

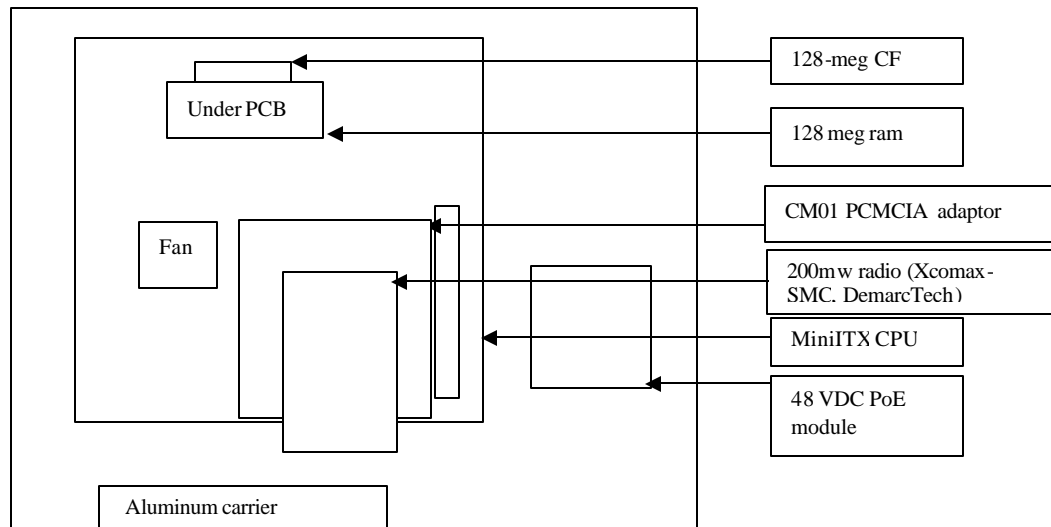


QNODE OWNERS DOCUMENTATION 4.4 (PRELIM)

August 15, 2005

The Qorvus Qnode™ is a ruggedized high-power weather-resistant miniITX-based outdoor PC that has been WiFi mesh-enabled via a combination of Qorvus proprietary software and open-source Linux-based software.

The basic layout and components in the Qnode are as follows:



The entire system is mounted on a machined aluminum carrier plate, which, in turn is mounted in a weather-resistant clamshell case. This case has been coated internally with a conductive RF coating, and externally with reflective epoxy-based paint for heat control in direct sunlight. In addition, the cover has been equipped with an RF and weather-resistant conductive gasket, thus assuring an excellent RF and static seal when the cover is completely closed.

The internal aluminum carrier is mechanically attached to an exterior machined aluminum mounting bracket to insure maximum heat transfer to the outside, without the need for internal fans in many U.S. weather conditions. Export systems shipped after January 2005 have the optional fan installed.

Basic setup and installation instructions :

Software setup:

For pre-configured equipment:

The compact flash in this system has been pre-loaded with the most recent version of the Qcode mesh software and if requested upon equipment order, has been configured to your specifications and registered to your existing account at Wiana. The Wiana servers provide central IP assignment, server-based data-collection and can provide radius services for Wiana registered systems. For more information please see the wiana.org website.

Each Qnode is equipped with a local embedded web-based management system (at port 81) that maintains basic compatibility with non-Qorvus meshAP hardware and software. This system has been designed for real-time direct management of the Qnode, and supports a number of useful features for both open and closed network deployment. Some of these include real-time signal strength and s/n meter, granular radio control for fine-tuning radio links, radio link quality statistics display, hidden SSID's for stealth network operation, MAC authorize / de-authorize, real-time block and unblock of other nodes, traffic-shaping with true QoS, pptp VPN client / host with VPN pass-through and local name / password entry, and customizable Captive Portal (click on Captive Portal with custom logo and true Walled Garden support . Detailed help for the web interface is available at www.qorvus.com/helpmenu and the Qorvus Mesh Q&A Forum is located at www.qorvus.com/phpBB2 An operating Qnode can be seen at www.qnode.net In addition, for new customers email and telephone support is available at support@qorvus.net and 360.243.7371 at no additional charge.

Initial Setup:

While there are several ways to interact with the Qnode for initial setup, the easiest is to use the ethernet port as follows: (1) Attach the Qnode's ethernet port to your in-house router / switch (2) Power up the Qnode and allow it to receive a DHCP address from your in-house router (this can take several minutes) (3) Determine what address the Qnode has received from your router (generally by looking at the router's DHCP client list and finding the QMESH default node name) (4) Open an internet browser (e.g. Firefox, Internet Explorer, etc) on your desktop and surf directly to <http://<your Qnode's DHCP address>:81/> Note the Port 81 extension for the Qnode management interface. (5) The default name is admin and the default password is terra7.

Upon entering the default name and password you should see the Status page which shows an overview of system information and links to various additional status items. Please see <http://www.qnode.net/> for a live Qnode with balloon context help [?] that explains each button's functions. This context help is also built into your Qnode.

While the Qnodes are operating in your shop (as opposed to outside at their final location) they should be operated at the lowest power settings or “auto” to avoid saturating your laptop’s wireless card and resulting poor performance. Click on the Wireless link to manage the radio power settings.

The local web management interface can also be reached wirelessly by surfing to Port 81 of the broadcast IP address (eg.1.23.45.67:81) assigned to the Qnode (check the label on the inside cover or Compact Flash for details) after your laptop has received a DHCP address from the Qnode. In addition, non-admin users, after wirelessly associating and receiving a DHCP address from the Qnode, can just surf to any URL and the redirect captive-portal splash-screen (which is presented to your clients when they surf wirelessly though your mesh network), will prompt you for a password. If you have the portal set for guest access, you can click on the “guest” button to see the portal. PLEASE NOTE: To surf wirelessly through your local Qnode’s management interface to remote Qnodes you will need to be authorized by the built-in Captive Portal at least as a “guest” or the firewall will block you.

The default local web-based management system will reflect the initial settings entered by Qorvus for your equipment. The Qnodes are normally sent ready to install so you generally won’t have to change many of the settings to have a functioning system. However the usual default mode is as a gateway node, so that Qnodes intended for use as wireless mesh repeaters (no direct backhaul attached to the ethernet port) should have that mode selected in the interface under LAN/WAN tab. For gateway use, unless you place the gateway behind DHCP router, you will have to specify your static IP, netmask,

and DNS servers in the LAN/WAN tab. If you are currently using Wiana, it is recommended that you use it strictly as a upload monitoring service (prevent WIANA changes) by selecting the “Yes” radio button on the General Setting tab labeled “Lock Out WIANA Settings Change To This Node.” Any changes made locally to the Qnode using the web interface, will not be reflected at Wiana.

Wireless signal strength function: Of particular help during installations, the “radio signal strength” link under “Wireless” will allow you to make real-time adjustments to antennas during installation, by displaying bar-graphs of signal, noise, and signal-to-noise ratio (plus MAC and IP addresses) for all Qnodes and wireless clients within radio range.

For equipment using the standard open-source code without Qcode :

All initial configuration of the system can be done via a wireless notebook or by using a local monitor and keyboard as shown below. Login as root, using password Terra7. A detailed description of the MeshAP software and setup is beyond the scope of this document; but general information regarding its setup is available at several sites including:

<http://cvs.locustworld.com:8088/locustworld/wiki>

<http://www.locustworld.com/tracker/wiki?p=WikiIndex>

<http://www.wiana.org/>

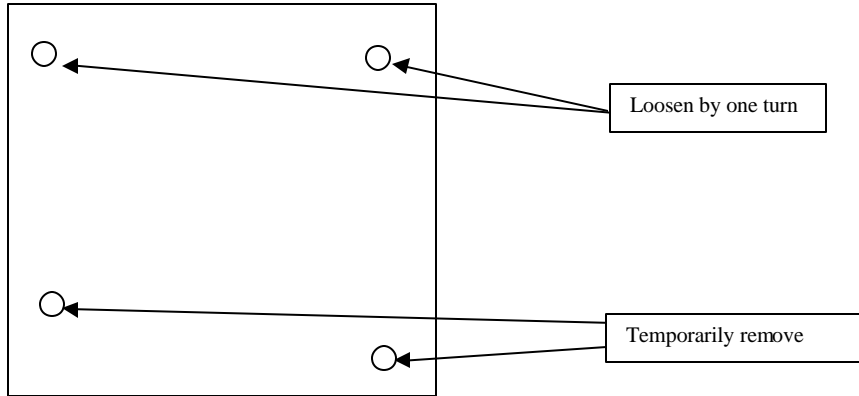
And detailed documentation regarding the inner workings of the open-source software can be found at

<http://www.qorvus.net/meshnotes> (you will be asked to register and then given access)

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Initial configuration can be done in one of several ways:

1) By attaching a keyboard and monitor to the miniITX CPU. This will require temporarily removing the two lower mounting screws that hold the motherboard against the mounting plate (carefully remove radio card if necessary), and loosening the two upper screws, and carefully tilting the motherboard up to allow access to the monitor and keyboard connectors:



Please note that upon Linux boot up several selectable modes are available, including meshbox and mesh-ultra. We recommend mesh-ultra because this will avoid loading up the Locustworld GUI, which consumes CPU resources and is not particularly useful in a standalone installation. After boot-up completes, Linux consoles are available by pressing `ctl/alt/F3` or `ctl/alt/F4` on an attached keyboard.

Once any required configuration, registration with Wiana, etc. has been completed, all 4 screws must be reinstalled and tightened to insure a good system ground.

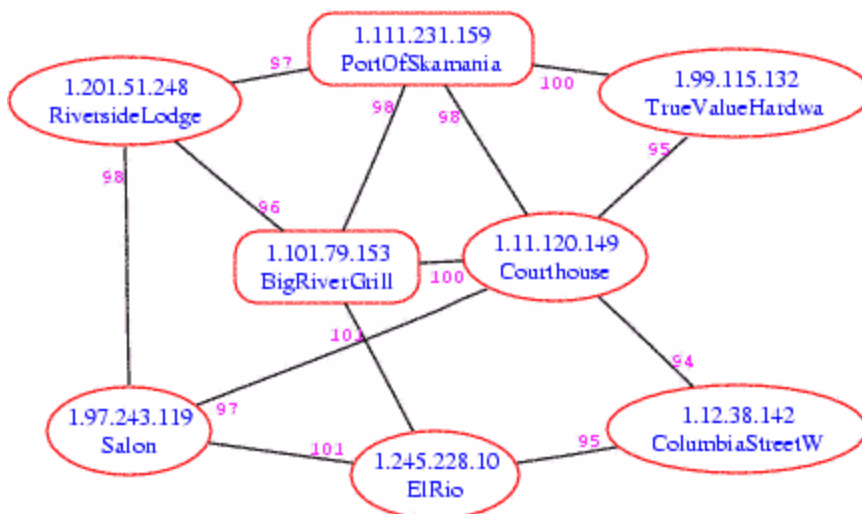
2) Via the unit's eth0 port. With an internet-connected dhcp router hooked up to the unit's Ethernet port (either directly into the unit's on-board Ethernet or externally via PoE junction box), power the unit up, wait for boot up to complete, using another PC on the same subnet, ssh into the unit at the 192.168.x.x address assigned to it by your router (username=root, password=terra7), change to the /hj directory, and you can initiate various Locustworld commands such as remotemanagment, getandverify, wianaregister, etc. Please see the Locustworld Wiki for more information.

Planning your installation:

A fixed-wireless mesh deployment has significant advantages of relatively relaxed planning and easy rollout of wireless connectivity when compared with traditional point-to-multipoint or hardwired access-point systems. In fact a single-radio Qnode mesh system will work with fairly haphazard placement of nodes so long as each node can see at least one other node wirelessly, with a signal to noise ratio that should never decrease below about 10 db. Nevertheless, the best results will be obtained when any node can see at least two other nodes wirelessly. This gives the built-in AODV routing algorithm a good opportunity to find alternative routes and routes around objects and hills for good performance in variable conditions. **Dual-radio Qnodes** require careful installation, antenna alignment, and frequency selection for best results. Please see: <http://www.qorvus.com/phpBB2/viewtopic.php?t=65> for details.

Node spacing:

There is so much variability between one location and another (and among client access equipment) that it can be quite difficult to predict the necessary spacing between nodes for optimum performance. As a general rule of thumb for single-radio Qnodes in a low-lying mesh, we suggest doing initial testing with **8db omni antennas at about 25 to 35 feet elevation** above terrain, or 10 to 15 feet above flat-roof buildings, and with **node-to-node spacing of about ¼ to ½ mile**. Once a basic mesh network consisting of one gateway node and two or three wireless-connected nodes has been installed, testing for coverage, building penetration, etc. can proceed and the node-to-node spacing can be increased or decreased depending upon your results.



A well-planned mesh installation covering a downtown area about 1.5 miles long.

Signal strength testing:

Each Qnode has several signal-strength testing and reporting functions built-in. In addition to the real-time bar-graph meter built into the web interface, signal strength between Qnodes is reported on check-in to wiana and can be examined there. Real-time signal strength can also be obtained on the command line as follows: ssh into each node as root using the password assigned via the wiana management tool (default password = terra7) and, from the root directory type “sigspy” which will give you signal and noise for each wirelessly visible node, updated every two seconds. Control Z terminates this process. Typing “reporter” will give you a display that includes eth0 and wlan0 IP and mac addresses, as well as static signal strength from other visible nodes on an IP basis. In addition, the web-based interface available via http on Port 81 has signal-strength graphing available under “wireless.”

For client-side signal strength testing, we recommend the use of the free downloadable software netstumbler or ministumbler on laptops or PDA’s respectively. This software requires the use of a prism-based PC card such as the Lucent / Orinoco / Avaya “gold” card.

Client access equipment (CPE):

Client access equipment and goals need to be understood as part of the planning process. In the layout shown above, the goal was for anyone in the downtown area to be able to connect using a laptop with a standard wireless card. This level of performance requires considerably higher node density than would be required for a situation in which clients are expected to use e.g. an external directional antenna and possibly a higher-powered card to communicate with the closest node. In addition, the prevailing construction techniques and foliage/ building density and size can have adverse effects on signal strength. A node density plan that works well in a town with few trees and wood frame construction, would be inadequate in an area with dense foliage and brick or concrete construction. In those types of settings, client-side external antennas would be mandatory except for clients within very close range of the nearest node.

Well-regarded client-side equipment includes the Senao CB3 and the Deliberant IE1100. **IMPORTANT:** These units should be set up for RTS / CTS of 250 for best mesh compatibility and hidden-node performance.

Equipment Installation:

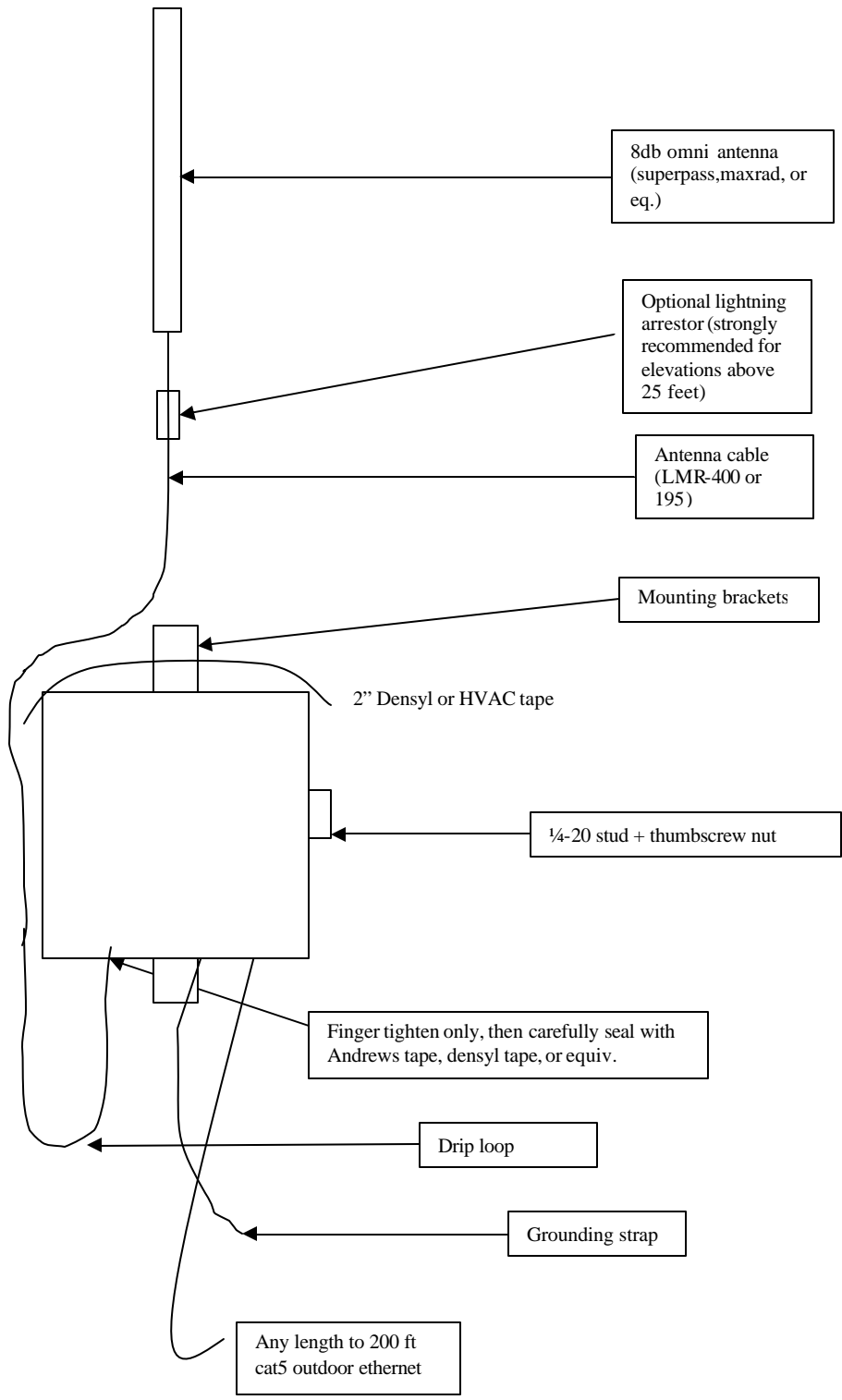
The Qnode is designed to be easy to install in various indoor and outdoor settings by an experienced professional wireless installer. It should be mounted within 20 feet of its external antenna, unless you are using an in-line pole-mount amplifier such as YDI. The antenna should be mounted so that passers-by cannot come any closer than 6" to any part of the antenna. The rear mounting bracket, supports wall mount or pole mount via commonly available hardware store fasteners such as self-tapping or moly-type mounting screws, lag bolts, or adjustable stainless pipe straps. The antenna and its support must be kept well away from power lines and above large objects that could interfere with its radiation pattern or present a safety hazard. Lightning protection is strongly recommended, especially for any tower mount situations. In addition, you are responsible for installing the equipment and antennas in accordance with applicable local, state, and federal regulations regarding EIRP limits with the supplied 200mw or 300 mw radios. For more information visit the Xcomax or DemarcTech websites.

Make sure that any mounting approach is capable of securely retaining the system weight of about 5 lbs plus the additional weight of any attached cables. In an outdoor application, the unit must be mounted vertically if it is to be directly exposed to the elements, and the top should be tightly sealed (with e.g. Densyl 2" conforming insulating tape or 2" aluminum HVAC tape) if strong blowing rains, dust storms, or similar conditions are prevalent.

For outdoor installations, the cable between the antenna and the Qnode, should be installed with a drip-loop of at least 10 inches, to avoid water penetration problems into the base of the unit. The wireless bulkhead (RPTNC or N) connector is flexibly mounted to accommodate normal cable loads without cracking the case. However, excessive force in mounting or excessive weight should be avoided. All antenna, power, and Ethernet cables should be securely fastened to the antenna pole or other mounting structure after installation to avoid excessive wind loads or flexing. The use of in-line lightning protection and system grounding via an added grounding strap is also strongly recommended.

The cable RF connector should be firmly finger-tightened only to avoid damaging the bulkhead connector's mount. As a final part of the installation, the use of rubber or Densyl 2" conforming insulating tape to completely waterproof the N-connector is MANDATORY. Waterproofing kits for RF connectors are available from Andrews Cable, among others.

In addition, if the unit will be mounted in direct exposure to heavy blowing rain or other extreme weather (as opposed to under the eaves) after final adjustments and closing, the top of the unit should be additionally sealed with a single 16" long piece of commonly available 2" wide Densyl conforming insulating tape or aluminum HVAC tape.



Power supply considerations:

The Qnodes are powered via the included 1 amp 48 volt switcher supply; a typically equipped Qnode draws around 1.2 amps. Please note that PoE installations over about 200 feet are not recommended, due to possible voltage drop and data integrity issues. All PoE installations should be made using good professional engineering practice including in-line filtering, shielded cable, and lightning protection as appropriate.

The Qnodes may also be special-ordered with custom power options such as photocell 15 amp Hubbel twist lock format for installation on street-lighting poles.

Wireless RF power considerations:

We recommend the use of the well-proven DemarcTech Reliawave, SMC2532W or Zcomax 325HP radio. These units (which are essentially identical) can provide output power up to about 300 milliwatts, sufficient for most typical mesh installations when coupled with an appropriate outdoor omni antenna such as a Maxrad or Superpass. In addition, FCC certified antennas for these radios are available directly from Demarctech, SMC and Zcomax. However, Qorvus can provide Qnodes with your choice of radio, or with external pole-mount FCC certified YDI amplifiers and antennas for even greater extended range operations. The output power of the radio is software-adjustable and, to avoid undesirable results, should be reduced to no more than 30 milliwatts when used in indoor settings during initial test, or with an external amplifier. **INSTALLERS IN THE USA MUST BE FAMILIAR WITH FCC REGULATIONS REGARDING MAXIMUM POWER OUTPUT WITH SPECIFIC ANTENNA TYPES IN BOTH POINT-TO-POINT AND POINT-TO-MULTIPOINT APPLICATIONS. WE SUGGEST USING ONLY ANTENNAS WITH GAIN CHARACTERISTICS EQUIVALENT OR LESS THAN THOSE CERTIFIED WITH DEMARCTECH, SMC2532W OR XCOMAX 325HP RADIOS. THE OWNER OF THE EQUIPMENT IS RESPONSIBLE FOR OBSERVING APPLICABLE LAWS. FOR MORE INFORMATION SEE:**

<http://www.fcc.gov/oet/info/rules/>

Your feedback is requested!

Qorvus is committed to a continuous improvement process. Your satisfaction is guaranteed or your purchase price will be refunded upon undamaged return of the equipment. Please let us hear your comments and suggestions for product modifications or improvements. We can be reached at 360.243.7371 or via email at support@qorvus.net

Appendix A: Initial System Specifications:

Radios:

- Supports 802.11b prism 2.5 OR 3.0 radios, (Atheros in fourth quarter 2005)
- Power adjustable from 1 to 300 Mw internal, up to 1 watt with optional external amp
- RX Sensitivity: approx -90db
- Single or dual radio support, with optional diversity reception
- 2048 bit node-to-node encryption, 128//64 bit WEP, VTUN secure tunnels
- Bulkhead RF connectors (RP-TNC domestic, N export) support wide variety of antennas.

Built-in mesh-routing and hotspot services:

- DHCP server
- DNS server
- Selectable client or AP initiated hand-off
- Built-in captive portal, splash logon, and redirect with walled-garden options
- Classful bandwidth, QoS, and firewall
- VPN support (GRE, L2, PPTP, NAT)
- Full WiFi compatibility requires no proprietary client-side application
- Host mapping and port-forwarding support
- Mesh routing via AODV and RSSI
- Lock to gateway and prefer gateway function

Management:

- Qcode 2.4 web management system via SSL
- Radius central management
- Built-in SNMP available
- Secure remote CLI management via SSH and SCP
- Remote firmware updating with saved settings
- Web-based realm management
- Configuration save and restore
- Installer-friendly RSSI, packet-loss, site-survey, and bandwidth real-time graphing

Weather and Temperature Specifications:

- Operating temperature: -30 °C to 55 °C
- Storage temperature: -40 °C to 80 °C
- Weather tight when installed according to instructions
- Wind survivability :>145 mph
- Tested in hard freezes and blowing rain

Certifications:

- Tested for FCC / CE compliance
- UL listed level 3 switching supply

Warranty:

- One year limited warranty against defects in materials or workmanship FOB Vancouver, WA
- Six months free software upgrades (client initiated)

Hardware Specifications:

- 10/100BaseT Ethernet
- Power over Ethernet average load is .35 amp at 48 VDC
- 90-240 VAC switching power supply
- Power consumption: 12 to 15 W typical
- Dimensions 12" x 12" x 4.5" deep; brackets extend 1.5" above and below edge of cabinet.
- Weight: 5 lbs
- Interior coated with nickel conductive coating & exterior coated with reflective silver epoxy paint.

Included in package:

- Qnode
- 48-volt power supply
- Hardware Installation Guide
- AC power cable
- Power over Ethernet injection block.