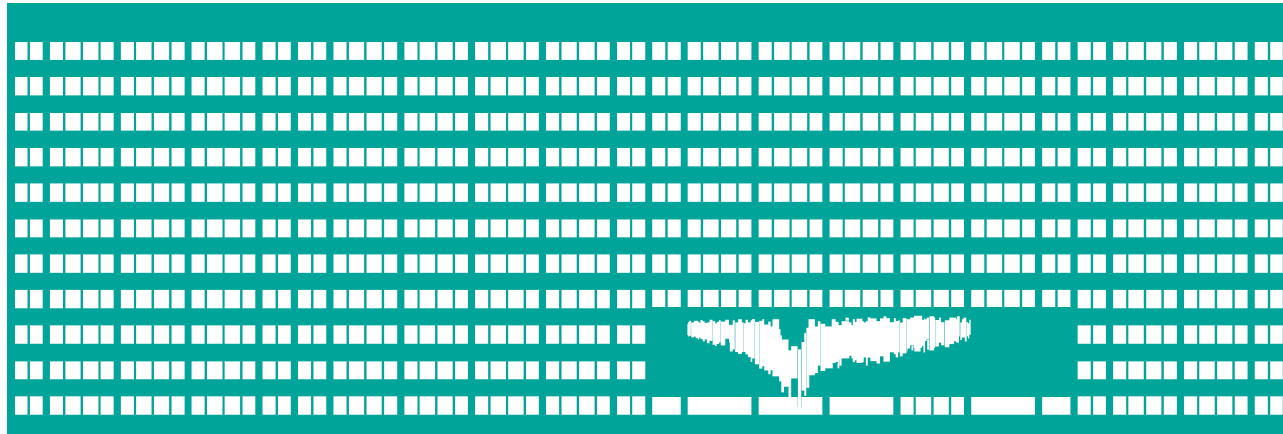


Introduction to Advanced Technologies of Computer Networks



Computer Networks Lecture 11

Routing in the Internet Backbone

- What is the “Internet backbone” in reality?
- Autonomous system
- Routing between ASes
 - BGP, path-vector principle
 - Transit and non-transit AS
 - Routing policies – usage of BGP attributes

Proximity Routing

- Anycast
 - Principle and potential usages
 - Anycast implementation
- Proximity Routing
 - Usages:
 - service location, P2P structures (resource sharing etc.), ...
 - Under control of the network infrastructure provider
 - Provider does not want to reveal the network structure to the user
 - User wants to define constraint values for the service instance to be used
 - Standards are still under development

Multicasting

- Multicast principle and advantages
- Multicasting on LAN
 - multicast MAC addresses
 - multicast support in LAN switches
- Multicasting on WAN
 - Distribution trees
 - PIM-SM

Quality of Service (QoS)

- Why do we need QoS ?
 - Interactive applications, multimedia transport, IPTV, VoIP/ videoconferencing, ...
- QoS on LAN and WAN
- QoS Models
 - Integrated Services
 - bandwidth reservation
 - RSVP used for signalling
 - non-scalable
 - Differentiated Services
 - Traffic classes – classification + marking
 - packet-level: IPv4/IPv6 header
 - Frame-level: 802.1p

QoS Implementation (DiffServ)

- Various queueing disciplines
 - Software or/and hardware queues
 - Priority, Proportional, Fair, ...
 - Queues organized in single-level or in a hierarchy (tree)
- Artificial fragmentation + interleaving (on slow links)
- Influencing the TCP connection behaviour
 - Delaying of ACKs
 - (Weighted) Random Early Discard

Mobile IP

- Allows the roaming machine to keep the same IP address while it is present in foreign networks (roaming)
- Mobile servers with fixed public IP address
- Maintain established TCP connections/ UDP sessions
- Allows roaming client to pass its traffic through ACLs as if it was in its home network
- Home agent + triangular routing
- The mobile node has to have a MoIP support in its OS

Advanced VPNs

- Dynamic creation of VPN tunnels
 - Necessary for hundreds and thousands of nodes where manual full-mesh configuration is not possible
 - Originally the hub and spoke infrastructure is configured
 - Spoke to spoke tunnels are automatically created when particular spoke-to-spoke traffic increases over a predefined threshold
- Tunnel-less VPNs
 - Group of peer routers register with Key server that (periodically) distributes encryption keys
 - Only the secure tunnels between routers and key server have to be pre-configured manually