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Bridging Outdoor ITS Equipment

Antaira's APX-120N5 Outdoor Wireless AP/Bridge/Client

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Since the 1950's there has been a steady worldwide percentage increase of people relocating from rural environments to urban cities. As of 2014, 51% of China, 75% of Europe and 79% of the US have living populations in urban areas; with an overall 51% of the worldwide population in urban areas. Many of these large cities are not new and there was no way for the original city developers to have anticipated or effectively prepared the infrastructure of a city to transform into a mega-city (city with population over 10 million).

Through advancements in technology and consistent upgrades to the city's infrastructure, there have been more benefits than problems that have resulted in general urbanization. The all-encompassing transportation sector plays an incredibly large role in daily lives of all people living in cities. Whether it is from transporting consumable or tangible goods on big rig trucks to consumers or moving people from place-to-place on light rails, busses and of course cars. The transportation sector has grown and is evolving into an intelligent transportation system that is better suited to oversee and manage a scalable Ethernet network infrastructure. Linking valuable equipment such as traffic controllers, VMS (Vehicle Message Signs) and cameras in large metropolitan areas is a TMC (Traffic Management Center), which acts as a central nervous system, which will monitor and manage how efficient the system is running based on the available data.

Just like a well working reliable car requires periodic services and upgrades, the transportation infrastructure benefits from maintenance and upgrades. A scalable Ethernet Network of an ITS (Intelligent Transportation System) creates a more efficient TMC. Creating a more intelligent transportation system requires more information from traffic management equipment, such as, traffic controllers, priority sensors, VMS, meters, cameras and sensors to provide a larger picture. The largest hurtle to overcome in creating a more intelligent transportation system is the city itself. Older cities will often times require some sort of construction to install or expand upon the existing Ethernet or fiber optic communication network. However, construction is very time consuming and can create a financial burden. Moreover, there is going to be a delay in traffic and a loss of revenue to businesses located around the construction.

Due to the previously stated challenges, IEEE 802.11 wireless technology would be one of the most efficient and flexible solutions to upgrading a city's infrastructure rather than doing construction. With continued advancements made to the IEEE 802.11 wireless communication standard, it is now becoming a more attractive alternative in industrial applications. IEEE 802.11n provides increased throughput and longer communication distances with unique uncrowded frequencies. IEEE 802.11i and 802.1x greatly enhance the wireless security with WPA2 and authentication respectively. IEEE 802.11 wireless radios have thus become a reliable, cost effective alternative solution to laying hardwire through construction. An IEEE 802.11 wireless radio can be used to link a smaller, new, network of devices to the main network through a single wireless connection. If 802.11 wireless is chosen, prior to installation the user should be well aware of the environment the units will be deployed in to prevent unexpected circumstances. For instance, both end units should have a clear line of sight for optimum performance.

Objects such as thick steel buildings, rock formations and trees will reduce the efficiency of the units. Be aware of locations with electromagnetic interference such as power sub stations or high power lines which can also reduce the overall performance of the IEEE 802.11 wireless. The 802.11 wireless standards offer selectable configuration options such as access point, client, bridge and repeater mode allowing for versatility. For example, from a security standpoint, an 802.11 wireless bridge will create a more secure point-to-point link between two units than other modes, preventing unintended users from accessing the network. Whereas an access point will be more ideal when creating multiple 802.11 wireless connections from different directions.

There are many possible traffic management applications that can improve the efficiency, safety or security of a pre-existing transportation medium, take for instance a light rail system. There are a lot of light rails that operate on surface streets or in the middle of highways. Now the light rail depots will typically have some sort of pre-existing network infrastructure in place; such as serial, Ethernet or maybe even fiber. Say for example, surveillance cameras are needed on and around the platform to setup a CCTV (Closed Circuit Television). The new cameras will need to be installed and connected to the network. This particular installation has at least two limitations that traditional wiring will encounter. The first is the inherent distance limitation of Ethernet cable (100 meters). Secondly, how will the cable be run to the camera? Most likely the wire will need to be hidden from the public, located either in the floor or walls, which will require cutting or drilling. In this application, wireless would be an ideal solution to bring the CCTV signal back to the TMC without shutting down the light rail platform. One difficulty that an end user might run is the configuration of the IEEE 802.11 wireless device process. To help solve this issue, some wireless units, such as Antaira Technologies' APX-120N5 are sold as a preconfigured pair of units for plug and play applications.

PRECONFIGURED

Another possible implementation of IEEE 802.11 wireless technology could be used to upgrade an older section of the transportation infrastructure with equipment such as traffic controllers, VMS and priority sensors. Connecting this newly upgraded section with the existing network can be done with a wireless bridge making the upgrade quick and cost efficient. A similar upgrade could be made to the ERS (Emergency Response System). This is a system that prioritizes traffic signals so that when an emergency response vehicle is approaching an intersection, the light turns green for the emergency vehicle.

A study in Texas concluded that an ERS system could reduce the amount of time an emergency vehicle takes going through a single intersection by as much as 30 seconds. There has also been a steep decline

in the number of accidents between motorists and emergency response vehicles that go through intersections on the way to the initial emergency call. Unfortunately, if a traffic intersection has not been networked with Ethernet or fiber to the intelligent transportation network, it is not ERS enabled. This is because the traffic intersection needs to receive a command from either a fire station or 9-1-1 dispatcher enabling the traffic intersection to receive a signal from the approaching emergency response vehicle. Without receiving the traffic signal prioritization command from a fire station or 9-1-1 dispatcher, the traffic lights will not change as the emergency vehicle approaches. There are a couple factors that can attribute to a traffic intersection not being networked. A physical restriction, such as a bridge could prove challenging to cut and lay network cables into. The distance between traffic signals can easily exceed Ethernet's 100 meter distance capability and fiber cabling is both expensive and also requires a trench to be dug. Due to these factors, IEEE 802.11 wireless bridges can be used to link the network from an ERS capable intersection to one that does not have a network connection. Granted the signaling equipment will still need to be installed on the intersection lights.

Some of the challenges with respect to setting up an IEEE 802.11 wireless network begin with selecting the correct radios and the appropriate antennas. One must make sure all of the correct cables are used between the radios and antennas, as well as to make sure the mounting requirements for all the components are verified. Wireless radios are smart managed devices that will typically require the user to configure the device and implement any additional feature that might be beneficial.

The APX-120N5 from Antaira Technologies has been designed for easy installation and is a preconfigured bridge allowing for rapid deployment. Settings such as the IP address, SSID and WPA2 security settings have already been set up on the devices. The user only needs to power on the devices and the units will automatically link up and be ready to pass data. Additionally, the units have management capabilities if the user was interested in making adjustment to some of the settings. The APX-120N5 uses PoE (Power-over-Ethernet) to power the device, capable of being powered from either 24 volt PoE or the standard 48 volt PoE. With an 800mW radio the wireless bridge is able to support long range high speed communication of up to 150Mbps. Reducing the number of components needed, the antennas of the units are built-in using a 5GHz 19dBi dual-polarization antenna. These units have an operating temperature of -20°C ~ 70°C and have an IP67 water resistant rating which is suitable for outdoor locations. Security features on the units can be used to increase the protection of the user's information which includes: hidden SSID, MAC address filtering, WEP (Wired Equivalent Privacy) in 64 and 128 bit as well as IEEE 802.11i and 802.1x security authentication. Antaira Technologies' wireless bridge units are the ideal point-to-point solution that can provide a network connection to a location that was previously not on a network.