3C03 Concurrency: Concurrent Architectures - Announcer/Listener

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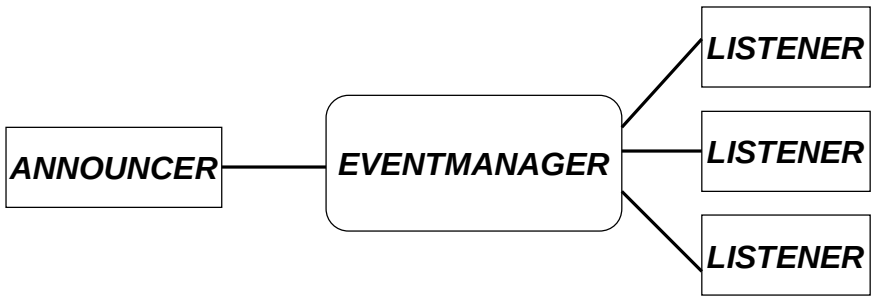
Outline

- Motivation
- Announcer-Listener
- Announcer-Listener Model
- Announcer-Listener Safety and Progress
- Announcer-Listener Implementation
- Summary

Motivation

- *Notification of events*
- *Originate in one location (announcer)*
- *Communicated to multiple interested parties (listeners)*
- *Announcer does not know listeners*
- *Listeners do not know announcer*
- *Communication managed by connector called event manager*

Announcer-Listener Architecture



Application Examples

- *User Interface Frameworks:*
  - *AWT Listeners are ordinary objects*
  - *Events are mouse clicks, button presses*
  - *Events cause operations to be invoked in Listeners*
- *CORBA Event Service*
  - *Event Producers are Announcers*
  - *Event Channels are Event Managers*
  - *Event Consumers are Listeners*
  - *Used, for example in distributed stock tickers*

Filtering & Recursive Events

- *Listeners may only be interested in a subset of events*
- *They register with Event Manager using a "pattern" of events they wish to receive*
- *Listeners may themselves be announcers and forward events into subsequent Event Managers*
- *Listeners do not have to be active processes*

Event Manager Model

```
set Listeners={a,b,c,d}
set Pattern = {pat1,pat2}
REGISTER = IDLE,
IDLE=(register[p:Pattern]->MATCH[p]
     |announce[Pattern]->IDLE),
MATCH[p:Pattern]=
  (announce[a:Pattern]->
     if (a==p) then (event[a]->MATCH[p]
                    |deregister->IDLE)
               else MATCH[p]
  |deregister->IDLE).
||EVENTMGR=(Listeners:REGISTER)
           /{announce/Listeners.announce}.
```


LTSA

Announcer-Listener Model

```
ANNOUNCER = (announce[Pattern]->ANNOUNCER).
LISTENER(P='pattern)=(register[P]->LISTENING),
LISTENING=(compute->LISTENING
          |event[P]->LISTENING
          |event[P]->deregister->STOP
          )+{register[Pattern]}.
||ANNOUNCER_LISTENER=( a:LISTENER('pat1)
                     ||b:LISTENER('pat1)
                     ||c:LISTENER('pat2)
                     ||d:LISTENER('pat2)
                     ||EVENTMGR
                     ||ANNOUNCER).
```

Announcer-Listener Analysis

- ***Safety-Properties:***
  - ***Listeners receive events then and only then when they are registered for them***
  - ***Listeners only receive events that match the patterns they have registered for***
- ***Progress-Properties***
  - ***Announcer should be able to announce events independent of state of Listeners***

Announcer-Listener Analysis

- ***Safety Properties:***

```
property
  SAFE=(register[p:Pattern]->SAFE[p]),
  SAFE[p:Pattern]=(event[p]->SAFE[p]
                  |deregister->SAFE).
```

- ***Progress Properties:***

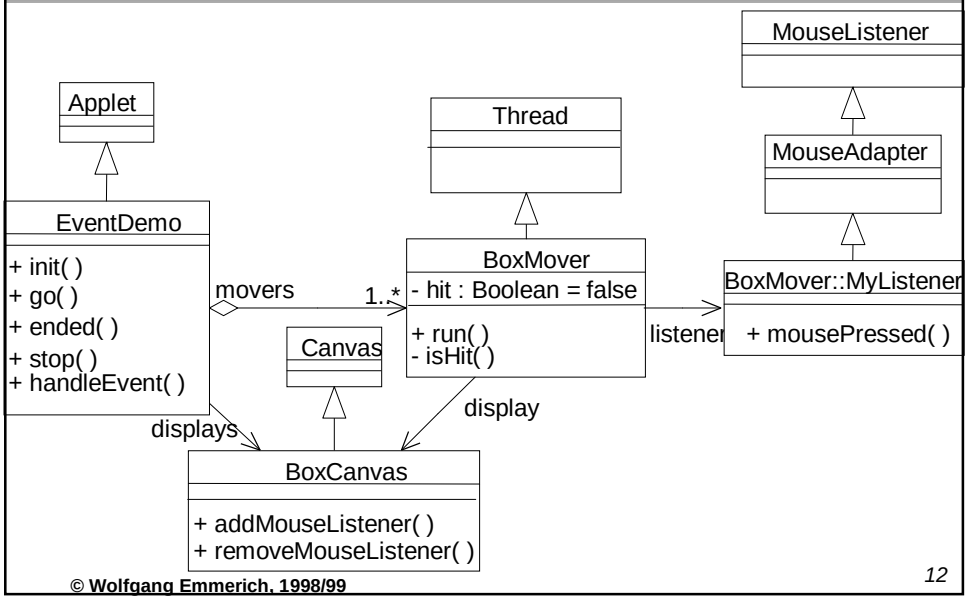
```
progress ANNOUNCE[p:Pattern]={announce[p]}
```

Announcer-Listener Example

- ***Game:***
  - ***Coloured Blocks are moving around on a canvas***
  - ***Hit them with a mouse press***
  - ***A hit block turns black and stops moving***
  - ***Blocks are threads that listen for mouse events***
  - ***Events are announced by the display canvas***
  - ***Events are generated by the AWT classes for Event handling***

Demo

Announcer Listener Design



Summary

- *Announcer-Listener*
- *Applications for Announcer-Listener*
- *Announcer-Listener Model*
- *Announcer-Listener Safety and Progress*
- *Announcer-Listener Implementation*
- *Summary*