Ontology Based Updates in Sparse MANETs for Rescue Scenarios

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Outline

- Problem statement
- Ontology Based Update
- Dynamic Update
- Example Rescue Ontology
- Related work
- Future work
Problem statement

- Network wide information sharing in rescue operations
  - Avoid information overflow
  - Cross organisational administration
  - Information not static, frequent updates
  - Only partial view of available information

- Three main tasks
  - Establish who needs what information
  - Enable vocabulary sharing & mapping
  - Efficient metadata management
Ontology Based Update in Rescue Scenarios

- Motivation
  - Accommodate rescue operation structure and organisation
  - Better dissemination of most important information

- Influencing factors
  - Rescue operation context model
  - User role in rescue operation
  - Type and importance of information
Achieving Ontology Based Update – suggested solution

- Ontologies to represent
  - rescue operation context model
  - profiles for user, device and information

- Update priorities
  - information types
  - rescue operation roles

- Operational structure and organisation
Issues of Dynamic Update

- Dynamicity and limited resources
  - unstable availability

- Frequent updates
  - increased communication needs
  - consistency issues

Need efficient metadata management to achieve ontology based update in this environment
Three-layered approach

Conceptual

Ontology layer

Semantic/topical Context

Information layer

Implementation

SDDD – linking level

LDD – metadata

SDDD = Semantic Linked Distributed Data Dictionary. LDD = Local Data Dictionary.
Dynamic Update

- Update special case of SDDD exchange
- Timestamps
- List of previous exchanges
- Only update changes since time of last exchange
## Kinds of Dynamic Update
- **Overview**

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<thead>
<tr>
<th></th>
<th>Between Entities</th>
<th>Metadata or Data</th>
<th>Change or Append</th>
</tr>
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<tbody>
<tr>
<td>(Vertical) Local update</td>
<td>Different level data dictionaries</td>
<td>Metadata</td>
<td>Both</td>
</tr>
<tr>
<td>(Horizontal) Metadata Exchange</td>
<td>SDDDs</td>
<td>Metadata</td>
<td>Append</td>
</tr>
<tr>
<td>(Horizontal) Ontology Based</td>
<td>SDDDs &amp; KBs</td>
<td>Both</td>
<td>Both</td>
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SDDD = Semantic Linked Distributed Data Dictionary. KB = Knowledge Base.
Example of Organisation and Structure in Rescue Operations

Legend:
RCC = Rescue Command Central
RSC = Rescue Sub Centre
OSC = On Scene Commander
Simple Model of Rescue Operation Roles
Upper Ontology for all Profiles
Information Profile and example information priorities
Rescue Scenario Timeline – Populating the Knowledge Base

- **Phase 1:** initial population of knowledge base
- **Phase 2:** ontology individuals for current operation
- **Phase 4:** adjustments: changes and new arrivals
Handling Profile Ontologies in our Architecture

- **Storage - who keeps what?**
  - Based on user role in rescue operation
  - Each node keeps its own device profile and user profile

- **Components**
  - Rescue ontology profiles
    - Profile and Context Management
    - Semantic Metadata and Ontology Framework
  - Sharing and dynamic update
    - Data Dictionary Manager

- Viewed as resources to be shared
Approaches to Update in Related Work

- **MoGATU**
  - profiles and ontologies for filtering and prioritising

- **AmbientDB**
  - database update queries, rule based

- **Shark**
  - stationary KB for synchronisation, Knowledge Ports (ingoing, outgoing) for information exchange

- **DBGlobe**
  - updates, profiles and metadata storage handled by stationary servers
Future Work

- Consistency
- Vocabulary Mapping
- Rescue Ontology
  - profiles for modelling dynamic context
  - models for different rescue operations
  - support configuration decisions for metadata management
Thank You!

Questions?

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