Network Layer

Study-Ready Notes

Compiled by Andrew Photinakis

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Chapter 4: The Network Layer — Data Plane

1 4.1 Overview of Network Layer

1.1 Core Role and Architectural Placement

1. Network layer is third layer of the internet protocol stack
2. Resides between the transport layer and link layer
3. Fundamental role is to move network layer packets, called datagrams, from a sending host to a receiving host.
4. Host-to-Host Communication
    - While transport layer provides logical communication between processes, network layer provides logical communication between hosts
5. Universal Implementation
    - Transport and application layers run only on end systems (hosts)
    - Network layer runs in every host and router in network
    - It's esential b/c routers must examine datagram headers to perform their forwarding function
6. Router Protocol Stack
    - Routers are network-layer (Layer 3) devices
    - Consist of "truncated" protocol stack, implementing physical, link, and network layers
    - Do not implement transport or application layers
    - Sole purpose is to forward datagrams, not run end-user applications
7. At Each Stage
    (a) Sending Host
        - Network layer takes segments from transport layer, encapsulates them into datagrams, and sends these datagrams to its nearby router

    (b) Receiving Host
        - Network layer receives datagrams from its nearby router, extracts transport-layer segments, and delviers them up to transport layer

    (c) Routers
        - Core function to examine header of an arriving datagram and forward it to appropriate output link
        - Routers are 'Layer 3' devices
        - Typically have a 'truncated' protocol stack, implementing up to network layer but not transport or application layers

1.2 Planes

1.2.1 Data Plane

- Performs per-touer function of forwarding datagrams from a router's input link to its appropriate output link

1.2.2 Control Plane

- Performs network-wide logic that controls how datagrams are routed along an end-to-end path from source to destination host

2 4.3 The Internet Protocol (IP): IPv4, Addressing, IPv6, and More

2.1 Overview

- Delves into foundational protocols and addressing schemes of the Internet Protocol (IP) that enable the Internet's network layer.
- IP Protocol provides essential, unreliable, best-effort delviery service that underpins all higher-layer communcation
- IP Protocol is hte only network-layuer protocol used in the Internet

2.1.1 IP Protocol

- Is the only network-layer protocol in the internet
- Is the "narrow waist" of the hourglass, the single protocol that everything else - every transport protocol (TCP, UDP) and every applciaiton (HTTP, DNS) - must run on top of
- In turn must be able to run over any link-layer technology (Ethernet, WiFi, 4G, etc)