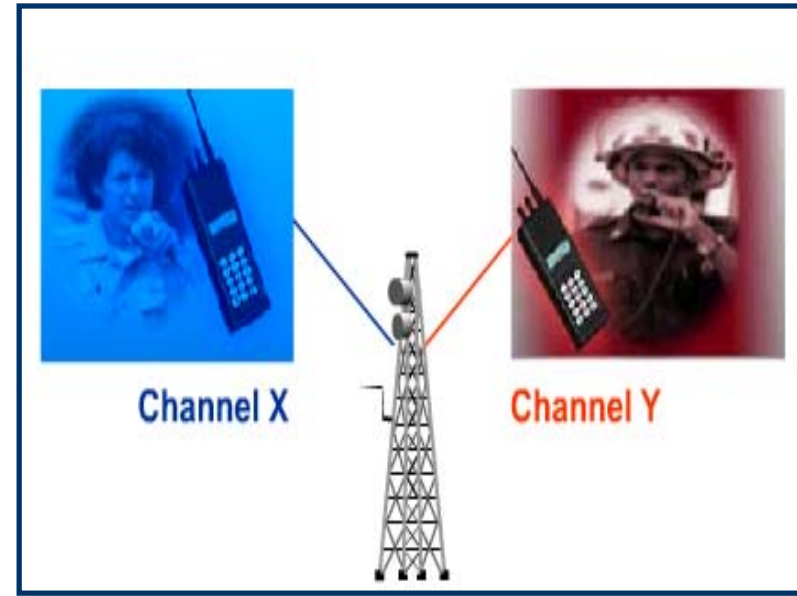


The State of Public Safety Communications

International Symposium on Advanced
Radio Technologies
March 2nd, 2004

- **Wireless interoperability** is the ability of public safety service and support providers to talk with each other via voice and data
 - on demand
 - in real time
 - when needed
 - when authorized
- Wireless interoperability is necessary to—
 - Improve the ability of public safety officers to save lives and property
 - Facilitate rapid and efficient interaction among all public safety organizations
 - Provide immediate and coordinated assistance in day-to-day missions, task force operations, and mass-casualty incidents



Several high-profile events have underscored the critical importance of interoperability

1980

- Crash of Air Florida Flight 90, Washington, DC—January 13, 1982
 - “Stovepipe” public safety communications systems complicated on-scene, inter-agency communications
 - No provision for communications interoperability among the existing systems was in place
 - Sheer volume of calls exceeded system capacities



1990

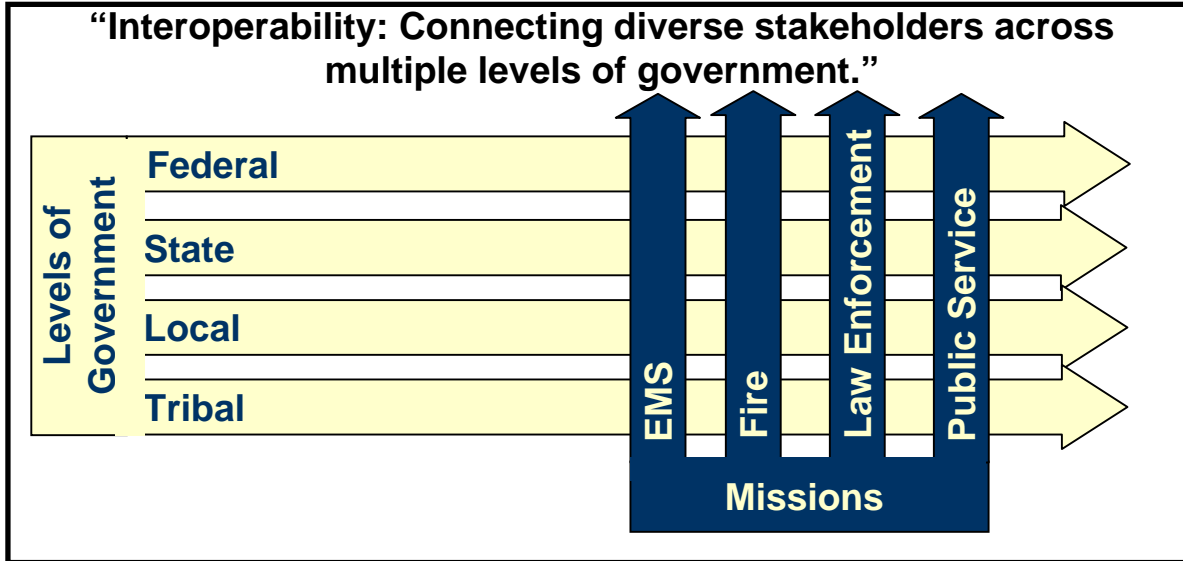
- Alfred P. Murrah Building Bombing, Oklahoma City—April 19, 1995
 - In the aftermath of the attack, 117 local, state, and federal agencies responded with more than 1,500 personnel on the scene
 - Overwhelming call volume and disparate frequencies complicated emergency response
 - Responders were forced to rely on relay runners to disseminate critical, time-sensitive information



2003

- World Trade Center Attack, New York City—September 11, 2001
 - After the south tower collapsed, police helicopters relayed a message for public safety officials to evacuate the north tower
 - Firefighters never received the police warning because their legacy radio systems malfunctioned and did not interoperate with the police communications systems





- Interoperability directly impacts the first responder community, which consists of over 44,000 public safety agencies including—

- 960,000 Firefighters
- 830,000 EMS Personnel
- 710,000 Law Enforcement Officers

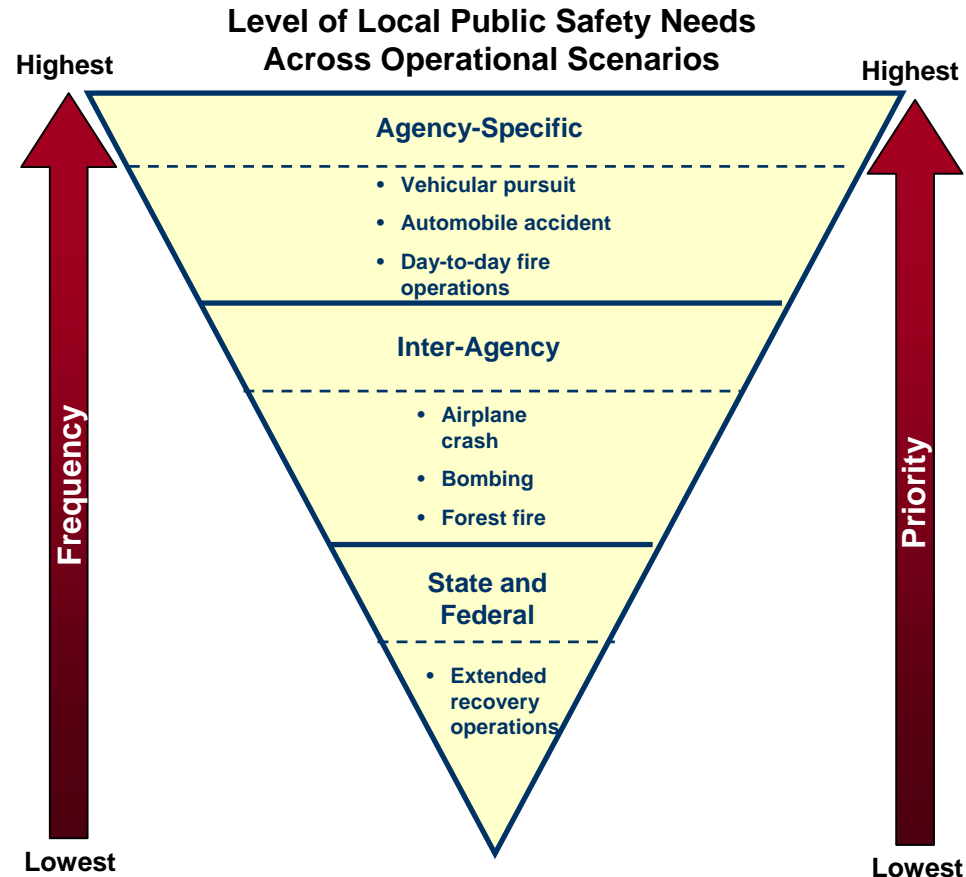
- 28,495 Fire Departments ¹
- 5,841 EMS Departments ¹
- 27,496 Law Enforcement Agencies ¹

- 25,763 Local Agencies ¹
- 6,396 State Agencies ¹
- 2,967 Federal Agencies ¹

- Interoperability also affects the public service arena, which includes legislative officials, utilities agencies, and chief information officers

¹ Source: www.SafetySource.com

- Local agencies are primarily concerned with communications within their own agency, but must work with other surrounding agencies
- The local public safety community’s responsibilities range from—
 - Stabilizing the situation; to
 - Establishing initial communications links
- Local and state agencies own more than 90 percent of the existing public safety communications infrastructure
- A survey indicates that nearly one-third of local public safety agencies cite interoperability as inadequate



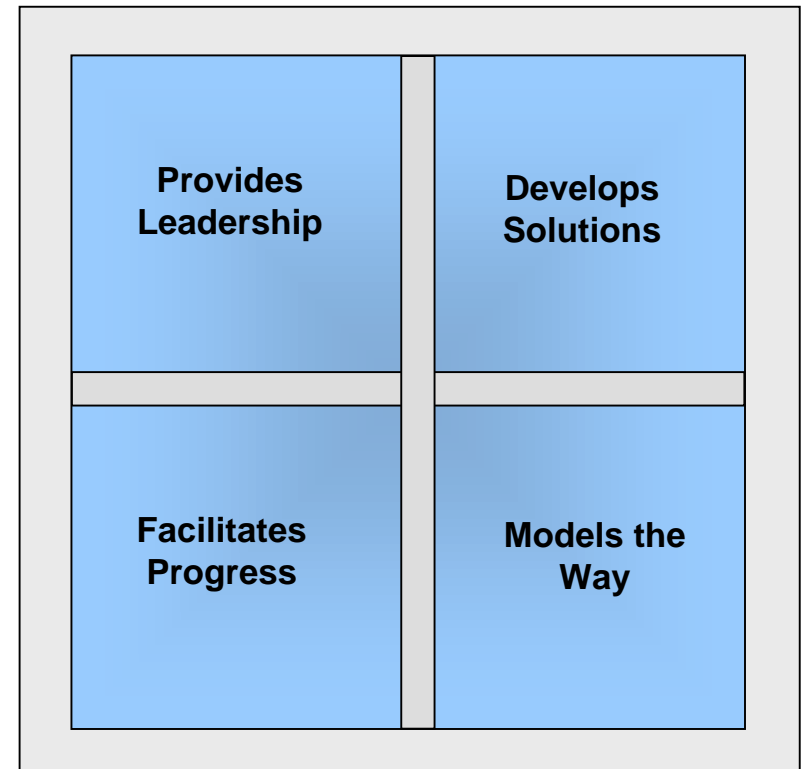
The Federal Government—

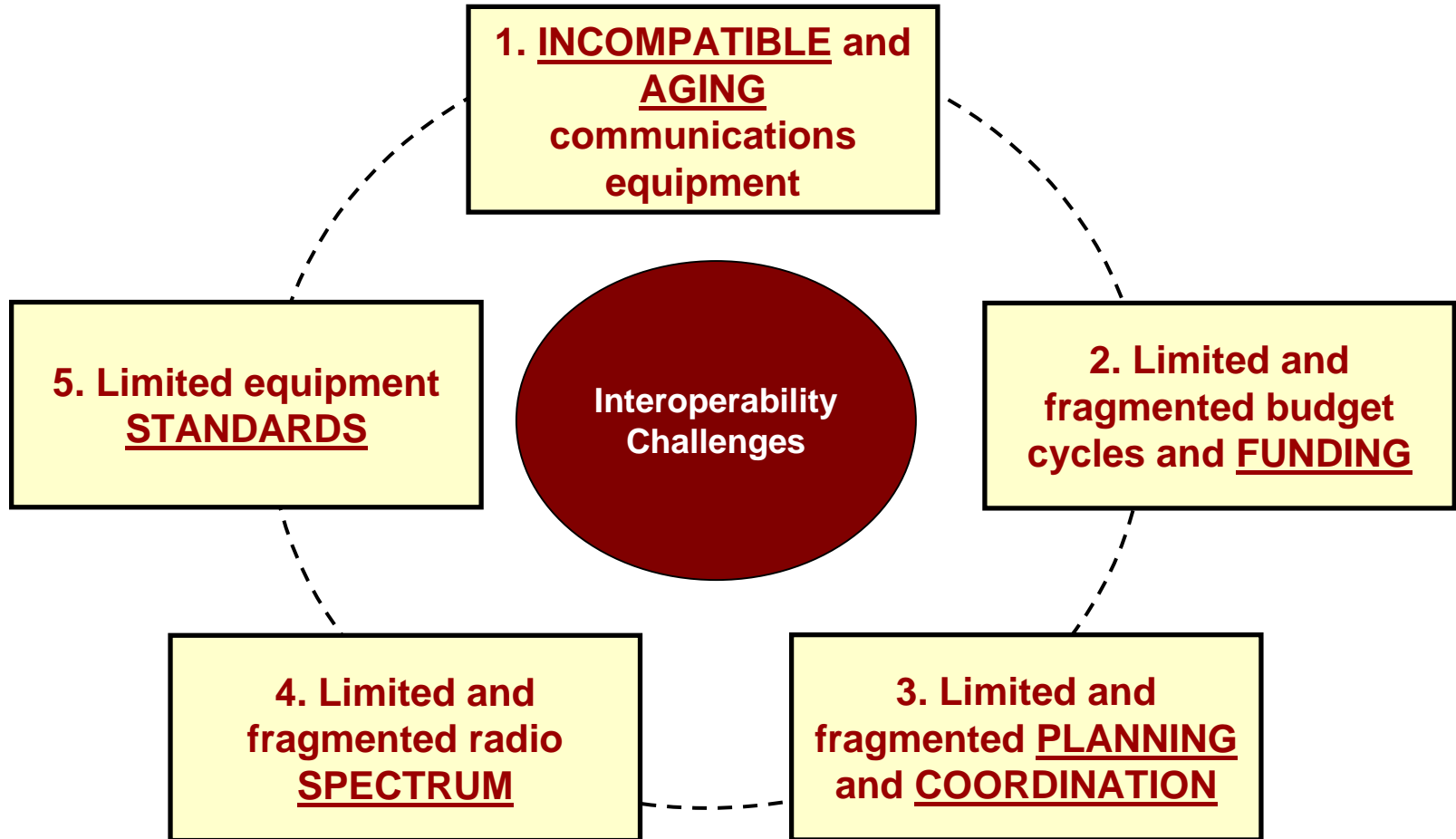
- Establishes a vision and charts a course for improvement
- Tests emerging technologies to identify innovative interoperability solutions
- Develops and promotes pilot systems to evaluate and promote solutions
- Builds collaborative relationships where federal agencies assist local and state agencies with solution implementation

Federal Government Constraints—

- Cannot single handedly fund interoperability improvements at all levels of government
- Cannot mandate that local and state agencies purchase new equipment to achieve interoperability

Roles of the Federal Government as an Enabler

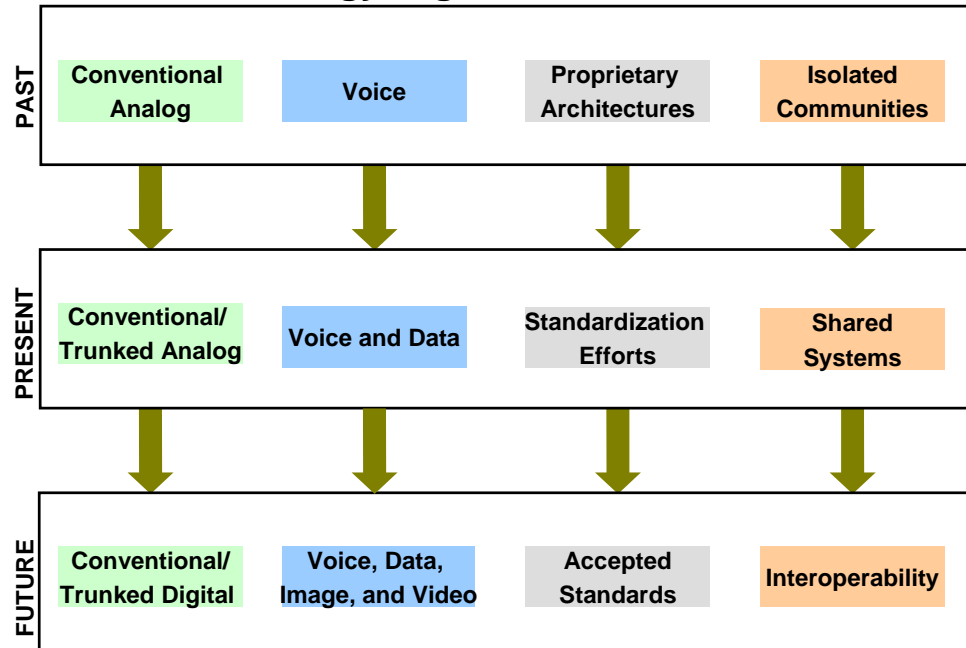




These five issues were identified by the National Task Force on Interoperability in its February 2003 final report, *Why Can't We Talk? Working Together to Bridge the Communications Gap to Save Lives*.

- Public safety communications infrastructure and equipment is often in use well past its useful life
 - Outdated analog infrastructure exists in many jurisdictions
 - Many communications systems are up to 30 years old, rendering interoperability difficult
- Outdated equipment is unable to accommodate advanced features needed to support operations
- Agencies using equipment operating in disparate frequency bands cannot communicate with one another
- The use of proprietary technologies hinders the ability to interoperate with other agencies

Technology Migration – Past to Future



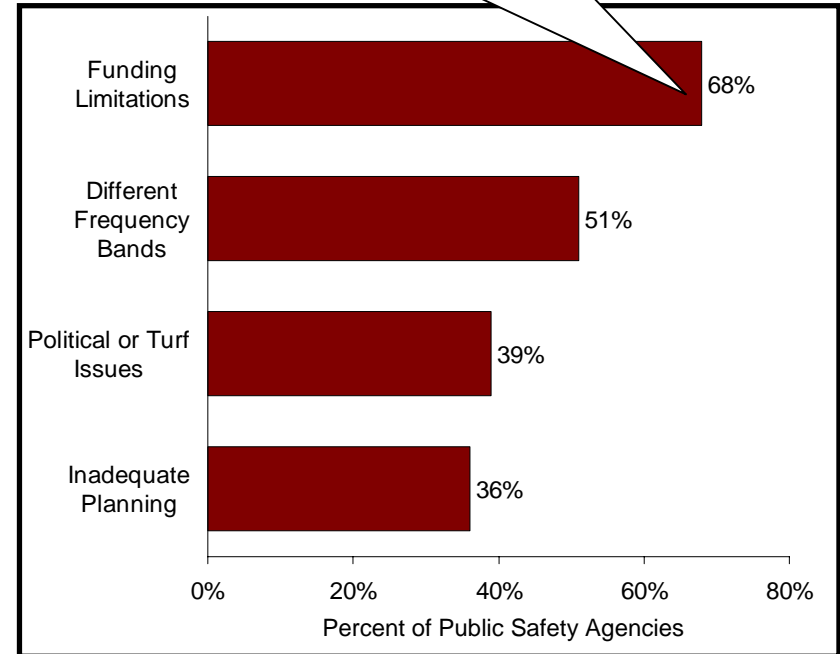
“We have 30-year systems being implemented in a 18-month technology cycle .”

- SAFECOM Strategy Planning Workshop participant, May 2003

Reason 2: Limited and fragmented budget cycles and funding

- Additional funding is needed to address interoperability
 - Existing infrastructure capital investment for local, state, and federal LMR systems have been estimated to be in excess of \$18 billion
 - Replacement of LMR systems could reach \$40 billion
 - Funding for wireless systems is in direct competition with other priorities
- Coordinated grant guidance is needed
 - Historically, many programs provided funding for communications equipment with different requirements and guidance
- Budget coordination is needed across levels of government
 - Local and state agencies have different acquisition requirements, planning cycles, and technical requirements
 - Traditionally, funding has been stove-piped to meet individual agency needs
 - Each agency may be in a different stage of technology replacement

Funding was identified by public safety agencies as the primary obstacle to interoperability



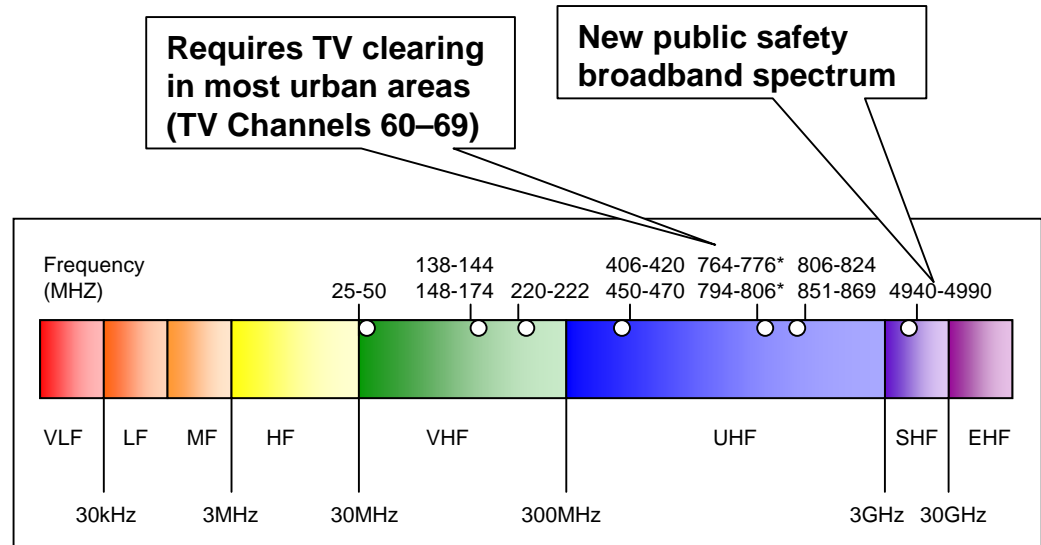
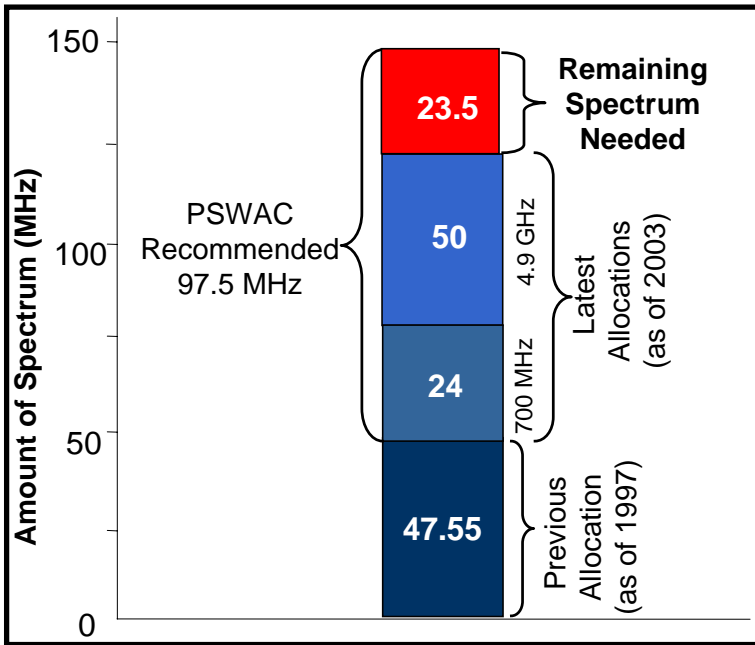
Source: Combined analysis of National Institute of Justice law enforcement and PSWN Program fire and EMS interoperability studies.

Reason 3: Limited and fragmented planning and cooperation

- Jurisdictional boundaries and unique missions often create barriers that hinder cooperation and collaboration
 - Many agencies are small, often volunteer organizations with limited budgets and little engineering expertise
 - No universal solution for every jurisdiction exists
- Financial and human factors that complicate interoperability planning include—
 - Lack of funding and resources
 - Management and control issues
 - Integration of policies and procedures
 - Cultural and operational differences among local, state, federal, and tribal agencies
- Interoperability is not sufficiently understood by decision makers or the organizations that influence those decision makers
- In the past, federal interoperability efforts were not coordinated effectively
 - Coordination among grant providers is needed to establish common grant criteria and requirements
 - Federal interagency communications has struggled due to a lack of coordination



Reason 4: Limited and fragmented radio spectrum



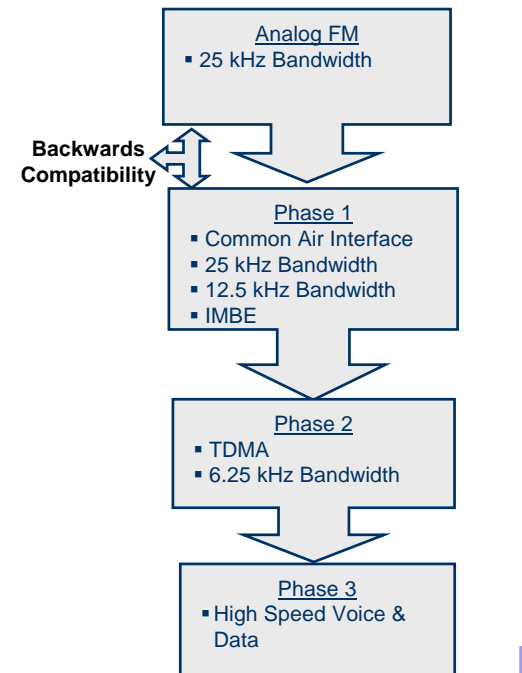
- The radio spectrum extends from 9 kHz to 300 GHz and is separated into more than 450 bands
 - Most public safety spectrum exists between 25 MHz and 800 MHz
- Spectrum available for public safety is limited and distributed across 10 disparate bands
- In 1996, the Public Safety Wireless Advisory Committee (PSWAC) estimated that an additional 97.5 MHz of radio spectrum would be needed to meet public safety communications requirements
 - Only 24 MHz has been allocated; however, none has been turned over for public safety use

Issues—

- The lack of a universally recognized, fully open, implementable standard for public safety has limited the cost efficiencies of interoperability
- Public safety has lagged behind the commercial sector in adopting new technology and open standards
- Development of proprietary protocols, resulting in equipment that is not interoperable
- Lack of competition in the land mobile radio (LMR) marketplace

Project 25—

- Steering committee, called Project 25 (P25), was formed by APCO, NASTD, and Federal Government agencies for selecting common digital system standards
- P25 has been segmented into three phases based on two underlying objectives—
 - **Improving interoperability** among first responders
 - **Introducing competition** into the LMR marketplace
- Output of P25 is a suite of standards and bulletins that outline equipment interoperability and compatibility requirements
- Advantages of P25 standards include—
 - Cost effective equipment upgrade and maintenance
 - Backwards compatibility
 - Improved interoperability
 - Increased competition in the LMR marketplace



Evolution of P25 Technical Specifications

Other key challenges that hinder interoperability include...

Inadequate Commercial Alternatives

- The commercial marketplace does not offer public safety grade voice services
- Little competition exists in the public safety equipment marketplace
- Commercial systems do not support one-to-many communications
- Priority access and/or dedicated services are not available to public safety

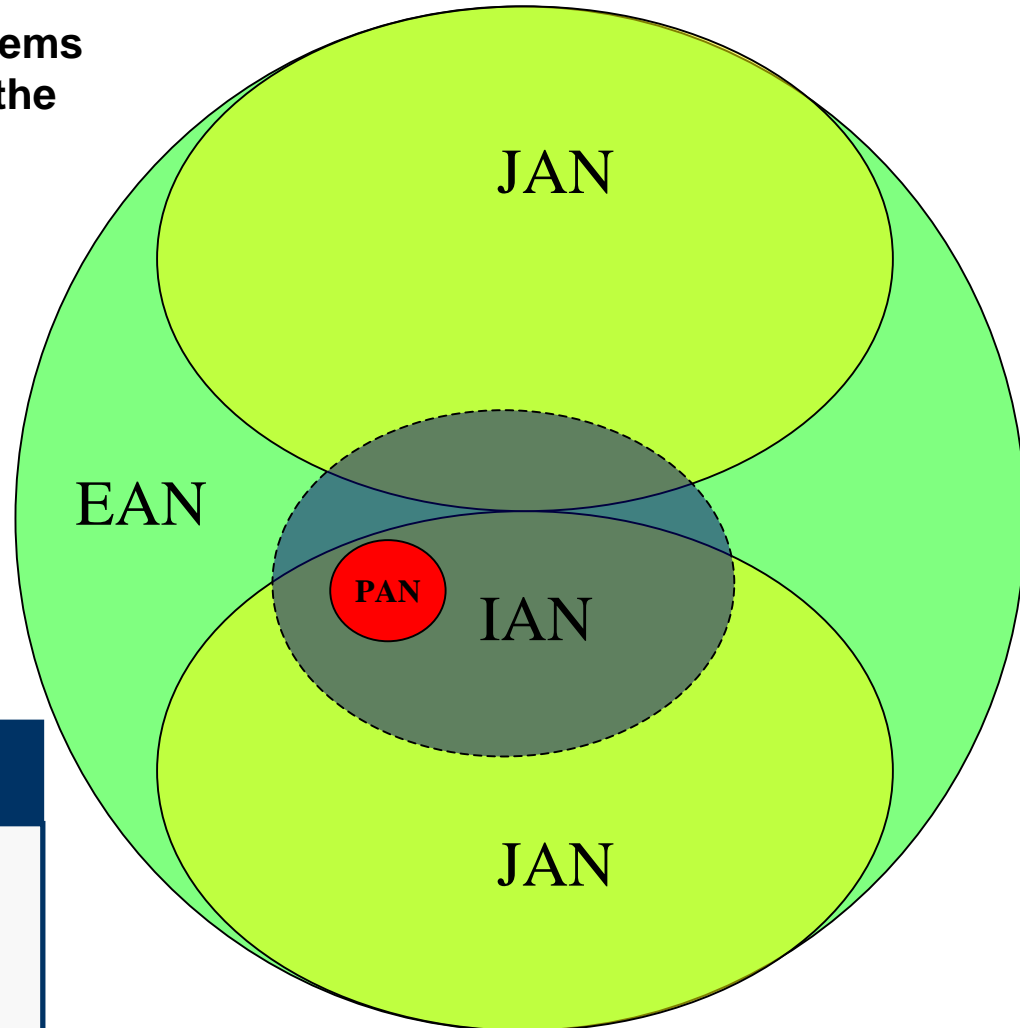
System Security Constraints`

- Varying levels of security complicate efforts to integrate networks
- Network security vulnerabilities continue to increase rapidly due to the proliferation of new technologies
- Interoperability itself introduces security vulnerabilities
- Agencies are unfamiliar with new computer-based threats

Insufficient Understanding of Interoperability

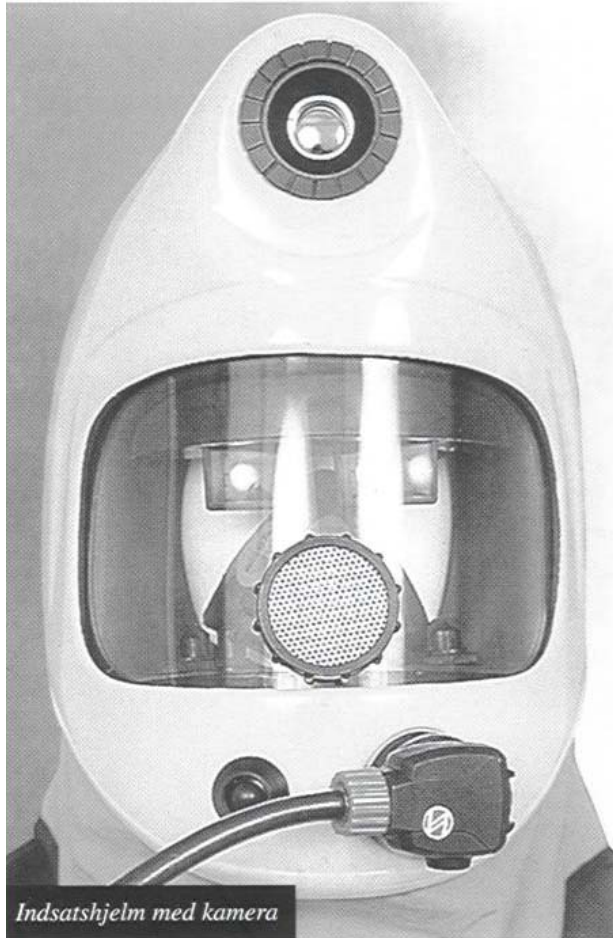
- There is a general lack of awareness of the interoperability issue
- Decision makers have a limited understanding of the priority placed on interoperability
- There is uncertainty regarding the appropriate actions for addressing interoperability

Different communications systems seamlessly integrate to form the various networks



The System of Systems involves interaction between the:

- Personal Area Network (PAN)
- Incident Area Network (IAN)
- Jurisdiction Area Network (JAN)
- Extended Area Network (EAN)



Indsatshjelm med kamera



Copenhagen Fire
Brigade
The 112 Group

The IP FireFighter

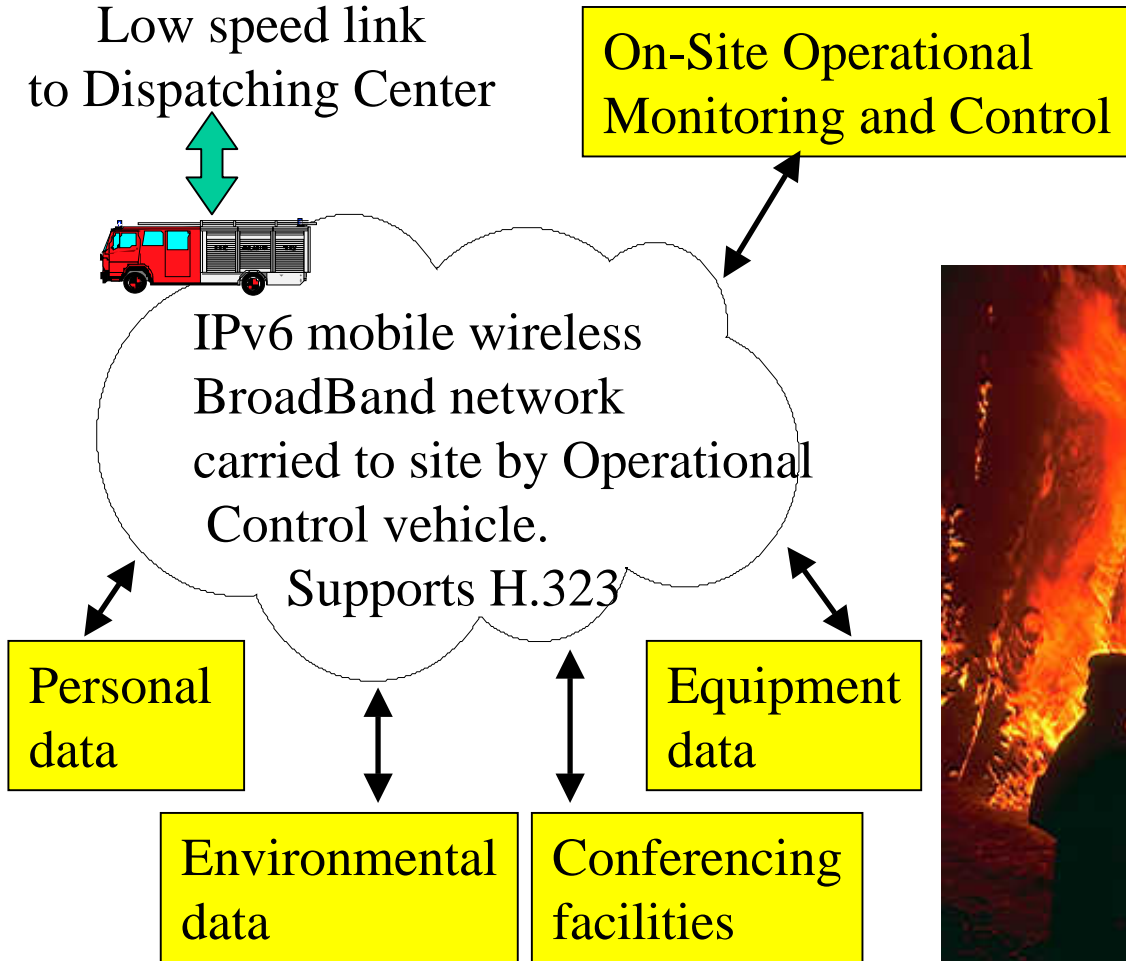
Kurt Christensen

kurtc@112.dk

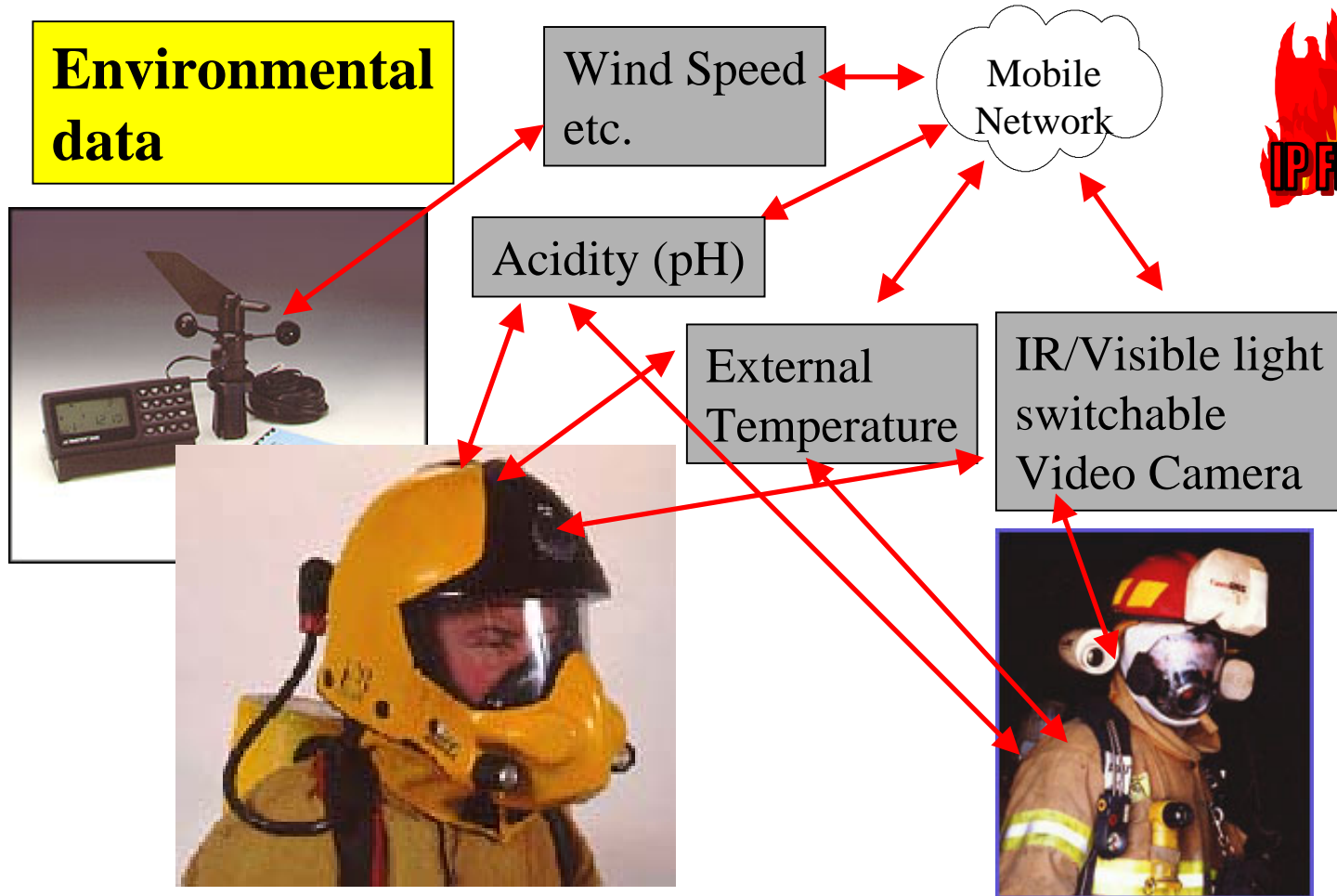
Jens C. Behrens, Ph.D.E.

jens@behrens.cc - behrens@112.dk

The IP Firefighter

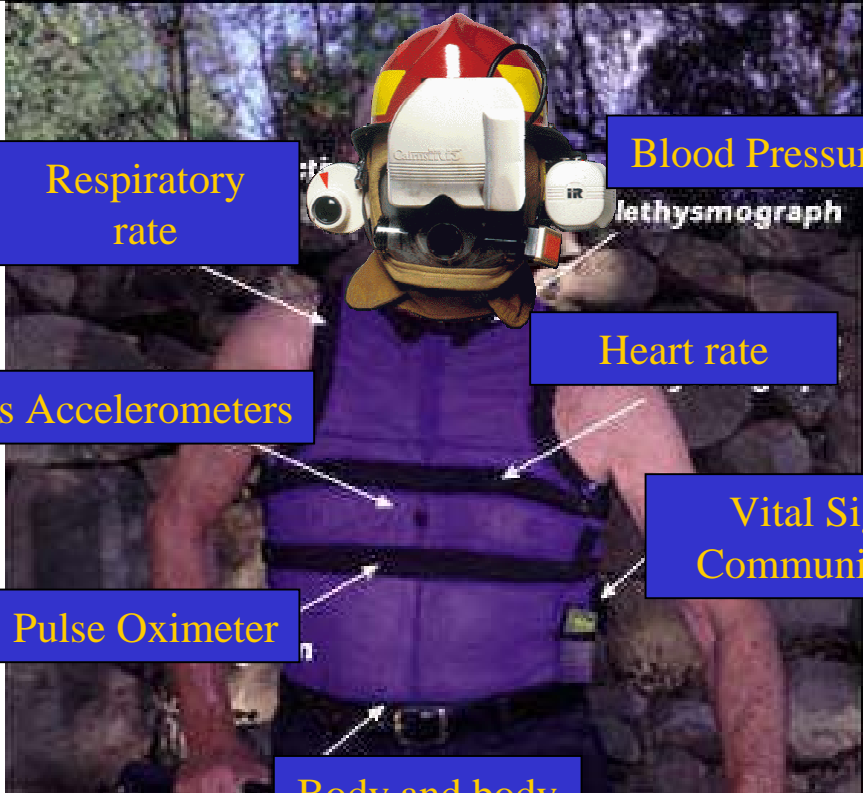


Copenhagen Fire Brigade
The 112 Group



Copenhagen Fire Brigade
The 112 Group

Vital Signs



Respiratory rate

Blood Pressure

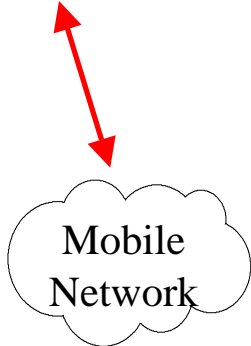
Heart rate

Dual Axes Accelerometers

Vital Signs Communicator

Pulse Oximeter

Body and body surface Temperature

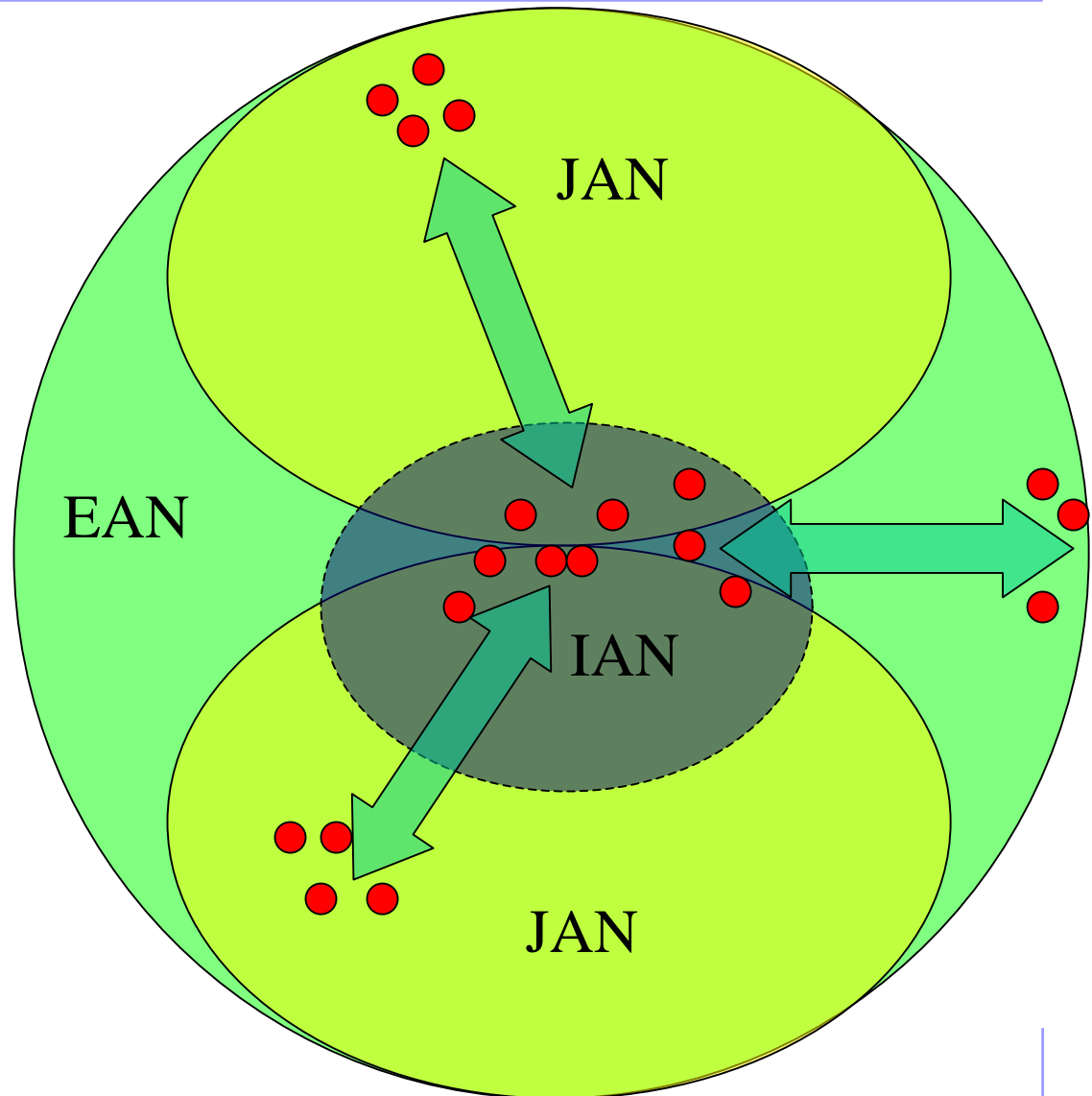


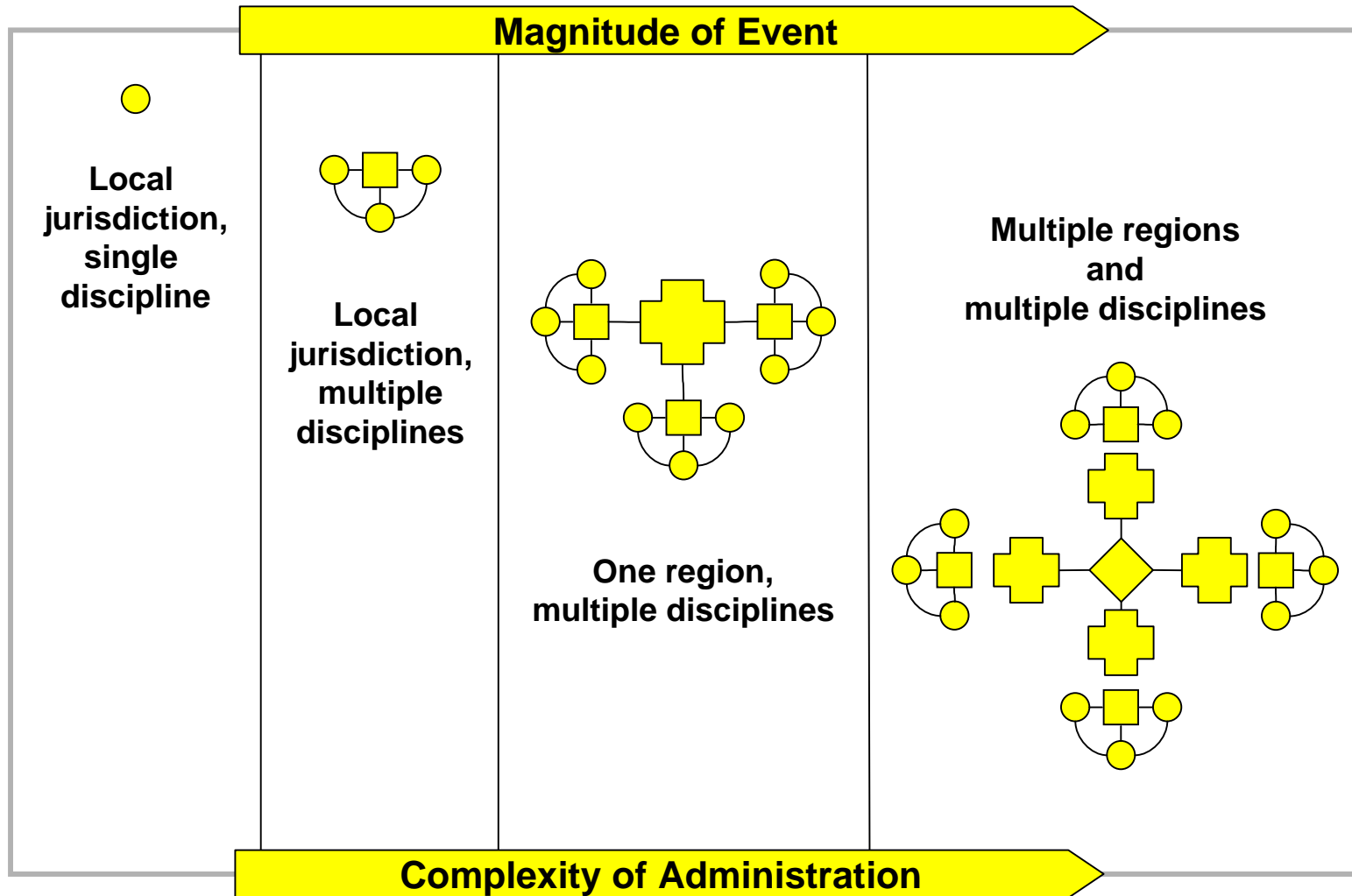
Copenhagen Fire Brigade
The 112 Group

An emphasis on the individual public safety practitioner

System Capabilities

- Practitioners seamlessly move between Jurisdictional Area Networks
- Practitioners join and leave networks as needed
- Allows for the creation and growth of temporary networks
- System can recognize, register, authorize, and grant interoperable communications with the new resources



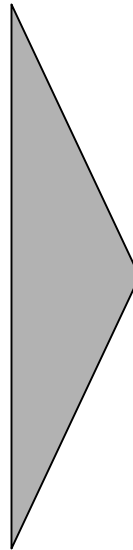


	Agency Involved	Situations	Communications Requirements
Routine	<ul style="list-style-type: none"> Primarily single agency/discipline May include some communications with other disciplines or agencies 	<ul style="list-style-type: none"> Day-to-Day operations and duties 	<ul style="list-style-type: none"> Must be able to set usage priorities and standard procedures Encryption
Mutual Aid	<ul style="list-style-type: none"> Multiple disciplines from multiple jurisdictions May include local, state and national level agencies 	<ul style="list-style-type: none"> An unplanned event causes numerous agencies to coordinate 	<ul style="list-style-type: none"> Must be able to establish communications quickly and effectively Reactive to the situation
Task Force	<ul style="list-style-type: none"> Cooperative effort among mixed agencies/disciplines Specific roles and responsibilities 	<ul style="list-style-type: none"> Planned operations with a common goal 	<ul style="list-style-type: none"> Must be able to communicate with a large amount of people simultaneously Proactively planned communications procedures

	Voice	Data
Interactive	<ul style="list-style-type: none"> • Requires immediate and high quality response. • Higher performance demands than that of commercial users. 	<ul style="list-style-type: none"> • Query based • Includes automated queries
Non-Interactive	<ul style="list-style-type: none"> • Similar mission-critical needs as the interactive service. • Includes broadcast messages to a select user group. 	<ul style="list-style-type: none"> • A one-way stream of data, from the responder to the commander. • Includes biometrics and location information.

Basis

- Functional needs of public safety first responders
- Intended to be “blue sky” in nature, not limited to current implementations or technologies
- Leverage current “state-of-the-art” technology
- Not keyed to the issue of spectrum allocation



Applications

- Consolidate Public Service vision for policymakers and the public
- Drive Federal Assistance programs
- Prioritize R&D investment strategies
- Creates the framework for discussion of operational issues

Mobility

User motion and user location cannot inhibit use

Security

Access Control, Integrity, Monitoring, Privacy, Attack detection and prevention

Call Types

Simulcast, multicast, and broadcast transmissions

Scalability

Vertical and Horizontal Scaling

**Command and Control,
Maintenance, &
Operations**

Includes creation and maintenance of temporary networks
Command and Control functions must be inherent in the technology
Specifies communication prioritization

COTS based products

Must be leveraged or used wherever possible

Open Standards-based design



Must be based on standards and not contain IPR that is not in the public domain

Backwards Compatibility



Must provide backwards compatibility with prior implementations, and is cost effective and feasibly efficient

Migration path for Legacy systems



Must provide a well-defined, cost effective for legacy migration

Spectrum and Network Efficiency



The RF system and goodput of the network must be specified to a minimum quantifiable degree.

Ergonomic and Environmental



Sets physical and power usage characteristics

Extensibility



Must be extensible through system performance enhancements and physical add-ons

Modularity



Must be extensible to feature/functionality enhancements



SAFECOM was created to coordinate interoperability efforts across the Federal Government

SAFECOM serves as the umbrella program within the Federal Government to coordinate the efforts of local, state, federal, and tribal public safety agencies working to improve public safety response through more effective, efficient, interoperable wireless communications

- SAFECOM is one of the President's top three E-Government initiatives
- SAFECOM is a program driven by public safety practitioners
- Dedicated to develop better technologies and processes for the cross-jurisdictional and cross-disciplinary coordination of existing systems and future networks
- Responsible for outreach to local, state, and federal public safety agencies and to assist in interoperability planning and implementation

- **Provide Policy Recommendations**

- Represent public safety on the Federal Government Spectrum Task Force
- Inform the FCC and other federal agencies on the impact of their policies on local and state public safety agencies

- **Develop a Technical Foundation**

- Research and Development
- Fund demonstration projects of innovative technologies and solutions
- Support the development of standards to achieve interoperability
- Provide industry with public safety requirements and guidance

- **Coordinate Funding Assistance**

- Tie federal funding assistance to grant guidance
- Create a clearinghouse of interoperability information about grants, best practices, and equipment purchases

- **Provide Technical Assistance**

- Develop and promote best practices for local and state agencies
- Provide handbooks, publications and on-line information to assist local and state agencies
- Provide technical support to local and state agencies in the implementation of communications systems



Anticipated accomplishments over the next 18 months

- **Publication of a Statement of Requirements for Public Safety Wireless Communications and Interoperability**
 - NPSTC to Review and Vote on the SoR on March 11.
- **Spectrum Policy and Standards Development**
 - Participate in the Federal Government Spectrum Task Force as the state and local liaison
 - Coordinate with NIST on the status of P25 standards
- **Grant Guidance**
 - Fully integrate guidance across the Federal Government
- **Technical Assistance Publications**
 - Develop FAQs and Primers for local public safety communications users to assist in the planning and implementation of interoperable communications systems
- **Interoperability Information Center**
 - Create a Web-based interoperability information center for public safety users
- **Demonstration Projects funded through a Broad Agency Announcement**
 - Identify and fund demonstration projects across the country
 - Leverage demonstration projects to identify new technologies and processes for interoperable communication
 - BAA Release (April 2004).