

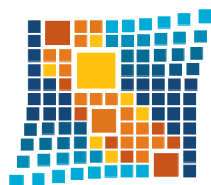


California
Public Safety
Microwave Network
Strategic Plan

March 3, 2011

2011

A Unified Strategy for Communications



California
TECHNOLOGY AGENCY

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CALIFORNIA TECHNOLOGY AGENCY

Office of Enterprise Services
Public Safety Communications Office
601 Sequoia Pacific Boulevard
Sacramento, CA 95811-0231
(916) 657-9903 FAX (916) 657-9259



March 3, 2011

Dear Fellow Californians:

As most of us know from firsthand experience, this State has seen its share of unfortunate natural and manmade disasters—from colossal fires and earthquakes to disruptive human events. In addition to the potentially devastating destruction that they can cause, such emergencies can severely congest or interrupt our commercially-provided communications systems, precisely at the time when those systems are most sorely needed for recovery efforts.

Yet, the California Technology Agency's California Public Safety Microwave Network (CAPSNET), which supports the communications needs of many key state and local government public safety agencies within California, has consistently provided reliable service to its client agencies during such disasters. Throughout its half century existence, CAPSNET's reliability and sustainability has allowed public safety practitioners to communicate even when users of other communications services cannot.

In recent years, we have seen incredible technological advancements made in all sectors of our society, all of which present new benefits, challenges and applications. Those same advancements now present enormous opportunities to maintain and enhance a highly dependable and pervasive statewide network for California into the future, as CAPSNET has provided in the past. But they also present pressures for modernization of this network. To face the demands on public safety's aging communications equipment by evolving technologies, funding shortages, and a growing necessity for interagency emergency communications, the California Technology Agency eagerly sought to collaborate with its public safety agency partners and openly welcomed their input into the enclosed 2011 CAPSNET Strategic Plan.

While strategic guiding principles, technology drivers, industry trends, and realistic public safety concerns all make a compelling case for modernization of our public safety communications systems, fiscal realities force pragmatism and expediency. Rising to the challenge, this CAPSNET Strategic Plan achieves an equitable balance between a smooth evolution towards an advanced business model and network while, at the same time, leveraging legacy resources and practices to the greatest extent possible to save the state costs. By implementing this plan's strategic goals and objectives, we can ensure that up-to-date technologies enable the delivery of vital services to the people of California throughout the next ten years and beyond.

I would like to commend and thank our partners for their extraordinary, collaborative contributions in the development of this innovative Strategic Plan. The result of their hard work is a guiding document of considerable value to the entire State of California, from which we are already making significant progress!

Sincerely,

A handwritten signature in cursive script that reads "Christy Quinlan".

Christy Quinlan
Acting Secretary of California Technology

EXECUTIVE SUMMARY

BACKGROUND

Effective radio and data communications that reach all parts of California — from the most remote rural and desert areas to the densely populated cities in the Los Angeles Basin and the San Francisco Bay Area — is something that every one of the State’s first responders depends on both for their own safety as well as that of the general public. For more than 50 years, the State’s radio systems have relied on the State-owned and -operated California Public Safety Microwave Network (CAPSNET) to provide the critical telecommunications links which allow law enforcement, fire and critical infrastructure support personnel to remain in constant contact with their dispatch centers, backups and chains of command during routine operations and during times of crisis and disaster. Without the CAPSNET microwave network, these personnel simply would not be able to do their jobs. CAPSNET is the only way to get radio traffic from many remote mountaintop transmitter sites to distant dispatch centers. In the event of a major disaster, it is also likely to be the only State telecommunications network still operating, since historically the commercially provided carrier networks are susceptible to failure — or overloading — during major events such as a large earthquake.

KEY CHALLENGES

While the current microwave network has been in place and has met the State’s needs for nearly half a century, most of the components of this network have themselves been in place for 20, 30 or in some cases 40 years — well past their useful life. As a result, the network is outdated and difficult to support, requiring the State to maintain expertise and capabilities which were long ago abandoned by the private sector. In addition, the current technologies are not capable of supporting the next generation of radio transmission technologies which that State will be deploying as part of the 10-year CAPSCOM radio strategy which was published in 2010. It also lacks the capabilities to support the State’s Next-Generation 9-1-1 Strategy (NG9-1-1), which was also published in 2010.

VISION FOR CAPSNET

The California Technology Agency has defined a strategic vision for CAPSNET that is based on the following three imperatives:

- **CAPSNET must remain focused on the unique needs of the Public Safety Community¹.** Because of the importance of its core mission to support public safety radio communications, the focus of CAPSNET will remain solely on supporting public safety communications within the State; however, CAPSNET will no longer be narrowly focused on voice/radio communications (e.g., providing connections between remote mountaintop transmitters and dispatch centers). CAPSNET will also continue to differentiate itself from other State networks by remaining a separate, State-operated network capable of providing connectivity to any location in the State where connectivity is required (e.g., remote mountaintops which may not even have utility-provided electricity available) and capable of surviving large-scale disasters (e.g., major earthquakes) which are likely to incapacitate or otherwise overwhelm commercial carrier-provided telecommunications services.
- **CAPSNET must be perceived as a high-value service to its customers.** The California Technology Agency must enhance CAPSNET’s coverage, capacity and capabilities so that it is recognized as more than a way to connect remote transmitters on mountaintops to dispatch centers. It needs to be viewed as the digital backbone support for the State’s next-generation public safety communications capabilities. It needs to provide the services that the State’s responders need, wherever they need them.
- **CAPSNET must be enhanced so that it can provide the capabilities required in the State’s strategic plans for public safety communications and NG9-1-1.** By upgrading the technology on which CAPSNET is built onto MPLS and expanding its coverage across the State, CAPSNET can become the lynchpin for the CAPSCOM system of systems (SoS) and NG9-1-1.

CALL TO ACTION

The California Technology Agency must replace CAPSNET’s obsolete components and modernize CAPSNET’s capabilities beyond what has historically been provided to what is required to meet the State public safety community’s needs in the new digital age. This will require significant and sustained investment in new equipment, site upgrades and the human resources required to implement and maintain this infrastructure. In addition, this must be accomplished during an unprecedented period of austerity and tight State General Fund budgets.

Achieving the objectives outlined in this strategy will require significant collaboration by all stakeholder groups which rely on CAPSNET. This includes not only the California Technology Agency, but also the major public safety departments and the State’s local, tribal and federal government partners.

¹ See Code of Federal Regulations Title 47, Part 90, § 90.20 (Public Safety Pool) which establishes that “...any territory, possession, state, city, county, town or similar governmental entity is eligible to hold authorizations in the Public Safety Pool to operate radio stations for transmission of communications essential to official activities of the licensee...” (e.g., any bona fide local, regional, state, or tribal public safety/public service agency or bureau). CAPSNET accommodates Federal public safety entities as well.

Book 1:

**UNDERSTANDING CALIFORNIA'S PUBLIC SAFETY
MICROWAVE NETWORK (CAPSNET)**

WHAT IS A MICROWAVE NETWORK?

The term “microwave” refers to the part of the radio spectrum that is utilized to transmit data from one radio site to another. “Microwaves” are very small but high-powered, high-bandwidth radio waves. For example, they work in a microwave oven because they are the right size to “excite” water molecules, thereby heating up food, but they lack the ability to penetrate the oven and cook those nearby. The characteristics of microwaves create both advantages and disadvantages when they are used for telecommunications. They have the ability to transmit large amounts of information, but because of their poor propagation abilities (they cannot penetrate structures or terrain features such as vegetation or mountains) each microwave transmitter must have a direct-line-of-sight connection to the device it is communicating with. This means that a network of transmitters, typically located on tall buildings, transmission towers or mountaintops, is required to connect across large distances. A microwave radio relay is a technology for transmitting microwave signals between two locations on a line-of-sight radio path using pairs of directional antennas, which create a fixed radio connection between the two points. Long daisy-chained series of such links form microwave networks.



Figure 1 — Frazier Mountain in Southern California. Each dish provides a point-to-point connection with another location.

In public safety radio communications networks, microwave connections are often used to provide “backhaul” capability² between remote mountaintop transceiver sites and dispatchers at centralized or regional communications centers (e.g., California Highway Patrol [CHP] dispatch centers). As Figure 2 depicts, a typical application facilitates communications between a mobile radio that has access to a remote mountain repeater (A) by carrying the signal along a microwave path that may traverse a great distance, and multiple microwave transmission sites (B) to a dispatch center (C).

²For public safety communications in California, backhaul is the portion of the network that comprises the links between sites on the core network (e.g. dispatch centers) and remote transceivers at the “edge” of the entire hierarchical network. This is illustrated in Figure 2.

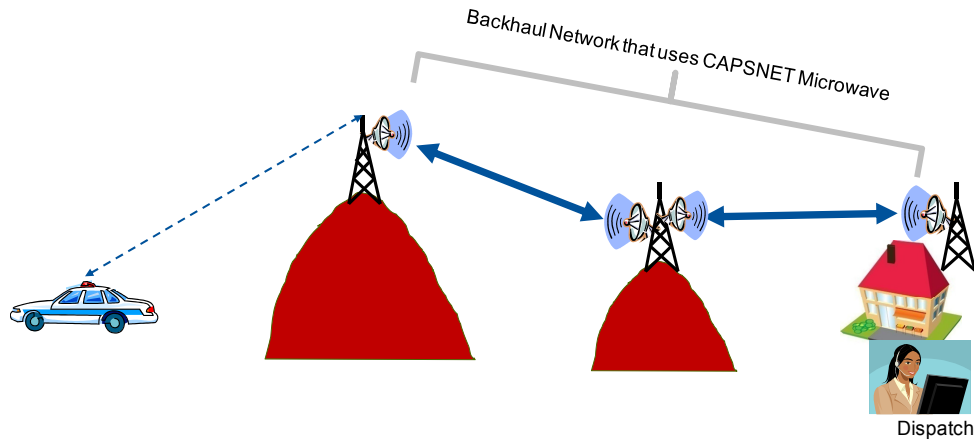


Figure 2 — How microwave systems support public safety radio backhaul needs

Microwave systems offer several distinct benefits over commercially provided terrestrial fiber optic or copper cable-based systems.

1. A well-designed microwave system is survivable — meaning that it is highly likely to remain operational during a massive catastrophe such as an earthquake. Depending on the type of disaster, traditional commercially provided systems typically are more susceptible to outages or overloading in the event of a disaster.
2. Microwave systems are highly secure, which means that it is difficult for unauthorized individuals or organizations to listen in.
3. Because microwave systems utilize line-of-sight radio licenses, except in highly congested areas there is typically a large amount of bandwidth capacity available at low or no cost from the FCC.
4. A line-of-sight technology can be a very efficient and effective way to connect radio transceiver sites, which typically will be located on high transmission towers or prominent geographic features to enhance their own coverage.
5. Microwave technology avoids the noticeable delay which the use of commercially provided geosynchronous satellite services typically introduces.

Because of these favorable characteristics, many public safety organizations use microwave systems as a “network of last resort” that first responders can depend on under most circumstances.

UNDERSTANDING CAPSNET

WHAT ARE CAPSNET SERVICES?

The California Technology Agency's Public Safety Communications Office (PSCO) owns and operates a statewide microwave communications network which is known as the California Public Safety Microwave Network (CAPSNET). CAPSNET is used primarily to support first responder voice and radio communications for all State of California public safety agencies. The current microwave network provides three main services:

1. **Radio Communications Backhaul** — The main reason for the existence of the microwave network is to provide connectivity between remote mountaintop radio transceivers, which are in direct radio communications with first responders, and the dispatch and emergency communications centers. In many cases the dispatch centers may be hundreds of miles from the transceiver location and the only way to get the user's audio to the dispatch center is by transmitting it over the microwave network. Without the microwave network, the radio user would only be able to communicate with other radio users who are within the range of the radio site they are communicating with; typically this is 20–50 miles.
2. **Remote Management of Radio Communications Equipment** — CAPSNET enables the remote configuration and management of equipment located at remote mountaintop sites. This includes programming new radio channels to support critical events such as major fires, and failing over to redundant equipment when there is an equipment failure. By using CAPSNET this can be done in a matter of minutes. Without CAPSNET, for many sites service restoration could take many hours or even days because of the long travel times required for a technician to get to many remote sites. It is worth noting that some sites are inaccessible during winter months due to weather conditions.
3. **Emergency Telephone Service (e.g., Green Phones)** — CAPSNET also supports an emergency telephone system consisting of two trunked phone switches and 11 PABX switches serving more than 100 State public safety subscribers statewide. This service is designed to ensure that personnel located in dispatch or emergency command centers have public switched telephone capability during a disaster in which their local carrier-provided voice telephone service might be unavailable. With the advent of cell phones and satellite phones, there is growing sentiment that these devices can replace the green phones for public safety agencies, but this perspective does not take into account the susceptibility of these systems to failure and/or congestion during major events. A private telephone exchange linking critical state disaster response personnel that is separate from public phone systems still has tremendous value. Although subscriptions to the Green Phone service have declined in recent years, communications managers from public safety agencies support Green Phones and have cited the need to better publicize their purpose and value to Public Safety agencies and to incorporate their use into State emergency training exercises like Golden Guardian.

WHAT DIFFERENTIATES CAPSNET FROM OTHER NETWORKS?

These services are provided by a State-owned and -maintained microwave network consisting of more than 290 locations located throughout the State of California. This network has four core attributes that make it uniquely valuable to the public safety community. The attributes are:

- **Disaster survivability** — The State’s history of natural disasters (e.g., earthquakes, fires and floods) places an emphasis on maintaining a survivable microwave network that can continue to operate during these emergencies. As a result, CAPSNET needs to be that important communications tool that can survive these disasters and provide the reliability that is important to first responders.
- **High reliability** — Because the microwave system carries public safety communications, the system must be reliable. Redundancy is built into CAPSNET at many levels. The backbone network is often configured to provide at least two paths in and out of the site. In addition, each individual microwave link is configured with redundant components, removing equipment failure as a cause for a user outage.
- **Connectivity to remote regions and difficult-to-reach locations** — Because of the geographic diversity and size of California, microwave communications is often the most efficient — and sometimes the only — method of communications between areas. In order to support remote sites, users require a system that provides the transfer of control information between remote field sites and centralized network monitoring equipment to facilitate service restoration and preventive maintenance efforts. This need is especially important for first responders, who need continuous communications with dispatch/communication centers. As such, high coverage is a key attribute that is cited as important by CAPSNET users.
- **Singular focus on public safety communications** — Stakeholders want CAPSNET to continue to focus exclusively on public safety communications and not to branch out to non-public-safety-related entities. Their concern is that, if the current focus on public safety is diluted, the responsiveness of CAPSNET to the unique challenges and high expectations of the public safety community may be compromised. They would like to see the State continue to maintain a dedicated public safety microwave network that continues to view providing transmission “backhaul” between remote mountaintop transceiver sites and dispatchers at agency communications centers as its primary mission. Without this “backhaul” capability, public safety personnel (e.g., CHP officers, CALFIRE fire personnel, etc.) who operate in remote regions or during urgent situations may not have access to their dispatch centers, putting both the officer and California’s public at risk.

HOW CAN CAPSNET BE EXPANDED?

While the public safety community values CAPSNET’s singular focus on public safety radio communications and history of being responsive to agency needs during critical events and emergencies, they are open to opportunities to leverage CAPSNET to meet other needs outside of the direct support of their radio communications systems. Examples of where CAPSNET services could be expanded include:

1. **High-speed, highly reliable data (including voice) communications between critical dispatch and emergency command centers.** Most of the facilities are already connected to CAPSNET for

radio backhaul, so the incremental investment to provide site-to-site data and voice connectivity would be minimal. The State currently operates approximately 120 dispatch or emergency command centers.

2. **Providing primary communications or backhaul services in support of the State's Next-Generation 9-1-1 infrastructure.** By leveraging CAPSNET, the reliability of the 9-1-1 system in the event of a major disaster can be significantly increased. CAPSNET could be used to shift 9-1-1 calls to alternate PSAPs in the event a disaster renders any particular PSAP interoperable. There are more than 450 PSAPs in the State. Approximately 50 of these centers are operated by the State and currently have CAPSNET service which could be expanded to support NG9-1-1.
3. **Providing primary or backup data connectivity between critical public safety organizations.** For example, today the State's 42 major prison institutions are interconnected by a high-speed, carrier-provided MPLS network. The backup connections for this network either utilize the same fiber infrastructure as the primary network or rely on satellite communications links whose performance could be improved through CAPSNET. Connecting the institutions to CAPSNET may prove to be both more cost-effective and a better solution.
4. **Providing a supplement to satellite communications as the State's communication network of last resort.** Today Cal EMA provides a satellite-based network known as OASIS to serve as the network of last resort for the State. This network consists of commercially provided satellite connections between major State command centers and key public safety locations in each county, typically the Sheriff's office. CAPSNET may prove to be a cost-effective augmentation or alternative to OASIS in the future.

WHICH PLANS FOR CAPSNET ARE ALREADY IN PLACE?

The California Technology Agency understands the potential for CAPSNET and has been proactive in planning to upgrade the system. CAPSNET is currently a hybrid network consisting of links based on antiquated analog equipment and legacy digital transmission equipment. The current digital links are Time Division Multiplexing (TDM)-based; however, a transition is planned to Multiprotocol Label Switching (MPLS) technology carried over Ethernet-capable radios.

The California Technology Agency has also built the potential usage of CAPSNET into the recently developed 10-year strategic plans for the State's public safety radio communications systems (the 2010 California Public Safety Radio Communications [CAPSCOM] Strategic Plan) and for the State's 9-1-1 network and services (the 2010 California 9-1-1 Strategic Plan).

The CAPSCOM Strategic Plan envisions the use of MPLS/broadband-based connectivity and capabilities to support a System of Systems (SoS). In the overview of Goal 4 — Establish System of Systems Architecture and Infrastructure in the CAPSCOM Strategic Plan, it states: "The SoS solution will use an IP/MPLS-enabled State Public Microwave Network to interconnect agency systems."

Goal 3, Objective 3.7 of the California 9-1-1 Strategic Plan states, "Robust services and delivery mechanisms, including leveraging existing or planned State infrastructure as appropriate. The

system must be fail-safe and offer multiple delivery pathways, including leveraging other State IP and data networks, and emergency communication systems, with active management reporting, while ensuring appropriate security standards.” The intent is for CAPSNET to be ideally positioned to meet these requirements of the 9-1-1 Strategic Plan.

Book 2:

STRATEGIC VISION

STRATEGIC GUIDING PRINCIPLES

The following strategic guiding principles were developed based on input from the 2010 California IT Strategy and outreach to the major user agencies that depend on and provide funding for CAPSNET. The principles were used to determine potential alternatives for CAPSNET and to ultimately shape the State's vision for CAPSNET in the future.

The six core principles are:

- **Network reliability and survivability must be maintained** — Network reliability and major disaster survivability are critically important to customers and must be maintained at current levels, or enhanced.
- **The evolving needs of the public safety community must be met** — Technological advancements and concomitantly increasing reliance on both data and voice communication must be supported by the new system. The current technologies cannot meet the network needs of the next-generation systems described in the 2010 CAPSCOM Strategy or the Next-Generation 9-1-1 Strategy. The evolving needs of customers and potential customers will require that CAPSNET modernize its infrastructure and expand both capacity and coverage.
- **Antiquated equipment and technology architectures must be replaced** — Older equipment, which is difficult for either the State or manufacturers to support, represents a high risk and must be a priority for replacement. In addition, this older equipment limits the functions and capabilities that can be offered to CAPSNET customers. CAPSNET must be able to provide a modern backbone to support the needs of Internet-savvy and dependent public safety users.
- **Focus on public safety must be undiluted** — Although the potential to provide microwave-based services to non-public-safety-related entities exists, the California Technology Agency must maintain the focus of CAPSNET on public safety usage. CAPSNET should not become “just another State network.” As such, this strategic plan is geared toward only public-safety-related agencies and needs.
- **Costs to enhance and maintain CAPSNET must be optimized** — Any investment decision to modify CAPSNET must be considered realistic and feasible, given the State's budget environment.
- **CAPSNET's customer base must be increased** — CAPSNET costs are recovered from its customers by current usage. By adding customers, CAPSNET will be able to distribute these costs among a larger base of customers which will lower the per customer cost for all.

DETERMINING THE APPROPRIATE DIRECTION FOR THE STATE

The CAPSNET strategic plan is based on the diverse alternatives considered, and outlines a sensible and feasible CAPSNET plan for PSCO to implement during its ten (10) year time frame.

Alternatives were considered across five areas: mission and scope, consolidation, operating model, implementation and technology. The formal transition from the current state to the recommended final state for each of the areas is illustrated in Figure 3 below:

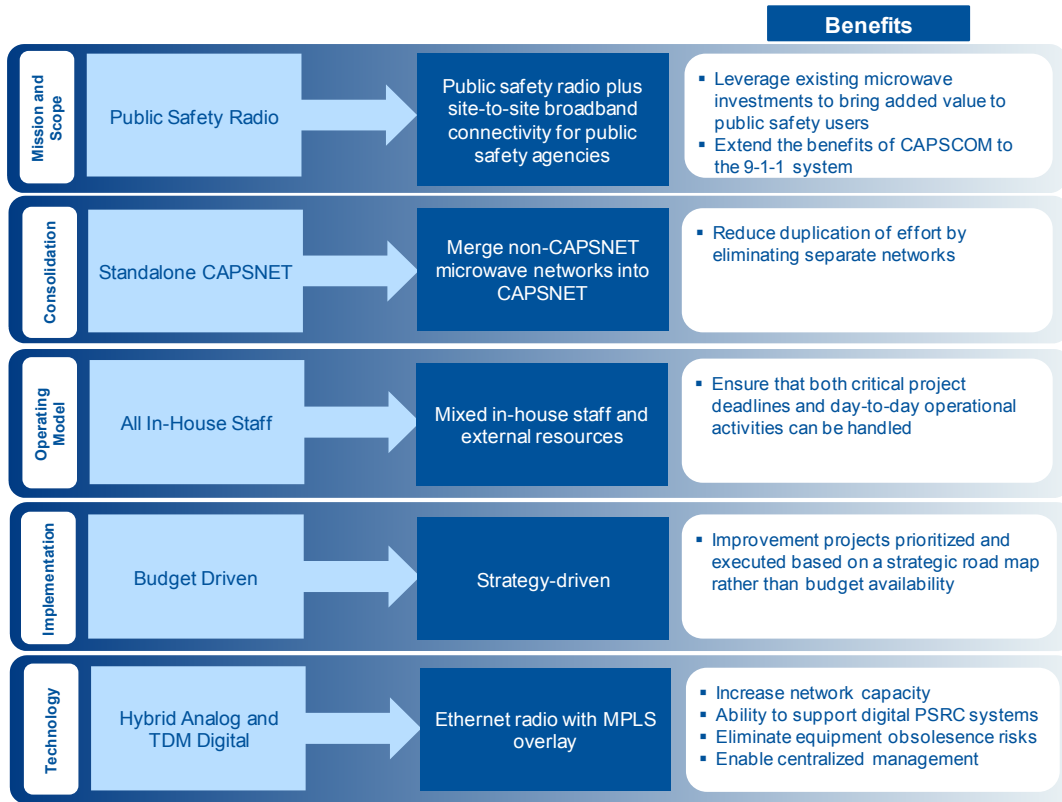


Figure 3 — Alternatives Analysis Summary

The rationale for determining each of these recommendations is described below:

MISSION AND SCOPE — Currently, CAPSNET’s singular focus is on supporting the provision of radio communications to public-safety-related agencies. Expanding CAPSNET services beyond supporting radio communications backhaul, while retaining an exclusive focus on the public safety community, will benefit the community in two ways. The provision of additional services will provide direct benefits to the agencies that choose to use these services, while providing indirect benefits to all current CAPSNET agencies, as the California Technology Agency will be able to leverage the CAPSNET network across a wider base of services and user agencies. Over time, this will result in lower rates for existing services/customers. Limiting the CAPSNET mission to the public safety community will ensure that the needs of first responders and other public safety radio users will continue to be met by technologists who understand and are part of their world.

CONSOLIDATION — CAPSNET is the largest State microwave network. Other departments that operate smaller microwave systems will soon have the opportunity to benefit from the enhanced capabilities of CAPSNET by combining their microwave infrastructures with CAPSNET. By

integrating general purpose non-CAPSNET State microwave networks into CAPSNET, the PSCO will be able to eliminate duplication of effort and achieve greater economies of scale.

OPERATING MODEL — The California Technology Agency currently relies primarily on in-house support staff (technicians and engineers). Recruitment and retention obstacles have made it difficult to attract and retain the number of technicians required to meet both day-to-day operational needs and those of Agency-sponsored projects. This has resulted in unacceptable delays to completing Agency-sponsored projects and equally unacceptable deferral of necessary system maintenance and modernization activities.

IMPLEMENTATION — There is no doubt that the California Technology Agency needs to modernize CAPSNET technology. Over the course of the next two to five years, nearly all of its 290+ microwave sites will need to be upgraded from current analog or legacy digital technology to the future-state architecture. The speed of this modernization effort is primarily driven by available resources to the California Technology Agency. Currently, the California Technology Agency is reliant almost exclusively on annual customer fees, which include a small amount for equipment refresh, to set the pace of modernization. The definition of a CAPSNET strategic vision provides PSCO with unified vision of enhancing CAPSNET to meet the needs of its customers. In the future, PSCO will make the investment decisions to modify CAPSNET based on the road map laid out in the CAPSNET Strategic Plan. To support this approach it may be necessary to identify additional funding sources or to implement a multiyear technology modernization revolving fund.

TECHNOLOGY — The current CAPSNET technology is a mixture of analog and legacy TDM digital transmission facilities. The California Technology Agency has adopted a future-state architecture which is based on “State of the Market” technologies. The implementation of this architecture will significantly increase the capacity of the network. It will improve the ability of the State to remotely manage the network and configure it to automatically route traffic around failed components or links. Both of these features should make CAPSNET less labor-intensive to support, as well as increase its overall reliability. The rates charged to customer agencies include funding intended to support the gradual modernization of CAPSNET. Using this funding stream, some portions of the network are currently being upgraded to the new technology platform.

A VISION FOR THE FUTURE

The recommendations in the previous section can be summarized into a strategic future vision for CAPSNET that is based on the following three imperatives:

- **CAPSNET must remain focused on the unique needs of the Public Safety Community.** Because of the importance of its core mission to support public safety radio communications, the focus of CAPSNET will remain solely on supporting public safety communications within the State; however, CAPSNET will no longer be narrowly focused on voice/radio communications (e.g., providing connections between remote mountaintop transmitters and dispatch centers). CAPSNET will also continue to differentiate itself from other State networks by remaining a separate, State-operated network capable of providing connectivity to any location in the State where connectivity is required (e.g., remote mountaintops which may not even have utility-provided electricity available) and capable of surviving large-scale disasters (e.g., major earthquakes) which are likely to incapacitate or otherwise overwhelm commercial carrier-provided telecommunications services.
- **CAPSNET must be perceived as a high-value service to its customers.** The California Technology Agency must enhance CAPSNET’s coverage, capacity and capabilities so that it is recognized as more than a way to connect remote transmitters on mountaintops to dispatch centers. It needs to be viewed as the digital backbone of the State’s next-generation public safety communications capabilities. It needs to provide the services that the State’s responders need, wherever they need them.
- **CAPSNET must be enhanced so that it can provide the capabilities required in the State’s strategic plans for public safety communications and NG9-1-1.** By upgrading the technology on which CAPSNET is built to MPLS and expanding its coverage across the State, CAPSNET can become the lynchpin for the CAPSCOM system of systems (SoS) and NG9-1-1.

Each is more fully described below.

CAPSNET MUST REMAIN PUBLIC-SAFETY-FOCUSED

By retaining a singular focus on public safety, CAPSNET serves the greater good for the State of California. The results of a recent survey of current and potential customers make it clear: the overarching value of CAPSNET is its focus on public safety, public safety needs and public safety organizations.

Public safety organizations are different from other organizations. In the event of network slowdowns for a non-public safety network, network customers may experience a degradation of service possibly resulting in a customer anger — all negative consequences — however, if CAPSNET experiences a similar degradation of services, lives are put in jeopardy, the public’s safety is compromised, citizen confidence in government is shattered and numerous inquiries are made into the failure. In short, the value in CAPSNET is based on its public safety focus, and remaining true to this vision is a critical point for CAPSNET.

Currently the core of CAPSNET’s focus is on public safety radio. As described in the Mission and Scope analysis, the State of California is best served by an expanded and extended scope of clients and services. In its extended mission, PSCO keeps its focus on radio but broadens it to include communications center connectivity using radio. In its expanded mission, it also supports data communications using site-to-site broadband-based connectivity. A graphical representation of this vision is shown in Figure 4.



Figure 4 — CAPSNET Focus

The strategic vision of CAPSNET remains true to this public safety focus. While historically CAPSNET has been focused on radio backhaul capabilities, the extended and expanded mission is focused on public safety site interconnectivity and moving from purely radio to include accommodating diverse public safety data requirements. As such, CAPSNET remains focused on public safety and continues to fulfill its mission and mandate. The critical success factor for this vision point is:

CAPSNET MUST BE PERCEIVED AS A HIGH-VALUE SERVICE TO ITS CUSTOMERS

In a recent customer survey, CAPSNET customers repeatedly highlighted the values of coverage, survivability and reliability as reasons that they use (or plan to use) the CAPSNET. Unfortunately these needs can be obscured with a hyper-focus on cost. While no one debates the value of a low cost of service, there needs to be equal (or even greater) focus on the attributes of coverage, reliability and survivability. These attributes do not come cheaply. Customers, however, are continuously bombarded with messages from commercial service providers who offer lower rates but at a much lower level of reliability, survivability and coverage than CAPSNET. In a public safety-centric network view, the value for service that CAPSNET provides far exceeds that of commercial service providers.

The transition to Ethernet and MPLS technology allows much greater bandwidth and is a much more effective solution. This new technology opens the possibilities for functions and features that were previously not available to customers (e.g., site-to-site connectivity for both radio and data). Finally, and most importantly, the newer technology dramatically increases the ease with which the California Technology Agency can meet the necessary requirements for survivability and reliability.

CAPSNET MUST BE ENHANCED SO THAT IT CAN PROVIDE THE CAPABILITIES REQUIRED IN THE STATE’S STRATEGIC PLANS FOR PUBLIC SAFETY COMMUNICATIONS AND NG9-1-1

At present, CAPSNET has a serviceable but antiquated technology infrastructure, and this limits the success of CAPSNET. As mentioned, CAPSNET needs to remain focused on public safety and, to meet that charge, it is imperative that the CAPSNET technology is modern, reliable and supportable. The current hybrid mixture of analog and TDM-based digital technology is, by technology standards, antiquated and is increasingly difficult to support. Staff routinely experience challenges in finding replacement parts for this old equipment, and it is difficult to meet the continuously growing demands of public safety organizations.

In addition to the needs of its current customers, the CAPSNET is envisioned to be an important part of the CAPSCOM Systems of Systems (SoS) and, subject to further study, could play a significant role in supporting Next-Generation 9-1-1 (NG9-1-1). These important public safety plans cannot be fulfilled if CAPSNET continues using its current analog and TDM digital equipment. MPLS offers numerous advantages to the public safety community and is the de facto microwave standard. A rapid evolution to this technology will immediately benefit CAPSNET customers (see Figure 5).

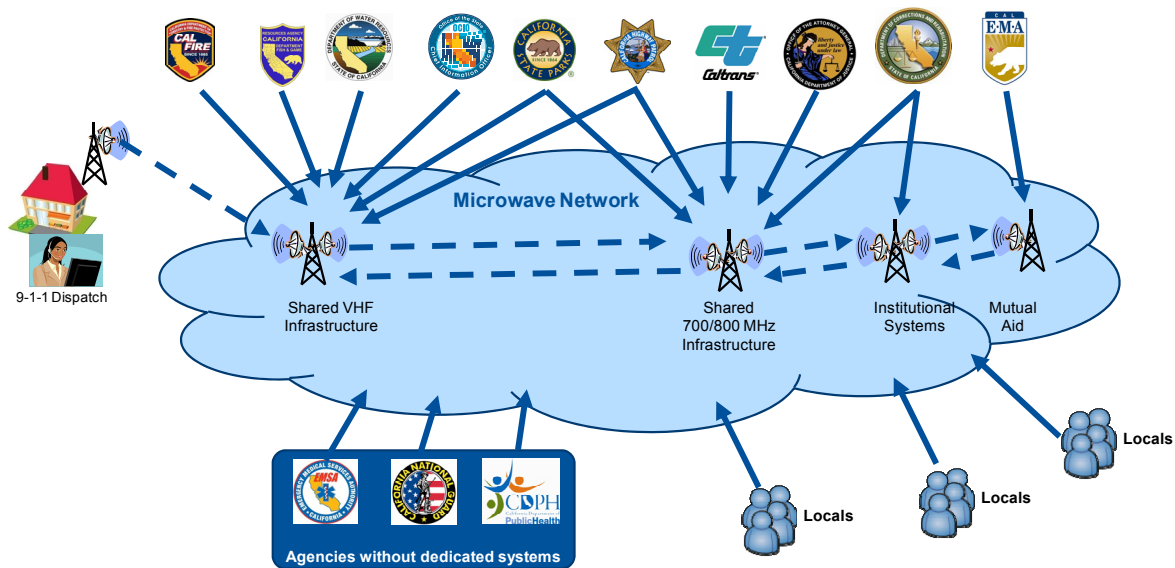


Figure 5 — CAPSNET must be enhanced to support strategies such as CAPSCOM and NG9-1-1

BOOK 3:
STRATEGIC GOALS AND OBJECTIVES

STRATEGIC GOALS AND OBJECTIVES

The following strategic goals and objectives are derived from the strengths, weaknesses, threats and opportunities that face CAPSNET; the technology, personnel and rate gaps; and the strategic alternatives that CAPSNET has available to it. As such, these things form the framework from which the strategic goals and objectives are derived.

- **Goal 1: Modernize technology** — Rapidly modernize the California Public Safety Microwave Network (CAPSNET) infrastructure by replacing it with equipment capable of supporting next-generation broadband public safety voice and data communications requirements.
- **Goal 2: Support the System of Systems** — Be the primary backhaul network for voice and data associated with the System of Systems (SoS) described in the CAPSCOM Strategic Plan published by the State CIO in 2010.
- **Goal 3: Increase the redundancy and resiliency of the microwave network** — Improve the quality and survivability of the CAPSNET, and increase its redundancy and resilience, by identifying and fixing potential vulnerabilities within the network (e.g., by building a microwave loop around Sacramento).
- **Goal 4: Develop and deploy new capabilities** — Develop and deploy new capabilities that are enabled by the advanced CAPSNET infrastructure envisioned by Goal 1. CAPSNET services are intentionally focused on those entities that support PSCO's broad public safety communications mission.
- **Goal 5: Strengthen operational capabilities** — Enable PSCO to provide more-flexible and more-efficient digital solutions.
- **Goal 6: Manage unmanned remote (e.g., mountaintop) sites** — Assume management and control over all remote communications sites where CAPSNET equipment is present.

The relationship between these goals and the strategic imperatives are shown in Table 1.

Table 1 — Linkage of Strategic Goals to Vision Tenets

GOALS	PRIMARY BENEFITS	VISION IMPERATIVES		
		PUBLIC SAFETY	HIGH VALUE	NEW CAPABILITIES
Goal 1: Modernize technology	<ul style="list-style-type: none"> Eliminates risks associated with using obsolete equipment that is no longer supported by vendors 	✓	✓	✓
	<ul style="list-style-type: none"> Increases network capacity, manageability and reliability 	✓	✓	✓
	<ul style="list-style-type: none"> Enables the network to support next-generation digital radio systems 	✓	✓	✓
Goal 2: Support the System of Systems	<ul style="list-style-type: none"> Enables the State to implement a next-generation public safety radio communications capability 	✓	✓	✓
Goal 3: Increase the redundancy and resiliency of the microwave network	<ul style="list-style-type: none"> Improves the reliability and survivability of CAPSNET 	✓	✓	
Goal 4: Develop and deploy new capabilities	<ul style="list-style-type: none"> Provides high-speed, high-availability data connections between critical public safety facilities 	✓	✓	✓
Goal 5: Strengthen operational capabilities	<ul style="list-style-type: none"> Allows PSCO to quickly adjust its staff’s project and maintenance capabilities based on the needs of their customers and technical issues that arise 	✓	✓	
	<ul style="list-style-type: none"> Improves PSCO’s technical capabilities to support more-advanced technologies (e.g., broadband) 	✓	✓	
Goal 6: Manage unmanned remote (e.g., mountaintop) sites	<ul style="list-style-type: none"> Improves PSCO’s ability to maintain, plan and grow CAPSNET 	✓	✓	
	<ul style="list-style-type: none"> Enhances PSCO’s response times to issues at the site 	✓	✓	

GOAL 1: MODERNIZE TECHNOLOGY

DESCRIPTION: Rapidly modernize the California Public Safety Microwave Network (CAPSNET) technology infrastructure by replacing it with equipment capable of supporting next-generation broadband public safety voice and data communications requirements. The resulting network will have the following key attributes:

- Highly reliable and secure
- Digital, broadband, any-to-any topology
- Seamless support for existing legacy systems and services
- Highly scalable capacity capable of supporting broadband applications, and
- Centralized management and monitoring capabilities

Objective 1.1 — Implement a next-generation, broadband-enabled architecture that utilizes a Multiprotocol Label Switching (MPLS) overlay over Ethernet digital transmission links across all of CAPSNET by the end of 2015.

This implementation is the key to the successful transformation of CAPSNET from a hybrid legacy analog/TDM digital network to a more modern, supportable and reliable network using MPLS. MPLS greatly extends the existing infrastructure and lays the groundwork for the ability to offer advanced data and voice capabilities to new and existing customers.

PSCO needs to replace all of the 20- to 40-year-old analog transmission facilities and circuits with broadband connections. CAPSNET’s legacy analog transmission equipment and links are antiquated and in need of replacement. By replacing this legacy analog equipment with modern digital technologies, PSCO will improve the reliability and supportability of the equipment and significantly enhance CAPSNET’s capabilities and value to both existing and new users. More than half of CAPSNET’s links are analog and need to be replaced. Each link consists of two pairs of transmitters and related equipment on each side of the link.

PSCO also needs to replace its 10- to 20-year-old digital transmission facilities based on legacy Time Domain Multiplexing (TDM) technologies with broadband connections. The TDM digital equipment, while newer and more reliable than the analog equipment, is still quite old and hinders the reliability and supportability of CAPSNET. By upgrading to the next-generation broadband technology, PSCO can improve CAPSNET’s reliability, supportability and viability to existing and potential users. Less than half of the CAPSNET links are legacy digital link that need to be replaced. Each link consists of two pairs of transmitters and related equipment on each side of the link.

The future-state architecture has already been selected. Sufficient equipment to upgrade approximately 60 microwave links (30% of total links that require upgrading) has already been purchased using funds from the “refresh” portion of the Agency’s microwave charges. Implementation of this equipment is currently being planned. Figure 6 depicts the migration from the current state to more-modern technologies.

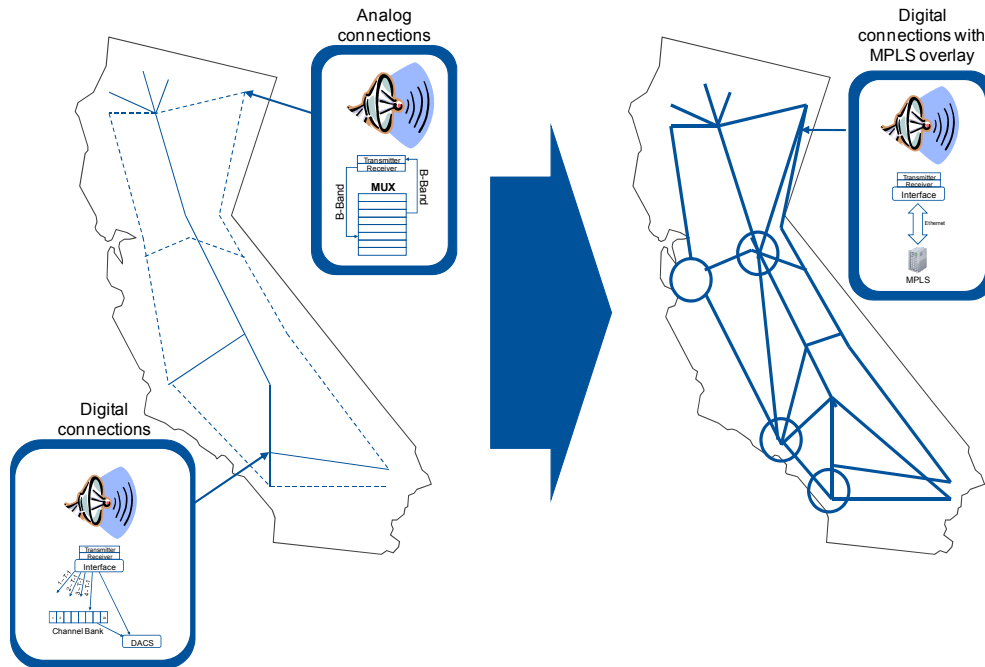


Figure 6 — Moving to a modern architecture

Objective 1.2 — Implement modern, automated and centralized network operations capabilities capable of monitoring both CAPSNET and current/future public safety communications applications.

The current Network Operations Center (NOC) is located in mechanical areas on the top floor of a State building. Not only is this a poor working environment for the NOC staff, but it is also a portion of the building which has not been seismically reinforced. The nature of the technologies used to manage the legacy analog and digital transmission infrastructure dictates that NOC functions should remain in this location until all of the legacy analog technology in the network has been modernized.

The modernization of the NOC should occur as the modernized broadband/MPLS infrastructure is installed. As part of this installation, the NOC facilities should be relocated from their current location (note: legacy management systems should be retired, not relocated) to a new NOC location. Because the management technology used to manage the modernized microwave network will be based on Internet-type technologies, there is no longer any requirement that it be co-located with a major transmission facility. In fact, it should be located in a facility which is not part of a transmission site and has the ability to connect to the microwave network through at least two separate paths. In the event that the NOC's microwave transmission facility experiences a single path failure, the NOC will still be able to connect with and manage the network via the other path. A backup NOC location should also be established. The backup NOC location should fully duplicate the critical management systems and configuration storage databases that are required to maintain the network in the event of an emergency or other event.

Both NOCs should be located in dedicated facilities with adequate physical security to ensure that only authorized personnel have access to NOC systems. Both NOCs should also be located outside of earthquake risk zones and Corps of Engineering-designated flood zones. Because the staff who will operate the NOC are based in Sacramento, both NOCs should be located in the Sacramento area. However, there should be adequate separation between the primary and secondary NOCs to ensure that a single disaster does not affect both NOCs.

Both NOCs should contain management systems that support the following key functions:

- Monitor CAPSNET components/elements including:
 - Microwave transmission facilities
 - Cross-connect facilities/DACS
 - Routers and switches
 - Physical security systems/telemetry at remote sites
- Configuration management systems and databases for all elements
- Performance and utilization monitoring systems for all elements
- Access control systems for all elements
- Trouble ticketing and workflow management systems
- Change management systems

GOAL 2: SUPPORT THE SYSTEM OF SYSTEMS

DESCRIPTION: CAPSNET will be the primary backhaul network for voice and data associated with the System of Systems (SoS) described in the CAPSCOM Strategic Plan published by the State CIO in 2010.

The SoS plans to use a broadband/MPLS-enabled microwave network to interconnect agency systems, which is perfectly in line with CAPSNET. The SoS, once developed, will allow each agency to operate on a feature-rich network that is tailored to its specific needs, and which also facilitates multidiscipline, multi-jurisdiction interoperability, thereby enhancing the viability of both the SoS and CAPSNET for any current and potential users.

The broad implication of this requirement for CAPSNET is threefold:

1. The entire existing CAPSNET microwave infrastructure will need to be upgraded and modernized as described in Goal 1.
2. A sophisticated network monitoring and management center which utilizes a suite of network and security monitoring tools will need to be established. This NOC will be staffed on a 7x24 basis.
3. Additional sites will need to be implemented to support the proposed CAPSCOM architecture. The precise number of new CAPSCOM sites cannot be known until the CAPSCOM project has begun and selected a radio communications and backhaul architecture. It is likely that most new CAPSNET sites will be existing public safety radio communications sites and not virgin sites requiring ground-up development. For estimating purposes, this strategy assumes that CAPSCOM will drive the need to increase the number of CAPSNET sites by 25–35%. This translates into about 65–100 more sites.

Objective 2.1 — Participate in CAPSCOM requirements development and design activities.

The CAPSCOM Strategy is based on a statewide System of Systems (SoS). Although PSCO is currently in the process of defining the SoS requirements and design, it has become clear that CAPSNET should provide the required backhaul capability for the SoS. In order to meet the demands of the SoS, all future development of PSCO's CAPSNET should be fully collaborated with SoS developments under CAPSCOM. PSCO — and more specifically, the CAPSNET engineering team — must play a major role in this coordination. Through coordination and collaboration, CAPSNET's benefit to PSCO's SoS customers will be maximized, further strengthening its viability to all users.

Objective 2.2 — Add capacity and redundancy to support CAPSCOM.

The implementation of the CAPSCOM Strategic Plan is under development. However, it is expected that PSCO will need to increase the capacity and improve the redundancy of CAPSNET to support the Plan. Because enhanced capacity and redundancy benefit current customers as well as the CAPSCOM Strategy, PSCO should perform load analyses to determine how much additional capacity will be required to support CAPSCOM, and should take the necessary steps to accommodate the necessary capacity and redundancy requirements.

Objective 2.3 — Add locations to support CAPSCOM.

At present, the development of requirements and a design for the next-generation CAPSCOM system has not yet begun. The development of a strategic road map which will guide this process is under development. It is clear that, to support the CAPSCOM vision and strategy, CAPSNET will need to expand its service to additional geographic locations. A likely estimate is that 65–100 new CAPSNET locations will be required. As part of the CAPSCOM design project, PSCO and the selected CAPSCOM integrator will perform coverage analyses to determine which additional locations will be required to support CAPSCOM and will take the necessary steps to add these locations. PSCO will have responsibility for implementing CAPSNET at these additional sites and for operating and managing them on an ongoing basis.

GOAL 3: INCREASE THE REDUNDANCY AND RESILIENCY OF THE MICROWAVE NETWORK

DESCRIPTION: Improve the quality and survivability of CAPSNET, increasing its redundancy and resilience by identifying opportunities to strengthen the network (e.g., by building a microwave loop around Sacramento).

Objective 3.1 — Building a microwave loop around Sacramento.

CAPSNET has a significant presence at a single location in Sacramento. It is a hub comprising 10 links, and has long been a center of operations for CAPSNET. Due to potential seismic issues, the long-term future of the Sacramento building has been in question and, at one point, plans for its removal were under way. Irrespective of the fluctuating fate of the building, CAPSNET’s vulnerability is obvious. As a result, an authorized plan to “decentralize” the California Technology Agency’s CAPSNET operations from this building by creating a more fault-tolerant loop architecture in the Sacramento region is being implemented. The California Technology Agency should move forward with this project; however, to facilitate monitoring the diminishing analog technologies, California Technology Agency should retain CAPSNET presence at existing facilities until all analog paths have been converted to digital paths.

Objective 3.2 — Strengthen and advance the network.

CAPSNET’s mission is focused on public safety and, with that public-safety-centric mission, the reliability of the network is critical to PSCO’s public safety clients. As a result, it is imperative that PSCO identify potential opportunities for improvements within the CAPSNET network and address them. By doing so, PSCO can continue to meet the needs of its customers. Potential areas for improvement include CAPSNET hub locations with many paths which, if disabled or experiencing unusually high traffic loads, would compromise CAPSNET’s ability to effectively reach one or more of its clients’ locations. Redistributing one or more paths from hubs to other locations can mitigate potential issues. An accompanying strategy for this is deploying a mesh solution. A mesh solution increases redundancy and resiliency by providing alternative paths to a single location. As part of this effort, PSCO should identify and enhance key sites to also improve network redundancy and resiliency.

GOAL 4: DEVELOP AND DEPLOY NEW CAPABILITIES AND EXPAND THE SYSTEM WHERE NECESSARY

DESCRIPTION: Develop and deploy new capabilities that are enabled by the advanced CAPSNET infrastructure envisioned by Goal 1. CAPSNET services are intentionally focused on those entities that support PSCO’s broad public safety communications mission. PSCO should add strategic locations, increase capacity to accommodate anticipated traffic loading and growth, and improve redundancy throughout the network.

Objective 4.1 — Provide secure, high-speed digital network connectivity to accommodate broadband capability between and among public safety communications/dispatch centers and other critical facilities related to the State’s public safety communications systems.

The core of CAPSNET has historically been on providing voice communications to public safety entities. The needs of customers have grown, yet CAPSNET’s offerings have lagged behind. It is important that PSCO grow its capabilities to match the needs of its customers. By providing secure, high-speed broadband data access between/among public safety communications/dispatch centers and other critical public safety facilities, PSCO can better meet the needs of its clients.

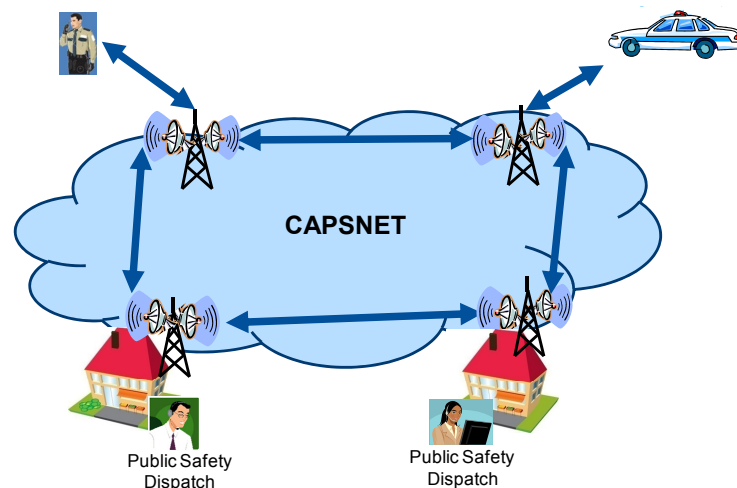


Figure 7 — High-speed broadband connectivity between dispatch centers

Objective 4.2 — Provide secure, high-speed digital network connectivity to accommodate evolving voice and data requirements between the State’s communications systems and correlating local, tribal and federal government partner public safety communications systems.

While Objective 4.1 addresses broadband communications between and among State agencies, this objective provides the broadband communications between the State’s public safety communications systems and correlating systems operated by local, tribal and federal government public safety practitioners. As with the prior objective, this allows PSCO to best use CAPSNET to meet evolving customer needs.

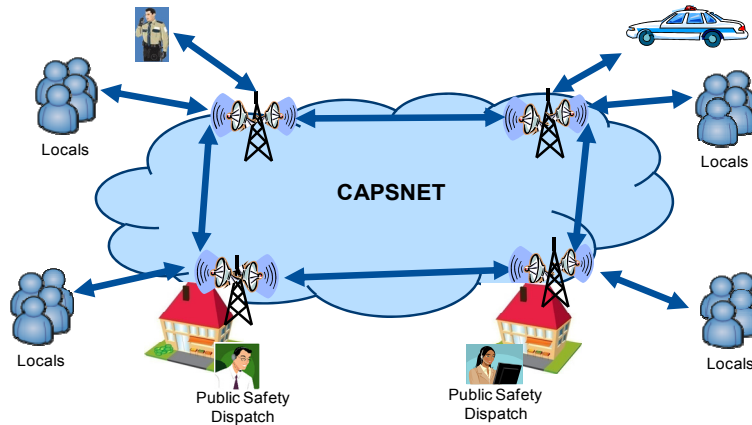


Figure 8 — Enabling high-speed broadband connectivity for non-State public safety entities

Objective 4.3 — Provide secure, high-speed digital network connectivity to critical public safety locations.

There are a number of public safety locations that could benefit from CAPSNET functionality, and PSCO should seek to provide secure, high-speed digital connectivity to them. While the location purposes may vary, the need for high-speed data communications can be met by CAPSNET.

Examples of such systems include:

- Interconnected facilities (e.g., correctional institutions, correctional health centers and work camps, mission-critical highway patrol locations)
- Rapid response locations (e.g., fire stations, air-attack bases, fire equipment maintenance facilities)
- Base locations (e.g., major State office buildings which house public safety personnel)
- Repair facilities (major Caltrans maintenance facilities, bridges or district headquarters)
- Emergency communications (e.g., Cal EMA sites).

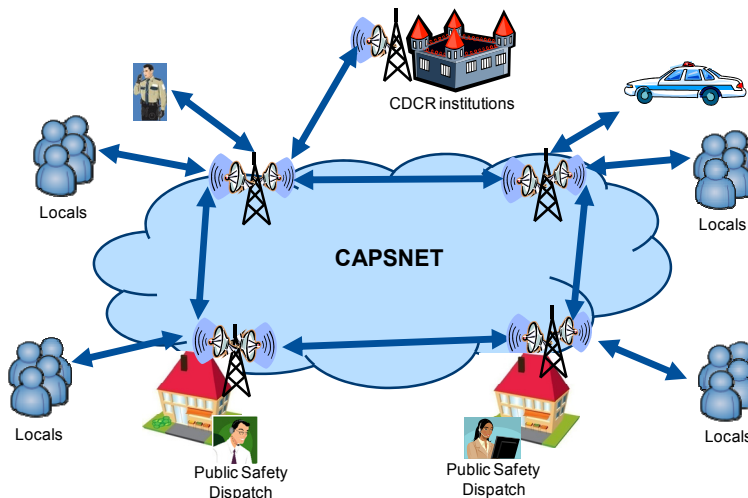


Figure 9 — Enabling high-speed broadband connectivity to critical public safety locations (e.g., CDCR institutions)

PSCO must add strategic locations, increase capacity to accommodate anticipated traffic loading and growth, and improve redundancy to support the rollout of different customers.

Objective 4.4 — Develop enhanced capabilities such as those required by NG9-1-1.

Next-Generation 9-1-1 (NG9-1-1) is a prime example of an evolving public safety requirement for which CAPSNET may support critical (and missing) functionality. CAPSNET could increase the resiliency and efficiency of NG9-1-1 infrastructure described in the California 9-1-1 Strategic Plan published by the State CIO in 2010.

For NG9-1-1, PSCO should conduct a study to determine the ability of existing or new CAPSNET locations (once upgraded to the new architecture described in Goal 1) to integrate or coincide with the California Public Safety Answering Point (PSAP). PSCO should also participate actively in related 9-1-1 architecture and design activities in order to determine backhaul network requirements, and should incorporate these requirements into the CAPSNET tactical and strategic road maps. Finally, PSCO should perform a study to add strategic locations, increase capacity to accommodate anticipated traffic loading and growth, and improve redundancy to support the rollout of the NG9-1-1 infrastructure and capabilities.

Objective 4.5 — Establish marketing materials and processes for new features and services and to recruit and successfully bring new clients on board.

Under this strategic plan, PSCO will be adding a number of customers, as well as adding services to existing customers. As a result, it is important that PSCO develop marketing materials for new features as well as develop onboarding materials, training and processes for new clients (or existing clients with new features). In addition to marketing materials, standard rates for different services should also be included. This will make it easier to make other public safety agencies aware of CAPSNET capabilities and costs.

GOAL 5: STRENGTHEN OPERATIONAL CAPABILITIES

DESCRIPTION: Enable PSCO to provide more-flexible and more-efficient digital solutions.

Objective 5.1 — Improve the California Technology Agency’s resourcing capabilities to enable the organization to hire and retain the number of system engineers and technicians necessary to operate and maintain CAPSNET.

Prior to this report, PSCO did not have a defined vision for CAPSNET which previously limited PSCO’s efforts to modernize the system to react to immediate customer demands. The definition of a vision and strategy for CAPSCOM will prompt more proactive planning and design activities from PSCO. Successfully designing, deploying and supporting CAPSNET requires the efficient application of skilled technical and engineering staff. The engineering department is well-staffed, but there is a shortage of skilled technicians — and this critical resource deficiency will delay customer projects and will most likely stall future efforts to modernize CAPSNET’s technology. A lingering pay disparity between State technicians and local government and private companies made it difficult for the California Technology Agency to attract and retain skilled technicians. The California Technology Agency needs to align technician compensation with market expectations in order to attract, hire and retain skilled technicians. Engineer compensation was addressed several years ago and does not appear to be an issue.

Objective 5.2 — Enhance PSCO’s ability to support customer- and strategy-driven projects.

The California Technology Agency must be able to respond to fluctuations in workload that it encounters as a result of project work which was not anticipated when staffing levels were set for the year. One response to the varying workload is to create a staffing model that uses external resources to perform well-defined, short-term work for which hiring permanent employees is impractical or does not meet project timelines. This model has been used successfully in other parts of the California Technology Agency, such as the data center and network support areas. Another response would be to hire limited-term resources so that, when critical project work is identified, there is a pool of available resources from which to pull.

By judiciously and intelligently using these external resources, the California Technology Agency can dramatically increase its ability to respond to customer needs in a timely fashion while still relying on core State resources for work. If done well, this flexible model benefits the California Technology Agency, its workforce, its customers and its users in terms of speed of implementation and response, costs and operational efficiencies.

It is anticipated that, once the major upgrade work related to the refresh of the CAPSNET infrastructure and the implementation of the CAPSNET enhancements required by the CAPSCOM and Next-Generation 9-1-1 Strategies has been completed, the need for external resources would decline significantly.

Objective 5.3 — Acquire needed skills and experience.

The California Technology Agency needs to acquire the necessary skills and experience to engineer, build and operate the modern, broadband radio and microwave networks. Three things are necessary to have the requisite skills available: training, hiring and contracting. The use of appropriate training is necessary to either maintain or supplement the skills of current employees. Over time, even the most diligent employee needs training to refresh his/her skills and to develop skills that better suit the newer technologies that are in place. This is especially true in more-technical positions such as engineers and technicians. Providing timely and appropriate training represents an investment in the employee and in the California Technology Agency, and enables growth for both. In some cases, training might not be enough; in this case, industry best practices have shown that contracting for short-term resources with critical skills and having them work side-by-side with existing resources can be one of the most effective ways to achieve skills transfer.

Over time, attrition, transfers and promotions will lower the number of employees in engineering and technical disciplines. The California Technology Agency needs to actively and continually recruit new highly skilled individuals. For future hiring, preference should be given to resources with the skills necessary to support the future-state technologies rather than the current-state, legacy technologies. The existing workforce can provide on-the-job training for new employees in the maintenance and operation of the current legacy systems.

Finally, the California Technology Agency needs to make use of skilled external resources who are available when necessary. With external resources, the California Technology Agency has a greater ability to surge (as mentioned in Objective 5.2), but it also allows it to quickly bring on board resources who are highly trained in the particular task that needs to be accomplished. Having these external resources collaborate with California Technology Agency staff enables the transfer of critical skills associated with modern technologies. Hence, external resources represent a viable option for skilled staff to support PSCO.

GOAL 6: MANAGE REMOTE (E.G., UNSTAFFED) SITES WITH CAPSNET PRESENCE

DESCRIPTION: PSCO should assume management over all remote (e.g., unstaffed, mountaintop or multi-agency) communications sites where CAPSNET equipment is deployed. At present, these remote sites are owned by a variety of different agencies/departments and this significantly limits the ability of PSCO to properly manage them. Taking over management of the sites will help PSCO to ensure the successful operation and maintenance of the sites while concurrently improving their efficiency.

This goal is in alignment with CAPSCOM Goal 2, Road Map Item H: “PSCO must work with the agencies to begin transferring ownership and responsibility of remote sites to PSCO.”

Objective 6.1 — Plan the transition.

Successfully transitioning the remote sites to PSCO ownership requires the development of a detailed plan that addresses the logistical, legal and financial aspects of the transition. This plan needs to encompass how PSCO takes management responsibility for developing and maintaining the physical assets (towers, vaults, generators, roads, fences, etc.) at each location. In addition, PSCO needs to develop and implement the mechanisms by which management responsibility is passed to PSCO.

Objective 6.2 — Assess each location.

Once management responsibility has been passed, PSCO needs to do an extensive assessment of the remote sites and note any deficiencies or gaps with each site. These deficiencies should be prioritized into categories based on the criticality of the deficiency, the likelihood that the deficiency will cause service issues, and the cost to repair the deficiency. Based on this prioritization, a remediation plan should be developed.

Objective 6.3 — Remediate each location.

Based on the remediation plan and the prioritization, PSCO should rapidly execute its remediation plans. Funding for executing the remediation plans will require the development of one or more compelling and defensible cost-benefit proposal(s). By following the process and focusing on the highest-needs sites first, PSCO can successfully manage all of CAPSNET’s remote sites.

CRITICAL SUCCESS FACTORS

Achieving the vision laid out in this strategic plan is dependent on the following critical success factors:

- Active, consistent, executive-level support from the California Technology Agency and key public safety agency executives and CIOs.
- PSCO coordinates CAPSNET planning to enable compatibility with NG9-1-1 development.
- PSCO collaborates with PSRSPC to align the CAPSNET and CAPSCOM strategies.
- Proactive communications to existing and potential customers to market CAPSNET's existing value and expanded capabilities.
- The California Technology Agency successfully and amicably addresses workforce-related issues with all affected stakeholders.
- The California Technology Agency is able to assume management of the remote sites where CAPSNET infrastructure is located, and is able to implement upgrades required to support the CAPSNET modernization.
- The California Technology Agency matures current operational processes and capabilities to support new functions and features — and more customers.
- The California Technology Agency is able to identify one or more additional funding sources that can be used to accelerate the modernization of CAPSNET equipment.

Book 4:

STRATEGIC ROAD MAP

STRATEGIC ROAD MAP

During the next 10 years, PSCO will need to work aggressively to realize its vision. This is shown graphically in Figure 10.

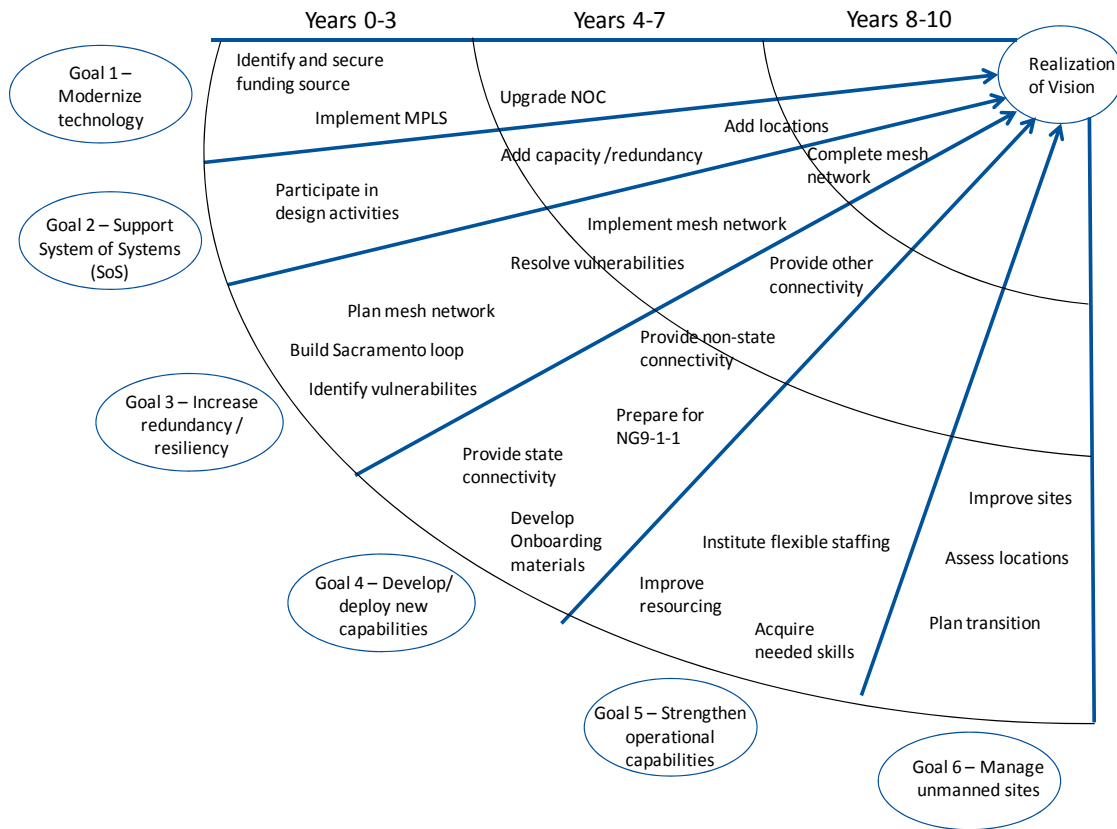


Figure 10 — Road Map

As shown, the next several years will be intense times of change, but this is necessary to achieve the end state that is described in this document. The work will need to be accomplished as follows:

- Years 0–3: In this initial time period, substantial progress needs to be made under each goal.
 - Goal 1 — The California Technology Agency will identify and secure a consistent funding source for the modernization and continued support of CAPSNET. PSCO should start to implement MPLS, a project that is likely to take two to three years to accomplish. It is fair to say that this is the single-most important activity that will need to be performed, since the accomplishment of the vision rests upon this achievement.
 - Goal 2 — Future developments of PSCO’s CAPSNET should be fully collaborated with SoS developments under CAPSCOM. Through collaboration, CAPSNET’s benefit to PSCO’s SoS customers will be maximized, further strengthening its viability to all users.

- ❑ Goal 3 — In this goal, PSCO should start to identify vulnerabilities along the network, with the plan to resolve the most critical of those points during the next three to five years. PSCO should also plan for and begin implementing expansion paths that will enhance CAPSNET’s mesh network capabilities.
- ❑ Goal 4 — PSCO will provide the first level of connectivity to State agencies, but this will likely need to trail the upgrade to MPLS. The faster the MPLS upgrade goes, the faster the provisioning of additional connectivity will occur. In addition, the onboarding materials should be developed.
- ❑ Goal 5 — PSCO should start to work on all of its objectives during this time period, but should recognize that completing all three objectives will take several years.
- ❑ Goal 6 — PSCO should begin to plan the transition to PSCO of primary management of the unmanned remote mountain sites where CAPSNET has presence.
- Years 4–7: In this time period, work is likely to be wrapping up for many of the initial tasks, and this allows the next set of tasks to occur.
 - ❑ Goal 1 — By this time, the MPLS upgrade should be complete and work should start to upgrade the NOC. This upgrade is likely to take two to three years to accomplish.
 - ❑ Goal 2 — Based on the speed of the SoS development, PSCO should begin to add the additional capacity and redundancy that are required for SoS.
 - ❑ Goal 3 — Within this time period, the Sacramento loop build-out should be complete and other critical vulnerabilities should (largely) be rectified. CAPSNET refinements toward establishing a robust mesh network should continue.
 - ❑ Goal 4 — Based on the speed of the NG9-1-1 effort, PSCO should continue to support the NG9-1-1 development as well as begin work to connect to non-State entities.
 - ❑ Goal 5 — By this time period, PSCO should have fully accomplished all the Goal 5 tasks.
 - ❑ Goal 6 — Depending upon the transition timing, the planning is likely to be complete and the location assessments can occur.
- Years 8–10: Most of the tasks should be accomplished, but several remain.
 - ❑ Goal 1 — PSCO should continue to add capacity and redundancy as well as add new locations.
 - ❑ Goal 2 — PSCO should complete within the remaining three-year period the achievable mesh network enhancements originally envisioned.
 - ❑ Goal 3 — PSCO should focus on providing all the expansion connectivity called for in this plan.
 - ❑ Goal 4 — PSCO should wrap up the remediation of the remote mountaintop sites.
 - ❑ Goal 5 — By this time period, PSCO should have fully accomplished all the Goal 5 tasks.
 - ❑ Goal 6 — By this time period, PSCO should have fully accomplished all the Goal 6 tasks.

APPENDICES

APPENDIX A — GLOSSARY

Backhaul — Backhaul is the portion of the network that comprises the links between sites on the core network (e.g. dispatch centers) and remote transceivers at the "edge" of the entire hierarchical network

Caltrans — California Department of Transportation

Cal EMA — California Emergency Management Agency

CAL FIRE — California Department of Forestry and Fire Protection

CAPSCOM — California Public Safety Radio Communications Strategy

CAPSNET — California Public Safety Microwave Network

CDCR — California Department of Corrections and Rehabilitation

CHP — California Highway Patrol

DFG — California Department of Fish and Game

DPR — California Department of Parks and Recreation

DWR — California Department of Water Resources

Microwave — Small but high-powered, high-bandwidth radio waves

Microwave Network — Long daisy-chained series of microwave radio relays

Microwave Radio Relay — A technology for transmitting microwave signals between two locations on a line-of-sight radio path using pairs of directional antennas, which create a fixed radio connection between the two points

MPLS — Multiprotocol Label Switching

NG9-1-1 — Next-Generation 9-1-1 Strategy

NOC — Network Operations Center

OASIS — Cal EMA-provided, satellite-based network

PSCO — The Public Safety Communications Office within the California Technology Agency

SoS — System of Systems: a network of systems interconnected by a communications backbone that allows for communications between systems and the sharing of systems

TDM — Time Division Multiplexing

