Improving Virtual Team Collaboration with Internet2

More Than Just Video Conferencing

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Virtual Teams

- Traditional Teams tend to be colocated - working in close proximity to each other.
- Virtual Teams are composed of individuals that are dispersed geographically and/or temporally.
- Virtual Teams form as a result of globalization, consolidation, telecommuting, and academic collaboration.
- Virtual Teams are not like traditional teams. They have different management, scheduling, communication and technical infrastructure needs.

Virtual Team Challenges

Virtual teams face many unique challenges, most stemming from reduced face-to-face interaction.

- Remote Management - Virtual teams require more autonomy, less hand-holding, and longer development cycles.
- Team Dynamics - More difficult to achieve cohesion. Virtual teams often fail to get passed the "Storming" phase.
- Technical Hurdles - Members will eschew cumbersome tools. Unreliable or insufficient infrastructure guarantees project failure.

Virtual Team Challenges

- Project and Participant Awareness - VT members require more explicit awareness of project status, forward progress, availability and participation of other members.
- Trust - Lack of subtle communication cues and participation awareness can undermine trust between team members, and between management and the team.
- Global Virtual Teams add addtional temporal, language, and cultural challenges.

Virtual Team Needs

- Common Workspace - Shared storage to maintain group artifacts: designs, documents, source code, releases, project web page, communications archive.

- Real-Time Formal Meetings - Scheduled meetings with agendas. Video/teleconference, conference calls, face-to-face meetings, etc. Usually project-related. Requires schedule coordination.

- Real-Time Informal Meetings - As need arises. Video conference, telephone, IM, chat. Usually task-related or social interaction. Requires participant availability awareness.

Steinfeld, Yang, Pfaff [1999]

Virtual Team Needs

- Asynchronous Communications - Email, discussion lists, etc. Reduces interruptions, allows thoughtful statements and responses, eases temporal difficulties.
- Project and Participant Awareness - Improves sense of community and commitment. Project web page, blogs, regular status reporting (SCRUM), progress logs, member presence and availability.
- Reliable, Configurable Infrastructure - Different teams and projects have different requirements. Environment should be configurable and extensible. Cumbersome or unreliable components will go unused.

Theory of Media Richness

Different media will be chosen for different tasks based upon varying characteristics of the media.

Task performance will be improved when task needs are matched to a medium's richness.

Daft, Lengel [1996]

Theory of Media Richness

- **Equivocal** - ambiguous, subjective, multiple or conflicting viewpoints.
- **Unequivocal** - unambiguous, objective, shared viewpoints, common references.
- **Uncertain** - absence of information, attempt to acquire information.
- **Certain** - provide information to resolve uncertainty.
- **Socio-emotional** - interpersonal, social, community and trust building.

Daft, Lengel [1996] Rice, Love [1987]

Theory of Media Richness

Socio-emotional

Equivocal — Unequivocal

Certain — Uncertain

Lean Media — Rich Media

Interpersonal

Task Work

Group Management

Tools/Media

Graveline, Geisler, Danchak [2000]

Time, Interaction, Performance

"The richness of a medium - its ability to change understanding within a time interval - is linked not only to is social factors, but also to its information processing capabilities.

For communication to be successful, the receiver must understand the message the sender *intended* to send, and *both* the sender and receiver must *agree* that the receiver understood the message."

Dennis, Valacich [1999]

Time, Interaction, Performance

- **Immediacy of Feedback** - supports rapid bi-directional communication.
- **Symbol Variety** - the number ways (channels) in which information can be communicated.
- **Parallelism** - ability to maintain simultaneous conversations effectively.
- **Rehearsability** - allows the sender to rehearse or fine-tune the message before sending.
- **Reprocessability** - allows a message to be reexamined or processed again in context.

Dennis, Valacich [1999]

Time, Interaction, Performance

Rehearsability

Reprocessability

Parallelism

Feedback

Symbol Variety

Asynchronous

Synchronous

Dennis, Valacich [1999]

Current Web Meeting Products

- WebEX - Meeting Center
- Placeware/LiveMeeting - Conference Center
- Raindance - Meet, Present, Train
- Centra - eMeeting, Conference
- Genesys - Meeting Center
- Latitude - Meeting Place
- First Virtual Communications - Meet Premier
- Intercall - InView, MeetingCenter
- VIACK - VIA3 Secure Meeting
- Cal Tech - VRVS

Superset of Product Features

- Event Scheduling
- Participant Management
- Instant Messaging
- Audio and/or Video Conferencing
- Shared Desktop or Application *
- File Exchange
- Archive/Playback Meeting
- Moderated Question & Answer
- Polling/Voting

Shared Application or Desktop

4 Flavors of Shared Application Component

- Remote Window/Desktop Display - view-only by others
- Shared Whiteboard - overlay scribbling by others
- Remote Window/Desktop Control - control granted to others one at a time
- Collaborative Editing - local application and window, change propagation to others

Technological Benefits of Internet2

How can these capabilities be leveraged to improve the Virtual Team Collaboration Experience?

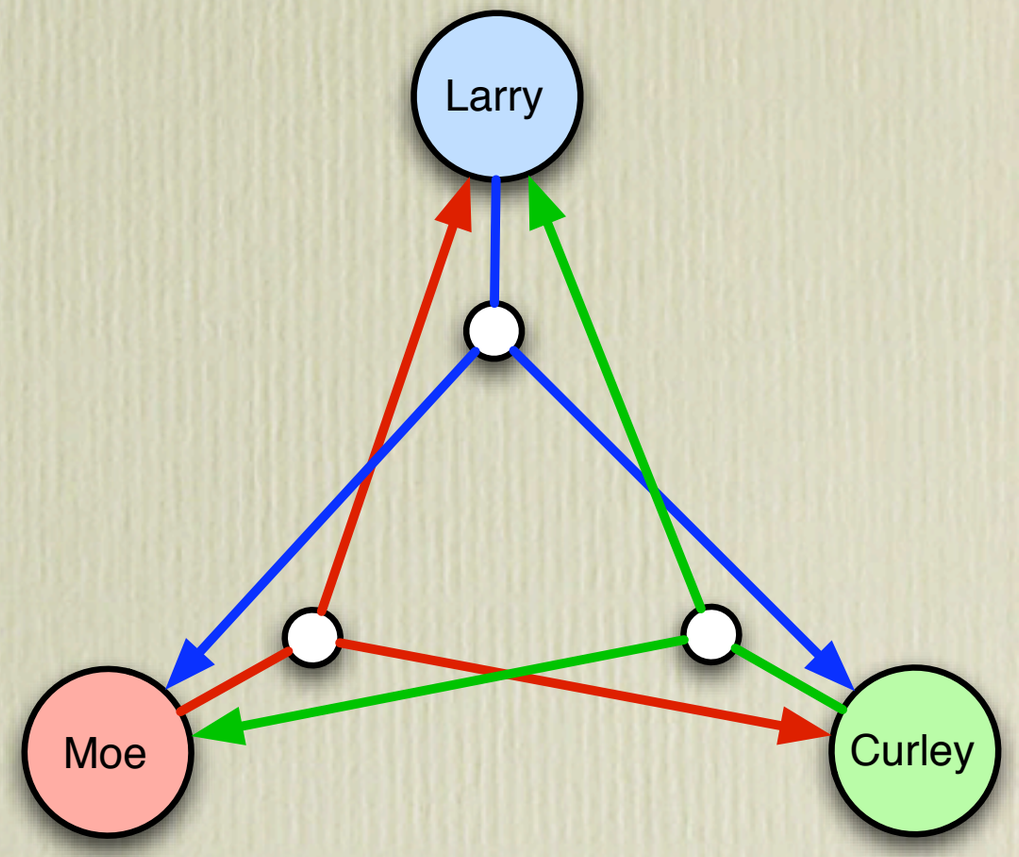
- High Bandwidth
- Multicast Routing
- Quality of Service
- IPSec
- Large frames
- 128 bit IP addrs

Improved Virtual Team Mechanisms

- Multi-Participant Video Conferencing
- Remote Window/Application Display
- Rich Media Streaming to Archive/Replay meetings
- Remote Filesystem for Common Workspace
- Distributed Filesystem to hold Rich Media Archive
- Private and Secure Communications
- Standards-compliant Components for improved interoperability and extensibility

Multiple Participant Video Conferencing

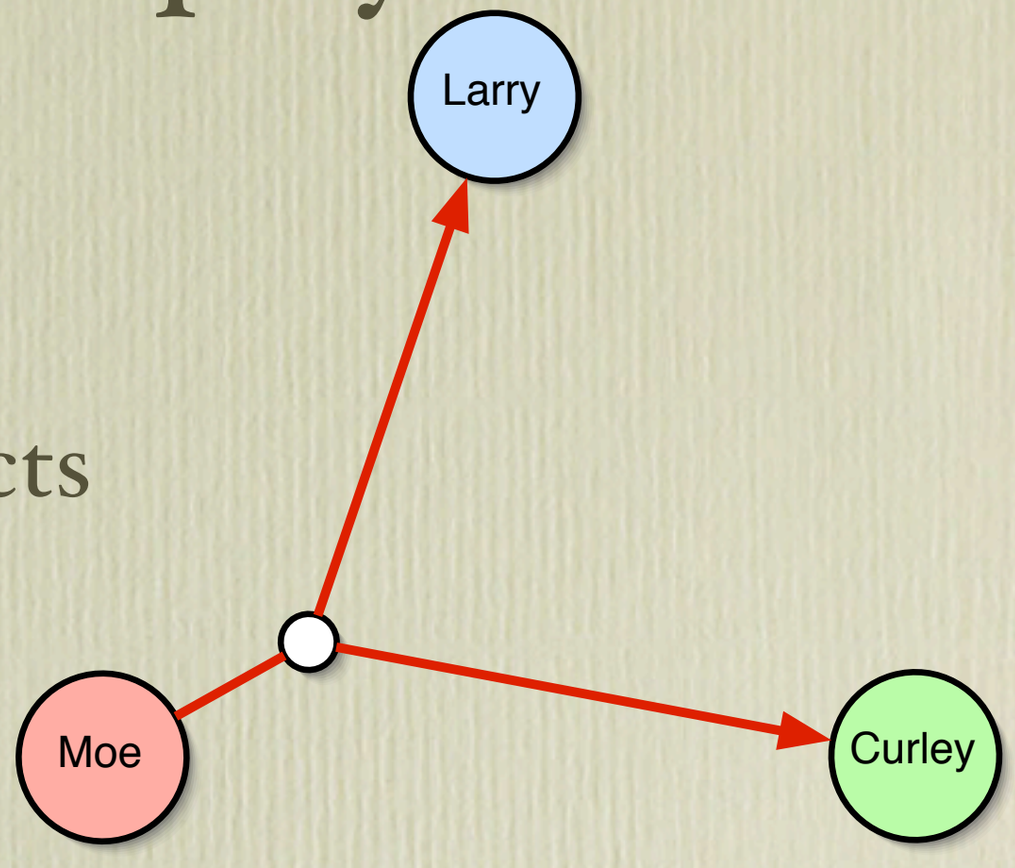
- Yesterday - Multiple meant 2
- Today - Participant streams are multiplexed, tiled and rebroadcast
- Tomorrow - Multicast routing directs a participant's stream to all other participants.



Multicast Routing

Remote Window and Application Display

- Export window display to all participants via multicast
- Use Compositing for overlay effects
- All 4 window access models are useful
- Window manager support would be ideal
- Bandwidth would allow even brain-dead bit scraping mechanisms



Presentation Display using Multicast Routing

Group-aware Synchronous & Asynchronous Communications

- Enhance traditional communication channels to be "Group-aware" (listsrvs, RearViewMirror, mail aliases, chat rooms, wikis, etc).

- Group member management at the team leader or project manager level.

- Employ subtle (non-intrusive) presence and availability awareness. Allows participants to know if a fellow team member is available for a synchronous exchange. Participants may be "present but unavailable" (heads down or in meeting).

Concurrent Document Editing

- Applications are becoming network aware - allowing concurrent real-time manipulation by multiple participants.
- Multiple instances of the application coordinate changes and maintain consistency.
  - Microsoft Office 2K & XP
  - CASCADE
  - CoCoDoc
  - Groove Workspace
  - Hydra (now SubEthaEdit)
  - Iris

Rich Media Streaming to Archive/Replay Meetings

- Archiver can be a “silent participant”, receiving all multi-cast streams and saving them.
- Allows non-participants to view meetings at a later date. Late arrivals can view from the start.
- Provides a historical record for participants.
- Would likely require a distributed file system to handle the data rate and volume.

Remote Filesystem for Common Workspace

- Globally available network filesystem will simplify access the shared workspace.
- Reduced dependance on multiple protocols and mechanisms attempting to solve similar problems. CVS servers, DMS, ftp, http, WebDav...
- Enhanced group access rights and versioning?

Privacy and Security

- Virtual Teams should feel confident that their collaboration efforts are free from prying eyes.
- A Group-private network?
- Various levels of access for participants and stakeholders.
- How much recording of communications is “right” - useful but not Orwellian or wasteful?
- Security at Line Speed for VC?
- Secure data in distributed stores.
- Built on top of Authorization & Authentication, IPSec, VPNs, encryption, group access rights.

Extensible and Configurable

- Different teams and institutions have different requirements.
- A collaboration infrastructure wants to be **customizable** to suit the team's needs.
- And **extensible** to support future grown and specialization.
- Standards-based **interoperability** to allow institutions using different tools to collaborate. (but this adds infrastructure reliability risk)
- This implies that monolithic or monopolistic products might not be sufficient or desirable.

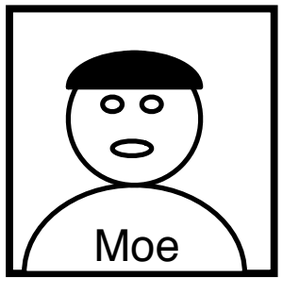
Proposed Virtual Team System

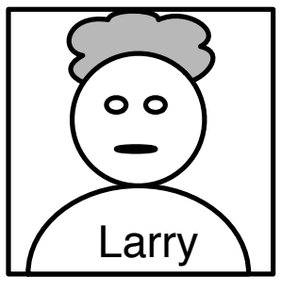
- Muticast Real-Time Video Conferencing with multiple participants
- Support for each of the 4 Window/Application sharing mechanisms
- Event and Project Scheduling and Participant Management
- Archive/Search/Replay meetings
- Shared Workspace as a network mounted volume with team artifact management

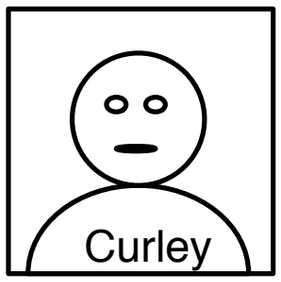
Proposed Virtual Team System

- Project portal to gain access to project status and important artifacts
- Workflow mechanisms
- Search over all archived content
- Instant Messaging / Chat / Discussions
- Action Items
- Group Awareness/Availability features
- Q & A
- Polling / Voting

VTeam File Edit Tools Window Help Fri 2:29 PM





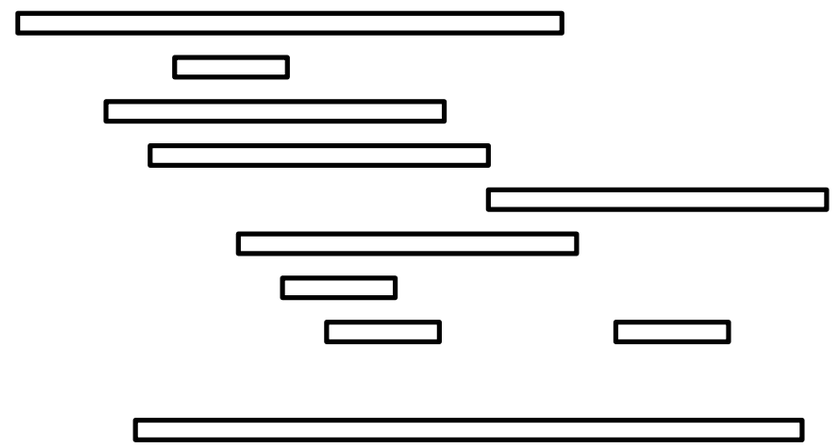


Proj X Spec [Shared]

Collaboration players (email from Cliff Ried)

1st Tier
WebEX
Raindance
Placeware
Centra
2nd Tier
Genesys
Latitude
First Virtual Commu
Intercall
VIACK

Proj X Gannt [Moe]



Attendees

Moe Howard;
Big Company
Los Angeles, CA

Larry Fine:
Pies 'R' Us
Houston, TX

Curley Howard:
Grateful Dead
Heaven

Chat

Moe: Listen up you guys! I got a great idea on how we can earn some dough.

Larry: Jeez, Moe, we got creamed last time!

Curley: Yip yip yup yip yip

Action Items [Shared]

Get pies [Moe]
Acquire wallpaper and paste [Larry]
Get brushes, ladders [Curley]
Collect underpants [Shemp]
???
Profit!

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< http://www-personal.si.umich.edu/~handel/research/rvm/documents/TeamPortal-handel.pdf >

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< http://www.ietf.org/rfc/rfc2446.txt >

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< http://www.ietf.org/rfc/rfc2447.txt >

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Additional Links

Links

Rear View Mirror User Guide:
http://www.dcs.qmul.ac.uk/research/imc/mmc/rvmguide.html

Internet Mail Consortium Personal Data Interchange
(vCard, vCalendar, iCalendar):
http://www.imc.org/pdi/

David Woolley's Virtual Team Collaboration Technology Portal:
http://www.thinkofit.com/webconf/

Web Conferencing Products we looked at:

WebEX: http://www.webex.com

PlaceWare: http://main.placeware.com

Raindance: http://www.raindance.com

Centra: http://www.centra.com

Genesys: http://www.genesys.com

First Virtual Communications: http://www.fvc.com

Intercall: http://www.intercall.com

VIACK: http://www.viack.com

Latitude: http://www.latitude.com/

Additional Links

Collaborative editing technologies:

CoCoDoc: http://citeseer.nj.nec.com/terhofte97cocodoc.html

CASCADE: http://www.sis.pitt.edu/~cascade/

Iris:
http://www11.informatik.tu-muenchen.de/publications/pdf/Koch1996b.pdf
http://www11.informatik.tu-muenchen.de/publications/pdf/Koch1995a.pdf

Hydra/SubEthaEdit: http://hydra.globalse.org/features.html

Collaborative authoring with document fragments and contracts:
http://homepages.cwi.nl/~media/publications/ecscw2001poster.pdf

Collaborative editing plugins for Microsoft Office products:

Microsoft Office 2000 and XP seem to have conferencing and collaborative editing built-in

Groove Workspace: http://www.groove.net/pdf/ms_oxp.pdf

Workshare Synergy: (MS Word only)
http://www.workshare.net/products/pr_synergy_overview.htm