



Networking Fundamentals

Computer Networks



Andriy Berestovskyy
2017



Networking Fundamentals

- > Computer Networks
- Networking Models
- Local Networks
- Internet
- IPv4 Routing
- Transport Protocols



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Computer Network?

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Computer network — telecommunications network
which allows nodes to share resources

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

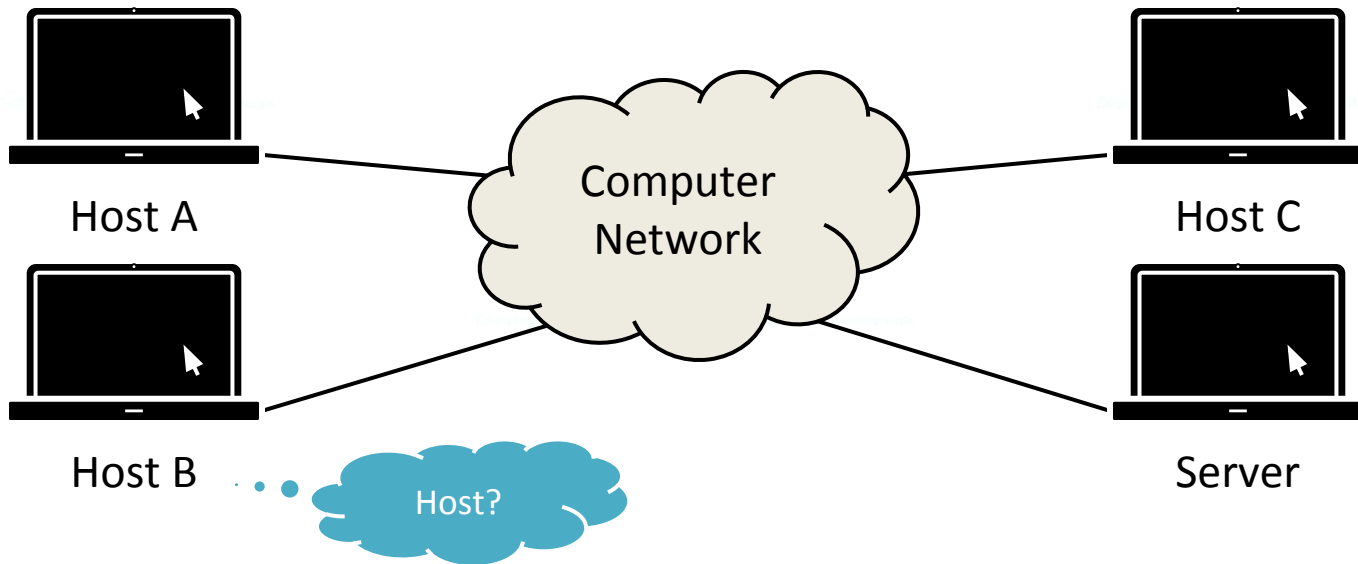
— Wikipedia

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Computer Network

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>





Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Host computer — consumer of communication services

— RFC 1122

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



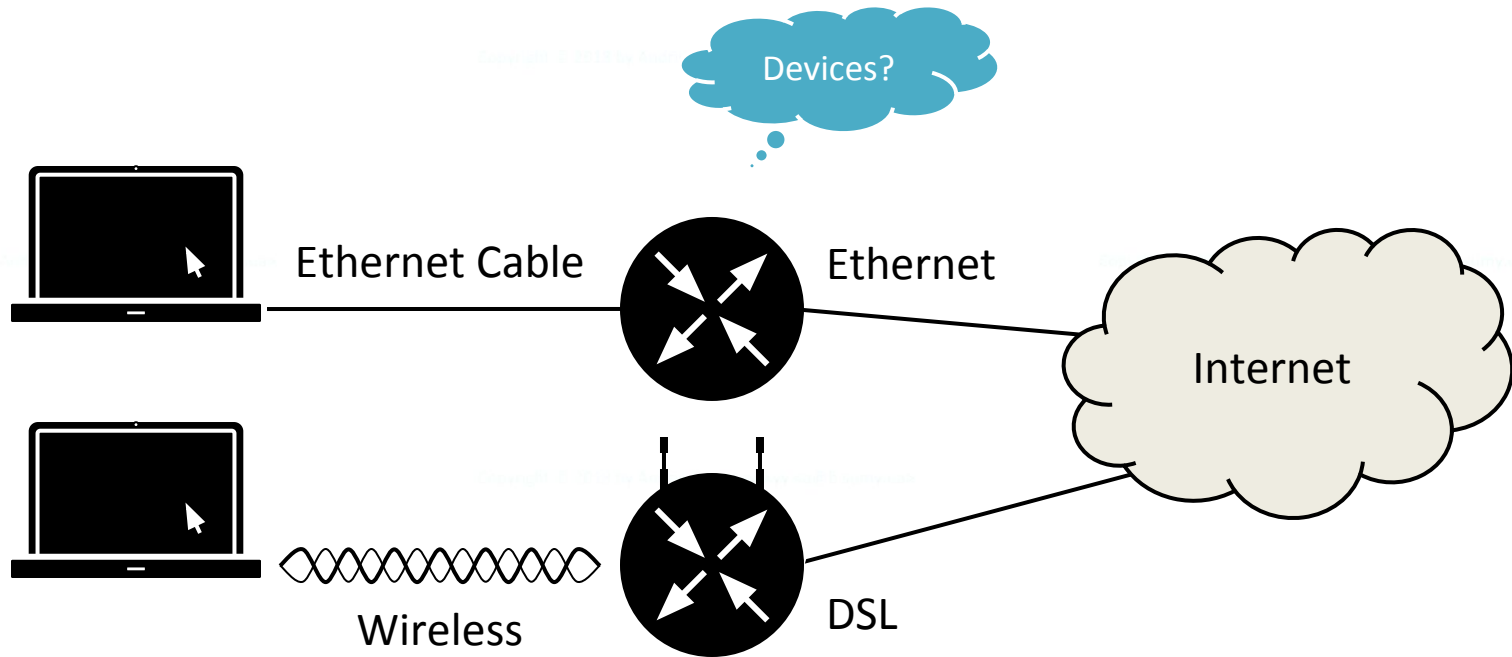
Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Request for Comments — principal technical and standards-setting documents for the Internet

— Wikipedia

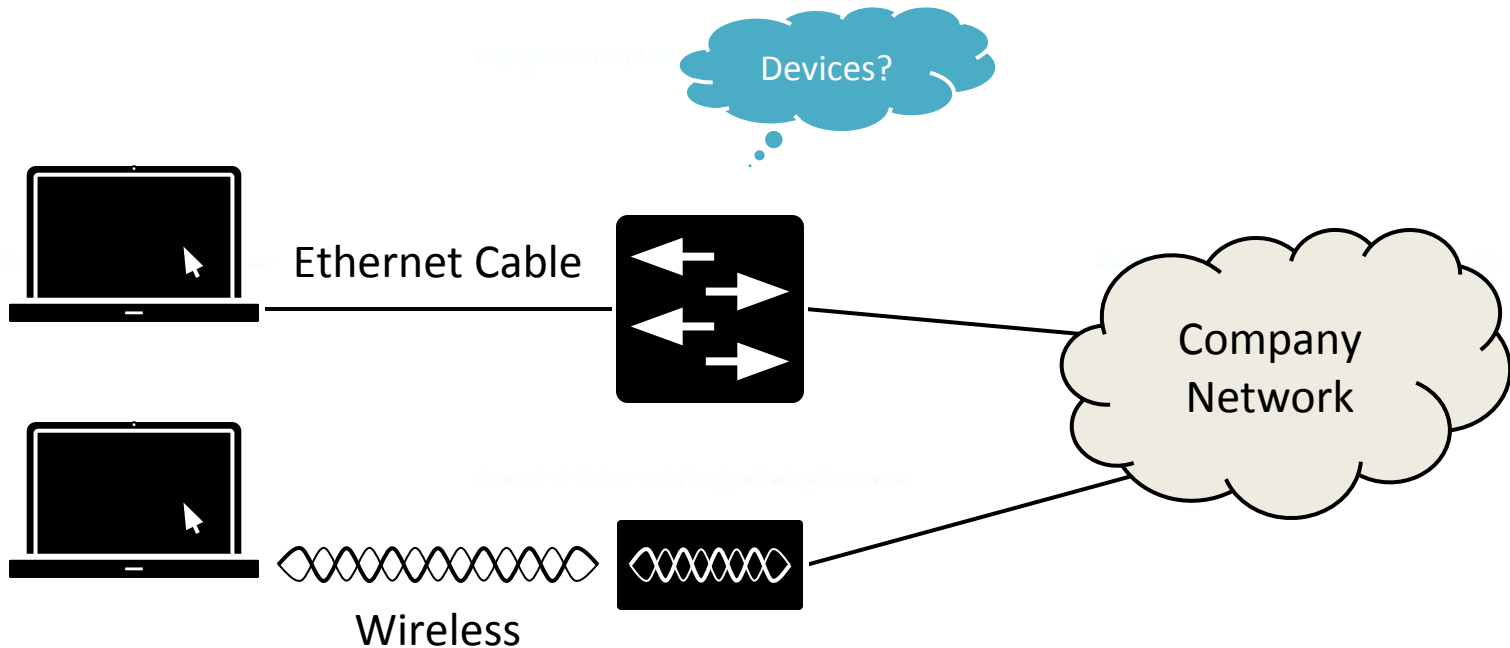
Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Networking: Home User View



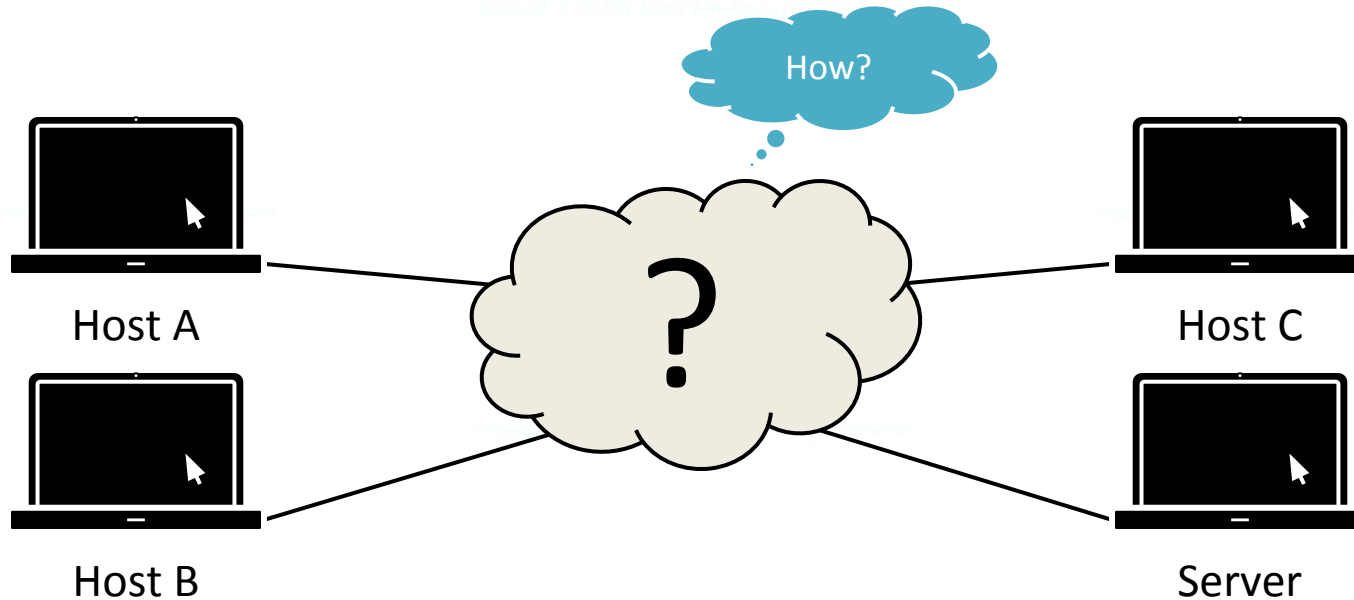


Networking: Business User View



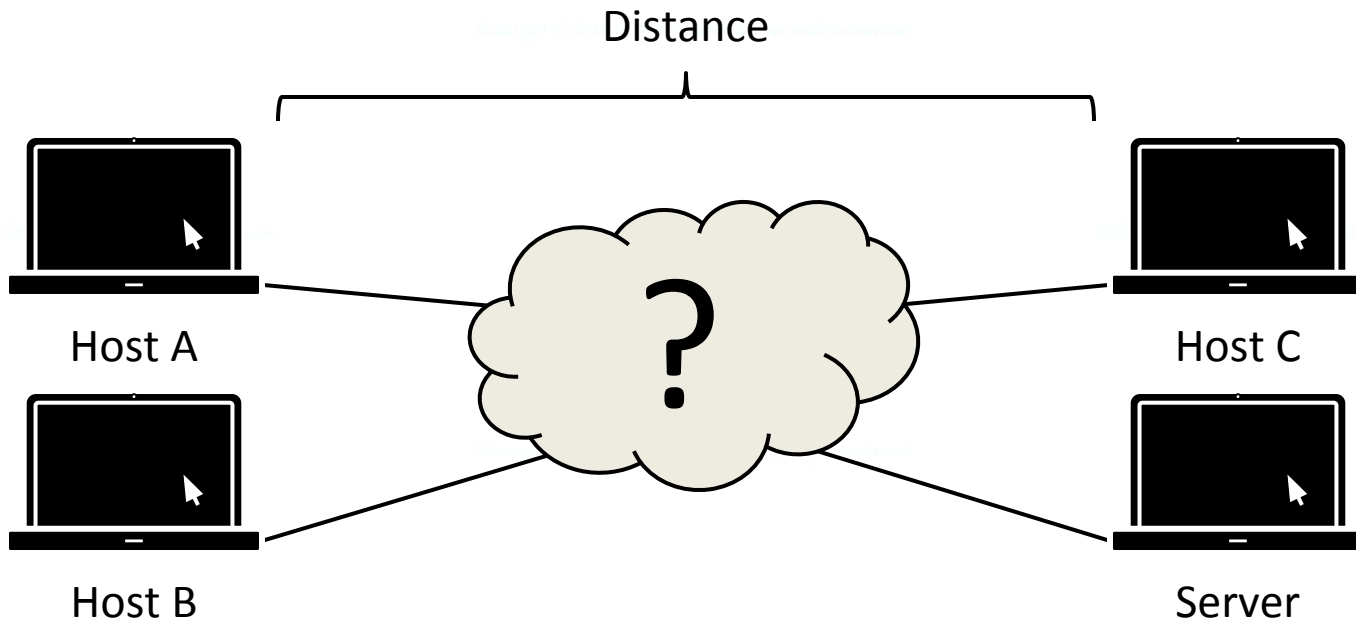


Computer Network Design





Computer Network Size





Local Area Network (LAN) interconnects hosts within a limited area and has its network equipment and interconnects locally managed.

Metropolitan Area Network (MAN) interconnects several local area networks by bridging them with backbone lines.

Wide Area Network (WAN) covers a larger geographic distance, also generally involves leased telecommunication circuits or Internet.

— Wikipedia

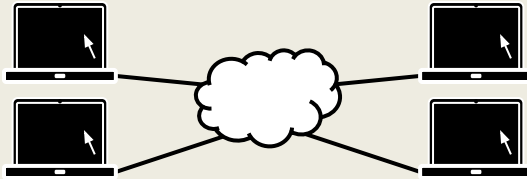


Local Area Network

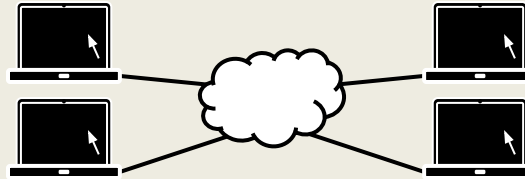


Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

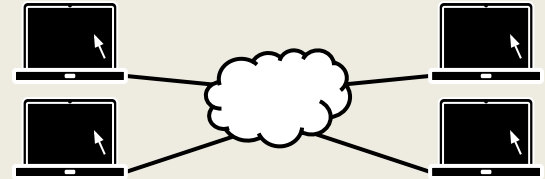
Krakusa 11, 1st floor



Krakusa 11, 2nd floor



Krakusa 11, 3rd floor



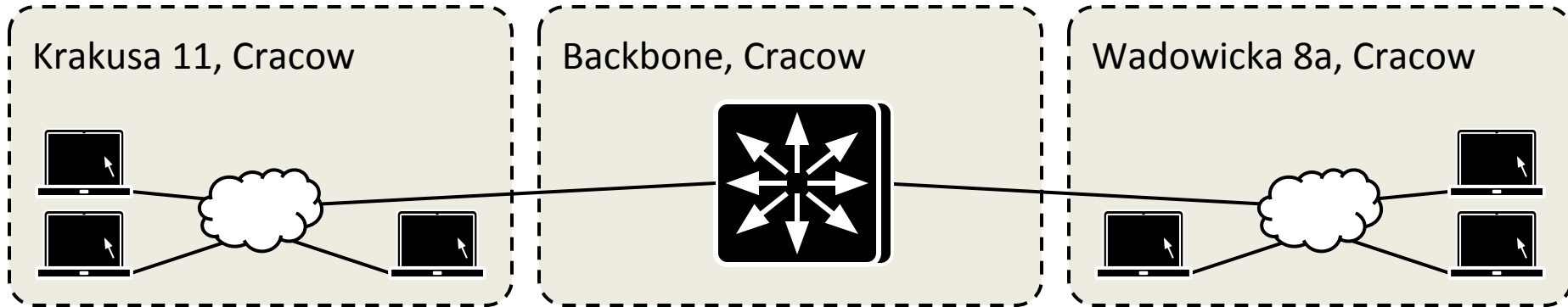
Interconnects hosts within a limited area and has its network equipment and interconnects locally managed



Metropolitan Area Network

How?

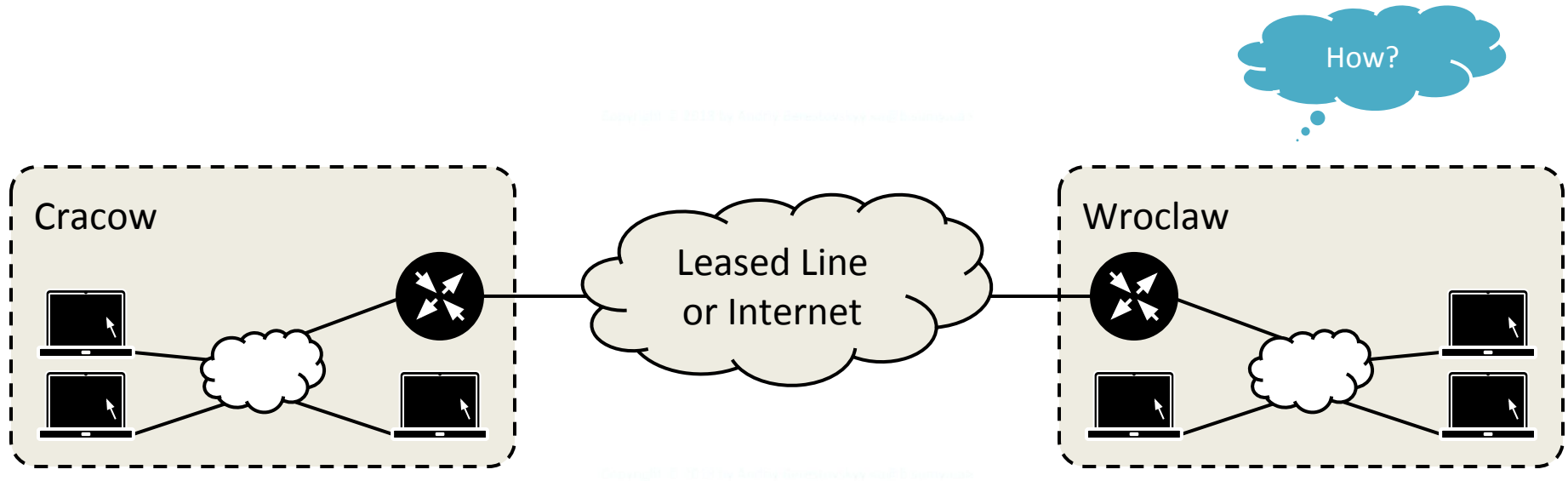
Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Interconnects several local area networks
by bridging them with backbone lines



Wide Area Network



Covers a larger geographic distance, also generally involves leased telecommunication circuits or Internet



Ethernet is Everywhere

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Ethernet — family of networking technologies
commonly used in LAN, MAN and WAN

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

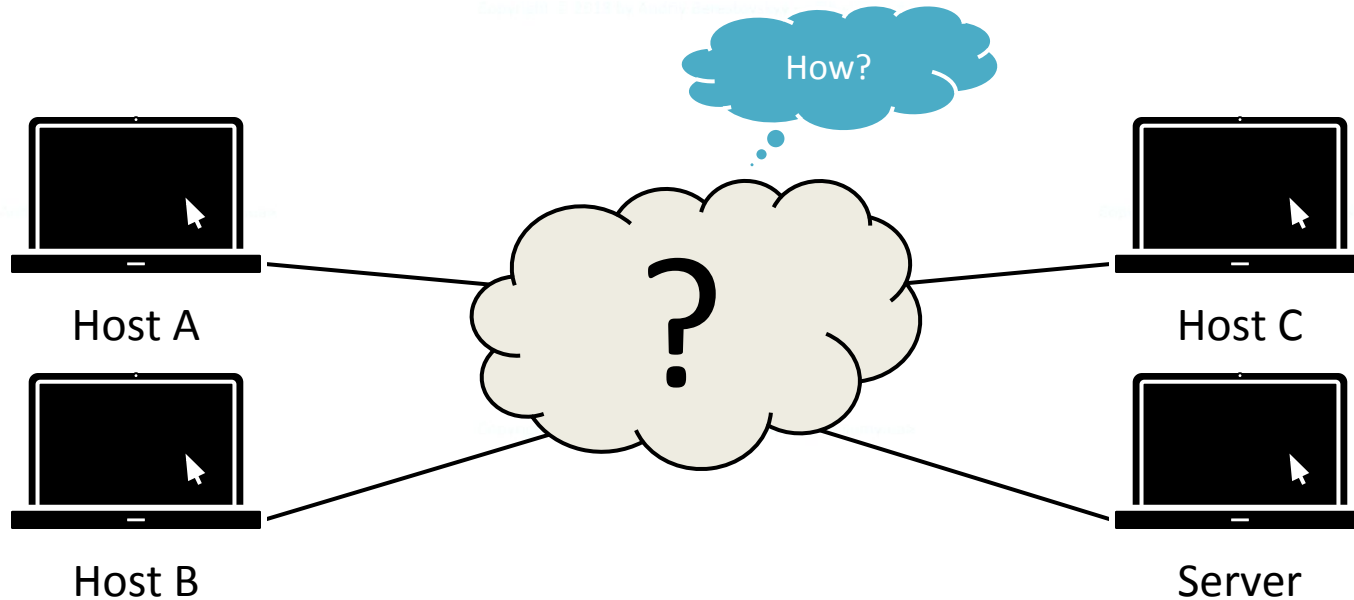
Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



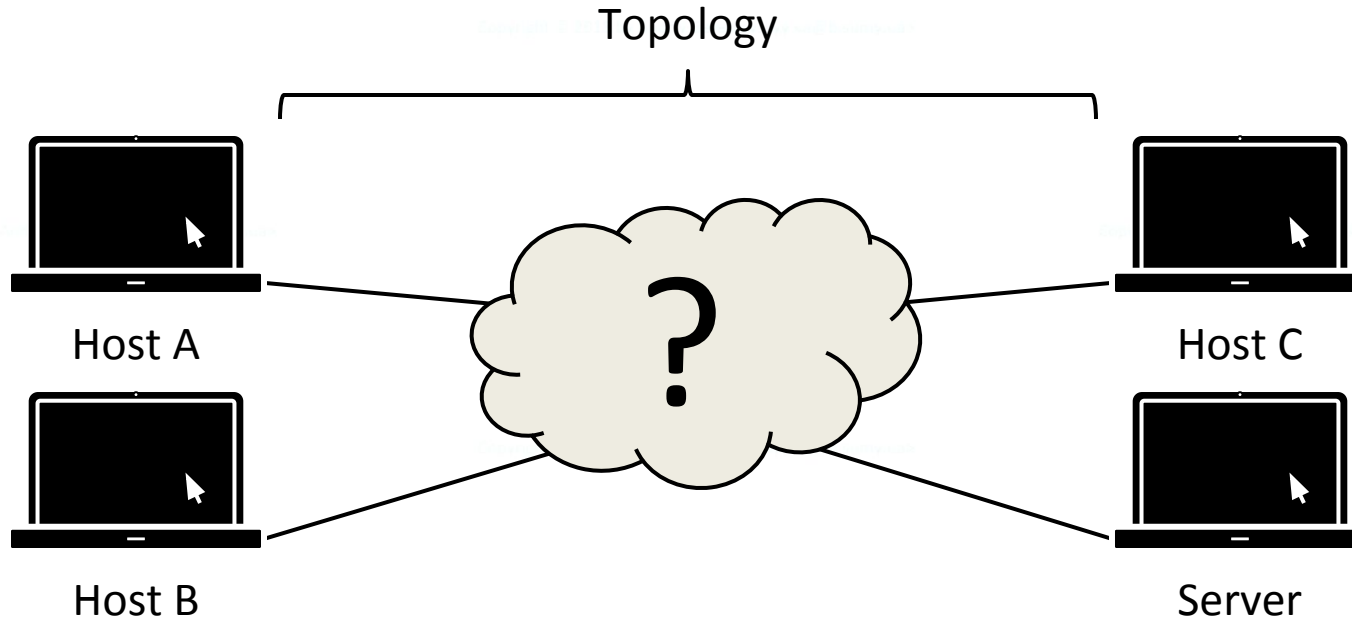
— Wikipedia



Computer Network Design



Computer Network Topology





Network Topologies

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Point-to-Point — communications between two endpoints.

Bus — nodes are directly connected to a common link called a bus.

Star — central hub with a point-to-point connections.

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

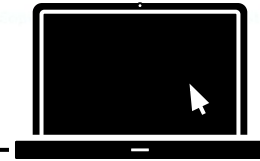
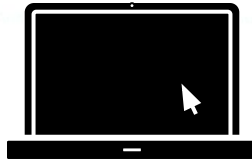


— Wikipedia



Point-to-Point Network Topology

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

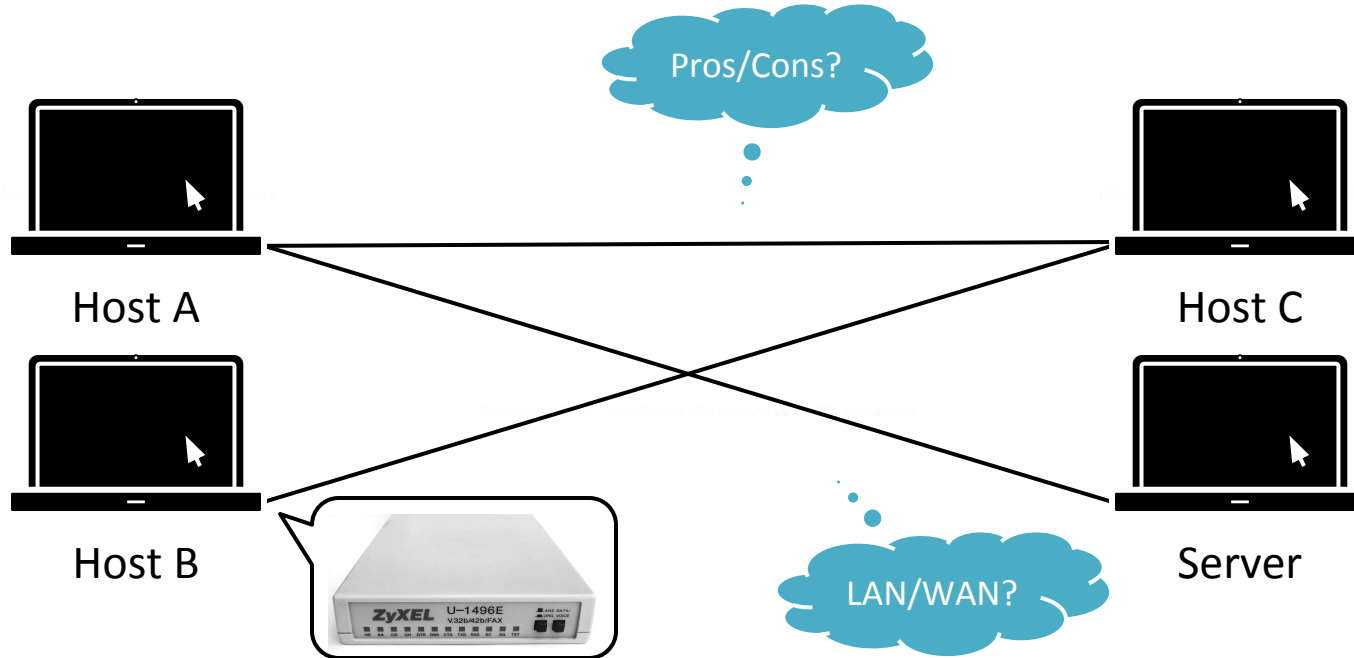


Communication between two endpoints

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

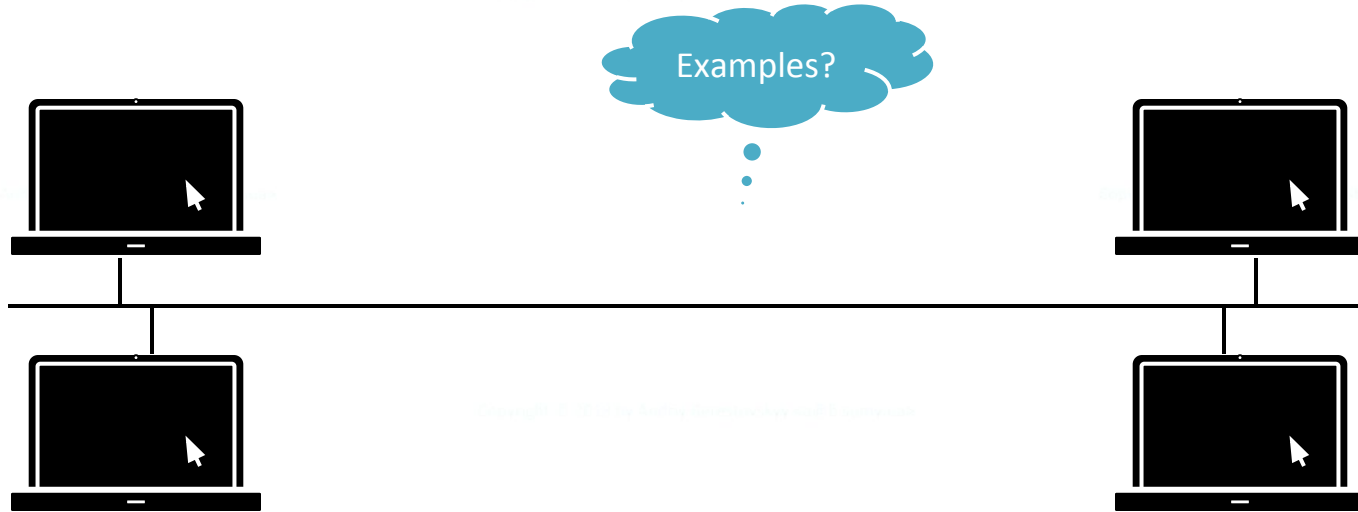


Point-to-Point Topology Example





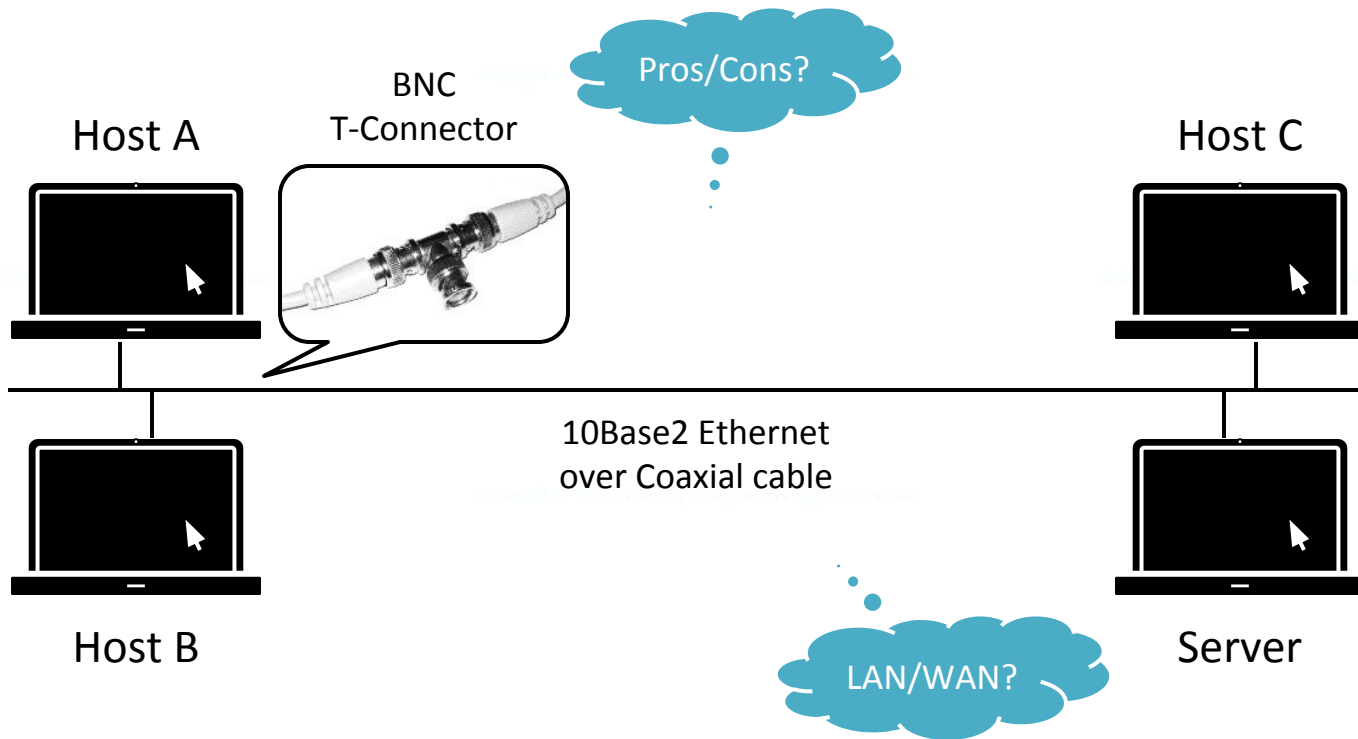
Bus Network Topology



Nodes are directly connected to a common link called a bus

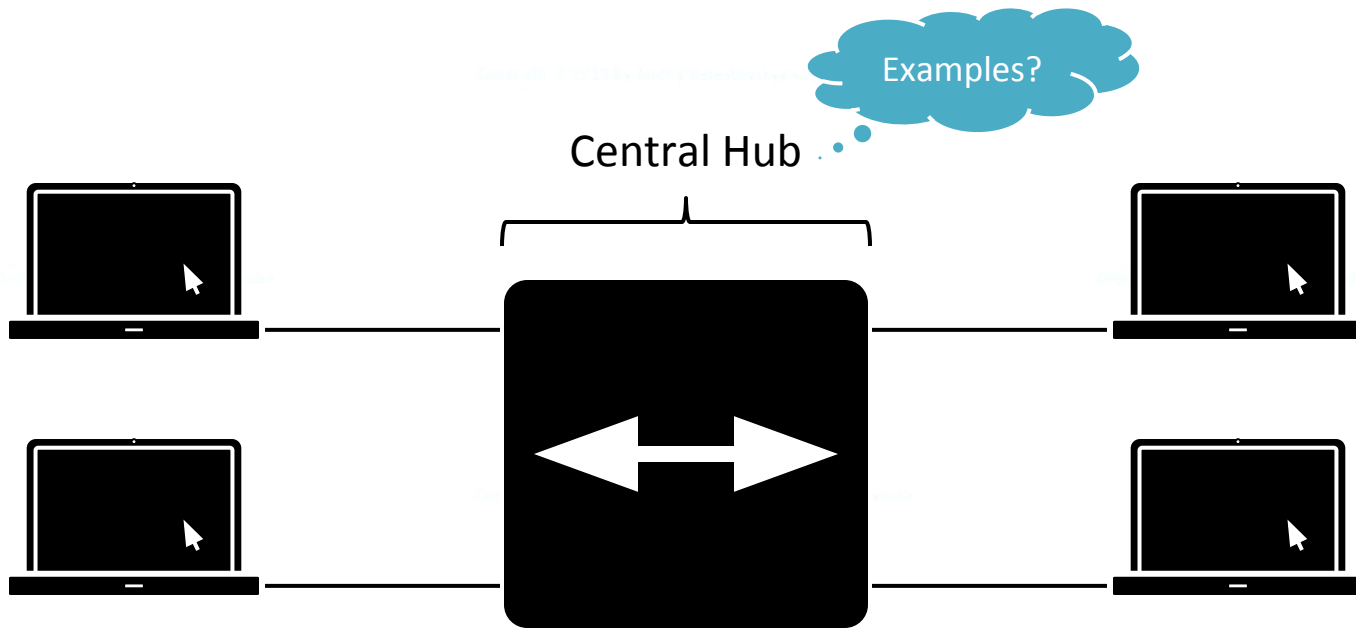


Bus Topology Example





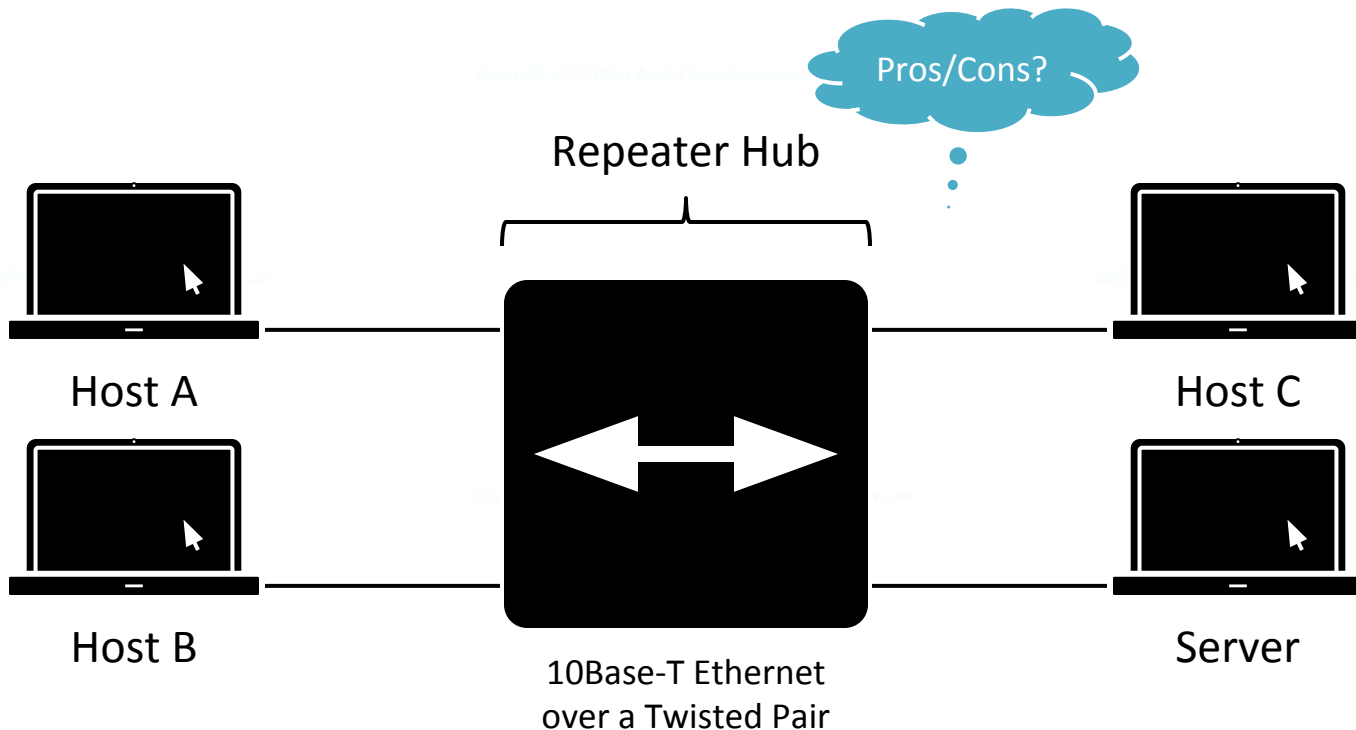
Star Network Topology



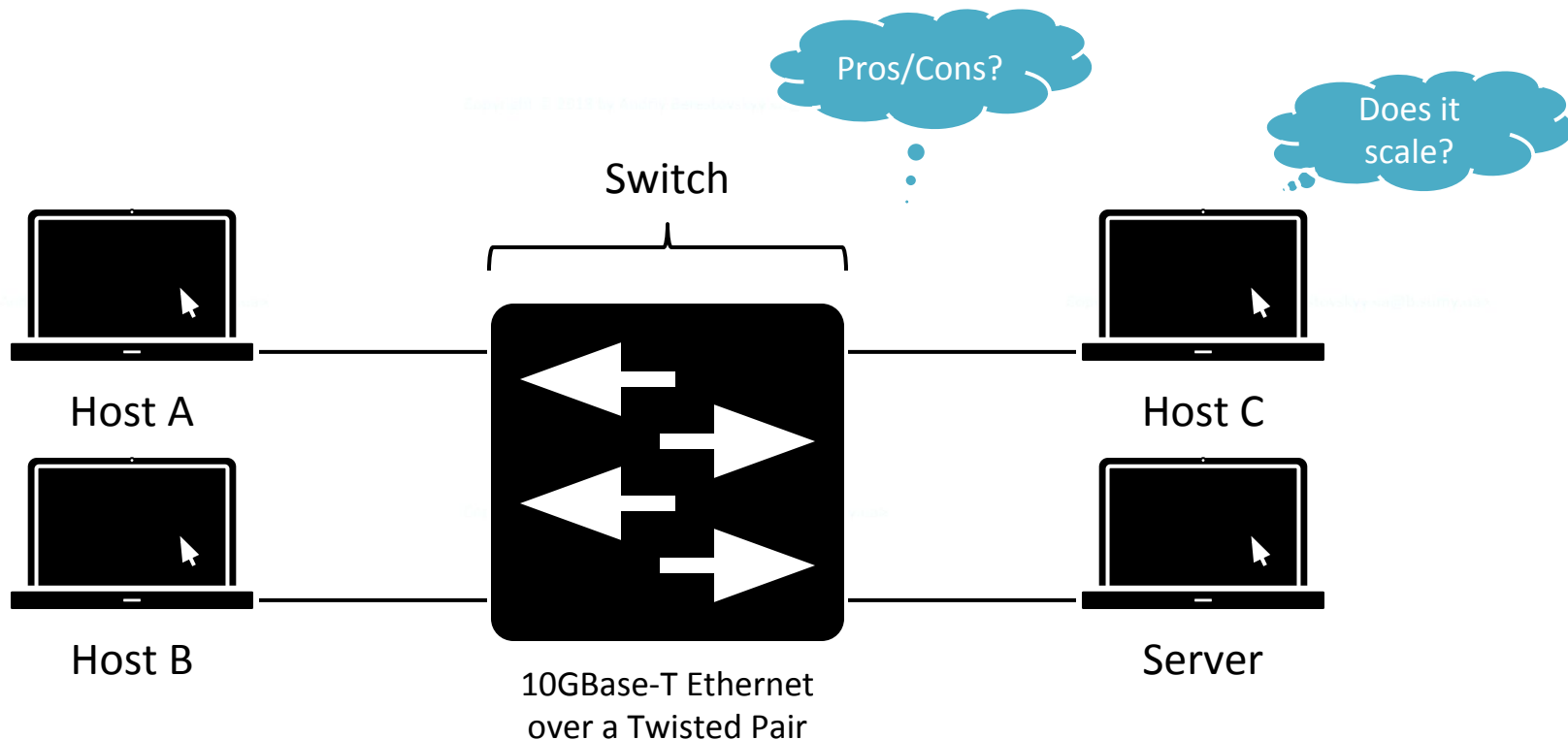
Central hub with a point-to-point connections



Star Topology Example: Repeater



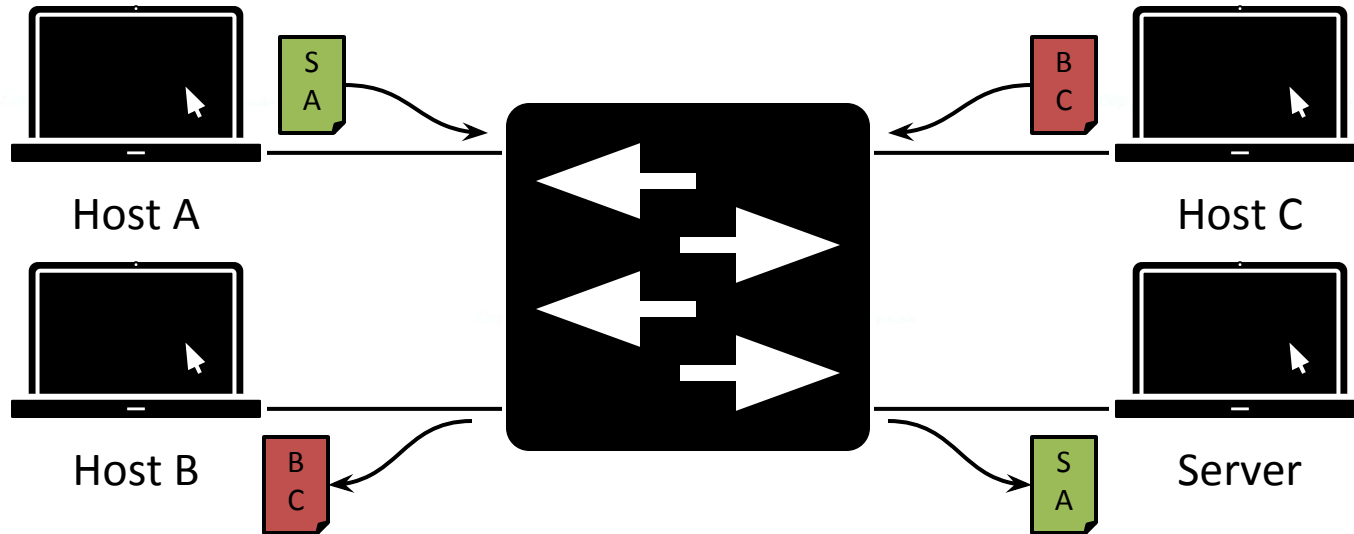
Star Topology Example: Switch





Unicast Transmission

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Unicast — one-to-one transmission from one point
in the network to another point

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

— Wikipedia

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

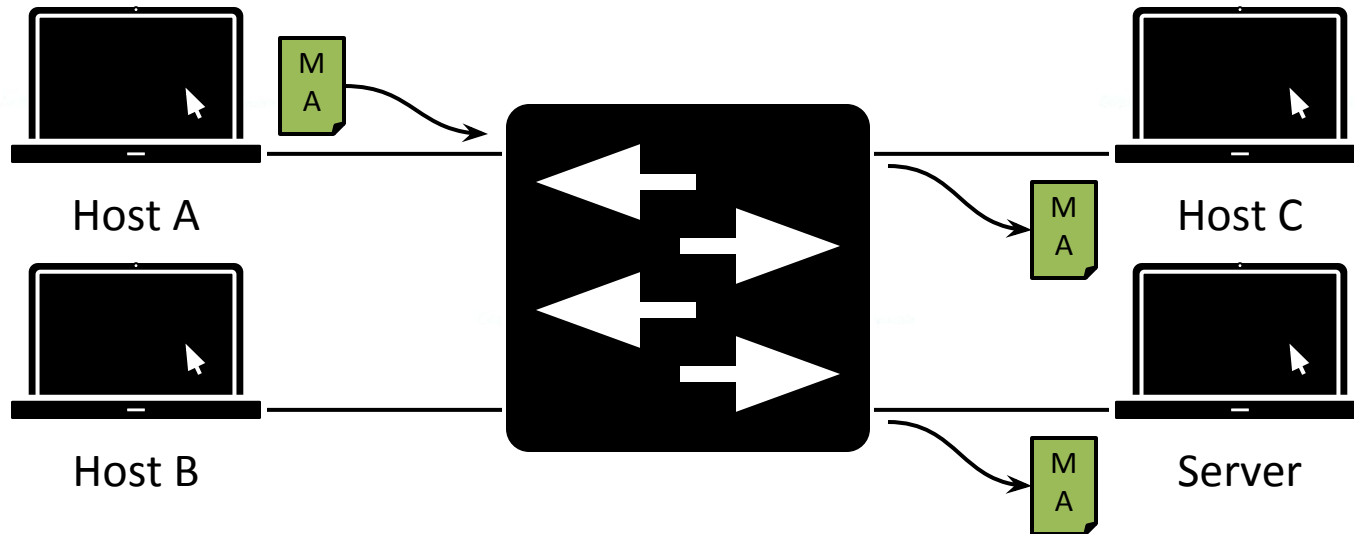


Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Multicast Transmission

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Multicast — information is addressed to a
group of destination computers simultaneously

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua> | www.andriyberestovskyy.com | a@b.sumy.ua

— Wikipedia

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



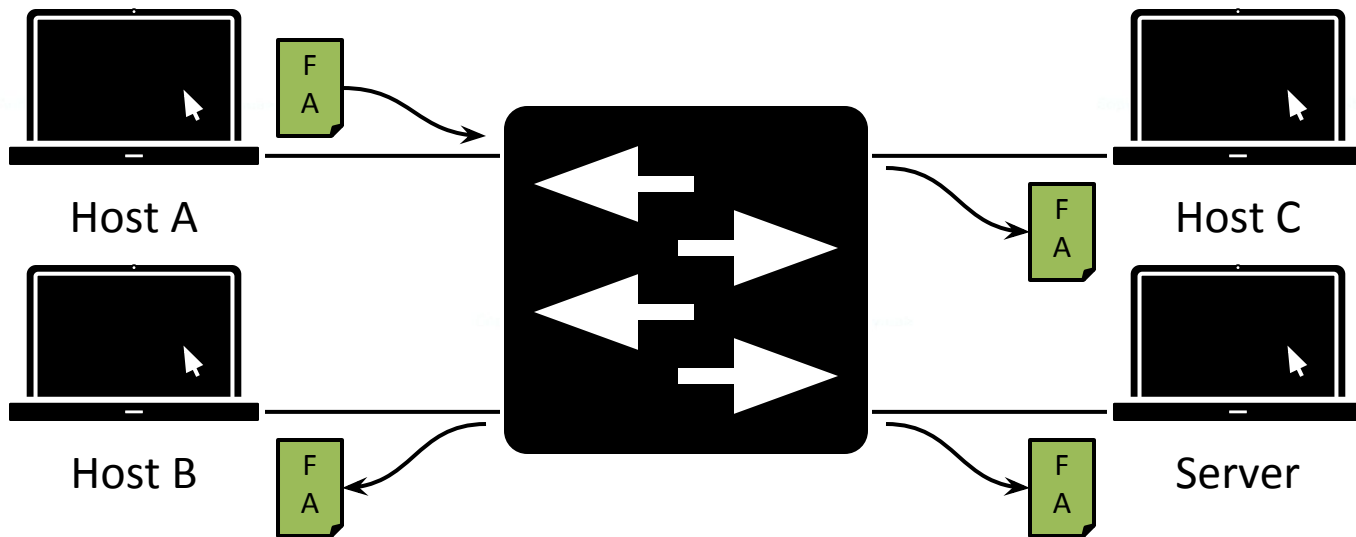
Examples?

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Broadcast Transmission

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Broadcasting — method of transferring a message
to all recipients simultaneously



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

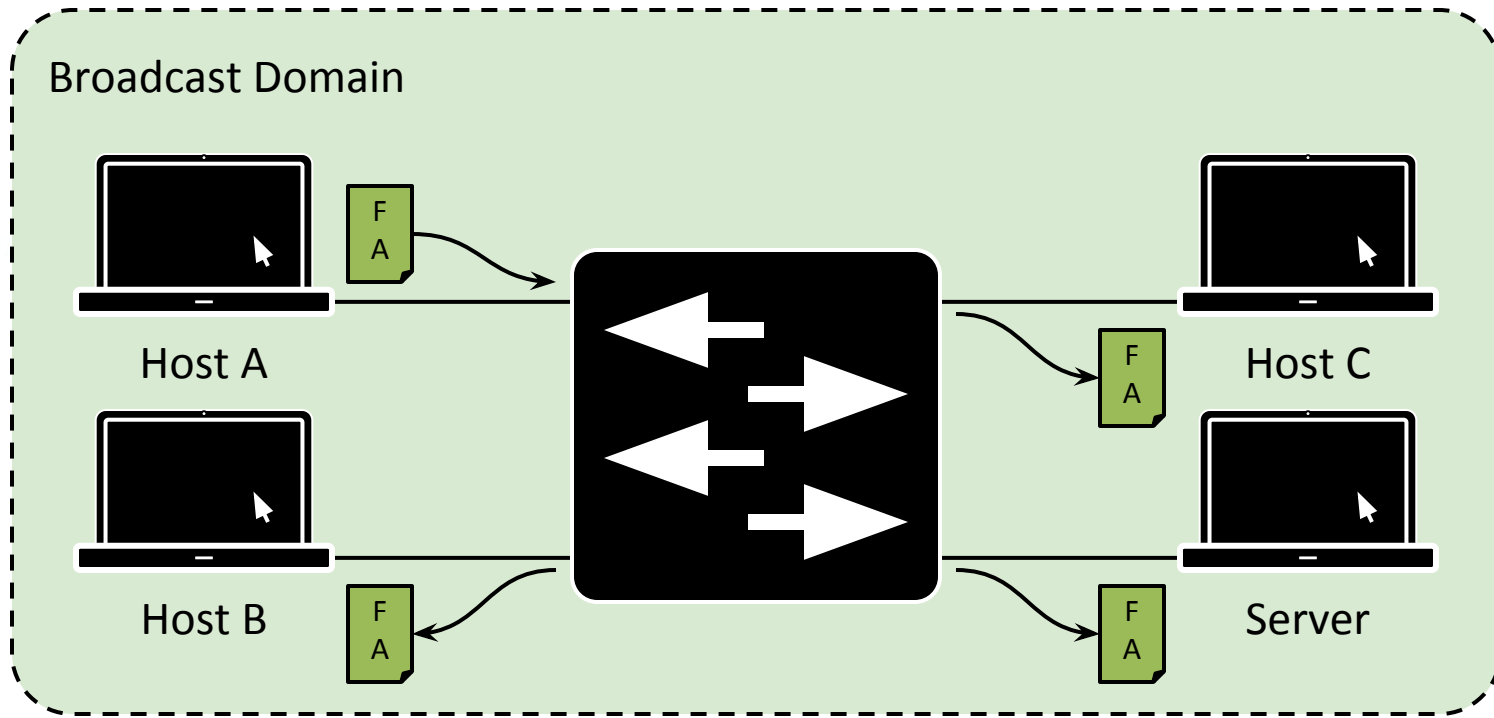
— Wikipedia



Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Broadcast Domain





Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



Broadcast domain — computer network in which all nodes can reach each other by broadcast at the data link layer

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

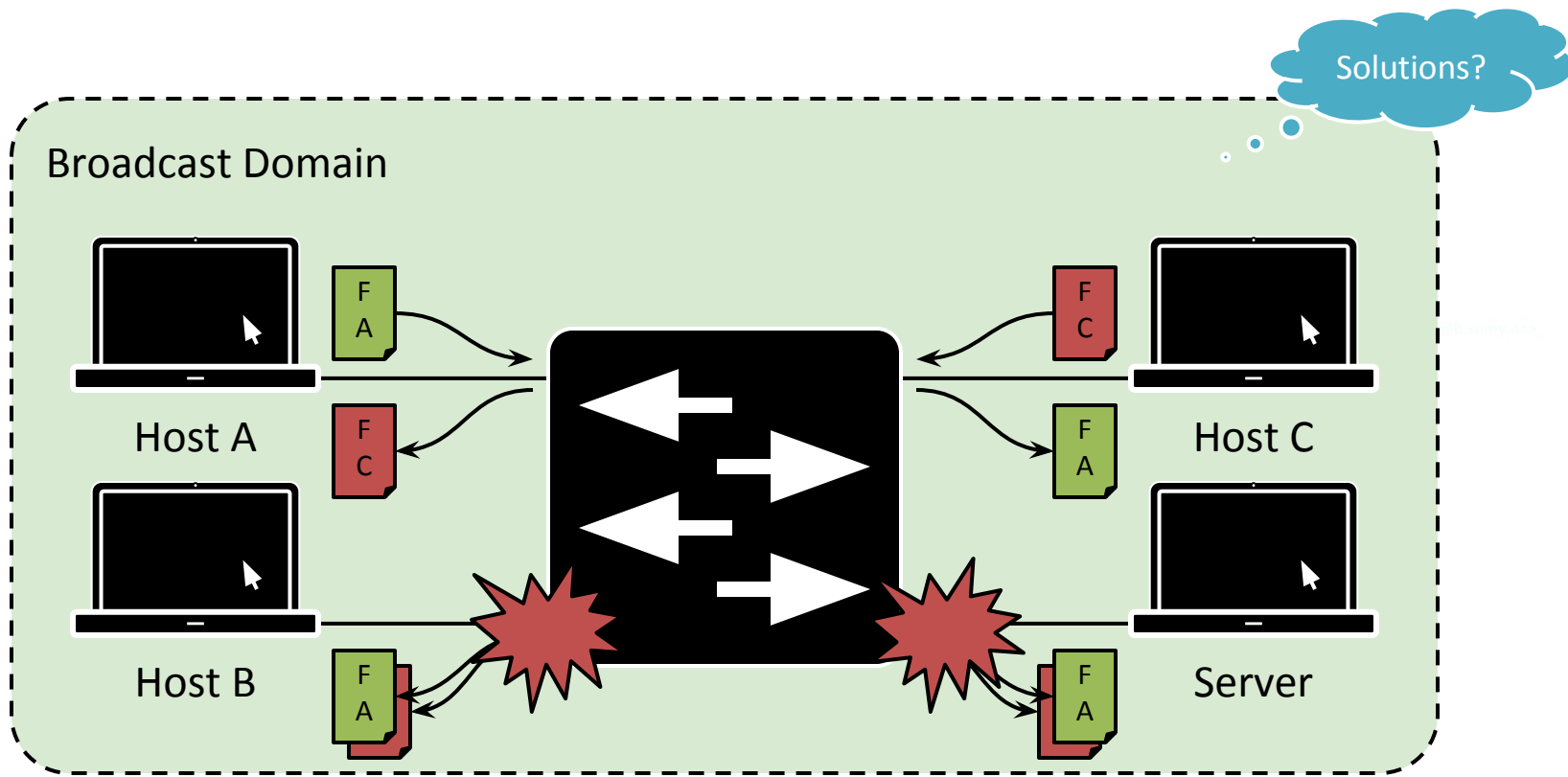
— Wikipedia

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



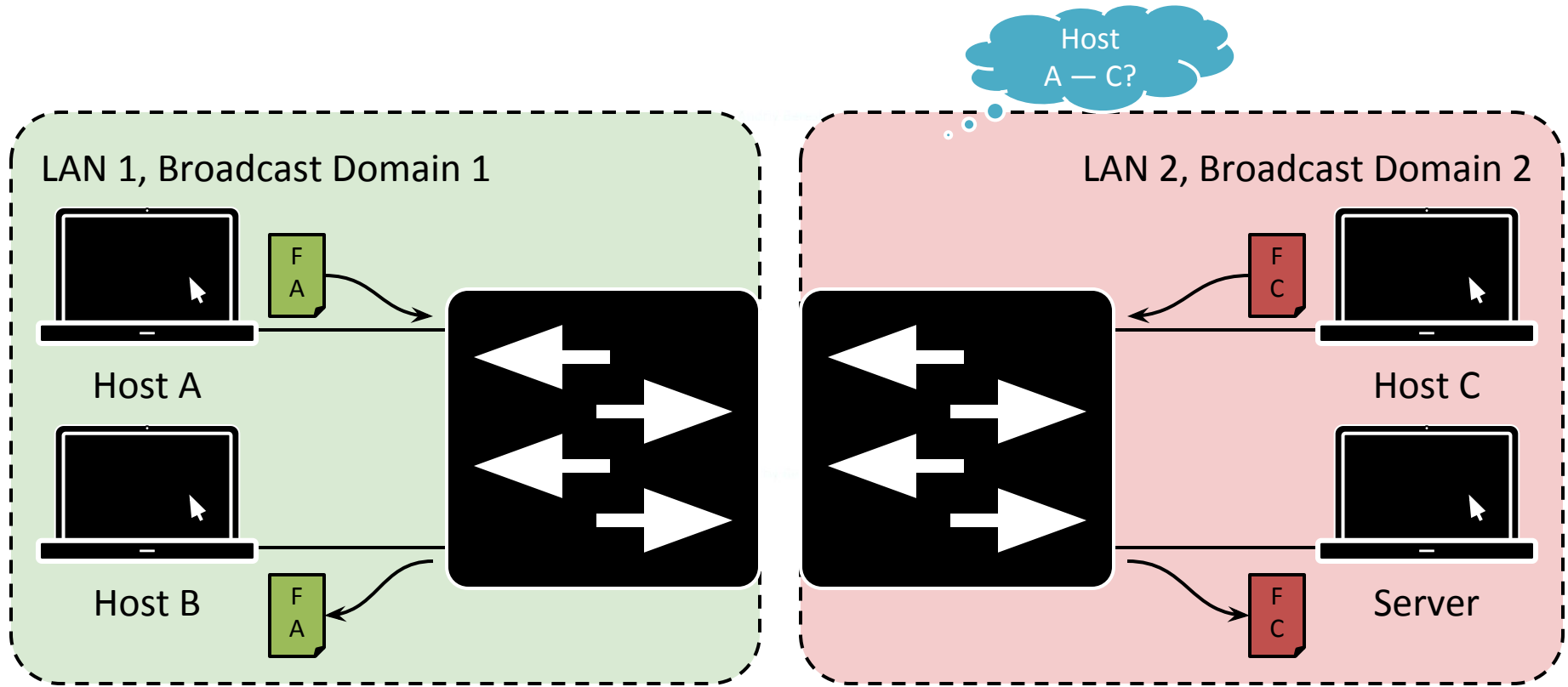


Broadcast Storm

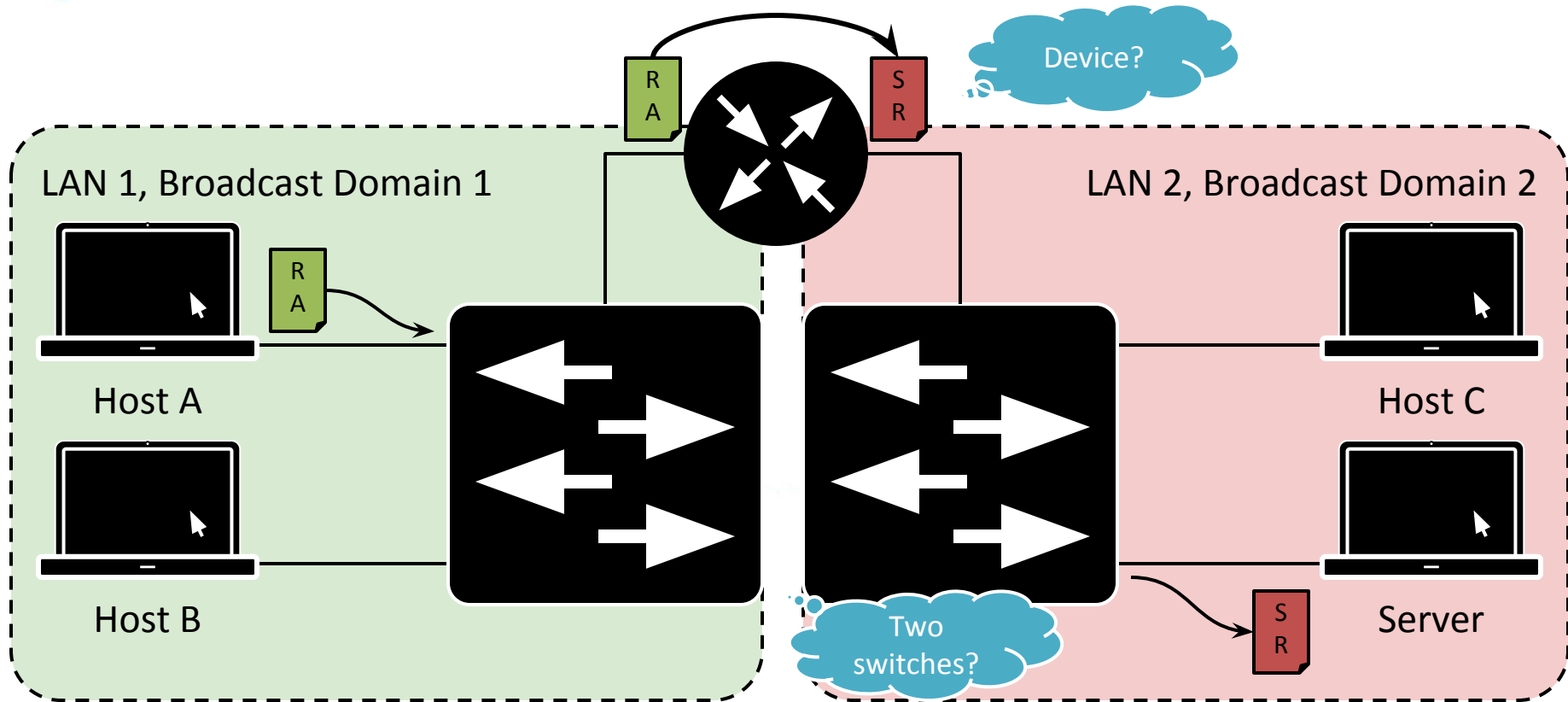




Splitting Broadcast Domain



Connecting Broadcast Domains





Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

VLAN — any broadcast domain that is partitioned
at the data link layer (OSI layer 2)

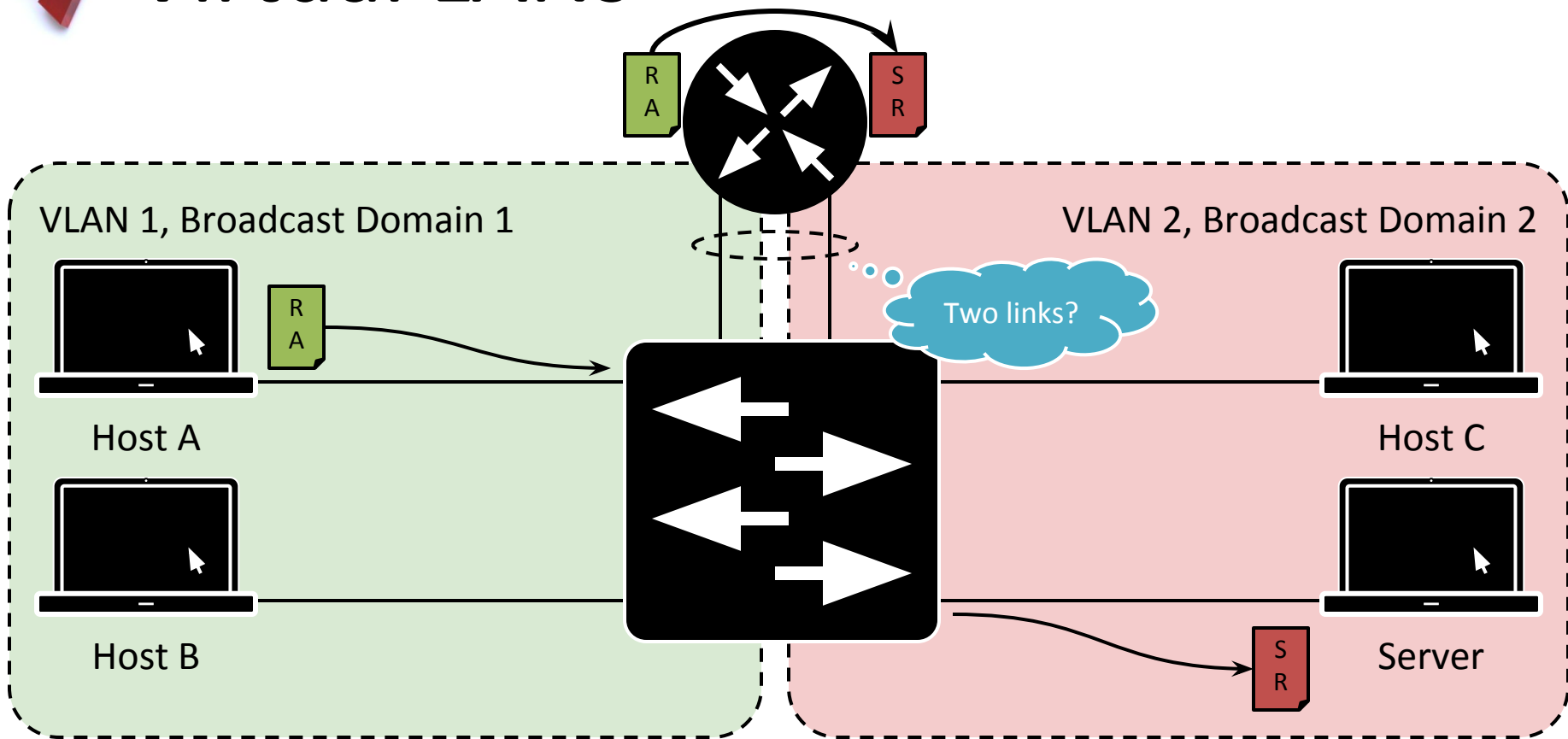
Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

— Wikipedia

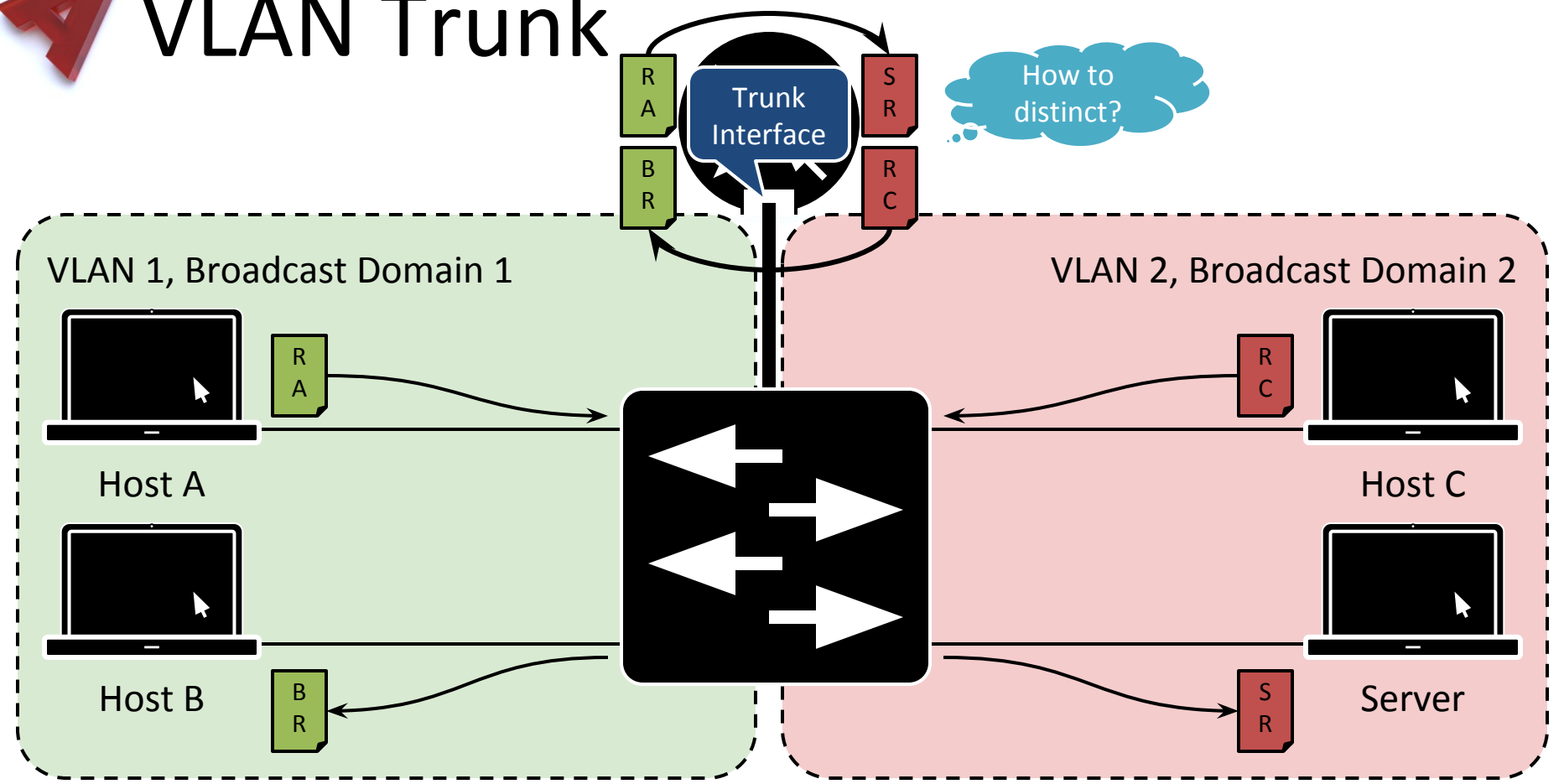
Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Virtual LANs

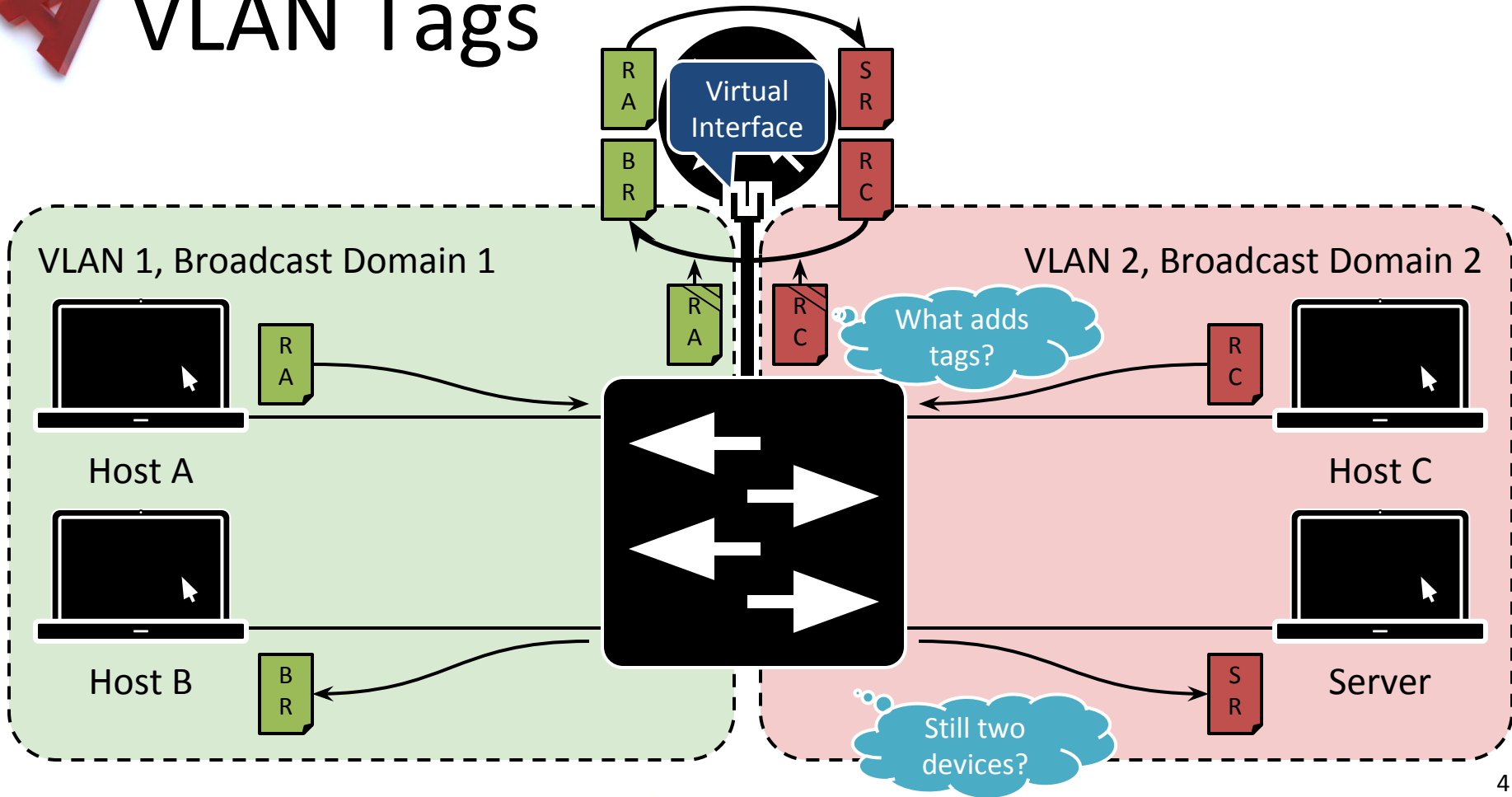




VLAN Trunk

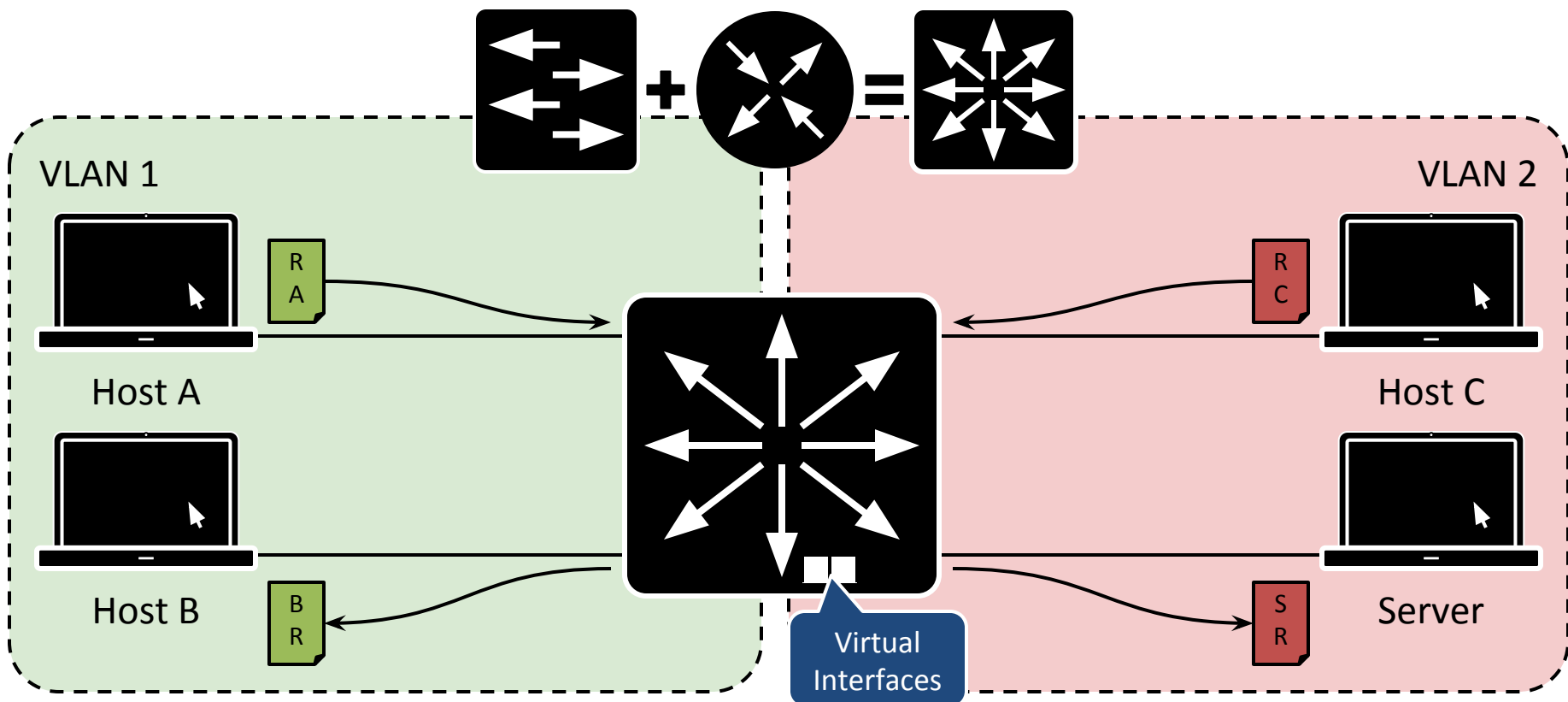


VLAN Tags

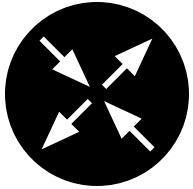




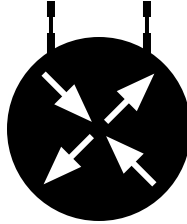
Multilayer Switch



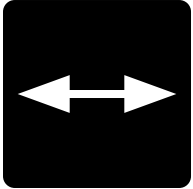
Icons



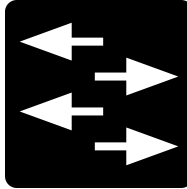
Router



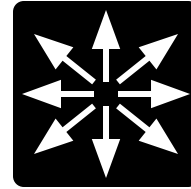
Wireless Router



Repeater Hub



Switch



Multilayer Switch



Access Point

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Computer Networks Checklist

1. Host?
2. RFC?
3. LAN?
4. WAN?
5. Network topologies?
6. Unicast, multicast, broadcast transmissions?
7. Broadcast domain?
8. VLAN?
9. VLAN trunk?
10. Multilayer switch?

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>

Copyright © 2018 by Andriy Berestovskyy <a@b.sumy.ua>



References

1. Kevin Wallace. CCNP Routing and Switching ROUTE 300-101 Official Cert Guide. Cisco Press, 2014
2. David Hucaby. CCNP Routing and Switching SWITCH 300-115 Official Cert Guide. Cisco Press, 2014
3. RFC 1122. Requirements for Internet Hosts — Communication Layers.
4. IANA Protocol Numbers: <http://www.iana.org/assignments/protocol-numbers>