COUNTY OF
MARIN

Marin Emergency Radio Authority [MERA]

Next Generation Radio System Implementation

Microwave Network Data Transfer

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Background

The Marin County Emergency Authority (MERA) is currently implementing a 700 MHz Project 25 (P25) Phase 2 compliant trunked radio system to support mission critical communications within Marin County.

As with all advanced trunked radio systems, the various tower sites will be connected to the central controller using an Internet Protocol (IP)-based digital network (the "backbone" or "backhaul") that will transport LMR traffic between locations using Ethernet frames. The medium used to transport the LMR traffic (known in network terminology as the Physical Layer or Layer 1) can take various forms such as copper cables, optical fibers, or radio links. In the new MERA radio system, the Physical Layer will be a digital microwave radio system supplied by Motorola/Nokia.

In the conceptual model of digital networks, the next level above the Physical Layer is the Data Link Layer (Layer 2), which defines how the Layer 1 devices (the microwave radios, in this case) establish connections and transfer data. Ethernet is the Layer 2 technology used for public-safety backhaul networks. Internet Protocol (IP) is a Layer 3 network protocol used on the vast majority of data networks. Multiprotocol Label Switching (MPLS) falls between Ethernet and IP (Layer 2.5) and along with Ethernet, are the two most common technologies used for public-safety microwave backhaul networks.

In the current MERA project, various discussions have taken place over the past two years regarding the technology to be used in the new microwave backhaul network. The conversations center around whether the new microwave backhaul network should use Layer 2 or MPLS.

At the request of MERA, this document describes the differences between Layer 2 and MPLS and the use cases where each approach can be most effectively used for carrying data for LMR and other applications on the MERA microwave network.

Layer 2

As explained above, Ethernet is a Layer 2 protocol used in microwave backhaul networks. Layer 2 is best suited to cases where a single type of traffic, for example land mobile radio traffic, is being transported over the network. This is because, although it can prioritize traffic, it is not as easy to configure and manage as MPLS.

Multiprotocol Label Switching (MPLS)

MPLS is commonly used for high performance telecommunications networks, designed to carry various traffic types simultaneously such as both radio and video traffic. MPLS provides the efficiencies and features needed by complex networks, particularly those that provide a variety of services to different user organizations.

MERA Use Cases

In considering what data-carrying technique should be used on the new MERA microwave network, two use cases should be examined:

Use Case #1 – Radio system traffic only

In this scenario, the new microwave network will only transport data associated with the voice radio network, which includes conventional, interoperability, and 700 MHz trunked voice channels, along with data used for system management. Layer 2 is sufficient to robustly and reliably support the traffic in this configuration.

This was the only case that was considered during the preparation of the project's Request for Proposals, in initial discussions with Motorola, and during contract negotiation. At that time, MERA did not express interest in transporting additional services such as fire video on the microwave network, and Federal Engineering was not made aware that any non-radio services were possibly using the existing microwave network

Use Case #2 – Radio system traffic plus other services

In this scenario, the new microwave network will transport not only the data associated with the voice radio network, but other data services as well. Additional data services might include video from fire detection cameras and security cameras at tower sites.

Because of the multiple services being carried by this network, the MPLS solution might be a better fit with its management capabilities and ease of use.

Conclusion

As shown above, Layer 2 Ethernet and MPLS are two methods used to transfer data over a telecommunications network. Although these methods are more than a couple of decades old, each is satisfactory and reliable when employed for the appropriate use case, and MERA must decide the appropriate case for the new microwave network.

If MERA decides that only voice radio system traffic will be carried by the network, then Layer 2 Ethernet will be adequate. This is the solution described in Motorola's project proposal, and they have committed to making it work. In this case, the cost of upgrading to MPLS is probably not be justified.

If, however, MERA decides now or in the long term to include other data services on the new microwave network (similar to those listed above), then MPLS might be a better fit.