COAST

An Open Source Smalltalk Framework
to Build Synchronous Collaborative Applications

Jan Schümmer, Till Schümmer, Christian Schuckmann

GMD - IPSI, Darmstadt, Germany
intelligent views, Darmstadt, Germany

{jan.schuemmer|till.schuemmer}@gmd.de
christian.schuckmann@i-views.de

focus

Support the development of

- object oriented,
- synchronous,
- interactive, and
- complex
  (e.g. hypermedia applications)

groupware.

motivation

requirements

application structure

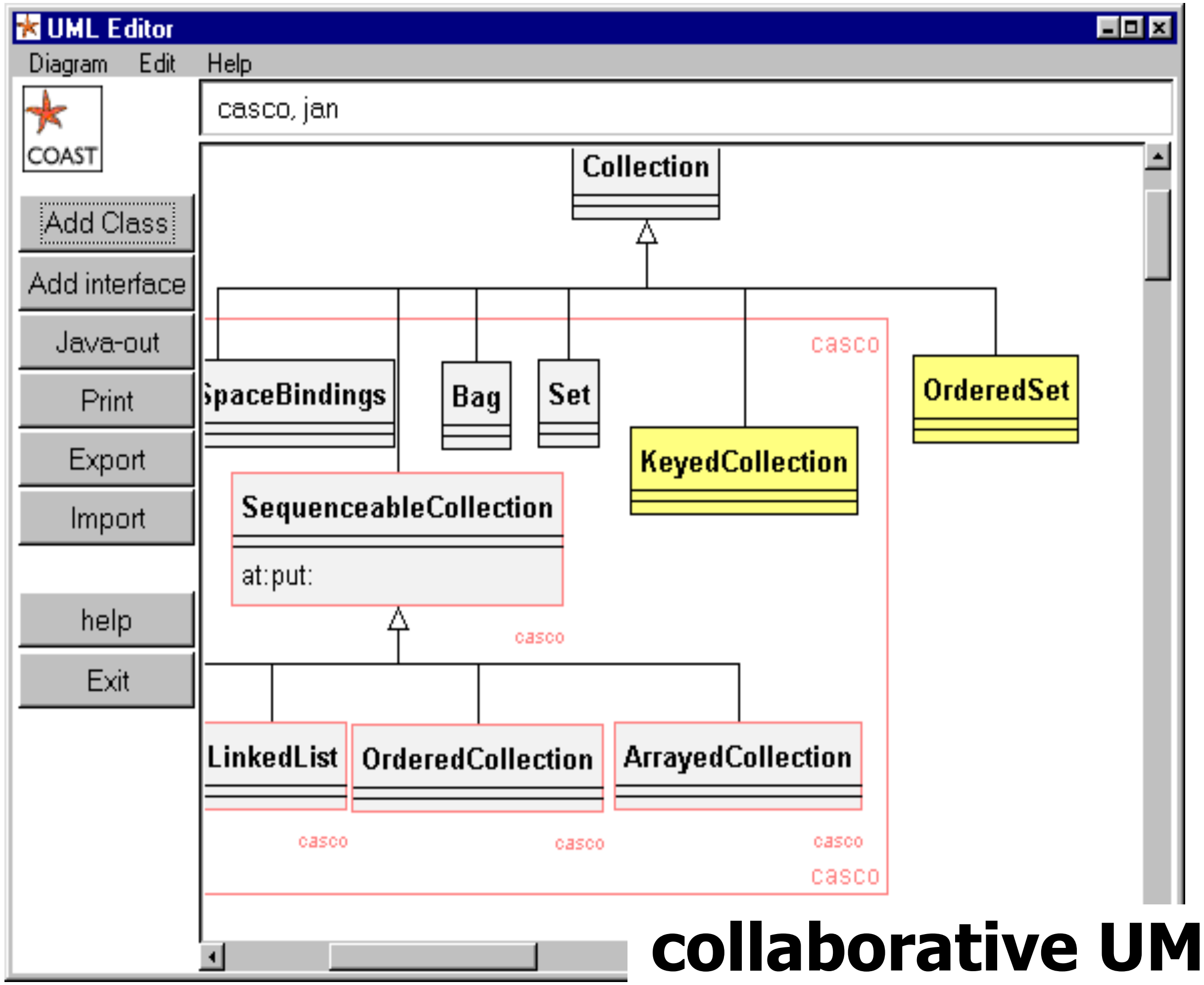
groupware model

realization

usage experiences

COAST

sample groupware application



collaborative UML editor

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problem statement

Writing groupware is difficult.

It is different from single-user application development.

- more than one user at a time (multiple I/O)
- provision of group awareness
- support of different collaboration modes

It is error prone.

- process synchronization
- data consistency
- network (components) failure

support groupware developers

architecture

- reference architecture
- ready-to-use components
  - e.g. server component

model

- class hierarchy serves as a template for groupware applications

implementation

- do and hide as much of the 'hard and dirty work' as possible
  - e.g. synchronisation of shared objects

requirements

groupware-specific requirements

- group awareness
- coupling control
- session management
- floor control

general requirements

- ease of use => right level of abstraction
- consistency, uniform approach
- reusability

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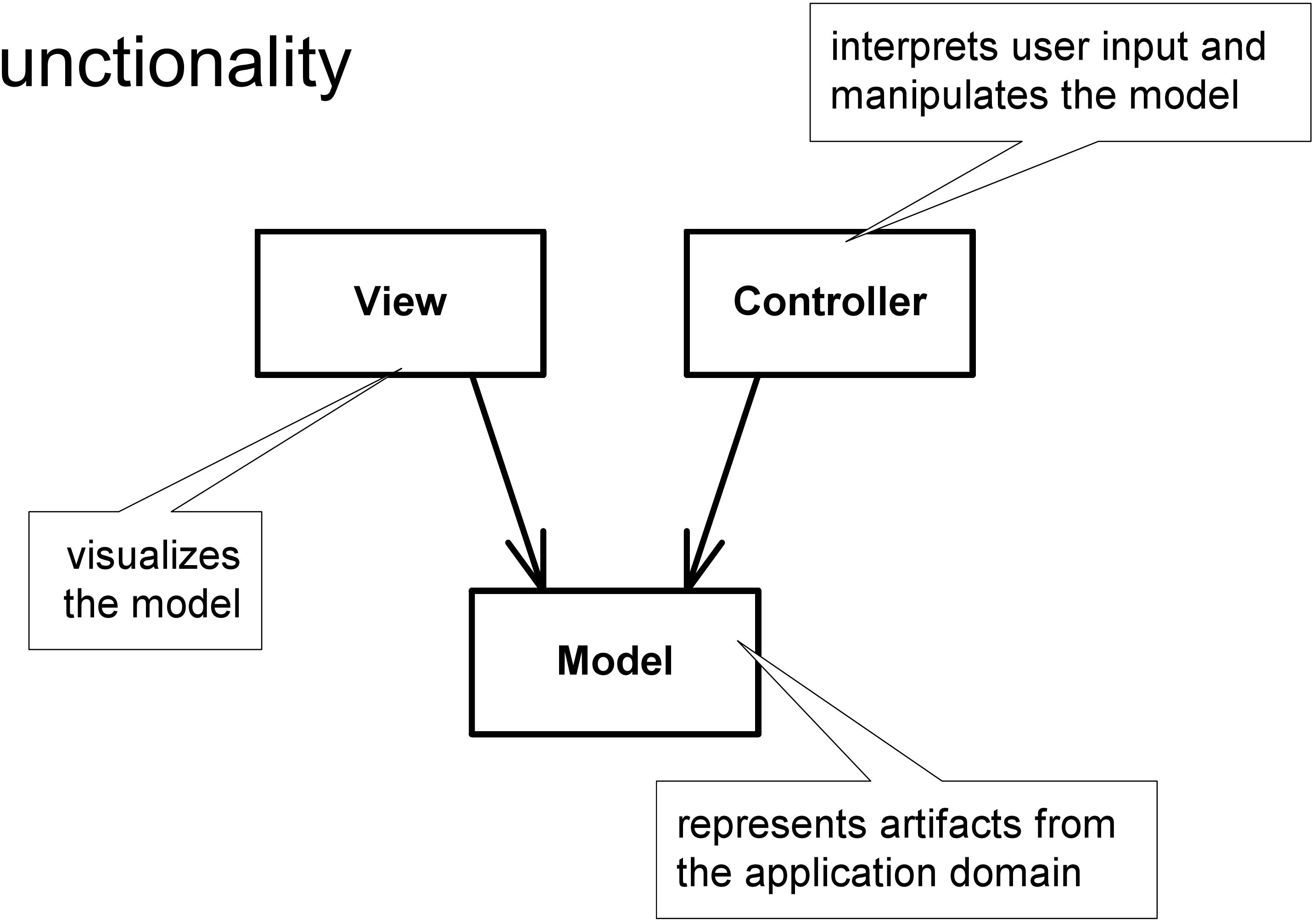
structure in single-user applications 1

divide functionality


interprets user input and manipulates the model
View
Controller
visualizes the model
Model
represents artifacts from the application domain

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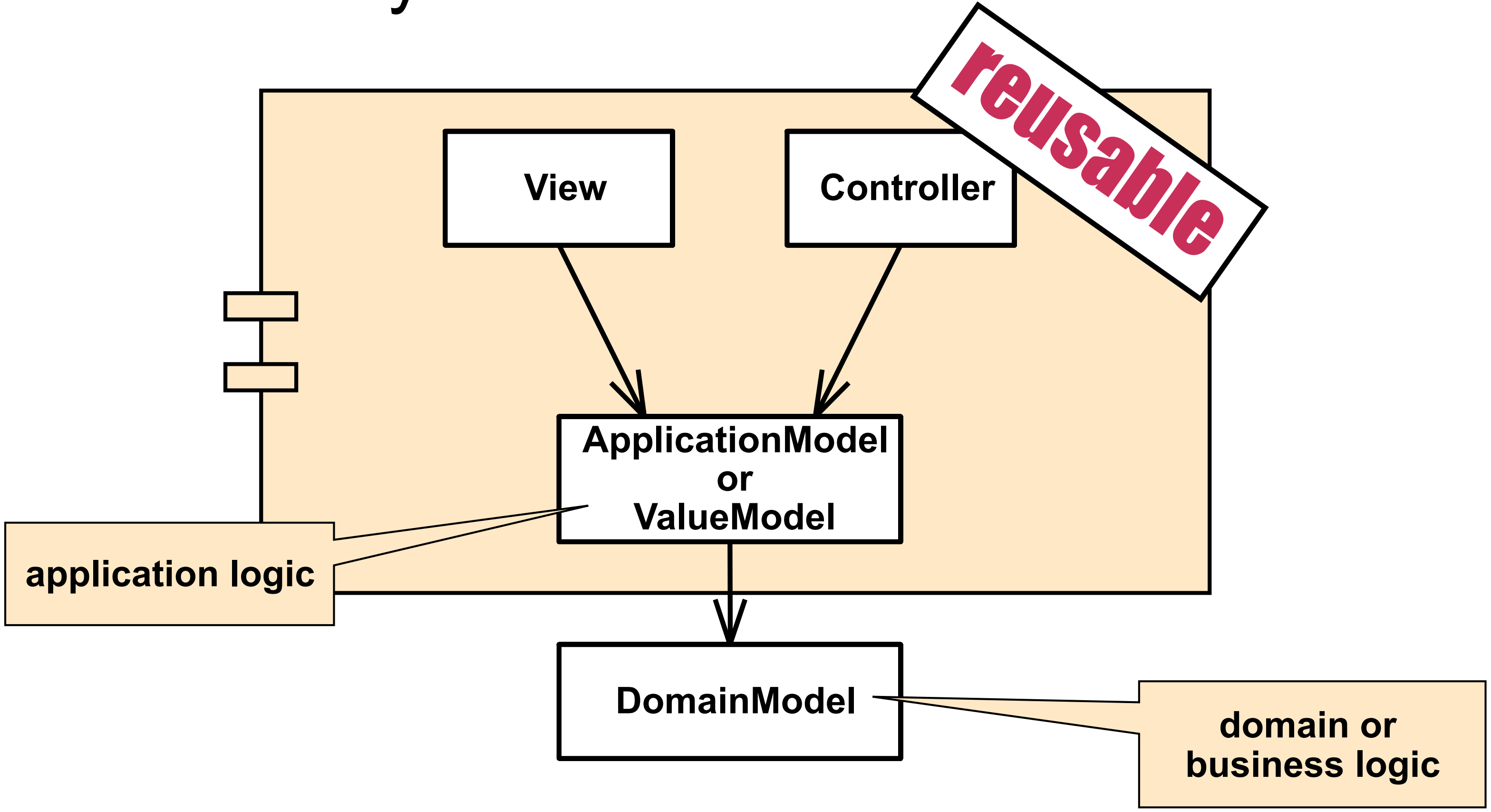
structure in single-user applications 2

increase reusability



application logic

domain or business logic

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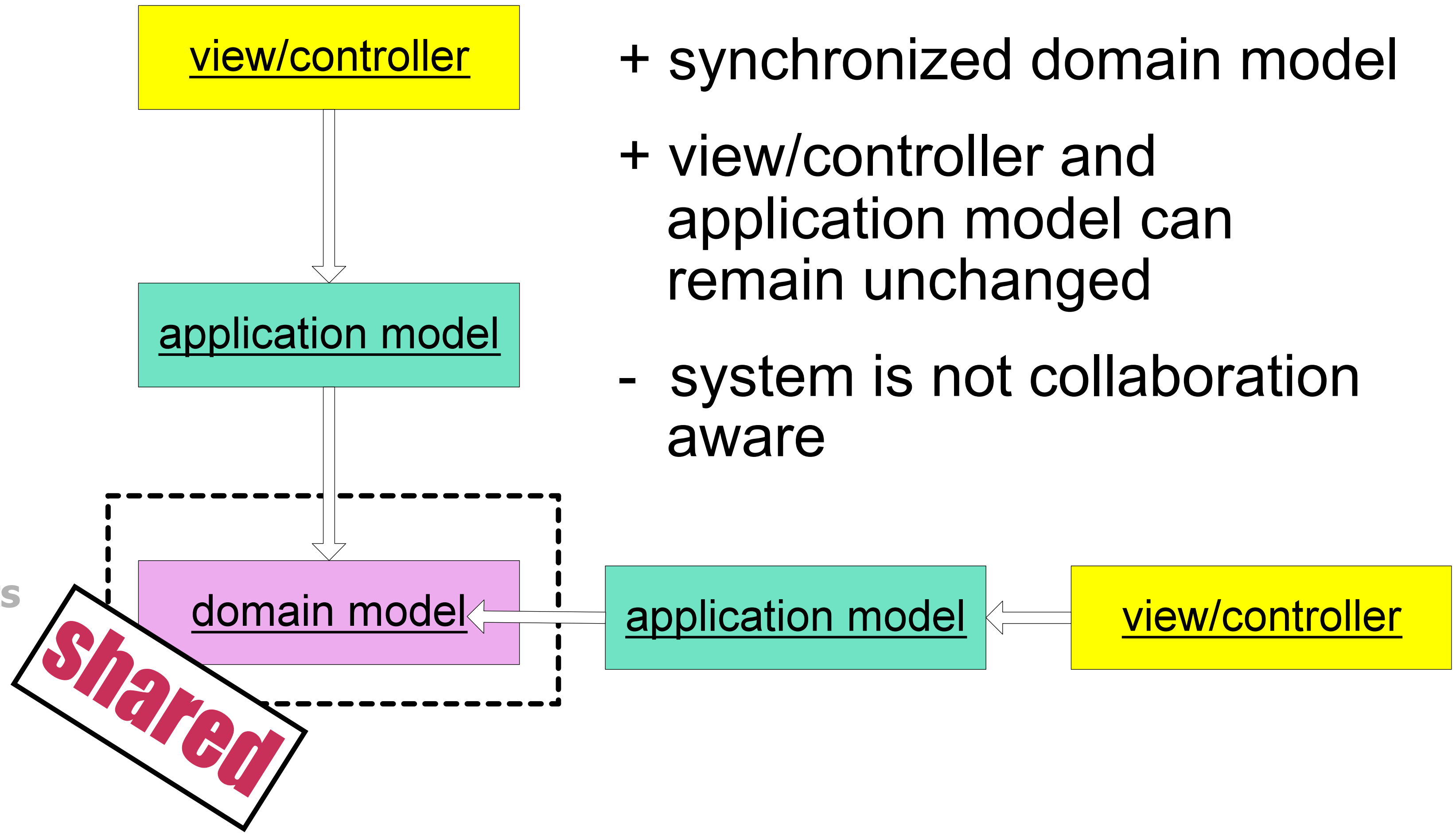
from single-user to multi-user: sharing the domain model



+ synchronized domain model

+ view/controller and application model can remain unchanged

- system is not collaboration aware

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from single-user to multi-user: sharing the application model

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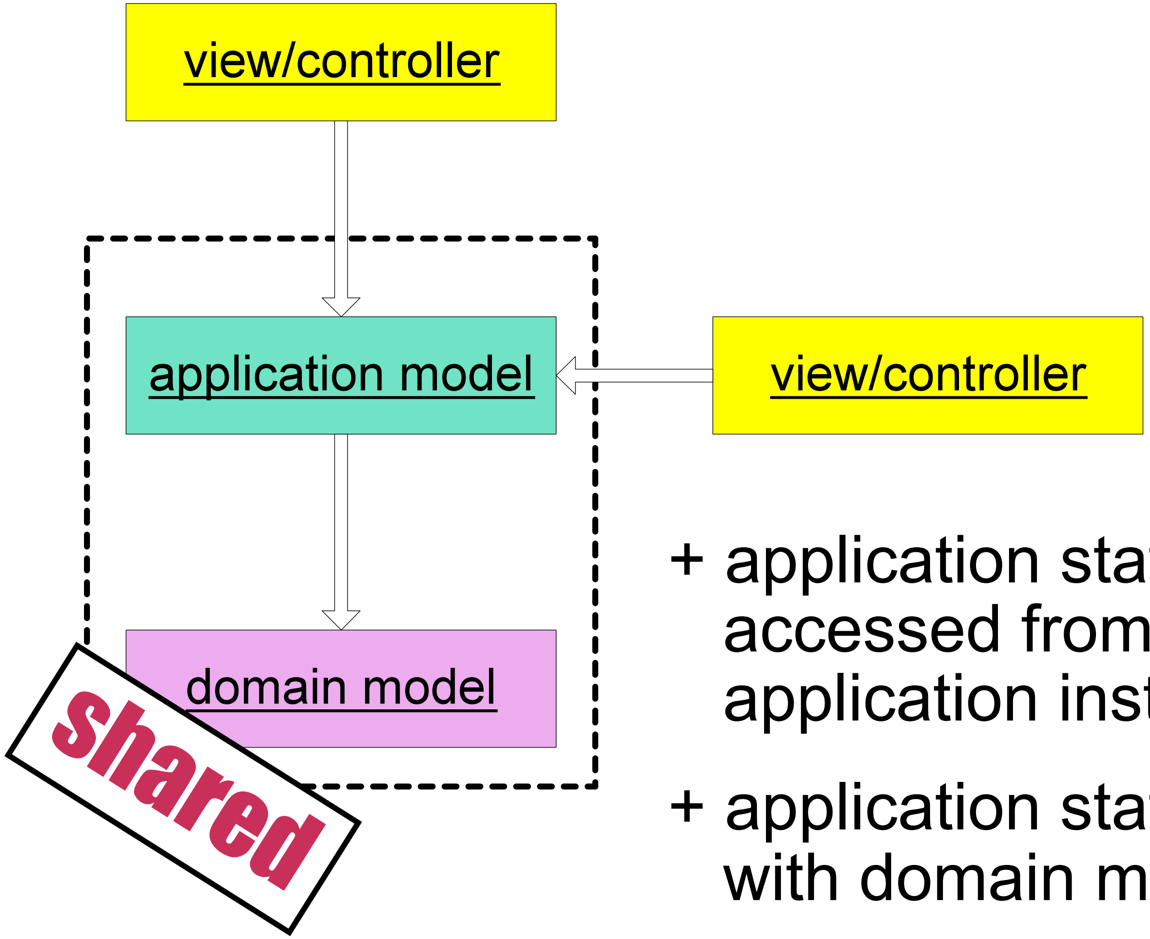

+ application state can be accessed from each application instance

+ application state consistent with domain model state

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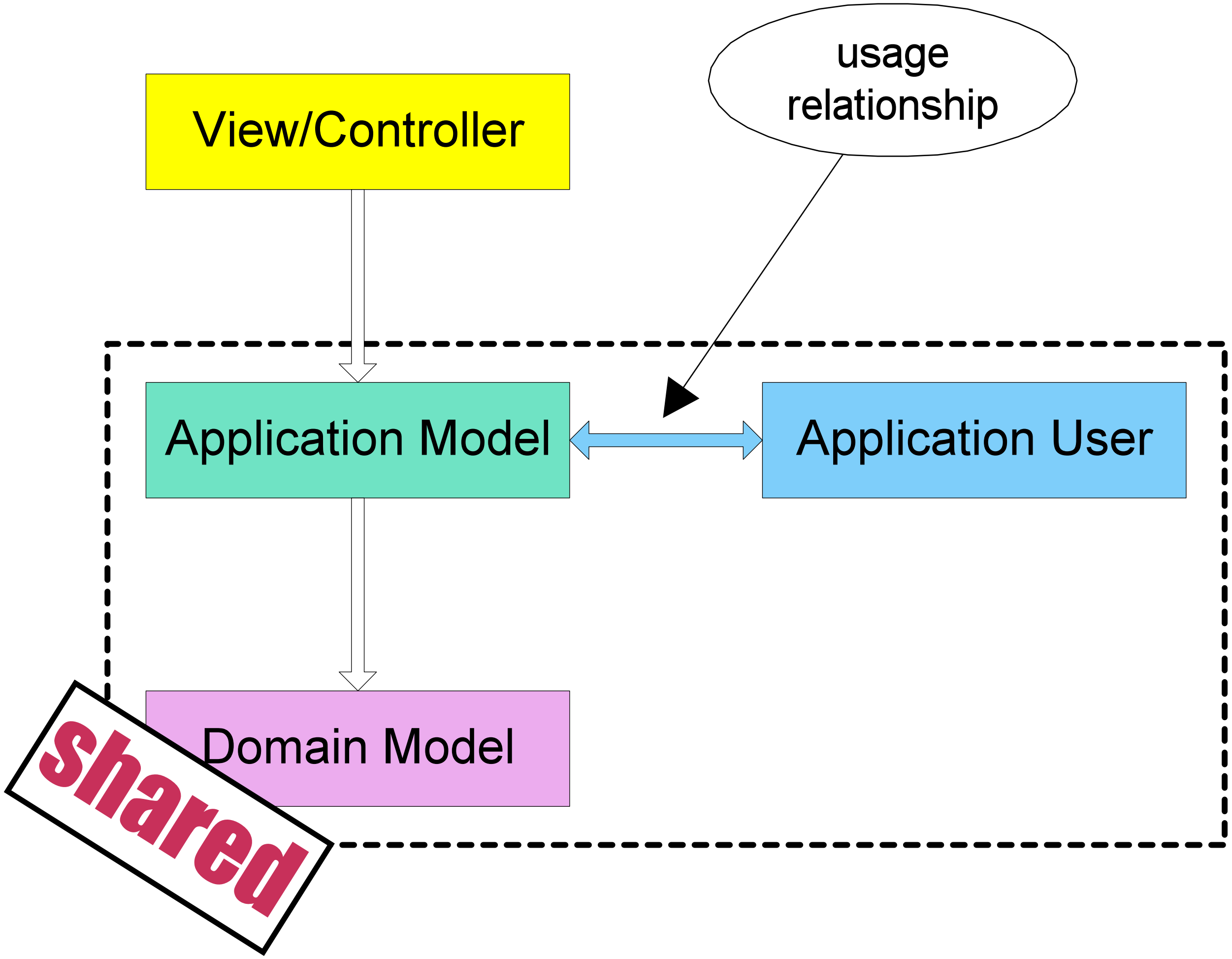
from single-user to multi-user: the user comes into play



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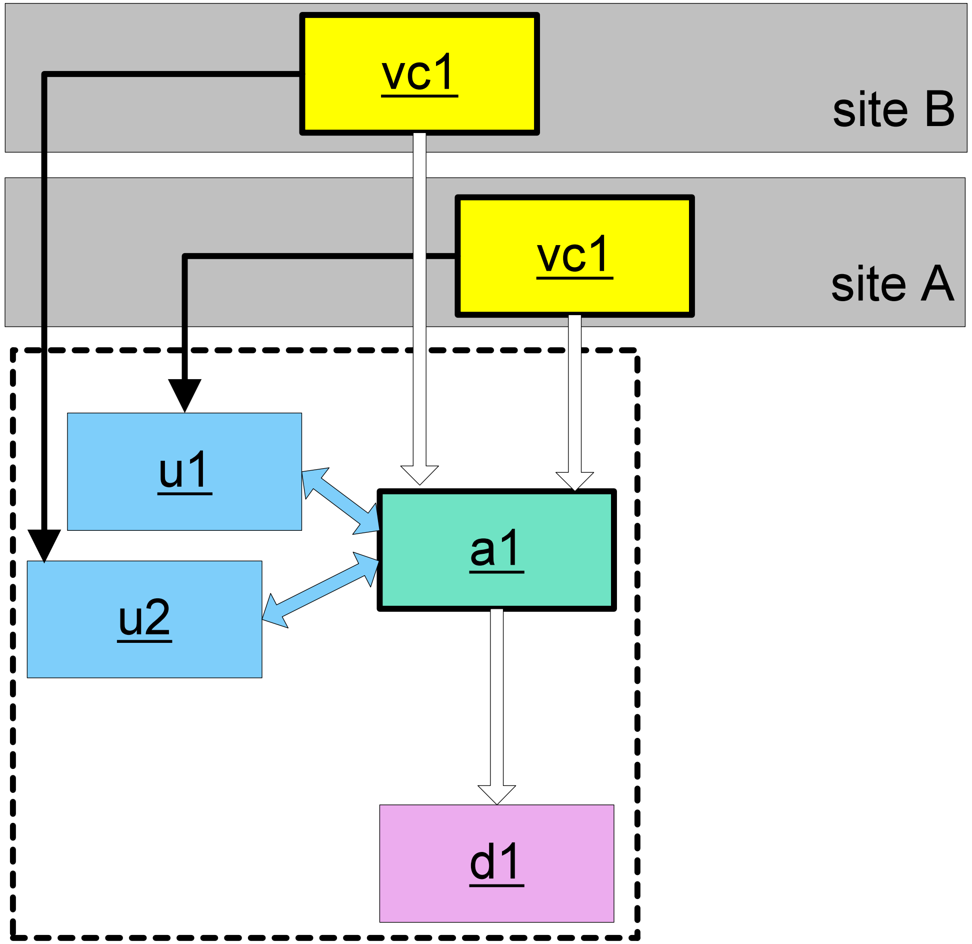
logical session management



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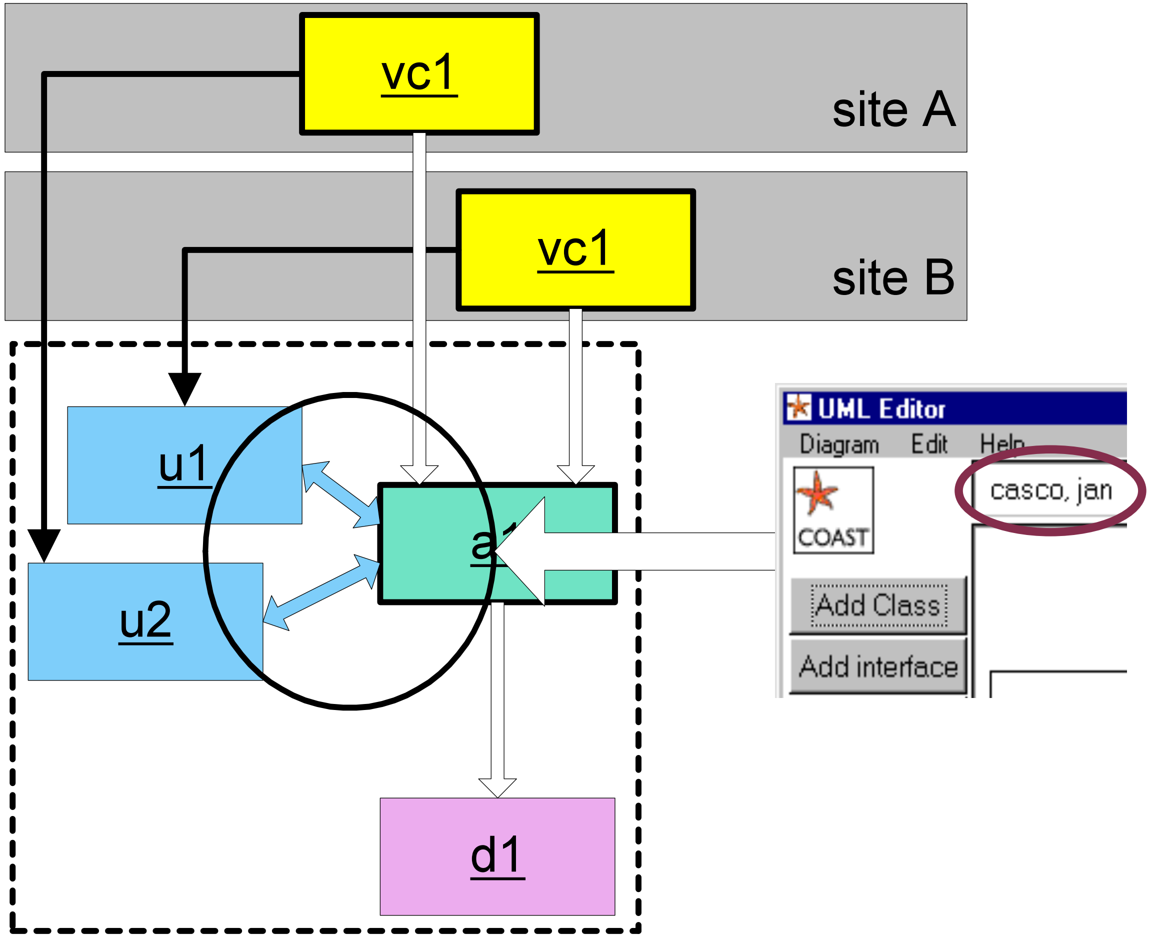
provision of group awareness



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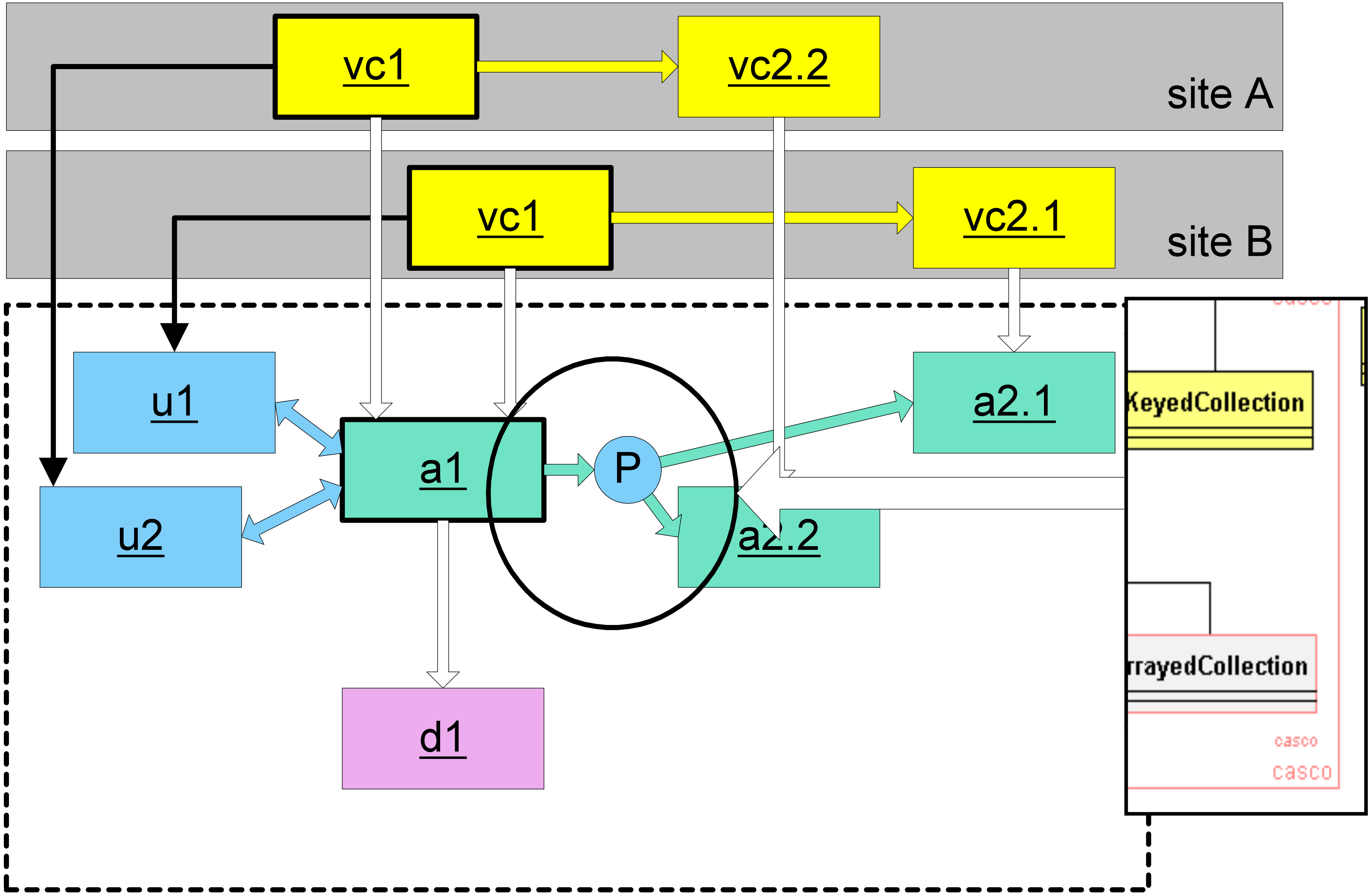
coupling control



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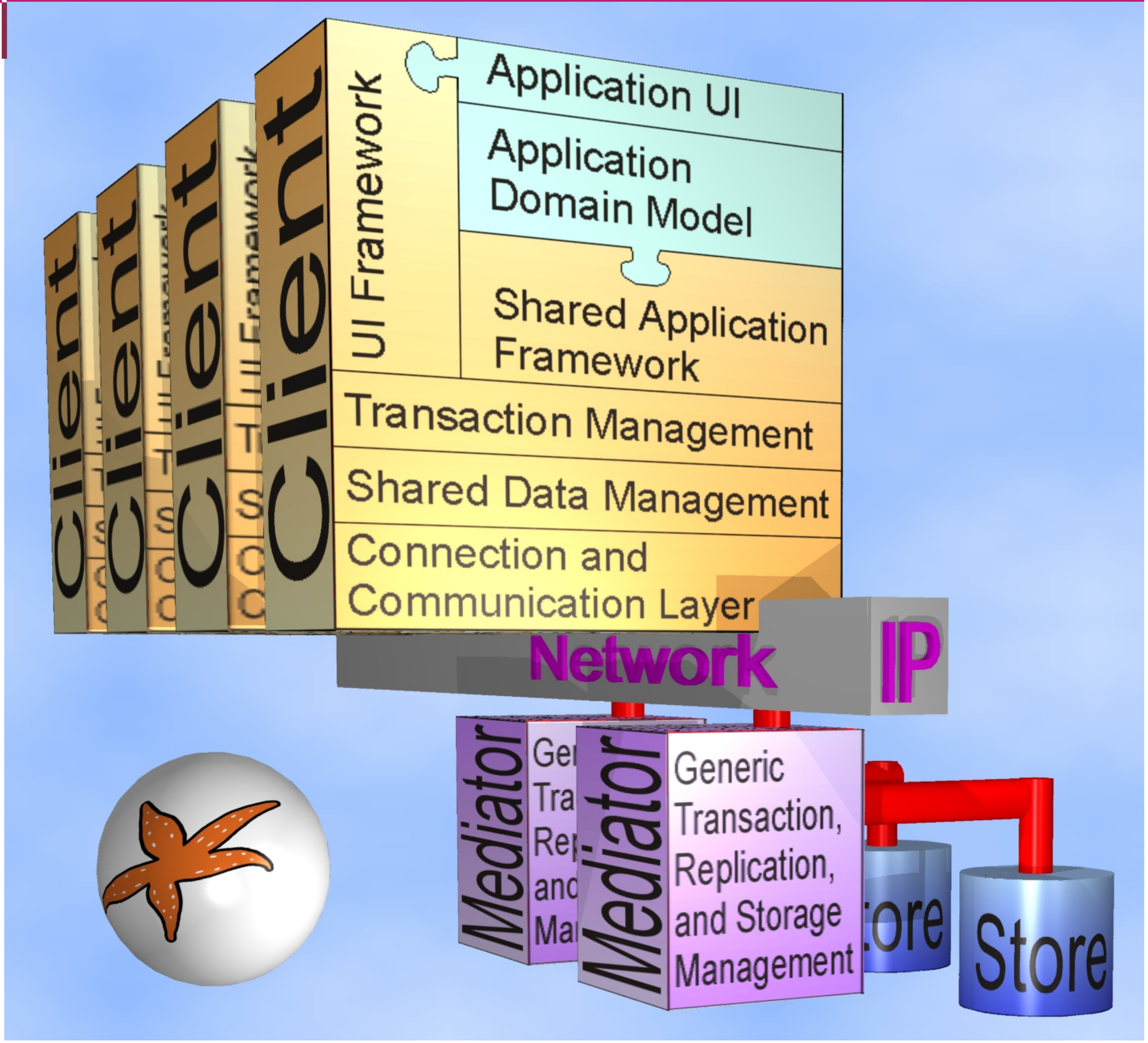
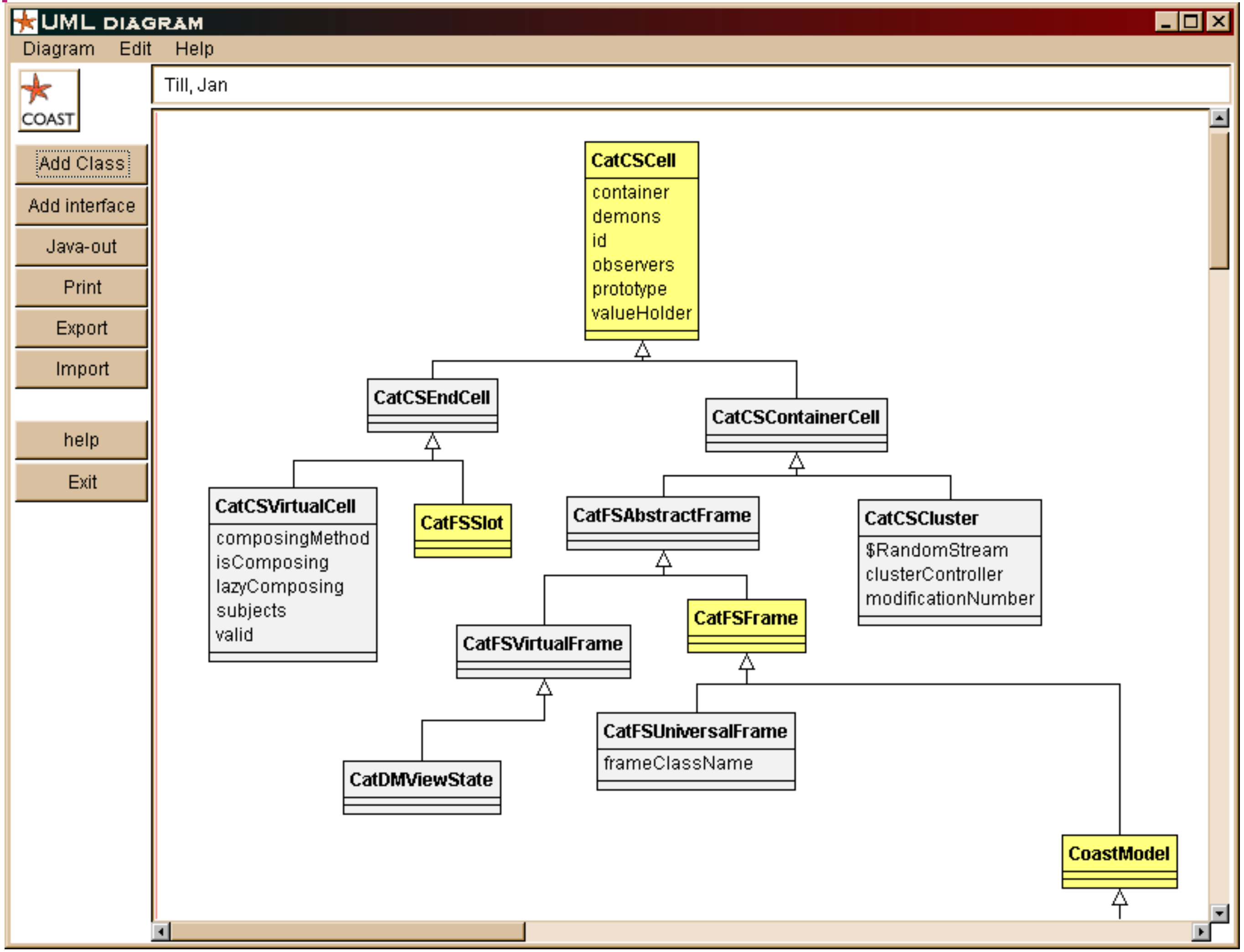
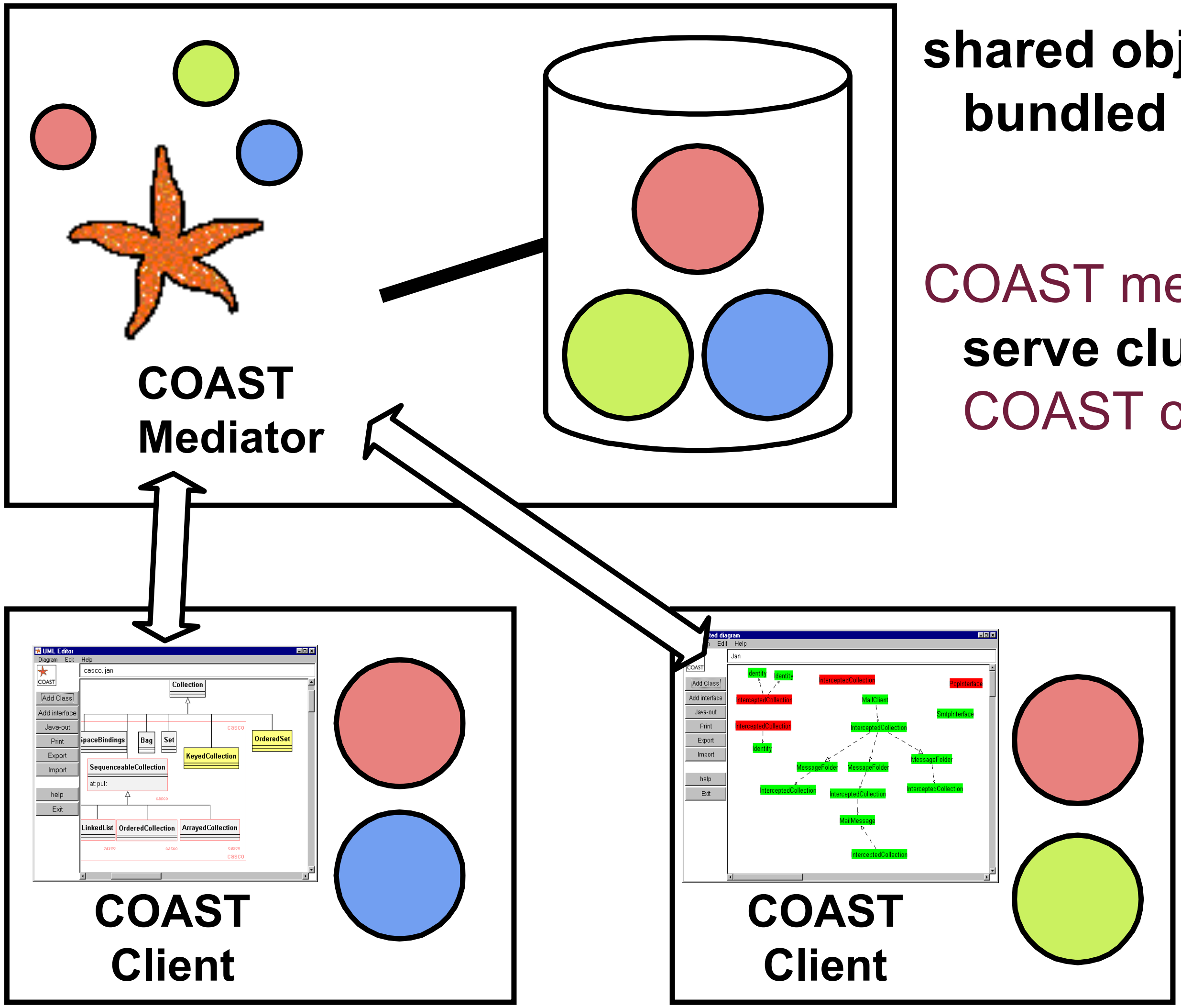
system architecture



COAST class hierarchy



shared data management



shared objects are bundled in clusters

COAST mediators **serve clusters to** COAST clients

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transactions

shared objects are modified in transactions

- prevent inconsistencies
- short transactions
- optimistic or pessimistic
- ACID properties

transaction processing

- local execution
- local commit
- send agenda to mediator
- global commit / reject
- broadcast changes to synchronize replica

view updating

virtual slots

- cache computation results
- computation
  - on demand (lazy)
  - on invalidation (eager)
- automatic invalidation
- dependencies between model and virtual slots are detected by the framework

views have virtual slots that trigger redisplay

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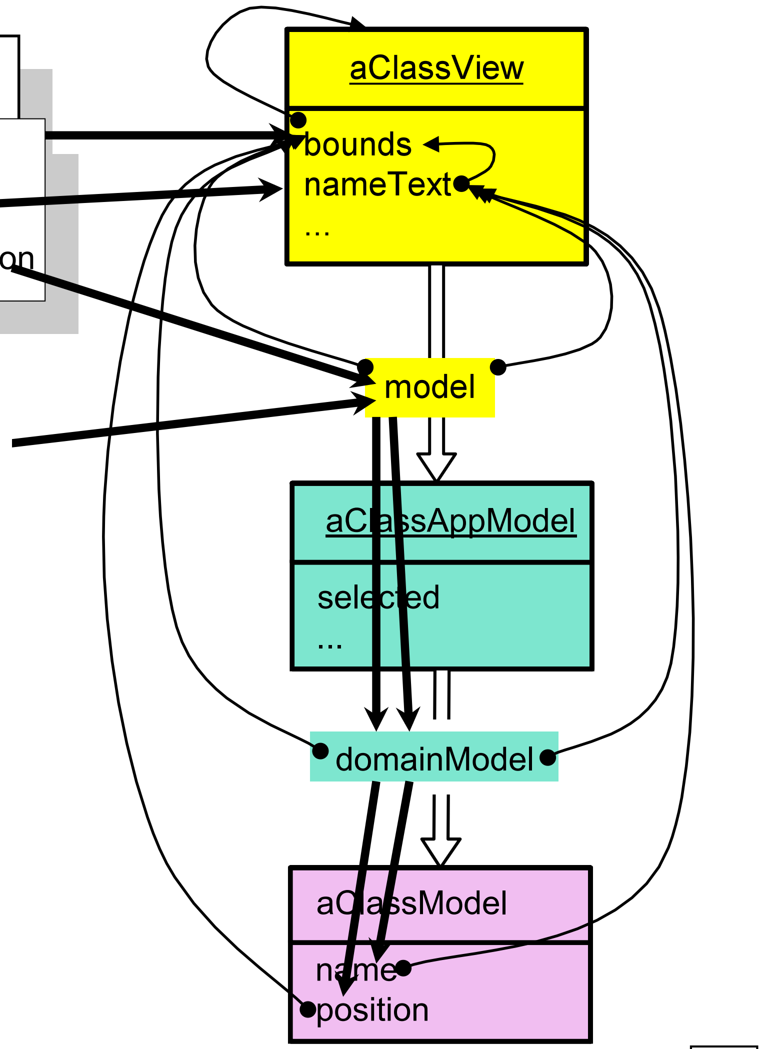
virtual slots: computation

```
composeDisplayOn: aGraphicsContext
    aGraphicsContext paint: ColorValue gray.
```

```
computeBounds
    | boundingRect |
    boundingRect := self nameText bounds.
    ^boundingRect translatedBy: self model domainModel position
```



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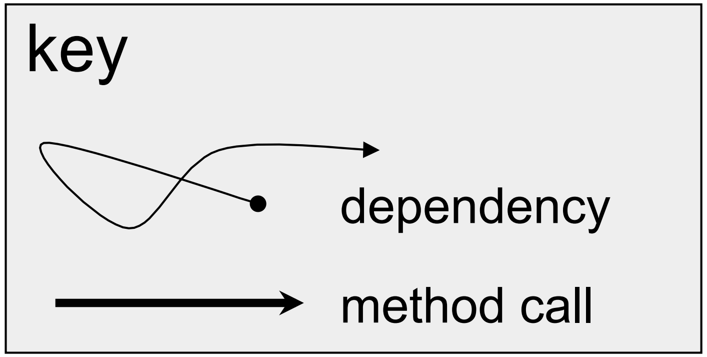

view updating

constraint mechanism ensures display consistency

display updating integrated into transaction scheme

- invalidation phase: accumulate display damage
- updating phase: repair display damage

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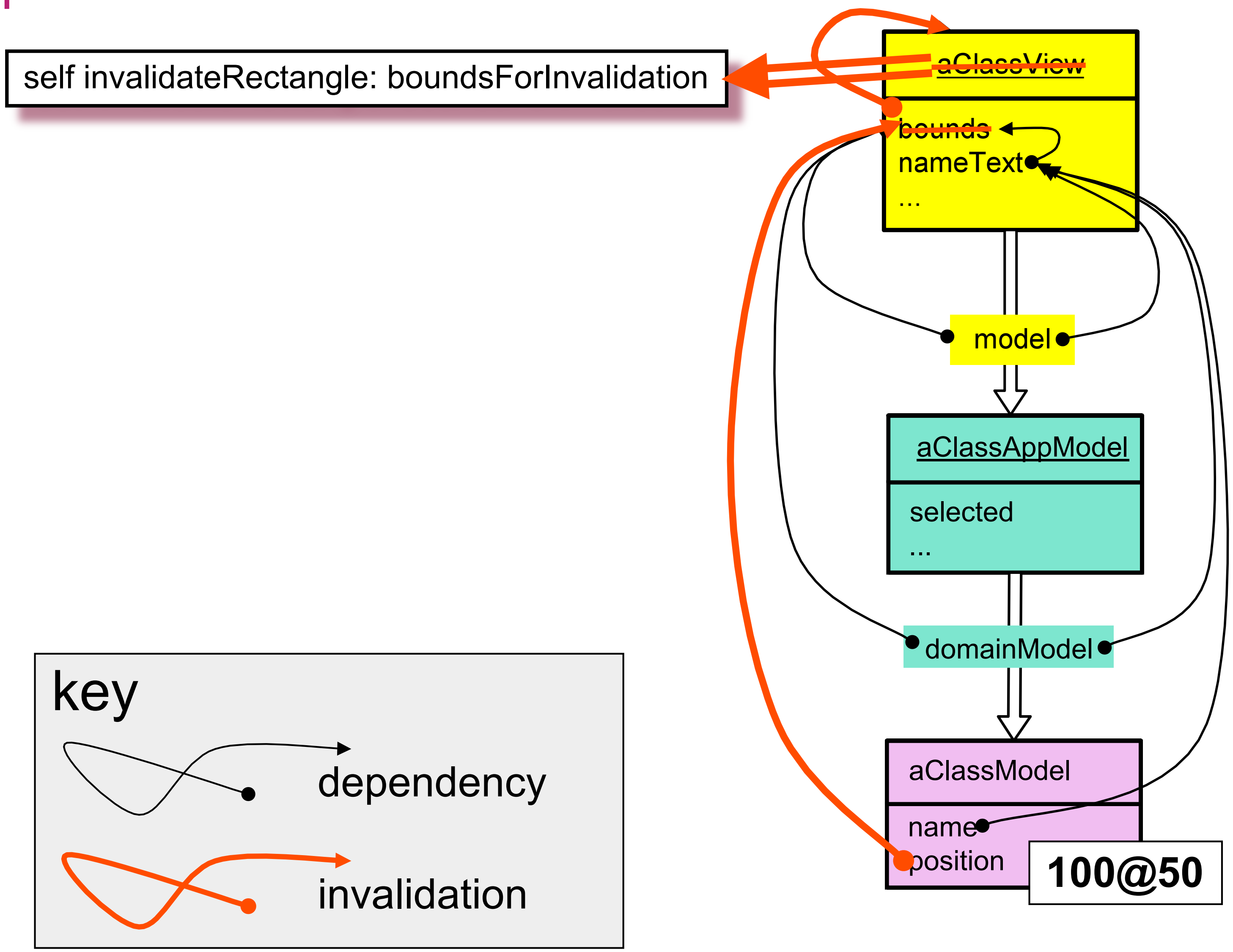
view updating: change notification



```
self invalidateRectangle: boundsForInvalidation
```

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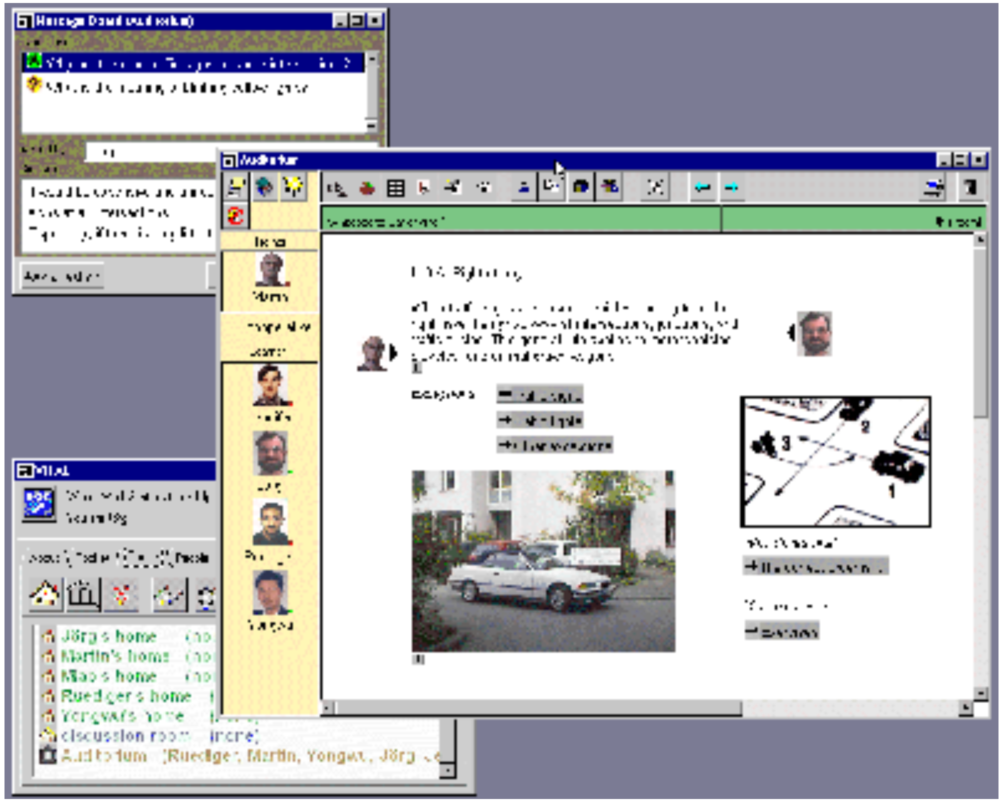
applications - learning

VITAL

CROCODILE



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applications - process modelling

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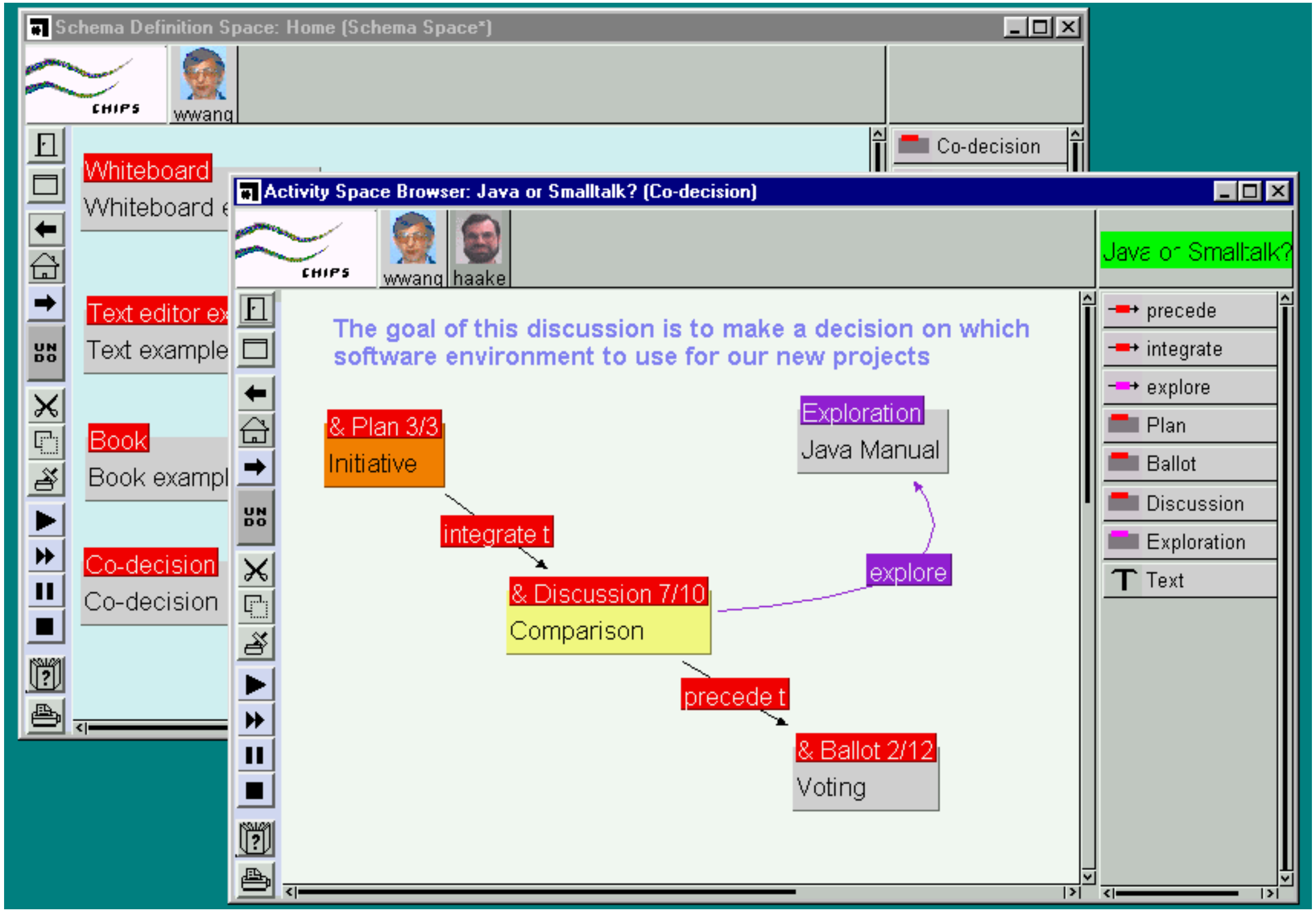
CHIPS



The goal of this discussion is to make a decision on which software environment to use for our new projects

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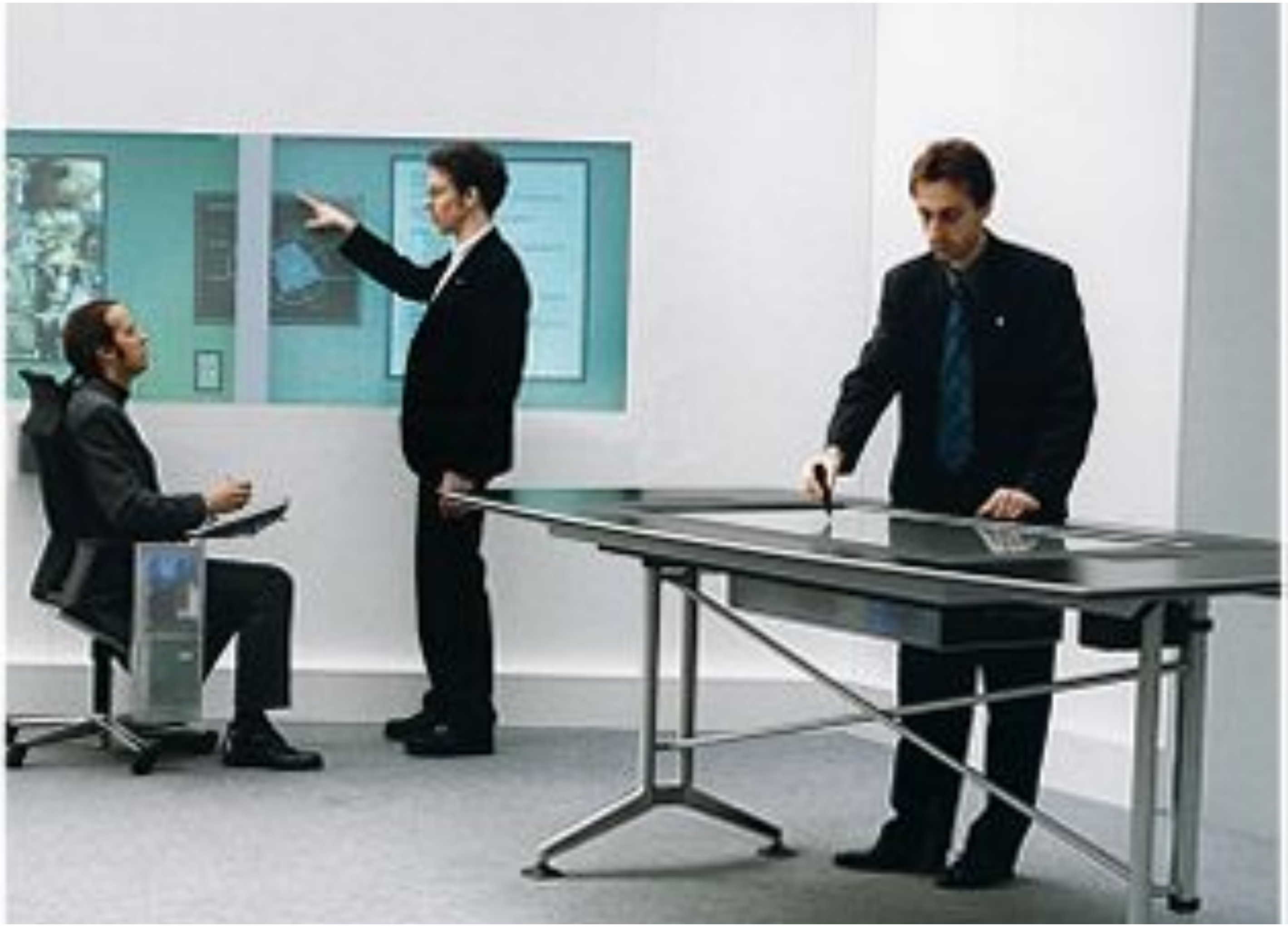
applications - roomware

Beach



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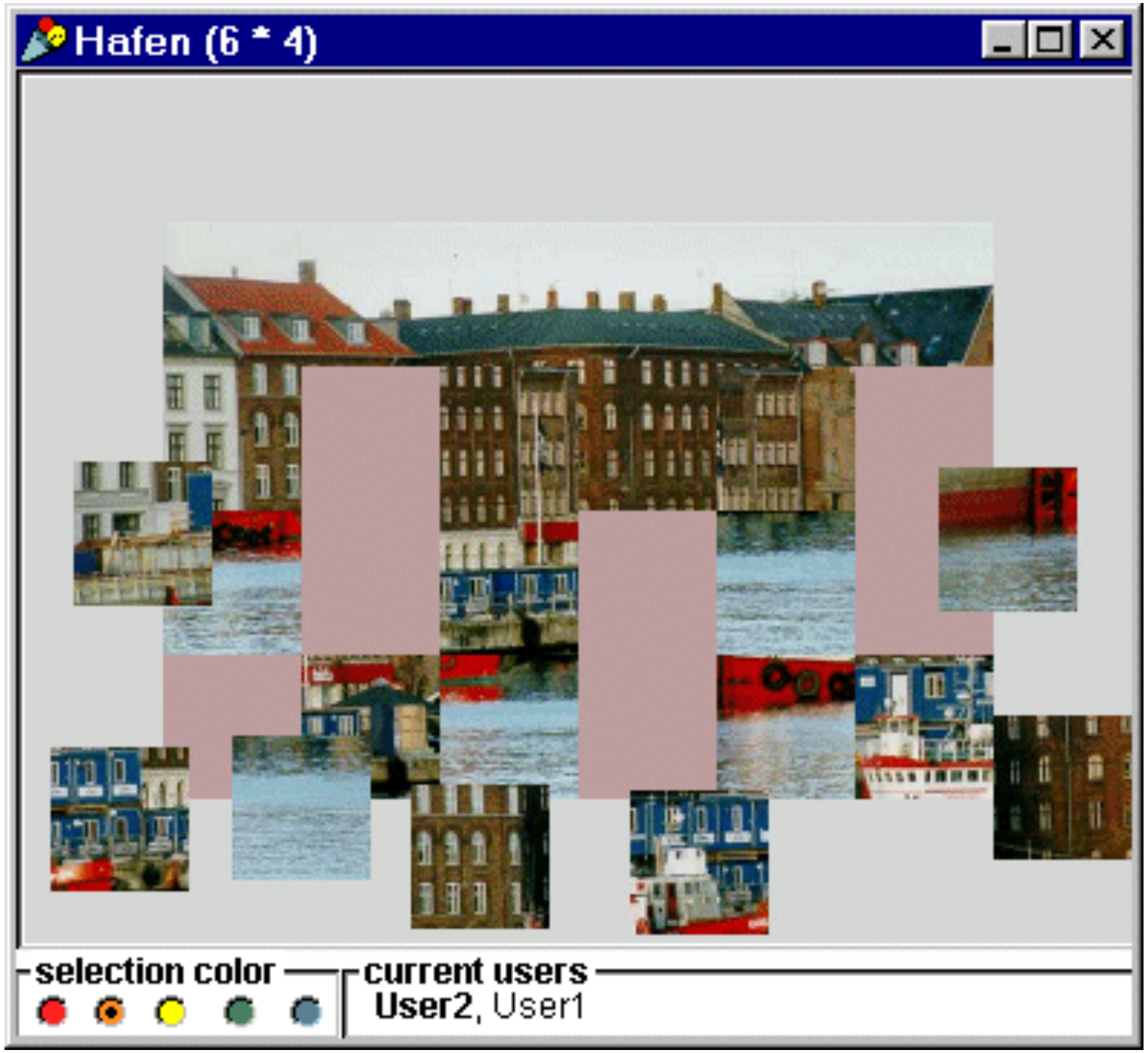
Co-operative Puzzle



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applications - software dev.

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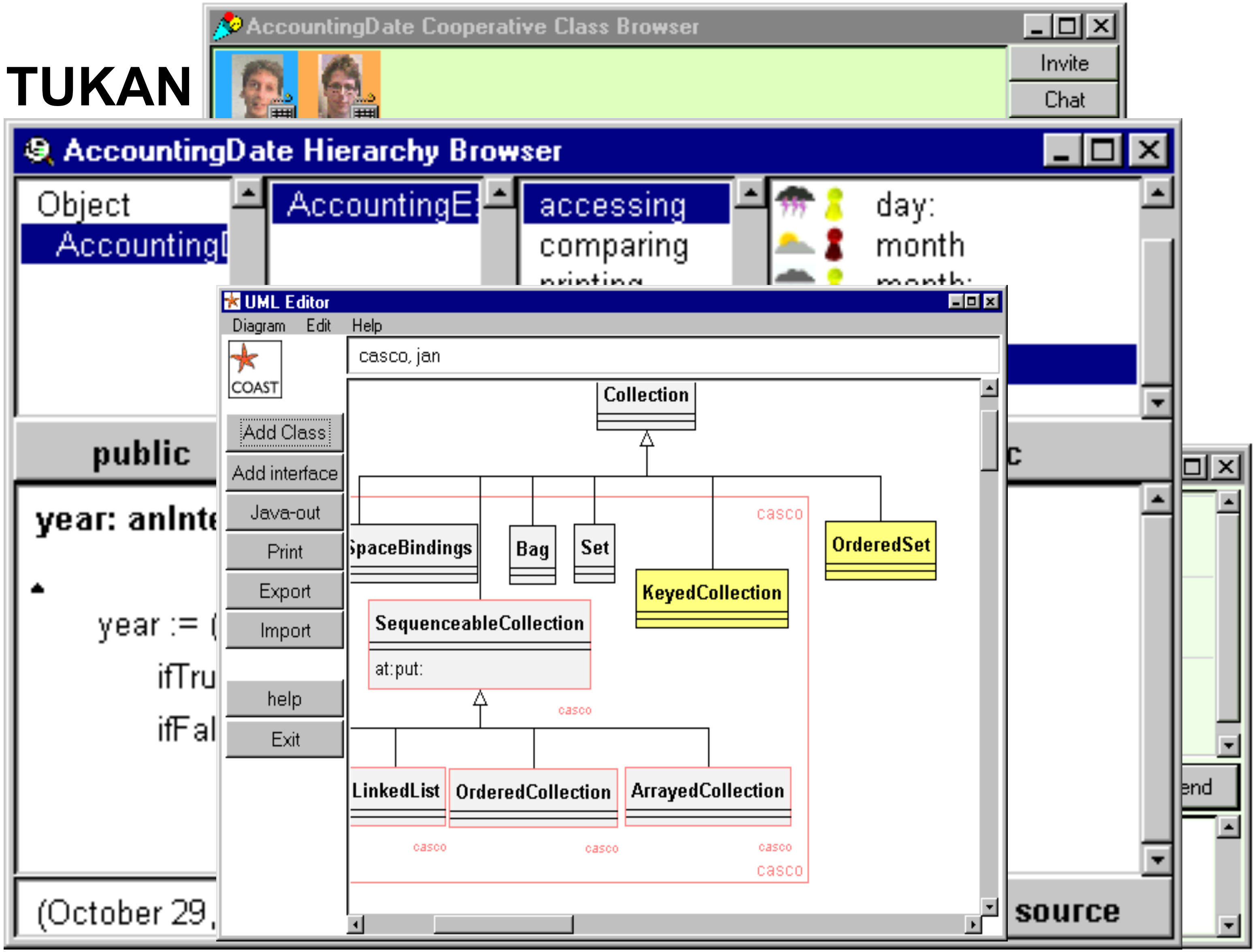
TUKAN



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**usage
experiences**

usage experiences 1

performance

- COAST-applications are as fast as comparable single user applications

size of the shared object space

- up to now, a maximum of 30.000 was reached

number of users

- VITAL was tested with up to 12 simulanousley working users

usage experiences 2

network connection

- low bandwidth for synchronisation of replica
- initial effort for replication
- VITAL tested via 28.800 Bps modem connection
- UML-editor tested between Germany and Argentina

development effort for COAST applications

- learning effort for newbys
- experienced developers
  - one week for first version of UML editor
  - one weekend for the collaborative puzzle

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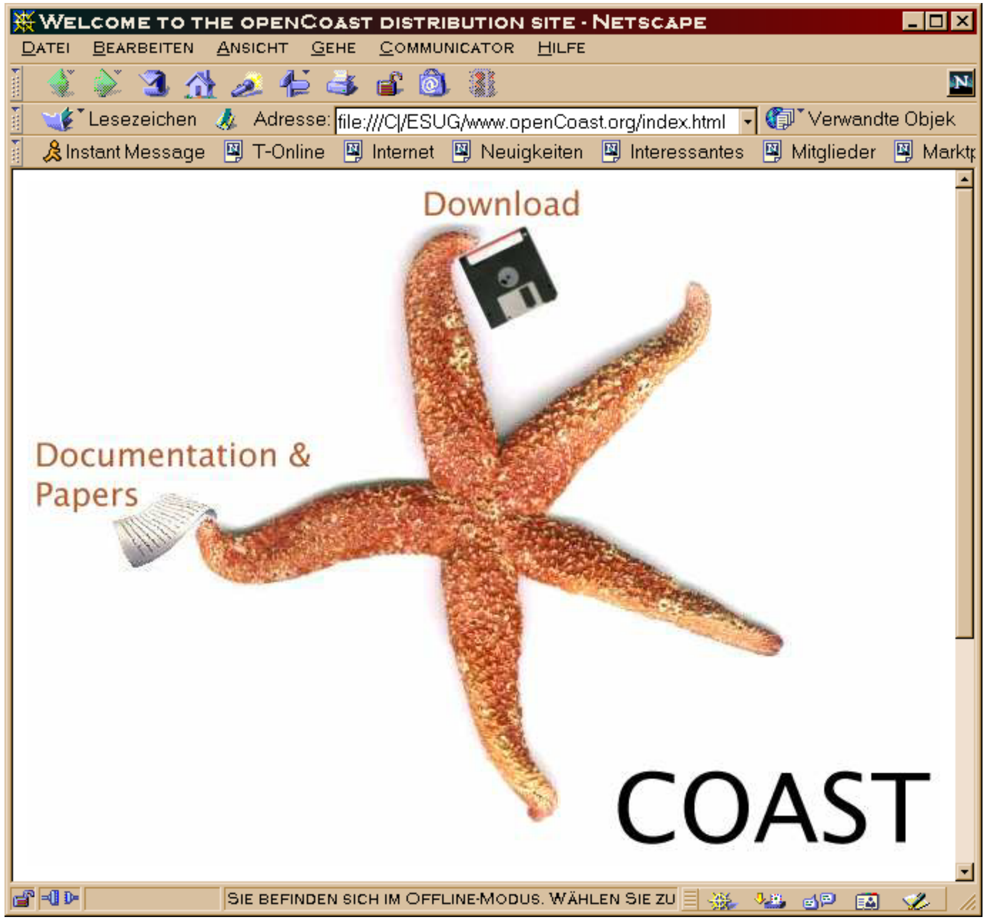
further info & download



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