Concept of a Portal for the Integration of COP-Objects from Heterogeneous Sources

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Integration of heterogeneous systems

C2IS should support network-centric operations (NCO)

• C2IS must provide a global infospace connecting all participating elements
• Joint, combined, interagency operations (JIMP) → multi-disciplinary teams
• Agility requires being able to respond to emerging situations
• Heterogeneous systems to be included
Integration of heterogeneous systems - Example

Operation center

Patrol

Global Infospace

strategic

operative

tactical level

Command and Control Information Systems
Integration of heterogeneous systems - Example

**Threat** in Area X

Operation center

**Plan**ed Route: Street x, y, z

Patrol

Global Infospace

- Strategic level
- Operative level
- Tactical level
Integration of heterogeneous systems - Example

Threat in Area X

Operation center

Correlation?

Global Infospace

strategic

operative

tactical level

Planed Route: Street x, y, z

Patrol

A semantic integration is necessary.
Legacy systems and COTS products do not allow for an easy semantic integration:
→ different business and logic data models
→ heavy heterogeneous data to be integrated
→ various formats and standards for communication, data storage, etc.
Portal technologies – Main idea

- System = collection of applications
- Own GUI for each application → integration on „pixel-level“
- Disadvantages:
  - Workflow: application driven
    (import → edit → store)
  - Difficult adaption to COP
  - Inconsistent, fragmented
    & misleading visualization
    - Different views, symbols, positions
Integration portal – Main idea

COP views of different services are combined within a common situational picture and service-crossing function calls are supported.

Integration of C2 applications at the visualization (presentation) layer.

No 'semantic' integration at the business objects layer. Harmonization of logical data models of services is not required!

The integration idea: consolidation of the visualization data from the business objects of services and their appropriate visualization at a common presentation layer.
Integration portal – Pros

Advantages of the integration portal:

1. Central integrated user interface based on COP
   • **homogeneous** overall view (uniform data visualization)
   • Misinterpretation and misunderstandings **decreased**

2. Better support for application-crossing business processes
   • **more intuitive** and **efficient** realization of business processes of the user
   • **increased** user acceptance

3. Encapsulation of GIS
   • **elimination** of redundant visualization components of C2IS
   • **uniform** presentation of spatial data
   • easy of **exchangeability** of GIS
   • **product-independent** integration of GIS (usage of open source possible)
Portal technology vs. Integration portal

**Portal technology**

- Full semantic integration:
  - time-consuming
  - very expensive
  - extremely complicated

**Integration Portal**

- no semantic integration necessary
- no ultimate solution
- flexible and cost-efficient compromise
Integration portal – Integration concept

- services pass **visualizable data** of their business objects to integration portal
- integration portal presents only **visualization elements**
  - abstract, platform independent objects
- **transformation** of business objects into visualization elements required
Integration portal – Example of service integration

BlueForceTracking Service

Mail-Service

Warning-Service

Send Mail

Warning

Information with priority

Btl 2  Btl 34
Coy 5  Coy 2  Plt 2
Plt 1

+Updates
Integration portal – Example of service integration

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associated Send Mail

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Command and Control Information Systems
Integration portal – Example of service integration

BlueForceTracking Service

Mail-Service

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+Updates

Send Mail

Warning Information with priority

associated

Transformation

user interface

visualization data from business objects

IntPortal

Btl 2 → Btl 34
Coy 5 → Coy 2
Plt 2
Plt 1

IntPortal

Btl 2
Coy 2
Coy 5
Plt 2
Plt 1

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Visualization elements – V-objects

**V-Objects**: abstract objects for visualization data of services visualized in the integration portal

<table>
<thead>
<tr>
<th>V-Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>objectID : String</td>
</tr>
<tr>
<td>objectData : Data</td>
</tr>
<tr>
<td>[optional Parameter]</td>
</tr>
</tbody>
</table>

- unique identifier
- data to be visualized
- optional data, parameters, etc.

**Example**: 2D spatial military v-object

- V-Object: `Kp 2 Gfstd`
- objectData:

- 2DMilData:
  - coordinate:
  - SID: `SFGPUCIM--AEGEG`

- Coordinate:
  - latitude: `34.513765`
  - longitude: `69.173695`
Visualization elements – Information groups

Information groups: represents structured groupings of thematic-related v-objects

- important structuring-tool
- possesses structure and linear order on its nodes
- two types of nodes: v-objects and groupings
Visualization elements – Service-functions

Service-functions: defined by some service, can be called by the user in the context of v-objects in the GUI, but are implemented and executed by the service itself.

- thematic-related v-objects constitute groups with similar functionalities
- services assign their functions to groups which semantic they know
- need for service-crossing standardization of description for information-groups
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Architecture of the Integration portal – Interfaces

Communication IntPortal ↔ Services based on Requests and Answers

Service-Requests: Service → IntPortal
- add, modify, and delete-requests for visualization elements

IntPortal-Requests: IntPortal → Service, or IntPortal → IntPortal Manager
- for handling of user calls to service-functions
- support the maintenance of the integration portal (e.g., log-off procedure)

Manager-Requests: IntPortal Manager → IntPortal
- manage the instantiation and initialization of the integration portal
Architecture of the Integration portal – Main components

- **Visual Object Manager**: consistency-preserving processing of service-requests
- **Display Manager**: efficient maintenance of visualization elements and their preparation for visualization
- **Graphical User Interface**: ergonomic presentation & interaction with the user

**Advantage**: the components can be distributed in the network according to the actual available resources
Integration portal – Solutions for **Resource Conflicts**

**Priority strategy:**
- enables for *priority-based handling* of requests
- defines the *processing order* of requests
- realized by dedicated components of integration portal: mediators

**Update strategy:**
- makes sure that only *the actual data* is visualized
- no more actual data is *deleted* or moved to *history*
- implemented in request-mediators

*Example*: Split priority strategy

- Every request gets from services two different priority-values:
  - **Request-priority**: valid among all requests of one service
  - **Service-priority**: valid among all services (cross-service)
- Values allowed for priorities are given the services by some instance of access-control-service
Integration portal – Visualization components

- Specific visualization components
  - As plug-ins
  - Fill their corresponding panels
- Highly flexible, adaptable to various data types
Integration portal – Encapsulation of GIS

- visualization of spatial data via GIS
- encapsulation of GIS via appropriate visualization components

Advantages:
- Elimination of redundant visualization components of C2IS
- Uniform visualization of spatial data
- Product-independence
- Easy exchangeability of GIS (even open source GIS possible)
Summary

• New integration concept for COP
  - based on integration of visualization elements
  - heterogeneous sources of data
  - modular architecture

• Integration portal as alternative solution for integration
  - Allows reuse of existing systems and services
  - Interesting compromise between portal technology and semantic integration
  - Step towards fully integrated, single system

• Collaboration
  - Shared and integrated handling of COP-objects from heterogeneous sources
  - Hiding underlying complexity from the user
  - Increased effectiveness through natural, service-crossing workflows
Thank you for your attention!