Introduction to Storage Systems Part 2, Bus Topologies

In computer technology, BUS is an interconnect that helps data to be transferred between CPU and different peripherals or between computers. a BUS fascilitates an organized and usually co-operative access on resources. in contrast to point to point connections, a BUS can logically accomodate several peripherals irrespective of their type and functionality as long as it confirms to the rules specified by the BUS specificaton. While learning about storage domain, different types of BUS technologies and standards come in to picture. Let's take a closer look in to the different BUS standards used in storage technologies.

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Common BUS Topologies

The BUS topology describes how peripherals are connected to the BUS physically. Usually, in a topology there will have one or more BUS Masters (usually CPU) and at least one Slave device (usually peripheral). In some interconnect mechanisms, peripherals are also can be masters on the BUS. This facilitates transactions to be initiated at peripherals will in contrast to some mechanisms where CPU is the only Master and all transactions needed to be initiated by the CPU. The physical structure of the BUS (All devices directly connected to single data path) puts it in a position where all the connected devices must be highly co-operative. Any malfunctioning device may put the functionality of the BUS in risk unless the situation is handled properly. Following are the most common BUS topologies used..

- Multi Drop
- Daisy Chain
- Switched Hub

Multi Drop

In Multi Drop topology, the devices are connected parallel on the BUS. The data transmitted by any device will be presented to all the other devices and it is up to each device whether it should accept or reject the data. If the data on the BUS matches with the criterion as per a device's requirements, the device may read in the data for further processing. Other wise the device will stay inactive as if no data is available on the BUS. A bus contention can happen if more than one device tries to transmit something on the BUS. To avoid this, Multi Drop Buses usually incorporate some kind of collision detection and correction mechanism as a part of the bus implementation. A very popular example for this is the CSMA/CD (Carrier sense multiple access with collision detection) implemented in Ethernet. In single master environments chances of collision are less unless more than one slave devices has got the same address or ID. But

mostly this happens by a mistake only. The following picture shows a basic Multi Drop bus topology.

Daisy Chain

Unlike in Multi Drop topology, Daisy Chain topology does not share a common data path among the connected devices. In this topology, each device is connected to two adjacent devices. Exception for this observation is the devices connected at the two ends of the topology. The following diagram will help to get a clear idea of how Daisy Chain topology looks like.

The major advantage of Daisy chain topology is that since it does not have a share data path, bus contention is practically zero. But a major disadvantage is that a device's direct accessibility is restricted to the two immediate peers only. If a device wants to communicate to another device which is not an immediate peer, the first device needs the help of either of the immediate peers. And if any device in the chain fails, the chain will be effectively broken in to two pieces and will be isolated from each other. As a solution for this, if the two devices in the far ends of the chain are connected together, we will get a Ring topology. In Ring topology, failure of one device won't break the entire network since in ring topology, two paths always exist between two devices. But if two devices happen to fail, the network will be broken.

Switched Hub topology

Switched Hub topology uses a Hub as a mediator for communication between devices. All access requests are routed through Hub only. The hub should be intelligent enough to rout the request to appropriate connected device. The following picture a switched hub topology.

The major advantage of this topology is that the chance for collision is virtually zero since all requests are routed through the Hub. And the disadvantages are increased cost due to additional hardware (Hub) and when the number of devices increases, the Hub will become a bottleneck in the network. The most popular examples of networks that use Hub topology are Ethernet and USB.

In the next article in this series, we will be looking in to some popular BUS technologies that is used in computers which are related to storage.