Some Device Terminology
Definition and Clarification

Hub

Switch

Bridge

Router

Brouter

Firewall

Gateway

Hubs

From Textbook Glossary:

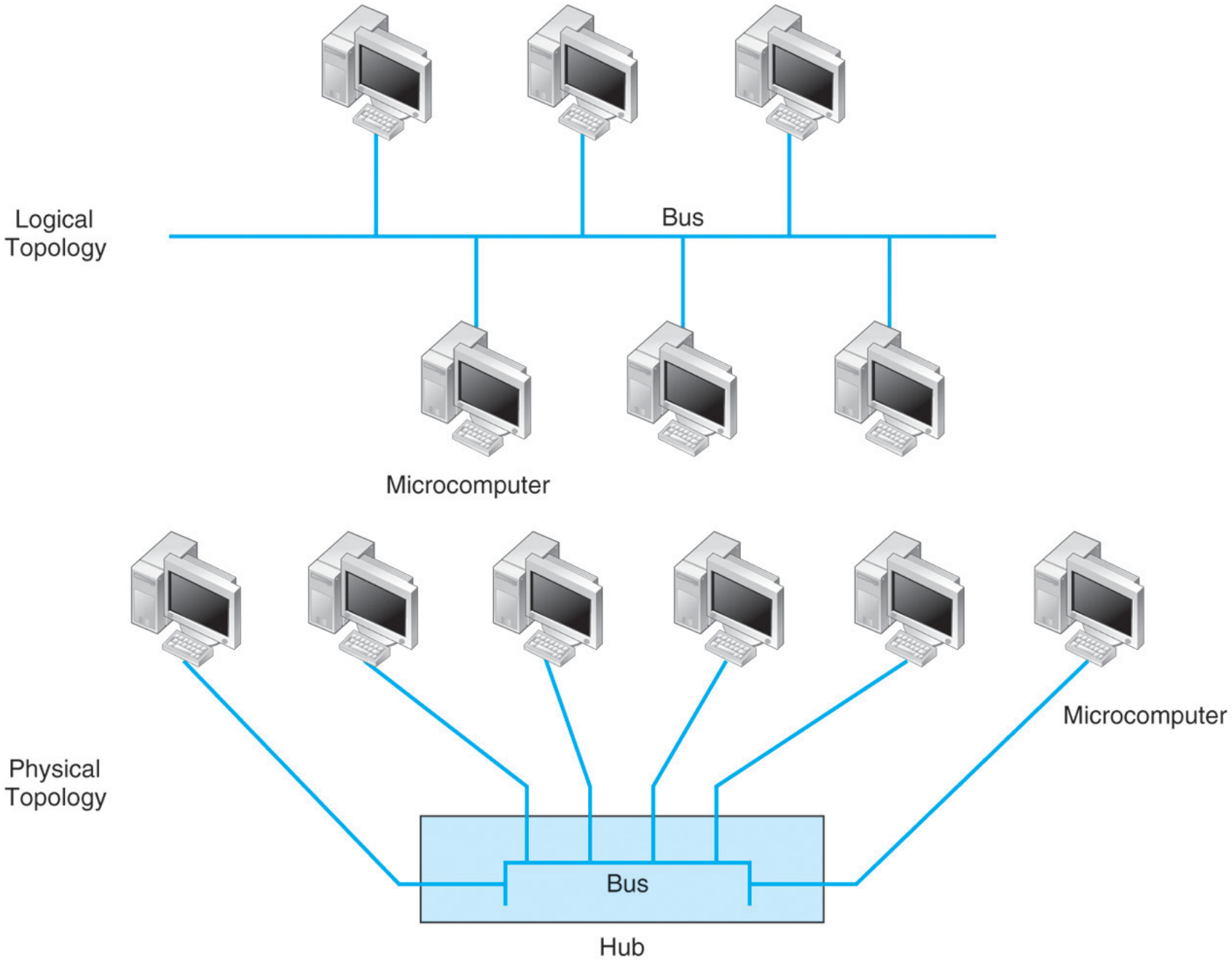
Network hubs act as junction boxes, permitting new computers to be connected to the network as easily as plugging a power cord into an electrical socket, and provide an easy way to connect network cables. Hubs also act as repeaters or amplifiers. Hubs are sometimes called concentrators, multistation access units [MAUs], multiport repeaters, or transceivers.

Other Charasterics:

1. Regenerates frame and outputs to all ports concurrently
2. Usually for wiring using RJ45 jacks (e.g. Cat5, Cat5e, Cat6, etc.)
3. Restricted for use in a single LAN
4. Physical layer device
5. Provides a connectionless oriented service

Latency: Very Low

Hubs


Logical
Topology
Bus
Microcomputer
Physical
Topology
Microcomputer
Bus
Hub

Switch

From Textbook Glossary:

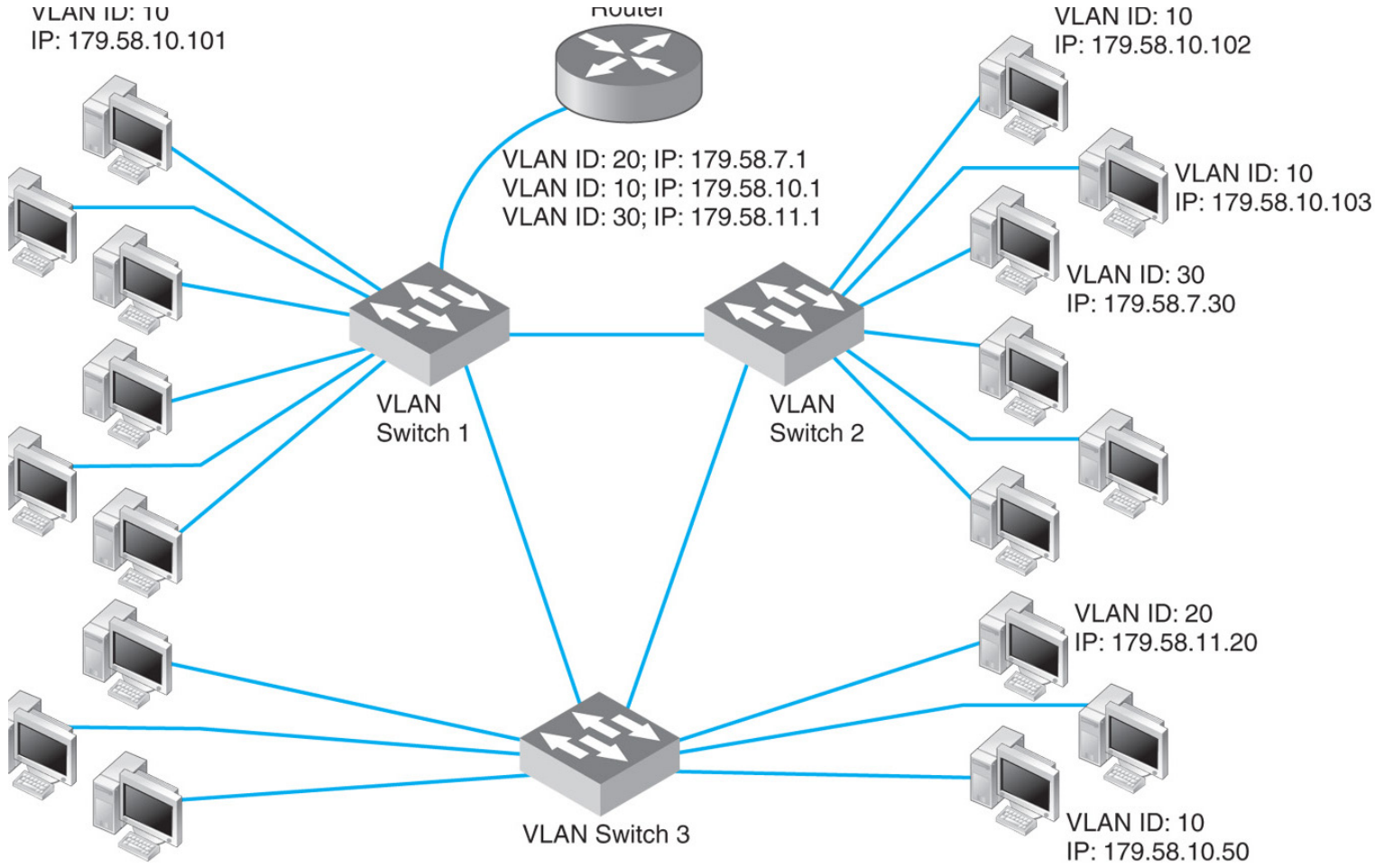
> *Switches connect more than two LAN segments that use the same data link and network protocol. They may connect the same or different types of cables. Switches typically provide ports for 4, 8, 16, or 32 separate LAN segments, and most enable all ports to be in use simultaneously, so they are faster than bridges.*

Other Characteristics:

1. Regenerates frame and outputs only to port where destination MAC is connected
2. May be VLAN enabled
3. May span multiple LANs
4. Data link layer device
5. Provides a connection oriented service

Latency: Low

Switch


VLAN ID: 10
IP: 179.58.10.101
Router
VLAN ID: 20; IP: 179.58.7.1
VLAN ID: 10; IP: 179.58.10.1
VLAN ID: 30; IP: 179.58.11.1
VLAN ID: 10
IP: 179.58.10.102
VLAN ID: 10
IP: 179.58.10.103
VLAN ID: 30
IP: 179.58.7.30
VLAN
Switch 1
VLAN
Switch 2
VLAN ID: 20
IP: 179.58.11.20
VLAN Switch 3
VLAN ID: 10
IP: 179.58.10.50

Bridge

From Textbook Glossary:

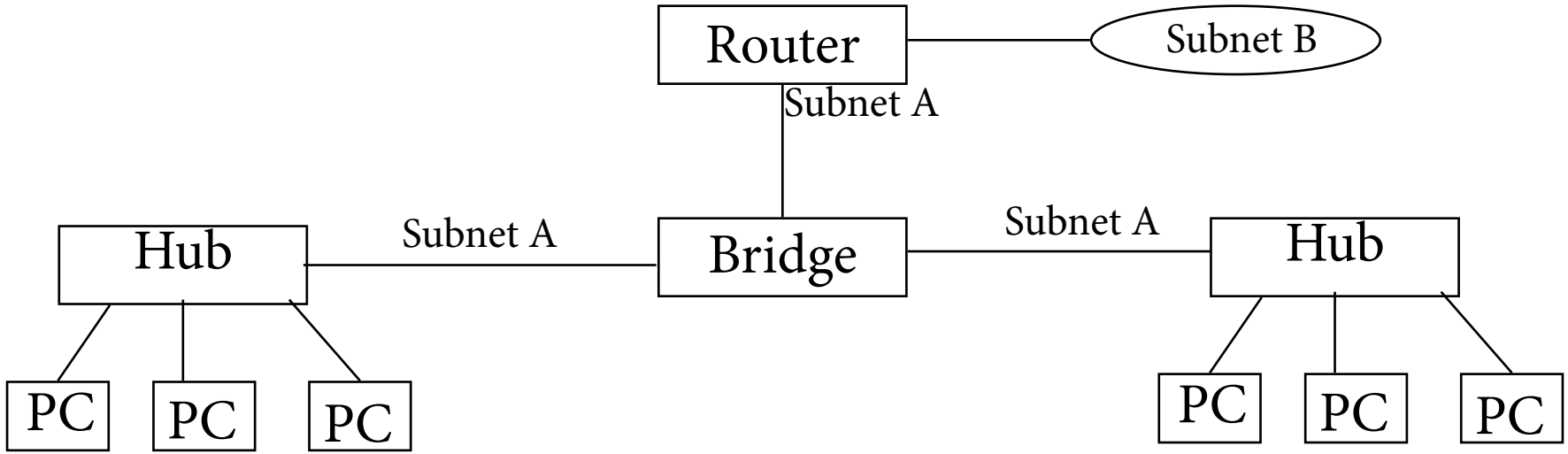
> *A device that connects two similar networks using the same data link and network protocols. Compare with* ***gateway****,* ***router,*** *and* ***brouter****.*

Other Characteristics:

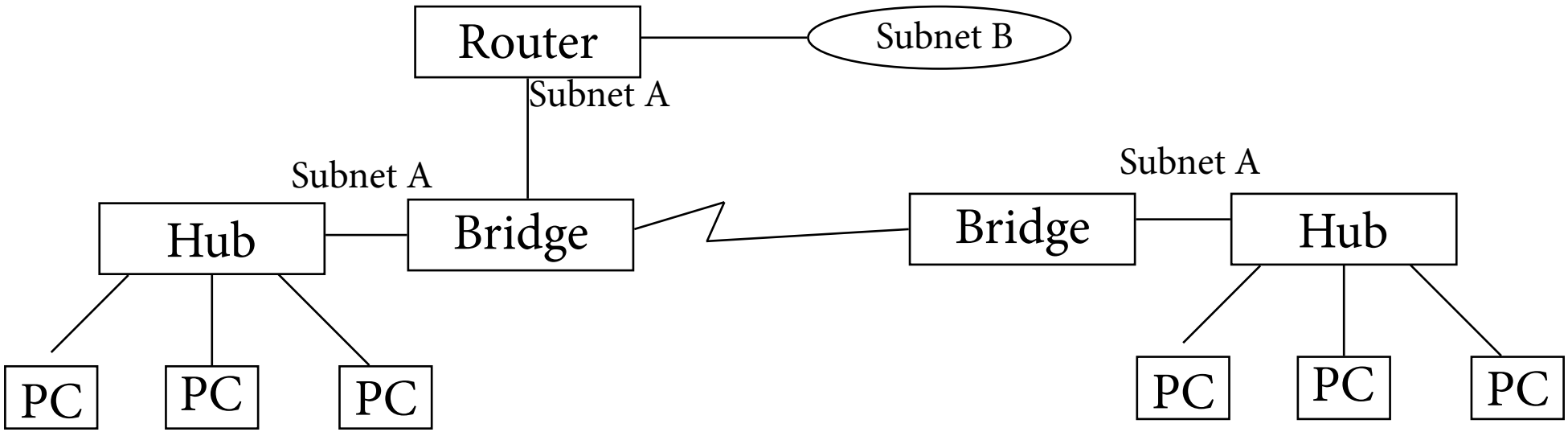
1. Regenerates frame and outputs only to port where destination MAC is connected (like a switch).
2. Often used in pairs to extend a LAN across different types of transmission media. e.g., An Ethernet cable and a T1 circuit.
3. Often used for LAN segmentaion to split one LAN into two LAN segments, usually to improve performance for the entire LAN
4. Data link leyer device
5. provides a connection oriented service.

Latency: Low to Medium

Bridge Used for LAN Segmentation



Pair of Bridges to Connect a LAN Across a T1 Circuit



Router

From Textbook Glossary:

> *A device that connects two similar networks having the same network protocol. It also chooses the best route between two networks when there are multiple paths between them. Compare with* ***bridge****,* ***brouter****, and* ***gateway****.*

Other Characteristics:

1. Performs address resolution (using ARP) to resolve a destination's IP address to its respective MAC address (layer 3 function)
2. May connect dissimilar types of cables from separate LANs.
3. May connect dissimilar layer 2 protocols.
4. Network layer device.
5. Provides a connectionless oriented service.

Latency: Medium

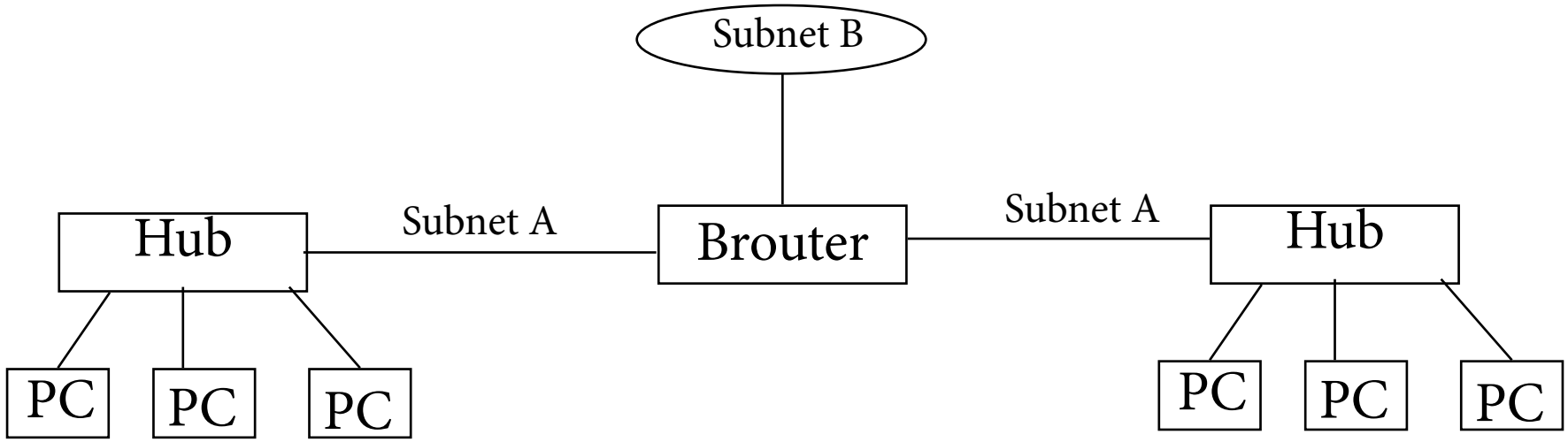
Brouter

From Textbook Glossary:

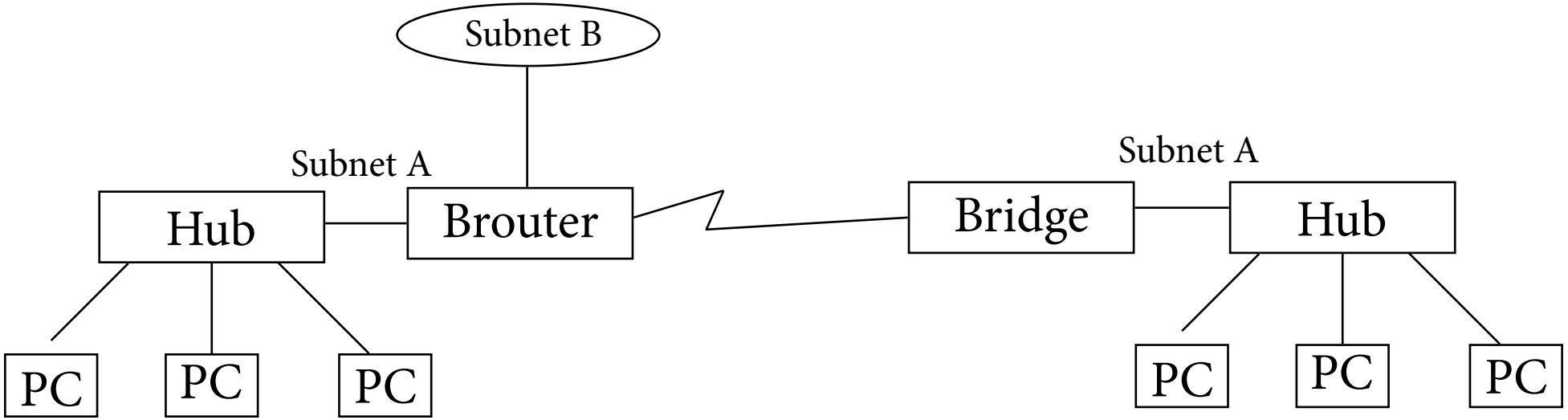
> *A piece of hardware that combines the functions of a bridge and a router. See also* ***bridge*** *and* ***router****.*

Latency: Medium

A Brouter Used for LAN Segmentation and Subnet Routing



Brouter and Bridge Used to Connect a LAN Across a T1 and for Subnet Routing



Firewall

From Textbook Glossary:

> *A firewall is a router, gateway, or special-purpose computer that filters packets flowing into and out of a network. No access to the organization's networks is permitted except through the firewall. Two commonly used types of firewalls are packet level and application level.*

Other Characteristics:

1. "Policy" statements are used to develop firewall filters.
2. Defines what is "authorized" access from "untrusted" sources to "trusted" sources.
3. Defines what is "allowable" access from "trusted" sources to "untrusted" sources.
4. ACL-Access Control Lists filters PDUs at the network and transport layers.
5. DPI-Deep Packet Inspection examines user data at the application layer.
6. May be either "stateful" or "stateless".

Latency: Medium

Network Gateway

From Textbook Glossary:

A device that connects two dissimilar networks. Allows networks of different vendors to communicate by translating one vendor's protocol into another

Other Characteristics:

1. Able to perform Network Address Translation (NAT) and Port Address Translation (PAT)

2. Able to connect with multiple types of transmission mediums

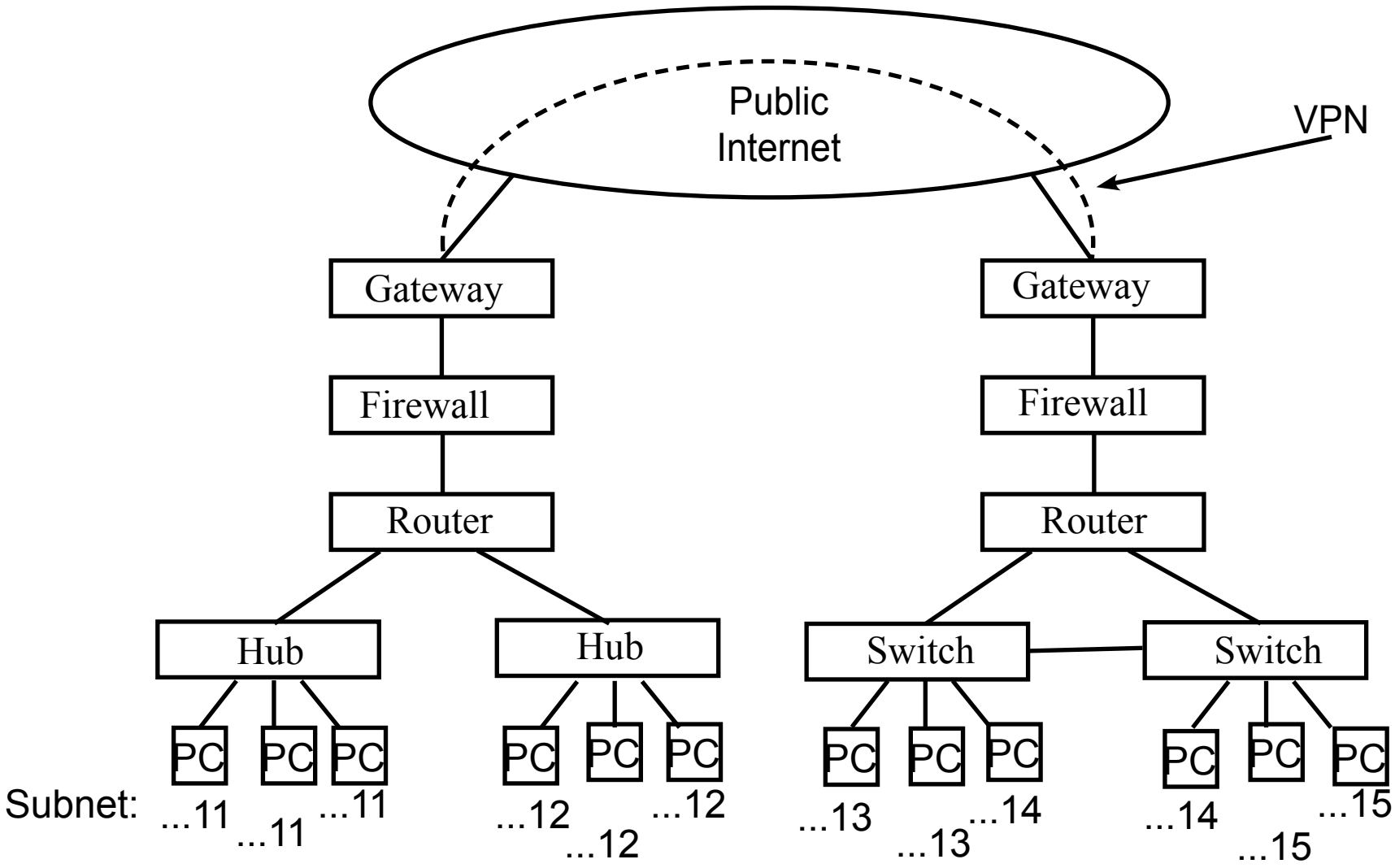
3. Able to create and use IPSec and L2TP VPNs

4. Able to connect *multiple* dissimilar networks

5. Modern devices are capable of all the functions of a Router, Firewall, and Gateway in one device. The name of such a device is specific to the manufacturer, but is frequently called an Internet Router or an Internet Gateway.

Latency: Medium

Typical Placement of Network Device Types



NOTES:
1. Gateway also known as an Internet Router
2. The lowest latency device is selected between Hub and Switch where possible
3. Hubs work for subnets ...11 and ...12 because they are exclusive to the LAN
4. Switches required for subnets ...13 and ...15 because they are not exclusive to the LAN, and becasue subnet ...15 is plit across multiple LANs. Thus, all three of these subnets are VLANs.

Device Latency

Hubs, switches, bridges, and routers all relay an Ethernet frame from a receive port to one or multiple output port(s).

After receipt of the necessary number of bits of information in the received Ethernet frame, a device requires an amount of processing time to make a determination which output port(s) is(are) to be used.

Sometimes the output port may be the same as the input port.

Sometimes the device may need to reconstruct the Ethernet frame with alternate header inforamtion.

Device	Process	Minimum Input Required
Hub	Relay to all ports	1-bit
Switch Cut Through w/o VLAN	Read MAC & search forwarding tbl output to 1 port	6 Bytes
Switch Cut Through w/ VLAN	Read VLAN tag search VLAN ID tbl output to 1 port	20 Bytes
Switch Fragment	Read fragment & search forwarding tbl output to 1 port	64-Byte fragement
Switch Store & Fwrd	Read frame, error check search forwarding tbl output to 1 port	Entire frame
Bridge	Read frame, convert protocol, output to 1 port	Entire frame
Router	Read frame, resolve IP to MAC, determine route, output to 1 port	Entire frame