SITUATIONAL AWARENESS DURING A CATASTROPHIC INCIDENT:

INSIGHTS FROM THE CR16 EXERCISE

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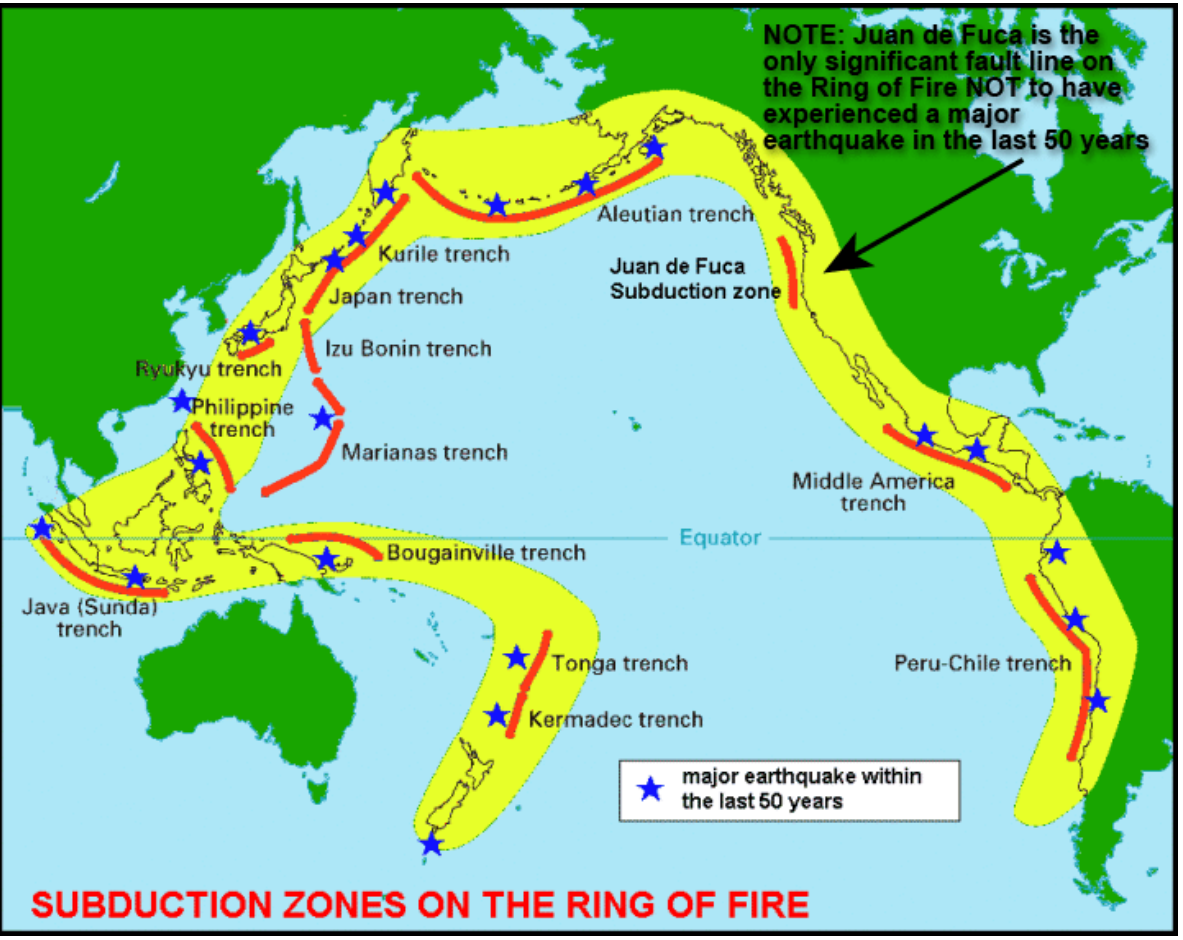
WHAT I AM GOING TO TALK ABOUT

- The Cascadia Rising 2016 Exercise
- Research Interest
- Literature
- Research Questions
- Methodology
- Findings
- Discussion
- Conclusions and Future Research
- Questions and Comments

THE CASCADIA RISING 2016 EXERCISE (1)

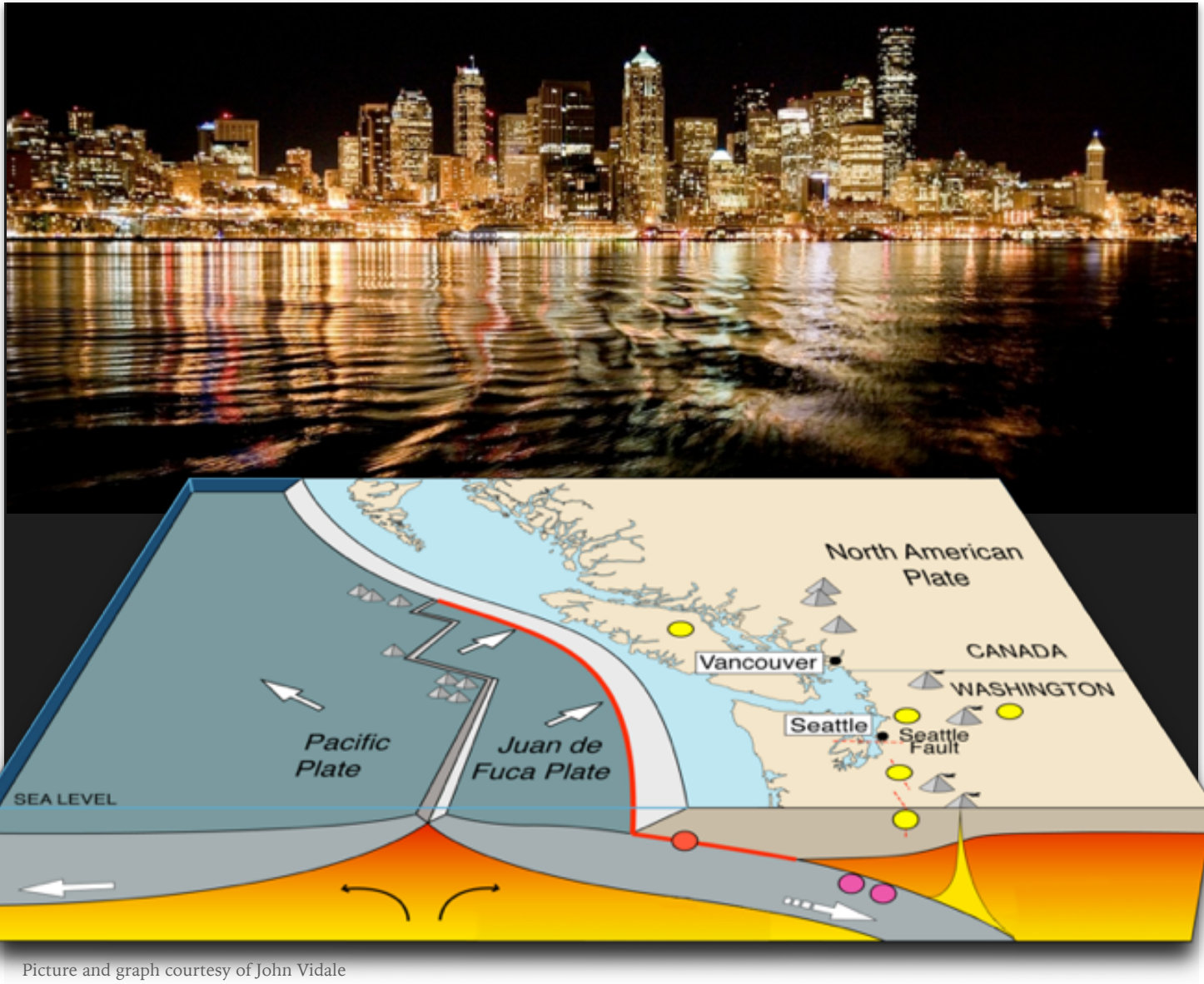
The Threat



Slide content courtesy of Lt.Col. Braun, WA National Guard and Wikipedia

- Ring of Fire
  - Accounts for 90% of all earthquakes, and 81% of the world's largest earthquakes
  - All but three of the world's 25 largest volcanic eruptions of the last 11,700 years occurred at volcanoes in the Ring of Fire.
  - Subduction zones are shown in red
  - The CSZ fault line is part of the Ring of Fire
- The CSZ is the only significant fault line on the Ring of Fire without a major quake in the last 50 years (see blue stars)

THE CASCADIA RISING 2016 EXERCISE (2)



Picture and graph courtesy of John Vidale

Exercise Details

- Conducted between June 7 and 10, 2016 (military: between June 7 and14, 2016) after two years of preparation
- Involved 23,000 participants across local, state, federal, tribal, Department of Defense, and non-governmental entities in Oregon, Washington, and Idaho with British Columbia associated
- One of the largest exercises ever conducted in the US; the largest multi-state exercise in the Pacific Northwest so far
- ***Objective***: Through disaster simulation, the purpose of this exercise was to test and validate catastrophic CSZ plans; the ability of Emergency Operations Centers (EOCs), throughout the whole community, to coordinate and communicate priorities and objectives; to share situational information; and to request, order, and transport life-saving resources to the areas most heavily impacted
- Scenario similar to the devastating March 2011 Tōhoku earthquake and tsunami in Japan

THE CASCADIA RISING 2016 EXERCISE (3)

Figure 1 *Cascadia Rising 2016 Exercise – M9.0+ Megathrust Impact Assumptions (Paci-Green et. al, 2015, p. 14)*

Impact Area

- West of and including the Interstate-5 corridor
- Zipper-like rupture from one end of the subduction line to the other is expected to occur along the 800-mile-long subduction line
- Thirty to forty-foot high tsunami would reach the coastline about 20 to 30 minutes after the rupture
- Several aftershocks of significant magnitude would be expected to follow the initial rupture inflicting more damage
- Impact on human lives and infrastructure would be the greater the closer the location to the coastline
- Impacted areas West of the Cascadian Mountain range would be inaccessible by ground transport or sea transport for extended periods of time
- Relief would first come predominantly by air transport
- Responders would find themselves stripped from using most modern information and communication technologies for the lack of power and intact communication infrastructures

RESEARCH INTEREST

- First responders' biggest challenges in early response are
  - the lack of ***situational awareness (SA)*** and/or ***shared situational awareness (SSA)***, which leads to an incomplete and distorted ***common operating picture (COP)***
  - Information and communication technologies (ICTs) are not always ***part of the solution*** but rather ***part of the problem***
- In this study we focus on the former, that is, information-sharing challenges as well as challenges to situational awareness, information sharing challenges

LITERATURE (ON SITUATIONAL AWARENESS)

- Situational Awareness (SA) and Shared SA (SSA)
  - Endsley presented a comprehensive SA framework, in which she distinguished
    - (1) perception
    - (2) comprehension, and
    - (3) projection

    as three intertwined levels of SA (Endsley, 1995)
  - The notion of and discussion about SA/SSA was informed and influenced by advances in other disciplines and not developed in Disaster Sciences
  - Research needs to address in more detail, which level of SSA is investigated, and how the three levels of SSA transition from one another (including feedback)

LITERATURE (ON EEIS AND INFORMATION INFRASTRUCTURES)

- Essential Elements of Information (EEIs)
  - Itemized lists of assets and critical infrastructure that help guide responders systematically through the collection of detailed and hazard-specific information (Scholl et al. 2017)
  - Strong hindrances to attaining even the entry level of SSA (perception) were also identified in the absence of planning and pre-configuring EEIs
- Information Infrastructures
  - Lack of standardization of information sharing procedures and protocols impeded all levels of SSA and prevented the necessary integration of information from different sources
  - Lack of unified disaster information architecture and a unified system platform shared by responders at all levels (Seppänen et al 2013, 2015)
  - Developing and maintaining SA/SSA and a shared COP depends on information infrastructures, which support vertical and horizontal information flows (Scholl & Patin 2014)

RESEARCH QUESTIONS

- Research Question #1 (RQ#1):
  - What are specific ***information-sharing challenges*** for professional responders in a catastrophic incident response?
- Research Question #2 (RQ#2):
  - What are specific ***SA/SSA-related challenges*** for professional responders in a catastrophic incident response?

METHODOLOGY

- ***Overall Design***: An exploratory study design was chosen based on the theoretical framework of "Resilient Information Infrastructures (RIIs)" in disaster response (Scholl & Palin, 2014)
- ***Instrument* and *Coding Scheme***: Six topical areas were covered, (1) management and organization, (2) technology, (3) information, (4) information infrastructure, (5) Resilient information Infrastructures (RIIs)/resiliency. A total of twenty-five interview questions and probes were incorporated
- ***Sample***: The purposive sample included responders from eight different groups: (1) City Emergency Operations Centers, (2) County Emergency Operations Centers, (3) Washington State Emergency Management Division, (4) WA State Agencies, (5) Health Districts, (6) Regional Aviation, (7) Washington State National Guard, and (8) Federal Emergency Management Agency (FEMA), region X. A total of 17 individuals were interviewed. Furthermore, after-action reports (AARs) from twenty-three agencies from all eight responder groups were collected and analyzed
- ***Data Collection***: Interviews were conducted in person between September 2016 and March 2017 and lasted between 33 to 107 minutes
- ***Data Analysis and Coding***: The initial codebook, which was based on the aforementioned conceptual RII framework, contained five category codes (one for each topical area) and 111 sub-category codes. Additional codes were inductively introduced during data collection, in individual coding sessions, and inter-coder sessions

TOP-30 CODES AND SUB-CODES

Table 1

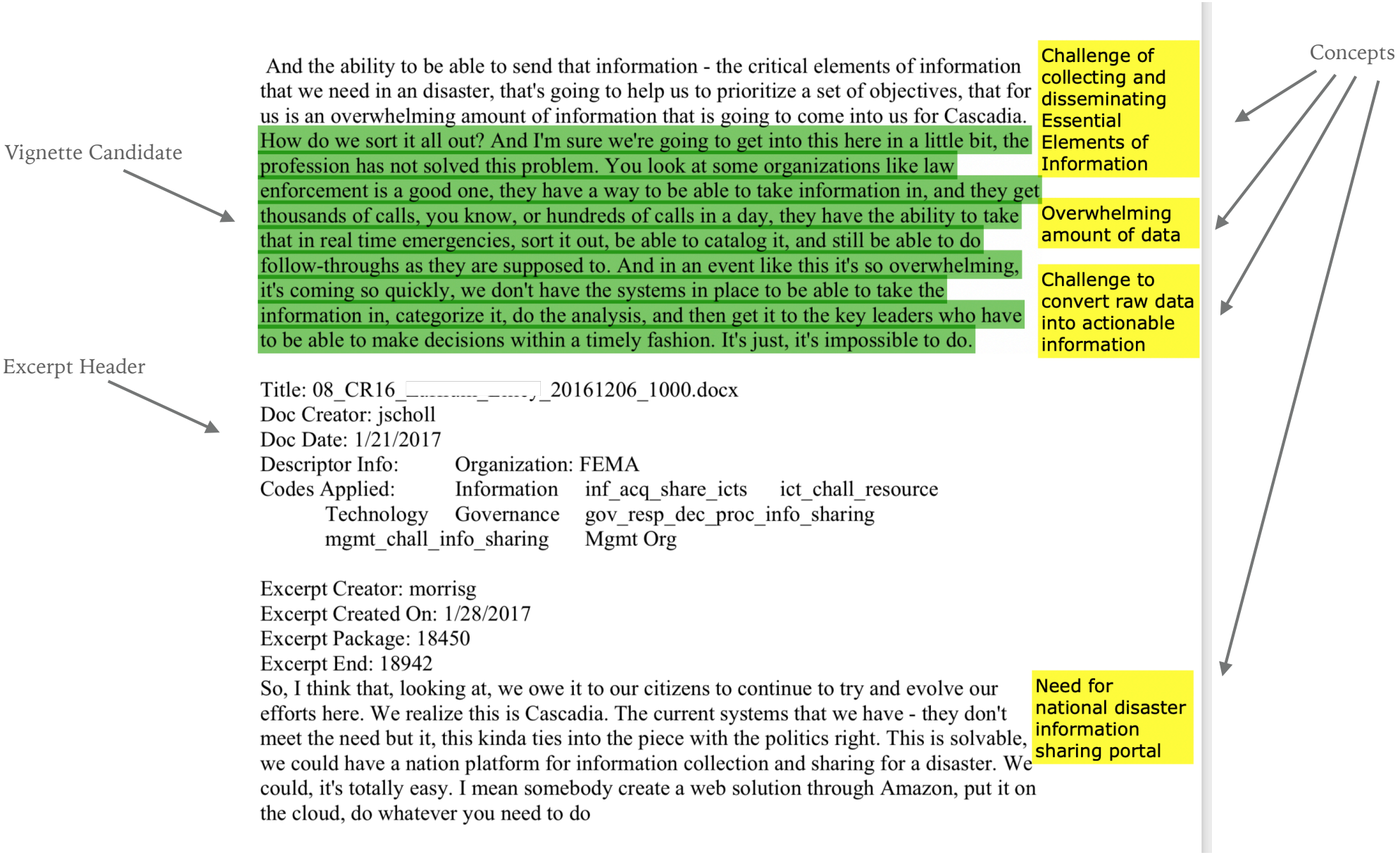
#	Code (grey) / Sub-code	Totals
1	Mgmt Org	9973
2	Information	8074
3	inf_situational_awareness	5311
4	Technology	5216
5	mgmt_chall_info_sharing	4449
6	Information Infrastructure	4088
7	mgmt_chall_resource	3827
8	Resilient IIs	3738
9	ict_use_info_sharing	3325
10	Governance	3156
11	mgmt_chall_org	2972
12	inf_common_operat_pic	2943
13	mgmt_external_partnerships	2773
14	mgmt_structure	2576
15	mgmt_chall_partnerships	2548
16	mgmt_preparedness_incl_lack_thereof	2485
17	ict_chall_using_icts	2278
18	mgmt_operational_rules	2190
19	mgmt_chall_coordination	2014
20	mgmt_resources	1988
21	gov_resp_roles	1716
22	ict_use_in/for_sit_awareness	1662
23	inf_lack_access	1583
24	ict_use_support_collab	1563
25	ii_vulnerabilties	1561
26	mgmt_training_incl_lack_of_training	1548
27	inf_need_resources	1420
28	inf_quality	1392
29	mgmt_assign_roles	1358
30	ii_means_info_handling	1335

Two Papers on "Situational Awareness"

Forthcoming Paper on "Managerial Challenges"

CODE FREQUENCY DESCRIPTOR BUBBLE PLOT (DEDOOSE)

CONCEPT ANALYSIS

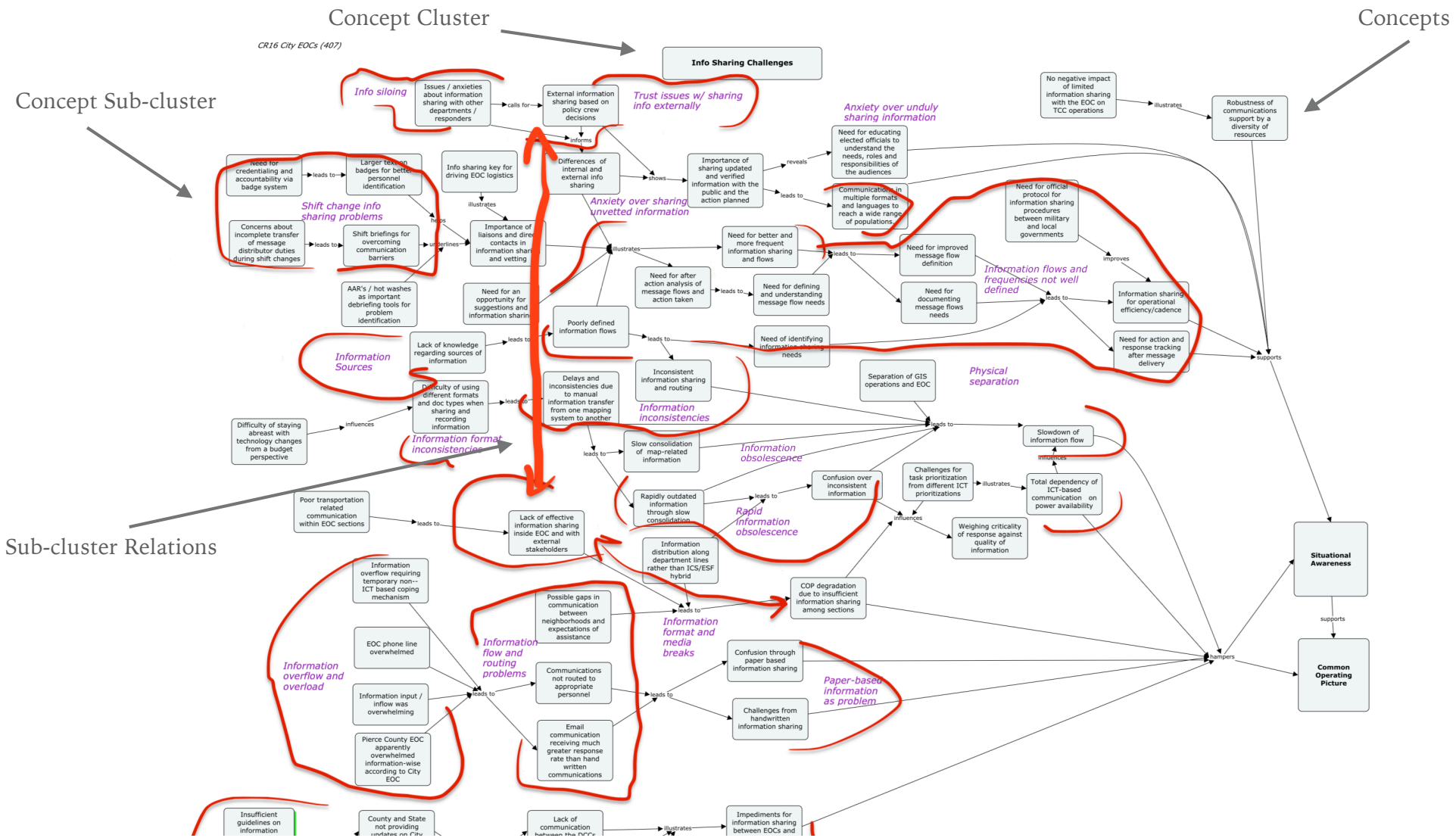


And the ability to be able to send that information - the critical elements of information that we need in an disaster, that's going to help us to prioritize a set of objectives, that for us is an overwhelming amount of information that is going to come into us for Cascadia. How do we sort it all out? And I'm sure we're going to get into this here in a little bit, the profession has not solved this problem. You look at some organizations like law enforcement is a good one, they have a way to be able to take information in, and they get thousands of calls, you know, or hundreds of calls in a day, they have the ability to take that in real time emergencies, sort it out, be able to catalog it, and still be able to do follow-throughs as they are supposed to. And in an event like this it's so overwhelming, it's coming so quickly, we don't have the systems in place to be able to take the information in, categorize it, do the analysis, and then get it to the key leaders who have to be able to make decisions within a timely fashion. It's just, it's impossible to do.

Title: 08_CR16_[redacted]_20161206_1000.docx
Doc Creator: jscholl
Doc Date: 1/21/2017
Descriptor Info: Organization: FEMA
Codes Applied: Information inf_acq_share_icts ict_chall_resource
Technology Governance gov_resp_dec_proc_info_sharing
mgmt_chall_info_sharing Mgmt Org

Excerpt Creator: morrisg
Excerpt Created On: 1/28/2017
Excerpt Package: 18450
Excerpt End: 18942
So, I think that, looking at, we owe it to our citizens to continue to try and evolve our efforts here. We realize this is Cascadia. The current systems that we have - they don't meet the need but it, this kinda ties into the piece with the politics right. This is solvable, we could have a nation platform for information collection and sharing for a disaster. We could, it's totally easy. I mean somebody create a web solution through Amazon, put it on the cloud, do whatever you need to do

LOGICAL AND CHRONOLOGICAL MAPS OF CONCEPTS



FINDINGS (1)

Ad **RQ#1** *(What are specific **information-sharing challenges** for professional responders in a catastrophic incident response?)*

- Lack of Standardized Information Flows, Protocols, and Flow Frequencies
  - Absence of clear-cut definitions and prescriptions of what information had to go where, when, in what frequency, in what format, and at what level of detail
  - Information needs of horizontally and vertically working response units were unclear, or, at least, not clearly known
  - No standardized push mechanism nor any standardized pull mechanism for sharing information between responder units, even within the same jurisdictions
  - Using the standard ICS213 message form, which only specifies the elements of basic messaging, does not do the trick
- Information Sources, Information Needs, and Information Overload/Overflow
  - Problem of identifying the adequate lists and paths for distribution of important information to recipients with a need to know
  - Lack of checklists known as hazard-specific “Essential Elements of Information” in many jurisdictions

FINDINGS (2)

Ad **RQ#1** *(What are specific **information-sharing challenges** for professional responders in a catastrophic incident response?)*

- Balance between detail of information and aggregation/consolidation of information
- Data overflow problems

➤ Information Inconsistencies, Obsolescence, Vetting, and Information Sharing Anxieties

- Information is incomplete, ambiguous, and even contradictory. Time consuming process of vetting, de-conflicting, and verifing
- Only vetted information was passed on at the expense of potentially valuable time lost
- Obsoleted information even before the vetting was complete
- Reluctance to sharing information beyond their own functional needs, or for other reasons

➤ Impacts of Shift Changes and Physical Separation

- Shift changes were found a missed opportunity for effective information sharing between responders (fatigue, lack of planning or protocol, or other reasons)
- Lack of relaying important information including COP causing costly double work

FINDINGS (3)

Ad **RQ#2** *(What are specific **SA/SSA-related challenges** for professional responders in a catastrophic incident response?)*

- Reliance on Trustworthy Channels, Quickness of Information Collection, and Issues of Verification
  - No standardization of the information vetting and verification process leading to SSA/COP
  - Trustworthiness of exchanged information resting on the trust that was pre-established between sender and receiver rather than the message content itself, or other criteria and indicators of veracityVarious COTS (commercial-off-the shelf) systems
  - Slow information collection leading to incomplete and delayed SSA/COP
- Importance of SSA/COP Visualization and Regular Status Updates
  - Pre-incident planning needs to focus on identifying means of how data can be meaningfully filtered without losing essential information in the process
  - Information overload to occur only as long as modern ICTs and networks are fully functional
  - Near-total blackout creates the more likely and prevailing problem of not obtaining important information
  - Importance of SSA/COP visualization, both low- and high-tech, based on interactive charts, status boards, and otherwise

FINDINGS (4)

Ad **RQ#2** *(What are specific SA/SSA-related information and communication technology (ICT) challenges to professional disaster responders on all levels in the early stages of response to a (simulated) catastrophe?)*

- Damage Assessment and the Important Role of Essential Elements of Information
  - Immediate assessing of damage to critical infrastructures also relative to responders' own capabilities
  - Windshield surveys conducted by Police and Fire for initial information collection on damage
  - EEI checklists proved invaluable when trying to instill order into the information collection, management, and dissemination process
  - Far from all juris-dictions had developed these checklists and standard-ized processes for information collection and handling

DISCUSSION (1)

- Persisting Known Problems
  - Several SSA/COP-related issues had been observed and analyzed before (missing standards for information sharing, the need for developing hazard-specific EEI checklists and contact lists,lack of information integration
  - The current study re-confirmed exactly the unabated persistence of these key issues
- This study: Additional issues and more detail regarding the known problems
  - Need for Standardizing Information Collection, Verification, and Dissemination Methods
  - Inclusion of mechanisms and methods for collection (push and/or pull)
  - Verification methods and levels (for example, confidence levels from unverified, verified in part, or fully verified)
  - Dissemination methods and formats (for example, standardized SitReps)ICT mirror infrastructures outside impact area as alternative
- Importance of "Essential Elements of Information" (hazard-specific lists) provide guidance through information collection and dissemination regarding assets of critical infrastructures

DISCUSSION (2)

- Rethinking the Information Sharing Paradigm
  - Vetting and verifying information before passing on or using it for informing response efforts ("erring on the side of caution")
  - Passing on information with a status label, which informs the recipient of the vetting status, might be preferable to hoarding and siloing information. This change of information sharing practice and policy may need some effort to implement including culture change efforts
- Information Integration and Visualization
  - Separate formats basically stayed separate and were not compiled into a single whole, so that information remained incomplete and distorted.
  - Once properly integrated information needs to be also adequately visualized (interactive charts or on paper/whiteboard-based status boards)
- Shift Overlaps for Maintaining SSA/COP as Low-hanging Fruits
- Need for Contingency Planning and Paper-based Operations

CONCLUSION AND FUTURE RESEARCH

- Response to a Catastrophe Markedly Differs from Responses to "Regular" Emergencies and Non-catastrophic Disasters
  - Balance between a high degree of procedural flexibility, while maintaining adherence to basic response paradigms and principles determines to a great part the quality of the SSA/COP
- Need for Scalability (Back to Pre-IT Times and Back Forward)
  - Paper-based, runner- based, as well as low- or no-technology-based operations need to be redeveloped and practiced along with their gradual transition to more advanced procedures and methods as soon as those become available
- Cascadia 2022
  - It was recommended (and now is planned) that the exercise be repeated and conducted under the assumption of an even more severe scenario with stingier injects
  - Practicing SSA/COP operations in a long-term blackout information environment as well as under the assumption of massive initial decimation in local response assets and capabilities
- Currently, the US Pacific Northwest would be caught absolutely flat-footed by a mega-thrust

THANK YOU!

QUESTIONS OR COMMENTS?