Network Interconnect Resiliency Requirements

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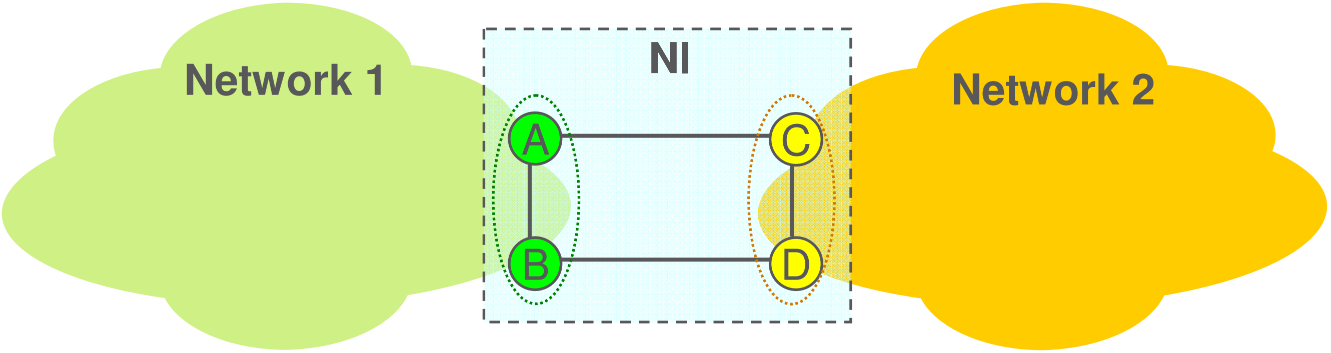
Target: Peering interconnect

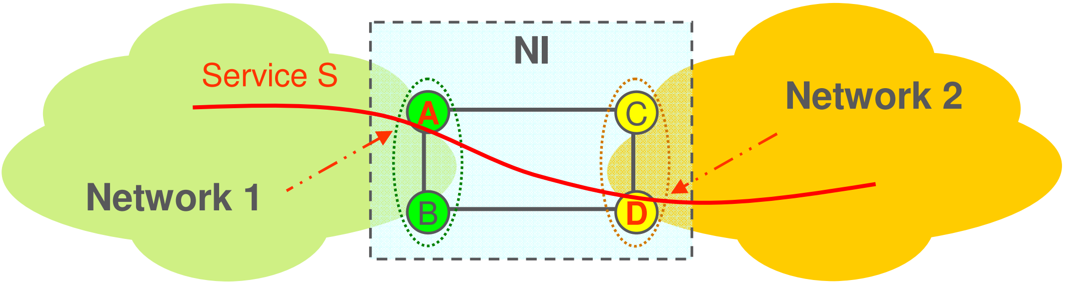
- The two independent providers have equal rights, none of them is inferior to the other; thus
- The network providers may have independent decisions
- The **Network Interconnect (NI)** has to adapt to providers' decisions and provide the connectivity
- NI has its own control: the **Network Interconnect Protocol (NIP),** which is independent from the control of the attached networks



R1 – Independent service assignments

- A provider may select an NI node for a service independently of the peering provider’s selection
- The service assignment is done by the provider (either by configuration or by a protocol run by the provider)

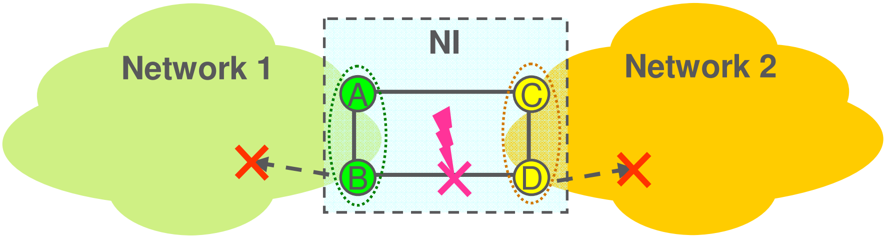
- For example
  - Network 1 selects NI node A for service S
  - Network 2 selects NI node D for service S



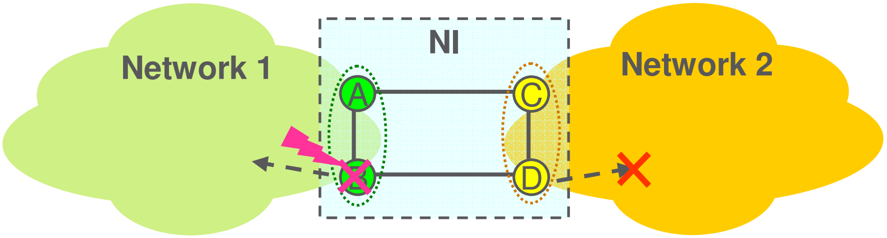
- Bundling maybe supported

R2 – NI failure isolation

- NI failure should not cause state change in the provider networks’ control protocols
  - Link failure
    - NI failure should not cause state change in any of the attached networks



  - Node failure
    - Affects the provider network comprising the node
    - Provider has to re-assign affected services



    - NI failure should not cause state change in the non-affected network
- Provider network failure may cause state change in the NI (e.g. a service is re-assigned due to a failure)

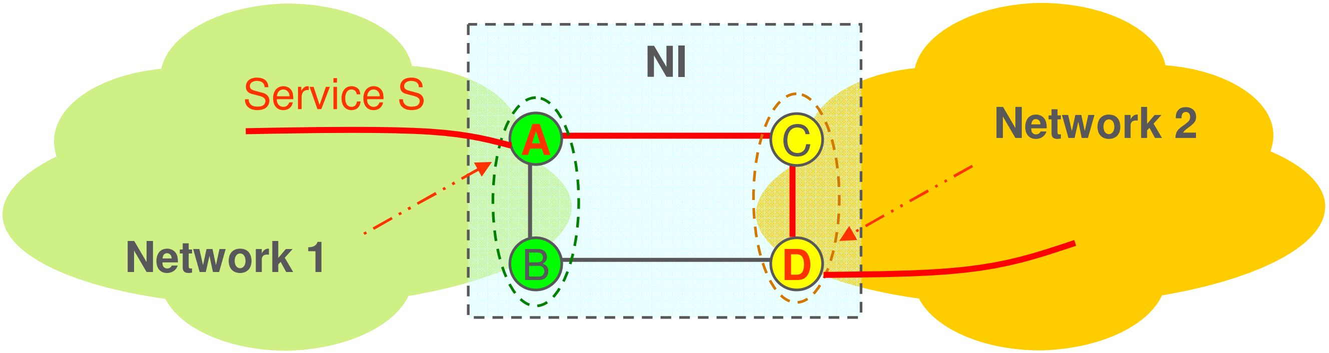
R3 – Failover time

- Link failure
  - NI should provide sub 50 msec failover time for link failures

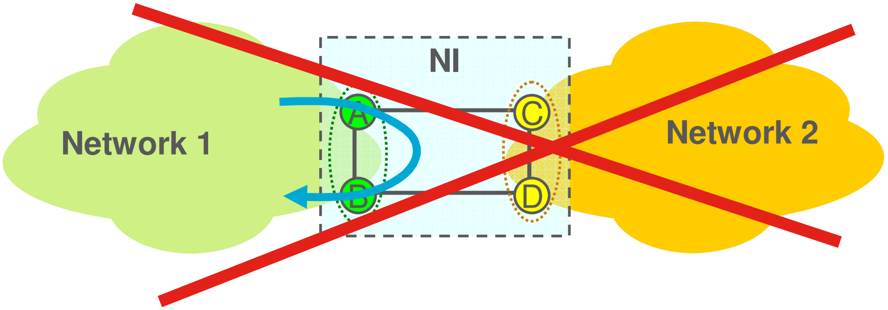
- Node failure
  - Time constraint shouldn’t be put on the entire failover
  - The provider has to re-assign the affected service(s)
  - NI then adapts to the service re-assignment
  - Time constraint could be put on NI adaptation

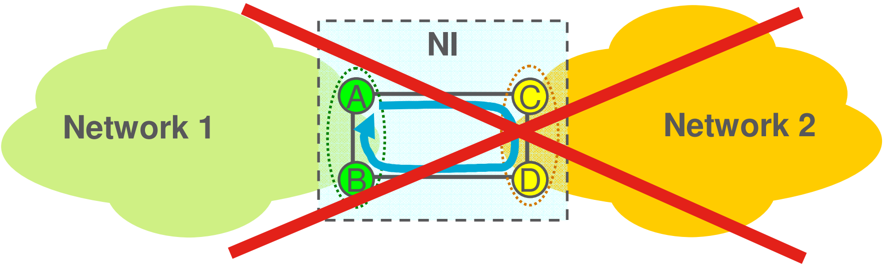
R4 – Connectivity

- NIP should provide loop-free connectivity between the attached networks
- NIP should adapt to service assignments



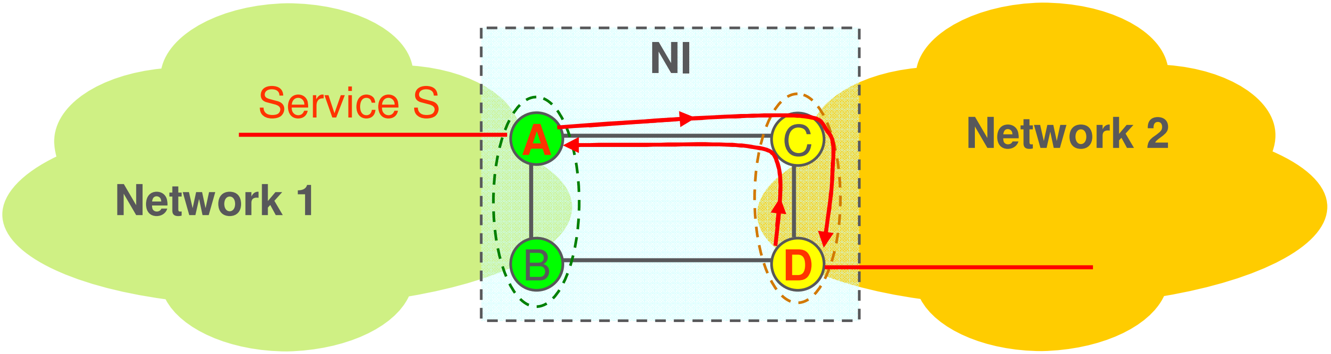
- NIP should ensure that frames are not looped





R5 – Congruency

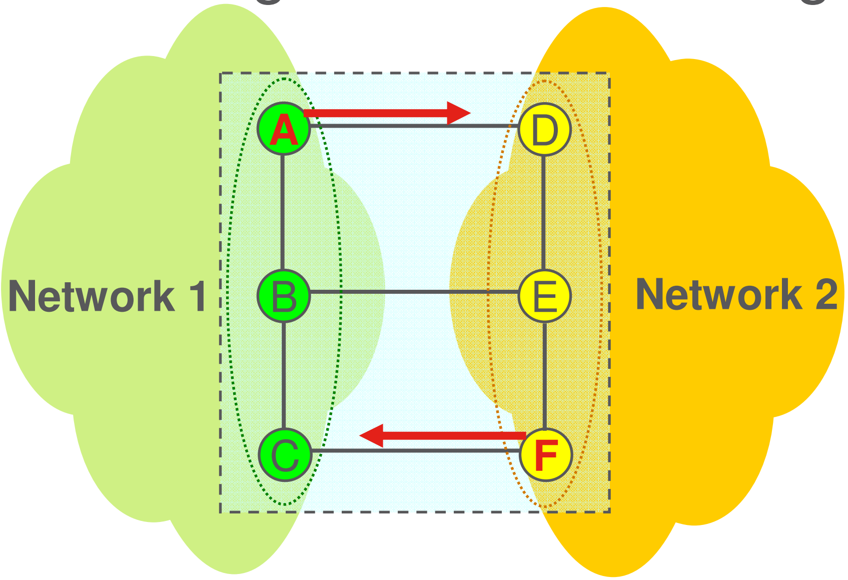
- Congruency should be supported
  - The same path used in the NI for the two directions of a service



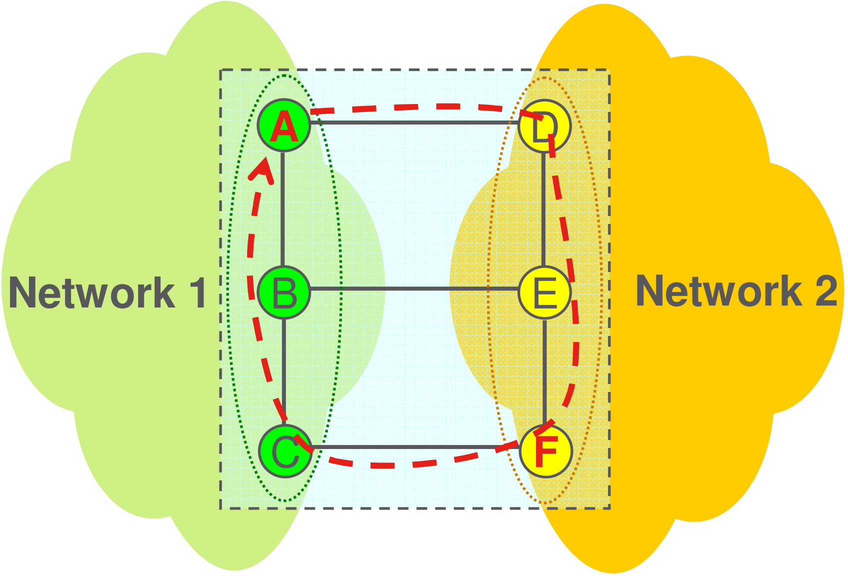
- Forwarding path may not be optimal due to the independent assignments
  - Providers may agree in the service assignments in order to use a direct link
  - Or one of them may relax service assignment for optimal path

If congruency is not applied

- Non-congruent NI forwarding paths



- Other means are needed to avoid loops

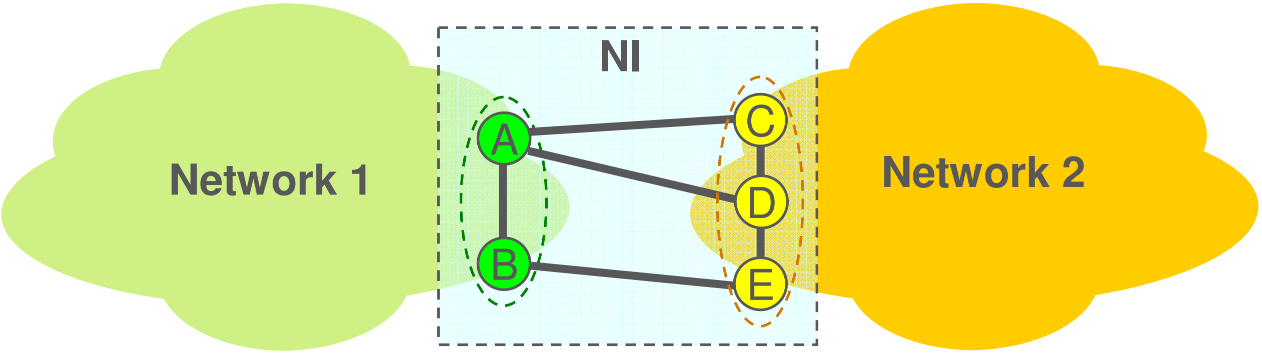


R6 – NI topology

- NI topology should be at least two-connected
- Connection between NI nodes of the same provider
  - An NI node should be connected to at least another NI node belonging to the same provider
  - The connection maybe physical or virtual

- NI topology might be arbitrary otherwise

Example:



Consequence – Load balancing

- Service by service assignment provides support for load balancing

Mapping the list of "criteria or potential requirements” from the Webex meetings

- 01 Protect a single service (VLAN) or a group of services (VLAN) – **R2**
- 02 Protect against any single failure or degradation of a facility (link or node) in the interconnected zone– **R2**
- 03 Support interconnection between different network types (e.g. CN-PBN, PBN-PBN, PBN-PBBN, PBBN-PBBN, etc.) – **R4**
- 04 Provide sub-50 ms fault recovery – **R3**
- 05 Provide a clear indication of the protection state – **R2**
- 06 Avoid modifying the protocols running inside each of the interconnected networks – **R2**
- 07 Maintain an agnostic approach regarding – **R4**:
  - the network technology running on each of the interconnected networks, and
  - any protection mechanism deployed by each of the interconnected networks
- 08 Allow load-balancing between the interfaces that connect the networks to ensure efficient utilization of resources – **R1**
- 09 The effects of protection events in the interconnected zone on the topology of the related attached networks should be minimized. – **R2**
- *10 Design the interconnected zone in a way that will ensure determinism and predictability.*
- 11 There can be at least one failure in every provider cloud, and at least one failure in every interconnect cloud, and connectivity will still be maintained. – **R2**
- 12 Support topologies with more than two nodes and more than two inter-cloud links, so that equipment can be taken down and replaced without a period of unprotected operation. – **R6**
- 13 Control packets cannot be 1:1 with customer services; that is, some kind of bundling is necessary in order to support thousands of services. – **R1**
- 14 The bundling of services for protection purposes (e.g. MST instances) can be completely different in different service provider clouds. – **R1**
- 15 The NNI protects services, not parts of services. – **R1**
- *16 If one service provider cloud becomes split into multiple disjoint clouds, it cannot depend on the interconnect cloud or any adjacent service provider cloud to provide connectivity among its parts.*
- 17 We cannot assume an ultra-reliable link. – **R6**
- 18 It must be possible to ensure the use of the same link in both directions for every service. – **R5**
- 19 Inter-domain coordination should be minimized. – **R1**
- 20 Support asymmetrical links -- not all the same speed or cost– **R5**
- *21 Do we support a encapsulation scheme in the interconnect cloud, or is the ENNI independent of the encapsulation?*
- *22 Do we assume that the bandwidth (or other Traffic Engineering parameter) of the interconnect cloud is adequate for all of the services, or do we do something special if it is insufficient?*
- *23 Do we need protocol for conveying service creating/deletion or traffic engineering requirements between Service Providers?*