MOTOROLA

Mobility in Manufacturing: Achieve a New Level of Lean — and a New Level of Profitability

Enterprise mobility is transforming today's manufacturers into more productive and profitable corporations that are better positioned to meet customer demands and deliver better customer service. In the following pages of this guide, you will see the power of enterprise mobility in action, — from the specific applications deployed by discrete and process manufacturers to how those applications are decreasing cycle times, stocking inventory requirements and the cash-to-cash cycle, while reducing errors and increasing yields, delivering a true competitive edge.

Table of Contents

The Power of Mobility in Manufacturing

The Power of Mobility in Manufacturing

Lean manufacturing — a core business initiative

Today's manufacturers face a number of business issues that threaten the health of the business, from the globalization of the marketplace to faster product life cycles and more demand for customized products. In order to maintain profitability in this environment, manufacturers must cut costs — without affecting quality, customer service or machine availability.

A well-proven model helps today's manufacturers address these challenges by continuously improving operational efficiency — lean manufacturing. The cornerstone of many of today's manufacturing operations, lean manufacturing concepts enable the identification and elimination of what are true burdens to this industry — the seven wastes typically found throughout manufacturing operations. And the elimination of these wastes drives costs down while improving quality and customer service, ultimately increasing overall profitability.

The hidden barriers to lean

One major issue that hinders lean initiatives is related to virtually every manufacturing workforce — the fact that a majority of the workers do not spend the day at a desk. Even though warehouse and production line workers are inside your four walls, they are rarely if ever at a desk. Warehouse workers are constantly on the move, processing and placing incoming shipments on the right warehouse shelf, replenishing product

The 7 Wastes of Manufacturing… and their impact on profitability

Regardless of what types of products you are manufacturing, the 7 wastes are likely hiding throughout your business processes, adding costs and impacting your profitability:

Over production
Increases the cost to purchase, carry and store inventory.

Waiting
Reduces the overall velocity of the supply chain by introducing delays into business processes.

Transportation
Forces employees to waste time traveling to needed assets, reducing time-on-task and increasing staffing costs.

Inappropriate processing
Forces employees to spend time manually creating reports that could be automatically generated by the computer.

Unnecessary motions
Duplication of efforts and time spent on tasks that could be automated reduce productivity — from the production line to upper management.

Defects/poor quality
Creates excessive re-work, increasing costs and reducing margins.

Unnecessary inventory
Larger-than-necessary buffer stocks due to the lack of real-time inventory visibility translate into excessive carrying costs and the cost of additional warehousing space.

on the production line, picking product to fulfill orders or packing orders in preparation for shipping. Production workers spend their day at their stations on the production line. Your sales and service workers spend their days outside the four walls, out in the field interacting directly with customers. And managers are on the move inside and outside your facilities as needed throughout the business day.

Regardless of whether these workers are inside or outside your four walls, they share one thing in common. They do not have access to the tools typically found at the desk — from the deskphone to back-end business applications and personal productivity applications, such as email. As a result, a lot of wasted time is injected into your business processes. Without real-time computer access at the point of activity, your workforce must collect business information on forms that are then entered into the computer at a later date. This 'double touching' of the data multiplies the opportunity for errors due to handwriting legibility issues and keying mistakes, but it also reduces the speed at which information moves through your operations, ultimately reducing supply chain efficiency. And while the workforce outside the four walls may have a cell phone and a notebook computer, the workforce inside the four walls is forced to waste a great deal of time moving to required resources to complete tasks — for example, locating a phone to reach a supervisor or pick up a call, traveling to a computer to access or input information or walking to a printer to pick up a work order.

Addressing the barriers to achieve an unprecedented level of lean…

…for your workforce

Mobility can practically eliminate these hidden barriers, paving the way for manufacturers to achieve an unparalleled level of 'lean'. Mobility allows manufacturers to place a virtual desktop computer and deskphone right in the hands of mobile workers, all on a single compact and easy to carry device that is designed to meet the needs of the worker, the application and the environment. Comprehensive wireless options ensure secure connectivity, regardless of whether your workers are inside or outside your four walls — from the delivery of highly cost-effective voice and data services over the wireless LAN inside your facility as well as via a cellular broadband connection to support even the most demanding applications out in the field. Your mobile workers now have the true anytime anywhere mobile voice and data access required to take any action, right on the spot. The result is an improvement in overall efficiency and data accuracy that drives the seven wastes of manufacturing right out of everyday processes — dramatically improving the 'lean score' in each and every operational area of your business.

…and for your plant communications architecture

In addition, mobility also allows manufacturers to address an often overlooked major area of waste — the communications architecture of the plant. Today's manufacturing operation typically operates six or more separate networks, including:

- A wired phone system
- A legacy text paging system
- The wired LAN
- The wireless LAN
- A trunked radio system
- Cellular network connectivity

The average benefits of streamlining and integrating your supply chain are dramatic:

- 25-50% reduction in total supply chain costs
- 25-60% reduction in inventory holding costs
- 30-50% improvement in cycle times

Source: AMR research

The Impact of Six Sigma

Pioneered by Motorola to address quality concerns throughout the company, Six Sigma has become a standard measurement for operational performance, defined as 3.4 defects per million opportunities (DPMO) — near perfection. At Six Sigma, less than four out of every million customers will experience any type of defect in your operations.

Manual processes — the completion of forms via pen and paper that are subsequently keyed into the computer — achieve approximately Two Sigma. But mobility replaces the two-step data collection process with a single, highly automated one-step process, allowing manufacturers to achieve Six Sigma levels of data accuracy: users with a handheld mobile device can capture the information on bar codes and RFID tags; many fields on form can be auto-populated; and drop-down menus and checkboxes help ensure the consistency and accuracy of data.

The benefits of Six Sigma can impact virtually every area of the business — and its value is well documented:

Motorola

- Saved $17 billion in 18 years

Allied Signal/Honeywell

- Saved $600 million in seven years
- Time from design to certification for aircraft engines reduced from 42 to 33 months

Ford

- Increased profitability by $52 million in 2000 and $300 million in 2001
- Waste elimination savings of over $350 million in 2002
- Improved over half of all "TGW" ("Things Gone Wrong")

American Standard

- Saved $35 million in one year
- Doubled production capacity on one assembly line
- Reduced energy costs by more than $300,000 at one plant

Source: Motorola website: The Impact of Six Sigma
http://www.motorola.com/content/0,,3081,00.html

The need to purchase, manage and maintain all of the networks infuses additional capital and operational expenditures into the manufacturing operation. And since the networks are typically 100 percent disparate, manufacturers must provide multiple device types to workers who require access to more than one of the above networks, driving capital and operational costs even higher — and forcing your workers to effectively waste even more time acting as human routers between networks.

But mobility allows the eloquent condensing of the multi-network/multi-device architecture into a unified voice and data architecture capable of delivering voice and data over the wireless LAN to any type of device — two-way radios, business smartphones, pagers, handheld mobile computers and more. Multiple networks can be replaced with a single highly resilient wireless LAN backbone that offers security equal to or greater than that of the wired LAN, able to easily meet the most stringent IT requirements. And the need for multiple devices per person is dramatically reduced — manufacturers can replace multiple 'point functionality' devices with a single device capable of delivering the appropriate services based on employee and task requirements.

Mobility: pure business advantage

Mobility allows you to provide your workers with an instant voice connection to customers, supervisors, co-workers and more — as well as a constant data connection to the back-end business and personal productivity applications your workers need to act as efficiently as possible. The result is the creation of the real-time enterprise. Automation drives time out of your business processes, improving productivity. The ability to automate data collection substantially reduces errors, enabling the achievement of Six Sigma data accuracy levels that improve quality, prevent costly re-work and ensure that orders are fulfilled accurately and shipped to the right place at the right time. Data entry is no longer delayed — information is visible in your business systems the moment it is collected. And management has the timely, actionable data required to make better business decisions that lead to a more profitable operation.

The result? The speed of business is dramatically increased. And the new level of supply chain efficiency reduces costs while improving product quality and customer service levels — a true business differentiator and a distinct competitive advantage.

What can you expect from mobility?

Mobility provides an extraordinary value. Its reach is universal — unlike a point solution, it extends benefits to each and every area of your operations, allowing you to take 'lean' to a new level throughout the business.

In a survey of mobile manufacturing workers involved in inventory and materials management, production, maintenance, quality, executive management and more, over one-third of the respondents indicated that mobile solutions enabled a minimal productivity gain of over 50 minutes per day.

Source: Motorola Enterprise Mobility Barometer

Following is just a small sample of the many applications and benefits that can be achieved through the deployment of a mobility solution:

- **A real-time view of your inventory** can enable significant reductions in stocking requirements and the associated required warehouse space — and eliminate costly out-of-stocks that can bring the production line to a halt.
- **Highly cost-effective material tracking** can provide the traceability you need to: ensure compliance with government regulations; perform rapid, focused and cost-effective recalls that minimize financial impact; and better protect consumers — and your brand.
- **The anywhere anytime ability to monitor SCADA, MES and other key machine metrics in real time** can keep the plant up and running at peak performance — protecting throughput, quality and yield.
- **The ability to give maintenance workers real-time access to all the information needed to maximize productivity as well as asset uptime** — from electronic and dynamic work orders to past service history, manuals, and available parts and tools inventory — ensures service of the right machinery in the right way at the right time.
- **The ability to achieve Six Sigma quality levels** throughout manufacturing processes can improve your 'lean' score by increasing overall operational efficiency and quality — without adding human resources.
- **The ability to check inventory, place orders and check order status in real time** allows your salesforce to maximize sales opportunities and provides the highest quality interaction with one of your most valuable assets — your customers.
- **The ability to give field service workers real-time access to the information required to maximize the value of customer visits** — from service history and service level agreements to appropriate after market products for on-the-spot cross-selling — increases the quality of service as well as revenue.

"The disconnect between real-time operations and business systems hinders improvements in enterprise-wide manufacturing performance."

Bill Swanton and Alison Smith, AMR Research

- **Instant and constant access to a real-time business intelligence dashboard** can provide managers and executive staff with the information needed to keep their fingers on the pulse of the business — anywhere and anytime. The result is better business decisions — and better management of the business.
- **The ability to wirelessly enable video cameras and allow your security officers to view real-time video surveillance** on an easy to carry mobile handheld device can substantially reduce the cost of your security infrastructure — while dramatically increasing the security of your facility.

Mobility: a horizontal solution for any vertical manufacturing industry

Regardless of whether you are a process or discrete manufacturer, what type of products you manufacture or the specific functions in your business, you can leverage the power of mobility to achieve a new level of lean — and a new level of profitability. The following chapters illustrate how mobility can help address the specific issues in six major vertical manufacturing markets — and how the benefits of mobility deliver a distinct competitive edge.

The wireless revolution is well underway. Nearly 75 percent of companies surveyed already have a wireless LAN (WLAN) installed, with over 16 percent planning to install a WLAN in the next 12 months. Based on those findings, 91 percent of all businesses will have implemented one or more mobility solutions by 2009.

Source: E-WLAN Market Monitor Report, Motorola/ CWMP/eRewards Market Research, February 2008

Aerospace

Mobility in the Aerospace Industry

Industry challenges

In the aerospace industry, safety is paramount. Historically the focus is not on productivity, but on quality, traceability and maintenance — all tightly governed by regulatory requirements to protect passengers, while also protecting the brand of the manufacturer as well as the airlines that purchase the aircraft. There is practically zero tolerance for quality issues, driven by the potential catastrophic results of a manufacturing defect in an airplane — quality processes must be error proof to ensure production of perfectly assembled aircraft. End-to-end real-time traceability is no small feat in this industry. Large commercial airliners contain upwards of six million parts, and each and every part — from instruments in the dashboard and trays in the back of a seat to every single wire, nut and bolt — must be fully traceable from 'birth' to retirement. And once assembled and delivered, aerospace manufacturers must continue to protect passenger safety by ensuring that the right maintenance services are performed at the right time, the right way — on each and every airplane in service around the world.

In the face of addressing these mandatory business initiatives every day, energy and labor costs continue to rise, and a downturn in the airline industry has contributed to reductions in topline revenue. To alleviate the resulting pressure on profitability and margins, aerospace manufacturers are following in the footsteps of the automotive and high tech industries and moving towards outsourced production. Today the manufacture of major assemblies and subcomponents, such as wings, are often produced overseas to help reduce capital and labor expenditures.

No longer in complete control of the end-to-end manufacturing process, aerospace manufacturers are under more pressure than ever to find efficient, cost effective ways to comply with government regulations and maintain control over product quality. Despite the new global reach of the supply chain, the aerospace manufacturer still must be able to guarantee quality as well as trace parts all the way back to the point of origin — even though some parts may be manufactured on the other side of the world.

How mobility can help

To address these issues, aerospace manufacturers have adopted a best-practice business initiative that has helped the automotive industry strengthen margins and profitability — lean manufacturing. In lean manufacturing, inefficiencies and errors are systematically and continually identified and removed from seven specific areas of waste identified in Figure 1.

Mobility can enable aerospace manufacturers to substantially 'lean' operations and address key business challenges. Manufacturers can accomplish more with fewer resources, improving quality and profitability in the face of rising costs and thinning margins. With real-time voice and data communications in hand, employees have the tools to not only perform virtually any task right on the spot, but also verify that the right task is being performed at the right time. With a small, yet rugged handheld device capable of scanning bar codes, direct part marks, RFID tags and more, a quick scan of parts at the receiving dock ensures the accurate capture of the point of origin. Workers in quality check incoming parts with an electronic form that ensures that every step in quality control is executed and that accurate data is instantly available in the business systems, eliminating any lag time that could result in defective parts reaching the shop floor. The ability to scan parts as they move through the facility — from the warehouse to the manufacturing line — provides cost-effective and complete traceability. In the event of a recall, parts can be located quickly, whether they are on the warehouse shelves, in planes that are in production (work-in-process) or in a plane that has already been delivered to a customer. And to ensure, as well as document the accuracy and timeliness of maintenance, aerospace manufacturers can provide service engineers with instant access to everything from a list of services to be performed to mechanical drawings, specific instructions, and step-by-step check boxes for granular accountability — all on a handheld device that is small enough to fit into any space where service must be performed.

With mobility in hand, large paper-trails can be completely eradicated — along with all the time previously spent on these manual processes and the associated errors. Through the power of mobility, the aerospace manufacturer can cost-efficiently attain Six Sigma quality

across operations, a concept pioneered by Motorola to address any type of improvement. (Today's standard measurement for operational performance, Six Sigma is defined as 3.4 defects per million opportunities, or near perfection — less than four out of every one million customers will experience any type of defect.)

The charts on the following pages examine the many areas where mobility can substantially improve the 'lean score' throughout operations, providing the end-to-end quality, traceability and accountability from the 'birth' of parts through assembly and post-sale maintenance that are crucial to success in the aerospace industry.

Figure 1.
The seven wastes of manufacturing

Waste	Issue	Result
Over production	• Poor demand information due to the lag time between when data is collected versus when it is available • Improperly sized KanBan	• High inventory costs • High storage costs
Waiting	• Poor plant scheduling • Plant shortages • Machine maintenance issues	• Increase in labor costs • High asset costs
Transportation	• Improper plant layout and design • Time wasted locating materials and tools	• Increase in labor costs • Decrease in productivity and throughput
Inappropriate processing	• Poor communications throughout and between facilities • Manually generated reports	• Lack of appropriate data for the best strategic decision making • Decrease in supervisor productivity
Unnecessary motion	• Redundant data collection and maintenance: paper-based processes • Need to analyze and manually re-calculate data to create reports and obtain needed information	• Reduced worker productivity • Delayed visibility into operations for better decision-making
Defects/poor quality	• Errors on the production line • Missing parts • Late shipments and excessive lead times	• Excessive re-work, increasing costs and reducing product margins
Unnecessary inventory	• Excess ordering and larger buffer stocks due to the lag time between when data is collected versus when it is visible • Improperly sized KanBan	• High costs associated with carrying unnecessary inventory — including increased capital expense and warehousing space

Aerospace Mobility Applications

Mobility in Materials Management

The warehouse is the central area of the business through which all raw materials and finished goods must pass. And in the aerospace industry, parts must be traced at every juncture of their journey through the warehouse and beyond. Mobility greatly improves warehouse management and enables error-free traceability by eliminating paper processes. Paper forms are replaced with real-time forms on mobile computers; a quick scan of a bar code, direct part mark or RFID tag enables workers to validate that the right parts are being picked from the shelves and delivered to the appropriate area of the assembly line at the right time, and that the right product is picked to fulfill an order. In addition, RFID provides automatic tracking of parts without the time and cost of human intervention. And voice can also be utilized to help streamline and error-proof warehouse processes with voice-directed picking applications. Through mobility, the real-time warehouse becomes a reality: the right set of data is available in the right place at the right time to enable the most efficient next action — and the most effective business decisions. Mobile materials management applications include:

Materials Management

Application	Description	Benefits
Warehouse Mobility	Warehouse mobility provides a real-time view of your inventory through the capture and availability of real-time data associated with your warehouse processes. In addition to enabling dynamic scheduling of picking, cross-docking and packing, knowing exactly what is in stock at any time significantly reduces: out of stocks; stocking inventory requirements and warehouse space requirements.	• Improves warehouse efficiency — fewer workers can handle more tasks • Enables the error-free warehouse by eliminating mistakes in activities such as put-away, letdown and replenishment • Reduces inventory costs by reducing stocking levels • Decreases the volume and cost of warehouse space
Material Tracking	Material tracking applications enable complete traceability of batch parts at any point in the manufacturing process, or after delivery to the customer. In the event that a particular batch of parts is found to be faulty, material tracking ensures fast and efficient recalls, protecting the safety of passengers, pilots, stewards and stewardesses. In addition, since material tracking is mandatory, dictated by government regulations, mobility enables aerospace manufacturers to meet compliance without burdening processes with time consuming paperwork.	• Enables highly efficient and accurate material tracking • Reduces the cost of material tracking activities • Provides real-time visibility to support just-in-time (JIT) inventory initiatives

Materials Management (continued)

Application	Description	Benefits
Raw Material Sequencing	Raw material sequencing utilizes mobile data collection to automate and error-proof the process of bringing materials to the production line in the correct order. This enterprise mobility application is especially valuable in today's manufacturing environment, where a single line is utilized to assemble different products. Ensuring that materials arrive line side in the correct sequence increases the speed and accuracy of assembly, and helps prevent expensive re-work for incorrectly assembled products.	• Improves the efficiency and accuracy of sequencing activities • Ensures accurate assembly — and product quality • Protects against unplanned downtime on the assembly line due to lack of materials
Vendor Managed Inventory (VMI)	This enterprise mobility solution supports the cost-effective implementation of VMI, a major cost-cutting initiative that requires vendors to maintain ownership of their material until the final point of assembly, as well as responsibility for placing the order, quality and availability. Parts are scanned and identified as they travel from the receiving dock to the assembly station, providing the ability to verify that material was received, utilized, inspected and charged at the point of use. As a result, capital expenditures for stocking inventory are dramatically reduced and the speed of the cash-to-cash cycle is greatly increased, improving cash flow as well as profitability.	• Enables rapid and cost-effective implementation of VMI solutions • Reduces capital expenditures and carrying costs associated with inventory • Improves cash flow and bottom line profitability

Real-time material tracking provides the visibility required to support just-in-time (JIT) inventory initiatives.

Mobility on the Shop Floor

At the heart of every manufacturing operation is the shop floor. With mobility on the shop floor, you have the power to: monitor your plant equipment in real time; prevent errors on the assembly line; enable business critical applications to meet market demand, such as line sequencing; and truly track that one elusive variable — the cost of your labor. As a result: throughput is protected, machine downtime is minimized and control over yield is increased, providing the assurance that the right product is manufactured the right way at the right time — and you gain a better understanding of labor costs to protect margins and overall profitability. Mobile shop floor applications include:

Shop Floor

Application	Description	Benefits
Mobile HMI/ SCADA	Visual Supervisory Control and Data Acquisition (SCADA) is traditionally only available for viewing in a central control room, requiring an area to be closed down for health and safety reasons whenever work is required line side. Mobile SCADA expands control and monitoring capabilities beyond the control room. Alarm assessment, repair, and random inspection of equipment can be accomplished anywhere, including line side without closing an area, as personnel can continue to view visual SCADA data when away from the control room.	• Improves line-side uptime • Increases workforce productivity
Machine Monitoring	The Manufacturing Execution System (MES) system is used to monitor plant usage, throughputs and efficiency to highlight bottlenecks, under-utilization and variances from pre-defined standards. However, any MES data captured by paper on the shop floor and then entered into data systems results in a time delay that can provide incorrect reporting — which in turn can have a major effect on yield. Automating the capture of data that cannot be acquired through machine technology ensures that accurate real-time key performance indicators (KPIs) are produced.	• Improves the efficiency and effectiveness of the machine monitoring process • Helps prevent the manufacture of non-standard product
Mobile Automation	Applying mobility to enable remote monitoring and maintenance of automation systems, such as Programmable Logic Controllers, enables more efficient use of expensive technicians.	• Improves staff utilization • Improves response times to conditions

Shop Floor (continued)

Application	Description	Benefits
Error Proofing	Error proofing solutions utilize mobile technology and data collection systems at each assembly station to ensure that operators use the correct parts, and have completed a manufacturing step correctly. Defects in the assembly process are eliminated, as well as the associated costly re-work.	• Eliminates inaccuracies in product assembly • Increases assembly speed
Shop Floor/ Line Sequencing	Mobile data collection technology enables and automates the validation of sequence and the production count, ensuring that the correct parts are in the correct order, improving assembly accuracy.	• Eliminates inaccuracies in product assembly • Increases throughput
Mobile Lean (eKanBan)	A key concept in lean manufacturing, this line side application enables operators to press a call button located at their workstation, sending a wireless signal directly to a forklift operator in the warehouse when more material is required. The forklift operator in turn receives the request on a mobile device, along with the exact location of the parts needed. Parts are replenished as efficiently as possible. The time, expense and errors of a paper-based system are eliminated. The drop in productivity experienced in systems when the call buttons are centrally located throughout the factory (requiring operators to leave their station to press the call button) is also eliminated. In addition, eKanBan does not require expensive wiring, can be implemented easily and inexpensively — and can be easily relocated whenever the line is re-worked. This single application can cut response time by 90% and eliminate 30% of line side inventory.	• Improves the efficiency of line-side replenishment by as much as 90% • Eliminates up to 30% of line-side inventory • Eliminates expensive wiring to initially deploy or relocate call buttons • Improves business agility — reduces cost to re-work production lines
Mobile Labor Cost Tracking	Labor costs represent one of the largest variables in the cost of your products, and accurate labor tracking is critical to ensuring and protecting profitability. Yet to date, most aerospace manufacturers use standard cost estimates instead of actual costs to calculate labor costs and establish product pricing. But by mobilizing the existing Time and Attendance (T&A) system, manufacturers have the ability to track actual time-on-task at a granular level. Now, a single set of labor cost data populates both the T&A and ERP systems, enabling the true reconciliation of production hours with job costing and payroll. And the ability to track time-on-task enables managers to spot and eliminate unproductive activities, leading to better utilization of the workforce.	• Ensures accurate product pricing • Protects profitability • Enables more competitive pricing • Substantial reduction in time required to reconcile actual hours worked, estimated hours worked and payroll • Improves productivity for managers and administrative staff

Mobility in Enterprise Asset Management (EAM)

In an aerospace plant, maintaining and managing the equipment on the shop floor is vital. Improper maintenance can translate into unplanned downtime on the production line — an incredibly expensive event in this industry, costing as much as $40,000 per minute — nearly $2.5 million an hour. And the resulting delay in delivery time can be just as financially catastrophic: the order-to-cash cycle time is increased, impacting cash flow projections and profitability. And the inability to deliver on time can also damage the company brand. In addition, inaccuracies in asset inventory can result in non-compliance with government regulations, translating into fines or excessive taxes.

Mobile computing, wireless LAN and RFID locationing technologies allow aerospace manufacturers to streamline all enterprise asset management functions. By stripping the inefficiencies out of your maintenance function, mobility can help ensure that the critical equipment out on the shop floor is serviced on time, with the right maintenance routines, performed correctly, complete with a comprehensive audit trail. And the ability to rapidly and accurately inventory assets out on the production floor — even without human intervention — can eliminate physical inventory processes, like cycle counting, freeing workers to handle other more business-crucial tasks. Mobile EAM applications include:

Enterprise Asset Management

Application	Description	Benefits
Mobile Asset Tracking	When locationing technologies or bar code scanning are deployed to count and track assets, errors and the high costs associated with manual inventory counts are eliminated. Workers can quickly and easily scan the bar codes or direct part marks on equipment with a handheld mobile computer, utilize a mobile RFID reader on a cart to quickly read all the RFID tags in a given area (such as a warehouse), or leverage wireless LAN or fixed RFID locationing technologies to constantly and automatically maintain inventory counts and even the actual location of an asset — all without any worker involvement.	• Improves efficiency of the inventory process — as well as worker productivity • Enables cost-effective compliance with government accounting regulations • Improves tool utilization, reducing tool inventory and management costs • Protects against loss or theft of assets • Ensures proper tax treatment of assets • Protects against financial penalties due to non-compliance

Enterprise Asset Management (continued)

Application	Description	Benefits
Mobile Asset Maintenance	Your machinery is your most important asset — proper maintenance is critical in order to achieve maximum uptime. Mobile asset maintenance ensures proper and timely scheduling of maintenance, provides maintenance history for machines to ensure the right maintenance routines are performed, and assigns the right tools and parts required for daily scheduled maintenance. In addition, if the manufacturing execution system (MES) or SCADA reveals a potential equipment problem, the system can dynamically schedule that piece of machinery for immediate service. And 2-way voice communications between plant and maintenance personnel can enable real-time responses to equipment challenges. As a result, machinery is always serviced at the right time, and your maintenance department is cost-efficient and effective.	• Improves uptime, protecting productivity and yield • Eliminates inefficiencies in the maintenance process • Ensures more timely maintenance — engineers can now service more equipment per day • Potential machinery problems can be addressed as they surface, before impacting production

Mobility helps ensure that critical equipment on the production line is serviced on time, every time — protecting uptime and profitability.

Mobility in Quality

In aerospace, quality is a mandatory initiative subject to government regulations to help protect the safety of everyone on board every aircraft. Mobility can enable aerospace manufacturers to improve not only the efficiency of quality processes, but even more so, the accuracy. Just as there are seven wastes in lean manufacturing, there may be seven hidden wastes in your quality function — and mobility can help you address every one:

1. Manual 'double-touch' of data: gathering information via handwritten forms which must then be entered into the computer at a later date
2. Manual research due to lack of real-time data
3. Manual consolidation of information from different sources for reporting and trend analysis — for example, data resident in computer applications and also on spreadsheets, databases and contact lists on individual computers
4. Lack of access to, or time spent traveling to and from computers and other resources to monitor processes or take required actions
5. Managing data errors — identifying, researching and correcting erroneous information
6. Heavy staffing requirements due to time intensive manual procedures
7. Lack of centralized data repository translates into the need for large amounts of email and high volumes of meetings to obtain data

In addition, there is a growing trend towards outsourcing, adding a level of complexity to the management of this crucial function. But the ability to put a mobile device running your quality applications in the hands of your vendors provides a number of major benefits. The manufacturer can ensure that the vendor follows the established quality processes; those processes are automated and streamlined, improving vendor productivity and reducing errors; and the instant transmission of information into your business systems ensures the real-time visibility required to protect not only the effectiveness of your quality function — but also the quality of your product. Mobile quality applications include:

Quality

Application	Description	Benefits
Mobile Forms	Quality engineers can manage up to 200 different forms, including forms for submission for government regulations, such as ISO 9000, or to comply with customer demands. Forms are often backfilled at the end of a shift rather than in real time as required. Mobility greatly simplifies the management of these forms, ensuring timely completion, providing time/date/operator stamps if desired, and dramatically increasing the productivity of your quality engineers.	• Eliminates the time and errors associated with double data entry • Provides visibility into real-time quality data
Real-Time SPC (statistical process control)	SPC programs are critical in determining the root cause of an increase or decline in yield, and how to address it. There are several key issues with today's SPC programs. The first is the 'data gap' created by the small amount of data (typically 20% to 30%) that cannot be collected automatically. This forces the need for manual collection of this data, and introduces the possibility of errors as well as a time lag between when the data is collected and when it is available to view. In addition, data used for final analysis is often up to three weeks old (and in some cases, up to one full quarter old). Mobility enables the real-time automated capture and instant transmission of this data into the SPC system, ensuring that your business decisions are based on an accurate real-time view of your global processes.	• Ensures proper yield • Eliminates need for additional warehouse space to store overages • Ensures product is completed on time
Six Sigma Data Capture	Six Sigma quality is a mandatory initiative for aerospace manufacturing, where there is just simply no room for error. Manual data collection processes (such as pen and paper or computer keyboard data entry) achieve approximately Two Sigma. The ability to scan a bar code, read an RFID tag or a direct part mark (DPM) and navigate drop down and check boxes heavily automates the completion of electronic forms. Inefficient and error-laden paper processes are replaced with the rapid and highly accurate collection of data, often delivering better than Six Sigma perfection across manufacturing processes — ensuring the quality of incoming parts, the assembly process and on-going maintenance post sale.	• Dramatically reduces the time and cost associated with achieving a Six Sigma level of quality
Track and Trace	Mobile technology enables fast and cost-efficient tracking of all activities relating to the assembly of a product. The resulting product 'genealogy' contains accurate real serial numbers for all parts, enabling all products containing a specific batch of parts to be recalled quickly, efficiently and quietly — regardless of where they are located in the supply chain, and without broad and highly visible media assistance. Brand equity is protected, the risk of recalling too much product is eliminated, customer loyalty is protected — and the threat of lost revenue is reduced.	• Dramatically reduces the time and cost associated with track and trace capabilities

Mobility in the Field

When it comes to field service, mobility not only helps provide your workforce with all the tools required to maximize efficiency in the field, but also enables another critical safety initiative — maintenance. Mobility provides a new level of visibility into the maintenance function and also significantly automates maintenance processes, helping to ensure that the right planes receive the right service, performed the right way, at the right time.

Field Mobility

Application	Description	Benefits
Mobile Field Service	Achieving Six Sigma quality in the maintenance function is crucial in the aerospace industry — human lives are dependent upon the efficiency and accuracy of this function. With mobility in hand, service engineers always have access to everything needed to perform service properly and on time, from a list of services to be performed, mechanical drawings, specific instructions, and step-by-step check boxes — all on a handheld device that is small enough to fit into any space where service must be performed. Real-time visibility into maintenance schedules ensures that maintenance is always performed on time — never late due to the slow travel of information through your business systems. Since work orders can be issued in real-time instead of just at the start of the day, the daily schedule can easily be modified to promptly address the most urgent issues. And a fully auditable trail provides visibility into the engineer that performed the service as well as documentation that the service was performed correctly and at the right time, providing the information supervisors need to better manage this function as well as proof of compliance.	• Improves workforce utilization — the same number of service technicians can handle more work orders per day • Ensures timely and highly accurate performance of maintenance • Improves customer service, satisfaction and loyalty

Field Mobility (continued)

Application	Description	Benefits
Mobile Fleet Management	Mobility provides the tools required to improve the management and utilization of your drivers and the vehicle fleet. Integrated GPS technology provides benefits for drivers and dispatch. Drivers enjoy the real-time navigation information required to ensure prompt arrival at the next destination — in spite of local traffic jams due to accidents and road construction. GPS also provides dispatch with the real-time location and historical route information required to create more efficient routing as well as enable dynamic routing throughout the day to cost-effectively meet customer service level expectations. In addition, telematics information provides real-time visibility into engine metrics. Fleet supervisors can now see and address adverse driving habits such as excessive speed, idling and braking, reducing fuel consumption as well as vehicle wear and tear. And visibility into engine fault codes enables the timely proactive maintenance required to help prevent a very high cost event — vehicle downtime.	• Enables the creation of highly efficient routes that minimize mileage, fuel costs and vehicle wear and tear • Reduces maintenance costs and extends vehicle lifecycle, improving both the return on investment (ROI) and total cost of ownership (TCO) for one of your largest capital investments — your vehicle fleet • Helps drivers to arrive on time every time, despite the constantly changing traffic conditions out on the road

Mobility provides the tools required to improve the management and utilization of both your drivers and your vehicle fleet.

Mobility in Management

Your managers are always on the move throughout the plant or traveling between office locations. Mobility ensures that, even though they may be on the go, managers always have access to the business information and personal productivity tools required to act on the spot — keeping the enterprise agile and ensuring the rapid response times needed to keep the business up and running at peak efficiency.

Mobile Manager

Application	Description	Benefits
Mobile Manufacturing Manager	This solution allows access to critical business intelligence on a handheld computer, enabling executives and other management to leave their desks and go wherever they are needed — from the plant floor to the field — while still keeping the information required to make the best business decisions right at their fingertips.	• Better plant management — faster reaction to changing conditions
Mobile Manager Productivity	The integration of voice and data onto a single pocket-sized device allows managers and engineers to keep the tools they need to take care of business — right in the palms of their hands. No longer tethered to a desk, managers are now free to remain where they are most effective — out in the plant — yet still maintain visibility into Key Performance Indicators (KPIs), plant messages and alerts as well as access to email, forecasting, scheduling applications and more.	• More effective managers — managers can now handle more tasks throughout the workday

Mobility and Plant Communications

Different types of workers need different types of business and mission critical voice and data services. Some workers require mission critical basic walkie-talkie style voice communications to protect employee safety and enterprise security. Others require a business critical connection to voice and data to streamline processes and improve productivity as well as business agility. For example, some workers require rich voice connectivity equivalent to a mobile version of the deskphone — the ability to receive incoming calls from customers and other associates as well as the ability to place calls inside and outside the four walls plus access to PBX features, such as call forwarding and conferencing. And still others require both rich voice and rich data communications, the mobile equivalent of the deskphone as well as the desktop computer for access to critical back-end business applications as well as personal productivity tools such as email.

To meet these many needs today, most manufacturers have deployed multiple disparate networks — including:

- A wireless LAN to provide workers inside the four walls with wireless access to business and personal productivity applications
- A trunked radio system to support two-way radios
- WWAN push-to-talk leased airtime to enable walkie-talkie style group calls for non-mission critical workers
- A traditional wired phone line (PBX)
- Wired Ethernet networks to serve those workers who spend the day primarily at a desk

Not only must separate networks be maintained and managed, but the devices on the separate networks cannot 'talk' to each other, forcing many workers to carry multiple devices — for example, managers may need to carry a two-way radio to communicate with some workers, a cordless handset to communicate with others as well as a mobile computer of some sort to access mobile data. The result? Your workers are forced to act as the bridge between your networks, effectively acting as routers by carrying multiple types of devices. And the business incurs unnecessary high capital and operational costs associated with purchasing multiple devices per person; time personnel spends managing multiple devices; and time IT spends managing the many devices and networks.

Mobility can address this issue by enabling the delivery of all voice and data communications over a common backbone, eliminating the need to maintain multiple disparate networks — dramatically simplifying and reducing the cost of the technology architecture.

Plant Communications

Application	Description	Benefits
Unified Voice and Data Architecture	Mobility allows the consolidation of disparate backbones into a single system, enabling cross-communications between the many types of devices deployed in your business. The high cost associated with maintaining and managing multiple wholly independent networks is eliminated — and the need to provide workers with separate devices for voice and data is eliminated. Now, regardless of what type of voice and data communications different types of workers require, they can be delivered to a single device. Voice services can include one-to-one private calls, one-to-one and one-to-many push-to-talk (PTT) walkie-talkie style calls, Cellular (WAN) calls, as well as the extension of the deskphone and all PBX features to the mobile device. Data services can be as simple as text messaging or as complex as full access to back-end critical business applications. As a result, workers are no longer forced to act as network connection points — for example, a manager with a mobile computer or supervisor with a business smartphone can communicate directly with workers that carry two-way radios. And the enterprise retains the freedom to match the right device to the job — from two-way radios with or without integrated text messaging to improve worker safety, business smartphones for workers that need the mobile equivalent of the deskphone and basic data functions, as well as integrated handheld mobile computers for workers that require rich voice and data connectivity. With this new simplified technology architecture, all voice and data traffic and mobile devices are essentially on the same network. As a result, the enterprise now has full control over the quality of the services, able to ensure toll-quality voice and application performance regardless of device type. In addition, the simpler architecture also greatly improves the efficiency of your IT organization. The issues, time and cost associated with managing disparate IT systems and multiple devices per person are eliminated — from inefficient asset management and unbalanced server resources to high application development costs and the general slow movement of information throughout the organization.	• Increase in worker accessibility through both voice and data • Significant reduction in the complexity and cost of the voice and data architecture, including mobile devices and networks • Improves employee safety, security and productivity — voice services can be extended as needed throughout the enterprise to more types of workers, without cost or compromise • Significant reduction in WAN costs leveraging VOIP for in-plant communications

Mobility in Facilities Management

To keep your facilities secure, live video monitoring is critical. But hard-wiring cameras throughout your facility can be a major expense in expansive facilities, which can include indoor as well as outdoor areas. Wireless video cameras capable of operating on either Wi-Fi or private wireless broadband networks eliminate the need and cost associated with running cabling to each camera — making cost-effective video surveillance in large manufacturing plants a reality. And when that video can be viewed on a handheld mobile device, further efficiencies are gained and security is improved — your security officers are no longer tied to the control room to monitor video, and are able to make rounds yet keep an eye on the real-time video feeds from all your cameras.

Mobile Manager

Application	Description	Benefits
Mobile Security Monitoring	Wirelessly-enabled video cameras and a wireless broadband backhaul network allows manufacturers to easily and cost-effectively implement a high-speed wireless video surveillance solution. The need to run cables to each camera is eliminated — substantially reducing the cost of video surveillance in large manufacturing environments. And mesh-enabled wireless cameras and wireless broadband networks further simplify and reduce wireless infrastructure costs. In addition, a mobile solution also frees your video feeds from their present day tether to the control room, allowing your security officers the ability to continue to view video from any camera in any facility on a handheld mobile device while on the move. Dedicated personnel are no longer required in the control room, enabling a reduction in the security workforce — as well as an improvement in overall facility security. And a single fully-featured integrated voice and data handheld mobile device provides business or mission critical voice and data communications for your security personnel. In addition to the ability to view live video feeds, officers will enjoy comprehensive mobile voice capabilities, including push-to-talk, one-to-one and group calls, 4-digit extension dialing and more. And access to back-end data applications enables officers with the ability to scan and verify an employee badge or, with a biometrics attachment, take a fingerprint to ensure identification in high-security environments.	• Enables cost-effective real-time video surveillance of expansive facilities or campuses • Increases facility security • Improves effectiveness of security officers, who can now continually patrol facility grounds without losing the ability to monitor live video • Reduces security officer staffing requirements — eliminates the need for around the clock staffing of the control room in addition to patrol staff • Eliminates the need to provide security officers with separate voice and data devices, substantially reducing the costs associated with purchasing, managing and maintaining mobile devices and accessories (such as batteries and chargers)

Case Study: Field Mobility

Solution category:	Field Mobility
Application:	Mobile Field Service
Industry:	Aerospace
Company:	Major aircraft manufacturer

Business Issue

Obtain a Six Sigma rate of accuracy for all processes and procedures associated with aircraft maintenance

The processes associated with day-to-day maintenance of aircraft in service were paper-based. The manual processes were time-consuming and error prone — and there was a significant time lag between when data was collected and when it was available for review. As a result, it was difficult to ascertain if processes and service procedures had been properly and completely executed in a timely manner. The task was further complicated by the fact that service is performed at airports around the world. The company was seeking a solution that would deliver a Six Sigma accuracy rating for the field service function — regardless of location.

The before scenario:
Technicians working on the tarmac servicing airplanes utilized a clipboard, paper and pen to note what maintenance and repair routines were performed on a given airplane. That information was entered into a computer at a later date. Supervisors then reviewed the service records to double check that all tasks were performed properly, comparing the data to a paper print out of required maintenance tasks.

Solution

Implement a real-time Mobile Field Service function with automated data capture

The after scenario:
Today, an always-connected handheld mobile computing device has replaced paper, pen and clipboard. At the press of a button, maintenance engineers access the list of maintenance routines that need to be performed on a specific aircraft, based on its hours of service. As each item on the list is selected, complete instructions for the task are presented, complete with a list of checkboxes. Service engineers are required to check each box as tasks are completed —

and the real-time data is automatically compared to the list of required maintenance routines, providing verification that service was properly performed. Exceptions are instantly and automatically noted, and an alarm sent to the technician performing the service as well as the facility supervisor. Schematics, manuals and other information are also available at the press of a button, ensuring that each and every technician, regardless of where in the world they are located, has instant access to all the information needed to properly perform service.

Benefits

The real-time two-way communication and automated data capture have delivered a number of critical benefits for this industry giant's field service function:

- **Accuracy rating increased from Three to Six Sigma.** The double manual procedures — clipboard, paper and pen as well as computer data entry — were providing an unacceptable accuracy rating of three Sigma. The automation of the manual procedures eliminated the errors inherent in the manual capture of data, enabling the achievement of the desired Six Sigma level of near-perfection for this critical function.
- **48% increase in quality of service.** Two factors contributed to a major increase in the quality of service: the ability to provide instant access to information needed to complete a given maintenance task; and the ability to identify — and correct — any errors or inadvertent missed steps in real time.
- **29% increase in supervisor productivity.** The need for supervisors to manually review service records was completely eliminated. The system automatically checked service tasks in real time — as they were performed — against service orders for a specific aircraft.
- **Worldwide visibility into maintenance issues:** The real-time capture of maintenance information around the world provided real-time visibility into trends that enabled the identification of issues that could be resolved — before passenger safety was compromised.
- **Complete elimination of service order backlog:** Each service engineer gained nearly ten hours a week, previously spent on paperwork, computer data entry and locating needed information. The resulting productivity increase allowed each engineer to spend more time servicing aircraft. Service is now always performed on time — and takeoff is never delayed due to a wait for mandatory scheduled service.

Case Study: Quality

Solution category:	Quality
Application:	Mobile Inspection
Industry:	Aerospace
Company:	Aircraft Parts Supplier

Business Issue

Improve productivity and accuracy of Inspections

For aerospace part suppliers, inspections are a critical function, driven by compliance as well as the fact that a quality issue can translate into irreparable damages in the form of human lives. As a result, a large number of highly specialized inspectors are dedicated to inspecting specific areas of the manufacturing process, such as the airframe, fasteners or metallurgy. As a part of the inspection process, this workforce must collect significant quantities of data to comply with both government regulations and the quality processes within the business. This cumbersome and time consuming process proved costly for this high dollar workforce. The manufacturer was seeking a way to reduce paperwork and improve inspector efficiency — as well as the quality of the inspection itself.

The before scenario:
The many inspections performed throughout the day accounted for 40 percent of the production line of the product —from incoming material inspection, multiple in-line inspections and random process audits to the final inspection and sign off. The data collection process was completely manual. Inspection data was collected on paper forms that were collated at the end of the production line and sent with the final product. In some cases, the data was keyed into a computer system for analysis by production and quality personnel. To meet regulatory requirements, the inspection data — the forms themselves — was then filed in a large storage room with two full time workers dedicated to searching for files to fulfill information requests from government agencies, airframe customers, and internal engineers.

Solution

Mobile Inspection Applications and forms

The after scenario:
Instead of paper, pen and clipboard, inspectors are equipped with a lightweight pocketable handheld mobile computer and belt-worn mobile

printer, both designed for all day business use. Now, inspectors simply scan the bar code on a shop traveler and all appropriate inspection requirements are automatically displayed on the mobile computer. Checkboxes and drop down menus ensure that each step is performed, and an electronic signature provides accountability for the inspection. A label is printed and affixed to the inspected part to provide visual verification that the part was inspected as well as who inspected the part and when it was inspected. All data is instantly transmitted to a secure central server that can be accessed by government agencies, airframe customers, quality engineers, and production engineers. The inspection data can then be either printed out and shipped with the product, or electronically transmitted as EDI with the customer invoice.

Benefits

The automation of data collection and the ability to move information in real-time delivered substantial benefits for this aircraft parts manufacturer:

- **15% increase in inspector productivity.** Inspectors no longer have to locate and photocopy inspection forms in large books to prepare for the various inspections; complete the forms and then enter forms into various computer systems. As a result, the company was able to reduce the inspection workforce from 20 to 18, allowing the company to re-deploy two workers to production operations.
- **5% improvement in quality metrics.** Quality and production engineers are able to retrieve and analyze quality information in almost real-time and react to changes in production results before a large number of parts are produced out of specification — also preventing the high cost of re-work.
- **40% improvement in response time to customer information requests.** The storage of quality information on a central server not only improved the speed of information retrieval, but also reduced the staff required to handle information requests. Since electronic records can now be located much faster than physical files, one person easily handles all the requests, allowing the company to re-deploy the other administrator to another area of the business.
- **20% reduction in production time.** The rapid data entry, elimination of key entry, electronic sign off, and central server architecture eliminated 20 percent of the production time of the final products, effectively improving the cost-efficiency of compliance and quality processes as well as margins — without adding human resources.

Case Study: Shop Floor

Solution category:	Shop Floor
Application:	Labor Cost Tracking
Industry:	Aerospace
Company:	Large Airframe Component Supplier

Business Issue

No timely visibility into product-specific labor costs

This aerospace component manufacturer produced a number of products that were very labor intensive — however, the company was unable to capture accurate labor information at the product level. Instead of true labor costs, the business assigned a standard cost (a dedicated labor cost) to each product for accounting and quoting of projects — an aggregate of plant and labor costs that is at best an estimate, and at worst a very outdated production cost. As a result, the company quoted and charged for jobs with inaccurate costing data, leading to underbidding and overbidding of jobs, affecting margins and profitability as well as the ability to compete.

The before scenario:
Once a year, engineers assigned standard labor costs for a specific product by auditing and analyzing all production processes associated with a specific project. The costs were then loaded into the ERP system and utilized to create quotes. Unfortunately, the short duration of the auditing process did not account for the peaks and valleys in production resources that were experienced throughout the year, nor did it reflect the effects of new employees, illness, injuries or a change in the required skillset. As a result, the utilization of the standard cost led the company to inadvertently estimate too low on some products, reducing margin, and too high on others, resulting in the loss of business — both scenarios that affected the overall health and profitability of the business.

Solution

Mobile Labor Cost Tracking

The after scenario:
Today, the company utilizes handheld mobile computers to collect accurate labor costs for every job, eliminating the inaccuracies associated with the use of standard costs. As a product arrives at a production center, the operator scans the traveler or shop ticket as well as the bar code on the employee badge, which starts the production timer for that specific center. Throughout the day, the traveler and employee

badge are scanned to indicate stop and start times for lunch, breaks or meetings. The mobile computer effectively acts as a time clock at every production station, allowing employees to 'punch in and out' in just seconds throughout the day. The result is a single set of highly accurate actual labor data for both the ERP and the Time and Attendance systems, providing accurate costing information as well as enabling the reconciliation of production hours with product costing and payroll.

Benefits

The ability to automate and enable real-time data collection at the point of work delivered substantial benefits for this large airframe component supplier:

- **35% improvement in costing information accuracy — from 60% to 95%.** Without mobility, plant management and finance staff were required to spend the last week of every month attempting to reconcile a 35% variance between estimated product labor costs and actual labor costs. Since mobility now provides real-time actual costs, the variance between product and labor costs is negligible. The large monthly administrative costs associated with reconciling variances is eliminated, and the real-time window into labor costs enables more efficient scheduling of plant staff.
- **7% increase in profitability.** The availability of true labor costs allowed the company to forgo bidding on low margin projects and focus on more competitive bidding in high margin projects, improving overall profitability.
- **25% reduction in quote time.** Because all cost estimators in the quoting office were aware that the existing standards-based costing system was flawed, hours were spent each day talking to production personnel in an attempt to better understand costs. Now, estimators can check real-time labor costs for any past job or job in process at the press of a few buttons, improving the response times for quote requests as well as reducing the administrative costs associated with the creation of each quote.
- **Eliminated physical labor audits.** The real-time capture of actual costing data eliminated the need for yearly physical labor audits, allowing the re-deployment of one industrial engineer elsewhere in the business.
- **Improved payroll accuracy.** Since supervisors can now manage time clock-related issues from a mobile handheld computer, work rules can be easily changed as needed throughout the day. As a result, time spent on different tasks with different rates of pay is easily tracked, preventing inadvertent under or overpayment.

Automotive

Mobility in the Automotive Industry

Industry challenges

All around the world, automotive manufacturers are experiencing tremendous pricing pressures. Competition has increased due to the globalization of the market, and the expectations of today's typical global customer have changed. Customers are now extremely sensitive to quality, cost and service — and even minor slips in any one area can have far reaching consequences on a manufacturer's brand and valuation. Today's customers demand the right car with the right options at the right price, delivered at the right time. Since the Internet is now widely used by consumers to research and shop for cars, if you can't deliver, your competitor is never more than a few keystrokes away. Finally, volatile energy costs are creating a demand for more energy efficient vehicles, requiring increased budgets for research and development as well as product marketing.

In order to succeed in this build-to-order world with razor thin margins, manufacturers must aggressively cut costs to ensure competitive pricing and preserve profitability — yet improve quality and manufacturing speed as well as deliver innovative new models to market.

How mobility can help

To help achieve these goals, automotive manufacturers must strive to strip every inefficiency and every wasted moment out of the manufacturing process — the goal of the industry's leading best-practice, lean manufacturing. Widely adopted by automotive manufacturers, lean manufacturing is the practice of systematically and continually identifying and eliminating inefficiencies — including errors — in seven specific areas of waste identified in Figure 1.

The leaner a manufacturer can become, the more streamlined operations become, improving the ability to serve customer needs — and profitability.

Mobility can help substantially improve the 'lean score' of an automotive manufacturer by enabling the real-time voice and data communications required to allow any employee to perform virtually any task right at the point of activity — regardless of whether they are responsible for production, quality, materials management, asset maintenance or sales, and whether they are task workers or supervisors. The result is a major improvement in efficiency throughout operations. Through the power of mobility, automotive manufacturers can do more with less — less inventory, less time, less space and less people, yet improve the accuracy and speed of throughput.

Through the power of mobility, automotive manufacturers can do more with less — less inventory, less time, less space and less people, yet improve the accuracy and speed of throughput.

Figure 1.
The seven wastes of manufacturing

Waste	Issue	Result
Over production	• Poor demand information due to the lag time between when data is collected versus when it is available • Improperly sized KanBan	• High inventory costs • High storage costs
Waiting	• Poor plant scheduling • Plant shortages • Machine maintenance issues	• Increase in labor costs • High asset costs
Transportation	• Improper plant layout and design • Time wasted locating materials and tools	• Increase in labor costs • Decrease in productivity and throughput
Inappropriate processing	• Poor communications throughout and between facilities • Manually generated reports	• Lack of appropriate data for the best strategic decision making • Decrease in supervisor productivity
Unnecessary motion	• Redundant data collection and maintenance: paper-based processes • Need to analyze and manually re-calculate data to create reports and obtain needed information	• Reduced worker productivity • Delayed visibility into operations for better decision-making
Defects/poor quality	• Errors on the production line • Missing parts • Late shipments and excessive lead times	• Excessive re-work, increasing costs and reducing product margins
Unnecessary inventory	• Excess ordering and larger buffer stocks due to the lag time between when data is collected versus when it is visible • Improperly sized KanBan	• High costs associated with carrying unnecessary inventory — including increased capital expense and warehousing space

The charts on the following pages illustrate the many mobility applications available to help automotive manufacturers achieve new levels of lean required to thrive, instead of merely survive, in today's challenging industry environment.

Automotive Mobility Applications

Mobility in Materials Management

The warehouse is a central area of the business through which all raw materials and finished goods pass. The poorly managed warehouse can actually become cost prohibitive, significantly impacting the cost of doing business — and general profitability. Mobility greatly improves material management processes by eliminating paper-based processes throughout the warehouse. Paper forms are replaced with real-time forms on mobile computers; a quick scan of a bar code, direct part mark or RFID tag enables workers to validate that the right parts are being picked from the shelves and delivered to the appropriate area of the assembly line at the right time, and that the right product is picked to fulfill an order. In addition, RFID enables automatic tracking of materials — such as tires — without the time and cost of human intervention. And voice can also be utilized to help streamline and error-proof warehouse processes with voice-directed picking applications. Through mobility, the real-time warehouse becomes a reality: the right data is available in the right place at the right time to enable the most efficient next action — and the most effective business decisions. Mobile materials management applications include:

Materials Management

Application	Description	Benefits
Warehouse Mobility	Warehouse mobility provides a real-time view of your inventory through the capture and availability of real-time data associated with your warehouse processes. In addition to enabling dynamic scheduling of picking, cross-docking and packing, knowing exactly what is in stock at any time significantly reduces: out of stocks; stocking inventory requirements and warehouse space requirements.	• Improves warehouse efficiency — fewer workers can handle more tasks • Enables the error-free warehouse by eliminating mistakes in activities such as put-away, letdown and replenishment • Reduces inventory costs by reducing stocking levels • Decreases the volume and cost of warehouse space
Material Tracking	Material tracking applications enable complete traceability of batch parts at any point in the manufacturing process, or after delivery to the customer. In the event that a particular batch of parts is found to be faulty, material tracking ensures fast and efficient recalls — without potentially brand-damaging media coverage. Brand equity is protected, the recall is handled in the most time and cost-efficient manner possible, and the risk of recalling too much product and leaving shelves potentially empty is eliminated.	• Enables highly efficient and accurate material tracking • Reduces the cost of material tracking activities • Provides real-time visibility to support just-in-time (JIT) inventory initiatives

Materials Management (continued)

Application	Description	Benefits
Raw Material Sequencing	Raw material sequencing utilizes mobile data collection to automate and error-proof the process of bringing materials to the production line in the correct order. This enterprise mobility application is especially valuable in today's manufacturing environment, where a single line is utilized to assemble different products. Ensuring that materials arrive line side in the correct sequence increases the speed and accuracy of assembly, and helps prevent expensive re-work for incorrectly assembled products.	• Improves the efficiency and accuracy of sequencing activities • Ensures accurate assembly — and product quality • Protects against unplanned downtime on the assembly line due to lack of materials
Vendor Managed Inventory (VMI) and eKanBan	This enterprise mobility solution supports the cost-effective implementation of VMI and eKanBans, a major cost-cutting initiative where vendors maintain ownership of their material until the final point of assembly, as well as responsibility for placing the order, quality and availability. Parts are scanned and identified as they travel from the receiving dock to the assembly station, providing the ability to verify that material was received, utilized, inspected and charged at the point of use. As a result, capital expenditures for stocking inventory are dramatically reduced and the speed of the cash-to-cash cycle is greatly increased, improving cash flow as well as profitability.	• Enables rapid and cost-effective implementation of VMI and eKanBan solutions • Reduces capital expenditures and carrying costs associated with inventory • Improves cash flow and bottom line profitability

Warehouse mobility provides a real-time view of your inventory, enabling significant reductions in stocking requirements.

Mobility on the Shop Floor

At the heart of every manufacturing operation is the shop floor. With mobility on the shop floor, you have the power to: monitor your plant equipment in real time; prevent errors on the assembly line; enable business critical applications to meet market demand, such as line sequencing; and truly track that one elusive variable — the cost of your labor. As a result: throughput is protected, machine downtime is minimized and control over yield is increased, providing the assurance that the right product is manufactured the right way at the right time — and you gain a better understanding of labor costs to protect margins and overall profitability. Mobile shop floor applications include:

Shop Floor

Application	Description	Benefits
Mobile HMI/ SCADA	Visual Supervisory Control and Data Acquisition (SCADA) is traditionally only available for viewing in a central control room, requiring an area to be closed down for health and safety reasons whenever work is required line side. Mobile SCADA expands control and monitoring capabilities beyond the control room. Alarm assessment, repair, and random inspection of equipment can be accomplished anywhere, including line side without closing an area, as personnel can continue to view visual SCADA data when away from the control room.	• Improves line-side uptime • Increases workforce productivity
Machine Monitoring	The Manufacturing Execution System (MES) system is used to monitor plant usage, throughputs and efficiency to highlight bottlenecks, under-utilization and variances from pre-defined standards. However, any MES data captured by paper on the shop floor and then entered into data systems results in a time delay that can provide incorrect reporting — which in turn can have a major effect on yield. Automating the capture of data that cannot be acquired through machine technology ensures that accurate real-time key performance indicators (KPIs) are produced.	• Improves the efficiency and effectiveness of the machine monitoring process • Helps prevent the manufacture of non-standard product
Mobile Automation	Applying mobility to enable remote monitoring and maintenance of automation systems, such as Programmable Logic Controllers, enables more efficient use of expensive technicians.	• Improves staff utilization • Improves response times to conditions

Shop Floor (continued)

Application	Description	Benefits
Error Proofing	Error proofing solutions utilize mobile technology and data collection systems at each assembly station to ensure that operators use the correct parts, and have completed a manufacturing step correctly. Defects in the assembly process are eliminated, as well as the associated costly re-work.	• Eliminates inaccuracies in product assembly • Increases assembly speed
Shop Floor/ Line Sequencing	Mobile data collection technology enables and automates the validation of sequence and the production count, ensuring that the correct parts are in the correct order and enabling faster assembly times.	• Eliminates inaccuracies in product assembly • Increases throughput
Mobile Lean (eKanBan)	A key concept in lean manufacturing, this line side application enables operators to press a call button located at their workstation, sending a wireless signal directly to a forklift operator in the warehouse when more material is required. The forklift operator in turn receives the request on a mobile device, along with the exact location of the parts needed. Parts are replenished as efficiently as possible. The time, expense and errors of a paper-based system are eliminated. The drop in productivity experienced in systems where the call buttons are centrally located throughout the factory (requiring operators to leave their station to press the call button) is also eliminated. In addition, eKanBan does not require expensive wiring, can be implemented easily and inexpensively — and can be easily relocated whenever the line is re-worked. This single application can cut response time by 90% and eliminate 30% of line side inventory.	• Improves the efficiency of line-side replenishment by as much as 90% • Eliminates up to 30% of line-side inventory • Eliminates expensive wiring to initially deploy or relocate call buttons • Improves business agility — reduces cost to re-work production lines
Mobile Labor Cost Tracking	Labor costs represent one of the largest variables in the cost of your products, and accurate labor tracking is critical to ensuring and protecting profitability. Yet to date, most automotive manufacturers use standard cost estimates instead of actual costs to calculate labor costs and establish product pricing. But by mobilizing the existing Time and Attendance (T&A) system, manufacturers have the ability to track actual time-on-task at a granular level. Now, a single set of labor cost data populates both the T&A and ERP systems, enabling the true reconciliation of production hours with job costing and payroll. And the ability to track time-on-task enables managers to spot and eliminate unproductive activities, leading to better utilization of the workforce.	• Ensures accurate product pricing • Enables more competitive pricing • Protects profitability • Substantial reduction in time required to reconcile actual hours worked, estimated hours worked and payroll • Improves productivity for managers and administrative staff

Mobility in Enterprise Asset Management (EAM)

In an automotive plant, managing and maintaining the equipment on the shop floor is vital. Improper maintenance can translate into unplanned downtime on the production line — an incredibly expensive event in this industry, costing as much as $40,000 per minute — nearly $2.5 million an hour. And the resulting delay in delivery time can be just as financially catastrophic: the order-to-cash cycle time is increased, impacting cash flow projections and profitability. And the inability to deliver on time can also damage the company brand. Finally, inaccuracies in asset inventory can result in non-compliance with government regulations, translating into fines or excessive taxes.

Mobile computing, wireless LAN and RFID locationing technologies allow automotive manufacturers to streamline all enterprise asset management functions. By stripping the inefficiencies out of your maintenance function, mobility can help ensure that the critical equipment out on the shop floor is serviced on time, with the right maintenance routines, performed correctly, complete with a comprehensive audit trail. And the ability to rapidly and accurately inventory assets out on the production floor — even without human intervention — can eliminate physical inventory processes, like cycle counting, freeing workers to handle other more business-crucial tasks. Mobile EAM applications include:

Enterprise Asset Management

Application	Description	Benefits
Mobile Asset Tracking	When locationing technologies or bar code scanning are deployed to count and track assets, errors and the high costs associated with manual inventory counts are eliminated. Workers can quickly and easily scan the bar codes or direct part marks on equipment with a handheld mobile computer, utilize a mobile RFID reader on a cart to quickly read all the RFID tags in a given area (such as a warehouse), or leverage wireless LAN or fixed RFID locationing technologies to constantly and automatically maintain inventory counts and even the actual location of an asset — all without any worker involvement.	• Improves efficiency of the inventory process — as well as worker productivity • Enables cost-effective compliance with government accounting regulations • Improves tool utilization, reducing tool inventory and management costs • Protects against loss or theft of assets • Ensures proper tax treatment of assets • Protects against financial penalties due to non-compliance

Enterprise Asset Management (continued)

Application	Description	Benefits
Mobile Asset Maintenance	Your machinery is your most important asset — proper maintenance is critical in order to achieve maximum uptime. Mobile asset maintenance ensures proper and timely scheduling of maintenance, provides maintenance history for machines to ensure the right maintenance routines are performed, and assigns the right tools and parts required for daily scheduled maintenance. In addition, if the manufacturing execution system (MES) or SCADA reveals a potential equipment problem, the system can dynamically schedule that piece of machinery for immediate service. And 2-way voice communications between plant and maintenance personnel can enable real-time responses to equipment challenges. As a result, machinery is always serviced at the right time, and your maintenance department is cost-efficient and effective.	• Improves uptime, protecting productivity and yield • Eliminates inefficiencies in the maintenance process • Ensures more timely maintenance — engineers can now service more equipment per day • Potential machinery problems can be addressed as they surface, before impacting production

Mobility helps ensure that critical equipment on the production line is serviced on time, every time — protecting uptime and profitability.

Mobility in Quality

In order to meet the needs of your dealers and the demands of your customers, you now need to manufacture custom products at record speed. As a result, the quality function becomes even more critical, protecting against the receipt and inadvertent inclusion of defective parts in your product, as well as ensuring that each vehicle meets manufacturing standards and includes the right options. The quality function is pressured by the increased pace of the business and the increased variety in product coming off your assembly lines. In order to maintain quality standards without adding costs, the efficiency of the quality function must be improved. Just as there are seven wastes in lean manufacturing, there may be seven hidden wastes in your quality function — and mobility can help you address every one:

1. Manual 'double-touch' of data: gathering information via handwritten forms which must then be entered into the computer at a later date

2. Manual research due to lack of real-time data

3. Manual consolidation of information from different sources for reporting and trend analysis — for example, data resident in computer applications and also on spreadsheets, databases and contact lists on individual computers

4. Lack of access to, or time spent traveling to and from computers and other resources to monitor processes or take required actions

5. Managing data errors — identifying, researching and correcting erroneous information

6. Heavy staffing requirements due to time intensive manual procedures

7. Lack of centralized data repository translates into the need for large amounts of email and high volumes of meetings to obtain data

In addition, there is a growing trend towards outsourcing, adding a level of complexity to the management of this crucial function. But the ability to put a mobile device running your quality applications in the hands of your vendors provides a number of major benefits. The manufacturer can ensure that the vendor follows the established quality processes; those processes are automated and streamlined, improving vendor productivity and reducing errors; and the instant transmission of information into your business systems ensures the real-time visibility required to protect not only the effectiveness of your quality function — but also the quality of your product.

Mobile quality applications include:

Quality

Application	Description	Benefits
Mobile Forms	Quality engineers can manage up to 200 different forms, including forms for submission for government regulations, such as ISO 9000, or to comply with customer demands. Forms are often backfilled at the end of a shift rather than in real time as required. Mobility greatly simplifies the management of these forms, ensuring timely completion, providing time/date/operator stamps if desired, and dramatically increasing the productivity of your quality engineers.	• Eliminates the time and errors associated with double data entry • Provides visibility into real-time quality data
Real-Time SPC (statistical process control)	SPC programs are critical in determining the root cause of an increase or decline in yield, and how to address it. There are several key issues with today's SPC programs. The first is the 'data gap' created by the small amount of data (typically 20% to 30%) that cannot be collected automatically. This forces the need for manual collection of this data, and introduces the possibility of errors as well as a time lag between when the data is collected and when it is available to view. In addition, data used for final analysis is often up to three weeks old (and in some cases, up to one full quarter old). Mobility enables the real-time automated capture and instant transmission of this data into the SPC system, ensuring that your business decisions are based on an accurate real-time view of your global processes.	• Ensures proper yield • Eliminates need for additional warehouse space to store overages • Ensures product is completed on time
Six Sigma Data Capture	Six Sigma requires timely and accurate collection of data. Manual data collection processes (such as pen and paper or computer keyboard data entry) achieve approximately Two Sigma. A handheld mobile computer eliminates manual data collection, enabling the automatic and instant capture of the information in a bar code, Direct Part Mark (DPM) or RFID tag right at the point of activity, increasing worker productivity, overall operational efficiency — and often delivering better than Six Sigma.	• Dramatically reduces the time and cost associated with achieving a Six Sigma level of quality
Track and Trace	Mobile technology enables fast and cost-efficient tracking of all activities relating to the assembly of a product. The resulting product 'genealogy' contains accurate real serial numbers for all parts, enabling all products containing a specific batch of parts to be recalled quickly, efficiently and quietly — regardless of where they are located in the supply chain, and without broad and highly visible media assistance. Brand equity is protected, the risk of recalling too much product is eliminated, customer loyalty is protected — and the threat of lost revenue is reduced.	• Dramatically reduces the time and cost associated with track and trace capabilities

Mobility in the Field

Field sales and field service teams are the primary interface with all your customers — including dealers and other automotive manufacturers. With mobility, you can provide these valuable workers with seamless access to all the tools that are in the office — right in the field. Whether involved in field sales or field service activities, your collective field workforce is empowered to provide the best possible interaction in the least amount of time, improving the customer experience — as well as retention and loyalty.

Field Mobility

Application	Description	Benefits
Mobile Field Sales	When sales people and delivery drivers are armed with a handheld computing device, a wealth of information is available to ensure the highest quality interaction with one of your most valuable assets — your customer. This valuable enterprise mobility application provides a wealth of benefits. Real-time access to inventory and sales systems combines with signature capture capabilities, enabling sales personnel to check inventory, place an order and process an invoice on the spot. And access to complete customer history files provides needed information to support cross-sell and up-sell opportunities.	• More effective sales calls • Improves sales force utilization — the same salesforce can now make more customer visits per day • Improves customer satisfaction and retention • Reduces order-to-cash cycle times, improving profitability

Mobility puts service contract, service history and after market product information at the fingertips of your field service workforce — improving customer service as well as sales.

Field Mobility (continued)

Application	Description	Benefits
Mobile Field Service	Your field service technicians often spend more time in front of customers than your sales force. This valuable enterprise mobility application allows that 'face time' with the customer to be maximized by providing a wealth of information to the technician on a handheld computer — such as appropriate after market products to promote, and service agreement information to ensure the right level of service is provided — and that services not covered under contract are billed. In addition, the ability to enter information enables the capture of critical customer and competitive information.	• Improves workforce utilization — the same number of service technicians can now make more customer visits per day • Improves customer service, satisfaction and loyalty • Increases sales • Improves vehicle utilization • Reduces fuel consumption • Reduces vehicle wear and tear
Mobile Fleet Management	Mobility provides the tools required to improve the management and utilization of your drivers and the vehicle fleet. Integrated GPS technology provides benefits for drivers and dispatch. Drivers enjoy the real-time navigation information required to ensure prompt arrival at the next destination — in spite of local traffic jams due to accidents and road construction. GPS also provides dispatch with the real-time location and historical route information required to create more efficient routing as well as enable dynamic routing throughout the day to cost-effectively meet customer service level expectations. In addition, telematics information provides real-time visibility into engine metrics. Fleet supervisors can now see and address adverse driving habits such as excessive speed, idling and braking, reducing fuel consumption as well as vehicle wear and tear. And visibility into engine fault codes enables the timely proactive maintenance required to help prevent a very high cost event — vehicle downtime.	• Enables the creation of highly efficient routes that minimize mileage, fuel costs and vehicle wear and team • Reduces maintenance costs and extends vehicle lifecycle, improving both the return on investment (ROI) and total cost of ownership (TCO) for one of your largest capital investments — your vehicle fleet • Helps drivers to arrive on time every time, despite the constantly changing traffic conditions out on the road

Mobility in Management

Your managers are always on the move throughout the plant or traveling between office locations. Mobility ensures that, even though they may be on the go, these executives always have access to the business information and personal productivity tools required to act on the spot — keeping the enterprise agile and ensuring the rapid response times needed to keep the business up and running at peak efficiency.

Mobile Manager

Application	Description	Benefits
Mobile Manufacturing Manager	This solution allows access to critical business intelligence on a handheld computer, enabling executives and other management to leave their desks and go wherever they are needed — from the plant floor to the field — while still keeping the information required to make the best business decisions right at their fingertips.	• Better plant management — faster reaction to changing conditions
Mobile Manager Productivity	The integration of voice and data onto a single pocket-sized device allows managers and engineers to keep the tools they need to take care of business — right in the palms of their hands. No longer tethered to a desk, managers are now free to remain where they are most effective — out in the plant — yet still maintain visibility into Key Performance Indicators (KPIs), plant messages and alerts as well as access to email, forecasting, scheduling applications and more.	• More effective managers — managers can now handle more tasks throughout the workday

Mobility and Plant Communications

Different types of workers need different types of business and mission critical voice and data services. Some workers require mission critical basic walkie-talkie style voice communications to protect employee safety and enterprise security. Others require a business critical connection to voice and data to streamline processes and improve productivity as well as business agility. For example, some workers require rich voice connectivity equivalent to a mobile version of the deskphone — the ability to receive incoming calls from customers and other associates as well as the ability to place calls inside and outside the four walls plus access to PBX features, such as call forwarding and conferencing. And still others require both rich voice and rich data communications, the mobile equivalent of the deskphone as well as the desktop computer for access to critical back-end business applications as well as personal productivity tools such as email.

To meet these many needs today, most manufacturers have deployed multiple disparate networks — including:

- A wireless LAN to provide workers inside the four walls with wireless access to business and personal productivity applications
- A trunked radio system to support two-way radios
- WWAN push-to-talk leased airtime to enable walkie-talkie style group calls for non-mission critical workers
- A traditional wired phone line (PBX)
- Wired Ethernet networks to serve those workers who spend the day primarily at a desk

Not only must separate networks be maintained and managed, but the devices on the separate networks cannot 'talk' to each other, forcing many workers to carry multiple devices — for example, managers may need to carry a two-way radio to communicate with some workers, a cordless handset to communicate with others as well as a mobile computer of some sort to access mobile data. The result? Your workers are forced to act as the bridge between your networks, effectively acting as routers by carrying multiple types of devices. And the business incurs unnecessary high capital and operational costs associated with purchasing multiple devices per person; time personnel spends managing multiple devices; and time IT spends managing the many devices and networks.

Mobility can address this issue by enabling the delivery of all voice and data communications over a common backbone, eliminating the need to maintain multiple disparate networks — dramatically simplifying and reducing the cost of the technology architecture.

Plant Communications

Application	Description	Benefits
Unified Voice and Data Architecture	Mobility allows the consolidation of disparate backbones into a single system, enabling cross-communications between the many types of devices deployed in your business. The high cost associated with maintaining and managing multiple wholly independent networks is eliminated — and the need to provide workers with separate devices for voice and data is eliminated. Now, regardless of what type of voice and data communications different types of workers require, they can be delivered to a single device. Voice services can include one-to-one private calls, one-to-one and one-to-many push-to-talk (PTT) walkie-talkie style calls, Cellular (WAN) calls, as well as the extension of the deskphone and all PBX features to the mobile device. Data services can be as simple as text messaging or as complex as full access to back-end critical business applications. As a result, workers are no longer forced to act as network connection points — for example, a manager with a mobile computer or supervisor with a business smartphone can communicate directly with workers that carry two-way radios. And the enterprise retains the freedom to match the right device to the job — from two-way radios with or without integrated text messaging to improve worker safety, business smartphones for workers that need the mobile equivalent of the deskphone and basic data functions, as well as integrated handheld mobile computers for workers that require rich voice and data connectivity. With this new simplified technology architecture, all voice and data traffic and mobile devices are essentially on the same network. As a result, the enterprise now has full control over the quality of the services, able to ensure toll-quality voice and application performance regardless of device type. In addition, the simpler architecture also greatly improves the efficiency of your IT organization. The issues, time and cost associated with managing disparate IT systems and multiple devices per person are eliminated — from inefficient asset management and unbalanced server resources to high application development costs and the general slow movement of information throughout the organization.	• Increase in worker accessibility through both voice and data • Significant reduction in the complexity and cost of the voice and data architecture, including mobile devices and networks • Improves employee safety, security and productivity — voice services can be extended as needed throughout the enterprise to more types of workers, without cost or compromise • Significant reduction in WAN costs leveraging VOIP for in-plant communications

Mobility in Facilities Management

To keep your facilities secure, live video monitoring is critical. But hard-wiring cameras throughout your facility can be a major expense in expansive facilities, which can include indoor as well as outdoor areas. Wireless video cameras capable of operating on either Wi-Fi or private wireless broadband networks eliminate the need and cost associated with running cabling to each camera — making cost-effective video surveillance in large manufacturing plants a reality. And when that video can be viewed on a handheld mobile device, further efficiencies are gained and security is improved — your security officers are no longer tied to the control room to monitor video, and are able to make rounds yet keep an eye on the real-time video feeds from all your cameras.

Mobile Manager

Application	Description	Benefits
Mobile Security Monitoring	Wirelessly-enabled video cameras and a wireless broadband backhaul network allows manufacturers to easily and cost-effectively implement a high-speed wireless video surveillance solution. The need to run cables to each camera is eliminated — substantially reducing the cost of video surveillance in large manufacturing environments. And mesh-enabled wireless cameras and wireless broadband networks further simplify and reduce wireless infrastructure costs. In addition, a mobile solution also frees your video feeds from their present day tether to the control room, allowing your security officers the ability to continue to view video from any camera in any facility on a handheld mobile device while on the move. Dedicated personnel are no longer required in the control room, enabling a reduction in the security workforce — as well as an improvement in overall facility security. And a single fully-featured integrated voice and data handheld mobile device provides business or mission critical voice and data communications for your security personnel. In addition to the ability to view live video feeds, officers will enjoy comprehensive mobile voice capabilities, including push-to-talk, one-to-one and group calls, 4-digit extension dialing and more. And access to back-end data applications enables officers with the ability to scan and verify an employee badge or, with a biometrics attachment, take a fingerprint to ensure identification in high-security environments.	• Enables cost-effective real-time video surveillance of expansive facilities or campuses • Increases facility security • Improves effectiveness of security officers, who can now continually patrol facility grounds without losing the ability to monitor live video • Reduces security officer staffing requirements — eliminates the need for around the clock staffing of the control room in addition to patrol staff • Eliminates the need to provide security officers with separate voice and data devices, substantially reducing the costs associated with purchasing, managing and maintaining mobile devices and accessories (such as batteries and chargers)

Case Study: Materials Management

Solution category:	Materials Management
Application:	Raw Material Sequencing
Industry:	Automotive
Company:	Large Tier 1 Supplier

Business Issue

Improve the accuracy and cost-efficiency of in-line sequencing manufacturing processes

This large Tier 1 supplier produces automobile seats for a car manufacturer that required seats to be delivered in the order in which cars will be built. The company's client ordered seats on an as needed basis, requiring over ten deliveries per day to the automotive manufacturing plant.

Any variation in seat order would cause the automobile production line to stop, costing this company's client approximately $30,000 per minute.

The present manual labeling process consistently pressed the edge of the allowable number of errors. Labels were often damaged in the tough environment and rendered unreadable, rippling into the need to manually determine which car seat was on the line and what work needed to be done at a given station. The manufacturing costs in general for the seats were too high, and the cost could not be increased — the present pricing structure represented the maximum value at this point in the automobile manufacturer's overall supply chain. The company sought a solution that would streamline and reduce the costs of the manufacturing process to increase profitability, as well as increase the accuracy of packing to a Six Sigma level.

The before scenario:
Seats with the same specifications were grouped for manufacturing. The tracking process was completely manual at every stage — assembly, inventory and shipping — conducted via clipboard with paper and pen. To keep the line moving, a separate person was required at each station, dedicated to the task of checking to make sure the seat was built to the right specification on the production line, logged into inventory correctly and placed in the right order in the shipping container. Not only did the manual procedures produce a number of mistakes that

barely met the contract specification for errors, but production times were also reduced, and costly staffing was required. The result was a negative impact on overall product margin — and profitability.

Solution

RFID automated real-time capture of data

The after scenario:
Today, RFID technology replaces the manual procedures as well as the additional personnel required at each station. Each seat starts down the line with an RFID tag that contains the specifications for the seat. At each station, operators are presented with a list of tasks to complete and a checklist to verify each step as it is completed. The list of tasks performed with verification is written back to the RFID tag on the product at every station. At the end of assembly, the RFID tag contains the original specifications along with the complete and verified list of modifications performed on the manufacturing line. At the last station, these lists are compared automatically, and if they match, the seat is verified as correct from a quality perspective, and transferred to the warehouse for packing and shipping. Another scan of the RFID tags verifies that the seats are in the correct order prior to shipping to the automobile manufacturer.

Benefits

The automatic capture of data increased productivity as well as product quality, enabling this manufacturer to achieve maximum efficiency in a make-to-order environment. Benefits included:

- **30% increase in productivity.** Manual processes and the additional people required to perform them were completely eliminated, resulting in a 30% increase in the productivity of production line workers.
- **95% increase in data quality.** The elimination of manual processes and the ability to verify the production processes at every step virtually eliminated errors in the manufacturing process as well as in the shipping order.
- **18% increase in profitability.** The streamlining of processes and the associated reduction in manufacturing time, combined with the elimination of the station operators for tracking resulted in a margin increase of 18% for this product line.
- **Six Sigma data capture and processes.** Automated data capture and processing reduced errors in the manufacturing and shipping processes to achieve Six Sigma, ensuring that the company is always well under the error limit specified in their contract.

Case Study: Shop Floor

Solution category:	Shop Floor
Application:	e-KanBan
Industry:	Automotive
Company:	Major automotive manufacturer

Business Issue

Increase productivity and accuracy of line-side inventory replenishment

This major automotive manufacturer utilized the typical paper-based KanBan system. This manual process required workers to leave the production line to signal for more materials. In addition, there were errors in the picking process, resulting in the occasionally inadvertent delivery of the wrong materials to the production line — and costly re-work. The company wanted to automate this process to eliminate those errors in material delivery, as well as the suspension in production required to signal for more parts.

The before scenario:
On the assembly line, when the last item in a bin or pallet was used, the assembly line worker physically took the paper card associated with the part down the line to signal the need for replenishment of parts. Forklift operators were given the appropriate paperwork for the order, with the station requesting the refill and the materials needed. Production was halted while the assembly line operator waited for the delivery of the parts.

Solution

e-KanBan: automated real-time line-side replenishment

The after scenario:
Today, workers on the production line simply press a button to signal for more parts — before the KanBan is empty. There is no need to leave the station, eliminating the need to stop production every time the KanBan is low.
The signal automatically sends a request for inventory to a forklift operator, who views the order on the screen of his or her wireless vehicle mount computer. The order is complete with the location of the station requiring inventory, the materials that are required, the location of those materials — and the fastest route to that location. And forklift operators scan the materials as they are picked, providing verification that the parts are correct.

Benefits

The power of real-time communication allows workers to call for parts right from the shop floor, delivering:

- **22% reduction in stocking inventory requirements.** Real-time visibility into inventory enabled a major reduction in stocking inventory, reducing capital requirements, warehouse labor costs, and warehouse storage space requirements.
- **13% increase in yield.** The elimination of the need to leave the production line to signal for more parts resulted in a 13% increase in yield.
- **16% productivity increase.** The elimination of the need to leave the production line to signal for more parts, and the wait while parts were located and delivered resulted in a 16% increase in productivity. In addition, the call for parts does not need to be manually processed and paperwork created for forklift operators — instead, the call for parts is processed automatically in real time, with the order delivered directly to an available forklift operator.
- **Six Sigma rate of accuracy in the replenishment of line-side parts.** Costly re-work due to the use of the wrong materials was eliminated, due to the ability to verify parts as they were picked, prior to delivery to the assembly line.
- **Virtually no errors in customer orders — Six Sigma quality.** The ability to verify items as they are picked, and double verify the items in the order prior to shipping literally eliminated errors in customer orders.

When this major automotive manufacturer replaced the paper-based KanBan system with a mobile computer, the resulting real-time visibility into line-side inventory requirements resulted in a 16% increase in productivity on the production line — and a 13% increase in yield.

Case Study: Quality

Solution category:	Quality
Application:	Mobile Forms
Industry:	Automotive
Company:	Major automotive manufacturer

Business Issue

Increase product quality to Six Sigma levels

The process to ensure the quality of automobiles moving down the assembly line was time-consuming, costly — and fraught with errors. Repairs sometimes took days to complete, and some cars slipped through the cracks and were either repaired farther down the line (where the repairs were more costly), or delivered without being repaired. The manufacturer wanted to streamline the quality control process to reduce the associated costs and increase the velocity of the process, while improving the overall quality of the company's automobiles to a level of Six Sigma — before the cars left the plant.

The before scenario:
When quality control engineers inspected each car, paper forms were completed, identifying any specific defects that were found. Those forms were then routed manually to the next station, where repairs were to take place before the automobile continued down the line. Repair personnel then filled out another form to indicate that all repairs were completed, including details about the repairs that were executed. Sometimes the paperwork did not arrive in time and a car would pass through a station without the needed repair.

Solution

Real-time quality control forms and processes

The after scenario:
Today, quality inspectors complete electronic forms on a mobile computing device instead of with paper and pen. When the car's unique identification number is entered, a series of drop down check boxes are displayed, based on the specific options for that automobile. Inspectors quickly move through the check boxes, indicating

which items passed or failed the inspection. As the car reaches the repair station, repair personnel enter the vehicle's identification number, and the electronic inspection form appears, complete with all repairs required. The service person indicates the completion of each repair, again via a checkbox.

Benefits

The automation of data collection and the ability to move information in real-time delivered:

- **100% elimination of defects in the manufacturing process – Six Sigma quality.** Required repairs are instantly visible as cars pass through a specific repair station. In addition, the car cannot be sent down the line until the service engineer has indicated that all repairs have been made. This combination of functionalities eliminates the possibility of a vehicle moving farther down the assembly line, resulting in more expensive repairs, or delivery of a defective vehicle to the end customer.
- **21% increase productivity.** The elimination of paperwork and the manual routing of forms resulted in a combined productivity increase for quality inspectors and repair personnel.
- **18% increase in yield.** The availability of real-time information and the elimination of manual processes enabled more rapid processing (quality checks) and repair of vehicles coming down the assembly line, ultimately increasing overall yield.
- **Reduced/contained labor costs.** The same number of people can now process and repair more cars, driving labor costs down.
- **Early identification of issues.** The data collected is compared for trends, revealing, for example, that a specific part has become problematic on a number of cars, or cars passing through a specific assembly station are prone to problems. The real-time information enables early identification and correction of problems before they have a chance to become more costly — and threaten profitability.

Consumer Packaged Goods/Food & Beverage

Mobility in the Consumer Packaged Goods (CPG)/ Food & Beverage (F&B) Industries

Industry challenges

In the fast moving world of the CPG and F&B industries, the supply chain is in high gear. For both perishable (produce to order in F&B) and non-perishable (produce to inventory in CGP) manufacturing, the velocity of the supply chain is truly in a class by itself: whether you are selling fresh bread, fruit and milk, canned goods, or toothpaste and laundry soap, items are constantly in high demand. And unlike many other types of manufacturing, orders are typically placed weekly — or even daily — from customers. Success requires the utmost efficiency in business processes. Manufacturers of both perishable and non-perishable goods need to be able to respond with the utmost agility, able to consistently and rapidly produce goods, process orders and deliver the right products at the right time, practically every day of the week — while complying with a myriad of stringent government regulations designed to protect consumer safety. Yet inefficiencies throughout core business functions can drain productivity and profitability out of the business.

The high cost of compliance with consumer-facing safety regulations

Regardless of whether you are manufacturing products for human consumption or use — from food to car seats — stringent laws protect consumer safety by requiring traceability from raw ingredients or components to finished

product. CPG manufacturers must be able to rapidly yet cost-effectively remove any defective component or finished product from the supply chain, regardless of where it is located — on the warehouse shelves, on the production line, on the shelves at the retail store or in the homes of customers. For F&B manufacturers, the focus is on food safety — where the impact of even a single small well-contained incident could ripple well beyond the geography of the occurrence, affecting consumer confidence and sales for months. To ensure compliance and protect brand equity, F&B manufacturers must collect a massive volume of data every day. And globalization of the supply chain further complicates this effort. Changing consumer tastes and the ability to utilize ingredients from manufacturers around the world have doubled food imports to the United States alone in the last ten years.[1] And regulations are increasing in number and in requirements. The Federal Public Health Security and Bioterrorism Preparedness and Response Act of 2002, the FDA Good Manufacturing Practice Regulations in the U.S. as well as the EU food laws defined by the European Commission (EC) now require the collection and maintenance of detailed information as food moves through the supply chain.

To protect consumer safety and comply with traceability and other government regulations, both F&B and CPG manufacturers need to cost-effectively, yet accurately collect, filter and react to a massive amount of information — without impacting productivity or margins.

The high cost of unplanned downtime on the production line

The pace of business in CPG and F&B manufacturing creates an environment where production line uptime is mission critical. Unplanned downtime translates into the high cost of idle workers and unfulfilled orders. Given the velocity of this supply chain and the availability of many competitive products, the inability to fulfill an order can quickly translate into lost customers, threatening not only current revenues, but the future health of the business. To keep the production line up and running, routine maintenance must be performed on time and any problems must be identified and addressed quickly and efficiently before the entire production line grinds to a halt. But the maintenance records are typically recorded on paper forms and placed in files — management often lacks the real-time visibility required to ensure that the right maintenance routines were executed on the right piece of equipment at the right time. In addition, the Manufacturing Execution System (MES) and Visual Supervisory Control and Data Acquisition (SCADA) that provide insight into a developing machine malfunction are typically only accessible in control rooms, translating into the high expense associated with maintaining dedicated staff

1. Import Alarm Keeps Sounding on Food Safety; USA Today; 2/9/08; http://www.usatoday.com/news/health/2008-02-09-foodsafety_N.htm

to monitor MES and SCADA metrics. These inefficiencies not only drive the cost of the asset maintenance function up, but can also negatively impact production line uptime.

The high cost of inefficiencies in the warehouse

For both F&B and CPG manufacturers, inefficiencies in the warehouse translate into the need for excessive buffer stock, overproduction, unnecessary carrying costs and unnecessary overhead costs. Without real-time visibility into the raw goods inventory, businesses are forced to increase safety stocks to protect against unplanned downtime. The larger buffer stocks in turn require more warehouse space — and more human resources to manage the stock. And lack of real-time visibility in finished goods can reduce order fulfillment speed, affecting customer service and satisfaction levels.

The high cost of inefficiencies in the direct store delivery (DSD) function

In the DSD function for F&B manufacturers, time is of the essence. This function must move product as quickly as possible from the manufacturer to the customer in order to maximize shelf time in the store and ensure customer satisfaction — yet these workers are laden with a multitude of tasks that must be executed at each stop. Part delivery driver and part sales person, DSD personnel record quantities delivered and batch data for forward traceability as well as credit product returned and record the sales of incremental product. Paperwork and manual processes reduce the number of stops a driver can make, which in turn reduce the velocity at which product moves through your supply chain, affecting the ability to consistently deliver product on time, reduce order-to-cash cycle times and improve profitability. In addition, without real-time visibility into driving behavior and vehicle location, the business lacks the data required to reduce vehicle wear and tear and fuel consumption to ensure a low total cost of ownership (TCO) for one of your more substantial capital investments — your vehicle fleet. These inefficiencies can quickly impact customer service levels as well as overall profit margins.

Poor return on investment for promotional programs

Both CPG and F&B manufacturers share another unique industry operation — merchandising. With the pressure to generate demand for consumer products in today's highly competitive market, a large percentage of manufacturer marketing budgets are spent on in-store promotional programs. However, poor in-store execution can significantly impact the effectiveness of these major investments. To help prevent insufficient return for these programs, manufacturers need

increased visibility into merchandising at the shelf level. Is merchandise displayed at the correct price? Does the display conform to the planogram? Are competitor's activities impacting promotion success? While the answers to these questions are crucial, the labor involved drives costs up, while the delay in the movement of this business critical data hampers the manufacturer's ability to correct issues in time to maximize promotional campaign success — and revenue.

How mobility can help

CPG and F&B manufacturers can address all of these business issues by adopting lean manufacturing initiatives — the systematic identification and elimination of inefficiencies and errors in your business processes. A long proven and highly successful best practice utilized for many years in discrete manufacturing, lean manufacturing is now being adopted in the CPG and F&B industry to address core business issues. Mobility allows CPG and F&B manufacturers to improve their lean score by automating and error-proofing business processes to eliminate the seven key areas of waste found in any type of manufacturing operation — discrete or process, as identified in Figure 1 on the next page.

The result is a highly efficient operation, able to meet the demands of a fast moving supply chain, with the Six Sigma accuracy in process execution and data collection. CPG and F&B manufacturers enjoy substantial productivity improvements that ripple throughout operations, increasing production line uptime, enabling highly cost-effective and accurate traceability and compliance and maximizing driver and vehicle utilization as well as promotional campaign dollars. The end result is the ability to do more without adding staff — manufacture and deliver more product on time with a reduction in days sales outstanding (DSO), improving margins and providing a distinct competitive advantage.

Figure 1.
The seven wastes of manufacturing

Waste	Issue	Result
Over production	• Poor demand information due to the lag time between when data is collected versus when it is available • Improperly sized KanBan	• High inventory costs • High storage costs
Waiting	• Poor plant scheduling • Plant shortages • Machine maintenance issues	• Increase in labor costs • High asset costs
Transportation	• Improper plant layout and design • Time wasted locating materials and tools	• Increase in labor costs • Decrease in productivity and throughput
Inappropriate processing	• Poor communications throughout and between facilities • Manually generated reports	• Lack of appropriate data for the best strategic decision making • Decrease in supervisor productivity
Unnecessary motion	• Redundant data collection and maintenance: paper-based processes • Need to analyze and manually re-calculate data to create reports and obtain needed information	• Reduced worker productivity • Delayed visibility into operations for better decision-making
Defects/poor quality	• Errors on the production line • Missing parts • Late shipments and excessive lead times	• Excessive re-work, increasing costs and reducing product margins
Unnecessary inventory	• Excess ordering and larger buffer stocks due to the lag time between when data is collected versus when it is visible • Improperly sized KanBan	• High costs associated with carrying unnecessary inventory — including increased capital expense and warehousing space

The charts on the following pages illustrate the many mobility applications available to help CPG and F&B manufacturers achieve the new level of business excellence required to excel in addressing the core business challenges and customer expectations of today and tomorrow.

CPG/F&B Mobility Applications

Mobility in Materials Management

The warehouse is a central area of the business through which all raw materials and finished goods pass. The poorly managed warehouse can actually become cost prohibitive, significantly impacting the velocity of your supply chain, the cost of doing business and general profitability. In the world of the produce to order (perishables), warehouse inefficiencies can be even more costly, resulting in losses due to spoilage of raw ingredients and finished goods as well as reduced revenues associated with the delivery of product with a less-than-standard shelf life. Mobility greatly improves material management processes by eliminating paper-based processes throughout the warehouse. Paper forms are replaced with real-time forms on mobile computers. The ability to scan or read a bar code or an RFID tag enables workers to validate that: the right ingredients are being picked from the shelves and delivered to the appropriate area of the production line at the right time; the right products are picked to fulfill orders; and the right shipments are loaded onto the right trucks for delivery to the customer — as well as capture the data required for forward product traceability. And voice can also be utilized to help streamline and error-proof warehouse processes with voice-directed picking applications. Through mobility, the real-time warehouse becomes a reality: the right data is available in the right place at the right time to enable the most efficient next action — and the most effective business decisions. And real-time inventory visibility provides the data required to drive down stocking inventory requirements and inventory carrying costs. Mobile materials management applications include:

Materials Management

Application	Description	Benefits
Warehouse Mobility	Warehouse mobility provides a real-time view of your inventory through the capture and availability of real-time data associated with your warehouse processes. In addition to enabling dynamic scheduling of picking, cross-docking and packing, knowing exactly what is in stock at any time significantly reduces: out of stocks; stocking inventory requirements and warehouse space requirements.	• Improves warehouse efficiency — fewer workers can handle more tasks • Enables the error-free warehouse by eliminating mistakes in activities such as put-away, letdown and replenishment • Reduces inventory costs by reducing stocking levels • Decreases the volume and cost of warehouse space • Increased warehouse velocity protects against the loss of perishable raw materials and also maximizes product shelf life in the retail store

Materials Management (continued)

Application	Description	Benefits
Material Tracking	Material tracking applications enable complete traceability of raw ingredient batches at any point in the manufacturing process, or after delivery to the customer in the form of finished product. In the event that a particular batch is found to be tainted or otherwise defective, this application ensures fast and efficient point recalls — the manufacturer knows the exact location of all contaminated product. The recall is handled in the most time and cost-efficient manner possible, protecting consumer safety. The need for potentially brand-damaging media coverage to 'get the word out' is eliminated, protecting brand equity. And the risk of recalling too much product — resulting in empty shelves and lost sales — is eliminated.	• Enables highly efficient and accurate tracking of raw materials • Reduces the cost of material tracking activities • Provides real-time visibility to support just-in-time (JIT) inventory initiatives

Mobility enables cost-effective complete traceability of raw ingredient batches at any point in time, protecting consumer safety — and your brand.

Mobility in the Plant

At the heart of every manufacturing operation is the plant. With mobility on the plant floor, you have the power to: monitor your equipment in real time; prevent errors on the production line; and truly track that one elusive variable — the cost of your labor. As a result: throughput is protected, machine downtime is minimized and control over yield is increased, providing the assurance that the right product is manufactured the right way at the right time — and you gain a better understanding of labor costs to protect margins and overall profitability. Mobile plant applications include:

Plant Operations

Application	Description	Benefits
Mobile HMI/ SCADA	Visual Supervisory Control and Data Acquisition (SCADA) is traditionally only available for viewing in a central control room, requiring an area to be closed down for health and safety reasons whenever work is required line side. Mobile SCADA expands control and monitoring capabilities beyond the control room. Alarm assessment, repair, and random inspection of equipment can be accomplished anywhere, including line side without closing an area, as personnel can continue to view visual SCADA data when away from the control room.	• Improves line-side uptime • Increases workforce productivity
Machine Monitoring	The Manufacturing Execution System (MES) system is used to monitor plant usage, throughputs and efficiency to highlight bottlenecks, under-utilization and variances from pre-defined standards. However, any MES data captured by paper on the plant floor and then entered into data systems results in a time delay that can lead to incorrect reporting — which in turn can have a major effect on yield. Automating the capture of data that cannot be acquired through machine technology ensures that accurate real-time key performance indicators (KPIs) are produced.	• Improves the efficiency and effectiveness of the machine monitoring process • Helps prevent the manufacture of non-standard product

Plant Operations (continued)

Application	Description	Benefits
Mobile Automation	Applying mobility to enable remote monitoring and maintenance of automation systems, such as Programmable Logic Controllers, enables more efficient use of expensive technicians.	• Improves staff utilization • Improves response times to conditions
Mobile Labor Cost Tracking	Labor costs represent one of the largest variables in the cost of your products and accurate labor tracking is critical to ensuring and protecting profitability. Yet to date, most manufacturers use standard cost estimates instead of actual costs to calculate labor costs and establish product pricing. But by mobilizing the existing Time and Attendance (T&A) system, manufacturers have the ability to track actual time-on-task at a granular level. Now, a single set of labor cost data populates both the T&A and ERP systems, enabling the true reconciliation of production hours with job costing and payroll. And the ability to track time-on-task enables managers to spot and eliminate unproductive activities, leading to better utilization of the workforce.	• Ensures accurate product pricing • Enables more competitive pricing • Protects profitability • Substantial reduction in time required to reconcile actual hours worked, estimated hours worked and payroll • Improves productivity for managers and administrative staff

Mobility in Enterprise Asset Management (EAM)

In CPG and F&B manufacturing plants, maintaining and managing the equipment on the plant floor is vital. Downtime on the production line — scheduled or unscheduled — is costly: from the cost of workers waiting on the production line to lost sales due to lack of product. Improper maintenance can translate into unplanned downtime, a very costly event involving the cost of idle employees and lost production. The order-to-cash cycle slows down, impacting cash flow and profitability. And since the items that are manufactured are purchased daily by customers, if they are not on the store shelves, customers will simply purchase a different product, impacting sales volumes, company brand, and distributor loyalty. And inaccuracies in asset inventory can result in more costs, from fines due to non-compliance with government regulations and excessive taxes due to inaccuracies in asset information.

Mobile computing, wireless LAN and RFID locationing technologies allow CPG and F&B manufacturers to streamline all enterprise asset management functions. By stripping the inefficiencies out of your maintenance function, mobility can help ensure that the critical equipment out on the plant floor is serviced on time, with the right maintenance routines, performed correctly. And the ability to rapidly and accurately inventory assets out on the production floor — even without human intervention — can eliminate physical inventory processes, like cycle counting, freeing workers to handle other more business-crucial tasks. Mobile EAM applications include:

Enterprise Asset Management

Application	Description	Benefits
Mobile Asset Tracking	When locationing technologies or bar code scanning are deployed to count and track assets, errors and the high costs associated with manual inventory counts are eliminated. Workers can quickly and easily scan the bar codes or direct part marks on equipment with a handheld mobile computer, utilize a mobile RFID reader on a cart to quickly read all the RFID tags in a given area (such as a warehouse), or leverage wireless LAN or fixed RFID locationing technologies to constantly and automatically maintain inventory counts and even the actual location of an asset — all without any worker involvement.	• Improves efficiency of the inventory process — as well as worker productivity • Enables cost-effective compliance with government accounting regulations • Improves tool utilization, reducing tool inventory and management costs • Protects against loss or theft of assets • Ensures proper tax treatment of assets • Protects against financial penalties due to non-compliance

Enterprise Asset Management (continued)

Application	Description	Benefits
Mobile Asset Maintenance	Your machinery is your most important asset — proper maintenance is critical in order to achieve maximum uptime. Mobile asset maintenance ensures proper and timely scheduling of maintenance, provides maintenance history for machines to ensure the right maintenance routines are performed, and assigns the right tools and parts required for daily scheduled maintenance. In addition, if the manufacturing execution system (MES) or SCADA reveals a potential equipment problem, the system can dynamically schedule that piece of machinery for immediate service. And 2-way voice communications between plant and maintenance personnel can enable real-time responses to equipment challenges. As a result, machinery is always serviced at the right time, and your maintenance department is cost-efficient and effective.	• Improves uptime, protecting productivity and yield • Eliminates inefficiencies in the maintenance process • Ensures more timely maintenance — engineers can now service more equipment per day • Potential machinery problems can be addressed as they surface, before impacting production

Mobility helps ensure that critical equipment on the production line is serviced on time, every time — protecting uptime and profitability.

Mobility in Quality

For CPG and F&B manufacturers, ensuring quality throughout operations is a top initiative — a major challenge given the fast pace of business — and especially critical in this industry where consumer health and safety can be at risk. In order to maintain or exceed quality standards across your operations without adding costs, the efficiency of the quality function must be improved. Just as there are seven wastes in lean manufacturing, there may be seven wastes in your quality function — and mobility helps you address every one:

1. Manual 'double-touch' of data: gathering information via handwritten forms which must then be entered into the computer at a later date

2. Manual research due to lack of real-time data

3. Manual consolidation of information from different sources for reporting and trend analysis — for example, data resident in computer applications and also on spreadsheets, databases and contact lists on individual computers

4. Lack of access to, or time spent traveling to and from computers and other resources to monitor processes or take required actions

5. Managing data errors — identifying, researching and correcting erroneous information

6. Heavy staffing requirements due to time intensive manual procedures

7. Lack of centralized data repository translates into the need for large amounts of email and high volumes of meetings to obtain data

In addition, production of consumables as well as packaging is often outsourced, adding a level of complexity to the management of this crucial function. But the ability to put a mobile device running your quality applications in the hands of your vendors provides a number of major benefits. The manufacturer can ensure that the vendor follows the established quality processes; those processes are automated and streamlined, improving vendor productivity and reducing errors; and the instant transmission of information into your business systems ensures the real-time visibility required to protect not only the effectiveness of your quality function — but also the quality of your product. Mobile quality applications include:

Quality

Application	Description	Benefits
Mobile Forms	Quality engineers manage up to 200 different forms, including forms for submission for government regulations, such as ISO 9000, or to comply with customer demands. Forms are often backfilled at the end of a shift rather than in real time as required. Mobility greatly simplifies the management of these forms, ensuring timely completion, providing time/date/operator stamps if desired, and dramatically increasing the productivity of your quality engineers.	• Eliminates the time and errors associated with double data entry • Provides visibility into real-time quality data
Real-Time SPC (statistical process control)	SPC programs are critical in determining the root cause of an increase or decline in yield, and how to address it. There are several key issues with today's SPC programs. The first is the 'data gap' created by the small amount of data (typically 20% to 30%) that cannot be collected automatically. This forces the need for manual collection of this data, and introduces the possibility of errors as well as a time lag between when the data is collected and when it is available to view. In addition, data used for final analysis is often up to three weeks old (and in some cases, up to one full quarter old). Mobility enables the real-time automated capture and instant transmission of this data into the SPC system, ensuring that your business decisions are based on an accurate real-time view of your global processes.	• Ensures proper yield • Eliminates the need for additional warehouse space to store overages • Ensures product is completed on time
Six Sigma Data Capture	Six Sigma requires timely and accurate collection of data. Manual data collection processes (such as pen and paper or computer keyboard data entry) achieve approximately Two Sigma. A handheld mobile computer eliminates manual data collection, enabling the automatic and instant capture of the information in a bar code, Direct Part Mark (DPM) or RFID tag right at the point of activity, increasing worker productivity, overall operational efficiency — and often delivering better than Six Sigma.	• Dramatically reduces the time and cost associated with achieving a Six Sigma level of quality

Quality

Application	Description	Benefits
Batch Traceability	Mobile data collection technology, in conjunction with batch record software, enables efficient and error-proof tracking of batches of raw material through the capture of accurate batch serial numbers. This electronic batch record provides visibility into all the products that contain a given batch of raw material, enabling rapid reaction time to product quality issues. At any point in the production process or after products are completed, products containing a specific batch can be easily identified and quickly recalled.	• Enables cost-effective batch tracking • Provides granular, forward traceability to enable targeted cost-effective recalls • Helps protect consumer safety • Cost-effective compliance with government regulations • Reduces non-compliance incidents and the associated fines
Environmental Compliance & Waste Management	Manufacturers must document efforts to reduce waste or pay recycling subsidies. The impact of not being able to produce documents to prove compliance can easily add up to millions of dollars. But the impact on productivity and overhead associated with the data collection to prove compliance is also significant. Deploying mobility at the point of waste creation to track waste not only provides the information required to prove compliance, but also significantly minimizes the effect on productivity and overhead.	• Automates the collection of environmental and waste data for cost-effective compliance — without adding resources or impacting productivity • Protects against high fines resulting from lack of timely compliance data

Mobility in the Field

Field sales and merchandising teams are out in the field every day, the primary interface with your customers. With mobile voice and data in-hand, these workers have the tools they need to act as efficiently as possible in the dynamic environment of life in the field. DSD drivers have the tools in hand to provide a superior level of service excellence for each and every customer. Drivers can address order changes, additions and returns, collect an electronic signature as proof of delivery, and simultaneously transmit the signed invoice to the business billing system and print out a copy for the customer, right on the spot — no need to complete paper forms which must then be entered into the computer upon return to the office. The efficiency improvement allows drivers to make more stops — and generate more revenue — per day. And the same device that streamlines the sales process also enables the rapid and accurate collection of compliance data to meet batch traceability requirements — and can transmit accurate invoices in real time to shave days of the order to cash cycle.

And when the pre-sales and merchandising workforce is armed with a fully-featured integrated mobile voice and data device that offers bar code scanning as well as image capture, they are empowered to collect and transmit the wealth of real-time information required to maximize promotional dollars and provide the business agility to respond instantly to competitive market moves.

Field Mobility

Application	Description	Benefits
Mobile Field Sales/ Pre-Sales	When sales people and delivery drivers are armed with a handheld computing device, a wealth of information is available to ensure the highest quality interaction with one of your most valuable assets — your customer. Real-time access to inventory and sales systems combines with signature capture capabilities, enabling sales personnel to check inventory, update an order and process an invoice — complete with returns and additions — on the spot. And access to complete customer history files provides needed information to support cross-sell and up-sell opportunities.	• Improves sales force utilization — the same workforce can now make more customer visits per day • Real-time invoicing reduces order-to-cash cycle times, improving profitability • Improves customer satisfaction and retention

Field Mobility (continued)

Application	Description	Benefits
Mobile Field Merchandising	Merchandisers in the Consumer Packaged Goods industry are responsible for regular visits to retail stores to record inventory levels, verify that product positioning on the shelf is according to the plan-a-gram, manage the execution of promotions and collect information on competitive products — from pricing to shelf space and inventory levels. This enterprise mobility handheld solution enables merchandisers to collect that information faster and more accurately, right at the point of activity — and transfer that information to your business systems immediately. The increase in productivity allows merchandisers to increase the value of the visit by collecting additional competitive information and spending more time with the store manager.	• Improves workforce utilization — the same number of merchandisers can now make more customer visits per day, effectively reducing the cost of the merchandising function • Increased sales • Increased business agility — maximize campaign revenue and respond more rapidly to competitive campaigns to preserve revenue • Stronger brand management • Better overall promotional campaign management • Maximizes promotional campaign return on investment (ROI)
Route Accounting/ Direct Store Delivery (DSD)	The Route Accounting and Direct Store Delivery (DSD) functions represent a substantial business investment, both in human resources (your drivers) and capital equipment (your vehicle fleet). Part delivery driver and part sales person, these hybrid workers are responsible for the execution of a wide range of business tasks in the truck as well as inside customer premises. It is this workforce that is the primary 'face' to the customer — their on-the-job efficiency and effectiveness directly affects the service levels your customers receive and perceive. A fully featured easy-to-carry integrated voice and data mobile computer can offer all the capabilities required to automate and streamline this diverse and complex business function. Bar code scanning can allow drivers to scan orders on and off the truck to ensure the right products are loaded at the beginning of the day, the right products are delivered at each stop — and forward traceability product data is captured to meet government regulations. A wireless WAN (WWAN) real-time connection to the office back office systems *...continued on next page*	• Real-time invoicing dramatically reduces the order-to-cash cycle, minimizing Days Sales Outstanding (DSO). • Cash flow is improved and inventory carrying costs are reduced, improving margins and profitability • Elimination of paperwork improves driver productivity — the same workforce can now make more stops, and drivers have more time to spend providing better service to customers • Improves vehicle utilization • Reduces fuel consumption

Field Mobility (continued)

Application	Description	Benefits
Route Accounting/ Direct Store Delivery (DSD)	*...continued from previous page* combined with the ability to scan returned product enables workers to process exceptions — returns and additions — in real time. Add signature capture and a mobile printer, and drivers can present an accurate electronic receipt for customer review as well as collect a signature for proof of delivery. Payment card processing on the mobile computer via a magnetic stripe reader allows drivers to collect payment in real time, complete with the ability to print a signed invoice. And since the WWAN connection instantly transmits all captured data back to the business systems, the high cost of paperwork is eliminated, as well as the errors inherent in paper-and-pen based procedures — drivers no longer need to manage paperwork, and administrators are no longer needed inside the four walls to enter the driver's paper trails into the computer.	
Mobile Fleet Management	Mobility provides the tools required to improve the management and utilization of your drivers and the vehicle fleet. Integrated GPS technology provides benefits for drivers and dispatch. Drivers enjoy the real-time navigation information required to ensure prompt arrival at the next destination — in spite of local traffic jams due to accidents and road construction. GPS also provides dispatch with the real-time location and historical route information required to create more efficient routing as well as enable dynamic routing throughout the day to cost-effectively meet customer service level expectations. In addition, telematics information provides real-time visibility into engine metrics. Fleet supervisors can now see and address adverse driving habits such as excessive speed, idling and braking, reducing fuel consumption as well as vehicle wear and tear. And visibility into engine fault codes enables the timely proactive maintenance required to help prevent a very high cost event — vehicle downtime.	• Enables the creation of highly efficient routes that minimize mileage, fuel costs and vehicle wear and tear • Reduces maintenance costs and extends vehicle lifecycle, improving both the return on investment (ROI) and total cost of ownership (TCO) for one of your largest capital investments — your vehicle fleet • Helps drivers to arrive on time every time, despite the constantly changing traffic conditions out on the road • Reduces vehicle wear and tear • Ensures timely maintenance to prevent vehicle downtime

Mobility in Management

Your managers are always on the move throughout the plant or traveling between office locations. Mobility ensures that, even though they may be on the go, these executives always have access to the business information and personal productivity tools required to act on the spot — keeping the enterprise agile and ensuring the rapid response times needed to keep the business up and running at peak efficiency.

Mobile Manager

Application	Description	Benefits
Mobile Manufacturing Manager	This solution allows access to critical business intelligence on a handheld computer, enabling executives and other management to leave their desks and go wherever they are needed — from the plant floor to the field — while still keeping the information required to make the best business decisions right at their fingertips.	• Better plant management — faster reaction to changing conditions
Mobile Manager Productivity	The integration of voice and data onto a single pocket-sized device allows managers and engineers to keep the tools they need to take care of business — right in the palms of their hands. No longer tethered to a desk, managers are now free to remain where they are most effective — out in the plant — yet still maintain visibility into Key Performance Indicators (KPIs), plant messages and alerts as well as access to email, forecasting and scheduling applications and more.	• More effective managers — managers can now handle more tasks throughout the workday

Mobility and Plant Communications

Different types of workers need different types of business and mission critical voice and data services. Some workers require mission critical basic walkie-talkie style voice communications to protect employee safety and enterprise security. Others require a business critical connection to voice and data to streamline processes and improve productivity as well as business agility. For example, some workers require rich voice connectivity equivalent to a mobile version of the deskphone — the ability to receive incoming calls from customers and other associates as well as the ability to place calls inside and outside the four walls plus access to PBX features, such as call forwarding and conferencing. And still others require both rich voice and rich data communications, the mobile equivalent of the deskphone as well as the desktop computer for access to critical back-end business applications as well as personal productivity tools such as email.

To meet these many needs today, most manufacturers have deployed multiple disparate networks — including:

- A wireless LAN to provide workers inside the four walls with wireless access to business and personal productivity applications
- A trunked radio system to support two-way radios
- WWAN push-to-talk leased airtime to enable walkie-talkie style group calls for non-mission critical workers
- A traditional wired phone line (PBX)
- Wired Ethernet networks to serve those workers who spend the day primarily at a desk

Not only must separate networks be maintained and managed, but the devices on the separate networks cannot 'talk' to each other, forcing many workers to carry multiple devices — for example, managers may need to carry a two-way radio to communicate with some workers, a cordless handset to communicate with others as well as a mobile computer of some sort to access mobile data. The result? Your workers are forced to act as the bridge between your networks, effectively acting as routers by carrying multiple types of devices. And the business incurs unnecessary high capital and operational costs associated with purchasing multiple devices per person; time personnel spends managing multiple devices; and time IT spends managing the many devices and networks.

Mobility can address this issue by enabling the delivery of all voice and data communications over a common backbone, eliminating the need to maintain multiple disparate networks — dramatically simplifying and reducing the cost of the technology architecture.

Plant Communications

Application	Description	Benefits
Unified Voice and Data Architecture	Mobility allows the consolidation of disparate backbones into a single system, enabling cross-communications between the many types of devices deployed in your business. The high cost associated with maintaining and managing multiple wholly independent networks is eliminated — and the need to provide workers with separate devices for voice and data is eliminated. Now, regardless of what type of voice and data communications different types of workers require, they can be delivered to a single device. Voice services can include one-to-one private calls, one-to-one and one-to-many push-to-talk (PTT) walkie-talkie style calls, Cellular (WAN) calls, as well as the extension of the deskphone and all PBX features to the mobile device. Data services can be as simple as text messaging or as complex as full access to back-end critical business applications. As a result, workers are no longer forced to act as network connection points — for example, a manager with a mobile computer or supervisor with a business smartphone can communicate directly with workers that carry two-way radios. And the enterprise retains the freedom to match the right device to the job — from two-way radios with or without integrated text messaging to improve worker safety, business smartphones for workers that need the mobile equivalent of the deskphone and basic data functions, as well as integrated handheld mobile computers for workers that require rich voice and data connectivity. With this new simplified technology architecture, all voice and data traffic and mobile devices are essentially on the same network. As a result, the enterprise now has full control over the quality of the services, able to ensure toll-quality voice and application performance regardless of device type. In addition, the simpler architecture also greatly improves the efficiency of your IT organization. The issues, time and cost associated with managing disparate IT systems and multiple devices per person are eliminated — from inefficient asset management and unbalanced server resources to high application development costs and the general slow movement of information throughout the organization.	• Increase in worker accessibility through both voice and data • Significant reduction in the complexity and cost of the voice and data architecture, including mobile devices and networks • Improves employee safety, security and productivity — voice services can be extended as needed throughout the enterprise to more types of workers, without cost or compromise • Significant reduction in WAN costs leveraging VOIP for in-plant communications

Mobility in Facilities Management

To keep your facilities secure, live video monitoring is critical. But hard-wiring cameras throughout your facility can be a major expense in expansive facilities, which can include indoor as well as outdoor areas. Wireless video cameras capable of operating on either Wi-Fi or private wireless broadband networks eliminate the need and cost associated with running cabling to each camera — making cost-effective video surveillance in large manufacturing plants a reality. And when that video can be viewed on a handheld mobile device, further efficiencies are gained and security is improved — your security officers are no longer tied to the control room to monitor video, and are able to make rounds yet keep an eye on the real-time video feeds from all your cameras.

Mobile Manager

Application	Description	Benefits
Mobile Security Monitoring	Wirelessly-enabled video cameras and a wireless broadband backhaul network allows manufacturers to easily and cost-effectively implement a high-speed wireless video surveillance solution. The need to run cables to each camera is eliminated — substantially reducing the cost of video surveillance in large manufacturing environments. And mesh-enabled wireless cameras and wireless broadband networks further simplify and reduce wireless infrastructure costs. In addition, a mobile solution also frees your video feeds from their present day tether to the control room, allowing your security officers the ability to continue to view video from any camera in any facility on a handheld mobile device while on the move. Dedicated personnel are no longer required in the control room, enabling a reduction in the security workforce — as well as an improvement in overall facility security. And a single fully-featured integrated voice and data handheld mobile device provides business or mission critical voice and data communications for your security personnel. In addition to the ability to view live video feeds, officers will enjoy comprehensive mobile voice capabilities, including push-to-talk, one-to-one and group calls, 4-digit extension dialing and more. And access to back-end data applications enables officers with the ability to scan and verify an employee badge or, with a biometrics attachment, take a fingerprint to ensure identification in high-security environments.	• Enables cost-effective real-time video surveillance of expansive facilities or campuses • Increases facility security • Improves effectiveness of security officers, who can now continually patrol facility grounds without losing the ability to monitor live video • Reduces security officer staffing requirements — eliminates the need for around the clock staffing of the control room in addition to patrol staff • Eliminates the need to provide security officers with separate voice and data devices, substantially reducing the costs associated with purchasing, managing and maintaining mobile devices and accessories (such as batteries and chargers)

Case Study: Field Mobility

Solution category:	Field Mobility
Application:	Route Accounting/ Direct Store Delivery
Industry:	Consumer Packaged Goods/Food & Beverage
Company:	Major worldwide beverage manufacturer

Business Issue

Eliminate inefficiencies in the invoicing function — and resulting impact on profitability

Two major issues in the distribution operation of a worldwide food and beverage manufacturer were impacting profitability, both in the direct store delivery (DSD) function. Food safety laws require the ability to trace product from shipping dock to the customer door to support product recalls — the manual process in place was error-prone and reduced driver productivity. In addition, the manual processes were too slow — information on changes and errors in customer deliveries did not reach the company's invoicing system in time to issue a correct invoice the first time. Not only was the general productivity of the accounting department affected, but the delay in proper invoicing also resulted in a delay of customer payments — and an increase in DSO (days sales outstanding). The company was searching for the best way to eliminate the inefficiencies of the manual data capture process.

The before scenario:
Over 20,000 drivers making an average of ten deliveries per day utilized a manual system — a clipboard, paper and pen — to complete delivery paperwork at the customer site. When the driver returned at the end of the delivery day, the paperwork was placed in the data entry bin along with paperwork from hundreds of other drivers, waiting for entry into the company's invoicing system. Exceptions to the original order — either errors in the order from improper packing at the warehouse, or changes the customer made at the time of delivery (such as a change in quantity and/or flavor) — were finally available in the company's invoicing system. By the time the order changes were noted in the system, the customer's invoice had already been issued. The invoice discrepancies and the time required to update and send corrected invoices translated into late customer payments. The DSO increased — with a negative impact on the company's cash flow.

Solution

Automated real-time capture of delivery data

The after scenario:
All drivers now carry a mobile computer equipped with bar code scanning capability, and wireless wide area network (WWAN) and wireless local area network (WLAN) connectivity. Now, product is scanned at the time of delivery, addressing both of the company's key issues. Discrepancies in the original order are immediately recorded, including additions the customer made at the time of delivery as well as warehouse errors. In addition, the same information provides the company with an accurate record of the end product location for regulatory compliance in the event of a product recall. Mobile devices within range of a WWAN instantly transmit the data to the company's invoicing system. Any data residing in the mobile computer when drivers returned at the end of the day (if, for example, drivers traveled outside the range of the WWAN during the day) is automatically uploaded to the company's invoicing system as soon as the device connects to the company's WLAN.

Benefits

Real-time automated data capture dramatically increased the productivity of the DSD function. With over 20,000 drivers, the productivity increase had a major impact on overall profitability. Benefits included:

- **15% decrease in DSO.** The availability of real-time data for accurate and timely invoicing streamlined the invoicing process, resulting in a 15% decrease in DSO — from 45 to 39 days.
- **Regulatory compliance for traceability.** Now that the bar codes of delivered product are scanned and the lot numbers are captured, the company is prepared for quick and easy traceability of the product right to the customer in the event of a recall.
- **10% increase in driver productivity.** The elimination of manual paperwork increased driver productivity. Each driver now can make a minimum of one additional stop per day, maximizing the company's existing workforce.
- **9% increase in sales.** Since drivers frequently sell additional product beyond the order at delivery time, the additional stop per day provided an increase in sales opportunities — and a 9% increase in actual sales.
- **15% increased productivity of administrative staff.** The elimination of the need to manually key in the information into the computer dramatically increased the productivity of the administrative staff, freeing staff up to spend more time on more critical business activities. The existing workforce is again maximized.
- **Six Sigma data capture.** The delivery process now achieves Six Sigma data capture due to the elimination of errors inherent with manual processes. Eradicating the redundant manual procedures removed two opportunities where data errors could occur: the manual completion of a paper form by the driver, and the entry in the computer by a data entry operator.

Case Study: Plant Operations

Solution category:	Plant Operations
Application:	Mobile HMI/SCADA and Machine Monitoring
Industry:	Consumer Packaged Goods/Food & Beverage
Company:	Major European food manufacturer

Business Issue

Eliminate regulatory compliance impact on productivity and profitability

European Union laws state that a consumer should receive products exactly as they are advertised. In order to ensure compliance, package weight must be exactly as stated on the package label, or higher. In order to maintain the exact weight throughout the manufacturing process, the company needed real-time visibility of the manufacturing execution system (MES) layer data and key performance indicators (KPIs) — impossible with the manual paper-based system that was deployed on the plant floor. In order to ensure adequate package weight, the company was forced to set the target weight higher than the stated weight. The resulting giveaway (amount exceeding specifications) was measured in thousands of pounds of raw material, negatively impacting profitability. In addition, the paper-based system was generally inefficient and error-prone, reducing employee productivity.

The before scenario:
Some of the MES layer data related to quality and process management as well as quality analysis was manually collected on the plant floor using a paper-based system, and entered into the computer at a later time. The resulting one-day time lag between when data was collected and when it was visible made it impossible to dependably manage the manufacturing process to meet stringent regulatory requirements, resulting in giveaway. Additional data required to prove compliance was also captured manually with paper and pen, further reducing productivity.

Solution

Real-time capture of MES layer data and remote SCADA visualization

The after scenario:
Plant floor employees now capture MES layer data in real time via mobile computers. The data is then transmitted instantly via a wireless LAN connection to the company's business system,

enabling real-time measurement and reporting of KPIs. The company's SCADA application has also been extended to a mobile computer, enabling SCADA visualization when away from the desk. As a result, production engineers now have the process information necessary to monitor the plant systems while actually on the plant floor. The real-time data provides the information to make instant decisions to maintain throughput and quality. Product weight is measured on the line every 15 minutes to ensure target weight is met — but not exceeded. And the ability to remain on the plant floor allows production engineers to watch the affect of any changes in real time.

Benefits

As a result of mobilizing plant data, this major manufacturer has dramatically increased plant employee productivity, nearly eliminated giveaway, and reduced the cost of meeting regulatory compliance. Benefits include:

- **Elimination of $35,000/day in giveaway.** Armed with the data to control the manufacturing process in real time, the company was able to minimize giveaway by $17,500 for each of the two daily shifts.
- **Dramatic 18% staff productivity increase.** Over 400 plant floor processes were automated – from MES data collection to regulatory compliance paperwork. The elimination of the time spent completing forms and entering the data into the computer not only increased productivity, but also reduced the errors inherent in manual data collection.
- **Cost-effective regulatory compliance.** The cost of the processes required to meet regulatory compliance was greatly reduced, due to the automatic capture of data. In addition, the storage of all QA (quality assurance) data as well as Hazard Analysis and Critical Control Point (HACCP) information ensures that the company is ready in the event of an audit.
- **4-month rapid return on investment (ROI).** The major savings in giveaway coupled with the staff productivity increase provided a very rapid return on investment in just 4 months.

Case Study: Quality

Solution category:	Quality
Application:	Mobile Forms
Industry:	Consumer Packaged Goods/Food & Beverage
Company:	US-based Food Processor

Business Issue

Reduce the inefficiencies and inaccuracies in the quality and compliance processes

In the Food & Beverage industry, internal quality process and government regulations require end-to-end traceability for all ingredients — from incoming raw materials to the final batch of processed food product. When materials arrive at the receiving dock, an enormous amount of data must be captured to prevent the introduction of any materials that have not been validated and tested into products. Materials must be inspected, and that inspection must be fully documented to ensure that the right procedures were executed properly and completed. Paper-based processes were utilized to initially collect the data, which was subsequently entered into the computer. The company sought to eliminate a number of issues associated with the paper-and-pen based data collection. There were unacceptable levels of data inaccuracies. In addition, the lag time between when the data was collected and when it was available in the business systems resulted in the slow movement of materials from the dock to the warehouse shelves, affecting the speed of the supply chain. Production cycle times were reduced. Product delivery times were impacted. And false out of stocks resulted in unplanned downtime on the production line — a very costly event — when in reality, the needed materials were sitting in quarantine on the receiving dock waiting for inspection.

The before scenario:
Incoming materials were noted as received and entered into the company's Enterprise Resource Planning (ERP)/Manufacturing Resource Planning (MRP) system. Then, the information on the paperwork that accompanied the materials was entered into the computer — including origination source and contents. The material was then moved to a holding area where samples were collected for compliance testing against specific parameters. After samples were collected, the materials were physically moved into the quarantine area until test results were complete.

Any materials that were out of specification were returned to the supplier. Validated materials were labeled with a bar code and moved to a production area waiting for disposition to support production orders. The slow movement of inspection status information resulted in several costly mistakes. Newer materials were sometimes moved out of quarantine before older materials, resulting in a 10 percent loss of inventory due to the perishable nature of the materials. And unqualified material was sometimes inadvertently delivered to the product line, resulting in the high cost of searching through paper files to locate all products that utilized that specific batch of materials and issuing recall notices — not to mention the impact on brand, including consumer and distributor confidence levels.

Solution

Real-time quality assurance and traceability

The after scenario:
Now, all suppliers place a bar code on all raw food materials that are shipped to this food processor. At the receiving dock, a worker scans the bar code with a mobile handheld computer, automatically: populating the right form with the supplier information, expiration date and more; registering the material into quarantine; and scheduling the material for testing. At test time, Quality inspectors armed with a mobile computer scan pre-labeled sample containers as well as the bar code label on the material and enter results from individual testing procedures on the mobile device. Since status information is now available in real time, a simple scan of the material provides immediate validation that testing has been completed and the results of that test. Approved material is quickly and efficiently directed to the appropriate warehouse to support production; materials that did not meet specifications are staged for return shipment to the supplier; and the risk of inadvertent use of substandard materials is eliminated.

In addition, the material is easily tracked in real-time as it moves through the production process, into finished goods and on to the customer. The result is a real-time traceability record for all materials, ensuring compliance with regulatory requirements and enabling a faster cost-effective response to any potential issues related to the quality of the product.

To further improve the quality function, the company is presently evaluating RFID and wireless LAN locationing technology to enable real-time material location without any human intervention.

Benefits

Mobility delivers substantial benefits for this food processor:

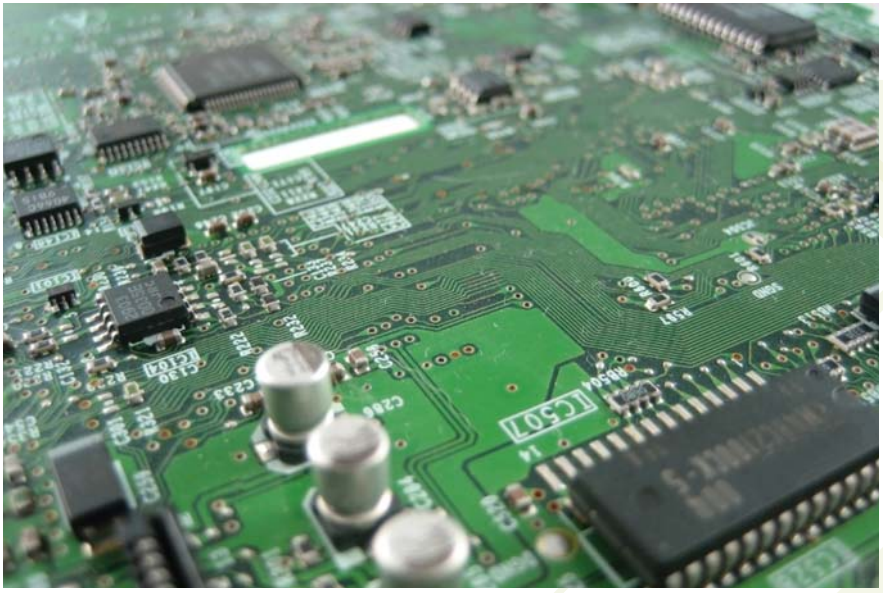
- **100% reduction in the use of non-validated materials.** The ability to simply scan a bar code label to retrieve real time status completely error-proofed the movement of material into the production process.

...continued on next page

- **80% reduction in waste due to spoilage of perishable materials.** First-in first-out management of materials did not factor in expiration dates, resulting in high losses associated with the spoilage of raw materials. But real-time visibility into expiration dates allowed proper prioritization of material handling, ensuring that materials with the shortest shelf life received priority processing.
- **20% improvement in warehouse and quality technician productivity.** Technicians spent more than 40% of their time searching for specific batches of material to collect samples or apply disposition. Real-time information enabled the creation of grid locations by status — the time spent simply finding material was cut in half, allowing the same number of workers to process more material per day.
- **A dramatic reduction in the number and cost of product recalls.** Since mobility completely prevented the use of non-validated materials in products, the number of product recalls was reduced to nearly zero — along with the associated operational costs and brand impact.
- **Substantial reduction in compliance costs.** The automatic collection of data allowed the capture of compliance information in seconds. The need to write information on a form and then enter that data into the computer was completely eliminated, dramatically reducing the cost of compliance.
- **Improvement in product delivery times.** Mobility improved the accuracy and speed of the movement of materials from the receiving dock to the production line, increasing the overall velocity of the supply chain.

High Tech

Mobility in the High Tech Industry



Industry challenges

In the high tech industry, margins and profitability are constantly threatened. Specific issues include heavy competition with offshore manufacturers, a high level of product commoditization, shorter product life cycles, and a trend towards customization. For example, today's customers want to specify what is inside the computer they purchase — from the amount of memory to the graphics card and size of the hard drive — instead of purchasing the computer in stock at a local distributor. Large orders are replaced with smaller, more frequent orders — or in the case of some computer manufacturers, even build to order. The production line must be able to accommodate a high level of customization, while maintaining quality and productivity levels.

At the same time, to help address ever-thinning margins, component manufacturing is being outsourced to overseas manufacturers. The resulting globalization of the supply chain presents another issue — quality. The high tech manufacturer may achieve substantial savings through offshore manufacturing of components, but without the controls in place to maintain quality, customer loyalty and retention as well as brand equity are threatened. Product defects in a world where there is plenty of competition can quickly translate into lost customers, lost sales — and lost profitability.

How mobility can help

To help achieve these goals, high tech manufacturers must strive to strip every inefficiency and every wasted moment out of the manufacturing process — the goal of the industry's leading best-practice, lean manufacturing. Widely adopted by many manufacturers, lean manufacturing is the practice of systematically and continually identifying and eliminating inefficiencies — including errors — in seven specific areas of waste identified in Figure 1.

The leaner a manufacturer can become, the more streamlined operations become, improving the ability to meet customer needs — as well as meet the profitability requirements of the business.

High tech manufacturers can achieve a higher 'lean score' throughout operations with mobility. With mobile voice and data in hand, employees can perform virtually any task, right at the point of activity — regardless of whether they are responsible for production, quality, materials management, asset maintenance or sales, and whether they are task workers or supervisors. The result is a major improvement in efficiency throughout operations. Through the power of mobility, high tech manufacturers can do more with less — less inventory, less time, less space and less people, while improving the accuracy and speed of throughput — all without additional human resources.

Figure 1.
The seven wastes of manufacturing

Waste	Issue	Result
Over production	• Poor demand information due to the lag time between when data is collected versus when it is available • Improperly sized KanBan	• High inventory costs • High storage costs
Waiting	• Poor plant scheduling • Plant shortages • Machine maintenance issues	• Increase in labor costs • High asset costs
Transportation	• Improper plant layout and design • Time wasted locating materials and tools	• Increase in labor costs • Decrease in productivity and throughput
Inappropriate processing	• Poor communications throughout and between facilities • Manually generated reports	• Lack of appropriate data for the best strategic decision making • Decrease in supervisor productivity
Unnecessary motion	• Redundant data collection and maintenance: paper-based processes • Need to analyze and manually re-calculate data to create reports and obtain needed information	• Reduced worker productivity • Delayed visibility into operations for better decision-making
Defects/poor quality	• Errors on the production line • Missing parts • Late shipments and excessive lead times	• Excessive re-work, increasing costs and reducing product margins
Unnecessary inventory	• Excess ordering and larger buffer stocks due to the lag time between when data is collected versus when it is visible • Improperly sized KanBan	• High costs associated with carrying unnecessary inventory — including increased capital expense and warehousing space

The charts on the following pages illustrate the many mobility applications that today's high tech manufacturers have implemented to achieve record levels of throughput and quality — and a distinct business advantage.

High Tech Mobility Applications

Mobility in Materials Management

The warehouse is a central area of the business through which all raw materials and finished goods pass. The poorly managed warehouse can actually become cost prohibitive, significantly impacting the cost of doing business — and general profitability. Mobility greatly improves warehouse management processes by eliminating paper-based processes throughout the warehouse and providing management with a real-time window into inventory. Paper forms are replaced with real-time forms on mobile computers; a quick scan of a bar code, direct part mark or RFID tag enables workers to validate that the right parts are being picked from the shelves and delivered to the appropriate area of the assembly line at the right time, and that the right product is picked to fulfill an order. In addition, RFID provides automatic tracking of materials without the time and cost of human intervention. And voice can also be utilized to help streamline and error-proof warehouse processes with voice-directed picking applications. Through mobility, the real-time warehouse becomes a reality: the right data is available in the right place at the right time to enable the most efficient next action — and the most effective business decisions. And real-time inventory visibility provides the data required to drive down stocking inventory requirements and inventory carrying costs. Mobile materials management applications include:

Materials Management

Application	Description	Benefits
Warehouse Mobility	Warehouse mobility provides a real-time view of your inventory through the capture and availability of real-time data associated with your warehouse processes. In addition to enabling dynamic scheduling of picking, cross-docking and packing, knowing exactly what is in stock at any time significantly reduces: out of stocks; stocking inventory requirements and warehouse space requirements.	• Improves warehouse efficiency — fewer workers can handle more tasks • Enables the error-free warehouse by eliminating mistakes in activities such as put-away, letdown and replenishment • Reduces inventory costs by reducing stocking levels • Decreases the volume and cost of warehouse space

Materials Management (continued)

Application	Description	Benefits
Material Tracking	Material tracking applications enable complete traceability of batch parts at any point in the manufacturing process, or after delivery to the customer. In the event that a particular batch of parts is found to be faulty, material tracking ensures fast and efficient recalls — without potentially brand-damaging media coverage. Brand equity is protected, the recall is handled in the most time and cost-efficient manner possible, and the risk of recalling too much product and leaving shelves potentially empty is eliminated.	• Enables highly efficient and accurate material tracking • Reduces the cost of material tracking activities • Provides real-time visibility to support just-in-time (JIT) inventory initiatives
Raw Material Sequencing	Raw material sequencing utilizes mobile data collection to automate and error-proof the process of bringing materials to the production line in the correct order. This enterprise mobility application is especially valuable in today's manufacturing environment, where a single line is utilized to assemble different products. Ensuring that materials arrive line side in the correct sequence increases the speed and accuracy of assembly, and helps prevent expensive re-work for incorrectly assembled products.	• Improves the efficiency and accuracy of sequencing activities • Ensures accurate assembly — and product quality • Protects against unplanned downtime on the assembly line due to lack of materials
Vendor Managed Inventory (VMI)	This enterprise mobility solution supports the cost-effective implementation of VMI, a major cost-cutting initiative that requires vendors to maintain ownership of their material until the final point of assembly, as well as responsibility for placing the order, quality and availability. Parts are scanned and identified as they travel from the receiving dock to the assembly station, providing the ability to verify that material was received, utilized, inspected and charged at the point of use. As a result, capital expenditures for stocking inventory are dramatically reduced and the speed of the cash-to-cash cycle is greatly increased, improving cash flow as well as profitability.	• Enables rapid and cost-effective implementation of VMI solutions • Reduces capital expenditures and carrying costs associated with inventory • Improves cash flow and bottom line profitability

Mobility on the Shop Floor

At the heart of every manufacturing operation is the shop floor. With mobility on the shop floor, you have the power to: monitor your plant equipment in real time; prevent errors on the assembly line; enable business critical applications to meet market demand, such as line sequencing; and truly track that one elusive variable — the cost of your labor. As a result: throughput is protected, machine downtime is minimized and control over yield is increased, providing the assurance that the right product is manufactured the right way at the right time — and you gain a better understanding of labor costs to protect margins and overall profitability. Mobile shop floor applications include:

Shop Floor

Application	Description	Benefits
Mobile HMI/ SCADA	Visual Supervisory Control and Data Acquisition (SCADA) is traditionally only available for viewing in a central control room, requiring an area to be closed down for health and safety reasons whenever work is required line side. Mobile SCADA expands control and monitoring capabilities beyond the control room. Alarm assessment, repair, and random inspection of equipment can be accomplished anywhere, including line side without closing an area, as personnel can continue to view visual SCADA data when away from the control room.	• Improves line-side uptime • Increases workforce productivity
Machine Monitoring	The Manufacturing Execution System (MES) system is used to monitor plant usage, throughputs and efficiency to highlight bottlenecks, under-utilization and variances from pre-defined standards. However, any MES data captured by paper on the shop floor and then entered into data systems results in a time delay that can provide incorrect reporting — which in turn can have a major effect on yield. Automating the capture of data that cannot be acquired through machine technology ensures that accurate real-time key performance indicators (KPIs) are produced.	• Improves the efficiency and effectiveness of the machine monitoring process • Helps prevent the manufacture of non-standard product
Mobile Automation	Applying mobility to enable remote monitoring and maintenance of automation systems, such as Programmable Logic Controllers, enables more efficient use of expensive technicians.	• Improves staff utilization • Improves response times to conditions

Shop Floor (continued)

Application	Description	Benefits
Error Proofing	Error proofing solutions utilize mobile technology and data collection systems at each assembly station to ensure that operators use the correct parts, and have completed a manufacturing step correctly. Defects in the assembly process are eliminated, as well as the associated costly re-work.	• Eliminates inaccuracies in product assembly
Shop Floor/ Line Sequencing	Mobile data collection technology enables and automates the validation of sequence and the production count, ensuring that the correct parts are in the correct order and enabling faster assembly times.	• Eliminates inaccuracies in product assembly • Increases throughput
Mobile Lean (eKanBan)	A key concept in lean manufacturing, this line side application enables operators to press a call button located at their workstation, sending a wireless signal directly to a forklift operator in the warehouse when more material is required. The forklift operator in turn receives the request on a mobile device, along with the exact location of the parts needed. Parts are replenished as efficiently as possible. The time, expense and errors of a paper-based system are eliminated. The drop in productivity experienced in systems when the call buttons are centrally located throughout the factory (requiring operators to leave their station to press the call button) is also eliminated. In addition, eKanBan does not require expensive wiring, can be implemented easily and inexpensively — and can be easily relocated whenever the line is re-worked. This single application can cut response time by 90% and eliminate 30% of line side inventory.	• Improves the efficiency of line-side replenishment by as much as 90% • Eliminates up to 30% of line-side inventory • Eliminates expensive wiring to initially deploy or relocate call buttons • Improves business agility — reduces cost to re-work production lines
Mobile Labor Cost Tracking	Labor costs represent one of the largest variables in the cost of your products and accurate labor tracking is critical to ensuring and protecting profitability. Yet to date, most high tech manufacturers use standard cost estimates instead of actual costs to calculate labor costs and establish product pricing. But by mobilizing the existing Time and Attendance (T&A) system, manufacturers have the ability to track actual time-on-task at a granular level. Now, a single set of labor cost data populates both the T&A and ERP systems, enabling the true reconciliation of production hours with job costing and payroll. And the ability to track time-on-task enables managers to spot and eliminate unproductive activities, leading to better utilization of the workforce.	• Ensures accurate product pricing • Enables more competitive pricing • Protects profitability • Substantial reduction in time required to reconcile actual hours worked, estimated hours worked and payroll • Improves productivity for managers and administrative staff

Mobility in Enterprise Asset Management (EAM)

In high tech manufacturing, managing and maintaining the equipment on the shop floor is critical. In addition, inaccuracies in inventory can translate into non-compliance with government regulations, translating into fines or excessive tax payments. And downtime on the production line — scheduled or unscheduled — is costly: from the cost of workers waiting on the assembly line to lost sales due to lack of product. Mobile computing, wireless LAN and RFID locationing technologies allow high tech manufacturers to streamline all enterprise asset management functions. By stripping the inefficiencies out of your maintenance function, mobility can help ensure that the critical equipment out on the shop floor is serviced on time, with the right maintenance routines, performed correctly, complete with a comprehensive audit trail. And the ability to rapidly and accurately inventory assets out on the production floor — even without human intervention — can eliminate physical inventory processes, like cycle counting, freeing workers to handle other more business-crucial tasks. Mobile EAM applications include:

Enterprise Asset Management

Application	Description	Benefits
Mobile Asset Tracking	When locationing technologies or bar code scanning are deployed to count and track assets, errors and the high costs associated with manual inventory counts are eliminated. Workers can quickly and easily scan the bar codes or direct part marks on equipment with a handheld mobile computer, utilize a mobile RFID reader on a cart to quickly read all the RFID tags in a given area (such as a warehouse), or leverage wireless LAN or fixed RFID locationing technologies to constantly and automatically maintain inventory counts and even the actual location of an asset — all without any worker involvement.	• Improves efficiency of the inventory process — as well as worker productivity • Enables cost-effective compliance with government accounting regulations • Improves tool utilization, reducing tool inventory and management costs • Protects against loss or theft of assets • Ensures proper tax treatment of assets • Protects against financial penalties due to non-compliance

Enterprise Asset Management (continued)

Application	Description	Benefits
Mobile Asset Maintenance	Your machinery is your most important asset — proper maintenance is critical in order to achieve maximum uptime. Mobile asset maintenance ensures proper and timely scheduling of maintenance, provides maintenance history for machines to ensure the right maintenance routines are performed, and assigns the right tools and parts required for daily scheduled maintenance. In addition, if the manufacturing execution system (MES) or SCADA reveals a potential equipment problem, the system can dynamically schedule that piece of machinery for immediate service. And 2-way voice communications between plant and maintenance personnel can enable real-time responses to equipment challenges. As a result, machinery is always serviced at the right time, and your maintenance department is cost-efficient and effective.	• Improves uptime, protecting productivity and yield • Eliminates inefficiencies in the maintenance process • Ensures more timely maintenance — engineers can now service more equipment per day • Potential machinery problems can be addressed as they surface, before impacting production

Mobility helps ensure that critical equipment on the production line is serviced on time, every time — protecting uptime and profitability.

Mobility in Quality

In order to meet the needs of your distribution channel and the demands of your customers, you now need to manufacture product — and custom products — at record speed. In addition, the globalization of the supply chain adds a level of complexity to quality control — parts are now arriving from all over the world. In the event a defective batch of parts is discovered, you need to be able to locate and remove all of those parts from your manufacturing chain — regardless of whether parts are in boxes on the shelves in your warehouse, in the KanBans on the assembly line, in work-in-process, on the shelves in your distribution chain, or even in the finished products in the businesses and homes of your customers. Without that traceability, defective parts can enter the production process, rippling into huge costs in the form of re-work. And the inability to cost-effectively remove or recall defective product from your supply chain can damage your brand equity — and erode your customer base.

As a result, the quality function becomes even more critical. In order to maintain quality standards without adding costs, the efficiency of the quality function must be improved. Just as there are seven wastes in lean manufacturing, there may be seven hidden wastes in your quality function — and mobility can help you address every one:

1. Manual 'double-touch' of data: gathering information via handwritten forms which must then be entered into the computer at a later date
2. Manual research due to lack of real-time data
3. Manual consolidation of information from different sources for reporting and trend analysis — for example, data resident in computer applications and also on spreadsheets, databases and contact lists on individual computers
4. Lack of access to, or time spent traveling to and from computers and other resources to monitor processes or take required actions
5. Managing data errors — identifying, researching and correcting erroneous information
6. Heavy staffing requirements due to time intensive manual procedures
7. Lack of centralized data repository translates into the need for large amounts of email and high volumes of meetings to obtain data

In addition, the growing trend towards outsourcing adds a level of complexity to the management of this crucial function. But the ability to put a mobile device running your quality applications in the hands of your vendors provides a number of major benefits. The manufacturer can ensure that the vendor follows the established quality processes; those processes are automated and streamlined, improving vendor productivity and reducing errors; and the instant transmission of information into your business systems ensures the real-time visibility required to protect not only the effectiveness of your quality function — but also the quality of your product.

Mobile quality applications include:

Quality

Application	Description	Benefits
Mobile Forms	Quality engineers can manage up to 200 different forms, including forms for submission for government regulations, such as ISO 9000, or to comply with customer demands. Forms are often backfilled at the end of a shift rather than in real time as required. Mobility greatly simplifies the management of these forms, ensuring timely completion, providing time/date/operator stamps if desired, and dramatically increasing the productivity of your quality engineers.	• Eliminates the time and errors associated with double data entry • Provides visibility into real-time quality data
Real-Time SPC (statistical process control)	SPC programs are critical in determining the root cause of an increase or decline in yield, and how to address it. There are several key issues with today's SPC programs. The first is the 'data gap' created by the small amount of data (typically 20% to 30%) that cannot be collected automatically. This forces the need for manual collection of this data, and introduces the possibility of errors as well as a time lag between when the data is collected and when it is available to view. In addition, data used for final analysis is often up to three weeks old (and in some cases, up to one full quarter old). Mobility enables the real-time automated capture and instant transmission of this data into the SPC system, ensuring that your business decisions are based on an accurate real-time view of your global processes.	• Ensures proper yield • Eliminates need for additional warehouse space to store overages • Ensures product is completed on time
Six Sigma Data Capture	Six Sigma requires timely and accurate collection of data. Manual data collection processes (such as pen and paper or computer keyboard data entry) achieve approximately Two Sigma. A handheld mobile computer eliminates manual data collection, enabling the automatic and instant capture of the information in a bar code, Direct Part Mark (DPM) or RFID tag right at the point of activity, increasing worker productivity, overall operational efficiency — and often delivering better than Six Sigma.	• Dramatically reduces the time and cost associated with achieving a Six Sigma level of quality
Track and Trace	Mobile technology enables fast and cost-efficient tracking of all activities relating to the assembly of a product. The resulting product 'genealogy' contains accurate real serial numbers for all parts, enabling all products containing a specific batch of parts to be recalled quickly, efficiently and quietly — regardless of where they are located in the supply chain, and without broad and highly visible media assistance. Brand equity is protected, the risk of recalling too much product is eliminated, customer loyalty is protected — and the threat of lost revenue is reduced.	• Dramatically reduces the time and cost associated with track and trace capabilities

Mobility in the Field

Field sales and field service teams are the primary interface with your customers. With mobility, you can provide these valuable workers with seamless access to all the tools that are in the office — right in the field. Whether involved in sales or service activities, your collective field workforce is empowered to provide the best possible interaction in the least amount of time, improving the customer experience — as well as retention and loyalty.

Field Mobility

Application	Description	Benefits
Mobile Field Sales	When sales people and delivery drivers are armed with a handheld computing device, a wealth of information is available to ensure the highest quality interaction with one of your most valuable assets — your customer. This valuable enterprise mobility application provides a wealth of benefits. Real-time access to inventory and sales systems combines with signature capture capabilities, enabling sales personnel to check inventory, place an order and process an invoice on the spot. And access to complete customer history files provides needed information to support cross-sell and up-sell opportunities.	• More effective sales calls • Improves sales force utilization — the same salesforce can now make more customer visits per day • Improves customer satisfaction and retention • Reduces order-to-cash cycle times, improving profitability

Real-time access to inventory and sales systems enables your salesforce to provide the highest quality interaction with your customers.

Field Mobility (continued)

Application	Description	Benefits
Mobile Field Service	Your field service technicians often spend more time in front of customers than your sales force. This valuable enterprise mobility application allows that 'face time' with the customer to be maximized by providing a wealth of information to the technician on a handheld computer — such as appropriate after market products to promote, and service agreement information to ensure the right level of service is provided — and that services not covered under contract are billed. In addition, the ability to enter information enables the capture of critical customer and competitive information.	• Improves workforce utilization — the same number of service technicians can now make more customer visits per day • Improves customer service, satisfaction and loyalty • Increases sales • Improves vehicle utilization • Reduces fuel consumption • Reduces vehicle wear and tear
Mobile Fleet Management	Mobility provides the tools required to improve the management and utilization of your drivers and the vehicle fleet. Integrated GPS technology provides benefits for drivers and dispatch. Drivers enjoy the real-time navigation information required to ensure prompt arrival at the next destination — in spite of local traffic jams due to accidents and road construction. GPS also provides dispatch with the real-time location and historical route information required to create more efficient routing as well as enable dynamic routing throughout the day to cost-effectively meet customer service level expectations. In addition, telematics information provides real-time visibility into engine metrics. Fleet supervisors can now see and address adverse driving habits such as excessive speed, idling and braking, reducing fuel consumption as well as vehicle wear and tear. And visibility into engine fault codes enables the timely proactive maintenance required to help prevent a very high cost event — vehicle downtime.	• Enables the creation of highly efficient routes that minimize mileage, fuel costs and vehicle wear and team • Reduces maintenance costs and extends vehicle lifecycle, improving both the return on investment (ROI) and total cost of ownership (TCO) for one of your largest capital investments — your vehicle fleet • Helps drivers to arrive on time every time, despite the constantly changing traffic conditions out on the road

Mobility in Management

Your managers are always on the move throughout the plant or traveling between office locations. Mobility ensures that, even though they may be on the go, managers always have access to the business information and personal productivity tools required to act on the spot — keeping the enterprise agile and ensuring the rapid response times needed to keep the business up and running at peak efficiency.

Mobile Manager

Application	Description	Benefits
Mobile Manufacturing Manager	This solution allows access to critical business intelligence on a handheld computer, enabling executives and other management to leave their desks and go wherever they are needed — from the plant floor to the field — while still keeping the information required to make the best business decisions right at their fingertips.	• Better plant management — faster reaction to changing conditions
Mobile Manager Productivity	The integration of voice and data onto a single pocket-sized device allows managers and engineers to keep the tools they need to take care of business — right in the palms of their hands. No longer tethered to a desk, managers are now free to remain where they are most effective — out in the plant — yet still maintain visibility into Key Performance Indicators (KPIs), plant messages and alerts as well as access to email, forecasting, scheduling applications and more.	• More effective managers — managers can now handle more tasks throughout the workday

Mobility and Plant Communications

Different types of workers need different types of business and mission critical voice and data services. Some workers require mission critical basic walkie-talkie style voice communications to protect employee safety and enterprise security. Others require a business critical connection to voice and data to streamline processes and improve productivity as well as business agility. For example, some workers require rich voice connectivity equivalent to a mobile version of the deskphone — the ability to receive incoming calls from customers and other associates as well as the ability to place calls inside and outside the four walls plus access to PBX features, such as call forwarding and conferencing. And still others require both rich voice and rich data communications, the mobile equivalent of the deskphone as well as the desktop computer for access to critical back-end business applications as well as personal productivity tools such as email.

To meet these many needs today, most manufacturers have deployed multiple disparate networks — including:

- A wireless LAN to provide workers inside the four walls with wireless access to business and personal productivity applications
- A trunked radio system to support two-way radios
- WWAN push-to-talk leased airtime to enable walkie-talkie style group calls for non-mission critical workers
- A traditional wired phone line (PBX)
- Wired Ethernet networks to serve those workers who spend the day primarily at a desk

Not only must separate networks be maintained and managed, but the devices on the separate networks cannot 'talk' to each other, forcing many workers to carry multiple devices — for example, managers may need to carry a two-way radio to communicate with some workers, a cordless handset to communicate with others as well as a mobile computer of some sort to access mobile data. The result? Your workers are forced to act as the bridge between your networks, effectively acting as routers by carrying multiple types of devices. And the business incurs unnecessary high capital and operational costs associated with purchasing multiple devices per person; time personnel spends managing multiple devices; and time IT spends managing the many devices and networks.

Mobility can address this issue by enabling the delivery of all voice and data communications over a common backbone, eliminating the need to maintain multiple disparate networks — dramatically simplifying and reducing the cost of the technology architecture.

Plant Communications

Application	Description	Benefits
Unified Voice and Data Architecture	Mobility allows the consolidation of disparate backbones into a single system, enabling cross-communications between the many types of devices deployed in your business. The high cost associated with maintaining and managing multiple wholly independent networks is eliminated — and the need to provide workers with separate devices for voice and data is eliminated. Now, regardless of what type of voice and data communications different types of workers require, they can be delivered to a single device. Voice services can include one-to-one private calls, one-to-one and one-to-many push-to-talk (PTT) walkie-talkie style calls, Cellular (WAN) calls, as well as the extension of the deskphone and all PBX features to the mobile device. Data services can be as simple as text messaging or as complex as full access to back-end critical business applications. As a result, workers are no longer forced to act as network connection points — for example, a manager with a mobile computer or supervisor with a business smartphone can communicate directly with workers that carry two-way radios. And the enterprise retains the freedom to match the right device to the job — from two-way radios with or without integrated text messaging to improve worker safety, business smartphones for workers that need the mobile equivalent of the deskphone and basic data functions, as well as integrated handheld mobile computers for workers that require rich voice and data connectivity. With this new simplified technology architecture, all voice and data traffic and mobile devices are essentially on the same network. As a result, the enterprise now has full control over the quality of the services, able to ensure toll-quality voice and application performance regardless of device type. In addition, the simpler architecture also greatly improves the efficiency of your IT organization. The issues, time and cost associated with managing disparate IT systems and multiple devices per person are eliminated — from inefficient asset management and unbalanced server resources to high application development costs and the general slow movement of information throughout the organization.	• Increase in worker accessibility through both voice and data • Significant reduction in the complexity and cost of the voice and data architecture, including mobile devices and networks • Improves employee safety, security and productivity — voice services can be extended as needed throughout the enterprise to more types of workers, without cost or compromise • Significant reduction in WAN costs leveraging VOIP for in-plant communications

Mobility in Facilities Management

To keep your facilities secure, live video monitoring is critical. But hard-wiring cameras throughout your facility can be a major expense in expansive facilities, which can include indoor as well as outdoor areas. Wireless video cameras capable of operating on either Wi-Fi or private wireless broadband networks eliminate the need and cost associated with running cabling to each camera — making cost-effective video surveillance in large manufacturing plants a reality. And when that video can be viewed on a handheld mobile device, further efficiencies are gained and security is improved — your security officers are no longer tied to the control room to monitor video, and are able to make rounds yet keep an eye on the real-time video feeds from all your cameras.

Mobile Manager

Application	Description	Benefits
Mobile Security Monitoring	Wirelessly-enabled video cameras and a wireless broadband backhaul network allows manufacturers to easily and cost-effectively implement a high-speed wireless video surveillance solution. The need to run cables to each camera is eliminated — substantially reducing the cost of video surveillance in large manufacturing environments. And mesh-enabled wireless cameras and wireless broadband networks further simplify and reduce wireless infrastructure costs. In addition, a mobile solution also frees your video feeds from their present day tether to the control room, allowing your security officers the ability to continue to view video from any camera in any facility on a handheld mobile device while on the move. Dedicated personnel are no longer required in the control room, enabling a reduction in the security workforce — as well as an improvement in overall facility security. And a single fully-featured integrated voice and data handheld mobile device provides business or mission critical voice and data communications for your security personnel. In addition to the ability to view live video feeds, officers will enjoy comprehensive mobile voice capabilities, including push-to-talk, one-to-one and group calls, 4-digit extension dialing and more. And access to back-end data applications enables officers with the ability to scan and verify an employee badge or, with a biometrics attachment, take a fingerprint to ensure identification in high-security environments.	• Enables cost-effective real-time video surveillance of expansive facilities or campuses • Increases facility security • Improves effectiveness of security officers, who can now continually patrol facility grounds without losing the ability to monitor live video • Reduces security officer staffing requirements — eliminates the need for around the clock staffing of the control room in addition to patrol staff • Eliminates the need to provide security officers with separate voice and data devices, substantially reducing the costs associated with purchasing, managing and maintaining mobile devices and accessories (such as batteries and chargers)

Case Study: Materials Management

Solution category:	Materials Management
Application:	Warehouse Mobility
Industry:	High Tech
Company:	Major electronics manufacturer

Business Issue

Increase warehouse productivity to improve margins and profitability

The warehouse functions for this major electronics manufacturer were primarily manual. From the receiving dock to the warehouse floor to the shipping dock, over 750 employees utilized clipboards and paper forms to capture information on incoming shipments, execute put-away and pick orders, and stage orders for shipment. The low productivity and number of errors associated with the manual processes resulted in high labor costs and low customer satisfaction levels. The company needed a solution that would drive the dramatic level of inefficiencies — and errors — out of warehouse processes. The resulting leaner operation would enable the company to increase razor-thin margins to improve overall profitability.

The before scenario:
Workers on the receiving dock manually checked incoming inventory shipments against the purchase order. Incorrect parts were set aside while paperwork was processed for its return. On the warehouse floor, paper orders were issued for put-away and picking. Items were checked off when complete and the data was entered into a computer at a later time. Items were often misplaced in the put-away process, resulting in the inability to locate inventory. And improper picking resulted in the customer receiving the wrong item(s). Delays in the ability to see inventory until data entry was complete resulted in a high number of stock-outs. And at the shipping dock, the manual processes resulted in a backlog, translating into late shipments, late billings — and reduced customer satisfaction.

Solution

Automation of all warehouse processes

The after scenario:
A mobile computer connected to the company's business systems via a wireless LAN is in the hands of every warehouse employee. With the power of real-time communication:

- Workers on the receiving dock scan incoming shipments, which are immediately and automatically compared against the purchase order. Correct items are staged for put-away. Any incorrect items are immediately cross-docked for return.
- On the warehouse floor, put-away and pick orders are sent to handheld computers, complete with the exact location of the items and the most efficient route. In addition, orders that involve the same items are consolidated to achieve maximum efficiency in the picking and put-away process. Workers scan items as they are placed into inventory, ensuring the items are always in the proper location in the warehouse. Items are also scanned as they are picked, providing verification that the right products were selected for the order.
- On the shipping dock, a scan of the outbound order verifies that it is correct, and information on the completed shipment is sent directly to the accounts receivable system.

Benefits

The power of real-time data in the warehouse function minimized time spent on every task, while providing crosschecks for accuracy at every step of every procedure. Margins were increased, improving overall profitability. The dramatic results included:

- **17% reduction in stocking inventory requirements.** The real-time connection with warehouse workers provided a real-time view of inventory — and that view enabled a major reduction in stocking levels, saving millions of dollars a year in capital as well as in labor managing the inventory.
- **28% reduction in the order-to-cash cycle.** The real-time transfer of information on shipments to accounts receivable resulted in the nearly instantaneous issue of invoices, driving days out of the order-to-cash cycle.
- **Virtually no errors in customer orders — Six Sigma quality.** The ability to verify items as they are picked, and double verify the items in each order prior to shipping literally eliminated all errors in customer orders.
- **38% increase in warehouse productivity.** The elimination of manual processes and procedures across warehouse functions resulted in an average productivity increase of 38%.
- **Elimination of stock-outs.** The ability to see inventory in real time virtually eliminated stock-outs, the resulting cost of the delay in shipment — and the impact on customer service.
- **Increased customer satisfaction.** Customers receive orders that are always correct, every time, and delivered faster than ever before — driving satisfaction and customer retention levels to an all time high.

Case Study: Enterprise Asset Management

Solution category:	Enterprise Asset Management
Application:	Mobile Asset Maintenance
Industry:	High Tech
Company:	Large computer manufacturer

Business Issue

Reduce assembly line downtime in two large, older manufacturing plants to meet increased production requirements

Major growth in sales of the company's computers and peripherals resulted in a large expansion at two manufacturing plants to accommodate the increase in orders: both plants increased from 6 buildings to 15 buildings, with each plant covering 2.5 million square feet. Service engineers could no longer keep up with the increased workload, resulting in a large backlog of work orders. Equipment on the production line no longer received timely service, translating into a significant increase in asset failure — and production line downtime.

Instead of hiring additional staff, the company was seeking a means to develop an asset maintenance program that could meet the increased day-to-day support needs.

The before scenario:
The asset maintenance function was completely manual. Technicians received work orders on paper, spent time determining and gathering needed parts and tools required for the day's work orders, logged in tasks as they were performed on a separate form, and then spent time at the end of each day entering the information collected on paper into the computer.

Solution

Real-time asset maintenance system

The after scenario:
The tools currently used today — paper-based forms and desktop computers — were replaced with mobile handheld devices with wireless connectivity. The mobilization of computing power for the employees in this key operational function enabled:

- Paper-less work orders: Work orders are now sent directly to the mobile device, eliminating time that administrative staff spent creating the paper orders and time service engineers spent managing the paper orders.
- Automated real-time data capture: Technicians recorded information on inspections and repairs directly into a handheld computer, eliminating time spent capturing information on paper and then entering that same information into the computer later that day. In addition to entering inspection and repair

information, a checklist of tasks associated with the scheduled maintenance was presented via a drop down box to ensure all tasks were performed — and performed correctly.

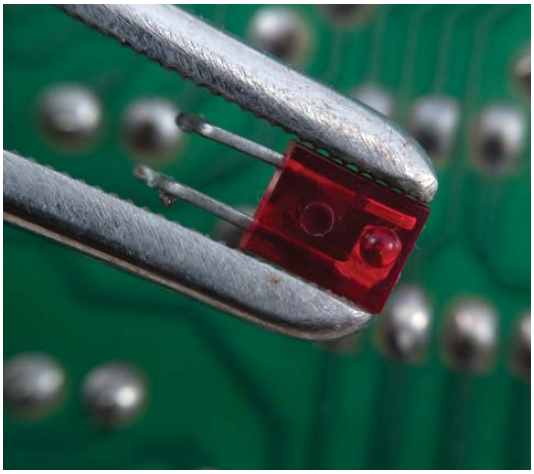
- Dynamic scheduling: When an issue is noted on a machine, usually through the company's MES or SCADA systems, that piece of equipment is now scheduled for maintenance instantly, and the new work order sent to the appropriate technician's handheld computer.
- Instant access to all appropriate records: The online system provided instant access to past history of problems and the type of repairs, as well as all standard maintenance performed, eliminating time spent tracking down and replacing files.
- Instant access to all manuals: In the event information is needed by the engineer when a machine is being serviced, information in the manual can be accessed at the press of a button, eliminating time spent tracking down and replacing manuals.
- Automated reservation of tools and parts: The real-time system automatically identifies the work orders for a given day and reserves the tools and parts needed. Time wasted locating tools and delays in repairs due to lack of parts is eliminated.

Benefits

Real-time automated data capture and data access eliminated many inefficiencies throughout the asset management function and delivered a dramatic increase in the productivity for this critical business function. Benefits included:

- **27% increase in productivity — equivalent to hiring 10 new service technicians.** The elimination of paper-based forms and the need to return to the office early to enter information on paper forms into the computer resulted in a dramatic increase in service technician productivity.
- **39% increase in asset uptime.** With the combination of increased productivity and more accurate data, maintenance is always properly scheduled and performed on time, resulting in an increase in asset — and production line — uptime. Unscheduled downtime was nearly eliminated.
- **19% increase in data accuracy.** The double manual procedures (paper and pen and subsequent computer data entry) were inherently error-prone. The automatic capture of data, including the use of drop down boxes, eliminated errors that resulted in improper scheduling of regular maintenance and incorrect historical data.
- **21% decrease in maintenance costs.** More equipment is now serviced daily with less staff. Real-time scheduling and inventory visibility reduced the inventory requirements for parts. The result is a reduction in overall maintenance costs.
- **Backlog of work orders eliminated.** The productivity increase quickly eliminated the backlog of work orders, and today, service engineers are easily able to keep pace, providing timely inspections and repairs.

Case Study: Quality



Solution category:	Quality
Application:	Outsourced production quality
Industry:	High Tech
Company:	Large electronic component supplier

Business Issue

Improve integration of quality processes with suppliers

When a large electronic component supplier outsourced the production of standard components to reduce costs for more competitive product pricing, a new issue arose — controlling quality. No longer in direct control of the production process, the manufacturer found it increasingly difficult and costly to manage the quality function beyond the inspection of incoming goods. As a result, the manufacturer had very little visibility into quality during actual production of the components, putting the quality of products, the manufacturer's brand name and the general health of the business at risk.

The before scenario:
In order to assure quality during the manufacturing process at outsourced suppliers, the company relied on two tools: frequent on site audits and more thorough inspection of incoming goods. Since some of the suppliers were overseas, audits could not easily be conducted with enough frequency to assure quality — additional staff was required and heavy travel costs were incurred. In addition, the more comprehensive inspection of incoming goods from suppliers added not only cost but time to the production process. And the reduction in supply chain velocity led to an increase in work in process (WIP) inventory and slower delivery times. As a result, a reduction in customer service levels and operational costs threatened the success of the outsourcing program. The company was seeking a way to reduce the costs yet increase control over the quality function for outsourced suppliers.

Solution

Mobile Outsourced Quality Process

The after scenario:
Today, when a contract is awarded, the manufacturer sends the supplier an ample number of handheld mobile computers. In addition to wireless LAN and/or wireless WAN connectivity, the mobile devices provide access to the manufacturer's quality application. Now, all throughout production, the supplier is guided through the manufacturer's quality process, prompted to inspect and audit against all the appropriate product parameters. The real-time connection enables the instant and automatic transmission of all data directly to the manufacturer's back end quality system, as well as the ability to return information to the supplier. This solution provided the visibility required to maintain control over production — even though it is outsourced. Inspection and quality information for the entire supply chain is in hand before product arrives at the loading dock, allowing prompt processing of incoming materials without the risk of a compromise in quality.

Benefits

Mobile computing delivered the real-time information required to substantially decrease the cost and improve productivity in the quality function. The company now enjoys a:

- **50% increase in inspection productivity.** The increase in scope for incoming inspections required a staff of 12 highly-skilled dedicated employees. The supplier-based inspection cut staffing requirements in half, allowing the company to reallocate six of the inspectors to product development.
- **20% improvement in product yield.** By eliminating supplier quality issues before product is shipped, the manufacturer was able to significantly improve yields. But the biggest improvement was being able to rapidly and proactively adjust operations based on early warning information from suppliers.
- **75% reduction in on-site audits.** Since the quality information for remote suppliers is now visible in real time, 75% of the on-site audits were no longer required, delivering a substantial reduction in the overall cost of the quality function. The 25-person team that routinely traveled the globe was reduced to an 8-person team. The result was a significant reduction in staffing costs as well as a 50% reduction in travel costs.

Petroleum and Chemical

Mobile Voice and Data in the Petroleum and Chemical Industries

Industry challenges

The focus in petroleum and chemical industries is operational excellence, defined by four key initiatives: operational performance, health and safety, productivity, and environmental compliance. In this extraordinarily capital-intensive business, an unplanned shutdown due to machinery failure for even a short duration can be a multi-million dollar event. The work environment itself is hazardous, posing a number of challenges — you need to take every step possible to protect your staff from injury, including monitoring their whereabouts at any time. Achieving peak employee productivity is another challenge. The work environments in this industry are typically large and geographically dispersed, including vast outdoor spaces. Workers spend a good part of the day just traveling to and from the point of work — you need to make sure they are as efficient as possible in order to maximize time on tools at the worksite. And last, but not least, is the fact that the environmental regulations in this sector continue to pose challenges. Compliance goes beyond reporting environmental incidents. Manufacturers must have up to date records available at all times — failure to comply with recordkeeping requirements results in heavy fines.

How mobility — wireless voice and data solutions — can help

Wireless voice and data solutions can help petroleum and chemical manufacturers improve operational excellence with a real-time connection that closes the gap between the field and your back-end systems. By automating processes and enabling real-time visibility into critical business data, mobility can effectively remove the inefficiencies buried in your business processes, effectively implementing lean manufacturing initiatives — a well proven and highly successful best practice utilized by discrete manufacturers all over the world to improve profitability. Mobile voice and data solutions can improve the 'lean score' of your business by focusing on eliminating inefficiencies across multiple processes.

Through the power of mobile voice, data and locationing technologies, petroleum and chemical manufacturers can improve asset uptime, better protect employees, improve employee productivity and achieve cost-effective compliance:

- **Improve asset reliability.** With a mobile computer in hand, workers can monitor the real-time state of machinery, and are able to spot and proactively address issues before they impact production. And when the asset maintenance function is mobilized, the result is proper and timely scheduling of maintenance, including visibility into what services were performed as well as how they were performed — providing the real-time data required to tightly monitor this critical function.
- **Improve employee safety.** When machinery is well maintained, workers are at less risk. But when workers have either a Real Time Location System (RTLS) or RFID-enabled badge or an intrinsically safe (I-Safe) mobile device with a GPS chip, employee whereabouts are always known, improving safety. You can monitor the evacuation of all personnel from an area in the event of an emergency. And since these solutions allow to you monitor movement as well as lack of movement, you can easily spot a man down even in very remote areas.
- **Improve employee efficiency.** By placing all the functionality of the deskphone, a two-way radio and desktop computer in an easy to carry integrated voice and data mobile device, workers can access the information they need to tackle any task throughout the workday, wherever they happen to be. The need to spend time in the office focused on paperwork instead of the job at hand is practically eliminated. Workers can now access and transmit that information from the field — regardless of whether they are performing routine maintenance or monitoring production volume. And, with a real-time

connection to the business systems, workers on a pipeline can access information that might be required to complete a repair, right at the point of work. As a result, the hours per day spent in the office can now be spent out in the field. Time on tools is substantially increased, improving overall utilization for these high value workers.

- **Improve accuracy and reduce the cost of compliance.** The myriad of regulations in this industry requires the nearly constant collection of a massive amount of data. A mobile computer significantly automates the collection of that data through drop down menus and check boxes as well as the ability to read a bar code, direct part mark or RFID tag — and connect a specialized device such as a gas detector to the mobile computer. As a result, data can be collected in less time, with fewer errors, and instantly transmitted to your business systems. Data accuracy is improved, up to date reports are available at any point in time, and data is collected in less time, bringing a new level of cost-efficiency to the compliance function.

The charts on the following pages illustrate the many mobility applications available to help petroleum and chemical manufacturers address core business challenges and achieve new levels of operational excellence.

Wireless voice and data solutions can help petroleum and chemical manufacturers improve operational excellence by effectively removing the inefficiencies buried in your business processes.

Petroleum and Chemical Mobility Applications

Mobility in Materials Management

The warehouse is a central area of the business through which all spare parts, raw materials, or finished goods pass. The poorly managed warehouse can actually become cost prohibitive, significantly impacting the cost of doing business — and general profitability. Mobility greatly improves warehouse management by eliminating paper-based processes throughout the warehouse. Paper forms are replaced with real-time forms on mobile computers. The ability to scan a bar code or read an RFID tag enables workers to validate that the right material is going to the right place at the right time. In addition, real-time visibility of inventory opens the door to reducing working capital and spare parts inventory, effectively delivering a significant near term benefit. Mobile material management applications include:

Materials Management

Application	Description	Benefits
Warehouse Mobility	Warehouse mobility provides a real-time view of your inventory through the capture and availability of real-time inventory data. In addition to enabling real-time inventory visibility, knowing exactly what is in stock at any time significantly reduces: out of stocks; stocking inventory requirements and warehouse space requirements.	• Reduces inventory costs by reducing stocking levels • Improves warehouse efficiency — fewer workers can handle more tasks • Enables the error-free warehouse by eliminating mistakes • Decreases the volume and cost of warehouse space
Material Tracking	Material tracking applications enable complete traceability of batches of raw material at any point in the manufacturing process, or after delivery to the customer in the form of finished product. In the event that a particular batch is found to be tainted or otherwise defective, this application ensures fast and efficient point recalls — the manufacturer knows the exact location of all contaminated product. The recall is handled in the most time and cost-efficient manner possible, protecting consumer safety. The need for potentially brand-damaging media coverage to 'get the word out' is eliminated, protecting brand equity. And the risk of recalling too much product — resulting in empty shelves and lost sales — is eliminated.	• Enables highly efficient and accurate tracking of raw materials • Reduces the cost of material tracking activities • Provides real-time visibility to support just-in-time (JIT) inventory initiatives

Mobility in the Plant

At the heart of every Petroleum and Chemical operation is the plant. With wireless voice and data solutions, you have the power to: monitor your plant equipment in real time, improve overall business efficiency and prevent errors to achieve true operational excellence and track that one elusive variable — the cost of your labor. As a result: throughput is protected, machine downtime is minimized and control over production is increased, providing the assurance that the right product is manufactured the right way at the right time — and you gain a better understanding of labor costs to protect margins and overall profitability. Mobile plant applications include:

Plant Operations

Application	Description	Benefits
Mobile Plant/ SCADA	Tracking and monitoring the performance of the plant equipment — from pumps to production volume — is traditionally restricted to the central control room. When machine metrics and key performance indicators (KPIs) are available on a mobile device, such as a handheld mobile computer or other converged device, managers and engineers have the information they need to act on the spot. Without mobility, if a potential issue arises, senior managers or engineers will need to drive to the location to access the control room. With mobility, plant equipment can be monitored from anywhere in real time, the enterprise becomes proactive instead of reactive, able to respond and troubleshoot issues more rapidly and efficiently.	• Faster reaction times help avoid serious and costly situations, such as injury or a production line shutdown • Increased employee productivity — workers no longer need to spend time traveling to the plant to resolve issues • Improved monitoring capabilities — senior management can keep a watchful eye on KPIs to protect yield
Operator Rounds	When operators are using a paper-based clipboard process to collect information on rounds, the information is not visible until the operator returns to the desk and enters the data into the computer. The resulting lag time can prohibit discovery of an equipment issue until well after the data is collected. But when workers have a mobile voice and data handheld device with a wireless connection to your business systems in hand, information is visible in real time. Now, operators scan a bar code or RFID tag to positively identify equipment and access the appropriate list of tasks to perform. Operators can enter the readings on valves and dials, and peripherals can be connected to the mobile computer to automatically capture and record information — for example, a vibration sensor can detect inappropriate levels of vibration; and a temperature gun can automatically determine if the machine temperature is in or out of normal range.	• Improves the efficiency and effectiveness of the machine monitoring process by eliminating paper processes • Improves accuracy of data by automating data collection and eliminating the 'double touch' of data (handwritten form and entry of data on that form into a computer) • Helps prevent machine and production line downtime • Protects asset lifecycle by ensuring prompt attention in the event of a machine malfunction • Helps prevent the manufacture of non-standard product

...continued on next page

Plant Operations (continued)

Application	Description	Benefits
Personnel Tracking/ Safety Locationing	The ability to track personnel in real time in hazardous environments such as petroleum and chemical plants is crucial to ensuring employee safety. With a real-time locationing system (RTLS), employees can wear a badge with either a Wi-Fi or RFID enabled tag to provide a real time view of employee location. These systems can provide a wide range of functionality, from the ability to determine which employees are in a specific zone (or area) of your facility to real-time information that can pinpoint employee location within five to 20 feet. Now, in an emergency evacuation, you can verify that all your employees are out of the danger zone. In addition, an alarm can be automatically sent to alert security staff if an employee did not leave an area when expected or has not moved in a given period of time, potentially signaling injury or illness. As a result, your security staff has the granular real-time location information required to maximize the safety of your workforce.	• Improves the safety and security of your workforce • Enables proactive instead of reactive action by providing real-time alerts when employee behaviors exceed pre-defined rules — for example, when a worker has remained motionless too long • Provides the means to meet and exceed current and future government regulations for protecting personnel in industrial environments

Mobility in Enterprise Asset Management (EAM)

In the petroleum and chemical manufacturing industries, maintaining and managing equipment is vital. Whether your production assets are located inside the enterprise walls or out in a vast or remote area — such as a natural gas pipeline or oil rig — improper maintenance can translate into unplanned downtime — a potential multi-million dollar event. In addition, inaccuracies in asset inventory can translate into non-compliance with government regulations, translating into fines or excessive taxes. Mobile computing, wireless LAN, and RFID locationing technologies can easily streamline enterprise asset management functions. Stripping the inefficiencies out of the maintenance function can help ensure that the business critical production equipment is serviced on time, with the right maintenance routines, performed correctly, complete with a comprehensive audit trail. And the ability to rapidly and accurately inventory assets out on the plant floor — even without human intervention — can eliminate physical inventory processes, like cycle counting, freeing workers to handle other more business-crucial tasks. Mobile EAM applications include:

Enterprise Asset Management

Application	Description	Benefits
Mobile Asset Tracking	Real time locationing systems and bar code scanning can enable petroleum and chemical manufacturers to easily and automatically track a wide range of assets located in expansive and often remote plant locations — from safety equipment to consumable supplies and production line machinery, including fixed assets such as pipelines to movable assets such as trucks, cranes and even drill bits. Now, safety equipment can be located instantly in the event of an emergency; movable equipment can be located when needed at another location; accounting information is available for leased equipment (time of arrival and time of departure through the yard gate); granular real-time inventory visibility in each remote location (such as an oil rig in the ocean) ensures the right equipment and supplies are always available, preventing downtime and protecting employee safety; and company-wide inventory information required to meet government regulations is available — all with minimal manual intervention.	• Improves efficiency of the inventory process — as well as worker productivity • Provides real-time visibility into asset inventories in remote locations to protect uptime and worker safety • Enables cost-effective compliance with government accounting regulations • Improves tool utilization, reducing tool inventory and management costs • Protects against loss or theft of assets • Ensures proper tax treatment of assets • Protects against financial penalties due to non-compliance

...continued on next page

Enterprise Asset Management (continued)

Application	Description	Benefits
Mobile Asset Maintenance	Your machinery is your most important asset — proper maintenance is critical in order to achieve maximum uptime. When electronic work orders can be sent directly to a mobile handheld computer, workers no longer need to spend time: in the office at the beginning of each day to collect the day's printed work orders; in the office at the end of the day to enter the information collected on forms into the computer; returning to the office during the workday to retrieve an emergency work order. Now, employees can spend nearly the full shift out in the field, able to receive and complete work orders in real time. And dispatch can easily alter schedules dynamically throughout the day to accommodate emergency service needs.	• Dramatically improves technician productivity — the same workforce can now fulfill more service requests per day • Ensures more timely maintenance due to real-time visibility into maintenance schedules, emergency service requests and real-time dispatch capability • Improves uptime, protecting productivity and yield • Enables potential machinery problems to be addressed the moment they are reported, before production is impacted
Spare Parts/ Tools Inventory Management	The ability to track parts and tools required for the maintenance function in real-time protects the efficiency of the maintenance function and prevents the need for larger spare parts inventory. A list of required tools and parts can be automatically compiled for each technician, based on the day's work orders. The technician scans all parts and tools as they are placed on the truck, providing real-time inventory and location information — the company now knows which tools and parts are on which trucks. Now, workers no longer need to take valuable time out of the field to return to the office to retrieve a missing tool or needed part. In the event of an emergency repair, dispatch can locate the nearest technician who has the appropriate tools and parts already onboard. And real-time tool and parts inventory eliminates the need for a large buffer stock.	• Protects the efficiency of the maintenance function • Reduces parts and tools inventory levels and the associated capital expenditure — typically resulting in millions of dollars in one time inventory savings alone • Reduces operational expenses — the reduction of inventory levels for parts and tools reduces the associated required warehouse space, allowing the business to either downsize the warehouse space or re-allocate area to meet other more crucial business needs

Mobility in Quality

For petroleum and chemical manufacturers, ensuring quality throughout operations is a top initiative — from the quality of the data collected to the quality of the product. In order to maintain or exceed quality standards across your operations without adding costs, the efficiency of the quality function must be improved. There are seven areas where inefficiencies are typically found in the quality function — and mobility helps you address every one:

1. Manual 'double-touch' of data: gathering information via handwritten forms which must then be entered into the computer at a later date
2. Manual research due to lack of real-time data
3. Manual consolidation of information from different sources for reporting and trend analysis — for example, data resident in computer applications and also on spreadsheets, databases and contact lists on individual computers
4. Lack of access to, or time spent traveling to and from computers and other resources to monitor processes or take required actions
5. Managing data errors — identifying, researching and correcting erroneous information
6. Heavy staffing requirements due to time intensive manual procedures
7. Lack of centralized data repository translates into the need for large amounts of email and high volumes of meetings to obtain data

Mobile quality applications include:

Quality

Application	Description	Benefits
Mobile Forms	Quality engineers manage up to 200 different forms, including forms for submission for government regulations, such as ISO 9000, or to comply with customer demands. Forms are often backfilled at the end of a shift rather than in real time as required. Mobility greatly simplifies the management of these forms, ensuring timely completion, providing time/date/operator stamps if desired, and dramatically increasing the productivity of your quality engineers.	• Eliminates the time and errors associated with double data entry • Provides visibility into real-time quality data

Quality (continued)

Application	Description	Benefits
Real-Time SPC (statistical process control)	SPC programs are critical in determining the root cause of an increase or decline in yield, and how to address it. There are several key issues with today's SPC programs. The first is the 'data gap' created by the small amount of data (typically 20% to 30%) that cannot be collected automatically. This forces the need for manual collection of this data, and introduces the possibility of errors as well as a time lag between when the data is collected and when it is available to view. In addition, data used for final analysis is often up to three weeks old (and in some cases, up to one full quarter old). Mobility enables the real-time automated capture and instant transmission of this data into the SPC system, ensuring that your business decisions are based on an accurate real-time view of your global processes.	• Ensures proper yield • Eliminates the need for additional warehouse space to store overages • Ensures product is completed on time
Six Sigma Data Capture	Six Sigma requires timely and accurate collection of data. Manual data collection processes (such as pen and paper or computer keyboard data entry) achieve approximately Two Sigma. A handheld mobile computer eliminates manual data collection, enabling the automatic and instant capture of the information in a bar code, Direct Part Mark (DPM) or RFID tag right at the point of activity, increasing worker productivity, overall operational efficiency — and often delivering better than Six Sigma.	• Dramatically reduces the time and cost associated with achieving a Six Sigma level of quality

Quality (continued)

Application	Description	Benefits
Sample Tracking	As workers collect samples throughout the day, they typically record where and when the sample was drawn on a paper form that remains with that sample. When sample containers are pre-marked with a bar code label, workers can scan the bar code on the sample container as well as the bar code or other identifying mark on the equipment (such as a direct part mark or RFID tag) to automatically populate the fields in an electronic form with date, time and the machine from which the sample was collected. Paper is completely eliminated, improving productivity as well as data accuracy. And alternatively, workers can carry a belt-worn mobile printer to enable on-the-spot printing of labels that can be placed on the lid of containers to prevent tampering, ensuring the purity of samples.	• Enables cost-effective sample tracking • Eliminates data errors • Ensures sample purity
Environmental Compliance & Waste Management	Manufacturers must document efforts to reduce waste or pay recycling subsidies. The impact of not being able to produce documents to prove compliance can easily add up to millions of dollars. But the impact on productivity and overhead associated with the data collection to prove compliance is also significant. Deploying mobility at the point of waste creation to track waste not only provides the information required to prove compliance, but also significantly minimizes the effect on productivity and overhead.	• Automates the collection of environmental and waste data for cost-effective compliance — without adding resources or impacting productivity • Eliminates fines due to lack of compliance data

Mobility in the Field

The field workforce is your primary interface with customers. With mobile voice and data in-hand, these workers have the tools they need to act as efficiently as possible in the dynamic environment of life in the field, enabling the delivery of a superior level of service excellence for each and every customer. Field personnel can collect an electronic signature as proof of delivery, transmit the signed invoice to the business billing system and print out a copy for the customer, right on the spot — no need to complete paper forms which must then be entered into the computer upon return to the office. The improved efficiency allows field personnel to make more stops — and generate more revenue or perform more service calls — per day. And the same device that streamlines the sales process also enables the rapid and accurate collection of compliance data to meet batch traceability requirements — and can transmit accurate invoices in real time to shave days of the order to cash cycle.

Field Mobility

Application	Description	Benefits
Mobile Field Service and Sales	When the field sales and service workforce is armed with a handheld computing device, a wealth of information is available to ensure the highest quality interaction with one of your most valuable assets — your customer. Real-time access to inventory and sales systems combines with signature capture capabilities, enabling the workforce to check inventory, update an order and provide accurate order delivery dates — on the spot. Access to complete customer history files ensures that your workforce is as knowledgeable as possible about the customer before setting foot on the customer site. And with real-time access to maintenance history and equipment information, field service personnel have the information they need to complete the service call in just one visit.	• Improves workforce utilization — the same workforce can now make more customer visits per day • Real-time ordering and order status improves customer satisfaction and retention

Field Mobility (continued)

Application	Description	Benefits
Petroleum industry-specific applications		
Field ticket management	In the oil industry, service is contracted to a third party provider through the creation of a field ticket. Traditionally, the service technician arrives on location and upon completion of the service requested by the oil company, obtains a physical signature on the field ticket. The service technician then delivers that form to his office. The form is processed, entered into the computer and an invoice is sent to the oil company, who then confirms the work was done per the field ticket. In the event of a conflict, more time is spent resolving any issues. The result is a very inefficient process that wastes time for both the service provider and the oil company. Mobility transforms these paper-based time consuming procedures into a real-time process. Now, field tickets are sent electronically to a mobile handheld device. When work is completed, the invoice can be automatically created in real time based on the work performed and presented to the oil company representative. The electronic signature of the authorized oil company representative can be captured on both the work order and the invoice. The service provider can send out an invoice complete with payment authorization that was collected at the time of service. And mobility provides an added value — the ability to provide a task list complete with detailed instructions and checkboxes to ensure that all tasks associated with a specific type of service are performed, and performed according to the agreed upon terms.	• Dramatic improvement in efficiency and data accuracy eliminates the cost of administrative processing for both service provider and oil company • Reduction in disputes — work orders and invoices are signed in real-time at the time of service • Improves accountability — service technicians must indicate completion of work at a granular task level • Improves quality of service regardless of whether the service technician is new or seasoned through the ability to present detailed task instructions • Improves order-to-cash cycle for service provider
Production Volume Reporting (PVR)	Every day, workers travel to well heads to collect the volume produced at each well — numbers that are critical to the proper allocation of production to the operator and its partners. Without mobility, this involves traveling to the wellhead, capturing the numbers on paper, returning to the office and then entering those numbers into the computer — a process that is rife with the opportunity for error. This process can be either partially or completely automated to improve the timeliness and accuracy of the data. A worker can utilize a mobile handheld computer instead of a paper form to capture Production Volume (PV) at each wellhead. The information is then instantly transmitted to your business systems, eliminating the need to enter the data into the computer. In addition, just as Advanced Meter Infrastructure (AMI) allows electric utilities to automatically collect meter information, the well heads themselves could be enabled to transmit Production Volume (PV) data at defined times, eliminating any need for human intervention.	• Improves the efficiency of the Production Volume Reporting (PVR) process • Reduces administrative costs associated with PVR • Increases data accuracy, providing extra assurance for partners that credit and profit calculations are correct • Increases the speed of the PVR process, ensuring timely issuance of credits or monies due

Mobility in Management

Your managers are always on the move throughout the plant or traveling between office locations. Mobility ensures that, even though they may be on the go, these executives always have access to the business information and personal productivity tools required to act on the spot — keeping the enterprise agile and ensuring the rapid response times needed to keep the business up and running at peak efficiency.

Mobile Manager

Application	Description	Benefits
Mobile Manufacturing Manager	This solution allows access to critical business intelligence on a handheld computer, enabling executives and other management to leave the desks and go wherever they are needed — the plant floor or out into the field — without losing real-time access to the information required to make the best business decisions.	• Better plant management — faster reaction to changing conditions
Mobile Manager Productivity	The integration of voice and data onto a single pocket-sized device allows managers and engineers to keep the tools they need to take care of business — right in the palms of their hands. No longer tethered to a desk, managers are now free to remain where they are most effective — out in the plant — yet still monitor KPIs; receive plant messages and alerts; and access email, forecasting and scheduling systems and more.	• More effective managers — managers can now handle more tasks throughout the workday

Mobility and Plant Communications

Different types of workers need different types of business and mission critical voice and data services. Some workers require mission critical basic walkie-talkie style voice communications to protect employee safety and enterprise security. Others require a business critical connection to voice and data to streamline processes and improve productivity as well as business agility. For example, some workers require rich voice connectivity equivalent to a mobile version of the deskphone — the ability to receive incoming calls from suppliers, consultants and other associates as well as the ability to place calls inside and outside the four walls plus access to PBX features, such as call forwarding and conferencing. And still others require both rich voice and rich data communications, the mobile equivalent of the deskphone as well as the desktop computer for access to critical back-end business applications as well as personal productivity tools such as email.

To meet these many needs today, most manufacturers have deployed multiple disparate networks — including:

- A wireless LAN to provide workers inside the four walls with wireless access to business and personal productivity applications
- A trunked radio system to support two-way radios
- WWAN push-to-talk leased airtime to enable walkie-talkie style group calls for non-mission critical workers
- A traditional wired phone line (PBX)
- Wired Ethernet networks to serve those workers who spend the day primarily at a desk

Not only must separate networks be maintained and managed, but the devices on the separate networks cannot 'talk' to each other, forcing many workers to carry multiple devices — for example, managers may need to carry a two-way radio to communicate with some workers, a cordless handset to communicate with others as well as a mobile computer of some sort to access mobile data. The result? Your workers are forced to act as the bridge between your networks, effectively acting as routers by carrying multiple types of devices. And the business incurs unnecessary high capital and operational costs associated with purchasing multiple devices per person; time personnel spends managing multiple devices; and time IT spends managing the many devices and networks.

Mobility can address this issue by enabling the delivery of all voice and data communications over a common backbone, eliminating the need to maintain multiple disparate networks — dramatically simplifying and reducing the cost of the technology architecture.

Plant Communications

Application	Description	Benefits
Unified Voice and Data Architecture	Mobility allows the consolidation of disparate backbones into a single system, enabling cross-communications between the many types of devices deployed in your business. The high cost associated with maintaining and managing multiple wholly independent networks is eliminated — and the need to provide workers with separate devices for voice and data is eliminated. Now, regardless of what type of voice and data communications different types of workers require, they can be delivered to a single device. Voice services can include one-to-one private calls, one-to-one and one-to-many push-to-talk (PTT) walkie-talkie style calls, Cellular (WAN) calls, as well as the extension of the deskphone and all PBX features to the mobile device. Data services can be as simple as text messaging or as complex as full access to back-end critical business applications. As a result, workers are no longer forced to act as network connection points — for example, a manager with a mobile computer or supervisor with a business smartphone can communicate directly with workers that carry two-way radios. And the enterprise retains the freedom to match the right device to the job — from two-way radios with or without integrated text messaging to improve worker safety, business smartphones for workers that need the mobile equivalent of the deskphone and basic data functions, as well as integrated handheld mobile computers for workers that require rich voice and data connectivity. With this new simplified technology architecture, all voice and data traffic and mobile devices are essentially on the same network. As a result, the enterprise now has full control over the quality of the services, able to ensure toll-quality voice and application performance regardless of device type. In addition, the simpler architecture also greatly improves the efficiency of your IT organization. The issues, time and cost associated with managing disparate IT systems and multiple devices per person are eliminated — from inefficient asset management and unbalanced server resources to high application development costs and the general slow movement of information throughout the organization.	• Increase in worker accessibility through both voice and data • Significant reduction in the complexity and cost of the voice and data architecture, including mobile devices and networks • Improves employee safety, security and productivity — voice services can be extended as needed throughout the enterprise to more types of workers, without cost or compromise • Significant reduction in WAN costs leveraging VOIP for in-plant communications

Mobility in Facilities Management

To keep your facilities secure, live video monitoring is critical. But hard-wiring cameras throughout your facility can be a major expense in expansive facilities, which can include indoor as well as outdoor areas. Wireless video cameras capable of operating on either Wi-Fi or private wireless broadband networks eliminate the need and cost associated with running cabling to each camera — making cost-effective video surveillance in refinery and chemical plants a reality. And when that video can be viewed on a handheld mobile device, further efficiencies are gained and security is improved — your security officers are no longer tied to the control room to monitor video, and are able to make rounds yet keep an eye on the real-time video feeds from all your cameras.

Mobile Manager

Application	Description	Benefits
Mobile Security Monitoring	Wirelessly-enabled video cameras and a wireless broadband backhaul network allows manufacturers to easily and cost-effectively implement a high-speed wireless video surveillance solution. The need to run cables to each camera is eliminated — substantially reducing the cost of video surveillance in large manufacturing environments. And mesh-enabled wireless cameras and wireless broadband networks further simplify and reduce wireless infrastructure costs. In addition, a mobile solution also frees your video feeds from their present day tether to the control room, allowing your security officers the ability to continue to view video from any camera in any facility on a handheld mobile device while on the move. Dedicated personnel are no longer required in the control room, enabling a reduction in the security workforce — as well as an improvement in overall facility security. And a single fully-featured integrated voice and data handheld mobile device provides business or mission critical voice and data communications for your security personnel. In addition to the ability to view live video feeds, officers will enjoy comprehensive mobile voice capabilities, including push-to-talk, one-to-one and group calls, 4-digit extension dialing and more. And access to back-end data applications enables officers with the ability to scan and verify an employee badge or, with a biometrics attachment, take a fingerprint to ensure identification in high-security environments.	• Enables cost-effective real-time video surveillance of expansive facilities or campuses • Increases facility security • Improves effectiveness of security officers, who can now continually patrol facility grounds without losing the ability to monitor live video • Reduces security officer staffing requirements — eliminates the need for around the clock staffing of the control room in addition to patrol staff • Eliminates the need to provide security officers with separate voice and data devices, substantially reducing the costs associated with purchasing, managing and maintaining mobile devices and accessories (such as batteries and chargers)

Case Study: Enterprise Asset Management

Solution category:	Enterprise Asset Management
Application:	Mobile Asset Tracking and Maintenance
Industry:	Petrochemical/Chemical
Company:	Global leading oil and natural gas manufacturer

Business Issue

Eliminate inefficiencies in the maintenance function for heavy equipment and pipelines

This major integrated energy company needed to increase the efficiency and productivity of the gas pipeline maintenance process and specialized heavy machinery leased out to other companies (for example, for heavy drilling or carving out mine shafts). More accurate data was required to ensure the timely scheduling of maintenance routines to protect against pipeline and equipment failure, as well as provide verification that maintenance was performed properly and on time. Improved general management of this function would:

- Reduce the possibility of an event that would require the pipeline to be shut down (and the significant financial implications)
- Protect against the failure of leased equipment, which would damage the company's reputation as well as further erode productivity due to the time required to locate an immediate replacement for the customer.

The before scenario:
Over 300 technicians were responsible for performing regular inspection and repair of gas pipelines over a 300-500 mile area every two weeks. Another 100 technicians were responsible for maintenance of the large pool of equipment available for lease.

Maintenance processes were all manual: schedules were printed out and handed to technicians daily, and data collection was also manual — technicians recorded information on work performed with paper and pen, and then entered the data into the computer when returning to the desk at day end.

Solution

A mobile application that automates scheduling and provides all needed information right at the point of activity

The after scenario:
All technicians now carry a mobile computer; pipeline workers carry a version that is certified as safe for hazardous environments. Manual processes are now replaced with an automated system that delivers the day's schedule of work orders and maintenance tasks directly to the technician's mobile computer.

Maintenance records and equipment manuals are available at the press of a button; inventory is automatically checked for any required parts to ensure availability; and any needed tools are pre-scheduled and waiting for the technician. Instead of on paper, completed inspections and repairs are recorded in the mobile computer. Information is transmitted instantly via a wireless LAN when technicians return to the building.

Benefits

This enterprise mobility solution provided a real-time maintenance function for the company's most important assets – the pipeline and large equipment. The streamlining of these critical business functions ensured:

- **100% scheduling accuracy.** Automation and real-time data ensured that maintenance was always scheduled — and performed — on time. The system now alerts supervisors of any exceptions, allowing the workload to be redistributed as needed in real time to protect the asset against equipment malfunction.
- **Improved technician productivity.** The elimination of manual processes saved an average of an hour and a half per technician/day due to an 80% reduction in paperwork and the elimination of the need to return from the field early to complete data entry at day end. As a result, technicians have more time to inspect and repair equipment, and can handle more work orders per day.
- **Decrease in errors.** The automation of data capture and elimination of the redundant process (capturing information on a form via pen and then later entered into the computer) dramatically decreased the number of data errors, improving the integrity of the overall maintenance function.
- **Improved information access.** Real-time visibility into the wide variety of maintenance data ensured that equipment was scheduled properly; the right tools and parts were available; any additional information required on a specific piece of machinery was instantly available; and that maintenance and repairs were performed on time — and correctly.

Case Study: Plant Communications

Solution category:	Plant Communications
Application:	Unified Voice and Data Architecture
Industry:	Chemical
Company:	Major chemical manufacturer

Business Issue

Provide secure and reliable mission critical voice communications

During times of emergency, whether directly related to a manufacturing facility equipment failure or a natural or man-made catastrophe, a manufacturing facility must be assured of secure and reliable mission critical voice communications. Often, public networks are overwhelmed during these times, preventing the critical voice communications required with remote staff to best protect the safety of workers and your facilities. The company sought a cost-effective solution that would provide dependable voice communications in the event of an emergency.

The before scenario:
Just prior to and during a major storm that affected the US Gulf coast, this chemical manufacturing facility was unable to efficiently communicate with staff that was working on site to secure the facility. Public networks were congested and unreliable. It was necessary to physically locate the individuals in order to relay information and obtain updates on the preparation status. This resulted in inefficient use of time during an emergency event, forcing staff to travel to and from a landline instead of tending to the mission critical task of securing the facility — as well as less than timely updates that affected decision making back at the corporate office.

Solution

Installation and integration of a private radio network into a unified voice and data architecture for seamless and secure facility coverage

The after scenario:
With the deployment of a private radio network, the company now owned the frequency, providing complete control of the voice network. Now, the company could ensure the ample network availability required for continuous, instant and direct voice contact with employees in remote locations. In addition, the integration

of the two-way radio network into the company's existing voice and data networks provided the ubiquitous network unification required to eliminate the need for supervisory and managerial staff to carry separate devices. Now, managers can easily communicate with two-way radios from a business smartphone or other handheld integrated voice and data mobile device.

The seamless voice connection between remote workers out in the field and co-workers and managerial staff back in the office enabled faster, more efficient emergency preparations — remote workers no longer needed to waste time running to wired phone to obtain an answer to a question or to provide a manager with a status update. The ability to simultaneously broadcast equipment startup and shutdown messages to all appropriate personnel improved the safety of all workers in the remote location. And the ability to provide management with a single device for business and mission critical voice communications dramatically reduced the capital and operational costs associated with the purchase and management of multiple devices per user.

Benefits

This Private Radio solution provides a number of benefits:

- **Secure and reliable mission critical voice communications.** The encrypted digital technology provides manufacturing facilities with truly private and highly dependable mission critical communications. The opportunity for eavesdropping, network interference or lack of network service due to network overload is eliminated, providing the reliability required in emergency situations.
- **10 minutes saved per user per day.** The availability of private push-to-talk communications for both group calls and private calls improved efficiency — the average worker saved a minimum of 10 minutes per day.
- **Reduction in capital and operational network costs.** The ability to integrate the two-way radio network with the corporate wireless LAN (WLAN) eliminated the need for co-workers and management in the corporate office to carry more than one device to maintain voice connectivity with remote workers. Now, regardless of what type of voice device staff inside the four walls carries, that device can communicate with two-way radios out in the field. The business is able to leverage the existing WLAN to enable cross-network communications, improving the return on investment for the WLAN. And there are fewer devices to purchase and maintain, simplifying and reducing the cost of communications, and eliminating the need — and associated cost — for IT staff and other workers to spend time managing multiple devices.

Case Study: Plant Operations

Solution category:	Plant Operations
Application:	Operator Rounds
Industry:	Petroleum/Chemical
Company:	Major multi-national energy company

Business Issue

Reduce errors and improve efficiency in the inspection process for critical equipment

The accuracy and timeliness of the information collected on operator rounds is crucial to maintaining operational continuity. However, this multinational energy company was experiencing an unacceptable amount of production line downtime due to the slow movement of data from the field to the company's business system.

In addition, information was collected on paper and pen in the field and later entered into the computer, providing many opportunities for data errors — and the high rate of errors masked equipment issues, further increasing machine downtime. Operators sometimes inadvertently wrote the wrong information down or collected information on the wrong piece of equipment. Handwritten information was sometimes transcribed incorrectly due to legibility issues. Errors also occurred due to mis-keying during data entry into the computer system. The company was seeking a way to drive these inefficiencies and errors out of the inspection process to better protect production line uptime and company profitability.

The before scenario:
Operators conducted rounds on every shift with a clipboard and a checklist. Operators were first required to identify the right piece of equipment — not always an easy task when identical pieces of equipment are situated side by side. Once the equipment was identified, operators then checked off each item as completed, capturing any needed readings and making any additional notes based on observations. Upon return to the office, the information on the forms is then keyed into the enterprise asset management (EAM) or reliability centered maintenance (RCM) systems. Once the information was available in those systems, the data was analyzed by engineers with the goal of predicting equipment failure — enabling the timely performance of maintenance to prevent unplanned machine downtime.

Solution

Automated and real-time data collection on operator rounds

The after scenario:
Operators now carry a lightweight and easy-to-use integrated voice and data mobile computer that ensures that the right piece of equipment is being inspected and enables the real-time collection and transmission of information right from the point of work. Now, operators use the mobile device to scan the bar code or read the RFID tag on the equipment, validating the identity of the equipment and automatically populating an electronic form with the equipment serial number. Checklists ensure that every task is completed. Readings on valves and dials are entered. And a vibration sensor and a temperature gun attached to the mobile device enable workers to automatically record variances — without any operator intervention. Once complete, the entire record is instantly transmitted to the appropriate computer system, along with a time stamp and the identification of the operator who collected the data.

Benefits

Mobility brings a number of benefits to the operator rounds application:

- **99% reduction in data capture and transcription errors.** The ability to heavily automate data capture and positively identify equipment virtually eliminated data entry errors in the EAM and RCM systems.
- **20% improvement in productivity in operator rounds.** The elimination of the need to spend time in the office collecting forms, visually identifying equipment, manually writing information down on paper forms and entering that same information into the computer at the end of the shift improved productivity — the same number of operators can now visually inspect more machinery per shift.
- **Reduced plant downtime.** The elimination of data errors combined with real-time visibility into machine metrics enabled engineers to more rapidly and accurately analyze and identify machine issues, allowing the proactive maintenance required to minimize plant downtime.

By automating the collection of information on operator rounds and enabling the real-time transmission of that data to the company's business systems, this multi-national energy company was able to substantially improve productivity — and reduce plant downtime.

Pharmaceutical

Mobility in Pharmaceutical Manufacturing

Industry challenges

The pharmaceutical industry is heavily regulated, requiring manufacturers to collect a massive amount of data at virtually every step in the supply chain. Designed to ensure the consistency and purity of products, U.S. government regulation 21 CRF Part 11 requires detailed documentation for every step in the manufacturing process — including human actions as well as manufacturing equipment statistics. Once the product comes off the manufacturing line and begins the trip down through the supply chain, there are more regulations. To prevent the introduction of counterfeit drugs anywhere in supply chain, a full pedigree for prescription drug shipments is now required in many states in the U.S. The pedigree must provide exhaustive documentation of every stop in the supply chain, including complete shipping information and the signature of each owner as well as the lot numbers, dosage form, strength and more.

There are regulations that affect packaging. All drugs packaged for hospitals must be bar coded at the dose level to help prevent the inadvertent administration of the wrong drug or wrong dose in a hospital environment.

Out in the field, the sales force is also subject to government regulations. In the U.S., the sales force cannot actually sell — they are only allowed by law to educate physicians about the drug as much as possible, a process known as 'detailing'. In a brief meeting with physicians, sales representatives attempt to provide a

detailed education on the drug (limited, however, to the information found on the printed package insert) and hopefully provide enough information to influence the physician to prescribe the drug. New regulations, developed in response to the increase in abuse of drug samples and counterfeit product, now require salespeople to track all samples distributed to hospitals and doctors, adding another administrative burden during the sales process.

And product trials, a critical step in the path to obtaining government approval to sell a product, also require a significant amount of data collection and analysis. Trial participants must keep a detailed diary throughout the trial. Traditionally this diary is recorded manually, and entered into a computer at a later date. In addition to a costly administrative load, this leaves a lot of room for data inaccuracies, from the inadvertent exclusion or erroneous recording of side effects to human error during the data entry — which can have a disastrous impact on future consumers of the drug as well as brand equity. In addition, lack of real-time data from participants can hamper the ability for researchers to recognize the presence of dangerous side effects — and take the timely appropriate action.

How mobility can help

Mobility allows pharmaceutical manufacturers to automate and error-proof the collection of the enormous amount of information for which they are responsible. Mobility can strip inefficiencies from business processes on the production line, in the warehouse, in field sales and clinical trials by removing wasteful steps and processes. This purposeful identification and elimination of waste is at the heart of lean manufacturing, a best practice that has been widely adopted by discrete manufacturers, and utilized to maximize efficiency, quality, supply chain velocity and profitability. As a result of the high degree of success of these initiatives, Pharmaceutical manufacturers are now adopting lean manufacturing principles as well, working to remove inefficiencies in seven key areas of waste identified in Figure 1 on the following page.

Through mobility, pharmaceutical manufacturing operations become leaner, and the resulting streamlining of business processes enables the business to address key business issues and achieve core company goals. The massive amount of data that must be captured to meet e-pedigree and other government regulations, ensure product quality as well as protect against the introduction of counterfeit product can now be captured automatically — providing highly accurate data without the addition of costly human resources. Out in the field, mobility can maximize the effectiveness of your sales force by providing the tools they need to truly make the most of short physician meetings, ensuring that the medical community is fully aware of the products you manufacture — and the benefits they can bring to patients. And in clinical trials, mobility can not only enable participants to more

Figure 1.
The seven wastes of manufacturing

Waste	Issue	Result
Over production	• Poor demand information due to the lag time between when data is collected versus when it is available • Improperly sized KanBan	• High inventory costs • High storage costs
Waiting	• Poor plant scheduling • Plant shortages • Machine maintenance issues	• Increase in labor costs • High asset costs
Transportation	• Improper plant layout and design • Time wasted locating materials and tools	• Increase in labor costs • Decrease in productivity and throughput
Inappropriate processing	• Poor communications throughout and between facilities • Manually generated reports	• Lack of appropriate data for the best strategic decision making • Decrease in supervisor productivity
Unnecessary motion	• Redundant data collection and maintenance: paper-based processes • Need to analyze and manually re-calculate data to create reports and obtain needed information	• Reduced worker productivity • Delayed visibility into operations for better decision-making
Defects/poor quality	• Errors on the production line • Missing parts • Late shipments and excessive lead times	• Excessive re-work, increasing costs and reducing product margins
Unnecessary inventory	• Excess ordering and larger buffer stocks due to the lag time between when data is collected versus when it is visible • Improperly sized KanBan	• High costs associated with carrying unnecessary inventory — including increased capital expense and warehousing space

easily collect a larger volume of more accurate study data, but also provide a real-time window into that data. The overall quality of clinical trials is improved, in turn helping the pharmaceutical manufacturer to bring higher quality and more effective products to market.

The charts on the following pages illustrate the many mobility applications available to help pharmaceutical manufacturers address the business issues of today by 'leaning' business operations — without adding human resources and additional processes that could adversely impact profitability.

Pharmaceutical Mobility Applications

Mobility in Materials Management

The warehouse is a central area of the business through which all raw materials and finished goods pass. The poorly managed warehouse can actually become cost prohibitive, significantly impacting the cost of doing business — and general profitability. Mobility greatly improves warehouse management by eliminating paper-based processes throughout the warehouse. Paper forms are replaced with real-time forms on mobile computers. The ability to scan or read a bar code or an RFID tag enables workers to validate that: the right ingredients are being picked from the shelves and delivered to the appropriate area of the production line at the right time; the right products are picked to fulfill orders; and the right shipments are loaded onto the right trucks for delivery to the customer — as well as capture the data required for forward product traceability. Voice can also be utilized to help streamline and error-proof warehouse processes with voice-directed picking applications. Through mobility, the real-time warehouse becomes a reality: the right data is available in the right place at the right time to enable the most efficient next action — and the most effective business decisions. Mobile materials management applications include:

Materials Management

Application	Description	Benefits
Warehouse Mobility	Warehouse mobility provides a real-time view of your inventory through the capture and availability of real-time data associated with your warehouse processes. In addition to enabling dynamic scheduling of picking, cross-docking and packing, knowing exactly what is in stock at any time significantly reduces: out of stocks; stocking inventory requirements and warehouse space requirements. In addition, pharmaceutical manufacturers must begin to track product the moment ingredients are received. RFID can provide highly cost-effective and accurate real-time tracking of all product as it moves throughout the plant, right up until product leaves the shipping dock bound for delivery — all automatically, without any human intervention.	• Improves warehouse efficiency — fewer workers can handle more tasks • Enables the error-free warehouse by eliminating mistakes in activities such as put-away, letdown and replenishment • Reduces inventory costs by reducing stocking levels • Decreases the volume and cost of warehouse space

Materials Management (continued)

Application	Description	Benefits
Material Tracking	Material tracking applications enable complete traceability of raw ingredient batches at any point in the manufacturing process, or after delivery to the customer in the form of finished product. In the event that a particular batch is found to be tainted or otherwise defective, this application ensures fast and efficient point recalls — the manufacturer knows the exact location of all contaminated product. The recall is handled in the most time and cost-efficient manner possible, protecting consumer safety. The need for potentially brand-damaging media coverage to 'get the word out' is eliminated, protecting brand equity. And the risk of recalling too much product — resulting in empty shelves and lost sales — is eliminated.	• Enables highly efficient and accurate tracking of raw materials • Reduces the cost of material tracking activities • Provides real-time visibility to support just-in-time (JIT) inventory initiatives

Warehouse mobility provides the real-time inventory visibility required to reduce out-of-stocks and stocking inventory requirements.

Mobility in the Plant

At the heart of every manufacturing operation is the plant. With mobility on the plant floor, you have the power to: monitor your plant equipment in real time; prevent errors on the production line; and truly track that one elusive variable — the cost of your labor. As a result: throughput is protected, machine downtime is minimized and control over yield is increased, providing the assurance that the right product is manufactured the right way at the right time — and you gain a better understanding of labor costs to protect margins and overall profitability. Mobile plant applications include:

Plant Operations

Application	Description	Benefits
Mobile HMI/ SCADA	Visual Supervisory Control and Data Acquisition (SCADA) is traditionally only available for viewing in a central control room, requiring an area to be closed down for health and safety reasons whenever work is required line side. Mobile SCADA expands control and monitoring capabilities beyond the control room. Alarm assessment, repair, and random inspection of equipment can be accomplished anywhere, including line side without closing an area, as personnel can continue to view visual SCADA data when away from the control room.	• Improves line-side uptime • Increases workforce productivity
Machine Monitoring	The Manufacturing Execution System (MES) system is used to monitor plant usage, throughputs and efficiency to highlight bottlenecks, under-utilization and variances from pre-defined standards. However, any MES data captured by paper on the shop floor and then entered into data systems results in a time delay that can lead to incorrect reporting — which in turn can have a major effect on yield. Automating the capture of data that cannot be acquired through machine technology ensures that accurate real-time key performance indicators (KPIs) are produced.	• Improves the efficiency and effectiveness of the machine monitoring process • Helps prevent the manufacture of non-standard product

Plant Operations (continued)

Application	Description	Benefits
Mobile Automation	Applying mobility to enable remote monitoring and maintenance of automation systems, such as Programmable Logic Controllers, enables more efficient use of expensive technicians.	• Improves staff utilization • Improves response times to conditions
Mobile Labor Cost Tracking	Labor costs represent one of the largest variables in the cost of your products and accurate labor costing is critical to ensuring and protecting profitability. Yet to date, most manufacturers use standard cost estimates instead of actual costs to calculate labor costs. But by mobilizing the existing Time and Attendance (T&A) system, manufacturers have the ability to track actual time-on-task at a granular level. Now, a single set of labor costing data populates both the T&A and ERP systems, enabling the true reconciliation of production hours with job costing and payroll. And the ability to track time-on-task enables managers to spot and eliminate unproductive activities, leading to better utilization of the workforce.	• Ensures accurate product pricing • Enables more competitive pricing • Protects profitability • Substantial reduction in time required to reconcile actual hours worked, estimated hours worked and payroll • Improves productivity for managers and administrative staff

Mobility in Enterprise Asset Management (EAM)

In pharmaceutical manufacturing plants, managing and maintaining the equipment on the plant floor is vital. Improper maintenance can translate into unplanned downtime, a very costly event involving the cost of idle employees and lost production. Inaccuracies in asset inventory can result in non-compliance with government regulations, translating into fines or excessive taxes.

Mobile computing, wireless LAN and RFID locationing technologies allow pharmaceutical manufacturers to streamline all enterprise asset management functions to eliminate these issues. Stripping the inefficiencies out of the maintenance function can help ensure that the critical equipment out on the plant floor is serviced on time, with the right maintenance routines, performed correctly, complete with a comprehensive audit trail. And the ability to rapidly and accurately inventory assets out on the production floor — even without human intervention — can eliminate physical inventory processes, like cycle counting, freeing workers to handle other more business-crucial tasks. Mobile EAM applications include:

Enterprise Asset Management

Application	Description	Benefits
Mobile Asset Tracking	When locationing technologies or bar code scanning are deployed to count and track assets, errors and the high costs associated with manual inventory counts are eliminated. Workers can quickly and easily scan the bar codes or direct part marks on equipment with a handheld mobile computer, utilize a mobile RFID reader on a cart to quickly read all the RFID tags in a given area (such as a warehouse), or leverage wireless LAN or fixed RFID locationing technologies to constantly an automatically maintain inventory counts and even the actual location of an asset — all without any worker involvement.	• Improves efficiency of the inventory process — as well as worker productivity • Enables cost-effective compliance with government accounting regulations • Improves tool utilization, reducing tool inventory and management costs • Protects against loss or theft of assets • Ensures proper tax treatment of assets • Protects against financial penalties due to non-compliance

Enterprise Asset Management (continued)

Application	Description	Benefits
Mobile Asset Maintenance	Your machinery is your most important asset — proper maintenance is critical in order to achieve maximum uptime. Mobile asset maintenance ensures proper and timely scheduling of maintenance, provides maintenance history for machines to ensure the right maintenance routines are performed, and assigns the right tools and parts required for daily scheduled maintenance. In addition, if the manufacturing execution system (MES) or SCADA reveals a potential equipment problem, the system can dynamically schedule that piece of machinery for immediate service. And 2-way voice communications between plant and maintenance personnel can enable real-time responses to equipment challenges. As a result, machinery is always serviced at the right time, and your maintenance department is cost-efficient and effective.	• Improves uptime, protecting productivity and yield • Eliminates inefficiencies in the maintenance process • Ensures more timely maintenance — engineers can now service more equipment per day • Potential machinery problems can be addressed as they surface, before impacting production

Mobility helps ensure that critical equipment on the production line is serviced on time, every time — protecting uptime and profitability.

Mobility in Quality

Controlling quality throughout operations is a top initiative in pharmaceutical manufacturing, heavily controlled by government regulations and vital to consumer safety. In order to maintain or exceed mandated quality standards without adding costs, the efficiency of the quality function must be improved. Just as there are seven wastes in lean manufacturing, there may be seven wastes in your quality function — and mobility helps you address every one:

1. Manual 'double-touch' of data: gathering information via handwritten forms which must then be entered into the computer at a later date
2. Manual research due to lack of real-time data
3. Manual consolidation of information from different sources for reporting and trend analysis — for example, data resident in computer applications and also on spreadsheets, databases and contact lists on individual computers
4. Lack of access to, or time spent traveling to and from computers and other resources to monitor processes or take required actions
5. Managing data errors — identifying, researching and correcting erroneous information
6. Heavy staffing requirements due to time intensive manual procedures
7. Lack of centralized data repository translates into the need for large amounts of email and high volumes of meetings to obtain data

In addition, some production processes as well as packaging is often outsourced, adding a level of complexity to the management of this crucial function. But the ability to put a mobile device running your quality applications in the hands of your vendors provides a number of major benefits. The manufacturer can ensure that the vendor follows the established quality processes; those processes are automated and streamlined, improving vendor productivity and reducing errors; and the instant transmission of information into your business systems ensures the real-time visibility required to protect not only the effectiveness of your quality function but also the quality of your product — and ultimately the safety of the consumer. Mobile quality applications include:

Quality

Application	Description	Benefits
Mobile Forms	Quality engineers manage up to 200 different forms, including forms for submission for government regulations, such as ISO 9000, or to comply with customer demands. Forms are often backfilled at the end of a shift rather than in real time as required. Mobility greatly simplifies the management of these forms, ensuring timely completion, providing time/date/operator stamps if desired, and dramatically increasing the productivity of your quality engineers.	• Eliminates the time and errors associated with double data entry • Provides visibility into real-time quality data

Real-Time SPC (statistical process control)	SPC programs are critical in determining the root cause of an increase or decline in yield, and how to address it. There are several key issues with today's SPC programs. The first is the 'data gap' created by the small amount of data (typically 20% to 30%) that cannot be collected automatically. This forces the need for manual collection of this data, and introduces the possibility of errors as well as a time lag between when the data is collected and when it is available to view. In addition, data used for final analysis is often up to three weeks old (and in some cases, up to one full quarter old). Mobility enables the real-time automated capture and instant transmission of this data into the SPC system, ensuring that your business decisions are based on an accurate real-time view of your global processes.	• Ensures proper yield • Eliminates the need for additional warehouse space to store overages • Ensures product is completed on time
Six Sigma Data Capture	Six Sigma requires timely and accurate collection of data. Manual data collection processes (such as pen and paper or computer keyboard data entry) achieve approximately Two Sigma. A handheld mobile computer eliminates manual data collection, enabling the automatic and instant capture of the information in a bar code, Direct Part Mark (DPM) or RFID tag right at the point of activity, increasing worker productivity, overall operational efficiency — and often delivering better than Six Sigma.	• Dramatically reduces the time and cost associated with achieving a Six Sigma level of quality
Batch Traceability (e-Pedigree)	Mobile data collection technology, in conjunction with batch record software, enables efficient and error-proof tracking of batches of raw material through the capture of accurate batch serial numbers. This electronic batch record, or e-pedigree, provides visibility into all the products that contain a given batch of raw material, enabling rapid reaction time to product quality issues. At any point in the production process or after products are completed, products containing a specific batch can be easily identified and quickly recalled.	• Enables cost-effective batch tracking • Provides granular forward traceability to enable targeted cost-effective recalls • Helps protect consumer safety • Reduces non-compliance incidents and associated fines
Environmental Compliance & Waste Management	Manufacturers must document efforts to reduce waste or pay recycling subsidies. The impact of not being able to produce documents to prove compliance can easily add up to millions of dollars. But the impact on productivity and overhead associated with the data collection to prove compliance is also significant. Deploying mobility at the point of waste creation to track waste not only provides the information required to prove compliance, but also significantly minimizes the effect on productivity and overhead.	• Automates the collection of environmental and waste data for cost-effective compliance — without adding resources or impacting productivity • Reduces non-compliance incidents due to lack of data and the associated fines

Mobility in the Field

In the past, sales representatives could count on meeting with a doctor for 10 or 15 minutes — today they are fortunate to have two to five minutes with physicians. With mobile voice and data in-hand, the pharmaceutical sales force has all the tools needed to provide the best possible interaction in the least amount of time. Now, sales representatives can collect e-pedigree, traceability and sample distribution information as well as validate the authenticity of samples, all in just seconds — allowing pharmaceutical companies to comply with government regulations and protect consumers from inadvertently receiving counterfeit or defective product, without impacting the quality of the sales call. And real-time access to product presentations and product information — resident on the mobile device as well as on the company intranet — provides representatives with all the details needed to address virtually any product-related question, right on the spot. As a result, your sales force remains effective, in spite of the increased burden of data collection for government regulations and the shorter meeting times with physicians.

Field Mobility

Application	Description	Benefits
Sales Force Automation	With integrated mobile voice and data on an easy-to-use handheld device, pharmaceutical sales representatives have the tools in hand to maximize the value of the physician meeting — no matter how brief. Bar code scanning allows representatives to validate the authenticity of samples, protecting against the inadvertent distribution of counterfeit product while efficiently and accurately collecting all the information required for compliance with e-pedigree and sample distribution laws. The ability to access real-time or stored information ensures that sales representatives can provide a detailed education on the drug as well as answer any questions to help influence the physician to prescribe the drug. The ability to download and carry the latest product collateral right on the device — such as brochures, datasheets, clinical trial results and more — enables printing or emailing of the materials on demand, right in the doctor's office. And access to presentation tools, such as Microsoft PowerPoint, enables pharmaceutical manufacturers to provide sales presentations that not only ensure consistency in messaging but also that all salient points are communicated in every meeting.	• More effective sales calls • Improves salesforce utilization — the same salesforce can now make more customer visits per day • Automates and error-proofs recordkeeping • Enables compliance with sample distribution and e-pedigree regulations — without adding administrative burden and cost or impacting productivity • Protects against the introduction of counterfeit product in sample distribution

Field Mobility (continued)

Application	Description	Benefits
Mobile Clinical Trials	When participants in product trials are provided with an integrated mobile computer capable of real-time voice and data communications, data accuracy and the safety of trial participants are improved. Drop down boxes and more help ensure the consistency of data required to support rich analysis. The wireless connection allows the instant and automatic transmission of data to the appropriate back-end business system. The additional handling and manual entry of data into the computer is eliminated, improving the accuracy of this crucial data. In the event specific potentially dangerous side effects are reported, instant alerts can be sent to product trial managers, improving the safety of trial participants. The data can be formatted to enable instant and automatic initial analysis of the data, providing real-time running reports for trial managers. And since the devices can also enable voice as well as fixed mobile convergence (FMC), trial participants can be given a 4-digit extension to dial, serving as a 'hot line' for reporting urgent matters.	• Enables the collection of highly accurate real-time trial data • Eliminates the lag time between when paper forms are submitted and when data analysis is available, providing the real-time visibility into participant data required to improve participant safety • Protects brand equity by helping prevent the inadvertent release of drugs with dangerous side effects due to inaccuracies in trial participant data records • Improves ability to recruit trial participants due to improvements in trial safety, including real-time monitoring and improved accessibility to company personnel • Simplifies and reduces the costs associated with applying for government approval to distribute a drug

Mobility in Management

Your managers are always on the move throughout the plant or traveling between office locations. Mobility ensures that, even though they may be on the go, these executives always have access to the business information and personal productivity tools required to act on the spot — keeping the enterprise agile and ensuring the rapid response times needed to keep the business up and running at peak efficiency.

Mobile Manager

Application	Description	Benefits
Mobile Manufacturing Manager	This solution allows access to critical business intelligence on a handheld computer, enabling executives and other management to leave their desks and go wherever they are needed — from the plant floor to the field — while still keeping the information required to make the best business decisions right at their fingertips.	• Better plant management — faster reaction to changing conditions
Mobile Manager Productivity	The integration of voice and data onto a single pocket-sized device allows managers and engineers to keep the tools they need to take care of business — right in the palms of their hands. No longer tethered to a desk, managers are now free to remain where they are most effective — out in the plant — yet still maintain visibility into Key Performance Indicators (KPIs), plant messages and alerts as well as access to email, forecasting and scheduling applications and more.	• More effective managers — managers can now handle more tasks throughout the workday

Mobility and Plant Communications

Different types of workers need different types of business and mission critical voice and data services. Some workers require mission critical basic walkie-talkie style voice communications to protect employee safety and enterprise security. Others require a business critical connection to voice and data to streamline processes and improve productivity as well as business agility. For example, some workers require rich voice connectivity equivalent to a mobile version of the deskphone — the ability to receive incoming calls from customers and other associates as well as the ability to place calls inside and outside the four walls plus access to PBX features, such as call forwarding and conferencing. And still others require both rich voice and rich data communications, the mobile equivalent of the deskphone as well as the desktop computer for access to critical back-end business applications as well as personal productivity tools such as email.

To meet these many needs today, most manufacturers have deployed multiple disparate networks — including:

- A wireless LAN to provide workers inside the four walls with wireless access to business and personal productivity applications
- A trunked radio system to support two-way radios
- WWAN push-to-talk leased airtime to enable walkie-talkie style group calls for non-mission critical workers
- A traditional wired phone line (PBX)
- Wired Ethernet networks to serve those workers who spend the day primarily at a desk

Not only must separate networks be maintained and managed, but the devices on the separate networks cannot 'talk' to each other, forcing many workers to carry multiple devices — for example, managers may need to carry a two-way radio to communicate with some workers, a cordless handset to communicate with others as well as a mobile computer of some sort to access mobile data. The result? Your workers are forced to act as the bridge between your networks, effectively acting as routers by carrying multiple types of devices. And the business incurs unnecessary high capital and operational costs associated with purchasing multiple devices per person; time personnel spends managing multiple devices; and time IT spends managing the many devices and networks.

Mobility can address this issue by enabling the delivery of all voice and data communications over a common backbone, eliminating the need to maintain multiple disparate networks — dramatically simplifying and reducing the cost of the technology architecture.

Plant Communications

Application	Description	Benefits
Unified Voice and Data Architecture	Mobility allows the consolidation of disparate backbones into a single system, enabling cross-communications between the many types of devices deployed in your business. The high cost associated with maintaining and managing multiple wholly independent networks is eliminated — and the need to provide workers with separate devices for voice and data is eliminated. Now, regardless of what type of voice and data communications different types of workers require, they can be delivered to a single device. Voice services can include one-to-one private calls, one-to-one and one-to-many push-to-talk (PTT) walkie-talkie style calls, Cellular (WAN) calls, as well as the extension of the deskphone and all PBX features to the mobile device. Data services can be as simple as text messaging or as complex as full access to back-end critical business applications. As a result, workers are no longer forced to act as network connection points — for example, a manager with a mobile computer or supervisor with a business smartphone can communicate directly with workers that carry two-way radios. And the enterprise retains the freedom to match the right device to the job — from two-way radios with or without integrated text messaging to improve worker safety, business smartphones for workers that need the mobile equivalent of the deskphone and basic data functions, as well as integrated handheld mobile computers for workers that require rich voice and data connectivity. With this new simplified technology architecture, all voice and data traffic and mobile devices are essentially on the same network. As a result, the enterprise now has full control over the quality of the services, able to ensure toll-quality voice and application performance regardless of device type. In addition, the simpler architecture also greatly improves the efficiency of your IT organization. The issues, time and cost associated with managing disparate IT systems and multiple devices per person are eliminated — from inefficient asset management and unbalanced server resources to high application development costs and the general slow movement of information throughout the organization.	• Increase in worker accessibility through both voice and data • Significant reduction in the complexity and cost of the voice and data architecture, including mobile devices and networks • Improves employee safety, security and productivity — voice services can be extended as needed throughout the enterprise to more types of workers, without cost or compromise • Significant reduction in WAN costs leveraging VOIP for in-plant communications

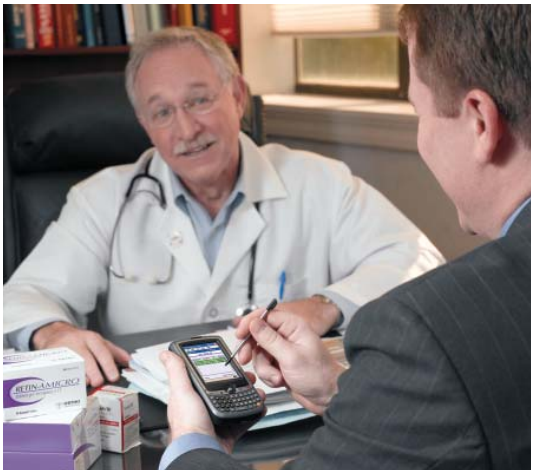
Mobility in Facilities Management

To keep your facilities secure, live video monitoring is critical. But hard-wiring cameras throughout your facility can be a major expense in expansive facilities, which can include indoor as well as outdoor areas. Wireless video cameras capable of operating on either Wi-Fi or private wireless broadband networks eliminate the need and cost associated with running cabling to each camera — making cost-effective video surveillance in large manufacturing plants a reality. And when that video can be viewed on a handheld mobile device, further efficiencies are gained and security is improved — your security officers are no longer tied to the control room to monitor video, and are able to make rounds yet keep an eye on the real-time video feeds from all your cameras.

Mobile Manager

Application	Description	Benefits
Mobile Security Monitoring	Wirelessly-enabled video cameras and a wireless broadband backhaul network allows manufacturers to easily and cost-effectively implement a high-speed wireless video surveillance solution. The need to run cables to each camera is eliminated — substantially reducing the cost of video surveillance in large manufacturing environments. And mesh-enabled wireless cameras and wireless broadband networks further simplify and reduce wireless infrastructure costs. In addition, a mobile solution also frees your video feeds from their present day tether to the control room, allowing your security officers the ability to continue to view video from any camera in any facility on a handheld mobile device while on the move. Dedicated personnel are no longer required in the control room, enabling a reduction in the security workforce — as well as an improvement in overall facility security. And a single fully-featured integrated voice and data handheld mobile device provides business or mission critical voice and data communications for your security personnel. In addition to the ability to view live video feeds, officers will enjoy comprehensive mobile voice capabilities, including push-to-talk, one-to-one and group calls, 4-digit extension dialing and more. And access to back-end data applications enables officers with the ability to scan and verify an employee badge or, with a biometrics attachment, take a fingerprint to ensure identification in high-security environments.	• Enables cost-effective real-time video surveillance of expansive facilities or campuses • Increases facility security • Improves effectiveness of security officers, who can now continually patrol facility grounds without losing the ability to monitor live video • Reduces security officer staffing requirements — eliminates the need for around the clock staffing of the control room in addition to patrol staff • Eliminates the need to provide security officers with separate voice and data devices, substantially reducing the costs associated with purchasing, managing and maintaining mobile devices and accessories (such as batteries and chargers)

Case Study: Field Mobility



Solution category:	Field Mobility
Application:	Sales Force Automation
Industry:	Pharmaceutical
Company:	Major pharmaceutical manufacturer

Business Issue

Increase effectiveness of sales force and efficiency of data collection for new regulatory requirements

The sales process for pharmaceutical representatives is heavily controlled by government regulation. Unable to actually engage in 'selling', representatives are only allowed to 'detail', or explain the product, its side effects and benefits. Today's physicians are so busy that meetings were reduced from 15 minutes to less than five minutes. In addition, new regulations now require representatives to obtain physician signatures as proof of receipt for drug samples, adding a paper-laden process to an already too-brief meeting. The company was searching for a means to better assist its sales force in maximizing the shortened physician meetings as well as simplifying the regulatory compliance process.

The before scenario:
Representatives called on physicians armed with product brochures and presentations on a laptop. The time the laptop took just to boot up ate into precious sales time, and historical information was not readily available. In addition, the physician needed to physically sign for samples received, creating a paper-laden process that rippled into additional record keeping requirements for sales personnel as well as administrative staff back at the office.

Solution

Enterprise-class all-in-one hand-held mobile computer with wireless connectivity

The after scenario:
Representatives now carry a wireless hand-held computer, complete with bar code scanning and signature capture capability. During a physician meeting, this single device provides all the information and capabilities required, including:

- A brief electronic checklist of points to cover to ensure the most important information is always reviewed in the meeting
- Wireless connectivity for access to the most current information (WWAN and WLAN) both in and outside of the corporate walls
- The ability to electronically record the physician's signature to verify receipt of samples, as well as scan bar code samples for traceability
- Wireless email to send a link right from the physician's office to enable the physician to view detailed information instantly — or when convenient

Benefits

Moving from a laptop to a smaller, more compact form factor with increased functionality enables representatives to deliver better service while meeting new regulatory requirements. Benefits include:

- **12% increase in sales representative productivity.** The ability to electronically capture signatures for regulatory compliance related to distribution of prescription drug samples eliminated the previous time consuming paper-based process. Representatives are now free to make more sales calls per day and spend more time on sales related activities, rather than administrative tasks.
- **Cost-effective regulatory compliance.** The ability to electronically capture the physician's signature enables compliance requirements to be met with minimal effort and cost.
- **Most effective use of time.** Representatives now utilize the few moments with a physician as effectively as humanly possible, with access to the most up-to-date data, and the ability to obtain real-time marketing information for other products the physician has sampled as well as usage rates.
- **More robust sales and marketing information, brand equity protection.** The ability to easily capture bar code information on samples distributed to physicians provides a tremendous amount of sales data for representatives. Accurate records of what samples a specific physician has received, if the samples are being used, and even more information is now is readily available. In addition, bar code scanning of samples provides complete traceability in the event of a product recall.
- **Instant follow-up.** With wireless email capability, representatives are able to follow up as promptly as possible — before even leaving the physician's office, a link immediately for 'self-detailing' can be sent. Physicians can also email a quick question and the representative can immediately respond, before returning to the office that evening.

Case Study: Quality

Solution category:	Quality
Application:	RFID/Track and Trace
Industry:	Pharmaceutical
Company:	Major pharmaceutical manufacturer

Business Issue

Provide counterfeit protection and preparation for future regulatory requirements

With counterfeiting on the rise, this pharmaceutical manufacturer sought a means to ensure the integrity and safety of products as they move through the supply chain to the customer. In addition, the company is anticipating that government regulations that already mandate the ability to trace food products at all stages of production, processing and distribution will likely be extended to include pharmaceuticals in the near future. Implementing the ability to track products from the manufacturing plant to the customer's door would not only protect against the introduction of counterfeit product into the supply chain, but would also position the company to quickly and cost-effectively meet new regulatory requirements.

The before scenario:
The company already had the ability to track batches of ingredients as they were used, providing the information needed in the event of a recall. This ability, however, did not exist to track product at the individual bottle or package level beyond the production line. The visibility required to protect against diversion, tampering and counterfeiting at the desired level did not exist. The company had two options: extend the existing bar code scanning system currently in place to the 'bottle' level from shipping to delivery to the customer, or complement the existing bar code scanning solution with RFID.

Solution

Automatic tracking at the individual product level

The after scenario:
The company chose to augment existing bar code technology with RFID to create an electronic 'pedigree' for every bottle of prescription drugs. An electronic pedigree

contains a full accounting of how a specific product (such as a bottle of pills) moved through the supply chain to the customer, including identifying information such as the serial number, lot number, and expiration date. This solution delivers robust protection against tampering and the introduction of counterfeit product — at various stages of the journey through the supply chain, electronic pedigrees are verified. If verification fails, the product is not authentic.

RFID tags are now placed on individual bottles and packages of products as they come off the production line. The products then pass through an RFID reader which records the unique identifier for each product contained on the RFID tag and stores the numbers in a database. The products then continue down the production line and are packed and sealed in cases. As the cases pass through another RFID portal, the RFID tags on the bottles in the case are read (while still packaged and sealed in the box) and compared to the existing database of serial numbers to ensure validity of product after the packing process. Cases are then again scanned and stored, awaiting shipment.

As orders are processed, the system indicates which cases should be picked based on information such as product type and expiration date, as well as the exact location of the cases. After the cases have been picked, another RFID reader verifies that the right cases were selected. The cases pass through the last portal and are loaded on the truck, and are again read when they are removed from the truck for delivery to the customer.

At no time is any human intervention required. The RFID tag acts as a passport, automatically verifying itself at every portal through which it passes. The resulting electronic pedigree provides the needed protection against tampering and counterfeiting without the introduction of any additional procedures or paperwork. Employee productivity remains intact, and each product has an associated secure file that provides a full accounting of every move through the supply chain, from the time the product was created, to the time it was shipped, and to the customer who received it.

Benefits

This RFID solution provides a number of benefits:

- **Strong counterfeit protection.** Counterfeit products can be easily and quickly identified and removed from the supply chain, providing a high degree of protection for the public. The ability to generate an electronic pedigree for every bottle or package of prescription drugs documents the safety and security of manufacturing and distribution — product without a valid pedigree is counterfeit.
- **18% increase productivity.** Warehouse employees no longer need to manually scan product as it moves through the packing and shipping process. The RFID solution collects all information without any human intervention, scanning product right in the box as it passed through portals, increasing employee productivity in the warehouse.

...continued on next page

- **Complete track and trace capabilities.** The company increases the cost-efficiency of regulatory compliance and protects brand equity simultaneously through the ability to quickly and easily identify customers who received a specific lot of a product. The customer information can be utilized to conduct a fast and efficient product recall, eliminating the prior need to broadcast the situation via mass media such as television.
- **Forward thinking systems approach:** A systems view of the needs today as well as tomorrow enabled the design and implementation of a solution to support today's requirements as well as expected new regulatory requirements. In addition to major cost-efficiencies, the company is a step ahead of the competition — a definite competitive edge.
- **More efficient 'first in first out' (FIFO) operations.** Warehouse workers do not need to spend any time identifying which box contains the oldest product when filling orders – the pick order is complete, automatically identifying the case with the oldest product as well as the exact location of that case.

Case Study: Enterprise Asset Management

Solution category:	Enterprise Asset Management
Application:	Asset Maintenance
Industry:	Pharmaceutical
Company:	Major worldwide medical system manufacturer

Business Issue

Eliminate inefficiencies in the maintenance dispatch function — and the resulting negative impact on profitability

This medical device manufacturer discovered a major inefficiency in the asset maintenance function — technicians were spending less than 50 percent of their time actually performing maintenance. More than half of their time was associated with heavily manual administrative tasks — from locating paper work orders and the records associated with equipment scheduled for maintenance to completing paper maintenance records by hand and then entering that data into the computer. In addition, these manual administrative procedures created a long lag time between when data was collected and when it was available in the system, fostering a series of issues. A report of a continuing issue with a machine may not be visible for days, preventing timely scheduling of maintenance to prevent machine malfunction or failure. And since the records for machines that had just been serviced took so long to appear in the system, technicians were often unknowingly working with an incomplete maintenance history — masking needed information to best diagnose and resolve machine issues. The ultimate result was an unacceptable amount of unplanned production line downtime — and the high cost of low technician productivity.

The before scenario:
The maintenance function was dependent upon a completely manual system — a clipboard, paper and pen. Paper work orders were distributed at the start of each day, and paper forms were utilized to collect maintenance information — from processes completed to new findings. At the end of the day, paperwork was placed in the data entry bin, waiting to be keyed into the company's maintenance and support computer-based system — a task that could easily take days or weeks.

...continued on next page

Solution

Mobilization of the entire maintenance function

The after scenario:
Now, all technicians are equipped with a lightweight yet rugged and easy to carry mobile handheld computer, providing two key capabilities that enabled dramatic efficiency improvements in the maintenance function — automated real-time data collection and real-time information access. Paper was completely eliminated — electronic work orders were dispatched directly to the mobile device, replacing paper-based work orders. Information on each job was entered on the handheld device — not a paper form — providing real-time visibility into the status of scheduled and emergency maintenance as well as the ability to better detect machine issues that required immediate attention. And real-time information access right at the point of work enabled technicians to view the complete up-to-the-minute maintenance history for a machine as well as associated manuals — eliminating time previously spent searching for physical files and other documentation.

In addition, the ability to instantly and dynamically issue work orders in response to a machine malfunction ensured the timely attention required to prevent machine downtime. Supervisors no longer need to spend time locating the right technician with the right expertise, nor does that technician need to spend time returning to the office to collect documentation.

Furthermore, efficiency gains were also realized in the management of the tools and parts inventory. Real-time visibility into the day's work orders enabled the tools and parts department to ensure that everything needed was available on the date of service, ready and waiting for pickup when the technician arrived. And since technicians entered the use of parts in real-time on the mobile device, parts were always replenished on time and available when needed.

Last but not least, visibility into real-time maintenance information provided engineers with the ability to better analyze operations. Machine issues are detected and resolved faster, ultimately reducing unplanned downtime on the production line.

Benefits

Mobility provided a dramatic improvement in the asset maintenance function, returning mutiple high value benefits:

- **5% reduction in equipment downtime.** Real-time visibility into equipment maintenance information and maintenance work orders allowed production engineers to better analyze equipment status. Real-time dispatch enabled proper and dynamic prioritization of the work schedule, ensuring the timely attention required to prevent downtime — without disrupting the entire maintenance organization.
- **45% improvement in technician productivity.** The elimination of paper and the instant availability of information as well as parts dramatically improved technician productivity.

Now technicians spend more 'time on task' — instead of spending 50% of the time on administrative tasks and 50% of the time performing maintenance, technicians spend 90% of their time on task and only 10% on administrative duties. As a result, more maintenance orders can be completed per day — without adding staff.

- **Six Sigma data accuracy.** The ability to automate data collection practically eliminated data errors. Now, technicians just scan the bar code, RFID or direct part mark on the machine to auto populate asset identification fields such as serial numbers. And a series of drop down menus and check boxes document the execution of maintenance tasks as well as pertinent machine information
- **10% reduction in off line jobs.** The technicians now have a means to record required ad hoc jobs that were not supported by a work order, enabling accurate reconciliation of labor at the end of each day.
- **80% reduction in data entry requirements.** Technicians now enter the information in real-time as the job is performed, virtually eliminating the need for subsequent data entry — enabling the re-deployment of administrative staff elsewhere in the business.
- **30% reduction in parts inventory.** Real-time visibility into the usage of parts enabled a major reduction in parts inventory, reducing capital and carrying costs as well as required warehouse storage space.

By eliminating paper processes from the asset maintenance function, this major medical device manufacturer achieved an incredible 45% improvement in technicial productivity — and a 5% reduction in unplanned downtime.

Unified Voice and Data Architecture

Unified Voice and Data Architecture

Plant communications: today's typical multi-network plant

Today's plant communication infrastructure is typically comprised of multiple networks (depicted in Figure 1) that enable the many different types of devices and communications required to support the business. This 'silo' network architecture was built over time, in reaction to the continued development and availability of new technologies and the addition of each new layer in the network topology delivered different benefits to the manufacturer:

- **PBX/wired phone line:** Delivers traditional voice communications and a host of productivity enhancing voice features to the deskphone, designed for workers who spend the day primarily at the desk.
- **Legacy text paging system:** Supports paging throughout the enterprise, enables paging between employees, organizes and filters the volumes of incoming data from plant equipment and provides supervisors and more with text messages and alarms whenever a machine is in danger of malfunctioning or becoming out of tolerance.
- **Wired Ethernet Local Area Network (LAN):** Provides traditional wired corporate network access to desktop computers, plant equipment and application servers.
- **Trunked radio system:** This independent radio network involves licensed frequencies, ensuring complete control of network performance and availability for mission or business critical two-way radio communications.
- **Wireless Local Area Network (WLAN):** This wireless extension of the corporate network provides wireless voice and data connectivity for mobile devices inside the four walls — including handheld mobile computers, laptops and Voice-over-IP handsets.
- **Wireless Wide Area Networks (WWAN):** Provides cellular-based voice and data connectivity outside the four walls — including push-to-talk one-to-one and group calls.

Since the various networks are disparate 'silos', workers that need to communicate over more than one of these networks are required to carry multiple devices. For example, a manager may carry:

- A two-way radio for a mission or business critical voice connection to remote workers
- A pager for equipment alarms and status updates
- A mobile handset for PBX-based voice communications inside the four walls
- A cell phone for voice and data communications outside the four walls
- A laptop and/or handheld mobile computer for on-the-move access to back-end business systems, voice services and more

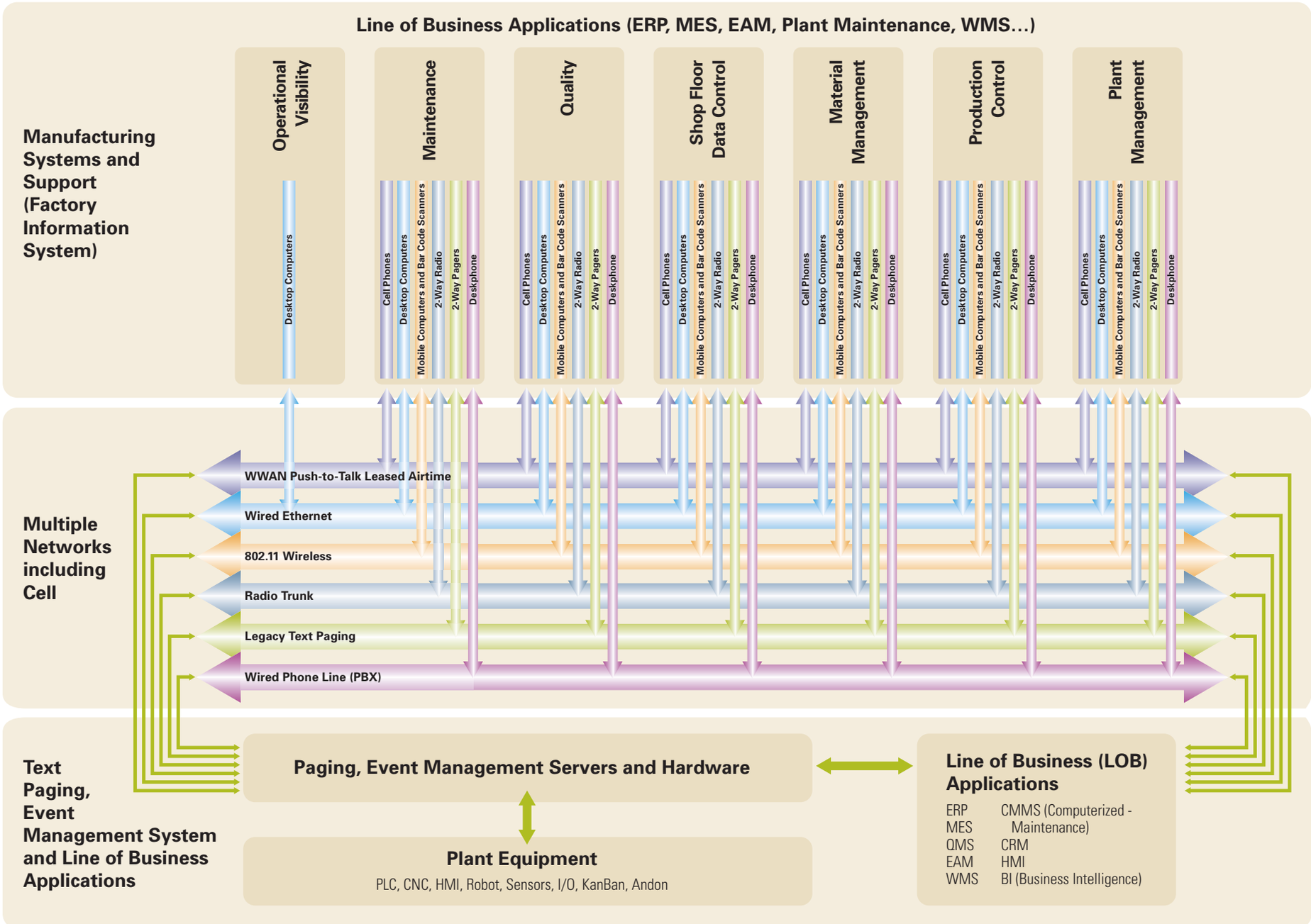
Today's Typical Manufacturing Plant:

A Multi-Network Architecture

A multiple-network/ multiple-device architecture is very costly, rippling into high capital and operational costs as well as reduced business productivity.

Figure 1.

Today's Typical Manufacturing Plant: A Multi-Network Architecture



Today's typical manufacturing plant maintains as many as six separate networks in order to enable voice and data communications to all workers, rippling into high capital and operational costs, lost productivity and reduced business agility.

The high cost of a multi-network architecture

The multiple-network/multiple-device architecture is very costly, rippling into high capital and operational costs as well as reduced business productivity:

Network-related expenditures

- **Capital costs:** Includes the purchase of network infrastructure, licensed frequencies, servers and the installation of network cabling and power outlets.
- **IT operational costs:** Includes the substantial time required for day-to-day management of multiple networks.

Device-related expenditures

- **Capital costs:** Includes the purchase of multiple devices per person, complete with required accessories, such as extra or high capacity batteries, headsets, holsters and more.
- **IT operational costs:** Includes the time associated with managing multiple devices per person — from initial staging and ongoing provisioning to troubleshooting and day-to-day management.
- **Employee-related operational costs:** Includes the time employees devote to managing multiple devices — from training and troubleshooting to battery and accessory management.

Operational inefficiencies

In addition to hard capital and operational costs, there are the soft costs involved due to the fact that your workers are forced to effectively act as routers between the networks: the multiple device types act as the ports on a router, while your employees become the router itself, the bridge between your networks. For example, a supervisor may receive a call on a two-way radio from a remote worker with an emergency. The supervisor will need to use a cell phone or mobile handset to contact upper management and determine the appropriate action, and then use the two-way radio to communicate that action to back to the worker. Or a quality engineer may receive a call on a mobile PBX-based handset from a warehouse worker who needs to know if a shipment has been cleared for use in production. In order to respond, the quality engineer must switch devices, either looking up the information on a laptop or handheld computer on the spot or returning to the desk to access the desktop computer.

As a result of this 'human bridging' of your networks, the speed at which information moves throughout your facility is reduced, impacting workflows and worker safety as well as production volumes and the velocity of your supply chain.

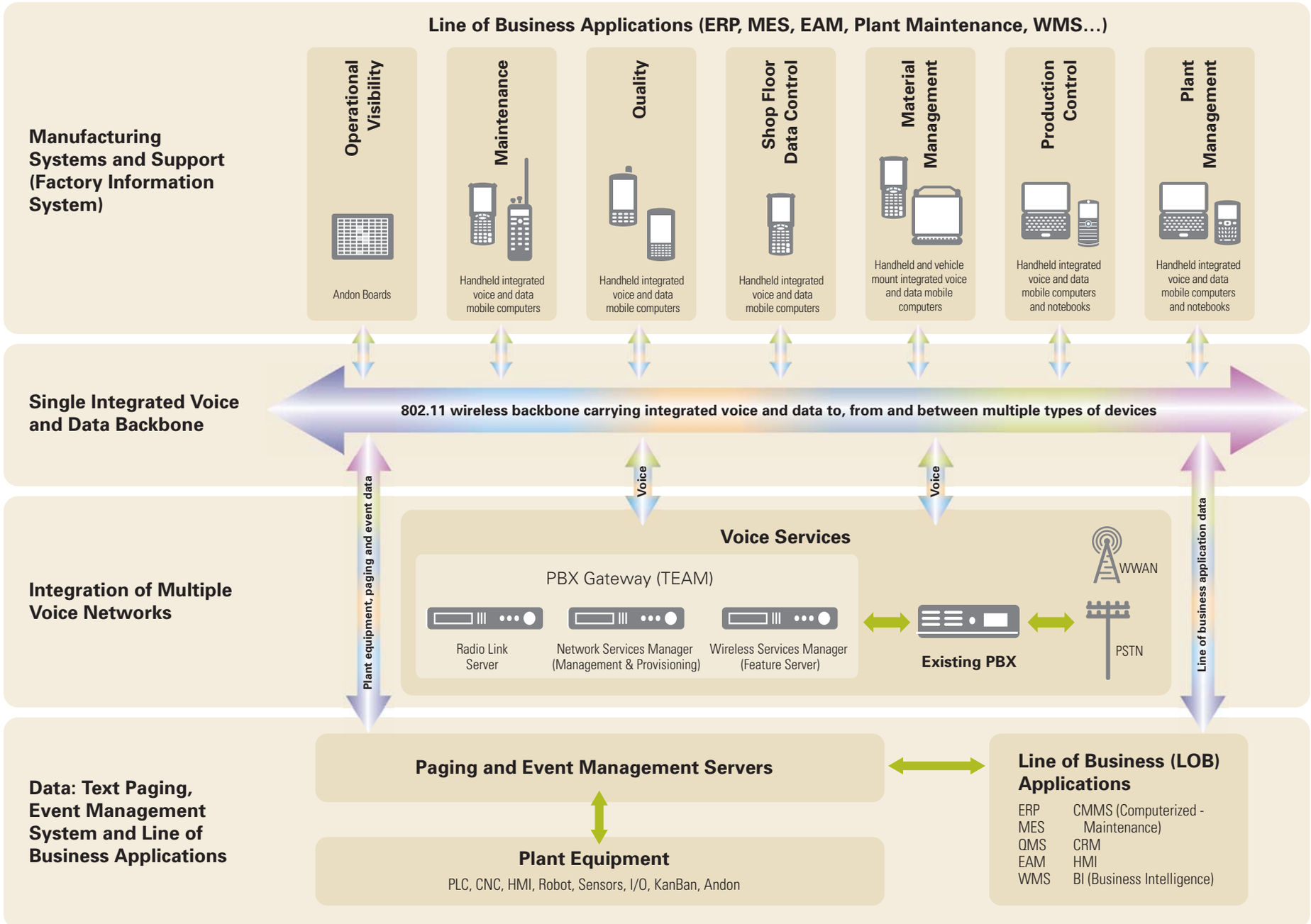
Tomorrow's Typical 'Mobilized' Manufacturing Plant:

A Unified Voice and Data Architecture

The integration of these disparate backbones into a single ubiquitous system enables virtually any type of communications between any worker and any type of device, inside and outside the enterprise walls.

Figure 2.

Tomorrow's Typical 'Mobilized' Manufacturing Plant: A Unified Voice and Data Architecture



By leveraging today's wireless technologies, today's manufacturer can integrate the disparate backbones of today into a single communication system that: greatly simplifies the voice and data architecture; is easier and less costly to manage; and provides the real-time voice and data connection to and between all your employees, plant equipment and crucial line of business applications required to truly streamline your operations — and improve the velocity of your supply chain.

The unification of the voice and data architecture

Today's technology allows manufacturers to integrate these disparate backbones into a single ubiquitous system, capable of enabling virtually any type of communications between any worker and any type of device, inside and outside the enterprise walls. The wireless LAN (WLAN) becomes the central network 'pipe', enabling the flow of comprehensive voice and data communications to and from employees who are located inside and outside your four walls — creating an effective and cost-efficient unified voice and data architecture. In addition, the ability to condense network traffic into a single pipe allows manufacturers to take advantage of the latest generation of integrated voice and data devices.

Now, manufacturers can provide workers with a single device that offers all required communications functionality — instead of multiple 'point-functionality' devices. And since the voice and data networks are integrated, all devices are essentially on the same network, enabling workers to easily reach each other regardless of device type. Workers are no longer forced to act as network connection points. For example, a manager with a handheld integrated voice and data mobile computer or supervisor with a business smartphone can communicate directly with workers that carry two-way radios — able to place and receive one-to-one or group calls to and from those workers.

The new WLAN-based unified architecture:

- Enables communications to and from licensed frequency private radio networks between two-way radios and different types of voice-enabled devices.
- Delivers event notification and alarms generated by your paging and event management servers to any type of device that supports mobile data.
- Routes calls from a wide variety of single and dual mode mobile voice-enabled devices through the PBX, allowing workers to effectively carry the equivalent of the deskphone in their pocket — regardless of whether they are inside or outside the enterprise walls.
- Provides handheld mobile computers and laptops with real-time access to virtually every business application — from individual productivity applications such as email, contact directories, scheduling applications and spreadsheets to back-end business systems including Enterprise Resource Planning (ERP), Warehouse Management System (WMS), Visual Supervisory Control and Data Acquisition (SCADA), the Manufacturing Execution System (MES) and more.
- Eliminates the need to deploy multiple devices per person. Manufacturers can now provide workers with a single device that delivers all the needed communications capabilities — for example, an integrated voice and data handheld mobile computer can replace a two-way pager, a cell phone and a laptop or PDA. In addition, the standards based integrated network allows manufacturers to retain the flexibility to select whatever device is right for the job, including:

- Two-way private radios can be deployed to remote workers who require mission critical voice communications to protect employee safety and facility security
- Business smartphones can be deployed to workers who need rich voice communications complete with deskphone functionality inside and outside the enterprise
- Mobile computers with advanced data capture capabilities can be deployed to help streamline business processes, enabling workers to scan bar codes, read RFID tags and capture images, signatures and documents
- Integrated handheld voice and data devices can be deployed to workers that require rich voice communications complete with deskphone functionality as well as robust data capture capabilities and access to business data and back-end applications.

The result is the power of one:

…one unified network capable of carrying traffic to and from the legacy paging system, the trunked radio system, the PBX, cellular networks and your line of business applications

…one unified voice and data device capable of communicating with virtually any device on your network

…creating a true and powerful virtual network between all your employees as well as your business critical machinery.

Advantages of the unified architecture

The unification of the voice and data architecture provides next-generation network simplicity for manufacturers, delivering results that are nothing less than astounding:

- **Dramatic reduction in network-related costs.** The need to maintain multiple networks is practically eliminated, dramatically reducing the technology architecture, as well as the associated capital and operational costs.
- **Dramatic reduction in device-related costs.** The ability to provide workers with one multi-function device eliminates:
  - the capital costs associated with purchasing additional devices and related accessories
  - the operational costs associated with the time that IT and employees need to spend managing the many devices and their related accessories
- **Dramatic overall improvement in business efficiency.** The number of networks is minimized — yet business functionality is maximized. The resulting mobility — anywhere and anytime access to voice and data — enables the rapid mobilization, automation and error proofing of a wide range of business processes, accelerating the ability to achieve lean manufacturing initiatives.

The anatomy of the unified voice and data architecture

There are four main solution components in the unified architecture. The chart below identifies each of these components and their role in the unified solution:

Solution component	Function
Wi-Fi 802.11 wireless LAN	Carries voice and data to and from any type of device inside the enterprise walls
Two-way radio gateway	Provides the connection between the two-way radio gateway and the PBX gateway; enables transmission of two-way radio calls between dissimilar devices (such as a two-way radio and a handheld mobile computer or smartphone) over the wireless LAN and wireless WAN (via the PBX gateway)
PBX gateway	Connects the radio trunk (via the two-way radio gateway) and the PBX to the 802.11 and wireless WAN (cellular) networks to enable the ubiquitous extension of any type of voice or data traffic to any type of voice and data enabled device; includes the ability to extend the deskphone extension and all deskphone functionality to nearly any voice-capable mobile device on either the wireless LAN or the wireless WAN
A 'trusted advisor' technology partner	Integrates the various systems in place today into a single cohesive voice and data architecture: requires deep understanding of all of the various voice systems and how they work as well as the long history and business critical nature of the text paging system in the manufacturing environment

Summary

In the quest for continuous improvement in the manufacturing plant, lean principles are applied every day to help identify and eliminate areas of waste — and the associated costs — from the business. But a multi-network architecture — a patchwork quilt of backbones — actually adds complexity and cost, injecting waste into plant communications.

A unified voice and data network addresses these communication inefficiencies by unifying legacy networks into a single wireless system. The result is a leaner network — and a leaner operation. Your employees have the true anywhere anytime voice and data communications they need to act on the spot. Information moves more rapidly throughout your facility, improving employee productivity, production volumes, customer service, profitability — and the overall health of your business.

Motorola: Your Enterprise Mobility Partner

Motorola: Your Enterprise Mobility Partner

Motorola: an industry leader, a true end-to-end solutions provider — and a partner you can count on

When you choose Motorola as your enterprise mobility partner, you get the power of one, the one company that offers everything you need for true inside-outside mobility — from the corner office to the plant floor to the yard and out in the field. The ability to deliver mobile voice and data whenever and wherever you need it enables the real-time enterprise, driving waste out of your business processes, from the start of your supply chain all the way to your customer — allowing your manufacturing operation to achieve a new level of lean.

Whether you need to extend mobile voice and data throughout a single location or whether you need to network multiple locations,

Motorola and its highly collaborative worldwide network of over 9,000 partners can provide the products and technology, applications, industry expertise, professional services, customer support, education and training you need to be truly mobile. Our end-to-end solutions offer everything you need to maximize the success of your mobility solution. We can provide the assistance you need to design and deploy your wireless solution in record time, with minimal business disruptions — and the expertise you need to ensure ease of use and rapid adoption. Our wireless infrastructure is loaded with Motorola only features that deliver a superior and reliable wireless connection for voice as well as data — and includes wireless LAN as well as

VARBusiness Magazine awards Motorola's PartnerSelect channel program with the coveted Five-Star rating for the breadth and depth of channel partner program offerings — a comprehensive network of partners that provides the proper IT strategies and solutions to corporations and institutions in a wide variety of vertical markets.

wireless broadband products. Our mobile device family includes mobile computers, two-way radios, bar code scanners and more. Our RFID infrastructure family includes fixed, handheld and mobile RFID readers. Our award-winning partner channel provides integration services, best-in-class applications, RFID tags for virtually every application and more. And our post deployment services provide the day-to-day support you need to keep your mobility solution up and running at peak performance.

Why choose Motorola?

Why have major corporations all around the world in manufacturing as well as retail, healthcare, travel and transportation, wholesale distribution, and government chosen Motorola as a trusted mobility partner?

- We offer proven solutions. Every day, businesses of all sizes across industries count on Motorola mobility solutions — including a majority of the Fortune 500.
- We offer proven award-winning products. Our diverse product portfolio has earned top market share in virtually every enterprise mobility product category: handheld mobile computing devices, bar code scanners, wireless local area networking (WLANs), UHF RFID readers, wireless broadband networks and 2-way radios.
- We make it our business to know your business. Our vertical expertise provides the unique advantage that comes from really knowing and understanding your business, from industry issues to industry best practices — including lean manufacturing.
- The 'founding father' of Six Sigma. As a pioneer of Six Sigma, we're well positioned to help you drive quality into your products and errors out of your business processes — a practice that saved Motorola over $17 billion dollars over an 18 year period.

A true technology leader

Standards leadership

As a founding member of the IEEE 802.11 Committee (the industry leader in open standards development), the Wireless LAN Association (WLANA) and the Wireless Ethernet Compatibility Alliance (WECA — now the Wi-Fi Alliance), Motorola has been involved from the beginning in the development of standards to support enterprise mobility and ensure interoperability for the elements required in these integrated solutions. And Motorola continues to be involved with emerging standards, working with EPCglobal on the development of open standards to support RFID, and with the WiMAX forum on standards certification and interoperability testing for 802.16 wireless broadband equipment.

Patent leadership

Motorola has been and continues to be instrumental in the development of the technology and products that deliver the platform for enterprise mobility. Over 1,500 patents to date span all areas of enterprise mobility, from wireless LAN and wireless broadband infrastructure, RFID, scanning, imaging and bar code symbology to ergonomics, business methodology, power management, printers and wired communications.

Many industry firsts

Motorola's technology leadership is well documented in a long history of industry firsts in mobility. Just a few of our many notable firsts include:

- The development of the first commercial portable cellular telephone to the creation of the first GSM and GPRS cellular system
- The first commercial digital radio system to offer push-to-talk (iDEN Digital Radio)
- The first generation wireless LAN (WLAN)
- The groundbreaking second-generation WLAN architecture
- The invention of bar code scanning and technology that ensures a first-time every-time accurate scan
- The first mobile RFID reader
- The first affordable direct part mark (DPM) bar code scanner
- The first enterprise-wide enterprise mobility management solution providing end-to-end centralized control and management of the wireless infrastructure, mobile devices and the data and applications resident on those devices

A world class portfolio

When it comes to enterprise mobility, look to Motorola for an unmatched portfolio of market-leading products and services:

Mobile computers

Regardless of your environment there is a Motorola mobile computer designed to meet your needs — from industrial class mobile computers built for the toughest outside environments to intrinsically safe devices built for use in environments where hazardous materials are present to enterprise class devices that offer lightweight PDA styling.

Two-way radios

Motorola's two-way portable and mobile radio families provide reliable and instant voice communications for your mobile work force — improving the efficiency, productivity and safety of your workers. This diverse portfolio offers: a variety of frequency ranges for operation anywhere in the world; rugged models with enhanced features; compact and lightweight devices to meet the needs of a wide variety of workers; and portable two-way radios that are certified to intrinsic safety standards for use in hazardous classified environments.

Bar code scanners

Motorola provides the industry's most robust and innovative line-up of Symbol scanner products — a portfolio that is unparalleled in breadth, reliability, features and functionality. Choose from corded and cordless, handheld and hands-free, and general purpose and rugged models that offer a wide variety of scanning capabilities — from laser scanners that offer high performance scanning for 1D bar codes to imagers that enable the capture of 1D, 2D and direct part marks as well as documents and signatures.

Payment systems and Micro Kiosks™

Interactive payment systems help build customer loyalty and maximize revenues while reducing payment and transaction-related costs. The advanced hardware and software architecture delivers the speed and performance required for rapid data transmission, with a wide variety of display and interactive capabilities.

A long history of firsts in support of enterprise mobility, wireless infrastructure, data capture and management solutions.

OEM scan engines

With millions installed worldwide, Symbol scan engines from Motorola are unmatched for reliability, performance, durability and size. These compact ready-to-scan devices are ideal for deployment in space constrained areas such as conveyors or checkout stands, or for integration into a wide variety of devices, from kiosks and medical instruments to ATM and vending machines and more.

Wireless infrastructure

Motorola's comprehensive portfolio of wireless LAN and wireless broadband infrastructure delivers world-class performance, security and resilience, regardless of whether you need connectivity inside or outside the four walls of your facility.

RFID infrastructure

Thirty years of innovative excellence in the Automated Identification Data Collection (AIDC) industry positions Motorola as a leader in the world of RFID technology. Our complete portfolio of products includes fixed, handheld and mobile RFID readers, antennas, inlays and tags, allowing you to extend the reach of RFID to every corner of your business.

Motorola Mobility Suite

Comprehensive mobility management solutions

The Motorola Mobility Suite delivers a true value-add for enterprise mobility solutions. This unique family of software solutions empowers companies to maximize the benefits and value of mobility by providing granular and remote control over every aspect of your mobility solution.

End-to-end lifecycle services

Our lifecycle services are available to help you get and keep your Motorola mobility solution up and running at peak performance. When it comes to planning, designing, implementing your solution, our Advanced Services offer 'from the manufacturer' product expertise and a wealth of vertical experience gained from deploying millions of devices across industries around the world. And once your solution has been deployed, our Customer Services provide the day-to-day technical support you need to maximize uptime.

An award-winning company

Following are just a few of the awards that Motorola has received as a company and for its technology advancements and products:

- *2003 Shingo Prize for Excellence in Manufacturing**
- *National Medal of Technology*
  Highest honor for technological innovation, USA, 1999* and 2004
- *Winner: Six Sigma Supply Chain*
  InfoWorld 100 Awards, USA, 2005
- *No. 1 in Manufacturing, Top 500 IT Innovators*, InfoWeek, 2006
- *Top 500 Innovators: No. 12*
  InformationWeek, USA, 2006
- *Top 10 Most Socially Responsible Businesses*, National Business Social Responsibility Survey, Israel, 2006
- *Industry Innovation Award*
  WiMAX Distributed Network Architecture, xchange Magazine, Best of WiMAX World Awards, USA, 2006
- *Supply Chain Top 25 Awards: No. 12*
  AMR Research, USA, 2007
- *World's Most Admired Companies*
  Fortune Magazine, 2008

* Originally awarded to Symbol Technologies, Inc., now a wholly owned subsidiary of Motorola, Inc.

Motorola — everything you need to go mobile

Every day, companies from small business to the Fortune 500 count on Motorola enterprise mobility solutions to stay lean, competitive and profitable with end-to-end solutions that offer:

- A comprehensive proven portfolio of products and technology, truly built for business
- A robust partner channel offering best-in-class applications
- Assistance from planning through deployment
- Superior post-sale product support
- And the many benefits you need to achieve a highly successful deployment — and a rapid return on investment.

For more information on how your organization can benefit from enterprise mobility, contact your local Motorola salesperson or visit:

www.motorola.com/business/manufacturing

About Motorola

Motorola is a recognized leader for enterprise mobility solutions delivering enterprise anywhere to enterprises everywhere. Our solutions include a wide variety of technologies and devices — from advanced mobile computers to automated data capture devices, Radio Frequency Identification (RFID), mobile radios, enterprise wireless LAN, and wireless broadband — to ensure unprecedented control of information across your operations. Along with our best-in-class channel partners, we provide end-to-end solutions that enable businesses to connect the right information with the right people at the right time…in real time from the corner office to the plant floor to the field. Motorola's products and solutions are proven to increase workforce productivity, reduce operating costs, drive operational efficiencies and realize competitive advantages for the worlds leading companies. For more information visit us at **www.motorola.com/business/manufacturing**

MOTOROLA

motorola.com