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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

	NAME	DOB	POSITION	STATUS	REG	ISSUE	EXPIRES	ISSUE	EXPIRES
Date Entry	7510	3-9	3-24 B.C.	OK	4-9	14-9	4-9	4-9	
Phil Ende	7632	3-7	3-21 W.S.	OK	4-10	4-10	1-10	4-10	
Diane Evans	7523	3-20	4-4 M.B.	HOLD					
Leon Davis	7534	4-9	4-23 J.M.	CHG.					
Gene Doyle	7619	4-7	4-21 W.S.		4-29	4-29	1-29	4-29	
Joe Prodan	7544	3-21	4-20 K.S.						
John Gillard	7537	3-10	3-24 P.S.						
Linda Deane	7515	3-8	4-5 J.W.						
Wang James	7600	3-14	4-10 K.S.						
John Wilson	7509	4-7	4-21 W.S.						
Don Deane	7602	4-9	4-29 B.C.						

Felt pen/whiteboard



Mobile Desks

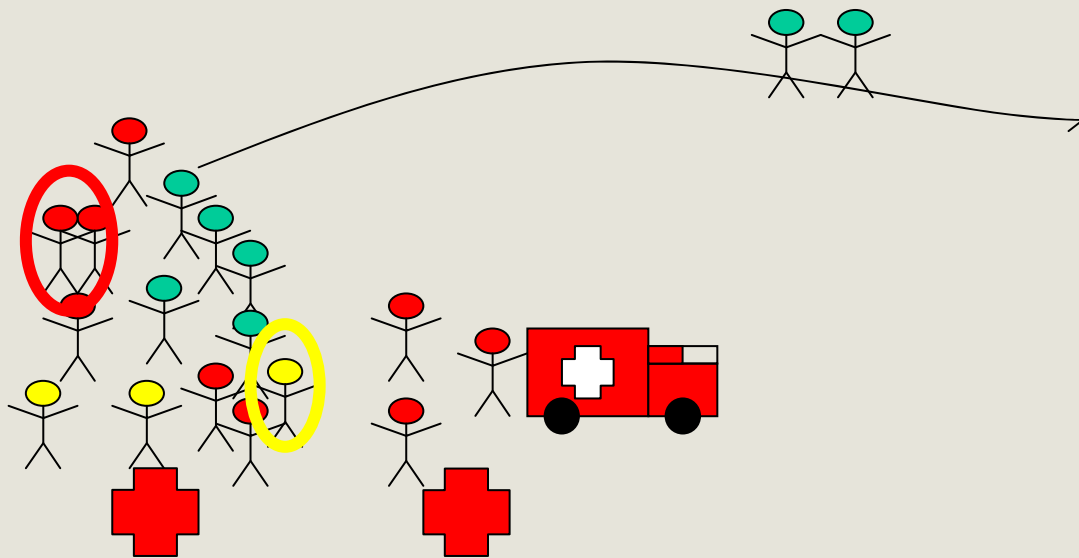


Triage Tags



Forms & clip board

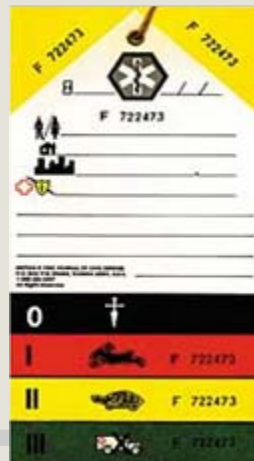
Known Problems with Field Care of Victims of Mass Casualty Events



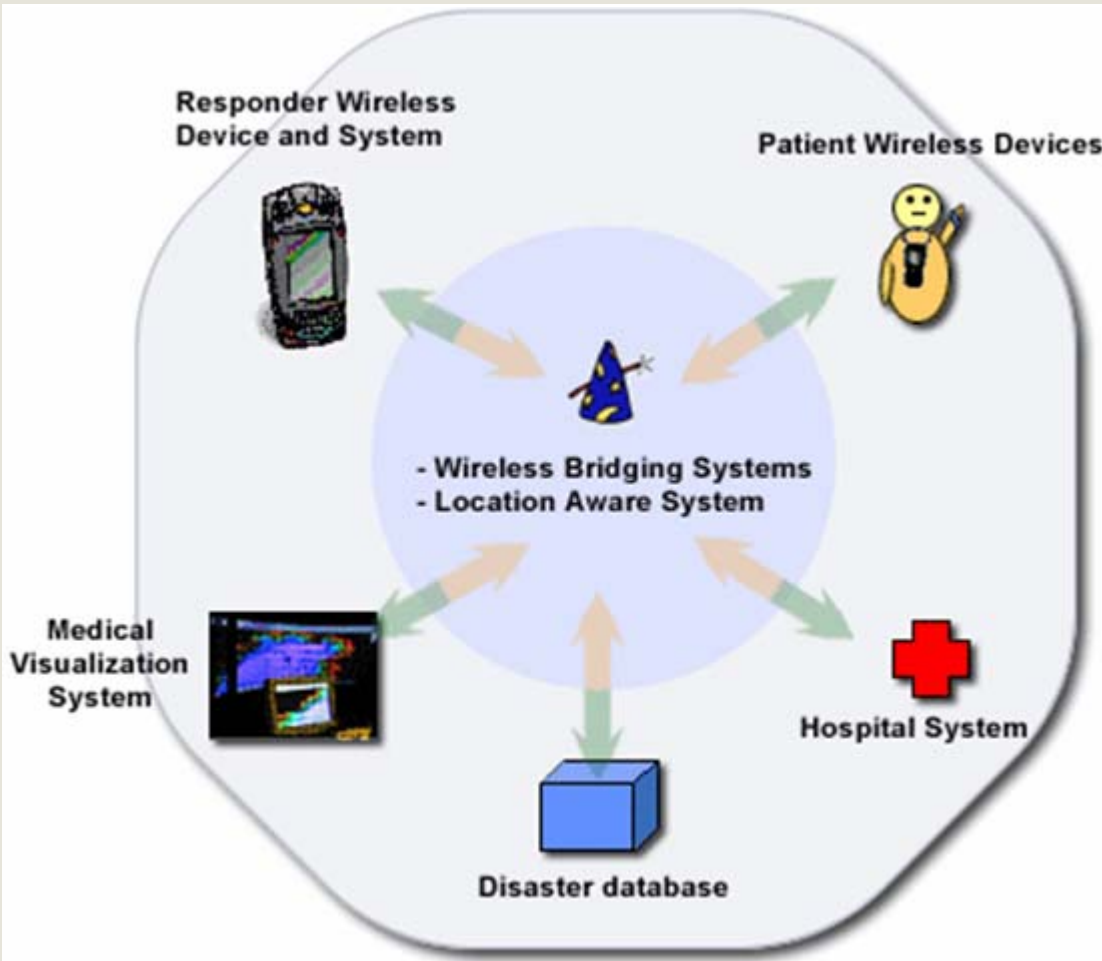
Field

Treatment
Station

Transport
station



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



Participatory iterative design

*One on One
interviews* *Interactive
design
workshops*

*Embedded
first responders*

**Operation
Cruise ship
5/2005**

**Operation
Moonlight
5/2004**

*Network architecture
electronic triage tags, pulse ox*

**Operation
Grand Slam
8/2002**

System design

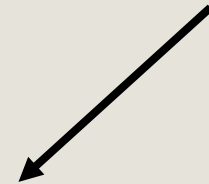
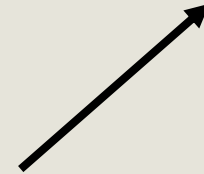
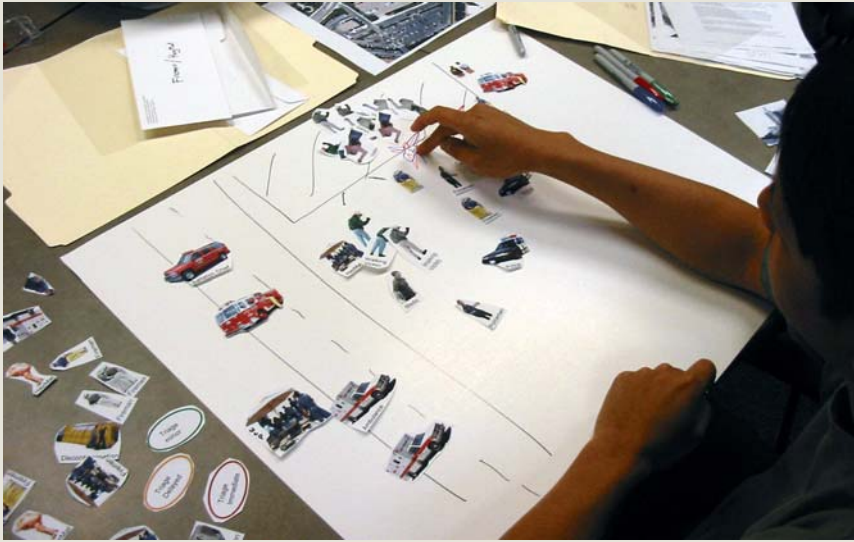
**Operation
Fairgrounds
11/2005**

**Handheld
Refined networks, video**

**Operation
Campus
Freedom
8/2006**

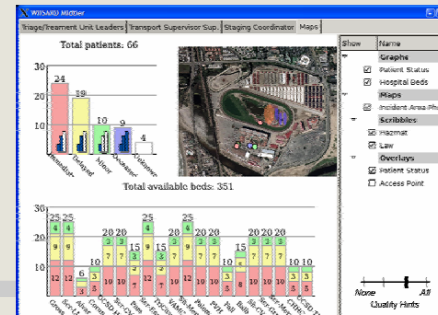
**Systems
integration**





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

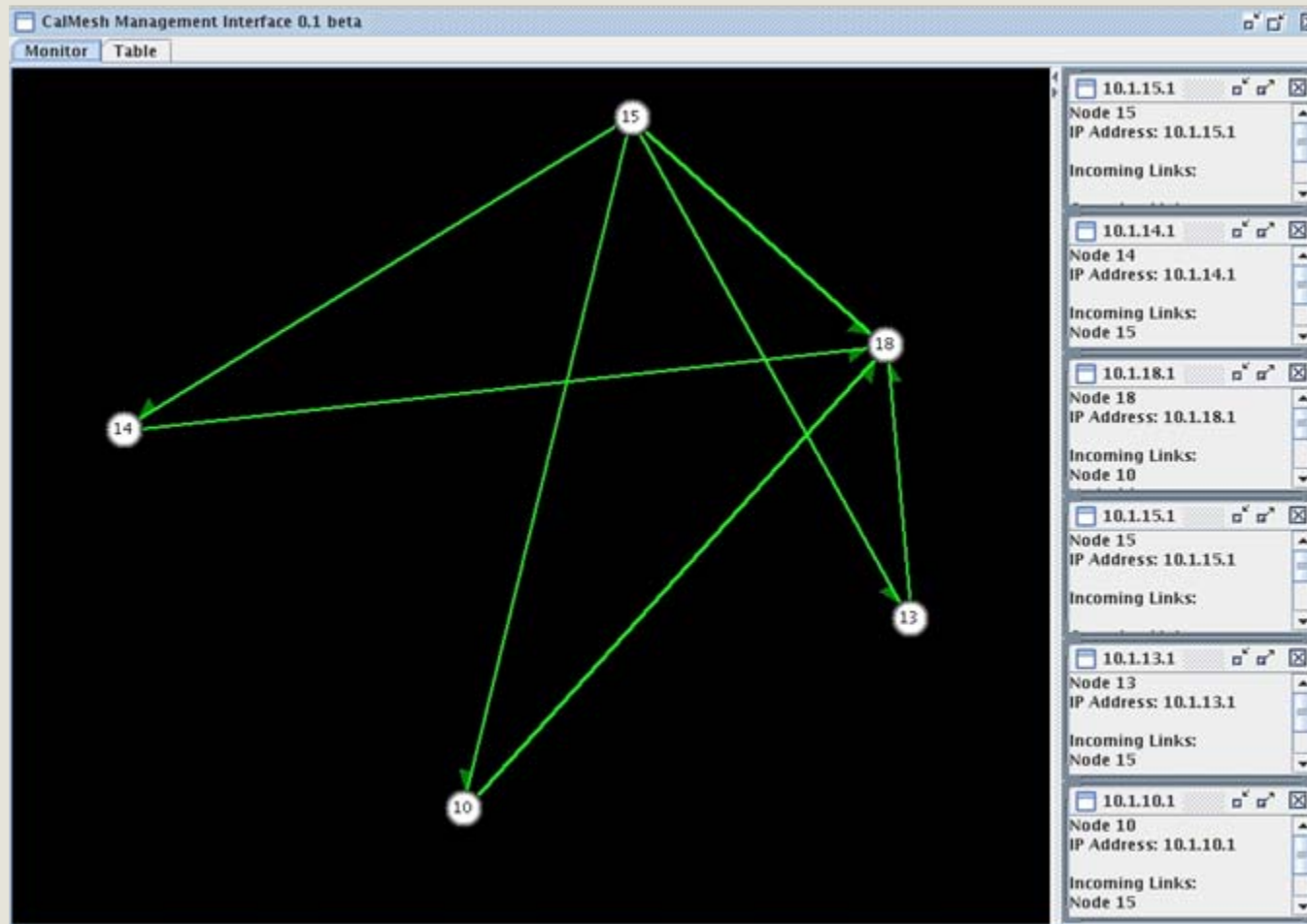


Calmesh geoware networking platform



- 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

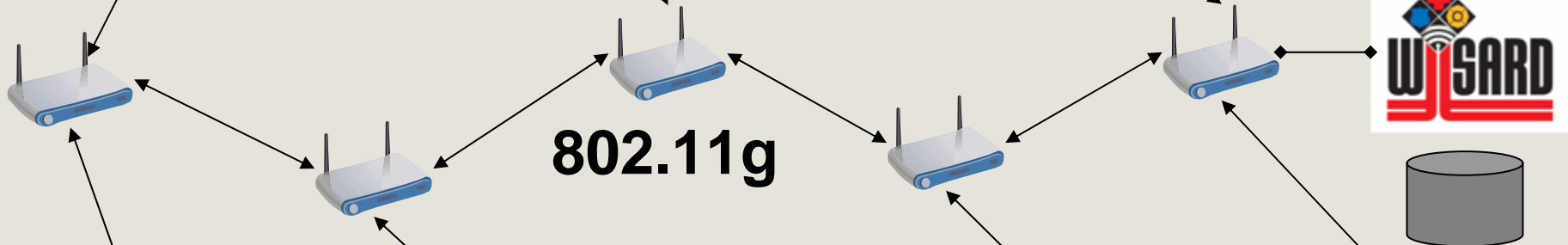




G3 cellular

WiMax

Satellite

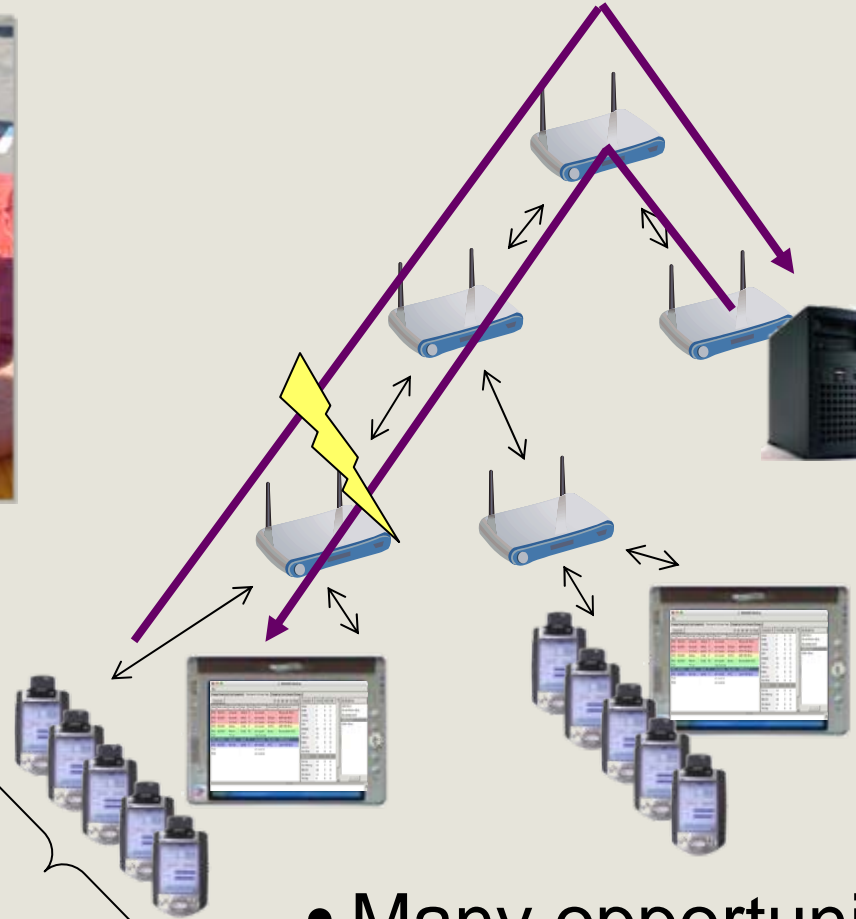


802.11g

802.11b



WIISARD Basics – Network View

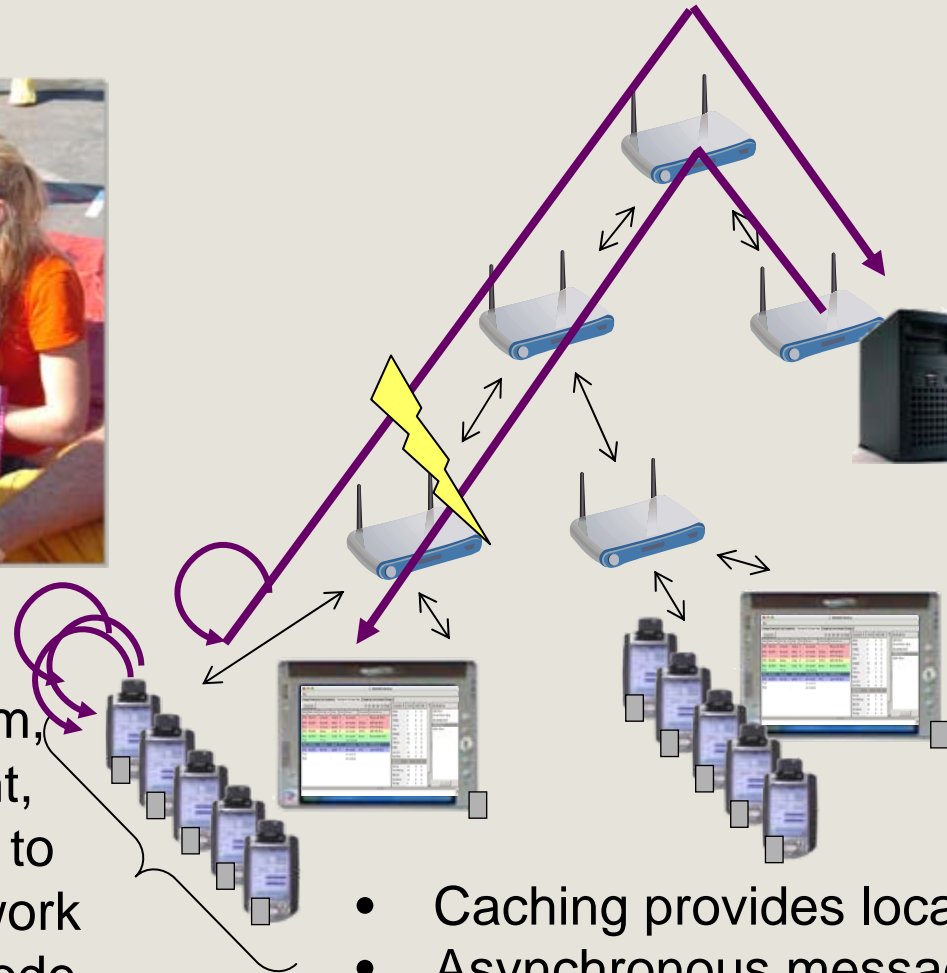


Single team,
line of sight,
connected to
same network
node.

- 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

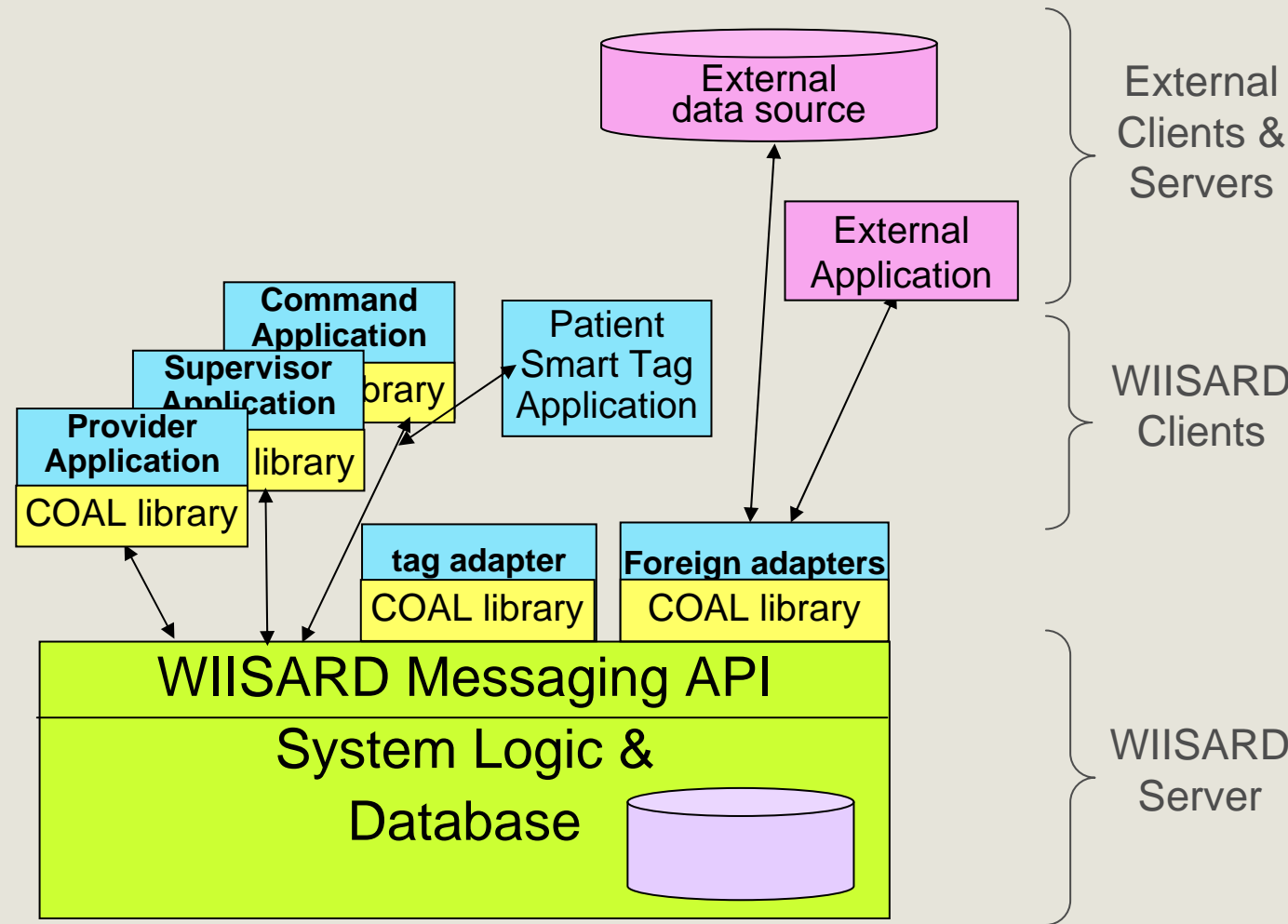


WIISARD Software Architecture

- *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

iTAG
WIISARD Triage Tag

Administration

WIISARD Device Control

Clicking the button below will immediately reboot the device. A reboot is necessary in order to change most configuration options.

Clicking the button below will reset all configuration options to their factory default values and the device will reboot. Note that the IP address of the device will also be reset and it may be necessary to change the address in your browser to access this website again.

Device Firmware Upgrade

To upgrade the device firmware, enter the name of the devicey firmware upgrade file, and click on the upgrade button below.

File to upload:

The upload may take up to 60 seconds.

Admin User Name:

Admin Password:

HELP

Options include:

Reboot

Reboot the processor. This loses all of the temporary data. Patient data and settings will remain stored in flash. When the processor reboots the web service is lost until the device reboots and reestablishes WiFi contact with an access point. That can sometimes take 10 seconds or more.

Reset Configuration

This causes all of the settings to be reset to their initial values. Be careful about doing this.

Device Firmware Upload

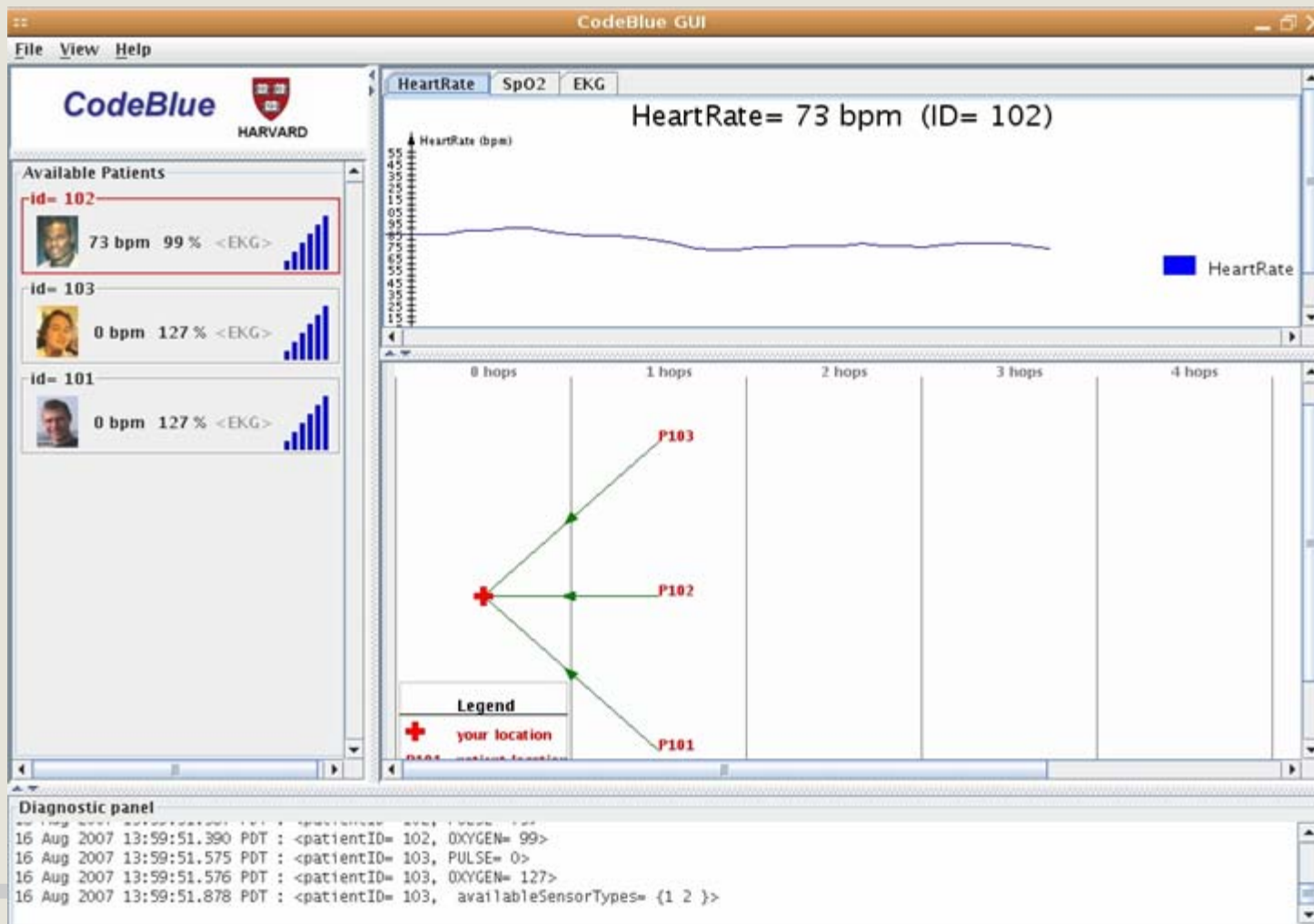
This is for skilled WIISARD technicians only. It 'burns' new firmware code into the system. This operation is fairly well protected from crashes but there is a possibility of irretrievable error. The code will be temporarily stored in flash and then will be checked thoroughly for loading errors. If no errors are detected the new code is saved in flash.

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

Pt: TAG045 - adult/male/mi...

File New Pt Scan Pt

Pts Triage PE/Tx ID/Loc

Age
 Adult
 Child
 Infant

Sex
 M F

Decon Status
 Drty Cln

Resp
 <= 30
 > 30

Cap Refill
 <= 2s
 > 2s

Follow Commands
 Yes No

Acuity
 Immediate
 Delayed
 Minor
 Deceased

Triage Info Submitted

15:37

Pt: TAG014 - //deceased

File New Pt Scan Pt

Pts Triage PE/Tx Summary Photo

Right Arm
Med Trma Brn

Numbness
Pain
Paralysis
Weakness

Enter

VS PE Findings Tx

12:45

Midtier system for field supervisors and regional hospital bed management

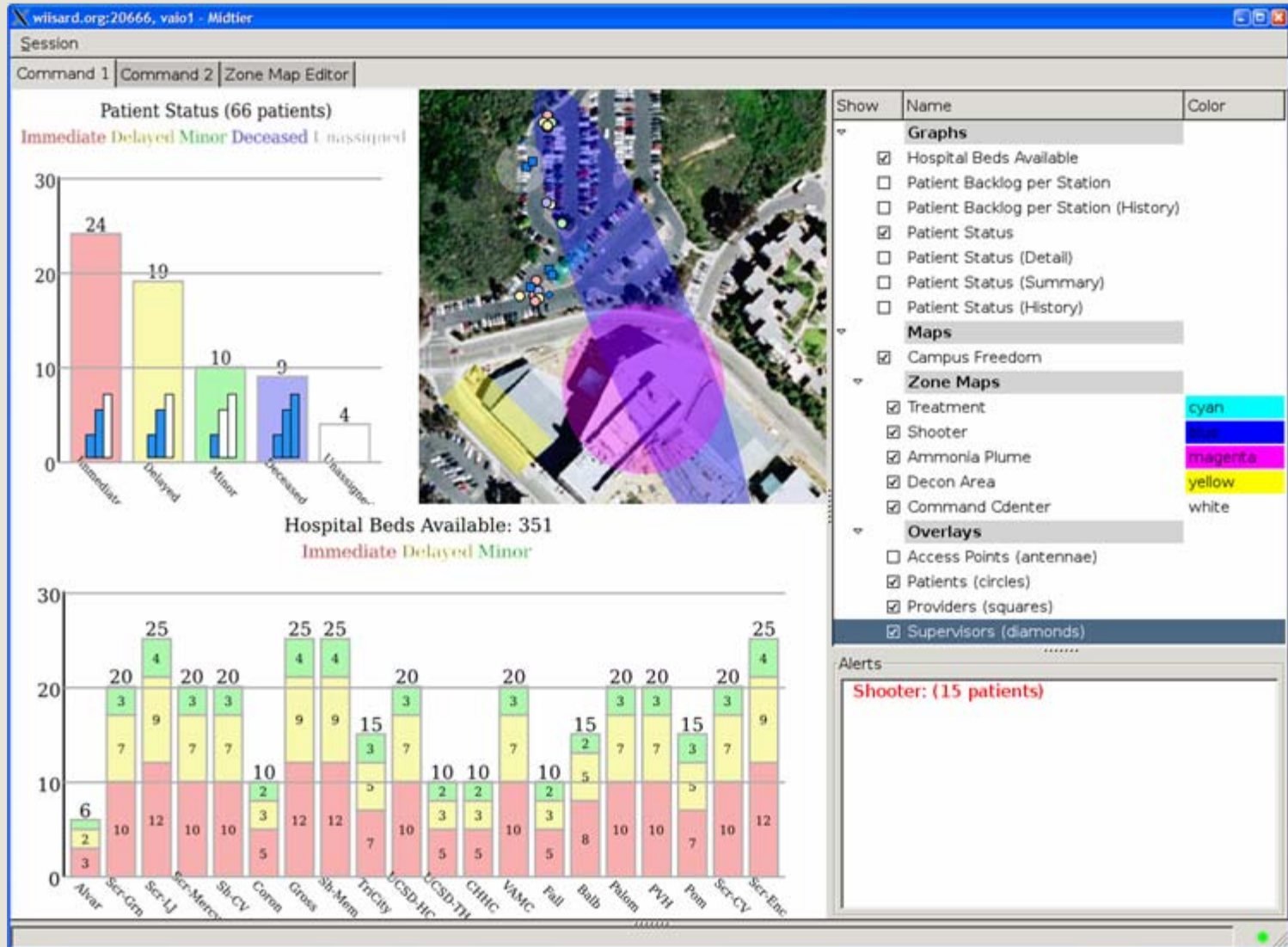


Role tailored software

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

The screenshot shows the WISARD software interface. At the top, there are tabs for 'Triage/Treatment Unit Leaders', 'Transport Supervisor Sup', 'Staging Coordinator', and 'MICN'. Below these is a table of transport units with columns for 'Ambulance', 'Order', 'Aka', 'Barcode', 'Acuity', 'Sex', 'Decon', 'Dispo', 'Hospital', and 'Ambulance'. A callout box points to the 'Columns' and 'View' dropdowns, stating 'Change viewable columns of info.' Another callout box points to the 'Filter options for patient viewing.' callout. A third callout box points to the 'Available Transport Units As Entered By Staging Mgr.' callout. A fourth callout box points to the 'Available Hospitals & Beds/Bed-Types As Entered By MICN' callout. The interface also includes buttons for 'load patient', 'unload patient', 'Set Hospital', and 'Unset Hospital'. The status bar at the bottom shows 'Last barcode scanned: 123233333333' and the system tray with the time '11:56 PM'.

Command Team System



Complete System

