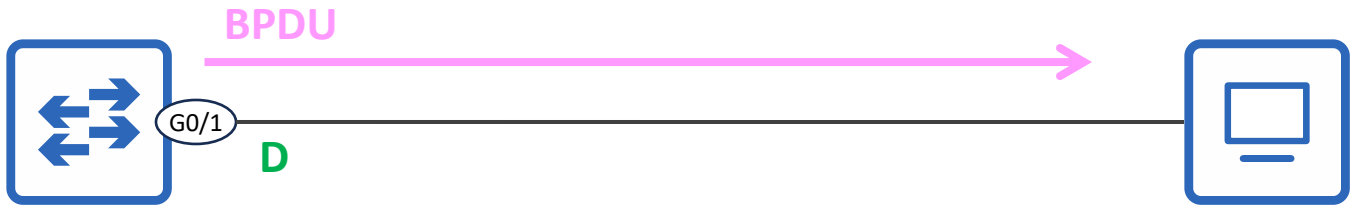
Things we'll cover

- STP Toolkit
  - PortFast
    - Allows switch ports connected to end hosts to immediately enter the STP Forwarding state, bypassing Listening and Learning.
  - **BPDU Guard – this video**
    - 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 – this video**
    - Stops a port from sending BPDUs or processing received BPDUs.
  - Root Guard
    - 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.

PortFast & BPDUs

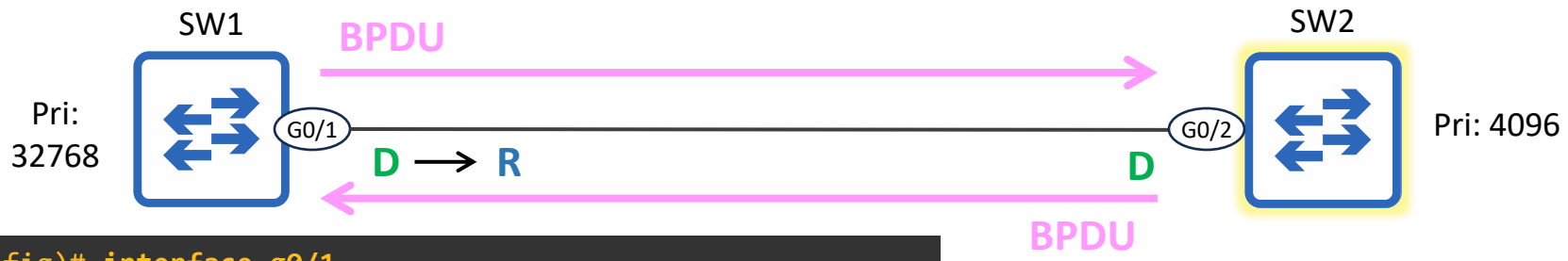



```
SW1(config)# interface g0/1
SW1(config-if)# spanning-tree portfast
SW1(config-if)# do show spanning-tree interface g0/1 detail
!output omitted
   The port is in the portfast edge mode
   Link type is point-to-point by default
   BPDU: sent 77, received 0
```

- **PortFast** makes a port start in the Forwarding state when it is connected, but it doesn't disable STP on the port.
  - The port will continue to send BPDUs every 2 seconds.

- Because end hosts don't run STP and send BPDUs, a PortFast-enabled port shouldn't receive BPDUs.
  - But what if it does?

PortFast & BPDUs

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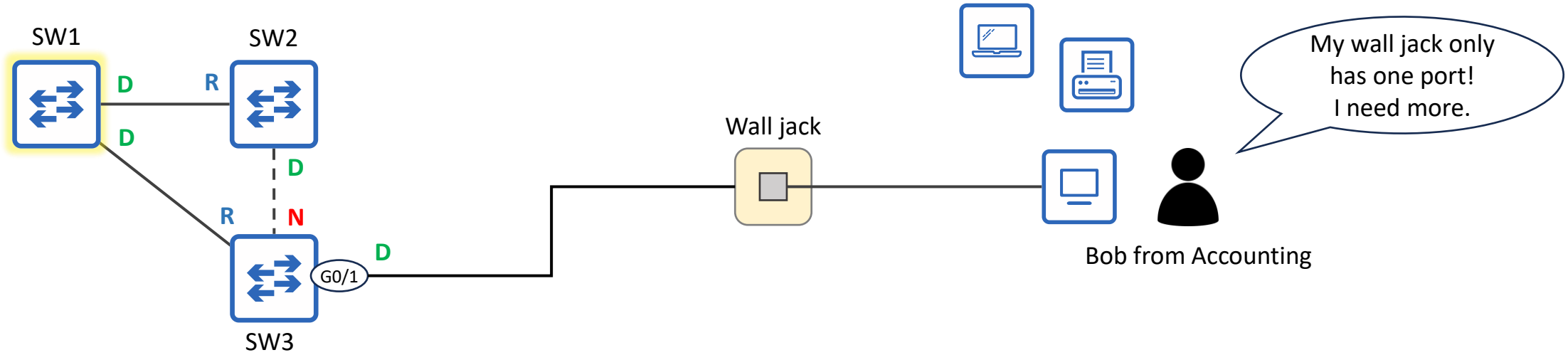
- **PortFast** makes a port start in the Forwarding state when it is connected, but it doesn't disable STP on the port.
  - The port will continue to send BPDUs every 2 seconds.

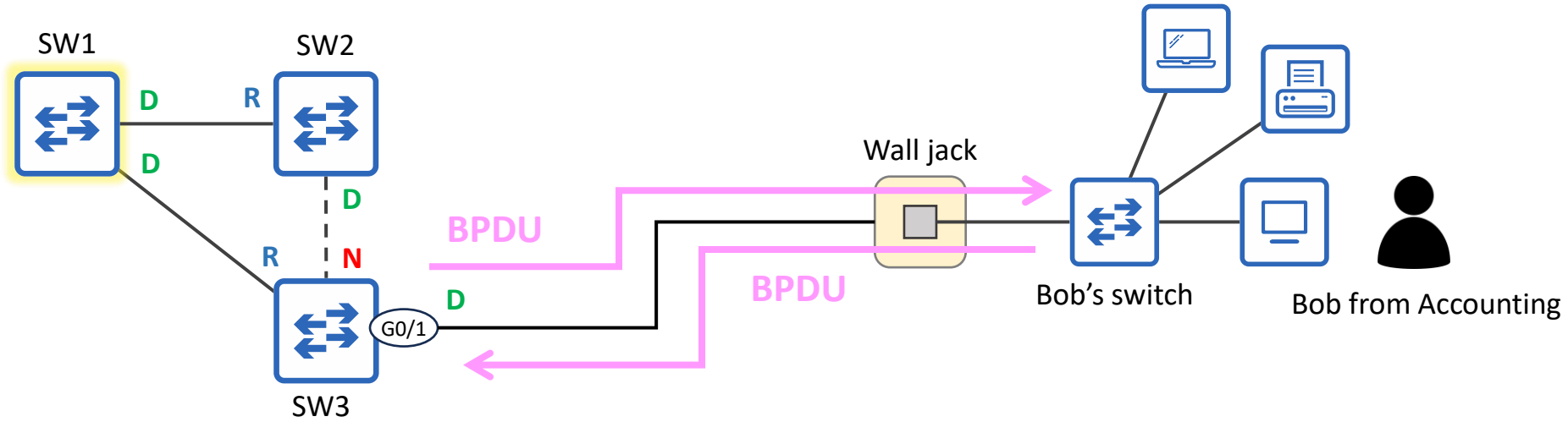
- Because end hosts don't run STP and send BPDUs, a PortFast-enabled port shouldn't receive BPDUs.
  - But what if it does?

- If a PortFast-enabled port receives an STP BPDU, it will revert to acting like a regular STP port (without PortFast).

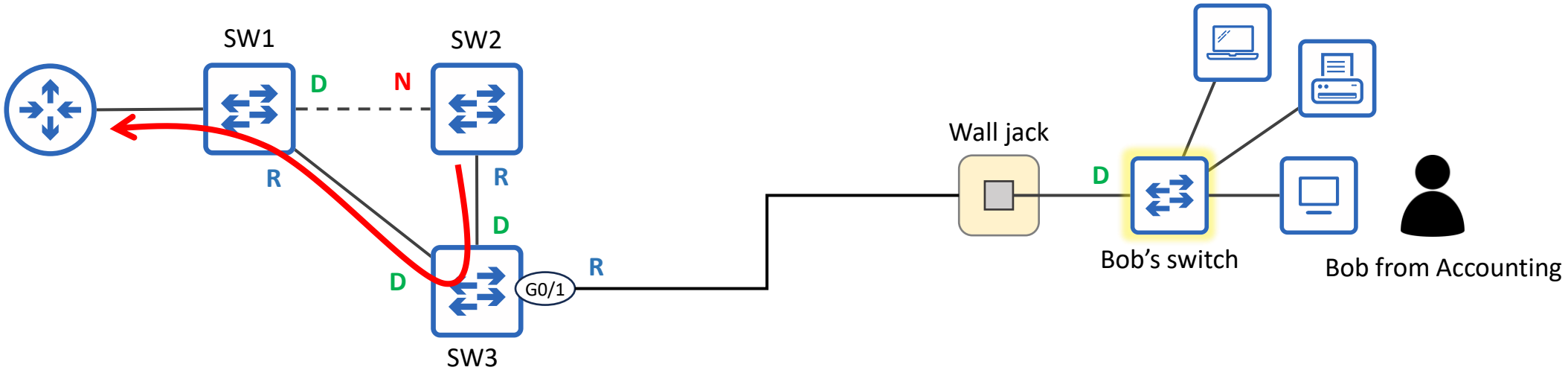
BPDU Guard – the problem



BPDU Guard – the problem

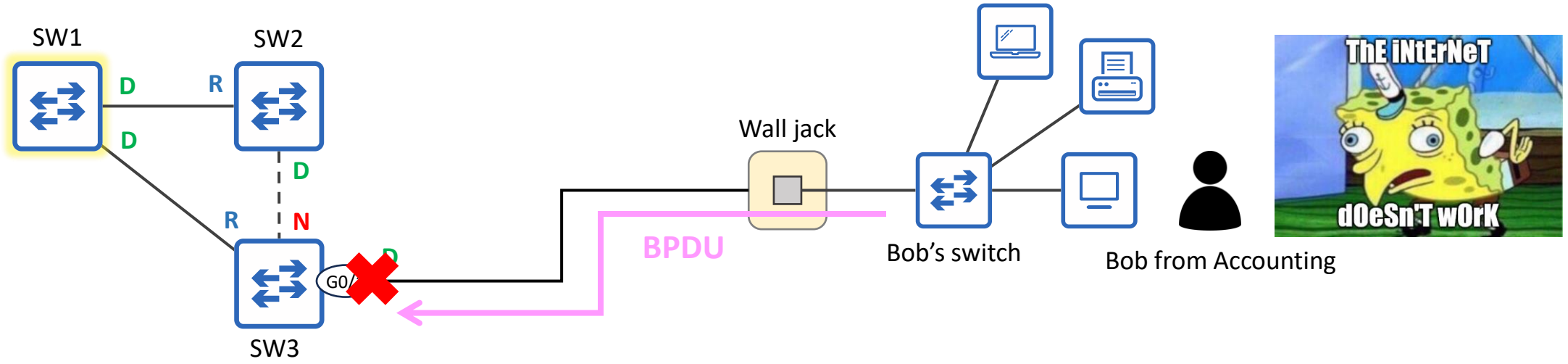


BPDU Guard – the problem



- PortFast should only be enabled on ports connected to non-switch devices (end hosts, routers).
  - These devices don't send BPDUs.
- A PortFast-enabled port still sends BPDUs and will operate like a regular STP port if it receives BPDUs from a neighbor.
- If an end user carelessly connects a switch to a port meant for end hosts, it could affect the STP topology.
  - **BPDU Guard** acts as a safeguard against this.

BPDU Guard – the solution



- **BPDU Guard** protects the network from unauthorized switches being connected to ports intended for end hosts.
- It can be configured separately from **PortFast**, but both features are usually used together.
  - They both enhance STP's functionality on ports intended for end hosts.
- A BPDU Guard-enabled port continues to send BPDUs, but if it receives a BPDU it enters the **error-disabled** state.
  - In effect, this disables the port.

BPDU Guard configuration

- Like **PortFast**, **BPDU Guard** can be configured in two ways:
  - Per-port:

```
SW3(config)# interface g0/1
SW3(config-if)# spanning-tree bpduguard enable
SW3(config-if)# do show spanning-tree interface g0/1 detail
 Port 2 (GigabitEthernet0/1) of VLAN0001 is designated forwarding
   Port path cost 4, Port priority 128, Port Identifier 128.2.
   Designated root has priority 24577, address 5254.001a.9d29
   Designated bridge has priority 32769, address 5254.0006.448f
   Designated port id is 128.2, designated path cost 4
   Timers: message age 0, forward delay 0, hold 0
   Number of transitions to forwarding state: 1
   The port is in the portfast edge mode
   Link type is point-to-point by default
   Bpdu guard is enabled
   BPDU: sent 93, received 0
```

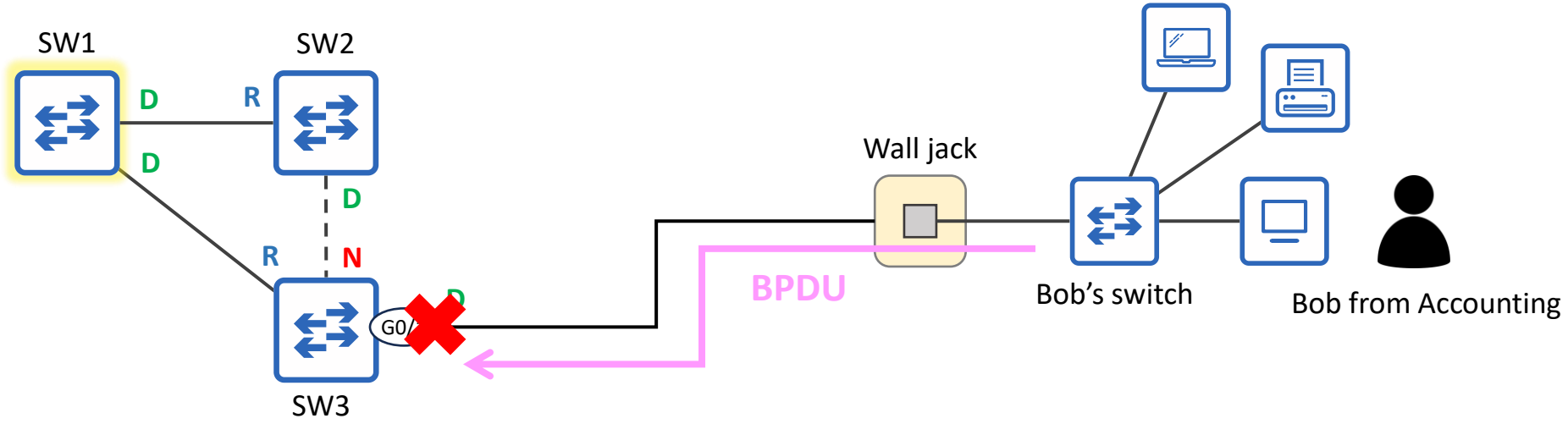
  - Default:

```
SW3(config)# spanning-tree portfast bpduguard default
SW3(config)# do show spanning-tree interface g0/1 detail
 Port 2 (GigabitEthernet0/1) of VLAN0001 is designated forwarding
   Port path cost 4, Port priority 128, Port Identifier 128.2.
   Designated root has priority 24577, address 5254.001a.9d29
   Designated bridge has priority 32769, address 5254.0006.448f
   Designated port id is 128.2, designated path cost 4
   Timers: message age 0, forward delay 0, hold 0
   Number of transitions to forwarding state: 1
   The port is in the portfast edge mode
   Link type is point-to-point by default
   Bpdu guard is enabled by default
   BPDU: sent 165, received 0
```

`spanning-tree portfast [edge] bpduguard default`

- When enabled by default, **BPDU Guard** is activated on all Portfast-enabled ports.
- Use **`spanning-tree bpduguard disable`** in interface config mode to disable it on specific ports.

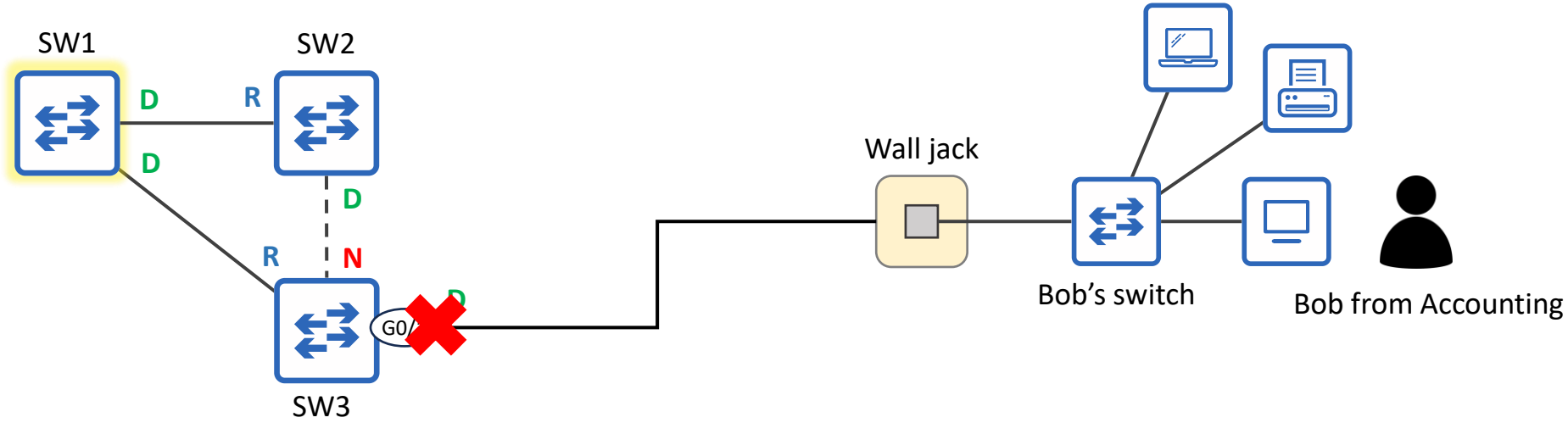
ErrDisable




```
*Sep  3 05:08:11.977: %SPANTREE-2-BLOCK_BPDUGUARD: Received BPDU on port GigabitEthernet0/1 with BPDU Guard enabled. Disabling port.
*Sep  3 05:08:11.977: %PM-4-ERR_DISABLE: bpduguard error detected on Gi0/1, putting Gi0/1 in err-disable state
*Sep  3 05:08:12.978: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to down
*Sep  3 05:08:13.978: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to down
SW3# show interfaces g0/1
GigabitEthernet0/1 is down, line protocol is down (err-disabled)
!output omitted
```

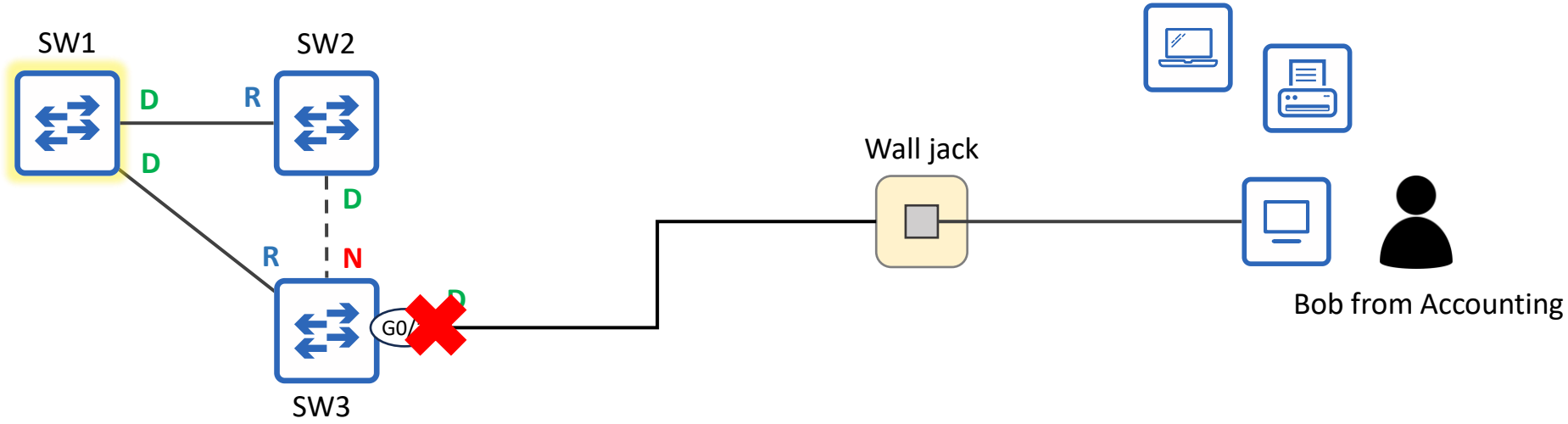
- **ErrDisable** is a Cisco switch feature that disables a port under certain conditions, such as a BPDU Guard violation.
  - You will learn a few others for the CCNA exam, such as:
    - Power Policing violations
    - Port Security violations
    - DAI (Dynamic ARP Inspection) violations

ErrDisable



- To re-enable an err-disabled port, first solve the underlying issue.
  - If you re-enable the port without fixing the issue, it will just be err-disabled again.

ErrDisable



- To re-enable an err-disabled port, first solve the underlying issue.
  - If you re-enable the port without fixing the issue, it will just be err-disabled again.

- You can re-enable an err-disabled port in two ways:
  1. Manual: use **`shutdown`** and **`no shutdown`** to reset the disabled port.
  2. Automatic: **ErrDisable Recovery**

ErrDisable Recovery

- **ErrDisable Recovery** is a feature that automatically re-enables err-disabled ports after a certain period of time.

```
SW3# show errdisable recovery
ErrDisable Reason            Timer Status
-----------------            --------------
arp-inspection               Disabled
bpduguard                    Disabled
channel-misconfig (STP)      Disabled
!output omitted

Timer interval: 300 seconds

Interfaces that will be enabled at the next timeout:
```

ErrDisable Recovery is disabled by default.

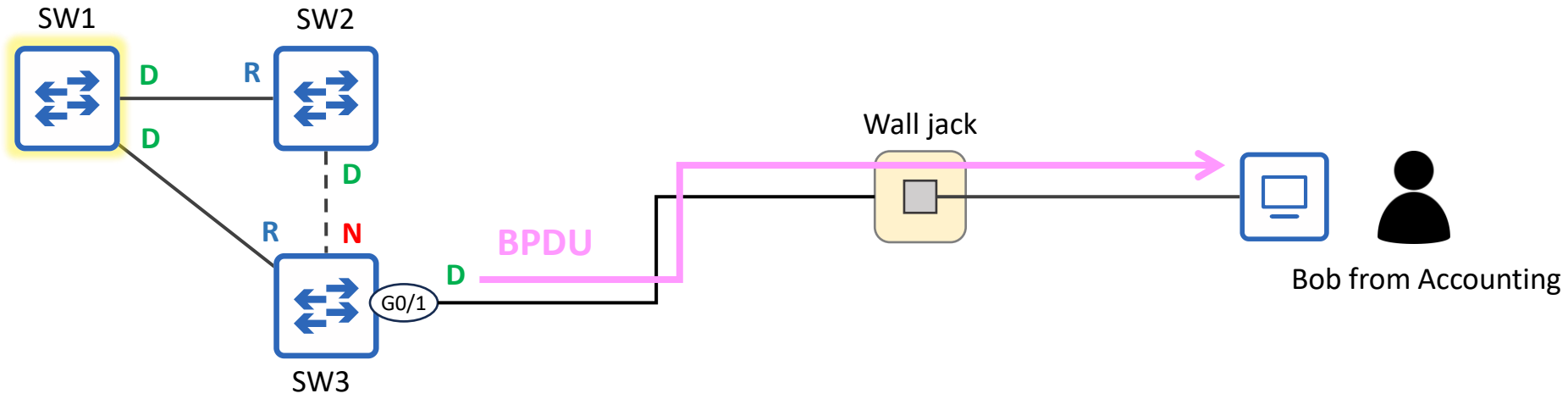
- The default recovery timer is 300 seconds (5 minutes).
  - Err-disabled interfaces will be automatically re-enabled after 5 minutes.
- Use `SW1(config)# errdisable recovery interval` *seconds* to modify the interval.

- Use **`errdisable recovery cause`** *cause* to enable ErrDisable Recovery for ports disabled by a particular cause.

```
SW3(config)# errdisable recovery cause bpduguard
SW3(config)# do show errdisable recovery
ErrDisable Reason            Timer Status
-----------------            --------------
arp-inspection               Disabled
bpduguard                    Enabled
channel-misconfig (STP)      Disabled

Timer interval: 300 seconds

Interfaces that will be enabled at the next timeout:

Interface       Errdisable reason       Time left(sec)
---------       -----------------       --------------
Gi0/1                 bpduguard           296
```

G0/1 will be automatically re-enabled after 296 seconds.

BPDU Filter – the problem

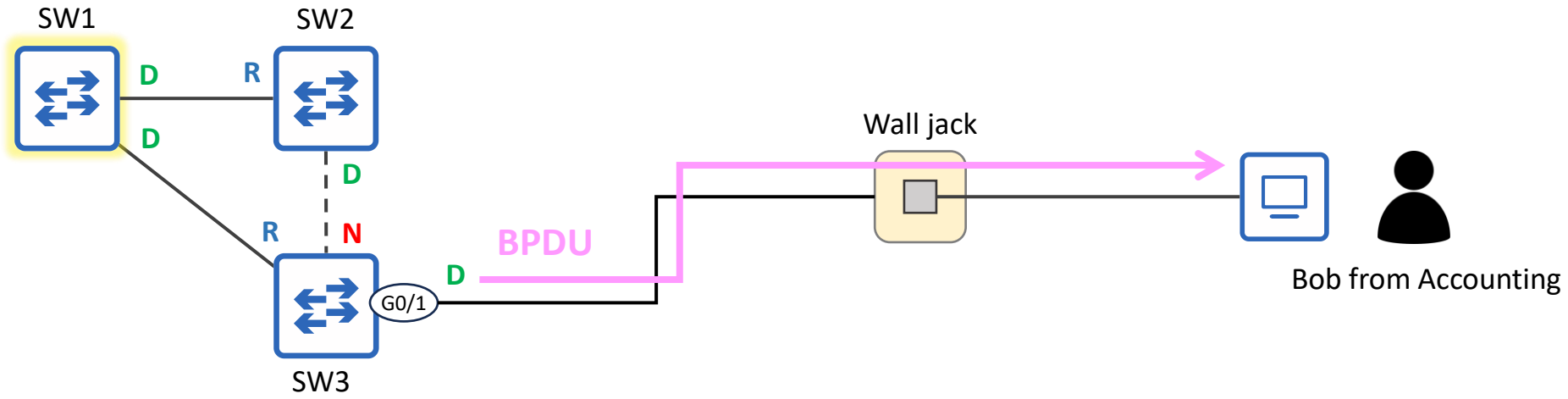


- A switch port connected to an end host continues sending BPDUs every 2 seconds.
  - regardless of whether PortFast and/or BPDU Guard are enabled

- If the port doesn't connect to a switch, sending BPDUs is unnecessary and undesirable for a couple of reasons:
  1. Sending BPDUs uses some bandwidth and processing power on the switch (although it's minimal).
  2. BPDUs contain information about the LAN's STP topology.
     - If maximum security is a concern, you should avoid sending this info to user devices.

- **BPDU Filter** solves this by preventing a port from sending BPDUs.

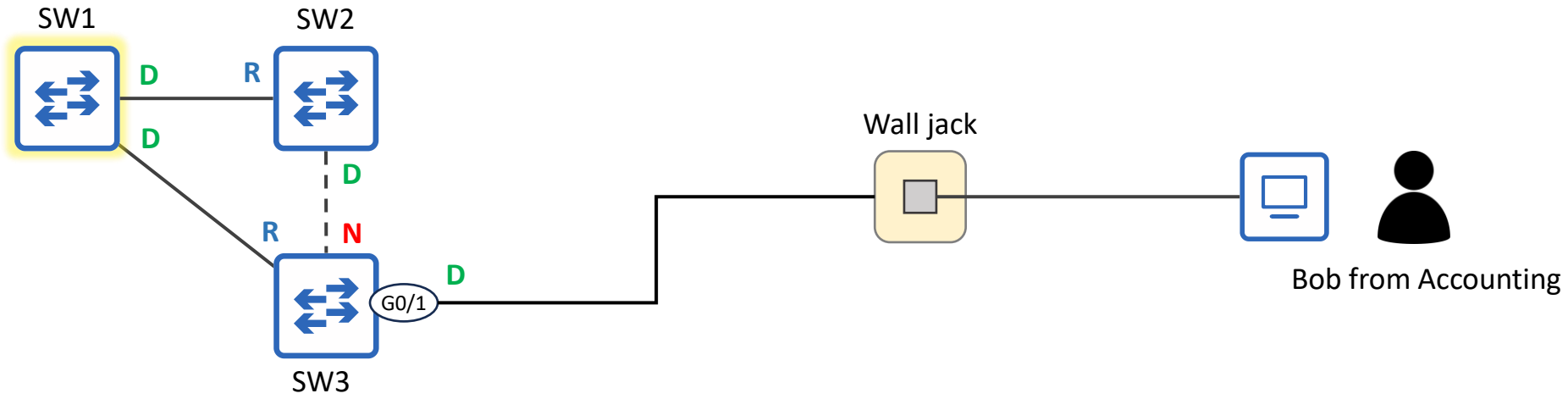
BPDU Filter – the solution



- **BPDU Filter** stops a port from sending BPDUs.
  - Unlike BPDU Guard, it does not disable the port if it receives a BPDU.

- BPDU Filter can be enabled in two ways:
  - Per-port: `SW3(config-if)# spanning-tree bpdufilter enable`
    - The port will not send BPDUs.
    - The port will ignore any BPDUs it receives.
    - In effect, this disables STP on the port. **Use with caution!**
  - Default: `SW3(config)# spanning-tree portfast [edge] bpdufilter default`
    - BPDU Filter will be activated on all PortFast-enabled ports.
      - You can use **`spanning-tree bpdufilter disable`** to disable it on specific ports.
    - The port will not send BPDUs.
    - If the port receives a BPDU, PortFast and BPDU Filter are disabled, and it operates as a normal STP port.

BPDU Filter – the solution



- My recommendation:
  - Enable PortFast and BPDU Guard however you prefer (per-port or by default).
  - Only enable BPDU Filter by default (global config mode).
    - unless you have a very good reason to enable it per-port

BPDU Guard and **BPDU Filter** can be enabled on the same port at the same time:

- If BPDU Filter is enabled in <u>global config mode</u> and the port receives a BPDU:
  1. BPDU Filter will be disabled.
  2. BPDU Guard will be triggered (and err-disable the interface).

- If BPDU Filter is enabled in <u>interface config mode</u> and the port receives a BPDU:
  - The BPDU will be ignored.
  - BPDU Guard will **not** be triggered.

Summary

- **PortFast** should only be enabled on ports connected to non-switch devices (end hosts, routers) that don't send BPDUs.
  - A PortFast-enabled port still sends BPDUs and will operate like a regular STP port if it receives BPDUs from a neighbor.
  - If an end user carelessly connects a switch to a port meant for end hosts, it could affect the STP topology

- **BPDU Guard** protects the network from unauthorized switches being connected to ports intended for end hosts.
  - If the port receives a BPDU, it enters the **error-disabled** (err-disabled) state, effectively disabling the port.
  - Per-port: `SW1(config-if)# spanning-tree bpduguard enable`
  - Default: `SW1(config)# spanning-tree portfast [edge] bpduguard default`
    - Enables BPDU Guard on all PortFast-enabled ports.
    - Use `spanning-tree bpduguard disable` to disable it on specific ports.

- An err-disabled port can be re-enabled in two ways:
  1. Manual: **shutdown** and **no shutdown**
  2. Automatic: **ErrDisable Recovery**
     - `SW1(config)# errdisable recovery cause bpduguard`
  - In either case, make sure you fix the underlying problem that caused the port to be err-disabled.

- **BPDU Filter** prevents a port from sending BPDUs.
  - Unlike BPDU Guard, it does not disable the port if it receives a BPDU.
  - Per-port: `SW1(config-if)# spanning-tree bpdufilter enable`
    - The port will ignore any BPDUs it receives. **Use with caution!**
  - Default: `SW1(config)# spanning-tree portfast [edge] bpdufilter default`
    - Enables BPDU Filter on all PortFast-enabled ports.
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