



## Arbinet Communications, Inc. (A)

*If you can look into the seeds of time, and say which grain will grow and which will not, speak then to me.*

—Shakespeare

Alex Mashinsky, founder of Arbinet Communications, pedaled his bicycle towards work, a cramped suite of offices above an East 54<sup>th</sup> Street nightclub in New York. Arbinet had created an online exchange that allowed telecommunications service providers to trade the use of telephony bandwidth. It was April 1999 and he would soon be negotiating the terms for his prospective financing. Arbinet had an unusual finance history and Mashinsky worried that this financing opportunity could be the last one he would get. A number of other potential series-A investments that he had expected had never closed, leaving Arbinet uncomfortably short of cash unless something happened relatively soon. Fortunately, Arbinet had several alternatives, and each prospective investor offered a proposal with somewhat different implications. Mashinsky wasn't sure how to think about the relative benefits of his alternatives.

He was sure that the business couldn't afford to wait. Arbinet had been the first to announce an online exchange model for telecom minutes and it was still the leader, but competition was beginning to enter its space. To some extent, Arbinet's lead was protected because it was technically difficult to create the telecom switching infrastructure needed to execute the business model, and perhaps even harder to communicate the benefits to carriers who used the traditional bilateral negotiating methods for trading minutes. Still, a number of startups had just recently announced that they planned to enter the space with business models unnervingly similar to Arbinet's. Carriers themselves were even trying to get into the game, aiming to create affiliated exchanges on their own terms before independents could get a foothold. Enron, a familiar name from energy trading, loomed as a widely known, well-financed competitor. As Mashinsky dodged a taxicab that had stopped suddenly in front of him, he realized that the upcoming negotiations could be both difficult and very important.

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*High-Tech Fellow Dan Green prepared this case under the supervision of Professor Jay Light as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.*

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## The Marketplace

*It's a manual, rather prosaic process that involves tortuous negotiations, endless due-diligence, and lots of changing of minds at the last minute.*

—Marcus de Ferranti, founder of competitor Band-X, Ltd.<sup>1</sup>

Revenues for the telecommunications industry were about \$850 billion in 1999. Of this, \$69 billion came from 93 billion minutes of international long-distance voice and fax calls. AT&T was the world leader in international call minutes, originating approximately 10 billion minutes in 1997. MCI Worldcom originated about 7.5 billion minutes, and Deutsche Telekom and BT originated 5.5 and 3.7 billion international minutes, respectively. Other, smaller international carriers originated less than 4 billion minutes each. The total Minutes of Use (MOU) was expected to grow by 12% annually, but falling prices were projected to slow revenue growth to only something like 1% to 2%.

Most carriers were or had recently been state-owned monopolies or protected franchises, and had generally built up substantial overcapacity because of regulatory or political subsidies. Some carriers, therefore, had a substantial and perishable supply of minutes that could lay economically idle for substantial intervals. "It's just like in the travel industry," remarked Mashinsky. "The airlines sell their seats at premium prices while the plane is waiting to be filled, but once the door is closed, those seats depreciate to zero." This overcapacity extended to international routes, where a number of newly formed private enterprises were laying new transoceanic fiber with enormous capacity. Transatlantic route capacity, for example, had tripled in 1998 alone. Overall, analysts believed some 80% of worldwide capacity lay unused at any given time. In spite of this, certain international routes were severely capacity constrained and others suffered from poor quality.

Carriers addressed oversupplies and capacity shortfalls by interconnecting with each other at hubs in the network and trading minutes. For example, Carrier A could agree to provide a million minutes of New York-to-Caracas capacity to Carrier B, perhaps in exchange for a million minutes of São Paulo-to-Miami capacity. Depending on the relative value of the two routes and the skill of the negotiators, either carrier might make a lump-sum payment (or pay rent) to the other. In another example, Carrier A could also simply lease dedicated circuits from Carrier B, getting rights to use a certain amount of capacity on key routes of Carrier B's fiber at certain times for a number of years. There were numerous variants on these two basic types of agreement, each involving some mix of barter, cash payment, rents, and maintenance and service fees. Bilateral negotiations to manage the trade were necessarily complex.

Bob Barbieri, Arbinet's vice president of Product Development, explained how the process was inefficient:

It is a buyer-driven process. Selling carriers don't call buying carriers and jockey to deliver the lowest rates. A typical carrier has a limited number of ports on its switch with which it can interconnect. It may be able to interconnect with only 55 or 60 other carriers. Once those 55 or 60 carriers are interconnected, how does it determine its trading partners? Because there's no exchange, a buyer is going to actively pursue sellers by phone to create a market that's as liquid as possible. Buyers have to create competition between those carriers to get the best price. And it is not likely that those selling carriers are looking to lower buyers' transaction costs. Buyers have to constantly negotiate with selling carriers to ensure that they're getting

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<sup>1</sup> John Blau, "Dealing Time—A Hot Young Commodity Market for Telecom Bandwidth Takes the Floor," *Tele.com*, April 19, 1999, accessed at <http://www.teledotcom.com>, April 5, 2000.

the most cost-effective means of transporting traffic. That's least-cost-routing in the old world.

Barbiere continued,

It's not a simple process to open or shut the floodgates to any *one* carrier. Even if the carrier is connected, it's typically a two- to six-week process before a route plan can be changed. What's the holdup? The holdup is that there's bureaucracy. The holdup is that there's a provisioning department that has to make whatever changes on the switch are necessary to make sure that I send that traffic to him and do all the changes to the software. The holdup is that there's an accounting or billing department that has to know what I'm going to pay or what I'm going to be paid for that minute of traffic. The holdup is that there's a risk management group that wants to make sure that if I'm selling to this carrier, that he's got the financial wherewithal to pay me, and vice-versa. The holdup is that there's a legal group that has to ensure that I *can* send the traffic legally. You're looking at all these different parts of the organization that all have to sign off in the approval process. That's for a guy who's *already interconnected to me*. That adds up to a lot of SG&A. We estimate that if the carriers already have an interconnection, but want to send traffic on a new route that hasn't been used before, conservatively, the time to set it up is two weeks, and the cost is \$700–\$800. We estimate that the cost for a carrier to conduct a *single transaction* with a new carrier that is not on its switch—and the time to set the circuit up is approximately 26 weeks—is approximately \$10,000.

International telecommunications carriers historically reached interconnection agreements at industry gatherings or through series of personal meetings. A carrier that needed more capacity on a certain route and wanted to buy it at a wholesale rate from another carrier had to contact prospects individually and hold a number of meetings. The meetings were used to hammer out a complicated agreement that detailed the capacity and quality of the route as well as the lease cost, maintenance costs, and various associated legal expenses and other fees. In general, the purchasing carriers with the most aggressive agents—those willing to call upon the largest number of potential suppliers for the wholesale minutes—received the best price. As other costs declined, SG&A became important in a carrier's cost structure. SG&A comprised 25% of revenues on average in the telecom industry in the late 1990s. Other costs related to technology, settlement fees, and call termination charges were shrinking because of technological advances and deregulation. Some carriers operated with SG&A as high as 75%. Jeff Parness, a financial consultant to Arbinet from IPO Associates, noted, "If the top four carriers in the United States could remove 500 basis points of SG&A, they would send a combined \$5 billion to the bottom line and as a result get a significant boost in their market cap."

The traditional bilateral agreements, however, offered some advantages to carriers—even with their inefficient processes. Because buyers wanted to ensure their customers received high-quality circuits, many carriers felt that it was important for them to know the counter-party from which they were buying. Carriers also saw value in the personal relationships that procurement agents, lawyers, accountants, and salespeople developed, since the trust enabled carriers to craft an infinitude of tailored agreements. For example, carriers could also trade bandwidth—high-capacity data lines—not just telephony minutes.<sup>2</sup> They traded not just spot capacity, but leases of varying

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<sup>2</sup> Minutes trades were technically short-term leases on a fixed-bandwidth (64 Kbps) portion of the capacity of a particular route over the Public-Switched Telephone Network (PSTN). The route for a minute began at a carrier point of presence in a major metropolitan area and terminated at a similar point of presence in another city, allowing multiple retail carriers to interconnect at either end and distribute the minutes anywhere in either city. Bandwidth trades, by contrast, were typically long-term leases of a high-bandwidth portion of a line that in most cases was configured for data, not telephony. Although the infrastructure was evolving to include more hubs at which bandwidth carriers could interconnect, bandwidth leases had more highly specific endpoints than

durations and terms, assigning costs associated with upkeep of the physical infrastructure to various parties. Capacity contracts could be for a specified number of months or years, and could cover one or more geographic routes. The complex nature of the negotiated trading process ensured that there would be an important role for personal relationships—and staunch defenders of the old bilateral negotiations within each carrier.

Mashinsky believed he didn't have to—and in fact couldn't—change these old processes right away, but felt that the process could be streamlined and efficiencies reduced by interconnecting through an exchange and letting the market pricing clear. “An exchange can't replace a good game of golf.” Mashinsky noted. “The relationships will be there to stay. But these relationships can be facilitated by an electronic trading system.”

## History of Arbinet Communications

Alex Mashinsky emigrated from his native Ukraine to Israel in his youth. An inveterate tinkerer and entrepreneur even as a teenager, he bought and resold confiscated goods from Customs in Tel Aviv. He learned how to tap into public phone lines, desisting when the Israeli phone company threatened to shut down his family's service. After attending three colleges, including Tel Aviv University where he completed coursework in electrical engineering, he left school early. Mashinsky moved to New York in 1988 and started a trading business specializing in contracts for the physical delivery of chemicals such as urea, gold, and sodium cyanide. The business traded \$25 million in contracts during its first year, but trading volume collapsed when sodium cyanide exports from China slowed to a trickle in the wake of the Tianamen Square crackdown. Mashinsky discontinued the business, and founded a new company, A+ Systems, that made PC-based voicemail software and interactive voice response applications for telecom carriers. Mashinsky recalled:

Citibank Mastercard was the first financing source. Then I managed to get about 15 more Visas and Mastercards, so I had about \$150,000 altogether in credit cards. They were drawn to the limit. I didn't have one dollar available on those cards. Fortunately, business was profitable that year. I had no choice. I *had* to be profitable. We didn't do anything that wasn't profitable *enough*. If a customer wanted something and it wasn't profitable *enough*, we said no. And we paid a high price for that—high turnover in customers.

Soon Mashinsky started another company, VoiceSmart, that made low-cost PC-based telecommunications switches to handle ordinary voice and Voice-over-IP (VoIP)<sup>3</sup> call routing. Switches were essentially sophisticated computers that connected circuits on one phone network to circuits on another phone network—and if equipped with routing functionality, data packets on one network to data packets on another. A+ Systems sold its software bundled with the VoiceSmart switches. In 1994, Mashinsky started up another company, utilizing his switches and software. He signed multimillion-dollar contracts with carriers like AT&T and Telstra to provide *least-cost-routing* (LCR) services. This third company was named Arbinet—short for *arbitrage of networks*.

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minutes leases—typically, from one specific building in a city (say, the NASDAQ building in New York City) to another (say, International Place in Boston).

<sup>3</sup> IP stood for the *Internet Protocol*. Only 0.2% of the 82.1 billion international call minutes was completed over the Internet in 1997, but the sector was growing as carriers updated infrastructure.

## Arbitrage

Least-cost routing was essentially an arbitrage activity in the early 1990s. International carriers that originated phone calls were required to pay a per-minute fee to the overseas carriers that terminated phone calls. The fee, called a settlement, varied from country-to-country. New York-to-Bogota, for example, had a different settlement than Sydney-to-Bogota. An arcane structure of complex settlements, many of them influenced by political negotiations, led to many ways to arbitrage the difference. In theory, if the Sydney-to-Bogota settlement was very high and the New York-to-Bogota rate was very low,<sup>4</sup> the Australian carrier could have Arbinet originate the call from New York, and therefore pay a lower per-minute rate by avoiding the Sydney-to-Bogota settlement fee. Alternatively, the Australian carrier could also use Arbinet to complete the call using the Internet Protocol—to send the voice as data—and avoid the settlements framework altogether. Arbinet made its money by claiming a percentage—typically around 30%—of the savings it could realize for a carrier.

“We went from providing interactive voice response software and equipment to being a service bureau for large overseas carriers,” Mashinsky recounted.

We did custom network design, minutes routing, and market penetration strategies . . . we were basically a SWAT team. Telstra, for example, wanted to dramatically lower the prices for minutes to Hong Kong. They came to Arbinet and said, “solve our problem.” We engineered the solution, sold them a piece of equipment, installed it, ran it for them, and saved them money. By 1997, this had evolved to putting boxes behind carrier networks and using our existing infrastructure—including a central database with all the route information—to clear all their capacity. Because we knew what was happening across the networks, we could make a better decision than they could.

Arbinet quickly grew. It was the first carrier to deploy VoIP equipment in Japan, and became a major provider of arbitrage services to AT&T. With major customers such as AT&T and Telstra purchasing arbitrage and network management services, Arbinet began to enjoy cash flows of \$300,000 to \$400,000 per month.

## Exchange

Unfortunately, however, Arbinet’s customers became worried that Arbinet would gain too much leverage with its intelligence on route costs, and they began moving this function in-house. Uneasy at the prospects for the long-term sustainability of the arbitrage, PC switch, and software businesses, Mashinsky wrote a new business plan to create a NASDAQ-like exchange that could interconnect carriers and clear their international minutes while permitting them to manage their own route costs. Mashinsky explained:

I looked at the opportunity to be a switch vendor and said “I’ll never win the war against Cisco, Lucent, and the other guys. Cisco will eat me alive in this market.” And the carriers didn’t like the arbitrage because they were afraid Arbinet would make most of the money. So I decided—why build a future on something that’s going to collapse? Nobody’s playing in the exchange market, and an exchange is going to happen.

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<sup>4</sup> This example is hypothetical.

In 1997, Mashinsky began developing the exchange model, racing against the potential deterioration of the arbitrage business. Drawing from the equipment and arbitrage businesses as sources of cash, Mashinsky conceived of the Arbinet Global Clearing Network (AGCN), which would allow carriers to trade circuit-switched minutes anonymously on the web for specific international routes. Arbinet would earn a percentage of the dollar value of each transaction as its revenue. In early 1997, Mashinsky began what would be a long series of travails to get the new business model financed. In the middle of the fray, in late 1997, a key manager was replaced at AT&T, and AT&T, nervous about Arbinet's route intelligence, canceled its service contract and wrote off the equipment it had bought from Arbinet. Similar events occurred with Arbinet's customers in Hong Kong and Japan, destroying the arbitrage business and cropping 80% of the cash flow from the company in a matter of months. By late 1998, VoiceSmart was bankrupt and Mashinsky had abandoned A+ Systems. Bereft of cash flow, Arbinet had been hurled back into early-stage fundraising. Mashinsky described the plight:

I had no cash flow coming in. I had 45 people who were just focused on producing paperwork and presentations for investors to convince them to invest money in a vision that said "global exchange, global clearing." No track record in doing it. At that point I was selling a totally new story to a totally new set of investors, and the only management team was me and a couple of other guys and the new COO I'd hired from AT&T (**Exhibit 1**). And she was new to the company.

## AGCN

Arbinet essentially offered a NASDAQ-like exchange. The exchange had an online trading floor connected to telecommunications switching equipment (**Exhibit 2**). Market participants connected to the switch, opened an escrow account with Arbinet,<sup>5</sup> and could then browse the exchange and either bid for minutes or list excess capacity for sale. The web interface listed the bid and ask price for spot minutes contracts at various quality-of-service ratings. A carrier wishing to sell wholesale minutes posted details on the destination and per-minute rate at the Arbinet website. An interested buyer then paid Arbinet a deposit equal to the value of minutes it wished to buy and wrote its bid online. The buyer's traffic was immediately routed onto the seller's network. Both parties remained anonymous, thereby protecting each carrier's strategic capacity utilization information. Arbinet then passed payment to the selling carrier after charging a \$0.0035 per-minute fee to the buyer and a \$0.0047 per-minute fee to the seller.<sup>6</sup> Using call quality-monitoring software, the exchange periodically checked to ensure that the quality of service was appropriate for the stated level at which it had sold.

Because the exchange allowed traders to determine how many parties were willing to sell below or above a certain price (**Exhibits 3a, b**), AGCN would prove a useful tool for carriers who sought to use the exchange to arbitrage pricing. Mashinsky noted that if he were a carrier, "I look at the exchange and I instantly know whether I'm a buyer or a seller." Unlike in the old arbitrage model, the exchange model did not require that exchange partners disclose highly confidential data describing capacity utilization on specific routes, and did not require the carrier to outsource the entire route management function. Moreover, the exchange effectively removed most transaction costs from carriers. Barbieri remarked:

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<sup>5</sup> Buyers could pay for trades either from an escrow account maintained at Arbinet or through third-party credit offered by J.P. Morgan & Co.

<sup>6</sup> The fee system had three tiers; fee size was based on the size of the trade.

On the Arbinet exchange, all you have to do is sign the “terms and conditions” document with Arbinet and connect to our switch once. Then you can execute transactions with any of our members, and each transaction takes less than an hour at an estimated cost of \$48, exclusive of Arbinet’s fees. The exchange assumes all risk, the exchange assumes all settlement responsibilities, the exchange assumes all programming and switch management, the exchange assumes all legal and regulatory issues. So now, if I need to do something new, it’s just a matter of making sure that I’m routing to the exchange instead of another carrier.

The business model allowed Arbinet to serve virtually all of the routes in the world with a modest capital outlay. In order to complete trades made on the web-based exchange, Arbinet determined that it needed to buy a total of nine switches for \$2.5 million each from Nortel, a leading manufacturer of international gateway switches. A smaller switch was already operational in New York, the largest telecom transit hub in the world.<sup>7</sup> Hundreds of carriers interconnected in New York, and by 1999, more than 14 undersea cables connected New York to the United Kingdom. In fact, New York’s interconnection capabilities were so robust, phone calls and Internet data streams from one country in Europe to another were often routed through the city. Mashinsky estimated that switches placed strategically in just a few of the world’s cities—such as New York, London, Los Angeles Frankfurt, Sydney, São Paulo, Hong Kong, and Tokyo—would allow interconnection with almost every carrier in the world.

The company owned four patents and had another nine pending regarding the use of minutes-exchanges. It also had applied for numerous offshore patents. While in early 1999 it only updated spot trade prices once per day, it planned to move to 15-minute intervals by 2000, and eventually, to real time.

## The Future

Additional products were possible once AGCN became operational. Arbinet could choose its priorities. On the trading side, Arbinet could open a derivatives business to complement the spot market for minutes. By giving carriers the opportunity to buy forward contracts or options on the spot capacity, it would provide them a valuable opportunity to hedge the risk associated with any pricing volatility that developed in the spot minutes market. In a typical derivatives market, the number of derivatives contracts traded was many times the volume of the underlying commodity. As a result, a derivatives market, once the spot market was well defined, would substantially augment the exchange’s revenues. Arbinet could also extend the business to provide tracking data for the telecoms industry, including indices of wholesale prices, industry news, and capacity trends, thereby choosing to be the Bloomberg for telecoms. It could provide an interface that gave all the participants all the information they needed to conduct their business.

## Competition

Arbinet was not alone in pursuing its vision. There were nearly a dozen potential competitors (**Exhibit 4**). Many were small, regional, or had not yet launched or attracted significant carrier attention. None had developed thus far as well as Arbinet. A few, however, had gained mindshare with distinct business models.

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<sup>7</sup> Major financial centers in the world had a high concentration of fiber and good presence of telecommunications carriers because of the data interconnectivity requirements of financial service firms.

**Band-X** Band-X was founded in the United Kingdom in June 1997. The flagship product (**Exhibit 5**) was a Web-based lead-generation service (or bulletin board) with 3,000 member companies from more than 100 countries. A carrier wishing to sell minutes through Band-X's lead generation service posted an offer on the Band-X bulletin board. The seller provided details on the origin, destination, number of minutes available, and the per-minute rate. The seller's identity remained undisclosed. A buyer interested in the seller's offer emailed a response to Band-X management. Band-X management introduced buyer and seller. On their own, buyer and seller established the details for interconnection to their networks and determined how many minutes were to be sold. If an agreement was reached, the seller paid Band-X a commission within seven days of receiving payment. The fee varied according to the size of the sale—2.25% on the first \$200,000 invoiced, 1.125% on the next \$200,000, and 0.6255% on all payment thereafter. Upon receipt of the commission, Band-X passed on 25% of its fee to the buyer. By holding out the promise of this sum, Band-X gave the buyer an incentive to ensure that the trade was reported and that the seller carried through with payment of commission. Fulfillment generally took between one and six months for a typical trade through the lead-generation service. By March 1998, the lead-generation service had stimulated more than 100 trades with an average size of 1 million minutes. Band-X had several other telecom-related bulletin boards, including one for real estate and one for personnel recruitment.

Band-X was founded by ex-RAF fighter pilot Marcus de Ferranti, an expert in IT integration who had worked in the Deputy Prime Minister's Deregulation Unit, as well as by Richard Elliott, a former investment banker from Kleinwort Benson equities division. The company had not accepted outside funding yet, but the press had reported that it was seeking \$2 million in first-round funding.

Band-X had also announced that it would start two real-time exchanges like Arbinet's—one that traded minutes, and another that traded bandwidth. Larger fees of about 5%, split between buyer and seller, would prevail for its switched circuits and routed bandwidth service. It was not clear, though, when or even if these exchanges would be operational.

**RateXChange** San Francisco-based RateXChange was a lead-generation service opened in January 1998 to facilitate trades of minutes and bandwidth. It reported facilitating over 100 trades per month in both minutes and bandwidth between its members. According to RateXChange, a typical trade was large—for millions of minutes at a time—and fulfillment generally took two to three months once RateXChange introduced buyer and seller.

RateXChange had also announced plans in September 1998 for a Real-Time Bandwidth eXchange (RTBX), an electronic exchange like Arbinet's that by "late 1999" would allow carriers to trade one-month spot and one-year forward contracts for circuit-switched and VoIP minutes instantly and anonymously through 12 switches in the United States. The first two had already been installed in New York and Los Angeles and were already switching a few voice circuits. RateXChange planned to roll out VoIP later. RTBX offered third-party credit guarantees, a standard interconnection contract, instant delivery of minutes, and classification of routes based on industry-standard metrics like ASR and PDD. Members of the RTBX were also categorized into three quality tiers to help overcome the buyers' reticence to contract with an unknown carrier. According to Carl Maybin, the president of a small California-based carrier, Pegasus, "RateXchange's A carriers are essentially the Tier 1s of the world.<sup>8</sup> B is the next level of aggregator, and C is literally the no-name category. That quality ranking hurts us to a certain extent because we're not a Tier 1 carrier and can't get an A rating. But that's how you select who's good."<sup>9</sup>

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<sup>8</sup> "Tier 1" was industry parlance used to describe a carrier with a large number of points-of-presence and a nationwide network.

<sup>9</sup> Brian Quinton, "Boulevard of Broken Dreams." *Upstart*. January 25, 1999. Accessed at [http://www.internettelephony.com/archive/Upstart1999/UpstartJan99/UPS1.25digitd\\_Quinton.htm](http://www.internettelephony.com/archive/Upstart1999/UpstartJan99/UPS1.25digitd_Quinton.htm), April 4, 2000.

The RTBX planned to offer spot and forward trades in a neutral, anonymous market. It planned to charge 2% of the value of the trade to each of the buyer and seller at time of trade, and another 2% each at the time of delivery. Lower rates would prevail for the lead-generation service. RateXChange's founder, Sean Whelan, was formerly a specialist in business development, wholesale sales, and alternate sales channel management at Sprint, MFS Communications and Worldcom. The firm was essentially still pre-revenue, privately backed and seeking its first round of funding.

**Enron** Enron was a carrier<sup>10</sup> that proposed to create standard units of trade, industrywide metrics of quality, and an efficient legal framework to enable rapid execution of bandwidth—not minutes—trading agreements from “pooling points” (i.e., hubs) across the world. Pooling points, in Enron's proposal, would be owned by carriers, but managed by a neutral, nonprofit third party called the Bandwidth Trading Organization (BTO). The first four pooling points, owned by Enron, were in San Jose, Los Angeles, New York, and Washington, D.C. Enron had begun circulating commodity market starter kits, complete with a prototype of a standard commodities contract, to other carriers to stimulate interest in bandwidth trading. Enron provided an example of a typical series of trades in its starter kit:

“On December 1, 1999, Jane at Enron Communications determines she needs to purchase two . . . segments [of bandwidth] for January 2000 through March 2000. The previous day she had spoken with three other firms that expressed an interest in selling. Jane calls her contacts at those firms directly, and decides to buy from Karen at Zsouth, a large carrier who offered the best price. . . . Jane and Karen confirm the terms. That same day, both Jane and Karen contact the Pooling Point Administrator (PPA), who confirms that the two sides of the deal match. Payments from Enron to Zsouth would flow according to the standard terms in the master agreement. On December 10, 1999, Jane decides that she really does not need the bandwidth she bought from Zsouth, and since the price has risen, she would like to sell and monetize the value of her trade. She again calls three traders and agrees to sell to Miranda at Slope9, another carrier, who presented the highest bid. Jane and Miranda confirm the commercial terms. That same day, Jane and Miranda call the PPA, who confirms that the two sides of the deal match. The PPA automatically uses the same circuit that Jane used to both buy and sell otherwise identical transactions, “netting” the transaction. The PPA provides Jane and Miranda with an access number that allows them (and only them) to monitor the trade. Payments from Slope9 to Enron would flow according to the terms of the master agreement.”<sup>11</sup>

In this scenario, the PPA scheduled the interconnection of traffic, maintained the pooling points, and collected a fee to cover its costs. The exchange would report neither the price nor the volume of contracts traded, and would not actively manage bandwidth quality, although it would maintain an online system to let trading partners monitor quality. The exchange would also not provide third-party credit guarantees and in fact would never see the money used to pay for trades. Trades, however, would be completed in accordance with a master contract with standard terms, including provisions that spelled out how damages should be paid in the event of performance problems on the networks.

Enron argued that its conception of a marketplace allowed carriers to standardize the contractual terms of trades without subverting what it felt to be the valuable relationship-intensive aspect of the business.

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<sup>10</sup> Enron was a diversified utilities company that used its significant pipeline rights-of-way to construct and operate a wholesale telecom network.

<sup>11</sup> “The Bandwidth Commodity Market: Market Starter Kit,” Enron Communications, pg 5. Accessed at <http://www.enron.com/bandwidth>, April 6, 2000.

**Min-X** Founded by IP Telephony guru Jeff Pulver, Min-X was an informal web-based introduction service that allowed members to post bids and offers for VoIP minutes, then followed up at quarterly “Dealing Room” meetings at which the potential buyers and sellers were introduced. Min-X did not provide switching or credit guarantees, although it did conduct background checks on market members to verify their network capacity. Pulver noted that the IP minutes inventory had barely begun to be tapped. “On the Internet, I can account for about 35 million IP telephony minutes in September [1998]. At the same time, I estimate there were about a billion minutes of capacity out there. And I believe one reason more minutes aren’t being generated is that the endpoints can’t find each other.”<sup>12</sup>

## What Makes an Exchange?

Whether international telephony minutes were a suitable commodity on which to base a NASDAQ-like, neutral, anonymous spot market was an interesting and actively debated question. There were several challenges to be overcome before minutes could be traded like pork bellies or gold. First, Arbinet would have to develop the standard quality grades essential for any commodity. Second, Arbinet would have to build its market with enough trading parties so that the trading floor was attractive to carriers.

### Commodity

At the most basic level, Arbinet had to define and popularize a standard unit of trade—an exercise that was made difficult by the need for quality standards and made complex by the inherently geographic nature of a minute.

Arbinet defined the standard trading unit on AGCN to be a minute of voice conversation on a specific route (e.g., New York to London, or Paris to Caracas), with a specific level of Quality of Service (QoS). Arbinet measured certain commonly measured variables, such as the answer-seizure ratio (ASR, the ratio of successfully-completed calls to total incoming calls) and the post-dial delay (PDD, the number of seconds a caller had to wait after dialing the last digit of a phone number for the phone to begin ringing). Arbinet then categorized circuits on its exchange into four major quality buckets using a variety of other parameters. Although most of the parameters used to define the quality buckets were well known in the industry, there was less agreement between carriers on how they should be weighted individually to create an overall quality factor. With a number of different startups in the field, each promoting its own somewhat different quality metrics, it was difficult for carriers to agree. Moreover, carriers were accustomed to measuring and managing route quality themselves, and might be a little reluctant to outsource this to an exchange. Many carriers had stated at public conferences that they valued their relationships with other carriers because it allowed them to learn how their trading partners defined quality. Purchasing minutes of only “fuzzily defined” quality from an anonymous carrier through an exchange could be uncomfortable.

Minutes were also geographically specific. A minute between New York and Moscow was not the same product as a minute between Karachi and Istanbul. These geographic differences in the products being traded made the selection of an overall benchmark impossible. A benchmark in a commodity market was a well-defined product which served as an anchor for the rest of the products in the market. In the oil markets, for example, West Texas Intermediate Crude was a commonly used

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<sup>12</sup> Brian Quinton. “The Bandwidth Brokers.” *Telephony*. November 2, 1998. Accessed at <http://www.internettelephony.com/archive/11.02.98/nmnews.htm>, April 4, 2000. See note 2 for an elaboration of bandwidth endpoints.

benchmark. Oil was a complicated product, described by dozens of quality specifications, many more than were used in telecommunications minutes. There were over 300 grades of crude oil that traded in 1999. West Texas Intermediate, however, was defined with a unique set of quality specifications as the benchmark, and prices of the other grades generally tracked its price. When the benchmark West Texas Intermediate crude went up, prices rose for most of the other 300 or so oil grades as well. When West Texas Intermediate fell, others did also. Different oil grade prices could thus be described easily and consistently by the premium or discount to the benchmark price. In telecommunications, however, movement in the geographic route prices would not necessarily be highly correlated. Each destination on the AGCN was therefore benchmarked independently. "My benchmark for New York-to-Los Angeles is different from New York-to-Pakistan," Barbieri explained. "If there's an earthquake in Turkey, it in no way affects the cost of a minute from New York-to-Cuba." As a result, the exchange was left with a myriad of benchmarks with complicated interrelationships, making it difficult for carriers to gauge how to use the market as a hedging tool.

There would be still deeper problems associated with trading bandwidth (viz., for Internet traffic such as IP telephony). Telephony QoS metrics had a headstart of approximately a hundred years on their bandwidth counterparts, making them substantially better understood by the carriers. While it was possible to measure variables such as the round-trip latency of a single packet as it traveled through the Internet, it was difficult to predict or characterize the quality of a large stream of packets such as a telephone conversation, since each packet traveled a different route. As a result, there was little agreement among carriers about how to define a standard trading unit or quality of service on the Internet.

Assuming Arbinet was successful at defining standard commodity grades for minutes, it still had to overcome several structural barriers in order to have a successful market. It would have to establish a market with *liquidity* and would need to persuade carriers that the pricing in the spot market was *volatile*.

**Liquidity** Liquidity was achieved when a market had enough buyers and sellers at any given time to ensure that assets could be traded without causing large short-term spikes in the asset's price. Arbinet had already signed up 48 carriers, but only 27 had actually placed trades on the exchange thus far. Five selling carriers accounted for more than three-quarters of the exchange's trading volume. Arbinet's trading floor listings (as well as the listings of its competitors) typically showed the market to be top-heavy with sellers. This suggested either that carriers were more comfortable selling than buying through the exchange, or that they had significant excess capacity. Whatever the reason, the imbalance, if not corrected, could undermine the liquidity of the exchange.

Potential traders in the market fell into three key groups (**Exhibit 2**). The first was composed of both capacity-constrained carriers who lacked standing agreements that matched their needs on certain routes and carriers with surplus capacity on particular routes. The second consisted of resellers who did not own their own network facilities, but hoped to profit by purchasing capacity from carriers, breaking bulk, and selling marked-up capacity to specialized customer bases. Examples of resellers included competitive local phone companies and prepaid calling card vendors. Finally, large corporations such as investment banks or insurance companies might also find an exchange useful, since they often owned or leased telecom or data networks, and therefore could buy or sell capacity.<sup>13</sup> Arbinet had to find a way to market its complicated service to this community of carriers, resellers, and large corporations, encouraging behavioral changes that would promote the use of an exchange.

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<sup>13</sup> Alternatively, large corporate clients could, in order to minimize expense, simply add more complexity to the equipment it already owned. They could also sign large outsourcing contracts with influential carriers—such as AT&T or Worldcom—that had the international negotiating savvy to construct low-cost agreements.

**Volatility** Arbinet also had to persuade carriers that there was ample price volatility in the market if it hoped to establish a futures-trading business. Prices established in some bilateral trades in 1999 were in a free fall (**Exhibit 6**). As an extreme example, wholesale minutes contracts to the United Kingdom from New York dropped from 11 cents per minute to 2.5 cents per minute in 1999. Arbinet's closing price data offered some insights into volatility (**Exhibit 7**). Industry observers expected that it would take years to fill up some of the optical fiber under construction by wholesalers such as Global Crossing and Williams (**Exhibit 8**). Wholesalers started up as little as 5% of the optical fiber capacity they constructed and expected to tap their available capacity better as demand increased.

## Financing History

### Easy Come, Easy Go

In March 1997, when Arbinet had completed its business plan for the exchange model, Mashinsky began to seek funding. He soon had a term sheet from Prospect Street Ventures, a lesser-known venture capital firm, for a \$5 million investment at a \$45 million pre-money valuation. This was before the deterioration of the arbitrage business, however, and Mashinsky had felt that his existing cash flow and customer base suggested a higher valuation. After some thought, Mashinsky instead asked for a \$60 million pre-money valuation, and refused to accept an exclusive no-shop provision that Prospect Street demanded during its due diligence phase. Prospect Street retracted the term sheet. At least in this case, Mashinsky appeared to have overplayed his hand.

Soon after, Mashinsky received a buyout offer from USA Global Link, for \$70 million in cash and stock. USA Global Link concurrently sought an investment from AT&T (which at the time was the important customer of Arbinet's arbitrage business). Unfortunately, though, shortly after the offer AT&T President John Walter left, and with him went the hope for an immediate AT&T cash investment in USA Global Link. Mashinsky in turn refused to accept USA GlobalLink stock for the sale of Arbinet, and the entire deal collapsed. AT&T executive Tom Evslin, who had worked for Walter at AT&T and had performed due diligence on the USA Global Link/Arbinet investment, left AT&T soon afterward.

Still searching for money in late 1997, Mashinsky received the outline of a prospective term sheet from Merrill-Lynch for a \$2.5 million investment at a "possible" \$50 million pre-money valuation. Merrill-Lynch indicated, however, that it would not serve as a lead VC, and stipulated that Arbinet select an investment partner from a short list of very high-quality venture capital firms. Merrill indicated that the pre-money valuation would, of course, have to be negotiated with and acceptable to the VC firm. Mashinsky picked Spectrum Equity Investors, a respected telecom VC. Soon after, Arbinet received a revised term sheet from Merrill-Lynch and Spectrum for a \$5 million investment at a \$25 million pre-money valuation. The term sheet imposed an exclusive no-shop period during the three months of due diligence that would follow the signing of the term sheet. Low on cash this time, Mashinsky agreed to the terms, but during the due diligence, the arbitrage business came unglued and Merrill-Lynch and Spectrum declined to invest. Instead, the two firms invested in an arbitrage network business plan that was promoted by former AT&T executive Tom Evslin. Evslin's company, ITCX, created a clearing network that arbitrated phone calls through an all-IP exchange. It functioned somewhat like Arbinet's arbitrage business. "I almost went bankrupt then," Mashinsky remembered. "I missed two payrolls, I told my people, 'I'll have money, I'll have money.' It was Thursday, I had no clue how I was going to meet payroll the next week."

Mashinsky called a prospective investor that he had met earlier, who took him

up to the umpteenth floor or whatever of Salomon Brothers, into an office with 10 guys in it. These guys ran \$500 million for Salomon Brothers, made \$30 million in bonuses, and were looking for personal investments. So I gave my pitch, and a guy said, "How much are you looking to raise?" and I said "About \$100,000," and he said, "Could you walk out of the room for a second?" Five minutes later, they brought me back in, and the guy said, "Two of us have decided to invest \$1 million in Arbinet." I said, "Great." These were really angels from heaven.

The two angels from the room invested a total of \$1 million at a \$20 million pre-money valuation. The deal included warrants, however, which would effectively bring the pre-money valuation down to something like \$13.5 million for the entire investment. With the million, Mashinsky evened up on payroll and paid a few debts, but then needed more money. A few weeks later, Arbinet received another buyout offer from a communications company for \$20 million in cash and stock. The stock for the proposed acquirer, however, had not grown since it went public, and offered little potential for appreciation. Mashinsky declined and accepted a credit line from a third party.

In February 1999, George Soros expressed interest in investing, along with a group he had put together. On the day the investment was to close, however, an article appeared in *The Industry Standard* that chronicled some of the earlier difficulties Arbinet had in raising financing as well as the rise of Tom Evslin's ITXC. Soros and the several firms he had brought together chose not to invest.

Mashinsky reflected,

You are distracted every day by people looking to buy you at unfair prices, and in the meantime you're trying to run a business. This is all 14-hour days and no help. It's tough. You can't even hire the people you want to hire. They come to the dinky place above the disco to do a job interview and they ask you who are your investors . . . you tell them, and they laugh at you and they leave. That's more or less what the job interviews were.

## Decisions

Arbinet really needed a \$10-\$15 million investment reasonably soon in order to develop the business. The company needed to develop technology to speed quote delivery and order execution, to install more switches, to sign up new carriers to interconnect to the exchange, and to put processes in place that would enable it to meet all the regulatory requirements that would be imposed once it became a mature financial market. Finally, Mashinsky agreed that Arbinet needed to hire a CEO (as was customary when startups received financing and began to scale up the business concept) and add several additional key managers, particularly in marketing and sales.

Arbinet had recently received an offer from Lone Star Capital,<sup>14</sup> a small merchant-banking firm in Dallas. Lone Star offered both to invest and to act as a placement agent for Arbinet—to raise money for a fee in cash and equity. It offered to attempt to raise \$10.6 million at a \$50 million pre-money valuation. Lone Star would itself invest \$3 million and raise the rest from its network of contacts. Lone Star proposed that it would take 8% of the amount it raised as a cash fee. It also requested warrants for 11% of the (post-money) company, with a strike price at the valuation of the round. Lone Star expressed some willingness to invest its \$3 million immediately, but had as yet

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<sup>14</sup> The name of the firm has been disguised.

made no commitment to do so. The Lone Star term sheet included a detailed timetable for taking Arbinet public within four months. Although Lone Star seemed to be a talented and adventuresome group of people, the firm had taken just a few firms public, and had used underwriters that were largely unknown.

“Into eight or nine term sheets,” Mashinsky recounted, “I began to realize that I’m just not really good at this thing. Maybe I should get somebody to help and evaluate the Lone Star deal.” He subsequently hired Jeff Parness to shop his business plan and assist him in evaluating offers. Parness recommended that Mashinsky start with a clean slate of options to compare to Lone Star. He solicited term sheets from a syndicate of three early stage funds (ICG, Communication Ventures and Bedrock Capital); from J.H. Whitney, a mid-stage fund; from Morgan Stanley Venture Partners, a late-stage fund; and from Credit Suisse First Boston (CSFB). Parness recounted his reasoning:

The reason I organized it that way is that I wanted the marketplace to tell us what stage they perceived the company was at. Each one of those firms had a very different perspective. The challenge was to marry Arbinet’s unusual history and risk profile to investors with a risk profile in the same stage. Now, Arbinet had seemingly later-stage metrics—a relatively long operating history, a team of people, and customers. The dogs were already eating the dogfood. Carriers had already signed up, and were sending us minutes. But until you reach critical mass, until the market fully accepts it, there’s still fundamental business execution risk. Arbinet was still trying to scale up a strategy it hadn’t done before. There was early-stage risk on the table.

J.H. Whitney and Morgan Stanley declined to offer term sheets, stating that while they really liked the business model, they wanted Arbinet to be farther along in executing it. CSFB expressed interest in serving as a placement agent, much like the Dallas firm. Parness realized that the value CSFB could bring was enormous:

We’re in these beautiful wood-paneled offices at CS First Boston, and they bring out their head telecom banker who’s just merged AT&T and TCI, and he says “I love you guys. I see your business model. We’ll help you raise money, and we’ll get it from all these strategic investors.” Now, since they bank all the major international telcos, they could expose us to the international telco community, all of whom are potential customers of the exchange or potential strategic investors.

Parness suggested,

If they’re going to run one of those telecom banking conferences where all the big public telecoms pitch, Alex should be their keynote speaker . . . because he’s going to be the only guy there who’s representing a business model that’s not directly competitive with anyone else in the room. And it’s a unique play, it’ll be great exposure. And CSFB could help make it happen.

Unfortunately, it would take some time to complete a CSFB financing. The bank would solicit institutional and strategic investors only after a period of due diligence. Parness expected that CSFB could spend six to eight weeks or more on due diligence prior to shopping a prospective Arbinet deal to its clients. The bank would likely charge a 3%–7% fee, some of which would be in warrants. Parness thought that the valuation might be higher than that which VCs would offer, though probably quite a bit lower than the Dallas firm. Unfortunately, Arbinet would not really know the valuation for sure until after the due diligence period, nor would they know the other terms. But “the real issue with bankers,” he noted,

is that you're not talking to a direct funding source. We would have to spend a couple of weeks getting them comfortable with the state of the company, potentially putting together a book, and then only afterwards would they go out and raise the money. So we have no visibility to the back end of the process to know who's going to be writing the check and how comfortable they are going to be writing it.

Finally, Parness' efforts yielded a term sheet from the syndicate of three early stage firms. ICG was a well-known but controversial firm that provided early-stage venture capital to business-to-business ecommerce exchange models (**Exhibit 9**). Communication Ventures, had participated in the financing of Ascend, Ciena, and Broadcom, "virtually a who's who of telecoms," Parness noted. Communication Ventures and Bedrock were both well-respected, though not high profile venture firms. Parness judged that with these VCs, Arbinet "knew where the money was coming from, and knew that these were going to be the guys who rolled up their sleeves and helped build the company." Parness particularly liked the fact that these firms included individuals who had been entrepreneurs themselves and had proven themselves operationally. Parness believed that, in part because of the timing, Arbinet's options with CSFB and Lone Star looked less attractive than its opportunity with the VCs, and recommended that Mashinsky attempt to negotiate the term sheet.

Perhaps so, but Mashinsky wondered if he didn't still have reasonable alternatives. Negotiations with the VCs over the terms for a potential investment were scheduled for the next day, and he would have the opportunity to structure a deal. He had a rough idea of what the deal might look like. He knew he needed \$10-\$15 million, and suspected that because of Arbinet's unusual situation, the VCs might be inclined to stage its investment into two tranches, with the second tranche dependent on fulfilling certain operational or recruiting objectives. He wondered whether different valuations should apply to each tranche and if so, what the overall impact on the company's valuation might be. He knew that he would have to consider Arbinet's historical and *pro forma* financial statements as well as comparable venture financing deals in order to make this determination (**Exhibits 10 and 11**). If the deal wasn't doable, he could always fall back on the two placement agent offers and perhaps persuade Lone Star to invest its \$3 million on a faster timetable than the \$7 million it planned to raise from others. So Mashinsky believed he still had flexibility. Mashinsky climbed off his bicycle at the East 54<sup>th</sup> Street nightclub that marked the stairway to Arbinet's offices. Today he would decide what valuation and deal structure to seek from the VCs, and think through just how good his alternatives were. Mashinsky lifted the bike to his shoulder to carry it up the stairs, and he ducked into the stairwell just as it began to rain.

**Exhibit 1** Management Biographies

**Alex Mashinsky, Founder, Chairman** Mr. Mashinsky is Arbinet's chief solution provider with primary responsibility for corporate vision and oversight of technical development. After completing his service in the Israeli Army in 1987, Alex moved to New York and established a business selling voice processing applications, providing alternate switching solutions for major international carriers worldwide. Mr. Mashinsky has led Arbinet to become the largest and most recognized real time exchange for telecom minutes and bandwidth with operations in 9 countries and over 50 employees. Arbinet has been featured in leading international publications such as *Business Week*, *Forbes*, *The Economist*, *CWI*, *Interactive Week*, *Technology Review* as well as on CNNfn. Overseeing technology development at Arbinet, Mr. Mashinsky designed and orchestrated the installation of the world's largest PC-based telephony switch. Named "Star of the Industry" by Computer Telephony Magazine, Mr. Mashinsky has also lectured at international conferences such as PTC, VON, and others on such topics as VoIP, Telecom Trading, and ATM Technology. He has applied for numerous patents relating to telecommunications design. Mashinsky's designs, currently being utilized by some of the world's largest carriers, have been incorporated into Arbinet's products.

**Rachelle Rees McCarthy, Chief Operating Officer** Ms. Rees McCarthy joined Arbinet in October 1998 as Chief Operating Officer. She is responsible for the daily operations of Arbinet's network as well as new product development and implementation. Prior to joining Arbinet, Rachelle acquired fourteen years of telecommunications experience with AT&T. Rachelle held a wide variety of positions, including systems engineering at AT&T Bell Laboratories, project management, service management, operations, product management, and marketing. Most of her experience has been in the international arena, focusing on voice services for large multinational companies. Rachelle also spent fifteen months with AT&T's joint venture in Canada, AT&T Canada Long Distance Services, as product director for its 800 service. Most recently, she had responsibility for managing a \$1 billion portfolio of international voice services, including global call centers, international toll-free services, virtual private networks, and nontraditional access arrangements to services. Rachelle holds a BS and MS in Industrial Engineering from Purdue University and an MBA from New York University's Executive MBA program.

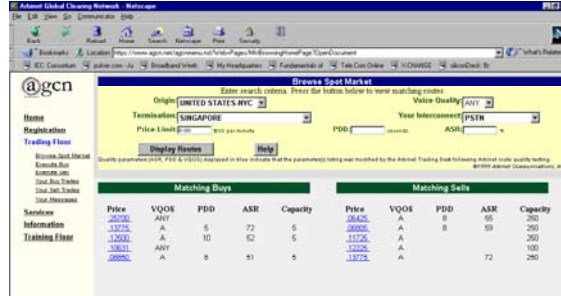
**Bob Barbieri, VP of Product Development** Mr. Barbieri joined the Arbinet team in August of 1997. As VP of Business and Market Development, Bob is responsible for the Product Management and Market Development of Arbinet's Telecom Exchanges as well as identification, due diligence, and negotiation of potential JV alliances, partnerships, and acquisitions. Bob possesses 12 years of telecommunication industry experience most recently as a consultant on emerging telephony technologies to international carriers. Bob's background extends to companies such as MCI, Phoneworks, and Worldphone. He is one of the pioneers of the Interactive Voice Response industry. His applications for over one hundred *Fortune* 500 companies range from customer service solutions to award-winning national sweepstakes. As Senior VP of Worldphone, Bob built the startup into an industry-leading multinational organization with 6 international offices and over 100 employees.

**Bob Sorrentino, VP of Network Infrastructure Planning** Mr. Sorrentino comes to Arbinet with over 29 years of telecommunications experience. He began his telco career at AT&T Bell Laboratories and helped develop some of the original digital switching and transmissions systems still used today. Bob's career moved him from Systems Engineering, to Project and Product Management responsibilities, and eventually to the role as AT&T's technical expert for Switched facsimile. Among his many accomplishments Bill deployed and put into operations the first of AT&T's Fax Service Centers. Due to his extensive system knowledge, he was put in charge of developing requirements for AT&T Advanced services such as 800/900, SDN, VPN, Audiotext, International Facsimile, and Audiotext. Bob holds a Master in Electronic Engineering from Monmouth University and a Masters Degree in Project Management from George Washington University. Bob also holds the patent for the Pay-Per-View ordering architectures used today by HBO, Comcast, and other cable services providers.

Source: Arbinet Communications, Inc.

Exhibit 2 Arbinet's Business Model

**WEB-BASED TRADING FLOOR**



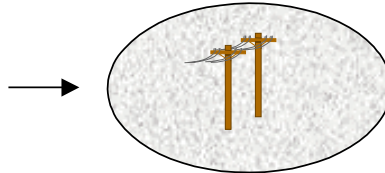
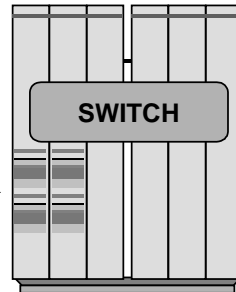
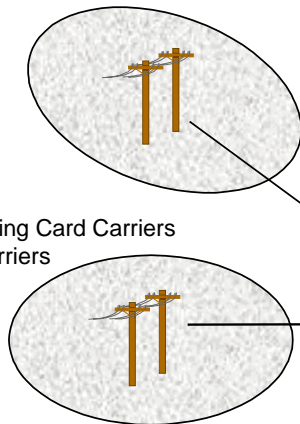
**CALL ORIGINATORS (BUYERS)**

Carriers & Wholesalers

- MCI Worldcom
- AT&T
- Enron
- Williams
- Qwest

Resellers

- Prepaid Calling Card Carriers
- Callback Carriers



**CALL TERMINATORS (SELLERS)**

Carriers & Wholesalers

- MCI Worldcom
- AT&T
- Enron
- Williams
- Qwest

Source: Arbinet Communications, Inc.

Exhibit 3a Arbinet’s Trading Interface: Main Trading Floor for U.S.–Singapore Routes

**Browse Spot Market**  
 Enter search criteria. Press the button below to view matching routes

Origin: **UNITED STATES-NYC** Voice Quality: **ANY**  
 Termination: **SINGAPORE** Your Interconnect: **PSTN**  
 Price Limit: **0.00** \$US per minute PDD:  seconds ASR:  %

**Display Routes** **Help**

Quality parameters (ASR, PDD & VQOS) displayed in blue indicate that the parameter(s) listing was modified by the Arbinet Trading Desk following Arbinet route quality testing. ©1999 Arbinet Communications, Inc.

Matching Buys					Matching Sells				
Price	VQOS	PDD	ASR	Capacity	Price	VQOS	PDD	ASR	Capacity
<u>25700</u>	ANY				<u>06425</u>	A	8	55	250
<u>13775</u>	A	5	72	5	<u>06805</u>	A	8	59	250
<u>12500</u>	A	10	52	5	<u>11725</u>	A			250
<u>10631</u>	ANY				<u>12225</u>	A			100
<u>08850</u>	A	8	51	5	<u>13775</u>	A		72	250

**Price Limit:** in US \$/minute. The views below list all spot buys exceeding your price limit and all spot sells cheaper than your price limit. In other words, the left panel shows buyers willing to pay your selling price and the right panel shows sellers that offer a price that is lower than or equal to what you are willing to pay. **Voice Quality:** A - best quality; B - mid quality; C - low quality. The left panel lists buyers who will accept your quality of service (i.e., your entered quality and below) and the right panel lists sellers who will meet your expected quality of service (i.e., your entered quality and above). Voice Quality is independent of the PDD and ASR connectivity measures specified separately. Voice Quality reflects such parameters as signal level, channel noise level, echo path loss, round-trip latency, coding quality and echo cancellation method. In general, Voice Over IP using today's gateway platforms will have a lower level of quality than wire-line PSTN. In the near future, the AGCN will also explicitly differentiate VOIP routes and list the specific gateway brands used. The Voice Quality listed is as stated by the selling carriers. Arbinet reserves the right to alter Voice Quality entries to reflect operational reality based on feedback from AGCN customers and on independent testing. **PDD:** Post-Dial Delay, in seconds. The lower left panel lists buyers who will accept your PDD (i.e., buyers who expect the same or a higher PDD) and the lower right panel lists sellers who will meet your expected PDD (i.e., sellers with the entered PDD or less). **ASR:** Answer Seizure Ratio; the percentage of calls answered out of the total call terminations attempted. The lower left panel lists buyers who will accept your ASR (i.e., buyers who expect the same or a lesser ASR) and the lower right panel lists sellers who will meet your expected ASR (i.e., sellers with the entered ASR or higher).

Exhibit 3b Arbinet’s Trading Interface: Route Details View for U.S.–Singapore Routes

Route Details	
Termination:	SINGAPORE
Order Date:	11/09/99 07:53:07 AM
Order Status:	ACTIVE
Order Number:	02-0000-1200
Type:	Buy
Svc Start Date:	11/09/99 MM/DD/YYYY
Svc End Date:	01/01/2000
Price:	\$0.08850 US per minute
Interconnection:	VoIP/Private Line
Voice Quality:	A
Average PDD:	8.0 seconds
Average ASR:	51.0%

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Route Details	
Termination:	SINGAPORE
Order Date:	02/22/2000 04:51:54 PM
Order Status:	ACTIVE
Order Number:	02-0000-1822
Type:	Sell
Svc Start Date:	02/22/2000 MM/DD/YYYY
Svc End Date:	GTC
Price:	\$0.06425 US per minute
Interconnection:	PSTN
Voice Quality:	A
Average PDD:	8.0 seconds
Average ASR:	55.0%
Capacity:	250 K mins per month
Exclusions:	None

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Source: Arbinet Communications, Inc.

**Exhibit 4** New Service Providers Emerge

Business Model	Companies Employing the Business Model		Description
	Minutes	Bandwidth	
Exchanges	Arbinet (AGCN)	RateXChange (RTBX)	Neutral third-parties that operate an Internet-based anonymous exchange and offer delivery, billing, and payment, and transparent price reporting. Revenues earned through transaction fees.
	Rate Exchange (RTBX)	Band-X	
	Band-X	InterXion	
	AIG Telecom	AIG Telecom	
	Asian Capacity Exchange (planned)		
Clearinghouses	Most carriers (internal function)	AT&T VoIP Clearinghouse	Non-neutral service providers that deliver low-cost interconnection agreements and in Arbinet's case, more complex least-cost routing software to negotiate rates, offering physical traffic delivery, payment settlement between clients. Revenues earned through arbitrage.
	Arbinet (discontinued)	ITXC	
		Telia VoIP Clearinghouse	
Pooling Point Developers	n/a	Enron's Bandwidth Trading Organization (planned)	Carriers seeking to improve the liquidity of bandwidth by creating hubs to facilitate bandwidth trades based on the outcome of bilateral negotiations. Typically, revenues earned through member fees with the intent to cover costs.
		LighTrade (planned)	
Lead-Generation Services	Band-X	Band-X	Web-based brokers that use a web site to generate supply and demand and match trades offline. Revenues earned through transaction fees.
	RateXChange	RateXChange	
	GTX Global TeleExchange (planned)	Min-X	

Source: Casewriter research. Adapted in part from Ross Mayfield, "Real-Time Trading Strategies for Carriers," *Telecom Business*, May 1999. Accessed at (<http://www.rateexchange.com/news/TelecomBusiness1.htm>) 6 April 2000.

Exhibit 5 Selected Offerings Available on Band-X's Lead-generation Service

**BAND-X** the bandwidth exchange. How the world shares ideas.

home about us register press / conferences indices / commentary blacklist links

To deliver a new class of customer relationships.

home | circuits: view/update my bids/offers | tender | switched | co-location | recruitment | dlq co-ord

**Bandwidth**

The following is a full list of bids or offers. Click the reference number for full details:

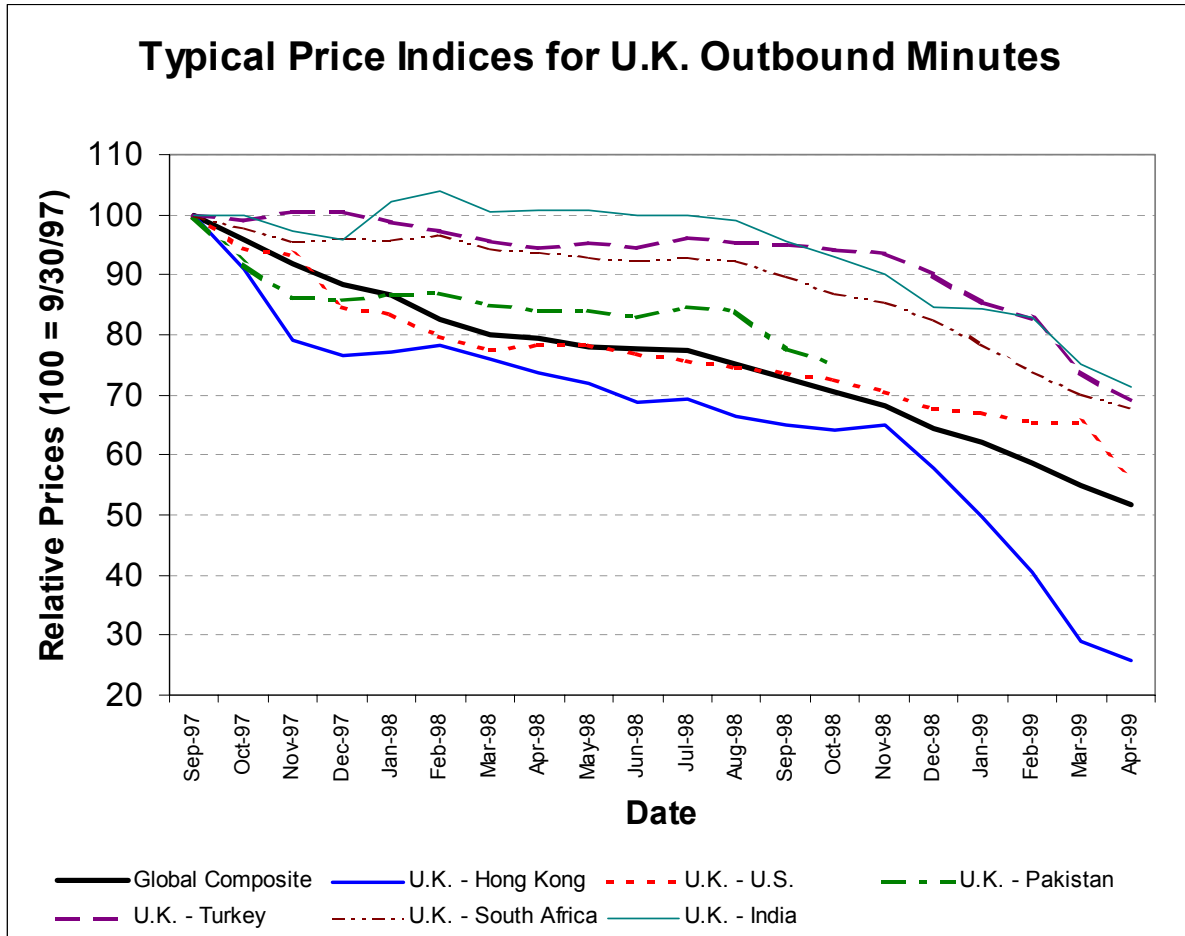
Ref	Origin	Destination	Speed	Bid / Offer	Price
<a href="#">B1738</a>	Los Angeles US	Sydney Australia	E1	offer	\$ 49,500 (per month)
<a href="#">B1493</a>	Los Angeles US	Sydney Australia	E1	offer	\$ 66,500 (per month)
<a href="#">B1769</a>	New York (Hudson) US	Vienna Austria	STM 1	offer	\$ 290,000 (per month)
<a href="#">B1765</a>	New York (Hudson) US	Brussels Belgium	STM 1	offer	\$ 150,000 (per month)
<a href="#">B1766</a>	New York (Hudson) US	Antwerp Belgium	STM 1	offer	\$ 190,000 (per month)
<a href="#">B1587</a>	New York US	Rio de Janeiro Brazil	E1	offer	\$ 45,000 (per month)
<a href="#">B1833</a>	Miami US	Rio Brazil	DS3	offer	\$ \$525,000 (per month)

<a href="#">B1777</a>	London (Telehouse) UK	New York (Hudson) US	STM 1	offer	\$ 90,000 (per month)
<a href="#">B1423</a>	Johannesburg South Africa	Washington DC US	E1 (2048k)	offer	\$ 38000 (per month)
<a href="#">B1835</a>	Many, U.S. US	Many, U.S. US	OC3	offer	\$ 500,000 (per month)
<a href="#">B1660</a>	Aberdeen UK	Houston US	T1	bid	\$ 8,000 (per month)
<a href="#">B1659</a>	London UK	Houston US	T1	bid	\$ 7,500 (per month)
<a href="#">B1719</a>	Frankfurt Germany	New York US	155mbps	offer	\$ 3,200,000 (1RU)
<a href="#">B1430</a>	London UK	New York US	45mbps	offer	\$ 48,000 (per month)
<a href="#">B1588</a>	Frankfurt Germany	New York US	STM1	offer	\$ 163,000 (per month)
<a href="#">B1739</a>	Los Angeles US	Hawaii US	T1	offer	\$ 8900 (per month)
<a href="#">B1250</a>	Dublin Ireland	New York US	2Mbit/s	offer	£ 140,000 (per year)
<a href="#">B1248</a>	Dublin Ireland	New York US	2Mbit/s	offer	£ 250,000 (1RU)
<a href="#">B1247</a>	Dublin Ireland	New York US	45Mbit/s	offer	£ 3,520,000 (1RU)
<a href="#">B1618</a>	London UK	New York US	STM-1	offer	\$ 80,000 (per month)

Source: Band-X Ltd. Reproduced with permission.

Exhibit 6 Price Trends on Major Minutes Indices



Source: Bloomberg.

**Exhibit 7** 1999 Selected Average U.S. Outbound Minutes (Selling) Offer Prices listed on AGCN (\$U.S. per minute)

From the U.S. to:	Prices for the Week of:				
	3/7/99	4/4/99	4/9/99	4/11/99	4/18/99
China				0.252	
Egypt		0.385	0.370		0.375
Brazil				0.162	
Chile		0.140		0.142	0.140
Hong Kong		0.038	0.042	0.054	
Vietnam					
Afghanistan	0.729	0.380			
Mexico				0.163	
Philippines				0.310	
Sri Lanka				0.525	
Taiwan				0.080	

Source: Arbinet Communications, Inc.

Note: Buyer bids are automatically connected when sellers' prices are matched. Consequently, these are effectively closing prices. Blank data indicate time periods without sell offers on the exchange. Not all destinations available on the exchange are listed.

## Exhibit 8 Jumping off the Bandwidth Wagon

AS SEEN IN

**The New York Times**

SUNDAY, JULY 11, 1999

**Jumping Off the Bandwidth Wagon**  
**Long-Distance Carriers Regroup**

By SETH SCHIESEL

**I**N a dingy warren of cables and wires on Manhattan's Upper East Side, phone calls are starting to look a lot like pork bellies.

There, in his cramped office above the Pulse Night Club, Alex Mashinsky, 33, has created an electronic trading floor for telephone service that resembles nothing so much as the international market for traditional commodities.

Commodities carriers from around the world, including giants like AT&T and Nippon Telegraph and Telephone, link to the Web site for Mr. Mashinsky's company, Arbinet Communications, to trade unused long-distance telephone minutes from New York to every corner of the globe. On Friday, a minute to Israel sold for as little as 8.4 cents, a minute to Hong Kong for as little as 4.6 cents.

Although it is tempting to hold up Arbinet as a creator of a new communications landscape, in fact it is only a stark symptom of a much larger shift in the electronic world: While consumers



and regulators focus on the communications bottleneck in the so-called last mile of wire to homes and businesses, long-distance communications capacity — or "bandwidth," a hot buzzword of the Information Moment — is fast becoming a commodity.

Deregulation, rapid advances in optical technology and generous capital markets have combined to create an explosion in communications supply — a supply that exceeds even the surging demands in communications unleashed by the Internet. Accordingly, long-distance prices are fall-



Norman Y. Lono for The New York Times

Alex Mashinsky amid the wires and equipment of Arbinet, his Manhattan exchange that deals in long-distance telephone minutes from New York. His business has boomed as the capacity for such calls has become a commodity, a result of deregulation and advances in technology.

ing sharply. On Friday, AT&T sold its biggest business customers a minute of telephone time to Israel for 35.4 cents, less than a third of the cost three years ago, and a minute to Hong Kong for 27.2 cents, down 57 percent. The big gap between the retail marketplace and spot markets like Arbinet's cannot last for long.

More significantly, for the companies and investors alike, margins in some parts of the communications business are following suit, as long-distance bandwidth for both telephone and data services turns from scarce to plentiful.

The shift is driving many of the strategy reversals and multibillion-dollar deals that have become almost commonplace in the industry. It explains AT&T's burst into the cable television business and the continuing, soap-opera-like bidding war between Qwest Communications International and Global Crossing for the Frontier Corporation and U S West.

At the same time, the fierce competition in the long-distance arena only highlights its relative absence in local markets. That, in turn, rein-

forces the almost overarching value of local communications networks — and is prompting some investors to rethink their portfolios for the digital future.

Mr. Mashinsky of Arbinet, the communications exchange in Manhattan, watches the new world of long-distance evolve every day on his computer screen. To him, the shift is clear. The future is not in electronic pork bellies; it is in the fiber optic equivalent of processed meats.

"Over the last three years, \$402 billion was invested in telecom worldwide, and a lot of that went into infrastructure," he said. But many companies "have not been able to fill up their networks, because there are too many people building networks.

"So a lot of these guys are refocusing," Mr. Mashinsky added, "and saying that if we want to retain our margins, we have to get a hold of some customers and add some value."

**Exhibit 9** Information on the Venture Capital Group

*Bedrock Capital Partners* was a well-regarded early-stage venture capital partnership founded in 1998 with \$130 million under management. It had offices in San Francisco, Menlo Park, and Boston. Its partners had established a reputation of successful investing in the health care and information technology fields, and typically led investments of \$2-\$7 million in size. It was affiliated with Volpe, Brown, Whelan, and Co. (VBW & Co), an investment bank that specialized in services for Silicon Valley and Bay area startups. Between 1992 and 1999, VBW managed more than 220 public offerings with an aggregate value of more than \$12 billion. During the same period, VBW provided financial advisory and M&A services to over 70 companies with an aggregate transaction value of more than \$8 billion. Volpe Brown Whelan and its partners also raised over \$500 million of private equity for early and late-stage private companies. VBW & Co. had been founded by Thomas S. Volpe (HBS '76). Prior to 1986, Tom Volpe had been President and CEO of Hambrecht and Quist, the leading underwriter and investment bank for information technology, health care, and other high growth businesses.

*Communications Ventures*, founded in 1997 by a seasoned group of investment bankers and venture capital investors, was a well-regarded, early-stage venture capital partnership based in Palo Alto. Its partners, working in various capacities for a variety of banks and funds, had invested in and advised a series of high profile communications companies since the 1970's, including Tellabs, MCI, America Online, Ascend, and Ciena. The firm's portfolio was dominated by investments in telecom equipment and service providers, and was known for taking a hands-on role in the management of its portfolio companies. One of the firm's founding partners, Cliff Higgeson, had just been profiled in the *San Jose Mercury News* as the venture capital investor who, according to VentureOne, had created the largest amount of private equity value—\$3.2 billion—in the industry. "When I first started doing communications companies," Higgeson had told the *News*, "no one cared about it. In 1974, I was a man from Mars."<sup>a</sup>

The *Internet Capital Group (ICG)* invested in business-to-business (B2B) exchanges. In mid-1999, it had 19 investment professionals and \$169 million invested in 29 companies. It had been funded in part by GE Capital, Compaq, Comcast, and Safeguard Scientifics, its former parent. Safeguard currently owned 14% of ICG, and Comcast owned 9.4%. ICG had formed numerous subsidiary investment companies and joint ventures to manage investments in specialized industries. Founded in 1996, ICG was not an investment partnership like almost all other venture firms. Instead, it was a corporation that currently intended to go public, and had scheduled its IPO for August 1999.

The company had demonstrated an ability to take investments liquid. It invested in VerticalNet, an online portal to industry-specific vertical exchanges, and took the company public in early 1999. The public offering raised \$50.8 million for VerticalNet, and the share price popped from \$16 to \$42.38 on the first day of trading, February 10, 1999. Earlier, in May 1998, ICG had sold MatchLogic, a website that offered an online ad management system, to Excite, for \$89 million in Excite stock. In the same month, it sold WiseWire, a company that created tools for publishing online directories, to Lycos for \$40 million in Lycos stock. By early 1999, ICG had announced that it would soon take portfolio company Breakaway Solutions public.

ICG's philosophy was to form a collaborative network of portfolio companies in major vertical segments of the economy. ICG promised to hold its investments for the long-term and actively use the resources in the firm's reach to develop the business models of startups. To help link the firms together, it had formed an advisory board of industry luminaries such as Geoffrey Moore, author of popular business monographs such as *Crossing the Chasm* and *Inside the Tornado*, and Esther Dyson, chairman of EDventure Holdings, chairman of ICANN (Internet Corporation of Assigned Names and Numbers), and respected author of the Internet newsletter *Release 1.0*. ICG planned to continue adding portfolio companies, however, raising questions about the availability of partners' time and the quality of oversight.

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<sup>a</sup>Chris Nolan, "Firm ventures a guess who's a winner at picking winners," *San Jose Mercury News*, February 12, 1998.

Exhibit 10 Arbinet *Pro Forma* Financial Statements and Cash Flow Projections

<b>Income Statement</b>		<b>1999</b>		<b>2000</b>		<b>2001</b>		<b>2002</b>
<b>Revenues</b>	\$	612,000	\$	75,276,000	\$	376,380,000	\$	677,484,000
<i>Cost of Minutes</i>	\$	2,754,000	\$	72,641,340	\$	353,797,200	\$	623,285,280
<i>Gross Margin</i>	\$	(2,142,000)	\$	2,634,660	\$	22,582,800	\$	54,198,720
<i>Indirect Costs</i>	\$	15,658,000	\$	23,487,000	\$	31,707,450	\$	34,878,195
<i>Depreciation and Amortization</i>	\$	19,920	\$	1,881,900	\$	2,258,280	\$	2,371,194
<i>Tax</i>	\$	-	\$	-	\$	-	\$	5,932,266
<b>Net Income</b>	\$	<b>(17,819,920)</b>	\$	<b>(22,734,240)</b>	\$	<b>(11,382,930)</b>	\$	<b>11,017,065</b>
<b>Balance Sheet</b>		<b>1999</b>		<b>2000</b>		<b>2001</b>		<b>2002</b>
<i>Cash</i>	\$	1,302,745	\$	-	\$	-	\$	-
<i>Accounts Receivable</i>	\$	33,534	\$	4,124,712	\$	20,623,562	\$	37,122,411
<i>Other Current Assets</i>	\$	130,275	\$	217,090	\$	1,085,451	\$	1,953,811
<i>Current Assets</i>	\$	1,466,554	\$	4,341,802	\$	21,709,012	\$	39,076,222
<i>Fixed Assets</i>	\$	214,200	\$	18,819,000	\$	22,582,800	\$	23,711,940
<i>Less Cumulative Depreciation</i>	\$	19,920	\$	1,901,820	\$	4,160,100	\$	6,531,294
<i>Net Fixed Assets</i>	\$	194,280	\$	16,917,180	\$	18,422,700	\$	17,180,646
<b>Total Assets</b>	\$	<b>1,660,834</b>	\$	<b>21,258,982</b>	\$	<b>40,131,712</b>	\$	<b>56,256,868</b>
<i>Accounts Payable</i>	\$	150,904	\$	3,980,347	\$	19,386,148	\$	34,152,618
<i>Other Current Liabilities</i>	\$	130,275	\$	398,035	\$	1,938,615	\$	3,415,262
<i>Note payable</i>	\$	1,000,000	\$	-	\$	-	\$	-
<b>Total Liabilities</b>	\$	<b>1,281,179</b>	\$	<b>4,378,382</b>	\$	<b>21,324,763</b>	\$	<b>37,567,880</b>
<i>Paid-in Capital</i>								
<i>Financing Need (plug)</i>	\$	18,199,575	\$	57,434,760	\$	70,744,040	\$	59,609,013
<i>Retained Earnings</i>	\$	(17,819,920)	\$	(40,554,160)	\$	(51,937,090)	\$	(40,920,025)
<b>Stockholders Equity</b>	\$	<b>379,655</b>	\$	<b>16,880,600</b>	\$	<b>18,806,950</b>	\$	<b>18,688,988</b>
<b>Total Liabilities and Equity</b>	\$	<b>1,660,834</b>	\$	<b>21,258,982</b>	\$	<b>40,131,712</b>	\$	<b>56,256,868</b>
<b>Cash Flow Statement</b>		<b>1999</b>		<b>2000</b>		<b>2001</b>		<b>2002</b>
<i>Net Income</i>	\$	(17,819,920)	\$	(22,734,240)	\$	(11,382,930)	\$	11,017,065
<i>Depreciation and Amortization</i>	\$	19,920	\$	1,881,900	\$	2,258,280	\$	2,371,194
<i>(Increase) Decrease in Accounts Receivable</i>	\$	(23,434)	\$	(4,091,178)	\$	(16,498,849)	\$	(16,498,849)
<i>(Increase) Decrease in Other Current Assets</i>	\$	(73,288)	\$	(86,816)	\$	(868,360)	\$	(868,360)
<i>Increase (Decrease) in Accounts Payable</i>	\$	95,972	\$	3,829,443	\$	15,405,801	\$	14,766,470
<i>Increase (Decrease) in Other Liabilities</i>	\$	117,930	\$	267,760	\$	1,540,580	\$	1,476,647
<b>Net Cash used in operating activities</b>	\$	<b>(17,682,820)</b>	\$	<b>(20,933,130)</b>	\$	<b>(9,545,479)</b>	\$	<b>12,264,166</b>
<b>Cash Flow from Investing Activities</b>	\$	<b>(199,200)</b>	\$	<b>(18,604,800)</b>	\$	<b>(3,763,800)</b>	\$	<b>(1,129,140)</b>
<b>Cash Flow from Financing Activities</b>	\$	<b>18,199,575</b>	\$	<b>38,235,185</b>	\$	<b>13,309,279</b>	\$	<b>(11,135,026)</b>
<b>Monthly Cash Balance Data</b>		<b>Jan-99</b>		<b>Feb-99</b>		<b>Mar-99</b>		
<b>Net Increase (Decrease) in Cash</b>	\$	(237,998)	\$	(179,569)	\$	(209,623)		
<b>Cash, beginning of period</b>	\$	1,205,401	\$	967,403	\$	787,834		
<b>Cash, end of period</b>	\$	967,403	\$	787,834	\$	578,212		

Source: Arbinet Communications, Inc.

**Note:** *Pro forma* financials are for discussion purposes only and in no way resemble Arbinet Communications, Inc.'s actual business plan.

## Exhibit 11 VentureOne Comparables

### Chemdex (<http://www.chemdex.com>)

#### COMPANY OVERVIEW:

Business Description	Provider of Web-based sales for various science research fields. The company's system provides a search engine and fully transactional electronic commerce interface. The company compiles product listings of life-sciences products. Industries of focus include the pharmaceutical, agriculture, biology and chemistry research markets.
Founded	09/97
Employees	87

#### INVESTORS:

	Participating Round #(s), * = Lead Investor
CMGI @ Ventures	1, 2, 3
Bay City Capital	1*, 2, 3
Kleiner Perkins Caufield & Byers	2, 3
Warburg Pincus Ventures	2, 3
K&E Management	2
Galen Partners	3*
Genentech	3
Goldman Sachs Group	3
Invesco Private Capital	3
Amerindo Investment Advisors	3
Bowman Capital Management	3
Johnson & Johnson/H&Q Health.net	3
Comdisco Ventures	n/a
Angel Investors, LP	n/a

#### FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	09/97	2.0		4.0	Shipping Product
2	2 <sup>nd</sup>	05/98	13.0		23.0	Shipping Product
3	3 <sup>rd</sup>	03/99	30.29		123.0	Shipping Product
4	VL	03/99	0.1		122.0	Shipping Product

### Internet Telephony Exchange Carrier (ITXC, <http://www.itxc.com>)

#### COMPANY OVERVIEW:

Business Description	Provider of high quality Internet-based voice-enabled services. The network and proprietary software can route high quality voice communications over the Internet and other data networks more cheaply than over traditional phone networks; calls are completed on affiliated carriers' networks. The company has affiliates, including Bell Atlantic, China Telecom, and Korea Telecom, in some 75 cities worldwide.
Founded	07/97
Employees	93

#### INVESTORS:

	Participating Round #(s), * = Lead Investor
AT&T	1
VocalTec	1, 2, 3
Intel Corporation	2
Chase Capital Partners	2*
Flatiron Partners, LLC	2, 3
Spectrum Equity Investors	2, 3*
Polaris Venture Partners	2, 3

#### FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	Corp	10/97	0.5		n/a	Shipping Product
2	1 <sup>st</sup>	05/98	10.0		17.5	Shipping Product
3	2 <sup>nd</sup>	02/99	15.0		63.0	Shipping Product

## Exhibit 11 (continued)

Colo.com (<http://www.colo.com>)

## COMPANY OVERVIEW:

## Business Description

Provider of neutral central offices for the deployment of next generation networks. The company offers space and technical services in these facilities to ISPs, CLECs, ILECs, IXCs, ASPs, and other network service providers. The company facilitates the efficient and rapid deployment of next generation networks by providing a flexible footprint of high quality, NCOs through a variety of markets; flexible access to multiple carriers; facilities that serve as commerce centers for customers to buy, sell, and exchange services; Internet and telco trained staff; and a cost-effective alternative to traditional facilities based network deployment strategies.

Founded

04/97

Employees

140

## INVESTORS:

Participating Round #(s), \* = Lead Investor

Individual investors	1
Athena Technology Ventures	1, 2
Menlo Ventures	2
Accel Partners	2
Highland Capital Partners	2

## FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	06/98	2.0		N/a	Product in beta test
2	2 <sup>nd</sup>	04/99	12.25		22.0	Product in beta test

GRIC Communications (<http://www.gric.com>)

## COMPANY OVERVIEW:

## Business Description

Developer of Internet-based communications and settlement solutions for industry-leading Internet service providers. The company established a TCP/IP network-based alliance of Internet service providers (ISPs) and telecommunications companies (telcos). GRIC provides an infrastructure and clearinghouse for the delivery of cost-effective Internet telecommunications services worldwide, including: Internet roaming, fax, telephony and remote corporate access solutions.

Founded

02/94

Employees

151

## INVESTORS:

Participating Round #(s), \* = Lead Investor

Not available.

## FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	12/97	0.68		2.0	Shipping Product
2	2 <sup>nd</sup>	01/98	3.235		8.0	Shipping Product
3	3 <sup>rd</sup>	01/98	7.0		23.0	Shipping Product

**Exhibit 11 (continued)****iBasis (<http://www.ibasis.net>)**

## COMPANY OVERVIEW:

Business Description Provider of international wholesale telecommunication services to carriers and telephony resellers. The company is an Internet Protocol (IP) telephony network at PSTN-level quality. The network itself has gateway and switching facilities in New York, Los Angeles, an operations center in Burlington, as well as points of presence (POPs) in Hong Kong, Israel, Japan, Korea, Singapore, and Taiwan.

Founded 08/96

Employees 96

## INVESTORS:

Participating Round #(s), \* = Lead Investor

Individual Investors	1, 2
Seruus Ventures	1*, 2
Charles River Ventures	2
Bain Capital	2
Menlo Ventures	2*

## FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	11/97	3.8		9.8	Product Development
2	2 <sup>nd</sup>	09/98	10.5		26.2	Shipping Product

**Commerx (<http://www.commerx.com>)**

## COMPANY OVERVIEW:

Business Description Provider of business-to-business e-marketplaces that enable buyers and sellers in industrial processing markets to transact business on the Internet. The company targets industrial processing markets characterized by large numbers of buyers and sellers, high levels of fragmentation, inefficient supply chains and large transaction volume. The company currently offers for sale on our procurement center over 30,000 plastics products, or SKU's, from approximately 50 suppliers.

Founded 07/95

Employees 100

## INVESTORS:

Participating Round #(s), \* = Lead Investor

Internet Capital Group	1*
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## FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	12/98	9.0		17.0	Shipping Product

## Exhibit 11 (continued)

VerticalNet (<http://www.verticalnet.com>)

## COMPANY OVERVIEW:

Business Description Creator of online business-to-business industrial communities. The company operates 20 vertical channels including Chemical Online, Food Online, Pharmaceutical Online, Hydrocarbon Online, and Semiconductor Online. The Web sites provide daily news updates, in-depth technical articles, product directories, and discussion forums for industry professionals.

Founded 07/95  
Employees 187

INVESTORS:	Participating Round #(s), * = Lead Investor
Internet Capital Group	1*, 2*, 4*
Koch Ventures	4
Wheatley Partners	4
EnerTech Capital Partners	4
Lambros LP	
Lehman Brothers Venture Partners	

## FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	09/96	1.0		2.3	Product Development
2	2 <sup>nd</sup>	07/97	2.0		6.5	Shipping Product
3	3 <sup>rd</sup>	10/97	0.2		10.0	Shipping Product
4	Mezz	05/98	16.0		50.0	Shipping Product
5	IPO	02/99	56.0		300.0	Shipping Product

LinkShare (<http://www.linkshare.com>)

## COMPANY OVERVIEW:

Business Description Provider of networks that enable businesses to form and manage online partnerships with thousands of independent Web sites for a variety of purposes. The company enables online merchants to establish performance-based relationships with thousands of Web site publishers who seek to convert visitor traffic into revenues by becoming marketing "affiliates" of those merchants. By providing a quick and easy way to establish hyperlink promotions for merchant members of the company's network, the company enables an affiliate Web site publisher to drive traffic from its site to the merchants' Web sites. If a visitor accesses a merchant's Web site through that hyperlink and takes a prescribed action, such as buying a product, the affiliate earns a fee payable by that merchant.

Founded 07/97  
Employees 139

INVESTORS:	Participating Round #(s), * = Lead Investor
Internet Capital Group	1

## FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	07/98	4.0		9.0	Shipping Product

**Exhibit 11 (continued)****Syncra Systems (<http://www.syncrasystems.com>)**

## COMPANY OVERVIEW:

Business Description Developer of software applications for collaborative business practices and cross-business, value-chain management solutions. The company's applications help retailers, manufacturers, and other trading partners interactively collaborate on forecasting and planning. The SyncraCt product is designed to be software-vendor neutral. Its main function is to support many-to-many supplier-customer relationships while being independent of the planning systems developed by its users. This application is based on the Voluntary Inter-industry Commerce Standards Organization's (VICS) draft specifications of collaborative planning, forecasting, and replenishment (CPFR) standards. .

Founded 04/98  
Employees 54

INVESTORS:	Participating Round #(s), * = Lead Investor
Internet Capital Group	1, 2
TL Ventures	1, 2
Prism Venture Partners	2
Pequot Venture Partners	2
Cambridge Technology Capital Fund I, L.P.	2
BancBoston Ventures	2
Zero Stage Capital	2*

## FINANCINGS TO DATE:

Round #	Type	Date	Amount (\$MM)	Raised	Post \$ Valuation (\$MM)	Company Stage
1	1 <sup>st</sup>	05/98	6.0		N/a	Product Development
2	2 <sup>nd</sup>	03/99	14.0		31.3	Shipping Product

Source: VentureOne's VentureSource database, (<http://www.venturesource.com>), accessed June 12, 2000.