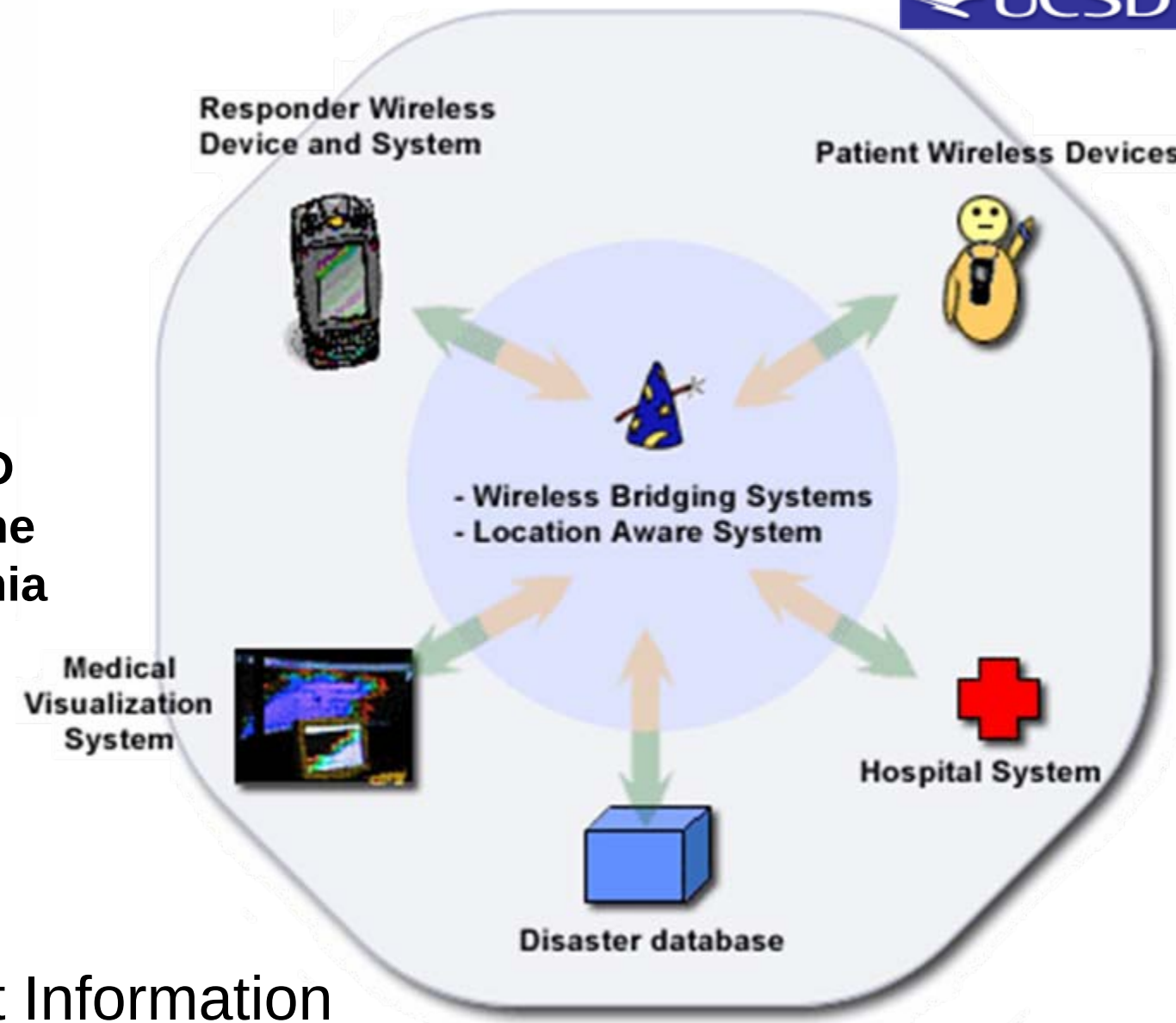
PI: Leslie Lenert,MD
Professor of Medicine
University of California
San Diego



Wireless Internet Information System for Medical Response in Disasters

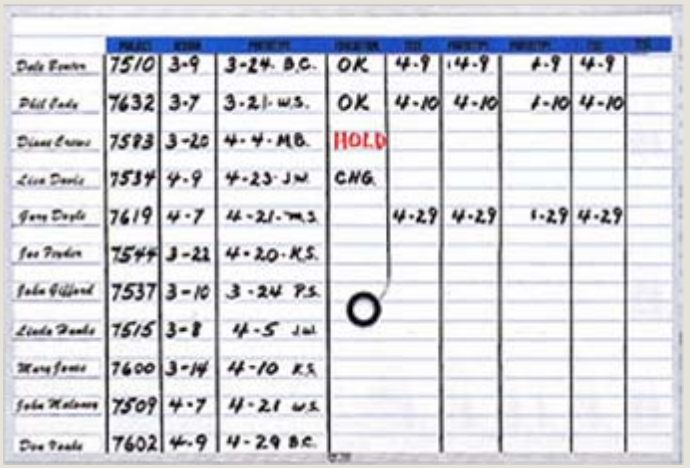
Objectives of WIISARD

- Apply scalable wireless Internet technologies to address life-threatening medical problems arising at the site of disasters and terrorist attacks
  - Focus on mature wireless technologies that could realistically be deployed in 3-5 years.
- Test systems in realistic conditions during large scale first responder training exercises

- Funding: National Library of Medicine (NIH)

Current Information Management Tools

800 mHz band radios



Felt pen/whiteboard

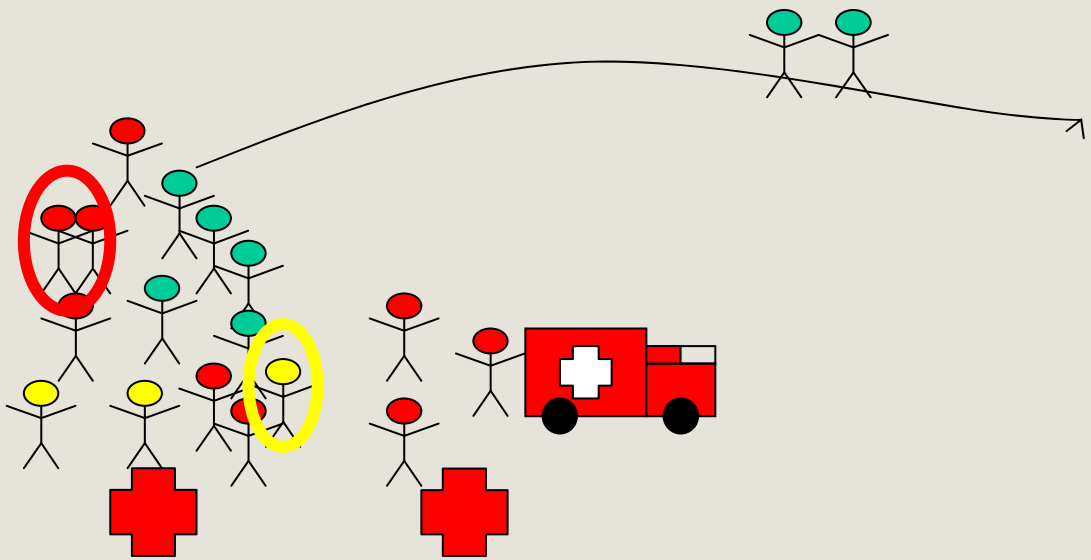
Mobile Desks

Triage Tags

Forms & clip board

INTEX
MOTOROLA

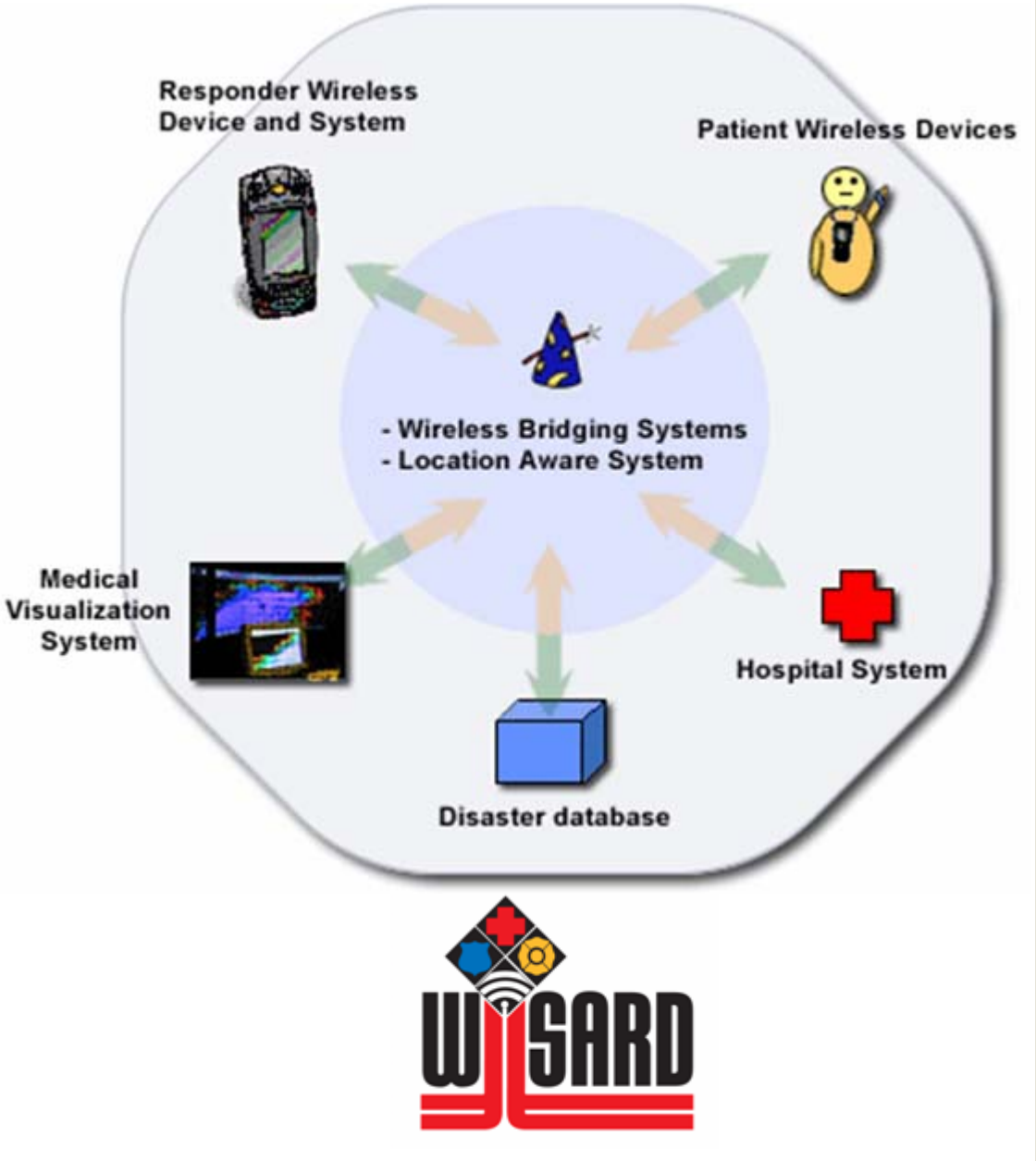
Known Problems with Field Care of Victims of Mass Casualty Events



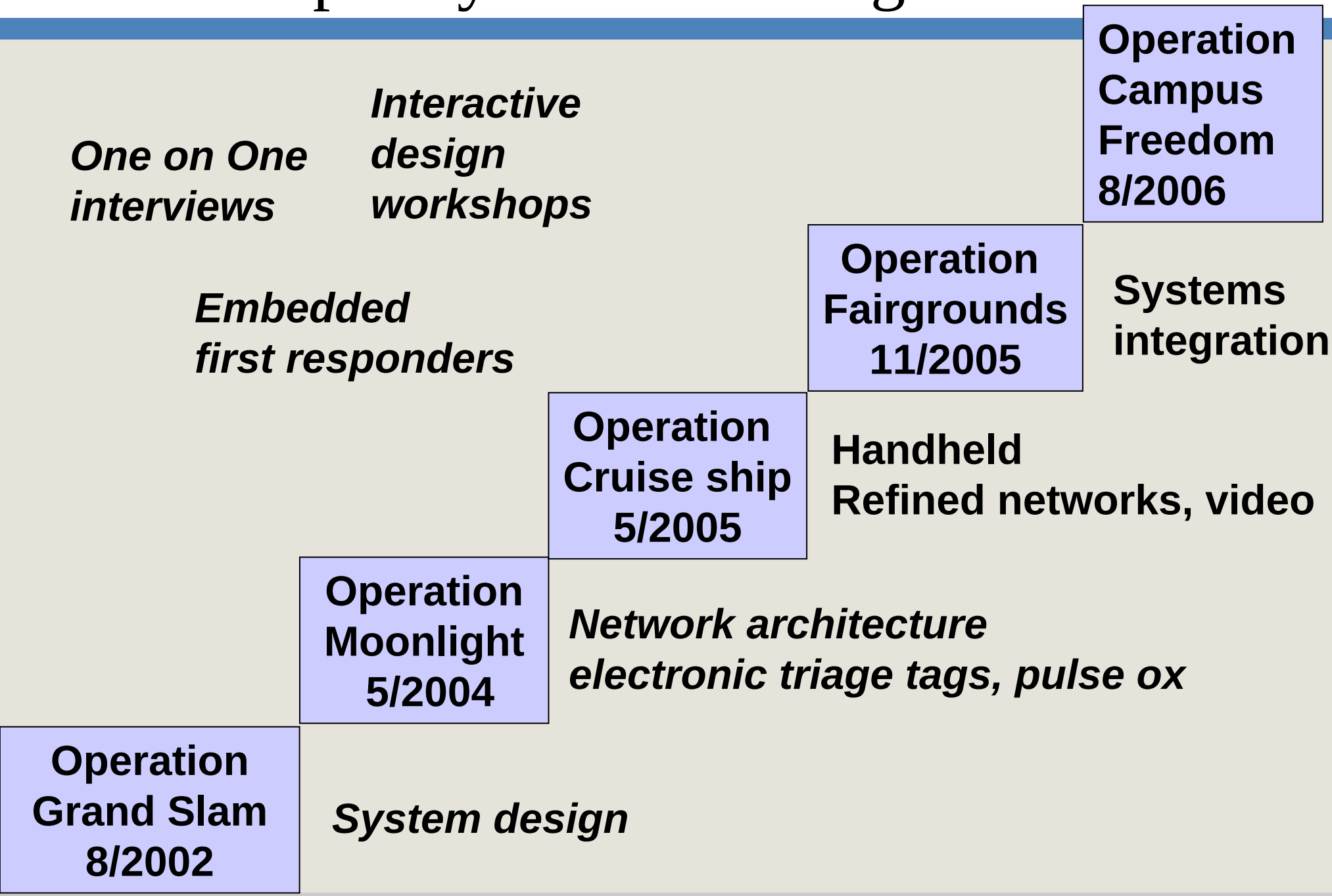
Field Treatment Station

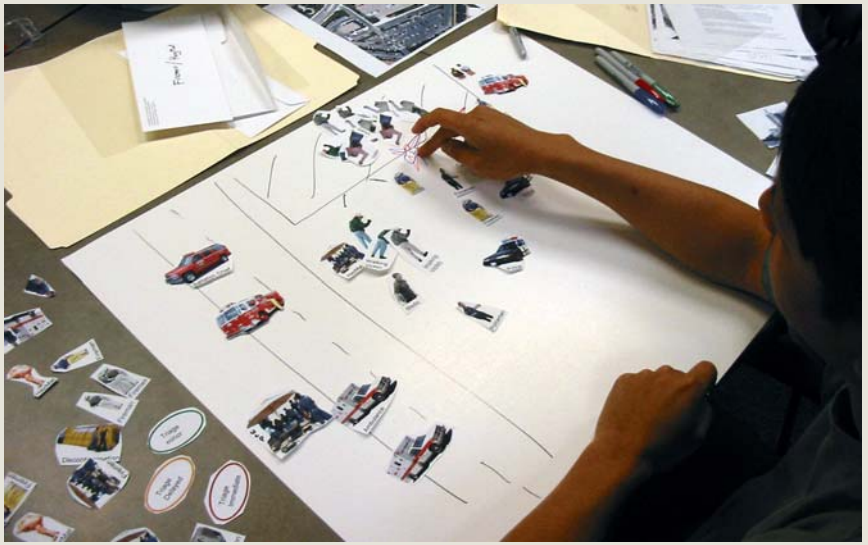
Transport station

- **Victims flee before decon causing secondary exposure (public, hospitals)**
- **Detection of change in status difficult (30% initial mistriage)**
- **Most severely ill not always transported first**
- **Destinations difficult to track**
- **Tags lost, clinical info incomplete/missing**
- **Hospital information incomplete**


Responder Wireless Device and System
Patient Wireless Devices
- Wireless Bridging Systems
- Location Aware System
Medical Visualization System
Hospital System
Disaster database
WISARD

Participatory iterative design

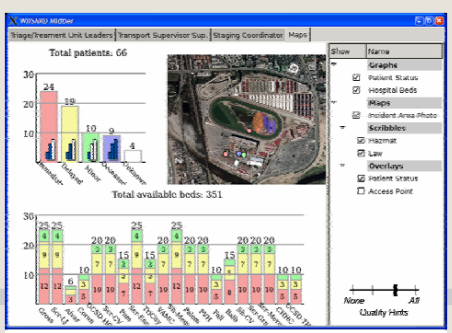




become a STAR!

WIISARD Components

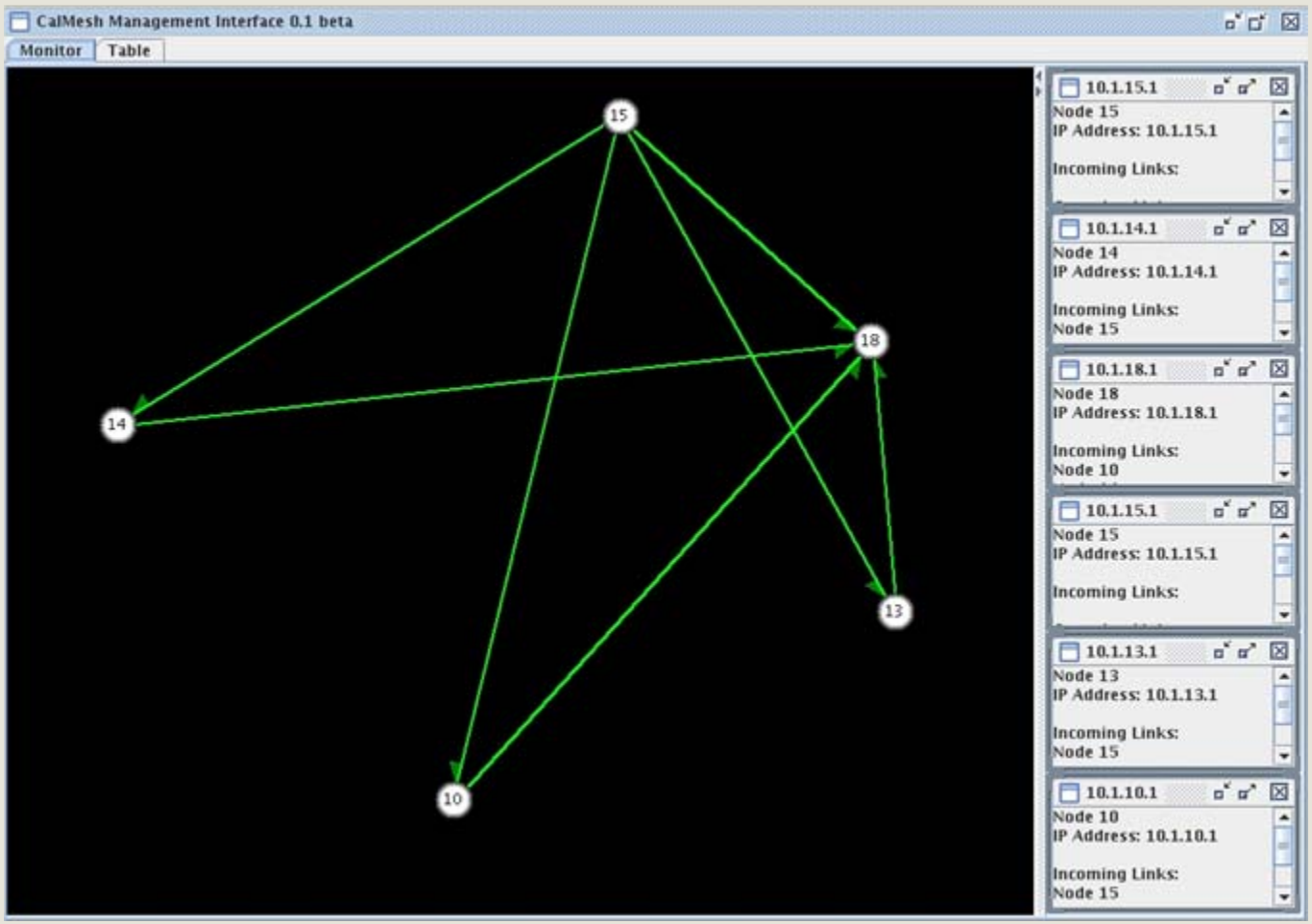
- Portable 802.11 location-aware mesh network
- Communications, alerting, monitoring and electronic medical records system for managing field care and regional hospital bed allocation
  - 802.11-based Intelligent Triage Tag (RFID tag)
  - Wireless pulse oximeter
  - Linux PDA's and Windows tablets
    - Integrated barcode readers
    - Victim imaging system
  - Command center system
    - Situational awareness and geoalerts
  - Wireless mobile video
    - Virtual reality interface

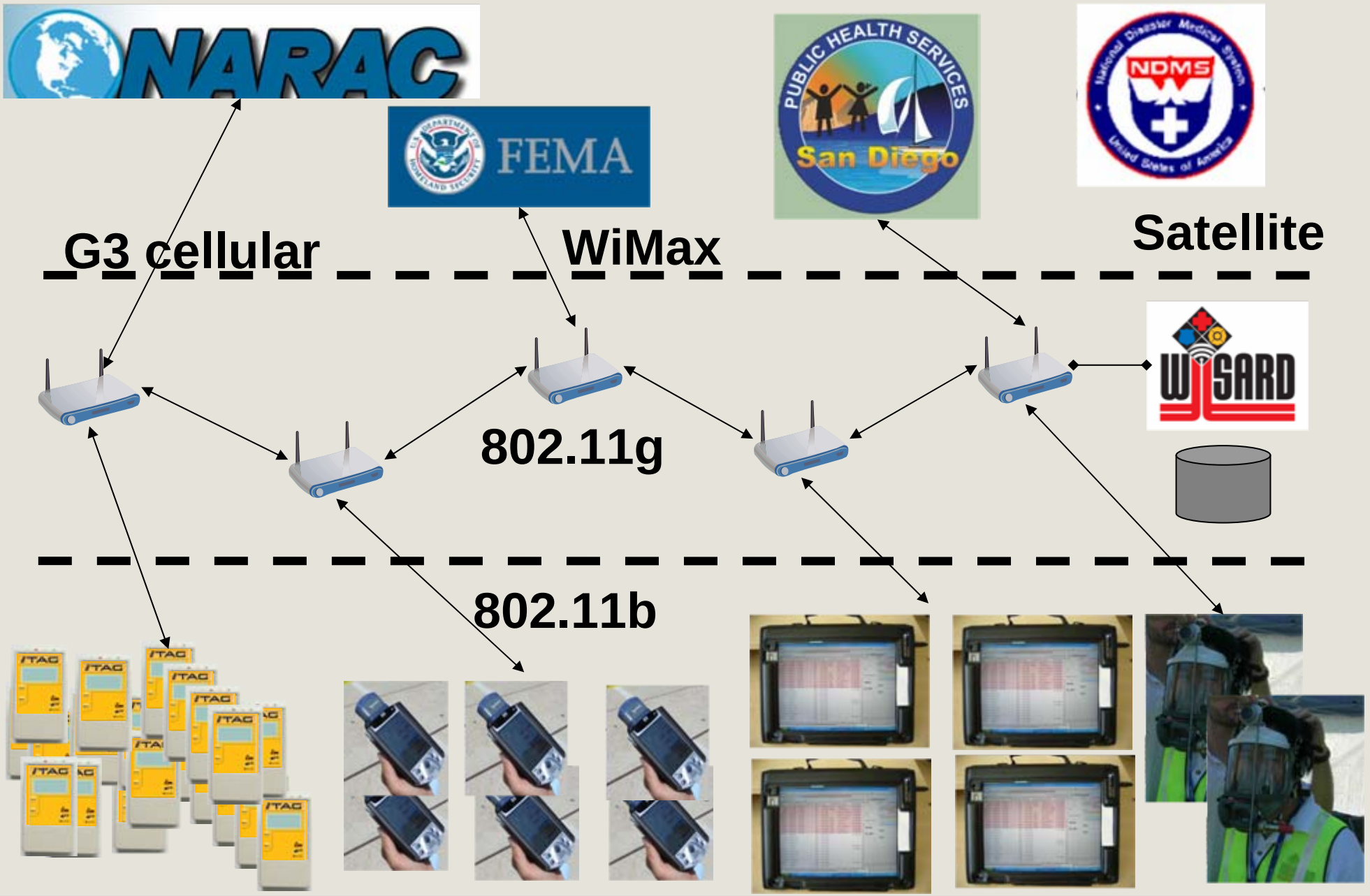


Calmesh geoware networking platform

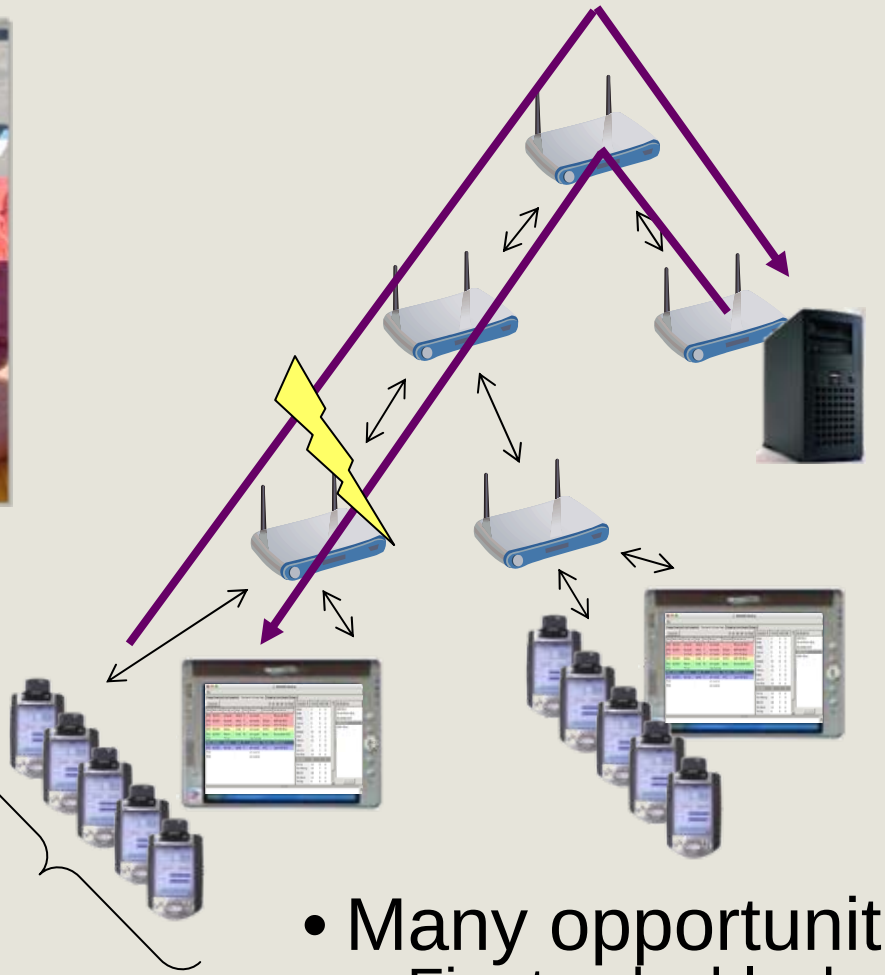
- Soekris NET 4521 133 Mhz 486
  - Linux microcomputer
  - Two 10/100 Mbit ethernet ports,
  - up to 64 Mbyte SDRAM memory
  - Compact Flash module
  - MiniPCI type III board
  - two PC-Card/Cardbus adapters
- Water resistant case,
- External antennae,
- 12V battery source provider 8-12 hours of continuous operation
- Single switch on
- External GPS

Network Diagnostic and Management Software




NARAC
FEMA
PUBLIC HEALTH SERVICES
San Diego
NDMS
G3 cellular
WiMax
Satellite
WISARD
802.11g
802.11b

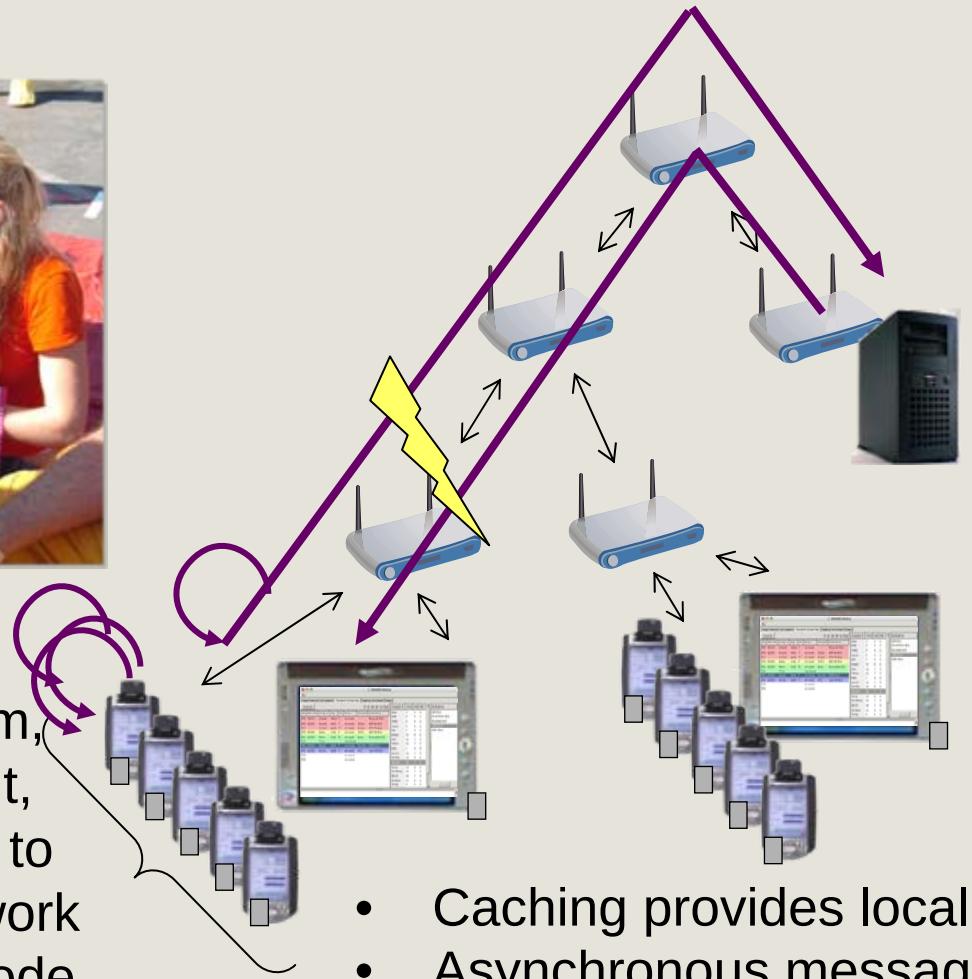
WIISARD Basics – Network View



Single team, line of sight, connected to same network node.

- Many opportunities for failure
  - Fire trucks block signals, other networks
  - Network nodes die, devices out of range

WIISARD Messaging Architecture

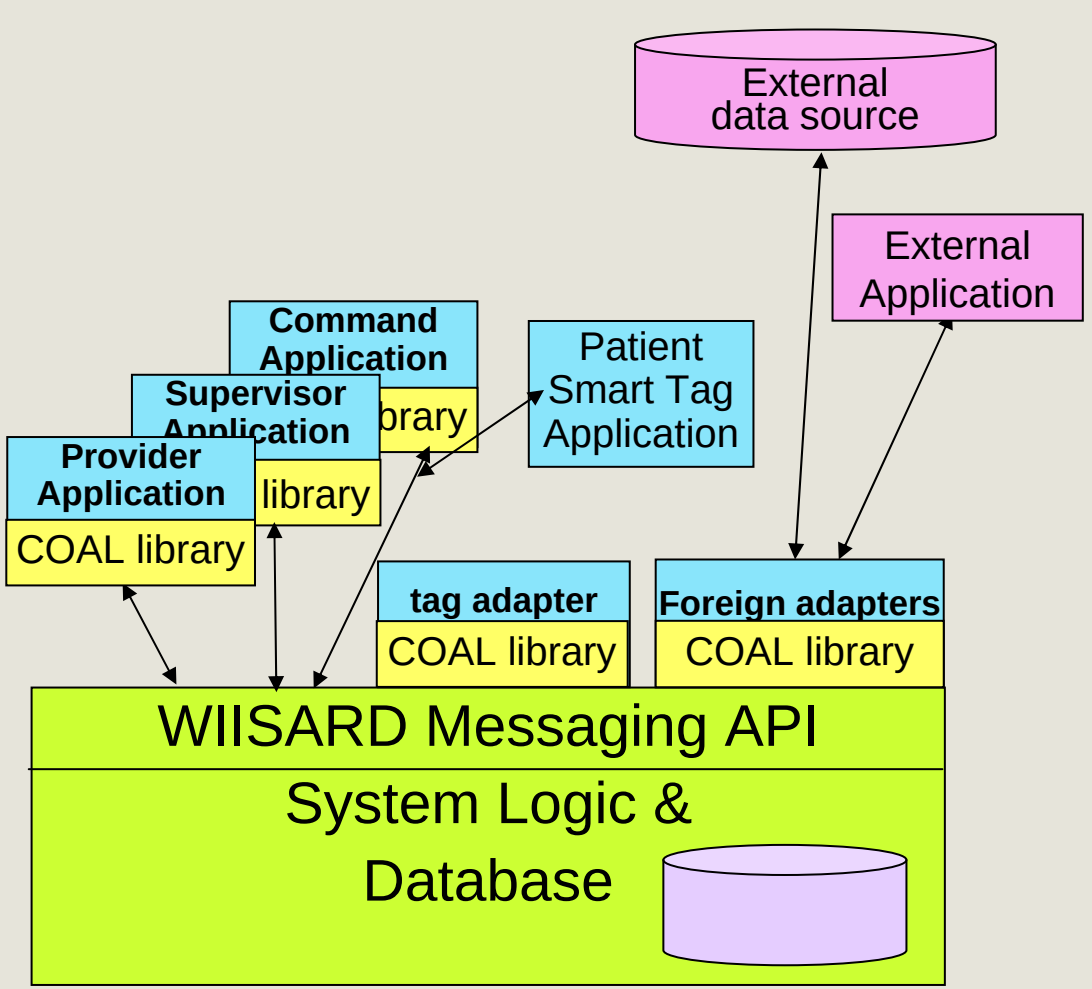


Single team, line of sight, connected to same network node.

- Caching provides local access
- Asynchronous messaging for transmission and receipt of data
  - Make changes to local copies of objects
  - Changes sent/received when reconnected

WIISARD Software Architecture

- *Remote object* model running over *publish/subscribe*
  - Client *subscribes* to objects of interest
  - Server *publishes* changes to objects to all clients with subscriptions
- Cached-object Abstraction Layer (COAL) for clients



Forward triage and monitoring with iTAG and iMOX

iTAG WiFi RFID features

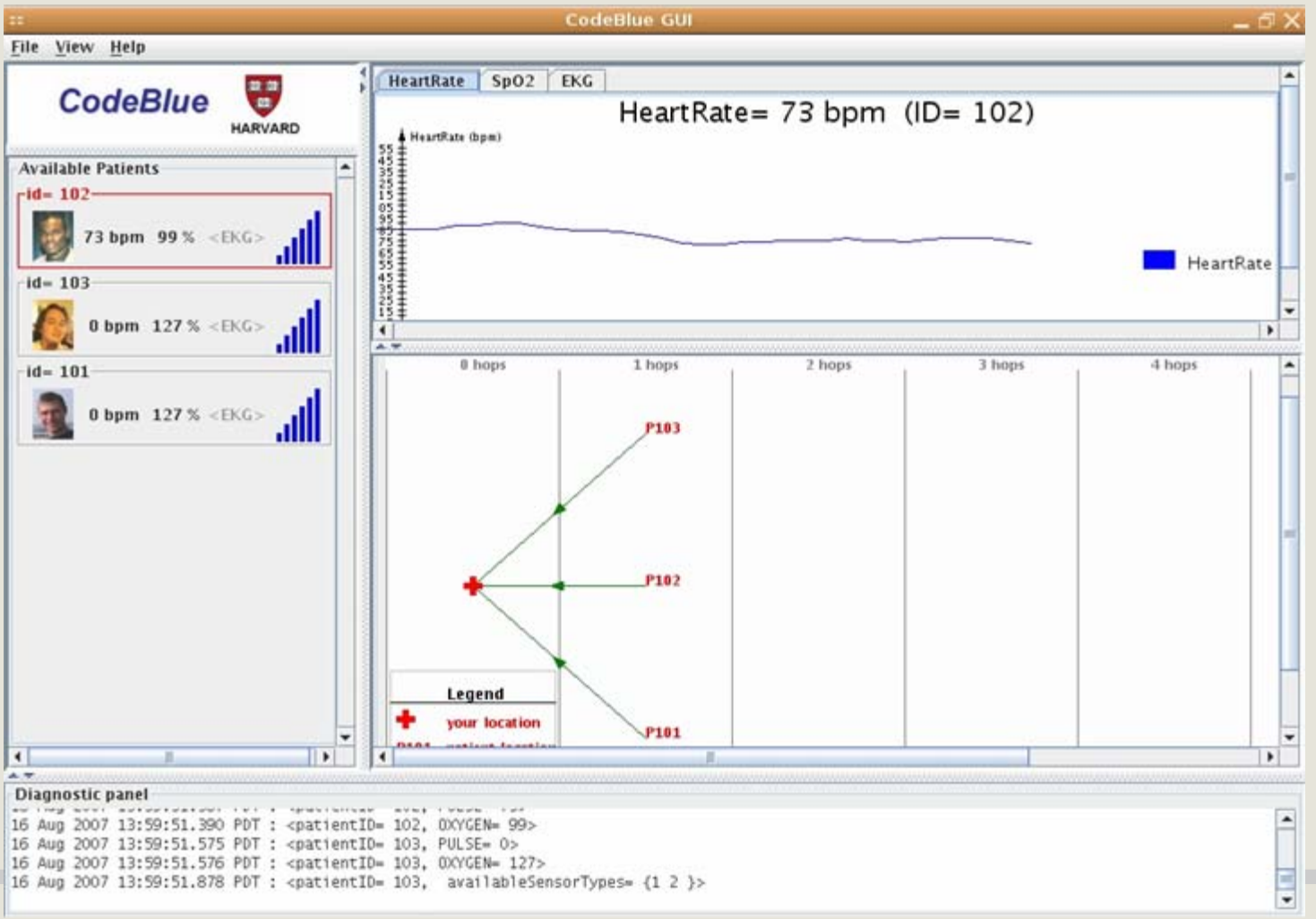
- Enter triage status
- Display triage status on LED and LCD and alerts
- Display updates from other systems
- Display ambulance for transport when assigned
- Stores medical records (512KB)
- Retrieve field care records via integrated web server
- Waterproof
- WAP and WEP security
- Commodity WiFi (parts: $200, production cost: $50)

iTag web server—field care records travel with the patient

iMOX WiFi pulse oximeter

- Built on Nellcor OEM platform (FDA certified)
- Uses generic 802.11b
- Integrated with handhelds and midtier
- Functions as iTAG
- Waterproof
- Parts cost $460 (mass production cost of less than $150)

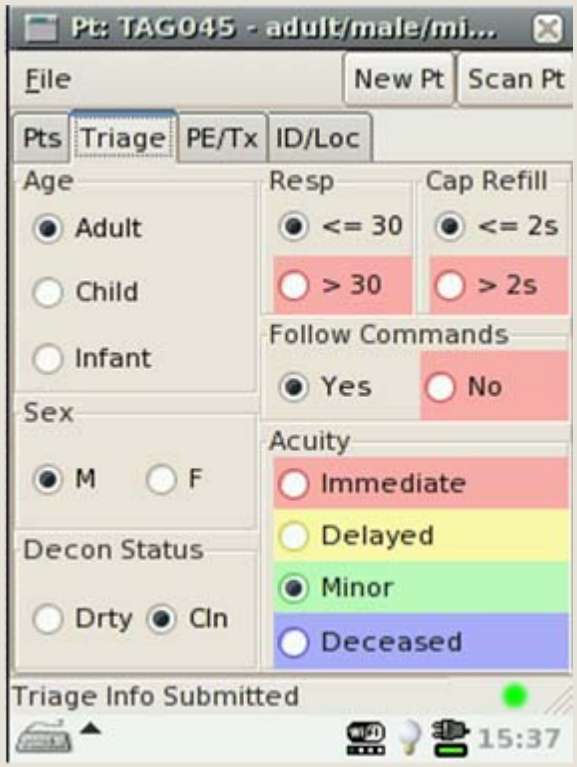
Integrating the Harvard CodeBlue Sensor Platform

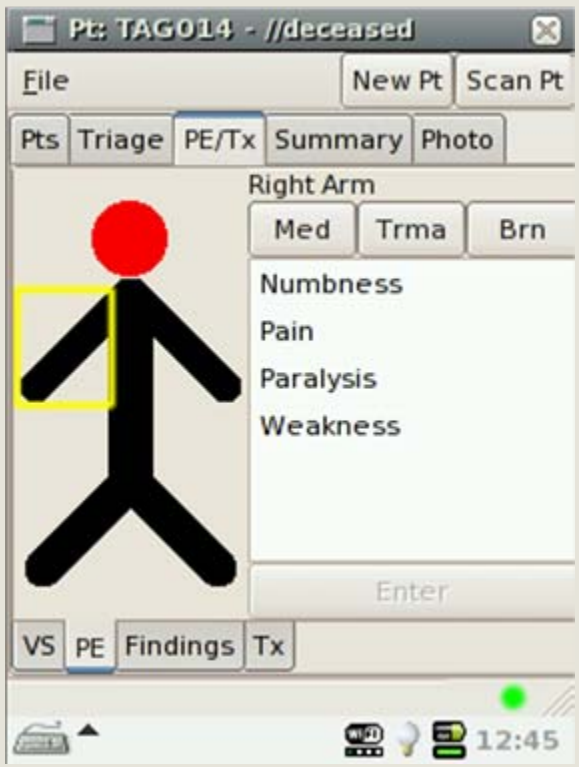


First tier responder handheld system

Handheld system features

- Linux PDA (HP 5555)
- Middleware for disconnected operations
- Barcode scanner
- Patient list
- PE
  - Triage, detailed physical exam
- Treatment
  - Menu and barcode
- Picture

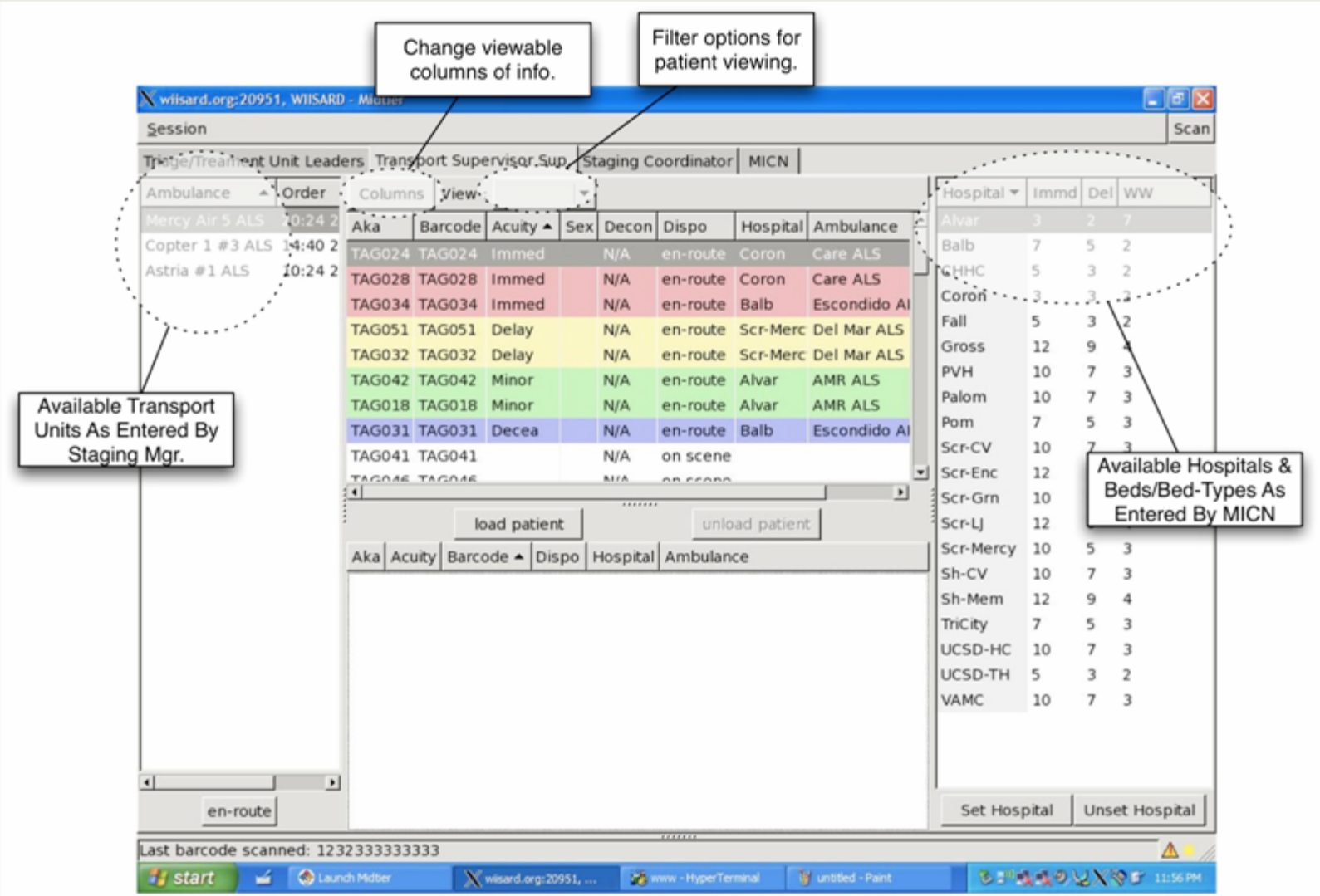




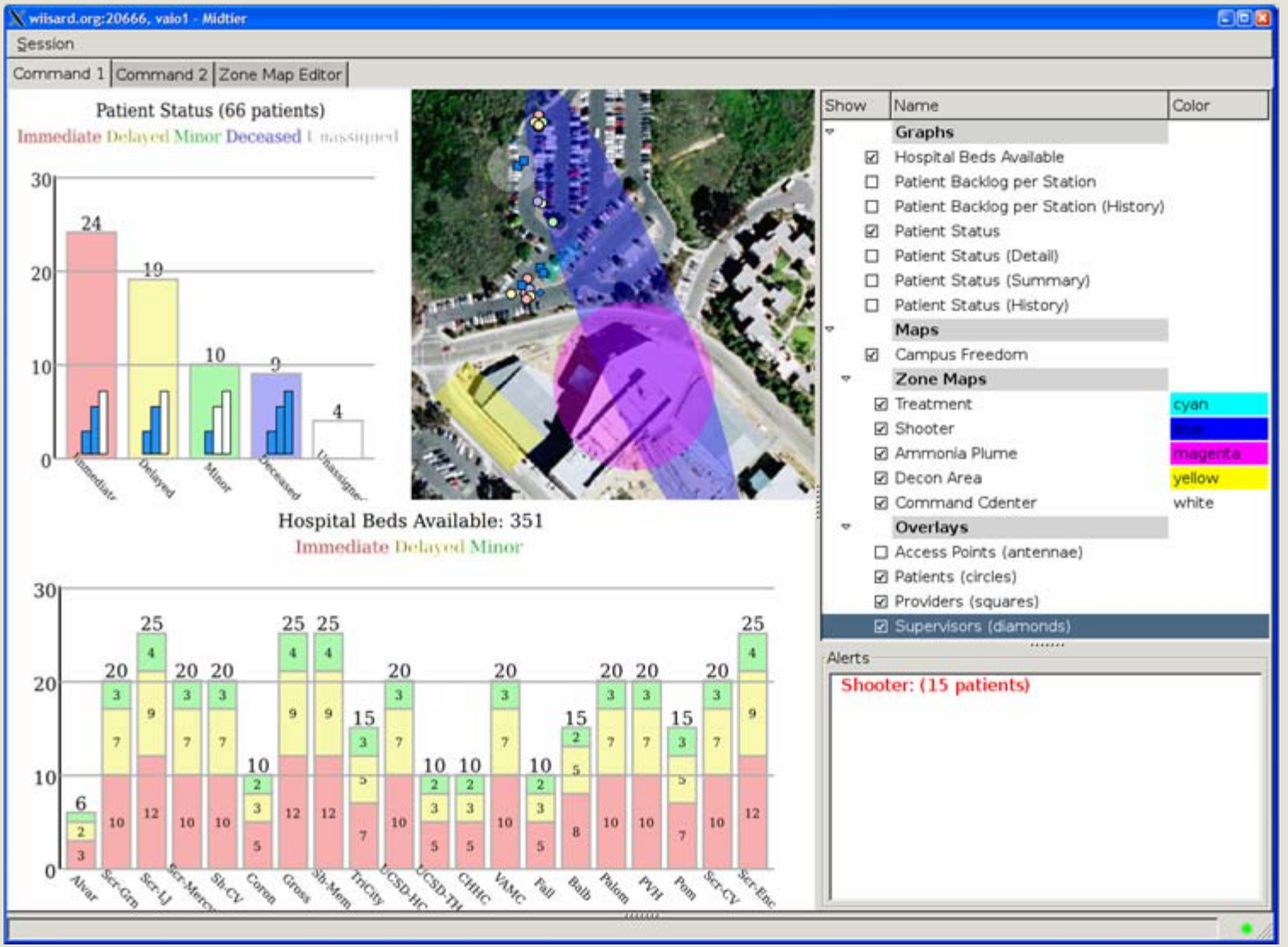
Midtier system for field supervisors and regional hospital bed management

Role tailored software

- Triage & Treatment
- Transport
- Ambulance staging
- Regional hospital bed availability (MICN)
- Victim photo ID system



Command Team System



Complete System