

# Ch1 Introduction

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- Internet
  - 5 layer
    - application: user to user
    - transport: process to process
    - network: host to host
    - link: hop by hop
    - physical: bit
  - communication links: fiber, copper
  - packet switches: router, switches
  - End systems access the Internet through **Internet Service Providers (ISPs)**
    - *Internet exchange point* between ISP: peer link
  - Internet: “network of networks”: Interconnected ISPs
  - Internet applications run on end systems
  - Protocols define **format, order** of messages sent and received among network entities, and **actions** taken on message transmission and/or receipt
- network edge
  - = runs network applications
    - Client, servers, host
  - end system
  - access networks
    - **Frequency division multiplexing(FDM)**: different channels transmitted in different frequency bands
    - Hybrid fiber coax (HFC): fiber + coaxial cable: 下行速度快于上行
    - digital subscriber line (DSL) tele
    - Local area network LAN: TP
  - links
- network core
  - Def. interconnects end systems
  - packet switching: on demand may wait
    - host break long msgs into pkts
    - store and forward: entire packet must arrive at router before it can be transmitted on next link
    - transmit at full link capacity

- not reserved: queuing delay and packet loss
  - forwarding and routing
    - forwarding: 在router里输入链路到输出链路
    - routing: 确定总路径
- circuit switching
  - reserved: traditional tele
  - TDM: At maximum rate of (wider) frequency band, but only during its time slot (s)
  - establish an end-to-end link
  - guaranteed constant rate
- network structure
- delay, loss and throughput 计算题
  - delay
    - queue(buffer)
      - congestion
    - transmission
      - packet length/transmission rate
    - propagation
      - length/speed
    - nodal processing
      - check bit error
      - determine output link
  - Traffic intensity
    - Traffic intensity =  $\frac{L\lambda}{R}$
    - $\frac{L\lambda}{R} \rightarrow 0$ : small queue delay
    - $\frac{L\lambda}{R} \rightarrow 1$  : queue delay  $\rightarrow \infty$
  - end-to-end delay
    - 要乘以router的个数
  - Throughput
    - bps
    - bottleneck
    - 注意share需要除以并行的个数
- protocol layers
  - 优势: modularization eases maintenance, updating of system.
  - 劣势: 高层和低层间功能重复, 层间信息传输
  - Each layer provide services to the layer above

- switch: link & physical
- router: network & link & physical
- security
  - virus: 有用户交互复制感染
  - worm: 无需用户交互就复制感染
  - infected host can be enrolled in botnet (僵尸网络), used for spam. DDoS attacks
  - DoS: Denial of Service---用虚假资源淹没资源
    - sniffing
    - IP spoofing: sending pkt with false src addr
  - 防范:
    - authentication
    - confidentiality 加密
    - integrity checks
    - access restrictions 有密码保护的vpn
    - firewalls
      - 过滤数据包, 检测DoS
- history