Nation building is our goal

NEPAL TELECOM

Ref no. : 076/77/47 **Date: 18th October 2019**

To Whom It May Concern

With reference to your letter **(Kathmandu Engineering College, Kalimati; Kathmandu)** dated 17th September 2019, we hereby inform you that **Mr. Saroj Khanal** has successfully completed two weeks Internship in the following field at the following Department of **Nepal Telecom.**

S. No.	Department	Subject
1.	Backbone Transmission Directorate	Backbone Transmission Systems Related

Sincerely yours,

.....

Prakash Man Pradhan
Manager

Prakash Man Pradhan
Manager

Nepal Telecom Training Center
Babarmahal, Kathmandu
Nepal

Nepal Doorsanchar Company Ltd.
www.ntc.net.np

Manager : 014786006
Fax: 014784219

Day: 1

2076-06-08

Date: 06/08

Internship in NTC, Babarmahal

=> Backbone of NTC has mainly three networks as:-

Microwave,
Optical
Satellite.

-> Backbone is referred to as the main body of NTC for its internal connection and data flow between many points and places for transmission.

-> NTC is a company of Nepal government under Act of company having

Nepal Telecom:- Nepal Doorsanchar Company Limited

-> Nepal goverment has a share about 91.49%.
Founded in April 13, 2004
total assets :- 8.115 trillion NPR till 2016

Date:

Microwave connection for NTC has frequency allocations of:
Upper 6 GHz → for long distance
8 GHz
15 GHz → for short distance

→ Phulchowki is a major repeater to many distance places like Birgunj, Dhading etc from Kathmandu.

→ Phulchowki to Bigu-Birgunj has a Aerial distance of about 80.1 km.

:- Birgunj (Transmission) has 6840 GHz
So,
Phulchowki (Receiver) has 6840 GHz
And,
Phulchowki (Transmitter) has 6500 GHz
So,
Birgunj (Receiver) has 6500 GHz

↳ Here Bandgap is 340 MHz

→ 4G has 800 MHz, 1800 MHz, 2300 MHz } for mobile

Date:

NTC uses the Bands of Band-III, Band-xx, Band xxxVIII from the Bands allocated by ITU

↳ Mainly the transmission is in FDD and TDD.
TDD is mainly based for digital network and is better one.

→ For remote distance the transmission is through VSAT.

:- For 2G:-
BTS — BSC — MSC

For 3G:
Node-B — RNC — MSC

For 4G:
eNode-B — MSC
↳ (BTS + BSC)

→ Bette 4G has MIMO formation for many inputs & outputs at a time.

Planning

Date:

-> 5G is not just network poor calls and data.
It is a highly-anticipitated network for the easy and better IOT performance too.

-> The primary technologies include: Millimeter wave bands (26, 28, 38 & 60 GHz are 5G.

-> 2G GSM has frequency of 1800 MHz

-> 3G has 10MHz bandwith & 2100 MHz

-> 4G started in 1800 MHz band in 2017, Jan. Nepal has WiMax internet service in 2300 MHz.

-> LTE 4G is 1800 MHz.

-> 4G is expected to have VOLTE & voice.

About :- NTC

Date:

-> Speed between two link is 2.5Gbps in NTC.

-> NTC has a major running project as :-
a) FTTH-NTC as Net provider
b) 4G-LTE around Nepal.

-> Director of NTC is appointed by Nepal goverment.

-> संचालक समिति मा ७ जना र अध्यक्ष सूचना तथा संचार मन्त्रालयका सचिव.

Services : ->Lease line Service #
-> Basic Telephony
-> ISDN, GSM, CDMA
-> E-mail, Internet fax
-> Internet leased line #
-> GPRS, Voice mail, payphone #
-> ADSL, WiMax #
-> 3G, 4G LTE

Day-2 Planning 05/06/09

Date: → manual tool

Path-loss - tool → for freq & LOS

→ Used as a data-base.
→ It has

Dadi —(410)— Sudi

→ Plan
→ Site
→ freq

→ It is used to plan frequencies to new places measuring/studying the line of Sight with terrain features

→ Path loss tool is used to allocate frequency to distant places.
→ It is a manual tool for which many/some features like required frequency, terrain features have to be added manually.

Planning

Date:

6 GHz → It has 8 channel.
8 channel

Polarization - Vertical, Horizontal
→ It is used to use same freq in different place

(6500 - 6840) V
(6500 - 6840) H
→ XPIC - property

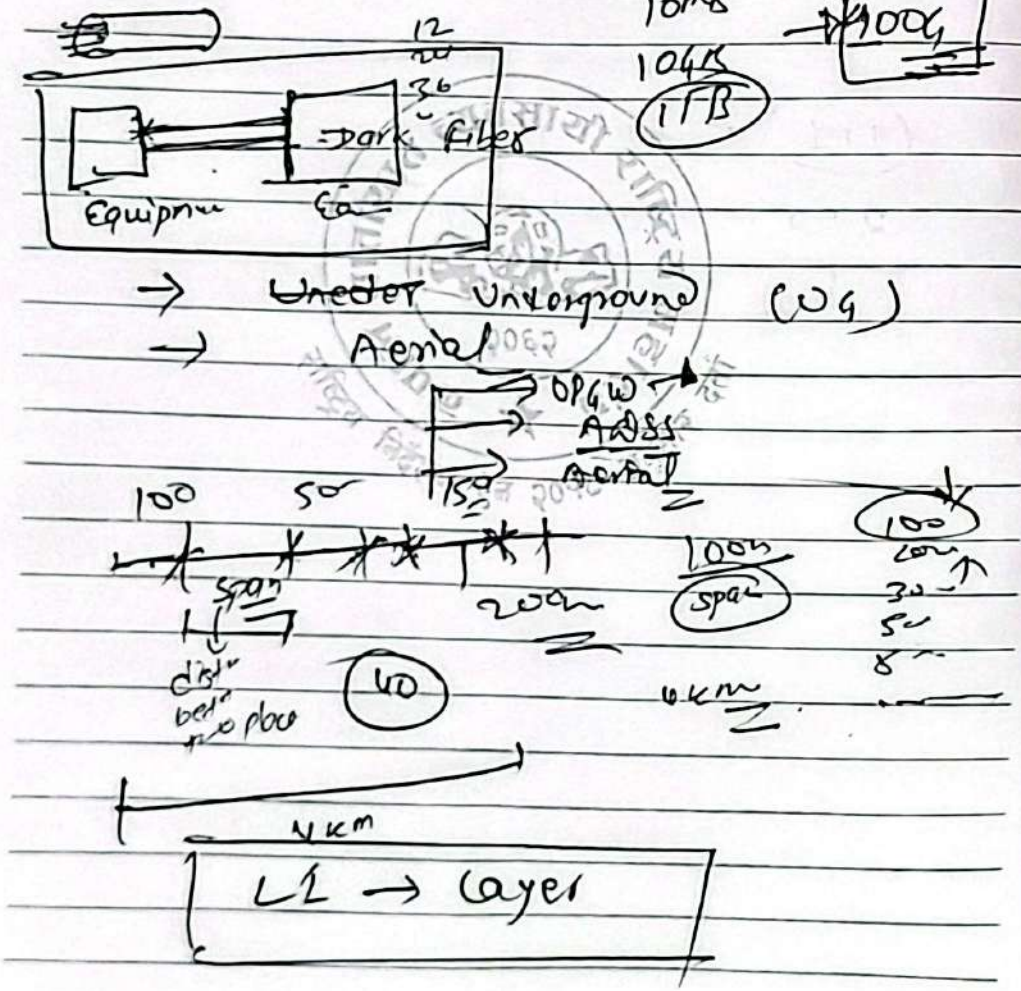
→ has option
1+1 - Hot stand by
2+0 - parallel operation
→ increases capacity but has no option

Wired

Wireless → M/W, satellite

Date: OPTICAL

→ Copper
→ Coaxial
→ UTP
→ Optical

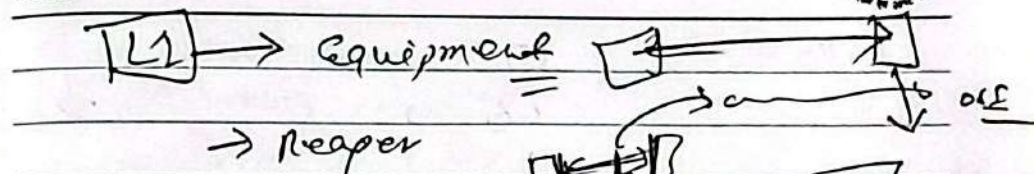


3dB

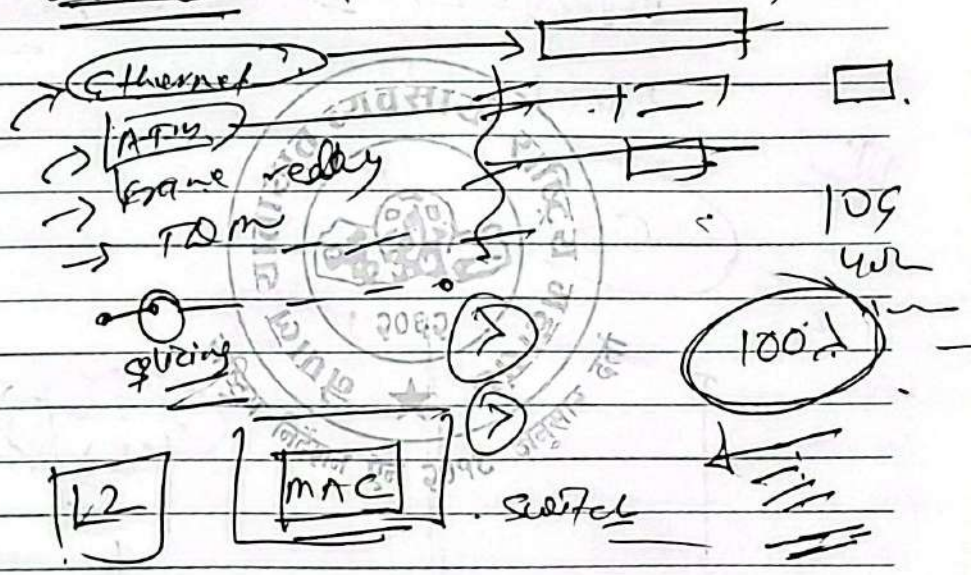
OSI

Phys

Date:



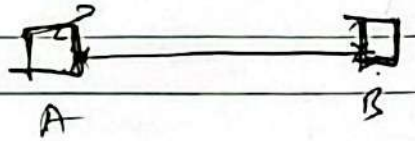
DWDM (λ → Lambda)



L3 IP Address

L4 Port address

Routers



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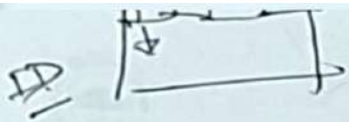
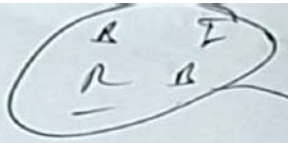
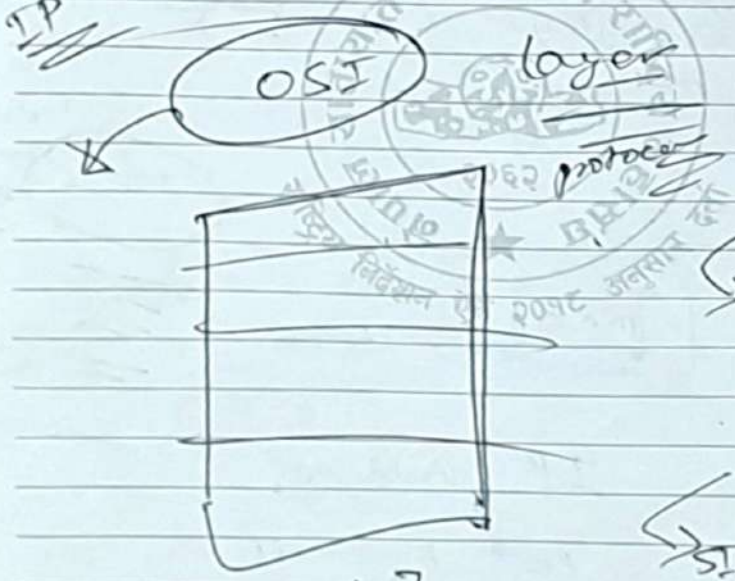




Hello → L7 → Application
L6 → presentation
L5 → session
L4 → port
Logical or L3 → IP address
Physical or L2 → MAC address
Physical L1



PWPM → L1
Switch → L2
Router → L3
→ L4

Planning

Date:

→ has transmission in speed of light

Optical fiber is a very fast medium for transmission but it's feature is banded by port and device used at the end point.

⇒ OSI is used for data transmission method.
→ OSI has seven layer for transmission process as:-

1) Layer-1 → Id is physical layer for physical device like optical fiber for transmission
Layer-2 → MAC address that every device has its fixed MAC Id for its known device and distinct it from others
Layr-3 → IP Address that has IP-Id for each network used so that each that is sent to fixed IP-Id point.
layer-4 → port :- for the connect both two points
Layer-5 → session → It is the session between the data transmission
Layer-6 → Presentat^ :- On how the data are presented. It's way of format & layout

Date:

layer-7 → Applicat^{n} :→ Application used & its way of sending data in order. #

Day-3

NOC

9761061110

Date:

DWDM

Backbone, NOC →

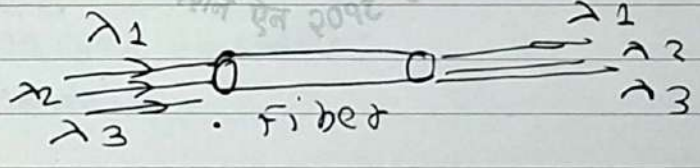
links → Backbone main link
↓ Satellite, Microwave, Fiber (DWDM)
Router, Switch.

→ DWDM, NG-SDH, Router, → Media.

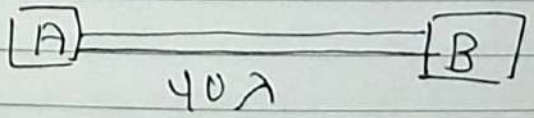
DWDM

→ Dense Wavelength Division Multiplexing

→ WDM →

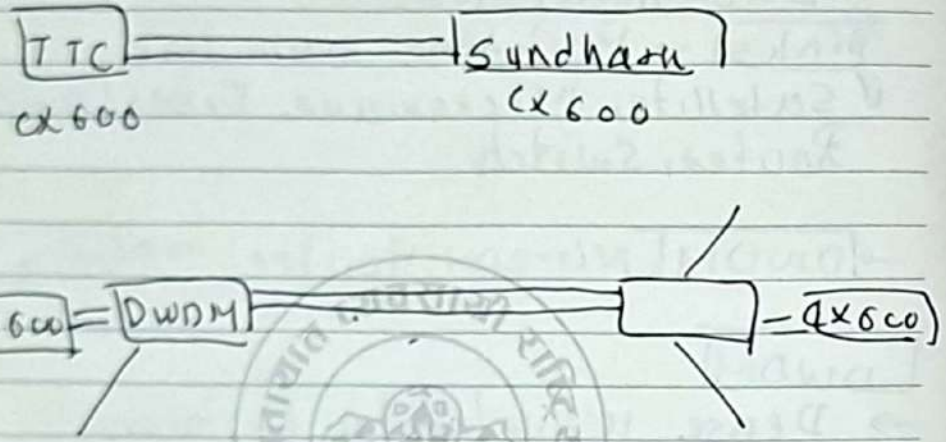


→ Utilization
DWDM → more λs
NT DWDM → 40 →



Date:

Router, CX600

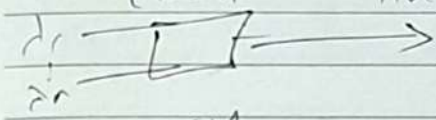


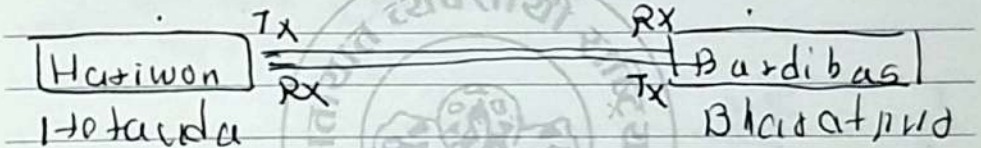
OSC -> optical Supervisory channel
OLA -> line amplifier

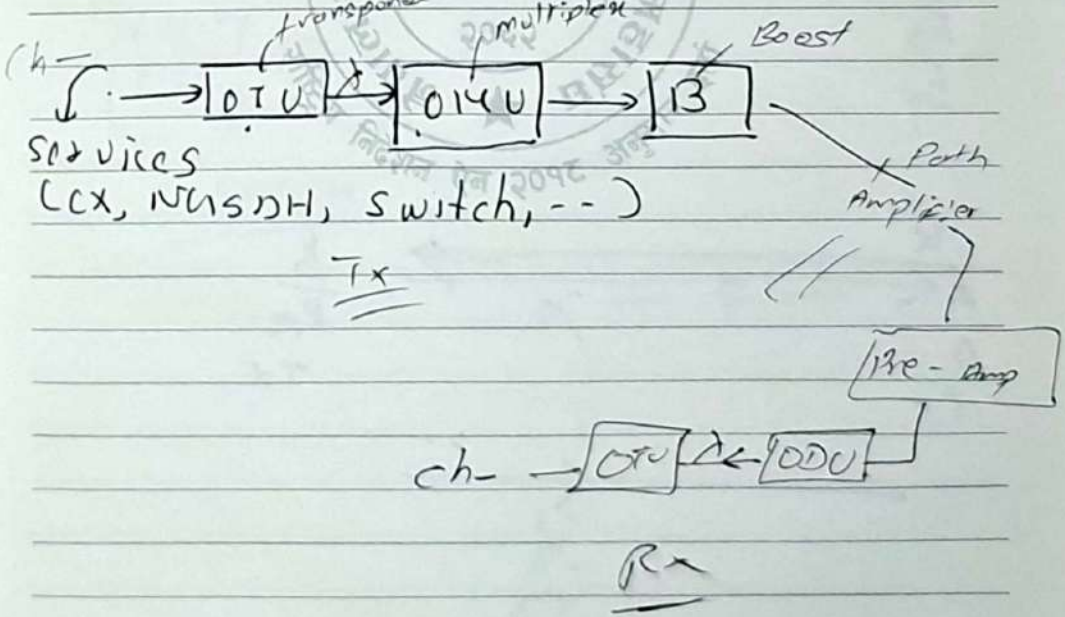
Date:

DWDM

Common NE in DWDM System







NOC

Date:

TDM :-

↓

Ip ... network :-

NG- SDH

Next Generation Synchronous
digital Hierarchy

E1 - 2MB
E2
E3
E4

Tx
A ←
A
Tx

→ B
Rx
Tx

λ1
λ2
λ3
λ4

NOC

Date:

2MB - E1
:
:
63 -

→ STM-1

OL1 / OL4 STM-1 x 4
OL16 STM-1 x16

A B

← OL64 →
STM-1 x64

64
x63 →

STM-64

← Return

Digital

Date:

Analog System

↓

Channel - Group, Super Group

↓

primary mux → 2MB → E1

30 channels Multiplexing

31 ⋮ 32 → 2MB

secondary → 8MB → 1 2 3 4 → 34 MB → 1 2 3 4 → 140 MB

Digital System

↓

P.D.H

↓

plesiochronous Digital Hierarchy

NOC

Digital

Date:

140MB — 64E1

STM-1 - 155MB - 63

Multiplexing of Synchronous Digital Hierarchy

2MB

TU12

TU12 → TUG2

TU12

TUG2 → 1 2 3 4 5 6 7

3 × 7 × 3 = 63 MS

TUG-3 → VC3 → 1 2 3 → VC4

1 VC4 or AU4 STM-1

↓

IP transmission

Date:

Description of :- a) DWDM (multiple channel in one)
b) SDH (1-line - 1-channel)

Day-4 ⇒ LOS

Date: Microwave Radios

- 6GHz
- 8GHz
- 15GHz

- Ceragon
- SIAE
- Harris
- Fujitsu
- NEC
- Paslink

NT maintain.

- Huawei RTN ⇒ Huawei scope

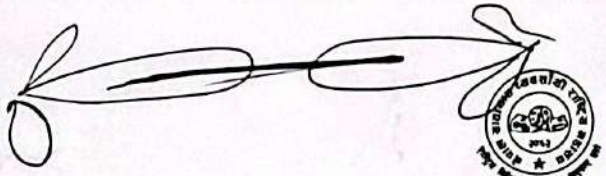
Ceragon → 50 Mbps, 200 Mbps → Aspur link

8GHz / 15GHz

Ethernet link capacity

GSM BTS

14645 - 15695



Date:

Tx Rx RSL = dBm

Rx Tx

RSL

50

-40

RSL ⇒ dBm

2.2m dia

2.8m dia

0.3m

Aspur link

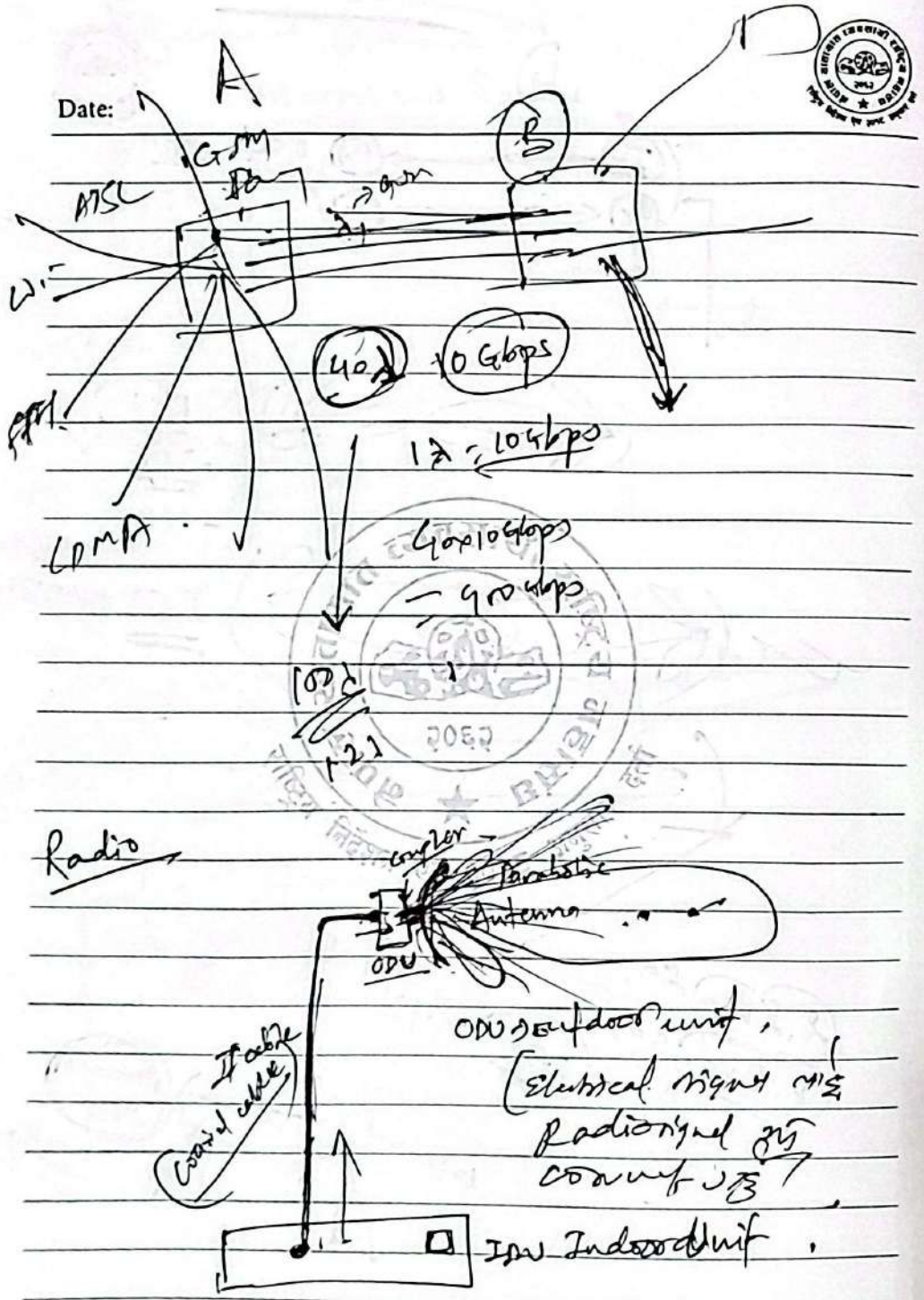
0.3m

Ratnagiri BTS

1-0 mtrs

baberwal

Date:

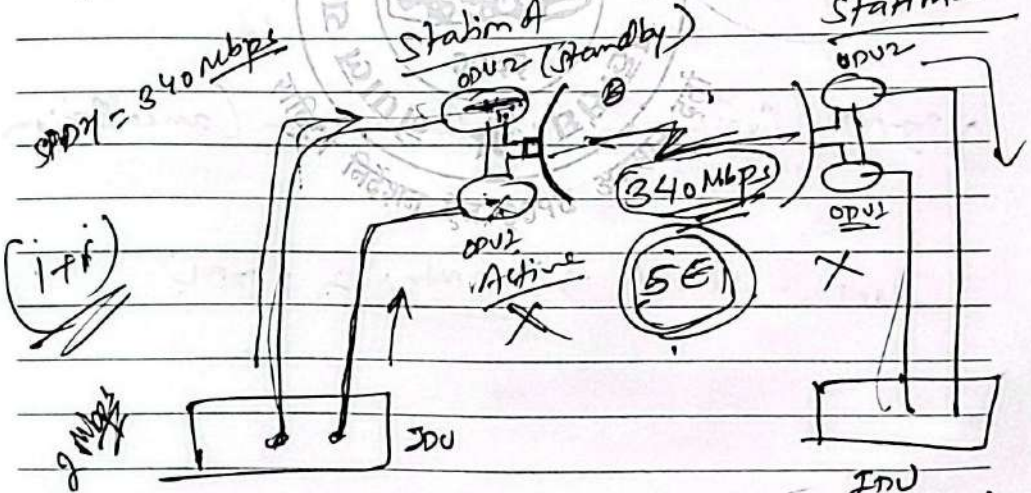


Date:

SIAE → PDH radio Completely TDM traffic.
→ SPDH (super PDH)
→ Hybrid

PDH :- ALC IDU ✗
SPDH: ALC plus2 IDU ✓
Hybrid:- ALC plus2e ✓
] Main link.

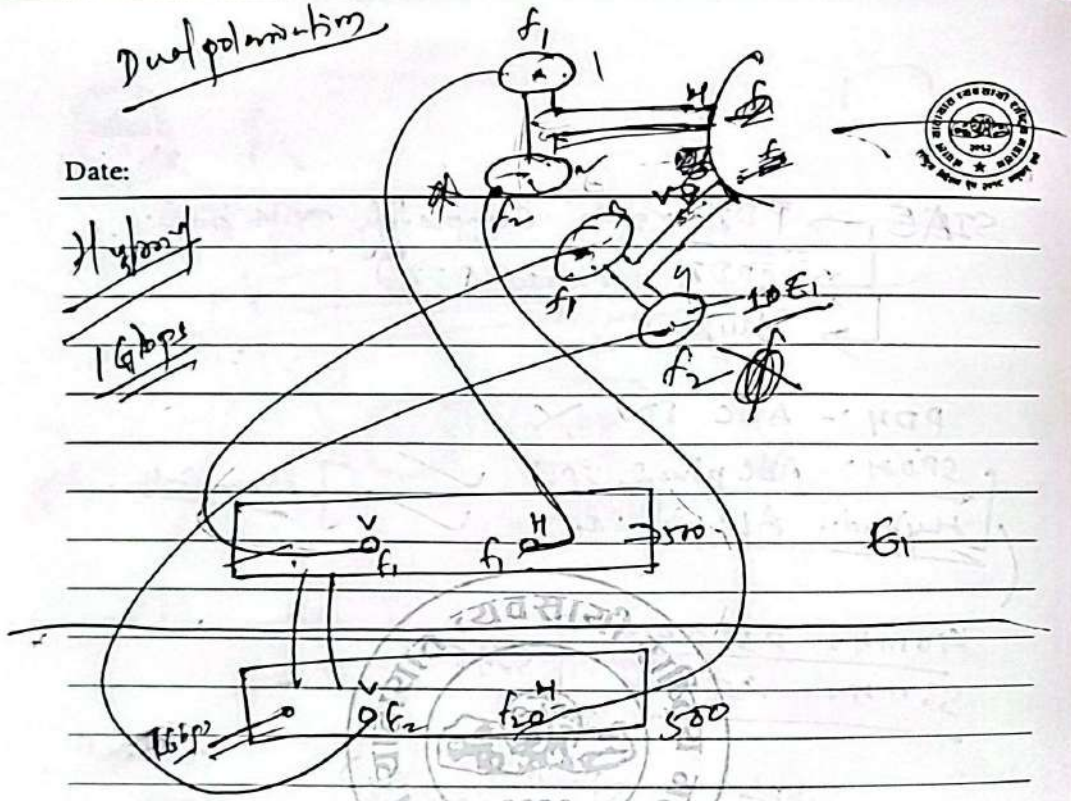
40MHz - 256 QAM
56MHz - 256 QAM
] SIAE



No IF cable — SPDH (single polarization)
single polarized Antenna.

Total capacity = 340 Mbps → TDM + Ethernet.

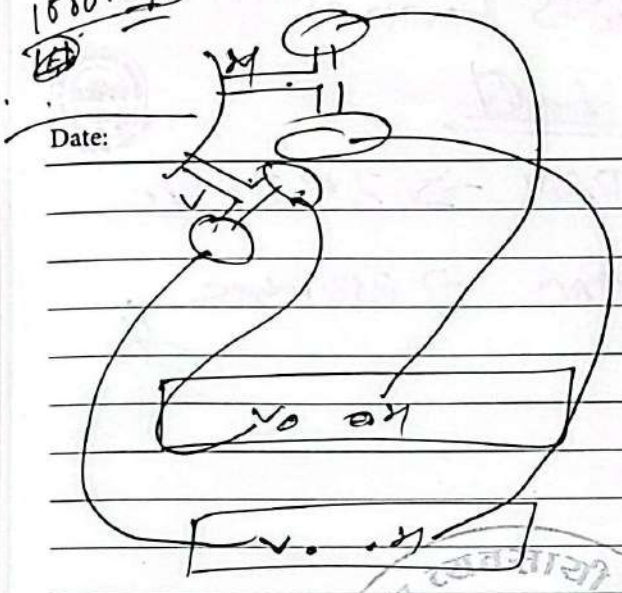
Dual polarization



XPIC :- Cross polarisation Interference Cancellation

4 DMR - 256 QAM ⇒ 250 Mbps ⇒ 1 ODU

1000 Mbps



(1) All ODU in operation, ∑ 10 E1 in ODU No. 4

⇒ Calculate ethernet capacity

1000 - 20 = 980 Mbps

(2) If ODU No 4 is faulty,

(3) ODU No 3

Phelchowki -> Falafel

Date: Hybrid

56MHz 256 QAM -> 340mbps

40MHz - 256 QAM -> 250mbps

#

Day-5

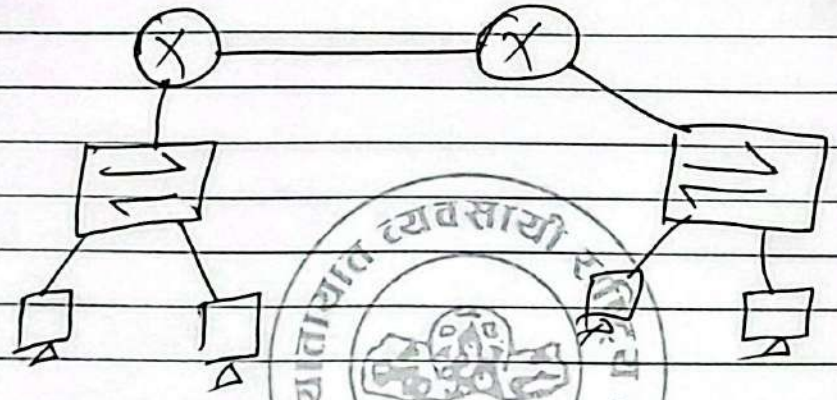
06-06-12

Router – Switch

Date:

Router / Switch [Data Comm^n Network]

TP



Router = layer 3 device

Switch = layer 2 device

OSI

7-layers

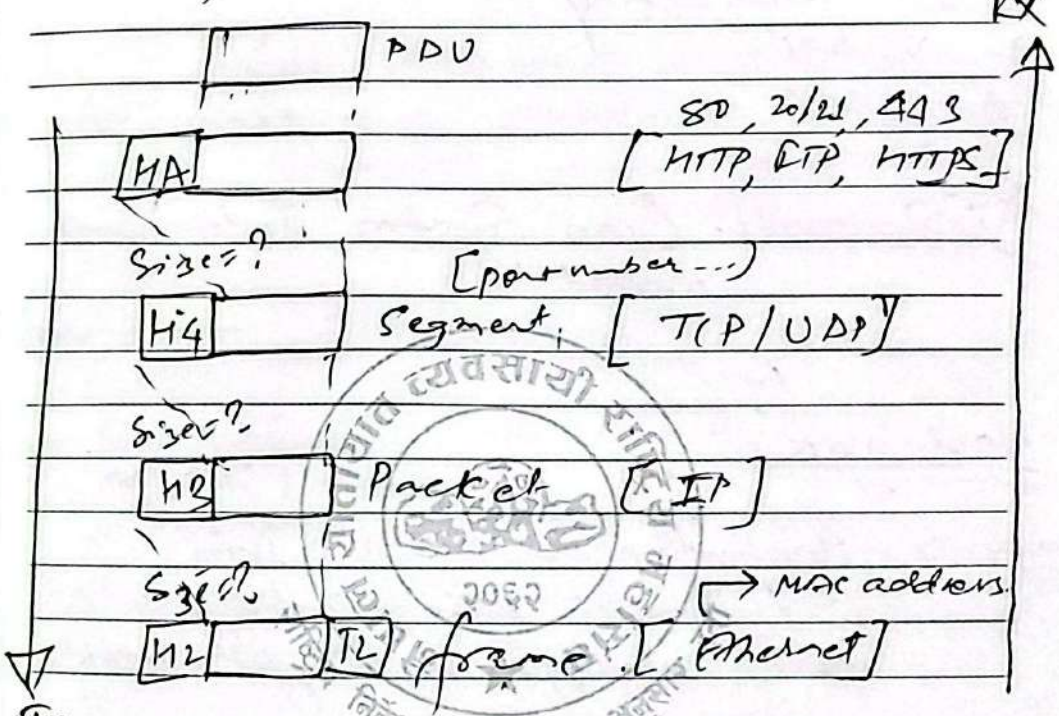
- Application
- Presentation
- Session
- Transport
- Network
- Data link
- Physical

TCP/IP stack → 5/4 layers

- Application
- Transport
- Internetwork
- Data link

Date:

http://www.facebook.com



Data encapsulation

Data decapsulation

* broadcast domain / collision domain
* OSI layer / function
* TCP/IP stack layer function
*

Date:

* IP addressing.
* IP Subnetting
* VLAN
* STP

1) OSI-model :- Open System Interconnection model

Def^n:

Host-layers:-

layer:- 7:- Application -> PDU = Data (Protocol Data Unit)
↳ High-level APIs, including resource sharing, remote file access

layer:- 6:- Presentation -> PDU = Data
↳ Translat^n of data bet^n a network service & an applicat^n; including character encoding, data compression & encrypt^n / decryption
↳ PDU = Data

layer 5:- Session:- Managing communicat^n sessions, ie continuous exchange of info. in the form of multiple back & forth transmission

Date:

layer 4:- Trasport :-> PDU = Segment, Datagram
↳ Reliable transmission of data segments bet^n points on a points on a network, including segmentat^n, acknowledgement & multiplexing.

layer 3:- Media-layers:

layer 3:- Network :- PDU = Packet
↳ Structuring & managing a multi-node network, including addressing, routing & traffic control

layer 2:- Data link :- PDU = Frame
↳ Reliable transmission of data frames bet^n two nodes connected by a physical layer.

layer -1:- Physical :-> PDU = Symbol
↳ Transmission & reception of raw-bit streams over a physical medium.
Eg:- Bluetooth, Ethernet

Date:

2) TCP/IP model :-

a) Process / Applicat° layer
b) Transport layer
c) Internet layer
d) Network Access layer

d) It corresponds to combinat° of data link layer & Physical layer
It looks out for hardware addressing & protocols present in this layer allows for physical transmission of data.

c) Corresponds to Network layer.
Responsible for logical transmission of data over entire network

b) Host to Host - layer :
→ Responsible for end to end communicat° & error-free delivery of data.

a) Process layer :- It is responsible for node to node comm° control & info specificat°

Date:

IP-addressing :- Internet protocol (IP address) is a numerical label assigned to each device connected to a computer network that uses IP for communicat°

Subnetwork or Subnet is a logical subdivision of IP network. The practice of dividing a network into two or more networks is called subnetting

A virtual LAN (VLAN) is any broadcast domain that is partitioned & isolated in a computer network at the data link layer (OSI - layer-2).

#SN

Day 5 Wireless 08/06/12

GMCC

Date:

Eg:-

KTM 106 - Dhoposi height 2.

Code for BTS.

Programming

R -

Python

oracle

-> BTS - BSC - MSC

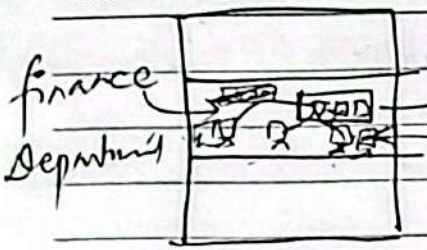
-> Tool for knowing Errors

-> Connectⁿ of BTS tower to device.

-> CPRI - cable, power wire & two wire for a Tx & Rx of a one frequency - bandwidth antenna.

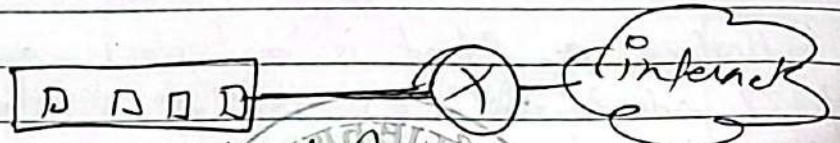
Date:

Vlan

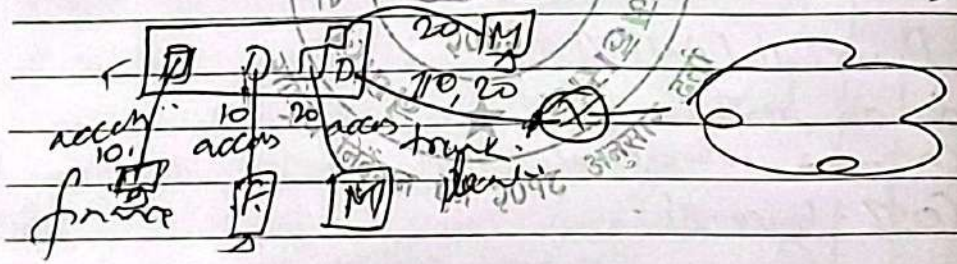


→ 1 network = 1 broadcast domain.

Suppose marketing Deptt. (Lie)

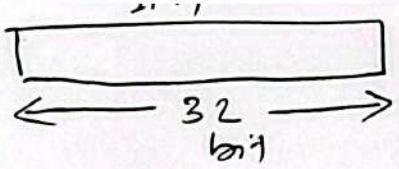


Logically (virtually) separate LAN = VLAN
↳ virtual



Vlan 10 ⇒ broadcast not reachable to Vlan 20 broadcast

Segmentation = Services
↳ differentiate Vlan

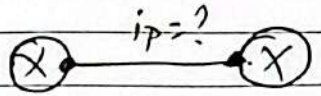


Date:

Subnetting

10.0.0.0/8 → 8 no. of bits on Network ip

↳ VLSM
↳ CIDR



10.0.0.0/30

Block Size = 2^n, n = no. of bits on Host part

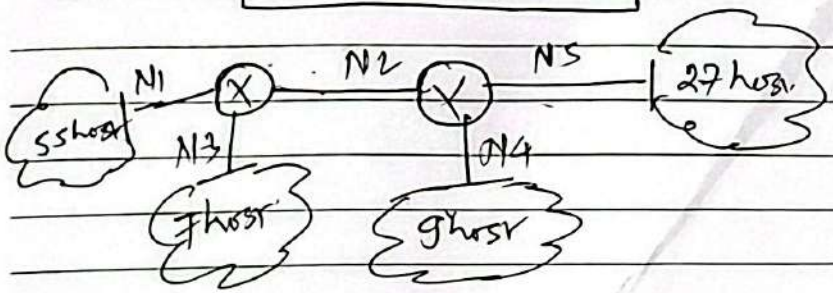
= 2^2

Block Size = 4 ⇒ no. of IP's on that Subnet

- Network IP = 10.0.0.0/30
  Broadcast IP = 10.0.0.3/30 } → Usable IP

Subnetting ∴ Example = ?

e.g. 192.168.1.0/24 → Class IP



Date:

Q11. 192.168.1.23/28

Network ip = ?

Broadcast ip = ?

Usable IP's = ?

Q12. 10.10.1.73/27

N. IP = ?

B. IP = ?

U. SP = ?