

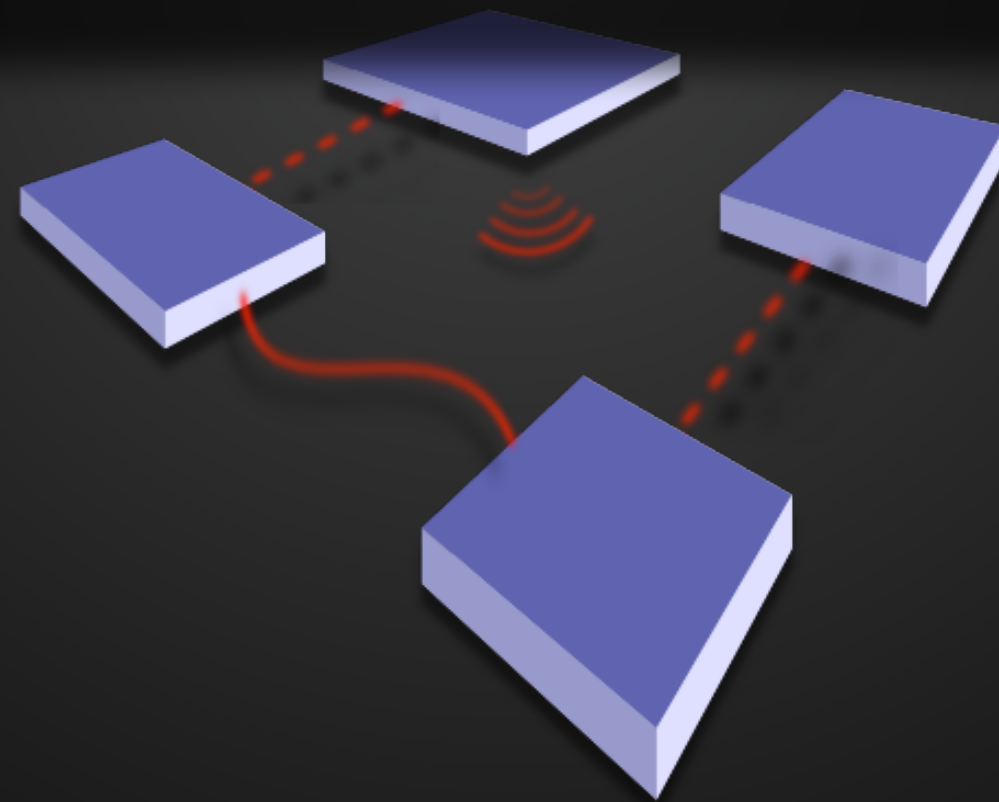
CS-435

spring semester 2025

Network Technology & Programming Laboratory

University of Crete
Computer Science Department

Stefanos Papadakis



CS-435

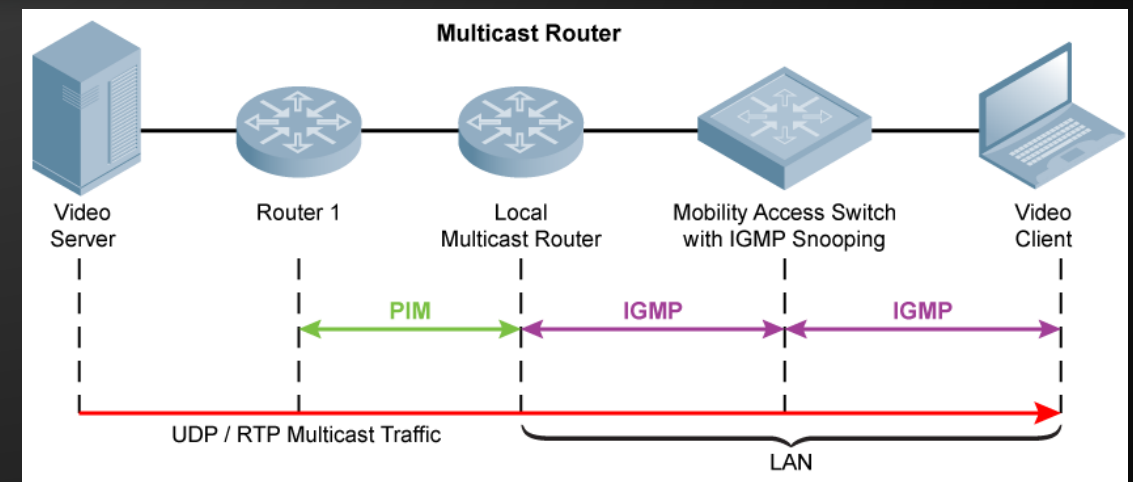
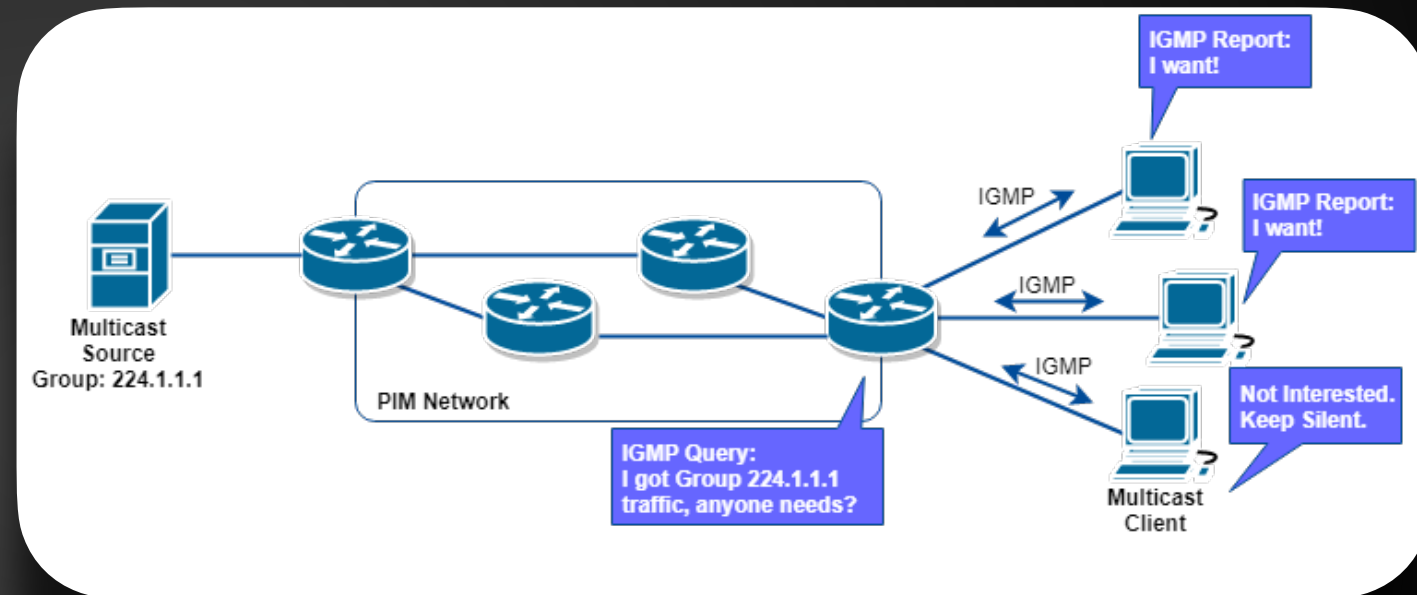
Lecture #16 preview

- IGMP
- STP/RSTP/MSTP
- storm control
- link aggregation
- SNMP
- discovery protocols

IGMP

Internet Group Management Protocol

- multicast flow management
- multicast group memberships
- IPv4 [IPv6 has MLD]
- network layer protocol
- IGMP implemented on hosts & routers
- IGMP snooping in switches
- IGMP v1, v2, v3
- PIM - Protocol Independent Multicast used between routers



(R)STP

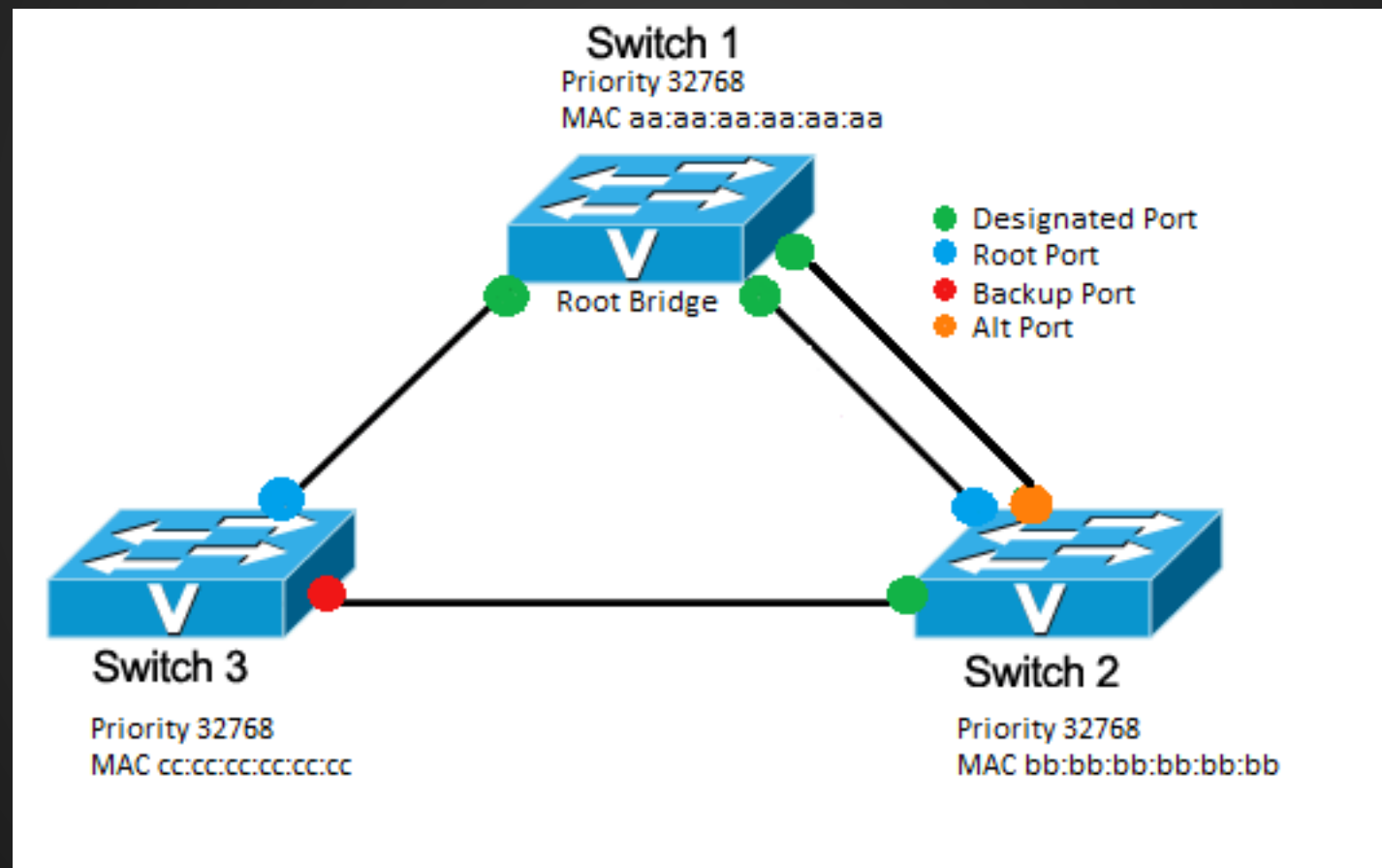
(Rapid) Spanning Tree Protocol

- layer 2 in ethernet
- used for ensuring loop-free logical topology
 - prevents broadcast storms & provides redundancy in case physical loops do exist
- STP = IEEE 802.1D
- RSTP = IEEE 802.1w
- MSTP (for VLANs)= IEEE 802.1s
- All included in IEEE 802.1Q-2014
- For signaling BPDUs (Bridge Protocol Data Units) are used

(R)STP

- Roles: Root Bridge
- The STP root bridge calculates the cost of each path based on bandwidth and selects the path with the lowest cost, as the preferred link
- Cost: STP 1Gbps/rate, RSTP 20Tbps/rate
- STP port states: blocking, listening, learning, forwarding and disabled
 - forward delay - several 10s seconds
- RSTP port roles: root, designated, alternate, backup, and disabled
- RSTP port states: discarding, learning, and forwarding
 - forward delay - few seconds

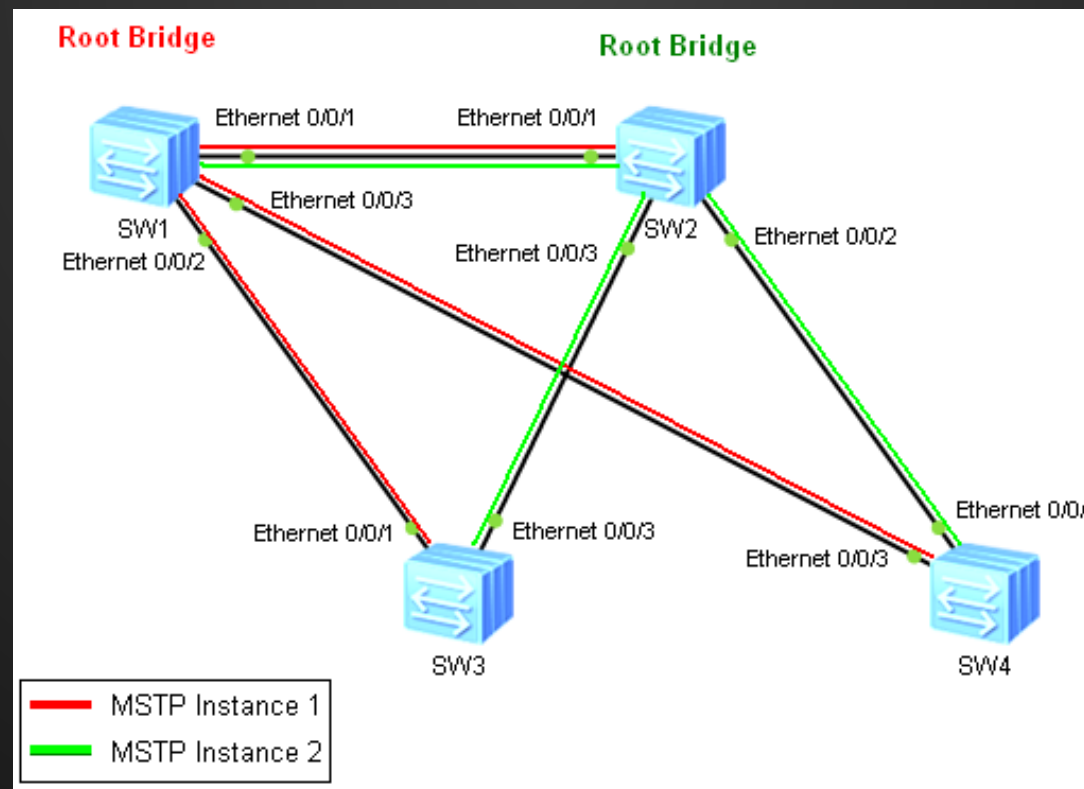
(R)STP



(M)STP

(Multiple) Spanning Tree Protocol

- Extension of RSTP for VLANs
- Multiple Spanning Trees - one instance for each VLAN



Storm Control

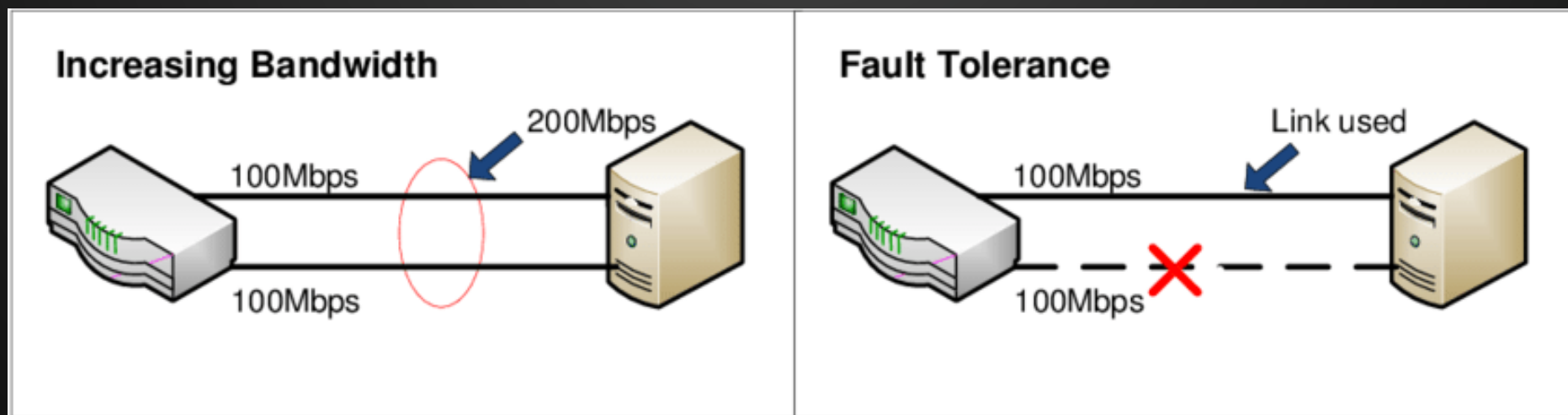
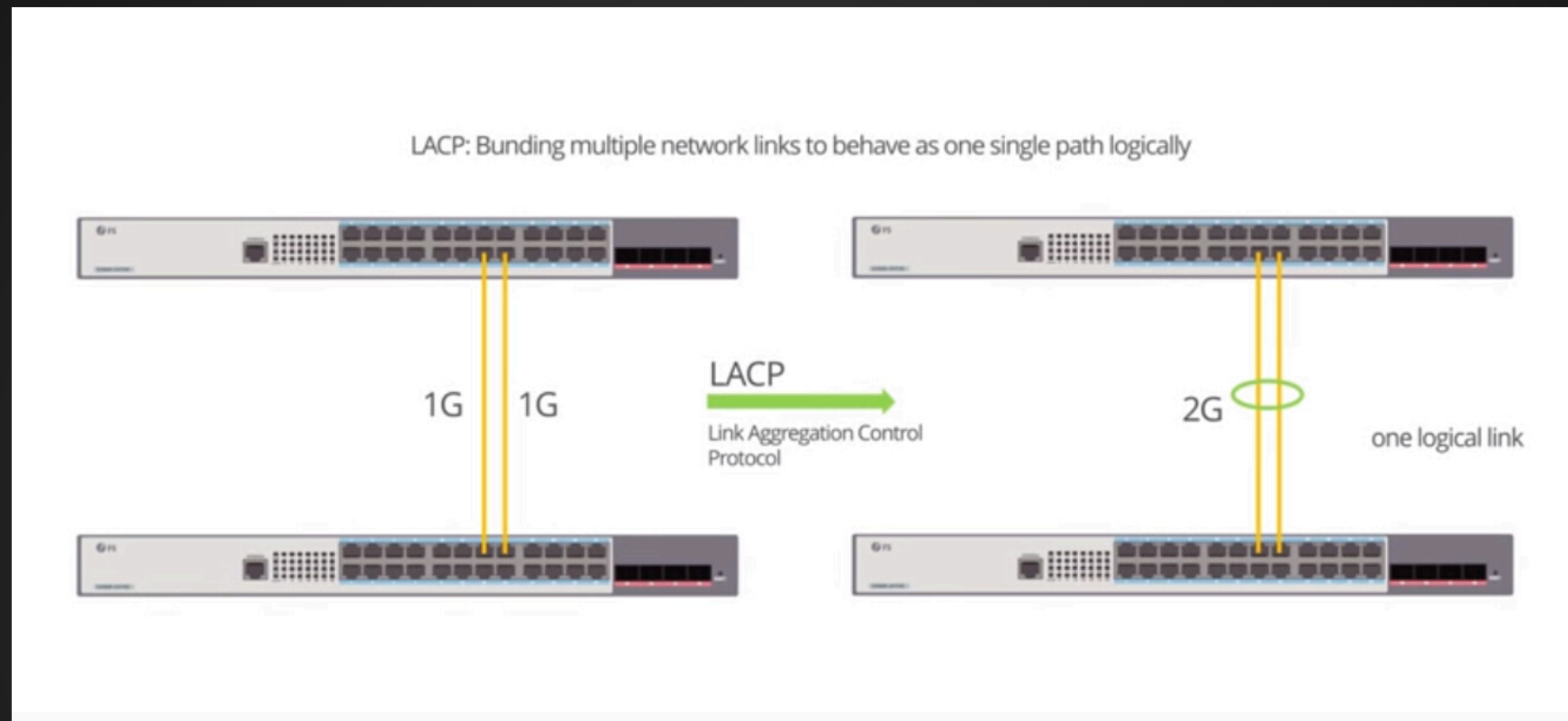
Broadcast poisoning/radiation/storm

- Broadcast storms can:
 - disable networks by overload
 - bring down hosts/servers in DoS fashion
- Mitigation:
 - network segmentation (VLANs, etc.)
 - filtering at routers
 - broadcast/multicast rate limits at switches
 - STP/RSTP to avoid loops
 - limit broadcast flow from & towards router (in WiFi hotspots for example)

Link Aggregation

- Link Aggregation Group (LAG): collection of physical ports combined together
- Link Aggregation Control Protocol (LACP): IEEE 802.1AX & IEEE 802.3ad
- LACP uses multicast
- bundled ports per group: usually from 1 to 8
- requires that each link is full duplex and all of them have an identical speed

Link Aggregation

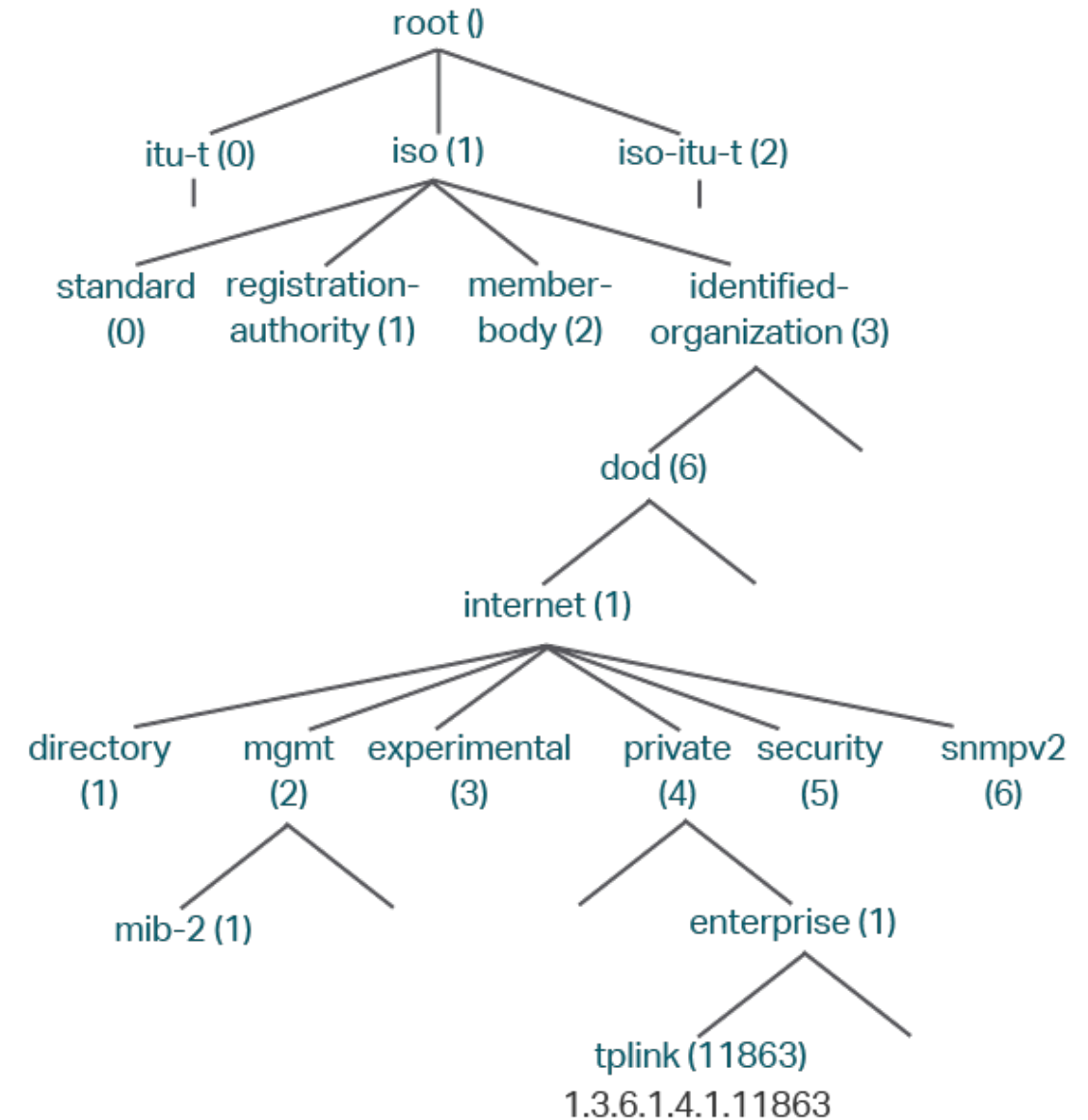
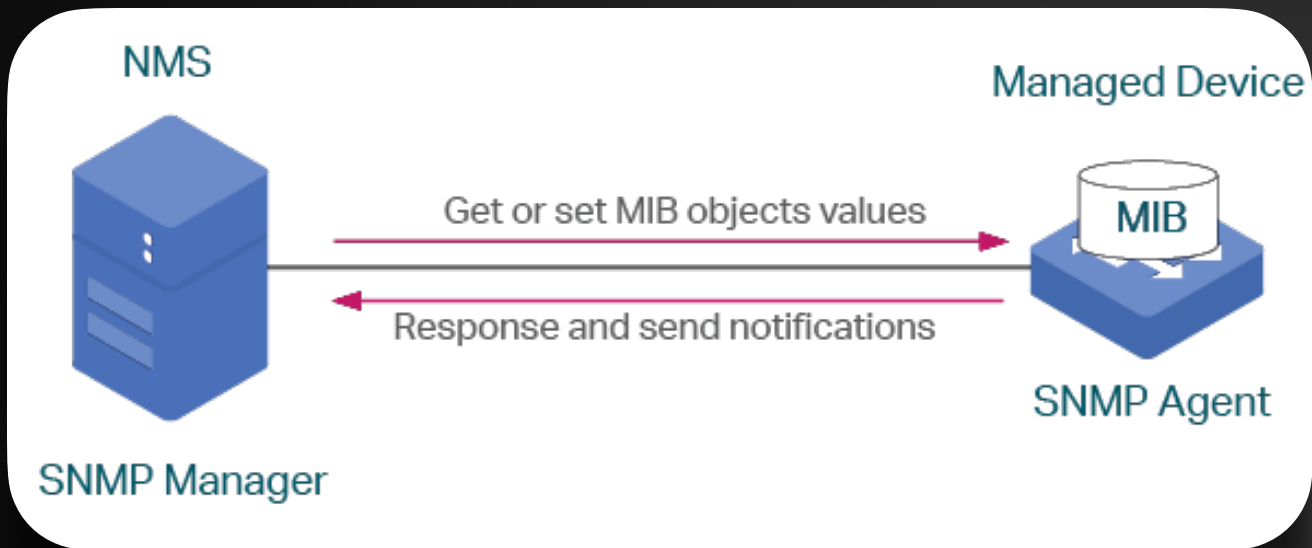


SNMP

Simple Network Management Protocol

- SNMPv1, SNMPv2c, and SNMPv3
- Components:
 - Network Management System (NMS)
 - SNMP agent
 - Managed object
 - Management Information Base (MIB)
- object identifier (OID)
- SNMP get/set/traps
- UDP p.161/162

SNMP



discovery protocols

- Cisco Discovery Protocol (CDP) [1994]
 - proprietary but popular
 - multicast announcements every 60s
 - mac address 01:00:0c:cc:cc:cc
- Link Layer Discovery Protocol (LLDP) [2005]
 - IEEE 802.1AB
 - LLDP Data Unit (LLDPDU)
 - EtherType field = 0x88cc
 - multicast announcements
 - mac address 01:80:c2:00:00:0e / 01:80:c2:00:00:03 / 01:80:c2:00:00:00
 - used also for active PoE

discovery protocols

