Efficient Wireless Backhaul

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Abstract:

The Internet is permeating virtually every society on the face of the earth and at every level of those societies. There has been a rush to provide access to the Internet for customers that now can be counted in the billions. But access to the Internet requires both local access and then a "pipe" to carry that local traffic to and from a point that is connected to one of the major switches that form the backbone of the Internet. These pipes and switches girdle the globe but unfortunately are not accessible to two groups that are disparate in their relative economic level: the first group are the hundreds of millions that populate vast areas of Africa and Asia where a combination of poverty and lack of infrastructure make it unlikely that fibre will be provided, at least in the near future; the second group consists of areas in relatively wealthy countries such as Canada and the USA where the density of population is insufficient to warrant construction of fibre trunks. The goal in both cases is to provide "broadband" service as opposed to dial-up service which has been available for some time to the group in the US and Canada. Despite the lack of access to fibre it is feasible to provide broadband service to both groups by using "hot spots" to provide local access. These hot spots are in turn connected to a wireless backhaul network that carries this traffic, via one or more hops, to an Internet access point. This access point will in a developed country be a connection to the fibre infrastructure; in an underdeveloped country this point will likely be a satellite link. The organization that provides this backhaul service and often the local access service is called a WISP (Wireless Internet Service Provider).
This paper describes a method of providing backhaul capability for WISPs that is superior to any presently utilized. Full bandwidth utilization, true priorities, packets are intermingled with fixed-bandwidth channels, and using the ring topology provides a level of “self-healing” if a break occurs.
These efficiencies lead directly to significant reductions in energy requirements and if applied to cell tower backhaul and to conventional packet networks could result in up to 25% reduction in energy consumption in those networks.