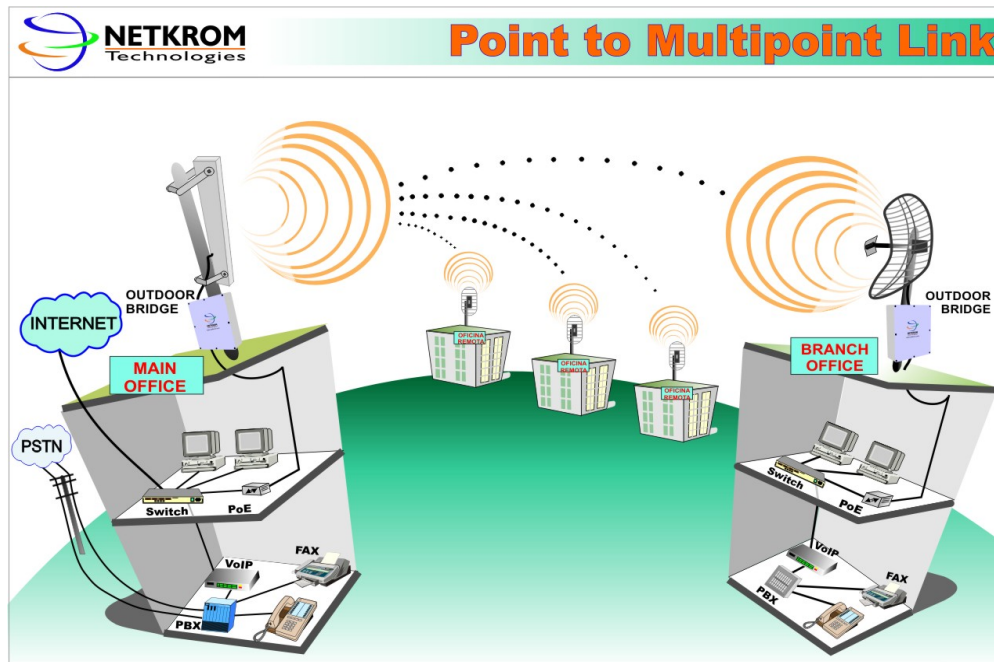




Tuning Access Points for Long-Distance Applications



Introduction

Wireless devices have traditionally been limited in range due to the inherent design of the 802.11 standard. Netkrom has incorporated the new Atheros chipset into our Wireless product (CPE Series, Outdoor Bridge Series and Multiband Outdoor Series), to support long-range deployments using wireless 802.11. Netkrom Wireless Products is now enhanced with the ability to manually adjust parameters such as slot time, ACK time-out and CTS time-out on the wireless device to achieve a longer range. Our proprietary algorithm also provides recommended values for the parameters and at the same time allows for manual fine-tuning for optimal performance. Practical uses of this improvement include the deployment of long-range point-to-point and point-to-multipoint wireless networks at a reduced cost.

Growth of 802.11

The number of 802.11 Wi-Fi networks has grown exponentially and is now widely accepted in countries such as US and Europe. The standard is commonly used in providing a wireless network in offices and homes. The vast popularity further drove an industrial standardization that resulted in mass production of the chips and the lowering of prices.

Limitations of 802.11

From the start, the 802.11 standard was designed specifically for indoor use. Outdoor use of 802.11 was limited by problems inherent in the design of the standard. Timeouts and retries were encountered frequently, which caused instability and poor reliability. Despite the lower costs of chips using the 802.11 standard, users have been unable to use these chips to implement long-range connections.

Specifically, extending the range of 802.11 devices with antennas and amplifiers has its limitations at the communications level. ACK packets are sent from sender to receiver, and a time limit is set for obtaining a reply, failing which the sender assumes packet loss and resends. A timeout of 9 usec is defined for 802.11a/g and 20 usec is defined for 802.11b standards by IEEE. Under the 802.11 standards, packets are retransmitted if ACK is not received within the allowed timeout duration. When distances are extended between two points, the packets have to travel a longer distance. The longer distance leads to an increase in transit time and therefore the packets may not reach back within the timeout window. Timeouts occur and the transmitting point will have to resend ACK. Continuous loss of ACK packets leads to network instability and poor reliability.



In the wireless medium, medium access control is carried out by CSMA-CD (Carrier Sense Medium Access with Collision Detection). An adapter does not transmit when it senses that another adapter is transmitting. In a wireless network, two senders may try to send to one receiver at the same time. In order to prevent collision between simultaneous uses of the medium, CTS (Clear-To-Send) is used to signal to one of the sender that the receiver is ready to receive. In long-range applications using the 802.11 standard, CTS has to be increased to prevent timeouts.

In addition to ACK and CTS timeouts, collisions in the medium will cause the sender to wait a certain amount of time before retransmitting. This is known as the slot time. The sender is informed of collision by another device on the network, and the time taken to do so is taken into consideration for the slot time. In long-range applications, the slot time has to be increased in order to prevent further collisions due to timeouts.

Extending the reach of 802.11 networks can be done by mounting radio transmitters and receivers on top of tall towers. This creative approach can reduce overall system costs involved with setting up long-range networks. Experiments have shown that it is possible to connect 2 distant points using 802.11 Access Points. Porting the 802.11 standard for longer ranges was not easy. The researchers identified several key issues that were inherent with 802.11 devices. ACK timeout was too small to work correctly over long-distance links. The contention window slot-time needed to be increased to adapt to the longer distances.

Netkrom Solution

The new Netkrom Wireless Access Points, Bridge and Routers incorporate Atheros chipsets which allow for manual adjustment of ACK timeout and RX sensitivity. By setting ACK timeouts to higher values, retries are reduced and connectivity is improved. Our proprietary algorithm also provides recommended values for the parameters and at the same time allows for manual fine-tuning for optimal performance. Netkrom Wireless Access Points Bridge and Routers can then be configured for use in outdoor long-range environments in a cost effective solution.

Configuration of Netkrom Access Points, Bridge and Router for long-range solution can be done through the web-based Uconfig application. Long distance parameters can be adjusted under "WLAN Advanced Setup" (see Figure 1).

An additional tool is packaged with the Access Points that makes it easy to deploy APs for long-range applications. The tool calculates slot time, ACK timeout and CTS timeout values based on input distance (see Figure 2). By entering the distance between two points, the tool automatically recommends values, which you can fine tune to improve performance based on the environmental conditions.

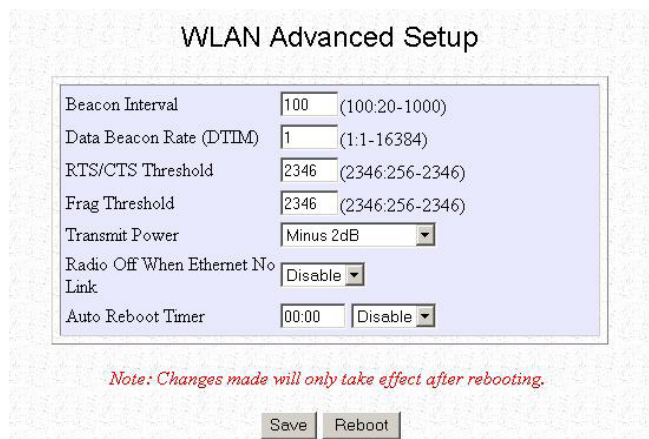


Figure 1

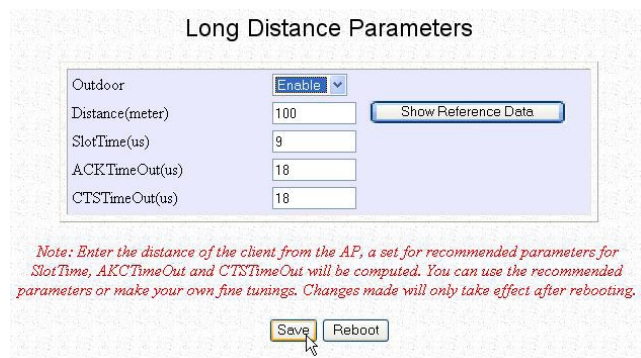


Figure 2



Long-range implementation:

Netkrom wireless access points can be used to set up a point-to-point link (As shown in Figure 3) and Multipoint or Wireless ISP Link (As shown in Figure 5) connecting two or more buildings in the most cost effective manner.

External antennas are mounted on a tower on top of the building. These antennas are connected to Netkrom Outdoor Access Points (Figure 4) located at the towers.

Application areas of this new feature:

A majority of the population in developing nations is in rural areas, where Internet access is limited. Providing an Internet connection to these areas can be costly due to the high costs of laying cables to reach these faraway places .Furthermore, the number of users is not able to justify the cost of implementing the network. Fortunately, a tremendous cost saving can be reached through the implementation of long-range wireless networks to connect rural areas to the Internet. Wireless ISPs can also make use of Netkrom's full range of wireless networking products to provide broadband connectivity to homes and businesses by transmitting across the air.

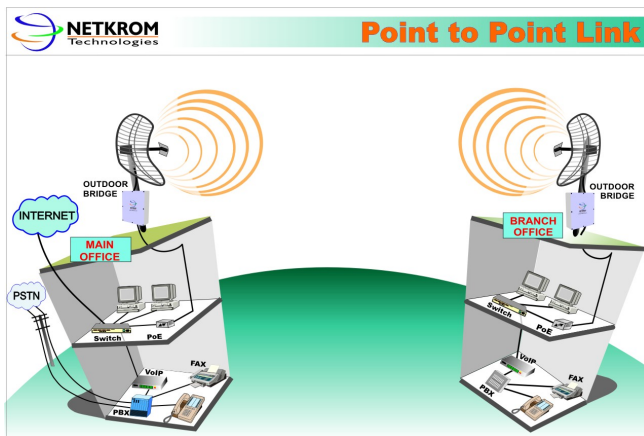


Figure 3



Figure 4

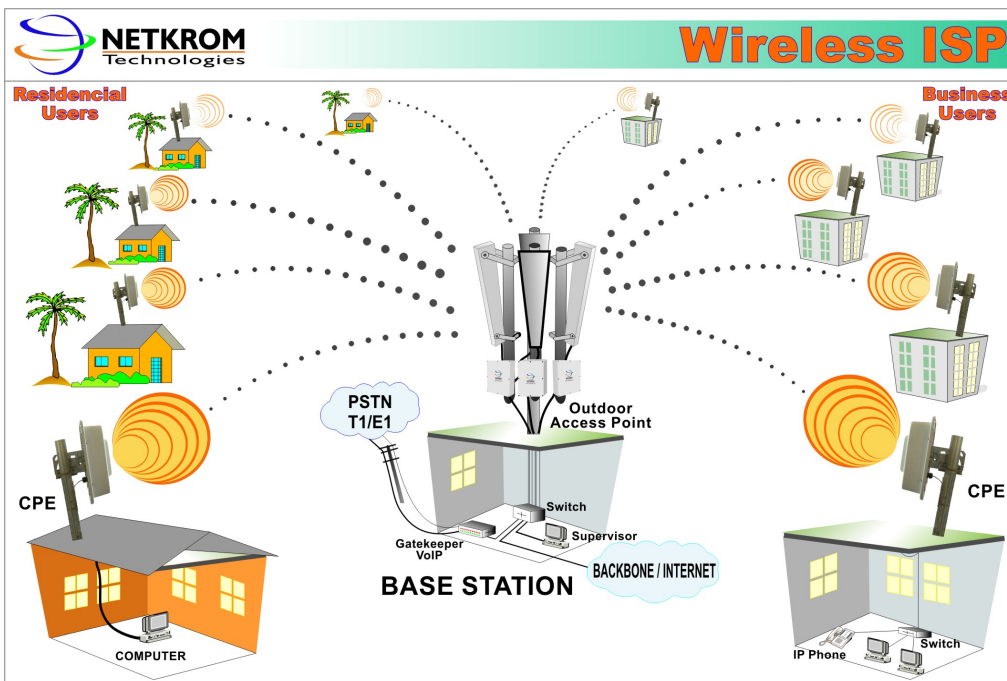


Figure 5