Mobile IP and VPN

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Overview

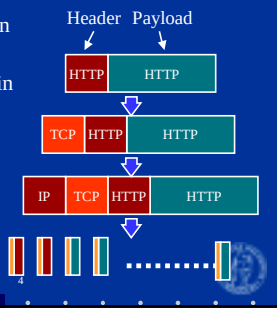
- Concept of tunneling
- Mobile IP concepts and deployment
- Virtual Private Network principles

Tunneling

- Technique for modifying data transport
- Used to transport data
  - with inconsistent addresses
  - belonging to incompatible protocols
- Packets belonging to Layer *n* are transported on Layer *m*, where *n* <= *m*
- Examples:
  - IP in IP (L3 in L3)
  - ATM in IP (L2 in L3)

"Regular" Data Packets

- Information packed in the *payload*
- Control information in the *header*
- Each layer adds its header



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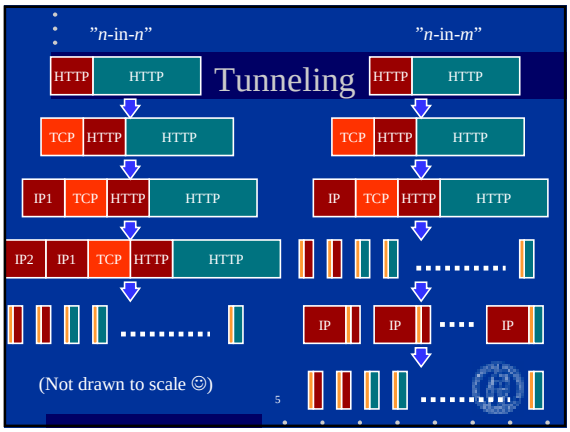
Tunneling



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Proc and Cons

+ Tunneling is essential for a range of new IP services
- It adds overhead and complexity to the communications
- We would prefer to *not* use it, whenever possible

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Mobility

Mobility Concepts

- Work in office and at home (DHCP, dialup)
- Home-network access wherever we are
  - VPN, IP-SEC, dialup
- Switch networks without service interruption
  - **Mobile IP**
- Other
  - WLAN roaming, protocol service discovery, cellular technologies

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Mobile IP Terminology

- Care-of-address: temporary address on a foreign network
- Home Agent (HA): computer on the home network responsible for tracking the mobile node
- Foreign agent (FA): computer on the remote network responsible for assigning the care-of addresses and informing HA about it

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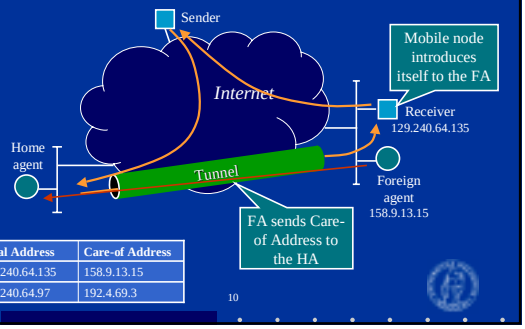
Basic Concept



Local Address	Care-of Address
129.240.64.135	158.9.13.15
129.240.64.97	192.4.69.3

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Mobile IP Protocol Components

- Agent discovery
- Registration procedure
- Handoff rules:
  - from one network to another
  - triggered by, e.g., traffic drop, retransmissions
- Address binding

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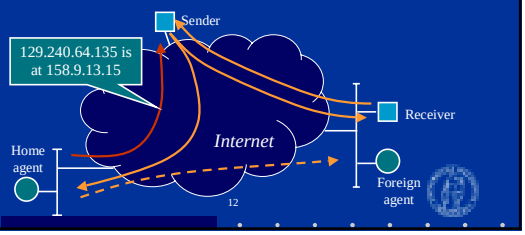
Route Optimization

- Avoiding the “triangle” communication through *binding updates*



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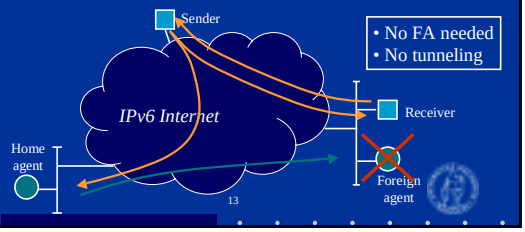
Mobile IPv6

- Node autoconfiguration in foreign network
- Secure binding updates
- Source routing through the routing header



Route Optimization in IPv6

- Routing header normally used
- If a packet arrives to the HA, it is assumed that the source does not know the COA, and the packet is encapsulated to the mobile node:

- Mobile node sends a routing update to the source

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Mobile IP Summary

- Mobile IP still not widely deployed:
  - IPv4 networks need substantial software to run Mobile IP (client protocol stack, FA, HA …)
  - IPv6 still on wait
- We believe Mobile IP will become widespread
- More work on
  - dynamic (smooth) handover
  - security
  - compatibility
  - merge between IP and telecom solutions

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Virtual Private Networks

Introduction

- Technique to interconnect networks on geographically spread locations
- *Public network infrastructure* is used instead of leased lines
- The network looks private to the user, hence term “virtual”

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VPN Advantages

- Cost-saving, as it gains from statistical multiplexing
- Flexibility (connecting new sites, contract modifications, points of presence etc.)
- Transfer of servicing tasks to the network provider

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VPN Challenges

- Security
- Reliability and QoS
- Lack of standards

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Security

- Authentication (how to know that the data is really sent by the peer)
- Policy enforcement (control lists, firewalls)
- Transport of confidential data over public networks (encryption)
- Monitoring network intrusions

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VPN QoS

- No QoS support in IP networks
- Heavy requirements on ingress points in order to maintain the traffic contracts
- Lesser efficiency

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Where to Implement?

- Layer 3 (IP SEC, GRE, L2TP, MPLS):
  - + Flexibility, simplicity
  - - IP only, poor standardization
- Layer 2 (FR, ATM, PPP):
  - + Multi-protocol, integration with access networks
  - - Maintenance, complexity

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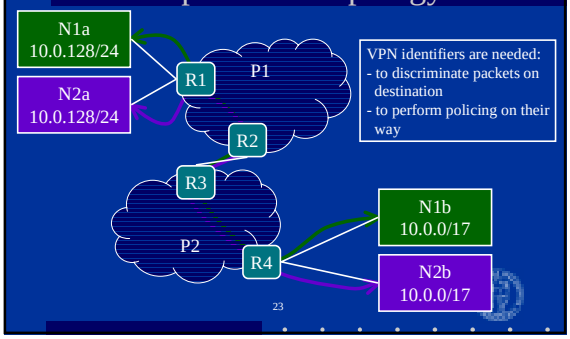
Simple VNP Topology



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Three VPN Categories

- Access VPN:
  - – remote, dial-in access to a “Point of Presence” in local area
- Intranet VPN
  - – site-to-site communication
- Extranet VPN
  - – business-to-business
  - – mutual access policies enforced

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Four VPN Implementation Methods

- Virtual Leased Lines
  - intranet/extranet, L2 forwarding (e.g. AAL5/IP)
- Virtual Private Dial Networks
  - access, L2 (e.g. PPP/L2TP/UDP/IP/PPP/L2)
- Virtual Private Routed Networks
  - intranet/extranet, L3
- Virtual Private LAN Segments
  - intranet, L2

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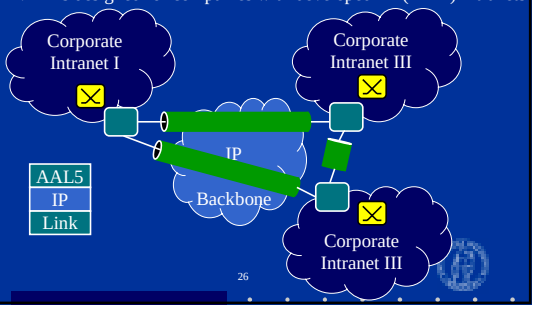
Virtual Leased Lines

VLL is designed for companies with developed L2 (ATM) intranets



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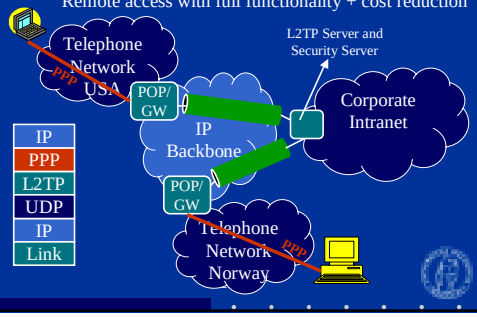
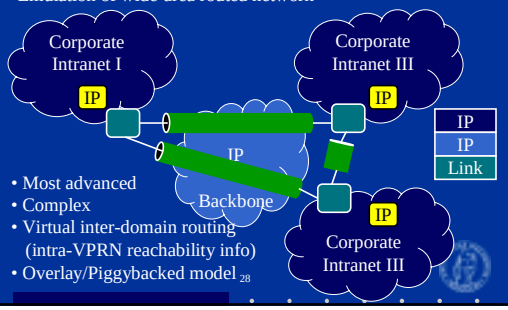
Virtual Dial Network

Remote access with full functionality + cost reduction



Virtual Private Routed Networks

Emulation of wide-area routed network



- Most advanced
- Complex
- Virtual inter-domain routing (intra-VPRN reachability info)
- Overlay/Piggybacked model

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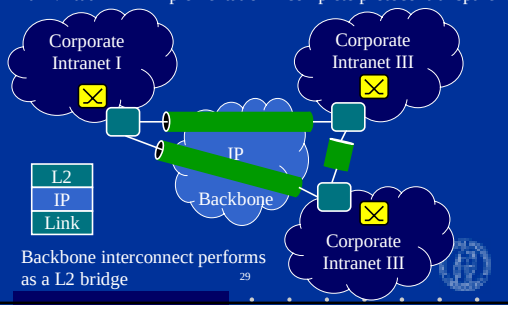
Virtual Private LAN Segments

Full virtual LAN implementation – complete protocol transparency



Backbone interconnect performs as a L2 bridge

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VPN Summary

- "Suboptimal in theory, perfect in practice"
- Cost-saving technology
- Security issues
- VPN QoS issues
- Full IP standardization needed

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