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Using Enterprise Networks for ROIP and VOIP
Verify Suitability Using the ETTA
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Enterprise class networks are often called upon to provide ROIP and VOIP (Radio or Voice over IP) end point connections. Unfortunately, what is often termed an "enterprise class" network doesn't meet ROIP connection requirements. The ETTA can be used to quickly approve or reject the network based upon actual measurements.

There is no official certification for "enterprise class" or "carrier class" networks. However, **enterprise class** is usually defined as a network that is adequate for the needs of an enterprise customer. It meets their requirements of bandwidth, latency, standards compliance, manageability, security, and reliability, among other factors. For most people, it usually means a network that provides high speed and reliability.

"**Carrier Grade**" or "Carrier Class" networks are typically one step up from "**Enterprise Class**". They contain all the characteristics of enterprise class along with meeting higher standards of reliability (often exceeding the "five nines" availability standards), faster fault recovery (often less than 50 msec), and better redundancy. These networks often provide more in-depth management and monitoring and are usually architected the same way as the old telephone company backbones

While most people specifying network connection alternatives and many network engineers don't realize it, there is a definite difference between "enterprise class" and "carrier grade" IP networks. Some network characteristics that are perfectly suitable for typical computer networking or SCADA connections simply don't have the robustness required for ROIP or VOIP use. It might be a subtle difference to many people, but important characteristics such a jitter and latency have a strong bearing on the successful implementation of a VOIP installation.

Typically, an enterprise or carrier class network provides adequate bandwidth the user's needs. In some cases that may be only 10 Mbps, in others it's 100 Mbps or even 1000 Mbps or more. But bandwidth is always specified when ordering circuits. Reliability is also assumed to be adequate for the job and poor reliability will be obvious.

After reliability and bandwidth, the two most important network characteristics in a VOIP/ROIP transport are latency and jitter.

Latency, or delay, is the time it takes for a packet to transit the network and arrive at its destination. That's the delay we measure when running a PING test. It should be consistent and low enough to not affect the quality of traffic being transmitted. VOIP connections work poorly with long delays.

Jitter is simply the difference or variation in packet delay(latency). In other words, jitter is measuring time differences in packet inter-arrival time. For an example, consider that a sending side transmits packets evenly spaced apart in time. In a perfect network, they would arrive with exactly the same time spacing. But in the real world, that time often varies due to network congestion, configuration errors, or queuing problems. So, the steady drum beat of packets becomes more erratic… some are closer together, some are farther apart. A "jitter buffer" is used to minimize the effect of transmission jitter, but it can only do so much towards curing the problem… and large buffers cause other problems such as more delays.

VOIP connections require adequately low latency and jitter along with suitable bandwidth and reliability.

How good is good enough? Specifications published by different VOIP manufacturers are often unique to their product characteristics but there are some commonly used values. Commonly seen specifications are:

Packet loss: < 0.1% (some less-critical systems will tolerate <1%)
Packet delay: < 40-50 msec (some long-haul systems can tolerate much greater delays, with degradation)
Packet jitter: < 20 msec (some long-haul systems can tolerate much greater jitter with degradation)
Bandwidth: Approximately 200Kbps per active radio or about 80 Kbps per audio channel (each direction). Some manufacturers recommend designing a network for three times the anticipated traffic.
MTU: 1500 bytes, with larger packets required for 802.1Q or encryption. Some as large as 1522 bytes
Ring Convergence: If a physical ring topology is used, 50 msec convergence is required.
DSCP: Required or preferred by almost all manufacturers
Multicast Transport: Required by most installations. May be provided by DCB UT encrypted bridges.

Should we test and "prove" that the network is valid BEFORE installing equipment? Of course! Assuming that the network you ordered is the one they delivered can cause a harder, longer installation time and future problems.

The ETTA is ideal to "proof" the network before installation and recording the results, you also have a baseline measurement to test against if you see audio or network degradation in the future.

The tests are simple to run so any technician can perform them. Some tests may be performed with a single ETTA, but thorough analysis requires a pair, one ETTA at each end of the circuit.

Basic test steps:

1. Verify connectivity. Use the ETTA's ping test with variable size packets to insure that there is basic connectivity. Be sure to include a test with the maximum size packets that you'll be using.

2. Verify bandwidth using configurable packet size, preload, rate limiting and intervals to learn the rate, PPS, minimum and maximum PPS capability of the network.

3. Measure network jitter. Run a longer term jitter test to insure that jitter meets maximum specs for the equipment you're installing.

4. Save the test results on a USB drive and transfer to your PC. Some organizations require an initial test and the results saved before putting a circuit into service. These results can used to meet their internal record keeping requirements. Even if the customer doesn't require them, retain these in spread sheet form for later analysis if there are communications problems.

The ETTA (Ethernet Traffic Test Appliance) is available from Data Comm for Business, Inc (DCB) either directly or through resellers such as Graybar or Anixter. At only $995, and small enough to carry along in a laptop case, each technician should have one, and a second one for the team to use at remote sites.

Read the ETTA data sheet at https://www.dcbnet.com/datasheet/ettads.html
More information about testing is in the ETTA manual at https://www.dcbnet.com/manuals/etta.pdf