Practical Mobility:

Creating Reactive Supply Networks

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Proceedings

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Executive Summary

Ready access to mobile applications and mobile web services is changing how enterprises move goods, deliver services, and complete transactions. The question is no longer whether this technology will be employed, but when, how, and from where the early adopters will come.

On October 24, 2002, the Silicon Valley World Internet Center convened a Think Tank Session around the question of what factors will bring mobile communications, in a practical manner, into supply chain management.

Twenty-four senior professionals, including end-users, solution providers and carriers, explored:

- Enterprises' supply chain challenges and how Practical Mobility could assist
- Barriers to adoption of Practical Mobility and facilitating factors supporting the creation of enterprise solutions
- Future state of Mobile Supply Chain Management solutions: What will be adopted and still working 5 years from now?

Practical Mobility and Mobile Supply Chain Management are clearly in the early stages of development. Users recognize that opportunities exist for significant improvement in the use of these processes, while providers work to present breakthrough applications. Technology has progressed to the stage where compelling solutions are possible and future efforts should be concerned as much with standards and integration as they are with dramatic new technological achievements. However, any significant adoption must also consider cultural changes, as these processes will involve employees across the entire enterprise. ROI remains at the core of any significant deployment and must be there in quantifiable terms prior to broad adoption. Enterprise processes needed to support MSCM will irreversibly and fundamentally change the way supply chain management has been done for many years. New procedures must be socialized with all parties involved which implies a cultural and temporal challenge for the integration of Mobile Supply Chain Management into the enterprise.

Enterprise processes needed to support MSCM will irreversibly and fundamentally change the way supply chain management has been done for many years.

A common thread emerged throughout the session regarding solutions around Mobile Supply Chain Management: "Make it simple." Participants wanted technology to be directed at basic and necessary tasks of standardization and simplification. End-users generally felt that while all the technology pieces supporting MSCM might exist, no one had yet put them together correctly in spite of marketing to the contrary. Thus, the everyday problems they wanted solved remained as problems. These solution gaps became the basis for discussions on user interfaces and the need to integrate Practical Mobility and Mobile Supply Chain Management across several areas of the enterprise.

Note: *The full proceedings are available electronically at www.worldinternetcenter.com. The proceedings include a review of the findings of the Think Tank Session, plus the following appendices:*

- *Practical Mobility: A Survey of Mobile Workers*
- *Individual Contributions to Think Tank Session Exercises*
- *Suggestions for Future Think Tank Sessions*
- *Results of Back-casting Exercise: Successful MSCM in 2007*
- *Practical Mobility: A Definition*

Introduction

Ready access to Mobile Applications and Mobile Web Services is changing how enterprises move goods, deliver services, and complete transactions. The question is no longer whether this technology will be employed, but when, how, and from where the early adopters will come.

Billions of dollars have already been spent to automate processes while reducing costs and improving customer experiences. However, the overwhelming emphasis up until now has been on solutions within the walls of the enterprise. While the Internet has been effectively used to integrate processes among firms within a supply chain, little has been done to automate the processes or activity occurring outside the enterprise campus. Today, over 10 million supply-chain workers in the U.S. carry a clipboard, a device over 100 years old, as their primary process tool when outside the facility of their employer.

Many enabling technologies are already in place that could directly address the mobility market. General packet radio service (GPRS), wireless local area networks (WLAN) and other mobile/nomadic data services are finally becoming accepted and will soon be ubiquitous. Additionally, wireless devices that make use of these services are plentiful and new entries are appearing almost daily. Yet, adoption of end-to-end mobile solutions continues to lag as enterprises struggle with how to integrate this newly found power into existing processes and practices. Clearly, the needs of enterprises will shape the development of applications, but what are the factors that must be addressed to make the promise of Mobile Supply Chain Management practical?

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- Future state of Mobile Supply Chain Management solutions: What will be adopted and still working 5 years from now?

Participants represented a range of solution providers, carriers, and end-users drawn from these companies:

- BPS Reprographics
- Catalyst Consultants
- CommTec Consulting;
- Coopetition, Inc.
- Daimler Chrysler
- DPR Construction
- Deutsche Telekom
- IBM Corporation
- IC Growth
- Incucomm, Inc.
- Osprey Ventures
- Ray Paquette
- Research/Strategy/Business
- Robert Noakes
- Rod Heisterberg Associates
- Sally Richards
- SAP
- SOHO Wireless
- SonicWALL
- SUN Microsystems
- Voetic Corporation

Practical Mobility: A Definition

Practical Mobility (PM) is a class of powerful enterprise solutions that are "practical" because they address real business issues , and because they use real tools that are available now. It is "mobile" because it extends beyond the traditional "four walls of the business." What it is *not*, is e-mail, nor is it web browsing to make reservations at a restaurant, nor is it even the telecommuter connecting to a virtual private network (VPN) while at the airport in order to answer his e-mail. These erroneous perceptions of Practical Mobility generate an often-pervasive view that it is already here, or that it is of

little consequence to real everyday business issues. Practical Mobility, on the contrary is at the core of business value, as it is the automation of business-to-business transactions now being done by people with steel-toe boots, by people at dock doors, and by people driving trucks between various places of business, keeping commerce alive.

Enterprise Needs for Mobile Supply Chain Management (MSCM)

Several scenarios illustrating enterprise needs emerged during the session. The three scenarios, below, exemplify the disparate environments in which mobile solutions for supply chain management must work.

Enterprise Need for MSCM: Multiple locations

A conceptually simple, and yet powerful, need arises in managing dynamic inventory in a local community where a company has multiple facilities and the inventory is consumed either as a result of satisfying a customer need, transferring it to another site, or directly selling it to a consumer. Often decisions are made "on the fly" to satisfy an immediate customer requirement with no records other than an attempt at reconciliation later. Because so much is done dynamically with scraps of paper that could get lost, the enterprise finds it difficult to get an accurate picture of inventory in a dynamic way.

This is an example of real world chaos that takes place in many businesses every day. Here, MSCM could consist of integrating the dynamics of the business among its various sites with the inventory control and accounting systems designed to manage the inventory within each single site. Great leaps in technology are not required. The main requirement is to obtain a solid understanding of the specific problem for the specific company and then apply available tools to solve it.

Enterprise Need for MSCM: Major manufacturer's factory floor

Individuals routinely track inventory with barcode scanners. If inventory is misplaced, it is difficult to find and get back into the system. Attempts are made to reduce the human element by the use of embedded radio frequency identification (RFID) tags in the individual product or parts. There is hope that the new, less expensive tags will make it easier to keep track of parts by automatically logging them as they enter or leave an area. The original manufacturer tags the parts so they can be tracked from the moment they entered the factory. Here a MSCM application integrates with multiple manufacturers resulting in highly reliable inventory management within a large, complex, and fluid factory.

Enterprise Need for MSCM: Just-in-time (JIT) maintenance for vehicles

Putting transponders in trucks that can monitor both truck location and status would permit mobile teams to be dispatched, with the correct parts, to depots where that vehicle is known to be loading or unloading. Therefore, maintenance performed at this time becomes just-in-time (JIT) maintenance, with the added benefit that there is also zero down-time maintenance. This concept is opening a completely new field called Service Logistics as more and more enterprise functions move outside historical boundaries.

Building Blocks for Making Mobile Supply Chain Management Work

There are several components supporting successful Mobile Supply Chain Management. Think Tank Session Participants outlined key areas, below.

Making MSCM Work: A Simple and Reliable Mobile Device

A mobile communications device for MSCM must be easy to use. It has to be simple and direct, and it must get the information to the enterprise as quickly as possible.

Participants were concerned that if it did not meet these requirements, the information's value could degrade with time and could easily be lost.

The hardware must also be reliable, durable, and be used competently after only a short learning period. Some discussion on training ensued, but the general feeling was that training, if done at all, should be short. As one participant remarked, "Ideally, it should work perfectly from the beginning." This led to discussions concerning a suitable architecture similar to a digital tablet type device, examples of which are now being introduced by several vendors. This could be an ideal device, even allowing for signatures and inputs without a keyboard. This device would naturally be intuitive and could be designed to look like the familiar clipboard, so the end-user need not experience radical change in the way he or she conducts daily business.

The discussion moved to considering custom devices versus standard devices. The consensus favored an inexpensive off-the-shelf unit that a digital tablet might satisfy. However, participants were sceptical that full functionality may only be achievable with a more expensive custom device. As one participant remarked, "FedEx can afford custom units, but almost no one else can."

Making MSCM Work: Connectivity

Participants, in general, reacted strongly in favor of real-time connectivity, as opposed to "store and forward." This preference was based on specific examples of data delivery requirements, such as when a field maintenance person needs to collaborate with peers at a depot, or when a customer is asking for a status.

Concerns that gaps in communication might occur just when new instructions are being downloaded supported the preference for real-time connectivity. Such gaps might be rare, but could still represent barriers to adoption if enterprises perceive them as significant.

Therefore, the difference between "real-time" and "store and forward" must be specifically defined. For some uses, an hour delay will be acceptable; for others 5 minutes will be too much. ROI, for some companies, directly depends on decision-response time. For them, there is clear value in the dynamics of always-on connectivity.

Some companies have many functional organizations and many different locations involved in their enterprises. This means that a delay in one area can have consequences in multiple areas. It would be helpful to have problems identified as early as possible so that actions could be taken as early as possible. This is one example where the data timeliness requirements of a given user do not adequately specify the true system requirements.

Done properly, effective in-house processes are seamlessly extended into the field. Although the specific rules may be different; the results, control and quality are the same.

Making MSCM Work: Business Rules and Process Issues

Participants noted that rules within a business would not necessarily be the correct rules outside the business. Some noted that simply adding external rules to a business with internal process problems would not fix those problems. A key factor for successful Practical Mobility is to establish effective rules and processes that are easier to keep than not. Done properly, the effective in-house processes are seamlessly extended into the field; although the specific rules may be different; the results, control and quality are the same. Others countered that the lack of business rules outside the business was, in many cases, the very reason why internal processes were

in chaos. Practical Mobility is more than just doing a better job of enforcing overall business rules; it is also the generation of relevant rules for outside the enterprise. Participants acknowledged that rules are harder to enforce outside the traditional walls of the firm. Since it is harder to enforce them outside, they must be simple to follow to begin with.

Barriers to Mobile Supply Chain Management

Participants identified barriers to adoption of Mobile Supply Chain Management. They distinguished barriers that exist in the mobile supply chain environment from those that exist within the enterprise. These are explained below.

Barrier to MSCM: A Smart Filtering and Security System Is Not Readily Available

The data available via mobile systems make them potentially powerful, but also potentially dangerous to the enterprise. Adequate user authentication is not a trivial issue. Any system must also be easy to use while at the same time be difficult to defeat or spoof. In addition to security, data filtering and access control must also be in place. Allowing a host of mobile users to have access to the data requires that controls be in place, as well, since not every user should have access to all available data. This requires considerable re-thinking of all the different parts of the supply chain, the identification of the user, the identification of the device, the security of the link, and even, perhaps, the location of the device, the date and the time.

Finally, extensive systems such as these allow so much information to be available that individuals using them can be overwhelmed by it. Participants discussed when the amount of data may become too much and raised issues distinguishing between data and information. This led to consideration of system concepts that would respond by providing only the crucial information needed at that specific time and place by that authorized individual. Clearly this is not an easy task. However failing to control the amount of data or information could generate barriers to broad adoption.

Barrier to MSCM: Cultural Resistance to Change

A system such as this can easily be perceived as tracking every move and recording every mistake more than as an aid to reducing mistakes.

Overwhelming comments from the group sparked a discussion that field personnel may be highly resistant to the introduction of new processes. These individuals often see rules as a manifestation of "Management" watching them too closely, especially if they have not been properly instructed or educated as to the overall need prior to its introduction. A system such as this can easily be perceived as tracking every move and recording every mistake more than as an aid to reducing mistakes. Security measures must be in place to ensure individual personal rights. The systems may be seen as a means for management to get more work without paying for it, and if there is an increase in productivity, the worker may be caught in the resulting layoff.

Presented improperly, change can, at best, be seen as unnecessary, additional work-load. At worst it could be a threat to the individual or the labor union. Workers have to see benefits for them to adopt new methods. For example, should a supplier not have what a trucker is supposed to pick up, the ability to communicate this in detail, while still at the dock, could positively enforce what should be done next and also what needs to proceed back at the home plant. Presenting advance notice to the point of delivery is valuable to the customer and valuable to the trucker. It must be clear to the daily user of this technology that it is valuable, easy to use, and will make his or her life easier.

Resistance to change can also apply to management and internal personnel. Management may perceive ensuing change as a loss of responsibility and importance. There will be resistance to give up what they have grown to rely on, even if it is not working very well. Resistance here may well be veiled in the form of rationalizing that MSCM is not really needed. As one participant noted, "The competition to mobile devices, in most cases, is paper. It is very hard to beat paper. That is what we find when we go out into the field. Paper is a real killer app."

Barrier to MSCM: Devices Not Up to the Challenge or Cost Too Much

There are many devices out there, but off-the-shelf devices appear to have serious drawbacks and custom devices are costly. Many concerns were also raised about battery life, durability, ability to merge data and voice, ease of use and the ability to back up the system. There was also concern that technology was moving so fast that anything purchased now would be obsolete in six months. Some participants opined that the lack of standards for such devices in these applications was a significant barrier and that, until those standards were developed and adopted, the problem would persist.

Barrier to MSCM: Justifying the Cost

How are companies expected to pay for Mobile Supply Chain Management in the current economy? This is especially true if hard evidence as to MSCM's effectiveness is disputed among decision-makers. The fact that device costs are still high and that these expensive devices can easily be misplaced in the field makes justifying the cost of MSCM difficult.

Barrier to MSCM: The Existing Mobile Infrastructure is Inadequate

Many participants believe that existing mobile infrastructures for communications, let alone for MSCM, are simply inadequate. As the World Internet Center CEO Susan Duggan remarked, "I cannot even drive up Sand Hill Road without my cell phone cutting out." The infrastructure is not robust or reliable enough to ensure that critical information would arrive late with resulting deadline failures.

Barrier to MSCM: Ability to Interface with Existing Legacy Systems Is Questionable

Many systems now in place are old yet still perceived to be adequate. We cannot assume that they will be easily changed. Therefore, system interface issues between new MSCM systems and these legacy systems may be overwhelming.

Barrier to MSCM: Every System Solution Appears to Be Unique

Every application is a unique system. Different applications seem to require custom solutions. Participants expressed concern about the ability to integrate solutions effectively on a adoption scale. In other words, how can broad, effective solutions be developed without requiring significant customization every time?

Where Do We Stand with Mobile Supply Chain Management Technology?

Participants considered applications of technology that would act as a solution to some of the identified barriers. They also identified areas of technology that are allegedly already in place but are not working, therefore adding to the barriers. Most of the items identified were clustered around three areas grouped as follows:

- Ease of Use and User Interface
- Security
- Connectivity and Standards.

Participants also voted for the most important technical issues that would open up and/or inhibit the market in the next 36 months. Two issues achieved overwhelming votes. They were:

- Packaging of the total solution and
- Standards.

Technology Status with MSCM: Ease of Use and User Interface

Several participants stressed that broad acceptance of Mobile Supply Chain Management would be difficult until off-the-shelf devices effectively mimicking the "paper experience" were available for less than $1000. Presently, typical mobile screen size is inconsistent with common paper size. Some participants commented that all that was needed was to implement proper translators that recognized the characteristics of a particular device. Most agreed that devices resembling the tablet PC will be a major step in the right direction. Interestingly, the tablet architecture also supports multi-modality, which was also presented as a necessary technology. Multi-modality implies a device that accepts inputs from multiple sources such as a keyboard, stylus and even voice. Such devices not only could mimic paper in the display mode, but would also be capable of accepting signatures and mimicking paper in the input mode. Some participants underlined that eventually the market will evole to adaptable screens: those that give you just what you want and just when you need it.

Voice is highly desirable as a user interface but its development is still considered a problem because of wide variations in speech patterns and even microphones. Until those problems are solved and the system is truly robust, voice cannot be a primary mechanism of user interface. True solutions to voice issues could also alleviate problems related to authentication that are now handled manually, or, unfortunately, sometimes ignored.

From a systems perspective, it was suggested that technology that allows field crews to check inventory directly from the field, coupled with the ability to check, simultaneously, multiple potential inventory sources, would be of great value. This technology goes beyond any single enterprise and would have to include advances in database structure and database maintenance.

Technology Status with MSCM: Security

Present approaches to security (including access and data conrol) are difficult to use, especially if it is necessary to log in and log out several times within a day. A likely example of this would be the case of an individual making deliveries or picking up merchandise. The fear was that, because of the difficulty of logging in, the system would not be used. Simple near term solutions were not readily apparent and many felt that eventual effective solutions would need to involve biometrics.

Technology Status with MSCM: Connectivity and Standards

Participants voiced a need for tested and reliable connectivity solutions that are off-the-shelf or, alternatively, are very easy to customize. They underlined that the mobile middleware industry is not significantly developed, therefore not supporting the advancement of MSCM.

The multiple air interface standards in the U.S. are also deleterious to growth. Lack of a single standard is causing users to hesitate on purchases, especially if there is a chance that what they buy may not be supported in a few years. As one participant noted, "Reliable coverage is needed where I need it and when I need it." This led to discussions regarding the importance of in-building coverage and the inclusion and integration of 802.11 into the overall MSCM equation. Generally, integration of 802.11 with 2.5-generation and 3-generation cellular standards was considered necessary for broad deployment.

RFID technologies were seen as a key components to mobilizing supply chain management. However, once again, the absence of well-defined and accepted standards was perceived as hampering its adoption and integration.

Market Factors Affecting the Adoption of Mobile Supply Chain Management

Participants considered whether the slow down in the U.S. economy would affect the growth and adoption of Mobile Supply Chain Management; or are key issues that would cause MSCM to move ahead of any general economic recovery. Participants were challenged to discuss both positive and negative market factors and to judge their importance and relevance. Positive factors generally were based on expected cost improvements, while negative factors were based on fear of unknowns. Below is a review of those key factors:

- Billing
- SCM ROI Culture
- Just-in-Time and Consumer Demands
- Simplicity
- Visibility of Process
- Consumer Demand
- Nanotechnology

Positive Market Factors for MSCM: Billing

Because supply-chain management implies change of ownership, and because there are so many ways to argue when that occurs in the supply-chain process, billing can be substantially delayed. MSCM provides a clear point in time as to when change of ownership occurs and, therefore, when billing could be initiated. This is more than a general improvement in efficiency; it is directly attributable to improvements in cash flow, a critical element of enterprise management. Changing invoice reconciliation from a 120-day exercise into a 1-minute exercise could be a strong enough motivator to break through any market resistance.

Positive Market Factors for MSCM: SCM ROI culture

Expect that as technology lowers the barriers, the early adopters will more likely be in supply-chain management (SCM) than in customer-relationship management (CRM) or any other segment. This is because supply-chain partners are more familiar with non-perfect solutions and are able to clearly see the short term gains, e.g. cash flow, from its use.

Positive Market Factors for MSCM: Just-in-Time and Consumer Demands

Just-in-time, the means by which inventory is reduced, has been successful. However it is still necessary to maintain buffers of inventory due to imperfect access to real-time inventory information. Effective uses of SCM and MSCM are being implemented to take further inventory out of the system.

Store personnel can scan the stock-keeping-unit (SKU) code and determine that an object is on a truck and will be in the store tomorrow. They can then hold it for the consumer. The consumer's increasing need for instant gratification and increased expectations for quick delivery are market drivers for SCM, and mobility is helping the demand side.

Positive Market Factors for MSCM: Simplicity

Even though some discussions have centered on complex systems that are clearly not available today, deploying simple systems that ask a few questions and then pressing "send" can provide a lot of value. The mobility access point can make it much more simple than taking paper back to the factory and can be a factor for adoption even in a tight economy.

Positive Market Factors for MSCM: Visibility of the Process

Outsourcing is and continues to happen. When part of the value chain leaves the four walls of the enterprise, it loses some visibility. Practical Mobility and MSCM restore some of this visibility and control and, in so doing, are positive market drivers.

One of the unique things about supply chain is third-party logistics. There are now companies that have taken over the infomediary and inventory mediary roles that

used to be exclusive to the enterprise. Market acceptance of this outsourcing is an important point of MSCM.

Positive Market Factors for MSCM: Nanotechnology

Nanotechnology, a new and emerging science of the very small, has the potential to help alleviate many of MSCM's technical issues. Even in this slow economy, interest in nano-technology is rising significantly, thus raising the likelihood that some of these problems will be solved ahead of the economy's recovery.

Negative Market Factors for MSCM: Labor Disputes

Most recent labor disputes at west coast ports have been over the introduction of technology. Therefore, a major issue is potential labor disputes that may arise because of MSCM adoption. This could result in a delay of significant adoption to a later time when there is vigorous growth, as high-growth environments are often more amenable to change.

Negative Market Factors for MSCM: Weak Economy

The economy is presently in a slump. This slump reduces the need for the new MSCM. Why should something be improved if it is good enough for now? That is, "Do not spend any money you do not absolutely have to." However, if there were significant growth, adoption might be easier. Under these conditions, enterprises could see themselves losing much needed capacity because of existing inefficiencies. Conversely, making a case for improving efficiency is much harder in a slow economy when "good enough" is okay.

Negative Market Factors for MSCM: Complicated Solution and Costly

Supply Chain Management is, by itself, a complicated and customer-driven solution. Adding a mobile component to SCM complicates the solution. Decision-makers often balk at adopting something new with additional, perceived as complicating, elements. Because MSCM is a customer-driven solution, providers find it difficult to build a standard solution, because the customer is saying, "I am the customer; do it my way." Thus, the adoption of MSCM is slowed without standardization available to support it in the marketplace.

There is a perception that if a solution is complicated, then it is expensive. If it is expensive, it will take a lot of time to integrate and to learn. Those two factors make decision-makers nervous and make it very hard for companies to invest in this MSCM, especially at this time of the market.

Conclusion

Practical Mobility and Mobile Supply Chain Management are clearly in the early stages of development. Users recognize that opportunities exist for significant improvement in the use of these processes, while providers work to present breakthrough applications. Technology has progressed to the stage where compelling solutions are possible and future efforts should be concerned as much with standards and integration as they are with dramatic new technological achievements. However, any significant adoption must also consider cultural changes, as these processes will involve employees across the entire enterprise. ROI remains at the core of any significant deployment and must be there in quantifiable terms prior to broad adoption. Enterprise processes needed to support MSCM will irreversibly and fundamentally change the way supply chain management has been done for many years. New procedures must be socialized with all parties involved which implies a cultural and temporal challenge for the integration of Mobile Supply Chain Management into the enterprise.

Appendix I:
Practical Mobility: A Survey of Mobile Workers

In preparation for this Think Tank Session, a survey was conducted by the Center's Knowledge Network Partner, Incucomm, Inc., to obtain external input from a statistically significant population on the current state of affairs. It concentrated on how enterprises are dealing with issues now and what they perceive as needs and barriers. The results of 42,000 requests generated an acceptable 250 responses, or about 0.6%. The survey passes a number of randomness tests, and compares favorably with other information technology surveys, in terms of participation, statistical significance, and by other measures.

The survey showed that a number of factors related to mobility are converging. Wireless build out continues as wireless carriers are seeing data to be a bigger part of market share and are therefore emphasizing it more. Many enterprises are seeing that they have an opportunity to improve their business since employees are already carrying cellular phones with them and therefore should be able to exchange data as well in order to make the processes more efficient. Mobile is an area where customers want to work and are willing to spend money. However, on the down side, there continues to be great variation in understanding of the definitions indicating that future actions must also include a considerable amount of education.

Cross-tabulating the data showed very strong positive indications in four areas: agility, lower operating costs, paperwork reduction and e-mail.

The survey showed that the general population has different views of what is significant from that of Mobile IT providers and both are different from those of regular IT providers. Interestingly, Mobile IT providers were the most misaligned with variations of 30-40%. Little brand or thought leader recognition was visible among the customers further indicating a somewhat chaotic view of what is out there and a need for education.

Another cross-tabulation clearly illustrated the need for security and coverage. The customer must believe that his information is safe and wants it wherever he/she happens to be. This last point raised some issues with the participants regarding a "Store-and-Forward" vs. "Always-On" system. The Always-On system would guarantee ubiquitous coverage while the Store-and-Forward system would download whenever coverage was available but would not necessarily be collaborative. This is especially interesting to note since paperwork reduction was listed as a key driver and paperwork, which now has a cycle time of days, would be relegated to minutes, even with a Store-and-Forward system.

Appendix II:
Results of Group Brainstorming Activities

Below is a verbatim compilation of individual ideas submitted during the Think Tank Session by the participants. The aggregation of these ideas served as the basis for a continued refined focus during the day.

Enterprise Needs Driving Adoption of Mobile Supply chain Management

- Ease of use:
  - Simple development… s/w, device, to database
  - Appropriate devices and applications
  - Simple, reliable user devices and interfaces
- Sturdy Hardware
  - Cost effective sturdy hardware
- Customer Relationship Management:
  - Customer responsiveness
- Real Time Decision-Making
  - Fault diagnosis and trouble shooting for field maintenance
  - Repair parts ordering in the field
  - Remote sensing and failure prediction of complex equipment on mission critical systems
  - Ability to predict problems sooner
  - Need to let people in the field make decisions w/o

going up the chain for approval
  - Information access:
    - SCM systems implemented past 10 years forced work to stationary work places
    - Need to have access to the info (existing investment) where it is needed.
  - Real-time reporting
  - Communications with critical path business
  - Managing work order data & telephone companies cable, etc.
    - Warehouse management
- Fleet control
- Interoperability
    - Need links (s/w) to legacy databases w/ interoperability

Barriers to Adoption for the Mobile User

- Keep the rules and processes simple
- Skepticism re: technology
- Devices
  - Airtime is too expensive
  - Battery life too short
  - Personal preference vs. corp. strategy
  - Global connection…one device
  - Mobile devices are not converged…. Voice, data, location
  - Durable devices
  - Device/application performance
  - Devices issues
    - Simple
    - Battery
    - Screen size
- Connectivity
  - Connectivity and coverage
  - Roaming issues
  - Coverage and reliability of connections
- Ease of use
  - Ease of use
  - Simple
- Usability
- Form factor
- Applications need to be intuitive and easy to use barrier is "difficult to use"
- Reliability
  - Reliability and performance of Mobile solutions
  - Dependability of application
  - Reliability of equipment and fail over
- Security
  - How do I authenticate users and secure data and make it easy to use?
- Mobile users
  - Overcoming resistance in the work force
  - Bubba does not care about rules
  - Mobile users resent "bean counters" trying to make me do the work of 2 people
    - "I might be the one laid off"
  - Mobile worker resents big brothers "tracking him"
  - Worker empowerment
  - If it is simple to use and doesn't handle the exceptions I deal with every day…. Not flexible. Then hard to use
- Asking me to do more work and no more time to do it.
- Is the company going to buy this and maintain it and the data or am I going to have to do it? Or can I pick what I want then they just integrate the data to the enterprise systems?

Barriers to Adoption Within the Enterprise

- ROI
  - Field logistics appliance ROI
  - Inside skepticism
    - Does it work?
    - What will I save?
    - What will it cost?
    - When will it work?
- Security

- Custom applications
  - Application customization
  - Back end interfaces …too many choices
- Technology vs. process
  - Tech vs. process
  - Understanding & communicating system limitations to correctly set expectations
    - Total solutions… not technologies
    - Many offerings today are still technical stovepipe offerings that are difficult on impossible to replicate
- System Interface
  - Integration with back office
  - Infrastructure accommodation
  - System integration issues
  - System interconnect
  - Back office integration of mobile solutions into existing IT infrastructure
  - Real time integration
  - Logistics application integration
  - Supply chain information interoperability
  - Integration with enterprise applications
  - Legacy system integration
  - Cost of integration to legacy systems
  - Integration to existing applications
  - Integration to existing back office systems
    - ERP
    - General Ledger
    - Procurement

Barriers to Adoption Outside the Enterprise

- I am a supplier and every big customer wants me to spend $1M to connect to their particular solution. I can not support all their different systems
- We cannot communicate a format for the customer's use that is simple and they would see as efficient and desirable. They are in a hurry and only want to speak their needs.
- Disproportional distribution of costs and benefits
- Interfacing with customers existing information systems

Enabling Technology Solutions

- Security
  - Secure sharing with partners
  - End to end data encryption; e.g.. ipsec, vpn, ssl
- WIFI (2 dots)
  - Hot spots
  - Wifi everywhere
  - Wifi ready handhelds
- Locations Based technology
- User Interface
  - Mobile devices that are equipped with bar code readers
  - Larger screen sizes
  - Cheaper, Ruggedized high resolution touch screens
  - Data presentation technologies
  - Full web screen visibility on a cell phone sized dis play
  - Converged devices, configurable, contextual
- Battery Life
- Real-time
  - Real-time data delivery
  - Dependable timely information
- Access control
  - Single sign-on identity w/ single access data repository
  - Single "Sign-On" authorization
- Culture
  - Educate companies …get away from hype show
- Mobile Solutions
  - Need shrink wrapped solutions
  - Prepackaged solutions:
    - Application
    - Hardware
    - Service providers
  - Business process/performance management
  - Mobile SCM Enterprise Information Portal Solutions

- Customizable SCM intelligent agent applications
- Mobile middleware
- Electronic dispatching
- A wireless connection from job site trailer that has zero lead time
- Field crew should be able to check inventory real time at one/multiple suppliers
- Device defined policy manager/transcoder
- Want world-wide communications of MSCM
- Field crew should be able to receive orders and approve invoices in the field and they should integrate with our finance and accounting systems

- Standards
  - Global standards
- Technology Roadmap
  - Slow down development.. Fear of technology obsolescence is slowing adoption
- Interface (1 dot)
  - Web services
  - Web services for collaborative commerce
  - XML, XHTML, Java, JDS, JAR
  - Web services
  - Reliable/faster wireless network
- Coverage (4 dots)
  - Real-time systems
  - Roaming
  - Enlarge network speed and quality
- RFID (2 dots)
  - Ruggedized super cheap RFID tags
  - Open standard RFID tags & readers
  - Simple 2 d barcode/RFID tag readers for mobile devices
  - RFID/Cubes/Bar Codes
    - Passive
    - Non-passive
  - Affordable RFID tags & wireless infrastructure
- Voice
  - Voice XML, Recognition
  - Reliable speed recognition technology
- Multimodality:
  - Voice
  - RFID
  - Barcodes
  - Stylus
- Voice capture of parts voice tagged

What Technology Solutions are NOT Working (or you don't trust them)

- Connectivity
  - Integration
  - Legacy accommodation
- Delivery & retrieval of real time data
- Standards (11 orange dots)
  - Does not work
    - Location systems for luggage
  - None or not sufficient standards for RFID tags
  - Lack of RFID global infrastructure or open architecture based on standards
  - Lack of standards for web services
- Affordable device
  - Low cost, generic, rugged, user devices
    - Tablet with modular air i/f for sub $1000
- User Interface (1 dot)
  - UI
  - No intuitive user interfaces on mobile devices
- Coverage (4 dots)
  - Coverage
  - Connectivity
  - World wide connectivity/communications for MSCM
    - Different technologies, s/w and devices
  - Cellular, GPRS, Wi-Fi: the problem is these work, but intermittently, not always available
- Stovepipe applications
  - Proprietary stovepipe apps
    - These don't age well on a scale
- Too Costly
  - Mobile telephony is too costly for non-voice data exchange

- Security (2 dots)
  - WAN security for data over the air
  - Security is perceived as either inconsistent or inefficient
  - Does not work
    - Security that finds and returns my keys
  - Wireless security (short range) on hardware level w/o having to deploy a VPN
  - Biting off too much

Appendix III: Suggestions for Future Think Tank Sessions

Participants requested future Think Tank Sessions to focus on the following subjects:

- Application Expo
- Mobile Middleware [2]
- Mobile Middleware Package
- Offline SCM applications
- More focused mobility discussion for supply chain
- Authentication/Security
- Mobile authentication/Identity of users
- Joint Wi-Fi & cellular solutions
- Micropayments for bandwidth/different providers
- Enabling technologies
- Use of off-the-shelf mobile devices on the factory floor (especially in manufacturing)
- Identify problems and brainstorm mobile solutions for specific applications (e.g. Pharma supply chain; electronic contract manufacturing supply chain; local delivery service; fashion industry supply chain)
- MSCM - Practical models and workflows (actually map out a workflow with real-world available solutions and identify the gaps where development is needed.)
- Use of super cheap RFID tags in manufacturing (especially focusing on the back-end integration of such solutions,)
- Application infrastructure requirements
- Bringing broadband solutions to a community with or without the phone company
- Wireless: Fixed vs. Mobile applications
- Consortium sessions
- Alliance/Partnership sessions
- More survey statistical sessions
- Information utility vs. telecom
- How to expedite application integration & customization
- Mobile convergence (networks & devices)
- Vertical SCM session (retail, logistics, software)
- Workable business models
- Web Services
- Information interoperability for mobile applications

Appendix IV: Results of Back-casting Exercise: Successful MSCM in 2007

The Time Machine: An Application of MSCM: October 24, 2007

At the end of the Think Tank Session, participants applied the ideas and conclustions that they had generated in the course of the day to consider what factors would, most likely, have to be in place to support the successful implementation of Mobile Supply Chain Management in the future. To do this, they considered themselves as entering a time machine, and projected 5 years into the future where they would see the results of using MSCM 5 years ago (i.e. today). Upon arriving, they found the results to be spectacular! So good, in fact, that they were just about to be interviewed for the cover story of Fortune magazine. The central point of the story was to be what they did, 5 years ago, that made them so successful. Three groups were formed, each group representing one enterprise and each given a short time to develop their idea and the reasons why it was so good in preparation for their "interview".

Each group focused on a "point of pain" with each creating an original enterprise that totally resolved it. Two approaches were based on starting new enterprises that

provided needed services and products to others. Believing that outsourcing trends would continue, they succeeded by helping others to succeed using MSCM. The third group assumed that a large enterprise already existed and applied Practical Mobility and MSCM in innovative ways to make it considerably more profitable.

The following is a summation of the three group's conclusions.

Group I: Daimler Chrysler Ford

By 2007, there came to be a great merger of several companies, to be named: Daimler Chrysler Ford (DCF). This company, realizing that it had suppliers in 53 countries, concentrated on solving the inventory-delivery process for their business. They implemented the use of RFID tags on every item of inventory, then added an infrastructure that could read them at all times. This was done by integrating 802.11 cellular capabilities and constructing a ubiquitous tag-reading environment within the enterprise's factories, the suppliers' factories, and the various units of transportation. This information was integrated into a knowledge base, so that the enterprise could constantly adapt in a dynamic way to differing transit times and transient anomalies. By doing this, they were able to take a full week out of their material cycle, significantly increasing the number of inventory turns per year. Additionally, this knowledge base, available for the first time in so extensive a manner, allowed the enterprise to track re-work on lot-by-lot bases and have real-time data on all parts. The results quickly identified any potential material quality problems and enabled prompt solutions. Therefore, the process not only saved money by reducing inventory, it also saved money by reducing re-work and minimizing redesign. At the same time it improved the customer experience.

Group II: Infoclear, a new company in 2007

Infoclear, an information clearing house, was created to respond to the huge amounts of trade now, in 2007, exist between the Far East and the United States. This bilateral trade will continue to grow at a vigorous pace creating challenges for supply chain management that go beyond technology to focus on cultural and personal factors. Infoclear grew to become a common point between these two dominant markets. As a single point, Infoclear was able to construct an infrastructure and tight organization across all levels of the supply chain using standards that they developed. Infoclear focuses totally on solving the interface problems of technical and cultural interoperability among the disparate sources of data and time zones. They derived their income from a small percentage of each facilitated transaction.

Appendix V: Practical Mobility: A Definition

Historically, the extensive application of technology to implement sophisticated processes outside the boundaries of an enterprise has been a rare occurrence. Exceptions such as FedEx and UPS exist, however it may be argued that they have only adopted sophisticated mobile technology in managing package logistics because that is at the very core of their businesses. More often a somewhat fatalistic attitude, as to what is possible, appears to permeate the area of the business outside of its well defined boundaries, where shortcomings and problems are often and easily identified, but little of substance seems to change.

Practical Mobility (PM) is a class of powerful enterprise solutions that are "practical" because they address real business issues and because they use real tools that are available now. It is "mobile" because it extends beyond the traditional "four walls of the business". It is the means by which the billions of dollars of worldwide wireless infrastructure will get real business done, and get it done better in the sense of cost, control and customer experience.

What it is not, is e-mail, nor is it web browsing to make reservations at a restaurant, nor is it even the telecommuter connecting to a VPN while at the airport in order

to answer his e-mail. These erroneous perceptions of Practical Mobility generate an often-pervading view that it is already here, or that it is of little consequence to real everyday business issues. Practical Mobility, on the contrary is at the core of business value as it is the automation of Business-to-Business transactions now being done by people with steel toe boots, by people at dock doors, by people driving trucks among various places of business and thereby keeping commerce alive.

It is the means to improve and make more efficient what they are doing now with clipboards and scraps of paper. It is the application of existing 21st century tools to replace the 19th century tools now in common use. It is deploying network intelligence outside the current bounds of the enterprise network, to workers who are currently in a very static and antiquated business process environment.

Today, those transactions, maintained and controlled on clipboards and paper, must be recoded and re-entered into the "Real System" inside the enterprise with all the resultant added cost as well as the myriad of additional opportunities to create errors. Enterprises are just now beginning to realize that they can automate the clipboard. But it is much more than just the avoidance of cumbersome and error prone rekeying efforts. It is bringing real decision-making and adaptability to the outside environment. For example, consider an order arriving at a dock that is not exactly what is on the Bill of Lading or Purchase Order. Practical Mobility allows the discrepancies to be handled and logged into the system in real time. Or consider the acceptance and acknowledgment of an order at the dock that can immediately "start the clock" for billing and thus reduce the aging of Accounts Receivable.

Done intelligently, it typically does not need large real-time bandwidth requirements in order to extract considerable business value. Consequently, it does not need to wait for new networks to be deployed before it can be deployed. It does not require 3G, or even very much of 2.5G. The process can be developed to leverage upon existing networks. Useful applications have even been developed using only CDPD. Obviously, as network improvements are implemented, Practical Mobility will adapt to fully exploit them, but a great deal can be done with what is there now.

In the case of supply chain management, Practical Mobility is especially attractive because of the highly visible and near term potential improvements possible in making the supply chain more agile and reactive thus reducing shortages while reducing inventory and improving cash flow.

Therefore, a common working definition of Practical Mobility is: The use of available telecommunications, middleware, and business process technology to add significant business value to today's businesses by extending the control and process normally associated within a business well beyond its traditional boundaries.