

# **The Business of VoIP**

Term Paper for

*15.912, Technology Strategy (Prof. Rebecca Henderson)*

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## **1. Introduction**

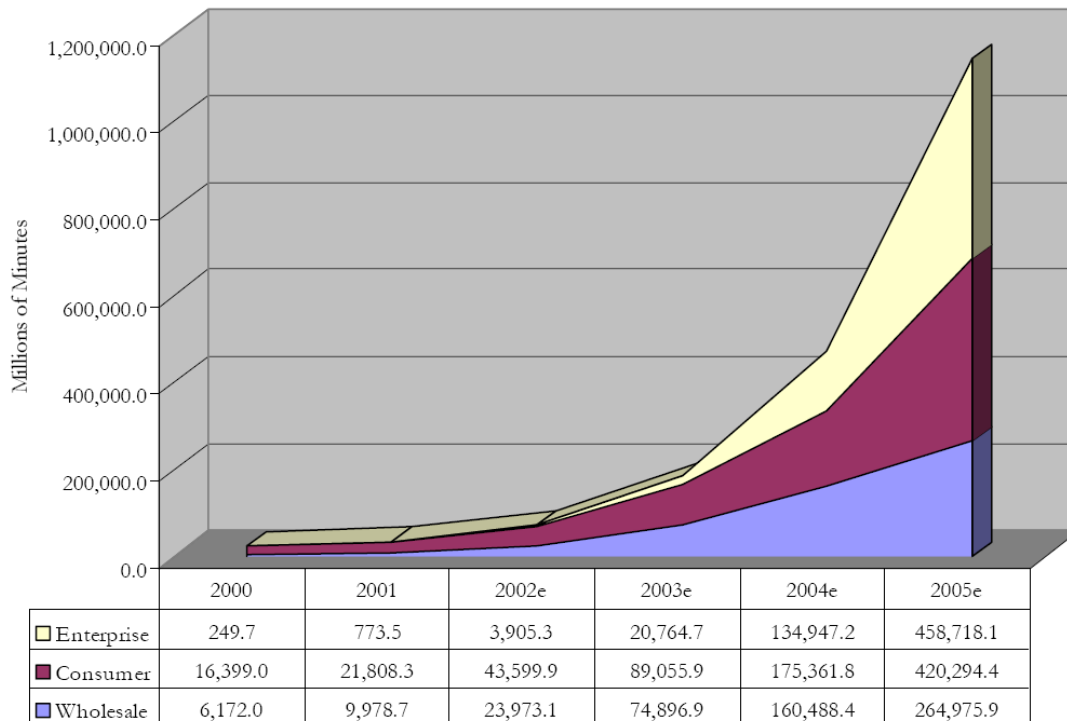
VoIP was first demonstrated in the early 1980s when BBN in Cambridge, MA set up a voice funnel over TCP/IP to communicate with its west coast researcher as part of its work with ARPA. But it was not until mid 1990s that the VoIP technology got people's attention when the internet took off and people started exploring its commercial feasibility.

The first commercial VoIP software was developed by a small Israel company Vocaltec in Mid 90s. But the quality of the earliest version of VoIP products was so poor because of low internet speed, limited DSP and microprocessor power, that it remained as just a toy for internet enthusiasts. The lack of complementary technologies hindered the development of the VoIP technology, and very limited value was created by VoIP alone.

But things changed in late 1990s. Equipment providers including heavy players such as Cisco, Alcatel, Avaya, Lucent as well as uprising startups Sonus Networks offered a variety of innovative VoIP product solutions that enabled service providers and business customers to offer high quality VoIP service. In 2004, all major telecom carriers including Sprint, Verizon, SBC, AT&T, MCI, BellSouth, etc started to launch VoIP services. Cable service providers such as Comcast and Time Warner also entered VoIP markets leveraging broadband technology and their access to residential homes with cable networks. Emerging VoIP service providers such as Skype signed up tens of millions of customers; Even Microsoft announced their support of VoIP in its Windows XP. The VoIP gold rush is on. To quote from the vice chairman of Verizon, who said,

“VoIP for mass market is coming and there is nothing anybody can do to stop it”. The following chart showed the projected worldwide VoIP volumes growth.

Worldwide VoIP Services Forecast (Minutes), 2000 – 2005



CAGRs for the forecast period

Enterprise 349.6%, Consumer 91.3%, Wholesale 112.1%

Source: Frost & Sullivan<sup>1</sup>

It is worth to ask the following questions: what forces have driven the evolution of VoIP business and in what way? With the adoption of VoIP technology, which industry created most of the value, which industry captured most of the value, and what industry lost most of the value? How have the standards of VoIP involved and what role did they play? How will the VoIP technology change the competitive landscape of the communication industry? In this paper, we will use several frameworks in technology strategy to explain

the evolution of the VoIP business, and if possible, predict the direction and trend of the VoIP business.

## **2. Creating value with VoIP: the evolution of the market**

### **2.1 S-curve**

The voice quality of VoIP products and services that appeared in early-90s was very poor—delays, jitter, echoes were common and packets were lost frequently. Also they were difficult to use: the early format of VoIP is limited to PC-to-PC, and traditional phones could not be connected to PCs using VoIP. At the ferment stage of VoIP technology, bandwidth was very limited, there was no industry standard, and the internet subscription rate was very low. Early service providers included diapad, net2phone which offered PC-2-PCfree service, and the early adopters of VoIP was limited to students and internet enthusiasts. The market was tiny, and little value was really created.

In late 1990s, the internet took off. Heavy investment was made to build network infrastructure and expand bandwidth in backbone networks, advance IP protocols such RSVP/MPLS was implemented to better manage bandwidth, broadband access based on DSL or Cable Modem drove up internet penetration, ITU and IETF developed VoIP standards, and more computing power and advanced DSP technology can more efficiently process voice data. With the advancement of complementary technologies and internet infrastructure, the quality of VoIP solution is massively improved. In addition, VoIP equipment vendors developed VoIP gateways and soft switches that bridged the IP network and the PSTN network, making it possible to use VoIP with PC-

2-Phone and Phone-2-phone. Both traditional telecom service providers and cable operators started offering VoIP services in late 2003. Businesses started to use VoIP and integrate with their data networks to complement the legacy PSTN/PBX services.

VoIP has just entered the rapid growth stage as evidenced by the accelerated adoption—in 2004 alone, more than 20 service providers launched VoIP services. We will see continued growth of the VoIP technology and strong competition among service providers in the next 10 to 15 years before maturity. Over this period, more functionalities will be built into VoIP solutions, such as multimedia conference, unified messaging, etc. VoIP will be more secure and will be seamlessly integrated with data services, and SIP protocol will become the dominant standard for VoIP. As a result, VoIP will be offered by several types of service providers, price will be further driven down, and VoIP will widely adopted. In the long run, both the VoIP service provider market and VoIP vendors market will consolidate with a few dominant players dividing the market, and the rest would be driven out of business.

## **2.2 Market Drivers**

So what are the forces driving VoIP adoption and why is it a disruptive technology to traditional circuit switched PSTN service?

VoIP is attractive because it offers a variety of advantages over PSTN and other operating benefits. For example, VoIP is based on packet switching rather than circuit switching, significantly reducing bandwidth usage and reducing cost. For consumers, it is much cheaper than traditional phone service. For business customers, it is costly to operate two separate networks: data networks and phone networks. Combining the two will reduce operating cost such as maintenance, upgrade, configuration, technical support. Most importantly, VoIP provides many advanced features that were not possible with PSTN, such as multimedia features, mobility, number portability, integration with emails, voice portal, and so on. These benefits over traditional PSTN services will drive the adoption of VoIP technology in the market place.

### **2.3 Crossing the chasm**

These market drivers played different roles at different stage of the VoIP adoption cycle. In the case of early adopters including cost conscious consumers and small businesses, *cost reduction* is the major concern. For students, making international phone call on the PC for free was an attractive option even though the quality is poor. For small businesses, bypass toll with basic phone service was valuable. Enterprise customers in established industries wouldn't consider using VoIP before it becomes at least as reliable and secure as PSTN.

But *business value* enabled by advanced functionalities is more important for early majority adopters such as established firms in mission critical industries. As the advancement of the VoIP technology caught up with the requirement of early majority adopters the adoption of VoIP will be accelerated. This is the phase we are seeing today, as evidenced by the higher voice quality and rich features that current VoIP service provides, by the fact that more than a dozen service providers launching VoIP service to business customers in 2004, and the 47% market growth rate of IP-PBX equipments designed specifically business customers. Clearly, we see the chasm is being crossed.

The following chart from Gartner showed the requirements of adopters at different stages.

### **3. Capturing Value with VoIP**

The local and long distance telephone services in the United States along are a \$100 billions business in the United States. Now the VoIP technology is turning this industry upside down with its highly disruptive nature. How will this potentially huge amount of value would be divided and captured by different players of the VoIP business?

In this section, we will examine the major players of the VoIP business and their positions in the competitive landscape and the value chain, as well as how their value-capturing positions will be changed with the accelerated adoption of VoIP technology.

### **3.1 The Equipment Vendors: Play by Technological Uniqueness**

The creator of the VoIP technology is the equipment manufactures including established telecom equipment powerhouses such as Cisco, Lucent, Nortel, Alcatel, Avaya as well as emerging pure player such as Sonus, which design and manufacture softswitches, media gateways and IP PBXes, which manage VoIP data and bridge IP networks with legacy telephone systems. They are the innovators and the owners of the technology. Their uniqueness lies in their super capability in developing extremely sophisticated VoIP products, with deep technical expertise and experienced engineers. Not many companies in the world that can design high quality carrier class VoIP switches and their uniqueness is easy to maintain.

However, technology alone is not enough to fully capture the value of VoIP.

Complementary assets such as network infrastructure such as local loop and cable networks, end customer ownership, network operation experience, brand awareness and sales channel, which are owned by service providers, are imperative to capture the value created by VoIP. So VoIP equipment providers have to work with service providers to share the pie, forming a two layers value chain. How much value equipment manufactures will capture out of the VoIP business? According to Deutsche Bank



research, the VoIP equipment market was \$1.5B in 2001, \$3B in 2003, and will grow to \$8B in 2007.

#### **The VoIP Equipment Market(\$MM)**

### **3.2 The Service Providers: Play the Strengths of Complementary Assets**

In comparison to VoIP equipment market, the overall VoIP service revenue was \$1.3B in 2004, and is projected to reach \$20B in 2009, according to Infonetics Research. How service providers capture and divide this pie?

Service providers rely on equipment manufacturers to provide the latest VoIP technology solution and leverage their complementary assets to capture value in the VoIP business.

In most cases, their complementary assets are tightly held and they are the closest to end customers. However there are several different types of service providers with different complementary assets, and the VoIP technology will dramatically change the market dynamics and shift entry barriers. To win the VoIP game, service providers will need to find a way to leverage their complementary assets to gain a competitive edge, and their new positions in the market will determine how much value they can capture.

a. **RBOCs**, including Verizon, SBC, BellSouth, own the local telephone network with access to homes and business buildings, providing local telephone service as well as DSL service. The traditional telephone service, which is cash cow for RBOCs, is cannibalized by the emerging VoIP service. According to IDC, the local phone service revenue (centrex) will drop from 4.3B to 2.7B by 2007. Though they own access to end customers and they can provide VoIP service through their installed customers base using DSL service, their higher cost structure on VoIP service due to unionized labor force make it very hard for them to compete with cable operators, which have a lower cost structure.

RBOCs are watching their lunches eaten by others and are positioned to lose big in the VoIP revolution.

b. **Cable Operators**, including Cox communications, Comcast, cablevision, etc. They own access to end customer's home through their cable TV network, have a lower cost structure to provide VoIP through broadband cable modems, and can provide bundled service including data, TV, and VoIP, to increase switching cost and lock customers in. VoIP enables cable operators to enter the voice market that was previously monopolized by RBOCs and turns cable operators to be the biggest winners.

c. **IXCs** (incumbent exchange carrier) such as AT&A, MCI and Sprint, owning large percentage of business customers, offer wholesale VoIP service to consumers as well as business VoIP service.

In summary, the VoIP service provider market will become more competitive as every service provider leverages its complementary assets differently trying to capture value.

### **3.3 Disruptive Pure Player—Skype: Network Effect and Reinforcing Loop**

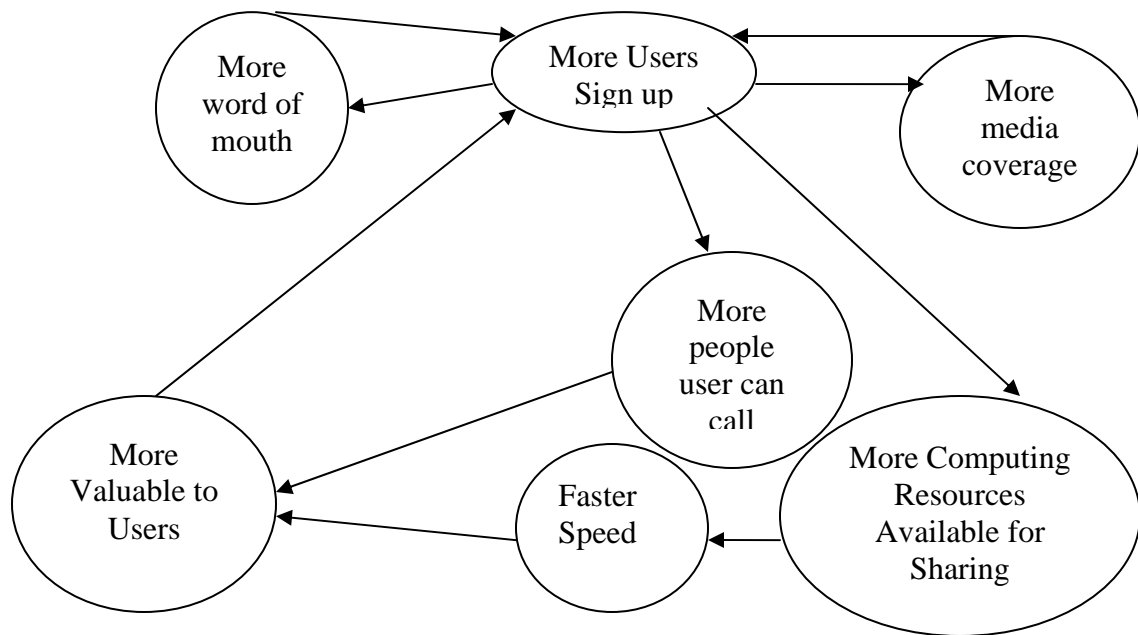
Skype is a free-downloadable software enabling users to have in-network voice communication based on peer to peer technology. The service is free and the revenue comes from value added service. The download rate is rapidly reaching 100 millions.

The Skype is purely disruptive in the sense that it is both a technology innovator and a service provider, sitting on top of service providers and bypassing equipment providers, creating huge value and splitting the value exclusively between themselves and end users. According to Michael Powell, Chairman of FCC, “I knew it was over when I downloaded Skype ... When the inventors of KaZaA are distributing for free a little program that you can use to talk to anybody else, and the quality is fantastic, and it’s free – it’s over. The world will change now inevitably.”

Skype is able to do that because of the P2P technology it creates, and the success of it is mostly due to the network effect of its business model. In P2P network, every user who sign up for the network will be contributing a portion of its own bandwidth and computing power to facilitate the transmission of other users’ data traffic within the network. Therefore, both *direct and indirect network effects* come into play and a *positively reinforcing loop* is formed: the more users sign up for the Skype network, the

more people you can talk with, and the more valuable it is for you if you sign up. In addition, the more users sign up, the more computing power and bandwidth the network will have, the better quality the VoIP will be, and the more valuable the service for you as well.

Skype's uniqueness was in its technology which was not easy to maintain – anybody could initiate a p2p network with the free software. The secret of Skype's success is *speed*: Skype is very quick in signing up large customer base and now with almost 100 million users worldwide, it has acquired invaluable complementary asset – brand name and customer base.



**Skype's Reinforcing Loop**

Going forward, as Skype improves its quality and ease of use, it will be even more widely adopted and will put downward pressure on price of VoIP, totally disrupting the VoIP market. However, it will not be able to replace other players in the market, because as a free-software, it has to rely on service providers to gain access to end users.

### **3.4 The Evolution and the War of the VoIP Standards, and the Race to Lock in Customers**

Earlier implementations of VoIP products used proprietary standards developed by vendors. These products do not interoperate with each other and hindered the adoption of VoIP technology, and as a result, customers kept watching and few was locked in.

Later, ITU(International Telecom Union) developed a set of standards called H.323 for voice and video when people began to explore the potential of broadband services. The protocol essentially defines a multimedia communications system over packet-switched networks. H.323 is made up of a set of protocols that are responsible for encoding, decoding and packetizing audio and video signals for call signaling and control, and capability exchange. H.323 was welcomed by equipment vendors who have a root in PSTN such as Lucent technologies because of their familiarity with ITU standards, and as an early protocol, it has a *large installed base* and is present in many of the new VoIP networks.

However, H.323 is a cumbersome standard and lacks many flexibilities enabled by IP network. Therefore, IETF, the standard organization that developed the TCP/IP suite,

developed a competing standard SIP protocol. SIP is an application layer control protocol that can establish, modify and terminate sessions or calls. The SIP protocol is welcomed by the new generation of data communication equipment providers. When heavy players Microsoft and Cisco decided to invest in favor of SIP, the *market was tipped*. The following chart from Gartner showed that while 80% customers support H.323 and only 13% support SIP, 70% plan to continue support SIP while 6% plan to continue support H.323 going forward.

#### **Tiping the market: VoIP Standards Supported by IP PBX Systems**

However, both H.323 and SIP are *open standard and publicly available*, creating a challenge for vendors to lock in customer and capture value. To tip the market toward SIP and permanently lock new customer in, vendors such as Cisco played the game strategically: they offered compatibility to H.323 in their SIP product to lower the switching cost and liberated early customers locked in by H.323; sent representatives to

IETF to lead the development and evolution of the SIP protocol; and most importantly, implemented and promoted a large amount of proprietary features with the proprietary implementation of SIP protocols in their products. This strategy “polluted” the open standard SIP and tried to lock customers in. Therefore wide interoperability has not been achieved in VoIP.

To address the interoperability issue and to further tip the market toward itself, Cisco has even promoted its own *proprietary protocol* between the gateway and the phone, Skinny, trying to create its own *network effect*. It has licensed Skinny to a few other vendors who produce Skinny phones. So while Skinny is not closed, access to it is limited to Cisco's partners. As a result of this standardization war, VoIP systems generally work best when they come from a single vendor, or a group of companies that have partnered with one another.

Going forward, both H.323 and SIP will co-exist for a while, but eventually H.323 will fade out and SIP will dominant as customers are afraid of being locked in by old protocol and gradually migrate to SIP. However, achieving true interoperability will take a longer time because major vendors are trying to tip the market toward themselves and implementing the SIP with proprietary features.

#### **4. Conclusion and Prediction**

In summary, the VoIP technology has evolved dramatically over the past 20 years and it is now taking off along the S- curve. Chasm is being crossed, dominant designs are emerging and the technology is being accepted by early majority adopters. It will take at least another 10 years for the technology to mature.

The VoIP technology has disrupted the traditional telecom service industry, and has created huge opportunities for emerging service providers by dismantling entry barriers. As a result, cable operators will win big with their new capability to enter the voice market while RBOCs will struggle to survive as their core business is threatened. Though old standard was overthrown despite large install base and new standard was embraced, vendors will continue trying to lock in customers with their proprietary implementation of the new standard.

All these factors will play out to make the VoIP market even more competitive.



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