Example of Using the LANforge Enforce Fairness Plug-in

Starting a series of UDP Layer 3 connections between virtual stations leads to unbalanced sending rates. The Enforce Fairness plug-in can be used to determine what reduction of bandwidth allows equal transmit rates among a group of virtual stations. There is a chapter in the LANforge User Manual describing the Enforce Fairness plug-in. Specifically, the Enforce Fairness plug-in will drop the beginning transmit rate according to this formula: \( R_{\text{final}} = (0.9)^{10} R_{\text{begin}} \). The final transmit rate will be about 34% of the beginning transmit rate. There are ten drop iterations performed by the plug-in, each dropping the bandwidth by 10% of the previous rate.

To effectively use this plug-in, you first want to compute a logical maximum of bandwidth per station. In the following example, we will be pointing twenty virtual stations at one 802.11abgn Access Point. The logical maximum per station is \( \frac{300Mbps}{20} = 15Mbps \) per station.

**Balanced Example:**

<table>
<thead>
<tr>
<th>Starting TxBps/Station</th>
<th>Ending TxBps/Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>20Mbps</td>
<td>(0.34)20 = 6.8Mbps</td>
</tr>
</tbody>
</table>

In this example, the traffic will balance out because the transmit rate will fall well below the logical maximum transmit rate per station.

**Unbalanced Example:**

<table>
<thead>
<tr>
<th>Starting TxBps/Station</th>
<th>Ending TxBps/Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>200Mbps</td>
<td>(0.34)200 = 68Mbps</td>
</tr>
</tbody>
</table>

In this example, the traffic will not have a chance to balance because the final transmit rate is still above the logical maximum transmit rate.

**Detailed Examples**

The remainder of this document is a series of steps that can be used as a cookbook for using the Enforce Fairness plug-in. It was conducted on two LANforge CT523 servers, one hosting a 802.11abgn virtual AP and the station machine with two 802.11ac radios running ten stations per radio.
1. We start with twenty stations, ten each on two radios. Stations 100-109 are on wiphy0 and stations 200-209 are on wiphy1.
2. In the **Layer-3** tab, create a UDP connection between *sta100* and *eth1*.
   
   1. Select wiphy0
   2. Set the TX rate to **20Mbps** for *eth1* and 0 for *sta100*.
   3. Set the Endpoint A and Endpoint B send and receive buffers to 2MB.
   4. Click Apply.

3. Use the **Batch Create** tool to make nine more of these on this radio.
4. You now have ten connections for wiphy0.

5. In the Layer-3 tab, create a UDP connection between sta200 and eth1.
   1. Select wiphy1
   2. Make the connection with TX rate and buffer the same as the previous connections.
   3. Click Apply.
6. Use the **Batch Create** tool to make nine more on radio *wiphy1*.

7. In the **Layer-3** tab you will see twenty connections. Highlight them all, right click and select the **Enforce Fairness** option. (Or go to the Plugins Menu and select the plugin there.)
8. In the Enforce Fairness plugin, set the Reporting Interval to 3s. Click Start. (Notice the button will change to Stop).

9. Let the plugin run for 5 minutes. The Stop button will change back to Start when done. The Enforce Fairness Reporting window will have pie charts giving you time slice views of transmission percentage per station.

1. See clear transmission inequity at the start:
2. See resulting equity in the final iteration:
3. The bottom of the report charts the overall transmission rates for each iteration: