

Mobile, Wireless, and Pervasive Computing

Management Information



- Code: 164292-02
- Course: Management Information
- Period: Autumn 2013
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01. Mobile Computing

- Mobile Computing
 - In the traditional computing environment it was necessary to come to the computer to do some work on it.
 - All computers were connected to each other, to networks, servers, etc. via wires.



<http://www.stepanoff.org>

01. Mobile Computing

- History of Mobile Computing
 - 1st: The first phase was to make computers small enough so they can be easily carried - Mobile devices.
 - 2nd: The second solution to the need for mobile computing was to replace wires with wireless communication media.
 - 3rd: The third phase was a combination of the first two, namely to use mobile devices in a wireless environment.
 - Referred to as wireless mobile computing, this combination enables real-time connections between mobile devices and other computing environments.



FR6000

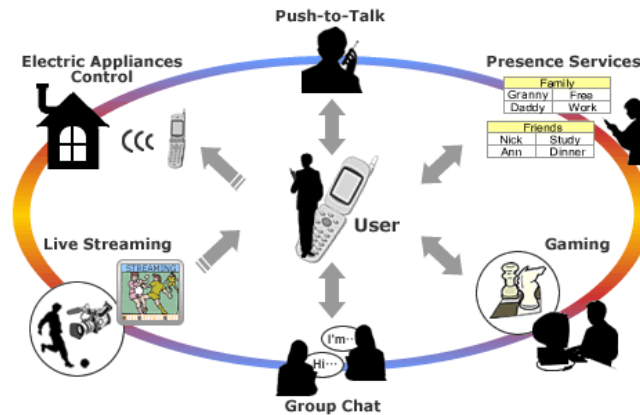


FR68

<http://aidanmitchell.blogspot.com>

01. Mobile Computing

- Ubiquitous Computing
 - Computing anytime anywhere
 - Constant connectivity



<http://www.imagelobster.com>

01. Mobile Computing

- Basic Terminology
 - Short message service (SMS)
 - A technology, in existence since 1991, that allows sending short text messages.
 - Enhanced messaging service (EMS)
 - An extension of SMS that is capable of simple animation, tiny pictures, and short melodies.
 - Multimedia messaging service (MMS)
 - The next generation of wireless messaging, this technology will be able to deliver rich media
 - Personal digital assistant (PDA)
 - A small portable computer, such as Palm handhelds and Pocket PC devices.



<http://www.lawyersweekly.ca>

01. Mobile Computing

- Basic Terminology
 - Wireless application protocol (WAP)
 - A technology that offers Internet browsing from wireless devices.
 - Smartphones
 - Internet-enabled cell phones that can support mobile applications.
 - Wireless fidelity (Wi-Fi)
 - Refers to a standard 802.11b which most of the wireless local area networks are based on.
 - Global positioning system (GPS)
 - A satellite based tracking system that enables the determination of a GPS device's location.
 - WLAN
 - Wireless local area network



<http://babylucuna.blogspot.co>

01. Mobile Computing

- Mobile Computing Characteristics
 - Mobile computing has two major characteristics that differentiate it from other forms of computing: mobility and broad reach.
 - Mobility
 - Mobility implies portability based on the fact that users carry a mobile device everywhere they go.
 - Therefore, users can initiate real-time contact with other systems from wherever they happen to be.
 - Broad reach:
 - Broad reach is the characteristic that describes the accessibility of people.
 - They can be reached at any time.



<http://www.itworldcanada.com>

01. Mobile Computing

- Mobile Computing Attributes
 - Ubiquity
 - Ubiquity refers to the attribute of being available at any location at any given time.
 - A mobile terminal in the form of a smartphone or a PDA offers ubiquity.
 - Convenience
 - It is very convenient for users to operate in the wireless environment.
 - All they need is an Internet enabled mobile device such as a smartphone.

● **유비쿼터스 세상**

냉장고가 식음료 알아서 주문

쇼핑 후 계산대 센서를 지나가면 하인 자동 계산.

관련 산업 : RFID, USN(Ubiquitous Sensor Network)

휴대전화기로 TV드라마 공짜 시청

불필요한 광고 없애고 골프 통계 시청 못하는 방송만 공짜 시청.

관련 산업 : DMB(Digital Multimedia Broadcasting), VOD(Video On Demand)

MP3 재킷 입고 걸으면서 음악감상

꼭입이 PC에 연결 통해 뉴스 검색.

관련 산업 : 있는 MP3플레이어, 있는 PC.

손목시계로 골프장 날씨 즉시 검색

휴대나 손에 달할 크기 피스널 서버 컴퓨터로 수시로 검색.

관련 산업 : 웨치콘, 스마트 워치, 피스널 서버

2030년쯤 인간두뇌능력 지닌 PC를 1000달러에 구입

2011년쯤 초고속인터넷 지금보다 50배나 빨라짐.

두루마리 디스플레이로 신문 구독

지하철 : 버스에서 인터넷 접속.

관련 산업 : 디제이퍼(De-paper), 이잉크(Ink), 휴대인터넷(WiBro)

집에서 1000만원짜리 MBA 수강

책가방 없이 들고, 기성 TV를 통해 해외 유명 MBA교장 수강, 휴대 전화에 강의 듣고 다니면서 공부.

관련 산업 : 이러닝(e-learning) 멀티닝(m-learning)

시청 중인 TV드라마 속 미녀 스타 핸드백 구입

TV보며 쇼핑하고, 국회의원 투표 참여, 목실 가운을 통해 뉴스 검색.

관련 산업 : 양방향TV, 홈 네트워크, 지능형 로봇, 음성인식기술

자동차 알아버리면 인공지능이 자동주행

원하는 곳까지 자동 운전.

관련 산업 : 텔레매틱스, 위치기반 서비스(LBS)

<http://www.chosun.com>

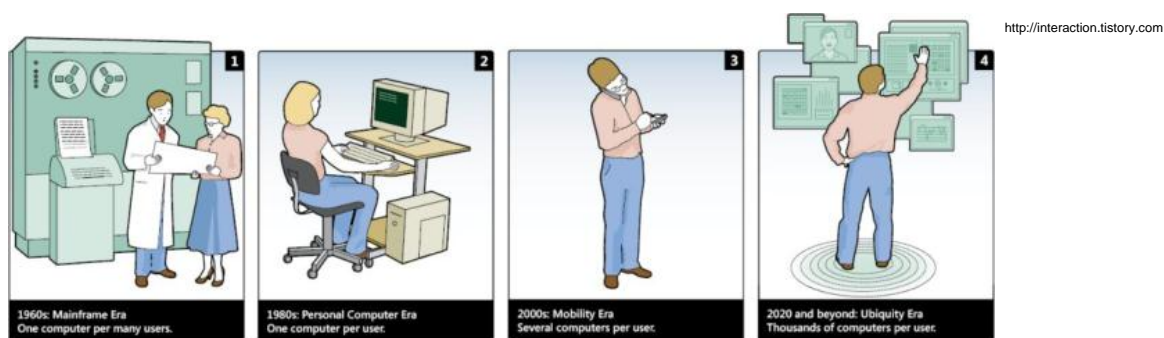
01. Mobile Computing

- Mobile Computing Attributes
 - Instant connectivity
 - Mobile devices enable users to connect easily and quickly to the Internet, intranets, other mobile devices and databases.
 - Personalization
 - Personalization refers to customizing the information for individual consumers.
 - Localization of products and services
 - Knowing the users physically location at any particular moment is key to offering relevant products and services.



01. Mobile Computing

- Mobile Computing Drivers
 - The development of mobile computing and m-commerce is being driven by number of factors.
 - Widespread availability of mobile devices
 - The number of cell phones exceeds 1.3 billion
 - No need for a PC
 - The Internet can be accessed via smartphone or other Internet-enabled wireless devices.
 - The handset culture
 - The widespread use of cell phones



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01. Mobile Computing

- Mobile Computing Drivers
 - Vendors are pushing m-commerce
 - Both mobile communication network operators and manufacturers of mobile devices.
 - Declining prices and increased functionalities.
 - Improvement of bandwidth
 - To properly conduct m-commerce, it is necessary to have sufficient bandwidth.
 - 3G (third-generation) technology provides the necessary bandwidth, at a data rate of up to 2 Mbps.



<http://hunscher.typepad.com>

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02. Mobile Commerce

- Mobile Commerce
 - M-commerce and m-business is any e-commerce or e-business activities performed in a wireless environment. It is not merely a variation on existing Internet services; it is a natural extension of e-business creating new opportunities.

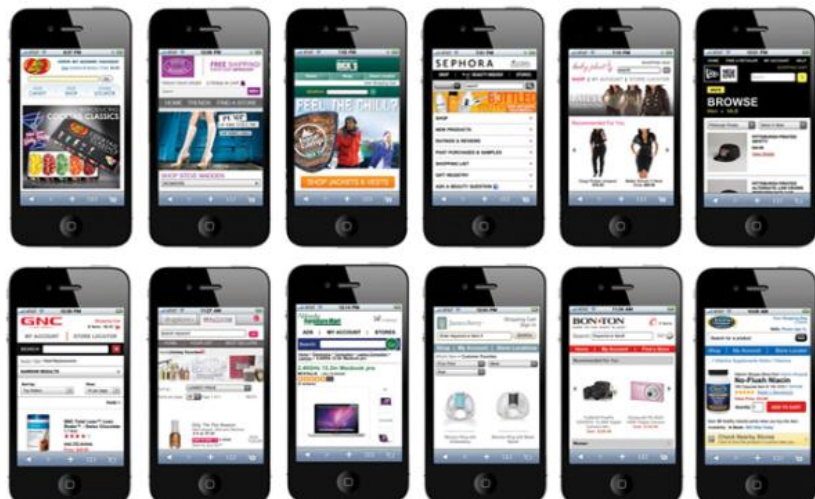


<http://www.tronshow.org>

Designed by Ken Sakamura

02. Mobile Commerce

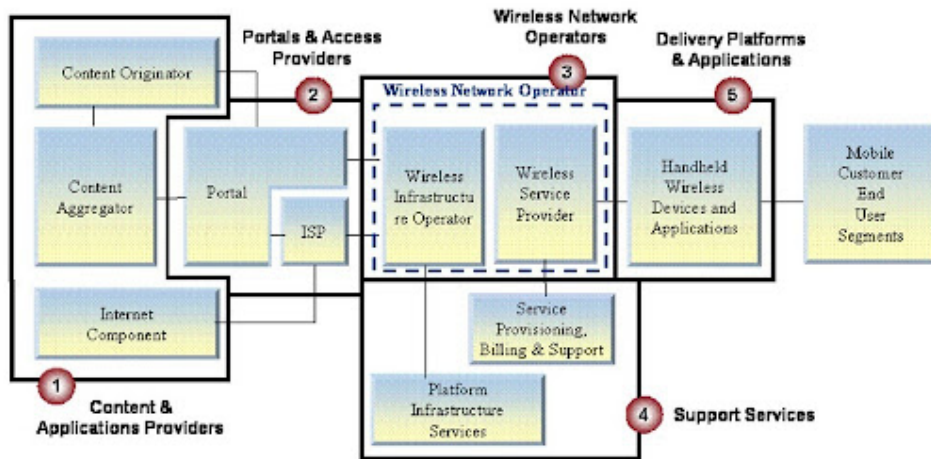
- Mobile Commerce Typical Applications include:
 - Financial applications
 - Inventory management
 - Field Service management
 - Product locating
 - Real Estate



<http://www.brandingbrand.com>

03. M-Commerce Value Chain

- M-Commerce Value Chain
 - M-commerce is a complex process involving a number of operations and entities (customers, merchants, mobile operators, etc.).
 - The key elements in the m-commerce value chain (for delivering content and applications to end users)



<http://what-when-how.com>

03. M-Commerce Value Chain

- M-Commerce Value Chain



<http://www.internetretailer.com>

Link	Function	Provider
Transport	Maintenance and operation of the infrastructure supporting data communication between mobile users and application providers	Technology platform vendors
Enabling services	Server hosting, data backup, and system integration	Infrastructure equipment vendors
Transaction support	Mechanisms for assisting with transactions, security, and billing	Application platform vendor
Presentation services	Conversion of content of Internet-based applications to applications suitable for mobile devices	Application developer
Personalization support	Gathering of users' preferences, information, and devices in order to provide individualized applications	Content developer
User applications	General and specialized applications for mobile users	Mobile service provider
Content aggregators	Design and operation of portals that offer categorized information and search facilities	Mobile portal provider

04. Mobile Computing Infrastructure

- Hardware Infrastructure
 - To conduct m-commerce, one needs devices for data entry and access to the Internet, applications, and other equipment.
 - Personal digital assistants (PDAs) with Internet access are now available.
 - There are many other devices that support wireless operations.



04. Mobile Computing Infrastructure

- Hardware Infrastructure Types
 - Cellular phones
 - Cell phones that are Internet-enabled phones, also known as smartphones.
 - Attachable keyboard
 - A larger keyboard attachment.
 - Interactive pagers
 - Two-way pagers with limited mobile computing and m-commerce activities on the Internet.



04. Mobile Computing Infrastructure

- Hardware Infrastructure Types
 - Screenphones
 - A telephone equipped with a color screen, a keyboard, e-mail service and Internet capabilities.
 - E-mail handhelds Integrated device
 - Includes a keypad, e-mail service and Internet capabilities without the need to dial into an Internet provider for access.



<http://www.afb.org>



<http://www.advancedsourcecode.com>

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04. Mobile Computing Infrastructure

- Hardware Infrastructure for Wireless Connectivity
 - M-commerce also requires the following hardware which is essential for wireless connectivity:
 - A WAN modem
 - A wireless LAN or MAN (metro-area network) adapter
 - A Web server with wireless support
 - A WAP gateway
 - A communications server
 - An application or database server
 - An enterprise application server
 - A GPS locator



<http://flatclassroom10-3a.flatclassroomproject.org>

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04. Mobile Computing Infrastructure

- Software Infrastructure
 - There is no widely accepted standard for wireless applications.
 - Therefore, software needs to be customized for each type of device.



<http://planmaster.tistory.com>

04. Mobile Computing Infrastructure

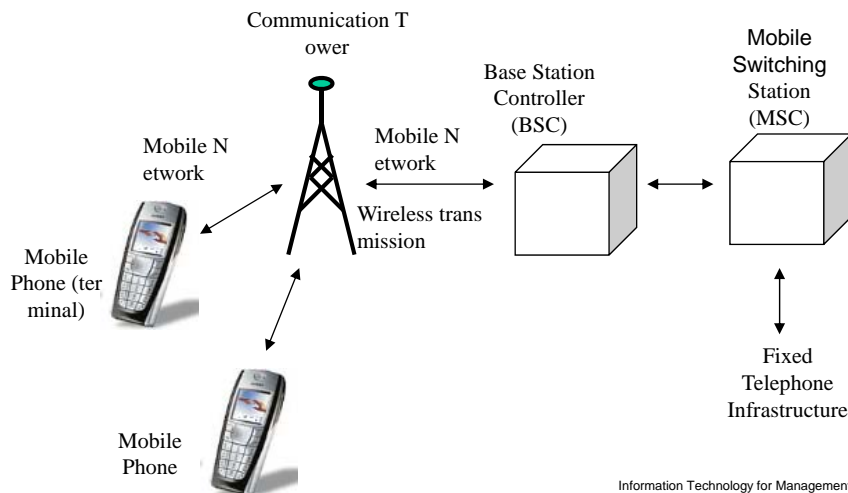
- Software Infrastructure

Software	Description
Microbrowser	A browser with limited bandwidth and memory requirements. Provides wireless access to the Internet
Operating system (OS) for mobile-client	An OS for mobile devices. Examples: Palm OS, Pocket PC, Win CE. Specialized OS's: Blackberry and Web browser.
Bluetooth (named for a Viking king)	Chip technology for short-range communication among wireless devices. See bluetooth.com .
User interface	Application logic for handheld devices.
Application middleware	Provides connecting among applications, databases, and Web-based servers.
Wireless middleware	Links wireless networks to application servers.
Wireless Application Protocol (WAP)	A set of communication protocols that enables wireless devices to "talk" to a server on a mobile network, so users can access the Internet. Specially designed for small screen. (see wapforum.org).
Wireless Markup Language	An XML-based scripting language for creating content for wireless systems.
Voice XML	An extension of XML designed to accommodate voice.

04. Mobile Computing Infrastructure

- WWAN

- At the core of most mobile computing applications are mobile networks.
- These are of two general types: the wide area and the local area.
- The wide area networks for mobile computing are known as wireless wide area networks (WWAN).



Information Technology for Management, Ed. 5, Efraim Turban et al., Wiley

04. Mobile Computing Infrastructure

- WWAN

- The success of mobile computing depends on the capabilities of the WWAN communication systems.
 - 1G:
 - The first generation of wireless technology.
 - It was an analog-based technology, in effect from 1979 to 1992.
 - 2G:
 - The second generation of digital wireless technology.
 - In existence today, 2G is based on digital radio technology and mainly accommodates text.



04. Mobile Computing Infrastructure

- WWAN
 - The success of mobile computing depends on the capabilities of the WWAN communication systems.
 - 2.5G:
 - An interim technology based on GPRS (General Packet Radio Services) and EDGE (Enhanced Data Rates for Global Evaluation) that can accommodate limited graphics.



04. Mobile Computing Infrastructure

- WWAN
 - The success of mobile computing depends on the capabilities of the WWAN communication systems.
 - 3G:
 - The third generation of digital wireless technology, which supports rich media such as video clips.
 - It started in 2001 in Japan, and reached Europe in 2002 and the United States in 2003.
 - 4G:
 - 4G will provide faster display of multimedia and is expected between 2006 and 2010.
 - The expected next generation after 3G.



04. Mobile Computing Infrastructure

- Protocol
 - Through multiplexing protocols mobile communication system providers will be able to service extremely large numbers of users.



<http://www.123rf.com>

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04. Mobile Computing Infrastructure

- Protocol
 - Three main protocols:
 - Frequency division multiple access (FDMA)
 - Used by 1G systems, this protocol gives each user a different frequency to communicate on.
 - Time division multiple access (TDMA)
 - Used with some of the more popular 2G systems, this protocol assigns different users different time slots on a given communications channel.
 - Code division multiple access (CDMA)
 - Used with most 2.5G and 3G systems, this protocol separates different users by assigning different codes to the segments of each user's communications.



<http://www.askaboutvalidation.com>

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04. Mobile Computing Infrastructure

- WLAN

- Wireless local area networks (WLAN) - another technology, has been making its way to the forefront as the market factors impeding its growth are being addressed.
- It is like a wired LAN but without the cables transmitting and receiving data over the airwaves.



<http://flatclassroom09-3.flatclassroomproject.org>

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04. Mobile Computing Infrastructure

- WLAN

- Wireless access point - a transmitter with an antenna, connected to a wired LAN that provides an Internet connection. (A wireless access point provides service to a number of users within a small geographical perimeter known as a "hot spot")
- Wireless network card incorporated with laptops, desktops, or PDAs will provide access



<http://www.endekagroup.com>

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04. Mobile Computing Infrastructure

- WLAN
 - WLAN's employ the Wi-Fi (wireless fidelity) standard developed by the IEEE
 - 802.11b Speeds up to 11Mbps
 - 802.11a and 802.11g Speeds up to 54 Mbps
 - Wireless Encryption Protocol (WEP) a built-in security system in Wi-Fi encrypts the communications between a client machine and a wireless access point.



<http://www.digitalnerds.net>

05. Mobile Computing Services

- Financial Services
 - Financial Services have the potential to turn a mobile device into a business tool, replacing banks, ATMs, and credit cards by allowing a user to conduct financial transactions any time and from anywhere.



<http://www.nvsoft.com>

05. Mobile Computing Services

- Financial Services
 - Mobile financial applications include:
 - Banking: offer mobile access to financial and account information.
 - Wireless payments: provides mobile phones with a secure purchasing tools capable of instantly authorizing payments
 - Micropayments: electronic payments for small-purchase amounts (generally less than \$10)
 - Wireless wallets: Software (e-wallet) that stores an online shopper's credit card numbers and other personal information.
 - Bill payment services: Paying bills directly from a mobile device
 - Brokerage services: stock trades and quotes
 - Money transfers: from one account to another



<http://topnews.net.nz>

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05. Mobile Computing Services

- Shopping
 - Shopping from wireless devices enables customers to perform quick searches, compare prices, use a shopping cart, order, and view the status of their order using their mobile wireless devices.



<http://www.cjem-online.com>

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05. Mobile Computing Services

- Shopping
 - Some shopping applications include:
 - Restaurant chains enabling consumers to place an order for pick up or delivery virtually any time, anywhere.
 - eBay offers “anywhere wireless” services as does Amazon.com.
 - Purchasing movie tickets by wireless device



<http://www.interactiveme.com>

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05. Mobile Computing Services

- Advertising
 - Knowing the current location of mobile users (using GPS) and their preferences or surfing habits, marketers can send user-specific advertising messages to wireless devices.
 - All when a potential buyer is within close proximity.
 - The most promising avenues of success for wireless advertising will incorporate it with other advertising media, Web sites or physical locations.



<http://www.akeywordsearchengine.com>

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05. Mobile Computing Services

- Advertising
 - This location-sensitive advertising, will informing a user about:
 - Sales at a specific shop or mall
 - Today's specials at a restaurant
 - Loyalty programs
 - and much more



<http://www.onlinemarketingdenver.net>

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05. Mobile Computing Services

- Mobile Portals
 - These are customer channels, optimized for mobility, that aggregates and provides content and services to mobile users.



<http://www.one.mk>

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05. Mobile Computing Services

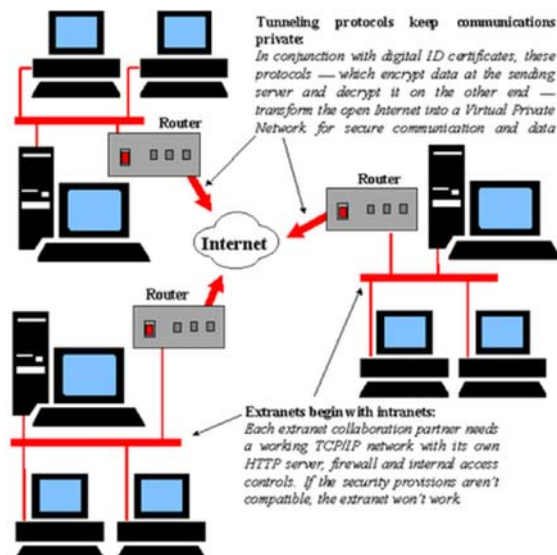
- Mobile Portals
 - The services provided by mobile portals include:
 - News
 - Sports
 - E-mail
 - Entertainment
 - Travel information
 - Restaurants
 - Event information
 - Community services
 - Stock trading.
 - Leisure-related services (e.g., games, TV and movie listings)

<http://www.vogardesign.com>



06. Mobile Intrabusiness

- Mobile Intrabusiness and Enterprise Applications
 - Today's m-commerce applications are mainly used within organizations.
 - Support of mobile workers are those working outside the corporate premises. Service technician's, sales personnel, delivery workers, etc.



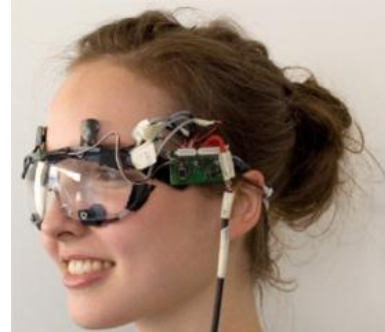
<http://4.bp.blogspot.com>

06. Mobile Intrabusiness

- Mobile Intrabusiness and Enterprise Applications
 - Wearable Devices
 - Employees may be equipped with a special form of mobile wireless computing devices
 - Camera.
 - Screen.
 - Keyboard/Touch-panel display.
 - Speech translator



<http://www.engadget.com>



<http://www.virtualworldlets.net>

06. Mobile Intrabusiness

- Mobile Intrabusiness and Enterprise Applications
 - Job Dispatch
 - To assign jobs to mobile employees, along with info about the task.
 - Transportation (delivery of food, oil, newspapers, cargo, courier services)
 - Utilities measurement (gas, electricity, phone, water)
 - Field service (computer, office equipment, home repair)
 - Health care (visiting nurses, doctors, social services)
 - Security (patrols, alarm installation).



<http://images.businessweek.com>

06. Mobile Intrabusiness

- Mobile Intrabusiness and Enterprise Applications
 - Supporting Other Types of Work.
 - Tractors
 - Mystery shoppers
 - Collaboration



<http://www.designboom.com>

06. Mobile Intrabusiness

- Intrabusiness Applications
 - Wireless applications in the non-Internet environment have been around since the early 1990s.
 - Wireless networking, used to pick items out of storage in warehouses via PCs mounted on forklifts
 - Delivery-status updates, entered on PCs inside distribution trucks
 - Collection of data such as competitors' inventories and prices in stores using a handheld (but not networked) device, from which data were transferred to company headquarters each evening.
 - Taking physical inventories



<http://www.eurotech.com>

07. Mobile B2B

- Mobile B2B
 - Mobile computing solutions (B2B and supply chain management) enable organizations to respond faster to disruptions by shifting resources related to critical events as they occur.
 - The wireless environment has enhanced these c-commerce transactions.



<http://www.trendbird.bi>



<http://mamikikeyu.wordpress.com>

07. Mobile B2B

- Mobile B2B with Mobile Devices
 - By integrating the mobile device into the supply chain, it is possible to
 - Make mobile reservations of goods
 - Check availability of a particular item in the warehouse
 - Order a particular product
 - Provide security access to confidential financial data
 - Reduce clerical mistakes and improve operations



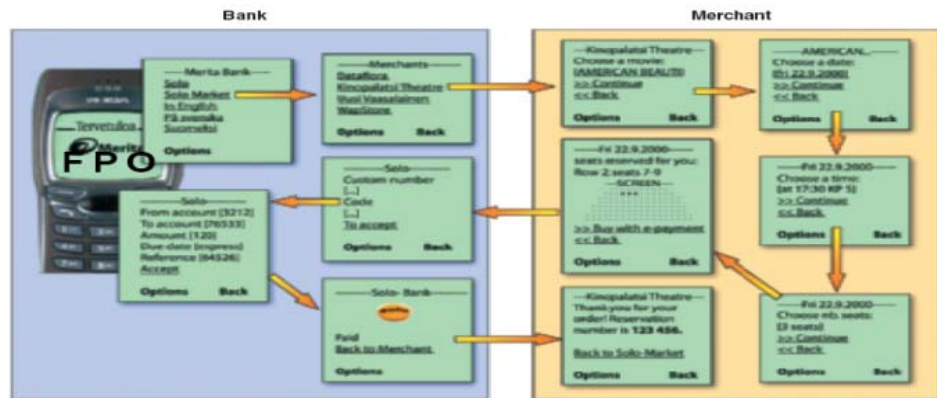
<http://www.paymentsessentials.com>



<http://www.whitegadget.com>

07. Mobile B2B

- Mobile B2B Applications
 - A large number of applications exist that support consumers and provide personal services.
 - B2C transactions
 - Personalize merchandise notification
 - Mobile games
 - Hotels services



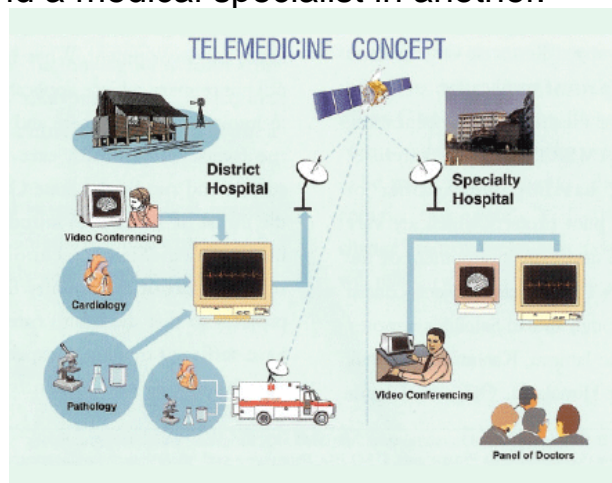
Information Technology for Management, Ed. 5, Efraim Turban et al., Wiley

07. Mobile B2B

- An Example of Mobile B2B
 - Wireless telemedicine
 - Storage of data and transferring of digital images from one location to another
 - Videoconferencing used for “real-time” consultation between a patient in one location and a medical specialist in another.



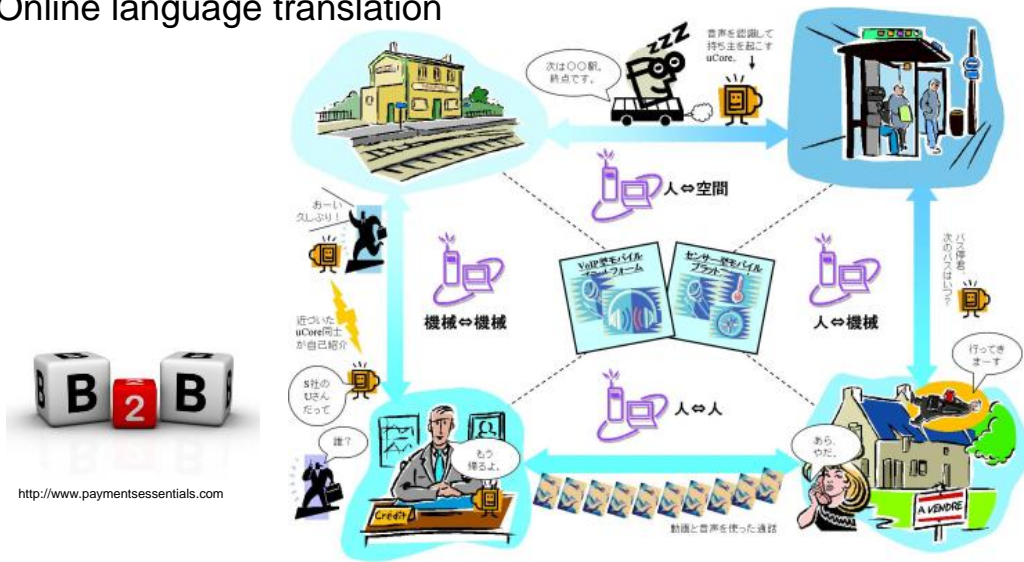
<http://www.paymentsessentials.com>



<http://www.withfriendship.com>

07. Mobile B2B

- Mobile B2B Services
 - News
 - Weather
 - Sports
 - Online language translation



<http://www.kri.sfc.keio.ac.jp>

08. Location-based Commerce

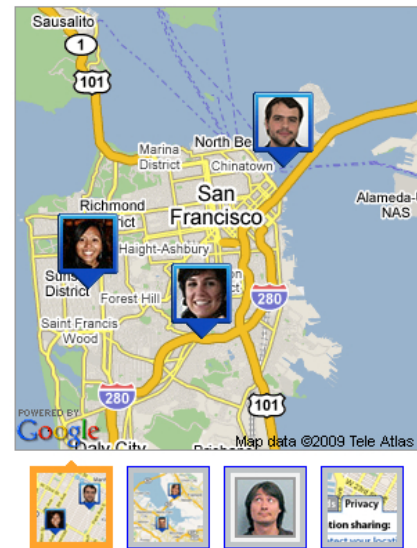
- Location-based Commerce
 - Location-based commerce (I-commerce) refers to the localization of products and services.
 - From a consumer's viewpoint, I-commerce offers safety.
 - From a business supplier's point of view, I-commerce offers an opportunity to provide services that meet customer needs.



<http://www.digitaltrends.com>

08. Location-based Commerce

- Location-based Commerce Areas
 - The I-commerce services revolve around five key areas:
 - Location: determining the basic position of a person or a thing (e.g., car or boat).
 - Navigation: plotting a route from one location to another.
 - Tracking: monitoring the movement of a person or a thing (e.g., a package or vehicle).
 - Mapping: creating maps of specific geographical locations.
 - Timing: determining the precise time at a specific location. online language translation

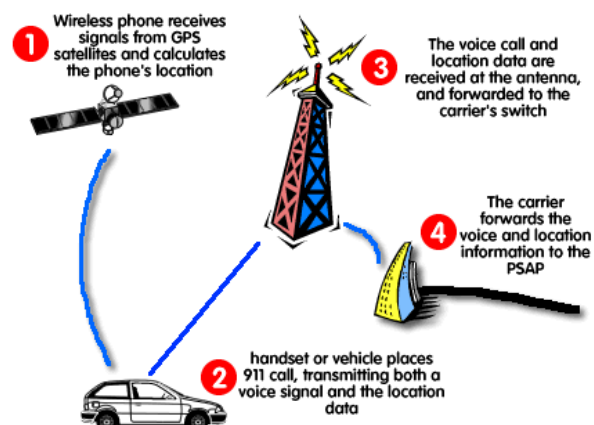


<http://www.expand2web.com>

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08. Location-based Commerce

- Location-based Commerce Technologies
 - Providing location-based services requires the following location-based and network technologies:
 - Position Determining Equipment (PDE):
 - This equipment identifies the location of the mobile device. (GPS)
 - Mobile Positioning Center (MPC):
 - The MPC is a server that manages the location information sent from the PDE.

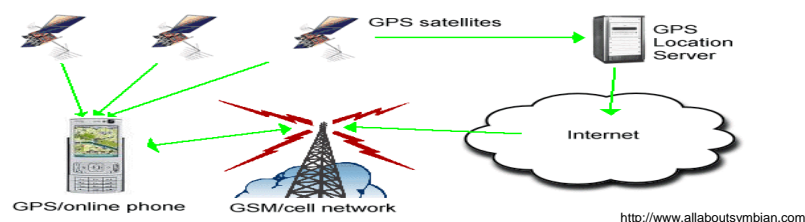


<http://adhi-id.blogspot.com>

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08. Location-based Commerce

- Location-based Commerce Technologies
 - Providing location-based services requires the following location-based and network technologies:
 - Location-based technology:
 - This technology consists of groups of servers that combine the position information with geographic- and location-specific content to provide an I-commerce service.
 - Geographic content: Geographic contents consists of streets, road maps, addresses, routes, landmarks, land usage, Zip codes, and the like. (GIS)
 - Location-specific content: Location-specific content is used in conjunction with the geographic content to provide the location of particular services.



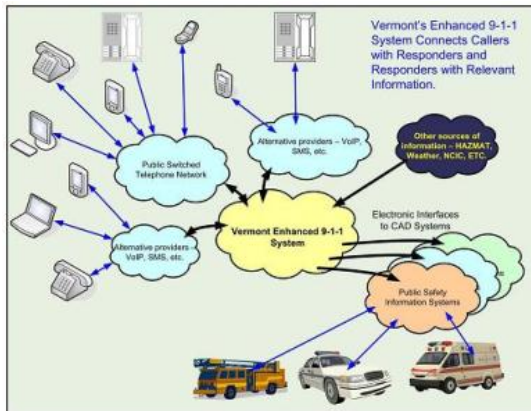
08. Location-based Commerce

- Location-based Commerce
 - There are many applications related to Location Based Commerce:
 - Location-based advertising.
 - The wireless device is detected, and similar to a pop-up ads on a PC, advertising is directed towards the PC.
 - A dynamic billboard ad will be personalized specifically for the occupant of an approaching car.
 - Ads on vehicles (taxicabs, trucks, buses) will change based on the vehicles location



08. Location-based Commerce

- Location-based Commerce
 - There are many applications related to Location Based Commerce:
 - E-911:
 - Emergency cell phone calls
 - Telematics and telemetry applications:
 - Integration of computers and wireless communications in order to improve information flow (OnStar system by GM)



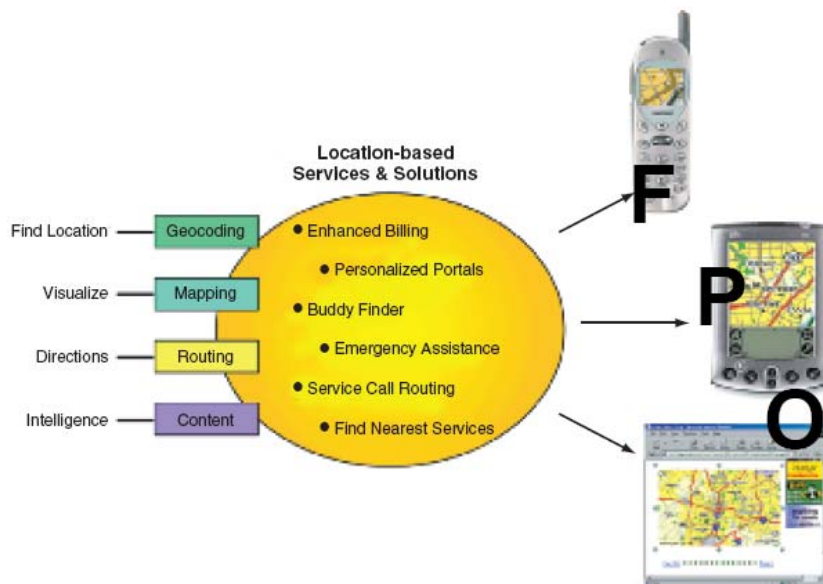
<http://e911.vermont.gov>



<http://www.intomobile.com>

08. Location-based Commerce

- Location-based Commerce



09. Pervasive Computing

- Pervasive Computing
 - A world in which virtually every object has processing power with wireless or wired connections to a global network.
 - The user doesn't have to think about how to use the processing power in the object; rather, the processing power automatically helps the user perform a task (Invisible Computing Everywhere).



<http://www.infosysblogs.com>

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09. Pervasive Computing

- Pervasive Computing
 - RFID (radio frequency identification) tag attached to items for sale.
 - Active badges worn as ID cards by employees.
 - Memory buttons are nickel-sized devices that store information relating to whatever it is attached to.
 - Contextual computing, refers to the process of understanding the user's interactions within a valid context, to better understand what the consumer needs, and what products or services they might possibly be interested in at this time. Context awareness refers to capturing a broad range of contextual attributes to better understand those needs.



<http://www.skyetek.com>

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09. Pervasive Computing

- Pervasive Computing – Smart Things
 - Several other devices and instruments can be made to be “smart.”
 - Barcodes.
 - Auto Identification (Auto-ID)
 - RFID: It is used in wireless tollbooth systems, such as E-Z Pass.

LibBest Library RFID Management System



<http://www.libbest.com>

09. Pervasive Computing

- Pervasive Computing – Smart Applications
 - Smart homes provide a local Intranet where appliances within the home communicate with each other and television, lighting, heating controls and home security are programmed and monitored by the system.



<http://www.lgnewsroom.com>

09. Pervasive Computing

- Pervasive Computing - Smart Applications
 - Smart cars have microprocessors controlling the radio, transmission, remembering your seat position, adjusting the temperature, making the suspension work better, helping you see in the dark, and warning when tire pressure is low.
 - In the shop, the onboard microprocessors are used to diagnose problems

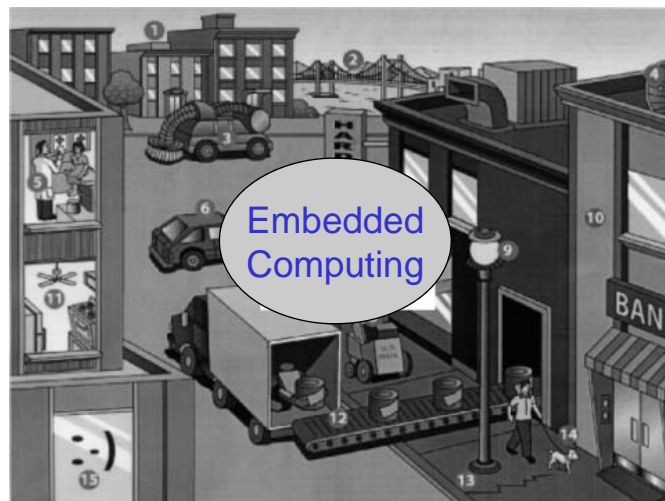


<http://www.seattlepi.com>

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09. Pervasive Computing

- Pervasive Computing Applications
 - Smart Schools explores communication between students, teachers, and the environment to create a smart learning environment.
 - Intelligent elder- care
 - Smart offices.
 - Digital cities.



Information Technology for Management, Ed. 5, Efraim Turban et al., Wiley

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