OPPORTUNITY RECOGNITION - PROJECT II:

Prof. Andrew Isaacs

OPPORTUNITIES FOR AGILENT IN IP TRANSIT MARKET

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BIBI EPHRAIM
AARON MAHIMAINATHAN
KAREN MARTELL
ADRIAN MOLDOVAN
LUCA SCHENATO
BRUNO SINOPOLI
HAKIM WEATHERSPOON
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INTRODUCTION

While traditional voice telecommunications traffic continues to progress at an annual growth rate of roughly 7 percent, demand to send data and voice calls that are broken down into data bits over clear-channel fiber-optic networks is said to be doubling every 72 days. Moreover, newer applications such as video-on-demand will only increase the demand for bandwidth. Accordingly, revenues from internet access are projected to grow at rate of 12% (Refer Figure 1). Such burgeoning internet traffic will require a robust infrastructure for support. The current internet infrastructure allows traffic to travel through networks that are owned by various telecommunication companies.

![Figure 1: Internet Access projections](image)


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1 Source: Derivatives Strategy – Aug 2000
These telecommunication companies can be divided into three tiers – Tier 1, Tier 2 and Tier 3 - based on the size and the reach of the networks they provide. Tier 1 companies are international players who own networks across country borders and are global players such as UUNet, Sprint, Cable & Wireless. Tier 2 companies are national players who have sizable share of the domestic markets, while Tier 3 companies are regional players who have strong presence in particular geographic regions. Although there is a clear distinction between Tier 1’s and Tier 2’s, the line between Tier 2’s and Tier 3’s is quite blurry. For example, some of the regional Bells are both Tier 2/3. For convenience, we will refer to Tier 1, 2 and 3 as T1, T2 and T3, respectively.

Figure 2 shows a breakdown of various T1 companies and the corresponding number of customer networks they own.

**Figure 2: Backbone market share # of customer networks**

Peering and Transit

Traffic through the Internet is predominately carried out by two arrangements – Peering and Transit. Peering is loosely defined as process of exchanging traffic from one network to another over a connection that is provided with no monetary exchange between the carriers. Most of the traffic between the T1 companies is handled through these peering arrangements.

Transit could be defined as the exchange of traffic from one carrier to another with one party paying another for its services. This is typically the arrangement that an Internet Service Provider (ISP) would have with the T2’s and T3’s. The following schematic explains the how transit works.

![Figure 3: How IP Transit Works.](image)

The end-users (customers) pay the ISP’s (e.g. Prodigy, net-zero, etc.) for their Internet access. The ISP’s in turn connect to the T1 and T2’s points of presence (PoP) in the net and through their network to the entire Internet. The ISP’s pay transit to again access to the Tier 1 and Tier 2’s networks.
In the course of this analysis, it is important for us to note the distinction between transit and bandwidth. Bandwidth refers to the physical capacity of a link between two nodes. Buying bandwidth means exactly reserving a certain capacity over a link. Buying transit of 100Mbps means reserving a 100Mbps pipe to the T1 PoP. From there on data can reach every point served by that network including peering partners. The relationship between these key traffic intermediaries is illustrated in the Figure 4:

![Figure 4: Transit vs. Bandwidth](image)

**MARKET ANALYSIS**

The Internet transit market is presently $4.9 Billion and is estimated to reach $15.7 Billion in the year 2005. The CAGR is forecasted at 26%\(^2\).

A few huge players presently dominate market share in IP transit market. The following figure shows the market share breakdown.

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Since the players in the IP Transit market are very few, the pricing margins are steep. The ISP’s have no choice than to adhere to the terms and conditions of the sellers. The contract negotiations and provisioning time involved in this transaction is fairly long. The negotiations are often a long process since there are no standardized contracts that can be drawn. The provisioning - the hardware and software setup, which culminates in the connections of the ISP to the Internet, is also carried out in a rather lethargic pace. While sales and general administration expenses are estimated in most American industries to equal just 16 percent of revenues, the figure runs closer to 25 percent in the telecommunications industry\textsuperscript{3}. Typically the contract negotiation and the provisioning phase could take up to 6 months. The contracts are also drawn for longer terms (minimum of 6 months) and priced for peak capacity even though the ISP’s hit peak less than 10% of time.

\textbf{Figure 5: IP Transit Market Share for 2000}  
CAN A SPOT MARKET FOR IP TRANSIT BE CREATED?

Where is the Pain?:
Today’s market structure has proven to be inefficient to adapt to the growing demand for new and faster Internet services. Today’s internet market is far more dynamic than it was a few years ago; in order to keep up with the pace of the new economy, new companies need more agile services, including faster setup, variable capacity, shorter contracts. As a consequence of this transformation, the way transactions are conducted is clearly inefficient to fit the new market landscape.

Contracts: The length of each contract ranges from a minimum of nine months to about two years. This jeopardizes the vitality of the market. T2/3 tend to be conservative in purchasing transit, to limit risks. Capacity cannot be modified to accommodate fluctuations in customer demand. Contracts are negotiated individually with each T1 provider. Once an agreement is reached, a physical connection must be established between the buyer and the T1 Point of Presence (PoP). The average provisioning time can be as long as six or seven months. This procedure is very costly not only for buyers, but also for T1 who have to cope with high SG&A costs.

Pricing: Pricing model is volume based. Usually buyers are billed according to the peak traffic (sometimes 95% of the peak). This pricing strategy limits not only small ISPs, who cannot offer competitive services, but also the bigger ones, who cannot easily modify the quantity of capacity.

3 Source: Derivatives and Strategy, August 2000
**Service Level Agreement (SLA):** as part of the contract, SLA guarantees basic connectivity, but doesn’t usually give any QoS assurance. This essentially precludes enhanced services via Internet, such as Voice over IP (VoIP) or internet broadcasting, limiting the possibility of generating new revenue streams.

**Why a Spot Market?**

A spot market refers to the exchange of immediately or promptly available quantities of the good for immediate payment\(^4\). As such, the spot market is a dream for every buyer. Buyers enjoy several benefits including the ability to: instantly buy transit access at the market price, choose between different providers, select according to network quality and geographical presence, decide varying contract length (possibly just a few days) and to be able to vary purchase capacity according to fluctuations in demand. Moreover standard contracts and SLAs will remove the need for negotiation and this too makes a spot market attractive to customers.

**Why not?** Sellers are not motivated to switch to a spot market because they are benefiting from the current situation, in which they hold all the power in the market. For example, suppliers can lock their customers in long contracts and therefore control prices to increase their margins. They also have minimal competition. A spot market would probably shift the power in the hands of buyers. As a consequence sellers won’t be able to set prices, and this could cannibalize their profits. On the other hand, a spot market would certainly increase market size, making IP transit more easily available to a wider

\(^4\) (source: Encyclopedia Britannica)
number of potential customers. However, it is not clear at this time if such an increase in demand and volume would offset the unavoidable price drop. Therefore, reluctance among T1 providers to adhere to a spot market constitutes the biggest threat to its development.

*Our Vision:* we believe that spot market will ultimately play a central role in IP transit exchange. Clearly, there are compelling reasons for buyers, as we have already spelled out. T1 will come to a spot marketplace for the following reasons:

- Increasing competition is gradually reducing market share of big players. Albeit Uunet is still the biggest player by far with its 45% of market share, its share is decreasing steadily due to the appearance of smaller but fierce competitors, who are embracing the spot market as an excellent marketing opportunity.

- Our analysis of the major T1 companies shows that SG&A costs grow proportionally with revenues. A spot market would allow more efficient economies of scale, thereby dramatically reducing costs.

- Fast provisioning would allow immediate billing.

- The possibility of selling futures will allow a constant cash flow that could help amortize high infrastructure investments
**Spot Market Requirements:**
Here is a list of requirements for the existence of a spot market:\(^5\)

*Volume*: only a large number of both buyers and sellers can prevent price elevation.

*Neutrality*: A Trading organization involved as third party manager of the exchange cannot be a market player.

*Anonymity*: Sellers would be able to sell excess capacity at a lower price, thereby protecting their brand name, or buy transit from other T1 to extend their coverage. Buyers, on the other hand, could become sellers of overbought capacity.

*Speed*: Near real time trades will provide almost immediate access, thus promoting capacity trading in the spot market. Buyers will be able to quickly change providers.

*Wide coverage*: Extensive geographical presence will allow trading between many buyers and sellers from different regions.

*Network quality monitoring*: An impartial third party will measure important network parameters to assess the overall quality. We shall address this issue in the following paragraphs.

*Standardized contract*: These types of contracts, based on capacity, duration, geographical coverage, and network quality, will favor liquidity and increase competitiveness between sellers.

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Band X: a spot market for IP Transit

Band X\(^6\) represents the most successful attempt to date to develop a spot market for IP Transit. Backed by financial services giants such as Goldman Sachs and Morgan Stanley, and empowered by Cisco technology, Band X is establishing worldwide presence. Started in London, in the year 2000, Band X has quickly expanded in the US by opening an exchange point in New York and in Asia by opening an exchange point in Honk Kong. In addition to IP Transit, Band X manages trading floors for bandwidth exchange, Co-location and network exchange (see www.band-x.com for details).

The IP transit floor, called routed IP by Band X, has already attracted some players such as Sprint, Cable & Wireless, Qwest, Level 3.

Band X offers to customers who are connected to the exchange point the following services:

- An **online trading interface** where transit can be purchased from anonymous sellers. Buyers will be able to choose the provider that fits their need based on a quality index over different geographical regions. At present contract length is one month minimum. Once a transaction has taken place, Band X provides the physical connection between buyers and sellers, guaranteeing 99.9% connectivity at the exchange point. A back up connection protecting the buyer in case of network failure can be purchased.

\(^{6}\) www.band-x.com
- **Monitoring**: Band X has a proprietary algorithm to estimate network quality. At its core this algorithm measures packet loss, latency and throughput of sample packets at approximately two hundred nodes at 30 minutes intervals. This kind of monitoring is very rough and not entirely reflective of the status of the network.

- **Billing**: Band X collects payments from buyers and Band X pays the same amount to sellers less a commission. If both seller and buyer are at an exchange point the time between the transaction and the actual beginning of service is within a few days.

**Opportunities in the IP-Transit Market:**
After analyzing the IP Transit market we have identified the following opportunities within the layers of the IP-Transit market:

1. Provide measurement hardware and software
2. Rating Services
   a. Measure and publish metrics
      i. Daily
      ii. Historical records
3. Provide billing and accounting services
4. Develop an IP-transit market place

The above opportunities are particularly promising for players with the right set of core competencies and resources to leverage benefits from partnerships. Based on considerations of alignment with current Agilent’s business we believe that providing measurement hardware and software as well as grading services are the best opportunities
for Agilent to play a leading role in this space. In the following sections we will examine each of the opportunities individually with particular attention to those that are best fit for Agilent.

**OPPORTUNITIES FOR AGILENT**

Based on considerations of alignment with current Agilent’s business we felt that providing measurement hardware and software as well as rating services are best opportunities for Agilent to play a leading role in this space. In the following sections we will examine each of the opportunities individually.

**Measurement Services: Hardware and Software**

A key requirement for providing IP-Transit services is to be able to quantify the amount and level of service provided. Our research shows that IP-Transit service providers differentiate their services in one or more of the following dimensions

- Global connectivity (connection across international boundaries)
- Peering portfolio: a measure of geographic capillarity
- Maximum reliability
- Minimal packet loss
- Minimal delay (low latency)
- Low rates
• Flexible billing solutions (e.g. fixed or per use)

• Easy to upgrade (allow customer to increase or decrease capacity as they need it)

• No overbooking (a way to guarantee that promised level of capacity is available)

• 24 X 7 X 365 troubleshooting (around the clock monitoring and fixing connectivity problems)

However, there are no widely accepted standards of IP-Transit service quality matrix. The IP Performance Metrics (IPPM) working group in Internet Engineering Task Force (IETF)\(^7\) has suggested a minimum set of features that any measurement tool should provide:

• **Unbiased**: statistical estimation of parameters must be performed on real data packets rather than the probing packets used by `traceroute` and `ping` routines. Routers give a higher priority to processing normal data packets and so the performance indicated by these tools could be worse than what a customer may actually experience,

• **Real time**

• **Passive**: these tools should not interfere with Internet traffic. `Traceroute` or `ping` would flood the net if used too frequently.

• **Application-oriented**: Parameters assume different importance according to the application. For example latency must be weighted differently if a packet belongs

\(^7\) Source: [http://www.ietf.org/html.charters/ippm-charter.html](http://www.ietf.org/html.charters/ippm-charter.html)
to a VoIP application or it is simply an email. Any meaningful metric must be based on the specific application considered.

We feel that this is a very important first step towards capturing, quantifying, and standardizing IP-Transit quality measurements. We feel that Agilent could play a leading role in driving and shaping the standardization effort. Particularly, Agilent could advance its standing in the space by targeting measurement matrices that include the following dimensions ⁸:

- **Burst loss**: The loss of a series of packets due to network congestion. Contrarily to random loss this problem can seriously undermine the quality of applications such as VoIP.

- **Latency**: The transmission time delay of a packet between source and receiver. For time critical application an excessive latency is equivalent to packet loss.

- **Jitter**: The variation on transmission time delay due to queuing at the routers. Packets sent in sequence could arrive at the receiver in a different order. A high jitter makes packet reconstruction challenging.

- **Routing Stability**: The likelihood that a packet will follow the same path between two nodes. A stable routing policy reduces jitter.

To the extent that the above are value added, they could serve as matrices by which IP transit service providers and consumers assess the viability of a given service. These are critical dimensions because they measure factors that affect directly customer satisfaction.

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⁸ Source http://www.computertelephony.com/article/CTM20010202S0004
Given that Agilent’s core competency is in the test and measurement business, the IP-transit measurement space is a natural for Agilent. However, the challenge is that the barrier to entry in this area by Agilent’s competitors is relatively low. Companies such as Teradyne and Technotronics could conceivably enter this market just as easily as Agilent. For this reason, it is critical that Agilent moves in this space, develop a wider network of customers and capitalize on a first mover advantage.

**Rating Services:**
Currently there is no independent verification of the level and quality of service claimed by IP-Transit providers. Our survey of IP-Transit providers’ claimed level of service reveals a wide range of variations in the claims.

For example, AT&T claims to offer the following as part of its service level agreement⁹:

- **Latency:** less than 120 mls Trans-Atlantic; less than 80 mls in the U.S.
- **Network availability:** 99.9 percent
- **Packet loss:** less than one percent
- **24 x 7 technical service support, with NOC to NOC communications**

The bottom line is, most customers have no independent way of verifying these claims. In some cases customers are forced to sign up with two or more providers just as a backup.

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insurance in case of quality degradation or service interruption\textsuperscript{10}. Clearly customers would benefit from a service that rates the quality of IP-Transit service.

The ability to rate IP-Transit services is closely tied to the ability to obtain reliable measurements along matrices that are most important to customers. From this point of view, a rating service is dependent on the wide acceptance standards along the lines discussed above. Any provider of such services will need to have established credibility not only in being able to provide the services but also in the neutrality of its ratings.

We envision the function of a rating service provider would spearhead the standards that will define the type, source, level and method of gathering measurements that would be used in rating IP-Transit levels of services.

The purpose of such a rating agency would be to provide customers with the ability to:

1. Choose the quality of IP service they would like to purchase

2. Base their purchase of services on assessment metrics that matter the most to them and are gathered by a neutral body

For IP Transit providers the benefits are:

1. They will have certified level of service

2. Helps them provide consistent level of service

\textsuperscript{10} Source: Agilent Group Meeting 04/2001
3. Helps them provides levels of services differentiated by well defined quality or other preferred metrics

This space is a natural fit for Agilent for two major reasons:

1. Agilent is a leading provider of test and measurement hardware and software. It has core competences and ongoing research\textsuperscript{11} in IP measurements that it can easily adopt to the IP-Transit market space.

2. Partly due to its roots as a Hewlett-Packard subsidiary, Agilent has an established credibility in the test and measurement space that it can leverage in establishing itself as the premier provider of service and a quality grading services in IP-Transit.

\textbf{Develop Market Place and Billing Services:}
Both developing a market place and establishing billing services pose significant challenges for Agilent. The fact that in both spaces there are well entrenched players means that Agilent would not enjoy a first mover advantage. In fact, there is a very high probability that Agilent would face stiff completion in this space from established players such as Enron and Band-X. For example Enron has been successful in establishing market places leveraging core competencies it acquired in the energy industry. The other player, Band-X has established partnership IP-Transit market backed by such powerhouses as Goldman Sachs and Morgan Stanley. It has also attracted major players such as Sprint, C&W, Qwest, and Level 3.

\textsuperscript{11} Source: Communication and Phone conference with Agilent 04/2001
For Agilent to be effective in creating and developing an IP-transit market place and/or to provide billing services in IP-Transit, it would have to develop core competencies in finance services and business management spaces. This could mean playing catch-up with the entrenched players. We feel that expertise in test and measurement business is not directly transferable to the skill set required in creating a market place. Therefore, to be successful in this space, Agilent should either establish strategic partnership with established players or acquire players with the right core competences. Both strategies pose considerable challenges, however the latter could prove extremely challenging mostly due to difficulties arising from effort to integrate divergent company cultures.

**Summary of Opportunities**

Figure 6 shows a summary of opportunities & risks for Agilent:

![Figure 6: Summary of Opportunities.](image-url)
Business models for Agilent:

Our analysis has highlighted two viable business models for Agilent, shown in figure 7.

![Agilent Opportunity Landscapes](image)

**Figure 7: Suggested Business Models**

In this paragraph we attempt to provide a quantitative estimate of the aforementioned opportunities. Table 1 gives an estimate of the market potential behind the HW/SW Supplier model. Table 2 presents a forecast for Certification Agency opportunities. Those calculations are based on a series of assumptions reported in appendix.
## HW/SW Supplier model

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<td>0.26</td>
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<td>IP transit market (bn $)</td>
<td>4.90</td>
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<td>9.80</td>
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<td>20%</td>
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<td>Total IP transit market (bn)</td>
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<td>% growth in revenues/PoP</td>
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<td>-10%</td>
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<td>Hardware revenue</td>
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<td>3,936,600</td>
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<td>Upgrade rev/PoP (10%)</td>
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<td>1,458,000</td>
<td>1,676,700</td>
<td>1,902,690</td>
<td>2,184,813</td>
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<td>Maintenance rev/PoP (10%)</td>
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<td>Total revenues</td>
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<td>Total costs</td>
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<td>Gross Profit</td>
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<td>2,500,000</td>
<td>3,112,000</td>
<td>3,711,400</td>
<td>4,280,020</td>
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Table 1

## Certification Agency Model

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<td>26%</td>
<td>26%</td>
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<tr>
<td>Monitoring commission</td>
<td>0.30%</td>
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<td>0.30%</td>
<td>0.30%</td>
<td>0.30%</td>
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<tr>
<td>Agilent market share</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
<td>75%</td>
<td>80%</td>
<td>80%</td>
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<tr>
<td>Monitoring revenues (mil $)</td>
<td>8.82</td>
<td>13.34</td>
<td>19.60</td>
<td>26.46</td>
<td>35.57</td>
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<td>Total revenues</td>
<td>8,820,000</td>
<td>13,335,840</td>
<td>19,603,685</td>
<td>26,464,974</td>
<td>35,568,926</td>
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<td>Number of PoPs</td>
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<td>14</td>
<td>18</td>
<td>23</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td>Labor cost/PoP</td>
<td>120,000</td>
<td>126,000</td>
<td>132,300</td>
<td>138,915</td>
<td>145,861</td>
<td>153,154</td>
</tr>
<tr>
<td>Annual growth in cost of labor</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Total Labor cost</td>
<td>1,320,000</td>
<td>1,764,000</td>
<td>2,381,400</td>
<td>3,195,045</td>
<td>4,229,962</td>
<td>5,666,690</td>
</tr>
<tr>
<td>Other costs/PoP</td>
<td>100,000</td>
<td>105,000</td>
<td>110,250</td>
<td>115,763</td>
<td>121,551</td>
<td>127,628</td>
</tr>
<tr>
<td>Annual growth in other costs</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Total other costs</td>
<td>1,100,000</td>
<td>1,470,000</td>
<td>1,984,500</td>
<td>2,662,538</td>
<td>3,524,968</td>
<td>4,722,242</td>
</tr>
<tr>
<td>Overheads</td>
<td>1,100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Total costs</td>
<td>3,740,000</td>
<td>3,565,000</td>
<td>4,708,450</td>
<td>6,212,260</td>
<td>8,122,341</td>
<td>10,769,714</td>
</tr>
<tr>
<td>Gross Profit</td>
<td>5,080,000</td>
<td>9,770,840</td>
<td>14,895,235</td>
<td>20,252,714</td>
<td>27,446,584</td>
<td>34,047,133</td>
</tr>
</tbody>
</table>

Table 2
The second business model, where revenues come as a percentage of total number of transactions, looks more promising than the first one. However this scenario is based on the assumption that Agilent will establish itself as the de facto standard in monitoring and certifying internet networks quality.

**APPENDIX**

When studying the financial implications of Agilent’s decision to sell hard/soft to PoPs or do just IP transit monitoring, we had to make a set of assumptions. The main assumptions are listed below:

- IP transit market growth 26.2% CAGR, following the forecasts predicted by IDC\(^2\).
- Additional growth due to commoditization: we assume the growth will be 20% higher. The possibility to stipulate short term contracts in a short time will create a new market that currently does not exist. Think, for example, to one time events like the Olympic Games, the America’s Cup, the Academy Awards, etc. Our estimate is conservative and not sustained by any specific research data.
- One PoP will be built for every $0.5bn transactions. We believe that by 2006 all major metropolitan areas will have an exchange point. We predict 37 exchange points in the US by 2006.
- $1m in revenue from selling HW/SW to PoPs –yr.1
- YoY growth in Revenue/PoP: -10%
- Hardware gross margin: 40%
- Overhead: $1.1m in Yr.1 and $0.1m thereafter: Software development is a one time cost. Only additional upgrades are necessary thereafter.
➢ Sales and Marketing expenses: $2m in year 1 and $1m thereafter

➢ Monitoring market share growing from 50% in Yr.1 to 80% in Yr. 6

➢ Transaction commission: 0.3%

In computing the labor costs for monitoring services we used the following data supplied by Agilent Technologies.

Labor requirements:

➢ 1 FTE System Administrator for 4 Exchanges

➢ 1 FTE Engineer for 8 Exchanges

➢ 1 Customer Service Rep for 4 Exchanges

➢ Labor Costs (loaded):
  o Sys Admin $175K/Yr
  o Engineer $250K/Yr
  o Service Rep $150K/yr