LE 517
Data Communications and Networks

Week 12:- Wide Area Networks

By

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Wide Area Networks

- Network Routing
  - Types of Routing
  - Routing Tables
  - Dijkstra's Algorithm
  - Bellman-Ford Algorithm
  - Routing Information Protocol (RIP)
- Public Data Networks
  - Packet Switched Network Modes
  - X.25 Public Data Network Interface Standard

WAN

- People use WAN for e-mail and file transfer.

- WAN must cooperate with different protocols
  - Protocol converters:- Translate from one protocol to another.

- Connection can be separate from layer 1 to layer 7
  - E.g. layer 3 generally called as "router", layer 7 called "gateway"

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Network Routing

- There are number of host and connecting, it needs direction to travel.
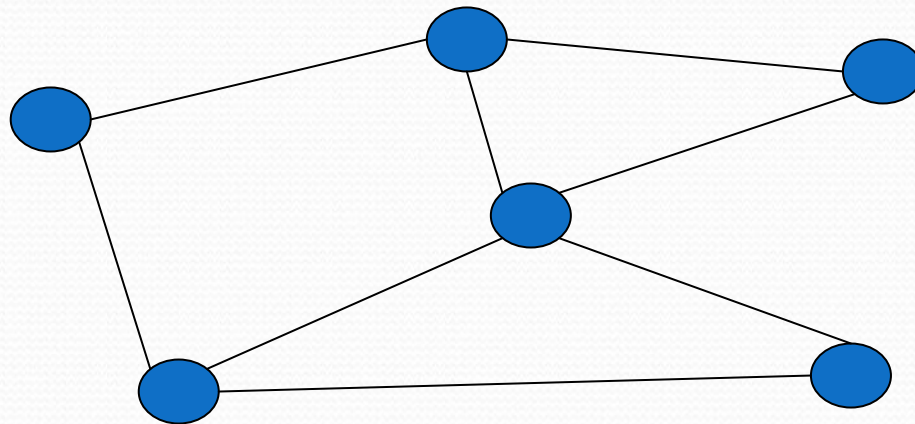
Network Routing

- Which path to go ?

- How to determine the best path?

- How to calculate ?

- Exchange data is required?

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Types of Routing

- Routing Algorithm
  - Centralized Routing
  - Distributed Routing
  - Static Routing
  - Adaptive Routing

Types of Routing

- Centralized Routing
    - All interconnection information is generated and maintained at a single central location.

    - It consists of a row and column indicates the first node, next node and cost.

    - From information of each node will calculated as final matrix.

Types of Routing

- Distributed Routing
  - Means no central control.
  - Each node must determine and maintain routing independently.
  - Difficult to calculate without global view.
  - Required special alogrithm to assist

Types of Routing

- Static Routing
  - Once a node determine its routing table, node does not change it.

  - The cheapest path is not dependent on time.

Types of Routing

- Adaptive Routing
  - Allow a network node to respond to change and update routing table accordingly.

  - E.g. traffic on network is increase significantly.

  - Concern: how to change this effectively/sensitivity ?

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Routing Tables

- To illustrate the next hop to go for appropriate data and destination.

- Please see previous lecture for detail.

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Dijkstra's Algorithm

- It can be called as "shortest path algorithm" or "forward search algorithm"

- Initially, cost is large (infinity).

- Then, first connection determine from the direct connection.

- The rest determine from cost(V) and update table with lowest cost.

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Bellman-Ford Algorithm

- Dijkstra's algorithm produced the cheapest path by working forward from a given source.

- Bellman-Ford work backward search algorithm.

- E.g. cost(A,Z) it looks 1. cost (A,B) + cheapest(B,Z)

  2. cost (A, C) + cheapest (C,Z)

  …..

Bellman-Ford Algorithm

- How the neighbor node knows the cheapest route to Z?
  - Because they are centralized and distributed.
  - So each node contains the matrix of connection
    - Initially state as unknown for indirect connect
    - Then update for each iteration.

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Routing Information Protocol (RIP)

- It use a hop count to determine.
  - Initially, it sends message along the network.
  - The message specify number of hops.
  - The router can determine which network and number of hops can be reached.
  - To repeat this steps, information will be storing and broadcast.

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Public Data Networks

- This to develop network that anyone could access.

- European country face the problem that standard is incompatible between the countries.

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Packet Switched Network Modes

- Virtual Circuits
  - Creating connection between two parties

  - This requested is routed through network nodes
  - Establishing a path between caller and destination

  - The connection is not a physical one.
  - Each node may have several virtual circuits.

Packet Switched Network Modes

- Datagram service
  - The path may not always be the best route
  - Each packet should be route for the best route in present time.
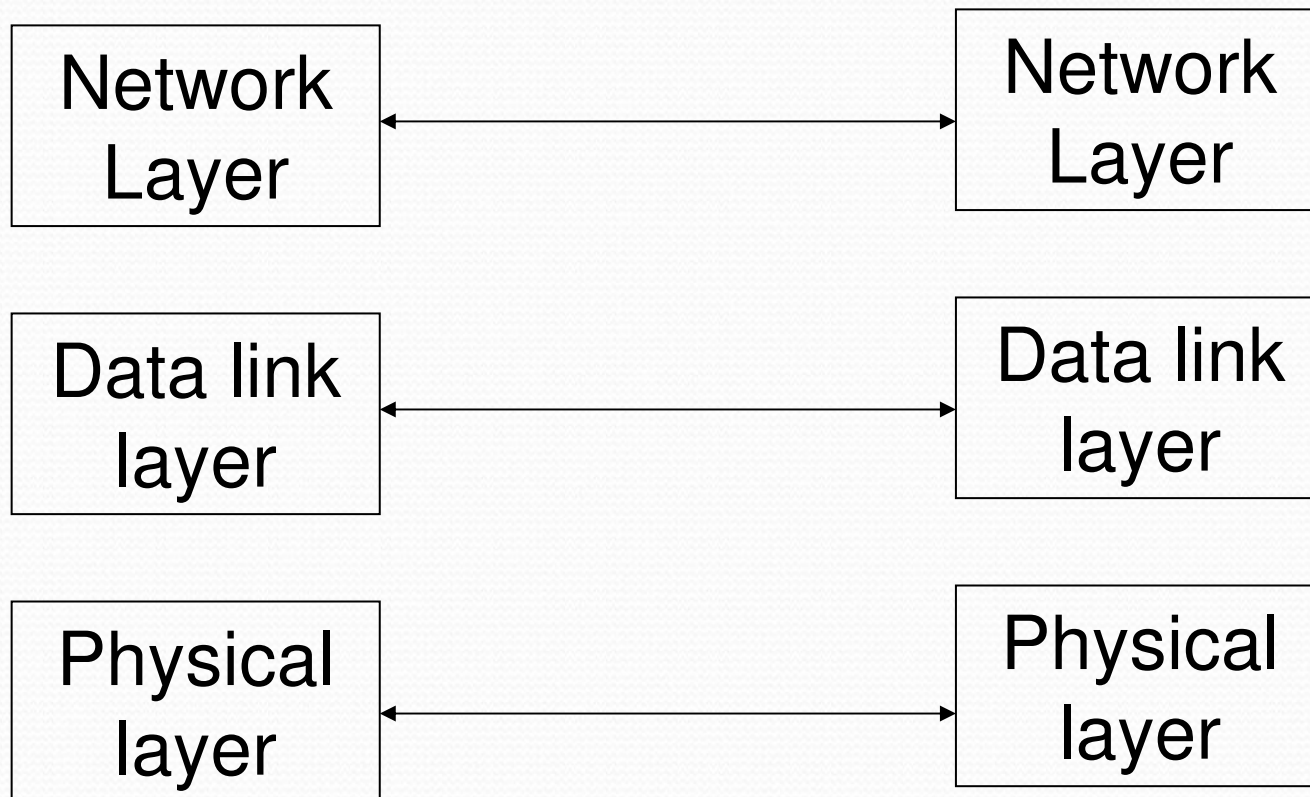
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X.25 Public Data Network Interface Standard

- X.25 defines the protocol between DTE and a DCE connection.

- X.25 defines a synchronous transmission analogues to the three lowest layers of OSI.

X.25 Public Data Network Interface Standard

Network Layer	←→	Network Layer

Data link layer	←→	Data link layer

Physical layer	←→	Physical layer

X.25 Public Data Network Interface Standard

- ## X.25 Packet Formats

Flags, logical group number | logical channel number | control| data

Data Packet

Flags, logical group number | logical channel number | control| other

Control packet

1   1   1   **variable**

(number of octets)

X.25 Public Data Network Interface Standard

- X.25 provides 2 types of VC
  - Permanent virtual circuit
    - Similar to leasing a leased line

  - Virtual call
    - Requires a call connection protocol to be performed data transfer

Reference

Q & A