

On Modeling, Collecting and Utilizing Context Information for Disaster Responses in Pervasive Environments

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- **Motivation**
- **Modeling & Utilizing Context Information in Disaster Scenarios**
- **Prototype Implementation**
- **Summary & Outlook**

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Motivation 1

- large-scale disasters require **large-scale response support** from various organizations & people
- **ad-hoc networks** of mobile devices
→ simplify the management of tasks responding to disasters & foster information gathering for disaster responses
- context information = information about the status of various entities (teams, support workers (+ their capabilities & activities), victims, infrastructures, resources and devices)
→ **dynamic** process planning (for GIS based disaster management & decision making)
- not only professional teams shall efficiently utilize (gathering & sharing) context information in pervasive environments but also **ordinary people**
→ collaborative gathering & sharing of context information



- **objectives: presentation of**

(1) extensible & interoperable representation for describing context information required for disaster responses

- existing context representations are not sufficient for disaster management
- disaster scenario; differences to existing scenarios? lack of an interoperable model!
- generic concepts exist → will be reused (e.g., XML, RDF, CC/PP, W4H)

(2) possible ways to utilize the representation (for gathering & sharing of context infos)

- disaster response management involves a lot of humans → need for fostering collection & dissemination of context information
- tools (for mobile devices) exist, but have to be integrated & adapted
- Sahana system, framework & specifications exist (e.g., EDXL, CAP, CIMS framework)

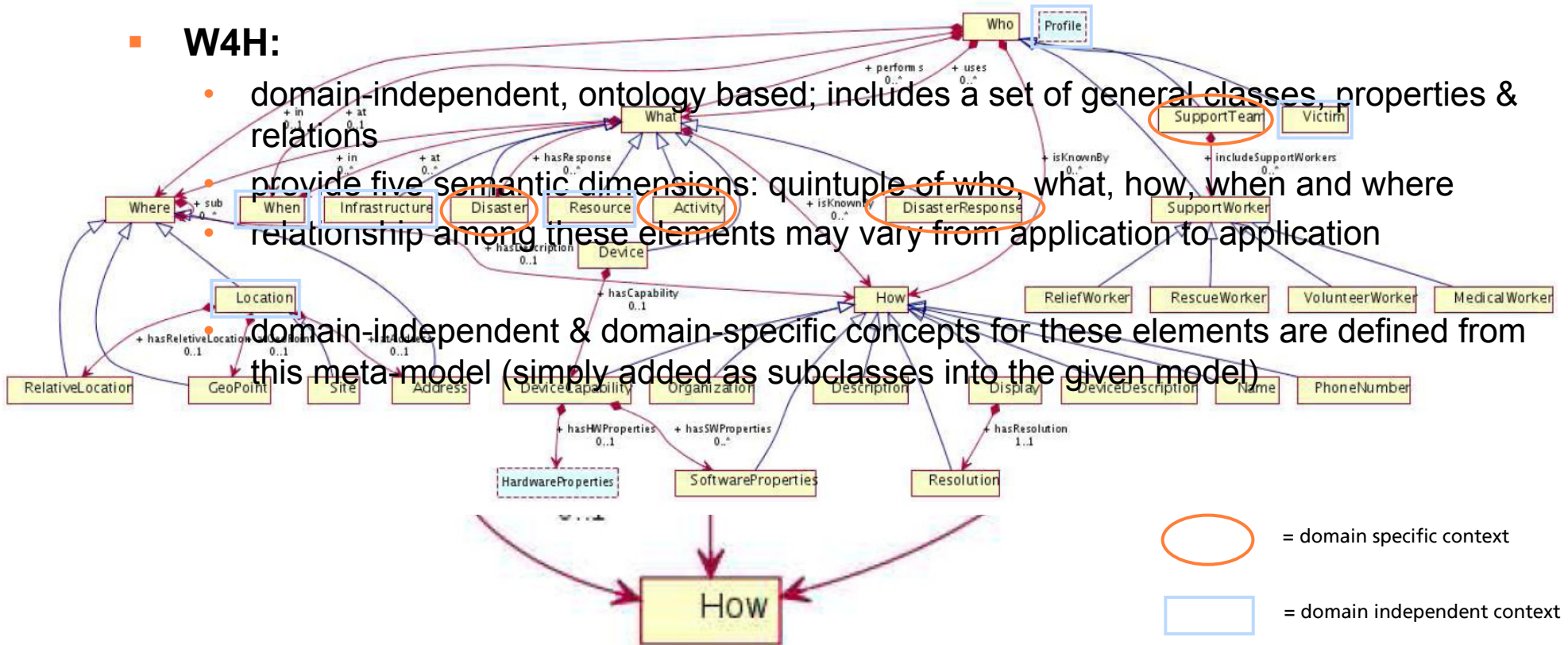


Modeling Context Information in Disaster Scenarios

- design of the context model is influenced by W4H classification (for context data) + generic ontologies, e.g., FOAF, vCard & OWL-Time

- W4H:**

- domain-independent, ontology based; includes a set of general classes, properties & relations
- provide five semantic dimensions: quintuple of who, what, how, when and where
- relationship among these elements may vary from application to application



domain-independent & domain-specific concepts for these elements are defined from this meta-model (simply added as subclasses into the given model)

- Context information should be gathered by using different devices
- XML for data representation based on interoperable data exchange model
- different context helpers libraries according to different types of applications (on PDAs, (sub)notebooks or desktop computers) & services (GIS or notification service)

(1)

- Java/C# classes were extracted based on XSD schema (which in turn is based on context model)
- these classes + SOAP libraries → **SOAP-based mobile clients & services**

(2)

- libraries for specifying & processing context information in JavaScripts, XForm & HTML forms and JSON
- these libraries + REST-based APIs → **Web-based GUIs & REST-based web services**



- many types of context information (location, device information, network) are automatically collected, e.g., via software sensors
- methods for gathering context information of different devices

(1)

- GUI-based applications
- context information (XML files) → team's context management service → back-end system (agreed terms defined in the context model & used in applications)

(2)

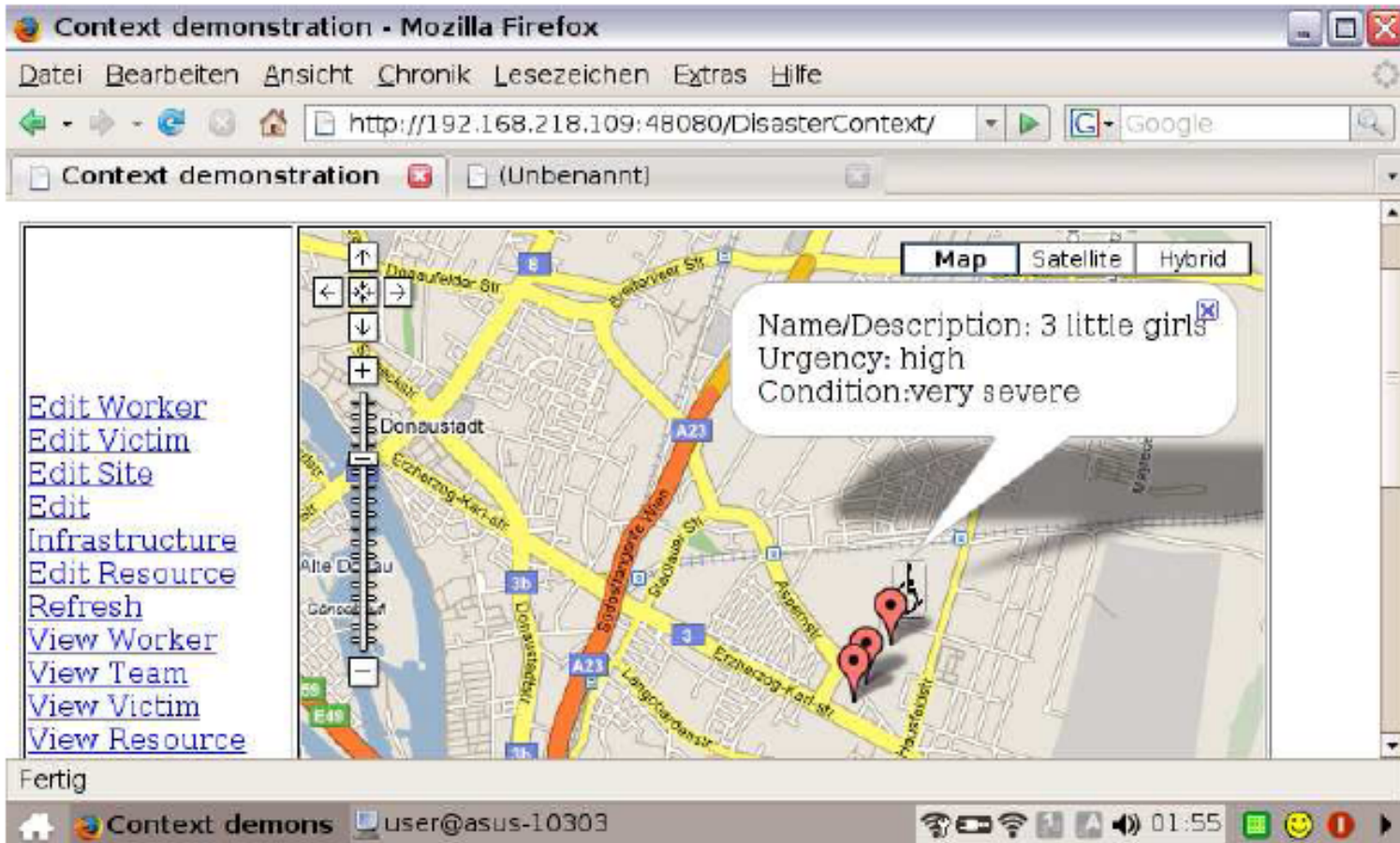
- software sensors can be embedded into the application's code
- conducted data with GIS tools → context management system (by enriching GIS data with context information (annotations) → context sensors extract context information for up-to-date status of the disaster response)



Prototype Implementation

- based on web service technology

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Front-end of teams: peoples and mobile devices

Back-end of teams: peoples and high-end servers

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Summary & Outlook

- **focus: software engineering (clients, libraries, framework) & integration issues with respect to context modeling & techniques for gathering & sharing context information**

future work:

- **integration with other context management services & situation-aware service composition techniques**
- **performance analysis in large scale setting**

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Thank you!

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