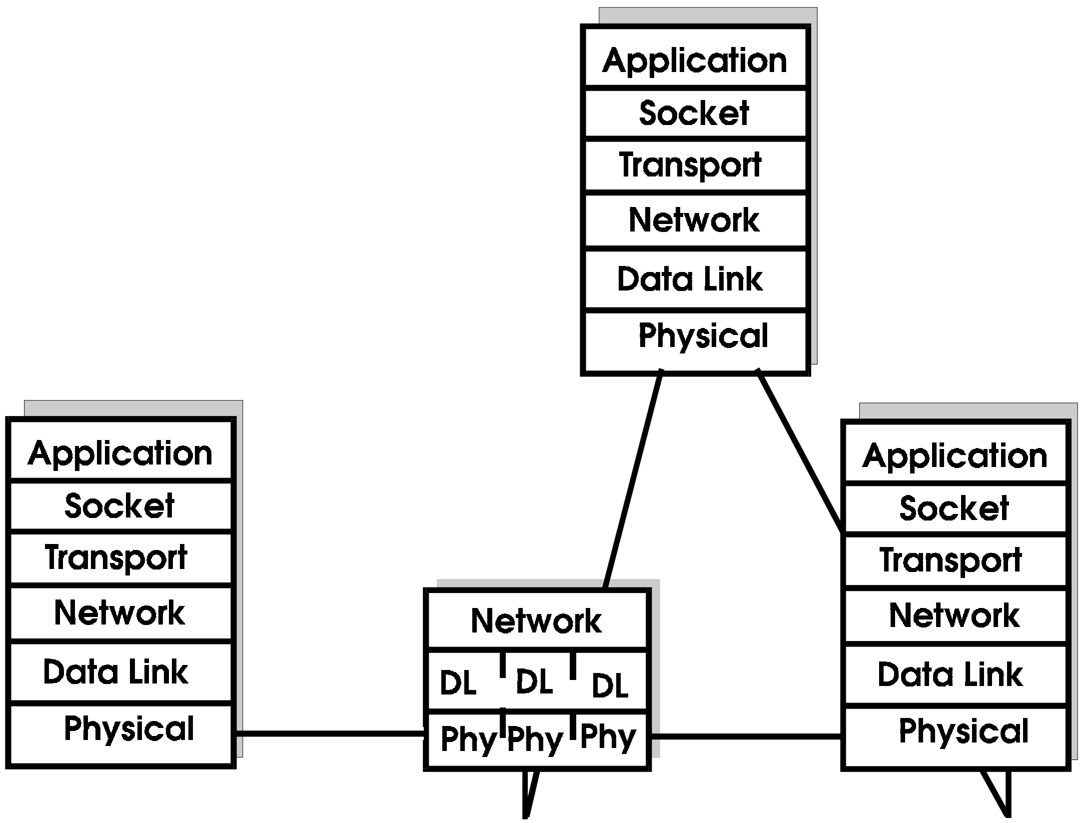
Exam Review



Application
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Physical
Application
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Application
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Data Link
Physical

Basic Concepts

- Packet switching versus circuit switching
  - Their advantages and disadvantages
- Layered network architecture
  - Various layers of a protocol stack
  - ISO/OSI model
  - Advantages of layering, disadvantages?

Physical Layer

- Physical media and their characteristics
  - Twisted pair
  - Broadband cable
  - Fiber optics
  - Wireless
- Architectures to reach end-users at home
  - Cable modems
  - ADSL
  - ISDN

Data Link Layer

- Services: framing, reliable communication, sharing, addressing
- ARQ-based protocols
  - Stop-and-wait, Go-back-N
- Point-to-point protocols
  - HDLC
- Multiple access protocols
  - Aloha
  - Slotted aloha
  - CSMA and its variants (non-persistent, 1-persistent, p-persistent)
  - Case study: Ethernet

Data Link Layer

- Group random access: use a well-defined algorithm to resolve contention (instead of random backoff)
- Token passing protocols
  - Case study: IEEE 802.5
- TDMA
- Reservation-based protocols
- How do we resolve data link layer addresses?
  - ARP
- How do we interconnect LANS?
  - Bridges, repeaters and switched ethernet

Network Layer

- Services: virtual circuits, datagrams
- Routing
  - Centralized versus distributed, static versus adaptive
  - Two basic approaches
    - Link state: centralized, dynamic; use Dijkstra's shortest path
    - Distance vector: distributed, dynamic
  - Broadcast-based routing: reverse path forwarding
  - Multicast routing
    - Shared trees versus source-based trees
    - DVMRP and link state multicast routing
  - Hierarchical routing: inter-domain and intra-domain routing

Network Layer

- Case study: IP
  - IPv4
  - Fragmentation and reassembly issues
  - Intradomain routing: RIP (distance vector-based), OSPF (link state)
  - Interdomain rotuing: BGP
    - Can exchange full path information
    - policy-based routing
  - IP Multicast
    - IGMP: used to join/leave from a multicast group
    - PIM: used to route and deliver packets
      - Sparse mode versus dense mode, rendezvous points

Network Layer

- ICMP: exchange control information
- IPv6: new functionality, compatibility issues
- Tunneling
- Case study #2: ATM
  - ATM Network layer
  - Virtual circuits
  - Call setup
- Switches and routers
  - Switching fabrics: memory, bus, crossbar

Transport Layer

- Multiplexing and demultiplexing to applications
- UDP case study
- Principles of reliable data transfer
  - Rdt 3.0: stop-and-wait protocol
  - Pipelined protocols
    - Go-back-N
    - Selective repeat
- Flow control
  - Implicit versus explicit flow control
  - Flow control in TCP

Transport Layer

- Congestion control
  - End-to-end, network-indicated, rate-based
- Case study: TCP
  - Byte-stream, cumulative acks, go-back-N
  - TCP ACK generation
  - Round-trip estimation and setting timeouts
  - Connection management: three way handshaking
  - Congestion control: slow start and congestion avoidance phases, AIMD

Application Layer

- Presentation services: part of the application layer
  - ASN.1
  - XDR
- Interface (API)
  - The socket abstraction
  - Client-server programming using sockets
    - Connectionless versus connection-oriented
- Example application layer protocols
  - Http: http 1.0, persistent http, web caching
  - DNS: distributed database for resolving IP addresses