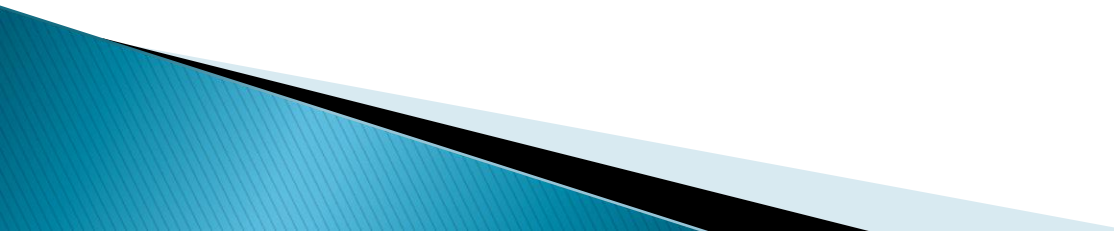


Internetwork Protocol Approaches

Jonathan B. Postel

Presented by–
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Interconnection of Networks

- ▶ Inter-Process
 - ▶ Gateway
 - ▶ Open Systems Architecture
 - ▶ Virtual Circuit – X.25 networks
 - ▶ Datagram – APRA networks
- 

Datagrams vs Virtual Circuits

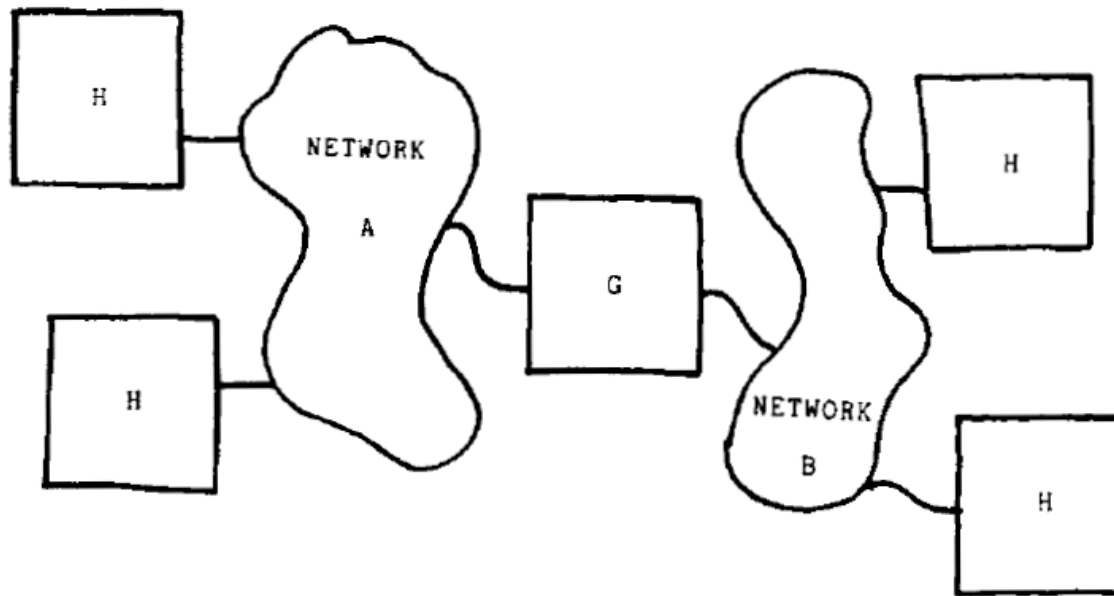
Datagrams

- Unreliable
- Simpler
- Complete addressing
- Just send data
- Transaction type of service

Virtual Circuits

- Reliable
- Complicated
- Addressing depends on type of packet
- Setup–send data–connection tear down
- Interactive computer systems

Gateways



H HOST

G GATEWAY

Fig. 2. Interconnected networks.

Gateways

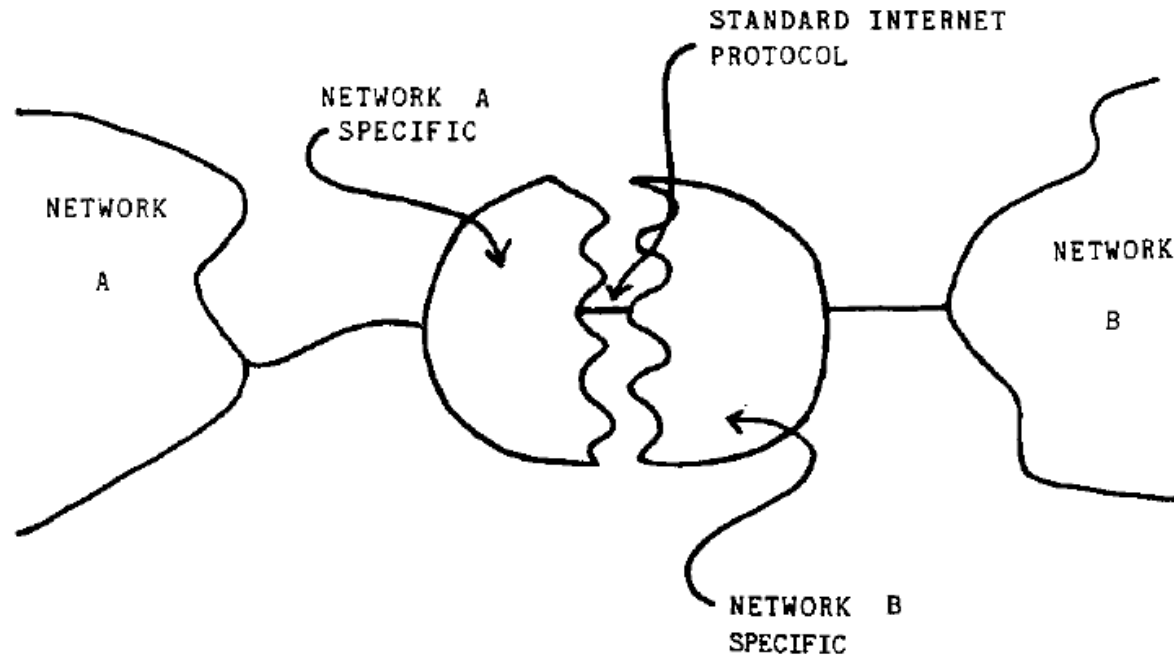
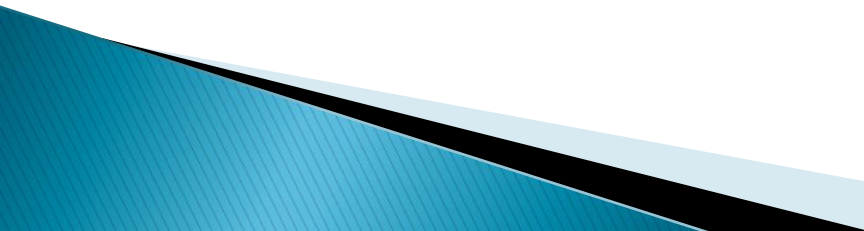


Fig. 3. Gateway halves.

Types of Gateways

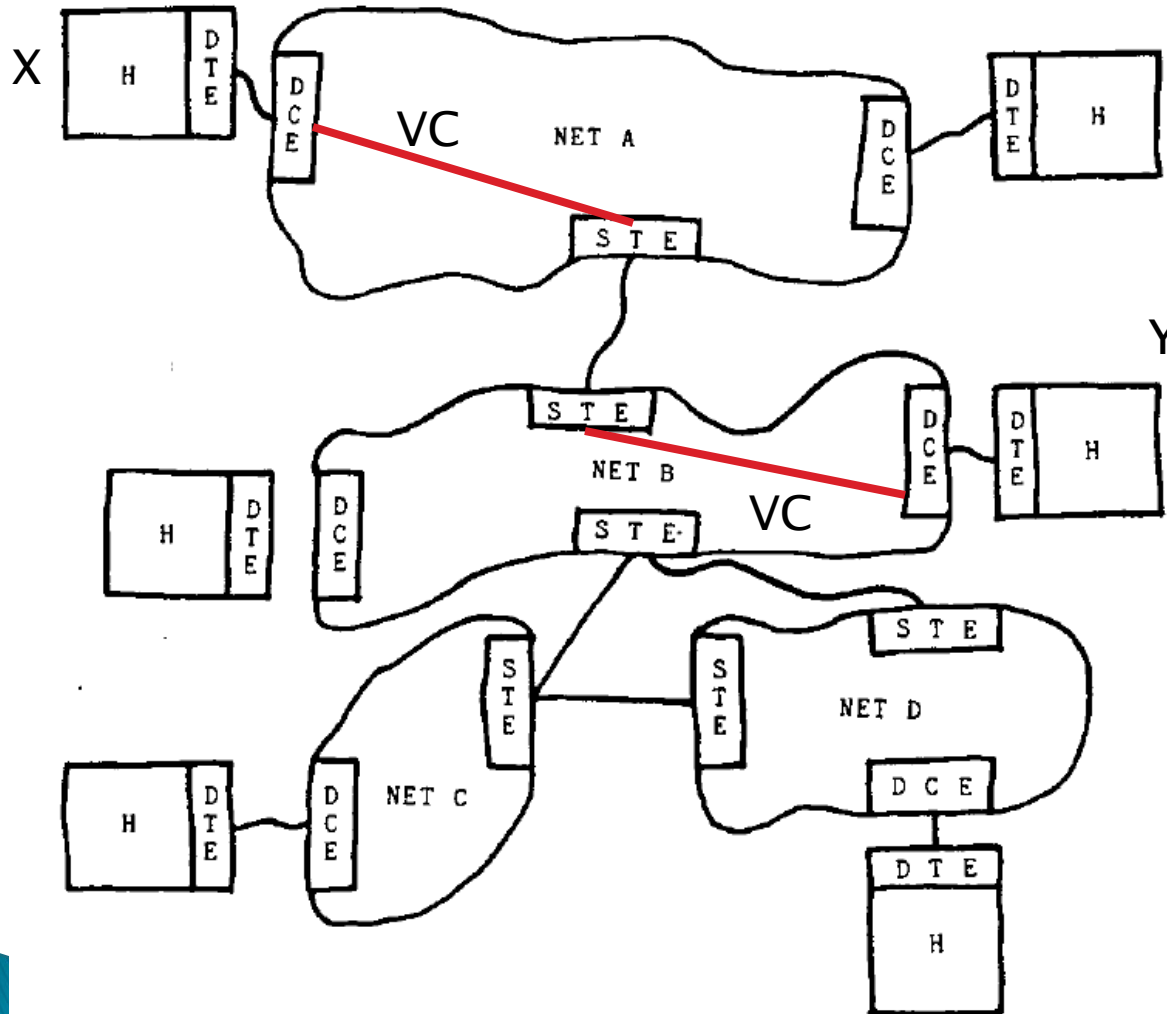
- ▶ Based on type of connectivity provided
 - ▶ Media Conversion Gateway
 - Connects different link and physical protocols
 - Provides Encapsulation and De-encapsulation
 - Simpler
 - ▶ Protocol translation Gateway
 - Network and Transport layers bridged
 - Might require address translation
 - Packet semantics can be entirely changed
- 

OSA

<u>Level</u>	<u>Function</u>
7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Link
1	Physical

- ▶ Lower layers (1–2)– hop by hop
- ▶ Higher layers (5–7) – interconnection of different protocols unlikely
- ▶ Layers 3/4

X.25 PDNs

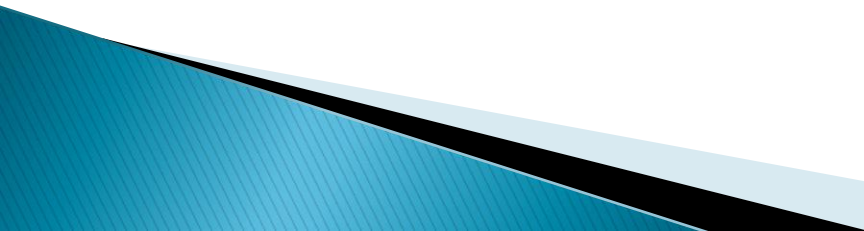


- ▶ Data terminal equipment
- ▶ Data circuit-terminating eq.
- ▶ Signaling terminal eq. (X.75)

X.25 PDNs

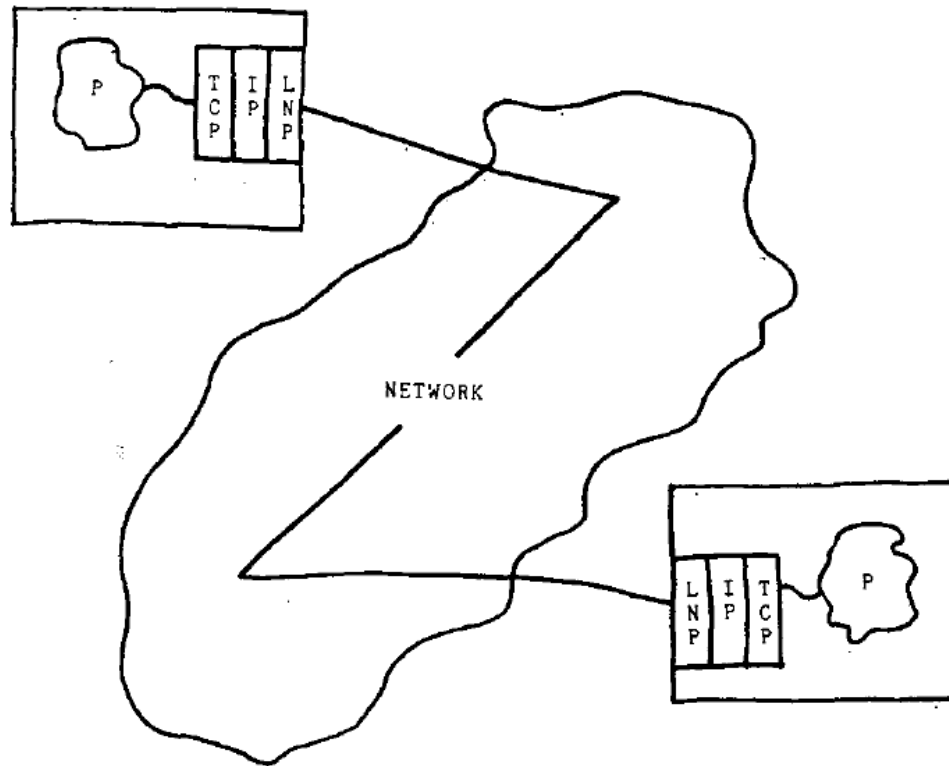
- ▶ Call has 3 phases:
 - Setup
 - Large header (20–166bytes) containing complete src–dst addresses
 - State information stored in various hosts
 - Data transfer
 - Simple 3 byte header
 - Termination

X.25 PDNs Characteristics

- ▶ Addressing: varies–60 bits (max)
 - ▶ Routing?
 - ▶ Flow control
 - Different for each virtual circuit
 - STE–STE links
 - Effects?
 - ▶ Error Control
 - Each portion has its own ack.
 - Unrecoverable failures– RESET or call cleared
 - ▶ Security
- 

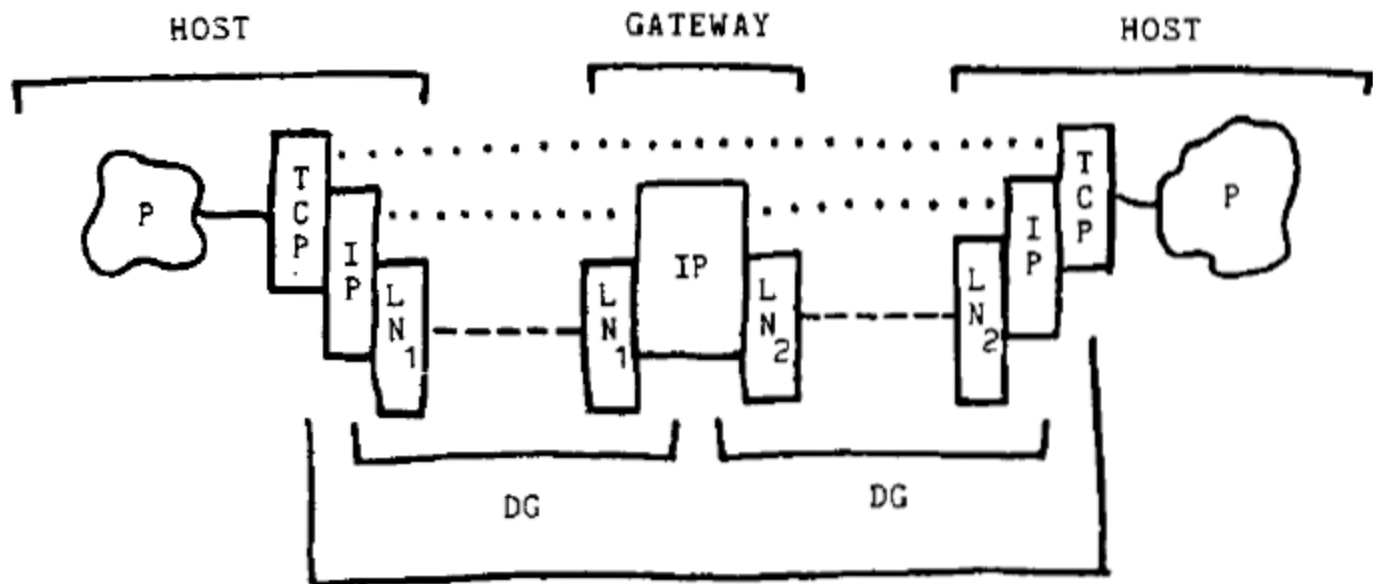
ARPA Inter-Network

- ▶ Developed based on TCP/IP
- ▶ Datagram based



ARPA-InterNets Communication

- ▶ IP in all gateways and hosts
- ▶ Source → Gateway → → Gateway → Dest
- ▶ TCP used for providing functionality equivalent to virtual circuits



ARPANets Characteristics

- ▶ Addressing
 - Network–1 Byte, Host–3Bytes (Fixed?)
 - Protocol identifier and port info also used
- ▶ Routing?
- ▶ Flow Control– by TCP
- ▶ Error recovery– by TCP
- ▶ Security
 - AUTODIN II
 - TCP checksum: test positive indicates fields have not been corrupted

Issues not addressed

- ▶ Congestion Control not identified as a problem/issue.
 - In ARPA Internetworks, “Gateways may protect themselves against congestion by dropping messages”