Course Name: Communication Networks
Course Code:ECE416

Dr. Charanjeet Singh
Professor
UID:21882

Connecting the world, one link at a time

Reuters World Business Markets Sustainability Legal Breakingviews Technology Investigations

Exclusive: Nokia in talks with Bharti Airtel for multi-billion dollar 5G contract, sources say

By **Supantha Mukherjee**

October 16, 2024 7:26 PM GMT+5:30 · Updated 2 months ago

STOCKHOLM, Oct 16 (Reuters) - Finland's Nokia (NOKIA.HE) is in talks with Bharti Airtel (BRTI.NS) about securing a multi-billion dollar contract to provide 5G telecom equipment for the Indian mobile operator which is expanding its network, three sources familiar with the matter said.

India is the world's second-largest smartphone market where companies such as Airtel, Reliance's (RELI.NS) Jio and Vodafone Idea (VODA.NS) have been spending billions of dollars to upgrade their networks to 5G.

THE ECONOMIC TIMES | Industry

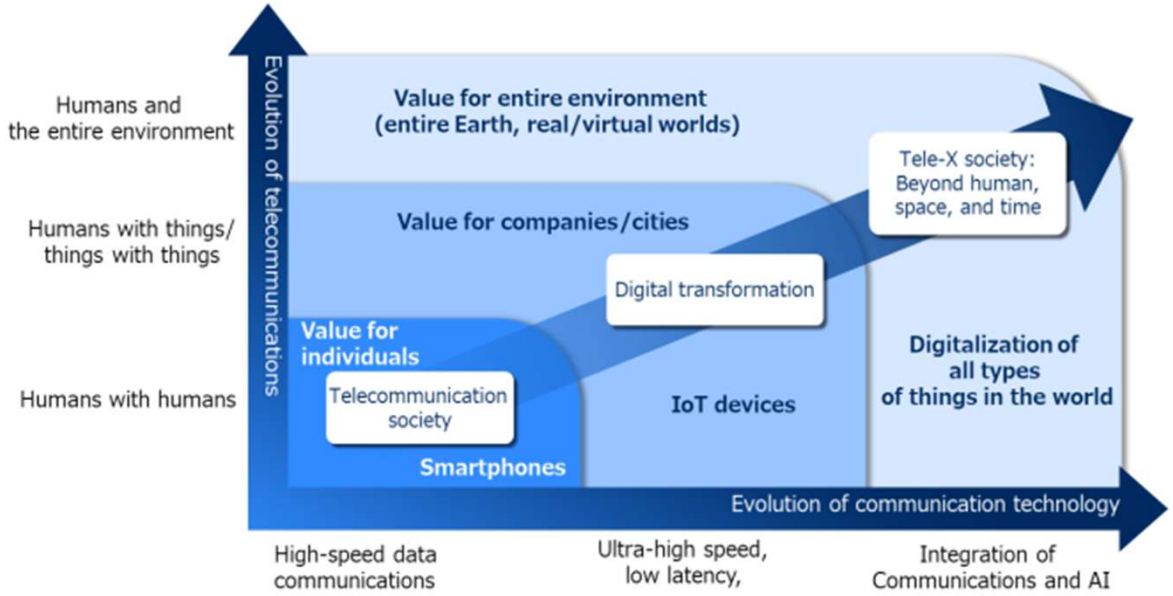
English Edition ▾ | Today's ePaper

ETPrime

New chip units to be key cog in India's 6G localisation strategy

By Kalyan Parbat, ET Bureau • Last Updated: Dec 17, 2024, 03:23:00 PM IST

India is leveraging new semiconductor plants in Assam and Gujarat to produce 6G network hardware domestically. This initiative aims to reduce reliance on imports, bolster national security, and drive the 'Make in India' program. The government is encouraging collaborations across industry and academia to develop a complete 6G product chain, from materials to finished goods, anticipating 6G's arrival by 2030.



Evolution of Telecommunication and Communication Technologies

Futuristic satellite transmitting high-speed data to Earth using optical communication.
It depicts the satellite in orbit with laser beams, showcasing advanced technology and global connectivity.

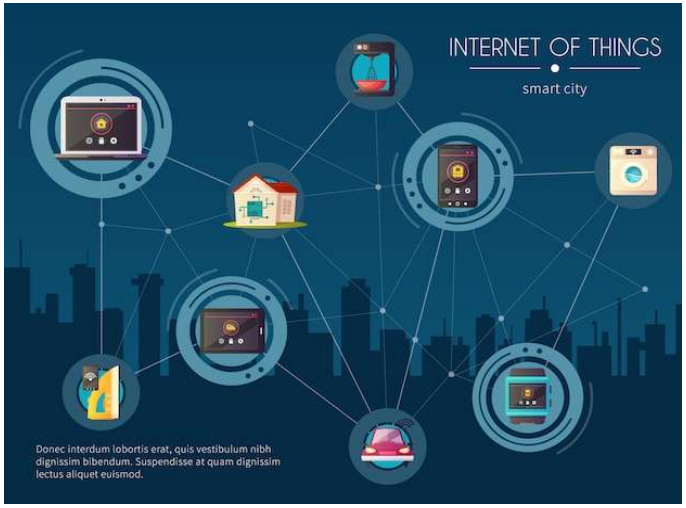
NASA achieved a record data transmission of 200 Gbps from a satellite using optical communications. This is paving the way for faster, more secure interplanetary data links.

Optical Networks

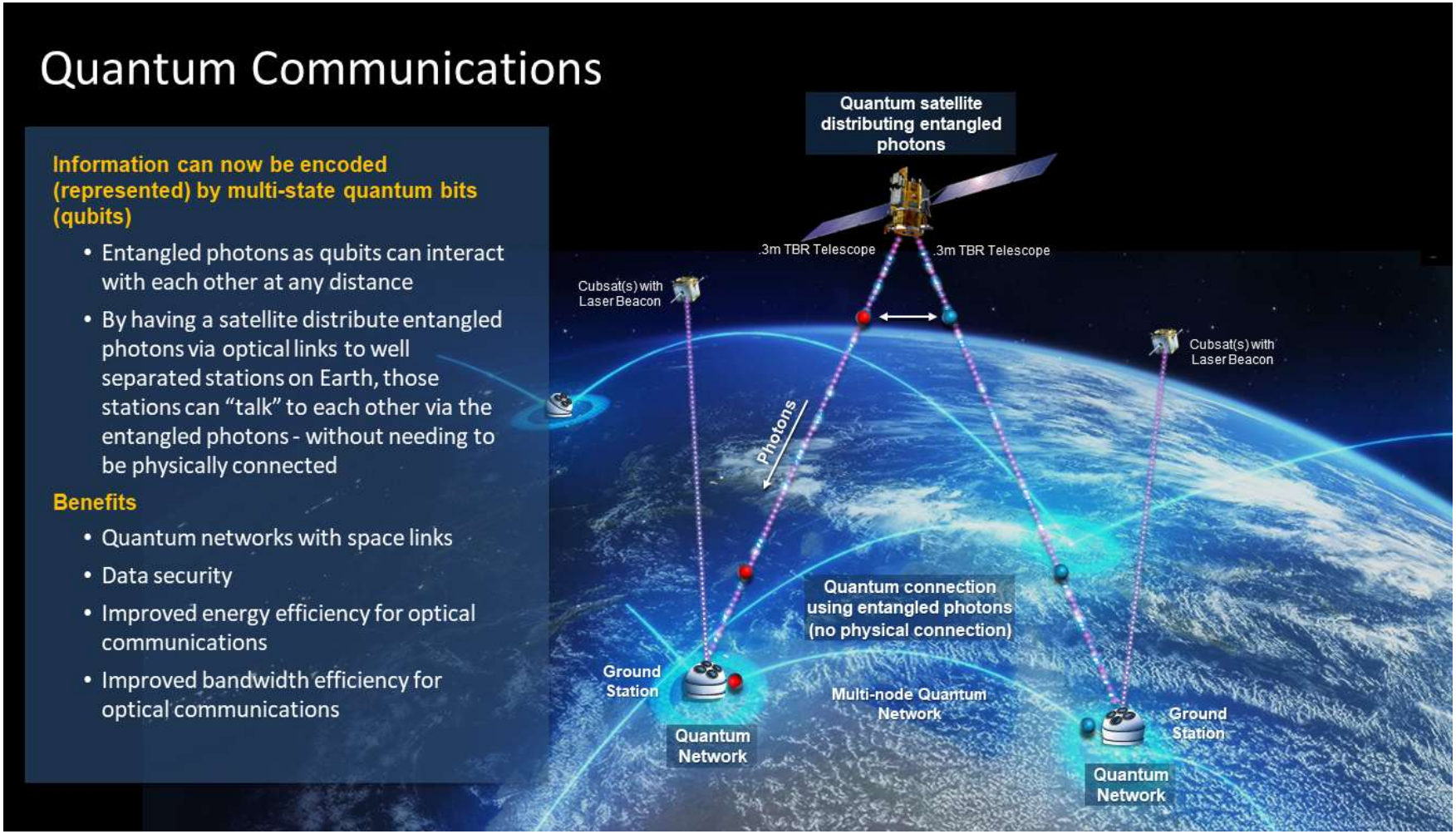
Ground-based optical network hub, showcasing futuristic technology with glowing fiber optic cables and lasers transmitting data to satellites. The urban backdrop emphasizes advanced infrastructure and connectivity.

High-tech ground-based optical network system, showcasing laser communication towers and glowing fiber optic cables integrated into a modern cityscape, emphasizing advanced connectivity and data transfer.

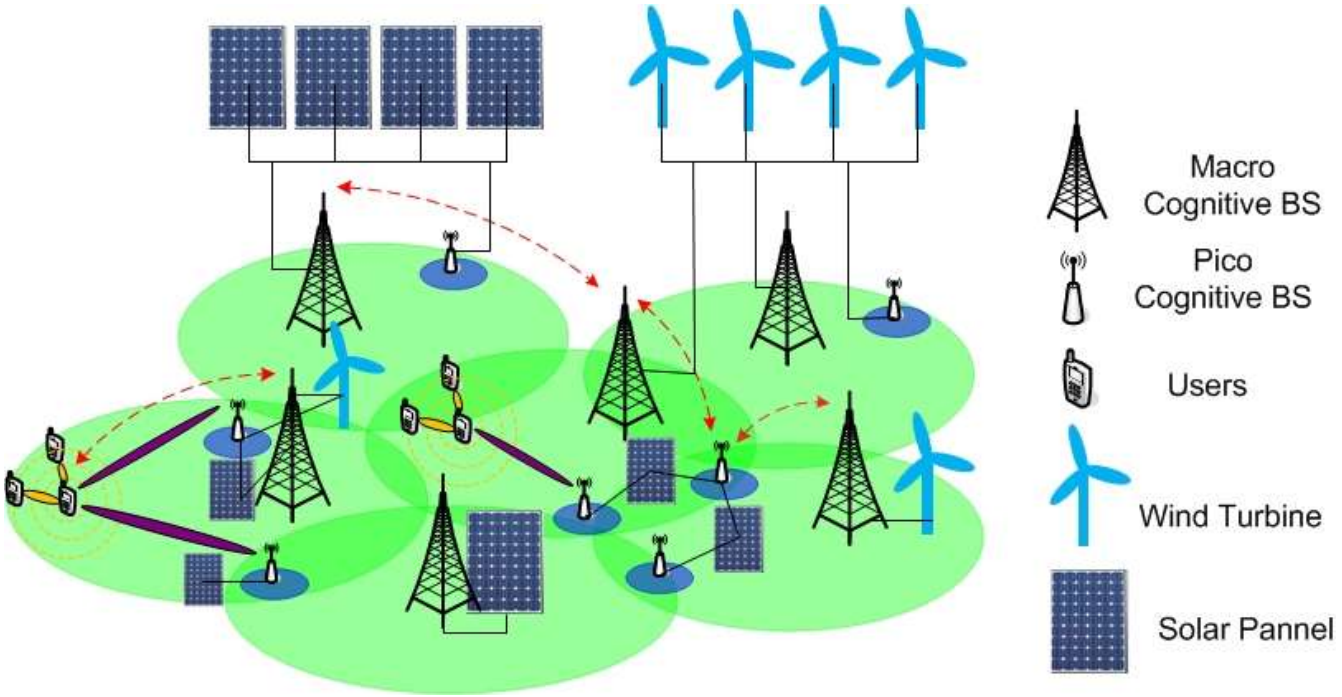
Internet of Things Network



Quantum Communication Network

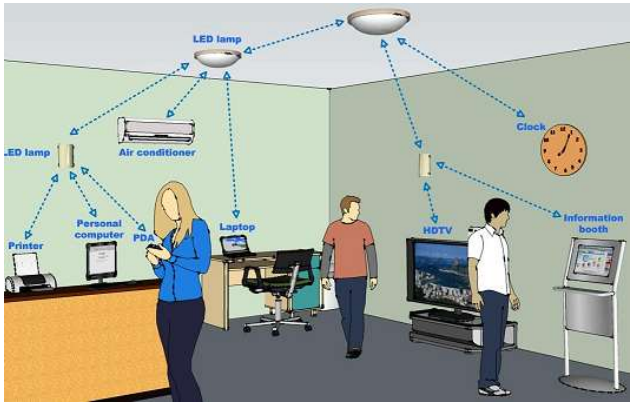


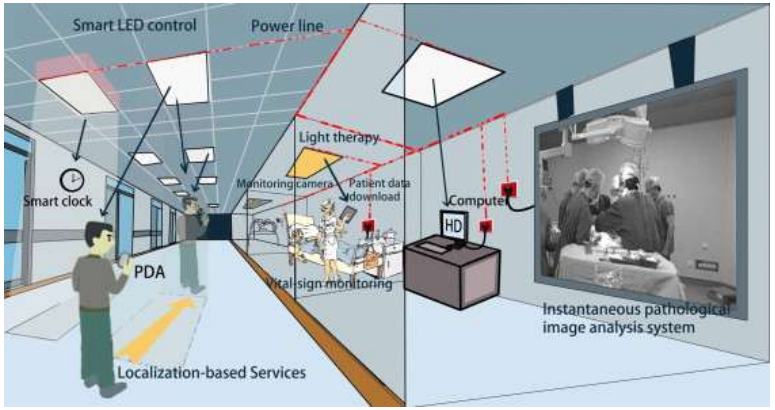
Green Communication Networks

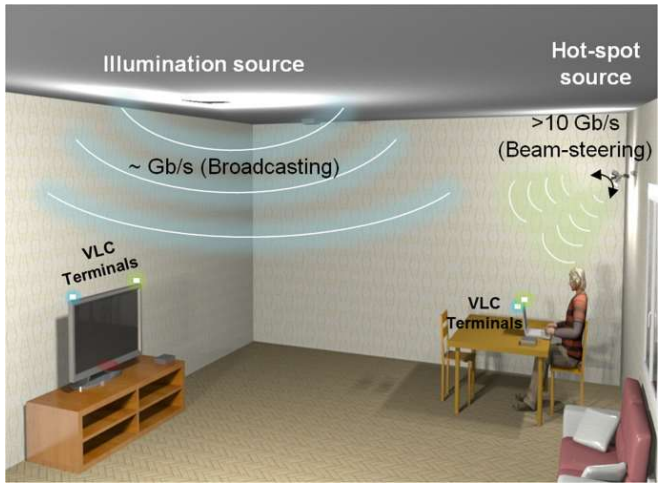


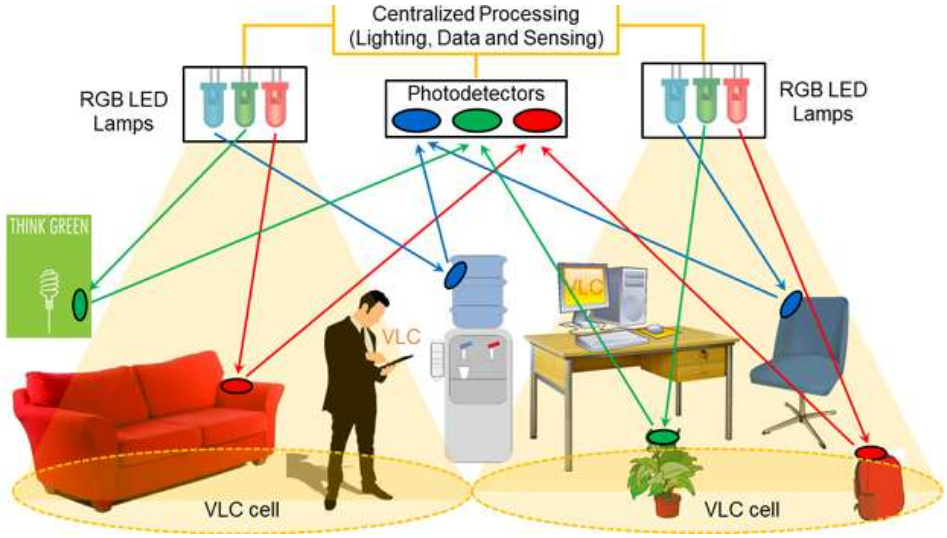
Cognitive Wireless Networking Powered by Green Energy

Visible Light Communication Network









Cohorts

- Network engineers
- Optical network engineer
- Telecommunications specialist
- Radio frequency (RF) engineer
- Network analyst
- Wireless network designer
- Automation engineer

Potential Job Providers

1. AT&T
2. Verizon Communications
3. T-Mobile
4. Ciena
5. Cisco Systems
6. Juniper Networks
7. Nokia
8. Ericsson

Lecture #0

Gist of

- Assessment Mechanism
- Course outline
- Why this course is being taught?
- Unit wise content
- The learning outcome

Course Details

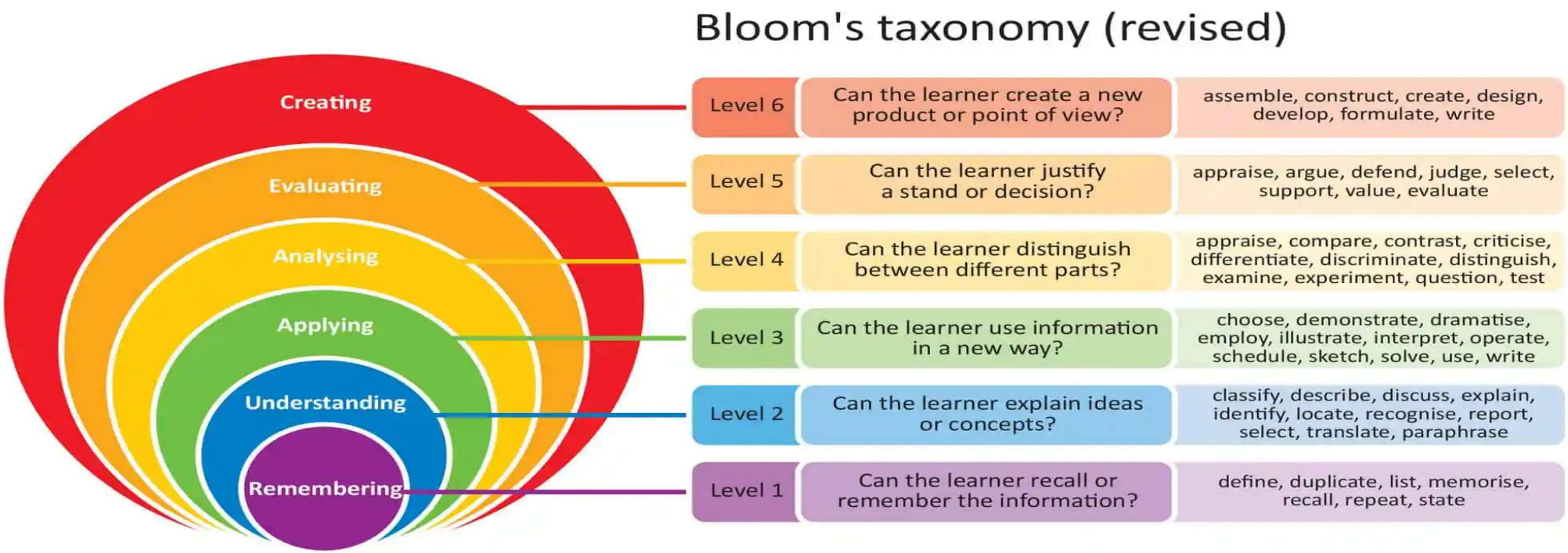
- **LTP – 3 0 0 [Three lectures/week]**
- **Text Books**

DATA COMMUNICATIONS AND NETWORKING by BEHROUZ A. FOROUZAN, TATA MCGRAW - HILL EDUCATION, 4th Edition, (2006)

- **References**

COMPUTER NETWORKS by ANDREW S. TANENBAUM, PEARSON, 5th Edition, (2012)

Revised Bloom's Taxonomy



Program Outcomes

PO1	Engineering Knowledge
PO2	Problem Analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex Problems,
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning

Course Outcomes:

CO1 :: Explain communication types, network configuration, topologies and hardware.

CO2 :: Learn multiple-access protocols for error-free data communication.

CO3 :: Evaluate congestion control policies in networks.

CO4 :: Choose the various kinds of routing techniques and algorithms.

CO5 :: Examine IP addressing protocols and security measures

CO6 :: Analyze the role of different types of OSI layers for data transmission

Syllabus

L:3 T:0 P:0 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: Explain communication types, network configuration, topologies and hardware.

CO2 :: Learn multiple-access protocols for error-free data communication.

CO3 :: Evaluate congestion control policies in networks.

CO4 :: Choose the various kinds of routing techniques and algorithms.

CO5 :: Examine IP addressing protocols and security measures

CO6 :: Analyze the role of different types of OSI layers for data transmission

Unit I

Introduction : Data communication, Communication networks, Protocols and protocols architecture, Analog and Digital transmission, Transmission Impairments, Layered Architecture of Computer Networks:OSI and TCP/IP Model

Unit II

Physical Layer : Transmission Media:Guided and wireless medium, Data Encoding:Line coding and transmission modes, Error detection, Error and flow control, Time and Frequency division multiplexing

Unit III

Data Link Layer : Medium Access Control:CSMA,ALOHA, Controlled Access, Ethernet, Wireless LAN, Broadband Wireless, Bluetooth, Circuit and Packet Switching, Connecting Devices

Unit IV

Network Layer : Network Layer Design Issues, Routing Algorithms:Flooding,Shortest path routing,Link state routing,Path vector routing,Broadcast and multicast routing, IP protocol, ARP and RARP, ICMP, DHCP, Network address translation(NAT)

Unit V

Transport Layer : Process to process delivery,Reliable/Unreliable protocol, User Datagram Protocol (UDP), Transport Control Protocol(TCP)

Unit VI

Application Layer : DNS(Domain Name System), Electronic Mail, FTP, WWW(World Wide Web):Client and Server Side, HTML and Web Pages, Multimedia:Audio and Video, Data Compression:Audio and video compression, State of the art in communication networks

Text Books:

1. DATA COMMUNICATIONS AND NETWORKING by BEHROUZ A. FOROUZAN, MCGRAW HILL EDUCATION

References:

1. COMPUTER NETWORKS by ANDREW S. TANENBAUM, PEARSON

Course Assessment Model

Marks break up*	Weightage
• Attendance	5
• CA (3 compulsory tasks)	25
• MTE	20
• ETE	50
• **Total -**	**100**

• Each CA will be of 30 marks

Evaluation

- **CA1- Learn by doing**
- It will be based on outside class activity of learn by doing wherein students will be required to visit classrooms of different blocks of the University and check laptop/mobile for signal strength, packet transfer TTL, uploading speed, downloading speed, connectivity check with Packet Internet Groper etc.
- **CA2-Descriptive Test**
- There will be 6 descriptive questions of 5 marks each
- **CA3-MOOC Certification**
- **https://onlinecourses.nptel.ac.in/noc25_ee12/preview (IIT Kharagpur)**

  Last Date of Registration for MOOC Course: 20 January, 2025

Rubrics for CA1

Presentation-15 Marks

Discussion of measured/checked parameters

Knowledge-10 Marks

Variation of different metrics as a function of location and time

Report-5 Marks

Formatting, Write up as per template

Total-30 Marks

Pedagogy

- Mandatory: Student will bring a notebook and make notes in class
- -AI intervention: submission of summary for topics covered in the week
  - (1) Take one-page print/handwritten document in English and Regional Language of Students Using AI Tool
  - (2) Write 5 Headings associated with summary
  - (3) Paste document on the subject notebook
  - (4) Notebook will be checked every week
- One CA 5 marks will be of notebook

Pedagogy

- Visualize to realize using CISCO PACKET TRACER Software
- For Better Insights,

➢ Functioning of Router

➢ Hub,

➢ Switch

➢ Routing Protocols

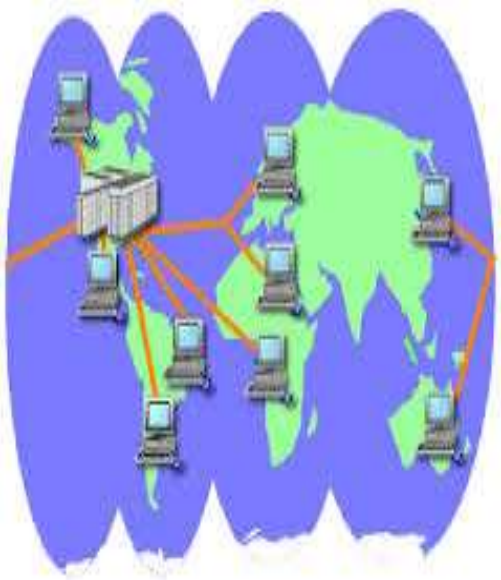
-Router Information

- Open Short Path First

Course Contents

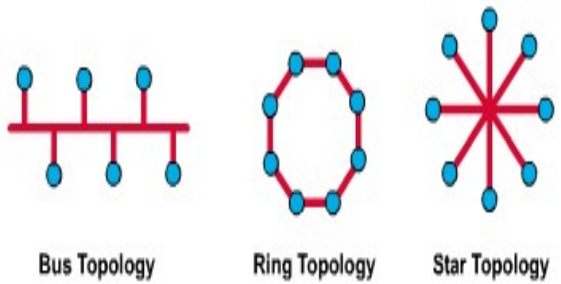
- Introduction
- Physical Layer
- Data Link Layer
- Network Layer
- Transport Layer
- Application Layer

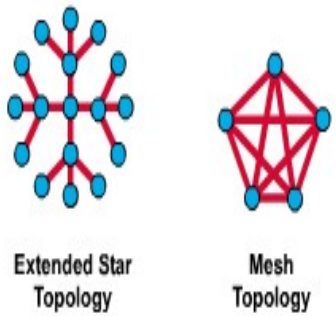
Why this course is being taught?

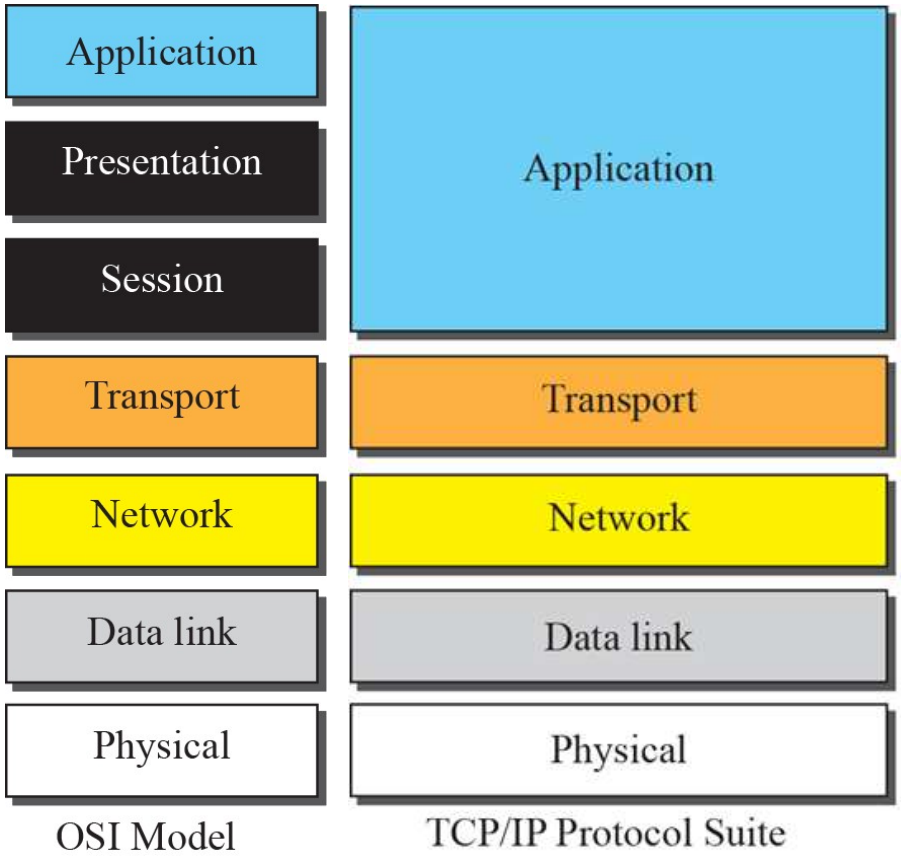


- E-mail
- Searchable Data (Web Sites)
- E-Commerce
- News Groups
- Internet Telephony (VoIP)
- Video Conferencing
- Chat Groups
- Instant Messengers
- Internet Radio

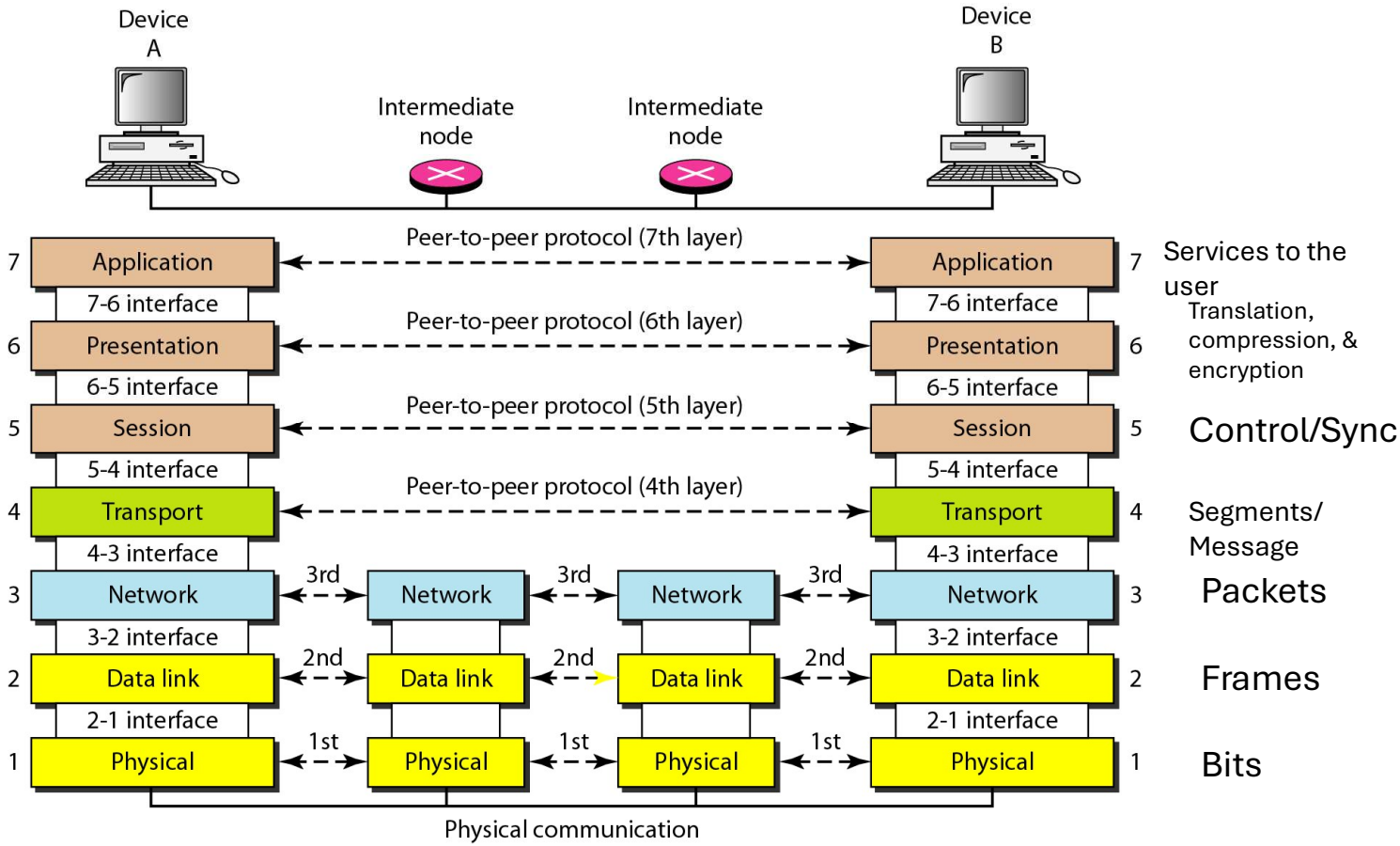
Introduction



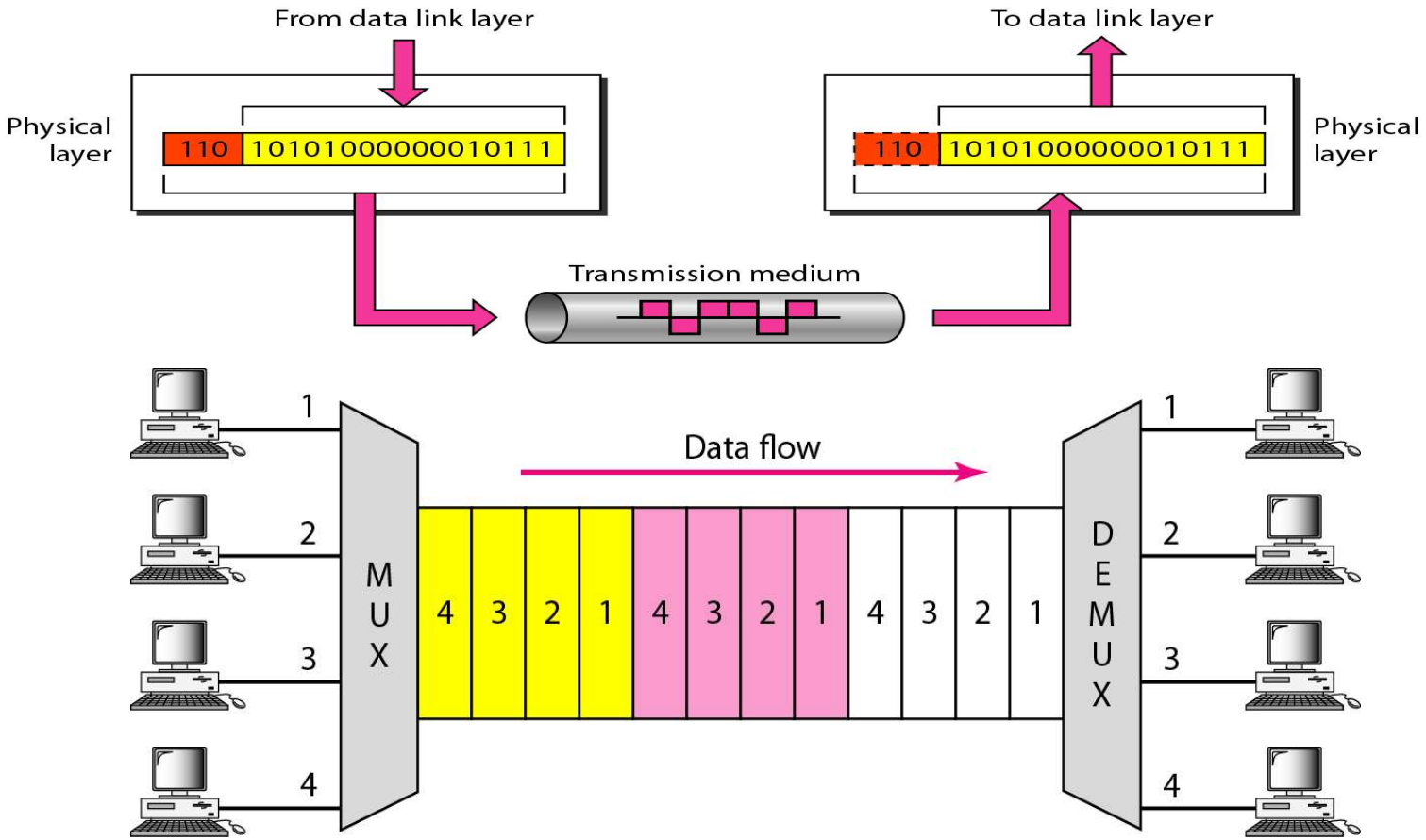




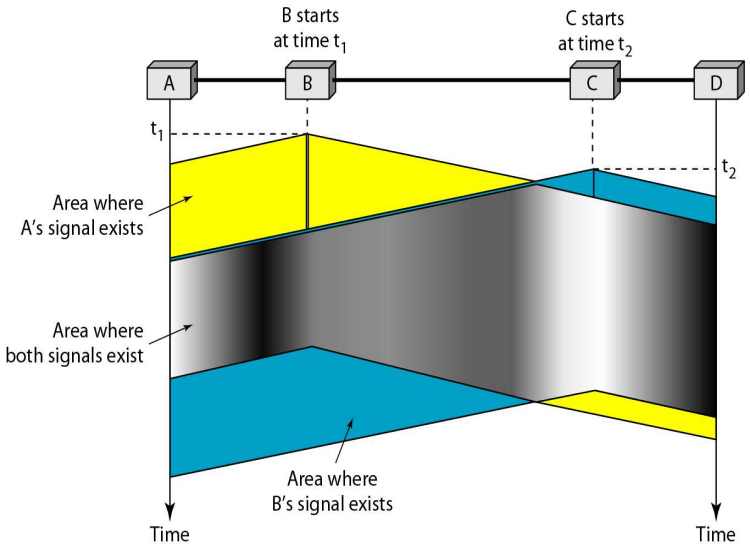
The interaction between layers in the OSI model

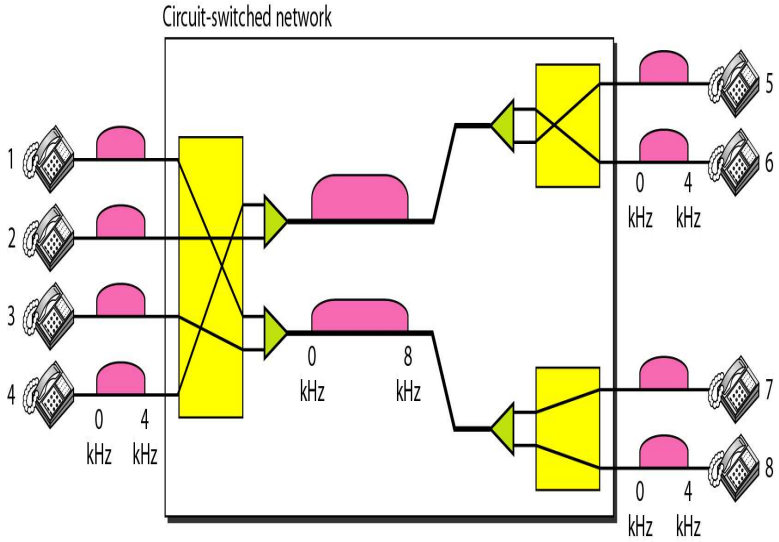


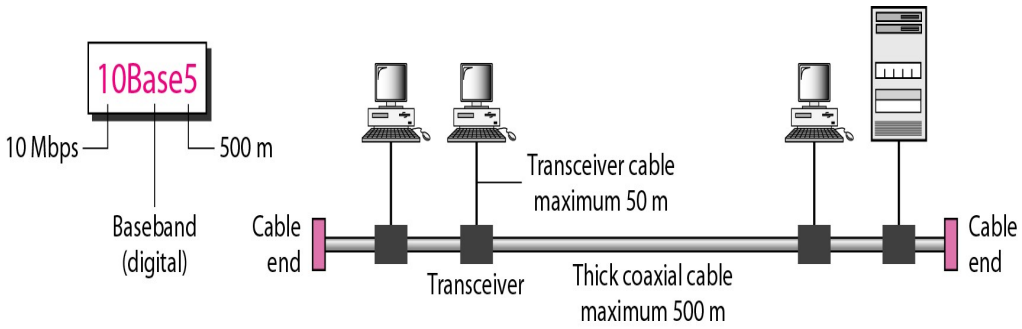
Physical Layer



Data Link Layer

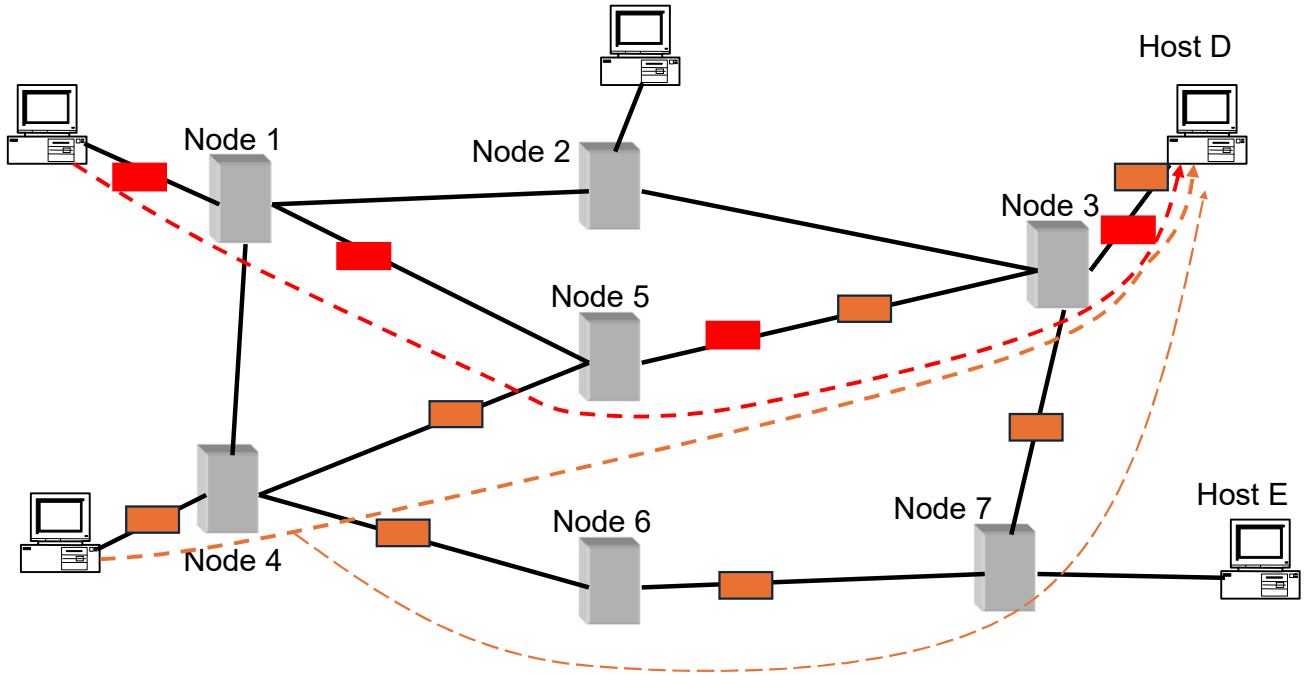




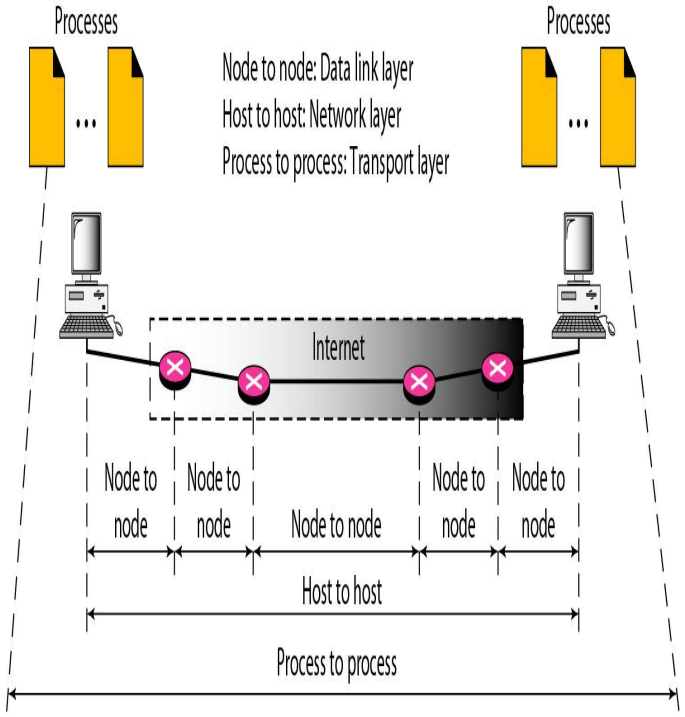


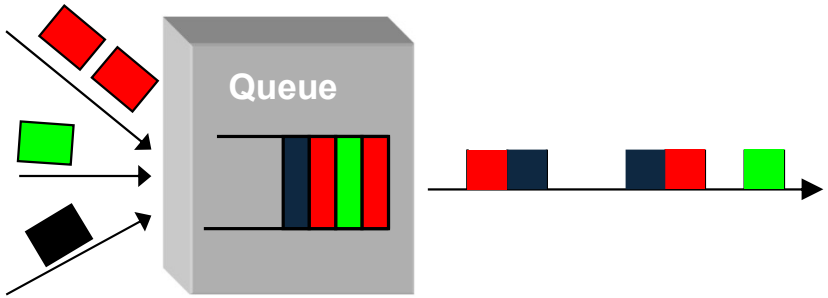
Bluetooth™

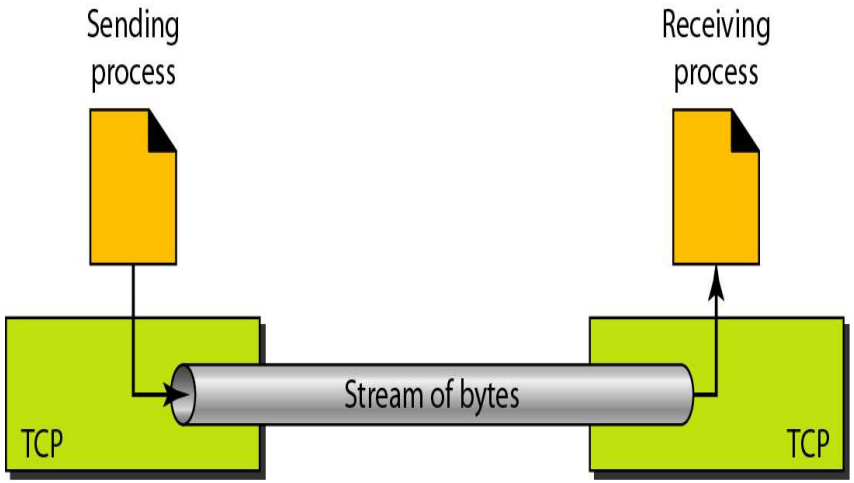
Network Layer



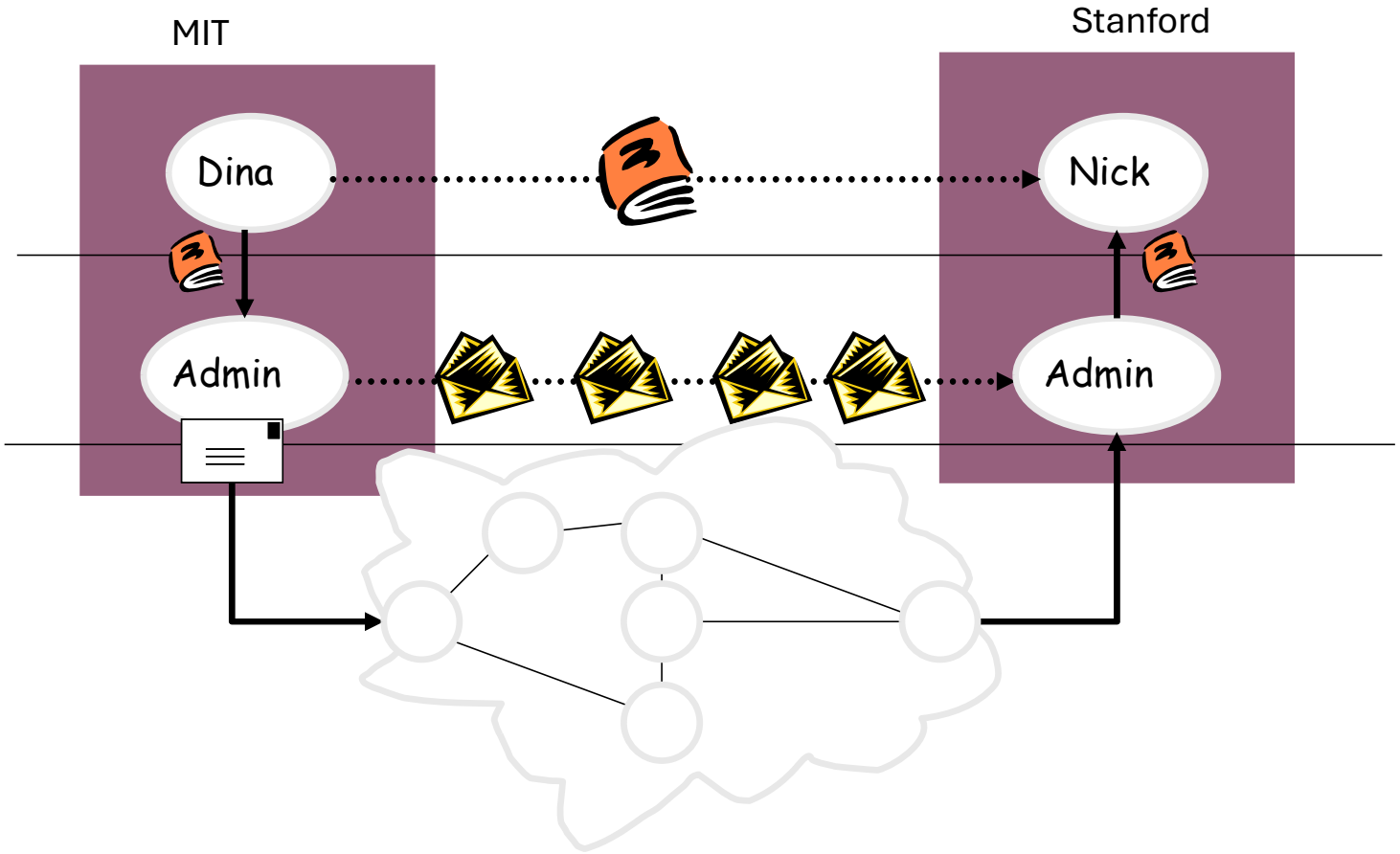
Transport Layer







Application Layer



Reliable, Resilient, and Always Connected-Wired or Wireless


Thank You