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AN ANALYSIS OF CIS ARCHITECTURE FRAMEWORKS USAGE IN THE MILITARY ENVIRONMENT

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Abstract:
Since 1990s, architecture modelling is used to define and design better communications and information systems. The experience of other nations demonstrated the value of developing and using of CIS architectures in order to better serve the business processes of an enterprise. Romanian MoD should use this experience to improve its own CIS.

Key words: CIS architectures, Architecture Framework, Architecture Engineering Methodology, Architecture Repository.

1. Introduction

The developers of communications and information systems (CIS) architecture frameworks try to shape designers' (architects) and users' (operators) minds to look not only in technical description of a system that supports a particular business, but also in the way that business is functioning and how the system best serves it. For a better understanding of different aspects in building such architectures, the need for formalization, simplification, comparison, the structuring of the design, budget allocation, the physical implementation, the operation and maintenance of the system etc., led to the development of architecture frameworks which define different points of views of the same architecture. Each (point of) view has a specific template and complexity, and serves a particular purpose and audience. The methodology of designing of such architectures is also described, more or less, in these frameworks.

In the military environment there are used different frameworks, depending of the ability, experience and interest of an organization to build and use such frameworks for developing their CIS. The US Department of Defense (DoD) was the first military institution which introduced the use of CIS architectures and the formalisation through an architecture framework in the middle of 1990s. The Ministry of Defence (MoD) of UK, NATO and the Department of National Defence of Canada followed and built their own framework. Other organizations chose not to have their own framework, but to use the already existing ones. The MoDs of France and Sweden, and the European Defence Agency (EDA) are such examples. Because the number of users was not very high and because of the diversity of such frameworks, the software tool developers were not very keen in developing all the aspects for all these frameworks but more to build them for a particular purpose. Because of all these, there was not a unique standard for structuring or a methodology for engineering of such architectures or to store them in standard repositories for later use. Also, the architects and users complained that these frameworks

are too complex and tend to concentrate more on the means of building of architecture and not on the final goal which is their implementation. This led to the need for a standardized meta-model and later to a unified framework. The experts in this field are working to merge the US's DoDAF (DoD Architecture Framework), the Department of National Defence / Canadian Armed Forces Architecture Framework (DNDAF), the UK's MODAF and the NATO's NAF (NATO Architecture Framework) in such called Unified Architecture Framework (UAF) which is envisaged to be delivered in 2016. The purpose of this unification is to standardise the interpretation of the architecture views, the tools and training [2]. Afterwards, the organizations will have to modify their own policies in order to be able to design, store, use and reuse of different architectures in accordance with UAF specifications.

2. Different views used in architecture frameworks, NAF in particular

The first architecture framework C4ISR Architecture Framework version 1 was developed in 1996 by the US DoD "*in response to the passage of the Clinger-Cohen Act"*. "*This Architecture Framework is especially suited to large systems with complex integration and interoperability challenges*." [1]. There were some refinements in version 2.0 in 1997 and further development in the DoD Architecture Framework 1.0 from 2003. This framework constituted the model for developing NATO Architecture Framework versions 1 and 2 in 2004. NAF v.2 was using 4 types of template categories, so called views: NATO All View (NAV), NATO Operational View (NOV), NATO System View (NSV) and NATO Technical View (NTV). The UK MoD extended the DoDAF v.1, adding more sets of views (viewpoints) in so called MODAF v.1. In 2007, NATO upgraded the NAF to version 3.0 (and later 3.1) which used as model the MODAF adapted to NATO needs. The set of views added in this framework were NATO Capability View (NCV), NATO Service-Oriented View (NSOV) and NATO Programme View (NPV), as well as the NATO Architecture Meta Model (NMM).

2.1 NAF 3.1 views description

The views are used to communicate easier with the systems' stakeholders. Each view contains a number of sub-views grouped by purpose. Each sub-view has a particular pattern, template, and defines the techniques for the creation, analysis and display of the sub-view. Depending on the audience level, purpose and/or the level of detail, the architectures can contain a certain number of sub-views.

For a better understanding of their purpose, I will briefly describe each of the views used in NAF 3.1 [3]:

- NAV – has a general purpose, and describes the overarching aspects of all other views used;
- NCV – analyses the delivery of military capabilities in accordance with the strategic intent and defines a capability taxonomy in order to investigate the capability gaps and overlaps;
- NOV – describes the activities, operational elements, organization and information exchanges required to accomplish war-fighting missions and business processes;
- NSOV – identifies and describes the services needed to support the operational domain described in NOV;
- NSV – describes systems and their interconnections supporting war-fighting and business functions, as well the system resources association to NOV;

- NTV – ensures the satisfaction of the operational requirements by a system and the guidelines of technical systems implementation;
- NPV – describes the correlation between capability requirements and the programmes that are being implemented.

The architecture meta-models are used for defining the languages and processes to model architecture sub-views and to facilitate interoperability between architecture development and analysis tools (e.g. Artisan Software Tools, Sparx, No Magic etc.).

To facilitate the sharing of information between different architecture sub-views and also between architectures, the data would be stored in a NATO architecture Repository (NAR) which follows a set of rules stipulated in the NMM.

3. The usage of NAF in the Romanian Armed Forces

The far as I know, the NAF was used in four cases in the Romanian Armed Forces: in the modernization of the Romanian Permanent Telecommunication Network from the National Defence Network (RTP/RMNC), in the definition of the C4ISR system architecture for a Mechanized Brigade, in the CIS technical exercise "CETATEA" and in an EDA training course organized at Bucharest.

The first case succeeded only to define the architecture of the management system for the RTP/RMNC due to the system's complexity, and the lack of the information exchange requirements for the business processes at the entire Romanian Forces level. The result of the second case was supposed to conduct to a gap analyses, the development of the technical specifications and the acquisition of a C4ISR system. Unfortunately, due to the lack of funds, the results were not fruitfully used. The last two cases tried to familiarize the CIS experts with the methodology of constructing CIS architectures according to the NAF.

In all the cases described above, the limited training and lack of experience of the Romanian military personnel, the great amount of work and resources necessary to allocate for the development of such architectures as well as the limited understanding by the decision makers of the usefulness designing of CIS architectures conducted to a misperception that the architectures are not necessary.

The developing and use of architectures is not the responsibility only for the specialists who are working in the CIS domain. Especially in the first phase of a CIS acquisition, when the operational requirements for the system are defined, the specialists from other domains should contribute and cooperate to the developing of different views to better reflect these requirements.

4. Conclusion

The Romanian Armed Forces should use other organizations' experience in order to better manage the processes and progresses in this field of expertise. This will allow the development of better systems, cheaper, more interoperable with other national and NATO CIS. I consider that the following steps are essential and may conduct also to a cultural change in longer term in this area:

- Develop a policy which describes the roles and responsibilities at Ministry of National Defence level. Documents like NATO Networked C3 Interoperability Policy (NIP) [4], NATO C3 System Interoperability Directive (NID) and C3 Classification Taxonomy [6] could be used as models. The acquisition procedures for CIS will be started only if the technical requirements are developed in accordance with an architecture framework (in particular NAF or

UAF). This would also permit to define the interfaces and interdependencies with other systems.

- Conduct an awareness campaign in order to familiarise different type of stakeholders with the benefits of usage of architectures. We can consider that the last three cases described contributed a little in this direction.
- Allocate funds for training different type of personnel on the methodologies of developing and usage of architectures. Introduce courses in the curricula of education and training structures. Even that in the last two cases described weren't used financial resources, some progress have been made but not enough, especially due to the limited number of the attended personnel.
- Conduct a top-down approach to facilitate a better definition of the operational requirements for the CIS by identifying all the processes and the information exchange requirements at the business level of the Romanian Armed Forces. This is a long and difficult process but, without it, the results may conduct to non efficient and effective solutions. In the first case described was used a bottom-up approach which it seems that was not the best solution in defining the operational requirements.

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