Collaboration services: Enabling chat in disadvantaged grids

*Frank T. Johnsen* and Trude H. Bloebaum
Norwegian Defence Research Establishment (FFI)

Luka Cetusic, Hans Kristian Flaatten, Karsten Kjensmo, Erik Lothe, Ole Johnny Pettersen, Thomas Martin Schmid and Bjørn Tungesvik
Norwegian University of Science and Technology (NTNU)
Our paper presents our implementation of ACP142 and a chat application over that protocol. The work was performed in context of NATO/STO IST-118.

Presentation outline

• Intro to IST-118
• Background / observations
• ACP142
• Chat solution
• Conclusion
IST-118 – SOA recommendations for disadvantaged grids in the tactical domain

• NATO STO/IST-118 aims to provide 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,
  – Poland, and
  – the United Kingdom.
• Interested in contributing/participating?
  – Please contact the group chairman, Peter-Paul Meiler (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
NATO C3 Classification taxonomy

- Taxonomy excerpt showing the «Core Enterprise Services» part of the «Technical Services».
- Expanded view of the «Unified Communication and Collaboration Services».
Background

• Collaboration
  – Text-based collaboration (instant messaging aka “chat”) is an important aspect.
  – Many different solutions, e.g., irc, XMPP, and others
  – SOA baseline specification: collaboration services
    • Identifies the eXtensible Messaging and Presence Protocol (XMPP)
  – XMPP
    • Client/server based.
    • Not well suited for use in disadvantaged grids / DIL environments.
    • Focus of IST-118: Enable core services in disadvantaged grids.
Observations

• Instant messaging can be one-to-one, but is more often one-to-many information dissemination

• Multicast
  – an efficient means of distributing one message to many recipients.
  – decentralized, no central server, thus no single point of failure.
  – Many implementations exist, also of reliable multicast protocols.

• Disadvantaged grids
  – low bandwidth, variable throughput, unreliable connectivity, and energy constraints
  – Also, occasional need for radio silence (EMCON)

• We need
  – A multicast protocol developed for use in tactical radio networks that can cope with mobility and disruptions.
ACP 142 / P_MUL

- The ACP142 protocol for reliable multicast has been designed specifically for use in tactical networks.
- Key properties
  - Reliable multicast messaging
  - Designed for bandwidth-constrained networks
  - Delayed acknowledgement for EMCON environments
- Thus, the protocol has all the properties we need in a reliable multicast solution for one-to-many communication in disadvantaged grids.
  - The specification defines the ACP142 for different transport protocols, including IP, which we focus on – “Everything over IP” mindset.
ACP142 implementation on UDP/IP stack

- Contribution: An implementation of ACP142 in Java
  - Free, open source, available at [https://github.com/libjpmul/libjpmul](https://github.com/libjpmul/libjpmul)
- Note that the network hosts and routers must support IP multicast, as indicated above.
Testing
ACP142

- ACP142 provides several parameters for fine-tuning the protocol’s behavior (e.g., MTU size, sending delay between packet fragments, etc.) and it is necessary to configure it to match the capabilities of each network before deployment.

- For more protocol details, see the specification
  - The Combined Communications-Electronics Board (CCEB), ACP142, P_MUL - A PROTOCOL FOR RELIABLE MULTICAST MESSAGING IN BANDWIDTH CONSTRAINED AND DELAYED ACKNOWLEDGEMENT (EMCON) ENVIRONMENTS

- Implementation and test details are in a technical report
  - https://github.com/libjpmul/report
P_MUL chat application

- Chat using ACP142.
- Topics mapped to multicast groups.
- Contribution
  - Free, open source release
    - [https://github.com/libjpmul/pmulchat](https://github.com/libjpmul/pmulchat)
  - Submitted for consideration to the NATO STO/IST-ET-070 exploratory team for tactical chat
A note on interoperability with XMPP
Conclusion

• Contribution – open source:
  – Implementation of ACP142 over UDP/IP, and
  – P_MUL chat for use in disadvantaged grids leveraging the above protocol.

• Work performed in context of IST-118. Submitted for consideration to the NATO STO/IST-ET-070 exploratory team for tactical chat.

• Future work
  – The IST-118 group plans to experiment with other Core Enterprise Services in disadvantaged grids in the tactical domain as well (such as the Publish/Subscribe service).