Mobile Computing

The Future is in your Hands !

By Andrew Leong

The Presenters & the Tutorials

Mobile Computing – The Future is in Your Hands

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iSoft Mobile Technology – Two Case Studies

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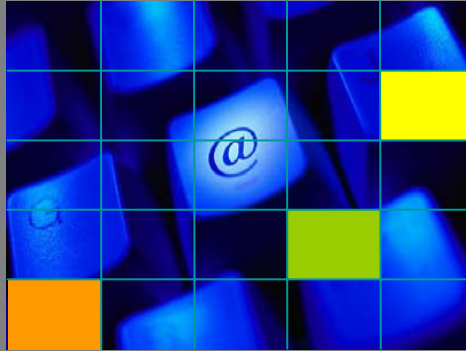

Mobile Computing Trend & Future Technologies

By Sung Ho Lee

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01: Introduction

The Future is in your Hands !

What is Mobile ??

1) Introduction
2) What is Mobile Computing ?
3) The mobile dream
4) Mobile devices
5) History of Mobile
6) Current usage of mobile

Introduction

Mobile computing and wireless technology usage has grown tremendously in recent years, to the extent where it is considered normal everyday technology in schools and many businesses.

For healthcare the opportunities are very exciting and mobile computing could be the answer to the truly "paperless" hospital.

In this workshop we will introduce about mobile technology, what it offers, its pitfalls and its future. We will also look at development strategies, implementation strategies and some case studies to determine is mobile computing a lot of hype or really the road to the future.

In the end you must decide for yourself because the future is in your hands !
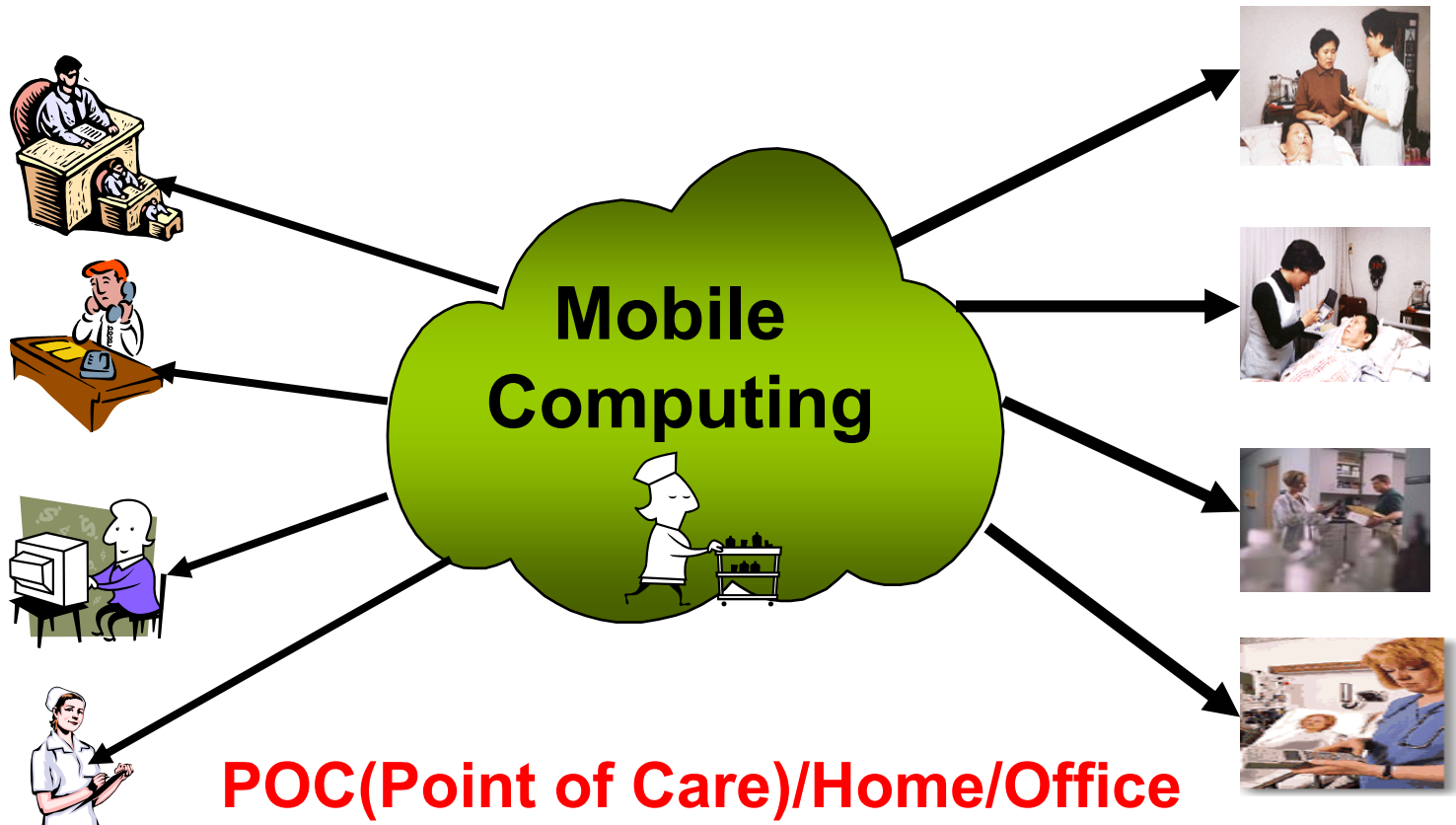
What is Mobile Computing ?

Mobile simply describes a computing device that is not restricted to a desktop. A mobile device may be a PDA, a "smart" cell phone or Web phone, a laptop computer, a tablet PC or any one of numerous other devices that allow the user to complete computing tasks without being physically connected to a network. Mobile computing does not necessarily require wireless communication. In fact, it may not require communication between devices at all.

Wireless refers to the method of transferring information between a computing device, such as a personal data assistant (PDA), and a data source, such as an agency database server, without a physical connection. Not all wireless communications technologies are mobile. For example, lasers are used in wireless data transfer between buildings, but cannot be used in mobile communications at this time.

The Mobile Dream !

- **Mobile Computing for**
  - Patient's clinical information available anytime, anywhere.
  - POC (Point of Care) information
  - Easy to use system for everybody
  - Prevent errors and promote efficiency

Mobile Computing

POC(Point of Care)/Home/Office

What are Mobile Devices ?

- Cart Laptops, Notebook PC,
- Win-PAD, Peripheral Devices,
- Hand-held PDAs, PDA Phone,Tablet PC
- Wearable Devices
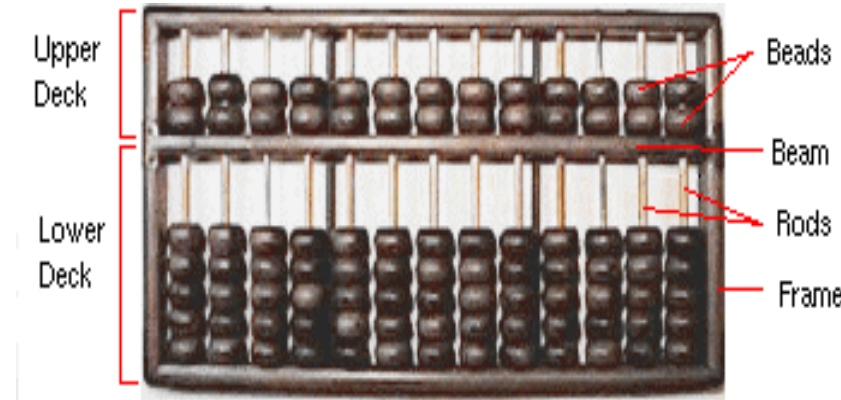
Pole w/laptop

WinPAD

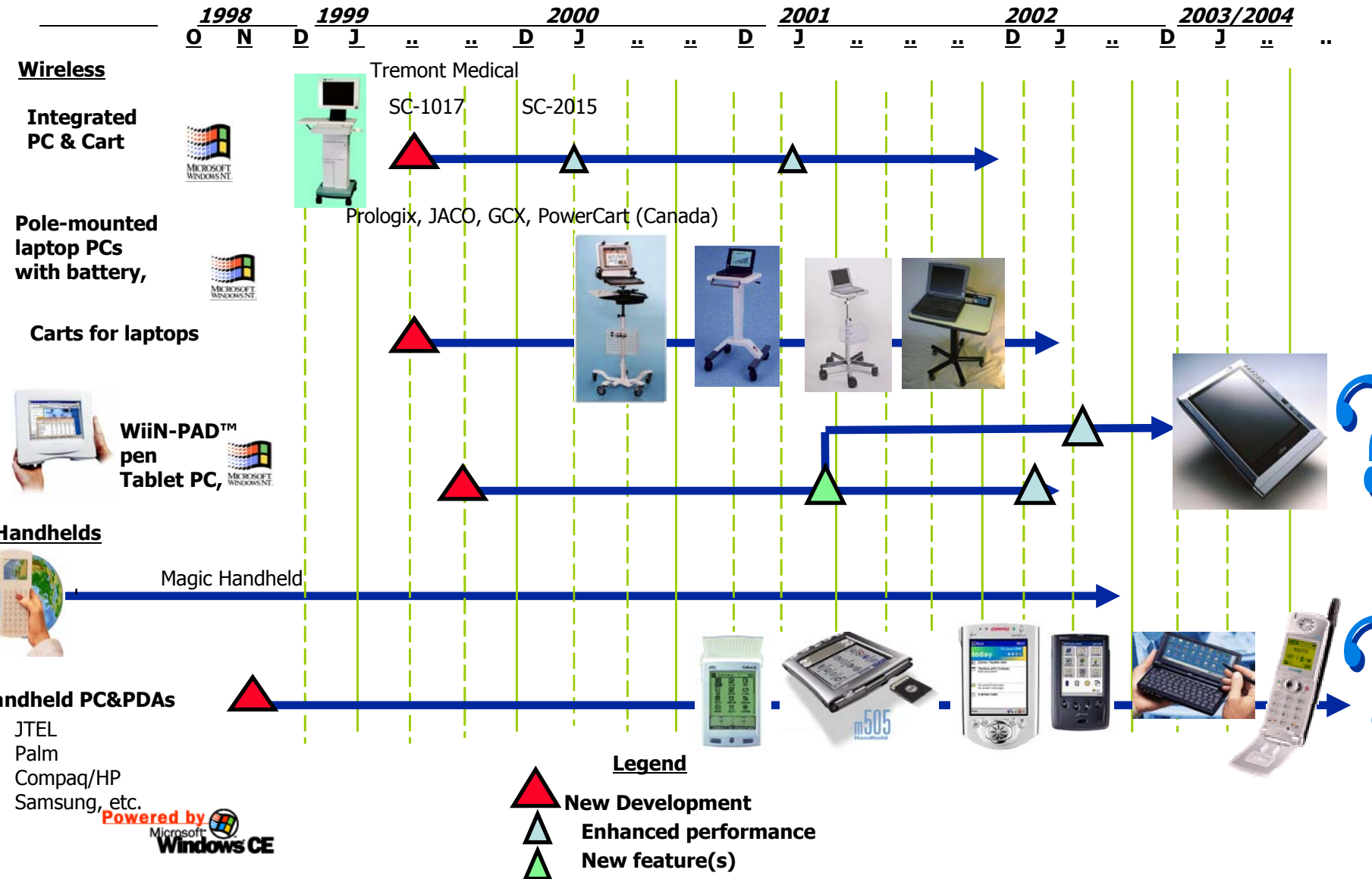Handheld PC

Handheld PDAs

Tablet PC

Mobile Phone Smart Phone

History of Mobile Computers

- 3000 BC – Abacus is invented in Babylonia

- 1972 – "Dynabook", first laptop concept handheld, wireless, full multimedia

- 1979 – Cell phones tested in Japan and Chicago.

- 1981 – First commercially successful portable computer, the Osborne I: 23 pounds (10.43 kg), 64K RAM.

- 1991 – Mobile, pen-based computers that can read handwriting introduced.

- 1992 – PDA (Newton) announced by Apple.

Upper Deck — Beads, Beam

Lower Deck — Rods, Frame

Current Status of Mobile Computing

	1998		1999									2000		2001					2002				2003/2004	
	O	N	D	J	..	..	D	J	..	..	D	J	..	..	..	D	J	..	D	J	..	..

Wireless

Tremont Medical

Integrated PC & Cart

SC-1017   SC-2015

Prologix, JACO, GCX, PowerCart (Canada)

Pole-mounted laptop PCs with battery,

Carts for laptops

WiiN-PAD™ pen Tablet PC,

Handhelds

Magic Handheld

Handheld PC&PDAs

JTEL
Palm
Compaq/HP
Samsung, etc.

Powered by
Microsoft
Windows CE

Legend

△ **New Development**

△ **Enhanced performance**

△ **New feature(s)**

Useage for Mobile Computing

Mobility of applications

Critical or Urgent

Intensity of healthcare environment

Chronic or Routine

On-site Trauma

ER

Nursing Unit

Surgery

Doctor's Rounds

Pharmacy

Home Care

Long-term Care

Supply Mgmt

Ambulatory Care

Physician Practice

Rounds, check-offs, inventory   Care plans, nursing notes

More demanding applications
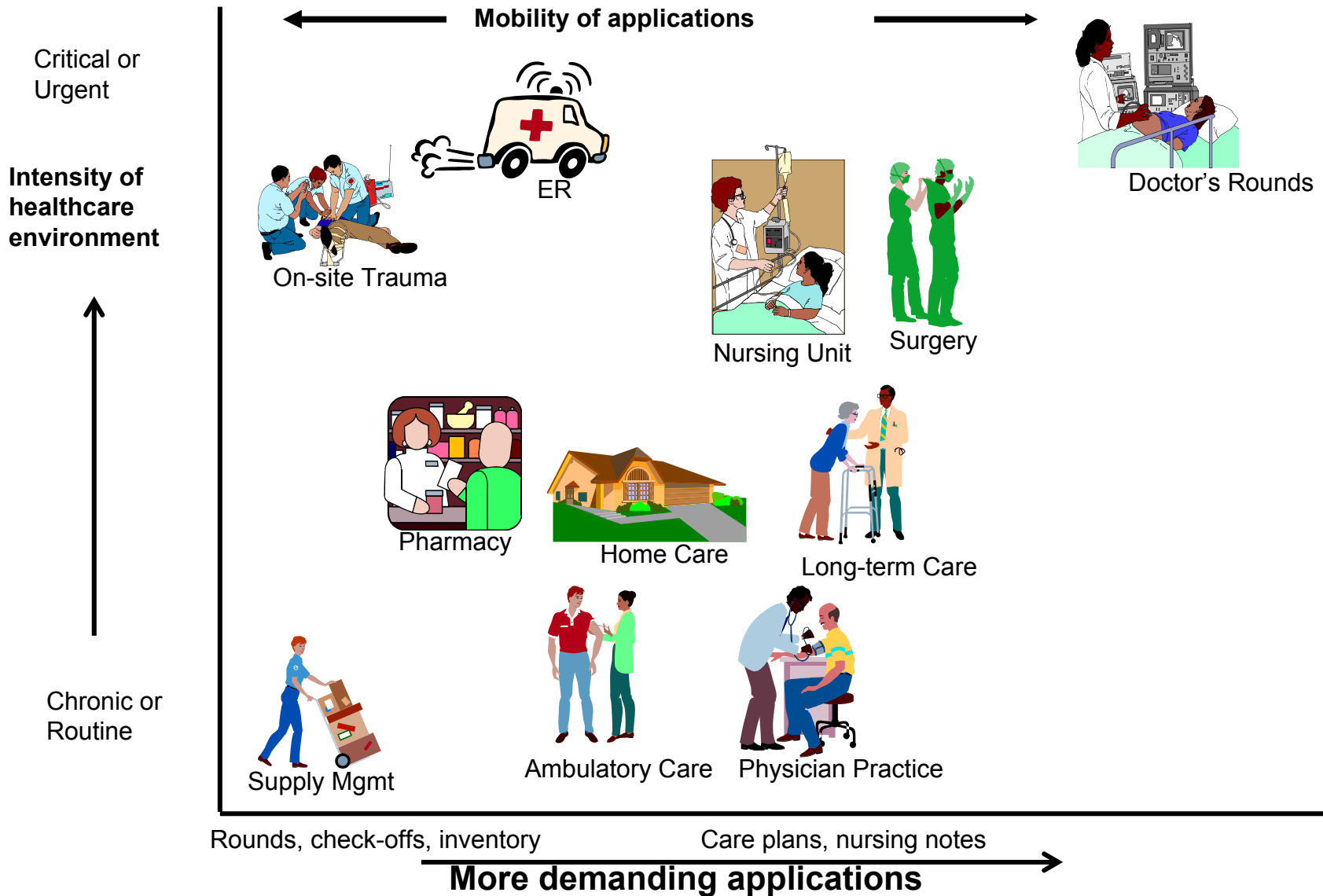
It's Already in Use !!

International Example

- Denver Memorial
- Duke University Medical
- University of North Carolina
- Harvard University
- Columbia University
- Florida Memorial
- Cooper Hospital
- Cleveland Clinic
- Georgetown University
- Frankford Hospital
- Toms River Hospital
- University of Pennsylvania
- Universal Health Care
- Scott and White

Korean Example

- Seoul National University Hospital
- Kyungpook National University Hospital:
- Ehwa Womans University Tongdaemun Hospital
- Workers Accident Medical Center :
- Korean National Red Cross Blood Mobile Unit
- Samsung Medical Center:
- Seoul Adventist Hospital
- National Health Insurance Corporation
- Ilsan Hospital: Bedside Charting
- Cachon Medical School
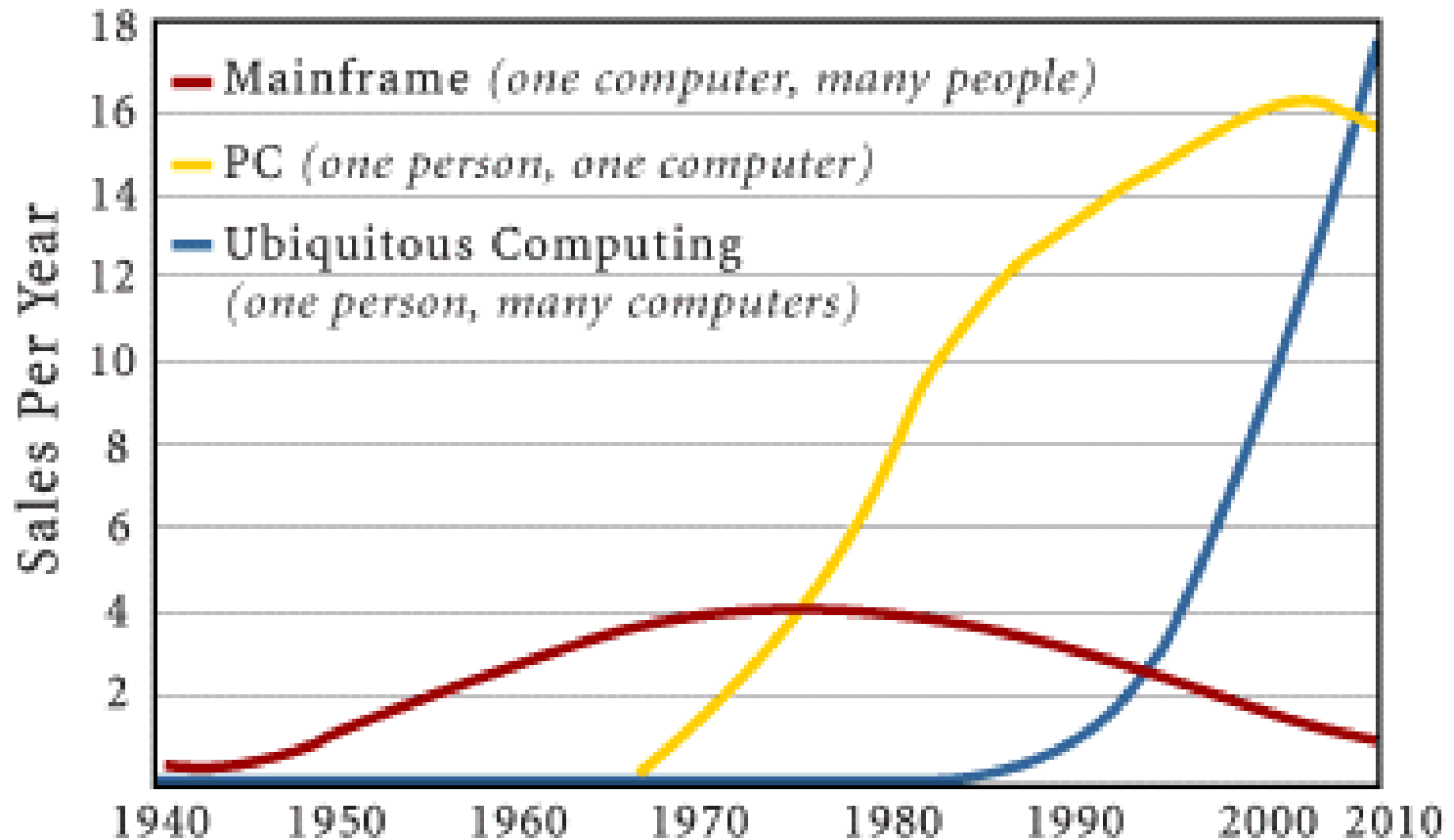- Gil Medical Center
- Incheon Gil Hospital
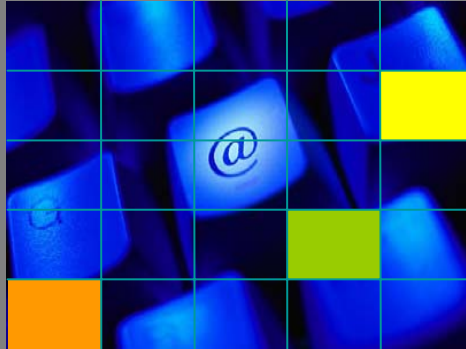
Mobile Trends

1) **Trends for Computing**

2) **Mobile trends for Healthcare**

3) **What has stopped early introduction**

4) **Current Healthcare problems**

5) **What's driving mobile computing**

6) **More than HIS**

Trends for Computing

The Major Trends in Computing

- **Mainframe** *(one computer, many people)*
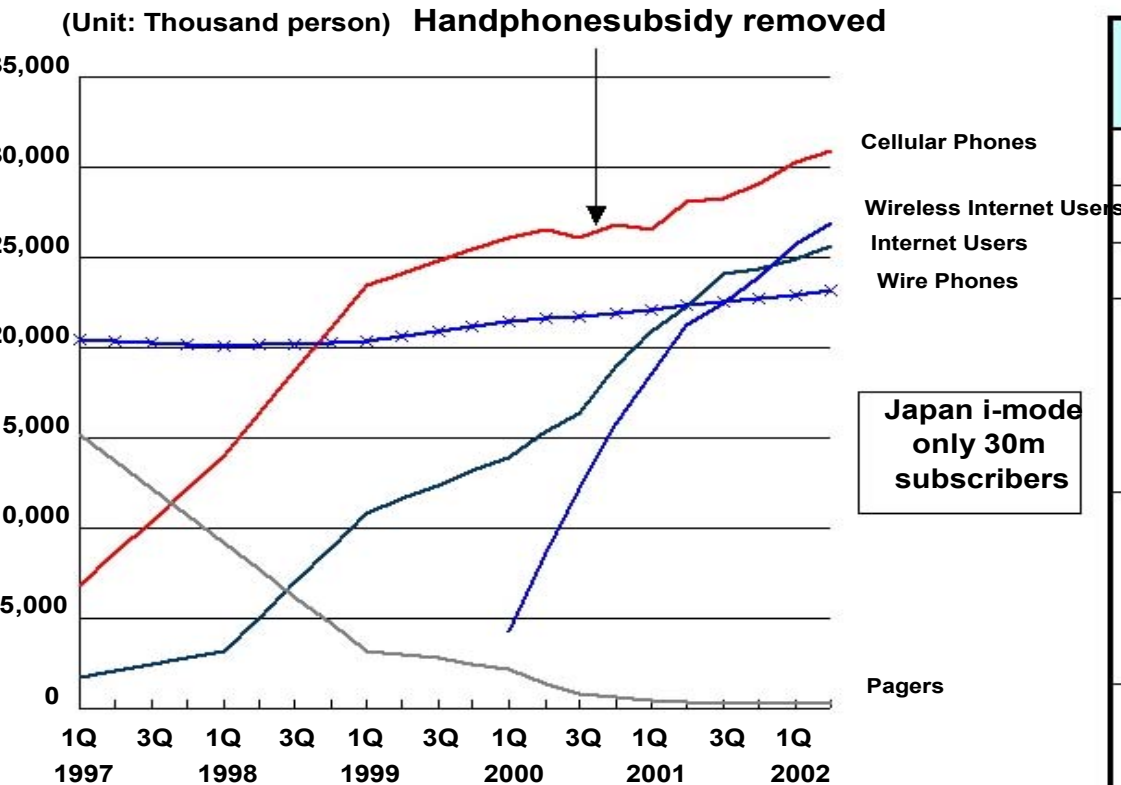- **PC** *(one person, one computer)*
- **Ubiquitous Computing** *(one person, many computers)*

Source: Mark Weiser, Xerox PARC, 1998 (www.ubiq.com/weiser).

General Mobile use is expanding

Koreans as rapid adopters:
Wireless Internet use is exploding

(Unit: Thousand person)

(Unit: Thousand person) Handphonesubsidy removed

Cellular Phones

Wireless Internet Users

Internet Users

Wire Phones

Japan i-mode
only 30m
subscribers

Pagers

		Cellular Phones	Wired Phones	Pagers	Internet Users	Wireless Internet Users
1997		6,828	20,422	15,199	1,634	-
1998		13,982	20,089	9,182	3,103	-
1999		23,443	20,326	3,212	10,860	-
2000	1Q	26,107	21,460	2,190	13,930	4,275
	2Q	26,570	21,600	1,250	15,340	8,635
	3Q	26,047	21,753	820	16,400	12,193
	4Q	26,816	21,932	568	19,040	15,785
2001	1Q	26,555	22,090	444	20,930	18,523
	2Q	28,093	22,358	355	22,230	21,236
	3Q	28,244	22,580	271	24,120	22,432
	4Q	29,046	22,725	236	24,380	23,874
2002	1Q	30,308	22,953	217	-	25,753
	2Q	30,887	23,159	182	25,650	26,871

Current Mobile Trends in Healthcare

- Less than 1% of physicians use handhelds for clinical transactions [1]

- 15% of physicians use handhelds for reference and look-up [1]

- By 2004:
  - \> 20% of US Physicians will use handhelds for transactions [1]
  - \> $2 billion in sales for handheld companies [1]

- In 2003 25% Home care clinicians using handhelds [2]

What has stopped early introduction ?

- Staff are not sure of benefits and practicality
- Does it waste time that could be used for patient care services.
- Security concerns ?
- Costs of mobile devices & the wireless infrastructure
- Vendors and products are immature.
- Mobile devices cannot replace PC functionality
  - Slower response, less memory, less bandwidth, small screen, harder to input and read data.

What has stopped early introduction ?...

Many different standards

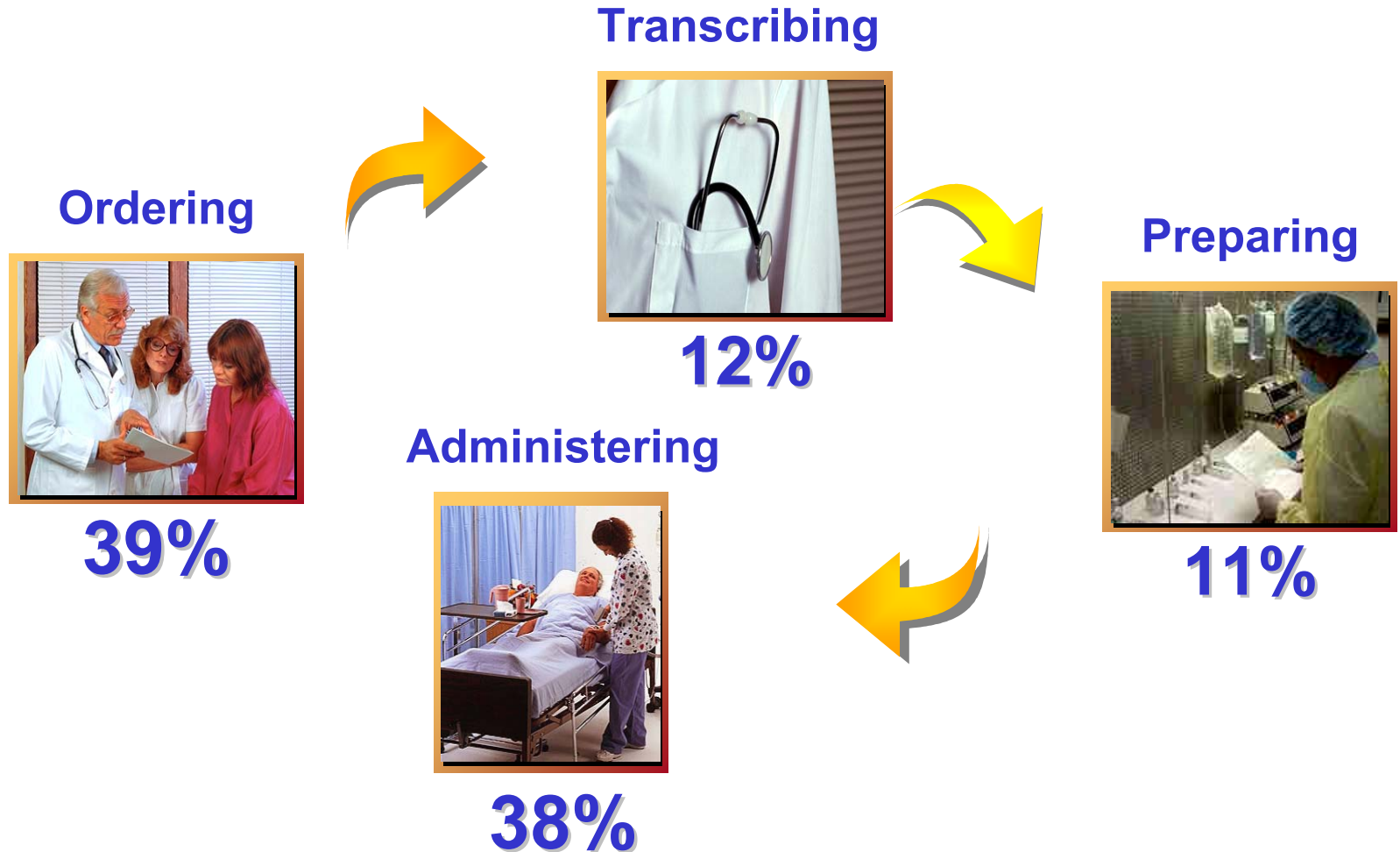|	The Wired Internet	The Wireless Internet
Devices	PC, Macintosh	Palm OS, WinCE/PPC, Nokia phone, RIM Blackberry pager
Applications Layer	Applications Layer	Applications Layer
Operating Systems	Mac PC OS	Palm OS Win CE Symbian RIM OS Motorola OS UP. Browser Nokia Browser
Networks	eg. TCP/IP	WLAN GSM CDMA TDMA
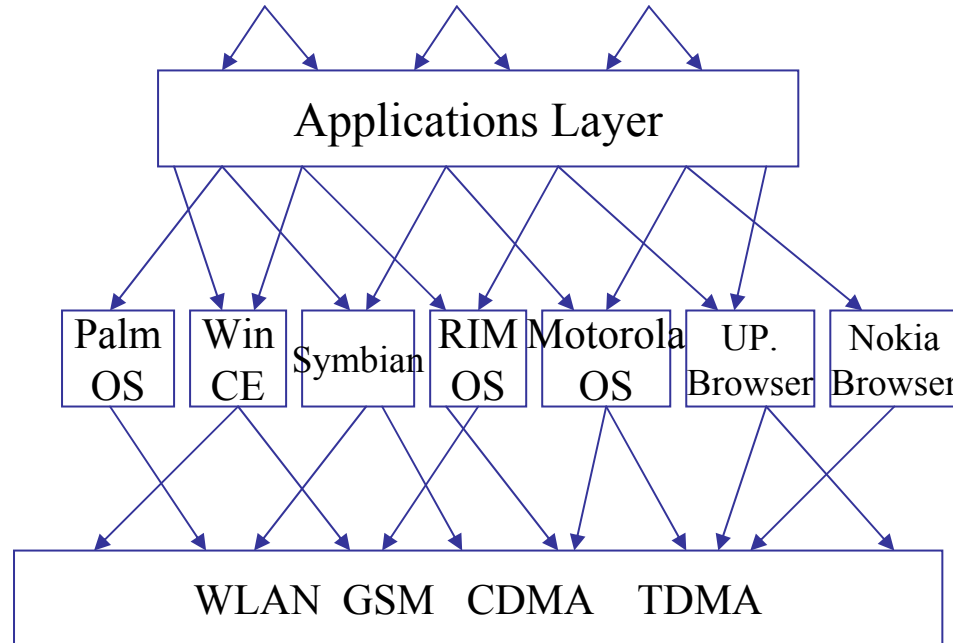
Current Problems in Healthcare

- Errors caused by Lost and inaccurate encounters affect patient care

- Bad data for improving future patient care

- Failure to get reimbursed for treatment administered

- Excess administrative overhead and frustration

- Not easy to get access to required clinical data.

Current Problems in Healthcare ...

Medical Errors & Where they Occur ?

Transcribing

Ordering

Preparing

Administering

39%

12%

11%

38%

Leape LL et al. Systems analysis of adverse drug events. JAMA 1995;274:35-43.
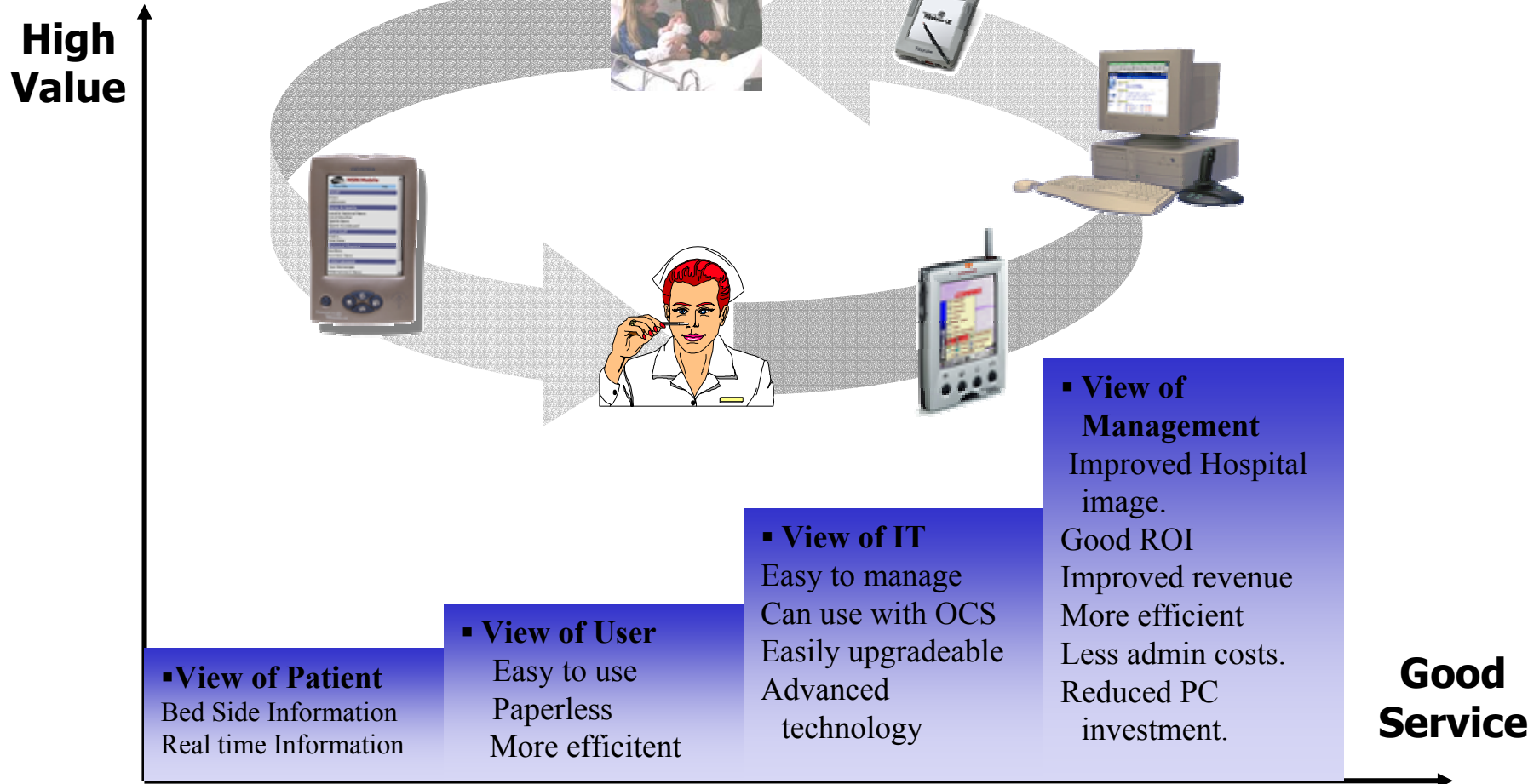
Current Problems in Healthcare ...

Blood Errors

- Majority of blood transfusion errors result from an identification error . . . mainly giving properly identified blood to the wrong patient.

Perceptions of Mobile

High Value

Good Service

▪ **View of Patient**
Bed Side Information
Real time Information

▪ **View of User**
 Easy to use
 Paperless
 More efficitent

▪ **View of IT**
Easy to manage
Can use with OCS
Easily upgradeable
Advanced
 technology

▪ **View of Management**
 Improved Hospital
 image.
Good ROI
Improved revenue
More efficient
Less admin costs.
Reduced PC
 investment.

What's driving Mobile Computing ?

Clinical Drivers

- In hospitals patients and medical staff are constantly moving.
- Difficult for staff members to take breaks to enter data leading to transcription errors, delays in test results, and incomplete records.
- Healthcare information needs to be available anytime and anywhere.
- Medical Staff require up to date information at point of care.
- Improve patient quality of care

What's driving Mobile Computing ? ...

Legistrative Drivers

- Reported 98,000 deaths caused by medical mistakes annually – 7,000 from medication errors.

- Adverse medication errors costs $2 Billion annually.

- Governments are demanding computerization of hospitals to reduce costs.
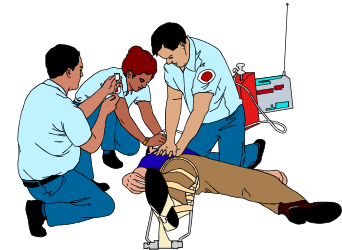
Financial Drivers

- According to the Leapfrog group report
  - Hospitals can save US$180,000 to US$900,000 annually from medical errors.
  - Also US$5,000,000 annually from reduction in duplicate lab testing and imaging.
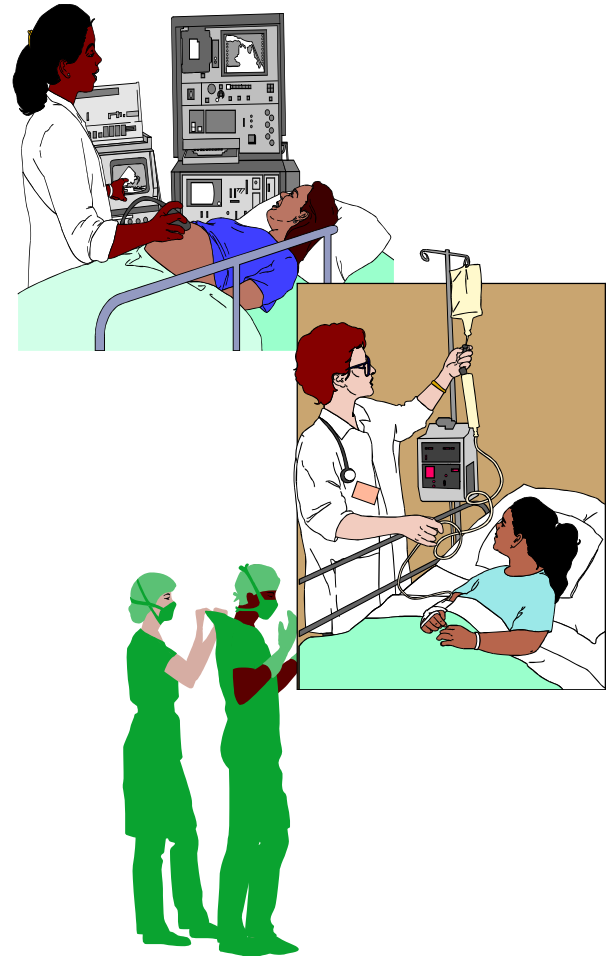
More than a HIS
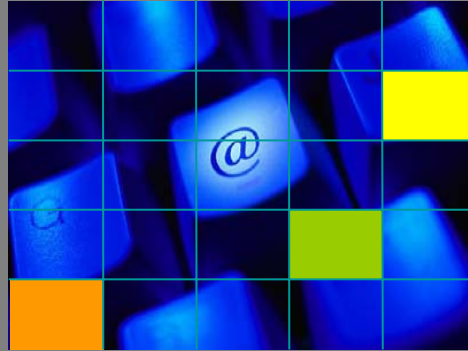
Difference between Mobile & HIS

Hospital Information System		Mobile Computer
Computer - desktop		Handheld
Stationary		Mobile
Comprehensive Usage	**Complements**	High yield Usage
Medical Record Context		Patient Context
Episode of Care		Point of Care
Complex interface		Simple Interface
Complete data access		Limited data access

03: Implementing Mobile

The Future is in your Hands !

The many challenges

1) Challenges to introduction

2) Keys to Implementation - Organizational

3) Keys to Implementation - Technical

Challenges to Implementation

Technical Challenges

- Hardware (Memory, CPU)
- Battery Life
- Networking
- Security
- Interfacing with legacy systems.
- User interface , Ease of Use :
- Communication Standards
- Interconnectivity, Synchronizing
- Archival and backups
- Durability

Organizational Challenges

- Difficult to calculate ROI
- Doctors difficult to accept new technology
- Staff don't like change
- Doctors too busy – to learn
- How to reorganize workflows

Challenges to Implementation

- Hardware (Memory, CPU)
  - Capacity of hardware, limits the applications that can be developed.
- Battery Life
  - No matter the device, Battery life is an issue. With devices shared by many users no one takes responsibilty for charging or even if battery is not working.
  - For PDAs if battery goes flat then lose applications
- Networking
  - incorrectly configured wireless LAN's can cause signal gaps, or signal drop out as users roam.
  - This can cause problems with data transfer

Challenges to Implementation ..

- Security
  - Sensitive patient information on unprotected device
  - Misplaced device
  - Interception of wireless transmissions
- Interfacing with legacy systems.
  - All the data is obtained from the legacy system which may not be easy to interface to.
  - Difficult to use Mobile device as standalone.
- User interface , Ease of Use
  - different useage from desktop. Screen usually smaller, no mouse or keyboard
  - Makes the device difficult to use.

Challenges to Implementation ..

- Communication Standards, Interconnectivity
  - Lack of transmission standards. Different devices have different physical connections as well as data connections.
  - Difficult to change to different mobile devices as will lose interconnectivity.

- Syncronizing
  - Problems can be caused from data not being syncronized with the HIS.

- Archival and backups
 - Lack of backup if data stored locally on device before syncronizing.

Challenges to Implementation ..

- Durability
  - Devices are much more fragile than desktops and more prone to damage.

Challenges to Implementation ..

- Difficult to calculate ROI
  - Defining the ROI can be difficult as well as measuring it.
  - How to tell how much money saved in lost orders, if you don't know you lost them ??

- Doctors difficult to accept new technology
  - Some doctors are only getting used to the keyboard. Pushing them to another device can be challenging.
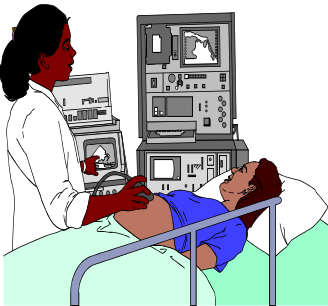
Challenges to Implementation ..

- ## Staff don't like change
  - – New mobile tech will mean change in workflow. Staff will resist as it means more time required to change.

- ## Doctors too busy – to learn
  - – For doctors, seeing patients are the most important and learning something new can be seen as "non-critical"

- ## How to change the workflow.
  - – New technology will require different ways of doing things but can be difficult to know what is the best method.

Keys to Implementation - Organizational

- Involve key physicians in selection process
  - not just IT committee members or younger staff who will use the new technology but influencers)
- Identify the people, process and technology changes
  - what is the impact on each area?
- Document the expected quantifiable benefits from mobile first and share with all users.
  - Expected ROI, financially.
  - Improved Workflow
  - Improved clinical documentation
  - Decreased manual tasks
  - Decreased clinician and patient wait times

Keys to Implementation – Organizational ..

- Insure system is individually customized to each user before go live
- Provide training, training, training.
  - Not just on application usage.
  - Also Looking after the mobile computer
  - How to get most benefits.
- Load other useful tools on device
  - like phone lists, schedules, and medical library information

Keys to Implementation - Technical

Selecting a Mobile device

- Understand the intended use with specific applications
  - Evaluate ALL the user population & determine their needs
  - How can the IT departement support it.
  - Will the application work effectively on the device?
- Technical Considerations
  - Screen resolution (images vs. text)
  - Input requirements (text input)
  - Durability
  - Expandability (memory & peripherals)

Keys to Implementation - Technical

Selecting a Mobile device …

- Technical Considerations …
    - Battery life. For shared devices ensure that there are adequate procedures to ensure battery is correctly charged.
    - Networking. For wireless LAN's the Access points need to be correctly placed so that there are no blind spots.

Keys to Implementation - Technical

Synchronizing Data – important for accurate data

- Web Based Approach
  - Deliver content specifically formatted for particular devices easily
  - Shorter development cycles
  - Requires constant WLAN connection for data access – like PC

- Client/Server Approach
  - Specially designed Application for the device that directly accesses the HIS database.
  - Requires constant WLAN connection for data access –like PC.

- Merge/Replication Approach
  - Synchronize either directly or from staging database to custom databases on device.
  - Data is contained in device and therefore portable.
  - Cradle or Wireless synchronization

Keys to Implementation - Technical

Security

Mobile solutions introduce a unique set of security issues

- Tamper proof devices and authentication of users
  - Prevents unwanted access to sensitive patient information.

- Encryption of wireless communications
  - Prevents interception of wireless communications.
  - This can be done from Hardware encryption on WLAN.

- Encryption of internet communications
  - Mobile devices using public internet can be intercepted.
  - Use Virtual Private Networks (VPN) for secure external access.

Keys to Implementation - Technical

Interfacing with Legacy systems

- Ensure that interfacing issues are resolved before any purchases or start of project..

- Speed of the interface connection should be thoroughly tested for no performance issues.

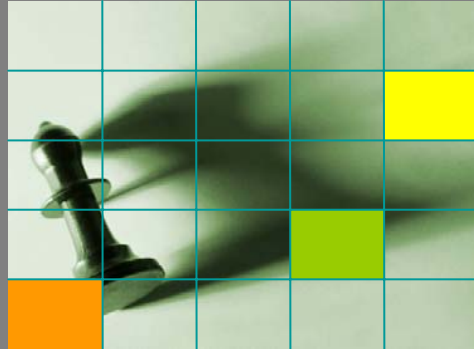- This can be a hidden cost that can delay a project and needs to be carefully planned.

Keys to Implementation - Technical

User interface & Ease of use

- Whether developing an application or buying a application product for the mobile device it is essential to test the user interface to ensure that users can comfortable use it.

- Copying a PC based program to a mobile device will not work ! As the way it is used is different.

- Initiate a pilot project first so that the application can be "field" tested first to determine if mobile computing can be used successfully.

- Access to data should be instant.

- Data entry needs to be simple and easy to use.

- Use barcodes and other accessories to speed input of data

How to make a Mobile Application

1) **Moving from HIS to Mobile**

2) **Developing a System**

3) **Development Challenges**

4) **Design Issues**

5) **General Design Concepts**

Moving from HIS to Mobile

- Need to change the mind set when moving from HIS to Mobile.
- Many hospitals/companies assume that to make a mobile application means to convert the fixed platform to a mobile one.
  - This is fast track to failure.
- Need to really focus on what's unique to mobile devices
- Mobile devices are different and will create new paradigms.
  - It will change the way we communicate.
  - It will change the type of data we require
  - It will change the way we work.

Developing a System

- Mobile solutions should be process orientated.
- Need to determine user information needs and understand their workflow process
  - Document process steps and components
  - Information use within and between processes
- Don't try and develop everything at once.
  - Build in stages to ensure that what is built actually works out in the field.
- Need to understand how the mobile solution will compliment the HIS rather than replacing
- Focus on minimal, easy steps to get the work done
  - Users will be at POC. They want to spend minimal time working on the mobile solution.
- Talk and talk to the end users for getting different ideas.

Development Challenges
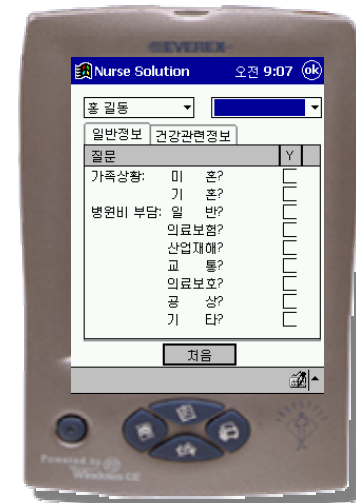
Medical Record form

→ Patient related Master information from HIS

→ Patient Data input into mobile application

How Can it All Fit ??

Development Challenges

- Device Independent – How to make the application work on more than one device.
  - *Best to pick a device that fits with strategy.*
  - *Difficult to cover all devices.*
- Network Independent – Different technologies offer different advantages.
  - *As TCP/IP is becoming the standard protocol, less of an issue.*
- HIS independent – As every HIS is different will require lots of customization for integration.
  - *Try and follow emerging standards like HL7 and hope others do too !*

Design Issues

Functions should be chosen carefully so that the user can work quickly and efficiently. Some functions that create workflow problems should be left out of Tablet PC designs. These functions are done better on desktops.

Functions are totally clickable
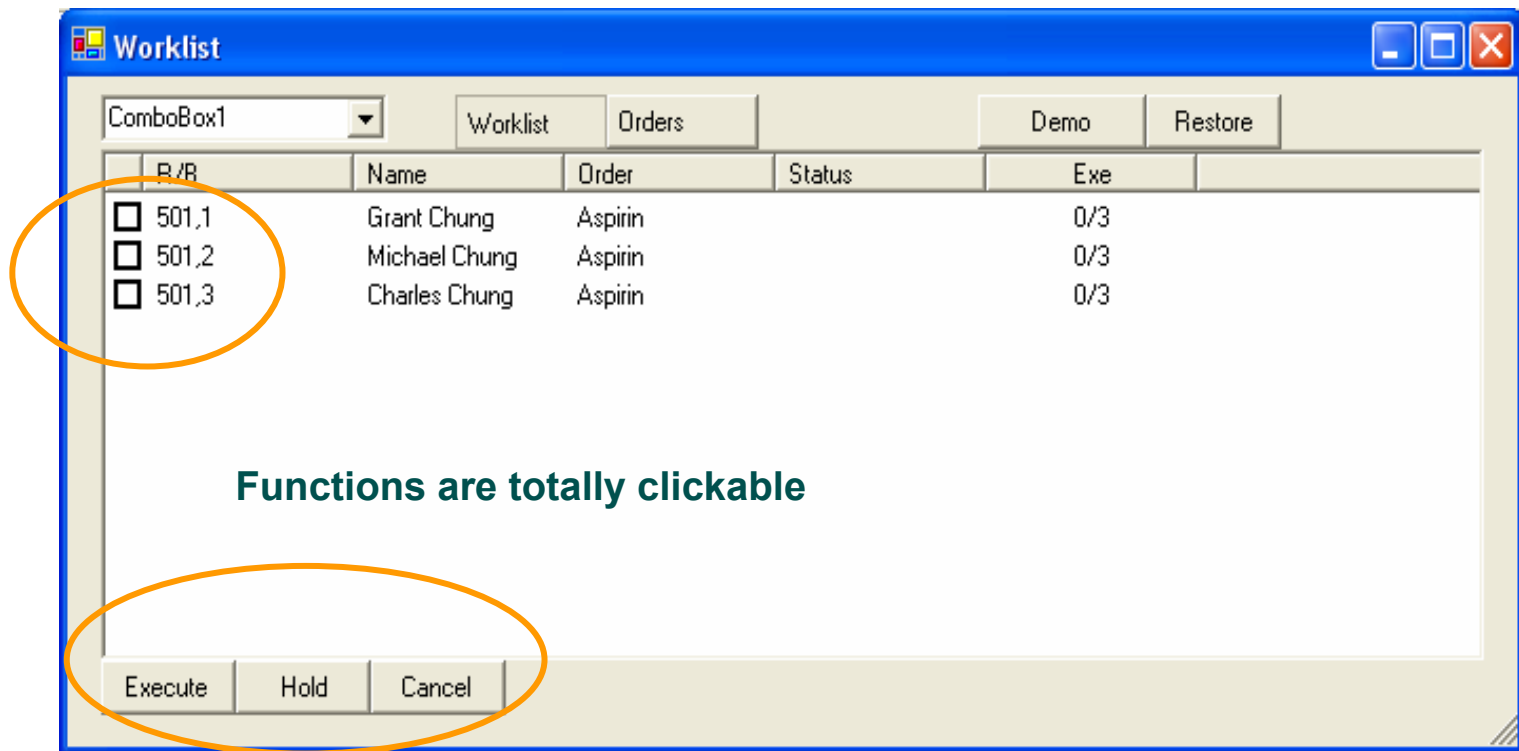
Design Issues

Forget keyboard entry and inking methods – they are too tedious. Must think of other creative ways of input.
Eg. Dictionary input.

Select character

And user can select from list of words for input.

General Design concepts

- Clickable inputting
  - forget about text inputting as it is too slow.

- Make it easy to get around the screen
  - Simple left/right or up/down flow
  - Jumping around for input makes it confusing.

- Minimal amount of clicking to get/input required data.
  - Users will be busy talking to patients so not much time for using device.

- Keep it Simple.
  - If it is too difficult to use then users won't have time to use it.

- Time saving functions are appreciated.

- Be creative !!

Applications for Mobile

1) **What Kind of Mobile Applications**
2) **Application Ideas**
   - **Doctors**
   - **Nurses**
   - **Imaging & Lab**
   - **Stock & Pharmacy**
   - **Emergency**

What kind of Mobile Applications ?
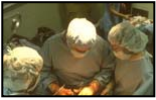
- **Hospital Doctors & Nurses**
  - Patient demographic information
  - Admission, discharge, transfer notes
  - Laboratory, Radiology & Other diagnostic tests results(EKG, ..)
  - Order Entry systems.
  - Reference materials. Clinical decision support
  - Bedside chart information (vital signs, nursing notes)
  - Dictation
  - Alert information
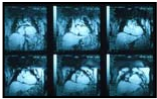
- **Imaging Center**
  - Transcribed reports
  - Voice transcriptions
  - Images (X-ray, CT, MRI, Ultrasound, Nuc Med)

- **Laboratory**
  - Test results, specimen collection

- **Stock**
  - Management of materials , picking lists

- **Pharmacy**
  - Formulary lists
  - Medication list

- **Emergency department**
  - Patient demographic information, and registration
  - Transcribed notes that have been digitized
  - Triage information

Application Ideas for Doctors

- Clinical systems information (patient-centric)
  - Labs, radiology and other department results.
  - Historical information when pertinent
- Clinical Decision Support
  - Threshold and alerts in specific situations.
  - Checks drug - drug interactions, allergies,
  - Duplicate drugs.
  - Coverage by insurance
- Centralized reference materials
  - Commonly used in PDA's among physicians
  - Especially drug reference

Application Ideas for Doctors ...

- ## Order Entry (CPOE)
  - Assist in orders for patients.
  - Grouping of common sets for doctors.
  - Linked with Clinical pathways
- ## Electronic Medical Record.
  - All information on chart contained electronically.
  - Ensure all information is recorded for patient.
  - Automated discharge summaries.
- ## Coordinate the workflow with nursing
  - Don't want to chase down nurse or assistant
  - Send alerts to notify status of new order
- ## Alerts for orders requiring signatures or approval.
  - High value to medical records management
  - Ability to electronically sign-off on orders

Application Ideas for Doctors ...

- ## Dictation
  - Ensures accurate and compliant documentation
  - Device is a smart recording instrument; on-device speech to text still 5+ years out

- ## Task/ to-do list to help manage patients through shift changes
  - Healthcare CRM paradigm, managing patients in a similar fashion to corporations and their customers

Application Ideas for Nurses

- ## Input of vitals and I&O's
  - Alarms from monitoring devices.
- ## Task/ to-do list for nurse rounding.
  - Viewing output of medical devices
  - EKG, ventilator, oximetry
  - Nurse acting checks.
  - POC bar code printing for samples.
- ## Workflow interaction with doctors.
  - Notification of new orders.
  - Treatments to be performed.
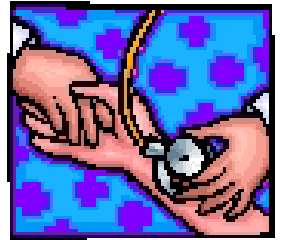
Application Ideas For Imaging & Lab

- Management of orders to be processed.
  - Transcribing reports.
  - Voice transcriptions.
  - Reviewing patient information.

- Monitoring of test results.

- Bar coding of orders and specimens.

- Initiate printing job requests.
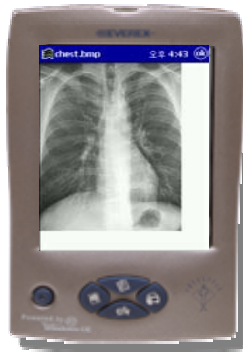
Application Ideas For Stock & Pharmacy

- Barcodes for inventory to provide easy identification users.

- Streamlining processes for both clinicians and inventory staff
  - Get rid of the inefficient and resource intensive systems
  - Improve the process of patient charge capture
  - Robust functionality for materials staff including par counts and other inventory functionality

- Pharmacy
  - picking lists
  - Reference information

Application Ideas for Emergency

- Details about where patients are, how long they have been waiting, what action is necessary, and who is caring for them (POC Triage)

- Enable tracking of staff and their workload.

- Improved workflow by providing realtime data to doctor via mobile device. (e.g., lab & radiology results)

- Extend current HIS systems functionality for true workflow integration
  - POC, Registration and patient information
  - Clinical results and order entry
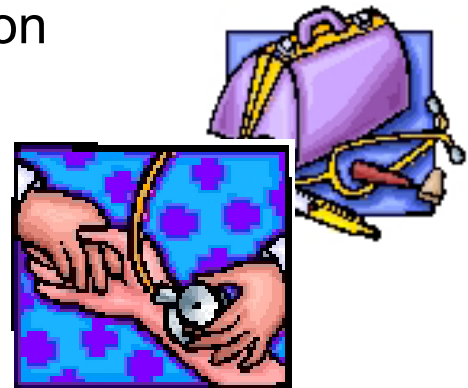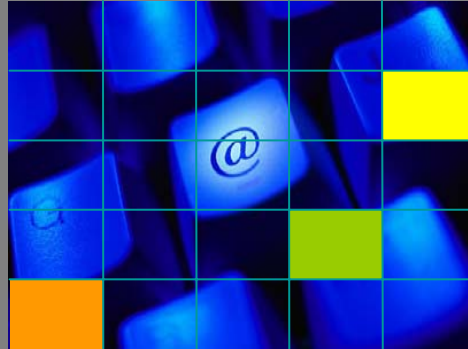
Korean Pilot Project

1) **Korean Pilot Project**

2) **Scope**

3) **System Configuration**

4) **Conceptual Model**

5) **Deliverables**

6) **Project results**

7) **Things to learn**

Korean Pilot Project

Chonnam University Hospital

- 1500 beds
- Pilot Work: OBGY (109B) – 40 beds
- OCS, EMR: 1994 Custom development (by HIT)
- 10 servers for OCS, PMPA, Lab, GM, EMR, Web, MIS, Test etc
- Oracle 7.3.4
- Middleware Tuxedo 6.3
- Power builder
- 15 IT staffs

Scope

- Mobile Nurse functions - PDA

- Data agent for interfacing between PDA and HIS (PDA to Client to Server) - Client

- Code table management - Client

- Sync Handler

System configuration

OCS   **EMR**   **LAB**

HIS Server

Mobile Handling System   **Applications**

Conceptual model

Hospital Information System

Mobile Handling System

PDA

Client PC
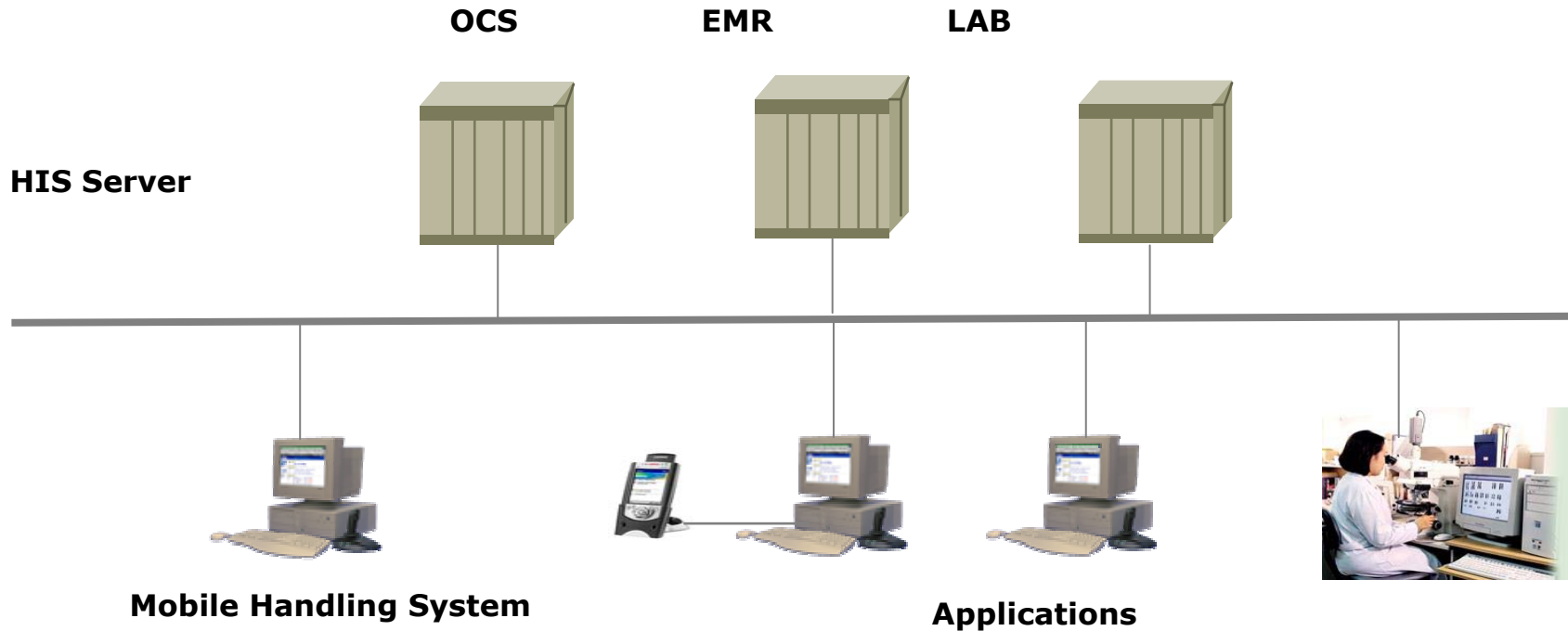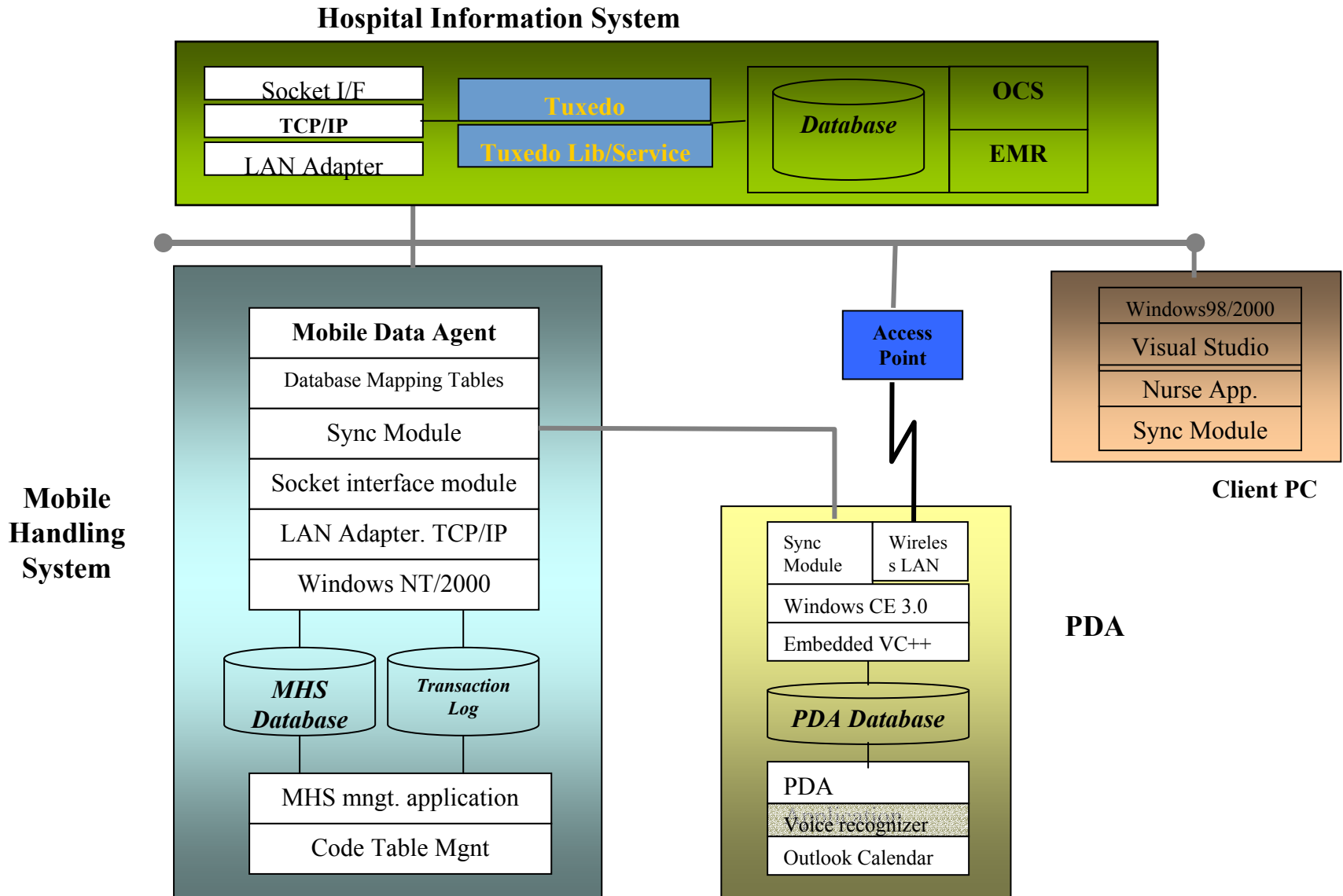
Deliverables

Patient Information

- Patient list: Bed, Name, Sex/age, Dept
- Patient details: Registration id, Doctor, Date admitted, Diagnosis
- Patient history: Category, Questionnaire, Options

Nursing Activity & Record

- Vital Sign: Bps, Bpd, Temperature, Pressure, Respiration
- Intake/Output: In (Oral, Non-oral), Out (Urine, Stool, Drain etc)
- Order: Medication/Treatment, Lab etc
- Results: Lab, Radiology (text format)

Additional function

- Appointment
- Hycare Nurse key activation
- Dictionary

Interface

- Data Agent for interface among PDA, MHS and Server
- Configuration Synchronization
- Code table management

Project Results

- Project was pushed from management down.

  - No ownership from users.

- Data sync on cradle, not wireless connection

  - No budget for wireless connection.

  - Slow to upload/download data between PDA and Server.

- Difficulty to handle PDA

  - Considered too fragile.

  - Also too small to be able to see all information at once.

Project Results

- Security
  - Being easily stolen, it put more stress on nurses to worry about using it.
  - Often kept locked up in drawer.
- Battery Life and charging.
  - Nurses easily forget to charge PDA especially after changing of shifts.
  - Due to security, lock away PDA which meant not charged.
- Input method
  - Too different a way to input compared to PC.
  - Would prefer using a notebook.

Things to learn

- Necessary to have end-user ownership and involvement in the project.

- Nurses acknowledge convenience of POC but disadvantages must be resolved first.

- Invest in wireless connections for continuous syncronization.

- Security and charging PDA needs to be well planned beforehand.

- Various input method such as voice, Bar-code to make it easier for input of data.

- Doctors more attracted to PDA.
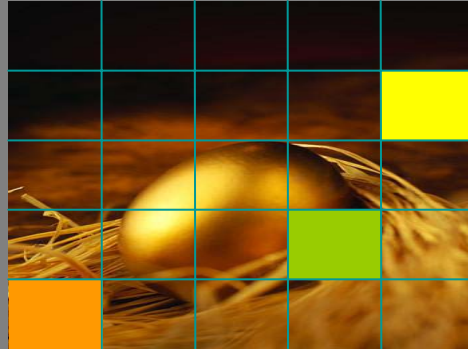
Final Summary

1) **Benefits**
2) **IS Mobile Computing for You ?**
3) **The Future in Mobile**
4) **Conclusions**
5) **Q & A**

Benefits

- Medical information at Point of Care
  - Can keep latest patient information always at hand and with increased access.
  - Provides easy access to reference information.
  - Clinical decision support
- EMR & Order Entry directly at Point of Care
  - Documentation at the point of care
  - Eliminates paperwork.
- Is more efficient saving time.
  - Reduces telephone interactions for checking
  - Decreased chart access times
  - Saves time looking for chart and patient information

Benefits

- **Safer work processes**
  - Integration of bar coded elements allow sequence of tasks to be tracked
  - Ensures the process was correctly carried out
- **Prevents errors**
  - Eliminates mistakes from poor handwriting.
  - Verification of Patient, Drug & Delivery System information.
  - Interruptions will not produce errors.
- **Permits flexibility in delivery of care**
  - Provides staff with more options quickly finding alternative drugs, etc
  - Provide guidelines through clinica decision support.
  - Caregiver judgment, experience, and technique enhanced, not replaced.

Benefits
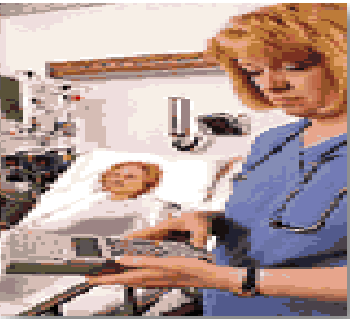
- Enhance workflows.
  - Improve efficiencies & Productivities
  - Doctor can manage own schedules
  - Faster response times
  - Increased patient contact times reduce patient waiting times.
- Save costs
  - Reduces costs from paper forms and filing.
  - Less checking required for insurance
  - Decrease incomplete charts.
- Increases Hospitals revenue
  - Enables more accurate charge capture
- Improve patient care.
  - Practice better medicine
  - Increased patient satisfaction

Is Mobile Computing for You ?

Mobile computing will become more predominant in the future but is the time right for it to be introduced now ?

• It must be part of an integrated solution with HIS.

• For best benefit Wireless LAN is a necessity. Must consider this investment.

• Can you and all staff identify the benefits and ROI to be obtained from mobile computing.

• Do you have commitment from end-users to change workflows and persist through the transition period.

Is Mobile Computing for You ? ...

- Do a pilot project first
  - Mobile computing is sufficiently different to have greater risks than a traditional system
  - A pilot project will reveal hidden problems that need to be addressed.
  - It will confirm if the timing is right for your hospital.
- New technology like mobile computing is only an enabler and not a answer to all the problems.

The Future in Mobile ?

- Converged devices.
    - Combining data, video and voice
    - Communications anywhere, anytime as if all parties in same room.
- Devices will be convenient enough to carry all the time with fuel cells that last days.
- Mobile computing will be a commodity with prices similar to today's PC's
- Government and organizations will have developed standards for sharing information.
    - user can have one mobile device that can connect to different hospitals depending upon appropriate authorisation.

Conclusions

- **Each POC device has unique needs**
- **Each Clinician has unique needs**
- **Buy mobile devices with integrated wireless LAN.**
- **Mobile applications require a new way of thinking. Generally simpler the better.**
- **Healthcare vendors have only barely tapped the potential of mobile computing.**
- **The future will reveal further mobile opportunities as it moves towards being a standard piece of equipment in hospitals.**

Questions &
Answers

Delivering the highest standard in healthcare systems. ™
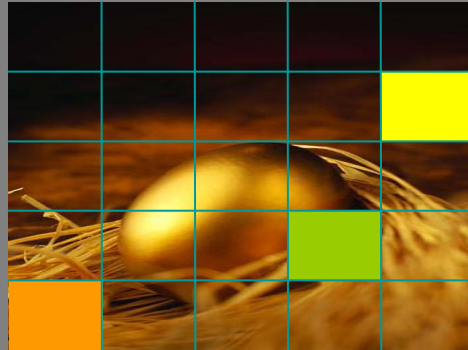
Thanks!

Presenter Details

1) **Andrew K. Leong**

2) **Martin Shen**

3) **Sung Ho LEE**

Presenter Details

Mr Andrew K. Leong is currently the General Manager for marketing & consulting at Hycare Systems, Inc in Korea. He was born in Australia and educated at Monash University. He has had over 10 years of experience in consulting and project implementation. His major interests are in hospital information systems, packaged based software, EMR, medical imaging, computerized patient record, mobile-solutions and other medical informatics in general.

Contact: Andrew.Leong@hycare.com

Dr. Martin Shen is currently the clinical director for Asia Pacific at iSoft Plc. He is a graduate from the University of Western Australia and has practiced Medicine in both the public hospital sector and the Australian military, as well as being the senior hospital administrator in the first foreign JV hospital in the P.R.China. Dr. Shen was a recipient of the Australian Students Prize as a top 200 student in Australia and entered medical school at the age of 16.

Contact: martin.shen@isoftaus.com.au

Mr Sung Ho LEE is currently the Technical Marketing Manager of Intel Korea (Asia Pacific Solutions Group). He is responsible for Technical marketing, support, consulting, solution enabling & optimization, ...etc on various enterprise solutions in terms of platform technology perspective (such as Pentium4, Centrino Mobile Technology, Xeon, Itanium2, Arm processors, etc..) for end-customers, ISVs, SPs(Solution Providers), HW OEMs. Mr Lee graduated from Kyungbook National University in Daegu majoring in Computer Science/Electronic Engineering.

Contact: sung.ho.lee@intel.com

iSOFT Mobile Technology

Dr Martin Shen

Agenda

- iSOFT Introduction
- Logan Hospital − QLD Health
- Worcestershire Healthcare - NHS Trust
- Lorenzo Demonstration

Introduction to iSOFT

iSOFT Mission Statement

"To be the leading application content provider to healthcare economies involved in information systems modernisation."

- Mission Statement in MBO Business Case (1998)

iSOFT – The Health Innovator

- Provider of Software Application for Healthcare
  ## Delivering Technology + Content

- Focused on modernising and reforming healthcare economies

- #1 provider outside of the United States

- A successful British company listed on the London Stock Exchange (FTSE 250)

- 580 employees world-wide – 250 in Asia Pacific

- Focused on extending the reach of healthcare information through innovation and invention

Representative iSOFT customers

- Hunter Area Health Service (25+ Hospitals, Australia)
- Western Sydney Area Health Service (Australia)
- Auckland District Health Board (New Zealand)
- Barwon Health (Australia)
- South Auckland Health (New Zealand)
- Logan Hospital (Australia)
- Guys' and St Thomas' Hospital (4 hospitals, UK)
- ACHA (5 Hospitals, Australia)
- Birmingham City Hospital NHS Trust (UK)
- Singapore Health Services (16 Institutions, Singapore)
- Beijing Family United Hospital & Clinics

Product Offering

- **Patient Record Systems**

- **Patient Management Systems**

- **Advanced Clinical Systems**

- **Pathology Systems**

- **Pharmacy Systems**

- **Booking Systems**

- **Health Record Systems**

Logan Hospital

Hospital Pharmacy

Logan Hospital – QLD Health Department

- Logan Hospital is 300 bed hospital

- Providing services across the continuum of care including:

    - Medical & Surgical services, Obstetrics, Paediatrics, ENT, Emergency
    - Specialist outpatient clinics: Oral Health, Pathology, Medical Imaging & Allie...
    - Community He... ...tion , Child Health Clinics, Menta...

- Facilities includ... 1 day surgery unit
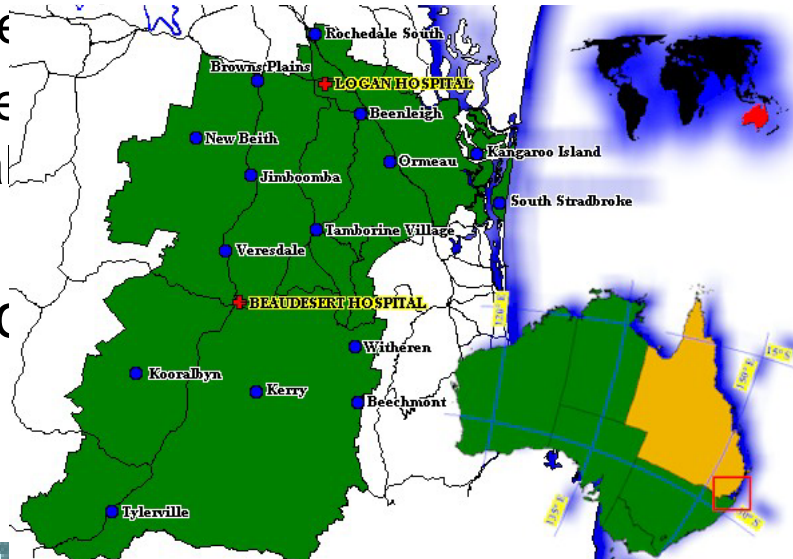
Situation – Hospital Pharmacy

- Manual system which involved the transcription of the doctors prescription

- The Hospital Pharmacy recently trailed Microsoft Windows CE-powered Compaq Aero 8000 subnotebooks , however limited functionality of the Aero 8000 devices , slow processors, limited application compatibility and dwindling battery life has driven the pharmacy to look for an alternative solution

- Pharmacy staff see more than 200 patients in a typical day and need to stay up to date with information on thousands of medicines distributed through the hospital

Software implemented

- Logan Hospital has implemented iSOFT's Pharmacy application providing pharmacy staff with:

  - Patient dispensing
  - Stock control
  - Reporting

Overview of wireless technology

- Mobile PC's powered by Intel Centrino mobile technology as a replacement for two Microsoft Windows CE powered Compaq Aero 8000 subnotebooks

- The solution at Logan Hospital is to provide several full-featured Intel Centrino mobile technology-based PCs, wirelessly linked to the hospital network, for pharmacy staff to use throughout their rounds and when managing the pharmacy's inventory/patient dispensing etc

Outcome

- By linking the Mobile PC's into the pharmacy management system using a wireless LAN card, pharmacy workers have been able to reduce the number of trips they make to the bed side
- Due to the current chronic shortage of pharmacists, a more efficient method of utilising these scarce resources, to provide a better quality of service was required

  - The use of wireless technology optimises the pharmacist time in the ward with the patient and medical team
  - Reduces the mistake rate by dispensing directly off the prescription
  - Satisfied legal requirements
  - Mobility of the pharmacist enables a better pharmacy service to the patient by being able to answer questions on medication issues and provide appropriate medicine information at the bedside
  - Intel chip used in conjunction with the I.Pharmacy system provides

Benefits

- Centrino technology incorporates many features which provide benefits that suite the way the hospital workers spend their days

    - Extended battery life, for example, means pharmacy workers can keep using a device throughout an entire shift without having to recharge

    - Provides better stability then previous wireless devices and provides fast screen refreshes

- Integrated wireless access means connectivity problems with the solution will be reduced
- Eliminating manual entry processes has increased productivity of pharmacist and improved staff utilisation

Benefits continued…

- Logan Pharmacy staff use re-stock trolleys to hold the PC which work extremely well in the pharmacy environment which requires medication/drugs etc to also be stored on the trolley. This approach also removes issues with all of the following;

  − Physical security − device can be secured to trolley

  − Weight − no one has to carry around the devices

  − Both hands free

  − Larger screens can be used − improved User Interface

- Direct entry of medication orders into Pharmacy system

Lessons

- Configure the system well before implementation (eg print drivers, print set up, laptop etc)

- Ensure that all staff are involved and understand the process

- The clinical pharmacist should ensure that all labels are printing correctly in the pharmacy

- Under promise and over deliver

Worcestershire Healthcare NHS Trust

Mobile nursing

Worcestershire Healthcare NHS Trust – UK

- Worcestershire Healthcare NHS Trust provides day to day community healthcare and mental health services to more then 545,000 people
- Worcestershire provides a range of services including; inpatient, outpatient, community nursing & therapy
- Also consists of speciality clinics such as community dentistry, sexual health & child services
- Services are delivered to the community from over 70 sites across the trust as well as GP surgeries and home visits
- Sites include five key community hospitals

Situation

- i.Patient Manager implemented throughout the trust in 1994

- Over 1,000 users covering community and mental health services

- Large community based staff hence need to access up to date patient information from any care setting eg. from the patients home

- Paper based system, community staff including nurses were required to keep paper records which would need to be entered in to the system

- Worcestershire NHS Trust wanted to allow its mobile nursing staff and community care staff to experience the benefits of working wirelessly

Products implemented

- Worcestershire has implemented iSOFT's Patient Administration application providing staff with:

    - Inpatient/Outpatient Management
    - Clinic Management
    - Community & Mental Health
    - Accident & Emergency
    - Patient Document Tracking
    - Orders & Results

Technology

- General Packet Radio Service (GPRS) enabled notebooks Dell Latitude C400

- GPRS is encrypted end to end and as not data is actually downloaded onto the device, security is maximised

- GPRS has the capability to give users 'always on' access to email, the internet and links directly to the trust network services

- GPRS enabled community staff and mobile nurses to download and update patient records whilst on location

Technology cont…

- In summary, users obtain:
    - Pre-configured, built-to-order notebook that includes the Dell TrueMobile GPRS PC card
- All software and drivers
- Pre-installed SIM card from one of two major operators in the UK: O2 and T-Mobile

In addition, the corporate solution includes:

- Partner-provided installation services
- Optimisation software from Broadcloud Communications
    - which significantly enhances the performance and end user experience over GPRS, especially when accessing the web or Microsoft Exchange email.
- GPRS-enabled leased line connectivity between the GPRS and corporate networks

6 month Pilot

- Began in January 2002
- 22 staff currently using GPRS notebooks
- Initially involved staff within teams across intermediate care, hospital at home including both primary care and mental health patients
- First phase focused on the assessment of data transmission rates and service reliability
- Evaluation of different mobile devices
- The pilot has been running for over 1 year and has been extended indefinitely

Benefits

- On demand retrieval of real time patient information, email internet from the point of care − critical for community nursing

- Improved quality of care

- Increased productivity of healthcare workers

- Reduction in cycle times for data collection and treatment decision

Extending the reach

iSOFT - Sustaining Modern
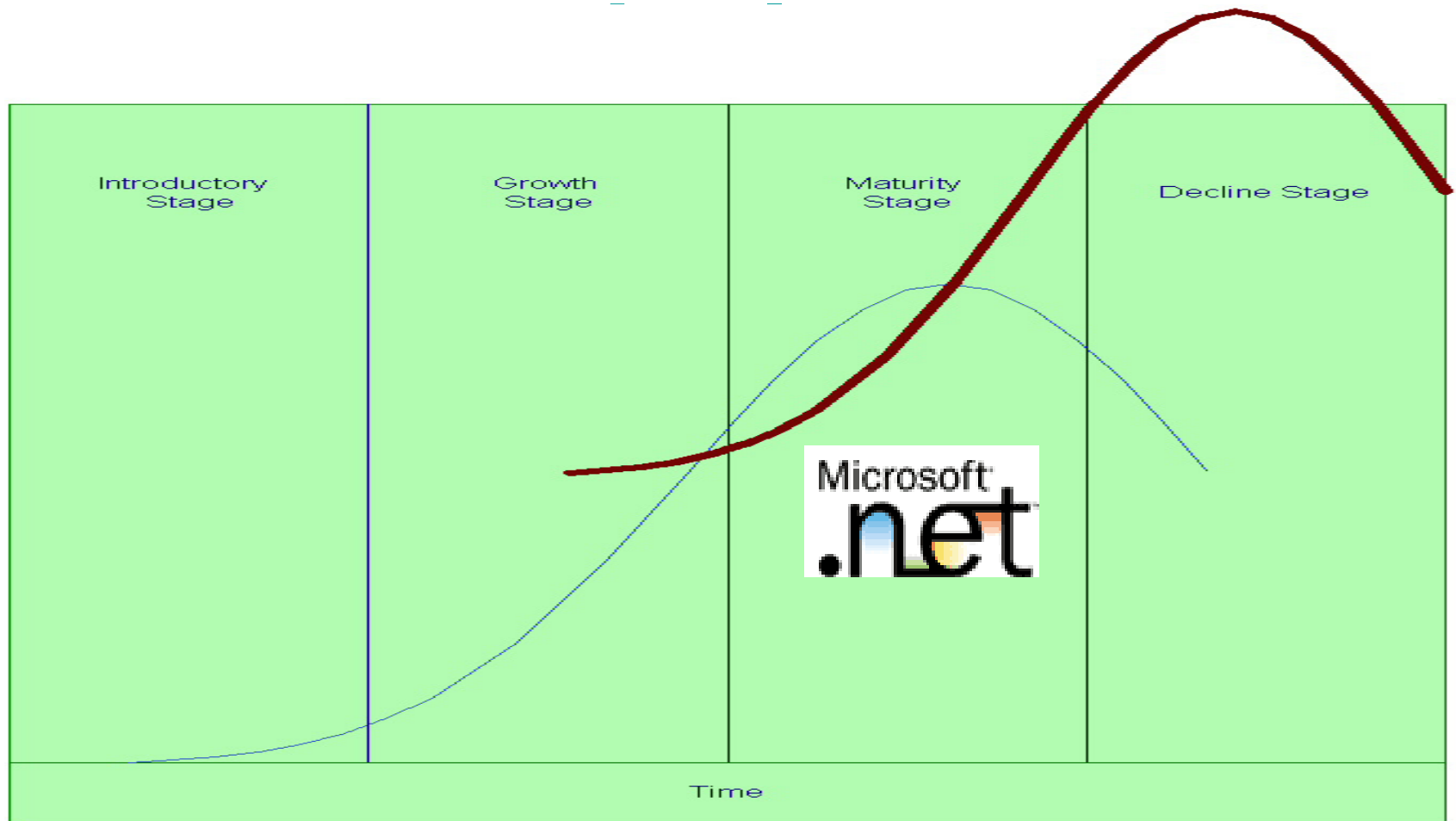
Software Evolution – The Drivers

Extending the reach

The User Interface & Mobility

Scalability & Robustness

User Interface & Mobility

- **An exciting user experience**

- **Intuitive & efficient navigation**

- **Device independence**

- **Inherently leverage technology**

- *AND*

- **Think beyond traditional computing**
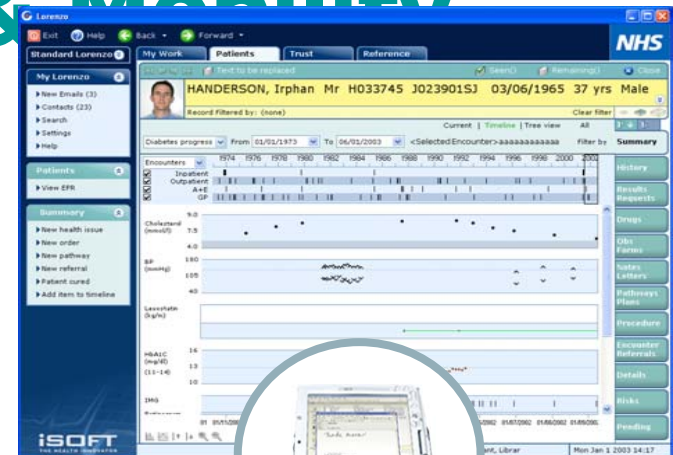
Lore...

- Developed on .NET
- Superior interface design
- Handwriting recognition
- Graphical illustration
- Inherently leverages Tablet PC and Centrino
- Voice recognition
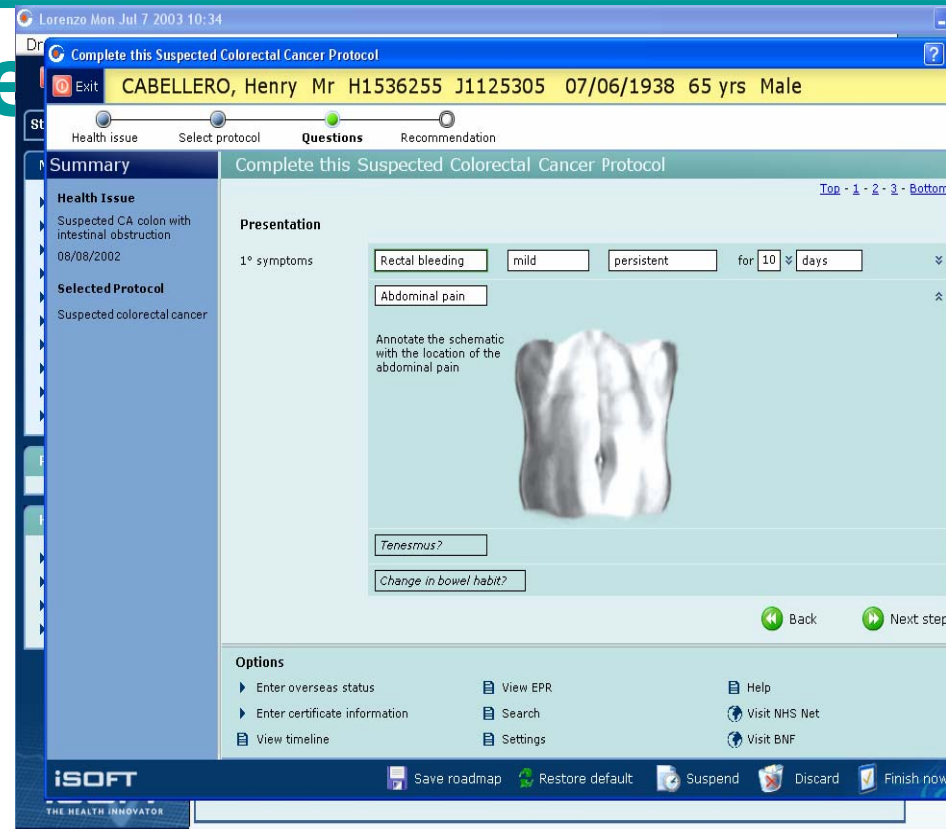
LORENZO Demonstration

LORENZO

Please enter your details

Username ▶ [PMcCabe]

Password ▶ [●●●●●●●●●●●●●]

Location ▶ [▼]

[Clear]   [Login]

iSOFT
THE HEALTH iNNOVATOR

LORENZO

- **integration of iSOFT applications**
  - **PiMS**
  - **iCM**
  - **STOCCA**

- **continued enhancement and development**
  - **enhanced clinical documentation**
  - **inclusion of a vocabulary/lexicon**
  - **workflow and business process model**

- **new user interface experience**
  - **intuitive**
  - **usability**
  - **utility**

Dr Pauline McCabe GP Stockport Medical Centre

- View Patient Record
- Order Investigation
- Order Drugs
- Book Appointment
- Create referral
- Cancel Appointment
- View My Patients

Todays Task List - 09/02/2003

(11) Total   (3) New   (3) Urgent

Referrals

Patient Name	Date of Birth	Referral Summary	Priority	Date
Gary Phillips	08/03/76	Home visit request	Routine	
Johnathon Grimble	03/05/74	Second opinion request	Urgent	
Jo Bleasdale	03/05/66	Not specified	Routine	
Gemma Smith	02/02/55	Home visit request	Routine	
Richard Johnson	14/12/77	Not specified	Routine	
David Gonzalez	22/11/88	Second opinion request	Routine	

Investigations Results

Patient Name	Date of Birth	Result	Priority	Date
Stuart Phillips	08/03/76	FBC,U&E	Routine	
Paul Shambrook	03/05/74	Chest X-ray	Urgent	
Sacha Woods	03/05/66	CT Head	Routine	
Puneet Patel	02/02/55	Diabetic profile	Routine	

Orders

Patient Name	Date of Birth	Order Type	Priority	Date
Stuart Phillips	08/03/76	Prescription	Routine	

Tasks

Messenger   (5)

- Dr Johnson
- Nurse Davies
- Andrew
- Steve
- Dr Roland
- Paul
- Adam

Patient List   (2) Total   (1) New

Patient Name	Age	Appointment Type	Time
John Stevens	27 yrs	Routine	10:00
James Barking	76 yrs	Routine	10:30
Simon Gelling	55 yrs	Routine	11:00
David Wells	45 yrs	New	11:15

PROJECT LORENZO

Address

Postal:	14 Orange Road, ST56 6YH
Phone:	0161 477 5643
Mobile:	07965893246

GP Details

Name:	Dr Pauline McCabe
Phone:	0161 447 9658
Practice:	MCCAB01

Active Health Issues

Health Issue	Onset Date	Entered Date
Asthma	01/03/1995	10/03/1995

Active Medications

Name	Summary	Stop Date
Ventilin	2 puffs	

Active Professional Carers

Role	Name	Phone	Entered Date

Patient Alerts

Type	Alert	Entered Date
Drug	Allergy to penicillin	01/05/1998

Summary

Details

Notes

Results

Drugs

Pathways

Referrals

Letters

Contacts

iSOFT

THE HEALTH iNNOVATOR

NHS

Exit | Help

| My Work | **Patient** | Trust | Reference |

JONES, Richard Mr H507496 J1137743   08/02/1948 55 yrs Male

Close

Filtered by: (none)   Clear filter

List View | Trend View   List and Details | Preview | List

	Investigation Name	Service Department	Sample Date/Time	Result Date/Time
!	Full Blood Count	Haematology	10/05/2002 12:00	10/05/2002 12:45
!	Abdominal Ultrasound	Diagnostic Imaging	12/05/2002 10:20	12/05/2002 12:50
!	U&E	Biochemistry	11/05/2002 14:10	11/05/2002 14:50
!	LFT	Biochemistry	16/05/2002 15:00	16/05/2002 15:30
!	Aortogram(3D reconstruction)	Diagnostic Imaging	22/05/2002 10:00	22/05/2002 17:30

FBC   Department: Haematology   Ref No: 09901101

Performed	10/05/2002 12:00
Status	Results fully available
Result	Hb 13 MG/DL 11-14
	WBC 4.7 x10^9/L 4-11
	Platelets 155 x10^9/L 150-450
	MCV ↑ 97 fL 76-96
Comments	No comments entered

Side navigation:

tandard Lorenzo

My Lorenzo
- New Emails (3)
- Contacts (23)
- Search
- Settings
- Help
- Register patient
- Find patient
- Book appointment
- Create referral
- Add to pathway

Summary

Right tabs:
- Summary
- History
- Results Requests
- Drugs
- Obs Forms
- Notes Letters
- Pathways Plans
- Procedure
- Encounter Referrals
- Details
- Risks

iSOFT
THE HEALTH INNOVATOR

Exit　　Help

My Work　｜　Patient　｜　Trust　｜　Reference

JONES, Richard　Mr　H507496　J1137743　08/02/1948　55 yrs　Male

Close

Standard Lorenzo

My Lorenzo

- New Emails
- Contacts (23
- Search
- Settings
- Help
- Register pati
- Find patient
- Book appoin
- Create refer
- Add to pathw

Summary

Clear filter

List and Details | Preview | List

Ultrasound Image Viewer

OK

Summary

History

Results Requests

Drugs

Obs Forms

Notes Letters

Pathways Plans

Procedure

Encounter Referrals

Details

Risks

	ment		Sample Date/Time		Result Date/Time	
			10/05/2002 12:00		10/05/2002 12:45	
	..aging		12/05/2002 10:20		12/05/2002 12:50	
			11/05/2002 14:10		11/05/2002 14:50	
			16/05/2002 15:00		16/05/2002 15:30	
	..aging		22/05/2002 10:00		22/05/2002 17:30	

Department:　Diagnostic Imaging　Ref No:　00901890

absence of the left kidney and low-grade ostial stenosis of the distal , atherosclerosis. The sole kidney measures 14 cm x 7.1 cm x 3.6 cm

Recommendations　　No recommendation entered

Images　　　　　　　▶ CT Scan

iSOFT
THE HEALTH INNOVATOR

David Wells   D4532167   09/06/1967   ♂

1 ─────────── 2
Select Investigations Place order

[Save]
[Restore]

Summary ⊗

Search:

[   ]

Advanced Seach ⊗

Scratch Pad:

[   ]

[Clear] [Go]

Order Results:

Select date of request:

Frequency: [▼]

Starting: [09/03/02 ▼]

Number: [▼]

[Add]

1. Select Investigations

Requester:	Dr Koti Lakshmanan	[Change]
Primary Carer:		[Change]
Specialty:		[Change]

Results will be sent to:

Dr Koti Lakshmanan (Pending Folder)
Mr MacClennon (Urgent messaging)
Ward 8 (Urgent messaging)

[Change]

Orders

Investigation name	Service Dept	Req. Date/Time
U&E	Biochemistry	09/03/02
Alpha fetoprotein	Biochemistry	09/03/02
CEA	Biochemistry	09/03/02

Edit individual orders:

Date to be done: [▼]   Priority: [▼]

Current Problems

Description	
Asthma	☐
Suspected Ca colon	☐

Comments:

[   ]

Select commonly used phrases to add to clinical details:

[Phrases]

[Next]

Save   Discard   Finish

Demonstration of Lorenzo on Microsoft Tablet PC

Mobile Computing Trend & Future Technologies

Sung Ho Lee

Technical Marketing Manager

Intel Korea

(sung.ho.lee@intel.com)

Agenda

- Mobile Trend
- Mobile@Health Care
- Mobile Devices for now & future

Mobile Trend

We are working differently

Mobility has changed business software requirements

Mobility Vision

All Computers will Communicate

All Communications devices will compute

Cellular 2.5/3G

WiFi 802.11'x'

- Mobility Aware applications
- Applications are Portable, Scaleable
- Write Once, Run Best across Intel Processors

The Mobility Client Space
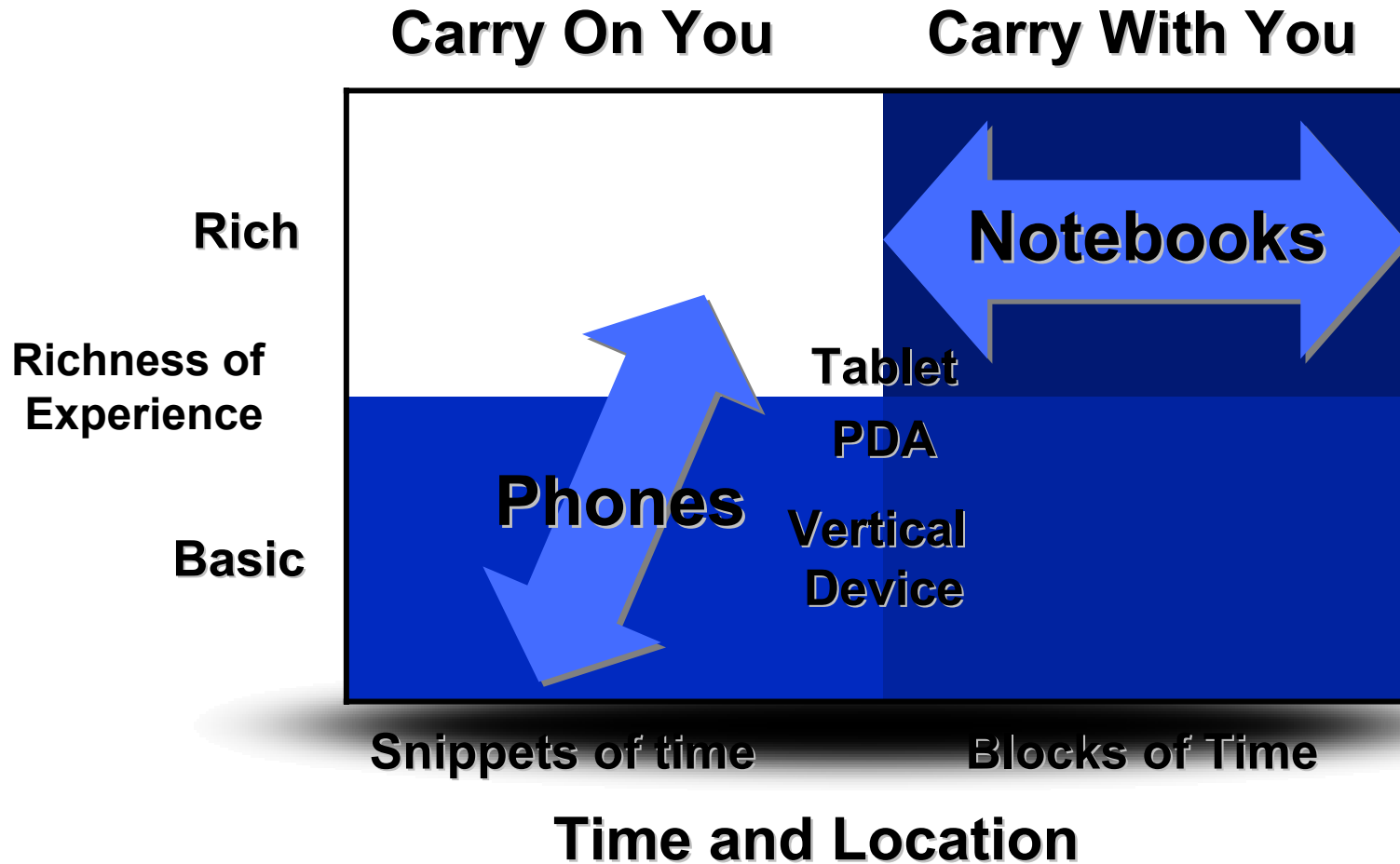
Wireless LANs Are Taking Off

Worldwide WLAN Market
includes embedded clients, add-on client cards, & infrastructure equipment for both the business and consumer segments

($ Billions)

CAGR = 43%

Year	Value
2001	$1.7
2002	$2.6
2003	$3.3
2004	$6.0
2005	$9.0
2006	$10.3
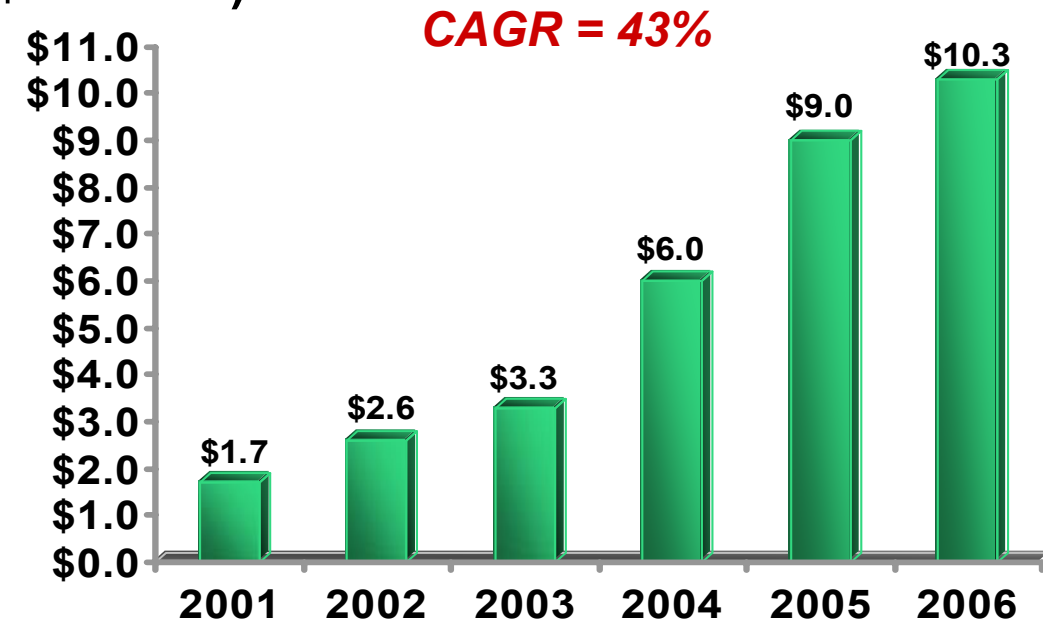
Source: Forward Concepts, 2003

Future Growth Expectations Due To

✓ **Out of Box Security**
✓ **Standards**
✓ **Low Cost**
✓ **Embedded in Laptops**
✓ **Variety of Devices**
✓ **Voice + Data**
✓ **Employee Demand**
✓ **Ease of Deployment**
✓ **Network Mgmt. Tools**
✓ **Multiple Applications**

The Shift to Mobile is On

- **Leading Global Companies See the Value in Mobile Computing**

- **Together, an excellent platform for corporate mobile computing, Windows® XP Professional and the Intel® Centrino™ mobile technology**

NOKIA CONNECTING PEOPLE — 50%

Procter&Gamble — 60%

Marriott — 60%

AT&T — 65%

intel — 77%

BOEING — 80%

PEOPLE Soft — 90%

0%   20%   40%   60%   80%   100%
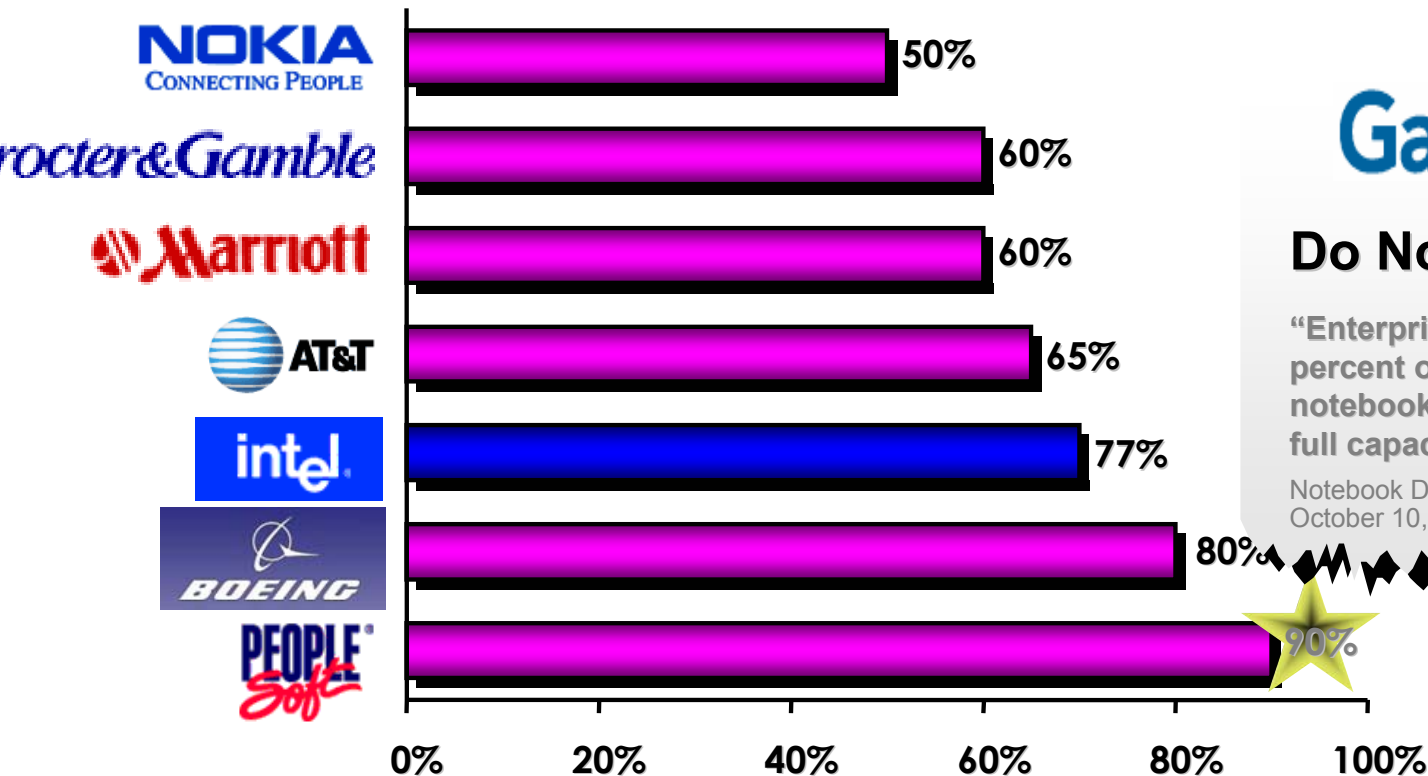
Gartner

Do Notebooks pay?

"**Enterprises with less than 35 percent of the workforce using notebooks may not be receiving full capacity from their workers.**"

Notebook Deployments in the Enterprise October 10, 2002, Gartner

Percentage of Knowledge Worker Employees with Mobile PCs

Source: Intel Corporation, 2001

The Benefits of Wireless

Productivity Graph

Notebook with WLAN Productivity

11 hrs

Desktop Productivity

3 hrs
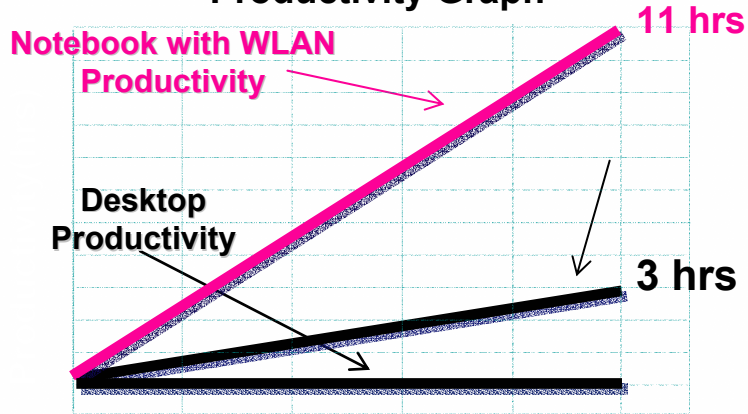
- Gains of up to 11 hours per week in added productivity*

- ROI is quickly realized through productivity gains and lower mobile TCO**

* Gartner, Inc., August 2002 "Desktop PCs: Technology Overview"
** Gartner, Inc., Oct 2002 "Notebook Deployments in the Enterpris

- Wireless connectivity boosts productivity by enabling maximum speed, agility and flexibility to meet changing work environments

- Effective security solutions available today

- Increased flexibility boosts employee satisfaction

The Benefits of Wireless (Quote)

"The ability to make decisions in real time saves us development cycles. And development cycles equate to dollars in our industry."
oan Vandermate, VP, Product Manager Platforms, Siemens Information and Communications Networks, Inc.

"Our wireless LAN is just as secure as our wired network. We're totally comfortable with our wireless security; otherwise, we would not have deployed it on such a large scale."
Jawad Khaki, Corporate Vice President, Windows Networking and Communications Technologies, Microsoft Corporation

Hotspot Growth Continues

- Intel building awareness of public WLAN hotspots worldwide by verifying hotspots with Intel® Centrino™ mobile technology
    - Initially focused on business users and the locations they frequent
- Access Point Growth
    - Public WLAN hot spots worldwide set to increase to 120,000 access points world wide by 2007. [1]

[1] Gartner "Public Wireless LAN Hot Spots: Worldwide Trends and Forecasts", 09 August 2002, Ian Keene, John Calvert

Public Wireless LAN Hotspot Acceleration

By 2005, over 80 percent of professional notebook PCs will have an IEEE 802.11 WLAN interface*

By 2008, there will be over 75 million users of public WLAN hot spots*

By 2008, there will be over 167,000 public WLAN hot spot locations*

Figure 1-1
Public WLAN Hot Spot Locations Worldwide, 2001-2008

Public WLAN Hot Spot Locations

114650-01-01
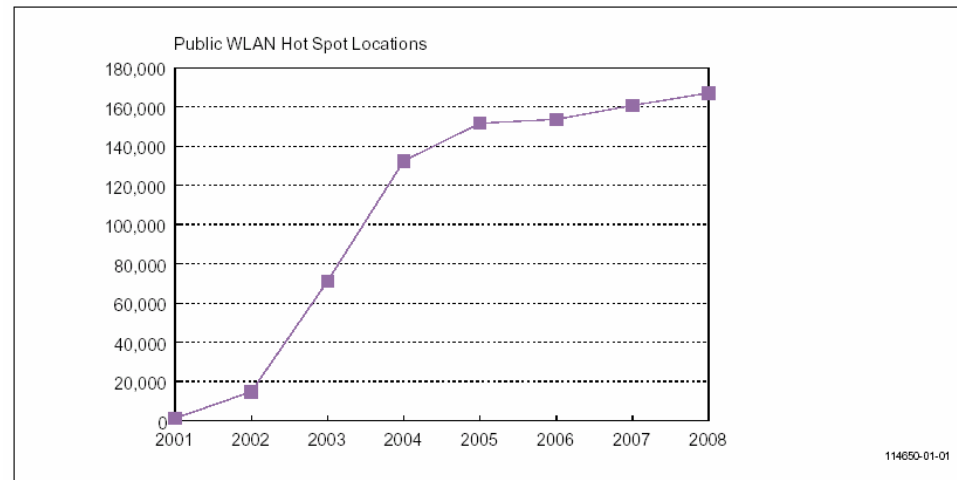
Source: Gartner Dataquest (April 2003)

* Source: Gartner, Inc, May 2003 "Public WLAN Hot Spot Locations Worldwide, 2001-2008"

Wireless Verification Program: Results
Enhanced Experience at Verified Hotspots

Americas — 16 Service Providers, 4,000+ Hotspots

Europe — 21 Service Providers, 1,500+ Hotspots

Japan — 9 Service Providers, 1,800+ Hotspots

APAC — 12 Service Providers, 9,100+ Hotspots

wireless internet access here
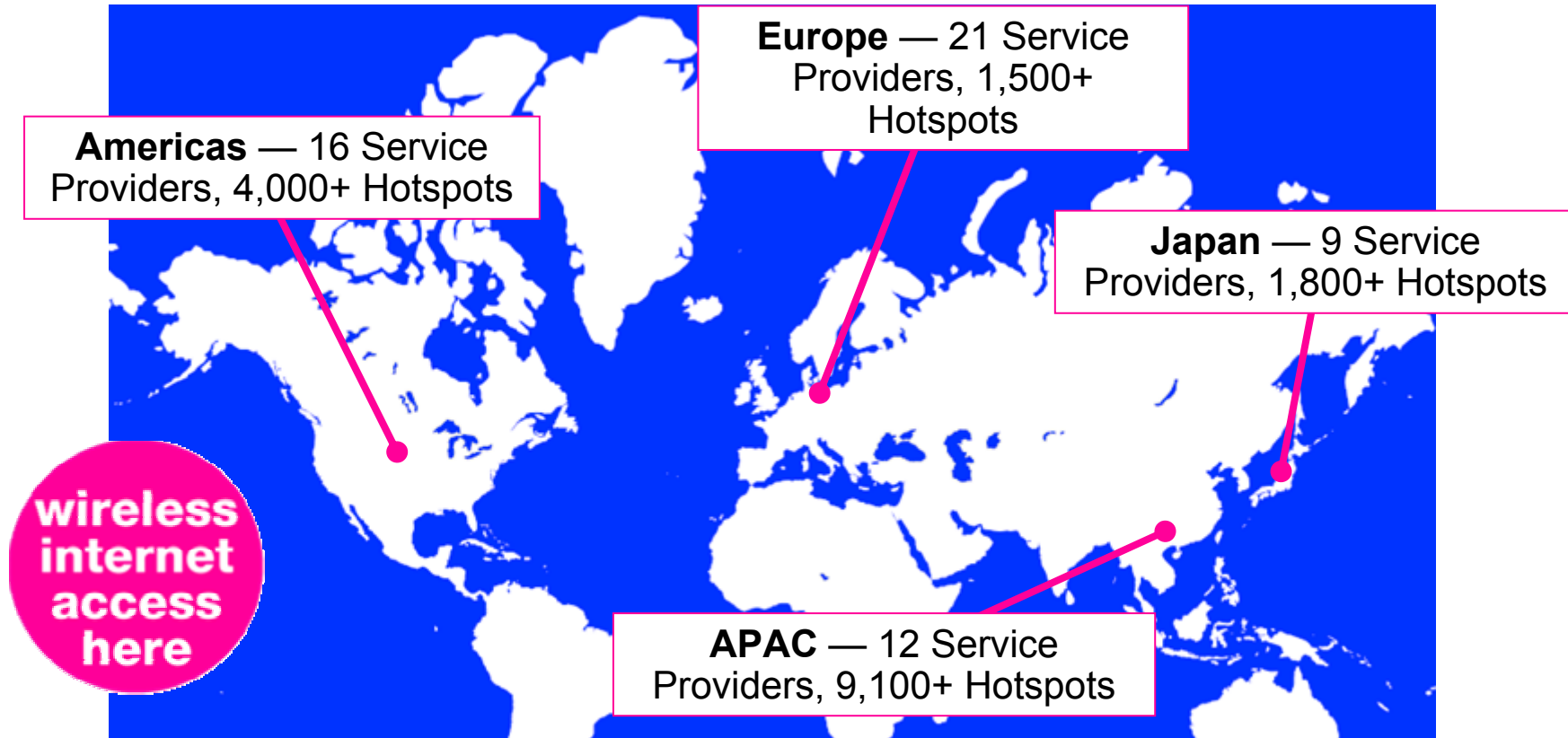
Intel has worked with leading wireless LAN service providers to proactively verify interoperability with their Wireless LAN networks, covering over 16,000 hotspots worldwide, to enhance your Intel® Centrino™ mobile technology wireless LAN experience at verified hotspots.[1]

1 Wireless connectivity and some features may require you to purchase additional software, services or external hardware. Availability of public wireless LAN access points limited.

End-to-End Wireless LAN Security

Backend infrastructure handling: Authentication and/or Encryption

Authentication & Encryption via VPN or WLAN Security Standards Client Firewall Virus Scan

WLAN Security Standards implemented in the WLAN Infrastructure

More information on "Deploying Secure Wireless Networks"
http://www.intel.com/ebusiness/it/solution/wp032201_sum.htm

Secure Wireless Networking Extends Your Enterprise

- Using a VPN to secure your Wireless LAN is a proven model that you can implement today
  - Plus get the additional productivity benefits of secure remote access at home or on the go

- The Wireless LAN Security Standards and Extended Solutions continue to be enhanced
  - Wi-Fi Protected Access* [1,2]
  - Enhanced security support for LEAP, CKIP and other Cisco Compatible Extensions[1,2] available from certain PC Manufactures

- Intel® Centrino™ mobile technology with integrated wireless LAN capability[1] is built from the ground up for mobility
  - Verified with leading wireless security hardware, Virtual Private Network, firewall and access point providers

Intel® Centrino™ Mobile Technology: Wireless LA
Security Support

- Verified with leading security solutions

- Industry standard wireless LAN security support is available (802.1X, WEP, WPA*[1,2]) with enabling software implementation

- Cisco* Compatible Extensions (such as LEAP and CKIP) support is available on certain models[1,2]

Intel® Centrino™ mobile technology can enable a more secure WLAN environment

1. Wireless connectivity and some features may require you to purchase or download additional software, services or external hardware. Availability of public wireless LAN access points limited. System performance measured by MobileMark 2002. System performance, battery life, wireless performance and functionality will vary depending on your specific hardware and software configurations. See http://www.intel.com/products/centrino/more_info for more information. 2. Intel® PROSet software and/or some security solutions may not be supported by your PC manufacturer. Check with your PC manufacturer for details on availability.*

*Other names and brands may be claimed as the property of others.

802.11 and 3G:
"Complementary, not Threatening"

802.11 is Driving 3G Adoption:

- WLAN is cheap and fast and is **introducing** many business users to the value of wireless data
- 3G satisfies new-found user demand for:
  - Mobility
  - Environmental Control/ Security
- Benefits of dual technologies:
  - <u>User</u>: High speed data access anywhere
  - <u>Operator</u>: High speed data access provider for the mobile user

Role of 3G vs. 802.11: Mobility vs. Bandwidth
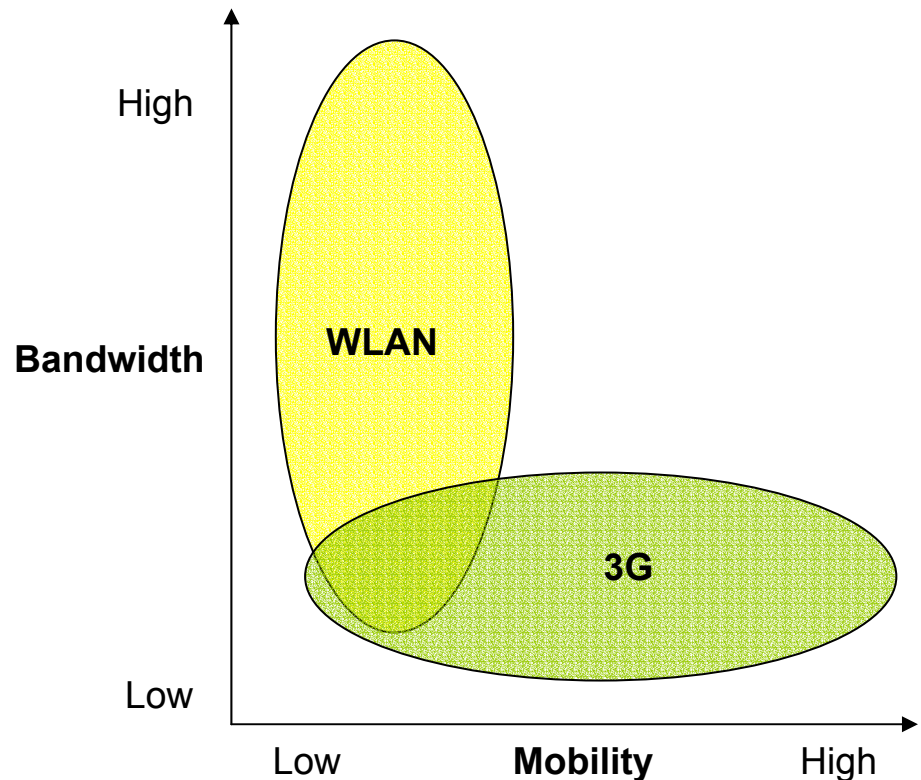
Wireless LAN Standards – **Interoperability**

802.11a/b AP

Effective .11a Throughput ~ 22-26 Mbps

Effective .11b Throughput ~ 6 Mbps

802.11a Client

802.11b Client

802.11b/g AP

Effective .11g Throughput ~ 22-26 Mbps

802.11g Client

802.11b/g AP

Effective .11g Throughput Degrades to ~ 13-15+ Mbps

Effective .11b Throughput ~ 6 Mbps

802.11b/g Client
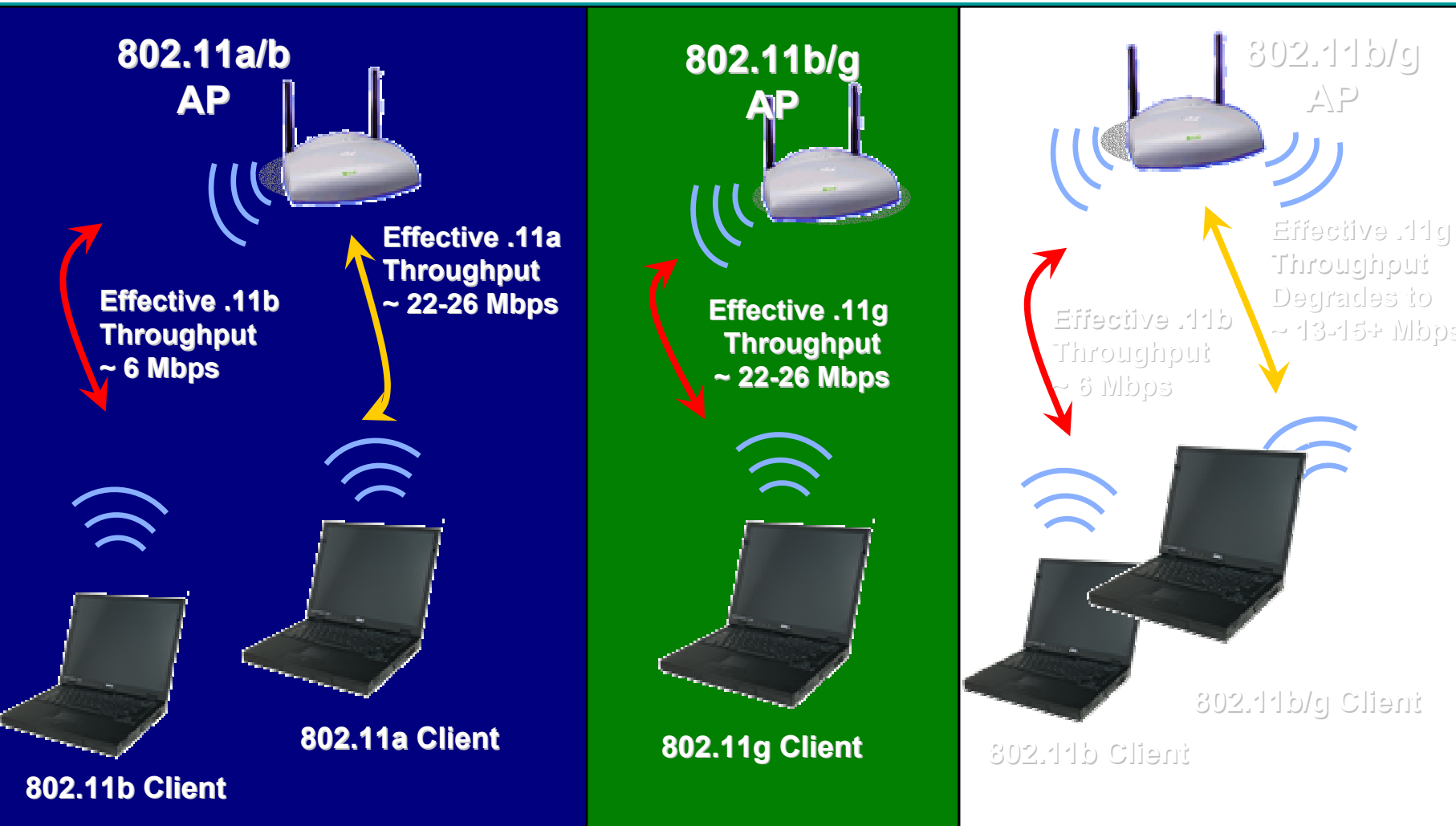
802.11b Client

*Source: Intel White Paper, Dec 2002 "54 Mbps IEEE 802.11 Wireless LAN at 2.4 GHz"

What Wireless LAN capability should you deploy to your business?

	H1'03	H2'03	H1'04	H2'04
Client	802.11b	802.11b	802.11b	802.11a/b/g*
Infrastructure	802.11b	802.11a/b	802.11a/b/g *with 802.11i when available*	802.11a/b/g

*Note: Intel Stable Platform guidance shows Intel PRO/Wireless 2100 network connection (802.11b) into H2'04

Migrate to high speed, multi-standard infrastructure support to maximize flexibility and freedom

Mobility@Health Care

Critical Trends in Healthcare

1. Scarce resources and infinite demand
   - Demographics, SARS, capital constraints ($$ & humans); operational efficiencies are critical to resolve rising costs

2. Quality finally matters in Healthcare
   - Accountability, Accuracy, Safety, Operational Efficiency

3. Regulation & Legislation changes everything
   - Pending US Medicare drug benefit legislation requires CPOE by 2007
   - Health Ins. Portability & Accountability Act of 1996 (HIPAA)
   - Electronic Medical Records (EMR)
   - DHS, VA, and DoD standards push; Feds License SNOMED-CT; FDA adopts Bar codes

4. Wireless, Wireless, Wireless seen as a viable way to meet HC challenges
   - Mobile Point-of-Care (POC) solutions such as:
     - **Clinical Decision Support Systems (CDSS)**
     - **Computerized Physician Order Entry (CPOE)**

Current Drivers In Healthcare

- Fewer caregivers
  - By 2020, 44 states, DC expect nursing shortage[1]
- Improve patient safety through electronic data capture
  - CPOE, CDSS, EMR initiatives, Mobile Point of Care (POC)
- Secure information management with real-time update
  - HIPAA
- Operational efficiency through integration of business processes at POC
  - Improved Supply Chain Management
  - More accurate records, management from item inventory release to administering to patient

Opportunities for Business Process Re-engineering for Business Efficiencies

- Increase customer service with access to real time data almost anywhere
    - Increase demand for patient safety
    - Reduce patient waiting times

- Increase accuracy and reduce overhead with one-time data entry by health professional at point-of-care (POC), initially focusing on order entry:
    - Prescription orders
    - Laboratory orders
    - Radiology orders
- Replace expensive, proprietary and immobile stations required for viewing medical imaging:
    - Radiological imaging systems (RIS)
    - Magnetic resonance imaging (MRI)
    - Computed tomography (CT) scans

- Improve cost controls and productivity of care givers are critical

Care delivery needs better integration with business process

Scenario #1: Mobile Point of Care (POC) Solution

Business Opportunity:
- Caregivers need access to real-time up to date Clinical Decision Support Systems (CDSS) delivered at the point of care
- Data that is captured once at the point of care is inherently higher quality, and could be available in real-time to the entire healthcare infrastructure

Healthcare Benefits:
- Improved patient safety by having the correct, real-time data
- Streamlined nursing tasks to provide higher job satisfaction and more time for value added nursing activities

Operational Benefits:
- Automated processes reduce order errors and delays
- Increased workforce productivity and reduced labor costs

Business Benefit – Mobile POC Solution

Solution:
- **Mobile wireless clients:** Laptops, Centrino Tablets, PDAs running CPOE and CDSS applications with workflow modified for mobile environments. Vendors include, McKesson & Eclipsys on LT; Allscripts & Patientkeeper on PDAs
    - Med, lab and radiology orders (with CDSS)
    - Clinical notes (Allscripts dictation)
    - ADT reg
- Electronic Medical Record Vendors such as EPIC, Eclipsys, McKesson and Siemens are working with Intel to port back end to Itanium. (end to end IA)

Why Powerful PCs?
- Thick client performance allows secure wireless and mobile devices as well as clinicians like to multi-task across multiple clinical applications.
- Concurrent access to patient record to eliminate repetitive data entry
- Reduce functional dependence on network processing and availability
- Overcome user barriers with smarter interface and faster response times
- Notebooks and tablet PCs can capture vital signs at the mobile POC:
    - blood pressure and blood oxygen saturation, lung function, pulse, temperature
- Secure wireless and mobile access to EMR and CPOE systems:
    - allergy alerts, drug interactions, e-prescription, lab results, medication schedules, clinical notes (input via pic list, voice dictation, or hand writing)

Mobile POC Solution Proof Points

- According to Microsoft, carrying a mobile device for CPOE replaces 2000 pounds of medical documents with real time medical reference, order entry and clinical formulary data.
- Almanance Regional Medical Center realized a 72% reduction in medication errors during a three-month period.
- Montefiore Medical Center showed an error reduction rate of more than 50%.
- The CPOE system resulted in a prescribing error reduction rate of 37% at Boston Medical Center and saved them saved hundreds of phone calls per day.
- Brigham and Women's Hospital in Boston showed a CPOE system reduced medication error rates by 55%. Hospital savings $5M-$10M
- Wishard Memorial Hospital reduced patient charges 13%
- AMA study showed avg. savings of $86,400 over 5 years
- Leapfrog is piloting a program to pay qualifying hospitals 4% bonuses to jump-start their automation efforts with CPOE. Empire Blue Cross Blue Shield had 10 hospitals lined up to receive the quarterly bonus in July of 2003.
- Physician practice affiliated with the Novi, Mich.-based Trinity Health System records system returned within 18 months. Eliminating the dictation of physicians' notes alone saved $400,000 per year. As a result of more accurate coding, physician emergency room reimbursement was up $1.2 million the first year the system was used

Under legislation enacted in 2000, hospitals and surgical clinics in California must implement ePrescription software by 2005. National legislation expected in the next few years.

Mobile Point of Care Proof Points

"Now, I can be talking with a patient while entering the order and a nurse will walk in to draw blood because she's been notified. It's not that fast all the time, but when it is the patient's jaw drops."

-Frank Orth, D.O., director of Mount Carmel St. Ann's emergency physicians

"We're pursuing CPOE to improve clinical decisions and achieve higher quality of care,"

-John Haughom, M.D., senior vice president of PeaceHealth's health care improvement division

It took three minutes for computer-entered orders to reach the pharmacy or other points where meds are dispensed," says. "It took an average of 96 minutes using paper."

- Kenneth Fath, M.D., a cardiologist affiliated with Alamance Regional Medical Center

"The technology is complex but not the biggest problem…That's managing cultural change…physicians are starting to drive the process. Regarding CPOE…they are highly skeptical… They say, 'Show me the value.'"

-John Haughom, M.D., senior vice president of PeaceHealth's health care improvement division

According to a recent survey of 441 delivery systems by Dorenfest Associates, 37% of integrated delivery systems are considering the acquisition of a CPOE system. The total cost of medical error to hospitals is believed to exceed $2 billion each year.

Scenario #2: Medical Imaging Solution

Business Problem
- Alternative to the expensive, proprietary and immobile stations are used for viewing medical imaging:
  - digital imaging and communications in medicine (DICOM)
  - picture archiving and communications system (PACS)
  - radiological imaging systems (RIS)
  - magnetic resonance imaging (MRI)
  - computed tomography (CT) scans

Healthcare Benefits:
- Better efficiencies through faster care, maximizing scarce radiologists skill set, reducing duplicate testing and digital transfer of file instead of mailing of hard copy images. Delivery of images to radiologists and POC

- Potential to Integrate medical imaging with other CDSS at the mobile POC for better decision support

Operational Benefits:
- Replacing $100,000 proprietary viewing station with multi-purpose PCs, frees up capital budget for more value-add options
- Large decreases in department cost, film development, and courier services

Business Benefit: Medical Imaging Solution

Solution

- Desktop or tablet PCs running Stentor, AcuoMed* or RealTime Imaging* applications can capture and display images:
  - Intel alliance Stentor uses wavelet algorithms, which reduce an image into layers that are delivered as needed over the network without the need for compression. Only the part of the image being viewed on screen is delivered. So, the facility receives the benefits of PACS without the cost of network upgrade required by other systems.
- Established vendors such as Emageon, Kodak, Siemens and GE Medical are showcasing their applications running on tablets as well. However, these solutions require network upgrade to distribute large PACS images.

Why Powerful PCs?

- Large viewing area and pinpoint precision required for accurate diagnosis
- OCC captures and displays 10-100 MB files without clogging up bandwidth
- Security is processed "on-the-fly" with fewer delays:
  - encryption, VPNs
  - biometrics, passwords, smart-card authentication
- Unlike dedicated systems, PCs support standard-based functionality and multiple applications

PACS Proof Points

"iSite will save Providence $4.5 million over the next five years by eliminating film processing, storage, and distribution costs."

> -Dan Robins, Chief Information Officer for Providence Health System San Fernando Valley Service Area.

By using leading edge technologies provided by Stentor and IBM, we have been able to move UPMC to a completely filmless environment, resulting in improved physician efficiency and enhanced patient care."

> -Dan Drawbaugh, CIO of University of Pittsburgh Medical Center

"Our PACS is a wonderful tool, especially because we have fewer radiologists to read images now, and this has greatly improved their workflow," "We do more than 800,000 reads a year, so faster access to images and easier distribution, and other advantages to using PACS technology, are compelling to a facility like ours."

- "Louis Lannum, Manager of Radiology Informatics at Cleveland Clinic

"We get the same resolution as the $60,000 station for $1,500"
-Leann Beird, the Picture Archival and Communication

Systems (PACS) Administrator at the VA hospital

By 2008, Frost & Sullivan predicts that 36% of North American hospitals will have a radiology PACS, along with 20% of non-hospital imaging facilities. That translates to more than 3,000 installed PACs

Scenario #3: Near Future: *Integrated Mobile POC Platform*

Business Problems

- Multiple clinical vendor data streams need to converge for clinical decision support through the electronic medical record
- Care delivery needs better integration with business processes, especially for billing/inventory purposes (charge capture).
- Information delivery to an array of form factors (physical constraints) and stakeholder types (roles and policy definition).

Benefits

- Tangible cost savings and faster returns on IT investment
- Automated safety checks and tasking across the organization—from mobile POC to backend processes
- Helps compensate for shortage of fulltime nurses, radiologists, other skill sets—projected to worsen in the next decade

"…CPOE systems typically must draw data from other sources, such as pharmacy information systems. This raises systems integration issues."

-Fran Turisco, research director, First Consulting Group Inc., Long Beach, Calif.

Near Future: *Integrated* Mobile POC Platform

Solution

- An integrated mobile computing platform that improves both care delivery, patient safety and operational efficiencies

Why Powerful PCs?

- POC and LOB can run simultaneously through the same mobile interface; McKesson* AdminRx* (prescriptions) and SupplyScan* (SCM)
- Clinicians to appreciate functionality at the POC through broad array of developing software capabilities essential for the medical industry:
  - Automated alerts — Push/pull data- real time synchronization
  - Voice recognition — VoIP
  - Video streams --Remote sensing and telemedicine
- IT to demand Robust clients contribute to a stable computing platform:
  - Long-term hardware and software image reliability
  - Lower IT support and requalification costs

Near Future: *Integrated* Mobile POC Platform Proof Points

West Coast Provider, United States
- E-prescription system: McKesson* AdminRx*
- Client refresh: Dell* desktops, Intel® Pentium® 4 processors 1.9 GHz
- Result: Pharmacy turnarounds reduced from 95 to 41 hours (> 64% improvement)

United States Provider (anecdotal)
- Mobile POC integration with barcode scanning system:
  – keyboard video monitors (KVM) in supply rooms
  – Welch-Allyn readers in patient rooms
  – PDAs in nursing supply stations
- Automated processes:
  – e-catalog entries   — supply cart refills
  – price optimization   — vendor management
  – supply reordering
- Result: Inventory turned over 13 times per year - payment on all supplies with a net 30-day invoice

Near Future: Integrated Mobile POC Platform

Intel/Cap Gemini joint pilot

- Study sites at nine hospitals (TBD); application integration from multiple vendors: Cisco*, Patientkeeper*, PocketPresence*, QRS* and Sensitron*
- User interfaces include wireless notebooks and tablet PCs built on the Intel® Centrino™ mobile technology
- Platform integrates mobile POC and LOB applications:
  - ADT reg
  - lab results & alerts
  - shadow-record notes
  - vital signs capture
  — e-prescription linked to SCM
  — drug references & alerts
  — VoIP telephony or soft phone
  — data-push notes
- Projected care delivery benefits include:
  - Order-entry errors reduced by nearly 100%
  - Patient stays reduced by 1-2 days
  - Access time to information systems reduced by 10%
  - Routine nursing tasks streamlined by 25%
- Savings and revenues to be gained in:
  - inventory control
  - vendor management
  - order fulfillment
  — process automation
  — price optimization
  — supply replenishment

Mobility PC Usages

- Deploying wireless laptops…
  - Enables immediate data entry to EMR
  - Increases availability to care for patients
  - Provides better information for decision-making

- Deploying secure wireless networks/ VPNs…
  - Protects patient data/institution compliance
  - Makes data available for treatment decisions

- Integrating bar codes into supply chain…
  - Closely manages inventory flow, turn
  - Improves patient safety

Jena Hospital, Germany[1]

- Replaced handhelds with Fujitsu-Siemens* Tablet PCs built on mobile Intel® processors
- Tablet PCs allow nurses to push data, eliminating manual entries
- Result: Time savings of 2 hours per nurse per shift

At the end of the day, mobile computing can improve patient care and reduce costs, by being more efficient.

Benefits of Wireless in a Healthcare Environment – Mater Hospital

Mater Hospital* – Mater Health Services

- More treating, less walking
- Easier systems access
- More efficient pharmacy practice

Video Testimonial

"Previously, pieces of information usually got written on various pieces of paper and were re-entered later in the shift. When this information can be captured in real time, our speed and accuracy will go up. The reduction in footwork will be dramatic."
Robert Trethewey, project manager of modernization initiatives, Mater Health Services

*Other names and brands may be claimed as the property of others.

Mobile Devices for Now & Future

Mobilized Software..

"..is a mode of computing where applications keep working productively for the client, whether the network connection is available or not."

Mobility creates New User Expectations

- Seamless connectivity & communications
  - Applications must handle network connection changes gracefully and bandwidth changes efficiently

- Work anywhere, anytime, on any device
  - Productivity gains through application & data access online <u>and</u> offline
  - Data and Business Logic synchronization to optimize connection time & efficiency
  - Prioritize & personalize content; interact with back-end when bandwidth is available

- Longer battery life <u>and</u> performance
  - All day computing "on the road"
  - Expect similar App performance on laptop or desktop

Driving New Requirements for all Software
- Mobilized Software Initiative-

Key emerging Mobile (Offline) Applications

Structured Data Synchronization (Database, Object, Forms, Content Processing),
Sales Force Automation, Field Service, Supply Chain, Forecasting and ERP

Application Requirements Merge

Standalone Systems
- No Connection Required -

Enterprise Systems & Clients
- Connection Required

Roam across networks
Connect securely
Scale automatically
Manage power

Offline processing
Synchronize client
Scale automatically
Management/Billing

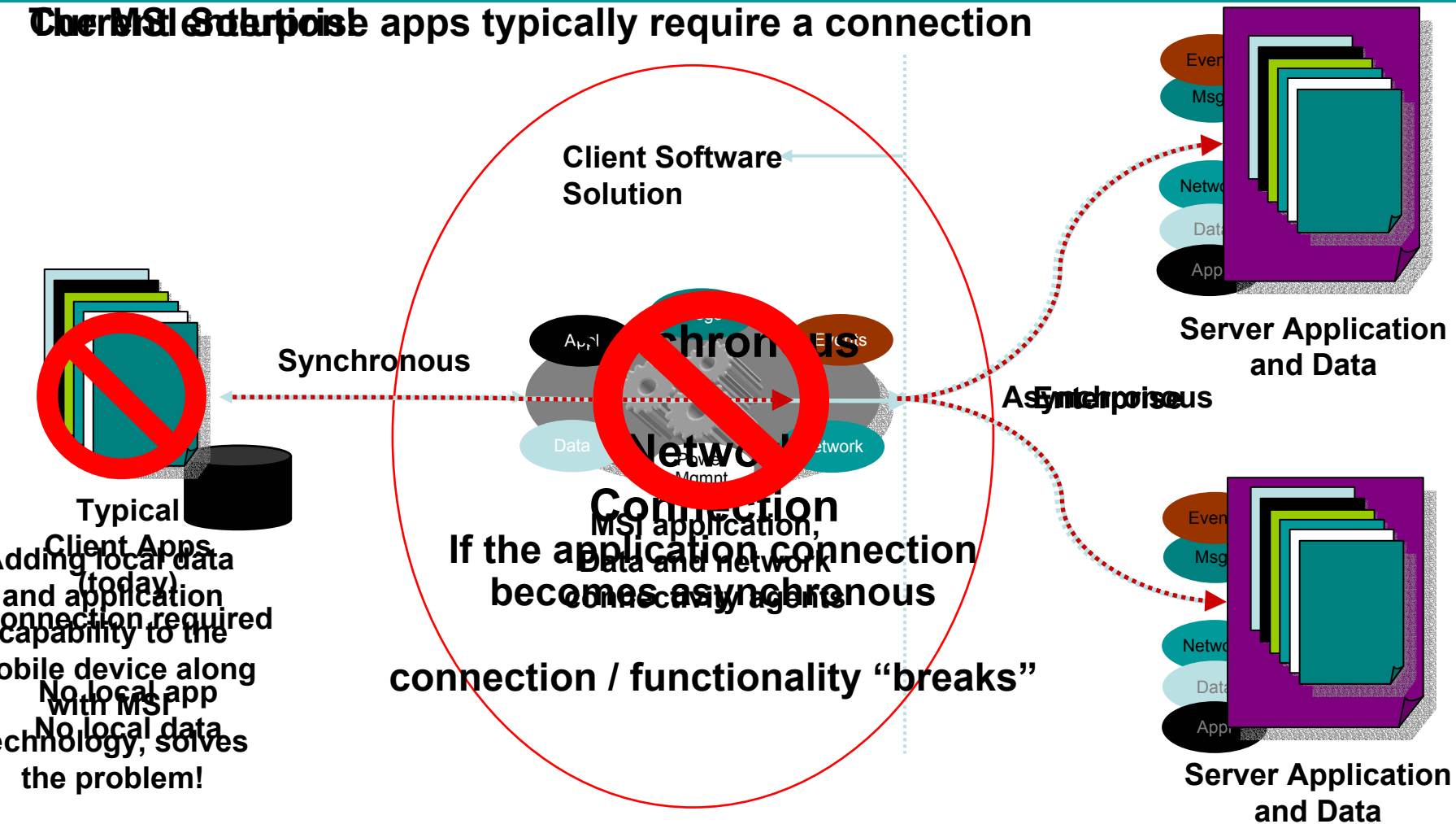# Leading *Mobile Application* Developer Concerns

- Portable Devices
  - **Limited resources, e.g. power, display, etc.**
  - **Heterogeneous Usage Models**
- Wireless Networks
  - **Unreliable, intermittent connectivity**
  - **Insecure and heterogeneous networks**
- Mobility
  - **Dynamic logical addressing, and routing**
  - **Unpredictable changes in application context, e.g. location, security, device, etc.**

How does MSI solve this?

The MSI Solution

Current enterprise apps typically require a connection

Client Software Solution

Synchronous

Synchronous

Asynchronous

Enterprise

Network Connection

If the application connection becomes asynchronous connection / functionality "breaks"

MSI application, Data and network connectivity agents

Typical Client Apps (today)

Adding local data and application connection required capability to the mobile device along with MSI technology, solves the problem!

No local app

No local data

Server Application and Data

Server Application and Data

If the connection is occasional, mobile or intermittent, the app ceases to function properly

Intel® Centrino™ Mobile Technology
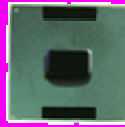
Performance
Benefits
- Mobile optimized micro-architecture
- 1MB L2 cache
- Scaleable chipset solutions
- USB 2.0

Wireless
Benefits
- Integrated Intel® PRO/Wireless Network Connection
- Extensive verification

Intel® Centrino™ Mobile Technology
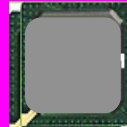
Pentium® M Processor   **Intel® 855 Chipset**   **Intel® PRO Wireless**

Battery Life
Benefits
- Mobile optimized micro-architecture
- Support for Enhanced Intel SpeedStep® Technology
- Power optimized processor bus
- Optimized internal clock gating

Form Factor
Benefits
- Improved thermal solutions
- Thin micro FCPGA/BGA packaging
- Increased integration

More Than A Processor –
Designed to Enable on the Four Criteria of Mobility

Intel® Pentium® M Processor
Performance and Battery Life

Intel® Pentium® M Processor 1.6H FEZ

Relative Performance

1.34

Performance Baseline

MobileMark* 2002 – Performance

Battery Life (minutes)
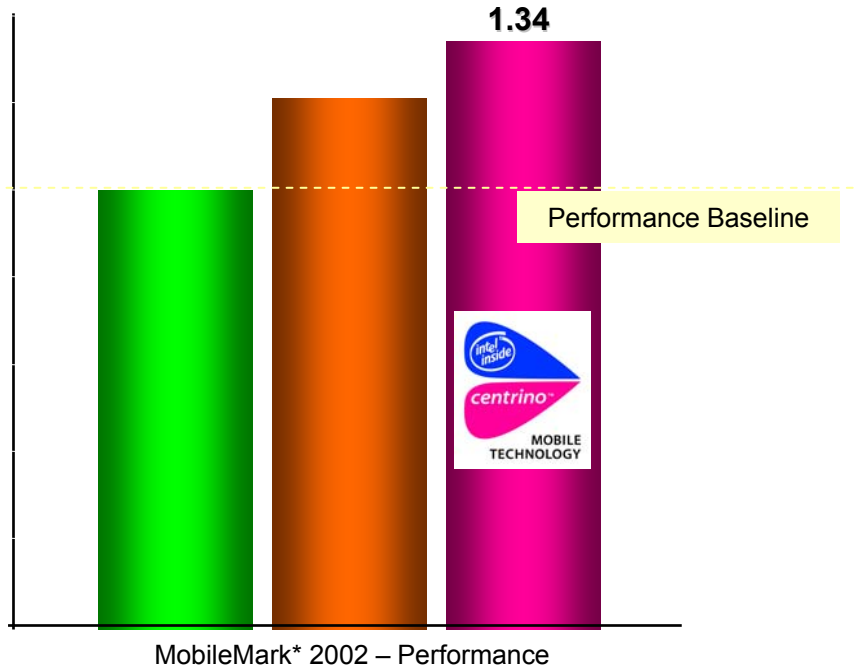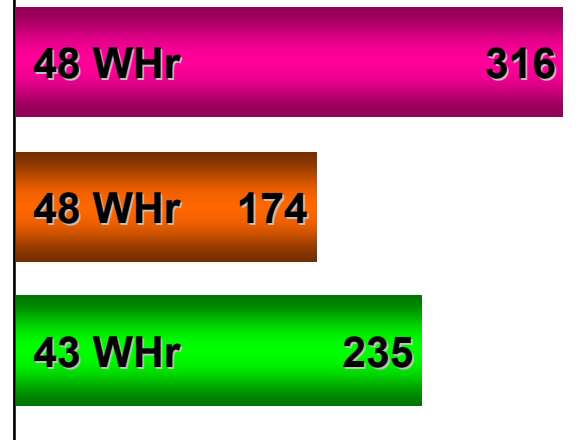
48 WHr 316

48 WHr 174

43 WHr 235

MobileMark* 2002 – Battery Life (Minutes)

Intel® Pentium® M Processor based systems deliver outstanding mobile experience[1]

Configurations and Disclaimers

Source: Intel. **Configuration: Intel® Pentium® M Processor 1.60 GHz**, Intel 855PM chipset, 512MB PC2100 DDR266, ATI* Mobility* 7500, Battery Capacity 48WHr; 14.1" TFT 1024x768. **Mobile Intel® Pentium® 4 Processor-M, 2.40 GHz**: Intel 845MP chipset, 512MB PC2100 DDR266, ATI* Mobility* 7500, Battery Capacity 48WHr 14.1" TFT 1024x768. **Mobile Intel® Pentium® III Processor-M 1.20 GHz**, Intel 830M chipset, 512MB PC133 SDRAM, S3* SuperSavage* IXC 1014, Battery Capacity 43WHr; 14.1" TFT 1024x768. **All Platforms**: 40GB hard drive 5400 rpm, 1024x762x32bit color, FAT32 File System. *Windows* XP* Professional*.

1 System performance, battery life, wireless performance and functionality will vary depending on your specific hardware and software configurations. See http://www.intel.com/products/centrino/more_info for more information.

A Family of Products
For all Notebook PC Designs

Size & Weight

- Full Size Notebook
- Thin & Light Notebook & Convertible*
- Mini Notebook & Convertible*
- Sub-Notebook & Convertible*
- Slate*

*Tablet PC Form Factors

2002   2003

intel inside
pentium 4

intel inside
pentium III

intel inside
centrino™
MOBILE TECHNOLOGY
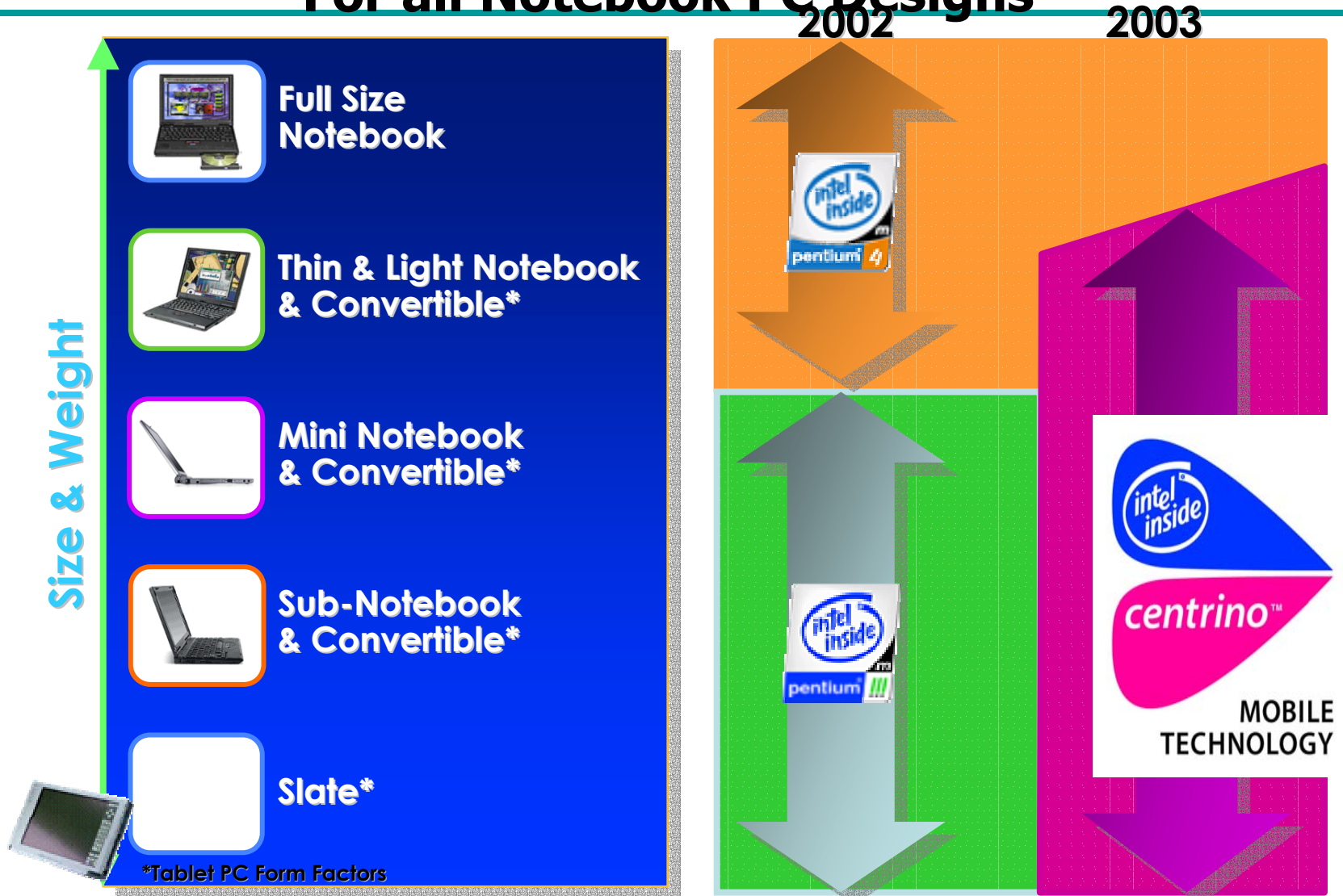
**Intel® Centrino™ Mobile Technology
Scales Across All Notebook PC Form Factors**

Tablet PC based on CMT

Most of the portable PC is expecting to be moved to tablet in 5 years

• **Pen-based input**
• **Below 1.4kg(3lbs)**

• **Zero Configuration for wireless Network**
• **Long battery life**
• **SW compatibility with Laptop**
• **About 2 min to change from suspended mode to active mode**

Operating System: Microsoft® Windows® XP Tablet PC Edition

Intel® Centrino™ mobile technology: Continues t get Better…

- 2H'03
- Intel® Pentium® M processor
  - Dothan processor
- Intel® PR0/Wireless network connection
  - Midyear '03 802.11a/b[1]
- New Intel graphics chipset
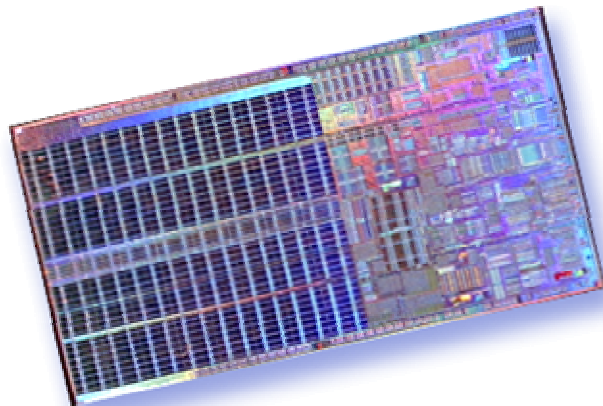
- 2004:
- Next Gen. Wireless LAN:
  - Q1 '04 802.11b/g[2] & H1 '04 802.11a/b/g[2]
- Next Gen. Mobility Platform:
  - Newport Concept[2]

1. Dual band availability targeted to follow Intel Centrino mobile technology launch supporting low band (5.15 GHz to 5.35 GHz). Low band capabilities not supported in all countries, contact your PC manufacturer for more details. 2. Future dates, products, features, etc subject to change at anytime

Intel® PCA enables convergence vision

- Communications (Cellular or Wi-Fi) and Computing evolve independently

- Applications written to a general purpose processor based on Intel® XScale™ Technology

- Ease portability of apps and services across Intel Architectures

PDA

Compute

Memory

Intel® XScale™ Microarchitecture Based Processors

w/ Integrated Performance Primitives

Intel® Flash Memory

Intel® Flash Software

Intel Baseband Chipsets

with

Intel® Micro Signal Architecture

Phone

Communications
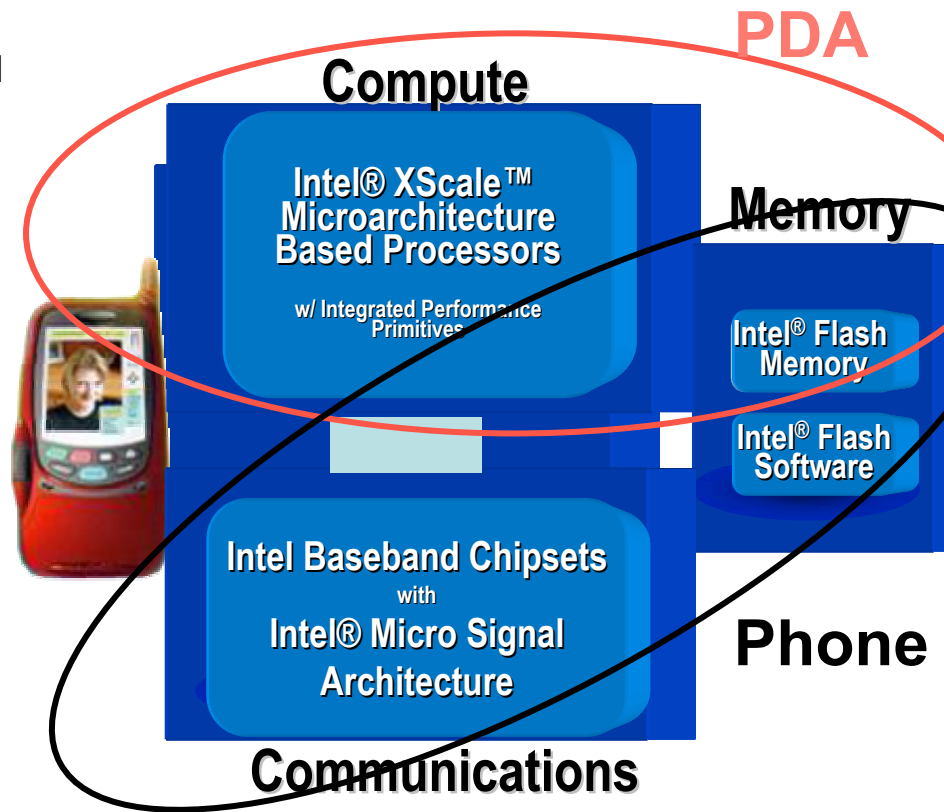
Industry leading technology

Sample of Intel® PCA based devices

- PocketPC*, Linux and PalmOS* devices shipping now.
    - Integrated or add-on WiFi and 2.5G capabilities
    - Dell, Toshiba, HP, Sony, Palm

- Smart Phones with Intel XScale technology.
    - Hitachi, Samsung, Mitac ..

- New Intel® PXA800F Cellular Processor based phones expected by early 2004.

Other names and brands may be claimed as the property of others. Dates are estimates only and are provided for informational purposes only and may be subject to change without notice

http://intel.com/design/pca/devicelist.htm

Intel® PCA Enterprise Ecosystem

**Carriers /
Mobile Service Providers**

**Intel
PCA**

**Scalable / Repeatable
Solutions**

**System
Integrators**

**Enterprise IT &
End Users**

Device OEM/ODM

**OS / ISV /
Content Developers**

Ever Growing Demand for performance on mobile devices

Foreground

- Multimodal Rich human interface
- CRM, SCM, ERP apps
- Collaboration
- E-mail
- Dynamic browser
- Java applets

Future
- Enterprise apps available online and offline
- Web services
- XML on the device

2003   *Future*
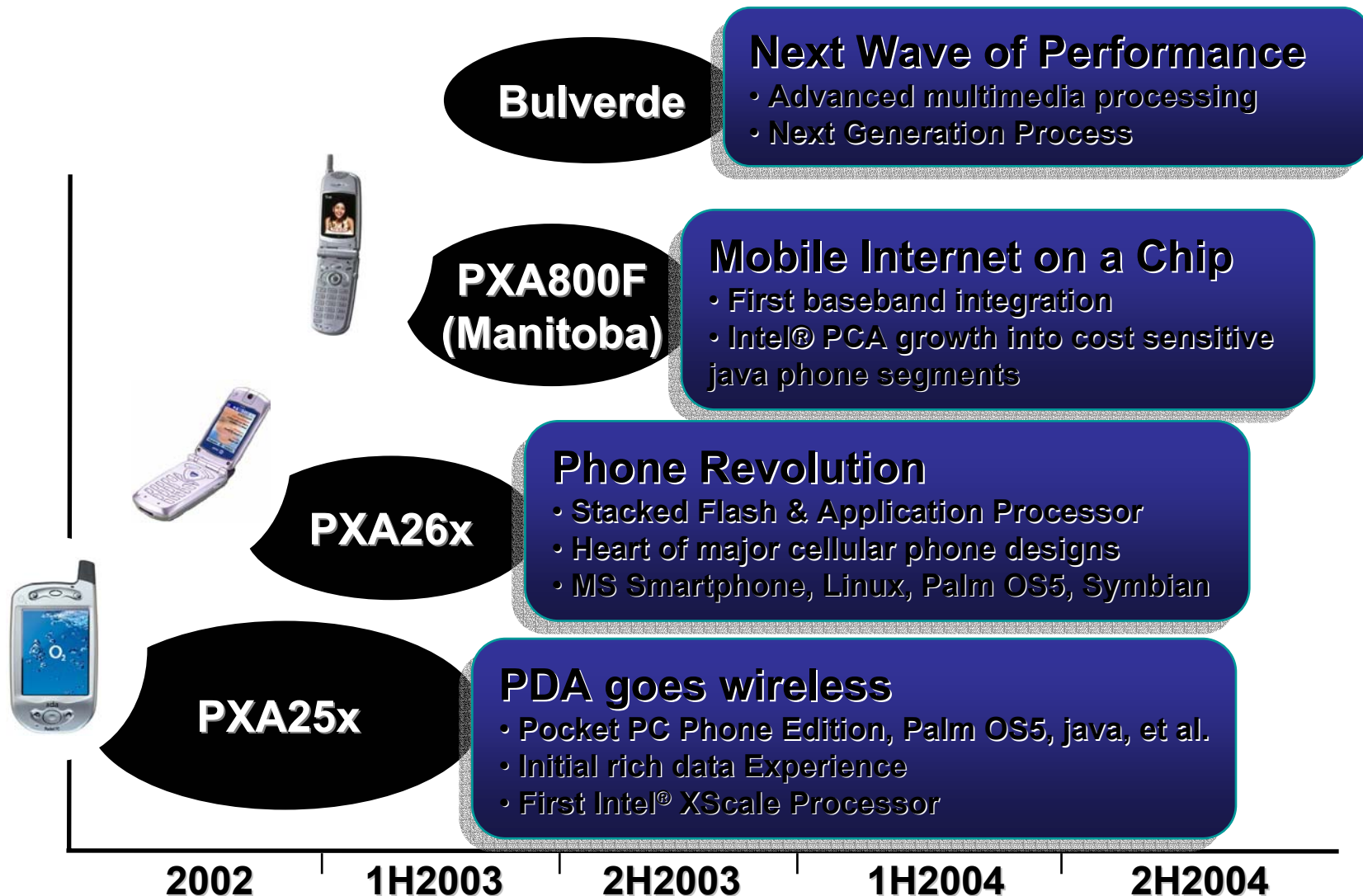
Background

- Virus scan
- Compression
- System management
- Authenticate & encrypt
- Synchronization
- Push/pull agents
- Biz automation svcs.
- Multitasking OS

Future
- Even stronger security
- Rules-based, event-driven app interaction on client
- Multitasking OS

Security, Multitasking, Occasionally connected usage model, and multimodal human interface drive performance

Intel® PCA Building Blocks Roadmap

Bulverde

Next Wave of Performance
- Advanced multimedia processing
- Next Generation Process

PXA800F (Manitoba)

Mobile Internet on a Chip
- First baseband integration
- Intel® PCA growth into cost sensitive java phone segments

PXA26x

Phone Revolution
- Stacked Flash & Application Processor
- Heart of major cellular phone designs
- MS Smartphone, Linux, Palm OS5, Symbian

PXA25x

PDA goes wireless
- Pocket PC Phone Edition, Palm OS5, java, et al.
- Initial rich data Experience
- First Intel® XScale Processor

| 2002 | 1H2003 | 2H2003 | 1H2004 | 2H2004 |

Intel® PCA Developer Network

- **Global community of hardware and software developers**
  - Early access to technical information / Dev tools :
  - Development, technical and marketing support
  - SWr Optimization Labs
  - Wireless Competence Centers : Asia, Europe, Japan

✓ **2900 Member Companies**
✓**700+ Solutions Listings**
✓**Vol 4 of SOLUTIONS Publishe**
  ✓ **70% Articles from TPVs**

Intel Research

Precision Bio

Intel Research is an organization within CTG chartered to build the technical leadership, knowledge assets and systems perspective to make Intel the preeminent driver of emerging information technologies.

Key goals are:

• Establish Intel as a Research Leader in Ubiquitous Computing: Software, Systems, Networking and Applications Research.
• Be a leader in the identification of 'disruptive' technologies and events – independent of their origins.
• Gain systems perspective through prototyping and data driven analysis.
• Lay the groundwork for sustainable technical leadership and make Intel THE recognized world leader in Internet-era research.

Thank You!