Multicast and MPLS

Matthew Finlayson
VP Development and Requirements
Networking Protocols Group

matthew.finlayson@dataconnection.com

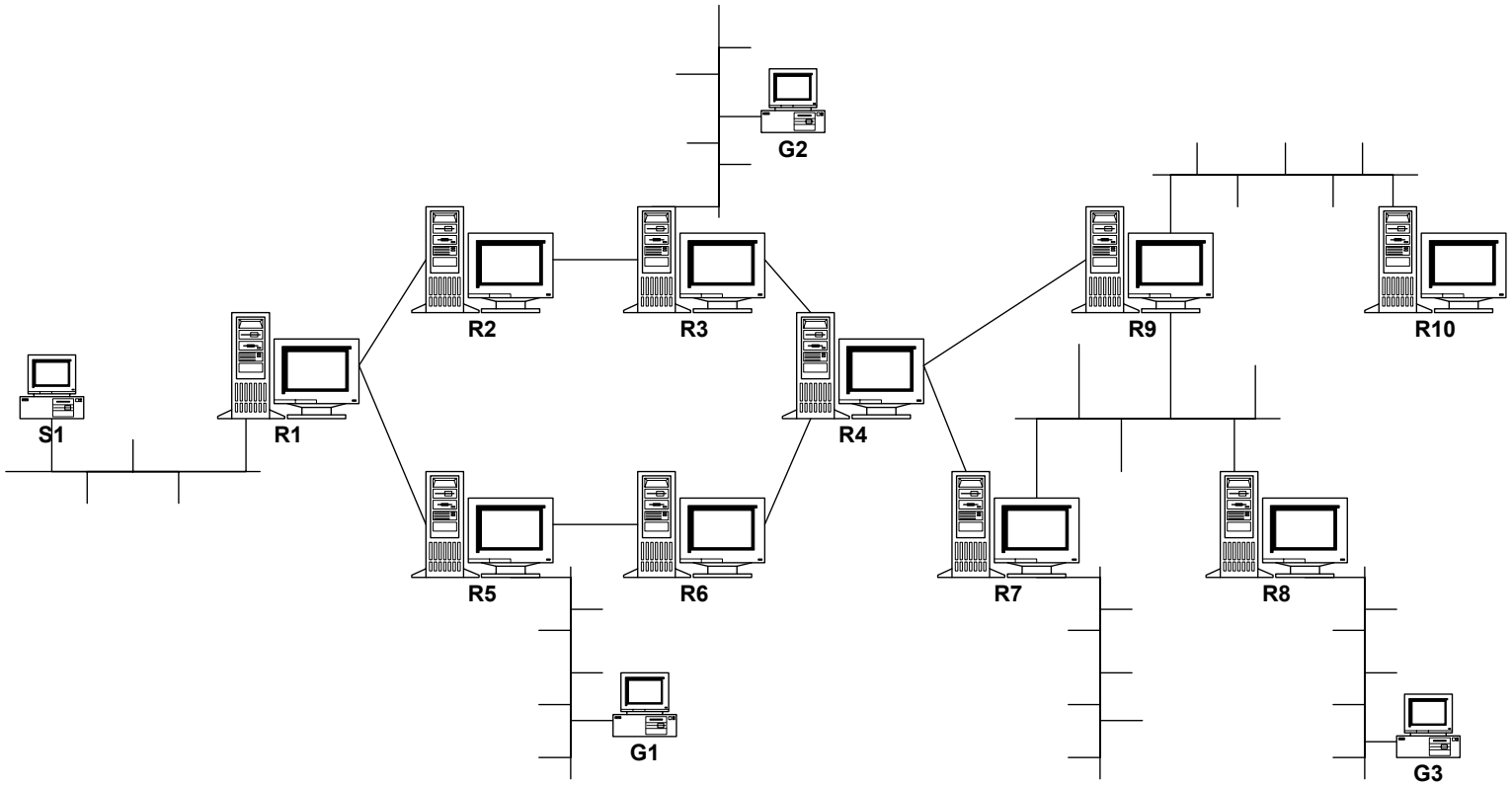
Why is Multicast Important?

- Video broadcast
  - Media
  - Corporate
  - Near Video-On-Demand
- Video conferencing
- Financial
- Defense / Simulation
- DSL / Cable

How Does IP Multicast Work?

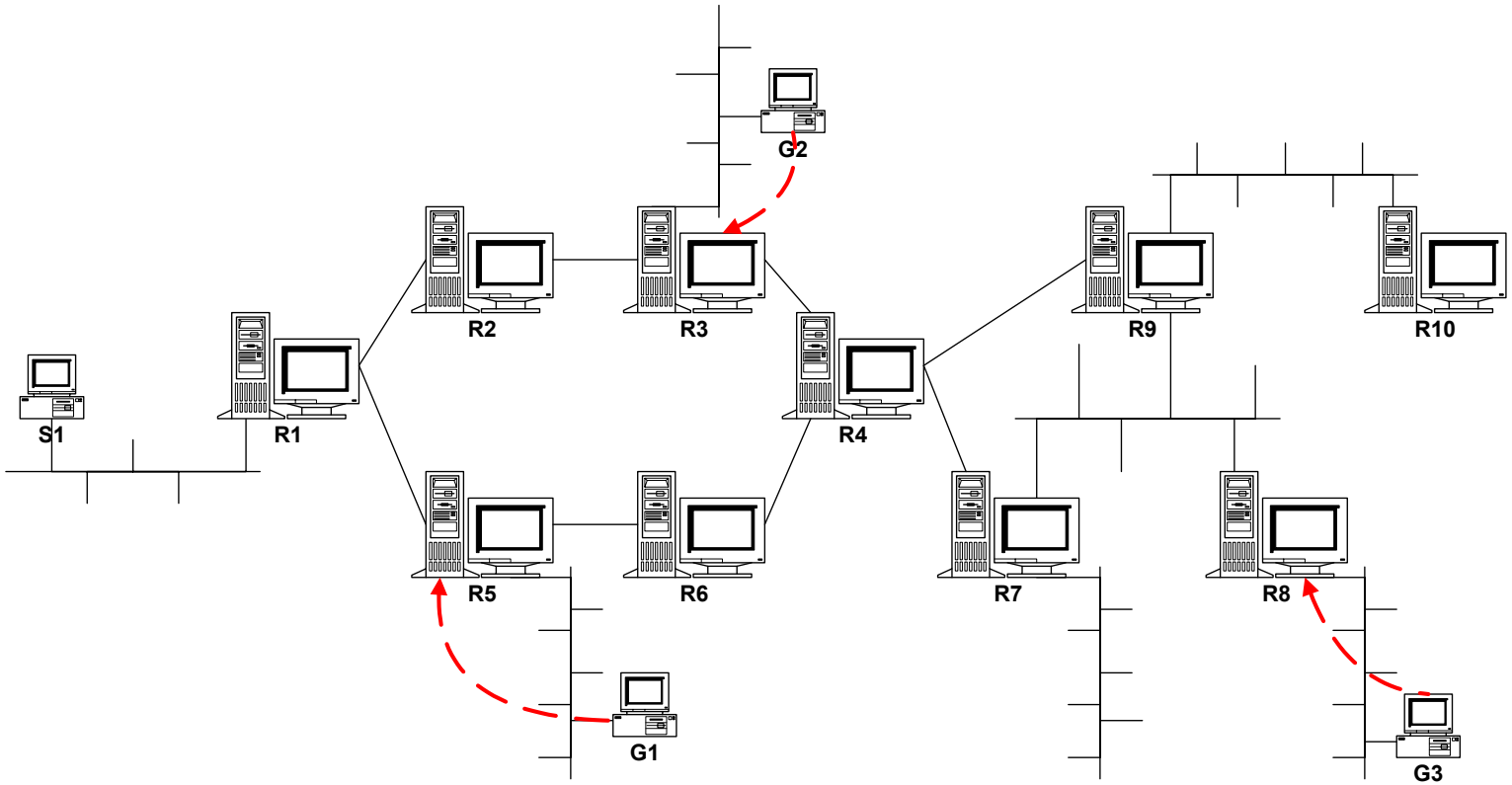
- End station receivers (sinks) announce that they want to listen to specific multicast addresses (channels)
- Multicast routers work out an "optimal" way of routing the data
  - What is "optimal"?
- Broadcasters (sources) just start sending

Multicast Sources, Routers and Sinks - 1



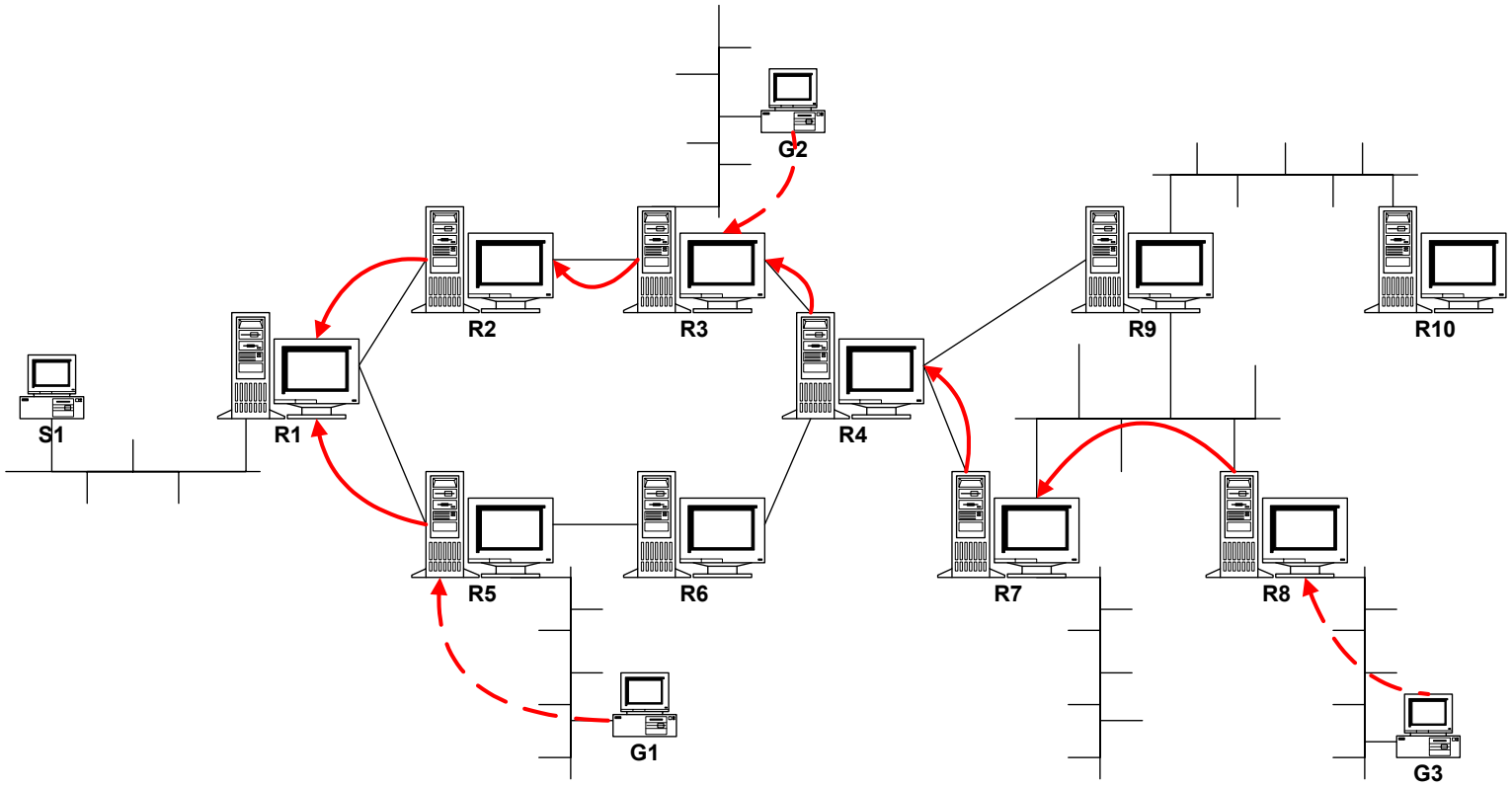
Multicast Sources, Routers and Sinks – 2

The sinks register their interest



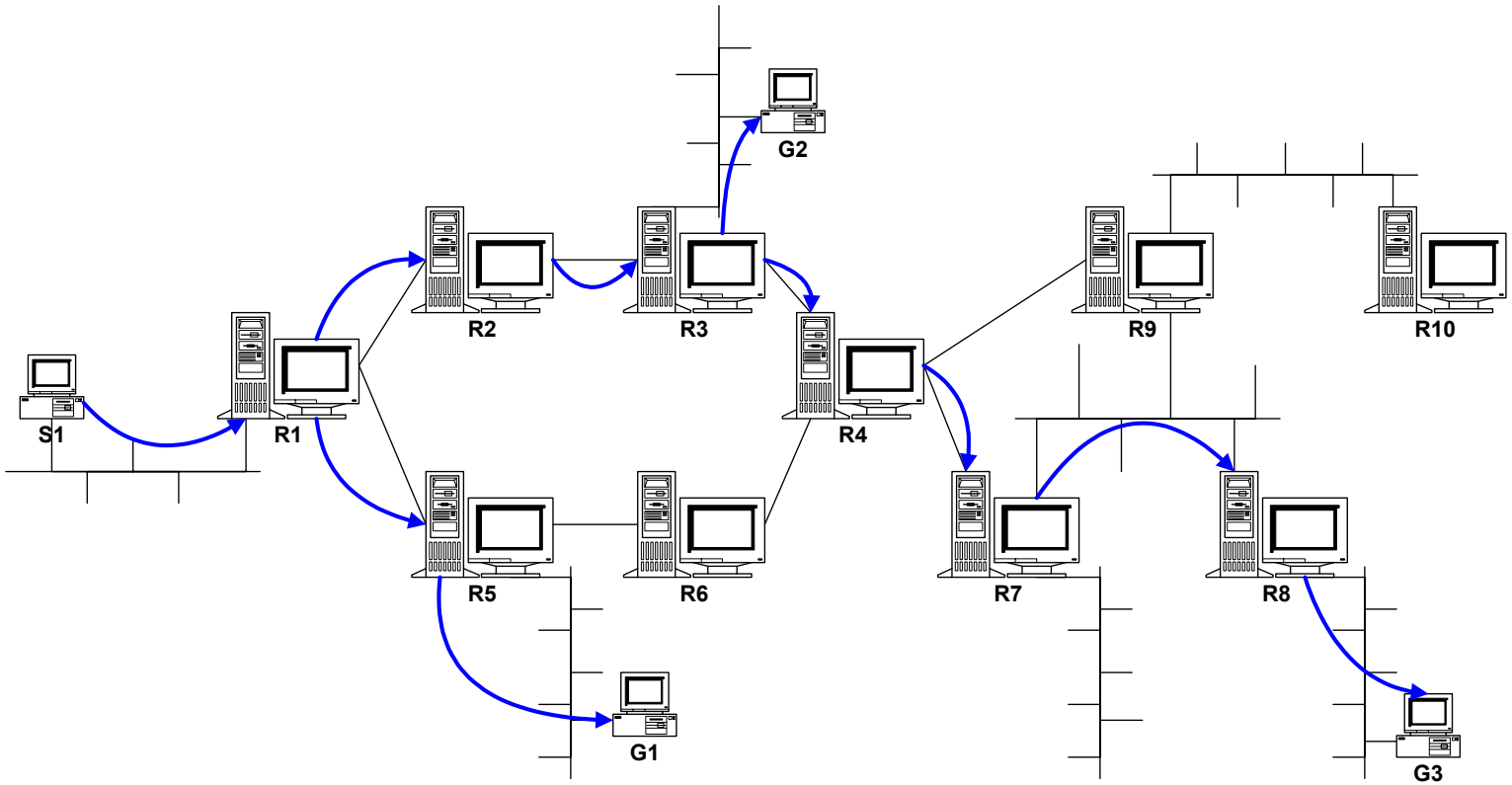
Multicast Sources, Routers and Sinks – 3

The multicast routers work out an optimal route



Multicast Sources, Routers and Sinks – 4

The sources start sending



IP Multicast Protocols and Terms – 1

- IGMP (Internet Group Management Protocol)
  - Used by sinks/receivers to register their interest in particular traffic
  - MLD is the IPv6 equivalent
  - IGMP Proxy, IGMP Snooping
- PIM-SM v2
  - Protocol Independent Multicast – Sparse Mode
  - Probably the most popular Multicast Routing Protocol
  - Uses "shared trees"

IP Multicast Protocols and Terms – 2

- "PIM-SSM"
  - PIM Source Specific Mode
  - Subset of PIM-SM v2
  - Allows receivers to register for specific origin addresses
- BIDIR-PIM
- PIM-DM

Other Multicast Protocols

- DVMRP
  - Substantial historical deployments (MBONE)
  - Now less interesting
- MOSPF, CBT
  - Basically irrelevant at the moment

Multicast across Domains

- MSDP
  - Very simple protocol to allow information about PIM-SM sources to be shared
  - Requires coordination of multicast addresses
  - Doesn't scale to lots of sources
- PIM-SSM
  - Side-steps requirement for PIM-SM
  - Good way of getting things working
- BGMP
  - The "architectural" way to do things
  - Not coming any time soon

So why Multicast and MPLS? - 1

- Similar reasons that applied to IP Unicast
  - Fast switching
  - Traffic Engineering
  - Bandwidth Management
  - Fast Reroute around failures

So why Multicast and MPLS? - 2

- Lack of multicast in the core
  - Growing… ~500 ASs now, compared with ~300 in January 2004
  - But compare with over 17,000 ASs in total!
  - Fear that turning on multicast protocols will hit OAM, CPU/memory and stability

So why Multicast and MPLS? - 3

- Many SPs have deployed MPLS-based VPNs
  - Layer 2 and Layer 3
  - As the enterprise use of multicast grows – these need to efficiently carry multicast traffic

How do you extend MPLS to support Multicast? - 1

- Historically, a number of approaches have been suggested

- Carry MPLS labels in PIM
  - Multicast equivalent of LDP
  - draft-farinacci-mpls-multicast-03 (expired 2001)

How do you extend MPLS to support Multicast? - 2

- Use RVSP broadcast
  - Transmit PATH messages out to all LSRs in the network and let them choose whether to respond
  - Doesn't require external knowledge of where the tree should go
  - Very different to existing RSVP-TE
  - draft-choi-mpls-grouplabel-requirement (expired April 2004)

How do you extend MPLS to support Multicast? - 3

- Create P2MP trees based on external requirements
  - Similar concept to existing RSVP-TE
  - draft-ietf-mpls-p2mp-requirement
  - draft-raggarwa-mpls-rsvp-te-p2mp

Multicast and MPLS VPNs - 1

- Layer 2 / VPLS
  - In theory already support Multicast
  - Inefficient
  - Improve
    - with IGMP snooping
    - PIM NBMA
    - using BGP
    - using P2MP trees

Multicast and MPLS VPNs – 2

- Layer 3
  - Challenging problem to solve
  - Several different solutions proposed
  - Most popular uses non-overlapping PIM-SM domains for CE-PE and P-core communication
    - Other options suggest
      - Use of PIM-SSM
      - Use of BGP
  - How does MPLS fit in?
    - MPLS in GRE
    - P2MP trees

Summary

- Multicast is growing rapidly in importance
- New revenue areas and cost-savings obvious for SPs
- Significant work needed to allow MPLS to encourage future growth