COMP1203 - Metadata

Dominik Tarnowski (tdom.dev)

12/11/19

Networking

Network layers

Network access layer

- deals with local (physical) link
- each host has a link-unique address (48-bit MAC) This operates on one of the following physical standards:
- LAN
    - Ethernet
    - Wireless LAN
    - Wireless Personal Area Network
        * Bluetooth
        * Low-rate WPAN
- ADSL
- Mobile (3G, 4G, 5G, . . .)

Switches

- switches operate at the Network access layer
- only forwards traffic between the ports

Internet layer (IPv4, IPv6)

- handles next-hop routing (routing between different networks)
- passes received packet's payload to correct transport layer
- provides unique addressing
- only provides "best effort" packet delivery -> packets are not checked if transmitted correctly or even delivered

IPv4

- 32-bit address
- 2^{32} devices (4.3 billion)
- minimum 20 byte header

Obviously these days we are running out of public IPv4 addresses. This can be solved by **NAT** and **IPv6**.

NAT

Router has one public IP and uses a translation table to send/receive data. This does propose new issues as the individual devices cannot be directly connected to without e.g. port forwarding.

IPv6

- 128-bit
- Written in colon-delimiter hex (2001:0db8:85a3:0000:0000:8a2e:0370:7334a)
- 40 byte header

ICMP & ICMPv6

- used for diagnostic and control purposes
- contained within standard IP packet
- used by ping and traceroute

Transport Layer

- provides host-to-host connection (hides previous abstraction)
- Uses TCP or UDP

	TCP	UDP
Connection	Stable	"Fire and forget"
Reliability	Handles ACK & retransmissions	-
Data order	Always in order	-
Packet size		

TCP Flow / Congestion flow

- **TCP FLOW**: prevents fast sender from overwhelming a slow receiver

- **Congestion flow**: reduces send rate to cope with network congestion

Application Layer

- software that uses the network

Naming and addressing

Layer	Name
Application	Domain
Transport	Port
Internet	IP
Link Layer	MAC

DNS

- maps domain names to IPv4 or IPv6

ARP / NPD

- Address Resolution Protocol (IPv4)
- Neighbour Discovery Protocol (IPv6)
- Operates at link layer, translates IP to MAC

Routing

- At the Internet Layer
- Each router has an IP address in each address space it routes between
- Can also have a firewall, DNS, DHCP, etc

Multiple paths for routing

- Globally, to use the shortest/fastest path, we use **BGP**
- Locally, we use **RIP** or **OSPF**

Monitoring

- In the UK, ISPs can be required to store certain connection information.

Staying anonymous

- Anonymous VPNs (still create logs, exit points can be monitored)
- ToR
    - Routes traffic through random series of hops
    - Encrypted up to exit node
    - Reduces performance