Ethernet Connection Service

Paul Bottorff, Ethernet Architect

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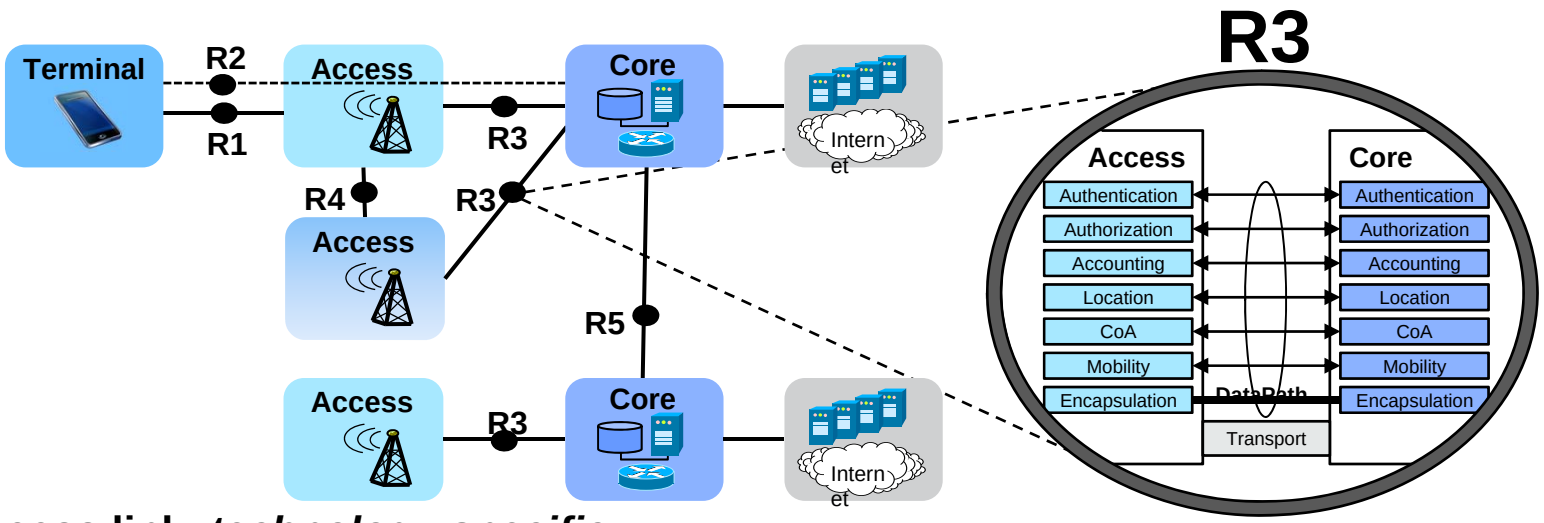
OmniRAN Architecture and Reference Points



R1: Access link, *technology specific*

R2: User & terminal authentication, subscription & terminal management

R3: Authorization, service management, user data connection, mobility support, accounting, location

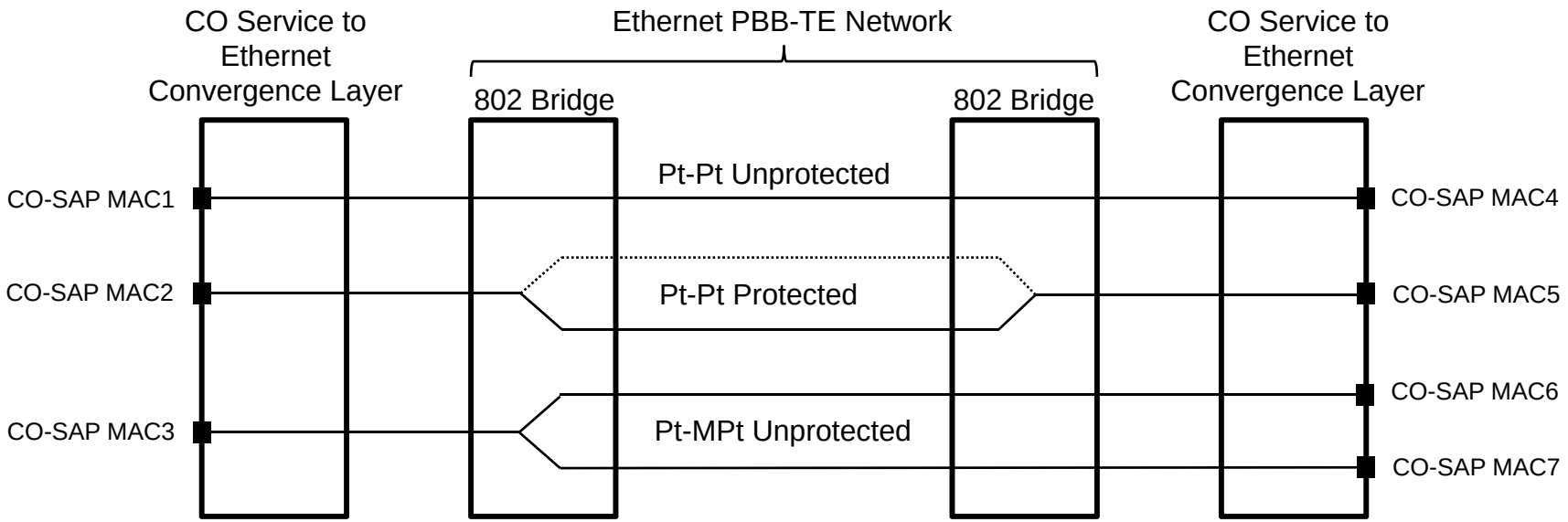
R4: Inter-access network coordination and cooperation, fast inter-technology handover

R5: Inter-operator roaming control interface

Some 802.1Q Technologies to Consider for R3

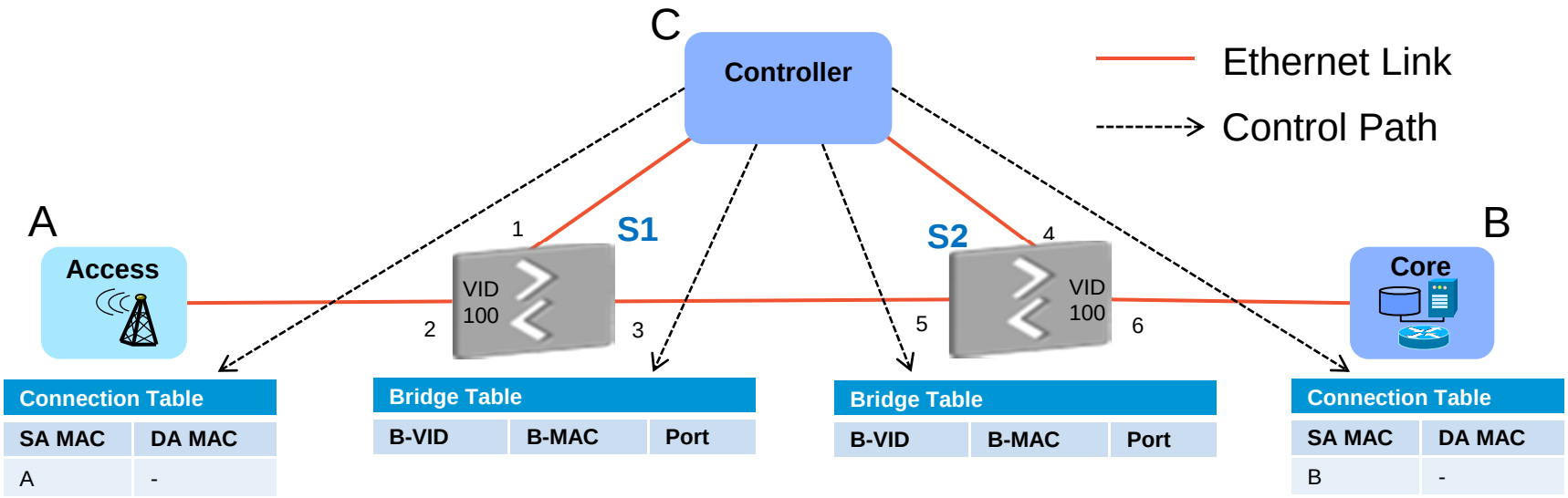
- **802.1 Access Network Components**
  - 802.1Q S/B/I/T-Components
  - 802.1Q Port Mapping S-VLAN Components
  - 802.1AX D-LAG Link Protection
- **SDN Networking**
  - 802.1Q PBB-TE with or without Mac in Mac
- **High Scale Distributed Control Protocols**
  - 802.1Q SPBM, SPBV, SPB-PCR (High Scale Service Protocols)
- **End Station Signaling**
  - 802.1Q VSI Discovery and Configuration Protocol
- **Hybrid (SDN/Distributed) Control Plane**
  - 802.1Q MSTI B-VID assignment
- **802.1X/AE Security Protocols**

Connection Oriented Service using PBB-TE



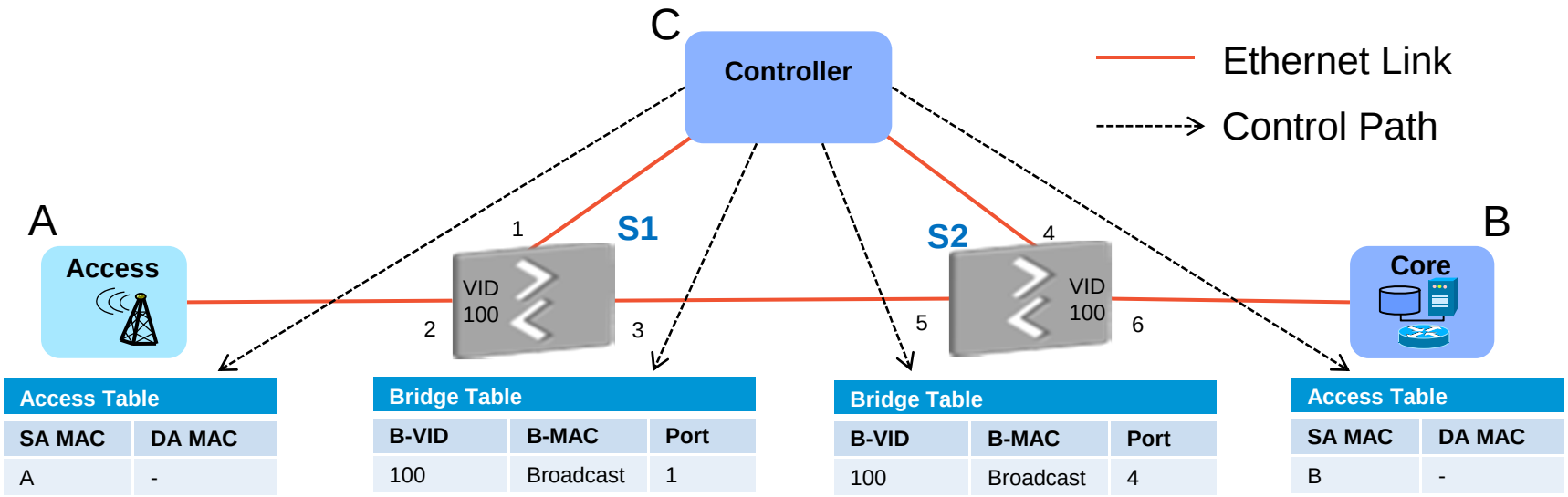
- **3 examples of connection service instances**
- **Each CO-SAP is identified by a MAC**
- **Each connection is identified by a MAC tuple <MAC1,MAC2,…>**

PB Switches S1 and S2 and SDN Controller C



- **S1 and S2 are Provider Bridges configured for PBB-TE forwarding**
  - All learning is disabled
  - All frames with unknown addresses are discarded
- **C is an SDN controller which will control the configuration of all switchs**
  - C may use OpenFlow, SNMP, NetConf, etc for it's operating protocol

Controller Configures to Intercept Broadcasts



Access Table	
SA MAC	DA MAC
A	-

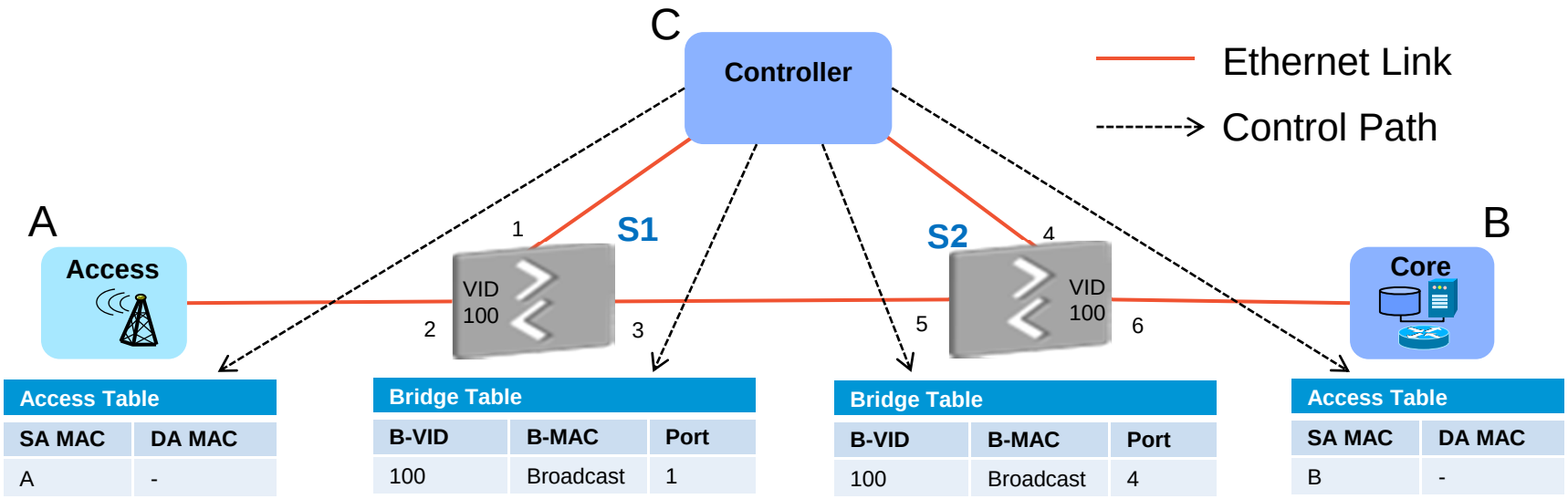
Bridge Table		
B-VID	B-MAC	Port
100	Broadcast	1

Bridge Table		
B-VID	B-MAC	Port
100	Broadcast	4

Access Table	
SA MAC	DA MAC
B	-

- **The controller discovers all switches and sets there initial configuration**
  - The switches my exchange control frames such as LLDP between their control planes, however all data frames are discarded (since we are using PBB-TE forwarding)
  - The controller discovers all bridges using static configurations, LLDP discovery, topology advertisements, etc
  - The controller sets all switch ports to use a default B-VID selected from the B-VIDs allocated to PBB-TE
  - The controller sets all filtering databases to forward any broadcast frames to the controller

End Stations A and B Send Initial Broadcasts



Access Table	
SA MAC	DA MAC
A	-

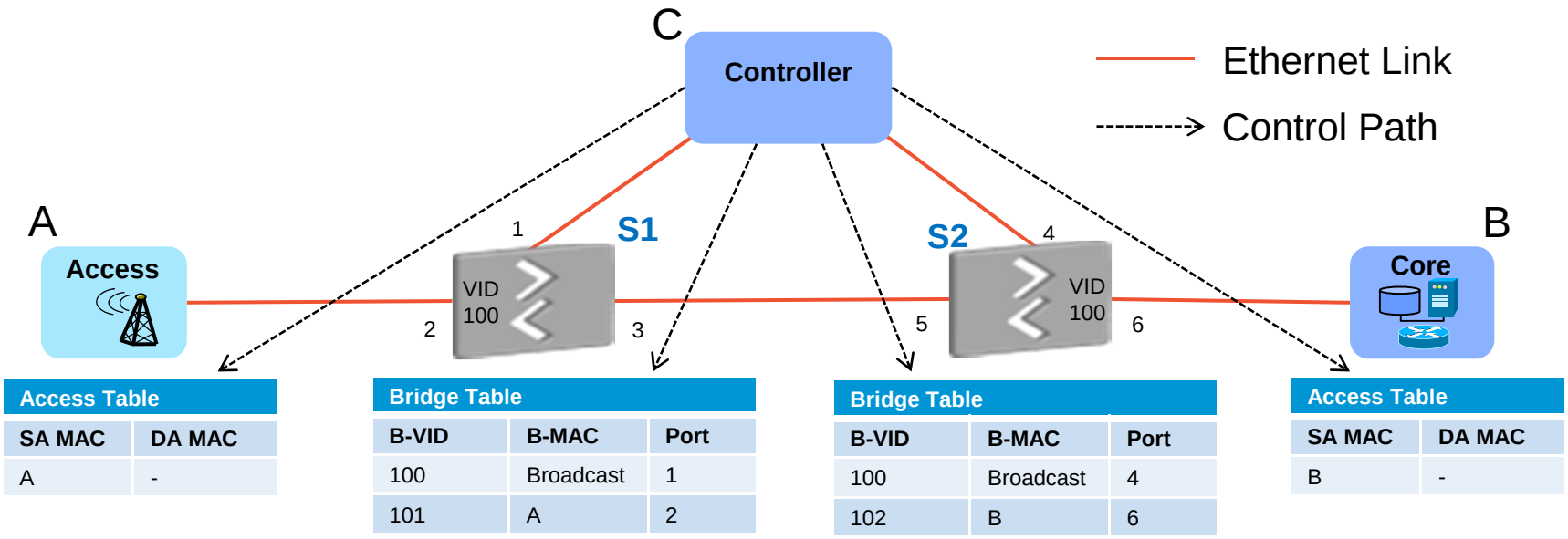
Bridge Table		
B-VID	B-MAC	Port
100	Broadcast	1

Bridge Table		
B-VID	B-MAC	Port
100	Broadcast	4

Access Table	
SA MAC	DA MAC
B	-

- **Initially A and B identify themselves to the controller by sending broadcast frames into the network which are delivered to the controller**
  - Initially the Controller programs an Ethernet Switched Path (ESP) from all switch ports to the controller for the broadcast address, this is a unidirectional path
  - The initial frames are typically DHCP requests

Controller Intercepts all Broadcasts



Access Table

SA MAC	DA MAC
A	-

Bridge Table

B-VID	B-MAC	Port
100	Broadcast	1
101	A	2

Bridge Table

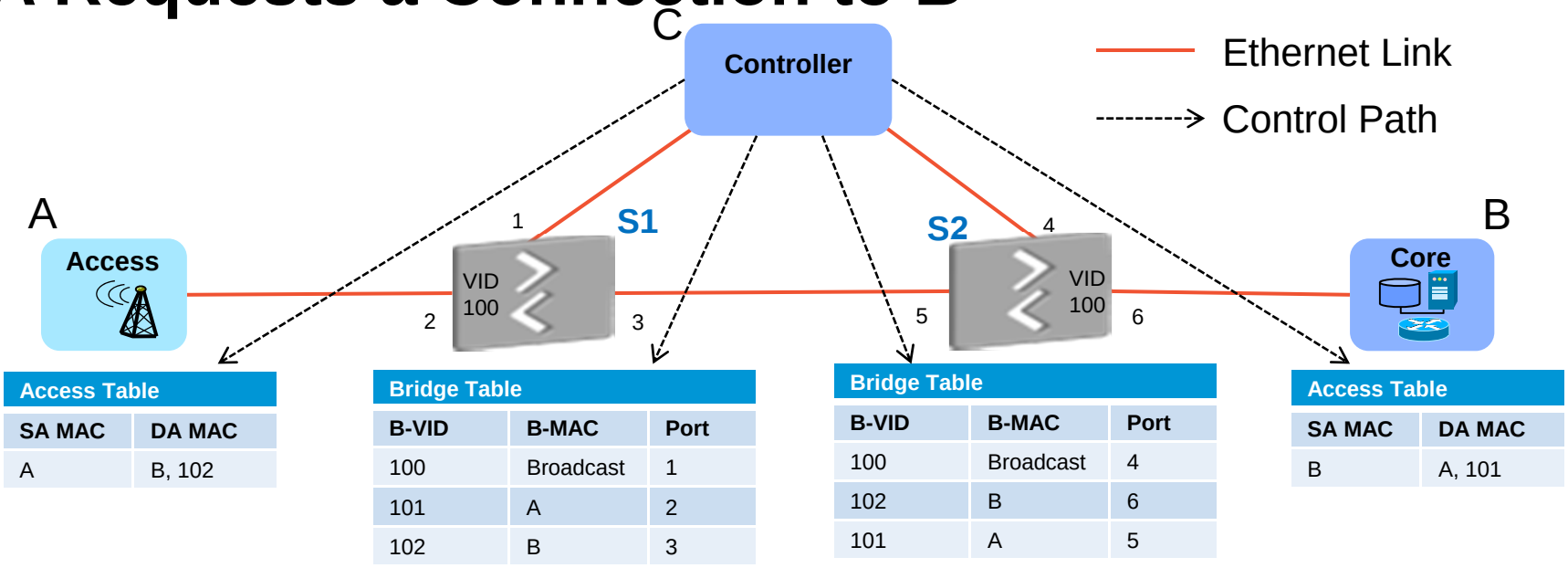
B-VID	B-MAC	Port
100	Broadcast	4
102	B	6

Access Table

SA MAC	DA MAC
B	-

- After receiving an initial request the controller programs the A and B MAC addresses into switches S1 and S2 forming Pt-Pt (C,A,101) and (C,B,102)
- The controller can then send responses to A and B with the requested configuration information

A Requests a Connection to B



Access Table	
SA MAC	DA MAC
A	B, 102

Bridge Table		
B-VID	B-MAC	Port
100	Broadcast	1
101	A	2
102	B	3

Bridge Table		
B-VID	B-MAC	Port
100	Broadcast	4
102	B	6
101	A	5

Access Table	
SA MAC	DA MAC
B	A, 101

- **Station A requests a connection to B using a broadcast frame**
- **In response the controller forms (A,B,102) and (B,A,101) by programming S1 and S2 FDBs**
  - Programs S1 to forward B's Address on the default B-VID
  - Programs S2 to forward A's Address on the default B-VID
- **The controller then responds to A to identify (A,B,102) filling in A's table**
- **On receipt of the first frame B may then uses the controller to find (B,A,101)**

Summary

- We can use existing PB switches configured for PBB-TE in conjunction with a Controller to build any number of Pt-Pt TESIs through the PB network
- We can extend this technique using Asymmetric VLANs (E-TREE) to increase link security
- This method may be extended to include all the IEEE features including Security, OAM, fault resiliency
- It is possible to combine this method with SPBM to allow for distributed control of some services in parallel with the central controller