Router Architectures
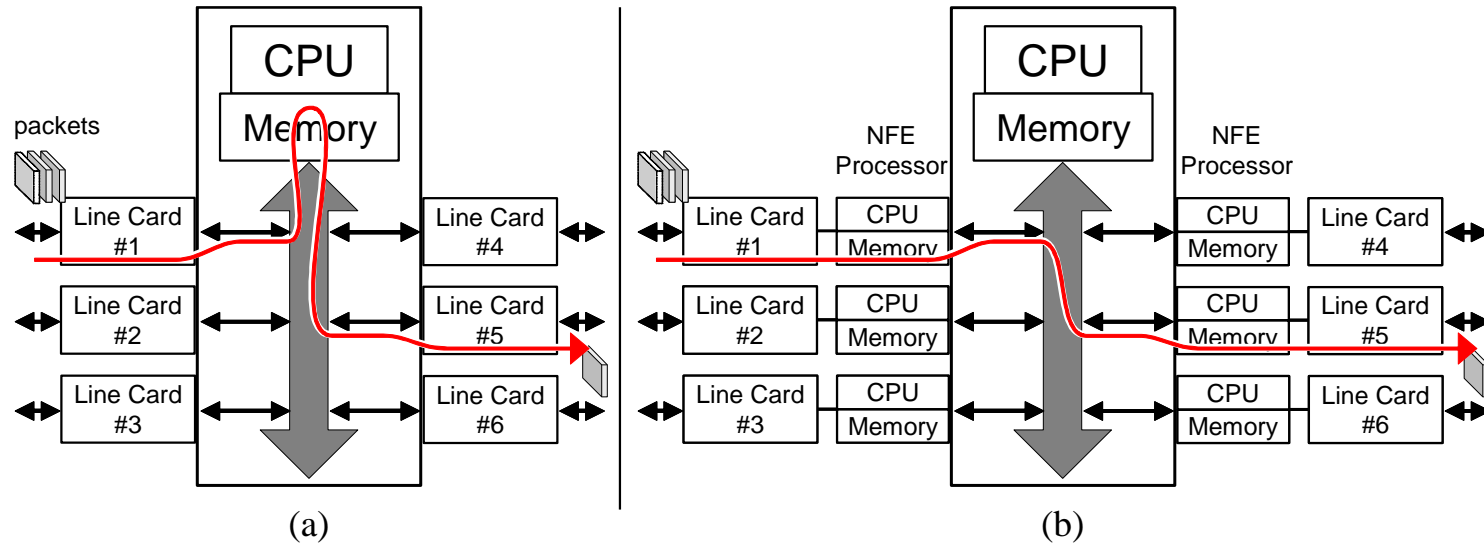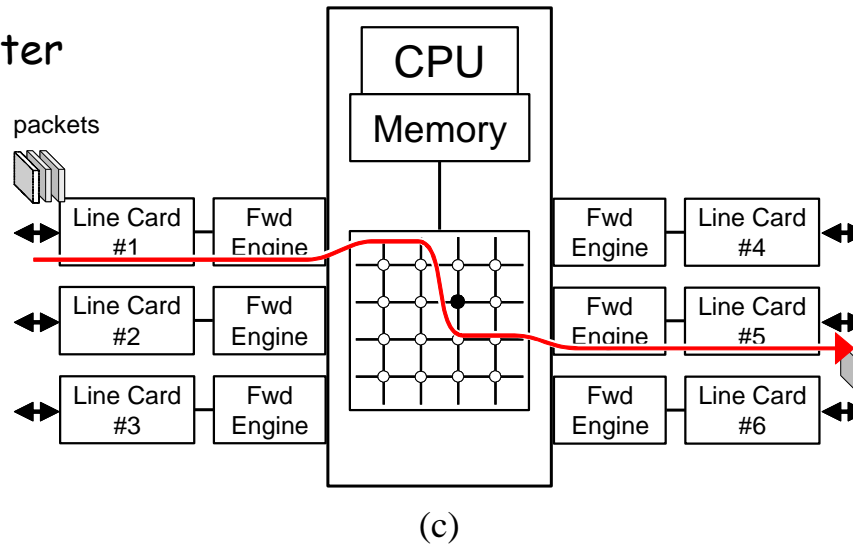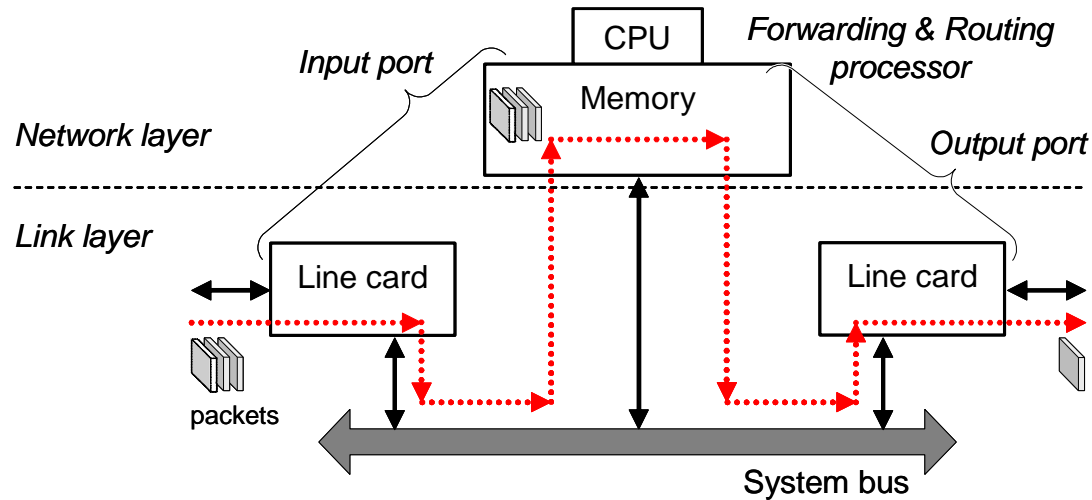

(a)

First generation router

(b)

Second generation router

(c)
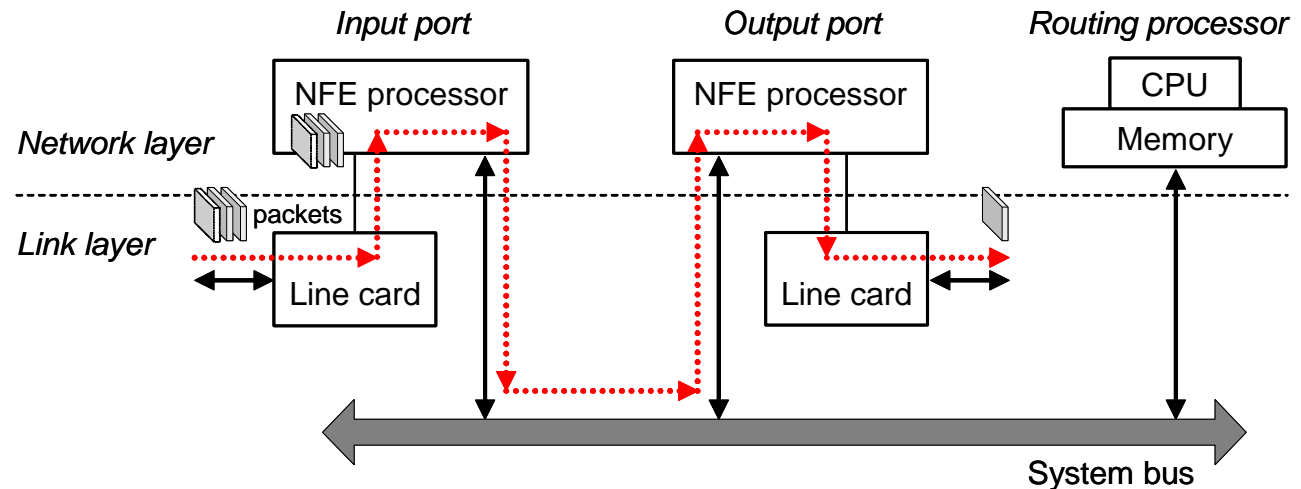
Third generation router

Switching via Memory / via Bus

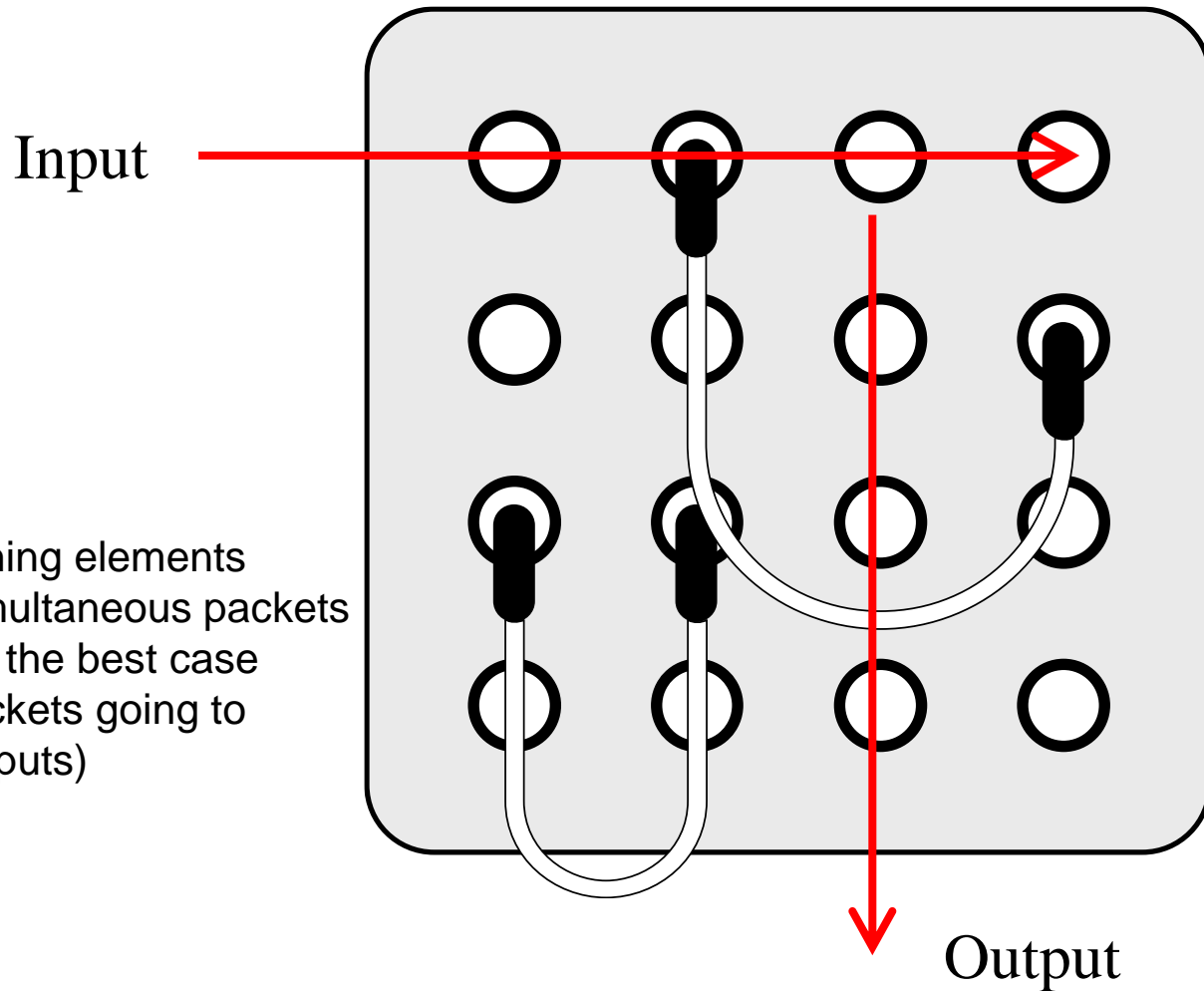

First generation router

Second generation router

Crossbar Switch Fabric

Input
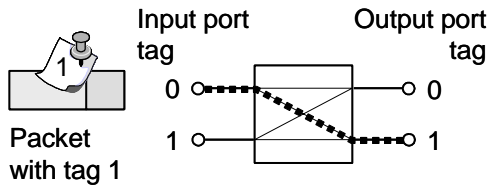
N x N switching elements allows N simultaneous packets switched (in the best case when all packets going to different outputs)
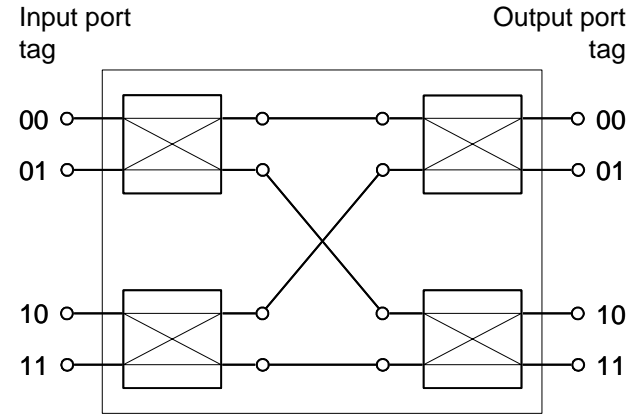
Output

Goal: Reduce # Switching Elements

- System bus (in 1st and 2nd generation arch's) allows only one packet switched at a time

- Crossbar allows up to N packets switched at a time

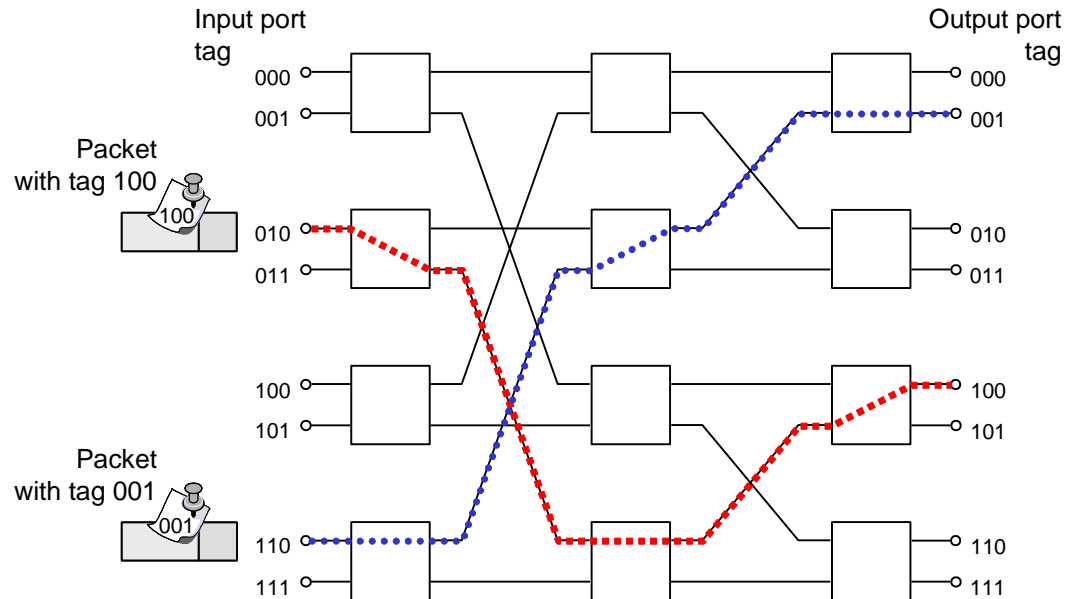- Something in the middle? (+cheaper!)

Banyan Switch Fabric

(a)

(b)

(c)

8x8 Banyan has only 12 switching elements (while 8x8 crossbar requires 64)
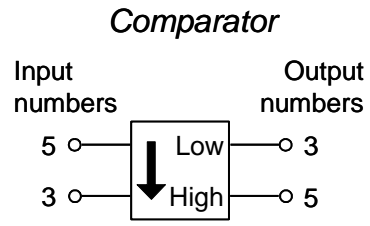But, much greater likelihood of collisions...
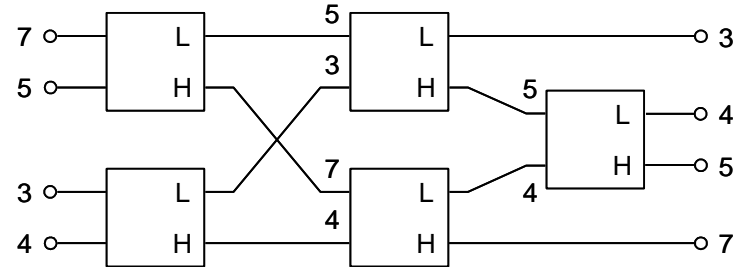
Reducing Collisions

- (Show slide with a collision example)
- Collisions can be reduced if packets are ordered on input ports by their output port number
- The router cannot choose the ordering of arriving packets, but we can insert a sorting hardware between the input network ports and the switching fabric …
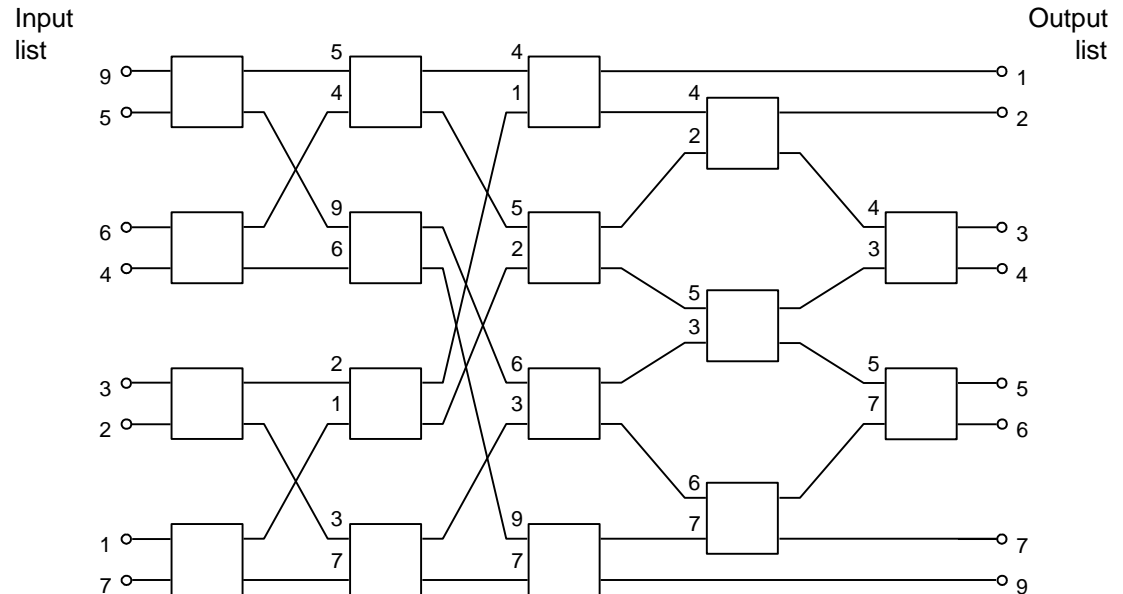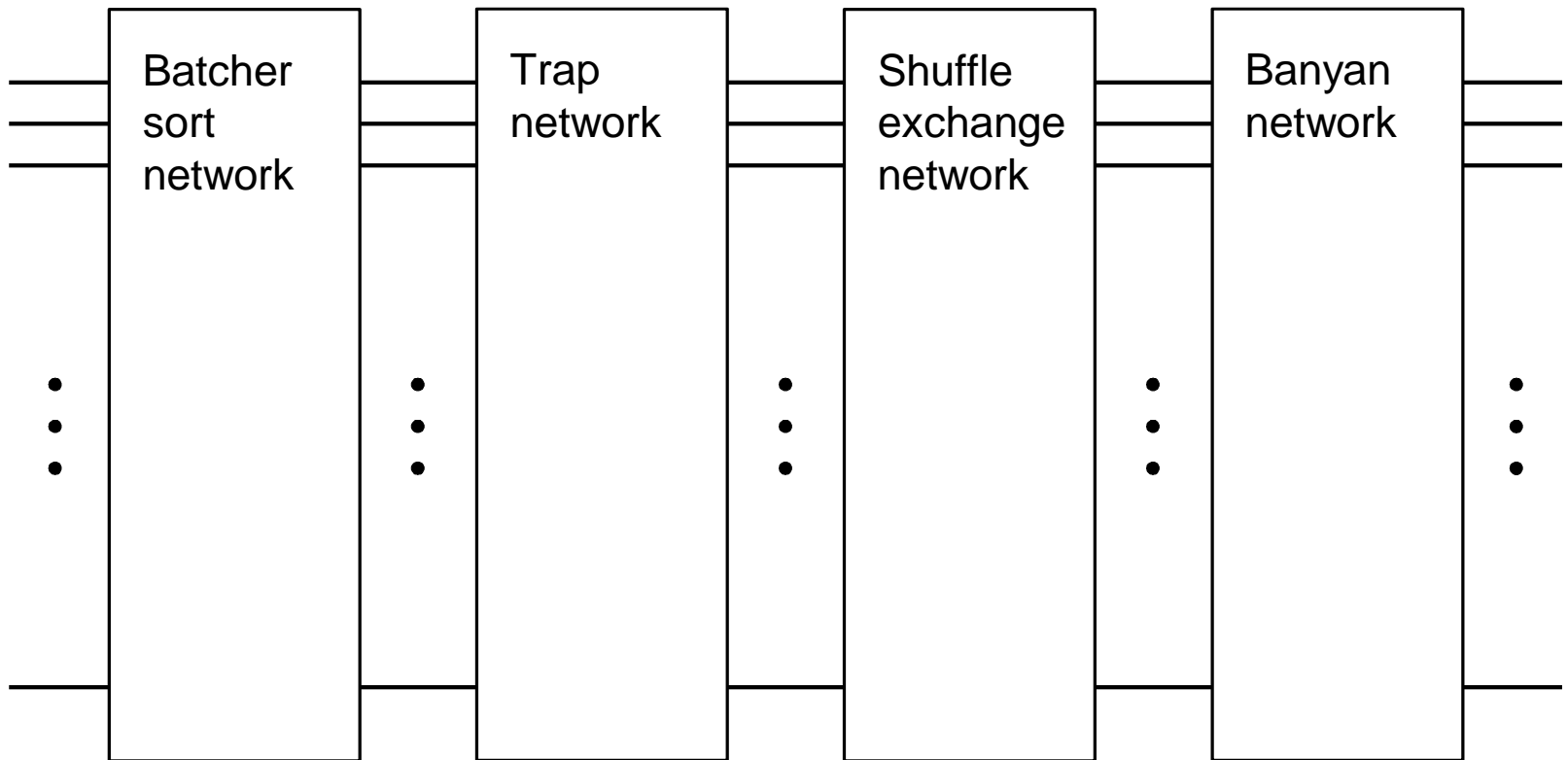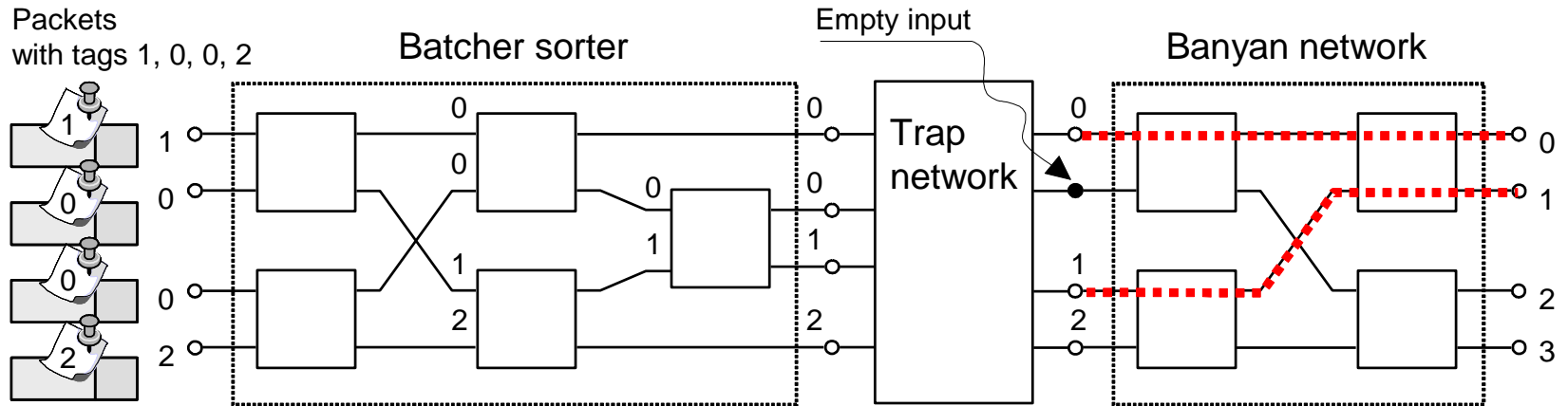
Batcher Network

Batcher-Banyan Network

| Batcher sort network | Trap network | Shuffle exchange network | Banyan network |

Why Batcher-Banyan Network

This figure is meant to illustrate why a concentrator is needed, because otherwise the gap in the input sequence will cause collision in the Banyan, but the example does not work for a 4x4 network -- need an 8x8 network example!!!!