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Per VLAN Spanning Tree (PVST)

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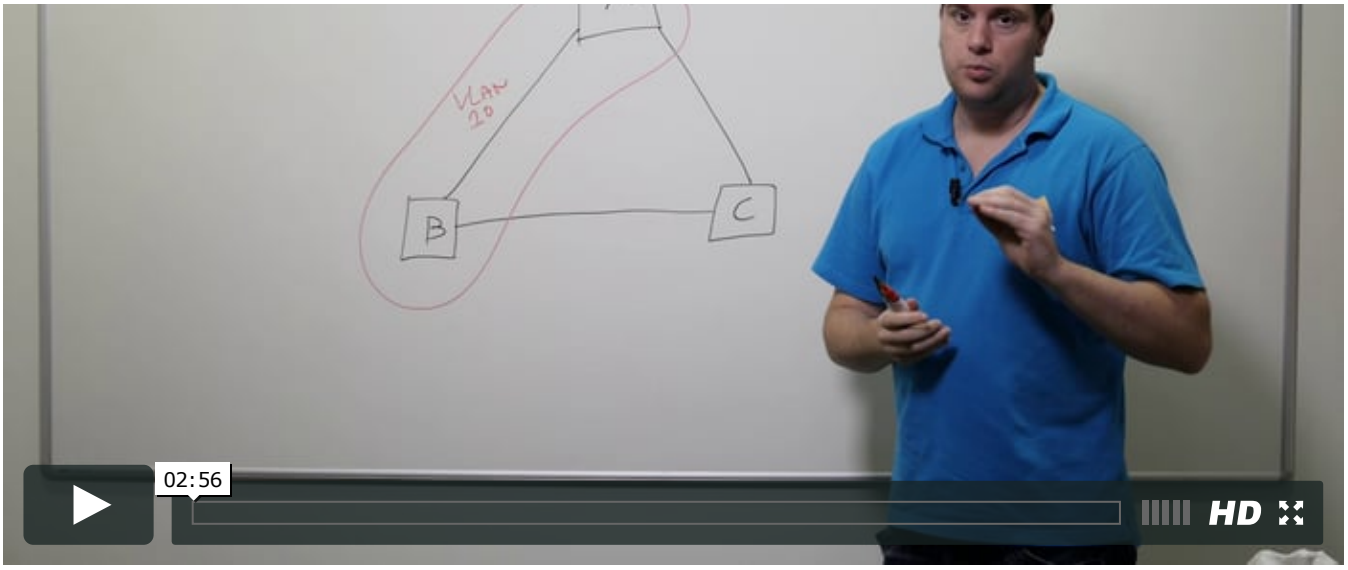
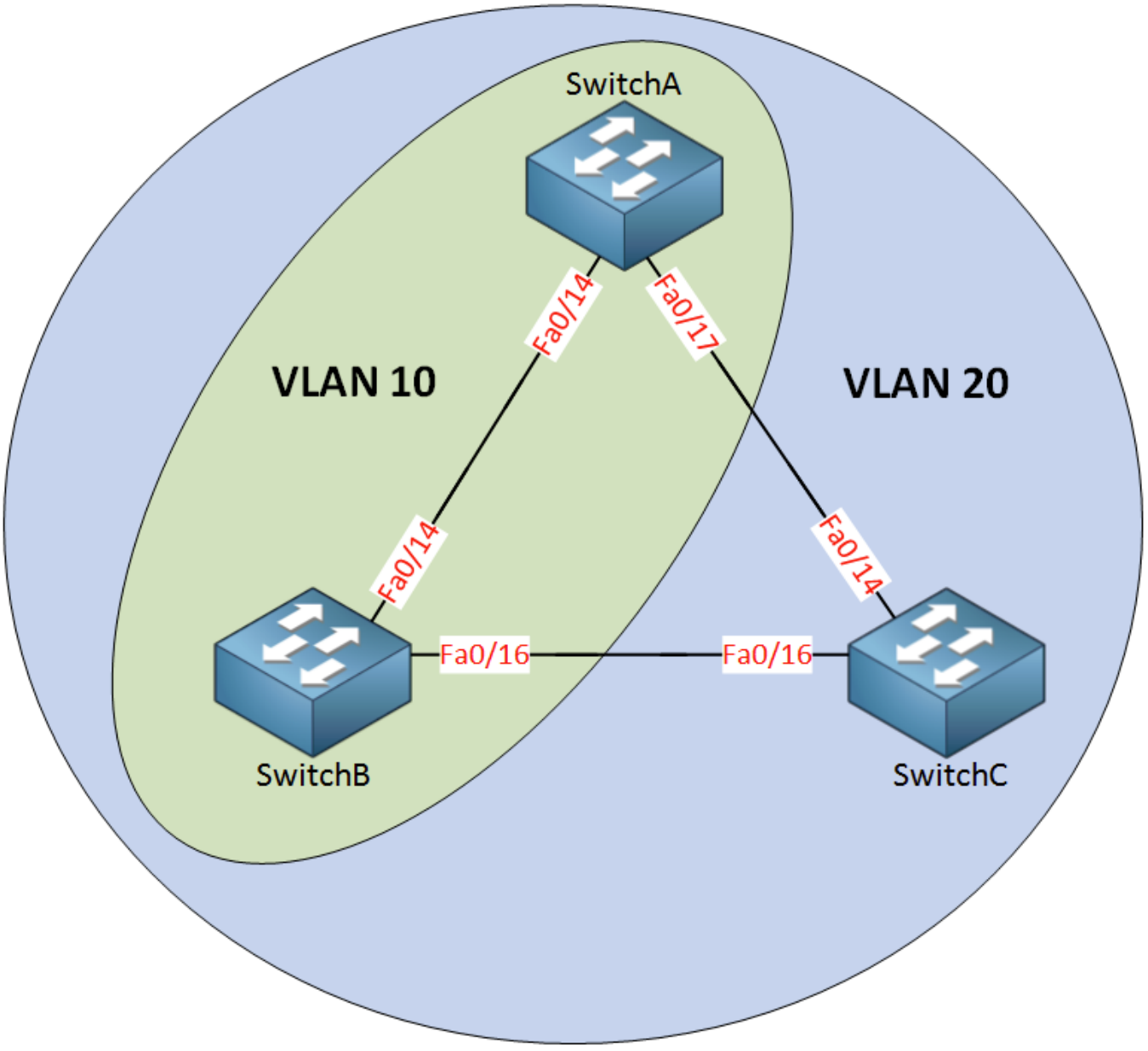
Since you are reading this I assume you understand how “classic” spanning-tree works. If you don’t, it’s best to read my Introduction to spanning-tree first before you continue.



Having said that, let's start with a nice picture:



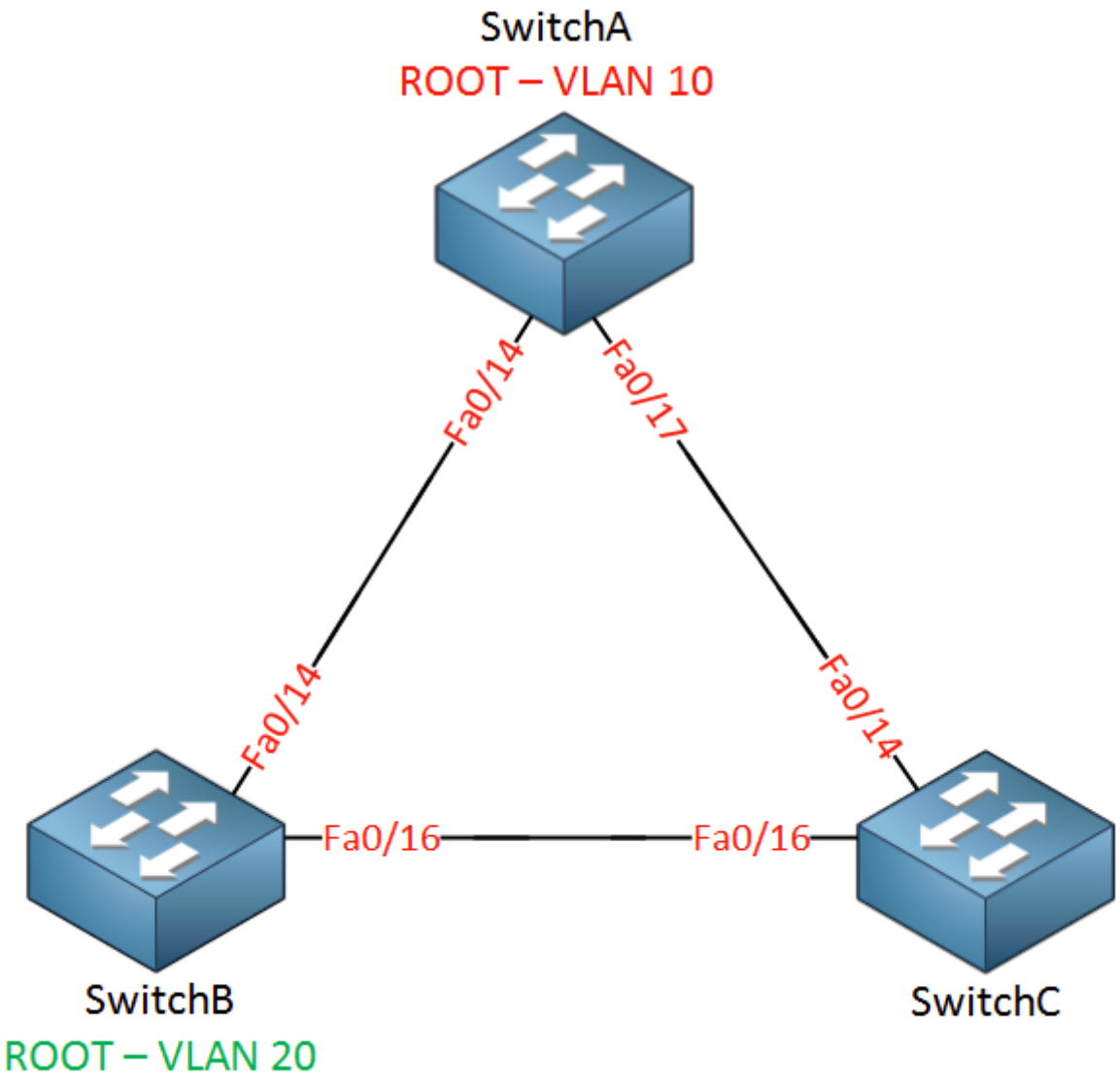
- VLAN 10 is configured on SwitchA and SwitchB.
- VLAN 20 is configured on SwitchA, SwitchB and SwitchC.

Question for you: do we have a loop in VLAN 10? What about VLAN 20?

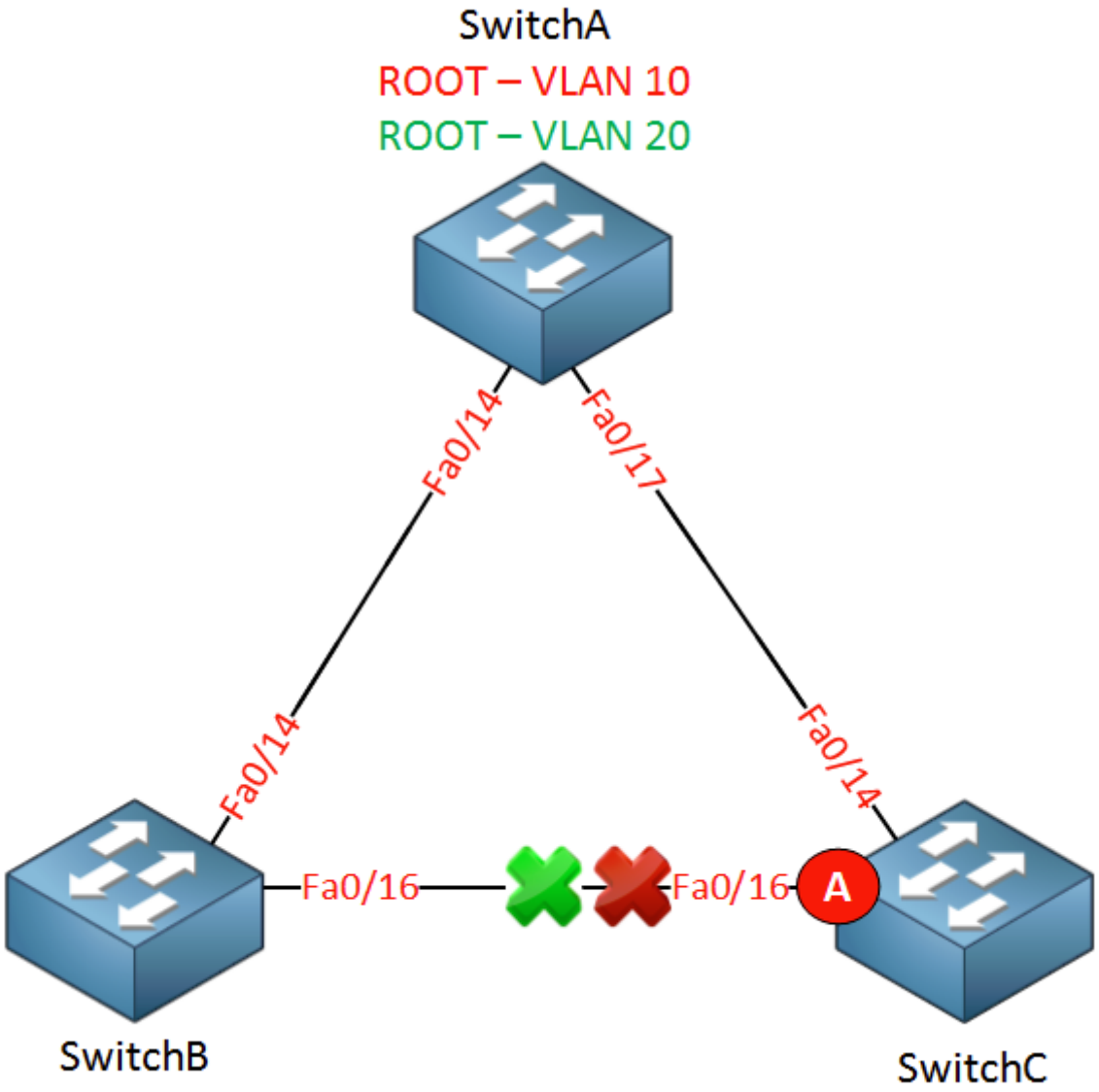
There's a big difference between our **physical** and **logical** topology. We don't have a loop in VLAN 10 because it only runs on the link between SwitchA and SwitchB. We DO have a loop within VLAN 20 however.

How does spanning-tree deal with this? Simple...we'll just calculate a different spanning-tree for each VLAN! The oldest version of spanning-tree is called **CST (Common Spanning-Tree)** and is defined in the 802.1D standard. It only calculates a **single spanning-tree for all VLANs.**

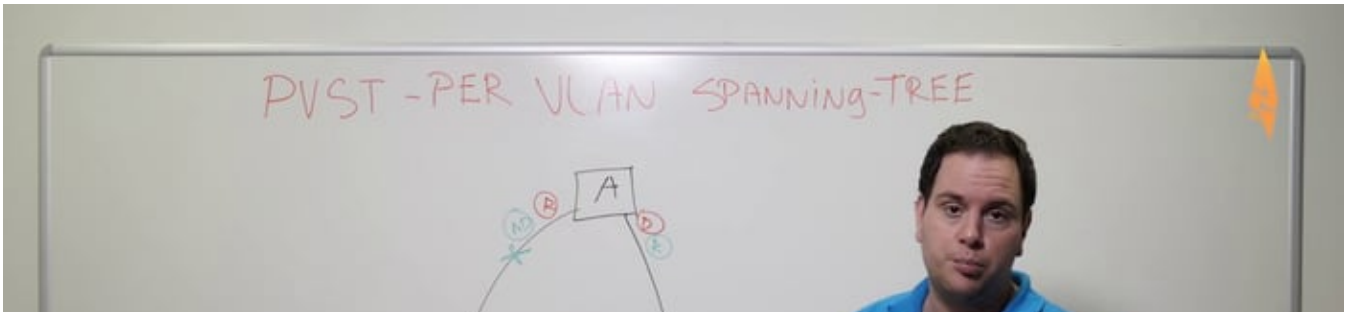
Another version of spanning-tree is able to calculate a topology for **each VLAN**. This version is called **PVST (Per VLAN Spanning-Tree)** and it's the **default on Cisco switches.**



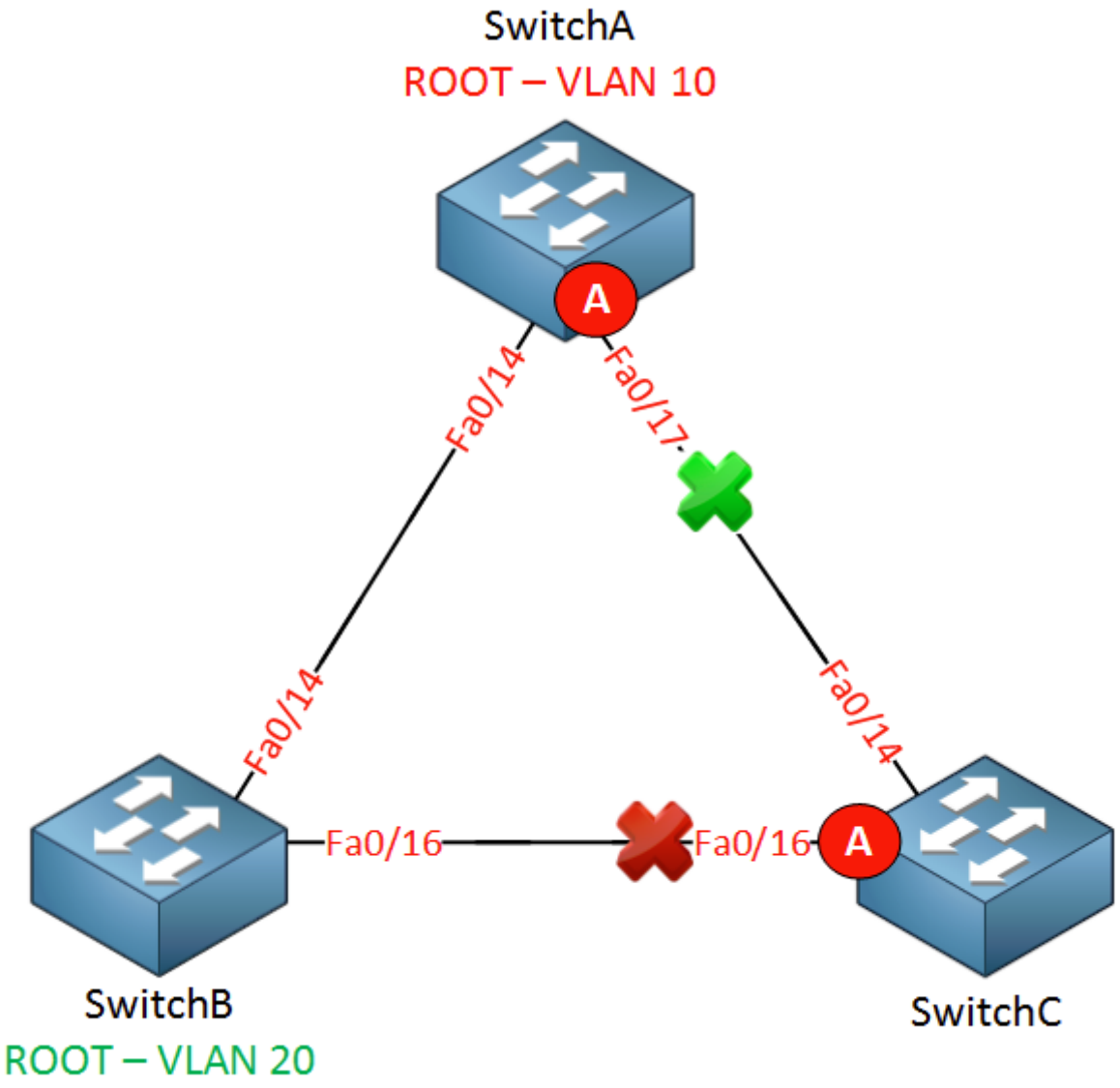
Above you can see that we have two root bridges. If we use PVST we can create a different root bridge for each VLAN if we want. SwitchA could be the root bridge for VLAN 10 and SwitchB could be the root bridge for VLAN 20. Why would you want to do this? Here's an example:



If I would make one switch root bridge for both VLANs then one interface will be blocked for both VLANs. In my example above SwitchA is the root bridge for VLAN 10 and 20 and as a result the fa0/16 interface on SwitchC is blocked for **both VLANs.** No traffic will be forwarded on the fa0/16 interface at all. Imagine these were 10 Gigabit interfaces. It would be a shame if one of those expensive interfaces wasn't doing anything right?



If I choose another switch as the root bridge for VLAN 20 we will see different results:



In my example I made SwitchB the root bridge for VLAN 20. As you can see the fa0/16 interface on SwitchB is blocked for VLAN 10 while the fa0/17 interface on SwitchA is blocked for VLAN 20. The advantage of having multiple root bridges is that I can do some **load sharing/balancing.**

I hope this has helped you to understand per VLAN spanning tree! If you enjoyed this lesson, please share it with your friends or colleagues!

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- September 14, 2014 at 13:42 #11705 Reply

Shaj
Rene, you overviews are really good and easy to understand, on the above example there is no fa0/16 on switch A. Unless I'm not seeing right. Thanks

September 16, 2014 at 10:51 #11706 Reply

Rene Molenaar
Keymaster
Hi Shaj,

Thanks! I just fixed it, it should be Fa0/17.

Rene

May 19, 2015 at 16:39 #11707 Reply

muhammed q
Participant
Hi rene , have u got any lessons on RSTP ??

M Q

- This reply was modified 18 hours, 7 minutes ago by Shantel - Networklessons.com.

May 19, 2015 at 16:43 #11708 Reply

Rene Molenaar
Keymaster
Hi Muhammed,

For sure, here they are:

http://networklessons.com/spanning-tree/rapid-spanning-tree-rstp/

http://networklessons.com/spanning-tree/rapid-spanning-tree-configuration/

Rene

August 25, 2015 at 06:07 #11709 Reply

Alberto s
Participant
Hi Rene, how do you configure PVSTP?
Could you give me an example?

August 25, 2015 at 21:03 #11710 Reply

Rene Molenaar
Keymaster
Hi Alberto,

PVST is the default on Cisco IOS switches. The example in this tutorial is PVST:

https://networklessons.com/spanning-tree/introduction-to-spanning-tree/

I only demonstrated VLAN 1 there but you can add VLAN 2 to it and take a look at it using the same commands, that's a nice exercise 🙂

Rene

October 29, 2015 at 05:11 #19290 Reply

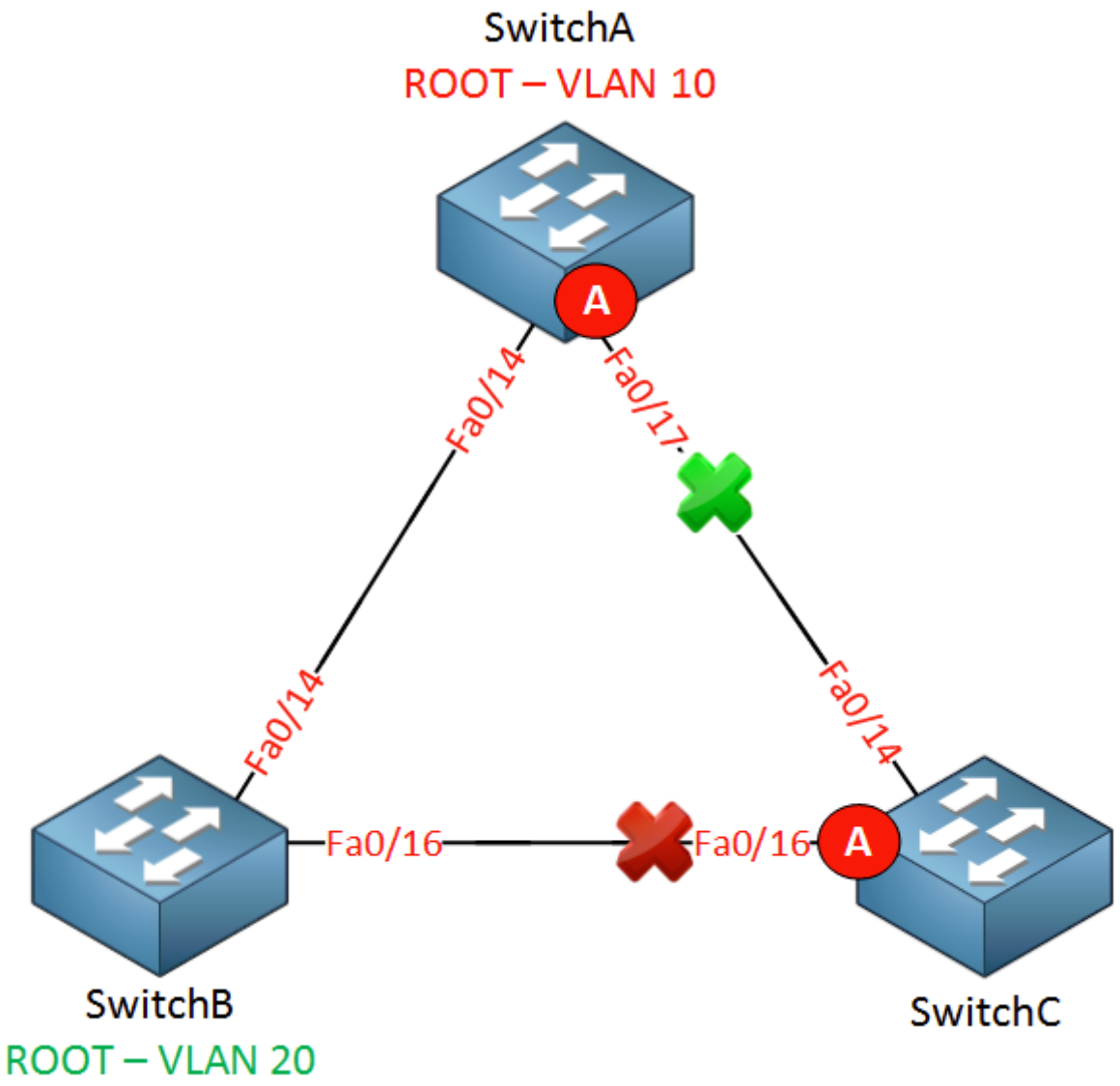
Siavash R
Participant
when switch B and switch A become root bridge the link between switch A and Switch C, blocked and also line between switch B and Switch C blocked. therefor the switch C there is not connection to the world. what happen to host connect to switch C?

Is this disconnection happen on trunk?

October 29, 2015 at 09:27 #19291 Reply

Rene Molenaar
Keymaster
Hi Siavash,

Are you talking about this image?



In this picture, Switch A FA0/17 is blocked for VLAN 20 and Switch C FA0/16 is blocked for VLAN 10.

When a host in VLAN 20 on Switch C wants to reach something connected to VLAN 20 in Switch A, we'll have to go through Switch B.

Rene

January 16, 2016 at 03:57 #20993 Reply

Karan D
Participant
What are the rules for Root Bridge election in PVST ? I mean going by STP rules in both cases Switch A should be selected as the Root Bridge. Can you explain that part as well.

Thanks,

K

January 16, 2016 at 14:36 #21005 Reply

Rene Molenaar
Keymaster
Hi K,

The switch with the best bridge ID becomes the root bridge. The bridge ID consists of the priority (default value 32768) and the MAC address.

With the default settings, it's up to the MAC address to determine which switch will become root bridge. This applies to all VLANs.

Rene

February 19, 2016 at 15:38 #22245 Reply

Ivaylo A
Participant
Karan,
I also wanted to add that in pvst+ you can change the bridge priority value by entering the command
`spanning-tree vlan [id] root [ primary | secondary ]` in global configuration mode.
This way controlling the election process

March 22, 2016 at 00:43 #22881 Reply

francesco r
Participant
Hello friends,
About timers ,the stp 802.1d, pvst and pvst+ do they use the same semantic? Things change for rstp rpvst+

March 22, 2016 at 18:24 #22890 Reply

Andrew P
Moderator
Hi Francesco,
Original Spanning Tree, PVST and PVST+ all use the same timers, adhere to the same standard (802.1 D), and all use the same BPDU packet version (zero). You are correct, that things change for RSTP and R-PVST+ (those use 802.1w, and BPDU packet version 2).

In case you were curious as to the difference between PVST and PVST+ … PVST is older and requires the Cisco proprietary ISL trunking mode to function, while PVST+ can function on 802.1Q trunks.

–Andrew

April 21, 2016 at 16:26 #23540 Reply

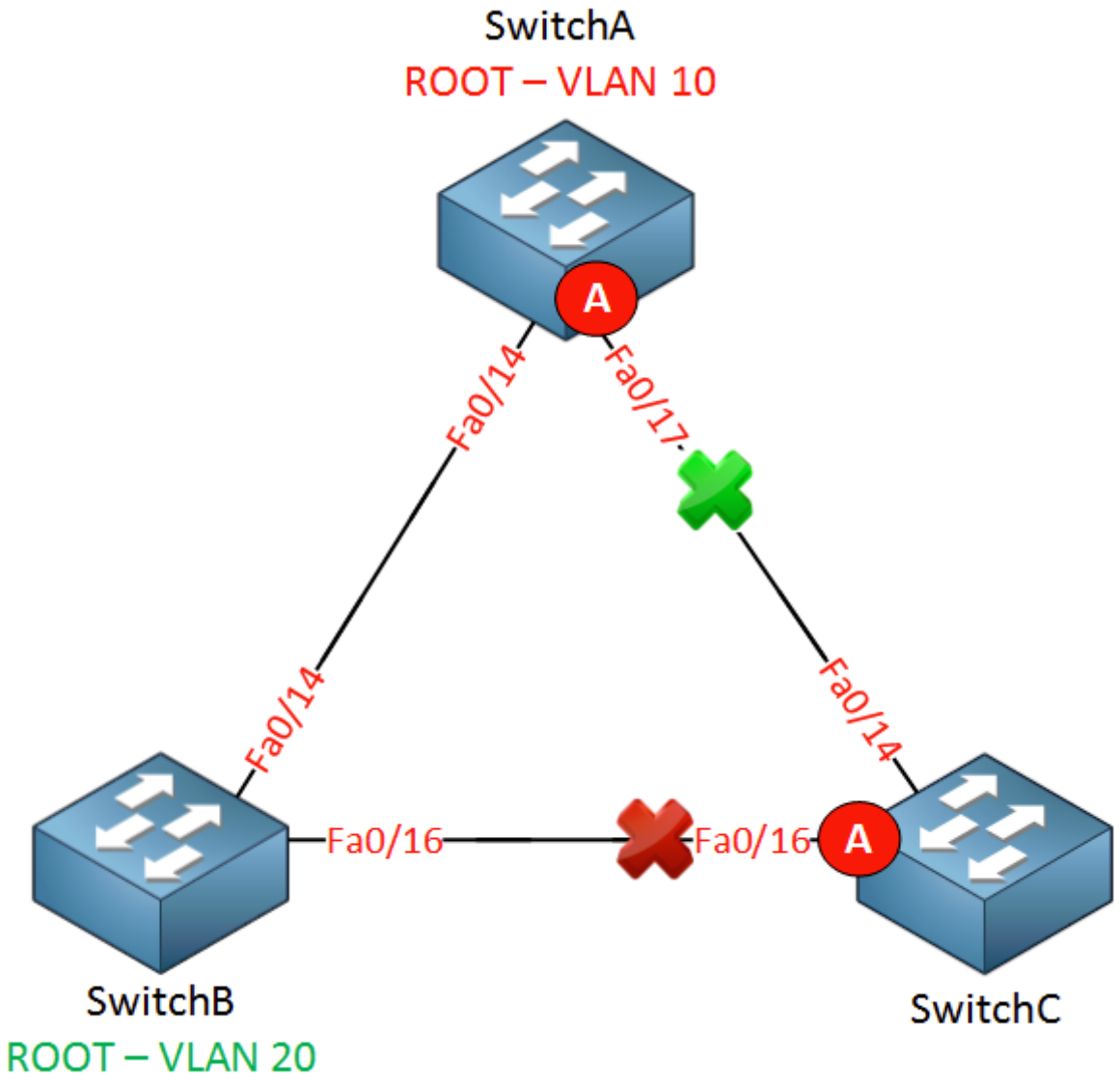
Jose A
Participant
Hello Rene, the answer you provided to Siavash on October 29th, 2015 I still think is not correct. You stated “Switch C fa0/16 is blocked for vlan20 and if a host wants to get to something on vlan20 in switch A, it will need to go through switch B.” That is not correct because fa0/16 on switch C is blocked, so to get to vlan20on switch A it will use the direct link fa0/14 to switch A. Also, if host in vlan20 on switchC needs to communicate to vlan 20 in switch B, it will need to communicate through switch A, because port fa0/16 on switch C is blocked for vlan 20.

Please let me know if this is correct or if I am missing something.

April 22, 2016 at 16:40 #23586 Reply

Rene Molenaar
Keymaster
Hi Jose,

I see I had an error in my reply, just fixed it. Just in case let’s post the picture again here:



- The red cross means the port is blocked for VLAN 10.
- The green cross means the port is blocked for VLAN 20.

So VLAN 10 is blocked on the Fa0/16 interface of SwitchC and VLAN 20 is blocked on Fa0/17 on SwitchA.

When we want to go from SwitchC to SwitchA in VLAN20, we'll have to go from C > B > A.

I should have used a green A (alternate port) in this picture to show the blocked port for VLAN 20 on SwitchA fa0/17 :).

Rene

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