UML essential

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Goals

- What/Why UML?
- Static
- Dynamic

- Sources
  - The Unified Modeling Language Reference Manual, James Rumbaugh, Ivar Jacobson and Grady Booch, Addison Wesley, 1999.
  - UML Distilled, Martin Fowler, Kendall Scott, Addison-Wesley, Second Edition, 2000.

UML

- What is UML?
- uniform notation: Booch + OMT + Use Cases (+ state charts)
  - UML is not a method or process
  - … The Unified Development Process is
- Why a Graphical Modeling Language?
  - Software projects are carried out in team
  - Team members need to ***communicate***
    - ... sometimes even with the end users
- "One picture conveys a thousand words"
  - the question is only which words
  - Need for different views on the same software artifact

Why UML?

- Why UML?
- Represents industry standard
  - more tool support, more people understand your diagrams, less education
- Is reasonably well-defined
  - ... although there are interpretations and dialects
- Is open
  - stereotypes, tags and constraints to extend basic constructs
  - has a meta-meta-model for advanced extensions

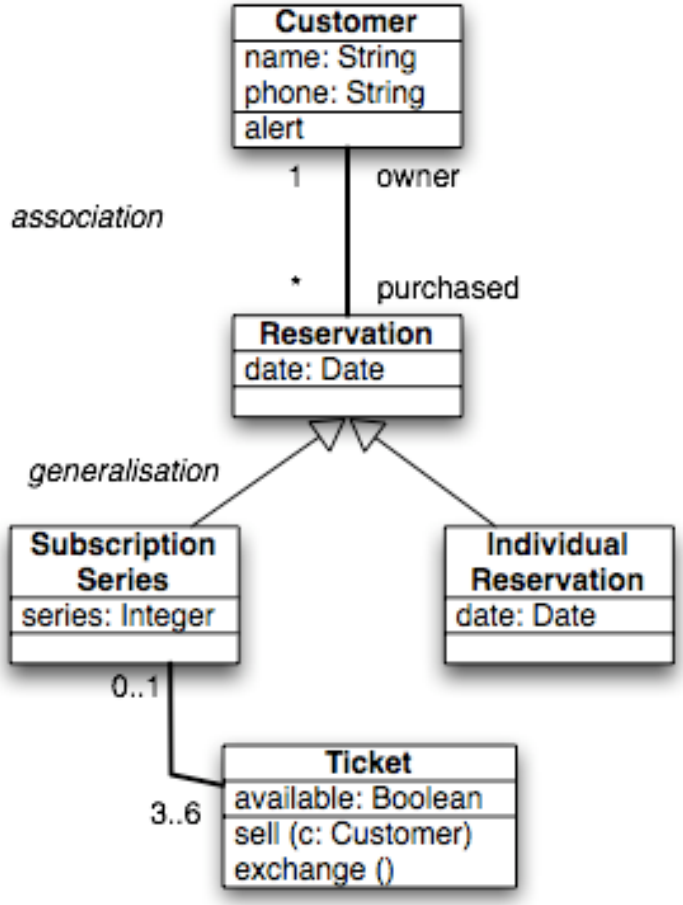
Goals

- What/Why UML
- ***Static***
- Dynamic

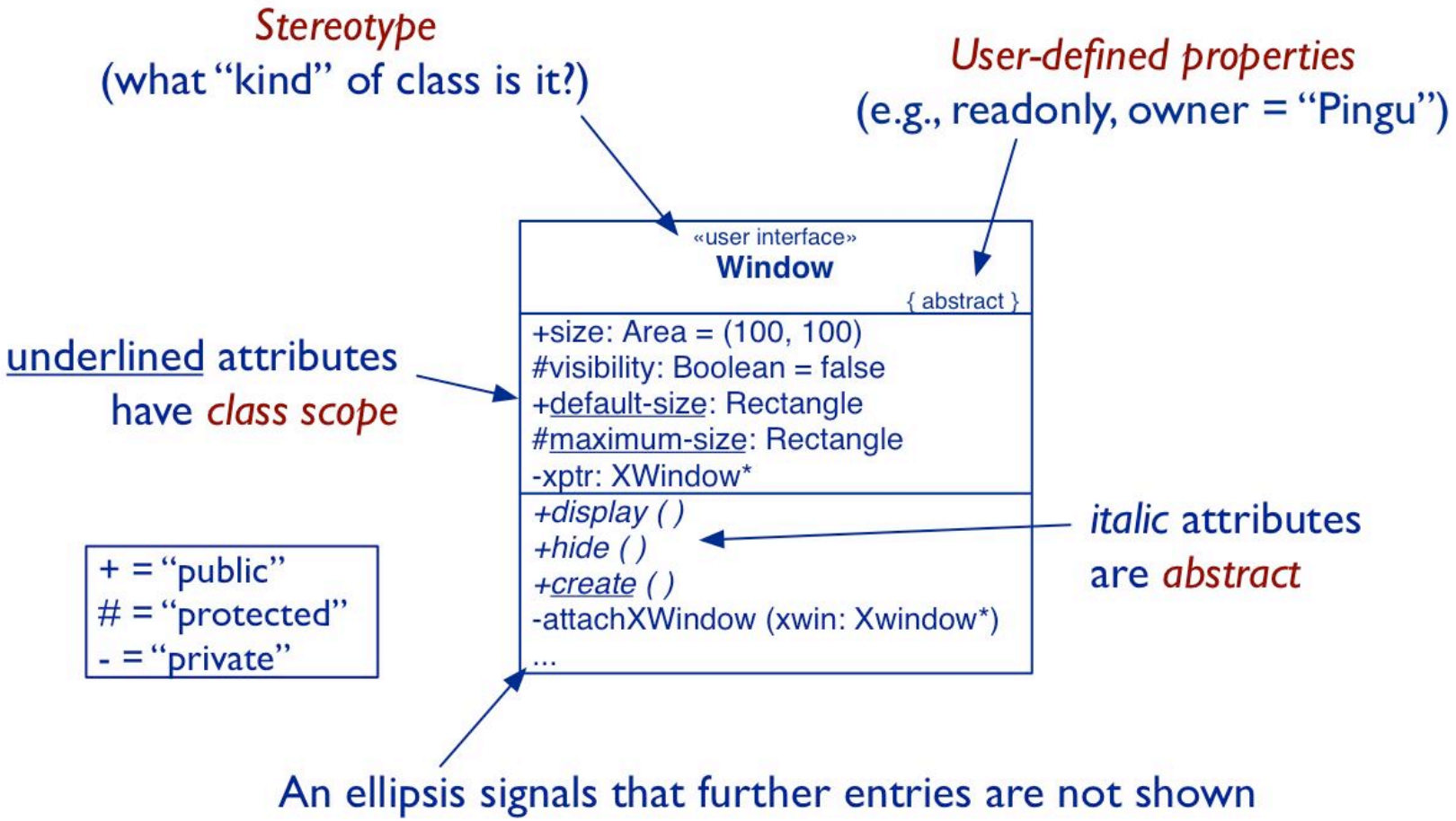
Class Diagrams

"Class diagrams show generic descriptions of possible systems, and object diagrams show particular instantiations of systems and their behaviour."

Attributes and operations are also collectively called *features*.



Features


Stereotype
(what "kind" of class is it?)
User-defined properties
(e.g., readonly, owner = "Pingu")
«user interface»
Window
{ abstract }
+size: Area = (100, 100)
#visibility: Boolean = false
+default-size: Rectangle
#maximum-size: Rectangle
-xptr: XWindow*
+display ( )
+hide ( )
+create ( )
-attachXWindow (xwin: Xwindow*)
...
underlined attributes
have class scope
italic attributes
are abstract
+ = "public"
# = "protected"
- = "private"
An ellipsis signals that further entries are not shown

UML Lines and Arrows

Constraint
(usually annotated)

Association
e.g., «uses»

Dependency
e.g., «requires»,
«imports» ...

Navigable
association
e.g., part-of

Realization
e.g., class/template,
class/interface

"Generalization"
i.e., specialization (!)
e.g., class/superclass,
concrete/abstract class

Aggregation
i.e., "consists of"

"Composition"
i.e., containment

Objects

Objects are shown as rectangles with their name and type underlined in one compartment, and attribute values, optionally, in a second compartment.

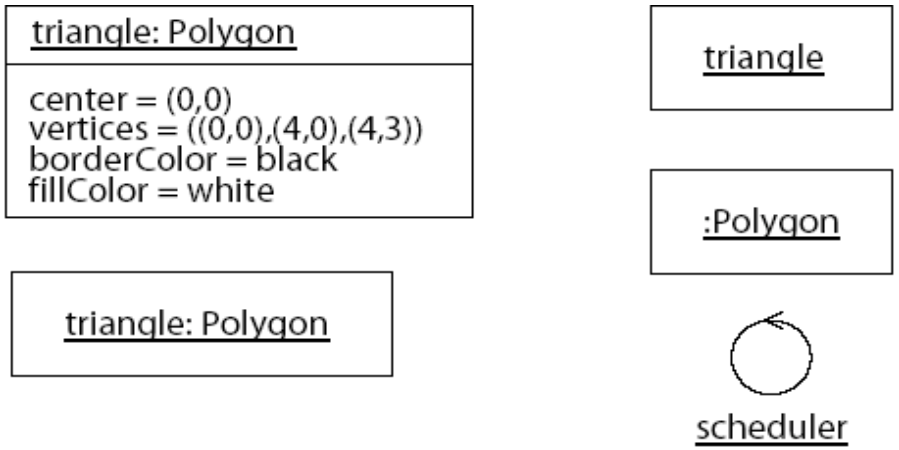


Figure 13-134. *Object notation*

At least one of the name or the type must be present.

Generalization

A subclass specializes its superclass:

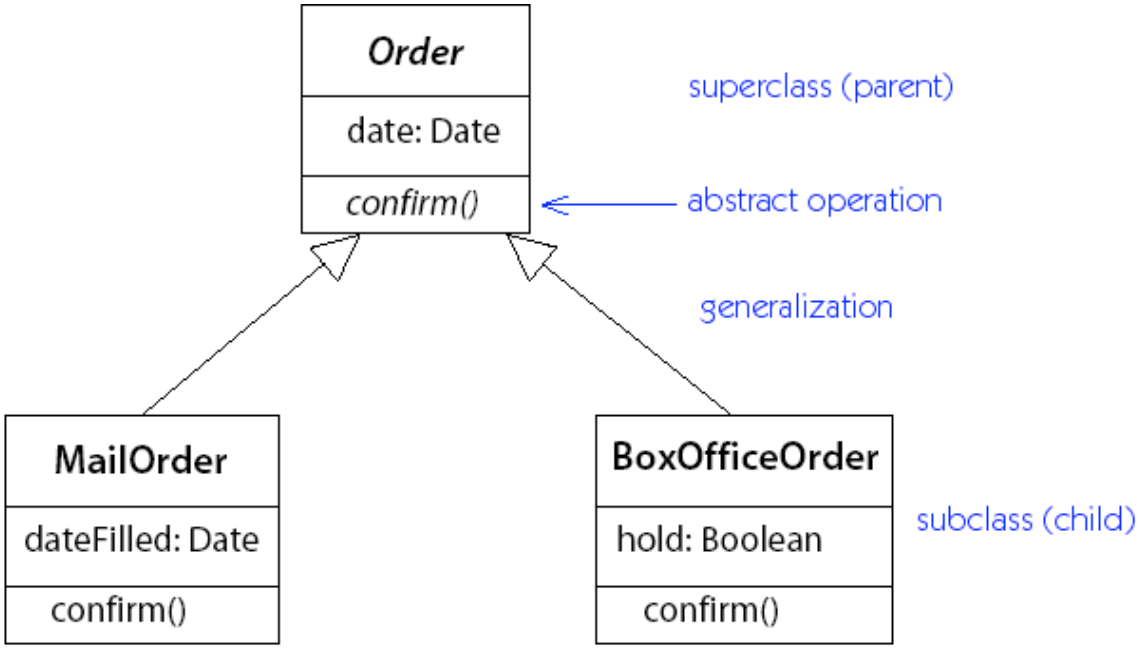


Figure 4-7. *Generalization notation*

Goals

- What/Why UML
- Static
- ***Dynamic***
  - Use Case Diagrams
  - Sequence Diagrams
  - Collaboration (Communication) Diagrams
  - Statechart Diagrams

Sequence Diagrams

A sequence diagram depicts a scenario by showing the interactions among a set of objects in *temporal order*.

Objects (not classes!) are shown as *vertical bars*. *Events* or message dispatches are shown as horizontal (or slanted) *arrows* from the sender to the receiver.

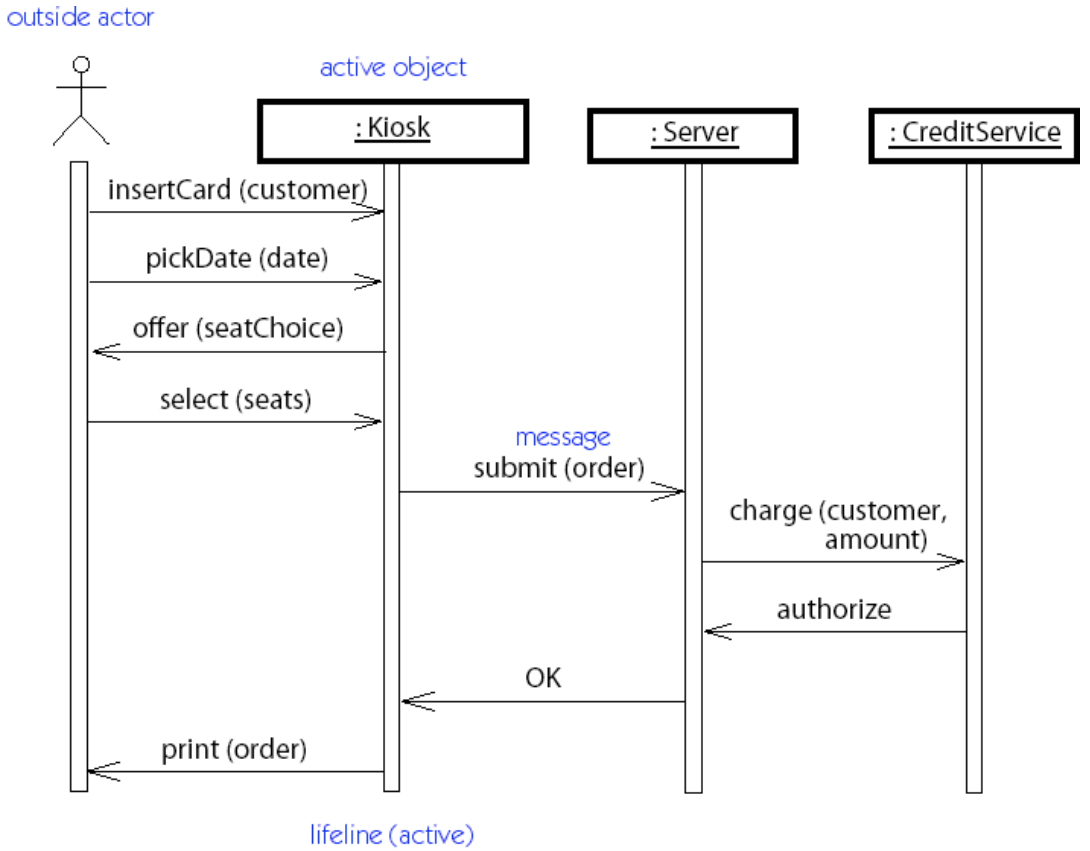


Figure 8-1. *Sequence diagram*

Collaboration Diagrams

Collaboration diagrams (called *Communication* diagrams in UML 2.0) depict scenarios as *flows of messages* between objects:

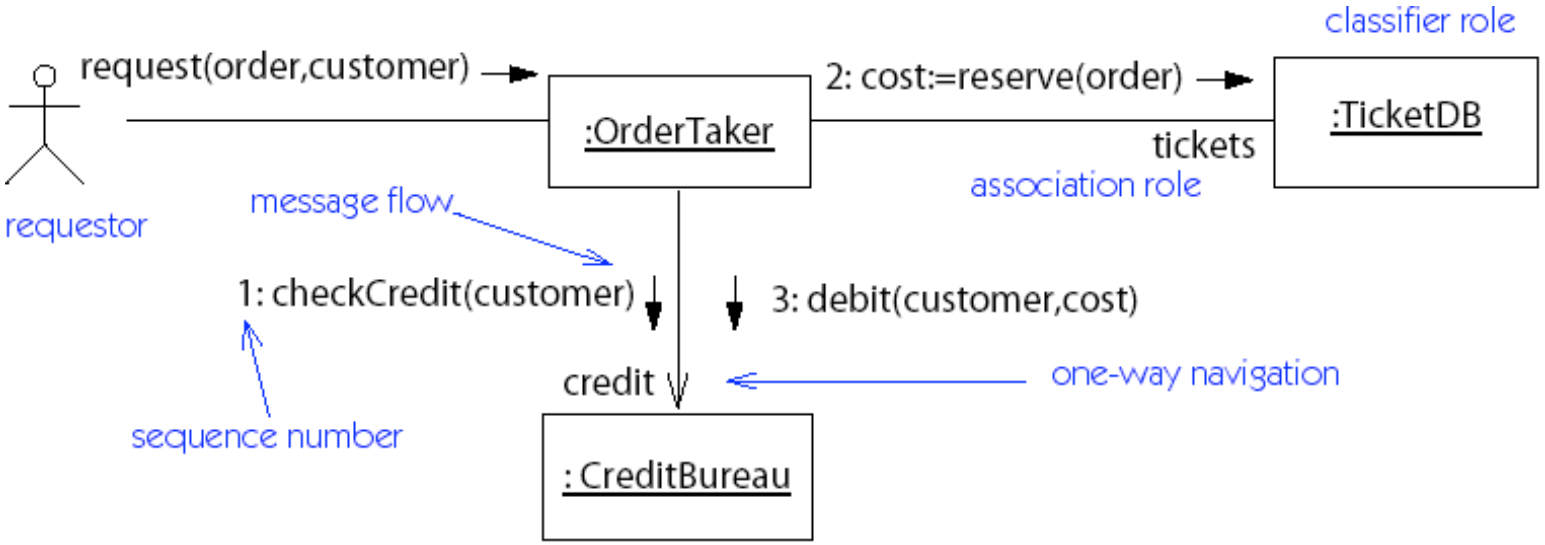


Figure 8-3. *Collaboration diagram*

Message Labels

Messages from one object to another are labelled with text strings showing the *direction* of message flow and information indicating the message *sequence*.

1. *Prior messages* from other threads (e.g. "[A1.3, B6.7.1]")
   only needed with concurrent flow of control
2. Dot-separated list of sequencing elements
   sequencing integer (e.g., "3.1.2" is invoked by "3.1" and follows "3.1.1")
   letter indicating concurrent threads (e.g., "1.2a" and "1.2b")
   iteration indicator (e.g., "1.1*[i=1..n]")
   conditional indicator (e.g., "2.3 [#items = 0]")

- *Return value* binding (e.g., "status :=")
- Message name
  1. event or operation name

5. Argument list

Nested Message Flows

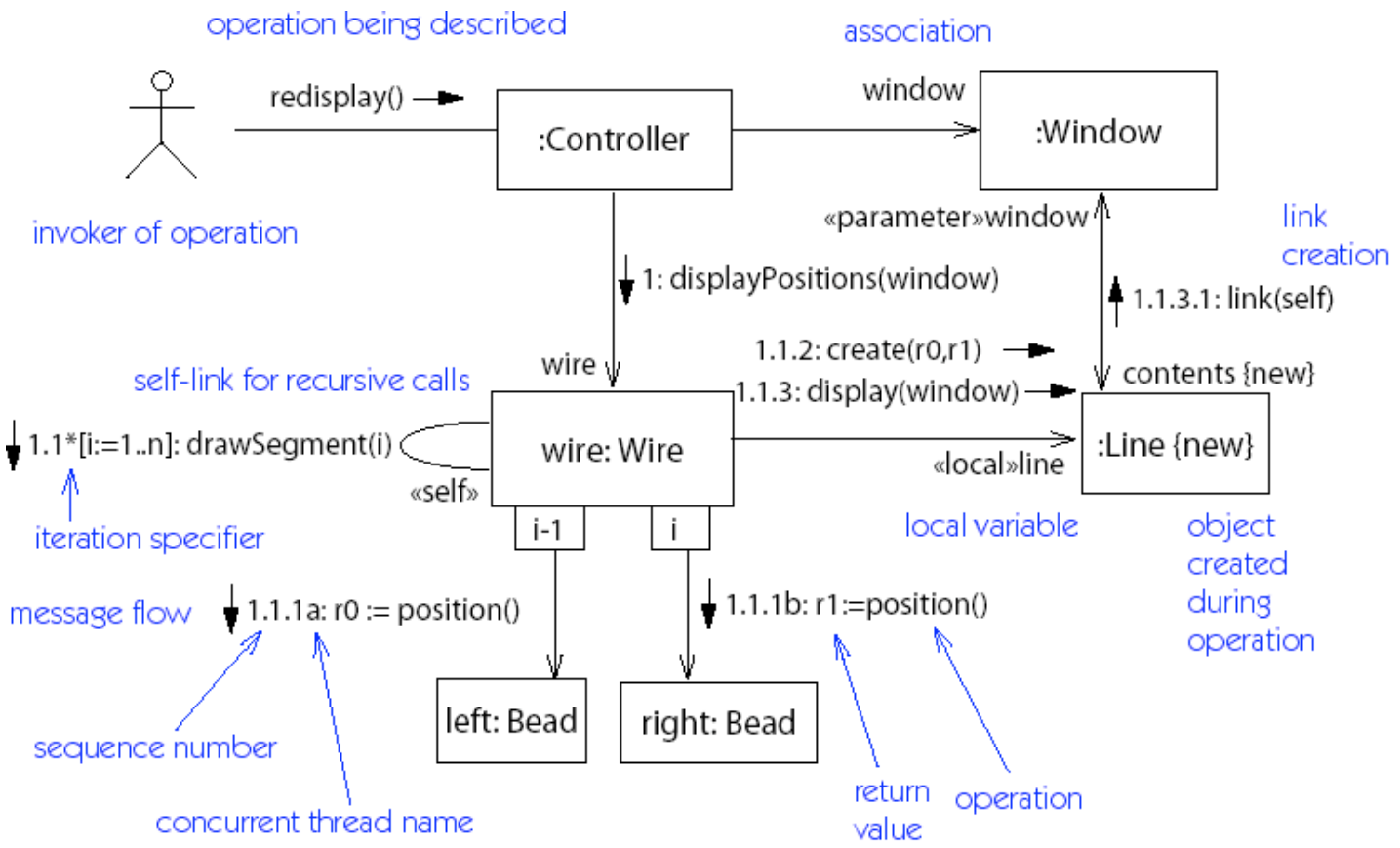


Figure 13-51. *Collaboration diagram with message flows*

Statechart Diagrams

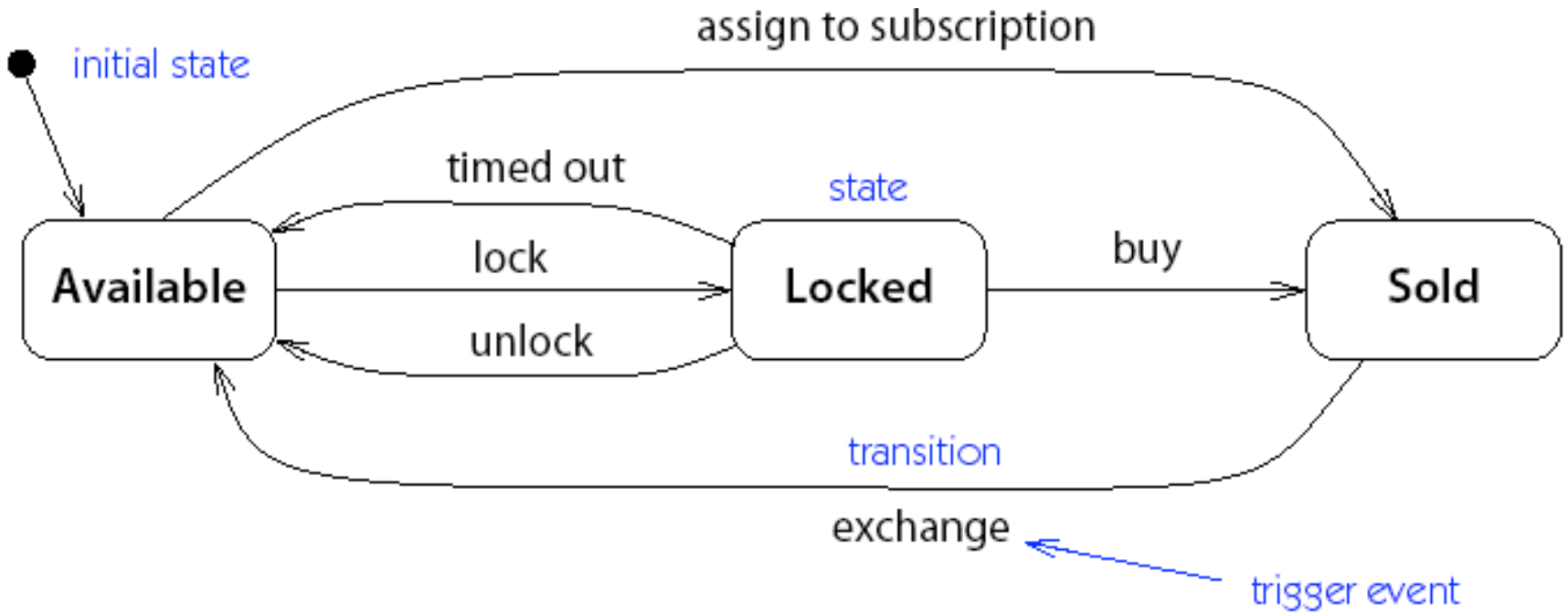


Figure 3-5. *Statechart diagram*

Statechart Diagram Notation

A Statechart Diagram describes the *temporal evolution* of an object of a given class in response to *interactions* with other objects inside or outside the system.

An event is a one-way (asynchronous) communication from one object to another:

— *atomic* (non-interruptible)

includes events from *hardware* and real-world objects e.g., message receipt, input event, elapsed time, ...

notation: ***eventName(parameter: type, ...)***

may cause object to make a *transition* between states

UML

You will get a complete lecture on that...

A notation not a process

Static

- Classes
- Relationships
- Generalization

Dynamic

- Messages
- Flows