Chapter II

Industrial Use of Semantics: NNEC Semantic Interoperability

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ABSTRACT

The North Atlantic Treaty Organisation (NATO) is shifting towards Net-centric operations paradigms driven by the nature of the new missions that the Alliance will likely be facing in the coming years. This new situation has forced the Alliance to pursue the achievement of the so-called NATO Network-Enabled Capability (NNEC). In this framework, the concept of a system of systems should give way to the new paradigm of federation of services, where any capability needs to be seen as a loosely-couple service. From the perspective of any of these services, one of the biggest issues will be to discover available services and, more importantly, the information provided for such services can be consumed. For this purpose, we present in this chapter the use of Semantic Web as a technology that will facilitate the explicit description of the services available on the Net that will eventually help in selecting the right services. The technology will also mediate between service consumers and service providers, so information is given a well-defined meaning and is comprehensible. Based on the foundations of the Semantic Web, we propose a concept demonstrator called SISearch, where well defined vocabularies from apparently different domains are defined by using ontology languages. Then, these different vocabularies are interpreted with respect to the vocabulary defined by a potential service consumer. Assisted by this interpretation and by inference services, the SISearch will translate both consumer-based queries to service provider specific-queries (using different vocabularies), and aggregating and interpreting the results with respect to the service consumer vocabulary. This approach will allow extending to new potential service consumer or service providers without having to develop specific modules or components.
INTRODUCTION

NATO member states are facing new challenges and new threats. NATO structure has changed considerably in the last fifteen years. The traditional strategic models, where enemy power could equalize those of the Alliance countries, are no longer of use.

A relevant example is the threat of terrorist attacks – asymmetric warfare – which cannot be focused on an organised state with traditional military forces. Another relevant example is related to the operations in which NATO is directly involved, from the Balkan crises to Afghanistan stabilisation operations. In any of these cases, these are peacekeeping operations which were not initially contemplated by the Alliance and, which became more striking, the new situation required information exchange with non-NATO Nations that are present on theatre. Furthermore, the response time needed in these situations, from force deployment to CIS (Communications and Information Systems) deployment, is not in tune with the past rigid structure.

These are some of the reasons that have forced to clearly define a new structure of the Alliance that would give response to the above mentioned challenges, NATO Response Force (NRF) (NATO, 2007b) being a representative of a more dynamic and ready to deploy forces. Along with this new restructuring comes a new set of necessary CIS capabilities adapted to more dynamic forces and to unforeseen operations, unlike those fixed stovepiped self-contained systems developed for very well known situations. This new paradigm (as opposed to the stovepipe paradigm) is the so-called NATO Network Enabled Capability (NNEC) (Buckman, 2005).

NNEC can be defined as net-centric environment, resembling the Grid concept (Foster et al., 1999), where systems are no more considered monolithic elements eventually connected at some point in time, but they are considered as specific net-centric functionalities or services. Moreover, these services will be connected and disconnected over time and, thus, must advertise their presence automatically. Besides, whenever any consumer service needs information, it will need a mechanism by which it discovers available and adequate services. The possibility of finding relevant information will enable any services, applying the necessary filtering, to have a better situational awareness and an enhanced coordination and force reaction.

The above descriptions make the case for specifying an Interoperability Framework by which NATO and National services will interoperate in this new environment. Several Research & Development initiatives within NATO are exploring different existing and promising technologies in order to enable and implement the interoperability requirements defined by NNEC. As a common ground, it is assumed that any net-centric solution should consider the Internet as a model: the ability of accessing any type of information, the possibilities of making available any type of information and the ability of dynamically discovering services.

Based on the foundations of the Semantic Web (W3C, 2007), we propose a concept demonstrator called Semantic Interoperability Search (SISearch), where well defined vocabularies from different domains are defined by using ontology languages. Then, these different vocabularies are interpreted with respect to the vocabulary defined by a potential service consumer. Assisted by this interpretation, the SISearch will translate both consumer-based queries to service provider specific-queries (using different vocabularies), and aggregating and interpreting the results with respect to the service consumer vocabulary.

This approach will allow extending to new potential service consumers or service providers without having to develop specific modules or components. It will be needed a way to declaratively exposing the new vocabulary and defining interpretations with respect to the consuming service. This will be achieved by being able to