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Date: 1/20 | Page No.

Assignment NO. 1

Title: To setup a wired LAN using Layer 2 switch of minimum four computers.

Problem statement :-

Setup a Wired LAN using Layer 2 switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.

Requirements :-

1. Cisco packet Tracer student
2. Wireshark Packet Analyzer Tool.
3. RJ-45 connectors, Crimping tool, CAT-6 cable, switch (Unavailable with us demonstrated by lab teacher)

Description :-

RJ-45 connector :

A registered jack is a standardised physical network interface for connecting telecommunications or data equipment. The physical connectors that registered jacks use are mainly of the modular connectors and 50-pin miniature ribbon connector types. The most common twisted pair

connectors is an 8-position, 8-contact (8p8c) modular plug and jack commonly referred to as RJ-45 connectors.

Crimping tool :

A crimping tool is a device that is used to make cold weld joints between wires and a connector through deforming one or both of them to hold the other.

Cat-6 cable :

CAT-6, derived from category 6, came out only a few years after CAT 5e. CAT-6 is a standardised twisted pair cable for ethernet that is backward compatible with CAT 5/5e and CAT-3 cable standards.

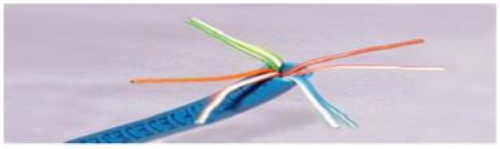
Switch :

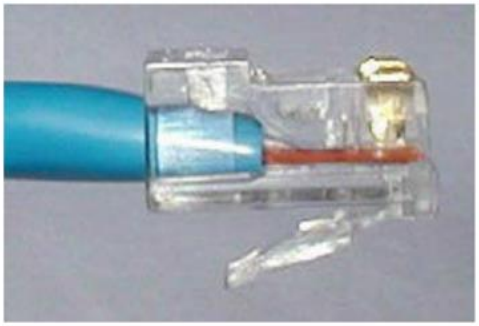
A layer 2 switch is a type of network switch or device that works on the data link layer (OSI layer 2) and utilizes MAC address to determine the path through ~~which~~ and where the frames are to be forwarded.

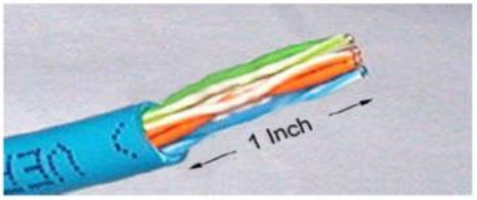
LAN Tester :

LAN tester covers the fields of installation and network control. It is mainly used for testing ethernet cables for faults or missing pair connection.

Required components:







Content Related theory :-

'Computer Network' is a system which allows communication among the computers connected in the network.

~~The OSI model~~

Types of LAN :-

A local area network (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus or office building and has its network equipment and interconnects locally managed. By contrast, a wide area network (WAN) not only covers a larger geographic distance, but also generally involves leased telecommunication circuits or Internet links. An even greater contrast is the Internet, which is a system of globally connected business and personal computers.

Ethernet and Wi-fi are the two most common transmission technologies in use for local area networks.

Ethernet LAN :

Ethernet is the most popular physical layer LAN technology in use today. It defines the number of conductors that are required for a connection, A standard Ethernet network can transmit data at a range up to 10 Megabits per second (10 Mbps). Other LAN types include

Token Ring, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Fiber Distributed Data Interface (FDDI), Ethernet is a popular because it strikes a good balance between speed, cost and ease of installation. These benefits, combined with wide acceptance in the computer marketplace and the ability to support virtually all popular network protocols, makes Ethernet an ideal networking technology for most computer uses today.

The Institute for Electrical and Electronic Engineers developed an Ethernet standard known as IEEE standard 802.3. This standard defines rules for configuring an Ethernet network and also specifies how the elements in an Ethernet network interact with one another. By adhering to the IEEE standard, network equipment and network protocols can communicate efficiently.

Fast Ethernet:

The Fast Ethernet standard (IEEE 802.3u) has been established for Ethernet networks that need higher transmission speeds. This standard raises the Ethernet speed limit ~~to~~ from 10 Mbps to 100 Mbps with only minimal changes to the existing cable structure. Fast Ethernet provides faster throughput for video, multimedia, graphics, Internet surfing and stronger error detection and correction.

There are three types of Fast Ethernet:
100BASE-TX for use with level 5 UTP cable;
100BASE-FX for use with fiber-optic cable and
100BASE-T4 which utilizes an extra two wires

for use with level 3 UTP cable. The 100BASE-TX standard has become the most popular due to its close compatibility with the 10BASE-T Ethernet standard.

Gigabit Ethernet :

Gigabit Ethernet was developed to meet the need for faster communication networks with applications such as multimedia and Voice Over IP (VoIP). Also known as "gigabit Ethernet over copper" or 1000 BASE-T, GigE is a version of Ethernet that runs at speed 10 times faster than 100 BASE-T. It is defined in the IEEE 802.3 standard and is currently used as enterprise backbone. Existing Ethernet LANs with 10 and 100 Mbps cards can feed into Gigabit Ethernet backbone to interconnect high performance switches, routers and servers.

10 Gigabit Ethernet :

10 Gigabit Ethernet is the fastest and most recent of the Ethernet standards. IEEE 802.3ae defines a version of Ethernet with a nominal rate of 10 Gbits/s that makes it 10 times faster than Gigabit Ethernet.

Unlike other Ethernet systems, 10 Gigabit Ethernet is based entirely on the use of optical fiber connections. This developing standard is moving away from a LAN design that broadcasts to all nodes, toward a system which includes some elements of wide area routing. As it is still very new, which of the standards will gain commercial acceptance has yet to be determined.

OSI Model :-

The OSI model (Open Systems Interconnection Model) is a conceptual framework used to describe the functions of a networking system.

OSI Layers	Function	Data type	Protocols	Network Components
① Application layer	User Application services, Allows access to network services that support Applications. Handles network access, Flow control and error recovery.	User Data	DNS; NFS; BOOTP; DHCP; SNMP; RMON; FTP; TFTP; SMTP; POP3; IMAP; NNTP; HTTP; Telnet	Gateway
② Presentation Layer	Data Translation; Compression and Encryption. All different formats from all sources are made into a common uniform format that the rest of the OSI model can understand.	Encoded User Data	SSL; Shell and Redirect-ors MIME	Gateway, Redirector
③ Session Layer	Session Establishment, Management And Termination. Manages who can transmit data at a certain time and for how long :	Sessions	NetBIOS, sockets, Named Pipes, RPC	Gateway

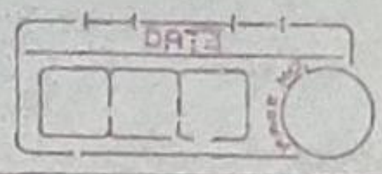
OSI layers	Function	Data Type	Protocols	Network Components
(4) Transport layer	Additional connection below the session layer Manages the flow control of data between parties across the network. Provides flow control and error-handling.	Datagrams/ Segments	TCP and UDP; SPX; NetBEUI/ NBF	Gateway, Advanced Cable testers Routers
(5) Network layer	Translates logical network address and names to their physical address. e.g. computer name to MAC address) Logical addressing; Routing; Datagram Encapsulation, Fragmentation and Reassembly; Error handling and Diagnostics	Packets	IP, IPV6, IPNAT; IPsec, MOBILE IP; ICMP; IPX; DLC PLP; Routing protocols such as RIP and BGP	Routers Routers, Frame Relay Device, ATM switch, Advanced cable Testers.
(6) Data Link layer	Handles data frames between the Network and physical layers. the sending end packages raw data from the physical layers into data frames for delivery to the Network layer. Logical Link Control; Media Access Control; Data Framing; Addressing Errors	Frames	IEEE 802.2 LLC, Ethernet Family; Token Ring; FDDI and CDDI; IEEE 802.11 (WLAN, Wi-Fi); HomePNA; HomeRF; ATM; SLIP and PPP	Bridge switch; ISDN Routers, Intelligent, HUB, NIC. Advanced cable Testers

OSI layers	Function	Data Type	Protocols	Network Components
	Detection and Handling; Defining Requirements. of physical layers			
(7) physical layers	Transmits raw bit stream over physical ~~Aspects~~ cable, Defines cables, racds and physical Aspects, Defines NIC attachments to hardware, how cable is attached to NIC. Encoding and signaling physical Data Transmission; Hardware specifications; Topology and Design.	Bits	IEEE 802 IEEE 802.2 ISO 2110 ISDN	Repeaters, Multiplexers, Hubs TDR, Oscilloscope Amplify.

Comparison between Guided Transmission Media :

	Twisted pair Cable	Coaxial Cable	Optical fibre.
(1.)	Transmission of signals takes place in the electrical form over the metallic conducting wires	Transmission of signals takes place in the electrical form over the inner conductor of the cable.	Signal transmission takes place in an optical form over a glass fibres

	Twisted pair cable	Co-axial cable	Optical fibre
(2)	Noise immunity is low, Therefore more distortion.	Higher noise immunity than the twisted pair cable due to the presence of shielding conductors.	Highest noise immunity as the light rays are unaffected by the electrical noise.
(3)	Affected due to external magnetic field.	less affected due to external magnetic field.	Not affected by the external magnetic field.
(4)	short circuit between the two conductors is possible.	short circuit between the two conductors is possible.	short circuit is not possible.
(5)	cheapest	Moderately expensive.	Expensive.
(6)	Can support low data rates	Moderately high data rates.	very high data rates.
(7)	power loss due to conduction and radiation.	power loss due to conduction.	power loss due to absorption, scattering, dispersion and bending.
(8)	low bandwidth	Moderately high bandwidth	very high bandwidth
(9)	Node rapparity per segment is 2.	Node rapparity per segment is 30 to 100.	Node rapparity per segment is 2.
(10)	Attenuation is very high.	Attenuation is low.	Attenuation is very low.



Comparison of LAN, MAN, WAN :-

BASIS	LAN	MAN	WAN
(1) Full Form	Local Area Network	Metropolitan Area Network	Wide Area Network
(2) Range	A communication network linking a number of stations in same local area. Range is 1 to 10 km.	The network shares the characteristics of packet broadcasting networks - Range is 100 km.	A communication network distinguished from a local Area Network. Range is Beyond 100 km.
(3) Media Used	Uses guided media.	Uses guided as well as unguided media	Uses unguided media.
(4) Speed	A high speed ie. 100 kbps to 100 mbps	Optimized for a large geographical area than LAN.	Long distance communications, which may or may not be provided by public packet network.
(5) Cost	cheaper	costly	expensive
(6) Equipment needed	NIC, switch and hub.	Modem and routers	Microwave, radio, infra-red layer.
(7) protocols	Attached Resource computer network (ARCNET), Token Ring	Frame relay and asynchronous transfer mode (ATM)	ATM, FDDI, SMDS.

Compaction between hubs, bridges, routers and switches.

	hubs	bridges	routers	switches
1) traffic isolation	no	yes	yes	yes
2) plug & play	yes	yes	no	yes
3.) optimal routing	no	no	yes	no
4) cut through	yes	no	no	yes

Steps for setting up LAN :

① Installation of Ethernet card in machine.

② crimping of Ethernet cable.

③ Make straight cable in order to form star topology network to connect 2 different types of components e.g. PC to switch or PC to router.

④ Make cross cable in order to form star topology network to connect 2 similar types of components e.g. PC to pc or router to router.

⑤ connect the cable to switch and from switch to the machine. Thus it forms STAR topology.

⑥ Assign ip address to machine 1, 2, 3 and 4 and ping from one machine to other machine.

Troubleshooting :-

Network troubleshooting is the combined measures and processes used to identify, diagnose and solve problems within a computer network.

Troubleshooting is an iterative process, the more data you collect and analyze, the higher the likelihood of developing a correct hypothesis.

Troubleshooting steps:

1. Collect information
2. Develop a hypothesis
3. Test the hypothesis
4. Implement a fix
5. Verify the problem was solved
6. Notify the users
7. Document the fix.

ping command :

The ping command is a command prompt / terminal command used to test the ability of the source computer to reach a specified destination computer.

E.g. ping 192.168.2.208.

Wireshark Packet Analyzer Tool :

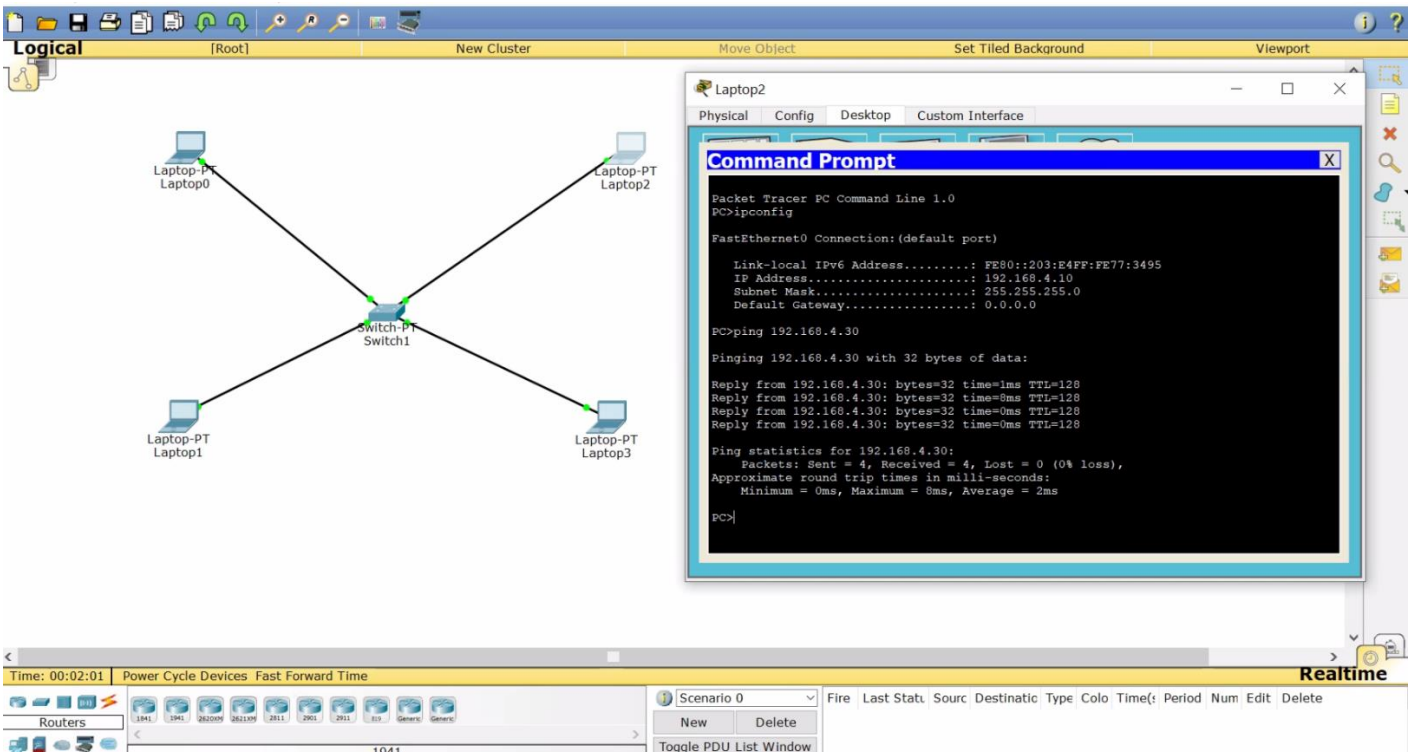
Wireshark, a network analysis tool formerly known as Ethereal, captures packets in real time and display them in human-readable format. Wireshark includes filters, color-coding and other features that let you dig deep into network traffic and inspect individual packets.

As soon as you click the interface's name, you'll see the packets start to appear in real

time. Wireshark captures each packet sent to or from your system. If you're capturing on a wireless interface and have promiscuous mode enabled in your capture options, you'll also see other the other packets on the network.

Conclusion :

We surressfully set a wired LAN connection using layer 2 switch. Also, used command prompt to PING IP addresses and analyzed the packets using Wireshark packet Analyzer Tool.


Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Laptop-PT
Laptop0
Laptop-PT
Laptop2
Switch-PT
Switch1
Laptop-PT
Laptop1
Laptop-PT
Laptop3
Laptop2
Physical
Config
Desktop
Custom Interface
Command Prompt
Packet Tracer PC Command Line 1.0
PC>ipconfig
FastEthernet0 Connection:(default port)
Link-local IPv6 Address.....: FE80::203:E4FF:FE77:3495
IP Address.....: 192.168.4.10
Subnet Mask.....: 255.255.255.0
Default Gateway.....: 0.0.0.0
PC>ping 192.168.4.30
Pinging 192.168.4.30 with 32 bytes of data:
Reply from 192.168.4.30: bytes=32 time=1ms TTL=128
Reply from 192.168.4.30: bytes=32 time=8ms TTL=128
Reply from 192.168.4.30: bytes=32 time=0ms TTL=128
Reply from 192.168.4.30: bytes=32 time=0ms TTL=128
Ping statistics for 192.168.4.30:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 8ms, Average = 2ms
PC>
Time: 00:02:01
Power Cycle Devices
Fast Forward Time
Realtime
Routers
Scenario 0
New
Delete
Toggle PDU List Window
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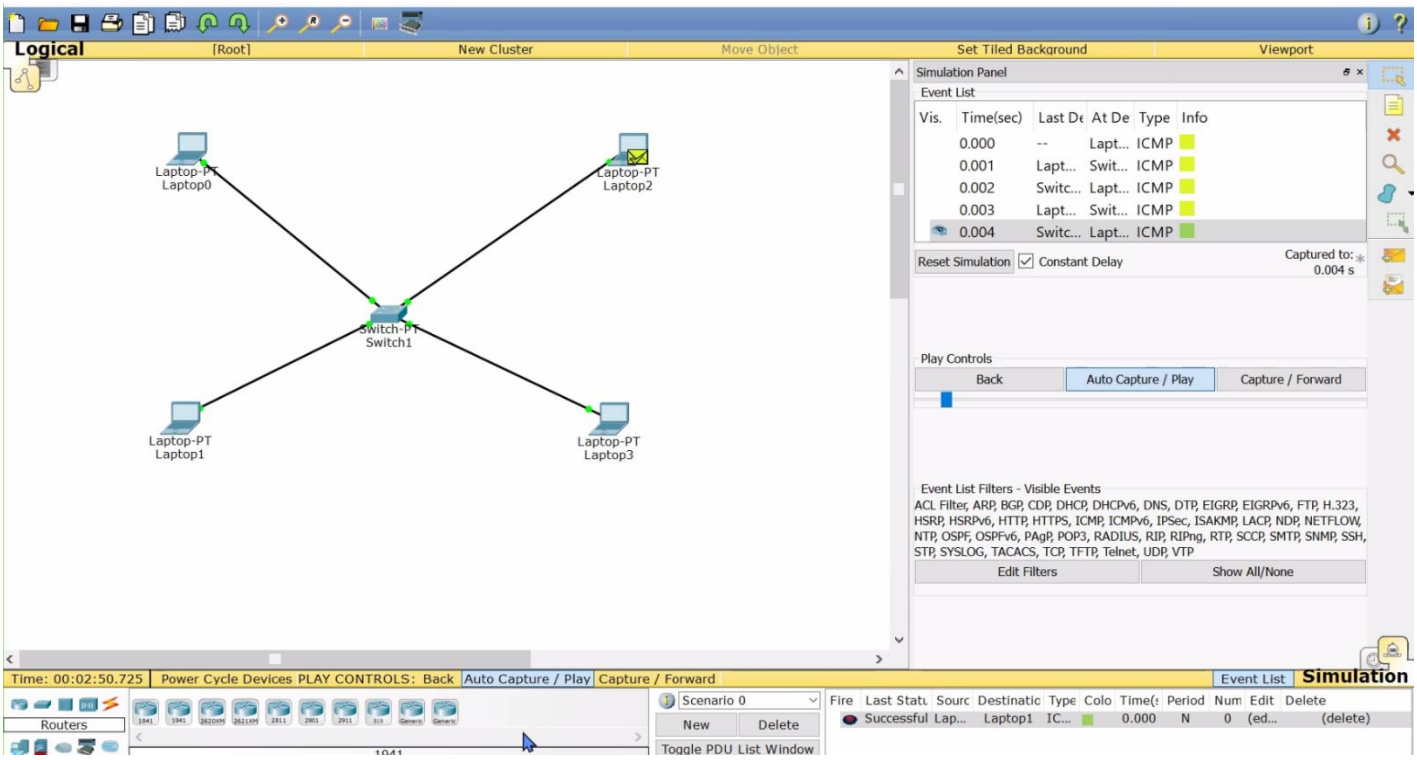
Logical
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Laptop-PT
Laptop0
Laptop-PT
Laptop2
Switch-PT
Switch1
Laptop-PT
Laptop1
Laptop-PT
Laptop3
Simulation Panel
Event List
Vis.
Time(sec)
Last De
At De
Type
Info
0.000
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Lapt...
ICMP
0.001
Lapt...
Swit...
ICMP
0.002
Switc...
Lapt...
ICMP
0.003
Lapt...
Swit...
ICMP
0.004
Switc...
Lapt...
ICMP
Reset Simulation
Constant Delay
Captured to:
0.004 s
Play Controls
Back
Auto Capture / Play
Capture / Forward
Event List Filters - Visible Events
ACL Filter, ARP, BGP, CDP, DHCP, DHCPv6, DNS, DTP, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPSec, ISAKMP, LACP, NDP, NETFLOW, NTP, OSPF, OSPFv6, PAgP, POP3, RADIUS, RIP, RIPng, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, VTP
Edit Filters
Show All/None
Time: 00:02:50.725
Power Cycle Devices
PLAY CONTROLS: Back
Auto Capture / Play
Capture / Forward
Event List
Simulation
Routers
Scenario 0
New
Delete
Toggle PDU List Window
Fire
Last Statu
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Type
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Period
Num
Edit
Delete
Successful
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Laptop1
IC...
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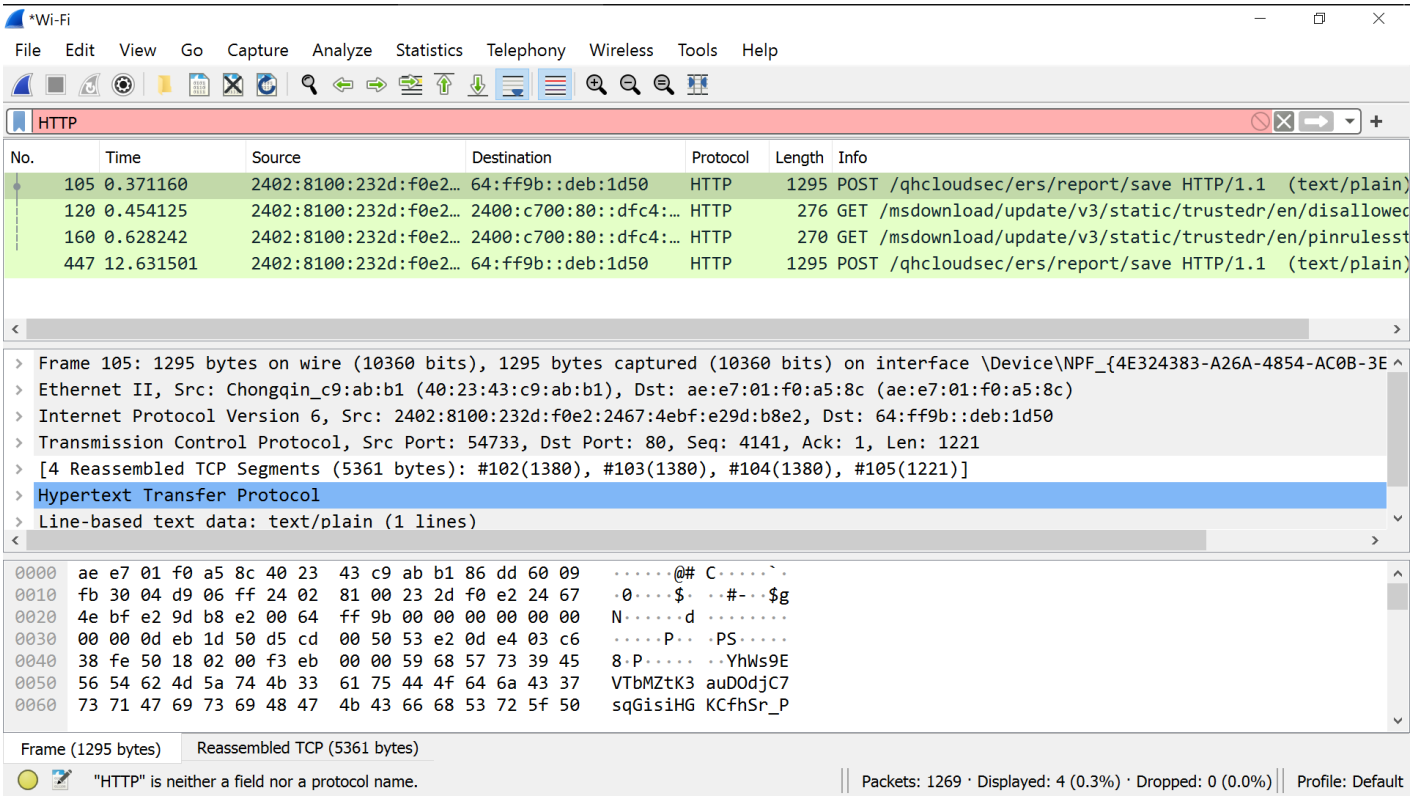
*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
HTTP
No. Time Source Destination Protocol Length Info
105 0.371160 2402:8100:232d:f0e2… 64:ff9b::deb:1d50 HTTP 1295 POST /qhcloudsec/ers/report/save HTTP/1.1 (text/plain)
120 0.454125 2402:8100:232d:f0e2… 2400:c700:80::dfc4:… HTTP 276 GET /msdownload/update/v3/static/trustedr/en/disallowed
160 0.628242 2402:8100:232d:f0e2… 2400:c700:80::dfc4:… HTTP 270 GET /msdownload/update/v3/static/trustedr/en/pinrulesst
447 12.631501 2402:8100:232d:f0e2… 64:ff9b::deb:1d50 HTTP 1295 POST /qhcloudsec/ers/report/save HTTP/1.1 (text/plain)
Frame 105: 1295 bytes on wire (10360 bits), 1295 bytes captured (10360 bits) on interface \Device\NPF_{4E324383-A26A-4854-AC0B-3E
Ethernet II, Src: Chongqin_c9:ab:b1 (40:23:43:c9:ab:b1), Dst: ae:e7:01:f0:a5:8c (ae:e7:01:f0:a5:8c)
Internet Protocol Version 6, Src: 2402:8100:232d:f0e2:2467:4ebf:e29d:b8e2, Dst: 64:ff9b::deb:1d50
Transmission Control Protocol, Src Port: 54733, Dst Port: 80, Seq: 4141, Ack: 1, Len: 1221
[4 Reassembled TCP Segments (5361 bytes): #102(1380), #103(1380), #104(1380), #105(1221)]
Hypertext Transfer Protocol
Line-based text data: text/plain (1 lines)
0000 ae e7 01 f0 a5 8c 40 23 43 c9 ab b1 86 dd 60 09
0010 fb 30 04 d9 06 ff 24 02 81 00 23 2d f0 e2 24 67
0020 4e bf e2 9d b8 e2 00 64 ff 9b 00 00 00 00 00 00
0030 00 00 0d eb 1d 50 d5 cd 00 50 53 e2 0d e4 03 c6
0040 38 fe 50 18 02 00 f3 eb 00 00 59 68 57 73 39 45
0050 56 54 62 4d 5a 74 4b 33 61 75 44 4f 64 6a 43 37
0060 73 71 47 69 73 69 48 47 4b 43 66 68 53 72 5f 50
Frame (1295 bytes)
Reassembled TCP (5361 bytes)
"HTTP" is neither a field nor a protocol name.
Packets: 1269 · Displayed: 4 (0.3%) · Dropped: 0 (0.0%)
Profile: Default