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BroVis Wireless Networks Go-to-Market Strategy

Bringing Affordable Broadband to India and Beyond

Having escaped the hot California sun with an iced Chai Latte in the Stanford Bookstore Café, Muthu Logan, CEO of BroVis Wireless Networks, let out a sigh of relief. During his frequent trips to Silicon Valley, he found it rejuvenating to spend time on the Stanford University campus. Still, Logan knew that there was no rest for the weary. Although Logan rarely had a moment's break, 2007 was approaching rapidly and he needed to make critical decisions that would determine the company's future.

He flipped back the cover page of a Forrester research report sitting on his table. A statistic immediately glared out at him: Only 3% of India's population had broadband access to the Internet, compared with United States' 39% and China's 41%.[1] How could India bypass the monstrous infrastructure investment required to overcome this digital gap? Logan smiled as he silently answered his own question: BroVis Wireless Networks. However, he needed to refine his go-to-market strategy for India. He was relying on Icon Base to carry out the go-to-market strategy for Southeast Asia. He also needed to decide whether the time was right to expand to north Asia, and if so, whether to start in Japan, Korea, or China. Brovis was a start-up with grand ambitions. Successful market entry at home in India and in select countries in Asia was critical to becoming a successful global company.

His cell phone began to vibrate, and judging from the caller ID, Logan figured that he was getting a Skype[2] call from India. Prem Kumar, Product Marketing Engineer for BroVis, was on the line:

Kumar: Hi Muthu, I hope your trip to corporate headquarters in Silicon Valley hasn't been too hectic. I finished gathering some of the market research you requested. Before I go into the details, how was your meeting with the VC firm?

Logan: It went very well. As expected, Parakletos Ventures signed the term sheet for our Series B funding and will also take the lead.[3]

Kumar: That's fantastic news! What were the driving factors behind the decision?

Logan: Our technology put us over the top. Our ability to deliver wireless broadband in difficult terrains will be incredibly useful for the 60% to 70% of the world that lacks wired

[1] Christopher M. Kelly and John McCarthy, "The Chinese and Australians Soak Up Broadband," Asia Pacific Consumer Technology Adoption Study, Forrester Research, Inc., May 2, 2006.

[2] Skype was a software application that enabled free computer-to-computer calls and low cost computer-to-phone calls.

[3] It was anticipated the BroVis' Series B funding round would close in March or April of 2007, and would bring in a total of $3 million from investors.

This case was prepared by Shalin Mantri, Research Associate for the Stanford Technology Ventures Program, under the guidance of Thomas J. Kosnik, Consulting Professor, Stanford School of Engineering as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

infrastructure.[4] Also, our solution enables customers to use the latest and greatest broadband wireless technologies, including Wi-Fi and WiMAX, a selling point for emerging markets like India, China, and countries in southeast Asia that wish to leapfrog to cutting edge technology.

Kumar: Congratulations Muthu – I know you've been working really hard to get venture capital funds. I will e-mail you the research summaries of target markets in Asia.

Logan: Thanks, this research will be really helpful as we look to expand our horizons in the region. We've done very well in India but we need to make sure we penetrate other markets in Asia before the big boys do. At the same time, India is our primary market and we can't ignore it. We need to refine our go-to-market strategy for India. Once rural entrepreneurs and service providers can make money using our technology, our products will spread like wildfire. In addition, we need to develop a go-to-market strategy for Japan, Korea, and China, and decide when to enter each country.

Kumar: I agree. We also cannot ignore the technology. Reliability and stability of our technology is an absolute must if we want to be globally competitive. Product development, quality assurance, and customer support will also require significant attention as we expand overseas.

Logan: You have read my mind. All right Prem, I'll let you go. I will download and read your summaries offline.

As soon as Logan hung up the phone, he opened his laptop and searched for available wireless networks. From where he was sitting in the café, his computer's connection to the bookstore's wireless network was very poor. As the research summaries began downloading in his Inbox at a snail's pace, Logan chuckled as he thought to himself: If only the café used BroVis' systems…

Company Background

BroVis Wireless Networks was a provider of broadband wireless infrastructure systems. BroVis' technology was tuned for all types of terrain, and as such, it was immediately applicable in developing countries where obstructions blocked the last mile of broadband Internet. As a Silicon Valley startup with operations in India, BroVis' customers mostly hailed from South Asia.

Muthu Logan founded BroVis in mid-2003 with a vision of providing affordable broadband to the masses. Born in India, Logan graduated from University of Texas with a M.S. and an MBA. Two decades of work for American companies followed this education. He held various engineering and management positions at companies such as Ascend Communications, Intel, and Solectron. Immediately before founding BroVis, he served as Product Line Director for the DSL Broadband Access group at Lucent Technologies.

Although this education and work experience gave him insight into Western management practices and other best practices of leading U.S. technology companies, Logan felt the lack of a critical component: global entrepreneurship. Logan noted, "Somehow, I had an urge to be a global entrepreneur as Silicon Valley was a bit limiting for me." The bust of the Internet bubble in Silicon Valley in the early 2000s marked the time when Logan began executing his vision for BroVis.

The company's presence in Silicon Valley and India reflected Logan's professional experience and cultural roots, respectively. To enable access to funding sources and to bring global credibility to his fledgling startup, Logan decided to set up corporate headquarters in Cupertino, California. At the same time, to take advantage of India's intellectual capital and cost efficiency, he centralized operations and research and development (R&D) efforts in the South Indian city of Chennai. "We were one of the first companies to leverage technologies and expertise from United States and India to focus on emerging and mainstream wireless markets," noted Logan.

[4] Muthu Logan, phone interview by casewriter, October 2005.

Similar to Logan, other members of the BroVis team had entrepreneurial experience as well as broadband domain expertise. Babu Mandava, technology strategist and board member for BroVis, was a founder of Centillium Communications, a NASDAQ-listed semiconductor company focused on broadband products. A recent addition to the company was Dr. Paul Kim, chairman of BroVis, who was the founding and managing partner of Parakletos @Ventures, LLC, a Silicon Valley VC firm with investments in the United States, India, China, and Korea. See **Exhibit 1** for biographies of the BroVis management team members.

To support BroVis' R&D efforts, the company had utilized private funding sources. It received $500,000 in a Series A funding round in October 2003 and most recently in June 2006 added $2.5 million in Series B funding backed by Dr. Kim's Parakletos @Ventures. Other private investors included the founders of Centillium Communications and Tsuyoshi Taira, CEO of Tazan International Inc. Break-even for the company was anticipated by the end of 2007.

Market Opportunities

Although the worldwide market was replete with vendors attempting to tackle indoor broadband access, the overlooked segment that BroVis aimed to tackle was *outdoor broadband wireless access* through sales of its standards-based wireless equipment. In 2005, worldwide revenues for indoor and outdoor wireless LAN equipment were $1.07 billion, an 18-percent jump from the revenues in 2004.[5]

Since its inception in 2003, BroVis had primarily focused on India and Southeast Asia as its target markets. The grander vision was that, one day, BroVis would be the market leader in all of Asia. Logan knew that the sheer population size and income levels of Asian countries would drive the next wave of broadband wireless investment. A list of the top 10 most populous nations in the world revealed that six of these 10 countries were Asian, and these six countries represented more than three billion people and almost half of the world's population.[6] Although a significant percentage of the Asian population lived below the poverty line, Asia still accounted for more than 25% of world Gross Domestic Product (GDP). This share of world GDP paralleled Asia's share of worldwide WLAN equipment sales: Asia contributed more than 20 percent of worldwide sales.

See **Exhibit 2a** and **Exhibit 2b** for a comparison of GDP and Purchasing Power Parity (PPP) growth rates among BroVis' target markets in Asia. Further, **Exhibit 2c** highlights levels of technology penetration in those markets, and **Exhibit 2d** provides a summary of the ease of doing business in each market.

India

Daniel Yergin, author of ***The Commanding Heights***, aptly summarized the unique Indian market: "India is not expected to be a dragon or a tiger. Instead, the appropriate zoological analogy is the elephant—slow to rise and get up to speed but, once in motion, fast and steady, moving through thicket after thicket."[7]

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[5] "Market Share: Wireless LAN Equipment, Worldwide, 2005 (Executive Summary)," via Gartner, Inc., accessed May 2006.

[6] Adapted from U.S. Census Bureau, "World Population Information," U.S. Census Bureau Web site, http://www.census.gov/ipc/www/world.html, accessed December 15, 2006; Information Please, "World's 50 Most Populous Countries: 2006," Information Please Web site, http://www.infoplease.com/ipa/A0004391.html, accessed December 15, 2006.

[7] Joseph Stanislaw and Daniel Yergin, *The Commanding Heights: The Battle for the World Economy* (New York: Simon & Schuster, 2002).

With more than a billion citizens in 2006, India was the world's largest democracy and was more populous than the combined nations of the Western Hemisphere.[8] Its resemblance to an "elephant" underscored the nation's staggering political and economic inertia. Previously a socialist and command-and-control economy, India undertook economic reforms in 1991 to become a market-based mixed economy. Although the country's inertia slowed the transition, two significant economic trends had surfaced since the early 1990s. First, economic reforms enabled the rise of a prosperous and globally competitive information technology (IT) industry. Second, with an average nominal GDP growth rate of 6.6% from 2001 to 2005,[9] the Indian market had become one of the fastest growing markets in the world. Accompanying India's newfound economic success, a large and growing educated middle class – almost 60 million people strong – was promoting consumption on an unprecedented scale.[10]

This consumption was fueled by "rising income levels, lower interest rates, easy access to credit, and a young population."[11] The telecom sector had become a beneficiary of this consumption. Spurring the telecommunications industry, middle class Indian consumers were literate, savvy, and price sensitive. The annual income of a typical Indian middle class consumer in 2005 was greater than $900, 30% higher than the national per capita income in the same year.[12] The number of mobile subscribers burgeoned from 3.6 million at the end of 2000 to 65 million as of September 2005[13], and the number of Internet users rose from 5.5 million in 2000 to over 50 million in 2005.[14] Once lagging behind its counterparts in many other countries, the Indian broadband industry led the world with greater than 300% year-over-year growth in number of broadband lines added.[15]

Although these numbers highlighted torrid growth, they hid the fact that large disparities existed in broadband Internet penetration between India and other countries. 41% of Chinese consumers living in metropolitan areas had a broadband Internet connection, compared with only 3% of their Indian counterparts.[16] See **Exhibit 3** for a comparison of broadband adoption rates among various countries. Moreover, within India itself, a large disparity in broadband access existed between residents in metropolitan areas and villagers in rural areas. The metro areas were equipped with wired broadband infrastructure and many Internet cafés, while rural areas mostly lacked this infrastructure and cheap sources

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[8] Marcus Franda, *China and India Online: Information Technology Politics and Diplomacy in the World's Two Largest Nations* (Lanham, MD: Rowman & Littlefield Publishers, Inc., 2002), p. 1.

[9] Adapted from The World Bank, "Prospects for the Global Economy – Country-specific data," The World Bank Group, http://web.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/EXTGBLPROSPECTSAPRIL/0,,contentMDK:20413173~menuPK:659183~pagePK:2470434~piPK:2470429~theSitePK:659149,00.html, accessed September 30, 2006.

[10] Casewriter's calculations based on the number of Indian households with greater than $4,450 income per year and based on data from Census of India 2001, "2001 Census Table Finder: View India Level Data," Office of the Registrar General, http://www.censusindia.net/results/HH_Series/hh_series_pdf/hh16_India.pdf, accessed on September 13, 2006; NCAER, "The Great Indian Market," National Council of Applied Economic Research, www.ncaer.org/downloads/PPT/TheGreatIndianMarket.pdf, August 9, 2005.

[11] "Focus on India: A Tiger's Tale," Scotia Capital, July 2005.

[12] Adapted from NCAER, "The Great Indian Market"; *Key Indicators 2006*, (Manila, PHL: Asian Development Bank, 2006), http://www.adb.org/Documents/Books/Key_Indicators/2006/default.asp, accessed September 2006.

[13] Telecommunications: Wireless (Asia), Standard & Poor's Industry Surveys via NetAdvantage, January 1, 2006.

[14] International Telecommunications Union estimate in "India Internet Usage and Telecommunications Reports," Internet World Stats, http://www.internetworldstats.com/asia/in.htm, accessed September 2006.

[15] Tim Cox, *World Broadband Statistics: Q1 2006*, Point Topic Ltd., June 2006.

[16] Kelly and McCarthy, "The Chinese and Australians Soak Up Broadband," Forrester Research, Inc.

of Internet access. 72% of India's population lived in these untouched rural areas, sprawled over a majority of the country's 3 million square kilometers.[17]

India's physical terrain brought tough challenges to any broadband wireless vendor in the region. In a metropolitan area such as Mumbai, broadband wireless equipment had to overcome a high level of day-to-day radio interference as well as survive a deluge of seasonal monsoon rains. In rural areas, the equipment needed to be powerful enough to deliver wireless broadband across vast expanses of land.

Wireless broadband had not achieved critical mass in India. Wi-Fi access had been outfitted in small areas, such as airport lounges, Internet cafés, and hotels, but larger deployments were waiting for a new, faster variant of Wi-Fi called "WiMAX." WiMAX enabled high-fidelity and long-distance outdoor wireless communication. It was viewed as a key driver of the broadband wireless market in India and other developing countries due to its ability to support fast and reliable signals over large geographic expanses.

One of the unique attributes of the wireless broadband industry in India was the significant role of the Indian government. Blamed for some of the disparities in broadband access, government policy previously placed bans on radio spectrum needed for wireless broadband access. Moreover, some laws on the books did not make sense. For example, one law required that 802.11b (an early flavor of Wi-Fi technology) be used only indoors. Wireless vendors asked a common rhetorical question: How could you prevent a wireless signal from going out the window or through a wall?

In recent years, however, the Indian government took steps towards loosening these restrictions and weeding out inexplicable clauses in wireless laws. Having announced goals for increased broadband access throughout India, the Indian government addressed the country's lagging broadband penetration in the *Broadband Policy 2004* policy paper. In this paper, the government acknowledged that low broadband, Internet, and PC penetration rates had constrained demand for broadband access. See **Exhibit 4** for the broadband penetration goals defined by the Indian government. This policy paper also marked the de-licensing of radio spectrum designed for outdoor and indoor broadband wireless use.

Southeast Asia

With the Indian market as a launch pad, BroVis aimed to execute on an Asia Pacific growth strategy. In November 2006, it announced a strategic partnership with Icon Base Sdn Bhd, a Malaysia-based provider of telecom and wireless products with regional offices in several Southeast Asian countries. Icon Base handled production, marketing, sales, and support for BroVis products in Malaysia and nearby countries, enabling BroVis' market entry into the Southeast Asia (SEA) region. This region included Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam. With the exception of Singapore, these countries did not have advanced telecom and broadband infrastructures relative to other Asian countries such as Japan and Korea. They represented "greenfield deployment" opportunities with a significant potential market size.[18]

While the Icon Base partnership had targeted the SEA countries, Logan knew that other developed and developing countries in Asia presented untapped market opportunities. These countries included China, Japan, and Korea.

China

As noted in the book *Business Growth Strategies for Asia Pacific*, "Geographically, China and India undoubtedly possess the greatest potential for business growth. Each has a large population, a rapidly growing middle-class, competent engineers, solid scientific capability, diligent labor and pragmatic government policy."[19] Although estimates varied widely, the French bank BNP Paribas Peregrine found that China's middle-class consumer population numbered 50 million in 2002 and would reach 100 million

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[17] Key Development Data & Statistics, World Development Indicators database, September 13, 2006.

[18] *Greenfield deployment* is a term in the networking industry that refers to "the installation and configuration of a network where none existed before," according to www.WhatIs.com.

[19] Willie Chien, Stan Shih, and Po-Young Chu, *Business Growth Strategies for Asia Pacific* (Singapore: John Wiley & Sons, 2005), p. 22.

by 2010, figures that compared with the size of India's middle-class population.[20] However, China and India were not completely comparable. While the Indian elephant only began to trot in the early 2000s, the Chinese dragon already had been unleashing its fury on the world for 20 years. As the book explained, "With a total GDP that has basically quadrupled in the past two decades, China presents the largest potential of all Asia Pacific countries."[21] Further, China's broadband industry included one of the world's largest subscriber bases (second only to the United States') and led the world in terms of number of broadband lines added in the first quarter of 2006.[22]

Although China appeared to be an unparalleled market opportunity on paper, the realities of entering and doing business in China were daunting for a small company such as BroVis. For this reason, Dr. Paul Kim, the company's chairman and managing partner of the VC firm that funded BroVis, advised and helped Logan in arranging a co-marketing agreement with Azalea Networks, a China-based broadband wireless solution provider. Azalea Networks was another entrepreneurial company funded by Kim's VC firm, Parakletos @Ventures, and both Azalea and BroVis had similar but complementary product lines. The partnership, effective December 2006, entailed a bilateral OEM agreement: BroVis would sell Azalea's products in India under the BroVis brand name, and Azalea would sell BroVis' products in China under the Azalea brand name. Although Logan knew that this partnership might help BroVis form a beachhead in China, he did not know if it was enough to fully seize the market opportunity.

Japan

With a GDP larger than the combined GDPs of all other Asian countries, Japan was the most industrialized country in Asia and had the world's third largest broadband subscriber base.[23] Although the high cost of living hurt the purchasing power of Japanese consumers, they tended to be relatively wealthy and technology savvy. The authors of *Business Growth Strategies in Asia Pacific* commented that success in the Japanese market required addressing these unique consumer characteristics: "Japan can always be an important area for business growth provided that a market potential can be realized by offering differentiation instead of commonality."[24] Differentiated products afforded a price premium in Japan, attracting vendors that wanted to bypass the commoditization trend prevalent in other Asian countries.

Logan learned first hand that tapping into Japan's distribution network was not easy. Having had unfruitful attempts to find a partner in Japan, Logan thought that market success would result from a direct sales strategy that tapped into the proven reputation of the BroVis brand name. At the same time, introducing its brand name to the Japanese market would require substantial investment in product marketing. In addition, BroVis would need to invest in at least one sales person who was fluent in Japanese and skilled in selling communications solutions in the Japanese market. Logan wondered how best to assess the costs and implementation issues of setting up a satellite office there.

South Korea

One of the East Asian "Tiger" economies known for maintaining high growth rates and rapid industrialization in the last few decades, South Korea shared several commonalities with Japan. As a newly industrialized country, South Korea joined Japan as a new member of the Organization for Economic Cooperation and Development (OECD). Membership in the OECD highlighted the country's strong GDP output and consumer-oriented culture. Along with Japan, South Korea had some of the most advanced telecommunications infrastructures in the world. Buoyed by an early adopter and tech savvy consumer population, South Korea found itself home to wireless technology vendors that frequently tested their next-generation equipment on these consumers.

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[20] BNP Paribas Peregrine estimate in Xin Zhigang, "Dissecting China's 'middle class'", China Daily, http://www.chinadaily.com.cn/english/doc/2004-10/27/content_386060.htm, accessed December 2006.

[21] Chien et al., *Business Growth Strategies*, p. 58.

[22] Tim Cox, *World Broadband Statistics*, Point Topic.

[23] Ibid.

[24] Chien et al., *Business Growth Strategies*, p. 23.

The country represented an attractive market opportunity for BroVis due to the high proliferation of Wi-Fi "hotspots." A hotspot refers to a small geographical area, such as an Internet café, that offers wireless access to the Internet. Hotspots tend to serve highly dense metropolitan areas in which wired access is not available to end users. South Korea led the pack with the most number of hotspots in Asia. According to JiWire, an online Wi-Fi hotspot directory, South Korea had more than 9,400 registered hotspots. With the actual number possibly much higher, Logan knew that he could not ignore the Korean market.

Nevertheless, Korea's market showed signs of saturation: Although South Korea had the world's fourth largest broadband subscriber base by March 2006, it was not in the top 10 countries with respect to number of broadband lines added.[25]

BroVis intended to find a partner to penetrate the Korean market, and had begun preliminary discussions with several organizations. Dr. Paul Kim, BroVis' Chairman and lead investor, was Korean and had an extensive professional network in that country that would help with the search for the right partner.

Broadband Wireless Access Industry

Vendors in the broadband wireless access industry had to handle an intersection of many technologies (e.g., wireless, LANs, and broadband data access) and applications (i.e., indoor and outdoor). The key players in this industry fell into three categories:

1. Access equipment vendors
2. Chipset vendors
3. Service providers (including network service, Internet service, and hotspot providers)

Access equipment vendors ranged from startups such as BroVis to large companies such as Cisco Systems. In fact, having captured 52% of the industry's revenues in 2005, Cisco was the top equipment vendor with the help of sales of its wireless networking subsidiaries. Typical vendors in this category sold equipment that enabled broadband data traffic to travel wirelessly across regions and that allowed this traffic to be sent from or delivered to end Internet users.

Each system in the access equipment was configured with a wireless chipset, the most critical component in the system. Although 10 large vendors sold these chipsets, Atheros Communications, Broadcom, Conexant, and Intel comprised the dominant portion of the market. BroVis formed a key technology partnership with Atheros. Praveen Singh, India Country Manager for Atheros, commented on his company's position in the marketplace:

> Atheros Communications has a commanding lead in semiconductor sales to the enterprise and outdoor segment. Part of this has to do with Atheros' entrepreneurial background and part of it has to do with the fact that Atheros' chipsets have capabilities that enable these disruptive markets to happen. Today, many of the innovations coming out of startup networking companies happen using Atheros silicon.

Service providers included network service providers, ISPs, and hotspot providers.[26] These companies used access equipment to deliver broadband Internet to households, businesses, and other indoor or outdoor areas. The worldwide service provider market was highly fragmented, and each country typically had its own set of regional market leaders.

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[25] Tim Cox, *World Broadband Statistics*, Point Topic.

[26] "ISP" stands for Internet service provider. Hotspot providers deliver wireless Internet to a limited area, such as an airport lounge or Internet café.

Growth Drivers

Several trends fueled growth in the broadband wireless access industry. Primarily, governments around the world had begun opening radio spectrum previously barred for commercial wireless use. Because wireless data was transmitted through radio, availability of interference-free radio spectrum allowed the industry to improve quality of service, scale to new markets where wireless was previously unavailable, and unite vendors' efforts to promote interoperability of wireless networks.

In developing countries, another industry growth driver was the lack of wired broadband infrastructure. Due to limited capital and difficult terrain, developing countries did not experience the wave of wired broadband investment that occurred in their developed counterparts in the 1990s. As such, wireless broadband represented an opportunity to bypass a major infrastructure investment in favor of a lower-cost alternative. Muthu Logan estimated that the cost of deploying BroVis' wireless access technology was 30% to 60% of the cost of deploying a similar "wired" solution, taking into account initial cost and life-time maintenance expenses. Unlike developing countries, developed countries had already made the investment in wired infrastructure. Hence, service providers in these countries had a different motivation in switching to a wireless delivery model: decreased capital and operating expenditures.

A third trend fueling industry growth was increased equipment spending by service providers. They recognized that—with the introduction of wireless broadband—new markets opened as wireless technology could help them provide Internet to customers in hard-to-reach areas.

Broadband Wireless Technology

BroVis operated in an industry that experienced rapid change in underlying wireless technologies. Although these technologies had frequently improved or became outdated, the architecture for broadband access remained relatively constant.

In the early days of wired broadband Internet, end users received Internet service through physical wires and cables. If an Internet user in San Francisco were to download data from a Web page in New York, data would travel from region to region and from network to network through fiber optic cables, analogous to electricity passing through transmission lines from tower to tower. To travel long distances—for example, between states—the data might cross a few Wide Area Networks (WANs). Once the data approached the San Francisco Bay Area, it might pass into a Metropolitan Area Network (MAN). Once the data reached the Internet user's neighborhood, it might pass into a Local Area Network (LAN).

Broadband wireless technology had the potential to uproot existing MAN and LAN infrastructure in developed countries and to become the de facto standard in developing countries lacking MANs and LANs. By transmitting data wirelessly from point to point between Internet devices, this technology could eliminate the need to lay expensive fiber optic cable across large expanses of land. This less expensive alternative enabled developing countries to bypass investing in wired infrastructure and to roll out wireless broadband immediately. The price points of wireless components were decreasing at a rate that made it possible to bring access to a 3,287,263-square kilometer country such as India.[27]

Because the broadband wireless industry had many equipment vendors, including BroVis, their equipment had to communicate with those of other vendors. To promote interoperability of broadband wireless systems, the Institute of Electrical and Electronic Engineers (IEEE) group created communication standards adopted by most vendors. The official IEEE name for the broadband wireless standard is "802.11," but it is commonly referred to as "Wi-Fi." Several Wi-Fi protocols were supported in the industry in 2006, including 802.11a, 802.11b, and 802.11g. In 2005, 74% of all access points shipped with support for 802.11g.[28]

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[27] India surface area data from 1991 Census of India in "India at a Glance: Area," Census of India, http://www.censusindia.net/area.html, accessed December 2006.

[28] "Market Share: Wireless LAN Equipment," Gartner, Inc.

Looking ahead, a new broadband wireless protocol dubbed "WiMAX" (IEEE 802.16) was poised to complement Wi-Fi as the industry's next generation standard, especially in developing countries such as China and India. To support the needs of today's marketplace but also to prepare for next generation deployments, BroVis' systems were based upon these open standards technologies: They currently supported Wi-Fi and would support WiMAX in 2007.

BroVis Solutions

BroVis delivered solutions that enabled the broadband Internet to transmit wirelessly from point to point. These solutions comprised three major systems: *base stations*, *customer premises equipment* (CPE), and *access points* (APs). A critical component in each system was the core chipset. Atheros Communications, one of the world's leading broadband wireless chipset manufacturers, provided the core chipset used in each of BroVis' systems. In addition to the chipset, each system contained a radio that operated on typical broadband wireless frequencies and enabled communication with the other systems. See **Exhibit 5** for an illustration and description of the solution architecture.

To differentiate itself from vendors who had served developed markets, BroVis built and configured its solutions to support the needs of customers in developing countries. Primarily, BroVis' systems were configured for the difficult indoor and outdoor terrains found in such countries. The density of obstructions in such countries affected the radio signal emitted by the broadband access equipment, reducing its range and increasing the possibility of data loss. BroVis overcame this challenge through software features built into the systems – dubbed "Non-LOS mode" (Non-Line of Sight) – as well as on-site assistance during solution installation that ensured minimal obstructions to the BroVis systems.

A second way that BroVis catered to customers in developing countries was its software-centric implementation of its products. This implementation approach eliminated the need for heavy duty hardware, an expense that BroVis' target customers would not be able to bear. Moreover, the hardware and software installation was "plug and play," resulting in lower deployment costs than those of other vendor solutions. Finally, once the BroVis solutions were installed, system administrators had access to a suite of management software that provided fine-grained control over the systems.

Solving Real-world Problems

Although BroVis' systems incorporated open standards technology and industry-leading chipsets from Atheros, BroVis was not strictly a technology company. When Muthu Logan founded the company, he wanted the company's products to bring easy-to-deploy solutions to actual broadband delivery problems. This focus on product practicality translated to real-world applications for BroVis' technology. Some of these applications included:

1. Bringing broadband Internet to unwired rural areas
2. Retrofitting indoor and outdoor metropolitan areas with wireless Internet, including airport lounges and hotel premises.
3. Incorporating voice with high-speed data by supporting Wi-Fi-enabled phones

The wireless broadband industry was moving at warp speed, with technologies rapidly evolving, business models changing, and new applications being created. The speedy development of Wi-Fi and the potential of WiMAX promised a technological solution for bridging a digital gap in many regions not outfitted with expensive wired infrastructure.

Although BroVis was placing its bets on wireless broadband in the short-term, it was possible that wireless Internet access would not be the key long-term driver of wireless adoption in emerging markets. For instance, was it possible for a villager in rural India with a $150 annual salary (of which only $70 might be available for non-food expenses) to bear the cost of wireless Internet?[29] Muthu Logan thought it would be a tough sell. As such, BroVis designed its products to act as a conduit of more than Internet data; in the

[29] Income data from National Sample Survey Organisation, *Household Consumer Expenditure in India*, National Sample Survey, Report No 505, 2004, p. 109.

future, they would be able to carry voice traffic and other services, enabling service providers to give more to their users for a given price.

In fact, the arrival of Wi-Fi phones that allowed hybrid cellular and broadband connectivity was a potential boon to BroVis' platform. It could generate increased demand for Wi-Fi availability in emerging and developed markets, which in turn, would stimulate investment in the type of broadband wireless access systems that BroVis sold. Nevertheless, these hypothetical scenarios about future applications did not change the near-term fact that BroVis required patience in this market.

BroVis Target Customer Segments in India

Generally, BroVis' rapidly expanding list of customers in India fell into four different categories: Service Providers, Enterprises & Campuses, Telecom Operators, and Government & Defense. See **Exhibit 7** for a breakdown of the Indian market size by customer segment. BroVis' customers in each of these segments were differentiated by the geography of their broadband users, as many came from rural areas and some came from metro areas. See **Exhibit 8a** for a list of customers in India and **Exhibit 8b** for a table that illustrates the percentage breakdown of BroVis customers in rural and metro areas.

Service providers provided data, voice, and video communication services to end users and included Internet service providers and hotspot operators. These service providers encompassed almost half of BroVis' customers. A majority of these service provider customers (60%) were wireless hotspot operators. Traditionally, these companies delivered wireline services to homes and businesses and mobile telephony to Indian consumers. Increasingly, however, they were expanding their product offering to include wireless Internet access. For example, Sterling Infotech group, an India-based conglomeration of business interests in mobile telephony, telecom consulting, software, education, and food and beverages, created a new subsidiary in 2005 called Dishnet Wireless Limited. On March 7, 2005, Dishnet announced plans to invest $56 million (250 crore Indian Rupees[30]) in wireless services, including 6,000 Wi-Fi hotspots, over the ensuing 18 months. Dishnet selected BroVis as its primary access equipment provider for these Wi-Fi deployments, launching BroVis as a leading vendor in the Indian market. Another leading wireless hotspot operator, Microsense India Pvt Ltd, also used BroVis' access systems to deliver wireless Internet to end users. Dishnet and Microsense enabled BroVis to penetrate deep into India's hospitality segment, which included hotels, cafeterias, airports, and railway station lounges.

Some of BroVis' significant enterprise customers hailed from the hospitality segment. One such customer was Leela Palace Hotel in Bangalore, India, considered one of the city's most prestigious hotels. Educational institutions, including various colleges in India, also bought BroVis' solution to deliver wireless Internet to students on campus.

A third target customer segment comprised telecom operators. The opportunity in this segment comprised delivering "last mile" broadband access to consumers in hard-to-reach areas of India. Laying fiber to each and every home would be prohibitively expensive for a telecom operator; it would be more cost effective to carry the fiber to a certain point and then broadcast various data-oriented services (such as Internet service) wirelessly to homes. Although the cost efficiencies argument was a compelling one, BroVis had limited success with telecom operators. They tended to represent large organizations with potentially millions of customers; their inertia resulted in a complicated sale. Logan had not invested substantial effort in wooing these telecom operators. At the same time, he knew he could not ignore them.

The Indian government represented a fourth target customer segment. For example, India Postal Services was outfitting all post offices with wireless connectivity, beginning with those in the state of Kerala. BroVis' systems were the broadband access equipment being used in this nationwide deployment. Also, BroVis won a contract with Southern Railway to outfit broadband wireless within and between rail stations. With more than 500 million passengers traveling on the railway network every year, Southern Railway was a marquee customer in the government arena.

[30] "Crore" is an Indian unit of measure that equates to 10 million.

Another part of the Government and Defense business included providing access equipment for rural NGO projects throughout India. For example, the Stanford Asia-Pacific Research Center, along with the Government of India, was conducting pilot tests of providing free wireless access to rural villages. BroVis' equipment enabled the delivery of wireless Internet to these villages, as the cost of setting up wired infrastructure would be cost prohibitive. BroVis also worked with India-based NGOs such as M.S. Swaminathan Research Foundation, a group focused on improving access to communications for poor village communities.

The sales process for BroVis could be either very simple or very complicated, depending on the customer segment. For instance, private enterprises had well-staffed IT departments, and establishing an informal relationship with their business decision-maker (usually the IT director) soon led to equipment sales. On the other hand, government agencies took a long time to make buying decisions. Typically, these agencies engaged in a round of RFPs (Request for Proposals) wherein vendors submitted proposed solutions to the identified problems and challenges. Based on technical merit, economic efficacy, and occasional politics, a vendor would be selected to deliver the solution.

Regardless of the time or effort it took to sell its access equipment, BroVis held a deep source of pride in making customers successful. Prem Kumar cited a classic customer win in describing the company's success in the Indian market: the Broadband Wireless Project carried out at the Hiranandani Community in India's western port city of Mumbai. He noted, "The difficult terrain and the cost factor played a major role in allowing BroVis to win, wiping out most of the well-known competitors. It adds to our credentials that the link withstood the torrential rain that flooded Mumbai in early 2006."

BroVis' Business Model and Go-to-Market Strategy

Muthu Logan noted, "BroVis was not only the creation of an idea in the wireless space but also the search for a successful business model and go-to-market strategy." Indeed, in an industry dominated by multinational companies with access to greater resources, it would be a challenge for startups such as BroVis to develop a product from scratch and sell it against incumbent broadband equipment manufacturers. Moreover, BroVis' primary market – India – was highly price sensitive, necessitating efficient operations to support competitive prices. Muthu Logan attacked this two-pronged challenge with a combination of strategic corporate location decisions – headquarters in Silicon Valley and R&D in India – and an intense focus on capturing market share in India. The venture capital raised in the United States, along with the revenues generated by direct sales and partnerships in India, would enable BroVis to execute its global vision.

BroVis aimed to stand out from the crowd of broadband equipment providers by delivering a technologically superior solution relative to its cost. One of BroVis' primary differentiators was its 2X price-performance advantage relative to other competing products. In other words, for a given amount of money a customer would have to pay for broadband wireless equipment, BroVis strived to deliver a 100% equipment performance improvement over competitors' systems. A second differentiator comprised its Non-LOS features supported by patent-pending TrueEXOR™ technology. Helping overcome physical obstructions to wireless signals, these features allowed telecom operators and service providers to quickly setup high capacity networks in challenging terrains. This value proposition reflected the needs of emerging markets such as India and China, where customers demanded low cost and high quality equipment.

Beyond selling low-cost, high-quality wireless access systems, BroVis aimed to deliver more for its customers. BroVis provided management software with its hardware that came bundled with the solution, easing the process of system administration and maintenance. Also, unlike other vendors in the industry, BroVis set a high bar for customer service. Once a sale was made, BroVis offered both on-site and offsite training as well as assistance to customers as they deployed the wireless solution. Moreover, after customers deployed the solution, they would be charged only if they were satisfied. As Prem Kumar, Product Marketing Engineer for BroVis, commented:

> No leading well-known providers offer this level of customer service. This is a very unique selling point. It shows that we are not trying to push the product onto customers. Rather, we try to suit their

requirements. Once customers say 'Yes, we're satisfied,' they also say 'Yes, we're satisfied' to everyone they know.

References from satisfied customers brought new business for the company, especially in India.

In the end, BroVis required a difficult combination of high quality and low prices in order to succeed in emerging and developed markets. The company successfully balanced these sometimes conflicting goals. As Muthu Logan noted, "Users are replacing existing equipment with BroVis equipment, the biggest testimony to the strength of our products."

Staying competitive in the global marketplace required BroVis to keep pace with the dropping price points of its broadband wireless access products. Market research firm IDC estimated that the average selling price (ASP) of enterprise-class access points would drop from $487 in 2006 to $367 in 2009.[31] This trend further instigated BroVis to look into other markets that would expand the volume of prospective customers. See **Exhibit 6** for IDC's forecast of worldwide access point shipments, revenue, ASP, and base station revenues through 2009.

Marketing Communications

BroVis had taken a grassroots approach to marketing in India. Most leads were generated through road shows and seminars in major metropolitan cities. For example, in the latter half of 2004, BroVis and technology partner Atheros organized their first all-India press tour and educational seminar series. Although the tour did not generate a significant sum of revenues, BroVis was introduced to Leela Palace Hotel and other brand name enterprises that later became customers. In addition to these road shows and seminars, a significant portion of BroVis' marketing budget was slated for promotional advertisements in Indian newspapers and trade journals. This press exposure in India further established BroVis as an entrenched player in the market and as a thought leader among prospects and government authorities.

Logan did not know whether the same marketing communications media would be applicable to other markets. Logan noted, "In India, cold calls and e-mail can serve as initial icebreakers, but you must have face-to-face meetings to get anywhere." If their physical presence was required to gain traction in other markets, Logan knew that the expanded marketing budget would detract from product development. Logan mused to himself, How could BroVis efficiently create brand awareness and sales opportunities in other markets? Moreover, from a product marketing perspective, what were the best communications media that would support efforts to reach out to and maintain relationships with the company's international customers? Logan wanted to keep two-way communication channels open, as they allowed customers to provide product feedback.

Partnering for a "Whole Product" and Go-to-Market Strategy

BroVis' partners fell into three categories: *technology partners*, *suppliers & manufacturers*, and *sales and distribution channel partners*. See **Exhibit 9** for a complete list of the company's partners. These partners allowed BroVis to create a "whole product" including hardware, software and service that was superior to its competition. Some of them also played a role in BroVis' go-to-market strategy.

Technology Partners

The company's primary technology partner was Atheros Communications, a global leader in Wi-Fi chip technology based in Silicon Valley. This partnership began in 2003 when Muthu Logan called Praveen Singh, India Country Manager for Atheros, upon a tip from a mutual friend. At the time, Singh had finished leading the generation of business opportunities for Atheros in Japan, Korea and Europe. He wanted to shift his focus to India, a country in which Wi-Fi was a nonexistent term in the lay man's

[31] IDC, "Worldwide Enterprise Wireless LAN Equipment," #32858, May 2005, accessed May 2006.

vocabulary. To penetrate India and to seed the idea in the marketplace that India could bypass wired broadband investments with wireless technology, Atheros needed partners with local expertise. Muthu Logan's call came right on time.

As a pioneering organization in the broadband wireless industry, Atheros used its weight in the global marketplace to get in the door of various Indian government agencies. On behalf of Atheros, Praveen Singh brokered discussions and negotiations with these agencies, leading to the loosening of restrictions on broadband wireless technology in India. However, to truly stimulate the adoption of Atheros' chipsets in India, Singh knew that companies such as BroVis would be critical to its success. In Singh's words, "BroVis has the connections and understands the needs of the Indian market." Moreover, BroVis supported many rural initiatives that resonated with Atheros' philanthropic vision. As Singh explained:

> Atheros wants to spread wireless, not just by selling chips but also by bettering the lives of folks in India. To conduct pilot experiments in Indian villages, partners like BroVis are needed. To succeed, we can't just throw money at these deployments; they require know how. And that's what BroVis has.

In return, BroVis received technical credibility on a global scale, as Atheros' chips had already deeply penetrated many of the markets that BroVis was evaluating. Further, BroVis had access to the next generation of wireless chips from Atheros and obtained visibility into industry trends.

Suppliers & Manufacturers

BroVis formed relationships with a second category of partners: *suppliers & manufacturers*. In the Indian market, the company chose local suppliers to provide equipment components, and it put these components together in its Chennai production facility. This local sourcing and manufacturing model in India yielded cost savings (in the form of minimal labor, shipping, and handling expenses) that helped BroVis stay lean with its limited capital resources. The company's expansion to international markets would require development of a scalable equipment sourcing and manufacturing strategy. Should BroVis stick to its India-based suppliers and its homegrown production facility when selling equipment in other Asian markets? Muthu Logan would need to answer this question in his formulation of the company's Asia sourcing and manufacturing strategy.

Sales and Distribution Channel Partners

BroVis placed a high priority on developing and maintaining channel partnerships, an important component of the company's international expansion plans. As Prem Kumar noted, "Having channel partners who are local to and knowledgeable about a region reduces BroVis' overhead costs, gives good exposure to that region's market, and facilitates market penetration." BroVis' channel partners included *distribution partners* and *systems integrators* (SIs). Finding organizations to fill these roles required looking for companies in a similar domain. Contact with compatible organizations was initiated half the time through references and the rest through cold calls.

Distribution partners were attractive because, for relatively small cost to BroVis (between 5 and 10% of each equipment's average selling price), they could resell BroVis' products to regions of the world previously inaccessible to BroVis.[32] Beyond enabling the company to scale globally, geographically separate partners could help BroVis quickly penetrate multiple markets at the same time. However, significant challenges existed in maintaining successful distribution partnerships. Namely, BroVis had to train the partners to become experts in its products and to become independent from BroVis' product support staff. In this area, BroVis had struggled because on-site training, support, and supervision of channel partners resulted in a drain on financial resources.

System integrators were also important to BroVis because they assisted in developing add-on services and customizations on top of the base solution. To assist deployments in rural areas of India, BroVis searched the public domain – including the National Association of Software and Service Companies (NASSCOM) – for SIs in the northern states of the country. Systems Integrators typically

[32] In comparison, direct sales (i.e. systems sold by BroVis) would incur a cost of sales ranging between 15 and 20% of the equipment's average selling price.

negotiated a separate contract with customers who were buying BroVis products, and wanted help with implementation or customization but did not want to add full-time personnel to their internal Information Technology (IT) departments. Systems Integrators were typically did not receive a percent of the revenue from the sale of BroVis products. SIs also saw post-implementation support contracts as a revenue opportunity in some cases.

Overseas Partners

The company's new distribution partner in Southeast Asia was Icon Base. Based in Malaysia, Icon Base would serve as BroVis' eyes, ears, hands, and voice in the SEA market. In order to support this partnership, Logan had to ensure that all of his functional teams were addressing the partner's needs:

- The marketing team needed to provide the latest product information and marketing collateral to Icon Base.
- The sales team had to monitor, train, and assist the partner in its attempts to resell BroVis' products.
- The support team was responsible for proactively conducting technical training and reactively responding to technical issues that arose in the field.
- The operations team had to develop and support a remote product manufacturing arm in Malaysia.

To ensure that Icon Base would be given necessary attention, Logan knew that he would have to develop an internal partner plan that detailed the support requirements from each of his teams.

Beyond the SEA region, BroVis looked for ways to utilize channel partners to tap into the Chinese, South Korean, and Japanese markets. For China, BroVis had a newly minted and unproven partnership with Azalea Networks. With regards to South Korea, BroVis had not yet selected a partner in that region, but Samsung and Korea Telecom represented potential allies.

So far, attempts to find a reputable partner who could navigate the complicated and inefficient distribution network in Japan had been unsuccessful. To penetrate Japan, some companies decided to obtain a Japanese VC with deep connections and expertise, such as Softbank, Globespan Capital Partners, or Innobridge Capital. Logan thought that approaching these VCs for BroVis' next round of venture capital financing might give him a path to successful selling in Japan, using a direct sales model.

Surviving the Competition

By the end of 2006, BroVis was the only broadband wireless equipment provider selling primarily to the Indian market. Further, major global competitors had not yet invested heavily in India. Muthu Logan was sure that this agreeable competitive landscape would soon change.

BroVis strived to create barriers to entry in its markets on three key fronts: by having an attractive price-performance ratio, by developing reliable and relevant technology, and by offering industry-leading customer service and technical support. The operational efficiencies gained from conducting R&D in India translated into lower cost equipment, resulting in a highly competitive price-performance ratio for the company's products. In addition, the products themselves were tested and tuned for the markets they were sold to. This customization differentiated BroVis' solution from competitors' products. Along with offering attractive price-performance levels and relevant technology, BroVis sought to gain a reputation for industry-leading support in an industry dominated by technology vendors. See **Exhibit 10** for a list of BroVis' competitors and a side-by-side comparison of product and technology features.

Logan took advantage of India's unique business culture in further locking out competitors. For example, having personal familiarity with target customers—such as shared hobbies and interests or common friends—went a long way towards getting deals done. "Competitors are literally thrown out if you have a relationship with a prospective client," admitted Logan.

Commenting on BroVis' competitive stance in India, Praveen Singh from Atheros Communications stated:

> BroVis is making the connections in and understanding the needs of the Indian market. When a big company decides they want to look at the Indian market, they will stumble, fall, and break. They don't know how that game is played. In any case, whether they enter in a year, two years, or three years, these big companies will enter. When they do, BroVis will have become more intelligent about how the Indian market is unique.

Nevertheless, a few companies had the ability to transform the competitive landscape in India and in other target markets. One such company was Cisco Systems, the 800-pound gorilla in the broadband access equipment industry that had a 52% worldwide market share in wireless LAN equipment.[33] BroVis had competed with Cisco on a few minor accounts. In some instances, although BroVis' products would be acknowledged as technologically superior to Cisco's, conservative IT managers chose to buy Cisco's products.

So far, this brand name bias for Cisco or any other major company had not significantly inhibited BroVis' sales in India. However, as BroVis looked to enter other mature markets in Asia, it could become more of an obstacle. With 2006 fiscal year revenues of $1.29 billion in Japan, Cisco had a strong presence in Japan. Cisco was penetrating other Asian markets in a similarly strong way: Another 10 percent of the company's worldwide revenues ($2.85 billion) came from other regions in Asia.[34]

Further, indigenous competition represented a barrier to entry to BroVis in each of the countries it was evaluating. In China, Huawei Technologies and ZTE Corporation were major broadband wireless equipment providers; in Korea, Samsung had a significant presence; and in Japan, Fujitsu was a major player.

Challenges of Expansion

As a startup with a global vision but limited resources, BroVis faced a multitude of challenges in its quest to bring affordable broadband to the masses. Notably, its financial pockets were not as deep as those of major competitors, including Cisco. Although Logan was steering the company towards profitability by the end of 2007, a Series C venture capital funding round would be required to support operations until that point. If BroVis aimed to tackle the Japanese or Korean market, Logan knew that the cost of selling would be twice that of selling in the Chinese or Indian market, further necessitating the extra round of VC funding. Secondly, to support its expansion plans, BroVis could become heavily dependent upon partners and resellers. To make them successful and to retain a pristine global brand image for BroVis, Logan's team would need to conduct extensive product training and to effectively convey its wireless know how. A third constraint was rapidly evolving customer needs and preferences. Wireless technology could become antiquated in a matter of months, not years, and customers would inevitably demand that BroVis stay on top of the technology curve.

Logan knew that international expansion would create immense organizational challenges. For instance, on entering new markets, BroVis would face a recruiting challenge. Competing for local talent with well known employers in a region, BroVis had to overcome the stigma against startups, especially one that was based in a different part of the world. Another challenge existed in managing global teams. The time difference between India and Silicon Valley was 12.5 hours or 13.5 hours (depending on the U.S. daylight savings period), and with the representation of more time zones among the company's employees, it would be a challenge to conduct productive communication.

Moreover, BroVis' ability to enter new geographical markets hinged on the disposition of their governments. Although the governments of many emerging markets in Asia had deregulated their telecom industries and had supported broadband wireless initiatives, government certification of BroVis' products in other markets was a risky and important step in the international expansion process.

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[33] "Market Share: Wireless LAN Equipment," Gartner, Inc.

[34] Cisco Systems, Inc., 2006 Annual Report (San Jose: Cisco Systems, Inc., 2006), p. 24, http://www.cisco.com/web/about/ac49/ac20/downloads/annualreport/ar2006/pdf/ar_2006_complete.pdf, accessed January 2007.

Flight Time

As Logan finished reading the last market research summary, he glanced at his empty Chai Latte cup and then at his wristwatch. His flight time was closing in. He packed his bag and made his way towards the rental car. Walking through Stanford University's long archway-laden corridors near the Quad, Logan reviewed the decisions he needed to make.

First, now that the company had a growing base of customer references in India, how could BroVis fully penetrate the Indian market and establish itself as a market leader? Important considerations included development of a viable business model and go-to-market strategy that set priorities among BroVis' four target customer segments with a plan for how to market and sell to them.

Second, in addition to working with Icon Base to enter other countries in Southeast Asia, what geographical market in Asia should the company enter next - China, Japan, or South Korea? Although Logan strongly believed in BroVis' potential in India and SE Asia, he could not ignore the significant opportunities in other countries in Asia. To prepare for international expansion, he needed to answer the following questions:

- What was the relative attractiveness of China, Korea, and Japan as new country/markets, based on market size, product applicability, ease of doing business, and potential risks?
- What was the best go-to-market strategy for each country: working with channel partners or direct marketing and sales? How, if at all, should the marketing communications campaign for each country differ from the one BroVis was currently using as part of its go-to-market strategy in India?
- Once the preliminary go-to-market and marketing communications strategies were sketched out, which of the three countries should BroVis attempt to enter 2007 and 2008?
- Roughly $1 million of the $3 million in the Series B financing that BroVis was raising was targeted for international expansion. How much of the $1 million should be devoted to the go-to-market strategy for Southeast Asia (in partnership with Icon Base), China, Korea, and/or Japan? What milestones should he propose to investors that BroVis would achieve with their capital in its international expansion in 2007-2008?

In December 2006, with the intrepid spirit and forward-looking attitude of a global entrepreneur, Muthu Logan boarded his plane en route to India. By the time the plane would land in Chennai, BroVis Wireless Networks would have a new Asia Pacific business growth strategy ready for execution.

Exhibit 1: Biographies of BroVis Management Team

Dr. Paul Kim, Chairman

Dr. Paul Kim, is Founding and Managing Partner of Parakletos @Ventures, LLC, a Venture Capital Firm located in Silicon Valley, California, with investments in the United States, India, China and Korea. Among several successful investments, Dr. Kim was the first venture investor in Silicon Image, Inc (NSDQ:SIMG), PowerComputer (acquired by Apple), and Wumart (HKSE:8227.HK), and has founded GCT Semiconductor. His other venture investments include Techwell (NSDQ: TWLL), Anchiva, Azalea Networks WebEx China, Anapass Semiconductor. Dr. Kim serves on multiple boards of high tech companies and non-profits, such as the Living Stones Foundation, a U.S. Christian foundation with assets approaching $100 Million. He also serves as an Elder of Yoido Full Gospel Church in Korea, the world's largest Church, and as the Head Elder of Jubilee Christian Center, San Jose, California.

Muthu Logan , President and CEO

Muthu Logan had worked in the United States for over 20 years with experience at leading technology companies such as Lucent Technologies, Ascend Communications, Intel, Olin and Solectron. He had played a key role in the broadband industry since the mid-1990s, and he held a pivotal role in making the DSL Broadband Access group a major success story at Lucent Technologies. Previously, Logan held various marketing and business development positions at Ascend Communications, Madge/LANNET Data Communications and Solectron Corporation. He had also held various engineering/ management positions at Intel and Olin Corporation. He obtained a M.S. in industrial engineering from the University of Texas, United States, and a MBA. Logan was the founder of two technology ventures – both in Silicon Valley – including BroVis Wireless Networks. He served as technology advisor to three Venture Capital firms in the United States and had been a leading proponent of standards based Wi-Fi and WiMAX technologies.

Babu Mandava, Technology Strategist and Board Member

Babu Mandava was one of the most successful entrepreneurs in Silicon Valley, California, and was well known as the founder of the highly successful Centillium Communications, a broadband pioneer in the United States. Babu was also founder and president of Beceem Communications, a high profile WiMAX wireless chipset company. Prior to Beceem and Centillium communications, Babu was a key technical member of Cirrus Logic's communications division. He had worked for over twenty years in the high technology industry and had worked for prominent companies in both United States and India.

Source: Adapted from BroVis Wireless Networks, "About BroVis Wireless Networks," BroVis Web site, http://www.brovis.com/files/about3.htm, accessed December 2006.

Exhibit 2a: GDP Growth Rates for Target Markets in Asia

Country	2002	2003	2004	2005
China	8.4%	9.3%	9.5%	9.2%
India	2.5	6.9	5.3	6.6
Japan	-0.5	1.1	2.5	2.8
Korea, Rep.	6.5	2.7	4.2	3.5

Source: Adapted from country-specific data, World Development Indicators database, August 2006.

Exhibit 2b: GDP and Purchasing Power Parity (PPP) for Target Markets in Asia

The following table summarizes GDP and PPP data for BroVis' target markets in the Asian region. GDP refers to the *value* of all final goods and services produced in a country in one year. On the other hand, PPP serves as a measure of the *relative purchasing power* of different countries' currencies over the same types of goods and services. Because goods and services may cost more in one country than in another, PPP enables more accurate comparisons of standards of living across countries. If PPP per capita is much higher in one country than in another, it suggests that consumers in the former can afford a lot more purchasing activities than those in the latter.

Country	GDP ($ billion)	GDP per Capita ($ dollar)	PPP ($ billion)	PPP per Capita ($ dollar)
China	1,237	966	6,008	4,690
India	515	491	2,967	2,830
Japan	3,979	31,293	3,560	28,000
Korea, Rep.	477	10,006	838	17,580

Source: Adapted from Youthink!, The World Bank Group, http://youthink.worldbank.org/glossary.php, accessed January 2007; Economist Intelligence Unit in Chien et al., *Business Growth Strategies*, pp. 60, 63.

Exhibit 2c: Technology Penetration in Target Markets in Asia

Country	2002	2003	2004	2005	2006 (E)
China					
Population (millions)	1,288	1,288	1,288	1,290	1,307
Personal Computers (per 1,000 people)	25.3	31.8	40.0	50.3	63.2
Internet Users (millions)	59.1	69.0	94.0	103.0	123.0
India					
Population (millions)	1,095	1,095	1,095	1,112	1,112
Personal Computers (per 1,000 people)	7.4	9.0	11.0	13.4	16.3
Internet Users (millions)	16.5	22.5	39.2	50.6	65.3
Japan					
Population (millions)	128	128	128	128	128
Personal Computers (per 1,000 people)	391	407	425	443	462
Internet Users (millions)	57.6	63.8	70.5	78.1	86.3
Korea					
Population (millions)	48.1	48.1	48.1	49.9	50.6
Personal Computers (per 1,000 people)	470	512	558	608	662
Internet Users (millions)	23.3	25.8	28.6	31.6	33.9

Source: Adapted from World Bank ICT at a Glance, http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20459133~menuPK:1192714~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html, accessed December 2006; Internet World Stats, http://www.internetworldstats.com, accessed September 2006.

Note: “Internet users” refer to people who have accessed the Internet, whether or not they own a computer or pay for dedicated Internet connectivity.

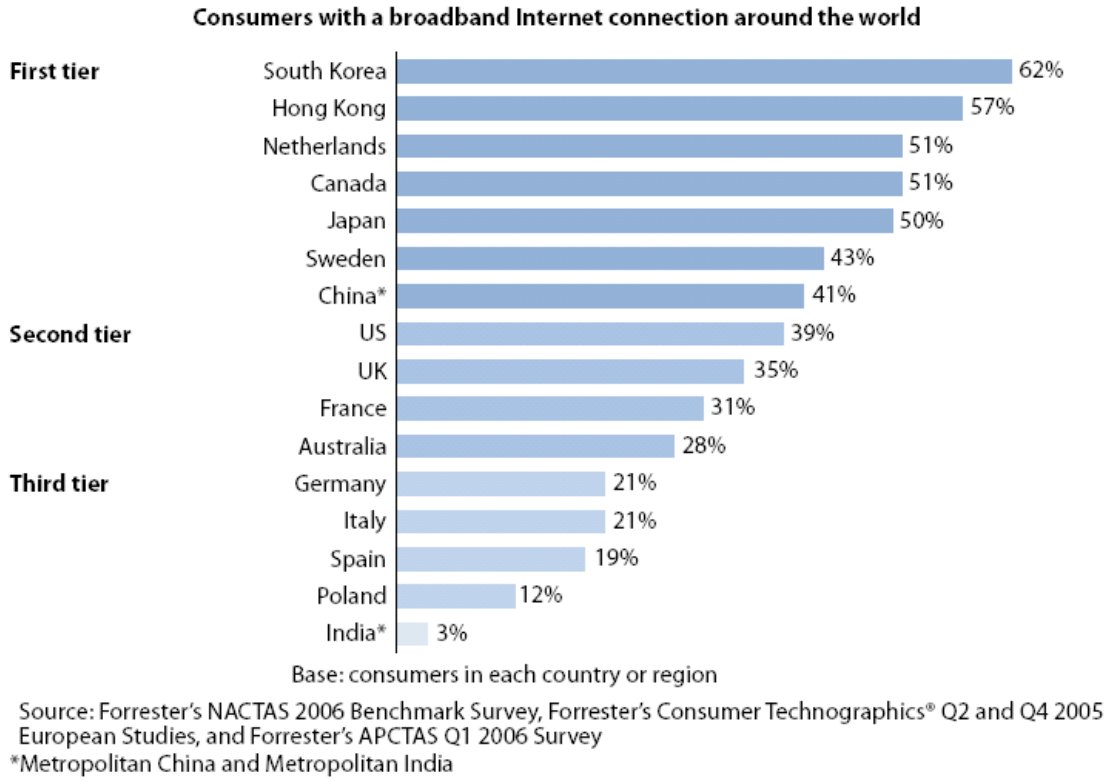
Exhibit 2d: Doing Business in Target Markets in Asia

This table provides a snapshot of each country's aggregate ranking on the ease of doing business and on some of the topics that comprise the overall ranking. The rankings cover 175 countries, and a lower ranking reflects more ease of doing business in that country.

Ease of…	Description	China	India	Japan	Korea
Doing Business	Overall ranking on the ease of doing business	93	134	11	23
Starting a Business	Topical ranking on the ease of launching a business	128	88	18	116
Procedures (number)	Number of steps that entrepreneurs can expect to go through to launch	13	11	8	12
Time (days)	Average time to launch	35	35	23	22
Dealing with Licenses	Topical ranking on the ease of building a warehouse	153	155	2	28
Procedures (number)	Number of steps to obtain licenses and permits, complete notifications and inspections, and obtain utility connections	29	20	11	14
Time (days)	Average time to complete procedures	367	270	96	52
Employing Workers	Topical ranking on the ease of hiring and firing workers. The indices in the two rows below assign values between 0 and 100, with higher values representing more rigid regulations	78	112	36	110
Difficulty of Hiring Index	Index that highlights challenges in hiring	11	33	28	11
Difficulty of Firing Index	Index that highlights challenges in firing	40	70	0	30
Trading Across Borders	Topical ranking on the ease of importing and exporting a standardized shipment of goods	38	139	19	28
Documents for export (number)	Number of documents that need to be filled out before exporting	6	10	5	5
Time for export (days)	Average time to complete documents	18	27	11	12
Documents for import (number)	Number of documents that need to be filled out before importing	12	15	7	8
Time for import (days)	Average time to complete documents	22	41	11	12
Closing a Business	Topical ranking on the ease of resolving bankruptcies	75	133	1	11
Time (years)	Average time required to resolve bankruptcies	2.4	10.0	0.6	1.5

Source: Doing Business, World Bank, http://www.doingbusiness.org, accessed December 2006.

Exhibit 3: Global Broadband Adoption Rates



Source: Kelly and McCarthy, "The Chinese and Australians Soak Up Broadband," Forrester Research, Inc.

Exhibit 4: Indian Government's Broadband Penetration Goals

India's *Broadband Policy 2004* adopted the following broadband penetration goals.

Year Ending	Internet Subscribers (Goal)	Broadband Subscribers (Goal)
2005	6 million *	3 million **
2007	18 million	9 million
2010	40 million	20 million

* Actual number of Internet subscribers was closer to 6.9 million

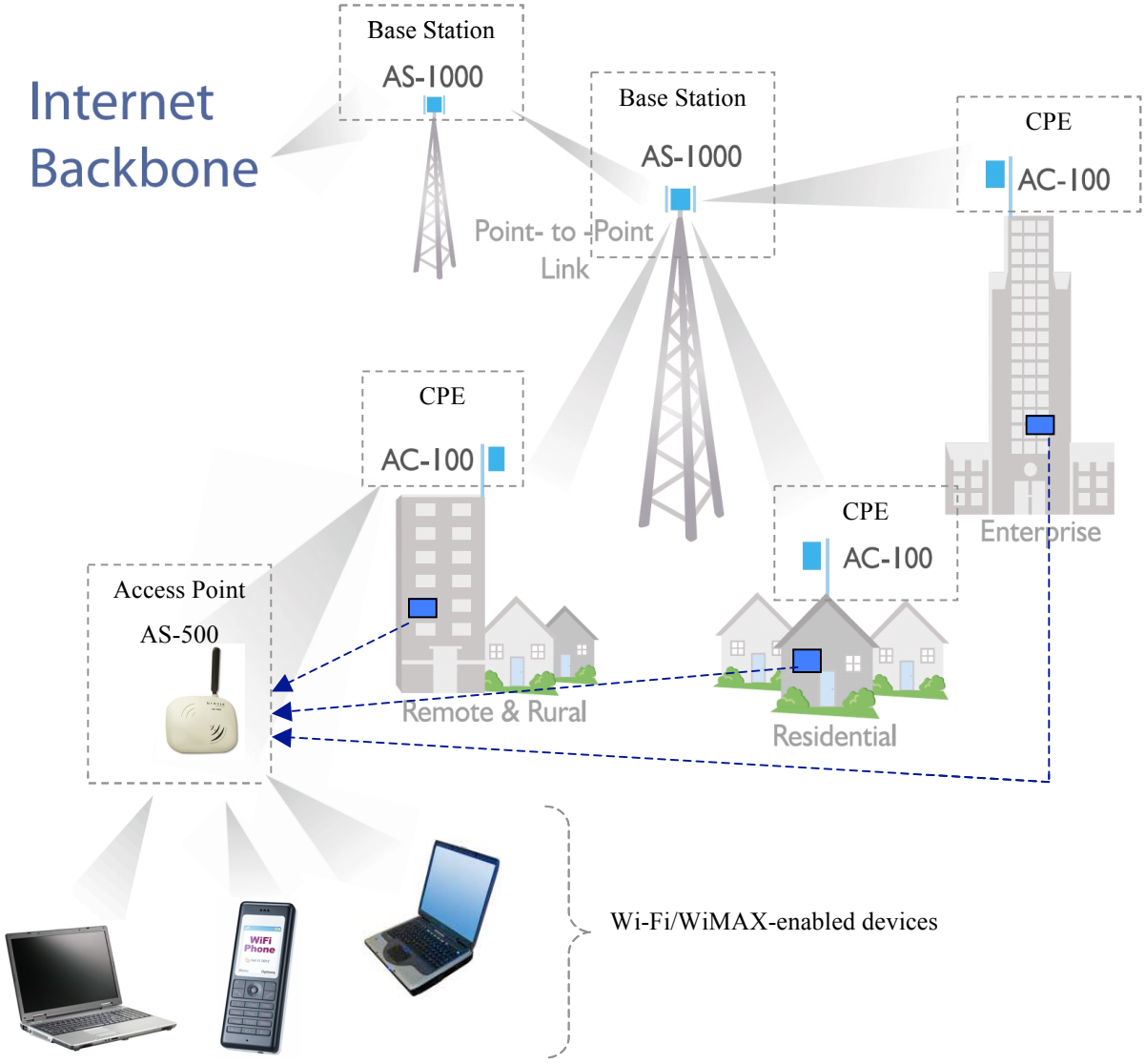
** Actual number of broadband subscribers was 835,000

Sources: Adapted from *Broadband Policy 2004*, Government of India Ministry of Communications & Information Technology and Department of Telecommunications, http://www.dotindia.com/ntp/broadbandpolicy2004.htm, accessed December 2006; Nicole Willing, "India Looks to WiMAX," Unstrung, http://www.unstrung.com, accessed December 2006.

Note: "Internet subscribers" refer to the number of paying customers of dedicated Internet services.

Exhibit 5: BroVis Solution Architecture

As part of its broadband access solution, BroVis sold *base stations*, *customer premises equipment* (CPE), and *access points* (APs). The following diagram illustrates how these components interact to form a complete broadband access solution.



Description of BroVis solution components:

- AirStation 1000 (AS-1000) – Outdoor dual radio *base station* that provides affordable long range connectivity between the Internet backbone and a local area.
- AirClient 100 (AC-100) – *CPE* that serves as a broker between a base station and access points. For example, it can take the broadband access signal from the base station and channel it to multiple, independent access points.
- AirStation 500 (AS-500) – Indoor *access point* that provides enterprise-class wireless connectivity from a CPE to Wi-Fi/WiMAX-enabled devices, such as laptops, PDAs, and cell phones.

Source: Adapted from BroVis Web site.

Exhibit 6: Worldwide WLAN Access Point Shipments and Revenue, 2003-2009

	2003	2004	2005	2006	2007	2008	2009
Enterprise- & Public Service-class Access Points							
Shipments (000)	1,033	1,557	2,320	3,179	4,006	4,727	5,436
Customer revenue ($M)	602	876	1,227	1,547	1,754	1,884	1,993
ASP ($)	583	563	529	487	438	399	367
Enterprise-Class WLAN Access Point Controllers/Modules/Appliances							
Revenue ($M)	53	156	252	375	502	588	652

Source: IDC, "Worldwide Enterprise Wireless LAN Equipment."

Note: "Access point controllers/modules/appliances" refers to dedicated systems required to control and manage multi-access point WLAN solutions. These systems include base stations.

Exhibit 7: Market Size of Customer Segments in India

The following table represents the total available market of units that could be deployed in the life of each category.

Customer Segment	No. of Base Stations / CPEs / Access Points	Percentage of Market
Campus/Enterprise	1.5 million	25%
Government & Defense	1.0	16
Service Provider	1.0	16
Telecom	2.5	43
Total	6.0 million	100%

Source: BroVis company estimates as of January 2007.

Exhibit 8a: List of BroVis Customers in India

Campus/Enterprise	Government & Defense	Service Provider	Telecom
Pilot Honda	Post offices in India	Hathway	Estel Technologies
The Leela Palace Hotel, Bangalore	Southern Railway	Dishnet	
The Residency Towers, Chennai	CyberGrameen (rural)	MicroSense	
Madras Pharma		HotSpot Express	
Bombay Fashions		Tommasso Technologies	
St. Joseph's College of Engineering		ISP Solutions India	
Kalsar College of Engineering		SIFY	
Jeppiar College of Engineering		Net4India	
MIT-Chennai		CogentView	
Photon Info Tech		SpectraNet	
GRT, Chennai		Lanka Communications	
CEC, Calicut		TAKE solutions	
KEC-Coimbatore		Netezen, Bangladesh	
Gurudatt Sugar (rural)			

Source: BroVis records as of September 2006.

Exhibit 8b: Breakdown of BroVis Customers in India's Rural and Metro Areas

Target Customer	Customer Share of Metro Areas	Customer Share of Rural Areas
Private players *	70%	30%
Government	20	40
NGOs	0	20
Other	10	10
Total	100%	100%

* Private players included service providers (45%), telecom operators (30%), and enterprises (25%).

Source: BroVis records as of September 2006.

Exhibit 9: BroVis Partner Network

Technology Partners

Name	Location	Description
Atheros Communications	Santa Clara, CA (U.S.)	Wi-Fi chipset provider.

Component Suppliers

Name	Location	Description
Pac Wireless	Bluffdale, Utah	Wi-Fi antenna manufacturer
Shreyas Communications	Chennai, India	Antenna manufacturer
Shrinar Communications	Chennai, India	Antenna manufacturer

Designers and Manufacturers

Name	Location	Description
Pactron	Sunnyvale, CA (U.S.)	Electronics design and manufacturing services firm
Wind River	Alameda, CA (U.S.)	Global leader in device software optimization; provides development and testing platform for BroVis' products
Wistron	Taipei, Taiwan	Original design manufacturer (ODM) based in Taiwan with service centers in China, Japan, Philippines, and United States

Distribution Partners and System Integrators (SIs)

Name	Location	Description
A&T Network Systems	Madurai, India	Internet networking & services provider in South India
Azalea Networks	Beijing, China	Wireless communication company certified as a "State-Encouraged Foreign Enterprise" by the Chinese Government
BPL Telecom	Bangalore, India	Communications & consumer electronics solutions and services provider in India
Icon Base	Kuala Lumpur, Malaysia	Solution provider in the voice, data, & video networking and communications industry in Malaysia and other South East Asian countries
LinkNet	Kerala, India	Network systems integrator
Microsense	Bangalore, India	WAN and Wi-Fi solution provider across India
Sohoware	North America	Specialized, value added distributor
Techser	Bangalore, India	Leading network SI and wireless solution provider in South India
Tommaso Technologies	Chennai, India	Software solution provider for hospitality industry in India

Source: BroVis records and company Web sites.

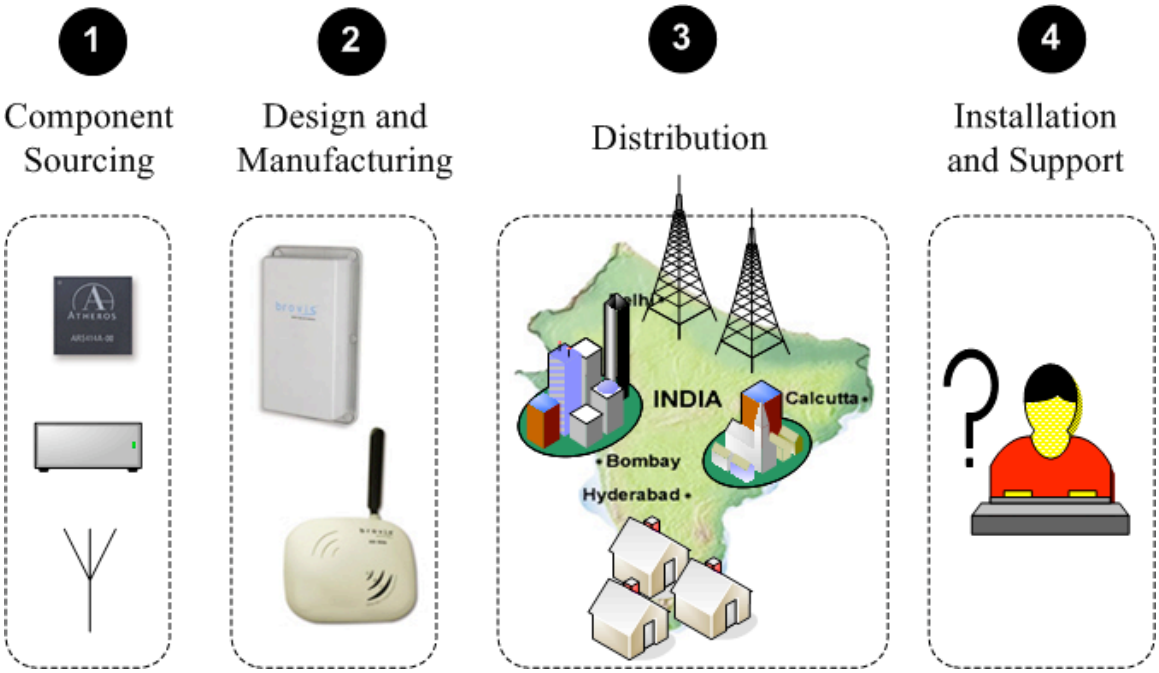
Exhibit 10: Comparison of Competitor Products and Technology Features

Feature	BroVis	Cisco	Alvarion	Motorola
Product(s)	AirStation/Client Series 	Aironet/Airespace 	BreezeAccess/Walk Air 	Canopy 
Position	Only vendor focused primarily on Indian subcontinent and Southeast Asia	Worldwide WLAN market leader	Outdoor broadband wireless market leader	Focused on wireless MAN solutions
Dual Radio Architecture	Yes	Yes	No	No
Capacity	54 Mbps, 108 Mbps (turbo)	54 Mbps	Up to 54 Mbps	54 Mbps
Open, Standard based and Migration Path	802.11a/b/g and 802.16d/e, 802.11n	802.11a/b/g and 802.16d/e, 802.11n	802.16a, 802.11a	802.11a/b/g
Frequency Band	2.3 and 5.9 Ghz, 2-11 Ghz in future licensed and unlicensed bands	2.4, 5.8 Ghz	5.8 Ghz and other licensed frequency bands	2.4 and 5.8 Ghz
Non-Line of Sight (NLOS) Technology	Yes (all products)	No	Yes (one product only)	No
Coverage	3 to 5 km (NLOS) 12 to 40 km (LOS)	Not known (LOS)	5 to 8 km claimed (NLOS)	Up to 30 km (LOS only)
Software Features	Quality of Service (QoS), Subscriber Management, and Voice software	Some	QoS planned	None
Tested/Tuned for Indian Subcontinent	Yes	No	No	No

Source: BroVis records.

Exhibit 11: Customer Value Chain

Each of the following components forms a part of the value chain that BroVis delivers to customers with the help of partners. To ensure success of its customers in a target market, each of these components must be handled by either BroVis or a partner.



Source: Casewriter. Pictures adapted from Atheros company Web site, http://www.atheros.com, accessed December 2006; BroVis company Web site, http://www.brovis.com, accessed December 2006; Premier Oil company Web site, http://www.premieroil.com/Asp/uploadedFiles/image/Maps/india.jpg, accessed December 2006.