Collaboration Bus: An Infrastructure for Supporting Interoperating Collaborative Systems

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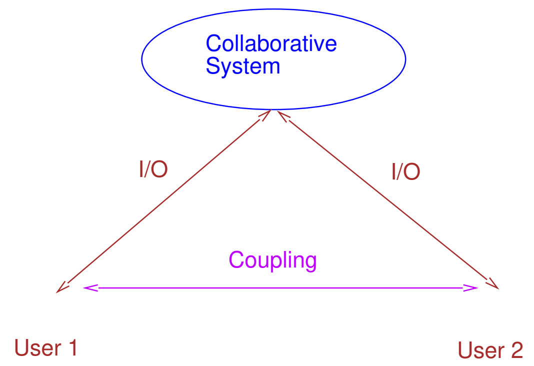
Definition



Example Collaborative Applications

Traditional Database, Mail and Talk Applications

Hypermedia Applications

Structured Mail (Malone '87, Winograd '92)

Active Mail (Goldberg '92, Borenstein '92)

Awareness Sytems (Mantei '91, Dourish & Bly '92)

Spreadsheet (Greif '92)

Coauthoring System (Fish '88, Neuwirth '90)

Proposal Reviewing System (Olson & Atkins '90)

Real–Time Calendaring System (Sarin & Greif '85)

Real–Time Document Editor (Greif '86)

Real–Time Text Editor (Prakash '90, Newman–Wolfe '91, Aspects '92)

Real–Time Outline Editor (Stefik '87, Ellis '91)

Real–Time Code Inspector (Brothers '90, Johnson '90, Riedl '93)

Real–Time Drawing Tools (Bly & Minneman '90, Greenberg '92)

Real–Time Instrument Monitoring (Prakash '94)

Air Traffic Control (Benteley '92)

Collaborative Virtual Reality (Curtis '90, Fahlen '93)

Video Walls (Abel '90)

Example Collaboration Infrastructures

Traditional DOS and DBMS

Shared Window Systems (Lantz '86, Abdel–Wahab '88, Ensor el al '88, Garfinkel et al '94, Jeffay et al '94, Menges & Jeffay '94, Chung & Dewan '96)

Group Toolkits (Crowley et al '90, Roseman & Greenberg '92 & '94, Abdel–Wahab '96)

Multiuser Languages (Stefik et al '87, Patterson et al '90, Dewan & Choudhary '91, Graham & Urnes '94, Tou et al '94, Prakash & Shim '94, Trevor et al '94, Feiner '96)

Process/Workflow Support (Stotts & Furuta '89, Kaplan et al '92, Kaiser et al '92, Medina–Mora et al '93)

Application Areas

Software Engineering

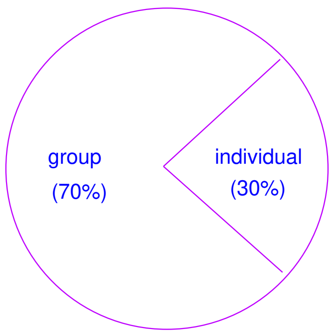
Training/Simulations

Design/Planning

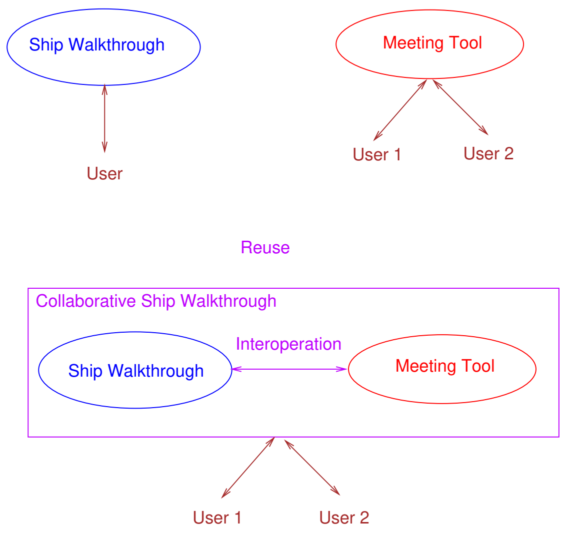
Writing

Air Traffic Control

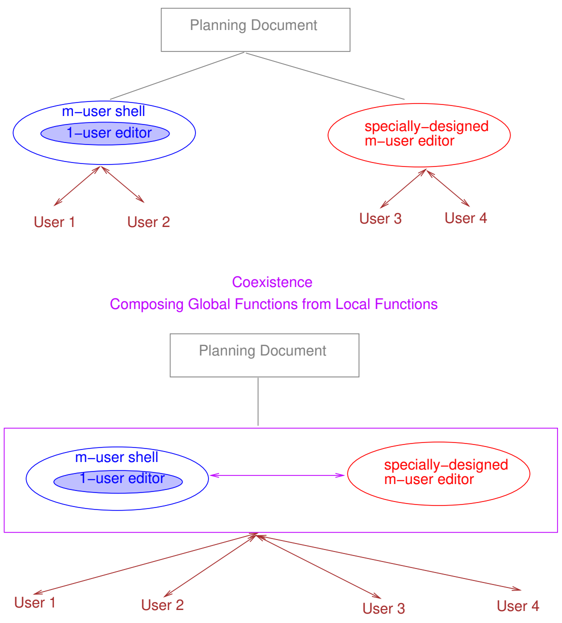
Casual Interaction



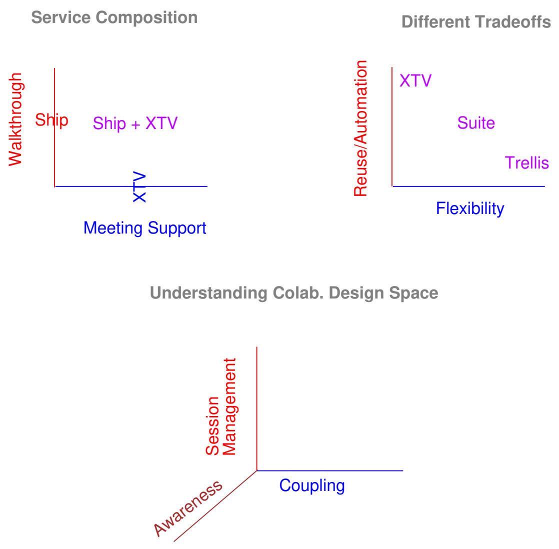
Inter-Service Interoperability



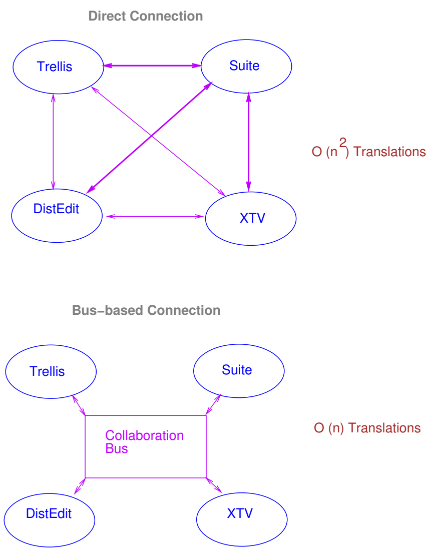
Intra-Service Interoperability



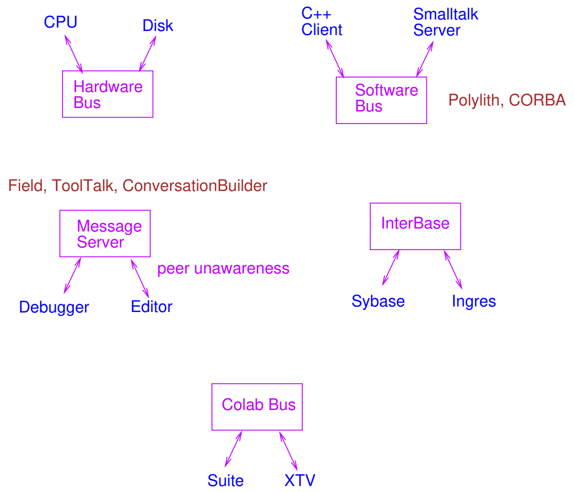
Interoperability vs Standardization



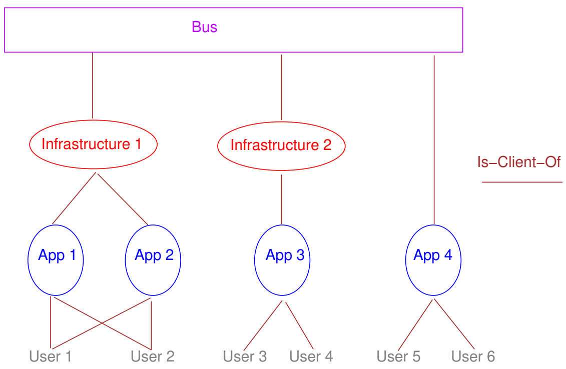
Interoperability Approaches



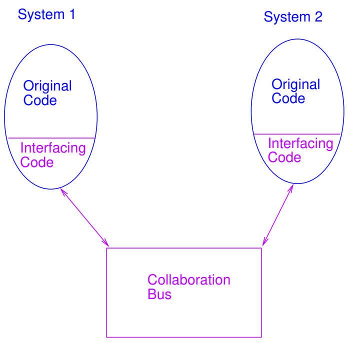
Relationship with other Bus Technology



Relationship with other Collaborative Software



Requirements



Generality

Semantics Preservation

Security

Automation

Efficiency

Incremental, Iterative Approach

Identify Orthogonal Services
↓
Select Services
↓
Select Service Instances
↓
Identify Interop. Scenarios
↓
Design & Implement Bus Support
↓
Design & Implement Interfacing Support
↓
Perform Interoperation Experiments
↓
Evaluate

Collaboration Services

1–User Services (Data + Semantics + User–Interface)

Session Management

Coupling

Concurrency Control

Process Control

Access Control

Undo/Redo

Merging

Awareness

Function

Real–Time (Scheduling + Networking) Support

Replication & Migration

Fault Tolerance

Implementation

Services and Instances

1–User — X Window Apps; Doc. Mgmt — HTML Docs — HTML Browsers; DistEdit; Suite Text Editor; VR Apps; Java Apps

Session Mgmt., Coupling, Conc. Control, & Awareness — Suite, DistEdit, XTV; GroupKit, DistView; Colab Java & Web Apps

Merging — Suite; Lotus Notes

Undo — Suite; DistEdit

Access Control — Suite; Lotus Notes

Process Control — Trellis, Oz; Conversation Builder

Real–Time Services — DiRT

Migration & Replication — XTV

Fault Tolerance — XTV

Scenarios

Session Management 1 + Session Management 2

Session Management + Coupling

Coupling1 + Coupling 2

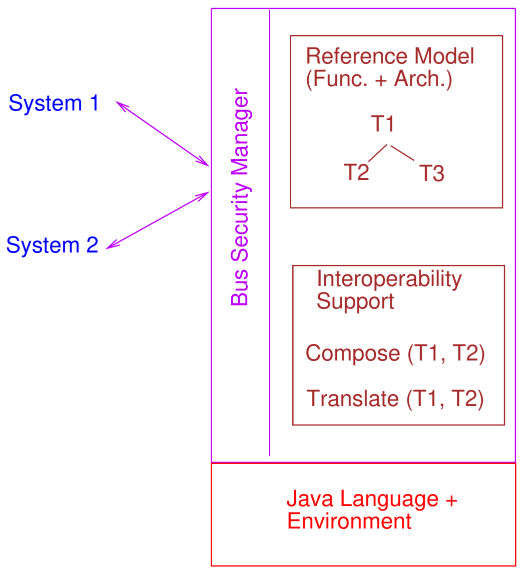
VE + (Flexible) Coupling + Real–Time Services

- Shared View VEs
- Position Coupled VEs
- Shared Model VEs

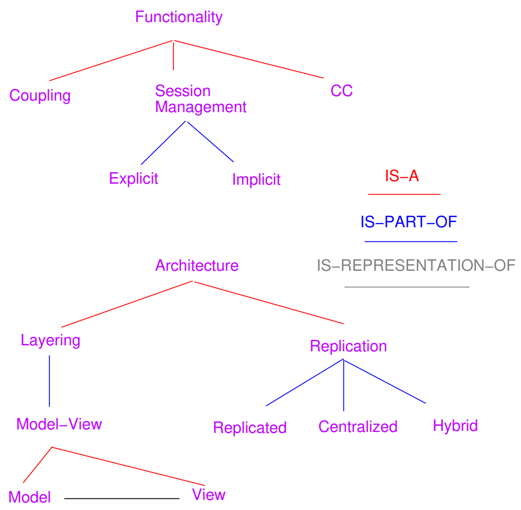
VE + Non–VE + Coupling

VE + VE + Concurrency/Access Control

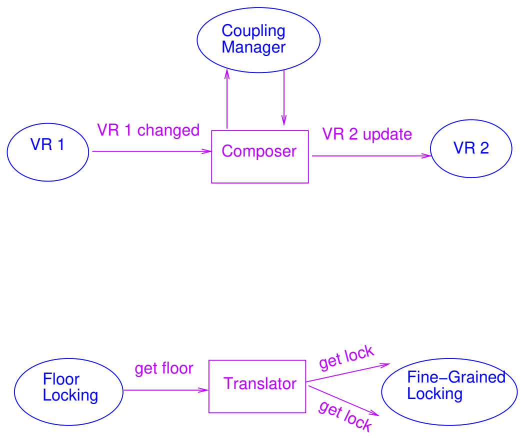
Bus Architecture



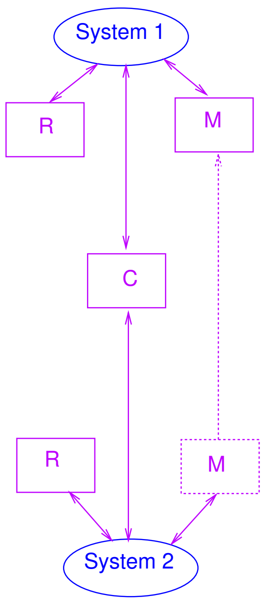
Bus Types



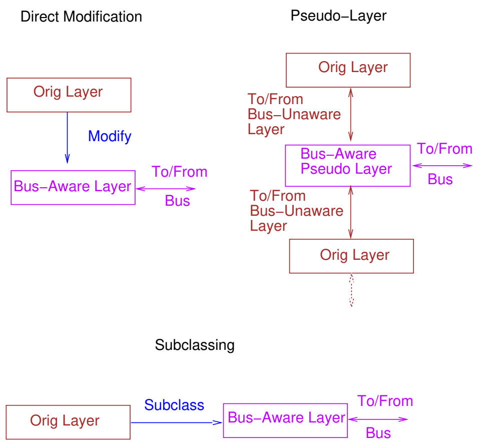
Intra- and Inter- Service Interoperability



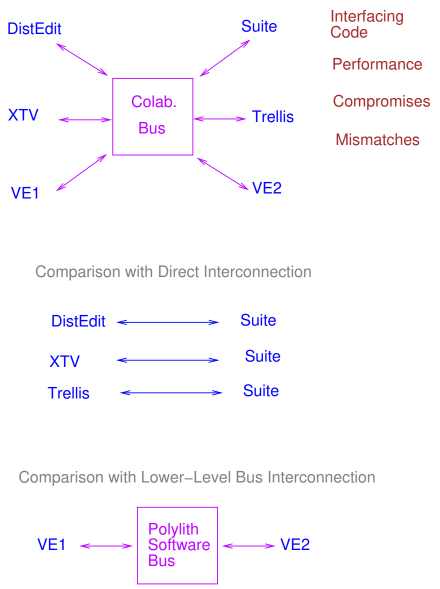
Bus Physical Architecture



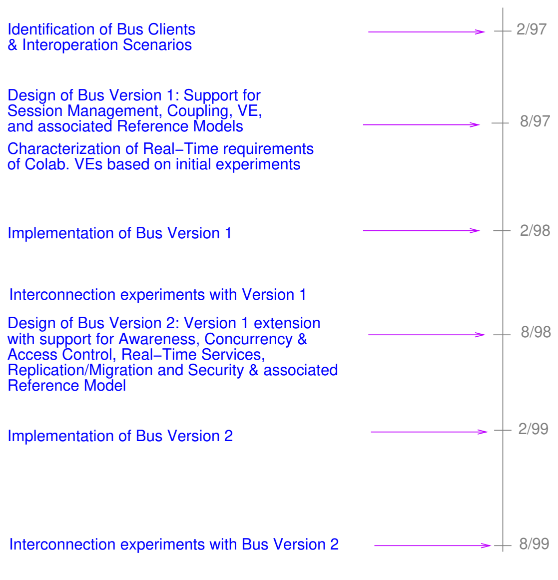
Interfacing to the Bus



Experiments and Evaluation



Milestones & Schedule



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