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# A Dynamic Link Allocation Router

Wei Song, Doug Edwards

Advanced Processor Group

The University of Manchester




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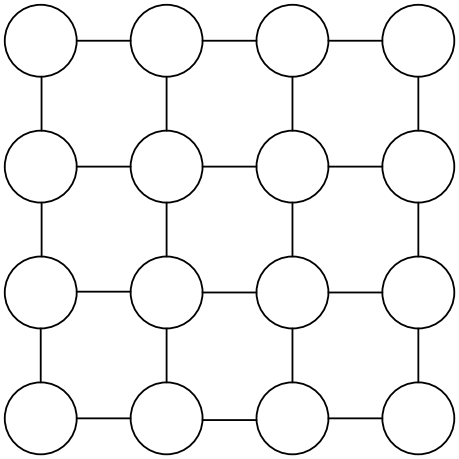
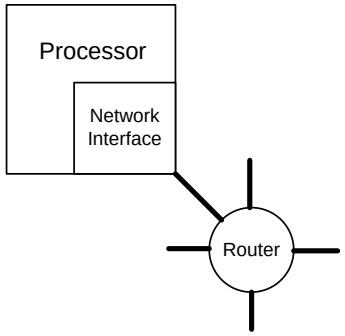
# Overview

- **Network-on-a-Reconfigurable-Chip**
- The Dynamic Link Allocation Flow control method
- The Dynamic Link Allocation Router (DyLAR)
- Conclusion

# The NoRC Platform






- NoRC: network on a reconfigurable chip
- Running multimedia applications
- Connection oriented
- Stochastic routing algorithm
- GALS: fully asynchronous routers linked by CHAIN

# Connection Oriented Routing

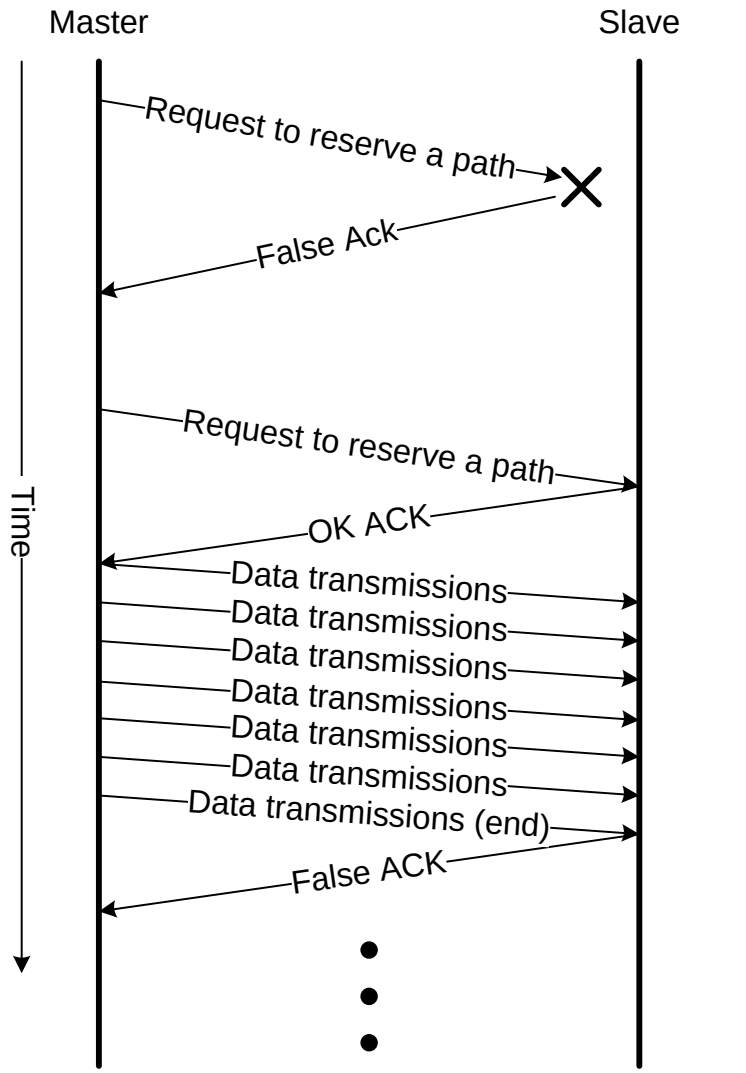
- Flit Definitions

## Request Flit

| data | request content | flit type | flit header |
|---|---|---|---|

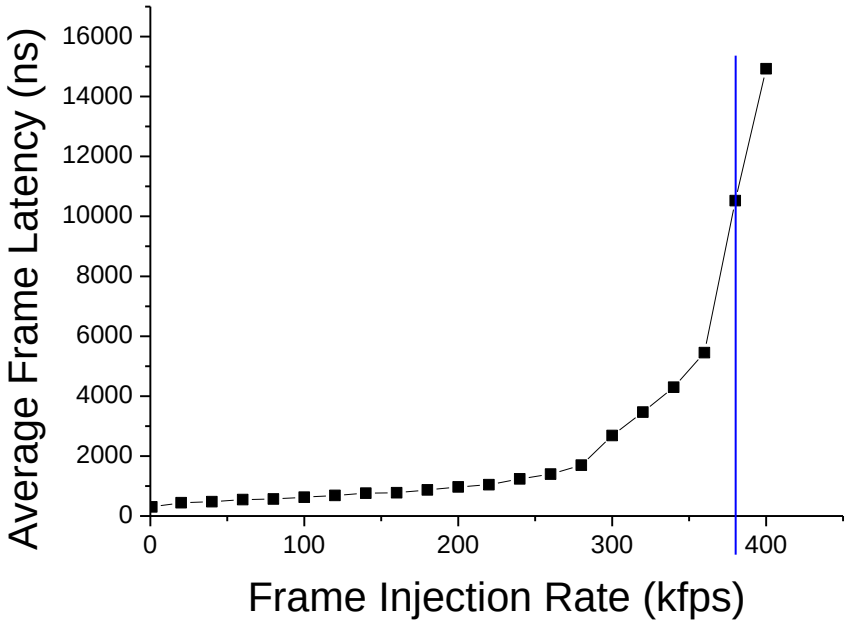
## Other Flits

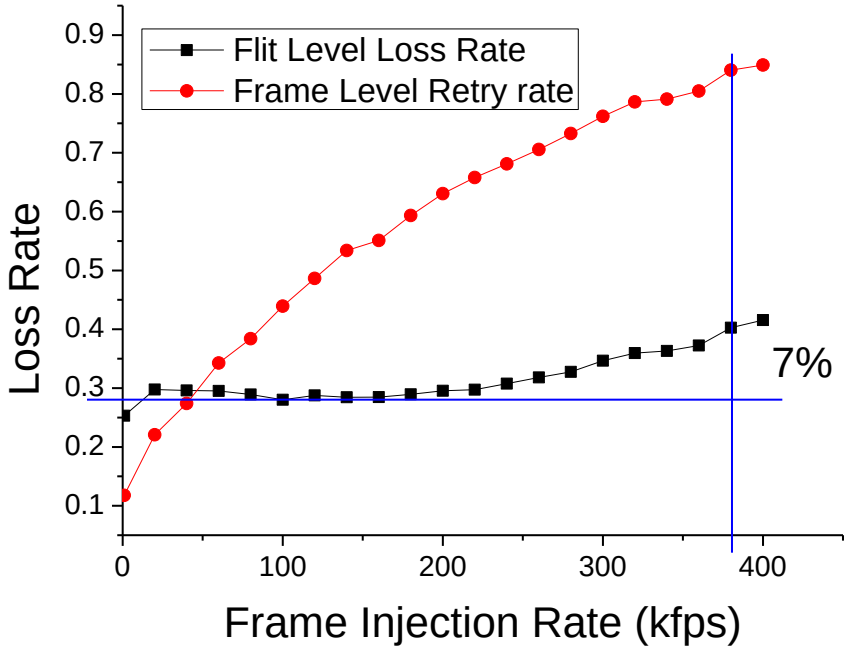
| data | flit type | flit header |
|---|---|---|



# The High Retry Rate

Simulation results of a 6x6 NoC with 12 functions in network.




***Virtual Channels are required to reduce to retry rate.***

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# Major Design Targets

- Implement some kind of virtual channels
- Increase the bandwidth of CHAIN links
- Reduce the area and power of the router

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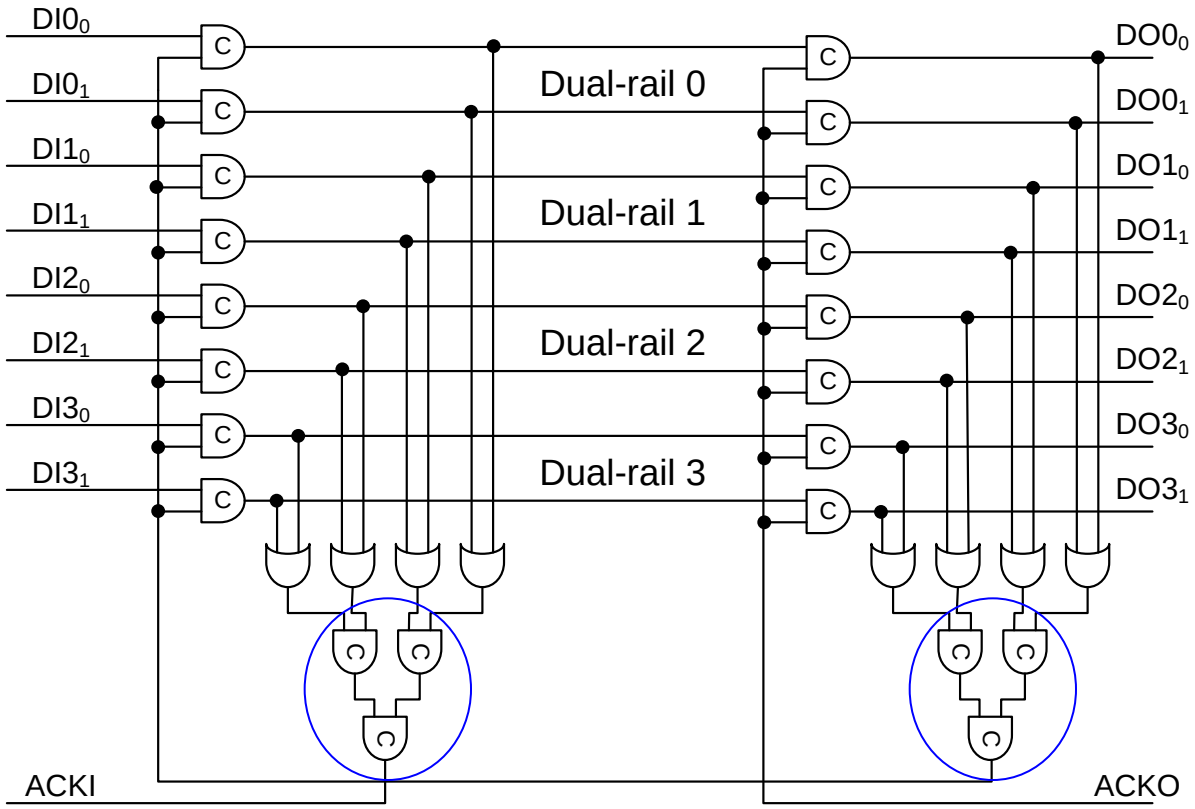
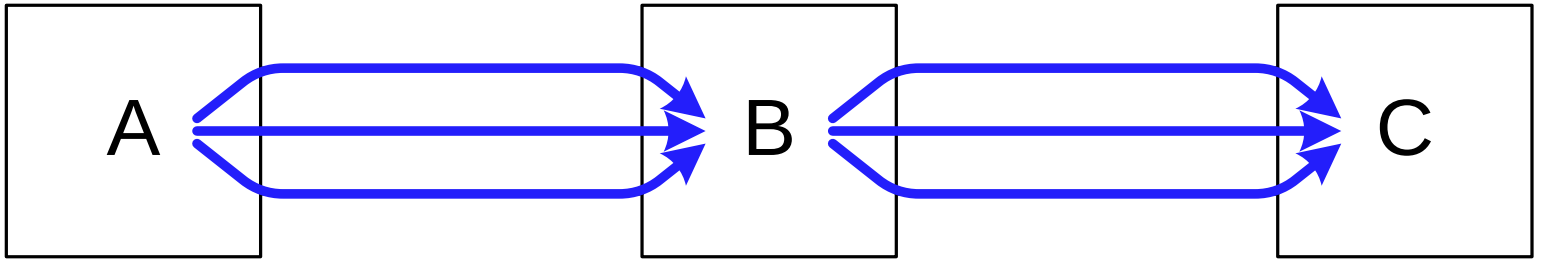
# Increase the bandwidth

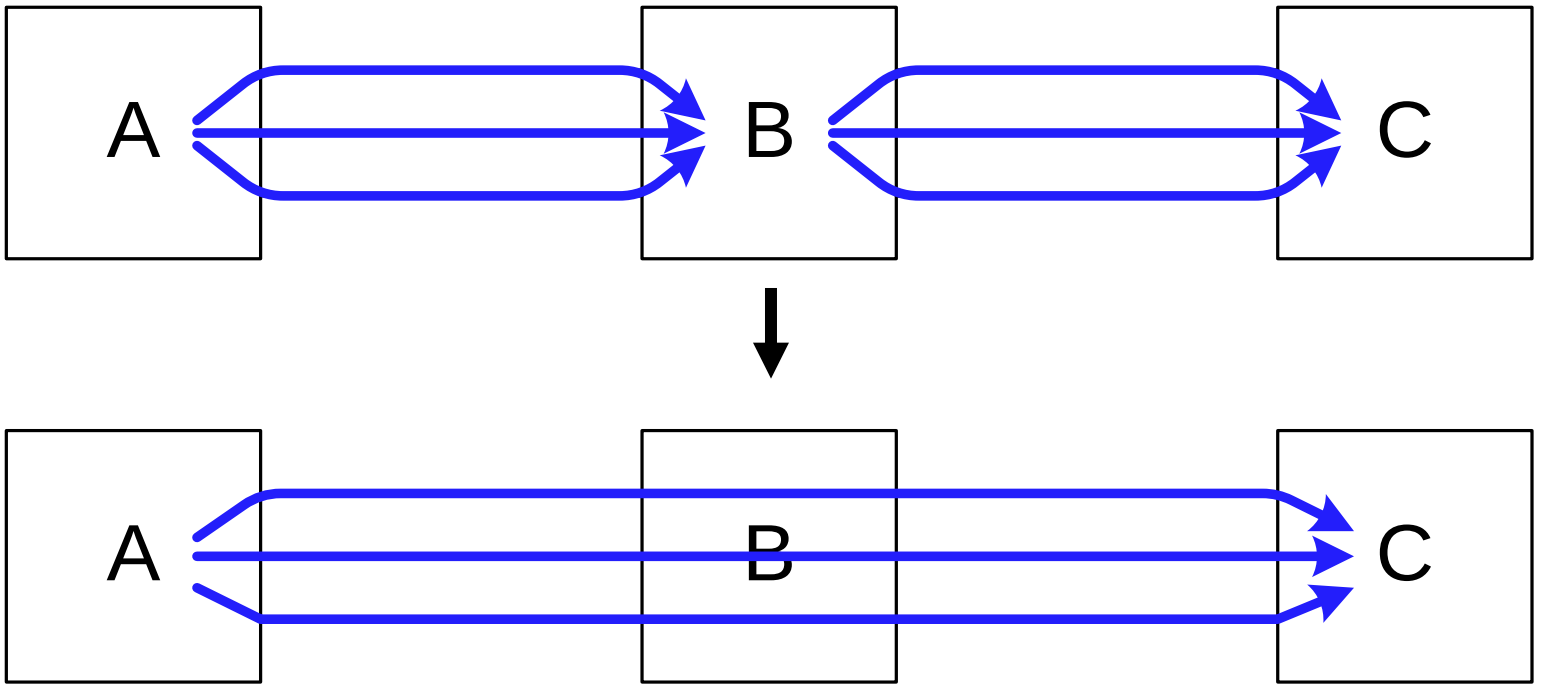



***Asynchronous Links work better with the lower wire count.***

# Increase the bandwidth

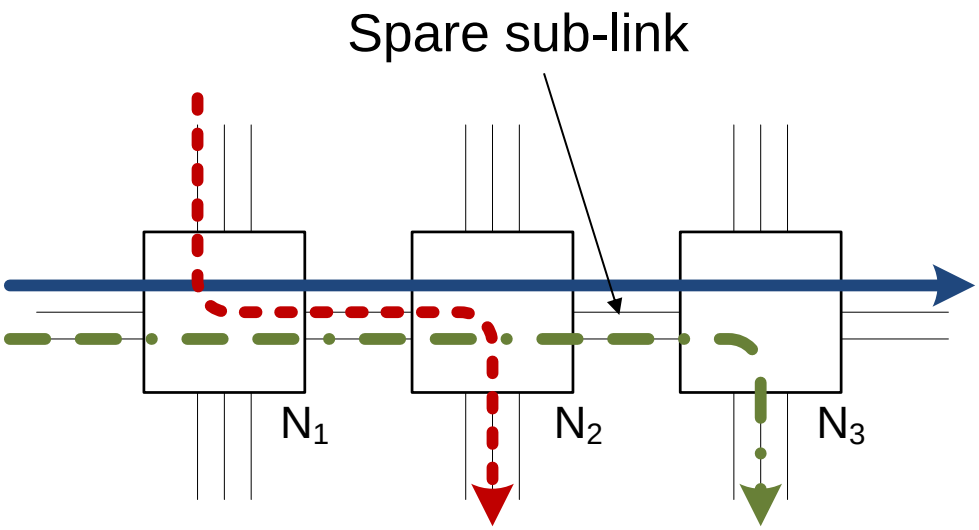


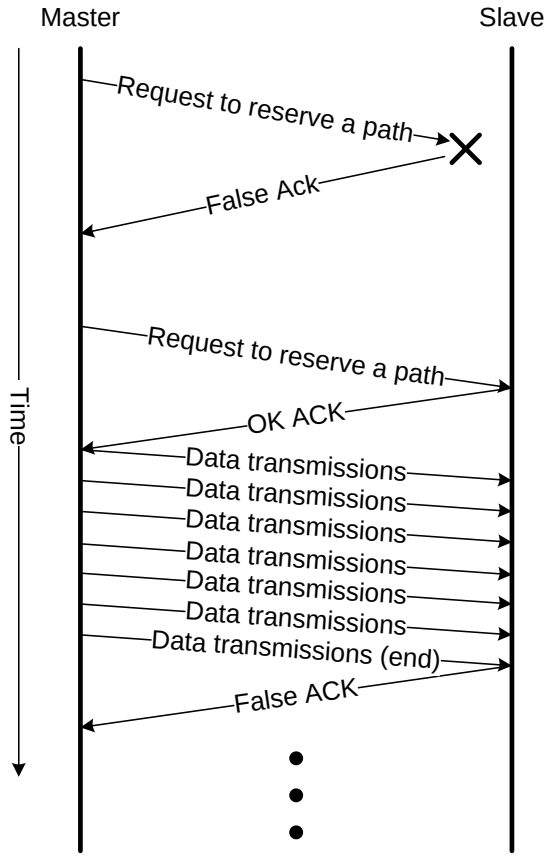
# Increase the bandwidth




***Spatial division multiplex (SDM) is a good choice for asynchronous NoCs.***

# Problems of SDM




***SDM has the low bandwidth efficiency.***

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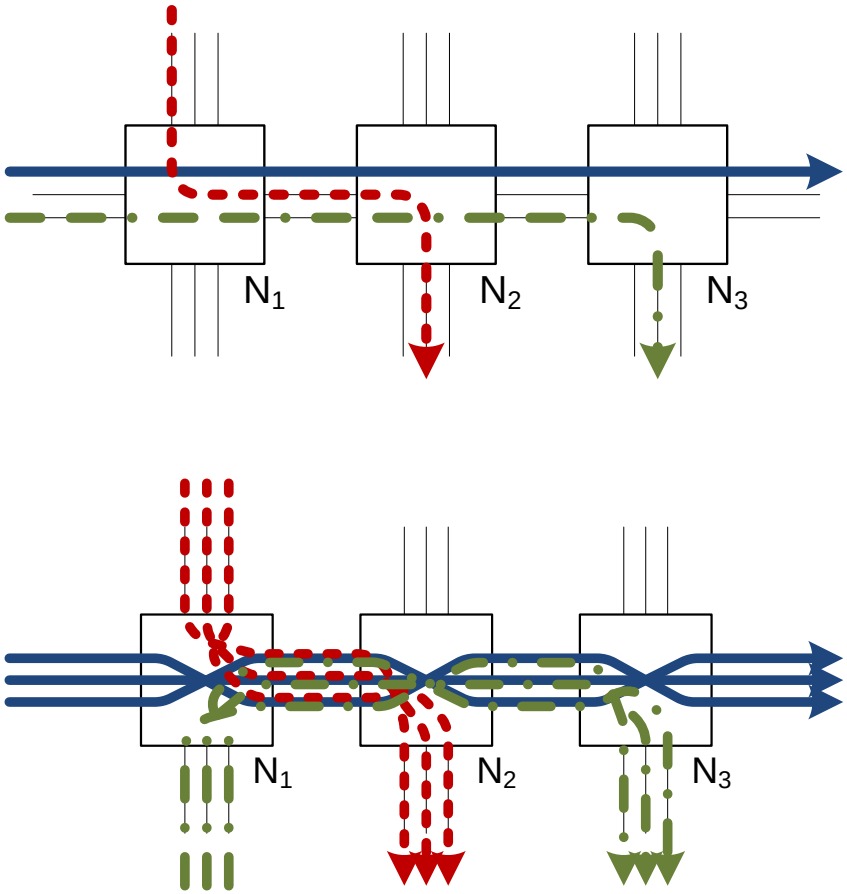
# Problems of SDM



# Dynamic Link Allocation

- Divide the sub-link allocation apart from the path reservation
- Allocate idle sub-link to active communications that reserved this link
- All communications fairly compete for the bandwidth

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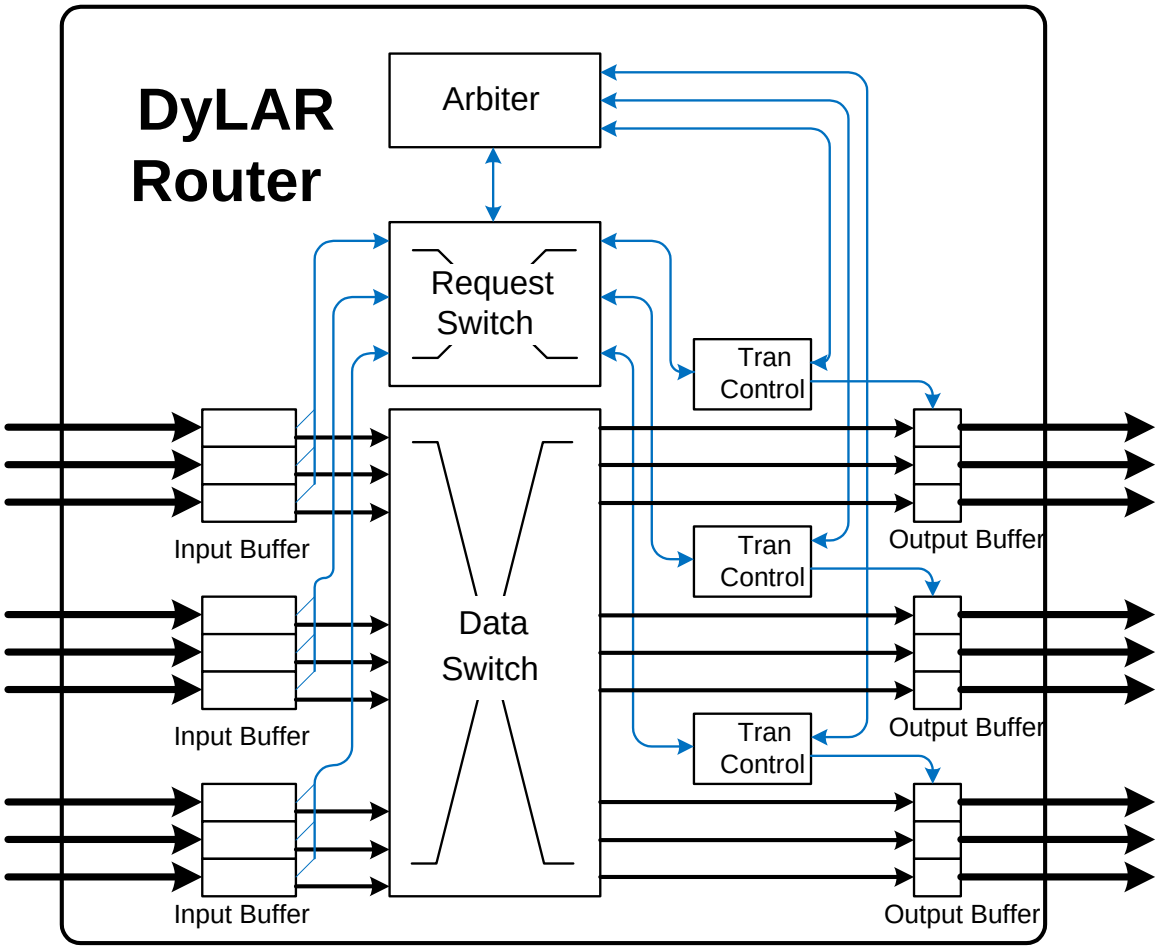
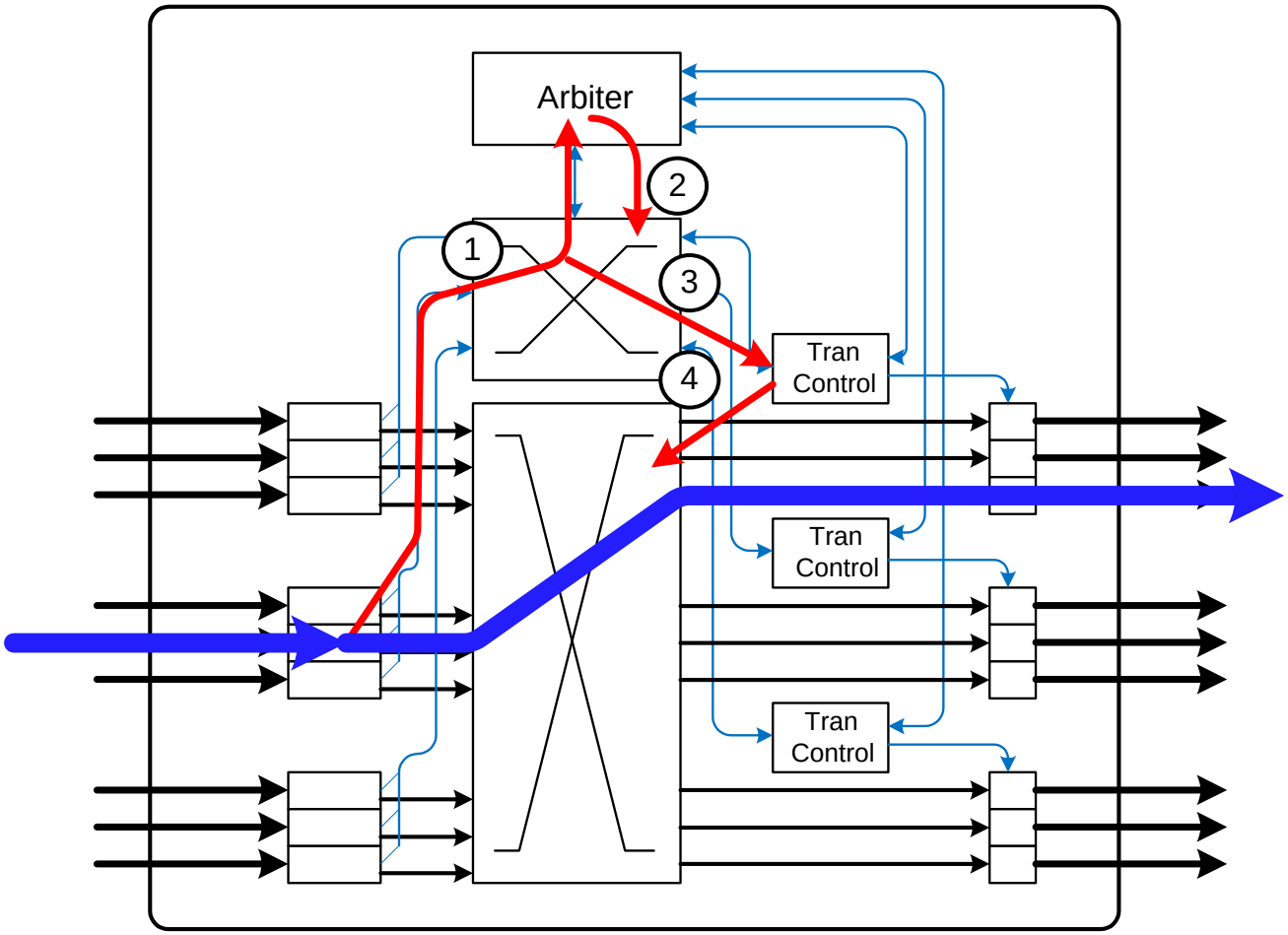
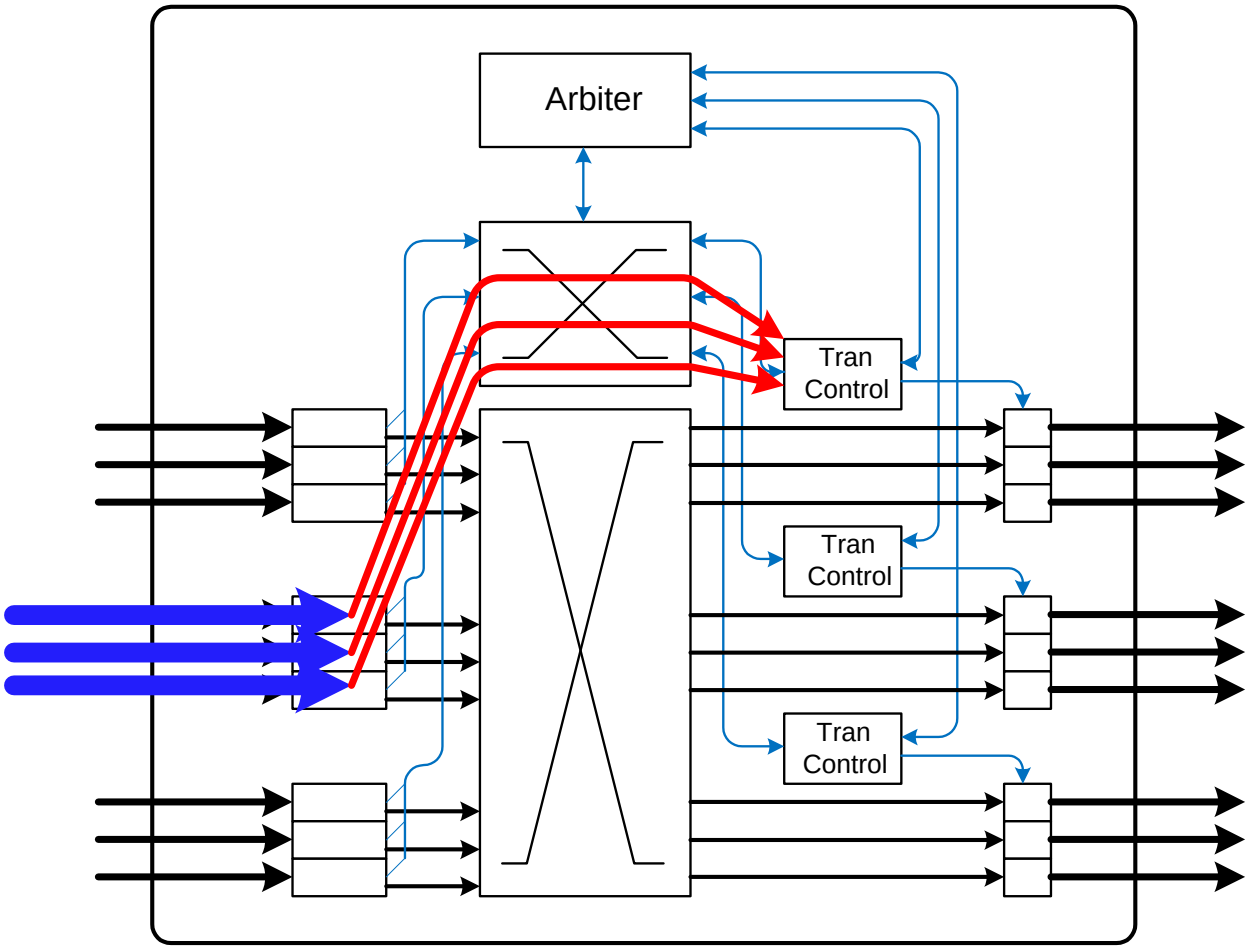
# Dynamic Link Allocation Router (DyLAR)



# Path Reservation Stage



# Data Transmission Stage



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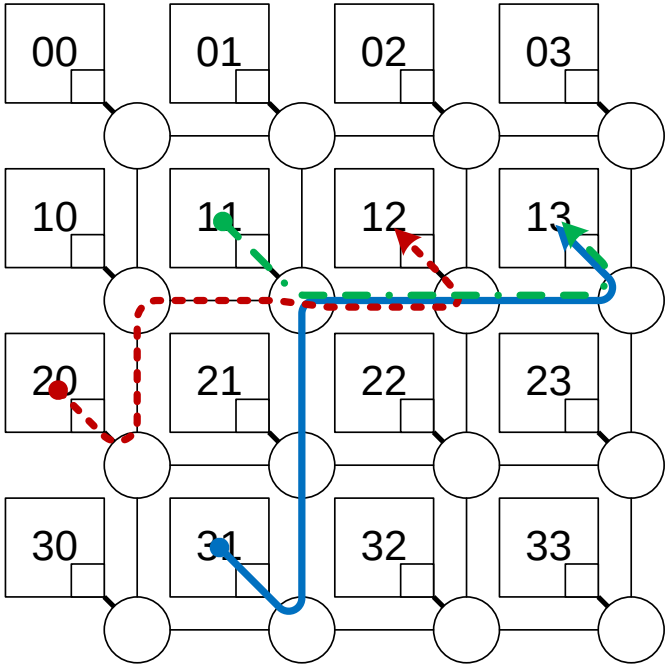
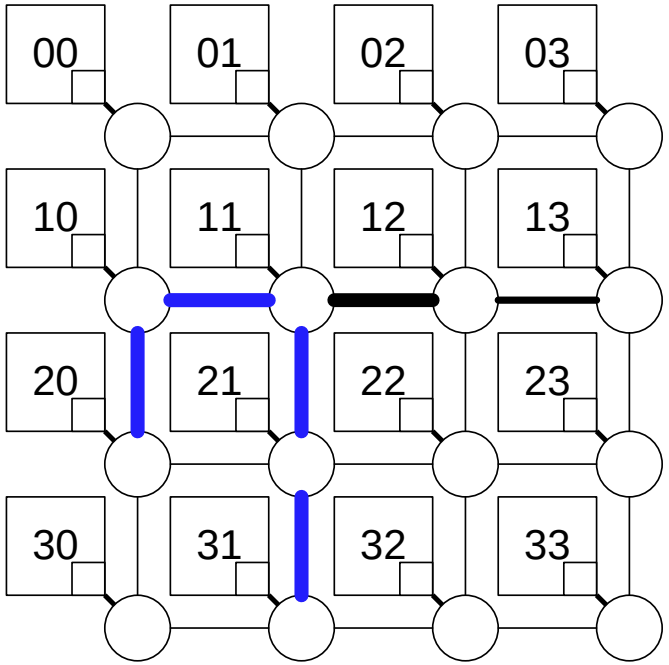
# Head-of-line (HOL) Problem



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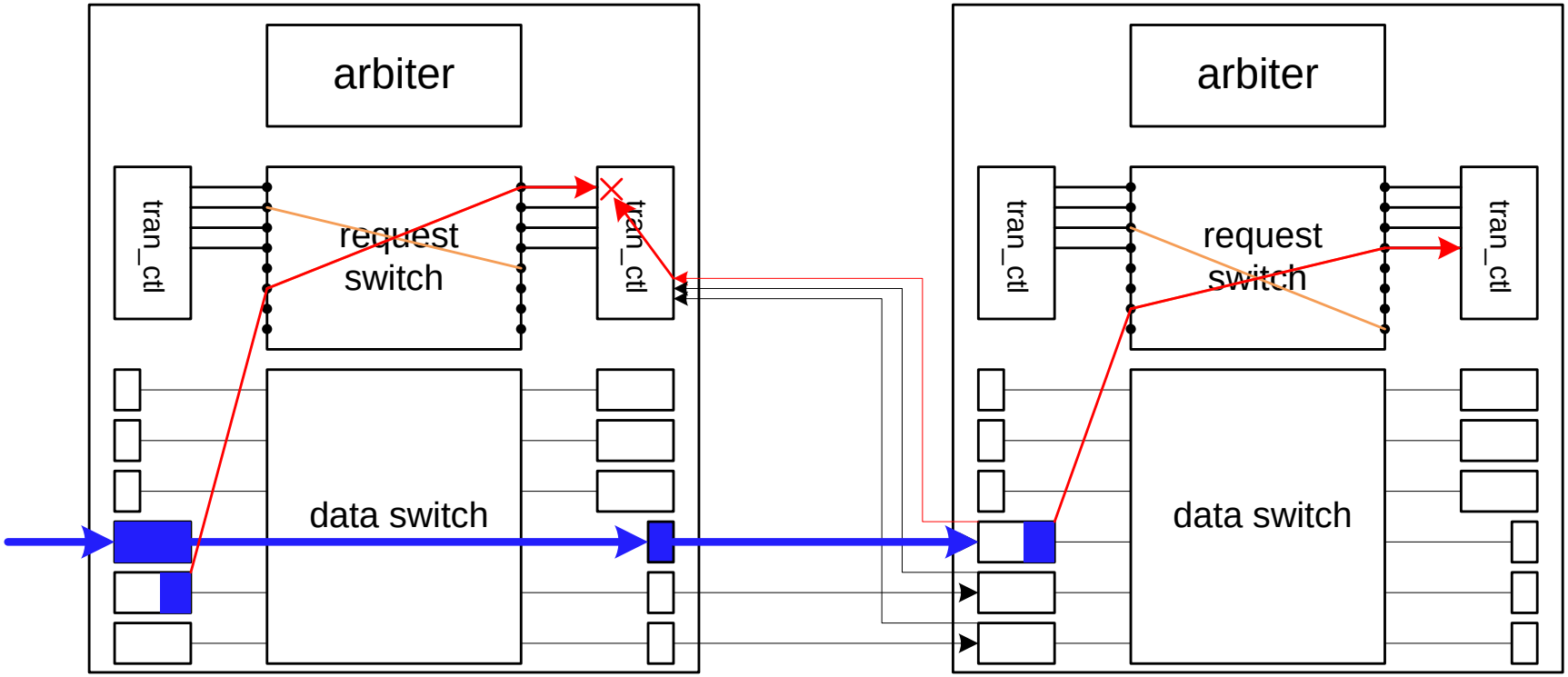
# Backpressure



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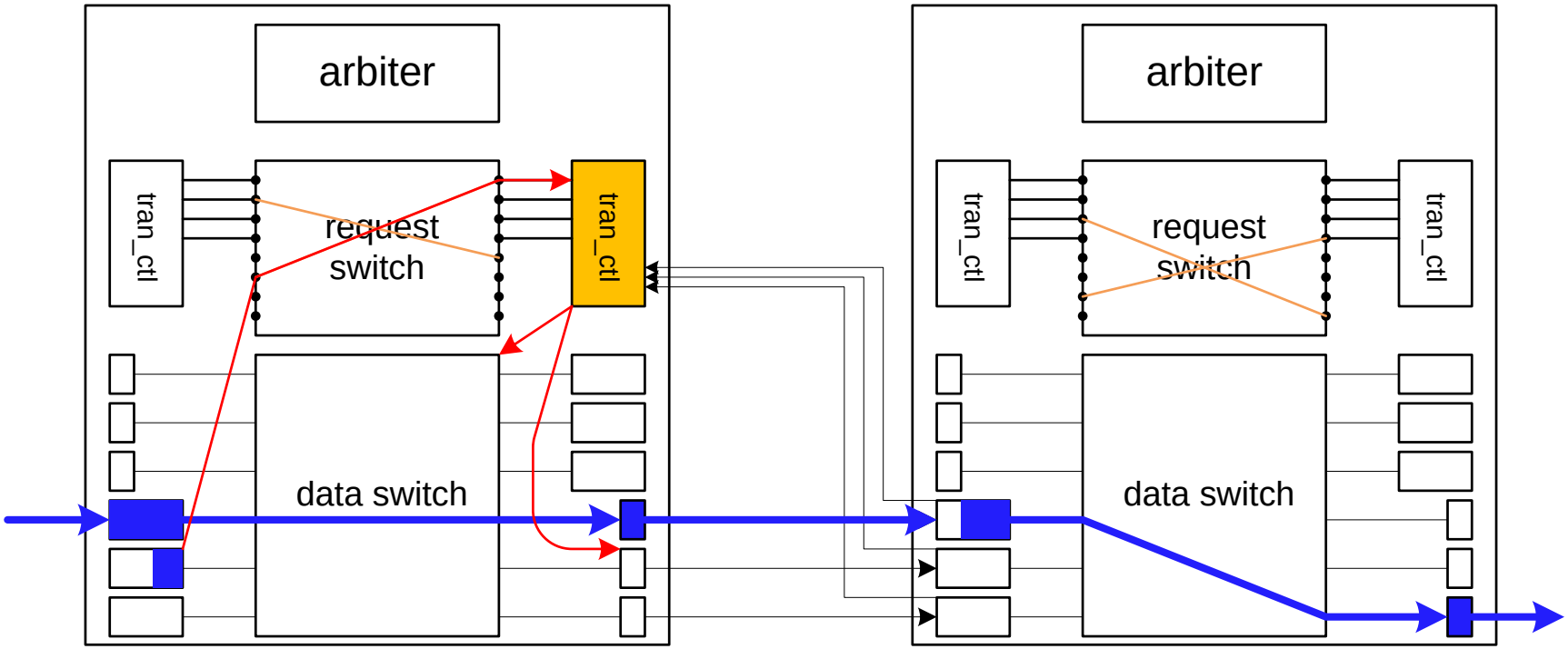
# Backpressure



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# Pros and Cons (comp. to SDM)

- Advantages
  - Smaller latency under zero load
  - Larger overall throughput under heavy load
  - Smaller retry rate (smaller power consumption)
- Disadvantages
  - An extra request switch in each router
  - Extra control logic
  - Increase the latency to pass a router

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# Thank You!

Questions?