

# Future Mobile Wireless Solutions for Threat Detection and Decision Support in the Field

Presentation made by Lee Hamilton at:  
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## The Field Officer of The Future ??

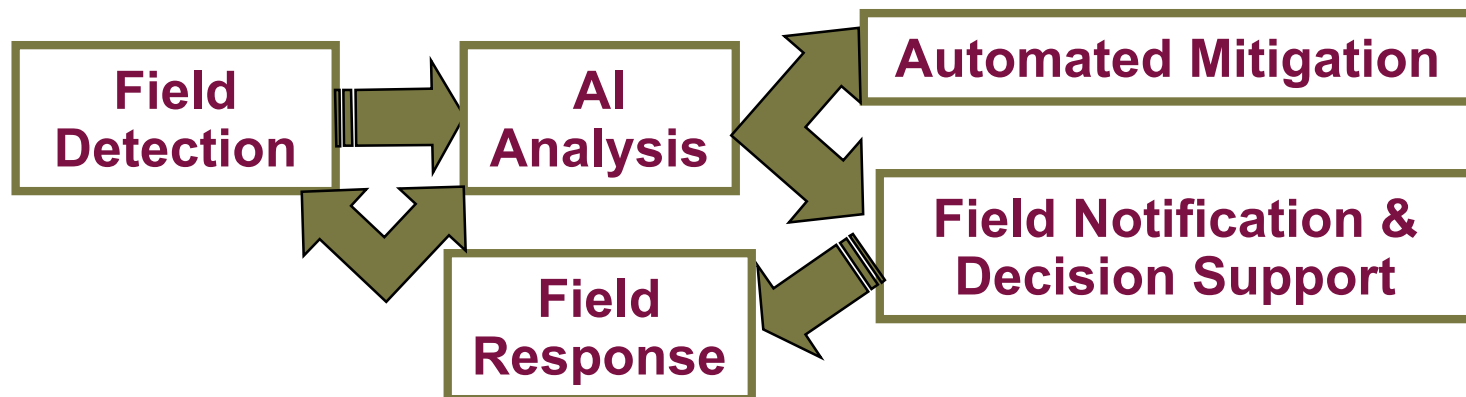


*US Army – 2025 Concept Photo*

## What Are Future Field Support Objectives?

- § **Orders of Magnitude Increase In**
  - **Safety of Officers and Bystanders**
  - **Response Speed and Appropriateness**
  - **Officer Efficiency**
- § **Early Detection and Mitigation of Broader Threat Patterns Across Wide Geographies**

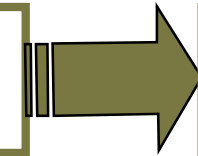
*Comprehensive systems with automated intelligence will be required to achieve future field support objectives*



## A Transitioning State Of The Art

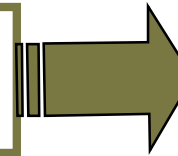
**2000**

**Wireless Laptop  
In Every Vehicle**



**2004**

**Wireless PDA For  
Every Officer**



**2008**

**Intelligent Agent  
Decision Support**

§ **Supplement Voice  
Dispatch**

- DMV Info
- Criminal Records
- Maps

§ **Point of Contact  
(POC) Transactions**

- Tickets
- Authenticate ID
- Maps

§ **Instant Knowledge  
Based Actions**

- Threat Analysis
- Automated Responses
- Wide Area Notification

*We are now in the next transition that will bring 100X improvements in officer safety, responsiveness and efficiency*

## Wireless Point of Contact Applications are Proliferating As Independent Deployments

### § **Local and Semi-Regional Agency Deployments**

- Ticketing
- Biometric Fingerprinting
- Image Based Information
- Interoperable Response Vehicles

### § **New Vendor Solutions**

- Over 50 of the vendors listed at [www.officer.com](http://www.officer.com) have products related to mobile wireless transactions

*Independent POC deployments have proven the concept but now must be incorporated in a wider systems to provide better decision support*

## Components of the Near Future Field Support Solution

**Low Cost Wireless  
Devices with  
Integrated Sensors**

**New RF  
Interoperability  
Solutions**

**Vast Increase in  
Public Wireless  
Data Services**

**Improvements in  
Wireless Security  
Protocols**

**Intelligent Agents to  
Aggregate, Analyze  
and Respond**

***The near future field support solution lies at the intersection of key enabling technologies***

## Mobile Cellular Smart Phones/PDA's

### § **Widely Available**

- All Cellular and PDA vendors now offer a device

### § **Integrate A Wide Range of Sensor Hardware**

- Digital Cameras
- Finger Printers and other biometric input
- GPS

### § **Provide Application Run-Time Platforms**

- Several operating systems
- Several application development environments
- HTML enabled Web Browsers

*The smart phone will extend sophisticated threat sensing and alert notification to the point of contact in the field: in-vehicle or on foot*

## Wireless Sensor Nodes

### § **Cost is Dropping**

- Price points will drop to under \$100 per node
- Node cost scales to application functionality

### § **High Level of Functionality**

- CPU, memory and operating system
- Integrated RF hardware & protocol software
- Integrated sensors and GPS
- RF Tag Capable

### § **Small Form Factors**

- Typically 1 cubic foot or less
- Smallest are MEMS (“smart dust”) at 5x5 mm

### § **Self-Configuring Networks**

- “Drop them out the door” type deployment

*Many vendors  
are targeting  
the low cost  
node market*

*Graviton*

*Crossbow*

*Ember*

*Millennial Net*

*Fixed sensor nodes will vastly increase the available information about the environment surrounding a point of threat in the field*

## Public Wireless Data Services

### § **High Speed Cellular Digital Data Services**

- Covers over 80% of population but small % of rural and unpopulated areas

### § **Low Speed Digital Data Only Services**

- Two-way paging and Cingular (Mobitex)
- Same coverage issues as high speed cellular

### § **Alternate Services with More Coverage**

- Analog Cellular
- High bandwidth VSAT
- Low bandwidth satellite data services

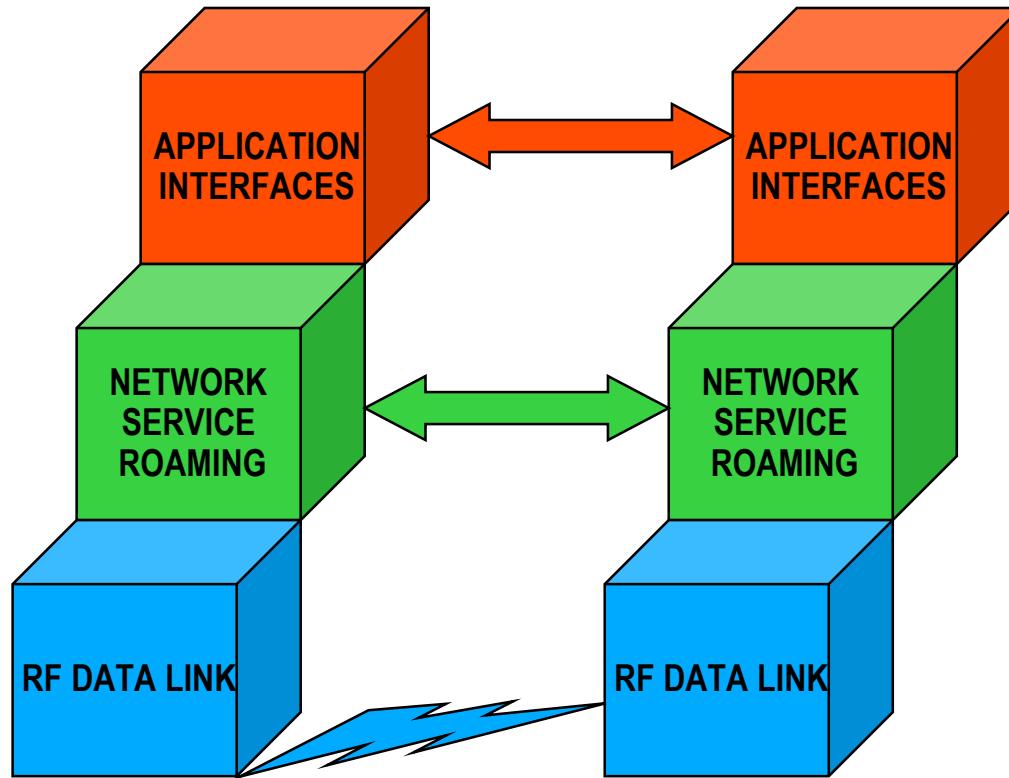
### § **802.11**

- Hotspots appearing
- Roll-out in populated areas over next 4 years

*The six major wireless carrier companies in the U.S. have spent billions integrating higher speed, digital CDMA and GSM technology into their networks.*

*Total coverage still requires integrating multiple wireless data services*

## Interoperability at All Levels



- § **Interoperability is a Multi-tiered Problem**
- RF Frequency and Protocol
  - Roaming Across Service Providers
  - Application Compatibility

*Vendors and service providers will solve RF and roaming interoperability. The bigger burden for agencies will be application interoperability*

## RF Data Link Interoperability:

### § **Rack Mounted RF Modules**

- Software to handle interoperability
- SMARTLINK : example dispatch center system
- Raytheon ACU-1000: system that can fit in a vehicle

### § **Multimode Chip Sets in a Single Device:**

- Tri-mode cellular: many vendors
- Tri-mode 802.11b,a,g (from Atheros)

### § **Wireless Anywhere Digital Assistant (WANDA): Texas Instruments Prototype Device**

- Uses Windows CE
- Allows voice and data over CDMA, GSM, 802.11 and Bluetooth

*A properly structured system architecture should allow switching out data link components without affecting the application*

## Roaming Interoperability:

- § **Roaming Over Cellular Networks**
  - Now de-facto standard
  - Anywhere pricing keeps getting cheaper
- § **Maintaining Static IP Addresses in 3G Cellular**
  - An issue as IP based applications transition from CDPD to 2.5 and 3G true packet based cellular
  - Example is Padcom's TotalRoam software for GPRS
- § **Emerging Roaming Market will Include 802.11**
  - Examples are Sprint/Boingo, T-Mobile
  - The market will drive all service providers to follow

*Roaming interoperability will remain a problem between public networks and privately deployed SMR or other mobile data networks*

## Application Interoperability:

### § **Operating System Environments**

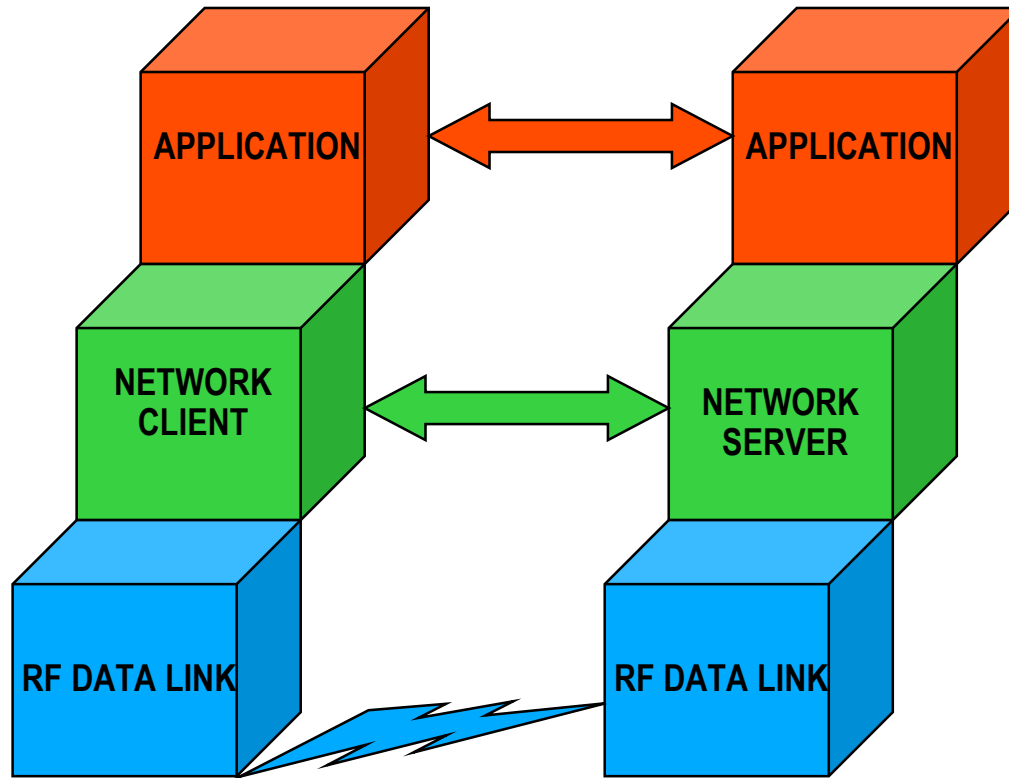
- **Symbian OS**
- **Palm OS**
- **MS Windows CE**
- **Linux**

### § **Application Run Environments**

- **Java 2 Platform Micro Edition (J2ME)**
- **Binary Runtime Environment for Wireless (BREW)**
- **MS Mobile 2003**
- **HTML and XML**

*Microsoft's investment in mobile application environments will increase its market share. J2ME will remain extremely important as will HTML*

## Security At All Levels



- § **Security Has Both Wireless and Other Components**
- **Wireless at RF Data Link Level**
  - **Network Client to Network Server**
  - **Application To Application**

*RF data link security is inherent in your choice of RF hardware. Network and application security is a more complex configuration/administration issue*

## Security: Emerging Technology Highlights

### § **RF Data Link**

- 802.11 versions G and I will address problems in the flawed 802.11 Wired Equivalent Privacy (WEP)
- Advances in cellular SIM card technology

### § **Network Client to Server**

- Mobile device OS's will all include latest IPV6 stack functionality that supports VPNs using IPSec

### § **Application to Application**

- Very Recent Push for SSL Remote Access
- Version of SSL to support application to application VPNs for all types of remote access including mobile
- Evangelized by Nokia and other industry heavyweights
- Eliminates administering complex IPSec policies

*Remote SSL will likely be a part of all security solutions with other levels implemented if warranted and if capable by end-user devices*

## Intelligent Agent Software

### § **What Must It Do**

- **Rapidly aggregate and analyze all information related to a threat detected in the field**
- **Determine a set of automated notifications/responses**
- **Identify patterns indicating wider threats**

### § **Current State of Art Provides Data Aggregation, Statistical Analysis and Business Rules – Not AI**

- **InterAct and others: Sophisticated CAD**
- **Sypherlink– A data aggregation tool**

### § **Currently Enormous Effort To Productize Academic AI Research – Quantum Leap Advances Within 2 years**

- **SRI Just Awarded \$22 Million DARPA Contract for “Cognitive Agent That Learns and Observes” (CALO)**

*The intelligent agent technology will catalyze the 100x increase in functionality of wireless field support applications over the next 5 years*

# What Will The Future System Be?

## § A Smart Phone With Built-in:

- Wireless Multi-mode Connectivity
- GPS Tracking
- Finger Print Scanner
- Digital Video Camera
- High Resolution Display

## § A Support Sensor Network To Track

- Traffic Flow
- Smoke/Fire
- Chemical Spills
- Biohazards
- Radiation

## § A Nearby Vehicle Representing:

- A Gateway To Other Systems
- A Local Cache of Intelligent Agent
- Enhanced Sensor Capability

## § An Intelligent Agent Driven Back-office:

- Connected via Multiple Wireless Networks
- AI Analysis and Actions
- Other Input For Threat Pattern Analysis

## Case Studies: 2 Systems Under Design

### § **The Aware Patrol Vehicle (APV)**

- An architecture to automate patrol vehicle threat detection and empower officers with knowledge based decision support information
- Incorporates RFID tags, biometrics and intelligent agents
- Trademark and Patent Pending – Kinetic Group ([www.consultkinetic.com](http://www.consultkinetic.com))

### § **The Safe City Initiative**

- A comprehensive system to incorporate strategic risk/threat assessment planning with an intelligent system to aggregate/analyze/mitigate real time threat data from the field
- An initiative being co-developed by Flywheel Group ( [www.flywheelgroup.net](http://www.flywheelgroup.net) ) with input from APCO

# APV RF Tag Architecture



**Vehicle RF Tag**

- VIN Number
- License Plate Number
- Registration Expiration Date



**Aware Patrol Vehicle**

- Beacon / Antenna - Energizes tag
- Tag Reader - Decodes tag information
- Lap Top - Compares tag information against database criteria
  - Alerts officer of matches
- Local Mass Storage - Stores preloaded information for near real-time analysis
  - Collects Tag traffic information for future analysis



**Network Attached Server  
To database and Mainframe**

# APV Biometric Authentication

PCMCIA  
Version of  
Fingerprint  
Collection Sensor  
"Remote  
PositiveID™"

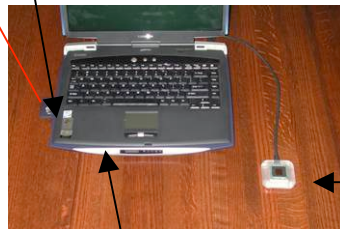


Handheld Standard Win CE based PDA  
with Bluetooth or 802.11 connection to in-  
vehicle lap top for field use by officer



Wireless connection

Wireless Card for connection to Law Enforcement Database  
or Remote PositiveID™ Fingerprint Collection Sensor



Ethernet connection

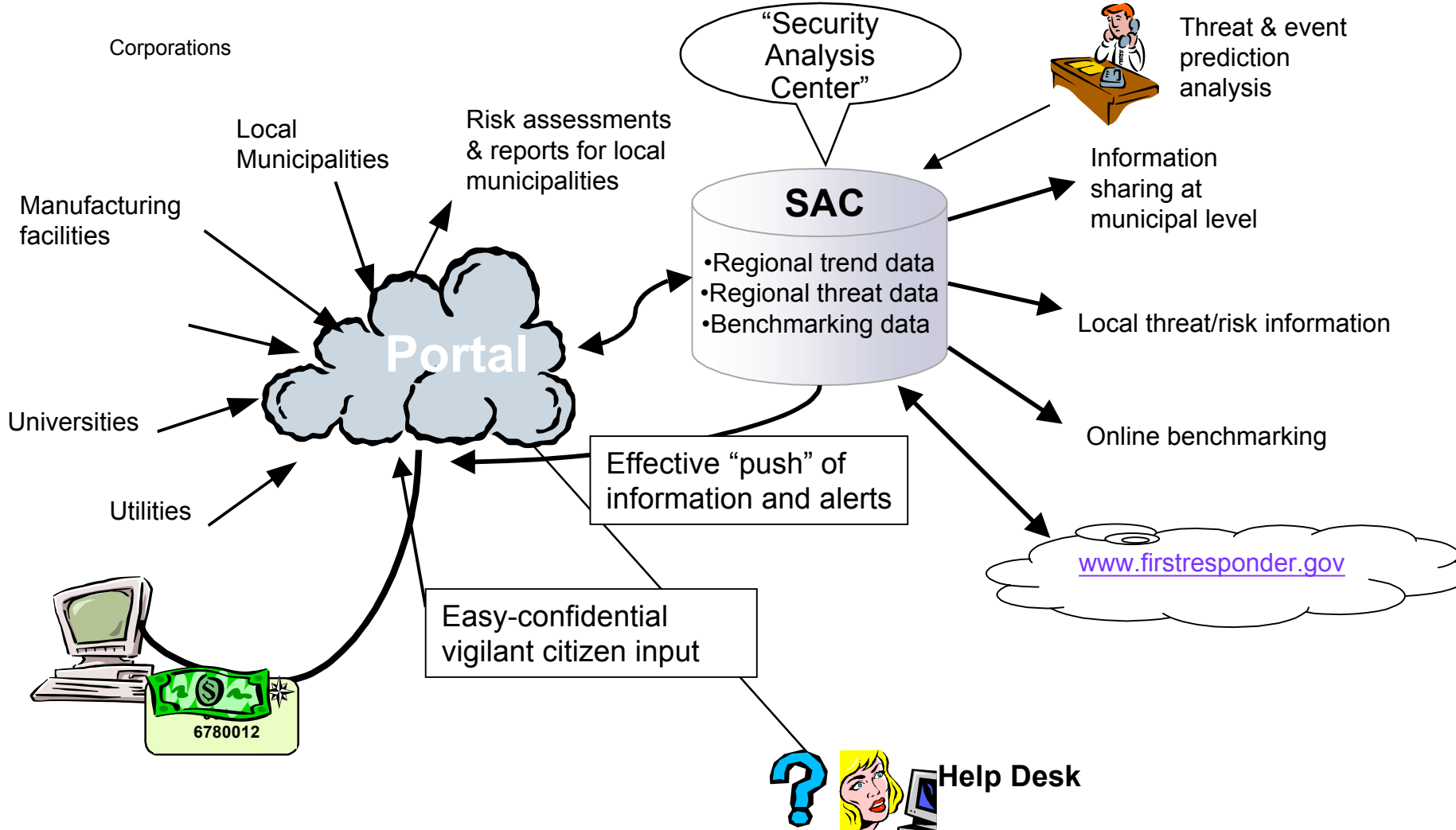
USB Fingerprint Collection  
Sensor For in-vehicle collection

Patrol Vehicle on-board Lap Top  
Computer with wireless connection to  
law enforcement department Databases.

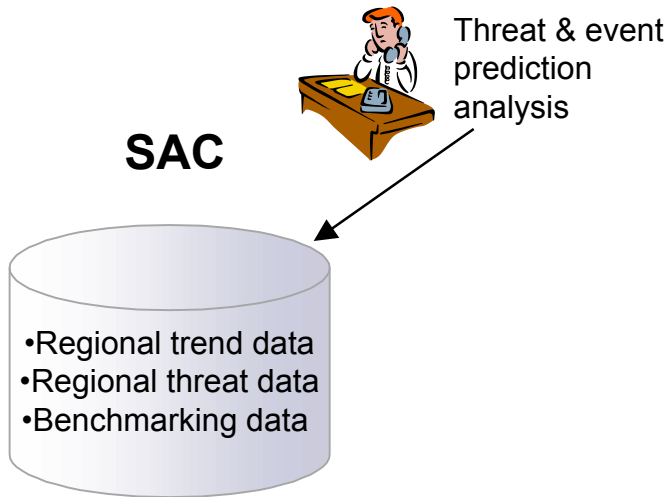


Network Attached Storage Unit mounted in  
trunk of patrol vehicle. It holds remote database  
of law enforcement "hotsheet" and department  
of motor vehicle Information, fingerprint images  
and outstanding warrant information

# Flywheel Group's Safe City Program Concept



# The Safe City Program Components & Partners **Security Analysis Center(s)**



## § **Security Analysis Center(s)**

- Large-scale summary data repository
- Collation of benchmarking information
- Data analysis tools for ad hoc analysis (i.e. SAS, or Excel...)
- Modeling and pattern recognition overlays built-in
- Modeling and simulation, with pre-loaded threat & risk scenarios, for local training
- Independent local-vs.-DHS threat level management & coordination