Using UML for Problem Frame Oriented Software Development

Christine Choppy
LIPN, CNRS UMR 7030
Université Paris 13
Villetaneuse
FRANCE

Gianna Reggio
DISI
Universita di Genova
Genova
ITALY

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- (other specification methodology issues, e.g. related to a specific language use)

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- Help to choose between various constructs, provide a precise, structured and well-founded way
(e.g. Astesiano & Reggio, SEFM 2003)

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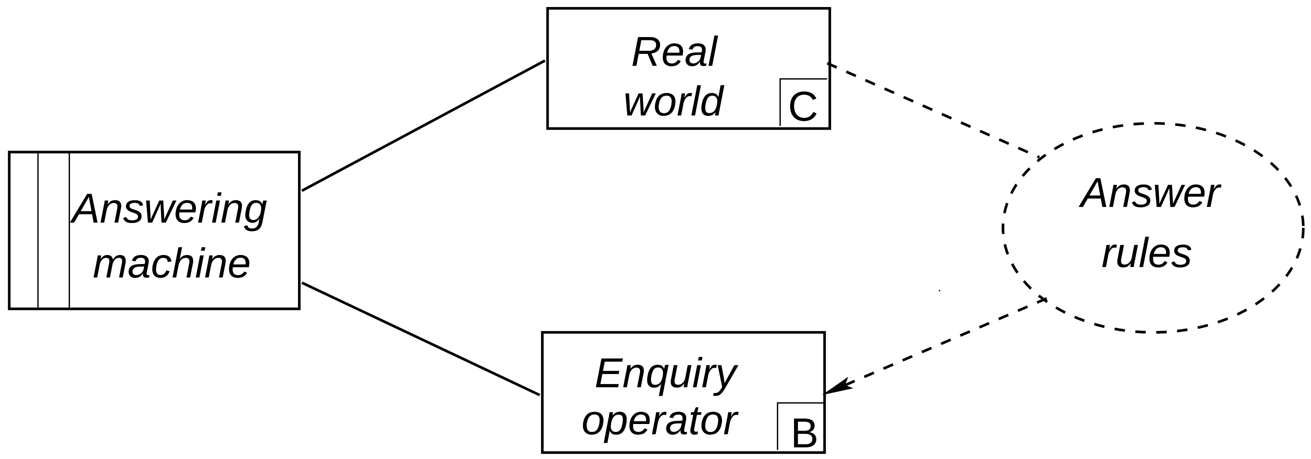
- Here for the Commanded Information Frame

Commanded Information Frame



Design Domain Requirements

B stands for “biddable”(people), C for “causal”(dynamic)

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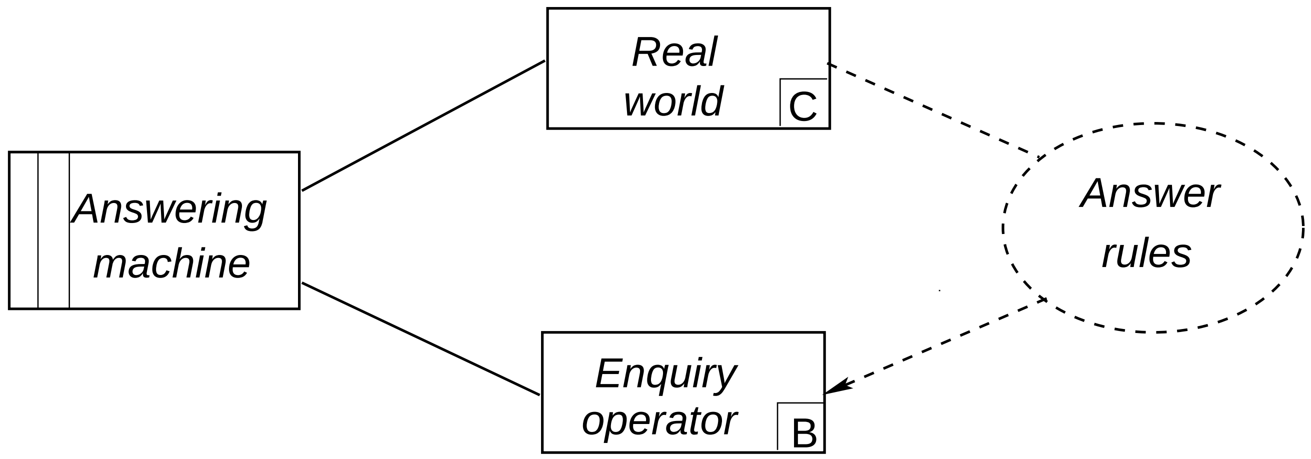

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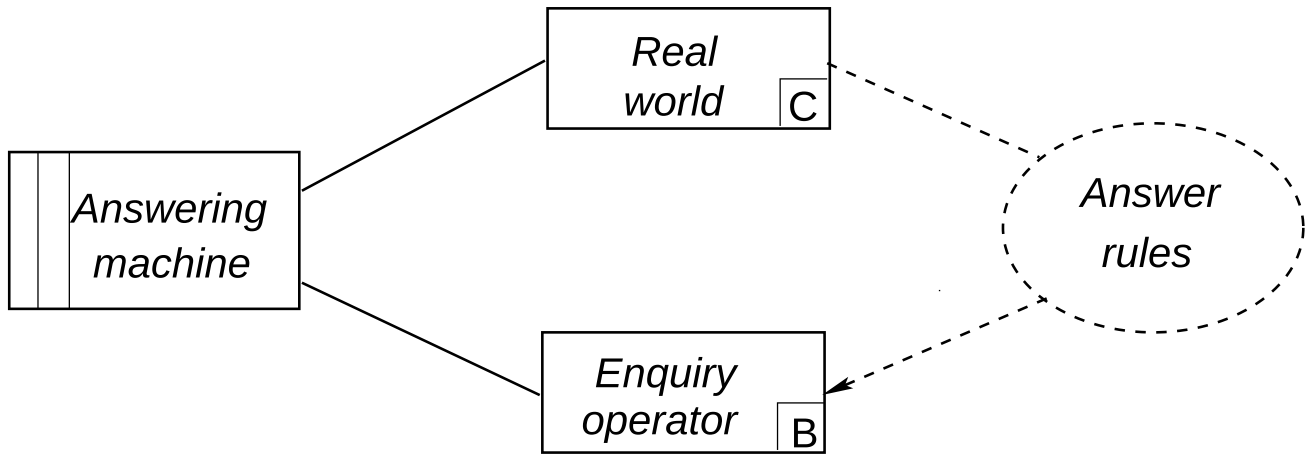

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Information directly presented to the Enquiry Operator (not by means of a Display)

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- Running Example: a Company Information System

Domain Model: *Real world*

- class diagram with an active class RealWorld
- a detailed description of the behaviour of RealWorld, or just a small conceptual model containing RealWorld and few other classes.

Requirement Specification (1)

- Choppy & Reggio 99: formal specification skeleton for the various parts of the Commanded Information Frame
- events (yield changes in the system state)
- the history of the events that occurred

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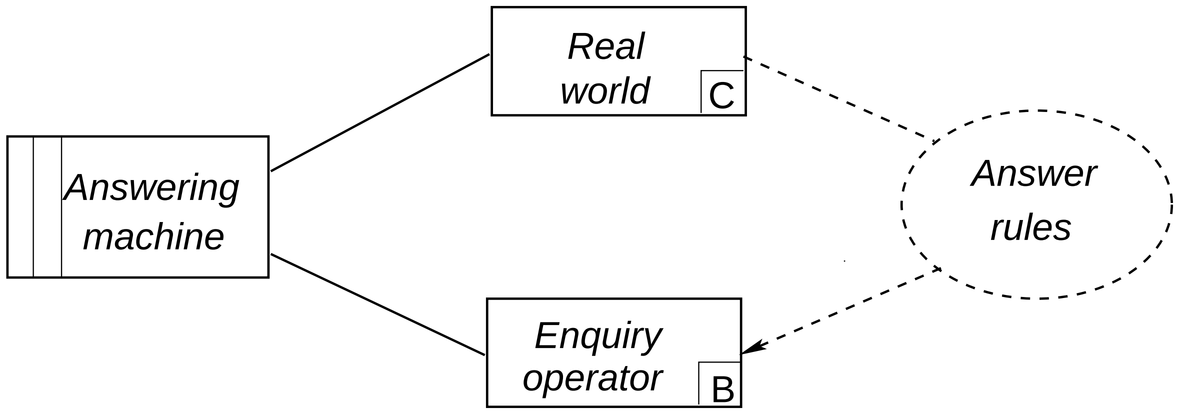
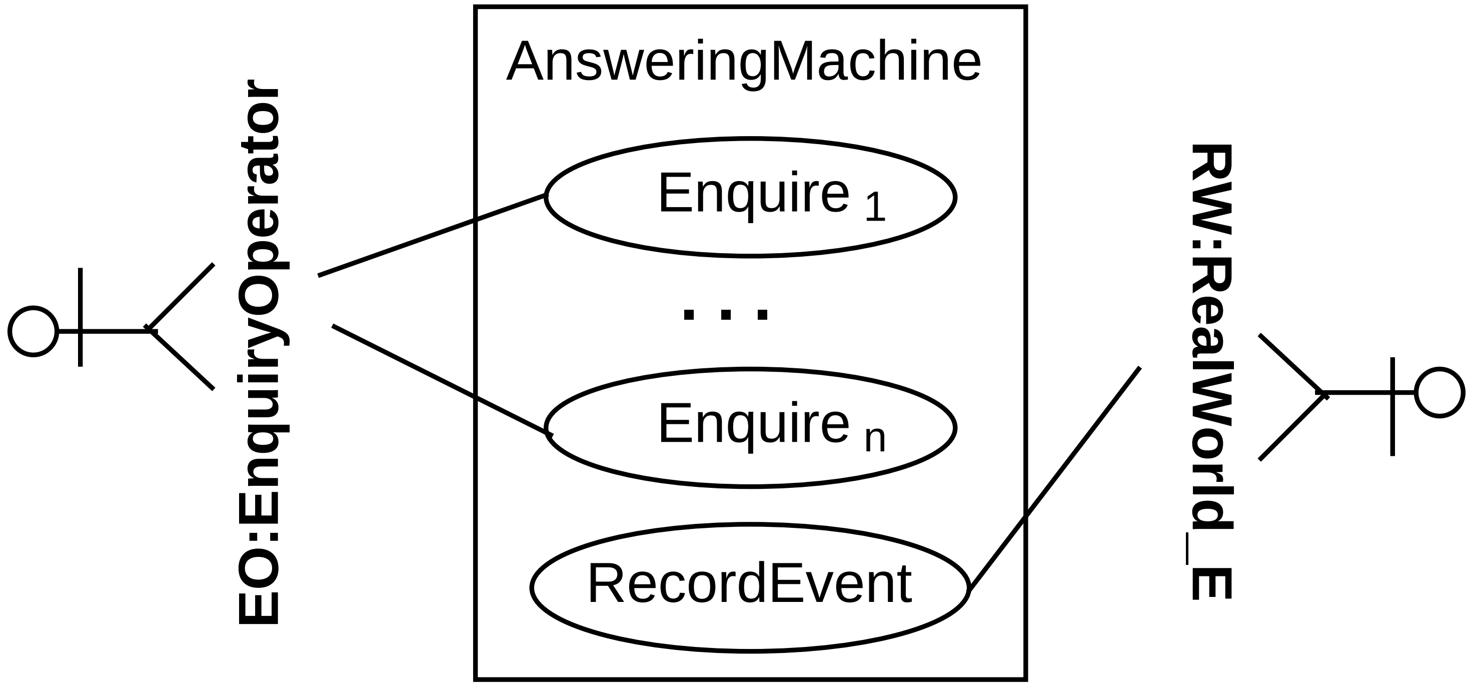


- interface between *Real world* and *Answering machine* labelled by events generated by the *Real world* that convey information about it.

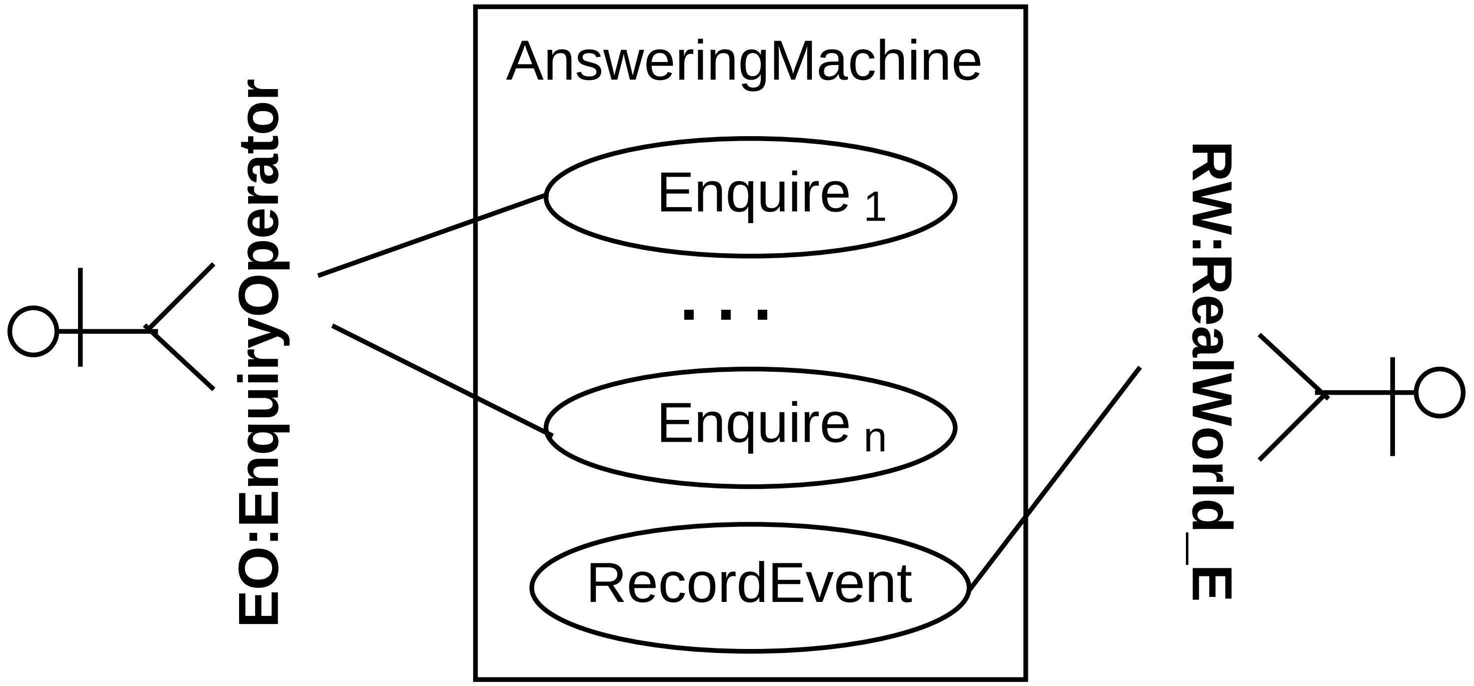
Requirement Specification (2)

- use case diagram



Requirement Specification (2)

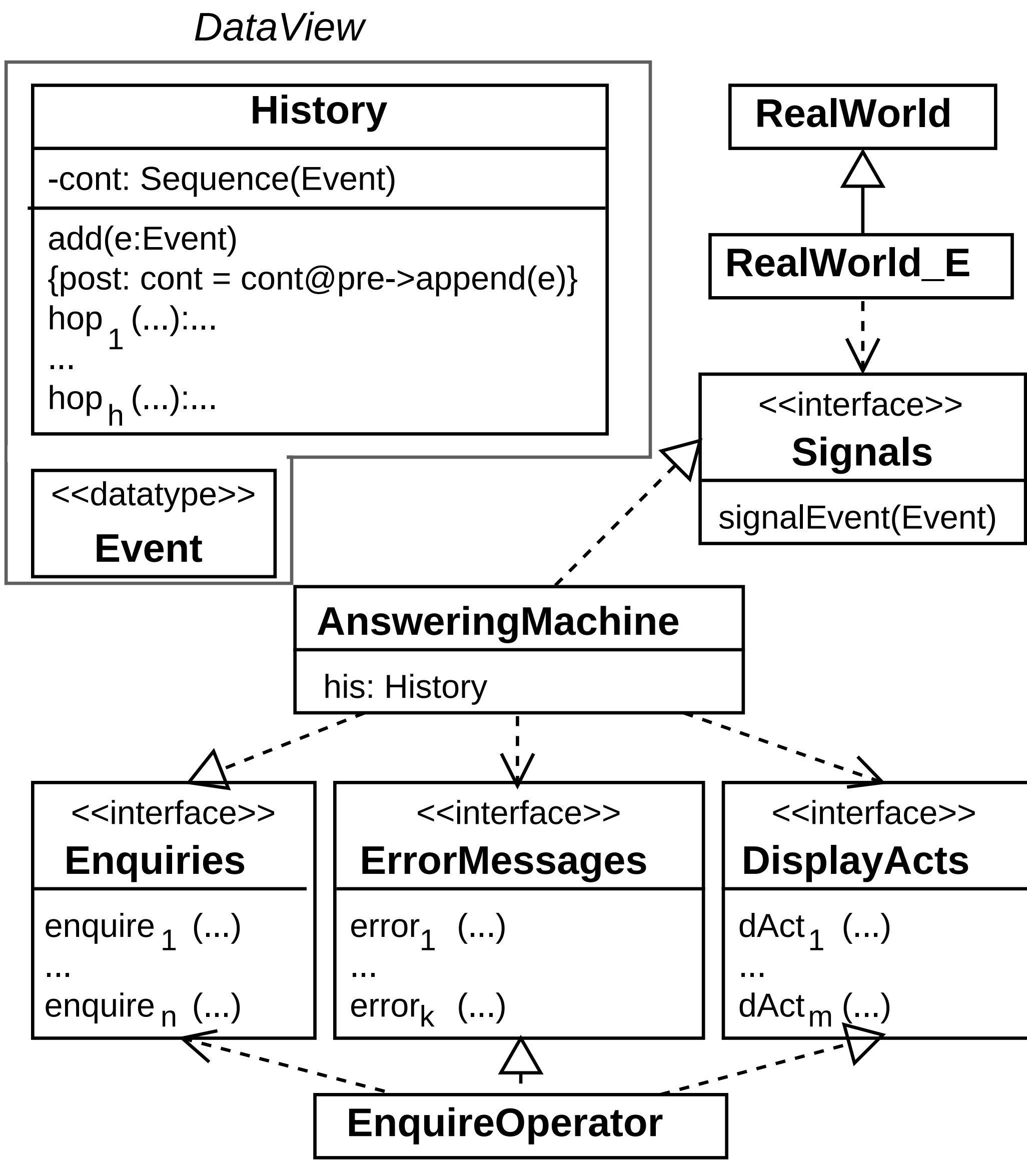
- use case diagram



- class diagram
- use case description (statechart)
- possibly other diagrams and model elements

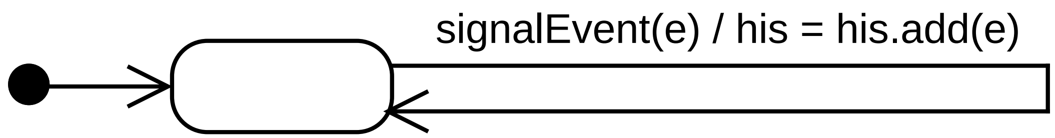
Requirement Spec: class diag

- RealWorld_E specializes RealWorld (signal events to *Answering machine* - Signals interface)
- Event
- AnsweringMachine interacts with RealWorld_E (event signals received) EnquiryOperator (Enquiries, DisplayActs, ErrorMessages)
- AnsweringMachine state: *Real world* past history
- History : hop_i



Req Spec: use case description

use case RecordEvent



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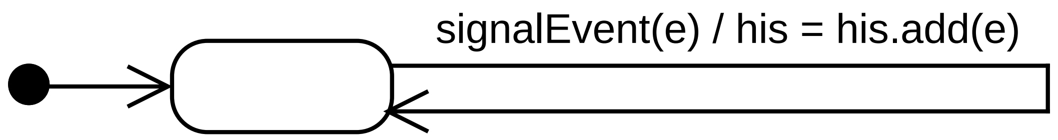

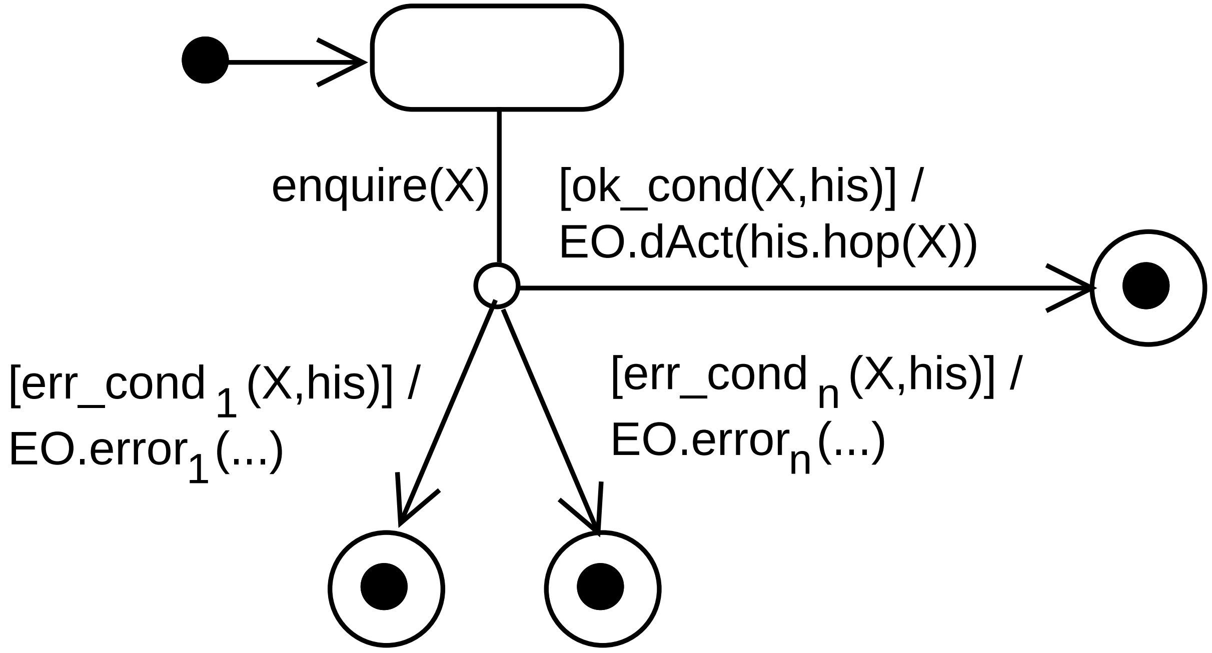

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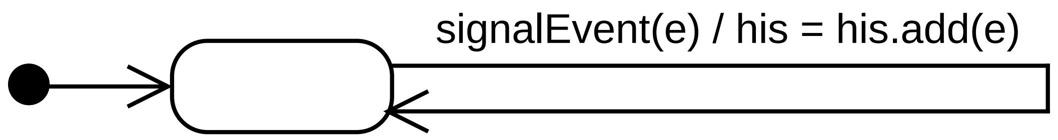
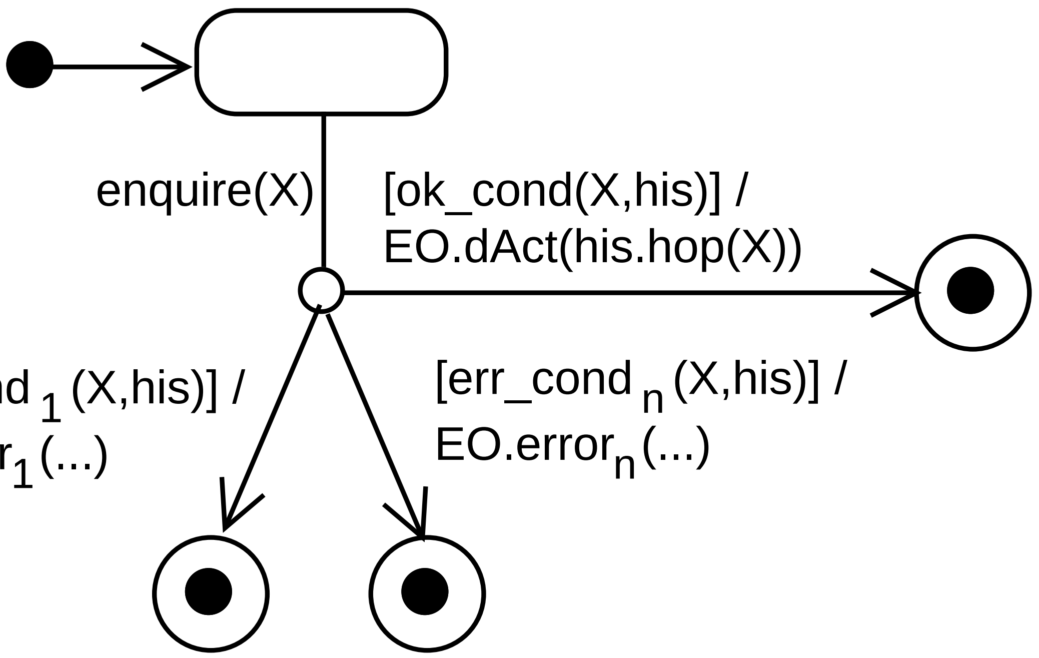




use case Enquire

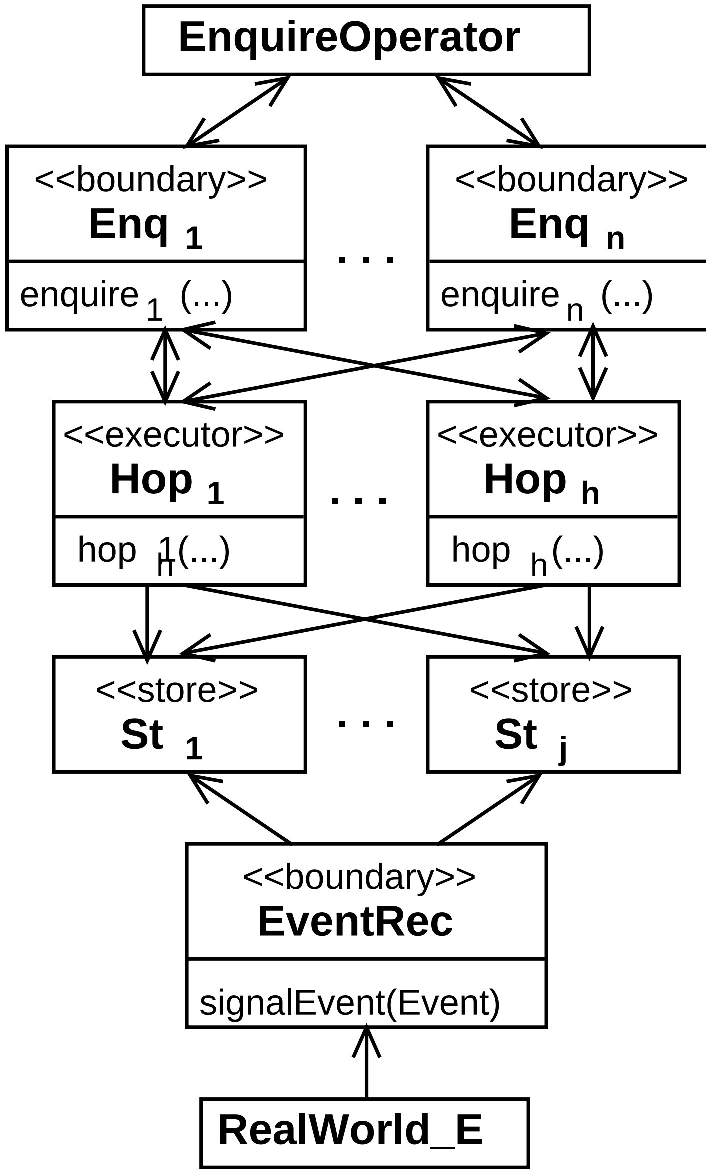
- other diagrams and model elements EnquiryOperator, RealWorld_E, and Event

Design Spec

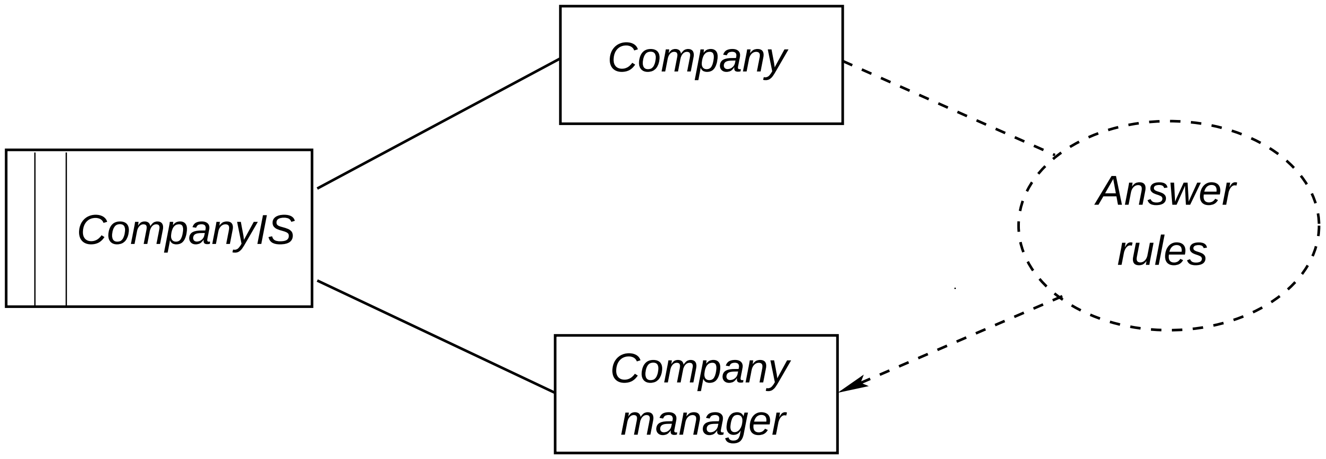
A class diagram

- EnquiryOperator & RealWorld_E external entities interacting with *Answering machine*
- three kinds of (stereotype) classes:
  ≪boundary≫ (sys interaction with external entities)
  ≪executor≫ (system activities)
  ≪store≫ (persistent data)

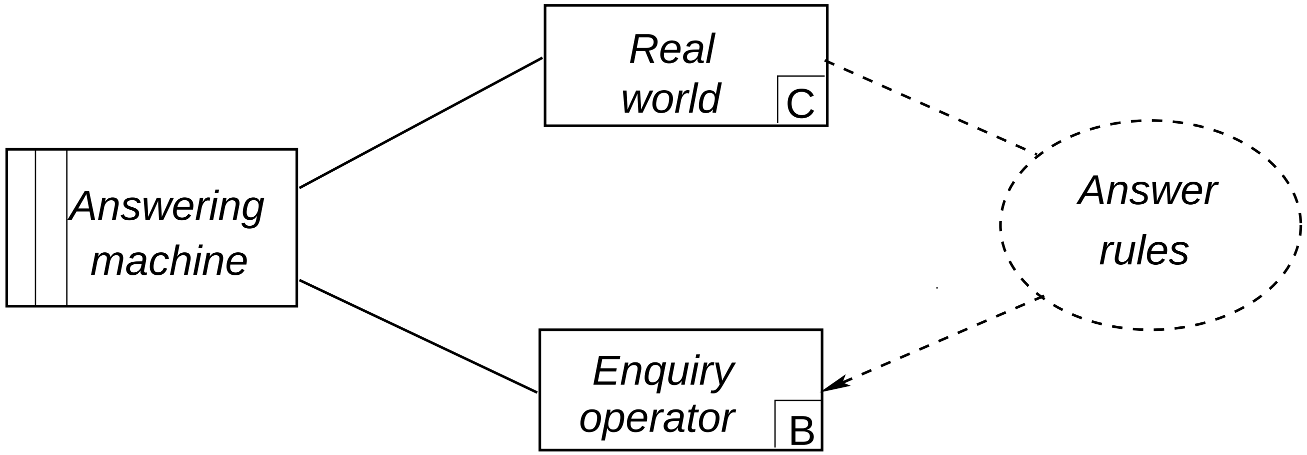
other diagrams and constraints:
behaviour of each class
- bound., exec. : statecharts
- methods, pre/post : store op



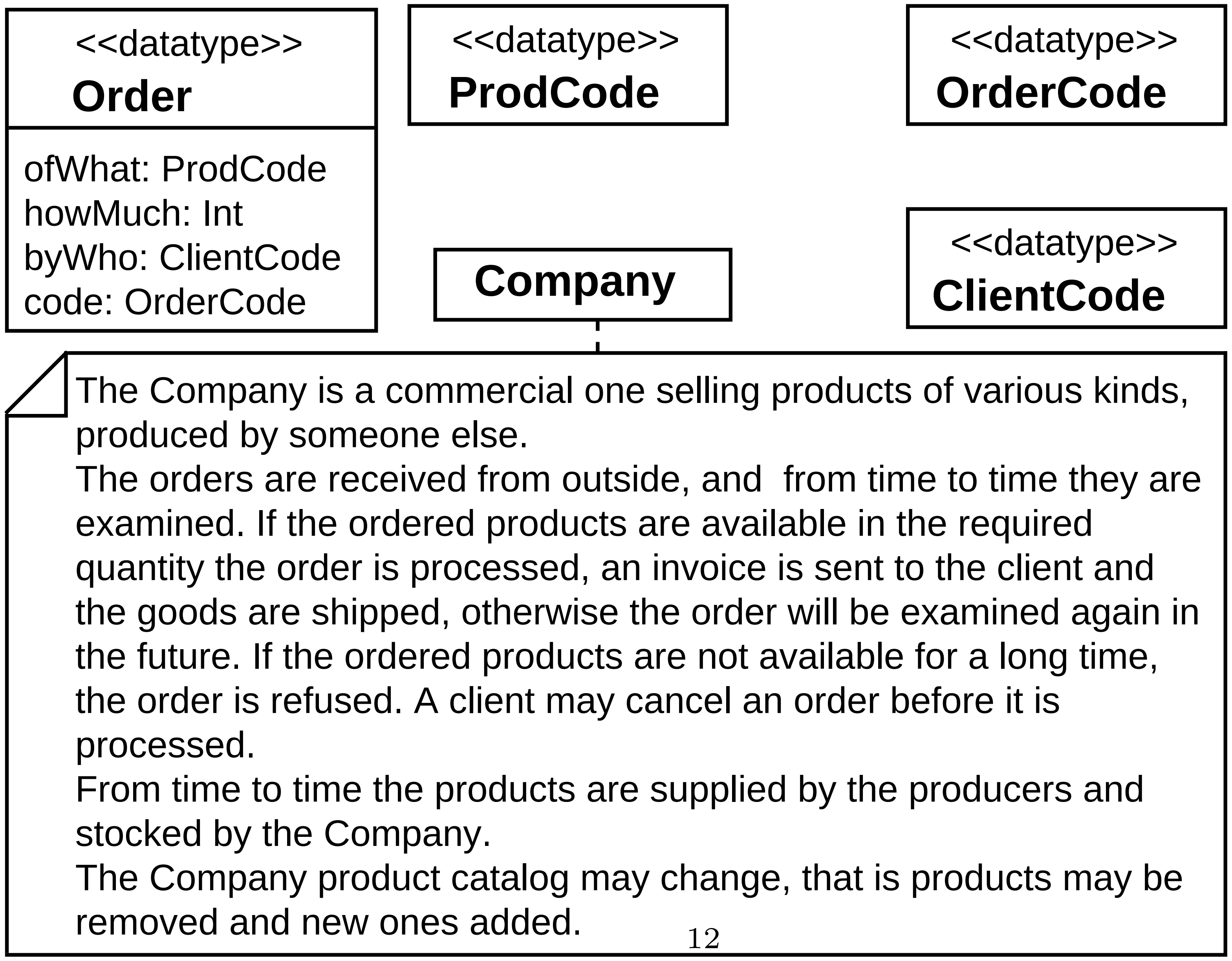
Company Information System



Matching the commanded information problem frame

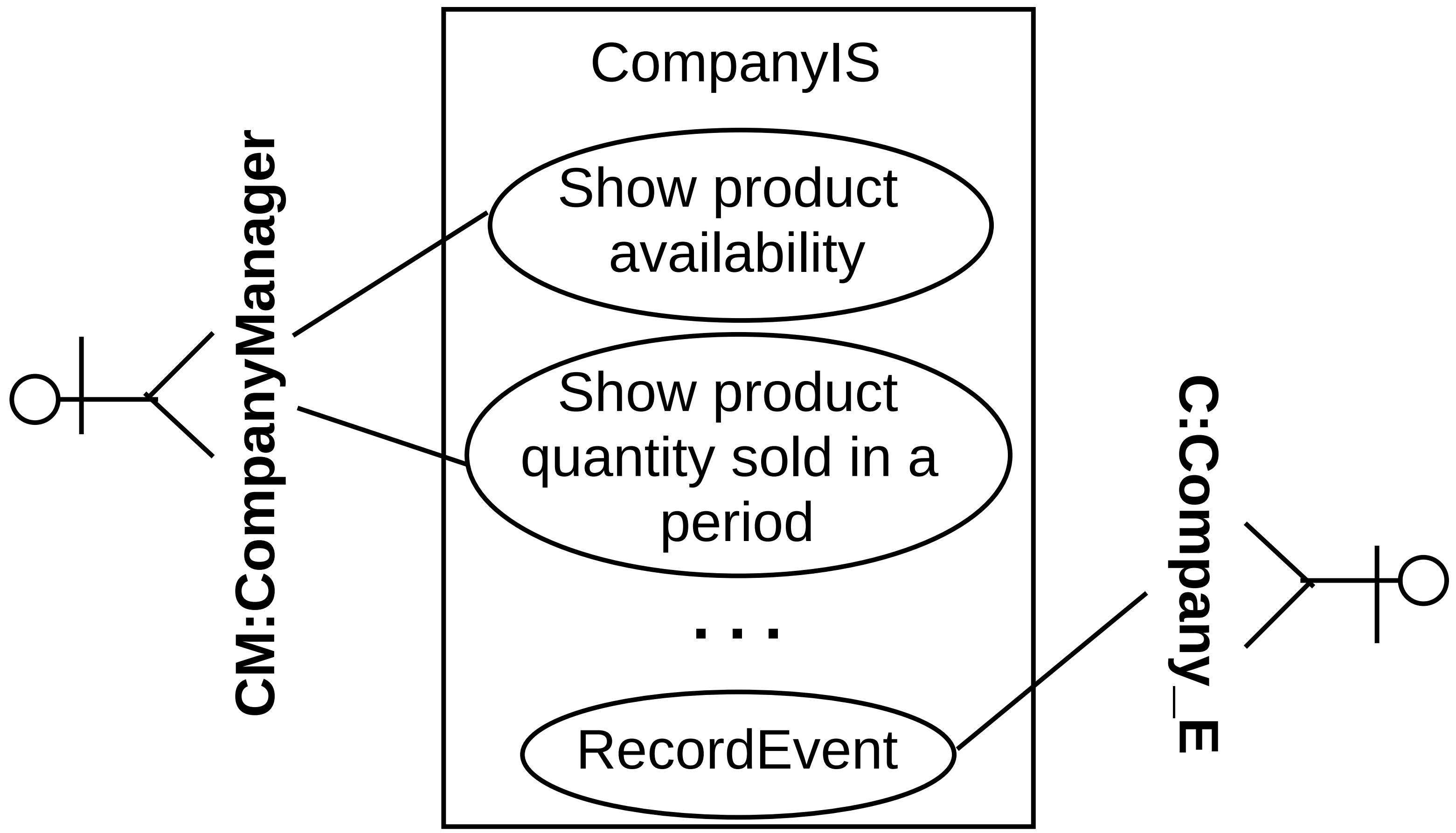


Company Domain Model

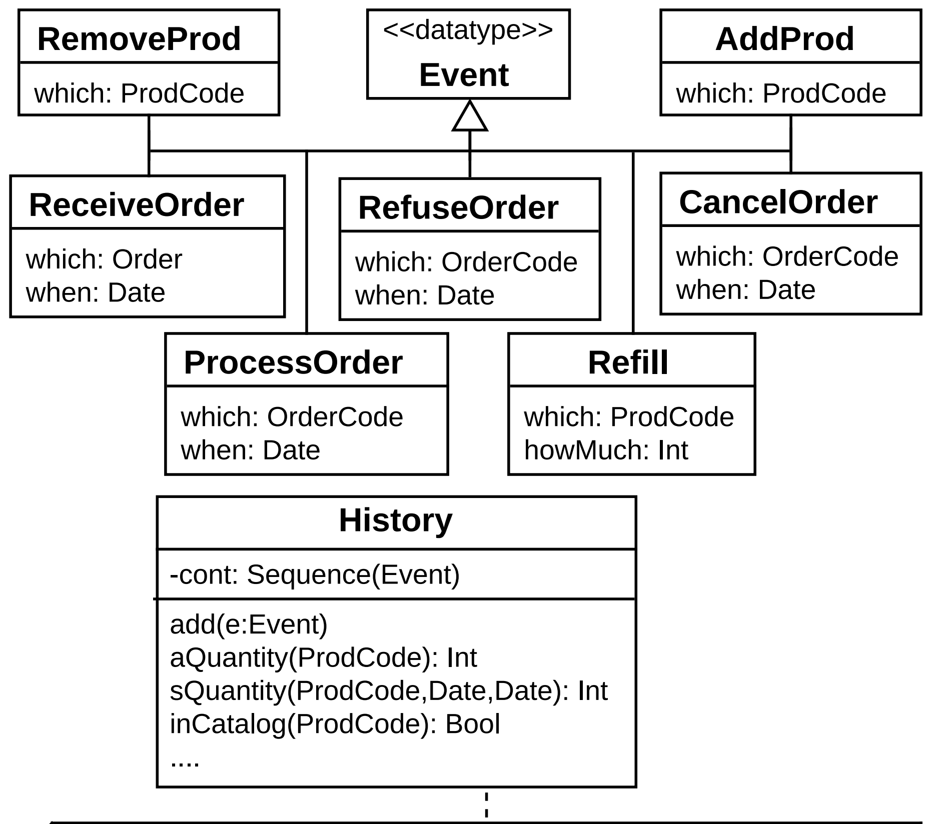


The Company is a commercial one selling products of various kinds, produced by someone else.
The orders are received from outside, and from time to time they are examined. If the ordered products are available in the required quantity the order is processed, an invoice is sent to the client and the goods are shipped, otherwise the order will be examined again in the future. If the ordered products are not available for a long time, the order is refused. A client may cancel an order before it is processed.
From time to time the products are supplied by the producers and stocked by the Company.
The Company product catalog may change, that is products may be removed and new ones added.

Company Requirement Spec 1

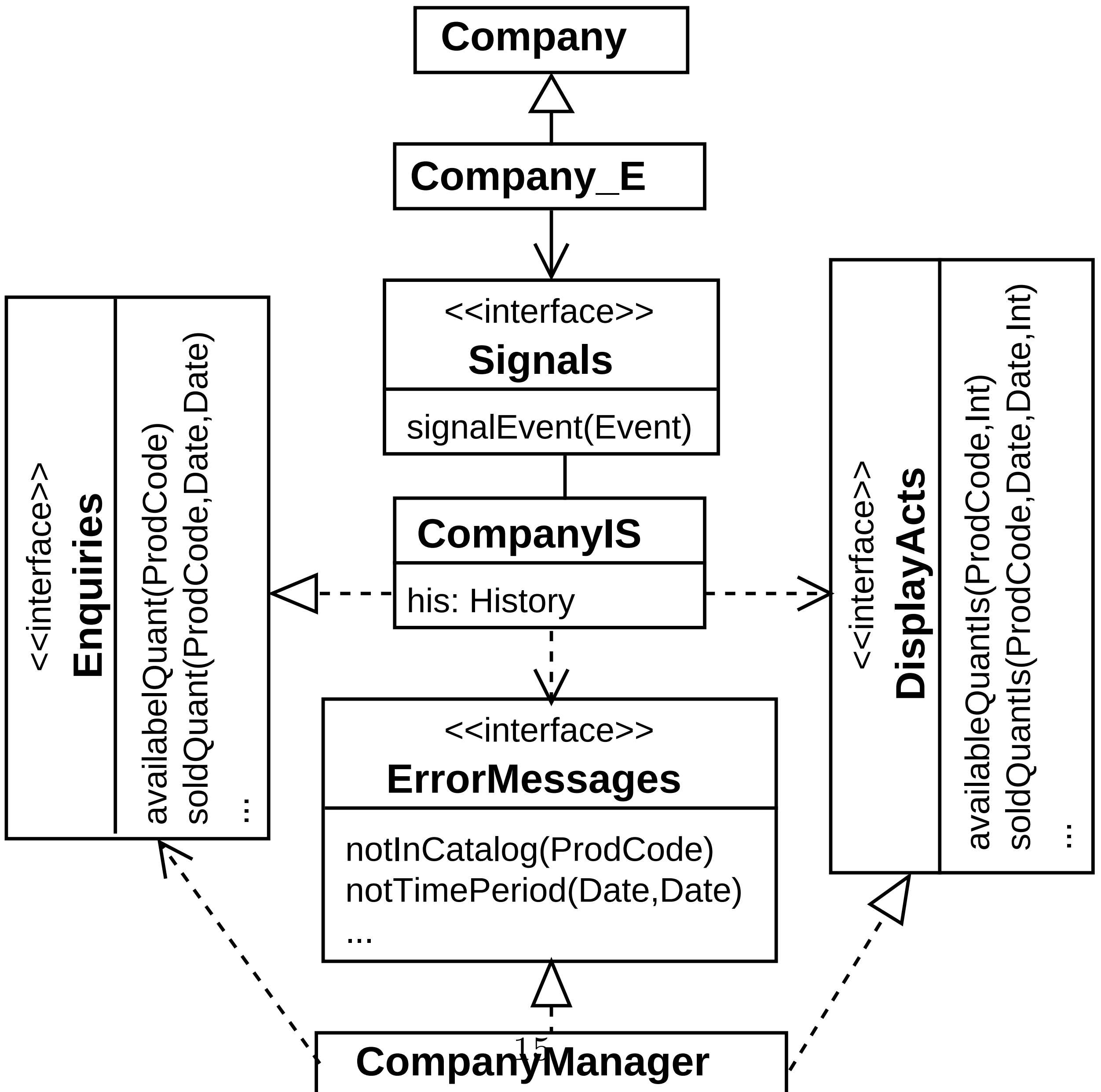

CompanyIS
Show product availability
Show product quantity sold in a period
. . .
RecordEvent
CM:CompanyManager
C:Company_E

Company Req Spec 2 (class 1)

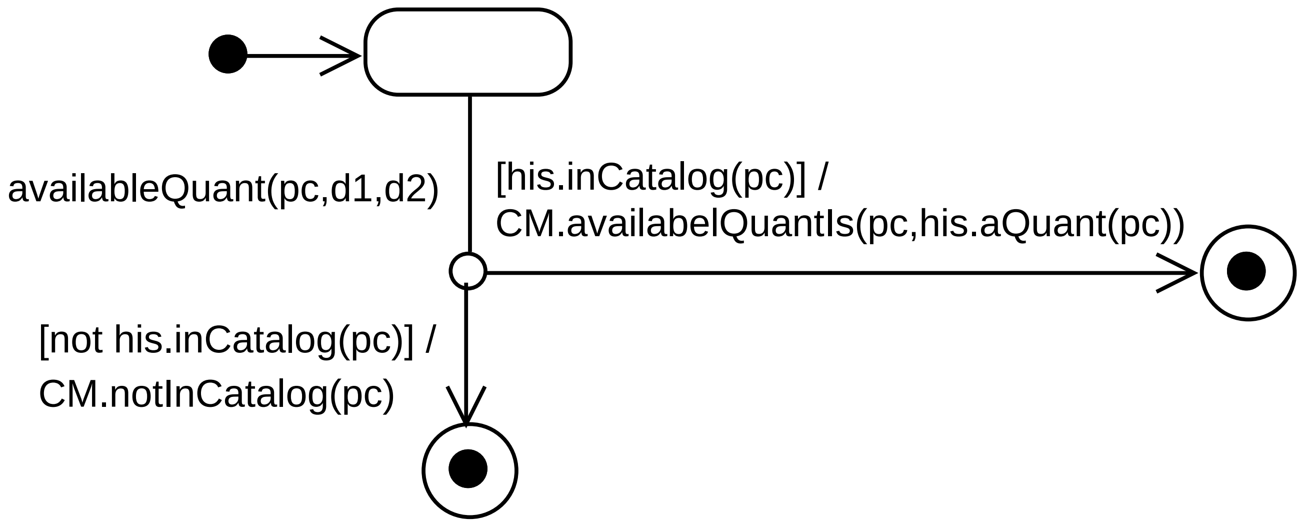


```
inCatalog(pc:ProdCode): Bool post:
result = exists i >= 1 s.t.
    self.cont[i]  is the addition of pc and
    for all j > i self.cont[j] is not the removing of pc

aQuantity(pc:ProdCode):  Int post:
result = cont -> iterate(e: Event; aQuant = 0 |                    )
    if e.hasType(Refill) and pc = e.which then
       aQuant + e.howMuch
  else  if e.hasType(ProcessOrder) and pc = e. which.ofWhat then
      aQuant-e.which.howMuch
  else aQuant )

sQuantity(pc:ProdCode, d1,d2: Date): Int post:
```

Company Req Spec 3 (class 2)



Company Requirement Spec 4



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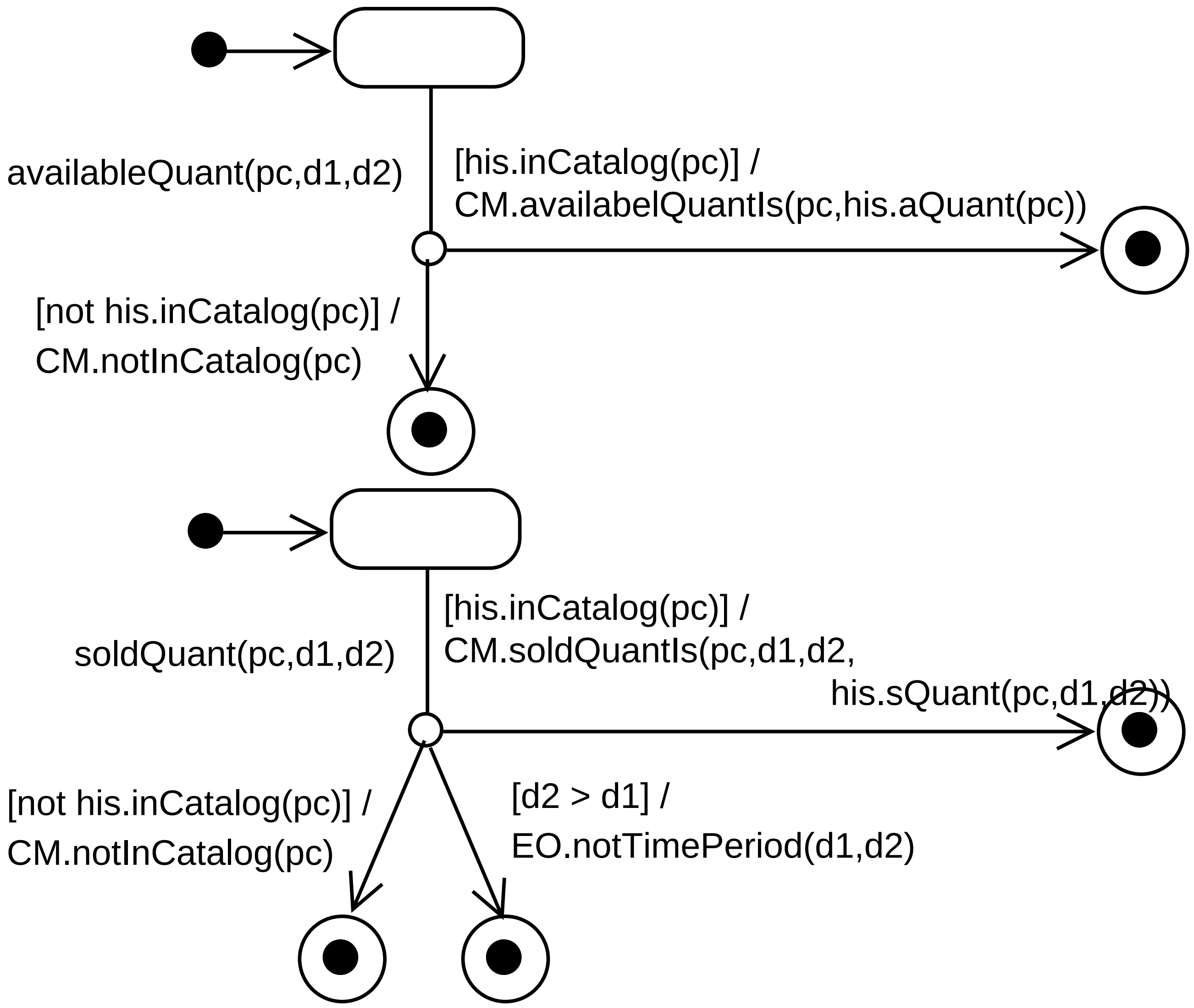

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- Precise guided use of UML constructs (time gain & concentration on relevant development aspects), for domain, requirements and design
- founded on formal specification experience
- the developer has to explicitly consider and describe the existing parts of the real world interacting with the system to be developed.

Related work, and . . .

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- Formal specifications skeletons (CASL Common Algebraic Specification Language `http:/cofi.info` , CASL-LTL extended with Labelled Transition Logics, temporal)
  for Translation/JSP, and Information System (IS)
  (Choppy & Reggio WADT'99 LNCS 1827)

  (LOTOS), together with connections to architectural styles
  (Choppy & Heisel WADT'02 LNCS 2755)

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THE END ! THANKS FOR YOUR ATTENTION !

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- Composition ?
  associate on problem frame with each use case
  (goal level?)
  compose developed solutions through component based architectures
  Choppy & Heisel, AFADL'04 (June)