Chapter 7 – SUMMARY AND CONCLUSIONS

This chapter will summarize the Final Report of NATO/RTO IST-061 RTG-027 on "Secure Service Oriented Architectures (SOA) supporting Network Enabled Capabilities". After introducing the general concept of SOA, the report has shown how these principles can be applied to the military concept of Network Enabled Capabilities. This general overview has been followed by a description of which technologies have been used by the group. Building on this, the scenario for the demonstrator of the group has been described. This description contained both, a military "story" and a high-level description of the technical building blocks used to create the demonstrator. The "story" described a sequence of events including the data exchange associated with them.

After the description of the actual realization of the demonstrator at the CWID site, the results of the demonstration have been explained. This has been done first for each participating organization and company and then from the perspective of the group. It was shown that, just as anticipated in the NATO NEC Feasibility Study, SOA is a valid technology for implementing NEC concepts. Especially the relatively low effort required to integrate two additional partners (Safelayer and NC3A) into the demonstration at a very late point in time shows that the expectations concerning the chosen approach are justified.

Nevertheless, it has become obvious that it is difficult to have products from different vendors interoperate, even if they claim to implement the same version of the same standard. This can in part be attributed to the fact that many SOA and Web Services related standards are quite new. Therefore, they still lack the required specificity to ensure interoperability between independent implementations in some places. At the same time, products often do not correctly implement the standards because of misunderstandings or programming failures.

Interoperability among different implementations of the same standard is a crucial factor to ensure seamless integration of military units from different nations. To achieve this, interoperability tests are required. The demonstrations and experiments conducted by this group have shown that (at least for the military community) CWID is a very good place for these interoperability tests.

To further enhance interoperability especially of Web Services (WS), the creation of a military WS profile appears to be a good way. In the civilian world, the "Web Services Interoperability Organization" [20] has specialized in these profiles. Active engagement of the military in this group could help to promote deployment of interoperability profiles in both, the civilian and military domain, benefiting both.

Security is one of the key requirements for NEC. On the other hand, current security technologies are not up to the task for several reasons that have been described in this report. Thus, while the demonstrations of the group showed that security is (in principle) possible, a lot of work is still required for operational deployment. The same can be said for the deployment of SOA and WS technologies in networks operating in resource constraint environments (which are sometimes called "Disadvantaged Grids"): While SOA and WS are the right way to go, the group feels that more research and standardization is required in this area.

One of the reasons SOA and WS are not yet ready for deployment is the status of the Service Discovery and Directory technologies. Especially UDDI, which has been used in the demonstrator, is not flexible enough for the highly dynamic environments common in tactical and operational environments. Especially in tactical environments, services can not be expected to cleanly disconnect from the registry. Network interruptions due to for example terrain, weather or enemy action are quite common. Such circumstances require a service registry and discovery service that offers a keep-alive service and handles disappearing services gracefully. On the other hand UDDI is lacking these features.

The Publish / Subscribe principle used during the demonstration has shown to be a good compromise between pure pull and pure push approaches. While the consumer can decide which topics are relevant for him, he does not have to constantly poll the producer for updates but is informed automatically. This reduces unnecessary network usage significantly.

For the general approach this group has taken, it concludes that the drawbacks such as the significant effort required for the implementation of the demonstrator are more than compensated by the advantages described in this report. This is true as well for the approach of having CWID 2006 as a fixed (and externally defined) date of delivery. Thus, work has been more focused on the central objectives of the group.

The results achieved clearly indicate that SOA is a good foundation for the NATO Network and Information Infrastructure. SOA has the potential of overcoming the limitations of current "stove-piped" solutions.

Even though in hindsight some aspects of the work could have been optimized, many important goals of IST-061 have been achieved. These many positive achievements certainly qualify for the label "Success". This group can therefore be proud of its results. Even the additional "lessons learned" are very valuable, although not necessarily intended, results.

7.1 RECOMMENDATIONS FOR FUTURE NATO ACTIVITIES

While the group does not recommend a continuation of its complete spectrum in a direct follow-up activity, several topics for future research within NATO/RTO have been identified. The primary topics are security technologies for Web Services and the deployment of SOA in disadvantaged grids. The first topic is already considered in NATO/RTO IST-068 RTG on "XML in Cross Domain Security Solutions".

As this group has identified shortcomings in the area of service discovery and service registry, it is recommended that this is made the objective of future research activities of NATO. This may be achieved either by creating a dedicated RTG or by including the topic in an existing group.

Additionally, the group recommends that further work on NATO profiles for Web Services is performed in the appropriate NATO forums such as the new Core Enterprise Services Working Group of the ISSC.