FNC Position

- **A basic scheme of maintaining associations of Remote (Client) MAC addresses and RPR MAC addresses**
  - Client VID optionally learned
  - 802.1D/Q Like learning/ageing mechanism
  - No GVRP, GARP etc. participation in the SAS
  - Management I/f to retrieve/define MAC address associations
- **Proposed extensions to address**
  - Incomplete learning/persistent flooding issues
  - Switching between Directed/Undirected modes and its impact on Strict mode frames
- **Clarification that SAS <-> SAS Only is not a technical limitation? Are there possible extensions?**
- **Clarification of environments where SAS is used.**

Incomplete Learning

- **Mainly due to the fact that RPR ring is not a completely shared medium – a key difference from legacy LANs**
- **This was discussed in Annex F/D3.3 Specification and caused persistent flooding**
- **Annex F/D3.3 solution for this was to always flood the remote frames**
- **In SAB, remote MAC addresses contained within directed frames may not be learned by some stations on the ring**
  - The resulting FDBs on different RPR stations can be different
  - Depending on the traffic flow pattern, some remote MAC addresses may not be learned by some RPR stations for relatively long time
  - The issue may not be as severe as persistent flooding but will result in unnecessary flooding
    - Consider the following communications scenario: A->C, D->C, C->D; A will never learn about C and will continue to flood on the ring, other stations that do not know about C will flood on attached segments

Incomplete Learning Example
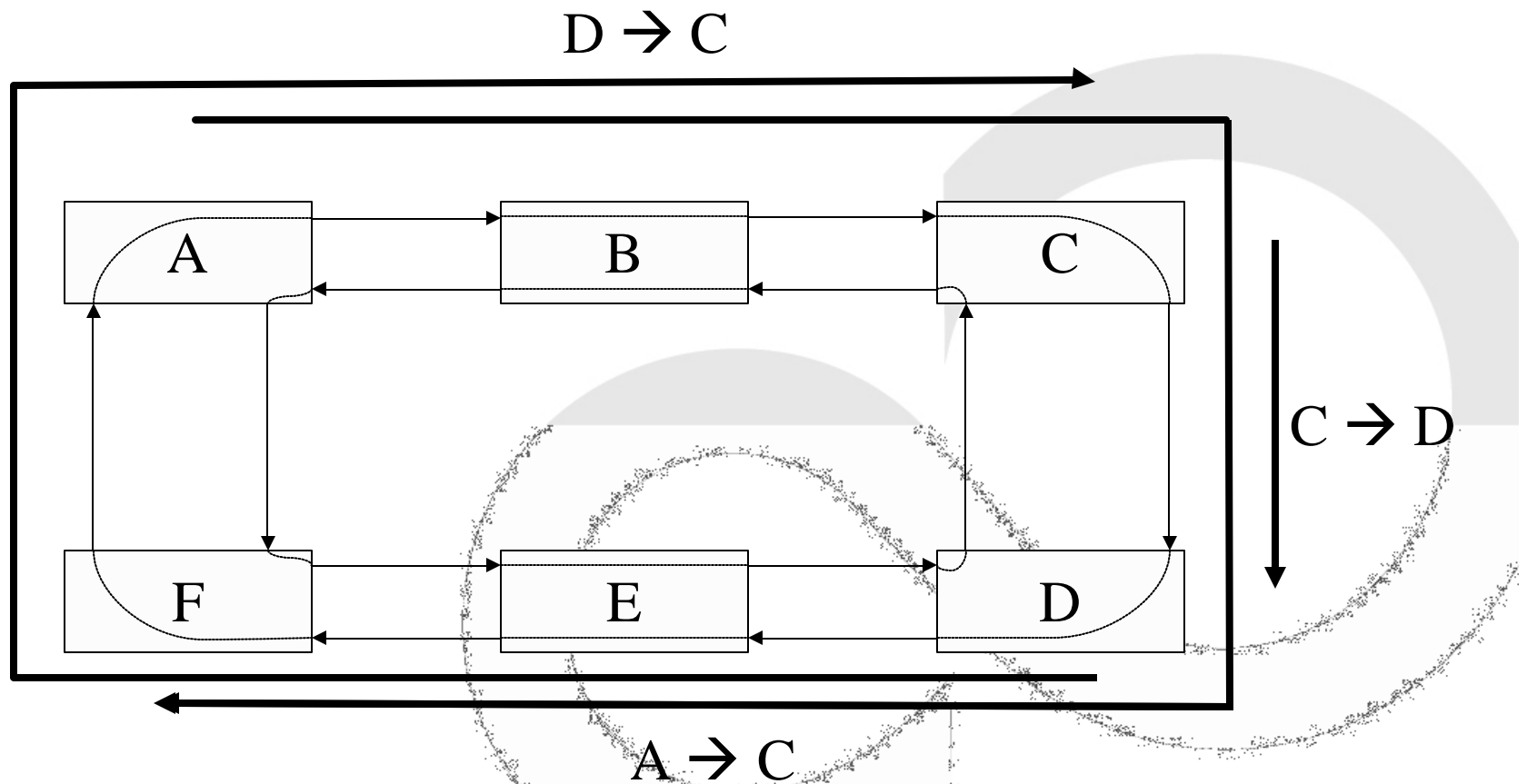
A -> C and D-> C are undirected, Every node learns A and D, C-> D is directed and C is not learned by anyone but D

Incomplete Learning Issue

- **Can the basic scheme be supplemented by a simple extension to alleviate the incomplete learning issue?**
  - Timed Undirected Transmissions
    - Timer based scheme – Maintain a flag with each LAN side entry in the FDB
    - The flag is set by a timer (once every n seconds, n should be less than minimum ageing time for all SAS aware stations in the ring) and also set automatically when a new FDB entry is created
    - When sending packet, if the flag is set -- use undirected transmission and then reset the flag
    - If a packet is flooded on to the ring for other reasons, then reset the flag for that Client address
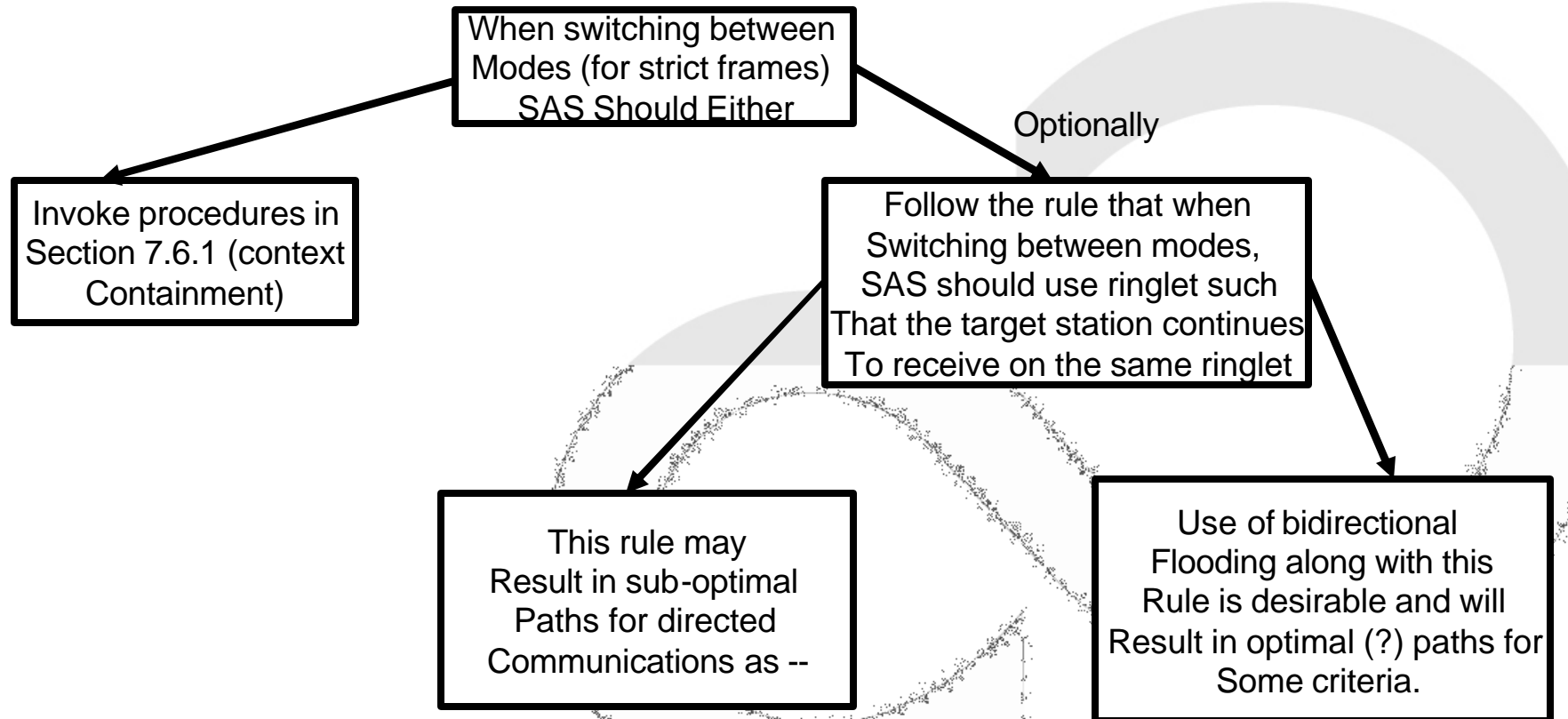
Switching between Undirected – Directed modes

- **SAB switches between undirected and directed modes (and vice-versa) as associations are made (aged out)**
- **There is a potential for causing packet duplication/misordering**
  - Specially, if the undirected frames are uni-directionally flooded
  - Depending upon algorithms for cleave point selection (undirected) and ringlet selection (directed)
    - One very simple example will be – use of ringlet 0/1 based on SA/DA when sending undirected, but use least hop when sending directed.
- **SAB should either**
  - have a mechanism to invoke procedures defined in Section 7.6.1 (Context Containment) or
  - Optionally follow the rule that maintains the use of same ringlet

SAS and Packet Misordering

When switching between
Modes (for strict frames)
SAS Should Either

Optionally

Invoke procedures in
Section 7.6.1 (context
Containment)

Follow the rule that when
Switching between modes,
SAS should use ringlet such
That the target station continues
To receive on the same ringlet

This rule may
Result in sub-optimal
Paths for directed
Communications as --

Use of bidirectional
Flooding along with this
Rule is desirable and will
Result in optimal (?) paths for
Some criteria.

Other events/actions that invoke 7.6.1 procedures are not
affected by this optional feature.

Switching between Undirected – Directed modes (Continued)

- **Add a simple (possibly optional) scheme that is more amenable for Strict mode frames**
- **One mechanism is -- The undirected frames are bidirectionally flooded with optimal cleave point (e.g. in terms of #hops)**
- **When switching to directed mode –**
  - Send frames on the ringlet on which the target destination resided, when undirected mode was used.
  - This ensures that the target destination continues to receive packets from the same ringlet upon mode changes
  - This is a preferred method because it will avoid data loss
- **What about the open ring scenarios? Cleave point recomputation with a Timer based solution, fixes it automatically the next time undirected transmission occurs.**
  - Steered open ring
  - Wrapped open ring

Learning mechanism

- **Why is spatial reuse limited to flows between two SAS aware pairs? Can the learning mechanism be extended to learn (CMAC-RMAC) from 802.17 D3.3 extended frame**
  - Achieve Spatial reuse between SAS and 802.17 D3.3 Annex F implementation (only for frames originating from SAS).
- **Learning behavior needs to be defined when**
  - Group address – but not flooded
  - Individual address – but flooded
- **Why flush the entire FDB upon topology changes**
  - Can it be pruned based on the new RPR topology?
  - Always use undirected transmissions when topology is unstable?
  - Set the flag for all LAN associated entries
  - Lot of flooding in a synchronized manner, if entire FDB is flushed?

Topology change

- Use the RPR topology database to determine which RPR stations are reachable

- Mark FDB entries associated with only reachable RPR MAC addresses as valid

- Should be further investigated to analyze stability and corner cases etc.