DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

College of Engineering and Technology,

SRM Institute of Science and Technology.

MINI PROJECT REPORT

EVEN Semester, 2020-21

Lab code & Name : **18ECC302J – Microwave and Optical Communications**

Year & Semester : **3rd,6th**

Project Title : Optical characteristic comparison of Bus and Star Topology

Lab Supervisor **: Dr. Neelaveni Ammal**

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Reg. No→ Mark split up ↓	118	120	124
Novelty in the project work (2 marks)			
Level of understanding (4 marks)			
Contribution to the project (2 Marks)			
Report writing (2 Marks)			
Total (10 Marks)			

Date: **Signature of Lab Supervisor**

TITLE:

Comparison of bus and star distribution system.

OBJECTIVE:

To form comparison showing total channel loss against the number of nodes for bus distribution system and star distribution system.

ABSTRACT:

Channel Loss occurs in any form of communication. In practical applications, channel loss can never be zero, but we can try to minimize the channel loss as much as we can. We compare two distribution networks – Bus and Star Topologies and plot a graph for both the topologies; Total Channel loss versus number of nodes present in the topology. Default parameter values are defined and then individually formulated for BUS and STAR, and finally, comparison graph is plotted. The code is programmed in SCILAB.

INTRODUCTION:

A star network is an implementation of a spoke–hub distribution paradigm in computer networks. In a star network, every host is connected to a central hub. In its simplest form, one central hub acts as a conduit to transmit messages. The star network is one of the most common computer network topologies.

The hub and hosts, and the transmission lines between them, form a graph with the topology of a star. Data on a star network passes through the hub before continuing to its destination. The hub manages and controls all functions of the network. It also acts as a repeater for the data flow. The star communication network has several participants. Each of these participants enables two-way communication between each of the nodes or people that are participating in the network. All the individuals in this network communicate with each other freely, permanently, and regularly.

Advantages:
If one node or its connection breaks, it does not affect the other computers nor their connections.
Works well under heavy load.
Appropriate for a large network.
No disruptions to the network when connecting or removing devices.
Each device requires just one port i.e. to attach to the hub.

Disadvantages:
Extra hardware is required (hubs or switches) which adds to cost

If the connecting network device (network switch) fails, nodes attached are disabled and can't participate in network communication.
The central hub is a single point of failure for the network.
Hub requires more resources and regular maintenance because it's the central system of star .

A bus network is a network topology in which nodes are directly connected to a common half-duplex link called a bus.

A host on a bus network is called a station. In a bus network, every station will receive all network traffic, and the traffic generated by each station has equal transmission priority.[3] A bus network forms a single network segment and collision domain. In order for nodes to share the bus, they use a medium access control technology such as carrier-sense multiple access (CSMA) or a bus master.

Advantages:

Very easy to connect a computer or peripheral to a linear bus.
It is easy to connect or remove devices in this network without affecting any other device.
Requires less cable length than a star network resulting in lower costs.
The linear architecture is very simple and reliable.
It works well for small networks.
It is easy to extend by joining cable with connector or repeater.

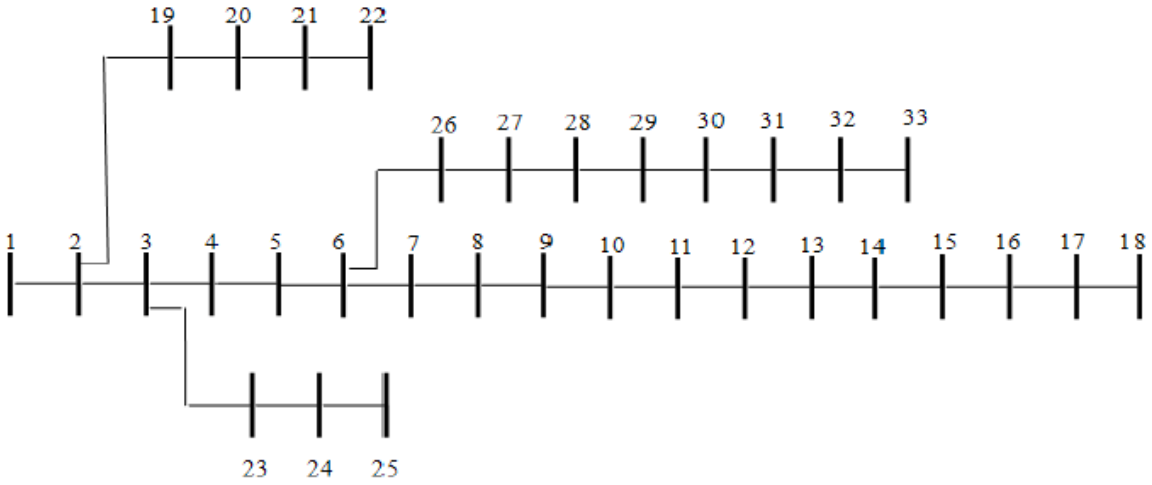
Disadvantages:
Collisions occur in the network resulting in packet loss.
Bandwidth is shared among nodes; Performance may degrade with many nodes on the network.
It is difficult to isolate faults in the network.
But the main issue with this cable is that, if anyhow one of the devices stops working then the whole system will be down.
Same is the case with the cable. If it is unpluggd at any end then it will put down the whole system.
If any link or segment of the bus is severed, depending on how the system has been designed, all network transmission may fail due to signal reflection caused by the lack of electrical termination.

HARDWARE/SOFTWARE REQUIREMENT & DESCRIPTION:

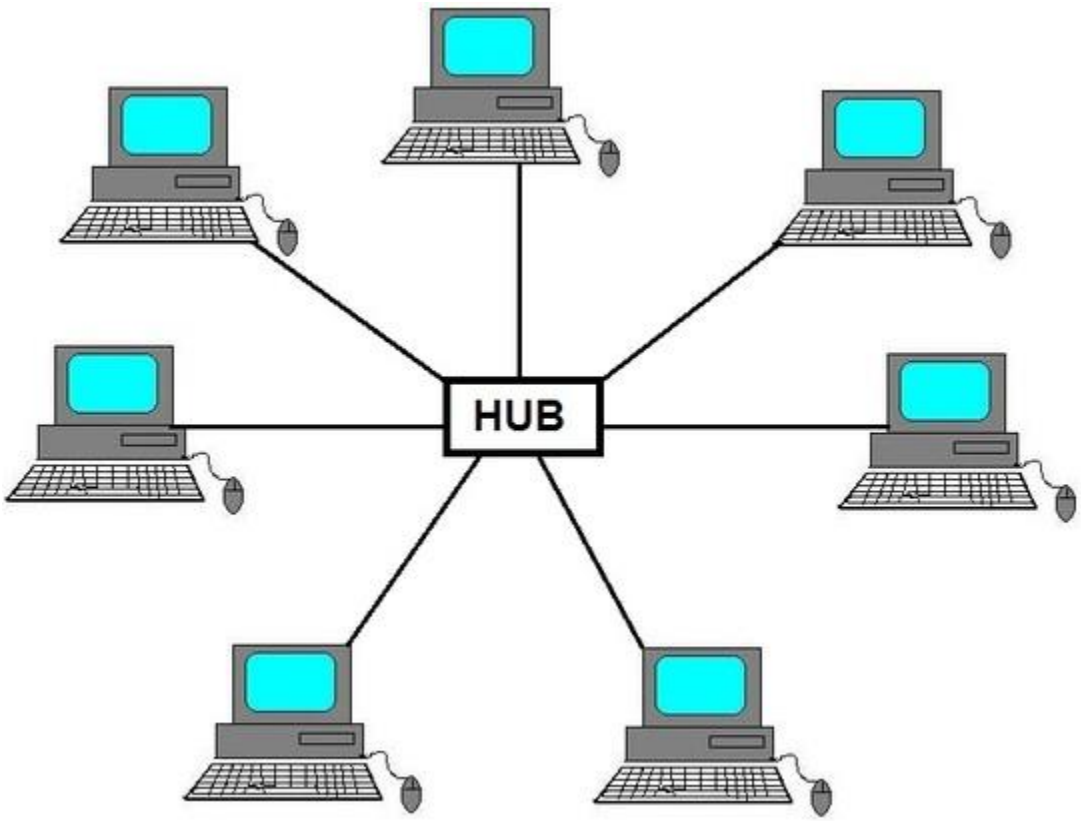
SCILAB v6.1.0

BLOCK DIAGRAM/ INTERFACE DIAGRAM:

Bus:



Star:



REALLISTIC CONSTRANTS:

Channel loss when calculated under practical circumstances, efficiency will be lesser than the expected efficiency. Since we are performing a simulation by giving the values, efficiency will be 100%. Expected output values will match the theoretical values.

APPROACH/METHODOLOGY:

Formula's Used:

1. In Bus Distribution:
   L_c = -10 log(1-Fc) -- connecting loss L_c
   L_{tap} = 10 log CT -- tap loss
   Lthru = -10 log $(1 - CT)^2$
   = -20 log (1 - CT) -- throughput coupling loss L_{thru}
2. In Star Distribution:
   Splitting loss = L_{split} = -10log(1/N) = 10log(N)

$$\text{excess loss} = L_{excess} = 10\log\left(\frac{P_{in}}{\sum_{i=1}^{N} P_{out,i}}\right)$$

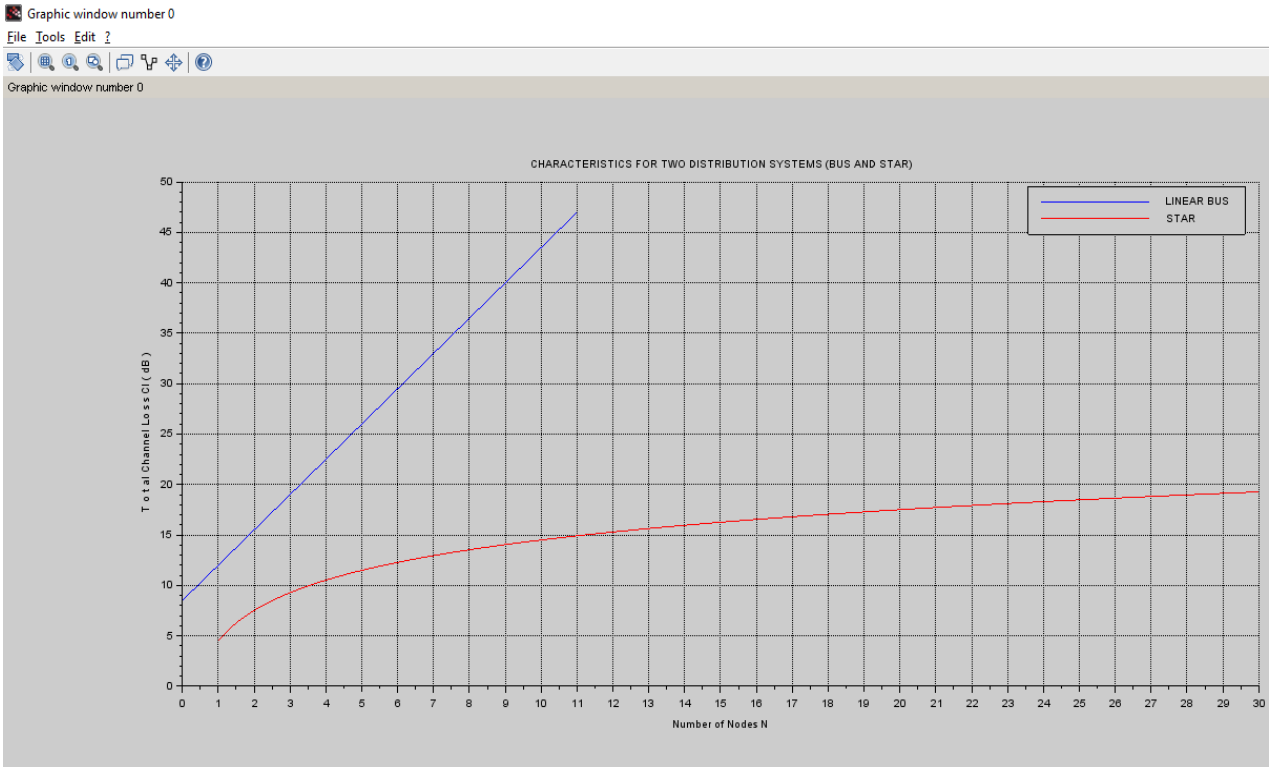
Cl_bus=2*alpha_cr+(N-1)*alpha_fc*L_bu+(2*alpha_cr+L_ac)*(N-3)+(2*alpha_cr+L_tr)+L_sp+alpha_cr
Cl_star =4* alpha_cr + alpha_fc * L_st +10* log10 (N) + L_ex

Where,
alpha_cr : CONNECTOR LOSS
alpha_fc : FIBER CABLE LOSS
L_bu : FIBER LENGTH
L_tr : ACCESS COUPLER TAP RATIO
L_sp : SPLITTER LOSS
L_ac : ACCESS COUPLER INSERTION LOSS
L_st : TOTAL FIBER LENGTH IN STAR ARMS
L_ex : STAR COUPLER EXCESS LOSS

PROGRAM AND OUTPUT:

```
//Program to form comparison showing to the channel loss against number of nodes for Bus Distribution System and Star Distribution System
clear ;clc ; close ;
// Given da ta
alpha_cr =1; //dB − CONNECTOR LOSS
alpha_fc =5; //dB/km − FIBER CABLE LOSS
L_bu =0.1 //m − FIBER LENGTH
L_tr =10; //dB − ACCESS COUPLER TAP RATIO
L_sp =3; //dB − SPLITTER LOSS
L_ac =1; //dB − ACCESS COUPLER INSERTION LOSS
L_st =0.1; //m − TOTAL FIBER LENGTH IN STAR ARMS
L_ex =0; //dB − STAR COUPLER EXCESS LOSS
```

```
//Bus Distribution System
N =0:0.01:11;
Cl_bus =2* alpha_cr +( N -1) * alpha_fc * L_bu +(2* alpha_cr + L_ac ) *( N -3) +(2* alpha_cr + L_tr ) + L_sp + alpha_cr ;
Hm =abs( Cl_bus );
figure ;
plot2d (N , Hm ,2) ;
// Star Distribution System
N =1:0.01:30;
Cl_star =4* alpha_cr + alpha_fc * L_st +10* log10 (N ) + L_ex ;
Hm =abs( Cl_star ) ;
plot2d (N , Hm ,5) ;
xlabel ( ' Number of Nodes N ' ) ;
ylabel ( ' Total Channel Loss Cl ( dB ) ' ) ;
title ( 'CHARACTERISTICS FOR TWO DISTRIBUTION SYSTEMS (BUS AND STAR) ') ;
xgrid (1) ;
 h = legend (['LINEAR BUS ' ; 'STAR ' ]) ;
```



RESULT:

Thus, the characteristics for the 2 distribution systems – Star and Bus were obtained through the graph, using SCILAB code.

REFERENCES:

1. https://en.wikipedia.org/wiki/Star_network
2. https://en.wikipedia.org/wiki/Bus_network#:~:text=A%20bus%20network%20is%20a,station%20has%20equal%20transmission%20priority
3. http://pongsak.ee.engr.tu.ac.th/le426/doc/OptCommC13.pdf (Formulas Reference)
4. https://scilab.in/textbook_companion/generate_book/401 (Source for Project)
5. https://en.wikipedia.org/wiki/Scilab

APPENDIX:

Scilab is a high-level, numerically oriented programming language. The language provides an interpreted programming environment, with matrices as the main data type. By using matrix-based computation, dynamic typing, and automatic memory management, many numerical problems may be expressed in a reduced number of code lines, as compared to similar solutions using traditional languages, such as Fortran, C, or C++.

This allows users to rapidly construct models for a range of mathematical problems. While the language provides simple matrix operations such as multiplication, the Scilab package also provides a library of high-level operations such as correlation and complex multidimensional arithmetic. The software can be used for signal processing, statistical analysis, image enhancement, fluid dynamics simulations, and numerical optimization. Scilab is one of the two major open-source alternatives to MATLAB, the other one being GNU Octave.

Fiber optic cable (also referred to as optical fiber cable) transmits data as pulses of light through flexible, optically pure fibers of glass or plastic. It has become a popular choice for Ethernet networking and telecommunications applications thanks to its fast data transmission speeds over long distances.
Fast data transmission, thinner, lighter cables and long signal range are just a few of the benefits that make fiber optic cable a solid choice for corporate data networking and telecommunications.
Only a simulation of the program is done using the open source tool SCILAB.