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Wireless IT support within hospitals: location-based systems and EMC considerations

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Outline

- Wireless IT in hospitals
  - Opportunities
  - Challenges
- EMC issues
- Using location information

Part 1:

WIRELESS IT IN HOSPITALS: OPPORTUNITIES AND CHALLENGES

Technology to the rescue?

- Medical errors: 40,000-100,000 US deaths/yr
  - 1 in 100 admitted to hospital?
  - Typically *System* Errors (Informational)
- Ex: Medication errors
  - 7-20% of medical errors
  - Huge economic & social impact
    - Costs in the US: $77B/yr
- Informatics should help minimize Medical Errors
  - computerized order entry or prescribing systems can reduce errors by up to 80%
  - 0.3 hr/hr could be gained for each avoided medication error

Wireless?

- Portability, mobility and ubiquity…
- Hospitals and wireless
  - Ban
  - Use in a few areas
  - Use throughout
- Most hospitals want wireless are stuck

Wireless opportunities

- Portability, mobility and ubiquity…
  - Pervasive IT
- Context awareness
  - IT that knows what the user is doing
  - This entails integration of many components, from sensors to central scheduling databases and patient electronic record.
  - Location is an important part of the context

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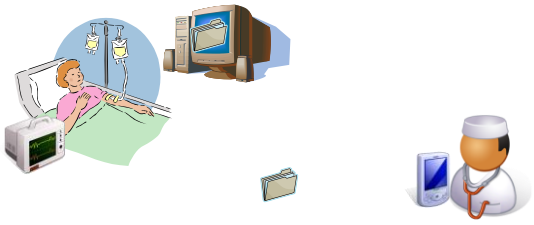
Example 1: Automatic patient file



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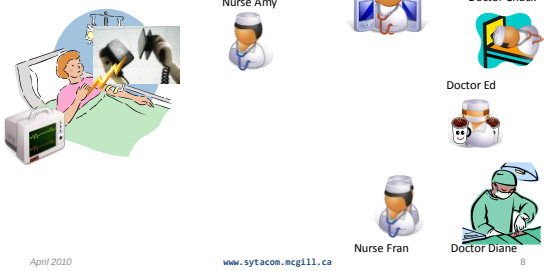
Example 2: Code blue



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Wireless Healthcare: challenges

- Is it safe?
  - Electromagnetic Interference issues
- Is it reliable?
  - "medical/clinical grade"
- Is it useful?
  - Acceptance issues

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Part 2:

EMC CONSIDERATIONS

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Managing EMI concerns

- EMI & Patient Safety
  - Now: Minimize real-world EMI risk
  - In the future: EMC in multi-source location-aware hospital
- Today: Use known ways to minimize EMI
  1. Educate
  2. Manage wireless sources & medical devices
  3. Ad-hoc test immunity of existing medical equipment

EMC-Healthcare Taskforce recommendations
(Proc. 2001 IEEE Int. Symp. EMC: 1308-12)

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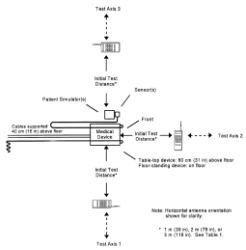
Ad-hoc Testing

- ANSI C63.18 ad-hoc test procedure



Wireless safety today

- Medical equipment is more immune to EMI
- EMI Malfunctions rare today

But...

- Hospital must have access to wireless-safety expertise
- Hospital must assess uncontrolled use situations
- Staff education and/or ad-hoc testing required

Multi-source Safety

- Healthcare tomorrow will employ wireless for pervasive information transmission
- 100s of sources in hospital areas
- standards & EMC recommendations only for one source, in free-space
- New research and guidelines are required
  - for multiple sources
  - in reflective settings

Part 3:

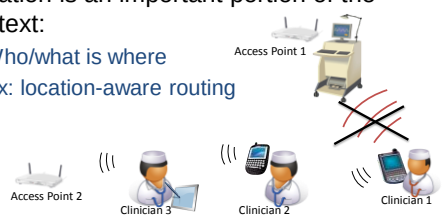
USING LOCATION INFORMATION

Using location information

- Location data greatly underutilized
- Asset tracking only first step
- Context-aware computing
- Workflow improvement

Location awareness

- Location is an important portion of the context:
  - Who/what is where
  - Ex: location-aware routing



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Location system

- Based on Ultra WideBand technology
  - Precision
  - Low interference
  - Resistance to multipath
- Wearable tags emit pulse regularly
- UWB receivers compute locations based on TDOA
- Post-processing to improve location information

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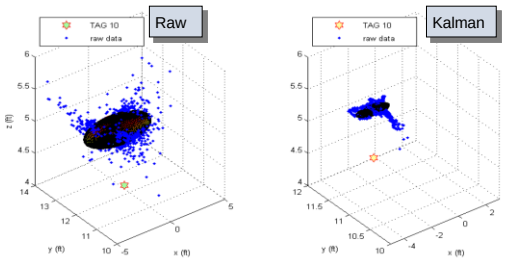
Stationary tag



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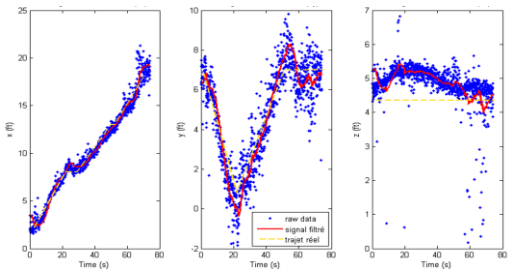
Moving tag



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System Deployment

- Deployment being currently done in ER in Montreal
- Used for
  - development of location-aware systems
  - Workflow monitoring

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