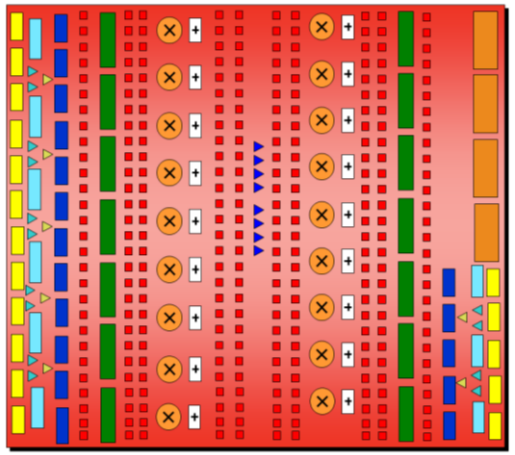
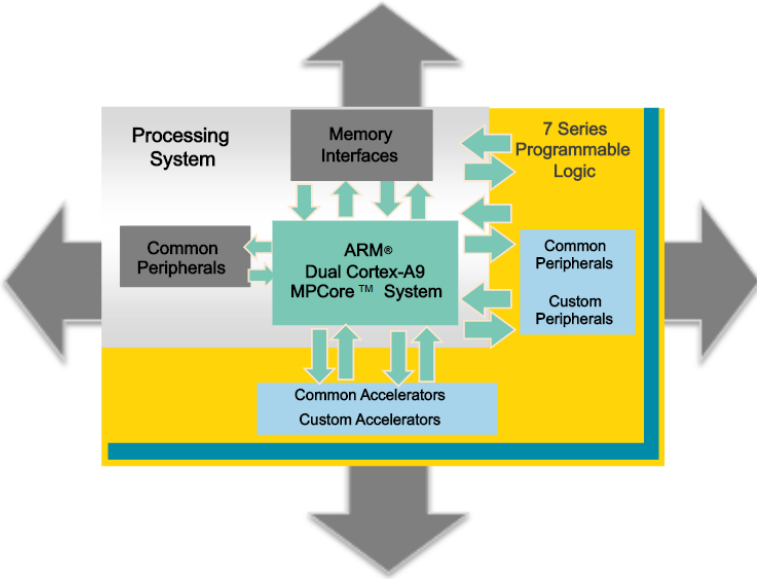
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

A2A
Algorithms to Architecture

ECE 270: Embedded Logic Design



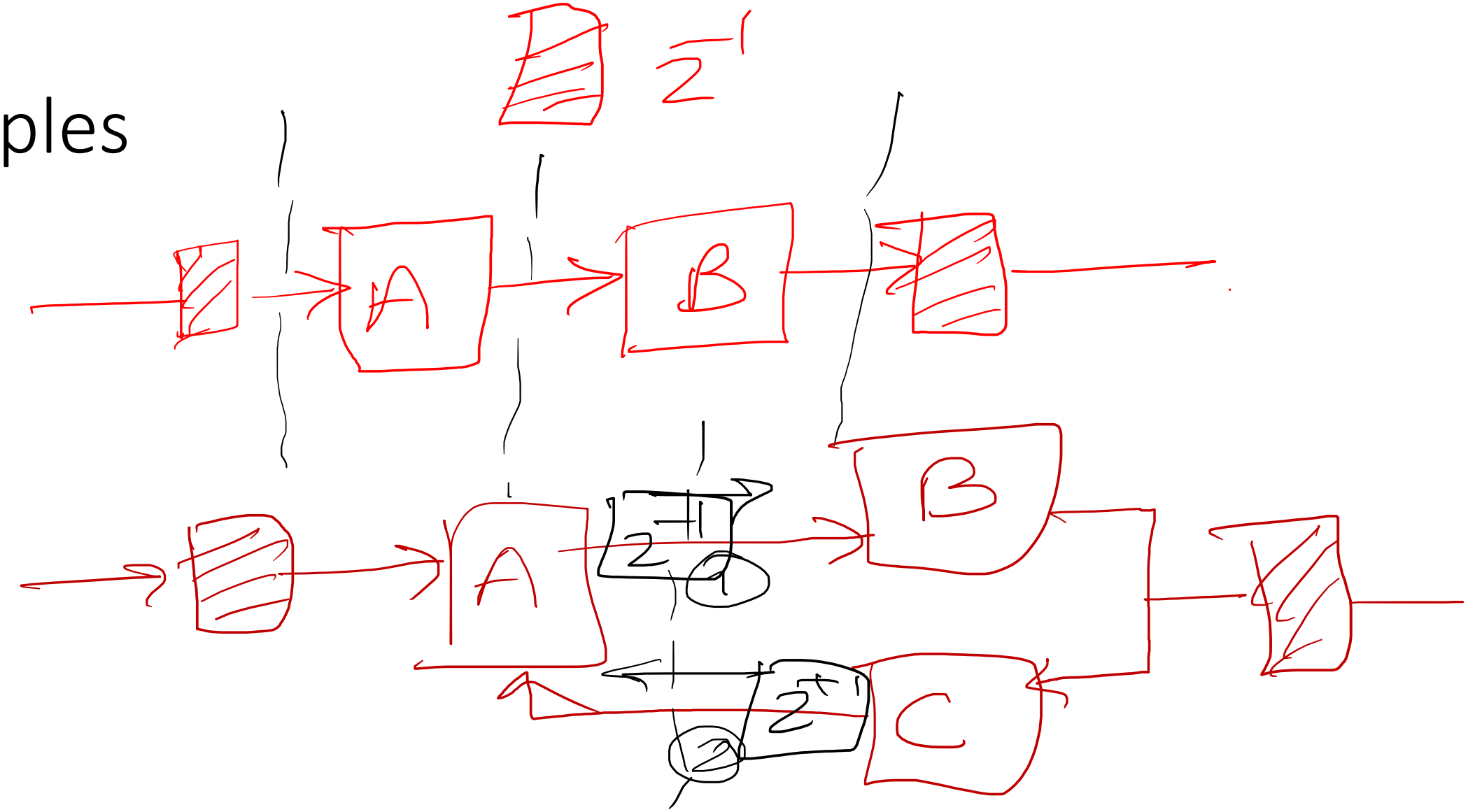


How to Pipeline Architecture?

Pipelining Via Cut Set Retiming

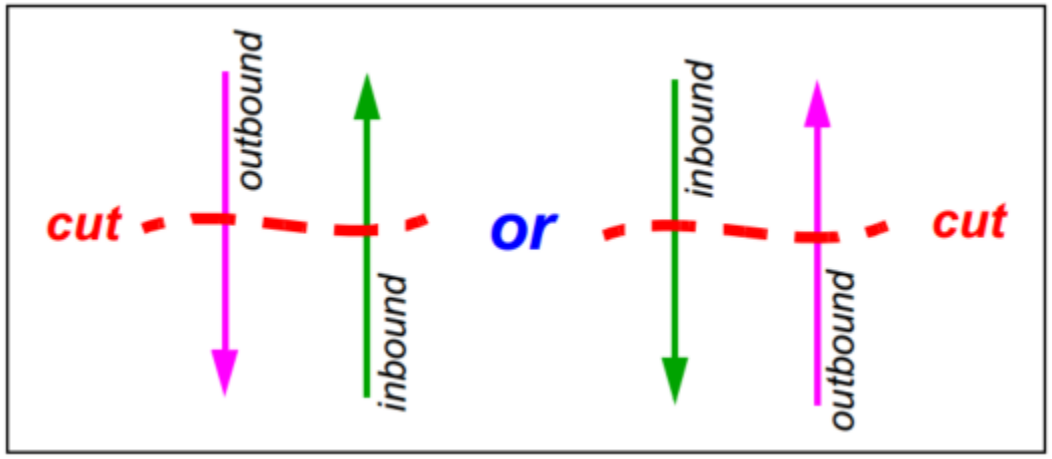
- One of the most powerful and valuable digital design strategies but simple to understand and use
- A cut-set is a minimal set of edges which partitions the architecture into two separable parts.

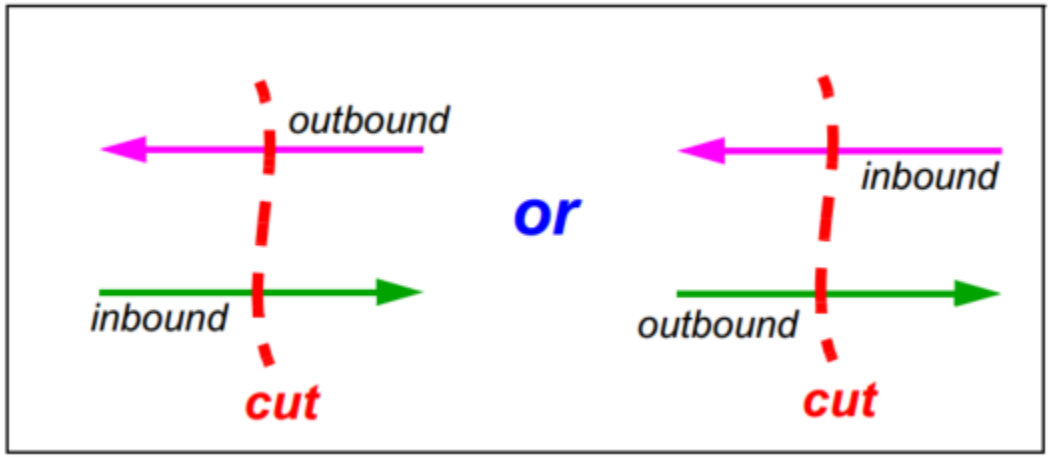
Examples



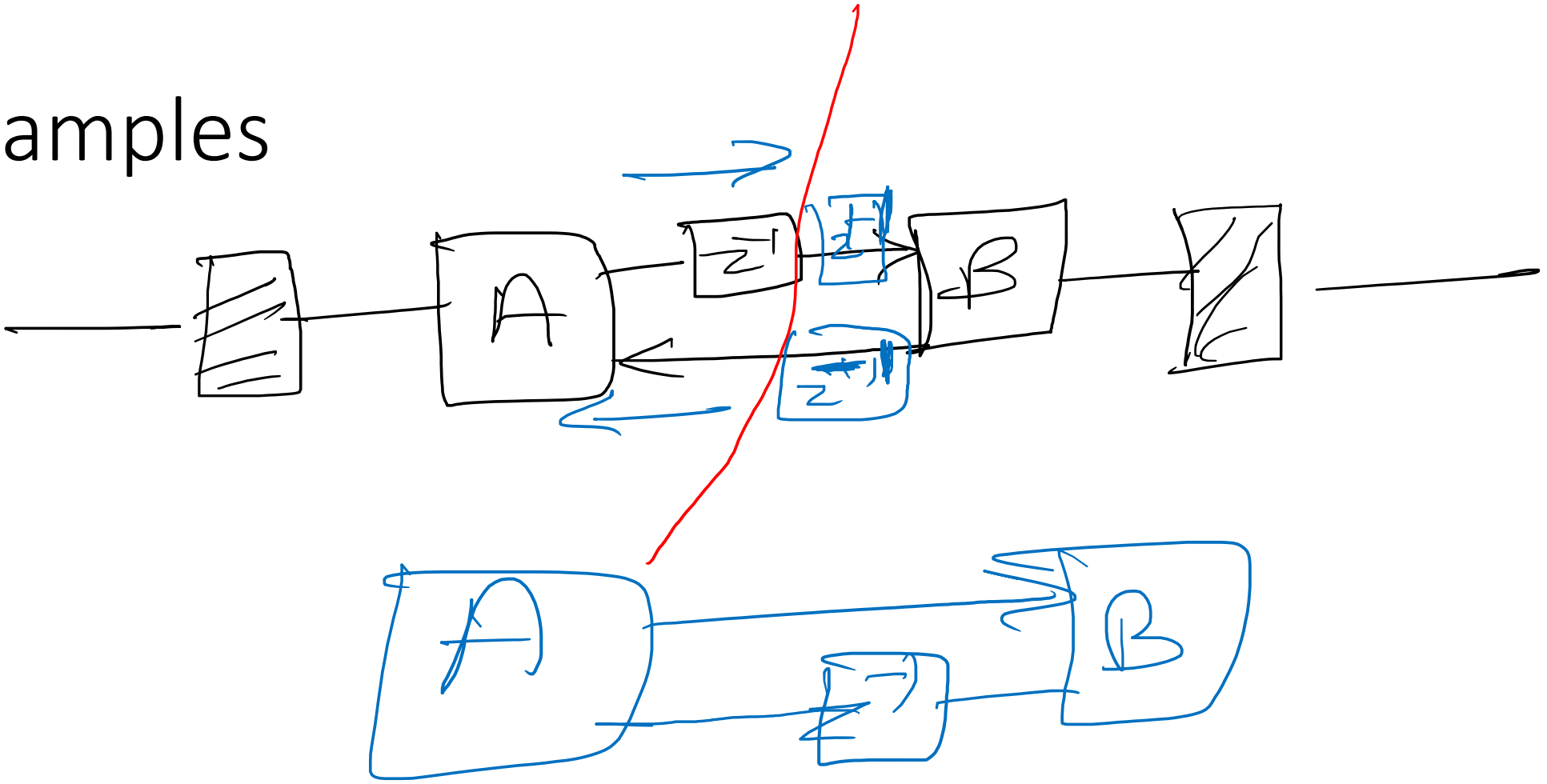
Cut Set Retiming

- **Delay Transfer Rule**: We can advance and/or delay the various edges in the architecture depending on their directions.
- A cut is drawn on the architecture and all signal connections passing into it from one direction are defined as inbound and those passing in the opposite direction as outbound.
- The cut can be drawn in any direction.

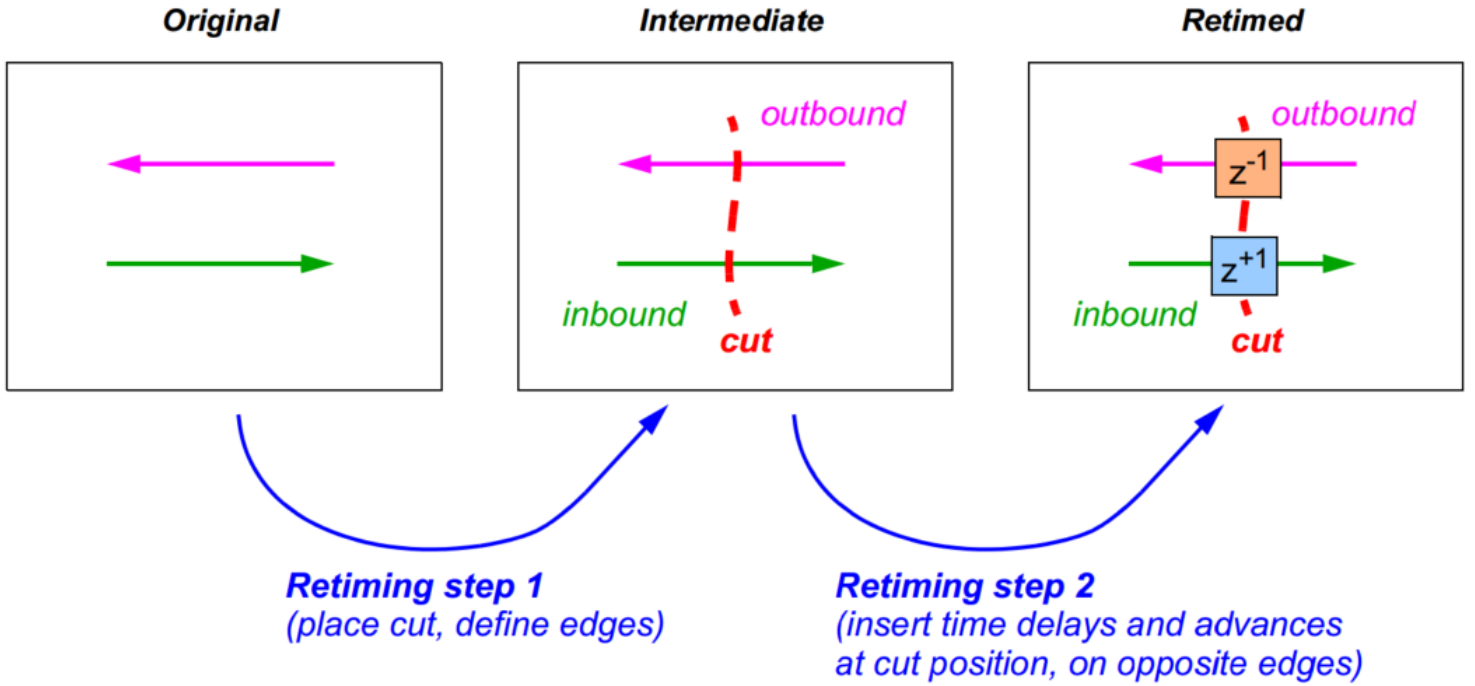




Examples

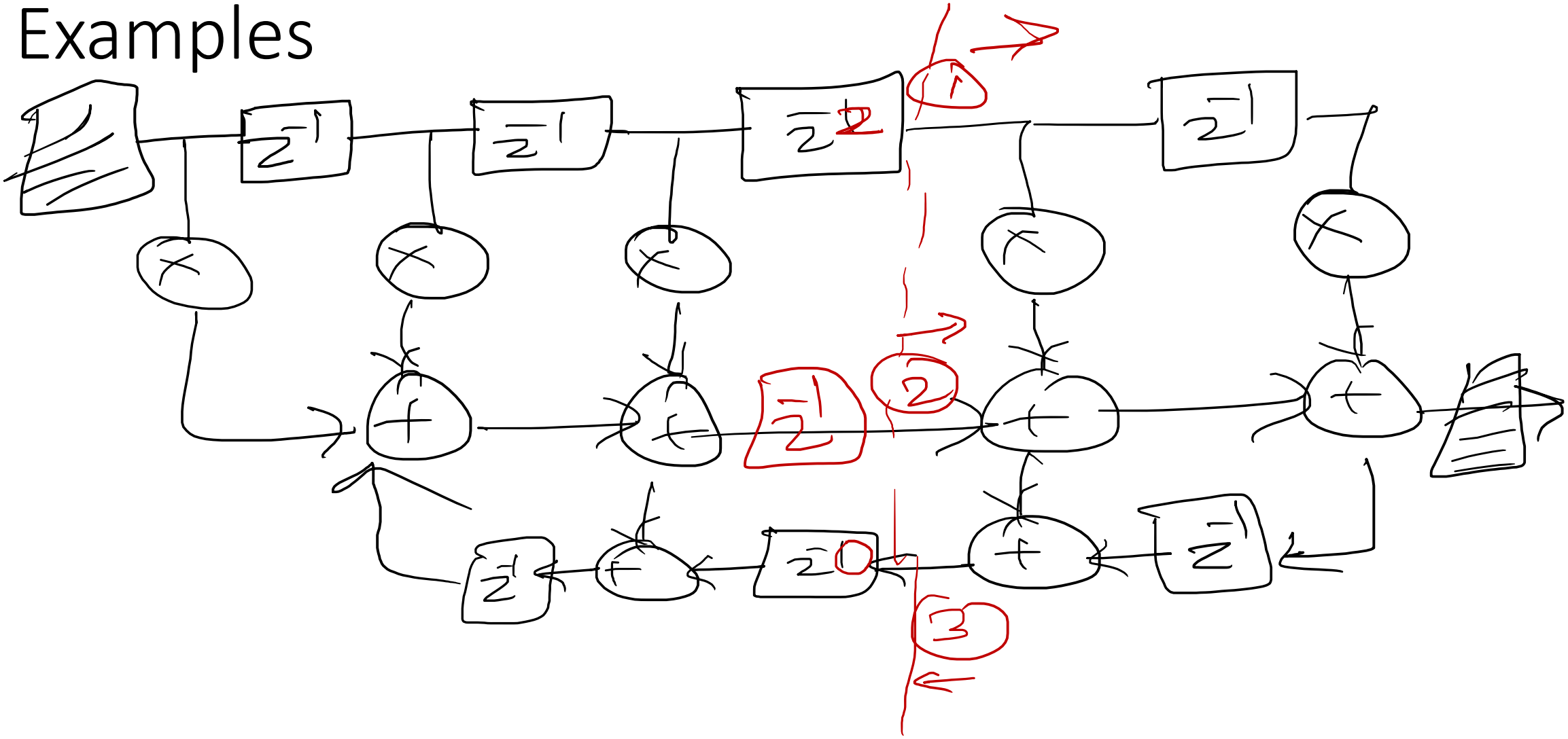


Cut Set Retiming

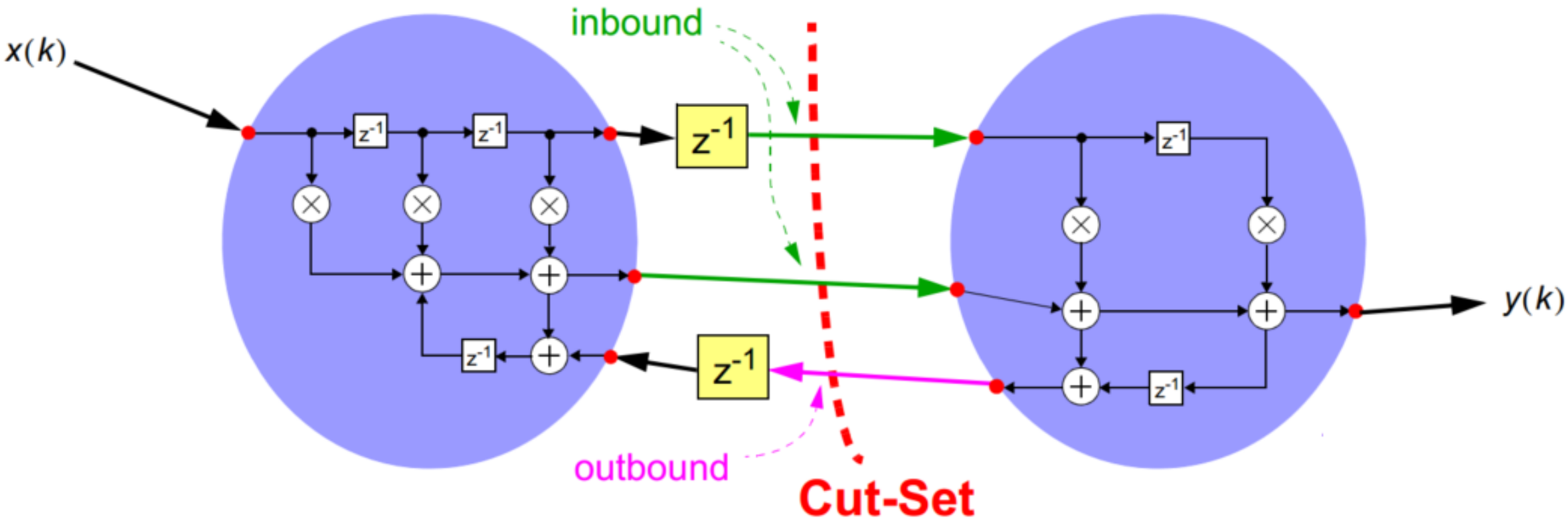


- **Delay Transfer Rule**: We can advance and/or delay the various edges in the architecture depending on their directions.
- We then apply a time advance to the inbound edges and a time delay to the outbound edges or vice-versa.
- We could also have chosen the opposite.
- New delays and advances are then consolidated with existing delays.

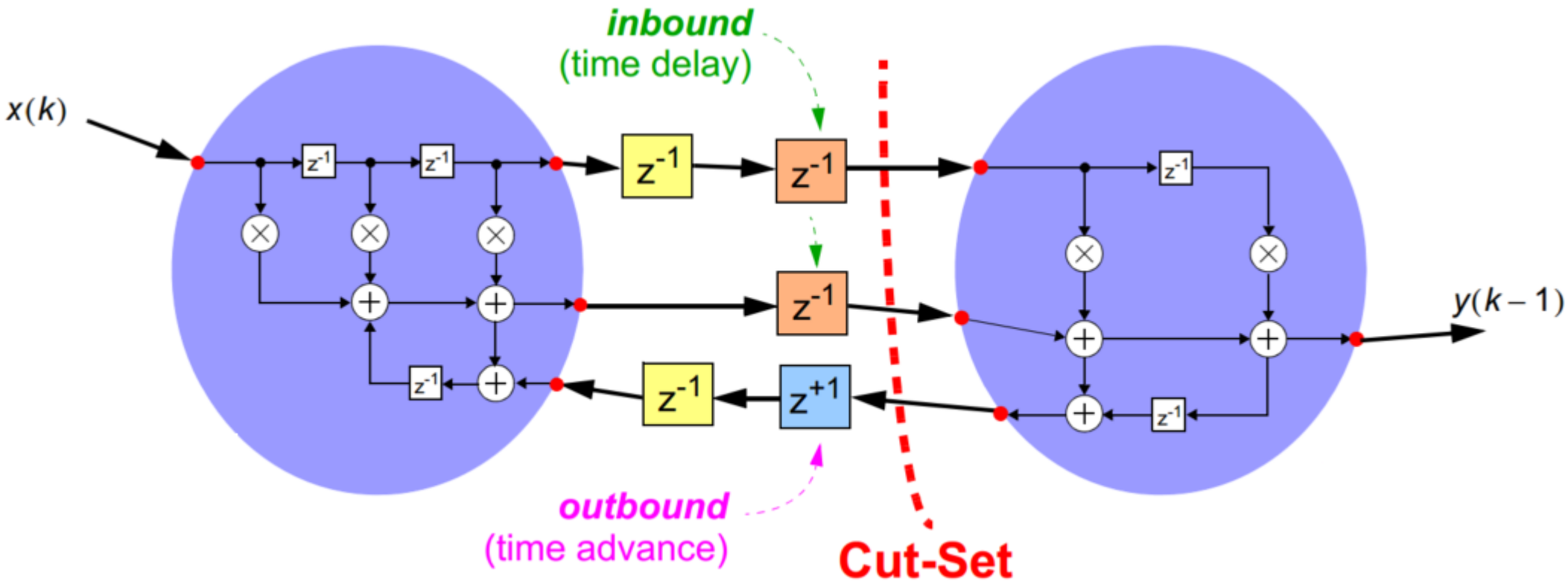
Examples



Cut Set Retiming

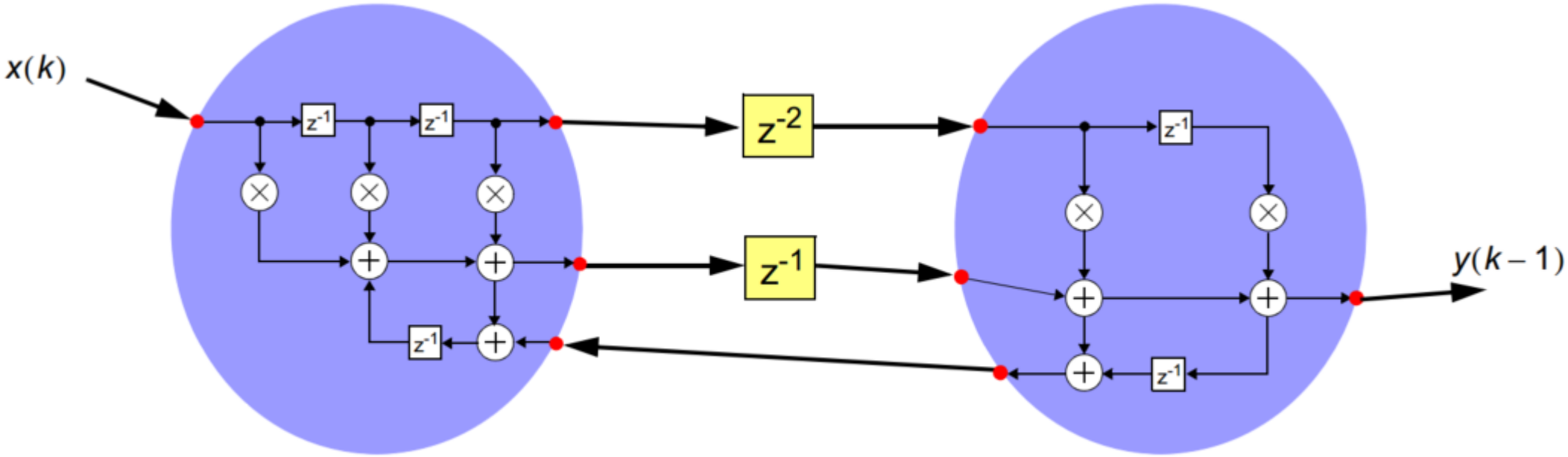


Cut Set Retiming



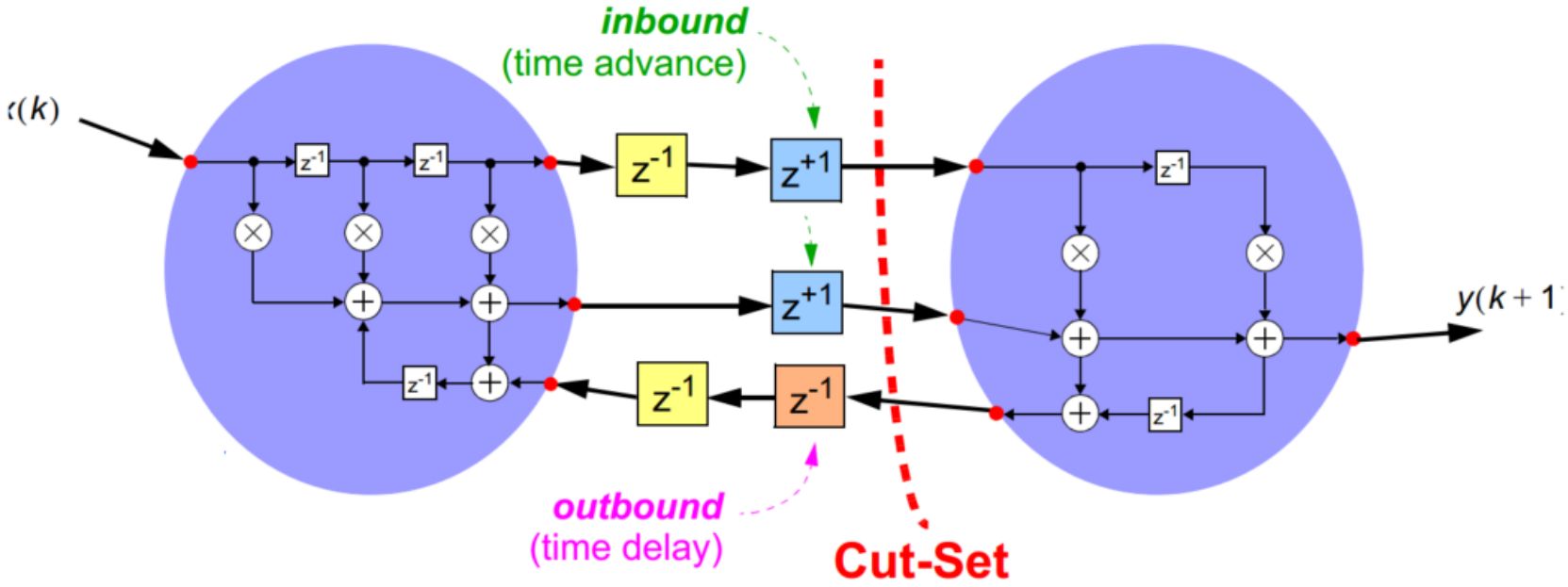
Cut Set Retiming

- After Delay consolidation -> Successful cut set retiming



Examples

Cut Set Retiming

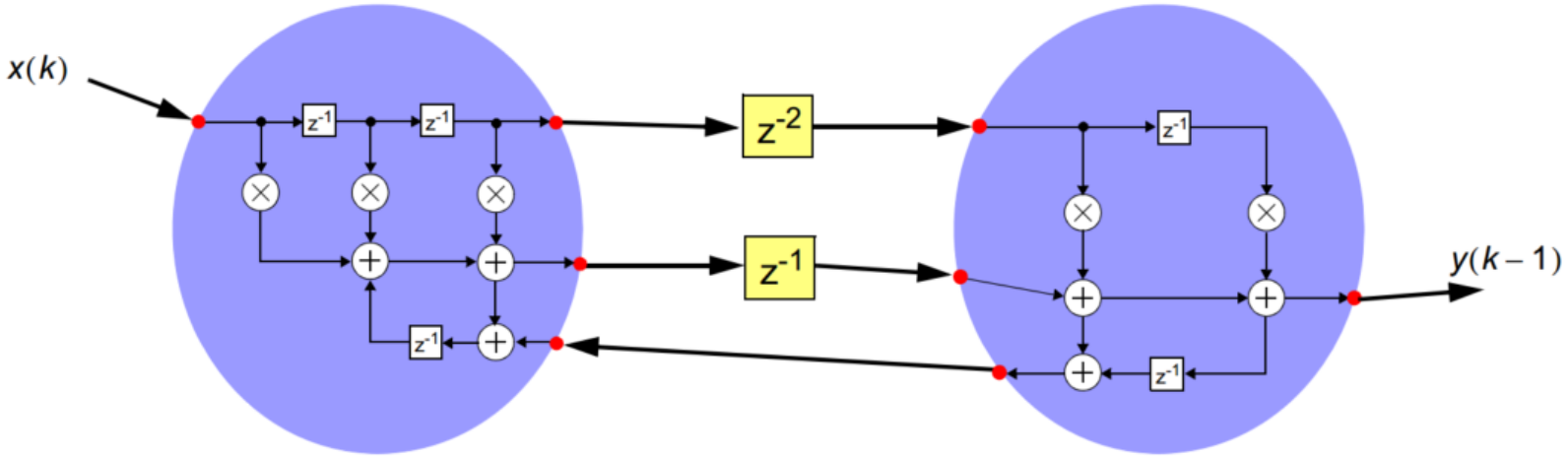


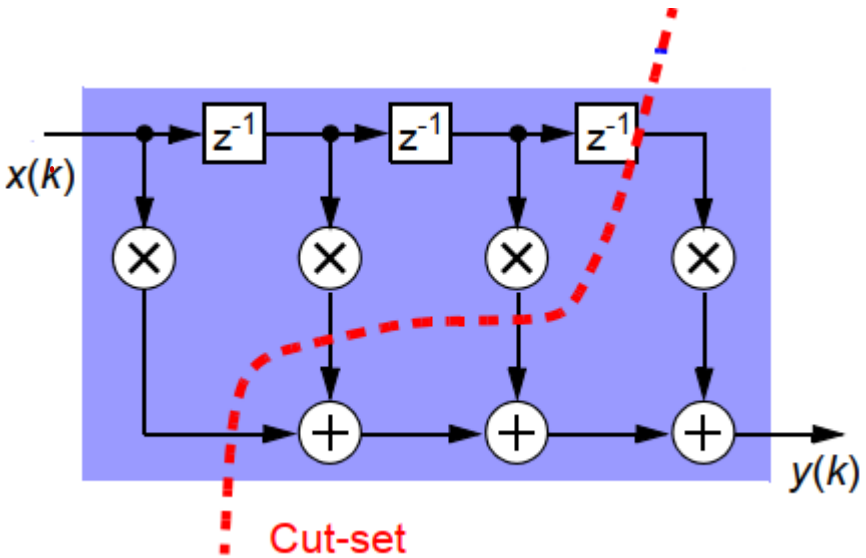
Cut Set Retiming

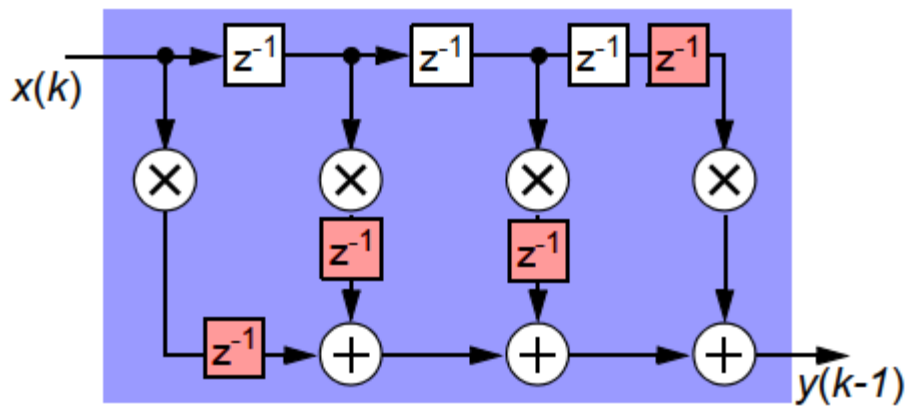
- Failed cut set retiming
- Architecture with advance delays is not synthesizable (Non-causal).
- Time advance is look ahead in time which is impossible.
- Care must be taken when performing cut set retiming: *The delays and advances should be allocated to inbound and outbound edges such that resultant architecture is causal.*

Cut Set Retiming: Latency

- 1 Sample of latency has been introduced as a result of the retiming
- In most applications, slight increase in latency is not usually a problem but we should keep track of it in order to maintain correct functionality.




x(k)
z-1
z-1
z-1
y(k)
Cut-set


x(k)
z-1
z-1
z-1
z-1
z-1
z-1
z-1
y(k-1)