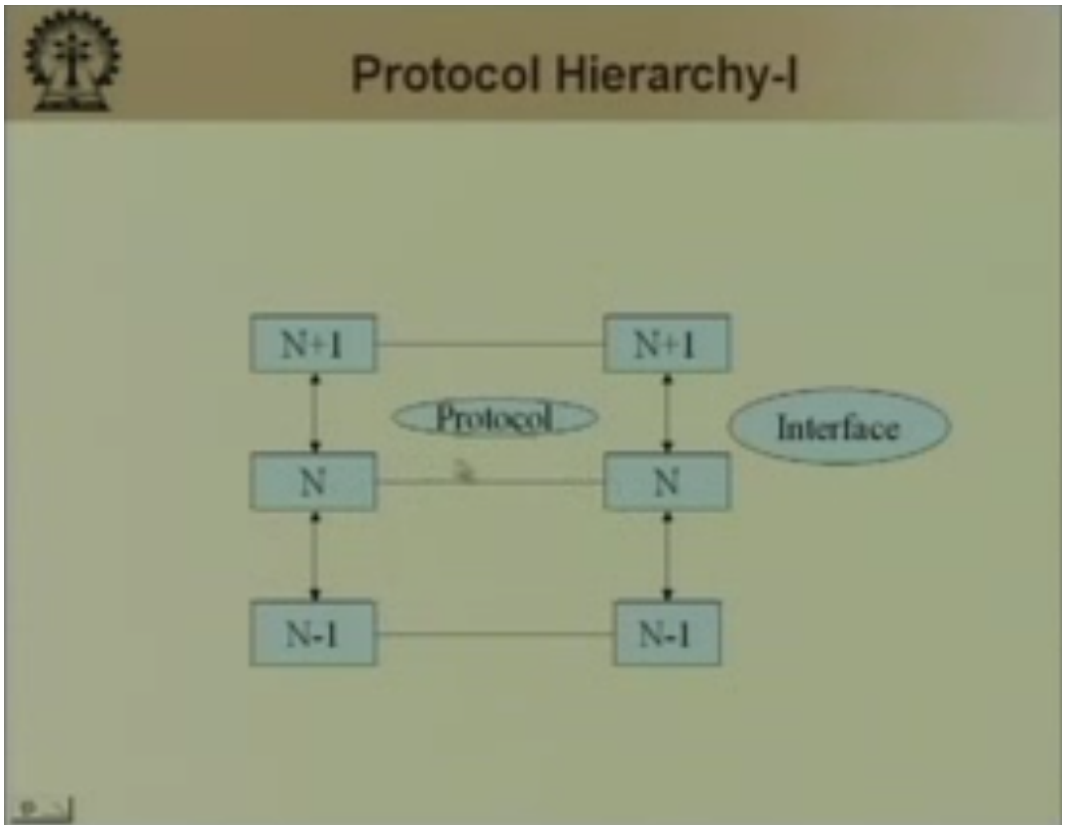
Computer Networks
NPTEL Notes

Contents

1 Formal Framework - Protocols

1. Building blocks of a network architecture.
2. Each protocol object has two interfaces.
   (a) *Service interface* defines the operations of the protocol.
   (b) *Peer to peer interface* defines messages exchanged with peer.

2 Protocol Hierarchy



- Most networks are organised as series of layers
- The task of each layer is to provide service to its upper layer
- Every layer is virtually connected to its peer.

- There is a peer to peer protocol running between any two corresponding and communicating layers.
- The interface between the layers in the same node is well defined.
- The implementation of each layer in each node is transparent to other layers.
- The peer to peer layer protocols can be changed if the peers all agree. However it need not be referred to other layers.
- The service definition tells what the layer does and nothing else.
- The interface tells the process above how to access it, what the parameters are and what are the results to expect.
- Known protocol stacks are:
  - OSI reference model
  - TCP/IP reference model
  - ATM reference model
  - There are some other protocol stacks as well and some new ones too.

3 OSI Reference Model

1. Application Layer
2. Presentation Layer
3. Session Layer
4. Transport Layer
5. Network Layer
6. Data link layer
7. Physical Layer

4 Peer Level Communication

- Message sent from one application to another on different layers.
  - travels down the layers of the sending machine as each layer adds up its header to the message.
  - bottom-most layer (physical layer) sends the message to the receiving machine.
- Sending message
  - Received by physical layer on the other side.
  - Passed up through each layer.
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5 OSI Model: 7 protocol layers

- **Physical** - How to transmit bits.
- **Data Link** - How to transmit frames.
- **Network** - How to route packets to the node.
- **Transport** - How to send packets to the application.
- **Session** - Manage connections
- **Presentation** - Encode/Decode messages, Security
- **Application** - Everything else!

6 Application Layer

- The application layer contains a variety of protocols which are used by various applications e.g smtp, ftp, http etc.
- The application layer usually contains some cheap connection to its peers. Example of peers are nodes giving some service and its clients.

7 Presentation Layer

- Handles the format of the data.
  - Protocol conversion
  - Data translation (ASCII)
  - Compression
  - Encryption

8 Session Layer

- Allows application on different layers to share a connection.
- Provides checkpoints, if a connection is lost only the required info is resent.
- Dialog control who can transmit.

9 Transport Layer

The basic functionality of transport layer is to accept data from layer above, split it into smaller units if necessary and ensure that the pieces all arrive at the right order at the other end. This should also be done in a cheap and efficient manner and isolate the upper layers from change in technology.

Types of transport services:

- Error free point to point channel that delivers message or bytes in the order in which they were sent.
- Transport of isolated messages with no guarantee of delivery.
- Broadcasting of messages to multiple destinations.

10 Network Layer

- It decides on what route to take locally so that intended message ultimately reaches its destination.
- It controls broadcasting by essentially segregating multiple networks.
- It handles technological mismatches like restriction on packet sizes.
- Congestion control is done in this layer.
- Billing information may be generated in this layer.
- It handles different policies pertaining to different networks.
- In broadcast networks, its functionality is minimal.

11 Data link Layer

- Make physical layer appear like it is free of transmission errors.
- Handle rate mismatch between sender and receiver.
- Control access of channels which are broadcast in nature.

12 Physical Layer

- This transmits raw bits over a communication channel.
- Physical issues like voltages, attenuation and noise levels, light intensity, ports and pins, modulating techniques are described in this level.