

# MACEDONIAN NATIONAL ENTERPRISE ARCHITECTURE FRAMEWORK

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## ABSTRACT

This paper will describe our proposed enterprise architecture framework for the Republic of Macedonia. The formal base of the framework is modified Zachman framework, as proven practice that has been accepted by few governments. The modified framework consists of the contextual model, conceptual model, logical model and physical model shown through data architecture, application architecture and technology architecture.

This paper also suggests the use of two proven methodologies that can be used for enterprise architecture development. The models given by the RUP methodology and SSADM methodology can be fully or partially mapped in each of the cell of the proposed framework matrix. This mapping will be shown.

The proposed enterprise architecture framework can be extended with service-oriented architecture. We will show the use of service-oriented paradigms.

## I. INTRODUCTION

Modernization of government and public administration with e-government projects is often partially coherent and overlapping projects are created [1]. In order to enhance interoperability, to support reusability, reduce costs and improve of e-services delivery several governments have established Interoperability Frameworks and National Enterprise Architecture programmes. The Republic of Macedonia is not following this trend. Our state has not accepted the proposed interoperability framework by the foundation Institute Open Society and General Secretariat of the Government of the Republic of Macedonia [2], nor have included nation enterprise architecture programme in the last published strategy [3].

## II. FRAMEWORK DESCRIPTION

Enterprise architectures are essential for evolving information systems, developing new systems and inserting new technologies. Best practices can be adapted and used for the model development, as shown in other countries. The use of reference architecture or model-driven architecture, in combination with service-oriented architecture has been shown as a good practice [5].

The Zachman framework will be used as a reference model. Additional information system development methodologies will be used.

### A. Zachman Framework

Zachman states that “The Framework for Enterprise Architecture is a two dimensional classification scheme for

descriptive representations of an Enterprise.”[4] Figure 1 provides an overview of the current Zachman Framework.

ENTERPRISE	What	Where	Why	How	Who	When
Conceptual	Entity Relations	Node Relations	Goal Relations	Process Relations	Persona Relations	Event Relations
Contextual	Entity Associations	Node Associations	Goal Associations	Process Associations	Persona Associations	Event Associations
Logical	Entity Attributes	Node Attributes	Goal Attributes	Process Attributes	Persona Attributes	Event Attributes
Physical	Entity Domains	Node Domains	Goal Domains	Process Domains	Persona Domains	Event Domains
Mechanical	Entity Definitions	Node Definitions	Goal Definitions	Process Definitions	Persona Definitions	Event Definitions
Instantial	Entities	Nodes	Goals	Processes	Personas	Events

Figure 1: Zachman framework [4]

The vertical dimension (the rows) describes the perspectives of those who use the models or descriptions contained in the cells. The top row represents the most generic perspective of an organization, while lower rows are successively more concrete. The bottom row represents a description of the actual data, code and people that make up the enterprise [6].

### B. Model description

	Data architecture	Application architecture	Technology architecture
Business requirements	List of business objects	List of business processes	List of business locations
Conceptual model	Semantic model	Business processes model	Logistics business model
Logical model	Logical data model	Application architecture	Interface description and basic system structure
Physical model	Physical data model	System design	Technology architecture

Figure 2: Framework overview

Our framework uses a modified version of the Zachman framework, shown in Figure 2. The columns in the matrix represent different perspectives of the architecture, while the rows different architecture development rolls.

	Data architecture	Application architecture	Technology architecture
Business requirements	Information needed for realization and functioning of business objects and relationships	Functionalities, processes and activities for information management	(Infra) Structure of elements (hardware, software, network etc...)
Conceptual model			
Logical model			
Physical model			

Figure 3: Framework columns perspectives

	Data architecture	Application architecture	Technology architecture
Business requirements	Planning, high level process description, key information and infrastructure		
Conceptual model	Conceptual view of business processes, information and infrastructure		
Logical model	Logical business model, logical data model, components and application design		
Physical model	Deployment plan, tools and technology, integration and testing		

Figure 4: Framework rows perspectives

Every column gives a distinct view of the architecture and therefore decreases the architecture complexity. Figure 3 describes the content of each of the views.

Every row gives a distinct view of the participants in the architecture development, since the whole architecture cannot be done by one person. Every person involved in the process has appropriate function and each of the rows describes this role. Figure 4 describes the content of each of the views.

C. Framework development: RUP and UML

The above presented framework needs a development methodology and in that purpose RUP [8] can be used, combined with UML. In order to achieve that an appropriate

mapping of the RUP development process to each of the cells of the matrix should be done, as same as the Zachman framework can be mapped with RUP [7]. The mapping is shown in Figure 5.

	Data architecture	Application architecture	Technology architecture
Business requirements	Domain model, Simple object or class diagram	Business modeling, Use case diagrams	Set of localities, Deployment diagrams
Conceptual model	Refinement of Domain model, Simple object or class diagram	Refine Business Process, Activity diagrams	Synthesize System Architecture, Locality Diagrams
Logical model	Database Design, Class diagrams	Use-Case Design, Subsystem Design, Class Design, CID, SMD, CoD	Refine the Architecture, Deployment diagram
Physical model	Physical model	System design	Technology architecture

Figure 5: Framework mapping to RUP

D. Framework development: SSADM

SSADM [9] can be also used for system development of the proposed framework. Since the SSADM methodology imposes certain limitations, a full mapping of the framework cannot be done. Figure 6 shows the limited mapping of the framework. The cells that cannot be fully mapped are mark with gray color.

E. Adding SOA paradigm

The service-oriented architecture (SOA) doesn't replace the enterprise architecture, but extends it with its principles. The principles of (SOA) are [10]:

- Standardized Service Contract
- Service Loose Coupling
- Service Abstraction
- Service Reusability
- Service Autonomy
- Service Statelessness
- Service Discoverability
- Service Composability

Ibrahim and Long from IBM suggested a mapping of the SOA domains into the enterprise architecture (EA). The mapping is shown in Figure 7 [11].

	Data architecture	Application architecture	Technology architecture
<b>Business requirements</b>	LDM No relations	DFD Level 1	Study plan
<b>Conceptual model</b>	LDM Level 1	DFD Level 2	Technology system architecture
<b>Logical model</b>	LDM Level 2	DFD Level 3, EEM, EAP, ELH, ECD	
<b>Physical model</b>	Physical design	App development standards, User Interface design, Physical Process definition	

Figure 6: Framework mapping to SSADM

Architecture domains	SOA solution stack	EA framework
<b>Business</b>	Business process	Business architecture
<b>Applications</b>	Services and components	Application architecture
<b>Integration &amp; Middleware</b>	Integration architecture / ESB	Technology architecture
<b>Data</b>	Data architecture	Information architecture
<b>Operations</b>	QoS, security, monitoring, and infrastructure	Technology architecture

Figure 7: Mapping SOA domains into EA

SOA domains are sub domains of the enterprise architecture. Every step of one architecture lifetime can be upgraded with the SOA paradigms. The United States of America have given a good example of embedding the SOA paradigms into their national enterprise architecture [12]. This example is shown in Figure 8.



Figure 8: Extending EA with SOA paradigms [12]

### III. CONCLUSION

The benefits of using the proposed framework, together with the suggested methodologies and architectures are the following:

- Uniform solution development
- Easier maintenance
- Identification of collaboration points and improved collaboration
- Increased transparency
- Improved service availability to citizens

### IV. FUTURE WORK

The proposed framework is only an initial solution. A further development should be done and a legal framework for the use of the proposed framework should be defined. Also an implementation evaluation methodology could be defined. Additionally, tools and repository containing examples and libraries can be created. The national frameworks and architectures are usually accompanied with prioritized qualitative and quantitative goals, which should be also defined.

### REFERENCES

- [1] K. Hjort-Madsen, "Enterprise Architecture Implementation and Management: A Case Study on Interoperability", Proceedings of the 39th Annual Hawaii International Conference on System Sciences, HICSS 39, Jan 4-7, Kauai, Hawaii, 2006.
- [2] Фондацијата Институт отворено општество - Македонија и Генералниот секретаријат на Република Македонија во соработка

со Фондацијата Метаморфозис, “Препораки за стандарди за ИКТ во државната управа”, December 2007.

- [3] Министерство за информатичко општество, Република Македонија, "Предлог - Национална стратегија, Стратегија за е-Влада, 2010 – 2012", 2009.
- [4] J. Zachman, "A framework for information systems architecture", IBM Systems Journal, Vol. 26, No.3, 276-292, 1987.
- [5] CIO (Chief Information Officer) Council, "Federal Service Oriented Architecture", Version 1.1, June 2008.
- [6] D.S. Frankel, "The Zachman Framework and the OMG's Model Driven Architecture", Business Process Trends, September 2003.
- [7] A. Sayles, "Development of Federal Enterprise Architecture Framework using the IBM Rational Unified Process and the Unified Modeling Language", IBM, 2003.
- [8] Rational Software White Paper, "Rational Unified Process, Best Practices for Software Development Teams", IBM, 2001.
- [9] "Introduction to Methodologies and SSADM", <http://www.comp.glam.ac.uk/pages/staff/tdhutchings/chapter4.html>
- [10] Thomas, E., SOA Principles, <http://www.soaprinciples.com/>
- [11] Ibrahim, M., Long, G., Service-Oriented Architecture and Enterprise Architecture, IBM, (2007).
- [12] CIO (Chief Information Officer) Council, Federal Service Oriented Architecture, Version 1.1, (June 2008).