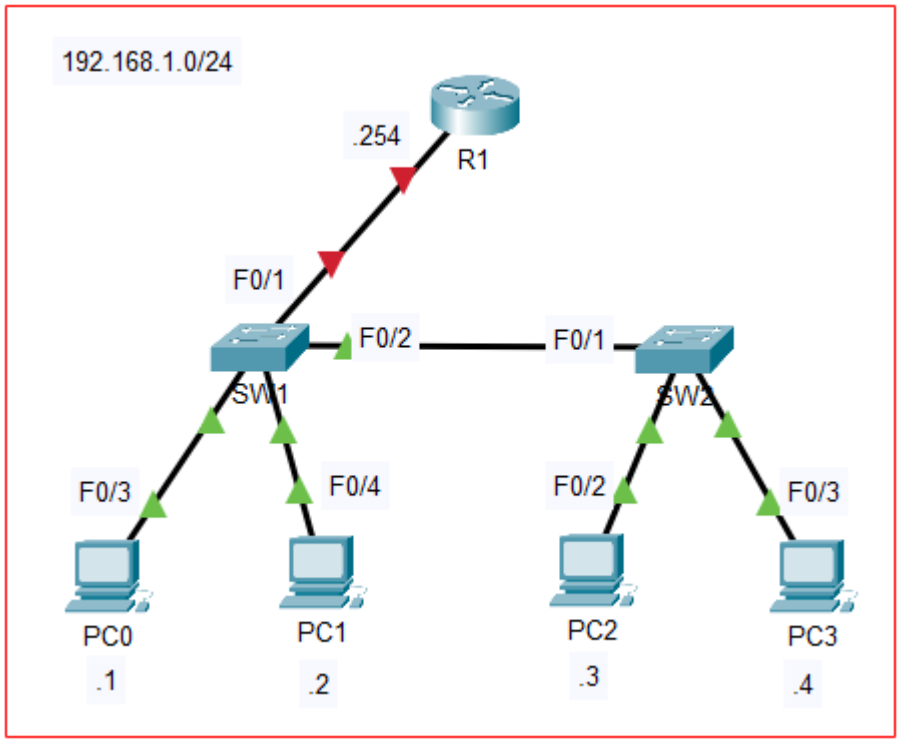
DAY 9 - Switch Interfaces

Switch Interface



Viewing Interfaces:

From SW1:

- **Viewing** SW1's interface (Same command as router): `show ip interface brief`

```
SW1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/1        unassigned      YES manual down                  down
FastEthernet0/2        unassigned      YES manual up                    up
FastEthernet0/3        unassigned      YES manual up                    up
FastEthernet0/4        unassigned      YES manual up                    up
FastEthernet0/5        unassigned      YES manual down                  down
FastEthernet0/6        unassigned      YES manual down                  down
FastEthernet0/7        unassigned      YES manual down                  down
FastEthernet0/8        unassigned      YES manual down                  down
FastEthernet0/9        unassigned      YES manual down                  down
FastEthernet0/10       unassigned      YES manual down                  down
```

- None of the interfaces have no **IP Assignment** because a **Switch is a Layer 2 Device** while IP Address is a **Layer 3 Addressing**.

    - There are reasons to assign IP Addresses to Switch's interfaces, but that comes later.
- **Router vs. Switch Interfaces**:
    - **Router** interfaces have the `shutdown` command applied by default (*`administratively down/down`* State)
    - **Switch** interfaces **DO NOT** have the `shutdown` command applied by default.
        - Will be in the *`up/up`* state if connected to another device.
        - Will be in the *`down/down`* state if **NOT** connected to another device.
- **View Speed and Duplex of each interface** via `show interfaces status`

```
SW1#show interfaces status
Port      Name               Status       Vlan       Duplex  Speed Type
Fa0/1                        notconnect   1          auto    auto  10/100BaseTX
Fa0/2                        connected    1          auto    auto  10/100BaseTX
Fa0/3                        connected    1          auto    auto  10/100BaseTX
Fa0/4                        connected    1          auto    auto  10/100BaseTX
Fa0/5                        notconnect   1          auto    auto  10/100BaseTX
Fa0/6                        notconnect   1          auto    auto  10/100BaseTX
Fa0/7                        notconnect   1          auto    auto  10/100BaseTX
Fa0/8                        notconnect   1          auto    auto  10/100BaseTX
Fa0/9                        notconnect   1          auto    auto  10/100BaseTX
Fa0/10                       notconnect   1          auto    auto  10/100BaseTX
Fa0/11                       notconnect   1          auto    auto  10/100BaseTX
Fa0/12                       notconnect   1          auto    auto  10/100BaseTX
Fa0/13                       notconnect   1          auto    auto  10/100BaseTX
```

    - **Name**: Description of an interface.
    - **Status**: *Connected* or *Not Connected*
    - **VLAN**: Will be covered later.
    - **Duplex**: Direction of sending/receiving data.
    - **Speed**: Depend on the **Speed of the slower of the two** (The interface *vs.* The device connecting to that interface).
        - eg: **10 Mbps** device connecting to the **100 Mbps** port will make the communication speed of this conncetion = **10 Mbps**.
    - **Type**: `10` (**Ethernet**, Slower than **Fa**) and `100` (**Fast Ethernet** or **Fa**)
        - No `1000` or `10G` since these are **Fa** (**Fast Ethernet**) interfaces an not **G** (**Gigabit Ethernet**)

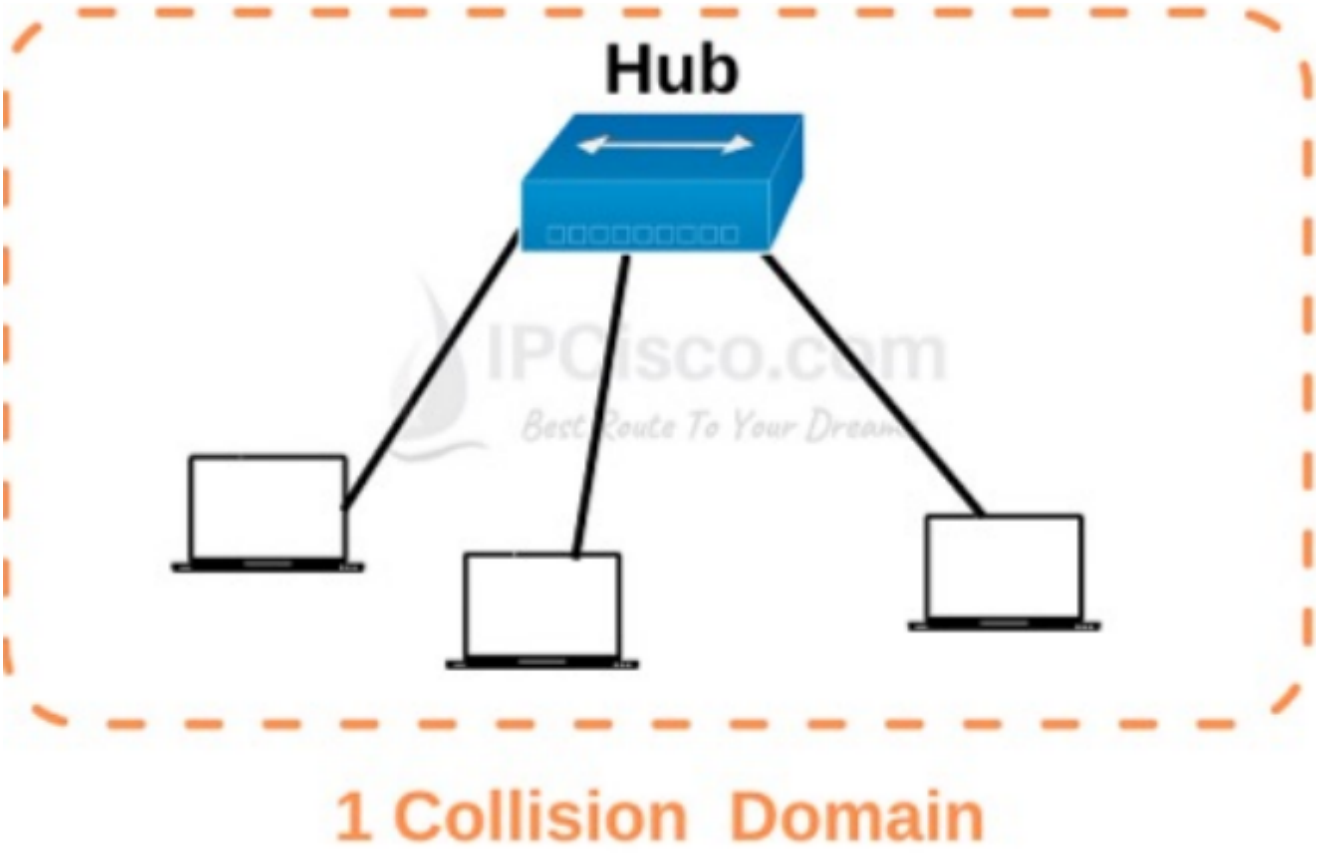
Duplex:

```
Switch(config)#interface f0/1
Switch(config-if)#duplex ?
  auto  Enable AUTO duplex configuration
  full  Force full duplex operation
  half  Force half-duplex operation
```

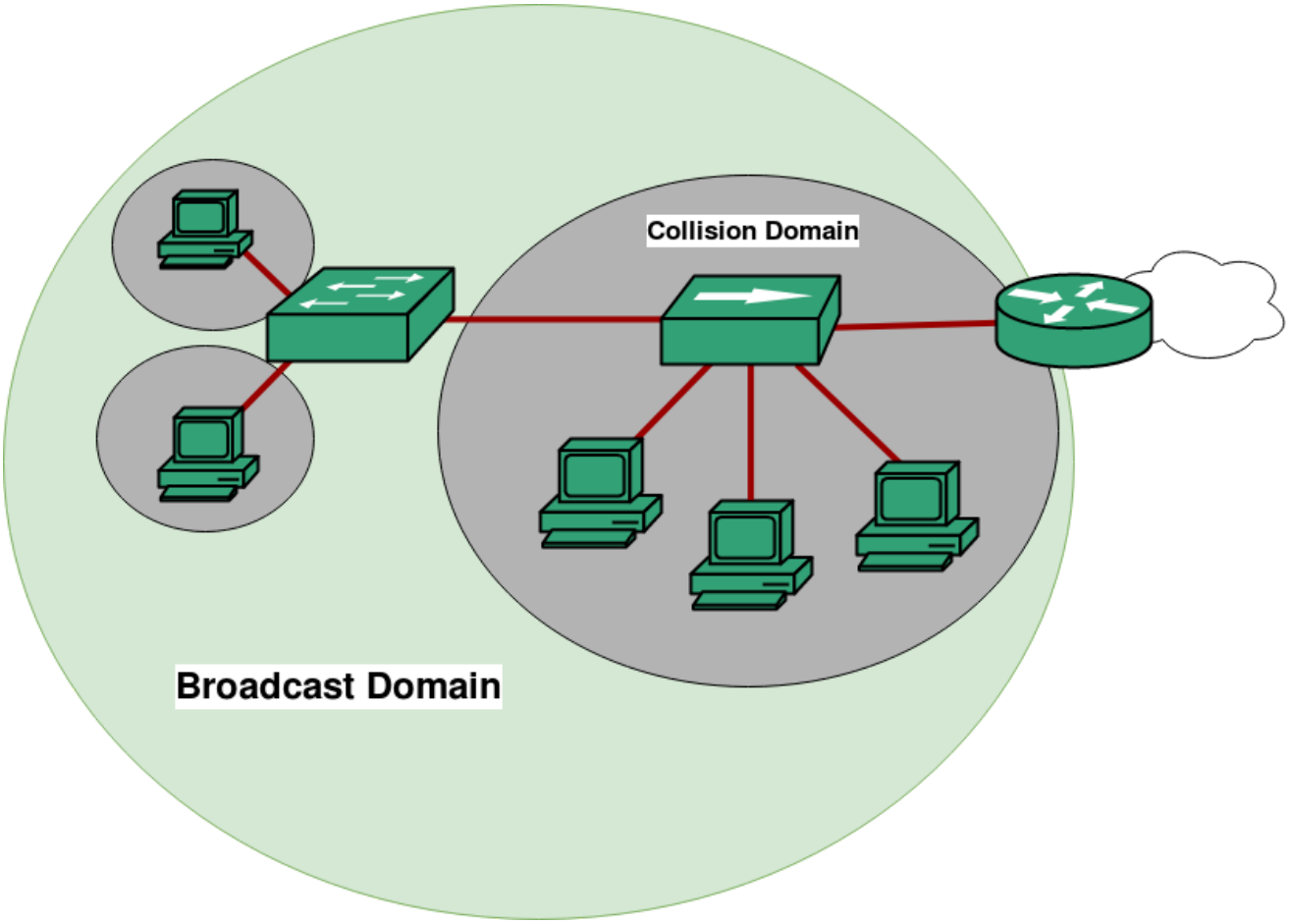
- **Full Duplex**:
  - The device *can send and receive data* **AT THE SAME TIME**, it does not have to wait. (Most Modern Devices have this capabilities.)
- **Half Duplex**:
  - The device *cannot send and receive* data at the same time.
  - If it is receiving a frame, it must **wait** before sending a frame.
  - eg: **Hub**

Hub:

- Is considered to be a **Layer 1 Device** instead of Layer 2 because it performs similar function to *switches* (**Frame Routing**) but **without** the use of any **MAC Addressing** or **MAC Table**.
- More similar to a networking *repeater*.
- Will **Always Flood** the frames regardless of the frame's type.
- Devices connected to a Hub must always operate in **Half-Duplex** mode.
- Have a mechanism to deal with collisions called **CSMA/CD**.



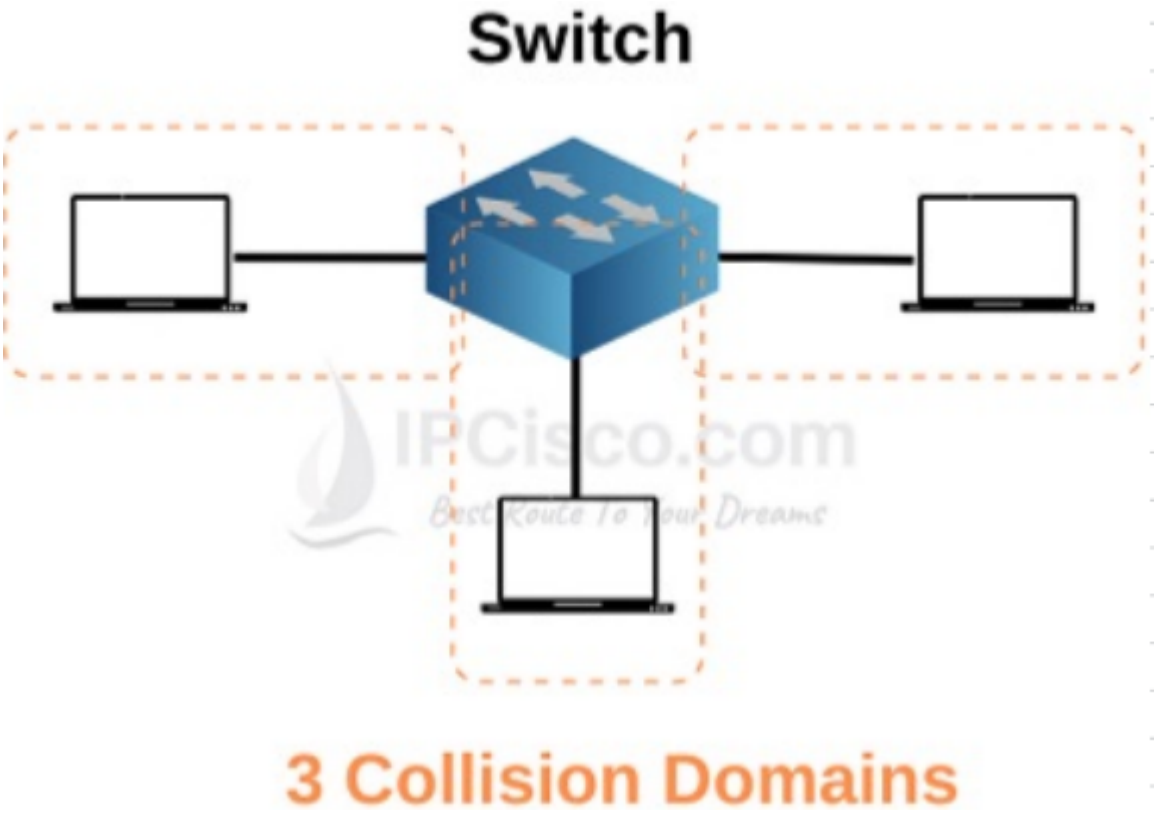
CSMA/CD in



- **C**arrier **S**ense **M**ultiple **A**ccess *with* **C**ollision **D**etection

- Used in Half-Duplex situation (like **Hub** network) to deal with collisions.
- Before sending frames, devices ***LISTEN*** to the **Collision Domain** until they detect that other devices are not sending.
- If a **Collision** does occur, the device sends a jamming signal to inform the other devices that a collision happened.
- Each device will wait *a random period of time* before sending frames again.

Collision Domain in Switches

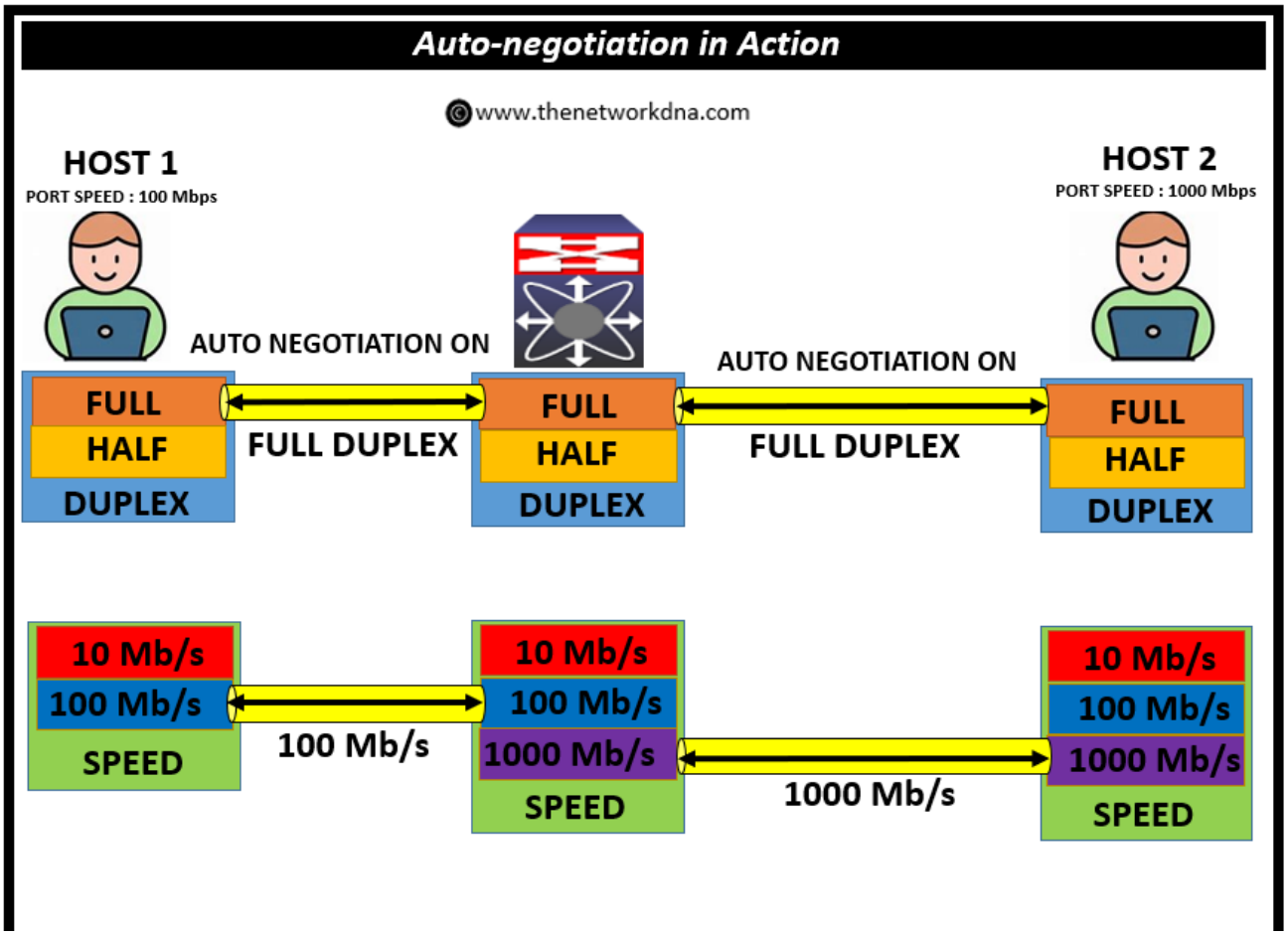


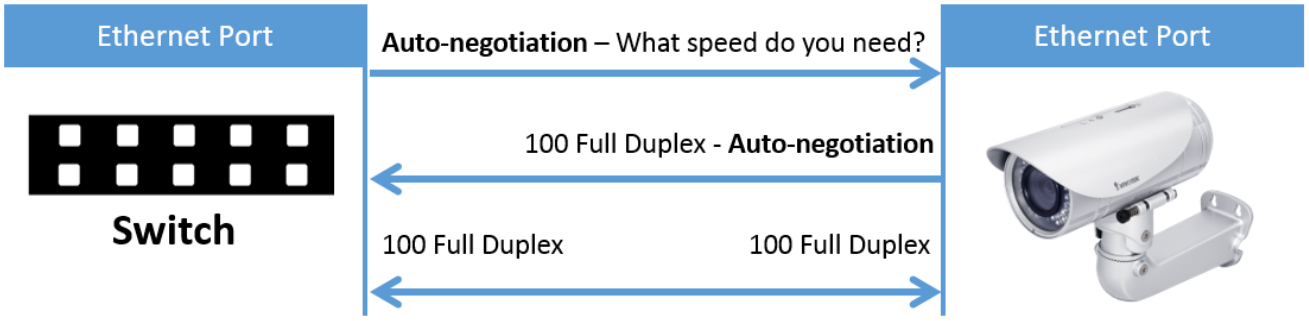
- As established, **Switches** are considered a **Layer 2 Device** due to usage of **MAC Addressing**, **Frame Forwarding** etc.
- Collisions *rarely* occur (More of a configuration fault rather than normal usual occurrences like in Hub)
- Devices connected to a Switch can operate in **Full-Duplex** mode.

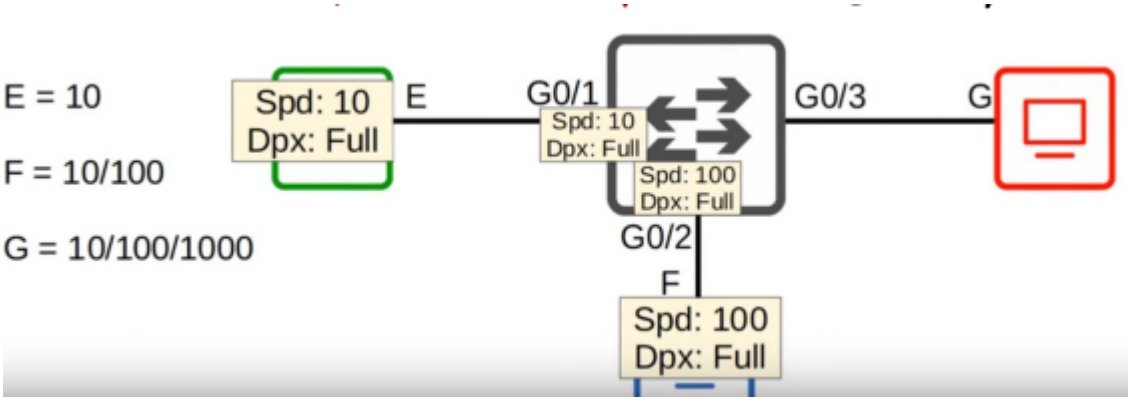
Speed:

```
Switch(config-if)#speed ?
  10    Force 10 Mbps operation
  100   Force 100 Mbps operation
  auto  Enable AUTO speed configuration
```

- Interfaces that can run at different speeds (**10/100** or **10/100/1000** have default settings of `speed auto` and `duplex auto`
- Interfaces **advertise** their capabilities to the neighboring device, and they negotiate the best `speed` and `duplex` settings they are capable of.

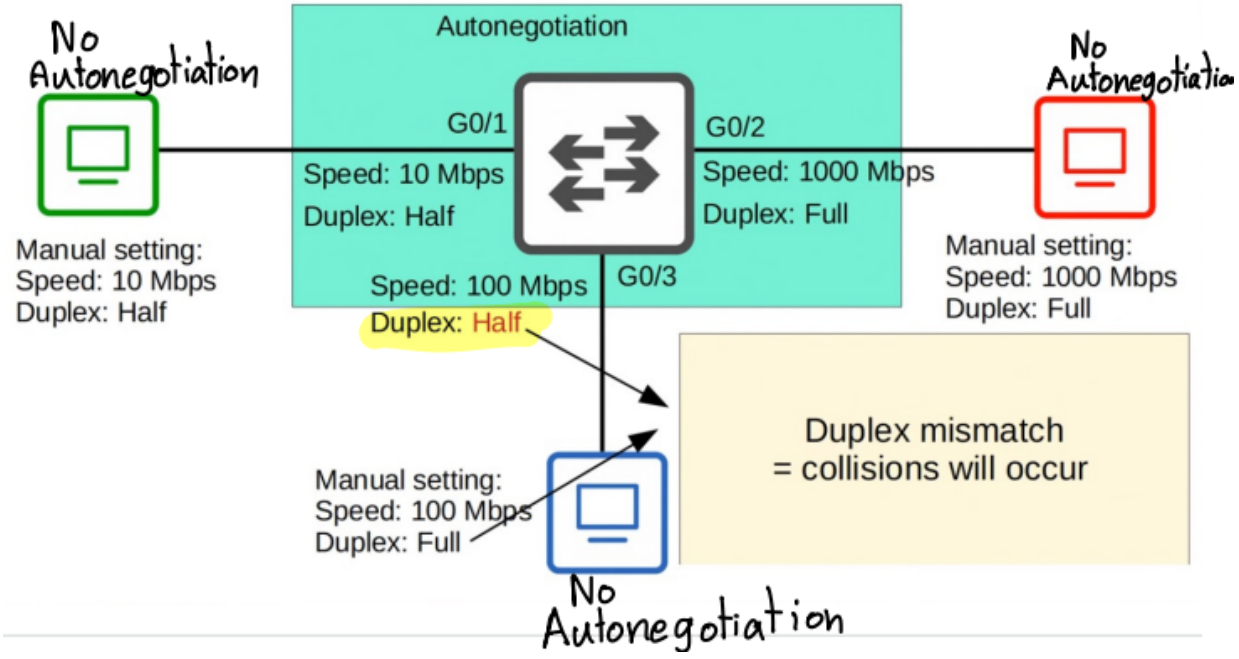






What if auto-negotiation is disabled on the device connected to the Switch?

- **Speed**: The switch will try to sense the speed that the device is operating at.
  - If it fails to sense the speed, it will use the **slowest supported speed**
  - eg. **10 Mbps** on a **10/100/1000** Interface
- **Duplex**:
  *If the speed is **10 or 100** Mbps, the switch will use **Half-Duplex**.*
  If the speed is **1000 Mbps** or greater, the switch will use **Full-Duplex**.



Interfaces Error

- `show interfaces {interface-name}` (Like routers).

```
Switch#show interfaces f0/1
FastEthernet0/1 is down, line protocol is down (disabled)
  Hardware is Lance, address is 0001.c7d2.8a01 (bia 0001.c7d2.8a01)
 BW 100000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 100Mb/s
  input flow-control is off, output flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:08, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     956 packets input, 193351 bytes, 0 no buffer
     Received 956 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 watchdog, 0 multicast, 0 pause input
     0 input packets with dribble condition detected
     2357 packets output, 263570 bytes, 0 underruns
     0 output errors, 0 collisions, 10 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

- Interesting statistics (Routers have similar statistics):

```
956 packets input, 193351 bytes, 0 no buffer
Received 956 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 watchdog, 0 multicast, 0 pause input
0 input packets with dribble condition detected
2357 packets output, 263570 bytes, 0 underruns
0 output errors, 0 collisions, 10 interface resets
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
```

  ***Runts**: Frames that are* Smaller *than the minimum Frame size (*64 Bytes*)*

  Giants: Frames that are *Larger* than the maximum Frame size (*1518 Bytes*)

  ***CRC**: Frames that failed the CRC Check (*Ethernet FCS trailer*)*

  Frame: Frames that have an incorrect format (due to errors)

  ***Input Errors**: Total of various counters, including the above four.*

  Output Errors: Frames the switch tried to send but failed due to errors.

Summary

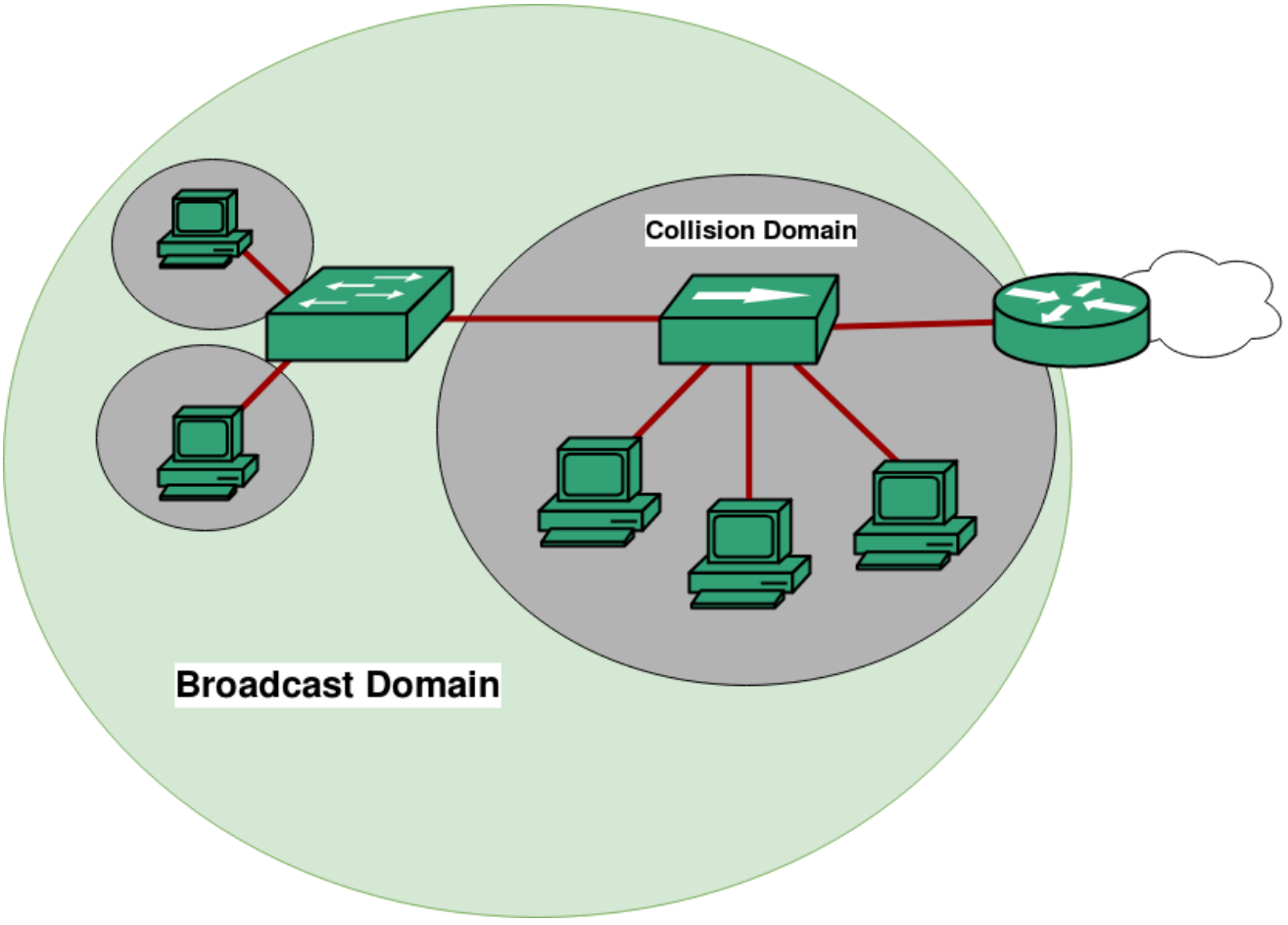
```
SW1#show interfaces status
Port      Name               Status       Vlan       Duplex  Speed Type
Fa0/1                        notconnect   1          auto    auto  10/100BaseTX
Fa0/2                        connected    1          auto    auto  10/100BaseTX
Fa0/3                        connected    1          auto    auto  10/100BaseTX
Fa0/4                        connected    1          auto    auto  10/100BaseTX
Fa0/5                        notconnect   1          auto    auto  10/100BaseTX
Fa0/6                        notconnect   1          auto    auto  10/100BaseTX
Fa0/7                        notconnect   1          auto    auto  10/100BaseTX
Fa0/8                        notconnect   1          auto    auto  10/100BaseTX
Fa0/9                        notconnect   1          auto    auto  10/100BaseTX
Fa0/10                       notconnect   1          auto    auto  10/100BaseTX
Fa0/11                       notconnect   1          auto    auto  10/100BaseTX
Fa0/12                       notconnect   1          auto    auto  10/100BaseTX
Fa0/13                       notconnect   1          auto    auto  10/100BaseTX
```

- View switch's interfaces using `show interfaces status`
  - Each interface do not have `shutdown` applied by default (**No `administratively down` like Routers**).
  - Will be in `up/up` state if connected to another device.
  - Be in `down/down` state if not connected.
  - **Duplex**: `Full`, `half`, or `auto`
  - **Speed**: Depends on the *slower* speed of either the interface or the device connected to the interface.
  - **Type**: Slower speeds than the interface and up-to-and-including the speed of the interface. (100Mbps Interface includes both 10Mbps and 100Mbps **but** not 1000Mbps)

```
269 packets input, 71059 bytes, 0 no buffer
Received 6 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
7290 packets output, 429075 bytes, 0 underruns
0 output errors, 3 interface resets
0 output buffer failures, 0 output buffers swapped out
```

- View specific switch interface's detail using `show interfaces {interface-name}`
  - **Runts**: Smaller than **64** Bytes (Minimum)
  - **Giants**: Larger than **1518** Bytes (Maximum)
  - **CRC**: Failed CRC Check
  - **Frame**: Incorrect Format
  - **Input Error**: Total Counters
  - **Output Error**: Switch failed to send
- **Duplex**: Direction of data communication.
  - **Full**: Send and Receive at the same time (eg. **SWITCH** networks).

- **Half**: Must wait before sending (eg. **HUB** networks)
  - **HUB**:
    - Considered to be a *Layer 1* device due to no MAC address nor table being used.
    - Will **always broadcast frames** regardless of type.
    - **Collisions** common.
  - **CSMA/CD**:
    - Used in **Half-Duplex** situation.
    - **C**arrier **S**ense **M**ultiple **A**ccess *with* **C**ollision **D**etection
    - Devices *listen* to the collision domain.
    - If a collision occur, the device sends a jamming signal to the collision domain.
    - Each device waits a random period of time before resending frames again.



- **Auto-Negotiation** (`speed` and `duplex`):
  - Interfaces usually can run at different speeds (**10/100** or **10/100/1000**) have default settings of `speed auto` and `duplex auto`.

- Interfaces **advertise** their capabilities to connected device and negotiate the `speed` and `duplex`.
- **If Auto-Negotiation is Disabled**:
  - **Speed**:
    - Try sensing the speed the connected device is operating at. If failed, it uses the *slowest supported speed*. (**10Mbps** on a **10/100/1000** Interface)
  - **Duplex**:
    - Speed of **10 or 100Mbps**, the switch uses **Half-Duplex**.
    - Speed of **1000Mbps** or higher, the switch uses **Full-Duplex**.
