Information sharing and technology in support of dynamic multi-organizational partnerships for DRM

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ICT solutions for dynamic collaboration

- COTS satellite telecommunications (Patricelli et al., 2008)
- Internet (IP) / Web-based systems
  - standard protocols
  - simple text interface (HTML / XHTML / XML)
  - widespread accessibility / affordability
- Service-oriented architectures   (Tanasescu et al., 2006)
  - modular / multi-use web services
- Semantic web   (Klein et al., 2006; Zobel et al., 2008)
  - capture and maintain tacit knowledge
- Web 2.0 tools
  - MySpace / Wikis / Google maps / Twitter

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Access to disaster-related information

"Of all the problems experienced during a disaster or humanitarian crisis, the most serious center on disabled communication and inadequate access to critical information." (Garshnek, et al, 2000)

- Technology
  - Does the technology exist / is it accessible / acceptable / cost-effective?
  - Is the existing and available technology compatible?

- Information
  - Is the right **information** available?

Information availability

- Access to information
  - Data sent from or to the right place (pulled or pushed)
  - The right type of data (phone call / web service output)
  - Relevant data (Ex: weather data, location of resources)
  - The right amount of data (not too little / not too much)
  - Timely data (no significant delays)

- Interoperability of data sources
  - Consistent data formats (use of appropriate _standards_)
  - Appropriate vocabulary / context / data types (semantics)

Types of collaboration: long-term

- Supports the determination, development, and maintenance of appropriate standards
  - Standardization supports flexibility

- Supports efficient and effective communication and information exchange
  - Opportunity to refine and improve

- Supports developing a tacit understanding of relative capabilities and behaviors

- Subject to fewer security concerns / higher level of trust

Ad hoc groups

"…traditional organizations are not necessarily always the prime social players at the height of disasters. **The crisis time period of disasters is characterized by the emergence of many new informal groups**…crucial to dealing with crisis-time major needs ranging from search and rescue to coordination of sector and overall response…**However, since these kinds of groupings are new to the situation and have no pre-impact existence, [their] use of computer related equipment will be rare at best**….It is the traditional organizations and agencies that are far more likely to have such equipment available."

<div align="right">(Quantarelli, 2007)</div>

Types of collaboration: dynamic

- Potentially more resilient
  - May be more flexible
  - Able to adapt more easily to changing conditions
- Still need to use standards
  - Tradeoff: simplicity vs. efficiency
- Questions in this situation:
  - How do you capture, store, and transfer knowledge?
  - How do you reduce / minimize time (cost) to join?
  - How do you incorporate new viewpoints?
  - How do you address information security issues?

Dynamic and Resilient ICT

- Physically resilient
- Supports distributed decision-making
- Supports distributed data access / knowledge mgmt
- Supports multi-purpose data
- Supports multi-source data
- Standards-compliant
- Uses flexible security policies
- User-friendly
- Modular / Extensible / Adaptable

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Further thoughts

- Long-term sustainability requires user acceptance
  - User-friendly
  - Understandable
  - Effective
- Effective communication supports effective action
- ICT can support both decision-making and knowledge transfer
  - Efficiently communicate and maintain a record of procedures / decisions / outcomes / context
  - Enable more effective dynamic contributions

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Backup slides

Examples of other ICTs for DRM

- Geographic Information Systems (GIS)
- Remote sensing (ground-based / air or space-based)
- Multi-sensor systems
- Early warning systems
- Group decision support systems
- Global DRM data aggregators

Standards

- There is a need for community-adopted standards to ensure information interoperability
  - Connectivity:
    - Existing international technical standards
    - Technologies must be chosen to be compatible

  - Semantic interoperability:
    - Information format: voice / XML / SOA
    - Information semantics
      - complex and time-consuming process
      - similar to developing common policies

Security

- Physical security
  - Protection of resources (human or technological) from the effects of the disaster

- Information security
  - Appropriate access permissions
    - Who should have access to the information?

  - Different concerns for an earthquake vs. a terror attack

Usability needs

- Appropriate technological sophistication
  - Effectiveness "behind the scenes"
  - Understandable / helpful user interface

- User buy-in / acceptance
  - Must be designed and developed with help of users
  - Must be adopted by users

"…most communications interoperability problems are not technical…and…better human organisation and willingness to cooperate are critical factors in making better use of IT for disaster management." (Marincioni, 2007)

Overview

- IT-based information sharing in a disaster context
  - Some potential solutions
  - Time critical (different phases = different profiles)
  - Subject to disruptions
  - Issues of:
    - Security
    - Usability

- Focus on dynamic collaborative networks
  - Information sharing needs
  - Potential ICT solutions

Communications infrastructure

- Access to communications technology
  - Does it exist / is it accessible / acceptable / cost-effective?
  - If it is in place, can communications be established?
    Ex: cell phone tower damaged / power grid down

- Interoperability of different technologies
  - Compatibility between components
    Ex: shared radio frequencies / shared protocols for data exchange

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ICT for collaborative networks

- General issues:
  - Impact of availability of communications infrastructure
  - Importance of pre-existing relationships
  - What is the focus of the network / sub-network?
    - Disaster mitigation
    - Emergency rescue
    - Humanitarian relief
  - Different information need profiles
    - different time pressures by DM phase
    - different types of information needed for tasks

Focus on dynamic collaborative networks

- Important considerations:
  - Number of organizations
  - Extent of pre-existing relationships
  - Different types of roles (security implications)
  - Relative degrees of technical sophistication
  - Different levels of contribution
  - Different types of contribution
  - Different time-frames of contribution

Focus on dynamic collaborative networks

- Pre-existing relationships support the development of solutions to many issues:
  - Technology availability
  - Technical interoperability
  - Data interoperability
  - Automated information exchange

  - Establish standards for data exchange and data representation
  - Establish a common vocabulary / semantics

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Characterizing disaster information

- **Spatial**
  - 2D / 3D (urban environments)
- **Temporal**
  - Availability (evolving situational awareness)
  - Immediacy (speed of decision making)
- **Multiple sources**
  - Human / automated
- **Uncertainty**
  - Missing data (what is available / important to know?)
  - Conflicting data (differing perspectives)
  - Corrupted data (technical issues / human malfeasance)

- Multi-organizational collaboration requires communication and exchange of information
  - There are different types of collaboration in a disaster management context
  - To determine ICT needs, it is important to define the <u>purpose</u> and <u>goals</u> of a given collaboration

- There is opportunity to learn lessons from the supply chain community – larger questions of multi-organizational collaboration and resilience

Questions

- Who needs the information ?
- What type of information is needed, and how much?
- How quickly is the information needed?
- Where is the information needed?
- For what purpose is the information needed?

- Is the information available?
- Is the information accurate?
- Is the information secure?

Voice and data communications

- Need for underlying technical infrastructure
  - Connectivity
    - Landlines / VoIP / radio / cell phones / satellite phones
    - Compatible technologies

  - Semantic interoperability
    - Information format
    - Information semantics: syntax / terminology / context

- Additional issues of availability / security / acceptance / etc.

Hybrid framework for collaboration

- Long-term core with established infrastructure
  - Speed and efficiency
- Short-term collaborators with flexibility to adapt
  - Make use of components of the infrastructure
  - May have different security levels
  - May have different degree of efficiency
    - depending on depth of collaboration
    - depending on type of contribution
    - depending on length and extent of contribution

Simple example

- Fixed collaboration
  - Pre-existing relationships – automated info. exchange
    - DHL – *transportation optimization*
    - Migros supermarket – *inventory optimization*
    - Canton of Graubünden – *distribution management*
- Dynamic collaboration
  - Individual volunteers
    - One-time deliveries of resources
    - Limited need for detailed logistical information
    - <u>But</u> need direction from someone with access to that information in order to contribute efficiently