Plug-and-Play Routers and Base Stations

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This presentation introduces two approaches to automatically configure routers and base sations in a plug-and-play manner.

When a set of base stations should act as one wireless hotspot, their configuration must be coordinated to provide best service to the clients. For example, base station should adapt the channel usage and transmission power to minimize interference or should perform load balancing to prevent overloads in single base stations. The proposed approach introduces an autonomous, self-organizing and decentralized management system. Compared to existing systems, where a central node computes and disseminates management information, the system's decentralized operation improves reliability by eliminating central points of failure and can decrease convergence times for large installations by enabling localized reconfiguration. Neighbored base station periodically exchange network state information from which each individual base station can derive an "optimal" local configuration. Another novel feature is the integration of external, third-party input into the distributed configuration algorithm, improving the quality of the configuration result and convergence times.

The configuration of routers is mainly concerned with the distribution of IP address spaces. A network interface of a router can act in two ways, either as an IP client or as the server for a subnet. As a client, it can retrieve an IP address through existing mechanisms like DHCP or IPv6 address auto-configuration. However, when acting as a server interface, the router must hold an IP address space that gets distributed to its clients. Nowadays, this configuration is usually manually prepared by an administrator. New mechanism are required to automatically distribute available address space among the routers within a network. The proposed architecture uses a management hierarchy tree, where the tree root holds the complete address space and upper level routers can delegate subspaces to routers on a lower layer. Each router tries to manage its subspaces with minimal interaction to its parent routers. This prevents bottlenecks and reduces the risk of single points of failure, as the configuration information is distributed through the network topology.