MOBILE WORKFORCE SOLUTIONS

CALL FOR COLLABORATION REPORT

Wired With Wireless

FOREWORD

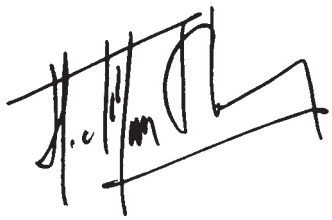
Most companies today would find it unthinkable to run their operations without IT. Wireless technologies can use existing IT infrastructure as a leverage to transform their businesses.

By going wireless, companies can experience improvements in productivity and customer service levels. Freed from the constraints of the office walls and wires, wireless technologies can also effectively empower employees in a diverse range of industry sectors and operational conditions.

The Info-communications Development Authority of Singapore (IDA) initiated the Mobile Workforce Solutions Call for Collaboration (CFC) in October 2001. The CFC serves to encourage the use of wireless technologies in business operations. The participating consortia deployed a series of pilot projects between May and December 2002.

This publication captures cases of how wireless technologies have transformed more than 20 real-life businesses. I hope these case studies will provide insights into how wireless technologies can be applied in your business operations.

Albert Einstein once said, “Discovery consists of seeing what everybody has seen, and thinking what nobody has thought.” May I now invite you to embark on this journey of discovery on mobile workforce solutions.



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MOBILE WORKFORCE SOLUTIONS CFC EXECUTIVE SUMMARY

Mobile workforce solutions refer to the use of wireless data technologies, such as WLAN and GPRS to empower employees and automate business processes. The key goal of such enterprise solutions is to make applications and information available to employees wherever and whenever they require it.

With the growing maturity of wireless technologies, there are emerging opportunities for enterprises to take advantage of wireless capabilities to address business concerns such as: -

- Increasing productivity
- Enhancing customer service
- Reducing business costs

This report has been designed for enterprises that wish to understand how wireless technology advancements are impacting the competitive landscape of business. It has been organised into two parts, the first, an executive report and the second, a set of case studies. Together, they can provide insight as to how wireless solutions can contribute towards improving business processes.

20 consortia participated in the Mobile Workforce Solutions Call for Collaboration over a period of 6 months. The consortia represented industries such as Construction and Facilities Management, Sales and Distribution, Manufacturing and Logistics and Services.

Applications piloted include sales force automation, field force automation, supply chain management and remote monitoring.

As a result of the use of wireless technologies, enterprises experienced benefits such as: -

- Cost savings
- Better control over operations
- Reduction in processing time
- Accurate and timely information for decision-making
- Faster response times
- Generation of new services and improvement of existing ones
- Reduction in customer disputes

01 Executive Report

MOBILE WORKFORCE SOLUTIONS CFC EXECUTIVE REPORT

1 INTRODUCTION

Mobile workforce solutions refer to the use of wireless data technologies, such as WLAN and GPRS to empower employees and automate business processes. The key goal of such enterprise solutions is to make applications and information available to employees wherever and whenever they require it.

With the growing maturity of wireless technologies, there are emerging opportunities for enterprises to take advantage of wireless capabilities to address business concerns such as: -

- Increasing productivity
- Enhancing customer service
- Reducing business costs

2 BACKGROUND

In October 2001, the Info-communications Development Authority of Singapore (IDA) announced the Mobile Workforce Solutions Call for Collaboration. A Call for Collaboration (CFC) is an open call for companies to collaborate in conducting projects to address areas of opportunity or gaps in the market. Companies were invited to work together, in the form of consortia, to propose and pilot the use of wireless technologies within the context of an enterprise's operations.

Through the various projects conducted, the CFC set out to examine the value proposition of wireless technologies to an enterprise.

3 CFC TIMELINE

After the CFC was announced, a public briefing was held for interested companies to better understand the scope and objectives of the CFC. A networking session was also held to facilitate the formation of partnerships.

At the end of January 2002, interested consortia submitted their proposals for pilot projects to IDA. Close to 60 proposals were received and these were evaluated by a committee comprising representatives from IDA and other statutory boards, selected industry associations and venture capitalists.

20 projects were selected for award. These projects were implemented over the next 6 months.

The following table summarises the activities undertaken as part of the CFC process: -

DATE	EVENT
15 Oct 2001	Mobile Workforce Solutions CFC launched
25 Oct 2001	Public briefing
22 Nov 2001	Networking event
25 Jan 2002	Submission of proposals by consortia
15 May 2002	Award of projects
31 Dec 2002	Completion of projects

Table 1 The timeline of CFC events

4 PROJECTS PROFILE

The 20 consortia involved in the pilots represented a wide cross-section of industry sectors. In total, more than 600 individuals were involved in the field-testing of the various types of applications under operational conditions. The different consortia used various wireless networks and mobile devices, representing a variety of technology choices currently available to enterprises.

The figure below illustrates the range of wireless technologies, mobile devices and applications used by the various CFC consortia.

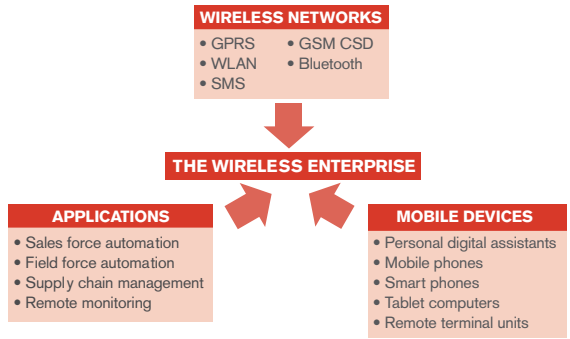


Figure 1 Overview of technologies piloted in the CFC

- **Sales force automation**
  Beyond enabling sales staff to take and submit orders electronically at the point of customer interaction, wireless sales force automation tools may include features that enable pricing controls, management of accounts receivables and access to customer purchase histories and inventory information. These features provide sales staff with information needed to service their customers better and shorten sales cycles. These also allow management to better control and monitor pricing, promotions and customer relationships.

- **Field force automation**
  Such applications provide field staff with access to information systems previously only available in the office. Data communications, rather than voice, are used to dispatch field service staff in response to job requests. By doing so, this addresses issues such as flexibility and responsiveness to customers, miscommunications between the dispatch centre and field staff, bottlenecks in business processes and unnecessary double entry of data.

- **Supply chain management / Enterprise resource planning**
  Supply chain management systems automate and streamline the enterprise's relationships with business partners and customers. Enterprise resource planning systems are used to manage other enterprise processes. This can involve tracking the movement of goods or consolidating information for operational decision-making. By going wireless, data entered into the systems can be automated and collected at the source, increasing the timeliness and accuracy of data. Management can access this information remotely, wherever and whenever they require it.

- **Remote monitoring**
  Wireless technologies can be employed to monitor instrumentation or data at remote locations. These solutions can provide central systems and staff with up-to-date information for decision-making, and if necessary, for remedial action to be taken. Monitoring can also be done in scenarios where it may not have been practical or cost effective to do so in the past.

The table below presents the participating companies and description of projects piloted under the CFC.

INDUSTRY TYPE	COMPANIES INVOLVED	PROJECT DESCRIPTION
Construction And Facilities Management	CPG Facilities Management Pte Ltd, Buildfolio Technologies Pte Ltd, Netalk Pte Ltd	CPG Facilities Management's legacy systems were integrated with a wireless application that enables the company's technical executives and contractors to use PDAs to receive orders, access and update the central database.
	Keppel FMO Pte Ltd, Nanyang Technological University, eMobile Pte Ltd, FOSPEX Pte Ltd	Keppel FMO's field technicians at the NTU campus were equipped with PDAs that allowed them to access maintenance checklists and inventory records remotely. The PDAs could also be used to receive work orders and to upload completed forms.
	Transvert Scaffold & Engineering Pte Ltd, DCS Solutions Ltd	Site supervisors were able to send and receive work requests remotely throughout the day, enabling Transvert Scaffold & Engineering's management to better distribute workforce and material resources across multiple projects.
	CPG Facilities Management Pte Ltd, Keppel Digihub Ltd, Institute for Infocomm Research	Devices were installed at electrical meters to provide readings and status updates wirelessly.
	Kiso Jiban Singapore Pte Ltd, Wisescan Engineering Services Pte Ltd, SysEng (S) Pte Ltd	Engineering companies Wisescan and Kiso Jiban used wireless technologies to monitor their field instruments and to carry out data collection.
Sales And Distribution	Diethelm Singapore Pte Ltd, Harpers Trading (S) Pte Ltd, Harpers Marketing Pte Ltd, Deloitte Consulting Pte Ltd, Maya Systems Consultants Pte Ltd	DKSH group of companies deployed a wireless sales force automation solution that enabled the company to improve its sales process and reduce administrative work for its salesmen.
	Philip Morris Singapore Pte Ltd, IBM Singapore Pte Ltd, Starhub Pte Ltd	Philip Morris implemented wireless technology to enhance existing sales force automation tools with payment features and real-time information services.
	Chee Fatt Co Pte Ltd, Kian Soon Hardware and Trading Pte Ltd, All-Wares Supply, Palm Singapore Sales Pte Ltd, Zara Technology Pte Ltd	SMEs used wireless technology to access their backend applications with mobile devices.
	ERA Realty Network Pte Ltd, AirGateway Pte Ltd, CET Technologies Pte Ltd	ERA agents were able to access updated property listings information, including rich graphics such as photographs and maps, from a range of mobile devices.
	SUN Microsystems Pte Ltd, iGine Pte Ltd	Integrating a "wired and wireless" sales cycle management application with existing systems enabled SUN to better manage sales activity and provide better customer service while reducing administrative workload.

INDUSTRY TYPE	COMPANIES INVOLVED	PROJECT DESCRIPTION
Manufacturing And Logistics	Ameroid Logistics (S) Pte Ltd, NEC Solutions Asia Pacific Pte Ltd	Ameroid leverages wireless job dispatching technology to facilitate job assignment, tracking and reporting processes.
	Fujitsu Asia Pte Ltd, Y3 Technologies Pte Ltd	Drivers are equipped with GPRS phones that allow them to electronically view and update their delivery orders wirelessly.
	Transnational Supply Chain Logistics Pte Ltd, GEO Millenium System Pte Ltd, Hewlett-Packard Singapore (Sales) Pte Ltd	Transnational equipped its couriers with wireless-enabled PDAs to facilitate the job assignment, tracking and reporting.
	ST Assembly Test Services Ltd, Hewlett-Packard Singapore (Sales) Pte Ltd	Wireless applications were used to streamline and expand the information flow between STATS backend Manufacturing Execution System and the different user groups.
	Ellipsiz Ltd, AirGateway Pte Ltd, SUN Microsystems Pte Ltd	Engineers from Ellipsiz were enabled with wireless devices to retrieve and update service data remotely.
	Sembawang Shipyard Pte Ltd, Hewlett-Packard Singapore (Sales) Pte Ltd	Sembawang Shipyard uses wireless technology integrated with legacy systems to track the deployment of workers within the shipyard and to reduce administrative workload.
Services	Changi International Airport Services Pte Ltd, KPMG Consulting Pte Ltd	Airline representatives were able to update their in-flight catering orders directly to CIAS' ordering system via PDAs. Flight-in-charge staff from CIAS were also equipped with similar devices used to access the latest order information.
	Comfort Driving Centre Pte Ltd, IdealSoft Pte Ltd	Comfort Driving Centre instructors were equipped with wireless devices that allowed them to retrieve and update student records remotely.
	The Singapore Police Force, CISCO Security Technology Pte Ltd, Ericsson Telecommunications Pte Ltd, National Computer Systems Pte Ltd, SingTel Mobile Pte Ltd	The Singapore Police Force piloted an MMS remote monitoring solution to complement its surveillance system in its facilities.
	Raffles International Limited, National Computer Systems Pte Ltd	Raffles International extended the reach of backend applications to service professionals through the use of wireless-enabled devices.

Table 2 Description of CFC consortia

Commonly used wireless technologies include: -

- **General Packet Radio Services (GPRS)**
  GSM is a digital cellular network designed to carry circuit-switched voice traffic. GPRS is an enhancement to GSM that enables the network to carry packet-switched data traffic, much like the Internet. GPRS, like GSM, is operated by the telecommunications operators and provides coverage across a wide geographical area.

- **Wireless Local Area Network (WLAN)**
  WLAN commonly refers to products adhering to the IEEE 802.11 family of standards. A single WLAN access point provides coverage of up to 100m. Enabled devices are able to move about within the coverage area and remain wirelessly connected to the network. WLANs can be installed by a private organisation for its own internal use or operated as commercial service by a hotspot operator.

Commonly used mobile devices include: -

- **Personal Digital Assistants (PDAs)**
  These are hand-held devices that typically have a touch screen interface and greater processing power as compared to mobile phones. Software applications can be installed to expand the original functionality of the device and a variety of add-on hardware options may also be available for use with the device.

- **Mobile phones**
  Beyond making voice calls, mobile phones can also be used for data purposes. For example, aside from person-to-person messaging, SMS can be used to interact with data servers. GPRS-enabled phones can also be used to provide access to a variety of information services.

5 KEY FINDINGS – BENEFITS

Operational staff from participating enterprises formed the pilot user base for the projects. These users continued to perform their operational roles throughout the pilot and by doing so, were able to gauge and validate the benefits of using wireless technologies.

The key benefits experienced can be summarised as: -

- Increased revenue
- Cost savings
- Better control over operations
- Reduction in processing time
- Accurate and timely information for decision-making
- Faster response times
- Generation of new services and improvement of existing ones
- Reduction in customer disputes

- **Increased revenue**

  Harpers Trading and Harpers Marketing, consumer goods distributors, increased the productive selling time of their sales staff by providing them with wireless-enabled PDAs to take and submit orders, with pricing and promotion controlled by the application. This resulted in a 10% increase in sales generated.

- **Cost savings**

  When supervisors at Transvert Scaffold & Engineering experienced delays returning to the office, backend packing and logistics staff ended up staying overtime to pack materials for the next day. Allowing supervisors to send back information throughout the day from the field reduced this bottleneck and allowed the company to cut down the number of overtime hours incurred and enjoy a 69% reduction in overtime cost.

- **Better control over operations**

  By combining automation and wireless communication for the collection of construction survey data, Wisescan Engineering Services was able to wirelessly retrieve sensor readings four times a day. By comparison, in the past, personnel were only allowed onsite once a night to retrieve the measurements. With the increased frequency of data collection and elimination of data entry errors, their clients not only benefited from increased onsite safety but also were able to receive more accurate information about construction operations.

- **Reduction in processing time**

  Facilities management company CPG Facilities Management equipped their Technical Executives (TEs) with wireless PDAs for work inspection, scheduling and monitoring. Part of their job includes preparing maintenance audit reports, which are used for ensuring compliance to service level commitments. Now, service level figures and key performance indicators can be reported almost immediately to the client and there has been a 66% reduction in time spent by TEs to generate the full maintenance report.

- **Accurate and timely information for decision-making**
  Comfort Driving Centre provides training for students learning to drive. Instructors used wireless PDAs to capture information on the number of learners and their progress at various stages of the driving course. Comfort Driving Centre's management requires this information for capacity planning and decision-making. The preparation and analysis of such data previously required up to 7 days and can now be accomplished within 1 day.

- **Faster response times**
  Keppel FMO, a provider of maintenance services at the Nanyang Technological University campus, equipped its service technicians with WLAN- and GPRS-enabled PDAs to disseminate service requests and update job sheets. By streamlining the flow of information between the Fault-Reporting Centre and the service technicians, this saw a 52% improvement in response times to maintenance tasks.

- **Generation of new services and improvement of existing ones**
  ERA Realty Network enabled their agents with access to property information through devices such as mobile phones, PDAs and tablet computers. As a result, agents can respond to their clients faster and provide new services such as allowing clients to look at images of potential properties before arranging visits. Matching clients with properties used to take up to 1 day as it required access to information in a central system. Using the wireless application, this can now be done almost instantly.

- **Reduction in customer disputes**
  Ameroid Logistics implemented a wireless system to handle job dispatching. By automating tasks and reducing the amount of documentation that drivers handle, there has been a reduction in errors when recording cargo details used for billing purposes. This has resulted in a 30% reduction in customer disputes over invoicing.

INCREASING PRODUCTIVITY	ENHANCING CUSTOMER SERVICE	REDUCING BUSINESS COSTS
Increased mobility	Created new services	Reduced need for travelling
Eliminated double entry of data	Enhanced richness of information	Improved resource management
Increased visibility and control	Better accuracy and timeliness	Reduced Administrative workload
Improved response times	Provided flexibility in service location	Minimised disputes

Table 3 Benefits of wireless solutions

6 KEY FINDINGS – IMPLEMENTATION CONSIDERATIONS

The pilots conducted by the consortia provided insights on key implementation factors that should be considered by any business planning to take advantage of wireless solutions. These include: -

- Choice of wireless network
- Choice of mobile device
- Implementing process improvements
- Gaining user acceptance
- Security over wireless networks
- Application design

- **Choice of wireless network**

  Various types of wireless networks are available for enterprises to choose from. These range from cellular networks such as GPRS to privately installed WLAN or public WLAN hotspots. The choice of which wireless network to use is dependent on the following factors: -

  - **Coverage requirements**

    WLAN provides coverage of up to 100m from each access point whereas GPRS and SMS provide coverage over a wide geographical area. If the application is to be used in a limited area such as a manufacturing floor, WLAN coverage may be sufficient. On the other hand, where field staff visit widely dispersed customer locations or sites, GPRS may be more appropriately used to transmit data back to the enterprise's central servers.

  - **Network costs**

    Operator-based networks such as GPRS or public WLAN hotspots involve recurrent subscription costs. Alternatively, setting up a wireless network such as WLAN involves expenditure on hardware, installation and ongoing maintenance. Where there are several possible alternatives, factors such as the amount of data to be transmitted between the server and the mobile device and the frequency of such transmissions can be considered in deciding the most cost effective wireless network to employ.

  - **Network speed**

    Multiple factors determine the speed of data transmitted over a wireless network. In networks such as GPRS, this includes the availability of radio resources at a particular location, the compatibility of the wireless device with the network, the number of timeslots the wireless device is capable of using and even the design of the application. Faced with these issues, the consortia did extensive testing of the wireless applications, both in the development environment and in the field. This also involved many consortia engaging the operators for support and troubleshooting during the conduct of the projects.

- **Choice of mobile device**

  Devices can form a substantial portion of an enterprise's investment in a wireless solution. Generally the cost of each device increases with the number of features it has. The following section outlines some of the factors taken into account by the consortia as they evaluate which devices to use: -

  - **Form factor**

    The size and weight of the device can be important considerations for staff who are constantly on the move. Ranging from laptops to tablet computers to PDAs and mobile phones, the choice of form factor depends on the user requirements and the design of the application. For example, a tablet form factor with a large screen size could be ideal for showing images and making presentations to clients whereas a stock inventory query may only require an SMS-capable mobile phone. Different devices also have different means to input data. PDA users may use a stylus on a touch screen whereas mobile phone users may have to navigate menus using the phone's keypad. Depending on the operating environment, devices can also be ruggardised to withstand shocks from being dropped and sealed to keep out water and dust. There is a need to balance the features needed in a mobile device with the mobility requirements. Figure 2 illustrates the general trade-offs between the various types of devices.

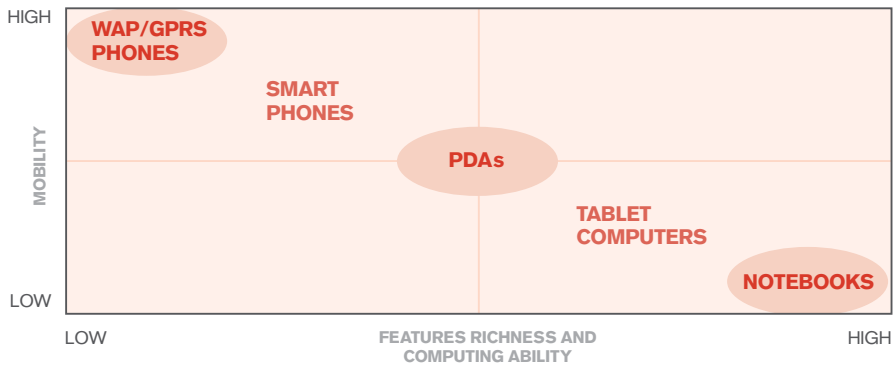


Figure 2 Mobility vs Features of mobile devices

  - **Connectivity**

    Some devices, such as PDAs and laptops, may not come with in-built wireless modems for connecting to the wireless network. There are various ways to wireless-enable such devices. One possibility is to use the mobile phone as a wireless modem to connect the device to the cellular network. Alternatively, a variety of add-on WLAN or GPRS cards are also available, and can be plugged into the device to provide wireless connectivity. Increasingly common are devices, such as PDAs, that are available with in-built wireless modems.

- **Battery consumption**
  In general, the more feature-rich the device, the greater its power consumption. This corresponds to a shorter operating lifespan before the device needs to be recharged. For example, a PDA typically has a shorter battery life compared to mobile phone. In choosing the device, consideration may have to be made as to whether the device has sufficient battery life to last an entire operational cycle or if provisions need to be made to keep the device charged.

- **Peripherals**
  Different types of mobile devices can support different peripherals. Depending on the user requirements, peripherals such as barcode scanners or Global Positioning System receivers can enhance the functionality of the mobile device. Mobile printers using Bluetooth or infrared are also available for use with mobile devices should there be printing requirements.

- **Implementing process improvements**

  Investments in wireless solutions should not simply attempt to replicate existing paper-based processes in an electronic form. Instead the implementation of wireless solutions provides opportunities for business process improvements. Wireless solutions can serve to consolidate information found in various legacy systems and minimise slow manual processes such as double entry of information. Common areas for process improvements include: -

  - Eliminating unnecessary workflow steps
  - Eliminating unnecessary time wastage
  - Empowering staff to make more effective decisions
  - Improving coordination between individual activities

- **Gaining user acceptance**

  Getting individual user buy-in is important for the successful implementation of a wireless solution. The experience of the consortia demonstrated that while some resistance can typically be expected from the users within the first few months of implementation, acceptance gradually increases after staff become more familiar with the wireless solution. This is regardless of the age or IT literacy of the user. Factors to be taken into consideration include: -

  - **Identifying and communicating benefits for individual end users**
    Individual staff can enjoy benefits as a result of process improvements implemented as a result of wireless solutions. Doing away with double entry of data by staff or reducing the need to physically report to the office, can translate to staff finishing their workday on time where previously they would have had to stay back to complete administrative paperwork. These process changes should be translated into tangible benefits and clearly communicated to operational staff.

- **Training**
  A comprehensive training plan and change management process should be put in place when introducing mobile devices to a workforce that is used to manual or paper-based processes. Users involved in the consortia's projects were provided with training on both the mobile devices as well as the wireless applications. In some cases, the solution vendors and company's IT staff even provided on-the-job coaching for operational staff.

- **Security over wireless networks**

IT security is always a concern for companies, and more so where enterprise data and applications are extended to remote terminals such as PDAs. There are several ways in which security can be managed. These include: -

- **Application-level security**
  Applications can be designed to authenticate users through valid user names and passwords as well as restricting access rights of users based on their roles and responsibilities. Systems can also authenticate users by their devices, for example, by only allowing registered mobile numbers to make data queries.

- **WLAN access point security**
  Enterprises can manage the devices that have access to the WLAN by enabling and periodically changing encryption settings at the access points, as well as restricting the set of valid hardware MAC addresses registered with WLAN access points.

- **Secure sockets layer (SSL)**
  Typically used in browser-centric applications, SSL can be implemented to authenticate backend systems and encrypt data transmitted over the wireless network.

- **Network segmentation of wireless applications and firewalls**
  Wireless access points and servers hosting wireless applications can be kept separate from the rest of the network by a firewall. This treats the wirelessly accessed network segment as part of an 'untrusted' network. Servers and data that do not need to be accessed by mobile devices can continue to be kept secure behind the firewall.

- **Virtual private networks (VPN)**
  VPN solutions can be used to secure data transmission over wireless networks, both WLAN and GPRS. Devices, such as PDAs, can be authenticated and secure "tunnels" created for encrypted data to be passed back and forth with backend systems. Attention may possibly have to be paid to issues such as conflicts between GPRS and VPN addressing, and the availability of VPN client software for mobile devices.

- **Application design**

  The design of the application impacts the usability and effectiveness of the solution in operational scenarios. Factors to be considered in this respect include: -

  - **Online vs offline operation mode**

    Applications can be designed to work online or have the option for offline operation. An example of the former may be where the device is used within a WLAN environment and can remain continually connected at all times. In other scenarios, reasons such as lack of wireless coverage or wireless usage costs, may mean that working unconnected to the network, doing some data processing on the device, and only later re-connecting wirelessly to submit the information, can be a more effective mode of operation.

  - **Input of data**

    Depending on the application and sophistication of data being entered, the application's user interface can be designed to make use of check boxes and drop down lists for ease of use. Large sized buttons can allow PDAs to be operated even without the use of a stylus and colour screens can allow related tasks to be colour-coded. Where applicable, consortia have used technologies such as barcode scanners to input data, not only increasing the usability of the application but also the accuracy of data captured.

  - **Communications exception handling**

    Connections in wireless environments may not always be reliable. To ensure the robustness of their solutions, several consortia designed their software to automatically re-connect to the network should the wireless connection be lost. Data can also be stored on the device and re-transmitted when a connection can be re-established. By doing so, this serves to ensure the integrity of data being transmitted wirelessly.

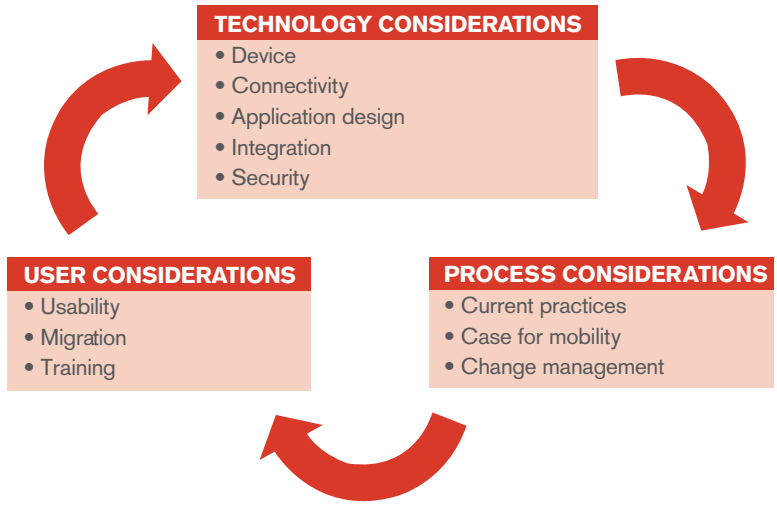


Figure 3 Enterprise considerations for wireless solutions

7 CONCLUSION

The 20 consortia that participated in the Mobile Workforce Solutions CFC successfully implemented projects that allowed them to gauge both the technical feasibility, as well as the business implications of wireless solutions. Even as the technological elements of wireless enterprise solutions, such as wireless data networks and mobile devices, continue to develop and improve, it is already possible to capitalise on the current state of technology to effectively deploy such solutions.

The business case for wireless solutions is also increasingly compelling. The consortia that initiated the pilots have plans to either expand the use of the solution to the rest of their business operations or further build upon the scope of the initial pilot.

The experience of the consortia also demonstrated that wireless solutions provide opportunities for enterprises to re-examine their business processes and use technology to better manage and improve operations. Not every business function can benefit from the use of wireless solutions, but where applied appropriately, tangible benefits can be reaped. The process of consideration should involve multiple levels within an enterprise including management, line departments, IT departments and even external vendors. Ultimately, the goal is to take advantage of technological developments and provide a competitive edge for the enterprise's business.

In summary,

- The 20 consortia that participated in the Mobile Workforce Solutions CFC demonstrated quantifiable business benefits from using wireless solutions.
- Wireless networks and mobile device technologies continue to evolve but are feasible for operational deployment now.
- Enterprises can maximise their returns on wireless investments by studying how business workflows and processes can be improved through the use of wireless technologies.

02 Case Studies

Construction And Facilities Management
Sales And Distribution
Manufacturing And Logistics
Services

Case Study Title

Mobile Facilities Management System

Fast Facts

Synopsis
CPG Facilities Management's legacy systems were integrated with a wireless application that enables the company's technical executives and contractors to use PDAs to receive orders, access and update the central database.

Benefits
- Saved time and effort in manually updating the central database.
- Reduced the time needed to respond and rectify a problem by over 20%.
- Increased visibility of contractors and work in progress.

Key Takeaway
Wireless solutions can be used to integrate multiple IT systems and allow enterprises to improve operational workflows.

Companies Involved
CPG Facilities Management Pte Ltd,
Buildfolio Technologies Pte Ltd and Netalk Pte Ltd.

Overview Of Operations

CPG Facilities Management Pte Ltd (CPG FM) provides integrated facilities management services for over 1,000 buildings in Singapore and the region. These include commercial and residential buildings, educational institutions, recreational facilities, hospitals and shopping complexes.

Facilities management covers a broad scope of services, including real estate planning, space management and interior planning. The major component of facilities management is building maintenance and operations. Two critical components of maintenance works are:

- **Preventive maintenance**
  A predefined maintenance schedule for each asset to minimise breakdowns and service interruptions.

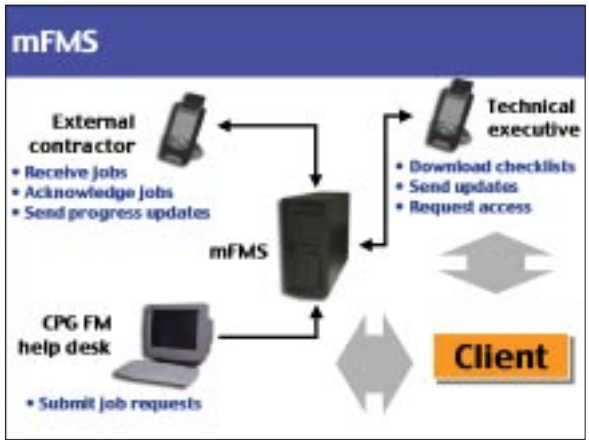
- **Corrective maintenance**
  Responses to specific requests and unanticipated events, including emergency services.

Technical Executives Coordinate Both Preventive And Corrective Maintenance

These services are provided via CPG FM's team of technical executives, supported by external contractors. The role of the technical executive is to carry out scheduled inspections, respond to work requests from clients, and monitor the progress of work by contractors.

For preventive maintenance, the technical executive retrieves the relevant paper-based checklists and proceeds to the site to carry out the audit inspection. Following the inspection, the technical executive enters the results into a central system. If maintenance work is needed, the system generates a job order for the relevant contractor.

Corrective maintenance is initiated when clients call CPG FM's help desk. Contractors are then dispatched to carry out the work. When additional parts and labour costs



mFMS

- Developed by CPG Facilities Management Pte Ltd and Buildfolio Technologies Pte Ltd.
- Provides wireless access to legacy systems for building management, customer relationship management and security access.

are involved, the contractor invoices CPG FM based on the Fixed Schedule of Rates (FSR), a set of rates agreed between the contractor and CPG FM.

Manual Processes Create Unnecessary Administrative Work

In the course of inspection, audit checklists are completed on paper and need to be manually compiled. Substantial effort is required for a technical executive to generate an full inspection report. These reports are used for ensuring compliance to committed service levels.

Technical executives also need to verify invoices created by contractors against the thousands of rates in the FSR documentation before they can be processed. This results in additional administrative work for them once back in the office.

Mobile Facilities Management System

CPG FM worked with Buildfolio Technologies Pte Ltd and Netalk Pte Ltd to develop the Mobile Facilities Management System (mFMS). The application consists of four integrated modules:

- **Mobile Maintenance Inspection Checklist**
  This module provides technical executives with mobile access to all the necessary maintenance inspection checklists for each facility. Upon completion of the inspection, the central server is directly updated via GPRS with the results and time of the audit.

- **Wireless Scheduling & Monitoring of Contractor's Work**
  Contractors receive and acknowledge job orders wirelessly from CPG FM's Customer Relationship Management (CRM) system using this module. Time logs and progress updates can also be updated wirelessly.

- **Wireless Performance Monitoring System**
  This module is integrated with the Building Management System, which monitors fault alarms at clients' facilities. It enables CPG FM staff to check the status of these systems remotely, and if necessary, immediately notify contractors to take remedial action.

- **Wireless Access Control**
  This module enables users to wirelessly unlock doors fitted with the Simon Voss network lock system.

For the pilot, PDAs installed with mFMS were distributed to CPG FM's team in charge of educational institutions and four external contractors.

"Wireless technology has equipped our staff with real-time information everywhere and anytime, and truly empowered them to make field-based decisions."

Mr David Lum,
Managing Director, CPG Facilities Management Pte Ltd

mFMS Enables CPG FM To Track Contractors' Progress

A client who requires maintenance work calls CPG FM's help desk, where the request is logged into CPG FM's CRM system. The system then sends a work instruction to the relevant contractor via GPRS. The contractor in turn, acknowledges receipt using the PDA.

Upon arriving on site, the contractor scans a barcode located there before commencing a job, and again when the job is completed. This enables CPG FM to track the progress of the work, as well as the response time to the job request.

Easy-To-Use Interface And Training

Most of the pilot users were between 24 and 40 years of age, and had either a diploma or technical certificate. Some users, particularly the contractors, were initially not familiar with using a PDA. The mFMS interface was designed to be easy to use, and with proper training, users became comfortable with the application by the end of the pilot.

By integrating three systems within CPG FM – the Building Management System, the Customer Relationship Management system and the Simon Voss system, mFMS leveraged existing resources and eliminated the need for data re-entry across multiple systems.

Significant Improvements To CPG FM's Efficiency

With mFMS, CPG FM's technical executives and help desk staff no longer needed to update the work status and inspection records manually. Technical executives were also able to respond immediately to client queries while on site. CPG FM's management had better visibility of contractors and inspection results since the central system was more frequently updated.

FSR information was also available on the PDA. Technical executives could now verify invoices against the listed rates immediately rather than having to do so back in the office. This reduced the administrative time taken to process invoices for jobs completed.

The implementation of mFMS enabled CPG FM to improve its response time by 21%, and reduce time taken to rectify a problem by 24%. The most significant improvement in efficiency was the time taken to complete a maintenance report – down from 6 days to just 2 days.

For CPG FM's clients involved in the pilot , this translated to less down time and inconvenience.

Plans To Expand User Base And Functionality

With the success of the pilot, CPG FM intends to rollout mFMS to its other divisions. As this roll-out impacts many different parties, special consideration is being given to change management. CPG FM also has plans to further enhance the features and flexibility of the mFMS.

Case Study Title

m-Services In Facilities Management @ NTU

Fast Facts

Synopsis
Keppel FMO's field technicians at the NTU campus were equipped with PDAs that allowed them to access maintenance checklists and inventory records remotely. The PDAs could also be used to receive work orders and to upload completed forms.

Benefits
- Saved travelling time and effort for field technicians by reducing the need to visit the Fault-Reporting Centre.
- Improved maintenance response times by 50%.
- Reduced potential for miscommunication between the Fault-Reporting Centre staff and the field technicians.

Key Takeaway
Wireless solutions can be used to improve the response time of field service personnel.

Companies Involved
Keppel FMO Pte Ltd,
Nanyang Technological University,
FOSPEX Pte Ltd and eMobile Pte Ltd.

Overview Of Operations

Keppel FMO Pte Ltd (KFMO) is a leading provider of integrated facilities maintenance services for large-scale facilities that require mission critical solutions. KFMO currently provides maintenance services for over 50 buildings, spread across 200 hectares, at the Nanyang Technological University (NTU) campus.

KFMO operates a Fault-Reporting Centre (FRC) at the NTU campus that manages teams of field technicians. These teams support the maintenance of air-conditioning systems, electrical equipment and other critical building systems on the campus.

Technicians capture information using printed forms and checklists as they carry out routine maintenance activities on the field. This information is later manually entered into a central system at the FRC for archiving purposes. Customer requests for non-routine maintenance services are received by the FRC and disseminated to the maintenance teams.

Technicians in the field can communicate with FRC staff via walkie-talkies, but still have to frequently return to the centre to collect job sheets and reference documents, and to submit documents for archiving.

m-Services

- Wireless application developed by FOSPEX and eMobile.
- Leverages on FOSPEX's web-based application.
- Enables the dissemination, capture and archiving of information in a central system using a PDA client application.
- Designed for use with both WLAN and GPRS networks.

Paper Documentation Hinders Field-Oriented Activities

The facilities maintenance industry is extremely field-oriented. The flow of information between the FRC and the field technicians is a critical component of the maintenance process. Information that needs to be disseminated include job orders and the maintenance status of facilities.

The use of paper documents to communicate this information is cumbersome because it requires field technicians to visit the FRC to collect forms. The subsequent process of manually re-entering data into the central system is not only resource-consuming but also error-prone.

m-Services In Facilities Management

To improve operations, KFMO implemented a pilot to explore the feasibility of incorporating wireless technology into its facilities management operations at the NTU campus.

The goal was to create a wireless-enabled system that could:

- Disseminate work requests to field technicians
- Enable technicians to download checklist templates for routine maintenance work and upload the completed forms into the central system for archiving
- Allow technicians to verify the availability of parts in the store through the inventory database

The project would leverage the web-based facilities management application offered by FOSPEX, complemented with a PDA client application developed using J2ME. The pilot would be conducted using both the commercial GPRS network as well as NTU's extensive Wireless LAN network.

Less Frequent Visits To FRC

KFMO equipped its field technicians with WLAN- and GPRS-enabled PDAs. The wireless application significantly reduced the number of times that technicians from both routine and ad hoc maintenance teams needed to return to the FRC.

Routine maintenance technicians were able to download checklists onto their PDAs while onsite. They could carry out the maintenance service and upload the completed forms from the field.

Ad hoc maintenance technicians were able to receive and acknowledge job requests via messaging services. Technicians from both teams were able to use their PDAs to check the inventory database for the availability of parts in real-time.

Offline Mode Of Operation

One feedback provided by pilot users was that WLAN and GPRS coverage was weak in some areas within the campus. However, since the application was designed to allow operation in an offline mode, i.e. disconnected from the wireless network, this was not a major issue. The technicians would work offline and subsequently upload the data to the server from a location where the wireless connection was good.

Reduced Miscommunication And Quicker Turnaround

KFMO's service agreement with NTU requires it to respond to life-threatening situations such as fire and flood within ten minutes. Other urgent requests have to be attended to within 30 minutes. The wireless solution enabled accurate and fast dissemination of information to field staff to better achieve these goals. It also helped KFMO provide timely feedback to the client on the status of service requests.

Apart from reduced travelling for technicians, the wireless solution also reduced the heavy reliance on voice communication, via walkie-talkies, which was prone to miscommunication. Since the information transmitted was in text form, instructions between FRC staff and technicians could be stored for reference and were no longer open to dispute.

"We now use less paper for routine maintenance, since there is no need to photocopy the checklists. Idle time is also reduced since field technicians do not have to go back to the FRC to pick up the print outs."

Mr Alkivin I. Pasajol,
Technical Officer, Keppel FMO Pte Ltd

The wireless application was able to reduce the time needed to assign and report a routine maintenance request from 25 minutes to 12 minutes. Using the wireless application, technicians were also able to reduce the time needed to check for the availability of parts in the inventory database by 60%.

Barcodes To Facilitate Information Input

Going forward, KFMO plans to enhance the PDAs with barcode readers. This will allow technicians to quickly identify the equipment that they are working on, and access its maintenance history from the central database.

KFMO may also provide a web-based interface for building occupants to lodge service requests. These requests will be conveyed directly to the relevant field technicians and enable faster problem resolution.

Case Study Title

Wireless Project Resource Management System

Fast Facts

Synopsis
Site supervisors were able to send and receive work requests remotely throughout the day, enabling Transvert Scaffold & Engineering's management to better distribute workforce and material resources across multiple projects.

Benefits
- Eliminated the need for double entry of work request information.
- Increased visibility of progress at individual sites from HQ and more effective resource and workforce allocation.
- Estimated to save 20% to 45% of overall costs annually.

Key Takeaway
Information provided by mobile workers can be used to maximise productivity and effectiveness of decision-making.

Companies Involved
Transvert Scaffold & Engineering Pte Ltd and DCS Solutions Ltd.

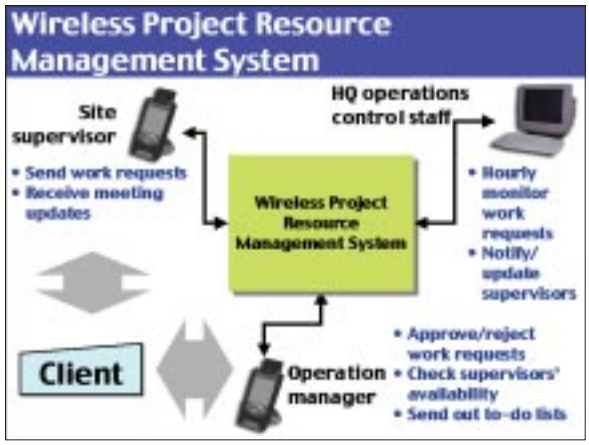
Overview Of Operations

Transvert Scaffold & Engineering Pte Ltd (Transvert) rents and installs metal scaffolding, a ubiquitous safety requirement in almost any construction project. Installation of scaffoldings is performed by an operations team that may be tasked to service up to four sites concurrently. The installation process is not only labour-intensive, it also requires timely and accurate information. The availability of workers and delivery of various materials during each phase of the installation process is critical in ensuring that there are no delays to the overall construction work.

Upon winning a contract, Transvert first creates construction drawings of the project site and distributes it to its site teams in preparation for the installation. Because construction works take place in phases, the client often informs Transvert of the need for additional scaffolding on a day-by-day basis. As such, requirements for scaffolding materials and labour resources are given on short notice, sometimes as little as one working day in advance.

Planning On A Day-By-Day Basis

Upon a client's request for scaffolding work in a specific area, Transvert's site supervisors would either notify the Operation Control Headquarters (HQ) immediately or consolidate the orders and update HQ at the end of the day.



Wireless Project Resource Management System

- Developed by DCS Solutions Ltd.
- Designed to assist resource management by facilitating communications flow between HQ and site personnel.
- Integrates resource management across multiple project sites.

In the evenings, the operation manager reviews the workforce and materials requirements for each site. If necessary, the operation manager uses a fixed line to contact the site supervisors for clarificiations. Once the next day's schedules are finalised by the operations manager, they are verbally communicated to the site supervisors by telephone.

While site supervisors verbally update the HQ via walkie-talkie at the end of each day, the project files are only updated once or twice a week when the supervisors return to the office. Hence, the files at the HQ may not correctly reflect the current state of work and resources used at the site.

Streamlined Reporting Process To Increase Productivity And Improve Resource Allocation

Transvert worked with DCS Solutions Ltd (DCS Solutions) to develop a solution to automate this business reporting process. One goal was to increase productivity and reduce the duplication of effort from HQ staff having to enter the requirements supplied by the site supervisor.

Another aim was to enable Transvert to plan resource allocations more effectively by improving HQ's ability to monitor the status of projects.

Wireless Solution Put Site Supervisors And HQ Staff On The Same Wavelength

DCS Solutions developed the wireless Project Resource Management System to enable Transvert's site supervisors and operations managers to communicate project requirements and to provide updates wirelessly. A PDA application was developed that would enable users to interface with Transvert's backend systems.

The wireless solution enabled site supervisors to:

- View their daily tasks.
- Send work requests to HQ and view responses.
- View planned jobs.

Operation managers could:

- View and approve/reject work requests.
- View the availability of site personnel.

HQ staff could:

- Send meeting reminders to each site supervisors' PDAs. These reminders were directly included into the scheduler.
- Receive real-time updates of client's requests from site supervisors.

More Robust Processes Enabled By Wireless

The pilot involved nine Transvert staff – including site supervisors, operation managers and HQ staff.

As a result of the introduction of the wireless Project Resource Management System:

- Central planning for project requirements at Transvert took place earlier. This enabled the work schedule to be forecasted further in advance and consequently, individual site supervisors were able to provide their clients with a clearer indication of when work could be completed.

- Site supervisors no longer waited at the site to be verbally notified via telephone of the next day's activities. Instead, they were notified via SMS when the daily to-do list was ready, and synchronised their PDAs to download the information.

- Site supervisors would update the files tracking the work progress of each site wirelessly three times a day.

- HQ staff monitored incoming work status for any delays, and rearranged transport requirements accordingly.

Wireless Solution Provided Management With Greater Visibility

With the implementation of the wireless Project Resource Management System, the files at Transvert's main office were kept up-to-date. This system provided greater visibility of resource usage and allowed management to make more informed decisions related to manpower and materials allocation. Ultimately, this enabled Transvert to provide better customer service both in terms of actual delivery of materials and time taken to respond to queries.

Transvert also found that the system allowed each operation manager to manage more site supervisors. Overall, the company estimates that the wireless solution would enable it to reduce its costs by 20% to 45% annually.

Expanding The Use Of The Application

In view of the benefits of the wireless solution and the high level of acceptance amongst pilot users, Transvert intends to roll out the solution to the rest of its local operations. With Transvert exploring growth opportunities for its business in markets such as China and Thailand, the company also has plans to extend the use of the wireless application for these overseas operations.

"Timely information management and accurate work reporting is needed to effectively carry out our work. The wireless application has been beneficial for us in this area."

Mr Jonathan Wan,
Manager, Transvert Scaffold & Engineering Pte Ltd

Case Study Title

Wireless Remote Monitoring For Electrical Meter Reading And Logging

Fast Facts

Synopsis
Devices were installed at electrical meters to provide readings and status updates wirelessly.

Benefits
- Enabled the gathering of continuous meter readings to create an energy profile for analysis.
- Eliminated the need for site visits by technicians to read meters.
- Does not require major re-wiring of the site.

Key Takeaway
Wireless devices can be used to cost effectively perform repetitive data collection.

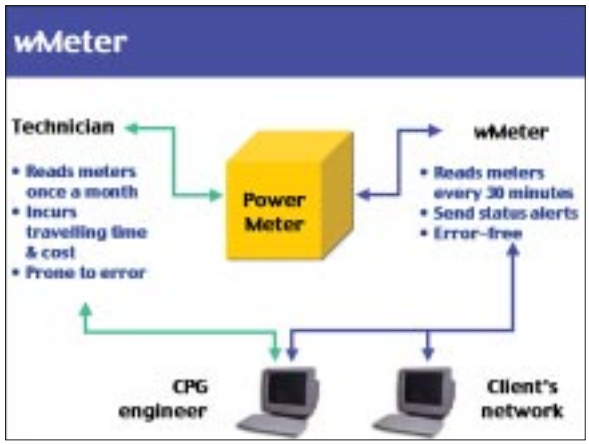
Companies Involved
CPG Facilities Management Pte Ltd,
Keppel DigiHub Ltd and
the Institute for Infocomm Research.

Overview Of Operations

CPG Facilities Management Pte Ltd (CPG FM) provides integrated facilities management services for over 1,000 buildings in Singapore and the region. CPG offers a full range of property management services including facilities management consulting, integrated facilities management services, project management, energy management and environmental health management.

The restructuring of the energy market in Singapore will enable landlords to potentially buy energy at lower prices by making an en-bloc purchase of energy from an alternative retailer. To do so, however, buildings will need sub-meters in order to address the issue of billing between the tenants.

Currently, site technicians record meter readings for buildings on a monthly basis. They monitor the energy consumption of individual tenants and major pieces of equipment. From these readings, energy consumption is calculated and tenants are invoiced accordingly.



*w*Meter

- Developed based on Institute for Infocomm Research's SmartEdge devices.
- Reads meter data and wirelessly transmits it to central servers.
- Interfaces with logging/management applications as well as billing/reporting software.

Detailed Energy Profile Crucial In Restructured Energy Market

It is labour-intensive to monitor the power consumption in buildings without a comprehensive metering system. Technicians have to travel to the remote site, often having to make pre-arrangements with site staff for access.

Data analysis is typically not performed as technicians are not able to download any other information aside from the current meter reading. If a detailed information log is required, additional digital power meters need to be connected to the main meter to capture the power and voltage trends. Energy profiling will be important in a deregulated energy market, as landlords may choose to implement a tariff structure for their tenants based on usage patterns.

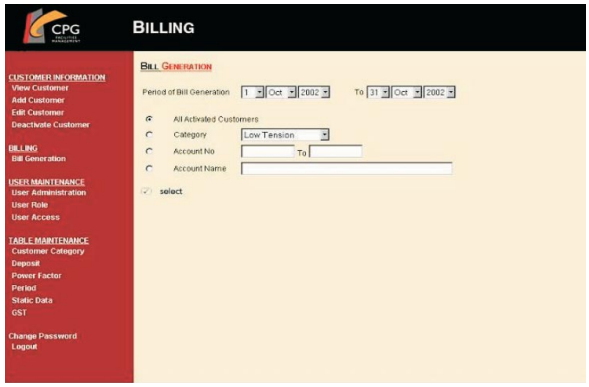
Some companies also install additional monitoring points for major equipment to better understand operational power needs and system efficiencies. In these cases, logged data is manually downloaded by onsite technicians, and later analysed by engineers.

*w*Meter – A 24-Hour Meter Reader

The Institute for Infocomm Research (I2R) worked together with CPG FM and Keppel DigiHub to develop the *w*Meter, a device to automate the task of recording meter information. Using SmartEdge technology from I2R, *w*Meter takes and stores readings, and transmits them to backend servers for processing at regular intervals. The device also sends status messages periodically, or provides alerts when a fault occurs. Meter readings can also be activated remotely via SMS commands.

The data received at a central server at CPG FM would be fed into a PC-based logging and management software as well as a billing and reporting application.

CPG FM chose to adopt a wireless approach because to connect the meters via cable would require major re-wiring and this would cause inconvenience to the site owners. In comparison, wireless meters could be installed and replaced easily with little disruption for site owners.



*w*Meter Provides Continuous Meter Readings And Status Updates

The *w*Meter was piloted at 2 building locations. With the wMeter installed, engineers and technicians no longer needed to regularly travel to sites to collect monitored information. Meter readings were automatically sent back at regular intervals, or could be activated by SMS. The automatic diagnostic feature sent status updates to CPG FM regularly, and could also generate an immediate SMS alert when a system fault occurs.

With the depth of information collected by *w*Meter, CPG FM's engineers were able to perform energy profiling to understand the trends in energy consumption across the days of the week, or even throughout each day. This was not possible under the traditional manual meter reading process.

Energy Profiling Ability Crucial For Restructured Energy Market

The main benefit of *w*Meter is its ability to provide a more detailed collection of data for energy profiling. Having access to instant monitoring and trend analysis will help enterprise energy users improve operational procedures leading to energy savings. This is crucial in tariff planning under Singapore's new restructured energy market.

"Wireless technology has enabled us to operate more productively, since manual site meter reading is no longer required."

Mr Derrick Hong,
General Manager, Energy Management Application Services,
CPG Facilities Management Pte Ltd

The information provided is also more accurate since mistakes in meter reading and data entry can be avoided. A direct interface with billing software will also eliminate the possibility of human error in calculating tariffs.

The automated system will also free technicians and administrative staff from mundane routine tasks of meter reading. This allows them to focus on more important areas in customer service, maintenance and other operational issues.

Plans To Expand Functionality

In the next phase, CPG FM aims to reduce system and operational costs by implementing a consolidated architecture. CPG FM also intends to reduce the size of the *w*Meter device, and further enhance the solution to enable remote diagnostics and programming.

Case Study Title

Wireless Remote Field Monitoring

Fast Facts

Synopsis
Engineering companies Wisescan and Kiso Jiban used wireless technologies to monitor their field instruments and to carry out data collection.

Benefits
- Saved up to 95% in manpower costs.
- Enabled more accurate and around the clock monitoring.
- Alerted engineers to critical issues in a timely manner.

Key Takeaway
Wireless solutions can cut costs and reduce errors associated with field data collection.

Companies Involved
Wisescan Engineering Services Pte Ltd,
Kiso Jiban Singapore Pte Ltd and SysEng (S) Pte Ltd.

Overview Of Operations

Field monitoring is a crucial element in many types of construction projects, particularly in cases where construction activities could impact public safety, nearby structures or underground services. Errors in field monitoring could result in traffic jams, damaged buildings and in some cases, even lead to loss of lives.

Manual Recording Is Slow And Expensive

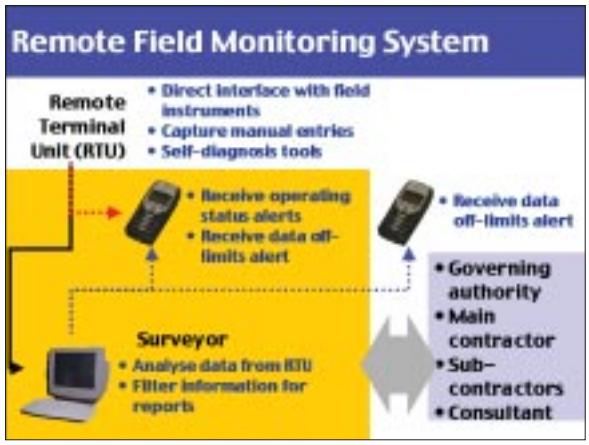
Traditionally, field instruments are installed at a site and read by a trained worker at certain intervals. This monitoring process could continue around the clock for critical excavation and tunneling works. The data obtained needs to be sent back to the monitoring companies' main office and manually keyed into a computer so that it can be analysed.

This process is prone to human error, and is also time-consuming and expensive. Varying conditions and ongoing activities at the site can make it hard to ensure the collection of information at regular time intervals.

In some critical projects, automatic data loggers are used. These loggers are able to record sensor readings but lack the intelligence to process the information and to alert the relevant people when necessary.

Meeting Critical Operational Requirements

The key challenge in field monitoring is to collect and process the incoming data quickly and accurately. If critical issues arise, the relevant personnel need to be informed immediately. Failure to do so could lead to serious operational consequences. However, taking field readings around the clock can take its toll on human workers. Automating the manual processes involved would help to meet these operational requirements.



Remote Field Monitoring System

- Developed by SysEng (S) Pte Ltd.
- Includes a Remote Terminal Unit which takes readings from field instruments.
- Wirelessly transmits field data to backend servers.

SysEng (S) Pte Ltd (SysEng) worked with engineering companies Wisescan Engineering Services Pte Ltd (Wisescan) and Kiso Jiban Singapore Pte Ltd (Kiso Jiban) to develop a wireless Remote Field Monitoring system. The solution revolved around the Remote Terminal Unit (RTU), a device that took readings from the various field sensors, and wirelessly sent them to a central server using GSM circuit-switched data services.

At the site monitored by Wisescan, the instrumentation used to monitor site conditions was directly connected to the RTU. The data is automatically collected and wirelessly transmitted to the server in Wisescan's office. The RTU also includes a self-diagnostic function that sends out a daily SMS alert to report its operating status.

At Kiso Jiban's site, 90% to 95% of the field instruments being measured did not have a computer interface to connect an RTU to. As a result, workers would manually read the data and key the information into the RTU. This would be likewise transmitted back to Kiso Jiban's office.

In the respective offices, engineering software processed the incoming data. Originally, the system was designed to automatically send out SMS alerts to the relevant construction personnel should readings exceed predefined conditions. However, during the pilot, it was found that this sometimes led to false alerts, resulting from sensors being moved accidentally. These false alerts led to unnecessary work stoppages for some events.

Based on this experience, the system was reconfigured to send an SMS alert to a qualified staff should the threshold conditions be exceeded. The staff would investigate and perform a second check and if necessary send out the information to the relevant parties.

Non time-critical status reports would be sent out by email or fax to stakeholders in the construction project, such as governing authorities, main contractors, sub-contractors and consultants.

Significant Gains In Timeliness And Quality Of Data

The increased speed and access to data, coupled with manpower cost savings, has given Wisescan and Kiso Jiban a tremendous business edge. After the wireless Remote Field Monitoring System was implemented, the time spent acquiring field data was reduced by over 90%. This translated to cost savings in terms of manpower and transportation costs.

"The automatic wireless system has enabled our company to obtain real-time surveying measurements more efficiently than before and improve our operations."

Mr Chua Keng Guan,
Managing Director, Wisescan Engineering Services Pte Ltd

Furthermore, in certain work environments such as tunnels, surveyors were only given site access once a night, to take the readings. With the wireless Remote Field Monitoring System, this was no longer an issue as data could be automatically collected throughout the day, without the need for human intervention.

Data provided by the RTU had to be dependable. In order to ensure the integrity of the RTU and data transmitted, SysEng developed a hardware error recovery protocol solution to address any wireless signal dropout. In an event of such an occurrence, the RTU could automatically recover the line without the need for an engineer to physically travel down to the site.

Improving Ease Of Use And Network Compatibility

SysEng, together with Wisescan and Kiso Jiban, aims to make the remote monitoring system easier to set up and use. Future versions of the RTU are likely to include enhanced self-diagnostic tools and allow operators to troubleshoot remotely via the Internet.

In addition, there are also plans to enable the system to operate over different alternative wireless standards such as GPRS, CDMA, WLAN and WCDMA, this would facilitate the rollout of the solution in other countries.

Case Study Title

Wireless Sales Force Automation And Marketing Information System

Fast Facts

Synopsis
DKSH group of companies deployed a wireless sales force automation solution that enabled the company to improve its sales process and reduce administrative work for its salesmen.

Benefits
- Increased productive selling time by 20%.
- Reduced errors in order taking and data-entry.
- Increased delivery turnaround time.

Key Takeaway
Wireless technology can be used to implement operational process changes and improve existing workflows resulting in benefits for individual users and significant return on investment for the organisation.

Companies Involved
Diethelm Singapore Pte Ltd,
Harpers Trading (S) Pte Ltd,
Harpers Marketing Pte Ltd,
Maya Systems Consultants Pte Ltd
and Deloitte Consulting Pte Ltd.

Overview Of Operations

In Singapore, the DKSH group of companies market and distribute over 5,000 different consumer and healthcare products from over 100 leading brands to more than 4,000 retail outlets and wholesalers.

Diethelm Singapore Pte Ltd, Harpers Trading (S) Pte Ltd and Harpers Marketing Pte Ltd, part of the DKSH group, operates in an increasingly competitive environment. Partners are also more demanding on the level of service and the degree of process transparency from the company.

The consumer goods retail process typically involves tedious manual paperwork and a significant amount of duplication. Any efforts to remove operational efficiencies, however, have to take into account the client's willingness to accept the resulting changes that may also impact them.

DKSH's salesmen spend at least the first two hours of each day submitting the previous day's sales, compiling daily reports, getting updates on new promotions and prices and printing individual customer's outstanding account receivables report.

The salesmen then visit their customers' outlets for the remainder of the day, where they take orders using call cards, collect payments and process returns requests. Each salesman visits an average of 5 to 8 outlets a day.

The call cards, returns advices and payments are submitted to the office on the next working day, where data entry clerks input the information into the backend system. It normally takes 48 hours, from the time of ordering, for the goods to be delivered.

The salesmen also generate daily and weekly reports. These reports are used by managers to monitor the performance of each salesman

SalesExpress

- Developed by Maya Systems Consultants Pte Ltd.
- Integrated with backend SAP system.
- Manages sales orders, trade returns, price controls and promotions.

From the management's perspective, pricing and promotion control is key since DKSH has to commit to the prices that are recorded by the salesmen on their call cards. In addition, DKSH needs to be able to replenish their stocks in a timely manner, in order to effectively meet their customer orders.

PDA Solution Leverages On The Backend System

DKSH engaged Maya Systems Consultants Pte Ltd and Deloitte Consulting Pte Ltd to develop and implement the SalesExpress wireless mobile sales system to address these challenges. In the pilot, users were provided with a wireless-enabled PDA that had the following features:

- **Sales order**
  Users could submit orders and check for stock balance and credit status.

- **Trade return**
  Users could submit return requests, which were automatically accepted unless they exceeded a stipulated value.

- **Van inventory control (for van sales)**
  Users could keep track of the stock of various products in the vehicle.

- **Call management module**
  Users could view and adjust their itinerary.

- **Synchronisation**
  Users could get updated information on products, pricing, customers, outstanding invoices and debt status.

The PDAs communicate via GPRS with a sales force automation application server at the Diethelm office. Here, a reporting module allows sales managers to view the performance of individual salesmen, or consolidated division results. The application also generates summary reports by customer and by product.

The SalesExpress server was integrated with DKSH's backend SAP system, and these systems are synchronised daily to trigger off the processing of orders.

Familiarising Pilot Users To The New System

The average salesman was 35 years old. Half of them were not very proficient in English, and many had little or no knowledge of computers. Despite this, the salesmen involved in the pilot found it relatively easy to use the application. Salesman were provided with a one day training session and used the PDA along with existing paper-based methods for a week. After this, the system went "live".

Streamlining Business Processes

DKSH's salesmen were no longer required to carry call cards and reports. Customer information, for example, outstanding debts, were loaded in the PDAs for easy reference. Paperwork was also reduced since they did not have to compile sales reports in the office at the start of each day. This enabled the salesmen to focus on their core tasks of servicing their customers. It is estimated that the system has increased the productive selling time of the salesmen by 20% per day.

The time taken to fulfil customer orders was reduced from 48 hours to under 24 hours. Urgent orders could be submitted immediately via GPRS. Orders received by 10 am were delivered on the same day while those received by 2 pm would arrive the next morning. There were also fewer errors made in invoicing since there was no manual re-entry of data into the SAP system.

DKSH adjusted its business process such that sales managers were no longer required to approve returns unless they exceeded a stipulated value. Hence, most returns requests submitted using the PDA were actually automatically approved.

Pricing and promotions were controlled by the system and updated to the PDA on a daily basis. Salesmen no longer had to remember different prices and changing trade promotions. At the same time, the organisation was also able to reduce disputes and mistakes resulting from erroneous pricing.

DKSH reports that these operational efficiencies have resulted in more productive sales efforts. The wireless system has also increased their sales by 10% and reduced costs caused by incorrect invoicing by more than 50%.

"The key benefit of the wireless solution is that business can be conducted at anytime, anywhere, in the most efficient manner. We have shortened the business processes and increased our service level to our customers."

Mr Chris Oo,
General Manager, Health & Nutrition Division,
Harpers Trading (S) Pte Ltd

Future Plans

Given the attractive returns on investment of the SalesExpress application, DKSH plans to deploy the solution to its other divisions. There are also plans to enhance the solution to include additional functions such as the tracking of customer's inventory and "favourite" items, highlighting promotional items on the PDAs.

Case Study Title

Wireless Sales Force Automation

Fast Facts

Synopsis
Philip Morris implemented wireless technology to enhance existing sales force automation tools with payment features and real-time information services.

Benefits
- Saved time and resources in handling cheque and cash payments.
- Increased customer service enquiry response time.
- Enabled better resource allocation and inventory decisions by obtaining almost real-time sales and inventory information.

Key Takeaway
Sales force automation tools can be enhanced with payment options and location-based services.

Companies Involved
Philip Morris Singapore Pte Ltd,
IBM Singapore Pte Ltd and Starhub Pte Ltd.

Overview Of Operations

Philip Morris Singapore Pte Ltd (Philip Morris) is a multi-national consumer packaged goods company that runs direct sales and distribution operations. Its field force services a customer base of about 7,000 retailers. 80% of these retailers are general trade "mom-and-pop" shops, restaurants, kiosks and convenience stores. The remaining are large retail operations such as NTUC, Carrefour and 7-Eleven.

The sales representatives make sales visits to the customer base on a weekly basis. During each visit, the sales representative makes the sale, delivers the goods, issues tax invoices and collects payments. At the end of each day, the sales representatives return the collections and the unsold inventory to the sales office. To facilitate this process, each salesman uses DOS-based handheld computers in the field that need to be docked in the office.

Philip Morris has used such sales force automation tools for over ten years. The company's front-end sales office application is also fully integrated with the backend enterprise system.

Verifying Cash And Cheque Payments Is Time-Consuming

Most of the 7,000 retailers pay using either current or post-dated cheques. Some also make payments in cash. Processing these payments is labour-intensive and time-consuming. The payment is first verified or counted (in the case of cash) when the sales representative receives it from the retailer. The back office staff repeats this process when the sales representative hands in the collections at the end of the day.

Wireless Sales Force Automation System

- Developed by Philip Morris Singapore Pte Ltd, Hunting Consultancy Services Pte Ltd, IBM Singapore Pte Ltd and Starhub Pte Ltd.
- Includes wireless gateway to allow WAP banking.
- Data updates from mobile devices synchronised with backend systems for real-time inventory and order management.
- Able to track the location of sales force based on cell-based information provided by Starhub.

Information from the representative's handheld computer is also downloaded into Philip Morris' backend system for consolidation. This information enables management to manage manpower resources and inventory levels.

Wireless Solution To Extending Sales Force Automation

Philip Morris worked with IBM Singapore Pte Ltd and Starhub Pte Ltd to explore how the existing sales force automation process could be further enhanced. This resulted in the development of a new wireless sales force automation application. The PDA-based application included the following functions:

- **Order management system**
  Allows sales representatives to keep track of their sales, collections, and inventory in their vans. Using the GPRS network, the data in the application can be remotely synchronised with the data in the backend enterprise system.

- **Business-to-business (B2B) payment system**
  Provides the retailer with the option to make immediate and post-dated payment to Philip Morris via WAP banking.

- **Messaging and location services**
  Allows the sales office to send instant messages to each sales representative, and also to manage field activities.

Philip Morris carried out a pilot of the new system involving three sales teams. Managed by a sales executive, each sales team comprised of one senior sales representative and five other sales representatives. Together, these three teams service approximately 2,000 retailers.

Securing Retailer Participation

The key challenge faced was enabling the retailers to be able to make payment via WAP banking. To participate, the retailers had to have personal accounts as WAP banking was not available for corporate banking accounts. This required a significant change in payment behaviour of the retailers and it was a challenge getting active participation from the retailers.

To encourage retailers to participate in the wireless payment trial, a promotional campaign was held. This resulted in 320 retailers agreeing to participate.

Wireless Solution Brings Productivity Gains

After having used handheld computers for several years, Philip Morris' sales representatives had to adapt to the stylus interface of the PDAs as the old devices had a keypad interface.

"There is no doubt that this project has substantially improved Philip Morris' productivity level internally as well as raised our service level to customers."

Mr Anthony Lau,
General Manager, Philip Morris Singapore Pte Ltd

Teething issues notwithstanding, the new application helped to save time and reduce the administrative workload for sales representatives and retailers, as well as for Philip Morris' administrative staff involved in verifying daily collections.

With the wireless application, the sales representatives were also able to obtain up-to-date information on a customer's payment status, even when out of the office. This resulted in better credit management and reduced the company's risk exposure.

Philip Morris' management is now provided with better information for decision-making. With records covering sales history, retailer information, stock levels and other areas uploaded from each sales representative every day, the almost real-time information enables better resource allocation and inventory re-stocking decisions.

Exploring Wireless Payments

Business-to-business wireless payments are seen to be an important functional feature that can enhance the value of a sales force automation application. This is especially so for industries that traditionally rely heavily on payment methods such as cheques and cash. While such payment solutions are still emerging, Philip Morris plans to continue to assess suitable direct payments methods that are able to meet their needs and requirements.

Case Study Title

Wireless Interface To SME Applications

Fast Facts

Synopsis
SMEs used wireless technology to access their backend applications with mobile devices.

Benefits
- Allowed users to check product and price availability remotely.
- Reduced administrative workload.
- Reduced average settlement period by over 20%.
- Improved management overview of supply chain and business operations.

Key Takeaway
Vendors can extend the utility and efficiency of SME applications by enabling access via mobile devices.

Companies Involved
Chee Fatt Co Pte Ltd,
Kian Soon Hardware and Trading Pte Ltd,
All-Wares Supply, Zara Technology Pte Ltd
and Palm Singapore Sales Pte Ltd.

Overview Of Operations

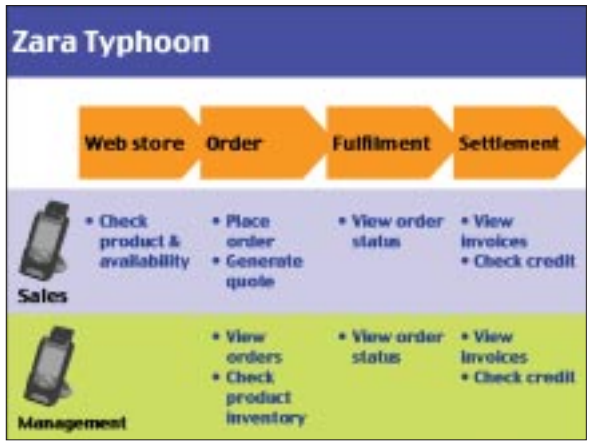
The companies involved in the pilot are Chee Fatt Co Pte Ltd (Chee Fatt), Kian Soon Hardware and Trading Pte Ltd (Kian Soon), and All-Wares Supply (All-Wares).

Chee Fatt distributes 75 leading brands of hand and power tools in the region. Kian Soon supplies high quality fasteners to technology manufacturers. All-Wares is a general supplier of industrial products and services to various industries including shipping, oil, the military and the government.

All three SMEs have interests across the Asia Pacific, and China in particular.

Using Limited Resources To Meet The Business Needs Of SMEs

As local SMEs grow their businesses, many have developed relationships with suppliers and customers in the region. The increasing number and complexity of these relationships require SMEs to manage their business operations and processes more efficiently.



Zara Typhoon

- Developed by Zara Technology Pte Ltd.
- Designed as a wireless extension to allow users of the Zara NetSuite application to access the application using mobile devices.

By definition, SMEs have a small number of employees, and are often unable to spare the time or resources to explore new technology options. For the same reason, processes that save time and effort, while enabling a higher level of customer service, provide a value proposition to the SMEs.

Administrative Staff Needed To Facilitate Information Access

Prior to the pilot, the three companies operated by traditional sales and supply chain processes. When meeting a potential buyer, the sales person would call upon administrative staff to check on the price and availability of a product. When stocks were insufficient or low, a management would decide whether or not to reorder new stocks.

The three SMEs store their enterprise data on a backend application known as Zara NetSuite. Users have to log-in to the company's local area network to access or update this information. As such, sales staff and management, who spend most of their time out of the office meeting clients, have to return back to the office to access the backend information. Alternatively, they would call and ask office-based administrative staff to access the system on their behalf.

Wireless Application Extends Access To Back-End Database

In the pilot, Zara Technology Pte Ltd (Zara Technology) enabled the three companies to use wireless technology to connect sales force and management personnel to backend application. The objectives of the project were to:

- Enable management to better monitor business operations, and identify potential bottlenecks before they occur.

- Provide the sales force with immediate access to price, inventory and delivery information, enabling a higher-level of customer service.

The solution comprised four modules connected to the SME's Zara NetSuite application over GSM circuit-switched data services or GPRS. The wireless application could be used on mobile devices such as smart phones or PDAs.

The four modules were:

- **WebStore**
  Enabled sales staff to access current price and availability information for a product based on a stock code or manufacturer.

- **Orders**
  Upon confirmation of a sale, this module allowed sales staff to place an order and generate a quotation. Management was able to view customer orders, and identify when stock of a product falls below acceptable levels.

- **Fulfilment**
  Enabled sales staff and management to find out if delivery orders had been fulfilled.

- **Settlement**
  This module enabled the user to view the allocated credit limit and outstanding invoices for a customer.

Following the implementation of the application, sales staff and management were able to access these applications remotely, freeing up the administrative staff to concentrate on their core roles.

Higher Productivity And Shorter Settlement Period

With the wireless solution in place, the backend application were more accessible to sales staff. They were able to access product pricing and availability directly, and did not have to use administrative staff resources.

"My whole operation is literally online. I can access all my company's information wirelessly from web store, orders, fulfilment, settlement and accounts. Zara's NetSuite enables wireless web services, through which my customers can also access information and their account status."

Mr Anthony Poh,
Director, Chee Fatt Co Pte Ltd

With the Settlement module made accessible via PDA, sales staff were able to more effectively collect payments from the customer. This saw the average settlement period being reduced from 69 days to 53 days as a result of the implementation of the wireless solution.

Future Plans

Zara Technology has since progressed from the pilot to develop a new application called SteelClaws Mobile. This application makes the features of the pilot application available to J2ME-enabled devices

Case Study Title

Mobile Property Sales Force Management System

Fast Facts

Synopsis
ERA agents were able to access updated property listings information, including rich graphics such as photographs and maps, from a range of mobile devices.

Benefits
- Enabled agents to perform faster matching of buyers' requirements with property listings.
- Provided buyers with immediate, up-to-date information along with photographs and maps.
- Reduced administrative support costs.

Key Takeaway
Companies can leverage on wireless technologies to provide a competitive advantage and differentiate themselves from their competitors.

Companies Involved
ERA Realty Network Pte Ltd,
CET Technologies Pte Ltd and AirGateway Pte Ltd.

Overview Of Operations

ERA Realty Network Pte Ltd (ERA) is a property agency that manages more than 1,300 real estate specialists. ERA agents match about 250 buyers and sellers each week, accounting for about 25% of the Singapore market.

The ERA-agent relationship is that of a franchiser-franchisee. ERA provides training, property listings and other services to its agents and in turn earns a commission for each successful transaction.

Agents Need To Access Property Listing Information From The Field

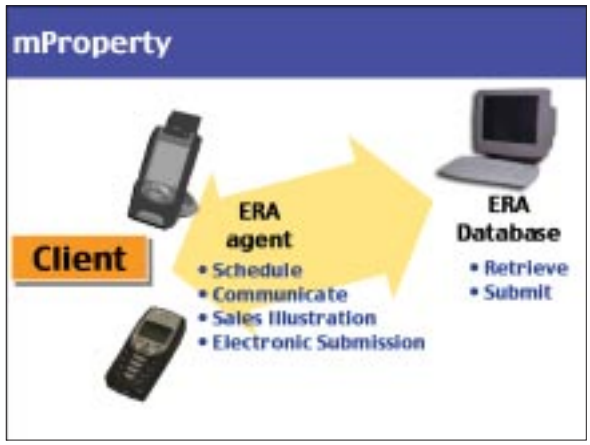
ERA agents are very mobile, meeting with potential buyers and sellers on a daily basis. With sellers, the agent highlights ERA's competitive advantages in trying to win the exclusive right to market the property. When meeting buyers, ERA agents provide detailed information on current property listings, including location, pricing, property type and features.

If a buyer is interested in a property, the agent will arrange for a viewing. This entails finding a mutually convenient time for both parties, and can take several days to arrange.

Agents also submit information on potential buyers and sellers back to ERA's central database. This is done manually via paper forms and entered into a central database by ERA administrators. Other ERA agents can then access the information.

Immediate Answers Help To Win Customers

The ERA agent's main challenge is to be able to provide immediate answers to client queries about properties on sale.



mProperty

- Developed by CET Technologies Pte Ltd and AirGateway Pte Ltd.
- Comprises of five integrated modules: Property management, Personal information management, Customer profile management, Electronic submission and Sales illustration and matching.
- Can be used with different devices (PDAs, tablet computers, mobile phones) and technologies (GPRS, SMS, WAP).

With the introduction of new communication technologies, client expectations have risen with regards to the detail of property information required and speed with which they receive it. Being able to give detailed and accurate answers provide ERA agents with a key advantage in the competitive real estate environment.

Scheduling and time management are also important to agents, as they have to constantly travel between appointments, while moving back and forth to the office to check their emails and carry out other administrative tasks. At the same time, they have to coordinate their schedules with that of their clients, with constant requests for appointments coming in via phone, email or SMS.

mProperty Brings The Office To The Agent

ERA chose to conduct a pilot of a mobile property sales force management application, mProperty, with CET Technologies Pte Ltd providing technical consultancy and design, in collaboration with AirGateway Pte Ltd. mProperty incorporates a host of five integrated modules:

- **Property management**
  Manages the agent's portfolio of sales and potential sales.

- **Personal information management**
  Assists in managing the agent's personal communications such as email, schedule of appointments and list of contacts.

- **Customer profile management**
  Enables agents to view and edit customer profiles, with an option of setting up an appointment.

- **Electronic submission**
  Allows agents to upload contact information of potential customers to ERA's central database.

- **Sales illustration and matching**
  Matches a customer's requirements to a listed property, and graphically illustrates the property's features for the client's viewing.

The pilot involved a total of 51 agents using three types of mobile devices – tablet computers, PDAs and mobile phones. Mobile phone users had the option of either using WAP or SMS to access the mProperty application.

Wireless Enables Faster And More Detailed Responses

With the wireless solution, ERA agents were able to respond to clients faster since they no longer had to make calls to the office to obtain the information. Those using the tablet computers were also able to display photographs and maps of properties to potential buyers. In some cases, this reduced the number of appointments that had to be made as buyers could short-list their preferences.

Agents using tablet computers and PDAs were also able to use the personal information management module to view and reply emails, and schedule appointments.

"The system is productive and efficient; it reduces our travelling time and expenses while giving us more time to concentrate on the other aspects of the transaction."

Mr Mark Teo,
Group Centre Director, ERA Realty Network Pte Ltd

Usability, A Key Factor For User Adoption

The tablet computer was the most popular mobile device used to access the mProperty application, with an approval rating of 85% from its users. This was followed by the use of SMS over mobile phones, because of its simplicity and low cost. WAP phone users, however, reported that it was not convenient to access mProperty because entering data with the phone's keypad was slow and cumbersome.

Wireless Provides ERA Agents With A Competitive Advantage

Previously, it took an average of one day for an agent to obtain information on a property, match a client's needs with a property, or submit information to ERA's central system. Using mProperty, each of the processes could be done almost immediately. Agents also found that the ability to show potential buyers photos of properties, instead of having to visit the physical location, saved them up to 3 man-days per property sold. ERA estimates that mProperty has helped to reduce sales costs by 15%.

More importantly, the system provided a competitive advantage to ERA agents by allowing them access to immediate, rich and accurate information for their clients. ERA estimates that the implementation of mProperty has contributed to a 10% increase in the number of transactions closed among pilot users.

Expanding The Use Of The System

ERA is exploring ways of enhancing the mProperty solution by incorporating more features and modules. If the application continues to be successful amongst local ERA agents, ERA is likely to roll out the wireless solution to its franchisees in the Asia Pacific.

While the mProperty solution is designed specifically for agents, ERA is also considering incorporating some of its features into the ERA website as a service to individuals buying or selling their homes.

Case Study Title

Integrated Sales Cycle Management

Synopsis

Integrating a "wired and wireless" sales cycle management application with existing systems enabled SUN Microsystems to better manage sales activity and provide better customer service while reducing administrative workload.

Benefits

- Wireless access allowed sales representatives to update sales leads and forecast information without returning to the office.
- Reduced administrative workload for marketing and finance teams.
- Reduced response time to customers' price queries and requests for special discounts.

Key Takeaway

Wireless technologies can integrate information flows between different internal departments, reducing unnecessary workload and accelerating the sales process.

Companies Involved

SUN Microsystems Pte Ltd and iGine Pte Ltd.

Overview Of Operations

Established in 1982, SUN Microsystems Pte Ltd (SUN) is involved in the sale and manufacture of IT hardware, software and the provision of IT services. Together with an extensive network of partners, it provides industrial strength IT solutions to almost every industry. SUN can be found in more than 170 countries and on the World Wide Web at www.sun.com.

Sales Force Activities Tracked On An Individual Basis

Currently, most sales force related operations and information are tracked via SUN's intranet system and through individual processes put in place by their partners' sale representatives.

Leads gathered by SUN's marketing team during marketing events are assigned to SUN sales representatives and partners for follow-up. Sales representatives are expected to update the marketing team on the status of the leads they follow. At the same time, SUN sales representatives also submit sales forecasts via SUN's intranet system. These are consolidated as a forecast to the management.

Current pricing information is available to both sales representatives and partners via a secure website. Any special discount approval would be transmitted to a SUN approving officer through SUN's B2B system. SUN partners to also place orders through the B2B system.

Integrated Sales Cycle Management System

- Developed by iGine Pte Ltd.
- Integrated with backend B2B Ordering system.
- Enables mobile access for features such as leads management, sales pipeline management and special terms requests via GPRS and SMS.

Integrating Wired And Wireless Applications To Support The Sales Cycle

To track and manage sales activities more effectively, SUN worked with iGine Pte Ltd (iGine) to implement a wireless integrated sales cycle management tool with the following features:

- **Leads management**
  This module enables the marketing team to create and assign leads using a web-based interface. Individual sales representatives, both from SUN as well as partner distributors, are able to view and update the leads assigned to them on their PDAs.

- **Sales pipeline management**
  Sales representatives use this module to add or update their sales forecasts. This information is consolidated by the sales pipeline module, which is integrated to SUN intranet systems. This allows the results to be accessed by SUN's management on their PDAs. The module also sends out SMS alerts to remind all sales staff to update their leads before every consolidation period.

- **Price queries and special discount**
  Sales representatives are able to check product prices on SUN's website using their PDAs or via SMS. Requests for special discounts would trigger an SMS to the relevant SUN officer, who would approve or reject the request via the PDA. The system would then inform the requestor of this decision via SMS.

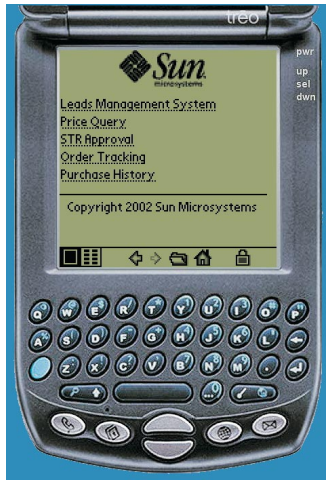
- **Order tracking**
  This module extends the ability of sales representatives to view order information remotely from their PDAs.

- **Purchase history and customer information management**
  This module enables sales representatives to access a customer's purchase history from their PDAs.

- **Management visibility**
  This module allows SUN's sales managers to access current and historical order revenues via the Internet and through their wireless devices.

Overcoming Integration And Security Issues

Integrating the Order tracking module to SUN's B2B system was made easier by the fact that the legacy system had also been developed by iGine. However, creating a real-time link for the Sales pipeline and Price query components was a more difficult task as these modules had to interface with SUN's international backend



"The Mobile Sales Project gives SUN and our partners sales force a significant productivity edge. Working in conjunction with iGine, we are in the planning process to introduce the Mobile Sales tools across the Asia South to enhance the productivity of SUN and partners sales force."

Mr Keith Leong,
Channel Director, SUN Microsystems Pte Ltd

system, which was outside the control of the regional office. To address these issues, the required data was downloaded regularly into a mobile server during the pilot period.

Administrative Workload Reduced

Previously, communication between the marketing and sales teams had largely been via email. The marketing team has to spend considerable resources following up with sales representatives. Updating of assigned leads was difficult as sales representatives were often out of the office, and had limited email access.

The Leads management module addressed this issue by enabling sales representatives to access sales leads remotely. The module could also be configured to send the sales representatives SMS reminders to update records. In the same way, consolidating the sales forecasts has become a more efficient process, since sales staff did not have to return to the office to update the system.

The Price query module allowed sales representatives to finalise orders in a shorter time. Customers often made several price queries, usually one after another, prior to confirming an order. Previously, each query was handled by making a call to someone in the office or only when the sales representative physically returned to the office. The Price query module enabled the sales representative to provide a quotation to the customer almost immediately.

Increasing Sales While Reducing Administrative Workload

The integrated sales cycle management tool has provided two key benefits to SUN. First, the system has helped improve SUN's leads management, and has enabled the sales team to respond to customers' price queries and requests for special discounts, in a more timely manner. This has resulted in a higher number of sales due to a reduction in the attrition from the "sales funnel".

Second, SUN enjoys significant savings in resources across its sales, marketing and finance department. This is because the administrative processes, such as tracking of leads or consolidating sales forecast, are enhanced wirelessly.

The pilot involved 20 internal users, but SUN intends to expand the pilot and enable its partners to use the system in the coming months. There are also plans to rollout the solution to SUN's other operations in Asia Pacific.

Case Study Title

eLogistics Job Dispatch Management System

Fast Facts

Synopsis
Ameroid leverages wireless job dispatching technology to facilitate job assignment, tracking and reporting processes.

Benefits
- Enabled the tracking of delivery items on a real-time basis.
- Reduced time taken to assign jobs by 30%.
- Reduced cost of disputes by almost 40%.

Key Takeaway
Logistics operations can become more streamlined and error-free by using wireless technologies.

Companies Involved
Ameroid Logistics (S) Pte Ltd
and NEC Solutions Asia Pacific Pte Ltd.

Overview Of Operations

Ameroid Logistics (S) Pte Ltd (Ameroid) is a logistics solutions provider. Focused on the electronics industry, Ameroid provides door-to-door deliveries as well as import and export services such as door-to-airport/ airport-to-door deliveries, coupled with customs clearance and documentation services.

Job orders are received by Ameroid's traffic controllers (TCs) who are stationed onsite with customers. These orders may be received on paper, telephone or through the customers' intranet terminals. The TCs manually record each order onto a spreadsheet, and assign delivery teams to carry out the job. Upon job completion, the delivery teams then inform the TC, either via mobile phone or two-way radio. The TCs then update the spreadsheet accordingly.

If there is an urgent job request, the TCs need to first determine the availability of the delivery teams. In order to do this, they would use the radio to contact the delivery teams perceived to be the most conveniently located, based on the information on the spreadsheet. Ameroid will only commit to the client's urgent request if the driver's actual location and existing job schedule are able to accommodate the additional job.

The spreadsheet for each customer site is printed out at the end of each day and sent to Ameroid's headquarters for consolidation.

Customer Service And Operational Efficiency Are Key Success Factors

Ameroid's customers mainly operate using the "just-in-time" production process and as such, often require timely confirmation of job acceptance and prompt updates on delivery status. Any delays or errors in delivery will have a chain effect on the production schedule.

eLogistics Job Dispatch Management System

- Developed by NEC Solutions Asia Pacific Pte Ltd.
- Designed as a logistics application with Admin, Traffic controller and PDA modules.
- Integrates a Global Positioning System (GPS) tracking system.

Apart from maintaining a high service level, another critical success factor for the logistics industry is operational efficiency. Ameroid's headquarters and TCs need accurate and up-to-date information on how the available resources are being utilised, in order to re-deploy resources in the most effective way.

The current process of communication between the TCs and the delivery teams using two-way radios and mobile phones is slow and prone to error. Specifically, the process of assigning a delivery team to a job order can take up to one hour. This includes the time needed for TCs to track the locations of the delivery teams and to verify their schedules. Occasionally, there is miscommunication over the time or location of deliveries, leading to disputes over the job orders.

Managing Jobs With Greater Efficiency

To address these challenges and create greater operational efficiency, Ameroid explored the use of the eLogistics Job Dispatch Management System (JDMS) that was jointly developed together with NEC Solutions Asia Pacific Pte Ltd. Ameriod deployed a pilot involving 30 delivery teams and five TCs based at four customer sites.

The JDMS comprises four modules:

- **Administrative module**
  Used at its headquarters, this module enables Ameroid's management and administrative staff to manage customer and consignee records, manage delivery resources, track delivery teams in real-time and generate status reports.

- **Traffic controller module**
  A web-based application that enables TCs to manage job orders, manage consignee records, manage delivery resources, track delivery teams in real-time and generate status reports.

- **PDA module**
  Each delivery team has a PDA which enables them to view job schedules, receive new jobs, and send acknowledgements and delivery status updates to the TCs.

- **Geographic Information System (GIS) module**
  This module contains a vector map of Singapore, and is able to locate delivery vehicles on this map using the Global Positioning System (GPS). This information allows TCs to track the position of delivery teams in real-time.

"The wireless solution enables us to communicate job orders accurately, and assign resources more quickly and efficiently, improving our commitment to service deliveries."

Mr Alvin Lee,
General Manager, Ameroid Logistics (S) Pte Ltd

Automated Job Assignment And Reporting Processes

The JDMS application enabled Ameriod headquarters and the TCs to monitor in real-time the location of delivery teams and obtain the status of pending job orders. The application also facilitated the assignment and dispatch of new job orders. Delivery teams would receive new instructions via GPRS on their PDAs, and were expected to confirm their acceptance. There was no room for miscommunication since the job orders were received in a text format and could be stored on the PDA for reference.

Upon delivery, the teams used their PDAs to update the TCs on the job status. Previously, TCs had to compile spreadsheets into daily job summaries to be submitted to Ameroid's headquarters. Now, TCs use the JDMS application to generate these daily reports.

Wireless Solution Has Helped To Increase Productivity And Reduce Errors

The JDMS application enabled Ameroid to meet its twin goals of improving customer service while increasing operational efficiency.

In the pilot, the time needed to assign a delivery team to a job was reduced, on average, by 30%. This was attributed to real-time tracking, reduced voice communication and reduced data-entry. Customer enquiries on the delivery status or location of their goods could also often be met without having to contact the delivery team.

The system has also helped to reduce errors in job orders. The cost of disputes fell by almost 40% for the operations involved in the pilot.

Based on these benefits, Ameroid has further plans to deploy the application to the rest of its operations.

Case Study Title

Electronic Proof Of Delivery For Mobile Supply Chain Transactions

Fast Facts

Synopsis
Drivers are equipped with GPRS phones that allow them to electronically view and update their delivery orders wirelessly.

Benefits
- Increased driver productivity by over 10%.
- Reduced trucking and deployment expenses by 5% to 10%.
- Reduced administrative workload in terms of processing delivery orders by more than 7%.

Key Takeaway
Wireless technology can be used to keep IT systems updated in real time on actual operational events.

Companies Involved
Y3 Technologies Pte Ltd and Fujitsu Asia Pte Ltd.

Overview Of Operations

YCH Group Pte Ltd (YCH) is a homegrown logistics and supply chain management (SCM) company, which specializes in providing end-to-end SCM services to multi-national corporations (MNC) in three industries – electronics, chemicals/healthcare, and fast moving consumer goods. In addition to developing and managing integrated supply chain networks across Asia, Europe and the Americas, YCH also manages an extensive high velocity distribution network for the delivery of a spectrum of goods within Singapore.

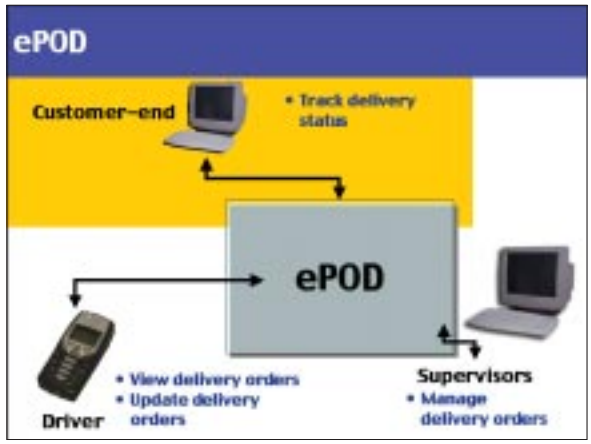
YCH's key clients include a leading regional Food and Beverage (F&B) company, a major convenience chain, an European-based F&B conglomerate, and a leading diagnostics & healthcare MNC. YCH also manages an extensive network of transportation agents to complement its extensive fleet and transportation capabilities, for optimal efficiency and scalability. Corporate Cargo Express Pte Ltd (CCE) is one such transportation and trucking agent, appointed to deliver goods to YCH's clients throughout Singapore.

Paper-Based Documentation Process Slow And Error-Prone

When a product is delivered, the receiver signs a delivery order (DO). This is a binding document that confirms the delivery of the physical goods and triggers the financial settlement.

CCE, like most local transport companies, use a paper-based proof of delivery (POD) process. The time taken between actual delivery and sending out the invoice is usually about eight days due to the processing involved. Errors can also occur, or documents may be lost or modified. These can take further time to investigate and resolve.

In addition, given the time-sensitivity of the business, customers occasionally wish to track the movement of their orders. Such requests may be made through a variety of channels – phone, email, telex or in person.



ePOD

- Developed by Fujitsu Asia Pte Ltd and Y3 Technologies Pte Ltd.
- Allows updates to delivery status through a mobile device.
- Can be integrated with legacy logistics management and tracking systems.

Given the large disparity in terms of IT systems used by YCH and its agents, YCH aimed to improve its agents operational procedures and efficiencies by leveraging on these systems.

ePOD Solution Aims To Keep The SCM Application Up-To-Date

Fujitsu Asia Pte Ltd (Fujitsu) and Y3 Technologies Pte Ltd (Y3) conducted a pilot with YCH and its agents, to explore streamlining and automating the POD process through an electronic proof of delivery (ePOD) system. The ePOD system would update the backend SCM system as soon as delivery was made and trigger off the necessary backend processes.

Participating in the pilot were some of YCH's key operational units, as well as selected transportation agents.

In all, 30 drivers and their supervisors were involved in the pilot. Using GPRS-enabled mobile phones, drivers were able to view and update their delivery orders.

Users' Familiarity With Mobile Phones Ease Adoption Issues

Mobile phones were chosen over PDAs because most drivers were already familiar with using them. The use of mobile phones was aimed to ease the learning curve. Furthermore, mobile phones had a cost advantage over PDAs.

While the majority of drivers participating in the ePOD trial could read and converse in English, there were some that were only fluent in Mandarin. Despite this, almost all the drivers were able to use the ePOD system after just one training session. This is because the interface was simple and the number of steps was kept to a minimum.

While implementing the pilot, one issue encountered was dealing with the confidentiality of YCH's clients delivery order database. This database contained customer information and delivery items and needed to be integrated with the ePOD system. The main challenge was not in the technical integration, but in addressing the client's concerns related to the security and confidentiality of the system.

Delivery Status Is Immediately Updated Upon Receipt Of Goods

With the wireless solution, when the delivery was made during the pilot, the person receiving the goods would confirm receipt by keying in an identification number into the driver's mobile phone. Alternatively, the person's own device could also be registered to authenticate delivery to the ePOD system. There was no need for drivers to return signed delivery orders for processing since the backend database was automatically updated.

Because ePOD has XML capability, integration into YCH's online tracking system, Y-TRACK, can be implemented in short cycles depending on specific client XML tag specifications. This allowed clients to monitor delivery order performance and movement online.

"The wireless solution gives us true empowerment and extended visibility on the field. By enhancing mobile productivity, we have substantially created value through the improvements in our operating channels. There is also huge potential for further spin-offs in other operational applications."

Mr Andrew Seah Ser Tong,
Managing Director's Office, YCH Group Pte Ltd

Increased Productivity And Lower Costs

The ePOD system increased fleet visibility. By optimising the deployment of vehicles, it is estimated that there has been a 5-10% reduction in trucking costs. Operation managers were also able to reduce the turnaround time for ad hoc deliveries by about 25%.

With ePOD, there was also less administrative work. The time taken to process a delivery order was reduced from five days to within one or two days. There were also fewer voice calls to administer since clients have access to up-to-date delivery information online. This freed up administrative staff and supervisors to concentrate on other tasks.

In the long run, this is expected to translate to greater competitive advantage as well as customer satisfaction. By deploying the ePOD system, this served to bridge the gap between the status of IT systems and actual events. Smaller transportation agents were also able to leverage on the powerful backend systems of supply chain management companies such as YCH.

Going forward, Fujitsu and Y3 are considering the development of a PDA version of ePOD and to incorporate a barcode reader that would facilitate the identification of items delivered.

There are also plans to make enhancements to the ePOD application's control module to cater for greater supply chain exception handling, and provide graphical analysis and reporting tools. Multilingual support is also likely given plans for a regional rollout of ePOD.

Case Study Title

Wireless Logistics System

Fast Facts

Synopsis
Transnational equipped its couriers with wireless-enabled PDAs to facilitate the job assignment, tracking and reporting.

Benefits
- Enabled the tracking of delivery items on a real-time basis.
- Increased productivity of administrative staff and managers with reporting tools.
- Reduced response times to customer enquiries.

Key Takeaway
Wireless updating and tracking can be used to monitor the progress of time-sensitive jobs.

Companies Involved
Transnational Supply Chain Logistics Pte Ltd, Hewlett-Packard Singapore (Sales) Pte Ltd and GEO Millenium System Pte Ltd.

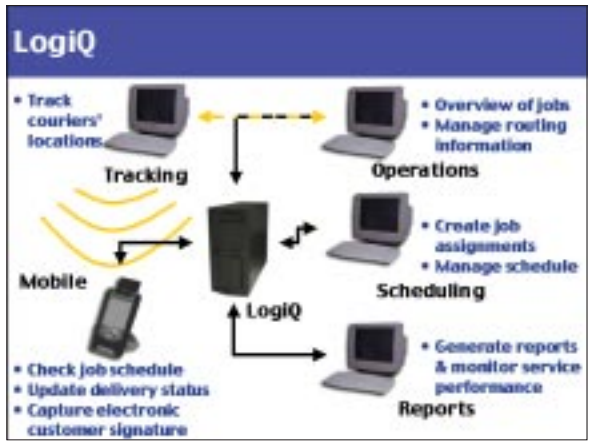
Overview Of Operations

Transnational Supply Chain Logistics Pte Ltd (Transnational) was established in Singapore in 1978 as a general courier service. It has since grown and diversified and now provides integrated logistics and distribution solutions to customers in Singapore, Indonesia, Hong Kong, China, Taiwan and Sri Lanka.

In Singapore, Transnational focuses on serving the banking industry and other niche markets that require efficient and time-sensitive solutions. It provides distribution solutions for more than 4,000 dispatches per day, ranging from cheques, to documents, tapes, medical products, delicate electronic parts, bulk hardware and even laboratory samples.

Maximising Service Standards, Minimising Costs

When the banking industry in Singapore adopted the automated cheque clearing system in 1982, it generated a demand for logistics support that was capable of meeting stringent time-sensitivity, reliability and security standards.



LogiQ

- Developed by Hewlett-Packard Singapore (Sales) Pte Ltd.
- Designed as a logistics application with modules for scheduling, operations and reporting.
- Incorporates barcode scanning and GPS.

Transnational filled this niche by offering a comprehensive suite of services encompassing the delivery of reports, banking documents and cheques between multiple destination points. Jobs are carried out either according to a predetermined time schedule or in response to ad hoc delivery requests.

The elements of this service are time control and scheduling, accountability and the ability to cater for contingencies such as road accidents and adverse weather.

The key challenge for Transnational was to manage its distribution network in an efficient, reliable and yet cost-effective manner. This was necessary for the company to offer competitive rates without compromising on service standards.

Mobile Interface Extends Functionality Of Logistics Application

To address this, Transnational piloted a wireless logistics application, LogiQ, developed by Hewlett-Packard Singapore (Sales) Pte Ltd.

The LogiQ application comprised of four main modules. At the central office, a Scheduling module allowed Transnational to create, modify and delete assignments. It could also be used to create ad hoc assignments to be carried out the same day. An Operations module enabled operations and control staff to have an overview of jobs done and pending, as well as the routes for each courier.

For couriers, a PDA-based Mobile module enabled them to view their job assignments on a real-time basis. Couriers could also update the central office database on the items that had been collected and delivered. The application also allowed them to electronically capture the customer's signature, and send it back via GPRS. Barcode readers were also added to the PDAs to facilitate accurate data entry.

Finally, a Reports module enabled management to easily generate reports based on the information gathered by the other modules on a daily, weekly or monthly basis.

In addition, Transnational's logistics solution also incorporated the FleetCom2000 application, which allowed controllers to track the real-time location of the couriers aided by a GPRS/GPS client application residing on their PDAs.

A Win-Win-Win Solution For Transnational, Its Clients And Its Employees

With the improved ability to track its couriers' location and activities, Transnational was able to reduce the response time to customer inquiries to less than 5 minutes. Ad hoc tasks were also recorded more quickly and effectively assigned to the couriers.

The direct transfer of data from the mobile devices to LogiQ's reporting module also significantly reduced the workload for Transnational's management and administrative staff. This helped to improve resource management since information needed for planning purposes was now more easily available.

The implementation of the system also benefited the couriers. Computing the attendance and payment for each courier used to take up to 10 days, but the process has been reduced to within 1 day using LogiQ's Reports module.

Building on the results of the pilot, the use of the wireless system will be expanded in stages to serve additional customers. Transnational also plans to further integrate additional business functionality into the system.

"The project provided a platform that facilitated a paradigm shift in mindsets and expectations. At the end of the day, with information gathered in real-time, it gives us a better ability to monitor all assignments and respond to any service deviations in good timing."

Ms Daphne Liew,
General Manager,
Transnational Supply Chain Logistics Pte Ltd

Case Study Title

Wireless Manufacturing Solution

Fast Facts

Synopsis
Wireless applications were used to streamline and expand the information flow between STATS backend Manufacturing Execution System (MES) and the different user groups.

Benefits
- Improved the timeliness and accuracy of the data stored in the MES.
- Managers, supervisors and engineers could wirelessly access the MES from anywhere.
- Increased visibility and speed at which decisions could be made.

Key Takeaway
Wireless can provide machine operators and engineers with mobile access to backend information systems from the shop floor.

Companies Involved
ST Assembly Test Services Ltd
and Hewlett-Packard Singapore (Sales) Pte Ltd.

Overview Of Operations

STATS obtains wafers from foundries and delivers tested and packaged products. The services they offer include wafer sorting, package design and assembly, test development, final testing and drop shipment. STATS operations run 24 hours a day, around the clock.

Across the manufacturing process, manufacturing specialists would check the physical quantity of each lot since units may be rejected for failing to satisfy the quality criteria. The specialists also record the information and update the backend Manufacturing Execution System (MES). This system allows managers to keep abreast of the work-in-progress, and understand the cycle time.

Two important steps in the manufacturing process are plasma cleaning and wirebonding.

Improving Timeliness And Accuracy Of Manufacturing Data

The wirebonding process follows the plasma cleaning process. Prior to the implementation of the pilot, the lots being loaded into the wirebonding machines were not tracked in the MES. This was because of the limited space for PC workstations in the clean room environment. Also since it was not possible to detect if there were any rejected lots as a result of the plasma cleaning process, the tracking of the lots after plasma cleaning was not critical. As such, the MES was only updated after the wirebonding process was completed.

Nonetheless, this meant that the MES did not actually provide real-time tracking of the status of the lots. It would reflect that a lot was in the plasma cleaning process for a long time, and then in and out of the wirebonding process in a spilt second, where in fact the wirebonding process actually took seven to eight hours.

Wireless Manufacturing Solution

- Developed by Hewlett-Packard Singapore (Sales) Pte Ltd.
- **iQmove:** An application to facilitate data entry to MES.
- **iQlook:** An application to enable real-time monitoring of plant equipment within the manufacturing facility.
- **iQknow:** An application that generates and sends mini-reports from the MES to users.

The lots were manually recorded on the lot travelers (paper-based records that follow the lots through the manufacturing process) by one specialist, and entered into the MES by a different specialist. This double entry of data increased the possibility of data errors in the MES.

Ultimately, this affected the timeliness and accuracy of the information which STATS managers based their decisions upon.

Wireless Solutions Extend The Backend MES System

STATS decided to extend the functionality of the MES through the use of three wireless applications developed by Hewlett-Packard Singapore (Sales) Pte Ltd:

- **iQmove**
  Using wireless-enabled PDAs equipped with barcode readers, manufacturing specialists could update the MES without having to walk to a common desktop computer. Specialists could track the lots as they were being loaded in and out of the wirebonding machines and directly update the MES. This eliminated the need for double entry of data and reduced the risk of data entry errors.

- **iQlook**
  Managers and supervisors could view the real-time status of the equipment across various levels from anywhere in the facility.

- **iQknow**
  This application generated mini-reports from the MES and sent it to managers and engineers within the facility, or via GPRS at a customer site or from home.

Overall, the goals of the project was to improve the productivity of the manufacturing specialists. Operational decision-making would be improved by giving real-time machine status updates and systems reports to supervisors and managers via wireless technologies.

Using Transmission Technologies In Clean Room Conditions

STATS used a combination of WLAN and GPRS transmission technologies in implementing the pilot.

WLAN was used within the clean room environment. As the installation of WLAN access points had to be in compliance with clean room procedures, a specialised vendor familiar with clean room projects carried this out.

GPRS users were connected through a Virtual Private Network (VPN) to the corporate network. The authentication profile of each user had to be edited in the VPN firewall server in order to allow STATS managers and engineers access via GPRS.

At the manufacturing line, the PDAs were shared between specialists who were working in different shifts. As production was carried out around the clock, charging cradles were put in each clean room to mitigate the

limited battery life of the PDAs. Backup copies of the PDA application were also kept to enable immediate restoration if required. While a PDA is not much cheaper than a desktop workstation, the benefit was that it took up much less room – an important consideration given space constraints in a clean room environment.

Wireless Data Entry Reduces Latency And Error

The implementation of the iQmove solution has streamlined the information flow on the manufacturing floor. Manufacturing specialists update the MES system at each step of the process via PDAs. Latency between a process actually taking place and the time it is logged into the system has been significantly reduced, leading to information on the MES becoming more up to date. It also reduces the double entry of data at fixed-location PCs.

The reach and utility of the information on the MES has also increased with the implementation of the iQlook and iQmove applications. Managers, supervisors and engineers are able to access the system while on the move, whether in the office through the WLAN or outside via GPRS. In essence, the system is now able to provide management with greater visibility, achieving the goals of improving operational decision-making and minimising downtime.

Automating Information Flows

Automation of information coming in from manufacturing equipment remains key to STATS operations. Building on the experience of the wireless pilot, work is being carried out to establish the direct communication link between manufacturing equipment and the MES. In such a scenario, it would no longer be necessary for manufacturing specialists to key in data as it would be automatically updated in the MES. This would also help to completely remove latency and errors due to human factors.

The use of wireless technologies as a means of retrieving information will remain useful as it improves the mobility and responsiveness of the engineer who needs to access the MES. STATS also has plans to explore the use of wireless applications for other areas of their operations such as shipping and handling.

“The project not only allowed STATS to deploy the benefits of wireless solutions to manufacturing, but also provided valuable insights on how to effectively and efficiently implement wireless solutions to other areas of operations.”

Mr Vincent Chee,
Director, Factory Information System,
ST Assembly Test Services Ltd

Case Study Title

Wireless Platform For Service And Maintenance Management

Fast Facts

Synopsis
Engineers from Ellipsiz were enabled with wireless devices to retrieve and update service data remotely.

Benefits
- Provided engineers with the ability to check parts availability at the customer site.
- Improved response to time critical client requests.
- Increased operational visibility and control of work done.

Key Takeaway
Enterprises can expand the use of backend systems by providing wireless access to staff who require it.

Companies Involved
Ellipsiz Ltd, AirGateway Pte Ltd and Sun Microsystems Pte Ltd.

Overview Of Operations

Ellipsiz Ltd (Ellipsiz) distributes, installs, and provides support for highly specialised equipment and systems for wafer fabrication plants and other semiconductor manufacturers. In addition to performing routine maintenance on site, Ellipsiz engineers also respond to ad hoc service requests from clients, perform site assessments, as well as deliver and commission equipment.

Key Goal To Reduce Client Downtime

For Ellipsiz's clients, who operate on a 24x7 basis, each hour of equipment downtime can translate to lost revenues. Hence, any customer request for service, equipment or spare parts requires an immediate and effective response.

Ellipsiz's goal was to reduce the downtime experienced by their customers by using wireless technology to facilitate communication and access to information amongst their service engineers.

mMaintain

- Developed by AirGateway Pte Ltd.
- Designed as a wireless application extension to SAP R/3 Service Management module.
- Scalable to support new mobile services and devices.
- Provides access through multiple mobile devices like PDAs and mobile phones.

Information Lag Impedes Workflow

Ellipsiz's service engineers would typically visit the client's site during the day to carry out the required tasks. Should information they require not be available, the tasks would usually be put on hold till the engineers obtained access to the Enterprise Resource Planning (ERP) system back in the office. In certain cases, the engineers would call the customer service staff in the office to assist in retrieving the relevant information from the ERP system.

Only upon an engineer's return to the office would he be able to update the status of each project into the ERP system. As a result, there was a lag in the information captured by the system and the actual tasks accomplished by the engineers.

Direct Access To ERP System Cuts Response Time

Ellipsiz realized that it could increase the speed and efficiency of its service engineers by streamlining information flows. What was needed was a solution that could allow them to retrieve and update information directly from the ERP system in the office while they were still out in the field.

A key consideration was that the application needed to be easy to use. It would also have to provide secure access controls in order to maintain the integrity of company data. The solution would also have to be cost effective, since it would be deployed across a large user base.

mMaintain Solution Provides Wireless Access To Service Module

Ellipsiz opted for the mMaintain system, a wireless application developed by Airgateway Pte Ltd. mMaintain allowed access to the service module of Ellipsiz's ERP backend system via mobile phones and PDAs.

During the pilot, upon receiving notification of new jobs, service managers would assign the tasks to service engineers via the mobile device.

Service engineers could accept service notifications and check on parts availability without returning to the office. The system also allowed them to perform the requisite follow-up tasks, such as updating the ERP database or triggering the requisition of ex-stock parts, all from their mobile device.

Wireless Solution Accelerates Ellipsiz's Responsiveness

Previously, service engineers who needed to check the availability of parts or the delivery schedule would have to do so through the customer service department in the office. This process could take up to as much as a day. With the wireless system, service engineers were able to self-access the information on the ERP service module via mMaintain.

Expanding The Use Of The Service Module

The system has allowed Ellipsiz to increase the level of service provided to their customers. Engineers are able to be more responsive to new jobs and obtain critical information much faster than before.

Managers are able to quickly assign tasks efficiently and can monitor the work progress of job sites he is in charge of in real-time. Office staff have less ad hoc calls from engineers requesting for information and can concentrate on other areas of work.

Based on the success of the pilot, Ellipsiz will be extending the wireless solution to its entire service staff, and is also looking at implementing mMaintain in overseas operations as well.

"With mMaintain, we are able to obtain critical information much faster, and even generate service orders at the customer site. There is no longer a need to look for a PC or return to the office to use the ERP system, and we spend much less time calling the office to obtain information."

Mr Wong Khong Meng,
Service Manager, Ellipsiz Ltd

Case Study Title

Wireless Labour Tracking System

Fast Facts

Synopsis
Sembawang Shipyard uses wireless technology integrated with legacy systems to track the deployment of workers within the shipyard and to reduce administrative workload.

Benefits
- Access to real-time information on worker deployment enabled more informed and timely decisions on deployment of the workforce.
- Freed up administrative staff for more value-added work and improved the efficiency of backend processes.
- Field verification of worker's legality status and skill sets.

Key Takeaway
Companies with a mobile workforce can leverage on wireless technologies to improve workforce visibility and reduce administrative workload.

Companies Involved
Sembawang Shipyard Pte Ltd
and Hewlett-Packard Singapore (Sales) Pte Ltd.

Overview Of Operations

Sembawang Shipyard Pte Ltd (Sembawang Shipyard) is a world-class shipyard offering a combination of facilities and expertise for ship-repair and conversion. It serves a worldwide clientele from more than 35 countries, repairing or converting more than 200 vessels each year.

In particular, Sembawang Shipyard is a recognised specialist in the niche market of passenger ship conversions/refurbishment, FPSO/FSO conversions, offshore vessels conversions, complex lengthening conversions, chemical tankers, liquefied gas carriers, dredgers, offshore rigs and navy ship repairs.

The shipyard deploys a direct workforce complemented by marine sub-contractors for ship repair and conversion activities. These activities involve major production trades such as steel fabrication and fittings, pipe work and blasting and painting.

Workforce Management Important For Cost Management And Project Delivery

Shipyard work is labour-intensive, and the deployment of workmen onboard vessels has to be closely monitored and verified. Typically, 3000 to 5000 workmen enter the shipyard daily. As such, it is important not only to keep close supervision of the work but also to ensure efficient deployment of various skill sets across the ships and workshops. The optimal deployment of the workmen of various skills and trades is key to managing costs and successful delivery of the various projects.

Prior to the pilot, paper-based job sheets were used for labour tracking. Supervisors fill paper forms at the end of each day and submit them to the administrative staff in the production department. This data is then manually entered into the enterprise's backend system. Cross-deployment planning and re-deployment decisions are made by gathering inputs of the various supervisors and production managers.

Wireless Labour Tracking System

- Developed by Hewlett-Packard Singapore (Sales) Pte Ltd.
- Uses a PDA with barcode scanner to enable fast scanning of data.
- Mobile application server linked with enterprise backend system, internal budgeting system and MaRIS application.

Real-Time Information To Facilitate Cross-Deployment And Verification Process

Though adequate for payroll and scheduled deployment purposes, having more timely data in the system (real-time as opposed to previous day) would provide "deployment intelligence" that would allow production managers to meet dynamic planning requirements.

Having updated information on the manpower status in the database also facilitates the verification of each worker's work permit status, skill set suitability and qualifications. Manpower regulations stipulate that all workers need to have suitable work permits and safety training certifications in order to work in the shipyard. To ensure that its workers do indeed fulfil the necessary permit and certification requirements, Sembawang Shipyard verifies each worker's information with the marine industry's online Marine Resource Information System (MaRIS).

Near Real-Time Worker Deployment Tracking

Sembawang Shipyard together with Hewlett-Packard (Sales) Singapore Pte Ltd developed a Wireless Labour Tracking System, and implemented a pilot involving five supervisors and thirty workers.

Identification barcodes were assigned to the selected workers' entry passes and the supervisors were equipped with WLAN-enabled PDAs. Using barcode scanners that were attached to the PDAs, the supervisor scanned each worker "in" when he commenced the job and scanned the worker "out" when he completed the job.

The data in the PDAs is synchronised via WLAN to the data in a central mobile application server. This server is integrated with:

- The enterprise's backend system, where actual man-hours worked are uploaded for timesheet calculation.
- The MaRIS, to verify work permits legality.
- An internal budgeting system, where actual man-hours worked on each job are compared with the original estimates.

Adapting To The Shipyard Environment

The PDAs and the WLAN equipment had to be adapted to suit the shipyard environment. Directional WLAN antennas were mounted higher in order to provide sufficient coverage over the various vessels in the dry dock.

The application user interface was also designed to allow ease-of-use by the supervisors. Some of the features include:

- User friendly GUI with illustrative icons and large screen buttons.
- Intuitive functions e.g. 'Scan in', 'Scan out' and inquiries.
- One-touch buttons for synchronisation and for checking the WLAN signal strength.

Wireless Solution Also Reduced Administrative Workload

The Wireless Labour Tracking System reduced the latency between the actual event and the time the worker deployment information is updated from one day to near real-time. This reduction led to more informed and timely decisions on deployment of the workforce to the dynamic work environment.

Integration of the wireless solution with the enterprise backend alleviates the follow-on administrative work from the manual system. This was the biggest area for cost savings and freed up the administrative staff for more value-added work. The automated matching of workers man-hours charged to job numbers also enhanced the efficiency of the backend process.

Over the longer term, the information tracked within the backend yields manpower deployment trends and cost data that allows for better estimation of manpower requirements, sub-contracting costs and pattern of manpower deployment. Such gathering and processing of 'deployment intelligence' also allows for potential spin-offs in terms of safety management and equipment tracking.

"It is envisaged that a wireless solution would allow for the real-time reporting of our workforce. Such 'deployment intelligence' will also allow us to optimise the use of our workforce in the dynamic work environment. Being able to harness such field knowledge will form one of our foundations to be an electronically-enabled organisation."

Mr Heng Chiang Gnee,
Chairman, Sembawang Shipyard Pte Ltd

Future Plans

The pilot has proven valuable to Sembawang Shipyard. A full-scale rollout would have to consider the large number of workers and the shipyard's sizable operating environment. Consideration is being given to combining the piloted approach together with other methods and wireless technologies to further address the issue of maintaining visibility over available resources.

Case Study Title

Wireless Self-Service In-Flight Meal Order System

Fast Facts

Synopsis
Airline representatives were able to update their in-flight catering orders directly to CIAS' ordering system via PDAs. Flight-in-charge staff from CIAS were also equipped with similar devices used to access the latest order information.

Benefits
- Reduced invoicing errors and improved accountability.
- Enabled orders to be processed more quickly, hence reducing possibility of shortages or wastage.
- Reduced paperwork for CIAS control centre staff.

Key Takeaway
With the use of wireless technology, a company can enable its clients' mobile workforce to interface directly with the company's enterprise system. This helps the company increase efficiency and reduce errors.

Companies Involved
Changi International Airport Services Pte Ltd and KPMG Consulting Pte Ltd.

Overview Of Operations

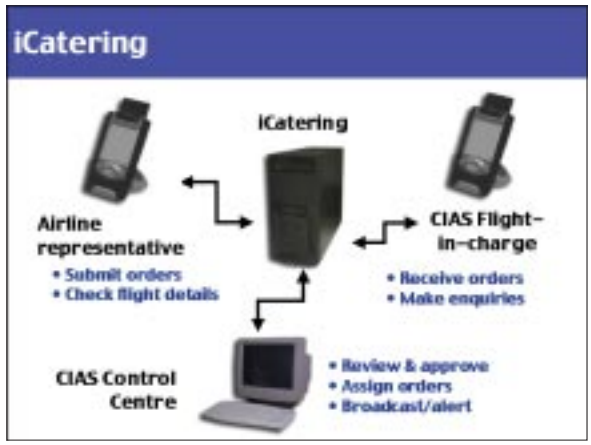
Changi International Airport Services Pte Ltd (CIAS) offers a full range of airport services to different airlines that pass through Singapore Changi Airport. These include cargo handling, flight operations, aircraft interior cleaning, passenger services and in-flight catering.

The in-flight meal ordering process involves three groups of people: the airline representative (usually a supervisor in charge of placing meal orders), the CIAS catering control staff who take orders and coordinates with the kitchen, and the CIAS Flight-in-charge staff who uplifts the orders into the aircraft.

Initial orders given by the airlines to CIAS are estimates. The exact passenger loads and requirements, such as special meal orders, often change in the hours just before a flight.

Airline representatives would make intial orders for in-flight meals and dry store items by contacting CIAS' control centre staff, either by telephone, fax, telex or walkie-talkie. The CIAS control centre staff then manually writes these orders into a master registry. The CIAS staff also keys the same information into a catering application called the Orders and Production System. This system is subsequently used to print out the orders at the respective kitchens. At the kitchens, the food is then prepared and assembled before it is uplifted onto the aircraft.

Airline representatives often have to make frequent and last minute meal order alterations as their requirements often change. As with the original orders, these changes are communicated to the control centre staff using telephone, fax, telex or walkie-talkie.



iCatering

- Developed by KPMG Consulting Pte Ltd.
- Comprises of PDA-based Wireless Ordering Application and PC-based Control Centre Administration Module.
- Integrated into CIAS' legacy Orders and Production System.

Manual Processing Is Error-Prone And Labour Intensive

The manual ordering process is open to communication errors and occasional mistakes during data entry. This can potentially lead to disputes about invoicing between the airlines and CIAS. CIAS control staff resources are needed to process these orders, and these are sometimes inadequate at peak periods to handle multiple, concurrent requests.

iCatering Transforms In-flight Catering Into A Self-Service Process

To address these issues, CIAS decided to make the ordering of in-flight meals and dry store items a self-service process for their client airlines. The pilot of the iCatering wireless ordering application involved 12 CIAS staff and 13 airline representatives from two airlines.

Representatives of the participating airlines and CIAS flight-in-charge staff were issued with GPRS-enabled PDAs to access the application. This application enabled airline representatives to:

- Submit changes to orders of in-flight meals and dry store items
- Check existing and historical orders
- Enquire about flight information
- Receive notifications and confirmations (via SMS) and to print receipts

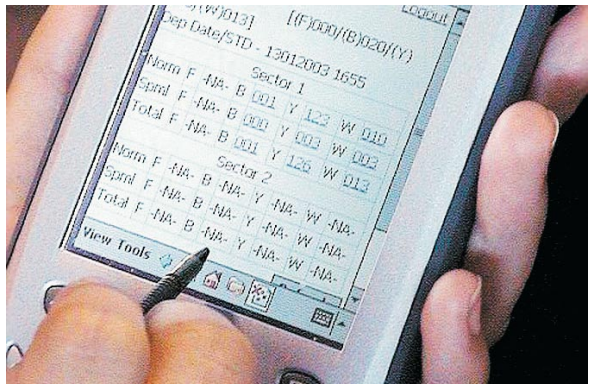
The PDA application interfaced with a Control Centre Administration Application, which was linked to the CIAS legacy catering system. This enabled CIAS control centre staff to:

- Assign CIAS Flight-in-charge personnel to individual flights
- Review and approve all orders received from the airline representatives
- Check existing and historical orders
- Broadcast SMS messages to airline representatives

Wireless Access Streamlines The Ordering Process

During the pilot, airline representatives keyed in their orders into a PDA. The orders were then transmitted to CIAS' catering control system.

CIAS control centre staff no longer received requests for order changes manually. Instead they reviewed and approved incoming orders on the Control Centre Administration Application. The Flight-in-charge staff were kept informed of the order status (including recent changes) of their assigned flights on their PDAs.



iCatering Quickly Gains Acceptance With Users

Most of the pilot users were computer-literate and typically took about a week to become familiar with the PDA and application. The iCatering application proved to be popular amongst the airline representatives. Pilot users chose to use the system to place their orders even though "traditional" channels were still available.

iCatering Improves Accountability And Information Flow

With the iCatering system, CIAS was able to offer improved customer service in two ways. The self-service ordering system improved accountability and order tracking, while reducing the potential for errors due to miscommunication and data entry.

The streamlined communications process, which allowed real-time access, enabled the CIAS Flight-in-charge staff to be aware of the latest changes and this in turn, improved their response time to client requests.

Overall, the wireless project led to a 20% reduction in the time spent processing orders by control centre staff, and an improvement in the dissemination of additional meal orders to CIAS Flight-in-charge staff.

"The wireless solution improves accountability for meal ordering and allows real-time enquiry of meal ordering details. It has also streamlined communication between airlines, mobile staff and control room by providing an additional channel for information exchange and data capturing."

Mr Rajoo Sugumaran,
Assistant Manager, Catering Operations,
Changi International Airport Services Pte Ltd

Operational Rollout

CIAS intends to extend the system to serve additional airlines in the near term. There are also plans for enhancements such as allowing the application to be used to cater for special passenger requirements such as wheelchairs. Further wireless applications would also be considered to cater to other aspects of CIAS' ground handling operations.

Case Study Title

Wireless Learner Progress And Asset Tracking System

Fast Facts

Synopsis
Comfort Driving Centre instructors were equipped with wireless devices that allowed them to retrieve and update student records remotely.

Benefits
- Eliminated the manual processing of Student Record Cards.
- Avoided the need for double entry of student pre-test evaluation information.
- Provided real-time updates of asset tracking forms to facilitate resource management.
- Enabled better tracking and analysis of student performance, leading to improved curriculum planning.

Key Takeaway
Enterprises can leverage on wireless technology to enable mobile workers to access and update information on the enterprise network without having to return to the office.

Companies Involved
Comfort Driving Centre Pte Ltd
and IdealSoft Pte Ltd.

Overview Of Operations

Learner drivers in Singapore have to pass both theory and practical driving tests in order to qualify for a driving license. Comfort Driving Centre (CDC) offers both theory and practical driving lessons.

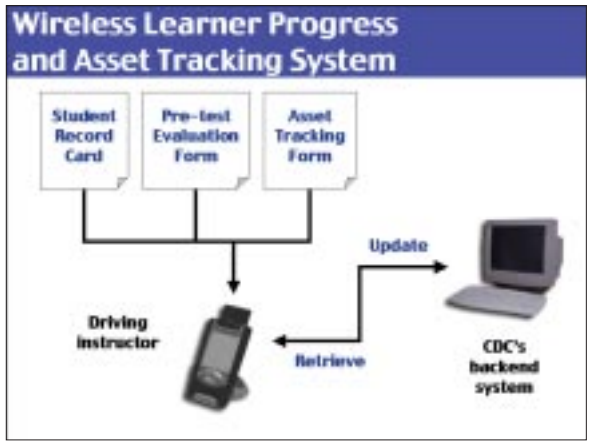
The key challenge for most learner drivers is passing the practical driving test. In preparation for the practical test, students often enrol for at least 20 practical sessions over several months. CDC offers a module-based curriculum that each student has to complete before he or she is allowed to sit for the actual driving test.

Each year, CDC tracks the progress of 120,000 individual students, who are assigned to one of its 150 instructors for each practice session.

Existing Workflows Involve Manual Processes

Prior to implementing the wireless solution, the instructors at CDC used paper-based Student Record Cards to record a student's progress. At the beginning of each day, the instructors would retrieve the cards belonging to the students assigned to them for that day and leave them at the counter. The students would arrive five to ten minutes before the lesson to collect their cards. The counter staff would ensure that each student takes the right card. The instructor would update the cards manually during the lessons, and file them away again at the end of the day.

Instructors would also conduct trial tests for students prior to an actual test. Paper forms are once again used to track the performance of each student, after which the results are manually entered into the server in the office.



Wireless Learner Progress Management And Asset Tracking System

- Developed by IdealSoft Pte Ltd.
- Allows for the update of student records directly into the backend system.

CDC operates a fleet of 80 training vehicles for use during these practical sessions. Each instructor is assigned a vehicle for the day, and has to ensure that all the items (such as toolkits, first aid kits and fire extinguishers) are present or replenished. At the end of the day, one instructor is tasked to check that all vehicles are accounted for.

Eliminating Tedious And Time-Consuming Procedures

The manual processes were tedious and time-consuming for all the parties concerned. Instructors would spend several minutes retrieving Student Record Cards and returning the updated cards each day. They also had to manually re-enter the results of students' trial tests into the office server to keep an official record. Students also had to arrive five to ten minutes early to retrieve their student cards from the counter staff.

Wireless Solution To Streamline Workflow

With its decision to go wireless, CDC equipped its instructors with wireless-enabled PDAs loaded with two wireless applications – the Student Progress Management System and the Asset Tracking System. A key consideration was that the devices and applications had to be easy-to-use, as most instructors had a basic level of IT literacy and little experience with PDAs.

Overcoming Technical Challenges

The pilot used WLAN as a mode of transmission. Network signals were initially weak in certain areas of the CDC compound. Subsequently, a longer antenna on one access point had to be installed to provide improved WLAN coverage. In the post-pilot phase, an auto-switching programme will enable the device to switch to GPRS if it does not detect a WLAN network.

Users also initially experienced long transmission times of two to three minutes, as all of a student's details would be synchronised upon each login. By amending the design of the application to only send lesson details, transmission times were reduced to 30 to 40 seconds.

Training A Key Factor For User Adoption

The implementation of this project also met non-technical, human-related challenges. The instructors were comfortable with the existing paper-based processes and initially reluctant to change over to a wireless solution. It was explained to them that wireless technology would allow CDC to provide better service, savings of students' time, the ability to better plan curricula, and manage resources better. It would also ultimately improve the workflow and save time for the instructors themselves.

"The key benefit is in eliminating the time spent on filing and sorting student record cards. The gathering of real-time information through wireless technology also enables CDC to tailor the curriculum to suit individual learners."

Mr Huam Chak Khoon,
Executive Director, Comfort Driving Centre Pte Ltd

Training was provided to familiarise users with the device and the application. This included how to react to problems such as low battery power levels, lack of network signals, improper connections, as well as how to navigate and use the wireless application.

Wireless Results In Time Savings

A survey conducted before project implementation found that an average of 23 minutes a day was spent in preparing and collecting the Student Record Cards. After the lesson, physically filing away the cards took an average of 8 minutes. With the wireless system in place, instructors no longer were required to do these tasks. This translates to time savings for the instructors.

Improved Management Of Resources And Lesson Planning

More importantly, errors in the student records were reduced by providing instructors with wireless access to student and scheduling information in the field. The wireless application also facilitated capacity planning, since the data was directly captured into the backend system and could be easily processed and analysed. Management reports needed for planning purposes used to take up to seven days to prepare. This could now be done within one day, saving administrative costs. Management is now more aware of when the peak periods are, and can make arrangements for additional instructors and vehicles.

With the additional student information uploaded into the main system, CDC's management is able to track and analyse the students' progress in real-time. This provides a useful tool for lesson planning, and has enabled the centre to customise the course curriculum for different demographic groups.

Case Study Title

MMS Remote Monitoring

Fast Facts

Synopsis
The Singapore Police Force piloted a MMS remote monitoring solution to complement its surveillance system in its facilities.

Benefits
- Enabled officers to visually inspect remote sites while on the move.
- Alerted users to movements and alarms within the surveillance area.

Key Takeaway
MMS technology can be applied beyond pure person-to-person messaging applications to address the requirements of enterprise users.

Organisations Involved
The Singapore Police Force,
CISCO Security Technology Pte Ltd,
Ericsson Telecommunications Pte Ltd,
National Computer Systems Pte Ltd
and SingTel Mobile Pte Ltd.

Overview Of Operations

The Singapore Police Force (SPF) plays a critical role in ensuring the safety and security of Singapore residents and properties. In line with its role, SPF performs patrolling and surveillance activities to deter any criminal activity. In particular, added attention is given to sensitive installations such as Government and SPF buildings.

The pilot was conducted at the data centre of the SPF's Cantonment Complex. On-the-ground duty officers of the Security Unit provided security at the data centre and the area around the data centre was also equipped with security cameras and sensors.

Senior management at the Complex and the operation managers of the data centre would be alerted via pager or mobile phone in the event of any incidents that required their attention.

Real-Time Transmission Of Images And Audio Enables Users To Better Assess The Nature And Criticality Of The Incident

There are already several security solutions in the market that alert their users of security breaches via pager or SMS. These channels, however, can only provide limited information, usually in the form of text, which may not enable the recipient to make an accurate assessment of the situation without physically visiting the premises.

The use of the Multimedia Messaging Service (MMS) allows images to be captured from the security network camera and forwarded to users' MMS mobile phones. With these images to accompany the text alerts, users are able to respond to the incident with more accurate and immediate information.

In this pilot, five trial users (comprising the Complex's senior management and the data centre's operation managers) were equipped with MMS mobile phones to

MMS Remote Monitoring Solution

- Sends images from surveillance cameras to mobile phones via MMS.
- MMS "updates" can be scheduled, event-driven or user-triggered.

be able to receive MMS updates of the area being monitored. Test equipment and cameras were set up to allow the remote monitoring of the Data Centre.

The MMS remote monitoring solution was developed by CISCO Security Technology Pte Ltd (CST), Ericsson Telecommunications Pte Ltd, National Computer Systems Pte Ltd, and SingTel Mobile Pte Ltd. The solution featured four types of alerts – motion-triggered, event-triggered, time-based monitoring and user-triggered.

- **Motion-triggered/ Intrusion detection**
  The system sends users images from the security cameras when motion-sensors have been triggered. This enables each user to quickly identify if there is an intruder on the premises.

- **Event-triggered**
  When a smoke or fire alarm is triggered, security camera images can be transmitted to the user's MMS phone to allow the user to determine if it is just a false alarm. To demonstrate this feature in the trial, a set of door sensors were installed to trigger a camera to capture images whenever someone entered the restricted area. (In this case, the event was the opening of a particular door.) This allowed the users to visually monitor who was accessing the area.

- **Time-based monitoring**
  The system was also configured to send out MMS alerts on a regular, scheduled basis. The interval between alerts could be adjusted depending on the requirements of the user. It is envisioned that in the future this could complement or perhaps even replace routine patrolling for certain remote areas.

- **User-triggered**
  The user sends an SMS to request the system to send a real-time image from the security camera.

User Feedback

The users reported that the solution was simple and easy to use, and the system gave them an additional means of monitoring the site. Instead of having to go down to the site each time an event occurred, officers were able to visually monitor the site from wherever they were. This would also prove useful in enhancing the security of infrastructure establishments and could even be used as a tool for delivery of richer information to the public or a specific group of users.

Greater User Control And Clearer Images

Based on the positive response to the pilot, CST plans to further enhance the system and possibly incorporate it into their existing surveillance products. Future versions may allow the user greater ability to control the image. This might possibly include zooming and panning functions. CST also intends to improve the picture resolution of the images sent.

The pilot has demonstrated the value of being able to visually monitor remote locations, above and beyond receiving simple text alerts. As the use of MMS becomes more widespread, such solutions can be expected to be deployed in the private sector in areas such as shopping centres, offices, private estates and even in homes.

"The solution gives great mobility to our officers, providing an interactive channel where we can request for visual information, anytime and anywhere. This enables us to respond faster as well as to provide real-time updates on the status of the situation in the data centre to the management."

Mr Lawrence Tham,
Assistant Director, Police Technology Department,
Singapore Police Force

Case Study Title

Mobile Enabling Hospitality Suite

Fast Facts

Synopsis
Raffles International extended the reach of backend applications to service professionals through the use of wireless-enabled devices.

Benefits
- Enabled staff to respond faster to customer requests and enquiries.
- Increased staff productivity and allowed them to focus on core duties.
- Provided management access to more accurate operational intelligence for planning purposes.

Key Takeaway
Wireless-enabling an enterprise's multiple contact points with the customer can significantly improve the speed and level of customer service.

Companies Involved
Raffles International Limited
and National Computer Systems Pte Ltd.

Ensuring High Standards Of Quality Across Multiple Points Of Contact

As the owner and operator of fine hotels and resorts, Raffles International Limited (Raffles) consistently delivers high standard of quality service to its hotels' guests through its team of dedicated service professionals. To ensure that these service standards are maintained at all levels, from front office to 'back-of-the-house' operations, prompt communication of information within and between different departments is vital.

To improve its business processes, profitability and customer service, Raffles harnessed wireless technology and invested in state-of-the-art systems to allow wireless access to hotel management applications and to promote instant information sharing amongst its service professionals.

Wireless Solution Addresses Both Customer-Facing And Operational Requirements

Raffles and National Computer Systems Pte Ltd engaged in extensive research and development to build a suite of five integrated modules to support the hotels' service professionals.

102 staff from Swissôtel the Stamford and Raffles the Plaza participated in the pilot. They were equipped with either a WLAN-enabled PDA or a tablet computer that could access specialised applications in the Mobile Enabling Hospitality Suite (MEHS).

mConcierge, mOrdering, mSales, mHousekeeping and mSecurity forms the five integrated modules in MEHS that interfaced with the hotels' extensive suite of management systems.

Mobile Enabling Hospitality Suite

- Developed by National Computer Systems Pte Ltd.
- Enables users to wirelessly access legacy hotel applications such as the Property Management System and new role-specific applications (such as Task Management for housekeeping, Order Management for restaurants) through mobile devices.

MODULE	BEFORE IMPLEMENTATION	AFTER IMPLEMENTATION
mConcierge	To help guests to plan their itinerary, the concierge gathers information from publications and through the phone.	Concierge can access guests information and the Internet from their PDA. Information can be printed out wirelessly via an infrared enabled printer.
	The individual concierge may write down a guest's request or simply keep it in mind until the guest has been serviced.	Guests' requests and preferences are recorded on the PDA. This enables a concierge to better understand the guests' preferences and follow-up on requests logged in by other colleagues.
mOrdering	Waiters record customers' orders on paper, which is transferred to a Point-Of-Sales system at a fixed location.	Orders, including special requests, are now entered into the PDA and sent directly to the kitchen, without the need to walk to any Point-Of-Sales system.
	Queries (usually regarding the ingredients used) are relayed to the kitchen before reverting to the guests.	Waiters now access information on menu items on the PDA, and guests can also view video clips of dishes that are on promotion.
mSales	Sales staff makes booking requests for hotel and function rooms by calling the main office to check. Customers usually get a reply the next day.	Sales staff can confirm rooms and facilities reservation via GPRS anytime, anywhere. It provides the convenience of remote access to multimedia and real-time information that can be presented to potential clients on-the-spot.
mHousekeeping	Tasks and instructions are distributed to room attendants on paper roster each day.	The housekeeping team receive their assignments via PDA. The system automatically rosters the tasks, and also assigns ad hoc tasks in real-time.
	There is no fixed process for addressing unscheduled housekeeping requests.	The PDA is also used to keep track of the inventory in each room and the guest's preferences.
	There is lag time in updating the availability status of the rooms after they have been cleaned.	The module is integrated with the backend Property Management System such that front desk would be updated immediately when a room has been cleaned.
mSecurity	Security officers use voice communication via handsets. Information can often be distorted due to the clarity of voice & method of description.	Security officers can view images from surveillance cameras from their PDAs. Photos of VIPs or suspicious characters can also be easily disseminated. Instructions are clearer and more discreet.
	All incidents are recorded in a logbook at the security command centre either via voice communication or physically updated when the officer returns to the command centre.	The officer now files information on the spot and is able to access incident reports while on the move. This keeps the command centre updated on any of the latest incidents.

Commitment To Customer Service

The results of the pilot and feedback from the users showed that the time taken to relay orders at the restaurants improved by more than 40%. Information required by the security officers could also be quickly disseminated as compared to before. The risk of error or miscommunication was tremendously reduced.

The ability to access timely, accurate and detailed information remotely also enabled the service professionals to take a more proactive approach to customer service. The concierge was able to use the tablet computer to locate information requested by guests. Adventurous guests could even take the tablet computer to surf for information from anywhere in the lobby and to print the required information out at a nearby printer.

Productivity increased as staff were able to access information directly. Raffles reported that the use of wireless technology, which resulted in improved efficiency, has also further motivated its staff to improve their service standards.

These modules also improved information and operational control. Managers in housekeeping could control the duty roster and tasks list remotely. Rooms that had been cleaned were updated in real-time to the management system. With this increased visibility over operations, Raffles International's management was able to better plan activities and more importantly, meet guest requirements.

Extending The Wireless Solution

Following the success of the pilot Mobile Enabling Hospitality Suite implementation, Raffles intends to increase the number of WLAN hotspots within the hotels' premises to improve coverage and connectivity. Also in the pipeline are plans to extend this wireless solution to all four Raffles International hotels in Singapore.

"We are able to check the availability of function rooms in 'real-time' through wireless LAN or GPRS; guests no longer have to wait for us to make long enquiry calls before confirmation. This empowers us with the flexibility to propose alternate dates or function rooms on-the-spot should the request be unavailable. It also impress our guests with confidence and professionalism."

Mr Adrian Wong,
Director of Convention Centre,
Raffles City Convention Centre,
Raffles The Plaza and Swissôtel The Stamford, Singapore

03 Company Listings

User Companies
Vendors

COMPANIES MENTIONED IN THIS REPORT

User companies

All-Wares Supply
www.all-wares.com

Ameroid Logistics (S) Pte Ltd
www.ameroid.com.sg

Changi International Airport Services Pte Ltd
www.cias.com.sg

Chee Fatt Co Pte Ltd
www.cheefatt.com.sg

Comfort Driving Centre Pte Ltd
www.comfortdrivingcentre.com.sg

CPG Facilities Management Pte Ltd
www.cpgfm.com.sg

Diethlem Singapore Pte Ltd
www.diethelm.com.sg

Ellipsiz Ltd
www.ellipsiz.com

ERA Realty Network Pte Ltd
www.erasingapore.com.sg

Harpers Marketing Pte Ltd
www.dksh.com

Harpers Trading (S) Pte Ltd
www.dksh.com

Keppel FMO Pte Ltd
www.keppelfmo.com.sg

Kian Soon Hardware And Trading Pte Ltd
www.kiansoon.com.sg

Kiso Jiban Singapore Pte Ltd
www.kiso-jiban.com

Nanyang Technological University
www.ntu.edu.sg

Philip Morris Singapore Pte Ltd
www.philipmorrisinternational.com

Raffles International Limited
www.raffles.com

Sembawang Shipyard Pte Ltd
www.sembship.com

Singapore Police Force
www.spinet.gov.sg

ST Assembly Test Services Ltd
www.stts.com

SUN Microsystems Pte Ltd
www.sun.com

Transnational Supply Chain Logistics Pte Ltd
www.transnational.com.sg

Transvert Scaffold & Engineering Pte Ltd

Wisescan Engineering Services Pte Ltd

YCH Group Pte Ltd
www.ych.com

COMPANIES MENTIONED IN THIS REPORT

Vendors

AirGateway Pte Ltd
www.airgateway.com

Buildfolio Pte Ltd
www.buildfolio.com

CET Technologies Pte Ltd
www.cet.com.sg

CISCO Security Technology Pte Ltd
www.cisco.com.sg

DCS Solutions Ltd
www.dcssolutions.net

Deloitte Consulting Pte Ltd
www.dc.com

eMobile Pte Ltd
www.emobile.com.sg

Ericsson Telecommunications Pte Ltd
www.ericcson.com

FOSPEX Pte Ltd
www.fospex.com

Fujitsu Asia Pte Ltd
sg.fujitsu.com

Geo Millenium System Pte Ltd
www.geonav.com.sg

Hewlett-Packard Singapore (Sales) Pte Ltd
www.hp.com

IBM Singapore Pte Ltd
www.ibm.com

IdealSoft Pte Ltd
www.idealsoft.com.sg

Institute For Infocomm Research
www.i2r.a-star.edu.sg

iGine Pte Ltd
www.igine.com

Keppel DigiHub Ltd
www.keppeldigihub.com

KPMG Consulting Pte Ltd
www.kpmg.com.sg

Maya Systems Consultants Pte Ltd

National Computer Systems Pte Ltd
www.ncs.com.sg

NEC Solutions Asia Pacific Pte Ltd
www.nec.com.sg/ap

NETalk Pte Ltd

Palm Singapore Sales Pte Ltd
www.palm.com

Singtel Mobile Pte Ltd
www.singtel.com.sg

StarHub Singapore Pte Ltd
www.starhub.com

SUN Microsystems Pte Ltd
www.sun.com

SysEng (S) Pte Ltd
www.singnet.com.sg/~syseng

Y3 Technologies Pte Ltd
www.y3technologies.com

Zara Technology Pte Ltd
www.zaratechnology.com

04 Glossary

GLOSSARY

TERMS	DEFINITIONS
Barcode	A barcode uses a sequence of vertical bars and spaces to represent alphanumeric characters.
Bluetooth	Bluetooth is a specification that describes how devices such as mobile phones and PDAs can interconnect with each other over a short-range wireless connection.
Circuit-switched data	Circuit-switched data or CSD dedicates a single connection between two end-points in the network for the transmission of data. This is in contrast with packet-switched data networks like GPRS.
Firewall	A firewall is a program that protects the resources of a private network from users from other networks. It can be used to prevent outsiders from accessing a private network and for controlling what outside resources internal users have access to.
GPRS	GPRS or General Packet Radio Services is an enhancement to the GSM network that enables the network to carry packet-switched data traffic. It is commonly referred to as a "2.5G" technology.
GPS	The GPS or Global Positioning System consists of satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy usually ranges from 10 to 100 meters.
GSM	The Global System for Mobile communication (GSM) is a digital wireless communication technology for mobile phones widely used in Europe, Asia and other parts of the world.
Packet-switching	Packet-switching describes the type of network where data is transmitted in small units called packets. This allows the same data path to be shared among many users in the network. This is in contrast with circuit-switched networks.
PDA	A PDA or Personal Digital Assistant is a small mobile computing device commonly used for storing contact information or schedules. Additional applications can also be installed into the device to increase its functionality.
RTU	RTU or Remote Terminal Unit is a device that can be installed at a remote location to collect data and transmits this back to a central station.
SSL	SSL or Secure Sockets Layer is a protocol for managing the security of a message transmission on the Internet. SSL uses a public-and-private key encryption system, which also includes the use of a digital certificate.
Smart phones	Smart phones represent the convergence of the features of PDAs and mobile phones into a single device.
SMS/ EMS/ MMS	SMS or Short Message Service allows text messages of 160 characters to be transmitted over GSM. MMS or Multimedia Message Service allows users to send richer media such as images and audio attachments along with text messages.
Synchronise	To interchange data between two devices or applications such that they both contain the same set of information.
Tablet computer	A cross between a PDA and a laptop, a tablet computer usually has a large screen and can display high-resolution colour images.
WAP	WAP or Wireless Application Protocol is a set of communication protocols for mobile devices to access data over the wireless network.
WLAN	WLAN or Wireless LAN allows a user to connect to network through a wireless radio connection, typically based on the IEEE 802.11 family of standards.
VPN	A VPN or virtual private network is a means that provides users with secure access to their organisation's network via public networks, such as the Internet.

iDA INFOCOMM DEVELOPMENT AUTHORITY OF SINGAPORE

Infocomm Development Authority of Singapore (IDA) develops, promotes and regulates info-communications in Singapore, with the aim of establishing Singapore as one of the world's premier infocomm capital. To nurture an internationally competitive infocomm industry, IDA offers a comprehensive range of programs and schemes for both local and international companies.

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