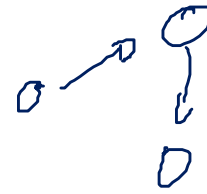




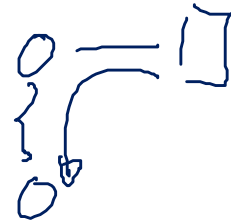
# Peer-to-Peer Networks

## 10 Fast Download

Christian Schindelhauer  
Technical Faculty  
Computer-Networks and Telematics  
University of Freiburg



• unicast

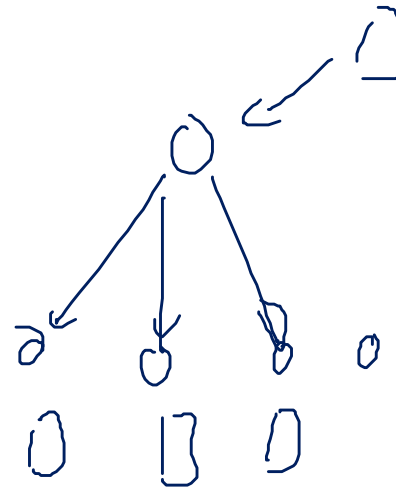


e-mail,  
ftp,  
TCP, Bluetooth

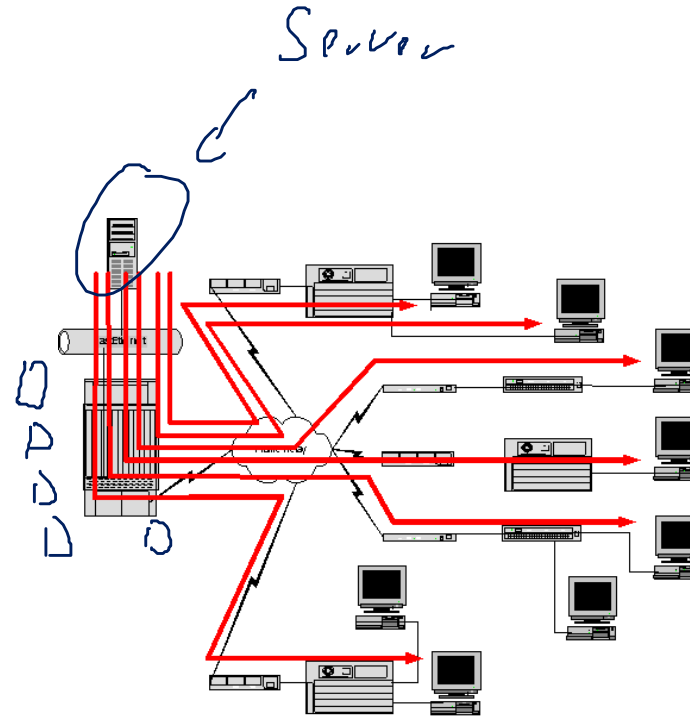
• broadcast



• multicast



- Motivation
  - Transmission of a data stream to many receivers
- Unicast
  - For each stream message have to be sent separately
  - Bottleneck at sender
- Multicast
  - Stream multiplies messages
  - No bottleneck



Peter J. Welcher  
[www.netcraftsmen.net/.../papers/multicast01.html](http://www.netcraftsmen.net/.../papers/multicast01.html)

FEC

## ▶ IPv4 Multicast Addresses

- class D
  - outside of CIDR (Classless Interdomain Routing)
- 224.0.0.0 - 239.255.255.255

## ▶ Hosts register via IGMP at this address

- IGMP = Internet Group Management Protocol - ICMP
- After registration the multicast tree is updated

## ▶ Source sends to multicast address

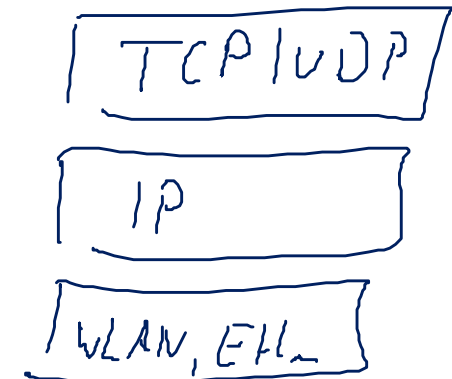
- Routers duplicate messages
- and distribute them into sub-trees

## ▶ All registered hosts receive these messages

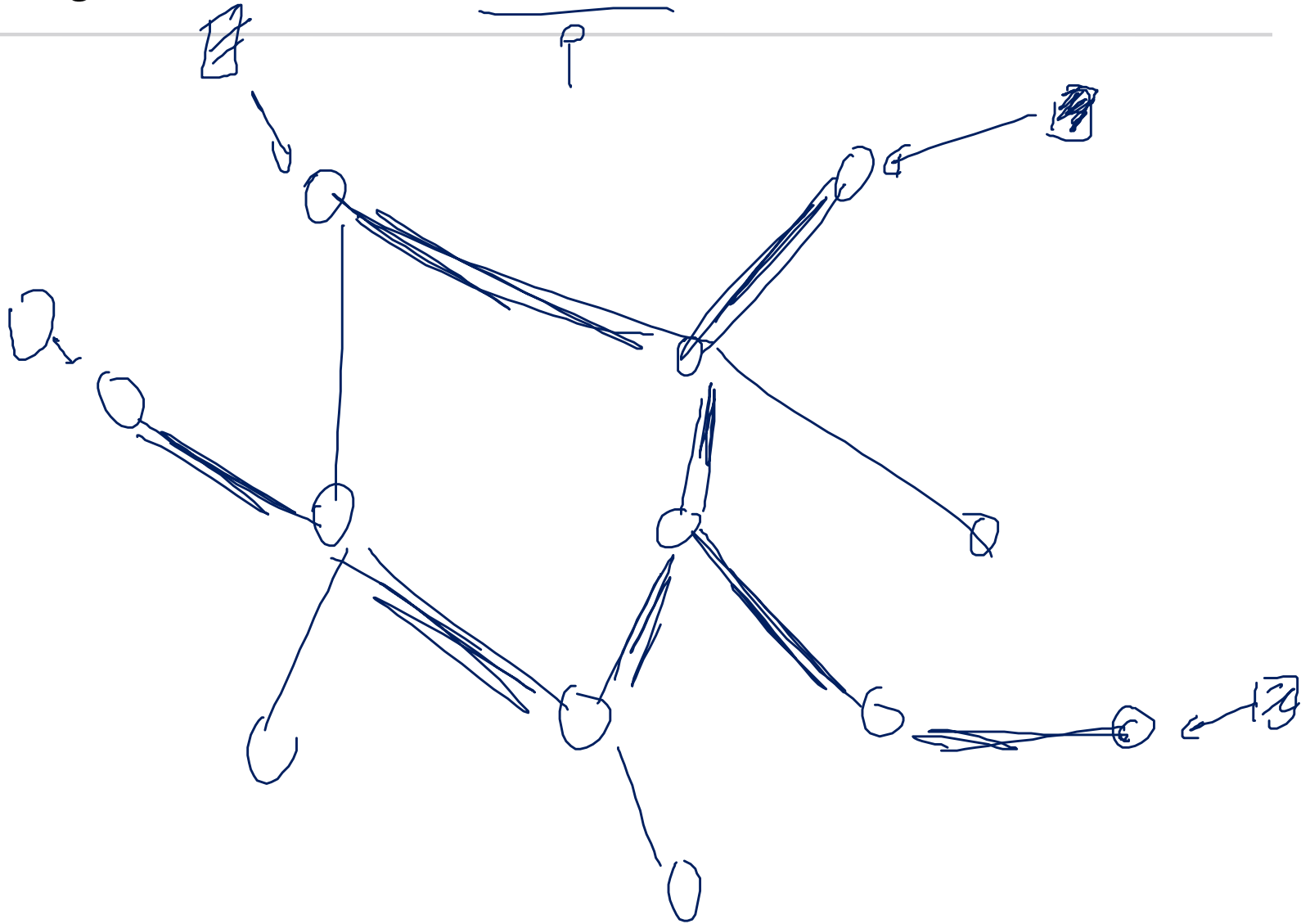
- ends after Time-Out
- or when they unsubscribe

## ▶ Problems

- No TCP only UDP
- Many routers do not deliver multicast messages
  - solution: tunnels



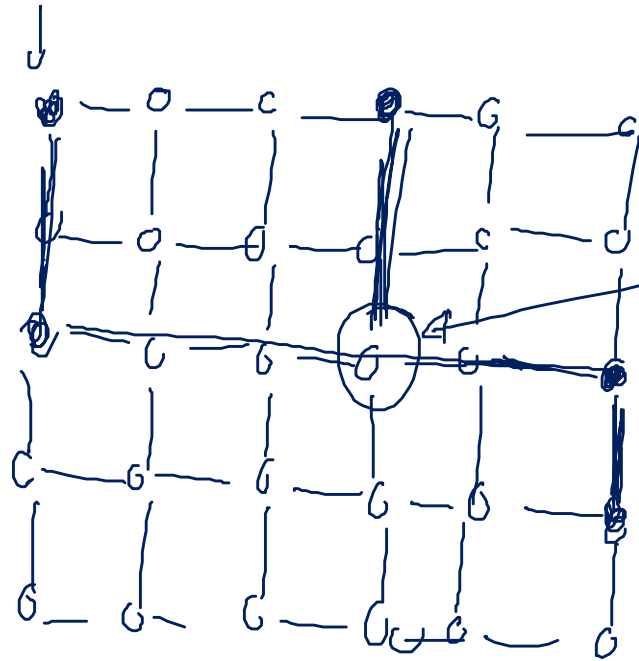
MST  
P



# Steiner Tree Problem

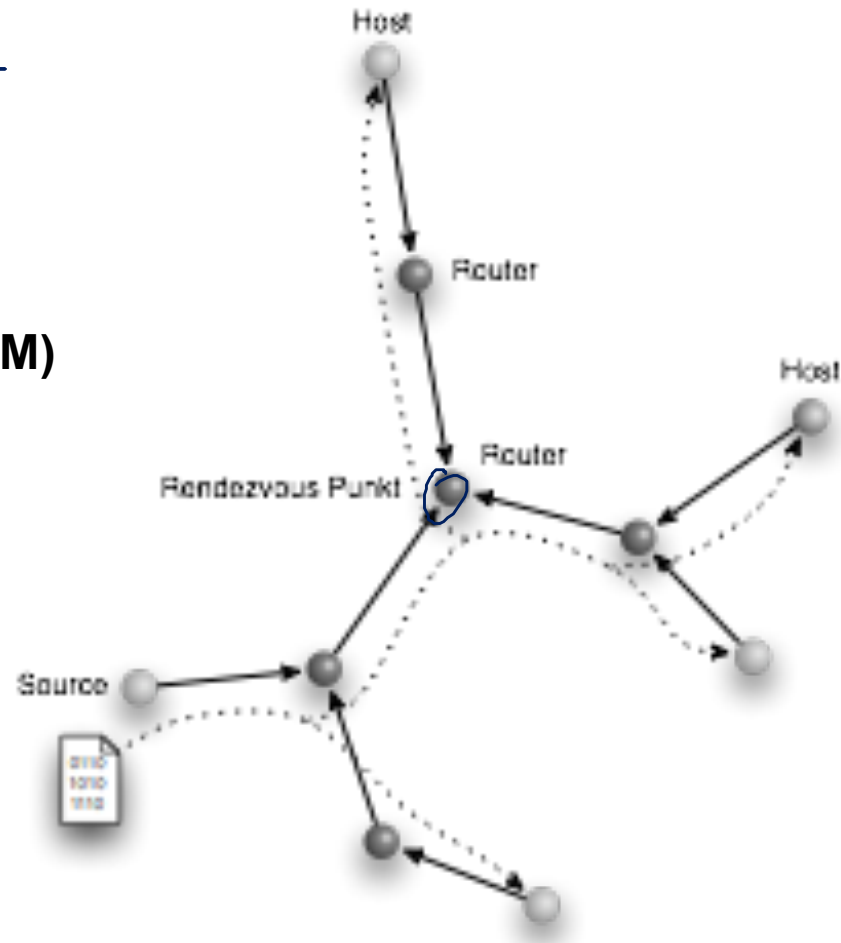
Terminals

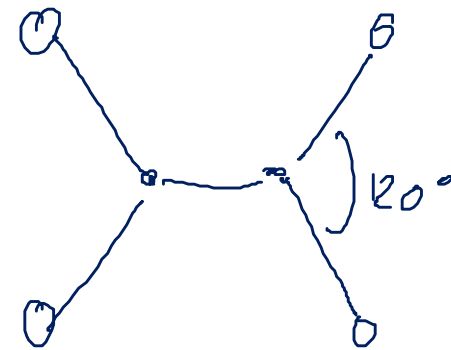
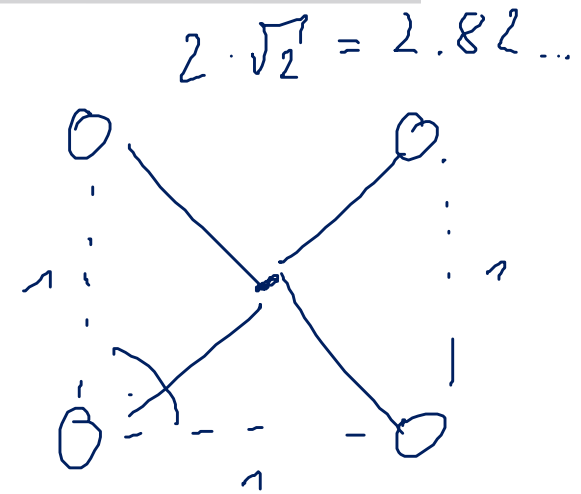
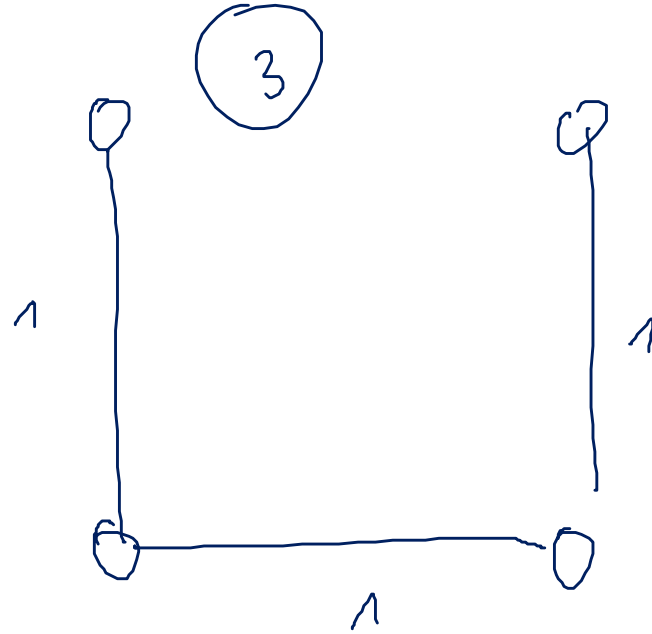
- NP-hard



Steiner point

- **Distance Vector Multicast Routing Protocol (DVMRP)**
  - used for years in MBONE
  - particularly in Freiburg
  - own routing tables for multicast
- **Protocol Independent Multicast (PIM)**
  - in Sparse Mode (PIM-SM)
  - o current (de facto) standard
  - prunes multicast tree
  - uses Unicast routing tables
  - is more independent from the routers
- Prerequisites of PIM-SM:
  - needs Rendezvous-Point (RP) in one hop distance
  - RP must provide PIM-SM
  - or tunneling to a proxy in the vicinity of the RP

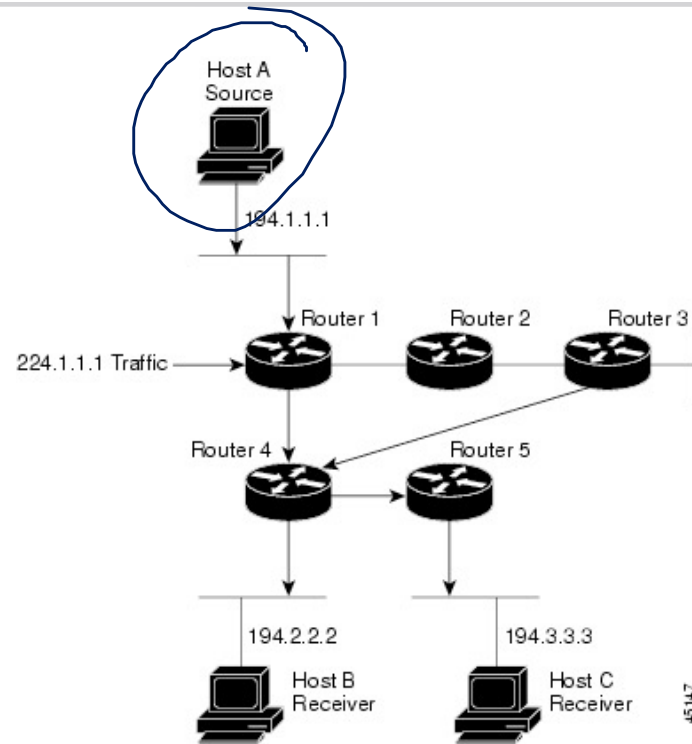
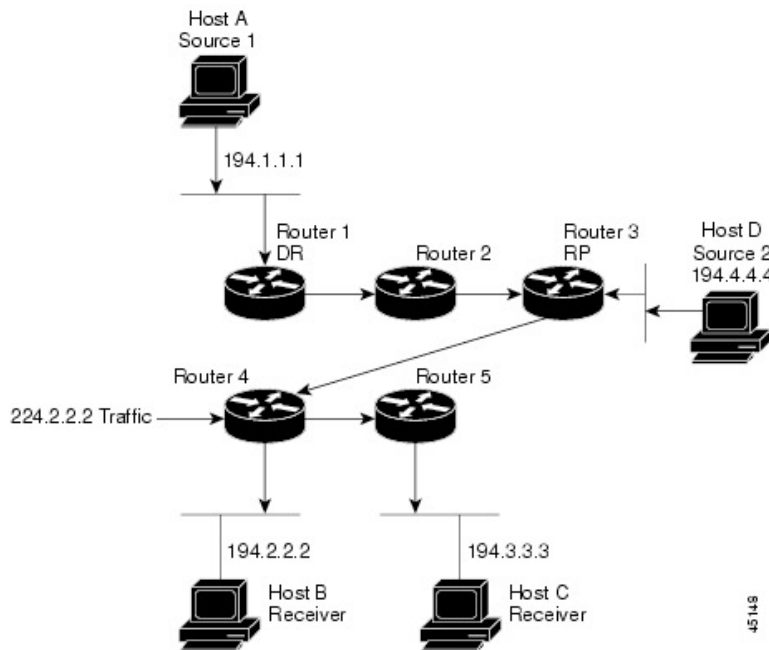




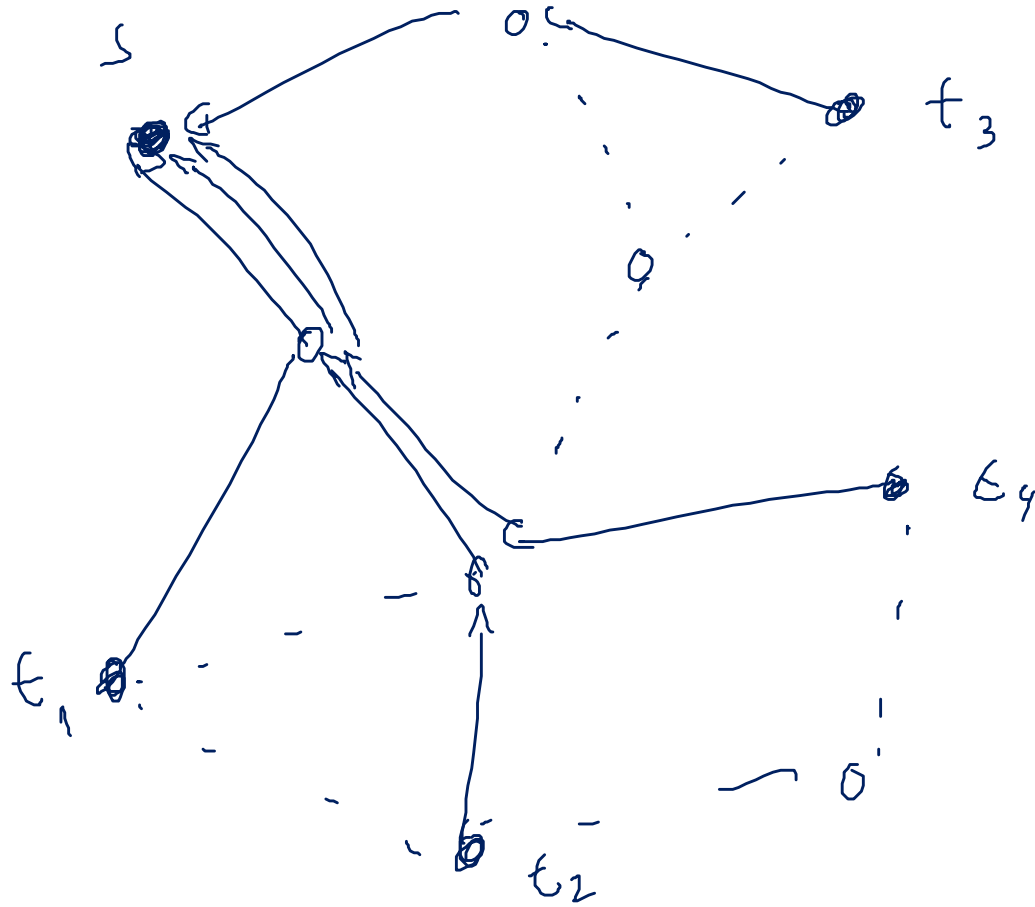


# PIM-SM Tree Construction

- ▶ Host A Shortest-Path-Tree
- ▶ Shared Distribution Tree



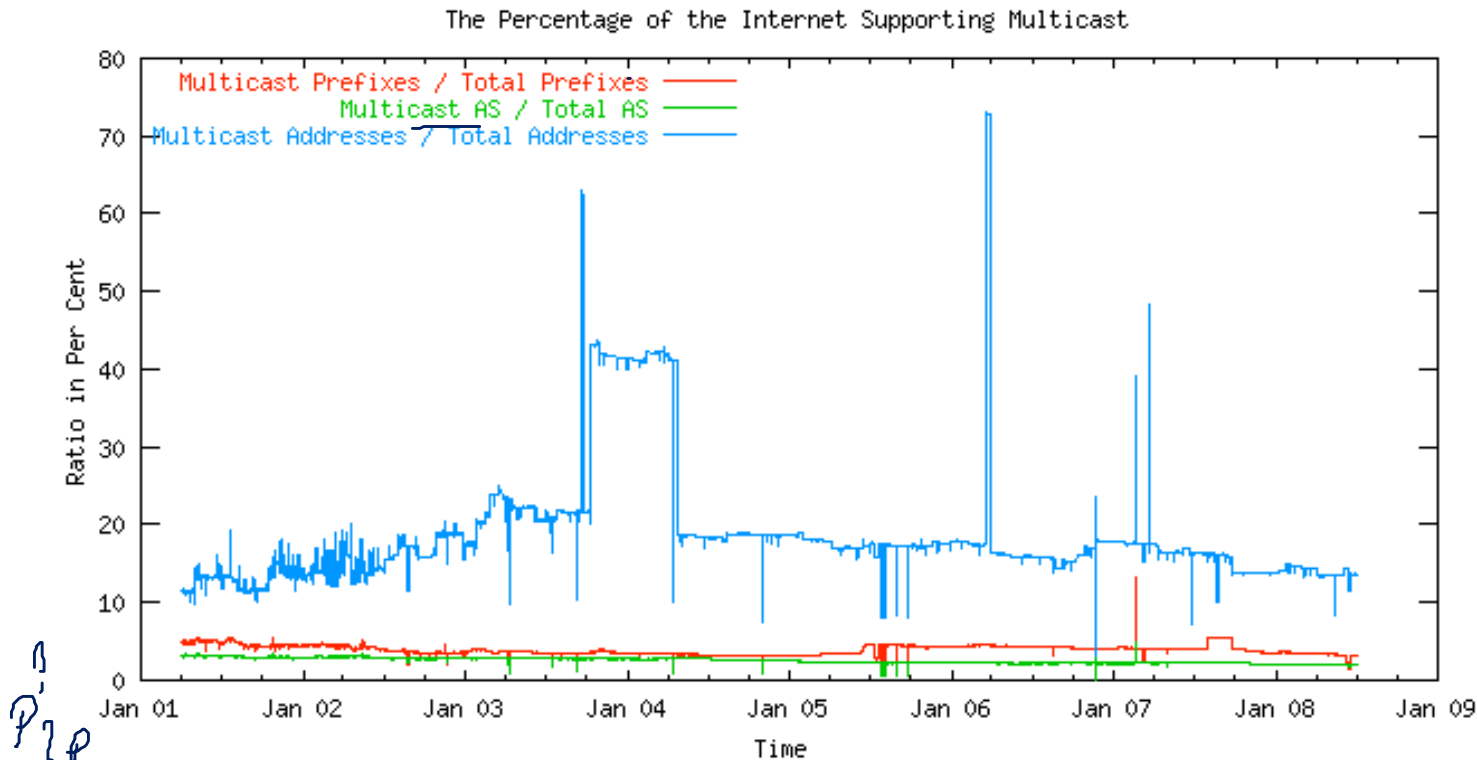
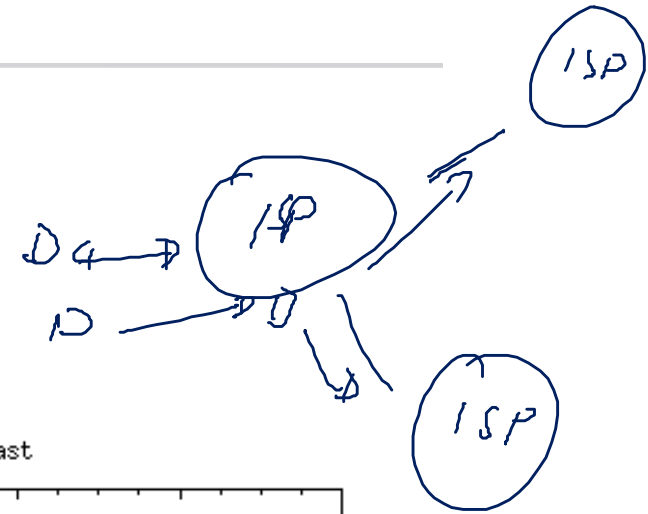
From Cisco: [http://www.cisco.com/en/US/products/hw/switches/ps646/products\\_configuration\\_guide\\_chapter09186a008014f350.html](http://www.cisco.com/en/US/products/hw/switches/ps646/products_configuration_guide_chapter09186a008014f350.html)



# IP Multicast Seldomly Available

- ▶ IP Multicast is the fastest download method
- ▶ Yet, not many routers support IP multicast

– <http://www.multicasttech.com/status/>



P2P

# Why so few Multicast Routers?

## ▶ Despite successful use

- D • in video transmission of IETF-meetings
  - MBONE (Multicast Backbone)

## ▶ Only few ISPs provide IP Multicast

## ▶ Additional maintenance

- difficult to configure ✓
- competing protocols ✓

## ▶ Enabling of Denial-of-Service-Attacks

- Implications larger than for Unicast

## ▶ Transport protocol

- only UDP
  - Unreliable
- Forward error correction necessary
  - or proprietary protocols at the routers (z.B. CISCO)

## ▶ Market situation

- ↳ • consumers seldomly ask for multicast
  - prefer P2P networks
- ↳ • because of a few number of files and small number of interested parties the multicast is not desirable (for the ISP)
  - small number of addresses

