

## Appendix A — Project Next Steps

### Next Steps

Given the time constraints and the difficulty in gathering some data, we outline below the next step areas we believe would improve our analysis the most and extend beyond our work.

For the market competitive analysis, the largest driver of work was the speed at which the broadband market is moving. From one perspective, it was educational to see our beliefs about the market playing out in front of our eyes. At the same time, it also created a lot of additional work. There is not necessarily anything that can be done about this. But it does point out the need to be aware of the current market landscape and use that as the basis for analysis.

For the financial and operational analysis, the "blue chip" Internet stocks were primarily focused on. By choosing the leaders of the industry, we immediately set a high bar for future expectations. This also introduces a survivor bias into the valuation. To improve the comfort with the financial market analysis, a broader group of industry stocks should be surveyed and analyzed. There are also a lot of startups that will be the next greatest companies. Exploration into some of their innovations and angles would provide a more bleeding edge (as opposed to our cutting edge) survey of the players. This would be valuable from a potential acquisition perspective since many of these players will develop specialized systems to aid the expansion of the broadband market.

What came out late in the project timeline was an interest by the client in exploring alternative sales channels, like national electronic chains or PC hardware manufacturers. Given our time constraints, we were unable to generate other channels or study the financial impact on the model of addressing these channels. We still believe that Baker does not want to become an ISP, which would be necessitated by the alternative sales channel acquisitions. It makes more sense to leverage the energy of existing ISPs to sell to their existing established customers, avoiding acquisition costs and recurring customer care costs. However, in the spirit of creating new paradigms for marketing with the Internet, alternative sales channels would be an important area of next step exploration. Our market analysis shows that there are a lot of hungry ISPs out there trying to figure out how they will survive in the future. Common sense suggests strategies that avoid companies willing to bet the farm given their survival instinct. The ISP market is one of cut throat competition and low margins. Customer mass allows for the expansion into complementary services and higher margin services.

For the market size analysis, we attempted to use a wide range of market forecasts. It is difficult to reconcile all of the numbers found given the differences in defining the Internet market, users or households, US or worldwide, yearly average or end of year, etc. To improve the work with the diffusion models, collecting more historical data and future forecasts would create more confidence in the model fit. It would also enable getting a better notion of the range of uncertainty about the market size to feed the sensitivity analysis.

For the conjoint analysis, we were more interested in getting a rough estimate of the utilities of different product attributes. To further this work, a larger sample size would be surveyed, addressing a more representative sample of the Internet population. Some of the questions could also be refined and extended given what we found in the results of the initial survey.

The client was also interested in determining if there was any significant behavioral patterns exhibited with current subscribers to first, second and third tier ISPs. AOL is perceived to have a customer base that is below average in net usage and technical knowledge. This would encourage further exploration into up-selling second and third tier ISPs to broadband service. The primary concern with selling to the third tier ISPs is that many are very small and there is more risk associated with servicing these small partners. If a conjoint analysis was able to determine that either these ISP customers were more likely to spend a lot of money on broadband enhanced services, it would make more sense to spend time figuring out the proper business model to address this market.

For the value model, it was necessary to attack revenue and cost from a very high level. Additional data collection and analysis would help clarify the revenue and cost components of operations. Further company and industry profiles would be valuable.

In regards to the value measure, further statistical analysis would be desirable for both the value drivers and the value weights. The companies addressed by nature of the time

Sensitive issues for the client that would greatly impact their play in the consumer space include changes in the regulatory environment. If AOL is able to open up the cable infrastructure to any ISP, this commoditizes the broadband access market, decreasing the significance of Baker's strategic position. On the other hand, there are FCC rulings that could reduce the costs of dealing with the Baby Bells on the local loop. Interoperability and openness of the Baby Bells will continue to be improved until the FCC allows them to enter the LD market. The regulatory environment could greatly change both the revenue and cost pictures of a data CLEC. Further scenario analysis into the strategic and cost implications for these events is prudent.

Many of the partnerships could be viewed as compound options, where partner agreements allow for a sequence of decision options through time. Baker clearly believes the wait option is the most valuable alternative at this time. The market has not crystallized enough (or consolidated) to motivate certain agreements. However, the market is close to the point where considerations of being left without any partners should be valued and weighed. Given the high valuations Internet companies are realizing in the markets today, it is important to address the embedded options in the players' positions. This would encourage the use of real option techniques, not only to better frame the strategic alternatives available, but also to help evaluate how much the options are worth.

It is important to assess the value strategies create. In the Internet world, a compelling strategy is also to build to be acquired. This angle was not addressed in our analysis. Sprint and MCI WorldCom have not aggressively pursued gaining access to the residential customer. Given the price AT&T has paid for cable properties to gain access to the home, it is compelling to build a data CLEC specifically catered to filling the holes of a Sprint or MCI WorldCom. This approach would create a very different focus in terms of strategies since it would suggest pursuing more of a data CLEC pure play than a aggregator of components of the value chain.

## Appendix B — Market Players

### America Online

AOL, being the market share leader in the consumer ISP market (17 million customers), is very ambitious in expanding its presence in the consumer Internet access market. It has been trying to achieve this objective by acquisition of other ISPs, alliances with network service providers, launching services in new regions, etc. By expansion, AOL hopes to acquire more residential customers and increase its profitability in the short term since the variable cost of supporting a new customer is minimal when compared to the fixed cost of operating its network.

Seeing the potential explosion of the broadband access market, AOL has been very active in seeking ways to prepare to ride the tide. AOL has already tagged along with Bell Atlantic and SBC in DSL services. Moreover, it is seeking to enter deals with satellite players to capture a small but fast-growing customer base. Being unable to secure a cable deal, AOL has also been lobbying Congress and the FCC to impose regulations on the cable service providers to open up their networks for Internet service if the cable companies are to enter the broadband access market with their TV networks.

AOL and Hughes (unit of GM) will team up to unite satellite TV and Internet access in a service that would let people tune in Hughes's DirecTV and surf the Web with AOL from the same set-top box. So far, satellites have more bugs than cable and phone technologies. Typical satellite setups are strictly one-way, they can send data down only.

Along with penetrating the US market with its marketing expertise, AOL has also launched its service internationally to increase its global presence. In 1997, AOL entered into an agreement to exchange its ANS subsidiary with WorldCom in exchange for CompuServe. This acquisition has definitely enhanced AOL's presence in Europe and other parts of the world as well as in North America. This acquisition move also enhanced AOL's strategic alliance with WorldCom in generating and deploying new high-speed broadband services.

AOL sees itself as a very fast-growing business entity. It rejected an acquisition attempt made by AT&T earlier, which most financial analysts viewed as having very lucrative terms for AOL's shareholders. Since the AT&T cable deal AOL's stock price has lagged. Stakeholders are concerned that AOL may be left out of the broadband move. The deal with Hughes, being more show than substance, is likely a response to that. AOL is trying to stay agnostic on the access issue but may be forced to take a side between cable and DSL. And more likely they will be forced to choose DSL unless the FCC requires the cable companies to open up their networks. Analysts that follow AOL site a prediction that in 2002, 83% of Internet customers could still be dial-up modems.

## **Cable Industry Overview:**

Approximately 80 million US households have cable service. Approximately 22 million will have their cable upgraded to two-way cable by the end of 1999. The primary hurdle the industry must overcome is upgrading the rest of the networks. Consequently, the cable industry is rapidly consolidating to finance the upgrades. This year AT&T purchased TCI and MediaOne, and Cox purchased TCA.

Some industry analysts predict the upgrades could take as little a year or two. In the meantime, the total cable broadband customer base is around 750,000 subscribers. @Home, the largest cable broadband service, is aiming to have one million customers by the end of 1999. There are two potential revenue streams from the new digital infrastructure: digital cable and cable modems. Digital cable allows for cable companies to better utilize the capacity potential of the coax cables into subscribers' homes. Cable modems allocate 2 frequency channels to deliver data services to the home.

## **Cable Broadband Attributes:**

*Strengths*- Cable provides always on internet access, significant speed advantages relative to analog modems and speeds up to 30Mbps. Cable and data services can be offered over the same line, and possible telephony features as well in the future, and likely voice over IP.

*Weaknesses*- Cable broadband is a shared medium. Most transmissions would require encryption. Also busy times during the day could cause network slowdowns. Traditional cable customers often encounter service problems with their existing lines. Cable companies are notorious for their lack of customer support and technical savvy. There remain issues in standardizing cable modems. And if phone service is offered over cable there must be lifeline service, offering 911 and emergency power over the line.

## *Misc*

Cable Modem service brands: @Home - 19 markets using Comcast, Cox, Marcus Cable, TCI systems. Internet Commander - 1 market Century. Jones Internet Channel - 1 market Jones Intercable. MediaOne Express - 4 markets MediaOne. Optimum Online — 2 markets Cablvision Systems. Power Link - 1 market Adelphia.

## **Cable Industry Players:**

### **AT&T**

AT&T is the largest long distance carrier in the US, with almost half the market. After the breakup of AT&T into the long distance carrier and the Baby Bells, AT&T had the entire US long distance market. Since then its market share has been eaten away by MCI WorldCom and Sprint. With profits falling in this area, AT&T has begun looking to other markets. Two of which are the consumer data/broadband market and local phone service. Another reason AT&T is interested in direct access to consumers is to avoid the \$10 B they pay annually in access charges to the Baby Bells.

Originally AT&T was considering accessing broadband customers through Wireless Cable or Satellite, but now have focused on Cable as their medium of choice. They are pushing hard and taking advantage of the regulatory environment. The FCC is so interested in competition they seem unwilling to interfere with mergers until a definite monopoly has been developed. AT&T, with their cable agreements and TCI and MediaOne deals, may be able to pass up to 60% of US homes- 62 million at most.

### *Recent Moves*

They paid 54 B for MediaOne, allows phone service to Comcast customers estimated price of \$4500 per customer. TCI coverage of 17 million households and MediaOne 8.5 million households prior to split off of 2 million customers to Comcast.

ATT formed a nonexclusive deal with Microsoft to include Windows CE in at least 2.5 million settop boxes for 5 B. ATT is now the majority owner of @Home and a stakeholder in RoadRunner from the MediaOne deal. The two internet cable providers will try to expand their customer base by tapping ATT s cable subscriber.

### *Analysis*

ATT has the best financials of any of the companies in the industry (excluding Microsoft) with a significant war chest. On top of that they will have access to the most homes of any player. However some of these access agreements with other cable companies are geared primarily toward phone service.

ATT has a tremendous burden in updating the cable networks of the companies they have agreements with. And the TCI network, which they own, may need the most updating of any network.

## **Time Warner**

Time Warner is currently the second largest US cable operator (displaced by the recent AT&T/MediaOne addition). They have around 20 million subscribers. They also have a majority stake in RoadRunner, the second largest cable broadband service. Their network is considered the most technically up to date. They currently offer broadband service in 13 markets.

In addition to owning their cable infrastructure, Time Warner has a significant portfolio of media content under its control including, CNN, Time, and Warner Bros. They also have music and publishing divisions that may be able to exploit the internet's massive promotional capabilities. Time Warner may be able to leverage synergies in e-commerce for music, publishing, and news.

### *Recent Moves*

AT&T and Time Warner have an agreement allowing AT&T to offer telephony services over Time Warner's network. In return, AT&T will help finance the upgrading of the rest of Time Warner's network.

### *Analysis*

Time Warner is in a unique strategic position given its high degree of vertical integration. It owns key businesses and brands that can be leveraged into the emerging new media world. They possess the single most impressive collection of media and entertainment assets generating significant potential to create and drive traffic both online and off-line. There is great potential for cross-promotional platforms (cable networks, magazines, broadcast etc.)

## **Cable Broadband Services**

@Home, which is a publicly held company with majority stakeholder AT&T, is the largest cable broadband service. @Home is 70% owned by the cable companies that they have agreed to provide service with (TCI, Cablevision, Cox, Shaw, Comcast, and Rogers). AT&T became the majority shareholder with their purchase of TCI. @Home has approximately 450,000 subscribers and is aiming for 1 million by year end. @Home passes 15 million homes with upgraded (two-way cable). They are aiming for 23 million by year end.

RoadRunner is the second largest cable broadband service. The company is not publicly traded, and is owned by Time Warner, MediaOne, Microsoft, Compaq, and Advance/Newhouse. Since MediaOne was acquired by AT&T, and their stake in RoadRunner as well, there will be probably be a reshuffling of ownership of the two services. There has been ongoing speculation about a merger between the two services since early this year.

The main difference between @Home and RoadRunner is that Time Warner's cable network is generally more up to date than those using @Home. Consequently, Roadrunner is focusing more on the cable standardization issues, whereas @Home trying to become a major media player. They are trying to sign up as many subscribers as possible and with their purchase of Excite have access to 20 million registered users.

Pricing for @Home and RoadRunner are both around \$40 to \$50 (monthly charge) and \$40 to \$200 for one time installation depending on the local cable provider. One of the main cost differences for cable broadband providers is that they have their own ISP service, whereas some of the DSL players do not. So the ISP's fees have to be added on top of the DSL charges and not on the cable service. @Home is claiming to offer speeds up to 2.88 Mbps, whereas typical dialup is 100 times slower at 28.8 Kbps.

@Home Network Overview- to overcome the performance limitations of the Internet, Excite@Home has developed a high-performance "parallel Internet." While it uses the same underlying protocols to ensure compatibility and seamless access to everything on the Internet, @Home's network architecture is markedly different.

Two key themes in @Home's network strategy are "pushing data closer" and "end-to-end management." To embody the first theme, Excite@Home uses a hierarchical, distributed network architecture with proprietary caching and replication technologies to ensure that the information a user wants is always "as close as possible" within the network. "End-to-end management" describes @Home's proactive network quality, service, and performance management systems. Because the network is centrally managed, @Home can avoid the "finger pointing" that plagues the general Internet, and dynamically identify and address network quality, service, and performance issues before they ever affect users.

## **Other Cable Players**

Comcast is third in the industry in customer base with around 8 million customers. They paid \$9 billion for 2 million customers from ATT/MediaOne.

Cox is the next biggest player with 5 million customers. They just bought TCA Cable paying \$4115 per subscriber. TCA's customers are mostly in smaller markets. Most of the larger cable markets have been staked out.

## **DSL Industry Overview:**

The DSL industry, unlike cable serves both consumers and businesses. DSL (Digital Subscriber Line) technology runs over existing copper lines. DSL service comes in many varieties, SDSL, VDSL, and ADSL. ADSL (Asymmetric Digital Subscriber Line) is the most important to the consumer market since it allows faster download speeds than upload speeds. Hence, the name asymmetric.

DSL service can be offered by all phone companies, long distance carriers, ILECs (incumbent local exchange carriers), and CLECs (competitive local exchange carriers). Today's DSL technology is estimated to be able to reach about 2/3 of the households. The limiting factor is the distance from the ILEC's central offices to homes (18,000 feet maximum). There are approximately 75,000 DSL subscribers today.

## **Product Attributes**

**Strengths-** DSL provides always on internet access and dedicated bandwidth from the side of the central office. DSL can guarantee minimum speeds. Significant speed advantages relative to analog modems (384 kbps — 7.1 Mbps vs. 28.8-56.6 kbps for analog service). DSL allows phone and data services offered over the same line- potential addition of cable features as well in the future.

**Weaknesses-** DSL will cannibalize higher profit data products like T1s. For this reason, the ILECs have been hesitant to roll out their DSL products. Currently there is not an existing modem standard. The DSL.Lite standard is forthcoming, sometime late this year. DSL.lite will use standard G.Lite modems, and should make service more uniform and less expensive for setup. G.lite modems allow plug and play, so a technician house call is not required to install a voice-data splitter. Another limiting factor for DSL is distance from the central office to homes. DSL service is not available more than 18,000 feet from the home. Unless there are significant technical improvements in DSL, DSL does not have as high bandwidth possibilities as the cable coax side.

## **Data CLECs**

### **Overview:**

There are three main data clecs, Covad Communications, Northpoint Communications, and Rhythms Netconnections. All three were started shortly after the Telecommunications Act in 1996. The companies lease co-location access to the baby bell Cos (central offices). They then provide DSL services over those lines to ISPs, resellers and businesses. The ISPs sell the services to businesses and consumers. The three originally provided services only to businesses and teleworkers. Covad currently offers services to consumers and the other two are moving in that direction.

### **Players:**

#### **Covad Communications**

Covad plans to provide service in 22 regions with 51 MSAs (Metropolitan Service Areas). They were the first of the three CLECs to go public, and they feel they have a first mover advantage. As of now, they are the only one offering service to consumers.

They have 200 ISP partners nationwide, lots of Fortune 500 clients (100 ISPs and 100 companies). The company will be in 22 markets, have 1000 co-locations, and pass 28 million homes by March 2000. They are currently in 9 markets, pass 8 million homes, have 249 co-locations and 6400 installed lines at the end of February.

Their TeleSurfer service, marketed toward home users, costs \$39-59 + \$10-30 ISP cost and provides 384 and 768 Kbps services. This service is offered in 25 MSAs, accessing 11 million households, with potential access to 65% of US HH. Covad provides delivery in 30 days. Covad is marketing speed, security, and service. Their TeleSpeed service, generally marketed to business users, costs \$135 and provides 144Kbps SDSL (Symmetric Digital Subscriber Line) and at the higher end for \$405, they offer SDSL at 1.1Mbps. ISPs are treated as the end users, get out of a lot of regulatory stuff.

Covad is part of a strategic alliance, Universal ADSL Working Group, with Microsoft, Intel, and Compaq. The group is trying to establish DSL.Lite as the standard for DSL service (using G.Lite standard modems). They have a national backbone alliance through AT&T (\$25M invested), Qwest (\$15 M invested) and NextLink (\$20M invested) who is more of a CLEC than long haul or data player.

Covad was funded by Intel, CrossPoint Ventures, and Warburg Pincus. Their management team is originally from Intel, and the company was started with Intel money.

## **NorthPoint Communications**

NorthPoint Communications is a national, facilities-based competitive local exchange carrier dedicated to providing affordable, dedicated high-speed Internet access over existing phone lines using digital subscriber line (DSL) technology. The company operates DSL-based local networks in 19 markets and intends to expand its service to 28 markets by the end of 1999. Upon completion of its planned expansion, NorthPoint's DSL network will be able to reach approximately 4 million businesses and 30 million homes. NorthPoint provides DSL-based Internet access service -- at speeds up to 1.5 Mbps, up to 25 times faster than common dial-up modems — through national and regional Internet service providers, CLECs, long distance carriers, value-added resellers and other partners. NorthPoint Communications, Inc. has focused on delivering dedicated data to growing businesses nationwide through wholesale agreements with service provider partners.

NorthPoint's data services satisfy the bandwidth requirements of small to medium-sized businesses. NorthPoint's service offerings hit the "sweet spot" of data connectivity for small- to medium-sized businesses: dedicated symmetric bandwidth at speeds from 160 kbps to 1.54 Mbps--the right speeds for the most popular business applications--at highly competitive prices.

The number of operational central offices increased during the quarter by 140 percent to 250 from 104 at December 31, 1998. The number of homes and businesses passed increased 125 percent during the quarter to approximately 9.2 million from approximately 4.1 million at December 31, 1998. Net installed lines increased 107 percent during the first quarter to approximately 2,900 from approximately 1,400 lines at December 31, 1998.

NorthPoint extended the availability of its DSL service from seven markets at the year ended December 31, 1998 to 14 markets in the first quarter, establishing the most widely available DSL offering of any data CLEC. NorthPoint currently offers service in 19 major markets and plans to expand service to 28 markets, or 68 metropolitan statistical areas (MSAs), by the end of the year. During the quarter, NorthPoint also formed or expanded strategic partnerships with several regional and national network service providers, including Verio and ICG. Today, NorthPoint DSL is available from more than 120 NorthPoint partners nationwide through 355 operational central offices connecting over 4,300 end users to its network.

NorthPoint has alliances with Verio, @Home, Tandy, and Frontier. They have investments from Microsoft among others.

## **Rhythms Netconnections**

Rhythms aims to become the leading national service provider of high performance networking solutions for remote offices and workers. The company claims competitive advantage in the following areas. Technical knowledge, industry expertise, great financial backers- Microsoft, KPCB, Enron, MCI WorldCom. From their company literature there is no official word that they will compete outright in consumer market- (telecommuters yes).

As of March 31, 1999, Rhythms had deployed services in 11 metropolitan areas, with Philadelphia being the most recently expanded area. Also as of March 31, 1999, Rhythms had 355 central office locations built or operational, up 78 percent from 200 built or operational central offices at the end of 1998. Rhythms had 1,235 DSL lines in service, an increase of 147 percent over the 500 lines in service at December 31, 1998.

In April, Rhythms entered into a multiyear service provider agreement and received a \$15 million strategic investment from Qwest Communications International Inc. Under the terms of the agreement Rhythms will provide Qwest with high-performance, DSL-based “last-mile” connectivity in 31 major metropolitan markets.

Rhythms business strategy focuses on five areas: exploit early mover advantage, focus on performance-driven business customers, expand network-enabled features and applications, establish strong distribution channels, and provide superior customer service.

Details on their distribution channel plans are the following. For large businesses, build a direct sales force and create joint marketing alliances (Microsoft for MS Network services and MCI WorldCom designated Rhythms its preferred provider of business DSL connections for large, medium and small businesses, and with Cisco jointly market and sell networking solutions to large businesses). For small and medium businesses, we will distribute our services through our service provider customers.

## **Regional Bell Operating Companies**

Today's Baby Bells look very different from the originals (Pacific Bell, Southwestern Bell, US West, Ameritech, BellSouth, Bell Atlantic, and NYNEX). Assuming the pending mergers go through, there are four remaining RBOCs- SBC, US West, Bell Atlantic, and Bell South.

The Bells have moved cautiously into the DSL market for two reasons. First, they already offer broadband services in the form of T1 and ISDN lines, and fear cannibalizing these (profitable) products. Second, DSL service is inherently non-uniform (service depends on distance from Central Offices), meaning the Bells cannot currently offer DSL service in some their distant regions. However, recent competition from the data CLECs (Competitive Local Exchange Carriers) and AT&T's binge of acquisitions should encourage the Bells to roll out their DSL offerings. Also, as a result of AT&T's purchases the FCC may consider allowing the RBOCs to offer service outside their regions (long-distance and data), if they demonstrate that they have opened their networks to the CLECs.

### **SBC-Pacific Bell-Ameritech**

SBC when combined with Ameritech would have approximately 50 million phone lines. Their primary focus is getting this merger past the FCC. A ruling is expected this summer. SBC also has a \$500M 10% stake in Frontier (which will be folded into US West- Global Crossing).

SBC claims to have launched the nation's largest rollout of ADSL in January of this year. They are aggressively pricing DSL in all their markets, using uniform pricing across all states and service areas. Today, SBC makes DSL available to two million homes. SBC plans to increase DSL availability to 8.4 million homes by the end of 1999 and to continue expanding its deployment in the coming years.

Southwestern Bell Internet Services plans to offer DSL service throughout Arkansas, Kansas, Oklahoma, Missouri and Texas beginning in 1999. By the end of 1999, service will be available to more than 3.2 million households and 440,000 business customers. Currently, DSL Internet Access is available in the following Texas cities: Austin, Dallas, Fort Worth and Houston. Approximately 60 - 65% of customers out of each central office will qualify for the service. Eventually, the evolution of network technology will allow us to reach the small percentage of customers who are on the most distant ends of our local networks.

SBC currently charges from \$200-\$300 for home setup and \$50 (384 Kbps -1.5 Mbps/ 128 Kbps) a month for basic service and \$80-200 a month for enhanced service 1.5 Mbps-6 Mbps/ 384 Kbps

### **Ameritech**

The cost for *SpeedPath* service is: \$49.95 per month for unlimited access, plus a one-time installation fee of \$150.00, and \$199.00 equipment charge.

For a limited time, they are waiving the \$199.00 equipment charge. Service is currently available in: Ann Arbor, MI, Birmingham, MI, Royal Oak, MI, Troy, MI, and Wheaton, IL.

## **US West-Global Crossing-Frontier**

US West and Global Crossing recently agreed to merge. Global Crossing is a fledgling telecommunications company based in Bermuda. They have laid a few intercontinental undersea fiber lines. They had just agreed to purchase Frontier Communications. Until this merger, US West had stayed on the sidelines of the recent telecom mergers. Collectively, the company wants to be able to compete with AT&T, SBC, Bell Atlantic. US West by itself has 25 million customers in 13 states. US West is generally considered the most advanced LEC in terms of data products.

### *DSL Offerings:*

For about \$30 a month plus a one time set up fee and modem, MegaLine gives the user 256 Kbps access to a corporate LAN or ISP. MegaLine Services offer connectivity at roughly 9 times the speed of a 28.8 Kbps modem. Those subscribers with greater bandwidth needs, can select MegaOffice, which provides 512 Kbps access for about \$65 a month plus a one time set up fee and modem. Heavier-use customers needing more bandwidth and video capability can get MegaBusiness. With 768 Kbps at about \$80 a month plus a one time set up fee and modem, customers can work from home at speeds once available only at the office.

MegaPak: US West.net is poised to offer an Internet solution coupled with MegaBit services in some areas. The package is called MegaPak, and it provides 256 Kbps access to the Internet for \$47.90 per month plus a one time service activation charge of \$110. Many customers find the modem and software easy to install. However, we offer on-site installation as an option for an additional \$149.95. MegaPak includes: Continuous 256kbps digital connection with U S WEST.net Internet Access\*, Netscape Communicator 4.0 Internet browser, 24-hour technical support 7 days a week, 2 e-mail boxes, 2 megabytes of Web page storage.

So far US West has seen an almost 20% increase in central offices where MegaBit Services is now deployed (central offices serving some 5.5 million customer households) in more than 40 cities in U S WEST's region. U°S°WEST will deploy 41 new 5ESS Digital Switches over the next two years, replacing analog central office switches and software in the network. The new technology is expected to allow U°S°WEST to: accommodate greater volumes of voice telephone calls as well as data transmissions, facilitate the installation of additional customers lines more quickly, and efficiently prepare for future customer services integrating voice, video, and data over one network.

## **Bell Atlantic-NYNEX-GTE**

Bell Atlantic, NYNEX, and GTE have approximately 55 million phone lines. The merger with GTE was tentatively approved by the FCC. GTE has a national data backbone (BBN). BBN offered all of the AOL networking services for a long time. GTE/Bell Atlantic are positioning to offer DSL to AOL customers in their territories. GTE currently can offer long distance service since it is not a Baby Bell. It is unclear how the merger will impact this.

### *DSL Offerings:*

Bell Atlantic's entry-level package of DSL service and Internet access — Bell Atlantic Personal Infospeed -- is \$49.95 a month. Personal Infospeed features speeds up to 640 kilobits per second (Kbps), Bell Atlantic.net Internet access and a link to a special version of the Snap portal service that is designed for Bell Atlantic's high-speed users. Bell Atlantic.net's two other package options are: Professional Infospeed at \$99.95 a month. Professional Infospeed features speeds up to 1.6 megabits per second (Mbps) and Bell Atlantic.net Internet access. Power Infospeed is \$189.95 a month, and offers speeds up to 7.1 Mbps and Bell Atlantic.net Internet access.

Initial fees are \$198 for the Bell Atlantic service packages during promotional periods, including the cost of setting up a connection and equipment, such as ADSL modems, needed to operate the service. To enjoy the full benefit of the promotions, customers must make a one-year commitment. The up-front, set-up costs during the promotional period include a \$99 one-time network connection fee and -- for Bell Atlantic.net subscribers -- an ADSL modem for \$99. Fees for inside wiring work and fees for a specialist to aid in the set-up of the person's at-home computer also will be waived for Bell Atlantic.net customers during promotional periods.

Bell Atlantic has an ISP Partnership Program that compensates participating Internet service providers (ISPs) for Infospeed DSL sales they stimulate. ISPs can package their own Internet access offerings with three levels of high-speed connections from Bell Atlantic, each priced as a flat monthly rate: Infospeed DSL 640K at \$39.95, Infospeed DSL 1.6M at \$59.95 and Infospeed DSL 7.1M at \$109.95.

AOL and Bell Atlantic: This summer America Online will start to offer Bell Atlantic's Infospeed DSL access as a premium upgrade for AOL members in Bell Atlantic's service area, as the technology becomes available in major markets. To support this multi-year agreement, Bell Atlantic plans to make its DSL technology available in areas covering 7.5 million homes by the end of 1999, a number that Bell Atlantic expects to nearly double to more than 14 million by the end of the year 2000. America Online will be announcing DSL pricing when the roll out begins this summer, but the DSL upgrade is expected to cost AOL members less than \$20 extra per month. AOL also intends to offer a special version of the AOL software that will provide DSL users with links to a customized Bell Atlantic Web site with information on the company's products and services. The companies are planning other co-marketing directed to AOL members with DSL access. In addition, Bell Atlantic will have opportunities to offer AOL members certain optional telecommunications products and services.

### *Other broadband services:*

Bell Atlantic offers a complete satellite television package with the DIRECTV System - for \$99. A high-quality, off-air antenna to deliver local broadcast channels to all televisions previously hooked up to cable can be installed for \$100.

## **BellSouth**

BellSouth has approximately 21 million phone lines. BellSouth is primarily offering DSL service through data CLECs. Traditionally, they have been a slow player in the data services market. Recently, they paid \$3.5B for 10% of Qwest Communications. The FCC currently restricts RBOC ownership to 10% until long distance relief. Qwest and BellSouth immediately begin coordinated marketing of services, with Qwest offering its full portfolio of data networking, Internet and voice services. BellSouth will offer a full complement of local networking services.

Once BellSouth is allowed into the long distance business, the companies will jointly develop and deliver a comprehensive set of end-to-end, high-speed data, image and voice communications services to business customers, with a heavy emphasis on the fast-growing broadband and Internet-based data services. BellSouth will assume retail leadership with customers based in the South; Qwest will provide support resources to assist BellSouth in the region as required with the primary emphasis of the Qwest sales force being focused on the rest of the country.

### *DSL Offerings:*

In Atlanta, Birmingham, Charlotte, Fort Lauderdale, Jacksonville, New Orleans, and Raleigh BellSouth.net FastAccess service is \$49.95 per month for unlimited monthly usage if you are a subscriber to the BellSouth Complete Choice telephone feature package. Complete Choice includes local phone service plus a choice of up to 20 calling features, such as Call Waiting Deluxe, Call Forwarding and Caller ID, for a flat monthly rate).

BellSouth.net FastAccess service is only \$59.95 per month for unlimited monthly usage when purchased by itself. Monthly telephone service charges are not included in these amounts. A one-time Installation Fee of \$199.95 will be charged for configuring your computer and phone line for BellSouth.net Fast Access Service if an installation visit to your location is required. The installation fee includes any of the following items of equipment (phone line splitter, ADSL modem, and/or Ethernet network PC card) and a reasonable amount of inside wiring and cabling materials as may be necessary to install the Service at your location. In addition, there is a one time Service Activation Fee of \$99.95 for the FastAccess line activation.

BellSouth also offers its wholesale ADSL service to other network service providers, including Internet Service Providers (ISPs), Competitive Local Exchange Carriers (CLECs), Interexchange Carriers (IXCs) and other large business customers.

## **Long Distance**

### **MCI WorldCom:**

Potential reach of 23.8 million households. Revenues, excluding Embratel, increased 14.7 percent to \$8.3 billion compared with pro forma revenues of \$7.3 billion a year before.

First-quarter core communications services revenues increased 17 percent to \$7.9 billion from \$6.8 billion a year ago. Operating expenses increased 3.2 percent to \$6.9 billion from \$6.7 billion a year ago.

During the first quarter, MCI WorldCom's revenue growth topped that of its main rivals as it benefited from its strong presence in the industry's fastest-growing areas -- Internet, international and data. These areas now represent 35 percent of MCI WorldCom's core revenues and generated 70 percent of the growth during the quarter.

Domestic data revenues increased 31 percent for the quarter, while Internet revenues increased 60 percent to \$758 million.

### **Sprint:**

Potential reach of 17.8 million households. Sprint is marketing a fully connected data network with all telecommunication services provided. They are replacing traditional backbone switched network with ATM, allowing better business services and ION delivery.

Sprint announced that they are planning to build out ADSL sites themselves. However, they are likely to lease some capabilities from existing data CLECs. Although SprintPCS is sucking a lot of cash out of parent Sprint, an acquisition of a data CLEC remains a possibility.

Meanwhile, they are making bets on the wireless avenue into the home. Potentially, they can reach 17.8 million homes with LMDS.

Internet service provider EarthLink Network and telecommunications company Sprint today said they would offer co-branded high-speed Internet access using Sprint's digital subscriber line (DSL) network. The companies said in a statement that the EarthLink Sprint DSL Internet service would start commercially today through Sprint's local telecommunications division. The service will be launched in Charlottesville, Virginia. Sprint and EarthLink predicted that by 2002, the service would be available to more than 2.5 million people. The DSL Internet services are offered in the 18-state Sprint local telecommunication service area.

After the Charlottesville launch, service will be introduced in Las Vegas, Nevada, and in selected communities in the Orlando, Florida, and Kansas City, Missouri.

Sprint's chief executive, William Esrey, is working to build momentum for his company's primary thrust: to build a new network that can handle voice, video, and Internet services using a single pipe. The network, called the Integrated On-demand Network (ION), has so far been a triumph of marketing over substance, according to many, highlighted by recent admissions from Sprint that only seven large customers are using its new services.

## Appendix C — Product Offerings and xDSL Breakdown

Company	Product	One Time Setup Fee	Monthly Fee	Monthly ISP Fee	Download Speed (Kbps)
Covad	TeleSurfer	Unannounced	\$39-59	\$10-30	384-768
SBC	Regular	\$200-300	\$50	\$0	384-1500
	Enhanced	\$200-300	\$80-200	\$0	1500-6000
Ameritech	SpeedPath	\$150	\$50	\$0	?
US West	MegaLine	\$110	\$48	\$0	256
	MegaOffice	\$110	\$65	\$0	512
	MegaBusiness	\$110	\$80	\$0	768
Bell Atlantic	InfoSpeed	\$198	\$50	\$0	640
	Pro InfoSpeed	\$198	\$100	\$0	1600
	Power InfoSpeed	\$198	\$190	\$0	7100
Bell South	FastAccess	\$300	\$60	\$0	?
Road Runner		\$40-200	\$40-50	\$0	2880
@Home		\$40-200	\$40-50	\$0	2880

## **xDSL Variants: A Flavor for Everyone**

### **Source: Analyst Reports**

DSL service comes in a wide range of variants. These fall into one of two general categories, symmetrical and asymmetrical. Symmetrical versions offer full duplex service over either single or double pairs of copper wires. These do not allow traditional POTS to coexist, and therefore, when the DSL service is down, so is phone access. Symmetrical versions are best suited to corporate applications. Asymmetrical versions offer different data rates upstream and downstream. One advantage is that asymmetrical versions do not interfere with POTS. Therefore, when the DSL service is down, the regular phone still works. Because of its asymmetrical nature, this type of service is best suited to users who receive a lot of data, but do not send much (e.g., Internet surfers). Some of the more common varieties include ADSL, RADSL, HDSL, SDSL, and VDSL.

### **ADSL**

Asynchronous digital subscriber line (ADSL) is the most common residential DSL deployment" ADSL uses a single unshielded twisted pair (UTP) copper wire from telecom central office to the customer's premises-the kind leading into virtually every building in the United States. Through digital coding, ADSL modems increase the capacity of the standard twisted pair by up to 120 times that of a 56 Kbps dial-up modem, without interrupting basic voice service.

Because ADSL does not interfere with the POTS already on the line, the user can simultaneously surf the Internet or watch a movie while talking on the phone. ADSL provides speeds up to 8 Mbps downstream (to the user) and up to 1 Mbps upstream, depending upon line length and loop and line conditions. The achievable data rate decreases as the distance between the central office and the home increases. DSL is essentially a "brute-force" compression technique. The farther the user is from the power supply, the greater the loss of power and the greater the speed degradation. ADSL, as its name implies, offers asymmetrical data transmission with a ratio of about 10:1, downstream to upstream capacity. Two common versions are ADSL-1 and ADSL-3, which differ in terms of speed and maximum operable distance from the central office.

ADSL service is "always on" and is fast enough to permit full-color, full-motion movies" Basic advantages of ADSL, as with DSL in general, are its use of existing infrastructure and its relatively low installation cost. Given this and given the increasing value of network access, we believe there will ultimately be broad residential demand for ADSL.

### **RADSL**

Rate adaptive DSL (RADSL) supports both symmetrical and asymmetrical applications on a single twisted pair and allows adaptive data rates. RADSL is an extension of ADSL that uses intelligent ADSL modems that can sense the performance of the copper loop and adjust transmission speed accordingly" This is advantageous where line quality is less than needed for full implementation or where there is a lower bandwidth requirement.

### **HDSL**

High-bit-rate digital subscriber line (HDSL) delivers T- 1 usable bandwidth (1.544 Mbps) in the United States. Unlike ADSL, HDSL is symmetric (i.e., equal bandwidth is provided in both directions) and requires two twisted copper pairs. HDSL has been used for some time by LECs to economically deploy T-1 capacity. T- 1 can normally handle 24 voice conversations. HDSL

requires specialized equipment at both the central office (CO) and the customer premises and functions up to 12,000 feet without repeaters at acceptable levels of attenuation (loss of signal strength).

### **SDSL**

Single-pair DSL (SDSL), also known as HDSL2 or S-HDSL, provides HDSL-type capacity over a single twisted pair. With SDSL, the local loop length is limited to about 10,000 feet. SDSL allows the implementation of symmetrical 768 Kbps capacity while maintaining POTS on the other pair. Also, since SDSL uses only one twisted pair, the capacity of existing infrastructure is greatly magnified.

### **VDSL**

Very-high-bit-rate digital subscriber line (VDSL) technology is still in the fairly early stages of development, but we expect major trials before the end of 1999 and limited commercial services introduced before the end of 2000. VDSL offers downstream speeds of up to 52 Mbps, but operates over a shorter distance range.

Speed is the main differentiation between ADSL and VDSL. Both use existing copper telephone lines, but VDSL is significantly faster than ADSL over short distances. VDSL can also be configured in an asymmetrical version or, unlike ADSL, in a symmetrical version. In its fastest asymmetrical form, VDSL will offer up to 52 Mbps downstream and up to 6.4 Mbps upstream over about 1,000 feet. In its symmetrical form, speeds of up to 34 Mbps in both directions are possible. As with other versions of DSL, there is a trade-off between distance and speed—the higher the speed, the shorter the range. The symmetrical version of VDSL will likely be adopted by corporate users first. The asymmetrical version will likely be deployed in multi-dwelling units (MDUs) or campuses first.

Over short distances, VDSL offer about five times the speed of ADSL. Over longer distances, VDSL will offer two to three times the speed. VDSL's distance range will always be less than that for ADSL. Because VDSL functions best over a limited distance, there is a need for high-capacity feed to bring the service to within about a mile from the end user. This feed will be a fiber link terminating at an optical network termination unit (ONU). At the ONU, the signal is transferred from the fiber to the final copper drop to the subscriber or user.

## Appendix D — Porter s Five Forces and the ADSL Market

### Porter Five Forces in the DSL market

#### Suppliers:

*Supplier switching/Substitutes* — Since no standard has yet been agreed within the DSL industry, equipment from one vendor is most likely incompatible with that from another manufacturer. Thus, switching among suppliers has been rather difficult, especially when a provider has already invested a huge amount in one vendor s technology. In other words, once a DSL provider has been committed to one vendor s products, it will be hard for the provider to find substitute products from other vendors. Nonetheless, some network equipment vendors, such as Cisco, help customers switch by offering to buy out their existing network equipment if they agree to build their network with Cisco s products. With the movement towards more standard networking components and the proliferation of ADSL vendors, it is hoped some of this vendor dependence will go away. In the telephony world, there are distinct standards developed to enable the interoperability of various hardware manufacturers equipment. However, it is still best to purchase from one vendor.

*Supply volume* — As most DSL equipment vendors are required to develop their products with well-documented processes, they tend to be large in size. They are also likely to have diversified themselves in developing and manufacturing other telecommunication equipment. Therefore, not many purchases from them are regarded as fatal.

*Competition among suppliers* — Owing to the short product life cycles in the high-tech arena, most DSL suppliers want to capitalize on their newly developed equipment in the shortest time. This suggests that large contracts will be negotiated for multiyear periods. This aids in both the purchasers network planning and in the suppliers demand forecasting and product R&D plans.

#### Buyers:

*Buyer concentration/volume* — Most broadband access consumers are price takers. However, as a whole, they do exert some force on the providers via their aggregate demand. Given the size of most business contracts and the potential revenue, businesses should be in a better position to negotiate with the DSL vendors. Businesses will also typically require higher levels of service and speeds, so any buyers power is mitigated by the shift in demand towards higher margin products.

*Consumer switching* — It has been a notorious fact that switching among dial-up ISPs has been very common with consumers. With most of the new broadband access services such as cable and DSL, which require a certain amount of set up cost, it seems like this switching trend has been on a downward slope. However, with the introduction of standardized modems in both the cable and DSL world, switching is expected to increase slightly. There is little incentive to switch after the service is installed. Installation is the frequent largest barrier to customer switching given the difficulties with early ADSL installation. Thus, there will likely be a tradeoff between commodity equipment and operational barriers to switching for consumers.

*Buyer information* — With the large marketing resources spent by most access providers, most consumers who are shopping for broadband access have no problems gathering information on which services fit their needs. There is an issue with educating consumers about what is the right

product. As with any new technology, there is a learning curve associated with determining what all of the new specs refer to (think of comparative PC shopping). With the introduction of broadband, players will attempt to differentiate their services by more than just price and speed. ISPs have traditionally used email accounts and web sites as a barrier to buyer switching. Broadband players will add to the mix various content packages (entertainment) and telephony services. This will make it more difficult for the consumer to bottom line compare all of the services in the market. But given the way of the PC industry, price and speed will continue to be the easiest marketing call.

### **Entry Barriers:**

*Capital expenditure* — As a broadband access provider, a very large proportion of the cost comes from setting up the network equipment and maintaining the network. Thus, a big barrier of entry exists in the form of a large capital expenditure that must be paid up front before any revenue could be realized from the operation. This would also mean that when there are indeed new comers to the market, they would be established players in a related industry with ample capital to spend, and they would be very determined to compete once they entered. However, the largest barrier to network entry is negotiating with the Baby Bells and the regulatory bodies. The Baby Bells dictate under what terms their central office space is used for emerging players. With three national data CLECs in play, the prime central office space is highly contested. There is also the need to file with local regulatory bodies to offer local phone services.

*Learning curve* — There are a lot of issues that a broadband access provider needs to resolve before it becomes an efficient operator in the industry. For instance, there is a long legal process for a company to gain the status of CLEC. Only after gaining such status will the company have access rights to install any equipment in central offices. The regulatory environment also requires specialization in managing both the FCC and local utility boards.

*Distribution access* — It has been an observable trend that most ISPs are looking at leveraging their consumer base into future businesses outside of their core access service businesses. Even though some ISPs are currently marginally profitable (or even losing money), they are still hanging on to see if there are complementary service revenues, such as contents, e-commerce, etc.

*Switching cost* — There are many broadband access technologies that are substitutes to the DSL technology, such as cable, wireless, etc. However, as most broadband access providers require certain forms of installation costs to be paid by the consumers up front, switching among different providers has been less frequent than it used to be among dial-up ISPs.

*Relative price* — Prices among competing broadband access technologies are quite close to one another. It seems that most consumers who are shopping for broadband access services are rather price sensitive. Right now, one could get a DSL/cable connection at home for about \$50 per month with a \$100 installation charge.

*Relative performance* — Since the competing broadband access technologies are based on different engineering concepts, their performance does differ under different scenarios. For instance, DSL can give consumers a guaranteed bandwidth, but with a strict limitation in terms of distance coverage. On the other hand, since cable access is built on shared media among a segment of homes, it could not guarantee its performance but it has a wider coverage.

### **Industry Competition:**

*Industry growth* — As predicted by most industry analysts, the broadband access market is going to grow exponentially as more and more households are getting online and demanding more interactive and multimedia content on the Internet. There may also be the emergence of some killer application, like the web 5 years ago, that could further drive broadband access demand.

*Switching cost* - As most DSL providers require certain forms of installation costs to be paid by the consumers up front, switching among different providers has been less frequent than it used to be among dial-up ISPs.

*Exit barrier* — With large initial capital investments in their network equipment, access providers have been viewed to have a large exit barrier. Besides, technological obsolescence and incompatibility may hinder them from selling their equipment. Nonetheless, as there are so many players interested in entering the broadband access market or expanding their presence by acquiring the customer base of existing providers, the exit barrier actually turns out to be lower than expected. However, nobody knows if this low exit barrier would still exist in the future if the consumer demand for broadband access to the Internet does not materialize.

*Competitor diversity* — Most competitors in the DSL industry have very similar structure and history. They started off by signing up for the status of CLEC, installing DSL equipment in the COs, providing DSL services to small and medium sized corporations, and now, start aiming at the consumer broadband access market. However, some ILECs have started to enter the residential DSL market aggressively, and other ILECs are expected to start their moves soon.

### **Insights for Baker**

#### *Suppliers:*

Baker has a long-term supply contract with Copper Mountain.

#### *Buyers:*

There seem to be more stickiness of broadband access consumers than for the dial-up market. Thus, Baker should focus on increasing the adoption rate of its services, and educating potential customers on the advantages of its DSL services.

However, the consumers seem to be very price sensitive relative to competing broadband access services. Although it would be wise for Baker to differentiate its services, it would be unwise for Baker to charge a premium for such differentiation.

#### *Entry Barriers:*

There are high entry barrier to the DSL market. However, for existing telcos who already own their network infrastructure, the entry barrier is minimal. Besides focusing on the existing players in the DSL market, Baker should spend some effort to identify potential entrants and analyze their strengths and weaknesses.

#### *Substitutes:*

Cable companies have been dominating the consumer broadband access market. They have already had an estimated customer base of about 500,000 customers. So, besides fighting for market share within the DSL space, Baker may also want to look at encouraging existing cable customers to switch. Of course, Baker can also wait for the bigger players to take the steps in expanding the DSL market, but this would come at a cost of losing the opportunity to establish footprints in the targeted market.

*Industry Competition:*

Every DSL player is aiming at expanding his or her customer base, even at the cost of low short-term profitability. Being of similar cost structure as its competitors, Baker should not try to pick a cost leadership strategy but rather a differentiation one. Differentiation can be accomplished by having better customer support services, more reliable network performance, etc.

Fortunately, if the demand for DSL access services does not materialize soon enough, Baker could most likely sell off its investment in the consumer market without much difficulties, and refocus in its core business customers.

## **Appendix E — Valuation and Model Methodology**

### **Value Strategy Measures**

To determine the value of strategies in the value model, we determined it would be informative to go beyond traditional NPV financial valuations and try to measure how the financial market were justifying the unreal market capitalizations of Internet companies. Of course, given the imprecise science of valuation, we did not desire to find "the" correct way of valuing Internet companies. However, we thought it valuable to track some high level value metrics across financial transactions and incorporate it into the value model in some manner. To pursue this goal, we broke the task into determining the value metrics and determining the weightings across each. The methodology is discussed below.

### **Value Metrics**

We began with a survey of important companies in each component of the value chain. We collected financial information and operational metrics to benchmark each. There were two observable sources of value: transaction valuations and market valuations.

Transaction valuations allowed us to determine how much companies were actually paying for subscribers in each one of the value chain components. For instance, unique monthly page hits for portals sold for close to \$100, ISP subscribers sold for around \$2000, and Cable subscribers sold for around \$4300. This provided some guidance to how much subscribers in the web, narrowband and broadband worlds were worth.

Market valuations allowed us to do comparable company analysis across different player in the market given financial performance. We found the market is currently valuing premier portals at 100 x current year revenue, ISPs by 16 x current year revenue and broadband players by 20 x current year revenue. This is an inexact measure, but indicates where the market feels the Internet potential lies. We could also determine for Internet access how much value is associated with being able to reach households (\$100 per household passed).

These metrics were obviously biased by the inclusion of only the "blue chip" Internet stocks. Compared to the transaction value for ISP subscribers, AOL is at \$7600, far above the average. @Home is valued at \$15k per subscriber. Of course, some of the multiples and valuation metrics are driven by future expectation of revenue and subscriber growth. There is also a winner/size bias included since we focused on the higher market cap companies. Overall, we felt it safe to assume a player entering in each one of the components of the value chain would get close to a similar valuation.

This comparable company analysis provided a rough estimate of how the markets were valuing various financial and operational metrics. By evaluating the performance of a data CLEC over time, we could attempt to provide an estimation of valuation given the various metrics.

### **Value Weightings**

We determined the most common metrics across all players were future NPV, revenue, subscribers, and household reach. By collecting NPV valuations, forecasts of revenue and various operational metrics reported in financial analyst reports for various companies, we were able to collect a table of data on companies spanning the value chain. The only area under-represented was the infrastructure component since there are few pure plays in the market that

could be used as proxies. We divided NPV and revenue streams into the four components of the value chain to get more clarity into which pieces of the value chain were receiving the highest significance from the Street. A multiple regression statistical analysis was performed to explain the different weights of the value metrics in explaining the current financial market valuations of the various players.

The NPV calculations performed by the financial analysts were the most significant indicator of current market valuation. There is some concern that most of the financial analyst models were somewhat "baked" to reflect the current market valuations of the players. However, it was encouraging to see some notion of long term potential was at heart in most financial models.

The appendix contains the financial results used in the valuation model. For Content, NPV held a 19% weight and revenue held a 9% weight. For Access, NPV held a 25% weight and revenue held a 4% weight. For Infrastructure, NPV held a 2% weight and revenue held a 2% weight. For Access, NPV held a 15% weight and Revenue held a 10% weight. The number of subscribers held a 10% weight and household coverage held a 4% weight.

The weightings suggest there is a slight valuation bias in the market towards the content and Internet service providers. This can be explained by the importance associated with owning the customer. Much of the narrowband dialup market is a commodity business, where yearly churn is 20-30%. It does not like there will be as many sources of commodity access in the broadband world, but with standardized cable and ADSL modems, there is little switching costs for the consumer. However, the Broadband access component remains significant (just not as high as content and access). The relative spread out distribution also hints that the market recognizes all pieces will be necessary to offer broadband content and services.

### **Valuation Thoughts**

We immediately admit that valuation is a tough business. Our interest was primarily to help gauge the value associated with non-financial metrics since the market valuations of Internet companies do not seem strongly grounded in anything related to expected financial return. We used the value drivers and value weightings to rank the alternatives explored in the strategy alternatives. The rankings of the various strategies still mirror a NPV ranking, which encourages us that the market is valuing financial performance, maybe just a little too much.

### *Construction of Financial Statements*

The followings are the general logic in the financial statements, given a quantified definition of a strategy:

- Recurring revenues and costs of each year are the products of the recurring items in the Strategy Config spreadsheet and the number of subscribers for that year.
- Non-recurring revenues and acquisition costs are the products of the non-recurring items in the Strategy Config spreadsheet and the number of new subscribers, taking into account the churn rate, for that year.
- Current assets of each year are modeled as a percentage of the total revenues for that year.
- Gross fixed assets are the products of the capital expenditure items in the Strategy Config spreadsheet and the number of new subscribers, taking into account the churn rate, or the number of added central offices or the number of added markets for that year.

- Depreciation costs are calculated from the gross fixed assets and deducted from it to obtain the net fixed assets.
- Current liabilities of each year are modeled as a percentage of the total costs for that year.
- Shareholders' equity of each year is modeled as the sum of the net profit for that year and the shareholders' equity of the previous year.
- Long-term liabilities of each year are modeled as the sum of all assets minus the shareholders' equity for that year.
- Interest expenses of each year are modeled as a percentage of the long-term liabilities for that year.
- Tax payments of each year are modeled as a percentage of the pretax incomes.
- Net incomes of each year are the sum of all revenues minus the sum of all costs and expenses for that year.
- Profit PVs of each year are the discounted values of the net incomes for that year.
- Profit PVs for all value chain layer are the sum of the Profit PVs across the analysis horizon.

### **Usage of Value Model**

The followings are the general steps to estimate the incremental shareholder value of any strategy:

1. Input predicted revenues, costs and growth rates in the Strategy Config spreadsheet.
2. Enter the strategy name with the corresponding strategy ID number in the Value Model sheet.
3. Determine proper model parameters, such as discount rate, equipment depreciation rate, annual CO growth rate, average household coverage per CO, etc.
4. Activate the new strategy by selecting the strategy number at the drop-down control box.

After these 4 steps, the income statement and balance sheet for the selected strategy over the next ten years will automatically be generated on the Income Statement and Balance Sheet worksheet respectively. A summary of the value measures as well as the incremental shareholder values would be included in the Value Model worksheet.

## Appendix F – Network Architectures 101

### The Importance of the Network for Broadband

In exploring the different delivery technologies for the broadband world, it is helpful to have some sense of the organization of the networking world (especially with Cisco down the Bay). The nice thing about it is that there are a few fundamental principles and concepts underlying it all. The difficult thing is everything uses different naming conventions, making it a war of terminology and not comprehension. It is helpful for differentiating products, but it loses the common foundations it is all built upon.

It is helpful to break all networks down to their protocol levels. The ISO OSI 7 Layers model of networking is the most common academic approach to teaching networking concepts. We will focus on the physical layer since most of the access technologies are providing new “wires” of communication to the home. There is also usually a layer of protocols sitting on top to provide routing information to where the information should be sent.

For example, ethernet provides a physical protocol for communication over the networking wire. IP (of the often heard TCP/IP Internet protocol suite) provides the routing information for packets to be redirected. TCP is yet a higher level protocol that maintains the connection and ensures error free delivery of packets to higher level services. The layered model helps separate different service types.

There are two fundamental ways of moving packets around: switching and routing. Switching is usually a hardware layer method where packets are automatically forwarded or ignored given the sender address. There is usually no intelligence in redirecting packets. Telephone switches are the classic example. Routing introduces some intelligence into the mix. A router takes, for example, the destination IP address of the packet, checks a table (or queries other routers) to see where it should be sent, and then makes the decision of which direction to send the packet. Routing allows for a lot more flexibility in managing a network. However, there is a tradeoff in performance since a router must perform some intelligent work every time a packet arrives. A switch, on the other hand, can be put in hardware and operate very quickly. Given the exponential growth of CPU speeds, the performance distance between the two is decreasing. There are also other crucial differences between the technologies that will be explored later when contrasting the telephone network with the Internet network.

In this appendix section, we quickly overview the major networks involved in the broadband and Internet worlds. It might aid in positioning where in the networking universe all of the broadband players are competing. We are not able to drill into minute detail, but we hope to give a appreciation of the technologies involved.

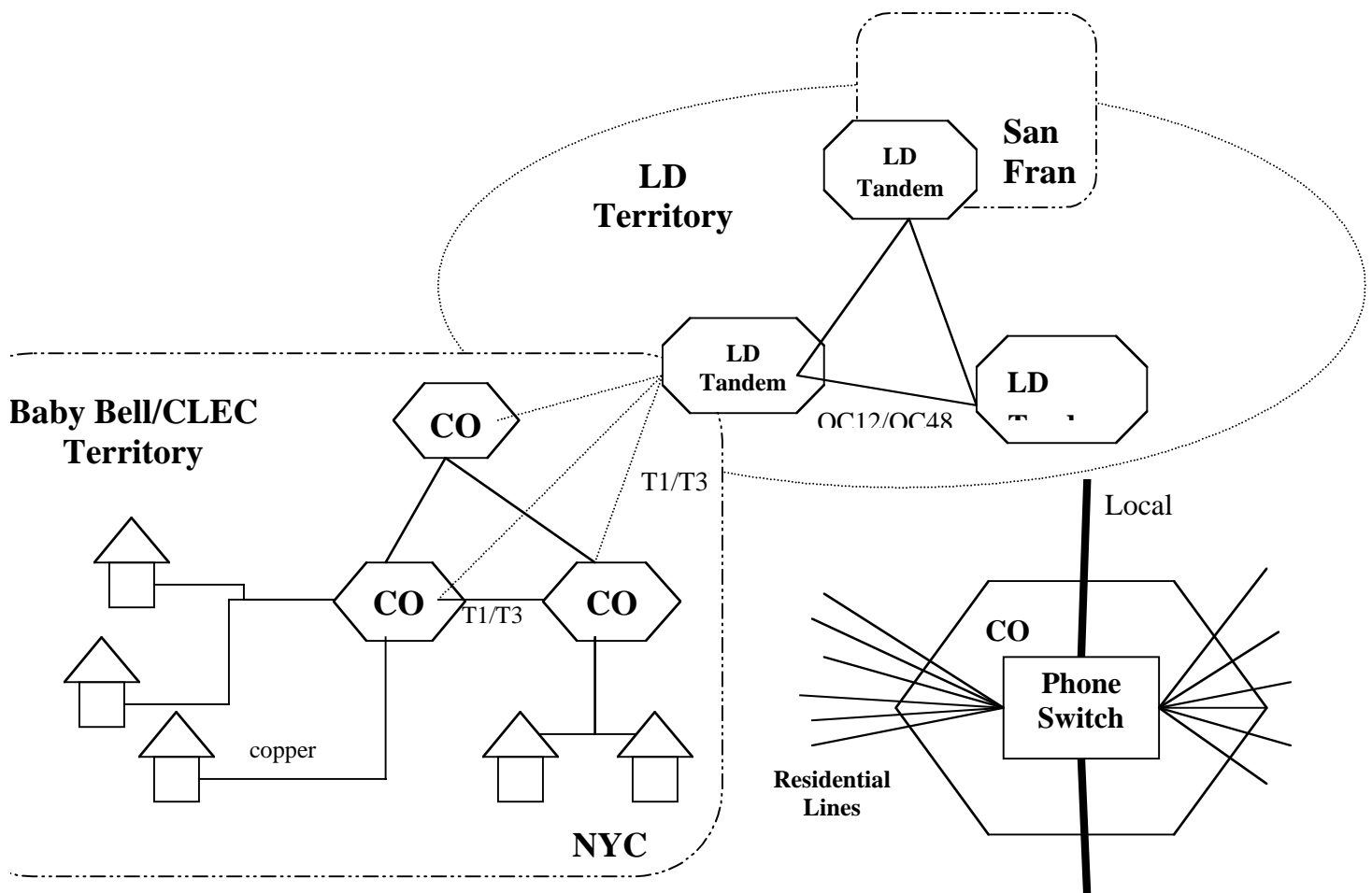
## Traditional Telephony Network

A simple picture of the telephony network is outlined below. There is a divide between the local and the LD networks. From your residence, the copper line is connected to the central office (CO). In the CO is a phone switch that either switches your call locally or to a long distance switch called a tandem. When you place a call, the telephone network dedicates a circuit or a path through all the switches through which your voice conversation flows. After the circuit is set up, the switches do not need any intelligence to route your call. Thus, the phone system works using switches and not routers.

The central offices and tandems are connected by either T1/T3 or OC-x lines. T1 is the signaling protocol for communication over copper wires. OC-x is the protocol used to transmit signals over a fiber optic line. In general, the LD networks are fiber based and the local networks are predominantly copper. This is changing as data requirements grow in the local loop. A T1 is 1.5Mbps, T3 is 45Mbps, a OC-3 is 145Mbps, a OC-192 is 10Gbps!

Another networking technology used more heavily in telco networks is ATM. ATM is a switched “cell” technology that allows more flexibility in service levels than a packet based network would. It can be considered the telco response to the computer networking routed packet world. ATM’s flexibility also allows it to carry IP traffic “on top” of the ATM layer. This allows telcos to capture both their traditional voice and data services, as well as the emerging demand for IP Internet services.

xDSL technologies change the way the copper signal is handled. This is discussed later.



## Internet Network

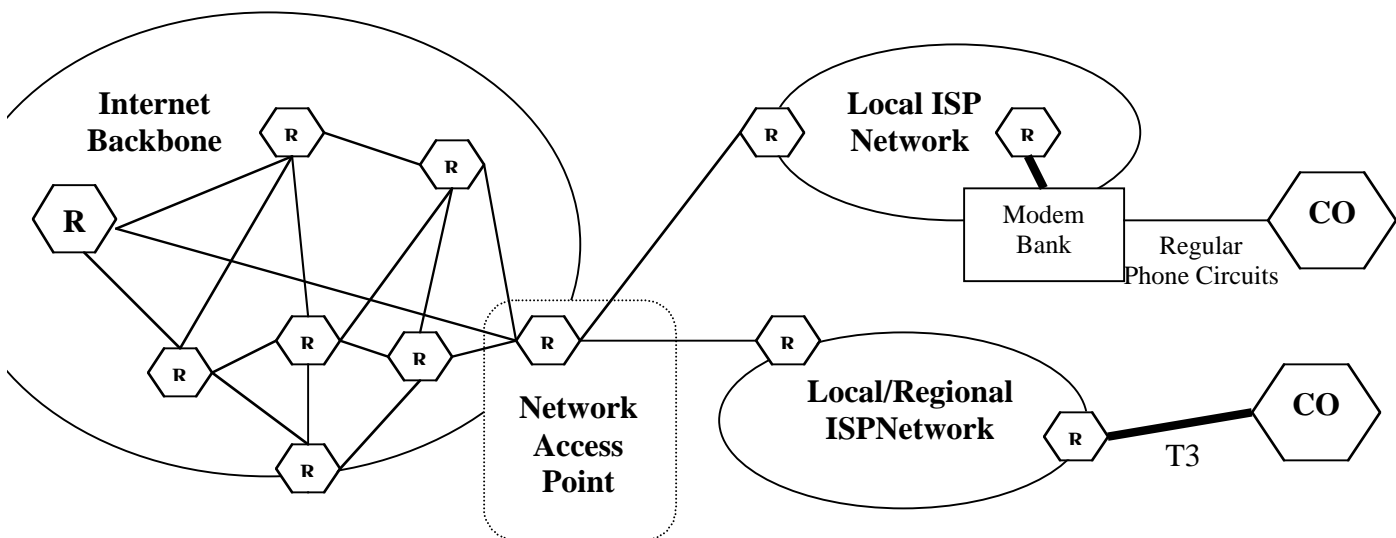
Below is a simplified view of the Internet. The Internet at its core is a collection of interconnected backbone networks owned by Sprint, MCI WorldCom/UUNet, AT&T, Qwest, and other players that have built long haul data networks. The traffic is primarily managed by routers, using the IP addresses as the key for delivery. The major backbones meet at regional peering points. A Network Access Point (NAP) is displayed in the diagram below. Some of these traffic aggregation points are also called Metropolitan Area Exchanges (MAE) and there are a growing number of variations on the same peering point theme.

At these peering points, local ISPs (who also have similarly structured networks) and the national backbone players exchange traffic. In general, this is an opening sharing agreement, where traffic is routed on whichever partner networks are available. The backbones get the traffic across the US, the local ISPs get the requests to the local users.

The most common Internet access method today is to dialup an ISP and have them handle your modem by interfacing with their modem bank. They translate your requests for the Internet and route your packet either on its way to the backbone or an ISP server (which might provide email or the ISP web site services).

Some ISPs and businesses also get dedicated data lines from the local telco (instead of modems) to the local or regional ISP.

TCP/IP is the protocol of choice for Internet traffic. But it does not necessarily have to be carried that way at all points on the network. As mentioned earlier, the LD companies (Sprint, MCI, etc.) are upgrading their backbone networks to ATM and offering ATM/IP data services. Qwest and Level 3 are two emerging fiber backbone players as well. They have committed to have primarily IP traffic backbones. The telco companies like the service qualities of ATM. The IP packet players see routers getting so fast it will not make a difference which technologies is used. Switched services take up resource. When a call is placed on the phone network, a dedicated circuit is taken. If a switch has no more circuits, the caller gets a busy tone. In contrast, a packet network router looks at the IP address and routes the packet immediately, avoiding the dedication of resources. This has forced local phone companies to upgrade their switches faster than though because of the added Internet traffic (each call to the ISP takes up a circuit on the network).





## Broadband Delivery - Cable

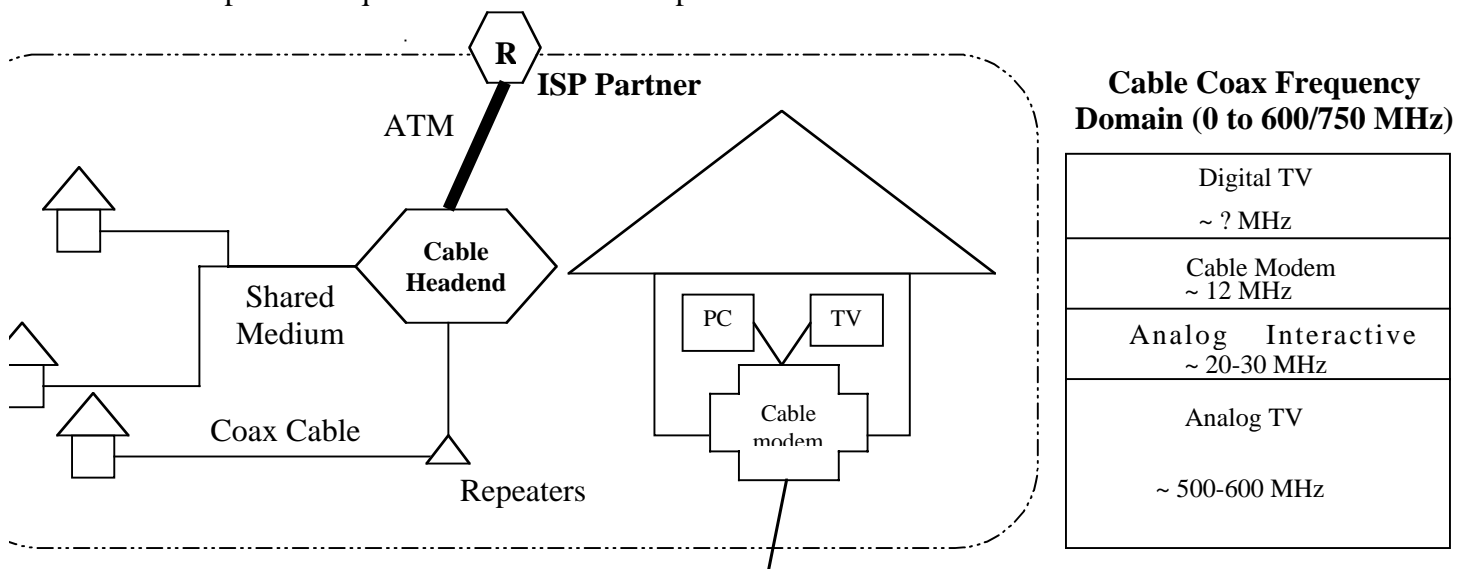
The cable infrastructure is pictured below. The analog was constructed to support the broadcasting of analog signals over the coax cables into the homes of subscribers. The head end is the key location for the cable network of where all media feeds (usually satellite) are received and converted to analog signals to send over the cable network. In the home, the cable box decodes the signals for the home's viewing pleasure.

The cable network was built with this kind of traffic in mind. The signal is put on the cable and sent to all households. In many areas, repeaters (depicted below) were added to extend the cable network to more households. Unfortunately, these repeaters only amplify received signals from one direction. This is one of the largest barriers for converting cable networks to be two way ready. The cable companies are making huge infrastructure investments to make their networks ready for digital cable and cable modems.

The frequency of the coax network is also depicted. Each analog channel takes up 6MHz of frequency (times 80 channels = 480MHz). The frequency is limited below and above (approximately < 50Mhz and >750MHz). Many cable networks were constructed with only 500-600MHz in mind (the repeaters only amplify certain frequency ranges). Digital TV and cable modems are putting renewed demand on this precious frequency space. Fortunately, digital cable allows companies to compress the video signal (up to 8 digital channels on a 6MHz slot). Of course, resulting picture quality begins to degrade. HDTV will also require a large chunk of 6MHz for high quality video and audio. And, AT&T wants to offer telephony services as well. All ensuring the existing analog cable base is not left with no channels. There is the space there, it just needs to be allocated differently.

For the cable modem world, 6MHz is allocated each for up and downloading. This frequency is shared by all cable modem customers currently online (broadcast cable network). As more subscribers are added, the Internet connection speed suffers. In the future, the cable companies can allocate more channel frequencies, but this comes at the cost of other services. There is the potential for a lot of bandwidth on the coax infrastructure. There is also a lot of technical hurdles which must be overcome to scale.

As with the xDSL world, the cable head end aggregates all Internet traffic and sends it to their ISP (@Home) to send to the Internet. @Home is providing some Internet caching services to avoid repetitive requests to the ISP and to speed broadband content.



## Broadband Delivery - Wireless

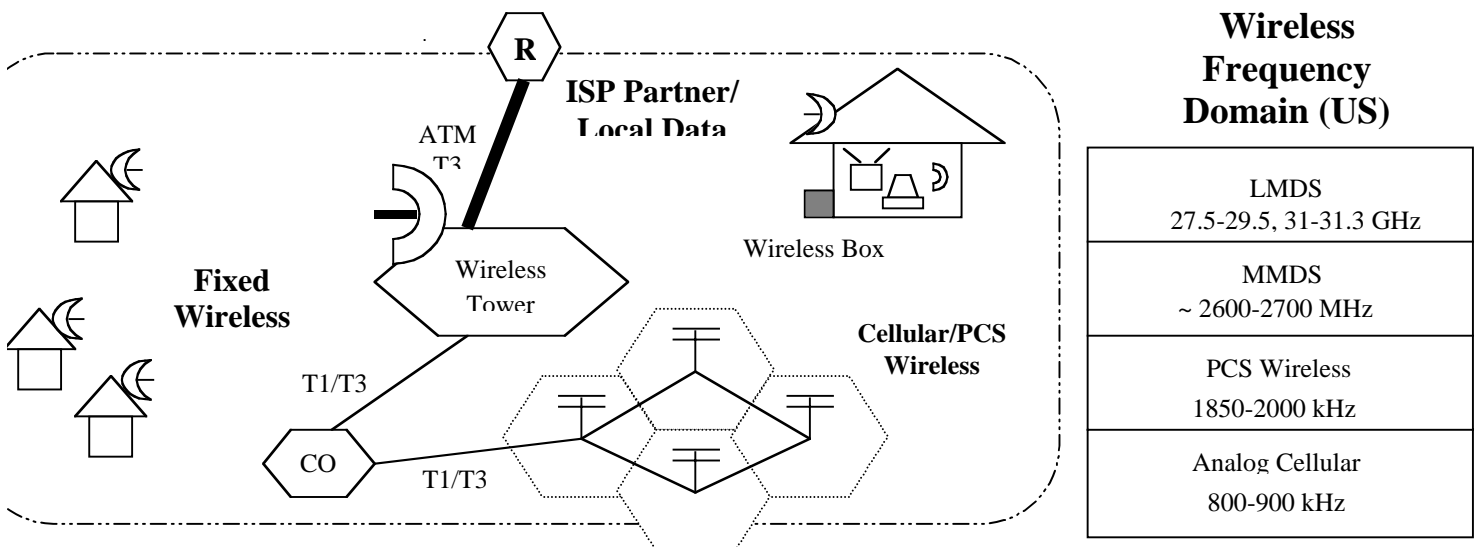
Components of the wireless infrastructure are depicted below. The FCC has auctioned off specific frequencies for various types of wireless services. Analog cellular started in the 800-900MHz frequency range. PCS licenses were added a few years back to spur on digital phones. There are also higher frequency ranges allocated for wireless cable and broadband data services. LMDS and MMDS are the best known since aggressive startups are offering broadband data services in these frequency ranges (Teligent, WinStar, and Advanced Radio Telecom). Fixed wireless solutions are easily separated from mobile wireless solutions. Most broadband data services are offered with fixed wireless technologies. But the 3G wireless PCS initiative hopes to provide 1-2Mbps data services in the next 3-4 years. Wireless data is a technology constrained, but rapidly improving.

The wireless infrastructure avoids the need to construct the costly “last mile” pipe to the home. AT&T’s Project Angel explored leveraging AT&T’s wireless properties and spectrum licenses to offer fixed wireless local services to the home. It is generally accepted AT&T was pushing the technology envelope before its time. They still have not abandoned wireless service offerings. With their fixed rate cellular pricing for local and LD, the price is close enough to compel people to drop their local service and use wireless phones exclusively.

There is also a significant interest in hooking up computing devices to wireless networks. The recently released Palm Pilot VII is the first major push into this space. There are, again, technology hurdles to be overcome. But wireless has a very attractive cost structure and high potential speed to make investment warranted.

Historically (and still to a great extent today), the mobile wireless networks are horrible for data transfer (high by the byte pricing and max speed of 8kbps). This is expected to change as PCS technology based data solutions are introduced.

There is also a higher wireless layer (Iridium, Teledesic, etc.) that hope to leverage the satellite cost model to provide voice and data services across the globe. There are even larger technological hurdles here. Iridium has not been able to generate the customer demand expected for their satellite phones. But again, if the cost model can be made to work with a technology, it is a very compelling medium to reach millions of customers.



## Appendix G - Glossary of Terms

**ACCESS PROVIDER**--Organization providing and maintaining network services for subscribers.

**ASYMMETRIC DIGITAL SUBSCRIBER LINE (ADSL)**--A method of transmitting at speeds of approximately 8 Mbps in one direction over a single copper telephone line, and at speeds of approximately 1 Mbps in the other direction.

**ASYNCHRONOUS TRANSFER MODE (ATM)**--A key emerging technology that uses fixed-length packets or cells to switch voice, data and video traffic over the local- and wide-area network.

**BACKBONE NETWORK**-- The main artery or link for a private or public network. Typically, the backbone carries a greater quantity of traffic ( data, voice, video or some combination) is capable of carrying significant bandwidth and is the network to which small/remote networks/links are attached.

**BANDWIDTH**--A term now used to describe the capacity or amount of traffic (data, voice or video) a certain communications line is capable of accommodating. Bandwidth is often measured or stated in kilobits per second (kbps) or Megabits per second (Mbps) for data transmission.

**BITS PER SECOND (BPS)**--The number of bits passing a point every second. The transmission rate for digital information.

**BRIDGE/ROUTER**--A device that can provide the functions of a bridge, router or both concurrently. Bridge/router can route one or more protocols, such as TCP/IP and/or XNS, and bridge all other traffic.

**BROADBAND**--Data transmission at a high rate, generally greater than T1 speeds (1.5 Mbps). This allows the transmission of voice, data and video signals over a single medium.

**CABLE MODEM**--Modem designed for use on TV coaxial cable circuit.

**CENTRAL OFFICE (CO)**--A local telephone company office which connects to the main system where circuit switching of customer lines occurs.

**CIRCUIT SWITCHING**--Switching system in which a dedicated physical circuit path must exist between sender and receiver for the duration of the "call". Used heavily in the phone company network, circuit switching often is contrasted with contention and token passing as a channel-access method, and with message switching and packet switching as a switching technique.

CLEC--A Competitive Local Exchange Carrier. Provides competitive local access services to the Local Exchange Carrier (LEC) or Incumbent LEC (ILEC).

CUSTOMER PREMISES EQUIPMENT (CPE)-- Terminating equipment, such as terminals, phones, routers and modems, supplied by the phone company, installed at customer sites, and connected to the phone company network.

DEDICATED LINE--A transmission circuit installed between two sites of a private network and "open," or available, at all times.

DIGITAL SUBSCRIBER LINE (DSL)--Another name for an ISDN BRI channel. Operated at the Basic Rate Interface (with two 64 kbps circuit switched channels and one 16 kbps packet switched channel), the DSL can carry both voice and data signal at the same time, in both directions, as well as the signaling data used for call information and customer data. Also used to represent other DSL-based solutions, including HDSL and ADSL.

ETHERNET --A baseband LAN specification invented by Xerox Corporation and developed jointly by Xerox, Intel and Digital Equipment Corporation. Ethernet networks typically operate at 10 Mbps or 100 Mbps over twisted pair, coaxial or fiber optic cable.

HIGH-BIT-RATE DIGITAL SUBSCRIBER LINE (HDSL)--Designed to be a cost-effective method delivering T1/E1 line speeds over unconditioned copper cable, without the use of repeaters.

INCUMBENT LOCAL EXCHANGE CARRIERS (ILECs) see RBOCs.

INTEGRATED SERVICES DIGITAL NETWORK (ISDN)--a CCITT networking standard devised to provide end-to-end, simultaneous handling of digitized voice and data traffic on the same link.

INTEREXCHANGE CARRIER (IXC)--(I) A long-distance telephone company offering circuit-switched, leased-line or packet-switched service or some combination.

ISP--Internet Service Provider.

LAST MILE--A reference to the local loop, the distance between a local telco wire center and the subscriber, a distance about 0 to 3 miles (0 to 4 kilometers).

LEASED LINE--A transmission line reserved by a communications carrier for the private use of a customer.

LIFELINE POTS--A minimal telephone service designed to extend "lifeline" communications service to the subscriber in case of emergency, particularly when electric power is lost.

LOCAL AREA NETWORK (LAN)-- The means by which a community of computer users can share information and resources electronically. Many communications protocols are used to

accomplish this, the most prevalent of which is Ethernet.

LOCAL LOOP--Refers to the physical copper pair or loop of wire from the telephone company's wire center to the subscriber.

POTS--Plain old telephone service.

RADSL--Rate-Adaptive DSL. A simple extension of ADSL to encompass a wide variety of data rates, depending on the line's transmission capability. Rate adaptation can be achieved via CAP or DMT ADSL.

REGIONAL BELL OPERATING COMPANIES (RBOCS)--The five LEC telephone companies created after AT&T divestiture: Bell Atlantic, Bell South, Ameritech, Southwestern Bell and US West.

SDSL--Symmetric single-pair 2B 1 Q-based xDSL.

SYMMETRIC TRANSMISSION--Transmission in which a channel sends and receives data at the same rate.

T1 --Digital transmission facility operating with a nominal bandwidth of 1.544 Mbps. Also known as Digital Signal Level 1 (DS1). T1 is the most common digital transmission technique in North America.

TELECOMMUTER--Person who performs work at home while linked to the office by means of a telecommunications-equipped computer system.

xDSL--High-speed Digital Subscriber Line technology. A family of technologies that provide high bandwidth over copper twisted pair. Varieties of xDSL include HDSL, ADSL and RADSL.

### **Digital Technologies and Players:**

#### **ISDN, T1, T3, ADSL**

These telephony technologies got their start in the enterprise but are finding their way into remote offices and homes as PC devotees demand the higher-bandwidth connections they are accustomed to at work. As with all nontraditional telephony technologies, these hookups often cost more than the average consumer is willing to pay. But as prices slowly come down and faster modems become available, the day is in sight when we'll look laughingly at the idea of connecting a PC over a plain old telephone system.

WHO'S DOING IT The Big Four (Cisco Systems, 3Com, Bay Networks, and Cabletron) and the telcos.

## **Ethernet, Fast Ethernet, frame relay, token ring, FDDI**

These are the mainstays, the DOSs of connectivity protocols. They have been around for years and probably will still be connecting a handful of desktops and the occasional LAN or WAN backbone decades from now. The most noteworthy developments lately have been in Fast Ethernet, which has improved as the Internet has spurred demand among corporate and remote users for faster connections.

WHO'S DOING IT The Big Four.

## **ATM**

About three years ago, Asynchronous Transfer Mode was being hailed as the networking technology that would solve all future bandwidth problems, from the telco to the desktop. But while ATM will have a considerable presence in future networks, it's far from the comprehensive technology everyone thought it would be. (In particular, ATM to the desktop spawned a wave of startup activity that quickly went the way of the nickelodeon.) Where ATM will continue to matter is as a backbone link on WANs, hooking up LANs to each other and to an organization's ISP or telephone carrier.

WHO'S DOING IT The Big Four, Fore Systems, and Ascend Communications.

## **IP over SONet**

Expect this protocol to succeed Gigabit Ethernet as the networking technology of the moment in 1998. The debate here is whether to map IP packets directly onto Synchronous Optical Network (SONet) systems or to map the signals to ATM first. Proponents of the former cite ATM's "cell tax," in which 10 percent of each packet's bandwidth is devoted to overhead information, as a reason that direct IP over SONet is more efficient. Detractors say IP can't match ATM for reliability. Either way, as voice and data networks become increasingly integrated, IP is expected to play a major role in WAN connectivity.

WHO'S DOING IT The Big Four and the telcos.

## **Gigabit Ethernet**

In 1996 and 1997 this was the most fashionable networking technology. Today, the Gigabit Ethernet market is heading for a major shakeout. "Gigabit Ethernet has the same problem as ATM: it was a good idea that was hyped way beyond any reasonable expectation," says Tom Nolle, president of the consultancy CIMI. The technology emerged partly as a reaction to a struggling ATM. With Ethernet and Fast Ethernet already firmly entrenched at the desktop, a gigabit version seemed like a logical fit for the backbone. However, performance and standardization problems have doomed it as a complete solution for bandwidth problems. It now appears destined for the LAN backbone. This is nothing to sniff at, but the market isn't big enough to sustain so many startups.

WHO'S DOING IT The Big Four, Extreme Networks, Foundry Networks, Alteon Networks, and legions of other startups.