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Collaborative Crisis Management for Protecting Critical Infrastructures

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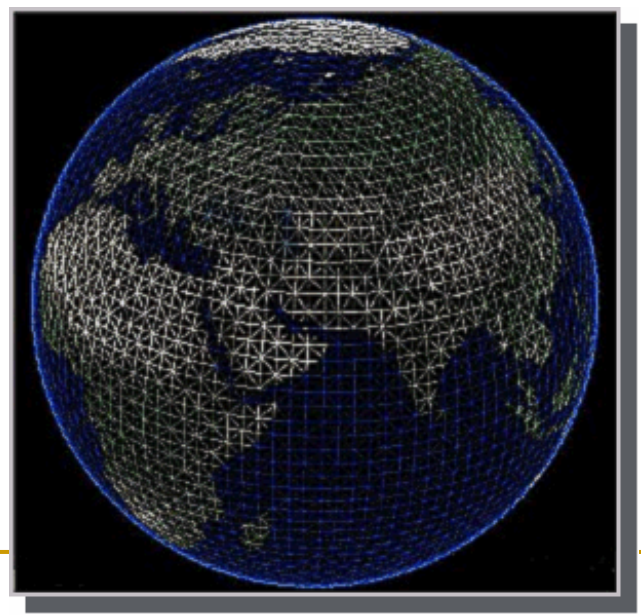
Contents

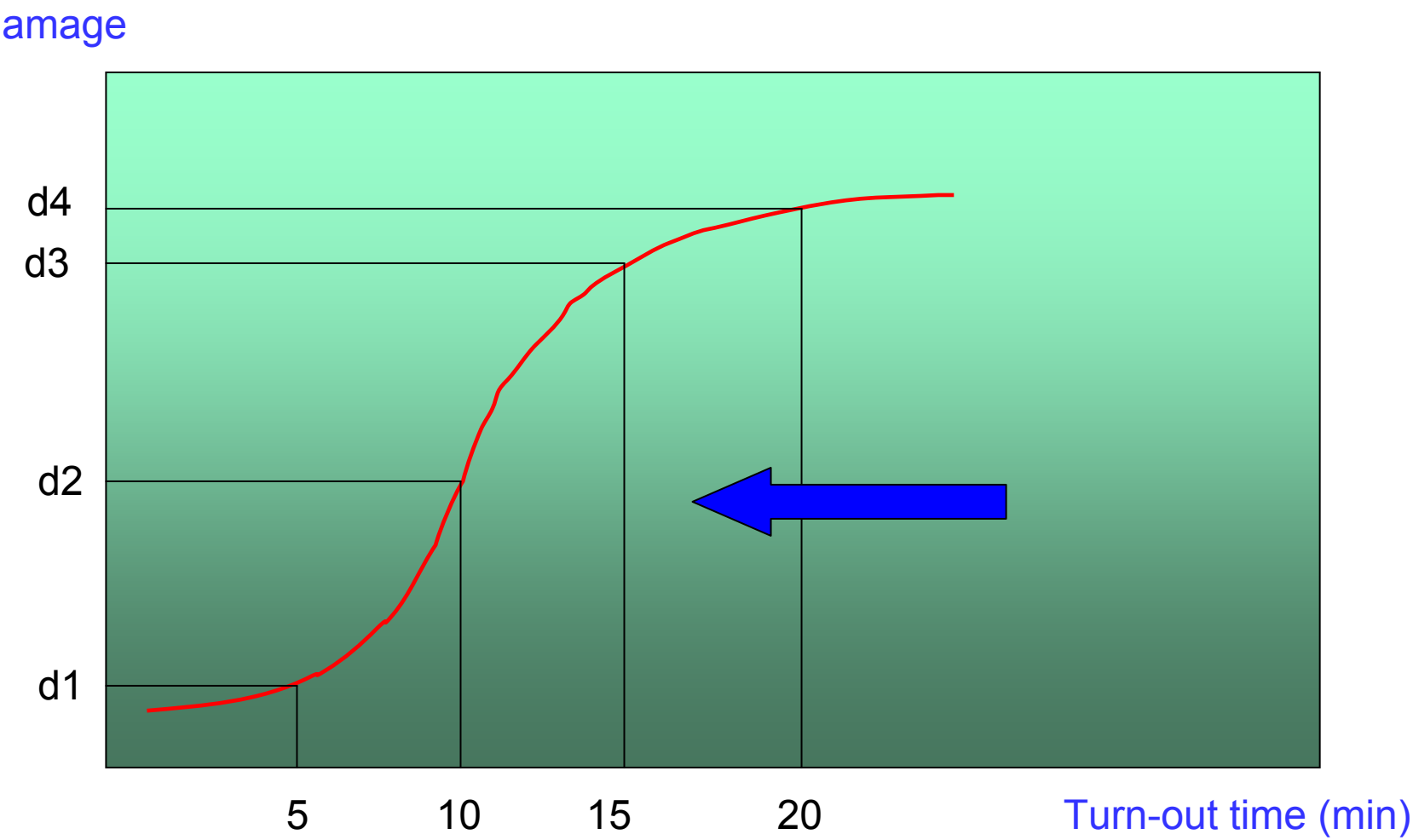
- Information technology and crisis management
- Collaborative aspects of crisis management in MEDSI
- GIS and geospatial interoperability
- Symbology and information fusion
- Conclusion and further work



Introduction

- Advancing the field of crisis management in Europe
- Information as a resource
  - The right information to the right people for the right task at the right time
- Integration from various sources in a meaningful way
- EU FP6 project MEDSI
  - Employ modern IT to increase preparedness to respond in emergency situations
- Two real-world scenarios:
  - Magdeburg flooding
  - Holon hazmat

Relationship: damage - time



Source: Swedish Rescue Service Agency, Karlstad, Risc Management Division

MEDSI partners

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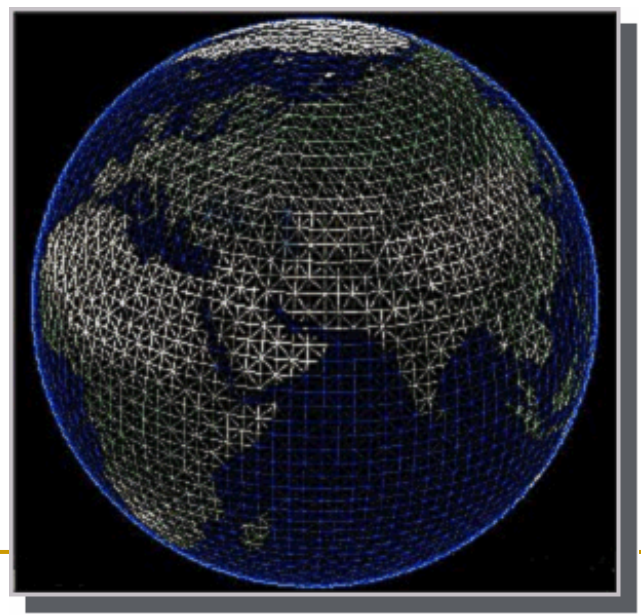

Collaborative Crisis Management

- Several organizations involved
  - under the coordination of Crisis Center
    - Police
    - Firemen
    - Emergency Health&Care
    - ...
  - other “civilian” organizations
    - Hospitals
    - Municipalities
    - Meteorology Service
- Organizations need to “act” coordinately
  - Exchange information
  - Understand each others information
  - Know real-time sensor data
  - Three C’s: Collaboration – Coordination - Communication

Collaborative Crisis Management

- Requirements for collaborative crisis management
  - distributed access to external data sources for real-time data
    - using web services – for “regular” data
      - e.g: number of available beds in a Hospital
      - e.g: water level provided by sensor networks
    - using Open Geospatial Consortium (OCG) compliant implementations – for GI
      - e.g: meteorology /environmental information
  - backed up by a large local repository for static data...
    - some managed by MEDSI
    - other uploaded to the crisis center upon agreement with the responsible organization

Collaborative Crisis Management

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- Requirements for collaborative crisis management (cont.)
  - distributed work environment also inside the crisis center
    - need for workflow support
    - need to “freeze” and share a view of the work environment
      - including GI views!
  - common understanding of symbology
    - ontology for CI objects – CI specific layers
    - symbology generator
      - based on metadata descriptions

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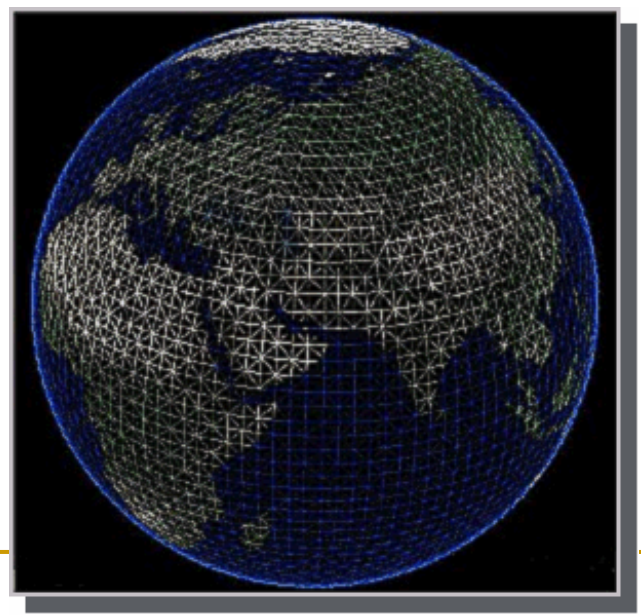
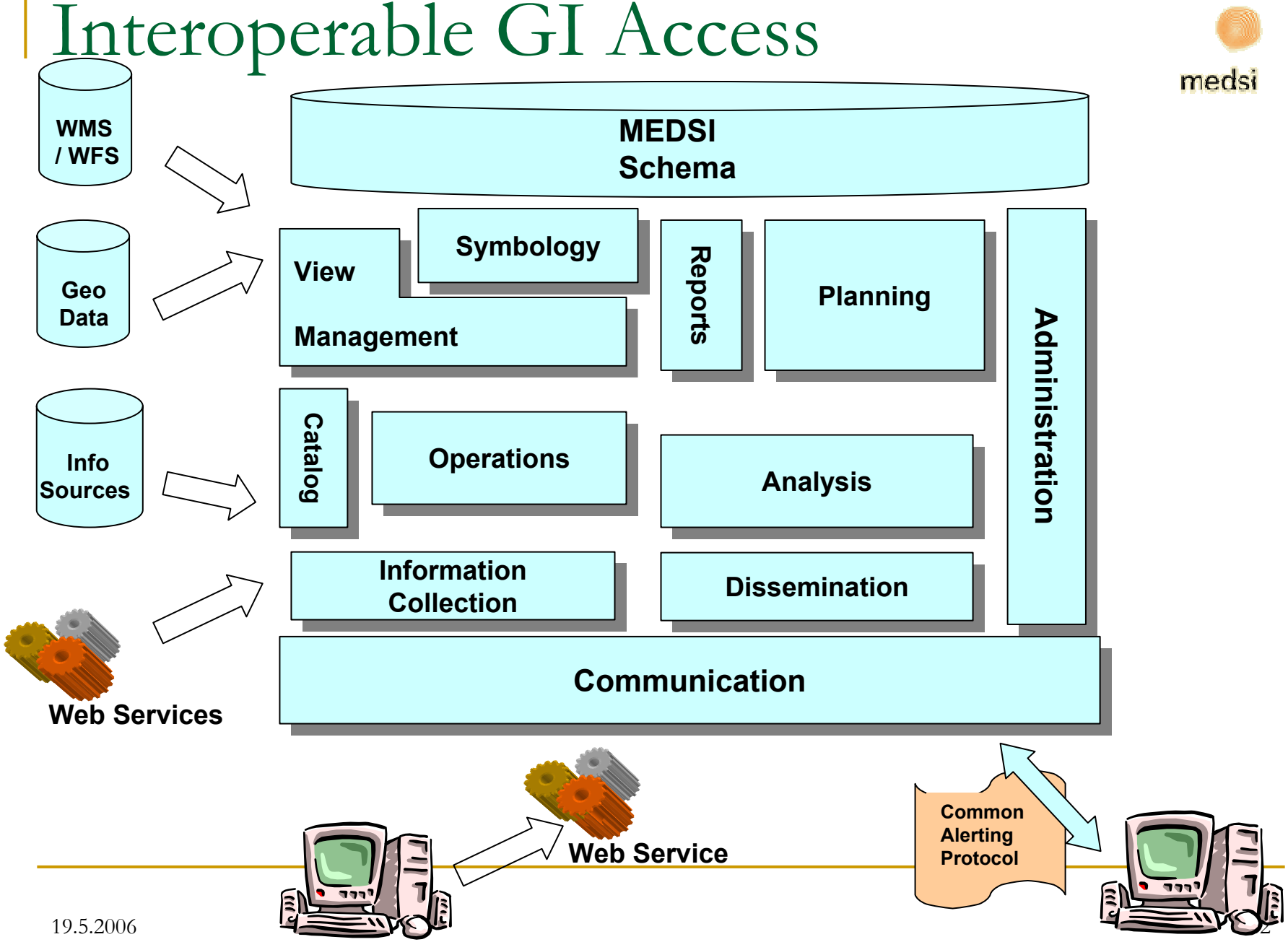


Interoperable GI Access

- Use of an OGC compliant WMS and WFS client
  - to access external geo-data sources
  - but also internal geo-data sources
- Finding “registered” data sources by means of a Catalog Service
- Currently, MEDSI prototype is accessing data from
  - a *deegree* server
  - a *GeoMedia (Intergraph)* server
  - a UMN *MapServer*

Interoperable GI Access



Interoperable GI Access

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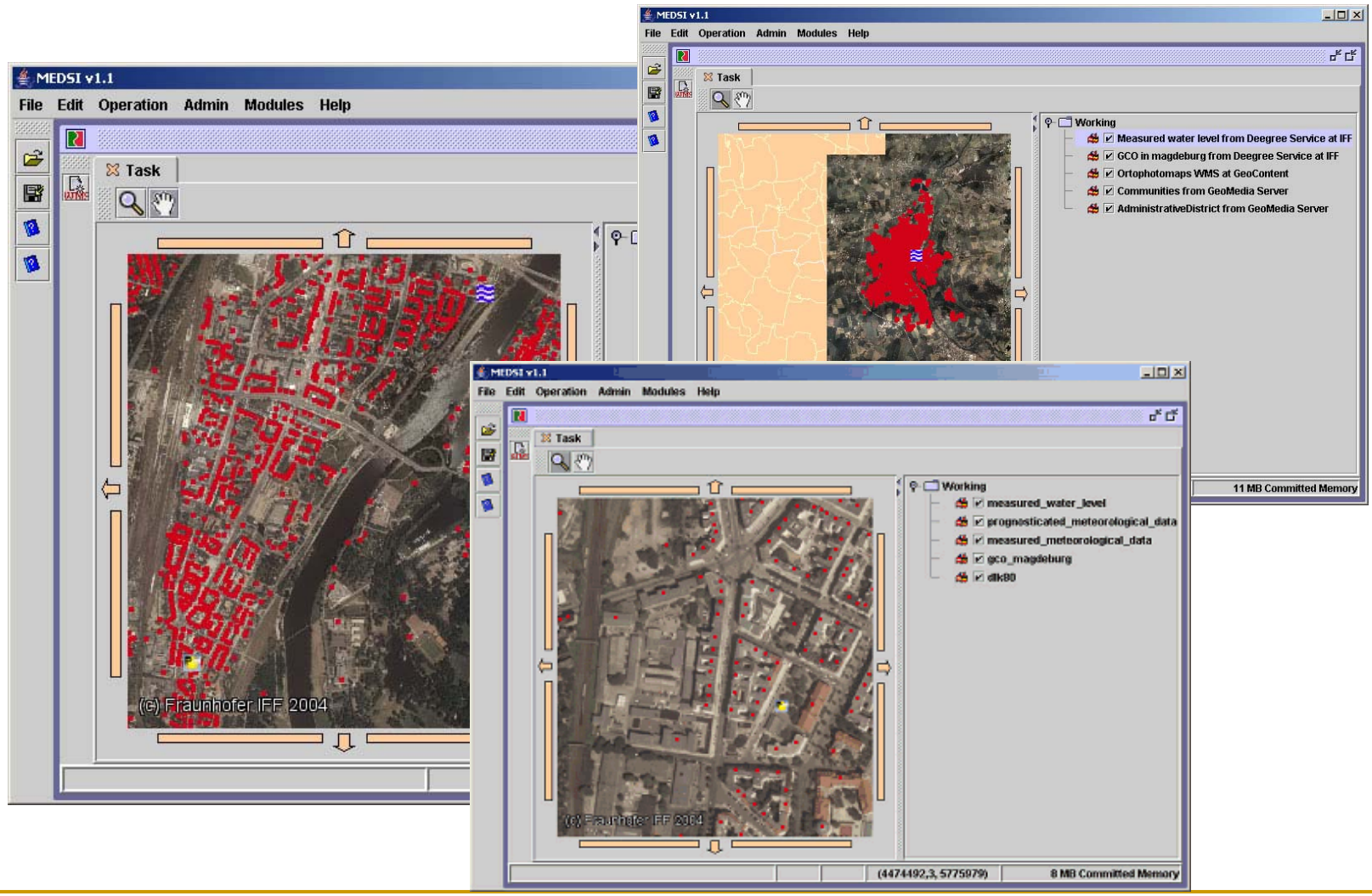

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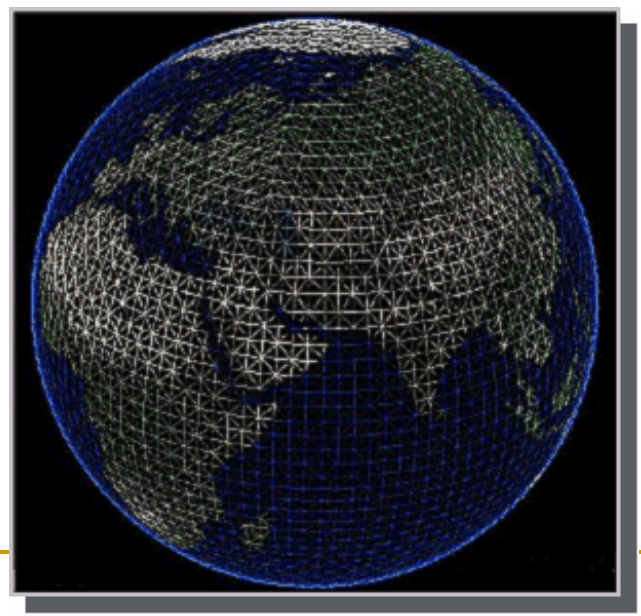
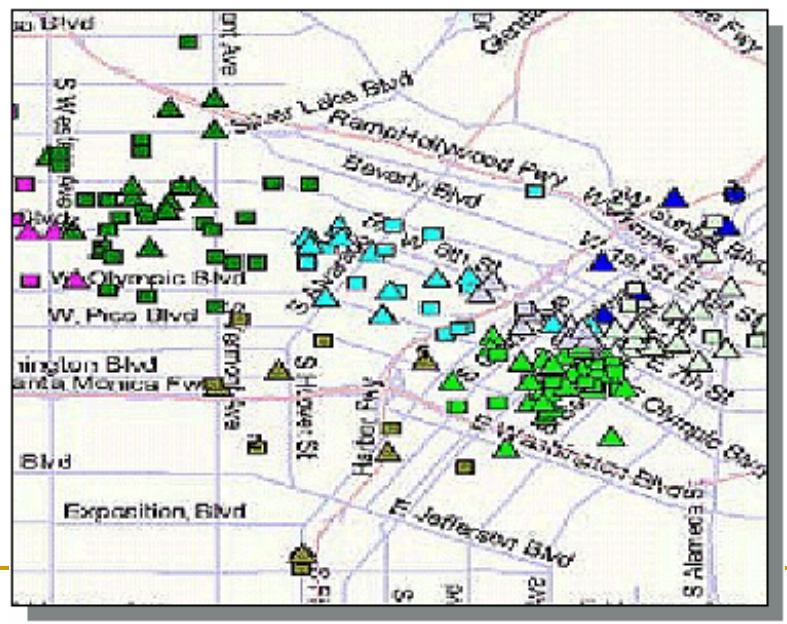
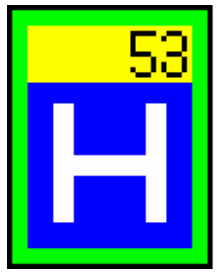


Symbology

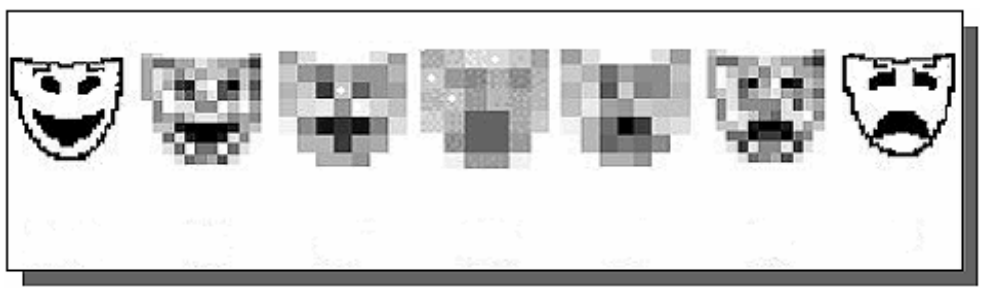
- Representation of objects on the map
  - point, line, area, volume
- Information content of a map with symbols
  - cognitive methods, information overload
- Information fusion
  - simplification
  - generalization
  - symbolization



Symbology



- Symbol components:
- Principles:
  - Stored icons (32x32), dynamically generated symbols
  - Commonly used symbols
  - Frame color indicates CI object status: green OK, red NOT OK
  - Reserved space for dynamic information: no. of beds in a hospital
  - Additional information with graphic operations
    - Example: blurred symbol for uncertainty, transparent for less relevant objects

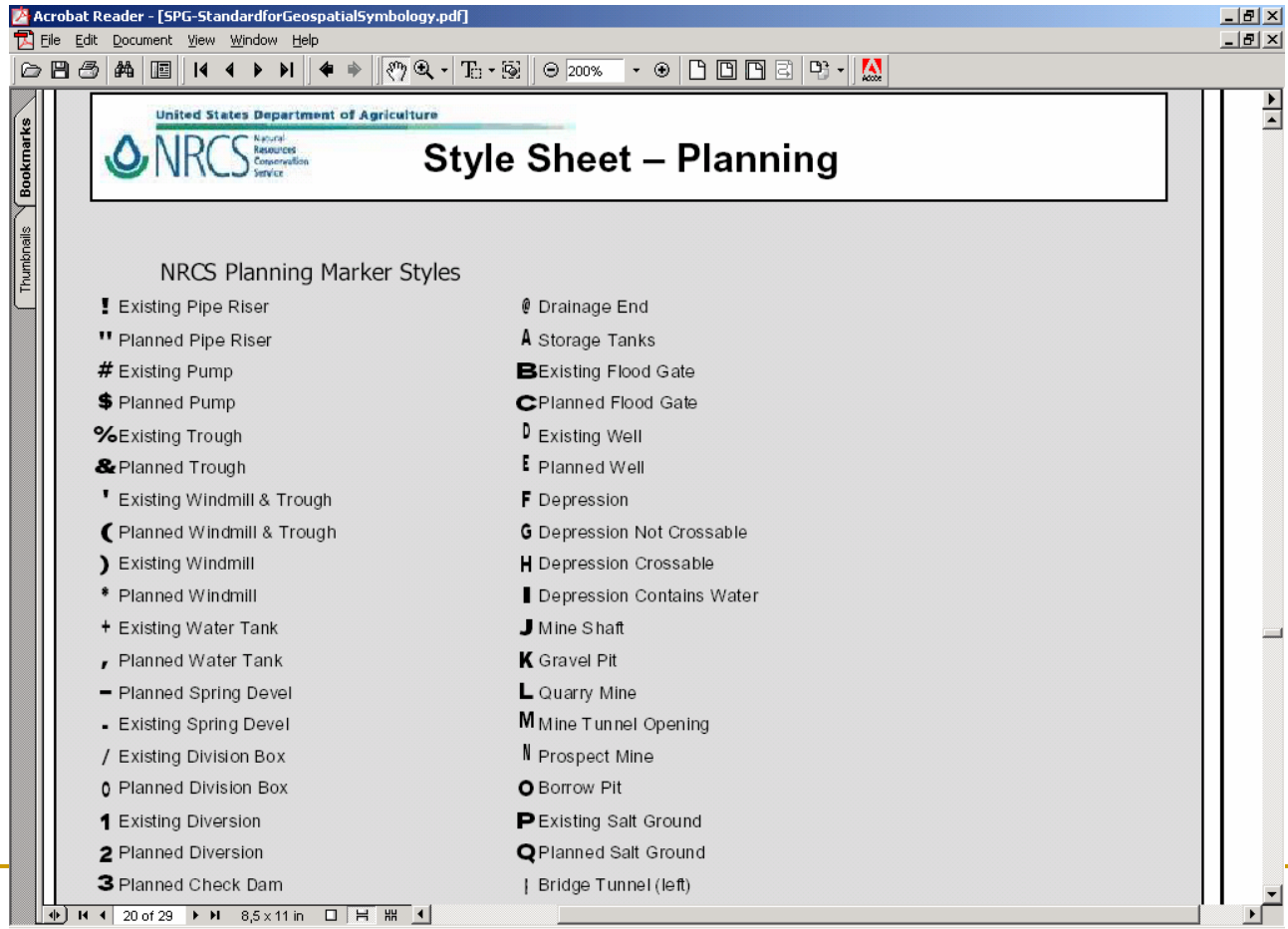


Overview of modern trends I

- OGC (www.opengeospatial.org)
  - SMS (Style Management Service): mapping from features to parametrized symbols
  - SLD (Styled Layer Descriptor): XML based descriptor
- Kent State University, Ohio (U. Dymon)
  - Symbology analysis
  - Theoretical framework for designing emergency mapping symbols
- State university of New York at Buffalo (A. Bisantz et al.)
  - Cognitive approaches to symbology aiming at increasing human performance
  - Information content of a map - information overload, data fusion, information fusion
  - Approaches to dynamic symbol design
  - Evaluation based on experiments

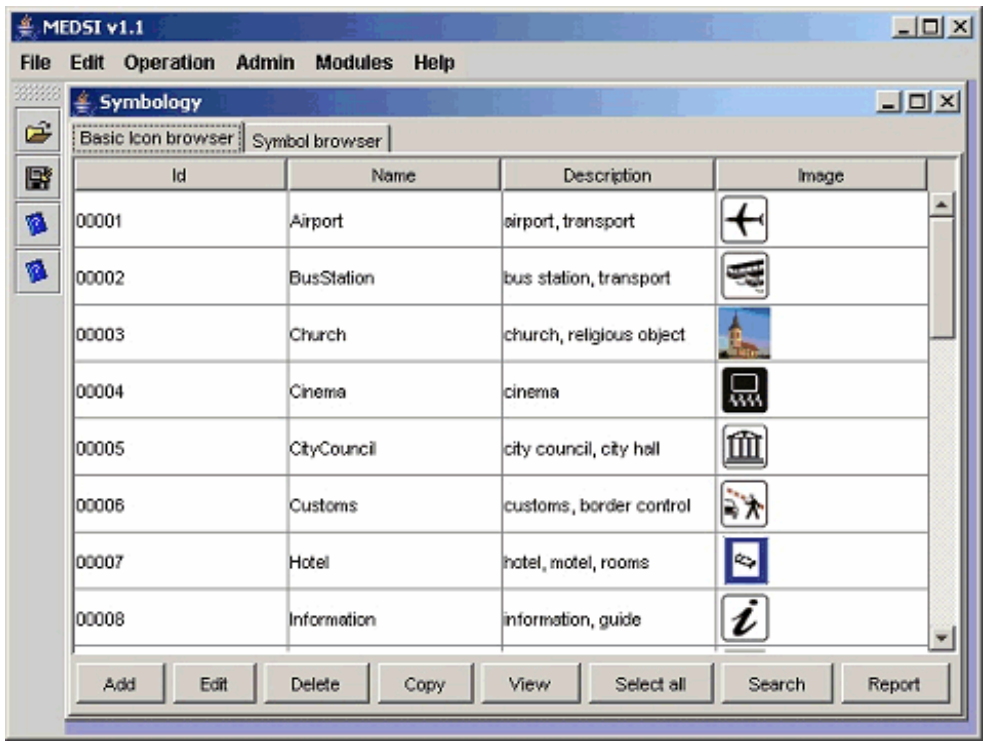
Overview of modern trends II

- Approach towards symbology standardization
  - United States Department of Agriculture (2004): Standard Geospatial Symbology



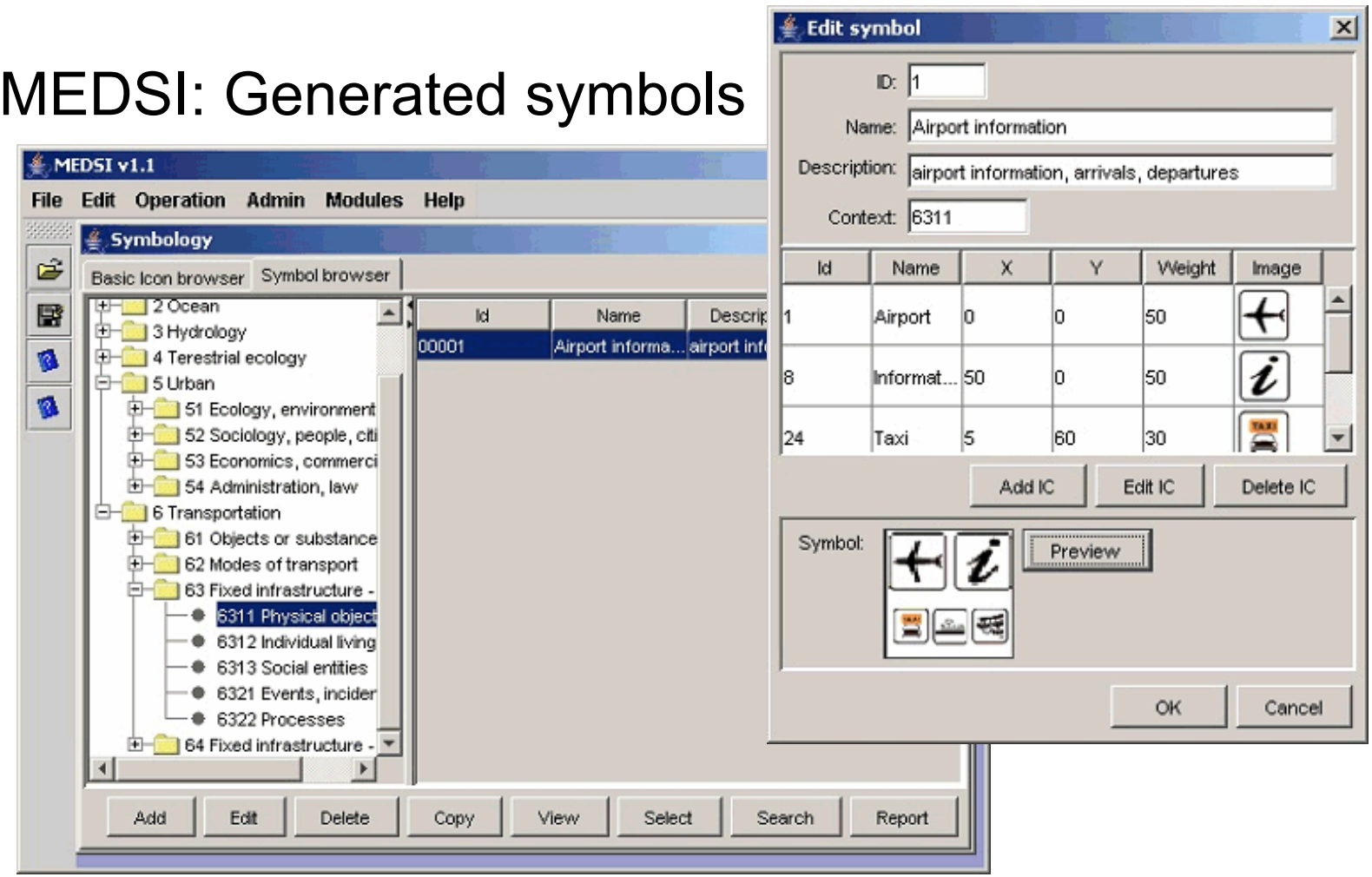
Symbology

- MEDSI: Basic icons browser



Symbology

- MEDSI: Generated symbols



Symbology ontology

- **Atmosphere** (Objects, Events, Processes)
- **Ocean** (Objects, Events, Processes)
- **Hydrology**
  - Surface hydrology (Objects, Events, Processes)
  - Groundwater (Objects, Events, Processes)
- **Terestrial ecology**
  - Plants (Objects, Events, Processes)
  - Animals (Objects, Beings, Events, Processes)
- **Urban**
  - Ecology, environment (Physical objects; Individual living beings; Social entities; Events, incidents; Processes)
  - Sociology, people, citizen (PISEP)
  - Economics, commercial (PISEP)
  - Administration, law (PISEP)

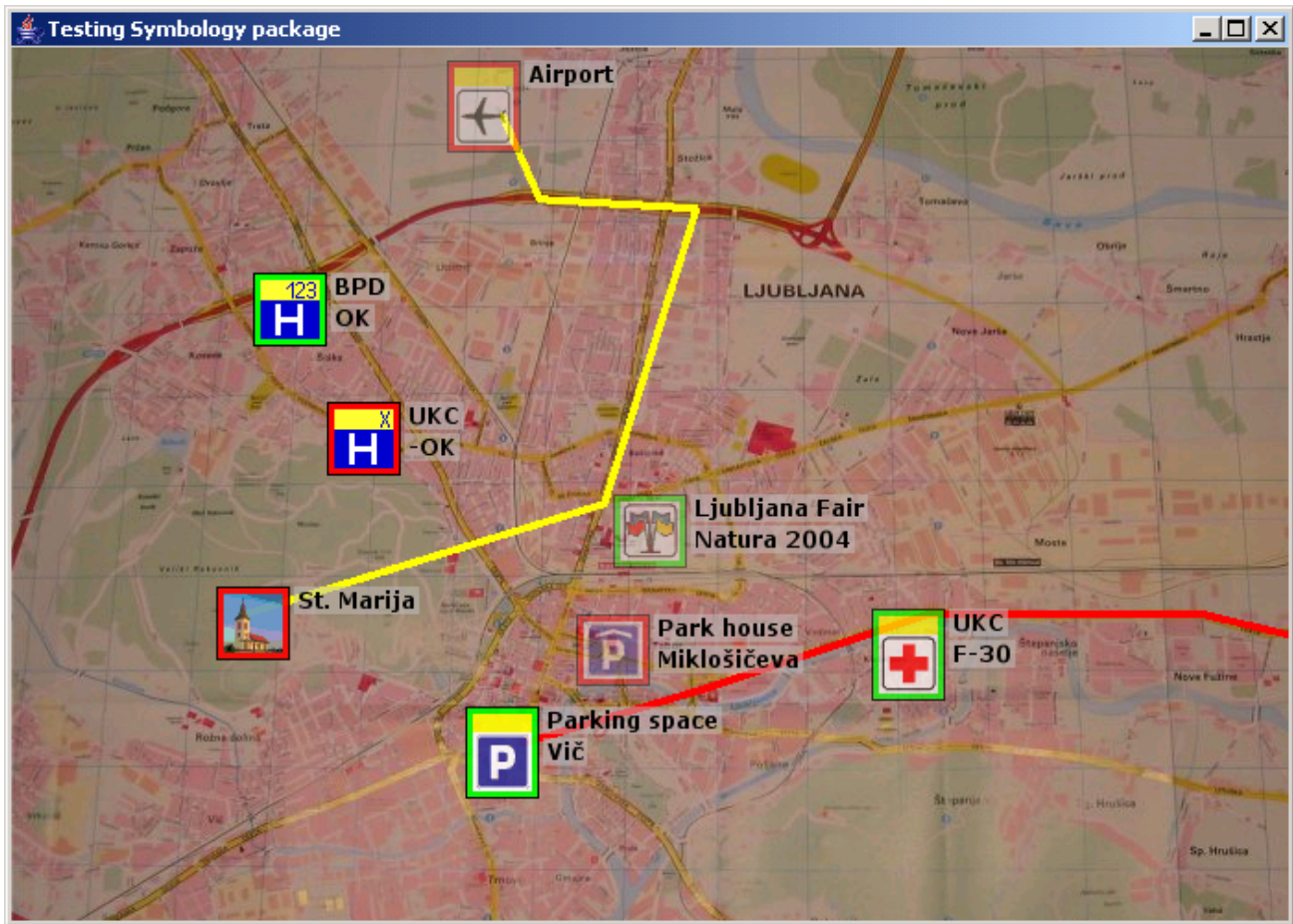
- **Transportation (attribute)**
  - Objects or substances moved (PISEP)
  - Modes of transport (Rail; Road; Sea, lake, river; Air)
  - Fixed infrastructure – nodes (PISEP)
  - Fixed infrastructure – links (PISEP)

CI monitoring reports

- Situation monitoring
- Situation report to the headquarters
- Resources management
  - Resources available
  - Resources deployed
- Information for the public
- Traffic information
- Evacuation
- Hospitals
- Threats

Symbology

- Demo: frames, dynamic info, transparency



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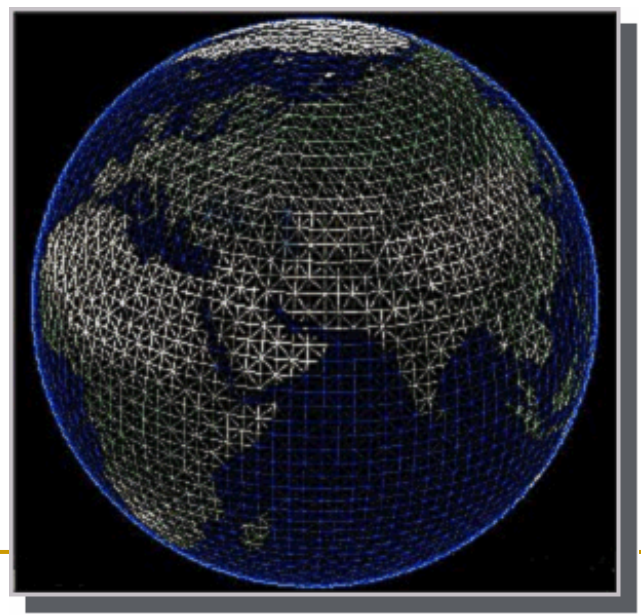

Conclusion

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- Collaborative CI protection in MEDSI
- Two real-world scenarios:
  - Holon - hazmat
  - Magdeburg - flooding
- Web services: from external data-sources to sensor networks interfacing
- The issue of data ownership: legislative framework, standardization
- Symbology: cognitive view, ontologies, standards

Further work

- Next iteration development within MEDSI
- Alleviate information overload, address the issue of trust in information
- Improve the domain model with appropriate ontologies