The **Spanning Tree Protocol (STP)** is a method for dynamically calculating the "best" spanning-tree of a computer network with or without loops. By definition a tree is loop free.

The STP do its works at layer 2 (data-link) of the OSI model. That's to say it runs at the Ethernet layer and it totally unrelated to dynamic IP-based routing protocols like RIP, OSPF or OLSR which can take into account factors that may be desirable in choosing a particular path, such as bandwidth, reliability, latency etc.

A computer network loops links may function as backup. If any link in a loop is lost, the rest of the loops equipment is still connected.

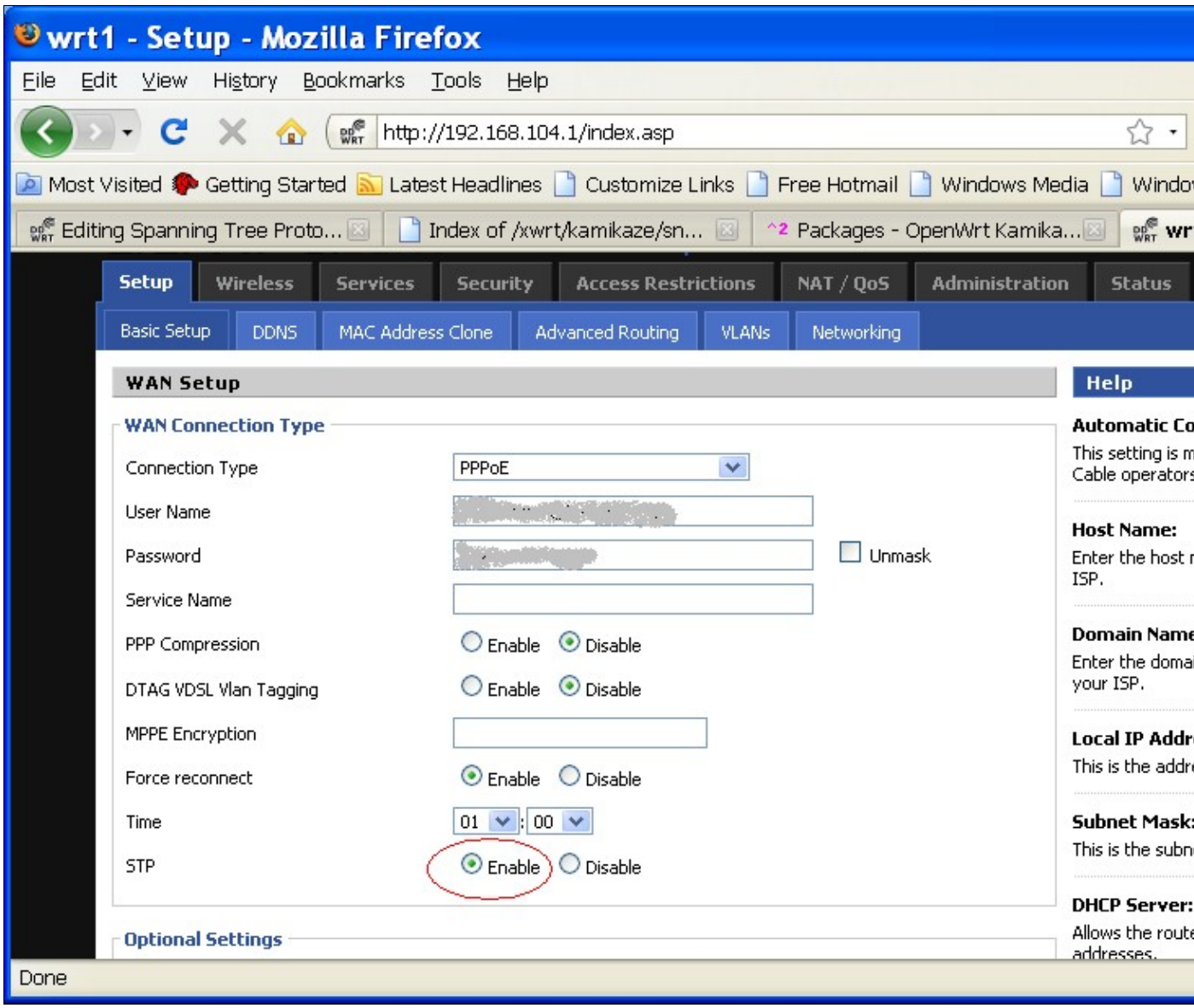
Mesh networks without STP enabled may experience Loopback. The need for STP occurs when your router is being used in a mesh network with multiple WDS-enabled repeaters, or in an ad hoc network with multiple ad hoc connections.

If your router is not being used in either of the given scenarios, then likely STP is not necessary. Therefore, it is recommended that you disable it because newly-connected ports sit in a learning state for approximately 50 seconds before entering a non-blocking mode. This can cause certain services on the client device (such as DHCP) to time-out.

Users of Comcast Cable should always disable this option and leave it disabled, as STP conflicts with the routers DHCP client for the WAN connection.

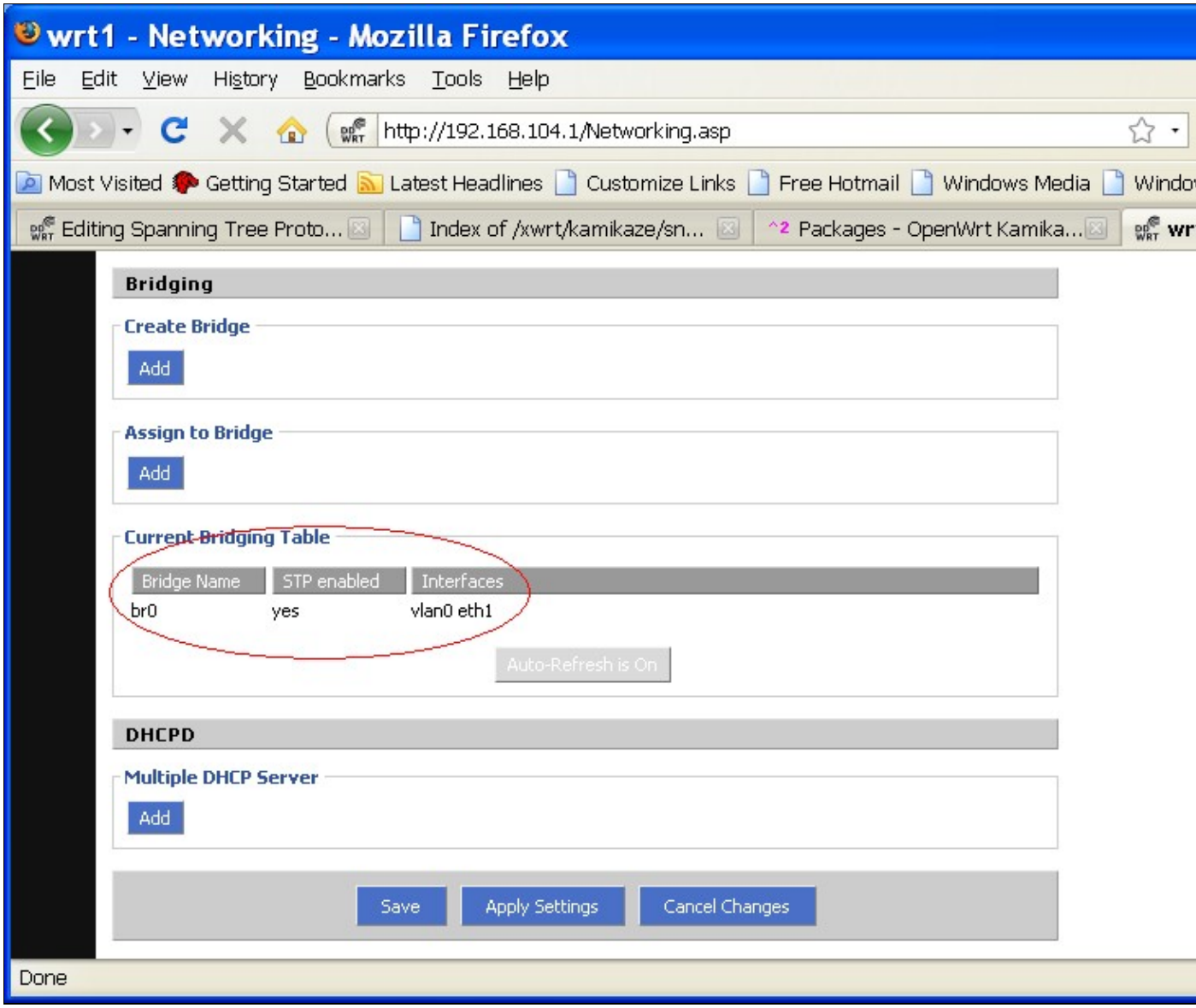
How-to

Turn STP on like this.



(wrt/index.asp)

Check it like this.



(wrt/Networking.asp)

Fine Tuning STP

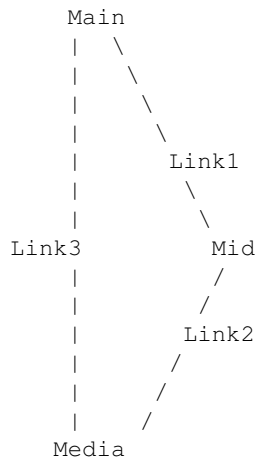
http://www.dd-wrt.com/forum/viewtopic.php?t=143892

Now the initial state: Three routers Main MAC:xxxxxxxxxxx Asus RT-N16 running dd-wrt.v24-14929_NEWD-2_K2.6_big Media MAC:xxxxxxxxxx1 WRT-310Nv1 running dd-wrt.v24-14929_NEWD-2_K2.6_std_nokaid_small Mid MAC:xxxxxxxxxx2 WRT-310Nv1 running dd-wrt.v24-14929_NEWD-2_K2.6_std_nokaid_small

Main Has the WAN link to a PPPoE DSL Link1 = WDS neighbors Main-Mid Link2 = WDS neighbors Mid-Media Link3 = WDS neighbors Media-Main

Now my ASCII art:

Code:



By default DD-WRT exposes a single button on the webpage to toggle Spanning Tree On/Off

I was having a problem with DHCP and topology changes on Spanning Tree and suspected that STP was not working properly. Specifically, my client would associate with the AP(dd-wrt router) but not get a DHCP assigned address. Curiously the wired ports on the back seemed to always work just fine. The issue was intermittant and bugged me greatly, in that I could simply turn off Link3 and have no issues at all for months at a time.

Since it was based on Linux I googled up spanning tree and ubuntu and linux and various combinations and found that Linux has been using brctl since kernel 2.2.

I found that none of the controls were exposed in the DD-WRT front end, so I ssh'd to the devices. (feel free to telnet or use the run command on the user interface for what follows)

first I checked to see if brctl was available with this command Code:

root@Main:~#which brctl /usr/sbin/brctl

I got it!! now to business brctl comes with the following options I will explain in a moment Code:

Usage: brctl [commands] commands:

```
addbr           <bridge>                add bridge
delbr           <bridge>                delete bridge
addif           <bridge> <device>       add interface to bridge
delif           <bridge> <device>       delete interface from bridge
setageing       <bridge> <time>         set ageing time
setbridgeprio   <bridge> <prio>         set bridge priority
setfd           <bridge> <time>         set bridge forward delay
```

```
sethello        <bridge> <time>         set hello time
setmaxage       <bridge> <time>         set max message age
setpathcost     <bridge> <port> <cost>  set path cost
setportprio     <bridge> <port> <prio>  set port priority
setportsnooping <bridge> <port> <addr>  set port snooping
clearportsnooping       <bridge> <port> <addr>  clear port snooping
showportsnooping        <bridge>        show port snooping
enableportsnooping      <enable>                enable port snooping
show                                    show a list of bridges
showmacs        <bridge>                show a list of mac addrs
showstp         <bridge>                show bridge stp info
stp             <bridge> {on|off}       turn stp on/off
```

I peeked around to see what bridges were available Code:

root@Main:~# brctl show bridge name bridge id STP enabled interfaces br0 8000.xxxxxxxxxxxx yes vlan1

eth1
wds0.1
wds0.2

Which tells me I have one bridge named br0

Code:

root@Main:~# brctl showstp br0 br0

```
bridge id               8000.xxxxxxxxxxxx
designated root         8000.xxxxxxxxxxx1
root port                  3                    path cost                100
max age                   20.00                 bridge max age            20.00
hello time                 2.00                 bridge hello time          2.00
forward delay              1.00                 bridge forward delay       1.00
ageing time              300.00
hello timer                0.00                 tcn timer                  1.79
topology change timer      0.00                 gc timer                   0.83
flags                   TOPOLOGY_CHANGE_DETECTED
```

vlan1 (1)

```
port id                 8001                    state                forwarding
designated root         8000.xxxxxxxxxxx1       path cost               100
designated bridge       8000.xxxxxxxxxxxx       message age timer         0.00
designated port         8001                    forward delay timer       0.00
designated cost          100                    hold timer                0.83
flags
```

eth1 (2)

```
port id                 8002                    state                forwarding
designated root         8000.xxxxxxxxxxx1       path cost               100
```

```
designated bridge      8000.xxxxxxxxxxxx       message age timer          0.00
designated port        8002                    forward delay timer        0.00
designated cost         100                    hold timer                 0.83
flags
```

wds0.1 (3)

```
port id                8003                    state                forwarding
designated root        8000.xxxxxxxxxxx1       path cost               100
designated bridge      8000.xxxxxxxxxxx1       message age timer        19.85
designated port        8004                    forward delay timer       0.00
designated cost           0                    hold timer                0.00
flags
```

wds0.2 (4)

```
port id                8004                    state                forwarding
designated root        8000.xxxxxxxxxxx1       path cost               100
designated bridge      8000.xxxxxxxxxxxx       message age timer         0.00
designated port        8004                    forward delay timer       0.00
designated cost         100                    hold timer                0.83
flags
```

root@Main:~#

Let's take a moment to interpret what we are seeing bridge id is the MAC of your local bridge interface with "8000." out in front (8000.xxxxxxxxxxxx) designated root is the MAC of the root bridge (spanning tree boss) with "8000." out in front (8000.xxxxxxxxxxx1) root port is the port used to communicate with the root bridge (this case 3 which is wds0.1) path cost is the culmulative cost of the path to root (how far away you are from the root bridge) max age and bridge max age are the maximum age of the STP topology which is 20 seconds by default hello time and bridge hello time is the number of seconds between hello messages on the bridge forward delay and bridge forward delay are the time STP will wait before forwarding packets onto an existing bridge which gives the new device time to find out what is going on before she starts talking into a network ageing time is the length of time a MAC address is held in the forwarding table the forwarding table remembers the source MAC when a packet crosses, then it will store that MAC/port relation so when an packet comes in destined for the MAC the switch will then forward the packet back down the port where it is last known to be hello timer, tcn timer, topology change timer, and gc timer are all the current values in the live timers flags is again a live value containing the last active flag value (my example indicates a topology change has been detected)

Looking at the remaining info are the port names(vlan1, eth1, wds0.1, wds0.2), physical port (number following the port names "1, 2, 3, 4"), port ids (8001-8004), state (forwarding), path cost (all ethernet ports are default 100, we will revisit this in a moment) , and a bunch of timers and stuff.

The root bridge appears to be my Mid Router and the path costs are default all the way around.

We would repeat the above procedure on the other two devices to ensure they all believed the root was the Mid Router and that all the path costs were the same. in my case they were. So STP should have calculated a distance to the root bridge via link3 to be 200 (path cost of link3 added to the path cost of link 2). Which it did not do in this case, because I initially had link3 disabled on the Media router. (so it would work)

first thing I wanted to do and I suggest for all involved. Bring the root bridge to the WAN router, Main Router, in this case the newest and most powerful device ASUS RT-N16

By default, DDWRT assigns a root bridge priority of 100, I want my Main Router to be root so I influence this decision by lowering the Main Routers bridge priority to 99. NOTE; real switch vendors set their default bridge priority much higher than this, cisco and brocade uses 32768 out of the box. There are some other out of the box default settings that DDWRT may want to review for compatibility with industry standard commercial hardware. Priority is one of the "needs to play nice" ones where the default 100 will make the DDWRT device assume root bridge from an existing STP domain.
http://www.brocade.com/support/Product_Manuals/ServerIron_SwitchRouterGuide/STP.pdf
http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/12.1/8aew/configuration/guide/spantree.html#wp102033

Code:

```
root@Main:~# brctl setbridgeprio br0 99
```

Code:

```
root@Main:~# brctl showstp br0 br0

bridge id              0063.xxxxxxxxxxxx
designated root        0063.xxxxxxxxxxxx
root port                 0                    path cost                  0
max age                  20.00                 bridge max age            20.00
hello time                2.00                 bridge hello time          2.00
forward delay             1.00                 bridge forward delay       1.00
ageing time             300.00
hello timer               1.81                 tcn timer                  0.00
topology change timer     0.00                 gc timer                   0.81
flags


vlan1 (1)

port id                8001                    state                forwarding
designated root        0063.xxxxxxxxxxxx       path cost               100
designated bridge      0063.xxxxxxxxxxxx       message age timer         0.00
designated port        8001                    forward delay timer       0.00
designated cost           0                    hold timer                0.81
flags

eth1 (2)

port id                8002                    state                forwarding
designated root        0063.xxxxxxxxxxxx       path cost               100
designated bridge      0063.xxxxxxxxxxxx       message age timer         0.00
designated port        8002                    forward delay timer       0.00
designated cost           0                    hold timer                0.81
flags

wds0.1 (3)
```

```
port id               8003                    state                forwarding
designated root       0063.xxxxxxxxxxxx       path cost              100
designated bridge     0063.xxxxxxxxxxxx       message age timer        0.00
designated port       8003                    forward delay timer      0.00
designated cost          0                    hold timer               0.81
flags
```

wds0.2 (4)

```
port id               8004                    state                forwarding
designated root       0063.xxxxxxxxxxxx       path cost              100
designated bridge     0063.xxxxxxxxxxxx       message age timer        0.00
designated port       8004                    forward delay timer      0.00
designated cost          0                    hold timer               0.81
flags
```

root@Main:~#

root@Mid:~# brctl showstp br0 br0

```
bridge id             8000.xxxxxxxxxxx1
designated root       0063.xxxxxxxxxxxx
root port                4                    path cost              100
max age                 20.00                 bridge max age          20.00
hello time               2.00                 bridge hello time        2.00
forward delay            1.00                 bridge forward delay     1.00
ageing time            300.00
hello timer              0.00                 tcn timer                0.00
topology change timer    0.00                 gc timer                 1.24
flags
```

eth0 (1)

```
port id               8001                    state                forwarding
designated root       0063.xxxxxxxxxxxx       path cost              100
designated bridge     8000.xxxxxxxxxxx1       message age timer        0.00
designated port       8001                    forward delay timer      0.00
designated cost        100                    hold timer               0.23
flags
```

vlan1 (2)

```
port id               8002                    state                forwarding
designated root       0063.xxxxxxxxxxxx       path cost              100
designated bridge     8000.xxxxxxxxxxx1       message age timer        0.00
designated port       8002                    forward delay timer      0.00
designated cost        100                    hold timer               0.23
flags
```

wds0.1 (3)

```
port id               8003                    state                forwarding
designated root       0063.xxxxxxxxxxxx       path cost              100
designated bridge     8000.xxxxxxxxxxx1       message age timer        0.00
designated port       8003                    forward delay timer      0.00
```

```
designated cost         100                  hold timer                0.23
flags
```

wds0.2 (4)

```
port id                 8004                 state                forwarding
designated root         0063.xxxxxxxxxxxx    path cost               100
designated bridge       0063.xxxxxxxxxxxx    message age timer        19.20
designated port         8003                 forward delay timer       0.00
designated cost            0                 hold timer                0.00
flags
```

root@Mid:~#

root@Media:~# brctl showstp br0 br0

```
bridge id               8000.xxxxxxxxxxx2
designated root         0063.xxxxxxxxxxxx
root port                  3                 path cost               200
max age                  20.00               bridge max age           20.00
hello time                2.00               bridge hello time         2.00
forward delay             1.00               bridge forward delay      1.00
ageing time             300.00
hello timer               0.00               tcn timer                 0.12
topology change timer     0.00               gc timer                  1.08
flags                   TOPOLOGY_CHANGE_DETECTED
```

eth0 (1)

```
port id                 8001                 state                forwarding
designated root         0063.xxxxxxxxxxxx    path cost               100
designated bridge       8000.xxxxxxxxxxx2    message age timer         0.00
designated port         8001                 forward delay timer       0.00
designated cost          200                 hold timer                1.08
flags
```

vlan1 (2)

```
port id                 8002                 state                forwarding
designated root         0063.xxxxxxxxxxxx    path cost               100
designated bridge       8000.xxxxxxxxxxx2    message age timer         0.00
designated port         8002                 forward delay timer       0.00
designated cost          200                 hold timer                1.08
flags
```

wds0.1 (3)

```
port id                 8003                 state                forwarding
designated root         0063.xxxxxxxxxxxx    path cost               100
designated bridge       8000.xxxxxxxxxxx1    message age timer        19.36
designated port         8003                 forward delay timer       0.00
designated cost          100                 hold timer                0.00
flags
```

root@Media:~#

And we can now see that the ASUS xxxxxxxxxxxx is the designated root across all three devices and the path cost to get to the root from the Media router is 200 (link1 plus link2)

now I want link3 to be less preferred so I want to make it's cost higher than the natural 100 (cost of link1 directly back to the root) but first i have to figure out which link is which.. hmm. that is stored in the nvram variables

so in Main

Code:

root@Main:~# nvram show | grep wds[23]_ | sort wl0_wds2_desc=Mid wl0_wds2_enable=3 wl0_wds2_hwaddr=xx:xx:xx:xx:xx:x1 wl0_wds2_if=wds0.1 wl0_wds2_ipaddr= wl0_wds2_netmask= wl0_wds2_ospf= wl0_wds3_desc=Media wl0_wds3_enable=3 wl0_wds3_hwaddr=xx:xx:xx:xx:xx:x2 wl0_wds3_if=wds0.2 wl0_wds3_ipaddr= wl0_wds3_netmask= wl0_wds3_ospf=

I see that the one I am interested in is wds0.2 so my command is

Code:

root@Main:~#brctl setpathcost br0 wds0.2 300 root@Main:~# brctl showstp br0 br0

```
bridge id              0063.xxxxxxxxxxxx
designated root        0063.xxxxxxxxxxxx
root port                 0                    path cost                  0
max age                  20.00                 bridge max age            20.00
hello time                2.00                 bridge hello time          2.00
forward delay             1.00                 bridge forward delay       1.00
ageing time             300.00
hello timer               0.69                 tcn timer                  0.00
topology change timer     0.00                 gc timer                   0.69
flags
```

vlan1 (1)

```
port id                8001                   state                forwarding
designated root        0063.xxxxxxxxxxxx      path cost                100
designated bridge      0063.xxxxxxxxxxxx      message age timer          0.00
designated port        8001                   forward delay timer        0.00
designated cost           0                   hold timer                 0.00
flags
```

eth1 (2)

```
port id                8002                   state                forwarding
designated root        0063.xxxxxxxxxxxx      path cost                100
designated bridge      0063.xxxxxxxxxxxx      message age timer          0.00
```

```
designated port        8002                  forward delay timer        0.00
designated cost           0                  hold timer                 0.00
flags
```

wds0.1 (3)

```
port id                8003                  state                forwarding
designated root        0063.xxxxxxxxxxxx     path cost               100
designated bridge      0063.xxxxxxxxxxxx     message age timer         0.00
designated port        8003                  forward delay timer       0.00
designated cost           0                  hold timer                0.00
flags
```

wds0.2 (4)

```
port id                8004                  state                forwarding
designated root        0063.xxxxxxxxxxxx     path cost               300
designated bridge      0063.xxxxxxxxxxxx     message age timer         0.00
designated port        8004                  forward delay timer       0.00
designated cost           0                  hold timer                0.00
flags
```

root@Main:~#

now I have to enable the port in the Media router so I can see it's port name so we do that in the gui repeat the

Code:

root@Media:~# nvram show | grep wds[12]_ | sort wl0_wds1_desc=Main wl0_wds1_enable=3 wl0_wds1_hwaddr=xx:xx:xx:xx:xx:xx wl0_wds1_if=wds0.1 wl0_wds1_ipaddr= wl0_wds1_netmask= wl0_wds1_ospf= wl0_wds2_desc=Mid wl0_wds2_enable=3 wl0_wds2_hwaddr=xx:xx:xx:xx:xx:x1 wl0_wds2_if=wds0.2 wl0_wds2_ipaddr= wl0_wds2_netmask= wl0_wds2_ospf=

and we see it is wds0.1 now. order is important this value will change based on where on the list it lies be careful when adding and disabling values on the webpage, these will move about and may cause unintended side effects.

Code:

root@Media:~#brctl setpathcost br0 wds0.1 300 root@Media:~# brctl showstp br0 br0

```
bridge id      8000.xxxxxxxxxxx2
designated root   0063.xxxxxxxxxxxx
root port         4         path cost       200
max age        20.00         bridge max age        20.00
hello time         2.00         bridge hello time      2.00
forward delay         1.00         bridge forward delay      1.00
```

```
ageing time       300.00
hello timer         0.00         tcn timer         0.04
topology change timer      0.00         gc timer       105.30
flags
```

eth0 (1)

```
port id      8001         state           forwarding
designated root   0063.xxxxxxxxxxxx   path cost       100
designated bridge   8000.xxxxxxxxxxx2   message age timer      0.00
designated port   8001         forward delay timer      0.00
designated cost    200         hold timer         0.66
flags
```

vlan1 (2)

```
port id      8002         state           forwarding
designated root   0063.xxxxxxxxxxxx   path cost       100
designated bridge   8000.xxxxxxxxxxx2   message age timer      0.00
designated port   8002         forward delay timer      0.00
designated cost    200         hold timer         0.66
flags
```

wds0.1 (3)

```
port id      8003         state             blocking
designated root   0063.xxxxxxxxxxxx   path cost       300
designated bridge   0063.xxxxxxxxxxxx   message age timer      3.41
designated port   8004         forward delay timer      0.00
designated cost      0         hold timer         0.00
flags
```

wds0.2 (4)

```
port id      8004         state           forwarding
designated root   0063.xxxxxxxxxxxx   path cost       100
designated bridge   8000.xxxxxxxxxxx1   message age timer      2.40
designated port   8003         forward delay timer      0.00
designated cost    100         hold timer         0.00
flags
```

root@Media:~#

Some References http://www.faqs.org/docs/Linux-HOWTO/BRIDGE-STP-HOWTO.html#STP
http://linux.die.net/man/8/brctl http://www.linuxfoundation.org/collaborate/workgroups/networking/bridge

setageing <bridge> <time> set ageing time (Default 300 seconds) Sets the aging time. The aging time is the number of seconds a MAC-address will be kept in the forwarding database after having received a packet from this MAC address. The entries in the forwarding database are periodically timed out to ensure they won't stay around forever. Normally there should be no need to modify this parameter. sets the ethernet (MAC) address ageing time, in seconds. After <time> seconds of not having seen a frame coming from a certain address, the bridge will time out (delete) that address from the Forwarding DataBase (fdb).

setbridgeprio <bridge> <prio> set bridge priority (default 100, lower is more preferred, industry standard default is 32768) Sets the bridge's relative priority. The bridge with the lowest priority will be elected as the root bridge. The root bridge is the "central" bridge in the spanning tree. sets the bridge's priority to <priority>. The priority value is an unsigned 16-bit quantity (a number between 0 and 65535), and has no dimension. Lower priority values are 'better'. The bridge with the lowest priority will be elected 'root bridge'.

setfd <bridge> <time> set bridge forward delay (default is 1, should be 4) Sets the forwarding delay time. The forwarding delay time is the time spent in each of the Listening and Learning states before the Forwarding state is entered. sets the bridge's 'bridge forward delay' to <time> seconds

sethello <bridge> <time> set hello time (default is 2, can be 1) Sets the hello time. Every (this number) seconds, a hello packet is sent out by the Root Bridge and the Designated Bridges. Hello packets are used to communicate information about the topology throughout the entire Bridged Local Area Network. sets the bridge's 'bridge hello time' to <time> seconds

setmaxage <bridge> <time> set max message age (default is 20, w/hello at 1, can be 4) Sets the maximum message age. If the last seen (received) hello packet is more than this number of seconds old, the bridge in question will start the takeover procedure in attempt to become the Root Bridge itself. sets the bridge's 'maximum message age' to <time> seconds

setpathcost <bridge> <port> <cost> set path cost (default is 100, higher is less preferred) Sets the cost of receiving (or sending, I'm not sure) a packet on this interface. Faster interfaces should have lower path costs. These values are used in the computation of the minimal spanning tree. Paths with lower costs are likelier to be used in the spanning tree than high-cost paths (As an example, think of a gigabit line with a 100Mbit or 10Mbit line as a backup line. You don't want the 10/100Mbit line to become the primary line there.) The Linux implementation currently sets the path cost of all eth* interfaces to 100, the nominal cost for a 10Mbit connection. There is unfortunately no easy way to discern 10Mbit from 100Mbit from 1Gbit Ethernet cards, so the bridge cannot use the real interface speed. sets the port cost of the port <port> to <cost>. This is a dimensionless metric.

setportprio <bridge> <port> <prio> set port priority sets the port <port>'s priority to <priority>. The priority value is an unsigned 8-bit quantity (a number between 0 and 255), and has no dimension. This metric is used in the designated port and root port selection algorithms. You use this one to distinguish between two equal cost ports.

To get mine to be stable and responsive to topology changes I tweaked it as follows I set the Hello to every one second vs two seconds, to make it detect a topology change faster I changed the maximum age from twenty seconds to four seconds to make it refresh the topology more often. I set the Forwarding delay to four seconds vs one second, to make it wait longer before participating in a STP domain

in the startup commands i put the following Code:

```
Main
```

/usr/sbin/brctl sethello br0 1 /usr/sbin/brctl setmaxage br0 4 /usr/sbin/brctl setfd br0 4 /usr/sbin/brctl setbridgeprio br0 99 /usr/sbin/brctl setpathcost br0 wds0.2 300

Code:

```
Mid
```

/usr/sbin/brctl sethello br0 1 /usr/sbin/brctl setmaxage br0 4 /usr/sbin/brctl setfd br0 4

Code:

```
Media
```

/usr/sbin/brctl sethello br0 1 /usr/sbin/brctl setmaxage br0 4 /usr/sbin/brctl setfd br0 4 /usr/sbin/brctl setpathcost br0 wds0.1 300

Now she is up and stable to test i took a wireless client from on the Media router started a streaming ping to google

removed power from the Mid router she took about 30 seconds to switch paths

restored power to the Mid router long pause while she booted while the ping was successful then ping stopped for about 2 mins then restored via the Mid router

removed power again from Mid router ping stopped for about 2 mins then restored over link3

restored power again to the Mid router long pause while she booted while the ping was successful then ping stopped for about 30 seconds then restored via the Mid router

not exactly a scientific test but she sufficed for my purposes. I can fail to an alternate path in less than 3 minutes if one of my routers go down. Which is really good for consumer applications.

External Links

http://www.cisco.com/univercd/cc/td/doc/product/rtrmgmt/sw_ntman/cwsimain/cwsi2/cwsiug2/vlan2/stpapp.htm