Multimedia Communications

Multimedia Technologies & Applications

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The Promise and Reality of Collaborative Computing

- Introduction to Collaborative Computing
- Characterization of Collaboration Tools
- Where Are We Today?
- Security as a Collaboration Enabler
- Collaboration Standards
- Challenges Implementing Collaboration Technologies
- Video Conferencing Systems
- Setting up for a Videoconference

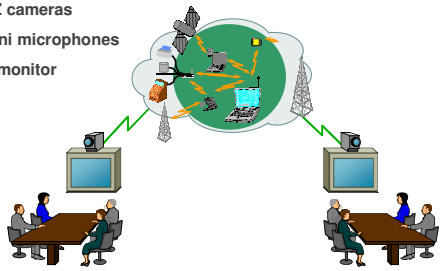
MM Conferencing Applications

- Applications
  - Distance Learning
  - Video Conferencing
  - Tele Medicine
  - Surveillance
  - Broadcast TV
- Enabling Technologies
  - Conferencing
  - Broadcasting
  - Video on Demand

Conferencing—Room to Room

Dedicated Systems

- Polycom, Sony, Tandberg
- A console package
- PTZ cameras
- Omni microphones
- TV monitor



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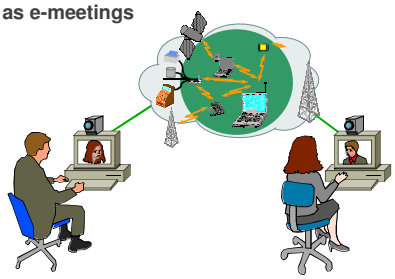
Conferencing—Desktop

Add-ons to PCs

- H.323 standard
- Known as e-meetings



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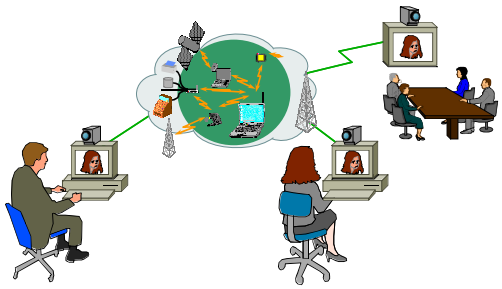
Conferencing—Multipoint

Three or more remote points

- Multipoint Control Unit (MCU)
- Continuous Presence



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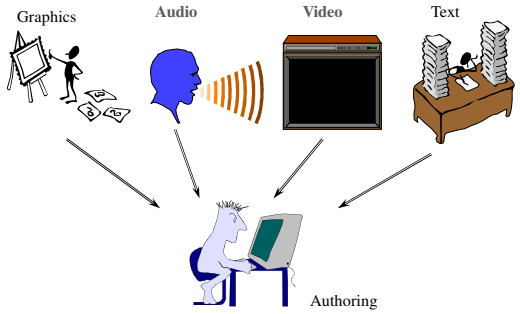
Multimedia -Authoring



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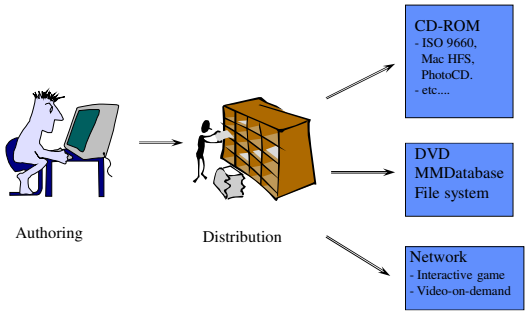
Multimedia Distribution



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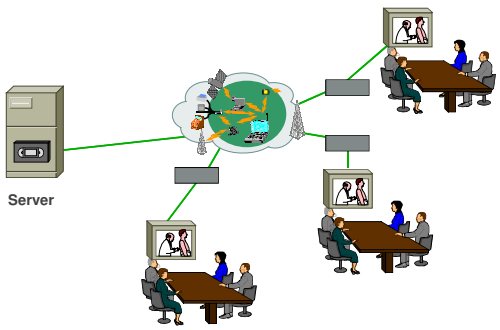
Broadcast—Pre-Recorded



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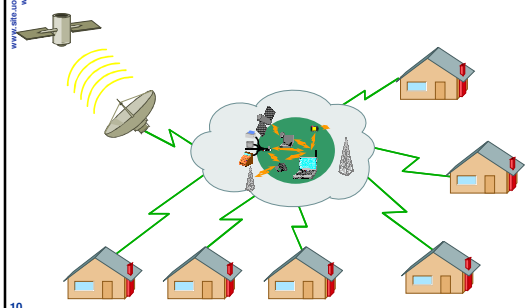
Broadcast—Video Distribution



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Beyond the E
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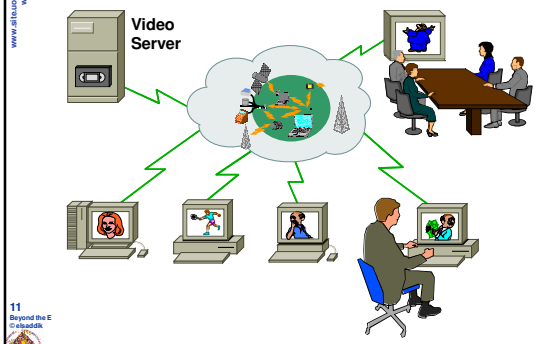
Video on Demand



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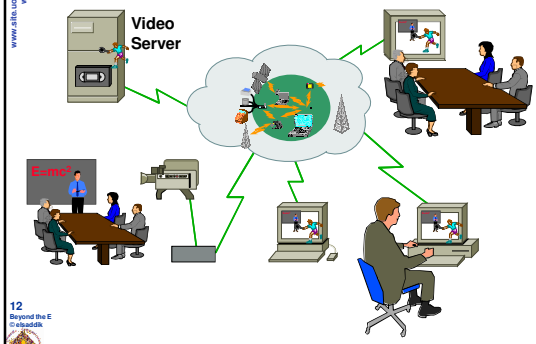
Live & Pre-Recorded MM



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Rules

- Rule #1
  - Remote collaboration is not (and it does not claim to be) like face to face collaboration and it will probably never be like that
    - May be one day when virtual reality will not be only a game anymore
- Rule #2
  - The computer does not have to be seen as a sobstitute to human interaction
    - It is only an instrument!
    - Distance/Computer based training will never sobstitute teachers completely!
      - I hope it for the best of humanity

Real-Time vs. Delayed Communication

Real-time communication (synchronous):

- participants meet in real time
- participants see each other's typed messages as they are typed
- examples: Talk and Chat

Real-Time vs. Delayed Communication

Delayed communication (asynchronous):

- Participants type, post, and read messages at their convenience
- Participants share an electronic mailbox related to the group's purpose
- Examples: email and Newsgroups

The Groupware Paradigm & Technologies

	same time/ Synchronous	different times/ Asynchronous
same place	face to face interactions public computer screens decision rooms brainstorming tools	continuous task team rooms group displays shift work groupware project management
different places	remote interactions video conferencing walls & hallways desktop conferencing shared views shared drawing/editors...	communication+coordination email bulletin boards asynchronous conferencing schedulers version control...

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Teleconferencing

- Just like the telephone, except you can see who you are talking to.
- You can talk to one or many other people at the same time, just as with the telephone.
- It is NOT video broadcasting.
  - Alternative names:
    Audio conferencing, telephone conferencing, phone conferencing, Internet Telephony.

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Two Types of Video Conferencing

Traditional	Internet
Use in special room; rare	Use anywhere; ubiquitous
Uses ISDN telephone lines	Uses Internet
High installation cost	Low installation cost
High usage cost	No usage cost
Usage at plateau	Usage growing rapidly
Professional operator	Do-it-yourself
Centralized control	Decentralized control
H.320 standard	H.323 standard

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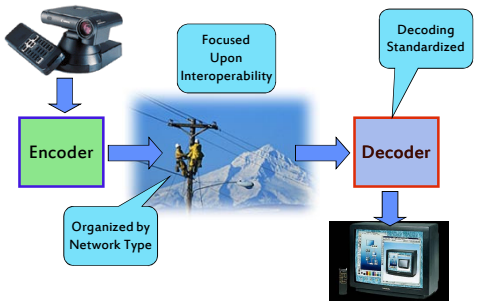
Videoconference Standards



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Collaboration Standards

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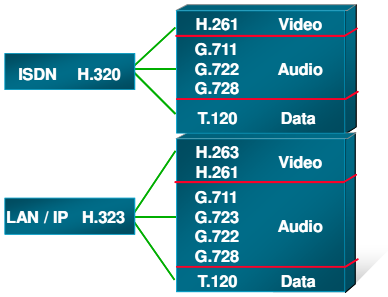
Video Conferencing Standards



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H.323 Defined

The H.323 standard is a summary recommendation that describes point-to-point and multipoint interoperability of audio and/or visual terminal equipment connected via a IP based non-guaranteed quality of service network.

- **Key Functional Components**
  - **Terminal:**
    Endpoint Equipment or "Terminal Application"
  - **MCU**
    Provides Multipoint Conference Connectivity
  - **Gateway**
    Provides Interoperability
  - **Gatekeeper**
    Manages "QoS"

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Terminal

- **H.323 terminals are client endpoints that must support:**
  - **H.225 call control signaling.**
  - **H.245 control channel signaling.**
  - **RTP/RTCP protocols for media packets.**
  - **Audio codecs.**
  - **Video codecs support is optional**



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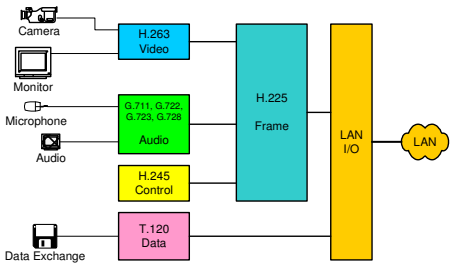
H.323 Terminal



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Multipoint Control Unit - MCU

Required With 3 or More Terminals In Conference

Internals:
- Multipoint Controller
- Multipoint Processor

Implementation:
- Hardware Based
- Software

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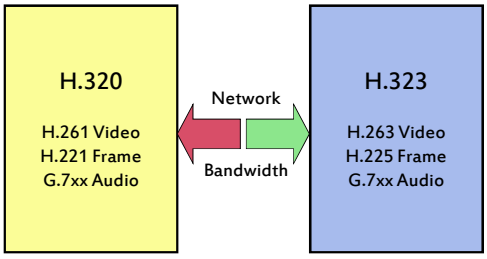
Gateway Requirements



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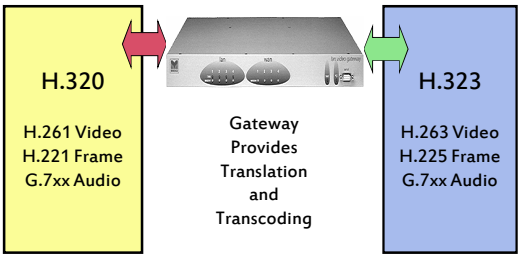
Gateway Solution



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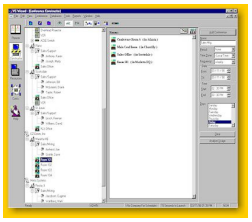
Gatekeeper

- Software products that reside on a server
  - Control Access
  - Call Routing
  - Address Translation
  - Bandwidth Management



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Remote collaboration: what hardware do we need?

Basic configuration

- Standard PC
- Sound card + Speakers
- Microphone

Optional devices

- Webcam/camera
- Scanner
- Tablet (es. Wacom, Mimio, etc)
- … … …

NETWORK CONNECTION

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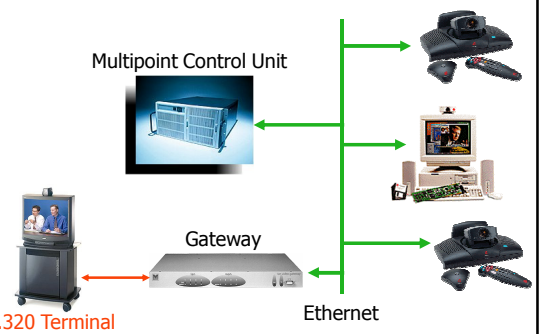
H.323 Implementation



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State of the Practice

Mostly asynchronous collaboration
Coordination and information sharing

Email

Discussion Groups

Information sharing Intranets

Group Calendaring

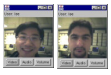
- Market segment strong (5-10 years)
- Stable technology base
- Scaleable to enterprise
- Some interoperability standards
- Most tools have some security support

State of the Art

Synchronous collaboration
Virtual meetings and interactive production

Text Chat

Audio/Video Conferencing



Shared Whiteboard

Shared Application

- Current product offerings are largely young (3-5 years)
- Issues with stability and scalability to support large conferences
- Requires sufficient network bandwidth, reliability, and quality of service
- Interoperability across tools, but can be spotty
- Issues with security and firewall support

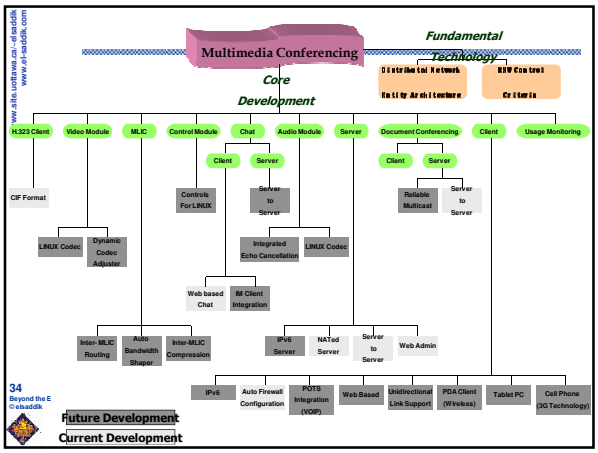
Problems of Today

Current System

- Requires dedicated ISDN lines to the desktop and Boardrooms, which mean additional infrastructure.
- Expensive MCU (Hub) is needed for mixing and re-transmitting.
- Expensive WAN link is proprietary and dedicated to video conferencing only.
- Expensive WAN bandwidth increases proportionally with each new user.

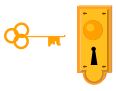
Research Areas of Future System

- Use your existing LAN infrastructure. Zero additional infrastructure cost.
- Do not require an expensive MCU. It uses a server.
- IP-based and merges with your existing corporate WAN link or uses the Internet.
- WAN bandwidth needs remain constant, irrespective of the number of users.



Collaboration and Security

- Security is often weakly addressed by collaboration tools
- Approach: Integration of security services with applications
  - Authentication to verify identity and protect from spoofing
  - Access control within collaboration tool
  - Data encryption to ensure privacy
- Approach: Use of external security mechanisms to secure the networks and/or provide authenticated access
  - Firewall support to enable safe collaboration with partners (includes tailored firewall policies, and firewall proxies)
  - De-militarized zone (DMZ) approaches
  - Extranets
  - Virtual Private Networks (VPNs)



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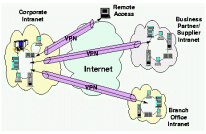
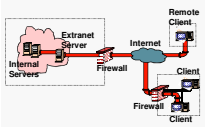
Collaboration Enablers

- Virtual Private Networks (VPNs) provide secure communications channel between two entities
  - A private, encrypted tunnel
- Extranets are a segment of an organization's network that is shared with partners
  - Authenticated access enables presentation of tailored views of shared data
  - Often coupled with VPN technology





Source: C. Eliopoulos, MITRE

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Motivation for Using VPNs and Extranets

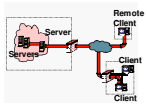
- Authentication and encryption techniques ensure user authentication, data privacy, and integrity
- Cost-effective way to eliminate expensive dedicated leased lines between sites and long distance calls for remote and mobile users
- Users can gain direct access to the company's resources from anywhere due to the almost universal availability of the Internet
- Facilitates the compartmentalization of information exchanges among selected user groups or organizations
- Replicated content and accompanying administration overhead no longer necessary

Source: C. Eliopoulos, MITRE

Challenges Implementing Collaboration

Infrastructure (easiest):
Networks, systems, support

Culture (hardest):
Learning a new "economics of trust"



Security (harder):
Risk management vs. risk avoidance

Infrastructure Challenges

Networks

- Bandwidth and bandwidth management
- Quality of service and bandwidth reservation
- Network protocols (e.g., IP Multicast, ATM)

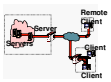
Systems

- Integration and interoperability
  - With other systems and applications
  - With partner's collaboration environments
- Maintainability, upgradability

Support

- Managing large scale roll-outs
- Robust administration tools
- Troubleshooting

Performance, scalability, reliability, cost



Security Challenges

Risk management vs. risk avoidance

Security is often weakly addressed by collaboration tools

- Authentication to verify identity
- Access control within collaboration tools
- Data encryption to ensure privacy
- Firewall support for safe collaboration with partners

Some solutions available (e.g., VPNs, PKI, Extranets)

Policies

- There are no policies for supporting virtual organizations
- Flexible concept of operations to enable secure collaboration
- Willingness to challenge and evolve policies to support collaboration goals

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Cultural Challenges (1 of 2)

- Learning a new "economics of trust"
- Modifying reward structure to incentivize team contributions
- Organizational readiness to change - timing is everything
  - Support from the top, clear benefits to participants
  - Dealing with resistance
  - Sharing ownership of the effort with partners
- Dealing with user's fears
  - The person who does the work does not receive the benefit
  - Failure to support exception handling
  - Existing power structure is modified
  - Work crosses organizational lines
  - Implicit behavior is made explicit

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Cultural Challenges (2 of 2)

- Understanding how to evolve the technology and the business process to realize improvement
  - Concept of operations, planned roll-out process, clear goals, managing expectations, letting users evolve concept of operations and new collaborative process, training and user support
  - Understanding social scalability
    - How you do establish virtual communities?
    - What is the best way to run a virtual meeting, a virtual team?
  - Few publications to guide; learning on the job

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Setting up for a Videoconference

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Setting up for a Videoconference

- Clothing
  - Solid color shirts
  - "Busy" outfits blur when on camera
  - Simpler patterns aid the video compression
- Lighting
  - Soft white light
  - Light from in front
  - Standard overhead lights don't cut it
  - Think of TV studio lighting
  - Camera can not focus in low light

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Setting up for a Videoconference

- Backdrop
  - No Hard Lines or complicated patterns
  - Can use a dry erase board
  - Solid color is ideal
    - Avoid red backgrounds
  - Give audience one thing to focus on
- Audio Setup
  - Separate Microphones and Speakers
  - Test levels ahead of time
    - Polycom's "Generate Tone"
    - Polycom's "Audio Meter"
  - May need to add echo canceling hardware

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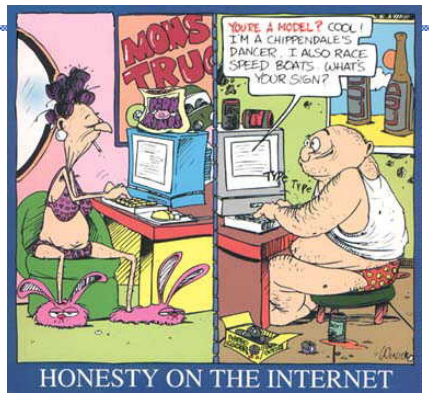

HONESTY ON THE INTERNET