

**A REPORT TO THE GOVERNOR**

*ENHANCING CALIFORNIA'S COMPETITIVE  
STRENGTH:*

**A STRATEGY FOR TELECOMMUNICATIONS INFRASTRUCTURE**

**November 1993**

**CALIFORNIA PUBLIC UTILITIES COMMISSION**  
San Francisco, California 94102

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**CALIFORNIA PUBLIC UTILITIES COMMISSION**  
San Francisco, California 94102

**PUBLIC UTILITIES COMMISSION**

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**November 29, 1993**

The Honorable Pete Wilson  
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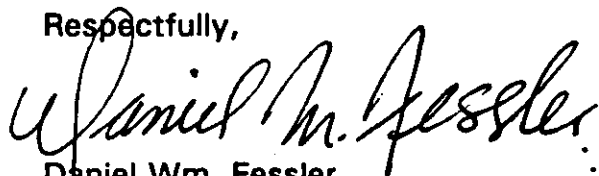
Dear Governor Wilson:

In accordance with your request, my colleagues and I are pleased to submit our proposed vision for California's telecommunications infrastructure. As you recognized when calling on us to undertake this important task, the strength and success of California's economy depend in no small measure on a world-class public telecommunications network. The vision we offer, and the strategy outlined to make that vision a reality, ensure a telecommunications future to revitalize our economy and sustain economic growth.

The benefits are clear: Establishing competitive advantage for California in an increasingly competitive global marketplace; generating new, higher paying jobs for the state's citizens as California expands its role as the next century's center of technological innovation; and, of critical importance, delivering the promise of the Information Age to all Californians.

The goals we propose are ambitious. To achieve them will require cooperation at all levels of government and among the state's many stakeholders. We believe California's consumers of telecommunications products and services expect, and deserve, no less.

Respectfully,



Daniel Wm. Fessler  
President

## **ACKNOWLEDGEMENTS**

This report was written at the request of Governor Pete Wilson. The Commission held a series of three public hearings in which participants offered their valuable perspectives on the evolving needs of the state. Agendas from the public hearings are attached as Appendix 3 of this report. The testimony provided in those hearings, along with written submissions by other parties and extensive staff research and analysis, form the basis for the conclusions and recommendations of this report. We appreciate the contributions of many individuals and organizations who provided useful information or ideas for our critical examination. The participating individuals and organizations are listed in Appendix 2.

This report was prepared under the Commission's direction by the staff of its Division of Strategic Planning. The project team for the report was led by Ernie Ting. Research on existing infrastructure and user applications was coordinated by Bob Lane, with the assistance of Steve Pangarliotas and Rob Wullenjohn. Bill Meyer and Jeff Dasovich also contributed to the analysis of issues. Brad Barnum provided generous assistance with the organization of our Full Panel Hearings. Kitty Smith assisted in the report's compilation, and all work was ultimately overseen by the director of the division, Gigi Coe.

We emphasize that this report is the result of a careful, legislative-style inquiry. Specific recommendations are attached as Appendix 1. Many of the elements of this plan will require formal review by this and other commissions, agencies and departments as well as the legislature before they can be affirmed, modified as appropriate, and given the force of law. The Commission will establish proceedings as soon as possible so this full consideration can begin.

The Commission will continue its work in this vital area, joining with leaders and experts from around the State to follow up on this plan. We invite comments and suggestions on this report. Please direct them to:

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# ENHANCING CALIFORNIA'S COMPETITIVE STRENGTH:

## A Strategy For Telecommunications Infrastructure

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# ENHANCING CALIFORNIA'S COMPETITIVE STRENGTH:

## A Strategy For Telecommunications Infrastructure

### Executive Summary

In his 1993 State of the State address, Governor Pete Wilson called for the state to take full advantage of advanced technologies to "set the stage for a California comeback." Noting the vital role that advanced telecommunications can and must play in restoring and improving the state's economic health, Governor Wilson asked the Public Utilities Commission to develop a comprehensive strategy to promote the development of an advanced public telecommunications network for California:

With this report, the Commission responds to the Governor's request and offers a statewide strategy designed to:

- *Ensure California's competitive advantage in the global economy;*
- *Foster the creation of new, higher-paying jobs for Californians;*
- *Bring the benefits promised by the Information Age to ALL Californians; and,*
- *Continue California's commitment to universal service.*

## **The Vision for California: World Class Services for All Californians**

### ***Leading the Way in Innovation***

Consistent with our state's tradition, we seek to place California at the leading edge of innovation in advanced telecommunications. In our view, such a goal is attainable by leveraging the state's unique competitive strengths, particularly its high-technology and entrepreneurial base. California's large size, sophisticated needs and remarkable diversity position the state to nurture new products and new markets which, in turn, will foster promising new gateways to markets in other states and abroad.

Our vision sees *all* Californians sharing not just in the benefits of today's advanced telecommunications, but in the opportunities and benefits promised by tomorrow's innovation. We envision a telecommunications future in which all Californians enjoy ready and affordable access to, and the opportunity to make productive use of, a wide array of networks which meet *the consumer's individual needs*. Our vision does *not*, nor should it, require individual consumers and businesses to use or benefit from the infrastructure in the same way.

We commend a future in which California's consumers enjoy the opportunity to exploit and benefit from interconnected networks offering the most advanced capabilities available nationally or abroad. We foresee alliances between public institutions and private firms, greatly enhancing the ability of consumers with more modest needs to use high-quality, low-cost telecommunications in new and yet unimagined ways. Building on policies of maximum access and consumer choice, users can make use of contemporary and future advances in telecommunications for an almost limitless array of activities: telecommuting; mobile communications; delivering and receiving essential services; making more efficient use of energy in the home and in business; providing health care; retrieving and sharing a vast wealth of information quickly and cheaply; continuing education in the school and home; personal business management; entertainment; and a host of others.



## The Benefits Are Substantial

Advanced telecommunications offers California the opportunity to gain competitive advantage in the global marketplace. That advantage will strengthen our economy and create tens of thousands of jobs. Expanded use of telecommunications will create new products and services, new businesses, new job opportunities and could increase the productivity of the state's businesses by billions of dollars. These economic benefits will significantly enhance the state and local revenues necessary to deliver vital social and community services.

Many of the benefits will flow beyond the private sector to enrich our educational system; the health care sector; libraries; public safety organizations; and other important institutions. Telecommunications promises to make government more efficient and responsive by doing more with less, by easing access to government programs and services, and by shifting focus toward a more consumer-oriented approach. Equally important, public sector agencies and non-profit organizations can exploit advanced telecommunications to develop new and valuable services that would otherwise not be possible using traditional methods.

Our strategy recommends specific, near-term actions to promote:

- ***Distance Learning*** to allow students anywhere in the state to learn from teachers with specialized expertise via two-way video links to the classroom or the home;
- ***Telecommuting and videoconferencing*** to improve business productivity, ease congestion, and improve the state's air quality;
- ***Remote medical monitoring*** to expand access to, improve the quality, and lower the cost of health care especially to remote areas of the state;
- ***Interactive design and manufacturing techniques*** to enhance industrial productivity and stimulate job and economic growth;
- ***Remote energy management*** services which combine telecommunications and energy technologies to allow energy consumers to better manage their energy bills, and electric utilities and other energy service providers to offer service more efficiently;

- **Multimedia information and entertainment** to allow Californians to participate more fully in our society and enrich their lives.

## **Begin Pursuit of the Vision Today**

Assembly Bill 1289 (Moore), signed into law this year by the Governor, specifically directs this Commission to begin proceedings as soon as practicable to consider an infrastructure strategy for the state.

Californians can begin to enjoy the benefits of our vision within the next year if we commit today the resources necessary to enact the strategy proposed in this report. Fundamental regulatory reform and streamlining represent two of the principal components of our strategy; each promises considerable benefits and proceedings can begin immediately.

Comparably important is the clear message our vision and accompanying infrastructure strategy seeks to convey: *California intends to shape policy with the specific intent of expanding private-sector opportunities within the state for new investment, new businesses, and new jobs.* This report offers recommendations designed to support that message with the actions necessary to help secure California's economic comeback.

Finally, outlined below are additional recommendations intended to further transform regulatory policy by the end of 1996. When enacted, these changes promise to unleash and foster the competitive forces and entrepreneurial energy necessary to accelerate the arrival, sustain the development, and extend the reach of the Information Age for all Californians. As we approach the turn of the century, these steps will lead to still greater benefits by ensuring that advanced telecommunications form an integral part of the state's economy and its society.

## **Principles Guiding the Vision: Innovation, Diversity and Access**

Innovation, diversity and access comprise the foundation on which our proposed strategy is built:

The telecommunications industry is and will continue to be subject to a punishing rate of technological innovation. Recognizing the difficulty of "predicting" futures under these conditions, this Commission rejects an interventionist approach to infrastructure development based on micromanagement or command-and-control regulation.

In testimony provided at public hearings and in material submitted to the Commission, most experts suggested that any attempt by government to mandate a "one-size fits all" approach risks hobbling the state with stranded or inferior facilities. The infrastructure strategy proposed here looks principally to the competitive forces of the marketplace as the driver and minimizes the potential for publicly funded infrastructure to burden California's consumers, and the state's economy, with the costs of uneconomic or obsolete investment.

For this reason, our strategy relies principally on the discipline and capital of private markets and investors to grow the most competitive, high value technologies for California. Recent announcements by Pacific Bell outlining their plan to offer residential video service, and cable companies interest in telecommunications build upon and reinforce this strategy.

This being said, the Commission will not stray from and remains resolute in its paramount obligation to protect the state's consumers of telecommunications services, particularly in those sectors where market forces remain weak or monopoly power persists.

- ***California's telecommunications infrastructure strategy must look beyond simply building technically sophisticated networks and focus as well on the importance of affordable applications, low-cost customer equipment and consumer education and training.***

For many consumers, the dearth of applications and affordable equipment, inadequate knowledge of how to use these applications, and a poor understanding of their value represent major obstacles to the use of advanced telecommunications. We will not overcome these hurdles solely by increasing investment in network technology. Indeed, consumers will reap real *value* from telecommunications when advances occur on all three fronts: 1) Networks

- *Above all, encourage relentless innovation in the ways advanced telecommunications is provided and used in the state.*
- *Support a diverse mix of services and products to meet the widely-varying needs of California businesses, individuals and communities.*
- *Increase affordable access to, and with it the value of, telecommunications with policies which:*
  - Commit to a level of universal service which keeps pace with current and future technological changes in the industry;
  - Require all public networks to be linked to form an integrated infrastructure for California;
  - Encourage applications designed to meet a wide range of individual consumer and business needs;
  - Establish the California Telecommunications Task Force to assist the Commission to devise and implement the means necessary to bring appropriate telecommunication technologies and services to our schools, libraries and community centers.
  - Promote aggressive information sharing and education and training programs designed to reach beyond the technologically rich sectors of our society to the state's disadvantaged populations.

### **Why this Strategy?**

The State's infrastructure strategy must be flexible to endure and adapt to continuous change; must be comprehensive in scope; and must build upon California's inherent strengths.

- *California's telecommunications infrastructure strategy must be flexible enough to survive, and indeed encourage, rapid change in both the types of technologies used and the ways in which consumers choose to use them.*

possessing adequate technical capabilities; 2) applications consumers value; and consumers knowledgeable of the applications and networks available, and 3) how to use them.

Our strategy attempts to bring these elements together to ensure that network investments in California bring high value uses and the attendant benefits to consumers rapidly, rather than result in idle infrastructure.

- ***To best strengthen and sustain its competitive position, California's telecommunications infrastructure strategy must leverage the state's inherent strengths and distinguish itself from other states and nations.***

California must not rely on a strategy whose goal is merely "to do more of what others are doing." California enjoys a rich and distinctive resource base. Accordingly, the state's infrastructure strategy must build on and match those characteristics, for this is the basis on which to establish sustained competitive advantage.

## **Getting the Job Done: Strategic Steps to Fulfill the Promise for California**

Success, and California's economic revitalization, requires cooperation among this Commission, the Governor's office, the California Legislature, individual and business consumers, telecommunications providers and the countless other stakeholders present throughout the state. Consistent with the principles outlined above, we recommend that the California legislature and agencies pursue the following actions. Recommendations directed to this Commission require formal review and consideration before taking effect.

1. **OPEN ALL MARKETS TO COMPETITION AND AGGRESSIVELY STREAMLINE REGULATION TO ACCELERATE THE PACE OF INNOVATION.**
  - Initiate reforms to release firms currently subject to Commission regulation but which lack market power from unnecessary regulatory

burdens restricting competitive innovation. This action would free the vast majority of providers from unproductive regulation.

- Eliminate, within the next three years, all remaining legal barriers to competition for telecommunications services in the state.
- Transform universal service from the current complex system of subsidies built around a monopoly provider to a program which allows a wide range of providers to compete directly to deliver such service.
- Streamline and better focus regulation to protect consumers more effectively from remaining monopoly power and marketing abuses while eliminating unnecessary costs of doing business in the state.

**2. CREATE THE NATION'S LARGEST ALL DIGITAL, VIDEO AND MOBILE MARKETPLACE.**

- Expand basic service to include optional digital access; make such access available to all Californians by January 1, 1997.
- Encourage the development of switched video and mobile access throughout the state by the end of the decade.
- Create a Commission-sponsored industry forum to set minimum quality and compatibility (interoperability) standards for firms offering expanded basic service, and to coordinate with national and international standard-setting organizations.
- To the maximum extent possible, maintain a technology-neutral policy. Emphasize "performance standards" over technology-specific standards to allow telecommunications providers to tailor their use of technology in a manner which best meets their needs.
- Work with the Legislature, the Department of Consumer Affairs, the Attorney General's Office and other appropriate agencies to ensure that fundamental consumer protections are in place.

**3. ENCOURAGE COORDINATION TO ELIMINATE BARRIERS PREVENTING THE USE OF ADVANCED TELECOMMUNICATIONS.**

- Encourage business to create private-public partnerships to help consumers make better use of advanced telecommunications. These partnerships could:
  - a) Make low-cost customer equipment available to different types of consumers;
  - b) Train consumers about the types and value of different applications; and,
  - c) Make network services more easily accessible.

These partnerships should emphasize flexibility, speedy trials and widespread distribution of trial results.

- Establish centers, with joint participation by the State and the private sector, to showcase advanced telecommunications applications of value to business. These centers would serve as an information clearinghouse and demonstrate new services, equipment and applications available from a variety of vendors. Potential users would have the opportunity to test different applications in "hands on" demonstrations, and receive education and training.
- Establish a user forum at the Commission to assess the advanced telecommunications needs of business and community users, and how they may be better met through the state's public infrastructure.

**4. DIRECT ALL STATE AGENCIES TO LEAD BY EXAMPLE.**

- Create an interagency group to examine the potential for making government more efficient through the use of advanced telecommunications. Examples designed to increase public sector efficiency include, but are not limited to, electronic access to public

documents, electronic document filing, and videoconferencing to reduce the costs, including environmental costs, related to travel.

**5. REINVIGORATE CALIFORNIA'S SCHOOLS AND LIBRARY SYSTEMS.**

- **Promote the use of advanced telecommunications by all California primary and secondary students and public libraries through a Schools and Libraries Information Technologies Grant Program providing up to \$150 million annually. The Grant's objective: to provide additional funding for planning, training and equipment to spur statewide development of valuable applications throughout California's K through 12 school and library systems. This modest amount of "seed" investment will foster demand for services and products in the home and in our communities, thus promising to bring the benefits of advanced telecommunications to Californians more rapidly.**
  
- **Establish as soon as feasible the California Telecommunications Task Force consistent with Senate Bill 600 (Rosenthal), signed into law by the Governor in 1993. The task force will assist the Commission to devise and implement the means necessary to bring appropriate telecommunication technologies and services to public institutions such as schools, libraries and community centers. The task force will be comprised of individuals representing communications technology and service providers, schools, libraries and community centers, as well as other pertinent stakeholders.**



CHAPTER I

A Vision for California's  
Telecommunications Future

As we approach the 21st century, our vision for California's telecommunications infrastructure and its use of advanced telecommunications includes four objectives:

1. ***A California in which businesses enjoy heightened productivity by choosing freely from a rich menu of improved telecommunications services and products, ranging from basic telephone service to the most sophisticated high-speed services.***

If achieved, this objective promises to improve California's competitiveness in national and international markets, spur job growth and increase the quality of employment opportunities.

2. ***A California in which consumers enjoy the benefits of greater choice among higher quality, lower cost telecommunications products and services which respond to the diverse demands of the state's growing population.<sup>1</sup>***

The array of tools and information offered by advanced telecommunications promises to empower Californians with the skills and the potential to better their standard of living, and as a consequence, the state's economic position.

3. ***A California in which telecommunications increases access to, and lowers the cost and improves the quality of vital services, such as education and health care, for all.***
  
4. ***A California in which the people of the state, regardless of social or economic circumstances, enjoy ready access to, and knowledge of, the fundamental telecommunications services necessary to participate in the changing social and commercial fabric of the state.***

Our objectives are simple; their achievement is fundamental to California's sustained economic vitality. Success requires that the State work cooperatively with and unleash the private sector to ensure that every Californian is able to access the Information Age. Our examination indicates that California is currently well-positioned to meet that challenge. The strategy we offer here is designed to ensure that California is positioned so that the state's businesses and each of its citizens has the opportunity to realize the substantial benefits of telecommunications as we enter the 21st century.

## **Infrastructure for an Information-Based Economy**

Advanced telecommunications uses computer processing to expand network capabilities. Where conventional telecommunications once carried voices from one location to another, advanced telecommunications now taps the growing power of computing to transmit greater volumes of information over networks, to alter information into a form desirable to consumers, and to store information in enormous data banks.

Computer processing generally involves what is referred to as "digitalization," the translation of audio, video, graphical and text information into the binary language--the so-called "zeros and ones"--of computing. Digitalization is the engine driving the convergence of telecommunications, computing and the media of broadcasting and publishing.

The focus on advanced telecommunications networks by business, government, and community leaders recognizes the dramatically expanded role

electronic communications plays in the way commerce is conducted. California's business community has been among the first to tap the power of modern networks through internal business applications. The growth of sophisticated "electronic highways," over which financial transactions are processed, electronic mail is sent, data bases are shared, cable television is delivered, and cellular telephone services are rendered, will expand to all sectors of society and further transform California's economy. Advanced telecommunications networks promise to play an increasing role in the daily lives of each Californian.

The astounding capabilities of advanced telecommunications technology will permit Californians to share information and ideas instantaneously with businesses and individuals across the country and around the globe. Whether in the form of audio, video, raw or processed data, the power to obtain and convey information quickly and conveniently creates opportunities to develop new services and products hardly imaginable only a few years ago. The capabilities are vast, yet the potential value of their use remains limited since many individuals and organizations have only begun to understand, adjust to and exploit these possibilities. With the ever-expanding array of available applications broadening at a breathtaking rate, it is currently popular to refer to our telecommunications resources in their entirety as a vital and integral part of our economy's "infrastructure."

California will foster and maintain the superior skills required to enhance California's standard of living and quality of life *only* when consumers of all kinds, including businesses, individuals, schools and government, enjoy ready access to information, and when the telecommunications infrastructure is there to support that access.

## **The Benefits of Advanced Telecommunications**

Participants at our full panel hearings generally agreed that the "telecommunications infrastructure is a critical factor in both the economic success and the quality of life of California."<sup>2</sup> John Young, Chair of Smart Valley Inc, and retired CEO of Hewlett Packard told us that the information infrastructure represents an engine for economic competitiveness and job creation. Equally important, Mr. Young noted that telecommunications can help us achieve vital social objectives.<sup>3</sup> A National Telecommunication and Information Administration

(NTIA) investigation of infrastructure policies exhibited a similar enthusiasm about the ability of the telecommunications infrastructure to play a critical role in improving both the welfare of Americans and the competitive position of U.S. business in the global marketplace.<sup>4</sup>

We agree. With respect to California, advanced telecommunications has considerable potential to offer additional significant benefits. Specifically, these products and services can assist to:

- Improve the competitiveness of California businesses;
- Improve the quality, availability and affordability of health-care;
- Improve the quality and lower the cost of education;
- Increase the efficiency, effectiveness and responsiveness of government;
- Reduce traffic congestion and improve air quality; and,
- Bring exciting new opportunities for knowledge, entertainment, and convenience to Californians.

The strategy we offer builds on the basic components of the vision outlined above, with the intent of fostering a telecommunications infrastructure which forms the foundation on which:

- Innovative telecommunications providers located in California, around the country, and abroad invest in and experiment with innovative technologies, bringing with them high-value services, products and jobs to the state.
- Students have electronic access to a wide variety of information, and individuals of all ages enjoy affordable and ready access to schools, teachers and courses from their homes and businesses, thus enabling lifelong learning.

- **Through the use of telecommunications which links home and remote worksites to offices, factories and other places of employment, individuals have the opportunity to choose among a variety of places to live without foregoing opportunities for productive and fulfilling employment.**
- **Commuters see their travelling times shrink or vanish, thereby reducing traffic congestion, improving air quality, and allowing employees more time for family, community and other interests.**
- **Disabled Californians overcome physical barriers and enjoy increasingly productive lives.**
- **Rural and remote consumers, electronically linked to employers, schools, health-care providers, businesses, government agencies and sources of entertainment and information, no longer face the potential limitations brought on by distance from urban centers.**
- **Government agencies exchange information electronically with other agencies, businesses and individuals increasing efficiency, reducing paperwork and improving service.**

**Our vision is ambitious. Yet we believe such ambition is consistent with California's tradition. In the remainder of this report, we consider the specific strategic steps necessary to realize this vision for the state.**



## CHAPTER II

### Principles to Guide the Vision

Billions of dollars are currently spent annually on telecommunications infrastructure in California. We agree that enhancing California's competitive position should be a goal at the core of any telecommunications strategy, particularly to the extent that massive additional investments in telecommunications infrastructure are contemplated. However, we must begin with a clear understanding of the basis on which California can enhance its competitive standing. Only then can we be assured that any steps taken work to California's competitive advantage and do not represent "empty" investments made in times of hopeful enthusiasm. We literally cannot afford policies based on a simple "throw more money at the infrastructure" approach.

We offer three principles designed to guide the development of infrastructure and advanced telecommunications. They arise from the pursuit of competitive advantage, an understanding of the basic features of the advanced telecommunications industry, and clear recognition of California's distinguishing strengths:

1. Foster relentless *innovation* in the delivery and use of advanced telecommunications.
2. Promote *diversity* in the range of choices among services and providers.
3. Ensure affordable, wide-spread *access* to California's public networks and the resources tied to those networks.

**Innovation:** California must reward innovation. We recommend that all state agencies work together to examine state policies which either directly or indirectly affect competitive innovation in telecommunications. As part of their review, agencies should take the steps necessary to: 1) align incentives embodied

in their policies to encourage innovation and facilitate experimentation<sup>5</sup>; 2) remove unnecessary barriers to the introduction of new services and products; and, 3) streamline regulations governing telecommunications products, services and related applications.

**Diversity:** California must foster consumer choice in the market for services and products in order to most effectively meet the diverse demands of California businesses, residences and community institutions. As such, policies should promote an infrastructure characterized by a "network of networks," or, in the words of Francois Bar and Michael Borrus of the University of California Berkeley Roundtable on International Economy (BRIE), a "network portfolio" designed to reduce the overall risk to Californians from the technological and market uncertainties inherent in a changing market for advanced telecommunications.<sup>6</sup> Equally significant, pursuing this strategy will facilitate the broadest and most valuable array of applications for California firms trying to compete in regional, national and international markets.

**Access:** California must encourage providers to make their services and products readily accessible and affordable to the greatest number of consumers in all sectors of society. California must continue to promote universal access to essential telecommunications services and encourage the development of interconnection arrangements to increase the value of all communications networks.

## Sources of Competitive Advantage

There are several key points which must be considered before selecting an infrastructure strategy that will enhance California's competitiveness.<sup>7</sup> These key points include:

- A state gains a competitive advantage when its businesses and other sectors of its economy are *more* productive than the economy of other states. California can gain a competitive advantage in a particular industry by being more productive -- producing goods and services at lower cost or of higher quality -- in that industry.



- When a state has superior productivity, and consequently a competitive advantage, it attracts business and jobs.
- In an industry subject to a high rate of technological and market change such as telecommunications, achieving a competitive advantage is not as significant as retaining it over time. A state can retain a competitive advantage in an industry by innovating *continuously* so it stays ahead of imitators. It can also play to its unique strengths, characteristics that other states cannot readily duplicate.<sup>8</sup>
- In summary, a state gains a competitive advantage over other states, and a nation gains a competitive advantage over other nations, because of differences in its resources compared to other states and nations, and how it takes advantage of these resources to improve productivity.

Michael Porter, a prominent researcher on competitive advantage, articulates a number of principles for government policy in particular:

[C]ompetitive advantage grows out of the capacity ... to improve and innovate relentlessly. Old advantages are eventually duplicated or obsolete .... Policies that convey static, short-term cost advantages but that unconsciously undermine innovation and dynamism represent the most common and most profound error in government policy toward industry. In a desire to help, it is all too easy to adopt policies such as sanctioning joint projects that avoid "wasteful" R&D, or approving mergers that allow efficiencies in corporate overhead but eliminate domestic competition. These sorts of policies, and many others that governments have adopted, usually defer, delay, or eliminate the perceived need to improve and innovate, or send the wrong signals about where to innovate.<sup>9</sup>

These points contain the seeds of the infrastructure strategy the Commission recommends for California. In particular, we emphasize the need for a telecommunications policy to support continuous change and innovation. We

reach this conclusion because the nature of competitive advantage requires it, and even more so given the exceptionally transitory nature of technological advantage in the telecommunications industry.

There is a "chicken and egg" dilemma to developing many advanced telecommunications markets which underscores the need for policies that adapt well to unforeseeable change. Which should come first -- the investment and development, or the demand? Since, by definition, there is no history on which to forecast demand for services which address new markets, investors in advanced telecommunications are often forced to proceed on several fronts with no advance knowledge of which new services will be met with positive consumer reaction. Moreover, the process of convincing business, community and individual consumers of the value from new technological capabilities is a complex and often subtle one where skill at marketing and developing "user-friendly" applications may be more crucial than technological capability.

## **Implications for a California Infrastructure Strategy**

California is the largest, and in many respects, the most diverse state in the Nation. Thirty-five million residents inhabit its one hundred thousand square miles representing some of the most highly-educated, and lamentably, under-educated segments of the population. In addition, California is home to one of the largest immigrant populations in the country. Commerce in California extends from advanced, high technology fields to labor intensive agriculture. The creative energy and cultural diversity of the state's indigenous markets offer fertile ground for growth in the creation and delivery of innovative goods and services, at home and abroad.

By design, the guiding principles we offer accentuate California's inherent strengths. California's immense size and diversity, both of which are positive attributes in the rapidly changing world of telecommunications, also persuade us to counsel against a "command-and-control" telecommunications strategy.

First, command-and-control planning rarely, if ever, works well amidst the immutable market forces of the sort currently underway in telecommunications.

Second, the breadth and scope of central planning and coordination necessary to respond to the immense diversity of consumer demands make this approach far more difficult in California than would be the case in other, more homogeneous states.

Third, command-and-control planning is incompatible with the astounding rate, vast scope and unpredictable nature of technological innovation within the telecommunications industry. The state of the art in telecommunications technologies are evolving so rapidly that recent advances are quickly eclipsed. This presents a hostile environment for conventional command-and-control government planning.

Finally, a command-and-control style telecommunications strategy would put California greatly at odds with the evolving policy direction at the federal level, where the shortcomings of such an approach have been recognized for some time.

By contrast, California's preeminent high-technology base and its entrepreneurial talent place the state in the enviable position of leveraging rapid private sector innovation as an engine of competitive advantage. What is more, California's diversity and growing demand can be to the state's *advantage* if it provides an environment in which in-state firms can nurture new markets well before other states and nations.

In sum, California's strategy must consciously and aggressively parlay its native strengths of diversity and growing demand into competitive advantage. As Porter correctly notes, gaining competitive advantage depends more on differentiating oneself from others, than on merely imitating. Moreover, if California hopes to *sustain* competitive advantage, its strategy must build on the state's many, varied, and unique strengths. The guiding principles discussed above adhere strictly to these notions.



**CHAPTER III**

**Specific Policies to  
Encourage Innovation and Competition**

**Toward Open Markets**

The guiding principles outlined in the previous chapter and the unique characteristics of California call for a vigorously competitive market. It is therefore essential that California's telecommunications-related markets be open to competitive entry. Unnecessary government protection and restrictions dampen the prospects that new products will come to market and that consumers will receive their attendant benefits.

If California is to be known as a state that welcomes and rewards competitive innovation, the state must commit to open markets, without relinquishing its obligation to effectively oversee firms that continue to retain market dominance during the transition, nor without relinquishing its commitment to universal service and consumer protection. Expanding market opportunities will accelerate the development of competitive alternatives even in segments of the market seemingly devoid of entrants at present, thus expanding the range of technologies, products and services available to Californians.

This being said, State policy and the Commission must continue to ensure that all Californians have the basic means of communication traditionally provided by the local telephone company. We address in this report how we intend to achieve that goal. To expand, not simply to preserve existing social benefits, we must secure and sustain the future economic health of the state. Planning today for tomorrow's fully competitive environment will help us do so.

As such, we propose to focus state regulatory oversight of telecommunications service providers on two principal objectives:

- Protect against unreasonable prices or restrictions on access to the networks by firms that continue to dominate local telecommunications markets; and,
- Protect against the potential for fraud and similar abusive practices that accompany a highly competitive market.<sup>10</sup>

While ensuring against abuses, we must simplify the way we regulate firms which still retain sufficient power to dominate the market. We will maintain rate ceilings to ensure consumers seeking access face reasonable prices where competition is absent. We agree with many witnesses at the hearings who indicated that open access to local telephone company networks is critical to the development of California's telecommunications infrastructure.<sup>11</sup> We will therefore continue to develop rules and policies requiring dominant firms to provide open access to other firms who need such access in order to offer services.

With appropriate statutory flexibility in place, the Commission can refocus its regulatory oversight in favor of consumer protection and affordable access to the network. Firms who do not enjoy market power should be free from traditional entry and pricing regulation. Where healthy competition exists, no significant purpose is served by continued government intervention. We believe aggressive streamlining of regulation will lower the cost of doing business in the state and shorten the time required to introduce new services.

In order to foster a fully competitive local telephone market, the Commission must work with federal officials to provide consumers equal access to alternative providers of service. To do so, the industry must overcome technological barriers such as the ability to provide "local number portability" -- the ability to keep your telephone number even if you change local providers.

Expanding market entry, thereby increasing the number of service providers, will undoubtedly pose a challenge to consumers. Achieving the benefits of competition requires effective consumer education programs. Moreover, state and local agencies must work cooperatively to establish programs which protect

consumers from the marketing abuses that may occur in a highly competitive market.

To protect consumers, interagency cooperation should have as its principal focus: 1) to develop disclosure rules necessary for consumers to make intelligent choices among an expanding range of technology and service options; 2) to ferret out unacceptable sales practices; and, 3) to assure that aggrieved consumers have avenues available to seek relief. Government agencies should substitute government intervention with cooperative efforts by enlisting the assistance of consumer groups and industry associations.

Community and industry representatives suggest that the Commission should permit local initiatives designed to test new or different approaches to telecommunications infrastructure development.<sup>12</sup> We believe the notion of designing state policies to preserve local flexibility where possible is reasonable and worth exploring. We urge other state agencies to consider, as appropriate, local flexibility when developing specific policies to implement the overall strategy we propose.

These experimental test zones, or "regulation-free zones," would not be free, however, from the need to protect consumers. Establishing zones would also require substituting new rules for existing ones. As such, a more precise label for these might be "open competition zones." Chief among the restraints to remove are "the regulatory and legal barriers that currently prevent most forms of competition in the local exchange market; "in short, the local telecommunications market."<sup>13</sup>

The effect of the combined proposals in this plan are to make the state of California an "open competition zone," rather than to focus on one region. Yet, in the interest of pursuing the means necessary to ensure the state realizes the benefits of early competitive innovation, we encourage any proposals for "open competition zones." However, the zone proposal requires us to look at many of the same, and some new issues, likely to arise from the permanent and statewide opening of competition we recommend here.<sup>14</sup> We urge proponents to seriously consider the question of whether establishing temporary open competition zones will have advantages over focusing our efforts on establishing a statewide approach.

## **Toward Standards for Integrating Multiple Networks**

We believe a "network of networks" best characterizes the technological vision we seek through a competitive market structure. We arrive at this view from the understanding that, to accommodate different types of providers, some services and providers may connect through a common network, while others will require separate networks for different services. For example, the most effective way to deliver state-of-the-art services to sophisticated users may be through specialized or customized networks. Still other users will not require such specialized networks, yet widespread availability of basic telecommunications capabilities, referred to as "connectivity", is essential.

Assuring broad accessibility to the resources of California's public networks -- our third guiding principle -- is of primary concern where a large number of separate networks may be involved. Many witnesses at the Commission's hearings urged us to direct our attention to the interconnection and interoperability of multiple networks.<sup>15</sup> Our policy will require interconnection and encourage a minimum level of interoperability among all the networks available to the public. We will not impose network-specific standards. However, we will review specific rules to ensure network reliability and security, to ensure the network can be used on a common basis.

Ensuring common carriage prevents firms from denying access or giving preference to affiliates or subsidiaries. However, users' ability to send messages they choose may be limited by technical capabilities of the network, and by applicable laws. Dedicated private networks that distribute a particular firm's information services will not be subject to common carriage requirements since they do not provide the same open conduit for the exchange of information that a public telecommunications network provides.<sup>16</sup>

As the number of service providers increases, the reliability of each network and its ability to interconnect with the public network becomes increasingly important. In addition to the usual service quality standards, we will require each firm participating in the public network to establish plans to reroute service, or direct its customers to alternatives, should its network fail. We will also routinely examine both the integrity of the interconnected public network and the security of information it transmits. To ensure network reliability and security, we will,



wherever feasible, coordinate efforts with national organizations responsible for setting standards.

## **Toward a Progressive Expansion of Basic Service**

Traditionally, basic service has referred to the group of telecommunications services that enjoy special status as essential for all Californians. With legislative guidance such as the Moore Universal Telephone Service Act of 1987, the Commission sets the availability and pricing of basic service to ensure that the greatest number of Californians receive it.

Many participants in our hearings suggested expanding the definition of "basic service." Some proponents of expanding the definition of basic service suggest including some form of basic digital access, such as that provided by Integrated Services Digital Network (ISDN) services, as a basic service. Doing so would provide all Californians with the ability to enjoy multiple phone, fax or other combinations of telecommunications services over a single line to the home.<sup>17</sup>

In the past, some commentators have gone further and advocated the immediate deployment of broadband capabilities, providing very high capacity services to every individual in the state. Proponents of this definition envisioned fiber optic cable transmission facilities to every California home and business at a cost which could approach tens of billions of dollars.

As advanced telecommunications becomes an increasingly integral part of interactions among individuals and businesses within the state, the definition of basic service ought to expand to ensure that all Californians enjoy the opportunity to participate fully in society and none is left behind in technology's wake. We propose to redefine basic service so that it may evolve over time as these expanding needs become more evident.

In so doing, we intend to refrain from specifying a particular technology, or adopting definitions which favor particular service providers however. This approach is consistent with the technology- and provider-neutral approach proposed in our open competition policy. For this reason, we decline to adopt any form of ISDN as part of an expanded basic service definition. Specifying ISDN

would necessarily favor a particular technological design and telephone companies over other innovative firms.

At this time, we also decline to incorporate broadband capabilities into a basic service definition. As we discuss further in Chapters V and VI, most existing applications of advanced telecommunications can be handled without broadband. Further, with recent developments in compression and "digital signal processing"--techniques which offer dramatic gains in the efficiency of transmitting digital signals--it is possible to deliver over existing copper lines many services that previously required new broadband capacity--saving billions of dollars for more cost-effective infrastructure investment. Rather than rely on government-mandated deployment schedule, we favor policies that clear the way for private firms such as telephone companies, cable companies and data network firms to make broadband capabilities available around the state as soon as appropriate technological and marketplace conditions warrant.

We propose a policy toward the expansion of basic service that balances the risk of drawing premature conclusions about the utility of new services with a concern that no segment of California's consumers be left behind in the need for vital telecommunications access. For the time being, we intend to be flexible about the particular level of transmission or processing capacity needed throughout California.

We propose to focus on and establish objectives for the *types* of telecommunications capabilities we wish to encourage throughout California. We specifically propose to establish a policy defining some fundamental level of digital capability that should be made available throughout the state by 1997, and a level of video and mobile capability that should be made available statewide by the end of the decade. These standards can be expanded over time as demand grows and costs decline. Basic capabilities are necessary to allow all consumers to learn by doing. Moreover, consistent with our desire to test possible solutions against real-life situations, a modest initial expansion of the basic service definition will permit us to see what new, useful applications arise from basic digital, video and mobile capabilities.<sup>18</sup>

Observing the initial results of the open market policies we propose will permit us to identify new functions to include in the definition of basic service. This experience will enable us to understand what new uses are, in fact, valuable

to most Californians. Additionally, it will allow us to see where Lifeline assistance or broader subsidies, if necessary, might be required to ensure that all Californians have the opportunity to participate in the new network.

### **A Two-Tiered Basic Service Approach**

Coinciding with the opening of all markets to competition on January 1, 1997, we propose to adopt a new two-tiered approach designed to manage the transition toward a redefinition of basic service. In the first tier, conventional *voice* telephone service would be offered by competing firms. The Commission would continue to oversee prices for first-tier basic service pending the emergence of a fully competitive market in this area.

We propose to add an optional second tier, basic digital access, to the definition of basic service. Since most new telecommunications products and services require digital capabilities, we propose to begin work on defining a common foundation upon which companies can test new telecommunications products and services. With this common digital foundation, we can learn which products and services competing providers voluntarily market, and which among those consumers find sufficiently valuable to purchase.

Specific regulatory treatment of the second tier would evolve. At first, the Commission would work with a consumer/industry forum to develop a common, but technology-neutral, definition of the minimum technical capabilities which should be available throughout California by 1997. Firms would be permitted to charge a separate price for second-tier service as it grows from a service initially used by a small proportion of consumers to a large and vibrant market. We expect to keep prices low by assuring that second-tier service--which is crucial to the interests of many businesses who wish to market new products and services throughout California via digital lines--is immediately open to competition.

As competition for second-tier service among private firms fosters the deployment of basic digital capability around the state, the Commission would monitor deployment and usage patterns. If geographic or other significant gaps occur and persist, we would consider the possibility of offering targeted subsidies to any competing firms willing to close them.

When a major portion of California's individual and business consumers find value in and uses for second-tier service, and digital access has become a common method for doing personal and commercial business, the Commission would also consider expanding Lifeline support to cover second-tier digital service. In this way, California will assure that the state does not slip into a "have and have not" society in vital telecommunications services.

We will encourage competing firms to extend their digital transmission capacity to support multiple channel and two-way video services for all California homes and businesses who choose these services. Telephone companies can use existing technologies, such as Asymmetrical Digital Subscriber Line (ADSL) to provide this multiple-channel, entertainment-quality video capability over existing copper lines, or may elect to deploy combinations of new and existing technologies. Cable network operators can adapt their coaxial cables which currently pass nearly all California homes to do the same. Cellular and other radio networks can also provide basic digital access.

We propose to remain neutral on the question of whether firms providing basic digital access should use networks separate from or combined with other voice, video or mobile networks. In this way, competing firms may use the most cost-effective portion of existing facilities, new technologies or both. However, we will require interconnection among all participating second-tier networks serving the public so that a consumer connected to a second-tier service may reach any other consumer of second-tier service in the state.

In pursuing widespread access to California's public networks, we also intend to address the varied demands of the diverse segments of the public. In particular, we will seek to establish standards for access that do not inadvertently deprive individuals with disabilities access to the Information Age. For example, as some experts have noted, many scenarios of future networks focus on video display capabilities, potentially raising new barriers for visually-impaired Californians.<sup>19</sup> We will expect the consumer/industry forum to address these types of access-related issues at the outset to minimize the need for expensive *ad hoc* solutions later on.

### **The Longer-Term Objective**

We also propose a longer-term objective: *To achieve statewide access by the end of the decade to full-motion switched video and mobile communications capabilities.* We do not propose to include these capabilities within our expanded definition of basic service at this time, but will consider adding them to the transitional second-tier at a future date. These two types of telecommunications capabilities are subject to an enormous amount of technological change. Switched video is not as developed as basic digital access, and mobile capabilities are being fundamentally restructured to account for major changes in radio spectrum availability underway at the federal level.

We therefore plan to pursue this longer-term objective by relying first on our open competition policy, thereby encouraging competing firms to foster the widespread development and use of these advanced technologies in the California market. As we monitor the constant competitive market and technological progress that will swirl around switched video and mobile for the next few years, we will keep them in mind for possible future inclusion in an evolving basic service definition for the 21st century.

### **Toward Competitive Basic Service**

Many policymakers, industry analysts and consumer representatives have reached conclusions similar to ours. We see this in their advocacy of a competitive telecommunications market structure, or in their acknowledgment that competition cannot be forestalled much longer. The hurdle we have yet to leap is how to reconcile the increasingly competitive nature of the industry with the existing system of subsidies to support universal service.<sup>20</sup>

We harbor no illusions that reformulating the current system will be simple; nor do we wish to abandon support for universal service. However, the current system is arcane and complex because of the "bandages" that have been applied over many decades. It is impossible to understand fully how the current system influences innovation and efficiency. The Commission has moved monopoly rates steadily closer to the true cost of service wherever possible without jeopardizing universal service. However, imposing outmoded regulations and unequal burdens on modern telephone companies and their emerging competitors discourages

competitive innovation. Moreover, such treatment may invite high-cost, less competitive firms to enter markets solely because of artificial price umbrellas maintained by hidden subsidies.

Clearly, in the inevitable transition to full competition, nothing should compromise the goal of universal service, including affordably-priced basic service for all Californians. But new means for doing so effectively and efficiently must be explored. Any new mechanism for funding statewide universal service must maintain affordable prices where competition has yet to develop.

The Commission encourages proposals for innovative new ways to fund universal service that do not depend upon maintaining a local telephone monopoly. The Commission will issue a rulemaking to reform the present system of subsidies with the expressed intent of maintaining and advancing universal service amidst a fully competitive environment.

The Commission expects to consider and implement the use of competition to provide universal service as it opens local telephone markets at the end of 1996. By providing strong incentives for efficiency, we expect to significantly reduce the aggregate subsidy required to develop an advanced statewide network, and maintain affordable prices for basic service. A lowered subsidy burden would allow the California economy to operate more efficiently and competitively overall.<sup>21</sup>

To assure affordable basic service and Lifeline service for low-income consumers, the Commission will consider a redesigned subsidy system to become effective on January 1, 1997 in which competing firms would bid the lowest price for which they would be willing to offer service in various areas of the state. Where all bids are above the ceiling price that may be charged for basic service, the lowest bidder would be awarded a multi-year contract which provides a subsidy equal to the difference between the winning bid and the capped price to the public. In instances where one or more bids are at or below the public ceiling price, no subsidy would be necessary.

If technical limitations were to delay equal access for local service, we would not implement all of the bidding elements of the new funding mechanism until a later date. In this event, LECs would continue to be required to offer universal service in their existing territories. Firms that bid to receive any form of

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subsidy would have to comply with closely-monitored minimum standards for interconnection, interoperability, ordering intervals and service quality.

As part of this proposal to use a competitive process to provide universal lifeline service, the Commission intends to propose an Infrastructure Fund, to be used to support universal service for areas which might not otherwise be served. Contributions to this fund would be independent of any individual firm's operations and would provide a unified source of subsidies. The fund could be generated by the proceeds from a small assessment on all telecommunications service providers in the state. Keeping the amount as small as possible in order to minimize the effect on competitiveness, and limiting the aggregate amount of subsidy to no more than that in the current system would be key objectives in structuring such a fund.

### **An Emphasis on Schools and Libraries**

The educational community is well aware that advanced telecommunications can significantly improve the quality of education. The challenge has always been securing adequate funding to ensure that students can benefit fully from these technologies and that teachers receive the training necessary to bring the benefits to students. With advances in digital imaging and computer-based reference materials, libraries will become an increasingly vital part of our educational system. Unless our schools, libraries and homes are adequately linked with each other and to the outside world, the benefits these technological advances offer will go untapped. This Commission strongly embraces Governor Wilson's commitment to providing every student access to both the world's advanced library systems and the state's best teachers. To do so requires a special partnership between schools, libraries, and the private sector. It also requires funding.

To support the use of advanced telecommunications in California's K through 12 schools and public libraries, the Commission recommends creation of a Schools and Libraries Information Technologies Grant Program providing up to \$150 million annually. Its objective: to provide funding for planning, training and equipment. Funding could come from a variety of sources such as issuance of state bonds, a small end user surcharge on all telecommunications services, a direct appropriation of state funds, or some combination. Further consideration is

necessary to determine the appropriate funding source for the program. This modest amount of "seed" investment will foster demand for services and products in the home and in our communities, thus promising to bring the benefits of advanced telecommunications to Californians more rapidly.

With the passage of recent legislation (SB 600), authored by Senator Herschel Rosenthal and signed by the Governor, the Commission will take immediate steps to form the California Telecommunications Task Force. This task force will assist the commission in devising and implementing ways to bring to our schools, libraries and community centers necessary communications technologies and services. This task force will be made up of representatives of telecommunications service providers; representatives of public institutions such as schools, libraries, and community centers; and citizens familiar with the environment in which these technologies will be used.

## CHAPTER IV

# Understanding the Challenge Ahead-- Why a Technology-Specific Path is Unwise

We believe that state policy should not dictate specific technologies to deliver advanced telecommunications, nor select specific firms that will be responsible for infrastructure development. Few things about the future market for telecommunications are predictable, and a more-directive approach to infrastructure development will expose California to unnecessary risks. The overwhelming rate of technological change in telecommunications, the incredible diversity of consumer needs in California, and the fundamental transformation in the way telecommunications will be used in the next century all argue against any central technology or market planning.

## The Unrelenting Pace of Technological Progress

Advanced telecommunications relies on the use of computing technology. As such, it is subject to major technological breakthroughs which can occur at rapid intervals measured in months rather than years. The state of the art in such areas as switching, transmission, compression and digital processing is advancing so rapidly that some "new" technologies never have the chance to mature commercially before they are eclipsed by more innovative, cost-effective technologies.

These conditions make a traditional planning approach a nightmare. With the specter of new technologies becoming overshadowed virtually overnight, and with the basic economics of the industry changing dramatically, multi-year planning is risky even for entrepreneurial firms.<sup>22</sup>

Government planning of telecommunications infrastructure is at an even greater disadvantage, facing at least four potentially fatal burdens. First, public decision-making is inevitably slower than that in the private-sector because of due process requirements. Second, government agencies are not generally able to sustain a state-of-the-art level of technical expertise because of budgetary and personnel constraints. Third, many of the most important innovations will continue to emerge from firms outside the universe familiar to regulators as the lines between the telecommunications, computing, information and entertainment industries continue to blur. Fourth, the *de facto* standardization imposed by a centralized government decision can freeze network innovation, by precluding the incremental and continuous improvement in the state's overall infrastructure that independent decisions made by many different firms can produce.

As one industry representative succinctly expressed it:

If you could today wave a magic wand and decide that instantaneously a new or specific technology would be deployed in the State of California, you should definitely resist that temptation, because it's been proven time and time again that as technology deploys itself further and further, deeper and deeper into markets, it always improves along the way. To make any investment into a single technology now would be to deprive consumers of improved technologies tomorrow.<sup>23</sup>

Simply put, telecommunications infrastructure is a hostile environment for conventional public planning. The astounding rate, vast scope and unpredictable nature of technological innovation strongly suggest that any public strategy which is preoccupied with direct technology planning faces a high probability of failure.

## **A Diverse State With Rapidly Changing Needs**

Another factor which must figure in the choice of an infrastructure strategy is the diversity of the hundreds of thousands of California businesses and tens of millions of California residents.

Telecommunications users range from individuals who have marginal reading and learning skills to the most technologically-sophisticated engineering and

## **The Risks and Rewards of Action**

This combination of technological change, market diversity and discontinuous transformation of the role of information is the environment which faces any government infrastructure strategy in telecommunications. California's telecommunications infrastructure must not only be a tool for change; it must adapt to change itself so it does not become a millstone around the neck of the California economy.

As in the private sector, public officials must understand the degree of uncertainty in this arena -- there are no guarantees for the success of any specific publicly funded infrastructure investments. With this in mind, the Commission decided in 1989 to abandon detailed investment reviews for California's two largest local telephone companies in favor of a regulatory process which encourages company management to invest on their own initiative, and to a certain degree, bear the risk of that investment. While California's infrastructure is being modernized at a pace comparable to that in most other states, we propose that the 1989 reforms be redefined and greatly enlarged to further allow the two largest telephone companies to invest on their own initiative, and to fully bear the risk and rewards of such investments.<sup>29</sup>

scientific research firms. This nation's largest state contains a massive and diverse population. It is also home to the largest high-technology centers in the United States, and contains some of the wealthiest communities in the nation. Its large urban areas are separated by vast rural areas.

Given this heterogeneous group of consumers, the prospect of satisfying the needs of all or even most Californians through a single, integrated network is overwhelming. A participant at the Commission's hearings expressed this sentiment:

Looking at the wide disparity in the number and types of users, the different potential applications they will utilize, the performance and price expectations they will have, leads to the conclusion that their communications requirements will be diverse and that no one technology will be the answer for all their needs.<sup>24</sup>

Such a task is more challenging when one considers the rapidly changing requirements of this diverse population, particularly those who require highly complex transactions which can often exhaust the capabilities of new telecommunications technologies as soon as they become available.<sup>25</sup>

The challenge presented by such diverse and mounting consumer requirements coupled with rapidly changing technologies, makes the prospect of anticipating the future risky at best. As one witness testified, "the new infrastructure will be used in ways that are unknown today. We cannot predict the future."<sup>26</sup>

Since information links nearly every aspect of our lives, the dramatic transformation in the way it can be managed and used can alter the way we lead our lives -- further complicating the challenge of traditional planning. As one expert stated: "(w)e are dealing with a technology involving social and political change on a scale and at a speed never before experienced by human beings."<sup>27</sup> One researcher who testified expressed the difficulty of projecting the future from past experience in telecommunications: "Instead of being well-understood and gradual ... the transformation that we are undergoing today is a drastic and discontinuous one."<sup>28</sup>

## CHAPTER V

# Critical Network Planning Issues

As the market for advanced telecommunications applications and consumer knowledge grows, so too, will California's demand for telecommunications products and services. Network capabilities must expand to meet the increasingly technical requirements of new applications, as well as the demands imposed on the network by a growing number of consumers.

### Demand for Advanced Networks

Experts premised early visions of telecommunications infrastructure on the assumption that new ways of using the network necessarily would require broadband capabilities. The term "broadband" refers to the ability of the network to transmit information at high speeds -- speeds generally made possible through the use of coaxial and fiber cable. While definitions vary, broadband transmission rates generally exceed forty-five million bits (megabits) per second or faster. It takes only sixty-four thousand bits (kilobits) per second of transmission speed to support simple phone conversation.

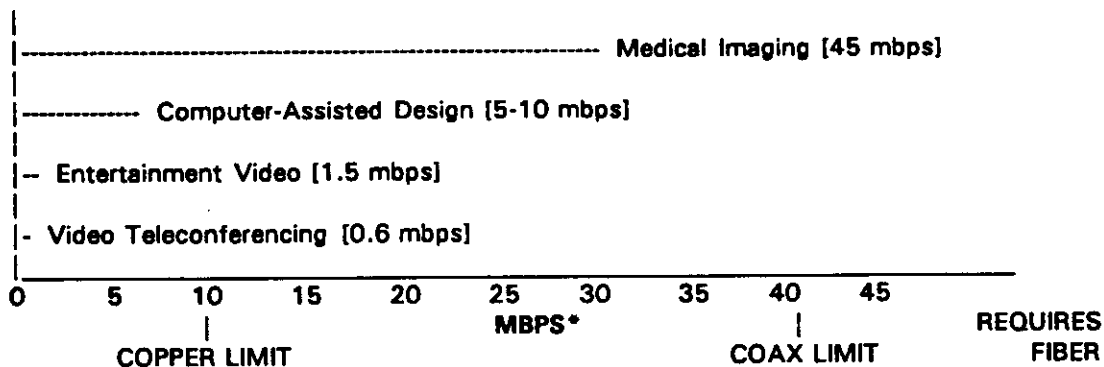
Currently, only highly sophisticated telecommunications applications such as medical imaging or supercomputing require broadband transmission rates. Most emerging applications still do not require broadband speeds. Many applications dependent on a great deal of bandwidth, such as computer-assisted design and medical imaging, involve the transmission of high-resolution, full-motion video. Indeed, these specialized applications can consume as much as forty-five megabits per second.

Using compression technology, most video applications, such as home entertainment video, can be provided over copper wires with approximately 1.5

megabits per second of transmission capacity. Simple video teleconferencing can be provided with only 600 kilobits per second or less of capacity. For example, remote video allowed witnesses from across the country to testify at the Commission's third public hearing. The remote video used required 336 kilobits per second of capacity. This transmission rate is less than one percent of the 45 megabits per second rate, which is identified as the *lower* end of the broadband range.

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Figure 1  
COMPARISON OF REQUIRED TRANSMISSION SPEEDS



\* Note: Coax and copper limits under approximate typical conditions.

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Nevertheless, there are currently specialized uses for broadband technology, and the use of broadband capacity will increase. In fact, the demand for high-speed transmission is steadily increasing. Some companies currently offer 622 megabit per second service; others plan to offer gigabit -- billions of bits per second -- services. Finally, terabit -- trillions of bits per second -- services are on company drawing boards.

## Technological Alternatives

California's current telecommunications infrastructure is currently a "network of networks" in which different consumers use different services requiring different



Most telecommunications industry analysts' views are summed up in this statement by AT&T:

The broad implementation of "fiber to the home" supporting broadband applications for each customer, while it may be a desirable long term objective, is expensive and more than a decade away. However, "fiber to the neighborhood", as a mechanism to aggregate several customers' copper-based access lines, can be more economical for a broad base of customers during the 1990's. In conjunction with this, most consumers and small businesses can get the full value of the information infrastructure with currently-available (and cost-effective) technology based on the embedded copper plant. Such available technology includes Integrated Services Digital Network (ISDN), High-bit-rate Digital Subscriber Line (HDSL) and Asymmetrical Digital Subscriber Line (ADSL).<sup>39</sup>

To this list we can add high bandwidth capabilities of the cable networks. Cable networks, originally designed for one-way video broadcasting, pass ninety-five percent of the households in the nation.<sup>40</sup> It is possible to modify the networks to provide two-way video transmission and switching.

Many experts at the Commission hearings opposed policies designed to force specific technologies.<sup>41</sup> Their arguments focus on the difficulty of planning for an uncertain future. Differences in opinion among some witnesses with respect to specific technologies underscores the risk of endorsing any particular technology and reinforces our conclusion that adopting a technology-specific path is unwise.

For these reasons, and others cited in this report, we do not believe that state policy designed to specifically mandate widespread or ubiquitous deployment of broadband capabilities is required at this time, but may be desirable in the future.

network designs.<sup>30</sup> Some analysts consider such a network to be both reasonable and desirable.<sup>31</sup> The diversity offered in a telecommunications infrastructure composed of multiple networks can minimize the consuming public's risk with uncertain changes in technology and markets. As stated earlier, the Berkeley Roundtable's Francois Bar and Michael Borrus have advanced the notion that "infrastructure should be thought of as a 'portfolio' of networks." They urge us to "...diversify the portfolio with different technologies and foster experimentation."<sup>32</sup> This view is consistent with ours.

A wide variety of experts, including witnesses at the Commission's hearings, suggest that adding to and improving the copper wire network in use today may offer the most cost effective way to improve telecommunications infrastructure. Computing pioneer Mitch Kapor stated, "[T]here is still a lot of life left in the copper plant that provides virtually all of the telephone service in the state."<sup>33</sup> Voice, data and video can all be carried over copper lines already in place, but to accommodate all three requires digitalization to increase the transmission capacity of "old copper."<sup>34</sup>

We can enhance our use of the existing copper network by taking advantage of well-established, narrowband ISDN configurations which extend up to 1.5 mbps of bandwidth. Network operators can also employ alternative technologies, such as Asymmetrical Digital Subscriber Line (ADSL), which is specifically designed to enable copper lines to carry video distribution or two-way video signals.<sup>35</sup> Recently-proposed national standards for ADSL, already deployed in some parts of the country, create four VCR-quality video channels (1.5 megabits each); the standards also create wideband data and voice channels, operating simultaneously over standard copper, each at vastly lower cost than would be the case by installing fiber optic cable.<sup>36</sup> ADSL can also support very high resolution video teleconferencing.<sup>37</sup>

Fiber and copper can also complement one another. Fiber optic cable is already used in the portion of lines closest to local telephone company switches, where network traffic is most concentrated. Fiber investments in the telecommunications network are economically feasible when the signals from hundreds, or even thousands, of individual subscribers have been concentrated. Replacing copper with fiber in this portion of the network will shorten the average length of copper remaining in telephone lines to the subscriber, dramatically increasing the transmission quality and capacity of the remaining copper wire.<sup>38</sup>

## The Debate Over Standardization

Debates over standardization arise whenever the components of a particular system are designed by different providers. When components are linked together to form a communications network, the debate becomes particularly urgent. In telecommunications and computing, both of which are characterized by freewheeling innovation, any standardization can dramatically shape the market and influence the ability of firms to compete successfully.

A government policy decision to impose a product or service standard must be a balancing act, where the freedom of individual firms to pursue different designs is limited to further some public benefit. Generally speaking, we favor a minimum of government intervention into competitive markets in order to spur the most rapid innovation, the greatest efficiency, and the most diversity to respond to differing consumer needs. Standards-setting involves a choice to sacrifice some measure of competitive innovation and diversity, and for that reason we recommend that it be used sparingly and be designed in the least intrusive way possible.

Advocates for standards argue that they yield obvious benefits. For instance, they can rationalize the maze of incompatible communications protocols that can result from extensive niche marketing by different service and equipment vendors. Absent an internetworking standard, consumers in one system may not be able to communicate with others using another. Worse, commands in one system might have wholly unintended meaning in another, leading to potentially catastrophic results. Equipment can convert traffic from one network into the format of another, but this too has a cost. On its face, compatibility problems argue in favor of mandatory standards.

Others favoring standards argue that if today's technological innovation will soon be useless, why not require new networks to operate with existing equipment? This argument favors what is referred to as a "backward compatibility" approach to standards.

But there is a tradeoff. Early official or *de facto* standardization freezes innovation at the point at which standards are adopted, foreclosing potentially superior technologies. In an environment characterized by rapid innovation, it is critical to determine *when* to adopt a standard in order to capture important

competitive benefits. The selection of a standard designates a "winning" design and can, if adhered to, relegate non-standard designs to museum status.

Selecting a state infrastructure technology standard early in the game forces California to pick a single design as the state's "official" entry in the national and international technology competition. As superior technologies later emerge, California may find itself with incompatible equipment or with investments that must be written off.

Premature or excessive standardization can also cripple the incentive for firms to develop new superior networks. Telecommunications providers often *avoid* compatibility with other networks in order to establish clear competitive differences from other firms, or to prevent other firms from "free riding" off their market advantage. To the extent that government does not mandate interconnection standards, firms will be encouraged to develop new networks based on the profits earned by competitive advantage. Firms can maintain competitive advantage to the extent they can prevent less capable firms from drawing on the capabilities of the superior networks.<sup>42</sup>

Backward compatibility requirements will either raise the cost of new approaches to telecommunications by an amount equal to the cost of establishing compatibility "backwards" toward old methods, or discouraging multiple approaches to networking in order to avoid such costs.

We believe these problems can be minimized by observing three principles:

- Consider standards only in cases where there is clear public benefit.
- Focus on standards for those aspects of the network which are indisputably fundamental to the state's economic health and, where the tradeoff between compatibility and innovation weighs clearly in favor of compatibility.
- Use performance standards whenever possible. Standards should be expressed in terms of results desired, *not* the specific way they are achieved.<sup>43</sup>

Standards should be crafted in a way that preserves the ability of firms to retain profits from the value they create. Regulators will need to oversee the interconnection terms of firms who continue to enjoy market dominance.



CHAPTER VI

**Making the Telecommunications Infrastructure  
Work for California**

**California Requires More Than an "Information Superhighway"**

Our ambitious vision for advanced telecommunications sets in motion a sea change in the way California's citizens interact and its businesses operate. To secure the benefits our vision promises requires more than constructing large "information pipelines" throughout the state. We must further ensure that consumers both understand and have access to the tools, or "applications," necessary to exchange and use information carried through these pipes. The importance of this point is heightened by the popular comparison between efforts underway in the 1990s to build a high-speed telecommunications infrastructure, and those undertaken starting in the 1950s to construct interstate highways.

Many have come to label the notion of an advanced telecommunications infrastructure with the title "information superhighway." This despite the fact that the analogy to automotive superhighways belies major differences between the two situations. The major components of modern automotive transportation were developed and in place by the 1950s; Americans were quite familiar with, and many used, cars and trucks; also well developed were networks of local roads' and gas stations were just short of ubiquitous. With these components in place, aggressive government programs to develop superhighways appeared poised to guarantee improved transportation for the public.

The advanced telecommunications industry of the 1990s faces dramatically different circumstances, however.<sup>44</sup> If information represents the modern equivalent of the people and cargo carried over our automotive superhighways, the "cars and trucks" which allow us to package and load information for its electronic journey may represent one of telecommunications weakest links. These "cars and

trucks" of advanced networks include video and data terminals, mobile handsets, the converter boxes and specialized computer boards which ready information for its journey along the highway, **and allow it to be used at its point of destination.** And unlike Americans' familiarity with cars and trucks during the 1950s and 1960s, significantly fewer are currently familiar with the tools of the Information Age.

To make our vision a reality, **each** of the components of our new infrastructure must fall into place: consumers must be equipped with the high technology "cars and trucks" required to use the Information Superhighway's high capacity; consumers must also know how to operate them to journey to the many known, or as yet unexplored destinations, to which the telecommunications highway leads.

We divide the different components of advanced telecommunications infrastructure into three distinct categories:

- Public Network Capabilities;
- Applications, including Customer Equipment; and,
- Consumer Education and Training.

Keeping with the transportation analogy, we use "public network capabilities" to refer to the telecommunications equivalent of the functions performed by public roads. These include the collective capabilities of interconnected networks that are available to the public to move information at low or high speed among different locations in the state. In short, the wires, cables or radio waves that carry information.

By "applications" we refer to the **services** delivered over the network. An example of one such service is an on-demand educational video library. A vendor wishing to market video libraries to schools will need to develop informative and interesting programs, as well as software, enabling consumers to tap the libraries' potential. The customer will require the video terminals and "converter boxes" necessary to receive and view the videos as well as the equipment necessary to gain access to the public network. All of this is in addition to the necessary network capabilities.



Finally, "consumer education and training" refers to the programs and information required to ensure consumers are aware of and know how to use applications. This represents a key component of any advanced infrastructure since without it consumers are unable to tailor services to best meet their specific circumstances and requirements.

Successfully integrating these three components means telecommunications networks must possess the technical capabilities that each application needs to operate; software and customer equipment available to users must combine with raw network capabilities to yield affordable services of value to consumers; consumers must know which applications exist and how to use them. If any of the three components is not ready when it is needed, the value of the infrastructure is diminished.

A significant number of California's consumers do not yet possess the analogous skills and knowledge which ensured the success of the transportation strategy of the 1950s, 60s and 70s. Thus, for our telecommunications infrastructure strategy to succeed for all Californians, we must develop an information superhighway that joins knowledgeable consumers with valuable applications.

## **How the Components of Infrastructure Work Together**

We find that policy discussions over infrastructure are often preoccupied with the subject of advanced network facilities, such as widespread fiber optic cabling. Such preoccupations imply that the public network represents the primary barrier we must overcome in order to achieve the goals we seek. In our view, this emphasis is misplaced.

Information culled at hearings convened by this Commission and other research indicates that a lack of affordable or valuable applications, as opposed to inadequate network capabilities, often limits the potential benefits consumers might otherwise reap. What is more, many cite consumers' lack of familiarity with applications as a primary barrier to the effective use of advanced telecommunications. Indeed, in many cases consumers do not exploit the full potential of the *existing* capabilities of California's public telecommunications networks. Consequently, it appears quite unlikely that a single-minded focus on

the aggressive development of the capabilities of California's public networks will offset inadequacies in applications, or lack of education or training.

The following examples, drawn from education, business, and transportation, help illustrate how the different components work together to create valuable services for California's consumers.

**Distance Learning in Education**

*Distance learning provides one example of how progress needs to be made on all three fronts to fully realize the benefits of this valuable application for California.*

Distance learning links multiple sites electronically so an instructor or group of instructors in one location can teach students in other locations. Distance learning can allow California to create "classrooms" which brings together students with similar needs or interests from across the state or across the nation. For example, a university professor can teach a high-school course in advanced mathematics simultaneously to small numbers of students in inner-city Los Angeles, suburban Cupertino, and rural Alpine County.

Distance learning allows school districts to match the diverse needs of individual students with appropriate educators. In this way, even the smallest school districts can enjoy access to specialized instruction, while large urban districts can better maintain a strong curriculum in the face of stringent budget constraints.

The Alliance for Distance Education in California proposes a balance of networks, applications and user training which is similar to and supports our definition of a successful infrastructure:

There are three essential elements which must be combined to bring educational technology to all of the students of California: first software must be developed and tested which responds to the various learning needs of children and aligns with the state frameworks for instruction; secondly, the infrastructure and hardware must be in place in classrooms so that students may access and utilize the

appropriate software whenever needed; finally, teachers at all levels must be trained to use media to both teach and manage instruction in an environment which is both effective and efficient.<sup>45</sup>

Optimal distance learning significantly diminishes the limitations of geographic distance by making two-way voice, data and video capabilities available in a network that connects the sites where teachers and students find themselves. The demands of distance learning networks can be met with a variety of transmission media such as copper, coaxial, or fiber optic cable or radio. Network capabilities required for distance learning could be provided over the public telephone network, a cable television network, or a private network consisting of satellite transmitters and receiving dishes operated jointly, for example, by universities and local schools.

Distance learning also requires a considerable amount of application-specific equipment at each site such as video cameras, screens, data terminals, associated processing hardware and cabling, and software. Developing this portion of the infrastructure required for distance learning can represent a particularly significant challenge for K-12 schools, since many school buildings are not yet equipped with even basic telephone wiring.

Finally, for our teachers to become effective distance educators requires training. Arguably, providing teachers with the training necessary to use distance learning software and hardware represents the more straightforward challenge. Yet a more subtle challenge focuses on the need to adapt curricula and teaching skills to the decentralized distance learning environment in which interaction and an enormous amount of stored information occurs via an electronic medium.

Successful distance learning simultaneously brings together each of the three components of telecommunications infrastructure--network capabilities, applications and training. Pioneers of such Information Age techniques include private-public partnerships such as the California Educational Technology Program (EdTech Program). The EdTech Program sponsors research and development into technology-based education, instructional support for schools and teachers, and model schools designed to test new teaching approaches.

**Computer-Aided Design and Manufacturing**

*The use of advanced telecommunications for computer-aided design and computer-aided manufacturing in business illustrates how developing improved applications equipment and software represents the key to expanding use of the application.*

Business currently uses computing technology to design, engineer and manufacture many products, including industrial machinery, automobiles and consumer electronics. When combined with high-speed communications networks, this power allows researchers and technicians at different locations to collaborate on computer modelling, simulating the performance of new products, and resolving complex production challenges.

Advanced network capabilities providing high-quality and high-speed transmission are vital to allow users in different locations to share the enormous amounts of data employed in computer-aided design and computer-aided manufacturing (CAD/CAM) applications. The demands on the network increase significantly when several users wish to interact to manipulate complex "three-dimensional" video images simultaneously. On the other hand, since in most instances only a limited number of discrete locations require CAD/CAM these requirements can be met with specialized telecommunications services.<sup>46</sup> Businesses interested in such distributed CAD/CAM applications generally have the ability to obtain such high-speed telecommunications links through a variety of existing public networks or through links currently being deployed in California.

Compared with distance learning directed toward K through 12 instruction, the expansion of distributed CAD/CAM applications in business depends less on improvements in consumer education and training. Consumers of distributed CAD/CAM generally exhibit high levels of technical sophistication and expertise. Thus, while some need for training and adjustment to new capabilities exists, it is less likely to represent the principal barrier to the use of this application.

Efforts to expand distributed CAD/CAM in business focus on both developing CAD/CAM applications and integrating them with design and manufacturing processes.<sup>47</sup> While network capabilities may be available, and users may be willing and interested in exploiting them, considerable complexity

persists in the design of technologies and systems required for businesses to use these tools.

**Telecommuting**

*With respect to telecommuting, maintaining adequate consumer education and training in the face of rapidly developing applications equipment and software appears to be the biggest challenge.*

Telecommuting substitutes travel to and from centralized work sites with telecommunications. Telecommuting allows individuals to work at home or work from remote offices and interact with headquarters via telecommunications.

Telecommuting offers undeniable economic and social benefits for Californians and for California businesses. Telecommuting spares employees the time and frustration of commuting long distances to and from work, thereby increasing job satisfaction and increasing time for other interests and responsibilities. Employers can use telecommuting to reduce costs, improve productivity and to attract and retain skilled workers. Freeways are less congested as a result, reducing the time that even non-telecommuters spend commuting. Of equal importance, telecommuting promises to help improve the state's unenviable air quality and further the state's energy efficiency goals.

Many experts indicated that the primary barrier to telecommuting is not a lack of network or computing capabilities, but rather the adjustment that organizations must make when workers perform their responsibilities away from the offices of supervisors and colleagues.<sup>48</sup> The capabilities of existing public telecommunications networks are "clearly sufficient to support substantial telecommuting activities."<sup>49</sup> Witnesses at the Commission's public hearings testified that "the infrastructure [for telecommuting] is there."<sup>50</sup> One telecommuter has stated that "at the current time, most of the limitation is a lack of imagination with technology."<sup>51</sup> Nevertheless, enhanced network capabilities would surely increase the type and scope of work that could be performed, as well as expand the long-term opportunities for telecommuting.

This being said, employers continue to harbor concerns about supervision, instruction and quality control, which tends to make them reluctant to develop telecommuting programs.<sup>52</sup> One participant in our public hearings asserted that

"the biggest barrier in realizing the benefits of telecommuting was the education of managers."<sup>53</sup> In a review of telecommuting issues, the *Washington Post* noted that "the biggest issue in telecommuting is overcoming the resistance of managers who believe that 'if you can't see someone, they must not be working'".<sup>54</sup>

Still others point to the fact that all tasks are not universally suited to remote locations without substantial redesign of business practices. Finally, telecommuting may diminish certain characteristics of the traditional office environment valued by employers and employees alike, such as interaction among co-workers and socialization of new workers into the organizational culture.

A variety of techniques exist which may help overcome these barriers. For example, telecommuters might work from "telework" centers located near their homes. A telework center provides office space and office and communications equipment nearer to an employee's home than to his or her traditional place of work. An organization might rent space at these centers and allow employees to commute there rather than travel further to a centralized place of business. Telework centers provide additional support, including clerical assistance and information service support, that would not be available at home.

The fact that telework centers can establish high capacity telecommunications links shared by many offers considerable benefits. The introduction of advanced telecommunications, such as high-quality two-way video channels that remain open continuously, may create the sense of physical proximity necessary to overcome managers' and employees' uncertainties and anxieties. Telework centers give telecommuters access to sophisticated telecommunications technologies and services, provide the employees with needed support, and give employees a chance to interact with co-workers.

Thus, the key to expanding telecommuting applications lies in educating executives, managers and employees about the benefits and successful implementation of telecommuting techniques.<sup>55</sup> In addition, current public policies may unintentionally discourage telecommuting. For example, existing tax treatment of in-home offices may discourage investment in telecommuting.

## **Barriers to Infrastructure Development**

Fostering an environment in which consumers enjoy ready access to the information springing from continued advances in planning, research and trials of advanced telecommunications applications represents a major challenge for California. The effective sharing and dissemination of such information promises to help consumers better understand their options and tailor services to meet their specific requirements. Below we identify barriers to the use of advanced telecommunications which we believe merit attention.

### **Network Capabilities**

Though our analysis does not identify the technical capability of California's public telecommunications networks as the dominant barrier, there nevertheless remain certain key issues tied to network capability that merit examination. Since a large number of the emerging applications we envision involve transmitting substantial amounts of digitized information, the success of California's infrastructure will depend in part on making digital telecommunications capabilities widely available at a reasonable cost to consumers.<sup>56</sup>

### **Applications, including Customer Equipment**

In our view, specific applications represent the key component to the success of California's infrastructure. Designing applications which consumers find accessible and affordable is particularly critical. Of comparable importance is the development of affordable, "user-friendly" equipment required to operate applications in homes and businesses. Digital phones, information terminals and other customer equipment often require substantial up-front investment and can act as a barrier to the use of advanced telecommunications. Technological advances, competitive innovation, creative marketing, and public policies as well can help lower this barrier.

### **Consumer Education and Training**

The issues tied to consumer education and training are often subtle but, as illustrated by the examples offered above, attention must be paid to education and training for California's infrastructure to succeed. Consumers' lack of education, in conjunction with issues tied to accessible applications design, often limit the

use of advanced telecommunications. Simply throwing resources at increasing network capabilities does not directly address barriers arising from inadequate education and training, though we recognize that increased market opportunities tied to new network capabilities will increase businesses' incentive to educate consumers.

Enhancing network capability will encourage the development and use of new applications. This in turn will ultimately make more obvious the need to educate the broad range of California business and individual consumers about the extent to which they can benefit from the use of telecommunications-based services and products. Just as with the automotive superhighway, each of the three components of infrastructure we have identified must be developed simultaneously, and it is only by examining each component that we can understand the work that lies ahead.



## APPENDIX 1

### Specific Recommendations

Various elements of this plan require consideration by the Legislature as well as formal review by this and other agencies before they can be initiated or given the force of law. With respect to its tasks, the Commission will establish proceedings as soon as possible so full consideration can begin.

#### Open All Markets to Competition

- Open all telecommunications markets, including local telephone service, to competitive entry by January 1, 1997.
- Support the removal of federal barriers to open competitive entry into telecommunications and information markets in states that have opened all telecommunications markets. In particular, support efforts to lift the federal restrictions on long-distance, manufacturing, and cable programming offerings by California telephone companies at the time the Commission opens the local telephone market to full competitive entry at the end of 1996.
- Support any further reallocations of radio spectrum and the licensing of additional service providers by the Federal Communications Commission for commercial mobile telephone and personal communications services.
- Continue with the implementation of open access rules already underway, until the local telephone market is fully competitive. The rules require the unbundling of monopoly services into component parts to provide an open platform for the development of innovative telecommunications applications.

- Encourage the most cost-effective use of existing infrastructure, moving toward cost-based rates for regulated services, using an incremental cost standard wherever possible.
- Coordinate the Commission's consideration of open competition zones with the statewide policies the Commission is proposing.

### **Promote a Common Statewide Foundation for Advanced Capabilities**

- Propose the adoption of a two-tiered approach to basic service effective January 1, 1997 to permit the transition to an expanded definition over time:
  - The first tier of basic service would include conventional *voice* telephone service and would be offered by competing firms. Prices for first-tier service would be subject to rate ceilings until the market becomes fully competitive.
  - Add an optional second tier of basic service to include basic digital access. Competing firms would be permitted to provide second-tier service and charge a separate price for its delivery.
- Initially, develop a common, but technology-neutral, standard governing the minimum technical capabilities of basic digital access to be made available throughout California by 1997.
- Monitor deployment and usage patterns as competing firms deploy basic digital capability around the state. If geographic or other significant gaps occur and persist, consider the possibility of offering targeted subsidies to any competing firms willing to fill such gaps.
- When a major portion of California's individual and business consumers find value in and use second-tier service, and digital access has become a common method for doing personal and commercial business, consider expanding Lifeline support to cover second-tier digital service.

- Encourage competing firms to extend the digital transmission capacity they offer under basic digital access to support multiple and two-way video distribution channels, among other capabilities.
- Require all providers of first-tier service to be interconnected with all other networks providing first-tier service; require all second-tier service providers to interconnect with all other second-tier service providers, thus enabling a consumer of service on one provider's network to reach any other consumer of the same service in the state.
- Require that basic service providers act as common carriers who may not discriminate as to the content carried over their networks.
- Create a Commission-sponsored industry forum to establish minimum service quality and compatibility ("interoperability") standards for firms offering expanded basic service. The forum should coordinate its efforts with national and international standards-setting bodies to the extent possible. The forum should emphasize a "performance standard" approach and maintain a technology-neutral policy to allow firms to select the most innovative or cost-effective technological design available.
- Consider access-related issues for individuals with disabilities in establishing standards.
- As a longer-term objective, strive to achieve statewide access by the end of the decade to full-motion switched video and mobile communications capabilities. Consider adding these capabilities to the transitional second-tier of basic service at a future time.

**Table 1  
SUMMARY OF ACCESSIBILITY AND AFFORDABILITY POLICIES**

| <b>TARGET DATE</b> | <b>SERVICE LEVEL</b>   | <b>AVAILABLE EVERYWHERE?</b> | <b>LIFELINE SERVICE?</b>  | <b>MAXIMUM RATE CEILING?</b>                                 |
|--------------------|--|------------------------------|---|--|
| <b>Current</b>     | <b>Voice Telephone Service</b>   | <b>YES</b>                   | <b>YES</b>  | <b>YES</b>   |
| <b>1997</b>        | <b>Expanded Basic Service</b>  |                              |   |  |
|                    | <b>FIRST TIER<br/>- voice telephone</b>  | <b>YES</b>                   | <b>YES</b>  | <b>YES</b>   |
|                    | <b>SECOND TIER<br/>- basic digital<br/>incl. low-speed<br/>video</b>                                 | <b>YES, as option</b>        | <b>Not initially,<br/>but to be<br/>considered<br/>after a major<br/>portion of<br/>consumers<br/>subscribe</b> | <b>NO, If<br/>Competitive<br/><br/>YES, If<br/>Monopoly.</b> |
| <b>2000</b>        | <b>Longer-Term<br/>Statewide<br/>Service<br/>- full-motion<br/>switched video<br/>- basic mobile</b> | <b>YES, as option</b>        | <b>To be<br/>considered<br/>later</b>   | <b>NO, If<br/>Competitive<br/><br/>YES, If<br/>Monopoly</b>  |

## **Maintain Effective Consumer Protection**

- Retain simplified, but firm, regulatory control of firms which dominate specific telecommunications markets in the state. Regulatory emphasis should be on protecting captive customers from monopoly practices of dominant firms.
- Cap rates for basic telecommunications services, indexing them to bring down the cost of telephone service for the average Californian. Protect ratepayers from monopoly pricing, while ensuring that they benefit from lower rates achieved through competition where it exists.
- Maintain the Commission's commitment to lifeline service, including low rates for voice telephone service. Continue to refine the lifeline program to further the Commission goal of universal telephone service. Consider reforms to make universal service compatible with a competitive market and multiple basic service providers.
- Work with the Legislature, the Department of Consumer Affairs, the Attorney General's Office and other appropriate agencies to ensure that fundamental consumer protections are in place.

## **Streamline Regulation**

- The Commission should work with the Legislature to develop a level of flexibility in the Public Utilities Code which will permit the Commission to achieve three objectives in conjunction with other public agencies:
  - Encourage free competitive entry and rapid innovation within minimum standards of interconnection and interoperability
  - Oversee the conduct of the relatively few firms which retain market power

- Ensure that consumers have appropriate information on which to make choices and have effective remedies against fraudulent practices.
- Within the new authority granted by the Legislature, the Commission should eliminate elaborate certification requirements and price regulation for firms that wish to enter California's telecommunications markets as new competitors.
- Within the new authority granted by the Legislature, the Commission also should end price regulation of currently-regulated services that face vigorous competition. We estimate that these steps would free the vast majority of firms now regulated by the Commission -- which only offer fully-competitive services --from comprehensive requirements of the Code.
- In lieu of entry and pricing regulation of new competitors and currently-regulated firms with fully-competitive services, the Commission should institute a simple registration program for all providers of telecommunications services which will facilitate the enforcement of minimum interconnection, interoperability, and consumer protection rules.
- Encourage private network operators to offer service to the public under the new registration status. Allowing private networks to make their telecommunications resources available to the public will diversify the options available to users, accelerate competitive innovation, allow for better use of existing telecommunications facilities, and generally improve the flow of information within the state by encouraging more fully interconnected networks.
- Promote a technology-neutral telecommunications infrastructure policy. Allow telecommunications providers in California to make their own investment decisions, including the type of technology employed. The Commission should reconsider its ban on fiber optic deployment beyond the feeder for local telephone companies.
- Reform the Commission's New Regulatory Framework to eliminate the rather small number of remaining incentives which distort investment decisions by making all dominant firms responsible, without limit, for the

profitability of their services and for observing any applicable rate ceilings. Alternatives to accomplish this might include 1) eliminating sharing mechanisms, and 2) removing the cap on earnings.

## **Action for the Legislature and State Agencies**

- Create a statewide program to support coordinated approaches to address the three factors which limit the use of advanced telecommunications:
  - 1) The availability of valuable applications and low-cost customer equipment for different types of users;
  - 2) Education and training of users about the existence and value of valuable applications; and,
  - 3) Availability of network services with necessary technical capabilities. Emphasize flexible approaches, quick implementation of trials, widespread distribution of information about results, and iterative development of solutions.
- Establish working groups, or support existing ones where appropriate, involving users, service providers, equipment and applications vendors, and public agencies to focus on overcoming hurdles to realizing expanded value from advanced telecommunications. Consider different working groups for each major type of application (e.g., telecommuting) or user (e.g., health care) to the extent limiting factors and potential solutions are substantially different. Working groups would pursue further work to pin down specific limiting factors to the use of advanced telecommunications, develop cost-effective approaches to overcoming such limitations, and coordinate applications and equipment development with user education programs and network services development.
- Promote aggressive information sharing and education and training programs designed to reach beyond the technologically rich sectors of our society to the state's disadvantaged populations.

We make the following specific recommendations:

- The Commission should establish a User Forum at the Commission to assess the advanced telecommunications needs of business and community



users, and how they may be better met through the state's public infrastructure.

- The Trade and Commerce Agency should work with the private sector to develop centers to showcase business applications of advanced telecommunications. These centers would demonstrate telecommunications service, equipment, and applications available from the wide range of vendors in the state, providing potential users with the ability try out different applications in "hands on" demonstrations and receive low cost consumer education.
- The state should encourage private/public partnerships between businesses and institution of higher learning to research ways in which advanced telecommunications can be used by California businesses to improve their competitiveness in the global economy.
- The Commission should remove regulations and streamline procedures which frustrate the attempts of California businesses to receive services from telecommunications providers in a timely manner and in a manner that fits their specific needs. The Commission will strive to act quickly where regulatory approval is required.
- The Commission should designate specific personnel at the Commission, familiar with the particular needs of California business, to assist businesses in getting the services they need and having their complaints handled by guiding them though the often complicated regulatory process.
- Consistent in the approach of building strength through diversity, the state should continue its policy of assigning fundamental responsibility for the management of information technology to each individual agency.
- The state should continue efforts to coordinate multi-agency use of telecommunications and information technology through the bodies such as the Multi-Agency Information Management Authority.
- Continue state and local government partnerships with business to explore uses of advanced telecommunications, with an emphasis on government "test sites" for new technology. State government will benefit from the

successful development of such applications and California business will benefit from real world testing opportunities.

- State agencies should work to complete transactions in electronic format via telecommunications services. Public information should be made available in electronic format and be accessible via telecommunications.
- The state should coordinate its effort to acquire funding for networking pilot projects from agencies such as the National Telecommunications and Information Administration. Matching funds may be made available to states, schools, libraries and other non-profit entities so that they can purchase computers and networking connections.
- The state should consider programs to allow government-operated networks to offer commercial service in rural and other areas where service is sub-standard.
- Planners at all levels of government should encourage developers and others to provide advanced telecommunications infrastructure just as it would encourage the proper sewer and transportation infrastructure.
- California, through the coordinated efforts of agencies such as the California Transportation Commission, CalTrans and the Air Resources board should continue and expand efforts to promote telecommuting, including the development of telework centers and the development and demonstration of telecommuting applications. Special emphasis should be on the development of private for-profit tele-work centers.
- California, through the coordinated efforts of the Multi-Agency Information Management Authority, the Department of General Services and CalTrans, should consider, and if cost effective, develop State Government Tele-Work Centers and allow various state agencies to share the facilities and equipment.
- California state government, along with regional and local transportation and air quality agencies, should continue and expand the demonstration of telecommunications technologies that improve air quality, reduce

congestions or otherwise allow for a more efficient and effective transportation system.

- The state, should investigate the effects tax policies have on telecommuting, identifying and seeking to eliminate any bias against investments and expenditures associated with telecommuting.
- The state should coordinate efforts to seek federal monies, such as funds from the Intermodal Surface Transportation Efficiency Act, the National Energy Policy Act and the Federal Technology Reinvestment Program, for development of tele-work centers and other telecommuting solutions.
- The state through the Office of Competitive Technology, should assist with the commercialization of telemedicine applications developed at public hospitals to encourage the development and use of telemedicine applications.
- The Secretary of Health & Welfare should establish a special task force to develop policies to ensure that the health care system in California takes full advantage of advanced telecommunications technologies and the innovative, competitive California telecommunications marketplace of the future. This special task force should work closely with the health care community, and may among other practices, work on development of standards for computer based patient records and electronic benefits payment.
- The UC and CSU systems and the Department of Education should establish curricula for training existing and new teachers with the skills necessary to tap the full potential of advanced telecommunications, especially distance learning.
- Institutions of higher learning should develop partnerships with businesses and local educators to assist K-12 schools to fully use advanced telecommunications technologies. Such a "technology mentor" program would provide training in the use of new learning technologies.
- The state should continue funding for the Education Council for Technology in Learning and actively seek federal funds to supplement the use of

technology in learning. Federal funding may be available from non-education agencies such as the National Telecommunications and Information Agency, which may provide matching grants to schools, and libraries so that they can purchase the computers and networking connections needed for distance learning and for interconnecting with computer networks such as NREN and Internet. The Education and Industry Councils for Technology in Learning can provide valuable resources to schools seeking such funding.

### **Information Technologies Grant Program for Schools and Libraries**

- To promote the use of telecommunications infrastructure in California's K-12 schools and public libraries, the Commission recommends the creation of an Schools and Libraries Information Technologies Grant Program providing up to \$150 million annually.

#### **Major features of the Program:**

- Its objective would be to provide expanded funding for planning, staff development and equipment purchases which will spur statewide development of valuable telecommunications applications in K-12 schools and public libraries.
- Education uses of the funding would be coordinated with the requirements of the Morgan-Farr-Quackenbush Educational Technology Act of 1992 (SB1510, Chapter 1309) and activities under the California Master Plan for Educational Technology.
- The fund would go primarily to support assessments of needs, planning, staff development and coordination of existing resources by local school districts and libraries.
- Funding for network facilities, hardware and software would be made available where such planning and coordination has been completed.

- Schools and libraries requesting funding for facilities would be asked to submit proposals that explain the role of information technologies in their programs, and identify the specific problems that are to be overcome with the additional funding.
- Schools and libraries would be required to provide matching funds to obtain grants for major investments and operating expenses, with the exception of those costs associated with pilot projects.
- Schools and libraries which requested funding for network facilities and other hardware would be asked to consider how their proposed designs would evolve to extend the usefulness of the investments as new technologies emerge.
- Consistent with the "technology neutral" and "provider neutral" policies in this Report, schools and libraries applying for grants would be encouraged to consider any combination of technologies and vendors to best enhance each recipient's education or library program objectives.
- Recognizing that funding could come from a variety of sources, consider funding the program through one or more of the following:
  - Issuance of state bonds;
  - Assessment of a small surcharge on all telecommunications services;
  - State General Fund appropriation; or,
  - Other options may also be considered as they are developed.
- Establish as soon as feasible the California Telecommunications Task Force consistent with Senate Bill 600 (Rosenthal), signed into law by the Governor in 1993. The task force will assist the Commission devise and implement the means necessary to bring appropriate telecommunication technologies and services to public institutions such as schools, libraries and community centers. The task force will be comprised of individuals

representing communication technology and service providers, schools, libraries and community centers, as well as other stakeholders.

**APPENDIX 2**

**List of Participants**

The following list includes the many individuals and organizations that participated in the Commission's study of telecommunications infrastructure issues or provided information for the Commission's research. We apologize for any inadvertent errors in attribution or omissions.

**The ATM Forum**

**AT&T, Richard A. Bromley, Jack Harrington, Ellwood Kerkeslager, David J. Lenehan**

**Alameda County Office of Education, August Scornaienchi**

**Alliance for Community Media, David R. Fertig**

**Alliance for Public Technology**

**Berkeley Roundtable on the International Economy, University of California, Berkeley, Francois Bar**

**British Telecom, North America, Ron Bamburg**

**California Bankers Clearinghouse Association, George Cheng**

**California Cable Television Association, Dale Bennett, Ron Cooper, Alan Gardner, Robert McRann**

**California Cellular Resellers Association, Incorporated, Peter Casciato**

**California Council on Science and Technology -- Project California, Roy Anderson**

**California Department of Consumer Affairs, Richard Elbrecht**

**California Department of Education, William L. Padia**

**California Department of Transportation**

**California Hispanic Chambers of Commerce, Manuel Rosales**

**California ISDN Users Group**

**California Payphone Association, Randy Kuhlmann**

**California Public Utilities Commission, Division of Ratepayer Advocates, Ed Texeira**

**California State Library, Cameron Robertson**

**California State University, Office of the Chancellor, Laura Guillory**

**California State University, Barbara O'Connor**

***Enhancing California's Competitive Strength:***

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California Telephone Association, Barry Ross  
Cellular Carriers Association of California, Stephen Carlson  
Center for Telecommunications Management, University of Southern California,  
Bill Davidson  
Citizens Utilities, Arthur Smithson  
City of the Future Committee, San Diego, John Eger  
City of Los Angeles, Susan Herman  
Clear View Elementary School, Ginger Hovenic  
The CompuMentor Project, John Coate  
Connecticut Department of Public Utility Control  
Consumer Action, Anna Alvarez Boyd  
Consumer Federation of America  
Consumer Research Foundation, Helen E. Nelson  
Cooper, White & Cooper, Alvin Pelavin  
Cox Cable, Robert McRann  
Dole Foods, Ben Zemel  
Economics and Technology, Incorporated, Lee Selwyn  
Educational Telecommunications Network, Patricia H. Cabrera  
Electronic Frontier Foundation, Mitchell Kapur  
Far West Laboratory, John Cradler  
Fight Back! Foundation, Kathie Klass  
First Pacific Networks, Earl Thelen  
GTE California, Incorporated, Barbara Burger, Thomas Sweet  
Genius Incorporated, Byron D. Wagner  
Graham & James, Richard L. Goldberg  
Hesse, Stobbe & Association, Andrew O. Hesse, William R. Stobbe  
Hughes Aircraft Company, George Buchanan  
Industry Council for Technology in Learning, Thomas West  
International Communications Association  
Jet Propulsion Laboratory, James E. Jacobson  
Kaiser Permanente Medical Group, Joseph K. Beaupre  
Korean Youth Center, Bong Hwan Kim  
League of California Cities, Jacki Bachrach, Walter Siembab  
Lincoln High School, Ann M. Quinn  
Los Angeles Community Colleges, Wallace B. Knox  
Los Angeles Metro Transportation Authority, Daniel Wright  
Metropolitan Fiber Systems, Royce Holland, Cindy Schonhaut  
MCI Telecommunications Corporation, Richard Severy



MTRW, Incorporated, Matthew A. Martinez, Mark Thompson  
Montgomery Securities, Paul Evenson  
The Honorable Gwen Moore, Chair, Utilities and Commerce Committee, California  
State Assembly  
Multimedia Development, Tim Boyle  
National Telecommunications and Information Administration, U. S. Department of  
Commerce  
New York Public Service Commission  
A. Michael Noll, University of Southern California  
North Peninsula Neighborhood Service Center Inc., Ortensia Lopez  
Northern Telecom, Incorporated, Ed St. Croix, Kent Hughes, Douglas G. Martin  
Oakland Chamber of Commerce, Robert L. Toney  
Pacific Bell, Lee Camp, Pat Lanthier, John A. Gueldner, Steve Harris  
Pacific Telesis Group, Elliot Maxwell  
Prodigy, George Perry  
RAM Mobile Data, Steve Apicella  
The Honorable Herschel Rosenthal, Chair, Energy and Public Utilities Committee,  
California State Senate  
Roseville Telephone, Greg Gierczak  
Sandia National Laboratories, John C. Crawford  
The San Francisco Hispanic Chamber of Commerce, Carlos A. Quiroz  
San Francisco Multimedia Development Group, Tim Boyle  
San Mateo County Economic Development Association, Denise de Ville  
Self Help for the Elderly, Anni Chung  
Marvin A. Sirbu, Carnegie Mellon University  
Smart Valley, Incorporated, John Young  
Southern California Association of Governments, Mark Pisano  
Sprint Communications Corporation, David E. Scott  
Sun Microsystems, Incorporated, John Gage  
Teleport Communications Group, Michael Morris  
Time Warner Broadcasting, Paul Jones  
Toward Utility Rate Normalization, Regina Costa, Thomas Long  
Utility Consumers Action Network, Michael Shames  
U. S. Office of Technology Assessment, U. S. Congress  
University of San Diego, Privacy Rights Clearinghouse, Beth Givens  
University of San Francisco, Heather Hudson  
Vision por Cable de Mexico, Rubin Alegre Bojorquez  
Whittle Communications, Chanel One, Theresa Devries

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Whittle Communications, Chanel One, Theresa Devries  
World Institute on Disability, Deborah Kaplan

**APPENDIX 3**

**Agendas from Public Hearings  
March - July 1993**

The Commission held a series of three public hearings at which business and community leaders, interested citizens, as well as industry experts from around the country, testified either in person or remotely via video links before a panel of Commissioners.

See the following pages for the complete agendas.

*California Public Utilities Commission*

FULL PANEL HEARING

Current Status of California's  
Telecommunications Infrastructure

April 14, 1993  
San Francisco, California  
Auditorium  
505 Van Ness Avenue  
San Francisco, CA 94102

- I Welcome by President Fessler (8:15)
- II Opening Comments by Commissioners (8:20 - 8:30)
- III Overview (8:30 - 9:00)
  - Dr. Bill Davidson, Center for Telecommunications Management,  
University of Southern California
  - Dean A. Michael Noll, Annenberg School for Communication,  
University of Southern California

IV. Session A (9:00 - 10:10)

*Status of California's Telecommunication Infrastructure Serving Business and Industrial Customers.*

- GTE California: Thomas Sweet, Director Area Planning and Engineering
- Teleport: Michael Morris, Director Regulatory and External Affairs
- 10 Small LECs: Alvin Pelavin, Partner, Cooper, White and Cooper
- MCI: Richard Severy, Director Regulatory and Government Affairs
- BT North America: Ron Bamberg, V.P. Business Development
- RAM Mobile Data: Steve Apicella, Vice President
- First Pacific Networks: Earl Thelen, Vice President and General Manager of the Utility Systems Business Unit

*Topics:*

What is your role in providing telecommunications Infrastructure?  
What infrastructure do you provide and what infrastructure do you utilize?

Discuss how well California's Telecommunications Infrastructure meets the existing needs of California business and industry. Please give specific examples of how existing telecommunications needs are, or are not, being met by the existing telecommunications infrastructure.

Break (15 minutes)

## A STRATEGY FOR TELECOMMUNICATIONS INFRASTRUCTURE

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### V. Session B (10:25 - 11:25)

#### *Status of California's Telecommunications Infrastructure Serving Residential and Small Business Users.*

- Pacific Bell: Lee Camp, Vice President Pacific Bell, CEO Pacific Bell Information Services
- Cable TV Ass.: Mr. Ron Cooper, Senior V.P. Continental Cablevision
- Roseville Telephone: Greg Gierczak-Director Regulatory
- AT&T: Jack Harrington, Regional V.P Network Systems
- Metropolitan Fiber System: Royce Holland, President
- Prodigy: George Perry, Senior V.P. and General Counsel
- Cellular Carriers Association of California: Stephen Carlson, Executive Director

#### *Topics:*

What is your role in providing telecommunications Infrastructure?  
What infrastructure do you provide and what infrastructure do you utilize?

Discuss how well California's Telecommunications Infrastructure meets the existing needs of California residential and small business users. Please give specific examples of how existing telecommunications needs are or are not being met by the existing telecommunications infrastructure.

### VI Session C. (11:25 - 12:25)

#### *Status of California's Telecommunications Infrastructure Serving Special Needs in Education, Health Care, Government and Transportation.*

- Citizens Utilities: Arthur Smithson, President Telecommunications Management Services
- Cable TV Ass.: Robert McRann, Sr. V.P. Cox Cable of San Diego
- Kaiser Permanente Medical Group: Joseph K. Beaupre
- Whittle Communications, Channel One: Theresa Devries, Director of School Relations
- League of California Cities: Jacki Bacharach, Chair League Committee on Telecommuting
- California State Universities: Laura Guillory, Office of the Chancellor

#### *Topics:*

What is your role in providing telecommunications Infrastructure?  
What infrastructure do you provide and what infrastructure do you utilize?

Discuss how California's Telecommunications Infrastructure meets existing, educational, health care, government agency, and

*Enhancing California's Competitive Strength:*

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telecommuting needs. Please give specific examples of how existing telecommunications needs are or are not being met by the existing telecommunications infrastructure.

VII. Commissioner's Concluding Remarks (12:25-12:30)

Before the California Public Utilities Commission  
Second Telecommunications Infrastructure  
Full Panel Hearing

THE EVOLVING TELECOMMUNICATIONS INFRASTRUCTURE  
THE VISION FROM THE USERS PERSPECTIVE

June 1, 1993  
U.S. Ninth Circuit Court of Appeals  
125 South Grand Avenue  
Pasadena, California  
9:30am - 3:30pm

*What capabilities will be needed in the future?  
How will these capabilities be used?  
What benefits will accrue to Californians?*

**I. Commissioner Opening Comments (9:30-9:40)**

**II. Overview: Information Age Visionaries (9:40-10:00)**

TIME WARNER BROADCASTING: Paul Jones, Senior Vice President Corporate  
Development  
AT&T: Ellwood Kerkeslager, Vice-President Technology and Infrastructure

**III. Telecommunications and Critical Community and Public Services (10:00-10:40)**

CITY OF LOS ANGELES: Susan Herman, General Manager Department of  
Telecommunications  
TURN: Regina Costa, Telecommunications Analyst  
SELF-HELP FOR THE ELDERLY: Anni Chung, Executive Director  
WORLD INSTITUTE ON DISABILITY: Deborah Kaplan, Director, Division on  
Technology Policy

**Break (10:40-10:50)**

**IV. Telecommunications and Business Growth and Development (10:50-11:30)**

DOLE FOODS: Ben Zemel, Manager Operations and Telecommunications  
VISION POR CABLE DE MEXICO: Rubin Alegre Bojorquez, Technical Director  
MONTGOMERY SECURITIES: Paul Evenson, Vice President  
CALIFORNIA BANKERS CLEARING HOUSE ASSOCIATION: George Cheng,  
Senior Vice President Bank of America  
CALIFORNIA HISPANIC CHAMBERS OF COMMERCE: Manuel Rosales, Pres.

Enhancing California's Competitive Strength:

V. *Telecommunications and Alternate Providers (11:30-12:10)*

What access to the local network do you need?  
What services will be provided?  
How will the capabilities of Alternate Providers benefit Californians?

MFS COMMUNICATIONS COMPANY, INC.: Royce Holland, President  
CALIFORNIA PAYPHONE ASSOCIATION: Randy Kuhlmann, President Amtel  
Communications

CALIFORNIA CELLULAR RESELLERS ASSOCIATION, INC.: Peter Casciato  
CALIFORNIA CABLE TELEVISION ASSOCIATION: Dale Bennett, Vice  
President and State Manager of TCI Cable vision

PACIFIC BELL: Pat Lanthier, Director Public Policy and Technology

Lunch (12:10 - 1:30)

VI. *Telecommunications and Education (1:30-2:00)*

CLEAR VIEW ELEMENTARY SCHOOL: Ginger Hovenic, Principal

LINCOLN HIGH SCHOOL: Ann Quinn

INDUSTRY EDUCATION COUNCIL OF CALIFORNIA: Thomas West, Asst.  
Vice-Chancellor for Information Resources and Technology for CSU

CALIFORNIA DEPARTMENT OF EDUCATION: William Padia, Director  
Research, Evaluation and Technology Division

VII. *Telecommunications and Transportation (2:00 - 2:25)*

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS: Mark Pisano,  
Executive Director

MTRW, INC.: Mark Thompson, President

LOS ANGELES METRO TRANSPORTATION AUTHORITY: Daniel Wright

Break (2:25-2:35)

VIII. *Scientific and High Tech Industries (2:35 - 2:55)*

JET PROPULSION LABORATORY: James Jacobson, Chief Technologist,  
Advanced Communications

HUGHES AIRCRAFT COMPANY: George Buchanan

IX. *Information Services and Entertainment (2:55 - 3:15)*

CALIFORNIA STATE LIBRARY: Cameron Robertson, Assistant State Librarian

GENIUS INCORPORATED: Bryon D Wagner

MULTIMEDIA DEVELOPMENT: Tim Boyle, Acting Executive Director

X. *Commissioner Closing Comments (3:15-3:30)*



CALIFORNIA PUBLIC UTILITIES COMMISSION

THIRD TELECOMMUNICATIONS INFRASTRUCTURE  
FULL PANEL HEARING

July 1, 1993

State Board of Equalization  
450 N Street,  
Sacramento, California

"HOW SHOULD THE FUTURE INFRASTRUCTURE NEEDS OF  
CALIFORNIA BE MET?"

I. INTRODUCTION (30 minutes) (9:00 - 9:30)

A. OPENING REMARKS BY COMMISSIONERS

President Fessler  
Commissioner Eckert  
Commissioner Shumway  
Commissioner Conlon

B. REMARKS BY INVITED DIGNITARIES

Senator Rosenthal  
Assemblywoman Moore

II. OVERVIEW SPEAKERS (60 minutes) (9:30-10:30)

- Mitchell Kapor: President, Electronic Frontier Foundation [Video link]
- Francois Bar: Program Director, Berkeley Roundtable on the International Economy
- Roy Anderson: Co-Chair, Project California
- Lee Selwyn: President, Economics and Technology, Inc. [Video link]
- John Gage: Director, Science Office, Sun Microsystems Inc.
- Ed St. Croix, Vice-president Business Development, Northern Telecom

*Break* (10:30 - 10:45)

III. ALTERNATIVE VIEWS ON PUBLIC POLICY FOR INFRASTRUCTURE

PANELS:

A. LOCAL TELEPHONE COMPANY PERSPECTIVE  
(50 minutes) (10:45 - 11:35)

*Presenter*

-Lee Camp, President and CEO, Pacific Bell Information Services

*Commenters*

-Lee Selwyn: President, Economics and Technology, Inc.  
[Video link]

-Alan Gardner: Vice President, Regulatory and Legal Affairs,  
California Cable Television Association

-Barbara Burger: Regional Manager Regulatory Affairs,  
GTE- California

-Ed Texeira: Director, Division of Ratepayer Advocates, CPUC

B. CABLE TELEVISION AND WIRELESS PERSPECTIVE  
(50 minutes) (11:35 - 12:25)

*Presenter*

-Robert McRann: Senior Vice President and General Manager,  
Cox Cable San Diego

*Commenters*

-Michael Shames: Executive Director, UCAN [Video link]

-Heather Hudson: Director Telecommunications Program,  
University of San Francisco

-Richard A. Bromley: Vice President, Government Affairs, AT&T

-Elliot Maxwell: Assistant Vice President, Corporate Strategy,  
Pacific Telesis Group

*Lunch Break* (12:25 - 1:30)

*Presentation: Innovations in a Multi-Provider Environment*  
(20 minutes) (1:30-1:50)

-John Young: Chair, Smart Valley Inc. [Video link]

-John Eger: Chair, City of the Future Committee, San Diego  
[Video link]

C. INTEREXCHANGE AND PUBLIC DATA NETWORK PERSPECTIVE  
(45 minutes) (1:50-2:35)

*Presenter*

-David E. Scott: Assistant Vice President, Strategic Planning,  
Sprint Communications Corp.

*Commenters*

-Barbara O'Connor: Director, Institute for the Study of Politics  
and Media, California State University

-Elliot Maxwell: Assistant Vice President, Corporate Strategy,  
Pacific Telesis Group

-Marvin Sirbu: Professor of Engineering and Public Policy,  
Carnegie Mellon University [Video link]

-Thomas Long: Staff Attorney, TURN

*Break (2:35-2:45)*

D. ALTERNATIVE ACCESS PROVIDER PERSPECTIVE (45 minutes)  
(2:45-3:30)

*Presenter*

-Gail Garfield Schwartz: Vice President, Government Affairs,  
Teleport Communications Group

*Commenters*

-Marvin Sirbu: Professor of Engineering and Public Policy,  
Carnegie Mellon University [Video link]

-Anna Alvarez Boyd: Director of Advocacy and Special Projects,  
Consumer Action

-Barry Ross: Executive Vice President,  
California Telephone Association

IV. SUMMARY REMARKS BY COMMISSIONERS (15 minutes) (3:30-3:45)

## Enhancing California's Competitive Strength:

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### *Questions to be addressed:*

1. Do the economics of advanced networks favor building from scratch or adapting existing networks?
2. Should the Commission encourage integrated networks or separate networks for separate purposes?
3. Should the definition of "basic service" be expanded beyond voice capabilities? If so, who should pay and what would be included?
4. Should the Commission expand the definition of universal access beyond network services to include premises equipment affordability, applications availability and user education. If so, who should pay and what would be included?
5. What common carrier obligations should non-traditional network providers have?
6. What, if anything, should the Commission do to facilitate trials of new telecommunications services and information applications?
7. Should the Commission push for interconnection and interoperability standards? How and by whom?
8. If the Commission encourages multiple providers of advanced network services, what alternative funding mechanisms, if any, should be developed to support universal services?
9. If the Commission encourages multiple providers, what steps should it take to lower barriers to competitive entry and innovation?

**APPENDIX 4**

**Assessment of California's Telecommunications Infrastructure Today**

The beginning of Staff's investigation included an evaluation of California's infrastructure in terms the regulated telephone utilities network investments -- measuring technology" deployed compared to other states. The Commission Staff's report, entitled "Staff Background Report, An Assessment of California's Telecommunications Infrastructure Today", found that California's telephone infrastructure is similar to that of other major states in terms of modernization. Contained in the report, the statistical analysis of telephone company networks show that the level of deployment of standard technologies such as digital switching, common channel signalling, Integrated Services Digital Network ("ISDN") capabilities and fiber optic cable in California is typical of those states examined. Furthermore, the plans of California's major telephone companies for the future deployment of technologies are generally similar to the deployment schedules adopted in formal plans of other states.

A shortcoming of this type of comparison of technology deployment by state is that these comparisons are based primarily on technologies used by local telephone companies and ignore innovative networks of alternative service providers. In California, as is the case throughout the nation, a substantial portion of the existing infrastructure is supplied by major networks other than the local telephone network. Video transmission is primarily supplied by cable television networks. The bulk of data services in the state is provided by unregulated public data networks and other providers. Comparisons which only use local telephone company data fail to reflect these major segments of existing infrastructure in each state.

Each of these observations suggest that although a simple cross-state comparison is worthwhile as background, it is of limited value. As we explain in the this report, a great deal of uncertainty exists about the direction and rate of technological innovation and evolution of new services markets. With this basic uncertainty it is not possible to be certain what combination of technologies will be most efficient or most effective at meeting future user needs. Yet a simple comparison of the amount of known technology deployed ignores the growing possibility over time that the technologies being tracked may become inferior to newer technologies.

Finally, and probably most important, simple comparisons of the amount of standard technologies deployed fail to account for differences in the technology *needs* of individual states. These differences may be due to the varying kinds of industries and customers that comprise local markets, as well as the density and distance between major markets. These differences may be particularly significant in evaluating the infrastructure of a state as unique as California. A competitive strategy for the state must be geared to the particular needs of California users, and the particular strengths of California businesses. Copies of the background report can be obtained from the Commission's Division of Strategic Planning, 505 Van Ness Avenue, San Francisco, California 94102.

NOTES

1. As elsewhere in this report, the term "consumers" itself includes individual business users as well as whole organizations and individuals who use products and services to address personal needs.
2. Testimony of Camp, July 1, 1993 public hearing.
3. Testimony of Young, July 1, 1993 public hearing.
4. National Telecommunications and Information Administration, (NTIA) Department of Commerce, NTIA Infrastructure Report: Telecommunications in the Age of Information, October, 1991, p. 21.
5. Francois Bar and Michael Borrus, The Future of Networking, First Draft, Berkeley Roundtable on the International Economy, March 16, 1993. Also, testimony of Anderson, July 1, 1993 public hearing.
6. Ibid, pp. 23-27.
7. One industry analyst has suggested that public policies toward infrastructure may be classified into one of three categories: "prohibit, permit, or promote". These three categories are useful as a way of envisioning a logical progression in which an infrastructure strategy can develop. "Prohibit" policies shape infrastructure by attempting to prevent conflicting private initiatives. "Permit" policies rely on market forces as the primary guiding force for infrastructure development. "Promote" policies attempt to shape infrastructure directly by affirmatively encouraging specific infrastructure.
8. Conversely, good policies for one state may be bad policies in another state. See Porter, Michael, The Competitive Advantage of Nations, The Free Press, 1990, pp. 623-624.
9. Ibid, p. 621.
10. These are the areas of economic regulation we propose. We anticipate the continuation of any necessary environmental health and safety regulation as well.
11. Testimony of Holland, April 14, 1993 public hearing; Kerkeslager, June 1, 1993 public hearing; Kapor, Anderson, Selwyn, Gage, Gardner, McRann, Young, and Schwartz, July 1, 1993 public hearing.
12. Testimony of Eger, July 1, 1993 public hearing.

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12. Testimony of Eger, July 1, 1993 public hearing.
13. Letter from Roy Anderson, Project California, to Commissioner Patricia M. Eckert, August 13, 1993.
14. Some parties conveyed support for the zone concept in written correspondence received by the Commission subsequent to its last public hearing. A greater number of parties expressed significant concern about the zone concept. Such parties included, among others, Teleport Communications Group, the California Cable Television Association, GTE Corporation, MCI Telecommunications Corporation, Sprint, and Prodigy Services Company. Some parties, such as Pacific Bell, expressed qualified support for the zone concept, but suggested that a statewide approach to competition might be preferable.
15. Testimony of Bar, Anderson, Selwyn, Gage, Camp, Gardner, McRann, Bromley, Maxwell, Young, Sirbu, and Schwartz, July 1, 1993 public hearing.
16. Testimony of Kapor, July 1, 1993 public hearing. Also: Computer Systems Policy Project (CSPP), Perspectives on the National Information Infrastructure: CSPP's Vision and Recommendations for Action, January 12, 1993, p. 17.
17. A leading proponent of ISDN capability as a basic level of service has been the Electronic Frontier Foundation (EFF). More recently, EFF has acknowledged the attractiveness of alternate technologies for digital access over copper lines, such as Asymmetrical Digital Subscriber Line (ADSL).
18. Testimony of Kapor, July 1, 1993 public hearing.
19. Testimony of Kaplan and Boyd, June 1, 1993 public hearing.
20. Testimony of Anderson, Gardner, Texeira, Young, Schwartz, Selwyn, and McRann, July 1, 1993 public hearing. Also written submission of the California Department of Consumer Affairs, May 25, 1993. Also the regional Bell companies' An "Infostructure" for All Americans: Creating Economic Growth in the 21st Century, April 1993, and the NTIA Report entitled, The National Information Infrastructure: Agenda for Action, September 1993.
21. Testimony of Sirbu at the July 1, 1993 public hearing, recommending a competitive mechanism for awarding universal service funding.
22. In this environment of rapid change, a traditional utility view of telecommunications infrastructure crumbles. When technologies and the cost of providing service are fairly stable, it is often argued that large "scale economies" favor having a single provider of service -- that is, it is cheaper for a single provider to do all the wiring and switching in a coordinated and bulk fashion than it is to have lots of competitors become small-time



providers, each with substantial overhead and less buying power from vendors. If technologies are changing every couple years so that the overall cost of service is dropping rapidly, a provider of service who waits a relatively short amount of time can have a cost advantage over an earlier provider even if the later competitor has a much smaller piece of the market. With the prevalence of microprocessors, many modern telecommunications technologies have much smaller scale economies.

23. Testimony of Gail Garfield Schwartz, July 1, 1993 public hearing, p.172.
24. Statement of AT&T submitted to the Commission, May 14, 1993.
25. Among these applications are high-performance computing, shared computer-assisted design and engineering, and "virtual reality" multimedia.
26. July 1, 1993 public hearing, p. 27.
27. Eger, John, "Technology Rings Up World", San Diego Union-Tribune, June 14, 1992.
28. July 1, 1993 public hearing, p. 23.
29. The staff background report, developed as part of this infrastructure examination, concludes that California's current telecommunications infrastructure is comparable to that of other major states and states with formal infrastructure plans. Division of Strategic Planning, Staff Background Report: An Assessment of California's Telecommunications Infrastructure Today, California Public Utilities Commission, July 1993.
30. Ibid.
31. Testimony of Francois Bar, Alan Gardner, and Marvin Sirbu, July 1, 1993 public hearing. Also, Bar and Borrus (1993). Also, Sirbu, "Telecommunications Technology and Infrastructure", in the Institute for Information Studies report, A National Information Network: Changing Our Lives in the 21st Century, 1992.
32. Bar and Borrus (1993), and the testimony of Bar at the July 1, 1993 public hearing.
33. Testimony of Kapor, July 1, 1993 public hearing, p. 20.
34. Testimony of Kapor and Gage, July 1, 1993 public hearing.
35. Testimony of Kapor, July 1, 1993 public hearing. Also Shooshan III, Harry, ISDN and The Public Switched Network: Building an "Open Platform", National Economic Research Associates, Inc., (NERA).

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36. Fleming and McLaughlin, "ADSL: The On-Ramp to the Information Highway," Telephony, July 12, 1993.
37. Testimony of Kapor, July 1, 1993 public hearing, p. 20-21.
38. At very short distances within office buildings, copper wires used in data networks can carry 100 mbps of traffic -- well into broadband range.
39. Statement of AT&T submitted to the Commission, May 14, 1993, p. 2.
40. Testimony of Gardner, July 1, 1993 public hearing.
41. Testimony of Young, Scott, O'Connor, and Sirbu, July 1, 1993 public hearing.
42. Milton Mueller, "Universal Service in Telephone History," Telecommunications Policy, July 1993, pp. 352-369. Mueller argues that early competition between Bell and independent networks which were *not* interconnected fueled rapid service penetration in the United States relative to other countries.
43. Testimony of Sirbu, July 1, 1993 public hearing.
44. We only consider one major difference between automotive and telecommunications infrastructure in the discussion. There are a number of other important ones, including the high rate of technology change in telecommunications.
45. See June 30, 1993 letter to CPUC President Fessler, from Tom Mossman, President Alliance for Distance Education in California.
46. As with all infrastructure investments, the benefits of having a particular advanced network capability deployed more ubiquitously must be balanced against the cost of widespread deployment.
47. Computer Systems Policy Project (1993), p. 13.
48. Testimony of Piasano, Martinez, and Write, June 1, 1993 public hearing, pp.129-140. Also testimony of Bacharach, April 14, 1993 public hearing, pp.159-166.
49. NTIA (1991), p. 80.
50. Testimony of Wright, June 1, 1993 public hearing, p. 141-142.
51. Frank Tanaka quoted by Barry Miller "If you were telecommuting you'd be right home now.", Government Technology, July, 1993, p. 48.

- 52.. NTIA (1991), p. 80.
53. Testimony of Bacharach, April 14, 1993 public hearing, p. 162.
54. Spayed, "Increasingly in Area, Home is where the Workplace Is." Washington Post, April 22, 1991, p. A15.
55. June 1, 1993 public hearing, p. 141.
56. Some applications continue to be developed on an analog basis. Voice and broadcast video are naturally analog in format, and some transmission systems for these types of information may continue to be analog for an extended period of time.



## GLOSSARY

**ADSL:** Acronym for Asymmetrical Digital Subscriber Line. Technology that will allow multiple, simultaneous high-speed services to be carried over existing twisted pair, thus dramatically increasing the potential of installed copper networks. Most of the capacity is devoted to distribution of video "downstream" to consumers.

**Audiotex:** A generic term for services that allow consumers to retrieve recorded voice information over the phone.

**Bandwidth:** Bandwidth is a measure of the information carrying capacity of a channel. The more bandwidth a network has, the more information it can carry.

**Basic Rate Interface:** A form of ISDN service that provides the equivalent of two 64 Kbps lines, each capable of carrying a voice conversation or data communications and a third 16 Kbps line capable of transmitting data, thus allowing more information to be carried over existing copper plant.

**Bit:** A binary unit of information that can have either of two values, 0 or 1. The most basic way of storing and transmitting digital information. Contraction of binary digit. Kilobit = one thousand bits; Megabit = one million bits; Gigabit = one billion bits; Terabit = one trillion bits.

**Broadband:** Transmission speeds of 45 Mbps (45,000,000 bits per second) or greater. A single broadband facility of 45 Mbps can carry 672 voice conversations. Some broadband facilities have transmission speeds in the billions of bits per second (gigabits per second of Gbps).

**Connectivity:** Ready availability and usability of telecommunications capabilities.

**Digitalization:** Conversion of analog or continuous signals into a series of ones and zeroes, i.e. into digital format.

**Distance Learning:** Instruction in which the pupil and instructor are in different locations and interact through the use of computer and communications technology.

**Externalities:** Consequences of a purchasing decision that are not considered by the buyer or seller. Negative externalities include environmental pollution that creates costs or disadvantages for people not party to the economic transaction. Positive externalities include general economic benefits resulting from telecommunications services beyond those reflected in the carriers' revenue.

**HDSL:** Acronym for High bit rate Digital Subscriber Line. Like ADSL, HDSL is a technology designed to expand the capability of the installed copper distribution system. However, HDSL is not oriented specifically toward video distribution.

**ISDN:** Integrated Services Digital Network. A switched network design that serves as a flexible pipeline, simultaneously transporting voice, data, and video information.

**Interconnection:** The connection of telephone equipment to the network, also the connection of one carrier with another, i.e. the interface between carriers.

**Internetworking:** The ability for networks to interface with one another, based upon standardization.

**Interoperability:** The condition achieved among communications-electronics systems or equipment when information or services can be exchanged directly between them or their users, or both.

**Lifeline:** Program that assures access to telephone service to every California resident by allowing a discount on monthly bills to eligible low-income subscribers.

**Narrowband:** Transmission speeds of less than 64 kbps.

**POTS:** Acronym for Plain Old Telephone Service; basic telephone service.

**Primary Rate Interface:** A higher capacity form of ISDN. It can provide 23 voice grade (64 kbps) channels and one 16 Kbps channel, allowing a total of 1.5 Mbps transmission capability.

**Protocol:** The rules for communication system operation which must be followed if communication is to be effected; the complete interaction of all possible series of messages across an interface. Protocols may govern portions of a network, types of service, or administrative procedures.

**Telecommuting:** The use of telecommunications as a substitute for travel to and from work.

**Teleconferencing:** A conference between persons linked by a telecommunications system. Can be audio only; can be video one-way and audio the other; can be video both ways.

**Telemedicine:** The application of telecommunications and information resources to the health field to facilitate delivery of medical information to both practitioners and consumers.

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