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

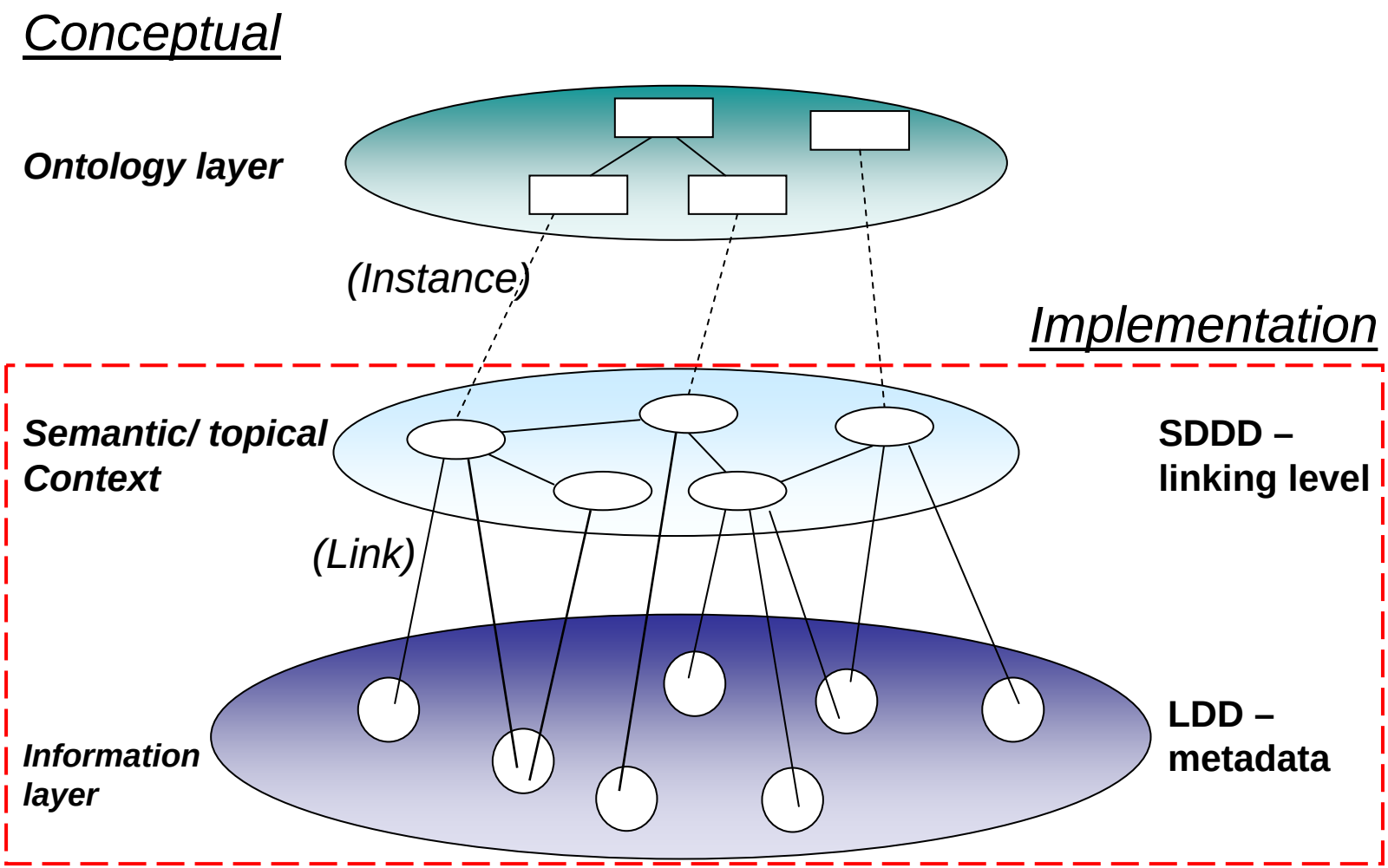
- Ontologies to represent
  - rescue operation context model
  - profiles for user, device and information
- Update priorities
  - information types
  - rescue operation roles
- Operational structure and organisation

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



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

Dynamic Update

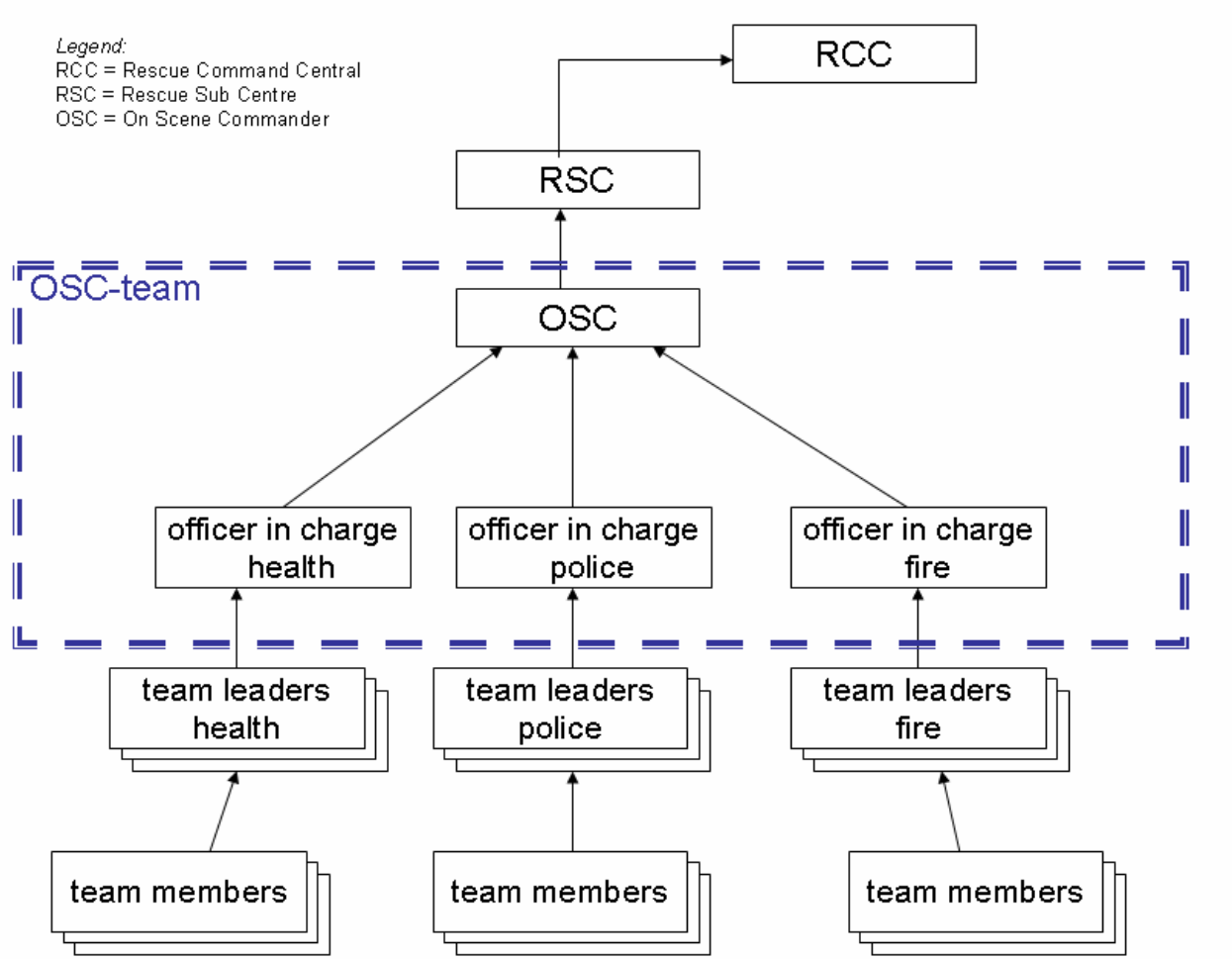
- Update special case of SDDD exchange
- Timestamps
- List of previous exchanges
- Only update changes since time of last exchange

Kinds of Dynamic Update - Overview

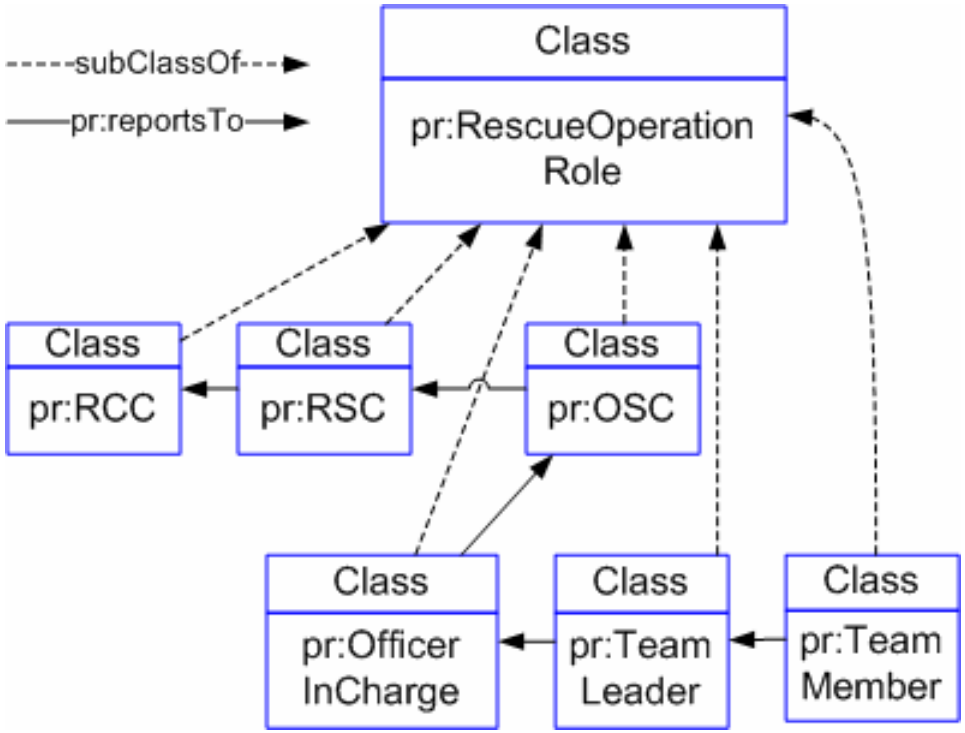
	Between Entities	Metadata or Data	Change or Append
(Vertical) Local update	Different level data dictionaries	Metadata	Both
(Horizontal) Metadata Exchange	SDDDs	Metadata	Append
(Horizontal) Ontology Based	SDDDs & KBs	Both	Both

SDDD = Semantic Linked Distributed Data Dictionary. KB = Knowledge Base.

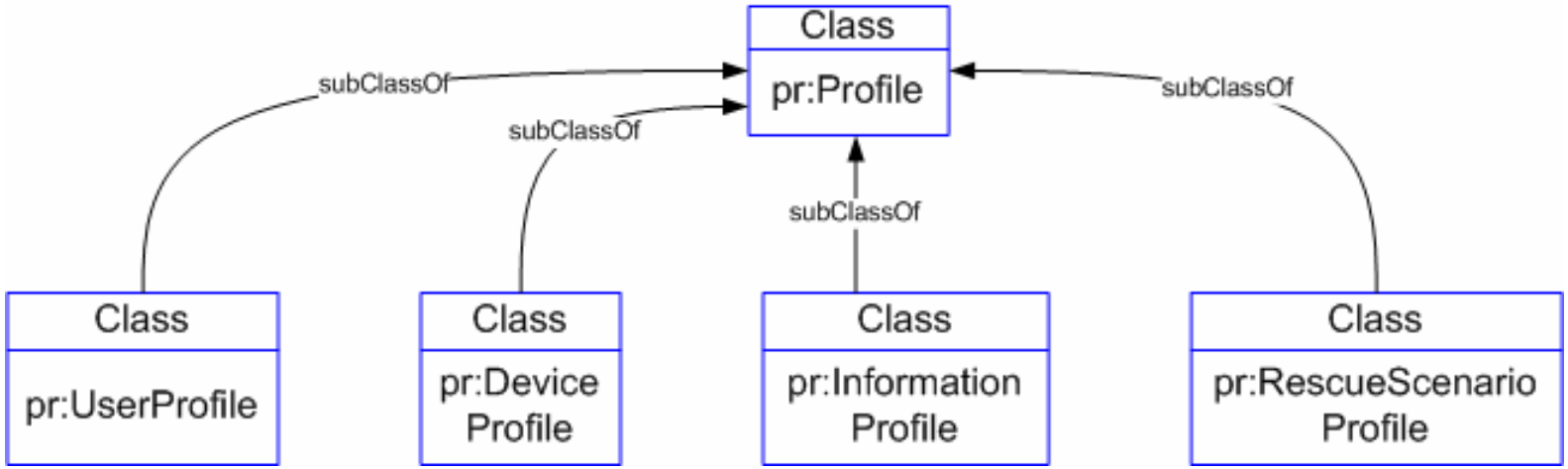
Example of Organisation and Structure in Rescue Operations



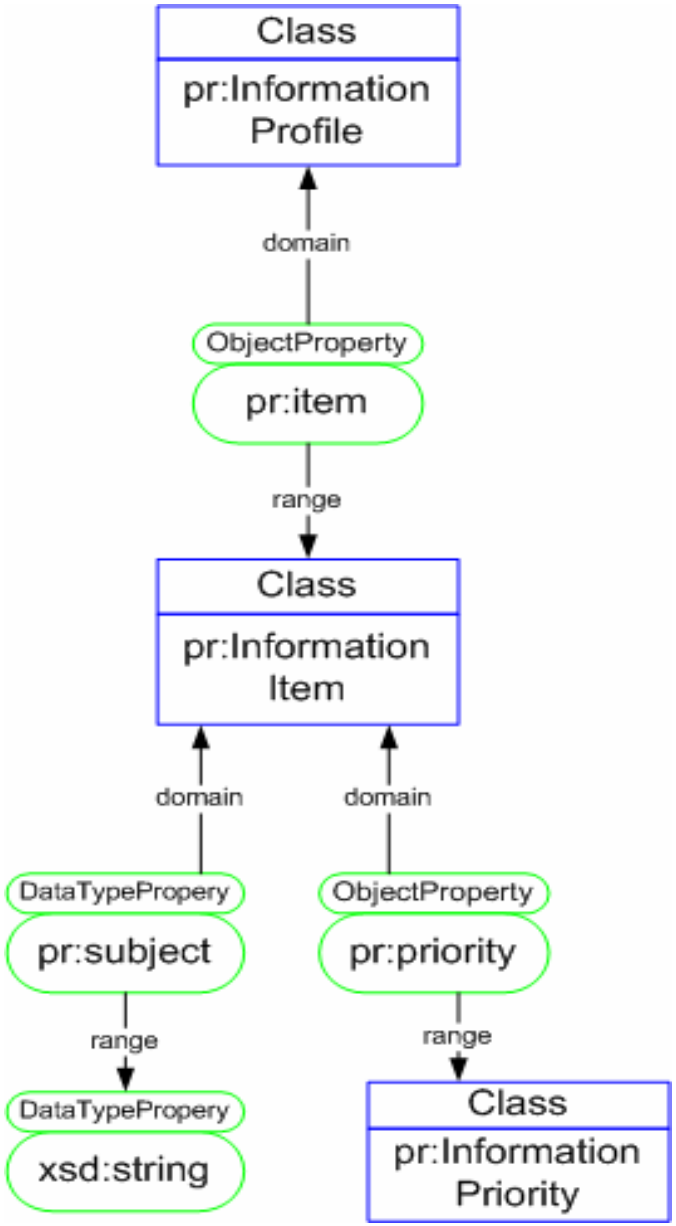
Simple Model of Rescue Operation Roles

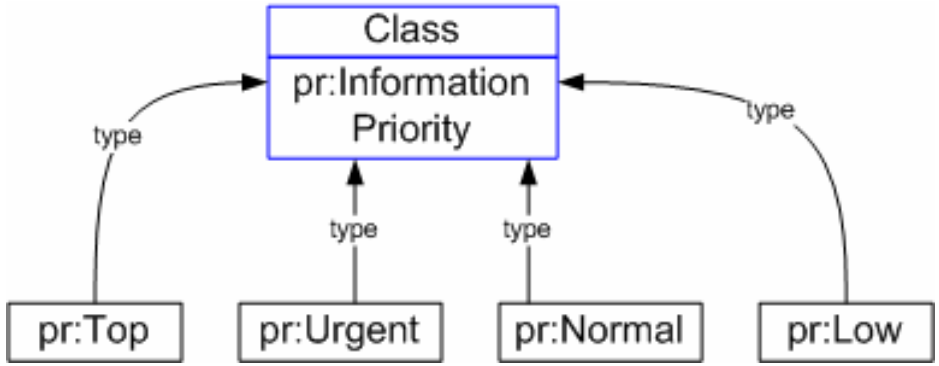


Upper Ontology for all Profiles

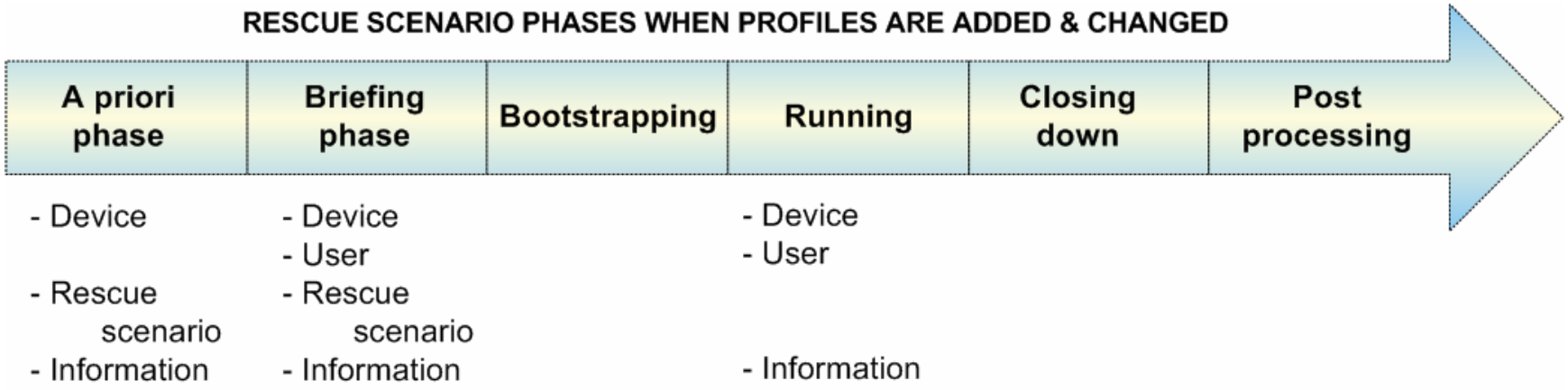


Information Profile and example information priorities





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 metdata 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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