There has always been a need for super computers, for tasks that involve many floating point operations like predicting the weather. With recent technologies, it has become convenient to design parallel computers with off the shelf processors.

When architecting a parallel computing system, one has to look at 4 major design decisions: operation mode, where we decide if we want to operate synchronously, asynchronously or a mix of both, we need to determine if we want a centralized control unit or distributed control, we need to decide if we will be implementing packet switching or circuit switching, and finally, weather we want a static network topology, and if so what kind, or a dynamic network topology that can be reconfigured by setting network switching elements.

Static topologies can be classified according to the dimensional requirement of the layout. For dynamic networks, we can identify 3 classes:

* single stage: composed of single stages of switching elements cascaded
* multi-stage: consists of many stages of switching elements and can be one or two sided. The one sided have I/O on only one side, while the two sided are classified in 3 categories:
  + blocking: where simultaneous connections can impair other
  + rearrangeable: can always create an I/O path regardless of the current occupation
  + nonblocking: can handle all possible connections without blocking
* crossbar: every input port can be connected to any output port without blocking.

Switching and control is implemented in switching elements. The communication has a 2 level hierarchy: the first level involves switching control algorithms that sets the settings on switches for reliable routing from source to destination, the second level handles the handshaking process among switching points.

Routing methods depend on network topology and operation mode used.