



BPMN 2: Business Semantics for Business Processes

**Conrad Bock
U.S. National Institute of Standards
and Technology
March 10, 2008**

Overview

- **Motivation.**
- **Business semantics for processes and choreographies.**
- **Compliance to rules, policies and choreographies.**
- **Modeler-defined taxonomies of processes and choreographies.**
- **Fully interoperable extensibility.**
- **Modeling and metamodeling for business semantics.**

Motivation

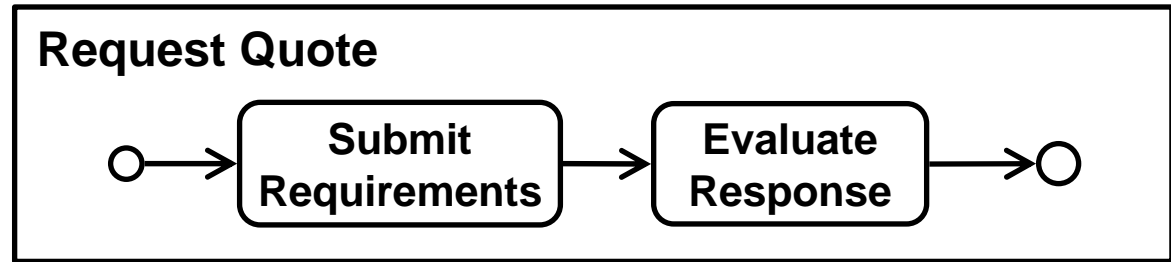
- **A defacto standard repository and diagram interchange format for BPMN already exists (XPDL).**
- **Other bodies could add choreography.**
 - **Easy to interchange “XML-ize” pictures.**
- **OMG’s technical strength is in metamodeling and semantics,.**
- **Use this strength to grow the market:**
 - **Powerful modeling capabilities.**
 - **Strong foundation for more.**

Business Semantics

- **Business people have common sense notions of process and time:**
 - One step happens before another.
 - One process happens during another.
- **They do not think in computational models (as for UML):**
 - Token flow
 - State machines
 - Other “operational” or virtual machine semantics.

Process Semantics (Business)

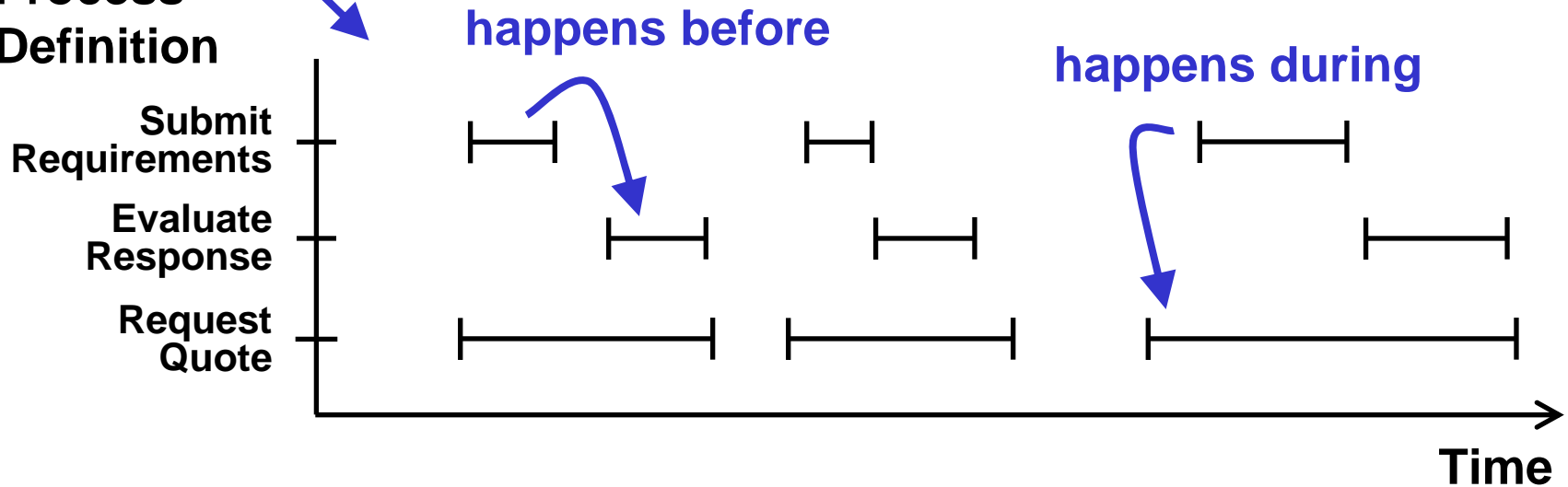
Model



Occurrences



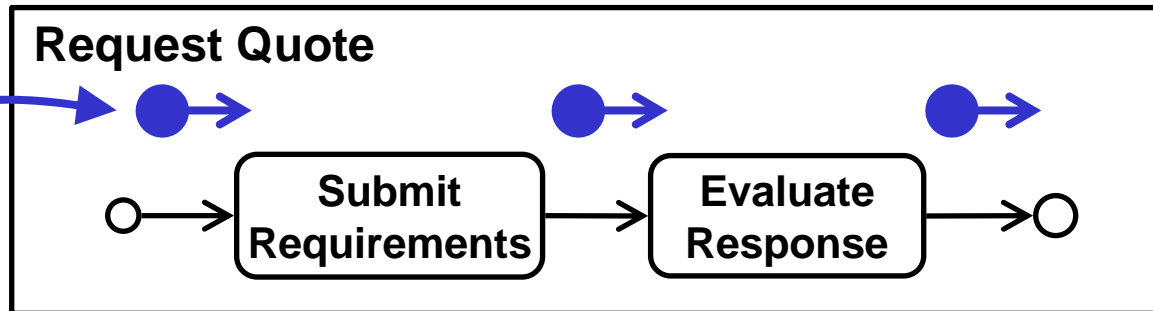
Process Definition



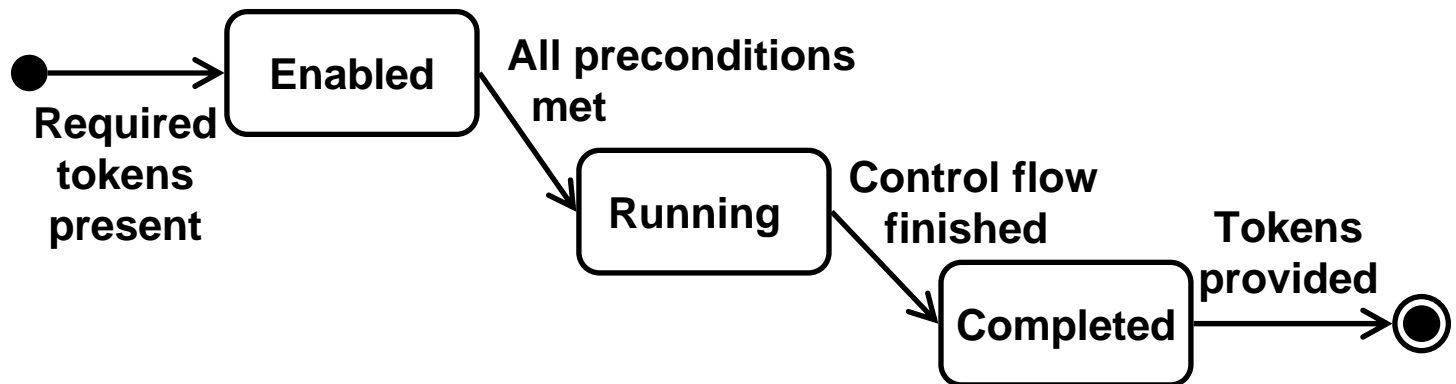
- Process models have *occurrences* in time (performances, enactments, executions).⁵

Process Semantics (Computation)

Token
Flow



State
Machine



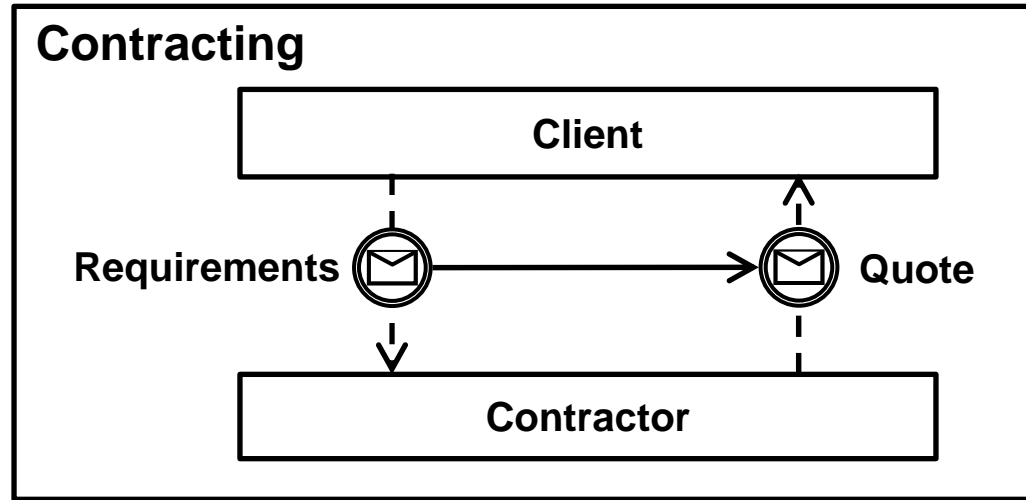
- Tokens “flow” between activities ...
- ... as determined by state machines.

Benefits of Business Semantics

- **Common sense notions of time and process are common for good reasons.**
 - Not just due to a lack of training in computer science.
 - Precise, but not computational.
- **Many benefits to business semantics for process and time:**
 - Powerful capabilities for modelers.
 - Strong foundations for related standards.

Choreography (Business)

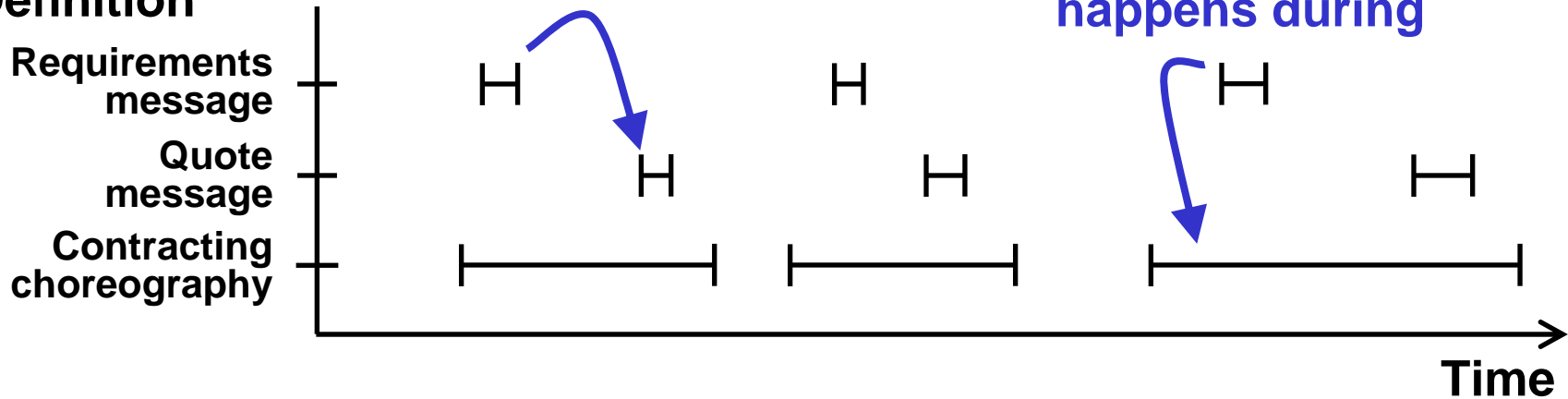
Model →



Occurrences

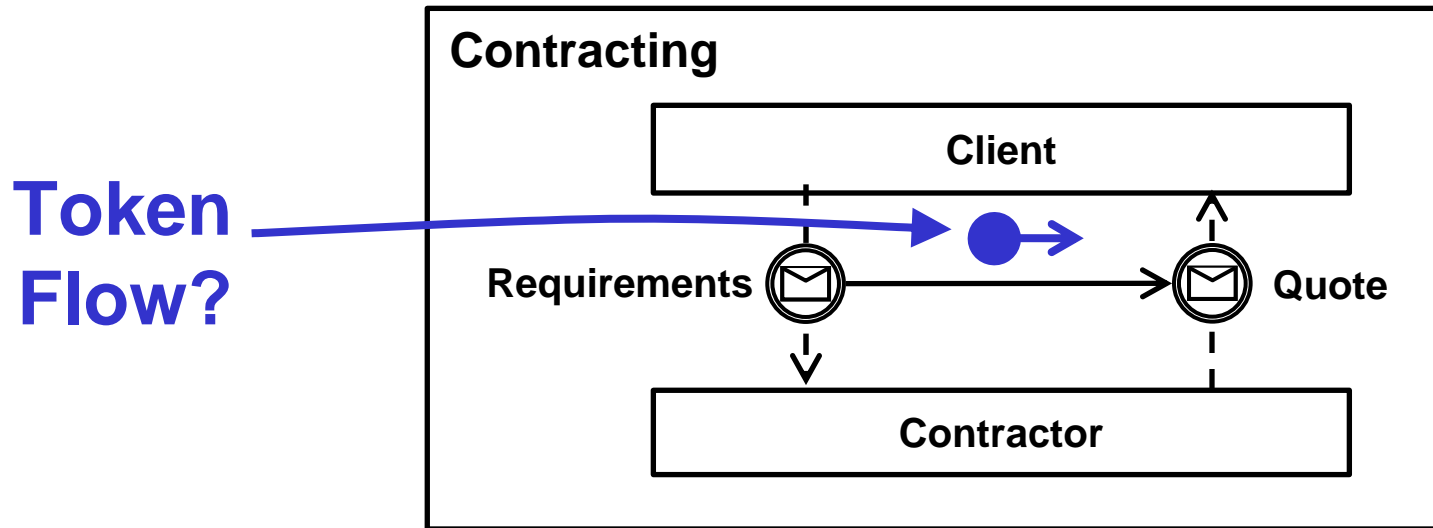


Choreography Definition



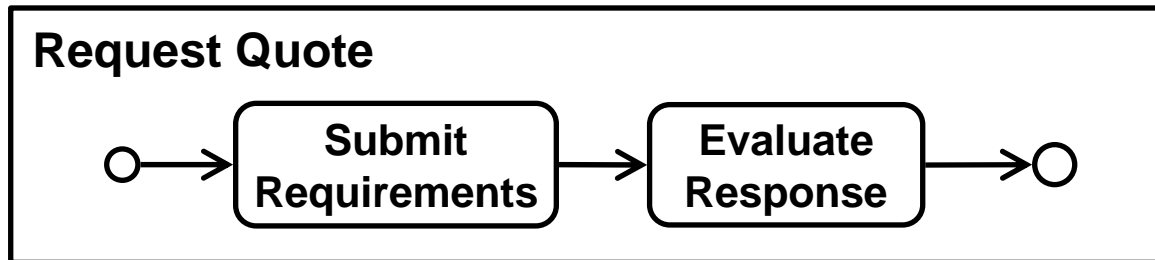
- Business semantics allows for “gaps” in the choreography while internal process is occurring.

Choreography (Computation)

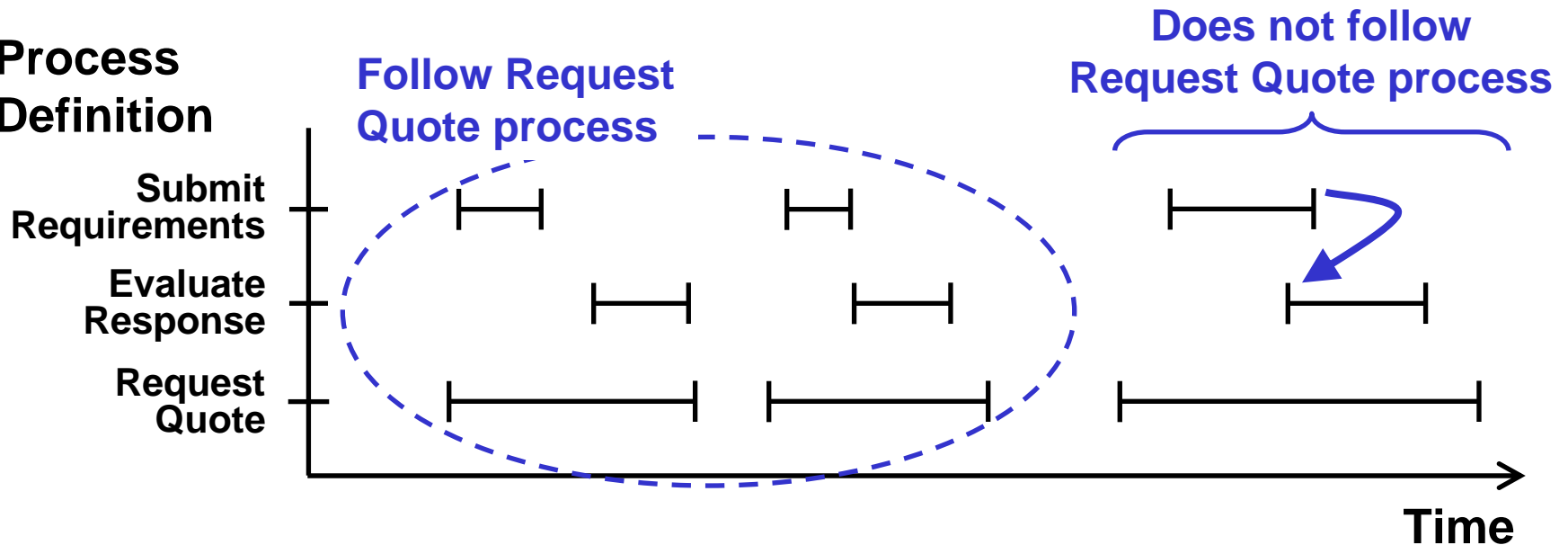


- Token flow does not allow gaps for internal processes.
- Computational models cannot provide *abstraction* over private processes.

Nonconformance (Business)

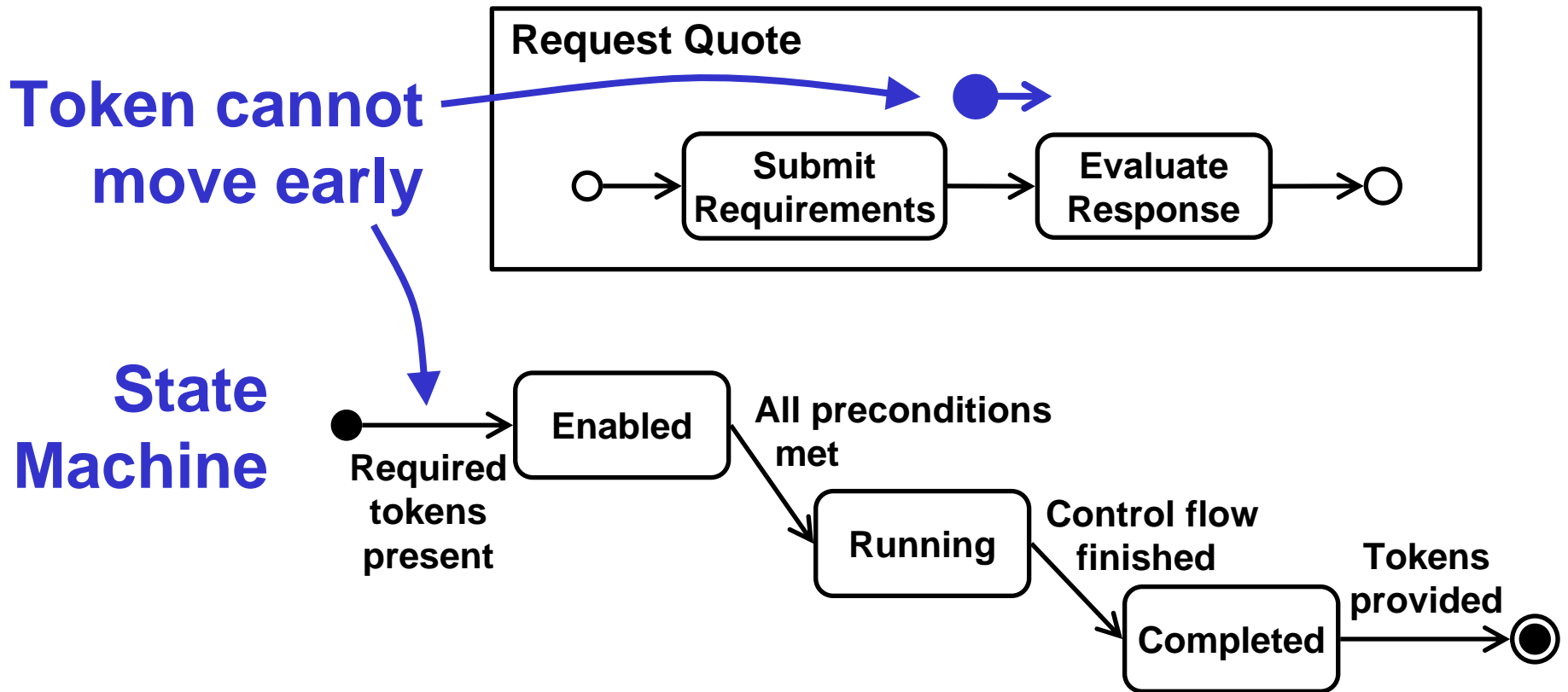


Process Definition



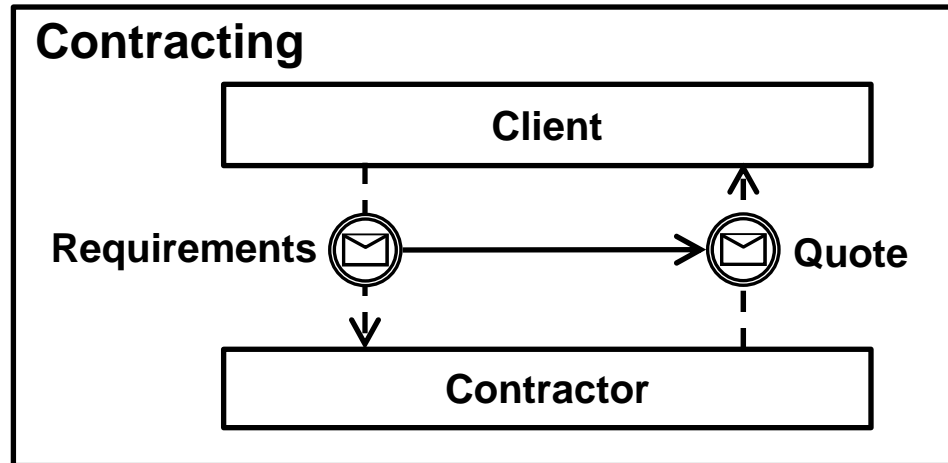
- Processes can occur differently from how they are intended.
- Captured with common sense notions of time.

Nonconformance (Computation)



- **Nonconforming occurrences cannot be captured in an operational semantics because**
 - virtual machines always perform as “programmed”.
 - usually have no model of occurrences.

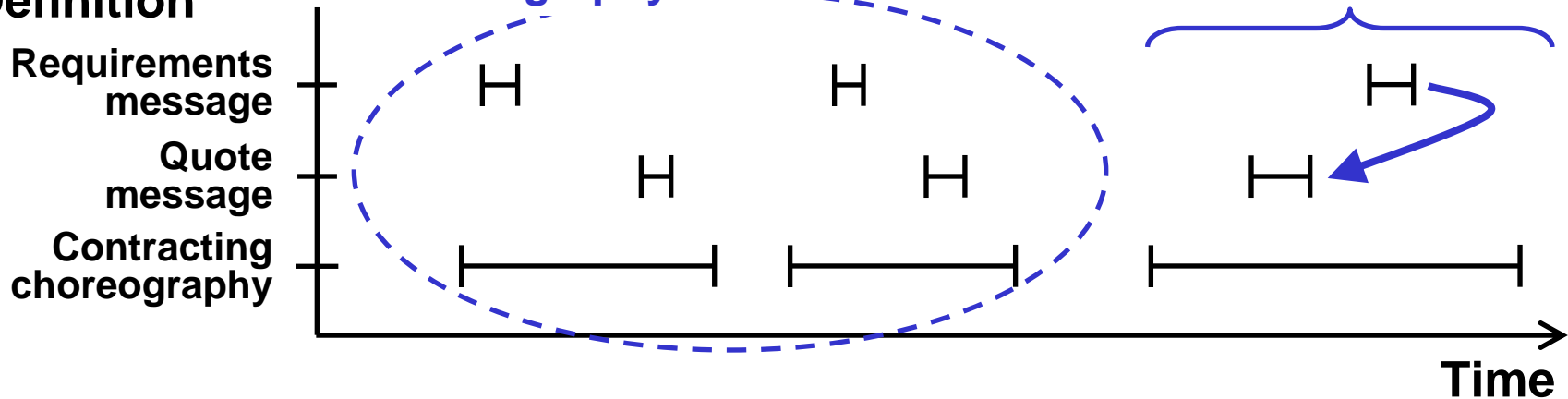
Choreography Nonconformance



Choreography Definition

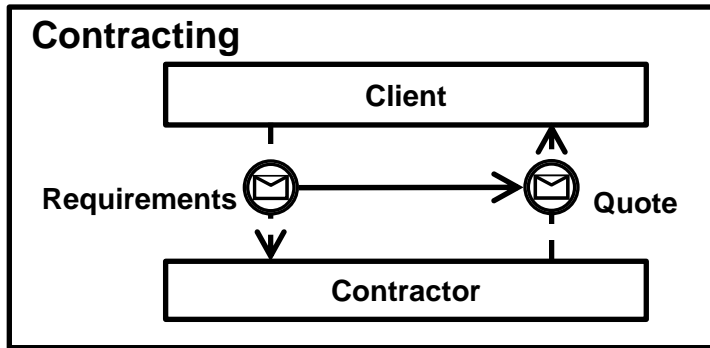
Follow Contracting Choreography

Does not follow Contracting Choreography

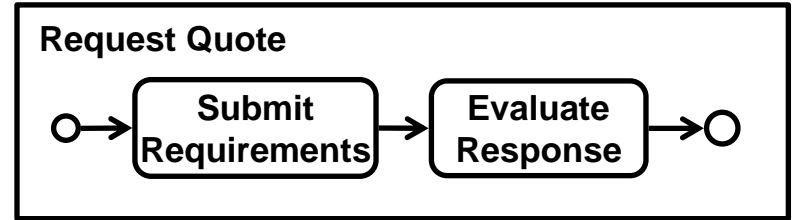


- **Choreographies can occur differently from how they are intended.**

Choreography Compliance



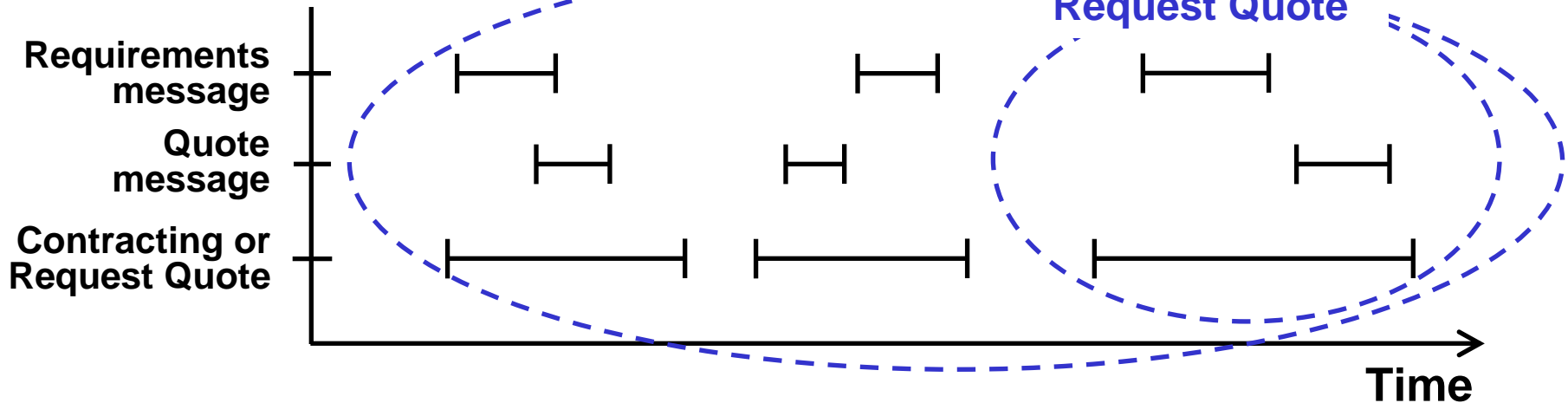
Generalization
(Business)



Process
Definition

Follow Contracting

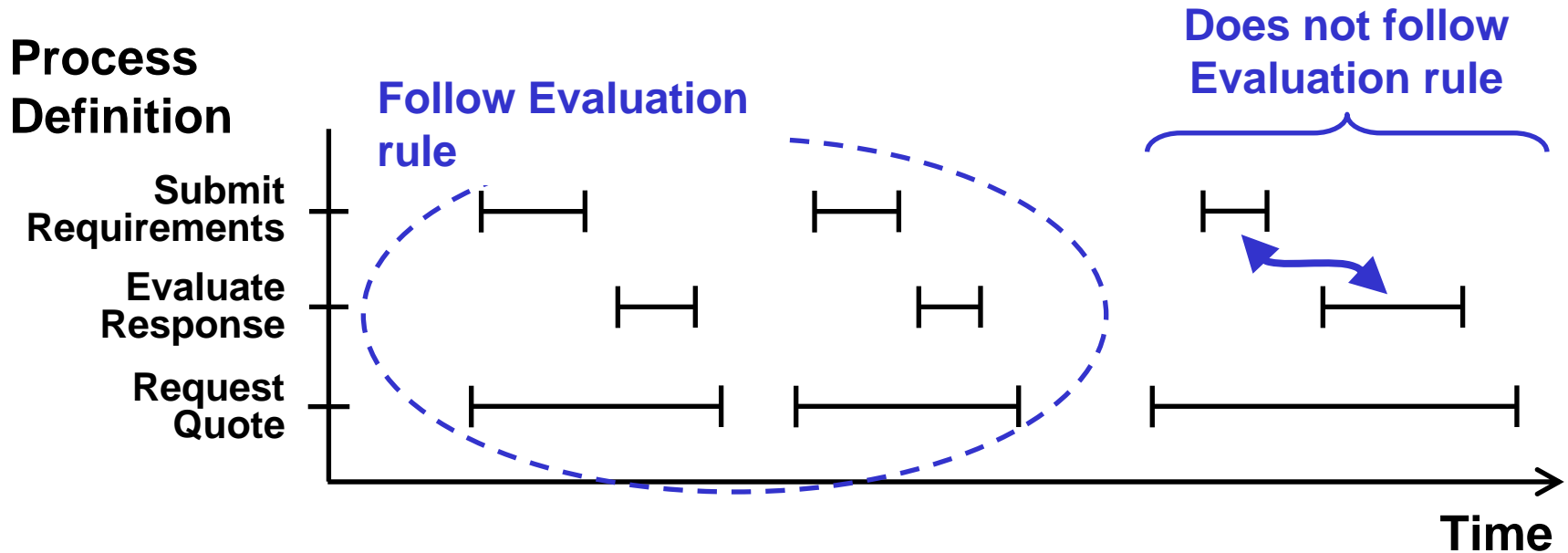
Follows
Request Quote



- Ideally want complete compliance.
- Processes can be formally checked for consistency with choreographies before deployment.

Rules and Policies (Business)

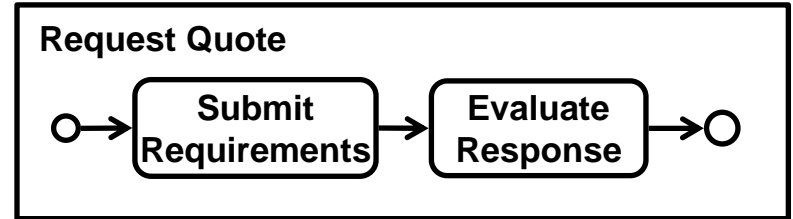
Evaluating response must take no longer than submitting requirements.



- **Businesses establish policies and rules that processes should comply with, but might not (“operative” rules in SBVR and Ross).** ¹⁴

Rules and Policies (Business)

Evaluating response must take no longer than submitting requirements.

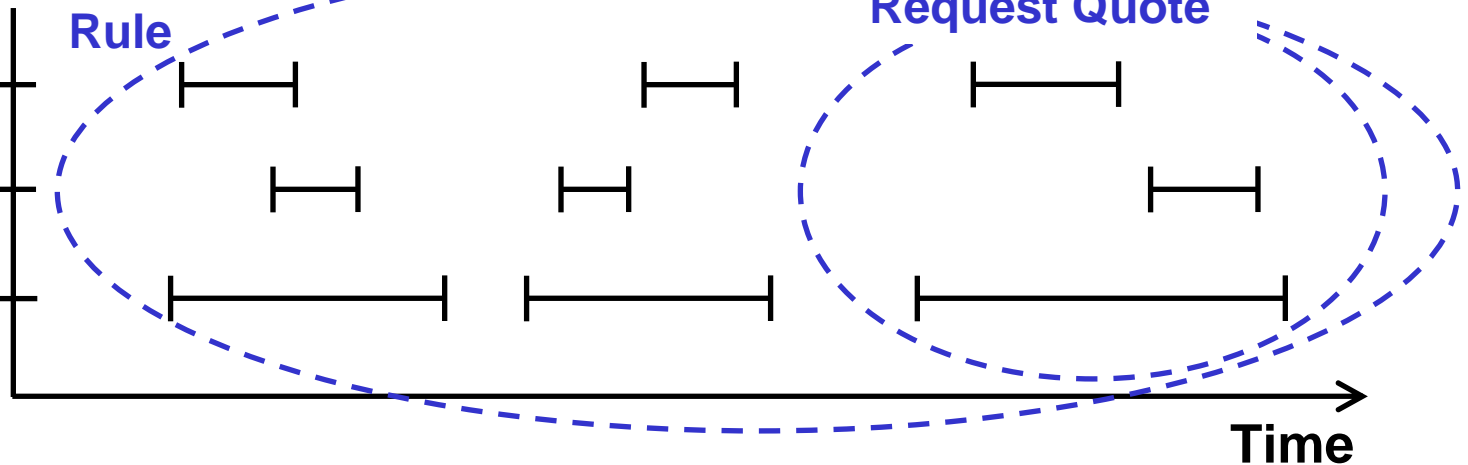


Process Definition

Follow Evaluation Rule

Follows Request Quote

Submit Requirements
Evaluate Response
Request Quote

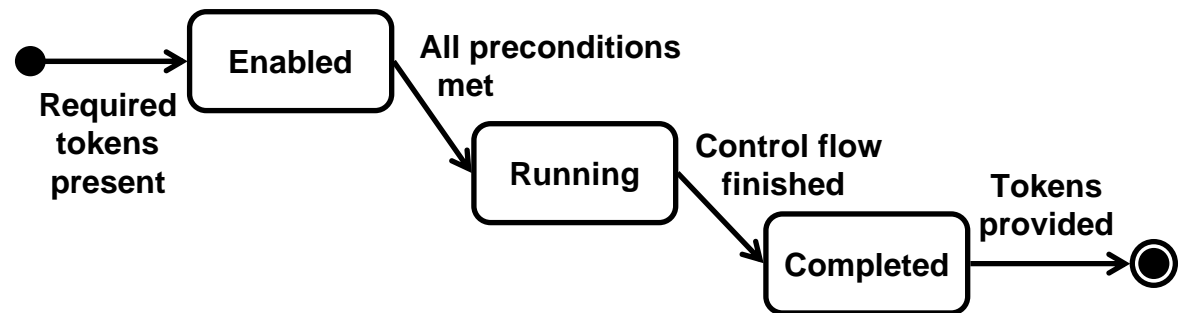
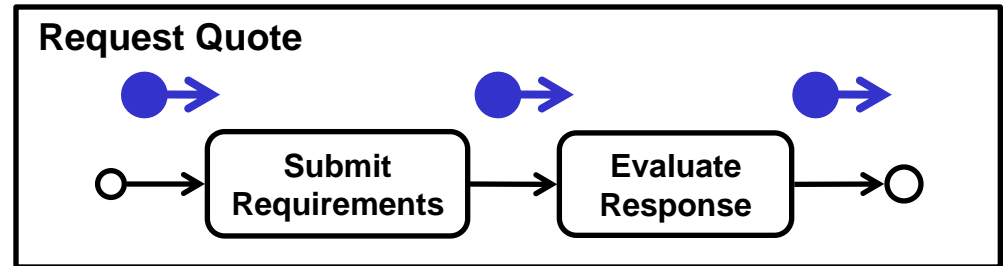


- Ideally want complete compliance.
- Models can be formally checked for consistency with rules and policies before deployment.

Rules and Policies (Computation)

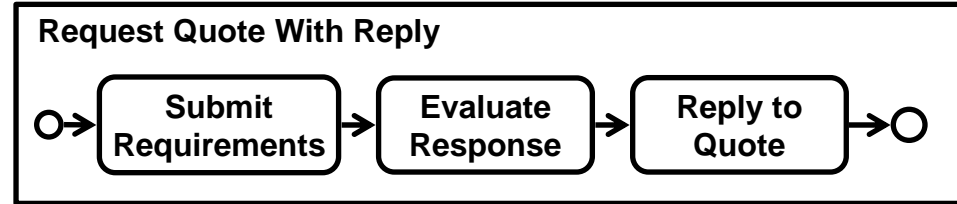
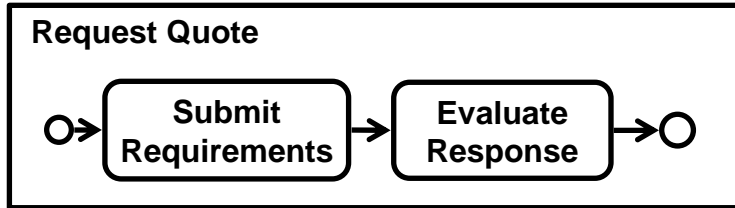
Rules about
token flow
and states?

.. tokens ... states
... states ... tokens
...

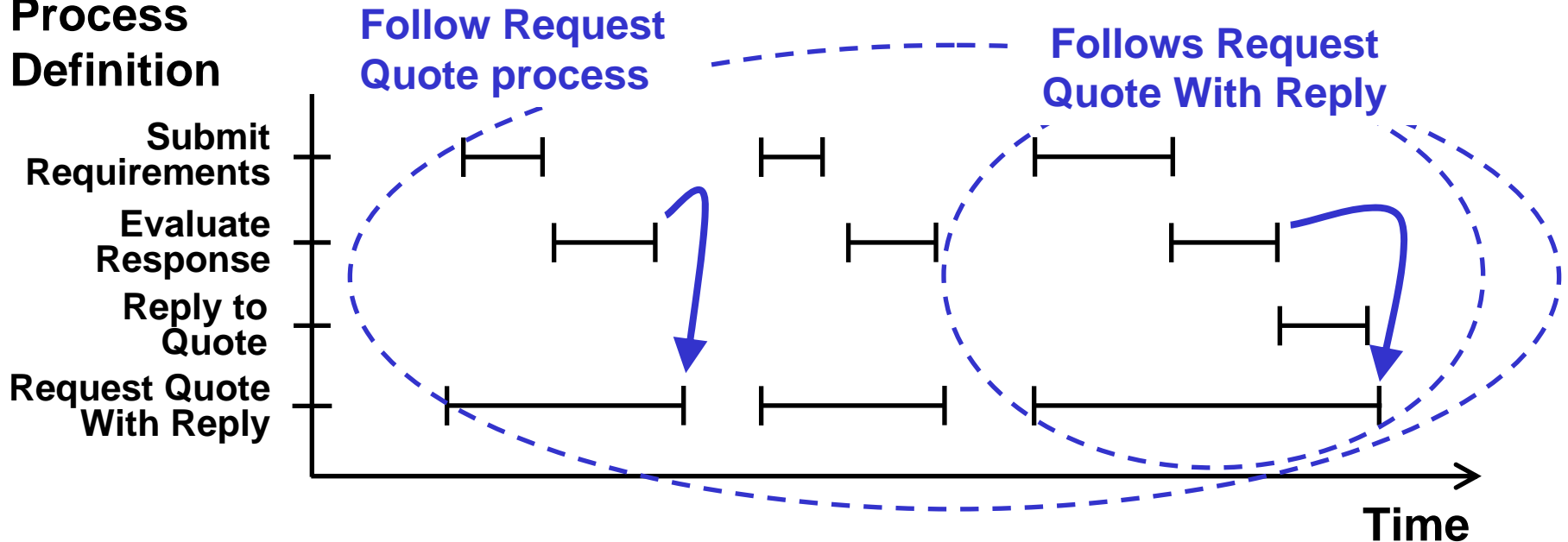


- Rule and policy compliance cannot be integrated with an operational semantics because
 - business rules use common sense notions of process and time, not virtual machines.
 - usually have no model of occurrences.

Process Taxonomies (Business)

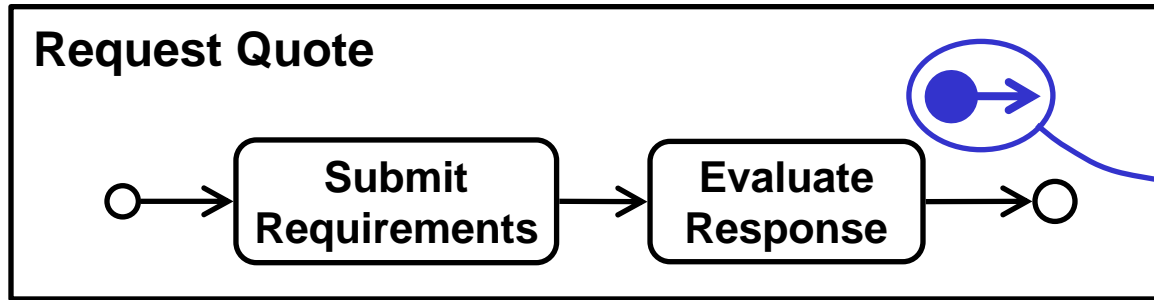


Process Definition

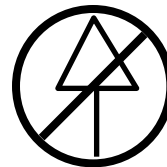


- **Special model follows the “happens before” of the general model. Same capability for abstraction used in choreography.**

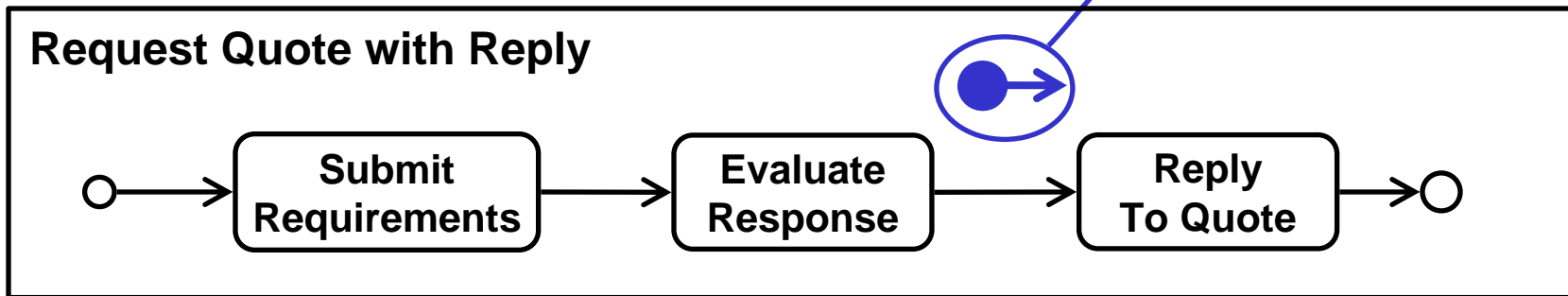
Process Taxonomies (Computation)



End of execution



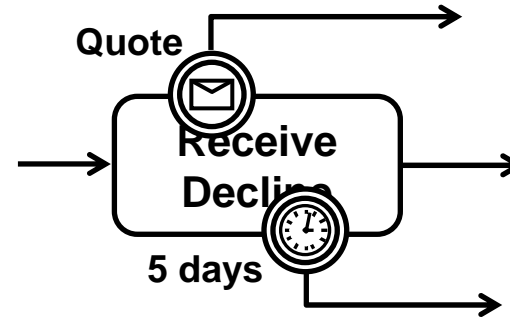
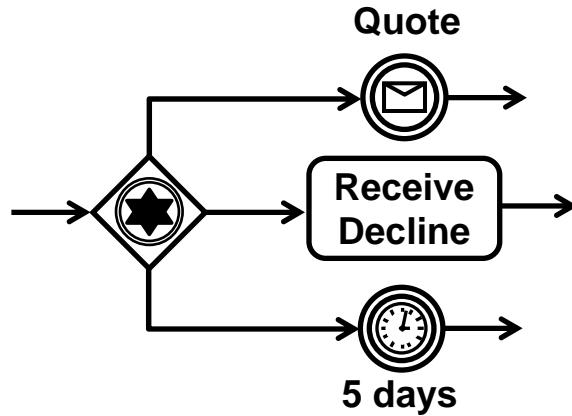
One more step



- **Cannot add steps in special model, because it cannot obey the token movement rules of the general model.**

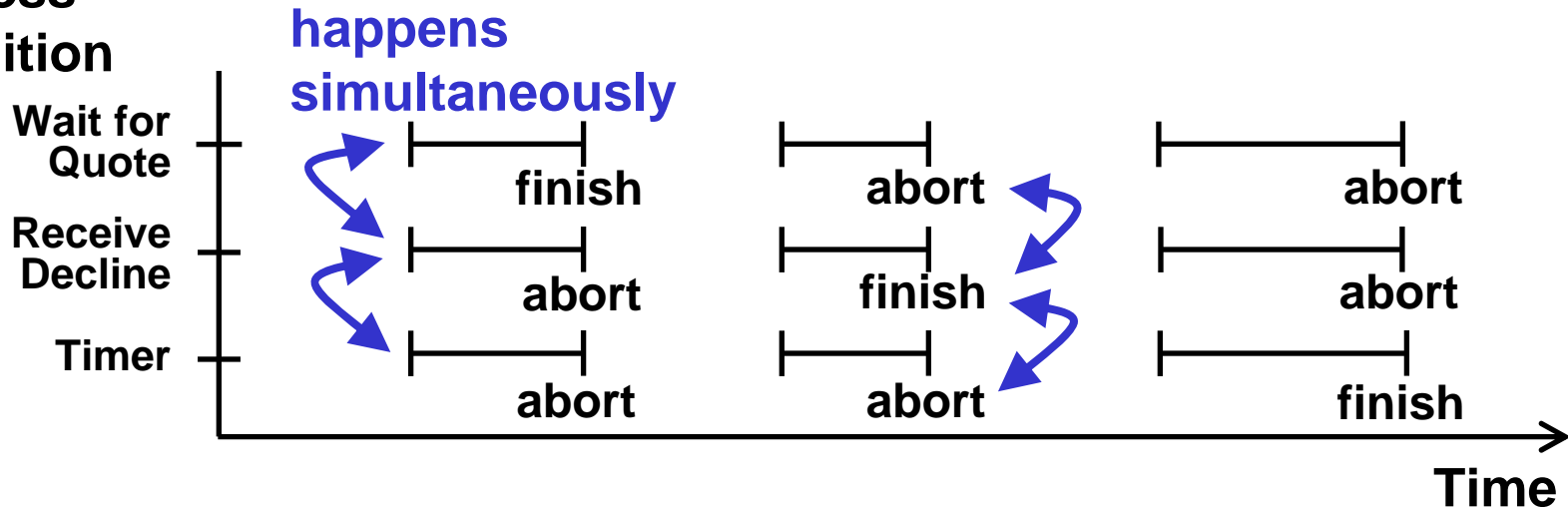
Occurrence Patterns

Event based gateway



Attached events

Process Definition



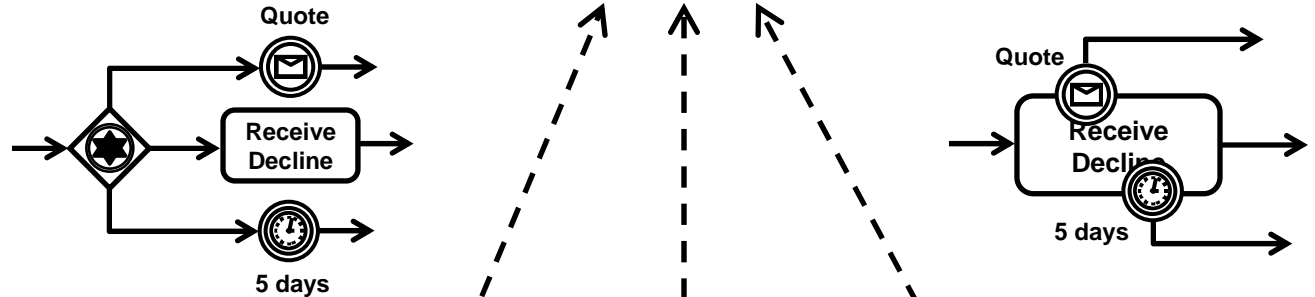
- Two notations, same occurrence pattern:
 - All start and end at same time, one finishes, the others abort (a “race”).

Modeling Occurrence Patterns

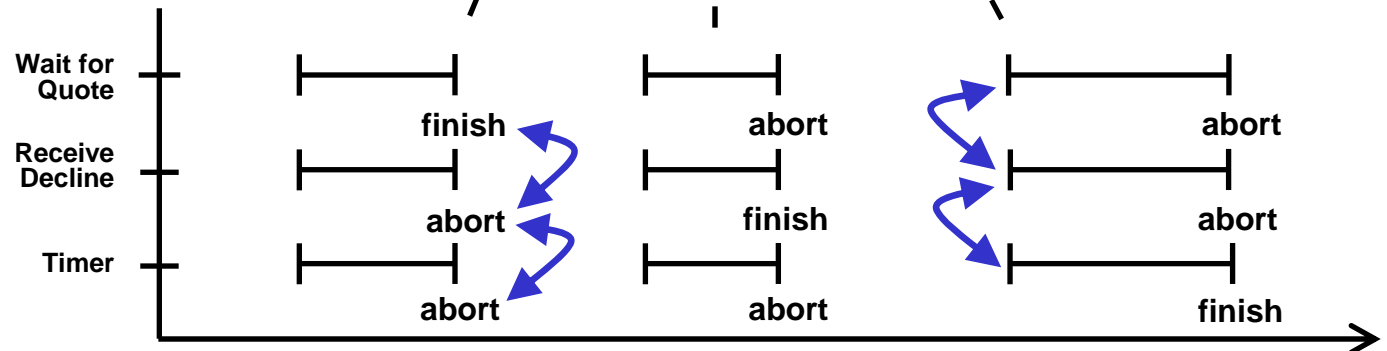
BPMN 2
Model Library
(M1)

User Model
(M1)

Racing Pattern:
All start and end at same time, one finishes, the others abort.



Occurrences
(M0)

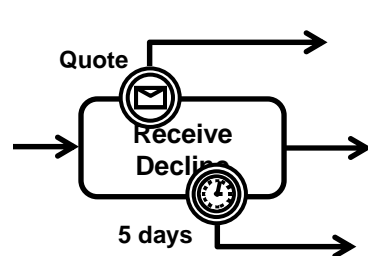


- Occurrence patterns are captured at the same metalevel as the user model ...
- ... in BPMN 2 Model Library (M1).

Extensible Occurrence Patterns

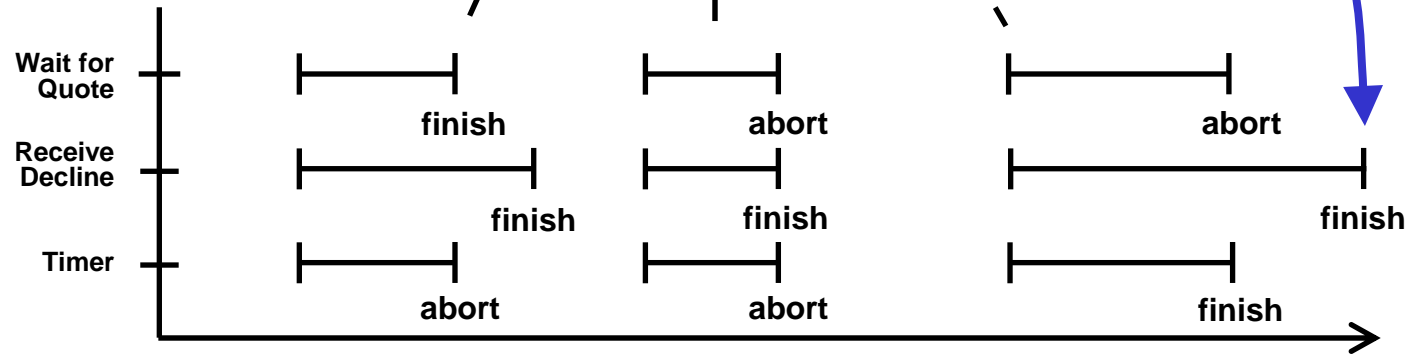
Modified Racing Pattern:
All start and end at same time, one finishes, the others abort, *except the Receive Activity*.

**User Model
(M1)**



**Activity
not aborted**

**Occurrences
(M0)**



- **Modelers define their own occurrence patterns.**
- **Interchanged patterns give the same behavior on receiving end.**

- Silver, B., "BPMS Watch: My BPMN Wish List," <http://www.bpminstitute.org/articles/article/article/bpms-watch-my-bpmn-wish-list.html>, November, 2007.

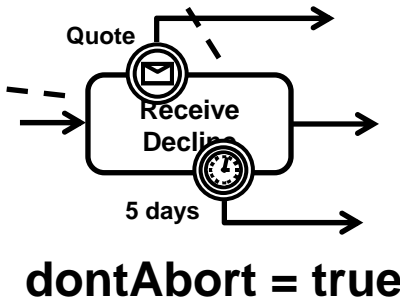
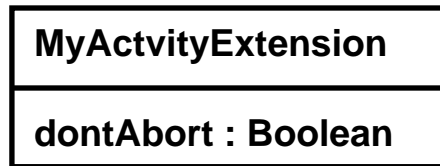
Syntax-Only Extensions

Metamodel
(M2)

Activity

Effect
on occurrences
not specified.

User model
(M1)



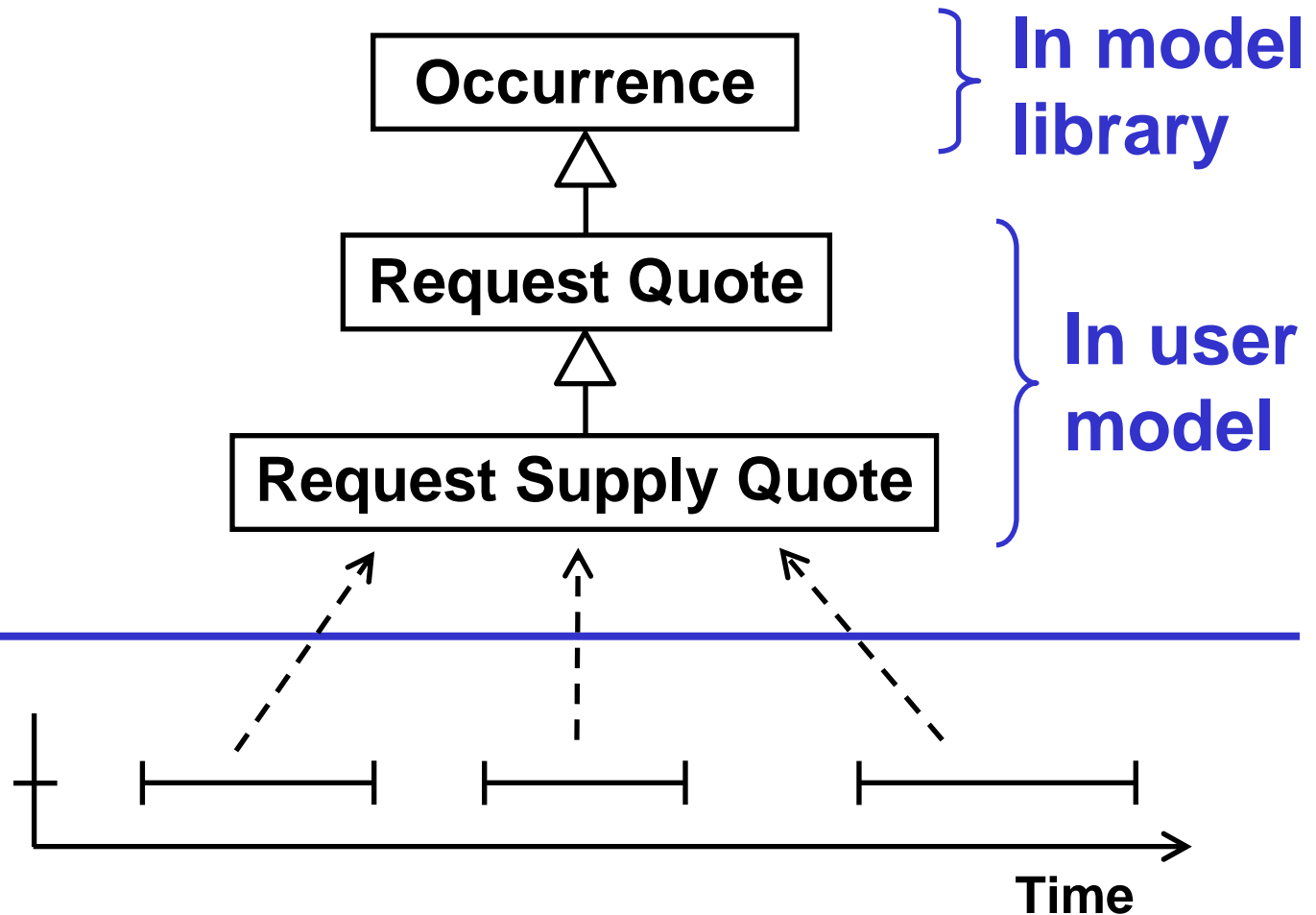
- Users extend *the metamodel* in their M1 models.
- Existing tools might load, save, and support modification, but will otherwise ignore them.
- This technique is used in extensions to UML (stereotypes).

Occurrence Modeling

BPMN 2
Model Library
(M1)

User Model
(M1)

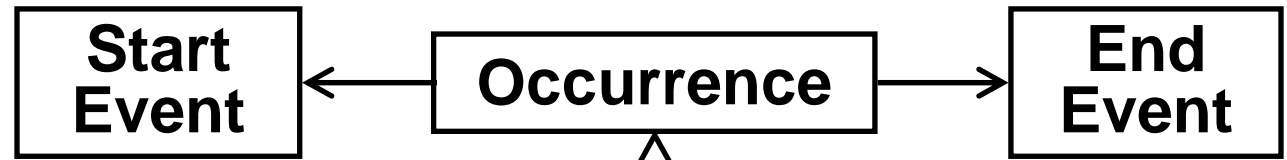
Occurrences
(M0)



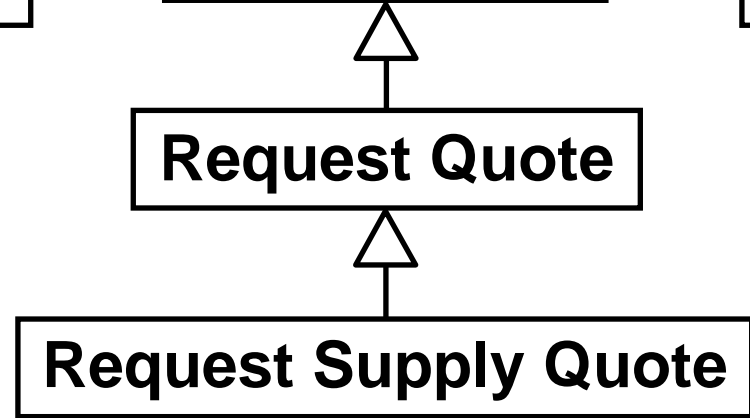
- **Classifier of all occurrences:**
 - Contained in BPMN 2 Model Library (M1).
 - Generalizes all user process and choreography models.

Occurrence Modeling

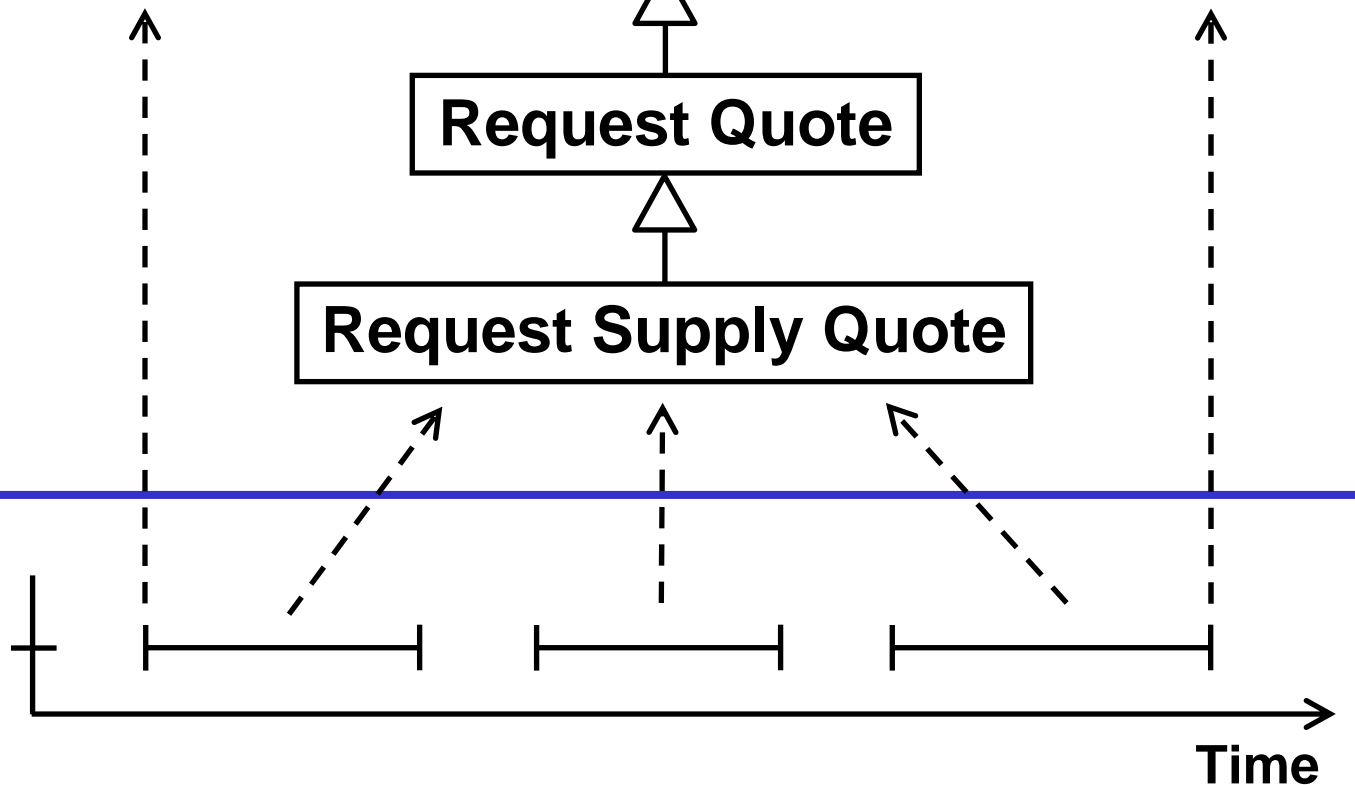
BPMN 2
Model Library
(M1)



User Model
(M1)



Occurrences
(M0)



- BPMN 2 Model Library contains event elements.
- Operations can be added in a BPRI extension.
- Familiar to workflow engine implementors.

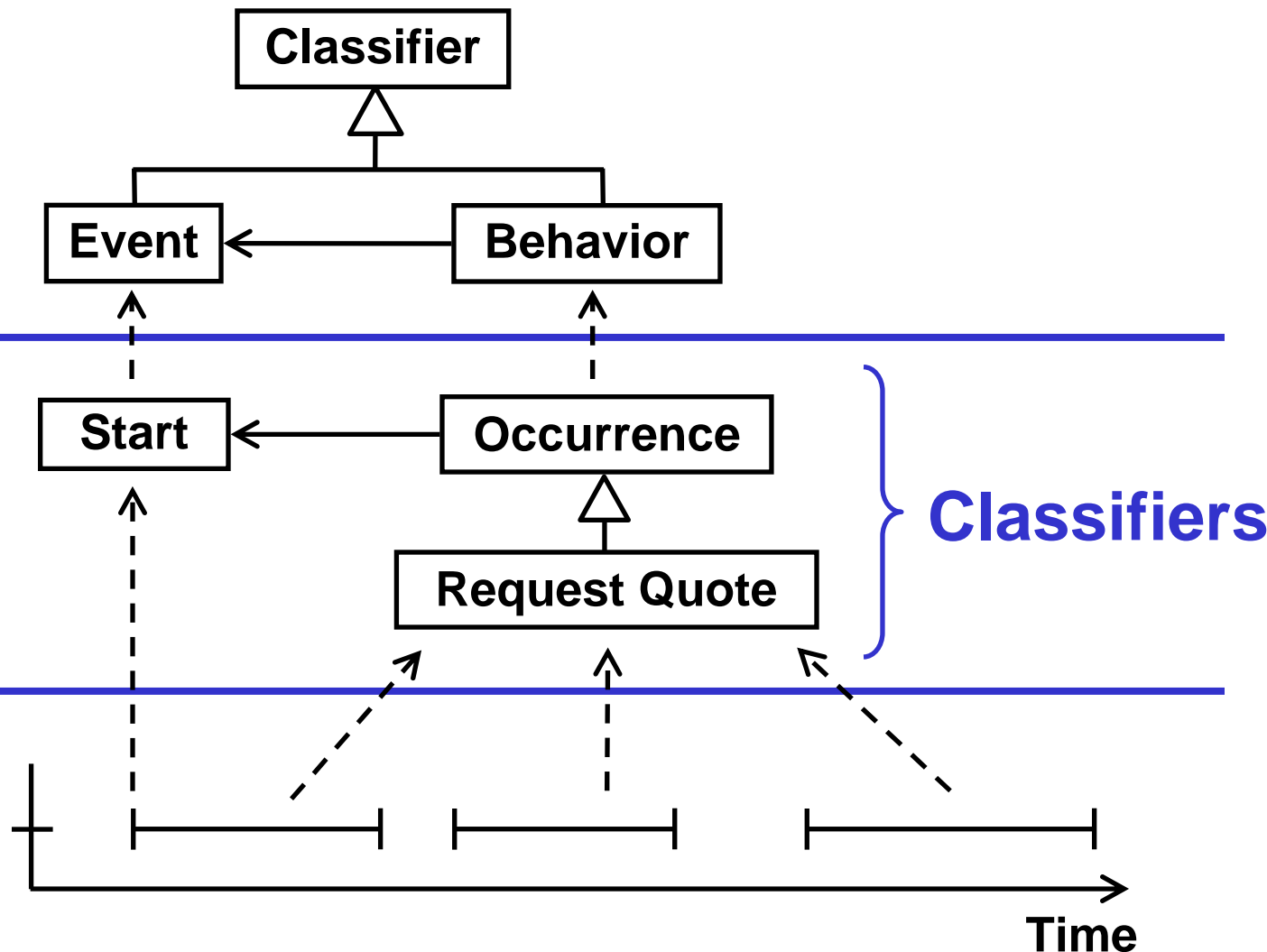
Metamodeling with Occurrences

BPMN 2
Metamodel
(M2)

BPMN 2
Model Library
(M1)

User Model

Occurrences
(M0)



- BPMN 2 Metamodel contains Classifier.
- Enables M1 models to classify M0 occurrences and generalize other M1 models.

Metamodeling without Occurrences

Metalinguage
(M3)

Classifier

Metamodel
(M2)

Event

Process

Classifiers

User Model
(M1)

Start Event

Request Quote

Not
Classifiers

■ Without Classifier at M2:

- M1 models cannot classify M0 occurrences or generalize other M1 models.
- Cannot achieve other benefits of occurrences.

Full Interoperability

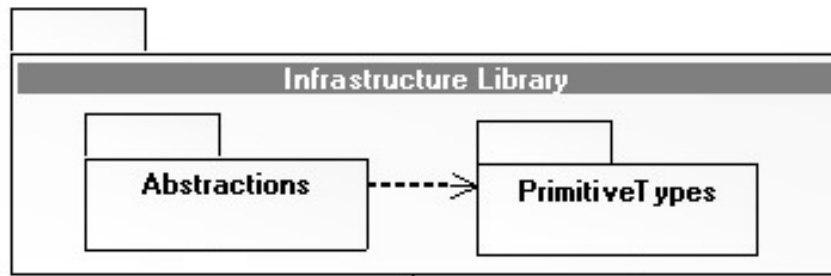
- **Diagrams:**
 - Bitmaps (PNG, etc), Shapes (SVG, etc).
 - Receiver's *screen* looks the same as Sender's.
- **Repository (metamodels):**
 - Orchestration and choreography models.
 - Receiver's *repository* has the same content as Sender's.
- **Semantics:**
 - Performances, enactments, executions, interactions.
 - Receiver's *occurrences* happen the same way as Sender's.

Semantic Interoperability

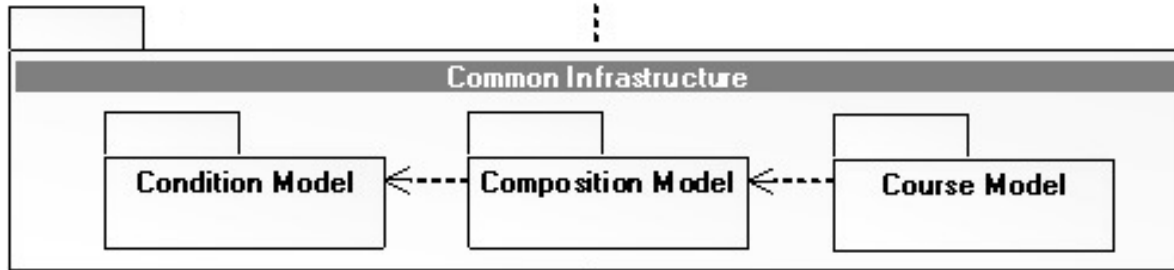
- **Large organizations have many kinds of workflow and process management tools from many vendors.**
- **Processes and choreographies must *occur* the same way before and after interchange.**
- **Benefit: more uniform performance, enactment, and execution, lower cost, higher ROI, modeling assets hold value.**
- **Otherwise: nonuniform execution, higher cost due to rework, lower ROI, fragile modeling assets.**

Infrastructure

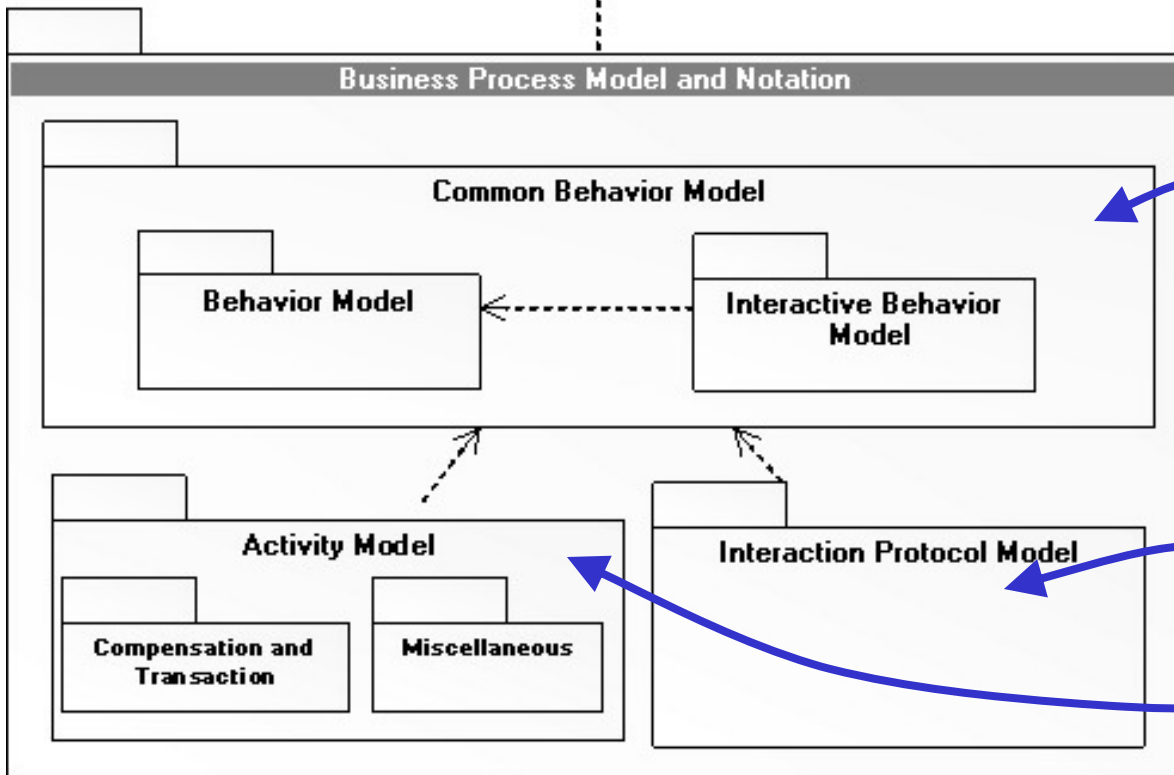
- **Bridging to IT:**
 - Shares high-level infrastructure with MOF/UML (Classifier, Property).
- **Support for related standards:**
 - Composition and other models.
 - Applicable to organization modeling.
- **BPMN vendors only use the concrete classes, with BPMN terminology.**



**Bridge to IT
(MOF/UML
Infrastructure)**



**For Related
Standards
(BPDM
Infrastructure)**



**Common between
Orchestration
and Choreography**

Choreography

**Orchestration
(BPMN 1.x)**

Service Oriented Architecture

**Organization
Modeling, etc.**

Compliance

**Workflow and
Runtime
Management**

BPMN 2

Full Interoperability

**Unified
Process and
Choreography**

**Modeler-
defined
Taxonomies**

**Modeler-
extensible
Semantics**

Business Semantics