Kevin Sofen - September 28, 2023

Dr. Lori Moore Merrell

ONE VOICE

National Emergency Response Information System (NERIS)

The goal of NERIS is to **empower** the local fire and emergency services community by equipping them with **near real-time** information and **analytic tools** that support **data informed decision-making** for enhanced preparedness and response to incidents involving **all hazards.**

Firefighting → "All Hazards"
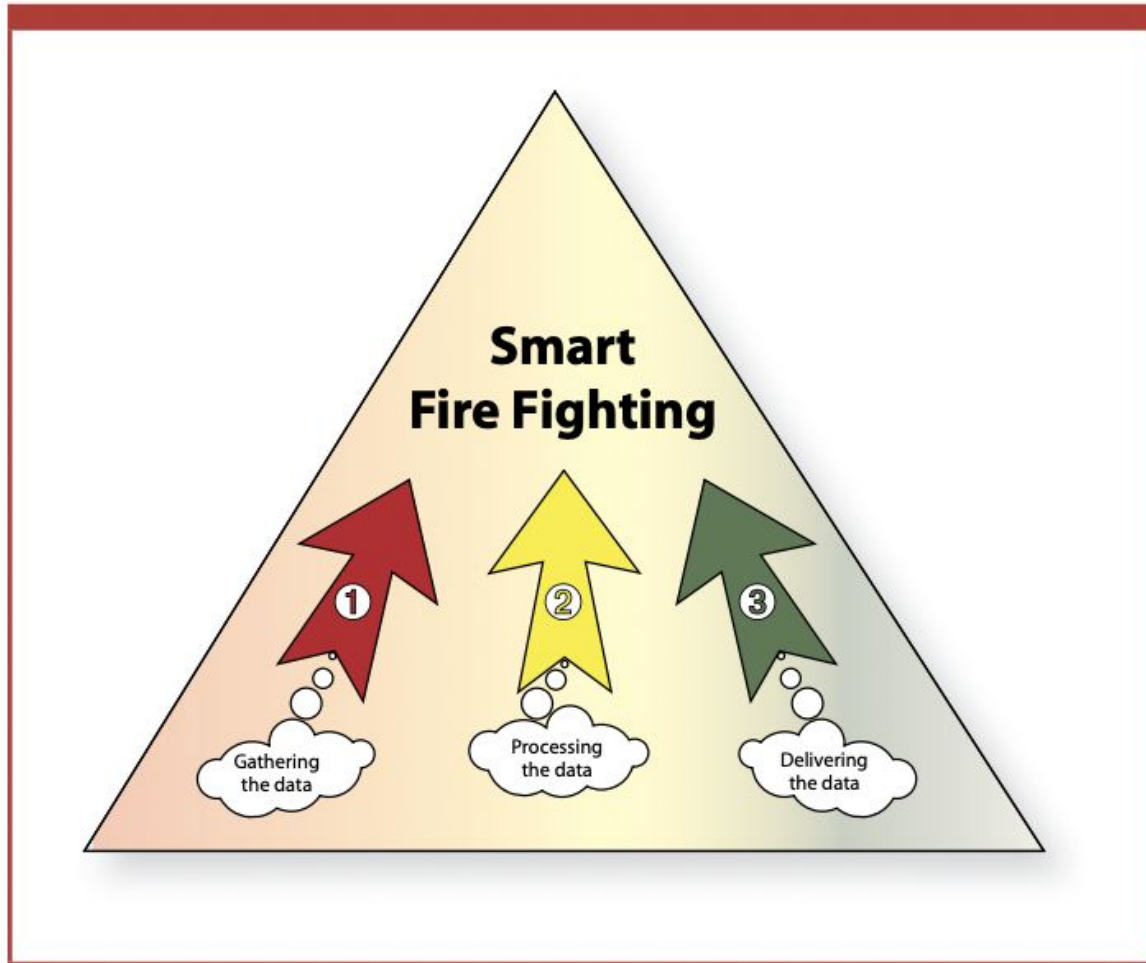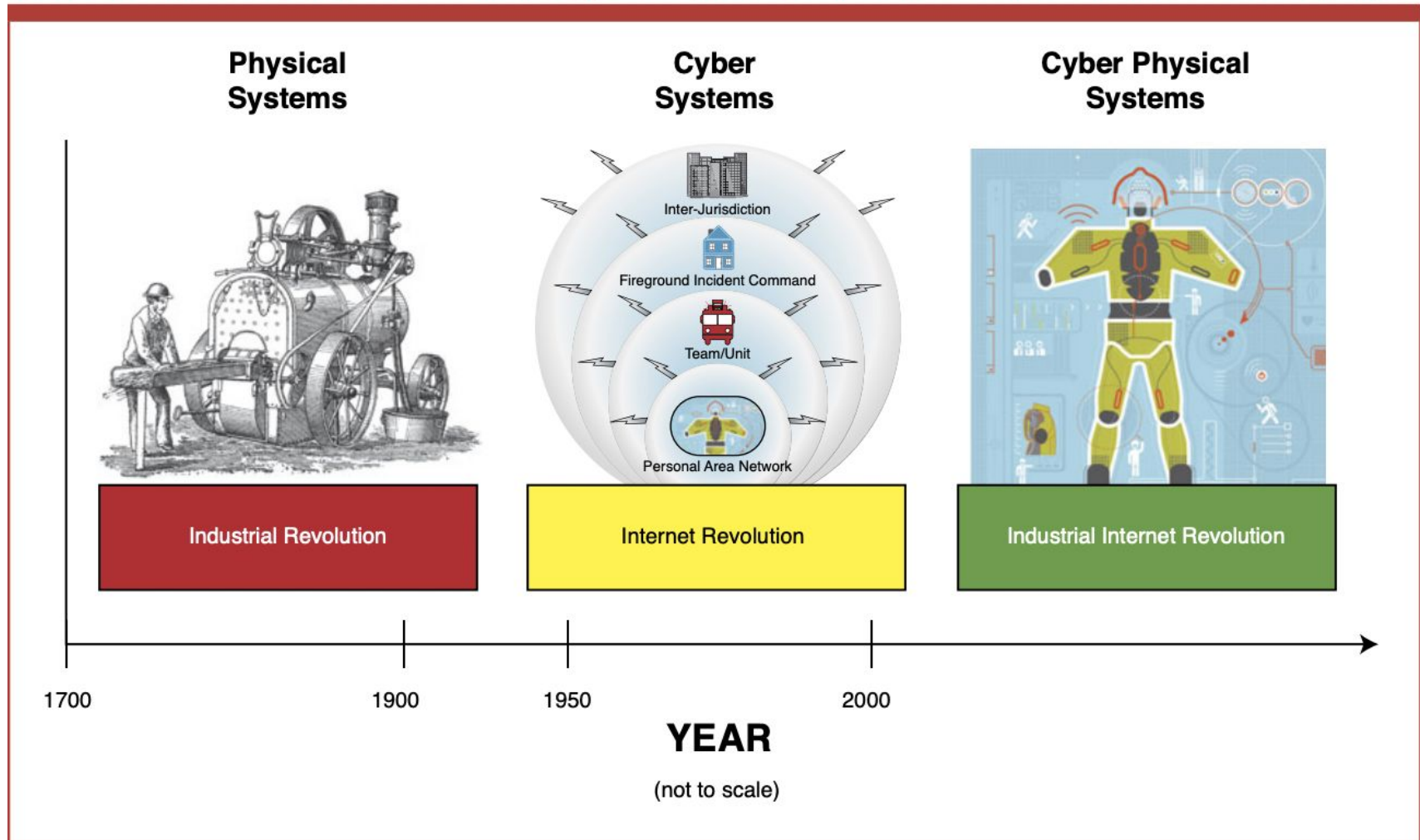
Figure 1.3 Key concepts of the Smart Fire Fighting framework.

Figure 1.2 Historical perspective on technology development. (Source, far left: Shutterstock, Kuznetsov Alexey)

Physical Systems — Cyber Systems — Cyber Physical Systems

Inter-Jurisdiction

Fireground Incident Command

Team/Unit

Personal Area Network

Industrial Revolution — Internet Revolution — Industrial Internet Revolution

YEAR

1700   1900   1950   2000

(not to scale)

Questions

- **User-Centric Design:**
  - How can we ensure that new smart firefighting technologies are user-friendly and intuitive for first responders?
- **Integration with Existing Systems:**
  - How can technological solutions be seamlessly integrated with current operational protocols and existing equipment to ensure a smoother transition and immediate operational impact?"
- **Safety and Efficacy Validation:**
  - What mechanisms or protocols should be in place to validate the safety and efficacy of new technologies before widespread adoption amongst first responders?

Questions

- **Training and Support:**
  - How can we develop robust training programs and ongoing support systems to alleviate concerns and challenges faced by first responders while transitioning to new technologies?
- **Data Management and Security:**
  - Given the sensitivity and critical nature of the information handled, what steps can be taken to ensure the utmost security and responsible management of data collected and processed by these new technologies?
- **Measuring Impact and Success:**
  - How should success be measured for new technology implementations, and what key performance indicators should be monitored to ensure technologies are delivering on their promise to enhance safety, reduce risk, and improve outcomes?

Table 1.1 Transformation from tradition-based fire fighting to Smart Fire Fighting.

Current State	Future State
Tradition-based tactics	Data-driven science-based tactics
Local information	Global information
Data-poor decision making	Information-rich decision making
Lack of awareness	Situational awareness
Untapped or unavailable data	Comprehensive data collection, analysis, and communication
Isolated equipment and building elements	Interconnected equipment and building monitoring, data, and control systems
Human operations	Human controlled, collaborative, and automated operations with inanimate objects (buildings, machines, etc.)

**Table 1.2** Example of existing and emerging fire-related information sources.

Source	Information Type
Fire Fighter	- Radio - PASS alarm - Thermal imaging cameras - SCBA cylinder pressure - Physiological monitoring - Fire hose water flow - Fire fighter location
Building	- Floor plans, firewall ratings, locations of standpipes, building entrances, interior stairwells, elevators, hazardous materials - Annunciator panel - Carbon monoxide alarm - Fire alarm - Activity/motion sensors - Fire sprinklers - Building information models - Surveillance cameras - Local temperatures - Occupant location

Figure 1.1 Example of the Smart Fire Fighting process.

Cognitive Load Theory

Intrinsic Load
(complexity of
new information)
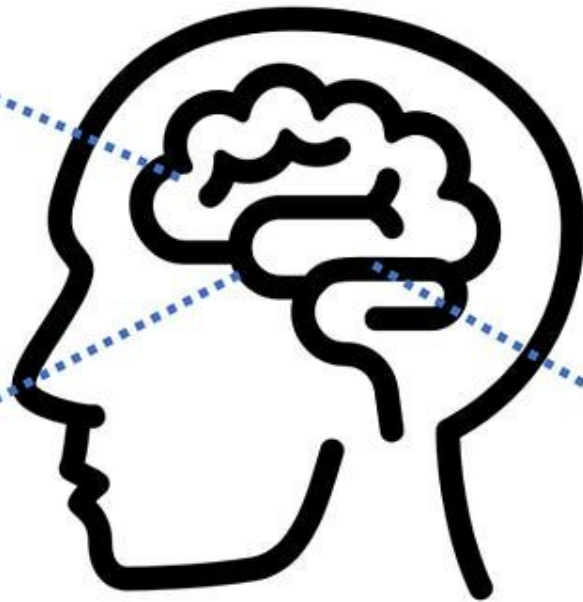
Germane Load
(linking new info
with current info)

Extraneous Load
(unnecessary and
distracting info)

& NOT OR

Figure 3.1 A tethered helmeted fire fighter prepares to enter a structure. (Source: Photograph from the Scottish Fire and Rescue Service Heritage Trust.)

New Technologies

Positive and Negative Externalities of "Green Tech" & Electrification

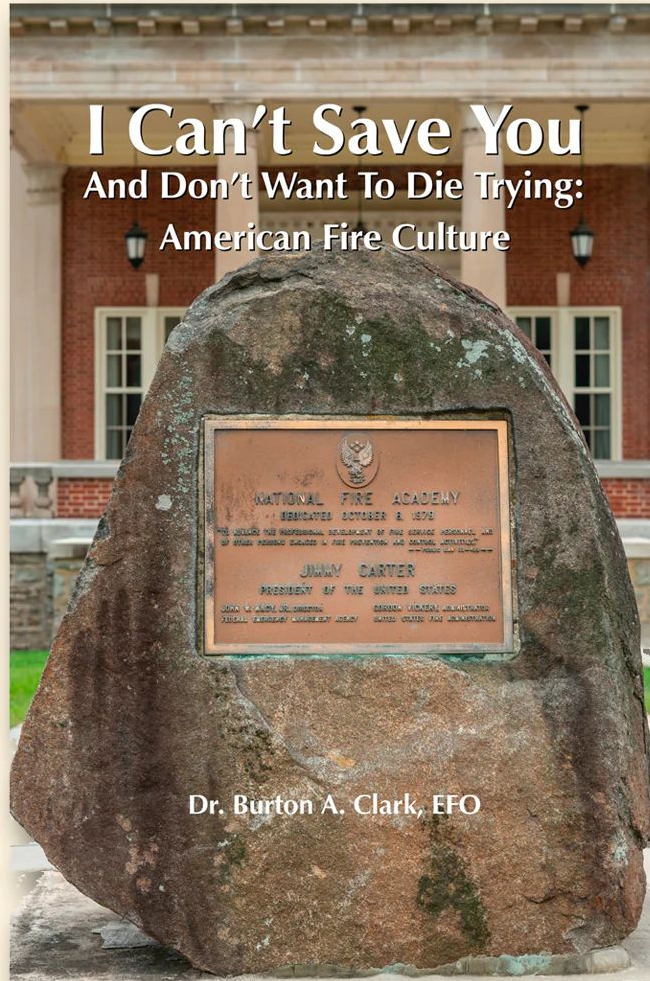# Positive and Negative Externalities of "Green Tech" & Electrification

Technology That Makes a Difference

- Self Closing Doors

- HVAC Dampers

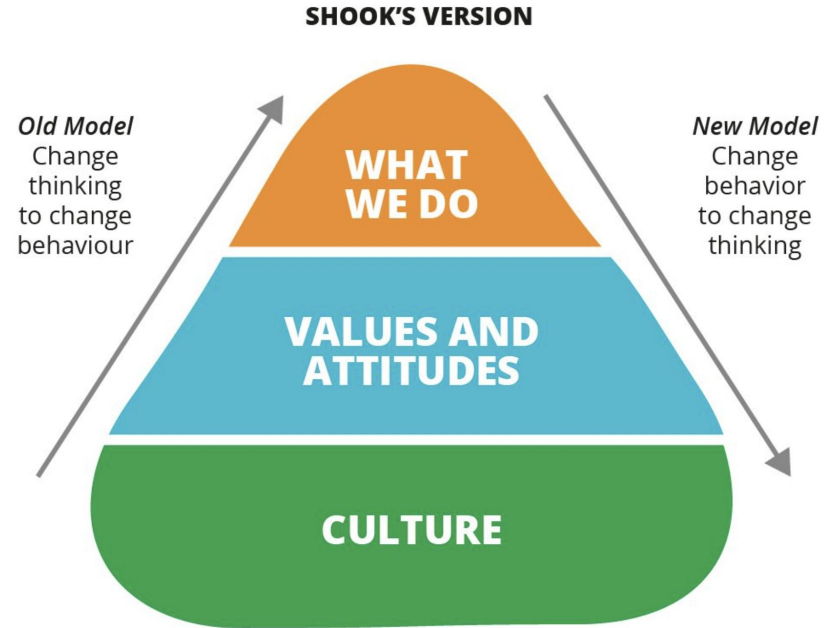- Sprinkler Systems

- Smoke Alarms

- Seat Belts

People and Culture (PAC)

- **Meet people where they are at**
- How do you consume info?
- How do your users consume information?
- What cultural differences exists?
  - Listen to end users, watch, tinker, deliver value
- Study trends - what is relevant today? What is not relevant today?
- Don't force your losing agenda on others
- Don't spend time talking about the way things used to be

SHOOK'S VERSION

Old Model Change thinking to change behaviour

WHAT WE DO

VALUES AND ATTITUDES

CULTURE

New Model Change behavior to change thinking

Cultural and Geographical Differences

Actionable Data for Firefighting Operations

~**Four major types of data:**

1. Community-based information
2. Building occupant information
3. Building information
4. Information related to fire fighters and their tools

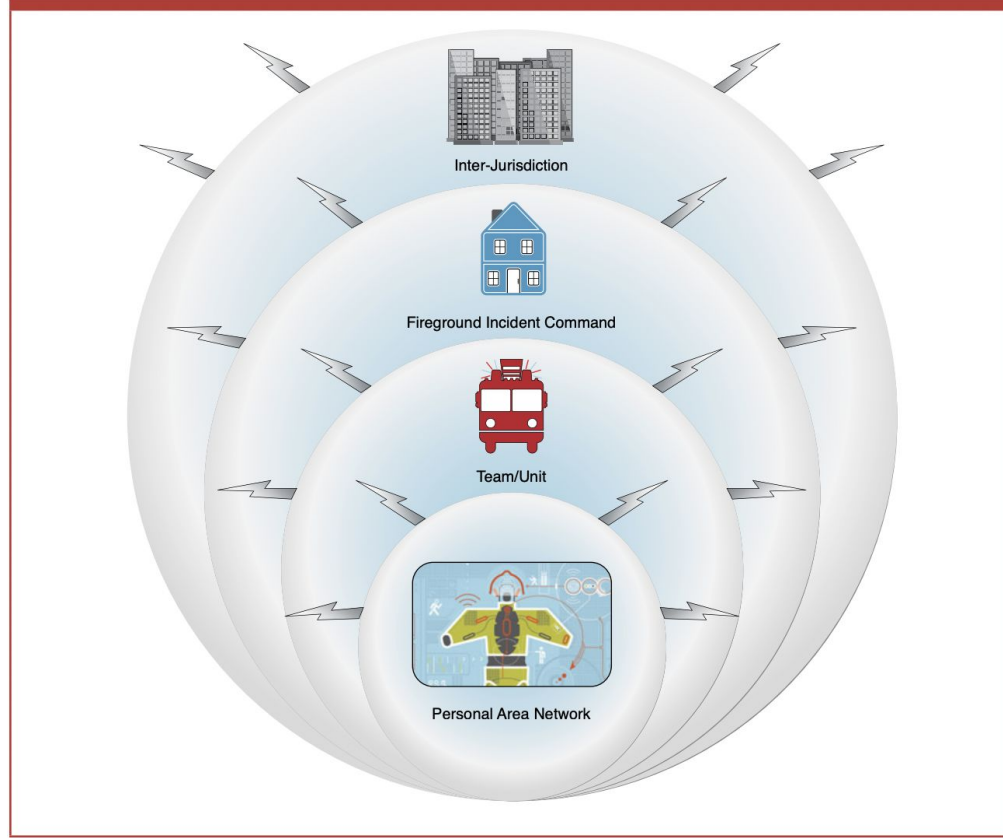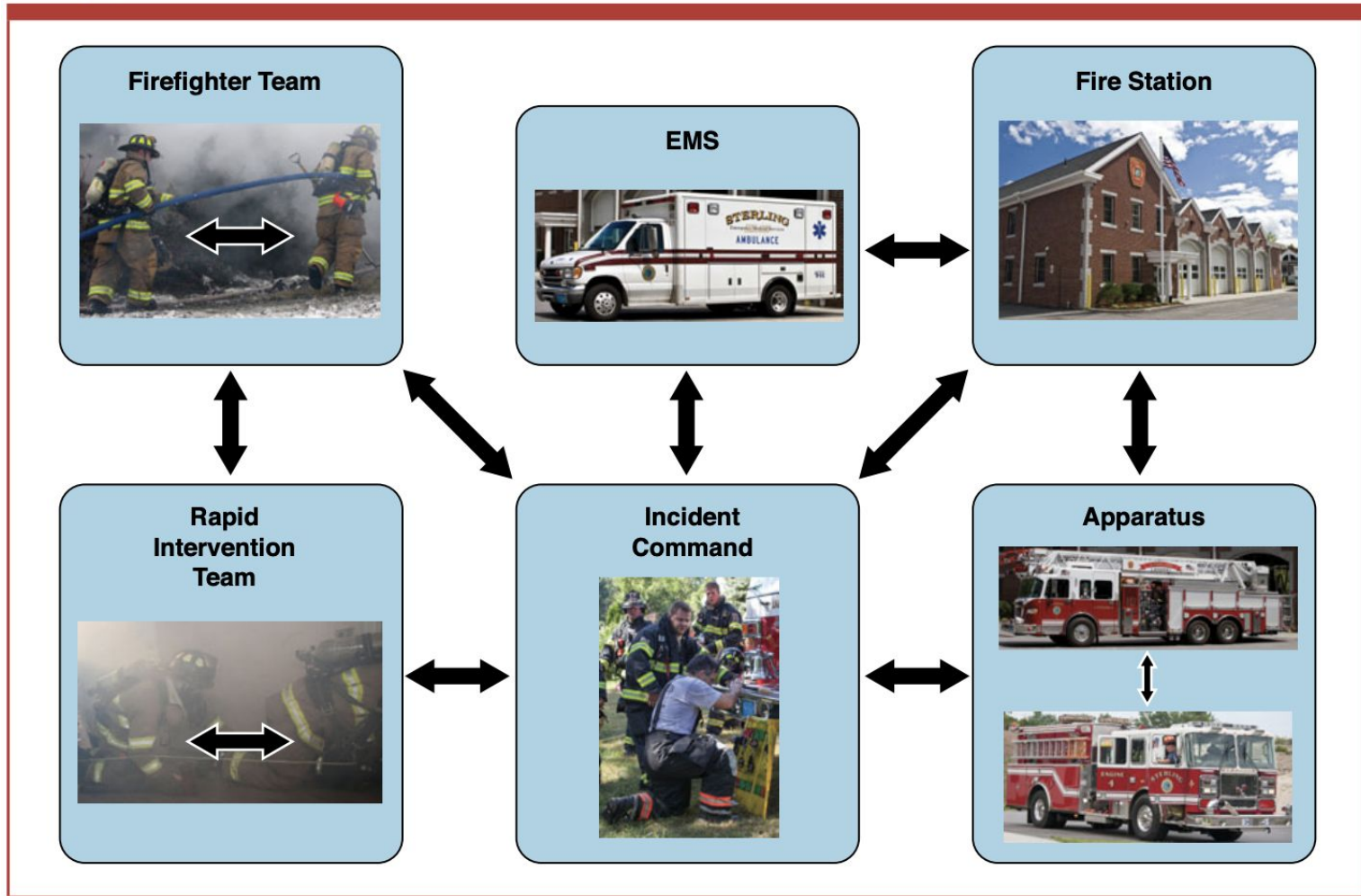Figure 2.1 Typical communication realms for an emergency event.

Inter-Jurisdiction

Fireground Incident Command

Team/Unit

Personal Area Network

Figure 7.1 Interoperability at emergency incident. (Source: Courtesy of the Sterling, MA, Fire Department — Photographer Tina Gianos.)

Sensors as Part of <u>PPE</u>, <u>Mobile</u> Sensors and <u>Stationary</u> Sensors

Figure 3.2 Schematic of multisensor fire fighter PPE.
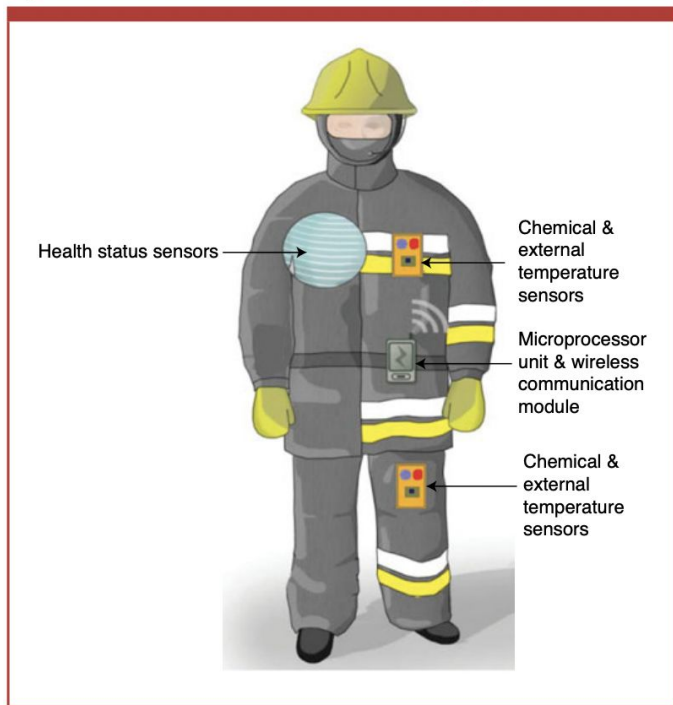
Vehicle Platform as a Data Center

Goal: Universal access to reliable connectivity and communications without having to think about it.

Step One: Turn on the vehicle. System automatically connects to available connectivity and provide wifi on board

Step Two: Perform standard SOPs with confidence that you will maintain connectivity to perform tasks & operations.

Acess to GEO & LEO Satellitle Connectivity

1

Access to LTE Cellular Networks: FirstNet, AT&T, T-Mobile

2

Connect to physical antenna conduits on vehicle platform

3

Blend connection with Smart Blended Satellite and LTE Blender on platform

4

Extend WiFi Mesh network on board and with deployable nodes

5

Utilize Smart connected devices such as drones, phones, tablets, cameras

6

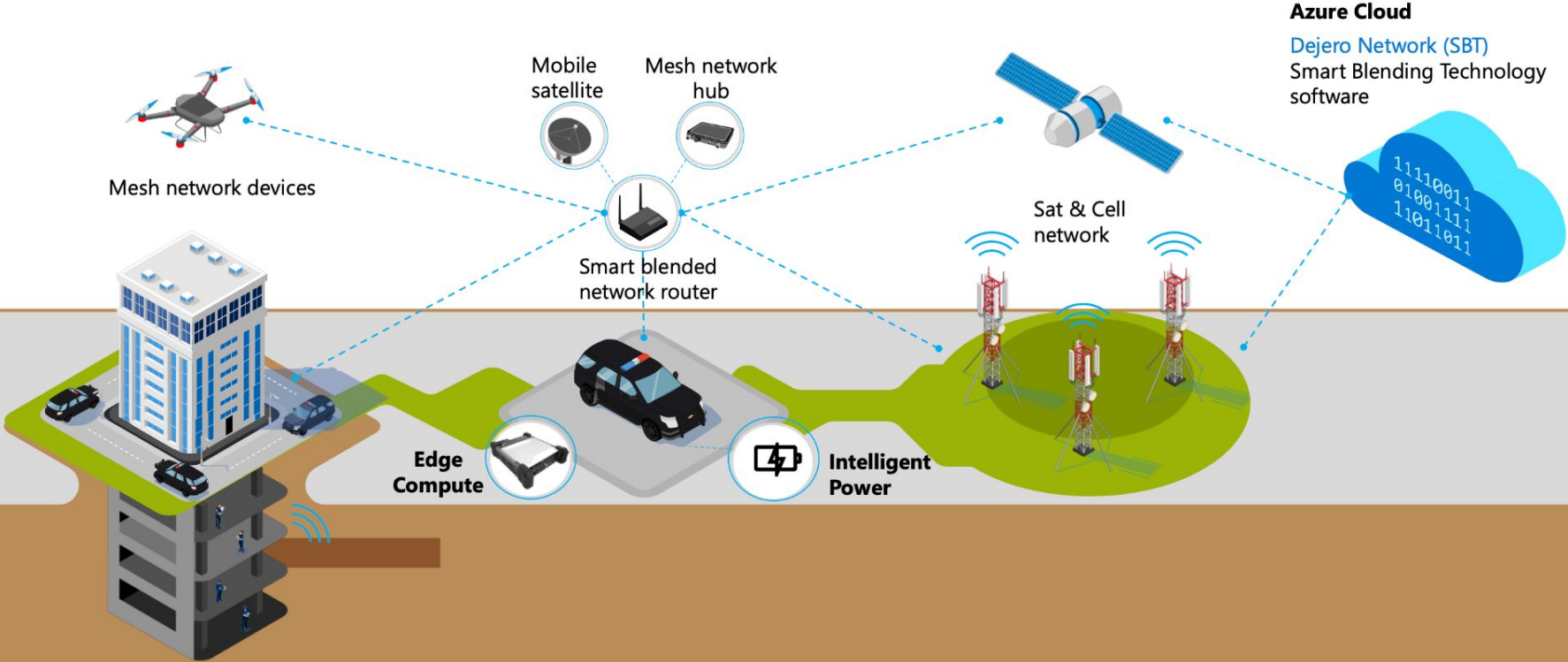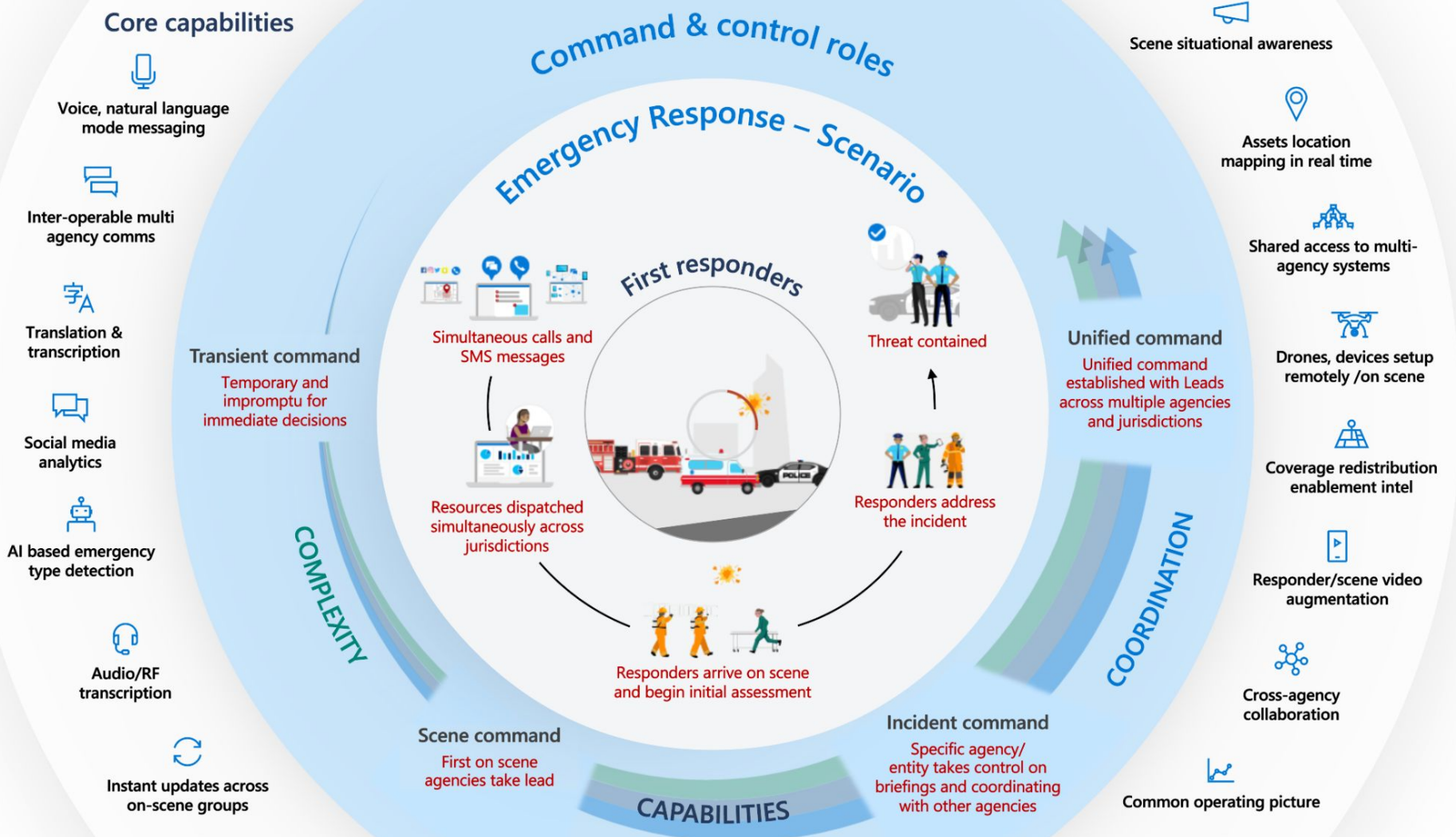**Leverage cloud connectivity to run APPs, AI, LLM, ML**

7

First Responders focus on task at hand, follow SOPs to protect lives & proerty and mitigate risk

8

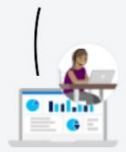# Resilient: Compute, Connectivity, Power

Mesh network devices

Mobile satellite

Mesh network hub

Smart blended network router

Edge Compute

Intelligent Power

Sat & Cell network

Azure Cloud

Dejero Network (SBT)
Smart Blending Technology software

Core capabilities

- Voice, natural language mode messaging
- Inter-operable multi agency comms
- Translation & transcription
- Social media analytics
- AI based emergency type detection
- Audio/RF transcription
- Instant updates across on-scene groups

Command & control roles

Emergency Response – Scenario

First responders

- Simultaneous calls and SMS messages
- Resources dispatched simultaneously across jurisdictions
- Responders arrive on scene and begin initial assessment
- Responders address the incident
- Threat contained

Transient command
Temporary and impromptu for immediate decisions

Scene command
First on scene agencies take lead

Incident command
Specific agency/ entity takes control on briefings and coordinating with other agencies

Unified command
Unified command established with Leads across multiple agencies and jurisdictions

COMPLEXITY

COORDINATION

CAPABILITIES

- Scene situational awareness
- Assets location mapping in real time
- Shared access to multi-agency systems
- Drones, devices setup remotely /on scene
- Coverage redistribution enablement intel
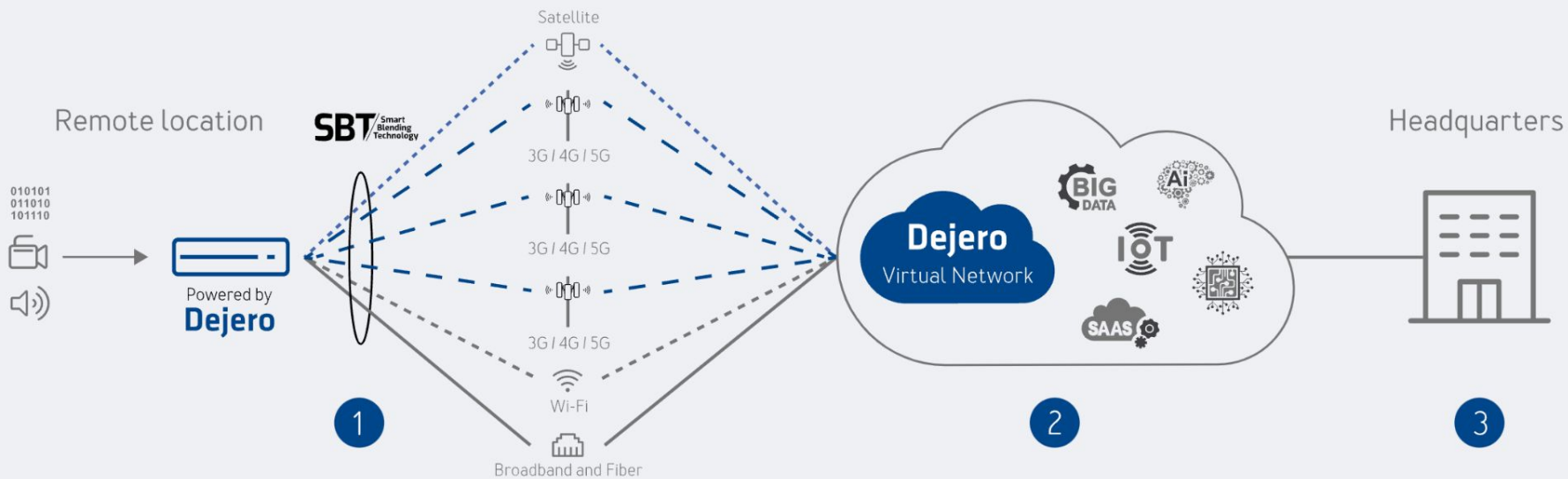- Responder/scene video augmentation
- Cross-agency collaboration
- Common operating picture

Remote location

010101
011010
101110

Powered by
Dejero

SBT / Smart Blending Technology

Satellite

3G | 4G | 5G

3G | 4G | 5G

3G | 4G | 5G

Wi-Fi

Broadband and Fiber

1

Dejero
Virtual Network

BIG DATA

AI

IOT

SAAS

2

Headquarters

3

① Combine the bandwidth of multiple network providers and diverse technologies with *Smart Blending Technology™*

② Access cloud resources such as compute, storage and software...

③ ...or connect to resources at headquarters or datacenters

System Integration of 21st century technology

Satellite Communications: Satcom access while on the move in remote areas

Mesh Network: Extension of communications via mesh network for flexible coverage

LTE & Communications Aggregations: Smart blended network connectivity

In Vehicle Power System: Lithium Energy Module with AC Inverter

Edge Computing, AI, Cloud: Cloud software stack for edge computing

Interactive Tablet Devices: high power touch devices for first responder operations

First Responder and Asset Tracking: Seamless tracking and accountability software

VTOL Drone: Quickly deployable quadcopter robot for situational awareness

Video Streaming: Real time transfer of video data from assets in field to vehicle

Modular Roof Rack System: Winch and other special features
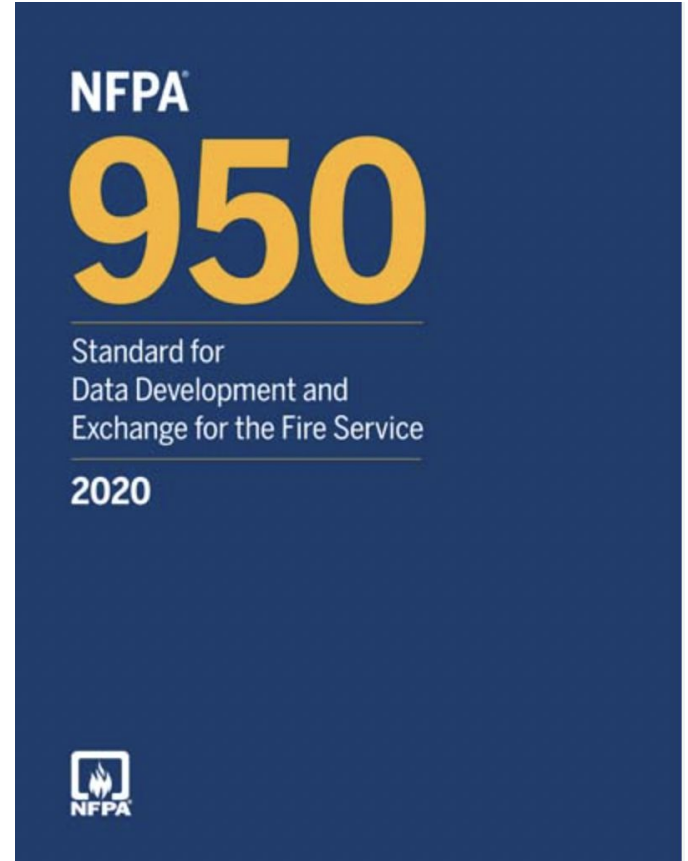
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800.323.0244

Standards

- 30,000 fire departments in the USA
- NFPA 950, Standard for Data Development and Exchange for the Fire Service
- NFPA 951, Guide to Building and Utilizing Digital Information
- ISO 37120, Sustainable Development of Communities — Indicators for City Services and Quality of Life [17].

Challenges with New Tech & Standards

- Secure standard methods of **transmitting a standard set of data** in a standardized format
- Standardized information for first responders and standard building **data models**
- **Ownership and maintenance** of and data schemas and queries for databases
- Choice of standard communication protocols and **user interfaces**
- Establishment of criteria to **automatically route 9-1-1** calls based on message content
- Implementation of appropriate authorization, **authentication**, and security protocols
- Development of **multi-hazard scenarios** for system design and **compliance**
- **Interoperability** standards for both **software and hardware**
- Standards for accessing and using **cloud-based services**
- Plug-and-play architectures that facilitate **integration of cyber and physical components**

Figure 14.1 Research priorities for CPS-Smart Fire Fighting.
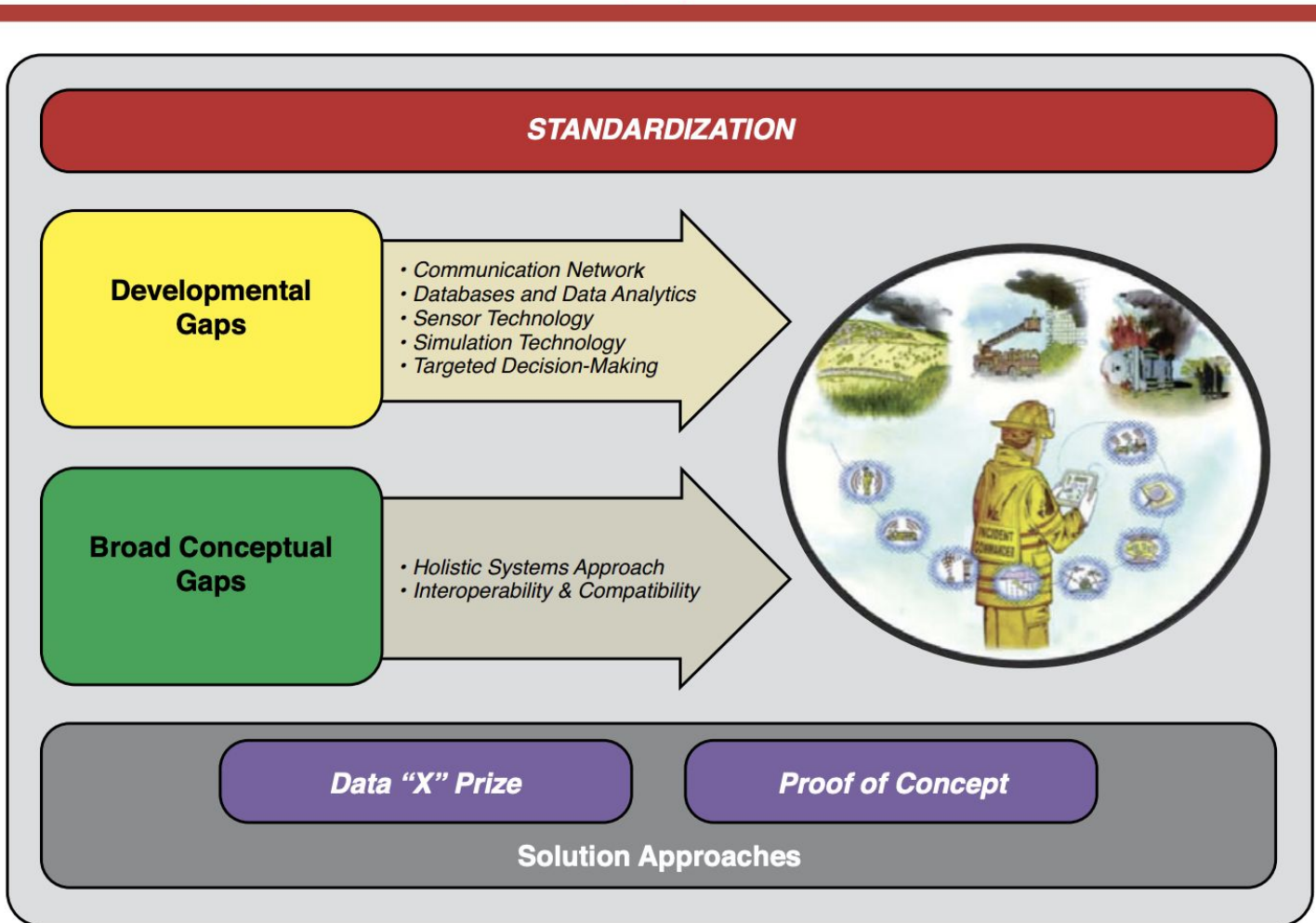
Tools in the Tool Bag for First Responders

Drones

Virtual Reality Training

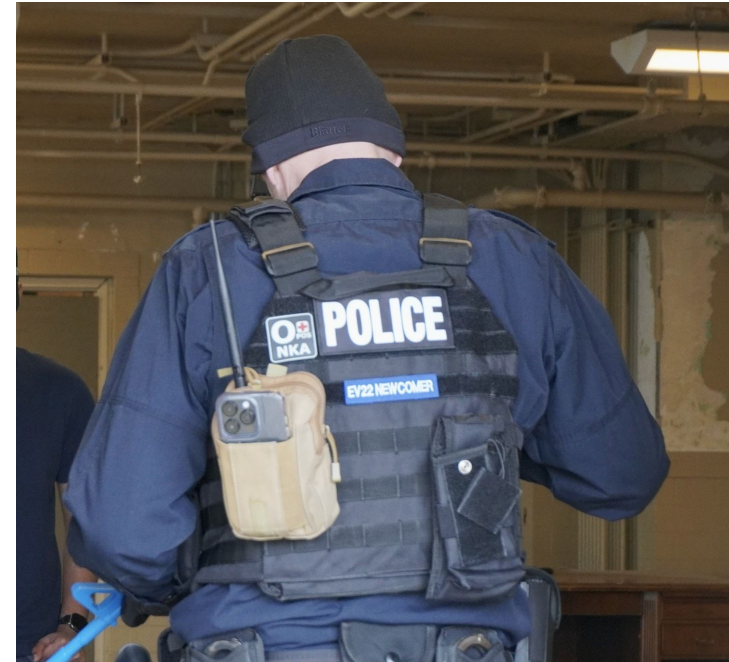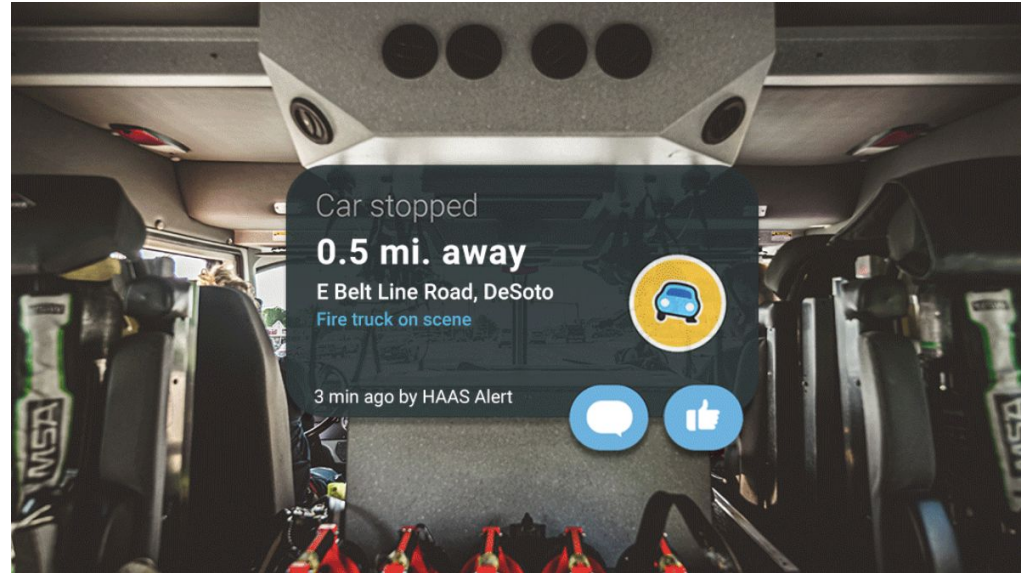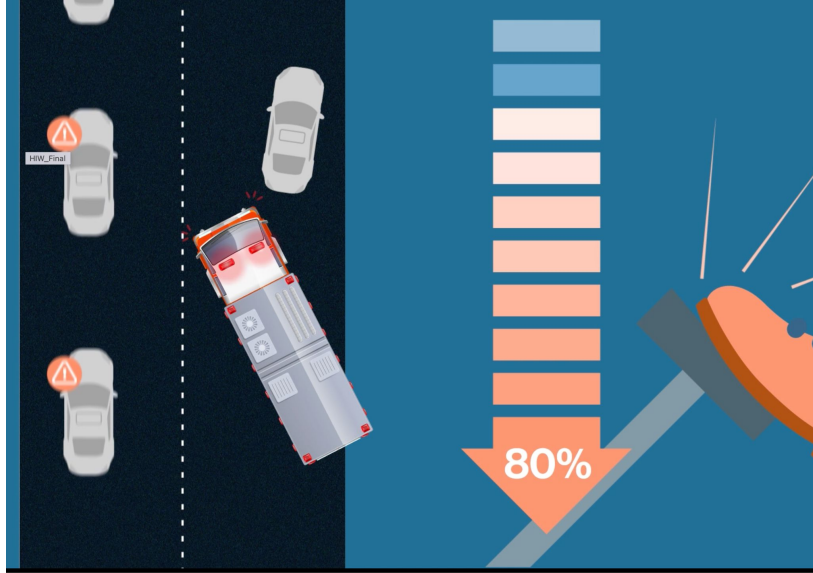# Virtual Reality Training

Virtual Reality Training

Personal Accountability, Biometrics & Indoor Localization

Vehicle to Vehicle Alerting System

"Bringing the tech of the future to today's fire and emergency service professionals…"
December 5 - 7, 2023
Irving Convention Center, Irving, TX

SMART FIREFIGHTING

Smart Firefighting

Smart Firefighting Podcast covers real-world deployments of smart technologies through conversations with technologists, innovators, companies, and forward-thinking public safety and government agencies. Learn from interviews with leaders as they share their insights and offer their expertise every week! Host Kevin Sofen is a co...

Read More

Search podcast...

EPISODE 153: BREAKING DOWN Z-AXIS TRACKING...

4/18/2023 | 19 min   Latest Episode

Part 2 of our FRST Challenge - Phase 4 Mini Series: Hello Smart Firefighting Community! Welcome to another episode of covering real world innovations via interviews with fire service and technology industry experts t...

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