Executive on the Move Business Scenario

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The views expressed in this Business Scenario are not necessarily those of any particular contributor or member of The Open Group.

Management Summary

This Business Scenario investigates the problem of providing effective IT support to Executives while they are away from their normal places of work, either at other locations, or in transit. It was developed by the Mobile and Directory Working Group of The Open Group in order to explore the requirements for Directories to support Mobile Computing and Communications.

Mobile Computing and Communications are increasingly used by Executives and other employees of a wide range of government, commercial, manufacturing, service, and other organizations. They help to:

- Minimize time when people are not doing productive, profitable work;
- Maximize Availability of Executives for Decision Making;
- Maximize Competitive Advantage by Timely Availability of Information; and
- Improve Quality of Enterprise Information.

They do this by enabling executives to conduct the core activities of conversation, conferencing, messaging, alerting, information access, information update, and on-line transactions. The Scenario identifies a number of requirements for the systems that support these activities, to meet the needs of executives that are away from their normal places of work.

Up to this point, this Scenario is solution-neutral. However, the original reason for developing it was to help identify requirements to support mobile computing and communications. The Scenario proceeds to put forward architectural considerations that are oriented towards a solution that uses Directories.

The Scenario envisages an architecture where applications and intelligent network components access information stored in Directories in order to support mobility. Some of that information is generated by applications and system administrators. Some of it is generated in real-time by network components.

Existing standard directory interfaces are not appropriate for the access through directories of real-time network information. The definition of standards for an interface that is appropriate would be very valuable, as it would enable the emergence of standards-based intelligent network component products and directory products.

In addition to standards at the protocol level, agreement is needed on the format of the information carried by the protocols. This could be through standard schema definitions, but a more practical approach would be to agree a common framework within which information mappings can be defined. The Common Information Model of the Distributed Management Task Force could, perhaps with some additions, provide such a framework.

The next steps are to create a Technical Plan for development of the architectural ideas presented in the scenario, and to create a Marketing Plan to promote those ideas to potential implementors and to appropriate standards bodies. A key element of these plans will be a Mobility Directory Challenge, which will demonstrate how many aspects of wireless computing management can be simplified and standardized using current and developing directory technology.

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Business Scenario Problem Description

Problem Summary

Executives, and indeed many other people, are increasingly reliant on the Information Technology infrastructure to:

- Deliver to them the information that they need for their work; and to
- Enable them to communicate.

Traditionally, the technology infrastructure supports people at their normal places of work. But Executives often visit other locations, and spend time traveling. They need support while "on the move".

Mobile communications technology is now beginning to *enable* effective support for the mobile Executive. But *providing* such support is not simply a question of ensuring that a network connection is always available – even a high-bandwidth one. An enterprise's infrastructure generally mistrusts everyone not physically located within the enterprise's buildings; often implicitly assumes that a particular person will be in a particular place; and invariably has difficulty coping with flexibility and change.

The problem described by this Business Scenario is that of providing effective IT support to Executives while they are away from their normal places of work, either at other locations, or in transit.

Background of the Scenario

This Business Scenario was developed by the Mobile and Directory Working Group of The Open Group in order to explore the requirements for Directories to support Mobile Computing and Communications.

The Mobile and Directory Working Group is a joint working group of the Directory Interoperability Forum and the Mobile Management Forum. The scope of this working group is the use of Directories in support of Mobile environments. Its objectives are: to develop the requirements for the use of Directory Services in Mobile environments, and to communicate them to appropriate standards bodies and influencing organizations.

The Business Scenario process is an excellent way of achieving these objectives. However, a good Business Scenario describes a significant business need or problem, rather than a specific solution, such as Directory.

This Business Scenario takes as its starting point the business problem of mobile people. It explores the problem, and develops requirements for a supporting technology architecture, including an information model.

Directories could potentially satisfy some of the requirements for information storage and retrieval. This Scenario does not assume that directories will be used to store particular items of information, or indeed that they will be used at all, when considering the problem, the objectives, the environments and processes, the actors, or the requirements. Consideration of the technology architecture, however, is restricted to those aspects

where directories could potentially play a role, and recommendations are made for the role that directories should play.

This Scenario is largely based on material from three sources:

- Work done within the Mobile Management Forum in the latter part of 2000 and early 2001 as demonstrated publicly at the *Wireless-Enabled Enterprise* conference held by The Open Group in April 2001 in Berlin; the overview scenario and scripts from this event as contributed by members of the MMF formed the impetus for, and foundation of, both the formation of the MaD group and this business scenario;
- The Business Scenario workshop held by the Mobile and Directory working group in October 2001 in Seattle, hosted by the Boeing Corporation to build on and develop the work above; and
- Further input to the Scenario from The Open Group conference that was held in October 2001, in Amsterdam.

The *Wireless-Enabled Enterprise* conference included presentations spanning the, then current, activities of the Mobile Management Forum from a range of organizations that use mobile communications and computing technology, and from technology vendor organizations. These provided much valuable background material. In addition, an example was enacted at the conference. It portrayed an Executive who was, while traveling, involved in a petroleum refinery contract negotiation. It showed how a part of the problem – *Sessions Management* – could be solved. It is used as a specific thread to illustrate this Business Scenario.

The Seattle workshop was held to develop input for this Business Scenario in accordance with the Business Scenario method (see *Appendix D: Business Scenarios*). Its starting point was the example enacted at Berlin. It addressed the topics listed below, and much of this Business Scenario description is derived from its input.

- What do we mean by executive on the move?
- Pain points associated with the lack of Support for the executive on the move Critical elements and roles of the environment Businesses
  - Business processes
  - People
  - Technical components
- The objectives of solving the problem
- Check if objectives are SMART
- Next steps.

Following the workshop, a presentation of the Scenario was developed and was given at The Open Group Conference in October 2001, in Amsterdam. This Business Scenario description incorporates feedback and input that was given there by members of the following forums of The Open Group:

- The Security Forum
- The Quality of Service Task Force
- The Mobile Management Forum
- The Directory Interoperability Forum.

Following the Amsterdam conference, the final version of the Business Scenario was developed by review of drafts by the Mobile and Directory Working Group.

Detailed Objectives

This Scenario identifies the following specific objectives of mobile computing to support the Executive on the move.

Minimize time when people are not doing productive, profitable work

Mobile computing and communications minimize the time that an executive is unable to be productive while in transit. This is important, although people can to some extent reorganize their work so that they can carry out activities such as reading or thinking that do not require communications while in transit.

Maximize Availability of Executives for Decision Making

A more vital consideration is the need for people to be available to participate in a group decision. When a time-critical decision is needed, mobile communications can enable a good decision to be made that would otherwise not have been possible because key people were in transit and could not communicate. The petroleum refinery contract example given in Berlin provides an excellent example of this.

Maximize Competitive Advantage by Timely Availability of Information

The petroleum refinery contract example also shows the value of timely availability of information, both from inside and outside the organization. The decision to change the bid depends partly on up-to-date knowledge of the petroleum futures market, available to the executive concerned through mobile communications.

Improve Quality of Enterprise Information

Quality of information is improved when information can be entered at the point of collection and at the time of collection.

Views of Environments and Processes

Business Environment

Introduction

Mobility is growing in the world of business. The mobile telephone is everywhere. Wireless-enabled Personal Computers (PCs) and Personal Digital Assistants (PDAs) are becoming commonplace.

Figure 1 is taken from the Directory-Enabled Enterprise Business Scenario in The Open Group White Paper: Assuring Interoperability for the Directory-Enabled Enterprise. It illustrates (among other things) that:

- Users can roam between different locations inside and outside the organization; and that
- In addition to fixed locations, an organization may have users who are mobile — in trucks, trains, boats, planes, etc.

Those users expect to be able to communicate with their colleagues, and to access information and IT services, when at other locations and while in transit.

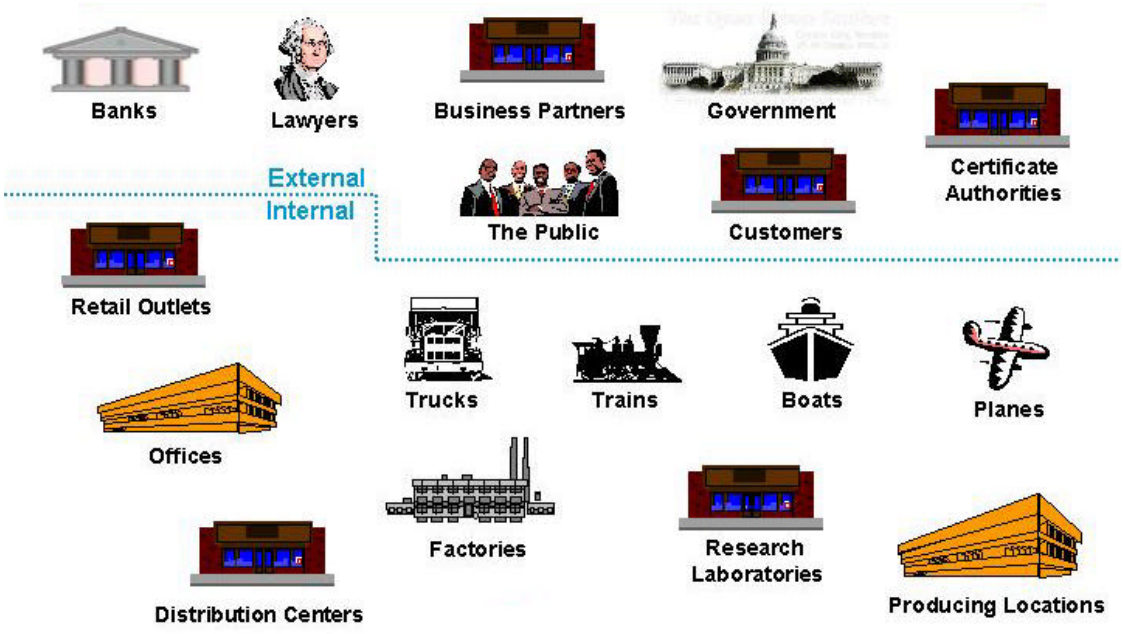

Figure 1. The Business Environment

Uses of Mobile Computing

At the Berlin conference of The Open Group in April 2001, speakers from Motorola, Symbol Technologies, and Bertelsmann Media Systems described general use of mobile computing and communications by Executives; while speakers from JP Morgan, Lufthansa, Brand Communications (on behalf of the Surrey, UK Police Force), St. Luke's Episcopal Hospital, Boeing, Critical Path, and Radicchio covered more specific topics. This Scenario incorporates information from these presentations, especially those describing general use by Executives.

Executives in organizations of all kinds can benefit from mobile computing, particularly if they travel on business frequently or work from home. Corporate executives and sales people are often frequent business travelers.

Many organizations now support so-called “telecommuting”, because it is cost-effective in office space, and good for employee relations.

Mobile computing, whether via wireless communications or by roaming use of fixed networks (for example by telephone dial-up) enables people to access corporate information and applications, and to communicate, even though they are physically outside the enterprise.

Petroleum Refinery Contract Example

The petroleum refinery contract example was presented at the Berlin conference to show use of mobile computing by business executives in the oil industry. It is not a real-life story, but puts together many real-life situations in a fictional setting to illustrate some key points of computing and communications support for the Executive on the Move.

A brief synopsis of the example is as follows. Françoise is a Project Manager at at XYZ.com. She is preparing a bid for construction of a petroleum distillation plant. At the start of the action, she is conducting a project review with Derek, XYX.com's VP of engineering; she is in her office, Derek is in his, and they are using NetMeeting. She is interrupted by a call from Ahmed, who is in the Middle East. He has identified a new source of local crude oil that would make their bid much more competitive, and she patches him into the electronic meeting to explain this. She then receives a GPRS alert of an oil futures price rise, and starts evaluating its impact using her project financials spreadsheet. At this point, a limo arrives to take her to the airport; she picks up her wirelessly connected PC, temporarily leaves the electronic meeting, and proceeds to the limo. Once in it, she reconnects to the meeting by mobile 'phone and continues her spreadsheet evaluation, which shows that the new crude oil source will give their bid a conclusive advantage. On arrival at the airport, she checks in then connects her PC to the Internet via wireless LAN and picks her NetMeeting session up again. She then confirms the changes to the bid in discussion with Derek, updates the spreadsheet and sends it to her secretary, and calls her secretary to discuss final preparation of the bid.

The full script for the example is reproduced in *Appendix A:*.

Business Drivers

The following are the drivers for these uses of mobile computing. In the business world, they all contribute to competitive advantage.

Productivity

People with access to information work faster and smarter.

Improved Decision Making when Timing is Critical

Enabling people to participate in decisions as needed wherever they are, and providing them with the information that they need to form their views, enables people to respond quickly in a crisis, and means that corporate decisions can be taken faster, and are of better quality.

Improved Corporate Information

When information can be entered at the point of creation, that information is available more quickly, and there are fewer mistakes. Better corporate information means that the enterprise as a whole is more efficient, and that reporting (for example, to shareholders) is more accurate and timely.

Security

Enabling remote access to corporate information means that there is no need to store copies of it on portable PCs.

Policies

Most organizations have policies that cover handling of information by their members. These policies are needed for a variety of reasons, including:

- To protect commercially-sensitive information;
- To protect information that is personally sensitive to organization members or others;
- To comply with legislation (such as European data-protection laws);
- To protect the organization from attacks by competitors or of a malicious nature (hacking);
- To help members of the organization work together effectively; or
- To protect the organization's infrastructure from overload.

An Executive may wish to work in his or her office, at another location in the organization, at the premises of an external organization, at home, at a public location such as an airport lounge or a hotel, or while in transit between any of these places.

He or she may use the organization's equipment, or may use borrowed or hired equipment. For example, a PDA may be hired from a car rental company, or equipment in a hotel business suite may be used.

The organization's policies must be enforced wherever people are and whatever equipment they use. Their application to mobile people is as important as – indeed, is often more important than – their application to people who always work in the same place on the organization's premises. But their consistent application to mobile people often presents great difficulties.

Business Processes

The oil-industry-related business processes involved in the petroleum refinery contract example presented in Berlin are:

- Proposal preparation and review;
- Decision making;
- Negotiation;
- Procurement;
- Sales; and
- Information provision.

These processes are representative of those in which Executives are typically engaged. The term "Executive" is not often defined and is often used quite loosely. Perhaps the defining characteristic of an Executive is that he or she participates actively in timely decision-making within an organization. Examples of such real-time decision-makers, that expand the common interpretation, are police officers and doctors. Timely information and communication can be a matter of life and death. The "Decision Making" and "Information Provision" processes are thus the key ones. In the case of "Information Provision", the Executive acts in some cases as a provider and in others as a receiver of information.

The example also showed some business processes of the companies providing the transportation and communications infrastructure:

- Connectivity provision;
- Handover (from one communications provider to another);
- Transportation provision; and
- Information provision.

Again, these processes are representative of those engaged in by companies providing transportation and communications infrastructure for Executives.

Technical Environment

The important aspect of the technical environment for this Business Scenario is networking. The networking environment is illustrated in Figure 2.

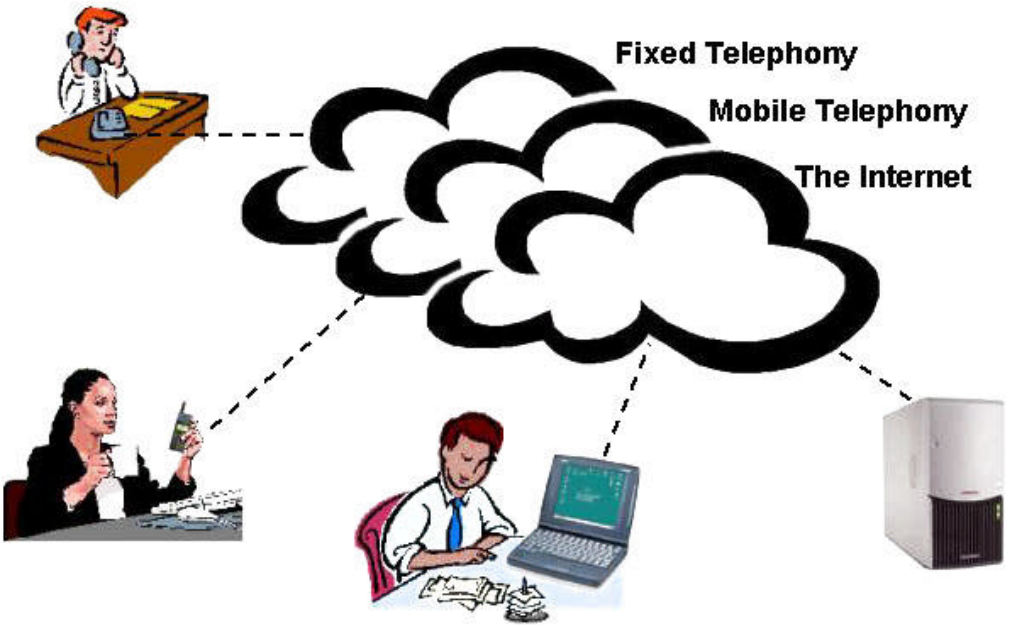

Figure 2. The Networking Environment

As the user sees it, there are three global networks: fixed telephony, mobile telephony, and the Internet. These networks actually share much common infrastructure, but their user interfaces are different, and they appear to be separate.

There is some integration between these networks. The fixed and mobile telephony networks are completely integrated for voice calls; anyone on either network can connect to anyone on the other. The data capabilities of the mobile telephony network have no counterpart in the fixed telephony network and are not integrated with it in any way. They do have counterparts in the Internet, both networks support messaging and information access, but there is little integration between them.

These three networks deliver quite different qualities of service. Fixed and mobile telephone connections are of fixed bandwidth and may corrupt information (in particular, distort the voice signal). The end-to-end delay is constant. In practice, the QoS of the fixed telephony network is very reliable; that of the mobile telephony network is less so, as the infrastructure is less mature. Internet connections are of variable bandwidth. It is possible to have error-free connections or lossy traffic streams. The end-to-end delay is unpredictable.

The Fixed Telephony Network

The fixed telephony network delivers the traditional voice telephone service. It is also capable via ISDN or by using analog modems of delivering a data service, but this capability is generally hidden from the end user: the telephone line typically provides the physical layer of a connection to the Internet, and the user perceives the connection as being an Internet connection. Via ISDN, it can deliver a video communication service.

The fixed telephony network is operated by a number of different organizations, but co-operation between them is good, and the user is generally unaware of dealing with multiple telephony service providers.

The Mobile Telephony Network

The mobile telephony network delivers the traditional voice telephone service plus data services in the form of text messaging and WAP web access. It can provide alerts. It can be used to provide Internet connections in the same way as the fixed telephone network, but today these are of low bandwidth only.

The mobile telephony network is provided by a number of different organizations. The user is more aware of this than in the case of the fixed telephony network, but it is not a factor of major concern.

The Internet

The Internet delivers a data service. By Voice-over-IP and Video-over-IP it can also be used for voice and video. These uses are largely still experimental, but Voice-over-IP is beginning to see serious use.

Ideally, the network connection bandwidth should be transparent to the user. In the real world, it is not transparent. The user may be painfully aware of low-bandwidth or unreliable connections.

The Internet is provided by a large number of different organizations. It consists of a great many interlinked subnets. This is a factor of importance for this Scenario, as will now be explained.

Internet Connections

Most Internet use follows the client-server model (in contrast to the telephony networks, where communication is peer-to-peer). The user operates the client device, and connects to servers that hold information or host applications. A connection typically passes through several different subnets. This is illustrated in Figure 3.

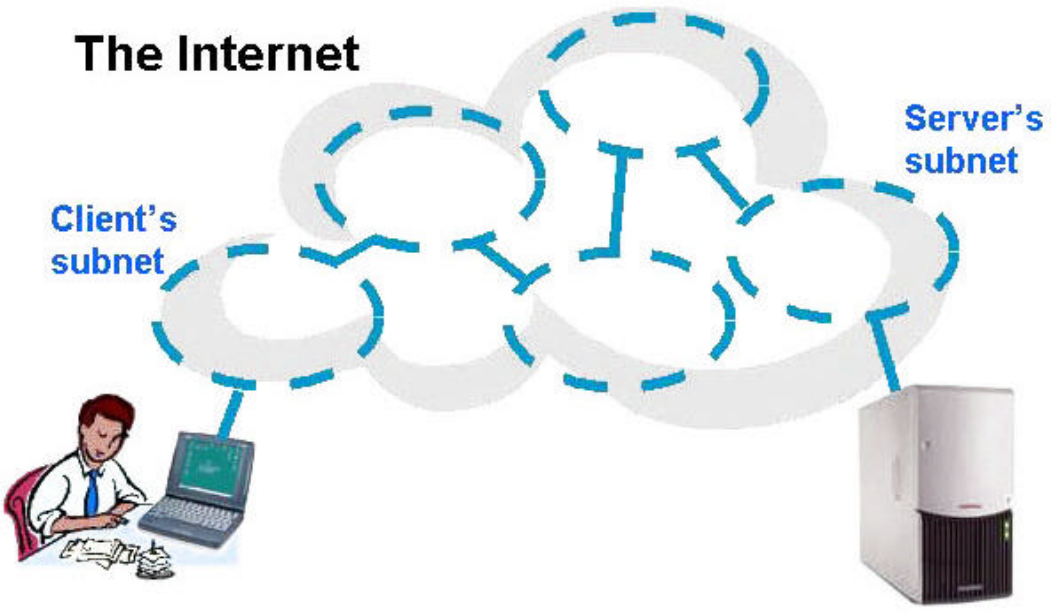

Figure 3. A Connection Across the Internet

Two of the subnets concerned are of particular interest:

- The subnet to which the client is directly connected, here called the *client's subnet*; and
- The subnet to which the server is directly connected, here called the *server's subnet*.

Client's Subnet

The client's subnet is commonly one of the following:

- A LAN, either fixed or wireless, in the user's organization. This is generally the case when the user is in his or her own office, or when the user visits another part of the organization.
- An ISP's subnet to which the user connects by analog or ISDN telephone dial-up, cable modem, or DSL. This is often the case when the user works from home or is "on the road". Generally, the user or the organization has a long-term contract with the ISP for Internet service.
- A LAN, either fixed or wireless, in another organization, which may even be a competitor to the user's organization. This may be the case when the user visits another organization and "borrows" a network connection. Increasingly, Executives are installing LANs in their homes.
- An ISP's LAN, either fixed or wireless. This will generally be the case when the user accesses the Internet from a hotel, airport lounge, limo, or airplane.

Connection to the client's subnet may be by LAN cable (coax, category 5 twisted pair, etc.), by wireless LAN (e.g. IEEE 802.11b), by "Piconet" (eg. Bluetooth), or by PSTN or ISDN dial-up. Figure 4 illustrates this. (This figure is taken from the draft MMF Sessions Management Architecture Description.)

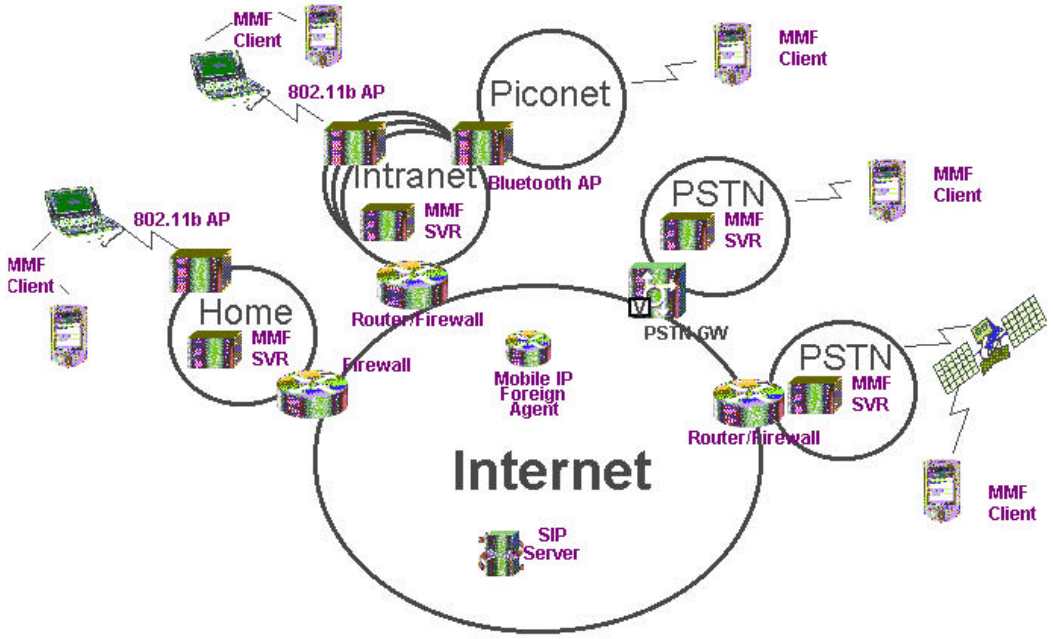

Figure 4. Connections to the Internet

The organization that owns the client's subnet will often have and enforce a security policy or a service-provision policy that applies to the user's connection. Enterprises generally have security policies, and often enforce them by firewalls and use of proxy servers. ISPs may not have security policies but will generally require users to establish their use entitlements, and may apply policies for QoS.

In each kind of client's subnet, it is common for IP addresses to be assigned to clients dynamically. This means that, while clients can connect to servers, it is generally not possible to make a connection to a client, since its address will be meaningless outside the client's subnet.

The client's subnet could be physically in motion, if it is situated on a train or airplane, for example. This is currently hard for the service-provider to implement, given the architecture of The Internet, but may be a more frequently encountered situation in the future.

An Executive on the Move will move from one subnet to another. For example, someone traveling to a meeting may connect from home in the morning, from an airport lounge while traveling, from the meeting in the afternoon, and from a hotel in the evening.

With sessions management technology, it is possible to maintain an application session while moving through different subnet connections. This was illustrated in the petroleum refinery contract negotiation example presented at the Berlin conference.

Server's Subnet

The server's subnet is generally a LAN to which the server is connected, either in

- An Enterprise; or in

- An Information Services Provider.

In either case, it is likely to be protected by a firewall, and access to it is likely to be restricted by a security policy.

An enterprise typically has one or more interconnected, firewalled campuses, plus mobile employees outside, connected via VPNs. It typically deals with other organizations such as customers, business partners, and competitors.

An enterprise will often restrict the kinds of traffic that may enter its network, and will generally restrict or disallow access by people who are not members of the enterprise.

An Information Services Provider will also often restrict the kinds of traffic that may enter its network. It may restrict access to subscribers, or may operate a public, unrestricted service.

Technical Processes

The list of processes in the *Business Processes* section is long, and is by no means complete. However, all of these processes require certain core activities that use mobile computing and communications. It is by enabling and enhancing these core activities that mobile computing and communications improve the effectiveness of business and other high-level processes. These core activities contribute to the business processes directly.

In addition, there are supporting processes that do not contribute directly to the business processes but enable the core activities to be carried out.

Core Activities

Conversation

Conversation is two-way communication between two parties. In most cases it uses only voice communication, but a conversation may involve data, voice, or video, or any combination of these.

Conferencing

This is multi-way communication between several parties. Again, voice conferencing is the most common case, but conferencing may also include data and video. Use of data conferencing in the form of the *net meeting* is increasing.

Messaging

Messaging is the transmission of information in *store and forward* mode, so that the recipient can receive it at a later time (or date). The original messaging paradigm is the letter post. Data e-mail and telephony voice-mail are now common.

Alerting

Alerting is distinguished from messaging in that alerts are delivered to the recipient as quickly as possible, and without the recipient making a specific request for them. A voice telephone call can serve this purpose. Data SMS-messaging and paging are other methods whose use is increasing.

Information Access

Access to public information is typically via the World-Wide Web. Access to enterprise information may be via a corporate web or by other applications, either general-purpose (an RDBMS, for example) or special-purpose (such as the Surrey Police Information and Knowledge Environment – SPIKE – used by the police force in Surrey, UK). Recorded messages can provide a way of enabling people to access information in voice form. As opposed to voice, data communications provides the more valuable and flexible form of information access, however.

Information Update

The ability of mobile employees to update the enterprise's information base can be very valuable. It generally involves data communication in the form of a data connection between the updater and the information server. It may be carried out via a range of applications, some general-purpose (for example, *ftp*) and some special-purpose.

On-Line Transactions

These include business transactions, such as buying and selling of stocks. (On-line gaming is a non-business activity of a similar nature.) They are relatively rare in mobile environments today, but are forecast by some to grow in importance.

Supporting Processes

Transmission

These are the processes of providing the basic communications services: fixed telephony, mobile telephony, and the Internet. They underlie the core activity technical processes such as conversation and messaging

Equipment Configuration and Upgrade

In many cases, equipment configuration and upgrade is now possible on-line over the Internet. This is an important service for people away from their supporting organization.

Actors and Their Roles and Responsibilities

Human Actors and Roles

The human actors and their roles are illustrated in Figure 5 and shown in Table 1.

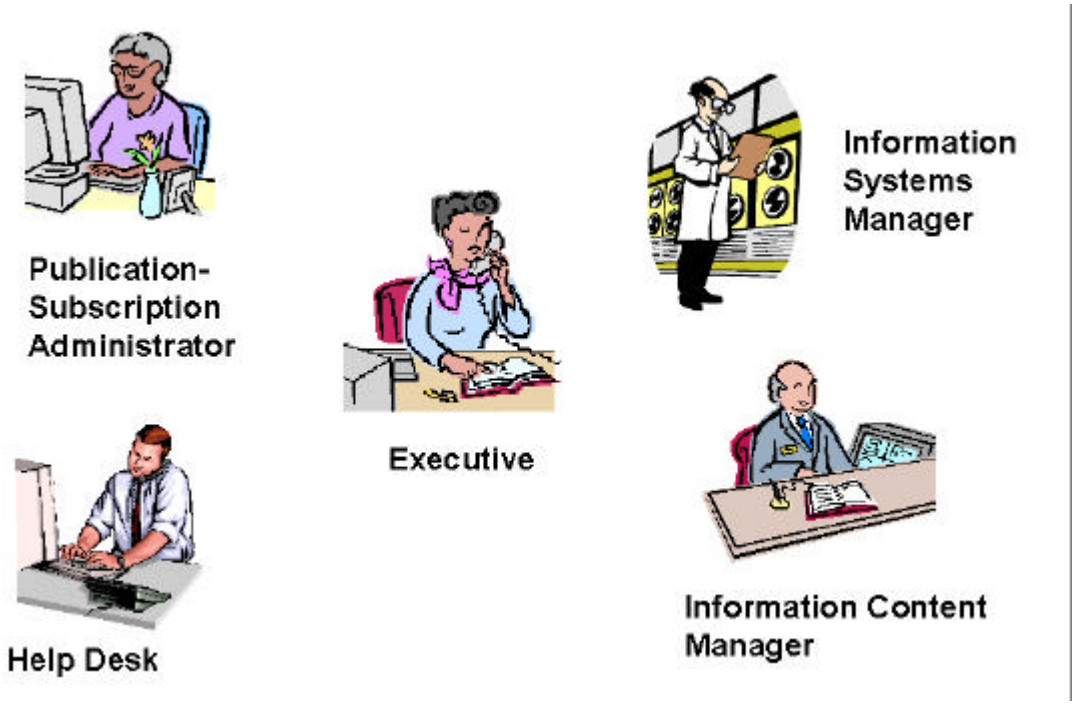

Figure 5. Human Actors

Human Actor	Roles
Executive	Uses conversation, conferencing, messaging, and other core technical activities to carry out the business processes of the enterprise, or high-level processes of other organizations.
Information Content Manager	Responsible for the organization's information content and for the content of information services provided.
Information Systems Manager	Responsible for design and operation of the organization's communication and information infrastructure. Sets policies for security and QoS.
Help Desk Operator	Helps users to operate the enterprise's communication and information infrastructure

Human Actor	Roles
Publication-Subscription Administrator	Acts as focal point for the collection and publication of information about subscribers to the service, to support • service provision by the service provider; and • hand-over to other service providers when the user moves from one network to another.

Table 1 – Human Actors and their Roles

The kinds of organizations involved, and the human actors within those organizations, are shown in Table 2.

Organization	Human Actors
Enterprise or other organization to which the Executive belongs	• Executive • Information Content Manager • Information Systems Manager • Help Desk Operator
Information Services Provider	• Information Content Manager • Information Systems Manager • Help Desk Operator
Communication Services Provider	• Communication Systems Manager • Publication-Subscription Administrator • Help Desk Operator

Table 2 – Organizations and Human Actors

Computer Actors and Roles

The computer actors and their roles are illustrated in Figure 6 and listed in Table 3.

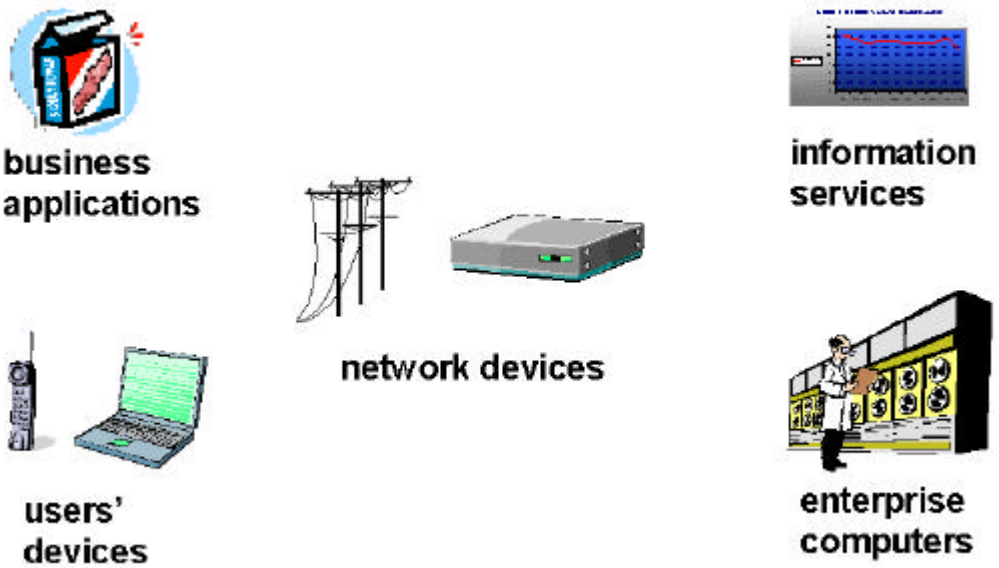

Figure 6. Computer Actors

Computer Actors	Roles
Business Applications	• Run on users' devices and/or on servers • Information processing and display
Users' Devices	• PCs, laptops, PDAs, fixed and mobile telephones, etc. • User Access to core technical activities • Local application execution • Local information store
Information Services	• Operated by Enterprises and Service Providers • Supply information to users
Enterprise Computers	• Operated by Enterprises and Service Providers • Central application processing and information store • Platform for information services • User identification, authentication, and access control

Computer Actors	Roles
Network Devices	• Information transport • Switching and routing of information in transit • Security of information in transit • Control of access to networks and systems • Network Quality of Service • Sessions management • Bandwidth management

Table 3 – Computer Actors

Requirements

Functionality

Mobile Communications must provide adequate transmission services to support the core activities of conversation, conferencing, messaging, alerting, information access, information update, and on-line transactions.

In addition to transmission services, mobile communications should also support configuration and upgrade of the user's equipment.

Mobile communications should support Voice-over-IP (in addition to telephony voice and also to data over IP).

Location-based services should be available. Examples of these are:

- At any time, find someone; and
- Trigger when a certain person is at a certain place.

Security

Security is not negotiable, and should be able to be taken for granted. It includes privacy of the individual, and integrity and confidentiality of information.

Security is needed for various reasons. Some people, for example in healthcare, may have legal requirements to preserve confidentiality. Others, for example salespeople, will have commercial reasons.

Executives need the security provided by the enterprise firewall, whether they are inside the firewall or not.

The following security considerations apply particularly in a mobile environment. Specific security requirements may differ as a user roams various networks.

- Enforcing enterprise security policy is much more difficult when people roam outside the organization than when they remain inside.
- Wireless transmission can be intercepted easily. It relies on encryption to preserve integrity and confidentiality. The easily circumvented WEP security in 802.11b is a particular major concern.
- Wireless transmissions can be "jammed". It can be easy to make a denial of service attack by jamming wireless transmissions.
- When people share a local subnet, it can be possible for them to access each others' information, for example using the MS Windows™ "Network Neighborhood" feature. Users must take special care to disable such features when on shared subnets outside their organizations.
- Where a user connects via a client subnet, a level of trust in the communications infrastructure is established. If the user moves to another client subnet, then that trust level must be re-validated, not taken for granted. Note that both parties in a communication need to be aware of the level of security they are using.
- Tracing people's physical location through the communications infrastructure is a stated requirement for some applications, but may also be an invasion of privacy.

- Particular security issues may arise for specific items of equipment. For example, there have been cases of SMS messages re-configuring WAP handsets.
- Unobserved bridging of wireless LANs is possible, resulting in members of one LAN being connected to another. Security policy will often require that this be prevented, but prevention may not be easy.

Ubiquity

The same functionality should be available everywhere.

Executives want to be able to perform their tasks wherever they are: office desk, visited location, home, hotel, car, airport lounge, and so on.

This includes transit vehicles (airplanes, trains, etc.) as well as fixed locations.

Convenience

Executives do not want to worry about which device to use. Ideally, all functionality would be available from a single, highly portable device, but this looks impractical for the immediate future.

Ideally, Executives do not want to have to do anything to be mobile - even raise an antenna.

An Executive wants seamless transition when moving between the environments in which he or she works.

Handoff from one network to another must be seamless. Many things - including re-authentication, and possibly change of encryption method - must be handled on the fly automatically.

Quality of Service

It should be possible to prioritize which users have access to particular communications links, by applying policy.

It should be possible to work within Service Level Agreements (SLAs). If an SLA is not met, penalties may be applied.

Policies may be needed in the situation where an SLA is not met, as well as in the situation where it is met. Even where congestion state changes unpredictably, expected behavior can be pre-provisioned.

High-priority traffic should be able to get through in congestion conditions. This may need pre-emption mechanisms.

User Profiles

Each user has a profile of allowed and preferred use of networks and applications. Indeed, a user may have different profiles associated with different roles; for example, a user may have one profile as an enterprise Executive, and a different profile as a private on-line banking customer. Profiles must be maintained and modified as the user moves, for security reasons and also for bandwidth reasons.

A user may at different times use various devices - PC, cell phone, PDA, for example – and use them to access the same or different services, and over the same or different

networks. In an ideal world, the user would want the same profile information to apply in each case. The goal is to get as close to this as is possible in the real world.

Regulatory

There are various regulatory requirements in various places, for example relating to siting of communications masts, that must be met by mobile communications.

The Executive's computing and communications environment must conform to applicable legislation, and should help the Executive to conform, for example by informing him of applicable legal requirements.

A particular concern for the mobile Executive is cross-border legislation.

- Encryption regulations are different in different places: sending encrypted messages from one country to another with different encryption legislation can be problematic.
- If a deal is concluded between people in different jurisdictions, it may not be clear what laws apply to it.

Data protection legislation varies from country to country, and may prohibit the export of certain information outside its country of origin. An Executive in one country conducting a salary negotiation with an employee in another may, for example, fall foul of this.

Management and Control

There are requirements in the following areas for management and control by organizations and, in some cases, by communications or information service providers.

- Configuration Management;
- User Profile Management - profiles must be maintained and modified as appropriate as people move, for security and for bandwidth reasons;
- Policy Management – note that policies are layered, relating to devices and to roles;
- Security management, based on policy, including management of authentication and authorization, and of provision of integrity and confidentiality;
- Communications management, based on policy;
- Registration of users and applications.

A passive "publish and subscribe" model is needed for access to information and services.

Resulting Technology Architecture Model

Introduction

Up to this point, this Scenario has been solution-neutral. However, the original reason for developing it was to help identify requirements to support mobile computing and communications. The architectural considerations put forward from this point onwards are oriented towards a solution that uses Directories. They identify areas where Directories might contribute to a solution, and show how Directories can contribute.

Proponents of other technologies are welcome to use the foregoing sections of this Scenario to assist in defining roles for those technologies in supporting mobile computing and communications.

This section will:

- Identify items of information that the human and computer actors need to share in order to support the Executive on the Move;
- Recommend how those items should be stored in Directories, or such that they are accessible via a directory interface; and
- Recommend what standards are necessary for how that information should be generated and accessed.

The broad principles underlying these last recommendations are that they should:

- Identify standards needed to enable markets for products that will contribute to more effective management of mobility; while
- Not calling for standardization in any other cases.

Constraints

The existing architectures of the fixed and mobile telephony networks, and of the Internet, are taken as given, as are the existing PC and server architectures. These networks and systems have huge installed bases, and there is no possibility of converting them to new architectures.

Further, the designers of new versions of these networks and systems have many requirements to address, one of which is the need to cater for mobility. Any architectural model put forward by this Scenario can thus not assume any particular development or direction in future networks and systems, though it may seek to influence developments and direction by offering possibilities for more effective management of mobility.

In particular, an architectural model put forward by this Scenario might enable new network and systems components to be developed that work more effectively in a mobile environment.

The architectural model put forward by this Scenario should take account of emerging new systems and communications architectures. In particular, it should take account of GPRS, 3G Mobile, Mobile IP and IPv6.

The existing installed base of applications cannot be assumed to be modified to enable any architecture put forward by this Scenario. But the Scenario can put forward an architecture within which new versions of applications can be developed that are more effective in a mobile environment.

Similarly, the architecture might enable the development of new mobile telephones and PDAs that are more effective than the current generation, though it cannot require changes to be retrofitted to equipment models that are currently in use.

Intelligent Communications

Several of the requirements for mobile computing imply greater intelligence in the communications infrastructure than are traditionally found in telephone networks and the Internet. These include:

- Location-based services;
- Policy-based security;
- Seamless hand-off between networks;
- Policy-based Quality of Service;
- User-profile based Quality of Service; and
- Configuration, management and control.

These requirements imply sharing of information between network components and applications. They also imply the ability of users and systems managers to access and modify this information in order to manage service provision and network performance.

There has traditionally been little ability for different networking products to share information, or for network components to respond to information provided by users and systems managers, other than that provided in infrequent “configuration” operations.

Support for mobile computing requires the development of network components that are much more information-driven. Such products will be referred to in this Scenario as *intelligent network components*. Such products are emerging. They include access points, firewalls, session managers, and bandwidth managers.

Information Needed to Support Mobility

The information needed to support mobility falls into three categories, as illustrated in Figure 7.

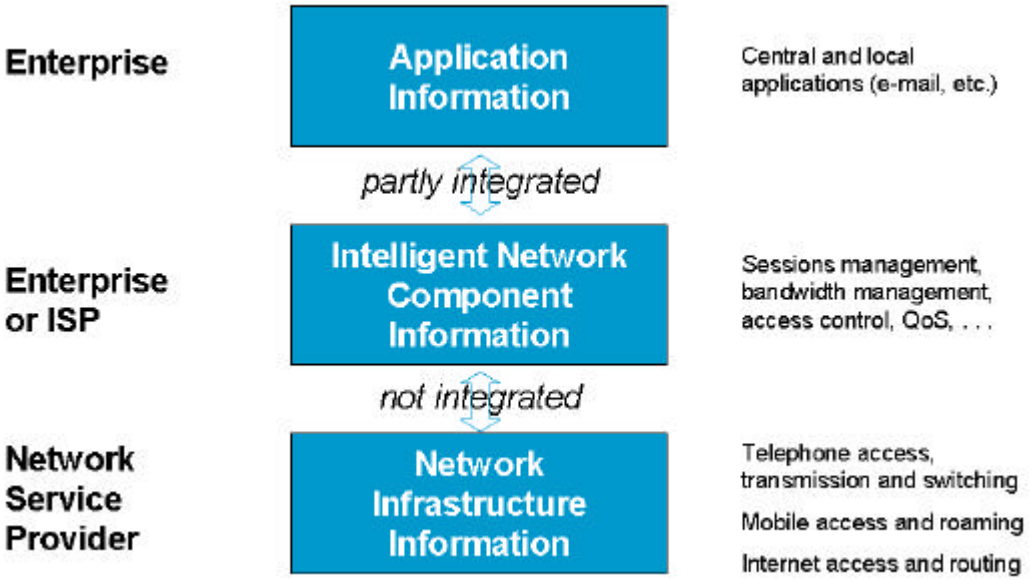

Figure 7. Information that Supports Mobility

Operation of the network infrastructure relies on routing tables, equipment databases, subscriber databases, home location registers, and other data. Such data is typically held by the network service providers. In some cases it is shared between service providers; it is generally not shared with customers.

Information used by intelligent network components is generally owned by the Enterprise or the Service Provider. It is separate from the basic network infrastructure information.

Information used by applications is generally owned by the Enterprise. It is integrated to some extent with information used by network components. For example, a user's security credentials may be used by applications and by network components.

This scenario is mainly concerned with intelligent network component information, and to some extent with application information. It is not concerned with basic network infrastructure information.

The intelligent network component and application information identified by this Scenario as being needed to support mobility is as follows.

- Address information;
- Configuration information;
- Information about links for QoS;
- User profiles for network access management and application access management;
- Policies for security and QoS;
- Security information;
- Register of users and applications;
- Locations of people and equipment; and

- Stateful information about all participating end-user systems and network components.

All of this information should in principle be accessible by applications and by network components. Some of it – user profiles and policy information, for example – is generated by system administrators and applications. Other information – such as information about links, locations of people, and stateful information about network components – is generated by the network components.

Technology Architecture Supporting the Process

Role of Directories

The role that directories can play is to make the information needed to support mobility available to applications and network components in a consistent and well-structured manner.

Directories support the X.500 information model and can be accessed by means of the X.500 Directory Access Protocol (DAP) or, more commonly, the IETF Lightweight Directory Access Protocol (LDAP). They are generally optimized for frequent-read-seldom-write operation. Many directory products can support distributed directory operation, either through the X.500 chaining and replication protocols, or through proprietary data distribution protocols. In general, distributed directories provide loose data consistency – but can be a highly effective distributed data store where this is acceptable.

Putting the information that supports mobility into a directory – or at least making it accessible via LDAP – means that:

- Applications and intelligent network components have ready access to the information through a well-defined interface; and
- Administrators can configure the information together with related information that may be stored in directories, particularly information about people.

However, there are reasons why not all this information should be stored in directories, and why the LDAP query-response paradigm is not appropriate for some uses by network components. The following requirements are not covered by LDAP.

Information References. Much of the information generated by network components changes frequently. Directories are not in general appropriate stores for such information, since directories are generally optimized for frequent-read-seldom-write. Information about links, locations of people, and stateful information about network components are all examples of frequently changing information. However, directories can still provide access to such information, either by returning pointers to locations where the information is held, or by going to those locations to find the information when they receive requests for it. In either case, the directory is not updated whenever the information changes.

Synchronization. In some cases the network components need information very quickly, and the time required for a directory request and response is too long. For example, a policy enforcement point in a network component may be making many policy decisions per second, and therefore need to obtain policy information in tens or hundreds of microseconds. This is much faster than a typical directory response

time. In such cases, it would be more appropriate for the network component to keep a local copy of the information. The requirement in this case is for it to be advised when information of which it has a local copy changes, so that it can synchronize its copy with the master.

Co-ordination. In other cases there may be a need for central co-ordination in real time of information distributed over several network components. The location of a person is an example of this: the network component (for example, wireless access point) that is directly serving the person will know the location, but without central co-ordination there is no way of telling which network component that is.

Figure 8 illustrates a way of handling this.

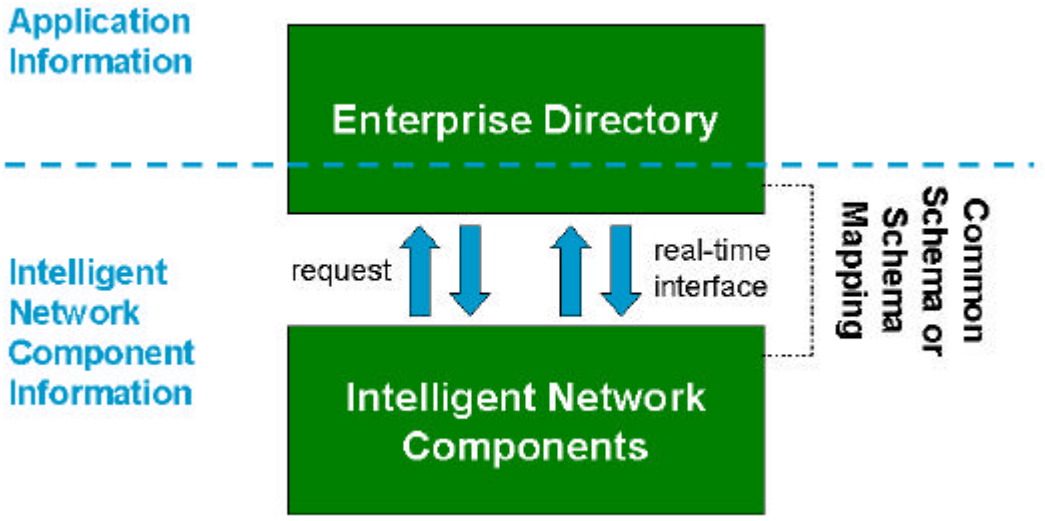

Figure 8. The Role of the Enterprise Directory

In Figure 8, the information generated or used by intelligent network components is partly stored in the directory and partly stored in the components themselves. It is all accessible via a request/response (LDAP) interface to the network components (and also to applications). Another interface, here called “real-time”, enables directory information to be accessed by the network components, and network components to be accessed by the directory, in cases where the request/response paradigm is not appropriate.

There is currently not an accepted standard for the “real-time interface” shown in Figure 8. Some directory products support interfaces that provide parts of the functionality that is needed. The standardization of such an interface would be very valuable, as it would enable the emergence of intelligent network component products and directory products.

Information exchange requires not only a protocol but also a shared understanding of the information format. For directory information, this implies a common schema, or a common model that allows the definition of schema mappings. A common schema would be the most efficient, as it would remove the need for schema mapping to be performed on the fly. However, it may not be practical to reach agreement on a common schema, and real-time schema mapping is a viable option, as evidenced by the existence of “mediation tools” and “adapters” in products today.

The Common Information Model (CIM) defined by the Distributed Management Task Force (DMTF) can provide a reference model, and other information representations can be translated into CIM terms. This would enable the definition of schema mappings that can be used when information is conveyed between directories and intelligent network components.

The Structure of The Enterprise Directory

In many cases, the "enterprise directory" includes number of different products, integrated to a greater or lesser degree. Metadirectory or virtual directory products may be used to enable a collection of different directories and other data stores, such as databases and flat files, to appear as a single directory, presenting an LDAP interface. In some cases, a directory product may incorporate metadirectory functionality, and be able to co-ordinate other data stores and provide an LDAP interface to them. Figure 9 shows a possible enterprise directory architecture in which a virtual directory, metadirectory, or similar component provides co-ordination between directories and other data stores so that a common request/response interface is presented to applications and intelligent network components. The "real-time interface" is supported by "back-end data stores" that are designed for the purpose of handling real-time information, and could be implemented using RAM or special-purpose hardware.

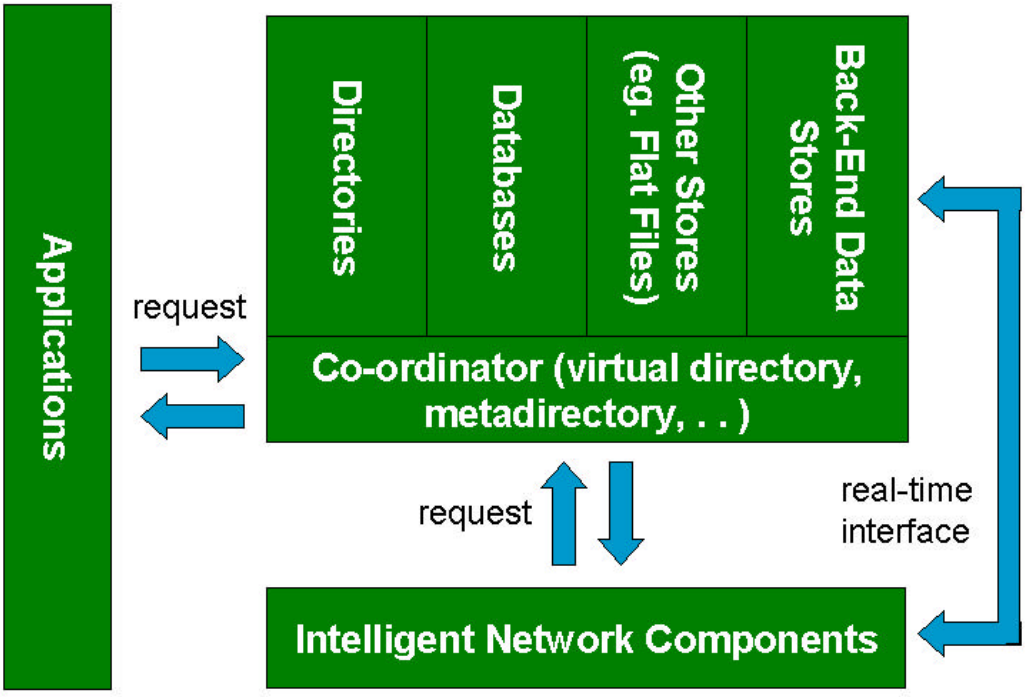

Figure 9. An Enterprise Directory Architecture

The architecture shown in Figure 9 is only one possibility. Directory products might for example include the co-ordinating functionality and even some or all of the back-end data store functionality.

Service providers have many of the same requirements as enterprises. A similar architecture could be appropriate for service providers' directories.

IT Principles

Required Standards

The standards required to support the architecture are:

- Directory Interface Standards
- Real-Time Interface Standards
- Information Content Standards.

Directory Interface Standards

The Lightweight Directory Access Protocol of the IETF is defined in RFC 2251 and related RFCs. The LDAP 2000 Product Standard identifies the RFCs and other standards to which a directory providing core LDAP version 3 must conform.

The Directory Services Markup Language (DSML) version 2, in conjunction with a transport mechanism such as SOAP over HTTP, could in future provide an alternative to LDAP.

Real-Time Interface Standards

Standards are required to define a real-time interface that meets the requirements for Information References, Synchronization, and Co-ordination, as described under *Role* of Directories.

There is no commonly accepted set of standards that meet these needs. CIM has a concept of "indications" that covers the Synchronization requirement. This kind of mechanism is implemented in various different ways in products. WBEM includes such a facility, based on ITU X.731 and X.733, and usually implemented using XML over SOAP, though other transport vehicles would be possible. CIM also describes a general mechanism that may cover the Co-ordination requirement. X.500 replication may in theory meet the Synchronization requirement, but is designed for replication between directories and may not be suitable for application to network components. Similar considerations apply to the IETF ldup work, which in any case is still at draft stage. There has been work in the Business Quality Messaging Forum and elsewhere on Message Queuing interface standards that might meet the Co-ordination requirement, but there is no commonly accepted message queuing standard.

These standards and drafts should be evaluated in the light of the requirements described in this Business Scenario. Recommendations should be made on what standards should be developed to meet the real-time interface requirements.

Information Content Standards

The directory information model is defined by the X.500-series recommendations. This model essentially comprises a hierarchical information paradigm and a set of access operations. Some common information types are defined also. Many of these types are used in directories with LDAP interfaces, as described for example in RFC 2256. These

information types are however not adequate for all the information needed to support mobility identified in this Scenario.

The DMTF CIM provides a more comprehensive information model. At first sight, it appears adequate to be used as a reference model for the information needed to support mobility. An LDAP Schema Mapping is defined for the CIM. This should be adopted as a reference model for mobility information. The DMTF should be asked to enhance it should it prove insufficient in any respect.

The real-time interface, and perhaps also the request-response interface, will need to make provision for schema mapping.

The full CIM Schema is unlikely to be used by any network component or directory, for performance reasons. A means of subsetting the CIM schema is therefore needed. It is understood that the DMTF is working on this.

Requirements Mapped to Technology Architecture

Functionality

The directory-based architecture described in this scenario does not contribute directly to the provision of transmission services (including Voice-over-IP).

By making location information accessible via the directory interface, the architecture enables location-based services.

Security

The architecture contributes to meeting security requirements by enabling security policies and credentials to be stored in directories and accessed via the directory interface.

Note however that the accessibility of mobility information via the directory interface does potentially raise security concerns. Attention must be paid to the security of information accessible in this way. The design of the real-time interface must take security considerations into account, so that this interface does not allow back-door access to sensitive information.

Ubiquity

Use of distributed directories could be an important aspect of making mobile computing ubiquitous. Distribution of directories is however not covered by the LDAP RFCs.

Convenience

The directory-based architecture described in this scenario does not contribute to the convenience of mobile computing and communications equipment. It may however make implementation of seamless handoff between networks easier.

Quality of Service

By making link information and QoS Policy information available through the directory interface, the directory-based architecture described in this scenario enables the

development of network components that can take account of service-level agreements and adjust the level of network service provision accordingly.

User Profiles

By making user profile information accessible via the directory interface, the directory-based architecture described in this scenario enables the development of network components and applications that can take account of user profiles.

Regulatory

The directory-based architecture described in this scenario does not contribute materially to the easing of regulatory problems.

Management and Control

The directory-based architecture described in this scenario contributes to management and control by making the following information uniformly accessible and modifiable through the directory interface:

- Configuration information;
- User Profiles;
- QoS Policies;
- Security policies and credentials;
- A register of users and applications.

Directories can assist implementation of a “publish and subscribe” model by recording who is subscribed to what information and services.

Next Steps

Following the publication of this scenario, the Mobile and Directory Group's next steps will be to create a Technical Plan for development of the architectural ideas presented in the scenario, and to create a Marketing Plan to promote those ideas to potential implementors and to appropriate standards bodies. The Technical Plan should include a review of relevant work carried out by other bodies, including the Common Information Model of the Distributed Management Task Force, and the message queueing interface of the Business Quality Messaging Forum.

A key element of the technical and marketing plans will be a Mobility Directory Challenge. This will demonstrate how many aspects of wireless computing management can be simplified and standardized using current and developing directory technology. Aspects to be demonstrated may include:

- User and user device information
- User and user device authentication and authorization
- Systems and network information
- Systems and Network use and state
- "Roaming" session persistence information requirements.

The targeted demonstration date for the Challenge will be early in 2003.

Appendix A: Petroleum Refinery Contract Example

Dramatis Personae

Announcer

Françoise, a Project Manager at XYZ.com

Derek, VP, Developments at XYZ.com

Ahmed, Field Supervisor

Bridget, Françoise's secretary

Hans, Limousine driver

SCENE 1

Announcer: As all of you are aware, there is a lot of buzz around what wireless is and what it will be able to do. Promises of unimaginable bandwidth leading to a wireless Internet abound. While there is considerable potential to an enterprise, there is still a lot of work needed to establish an effective infrastructure to extend or replace the wired environment. A primary objective of this conference is to demonstrate what a Wireless Enterprise can be TODAY. All products or services, which are represented here, are currently available or will be within 2 months. As you will see, there are many opportunities to gain business advantage with this level of capabilities.

Setting: Lights come up on stage for Françoise's Office. Françoise is a Project Manager building a proposal bid on the biggest deal for the company this year. She is presenting the status of her project to her management through NetMeeting.

We begin our scenario with Françoise, a project manager for an engineering company, XYZ.com, in a project review with Derek, the VP of Development. This is in preparation for a final bid review for a distillation plant for a petroleum company. The review is being conducted through on-line collaboration with Françoise connected by wireless LAN.

Françoise: [Speaking to Derek on the screen.] As you can see, our bid has a significant dependency on whether there is a sufficient supply of local crude. Based on current projections on oil futures, we need to dedicate a major reserve fund to cover expected costs. We will still be competitive with a reasonable risk factor. However, if we can assure our own local source, we can virtually lock up this project.

Derek: What options do we have for getting a local source?

F: Unfortunately, there aren't many. We have been looking to find a reliable spot broker willing to commit to meeting our requirements. The only other approach is to find our own oil wells.

D: Okay, I get the picture. Are there any other options to making our bid more competitive?

F: Not that I have found yet. We have pretty much minimized our costs within standard economic risk factors. Our new refining process is the core of our economic advantage. Naturally, it has its own risk factors, which we have minimized with all our pilot plant studies. There aren't any more process refinements to make at this point.

D: Well, I would feel much better having some extra edge in our hip pocket when we walk in to the bid presentations tomorrow.

F: I agree … [An alert flashes on her screen… Urgent Incoming Call from Ahmed] Excuse me sir. I have an urgent call from Ahmed. He went in early to see if he could find any options at the site itself. If you don't mind, I would like to take it.

D: Very well.

F: [Françoise puts Derek on hold and brings up Ahmed in a separate window] Ahmed, I am presenting the bid to Derek right now. What is so urgent?

Ahmed: Françoise, as you know, I came out to explore the site for new options. Well, I didn't quite get there; because I saw something I had to check out. While driving out to the site, I noticed a couple new drilling rigs. So I checked it out to see who it was. It turns out that it is a young sheik, who was drilling out his recent family inheritance. Well, he struck a previously unplotted reserve and it is top grade. He has no distribution arrangement yet so I explained our situation to him. He is open to selling us enough oil to meet our needs through our implementation phase, which is about how long he thinks it will take for him to set up his distribution. He is also open to giving us options after that.

F: Wow! That would give us a lock on our bid tomorrow!! Hang on and let me patch in Derek to tell him. [She links Ahmed in to her NetMeeting session with Derek.] Derek, Ahmed has found a potential local oil source for us! Here, let me have him tell you about it.

[As Ahmed describes his discovery to Derek, voice fades to background while Françoise digs out her GPRS phone, which is beeping.]

Announcer: It turns out that the alarm Françoise has received is an alert showing a rise in oil future prices. She checks her current market model spreadsheet for oil futures and sees the impact this can make on her projection model.

D: Françoise, Ahmed has just told me what he found and it sounds perfect. Ahmed, do you think you can lock them up on this?

A: Yes I do. He is just starting and could use our connections to get his feet on the ground and going.

[Just as Francoise concludes this, her secretary, Bridget, enters.]

Bridget: Françoise, your limousine is waiting for you downstairs.

F: [to herself] Mon Dieu, I am late for the airport. [Speaking to the monitor] Derek, Ahmed, I must leave now for the airport. Please continue the discussion. I will rejoin the discussion by phone and we can continue the NetMeeting when I get to the airport lounge to review the final revisions.

D: Okay, see you in a few minutes.

[Françoise picks up her laptop and exits.]

Announcer: As Françoise exits the office, her wireless LAN session stays open periodically polling for later pickup.

[Turn off the WLAN.]

SCENE 2

Setting: Limousine en route to airport.

Announcer: Scene opens with Françoise entering the limousine with assistance from Hans. As she settles in, Françoise's phone beeps indicating an SMS message. She sees that her plane is delayed for 90 minutes. She quickly dials Derek

Françoise: Hi guys, I'm back.

Derek & Ahmed: [in unison] Hi, Françoise!

F: My plane is delayed an hour and a half. Well, that should at least give me plenty of time to incorporate the changes into our final bid. Let me update the scenario in our projection model. I checked the latest oil futures and would estimate that if we can get him to deliver for $30 a barrel, we should be able to undercut any other bidder.

A: That should be no problem. I will video with him right away to confirm that.

F: Great! It looks like we will have to make some revisions to our bid to include an extra holding tank, but that should be it. Oh, and Ahmed, can you send me any information about your young sheik's family history in the business?

A: Sure, I'll email the Website to you right away.

D: Okay, that all sounds good. Go for it! Ahmed, please confirm the agreement and let Françoise know so she can release the revised bid to the print shop in Istanbul. Françoise, good luck and I will see you in Istanbul tomorrow. Oh, and by the way, plan to stay in Istanbul for another day. I think we will need that to start planning out our next steps for implementation.

F & A: Will do! Bye!

Announcer: Françoise terminates her call and connects the phone in to her laptop. She picks up her network connection and goes to the site Ahmed had mentioned. Just as she finishes, she sees that the limousine has arrived at the airport. She closes her notebook.

[Francoise emerges from the limousine and enters the airport. Turn on the WLAN.]

SCENE 3

Setting: At the Airport, near the Executive Lounge.

Announcer: As she arrives at the airport, Françoise electronically checks in for her flight on the iPAQ. While she is connected with the airline, she also checks her alternate flight options. Just as she finishes, her phone rings.

Françoise: Hello? … Oh, hi Ahmed. What have you been able to confirm with our new supplier? … $2/barrel less than OPEC? Great! And he was willing to come down to $30/barrel? … Super! I'll roll that in to the model. Good job! … See you tomorrow!

Announcer: Françoise continues on to the Executive Lounge where she sets up her laptop on their wireless LAN.

[There is a traveller in the lounge drinking coffee. The traveller discretely leaves after a few minutes.]

Announcer: She enters Excel and manipulates the spreadsheet, then picks up her NetMeeting session with Derek to discuss the changes to the proposal.

F: Hi Derek! If you'll go to the report page, you can see the changes I want to make. [F brings up her access screen and points to her parameter changes.]

D: Yes, I can see that right now.

F: Ahmed called and confirmed our numbers. I have incorporated some background material on our young sheik. His family ties may end up helping us through this as well.

D: It all looks great! It is exciting to see all of our hard work coming together like this. I'll see you in Istanbul tonight.

F: Okay! [Françoise then connects to Bridget. While this is happening, Peter enters the lounge and pulls out his PDA and starts working on it.] Hi Bridget.

B: Hello Francoise

F: I have the last minute changes to the presentation for tomorrow. I am sending you the spreadsheet with the modifications. Do you see it yet?

Bridget Yes, I have it.

F: Great. Do you see the formula changes in cell J22? That whole table needs to link in to a new PowerPoint page just before the financials.

B: Okay. That should be pretty straightforward. Are you going to want to highlight that on your summary page?

F: You're right! We need to put that point in neon lights. Let's see, why don't we make it the last point of the summary for drama?

B: Sounds good. By the way, your itinerary should have updated itself now to show we were able to upgrade to a wirelessly connected limousine in Istanbul. [Françoise checks her GPRS phone to see the new itinerary.] I will send the driver to pick up the materials at the print shop just before your flight lands so you should have it in hand when you arrive.

F: Great! That should give Derek and I a chance to do a final walkthrough en route.

[Her iPAQ beeps with the announcement of her flight.] Oh, they just announced my flight. Thanks, Bridget, for stepping in to get this finished for me. See you when I get back!

Appendix B: Generalizing the Scenario

Introduction

This Business Scenario relates specifically to the use of mobile computing to support Executives. There are however many other people who benefit from using mobile computing. It should be possible to generalize this Scenario to create a generic Mobility Business Scenario. This appendix is a starting point for such generalization. It considers each of the sections of the Scenario in turn.

Business Scenario Problem Description

This section needs to be completely re-written for a general Scenario.

Detailed Objectives

The following additional material arises from the Berlin presentations or was developed at the Workshop. There is a reasonable chance that by including this we will have captured the most important objectives for the general case.

Improve Quality of Enterprise Information

There are additional considerations for this objective.

> Healthcare provides good examples of this, and the improvement in quality of hospitals' patient information results in improvements to quality of life of people being treated, and in some cases it saves lives. E911 provides a related benefit to the emergency services, giving them information about the location of people in emergency situations. In commercial organizations, better information results in improved efficiency and higher profitability.

Improve Effectiveness of Field Operations

This is an additional objective for the general Scenario.

> Field operations, for example those carried out by the military or the construction industry, generally take place in situations where there are no fixed communications networks. Mobile communications can provide communications support for those operations when it is not possible to install fixed communications. Even where it is possible to install fixed communications, using mobile communications saves time, as there is no need to wait for installation. Where the need for communications is only temporary, as is the case on a construction site, for example, using mobile communications may be more cost-effective than installing a fixed network.

Views of Environment and Processes

Business Environment

The Environment is much wider for the general Scenario.

> Mobile computing and communications are now used by many people. The mobile telephone is an everyday item in the home and school, as well as in the office.

Special-purpose mobile terminals are often used for remote data entry by people such as delivery van drivers and warehouse staff.

As an indication of the size of the mobile computing market, BITKOM reports that the expected number of mobile business users in Europe by the end of 2001 is 24 Million, representing a turnover of over $5 Billion. They predict growth rates of 200% per year, leading to a turnover of over $40 Billion by 2005.

Uses of Mobile Computing

There are many uses of mobile computing other than by Executives. The following are examples.

Utilities

While on site, electricity, water, etc. company employees need information about building plans, wiring plans, and so on. They may want to bill a householder who is moving home immediately.

Financial Sector

Insurance agents visiting clients want to be able to issue quotes on the spot but, for security reasons, their companies can not let them take with them all the base information that they need.

Healthcare

Doctors and nurses both inside and outside hospitals need ready access to patient records, and the accuracy of record keeping is dramatically improved when they can enter details from the bedside. This not only speeds things up but also reduces mistakes – which can mean saving lives.

Logistics and Trucking

There are big efficiency gains when drivers can enter journey and delivery details while on the road.

Police

The effectiveness of the police force is improved when police officers can access details of criminals, vehicles, stolen property, etc., wherever they are. By producing insurance reports at the scene of the crime, they can give better service to the community.

Manufacturing, Maintenance and Field Service

Giving operatives access to product information, wherever they are, improves productivity and effectiveness. When a serious problem arises, maintenance and field service operatives may need to be contacted wherever they are. This applies to people working within an enterprise campus, as well as to people working outside the enterprise.

Construction

Mobile communications allow computing facilities to be established on-site instantly, and removed painlessly at the end of a project. They also enable project tracking information to be entered on-site, giving a major improvement in speed and quality of project decision making.

Emergency Services and Military

These people often need communications facilities, and sometimes need computing facilities, in places where there are no fixed networks.

E911

A specific use of mobile computing by the emergency services is to find where people needing help are located, by tracing their use of mobile communications. In the USA, this facility is known as E911, and the ability to support it is set to become a requirement for mobile communications equipment.

Space Exploration

The space station includes a wireless LAN.

Business Drivers

The following additional business drivers apply to the general Scenario.

Improved Service Delivery

People with instant access to information can serve customers better.

Shorter Project Times

Avoiding the need to set up networks can enable projects to be completed more quickly.

Cost Reduction

Avoiding the need to set up permanent networks for short-term operations can reduce costs. But this applies only in some circumstances; mobile communications are not generally cheaper to run than fixed networks.

Policies

No further considerations regarding policies are immediately apparent for the general Scenario.

Business Processes

Business and other processes involved in general uses of mobile computing include:

- Banking;
- Billing;
- Building construction;
- Building services maintenance;
- Criminal investigation;
- Delivery;
- Exploration;
- Field service;
- Firefighting;
- Goods transportation;
- Government administration;
- Humanitarian aid provision;
- Maintenance;
- Manufacturing;
- Medical treatment;
- Military operations;
- Rescue; and
- Stocktaking.

Technical Environment

It is likely that the Executive on the Move Scenario exposes the complete technical environment. This should however be validated.

Technical Processes

Again, subject to validation, the list of technical processes looks pretty complete for the general case.

Use and Value of Core Activities

In the general Scenario, it will be useful to have a section showing how the importance of the core activities varies in different uses. The following is a starting point for such a section.

Different core activities have greater or lesser value in different situations. In the petroleum refinery contract example, the greatest value is delivered by enabling an effective decision to be reached quickly. Conferencing and information access were the most important activities for this.

It is characteristic of Executives that they participate actively in decision-making. Maximizing availability for decision-making will generally be the most important objective where Executives are concerned. A good Executive can manage his or her time effectively so that time spent traveling is not wasted, by reading reports on a plane journey, for example. But if that Executive is needed for an important decision, no time-management can compensate for his or her non-availability.

For other people, other activities are more important. Delivery drivers, for example, rarely participate in decision-making, but can contribute to the effectiveness of their companies by efficient processing of delivery records. Improved quality of enterprise information is the most important objective where they are concerned, and information update is the vital core activity.

Voice conversation is far and away the most common core activity. The mobile telephone is the most widely used mobile device. Voice communication enables, to some extent, all of the uses described in the *Uses of Mobile Computing* section of this Business Scenario. However, lack of computer connectivity limits its value where access to data is required. (It is always possible to ask someone back in the office to enter or look up data for you; this is clearly less satisfactory than doing it directly yourself.)

After voice conversation, E-mail and 1-way SMS alerts are the most used core activities. They allow limited integration of data with other applications, which on the one hand makes them easier to deploy, but on the other hand limits their value. For many people that do not need on-line access to information, messaging is the only data activity they will ever need.

Actors and their Roles and Responsibilities

This section is very general. It could be used in a general mobility Scenario, with the substitution of “user” for “executive”.

Requirements

Additional requirements are likely to appear in a general Scenario, and some of the requirements identified in this Scenario may assume a lesser importance in general.

A specific additional requirement discussed during the workshop is the location of mobile users for emergency services - E911.

Appendix C: Use of Directories in the Petroleum Refinery Contract Example

XYZ, Inc Enterprise directory – Scene 1

Email

The directory for email depends on the email application being used. In the case of Exchange, the GAL is the email directory for the enterprise. If it is notes, there is another email directory. In the case of VOIP, we are using the Boeing Look Up Everything System (BLUES), based on an LDAP directory, as the corporate directory for telephony numbers.

Collaboration (Netmeeting)

The directory for Netmeeting uses an IIS directory to indicate who is available over the network using Netmeeting. This is now the third directory that is being used in the connectivity method.

On Hold

The directory for telephony is a different one than used previously if the Netmeeting VOIP or Video OVER IP being used with Netmeeting. The directory for telephony, unless it is VOIP, will be accessible only through the operator or through a Web lookup (if that is available from the telephony company).

Separate window

Patching in Derek

Derek is looked up in the Netmeeting IIS directory.

Voice

The directory for voice depends on the voice systems being used. An analog voice system uses a proprietary directory of system users who have allowed their names to be entered in the directory. The directory may be on the Web and available to someone who is using the voice system in addition to the Web. If the directory for voice is on a VOIP network, then the directory can be any directory that is accessible over the Internet.

Video

The directory for Video over IP depends on the video over IP application being used. In the case of the video part of Netmeeting, the video stream carries carries video and a separate VOIP stream is used to carry the voice to the other side of the Netmeeting session and uses the IIS directory that is native for the Netmeeting application.

Security

The directory for Netmeeting may include the criteria for an encrypted or secure session when discussing sensitive information that one may not want to disclose over the Internet.

Competitive advantage

The directory for email and collaboration may need to be invoked to gain productivity advantages that allow for information to be available easily and quickly.

Encryption

The information about what the encryption method is can be stored in the directory or selected by the product to apply to the application.

GPRS phone beeping (E.164 addressing)

The directory for GPRS can be either E.164 or any IP address directory.

Alert showing rise in oil futures price rising

The mobile network database of latest location or their directory infrastructure is used to send an alert to the GPRS customer. As the mobile telephony user moves around, there is the need to

follow the user and deliver the latest location through the Home Location Registry. As the mobile data user moves around, there is the need to follow the user through a cache or directory as they move around to deliver location in the WLAN or the MAN.

Francoise exits

Shut off the laptop, but not disconnected, and leaves the netmeeting

The information for disconnects in the sessions management realm is maintained by the server and delivered to the end user when they become reconnected to the network. This information could be stored in a cache or directory.

Moves to phone in the limo

The GPRS connection used in the limo for access to the Web page on the iPAQ or notebook is accessing a Home Location Registry (HLR) and/or a DNS/DDNS in accessing the desired Web site.

Phone beeping SMS in the limo with information about her plane being delayed

The directory for SMS is part of the GSM network and the HLR is used to locate the device.

Calls Derek back via voice

The voice directory is essentially using the HLR in order to locate the telephone.

Connects over GPRS to find the latest oil futures prices

The GPRS connection used in the limo for access to the Web page on the iPAQ or notebook is accessing a Home Location Registry (HLR) and/or a DNS/DDNS in accessing the desired Web site.

Francoise enters the airport

WLAN (PC-Card) inserted in notebook

DDNS is the directory for associating IP addresses with MAC addresses on the Internet.

Uses iPAQ (with PC-Card) to check on her flight

DDNS is the directory for associating IP addresses with MAC addresses on the Internet.

Francoise in the airline lounge

Uses laptop on WLAN in the executive lounge

DDNS is the directory for associating IP addresses with MAC addresses on the Internet.

Opens netmeeting and connects into the teleconference at

DDNS is the directory for associating IP addresses with MAC addresses on the Internet. It also uses the IIS directory for connecting the Netmeeting sessions together.

Uses Excel spreadsheet and shares it over Netmeeting

Bridget sees the changes required

Formula changes in cell J22

GPRS for new schedule

DDNS is the directory for associating IP addresses with MAC addresses on the Internet and the telecomm directory makes the E.164 connection to the cellular device. The HLR system makes the connection to the location of the device.

The Ipaq beeps announcing flight

Appendix D: Business Scenarios

The following detailed description is taken from Part IV of The Open Group Architectural Framework (TOGAF) - http://www.opengroup.org/public/arch/. This publicly available document describes an open framework and method for IT architecture, which includes Business Scenarios as a method for articulating the business and technical requirements that architecture work is to address.

Introduction

A key factor in the success of any IT architecture is the extent to which it is linked to business requirements, and demonstrably supporting and enabling the enterprise to achieve its business objectives.

Business scenarios are an important technique that may be used prior to, and as a key input to, the development of the architecture, to derive the necessary characteristics of the Technical Architecture directly from the high-level requirements of the business. They are used to help identify and understand business needs, and thereby to derive the business requirements that the architecture development has to address.

A Business Scenario describes:

- a business process, application, or set of applications, that can be enabled by the architecture
- the business and technology environment
- the people and computing components (called "actors") who execute the scenario
- the desired outcome of proper execution

A good Business Scenario is representative of a significant business need or problem, and enables vendors to understand the value to the customer organization of a developed solution.

A good Business Scenario is also "SMART":

- **S**pecific, by defining what needs to be done in the business
- **M**easurable, through clear metrics for success
- **A**ctionable, by clearly segmenting the problem, and providing the basis for determining elements and plans for the solution
- **R**ealistic, in that the problem can be solved within the bounds of physical reality, time and cost constraints
- **T**ime-bound, in that there is a clear statement of when the solution opportunity expires

Benefits of Business Scenarios

A business scenario is essentially a complete description of a business problem, both in business and in architectural terms, which enables individual requirements to be viewed

in relation to one another in the context of the overall problem. Without such a complete description to serve as context:

- There is a danger of the architecture being based on an incomplete set of requirements that do not add up to a whole problem description, and that can therefore misguide architecture work.
- The business value of solving the problem is unclear
- The relevance of potential solutions is unclear

Also, because the technique requires the involvement of business line management and other stakeholders at an early stage in the architecture project, it also plays an important role in gaining the buy-in of these key personnel to the overall project and its end-product - the IT architecture.

An additional advantage of business scenarios is in communication with vendors. Most architectures nowadays are implemented by making maximum use of commercial off-the-shelf software (COTS) solutions, often from multiple vendors, procured in the open market. The use of business scenarios by an IT customer can be an important aid to IT vendors in delivering appropriate solutions. Vendors need to ensure that their solution components add value to an open solution and are marketable. Business scenarios provide a language with which the vendor community can link customer problems and technical solutions. Besides making obvious what is needed, and why, they allow vendors to solve problems optimally, using open standards and leveraging each other's skills.

Creating the Business Scenario

Creating a business scenario is a 7-step process, as illustrated in Figure D-1.

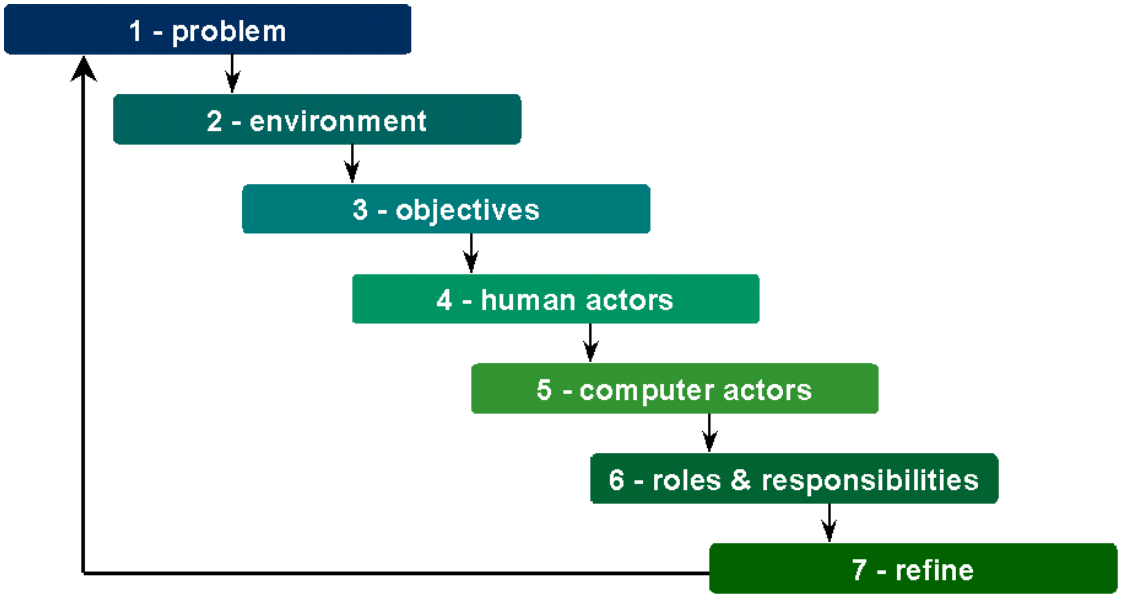

Figure D-1: Business Scenario 7-Step Process

1 - Identify, document and rank the problem driving the scenario

2 - Identify the business and technical environment of the scenario and document it in scenario models

3 - Identify and document desired objectives (the results of handling the problems successfully) - get "SMART"

4 - Identify the human actors (participants) and their place in business model

5 - Identify computer actors (computing elements) and their place in technology model

6 - Identify and document roles, responsibilities and measures of success per actor; document the required scripts per actor, and the results of handling the situation

7 - Check for "fitness for purpose" and refine only if necessary.

Contents of a Business Scenario

The documentation of a Business Scenario should contain all the important details about the scenario. It should capture, and sequence, the critical steps and interactions between actors that address the situation. It should also declare all the relevant information about all actors, specifically: the different responsibilities of the actors; the key pre-conditions that have to be met prior to proper system functionality; and the technical requirements for the service to be of acceptable quality.

There are two main types of content: graphics (models), and descriptive text. Both have a part to play.

Business Scenario models capture business and technology views in a graphical form, to aid comprehension. Specifically, they relate Actors and interactions, and give a starting point to confirm specific requirements.

Business Scenario descriptions capture details in a textual form. A typical contents list for a business scenario is given below.

Table of Contents

Contributions to the Business Scenario

It is important to realize that the creation of a business scenario is not solely the province of the Architect. As mentioned previously, business line management and other stakeholders in the enterprise are involved, to ensure that the business goals are accurately captured. In addition, depending on the relationship that an organization has with its IT vendors, the latter also may be involved, to ensure that the roles of technical solutions are also accurately captured, and to ensure communication with the vendors.

Typically, the involvement of the business management is greatest in the early stages, while the business problems are being explored and captured, while the involvement of the architect is greatest in the later stages, when architectural solutions are being described. Similarly, if vendors are involved in the business scenario process, the involvement of the customer side (business management plus enterprise architects) is greatest in the early stages, while that of the vendors is greatest in the later stages, when the role of specific technical solutions is being explored and captured. This concept is illustrated in Figure D-2.

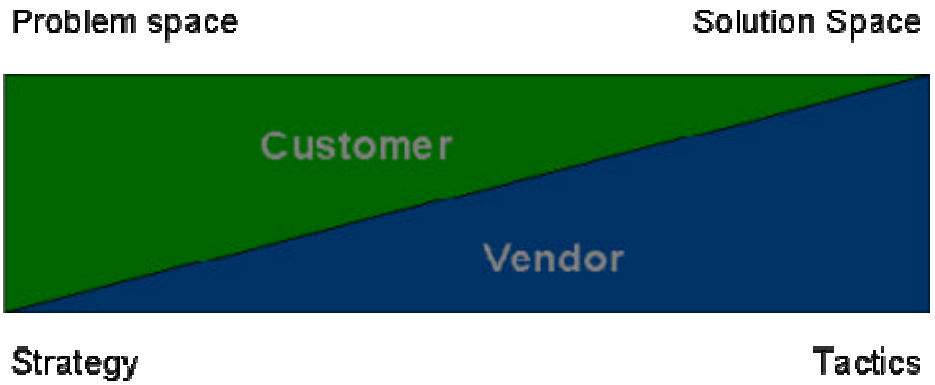

Figure D-2: Relative Contributions to a Business Scenario

Business Scenarios and the TOGAF Architecture Development Method

Business Scenarios figure most prominently in the initial phase of the Architecture Development Method (ADM), Initiation and Framework, when they are used to define relevant business requirements, and to build consensus with business management and other stakeholders.

However, the business requirements are referred to throughout all phases of the ADM life cycle, as illustrated in Figure D-3.

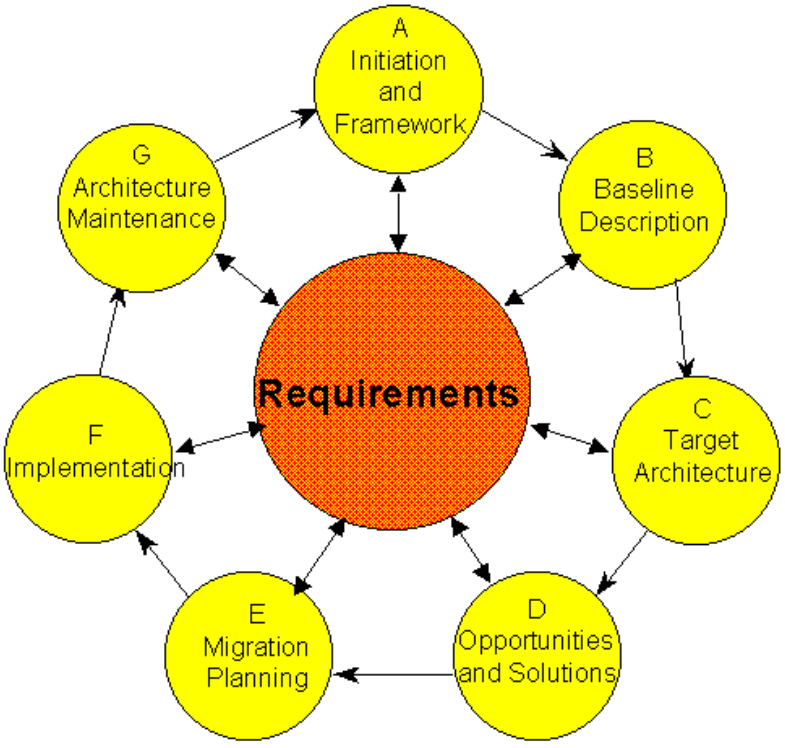

Figure D-3: Relevance of Requirements Throughout the TOGAF Architecture Development Method

Because business requirements are important throughout all phases of the ADM life cycle, the Business Scenario method has an important role to play in the TOGAF ADM, by ensuring that the business requirements themselves are complete and correct.

Guidelines on Developing Business Scenarios

Questions to Ask at Each Step

Step 1: Identify, document and rank the problem

Is the problem described as a statement of WHAT needs to be accomplished, like steps in a process, and not HOW (with technology "push")?

If the problem is too specific or a “how”:

- raise a red flag
- ask "why do you need to do it that way?" questions

If the problem is too vague or unactionable:

- raise a red flag
- ask "what is it you need to do?" questions

Step 2: Identify the business and technical environment, and document in models

Questions to ask about the business environment:

- the steps that need to be processed?
- location/scale of internal business departments?
- location/scale of external risk sharing partners?
- any specific business rules and regulations related to the situation?

Questions to ask about the current technology environment:

- what components are already presupposed to be used?
- are there any technology constraints?
- are there any technology principles that apply?

Step 3: Identify and document objectives

Is the "what" sufficiently backed up with the rationale for "why"? If not, ask for measurable rationale:

- return on investment
- scalability
- performance needs
- compliance to standards
- ease of use measures

Step 4: Identify human actors and their place in business model

An actor represents anything that interacts with or within the system. This can be a human, or a machine, or a computer program.

Actors initiate activity with the system, e.g.:

- computer user with the computer
- phone user with the telephone
- payroll clerk with the Payroll System
- internet subscriber with the web browser

An actor represents a role that a user plays: i.e., a user is someone playing a role while using the system (e.g., John (user) is a dispatcher (actor)).

Each actor uses the system in different ways (otherwise they should be the same actor).

Ask about the humans that will be involved, from different view points, such as:

- developer
- maintainer
- operator
- administrator
- user

Step 5: Identify computer actors and their place in technology model

Ask about the computer components likely to be involved, again from different points of view. What must they do?

Step 6: Document roles, responsibilities, measures of success, required scripts

When defining roles, ask questions like:

what are the main tasks of the actor?

will the actor have to read/write/change any information?

will the actor have to inform the system about outside changes?

does the actor wish to be informed about unexpected changes?

Step 7: Check for "fitness for purpose", refine if necessary

Is there enough information to identify who/what could fulfill the requirement? If not, probe more deeply.

Is there a description of when, and how often, the requirement needs to be addressed? If not, ask about timing.

Guidelines on Business Scenario Documentation

Textual documentation:

- Capture all the important details about a Business Scenario:
    - situation description and rationale

    - all measurements
    - all actor roles and sub-measurements
    - all services required
- Capture the critical steps between actors that address the situation, and sequence the interactions
- Declare relevant information about all actors
    - partition the responsibility of the actors
    - list pre-conditions that have to be met prior to proper system functionality
    - provide technical requirements for the service to be of acceptable quality

Business Scenario Models:

- Remember the purpose of using models:
    - capture business and technology views in a graphical form
    - help comprehension
    - give a starting point to confirm requirements
    - relate actors and interactions
- Keep drawings clear and neat
    - Do not put too much into one diagram
    - Simpler diagrams are easier to understand
- Number diagrams for easy reference
    - Maintain a catalog of the numbers to avoid duplicates

General Guidelines

The stakeholders (e.g., business managers, end-users) will tell you what they want, but as an architect you must still gain an understanding of the business, so you must know the most important actors of the system.

If the stakeholders do not know what they want:

- Take time, observe and record how they are working today
- Structure information in such a way that it can be used later
- Uncover critical business rules from domain experts
- Stay focused on the "what", not the "how"

This effort provides the anchor for a chain of reason from business requirements to technical solutions. It will pay off later to be diligent and critical at the start.

Finally, it is important to remember that Business Scenarios are just a tool, not the objective. They are a part of, and enable, the larger process of architecture development, and the architect should use them, but not get lost it them. The key is to stay focused - watch out for "feature creep", and address the most important issues that tend to return the greatest value.

Appendix E: Glossary of Abbreviations

DIF	Directory Interoperability Forum
DSL	Digital Subscriber Link
DNS	Domain Name Service
IP	The Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
LAN	Local Area Network
MMF	Mobile Management Forum
PC	Personal Computer
PDA	Personal Digital Assistant
PSTN	Public Switched Telephone Network
RDBMS	Relational Data Base Management System
SLA	Service Level Agreement
VPN	Virtual Private Network
WEP	Wireless Equipment Privacy