SASTRA
ENGINEERING · MANAGEMENT · LAW · SCIENCES · HUMANITIES · EDUCATION
DEEMED TO BE UNIVERSITY
(U/S 3 of the UGC Act, 1956)
THINK MERIT | THINK TRANSPARENCY | THINK SASTRA
THANJAVUR | KUMBAKONAM | CHENNAI

School of Computing

CSE323R01

Computer Networking Principles & Components Laboratory

B. Tech. (Computer Science & Business Systems) - Semester VI

Course Objectives

This course will help the learner to understand the network simulator environment. Also the learner will be able to understand working principle of various communication protocols and visualize the network protocol performance metrics.

List of experiments

1. Simulation and analysis of Wired Network in NS2/NS3
2. Simulation and analysis of Wireless Network in NS2/NS3
3. Implementation of error-detection technique - CRC
4. Implementation of error-correction technique - Hamming code
5. Implementation and analysis of Sliding window protocols
6. Implementation of Dynamic Host Configuration Protocol
7. Implementation and analysis of Distance vector routing
8. Implementation and analysis of Link State Routing
9. Implementation and analysis of Leaky bucket and Token bucket congestion control algorithms
10. Implementation of DNS lookup
11. Implementation of secured file transfer
12. Study of SASTRA network infrastructure

COURSE LEARNING OUTCOMES

Upon successful completion of this course, the learner will be able to:

- Demonstrate wired and wireless network simulation
- Differentiate error detection and error correction techniques
- Analyse the performance of flow control techniques
- Compare various adaptive routing protocols
- Demonstrate various congestion controls algorithms
- Analysis of application layers services

1. Simulation and analysis of Wired Network

Objective

Learn to construct the wired network using NS2/NS3 Simulator

Procedure

- Wired network can be created using a simple topology with n number of nodes connected by a wired link
- Nodes in the network can be connected using a various types of link and the link characteristics include bandwidth, delay and queue type
- Each node is assigned with label, color and shape

The following components are used in Simulator

NAM[Network Animator]:

- Used to view the Network simulation traces
- Supports packet transmission, topology, data inspection etc
- During the execution of simulation, it supports animation

Trace File:

- Used to store the coverage information or overall network information
- To generate a trace file, we have to first create a trace file using OTCL Script.

X-Graph:

- Used to visualize the resulting graph

AWK Script:

- Used to process the data from the log[i.e. trace file]

2. Simulation and analysis of Wireless Network

Objective

Learn to construct the wireless network using NS2/NS3 Simulator

Procedure

- Wireless network can be created using a simple topology with n number of nodes connected by a wireless link
- Nodes in the network can be connected and the link characteristics include bandwidth, delay and queue type
- Each node is assigned with label, color and shape

The following components are used in Simulator

NAM[Network Animator]:

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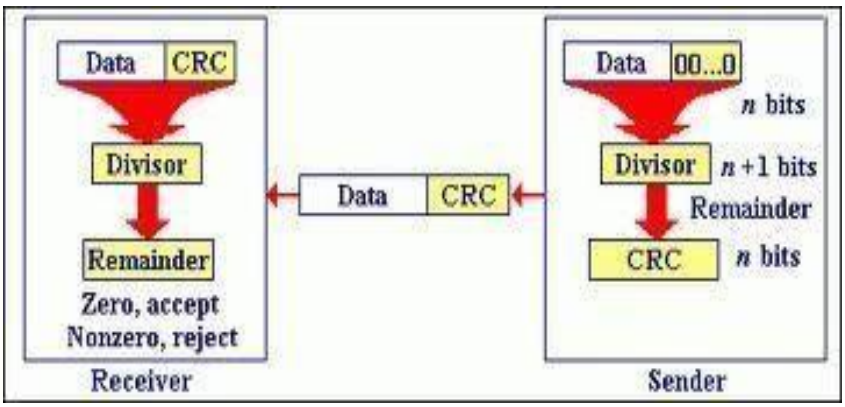
3. Implementation of error-detection technique - CRC

Objective

Learn error detection concepts, to choose Pattern P (divisor for CRC algorithms) and to generate Frame Check Sequence (FCS which is to be added at end of the message bits

Procedure

- Choose n and k(number of msg bits) value
- Where (n-k) is the frame check sequence (FCS) size.
- Choose pattern P where as it should be atleast one bit greater than the FCS.
- LSB and MSB in P should be 1.
- Divide the msg bit by P. Add the remainder with the msg bit.
- At the receiver end the transmitted data is divided by the same pattern P.
- If the remainder is zero, No Error in the code Otherwise Error is detected.



4. Implementation of error-correction technique - Hamming code

Objective

Learn error Correction concepts

Procedure

- calculate the redundancy bit r1,r2,r4 and r8
- Calculate the parity for each parity bit (a ? represents the bit position being set):
- Position 1 checks bits 1,3,5,7,9,11:

  ? _ 1 _ 001 _ 1 0 1 0. Even parity so set position 1 to a 0: 0 _ 1 _ 001 _ 1 0 1 0
- Position 2 checks bits 2,3,6,7,10,11:

  0 ? 1 _ 0 0 1 _ 1 0 1 0. Odd parity so set position 2 to a 1: 0 1 1 _ 0 0 1 _ 1 0 1 0
- Position 4 checks bits 4,5,6,7,12:

  0 1 1? 0 0 1 _ 1 0 1 0. Odd parity so set position 4 to a 1: 0 1 11 0 0 1 _ 1 0 1 0
- Position 8 checks bits 8,9,10,11,12:

  0 1 11 0 01 ? 1 0 1 0. Even parity so set position 8 to a 0: 0 1 11 0 0 1 0 1 0 1 0
- Code word: 011100101010.
- Error Detection and correction
  - Calculate r1,r2,r4 and r8.
  - if r1,r2,r4 and r8 are zero, No single bit error occurred.
  - By using these check bit values we can detect the error bit position.

5. Implementation and analysis of Sliding window protocols

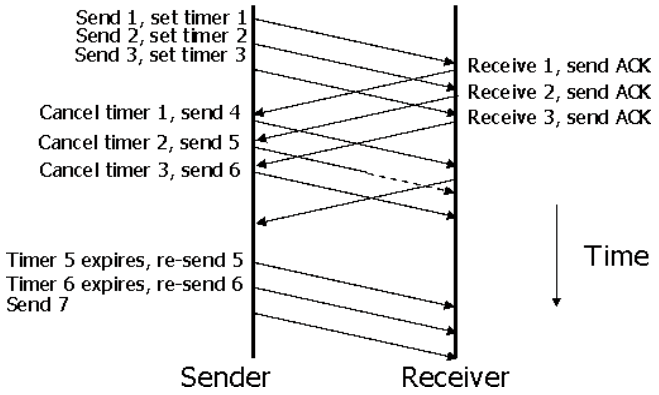
Objective

Learn transmission control protocols

Go Back n

- Divide the input data in to n packets
- Predetermined number of packets k should be sent to the receiver without ACK.
- Send will be waiting for the ACK , until it receives ACK.
- If ACK is missed for the any PKT r , all the pkts after r will be retransmitted.

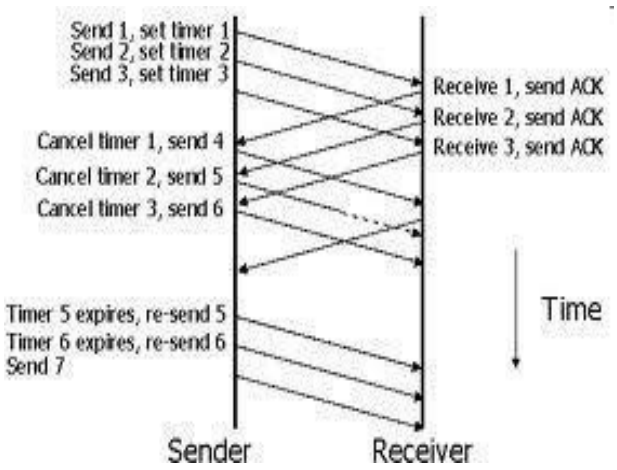
Picture of Go-back-n/Sliding Window



Selective Repeat

- Divide the input data in to n packets
- Predetermined number of packets k should be sent to the receiver without ACK.
- Send will be waiting for the ACK , until it receives ACK.

If ACK is missed for the any PKT r , the pkt r alone will be retransmitted



6. Implementation of Dynamic Host Configuration Protocol

Objective

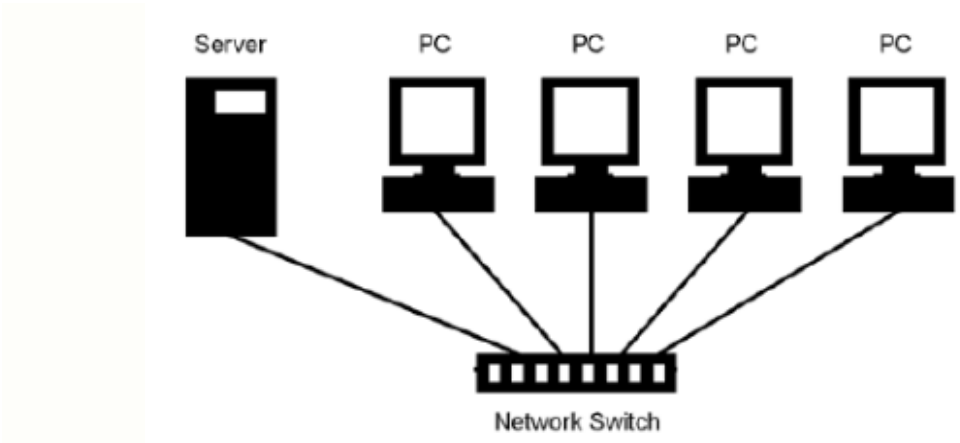
Learn the DHCP working Principle

Procedure

- A network administrator reserves a range of IP addresses for DHCP, and each DHCP client on the LAN is configured to request an IP address from the DHCP server during network initialization.
- The request-and-grant process uses a lease concept with a controllable time period, allowing the DHCP server to reclaim (and then reallocate) IP addresses that are not renewed
- Automatic allocation

  The DHCP server permanently assigns an IP address to a requesting client from the range defined by the administrator. This is like dynamic allocation, but the DHCP server keeps at able of past IP address assignments, so that it can preferentially assign to a client the same IPaddress that the client previously had.
- Manual allocation (commonly called static allocation)

  The DHCP server is disabled and the administrator allocates a private IP address based on a preconfigured mapping to each client's MAC address. This feature is variously called static DHCP



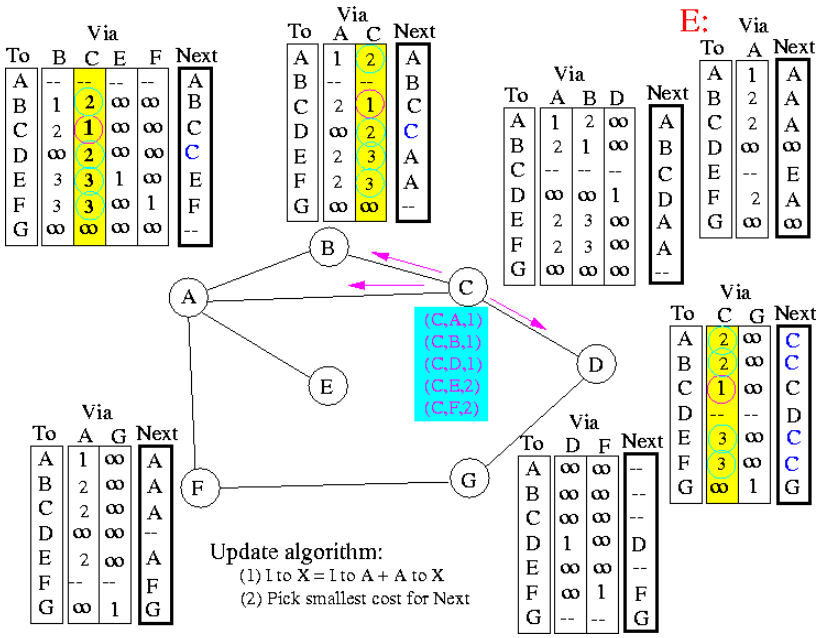
7. Implementation and analysis of Distance vector routing

Objective

Learn the working principle of Distance Vector Routing and analysis

Procedure

- Routers using distance-vector protocol do not have knowledge of the entire path to a destination
- Simulation of Distance vector routing protocols by constructing and displaying the routing table at each node



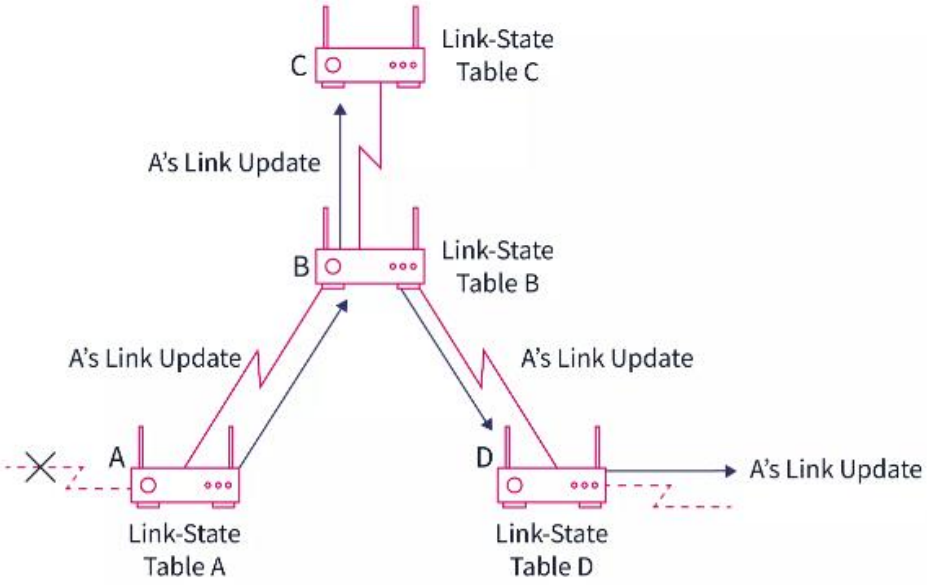
8. Implementation and analysis of Link State Routing

Objective

Learn the working principle of Link State Routing and analysis

Procedure

- Routers using Link state routing protocol have knowledge of the entire path to a destination
- Simulation of Link state routing protocols by constructing and displaying the routing table(LSB)



Link State Routing Algo

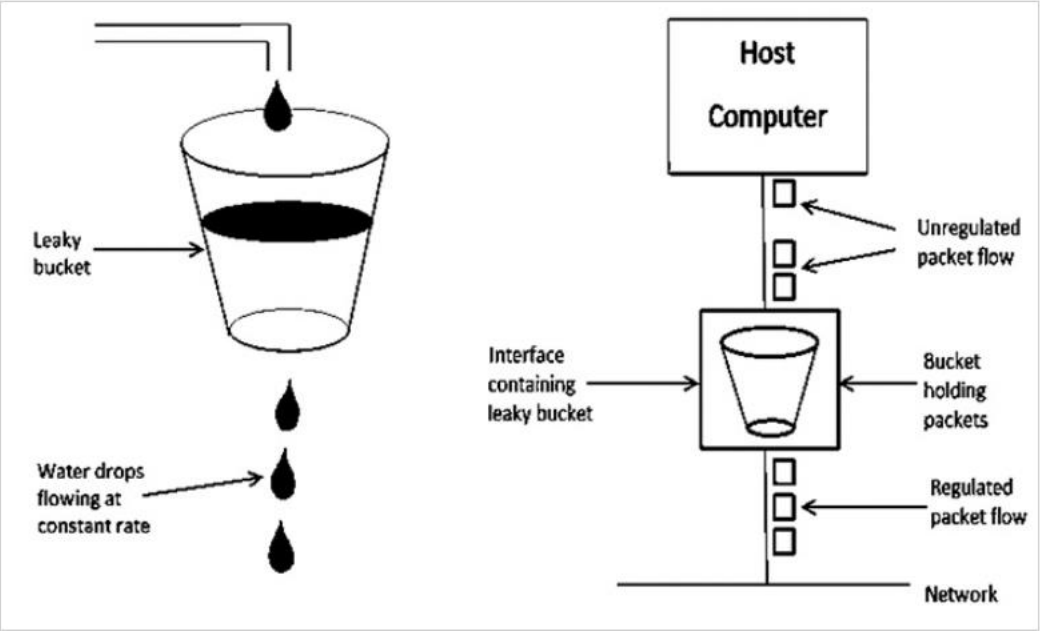
9. Implementation and analysis of Leaky bucket and Token bucket congestion control algorithms

Objective

Learn the working principle of Leaky bucket and Token Bucket congestion control

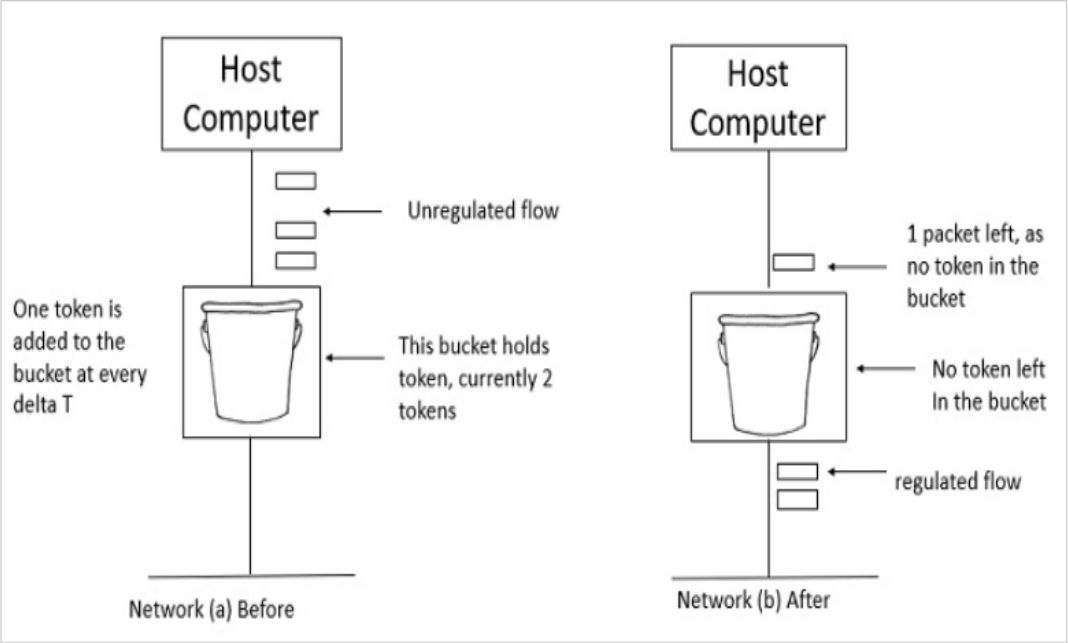
Procedure

- Let us imagine a bucket with a small hole at the bottom where the rate at which water is poured into the bucket is not constant and can vary but it leaks from the bucket at a constant rate.
- So (up to water is present in the bucket), the rate at which the water leaks does not depend on the rate at which the water is input to the bucket.
- If the bucket is full, additional water that enters into the bucket that spills over the sides and is lost.
- Thus the same concept applied to packets in the network.



Procedure

- In regular intervals tokens are thrown into the bucket f.
- The bucket has a maximum capacity f.
- If the packet is ready, then a token is removed from the bucket, and the packet is sent.
- Suppose, if there is no token in the bucket, the packet cannot be sent



10. Implementation of DNS lookup

Objective

Learn the working principle of DNS Lookup

Procedure

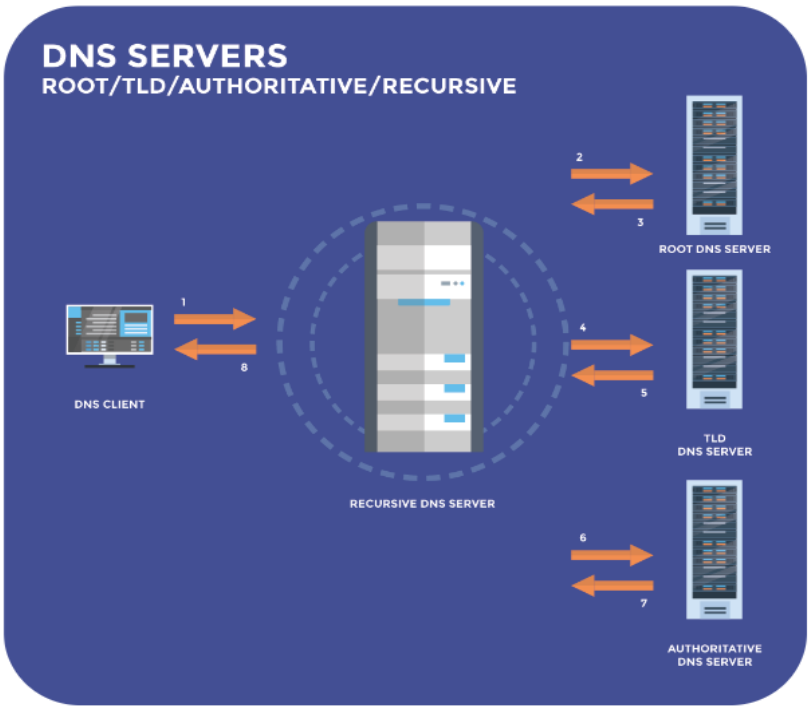
- There are two different types of DNS lookups
  - Forward DNS
  - Reverse DNS

✓ Forward DNS Lookups

- Forward DNS (also known as a forward DNS lookup) is a request that is used to obtain an IP address by searching the domain. This follows the standard DNS query journey when the user types in a web page or sends an email and is provided with the related IP address.

✓ Reverse DNS Lookup

- Reverse DNS is the exact opposite of forward DNS. It is a lookup request that is used to obtain the domain name related to an IP address. Reverse lookups are typically used by email servers to ensure that the servers they are receiving messages from are valid.



11. Implementation of secured file transfer

Objective

To encrypt a plain text using a key and transmit the cipher text; decrypt the cipher text at the receiver side to get back the original message (Hint: Use Ceaser Cipher)

Procedure

- Get the “key”.
- Replace each character with the character, which is, “key” positions ahead.
- Send the encrypted message.
- Decrypt the message received by replacing each character with the character, which is key positions behind.
- For file transfer, use either TCP or UDP

12. Study of SASTRA network infrastructure

Objective

To study and understand the architecture, topology adopted in SASTRA’s infrastructure.

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