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Information Systems Architecture

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Architecture

Architecture is a fundamental organisation of a system embodied in its components, their relationships to each other, and to the environment, and the principle guiding its design and evolution

Task

- We all know the term "architecture" from building and construction.
- Discuss in a group:
  - What does architecture mean for building construction?
  - What is the analogy to information systems architecture and enterprise architecture? What does the architecture specify and what could it be used for?

Definitions

- **Architecture** is a fundamental organisation of a system embodied in its components, their relationships to each other, and to the environment, and the principle guiding ist design and evolution.
- **Enterprise**: any collection of organisations that has a common set of goals and/or a single bottom line
- **Enterprise Architecture**: a coherent whole of principles, methods, and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems, and infrastructure
- **Informations Systems Architecture**: synonym for Enterprise Architecture

(Lankhorst et al. 2005, pp. 2f)

Enterprise Architecture / Information Systems Architecture

Objective:

- Describing the interaction between business and information technology
- Ensuring alignment of business strategy and IT investments

Business and IT Perspective

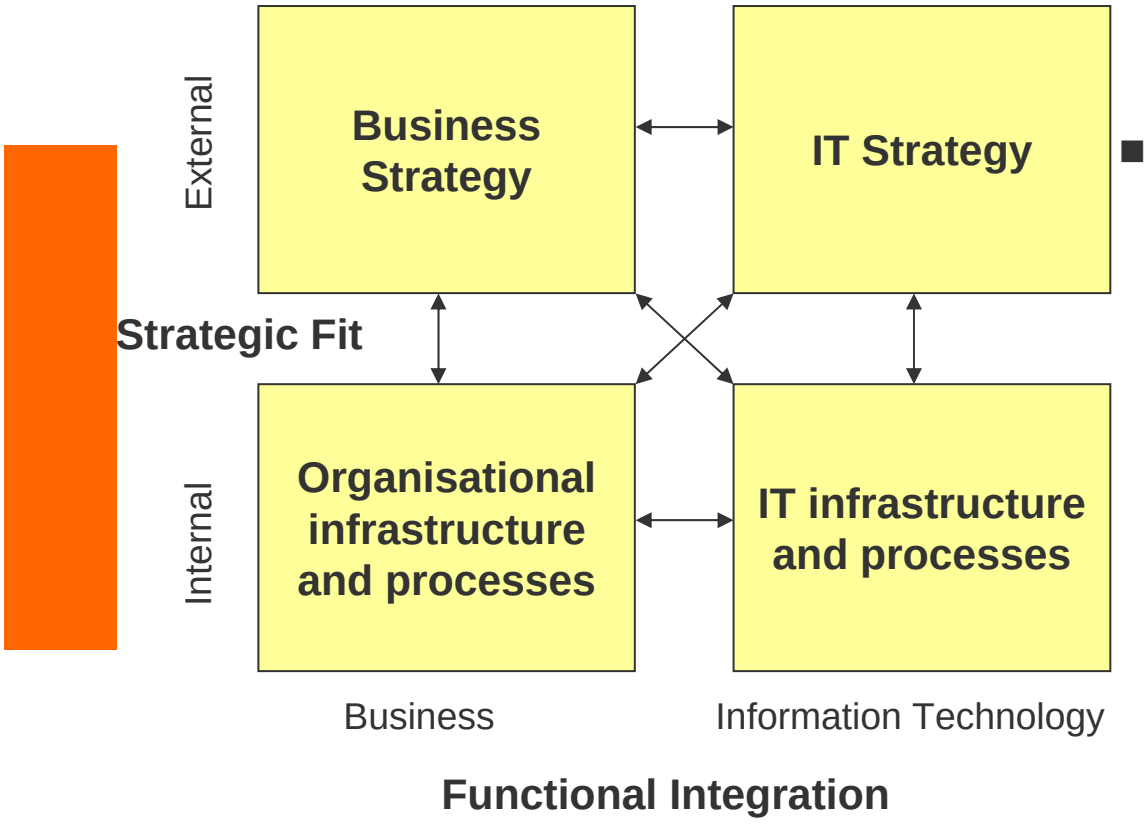
Business Perspective

- Business Motivation
  - Products and Services
  - Business Strategy
- Business Engineering
  - functions
  - business processes
  - organisational structure and responsibilities
  - buiness rules

IT Perspective

- Applications
- Systems
- Technology

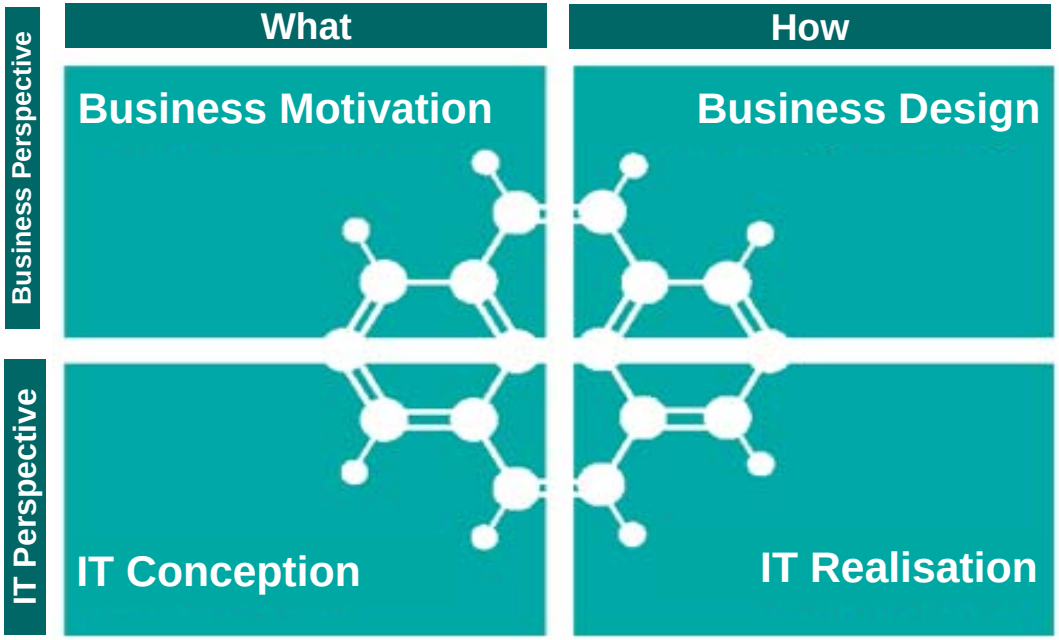
Strategic Alignment Model of Henderson and Venkatraman (1993)



- The strategic alignment model distinguishes between aspects of
  - business strategy and organisational infrastructure
  - IT strategy and IT infrastructure
- Four dominant perspectives to tackle alignment between these aspects:
  - take the business strategy as the starting point and derive the IT infrastructure either
    - via IT strategy or
    - through organisational infrastructure
  - focus on IT as an enabler and start from IT strategy deriving organisational infrastructure
    - via business strategy or
    - based on IT infrastructure

from (Lankhorst et al. 2005)

Model-Driven Enterprise Engineering



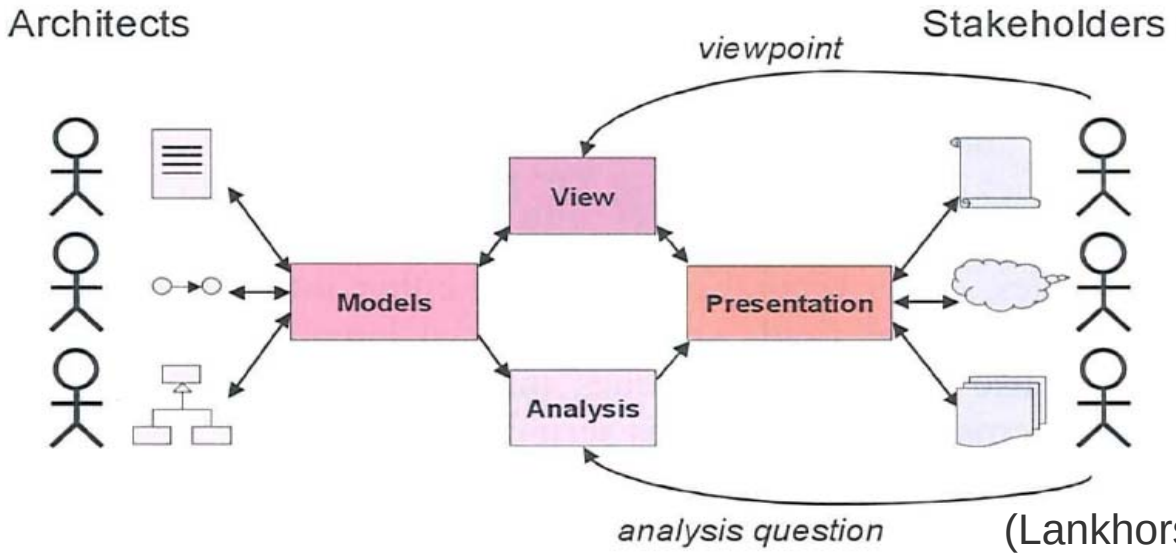
- MDEE is developed by KnowGravity
- It is based on the standards of OMG like MDA and UML

MDA – Model-Driven Architecture
UML – Unified Modelling Language

http://www.knowgravity.com/ger/value/mdee.htm

Communicating about Architecture

- Different types of stakeholders have their own viewpoints on the architecture
- Architectures are subject to change; methods to analyse the effects of changes are necessary
- An integrated set of methods for specification, analysis and communication of architectures is needed that fulfils the needs of different types of stakeholders



(Lankhorst et al. 2005, p. 4)

Task

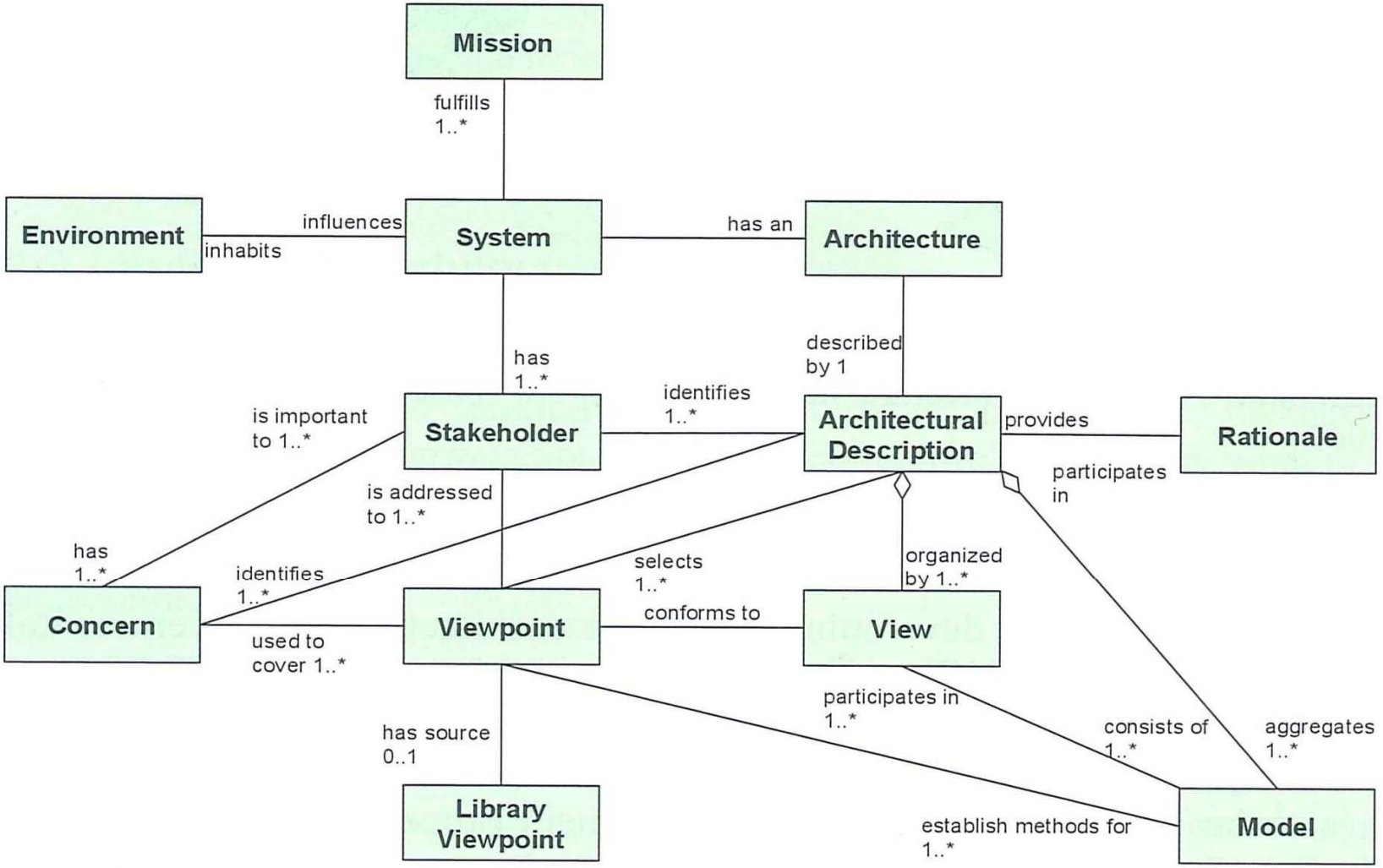
- Discuss in groups
  - What different stakeholders could you imagine in the development of an enterprise architecture?
  - What information would be relevant for their views?

Conceptual Foundation for Architecture IEEE Standard 1471-2000

- The IEEE Standard 1471-2000 is approved by IEEE Computer Society
- It builds a theoretical basis for the definition, analysis and description of system architectures providing
  - definitions for key terms and their relations – making a a clear separation between an architecture and its description
  - explainations of the roles of the stakeholders in the creation and use of an architecture description
  - a number of scenarios for architectural activities during the life cycle: architecture of a single system, iterative architecture for evolutionary systems, architectur for existing systems, architecture evaluation
  - architecture description practices
- It focuses mainly on software-intensive systems
- It does not recommend any modelling languages, methodologies, or standards

(IEEE Computer Society 2000)

IEEE 1471



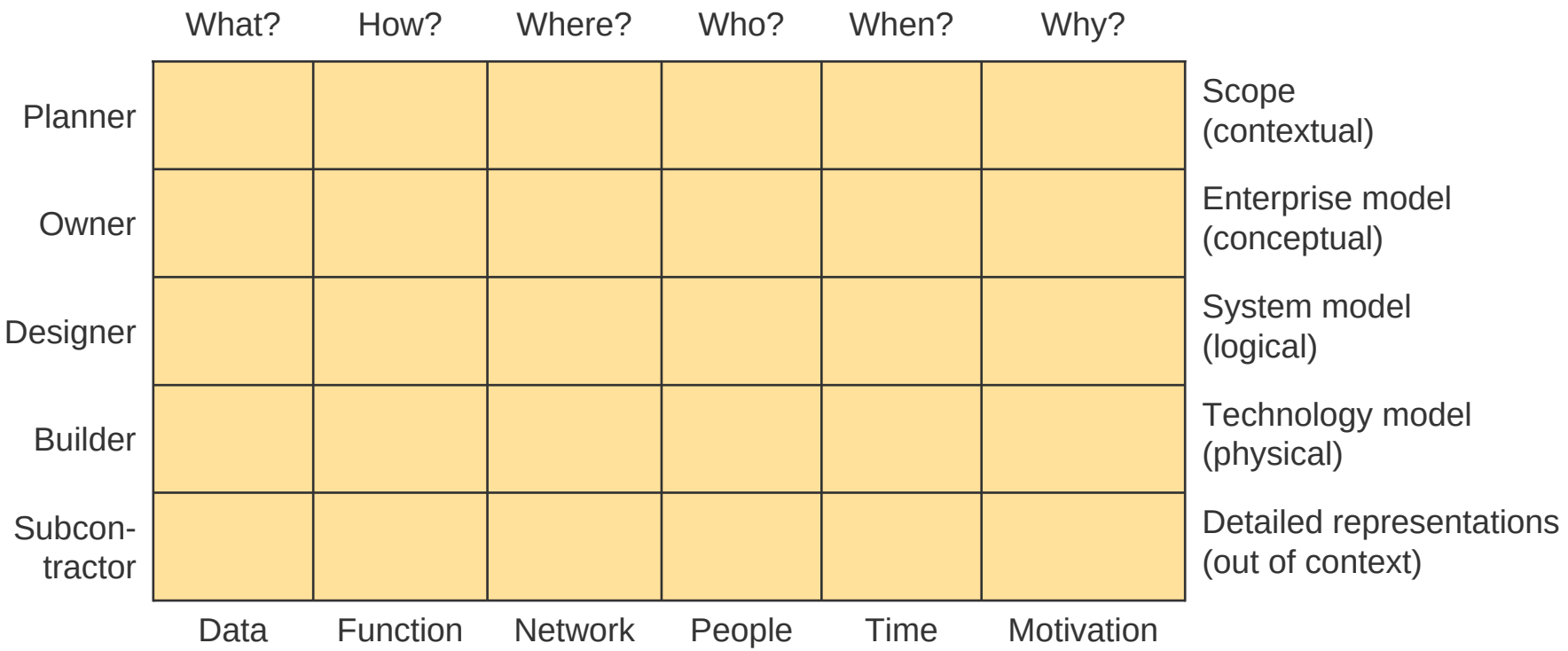
(IEEE Computer Society 2000)

Zachman Framework

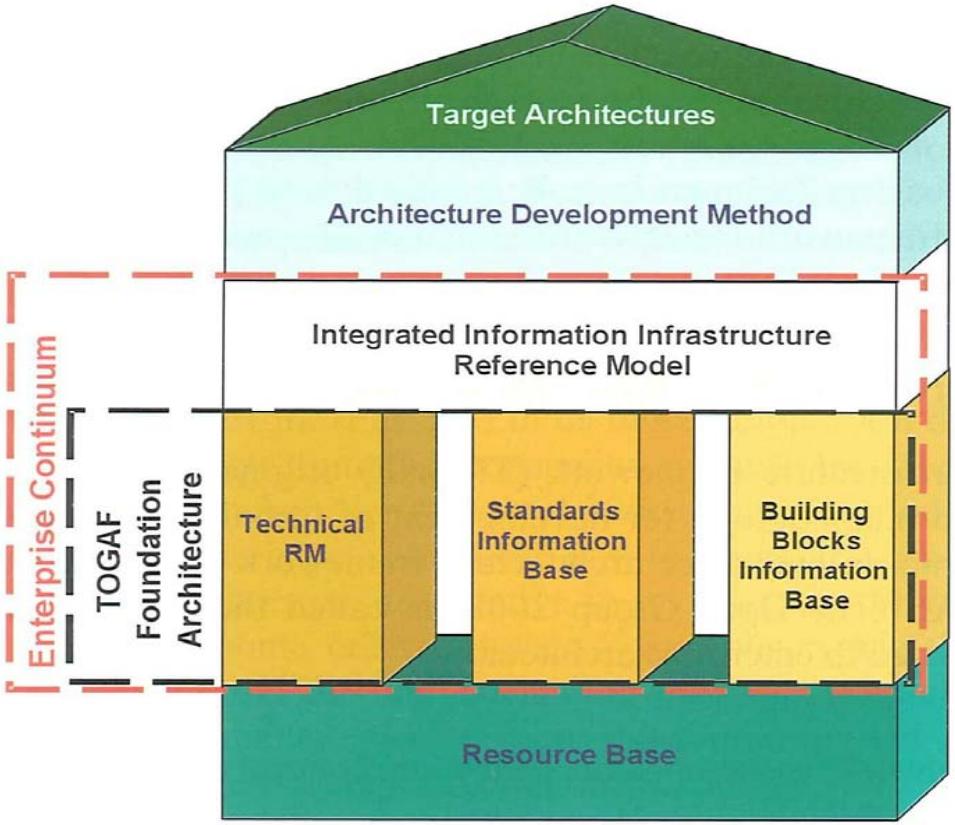
- The Zachman and is regarded the origin of enterprise architecture frameworks (although originally called "Framework for Information Systems Architecture")
- The Framework is often referenced as a standard approach for expressing the basic elements of enterprise architecture
- The framework is a logical structure for classifying and organising the descriptive representations of an enterprise that are significant to
  - the management of the enterprise
  - the development of the enterprise's systems

(Lankhorst et al. 2005, p. 24)

The Zachman Framework



TOGAF - The Open Group Architecture Framework



- TOGAF
  - originated as a generic framework and methodology of technical architectures
  - evolved into an enterprise architecture framework and method
- Main components
  - High-level framework based on a methodology called Architecture Development Method (ADM), composed of
    - Business Architecture
    - Data/information Architecture
    - Application Architecture
    - Technology (IT) Architecture
  - Enterprise Coninuum
    - Integrated Information Infrastructure
    - TOGAF Foundation Architecture
  - Resource Base (architecture views, business scenarios, case studies etc.)

(Lankhorst et al. 2005, p. 25f)

TOGAF Architecture Views

- TOGAF identifies a number of views, which are modelled in an architecture development process. The Architecture Views and the corresponding viewpoints, fall into the following categories
  - Business Architecture Views

    address concerns of people and describe buinsess information flow between people and business processes (people view, process view, Function View, Unability View etc.)
  - Engineering Views

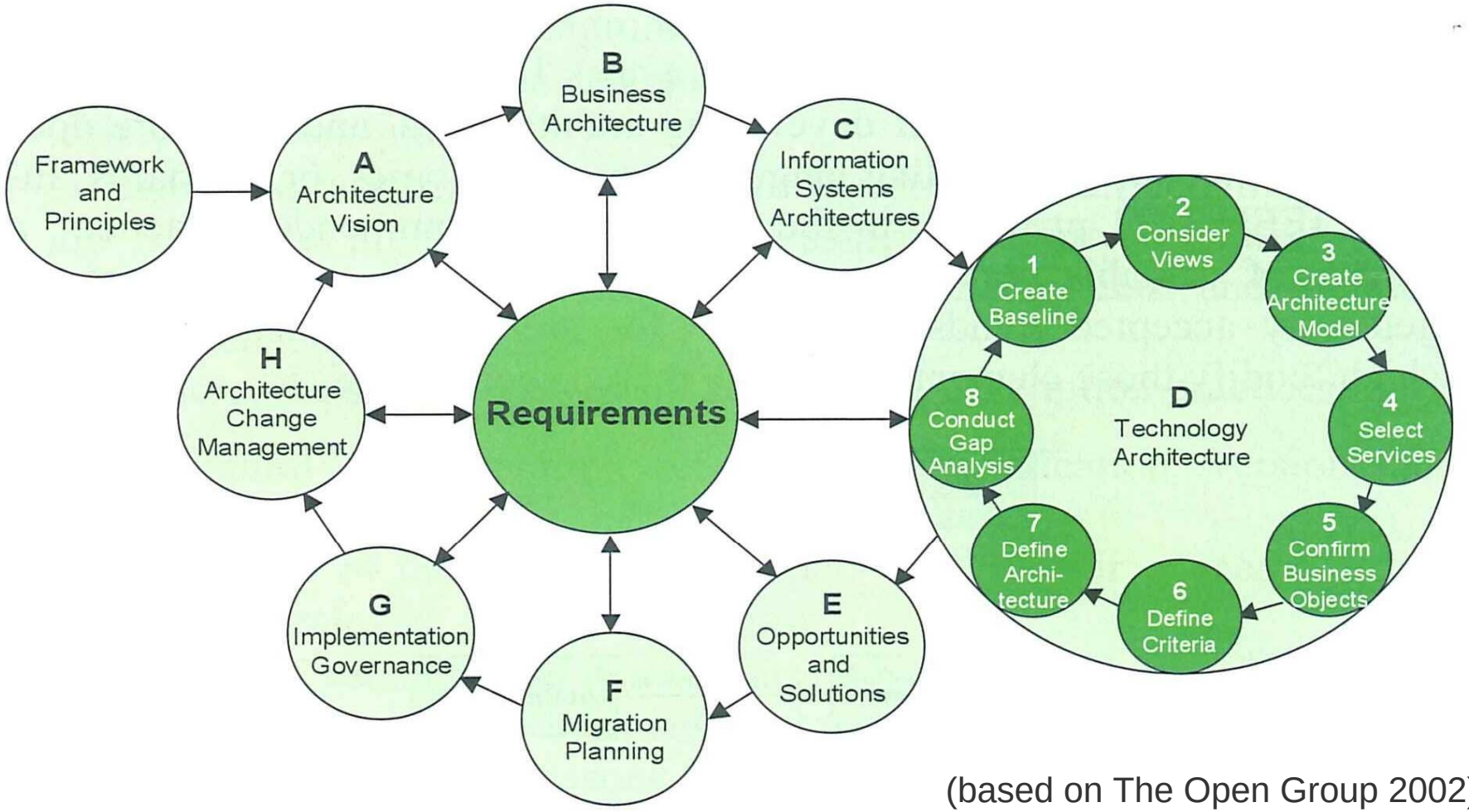
    address concerns of system and software engineers (Security View, Software Engineering View, Data View etc.)
  - Enterprise Manageability Views

    address concerns of systems administrators, operators, and managers
  - Acquirers Views

    address concerns of personell responsible for acquiring external software to be include in the system (Standards View, Building Blocks Cost View)

(Lankhorst et al. 2005, p. 26)

TOGAF Architecture Development Cycle



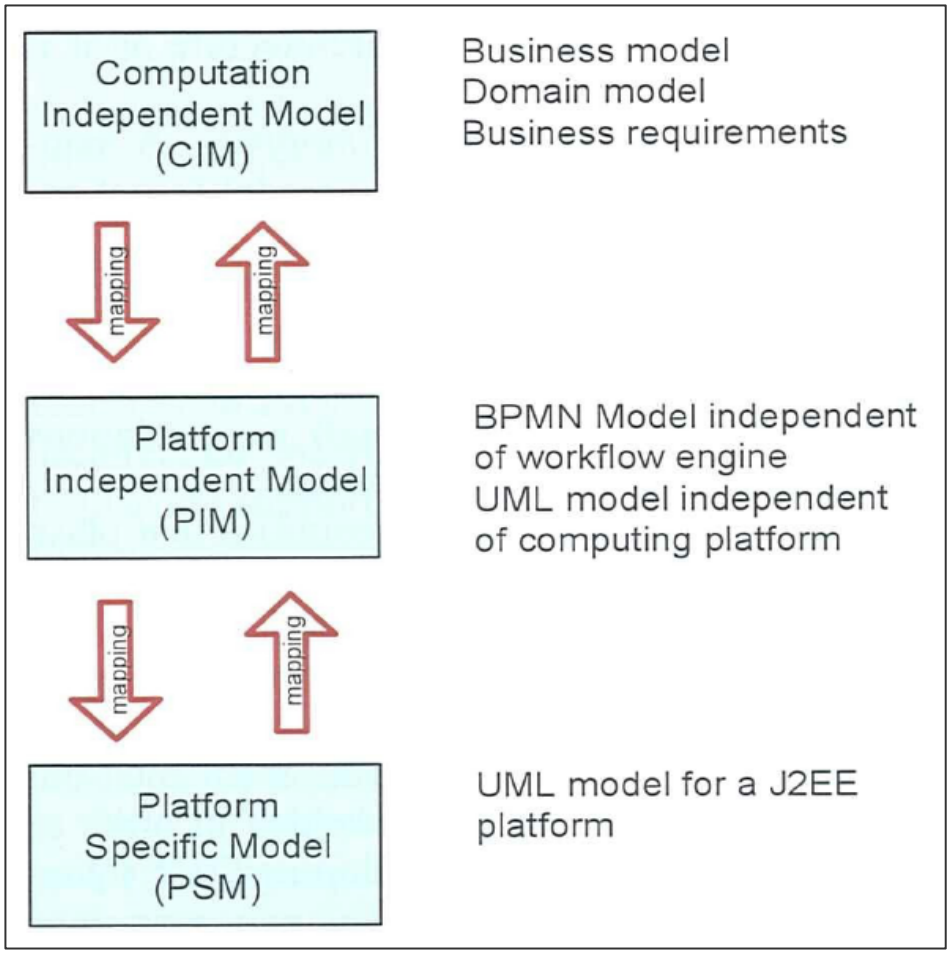
(based on The Open Group 2002)

OMG's Model-Driven Architecture

- MDA is provided by Object Management Group OMG
- Aims to provide an open, vendor-neutral approach to interoperability
- Builds upon OMG's modelling standards
  - Unified Modelling Language UML
  - Meta Object Facility MOF
  - Common Warehouse Meta-model CWM
- MDA wants to raise the level of abstraction at which software solutions are specified
  - generate code from models and views
  - Example: specify software in UML instead of programming it in Java
- Recenty, OMG has extended the focus of MDA to cover business aspects of a company, e.g.
  - Business process modelling notation BPMN
  - Business motivation model BMM
  - Semantics for Business Vocabulary and Rules SBVR

(Lankhorst et al. 2005, p. 25f)

Model-Driven Architecture MDA



MDA comprises three levels of abstraction with mappings between them

CIM Computation-Independent Model

- modelling the requirements for the system describing the situation in which the system will be used
- hiding much or all information about the use of IT systems

PIM Platform-Independent Model

- describing operations of the system while hiding details for a particular platform
- describing those parts of the system specification that do not change from one platform to another

PSM Platform-Specific Model

- Combines specifications of PIM with details about a particular type of platform

Architecture Languages

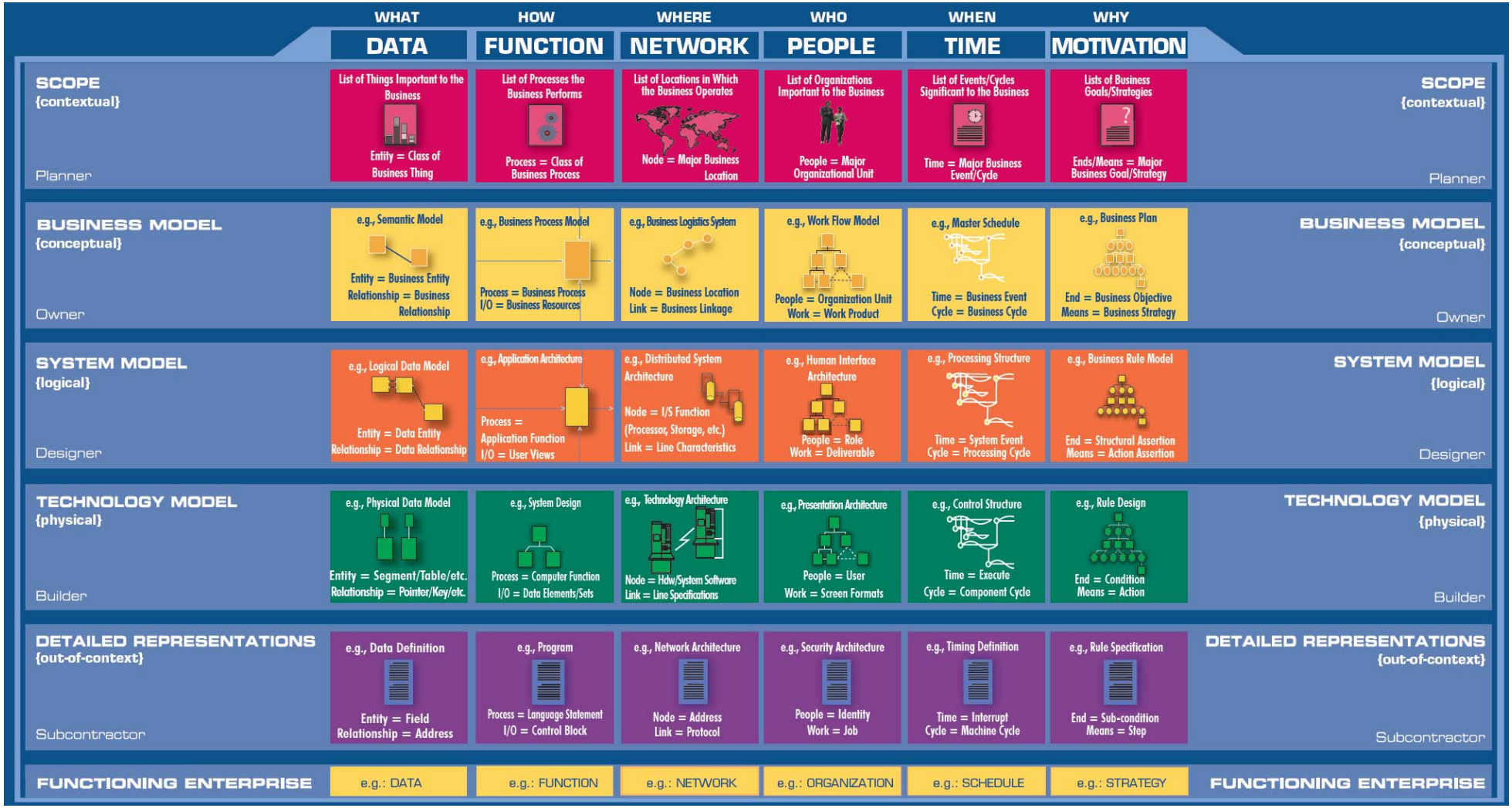
- The unambiguous specification and description of components and especially their relationships in an architecture requires a coherent architecture modelling language – or modelling languages
- Requirements for modelling languages
  - enable integrated modelling of architectural domains
  - should be understandable by both people from IT and people with a business background
  - allow transition from "as is" to "to be": provide analysis methhods for quantitative and qualitative impact of changes
- There are no languages specifically designed for describing enterprise architectures. However, there are languages for subdomains
  - Business Process Modelling
  - Software Modelling

Architecture Languages

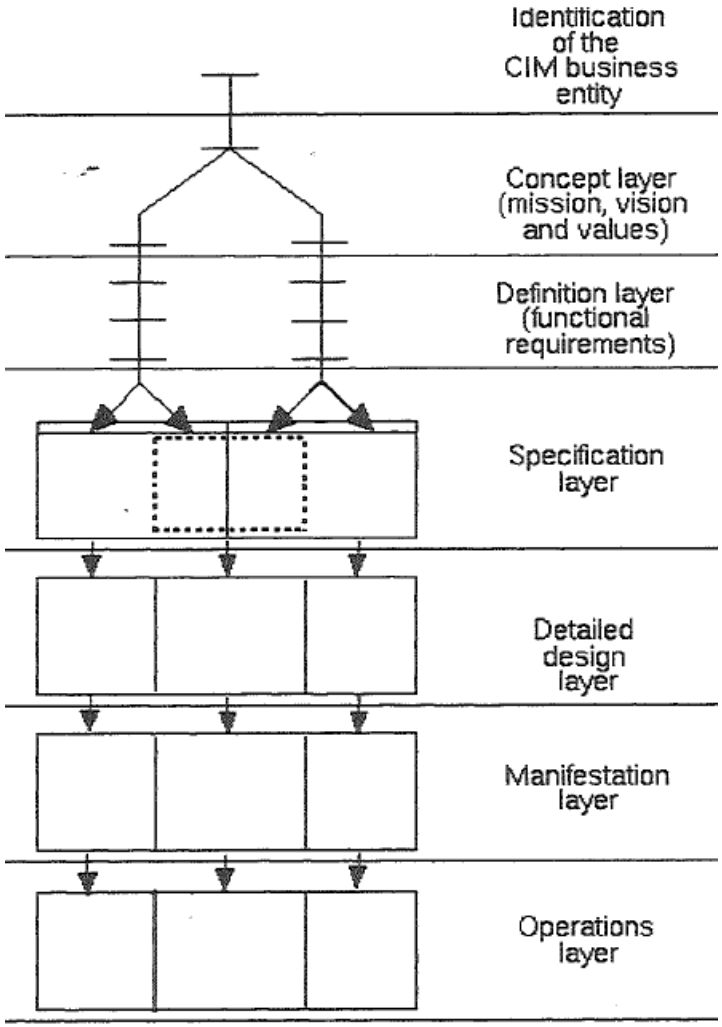
- Software Modelling
  - For software modelling, UML is the dominant language
- Business Modelling
  - For business process modelling there are a multitude of languages, e.g.
    - Business Process Management Notation BPMN
    - Event-driven Process Chains EPC
    - Flow Diagrams
    - Petri Nets
    - IDEF

    and a lot of vendor-specific variants
  - For other aspects there are emerging languages and standards, e.g. Business rules, Business motivation,

Zachman Framework



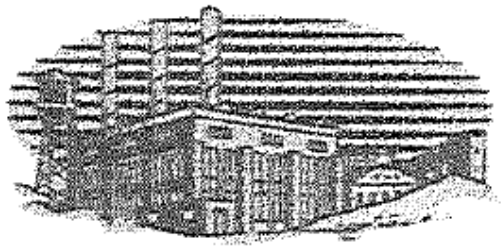
Enterprise Life-Cycle



- The enterprise architecture defines the the structure of the enterprise through its life-cycle
  - starting with the identification of the enterprise
  - followed by conceptual design including strategy, mission , vision and values
  - preliminary ('architectural') design
  - detailed design
  - establishing the enterprise
  - running the enterprise
- These life-cycle acitvities may be repeated many times: continuous development or renewal
- These decisions may be captured in descriptions of models
- The life-cycle activities are represented in a Enterprise Architecture Framework

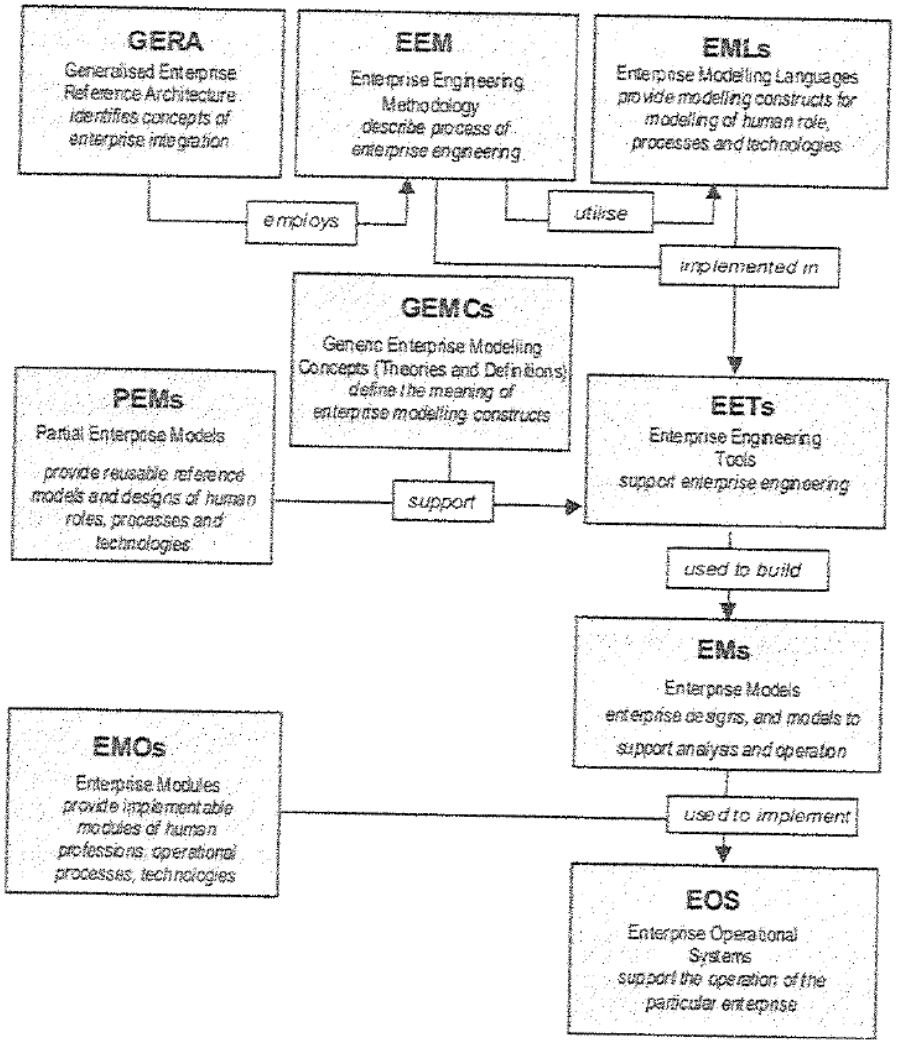
(Bernus et al. 2003, p. 5)

Components of an Enterprise Architecture Framework

Architecture	Methodology for	Tools
Enterprise Reference Architecture	Master planning and implementation 	Modelling languages Modelling Tools Reusable Models Reusable Building Blocks

(Bernus et al. 2003, p. 6)

GERAM – Generalized Enterprise Reference Architecture and Methodology



- GERA – Generic Enterprise Reference Architecture
  - Human-oriented concepts
  - Process-oriented concepts
  - Technology-oriented concepts
- EEM – Enterprise Engineering Methodoloy
- EMLs – Enterprise Modelling Languages
- GEMCs – Generic Enterprise Modelling Concepts
- PEMs – Partial Enterprise Models
- EETs – Enterprise Engineering Tools
- EMs – (Particular) Enterprise Models
- EMOs – Enterprise Modules
- EOSs – (Particular) Enterprise Operational Systems

(Bernus et al. 2003, p. 24)

Business Process Perspective

- From the business process perspective, enterprise architecture achieves enterprise integration through
  - capturing and describing processes, strategies, organisation structures, information and material flow, resources etc.
  - concentration on how to perform core business processes in an organisation
  - considering the information and material flow in the entire process
- In this sense, business process management (BPM) and business process re-engineering (BPR) rely on enterprise architecture
- Tools for BPM and BPR are part of the toolset of enterprise architecture

(Bernus et al. 2003, p. 9f)

Extended Virtual Enterprise

- Agile enterprises co-operate with large number of suppliers, partner, and sub-contractors, e.g.
  - components are manufactured outside
  - detailed design tasks may be subcontracted
  - after sales service may be provided by third party
  - a close cooperation with partners in a supply network
  - strategic relations with some suppliers
- When considering business processes of an enterprise, the scope must include all value-adding activities – internal and external

(Bernus et al. 2003, p. 10f)