IST-118 – SOA recommendations for Disadvantaged Grids in the Tactical Domain

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Our paper presents lessons learned from IST-090, and the plan of work for the recently started IST-118.

Presentation outline

• What is SOA?
• Important findings: IST-090
• Introducing IST-118, the IST-090 follow-on group
• Conclusion
Service Oriented Architecture (SOA)
It is a paradigm, not a technology!

• Definitions in the “Reference model for service oriented architecture 1.0”, OASIS standard, October 2006:
  – “SOA is a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations.”
  – “A service is a mechanism to enable access to resources, where the access is provided using a prescribed interface and is exercised consistent with constraints and policies as specified by the service description.”
Implementing a SOA

• The SOA paradigm can be implemented using different technologies
  – Examples are Web services, DDS, Corba, etc.
  – Currently, Web services technology is most widely adopted for this purpose.
    • Interoperable implementation based on WS-I profiles
    • Identified by NATO NEC feasibility study as the *key enabling technology for NATO NEC*

• However, the technologies have communication overhead
  – Web services and DDS have been looked at by NATO RTO/IST-090
IST-090 – SOA challenges for real-time and disadvantaged grids

• Motivation
  – The Service Oriented Architecture (SOA) approach has been chosen by the NATO C3 Board as the recommended method to achieve information interoperability in NATO.

• Objectives
  – identify challenges and show how to make SOA applicable at the tactical level

• Outcome
  – Awareness of challenges related to extending a SOA to tactical networks
  – Experimentation showing that SOA can work at lower levels than previously thought
Important findings: IST-090

- We identified three possible approaches to extend SOA to the tactical domain:
  1. Adapt existing Web services standards for use in disadvantaged grids.
  2. Use other technologies in certain sub-systems (e.g. DDS). Integrate these with Web services through the use of gateways.
  3. Employ other technologies in the entire information infrastructure.
- In IST-090 the two first approaches were both investigated
  - We adapted Web services for use in disadvantaged grids, and used DDS together with a DDS to Web services gateway in a sub-system.
- Because of the inherent interoperability benefits of Web services, the upcoming efforts in IST-118 will focus mainly on this technology.
Important findings: IST-090

- When adapting Web services to tactical networks, we identified three areas that need to be addressed:
  1. Dependency on end-to-end connections
  2. Network heterogeneity
  3. Network overhead
- In IST-090 we have addressed these issues both through national efforts and experiments, as well as through collaboration and the final IST-090 demonstration.
Important findings: IST-090

- Dependency on end-to-end connections can be removed by adding intermediaries (proxies) to the network.

- Hiding network heterogeneity
  - adopting the “Everything over IP” mindset
  - mitigating differences in network capacities and quality by adding delay tolerance to the messages exchanged

- Network overhead can be addressed through different approaches
Important findings: IST-090

• We considered different means to reduce the network traffic generated by Web services:
  – Reducing XML overhead with data compression.
    • E.g., EFX, GZIP
  – Reducing communication overhead by replacing the transport protocol.
  – Reducing information overhead by optimizing the applications’ need for information exchange.

• Proxies provide a convenient place to implement optimizations, so that clients and services can be COTS.
## Overview of optimization possibilities

### The protocol stack

<table>
<thead>
<tr>
<th>Layer</th>
<th>Optimization possibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Application</td>
<td>Optimize the application, e.g. content filtering</td>
</tr>
<tr>
<td>Web services messaging:    SOAP</td>
<td>Optimize SOAP, e.g. XML compression</td>
</tr>
<tr>
<td>HTTP/TCP  UDP Other transport protocols</td>
<td>SOAP is transport protocol agnostic. Can use other protocols than the Internet ones, e.g. MMHS</td>
</tr>
<tr>
<td>IP</td>
<td>The NATO NEC feasibility study suggests; “Everything over IP”. We assume IP in IST-090.</td>
</tr>
</tbody>
</table>

The lower layers of the protocol stack are beyond the scope of IST-090.
Importance of standardization

• A key principle when building a SOA is the use of standards in order to enable interoperability between domains.
• However, while basing system interaction on standards enables interoperability, it does not ensure it.
  – Optional features
  – Ambiguities
• Often, additional information is needed for interoperability
  – Interoperability profiles (by WS-I)
  – SOA baseline (by NATO CESWG)
  – These focus on infrastructure networks
• There is a need to provide guidance and best practices on how to make SOA applicable at the tactical level.
IST-118 – SOA recommendations for disadvantaged grids in the tactical domain

• IST-118 is a newly started NATO working group, which aims to provide concrete recommendations and guidelines when it comes to extending the SOA paradigm into the tactical domain.

• The group currently consists of domain experts from
  – the NATO Communications and Information (NCI) Agency,
  – Germany,
  – the Netherlands,
  – Norway, and
  – the United Kingdom.

• Interested in contributing/participating?
  – Please contact the group chairman, Peter-Paul Meiler ([peter-paul.meiler@tno.nl](mailto:peter-paul.meiler@tno.nl)).
The main focus is on identifying what we call tactical SOA foundation services. which core enterprise services do we need support for in the tactical domain?

We aim to investigate how services from the SOA baseline can be extended for use in tactical networks → Tactical SOA profile
IST-118 spiral approach
Conclusion

• We have seen the main findings of IST-090. Recommendations from that group include employing optimizations such as
  – removing the dependency on end-to-end connections,
  – addressing network heterogeneity, and
  – reducing the network traffic overhead of Web services.
• The group suggested introducing proxies to implement these optimizations, in an attempt to provide a separation of concerns between proprietary enhancements and COTS services and clients.
  – Alternatives to Web services (e.g., DDS) were considered for use in certain sub-systems, but the main focus was on Web services as that technology has been identified by NATO as the key enabler for NNEC.
• IST-118 is a recently started NATO STO group intended as a follow-on to IST-090.
  – The goal is to provide a profile for using (a subset of) the core enterprise services in tactical networks: a Tactical SOA Profile
  – All NATO nations are welcome to join the group