

Emergency Communications Microwave (EComm) T1 Optimization Plan

Background

Phase I of the ECOMM system provided connectivity to all Public Safety Answering Points (PSAP), significant radio infrastructure sites and provided a modern replacement for San Jose's obsolete microwave system. The system was comprised of 13 nodes arranged in a "LOOP" around the greater Silicon Valley Area and 3 nodes configured as a main "SPUR" off of the LOOP system to facilitate South County agencies terminating at the Gilroy PSAP. To provide connectivity to all PSAPs and significant radio sites considering the County topology Milpitas, Campbell, San Jose West Corporation Yard, Cadwallader Reservoir, Morgan Hill, Morgan Hill California Fire Center and Santa Clara County Sheriffs Office are connected to the main loop and/or spur by additional spur systems.

The purpose of this configuration is to provide reliable and resilient connectivity between PSAPs and Emergency Operations Centers for interoperability voice and data, to provide the modern microwave infrastructure required to modernize existing radio and data communications and to accommodate future regional voice and data communications needs.

Phase II of the project focused on the expansion of the Phase I system to accommodate the Regional Communications System (RCS) deployment as outlined in the Bearing Point P25 RCS Feasibility Study. Also included in the objectives for Phase II is the necessary equipment required to provide immediate benefit of system resources to all member agencies to move their critical public safety voice and low speed data traffic from commercial leased lines to the ECOMM system. This also provides all agencies with additional paths to expand, improve and/or modernize the operation of their current systems. In addition Phase II two provided the ability to integrate the County's microwave system with the ECOMM system.

Phase II Project Deployment and Acceptance

While Phase II of the system was being installed, configured and tested the Phase I portion of the system was carrying 100% of San Jose public safety traffic and some Santa Clara County, Milpitas and Los Gatos public safety traffic. Installation of Phase II equipment in some instances required close coordination and monitoring to ensure uninterrupted operations for Public safety. Because of this where possible Phase II equipment was configured as a parallel system to facilitate acceptance testing and minimize potential interruptions. Currently about 75% of the Phase II equipment is operating in this manner.

Discussion

The Capacity of the Loop and Main South County Spur is equivalent to operating 84 T1s. These T1s are more commonly referred to in the telecommunications industry as Digital Signal 1 (DS1). The ECOMM system consolidates the individual bandwidth of each DS1 which is 1.5 million Bits per second (1.5mbs) of data for a total of 155 Million Bits per second (155mbs) of data capacity. Typically a DS1 is configured through a device called a Channel Bank to provide 24 "Slots" referred to as Digital Signal 0 (DS0) which is a basic digital signaling rate of 64,000 bits per second (64kbs), corresponding to the capacity of one voice-frequency-equivalent channel. This is the typical capacity allocated to a single conversation with digitized voice being carried in two separate directions, receive and transmit. This is adequate to provide full fidelity for voice and up to 56kbs data.

The ECOMM system is designed to provide the flexibility to allocate bandwidth for the purpose of voice and/or low speed data consuming 1.5mbs Per DS1 provisioned with the remaining amount of the total bandwidth of 155mbs to be used for Ethernet Transmission Control Protocol/Internet Protocol (TCP/IP) Traffic. Currently the ECOMM system is configured to provide 28 DS1 on the loop and main spur with the balance of the 155mbs as Ethernet which provides around 100mbs for IP traffic. All spurs except Sunnyvale Corporation yard and Los Gatos between the Operations and PD buildings off the main system have a total capacity of 54mbs are configured for 2 DS1 and the balance for Ethernet.

The Sunnyvale and Los Gatos spurs are installed at a higher bandwidth of 155mbps to facilitate Ethernet connectivity in support of agency operations. All Phase I and II spurs installed in the system have this capability which requires a FCC license modification to allow activation.

Optimization

The ECOMM system currently carries all of San Jose's traffic and some of County's, Milpitas and Los Gatos. It is estimated that by next year the system may carry as much as 75% of all public safety traffic facilitating all agencies on their current systems. This will probably continue even after the deployment of an RCS that may be completely Digital Voice over IP, existing systems will then become "Legacy Systems".

The necessity for optimization became apparent during the Phase II project to integrate the Phase I and Phase II systems into one system and to add connectivity to the County's microwave system. The necessity for optimization is to achieve the most efficient use of resources before loading the system further. This can be done now with minimal coordination and interruption to public safety operations instead of waiting until all agencies are on the system then reconfigure resources because the allocation was not optimal.

The optimization plan will provide the most efficient use of resources based on bandwidth load, provide improved management of resources used by individual customers, minimize the potential for single points of failure and retain the highest level of redundancy.

The original allocation of DS1s on the loop and main spur had all sites in the systems dependent on point to point connectivity through San Jose Communications Center. This made San Jose the "Central Office" (CO) for all circuits or another way of looking at it is "All roads only lead to and from San Jose". This creates a problem with being a single point of failure for everyone's connectivity needs. If a catastrophic event such as a large earth quake caused the Loop to become segmented or open in two places then the sites that are isolated would lose all voice circuits on the system. This could be true to a certain degree with any configuration and we hope the system is resilient enough to withstand such an event as we have attempted to design it. By breaking up the monopoly of connectivity at San Jose and developing smaller COs at locations throughout the system it will improve the odds of experiencing such a failure.

The establishment of the smaller COs throughout the system is based on the concentration of connectivity required between a group of adjacent agencies and/or access to adjacent resources. This will cluster agencies in the North County, agencies adjacent to San Jose, South Silicon Valley with the County Communications and South County agencies. Part of the Optimization Plan includes the redistribution of key infrastructure components to develop the satellite COs to be located at Los Altos, San Jose, County Communications and the Holiday Lakes site.

This also improves efficient use of resources by moving the cross connects required to provide connectivity from one DS1 to another of each DS0 out to other locations increasing the system's capacity to cross connect resources. This also decrease the complexity of cross connects all being done in a single location and becoming a major single point of failure which could affect all public safety operations. This plan provides the ability to facilitate all customer needs with the equipment purchased by Phase II and provide reserve capacity. The current configuration would result in the system being at capacity or over.

Conclusion

The ECOMM system is designed to be scalable providing the ability to add bandwidth and flexibility to allocate the bandwidth for each purpose and provision service as desired. This plan was developed in collaboration with City of San Jose and County of Santa Clara technical staff with contributions from Aviat field engineering staff. The Optimization Plan development was influenced by the current system loading, current applications for service from member agencies, system survivability and what we could anticipate the future might require.