Switching Concepts

- Switches micro-segment a network into larger number of smaller collision domains.
- when each device connected to its own switch port , full duplex communication is possible.
- A switch builds MAC address table on the basis of source address of frames
- A switch will flood all broadcast & multi-cast frames as well as those destined for unrecognized MAC address.

Types of Switches-

Access Layer -

- Access layer switches are used to connect end devices to the network.
- Access Layer switches used to provide Layer 2 (VLAN) connectivity between users

Ex- 2960, 2950

Distribution Layer-

- Distro switches are used to connect access switches to Core layer switches
- Distribution layer is a layer 3 boundary where routing meets the VLAN of access layer switches.

Ex- 3550,3300,3400

Core Layer-

- It provides interconnectivity between all distro layer switches
- Core layer sometimes called backbone layer & capable of forwarding traffic from one distribution layer to other distribution layer efficiently

Switching Concepts – Cont's

Layer 2 Switching-

- Hardware based bridging
- Wire speed performance
- High speed scalability
- Low Latency
- Uses Mac address

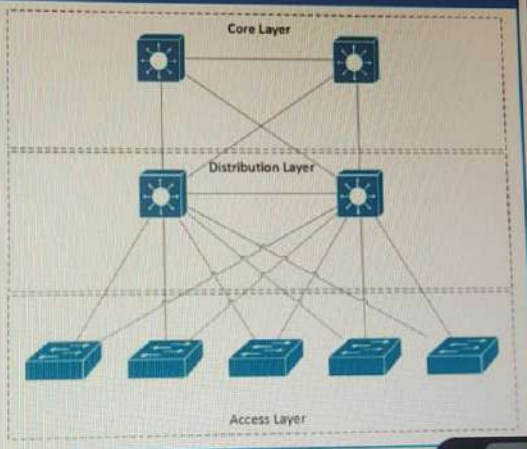
Layer 3 Switching-

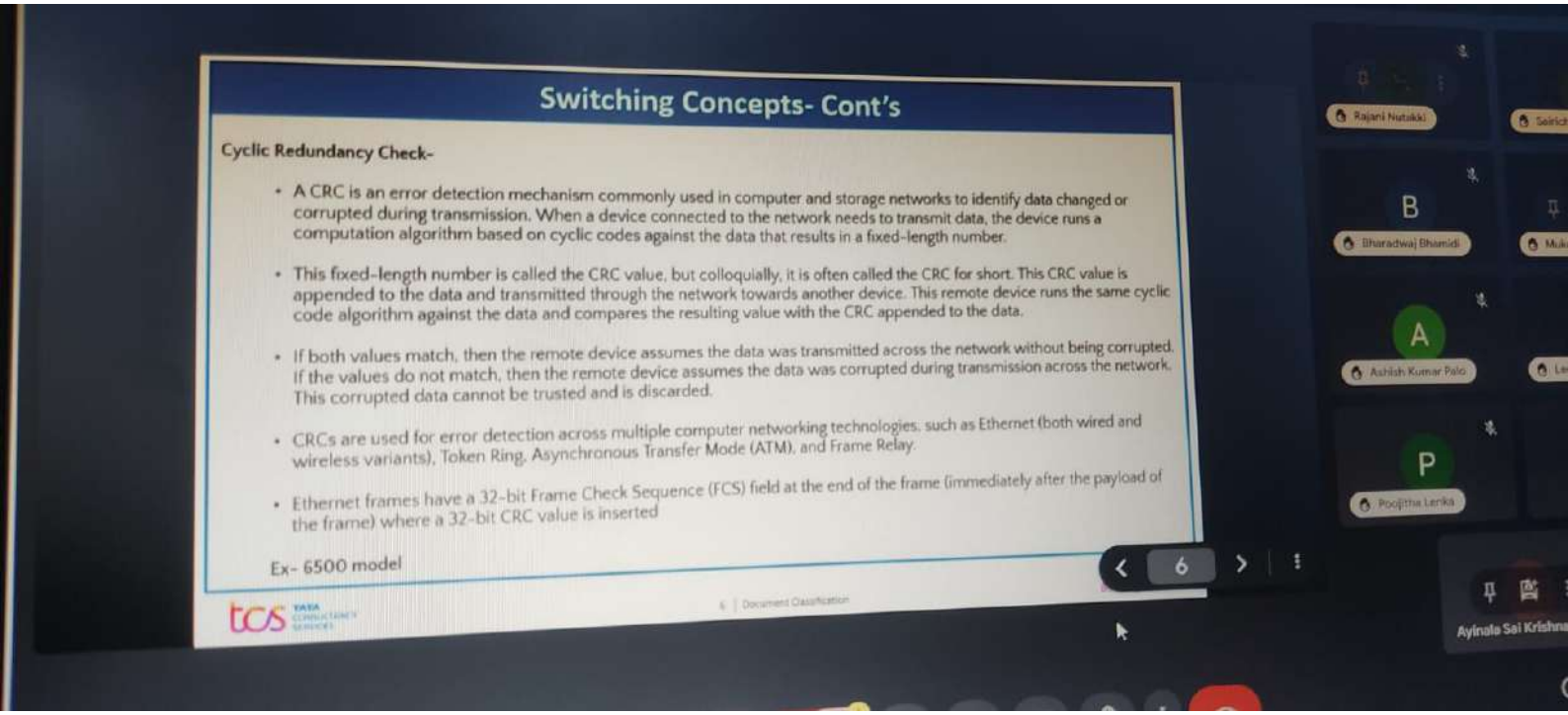
- Hardware based packet forwarding
- High performance packet switching
- Flow accounting
- Layer 3 switching
- Policy deployment.

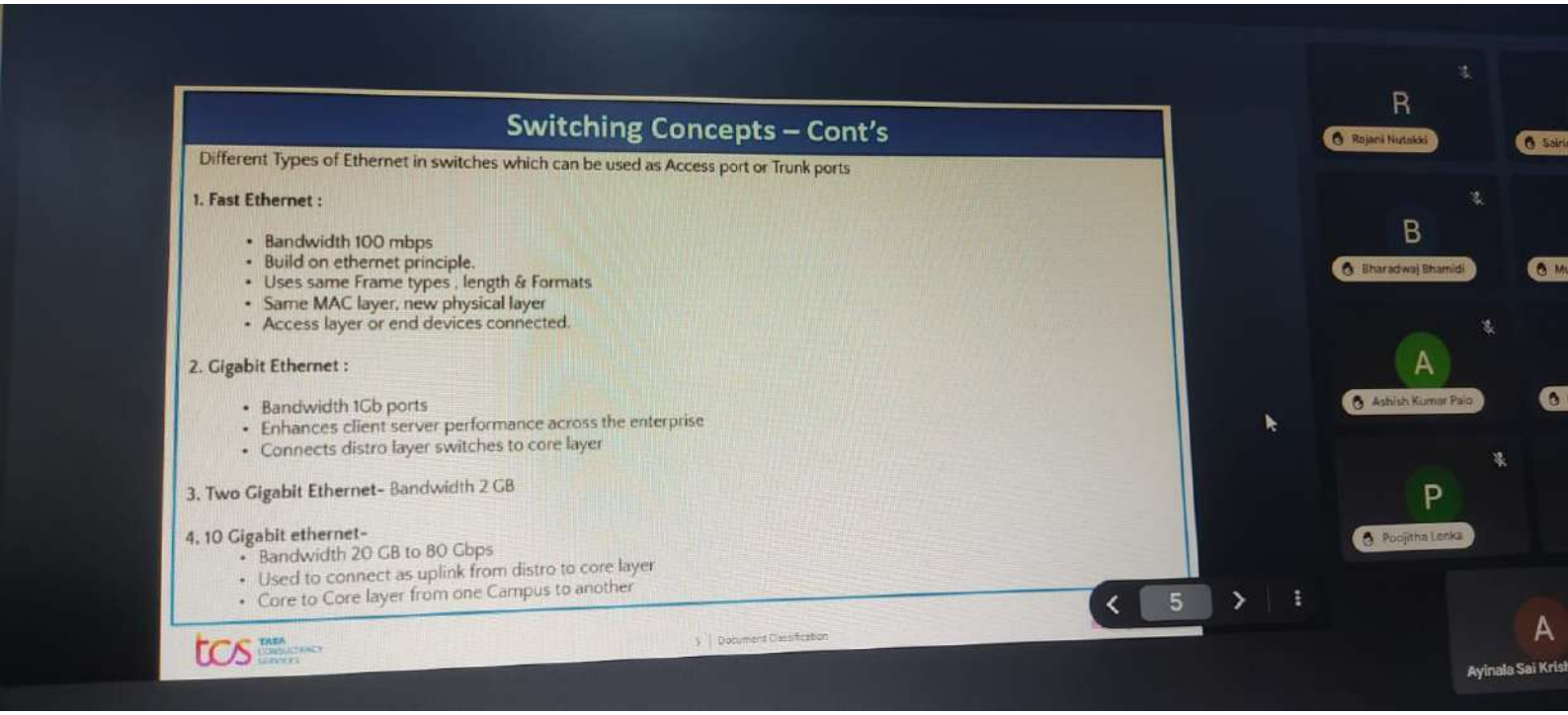
Multilayer Switching-

- Combination of Layer-2, layer 3, layer 4 switching
- High speed scalability
- Low Latency

Ex- 6500 model




Switching Concepts- Cont's
Cyclic Redundancy Check-
• A CRC is an error detection mechanism commonly used in computer and storage networks to identify data changed or corrupted during transmission. When a device connected to the network needs to transmit data, the device runs a computation algorithm based on cyclic codes against the data that results in a fixed-length number.
• This fixed-length number is called the CRC value, but colloquially, it is often called the CRC for short. This CRC value is appended to the data and transmitted through the network towards another device. This remote device runs the same cyclic code algorithm against the data and compares the resulting value with the CRC appended to the data.
• If both values match, then the remote device assumes the data was transmitted across the network without being corrupted. If the values do not match, then the remote device assumes the data was corrupted during transmission across the network. This corrupted data cannot be trusted and is discarded.
• CRCs are used for error detection across multiple computer networking technologies, such as Ethernet (both wired and wireless variants), Token Ring, Asynchronous Transfer Mode (ATM), and Frame Relay.
• Ethernet frames have a 32-bit Frame Check Sequence (FCS) field at the end of the frame (immediately after the payload of the frame) where a 32-bit CRC value is inserted
Ex- 6500 model
6
6 | Document Classification
Rajani Nutakki
B
Bharadwaj Bhamidi
A
Ashish Kumar Palo
P
Poojitha Lenka


Switching Concepts – Cont's
Different Types of Ethernet in switches which can be used as Access port or Trunk ports
1. Fast Ethernet :
• Bandwidth 100 mbps
• Build on ethernet principle.
• Uses same Frame types , length & Formats
• Same MAC layer, new physical layer
• Access layer or end devices connected.
2. Gigabit Ethernet :
• Bandwidth 1Gb ports
• Enhances client server performance across the enterprise
• Connects distro layer switches to core layer
3. Two Gigabit Ethernet- Bandwidth 2 GB
4. 10 Gigabit ethernet-
• Bandwidth 20 GB to 80 Gbps
• Used to connect as uplink from distro to core layer
• Core to Core layer from one Campus to another
5
Document Classification
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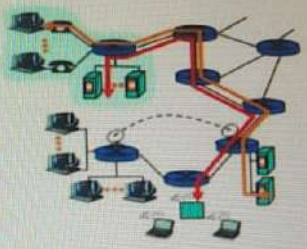
Switching Type

Circuit Switching-

Circuit Switching

- Circuit switching is a technique that directly connects the sender and the receiver in an unbroken path.
- Telephone switching equipment, for example, establishes a path that connects the caller's telephone to the receiver's telephone by making a physical connection.
- With this type of switching technique, once a connection is established, a dedicated path exists between both ends until the connection is terminated.
- Routing decisions must be made when the circuit is first established, but there are no decisions made after that time



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Switching Type – Cont's

2. Packet Switching-

Packet switching is a method of grouping data into packets that are transmitted over a digital network. Packets are made of a header and a payload. Data in the header is used by networking hardware to direct the packet to its destination, where the payload is extracted and used by an operating system, application software, or higher layer protocols. Packet switching is the primary basis for data communications in computer networks worldwide.

Types of Packet switching-

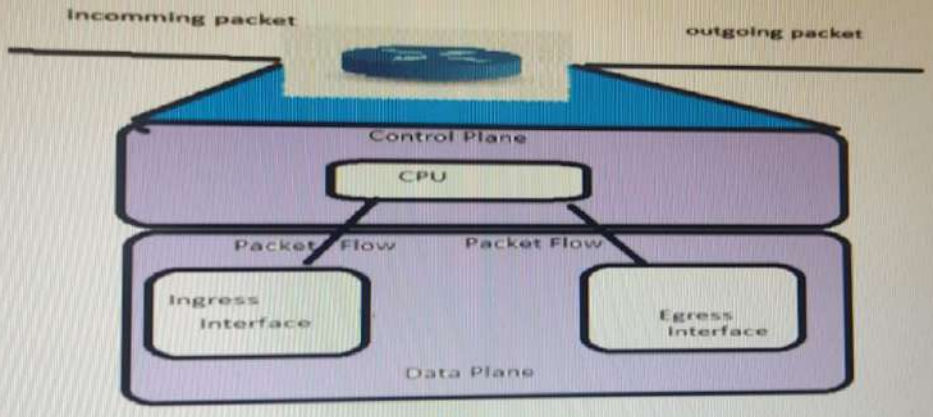
1. **Process switching-**

- Process switching is the oldest method of performing packet switching
- Process switching requires the CPU to be personally involved with every forwarding decision
- The switching decision made on a per packet basis.
- Process switching is the slowest method of packet switching.

To enable packet switching

Router(config-if)# no ip route-cache

Switching Type – Cont's



Switching Type – Cont's

Fast Switching-

- Fast Switching improves on the process switching by making use of a cache.
- The First packet to a destination is still a process switched by making a cache. future packets to the destination will be switched using information from cache, thus improving the speed on in this switching method.

To enable it
RW(conf-if)# ip route-cache.

Cisco Express Forwarding-

- CEF uses two component to perform packet switching

1.Forward Information Base- its nothing but similar to Routing table
2.Adjacency Table- Its similar to ARP table (ARP table contain information about IP address with mac address).

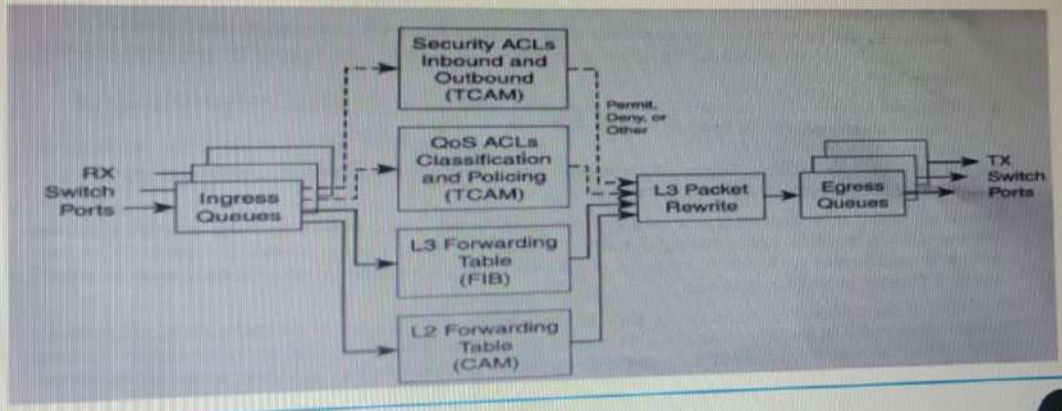
To enable
RW(conf-if)#ip route cache ref

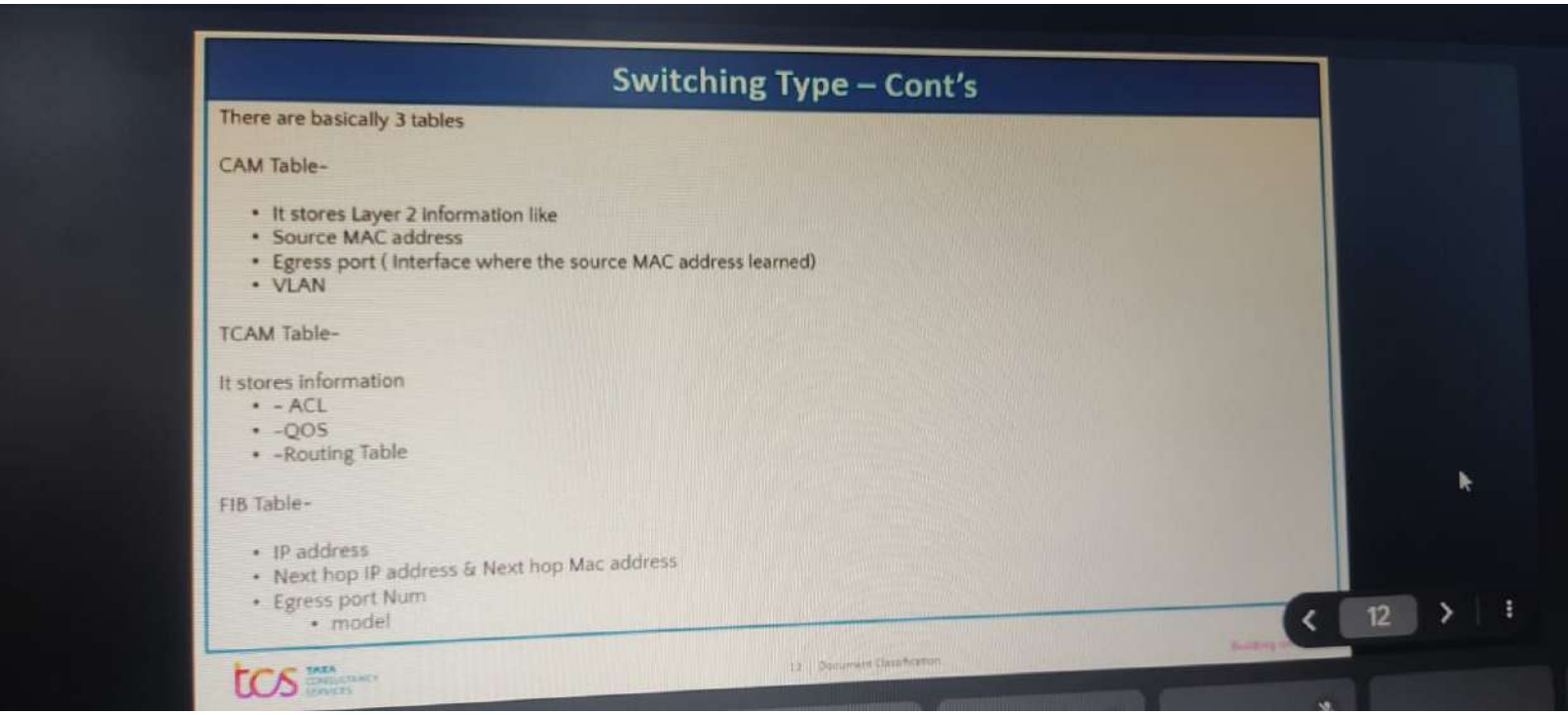
- 6500 model

Switching Type – Cont's

Packet Flow in Multi layer switching-

These packet flow in multi layer switching




Switching Type – Cont's
There are basically 3 tables
CAM Table-
• It stores Layer 2 information like
• Source MAC address
• Egress port (Interface where the source MAC address learned)
• VLAN
TCAM Table-
It stores information
• - ACL
• -QOS
• -Routing Table
FIB Table-
• IP address
• Next hop IP address & Next hop Mac address
• Egress port Num
• model
12
tcs
TATA CONSULTANCY SERVICES

Switching Type – Cont's

Packet when enters the egress interface is inspected for L2 & L3 destination Addresses.
Now the decision of where to forward the packet is based on two address tables, where the decision to how to forward the packets still is based on the ACL.

As a result below L2 switching are performed simultaneously in hardware.

1. L2 forwarding Table- The destination MAC address is used as an index to the CAM table. If the frame contains a Layer 3 packets to be forwarded, the destination MAC address is that of layer 3 port on the switch. In this case the CAM table address are used only to decide that the frame should be processed at layer 3.

2. L3 Forwarding Table- The FIB table is consulted using the destination IP address as an index. The longest match found (both address & mask) and the resulting next hop layer 3 address is obtained. The FIB also contain the next hop entry's layer 2 MAC- address & the egress switch port (and VLAN ID) so that further

3. Security ACL- In bound & outbound access list are complied into TCAM entries so that decision of whether to forward a packet can be determined as a single table lookup.

4. Qos ACL- Packet classification, policing, & marking all can be performed as single table lookups in the QOS TCAM.

The next hop address was found in the FIB and forwarded to the Egress interface.

- Ex- 6500 model

VLAN

VLAN-

- VLAN are used to divide one large broadcast domain into smaller broadcast domains.
- A large network can be divided into VLAN based on project department or function like Marketing, HR etc.
- VLAN provide broadcast segmentation.
- Each VLAN is a single broadcast domain
- Logical segmentation of LAN is called VLAN

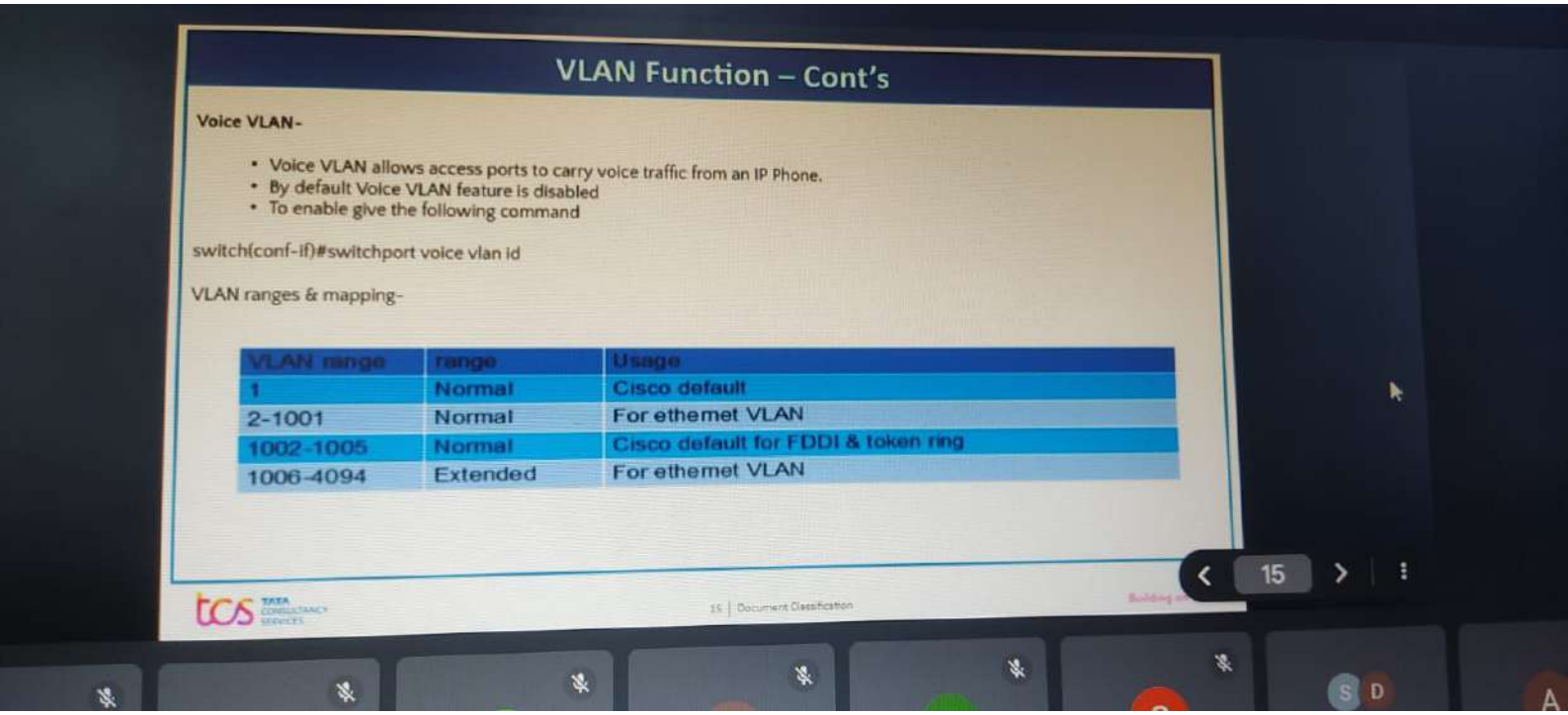
Two types of VLAN- 1. static VLAN 2.Dynamic VLAN.

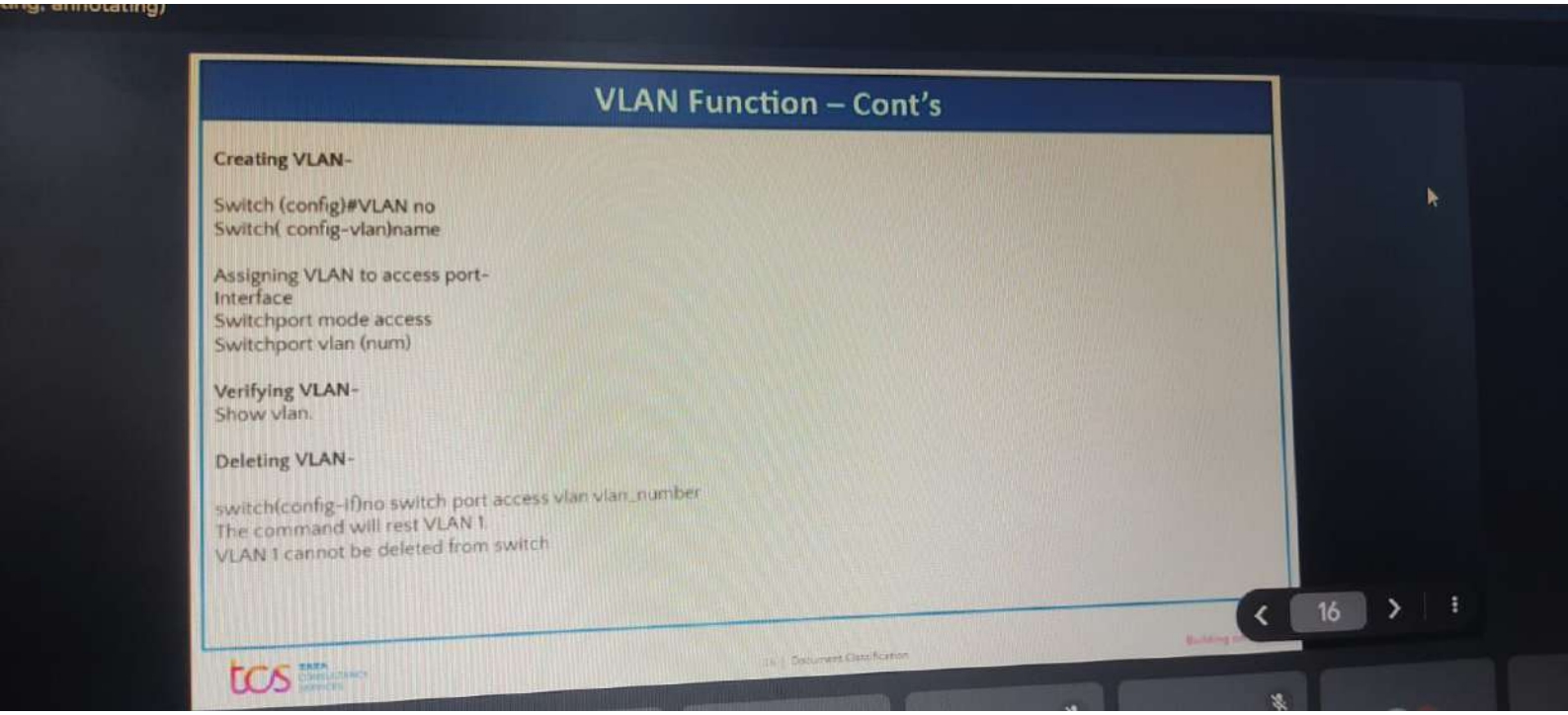
Static VLAN-

- They are called port based VLAN, so any device connecting to that port will become member of that VLAN.
- Most common method of assigning VLAN-
- There is a default VLAN, on Cisco switches VLAN 1.

Dynamic VLAN-

- Dynamic vlan are called MAC based VLAN.
- VLAN are automatically created by switch & assigned as per the MAC address of the connected devices.
- Dynamic VLAN are flexible compared to static VLANs.
- VMPS is required to configure Dynamic VLAN.


VLAN Function – Cont's
Voice VLAN-
• Voice VLAN allows access ports to carry voice traffic from an IP Phone.
• By default Voice VLAN feature is disabled
• To enable give the following command
switch(conf-if)#switchport voice vlan id
VLAN ranges & mapping-
VLAN range | range | Usage
1 | Normal | Cisco default
2-1001 | Normal | For ethernet VLAN
1002-1005 | Normal | Cisco default for FDDI & token ring
1006-4094 | Extended | For ethernet VLAN
15
15 | Document Classification


VLAN Function – Cont's
Creating VLAN-
Switch (config)#VLAN no
Switch(config-vlan)name
Assigning VLAN to access port-
Interface
Switchport mode access
Switchport vlan (num)
Verifying VLAN-
Show vlan.
Deleting VLAN-
switch(config-if)no switch port access vlan vlan_number
The command will rest VLAN 1
VLAN 1 cannot be deleted from switch
16

(Presenting, annotating)

VLAN Function – Cont's

Access port-

These are the ports which carries one VLAN information.
Here we can create a switch port either trunk port or access port.

Trunk port-

These are point to point link between two switches, between router & switch, or even between a switch server & carries multiple VLAN traffic. These are the port which carries inter Vlan communication

VLAN frame tagging-

- Frame Tagging means grouping of switches so that they share the same VLAN information.Its work in the way that each switch that frame reaches must identify the VLAN ID from the frame tag. It then finds out what to do with the frame by looking at information called filter table. If the frame reaches a switch that has another trunked link, the frame would be forwarded out of the trunk link port.
- Once the frame reaches an exit that's determined by the forward table to be an access link matching VLAN frame ID, the switch will remove the VLAN identifier. Here trunk port carries all the tagged & untagged traffic.
- Native VLAN- here if we are using 802.1q trunking all the untagged traffic will flow through Native VLAN i.e native VLAN which is by default VLAN 1 if no VLAN assigned & also carries untagged traffic.

VLAN Function – Cont's

Frame tagging Protocol-

Inter switch link-

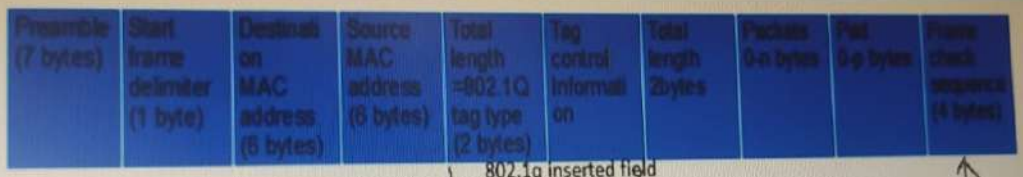
- Its a technique for tagging VLAN information onto the ethernet frame This tagging information allows VLANs to be multiplexed over a trunk link through an external encapsulation method.
- This allows the switch to identify VLAN membership of a frame received over a trunk link.ISL is proprietary to cisco switches & can be use in Fast ethernet & gigabit ethernet only.

IEEE 802.1q-

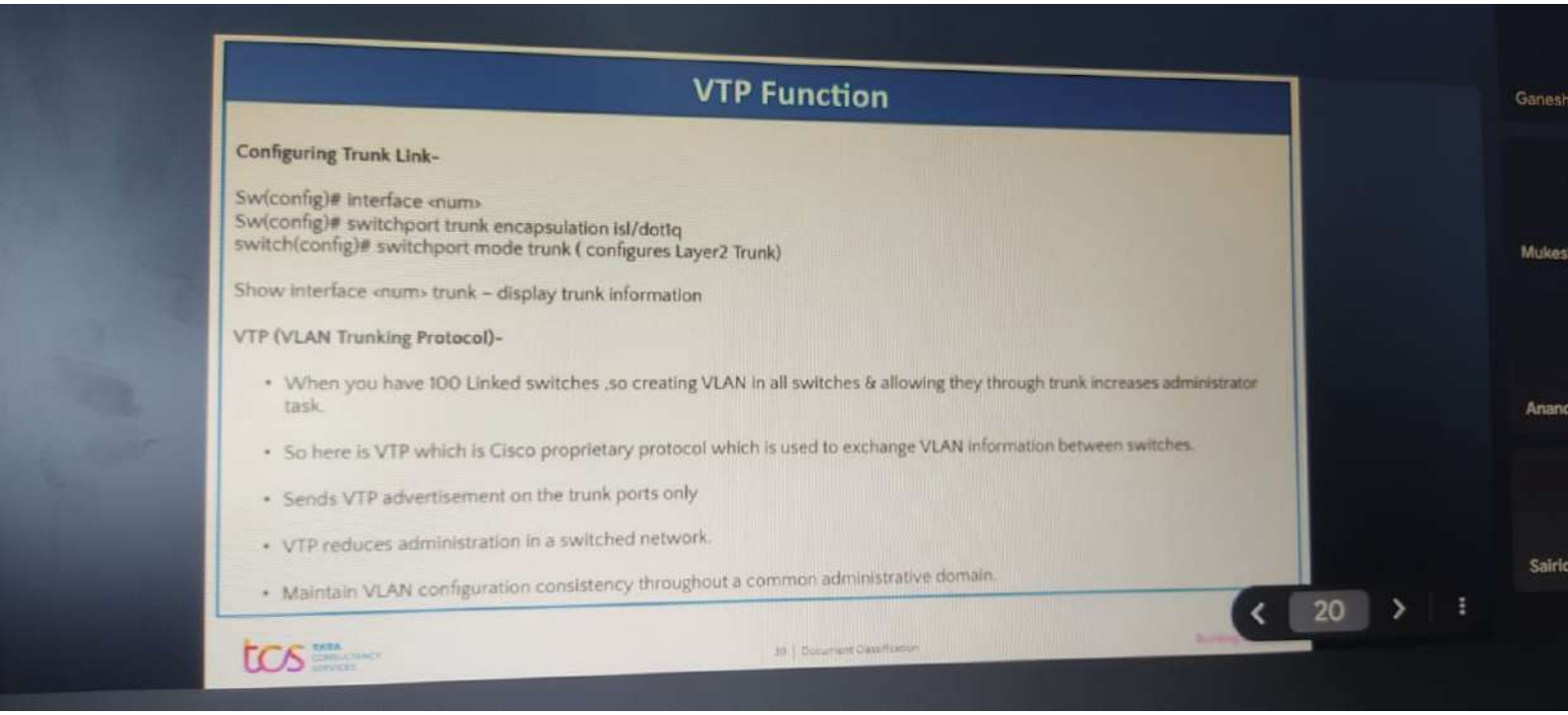
- It is the standard method created by IEEE. It actually inserts a frame to field to identify VLAN.If you are trunking between cisco switched link & other brand then need to use 802.1q.
- And it here inserts a 802.1q filed along with control information which is a 12bit VLAN ID, this field identifies 2^12,minus 2 for the 0 & 4095 VLANs which means an 802.1q tagged frame can carry information for 4094 VLANs.

Preamble (7 bytes)	Start frame delimiter (1 byte)	Destination MAC address (6 bytes)	Source MAC address (6 bytes)	Total length 2bytes	Packets 0-n bytes	Pad 0-p bytes	Frame check sequence (4 bytes)

VLAN Function – Cont's



3 bit- user priority field
1bit- Canonical Format identifier
12 bit- VLAN indentifier


VTP Function
Configuring Trunk Link-
Sw(config)# interface <num>
Sw(config)# switchport trunk encapsulation isl/dot1q
switch(config)# switchport mode trunk (configures Layer2 Trunk)
Show interface <num> trunk – display trunk information
VTP (VLAN Trunking Protocol)-
When you have 100 Linked switches ,so creating VLAN in all switches & allowing they through trunk increases administrator task.
So here is VTP which is Cisco proprietary protocol which is used to exchange VLAN information between switches.
Sends VTP advertisement on the trunk ports only
VTP reduces administration in a switched network.
Maintain VLAN configuration consistency throughout a common administrative domain.
20

Electronic Reservation Slip (ERS)-Normal User

Booked From	Boarding At	To
MGR CHENNAI CTL (MAS)	**MGR CHENNAI CTL (MAS)**	NELLORE (NLR)
Start Date* 26-Jul-2025	**Departure* 07:25 26-Jul-2025**	Arrival* 09:54 26-Jul-2025

FOOD CHARGES NOT INCLUDED

PNR	Train No./Name	Class
4422634926	12077 / BZA JANSHATABDI	SECOND SITTING (2S)

Quota	Distance	Booking Date
GENERAL (GN)	176 KM	24-Jul-2025 21:12:03 HRS

Passenger Details

#	Name	Age	Gender	Booking Status	Current Status
1.	CHARAN CHANDU	23	M	CNF/D10/7/WINDOW SIDE	CNF /D10/7/WINDOW SIDE

Acronyms: RLWL: REMOTE LOCATION WAITLIST PQWL: POOLED QUOTA WAITLIST RSWL: ROAD-SIDE WAITLIST

Transaction ID: 100005937917659

IR recovers only 57% of cost of travel on an average.

Payment Details

Ticket Fare	₹ 120.00
IRCTC Convenience Fee (Incl. of GST)	₹ 11.80
Travel Insurance Premium (Incl. of GST)	₹ 0.45
Total Fare (all inclusive)	₹ 132.25

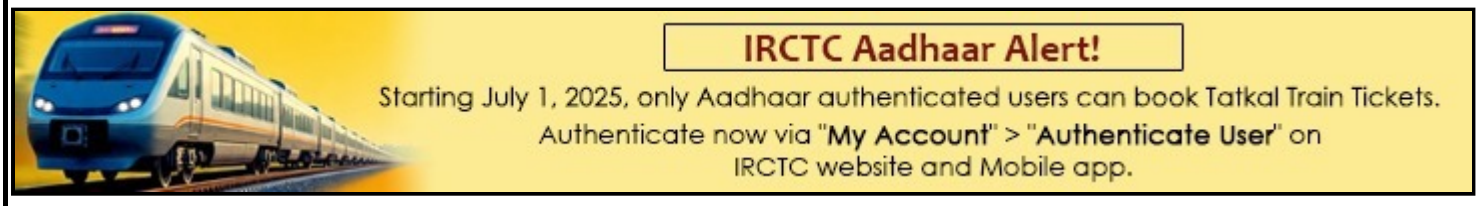
PG Charges as applicable (Additional)

- **Beware of fraudulent customer care number. For any assistance, use only the IRCTC e-ticketing Customer care number:14646.**

IRCTC Convenience Fee is charged per e-ticket irrespective of number of passengers on the ticket.

*** The printed Departure and Arrival Times are liable to change. Please Check correct departure, arrival from Railway Station Enquiry or Dial 139 or SMS RAIL to 139.**

- This ticket is booked on a personal User ID, its sale/purchase is an offence u/s 143 of the Railways Act,1989.
- Prescribed original ID proof is required while travelling along with SMS/ VRM/ ERS otherwise will be treated as without ticket and penalized as per Railway Rules.



Indian Railways GST Details:

Invoice Number:	PS25442263492611	Address:	Indian Railways New Delhi
Supplier Information:			
SAC Code:	996421	GSTIN:	07AAAGM0289C1ZL
Recipient Information:			
GSTIN:	NA		
Name:	NA	Address:	
Taxable Value:	120		
CGST Rate:	2.5%	CGST Amount:	0.0
SGST/UGST Rate:		SGST/UGST Amount:	
IGST Rate:	5.0%	IGST Amount:	0.0

Total Tax:

Place of Supply: NA **State Name/Code of Supplier:** Delhi/DL

INSTRUCTIONS:

1. Prescribed Original ID proofs are:- Voter Identity Card / Passport / PAN Card / Driving License / Photo ID card issued by Central / State Govt. / Public Sector Undertakings of State / Central Government ,District Administrations , Municipal bodies and Panchayat Administrations which are having serial number / Student Identity Card with photograph issued by recognized School or College for their students / Nationalized Bank Passbook with photograph /Credit Cards issued by Banks with laminated photograph/Unique Identification Card "Aadhaar", m-Aadhaar, e-Aadhaar. /Passenger showing the Aadhaar/Driving Licence from the "Issued Document" section by logging into his/her DigiLocker account considered as valid proof of identity. (Documents uploaded by the user i.e. the document in "Uploaded Document" section will not be considered as a valid proof of identity).
2. PNRs having fully waitlisted status will be dropped and automatic refund of the ticket amount after deducting the applicable CLERKAGE by Railway shall be credited to the account used for payment for booking of the ticket. Passengers having fully waitlisted e-ticket are not allowed to board the train. However, the names of PARTIALLY waitlisted/confirmed and RAC ticket passenger will appear in the chart.
3. A clerkage charge of Rs.60 per passenger plus GST for AC Classes and Rs.60 per passenger for Non AC classes will be deducted if the ticket remains Waitlisted at the time of Cancellation/Charting.
4. Passengers travelling on a fully waitlisted e-ticket will be treated as Ticketless.
5. Obtain certificate from the TTE /Conductor in case of (a) PARTIALLY waitlisted e-ticket when LESS NO. OF PASSENGERS travel, (b)A.C FAILURE, (c)TRAVEL IN LOWER CLASS. This original certificate must be sent to GGM (IT), IRCTC, Internet Ticketing Centre, 2nd Floor, Tower-D, World Trade Centre, Nauroji Nagar, New Delhi- 110029, after filing TDR online within prescribed time for claiming refund.
6. In case, on a party e-ticket or a family e-ticket issued for travel of more than one passenger, some passengers have confirmed reservation and others are on RAC or waiting list, full refund of fare, less clerkage, shall be admissible for confirmed passengers also subject to the condition that the ticket shall be cancelled online or online TDR shall be filed for all the passengers upto thirty minutes before the scheduled departure of the train.
7. In case train is late more than 3 hours, refund is admissible as per railway refund rules only when TDR is filed by the user before the actual departure of the train at boarding station and passenger has not travelled.
8. In case of train cancellation on its entire run, full refund is granted automatically by the system. However, if the train is cancelled partially on its run or diverted and not touching boarding/destination station, passengers are required to file online TDR within 72 hours of scheduled departure of the train from passengers boarding station.
9. Never purchase e-ticket from unauthorized agents or persons using their personal IDs for commercial purposes. Such tickets are liable to be cancelled and forfeited without any refund of money, under section (143) of the Indian Railway Act 1989. List of authorized agents are available on www.irctc.co.in under 'Find NGet Agents' option.
10. For detail, Rules, Refund rules, Terms & Conditions of E-Ticketing services, Travel Insurance facility etc. Please visit www.irctc.co.in
11. While booking this ticket, you have agreed of having read the Health Protocol of Destination State of your travel. You are again advised to clearly read the Health Protocol advisory of destination state before start of your travel and follow them properly.
12. The FIR forms are available with on board ticket checking staff, train guard and train escorting RPF/GRP staff.
13. Variety of meals available in more than 1500 trains. For delivery of meal of your choice on your seat log on to www.ecatering.irctc.co.in or call 1323 Toll Free. For any suggestions/complaints related to Catering services, contact Toll Free No. 1800-111-321 (07.00 hrs to 22.00 hrs)
14. National Consumer Helpline (NCH) Toll Free Number: 1800-11-400 or 14404
15. You can book unreserved ticket from UTS APP or ATVMs (Automatic Ticket Vending Machines) located in Railway Stations.
16. As per RBI guidelines, the refund of Ticket should be given in the same Bank account, which was used for booking. It is necessary that the Bank Account used for booking online ticket should not be closed at least up to 30 days beyond the date of the journey. If accounts are found closed at the time of processing refund, the refund will be regretted by the Bank.

Customer Care:

- For e-ticket booking ,cancellation and refund assistance , Please contact us at 14646 / 08044647999 /08035734999 or raise query at https://equery.irctc.co.in
- Just dial 139 from your landline, mobile & CDMA phones for railway enquiries as well as for giving suggestions/filing complaints on Rail Madad.
- For e-catering, to book and get food delivered on your train berth, please contact us at 1323 (24*7 Hrs Toll Free) or log on to www.ecatering.irctc.co.in.