Ugly truth about mesh networks

Posted by Sam Churchill on June 28th, 2004

Ugly truths about mesh networks – they dont scale – for now.

As founder and CTO of a Wireless Mesh networking company, I have pondered long and hard about whether or not I should submit this.

The buzz on mesh networking certainly works in our favor. However, there is more hype than reality around mesh networking. Its time for a reality check on what mesh can and cannot do.

First, Mesh networks are not a new concept. In some ways, the internet is a mesh network. And it works, despite its size – because it does not suffer from the limitations of conventional wireless mesh networks:

1- Radio is a shared medium and forces everyone to stay silent while one person holds the stage. Wired networks, on the other hand, can and do hold multiple simultaneous conversations.

2- In a single radio ad hoc mesh network, the best you can do is (1/2)^n at each hop. So in a multi hop mesh network, the Max available bandwidth available to you degrades at the rate of 1/2, 1/4, 1/8. By the time you are 4 hops away the max you can get is 1/16 of the total available bandwidth.

3- That does not sound too bad when you are putting together a wireless sensor network with limited bandwidth and latency considerations. It is DISASTROUS if you wish to provide the level of latency/throughput people are accustomed to with their wired networks. Consider the case of just 10 client stations at each node of a 4 hop mesh network. The clients at the last rung will receive -at best- 1/(16,0000) of the total bandwidth at the root.

4- Why has this not been noticed as yet? Because first there are not a lot of mesh networks around and second, they have not been tested under high usage situations. Browsing and email don t count. Try video – where both latency and bandwidth matter – or VOIP where the bandwidth is a measly 64Kbps but where latency matters. Even in a simple 4 hop ad hoc mesh network with 10 clients, VOIP phones wont work well beyond the first or second hop the latency and jitter caused by CSMA/CA contention windows (how wireless systems avoid collisions) will be unbearable.

Mesh networks are a great concept. But the challenge lies in managing the dynamics of mesh networks so users receive an acceptable level of performance in terms of both latency and throughput.

Its time to focus on solving some real problems to make mesh networks scale and provide stable performance.

In my next article I shall delve into some challenges for high perfomance – enterprise class – wireless mesh networking.

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