



OAM Proposal

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Introduction

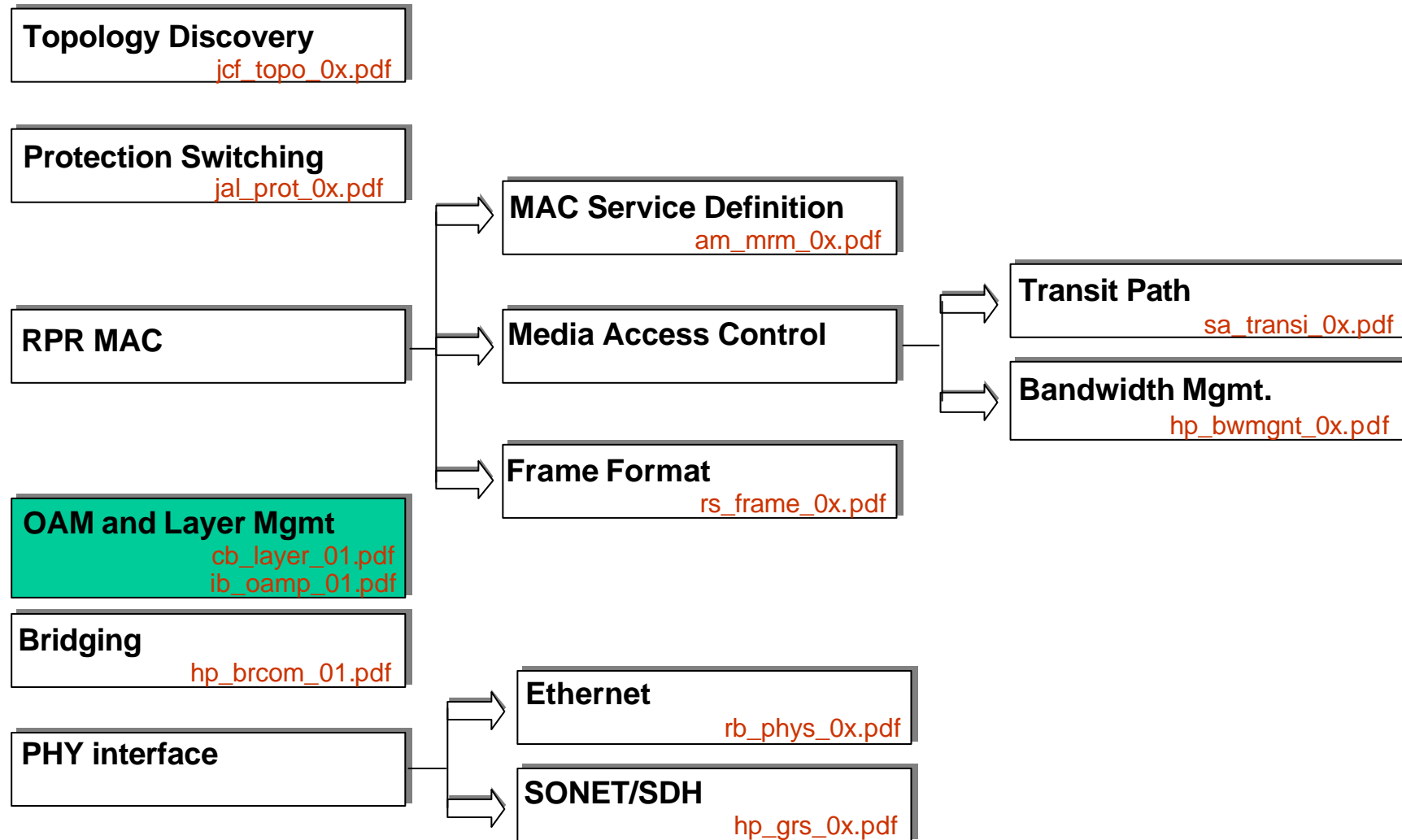


Introduction

- Some presentations have already addressed the OAM issues for RPR
 - July 2001 – “OAM&P Requirements for RPR” – I. Busi (Alcatel proposal)
 - September 2001 – “OAM in RPR” – I. Busi (Coalition proposal)
 - September 2001 – “OAM in RPR” – L. Bruckman (Corrigent and Telcordia joint proposal)
- This presentation collects all the previous proposals



Components of a complete RPR proposal





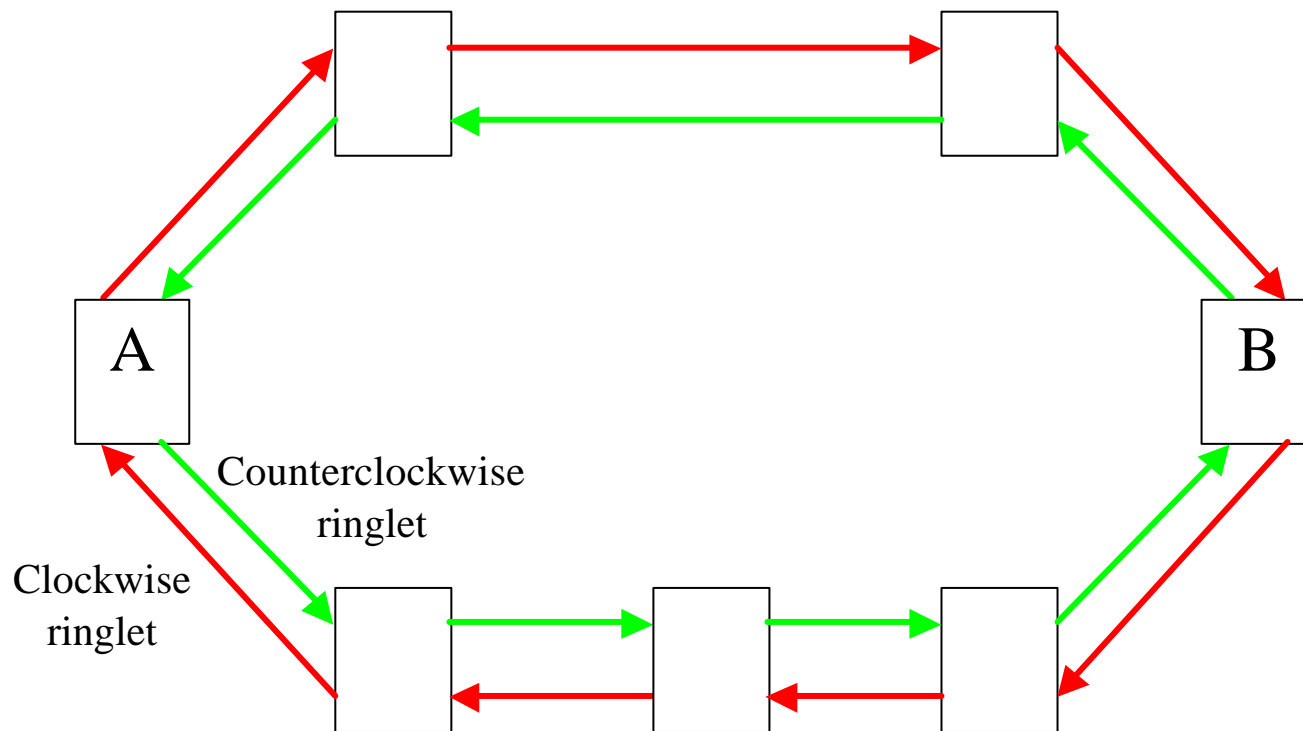
Scope of the Presentation

- Define OAM mechanisms that can be useful for fault management in a carrier grade RPR network
- Define the fault management requirements
- Define the basic mechanisms
 - Fault Management
 - Activation/Deactivation



Fault Management

Fault Management – Problem to be solved



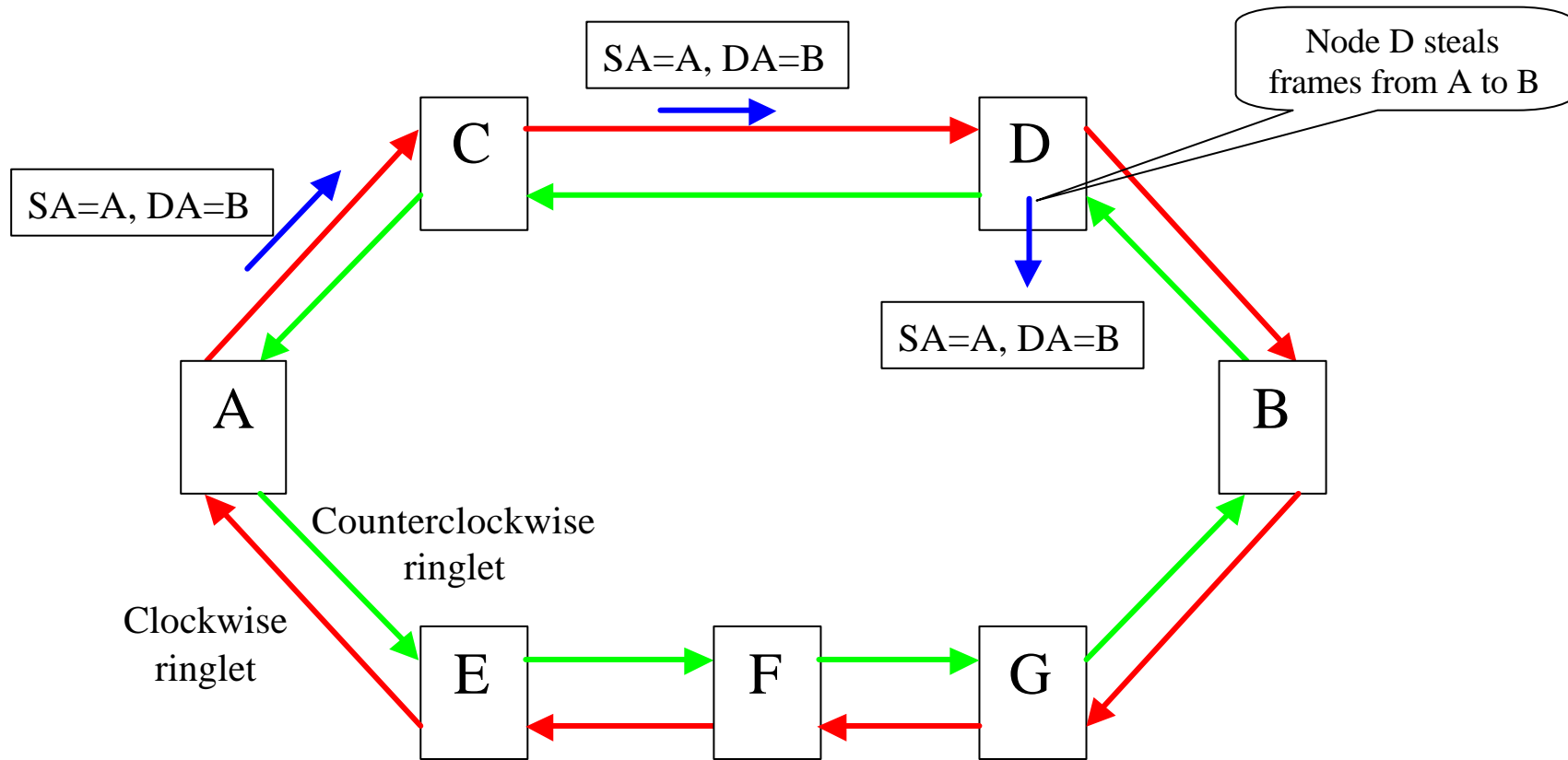
- Check the reachability at the RPR MAC layer between the two stations A and B



Fault Management Requirements

- Check the reachability at the RPR MAC level between two nodes on the ring
- There are some failures that cannot be detected at layer 1
 - Problems can arise between the PHY and the MAC sublayer
 - Some stations on the ring can “steal” packets addressed to some other stations

Example of failure



- Node D “steals” frames addressed to node B



Fault Management Requirements – 2

- Network operators needs mechanisms that are useful to
 - Detect if there are failures affecting the communication between two stations on the ring
 - Troubleshoot the network in case something does not work



Fault Management Mechanisms

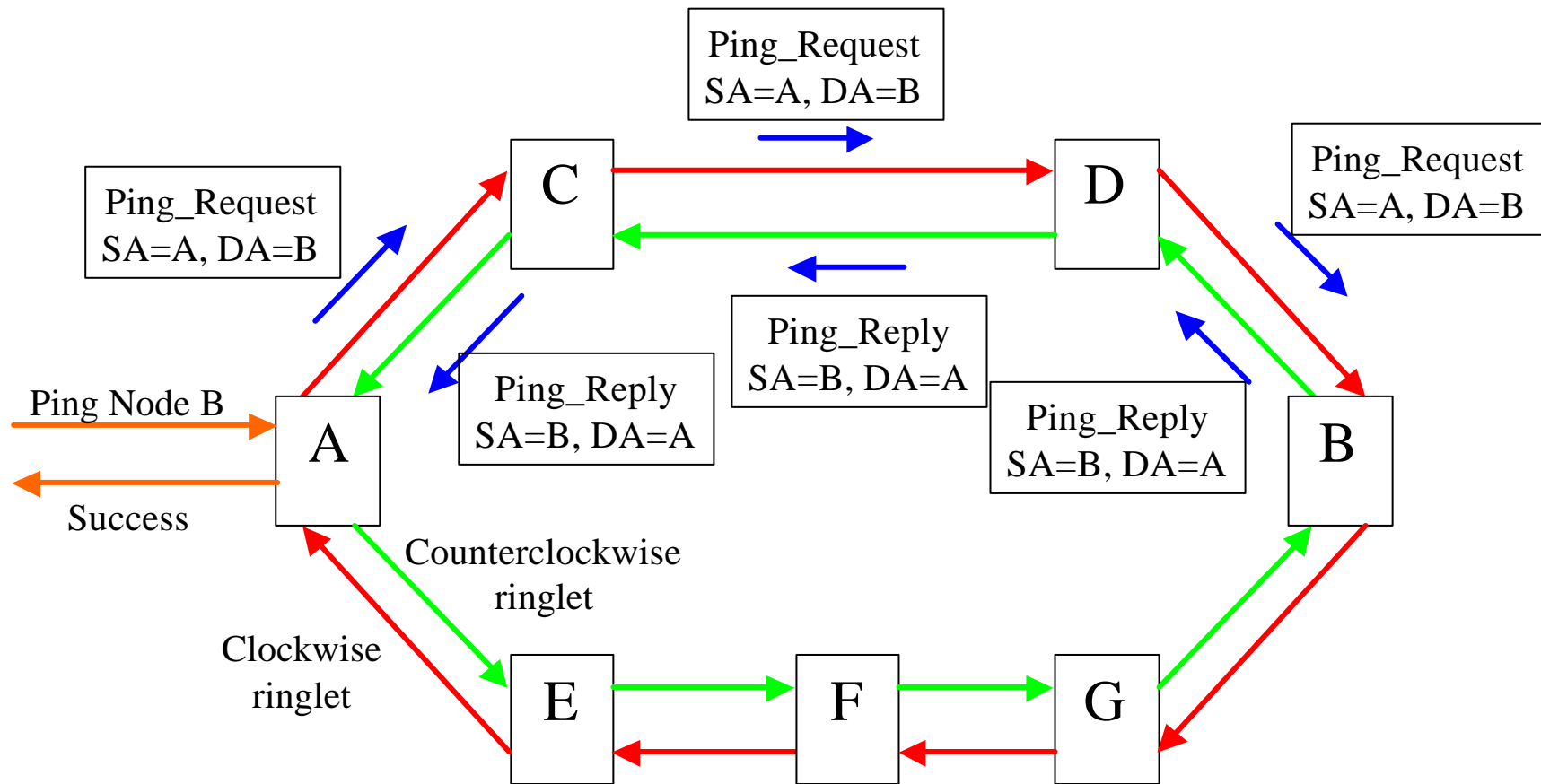
- The following OAM mechanisms are foreseen
- An on-demand in-service Ping mechanism used for troubleshooting (**reactive mechanism**)
 - It is triggered by the operator when something is not working on the network
- A continuity check mechanism used to fault detection (**proactive mechanism**)
 - It runs continuously and warns the operator when something does not work
- An RDI mechanism used to notify the remote failure condition to the source station



Ping Options

- The Ping mechanism can be used to check reachability through the normal data path
 - Both Ping Request and Ping Reply frames are sent through the shortest path
- The Ping mechanism can be used to check reachability through a particular ringlet (selected by the operator)
 - Ping Request and/or Ping Reply frames are sent through the ringlet (clockwise or counterclockwise) selected by the operator
- The Ping mechanism can be performed for a particular CoS
 - By default the highest priority is used

Succeeding Ping Mechanism

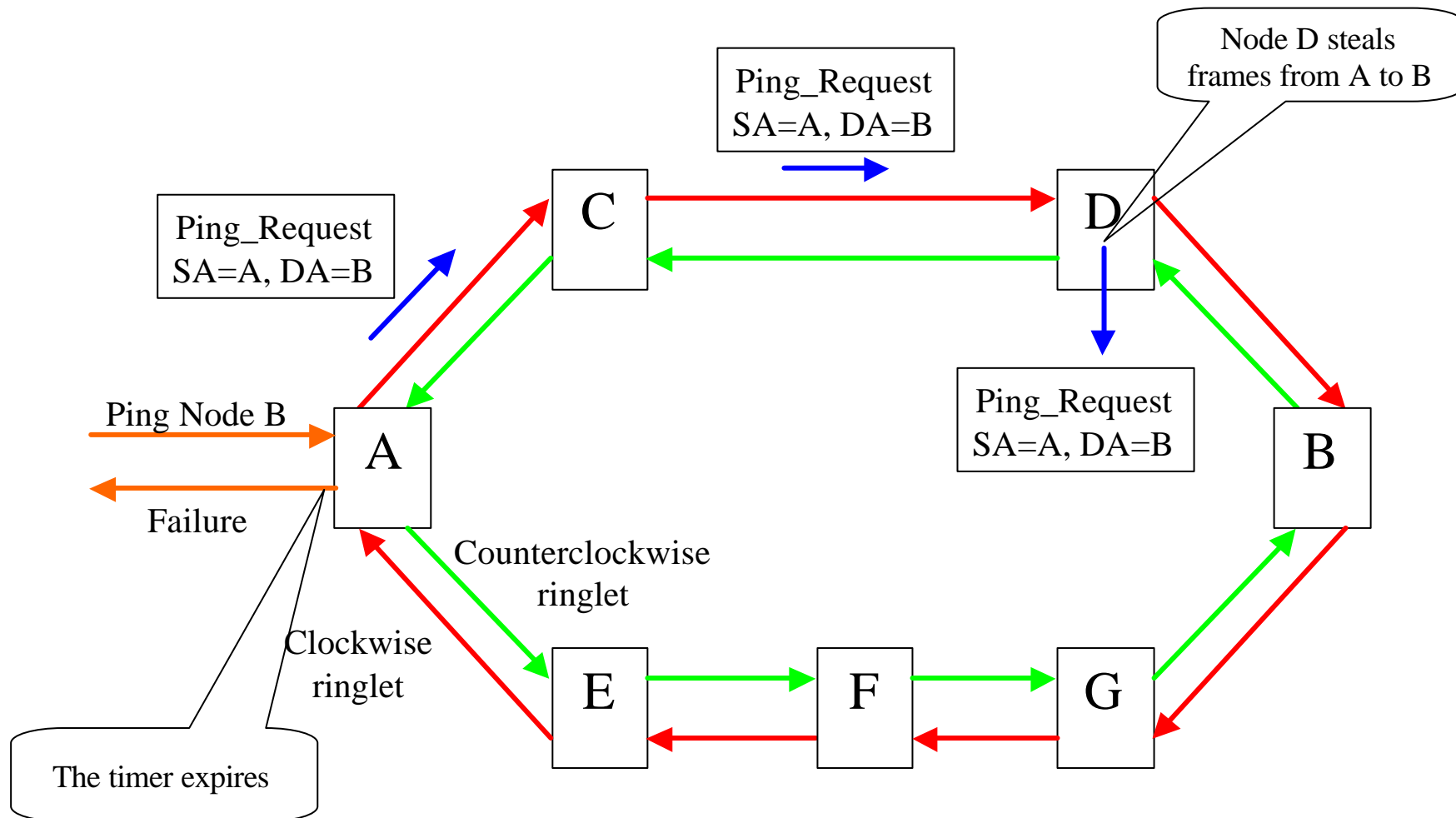




Succeeding Ping Mechanism Description

- The operator asks node A to perform a Ping to node B
- Node A sends the Ping Request message on the shortest path (clockwise ringlet)
- Nodes C and D forwards the Ping Request as a normal RPR frame
- Node B sends back the Ping Reply message on the shortest path (counterclockwise ringlet)
- Nodes C and D forwards the Ping Reply as a normal RPR frame
- Node A notifies the success to the Operator

Failing Ping Mechanism





Failing Ping Mechanism Description

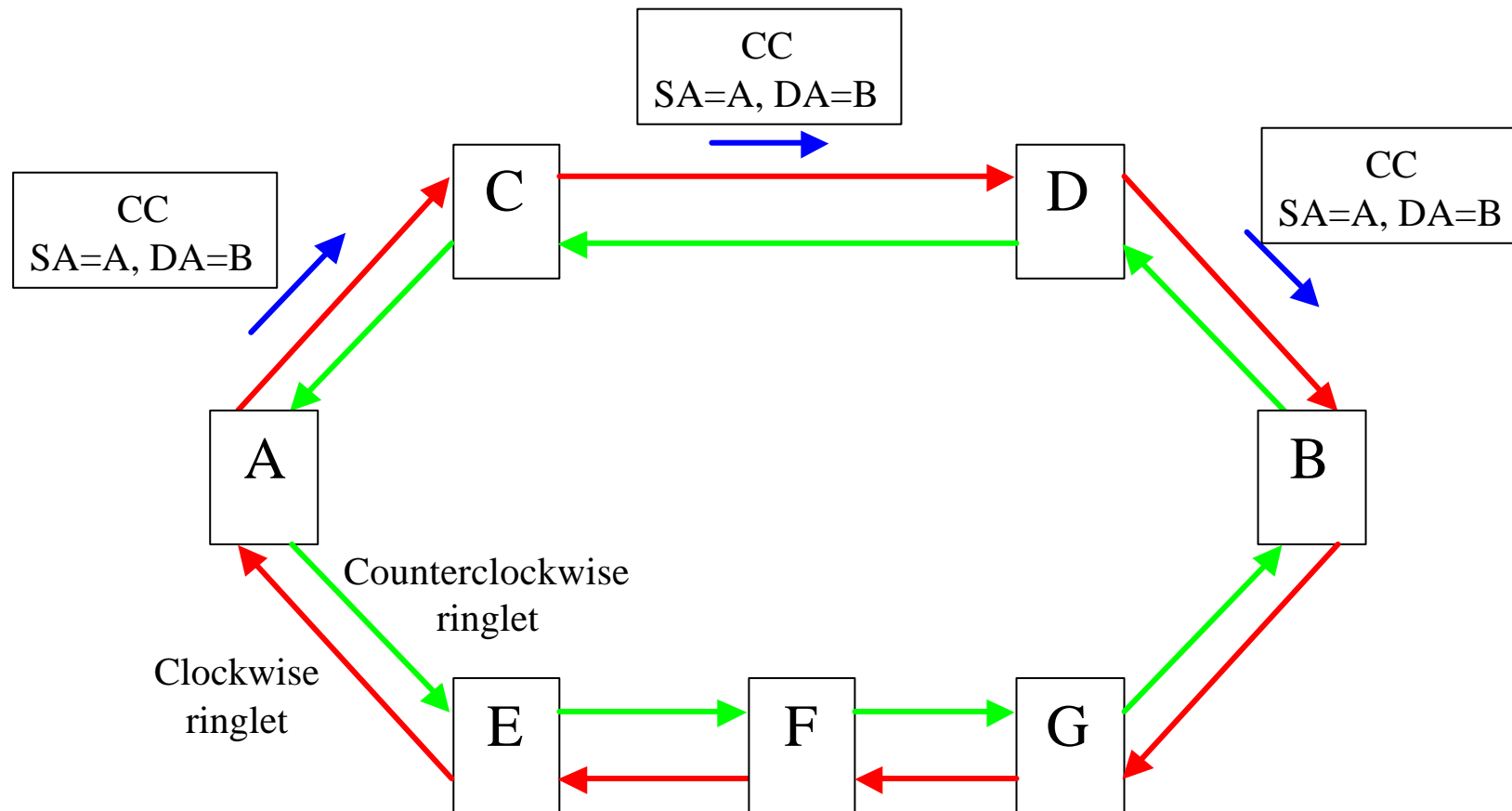
- The operator asks node A to perform a Ping to node B
- Node A sends the Ping Request message on the shortest path (clockwise ringlet)
- Node C forwards the Ping Request as a normal RPR frame
- **Node D “steals” the Ping Request as well as all the RPR frames from A to B**
- The timer in node A expires
 - It notifies the failure to the Operator



Continuity Check Options

- The CC mechanism can be used to check reachability through the normal data path
 - CC frames are sent through the path selected by RPR (shortest path or steered path)
- The CC mechanism can be used to check reachability through a particular ringlet (selected by the operator)
 - CC frames are sent through the ringlet (clockwise or counterclockwise) selected by the operator
- The RDI frames are always sent to the path selected by RPR (shortest path or steered path)
- The CC and RDI frames are always sent with the highest priority

Working CC Mechanism

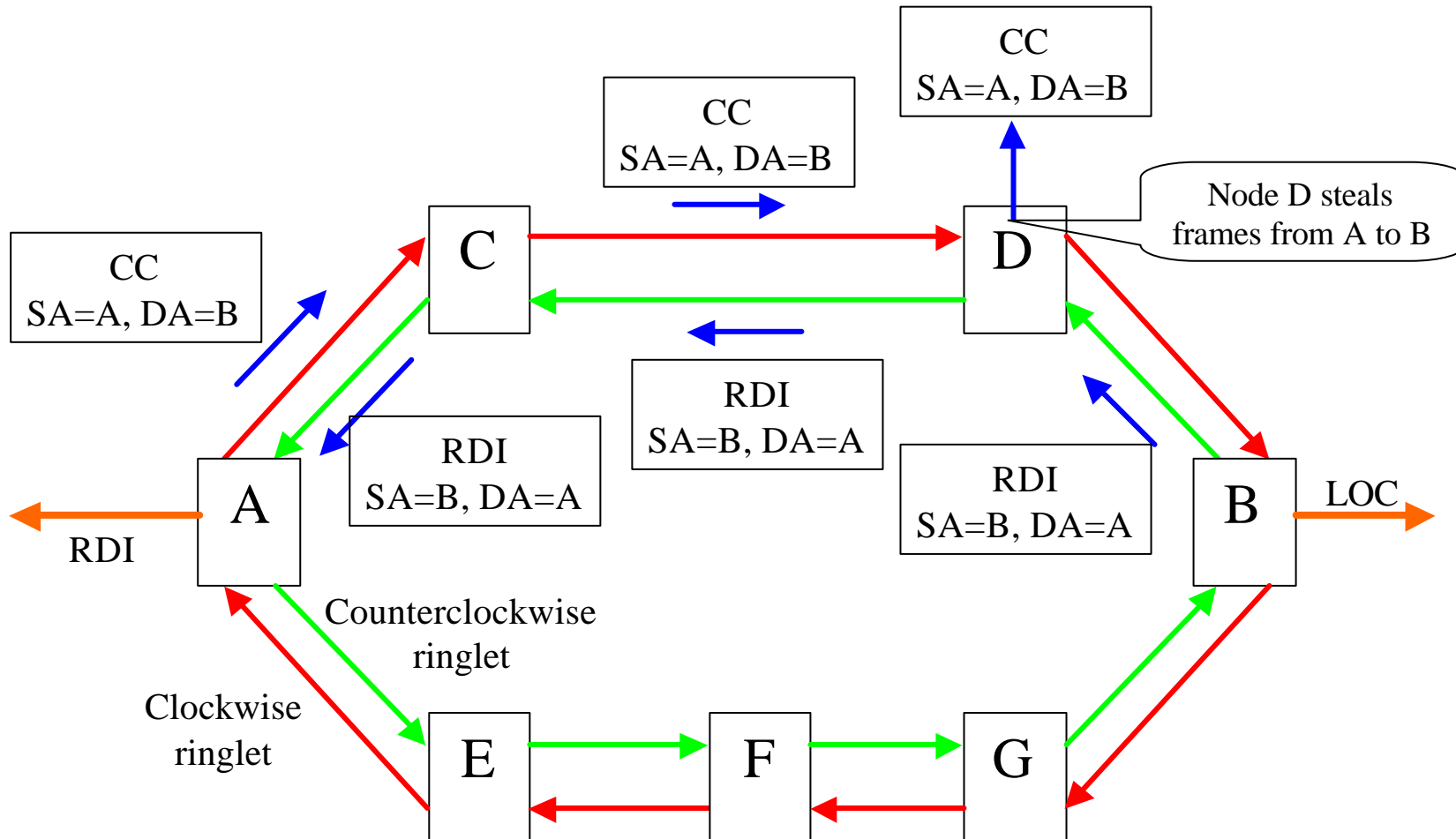




Working CC Mechanism Description

- Node A continuously sends CC frames to node B on the shortest path (clockwise ringlet)
- Nodes C and D forwards the CC as a normal RPR frame
- Node B receives the CC frames as expected
- The network is working properly
 - No alarms are sent to the Operator

Failing CC Mechanism





Failing CC Mechanism Description

- Node A continuously sends CC frames to node B on the shortest path (clockwise ringlet)
- Node C forwards the CC frame as normal RPR frames
- Node D “steals” the CC frame as well as all the RPR frames from A to B
- Node B does not receive the expected CC frames
 - It sends a LOC alarm to the operator
 - It sends back to node A an RDI frame on the shortest path (counterclockwise ringlet)
- Nodes C and D forwards the RDI frames as normal RPR frames
- Node A receives the RDI frames
 - It sends an RDI alarm to the Operator



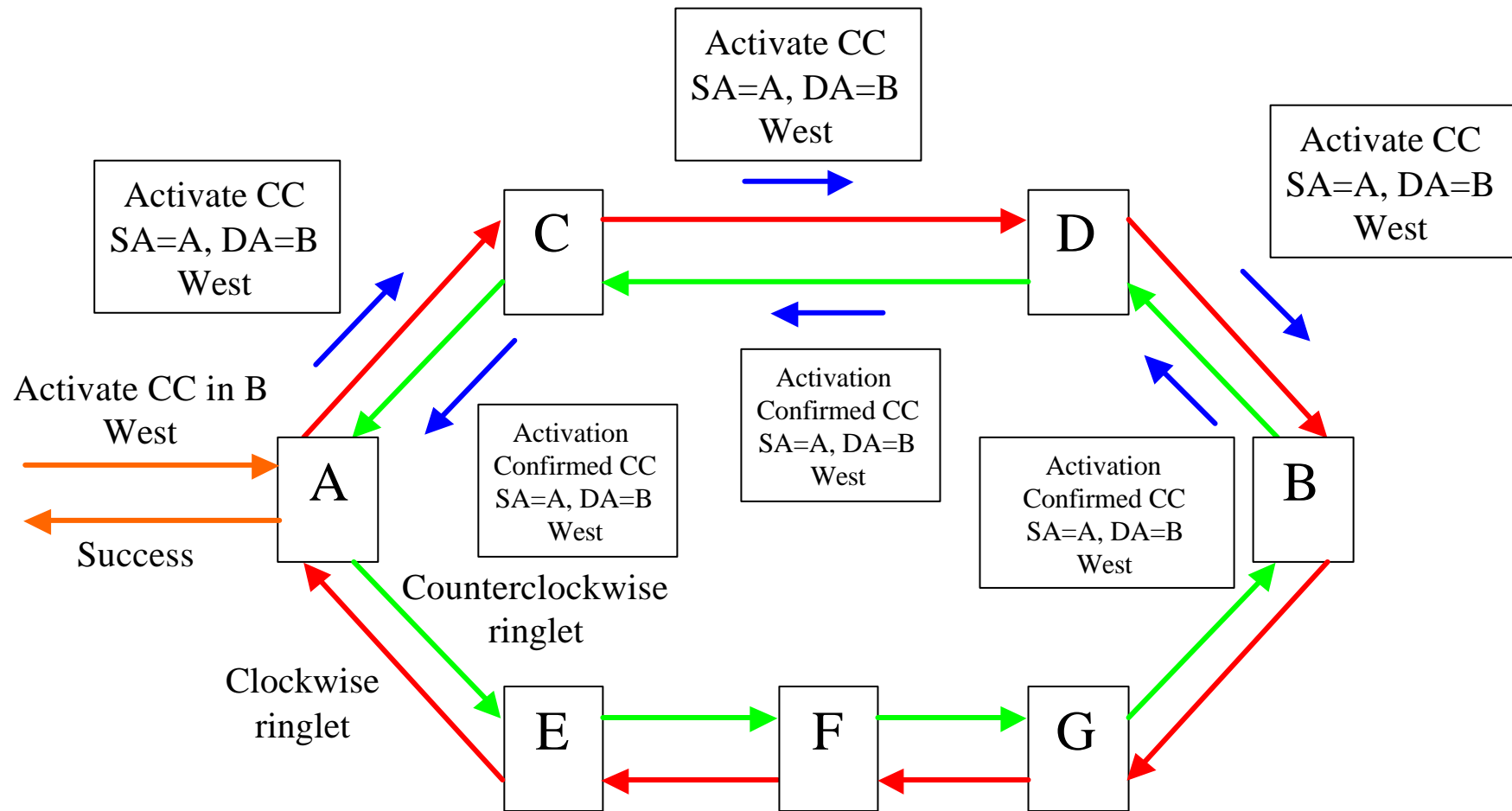
Activation/Deactivation Mechanism



Activation/Deactivation Options

- The Activation/Deactivation mechanism can be used to coordinate the beginning or end of the transmission and reception of CC.
 - Even if no integrated NMS is available
- The Activation/Deactivation mechanism conveys information regarding the CC method parameters
 - Direction of Activation/Deactivation of CC flow
- Activation/Deactivation frames are always sent with the highest priority

Succeeding Activation Mechanism

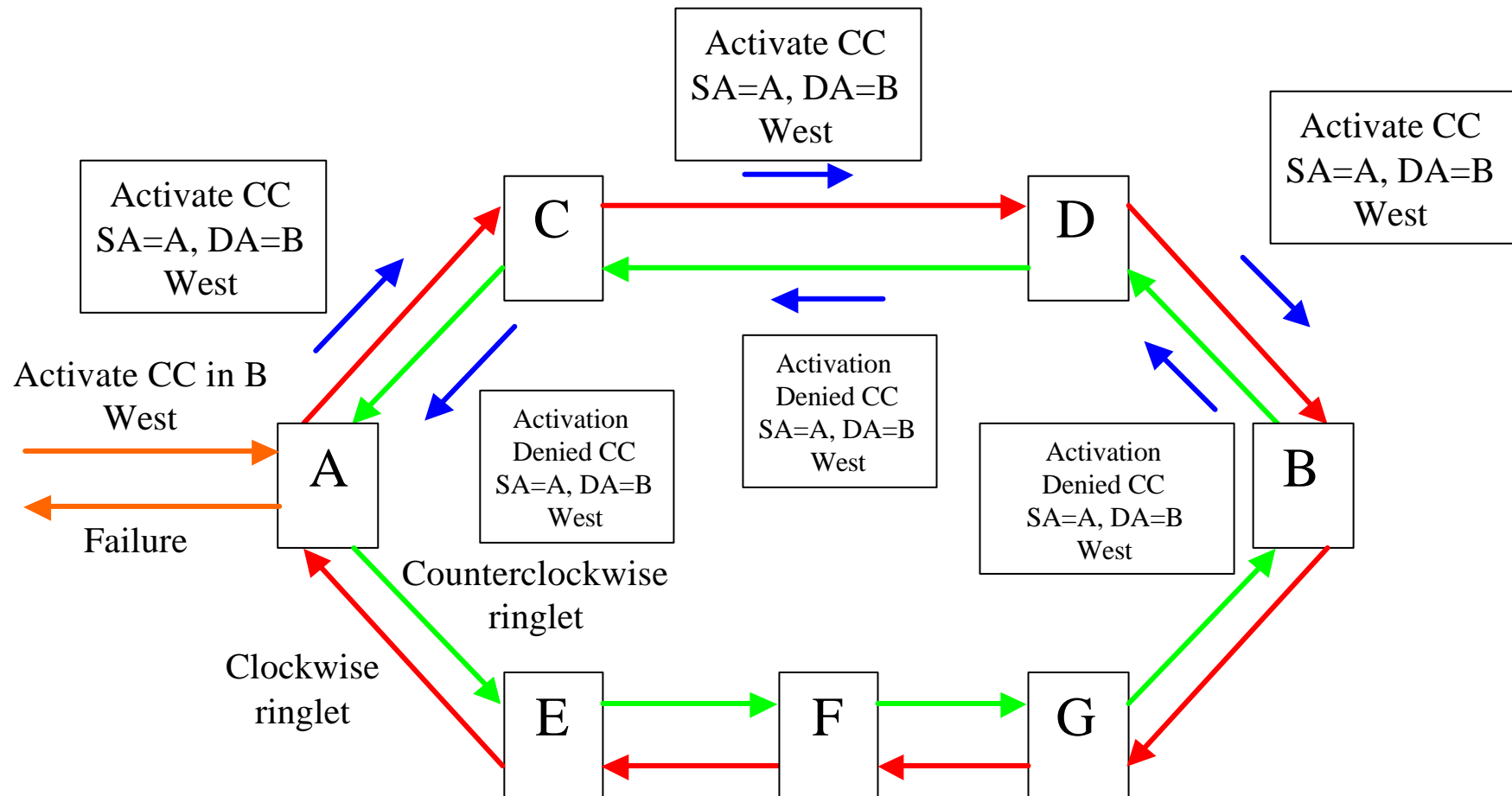




Succeeding Activation Mechanism Description

- The operator asks node A to Activate CC in West side to node B
- Node A sends the Activation message on the shortest path (clockwise ringlet)
- Nodes C and D forwards the Activation Request as a normal RPR frame
- Node B sends back the Activation Confirmed message on the shortest path (counterclockwise ringlet)
- Nodes C and D forwards the Activation Confirmed as a normal RPR frame
- Node A notifies the success to Operator

Failing Activation Mechanism - 1



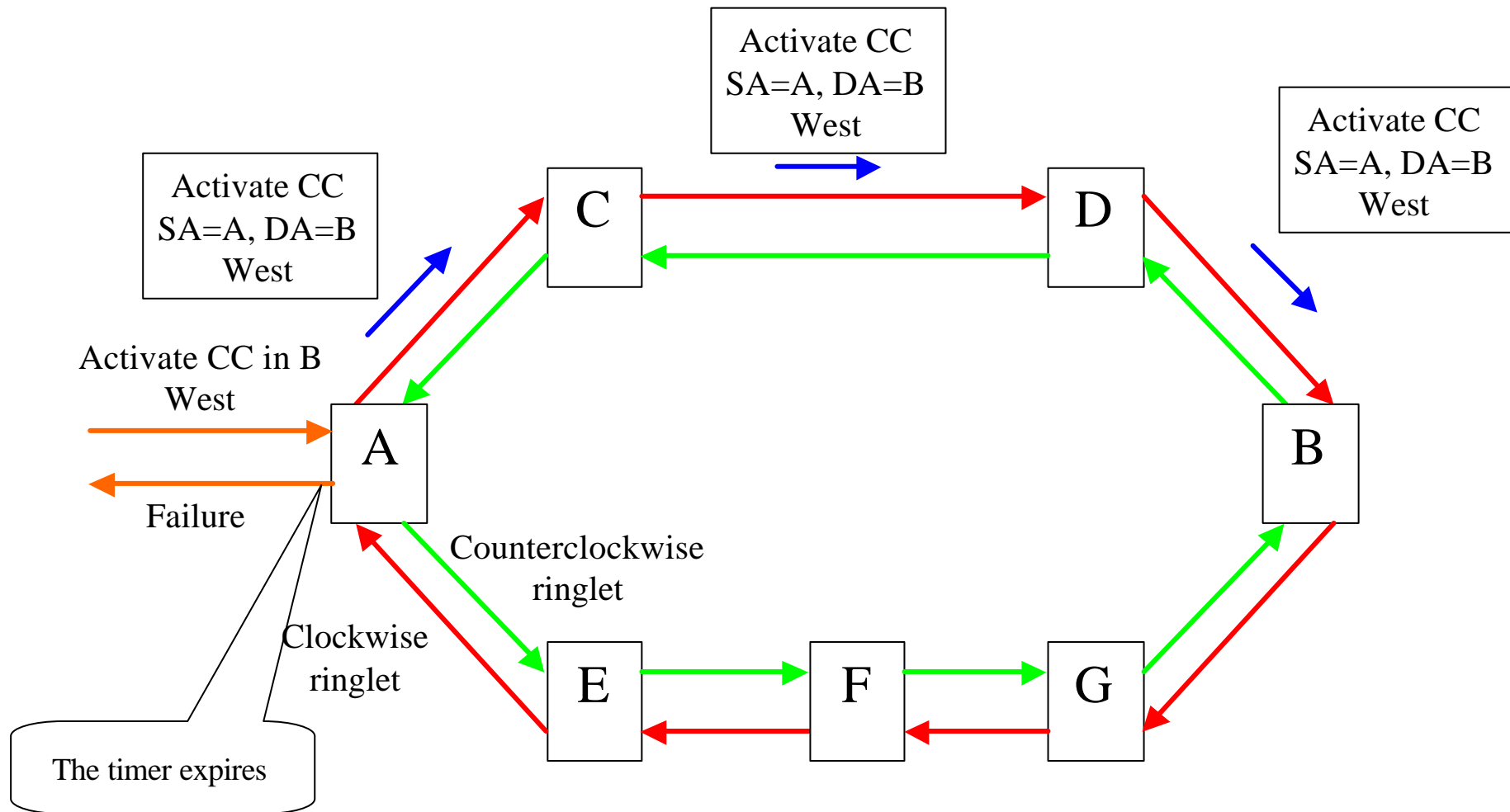


Failing Ping Mechanism Description

Case 1

- The operator asks node A to Activate CC in West side to node B
- Node A sends the Activate CC message on the shortest path (clockwise ringlet)
- Nodes C and D forwards the Activation Request as a normal RPR frame
- **Node B sends back the Activation Denied message on the shortest path (counterclockwise ringlet)**
 - **Node B does not support the CC flow**
- Nodes C and D forwards the Activation Denied as a normal RPR frame
- Node A notifies the failure to Operator

Failing Activation Mechanism - 2





Failing Ping Mechanism Description

Case 2

- The operator asks node A to Activate CC in West side to node B
- Node A sends the Activate CC message on the shortest path (clockwise ringlet)
- Nodes C and D forwards the Activation Request as a normal RPR frame
- **Node B silently discards Activation CC frame**
 - **Node B does not support the Activation/Deactivation flow**
- Timeout expires at Node A
- Node A attempts two more times to Activate CC
- Node A notifies the failure to Operator



Protection Issues



Protection of OAM frames

- With wrapping rings all the OAM frames (Ping Request, Ping Reply, CC, RDI, AD) are always wrapped at the nodes adjacent to the failure
- With steering rings, RDI and AD OAM frames are always steered on the protection path during failure conditions
- With steering rings, Ping Request, Ping Reply and CC frames are steered on the protected path, during failure condition, only when the operator is not forcing the ringlet selection. Otherwise they are never steered and then, during failure conditions, they are lost



Conclusions on OAM



Summary

- This presentation defines an on-demand in-service ping mechanism useful for troubleshooting
- This presentation defines a continuity check mechanism useful for failure detection
- This presentation also defines an activation/deactivation mechanism used for simplify CC activation/deactivation
 - The need for this mechanism (RPR rings operated by different management domains) is an open issue



OAM



This Proposal:

Addresses the fault management issues in an RPR network defining some in-band OAM flows

Other Proposals:

No other proposals are currently addressing the OAM issues

Summary:

This is a joint presentation that summarizes previous proposals and works above any proposed RPR MAC version