

# Intelligent Cities and Emergency Management: Creating Innovative, Collaborative Networks for Safety and Security

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# Intelligent City Architecture

- **Integrates human, collective, and artificial intelligence to enhance knowledge and innovation.**
- **Will it support emergency management functions of awareness, prevention, protection, response, and recovery?**

**The major contribution of technology should be to create new capabilities, not to enhance old ones, for all phases of emergency management.**

**We are asking:**

*“How can technology improve our ability to do what we are currently doing within the constraints of our existing policies, procedures and structure?”*

**We should be asking:**

*“What new things can technology enable us to do that will dramatically improve or change processes and will produce better outcomes?”*

# Sensing and Sensemaking are Critical When the Unexpected Happens

- **Sensing** is the capture of information from human and technological sources
- **Sensemaking** is the process of seeking, processing creating and using information to :
  - Determine what is happening
  - Decide what actions should be taken
  - Determine what should be learned from the situation
  - Compare perceptions with others
  - Decide what to pay attention to
  - Assess plausibility
  - Create a continuing evaluative process
- Source: Karl Weick, 1995

# Intelligent City Supports both Sensing and Sensemaking

Ability to understand threats and to react like an organism is made possible through:

- Networks of digital communication links—artificial nervous system
- Sensors—artificial sensory organs
- Embedded intelligence, computation power, data fusion, information display and intelligent agents—artificial brain

# Information and Decision Needs following an Unexpected Event

- Impacted people need information to enable their protective and life sustaining behavior.
- Decision makers need to acquire situational awareness, determine citizen needs, identify problems, resource availability and needs
- Response organizations should be able to conduct “needs finding”, not needs assessment
- Virtual decision making groups are formed around problems, functions and issues
- Information and decision needs are dynamic and change as the event evolves.

# Emergency Managers in an Intelligent City Must Avoid Flawed Fundamental Assumption

People impacted by extreme event are viewed as immobilized “victims” to be served by specialized response resources

In actuality, people affected by such an event are capable of helping themselves

They typically form emergent collaborative groups to help each other and to resolve the problems they face.

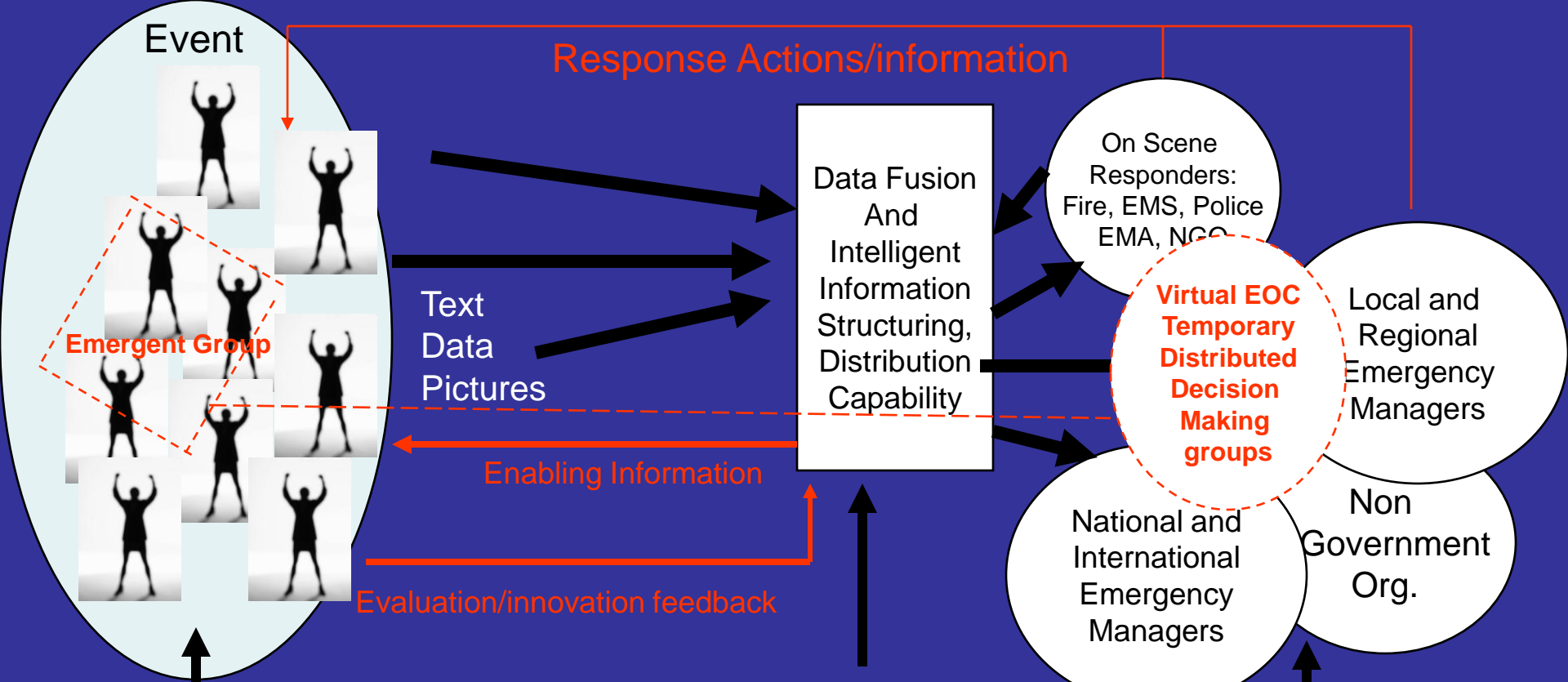
They are not victims, they are resources

# Why are People Resources During an Extreme Event?

- They know where they are and what problems they see
- They know what resources they need and what resources they need
- They know what they can do to help themselves and who is available to work with them
- They know what social networks and groups have formed in response to the event
- They know if response efforts are succeeding or failing

# How Can Citizens Be Used to minimize the impacts of a disaster or attack?

- They should be viewed as information sources, resources, and evaluators of response actions.
- They must be connected to and trusted by public sector responders and emergency managers.
- They must be connected to supportive social networks



- Impacted population acting as Citizen Sensors—enhanced cell Phone technology
- Direct observation of event
- threat information
  - impact information
  - needs
  - problems
  - capability
  - results

- Technology Required**
- Web based data collection and structuring
  - Data fusion
  - Intelligent agents
  - Data distribution

- Technology Required**
- Virtual group creation and management
  - Collaborative tools
  - Decision support and decision analysis tools
  - Visualization tools
  - Information sharing tools

## Collaborative, Innovative Networked eSafety and Security in an Intelligent City

# Operational Environment Following an Extreme Event

- An extreme event is a massive, unexpected, interruption of the normal. The operational environment is chaotic and dynamic.
- Information and communication needs evolve rapidly and formal and virtual decision making groups form around problems and issues.
- Protective behavior is based on understanding of present and future danger .
- Must understand the present, project the future to succeed in coping.

# Shared Situational Awareness

**Situational awareness involves:**

- 1. Perceiving critical factors in the environment.**
- 2. Understanding what those factors mean, particularly when integrated together in relation to the decision maker's goals.**
- 3. Understanding of what will happen with the system in the near future.**

# Technology Required to Achieve Shared Situational Awareness

- Data quality assessment, data fusion to evaluate and combine geospatial data from multiple sources
- Geospatial display technology to provide consistent and accurate representations of critical system knowledge and information
- Technology to share information, knowledge perceptions, interpretations, projections

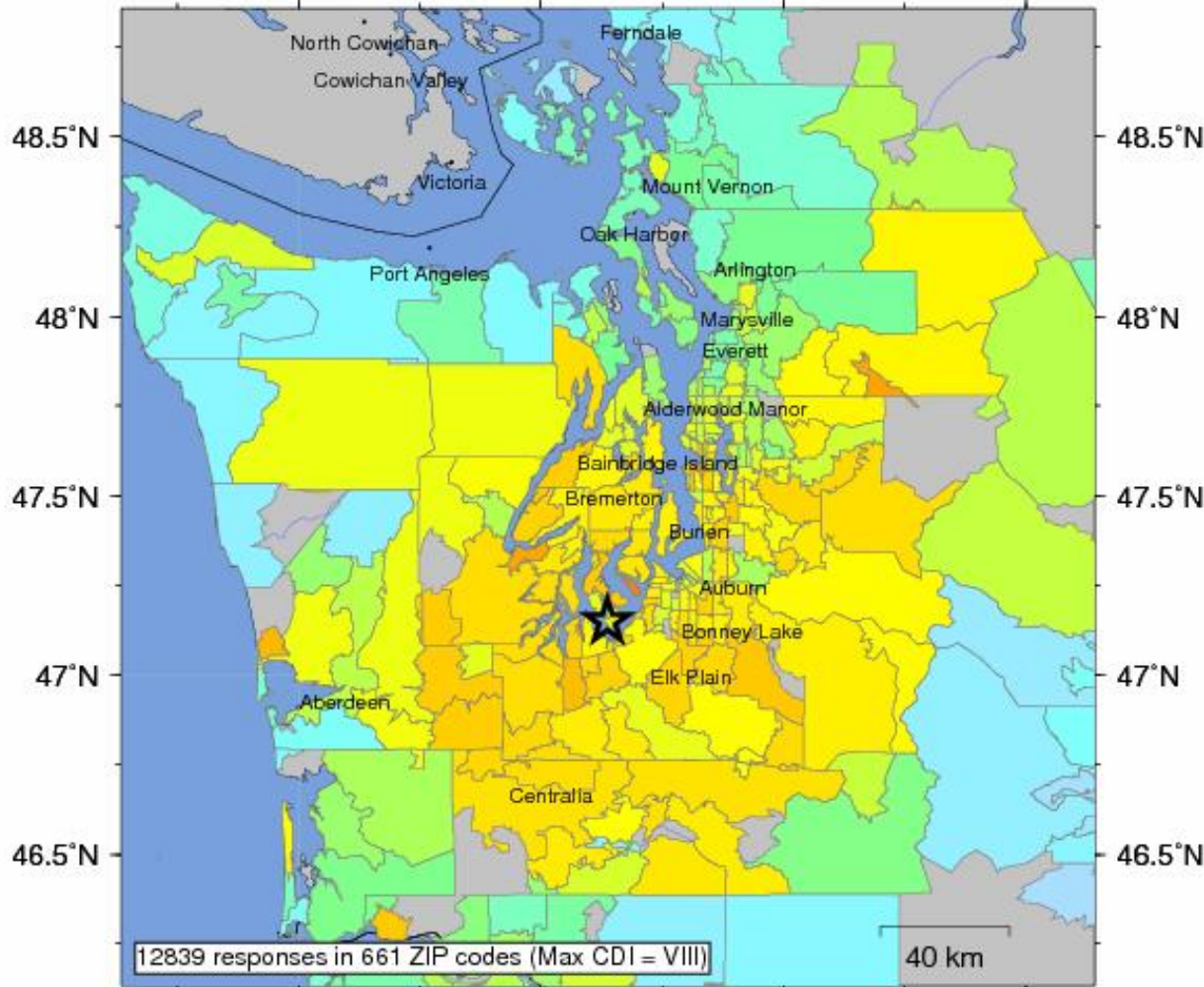
# Example: Situational Context One

- Extreme event impacting large geographical area and large, diverse population. Must warn people at risk
- Immediate life saving and life sustaining assistance required.
- Chaotic conditions prevail, cascading infrastructure failures and failures of health and medical system are major challenges
- Intelligent city information infrastructure must provide awareness, ability to coordinate and respond.

# USGS Community Internet Intensity Map

## Nisqually

Feb 28 2001 10:54:33 PST 47.1489N 122.7266W M6.8 Depth: 30 km ID:uw02281854



12839 responses in 661 ZIP codes (Max CDI = VIII)

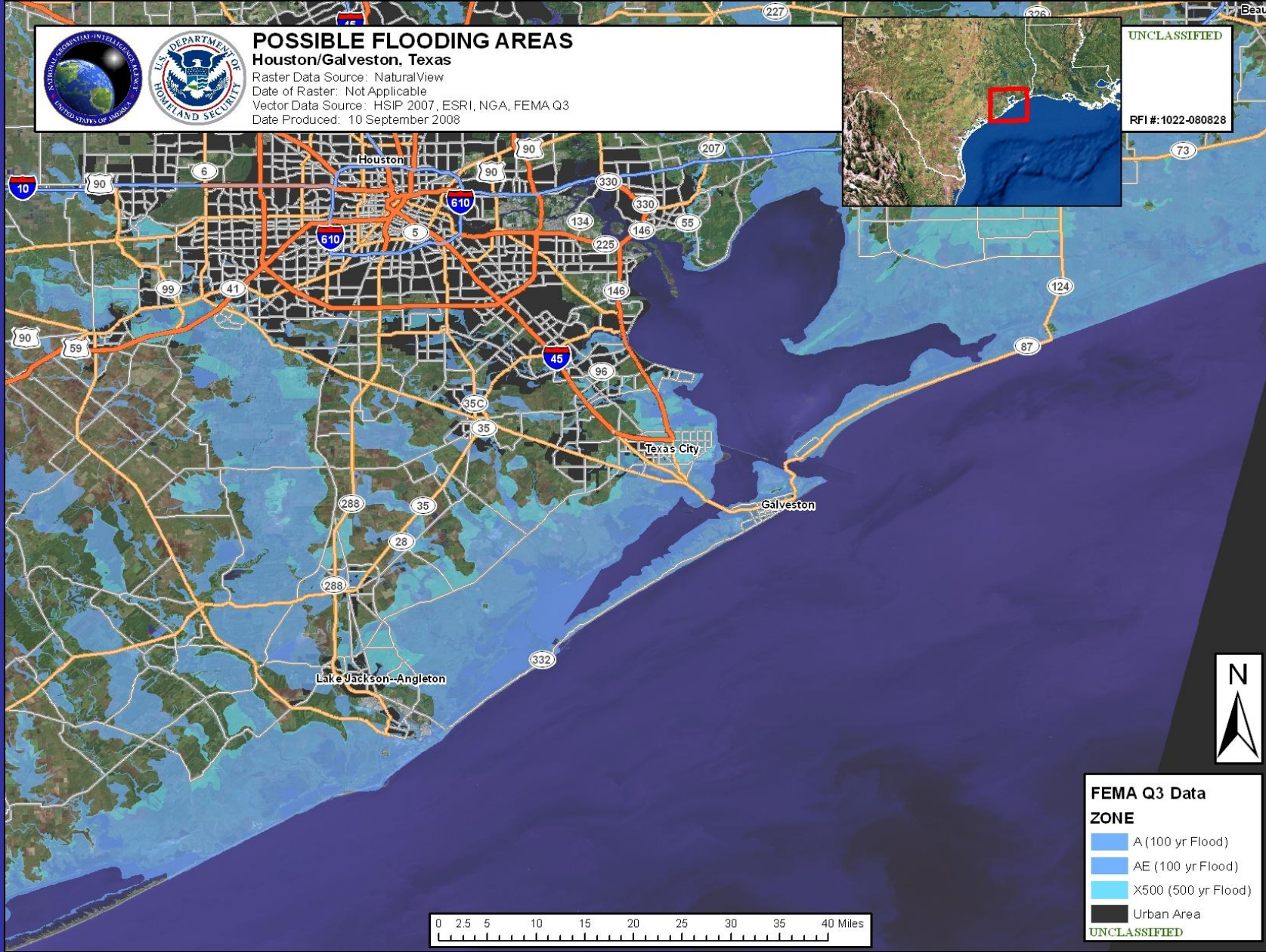
40 km

INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Tue Dec 16 01:40:50 2008

An Example of Citizen created Response tool

USGS “Did you Feel it” intensity Reporting system



## Hurricane Ike

An Example of information from models and sensors

## Example: Situational Context Two

- An attack on civilian targets by terrorists (e.g. Mumbai, Virginia Tech)
- Information available to responders is chaotic and partial
- Must warn people at risk
- Citizens and sensors are potential sources of precise information about where terrorists are, what they are doing—“using the haystack to find the needle” (Rothenberg)



Mumbai: Where are the terrorists? What are they doing?

Source: [www.boston.com.thebigpicture](http://www.boston.com.thebigpicture)



**Virginia Tech: Shooters-- How many, where, how armed?  
Victims?—How many, condition, location?**

Source: [FREEP.com](http://FREEP.com)

# The Intelligent City Challenge: Safety and Security requires Resilient Technology

- The information technology backbone provided by intelligent city design will enable formal response organizations to collaborate with, guide, and inform and be informed by individual citizens and citizen groups.
- However, when needed in catastrophic events in US (9-11, Hurricane Katrina), 20<sup>th</sup> century technology failed—communications, information management, coordination, command and control collapsed.
- Technology of 21<sup>st</sup> century must be resilient enough to work when needed most

# Technological Capabilities Required

- **Connections between citizens and responders and among responders must be collaborative, scalable, and functionally and technologically interoperable.**
- **Resulting physical networks should foster, track, and coordinate innovation, adaptability and feedback and should enable the evolution of social networks.**
- **Intelligent agents for data quality, data selection, data fusion; GIS, visualization and display technology for decision support and awareness**
- **End result must be managed connectivity, innovation, and creativity leading to more effective and efficient delivery of services**

# Thank You

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