INVENTION DISCLOSURE

1. **Invention Title.**

Dynamic E-Tree

2. **Invention Summary.**
We are proposing that BGP be extended to carry an additional attribute which would allow a much more VPLSesque configuration of E-Tree services.

3. **Invention Description**.

a. **Describe the invention in detail.**
General Invention: In an E-Tree service, all leaf nodes should only send traffic to the root node(s) while the root node(s) should send traffic only to the appropriate leaf node(s). This is accomplished by allowing MAC-learning at the root node(s) only. We suggest that E-Tree root nodes should be able to advertise that they are root nodes to all of the other nodes within that service. In this way, each leaf would have a list of available root nodes dynamically and each root node would learn of all the leaf nodes as in a VPLS service.
i.e: Each root node learns of every other node and does full MAC learning / switching (similar to a VPLS node). The leaf nodes however ignore all other leaf nodes and only perform MAC learning for root node(s).
This becomes extremely valuable in more complex service's where there are multiple root nodes.
Implementation Details:
We believe that the most elegant way to create this new functionality is by signaling Root vs. Leaf functionality via a bit in the Control Flags field of the "Layer2 Info Extended Community" as defined in RFC 4761 “BGP Auto-Discovery and Signaling for VPLS:”

```
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|   MBZ     |C|S|      (MBZ = MUST Be Zero)
+-+-+-+-+-+-+-+-+
```

Figure 4: Control Flags Bit Vector

With reference to Figure 4, the following bits in the Control Flags are defined; the remaining bits, designated MBZ, MUST be set to zero when sending and MUST be ignored when receiving this community.
We suggest that bit 5 in the Control Flags field be defined as the “L” or “Leaf” bit and that it be set to 1 to signal that the sender is a Leaf node, or set to 0 to signal that the sender is a Root node:

```
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|   MBZ   |L|C|S|      (MBZ = MUST Be Zero)
+-+-+-+-+-+-+-+-+
```

Because the current standard specifies that receivers ignore bits 0-5, this allows backwards compatibility in that any legacy equipment would simply ignore the Leaf bit, treating the

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node as a root and sending traffic (the VPN would work but may not fit the expected topology).

For routers compatible with our proposed changes, the following algorithm would allow the E-Tree VPN to be auto-discovered properly:

1. If Leaf and L bit is set to 0; build pseudowire, use for all non-local traffic (no MAC learning)
2. If Leaf and L bit is set to 1; do not build pseudowire
3. If Root; build pseudowire, perform MAC learning

This illustrates what we believe to be the fastest, most efficient way to implement this idea. It is not however the only way. If this invention is to be patented, we suggest not limiting it to one specific implementation method.

Illustration:

The drawings included below illustrate examples of the current options (Figure & Figure) as well as of this idea put into practice (Figure).

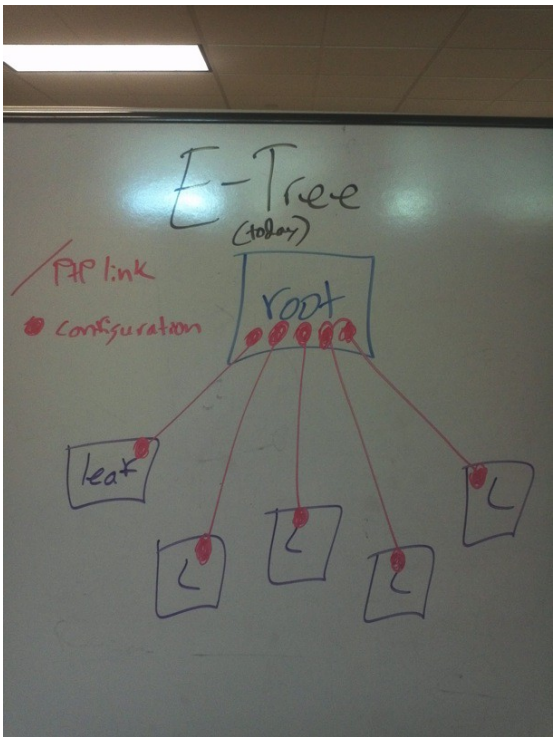

Figure - E-Tree Today

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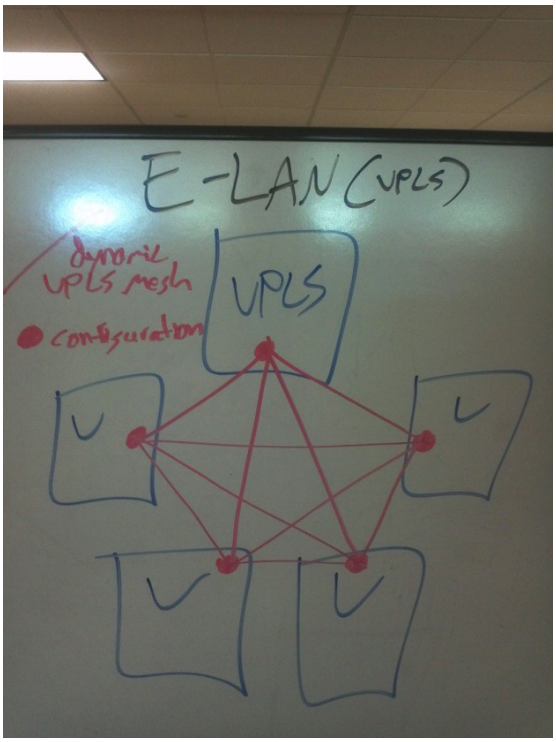

Figure - E-LAN / VPLS

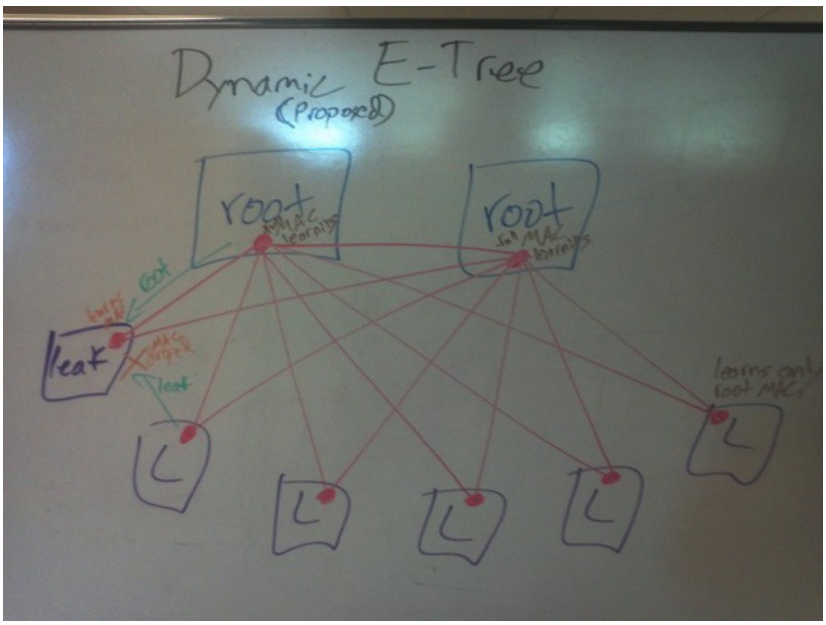

Figure - Dynamic E-Tree

b. **Why was the invention developed? What problem(s) does the invention solve? How is it better?**

Currently, VPLS or E-LAN type any2any/full-mesh Layer 2 VPNs can be built fairly dynamically. Upon initial configuration, all PE routers with a connected CE must be configured but when an additional customer site is required, only the one attached PE must be configured. VPLS takes care of all the signaling from there.

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However, for E-Tree or one2many Layer 2 VPNs, much more manual configuration is required. In practice, this type of service is configured as a series of individual point2point ("E-Line") services which all happen to terminate one end on a single PE. This means that at first turn up, configuration at the "primary" PE is much larger and for every new customer site required, the attached (leaf) PE as well as the primary (root) PE must be configured. This adds extra time and complexity to the process and can lead to a greater chance of operator error. This is true at turn-up and when troubleshooting, as the root PE has a much more complicated running configuration than a VPLS PE.

c. Briefly outline the potential commercial value and customers of the invention.

Many network service providers offer E-Tree L2 services, this idea would simplify the configuration and troubleshooting of these services, enhancing the customer experience and lowering operational costs. Routers with this feature are likely to be more desired than those without, once introduced.

4. **HOW is this invention different from existing products, processes, systems?**

The current solution is to manually configure E-Tree services, this idea allows a much more dynamic mechanism, using BGP to advertise leaf and root status of the nodes in an E-Tree Service. This simplifies configuration and troubleshooting dramatically.