

# Environmental Geoinformatics for Emergency Management

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# Project background

- Research plan:  
"Dynamic geovisualization in emergency management"
- Financing
  - Ministry of Education, Youth and Sports of the Czech Republic, 2005 - 2011
- Partners
  - Masaryk University, Brno
    - Faculty of Science, Institute of Geography,
    - Faculty of Pedagogy, Department of Geography
    - Faculty of Informatics
  - University of Defence, Brno
  - Independent consultancy

# Case study

- Scenario “Accident of vehicle transporting dangerous substance”
- Multidisciplinary approach
  - cartography,
  - Informatics,
  - emergency management.
- It aims at connecting of **adaptive mapping and process modelling on domain of emergency management.**

# Emergency management in the Czech Republic

- analysis of existing obligatory emergency management principles in the Czech Republic
- Integrated Rescue System
  - system of coordination, cooperation and modelled cooperation procedures
  - basic components: Fire Rescue Corps, Fire Prevention Units, Police of the Czech Republic, Medical Rescue Service
  - other components: local emergency services, municipal/town police ...
- coordination of activities: on **tactical**, operational and strategically

# Tactical level of coordination

- **Intervention commander**
  - coordination of the Rescue and Liquidation Works at the place of intervention of IRS components
  - **“Typical activities of the IRS components at the common intervention”** which models activity of the IRS component at Rescue and Liquidation Works with regard to the character of Extraordinary Events
- case study follows-up this document

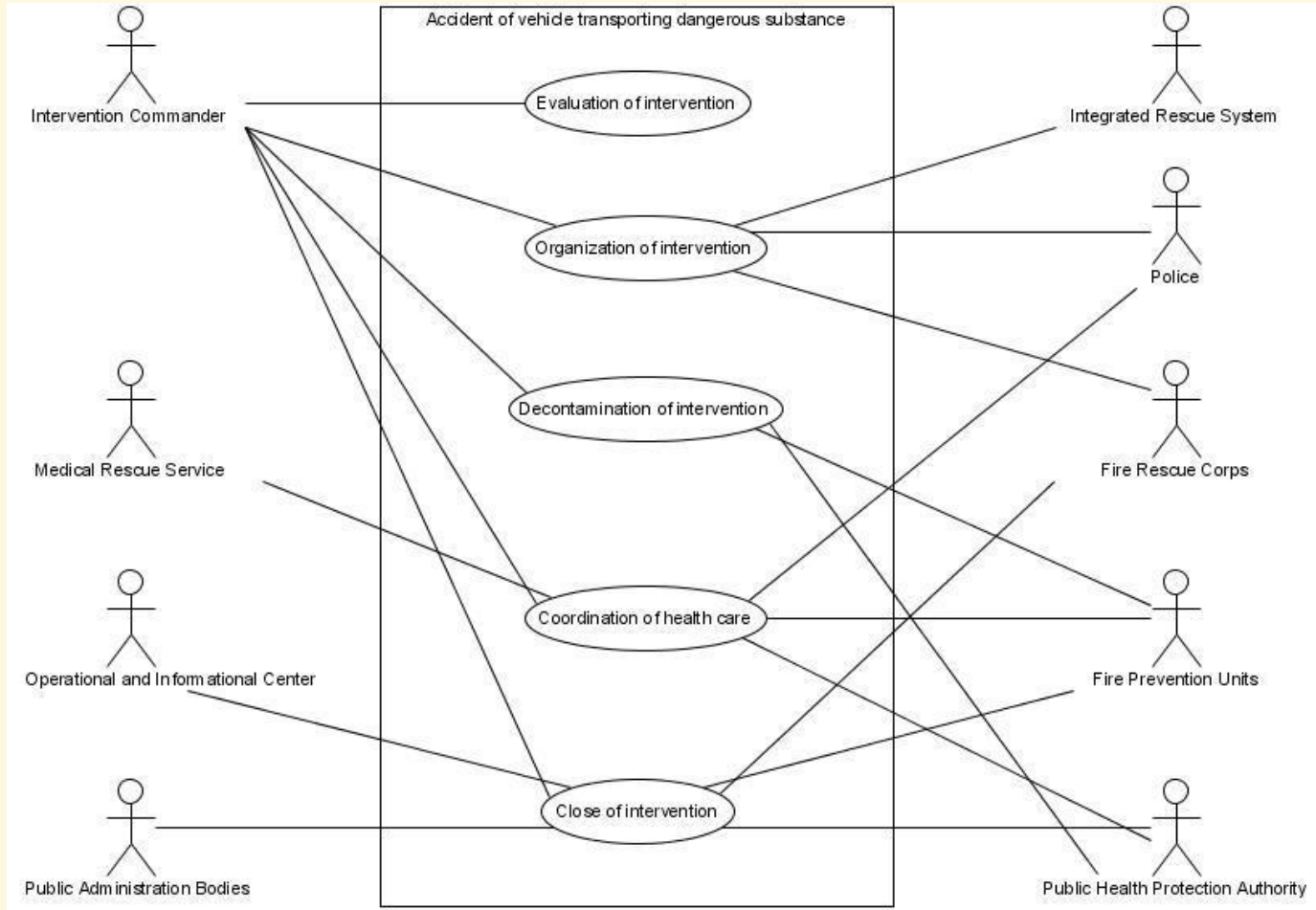
# Process modelling

## “Accident of vehicle transporting dangerous substance”

= event that can be described by Use case diagram as complex

- Based on the “**Typical activities of the IRS components at the common intervention**” are defined:
  - **actors** (users) who participate on the event “Who or what uses the system?” , “Who or what communicates with the system?”
  - **use cases** describe the main parts of the event - similar tasks grouped

# Use case diagram



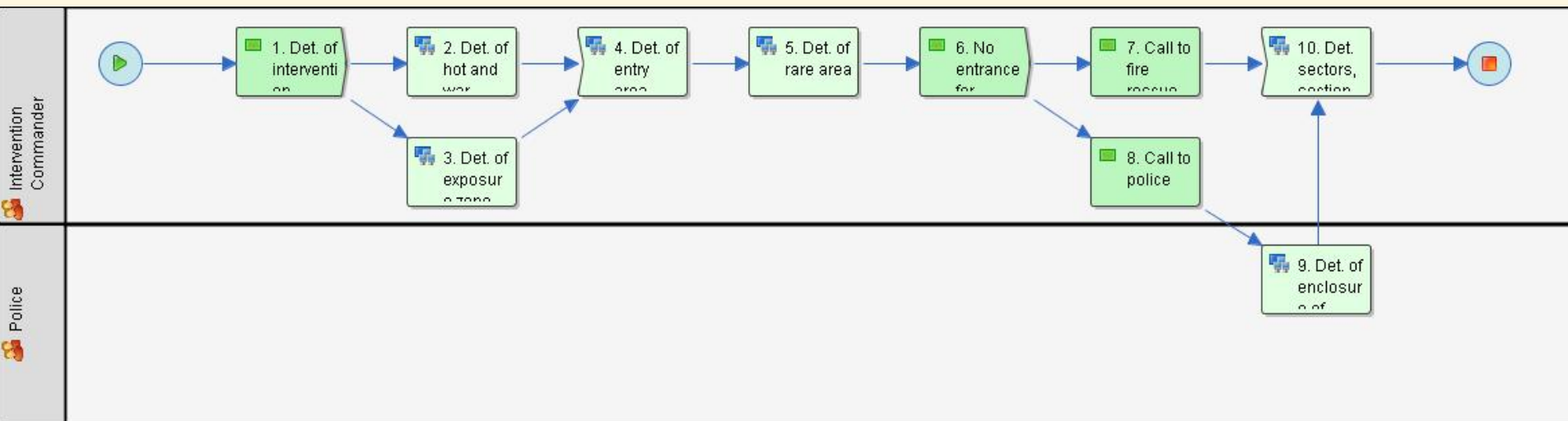
# Process map

- After modelling the use case diagram, it is possible to start creation of the specifications for the individual use cases – process maps
- To illustrate a process map the use case called **“Organization of intervention”** is processed



# Process maps

1. Determination of intervention organization,
2. Determination of hot and war endangered zones,
3. Determination of exposure zone,
4. Determination of entry area
5. Determination of rare area
6. No entrance for unauthorized person,
7. Call to fire rescue corps,
8. Call to police,
9. Determination of enclosure of exposure zone and its regime
10. Determination sectors, section and its commanders.



# XPDL

- All modelled processes (process maps) are transformed to XPDL (XML Process Definition Language) format - it specifies which geoinformation is needed

```

<Activity Id="newpkg1_wp1_act4" Name="4. Det. of entry area">
  <Implementation>
    <Tool Id="Visualization Server" Type="APPLICATION">
      <ActualParameters>
        <ActualParameter>BASETOPO</ActualParameter>
        <ActualParameter>OBJECT-HAZARD</ActualParameter>
        <ActualParameter>OBJECT-IN_DANGER</ActualParameter>
        <ActualParameter>LOCAL</ActualParameter>
        <ActualParameter>ZONE-A</ActualParameter>
        <ActualParameter>ZONE-B</ActualParameter>
        <ActualParameter>ZONE-C</ActualParameter>
        <ActualParameter>B-ENTRY</ActualParameter>
      </ActualParameters>
    </Tool>
  </Implementation>
  <Performer>Intervention Commander</Performer>
</Activity>
  
```

# CRUD matrix

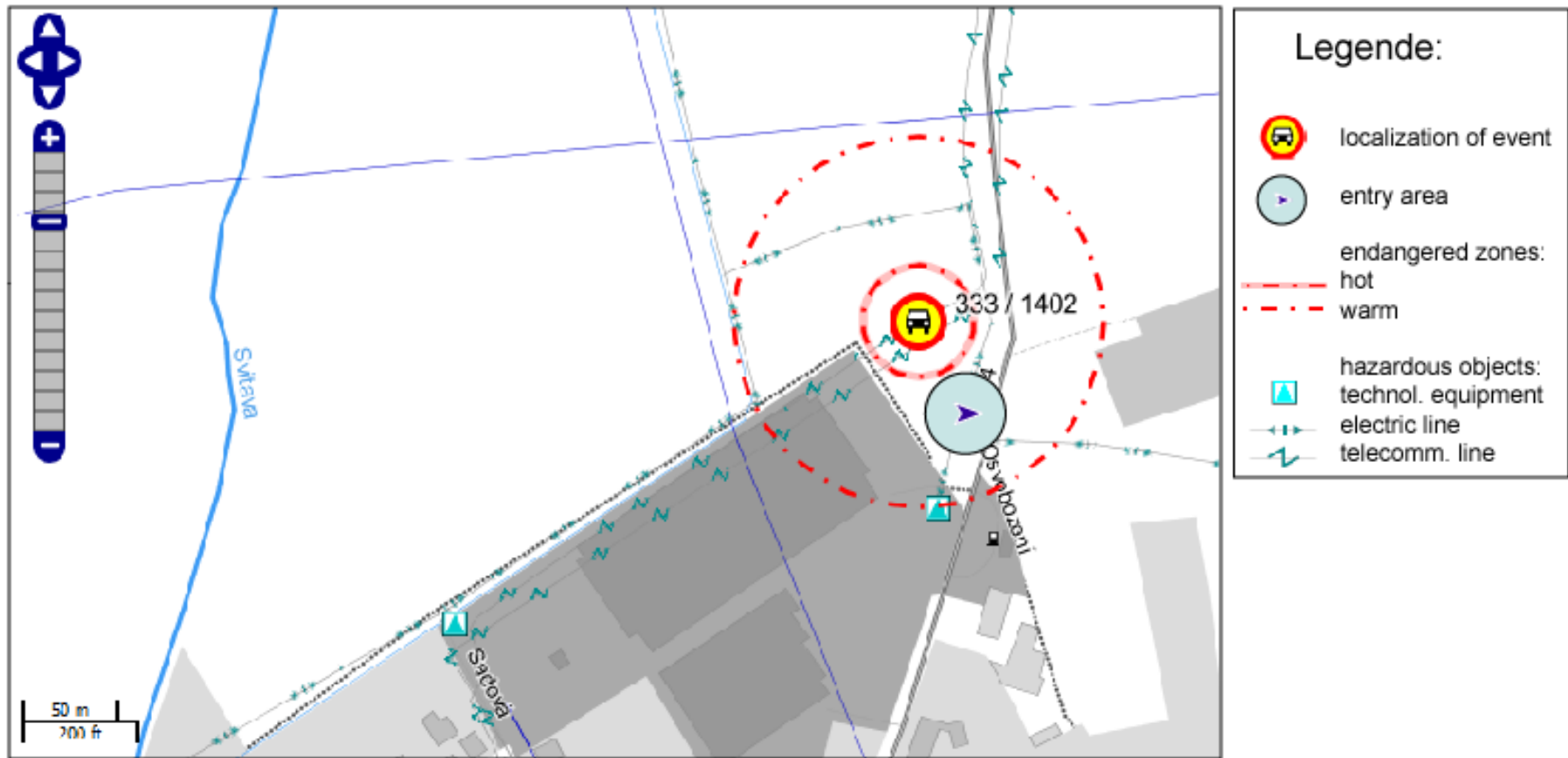
- processes and geodata are rebalanced using CRUD matrix
- specifies allowed operation on map feature (CREATE, READ)
- (operations UPDATE, DELETE are covered by another use cases)

|                  | 1.<br>Determination<br>of intervention<br>organization | 2.<br>Determination<br>of hot and war<br>endangered<br>zones | 3.<br>Determination<br>of exposure<br>zone | 4.<br>Determination<br>of entry area | 5.<br>Determination<br>of rare area | 6.<br>No entrance<br>for<br>unauthorized<br>person | 7.<br>Call to fire<br>rescue corps | 8.<br>Call to police | 9.<br>Determination<br>of enclosure of<br>exposure zone<br>and its regime | 10.<br>Determination<br>of sectors, section<br>and its<br>commanders |
|------------------|--|--|--|--------------------------------------|-------------------------------------|--|------------------------------------|----------------------|---|--|
| OBJECT-HAZARD    |  | R  | R  | R                                    | R                                   |  |                                    |                      | R   | R  |
| OBJECT-IN DANGER |  | R  | R  | R                                    | R                                   |  |                                    |                      | R   | R  |
| LOCAL            |  | R  | R  | R                                    | R                                   |  |                                    |                      | R   | R  |
| ZONE-A           |  | R  | R  | R                                    | R                                   |  |                                    |                      | R   | R  |
| ZONE-B           |  | R  | R  | R                                    | R                                   |  |                                    |                      | R   | R  |
| ZONE-C           |  |  | R  | R                                    | R                                   |  |                                    |                      | R   | R  |
| A-TECHNICAL      |  |  |  |                                      |                                     |  |                                    |                      |   | C  |
| B-DECONTAM       |  |  |  |                                      |                                     |  |                                    |                      |   | C  |
| B-ENTRY          |  |  |  | C                                    | R                                   |  |                                    |                      | R   | R  |
| B-COMMANDER      |  |  |  |                                      |                                     |  |                                    |                      |   | C  |
| B-HEALTH         |  |  |  |                                      |                                     |  |                                    |                      |   | C  |
| C-RANK           |  |  |  |                                      |                                     | C  |                                    |                      | R   | R  |
| C-ACCOUTRE       |  |  |  |                                      |                                     | C  |                                    |                      | R   | R  |
| ENCLOSE          |  |  |  |                                      |                                     |  |                                    |                      | C   | R  |
| AIR RESCUE       |  |  |  |                                      |                                     |  |                                    |                      |   | C  |
| EVAC STAND       |  |  |  |                                      |                                     |  |                                    |                      |   | C  |
| BASETOPO         |  | R  | R  | R                                    | R                                   |  |                                    |                      | R   | R  |

# Visualization within activity

## “Determination of entry area”

- Context PERIMETR: User - member of Fire Rescue Corps, Use case - organization of intervention, Typical activity - accident of vehicle with dangerous substance, Device - TabletPC, etc.



# Summary

- Geographic visualization within activities of Integrated Rescue System is becoming a must.
- It can significantly support decision making on all levels of emergency system management
- This interdisciplinary research focuses on connecting process modelling and adaptive cartographic visualization in emergency management.
- Such complex solution has two main advantages - it allows user to get the **right information** in the **right moment**.
- The **right information** is determined mainly by **user needs for specific action in specific situation**. Information can be transmit to user in **user friendly manner** (i.e. is adaptive visualized).
- The **right moment** is given by **analysis of task flows within the action that user is responsible for (i.e. process map)**. By process map it is determined which task needs support of spatial information and what **operations are allowed** on it.

**Thank you for your attention !!!**

<http://geokrima.geogr.muni.cz/>

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