# Adaptive Routing Notification for Load-balancing

draft-liu-rtgwg-adaptive-routing-notification

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# Background

- **Adaptive Routing (AR) /Dynamic load balancing (DLB):**

Dynamic routing decisions based on changes in network load status.

- **Local Adaptive Routing**

local congestion --->decide the traffic to be rerouted --->change the traffic path locally

- **Remote Adaptive Routing**

local congestion --->decide the traffic to be rerouted ---> no other local path available
--->AR notification(ARN) to upstream node(s)
--->upstream node changes the traffic path

**This document provides analyses on different ARN mechanisms, including the information carried in ARN and how they are delivered into the network.**

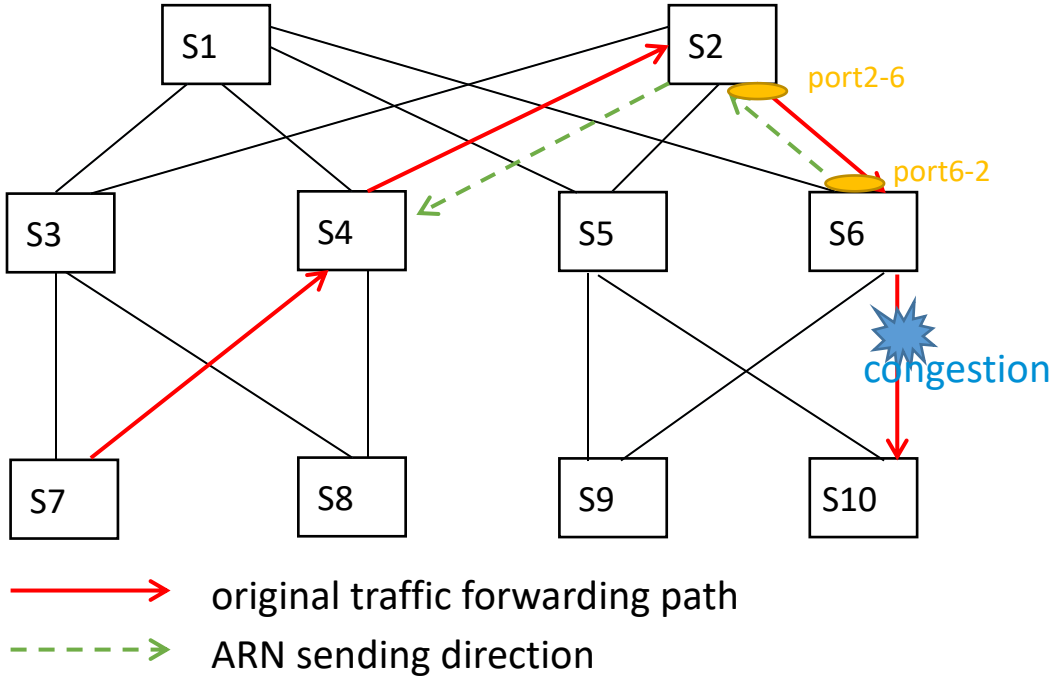
# Considerations for ARN

## KEY points for changing traffic path remotely

- **Local node generating ARN**
  - Which node(s) should the ARN be sent to ?
    ===> the destination address of the ARN message
- **Remote AR node**
  - Which traffic's forwarding table needs to be adjusted?
    ===>traffic identifier(e.g, flow ID, 5-tuples) in ARN, uniquely identifies traffic forwarded along the same path
  - Which port in the forwarding table needs to be blocked?
    ===>auxiliary info with ARN that helps locate the original outport on the AR node, directly carried or indirectly indicated

# ARN Option 1

- ARN sent to the upstream along the (reverse) traffic forwarding path
- Upstream AR node treats the ARN receiving port as the original outport




**pros**

no too much change for the routing and forwarding procedure

**cons**

records maintained on the local device for every flow requiring AR (stateful )

**S6 traffic forwarding**

- receive traffic 1
- record the traffic identifier and the receiving port (port6-2) of traffic 1

**S6 congestion processing**

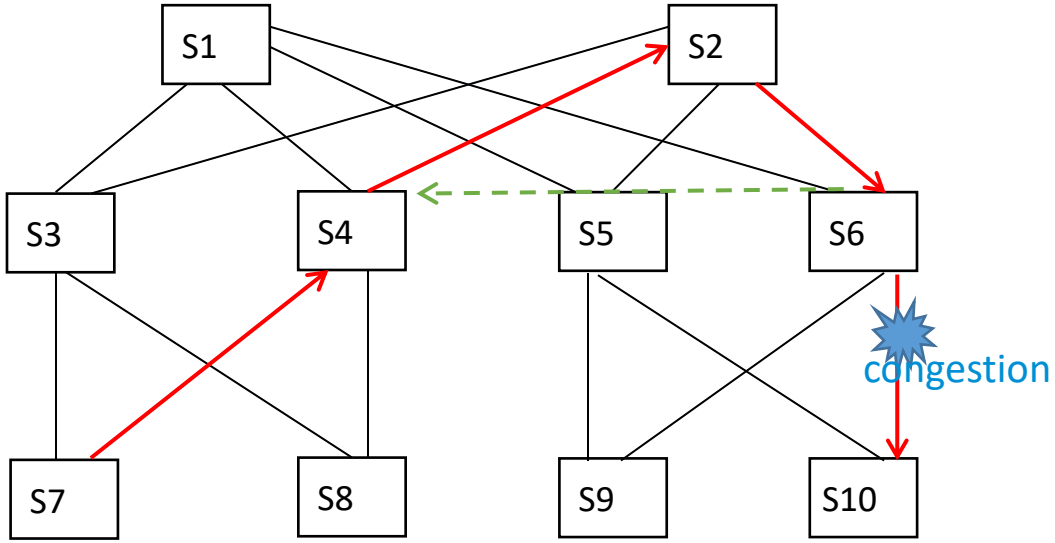
- congestion occurs
- traffic 1 needs to be rerouted
- look at the local record for the receiving port(port6-2) of traffic 1
- ARN sent to S2 via port6-2

**S2 ARN processing**

- ARN received from port2-6
- if other path available, block port2-6 in the forwarding table of traffic 1
- if no other none-congested path, further send ARN via its own receiving port of traffic 1(port2-4)

# ARN Option 2

- ARN sent directly to the nearest upstream node that is able to perform AR for this traffic
- Original outport on the upstream node of the traffic carried inside ARN




**pros**

no traffic receiving records locally

**cons**

need to modify packets of the traffic

**S7 traffic forwarding**

- more than one path(outport) available for traffic1
- choose one outport for traffic forwarding (port7-4)
- embed S7 ID and port7-4 ID in the packet

**S4 congestion processing**

- more than one path(outport) available for traffic1
- choose one outport for traffic forwarding (port4-2)
- replace SW ID and port ID with S4 ID and port4-2 ID

**S2 traffic forwarding**

- only one outport meets forwarding requirements
- forwarding traffic 1 directly

**S6 congestion processing**

- congestion occurs
- send ARN directly to S4 with S4 ID and port4-2 ID included

**S4 ARN processing**

- block port4-2 in the forwarding table for traffic 1

# ARN Tag

- **ARN mechanisms require the devices to consume additional resources.**
  - option 1 The nodes record the traffic identifier and receiving port of the traffic.
  - option 2 The nodes check whether there's more than one path for the packet and put the device identifier and outport identifier into the packet.

- **ARN is not necessary for all traffic**
  - Rerouting small flows has not much effect on alleviating congestion.
  - The path for some detection/telemetry messages may need to be maintained.

- **ARN Tag**
  - Only tagged packets are processed additionally after traffics are received.
  - ARNs are generated only for traffics to which tagged packets belong after congestion.

# Summary

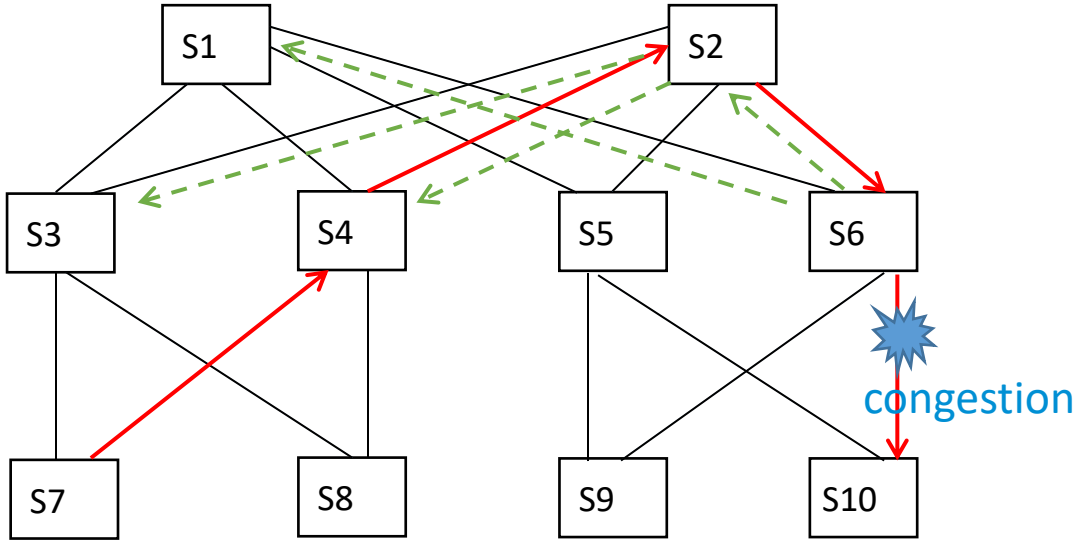
- The definition of AR varies in different contexts.
- In this draft, AR is regarded as a fast partial path adjustment mechanism,  in response to instantaneous traffic imbalances caused by network events.
- Each ARN option has its own pros and cons, the common point is that it requires additional consumption of device resources.
- ARN Tag helps to reduce the processing burden on the device.

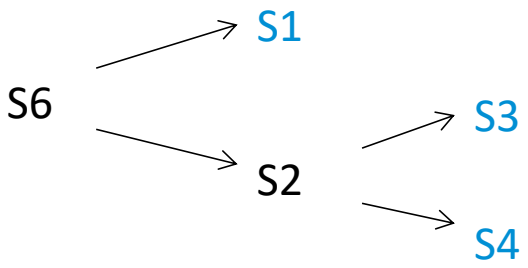
# Next Steps

- Continue to work on analysis on ARN options, e.g, sending ARN by multicast.
- Welcome feedback and comments !

# Thank You !

# Backup Slides




original traffic forwarding path

ARN sending direction