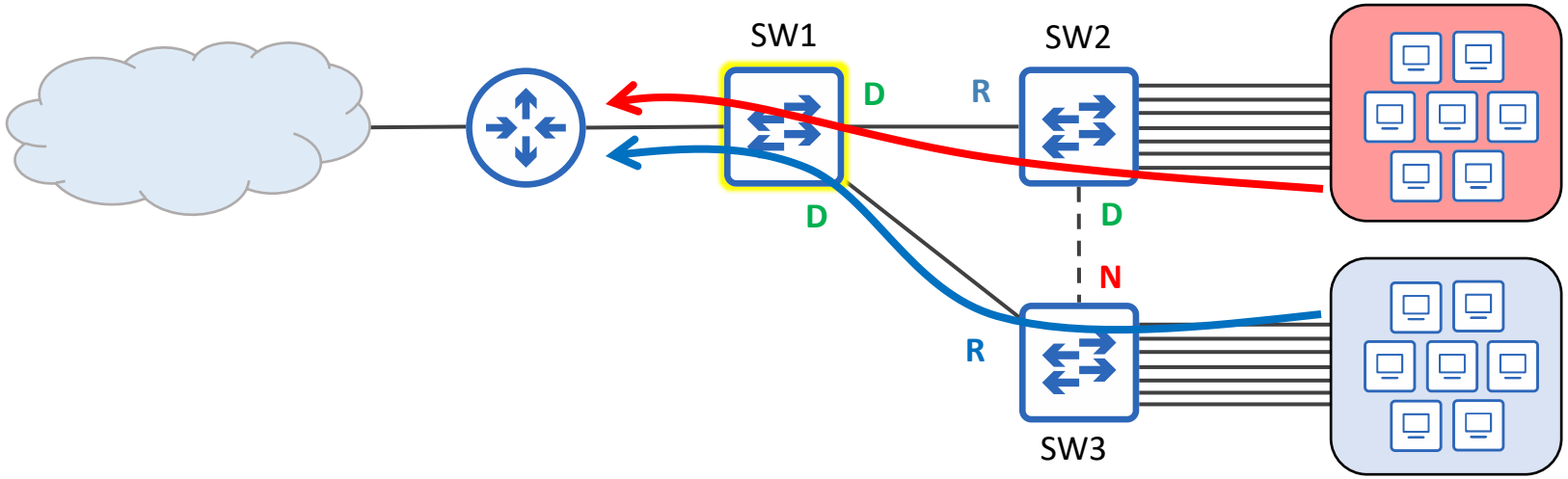
Things we'll cover

- 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

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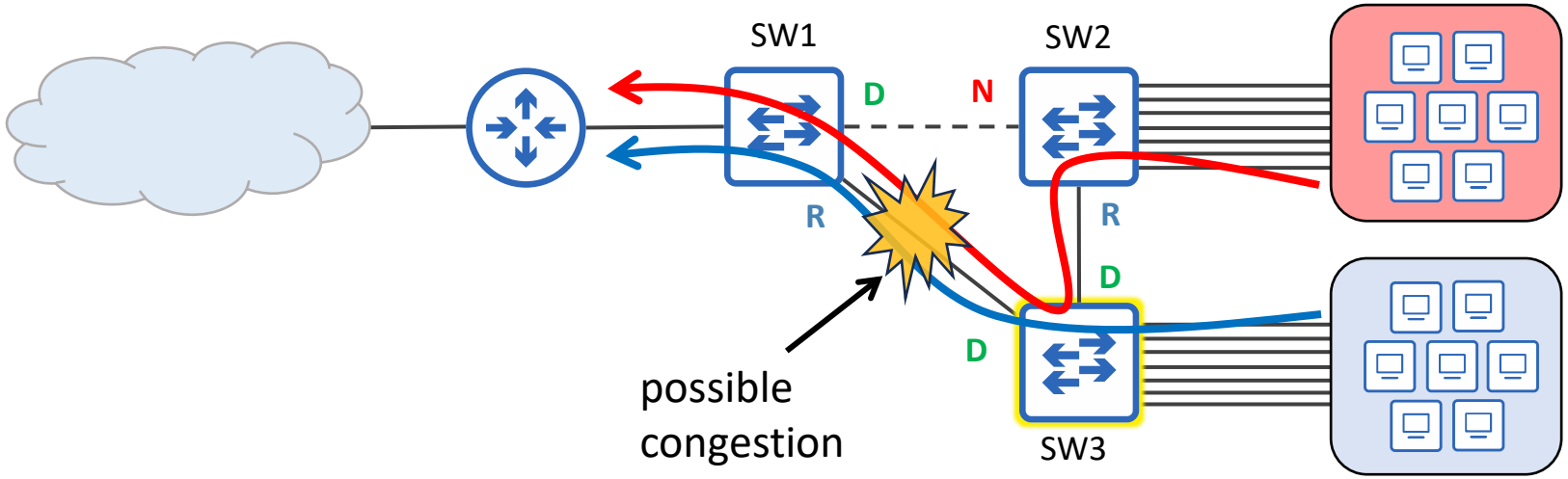

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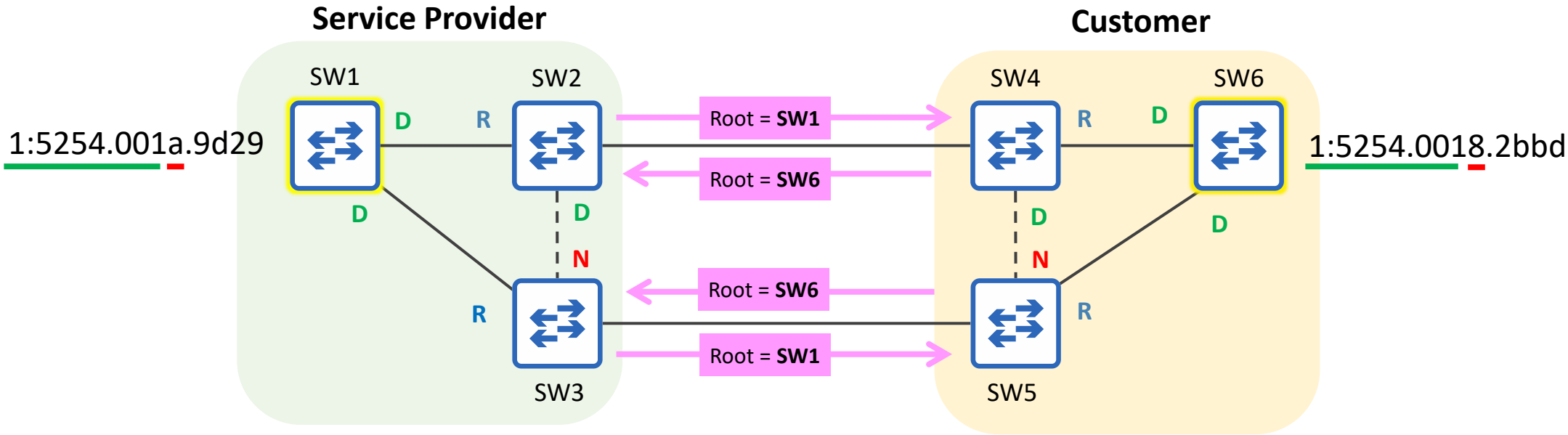
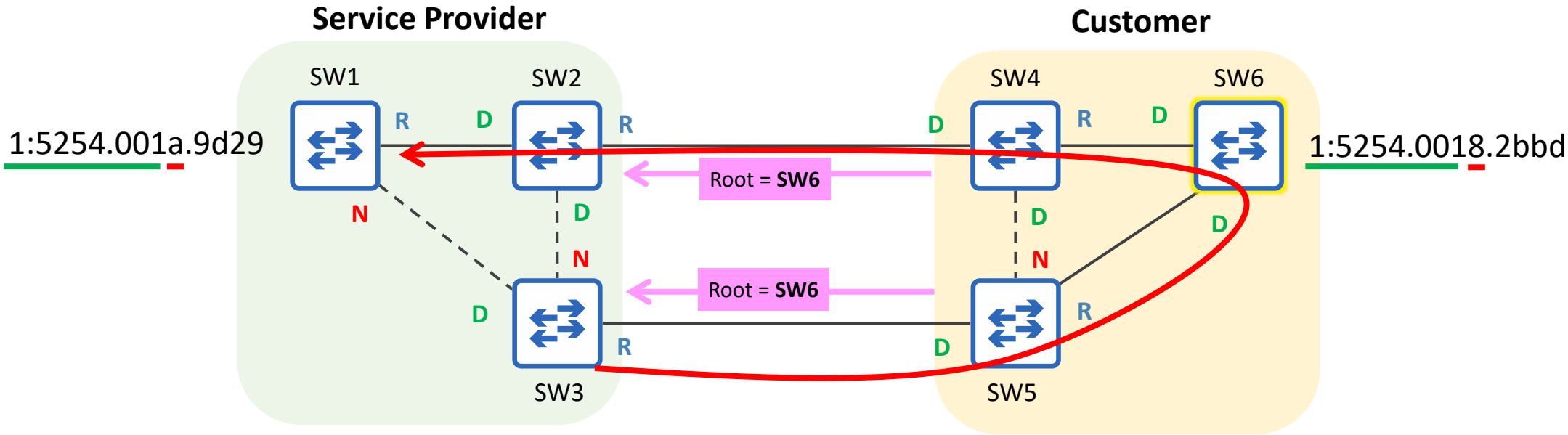
Root Guard: the problem



- 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.

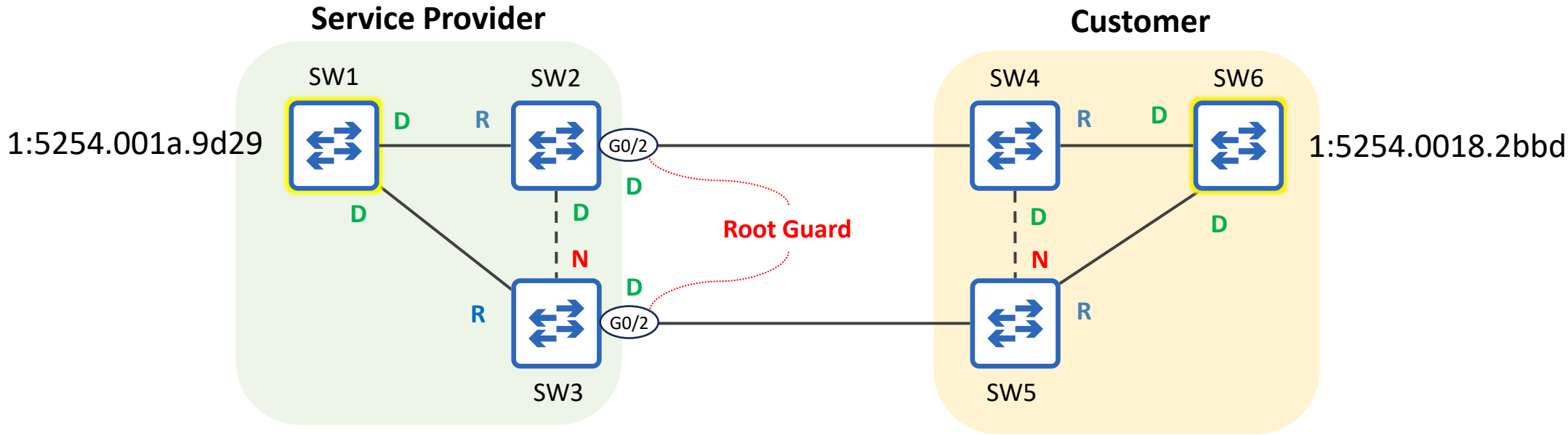
Root Guard: the problem



- 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 BPDU** = a BPDU that is superior in the STP algorithm (e.g. claiming a better root bridge ID).

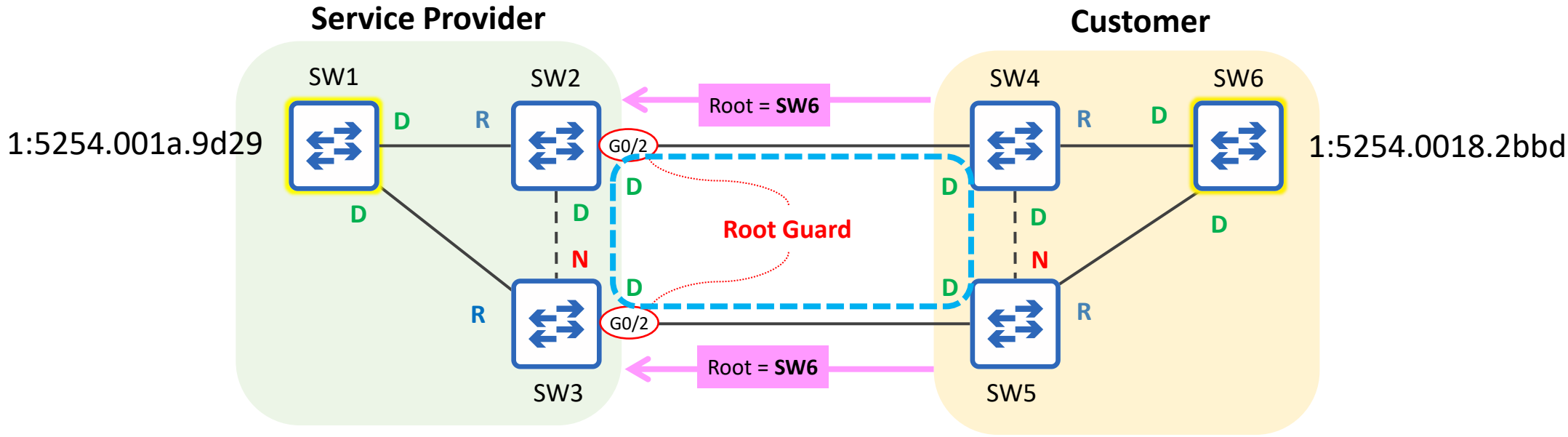
Root Guard: the solution



- 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.

Root Guard: the solution



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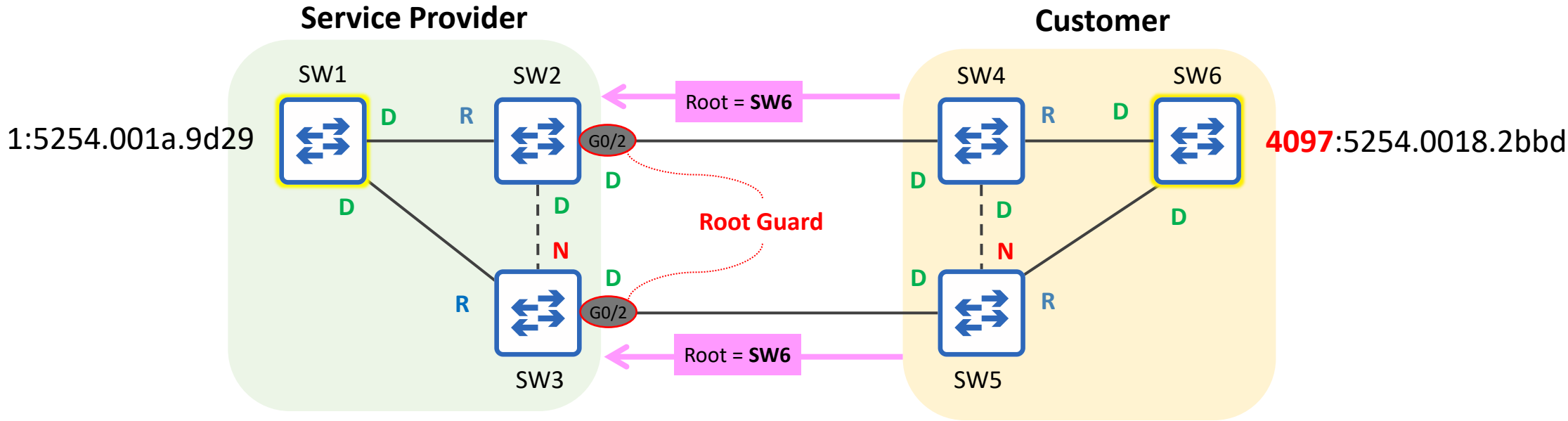
- Use `SW2(config-if)# spanning-tree guard root` to enable Root Guard on a port.
  - There is no command to enable it by default from global config mode.

- 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.

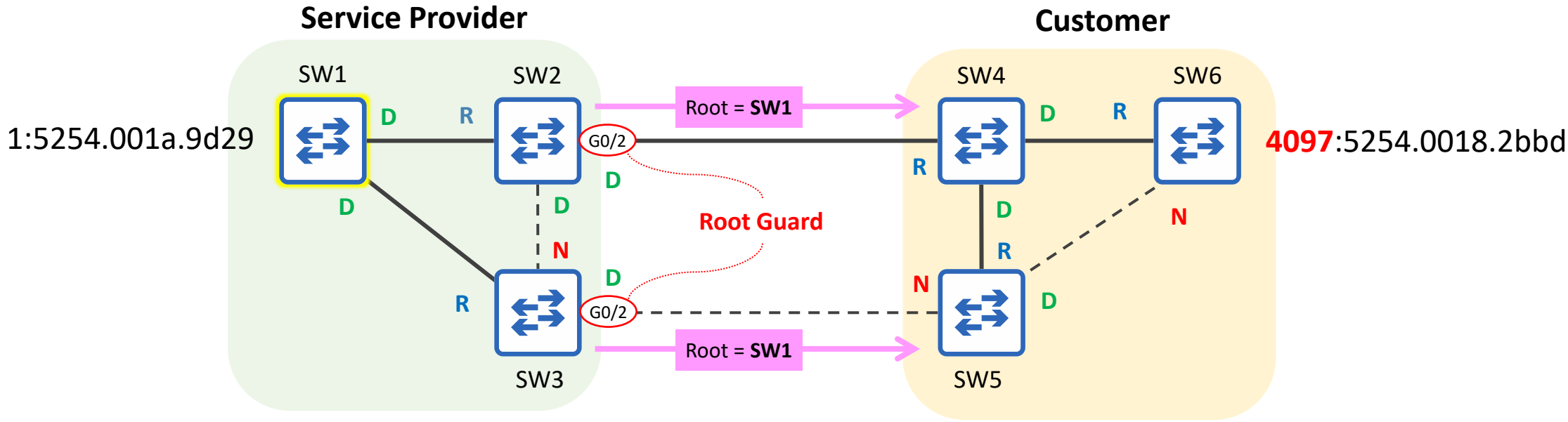
Root Guard: the solution



- 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 BDPUs.
  - 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: the solution



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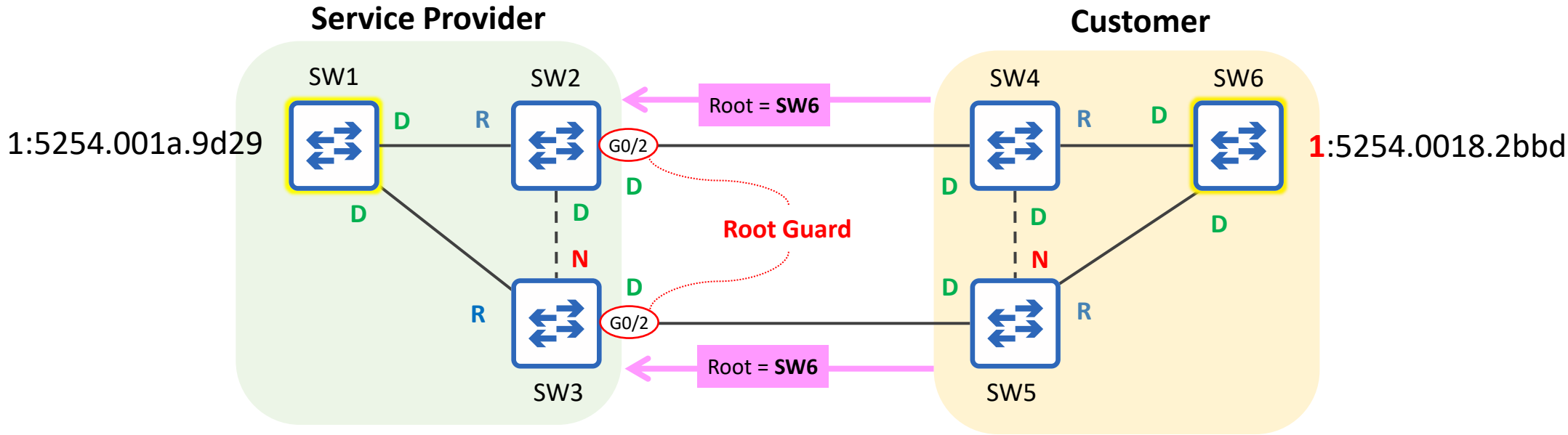
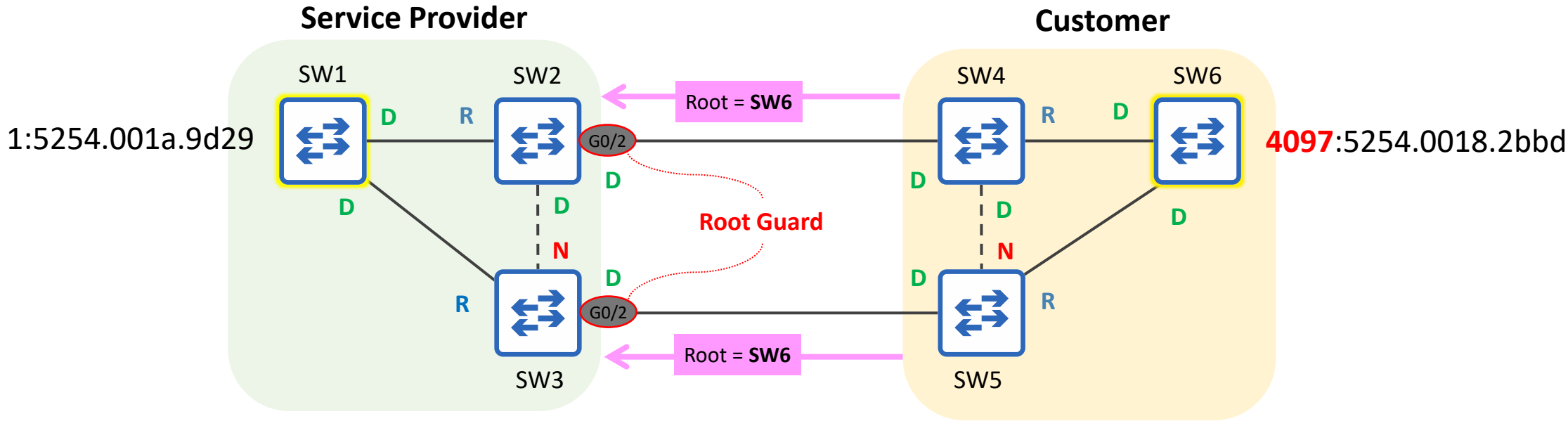
Root Guard: CLI demonstration




```
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
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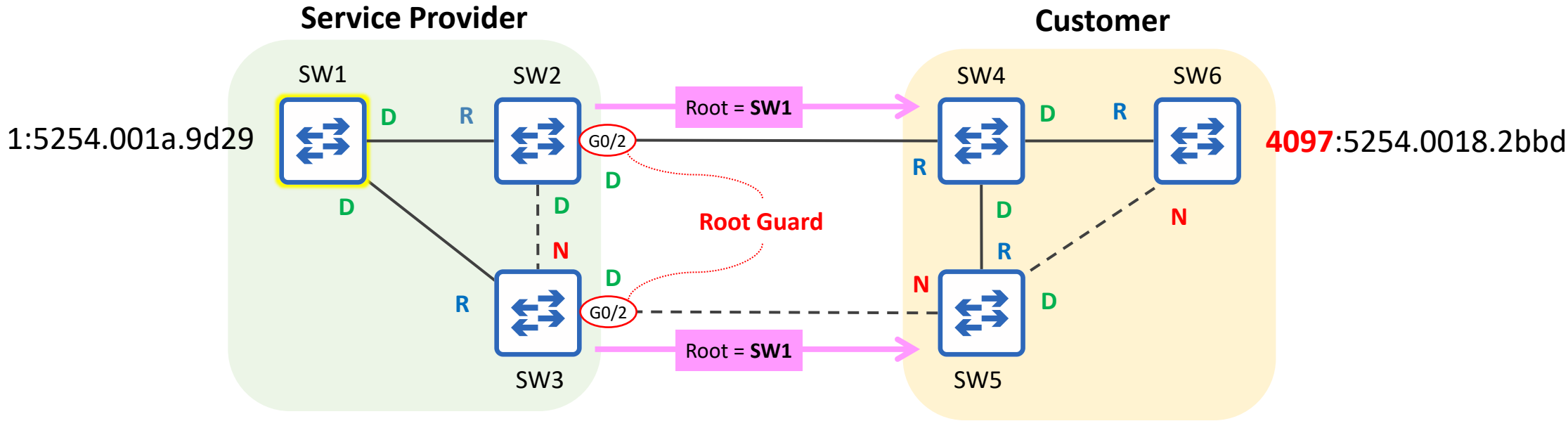


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Summary

- 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.