Gujarat University
Syllabus
M.Tech (Networking & Communications) – III

Subject Name: Routing Technology

Subject Code: MTNT - 211

Objectives:
The object of this course is to create in-depth awareness of packet routing in computer communication networks. The goal is to provide comprehensive details of routing algorithms, protocols and architectures of routers followed by the concepts of MPLS towards the next generation routing. In abstract, the course covers the following parts:

- Network Routing: Basics and Foundations
- Routing in IP Networks
- Router Architectures
- Introduction to Next Generation Routing

Prerequisites:
Fundamentals of Computer Communication Networks, Principles of Internetworking with TCP/ IP

Contents:

1. **Networking and Network Routing: An Introduction:**
   Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture

2. **Routing Algorithms: Shortest Path and Widest Path:**
   Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra's Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra's Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm

3. **Routing Protocols: Framework and Principles:**
   Routing Protocol, Routing Algorithm and Routing Information, Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost

4. **IP Routing and Distance Vector Protocol Family:**
   Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol Version 1 (RIPv1), Routing Information Protocol Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution

5. **OSPF and Integrated IS-IS:**
   OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS: Key Features, Similarities and Differences Between IS-IS and OSPF

6. **BGP:**
   A Brief Overview, Basic Terminology, BGP Operations: Message Operations, BGP Timers, BGP Configuration Initialization, Two Faces of BGP: External BGP and Internal BGP, Path Attributes, BGP Decision Process, Internal BGP Scalability, Significance of Route Flap Dampening, BGP Additional Features, Finite State Machine of a BGP Connection

7. **Router Architectures:**
   Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures

8. **IP Address Lookup Algorithms:**
   Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multi bit Tries, Search by Length Algorithms, Search by Value Approaches

9. **Introduction to IP Packet Filtering and Classification:**
   Importance of Packet Classification, Packet Classification Problem, Packet Classification Algorithms

10. **Towards Next Generation Routing: QoS Routing, MPLS and GMPLS:**
    Background of QoS and QoS Routing, QoS Attribues, Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching (MPLS), Generalized MPLS, MPLS Virtual Private Networks

11. **Routing in Ad hoc Network:**
    Introduction to Ad hoc Networks – Features/ Characteristics, Types and Applications, Limitations, Advantages and Disadvantages, Classification of Routing Protocols in Ad hoc Networks – Proactive Routing Protocols (DSDV, OLSR), Reactive Routing Protocols (DSR, AODV), Hybrid Routing Protocols (ZRP)

References:

1. Deepankar Medhi, Kartikeyan Ramasamy , "Network Routing – Algorithms, Protocols, Architecture", Morgan Kauffman Series Publication
2. Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, "Ad Hoc Mobile Wireless Networks – Principles, Protocols and Applications", Auerbach publications
3. Dharma Prakash Agrawal and Carlos De Morais Cordeiro, "Adhoc and Sensor Networks – Theory and Applications", World Scientific publication

Accomplishments of the student after completing the Course will be:

At the end of this course the student will be able to –

- Understand the fundamentals and requirements for packet routing in computer communication networks.
- Design the IP addressing scheme of the complex campus network.
- Decide the routing protocol for any level of complex network design.
- Deal with the different routing protocols requires to be configured in real routers along with the framework of the concerned routing algorithms.
- Gain knowledge about the internal architecture of routers.
- Draw the interest towards the research in the routing platform.
- Start working towards next generation routing and in the domain of wireless networking.

Subject Name: High Performance Computing

Subject Code: MTNT – 212(1)

Objectives:

- To introduce the principles and paradigm of Cloud Computing
- To understand the Service Model with reference to Cloud Computing
- To appreciate the role of Virtualization Technologies

Prerequisites:

Fundamentals of Distributed Computing

Contents:

1. **Introduction to Cloud Computing:**
   Overview, Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Assessing the role of Open Standards

2. **Cloud Architecture, Services and Applications:**
   Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frameworks, Software as a Service, Identity as a Service, Compliance as a Service

3. **Abstraction and Virtualization:**
   Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context

4. **Managing & Securing the Cloud:**
   Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence, Storage Area Networks, Disaster Recovery in Clouds

5. **Case-Studies:**
   Overview of Cloud services, Designing Solutions for the Cloud, Implement & Integrate Solutions, Emerging Markets and the Cloud

References:

1) Sosinsky B., “Cloud Computing Bible”, Wiley India
2) Buyya R., Broberg J., Goscinski A., “Cloud Computing : Principles and Paradigm”, John Wiley & Sons
3) Velte T., Velte A., Elsenpeter R., “Cloud Computing – A practical Approach”, Tata McGrawHill.
4) Arora P., Biyani R., “To the Cloud : Cloud Powering an Enterprise”, Tata McGrawHill
5) Linthicium D., “Cloud Computing and SOA Convergence in Enterprise”, Pearson Education India.
6) Shroff G., “Enterprise Cloud Computing”, Cambridge University Press
7) Smooth S., Tan N., “Private Cloud Computing”, Morgan Kauffman
8) Miller Michael, “Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online”, Pearson Education India

Accomplishments of the student after completing the course:

At the end of the work student will be able to

- Gain In-depth Knowledge of Cloud Computing.
- Discover the role of Cloud Services
- Ability to design and deploy Cloud Infrastructure

Subject Name: Network Management

Subject Code: MTNT – 212(2)

Objectives:

- Appreciate methods of analysis and problem-solving techniques for network management.
- Understand SNMP message formats.
- Integrate SNMP, SMI, and Web-based management.
- Understand the importance of SLAs and Policies in Network Management

Prerequisites:

Computer Networking

Contents:

1. **Overview:**
   Requirements for the Management of Networked Systems, Management Scenarios, Management Functions, Organizational Aspects of Management, Time Aspects of Management, Network Management Standards and Models.

2. **IP Network Management:**
   Introduction, Configuration Methods, Management Information Base, Simple Network Management Protocol, Extensible Markup Language, Common Object Request Broker Architecture, Configuration Protocols, Statistics collection, Policy Control, IP-Based Service Implementation, OSS, Provisioning Issues, Network Management Issues, OSS Architecture.

3. **SNMP & RMON:**
   Organization and Information Models, Communication and Functional Models, Features of SNMPv1, SPMPv2 and SNMPv3, RMON SMI and MIB, Features of RMON1 and RMON2

4. **Network Management Architecture:**
   Introduction, Defining Network Management, Network Management Mechanisms, Architectural Considerations

5. **SLA and Network Monitoring:**
   Passive Network Monitoring, Active Network Monitoring

6. **MPLS Network Management:**
   Introduction to MPLS, MPLS Applications, Key Aspects of MPLS Network Management, MIB Modules for MPLS, Overview of MPLS Management Interfaces, SNMP support for MPLS

7. **Optical Networks Management:**
   Overview of Optical Network Management, Optical Layer Services and Interfacing, Layers within Optical Layer, Multivendor Interoperability, Performance and Fault Management, Configuration Management, Optical Safety.

8. **Policy Management:**
   Overview of Policy Management, Defining Policy-Based Management, Defining Policy-Based Network Management, PBNM, Benefits of PBNM, High-Level Requirements of a PBNM System, Using Modeling to Solve Information Overload, Policy Used to Express Business Requirements.

9. **Network Management Tools:**
   System utilities for management, Measurement of network statistics, MIB engineering, Design considerations of Network Management Systems, NMS, Case Studies of NMS

References:

1) Farrel et al., "Network Management - know it all", Morgan Kauffman Publishers, Elsevier Press
2) Subramanian Mani, "Network Management – Principles and Practice", Pearson Education India
3) Burke Richard, "Network Management – Concepts and Practice", Pearson Education India
4) Comer D., "Automated Network Management System", Addison-Wesley
5) Morris S., "Network Management, MIBs and MPLS: Principles, Design and Implementation", Prentice Hall
6) Strassner J., Brabsner J., "Policy-Based Network Management: Solutions for the Next Generation", Morgan Kauffman
7) Clemm A., "Network Management Fundamentals", Cisco Press
8) Stallings W., "SNMP, SNMPv2, SNMPv3, and RMON 1&2, Pearson Education India
9) Gupta et. al., "IT Infrastructure and its Management", Tata McGrawHill Publication

Accomplishments of the student after completing the Course:

- Ability to access, compile and use MIBs.
- Ability to implement a Network Management System
- Ability to formulate SLAs and Policies for Network Management

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Subject Name: Social Media Application Development

Subject Code: MTNT – 212(3)

Objectives:

- To learn, how to reduce complex real-world situations to a simplified mathematical model
- Building a computer simulation based on mathematical model
- Appreciate the use of ideas borrowed from diverse fields like economics, sociology, computing and information science, and applied mathematics

Prerequisites:

Statistics, Probability Theory

Contents:

1. **Graph Theory & Social Networks:**
   Overview, Graphs, Strong and Weak Ties, Networks in their Surrounding Contexts, Positive and Negative Relationships

2. **Game Theory:**
   Games, Evolutionary Game Theory, Modeling Network Traffic using Game Theory, Auctions

3. **Markets and Strategic Interaction in Networks:**
   Matching Markets, Network Models of Markets with Intermediaries, Bargaining and Power in Networks

4. **Network Dynamics – Population Models:**
   Information Cascades, Network Effects, Power Laws and Rich get Richer Phenomena

5. **Network Dynamics – Structural Models:**
   Cascading Behavior in Networks, The Small World Phenomena, Epidemics

References:

1) Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press.
2) (Available Online: http://www.cs.cornell.edu/home/kleinber/networks-book/)
3) Jackson, Matthew O., "Social and Economic Networks", Princeton University Press.
4) Osborne, Martin J., "Introduction to Game Theory", Oxford University Press.
5) Gibbons, Robert, "Game Theory for Applied Economists" Princeton University Press.
6) Joel Watson, "Strategy: An Introduction to Game Theory ", Publisher: W W Norton & Company.

Accomplishments of the student after completing the Course:

- Ability to formulate a model for problems in the area of Computer Networks
- Ability to implement algorithms using Game Theoretic approach.
