

IK1350 Protocols in Computer Networks/ Protokoll i datornätverk Spring 2008, Period 3 Module 3: Switches & Switching

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For use in conjunction with *TCP/IP Protocol Suite*, by
Behrouz A. Forouzan, 3rd Edition, McGraw-Hill, 2006.



KTH Information and
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Outline

- Switches
- Switching
- Switching Protocols

Using Cisco's Packet Tracer - to build a simple network

Create a simple network with several switches, then simulate.

Packet Tracer 4.1 by Cisco Systems, Inc. - C:\Documents and Settings\maguire\My Documents\Class\IK1350\chip-example-20080114.pkt

File Edit Options Help

Logical [Root] New Cluster Move Object Set Tiled Background Viewport

Simulation Panel

Event List

Vis.	Time (s)	Last Device	At Device	Type	Info
	0.940	--	Switch1	STP	
	0.941	Switch1	Router0	STP	
	0.941	Switch1	Switch2	STP	
	0.941	Switch1	PC0	STP	
👁	0.942	Switch2	PC1	STP	
👁	0.942	Switch2	PC2	STP	

Reset Simulation Constant Delay Captured to: * 0.942 s

Play Controls

Back Auto Capture / Play Capture / Forward

Event List Filters

Visible Events: ARP, CDP, DHCP, EIGRP, ICMP, RIP, TCP, UDP, VTP, STP, OSPF, DTP, TELNET, TFTP, HTTP, DNS

Edit Filters Show All

Power Cycle Devices PLAY CONTROLS: Back Auto Capture / Play Capture / Forward Event List Simulation

Routers: 1841, 2620XM, 2621XM, 2811, Generic, Generic

Scenario 0

Fire Last Status Source Destination Typ

🔴	--	Server1	Router0	ICM
---	----	---------	---------	-----

Toggle PDU List Window

Select a Device to Drag and Drop to the Workspa

Figure 43: Simple network simulation

Cisco Discovery Protocol (CDP)

Cisco Discovery Protocol (CDP): to obtain protocol addresses of neighboring devices and discover the platform of those devices

- Operates over any media which support the Subnetwork Access Protocol (SNAP) protocol - see <http://wiki.wireshark.org/CDP>
- Each device periodically (~60 seconds) multicasts advertisements (to MAC address 01:00:0c:cc:cc:cc)
 - The advertisement contains type-length-value (TLV) tuples specifying: at least one address at which it can receive SNMP messages, type of device, name of the device, OS, the number and type of the local interface (port), the device product number, and the port ID
 - Advertisements also indicate how long they are valid (i.e., a holdtime - 180 seconds by default)
- CDP Version-2 (CDPv2)
 - In the case of VLANs the advertisement also includes a VLAN ID (IEEE 802.1Q) and the VLAN Trunking Protocol (VTP) domain name
 - Indication of if the link is full or half-duplex
 - Includes an error reporting mechanism
- Can be used for On-Demand Routing (ODR) based upon including routing information in the CDP announcements

- A CDP cache entry consists of a list of the following entries

```

CdpCacheEntry ::= SEQUENCE {
    cdpCacheIfIndex                Integer32,
    cdpCacheDeviceIndex            Integer32,
    cdpCacheAddressType            CiscoNetworkProtocol,
    cdpCacheAddress                CiscoNetworkAddress,
    cdpCacheVersion                DisplayString,
    cdpCacheDeviceId               DisplayString,
    cdpCacheDevicePort             DisplayString,
    cdpCachePlatform               DisplayString,
    cdpCacheCapabilities           OCTET STRING,
    cdpCacheVTPMgmtDomain          DisplayString,
    cdpCacheNativeVLAN             VlanIndex,
    cdpCacheDuplex                 INTEGER,
    cdpCacheApplianceID            Unsigned32,
    cdpCacheVlanID                 Unsigned32,
    cdpCachePowerConsumption       Unsigned32,
    cdpCacheMTU                    Unsigned32,
    cdpCacheSysName                DisplayString,
    cdpCacheSysObjectID            OBJECT IDENTIFIER,
    cdpCachePrimaryMgmtAddrType    CiscoNetworkProtocol,
    cdpCachePrimaryMgmtAddr        CiscoNetworkAddress,
    cdpCacheSecondaryMgmtAddrType  CiscoNetworkProtocol,
    cdpCacheSecondaryMgmtAddr      CiscoNetworkAddress,
    cdpCachePhysLocation           DisplayString,
    cdpCacheLastChange             TimeStamp
}

```

- Details at: <ftp://ftp.cisco.com/pub/mibs/v2/CISCO-CDP-MIB.my> ,
http://www.cisco.com/en/US/products/hw/switches/ps663/products_tech_note09186a0080094713.shtml#cdp ,
and <http://www.cisco.com/univercd/cc/td/doc/product/lan/trsrbr/frames.htm#xtocid12>

Hint: In Wireshark filter on: **ether dst 01:00:0c:cc:cc:cc**

```
dumpcap -i eth1 -f "ether dst 01:00:0c:cc:cc:cc" -a duration:180\  
-w cdp-080103d.pcap&
```

Note that the filter above uses the **libpcap** syntax and **not** the **Wireshark** filter syntax (<http://www.wireshark.org/docs/man-pages/wireshark-filter.html>)

See also Chapter 4 of [7] for more information about CDP.

HP Switch Protocol

DSAP = 0xf8 indicates the HP Extended LLC protocol

```
Packet Length=69, Captured Length =69
timestamp="Jan  3, 2008 11:46:40.321477000"
Frame 877 (105 bytes on wire, 105 bytes captured)
Arrival Time: Jan  3, 2008 11:46:40.321477000
Time delta from previous captured frame: 0.097393000 seconds
Packet Length: 105 bytes
Protocols in frame: eth:llc:hpext:hpsw
proto name=IEEE 802.3 Ethernet
Destination: 09:00:09:00:00:67
Address: 09:00:09:00:00:67
....  ...1  ....  ....  ....  ....  = IG bit: Group address (multicast/broadcast)
....  ..0.  ....  ....  ....  ....  = LG bit: Globally unique address (factory default)
Source: HewlettP_d6:c1:80 (00:17:08:d6:c1:80)
....  ...0  ....  ....  ....  ....  = IG bit: Individual address (unicast)
....  ..0.  ....  ....  ....  ....  = LG bit: Globally unique address (factory default)
Length: 91
Logical-Link Control
DSAP: HP Extended LLC (0xf8)
IG Bit: Individual
SSAP: HP Extended LLC (0xf8)
CR Bit: Command
Control field: U, func=UI (0x03)
000. 00.. = Command: Unnumbered Information (0x00)
```



```
Frame type: Unnumbered frame (0x03)
HP Extended Local-Link Control
DXSAP: HP Switch Protocol (0x0623)
SXSAP: HP Switch Protocol (0x0623)
HP Switch Protocol
Version: 0x03
Type: 0x01
Device Name: HP 2524
Version: F.05.55
Config: LAN-4846
IP Addr: 192.168.15.248
Field 7: 0x00
Field 8: 0x003c
Field 9: 0x0100
Field 10: 0x00000065
MAC Addr: 00:17:08:d6:c1:80
Field 12 (0x0c)
Device ID: Bad length 11
  value="0018fed131c0001f333100"
```

Spanning Tree Protocol (STP)

The Spanning-Tree Protocol (STP) (as specified in IEEE 802.1d) is a Layer 2 protocol designed to run on bridges and switches. The main purpose is to ensure that we avoid a loop while computing (redundant) paths in a network.

To provide path redundancy while avoiding formation of a loop STP defines a tree that spans all switches in a network - starting from a **root bridge**.

Note: If there are VLANs, then each VLAN has to have a root bridge; but these can be at different nodes.

VLAN Trunking Protocol (VTP)

VTP is a Layer 2 messaging protocol for managing the addition, deletion, and renaming of VLANs -- on a network-wide basis, hence maintaining consistency.

VTP traffic is sent over the management VLAN (VLAN1), therefore all VLAN trunks must be configured to pass VLAN1.

A Cisco animation of VTP is available at: http://www.cisco.com/warp/public/473/vtp_flash/

IEEE GVRP corresponds to VTP and it used by many vendors.

IEEE GARP (Generic Attribute Registration Protocol) VLAN Registration Protocol (GVRP)

GVRP is a Layer 2 protocol for automatic configuration of switches in a VLAN network.

Builds upon:

- GARP Information Declaration (GID) and
- GARP Information Propagation (GIP)

GVRP packets are sent to the MAC address 01:80:C2:00:00:2

Hint: In Wireshark filter on: [ether dst 01:80:c2:00:00:21](#)

VLAN Routing

Four different protocols, based on OSI Layer 2 bridge multiplexing mechanisms, are used for routing between VLANs.

Inter-Switch Link Protocol	Used to interconnect two VLAN-capable Ethernets. A packet-tagging protocol that labels an Ethernet frame with the relevant VLAN information associated with this frame.
IEEE 802.10 Protocol	Incorporates authentication and encryption technology to ensure data confidentiality and integrity. Designed for high-throughput, low-latency environments. Can utilize LAN or HDLC serial links.
IEEE 802.1Q Protocol	Used to interconnect multiple switches and/or routers utilizing VLANs.
Layer 3 Routing	Utilizing layer 3 routing requires that the IP address ranges of the VLANs have to be non-overlapping.

IEEE 802.1P for QoS Prioritization

Traffic is simply classified and forwarded \Rightarrow No bandwidth reservations are established.

IEEE 802.1P is a spin-off of IEEE 802.1Q (VLAN) standard. IEEE 802.1P standardizes the VLAN tag's prioritization field:

- VLAN ID (12-bit)
- Prioritization (3-bit)
 - IEEE 802.1P defines eight levels of priority (similar to IP Precedence).

Priority	Traffic Type
0	(default) Best Effort
1	Background
2	Spare
3	Excellent Effort
4	Controlled Load
5	Video
6	Voice
7	Network Control

- Not surprisingly the IP Precedence field can be mapped to a 802.1P Prioritization field.

Summary

This lecture we have discussed:

- Switches
- Switching
- Switching protocols

References

[25]