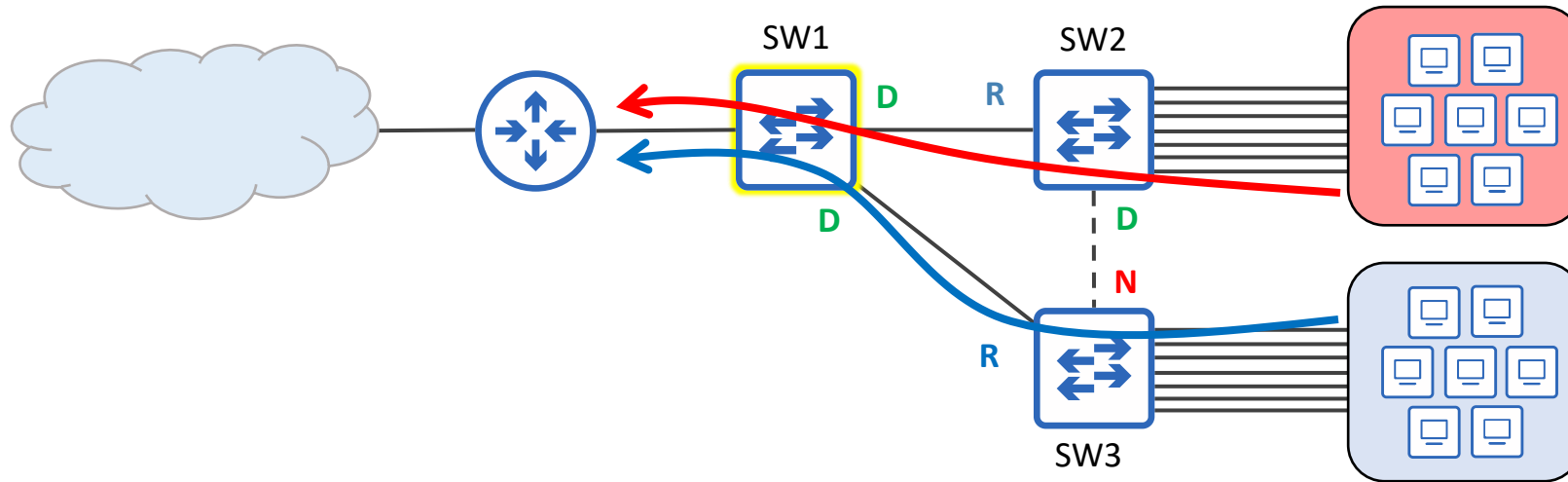


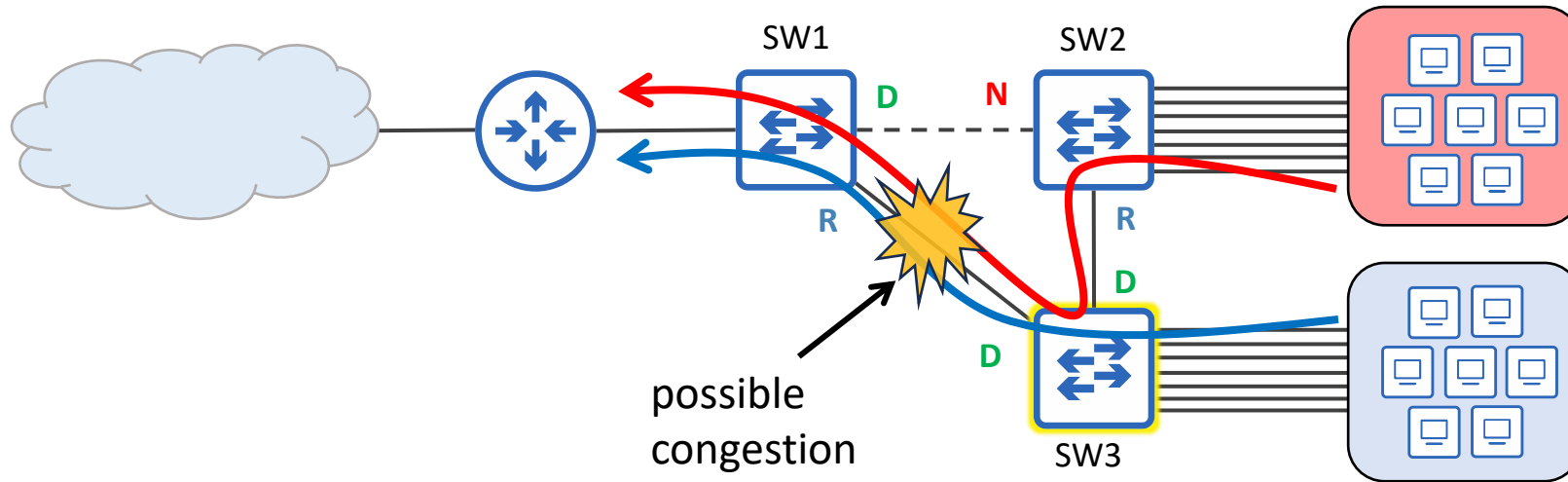
- STP Toolkit
 - PortFast
 - Allows switch ports connected to end hosts to immediately enter the STP Forwarding state, bypassing Listening and Learning.
 - BPDU Guard
 - Automatically disables a port if it receives a BPDU, protecting the STP topology by preventing unauthorized devices from becoming part of the network.
 - BPDU Filter
 - Stops a port from sending BPDUs or processing received BPDUs.
 - **Root Guard – this video**
 - Prevents a port from becoming a Root Port by disabling it if superior BPDUs are received, thereby enforcing the current Root Bridge.
 - Loop Guard
 - Protects the network from loops by disabling a port if it unexpectedly stops receiving BPDUs, ensuring it does not mistakenly enter the Forwarding state.

Root Bridge placement



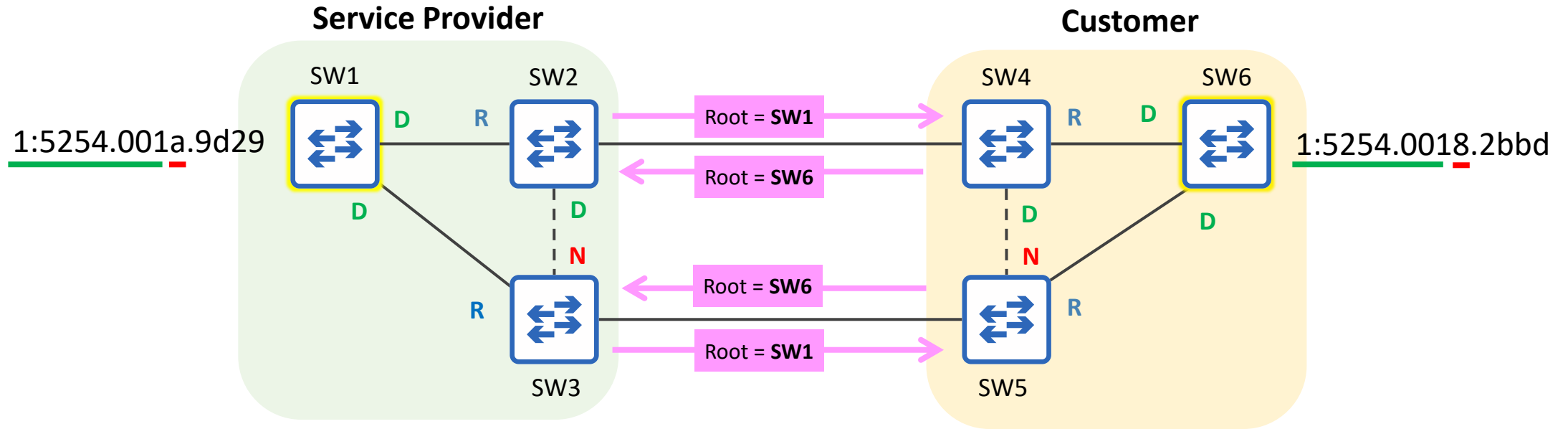
- STP prevents loops by electing a root bridge and ensuring that each other switch has only one valid path to reach it.
- You shouldn't randomly select the root bridge. Some things you should consider include:
 - Optimal traffic flow
 - minimize latency
 - minimize congestion
 - Stability and reliability

Root Bridge placement

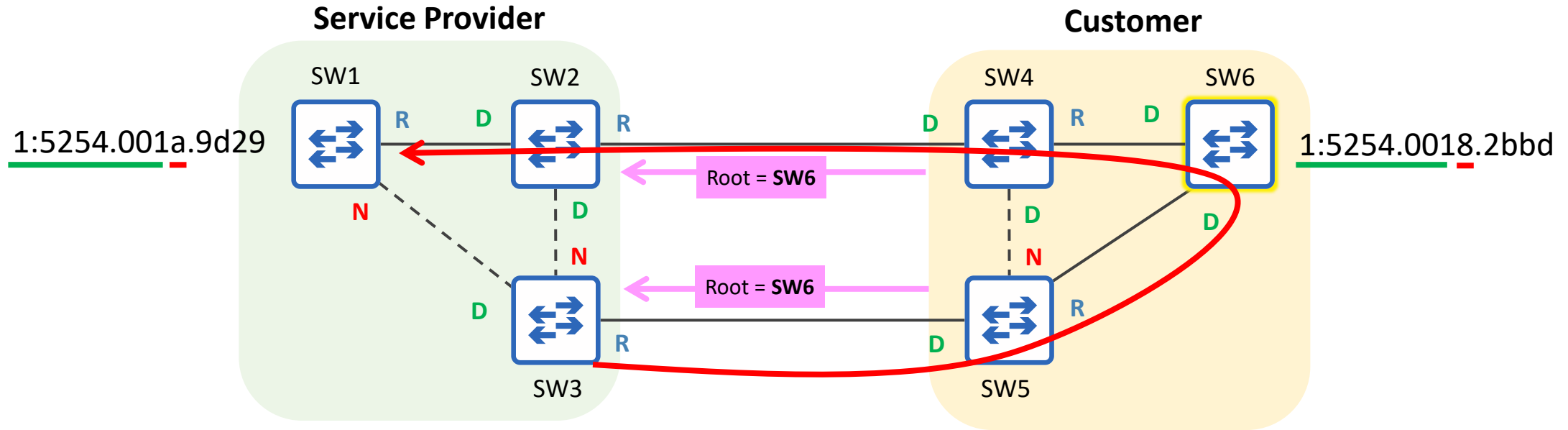


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- You shouldn't randomly select the root bridge. Some things you should consider include:
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 - minimize latency
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 - Stability and reliability

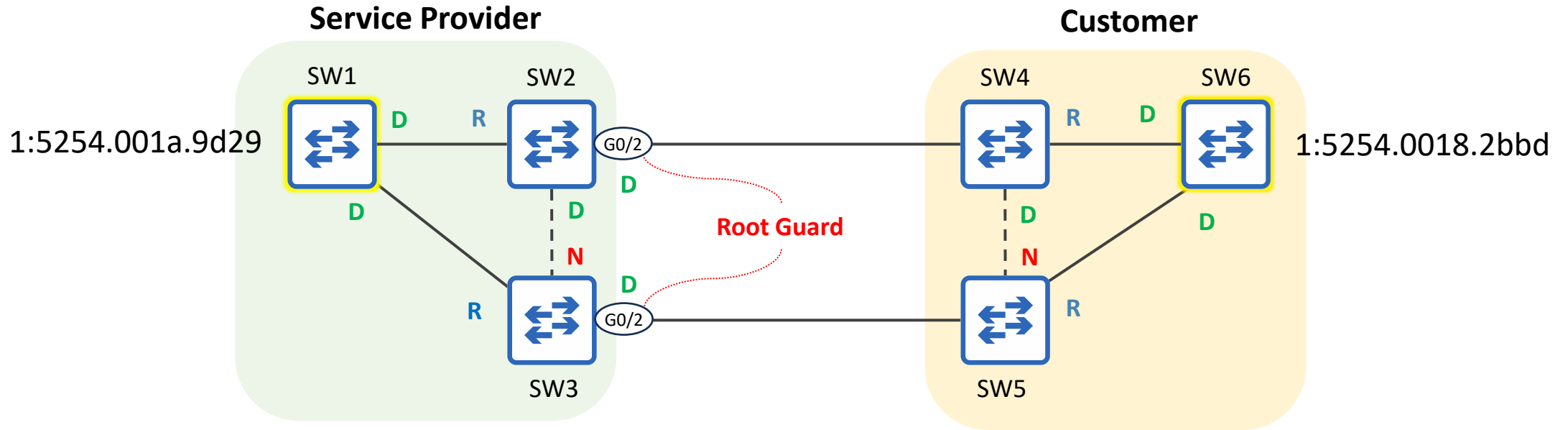
Root Guard: the problem



- Within your own LAN, you can easily control the root bridge by setting its priority to **0**.
 - But there are cases where you might connect your LAN to other switches outside of your direct control:
 - A service provider offering **Metro Ethernet** service to customers
 - often used to connect sites within a MAN (Metropolitan Area Network)
- Even if you set your root bridge's priority to 0, its role can be taken by another switch with a lower MAC address.

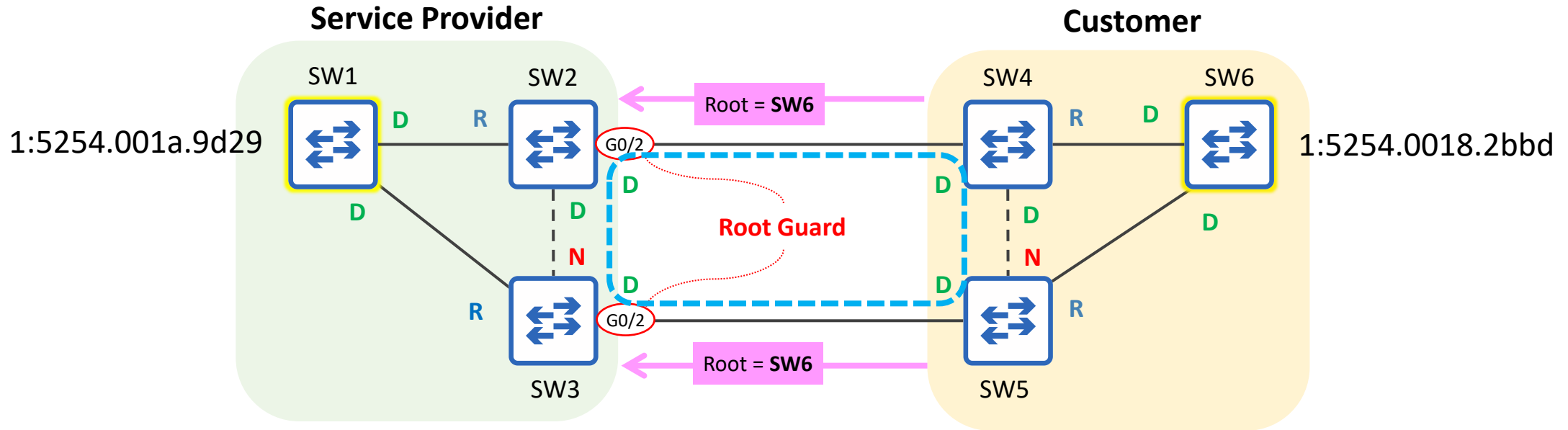


- With no safeguard in place, SW1, SW2, and SW3 accept SW6 as the root bridge, affecting the service provider's STP topology.
 - Frames from SW3 to SW1 must take a detour through the customer's LAN.
- **Root Guard** can be configured to protect your STP topology by preventing your switches from accepting **superior BPDUs** from switches outside of your control.
 - **Superior BPDUs** = a BPDU that is superior in the STP algorithm (e.g. claiming a better root bridge ID).



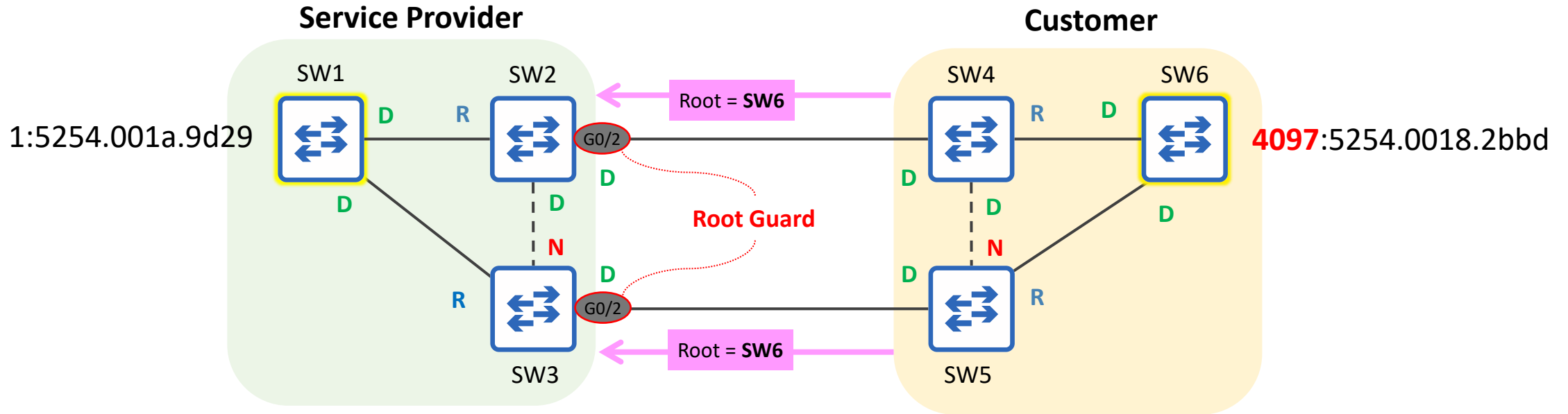
- If you want to ensure that the root bridge remains in your LAN, you can configure **Root Guard** on the ports connected to switches outside of your control.
 - SW2 G0/2, SW3 G0/2
- Use SW2(config-if)# **spanning-tree guard root** to enable Root Guard on a port.
 - There is no command to enable it by default from global config mode.

Root Guard: the solution



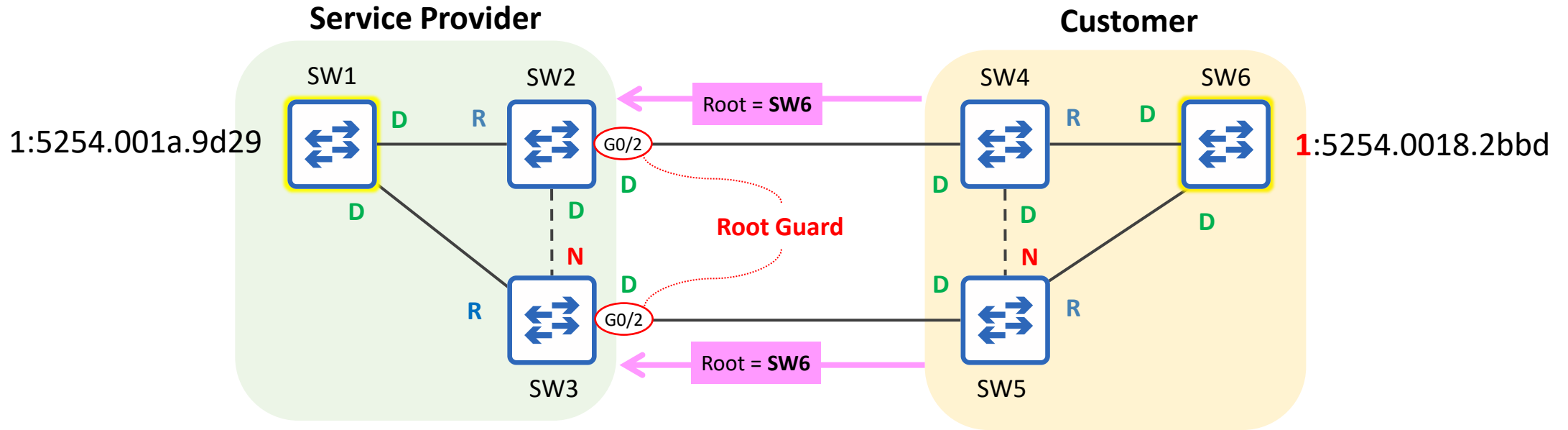
- If you want to ensure that the root bridge remains in your LAN, you can configure **Root Guard** on the ports connected to switches outside of your control.
 - SW2 G0/2, SW3 G0/2
- Use SW2(config-if)# **spanning-tree guard root** to enable Root Guard on a port.
 - There is no command to enable it by default from global config mode.
- If a Root Guard-enabled port receives a BPDU, it will enter the **Broken** (*Root Inconsistent*) state, effectively disabling it.
 - The port will not be able to forward data frames and will discard any frames it receives.
 - SW1, SW2, and SW3 won't accept SW6 as the root bridge.

Root Guard: the solution



- To re-enable a port disabled by Root Guard, you must solve the issue that disabled the port.
 - The disabled port must stop receiving superior BPDUs.
 - Tell the customer to increase the priority value of their switch.
- Once the superior BPDUs received by SW2 G0/2 and SW3 G0/3 age out, the ports will automatically be re-enabled.
 - A BPDU's Max Age is 20 seconds by default.

Root Guard: CLI demonstration

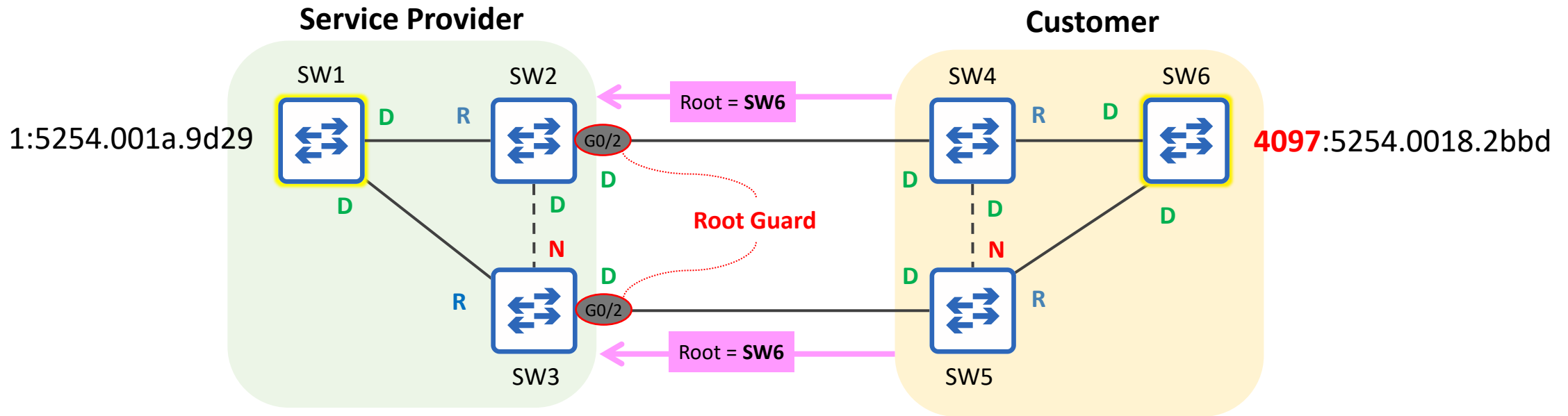


```
SW2(config)# interface g0/2
SW2(config-if)# spanning-tree guard root
*Sep 21 08:38:56.314: %SPANTREE-2-ROOTGUARD_CONFIG_CHANGE: Root guard enabled on port GigabitEthernet0/2.
*Sep 21 08:38:56.321: %SPANTREE-2-ROOTGUARD_BLOCK: Root guard blocking port GigabitEthernet0/2 on VLAN0001.
SW2(config-if)# do show spanning-tree
```

```
!output omitted
Interface          Role Sts Cost      Prio.Nbr Type
-----
Gi0/0              Root FWD 4         128.1   P2p
Gi0/1              Desg FWD 4         128.2   P2p
Gi0/2              Desg BKN*4 128.3   P2p *ROOT_Inc
```

BKN = Broken
ROOT_Inc = Root Inconsistent

Root Guard: CLI demonstration



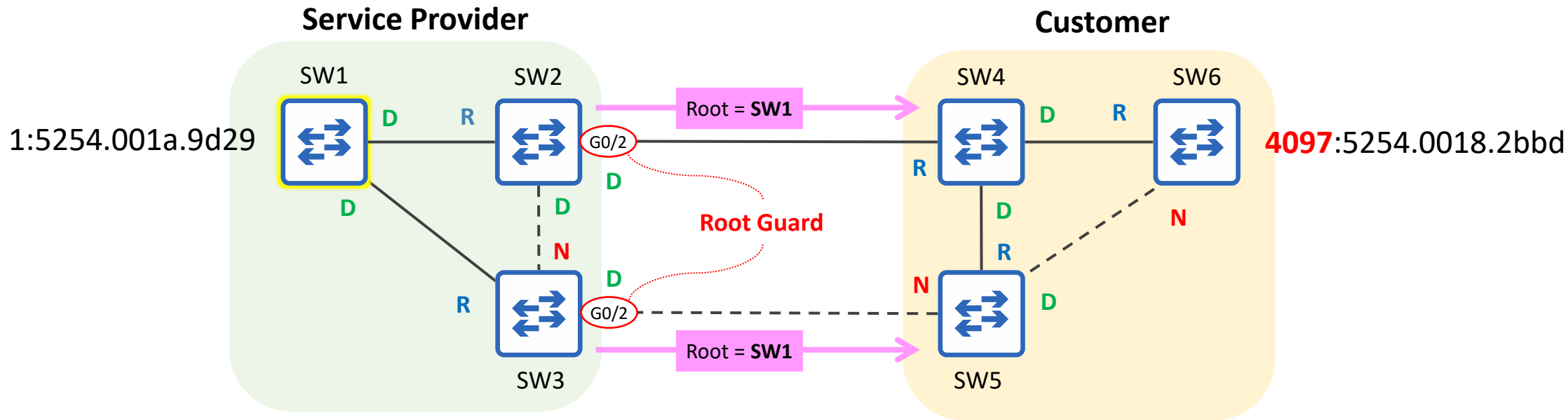
```
*Sep 21 08:54:26.955: %SPANTREE-2-ROOTGUARD_UNBLOCK: Root guard unblocking port GigabitEthernet0/2 on VLAN0001.
```

```
SW2(config-if)# do show spanning-tree
```

```
!output omitted
```

Interface	Role	Sts	Cost	Prio.	Nbr	Type
Gi0/0	Root	FWD	4	128.1		P2p
Gi0/1	Desg	FWD	4	128.2		P2p
Gi0/2	Desg	FWD	4	128.3		P2p

Root Guard: CLI demonstration



```
*Sep 21 08:54:26.955: %SPANTREE-2-ROOTGUARD_UNBLOCK: Root guard unblocking port GigabitEthernet0/2 on VLAN0001.
```

```
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Interface	Role	Sts	Cost	Prio.	Nbr	Type
Gi0/0	Root	FWD	4	128.1		P2p
Gi0/1	Desg	FWD	4	128.2		P2p
Gi0/2	Desg	FWD	4	128.3		P2p

- When selecting a LAN's root bridge, you should consider the following:
 - Optimal traffic flow
 - minimize latency
 - minimize congestion
 - Stability and reliability
- Within your own LAN, you can easily control the root bridge by setting its priority to 0.
 - There are cases where you might connect your switches to other switches outside of your control (e.g. service provider + client).
- **Root Guard** can be configured on specific ports to prevent them from accepting **superior BPDUs** from switches outside of your control.
- Use SW(config-if)# **spanning-tree guard root** to enable Root Guard on a port.
 - There is no command to enable it by default from global config mode.
- Root Guard prevents a port from becoming a root port if it receives a superior BPDU.
 - If the port receives a superior BPDU, it becomes Broken (BKN) / Root Inconsistent (ROOT_Inc).
- If the port stops receiving superior BPDUs, it will automatically recover.