Upper Layers

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Intro

- Contains:
  - Application Layer (layer 7)
  - Presentation Layer (layer 6)
  - Session Layer (layer 5)

Application Layer

- Significantly different from other layers
- Lower layers concerned with reliably communicating data from one process/machine to another.
- Application layer concerned with what to do with data once it arrives.
- Has a set of utilities:
  - Specific Application Service Elements (SASE) - FTAM, MHS, DS, VT
  - Common Application Service Elements (CASE) - provide access to Presentation layer, plus Concurrency Commitment and Recovery (CCR).

Specific Application Service Elements - SASE

- Basically abstractions for commonly used high-level network operations (procedure/interrupt libraries).
- FTAM - File Transfer Access & Management implements a virtual filestore.
- MHS - Message Handling Service for E-Mail applications.
- DS - Directory Service allow network services to be known by symbolic names. Implements a mapping of $names \rightarrow network\ ids$ ($TSAP's$).
- It allows operations to add/change/delete entrues so that processes can advertise ttheir existence, be closed down etc.

Common Application Service Elements (CASE)

- CASEs are primitives to give access to Presentation Layer equivalents.
- Commitment, Concurrency & Recovery (CCR).
- CCR implements fool-proof coordination of mult-message operations to difference computers even under repeated host crashes.
- Implemented by supporting atomic actions (either fail or completelet succees in their entirety).
- Requires Stable storage (i.e. disk storage) to hold state information and a 2 stage prepare then commit.

Presentation Layer

- Main concerns:
  - Access to the session layer
  - Representation transformations
- It's concerned with preserving the meaning of information sent over the network.
- It may represent the data (encode) in various ways, but the receiver side will convert it back into its original meaning.

Issues

- **Data format:** Convert data structures used on a machine (floats, ints, characters etc) into byte sequence. Peers agree on the format before exchanging. E.g. How many bytes to represent an integer etc.
- **Compression:** Reducing the number of bits required to transmit infomation.
- **Encryption/Privacy:** Encrypting data so that only authorised participants can read it. Authentication - verifying that remote party is really who they claim to be.

Source coding standards

- Standards for encoding source data are termed source coding standards.
- Have two main functions:
  - Ensure common format which manufacturers can adopt to ensure compatibility of devices.
  - Compression of the original source signal such that a good representation can be made using a smaller number of bits (for transmission and storage).
- Can be lossless or lossy depending on media type. Images and audio can tolerate lossy compression whereas text and binaries cannot.
- To maintain a high quality with a much reduced bit rate, the computational complexity is a real disadvantage.
- Can use a model to compress effectively, for example speech will compress by removing sounds outside of a frequency resolution (Ear has a lower frequency resolution at higher frequencies) and masking(Strong signals mask out neighbouring signals).
- To deal with variable signal strengths, the bit rates can vary too, due to more error checking needed at poorer signal strengths.

Audio Coding standards

- Bit rate (number of bits needed to represent one second of data) is given by:

  $Bitrate = number\ of\ samples\ per\ second \times number\ of\ bits\ per\ sample \times number\ of\ channels\ (mono/stereo)$

- Total amount of data can be calculated by:

  $Total\ amount = number\ of\ bits\ per\ second \times number\ of\ seconds$

- Download time is calculated by:

  $Time\ to\ download = \frac{Size\ of\ file}{data\ rate}$

- To download faster, compress more or increase data rate (throughput).

Image Coding Standards

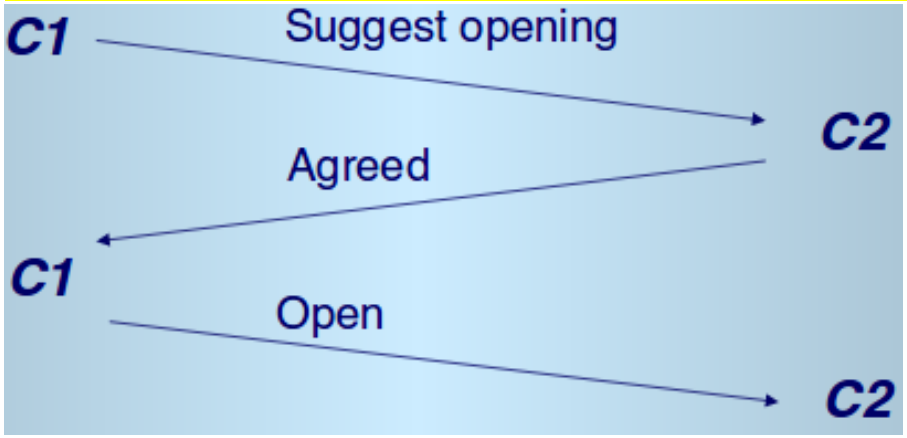
- Black and white images only need one bit per pixel and therefore an entire image is:
  $Size = pixels \times 1$
- Colour images require 24 bits per pixel (8 red, 8 green, 8 blue) and therefore:
  $Size = pixels \times 24$

Session

- Session layer and presentation layer add services to that offered by the transport layer which may be useful to the application layer.
- Avoids the application layer having to implement these itself.
- Some models (TCP/IP) the functionality of session and presentation layers is put in application and transport layers.
- This is the "thinnest" layer in the OSI reference model.
- Main functions:
  - Session connection establishment and release.
  - Synchronisation points
  - Dialogue interruption and resumption.

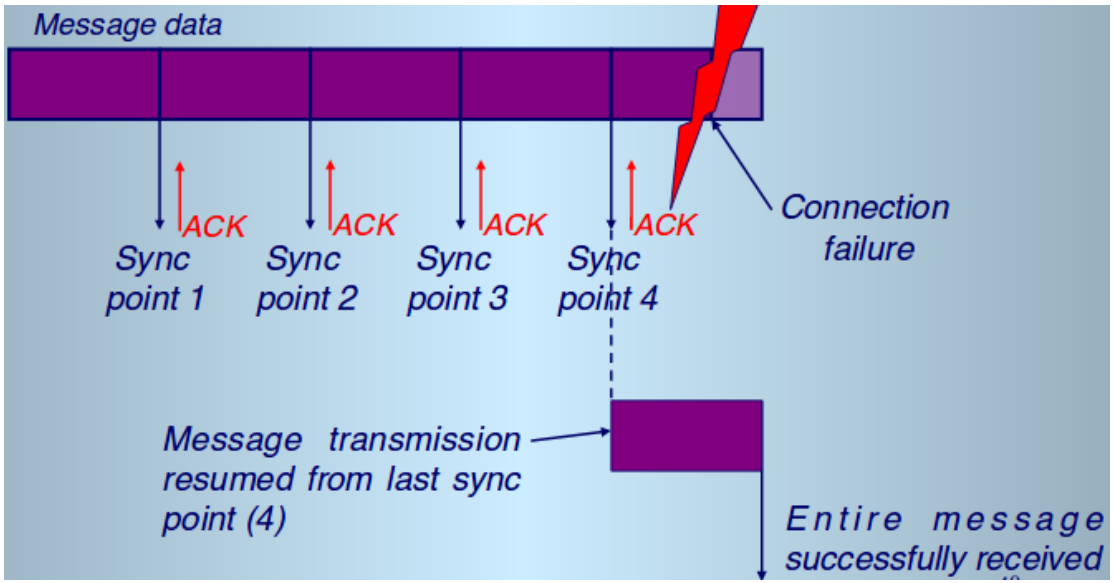
Connection establishment

- Transport layer connections accept session layer connections, termination requires orderly set up and release (both sides must agree) - 3-way handshake.
- Opening can be denied. Similar process for release - can be denied if further message needs to be exchanged.



Synchronization

- Points within a dialogue for recovery from agreed points if machine or network fails.
- Transfers grouped into activities and dialogues.
- Activities and dialogues can be structured as sequences of message exchanges punctuated by synchronization points.
- Points have to be acknowledged and allow for reversion to the last sync point.



Summary

- Examined the functions of the top three layers of the OSI reference model (and TCP/IP model)
- **Application layer:** Provision of functionality and for multi-party atomic actions
- **Presentation layer:** Provision for computer independant transfer syntax, compression and encryption.
- **Session layer:** Establishing session between machines, synchronization and dialogue control.
- Applications typiclly require some of these facilities.
- TCP/IP combines these layers into one layer.

The End