Movable Wireless Sensor Networks

First-Responder Automated Accountability Solution

WPI PPL Workshop

4 August 2008

TeraHop Solution Tells the IC:

Who's there.

TeraHop Solution Tells the IC:

Who's not.

TeraHop Solution Tells the IC:

Who's down.

Company Overview

- **Basics**
  - **Founded in 2001**
  - **Headquarters in an Atlanta suburb**
  - **32 employees/consultants**

- **Expertise**
  - **Moveable wireless sensor network technology, products & systems**
  - **Leadership & staff have *decades* of radio/wireless networking experience at Motorola, Lucent, Siemens, Nokia, Harris, WhereNet**
  - **14 patents issued/granted; 40+ pending**

TeraHop Focus

Movable Wireless Sensor Networks that monitor:

- **Presence**
- **Location**
- **Condition**

of

- **People**
- **Objects**
- **Environments**

As they change location, status, or condition.

TeraHop Technology

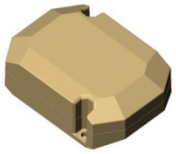
TeraHop technology *automatically* reports who/what is on-site and its condition.

TeraHop technology is *not* RFID-based.

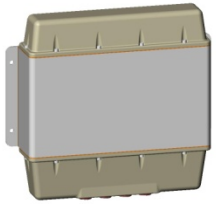
GPS is used in a secondary role.

TeraHop is looking for a within-site position-tracking technology.

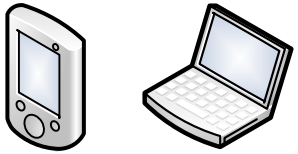
Main Solution Elements



RSN – Remote Sensor Node; worn by people and placed on assets; monitors their presence & motion.



Gateway Controller – mounted on vehicles &/or structures; routes & transfers RSN messages to/from other networks & user applications.

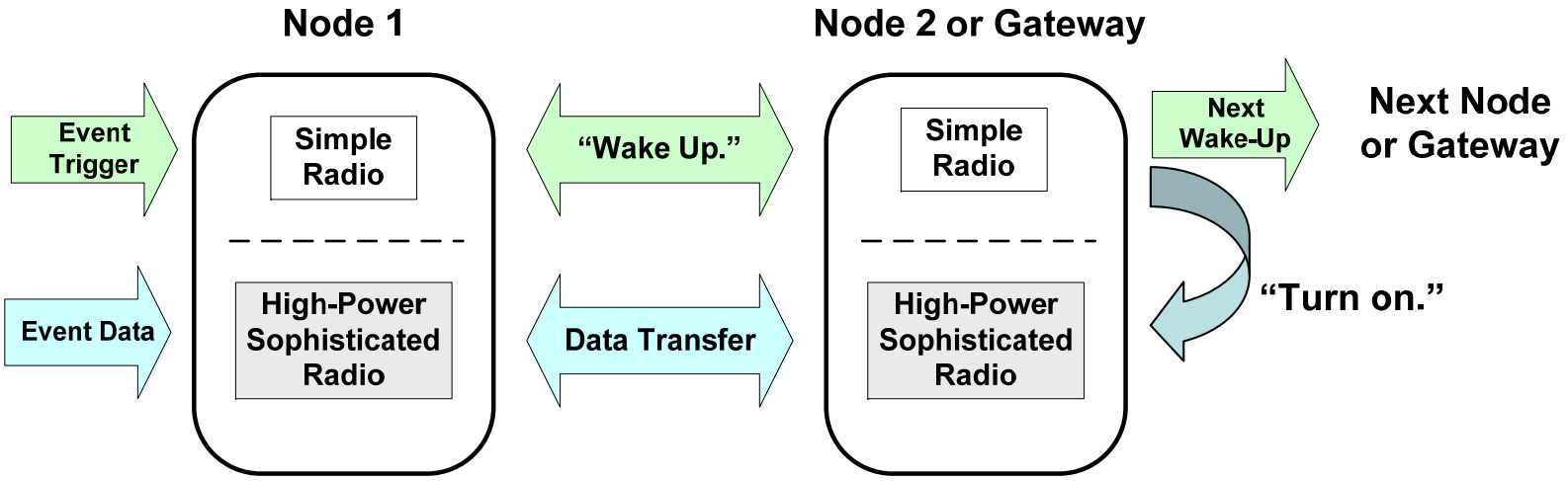


Laptops & PDAs – carried and used by ICs and other commanders; host the Incident Command application

Servers – located in buildings; host long-term incident data storage.

Technology Basics

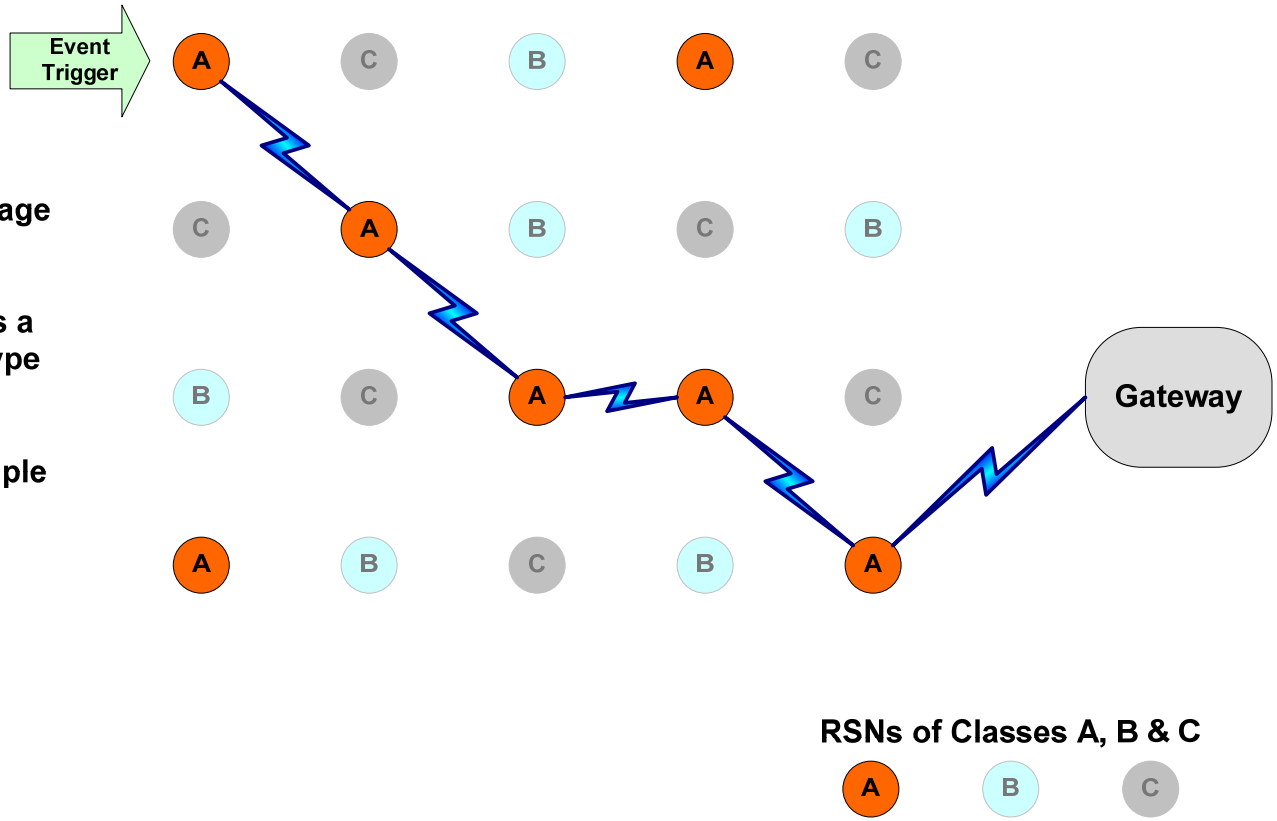
Wake-Up Radio: per a trigger, an always-on simple radio turns on the processor and a high-power radio, only when needed. Battery life is greatly extended, while rendering long range.



Technology Basics

Class-Based Networking: connectivity is based on Class, not proximity. Multiple users can share infrastructure.

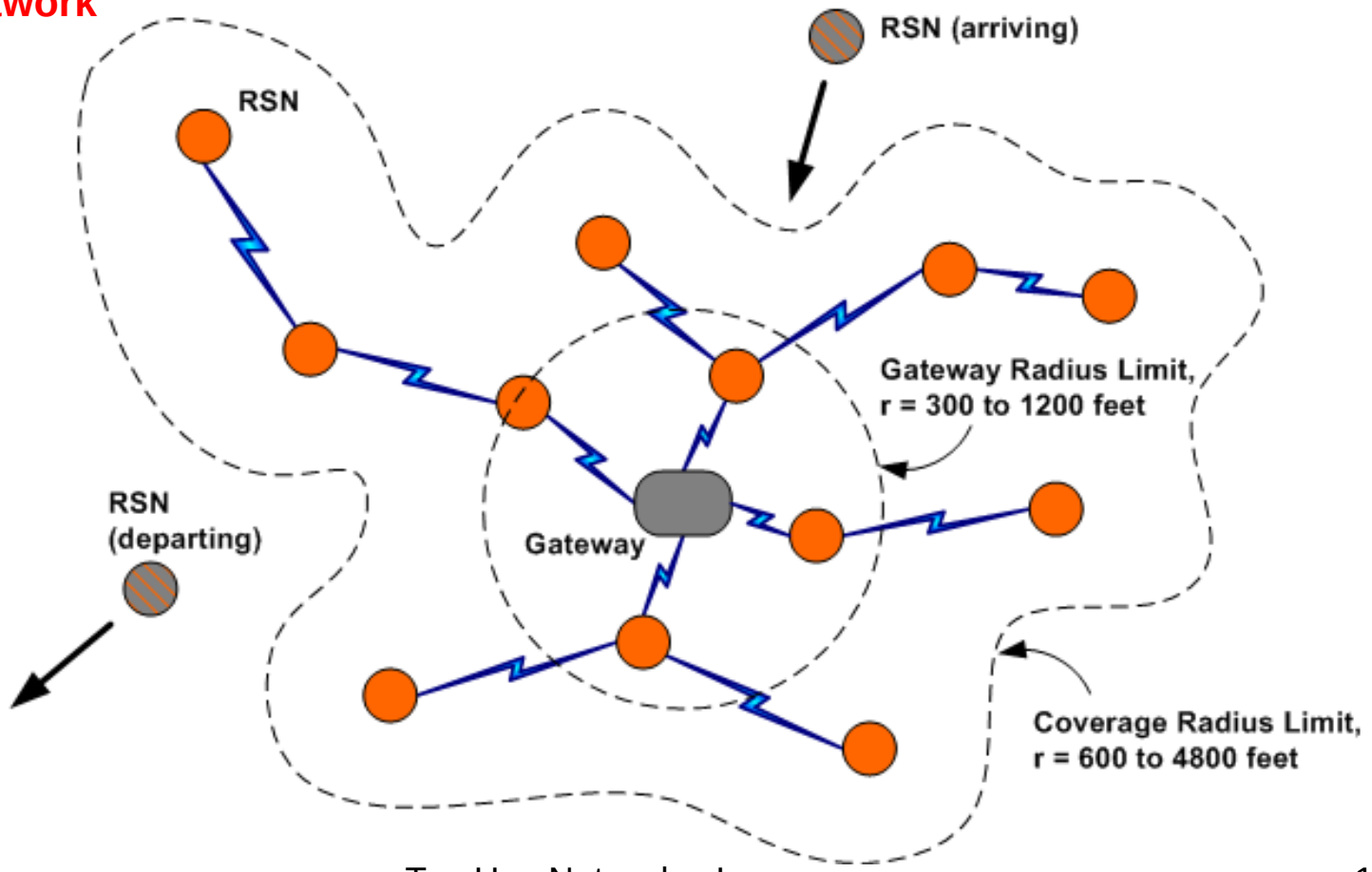
- Only nodes in the "right" Class participate in message delivery.
- A Class can be defined as a customer, an agency, a type of asset, etc.
- One node may be in multiple Classes.



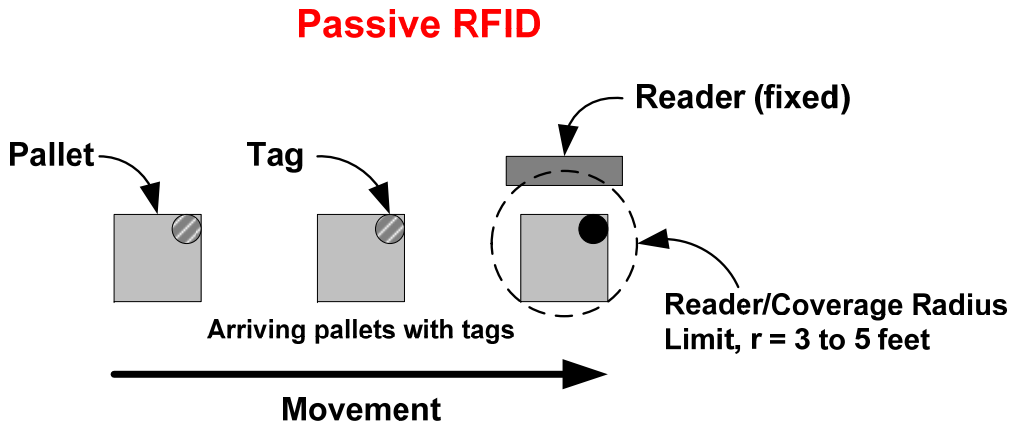
Technology Basics

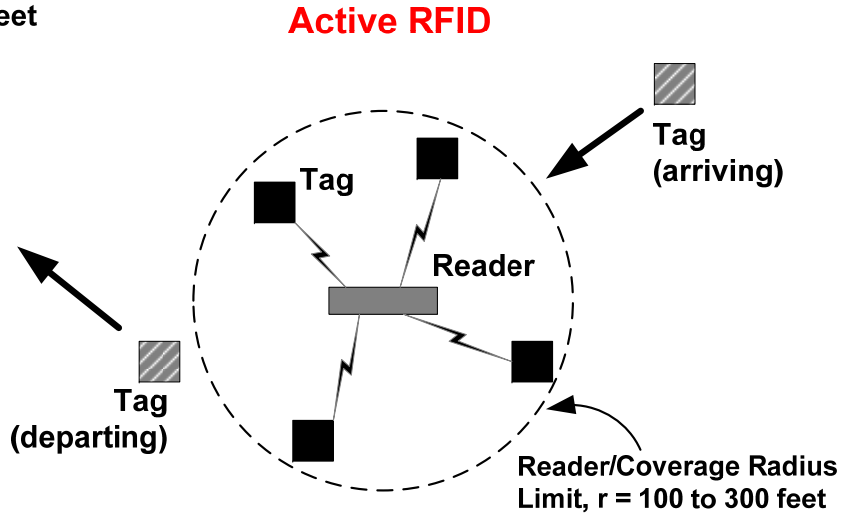
Hopping: RSNs can hop messages to/from the Gateway, which expands/deepens coverage – the network "breathes."

A TeraHop Network



For both passive and active RFID, range is limited to tag-to-reader range.





THN Technology

Advantages

- **Superior coverage & penetration.**
- **Superior battery life.**
- **Automatically forming and adjusting to changes.**
- **Permits high density of users.**
- **Inherent stealth.**
- **Infrastructure sharing.**
- **Networks can be mobile, temporary, or fixed.**

ICS – Incident Command System

NIMS – National Incident Management System

- **All incidents have ONE Incident Commander (IC).**
- **There is a hierarchy of command.**
- **Formal handoff is required for changes in command.**
- **All incident assets are known & periodically checked.**

ACCOUNTABILITY

Accountability Aggravations

- **Assets rarely arrive at the same time or together.**
- **Assets arrive from multiple directions.**
- **Assets come and go during an incident.**
- **Command often changes during an incident.**
- **Radio congestion & interference are common.**
- **Incidents can cover 10s-100s of acres, multi-level.**
- **Assets may be from different agencies & entities.**

Tools/Techniques Used Today

- Who has arrived?
- What are their skills

  - Check-in desks
  - Check-in radio calls

- What are their assignments?

  - Paper & Pencil
  - White Board
  - Software

- Are they in distress? → PASS Device
- Are they still here? → PAR Calls

But Wait! More Aggravations

- **Full-time fire assets *usually* arrive as units & are *usually* assigned as units.**
- **Part-time fire assets *usually* arrive individually but are *usually* assigned as units.**
- **Law enforcement assets *usually* arrive individually & are *usually* assigned as individuals.**
- **Fire assets stop moving when in distress.**
- **Law enforcement assets are mostly motionless.**
- **Most incidents are small. Any incident can grow.**

Summary of Problems

- IC often not sure who/what is present on-scene.
- IC often lacks timely notification of people/equipment arrival.
- IC often not sure what capabilities the people/equipment have.
- It's time-consuming & error-prone to collect data manually.
- It's time-consuming & tactically disadvantageous to query arrivals, especially if they have to report to a check-in location.
- It's distracting & difficult to keep tabs as assets come & go.
- It's distracting & difficult to keep tabs on asset well-being.
- Changes in command aggravate all of the above.

First Responder Solution

Features & Capabilities

- **Automated Accountability:**
  - **Who & what are on-scene (including skills & qualifications),**
  - **Who is unaccounted for (of checked-in assets),**
  - **Who is in distress.**
- **Area-wide wireless coverage (no check-in desk required).**
- **Always on, 2+ year battery life.**
- **Supports first-on-scene-in-command.**
- **Supports command transfers.**
- **Keeps a log of all incident events & assignments.**
- ***Manage* by units or individuals; *monitor* by individuals.**
- **Network forms automatically at the scene, and it "breathes."**

TeraHop Addresses

• **Who has arrived?**	☑ **Auto-notify**
• **What are their skills?**	☑ **Auto-notify**
• **What are their assignments?**	☑ **Auto-populate**
	☑ **Recording tool**
• **Are they in distress?**	☑ **Auto-engage**
	☑ **Auto-notify**
• **Are they still here?**	☑ **Auto-check-in**
	☑ **Auto-notify**

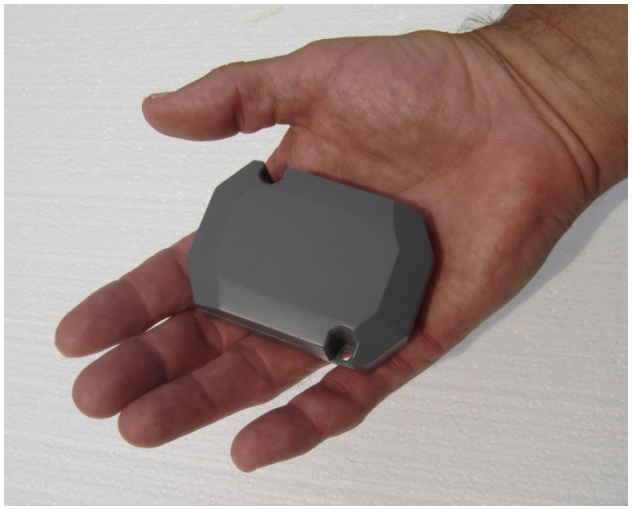
THN First Responder Solution

- **The THN solution does *not*:**
  - **Replace radios**
  - **Replace PASS devices**
  - **Replace PAR calls**
- **The THN solution does:**
  - **Complement radios, PASS & PAR**
    - **Increased safety**
    - **Better use of available resources**
  - **Relieves the IC of several manual accountability tasks by automating them**
    - **Faster**
    - **Easier**
    - **Simpler, with fewer mistakes**
  - **Minimizes distractions to the IC (exception-only notification)**
    - **Increased safety**
    - **Better planning & execution**

RSN Functions & Capabilities

RSNs are the I-am-here-and-this-is-my-condition devices.

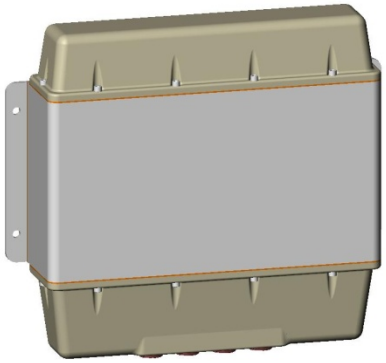
- **Automatically makes its presence known to IC, by communicating with Gateways.**
- **Carries ID information about the wearer & automatically reports it:**
  - **Name**
  - **Service**
  - **Jurisdiction**
  - **Qualifications**
- **Always on; no user controls.**
- **2+ years battery life**
- **Automatically detects & reports distress.**



Gateway Features & Capabilities

Gateways define/manage local networks & link to the rest of the world.

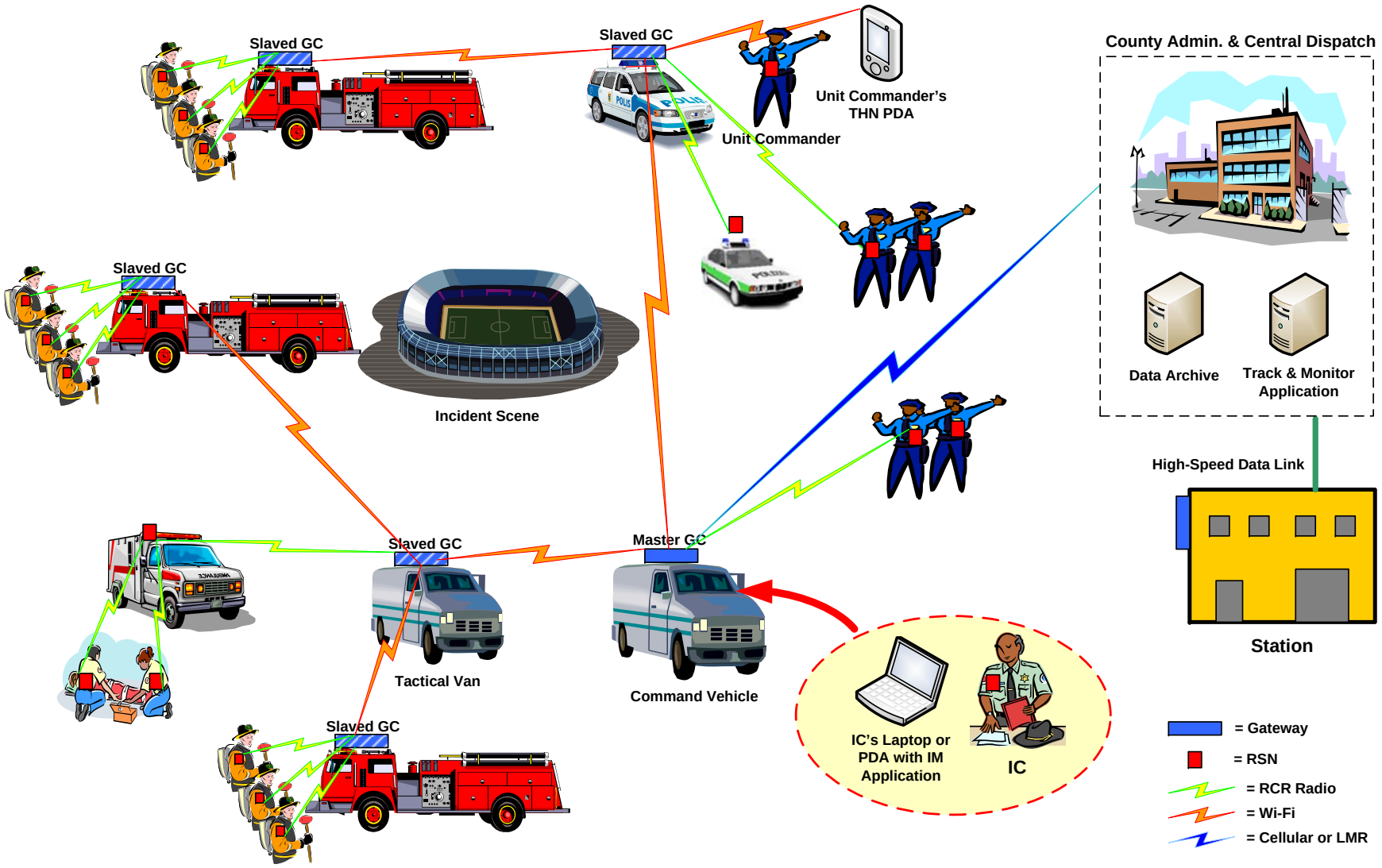
- **Establishes coverage at an incident**
- **Establishes presence of RSNs**
- **Collects data from RSNs**
- **Provides communications between local network and other networks & user applications**



Gateway

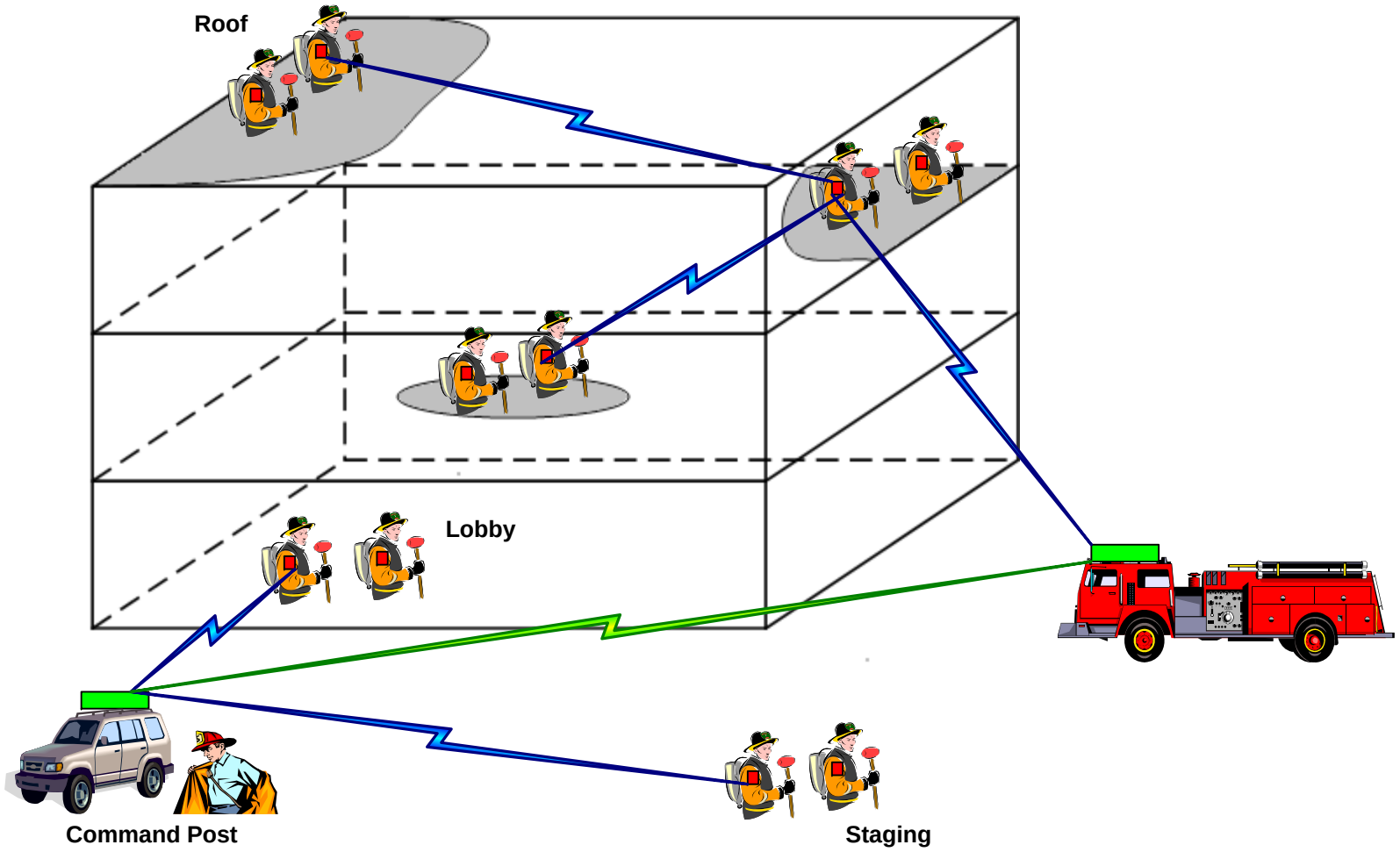
RSN

Deployment


Slaved GC
Slaved GC
Unit Commander's
THN PDA
Unit Commander
County Admin. & Central Dispatch
Slaved GC
Incident Scene
Data Archive
Track & Monitor
Application
High-Speed Data Link
Slaved GC
Master GC
Tactical Van
Command Vehicle
Station
IC's Laptop or
PDA with IM
Application
IC
Slaved GC
= Gateway
= RSN
= RCR Radio
= Wi-Fi
= Cellular or LMR

Deployment

Hopping affords wide, penetrating coverage.



Sample PDA Screen

Main Screen

Local Time: 13:44 Incident Timer: 02:56

Link Bat.

Present On-Scene

Screen ID	Svc	Assignment
Smith, J.	LE	Crwd/Trffc
Jones, W.	LE	Crwd/Trffc
Lt. Harper, K.	LE	SWAT
Eng. 42	FR	Div. A
Ladder 31	FR	Interior

View by Sect/Div | Tools | Exit

Summary – The Solution

- **Provides:**
  - automatic identification and presence reporting of the assets on-scene *to the Incident Commander.*
  - an incident management tool to record incident events & the arrival, assignment, and release of incident assets.
  - automatic notification of assets in distress & when assets cannot be accounted for.
- **Supports:**
  - ICS and NIMS.
  - relaying of data generated by other sensors.
- **Lacks:**
  - reporting of precise position within the incident area of on-scene assets.
- **Is:**
  - in a field trial with a major GA county sheriff's department.

TeraHop Solution Tells the IC:

Who's there.

TeraHop Solution Tells the IC:

Who's not.

TeraHop Solution Tells the IC:

Who's down.

Contact Info

Joe Denny

404-409-6247 (m)

jdenny@terahop.com

www.terahop.com

Backup

Sample PDA Screen

Main Screen

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Incident Timer: 02:56
Link
Bat.

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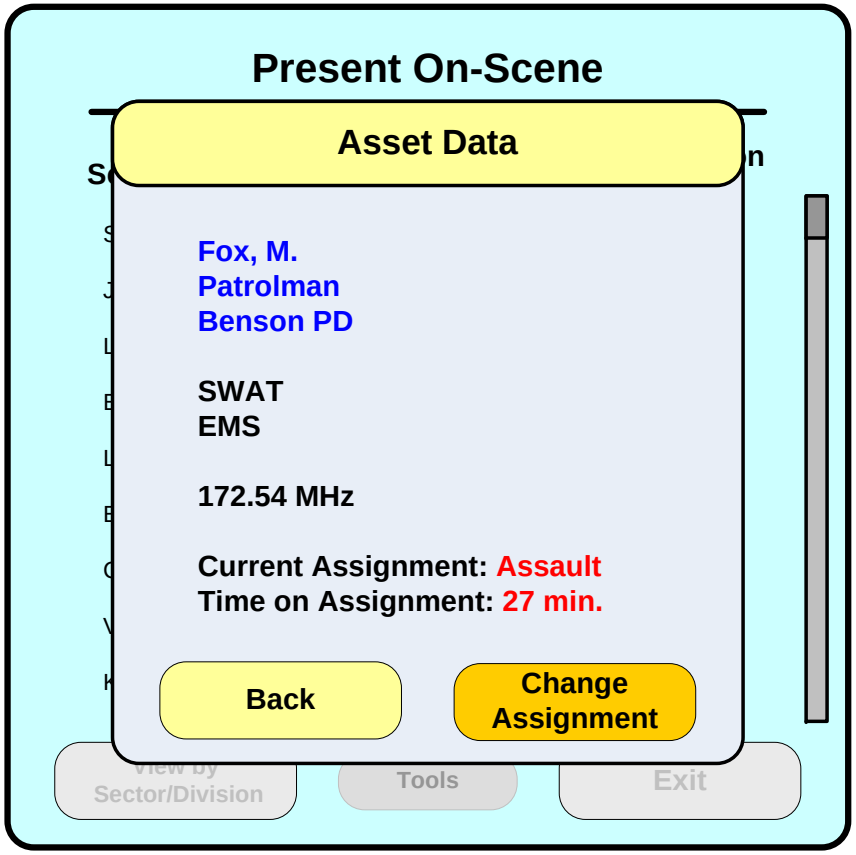
View by Sect/Div | Tools | Exit

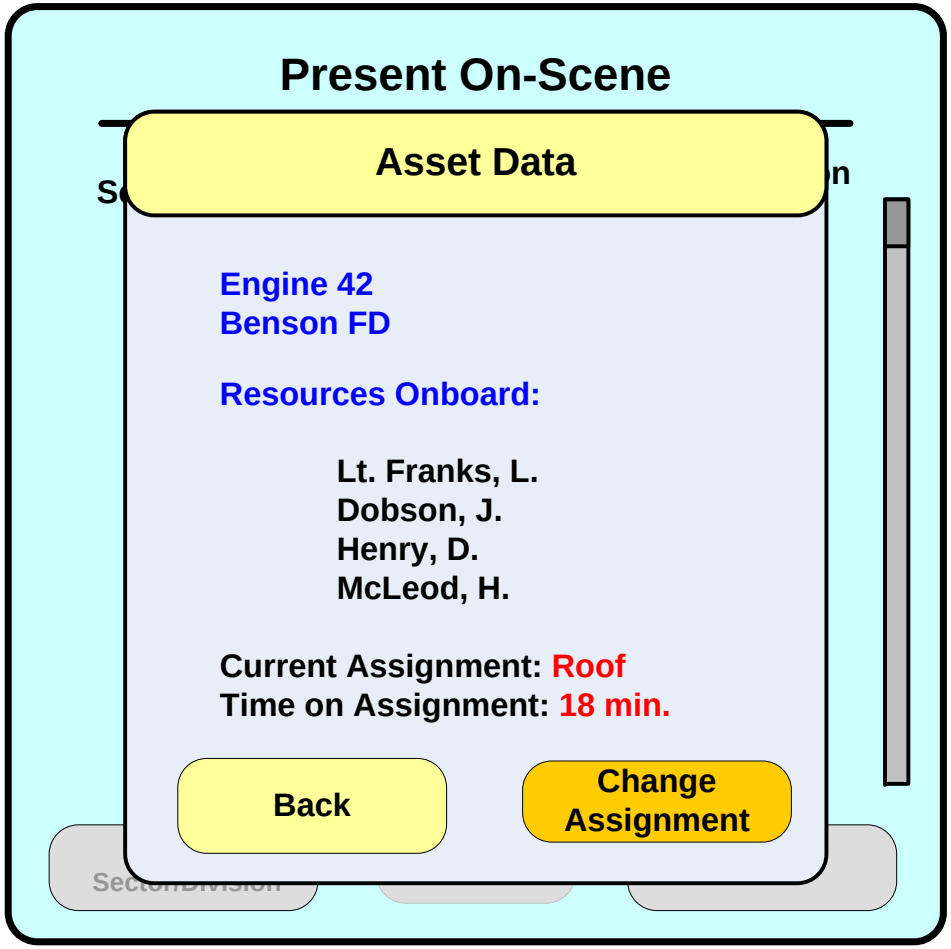
Sample PDA Screen

Asset Data - Individual



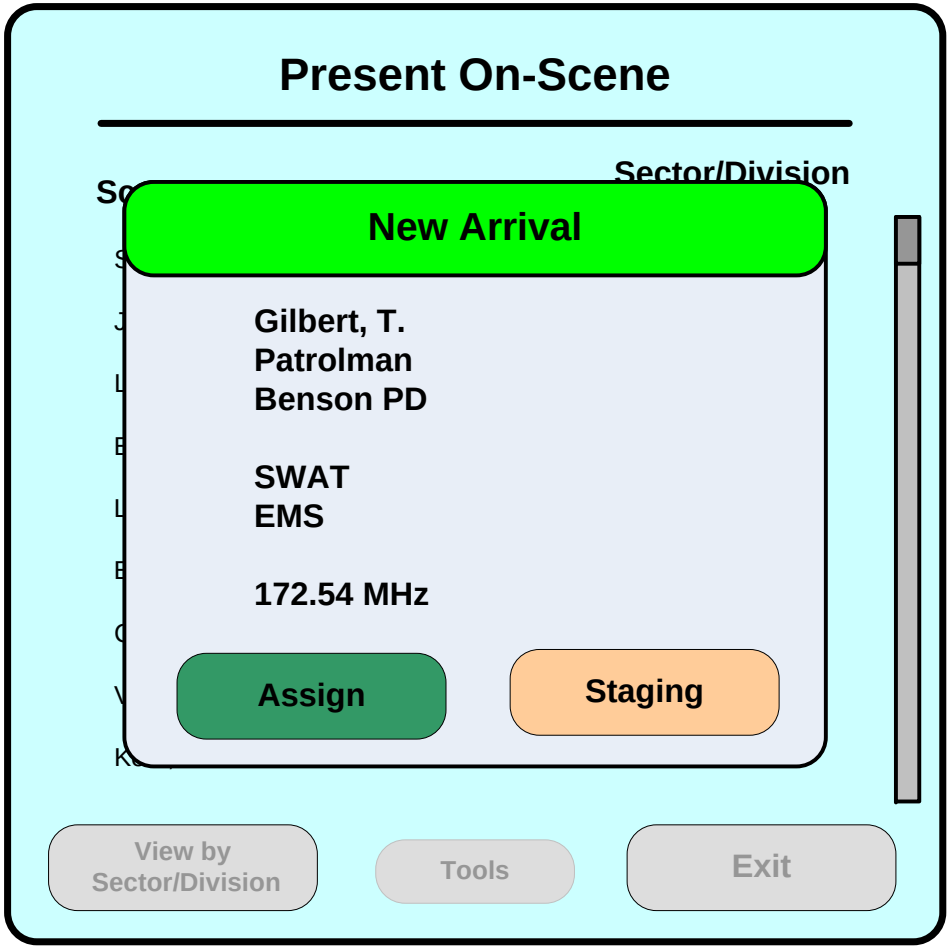
Sample PDA Screen

Asset Data - Unit



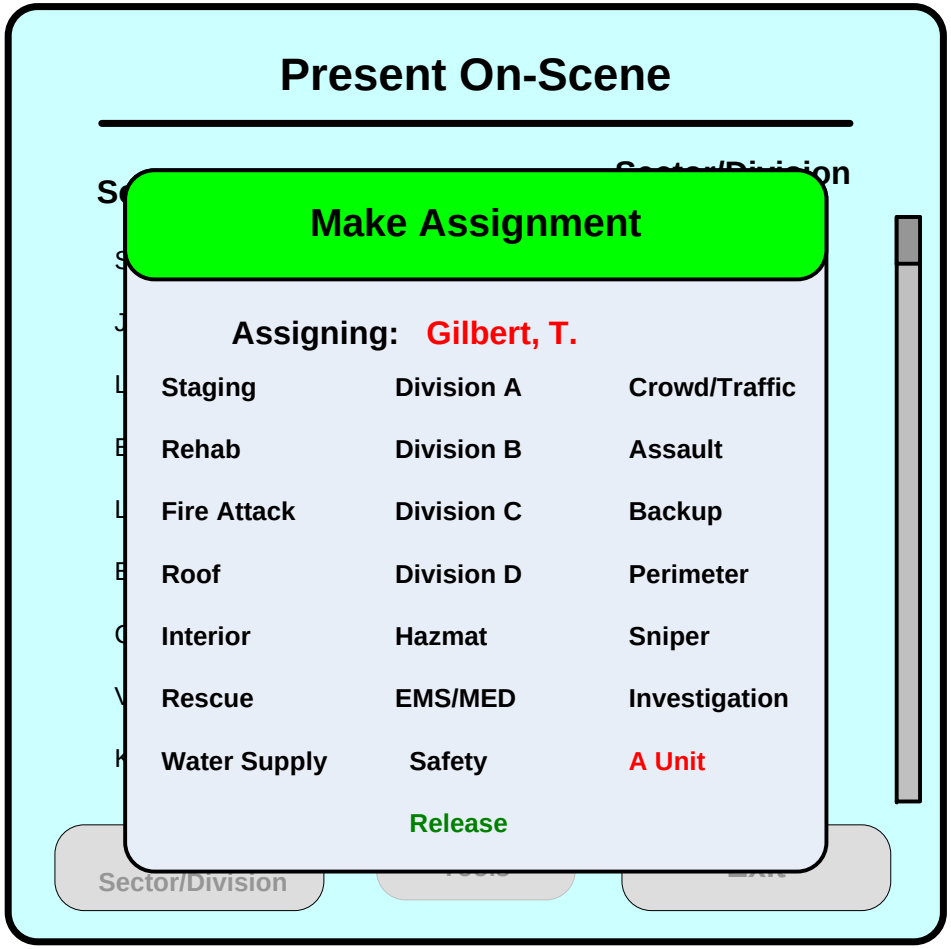
Sample PDA Screen

New Arrival



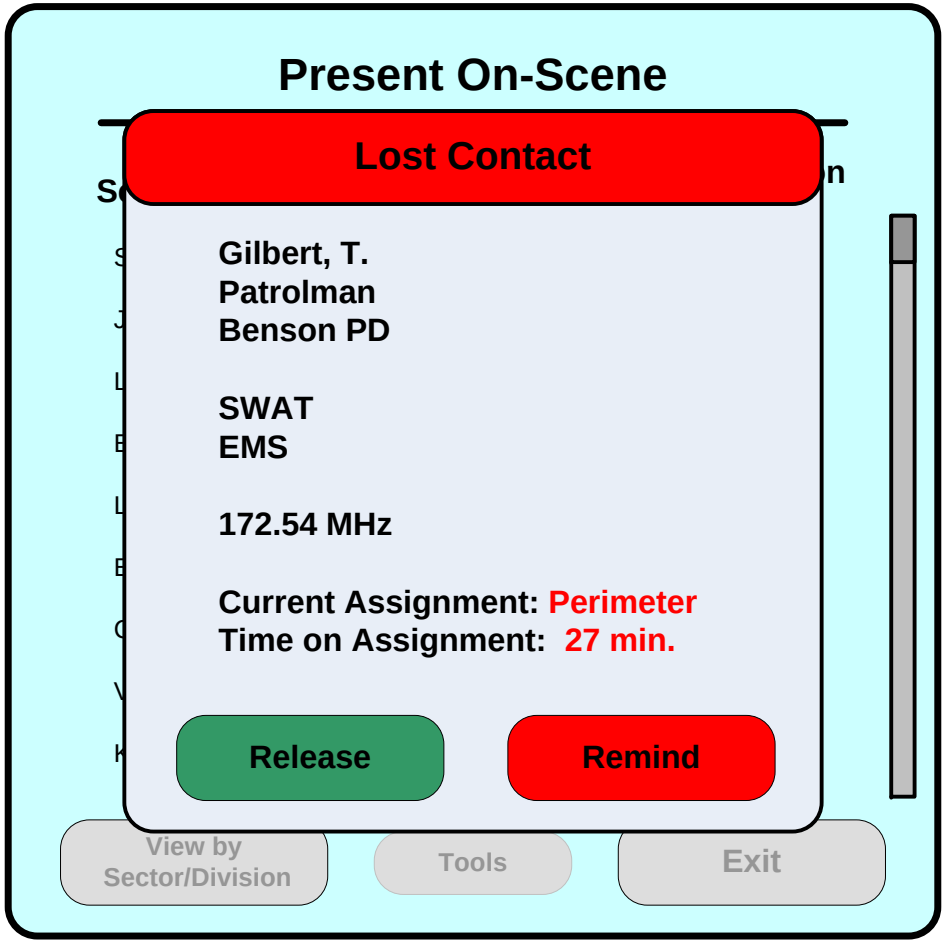
Make Assignment

Make Assignment



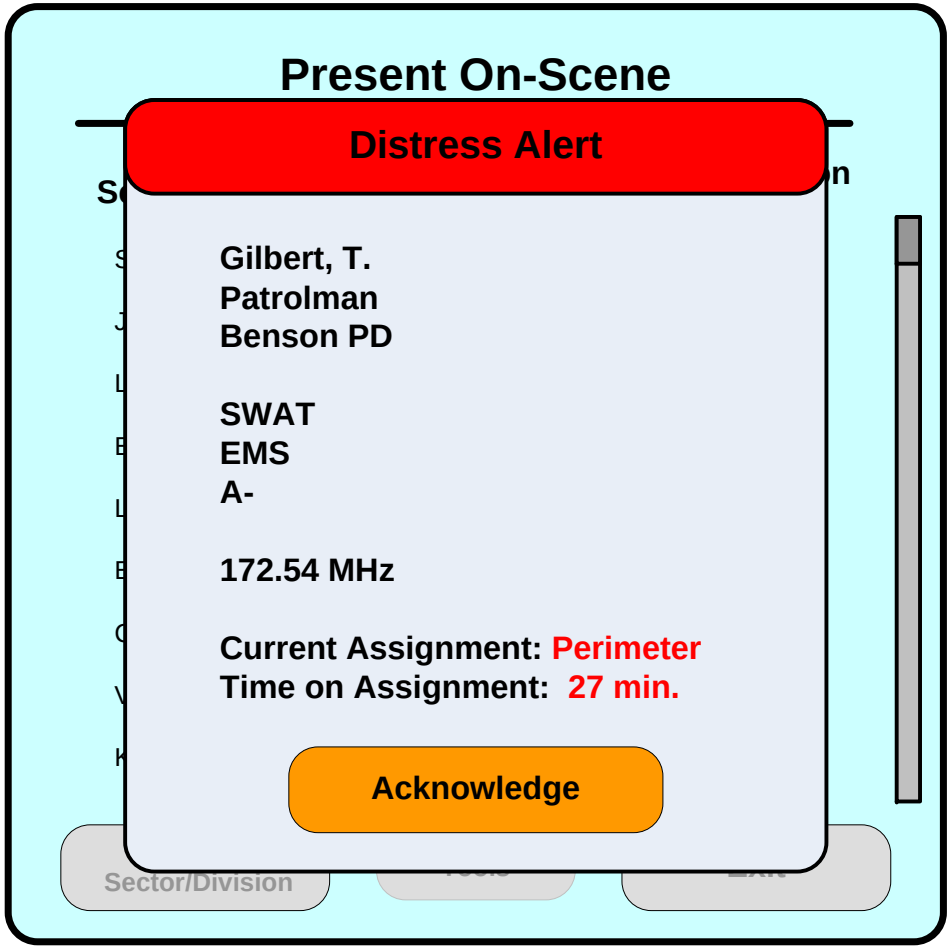
Sample PDA Screen

Lost Contact



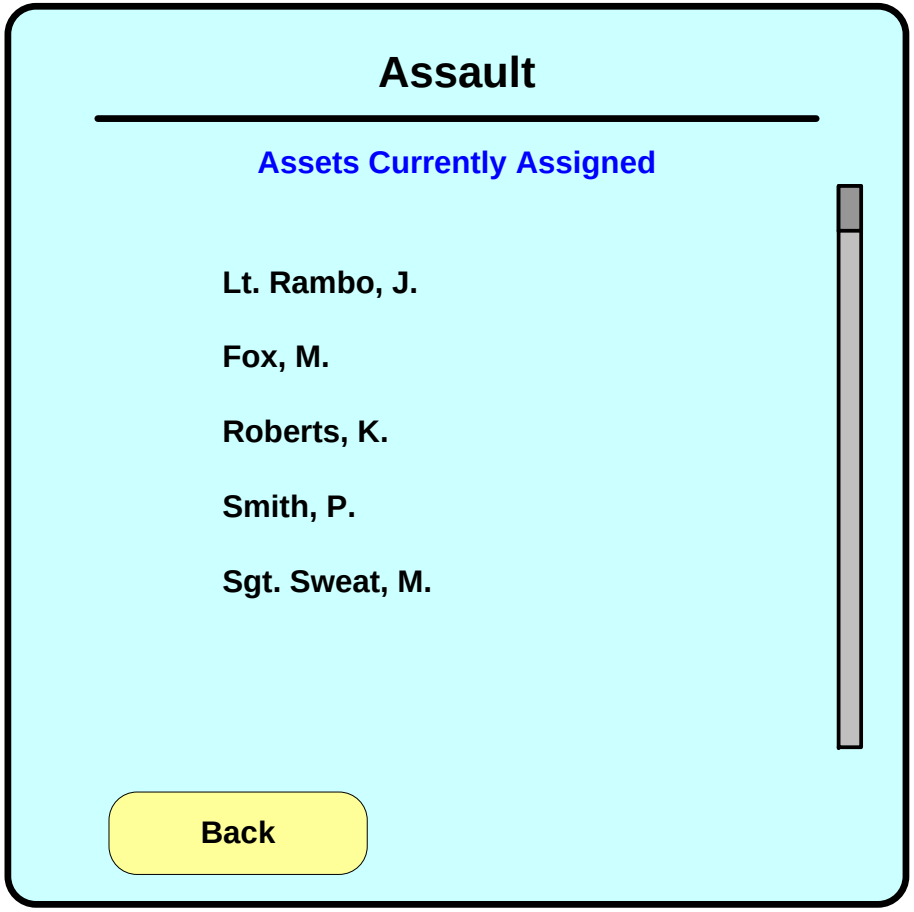
Sample PDA Screen

Distress Alert



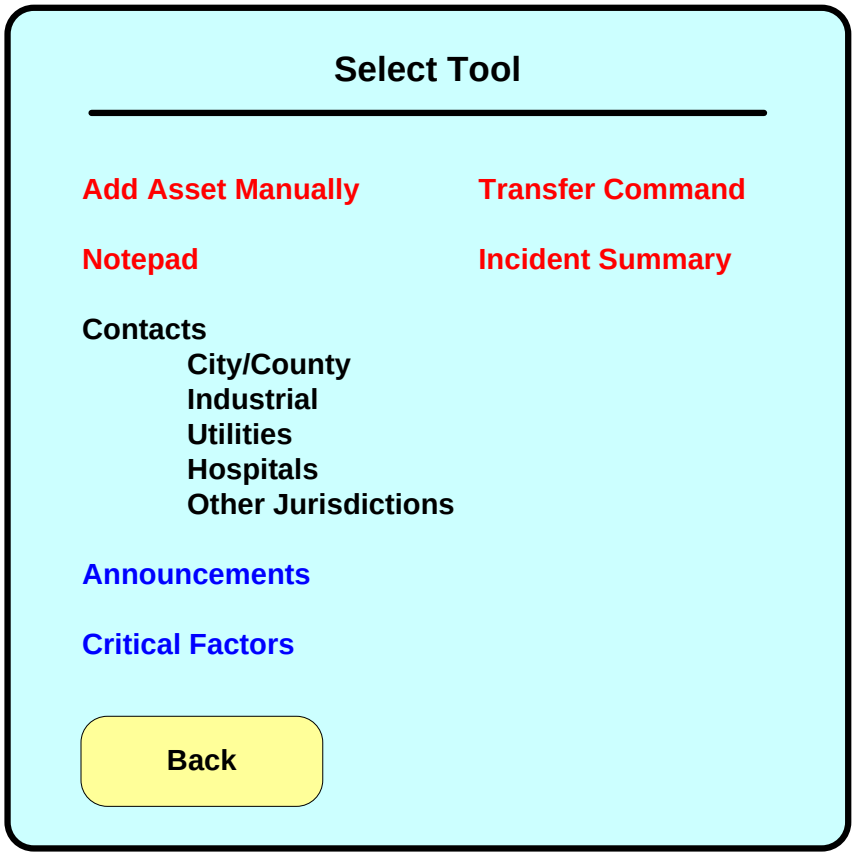
Sample PDA Screen

View Assignments of One Division



Tools Select Screen

Select Tool



Technology Comparison

	P-RFID	A-RFID	TeraHop	Satellite
Tag/Device Cost	< $1	$10-100	$200	$300-800
Infrastructure Cost	Low (1 gate) Very high (a site)	Med. (1 zone) Very high (a site)	Medium	None (Taxpayer funded)
Tag/Device Size	Postage stamp	ID badge to paperback book	Deck of cards	Paperback book
Internal Battery Life	NA	Months-years	2+ years	Uses asset's power
Service Charges	None	Low	Low	High
Location Precision	At a gate	Zone presence	Site presence	10-30 feet
Range Radius	3-5 feet	100-300 feet	600-4800 feet	Unlimited - outdoors
Sensor Monitoring	None	None-limited	Standard	Optional
Query Capability	No	Limited	Standard	Standard
Data Storage	No	None - limited	Standard	Optional
Device Density	Unlimited	Limited	High	Unlimited
Use at Temporary Sites	Limited	Limited	Unlimited	Unlimited
Infrastructure Complexity	Low	Low	Low	NA
Tags Are Networked	No	No	Yes	No
Tags Hop Messages	No	No	Yes	No
Tags Auto-Adjust to Site	No	No	Yes	NA
Asset Appropriateness	Small-size, low-value consumables	Medium-size, medium-value	Medium-large size high-value	Large-size, self-mobile

First Responder Solution

Features & Capabilities

- **Automated Accountability**
  - Auto reporting of on-scene presence of people & equipment
  - Auto reporting of asset ID & qualifications
  - Auto display of assets at unit & individual levels
  - Management by units or individuals; monitoring by individuals
  - Auto distress monitoring of people in/out of hot-zone assignments
  - Auto distress notification to IC
  - Auto notification when resources no longer present
  - Auto record-keeping of assignments & events
- **Area-wide wireless coverage** (no check-in desk required)
- **Always on, 2+ year battery life**
- **Supports first-on-scene-in-command**
- **Supports command transfers**
- **Network forms automatically at the scene, and it "breathes"**

PASS Device

PASS – Personal Alert Safety System

- Worn by firefighters, outside their suits.
- May be integrated into SCBA.
- Begins to beep if motionless for ~15 seconds.
- Screeches if motionless for ~ 30 seconds.
- Includes flashing light beacon.

PASS devices are aimed at alerting those who are *nearby* when one is in distress.

High heat often renders them inoperable.