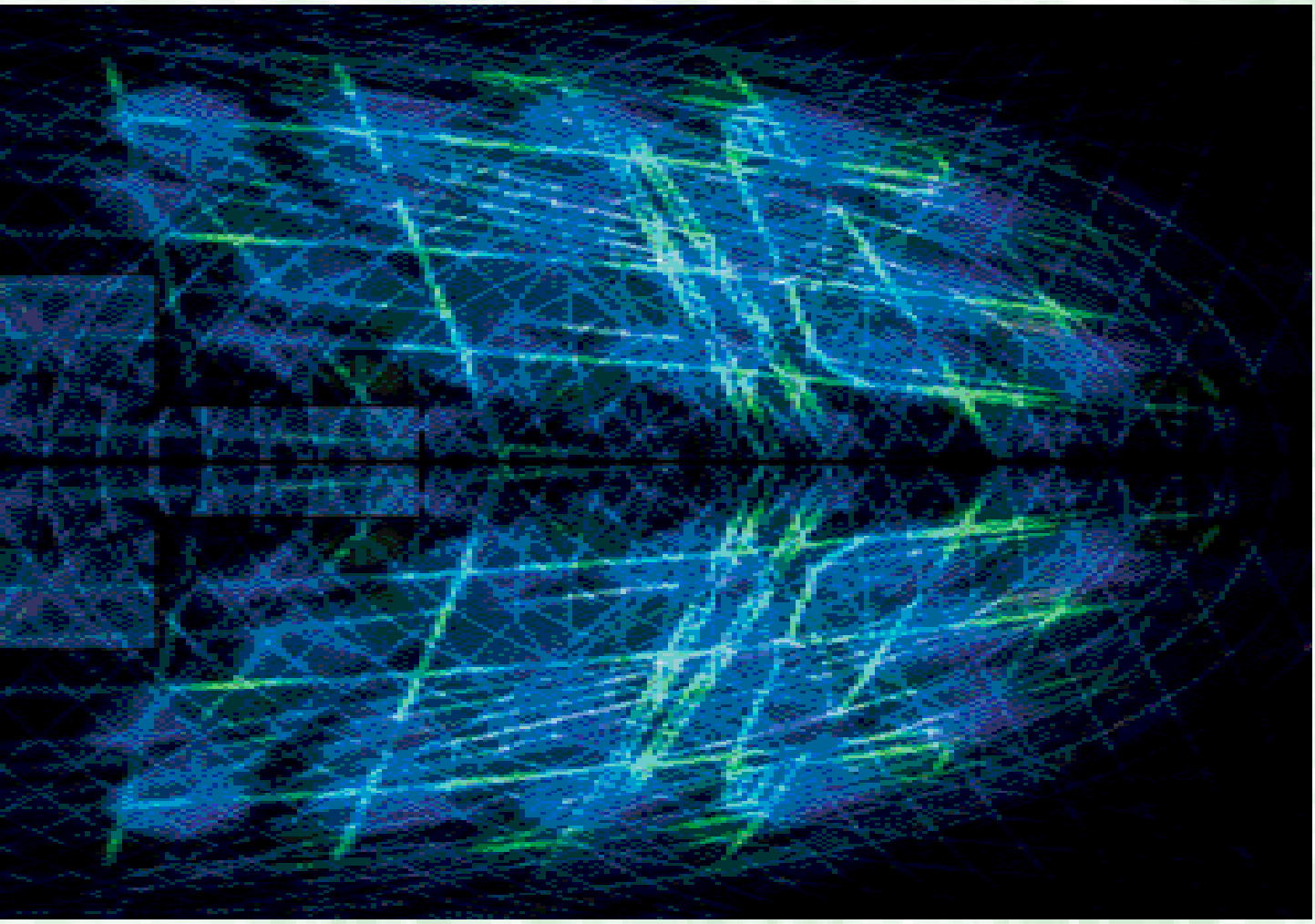
ONE GIGABIT OR BUST™ INITIATIVE

A BROADBAND VISION FOR CALIFORNIA SUMMARY REPORT



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Report Objectives

This report has been commissioned by the Corporation for Education Network Initiatives in California (CENIC). CENIC is a not-for-profit corporation that serves the networking needs of all of California's educational entities, from K–12 to the research universities.

The State of California has awarded a grant to CENIC to focus on speeding one-gigabit broadband to all Californians by 2010, or, in California shorthand, One Gigabit or Bust™. CENIC engaged Gartner to evaluate the economic potential of an acceleration of next generation broadband deployment in California. In addition, Gartner was asked to interview many of the top broadband thinkers, policy makers and consumer advocates within California and throughout the United States with a view toward understanding the opportunities and challenges a next generation broadband initiative in California might face.

The specific objectives of this report are to:

- Estimate the economic benefit to the state
- Scope the project in terms of what needs to be done
- Outline the important items to be considered in strategy formalization
- Identify the next steps to be undertaken

This report summarizes at a high level the results of the economic modeling as well as the key issues that were identified in the interviews and specific recommendations for next steps. We recommend the full report entitled One Gigabit or Bust Initiative—a Broadband Vision for California for those who are looking for more detail. The full report contains specifics from the interviews, which amounted to a wealth of information, gives examples of broadband applications, presents the rationale for the recommendations in this report and covers the details pertaining to the methodology of the economic model.

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Gartner and CENIC thank the CENIC Next Generation Internet Steering Committee members as well as the project interviewees for taking the time to express their opinions and concerns.

CENIC also acknowledges the ongoing support it receives from the California Technology, Trade and Commerce Agency.

Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the State of California.

A Call to Action

Deploying advanced broadband networks is critical for California—and the nation.

California is on the threshold of a multibillion-dollar opportunity. A $376-billion upside in gross state product (GSP) by 2010 is made possible with the implementation of a focused One Gigabit or Bust broadband initiative. Moreover, 2 million new jobs could be created.

One Gigabit is not a technology. It is not a transmission speed. It is not merely high bandwidth. It is not about capacity. One Gigabit is about the capabilities that the capacity makes possible.

Only 20 years ago, the average business desktop to computing device required a mere 9.6 kilobits per second (Kbps) of bandwidth. Today the average business desktop is networked using 100 megabits per second (Mbps)—an exponential increase of 10^5 the power. If we apply a similar increase to the U.S. Federal Communications Commission (FCC) definition of today's broadband at 200 Kbps, we'll require a speed of 20 gigabits within 20 years. Consequently, one gigabit broadband to every education institution, business and home by 2010 is a realistic goal.

Ironically, some of the biggest supporters of next generation broadband could become the greatest obstacles to its deployment. During the report interview process, Gartner repeatedly found conflicts

One Gigabit is not a technology. One Gigabit is about the capabilities that the capacity makes possible.

of objectives among the various parties. Each group is a proponent of next generation broadband deployment, but only on its terms.

Gartner asserts that given key players' duplicity in motives, it will be impossible to deploy ubiquitous next generation broadband without both exceptionally strong leadership and commitment to a common goal.

It is Gartner's recommendation that CENIC's Next Generation Internet (NGI) Roundtable take on the responsibility for bringing together the leaders of broadband initiatives to form a leadership team that will focus on the One Gigabit by 2010 goal and establish an action plan.

The NGI Roundtable should be inclusive: government, private industry, consumer advocates, education and research and service/application providers all are entities that must commit themselves to the task.

California has the most to gain from action and the most to lose from inaction.

Today, high technology, entertainment, biotechnology, agriculture, health care and many more industries call California home. California has the most to gain from action and the most to lose from inaction. Other states and countries will welcome those industries and are taking steps to attract them.

Now is the time to choose California's future.

The Need for a Gigabit

We can't emphasize it enough: Deploying advanced broadband networks is critical for California—and the nation.

From inception, CENIC has encouraged the development of advanced services networks. Having established such networks in university and research environments, CENIC would like to see the general public, schools and businesses experience the rewards of high-bandwidth networks. Invariably the question is posed, What would the public do with one gigabit? Gigabit networks unleash our collective imagination and encourage all manner of what-if scenarios.

The onset of these advanced, communication-rich networks and the multilayered applications that run on them promise to break conventional boundaries and propel our world into a true information age. To reach that next stage, we must overcome a number of barriers, which are technical, financial and social in nature.

Achieving CENIC's vision of One Gigabit or Bust, which increases the functionality and performance of California's wireline and wireless information infrastructure, holds enormous potential for statewide economic growth. One Gigabit or Bust accelerates the pace of innovation and development in California and unleashes unlimited prospects for new and exciting applications. With these stakes in mind, it's important to clarify what One Gigabit is—and what it is not.

One Gigabit is about transforming our personal, professional, and civic lives. It's about giving every person and every home the capacity to be an information producer and information user. When every California home, business and school achieves One Gigabit, then the new, information-centric, constantly connected world will surpass our wildest dreams by improving everyone's quality of life—not just that of the educated or the affluent.[1]

In the interview process, we found that everyone held a different definition of broadband and few said speeds as high as a gigabit were needed. Because of those findings, we assert that one of the initial challenges for this initiative is to define the essential attributes of next generation broadband.

Since most people define broadband by speed—anywhere from 200 Kbps and up—Gartner's recommended definition addresses that element first. By extrapolating from past trends, we believe we can establish a reasonable predictor of future needs. For example, only 20 years ago, the average business desktop to computing device required a mere 9.6 Kbps of bandwidth. Today the average business desktop is networked using 100 Mbps—an exponential increase of 10^5 the power. If we apply a similar increase to the FCC's definition of today's broadband at 200 Kbps, we'll require a speed of 20 gigabits within 20 years. However, it is the uses and content made possible, not the raw speed, that we say support the argument.

The following table shows the incremental content capability made possible as the data rate increases. Compact-disc-quality music requires a full megabit per second—or five times high speed's 200 Kbps. Basic streaming broadcast-quality video requires 1.5 Mbps. Higher-quality video requires even greater bandwidth.

Table 1. Broadband Capabilities

Speed	Functionality
100 Kbps	Fast Internet and e-mail, games, voice
1 Mbps	Music
1.5 Mbps	Broadcast-quality MPEG II video
10 Mbps	One (limited) HDTV channel and two basic channels
50 Mbps	Full HDTV support; off-site computing storage

Source: Gartner Dataquest, June 2002

These are applications we can readily identify today; there will be many more we do not anticipate. For those reasons, in addition to the need to make next generation broadband infrastructure investments lasting and meaningful, we assert that the speed of next generation broadband can realistically be a goal of One Gigabit per household by 2010.

In addition to speed, another next generation broadband essential attribute is symmetry. Because many of these applications will integrate voice and video with data, bandwidth must be equal in both directions.

A $376-Billion Opportunity for California

California is on the threshold of a multibillion-dollar opportunity. A $376-billion upside in gross state product (GSP) and 2 million additional jobs are estimated by 2010 with implementation of the focused One Gigabit or Bust broadband initiative.

- To estimate these benefits, a modeling technique based on the assumption of a positive correlation between the level of broadband penetration in a country or state and that of the gross domestic product per capita (GDPC) in that country or state was used. It is based on a study by the International Telecommunication Union (ITU) that found a basis for a broad correlation between communications—as a means of information diffusion—and the level of GDPC.

The ITU study illustrated that there is a positive correlation between level—or degree of sophistication—of communications and level of economic growth. As long as exchange of information plays an integral role in the economy, we believe the correlation continues as the level of sophistication deployed increases—that is, narrowband versus broadband communications.

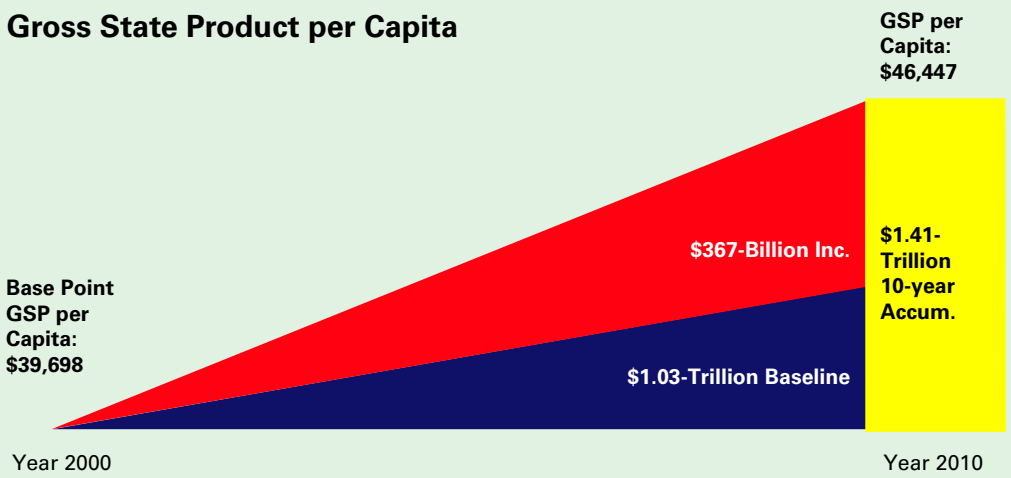
Extending this hypothesis to broadband penetration, the Gartner model results show an increase of $376 billion in incremental GSP over a 10-year period. On a per capita basis, the GSP increases 17 percent from $39,698 in 2000 to $46,447 in 2010. Without increased broadband utilization and associated productivity increases coincident with a broadband initiative, the GSP per capita would grow to $40,947 in 2010—an increase of only 3 percent. Figure 1 illustrates the growth potential as well as a 10-year accumulated GSP of $1.41 trillion.

The ITU study illustrated that there is a positive correlation between level—or degree of sophistication—of communications and level of economic growth.

Figure 2 shows the impact of applying these benefits to the specific industry segments so as to demonstrate the level of employment growth and increased GSP in each industry segment.

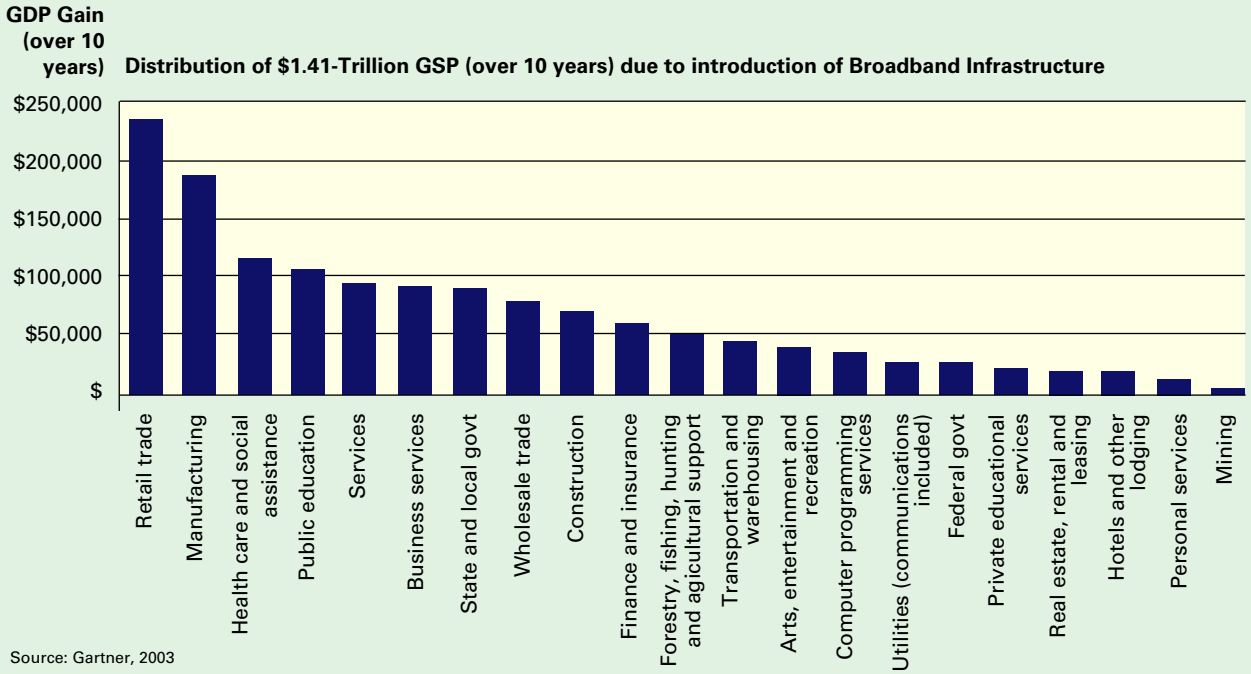
The resulting potential increase in California jobs created by the introduction of an almost ubiquitous broadband infrastructure through this method is estimated to be nearly 2 million over the study period. Figure 3 illustrates the incremental job growth stimulated over the 10-year period by the increase in availability and utilization of broadband applications.

Figure 1. Gross State Product per Capita



Source: Gartner, 2003

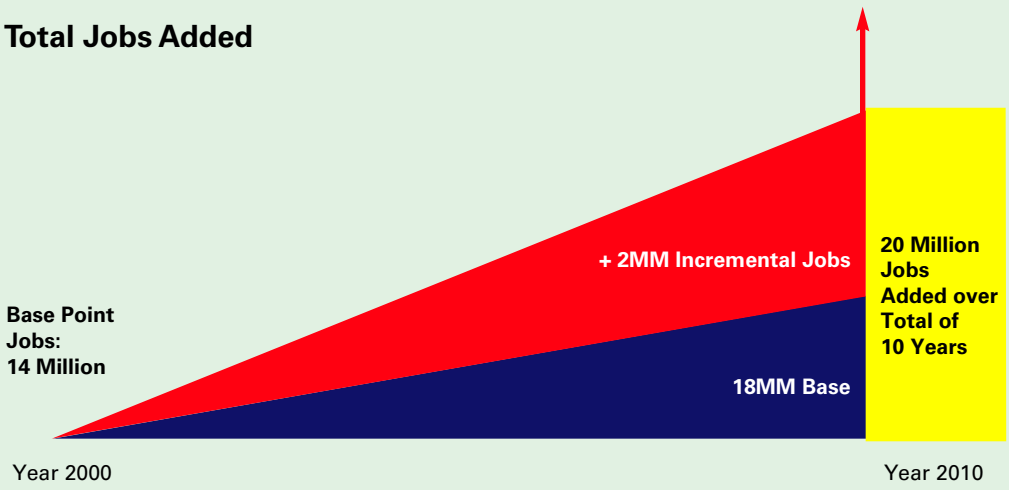
Figure 2. Distribution of Gain in Gross State Product by Industry



Source: Gartner, 2003

To summarize, this analysis corroborates numerous other economic studies that have shown a positive economic impact linked to broadband deployment. Even though it's at the macroeconomic level, this analysis establishes a positive correlation between broadband utilization and positive economic opportunity for the State of California. The benefits in reality may be greater or smaller. As almost every interviewee in this study said, economic studies are important inasmuch as they create a comfort level and point to a direction. However, without an initiative to further develop this opportunity, California will lose its competitive edge in comparison to other regions in the United States and globally that are taking positive action now.

Figure 3. Total Jobs Added



Source: Gartner, 2003

Dichotomy of Interests

Ironically, some of the biggest supporters of next generation broadband could become the greatest obstacles to its deployment. During our interviews, we repeatedly found conflicts of objectives among the various parties. Each group is a proponent of next generation broadband deployment, but only on its terms. Gartner asserts that given key players' duplicity in motives, it will be impossible to deploy ubiquitous next generation broadband without exceptionally strong leadership as well as commitment to a common goal. The Taxonomy of Agendas table that follows represents the potential outcomes absent and with a broadband initiative.

Taxonomy of Agendas

Group	Agenda	Outcome with No Broadband Focus	Outcome with Focus
Service Providers	Both cable and telcos want change only in the context of current business models and some use regulation as an excuse or delaying tactic. Both cable and telcos are struggling with changes to their business models and competition from alternate providers and technologies.	Communications providers will continue using the regulatory environment as a means of delaying drastic changes to investment strategies and business models. Both Internet-protocol-based networks and fiber to the user threaten cable and telcos' business models.	Will be challenged to participate in the next-generation network planning and deployment or face being excluded.
State Legislators	Have the willingness to advance a popular broadband agenda, but many may not understand what broadband is or what it means. They may lack the technical knowledge to create a long-term vision. Legislation is often reactionary to a perceived need.	Will continue advocating legislation that promotes clearly defined, narrowly focused and short-term agendas. They'll avoid legislation that requires funding or revenue reduction. They'll struggle to understand the implications of technology.	Will take advantage of a defined vision and will focus legislation to contribute to the vision, as needed.
State Regulators	View that they've dealt with broadband in previous proceedings. They're concerned about the utility—and are focused on identifying the cost versus the benefits.	Will continue focusing on enforcement of existing regulatory frameworks and on actions that fit within the context of current state regulatory norms. Absent specific legislative direction at the state level, will not address next-generation broadband.	Will welcome a vision to focus their regulatory agenda. A collaborative vision would eliminate contention and the protracted nature that many regulatory proceedings experience today.
Consumer Advocates	Understand that their constituents may not recognize the specific value of these issues. They say that broadband access is not a luxury and providers overstate costs.	Will continue struggling to educate constituents and policy makers. Services for constituents will continue to be viewed as discretionary and as a result, will not address the specific needs of these user communities.	Will focus on educating about the benefits of the defined vision, knowing their constituents will pay for perceived value. Will seek assistance to bridge the gaps and will be involved in R&D.
Economic Development Groups	Face an uphill battle—especially outside the first-tier markets—getting providers to invest. Must deal with issues beyond the technology itself such as technical literacy.	Will compete with other regions for state and corporate support. Success will be limited to the attractiveness of the market and the determination of local leaders. Experience gained may or may not be shared with others.	A focused broadband vision would promote collaboration, leading to an improved mechanism for success.

Taxonomy of Agendas (cont'd)

Group	Agenda	Outcome with No Broadband Focus	Outcome with Focus
Municipalities	Are frustrated and view broadband as an economic development necessity and are looking for ways to protect existing revenues and create new revenue sources. Some are taking matters into their own hands.	Will continue trying to address problems locally without an integrated plan or vision of what is possible. Many will attempt to develop their own networks and will fail, damaging the credibility of municipal actions.	Will allow for a collaborative process among municipalities utilizing best practices to meet common interests. Will lead to focused policies.
Academics & Technologists	Are living with technology and understand the future opportunity in terms of technological change. Their view is often too visionary for the short-term planning horizon of both policy makers and service providers.	Will continue exploring opportunities and applications. Funding will continue to follow the bust-and-boom cycles of the economy. Implementation of outcomes will be predicated on market pull.	Efforts will be more focused as well as more broadly and consistently supported.
Content Providers	Are happy with their current controlled distribution mediums and view broadband as another threat to their control over intellectual property.	Will continue using regulation and the courts to protect their current business models.	Will change the business models to take advantage of the new applications and services that will result from ubiquity.
Consumers & Small Businesses	Are looking for quality services at affordable rates.	Will continue to be left behind as content and service providers cater to higher-volume, cheaper-to-serve, greater-margin customers.	Will expand the number of consumers and businesses that enjoy the benefits of new services and a competitive market.

Other Key Report Findings

- California has been a world leader in the deployment of today's broadband technology. However, countries that California competes with today such as Canada, China, Japan, and South Korea are beginning to deploy 100–1,000 times faster next-generation broadband in order to strengthen their competitive position.
- Although the broad range of interviewees all favored ubiquitous deployment of broadband, there was no common definition of broadband in terms of speed or characteristics. Based on a review of the utilization of ever-increasing bandwidth over the past two decades, Gartner agrees that One Gigabit is a realistic goal for a ubiquitous next-generation broadband in 2010.
- There is no single, so-called killer application to justify the One Gigabit target. However, today's broadband applications in business, education, health care, and entertainment coupled with the emerging next generation broadband applications being used today by students in universities are the cumulative killer applications for a new communication platform.
- The gain of increased productivity and improved quality of life cannot come without significant effort. While the recommendations are stated simply, the policy, economic, and educational obstacles will require concerted and integrated hurdling to achieve the goal.
- California has an abundance of leaders in all segments, who are spearheading significant broadband projects. Unfortunately, many of the projects are isolated from each other, with no common vehicle to bring them together to form a cohesive leadership team focused on common objectives.

Next Steps

Start Now

It is Gartner's recommendation that the NGI Roundtable take on the responsibility for bringing together the leaders of broadband initiatives to form a leadership team that will focus on the One Gigabit by 2010 goal and establish an action plan.

The NGI Roundtable should be inclusive: government, private industry, consumer advocates, and service/application providers all are entities that must commit themselves to the task.

Set the Goal High

To assist in the definition of the goal, Gartner advocates the strawman goal of providing one gigabit of connectivity to each home and business in the state. Although many interviewees had difficulty grasping the concept of a gigabit without specific application examples, Gartner believes a gigabit of connectivity is a realistic requirement given the application evolution anticipated over the useful life of the infrastructure, as well as the time frame that will be required for implementation.

Take Action

The level of difficulty lies not in identification of the action steps, many of which are well-known; the difficulty lies in the implementation. California already has several initiatives at the state and local levels that can contribute to a successful initiative if all are focused on the same objective. Based on the interviews, we identified the following key action steps that the NGI Roundtable should undertake.

- *Identification of a leader or leadership team.* Based on the scope of this project and feedback from the interviewees, it is unlikely that one person or organization alone can successfully drive this project to completion. Layers of implementation effort will be necessary to drive all of the components of this initiative. As stated in this report, both top-down and bottom-up commitments are required. Top-down participants should include the following:
  - Senior-level technology leaders from both the private and public sectors
  - Key public policy influencers within the state and local governments
  - Key leaders within consumer advocacy groups and local and regional economic development efforts

  Bottom-up efforts must capitalize on the many local and regional programs in a way that helps achieve the overall state goal and also allows them to share implementation successes and failures. These organizations have valuable experience to contribute.
- *Development of a business plan that includes a specific definition of broadband, a description of the deployment goal, and a timeline for completion.* This report has offered a definition for next generation broadband and asserts that a gigabit is a reasonable goal. However, the definition and the goal must be adopted by the group that will be responsible for implementation. Once the goal has been set, the challenge will be to integrate it throughout the various efforts statewide. The detailed timeline is also critical so that specific goals are clear and progress gets measured and shared.

The NGI Roundtable should be inclusive: government, private industry, consumer advocates, and service/application providers all are entities that must commit themselves to the task.

- *Development of implementation scenarios.* This is an important step in the implementation process and maps specific actions and measurements to the project timeline. Regional plans and programs represent excellent starting points. Several economic development groups have begun this effort. Certainly, CENIC's programs will also play a key role. At the state level, the Governor's Office of Planning and Research is charged with creation of a plan for all infrastructure in California by December 31, 2003. The Equity, Economy and Environment plan represents a key opportunity to articulate the state goal and the implementation steps.

- *Development of specific costs.* The implementation scenarios must have some level of cost estimates, which are tracked against actuals. In this exercise, the impact of scale deployment as well as plans for shared facilities or aggregation of demand can be assessed and proposed.
- *Demand aggregation and anchor tenancy.* Government infrastructure and purchasing power must be leveraged to offer scale of demand and also incentives to providers so they'll participate in the initiative. In addition, existing subsidy funds should allow applicants to aggregate demand in a way that helps the broadest level of targeted organizations participate.
- *Coordination of regulatory/legislative policy between federal, state and local entities.* The adoption of a cohesive regulatory action plan for the state across all entities is a daunting task but will be a key success factor for the next generation broadband initiative. Small issues like disputes in local right-of-way cost will set precedents well beyond the initial dispute that will be detrimental to the larger goal. Differences in policy between jurisdictions or authorities will be arbitraged and will delay or undermine progress toward the goal. The California Public Utilities Commission (CPUC) should evaluate the current policies and regulations in the context of the initiative. The state legislature and the Governor's Office of Planning and Research have roles to play in helping the implementation team provide for the CPUC a direction consistent with the plan. No new building or redevelopment project should move forward without the requirement that fiber—or, at a minimum, conduit—is in place and accessible.
- *Public and private partnerships for all aspects of the project.* Research, infrastructure deployment, standards, applications and problem solutions all are elements of the partnership. California has a strong track record in this area. CENIC is managing programs that make excellent examples of partnerships that focus on practical outcomes. Technology underpins California's economy, and it provides a wealth of resources that can be productively harnessed to drive the success of this initiative.
- *Development of consumer technology literacy standards, programs and education.* This was identified many times in the interviews as a key issue. Without technical literacy, the digital divide will remain in place. Gaps must be specifically identified and matched with programs. Many local and regional groups are already attempting to deal with this issue. Technology firms and organizations such as TechNet have the resources and the willingness to participate in such efforts. It demonstrates enlightened self-interest on their part because they'll ultimately benefit from the growth of these markets.
- *Continued formation and utilization of commercial broadband market test beds.* These should be expanded and utilized to address specific community needs in as many diverse areas of the state as possible. Consumers should be brought in at early stages of development, and universal design principles should be applied to help ensure that the needs of all segments of consumers are being addressed.

California has the most to gain from action and the most to lose from inaction.

California Has a Choice: Lead, Follow or Get out of the Way

Today, high technology, entertainment, biotechnology, agriculture and many more industries call California home. California has the most to gain from action and the most to lose from inaction. Other regions will welcome these industries and are taking steps to attract them.

Now is the time to choose California's future.

Footnote

[1] One Gigabit or Bust™—Killer Apps: Proving the Need for One Gigabit, CENIC white paper, April 2003.

We recommend the full report entitled One Gigabit or Bust Initiative—a Broadband Vision for California for those who are looking for more detail. The full report contains specifics from the interviews, gives examples of broadband applications, discusses the rationale for the recommendations in this report and covers the details pertaining to the methodology of the economic model. It can be downloaded or read online at http://www.cenic.org, or a hard copy can be requested via e-mail to editor@cenic.org.

For more information:

Mark Gilbert
Gartner Consulting
+1-818-710 5928
Mark.E.Gilbert@gartner.com

Tom West
CENIC
+1-562-346-2280
twest@cenic.org
www.cenic.org

NGI Roundtable Steering Committee Members

Gretchen Beyer, *Vice President of Public Policy, TechNet*

Bob Campbell, *Vice President, SBC Communications, Inc.*

Tal Finney, *Interim Director, Governor's Office of Planning and Research, State of California*

Keith Frandsen, *Vice President of Corporate Development, Science Applications International Corporation*

Laura Ipsen, *Vice President, WorldWide Government Affairs, Cisco Systems, Inc.*

David Lema, *President and CEO, David R. Lema & Associates*

John Silvester, *Vice Provost for Scholarly Technology, University of Southern California and Chairman of the Board, Corporation for Education Network Initiatives in California*

Larry Smarr, *Director, California Institute for Telecommunications and Information Technology*

Tom West, *President, Corporation for Education Network Initiatives in California*

Carol Whiteside, *President, Great Valley Center*

List of Interviewees

Ender Ayanoglu, Center for Pervasive Communications and Computing

Ruzena Bajcsy, Center for Information Technology Research in the Interest of Society (CITRIS)

Dan Blumenthal, Center on Multidisciplinary Optical Switching Technology

Bob Campbell, SBC Communications, Inc.

Vinton Cerf, MCI

Fred Chang, SBC Communications, Inc.

Grant Cheney, Government of Alberta

Randy Chinn, California Senate Energy, Utilities, and Communications Committee

Eduardo Cusicanqui, National Council of La Raza

Gregory Duncan, NERA

Margaret Felts, California Telephone Association

Fassil Fenikile, California Public Utilities Commission

Tal Finney, Governor's Office of Planning and Research

Tessie Guillermo, Community Technology Foundation of California

Linda Gustafson, California Public Utilities Commission

Barbara Hale, California Public Utilities Commission

Dewayne Hendricks, Dandin Group

Greg Hidley, University of California, San Diego

Alan Hyden, Lennar Builders

Nikil Jayant, Georgia Institute of Technology

Tom Kalil, University of California, Berkeley

Kevin Kearns, King County INET

Jonathan Lakritz, California Public Utilities Commission

Robert Lehman, California Public Utilities Commission

Tom Long, California Public Utilities Commission

Richard Lowenberg, Davis Community Network

Tim McCallion, Verizon

Milo Medin, TechNet

Jeff Newman, California Technology, Trade and Commerce Agency

Terri Ooms, Inland Empire Economic Partnership

Larry Rowe, University of California, Berkeley

Mark Savage, Public Advocates

Jeffrey A. Schwall, Time Warner, San Diego

Nitin Shah, ArrayComm

Michael Shames, Utility Consumers' Action Network

John Silvester, University of Southern California

Larry Smarr, California Institute for Telecommunications and Information Technology

Nancy Sullivan, California Department of Education

Mark Vandervelden, California Public Utilities Commission

James Watkins, California Governor's Office of Emergency Services

Carol Whiteside, Great Valley Center

Carl Wood, California Public Utilities Commission

Robert Zitter, Home Box Office

Corporation for Education Network Initiatives in California
4665 Lampson Avenue
Los Alamitos, CA 90720