



A Dynamic, Data-Driven, Decision Support System for Emergency Medical Services

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Talk Overview

- Emergency Response
 - Why DDDAS's for first responders?
- Sensors for first responders
 - Situational awareness
- Emergency triage with real-time vital sign sensor data
 - Dynamic Data-Driven Decision Support System
- Infrastructure for Sensor Networks
- Research Partners and future work

Uncertainty Drives First Response

- Multi-dimensional uncertainty

- Where?, When?, What?, and How unfolds?



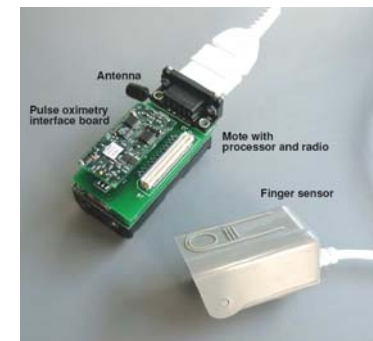
- Uncertainty => need for flexible applications

- How deployed
- How evolves



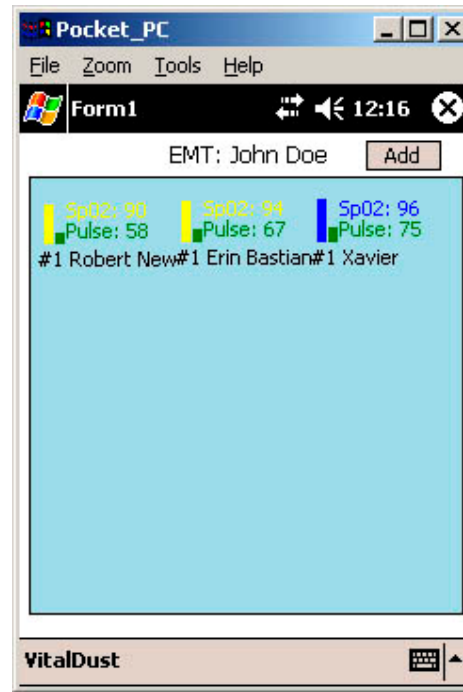
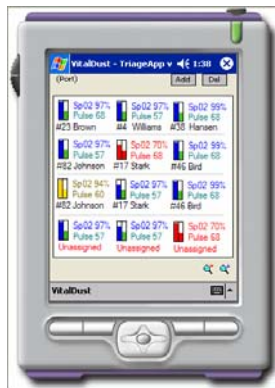
Sensors for EMS First Responders

- Wireless, small, power efficient
- Environment
 - Light, temp, humidity, sound, ...
- Physical
 - Vital signs (pulse/ox)
 - Body position and movement
- Position (in/outside)
 - GPS



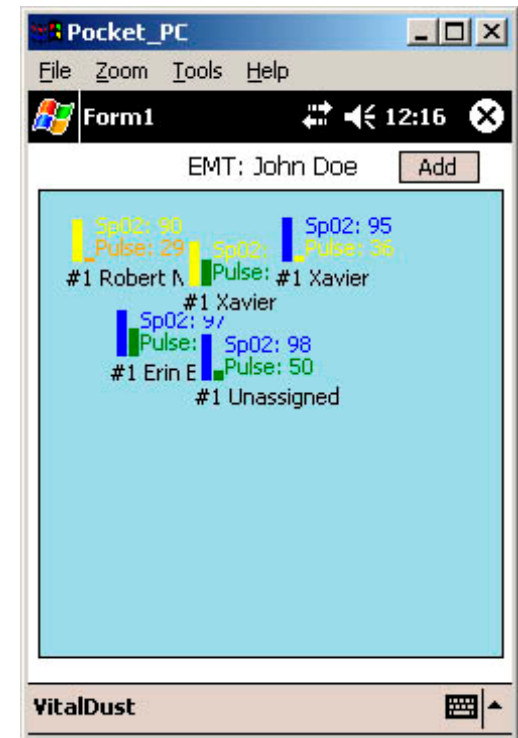
Real-Time Triage

- Triage based on the simple rules
- Command/local view
- Recommended order changes in real time based on vital signs from sensors

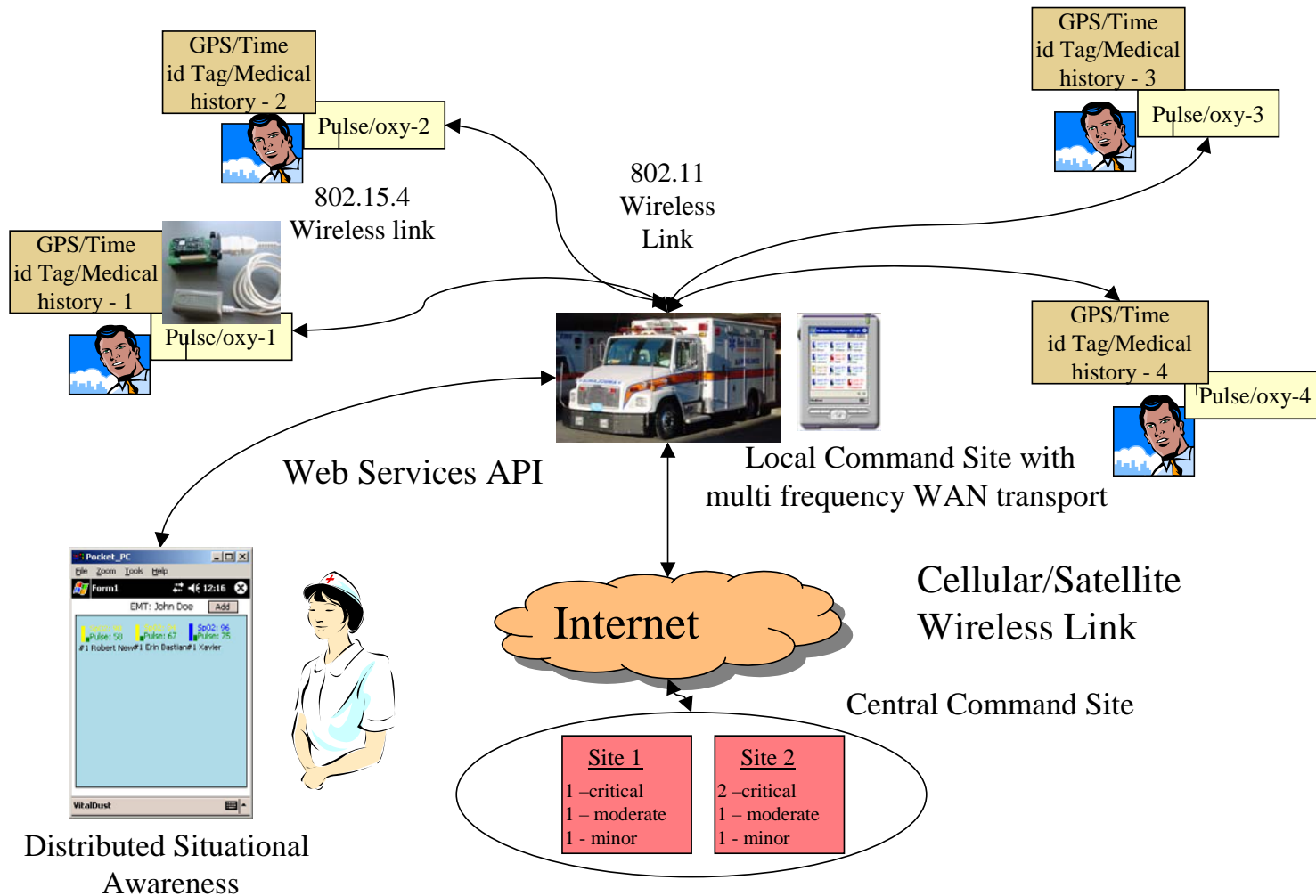


Stable

Dynamically
changes



Layered Triage for EMS



Layered Decision Making Based on Dynamic Data

Edge Based by EMTs

- Distributed Situational awareness by EMTs

Local command

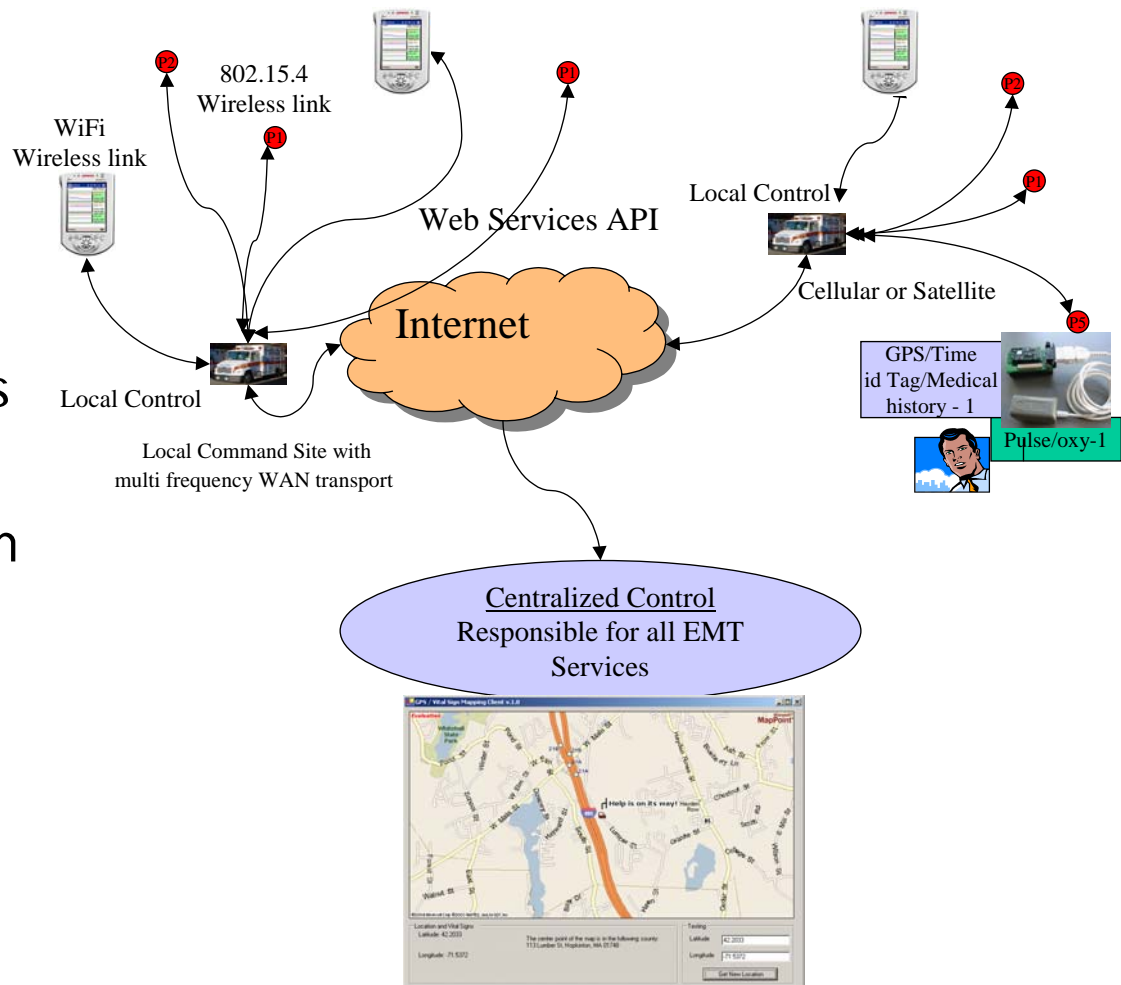
- Local situational awareness

Global coordination

- Command/control/inform
- GPS location tracking

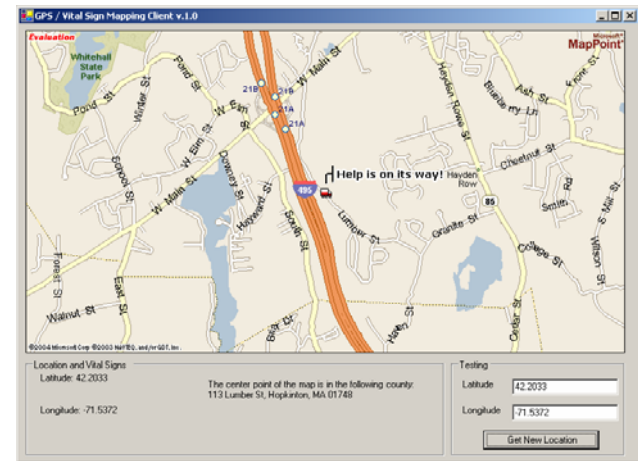
Self synchronization

- Each layer can self synchronize to perform efficiency working towards a common goal



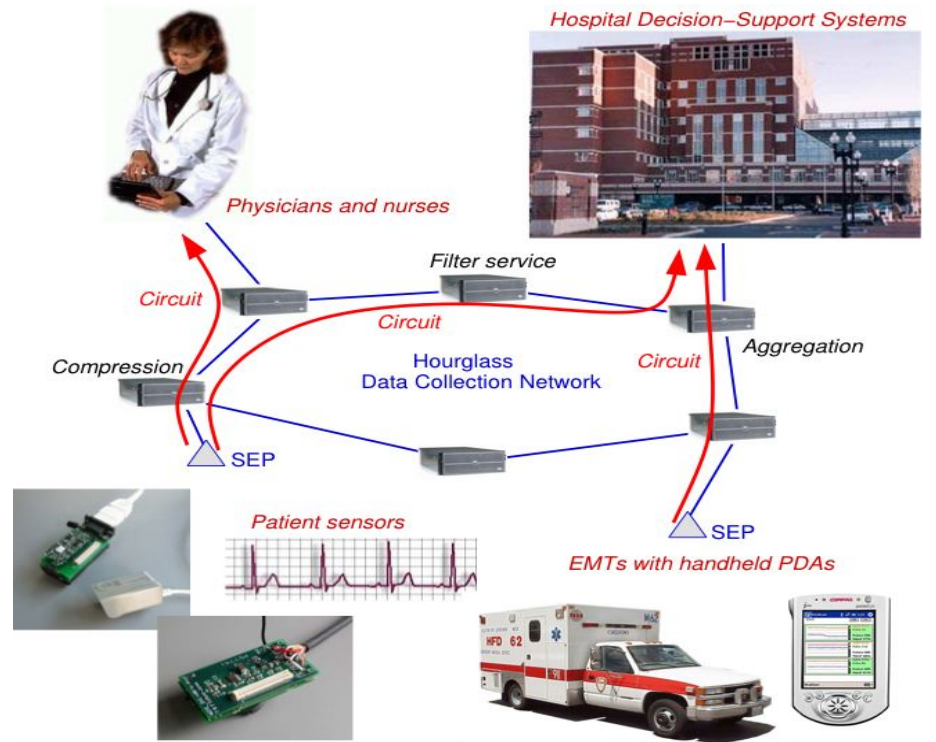
Geo Location Tracking

- GPS + Vital signs
- Using Microsoft Mappoint service
- Working on system with satellite imagery
- Future plans
 - Integrate real (or near real) time images,
 - Zoom in or out



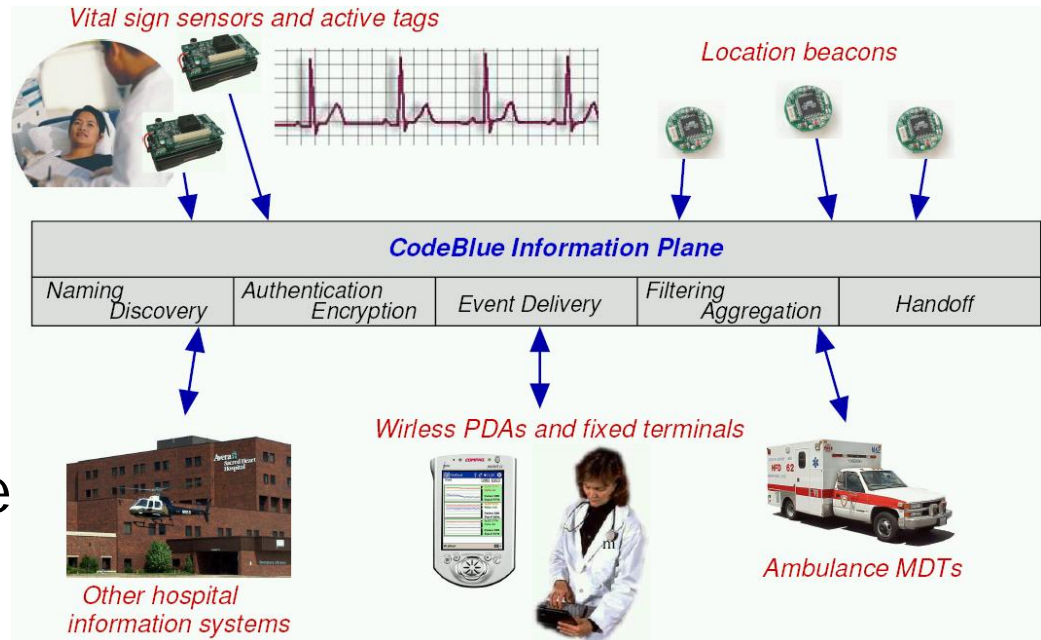
Networks Infrastructure for Sensors

- ⊕ Overlay network infrastructure
 - ⊕ Compression, filtering, aggregation,
- ⊕ SEP – sensor entry point
- ⊕ Web services API allow applications to consume real-time sensor data
- ⊕ Applications de-coupled from sensor networks



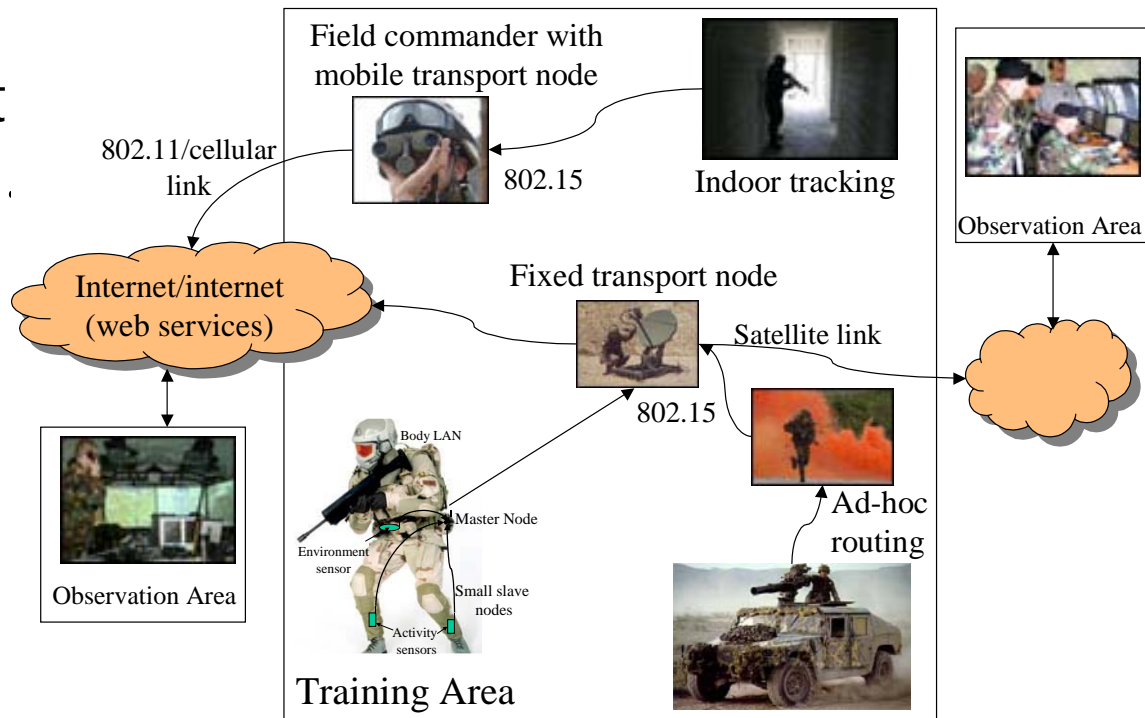
Future Research

- ➊ Distributed Decision making
- ➋ Rule based triage
- ➌ Integration of transport and hospital resources
- ➍ Sensor network infrastructure (codeblue Harvard – Matt Welsh)
- ➎ Hourglass (Harvard)



Other Similar Sensor Applications

- ⊕ Smart product management
 - ⊕ Tracking, theft environment, ...
- ⊕ Track training



Research Partners

- Boston University
School of Management
and School of Medicine
- Harvard University
- NSF
- NIH
- US Army
- CapWIN
 - Public safety wireless
infrastructure for
interoperability in capital
area
- Cataldo EMS – local
EMS provider



Conclusion



- Applications for first response are good match for DDDAs concept
- Working simple prototype of triage with geo location
- Web services access to sensor data for easy application development