Dynamic connection system

- Can provide connection according need of application.
- Have switch element (multiplexer).
- Access to channel is switching, so can be use for communicate multi nodes.
- For example:

1. Buses (bus-based design).
2. Multi stage network.
3. Cross multiplexer (switch-based).

In general, interconnection networks can be classified as static versus dynamic networks. In static networks, direct fixed links are established among nodes to form a fixed network, while in dynamic networks, connections are established as needed. Switching elements are used to establish connections among inputs and outputs. Depending on the switch settings, different interconnections can be established.

Shared memory systems can be designed using bus-based or switch-based INs. The simplest IN for shared memory systems is the bus. However, the bus may get saturated if multiple processors are trying to access the shared memory (via the bus) simultaneously. A typical bus-based design uses caches to solve the bus contention problem. Other shared memory designs rely on switches for interconnection.

Message passing INs can be divided into static and dynamic. Static networks form all connections when the system is designed rather than when the connection is needed. In a static network, messages must be routed along established links.

Dynamic INs establishes a connection between two or more nodes on the fly as messages are routed along the links. The number of hops in a path from source to destination node is equal to the number of point-to-point links a message must traverse to reach its destination. In either static or dynamic networks, a single message may have to hop through intermediate processors on its way to its destination.

Basic properties of dynamic system

- Timing:

1. Synchronous (with clock).
2. Asynchronous (handshake, interlocking).

- switching:

1. Circuit (path is allocate for each transmission), (low latency).
2. Packet (data are encapsulate into packet, transfer independency).

- Control:

1. Centralization.
2. Distributed.

Buses

1. Passive system connected to transfer data between communication nodes.
2. Buses using timing multiplex, transfer media is sharing .
3. In given time communication only two nodes.
4. Low cost, simple realization.
5. Low transmission, bad salability.
6. Weak (never) stability toward fail.

A single bus is considered the simplest way to connect multiprocessor, systems by Single bus system.

In its general form, such a system consists of N processors, each having its own cache, connected by a shared bus. The use of local caches reduces the processor memory traffic. All processors communicate with a single shared memory.

Multi stage linking network (1)

- General structure:

Multistage interconnection networks (MINs) were introduced as a means to improve some of the limitations of the single bus system while keeping the cost within an affordable limit. The most undesirable single bus limitation that MINs is set to improve is the availability of only one single path between the processors and the memory modules. Such MINs provide a number of simultaneous paths between the processors and the memory modules.

A general MIN consists of a number of stages each consisting of a set of 2×2 switching elements. Stages are connected to each other using Inter-stage Connection (ISC) Pattern. These patterns may follow any of the routing In MINs, the routing of a message from a given source to a given destination is based on the destination address (self-routing).

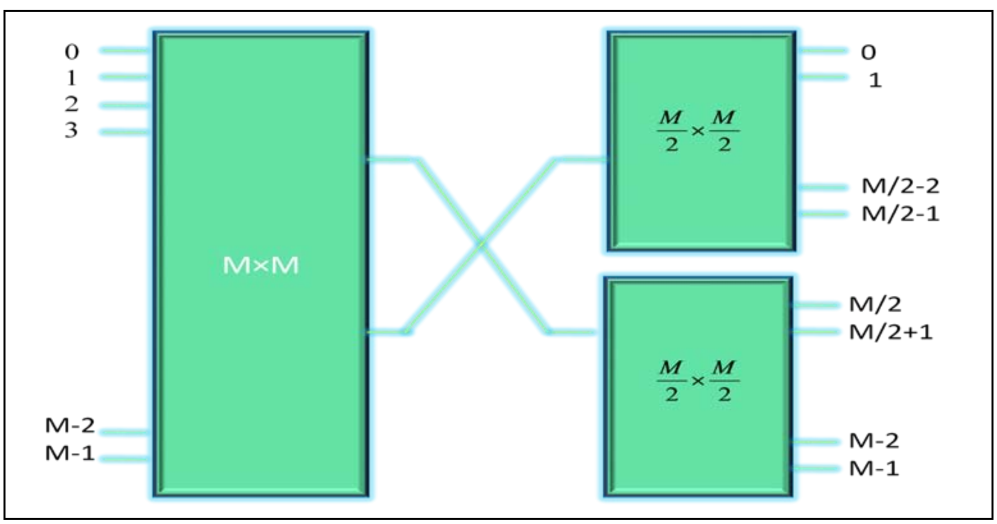
Multi stage linking network (2)

- Switch model:

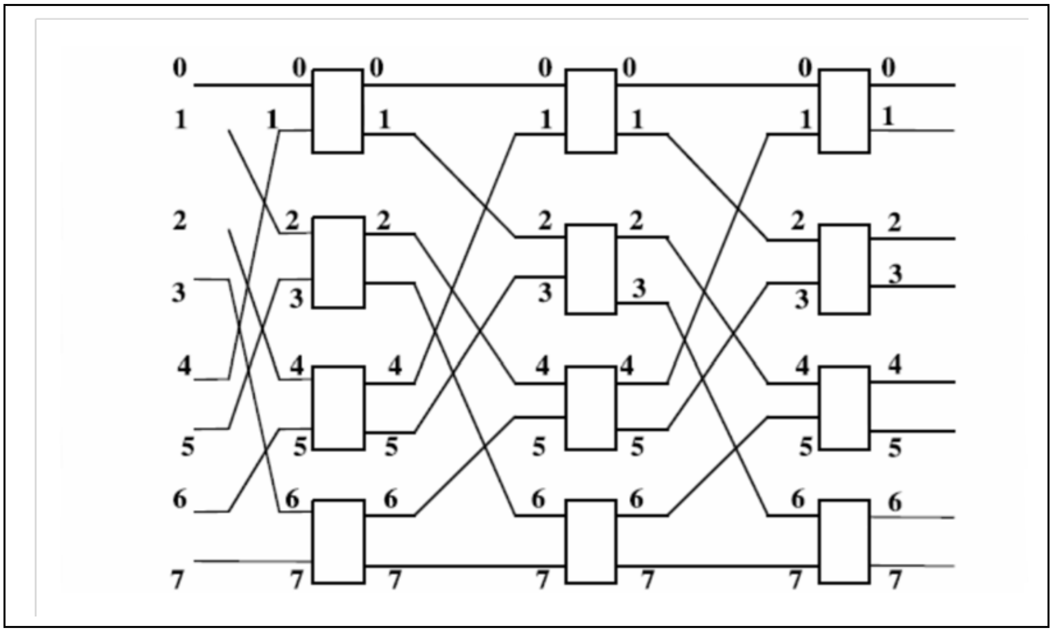
1. Have ***a*** input and ***b*** output.
2. In praxis used a=b=2^k

   Where k= count control signal
3. Can make permutation.
4. Examples: Baseline, Omega.

Baseline model



Omega connection



The omega is a simple dynamic network that connects each of the inputs on the left side to some, but not all, outputs on the right side through a single layer of binary switches represented by the rectangles. The binary switches can direct the message on the left-side input to one of two possible outputs on the right side. If we cascade enough single-stage networks together, they form a completely connected multistage interconnection network (MIN), the omega MIN connects eight sources to eight destinations.

These are dynamic INs because the connection is made on the fly, as needed. In order to connect a source to a destination, we simply use a function of the bits of the source and destination addresses as instructions for dynamically selecting a path through the switches.

The omega MIN, on the other hand, connects N × N pairs with N/2 (log N) components.

The omega MIN, on the other hand requires log N clocks to make a connection. The diameter of the omega MIN is therefore log N.

Cross switch

1. Single Network with N^2 unary switch.
2. Switch element must solve conflict for request a bout current access.
3. Have possibility wire are complex and expensive.
4. Realization is only for small system.
5. Cross multiplexer provides better transmission properties.

A crossbar network represents the other extreme to the limited single bus network. While the single bus can provide only a single connection, the crossbar can provide simultaneous connections among all its inputs and all its outputs. The crossbar contains a switching element (SE) at the intersection of any two lines extended horizontally or vertically inside the switch.

The crossbar switch clearly uses more binary switching components; for example, 2^n components are needed to connect N × N source/destination pairs.

The major advantage of the crossbar switch is its potential for speed. In one clock, a connection can be made between source and destination. The diameter of the crossbar is one.

Both networks (multistage”omega”, cross switching) limit the number of alternate paths between any source/destination pair. This leads to limited fault tolerance and network traffic congestion. If the single path between pairs becomes faulty, that pair cannot communicate. If two pairs attempt to communicate at the same time along a shared path, one pair must wait for the other. This is called blocking, and such MINs are called blocking networks. A network that can handle all possible connections without blocking is called a nonblocking network.

Problem

- **Hot-spot:**

1. Generated addresses are not equally distributed.
2. Multiple nodes want to communicate through small group switch.

- **Dead-lock:**

1. Routing unknown "unknown where we have to send message".
2. Or conflict on switch in network.

- **Live-Lock:**

1. Continue routing unknown (still conflict).