CSEP561 – Network Evolution

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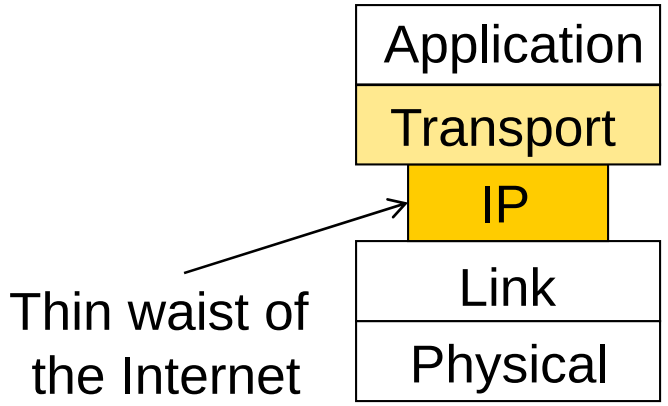
Network Evolution

- Focus:
  - How do we introduce new services?
  - New applications and link technologies are easy ...

- Issues
- Middleboxes and overlays
- Cases



Key Issues

- 1. Backwards-compatibility
  - What parts of the network need to change?
  - Application software, host OS, routers …
  - The answer will greatly determine the difficulty of change

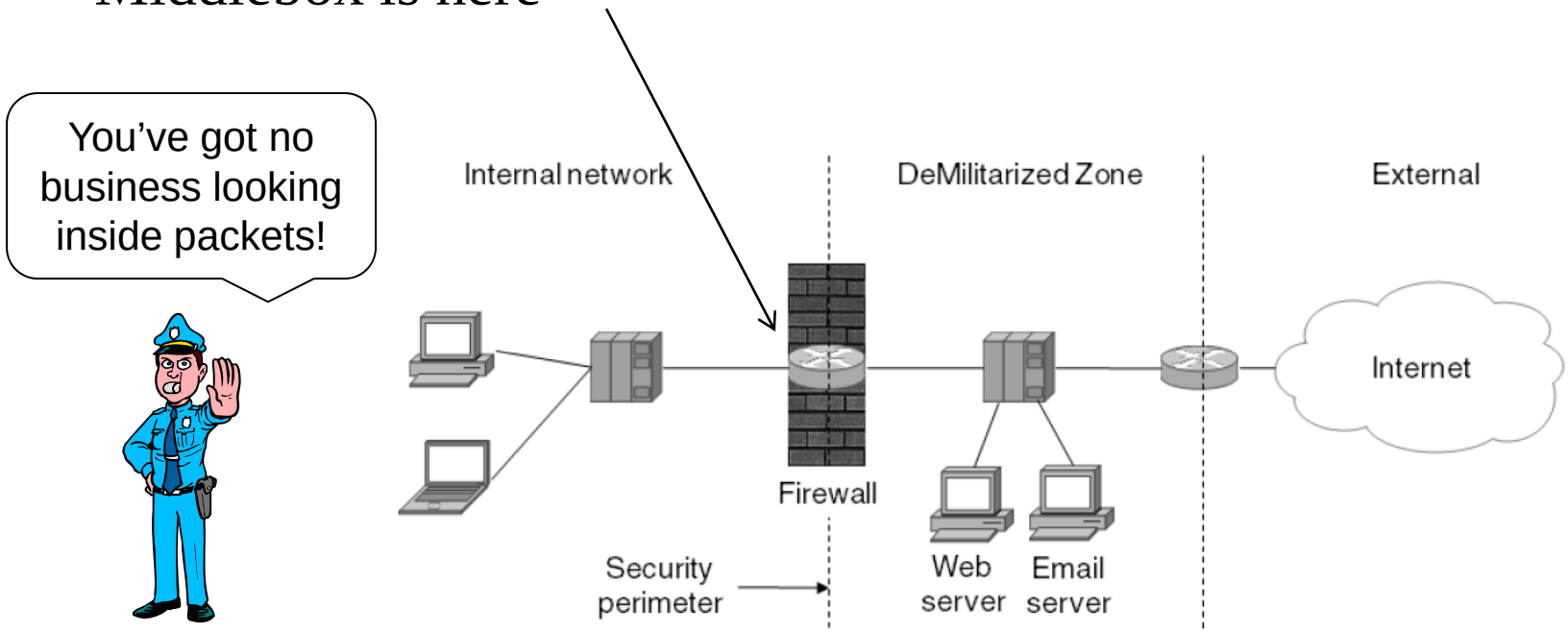
- 2. Incentives
  - Who benefits? User, ISP, Internet as a whole?
  - Often tied up with payment
  - This is the other part: change is not likely by a party without a benefit …

Middleboxes

- You know you really shouldn't mess with higher-layer semantics "in the network" but sometime it is easiest …
  - Boxes that do are called middleboxes
- Examples:
  - Firewalls, NAT boxes, transparent proxies

Firewall

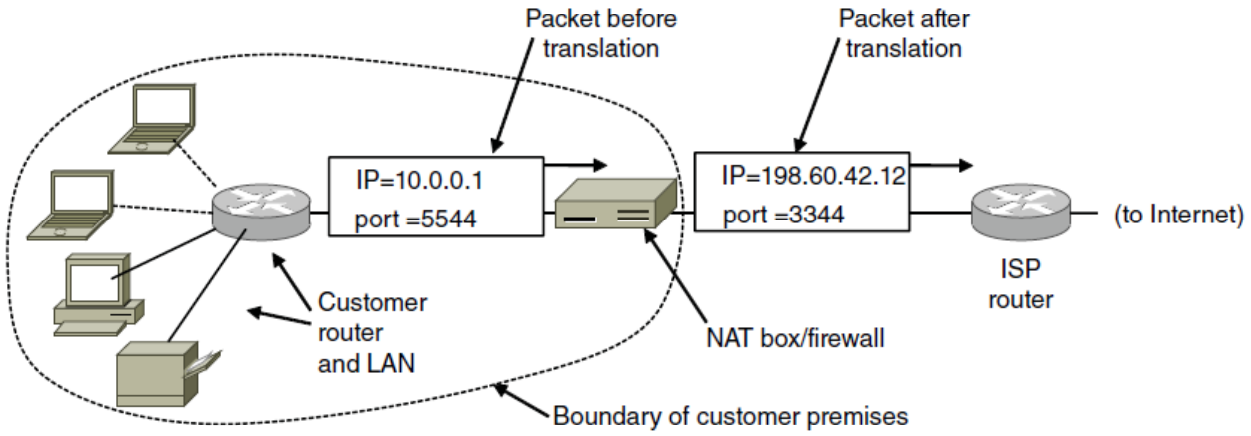
- Middlebox is here



- Breaks IP connectivity …

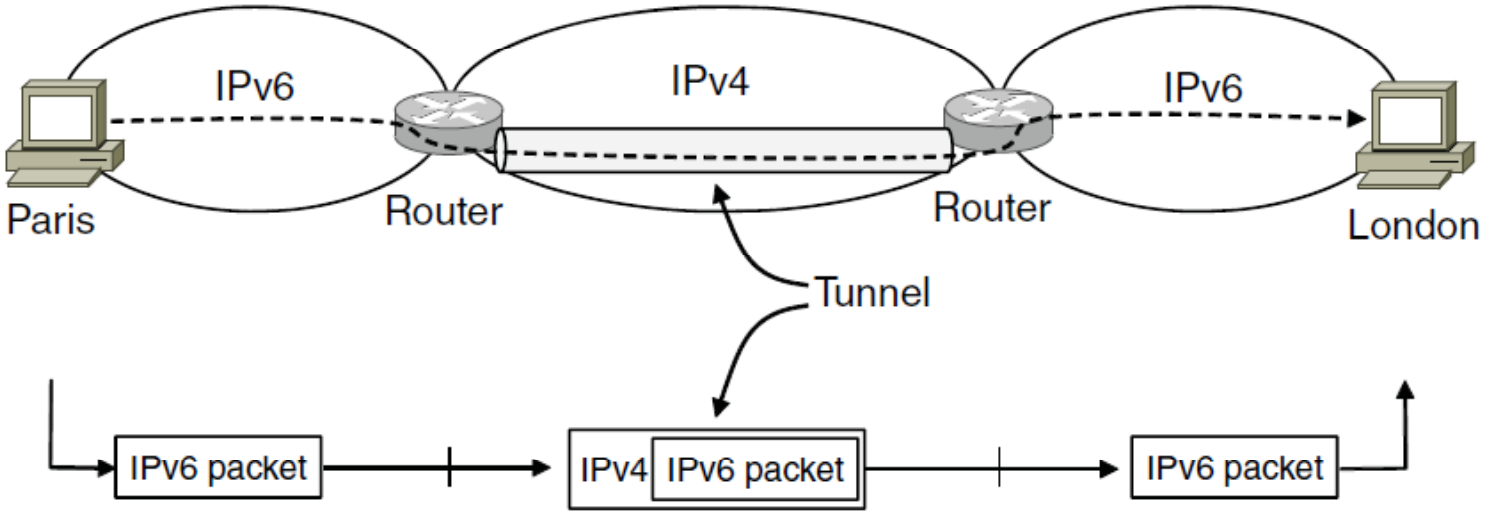
NAT box

- A small number of public IP addresses (on the outside) serve a large number of private IP addresses (on inside)
  - NAT box remaps the IP/port pairs
  - Breaks IP connectivity (can only connect inside-to-out)



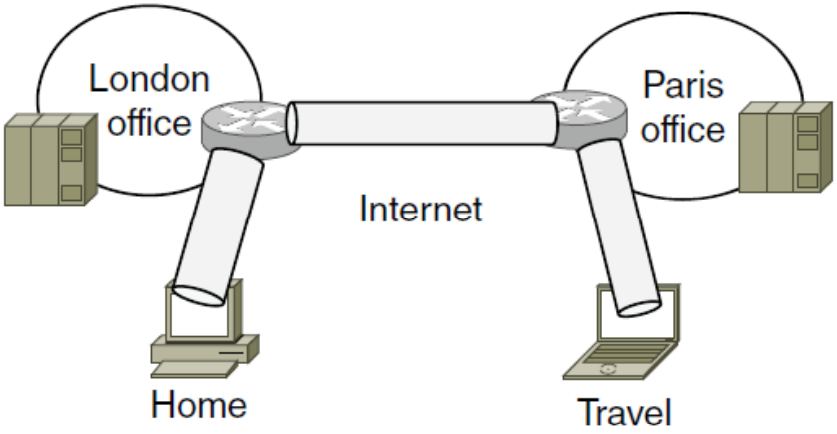
Overlays & Tunnels

- When you can't change a network, build on top of it …
- Examples: IPv6 over islands of IPv4; wide-area multicast; detour routing

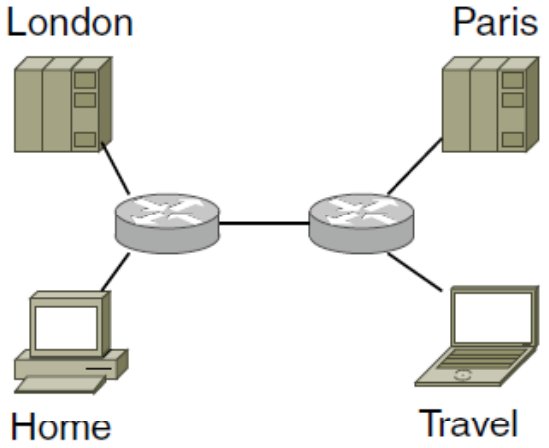


VPNs, an application of tunnels

- IPSEC functionality implemented at ends of tunnel



Actual topology



Topology as seen from the inside of the VPN

Cases to consider

- Web
  - CDNs
- Multicast
  - In or out of the network
- QOS
  - DiffServ and IntServ
- Addresses
  - IPv6 and NAT
- Security
  - E2E (IPSEC) and firewalls