

"POLITEHNICA" University of Bucharest
Faculty of Automatic Control and Computers

PhD Thesis

**ENTERPRISE MODELLING AND
REFERENCE ARCHITECTURES
FOR INFORMATIC SYSTEMS IN
INDUSTRIAL ENVIRONMENT**

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INTRODUCTION

An Overview

The globalization of economy and the unprecedented industrial competition, the overwhelming influence of information technology and communications, of the Internet and especially of its most important service, the World Wide Web, have a undeniable impact upon all companies. These influence competition, the accelerated output of new products and services by reducing the development time of the product life cycle.

This decade has proved that traditional enterprises are not able to meet market requirements, are not flexible, and not creative enough.

The present thesis, titled *Enterprise Modelling and Reference Architectures for Informatic Systems in Industrial Environment*, supervised by Mr **Florin Gheorghe Filip, Member of the Romanian Academy**, is a natural and useful resultant of the implementation of new enterprise models which are designed to meet high customer requirements and to increase enterprise promptitude and improve its ability to respond to the requirements of a dynamic and borderless marketplace as well as to facilitate the integration in the EU economy.

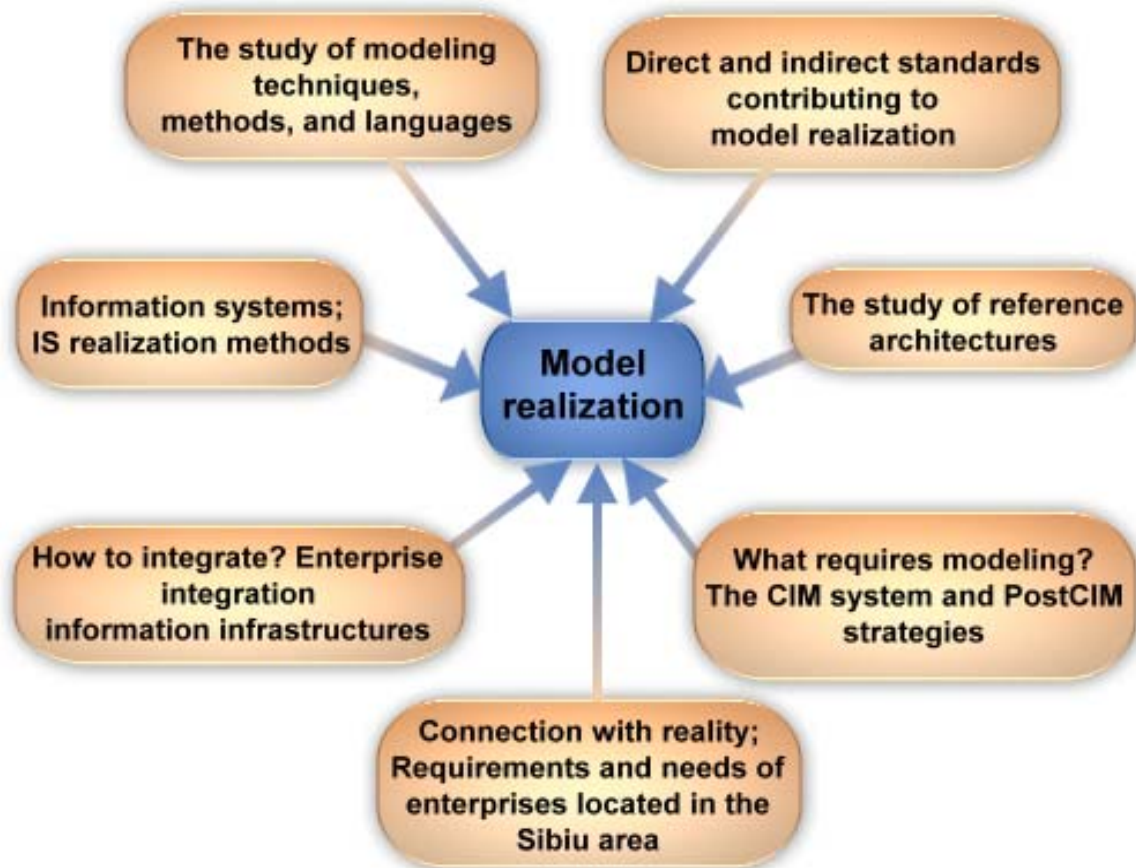
Thesis Purpose

The purpose of the present thesis is to develop a methodology (a theoretical model) for the integration of the enterprise and its divisions with its suppliers and customers in order to acquire promptitude in responding to changes on the market.

The model is theoretical because the purpose of this thesis is not to develop a system that can be readily implemented, but rather to integrate the components already existent within an enterprise (its divisions, human resources, software, hardware, etc.), due to the fact that implementation costs are lower than those of a specialized ERP system such as SAP, and it is easier to integrate the enterprise with its suppliers, customers and partners.

Research Methodology

The research methodology and aspects approached are described in the figure below:



Brief Presentation of the Thesis

Chapter one describes the CIM system and its subsystems and the new PostCIM paradigms, such as:

- Just in Time;
- Lean Management;
- Concurrent Engineering;
- Fractal Company;
- Agile Manufacturing;
- Extended Enterprise;
- Virtual Enterprise;
- Reengineering the Corporation.

Chapter two presents reference architectures:

- CIMOSA (Computer Integrated Manufacturing Open System Architecture);
- PERA (Purdue Enterprise Reference Architecture);
- GRAI (Graphs with Results and Activities Interrelated);
- IEM (Integrated Enterprise Modeling);
- ARIS (Architecture for Information System);
- GERAM (Generalized Enterprise Reference Architecture and Methodology),

and contains a multicriterial analysis performed in order to identify the most appropriate reference architecture and which is easily adaptable to the requirements of Romanian industry.

Chapter three deals with information systems and describes their life cycle: from the analysis, design etc. stages to the deallocation one. This third chapter also contains:

- information on systems (components and classification);
- the enterprise as a system;
- effects of using information systems in an enterprise;
- development of industrial information systems;
- identifying system requirements.

The final part of the third chapter describes decision support systems, CASE – expert systems and tools.

Chapter four presents the enterprise modeling methods, techniques and languages such as:

- GRAI/GIM (Graph with Results and Activities Interrelated/GRAI Integrated Methodology);
- Petri Networks;
- OOA (Object Oriented Modeling) and OMT (Object Modeling Technique);
- CIMOSA (Computer Integrated Manufacturing);
- The family of ICAM Definition Languages, short IDEF, (Integrated DEFinition);
- IEM (Integrated Enterprise Modeling);

- ARIS (Architecture for Information System);
- EXPRESS;
- UML (Unified Modeling Language),

and performs a multicriterial analysis of specialized modeling languages.

Chapter five presents information infrastructures used for enterprise integration starting with the most notable technologies such as CORBA, STEP, EDI, etc., and continuing with the newer concepts and developments of Web-oriented open system architectures based on Web technologies and the XML metalanguage. It also describes the enterprise integration levels:

- system integration, which incorporates system networks;
- application integration, which incorporates application networks;
- business integration, which incorporates process networks;
- enterprise integration, which incorporates enterprise networks.

Chapter six describes the GERAM enterprise integration methodology as well as case studies that are being implemented. Thus, several GERA elements are presented, such as: the life-cycle phases, the instancing of the GERA architecture starting from a general model, continuing with a partial one (which is specific to certain category of enterprises; for example, enterprises in the machine construction industry) and ending with a particular one (specific to a certain enterprise). This chapter also deals with the case studies that are being implemented by means of the UML language, the XML metalanguage, and Web technologies, the collaborative work of designing products by using the STEP standard, and a case study on a virtual assembly application.

Chapter seven highlights the conclusions and contributions of the thesis and formulates new research proposals on the subject.

Chapter eight contains the references, of which a number of 20 papers represent the author's contribution to the field.

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