Connecting Devices

The Problem

Coming up with potential applications for wireless control networks have never been a problem. In a lighting control system, wireless ballasts (lamps) would be much easier to install than ballasts that need wiring. The same is true in industrial environments, where wiring typically accounts for 80% of the cost of sensor installations. And then there are applications for sensors where wiring isn't practical or possible.

Several problems in wired and wireless networks set-up though, have been identified as major barriers in the market penetration of wireless control networks:

1. Parameter setting for network formation

In order to join and form a network each device needs to receive a set of parameters. In wireless networks for example, a device "needs to know" the network number, channel number, security key, self-address, etc. In large and expensive devices the parameters can be loaded trough connectors or touch panels. In small and low cost devices like wireless switches this is too expensive and prohibitive, since electricians and users don't expect, and are not trained to perform such actions. Another way to load parameters in wireless devices is through the wireless channel, but this action can only be performed by RF professionals and not by regular electricians and users. This method still requires a different way of loading the security key, as wireless loading can be intercepted, rendering the entire network vulnerable.

2. Device identification and location

After a network is formed, there is a problem for the management system, of device identification – "knowing" which device is which and where it is located. This problem is usually solved manually by loading names or by disconnection/connection of each device in turn, or by (expensive) wireless device locating techniques.

3. Binding

After the wireless network is formed the problem is how to perform "binding", for example, how to "tell" a switch which ballast (lamp) it controls. One common method is to press a button on each of the devices to be bind. This method is practical for small systems only. For large systems the binding is performed by RF professionals with dedicated equipment, and not by regular electricians.

The Solution

The problems in networks set-up are solved with the innovative TriDiNetworks "Point and Click" technology which enables mass deployment of wireless control networks. The main features of this technology are described:

A. Convergence of two unrelated communication channels

TriDiNetworks system uses a main communication channel to transfer control and management data. In our current implementations, we use low-power Wi-Fi networks for "lighting and air conditioning control".

In addition to the main channel, in each device we incorporate a secondary contactless channel used for the following goals:

- Set parameters for the main channel;
- Set security keys and relevant information;
- Set system parameters, "binding" definitions and device data.

The data on the secondary channel is transferred individually in each device from a dedicated *"Commissioning Tool"* based on off the shelf tablets or smart cellular phones.

B. System design methodology

In order to produce the data to be loaded from the *"Commissioning Tool"* to each network device, we developed a new design methodology. The methodology has two main stages. The first stage is done by the system architect and includes the definition and physical location of each device (ballasts/lamps, sensors, switches…) and the binding between devices. The second stage is performed by the "Engineer/Electrician", which defines network topologies, and assigns networks addresses to each device.

The output of the design is a database used by the management system to control the system.

C. System setup procedure

After the system design, we developed a new procedure *("Point and Click")*: the electrician loads the designed data and physically installs each device. During this procedure the devices can be un-powered. After the installation is completed, the system is powered up and the network is created automatically (addresses assigned, parameters are setup, and binding is established).

The Benefits

- Drastically reduce setup time and costs.
- No need for setup manuals and special tools.
- Setup and maintenance by technicians with basic skills.
- Out of band, built-in high security.