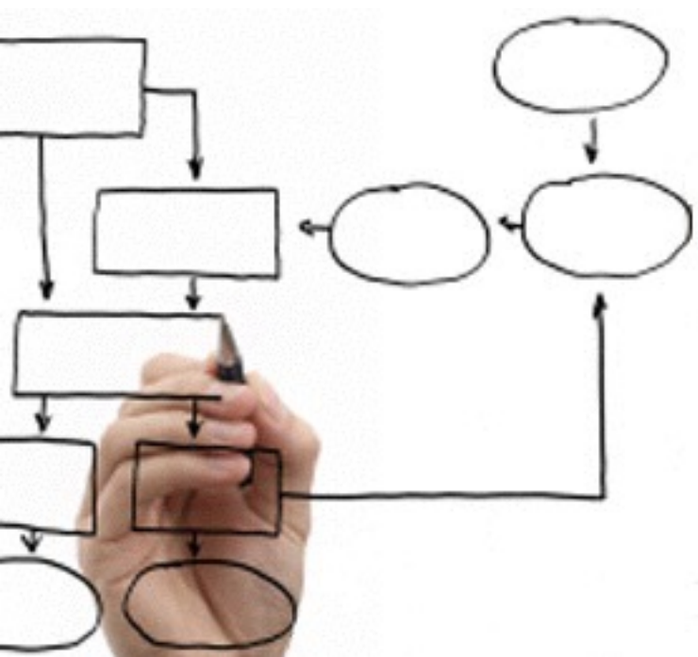
Methods for the specification and verification of business processes

MPB (6 cfu, 295AA)

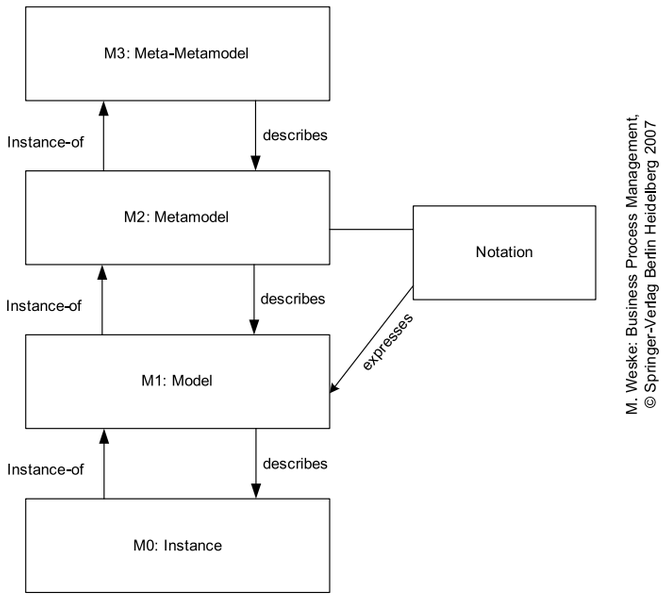


Roberto Bruni

http://www.di.unipi.it/~bruni

04 - Models and Abstraction

Object



Overview of the conceptual models and abstraction mechanisms in business process modeling

Ch.3.1--3.3 of Business Process Management: Concepts, Languages, Architectures

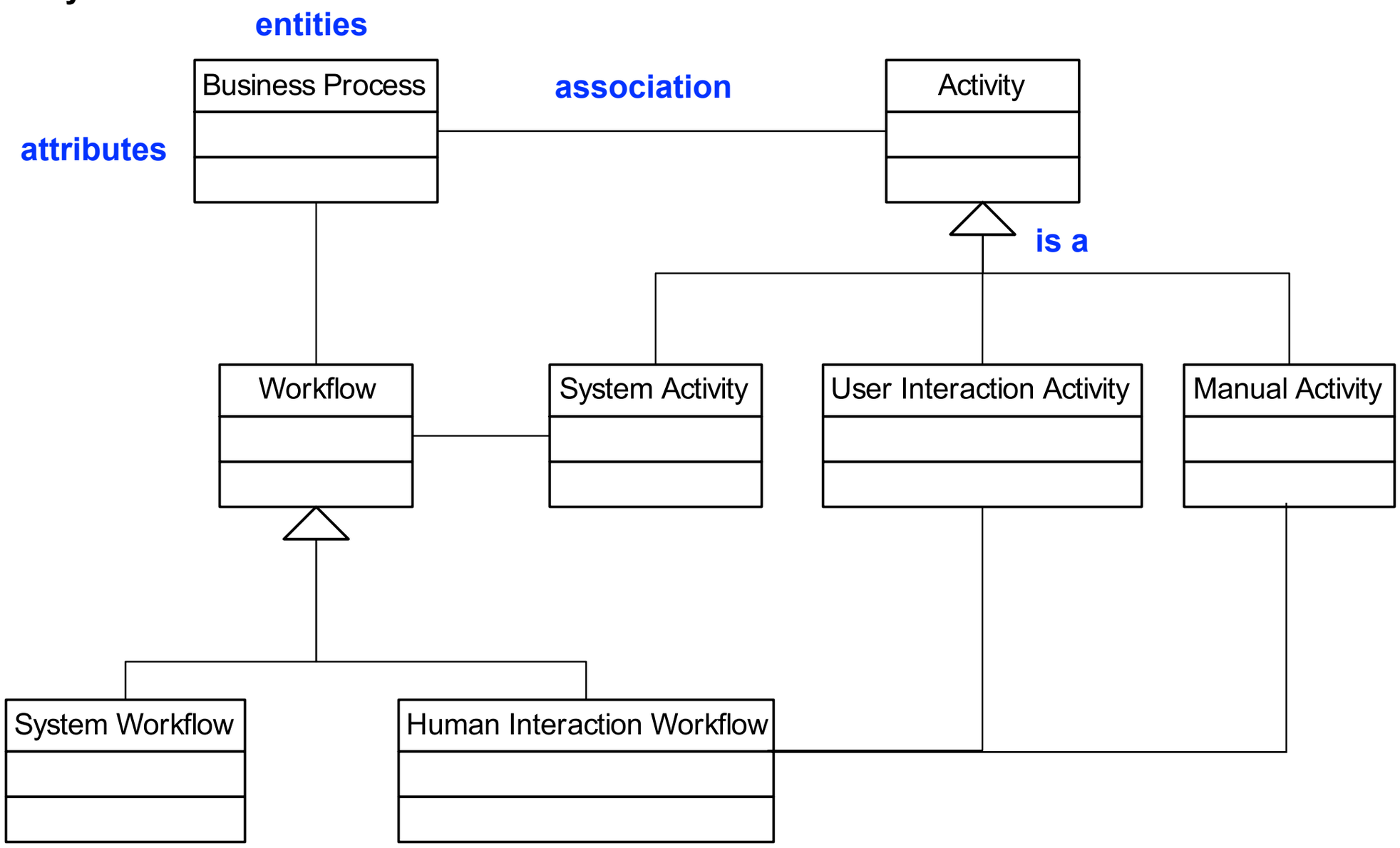
Model

A model is a simplified representation of reality

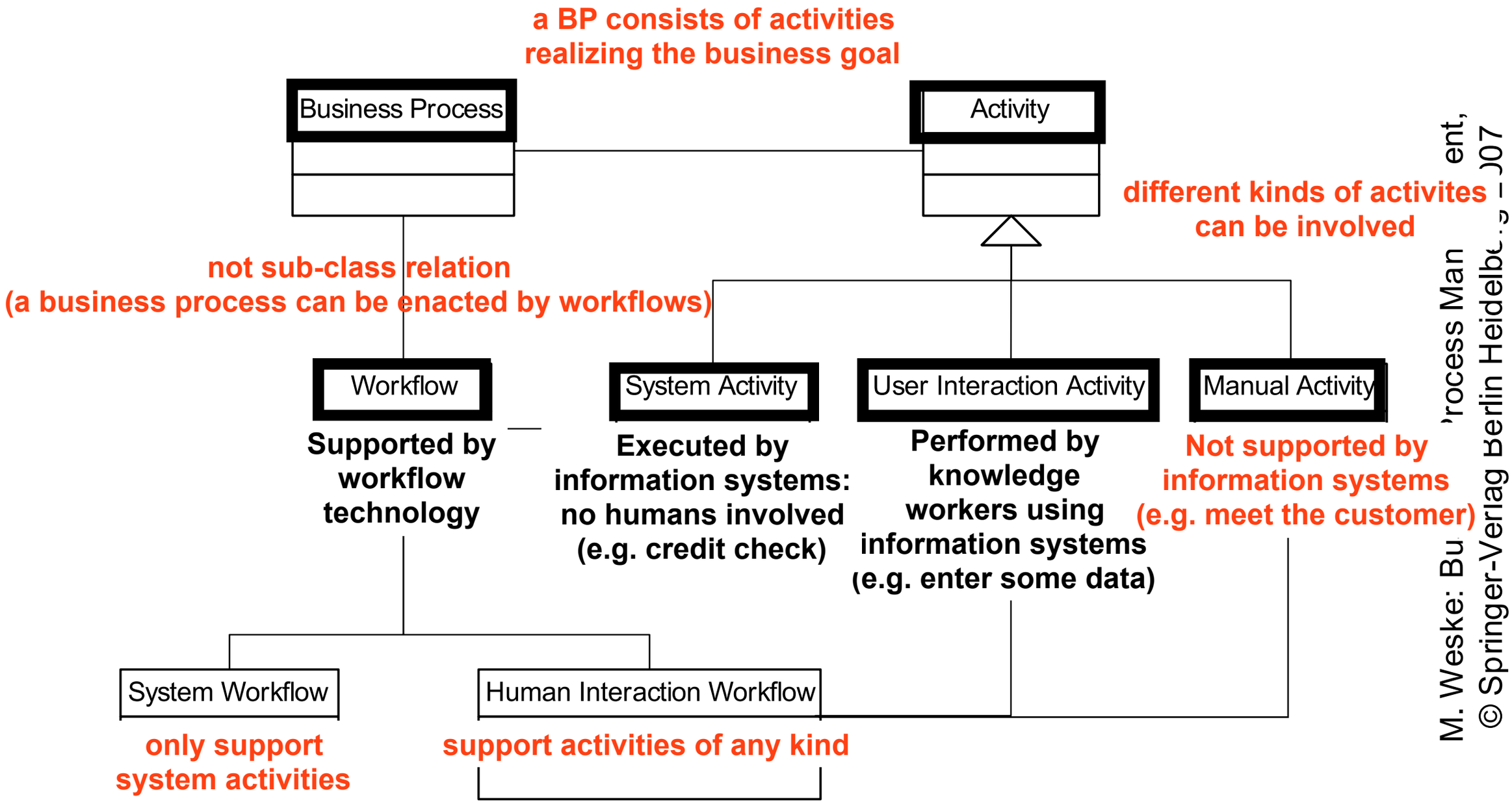
"Essentially all models are wrong,
but some are useful"
(George P. Box)

Conceptual model of business processes

UML-like syntax



Conceptual model of business processes



Workflow management

Needs of:

Explicit representation of process structures in process models

Controlled enactment of business processes according to these models

Workflow management coalition (WfMC)

Founded in the ‘90s by vendors, users, academia: fix standard for Wf representation and execution

http://www.wfmc.org

Workflow

Definition: a **workflow** is the automation of a business process, in whole or in part,

during which documents, information, or tasks are passed from one participant to another for action,

according to a set of procedural rules

Workflow Management Coalition

WfMC

Workflow management system

Definition: a **workflow management system**
is a software system
that defines, creates, and manages Wfs execution,
running on one or more workflow engines,
able to interpret the process definition,
able to interact with workflow participants, and
able to invoke the use of IT tools and applications

System workflow

Definition: a **system workflow** consists of activities that are implemented by software systems without any user involvement

Human collaboration

When task performed by humans are involved in the workflow, it is not sufficient to equip workers with adequate software:

their collaboration must be supported

shared data repositories and work handover can speed-up office procedure considerably

Human interaction workflows

Widely used for processes that have automated parts as well as non-automated parts

Goal: support automation by driving the human activities according to the process model

Benefits:

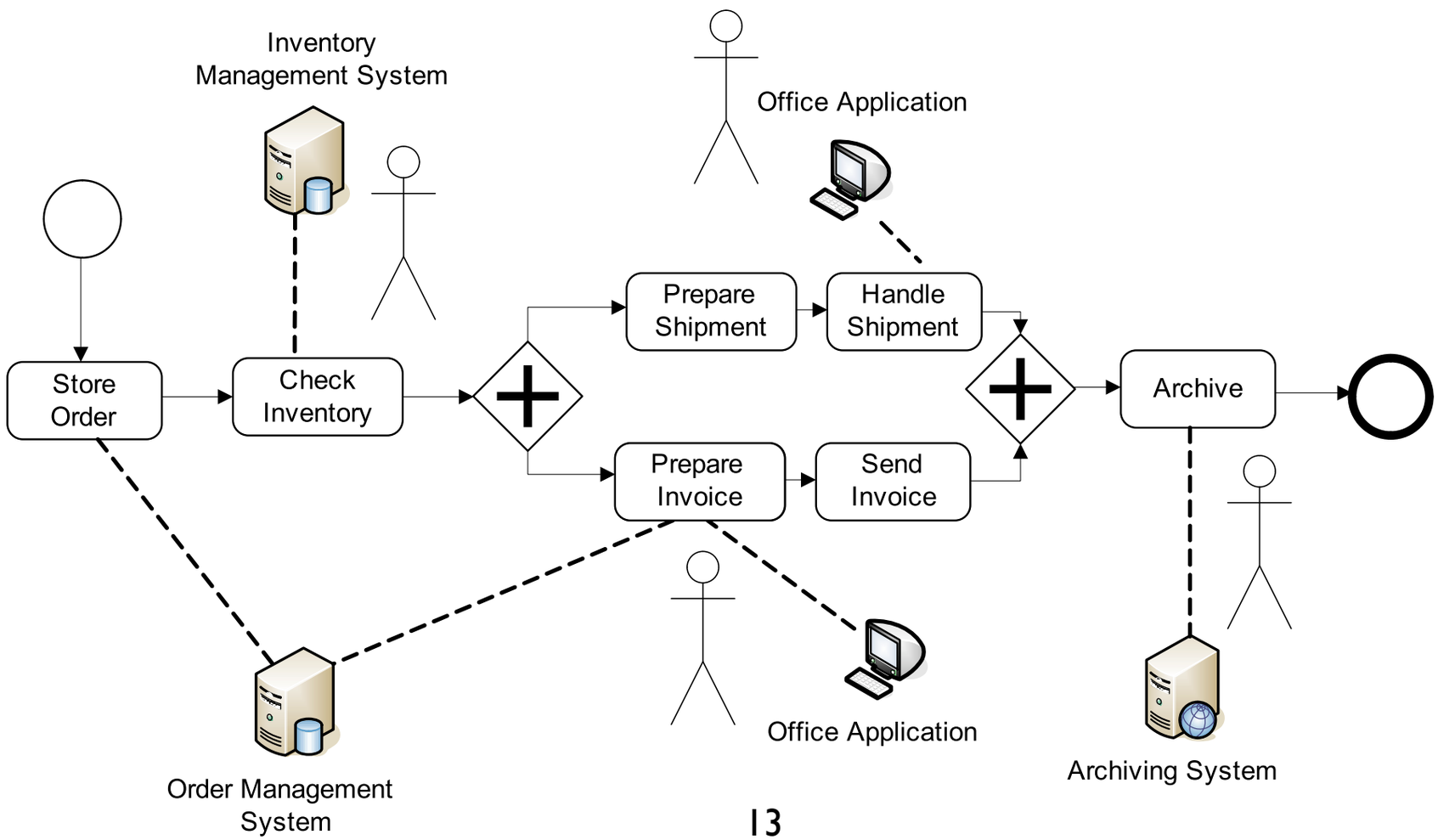
reduce idle periods

avoid redundant work

improve human/machine work integration

Human interaction workflow

Definition: Workflows in which humans are actively involved and interact with information systems are called **human interaction workflows**.



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Concepts in human interaction workflow

Roles = groups of employees that qualify for being responsible of certain activities.
Increased flexibility: different persons can cover the same role at different time in different cases

Work item list (also called **in-basket**) =
when an item is selected
the respective application is started;
when completed
the knowledge worker informs the workflow engine

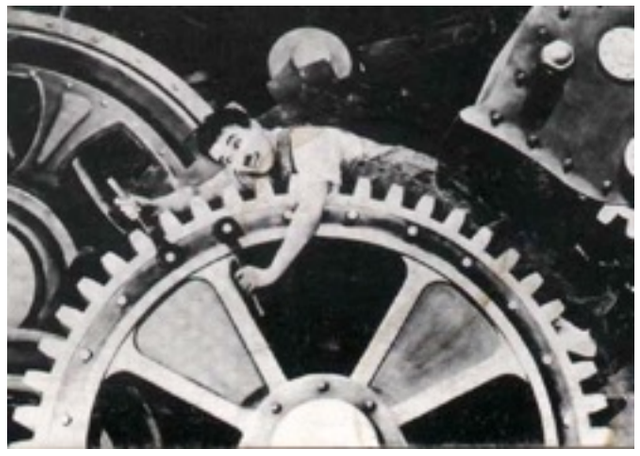
Some limitations

Problems with knowledge workers:

User acceptance issues

Machine burdening of workers

Little room for creativity and flexibility



Abstraction

To derive general rules and concepts
from specific examples of some phenomenon,
by selecting only the aspects which are relevant
for a particular purpose

A mean to cope with complexity

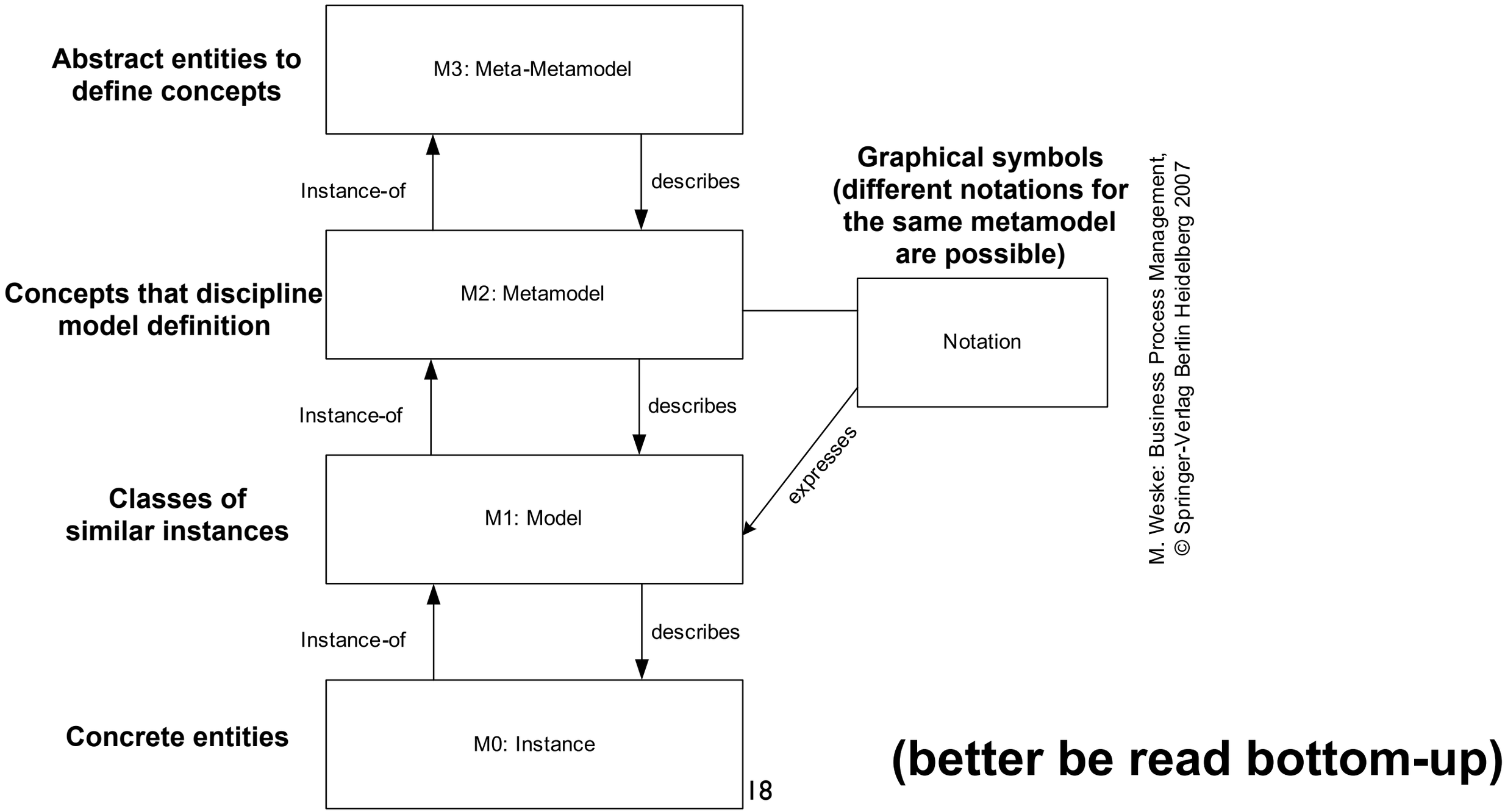
Abstractions

Horizontal: separation at different modeling levels

Aggregation: separation at different granularity levels

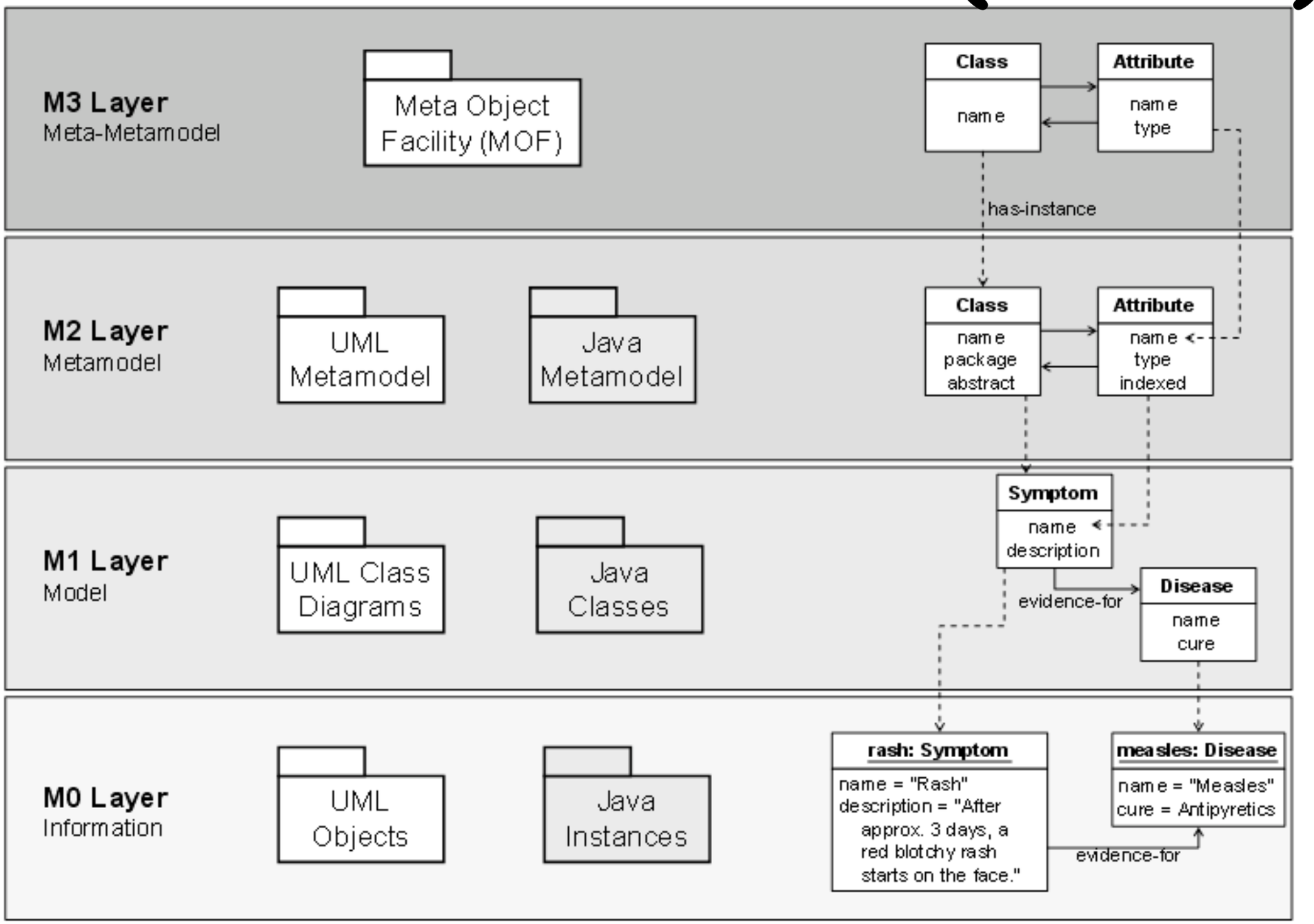
Vertical: separation at different subdomains

Horizontal abstraction (modeling levels)

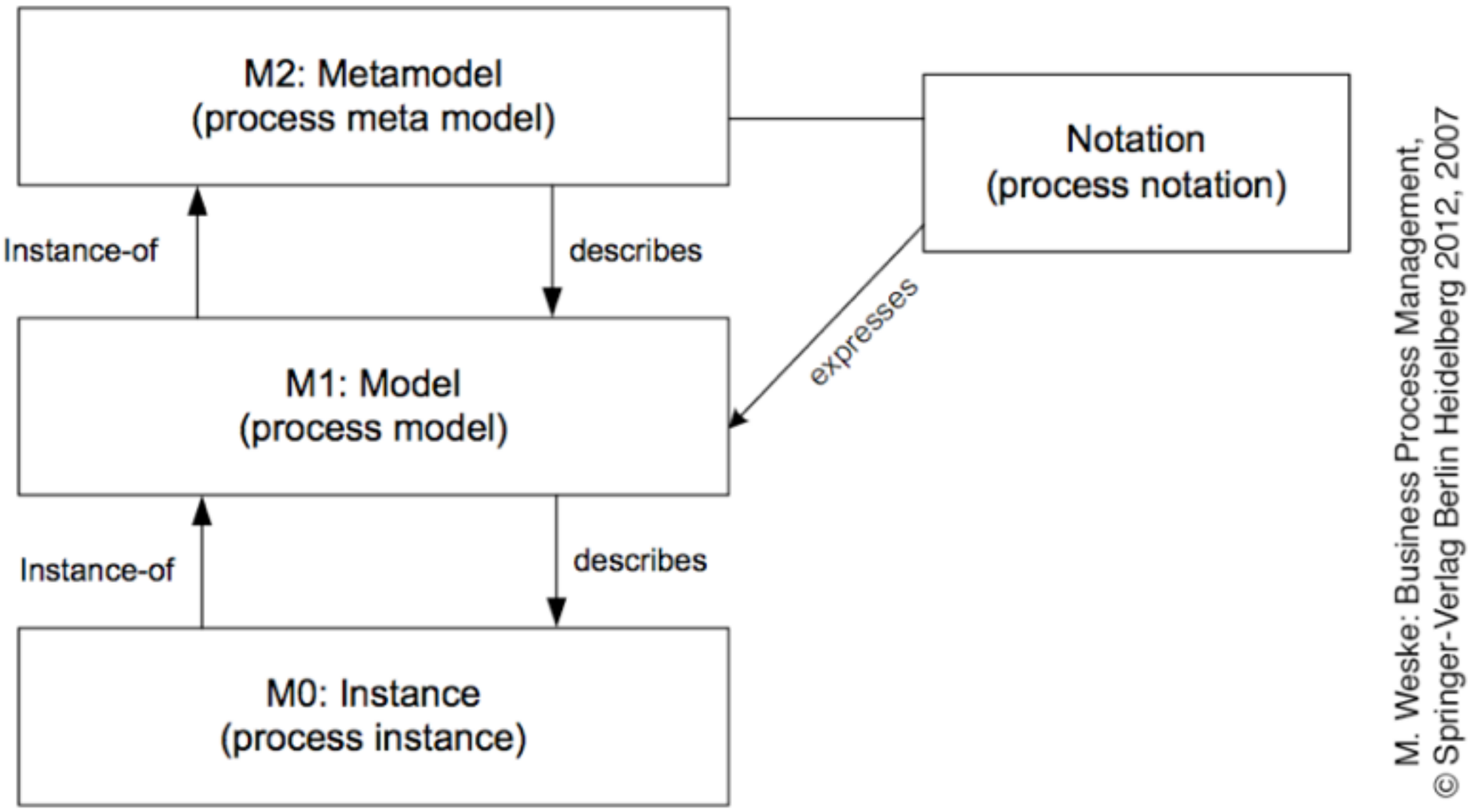


(better be read bottom-up)

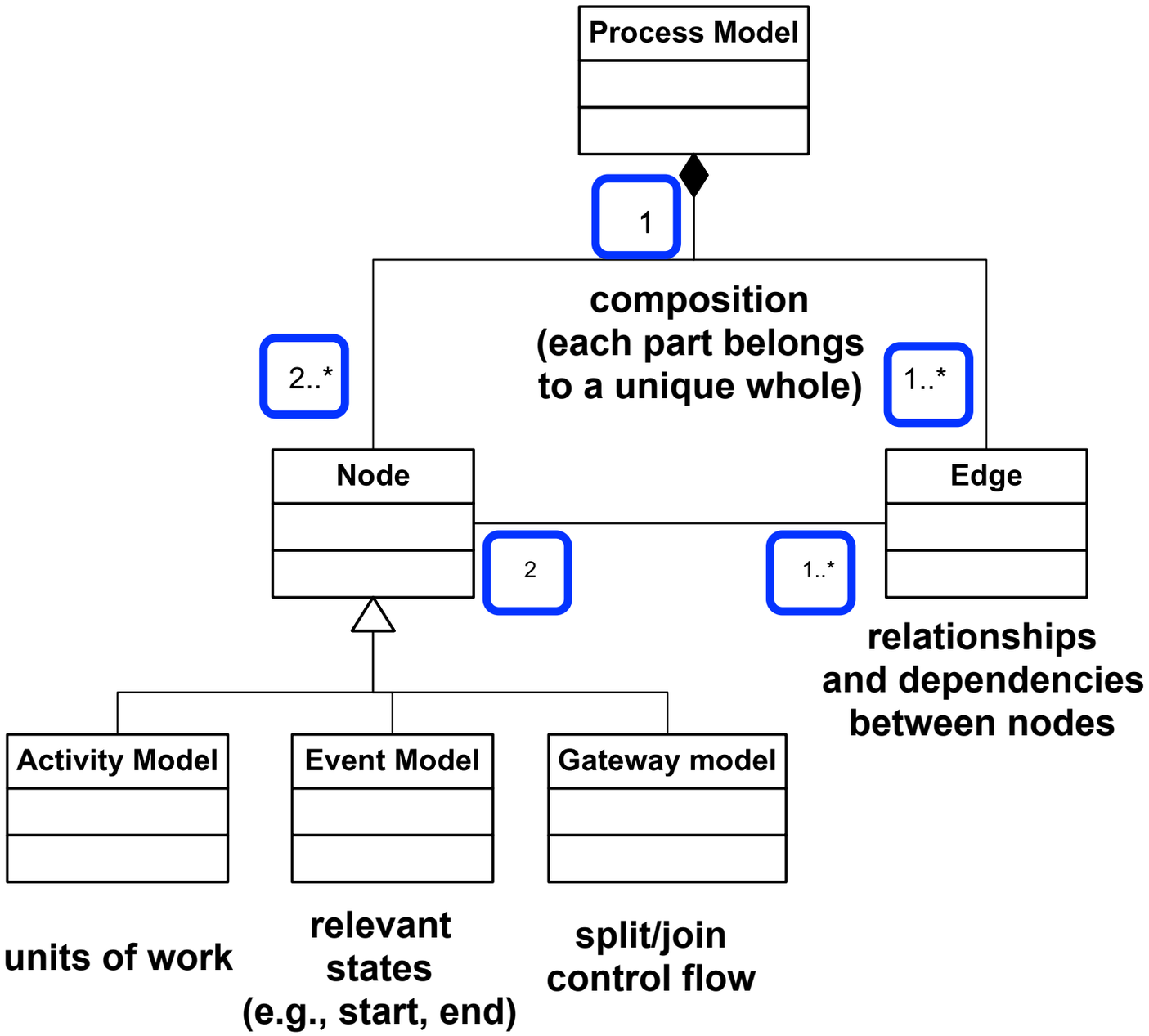
An example: MOF metamodel (OMG)



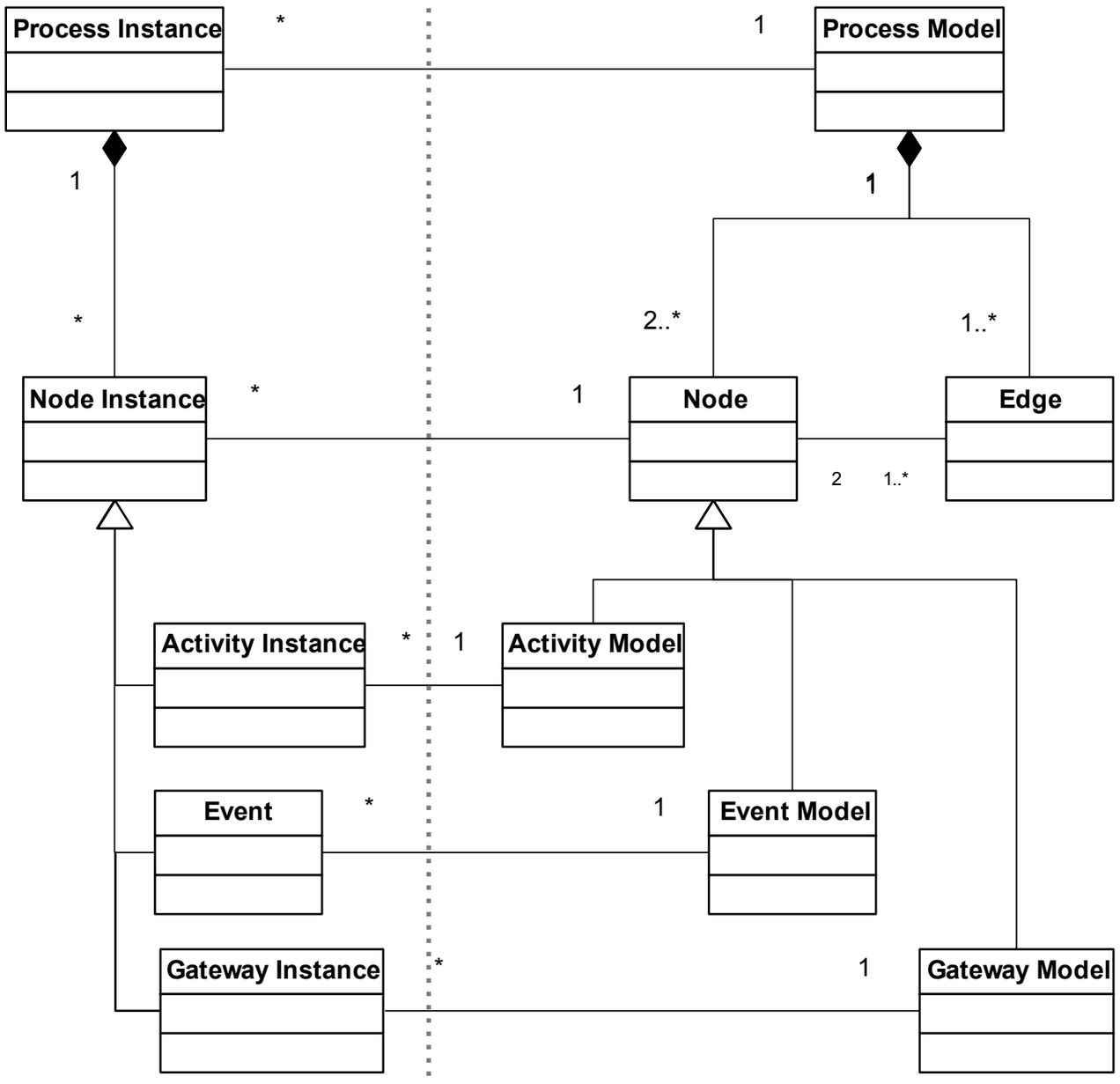
Process models and process instances



A process metamodel (level M2)



Process models and process instances

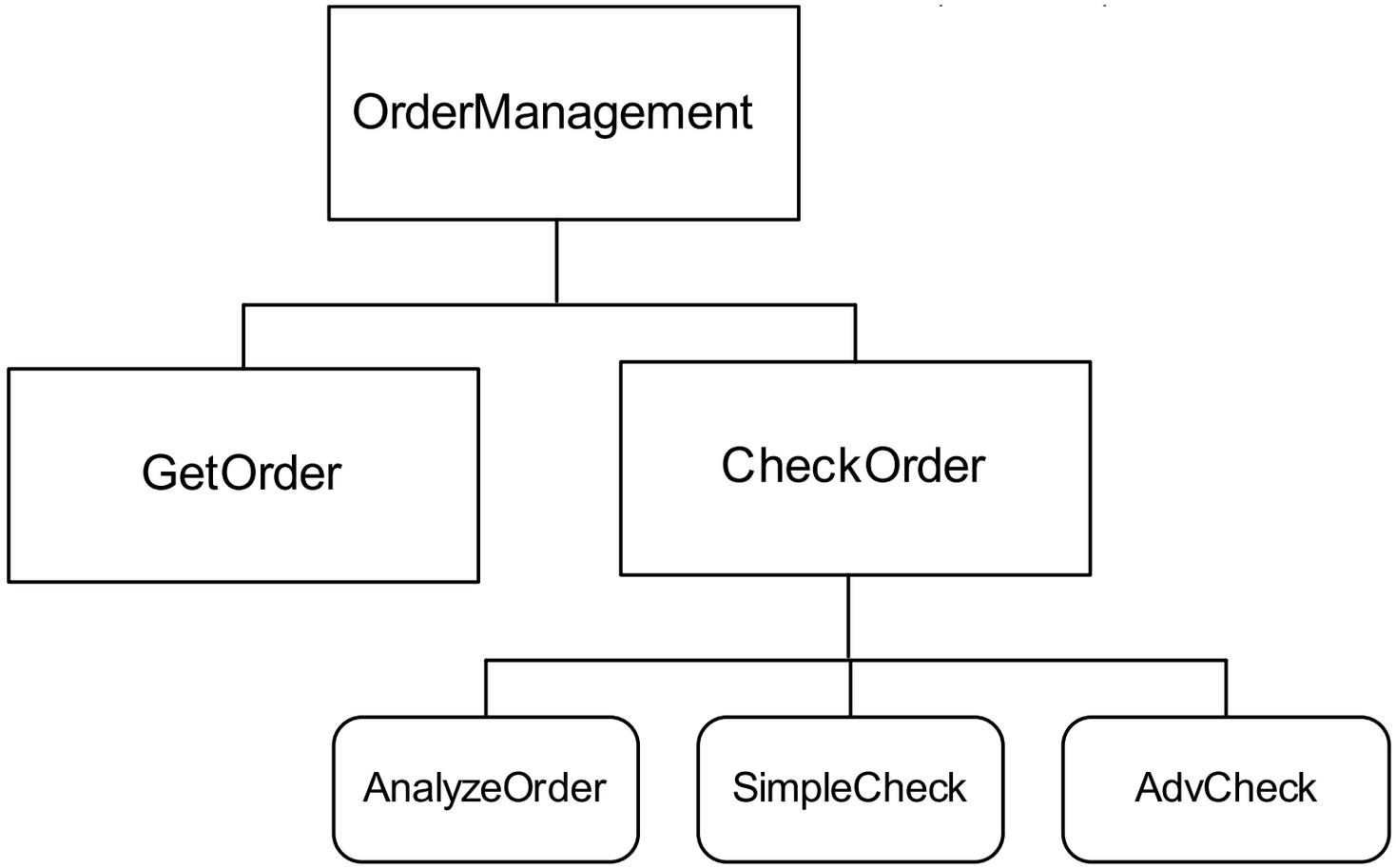


Aggregation abstraction

Multiple elements of a lower level of granularity can be grouped and represented by a single artifact at the higher level of granularity

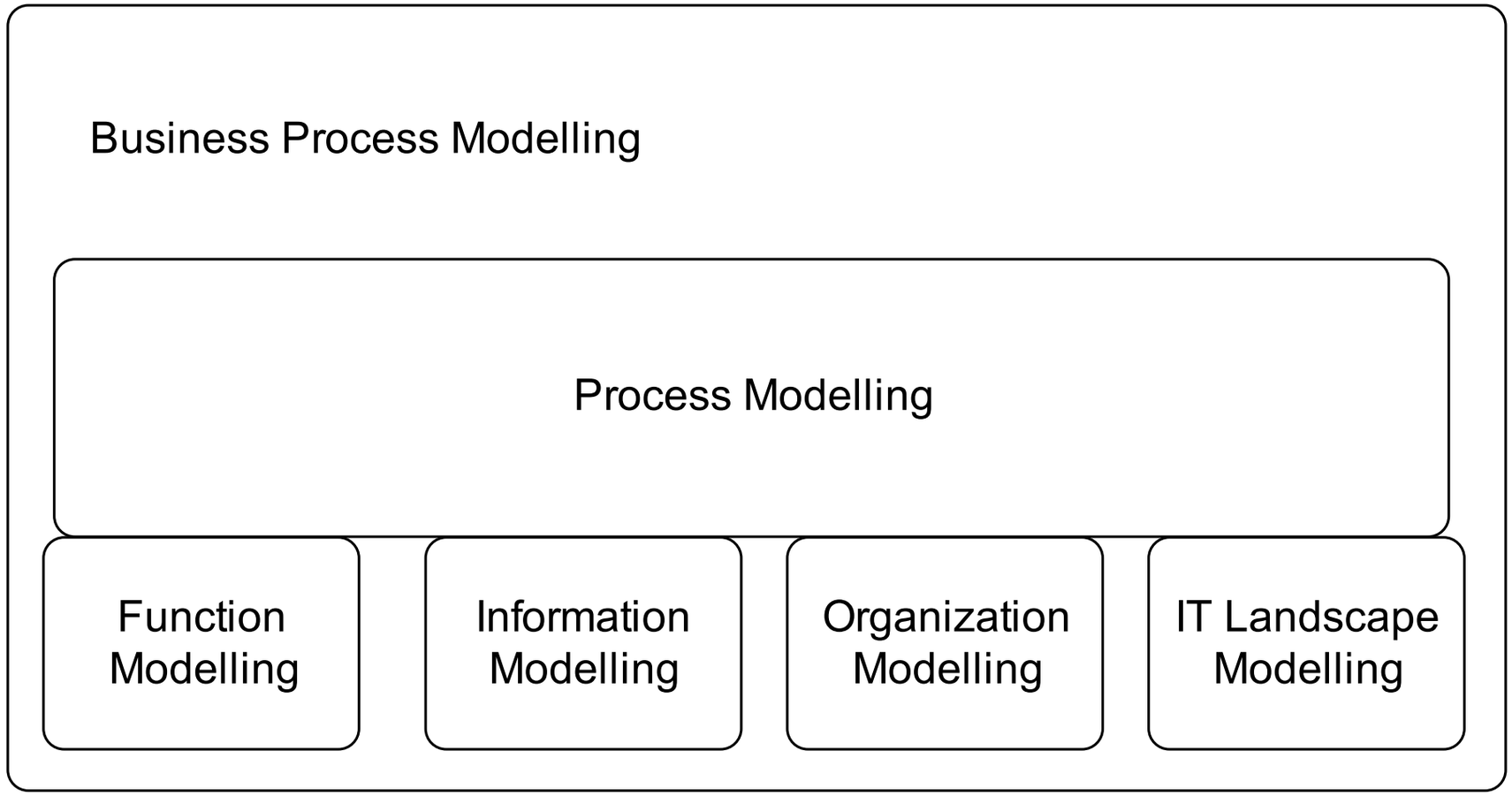
Different from horizontal abstraction:
all activities lie at the same level of abstraction

A sample aggregation



Vertical abstraction (domain separation)

BPM includes multiple modelling domains, integrated by Process Modelling

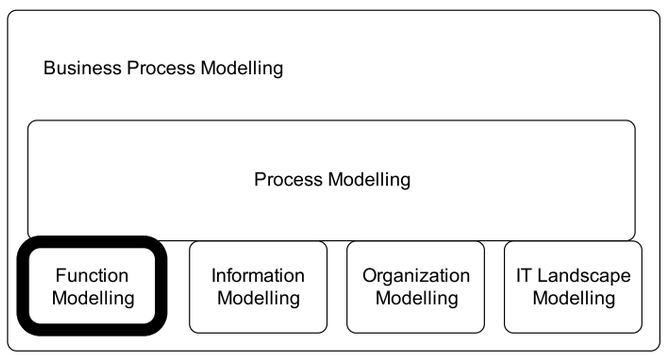


Function models

Units of work enacted by processes
(at different levels of granularity)

Informal description, textual documents
(coarse-grain business level)

Formal description, function specifications
(fine-grain software layer)



Value Chains

Value chains are a way to organize the work that a company conducts to achieve its business goal

Value chains were developed by Michael Porter to organize high-level business functions and to relate them to each other

Value chains can provide an immediate understanding of ``how a company operates''

Value systems

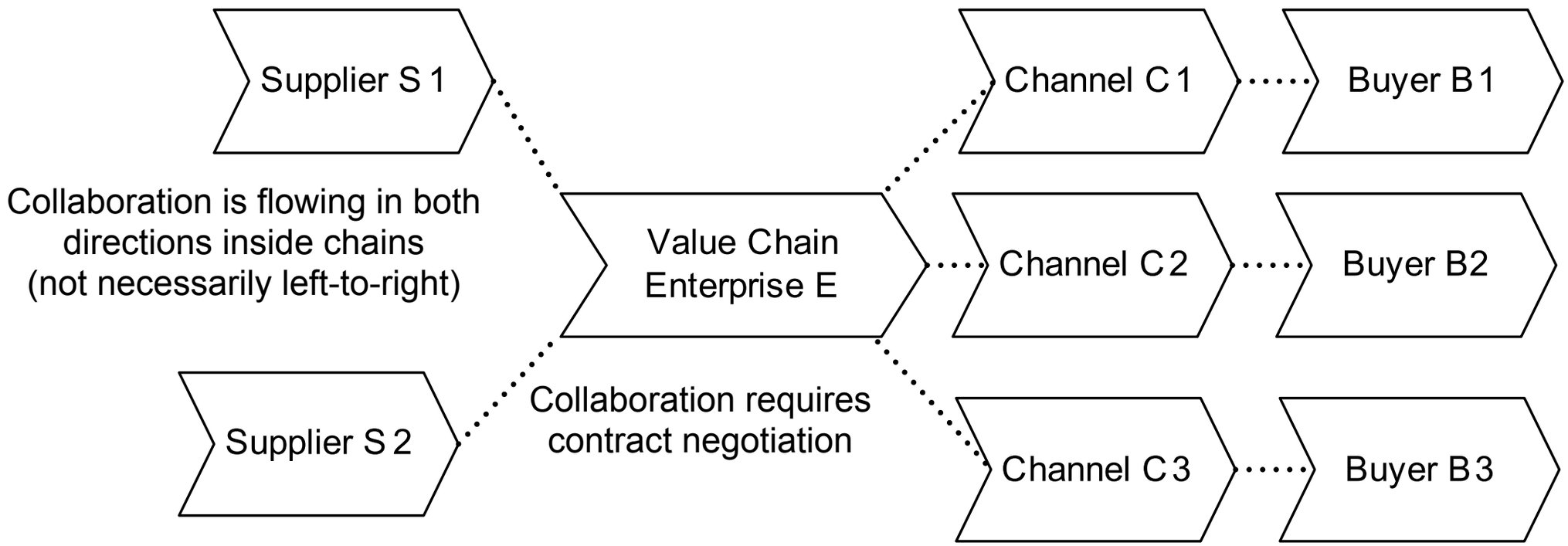
Companies have goals to fulfill

To reach their goals,
companies can cooperate with each other

The value chains of cooperating companies
become linked/related to each other:
they form a **value system**

Value systems

Informal, high-level business functions decomposition
produce a
Value system
made of
Value chains
centred at the enterprise E under consideration



Citing Porter

``*gaining and sustaining competitive advantage depends on understanding not only a firm's value chain but how the firm fits in the overall value system*''

all this defines the **Ecology of value chains**

High-level business functions

The value chain of a company has a rich internal structure, consisting of a set of coarse-grained business functions
(e.g. Order management, Human resources)

High-level business functions can be decomposed into finer-grained functions
(this is called **functional decomposition**)
(e.g. from ``Order management'' to ``storing'' and ``checking'' orders)

Value chains and processes

Porter was not able to identify the role of processes within value chains

However, process-orientation can fit very well with value-chains and functional decomposition

Key factor:
the granularity of business processes must be in line with the particular goals associated with the supported business function

Process Orientation

The mid 90's saw process orientation as a strong development not only to capture the activities a company performs, but also to **study** and **improve** the **relationships** between activities

Business process reengineering is based on the understanding that the products a company offers to the market are provided through **business processes**, and that **rapid, radical redesign of these processes is the road to success**

Taylorism

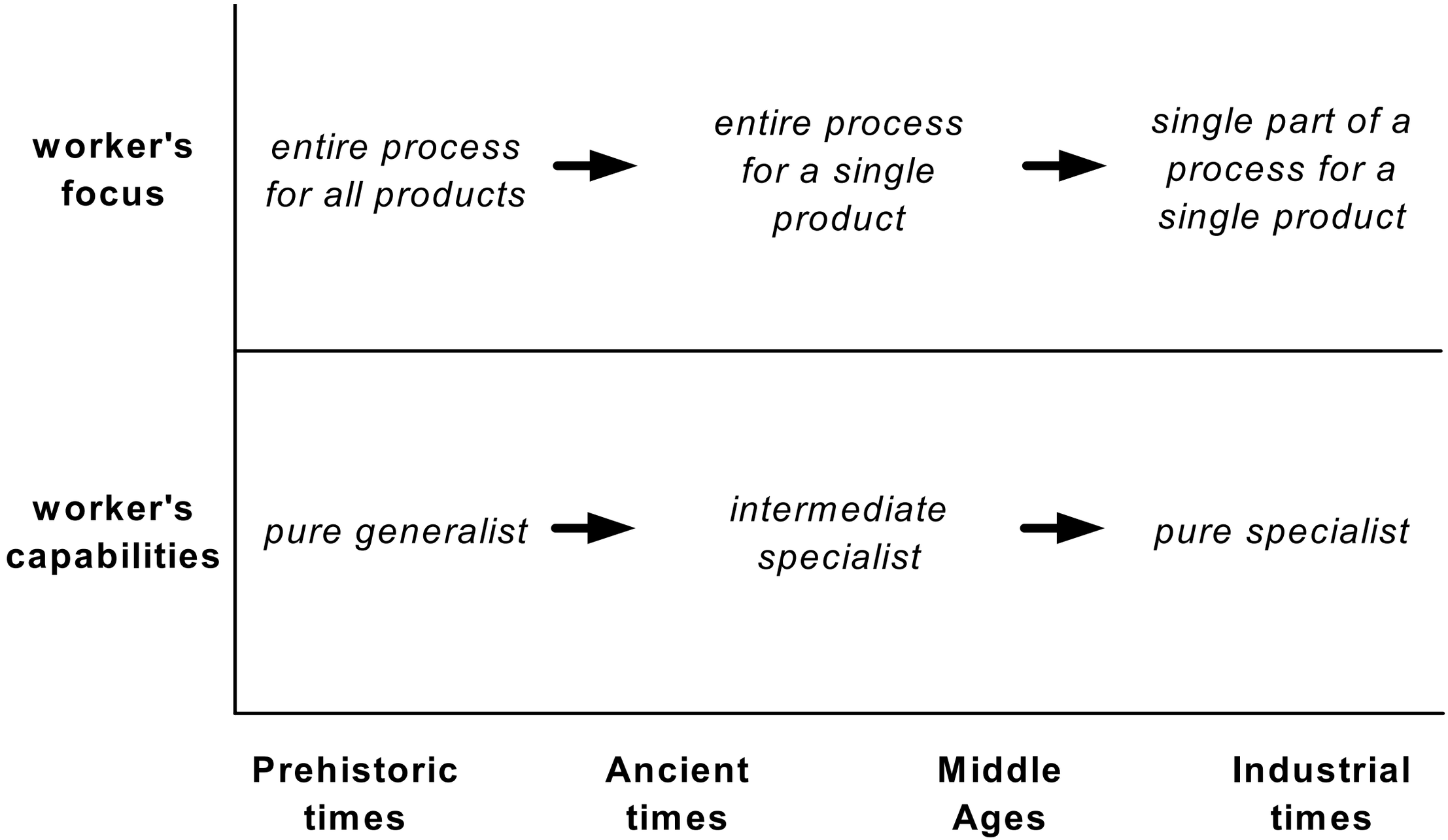
Process orientation is based on a critical analysis of a concept to organize work units originally introduced by Frederick Taylor to improve industrial efficiency

Taylorism uses functional breakdown of complex work to small granularities

Then, highly specialized work force can efficiently conduct these work units of small granularity

Taylorism has proved very successful in manufacturing and fuelled the industrial revolution

Taylorism


worker's focus
entire process for all products
entire process for a single product
single part of a process for a single product
worker's capabilities
pure generalist
intermediate specialist
pure specialist
Prehistoric times
Ancient times
Middle Ages
Industrial times

Handovers

Fine-grained activities require many handovers of work in order to process a given task

Until early nineteenth century the products were typically assembled in a few steps only, so handovers were not introducing much delays

Moreover, tasks were of simple nature and did not require any context information on previously conducted steps

Taylorism proved inefficient for organizing work in modern enterprises

Pitfall of Taylorism

Steps of a business process are often related to each other

Context information on the whole case is required during the process

The handovers of work cause a major problem because of that (workers required knowledge)

In the end, functional breakdown proved inefficient in modern business organizations that mainly process information

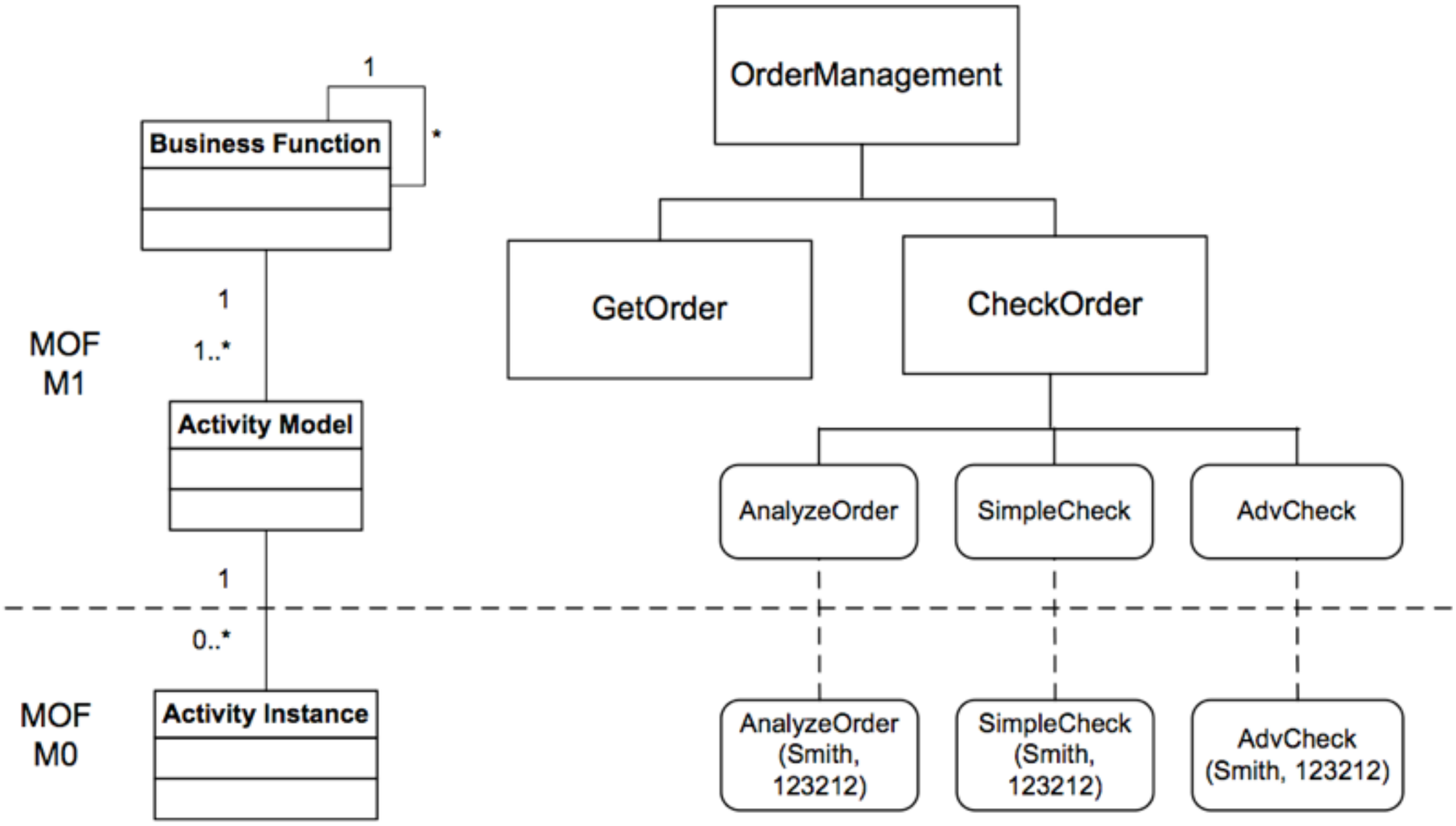
Process perspective

It is instrumental to combine multiple units of work of small granularity into work units of larger granularity to reduce the handover of work

As a consequence, workers must have broader skills and competencies
(knowledge workers must have a broad understanding of the ultimate goal of their work)

Main effect, at the organizational level, process orientation led to the characterization of high-level operations (usually, less than a dozen), called **organizational business processes**

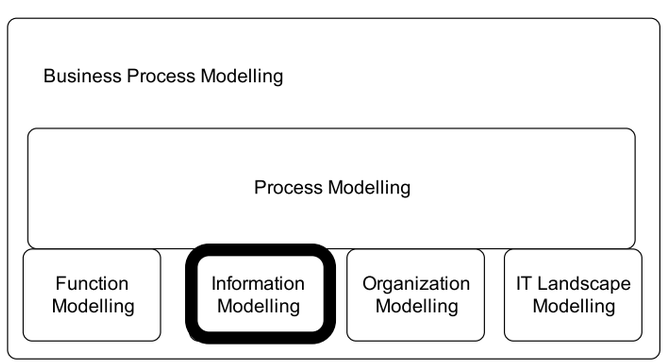
Activity models and activity instances



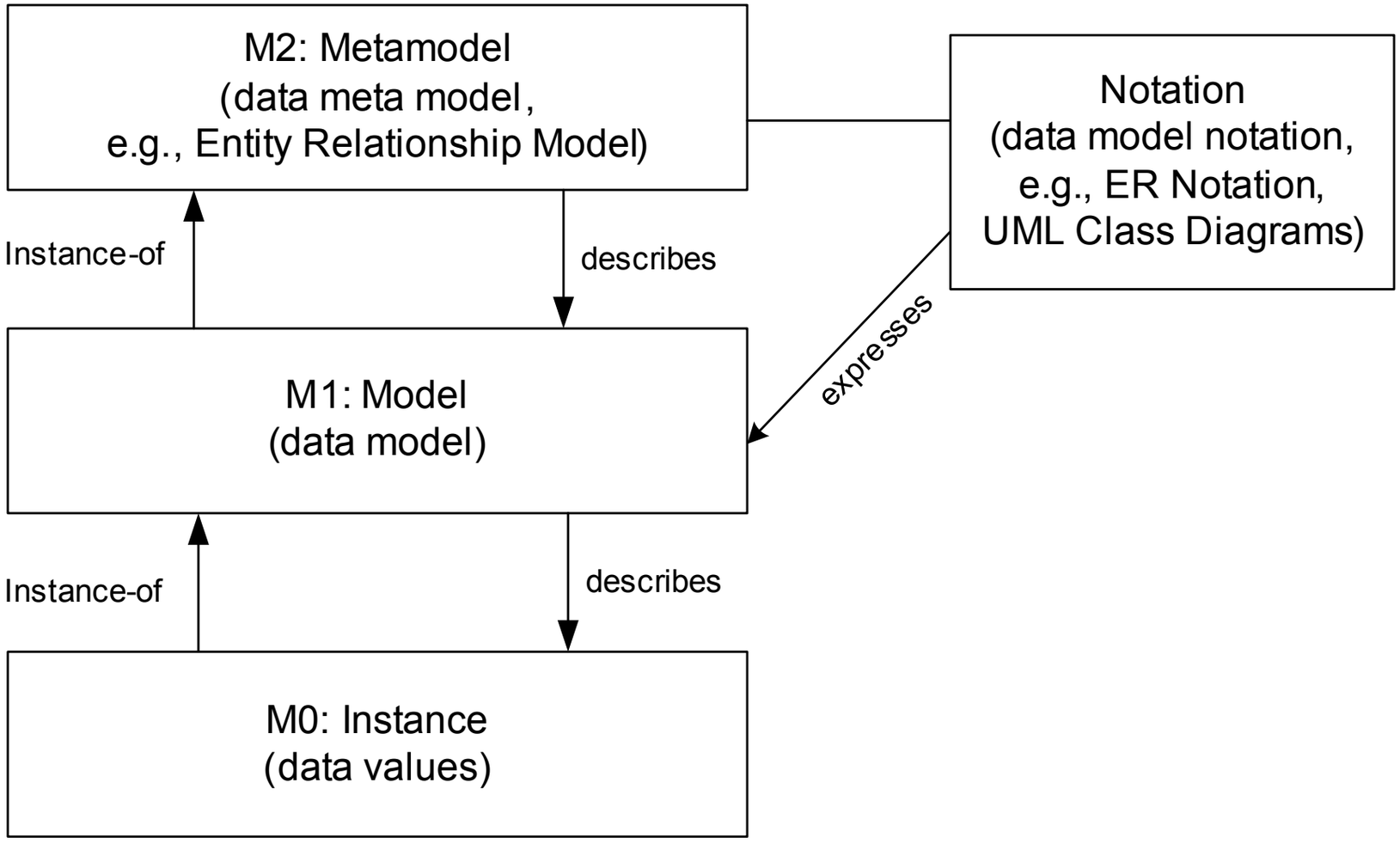
Information models

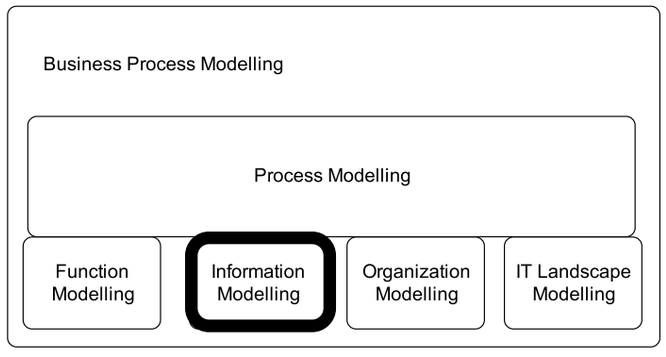
Data representation is crucial:
all decisions made during a business process
depends on data values

Data dependencies between activities
are also important
(ensure data-availability, reduce waiting time)



Data models



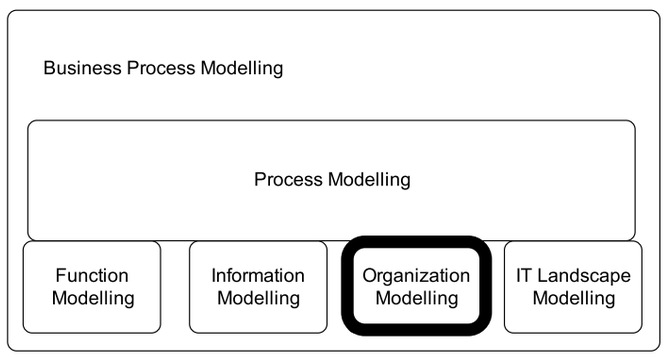


Organizational models

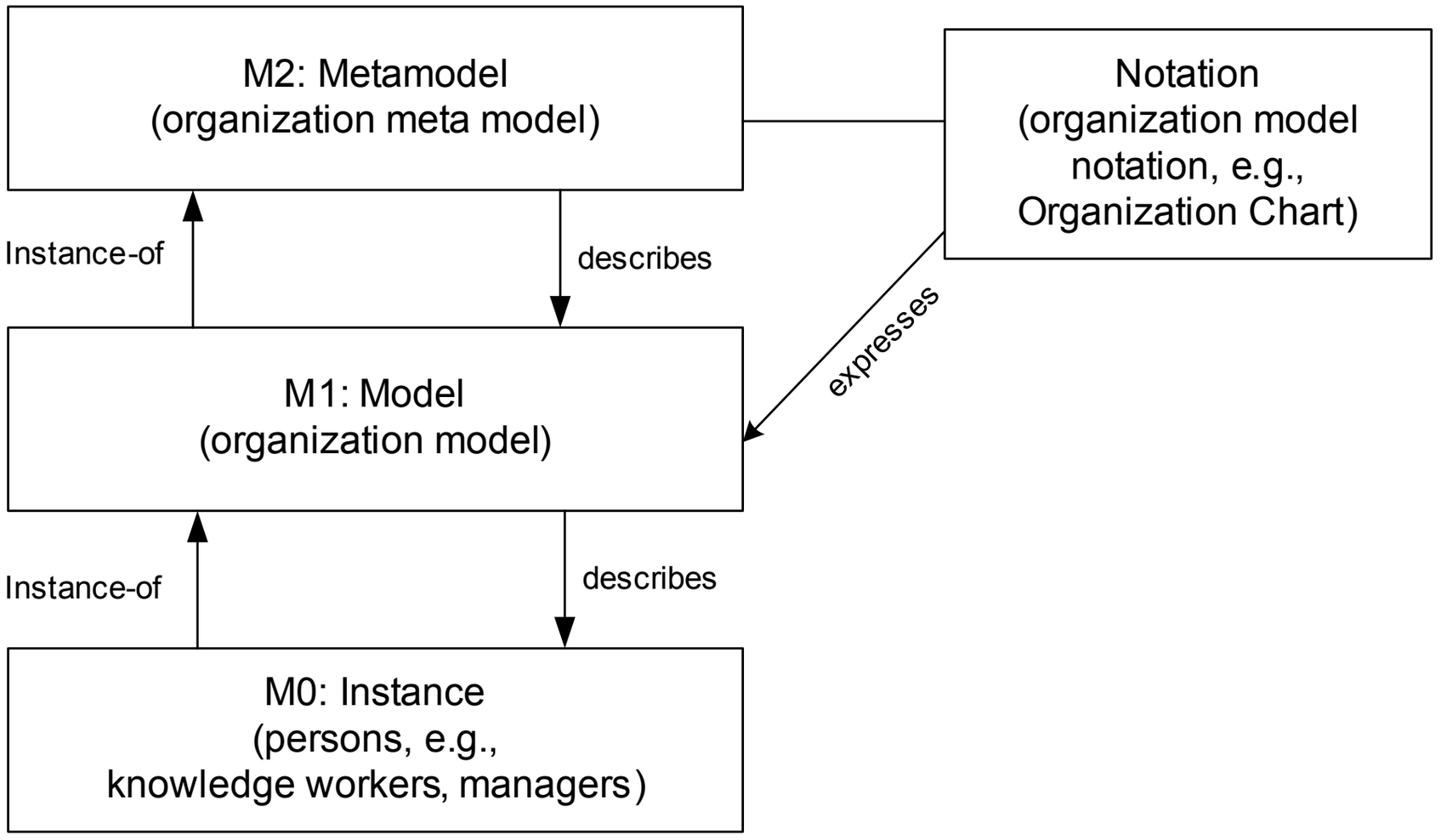
Organizational structure must be represented

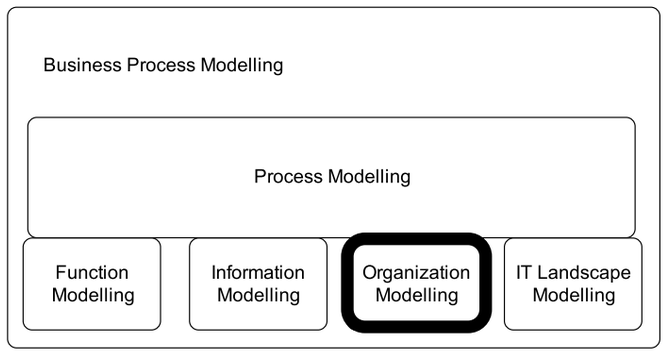
Activities must be associated

to specific roles or departments

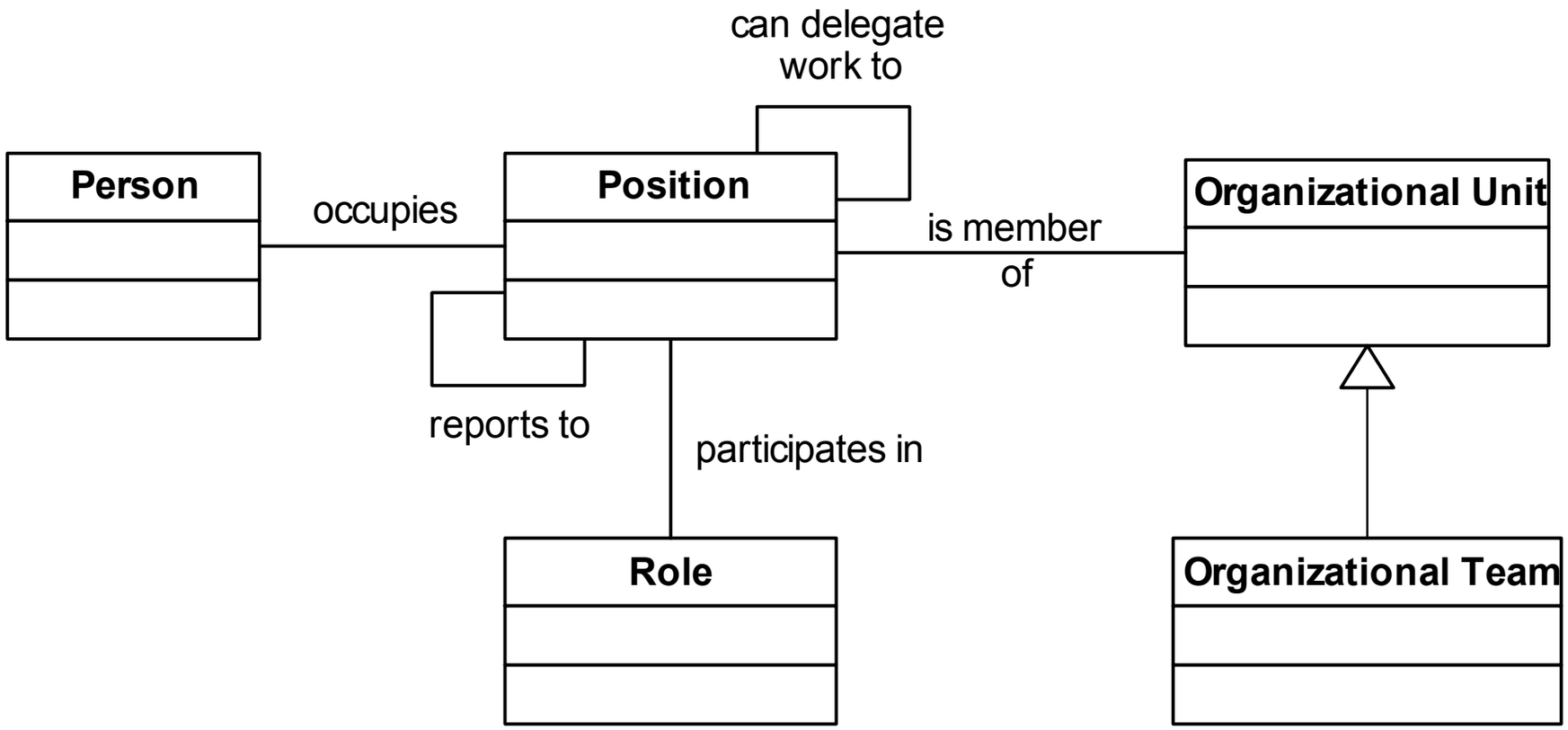


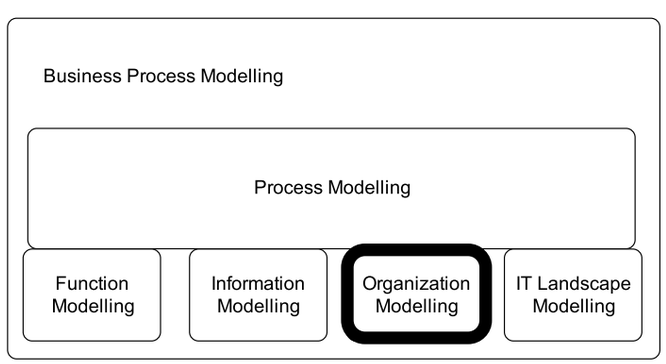
Organizational models





An organizational metamodel

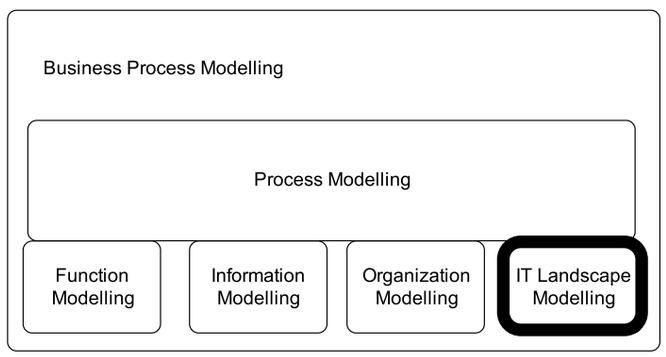




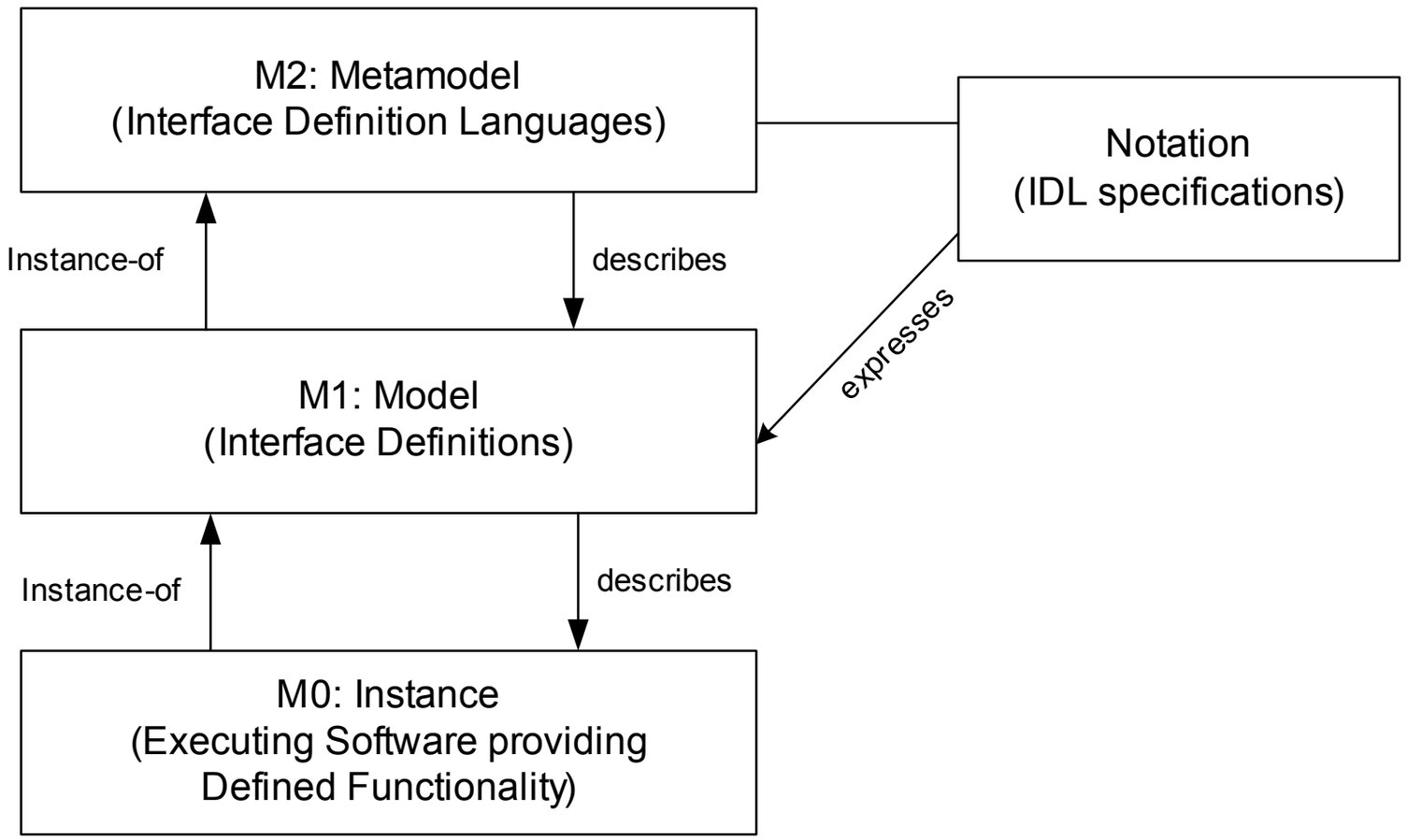
IT landscape

Many activities in a business process are supported by information systems

Information systems and programming interfaces needs to be represented because they provide functionalities



Interface Definition Languages



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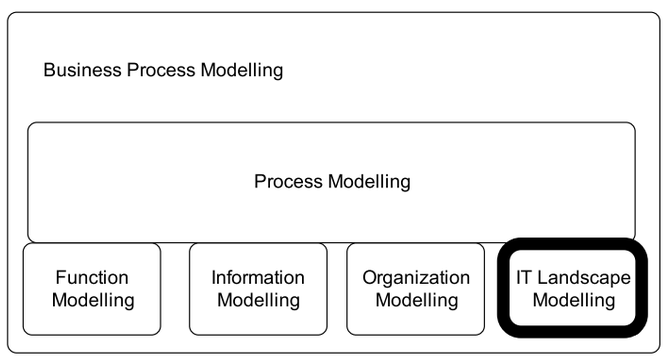
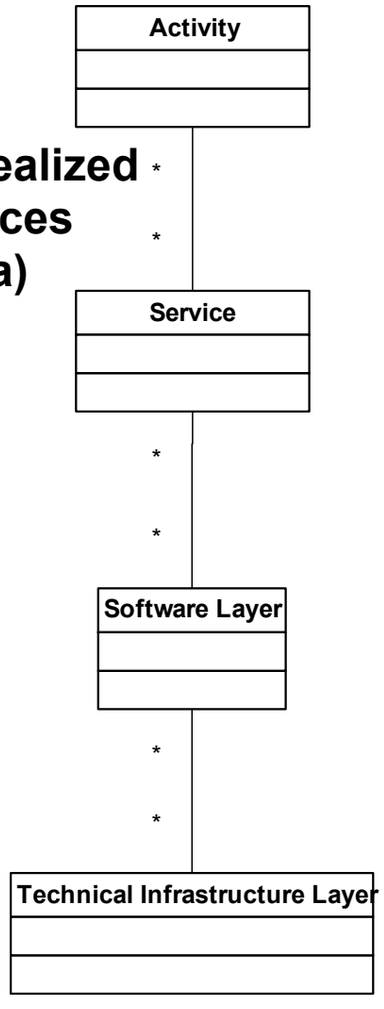
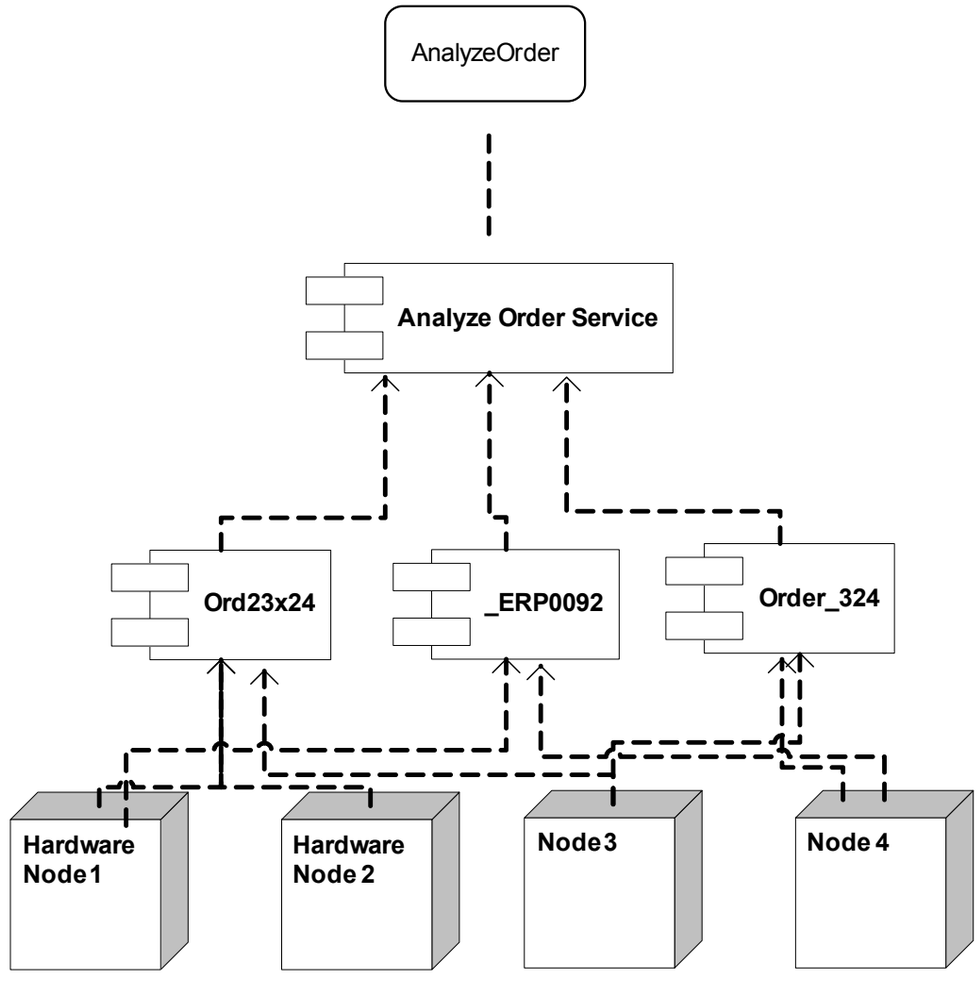
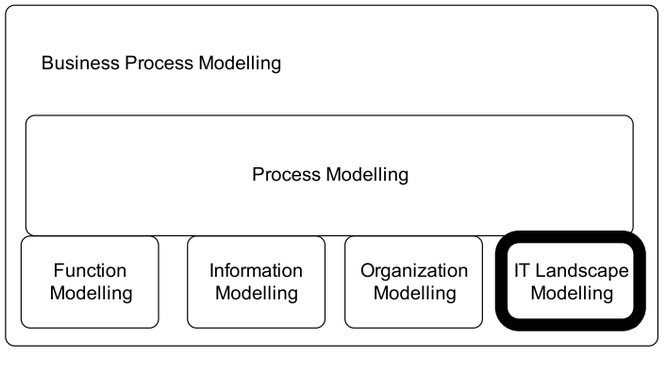


Service enabling

An activity can be realized by multiple services (and vice versa)





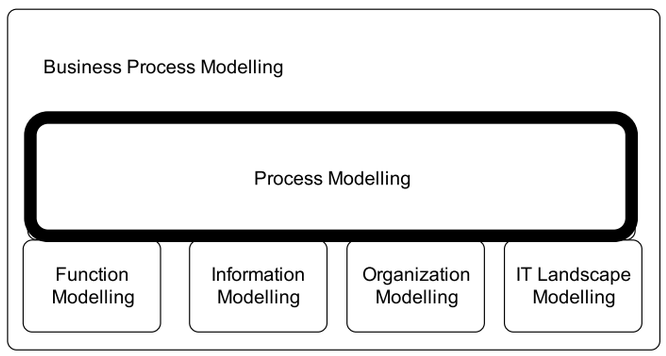


Process models

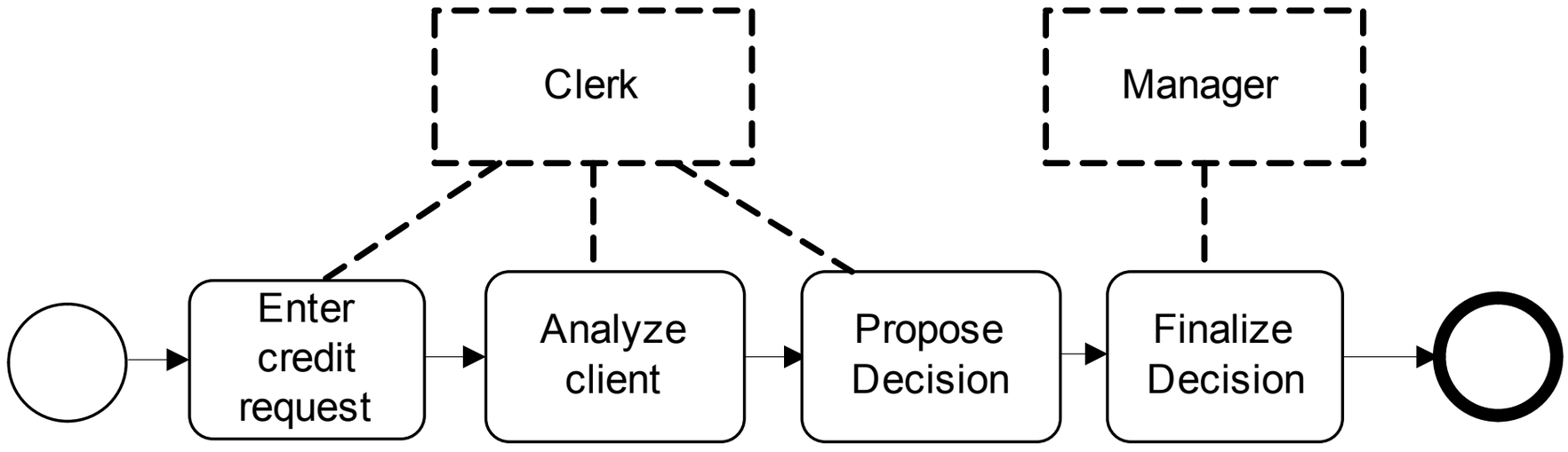
Define the glue between the subdomains

Relate functions and execution constraints

Relate data values with process instances
(e.g. the process of a credit approval may depend on the requested amount)



A process model with role information



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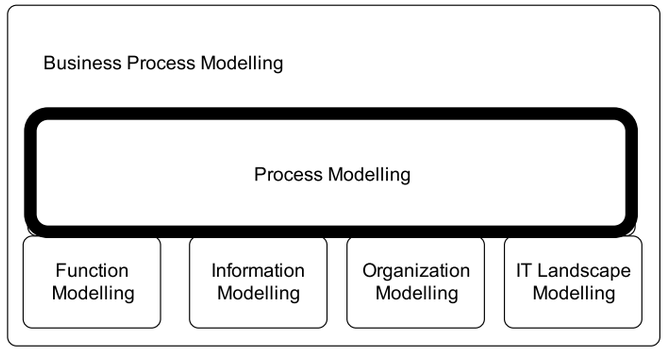
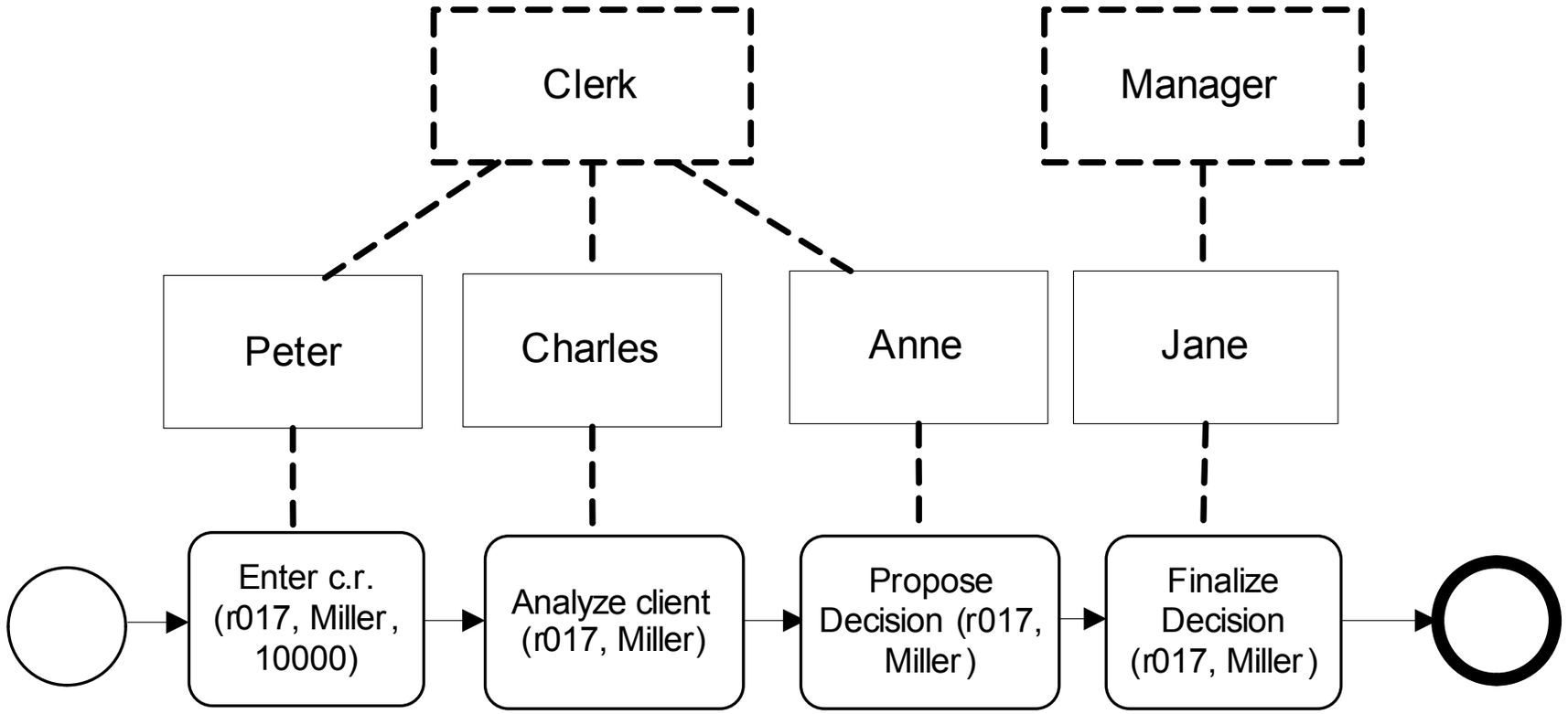
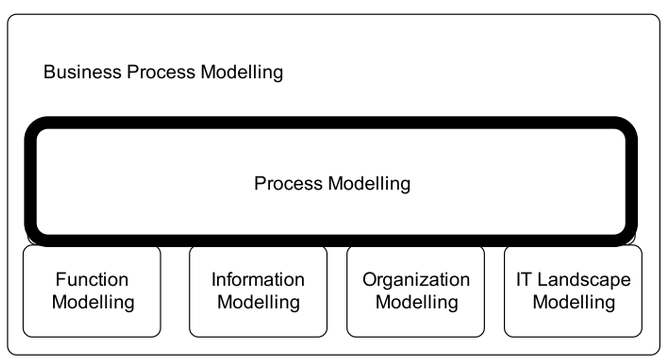


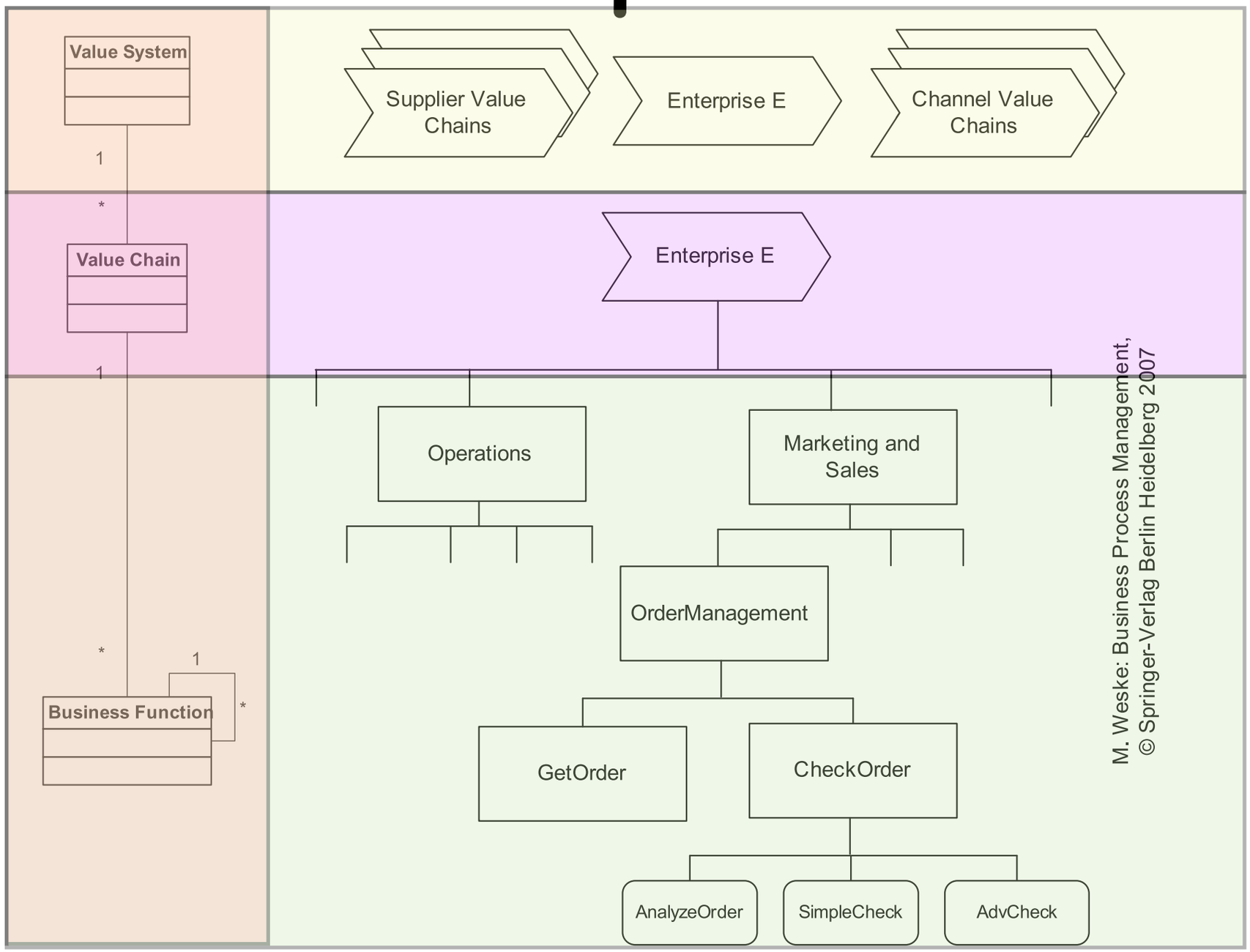
A process instance with workers information



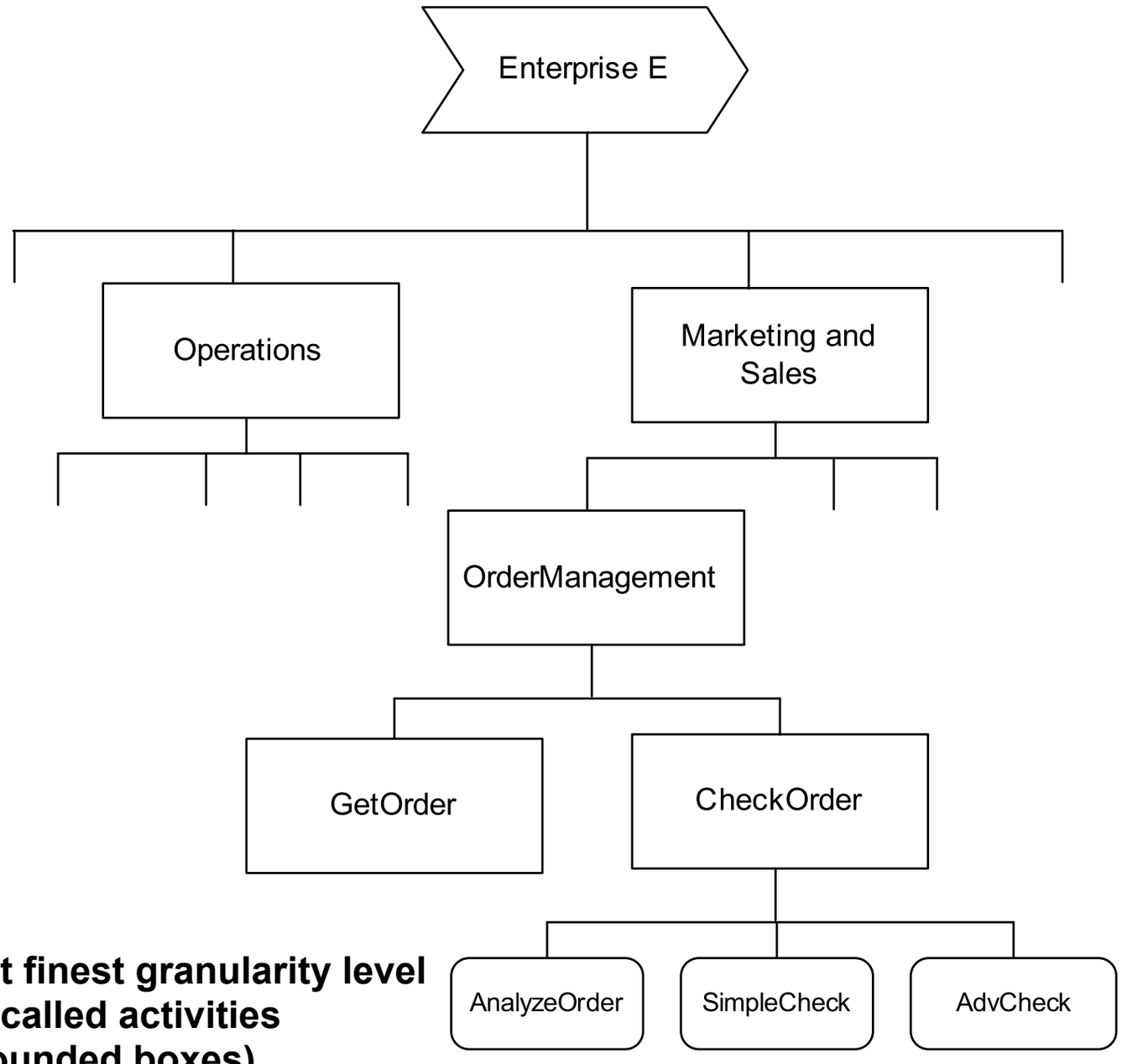


From business functions to business processes (and their implementation)

Step 1: Functional decomposition

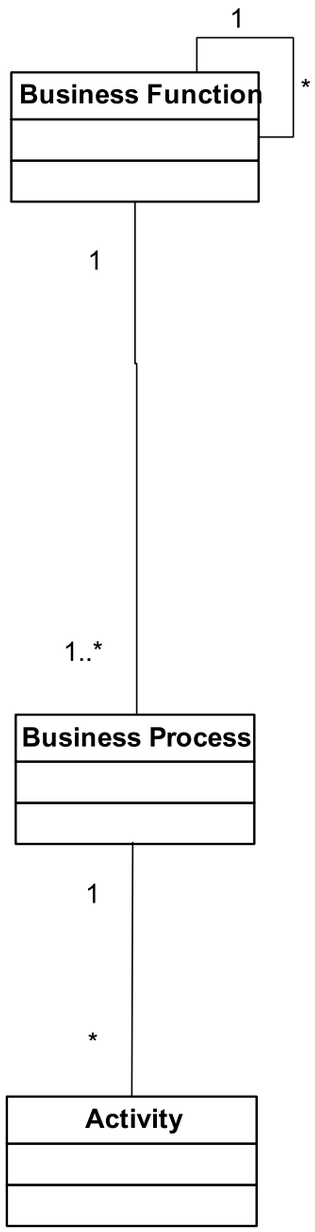


Business functions: activities

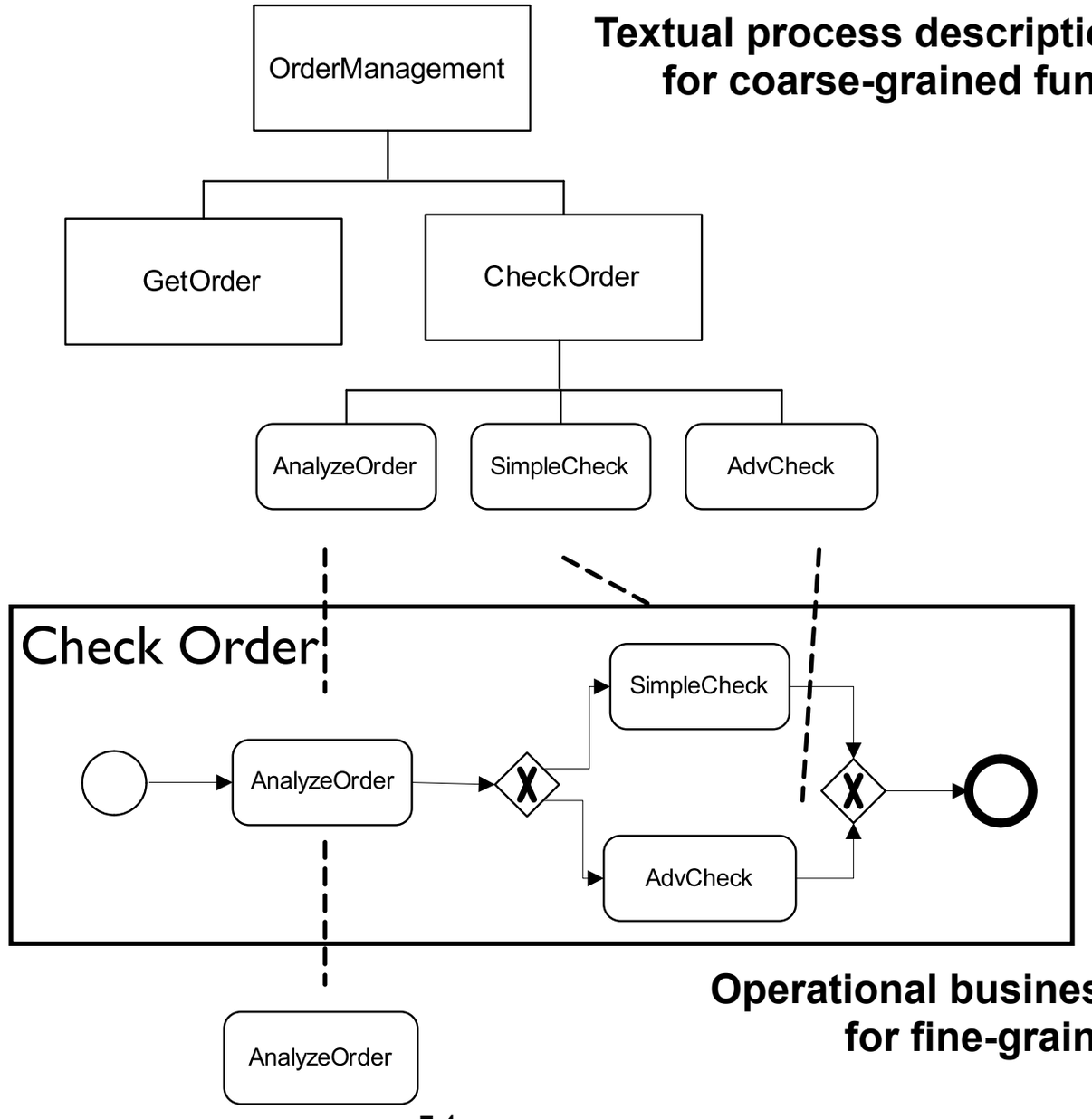


Functions at finest granularity level are called activities (rounded boxes)

Step 2: Structuring business processes



Fix execution constraints



Textual process descriptions are ok for coarse-grained functions

Operational business processes are ok for fine-grained functions

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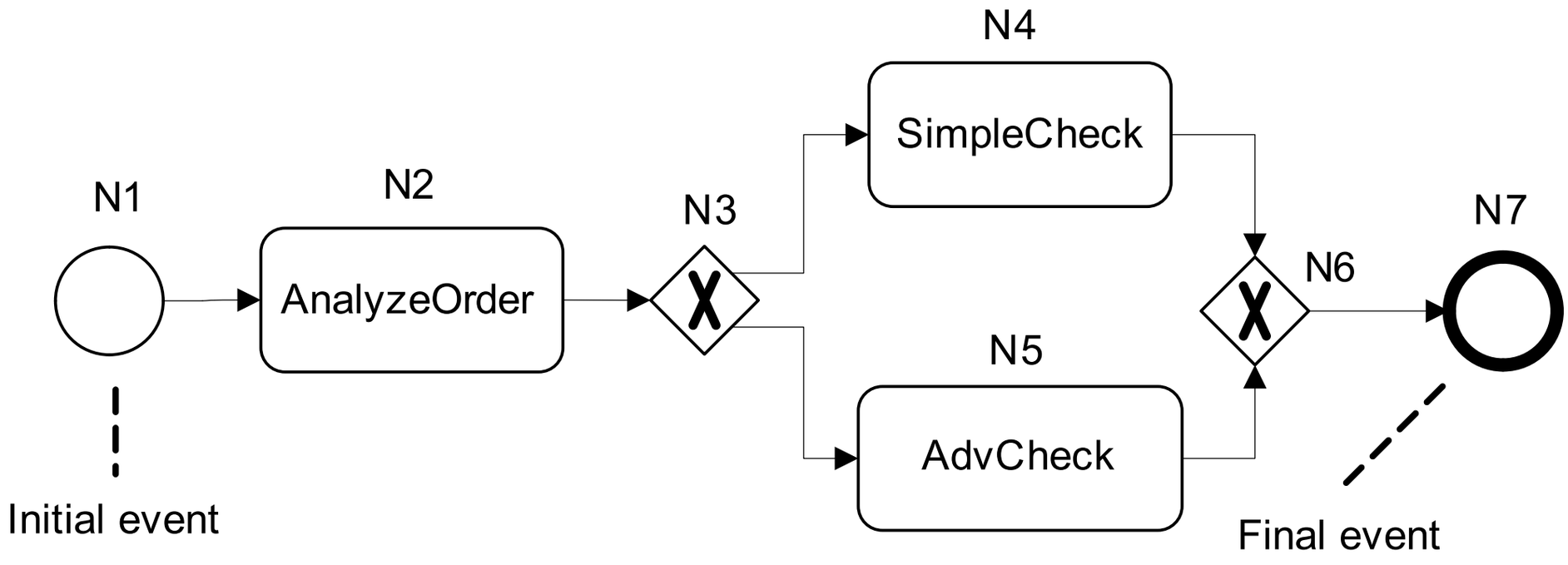
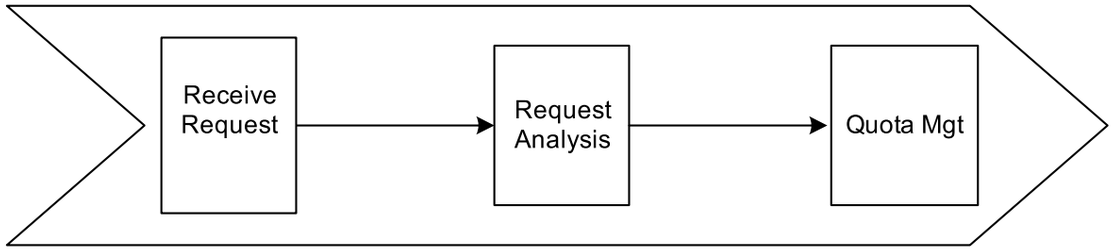
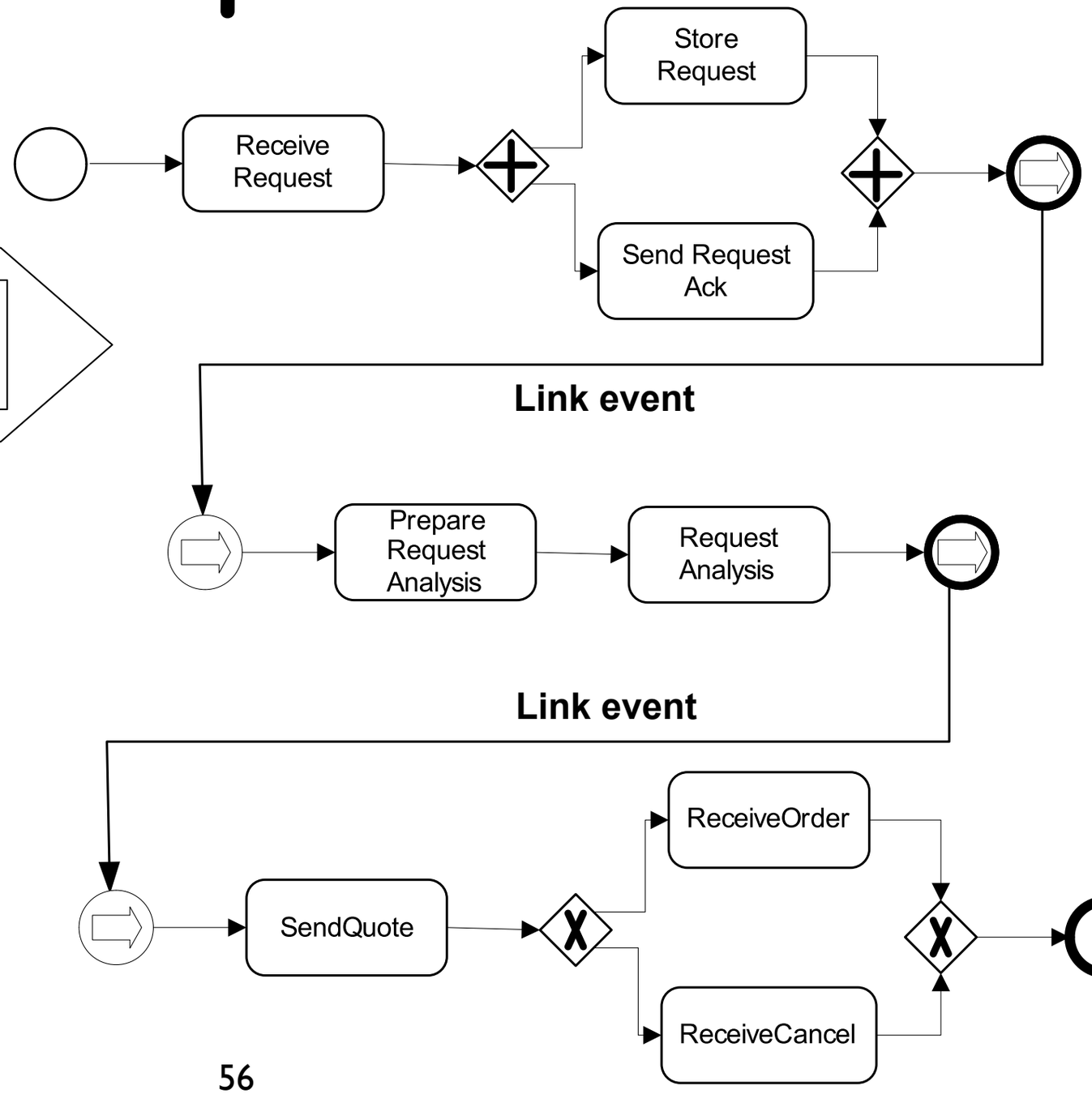
Start event / End event



Step 3: Related business processes

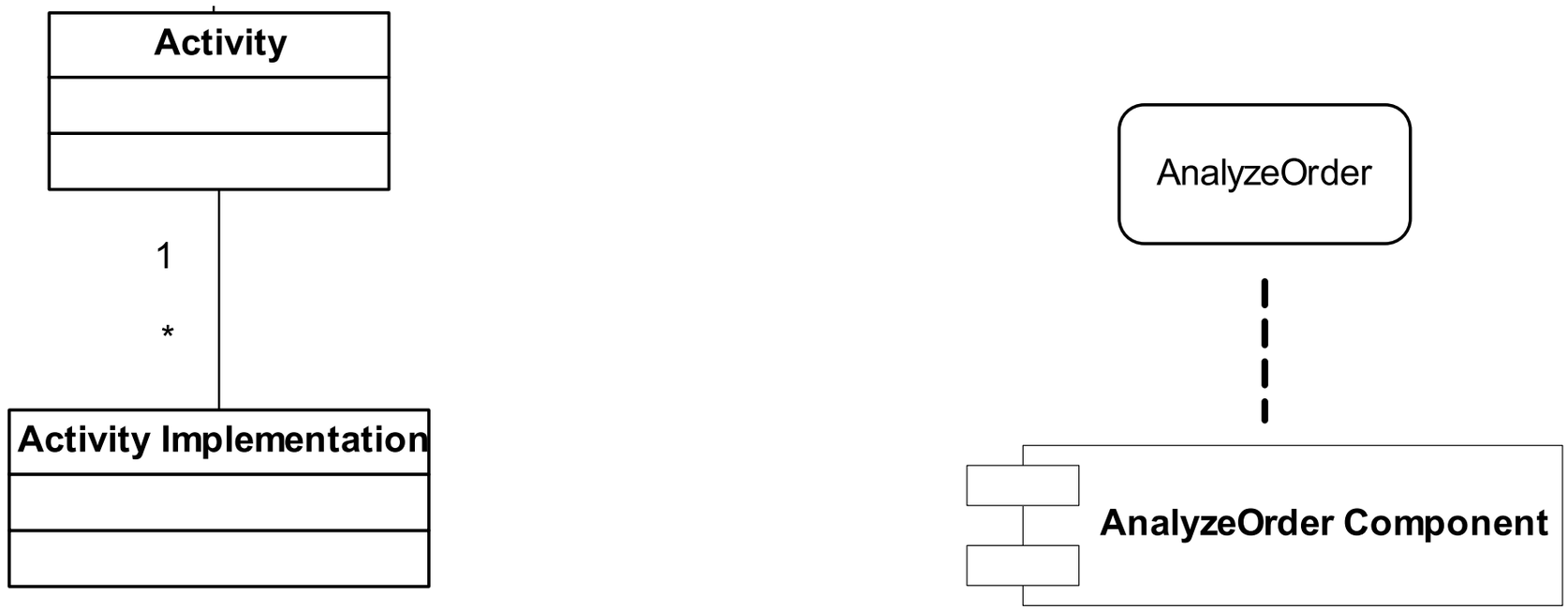


Value chain with related, high level functions



The end event of one process can trigger the start event of another process

Step 4: Activity implementation



Activities are functions at the finest granularity

They are the building blocks of operational business processes
(but sometimes activity implementation can be provided by knowledge worker)

From value system

...

...

to implementation