MOTOROLA LABS

AG Nodes with SSM

Maintaining “Shared Spaces” With Finer-Grained Bandwidth Control

January 31, 2001

Jeff Eschbach, Motorola Labs

IGMPv3 and SSM

- IGMPv3
  - Internet Group Management Protocol Version 3
  - IGMP controls sources/hosts joining a multicast group
  - IGMPv3: Proposal to enhance multicast with SSM
- SSM
  - Source Specific Multicast
  - Host selects subset of sources transmitting to a multicast group
  - Host only receives traffic from its selected subset
  - Network congestion: SSM reduces unnecessary multicast traffic

A Need for AG Nodes

- Bandwidth concerns
  - Currently nodes receive all traffic in a virtual room
  - DS3 = 45Mbps, OC3 = 155Mbps
  - Node can send a few Mbps of data: audio stream, multiple video streams, MJPEG in the future…
  - Tens of nodes can consume link bandwidth
  - Other demands on the bandwidth… always want to reduce congestion
- Finer-grained control over incoming traffic
  - SSM allows a node to select sources
  - No “wasted” bandwidth from nodes not displayed locally

What About Shared Spaces?

- AG nodes for shared spaces
  - Expectation that all in virtual room can interact
  - Not able to “avoid” others, same as being in a shared physical space
- SSM jeopardizes “shared spaces” model
  - Must select feeds from individual nodes
  - Some nodes/feeds not selected for bandwidth control
  - Node not selected, not aware of it in the virtual room
  - Space not “shared”
- How to maintain shared spaces with SSM?

Proposed Solution… 2 Multicast Groups

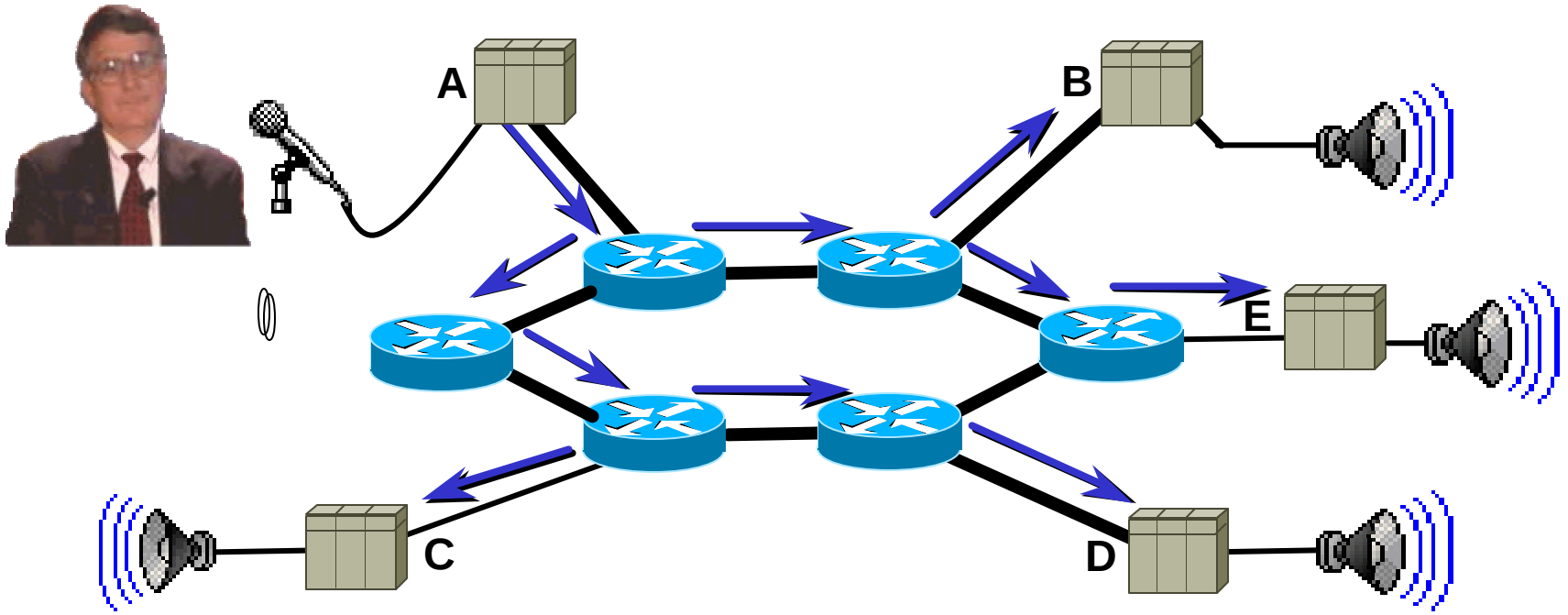
- Two multicast groups per audio/video transmission
- Shared spaces multicast group
  - Standard multicast
  - Distribute traffic to all nodes in the virtual space
  - Lower-bandwidth feeds: minimize required bandwidth use
  - Maintains shared spaces model
- Requested stream multicast group
  - SSM enabled multicast
  - Requested by individual nodes, not distributed to all
  - Higher-bandwidth feeds: only forwarded to requesting nodes, minimize unnecessary bandwidth use

Illustration 1: Audio/Video

- Standard multicast group for low-bandwidth traffic (ex: audio)
- Location “A” audio reaches all nodes
- Maintains “shared spaces”

= AG Node

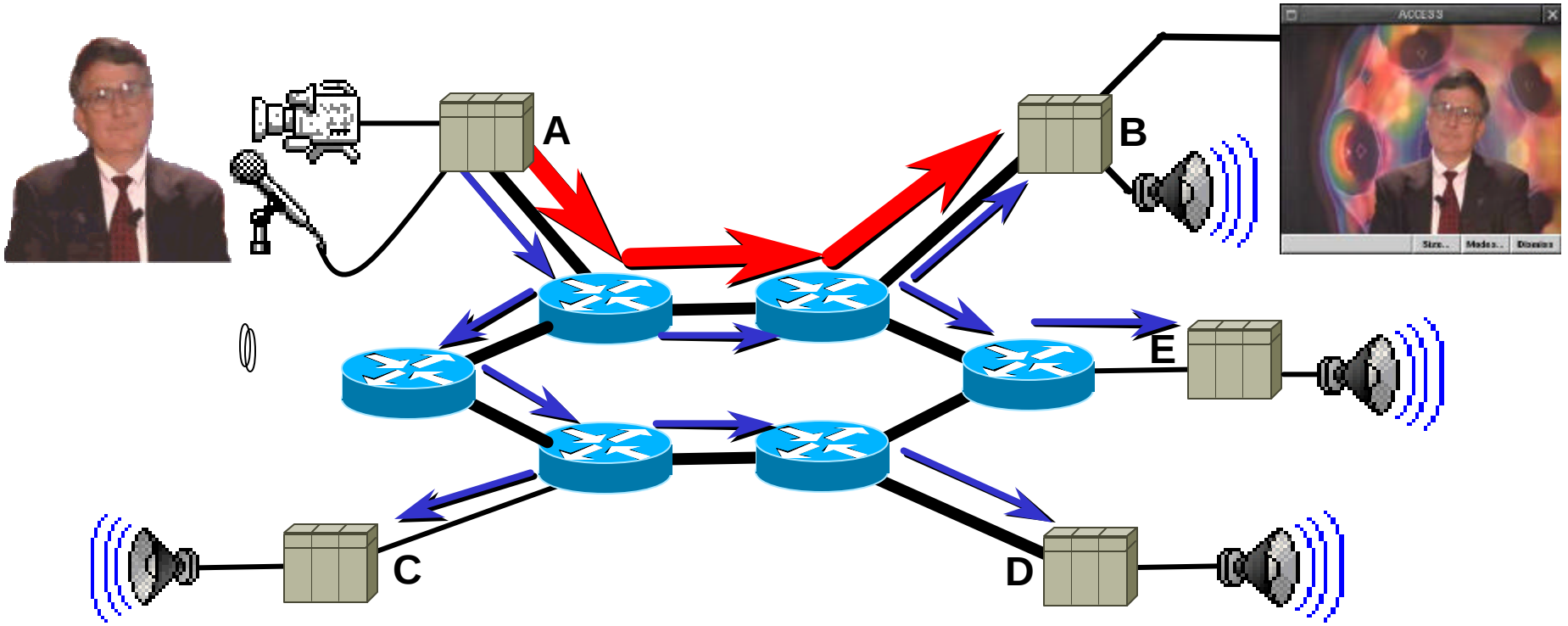
= Audio Traffic



Audio/Video Continued

- SSM multicast for video sources
- Only “B” selects “A” as a source
- Video traffic not sent to other nodes

= SSM Video Traffic



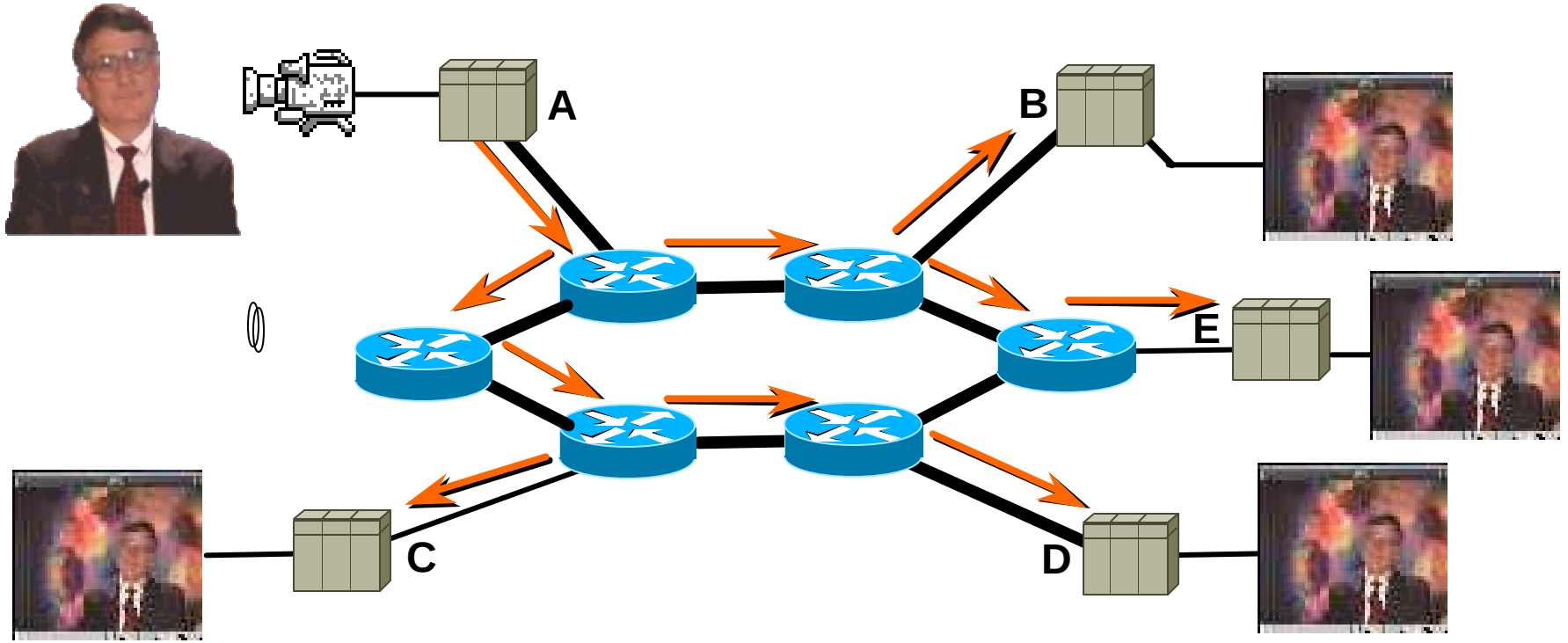
Approaches

- Audio with standard multicast, video with SSM
- Corresponding low and high quality feeds
  - Low quality audio/video with standard multicast
  - Corresponding high quality feeds through SSM
  - Node ignores low-q traffic if high-q feed is available
- Adaptive feeds: layering techniques
  - Combine layers to provide progressively better quality/resolution
  - Base layer with low-q to enable shared spaces
  - Enhancement layer via SSM to increase quality if selected
- Many other possibilities...

Illustration 2: Multiple Video Feeds

- Standard multicast group for low-bandwidth video feed
- Location “A” video reaches all nodes
- Low-bandwidth = low-resolution

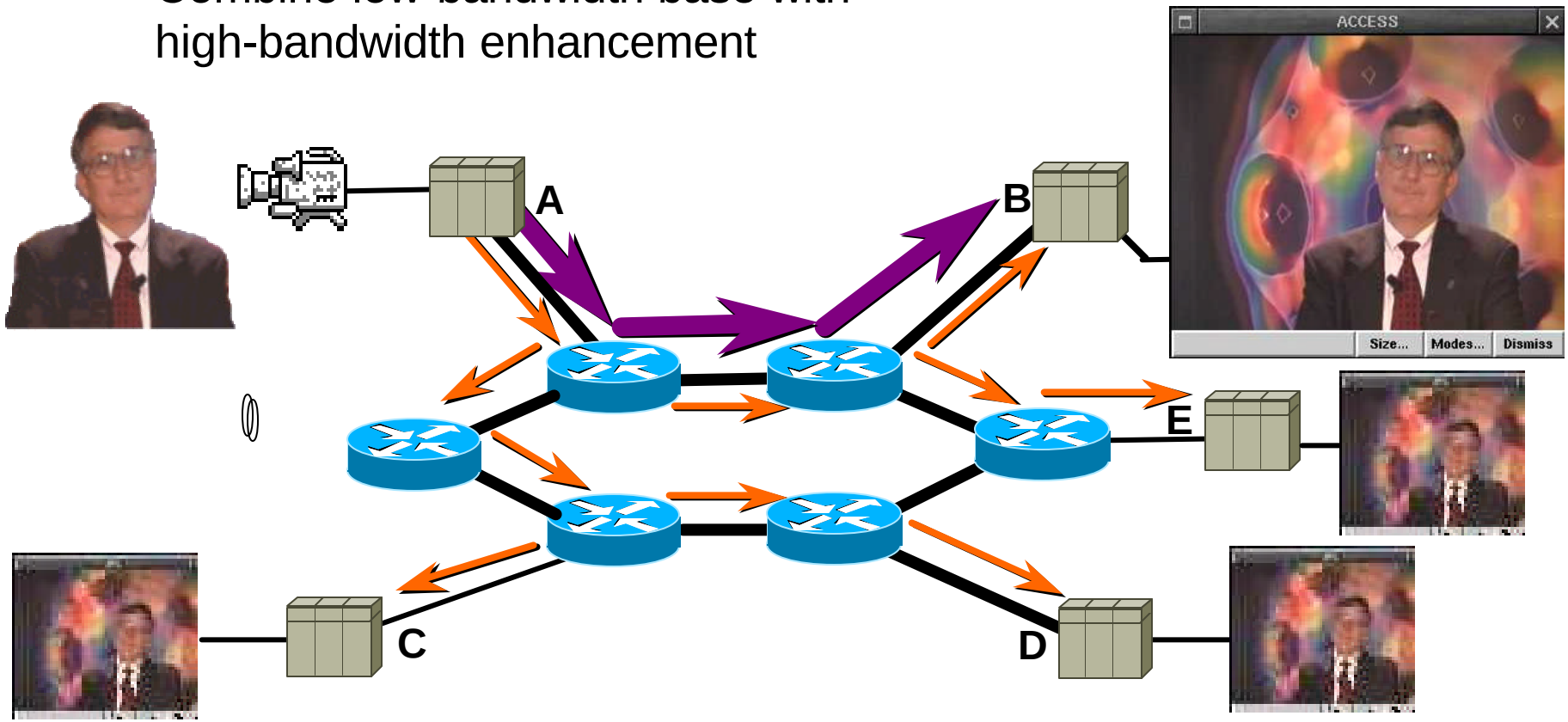
= Low-Bndw. Video Traffic



Multiple Video Feeds Continued

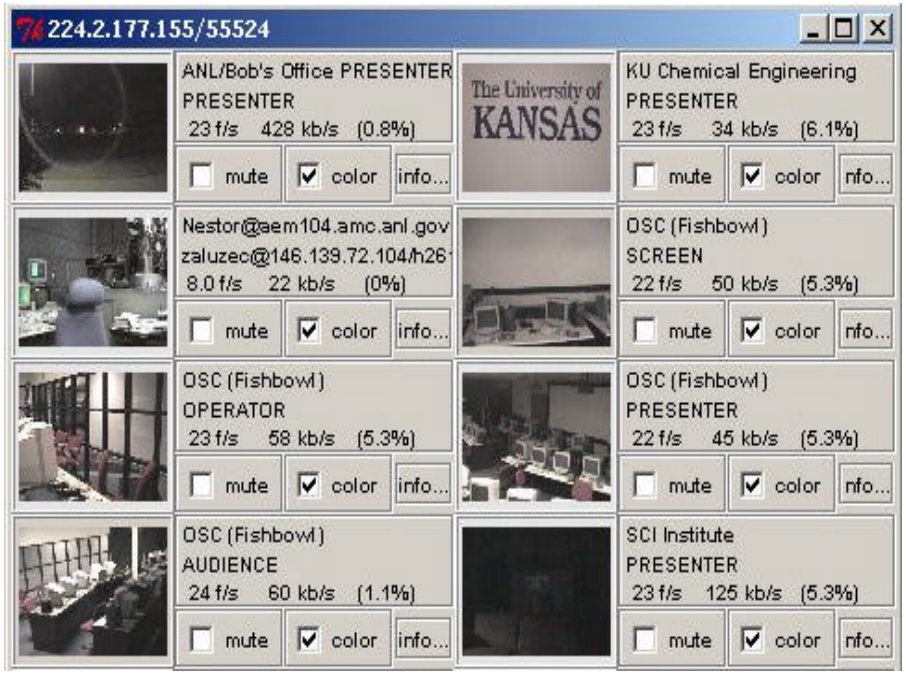
- Only “B” selects “A” as a source
- “B” uses high-bandwidth video
  - Drop corresponding low-bndw. data
  - Combine low-bandwidth base with high-bandwidth enhancement

= SSM High-Bndw. Video Traffic



Implementation Issues

- How to integrate w/ AG nodes?
- VIC and RAT
  - Necessary modifications?
  - How tie SSM feeds to the low-bandwidth feeds?
  - New operator interface?
- Human factors research
  - Complexity for operators
  - Operator vs. participant needs
  - Minimum requirements to enable shared spaces



Current VIC Interface
For Controlling Feeds

Concluding Remarks

- Idea for future investigation
  - No work beyond the initial concept yet
  - Research needed to validate overall method
  - Understand tradeoffs: technical difficulty, resource savings, human factors, etc.
- Thanks to Bill Nickless
  - nickless@mcs.anl.gov
- Feel free to contact me!
  - eschbach@labs.mot.com