Communications and Ubiquitous Computing

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Categories of HealthCare Communications and Ubiquitous Computing

- ◆ **Remote provision of care**
- ◆ **Intra-organizational wireless infrastructure**
- ◆ **Inter-organizational clinical data exchange**

Types of Remote Provision of Care

- **Routine transactions**
  - Treating an acute outpatient condition
  - Refilling a prescription
- **Monitoring chronic disease**
  - Congestive heart failure
  - Diabetes
  - Hypertension
- **Monitoring an acute episode**
  - Postoperative care
- **Accessing a specialist**
  - Primary diagnosis
  - Second opinion

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THE BRIGHAM AND WOMEN'S PHYSICIAN GROUP provides comprehensive adult medical care, from routine health screening to complex diagnostic evaluations. Our 10-physician general medicine practice includes a nephrologist, endocrinologist and cardiologist. All of these physicians are affiliated with Brigham and Women's Hospital and are faculty of Harvard Medical School.

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HEALTHCARE
Online Specialty Consultations

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Referring Physician Registration   **Patient Registration**   **Login**

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Welcome to Partners Online Specialty Consultations.

Partners Online Specialty Consultations is a health care consultation service provided by physicians at Partners hospitals, to physicians in conjunction with their patients. Physicians and patients, nationwide, may arrange remote specialty consultations to support their care by accessing the expertise of our physicians at Massachusetts General Hospital, Brigham and Women's Hospital and Dana-Farber/Partners CancerCare.

To learn more about the process visit these links:

- **About Us**
- **Frequently Asked Questions**
- **How does it work?**
- **Request a Consultation**

Are you a first time visitor?

- **Register as Referring Physician**
- **Register as Patient**

Are you already registered?

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Tele-Dermatology Trial Results

◆ **Dermatologists are at least 3 times as efficient providing teleconsultations as they are in the office**

◆ **Supporting evidence from patients**

– **Achieved symptom relieve twice as fast with teledermatology consult**

– **Scored 4.6 (1-5) on comfort with teledermatology process**

Home Visit Frequency

◆ **Average number of home visits to number of days in telemonitor nursing care:**

	N		Mean
	Valid	Missing	
Visit Frequency	19	0	18.21

◆ **Average number of home visits to number of days in standard home care (control) :**

	N		Mean
	Valid	Missing	
Visit Frequency	36	0	27.42

Care Impact of eConsults

◆ **Diagnosis changed in 5% of cases**

◆ **Care plan changes discussed in 85% of cases**
- New chemotherapy regimen recommended - 67%
- Other medical regimen & surgery discussed - 17%
- Radiation therapy suggested - 13%
- Termination of drugs recommended - 3%
- Drug dosage change suggested- 3%

Blood Pressure Monitors

Wrist Tech

Pros: relatively wearable. Almost inconspicuous.

Cons: no communication interface

Glucose Sensors

Cygnus GlucoWatch

Pros: wearable design

Cons: does not yet substitute for blood glucose monitoring. No communications capability

Handheld Devices: More Functionality, Faster Data Exchange and Smaller Form Factors

Mobile Phones

PDAs / Smart Phones

Embedded Digital Cameras & Multimedia

The Living Room is a Possible Platform

← X-Box →

← Sony Play Station →

← Communication via the TV →

← TIVO →

← Wireless →

← Broadband →

Business Models

- **Treating an acute outpatient condition**
  - Substitute visit reimbursement
  - Service differentiator
- **Monitoring chronic disease**
  - Insurer reimbursement
  - Efficient use of fixed assets
  - Staff productivity
- **Monitoring early discharge**
  - Efficient use of fixed investments
  - Per case reimbursement
- **Accessing a specialist**
  - Direct to consumer market
  - Corporation retainer/benefit
  - Insurer reimbursement

Types of Intra-Organizational Wireless Applications

◆ **Workstation extenders**

  – **Access information**

  – **Perform transactions**

◆ **Staff communications**

  – **Cellular phone/walkie-talkie**

  – **Instant messaging**

◆ **Equipment/staff/patient tracking**

Number of Communication Events in 1 hr on 3 Different MGH Units

	Ellison 7	White 8	Ellison 10
Incoming - Phone calls	29	21	59
Incoming - Nurse calls from patients	17	5	10
Outgoing - Overhead pages	33	14	32
Outgoing - Comm. to unit nurses	36	20	35

Potential "Lost" Equipment Savings

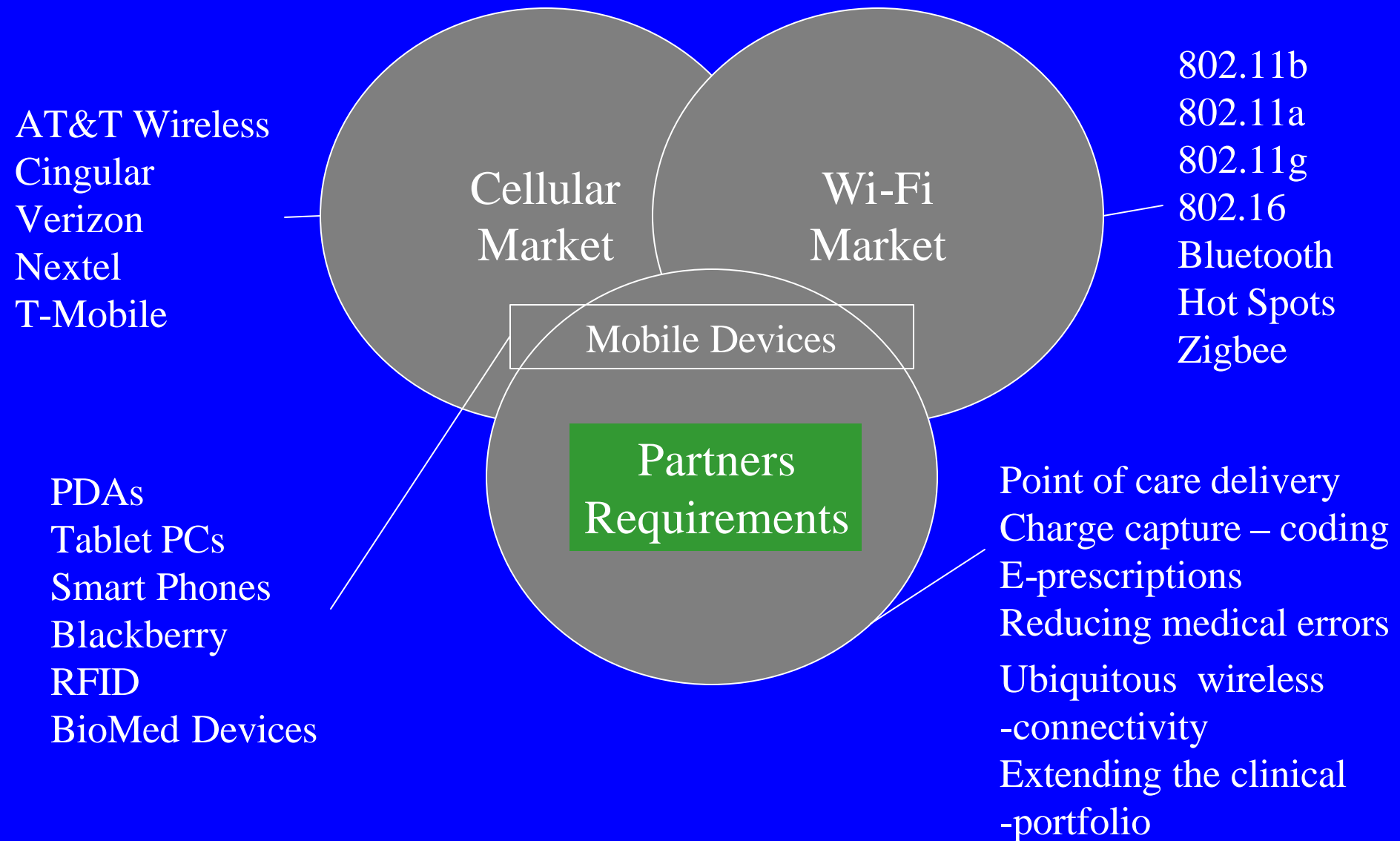| Item	Total number in use	Cost/unit	Current Loss Rate %	Annual Cost of Current Loss Rate	Target Loss Rate %	Potential Annual Savings
Transmitters	227	$ 1,600	9%	$32,000	0%	$ 32,000
Pacers	99	$ 4,400	36%	$58,400	5%	$ 136,400
12-lead cables	88	$ 300	100%	$ 6,400	9%	$ 24,000
Defibrillators	146	$ 9,520	1%	$9,520	0%	$ 9,520
Monitors	18	$13,310	6%	$13,310	0%	$ 13,310
Rental						
IV Pump rental @ $50/month	300	$600	100%	$180,000	50%	$ 90,000
				$419,630		$ 305,230

Outcomes of PDA Pilot at BWH Medicine Clinic

◆ Reduced time locating patients

◆ Testing results available while on rounds which improved discharge

◆ Improved access to desktop computers

◆ Improved revenue 20%

◆ Time lag from service to computer charge

◆ Input decreased by 21 days

◆ Improved data collection of ICD-9 codes

Requirements of Nursing Communications Device

- ◆ Smaller and lighter than most cell phones
- ◆ Wearable
- ◆ Can indicate unavailability and defer calls
- ◆ Can route calls for nurse call system directly to device
- ◆ Allow user to call other staff by name or role (as opposed to extension number)
- ◆ Long battery life
- ◆ Text message display, caller ID
- ◆ Earphone not required but able to use for private communication
- ◆ Can receive calls hands free
- ◆ Interrupts gently when a call comes through
- ◆ Can be cleaned and sterilized

Mobility – Putting the Pieces Together

AT&T Wireless
Cingular
Verizon
Nextel
T-Mobile

Cellular Market

Wi-Fi Market

Mobile Devices

Partners Requirements

802.11b
802.11a
802.11g
802.16
Bluetooth
Hot Spots
Zigbee

PDAs
Tablet PCs
Smart Phones
Blackberry
RFID
BioMed Devices

Point of care delivery
Charge capture – coding
E-prescriptions
Reducing medical errors
Ubiquitous wireless
-connectivity
Extending the clinical
-portfolio

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PROGRAMS | networked sensor systems

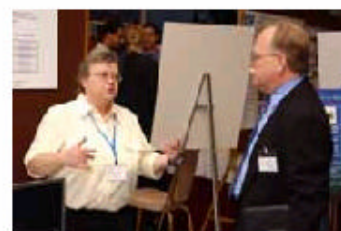**John Guttag, PhD**, Program Leader

John Guttag, PhD

Our goal is to eliminate barriers to safely delivered care and to demonstrate the power of advanced sensor networks to facilitate innovation in the practice of medicine. It is our vision that all patients throughout the system will be monitored to warn of impending urgent conditions requiring treatment and to enable safe, early release from the emergency room or hospital.

Problem
Devices within the health care system do not function as a system. This creates a number of limitations, including the inability to easily fuse data, share resources, upgrade algorithms, and systematically collect data for further analysis.

Medicine has not always moved ahead as quickly as the technology. Some amount of inertia is useful to provide the necessary level of safety. However, the key issues for the lag-behind include the cost of replacing equipment, and the difficulty of intermixing hardware and software from different vendors and different generations.

With upwards of fifty microprocessors in every hospital OR, computing already pervades surgical procedures. Processing can be found in ECG machines, blood pressure monitors, drug pumps, and even stethoscopes. Each device supports the physician's fundamental task of gathering information about the state of a patient and then using that information to choose (and guide) interventions to improve the patient's state.

Above: Dorothy Curtis explains Networked Sensor Systems projects at CIMIT's Annual Briefing
Below: A suite of sensors that could improve patient care in hospitals

Local intranet

Partners IS Research Projects

◆ **A trial of home-based monitoring in the care of congestive heart failure patients**

◆ **Electronic clinical messaging strategy at Partners**

◆ **Nursing communication: Analysis of needs and proposed solution**

◆ **The Partners handheld medical record**

◆ **Qualitative evaluation of the BWH medication system pre and post barcode/eMAR**

◆ **What can we learn from consumer-oriented IT?**

◆ **Digital camera in a cellular phone: advancing home healthcare**

◆ **Use of an indoor tracking system to reduce or eliminate asset loss**

◆ **IP telephony applications in health care**

◆ **The use of wireless devices and mobile access in an enterprise environment**

◆ **Real time collaboration: studying instant messaging technology and use cases in an enterprise setting**