The distributed nature of the system is apparent to the user.

A computer network is a collection of autonomous computers.

What is a computer network?

Internet standardization

Internet archeology

Network design

Fundamentals about network

Reading & Structure

2001-09-20

http://opendb.org/home/kitchel

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LIS55 Lecture 1
— packet-switched
— circuit-switched
Point-to-point network

• Decentralized control networks
• Centralized control networks
  • Dynamic
  • Static
Broadcasting or multicasting network

Types of Networks by transmission technology

• Interactive television
• Video conferencing
  • Email
  • Person-to-person communication
  • Video on demand
  • E-commerce
  • Data sources
  • Software
  • Access to remote information

Computer networks for communication

• Money savings through use of PCs
• Improve scalability
• Increase reliability
• Resource sharing

Computer networks for organizations
- Switching elements (router)
- Transmission lines
  consists of
  divided into subnets
  irregular topology
  interconnects a large number of hosts
  span a whole area or country

WAN

- high reliability
- low delay
- high speed

- ring e.g. IEEE 802.5
- bus e.g. Ethernet
  usually one cable that links all machines
  bounded size

LAN or MAN

Internet

MAN/WAN

LAN
- unreliable
  - retrans-apply
- acknowledged datagram
  - reliable
- connectionless
  - unreliable
- reliable
- stream
  - message stream
  - connection-oriented

Service types

- layers need to know about routes
- layers need to know about services
  - layers need to be aware of errors
  - duplex
  - half duplex
  - simplex

Design issues for networks

- between layers in the same machine there is an interface.
- protocols
- layers communicate with their peers according to known
  - in a way that is transparent to the higher layer
  - purpose of layer is to carry out services for the higher layer

Architecture is a set of layers & protocols

Network architecture
Example architecture: the OSI Reference Model

- Data Request
- Data Indication
- Connect: Request
- Connect: Confirmation
- Connect: Response
- Connect: Indication
- Disconnect: Request
- Disconnect: Indication

Example set of service primitives:

- Confirmation
- Response
- Indication
- Request

An entity confirms the response to a request.
An entity wants to respond to a request.
An entity is to be informed about action of the other.
An entity wants a service to do some work.
Service elements (functions)
bad policies •
bad implementation •

Session layer; little use; presentation layer empty
bad technology •
the appearance of the twoephemera
bad timing •

Why OSI never took off:

Like a mail clerk, a web client, and the corresponding servers.
This layer is concerned with the actual applications that run on the network.

OSI Layer 7: the application layer

Can use, for example, there can be windows, transactions, etc.
This layer provides a consistent set of user interfaces that applications
upper layer uses to access the session layer instead the connection.
This layer establishes connections between entities on the network. Once the

OSI Layer 5: the session layer

to the layer above.
Layer cannot transport the network layer either the gain or lose in error.
This layer is responsible for making the network layer reliable.

OSI Layer 4: the transport layer

Layer does not need to ensure that the delivery is reliable
Transport of data between entities that have different addresses. The network

OSI Layer 3: the network layer

That layer is being dealt with.
Relative to the address in the physical layer, then the data-link layer must

OSI Layer 2: the data-link layer

sets out what type of device may be used.
This layer concerns the transport of data across the physical layer. For each

OSI Layer 1: the physical layer

This layer concerns all the physical devices on the network. These may be the

TCP/IP Reference Model

Network Layer

Transport Layer

Application Layer

Internet Layer

Host to network layer

Internet Protocol

User Datagram Protocol

Address Resolution Protocol

Should be robust to a partial destruction because it was millcheck

Set up for a wide variety of physical devices

Radio services were added

Initially used for the ARPANET at a time when satellite and

critique of TCP/IP Reference Model

1. It is not a general model

2. Does not distinguish service, protocol and interface

3. Intranets, LANS

Host to network layer

TCP

Internet Layer

UDP

Transport Layer

Telnet rsh smtp http mtp dns

Application Layer

TCP/IP "reference model"...
• 1979: Internet research group organized to Internet Con-

• Internet research group developing protocols

• Integrated into Berkeley UNIX, freely available

• Protocol research leads to TCP/IP in 1974

• Over 30 hours in 1972-09

• Life with four hours in 1969-12

• Connected by Sokhop leased phone lines draw design

• Disk as MIPS

• 128 times 16 bit worlds memory multiplier without hard

Implementation

• Store and Forward principle

• Each IMP connected to 2 other IMPs

• IMP connected by transmission lines

• IMP breaks it up into packets smaller than 1000 bits

• Host sends message smaller than 8000 bits

• Network nodes have hosts and IMP

ARPAnet initial design

ARPAnet

• Mid 60’s: Pentagon says that it wants the, gives grants to

• Circuit switching

• Early goas Paul Baran promotes packet switching rather than

• Nuclear attack

• US worried about command and control structure after a

• 1967: USSR launches the Sputnik

Internet Origins
IANA

- RFC 1529, coordinates areas and working groups
- IETF
- IRTF
- IAB - board
  Reorganized in 1989

An autonomous organization
with the growth of the Internet beyond NSFnet, it became
formed out of the ICGB in 1983

Internet Architecture Board

Commancially through the TCP/IP protocol stack

EARN

Integration of other networks like SPAN, HEPlNET, BITNET,

The Internet

1990 ANS (MERIT, MCI, Inc) take over NSFnet

be connected to the backbone

additional funding for (eventually 20) regional networks to

NSFnet, the first publicly TCP/IP network, on 56kps.
1984 NSF links adds a nuzzeball to 12 supercomputers, sets up

run on a single box with dial-up lines since late 70s

Institutions to the ARPAnet

CSNET set up to link researches at non-ARPANET contract

1980: MILNET split off the ARPAnet

NSFnet
RFC categories

useful in some or all parts of the Internet,

Internet standard

TIP: This RFC is a draft standard. It is for comment and feedback, but not for use in the Internet. A list of numbered reports

RFC