Advanced Enterprise and Federation Application Integration with MDA, SOA and WS

MDA, SOA, and Web Services:
Delivering the Integrated Enterprise
Orlando, Florida
March 21-24, 2004

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Mathet Consulting, Inc.

- Integrated, Interoperable and Collaborative Systems Architecture and Engineering
- Global and Local Perspectives
- “Business” and Technology Unification
- Integrated, Interoperable and Collaborative Systems Architecture and Engineering
- Networks of Systems / Systems of Networks including software, enterprises, networks of enterprises, and “open” / global systems
- The Enterprise is the System: Agent, Component/Composite, Knowledge Domain / Application
- Embed MDA, SOA, and WS

- Member IEEE and OMG

Introduction and Background

MDA, SOA, and Web Services:
Delivering the Integrated Enterprise
Orlando, Florida
March 21-24, 2004

Positioning of Tutorial in the Workshop

- Integrates information presented the previous day with an holistic systems approach grounded in General Systems / System Theory and the "Modeling Discipline"
- Presents a "global" picture where following presentations will focus in on specific parts

Perspective and Focal Points

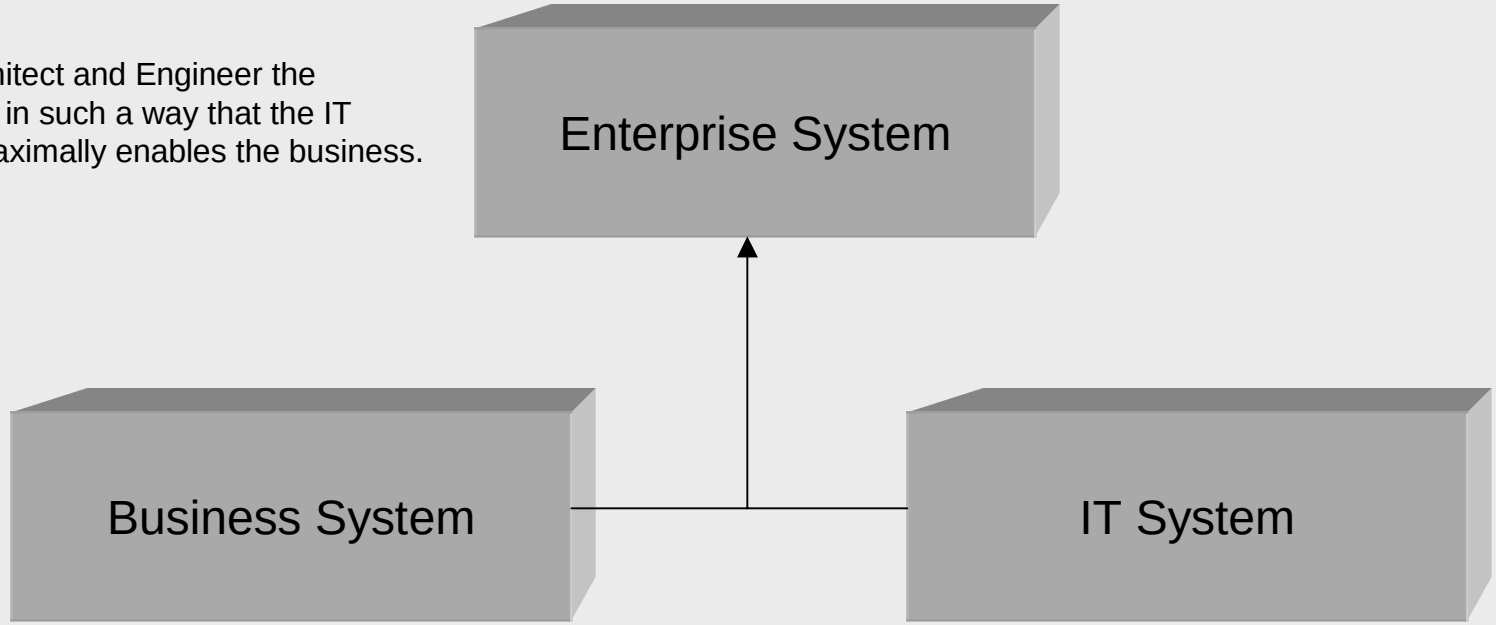
- Primary Perspective: Systems Architecture and Engineering
  - in the General Systems / Systems Theoretic Sense
  - With the “Modeling Discipline”

- Architecture and Engineering Focal Points for this tutorial presentation:
  - Enterprise Systems (Enterprises as Systems / Agents / Components / Knowledge Domains / “Applications”
  - Software Systems (Software Systems as Systems / Agents / Components / Knowledge Domains / “Applications”
  - Model Driven (and Cognition / Knowledge based) Systems
  - Service Oriented Systems
  - Web Services implementation of Model Driven (and Cognition/Knowledge based) and Service Oriented System Designs
  - (Inter-) Enterprise Application Integration (and Interoperability and Collaboration)

Perspective and Focal Points

Enterprise Architecture X Model Driven Architecture X
Service Oriented Architecture X Web Services

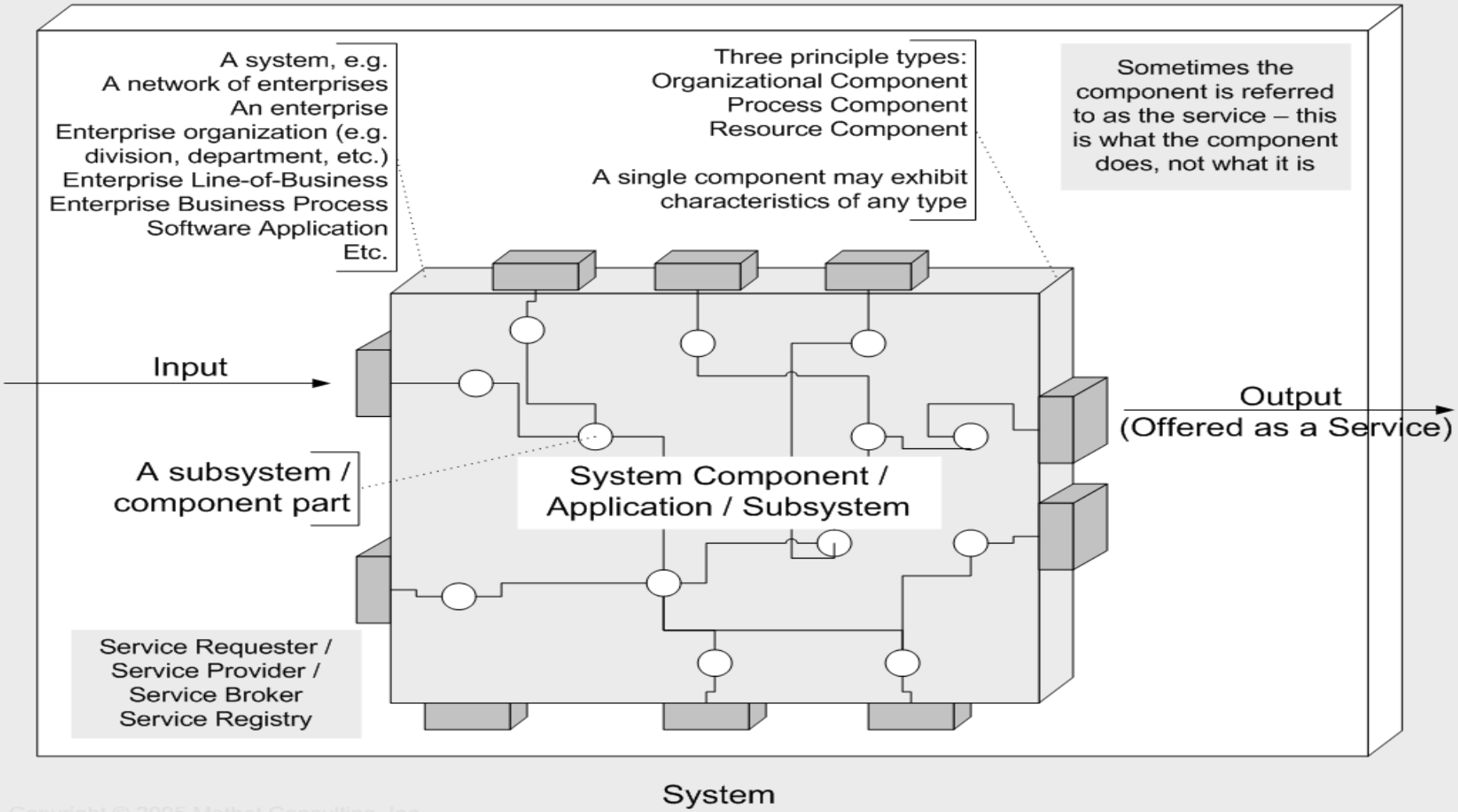
Goal: Architect and Engineer the enterprise in such a way that the IT system maximally enables the business.



The IT system is the platform, offering a set of IT services, for the business made up of an integrated, interoperable and collaborative set of applications.

Perspective and Focal Points

Enterprise Architecture X Model Driven Architecture X Service Oriented Architecture X Web Services



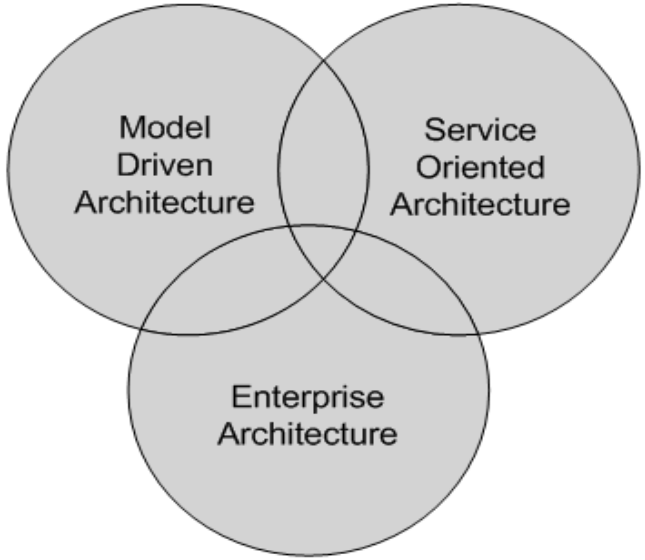
Approach

Tutorial will take an approach that unifies a number of domains into a unified approach to systems

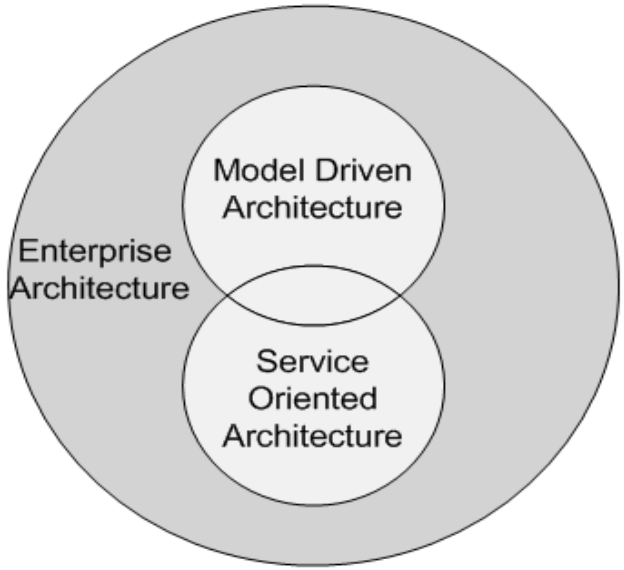
- General Systems Theory / Systems Theory
  - Emergence
  - Static and Dynamic Systems
  - Stationarity
  - Stability
  - Evolution
  - Learning
  - Cognition / Intelligence
- The “Modeling Discipline”
  - The Modeling Discipline Trichotomy
  - Modeling Systems,
  - Model Systems,
  - Modeled Systems
  - Meta

Shifts in Paradigms

- MDA, SOA, WS
  - Move from software component-based development to model-based development
  - Component management, service management → model management



Subject Areas are not equivalent but do have overlapping concerns.



Enterprise architecture has governance over model driven architecture and service oriented architecture within an enterprise

What is Meant by "Application" "Application Integration"

- Traditionally, an "application" refers to an large grained software system that is architected independent of business processes (e.g. 3rd party COTS products)
- Tradition is changing in that
  - virtual applications (within and between enterprises) may be a priori defined, specified and "instantiated" by business processes
  - There is a set of applications that do this
  - the virtual application may arise dynamically through negotiation

- The set of traditional applications, evaluated and selected for, within an enterprise must be integrated in such a way as to enable interoperability and collaboration among the members of the set within the parameters of a (meta) process
- The integration should be done in a way that
  - This is done in such as way so as to optimize performance, efficiency, and maximize value

Enterprise ("Application") Systems

- 10s of 1000s to evaluate, select and integrate
- CRM, ERP
- Analytical: Statistics, Mining, Reporting,
- (Business) Process, (Business) Rules, (Business) Activity, Workflow
- Security
- Warehouses
- Rules
- Performance and Capacity / Continuity
- Etc. Etc.

Outline

- Introduction to the Integrated, Interoperable and Collaborative Systems: Architecture and Engineering Approach (IICSAE™)
- Fitting IICSAE and MDA Together
- Relationships Between MDA, SOA, and WS
- Enterprise Application Integration Examples with MDA, SOA, and WS
  - Build Environments
  - Unified and Converged Communications
  - Security and Privacy

Advanced Conceptualization of Enterprise and Inter-Enterprise Integration, Interoperability and Collaboration

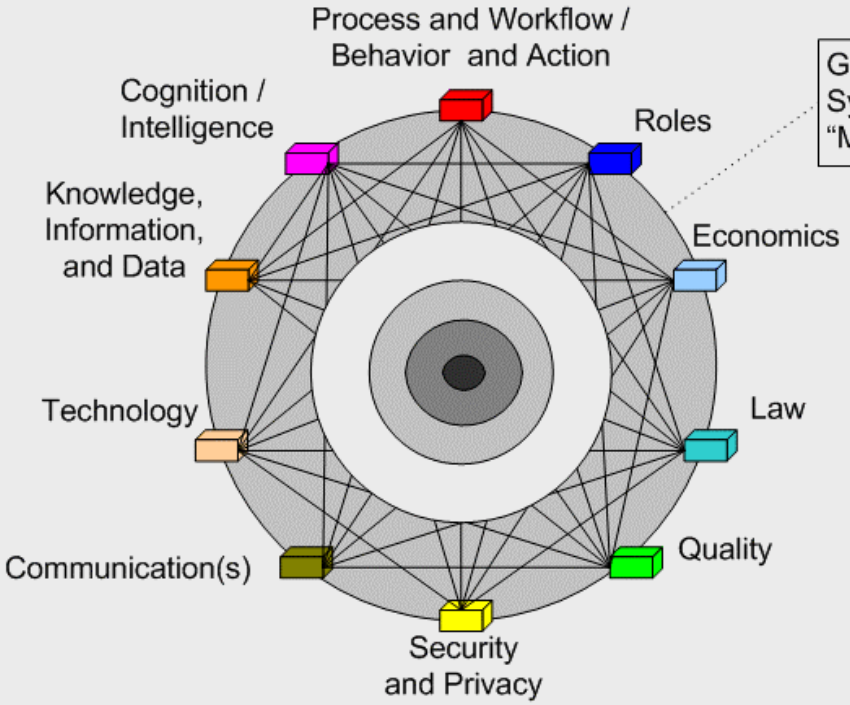
and

Systems and Model based Unification of EA, MDA, SOA, and Web Services to Achieve Integration, Interoperability and Collaboration

Advanced Conceptualization Systems and Model based Unification of EA, MDA, SOA, and Web Services

Introduction to the Integrated, Interoperable and Collaborative Systems: Architecture and Engineering™ (IICSAE™) Approach

Foundation Elements



General Systems / System Theory and the "Modeling Discipline"

Integration, Interoperability and Collaboration

Best Practices and Standards / Policies and Procedures

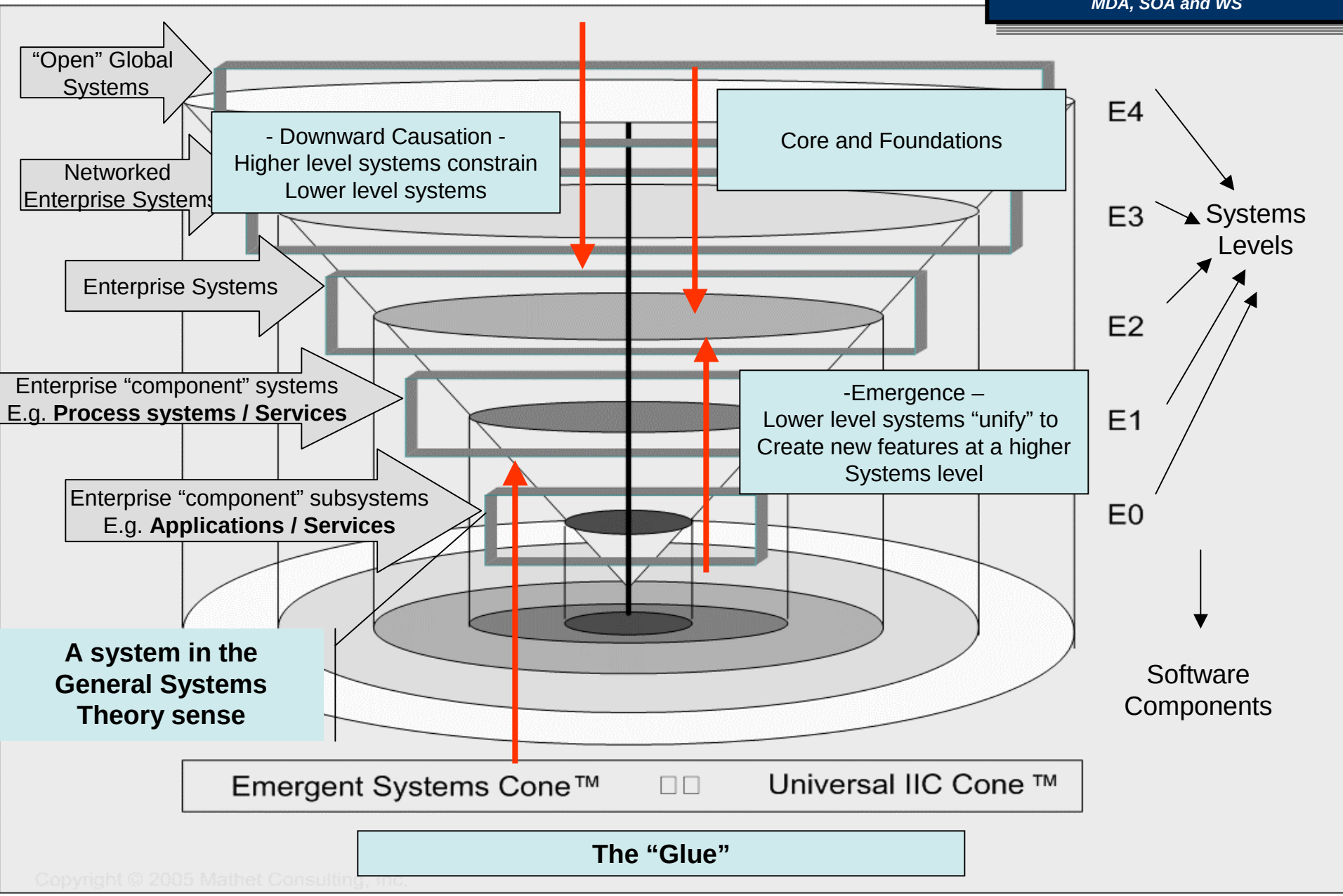
Algorithms and Computation

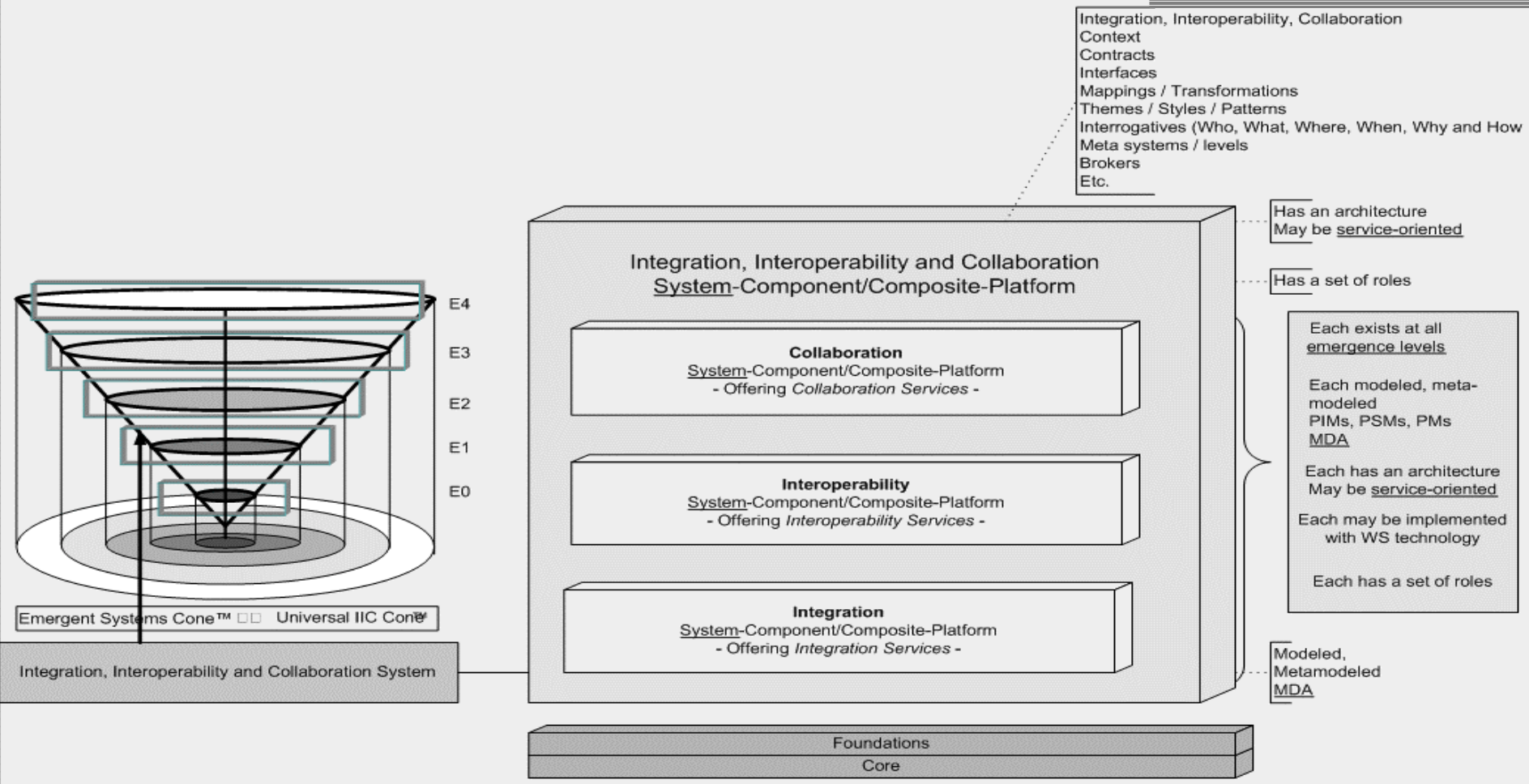
Ontology and Semiotics

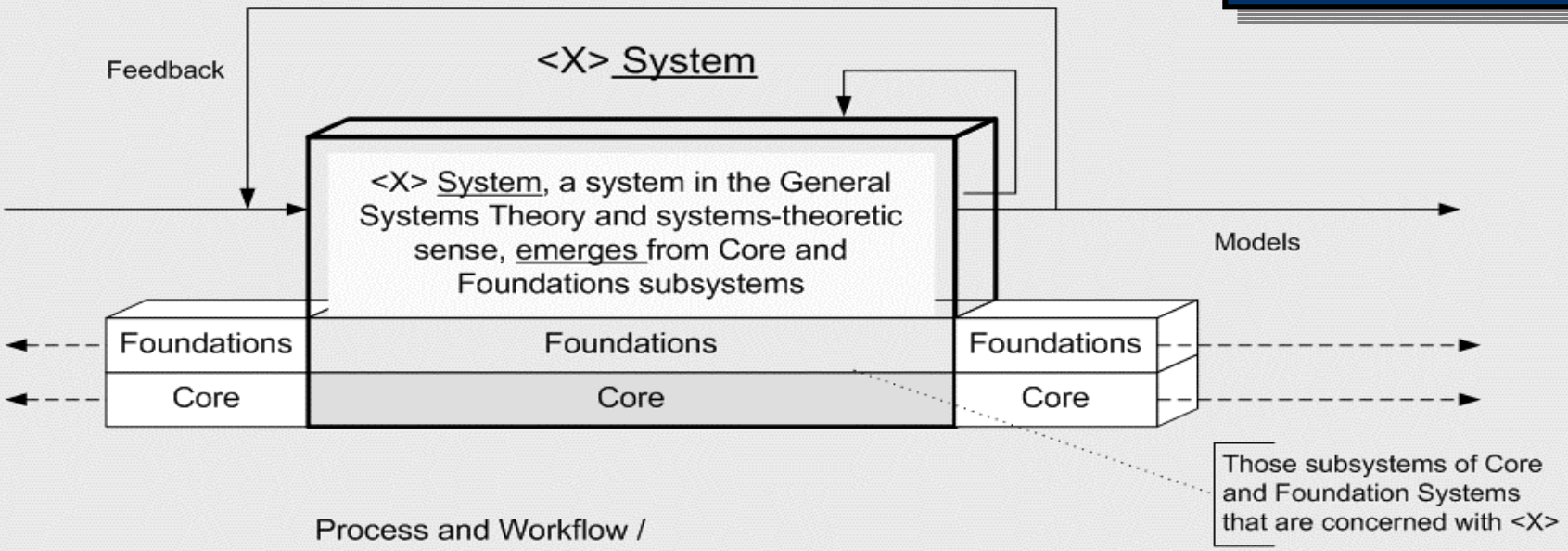
Core Elements:

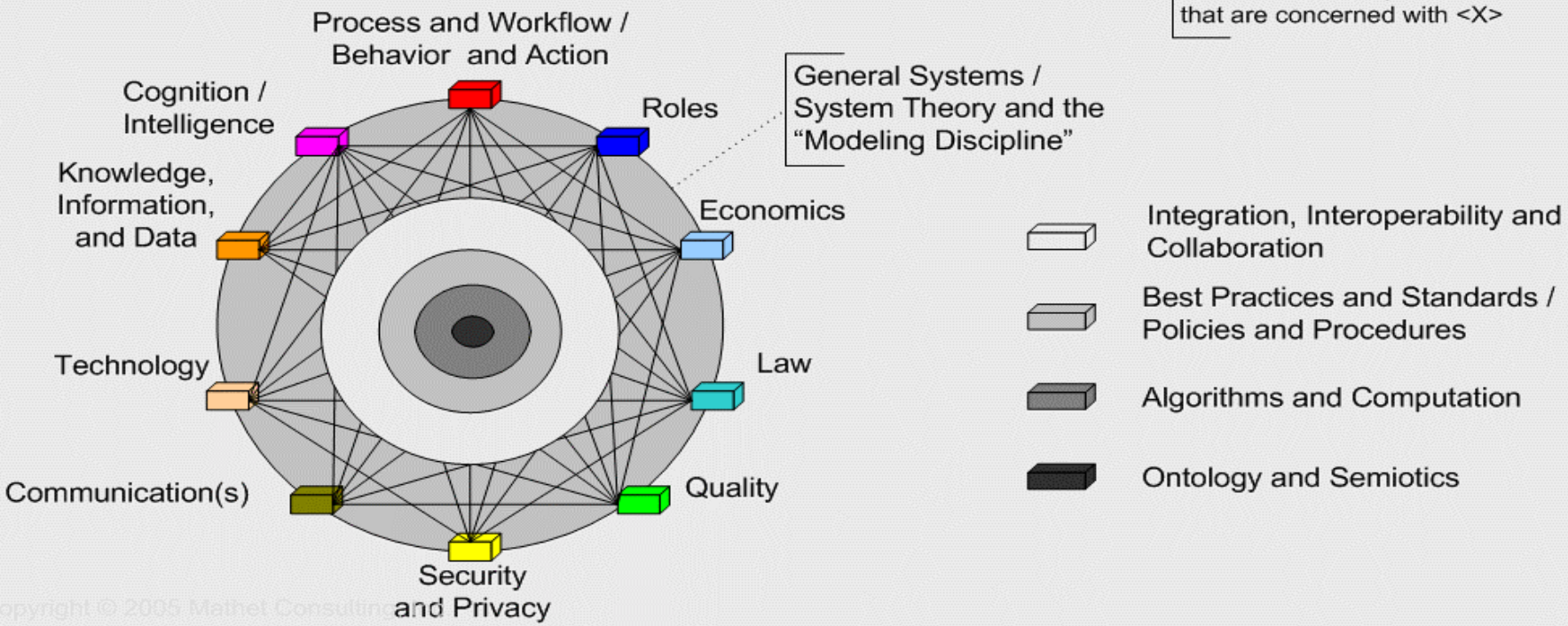
- All elements expressed in (semi-) formal (meta-) languages
- As concrete components – the meta is realized and implemented
- As intelligent agents – the meta is used in reasoning

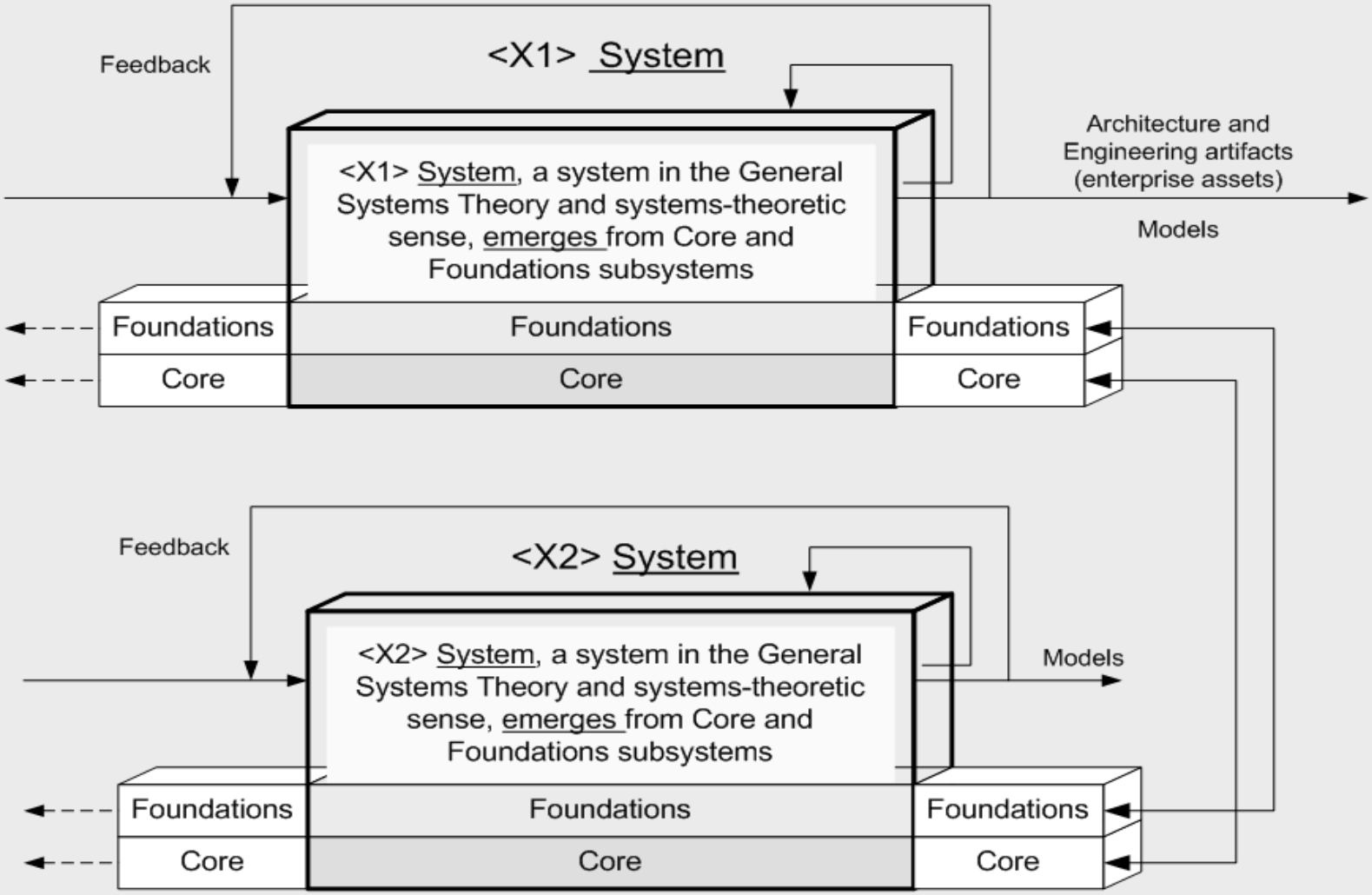
- Each element may be considered to be a knowledge domain
- Each element may be considered to be a system
- Each element may be considered to be a component
- Each element may be considered to be a viewpoint

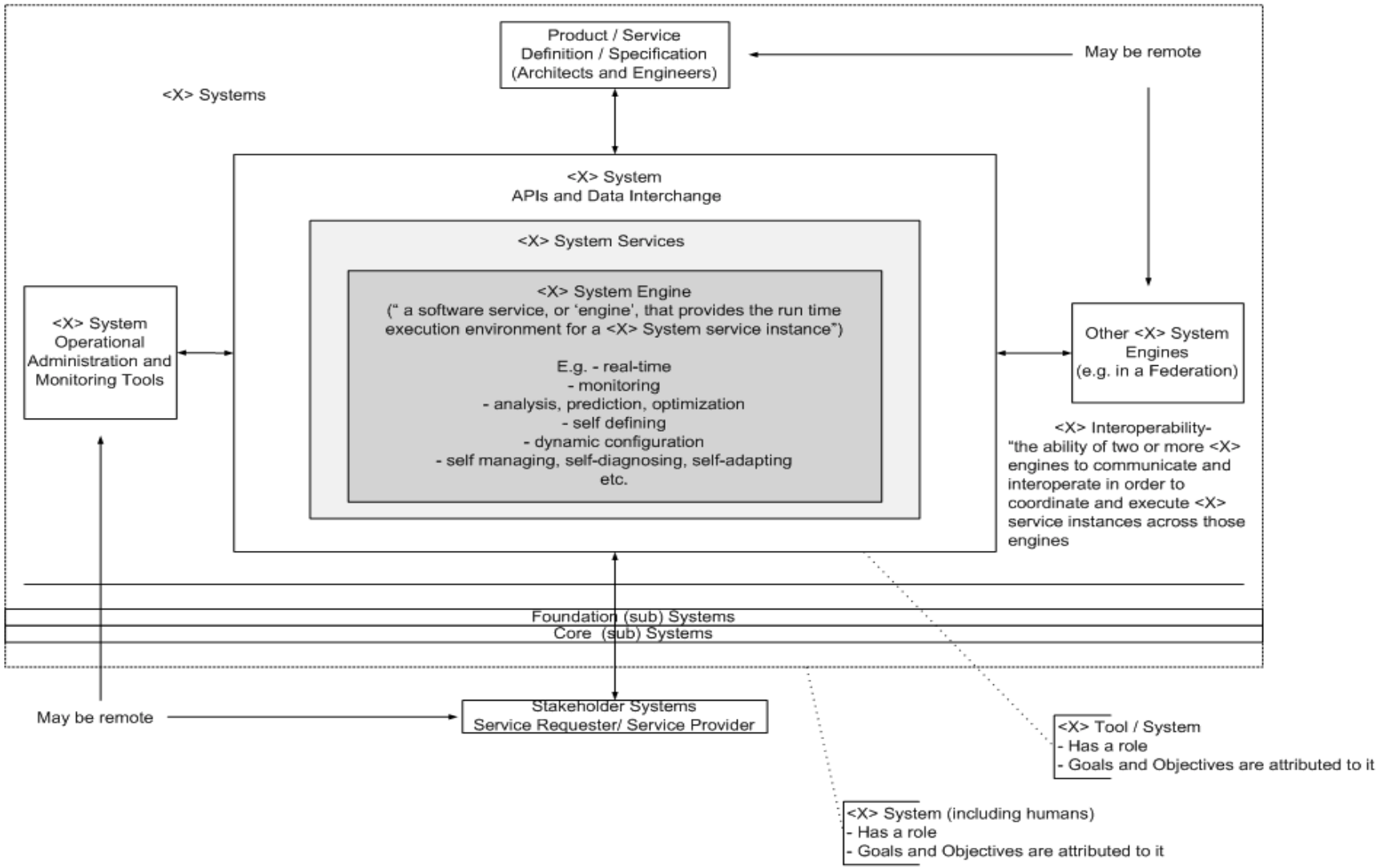


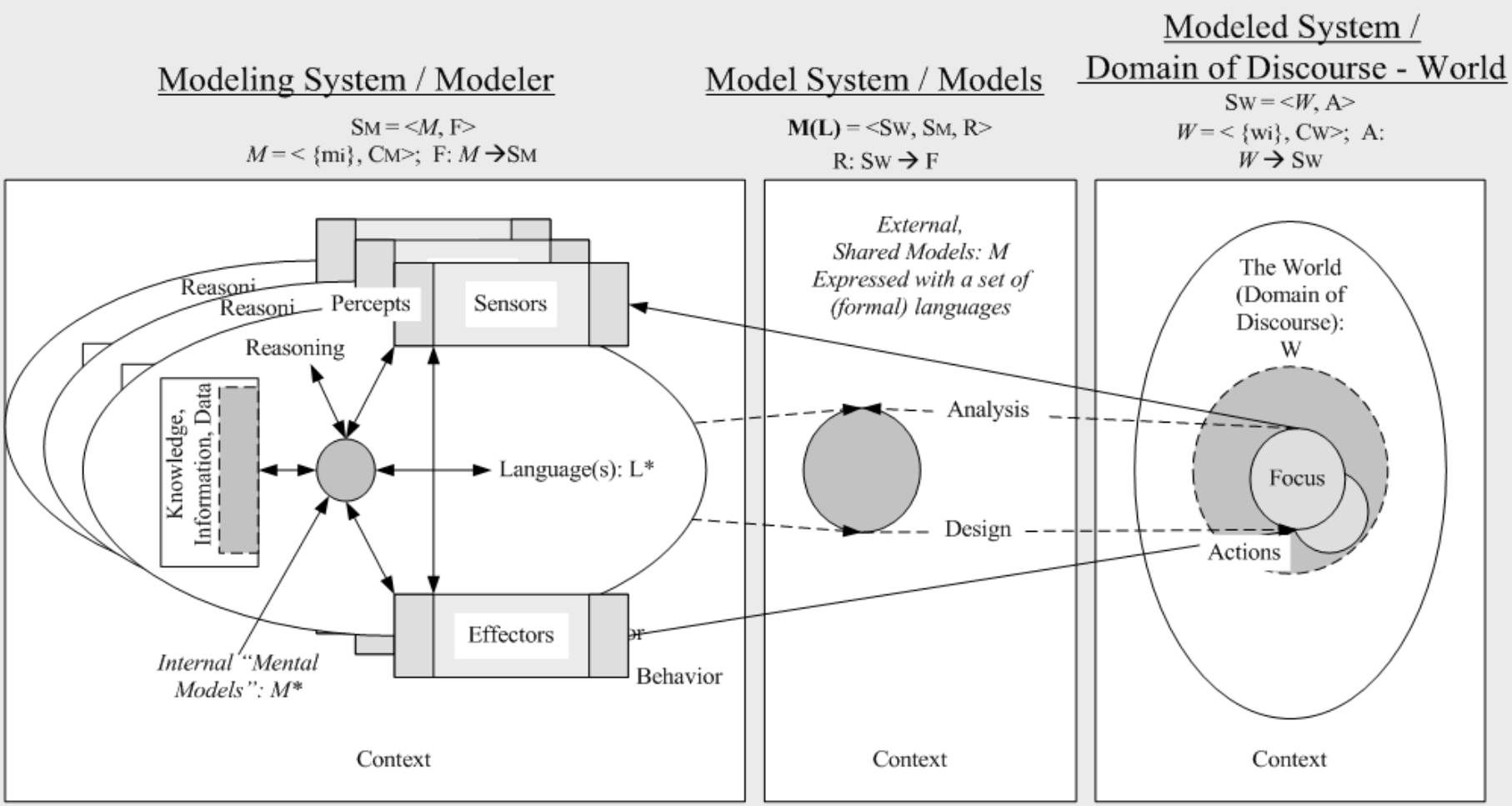












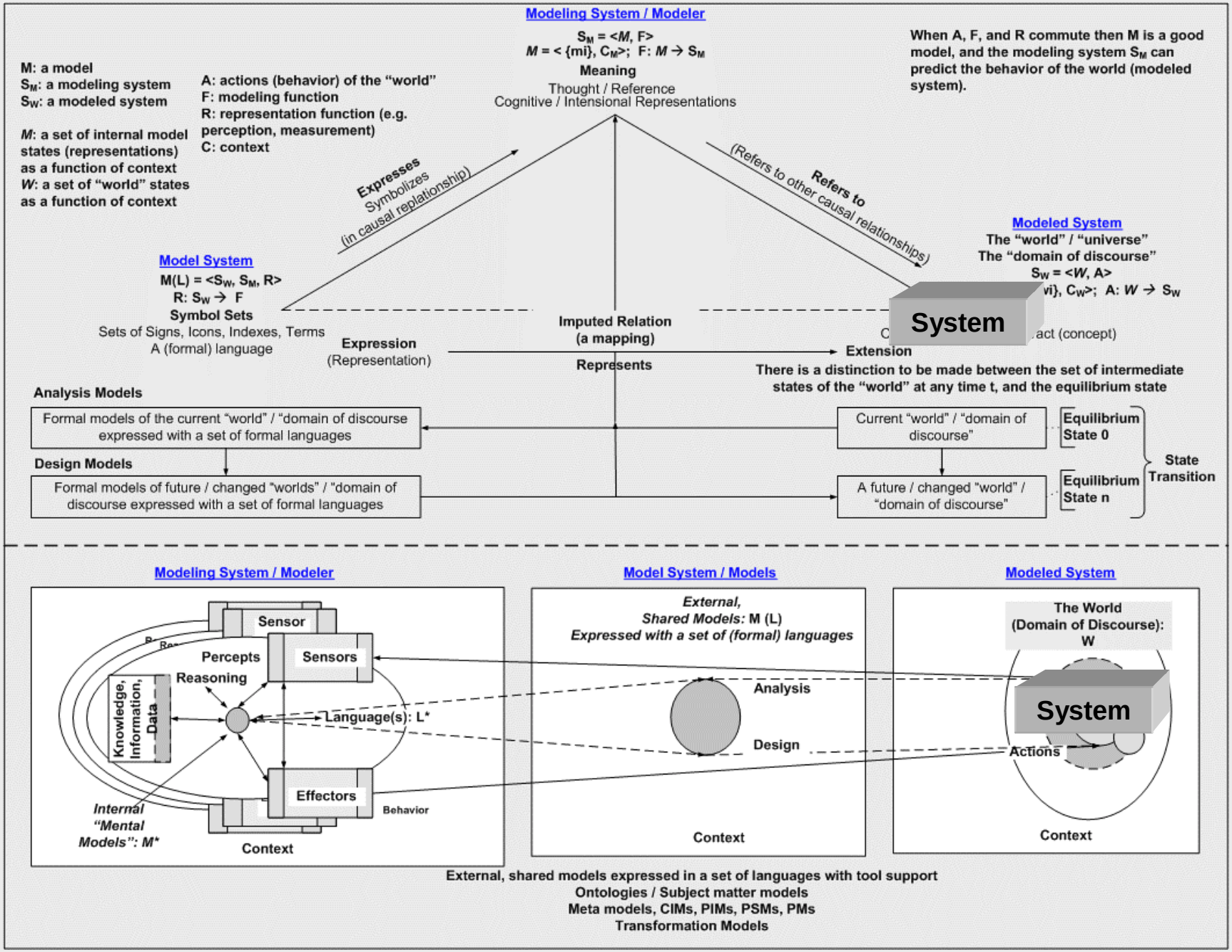
M: a model
SM: a modeling system
SW: a modeled system

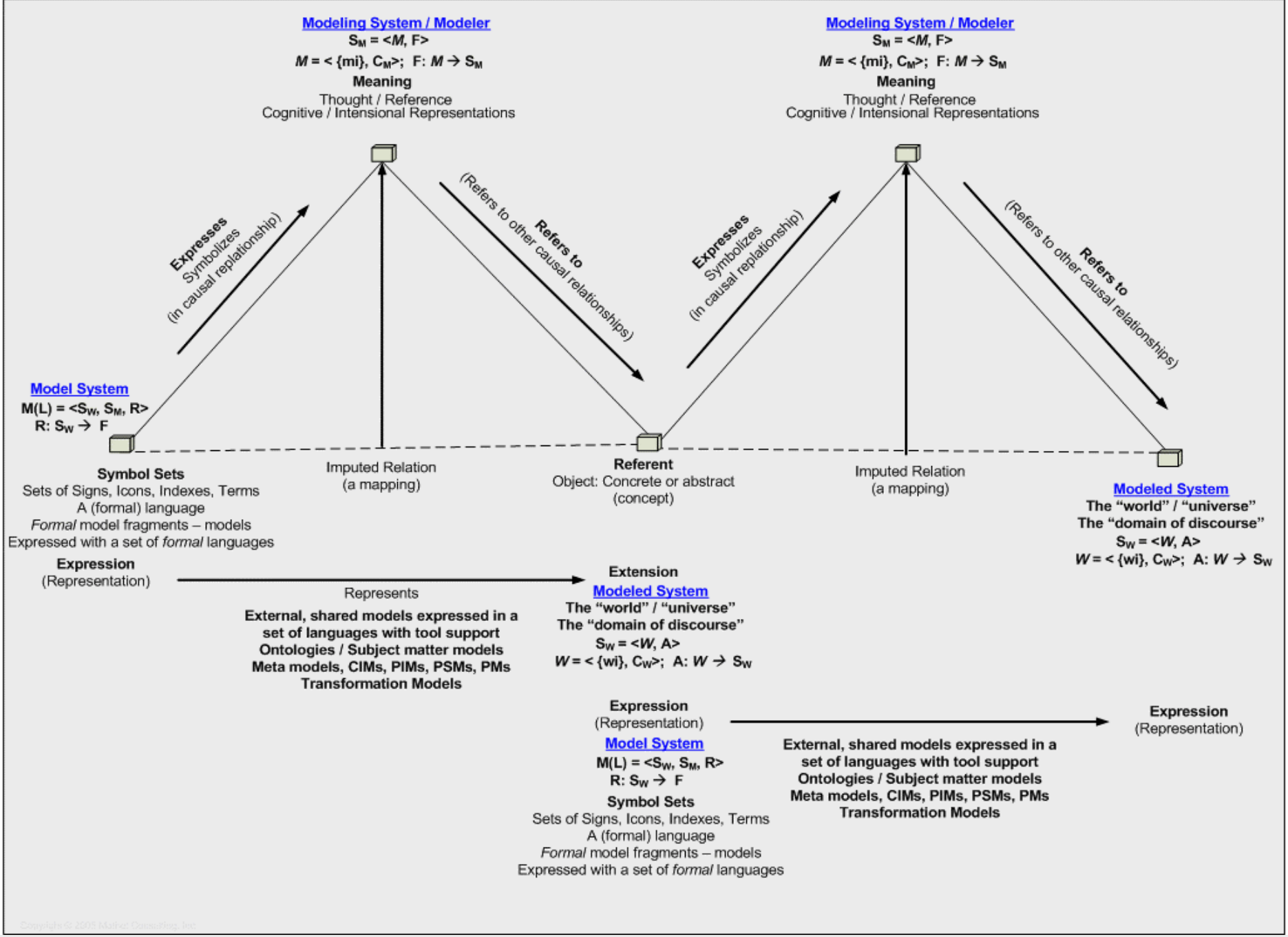
M: a set of internal model states (representations) as a function of context
W: a set of "world" states as a function of context

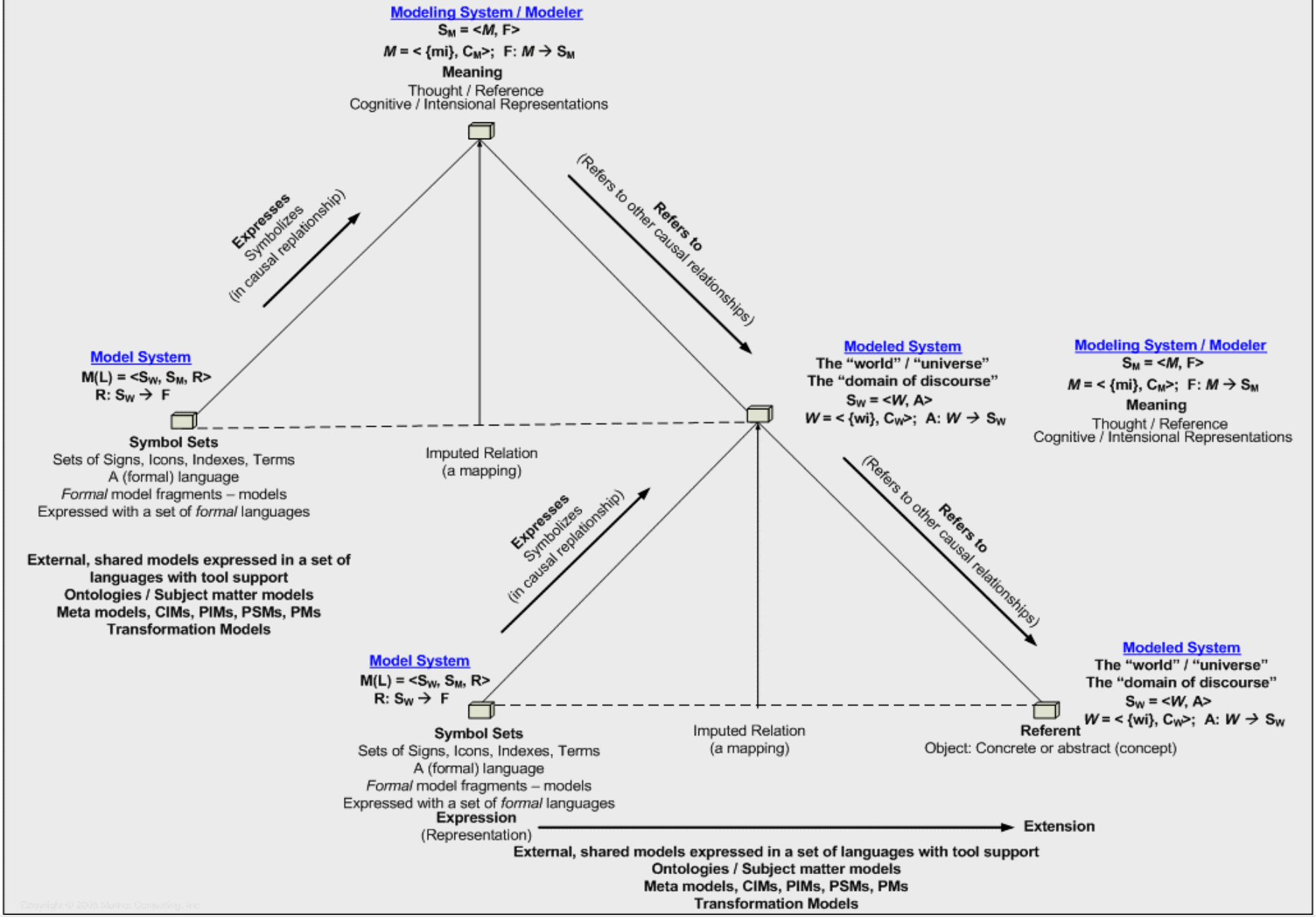
A: actions (behavior) of the "world"
F: modeling function
R: representation function (e.g. perception, measurement)
C: context

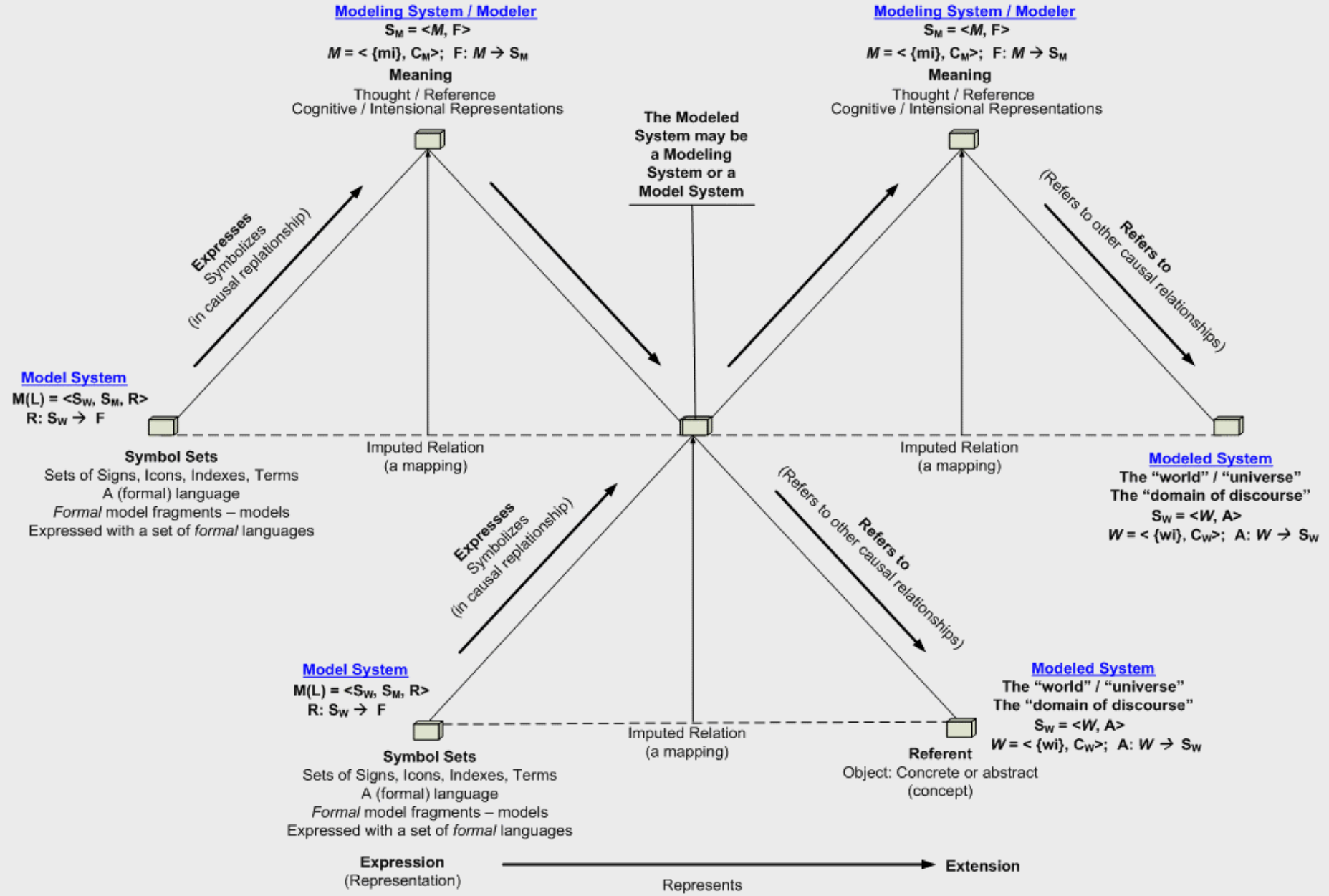
External, shared models expressed in a set of (formal) languages with tool support.

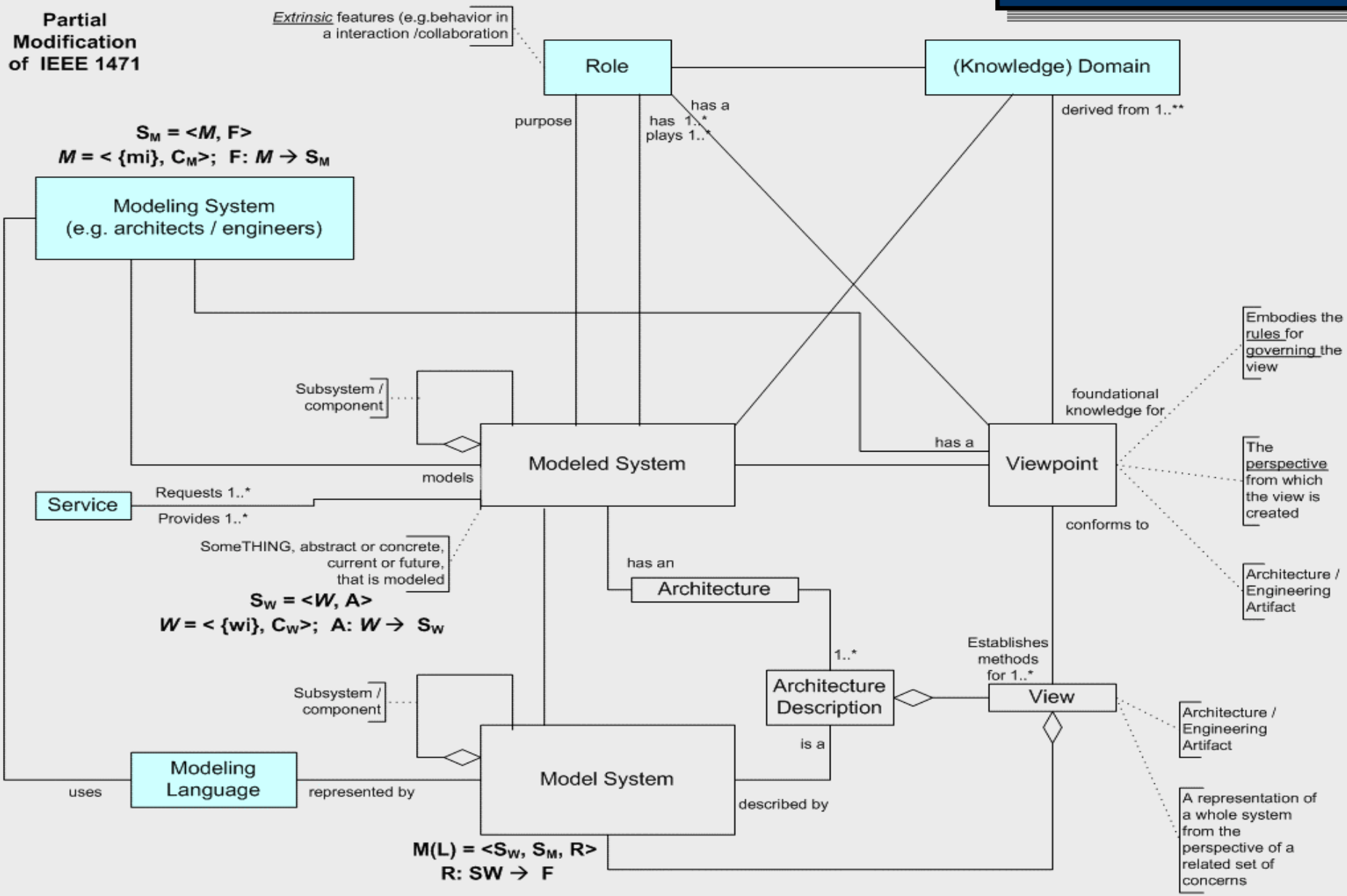
Ontologies / Subject matter models
Meta models
PIMs
PSMs
PMs
Transformation Models











Advanced Conceptualization Systems and Model based Unification of EA, MDA, SOA, and Web Services

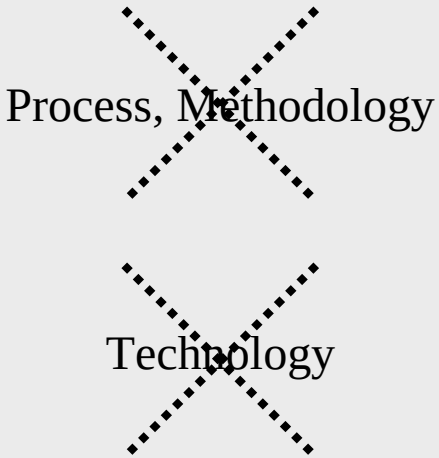
Model Driven Architecture™

Some Key Benefits of Model Driven Architecture

- Improved productivity for architects, designers, developers and administrators
- Decreased cost of development and management
- Enhanced integration, interoperability and collaboration
- Business models and technologies evolve independently at their own rate

Some Semantics

What it isn't



What it is

A general approach, strategies, to architect and engineer (information) systems

"An approach to IT system specification that separates the specification of functionality from the specification of the implementation of that functionality on a specific technology platform"
(Draft MDA Guide: www.omg.org/docs/ab/03-01-03)

An emerging knowledge domain, based in the "modeling discipline", whose universe of discourse is the engineering of information systems through models and modeling. (Mathet Consulting)

Some Semantics

"Model Driven Architecture"

Software System
"Model Driven Architecture"

Enterprise Systems,
Networked Enterprises Systems,
Global Systems
"Model Driven Architecture"

IT System
"Model Driven Architecture"

"Model Driven (IT System) Architecture"
The Technology Platform for the Business of the Enterprise Systems, Networked Enterprises Systems, Global Systems

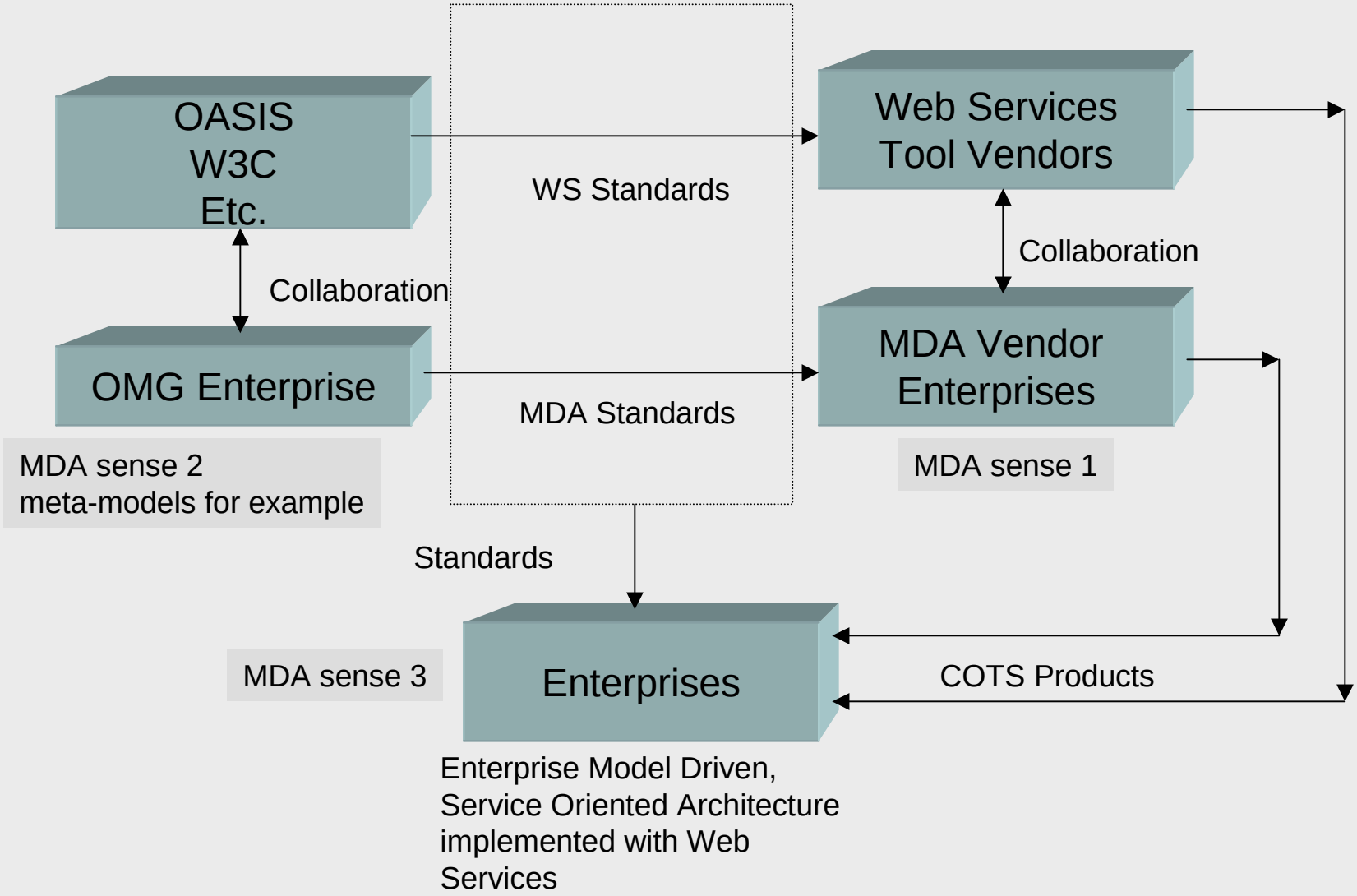
May be distributed at the
- Enterprise,
- Networked Enterprises,
- Internet Level

Sense 1: An architecture for MDA Tool Sets (a "platform" for creating system architectures)

Sense 2: An architecture for OMG standards

Sense 3: An (IT) system architecture created using the MDA approach and MDA tool sets

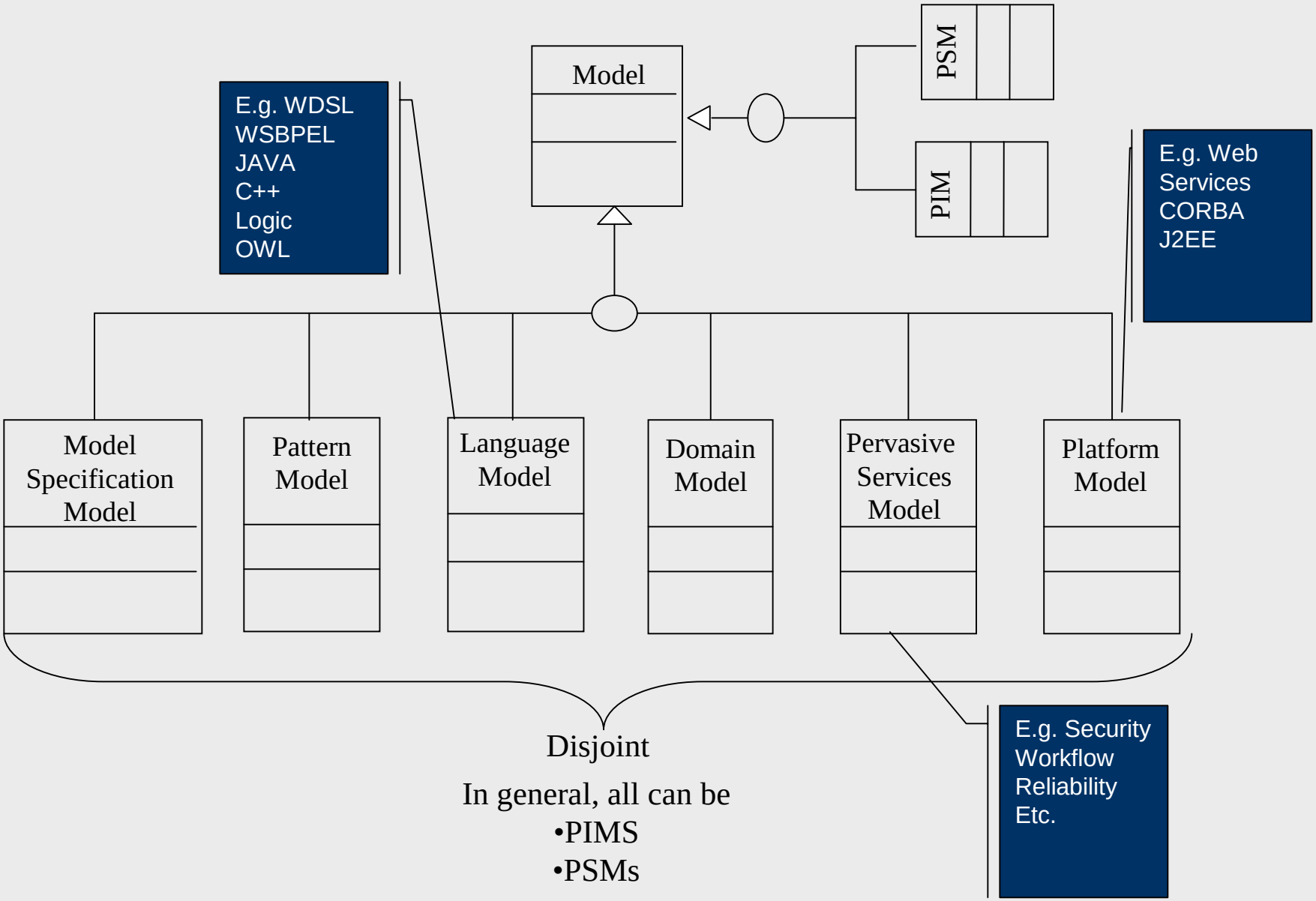
MDA Architecture Relationships



Platform Independent Models Platform Specific Models

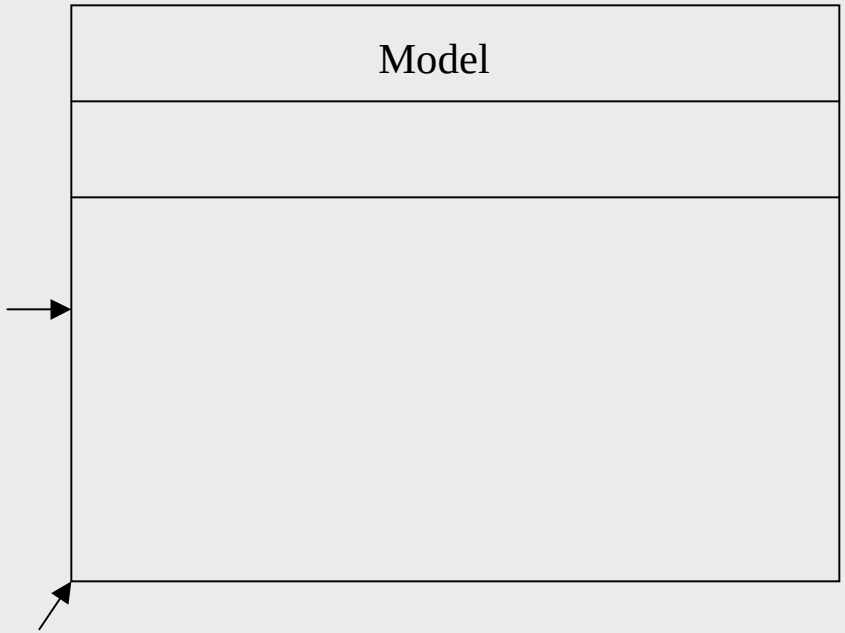
- Platform: “A set of subsystems / technologies that provide a coherent set of functionality through interfaces and specified usage patterns that any subsystem that depends on the platform can use without concern for the details of how the functionality provided by the platform is implemented” (David Frankel)
- Platform Independent Model (PIM)
  - A model: a representation / specification of some part of a current or future world
  - As a meta-model (MOF)
  - As a usage model
- Platform Specific Model (PSM)
  - A model
  - Specific to a platform
- The use of the MDA approach *explicitly architects the meta in systems being developed*
  - Ensures interoperability

A Model Classification



Equating Models as a Class and Modeling System

Model in Context:
- Goal
- Language
- Viewpoint
- Requirements
- Vertical Domain
- Community of Practice
- Business Domain
- Development Stage
- Problem Domain
- Etc.



M (L) = $<S_W, S_M, R>$

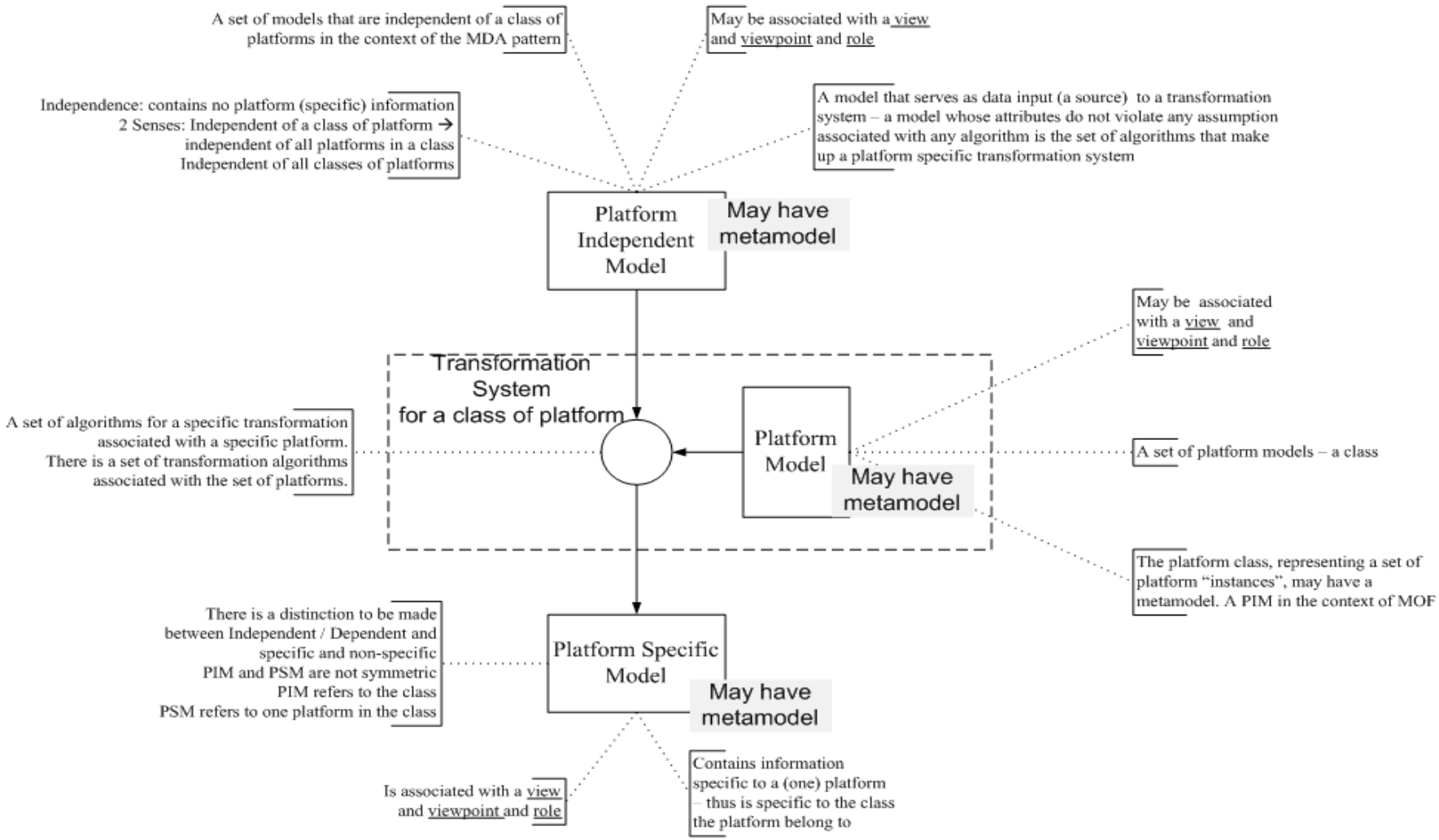
C → M(L)
M(L) → C

A UML Class: e.g. an algebra where **C** = $<AT, f_i: i = I>$
Where C – class, AT – set of Attributes (each attributes has a set of values),
F_i – family of operations.

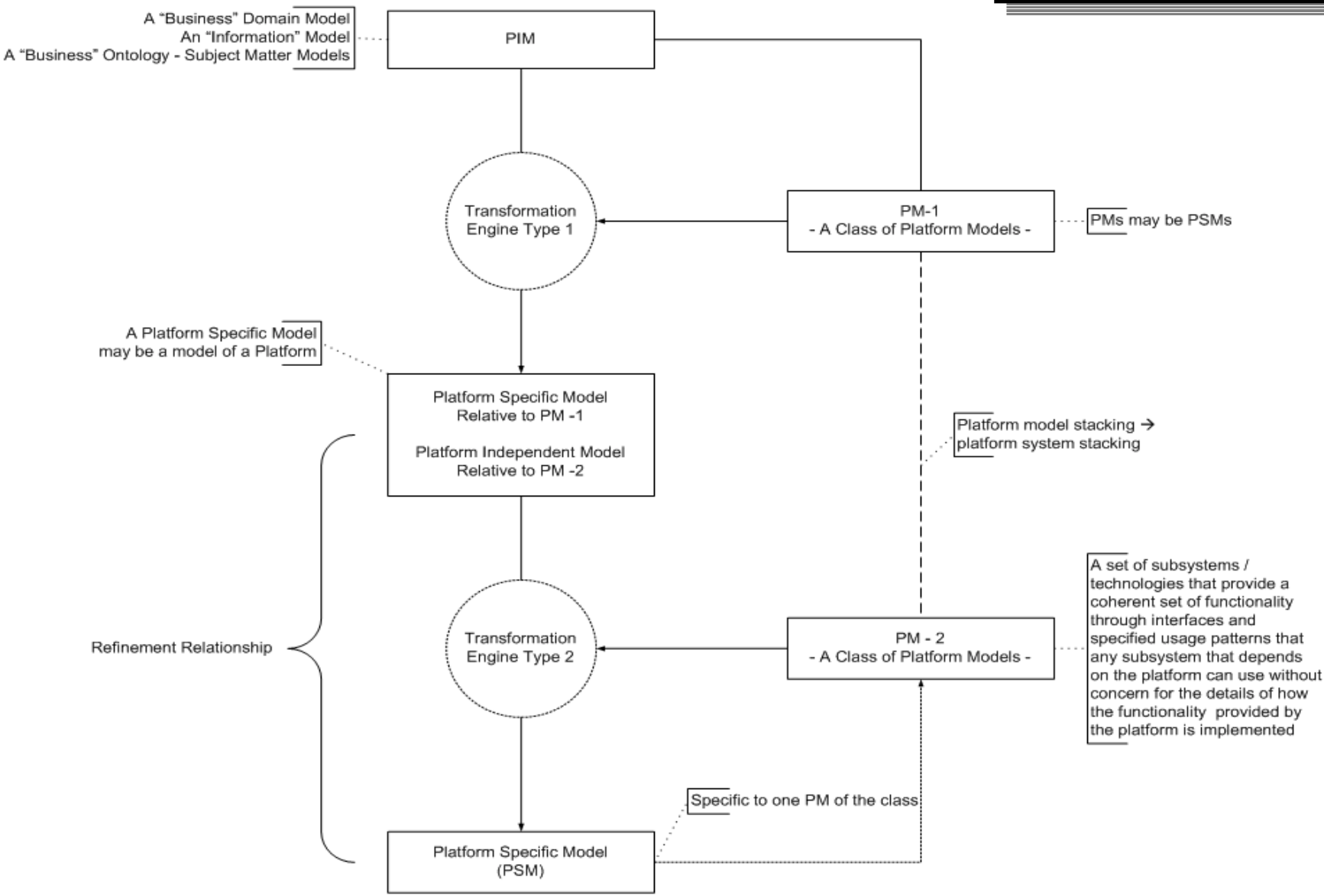
State-space is a subset of the cross product of the attribute domain sets:
SS $\subseteq A^n$, $A^n = a_1 \times a_2 \times \ldots A_n$, $a_i \subseteq A$ (any of which may be context dependent)

Note: This representation assumes that normal sub-setting relation with parent and child classes. If the sub-setting relation is disjoint, for example, the class is better represented with partial functions

THE MDA Pattern

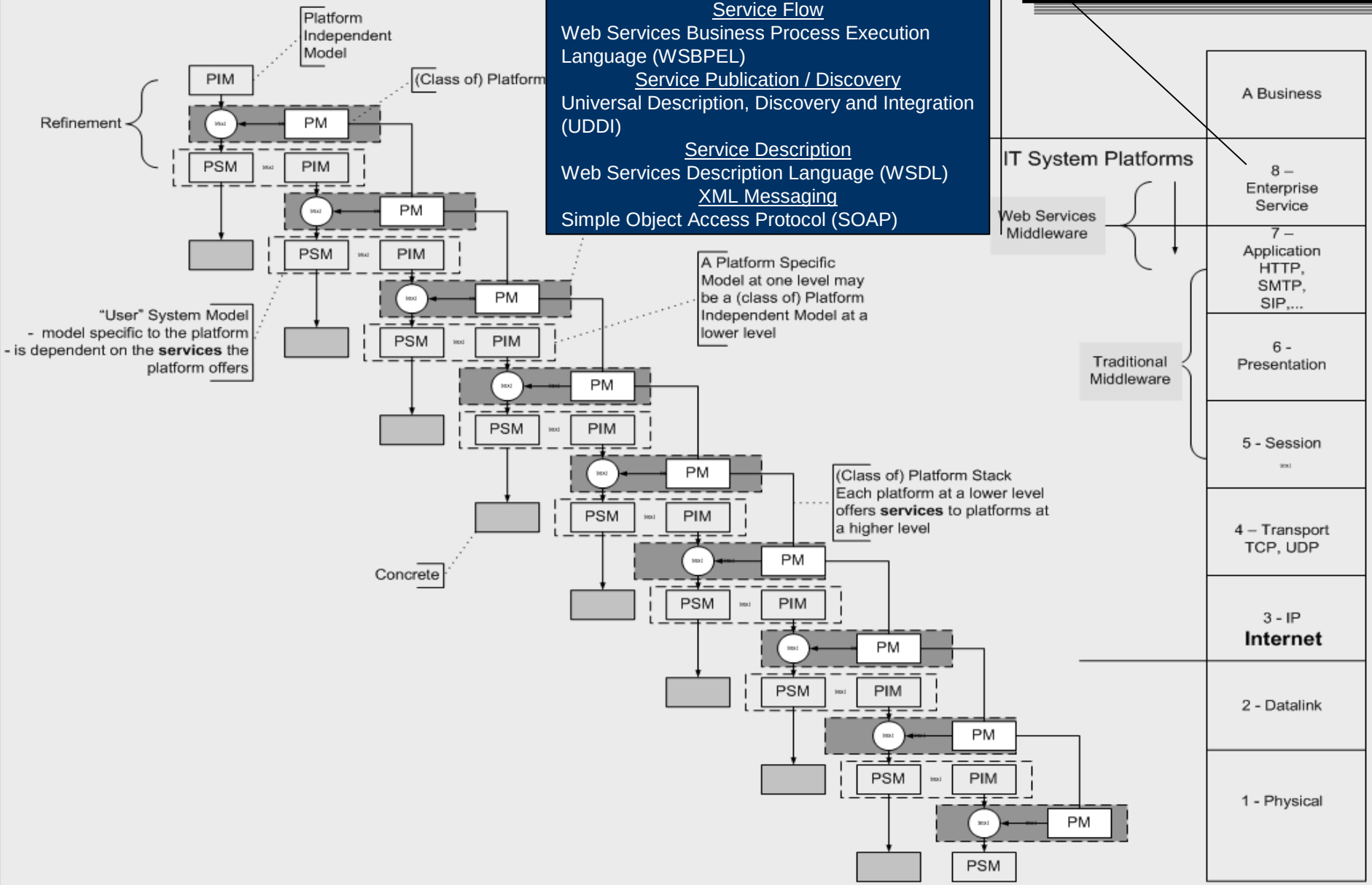


THE MDA Pattern

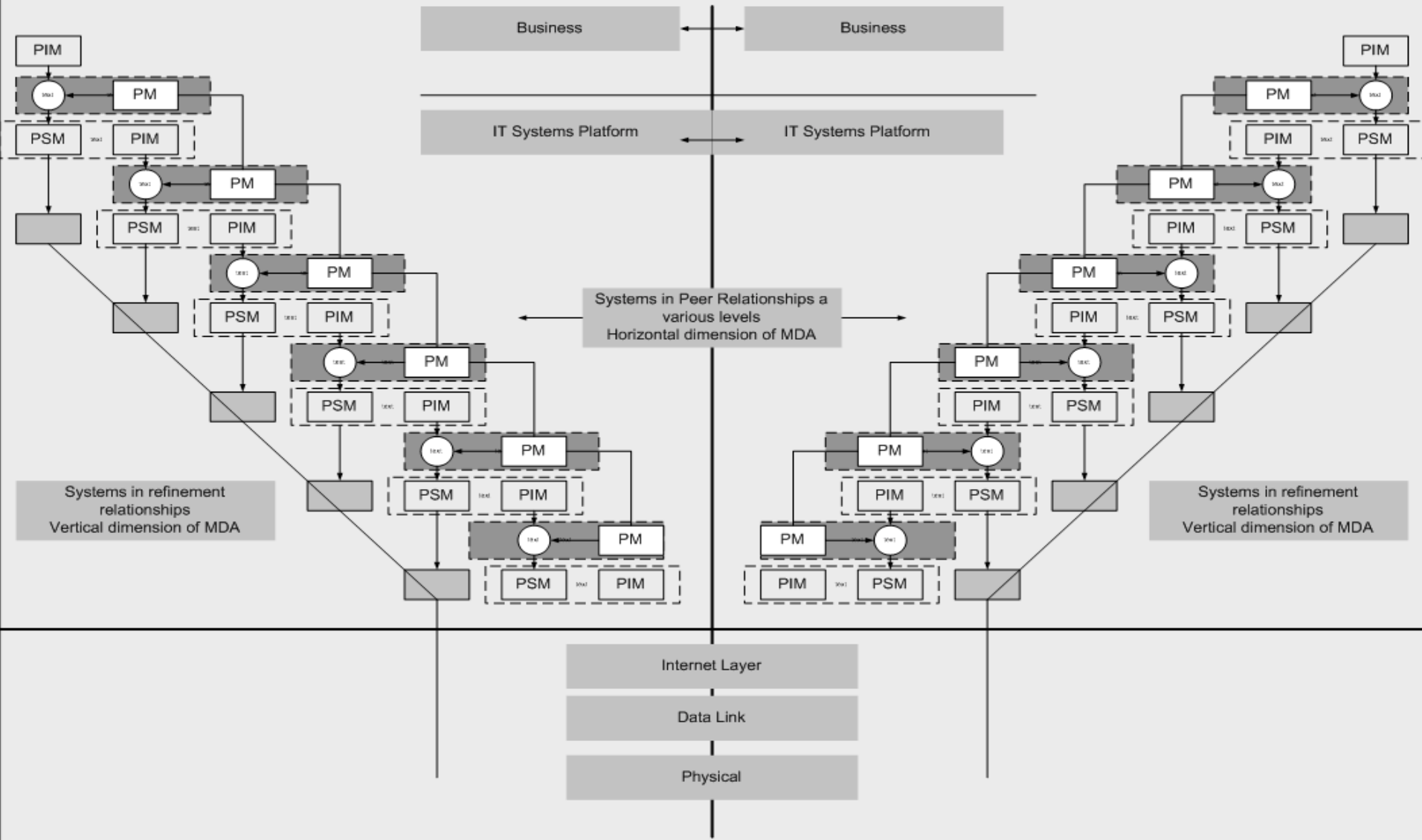


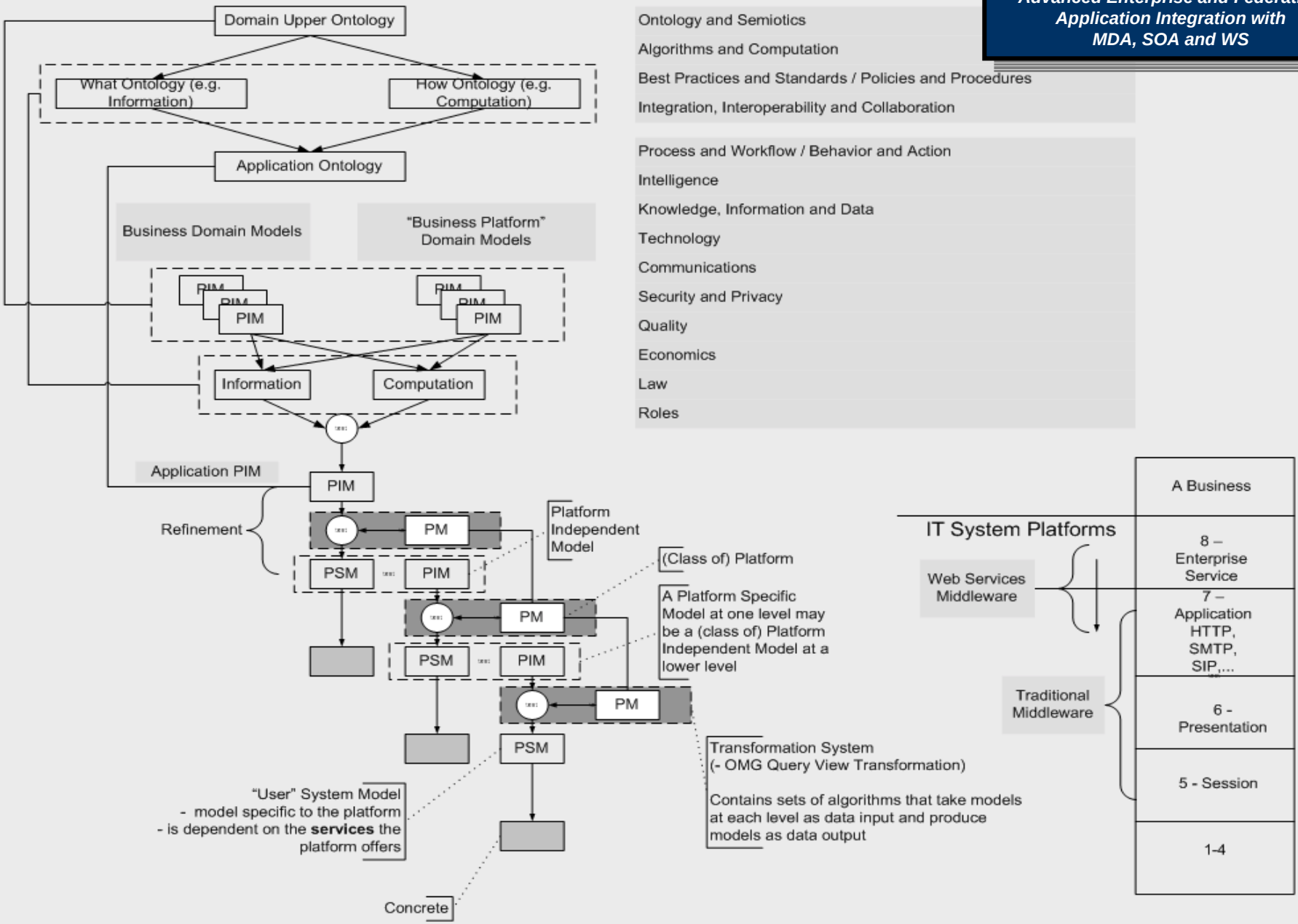
THE MDA Pattern

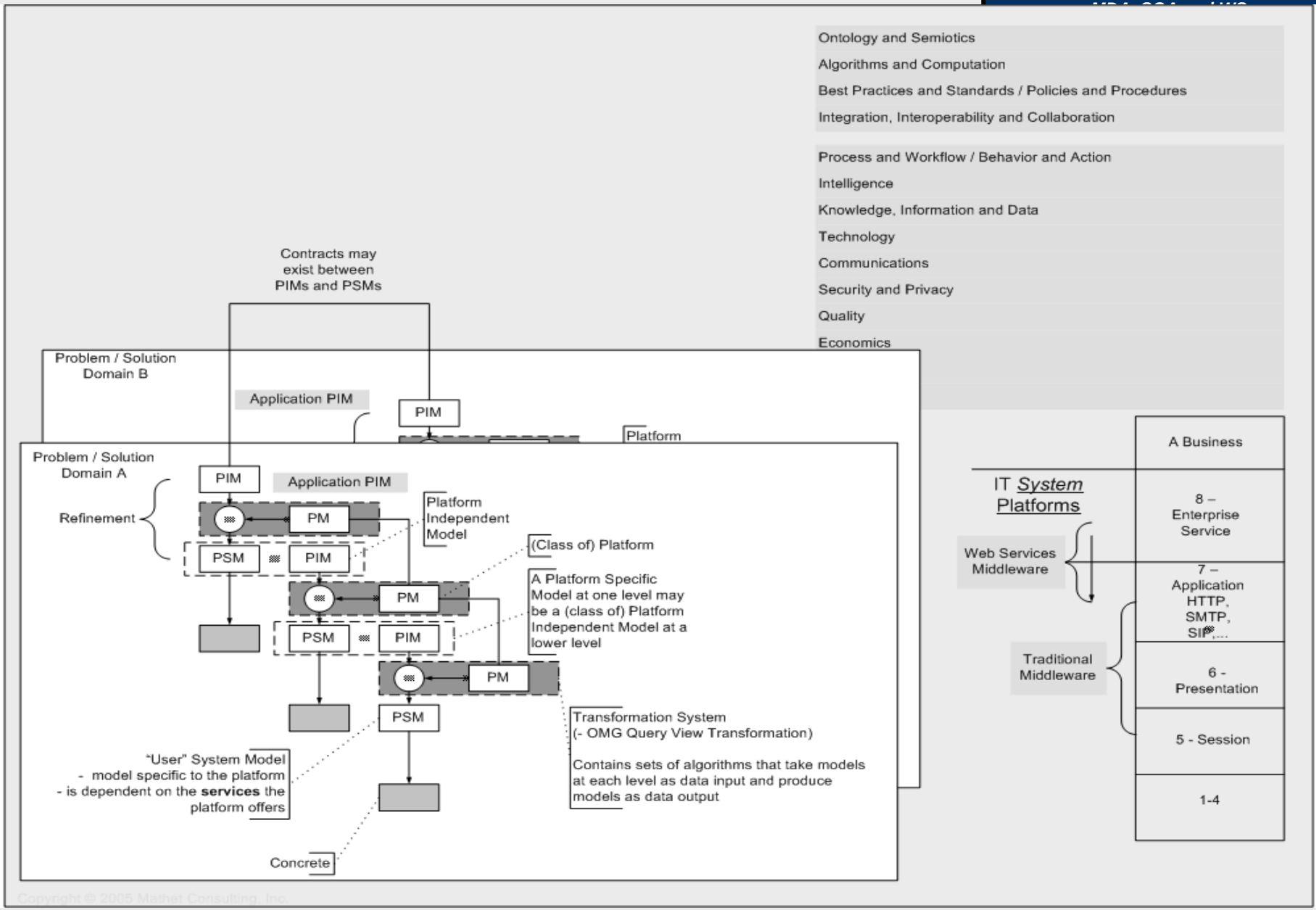
Composable Services and Processes
OMG Enterprise Distributed Object Computing (EDOC)
Service Flow
Web Services Business Process Execution Language (WSBPEL)
Service Publication / Discovery
Universal Description, Discovery and Integration (UDDI)
Service Description
Web Services Description Language (WSDL)
XML Messaging
Simple Object Access Protocol (SOAP)

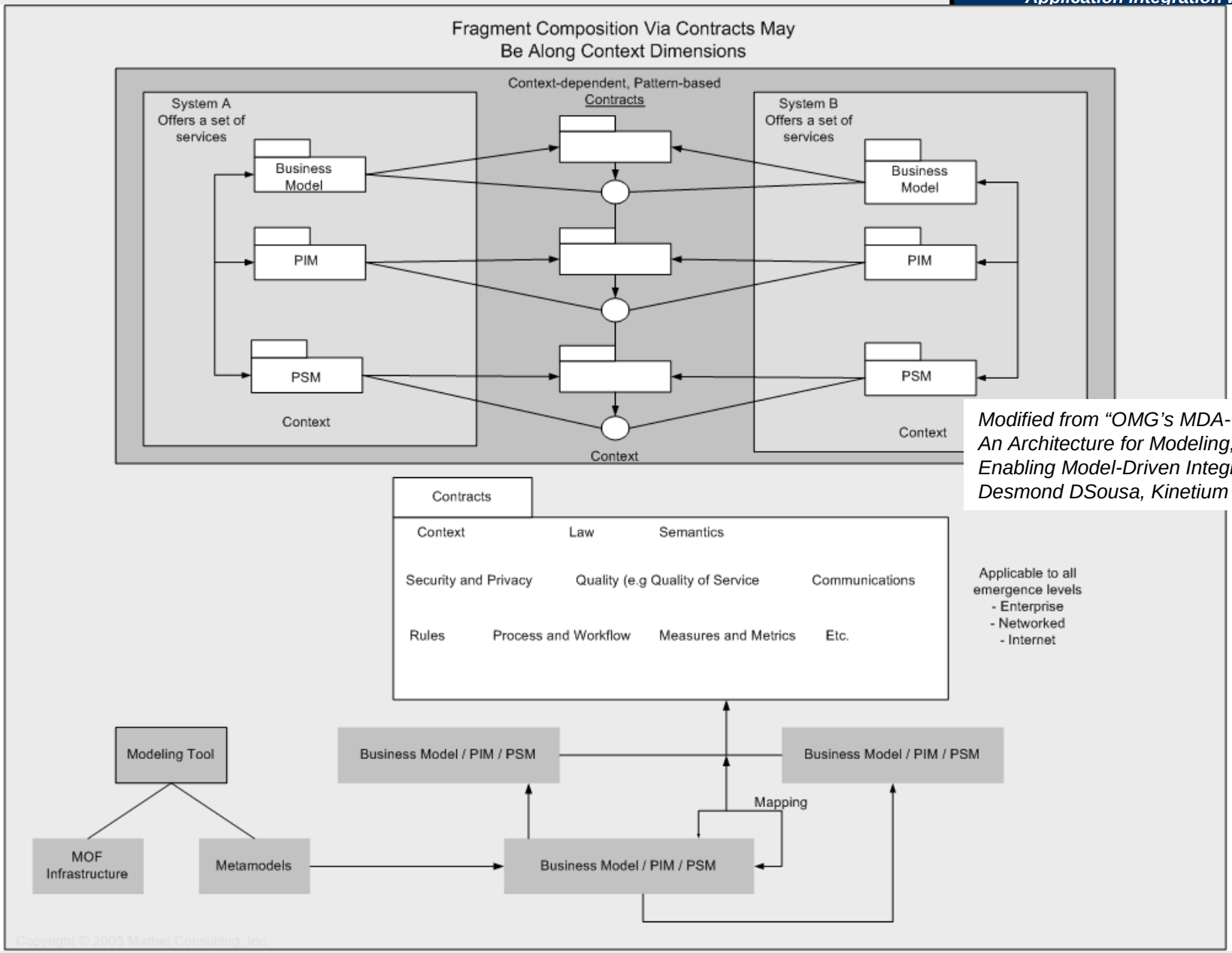


THE MDA Pattern – Two Independent Systems

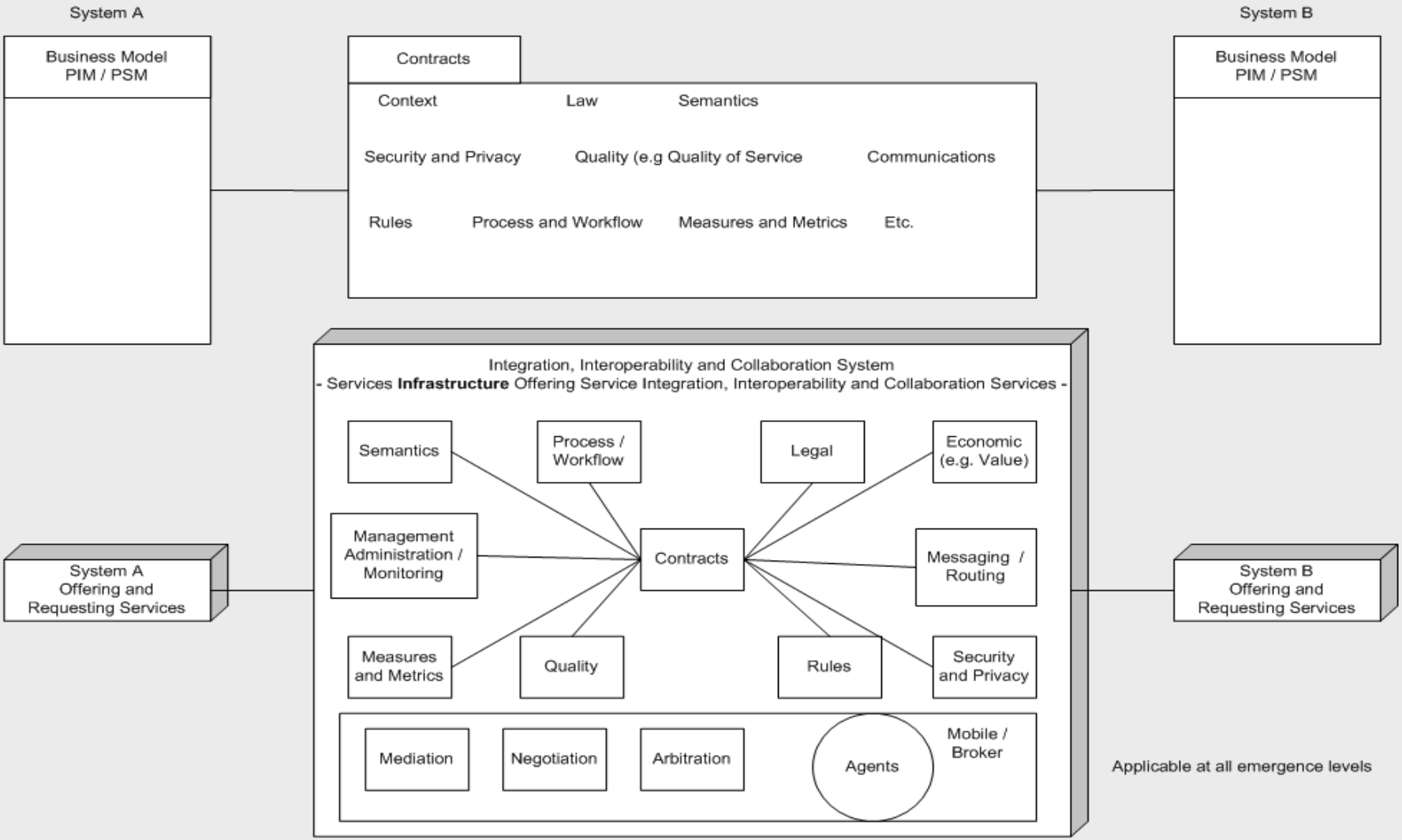








Modified from "OMG's MDA-
An Architecture for Modeling,
Enabling Model-Driven Integration"
Desmond DSousa, Kinetium



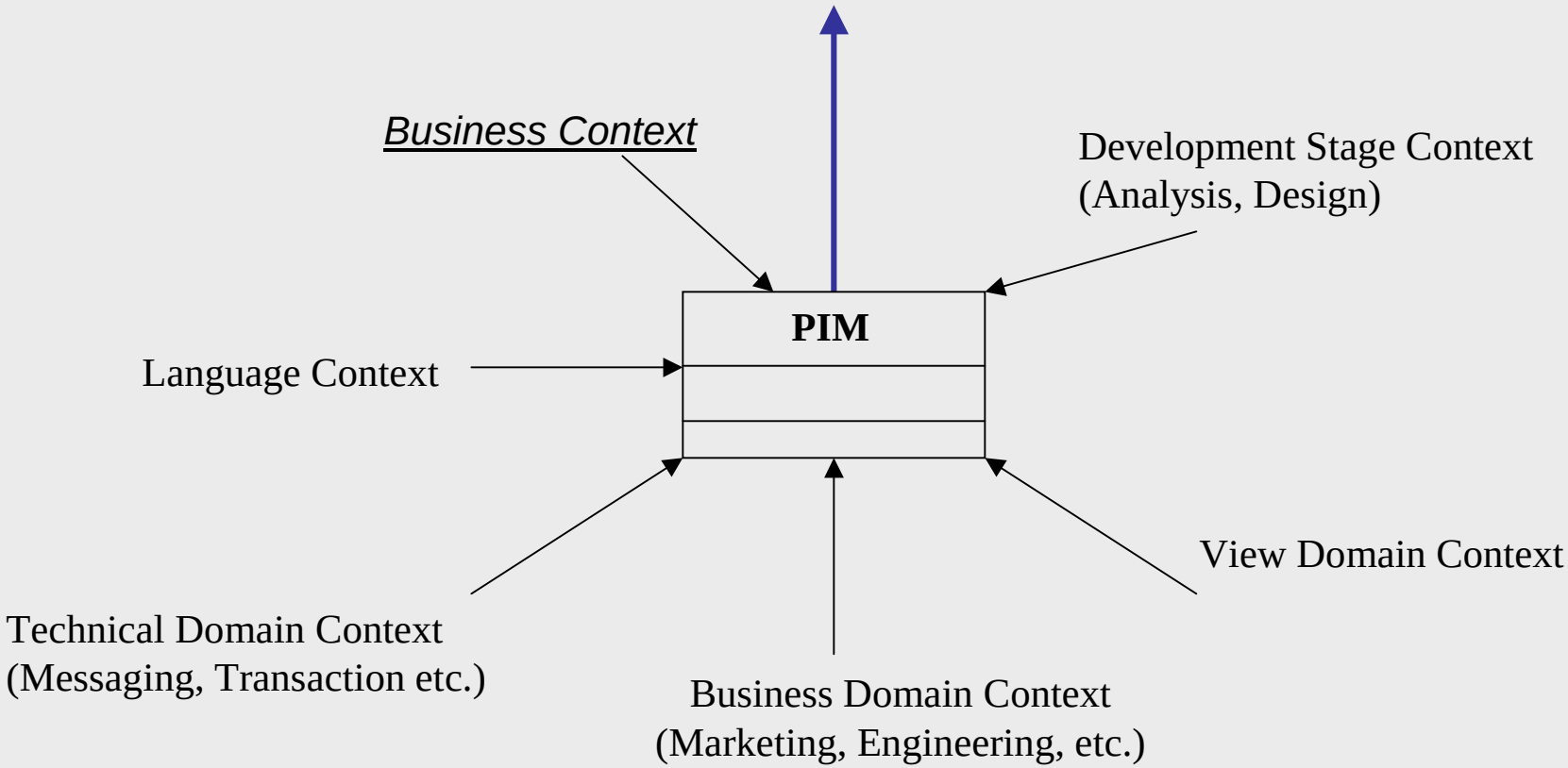
Contracts in Context

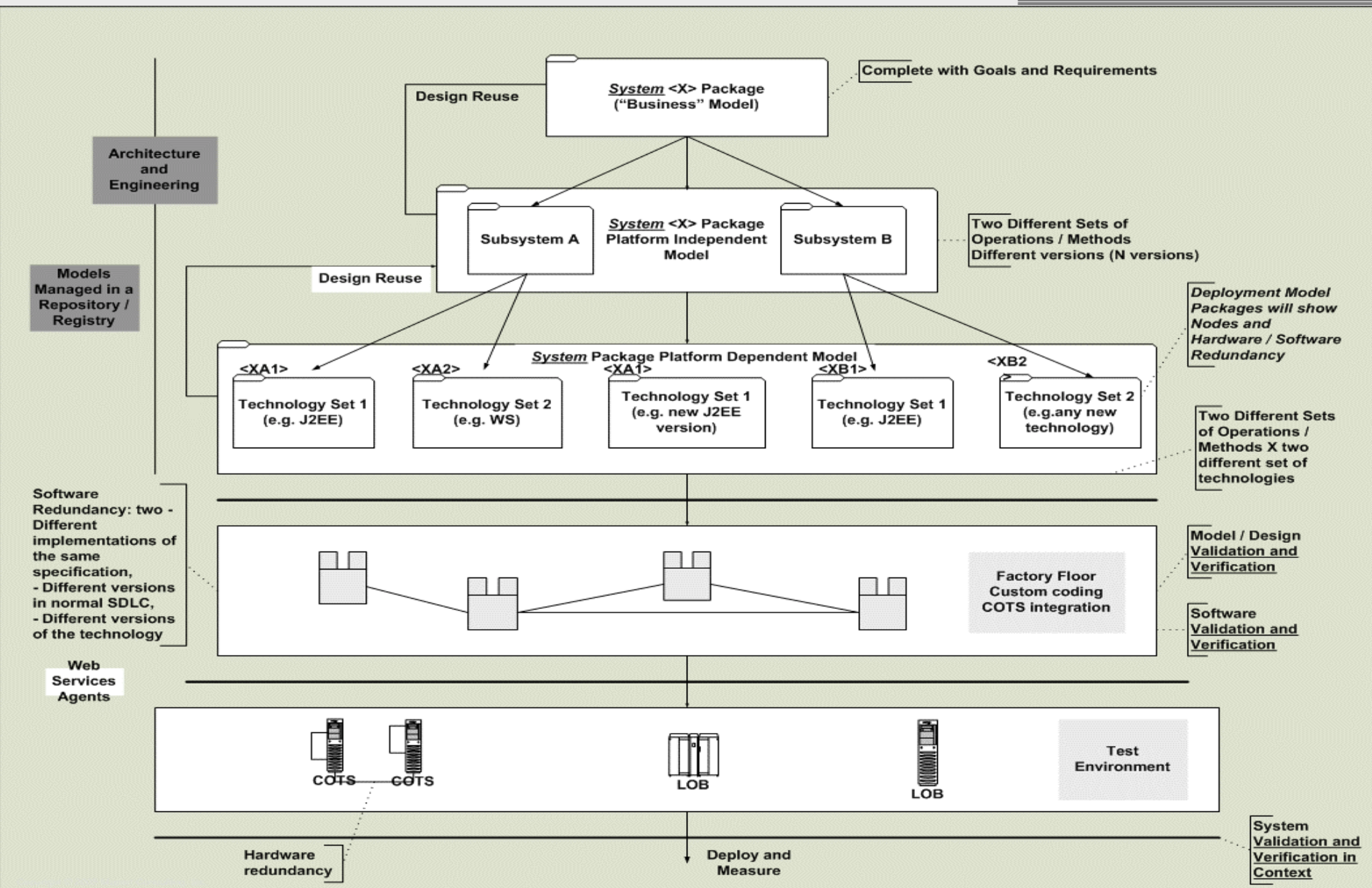
- Note that there are no explicit model dependencies. If a set of attributes are context dependent, and the context changes, the contract will change (e.g. new negotiation criteria)
- This helps to protect both service requester and service provider when the meaning of their models change as a function of context.

Model and Model Fragments are Created in an Instance of a *Context*

A representation / specification of some part of:

- The current world (of interest)
- A future world (of interest)





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Service Oriented Architecture and Web Services

Assumptions

- “Introduction to Web Services and Service-Oriented Architecture (Eric Newcomer)
- “Web Services and SOA in the Enterprise” (Cory Casanave)

Semantics

- "Service"
  - Sense 1: A system / component / agent that does something, a set of actions, for something else
  - Sense 2: The (set of) action(s) of a system / component / agent on the web (the output of a system / component / agent)

Semantics

- "Web" : port 80 / HTTP
- "Internet": all ports, all transport protocols
  - A logical network
  - independent of the underlying physical and data link communications protocols and technologies (platforms)
  - Provides services and supports all transport protocols regardless of the type of communications (voice, data, multimedia, etc.) and modes (e.g. e-mail, web, facsimile, phone)
- "Web Service"
  - Sense 1: A system / component / agent on the web that offers services
  - Sense 2: The (set of) action(s) of a system / component / agent on the web (the output of a system / component / agent)
- "Internet Service"
  - Sense 1: A system / component / agent on the Internet that offers services
  - Sense 2: The (set of) action(s) of a system / component / agent on the Internet (the output of a system / component / agent)

Standards

BPEL4WS (Business Process Execution Language for Web Services) 1.1 [IBM, BEA, Microsoft: Specification] à WSBPEL (Web Services Business Process Execution Language [OASIS: BEA, Hewlett-Packard, IBM, IONA, Microsoft, NEC, Oracle, SAP, SeeBeyond, Sun, Tibco, webMethods]
Common Base Event [IBM: Specification]
DNS Endpoint Discovery (DNS-EPD) [IETF: Committee Draft]
JSR 172 – J2ME Web Services [JCP: Specification]
JSR109 – (Web Services for J2EE) 0.3 [JCP: Public Draft]
SOAP (Simple Object Access Protocol) 1.2 [W3C: Specification]
UDDI (Universal Description, Discovery and Integration) 3.0 [OASIS: Specification]
WS-Addressing [IBM, BEA, Microsoft: Specification]
WS-Atomic Transactions [IBM, BEA, Microsoft: Specification]
WS-Attachments [IETF, IBM and Microsoft: Specification]
WS-BaseNotification [IBM, Sonic Software, TIBCO Software, Akamai Technologies, SAP AG, Computer Associates International, Fujitsu Laboratories of Europe, Globus, Hewlett-Packard: Specification]
WS-BrokerNotification [IBM, Sonic Software, TIBCO Software, Akamai Technologies, SAP AG, Computer Associates International, Fujitsu Laboratories of Europe, Globus, Hewlett-Packard: Specification]
WS-BusinessActivity [IBM, BEA, Microsoft: Specification]
WS-Coordination [IBM, BEA, Microsoft: Specification]
WS-Eventing [IBM, BEA, Computer Associates, Sun Microsystems, TIBCO Software: Specification]
WS-Experience Language (WSXL) 2.0 [IBM: Specification]
WS-Federation Language [IBM, BEA, Microsoft, RSA, Verisign: Specification]
WS-Federation: Active Requestor Profile [IBM, BEA, Microsoft, RSA, Verisign: Specification]
WS-Federation: Passive Requestor Profile [IBM, BEA, Microsoft, RSA, Verisign: Specification]
WS-I Attachments Profile 1.0 [WS-I: Working Draft]
WS-I Basic Profile 1.0 [WS-I: Specification]
WS-I Basic Profile 1.1 [WS-I: Working Draft]
WS-I Simple SOAP Binding Profile 1.0 [WS-I: Working Draft]
WS-Inspection 1.0 [IBM, Microsoft: Specification]
WS-Manageability – Concepts [IBM, Talking Blocks, Computer Associates: Specification]
WS-Manageability – Representation [IBM, Talking Blocks, Computer Associates: Specification]
WS-Manageability 1.0 [IBM, Talking Blocks, Computer Associates: Specification]

Standards – cont.

WS-MetadataExchange [IBM, BEA, webMethods, Microsoft, Computer Associates, Sun Microsystems, SAP AG: Working Draft]
WS-Notification [IBM, Akamai Technologies Inc., Globus Alliance, Hewlett-Packard, SAP AG, Sonic Software Corporation, Tibco Software Inc.: Specification]
WS-PolicyAssertions [IBM, BEA, Microsoft, SAP AG: Specification]
WS-PolicyAttachments [IBM, BEA, Microsoft, SAP, Sonic Software, Verisign: Specification]
WS-PolicyFramework [IBM, BEA, Microsoft, SAP, Sonic Software, Verisign: Specification]
WS-Provisioning [IBM: Specification]
WS-ReliableMessaging [IBM, BEA, Microsoft, TIBCO: Specification]
WS-ResourceLifetime [IBM, Globus Alliance, Hewlett-Packard: Specification]
WS-ResourceProperties [IBM, Globus Alliance, Hewlett-Packard: Specification]
WS-SecureConverstation [IBM, BEA, Computer Associates, Layer 7 Technologies, Microsoft, Netegrity, Oblix, OpenNetwork, Technologies, Ping Identity Corp, Reactivity, RSA Security, Verisign, Westbridge Technology: Specification
WS-Security 1.0 [OASIS: Open Standard]
WS-Security Addendum [IBM, Microsoft, Verisign: Supplemental Information]
WS-Security Kerberos Binding [IBM, Microsoft: Specification]
WS-SecurityPolicy [IBM, Microsoft, RSA, Verisign: Specification]
WS-Topics [IBM, Sonic Software, TIBCO Software, Akamai Technologies, SAP AG, Computer Associates International, Fujitsu Laboratories of Europe, Globus, Hewlett-Packard: Specification]
WS-Transactions [IBM, BEA, Microsoft: Specification]
WS-Trust [IBM, BEA, Computer Associates, Layer 7 Technologies, Microsoft, Netegrity, Oblix, OpenNetwork Technologies, Ping Identity Corp., Reactivity, RSA Security, Verisign, Westbridge Technology: Specification
WSDL (Web Services Description Language) 1.1 [W3C (IBM and Microsoft: note]
WSDL (Web Services Description Language) 1.2 [W3C (IBM and Microsoft: working draft]
WSRP (Web Services for Remote Portals) 1.0 [OASIS: Open Standard]

Vendors and Products (may be incomplete)

Web Services Suites

Actional Corporation (Actional SOA Command and Control)
Magic Software Enterprises (iBOLT Integration Suite)
Novell (Novell exteNd Enterprise / Professional Suite)
ReadiMinds Systems and Services Pte Ltd. (ReadiMinds WebServices Applications Suite – WSS)
Sonic Software Corporation (Sonic ESB)
Systinet Corporation (Systinet Product Suite)

Web Services Desktop Integration

NetEdge Software, Inc. (Web Services Enabler)
RatchetSoft, LLC (Ratcht – X)

Web Services Management

Actional Corporation (Actional SOAPstation)
AmberPoint, Inc. (AmberPoint Mangeement Solutions)
Blue Titan Software, Inc. (Network Director and Data Director)
Computer Associates Internaltional, Inc. (Unicenter Web Services Distributed Management – WSDM)
Confluent Software, Inc. (Confluent Evolution Service Manager)
Digital Evolution, Inc. (Digital Evolution Service Manager)
Flamenco Networks (Web Services Management) – acquired by Digital Evolution, Inc.
IBM
Infravio, Inc. (Web Services Management System)
Itellix Software Solutions (Wisiba)
webMethods Inc. (webMethods Fabric)
WestGlobal (mScape)

Web Services Development Tools

Above All Software, Inc. (Above All Studio)
Altova GmbH (xmlspy)
Ascential Software Corporation (Enteprise Integration Suite)
Attachmate Corporation (myEXTRA! Smart Connectors)
BEA Systems, Inc. (BEA WebLogic Workshop)
ClientSoft, Inc. (ServiceBuilder)
Commerce One Operations, Inc. (Conductor Composite Manager)
Compuware Corporation (UNIFACE)
FusionWare Corporation (FusionWare Integration Server)
GT Software, Inc. (Ivory Web Services)
IBM (Eclipse, Websphere)
InterSystems Corporation (Ensemble)
IONA Technologies (Artix)
iWay Software (iWay Web Services)
Pantero Corporation (Shared Data Services Suite)
Rogue Wave Software, Inc. (Lightweight Enterprise Integration Framework – LEIF)
Seagull Software Systems, Inc. (Trnasidiom and LegaSuite)
SeeBeyond, Technology Corporation (The SeeBeyond Integrated Composite Application Network – ICAN – Suite)
StrikeIron, Inc.
Swingtide, Inc.
TIBCO Software, Inc. (TIBCO Business Works)
Verity, Inc. (Ultraseek)
Vultus, Inc. (Webface Solution Suite)
WDI (Redbern)
WebCollage, Inc. (WebCollage Syndicator)
webMethods Inc. (webMethods Glue)

Vendors and Products (may be incomplete – cont.)

Web Services Orchestration

ActiveBPEL (ActiveBPEL)
Active Endpoints, Inc. (ActiveWebFlow)
Collaza, Inc. (Collaxa BPEL Server – acquired by Oracle Corporation)
Commerce One Operations, Inc. (Conductor Composite Manager)
Corticon Technologies, Inc. (Corticon Decision Management Platform)
Dralasoft, Inc. (Dralasoft Workflow)
IBM Corporation (WebSphere Business Integration Modeler)
Metastorm, Inc. (e-Work)
Novell, Inc. (Novell exteNd Enterprise Suite)
OpenStorm Software, Inc. (Service Orchestrator)
Oracle Corporation (Oracle BPEL Process Manager – formaly the Collaxa BPEL Server)
ReadiMinds Systems and Services Pte Ltd. (ReadiMinds WebServices Applications Suite – WSS
SeeBeyond, Technology Corporation (eInsightBusiness Process Manager)
Sonic Software Corporation (Sonic orchestration Server)
WebV2, Inc. (WebV2 ProcessCoupler)

Web Services Security

BEA Systems, Inc. (BEA Weblogic Enterprise Security)
Commerce One Operations, Inc. (Conductor Composite Manager)
DataPower Technology, Inc. (XML Security Gateway)
Digital Evolution, Inc. (DE Management Server)
Forum Systems, Inc. (XML Sentient)
Layer 7 Technologies, Inc. (SecureSpan)
Netegrity, Inc. (TransactionMinder)
Reactivity (Reactivity XML Firewall)
RSA Security, Inc. (RSA BSAFE Secure – WS
Sarvega, Inc. (XML Guardian Security Products)
Teros, Inc. (Teros Web Services Security Gateway)
Vordel Limited (VordelSecure and Vordel SOAPbox)
Actional Corporation (XML Message Server) – formerly Westbridge XML Message Server

Web Services Testing

iTKO Corporation (LISA)
Parasoft Corporation (SOAPtest)
Mindreef, Inc. (SOAPscope)
Segue Software, Inc. (SilkPerformer Component Test Edition)

XML Data Routers, Message Routers, and Adapters

Appligent, Inc. (APConductor)
BEA Systems, Inc. (BEA Weblogic Integration)
Commerce One Operations, Inc. (Conductor Composite Manager)
Kanemea, Inc. (Web Messaging Platform)
NEON Systems, Inc. (Shadow z/Services)
Novell, Inc. (Novell exteNd Enterprise Suite)
Sarvega, Inc. (XML Context Router)
SeeBeyond, Technology Corporation (eWay Intelligent Adaptors)
Actgional Corporation (XML Message Server) – formerly the Westbridge Message Server

XML Accelerators

DataPower Technology, inc. (XML Accelerator)
Sarvega, Inc. (XML Speedway Accelerator)
Tarari, Inc. (RAX Content Processor and XML Content Processor

Application of Advanced Conceptualization of EA, MDA, SOA, and Web Services and their Unification

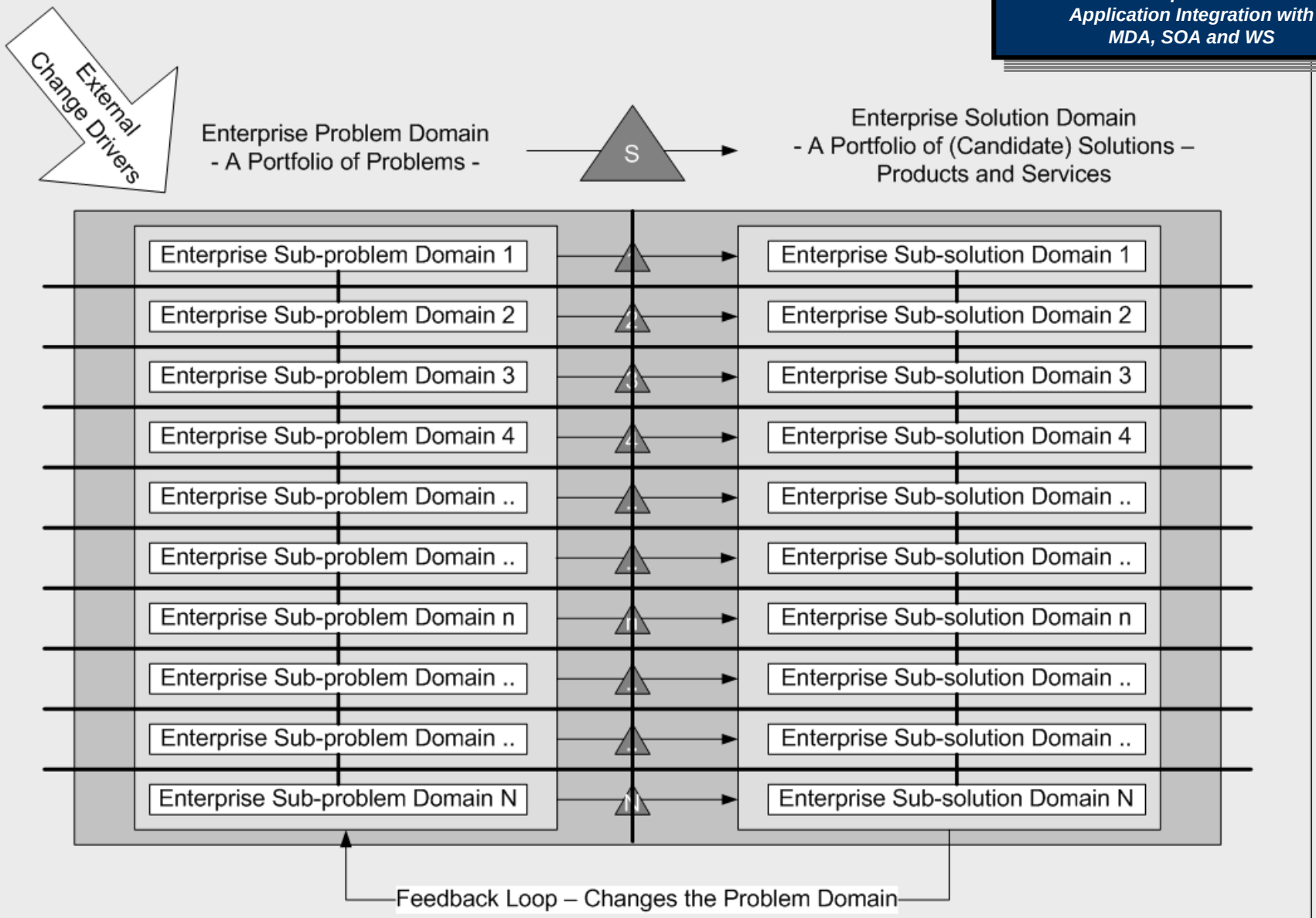
Application of Advanced Conceptualization of EA, MDA, SOA, and Web Services and their Unification

Enterprise Systems

Enterprise Integration, Interoperability and Collaboration with EA, MDA, SOA and Web Services

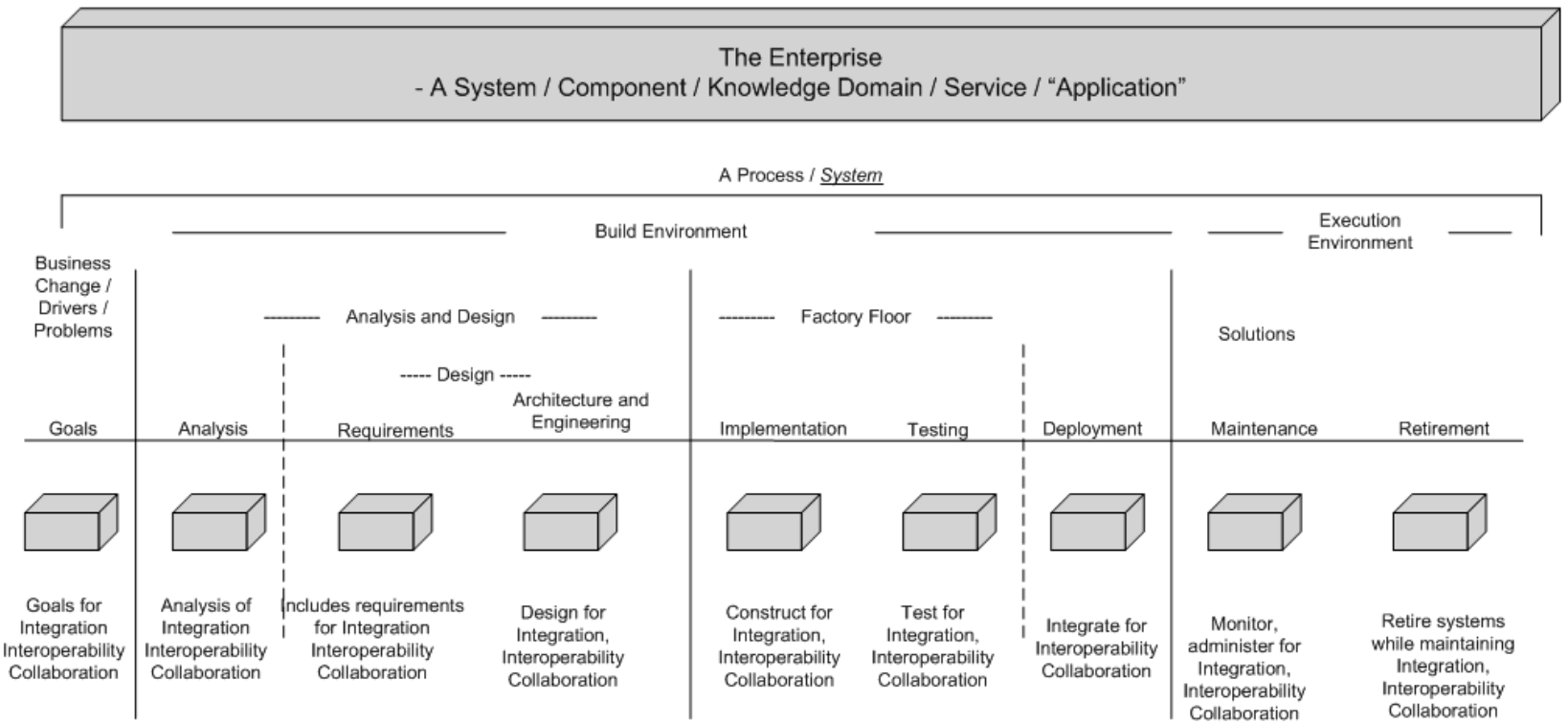
Change as a Fundamental Concern

- A fundamental, if not the fundamental, concern in an enterprise and any enterprise specification is *change / transformation*
- An enterprise is a system in the General Systems Theory sense
- Types of change / transformation include:
  - Reactive Change / Proactive Change
  - Planned Change: Strategic / Tactical / Operational
  - Reflexive change (Autonomic responses)
  - Responsive Change - A priori determined change
  - Responsive Change - Immediate change as a result of processing
  - Proactive Change



Advantages of Cross-Context Mapping / Merging

- Ensures consistency within an enterprise, federation
- Allows Validation and Verification at the different levels abstraction – information at lower levels do not confound evaluation at higher levels
- Allows new products / projects to be properly scoped and defined
- Allows the enterprise / federation, as a system to be emergent and adaptable
- Allows for the evaluation of discrepancies in model meaning between contexts
- Etc.



There is a (sub) system associated with each step.
Each (sub) system has their own set of processes – operating concurrently.
These systems are loosely coupled, highly coherent.
Each (sub) system has a role.
Each sub system provides services to other systems with multiple feed-forward and feedback loops and control points.
All (sub) systems are operational systems – including those in the Build Environment

The Enterprise System / "Application" is continuously evolving through, in part, continuous application integration.

*The output of the Build Environment may be an **Integration, Interoperability and Collaboration System** (e.g. an Enterprise Service Bus)*

Application of Advanced Conceptualization of EA, MDA, SOA, and Web Services and their Unification

Build Environments (Upper Level Transformation Systems™)

Integration, Interoperability and Collaboration with EA, MDA, SOA and WS

The Upper Level Transformation S
Primary System Components (Subsystems)

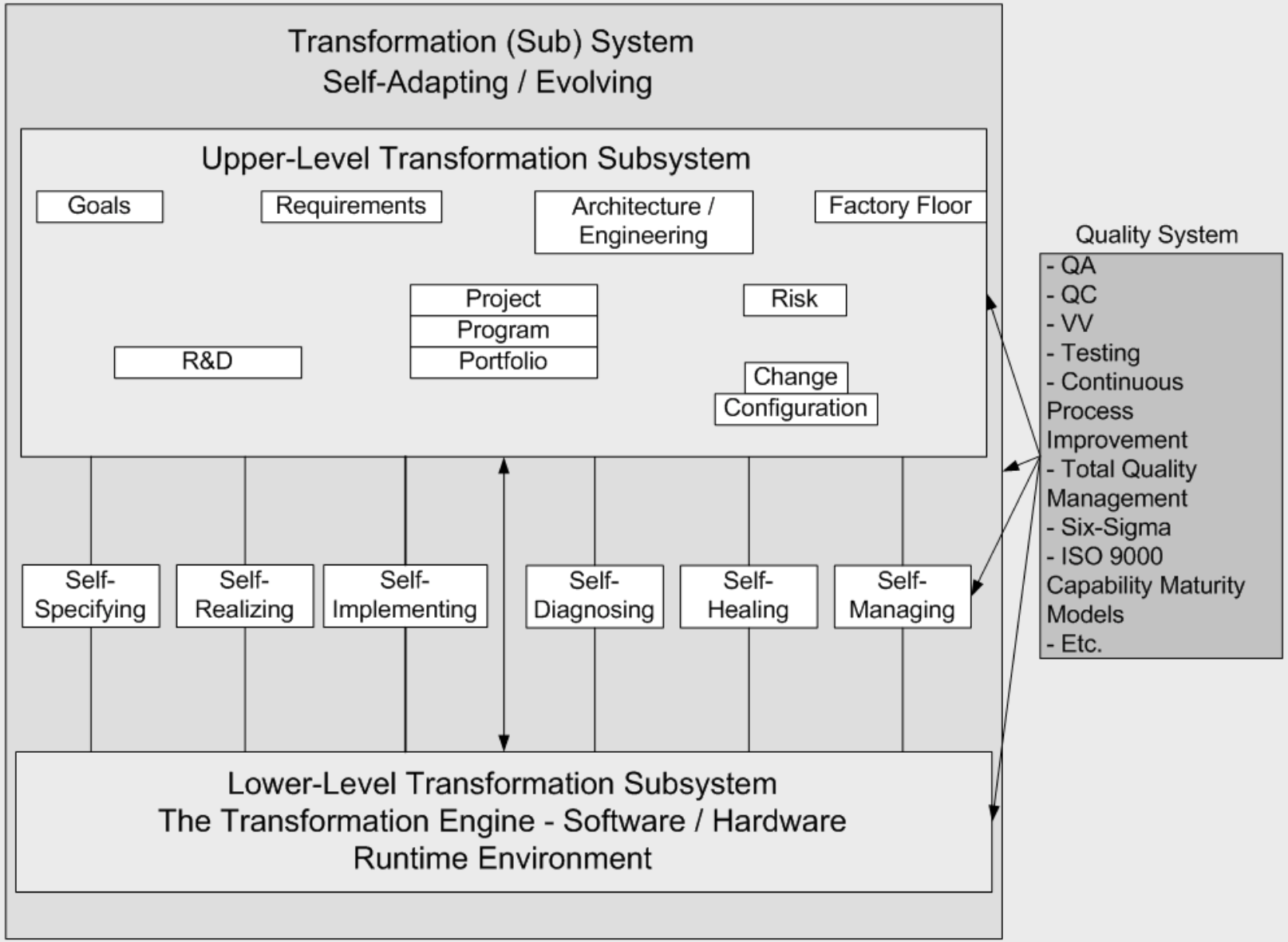
- Goal System (Mission / Vision, Goals and Objectives)
- Requirements System
- Architecture and Engineering System
- Factory (Floor) System (Custom and COTS Construction)
- Project / Program / Portfolio Systems
- Risk System
- Change and Configuration System
- Research and Development System

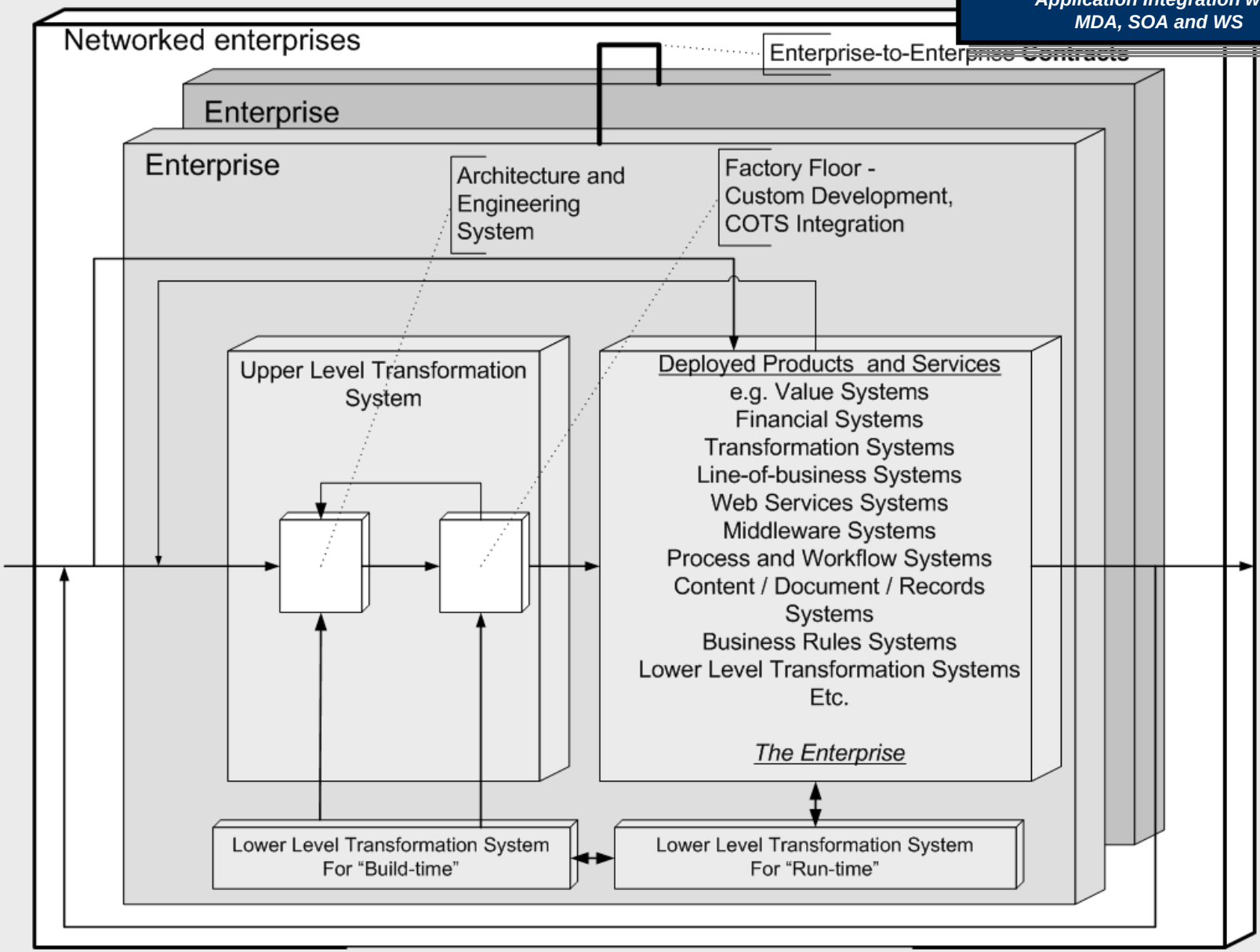
- Memory System (Experience Factory)
- Reasoning / Inference System (Induction and Deduction)
- Learning System

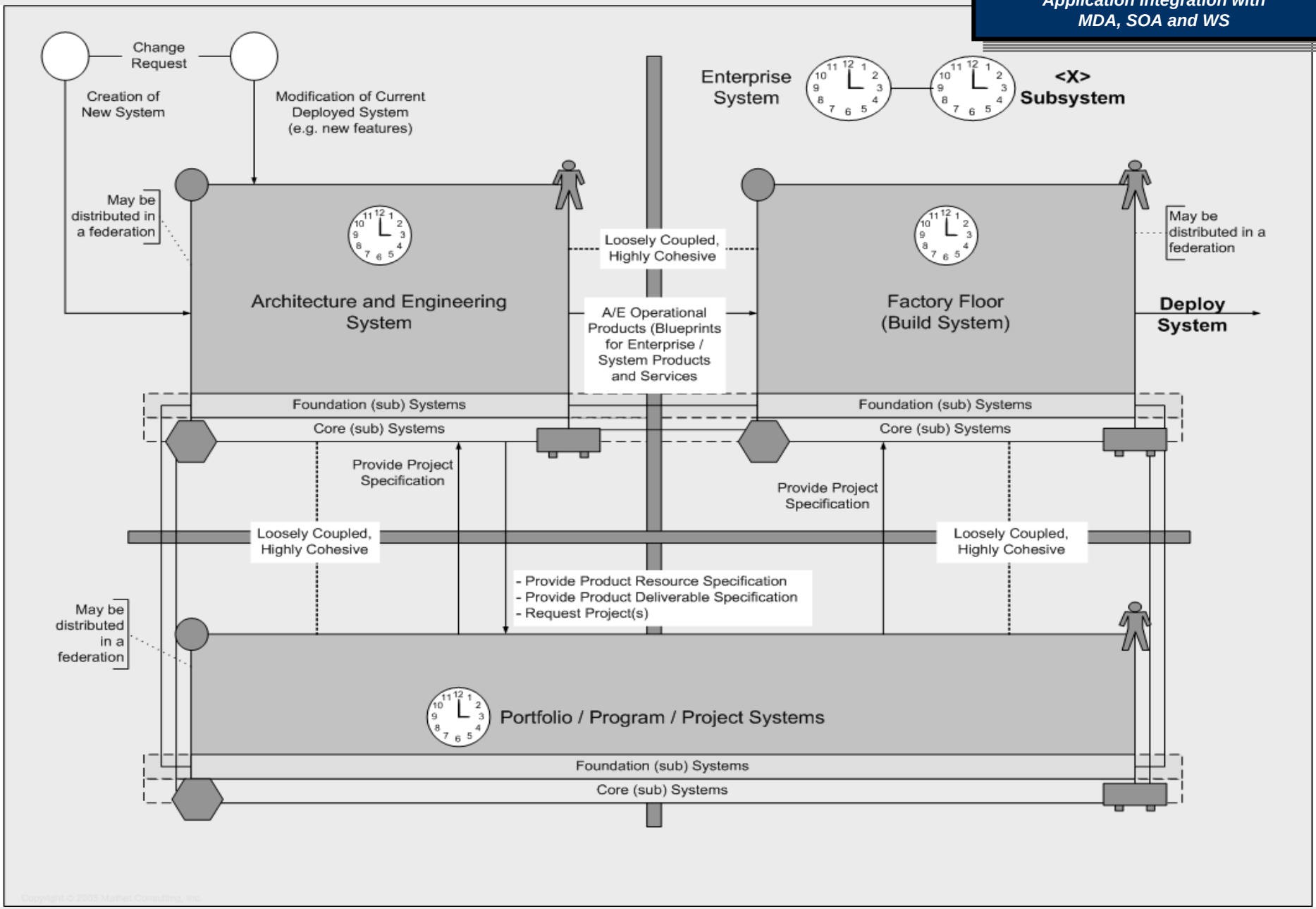
The Upper Level Transformation S
(Supporting System Components)

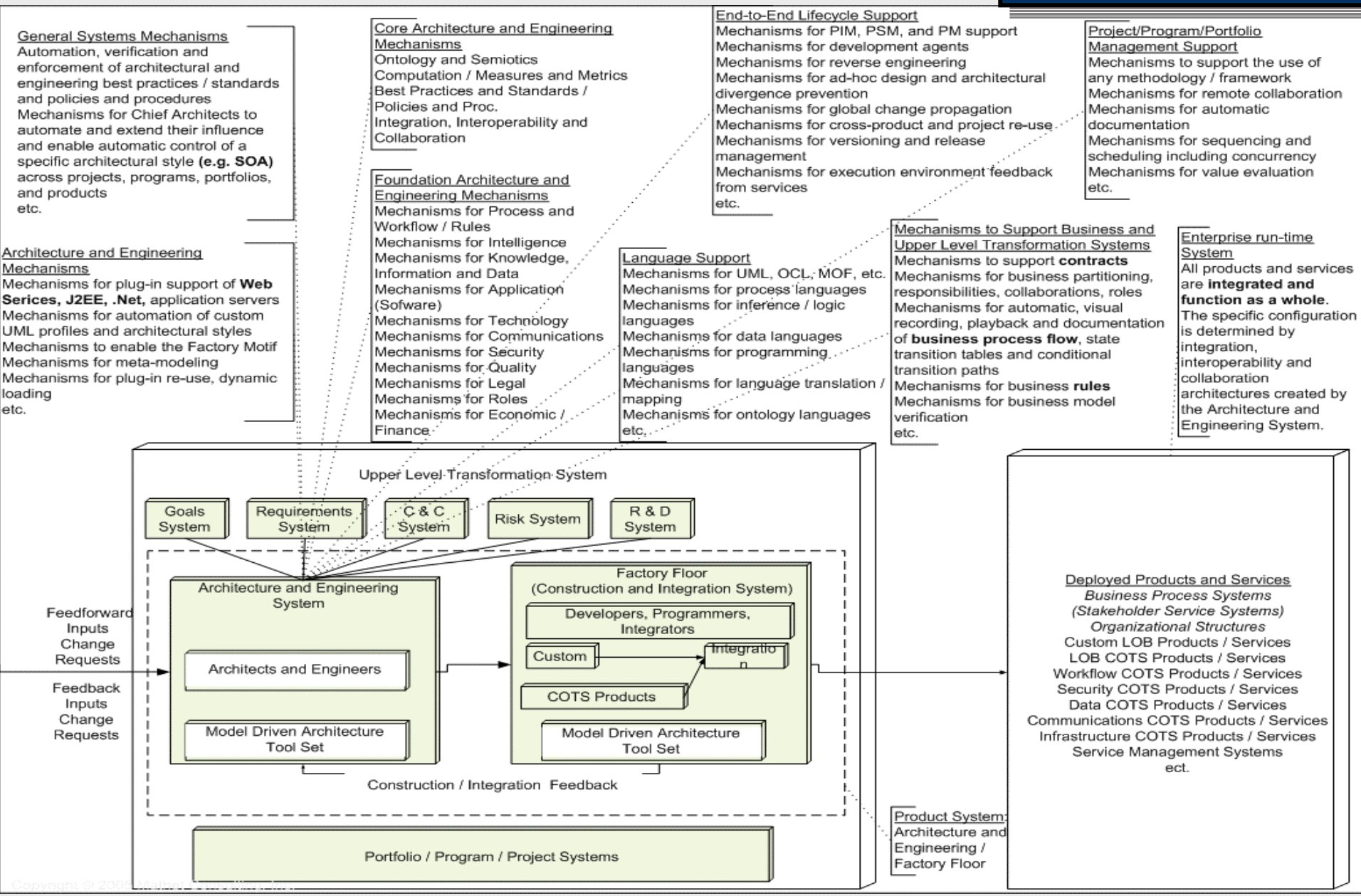
- Ontology / Semiotics
- Algorithms and Computation
- Best Practices and Standards / Policies and Procedures
- Integration, Interoperability and Collaboration

- Process and Workflow / Behavior and Action
- Intelligence/Cognition
- KID
- Technology
- Communications
- Security and Privacy
- Quality Law
- Economics (Value Systems, Financial Systems, etc.)
- Roles









Components / Systems / Processes and Value

Arbitrary System

(e.g. Enterprise, IT, A/E, Value, etc.)

Each component / system has a total value as a function of different value dimensions, such as strategic, tactical, operational, architectural; shareholder, customer, user; tangible, intangible; financial, resource, knowledge; etc.

Value, an extrinsic attribute, is a *function of* perception, the intrinsic attributes of the component / system, context, interaction / collaboration, priorities, goals, etc.

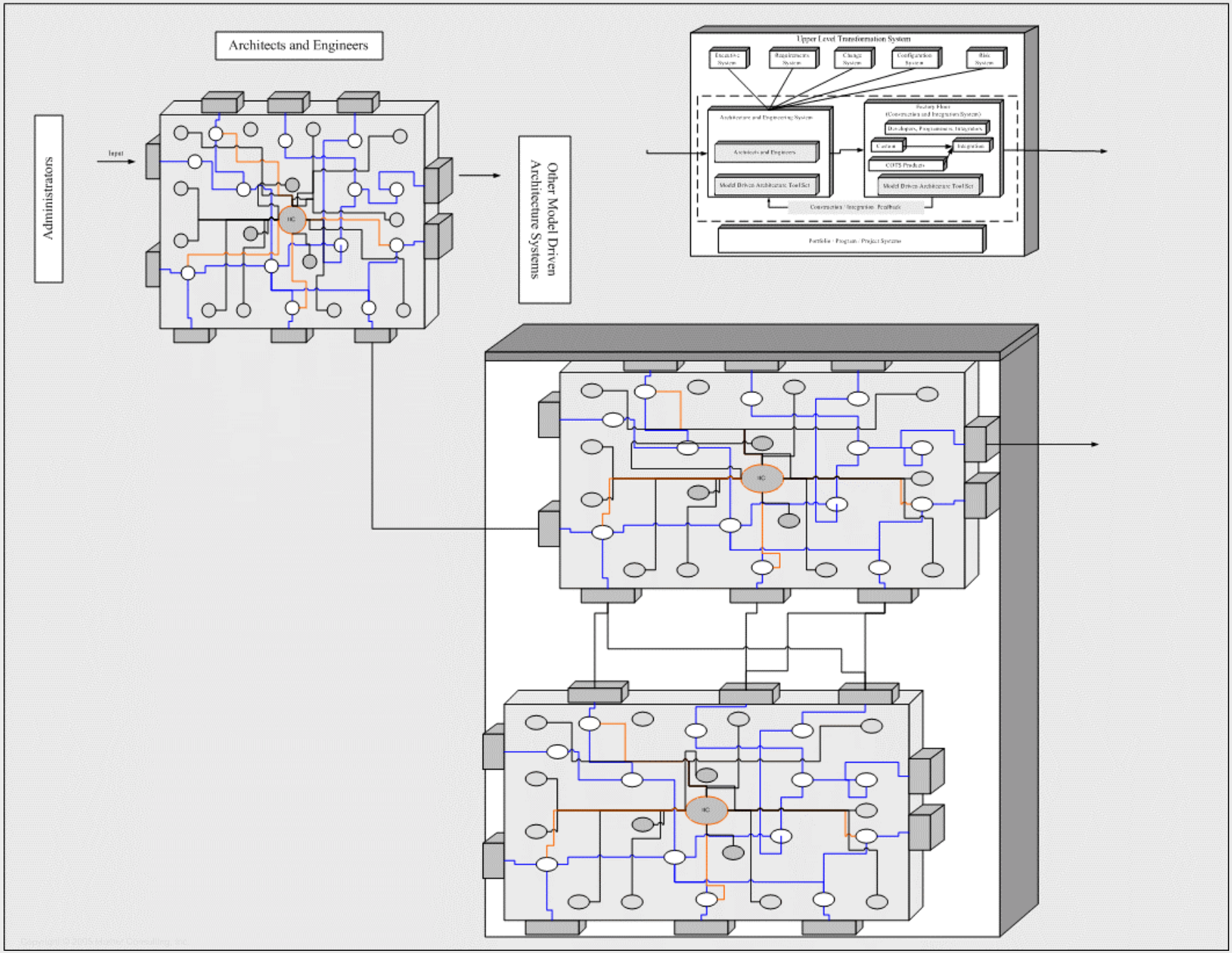
The actual component / system "fits" the "socket" to some degree – bases for component / system evaluation and selection.

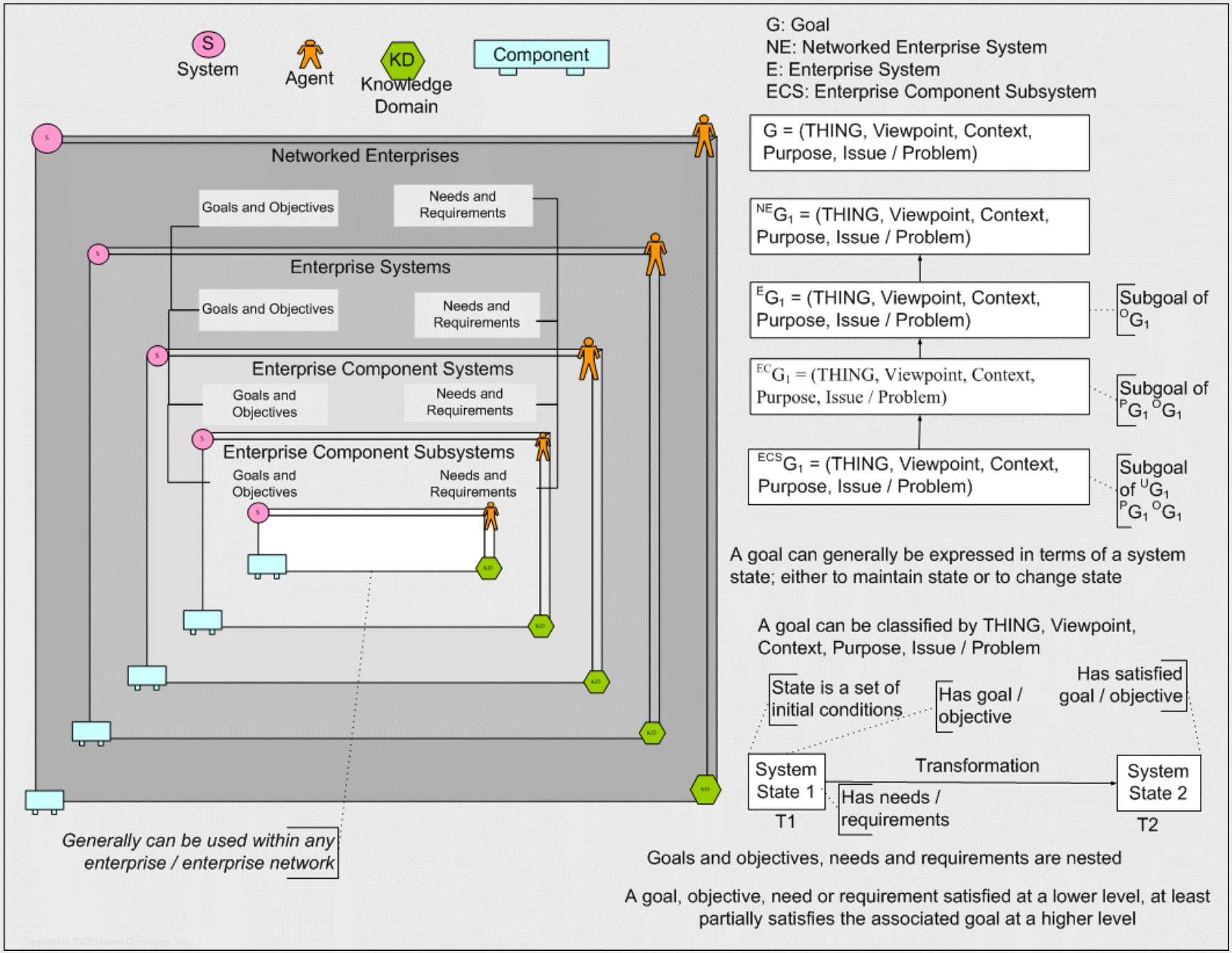
An system / component in a role offers a set of goods / services for use in a collaboration

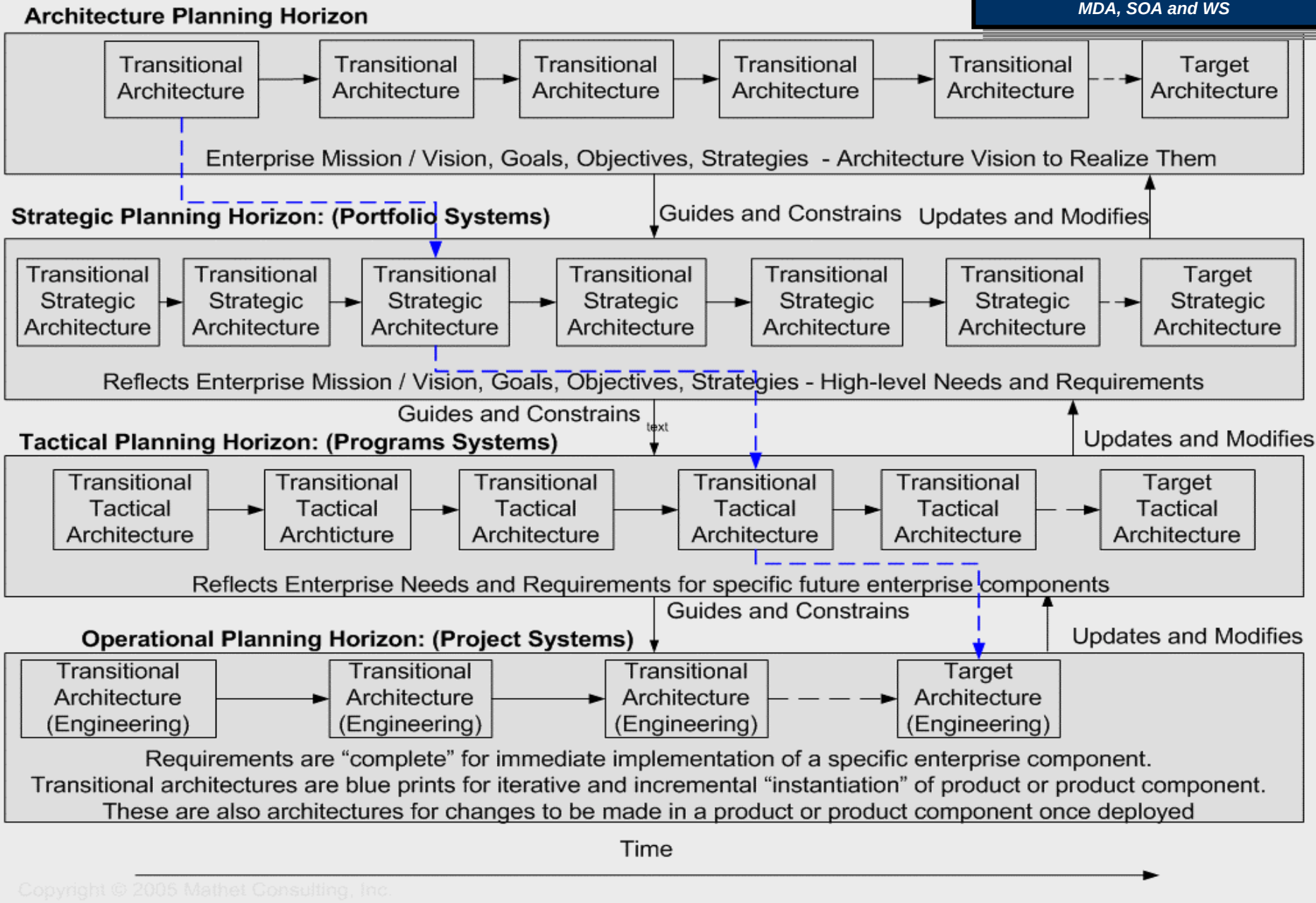
When an entity is in a role, the services associated with that role are "exposed" to other entities
Knowledge of the role provides information as to the services offered (expected behavior)

"Socket" (Target System)

Actual Component / System







The Upper Level Transformation System Mapping Vendor Products to Enterprise Reference Architecture

- The reference architecture is a PIM – a “unification” of PIM from multiple knowledge domains for defining / specifying the business
- The set of applications when integrated must align with the PIM reference architecture.
- In architecture and engineering – the IIC of set of applications must be done in a way to align with the enterprise PIM
- Enterprises are emergent systems → the IIC must align and fulfill all called for functionality even if none of the individual components have a specific feature called for in the PIM
- The PIM takes into account emergence

Application of Advanced Conceptualization of
EA, MDA, SOA, and Web Services and their Unification

Unified and Converged Communication(s) Systems

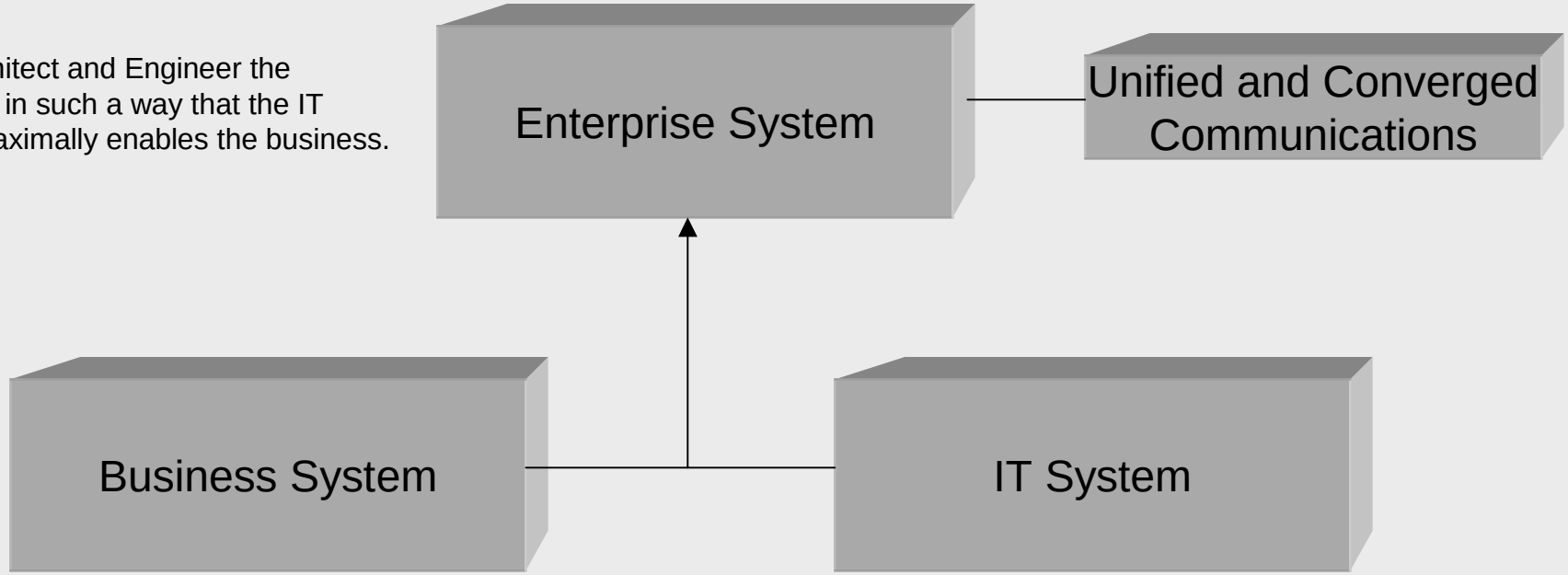
Integration, Interoperability and Collaboration with
EA, MDA, SOA and WS

Voice, Data, Graphics, Multimedia

Perspective and Focal Points

Enterprise Architecture X Model Driven Architecture X
Service Oriented Architecture X Web Services

Goal: Architect and Engineer the enterprise in such a way that the IT system maximally enables the business.



The IT system is the platform, offering a set of IT services, for the business made up of an integrated, interoperable and collaborative set of applications.

Perspective and Focal Points

Enterprise Architecture X Model Driven Architecture X
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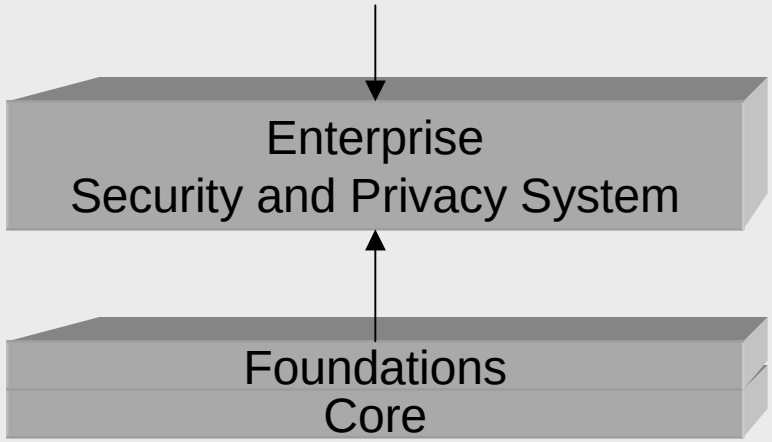


- Voice
- Data
- Graphics
- Multimedia

- Computers
- Handhelds
- Wireless phones
- Land-line phones

- E-mail
- Web
- Facsimile
- Voice
- Multimedia

- Architecture and Engineering
- Management – Administration and Monitoring
- Service Requestors
- Other Security and Privacy Systems

- Ontology / Semiotics
- Algorithms and Computation
- Best Practices and Standards / Policies and Procedures
- Integration, Interoperability and Collaboration
- Process and Workflow
- Intelligence
- Knowledge, Information, Data
- Technology
- Communications
- Quality
- Economics
- Law
- Roles

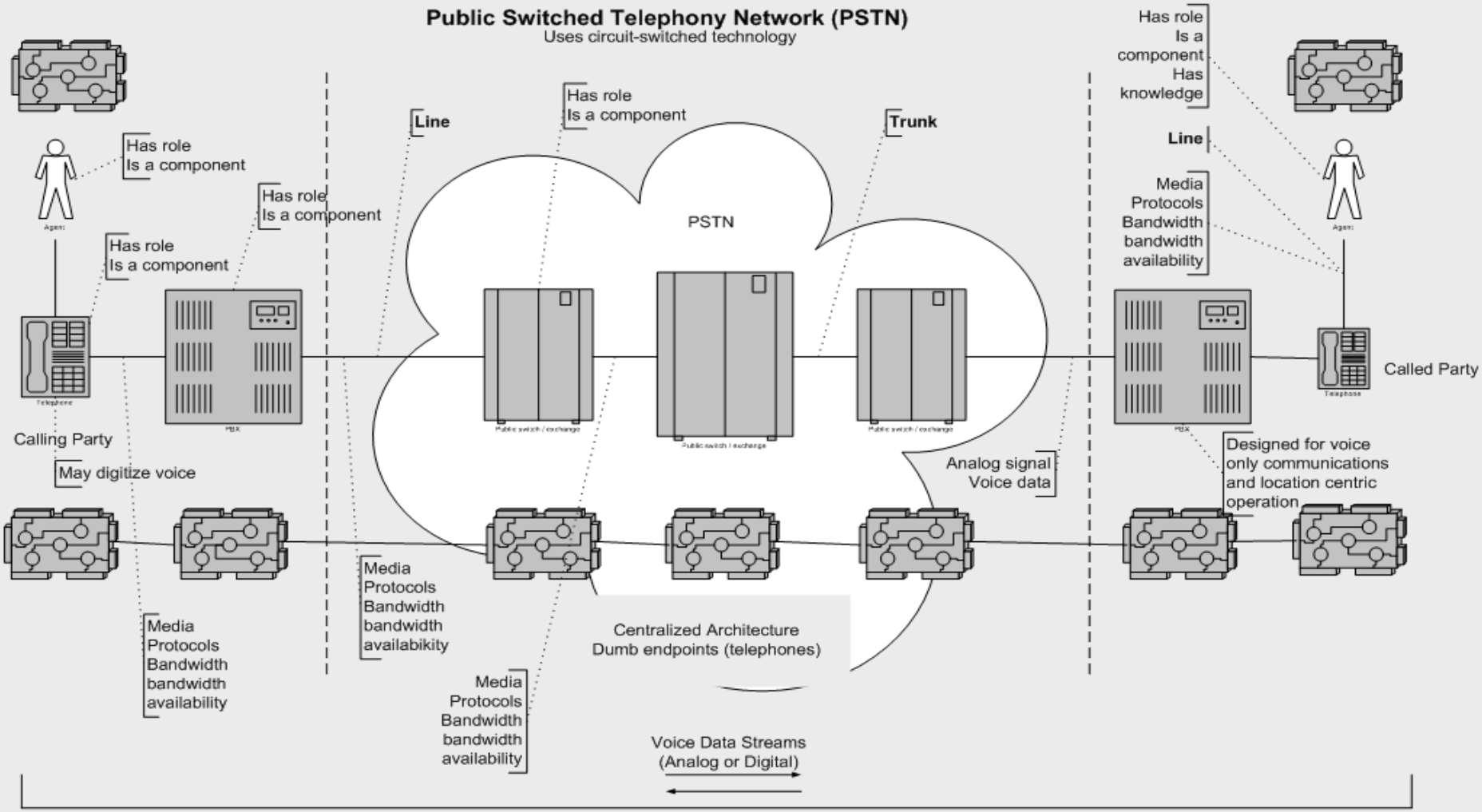
- Network
- Application
- Information

- Layering / Tiering
- Events – Notification
- Real-time, Ubiquitous and Pervasive

- Security and Privacy Law and Legal Compliance

Additional Concerns

- Not just computers but devices of all kinds – phones (land-line, wireless, digital / analog) → containers for software components that function as in the services motif (requester, provider)



Communications Loop
Bidirectional communications
Bandwidth of a circuit-switched connection is 64 kbs - each call gets a 64 kbs link (more than is need with today's technology
Resulting communications link is maintained for the duration of the call
The communications link / resource cannot be employed by any other party until the call is terminated
Central exchanges and PBXs stay in the loop after the call is set up, released when the call is terminated
Signals may be digital or analog
QoS: jitter - ccc
QoS: delay -

Unified and Converged Communications

- Real-time, distributed, device-independent, multi-modal interactions / collaborations
- Converged Communications
  - Data, Voice, Multimedia → **everything IP**
- Unified Communications
  - E-mail, Web, Facsimile, Voice mail, Etc.

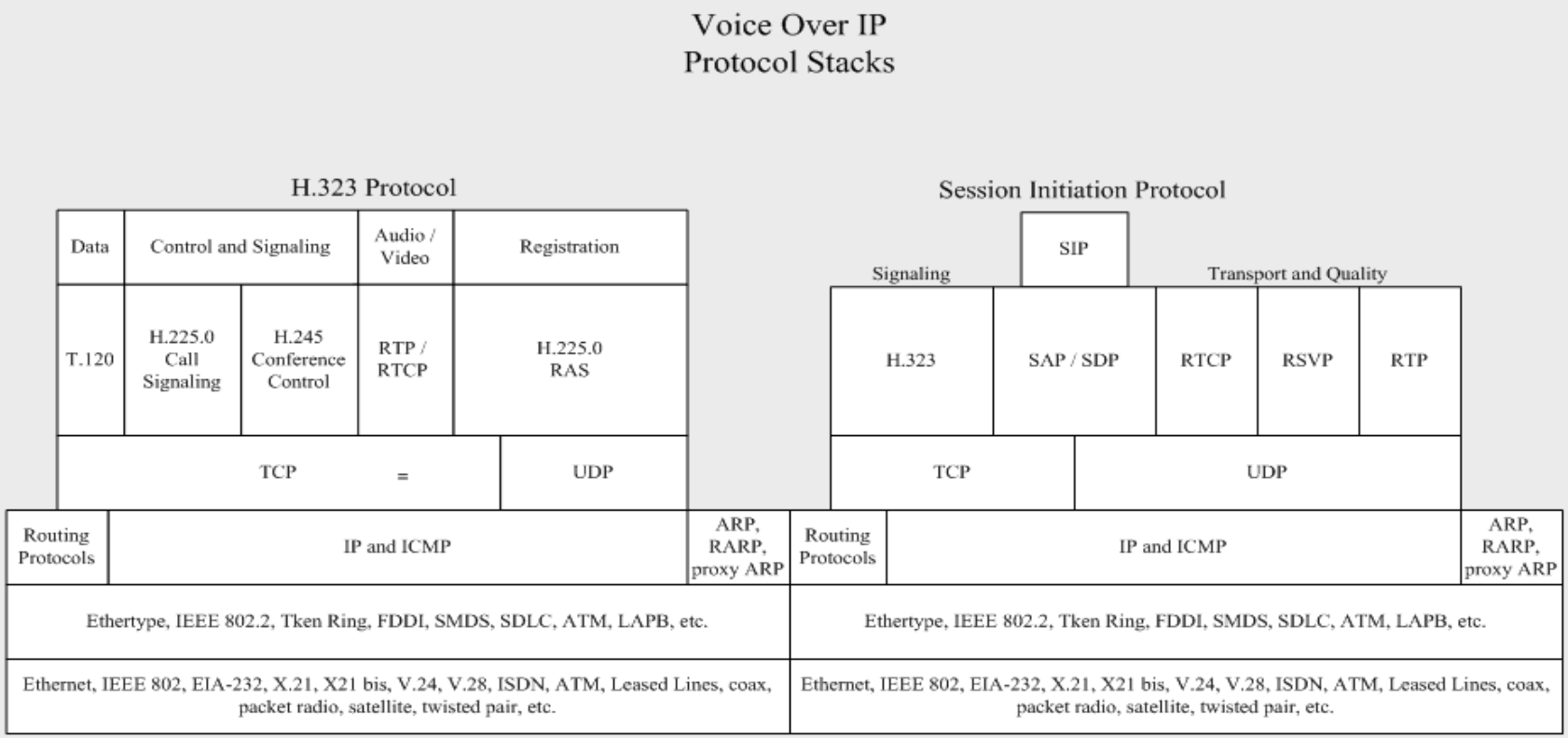
Unified and Converged Communications and Web Services

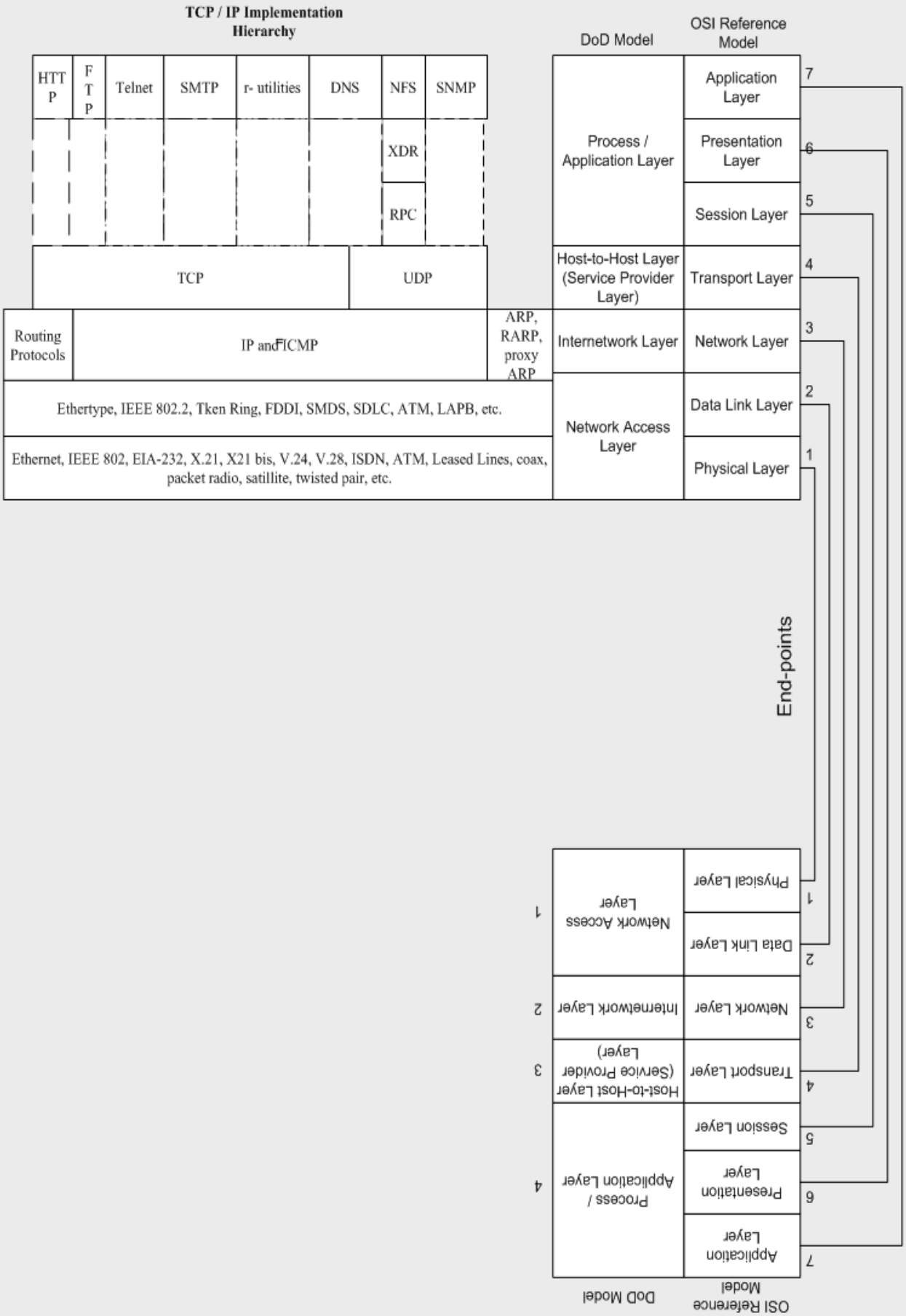
- Voice-enabled Web Services
  - A web service that allows “agents” to interact with the service via a telephone using speech or a telephone keypad
  - The web service communicates with the caller using pre-recorded audio or synthesized voice
  - The web service collects responses from the caller using speech recognition or touchtone recognition
- Why Voice-Enabled Web Services
  - Approximately 1.3 billion telephone users
  - Approximately 250 million computer users

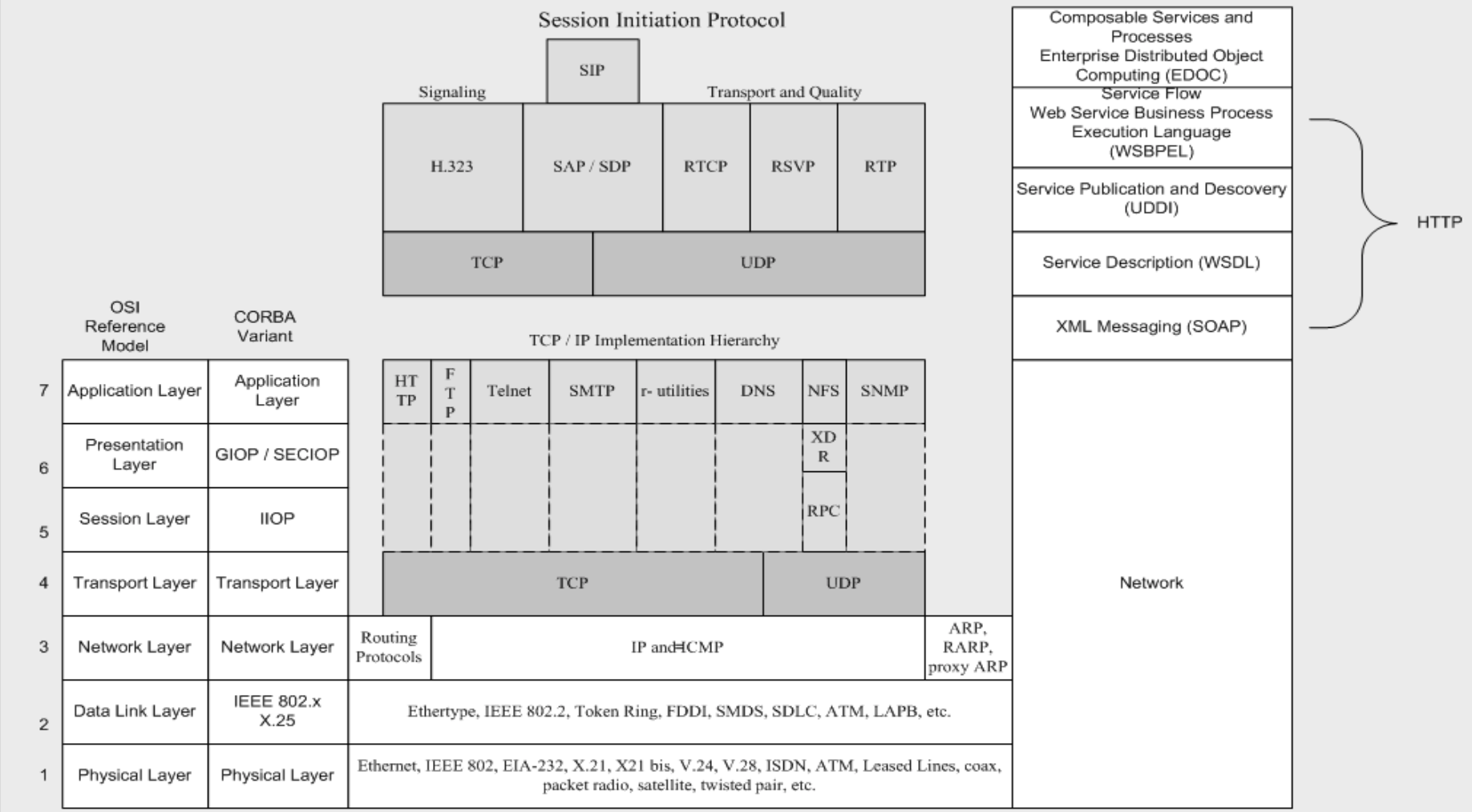
Unified and Converged Communications and Web Services

- Invoking a VoiceXML application (web service) (for example)
  - Callers access a VoiceXML application by dialing a dedicated phone number
  - The phone carrier processes the incoming call and forwards the call to the VoiceXML gateway
  - The VoiceXML gateway accepts the incoming call, maps the phone number into a URL, and makes the http request to fetch the main VoiceXML document with its associated resources from a document server (application server or Web server)
  - Once available, the VoiceXML application starts interacting with the caller; using ASR or DTMG for understanding voice input and TTS or pre-recorded audio to respond to the caller

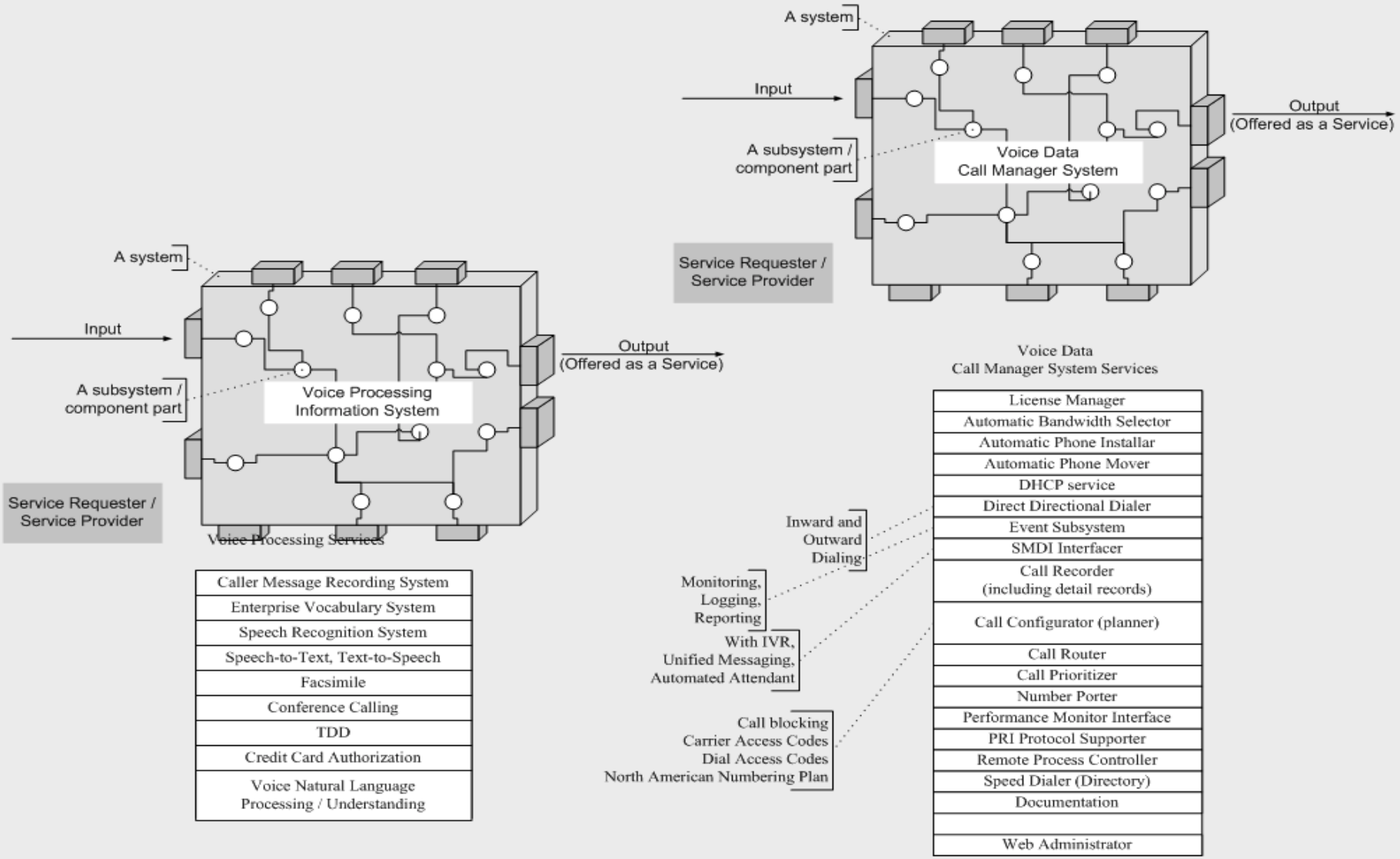
VoIP protocol stacks



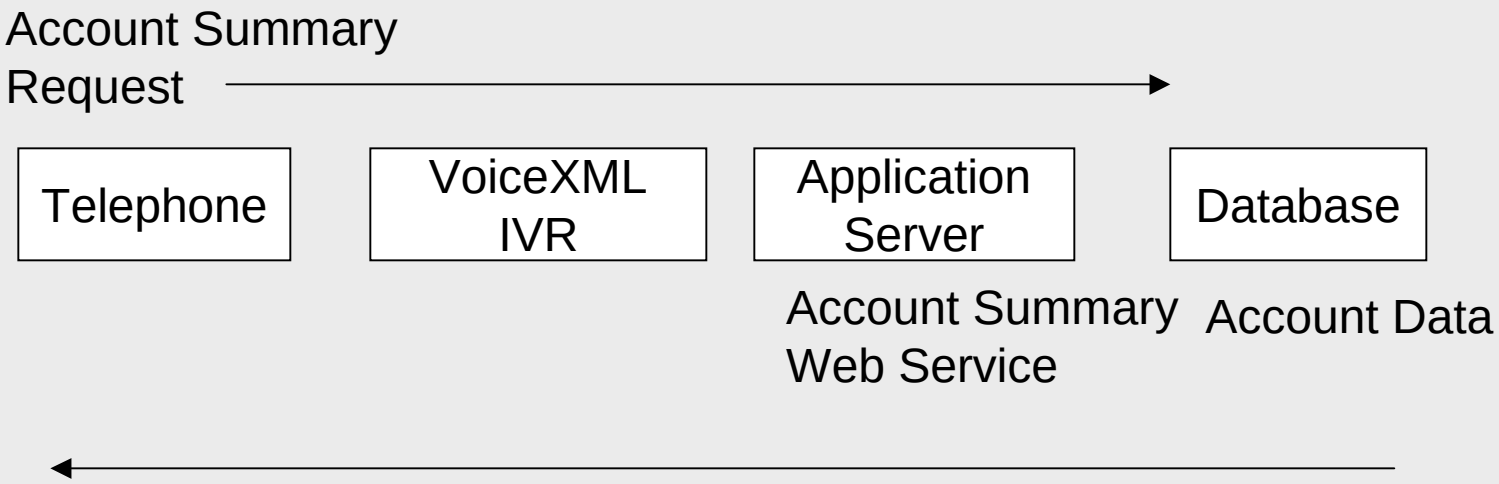




Voice Components



Voice Request



Security and Privacy Systems

Integration, Interoperability and
Collaboration with MDA, SOA, and WS

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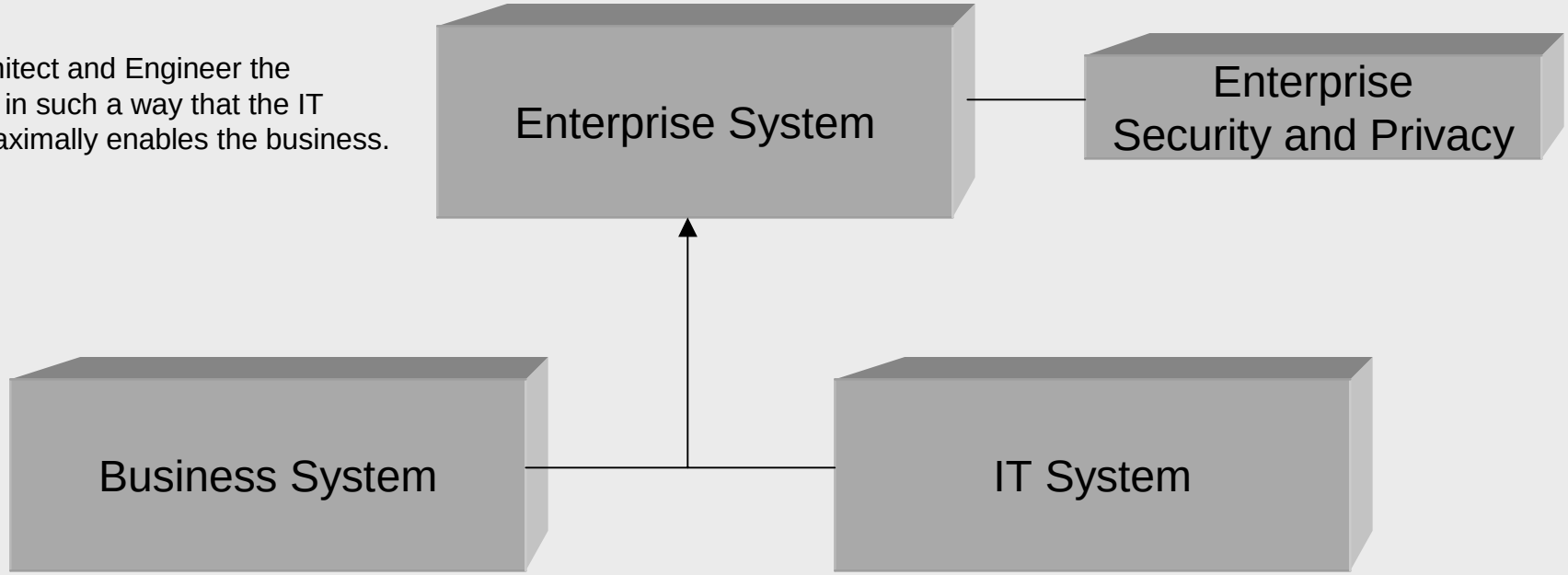

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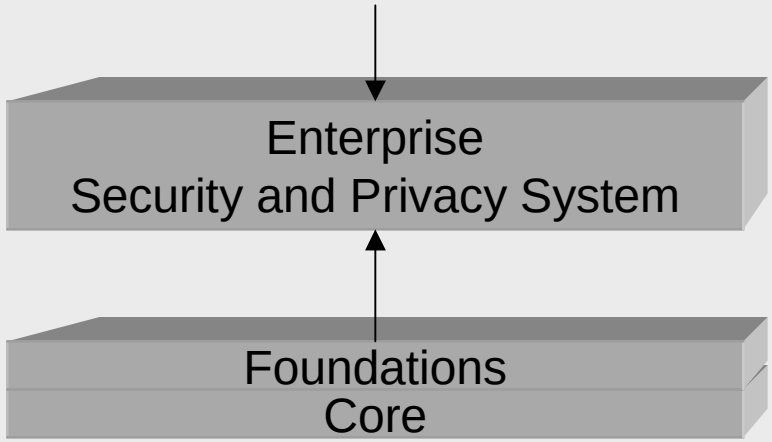

- Assessment
- Protection
- Detection
- Response
- Review

- Identification
- Authorization
- Authentication
- Access
- Encryption

- Non-repudiation

- Trust

- E-mail
- Web
- Facsimile
- Voice
- Multimedia

- Architecture and Engineering
- Management – Administration and Monitoring
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- Other Security and Privacy Systems

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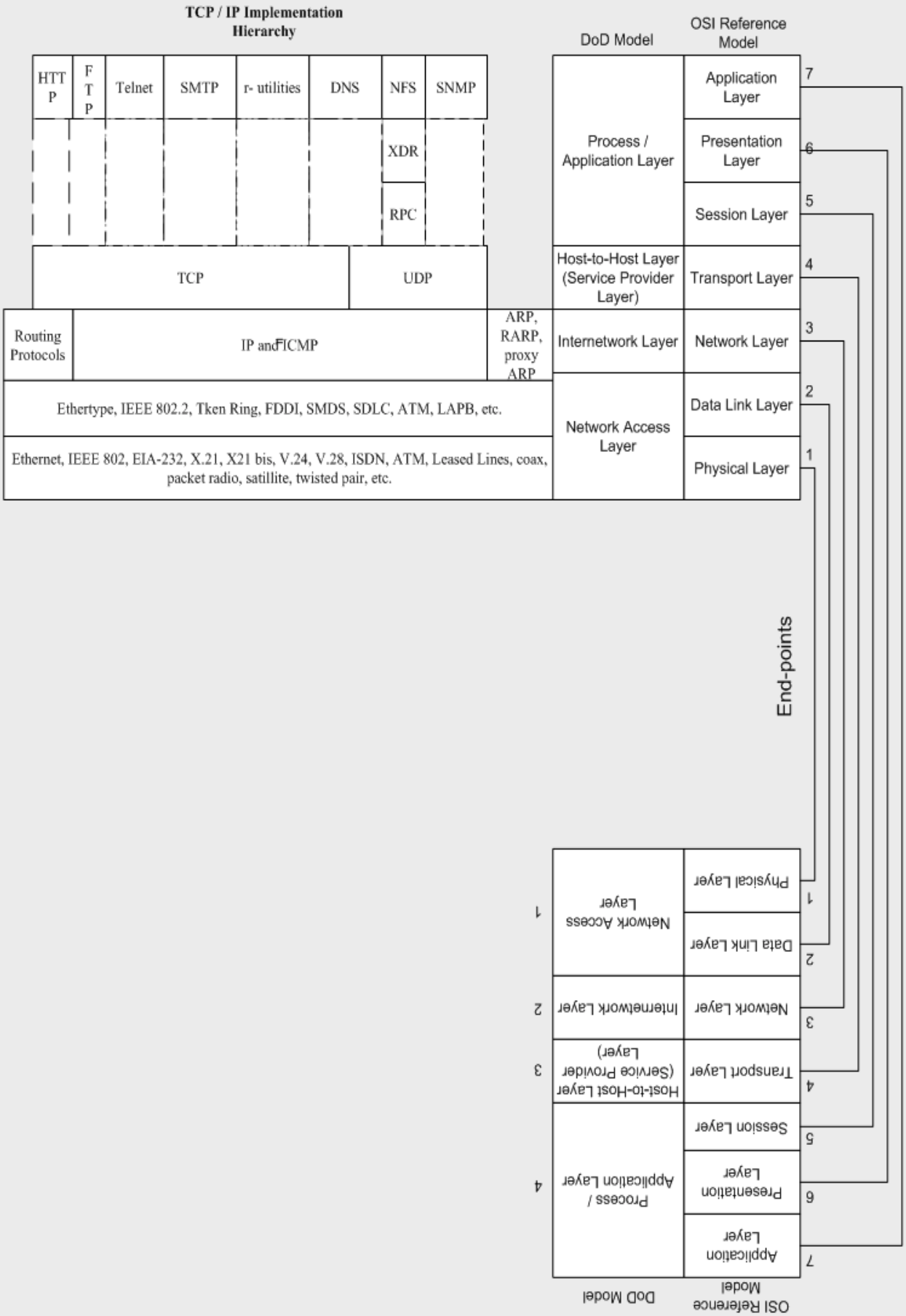
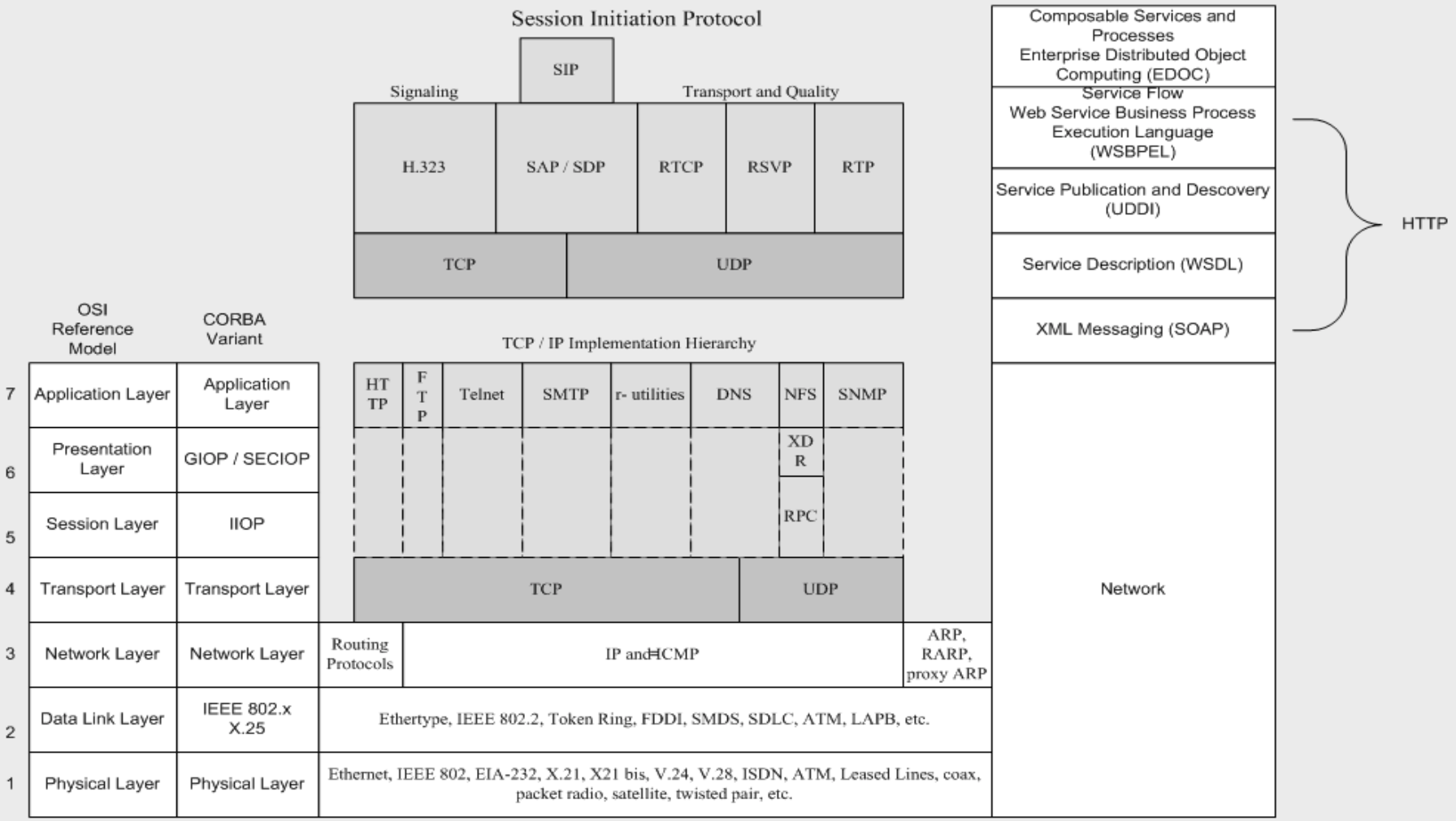
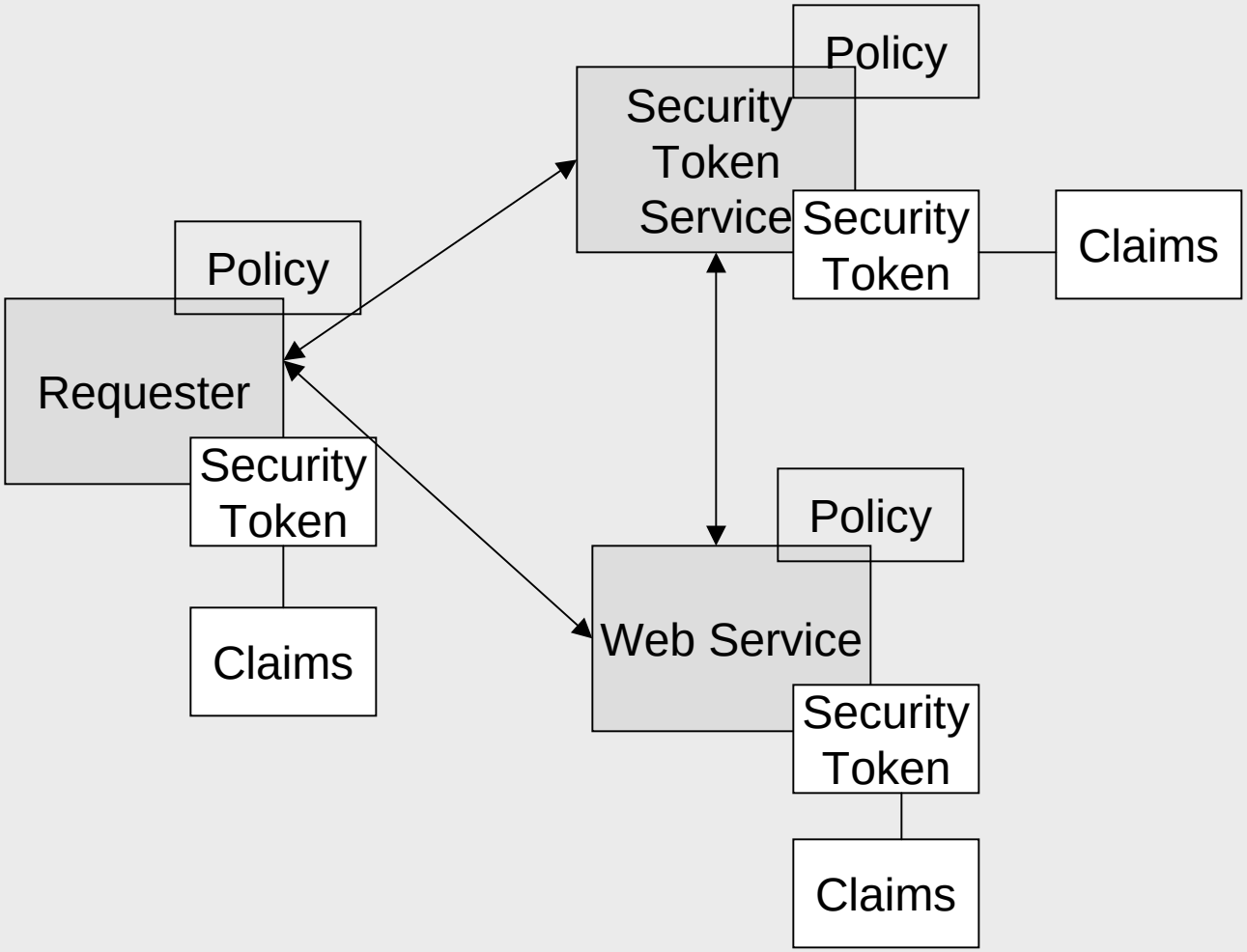




Web Services Security Model



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