International Telecommunications Infrastructure in Russia

The Transit Switch

By

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Abstract

This Report presents a summary of Russian Telecommunications and also presents a proposal for a concept of a Russian Transit Switch Business. The concept takes into account that the global international telecommunications markets is in excess of $100 billion and growing at a compound annual rate of 16%. This means that this market is anticipated to be one of the largest services markets available to any country. If the Transit Switch is considered, the paper argues that the operator of that switch may achieve a 20-25% gross profit margin on all traffic passing through the switch. In addition, if the switch can focus on 10-15% of the global traffic, especially that portion being driven by growth, then Russia has a target market of $10-15 billion with a free cash flow of $2-4 billion per annum, also growing at 16% annually.

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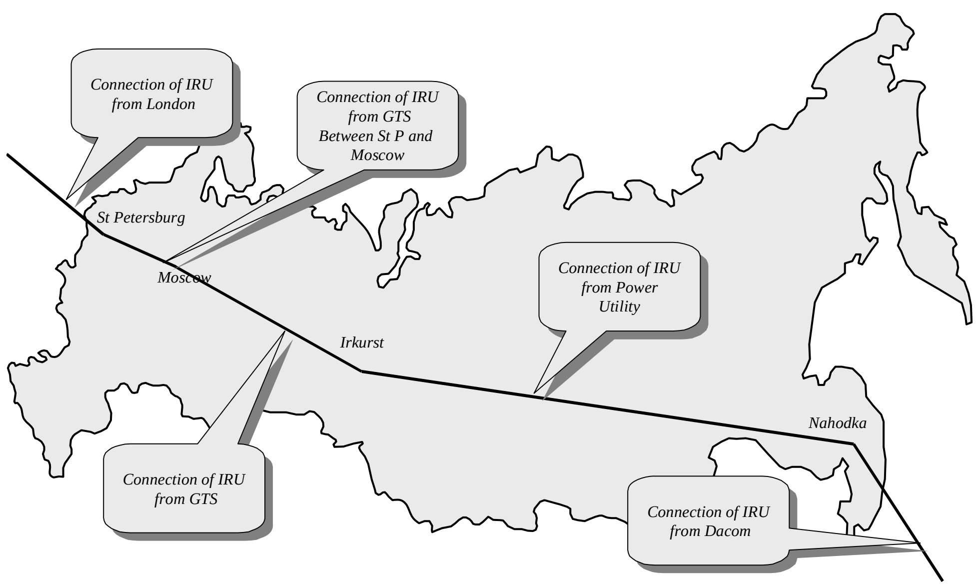
1. OVERVIEW

This Business Proposal articulates the strategy on how to implement the concept of taking transit traffic from the Atlantic to the Pacific across Russia. Apparently, others, like RosTeleCom, GTS and at least one other team seeking to use National Rail and National Electric Utility fiber optic infrastructure are also working on a similar approach. A special opportunity to break ahead of them all has been distilled. The Consortium of companies represented herein, has the ability, facilities, contacts, and skills necessary to accomplish this task.

GTS is building its own fiber infrastructure, presently from Russia's western border to Moscow, with presumed plans to continue across Russia. GTS has a Russian company with international experience actually laying its fiber, and is relying on right-of-way provided by LenEnergo, St. Petersburg, a Regional Electric Utility company. While the former is being paid on a contractual basis, LenEnergo's reimbursement is structured in the form of *ownership* of four strands (out of the 32 in the fiber cable being laid). In reality, LenEnergo's objective need is just 2 Mbps and, assuming that bandwidth can be contractually guaranteed, LenEnergo can safely sell its share of GTS cable capacity to another operator – something GTS would never consider doing for a competitor.

An alternative but very similar route exists in case GTS changes its plans. FinTeleCom, a Finnish operator, already has its fiber laid from Russia's western border to Moscow using right-of-way of the same regional Electric Utility, LenEnergo. The structure of the deal is identical – LenEnergo presently owns four strands of FinTeleCom cable and is open to the idea of selling that capacity.

The overall architecture for the Transit Switch proposal is as follows:



In this architecture the proposal is as follows:

1. *Obtain an IRU facility from the US and Western Europe to interconect to a site at or near St Petersburg. This would be an OC3 type connection, 155 Mbps or higher.*

2. *Obtain capacity from GTS or another provider from St Petersburg to Moscow. Again a 155 Mbps link.*

3. *Obtain capacity of a similar form from GTS to Irkust to Nahodka at 4 strands of WDM compatible fiber.*

4. *Connect from Nahodka to Pusan via the RJK fiber for Asian connectivity.*

5. *In addition facilities for gateway switches in Poland and in Korea would be necessary.*

InfoTel reports an actual *offer* from head of LenEnergo to his company: his estimate of the total cost of acquiring those four strands of fiber is about $3.5 million. Also there are opportunities for a similar deal is fully possible for fiber being presently laid in Siberia for RosTeleCom by the same Russian company, which is also working for. Since RosTeleCom is also using right-of-way from various local Electric Utility companies, who, will deal on terms quite similar to LenEnergo. A relationship Infotel has with the principals of the cable laying company will be conducive to cutting all the fiber strand ownership deals in question. The cost of four strands in the Novosibirsk to Blagoveschensk missing trans-Siberian fiber stretch is going to be between $8 and $12 million.

With these two assets, partial ownership of western border to Moscow and part of the trans-Siberian fiber, in hand, the network can safely approach RosTeleCom, and negotiate a deal. RosTeleCom believes it needs to own some strategic fiber capacity outside Russia. For political reasons it cannot do so:

- *RosTeleCom itself – no matter how attractive from the business point of view that might look – politically cannot justify any sizable foreign investment of its resources;*

- *RosTeleCom has no capital: for the balance of 1998 alone it is to pay $100 million to its foreign creditors with chances to meet those obligations being quite foggy. RosTeleCom's total foreign debt is around $350 million (from memory).*

RosTeleCom would likely be willing to participate in an off-shore company which could do all the above and more for them. Ownership of fiber capacity outside Russia – an asset sought by RosTeleCom – would give us capacity to swap for RosTeleCom bandwidth across approximately half of Russia, which we would still need after acquiring of four strands in the above mentioned fiber projects. We thus would offer RosTeleCom access to/ownership of the readily available transatlantic and other Western fiber capacity. In exchange RosTeleCom would give us:

- *part of its international traffic to take out "under" the settlement rates, and*
- *provide access to/ownership of those parts of fiber infrastructure it owns we would need to assemble an end-to-end fiber capacity across Russia.*

It is essential to understand that from RosTeleCom point of view two components are required to close the envisioned deal: personally motivated principals *and* a defendable reason to *transfer ownership* for part of the Russian fiber infrastructure it owns. The first is to be achieved through the off-shore in question. The second through offering RosTeleCom ownership of foreign fiber. Aside from the $12 to $15 million needed for fiber acquisition, another $2 million will be needed for:

- *Preparation of a technically detailed business plan for putting together the fiberoptic "permafrost crossing" connecting St. Petersburg and/or Moscow with Khabarovsk and/or Nakhodka,*

- *Funds for establishing the outside-of-Russia part of the deal, mostly securing financing and seeking operator alliances to guarantee transit traffic.*

Thus, assuming the Western partner already owns the transatlantic/other out-of-Russia fiber needed, the total capital required is about $17 million.

2. TRANSIT SWITCH CONCEPT

Russia is in a singularly unique global position for the twenty first century. The information economy requires and demands growing bandwidth and telecommunications infrastructure. Fiber networks such as FLAG and the TAE, Trans Asia Europe, fibers, span oceans and countries, in an attempt to connect Europe and Asia, the two growing markets. The United States stands alone in an overabundance of fiber which in a global economy must be interconnected via trans-Atlantic and trans-Pacific cables. Russia in contrast naturally connects Europe and Asia, interfacing with cable heads that in turn connect to the United States and all other markets. In contrast to FLAG and TAE, a trans Russian system would rely upon n above ground/single country system which would provide higher reliability and improved lifetime, resulting in lower costs and improved security. In addition the single Russian system would also permit the deployment of a national backbone network for domestic telecommunications. Currently, for example, Rostelecom has no more than sixty voice channels connecting East and west over a microwave circuit.

This proposal proposes the use of existing facilities, limited thought they may be, to generate a revenue stream, to deploy technology such as the IP telecommunications technology to obtain greater efficiency from the existing system, and then to build a network in an incremental fashion using the capital generated from the already existing networks. The Transit Switch concept is one that takes two or more locations in Russia, generally one in the east and one in the west, and these locations have connections to Europe and the US on one end and to Asia on the other. The using existing capacity, and using IP telecommunications technology, it sells connectivity from the west to the east and vice versa.

This proposal develops a concept for Russian Telecommunications infrastructure development and also presents a proposal for a concept of a Russian Transit Switch Business. The concept takes into account that the global international telecommunications markets is in excess of $100 billion and growing at a compound annual rate of 16%. This means that this market is anticipated to be one of the largest services markets available to any country. If the Transit Switch is considered, the operator of that switch may achieve a 20-25% gross profit margin on all traffic passing through the switch. In addition, if the switch can focus on 10-15% of the global traffic, especially that portion being driven by growth, then Russia has a target market of $10-15 billion with a free cash flow of $2-4 billion per annum, also growing at 16% annually. In the context of a Russian environment, the acceptance of the Transit Switch concept will provide an engine to finance the development and build-out of a Russian national fiber network.

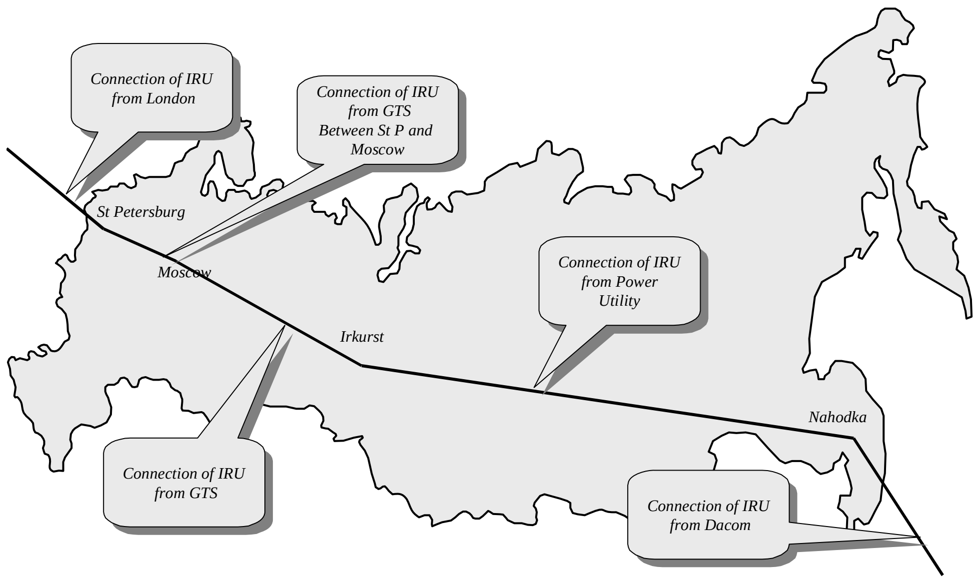
Russia is in a unique position to establish itself as the communications broker or market maker for all traffic from Western Europe and even Africa to and from the Far East. In addition, if it does this in conjunction with US carriers, it can jointly service both North and South America.

The approach taken in this proposal is to focus on the provision of services via a transit switch and then to utilize technologies such as TCP/IP and speech compression to establish a network that is ultimately the first global multimedia network supplying video, voice and data. The Transit Switch concept proposed for Russia is one which uses TCP/IP as a means to lower the capital of switching costs, to more efficiently use existing resources, and to leverage the technology to implement a full multimedia network capability.

The Transit Switch concept can be stated as follows:

Russia can become the Transit Switch facilitator between Europe/US and Asia by using switch access locations in the west in Moscow and in the east in Vladivostok (Nakhodka or Khabrovosk) by using the existing transport facilities, by using TCP/IP type networks, by using IP telephony integrated with data, fax, and multimedia. Russia can establish a set of Transit Switch locations, interconnect to western and eastern fibers for global connectivity, and interconnect east and west in a cost competitive and highly profitable fashion. The immediate result is a cash engine to fund the deployment of more fiber trans Russia, the development of the technologies to deploy TCP/IP Transit Networks, and the development of an advanced technological expertise base within Russia self funded from the Transit Switch cash flows.

Transit Switch recommendation and this concept is shown below.



The following observations have been made in the Proposal:

i. ***The current state of telecommunications in Russia is in a formative stage but it is poised for rapid growth subject to a well developed national plan***: The main concern it the existing telecommunications industry structure with Rostelecom and the other quasi government players may actually delimit growth. Also the concern is the development of an infrastructure. The issue of concern is that there is a battle of concepts between a Federalism for telecommunications and a full open free market. The free market has proven to be the most effective in the United States and the UK. It has only be tried in a limited way in other countries, but Russia has been one of those countries. It is argued that the free market approach is much more effective than Federalism.

ii. ***Regulatory Changes Globally and their impact on Russian Markets will be significant***: The GATT and GATS treaties and the WTO agreements as well as the recent FCC challenges to settlements and accounting rates present a real threat to Russia's position as a world player if it attempts to ignore them and not become a proactive player in that process. Russia must joint the WTO to be an effective player and such joining is consistent with the goals of a free market player.

iii. ***The Transit Switch Concept and Its Implementation***: The Transit Switch construct is a paradigm for telecommunications industry development. It has three elements; the switch infrastructure, the ability to buy transport "long" and sell it "short" in the world telecommunications market, and the need for a trans-Russia fiber infrastructure building on the plans and developments already in progress.

iv. ***Security of Telecommunications Networks***: If the Transit Switch is to become a reality then security is a key and essential guarantee to anyone seeking to use this facility. This section details some of the security concerns that this construct must meet. There is the concern of physical security, access security, and ultimately of transaction security. The Russian technology base may play a significant role in this development process.

v. ***Packet Telecommunications***: The deployment of standard telecommunications switches I merely an extension of what world carriers are doing. The use of TCP/IP type carriage, namely extended packet telecommunications moves the intelligence to the edge of the network. This is a critical move that must be deployed and must be used as a strategic advantage. Namely, the Russian Network can readily take advantage of its new start and do it in the vein of a TCP/IP world rather tenth hierarchical telecommunications world.

vi. ***Policy Developments and Russian responses***: The main focus is on the recommendation that an open market policy will allow for significant external investment and rapid growth. The main problem is the lack of clear laws and legal structures in Russia and the debatable concepts of contracts, property, and the ability to seek remedies in a structured and reliably consistent legal system.

vii. ***Strategies for Russian Telecommunications Development***: The final portion of the proposal details ways in which the Russian market can use the changes in technologies, changes in regulatory environment, and the opening of the Russian market to capture a significant share of global telecommunications infrastructure.

Simply stated, the switch is a set of telecommunications nodes on the East and the West that are connected by a fiber link in between. The nodes provide for interconnection by the most advanced telecommunications methods available and thus allow Russia to become the Market Maker in telecommunications interconnection. As New York and London make financial markets, Moscow and Vladivostok, or their alternates, can have the potential to make international telecommunications markets brokering telecommunications capacity to all players, East and West.

The major observations made in this proposal are summarized as follows:

i. ***Gap in West-East Telecommunications Links***: Most of the telecommunications links between the East and the West are transoceanic and are generally limited by the general problems of transoceanic cables. A link from East to West Russia, then linked to the US links, can create a virtual infinite capacity global network.

ii. ***Buying "Long" to sell "Short", or the Establishment of a Telecommunications "Market Maker":*** The Market Maker concept is that the Russian entity may be able to buy capacity by long term contracts and sell it short term to the open market. There already is a market for such services in the West and it is controlled by Teleglobe, a Canadian company. Allowing for the entry into the CIS then this approach is very viable.

iii. ***Large Rate of Growth in Telecommunications Demand***: Telecommunications demand is growing in excess of 20% in the regions bordering on Russia. This allows Russian entities to tap into this high growth market and establish a leading role.

iv. ***Changing Regulatory Environment***: The regulatory environment is rapidly changing. The WTO agreements establish new ways for opening markets. This can be viewed very positively by a Russian entity since it permits significant foreign investment as well as establishing investment safeguards and a process of recourse and remedy. It is strongly suggested that Russia actively participate in this venue.

v. ***Technology Introductions Allowing For Lower Capital Investment Costs***: TCP/IP, Frame Relay, ATM, and other new technologies have driven down the costs for infrastructure. At the same time it has made the fixed costs lower, the cost of entry lower, and the marginal costs almost one tenth that of the traditional carrier.

vi. ***Existing Market Base exists in CIS Demands***: The CIS countries have needs for rapidly expanding telecommunications. Russia via its own networks, geographic position, and based upon prior and current relationships is in a strong position to dominate that market.

vii. ***Growth Rate, Profit Margin, and Total Revenue Stream Establish Significant Position as Key Market Player for Telecommunications Arbitrage and Provisioning***: The market is growing rapidly, the total revenue potential will make it one of the largest markets in the world, and the margins in the near term are significant.

The key policy recommendations follow from the observations made herein:

i. ***Establishment of a Backbone***: The first element in the deployment of the strategy is the establishment of the fiber backbone connecting East and West. This has already been contemplated and is in various forms of implementation. The recommendation is the opening of this market to foreign capital consistent with the WTO agreements established in February of 1997 for most other developed countries. Allowing for multiple entries of carriers will establish a rapid deployment approach as well as drive down the costs by introducing significant competition. This will allow the transit costs to be commodicized as much as possible.

ii. ***Development of a Transit Switch Capability***: The Transit Switch construct requires implementation and this can be accomplished in a staged approach. Initially this can be done via nothing more that buying transport long and selling short and utilizing TCP/IP technology as the switching mechanism. This allows for lowest capital costs of entry, least costs rerouting from a commodity base, and the establishment of a rapid revenue base from CIS countries. One key element will be the need to assure security for the system. This ranges from the physical security to the end to end security from data and interaction privacy and security. This may mean both technical as well as contractual assurances.

iii. ***Establishment of Contractual and other Legal Structures to Assure Safeguards to Investment***: This means that there must be a mechanism for the surety of property and the enforceability of contracts either through the Russian Courts or through internal means and mechanisms.

iv. ***Utilization of TCP/IP as a Switching and Access mechanism***: The use of TCP/IP is one of several new technologies that allow for lower costs, greater flexibility, and the ability to provide a full multimedia environment and effectively bandwidth on demand.

v. ***Strategic Partnerships with Non Traditional Western Partners***: The development of this strategy may be a threat to traditional Western partners who may rightly view this as a direct competition to their existing base. In contrast non-traditional Western partners such as those it is recommended that the Transit Switch entity enlist a strategic partner, can be chosen on the criteria to be consistent with the requirement for innovation. Such a partner would thus likely be an innovative new carrier particularly competent in TCP/IP.

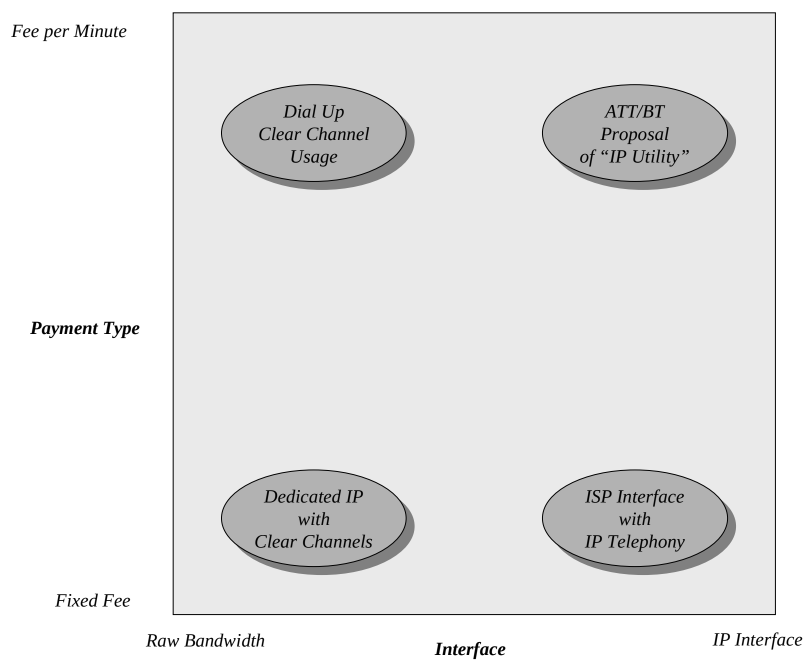
vi. ***Financing on Futures Contracts via Normal Market Mechanisms***: With contracts for service from CIS countries as well as through the relationship with the non-traditional Western partner, the entity may readily take this venture to the international markets and readily raise capital in a joint venture with its Western partner. This means an immediate and significant flow of funds that may even be raised on both equity and high yield debt basis.

2.1 IP Telephony Strategic Alternatives

This section discusses several of the alternative from an operation perspective of the IP telecommunications architectures. There are three that are now currently understood and being offered; the clear channel network approach wherein a dedicated circuit is used, the Internet backbone approach using the current Internet transport mechanism, and, for example, the proposed ATT/BT merger of the international IP which is an IP “service bureau” for other “carriers” to access their IP backbone which will provide a Quality of Service type of IP transport.

The provision of a global IP network that guarantees a quality of service, QOS, at a price point that is matched to the amount of service, its QOS, and possibly its actual usage. The IP service network approach allows the provider to become the network backbone at the IP level and that anyone interested in connecting to them must do so at IP level and not at the raw bandwidth level as is currently done today. In the current world of Internet providers, such an IP service offering is directed to the local IP Service provider and not to the carrier level. It is almost a "reseller" approach wherein the costs of service is above the EBIDTA line and not below it as a capital asset.

This section analyzes the various architectures that may be made available to the IP telecommunications community. There are four possible extremes. The following describes these extremes. There are four extremes depending on what the interface is, clear channel or IP backbone, and what the fee structure is, fixed fee per unit access or fee per transaction (bps, packet, minute, etc.). The four extremes shown that the standard IP telephony using the Internet use an IP interface but use a fixed feed per Internet access to an ISP, say $9.95 per month to a PSI backbone network per IP line. The ATT/BT approach is one which uses an IP interface but charge on a per transaction basis. The approach taken by companies such as Level 3, Qwest, Zephyr and others is an approach which use dedicated clear channel circuits. The interface is at the clear channel basis, namely bit per second, and they do the IP processing on their own network equipment. A fourth approach is a clear channel dial up wherein the IP is done independently. No carrier seems to use this approach at this time.

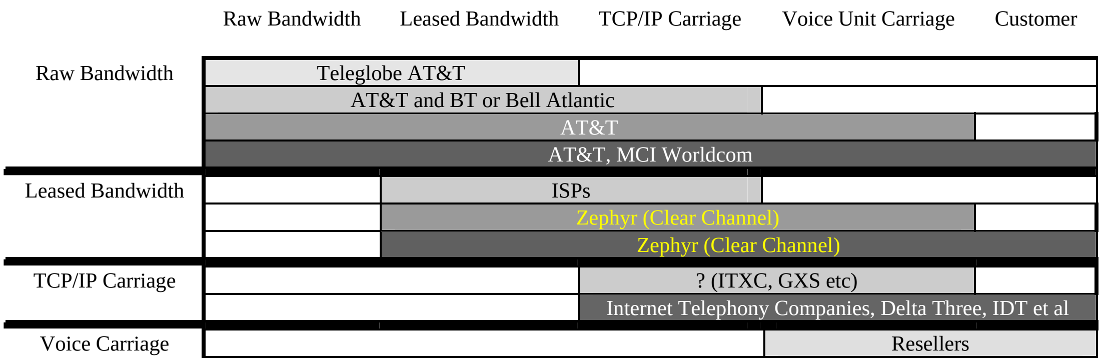


The most important point in the IP service approach is who is the responsible agent for the definition of interfaces and standards as compared to the open Internet environment of today. The offering of a fully open IP network will take a great deal of time to implement and will face significant regulatory as well as political hurdles. The first, as indicated, among them is the issue of who defines the IP interfaces and services. Currently the IP community is highly diversified and entrepreneurial and the last thing they want is an some third party telling them how to build the network.

The risks are this is the typical IBM strategy of pre-release to stall the development of any competitor networks. However, the strategy may backfire since the key here is the IP network combined with the globalization and open markets for bandwidth and the bandwidth lowering of costs on a global scale. Also the opening of most markets following the WTO agreements also opens the Pandora's Box of competition making this approach highly problematic.

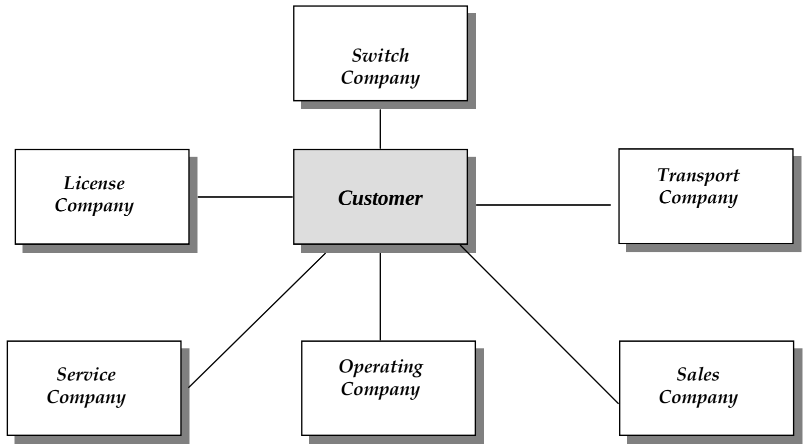
2.2 IP Positioning

The provision of telecommunications services via IP consists of the utilization of several elements. At one end is raw bandwidth that is installed in the ground, under the water, or in the skies above. The next step leased bandwidth, such as an E1 circuit. Then there is the access to TCP/IP backbone as may be obtained by accessing the Internet. The next step is the provision of voice carriage. Finally is the customer or end user. The following Table presents the multiple players and where the play within this segmented space, also know as the IP food chain.



The above chart depicts the essence of the theory of disaggregation. The theory of disaggregation states that technology and industry has developed in such a fashion that it is possible to effect all elements of a business in a virtual form by obtaining all functions necessary to deliver a service by purchasing them from third parties each of whom has themselves other similar customers and thus each of whom can deliver their element of the functionality in a minimal marginal cost manner. The disaggregation theory then concludes with the result that in many technologically intense services business, a virtual company can exist wherein all the functions can be purchased from third parties or capital equipment may be purchased in a fully interconnected fashion so as to achieve near equality between average and marginal costs from the very commencement of the business. The Disaggregated Company is the embodiment of the virtual business. The example below what the elements of any telephone company and how they may be Disaggregated.

The Disaggregated Telco



Zephyr Telecommunications Proprietary

The telephone company is comprised of the following disaggregatable elements:

1. Switch: This includes the ability to switch traffic as well as provide for the interface between the customer's lines and the backbone network. It is not merely the physical switch but also includes any and all software needed for the deployment of the services to be provided.

2. License: This is the license to operate. This may not be just one license but may be a collection or it may be the position to operate without a license in certain circumstances.

3. Services: These are the advanced services such as call forwarding, automatic number identification, voice mail, and other similar services which are generally software based but require access to a switch and a network.

4. Operating Support Systems: These are the billing, customer care, provisioning, and network management services, separately or integrated together.

5. Sales: This is the sales channels.

6. Transport: This is the local transport, the backbone transport, and may include the necessary interfacing with any protocols as may be necessary to provide that transport.

It is important to note that this segmentation into disaggregated elements is not unique and that further each of the elements may be further divided. In today's "telecommunications" market there are separate vendors for each of these services. One can create a "telephone company in a box" approach by adding and aggregating vendors in all areas. The Corollary, however, is that to be a telephone company one needs all of these elements, albeit disaggregated into separate elements and provided by various vendors. An IP telecommunications carrier cannot be a telecommunications services provider and not have all of these elements provided in some fashion.

The theory of disaggregation states that technology and industry has developed in such a fashion that it is possible to effect all elements of a business in a virtual form by obtaining all functions necessary to deliver a service by purchasing them from third parties each of whom has themselves other similar customers and thus each of whom can deliver their element of the functionality in a minimal marginal cost manner. The disaggregation theory then concludes with the result that in many technologically intense services business, a virtual company can exist wherein all the functions can be purchased from third parties or capital equipment may be purchased in a fully interconnected fashion so as to achieve near equality between average and marginal costs from the very commencement of the business. The Disaggregated Company is the embodiment of the virtual business.

The existence of the disaggregated business is a challenge to the antitrust laws and especially to the implementation of the 1996 Act. What this implies is that as a disaggregated company any new entrant can achieve the same of better efficiencies of operation of its business as any incumbent, right from the start. This then states that competition is then based solely upon the actions of the monopolistic incumbent and that these actions relate to only one area, interconnection and unbundling.

Disaggregation falls into three dimensions; technical, operational, and relational. We define each as follows:

Technical: Technical disaggregation the ability to overlay applications and platforms a disparate backbone of transport facilities and create a whole. An example of technical disaggregation is the client server architectures and the LAN networks in common use. This type of disaggregation is a result of the many technological advantages that have occurred in telecommunications as a direct result of the 1984 MFJ agreement. Another example of technical disaggregation is the ability to use a distributed system, such as PCS, Personal Communications Services, and have the actual “switching” occur at the end users handsets rather than at the old fashioned hierarchical central office. By distributing the technology and the intelligence we marginalizes the capital deployment requirement and thus achieve technical disaggregation. One example that we discuss in this Chapter is the concept of providing airtime. Namely the ability of a competitor to not only unbundle local loop, namely copper wire, but to unbundle frequency spectrum, namely airtime from an existing carrier.

Operational: Operational desegregation is the breaking apart of re-assembling in any fashion the operational or business elements to effect the successful provision of service. Namely we can separate billing, transport, sales, service, and network control into different pots and create a virtual corporate entity. We no longer have to do all. We only have to do that part that we do well. An example of operational disaggregation is the outsourcing business whereby a company, such as a Bell Operating Company, would use an outsourced customer service center to provide this function, or in another context of a bank who outsources all of its telecommunications network.

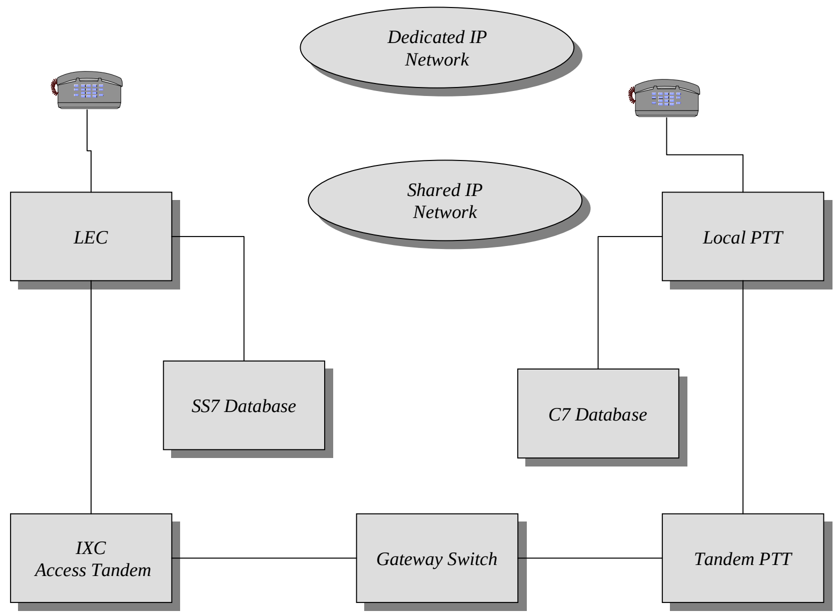
Relational: This will be the issue of who does what to whom in such entities as electronic marketing and distribution channels in a telecommunications cybernetwork. This is the most recent example of building cyber-network via relationships. Unfortunately many of the current examples are examples of failure; Prodigy with IBM, CBS and Sears, or MCI and News Corp. on the Internet side. In this Chapter we attempt to focus on the latter two elements. The first has been treated elsewhere.

This Disaggregator entity is a key differentiation in the market. The Disaggregator is one who may use the existing license holders access facilities as one of several means to provide service to a fixed customer base. It is argued that the Disaggregator is a different entity altogether and more importantly it is argued that the disaggregator is the most likely evolutionary entity to change as full competition is presented in the wireless market.

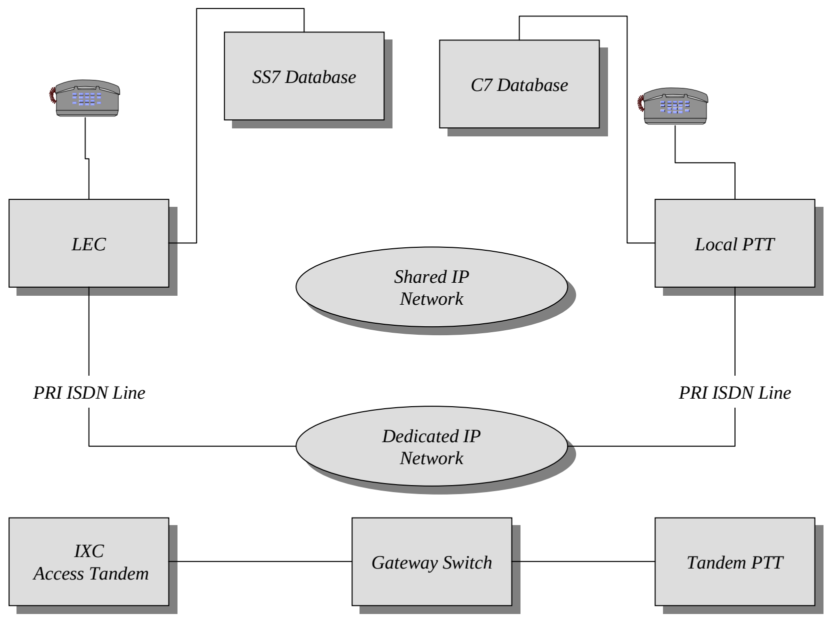
The author believes that by acting as a “Disaggregator” it can effect this competitive position. The Disaggregator works on the following principles. The provision of wireless services is based upon the integration of the service elements. This integration may be performed as an aggregation or as a desegregation approach. The Aggregation is the way most of the carrier entities now work, having control over all of the elements of “production”. The Disaggregator may have control of certain strategic elements but will “outsource” others.

2.3 *Integration With The Telco Networks*

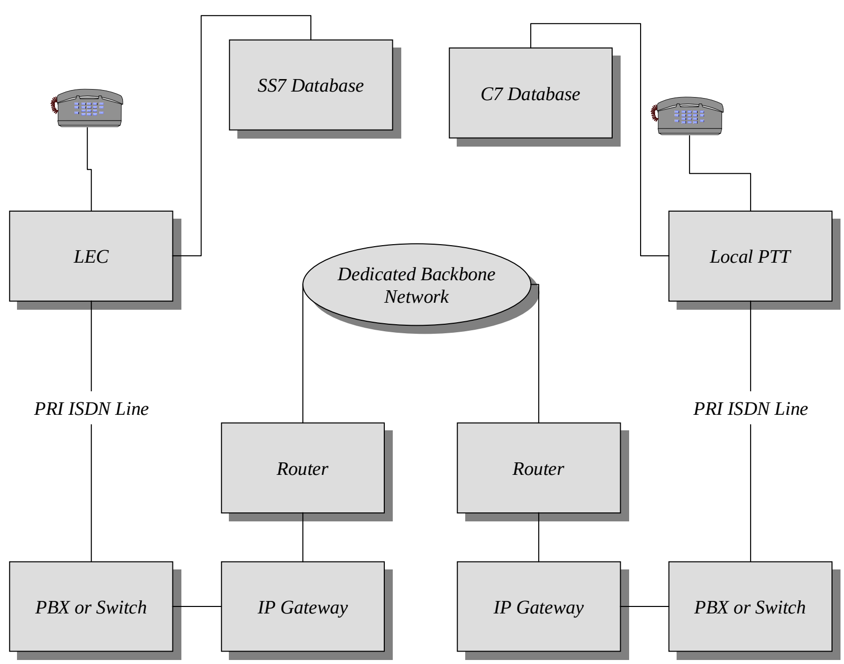
The standard international telephone connection is shown in the figure below. In this case the local LEC customer goes through their local switch, which in turn has access to the SS7 data base and system. This then connects to the IXC access tandem and then via an international set of circuits possibly to an international gateway switch(s) and then to the PTT access tandem and finally to the local PTT switch which has a C7, or SS7 variant, which must via the gateway convert from one to the other.



The next variant is with the use of an IP carrier. We have depicted two different types. The first is a decocted backbone IP network and the second is a shared IP backbone network. The shared is what we typically call the open Internet whereas the dedicated is the closed user Internet, sometimes called an Intranet, although this is generally reserved for a completely closed user group.

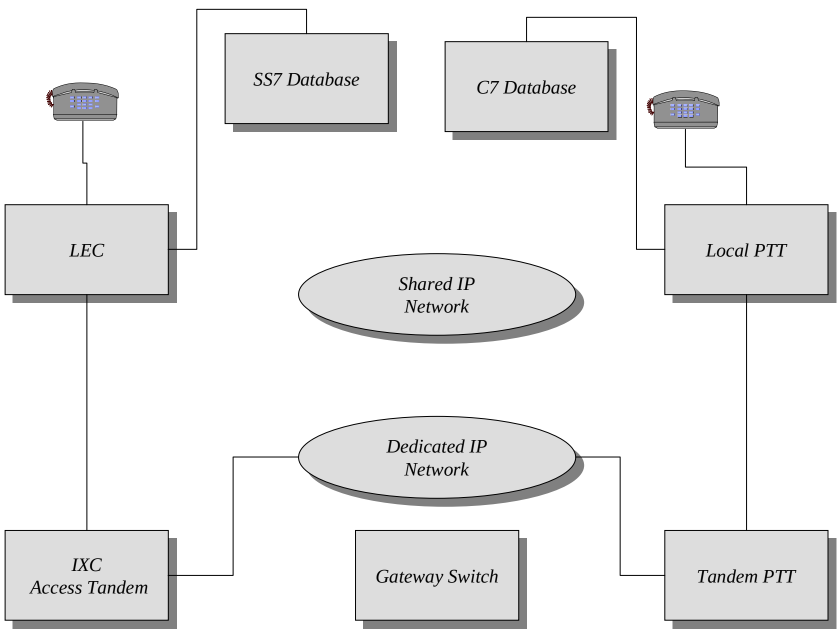


The IP carrier however is further characterized by certain elements as shown below:



In this Figure we depict the Routers, the clear channel backbone network as well as any IP gateways. However we also depict a PBX or switch for interconnect to the LEC or PTT. This may or may not be necessary.

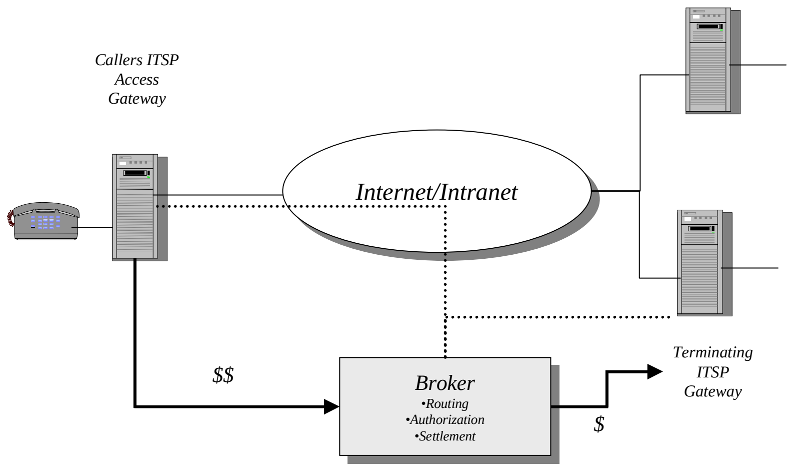
The following depicts a third view wherein the IP carriage is from tandem to tandem. This comes into importance when one connects via access tandems in country as one may do if one were an international record carrier.



Another alternative approach is the intermediary services broker. This is shown below. Companies such as ITXC and GXC have taken this approach assuming the following:

- There are many "naive" and unconnected ISPs that need a clearing house or middleman to effect their transactions.
- That currency transactions and settlements can be done by a multiplicity of third parties.
- That third party billing, network management, and infrastructure provisioning can and must be established.
- That there will be no entry by the more typical telephone carriers into the IP telephony market.

These assumptions are critical to such an approach but they are highly problematic given the needs of this market to have telephony and telecommunications expertise.



3. MARKET

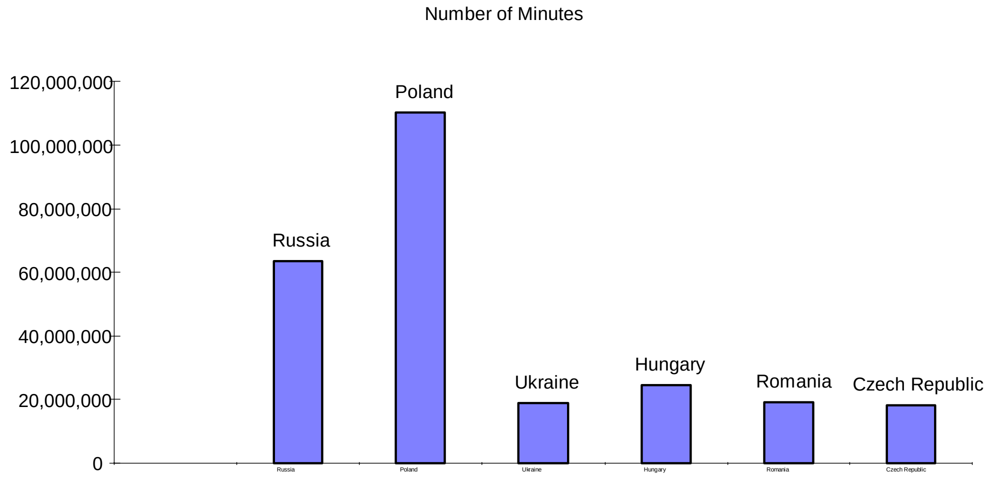
3.1 Transit

3.1.1 West to East Traffic

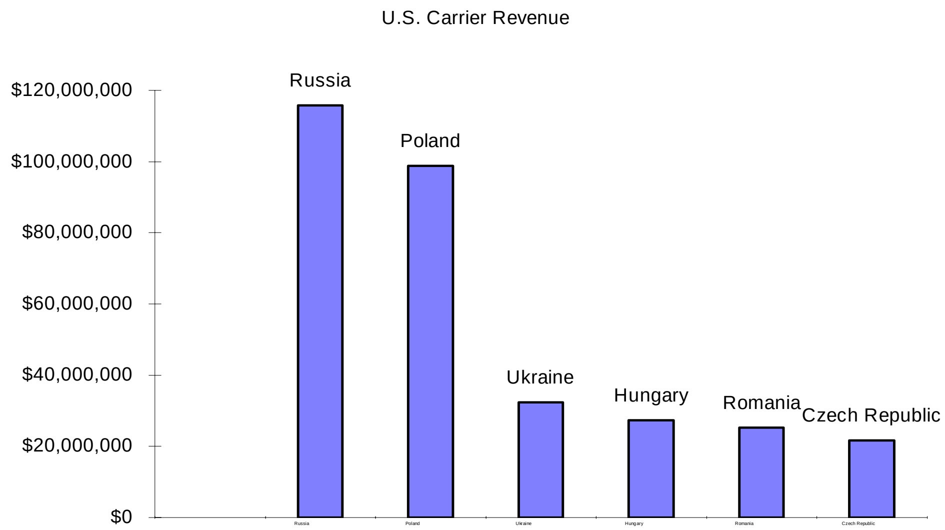
3.1.1.1 Eastern Europe Market

The following section depicts the Eastern European market summary. The total minutes from the States outbound is almost 350 million minutes. The revenue generated is almost $440 million. The traffic inbound from Eastern Europe is about 121 million minutes and generates a net revenue from settlements of $101 million. The following Table depicts the total traffic inbound summary. Poland has the largest call volume and has the lowest revenue per minute. Poland is dominated by TPSA but that is being privatized by 1998. Also depicted is the average duration per call. Most international calls are in the five to ten minute range limited generally by the fear of the clock ticking.

The following is a graphical summary of the minute distribution. It focuses on the top six countries by minutes. Recall that Poland has one tenth the population of Russia but has almost twice the call volume. Poland has approximately 10 minute per year per person of calling from the United States. The Polish market is 100,000,000 minutes from the US and about one third that from Poland to the US. Moreover, there is significant international calling from Poland to all other countries. The other fact is that Poland has the longest holding time.

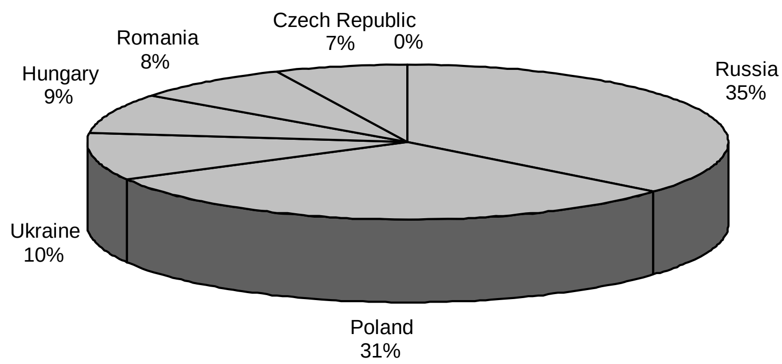


The following accounts for the revenue generated from outbound calls. Recall that Poland is the lowest per minute. The reversal is due to the higher rates for calls into Russia.



The following Chart reflects the calling pattern in percentages.

U.S. Carrier Revenue

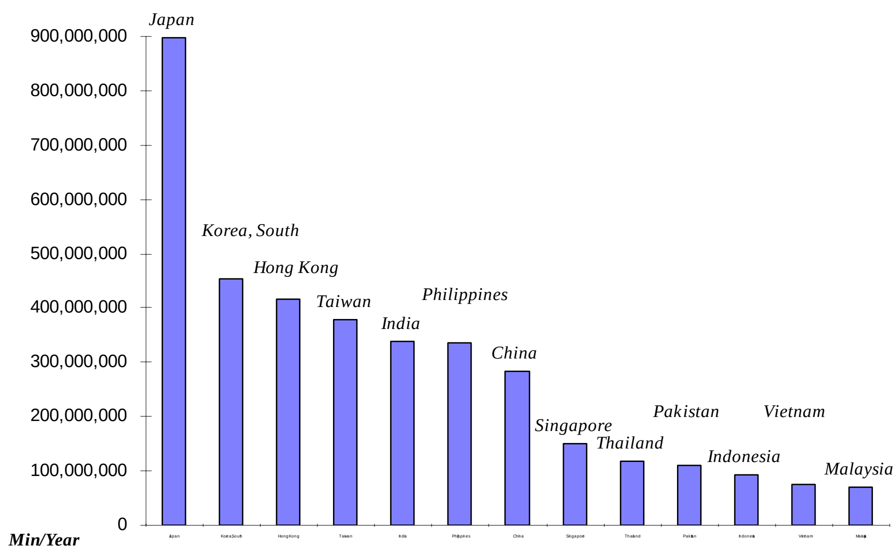


The Company has focused its initial activities on the Eastern European market for several reasons. First it is the least penetrated. Second, it is the fastest growing. Third it has the best potential long term economy. Fourth, it has the most open regulatory environment. Fifth, the Company has had an established base of operations there for three years.

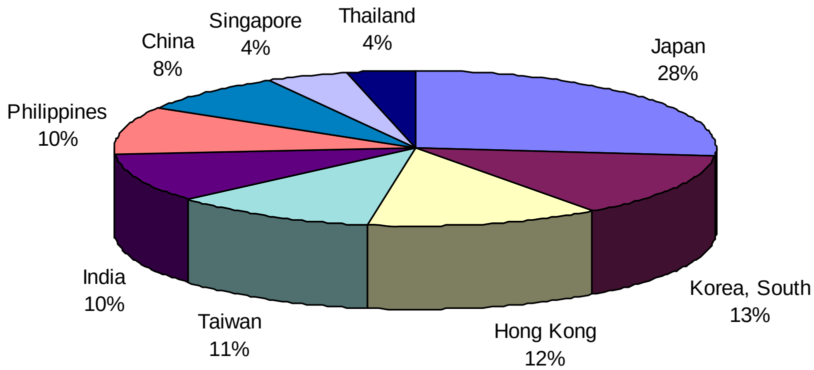
3.1.2 East to West Traffic

3.1.2.1 Far East

The Far East market is significant in size. The following Tables present the traffic of Far Eastern Countries to each country as a measure of the total traffic. It should be recalled that the US to country traffic is two third of the total US traffic and the total us traffic is only 20% of the total international traffic. Thus as a rule of thumb, the total traffic is approximately seven time the traffic from the US to that country.



In the above, the targets are clearly Korea, Japan, Taiwan, Thailand, Indonesia, Malaysia, and the Philippines. The following chart depicts the percent breakout. Unlike Central America, the Asian market is more equally distributed.



3.2 Internal

3.2.1 Infotel/Zephyr/Integra Deal

In addition to the traffic generated from east and West, the structure of the deal is such that the effort with Infotel allows for the provision of traffic within Russia. The details on this are presented below:

4. COMPETITION

The following Table depicts the summary of the major current global cable networking capacity and locations. Only two cables touch Russia, R-J-K at Nakhodka and DK-RUSSIA in Kingiseep. One is East and the other West. There is generally limited capacity in between.

Name	*Location A*	*Location B*
NPC	Oregon	Naoetsu
TPC-4	Vancouver/Oregon	Japan
TPC-5	California	Japan
ANZCAN	Vancouver	Sydney/Auckland
HAW-4	Hawaii	California
HAW-5	Hawaii	California
TPC-3	Hawaii	Japan
PACRIM EAST	Hawaii	Auckland
TASMAN 2	Auckland	Sydney
PACRAM WEST	Guam	Sydney
KJG	Korea/Japan	Guam
G-P-T	Hong Kong/ via Guam	Philippines
TAGU		
R-J-K	Nakhodka, Russia	Naoetsu, Japan Korea
T-V-H	Thailand/Vietnam	Hong Kong
H-J-K	Japan/Korea	Hong Kong
SEA-ME-WE 2	Jakarta	Via Colombo, Djibouti, Jeddah, Cairo
APC	Singapore, Manila	Tokyo
APCN	Australia	Indonesia
FLAG	London	Tokyo
IOCOM	Bangkok	Madras
CANTAT 3	Nova Scotia	UK & Stockholm
TAT-8	US	UK
TAT-9	US	UK
TAT-10	US	UK
TAT-11	US	UK
TAT-12	US	UK
TAT-13	US	UK
DK-Russia	Denmark	Russia (Kingiseep)
TAE	Frankfurt/Warsaw	Odessa/to/Shanghai
AMERICAS-1	Florida	Colombia/Brazil
COLUMBUS	Florida	Mexico/St Martin
SAT-2	Portugal/Canary Is	Capetown
PAN-AM	Ecuador	Chile

The status of the Russian fiber network is as follows. In 1990, there was only one fiber optic line between Minsk and Leningrad. One of Russia's major fiber optic networks was established in 1995 by installing the lines along the Oktyabrskaya railroad system, through the St. Petersburg metro system, and then throughout the surrounding regions along the *tramvai* routes. The use of the extensive public transportation systems as communication avenues has greatly reduced the overhead.

Similar strategies are being established in most other major cities. For inter-city and international communications, current Russian plans anticipate the creation of a national communication backbone consisting of international fiber optic submarine feeder lines and terrestrial extensions in both the northwest and southwest and in the Russian Far East. These Southern, Northern, and Far Eastern projects will eventually be interconnected through a Central project, such as the TransSiberian Line. Once all these projects are completed, Russia will have an immense fiber optic network. The Projects are characterized as follows:

- *The Southern Project will propose to connect Southern Russia with Italy via a submarine/terrestrial fiber optic cable. The cable will traverse both the Mediterranean and Black Seas. The first fiber optic leg will be a PDH submarine link operating at 565 Mbps and running from Palermo, Italy, through Istanbul, Turkey, to Novorossiysk, Russia. From Novorossiysk, there will be terrestrial fiber optic links to Rostov and Moscow which will use SDH equipment and transmit at 622 Mbps. A second fiber optic cable running from Istanbul to Odessa, Ukraine would eventually increase the international channel capacity by 7,680 circuits. The entire investment needed for the project is over $160 million.*

- *Current projects and future plans for the Russian Far East include for a Russian, Japanese, and Korean fiber optic submarine and terrestrial network which would link Vladivostok and Khabarovsk with the Asian Pacific telecom cable grid. Intertelecom, the major Russian telecom provider in the Russian Far East, hopes to create an overlay network with a channel capacity of 7,000 and with transmission speeds over 560 Mbps. The entire project is estimated at over $120 million.*

- *Trans-Siberian Line (which is presently in halt phase) is proposed to connect Moscow and Khabarovsk. The TSL would be an 8,000 kilometer fiber optic link bridging the Russian Far East networks with the Southern and Northwest backbones. TSL investment is estimated at over $160 million.*

5. DEVELOPMENT PLAN

The following is a schematic of the Transit Switch Concept. A switch site is located in the Moscow region and another in the Vladivostok region. These regions are generically selected.

- *East-West traffic can be sent across the network over the backbone between the two regions. The backbone must be sized to allow for the full and complete traffic transfer.*

- *The West-West and East-East traffic can also flow through any single region switch. This can be structured to meet the required least cost routing principle as well as meet the needs for lowered costs of settlement rates.*

- *Traffic can be carried on a TCP/IP backbone network, allowing for the introduction of lower costs and higher technological capabilities. This is the leap-frog approach to technology.*

- *Traffic can be incrementally handled on existing networks. For example on the 60 or so 64 Kbps microwave channels that Rostelecom has across Siberia, one can carry 8 to 16 times as much traffic.*

- *Traffic can be carried incrementally on other networks, many of them being underutilized in Russia.*

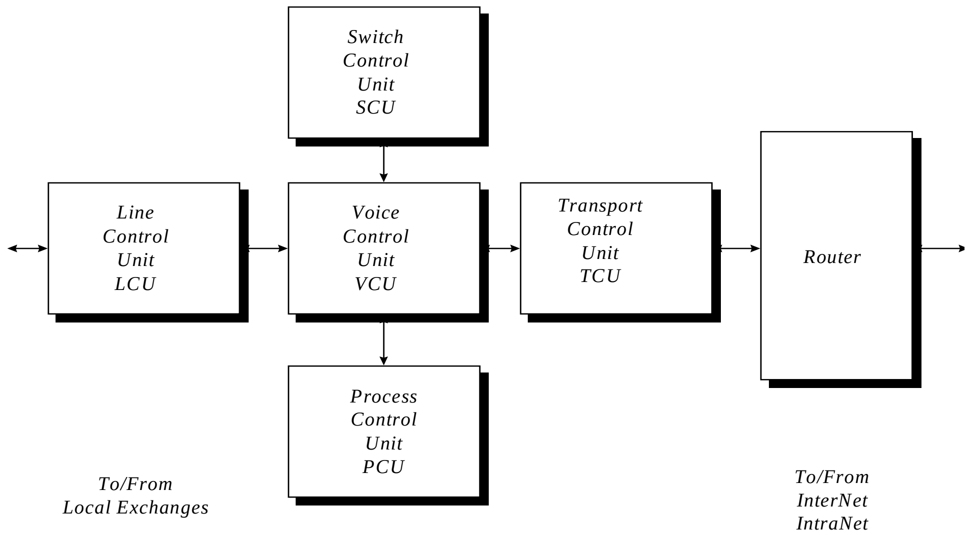
- *Fiber than can be built and essentially financed on the flow of transit traffic. A standard 4 Gbps fiber link can handle 5 billion minutes of peak hour traffic, and this can be done at a costs dramatically less than TAE, FLAG, and any of the other water based fibers. Repairs, maintenance and other elements are more readily handled.*

- *The network also automatically establishes a national Russian network. This means that again through effective self funding that the network can carry both domestic as well as international traffic.*

The telecommunications developments in the Far East have particular interest in the establishment of the basis of the Transit Switch Concept.

5.1 IP Infrastructure

The concept uses an IP Voice Node technology, an IVN. This technology is described below. Consider the connection between the local network and the Transit Switch network being established via the IVN. The IVN components are as follows:



LCU: The Line Control Unit, LCU, is the interface between the telephone network and the IVN. The LCU provides for call initiation and termination. The initial LCU provides for signaling to and from the local telephone network.

PCU: Process Control Unit, PCU, provides the capability of controlling the processes of a general nature such as network management, billing, and the IVN provisioning capability. The PCU has an SNMP agent for network management and a billing control unit, BCU, for the management of calling cards and other similar elements.

SCU: The SCU, or switch control unit, provides for the conversion between the telephone number for dialing and the TCP/IP address for IntraNet connectivity. On initiation, the IVN sends the SCU the telephone number to be called. The SCU converts the telephone number into an IP address and the SCU inserts this in the transmitted packet. On receive or termination the SCU converts the IP address and other header information into the terminating called number. The SCU sends this to the LCU which then connects this to the local exchange.

VCU: This is the IntraNet Voice Processor or the voice card. It is also capable of handling data, fax and multimedia applications. It compresses or decompresses the speech, turns it into a packet, and sequences, schedules, and protocol converts it for IntraNet access. It also converts between a local telephone number and an IntraNet address. The VCU compresses the analog voice signal into a digital signal. The current system converts the voice in an 8 Kbps signal. It can achieve a 4 Kbps compression in a year and a 2.4 Kbps compression in three years. This means that more subscribers can be supported on the same IntraNet backbone network.

TCU: The Transport Control Unit, TCU, provides for the packet synchronization between transmit and receive. It is the scheduler of the packets on transmit and the synchronizer of the packets on receive. It also provides for the sorting out of the packets on transmit and receive. The TCU interfaces with the Router via an Ethernet interface.

Router: This is a standard router such as provided by Cisco.

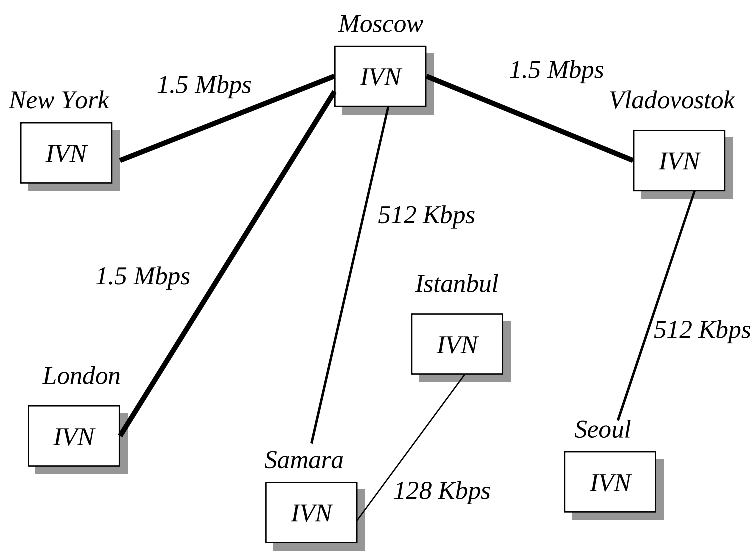
5.2 Network Architecture

A proposed network connectivity diagram is shown below. The network hubs, the IVNs are shown in the listed cities. They are connected via a backbone IntraNet using 1.5 Mbps, 512 Kbps, or 128 Kbps links. The sizing is performed as follows:

- *If a user uses the circuit for 100 min per month, then if usage is 8 hours per day and twenty days per month, and if we have a 2:1 peak traffic load and a 4% blocking probability, then this yields a 1% Erlang Load. Namely a port on the IVN that is connected to a local phone line can handle 100 customers at 100 min per month each, thus a port handles 10,000 min per month. An E1, of 30 ports handles 300,000 min per month.*

- *However and E1 is 30 voice channels, assuming 8 Kbps per channel, this is 240 Kbps. With UDP and RTP TCP/IP header compressions this requires a 256 Kbps channel.*

- *Thus a 256 Kbps channel handles 300,000 min per month. An E1 channel handle almost 2.5 million minutes pre month.*



5.3 Dynamic Least Cost Routing

Bandwidth can be obtained on a long term basis, built, or now it can be purchased on what can be called a spot market. The intelligent use of bandwidth will allow significantly lower costs to all parties, especially emerging nations. The issue of real time lease cost routing is a complex issue that means that costs are available, that routing tables can be dynamically changed, and that there may also be a bidding mechanism for bandwidth that can be sent down ultimately to the end user. This becomes a resource utilization issues as well as and end user and market pricing mechanism. The issue is one of implementing, controlling, informing, and communicating pricing information and decisions in a fully distributed fashion and using this at the IP layer as well as the TCP layer. Where should this be accomplished, what protocols in terms of bandwidth bidding should be used and what are optimal schemes.

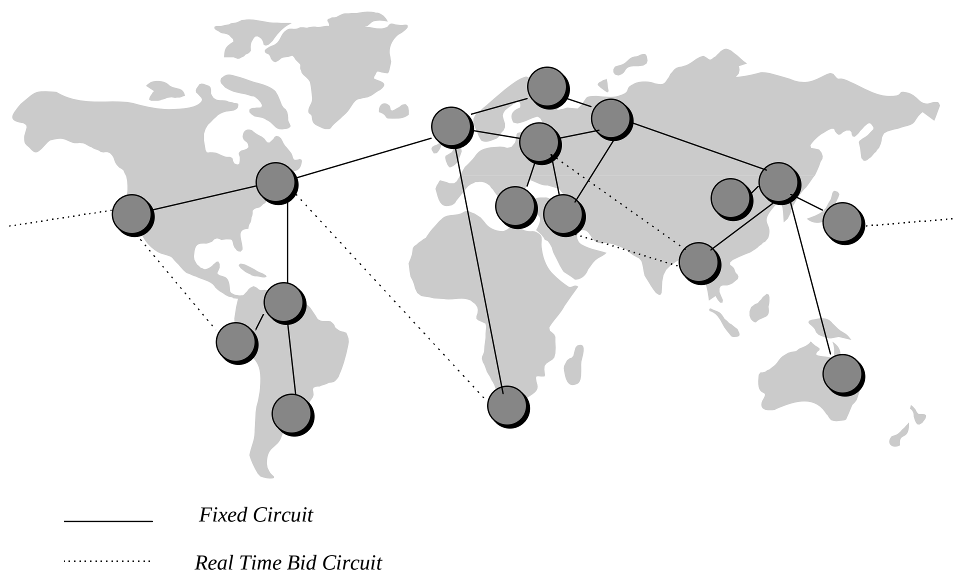
The following depicts an example of dynamic LCR. It functions as follows:

- *There exists an market mechanism to price bandwidth on demand. For example one of the carriers clearing houses such as Band-X and Arbinet.*

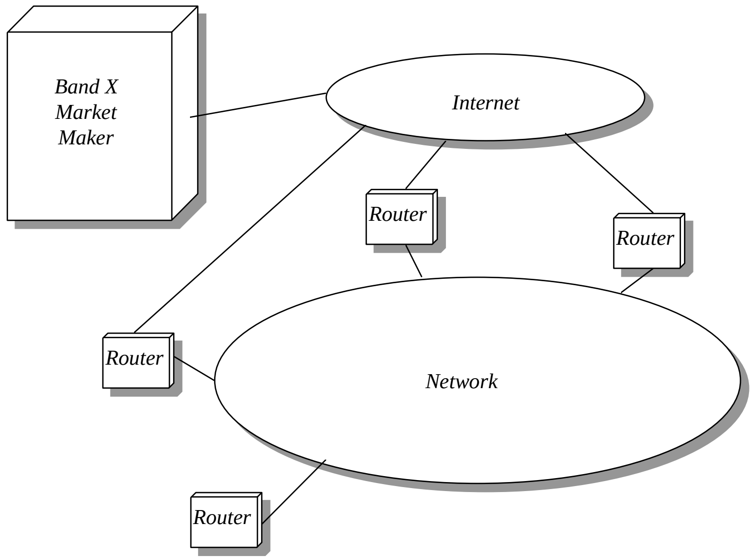
- *There exists a mechanism to real time interface with such a carrier.*

- *There exists a capability in the Router to determine the lease cost route and to adjust the router table to provide for that approach.*

- *The routers can communicate with the central facility and the market clearing mechanism to permit real time adaptation and least costs routing.*



For example, with such entities as Band X and others can work as follows:



5.3.1 Least Cost Routing

The success of any IP telephony model that relies on dedicated networks will depend upon least cost routing. This section presents an analysis and methodology to determine and implement least cost routing for the company in a dynamic fashion so as to ensure a minimal net present value cost to the network portion of the intranet network. The approach builds upon the work in the mid-1970s by the author in the deployment of least cost routing for dynamically variable satellite circuits with a traffic matrix constraint using integer programming techniques.

The cost of a link, L, is defined as P, and P depends upon the vendor, the from and to locations, the data rate and the duration of the contract. Thus P may be parameterized as follows:

$$P = P(M_i, M_j : D_k, T_m : V_n)$$

where M is the city or location, D the data rate, T the duration of the contract and V the vendor. The capacity of the link, C, defined by the above is given in the following:

$$C_{i,j} = D_k / E_k$$

where E is the efficiency of the IVN at that link.

The following chart depicts the prices per link for a specific vendor and for a specific set of locations parameterized on data rates and duration of contracts.

Vendor and Location by Data Rate and by Duration
(New York to Moscow)

Data Rate/Duration	***128 Kbps***	***256 Kbps***	***512 Kpbs***	***E1***
12 mos.	$14,000	$27,000	$36,000	$39,500
24 mos.	$13,000	$25,000	$34,000	$35,500
36 mos.	$12,000	$23,000	$32,000	$32,500

The following Table depicts the prices for a specific vendor and for a 6 month contract between several locations and at various data rates.

Vendor and Duration Rate by Location and Data Rate
(One Year Agreement)

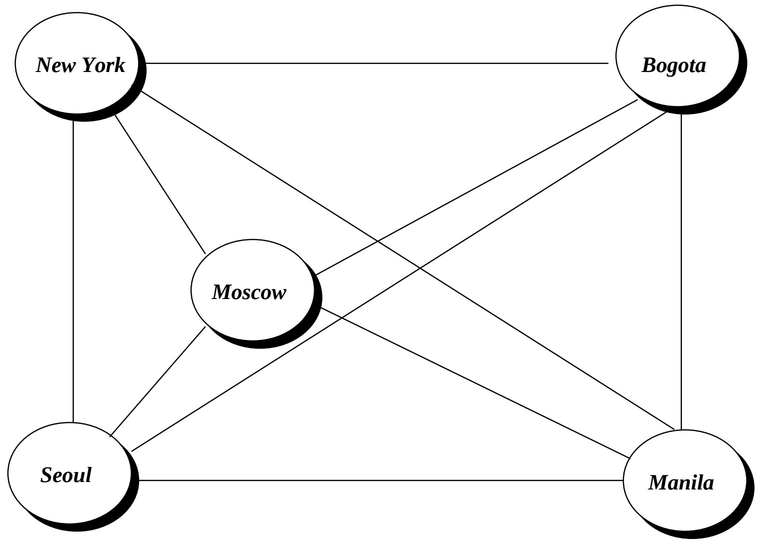
Data Rate/Location	***128 Kbps***	***256 Kbps***	***512 Kpbs***	***E1***
London	$4,000	$8,000	$12,000	$12,000
Frankfurt	$6,000	$12,000	$18,000	$22,000
Warsaw	$9,000	$18,000	$24,000	$36,000
Moscow	$14,000	$27,000	$34,000	$39,500

Consider the following illustration. The company selects nodes for operation in New York, Warsaw, Seoul, Manila, and Bogota. This is five cities. The traffic matrix in minutes per month are shown below:

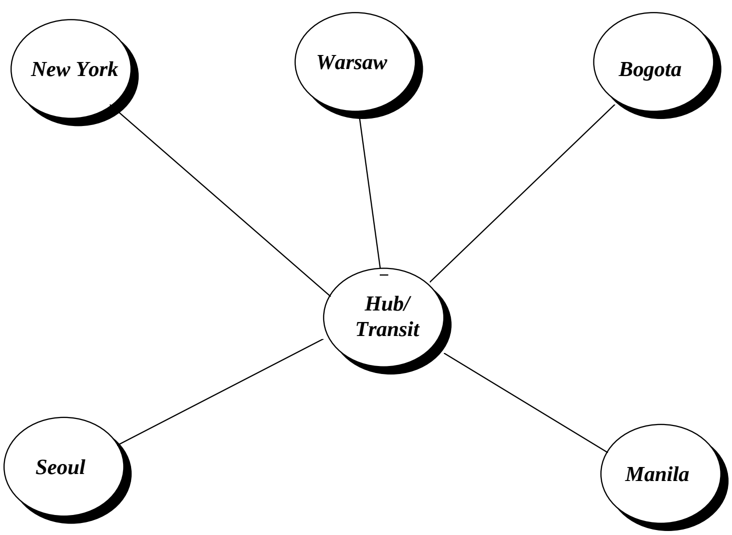
From/To	*New York*	*Warsaw*	*Seoul*	*Moscow*	*London*
New York		*500,000*	*700,000*	*400,000*	*400,000*
Warsaw	*300,000*		*100,000*	*100,000*	*100,000*
Seoul	*700,000*	*200,000*		*100,000*	*200,000*
Moscow	*300,000*	*200,000*	*100,000*		*500,000*
London	*500,000*	*100,000*	*100,000*	*100,000*	

It is possible to do a direct connect mesh network or to select a hub network using a transit switch approach as is done in the airline business. Also a sub-hubbing approach is possible. All depends upon the pricing matrix between countries. Note that pricing may include a differentiator between transit only and termination only.

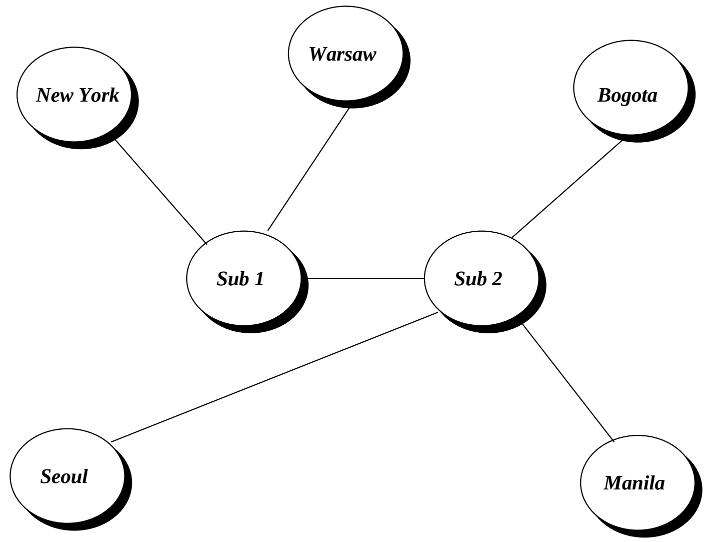
Point to Point: In this network the design is to procure the links on a fully interconnected basis and each link matches the traffic requirement for the network traffic matrix. This is generally the most inefficient use of network resources.



Hubbing: This configuration as shown below uses a hub or transit switch to connect the locations. The location of the transit switch is such that the overall costs of the network is minimized. The circuits from the country to the transit switch is generally sized on total traffic emanating from a country. This is the airline analogy and generally is the least cost approach.



Sub-Hubbing: This is an alternative that uses sub-hubs that may or may not be termination points on the network.



5.3.2 Dynamic Least Cost Routing

Bandwidth can be obtained on a long-term basis, built, or now it can be purchased on what can be called a spot market. The intelligent use of bandwidth will allow significantly lower costs to all parties, especially emerging nations. The issue of real time lease cost routing is a complex issue that means that costs are available, that routing tables can be dynamically changed, and that there may also be a bidding mechanism for bandwidth that can be sent down ultimately to the end user. This becomes a resource utilization issue as well as and end user and market pricing mechanism. The issue is one of implementing, controlling, informing, and communicating pricing information and decisions in a fully distributed fashion and using this at the IP layer as well as the TCP layer. Where should this be accomplished, what protocols in terms of bandwidth bidding should be used and what are optimal schemes.

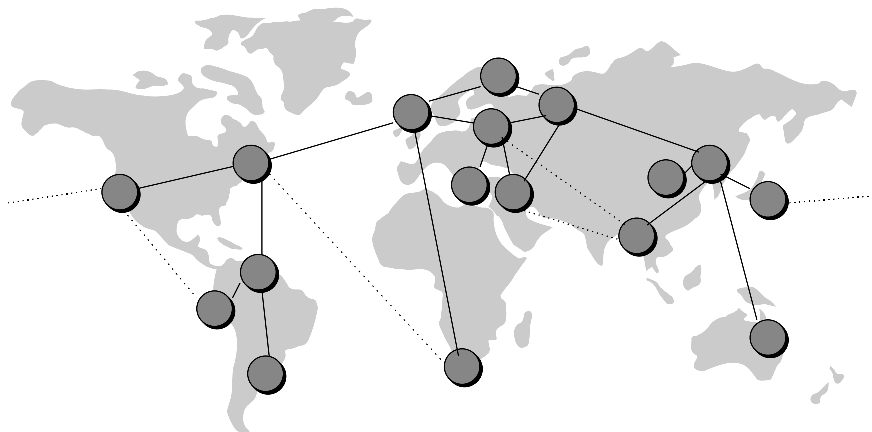
The following depicts an example of dynamic LCR. It functions as follows:

- *There exists a market mechanism to price bandwidth on demand. For example one of the carriers clearing houses such as Band-X, RateExchange, and Arbinet.*

- *There exists a mechanism to real time interface with such a carrier.*

- *There exists a capability in the Router to determine the lease cost rout and to adjust the router table to provide for that approach.*

- *The routers can communicate with the central facility and the market clearing mechanism to permit real time adaptation and least costs routing.*



5.4 Quality, Level, Grade of Service

Recent announcements from established international carriers highlight the standard set of telecommunications offerings and their migration over time using IP technology. The ATT/BT announcement, for example, states clearly that IP is at the heart of the offering. It also states that the offering is a re-composition of Concert which has been a failure on a global scale. Concert was first attempted by BT and MCI. Upon the MCI failure then BT sought another player and ATT with its new Chairman saw this as a play for attention for AT&T which was under stress.

The new IP offerings will provide the following benefits:

i. *Offer customers the widest range of seamless advanced global products and services to meet their end-to-end communications needs;*
ii. *Give customers unequalled levels of integrated service and support;*
iii. *Carry trans-border traffic on a greater scale and more efficiently than ever before.*

This is a standard set of combined offerings which already exist. The IP services to be offered by several new entrants are:

i. *highly secure, global virtual Intranets and associated IP-based applications;*
ii. *multimedia networks with point-to-point and multicast data, video and audio capabilities;*
iii. *a new system of global call centers providing 24-hour, multi-language customer support;*
iv. *new communications services to support the traveling executive and allow virtual meetings to take place with anyone, anywhere.*
v. *toll grade voice quality.*

The above four elements need some clarification. Security is the number one. Clearly, many carriers recognize this in order of priority and this must be incorporated into any such system design. Multimedia communications and customer support are also critical. The last item is a “follow me anywhere” concept which ahs been discussed elsewhere and which we will describe in some detail.

Telecommunications networks generally have levels of performance that are tested in the normal acceptance of a circuit. The set of typical criteria for acceptance are shown below.

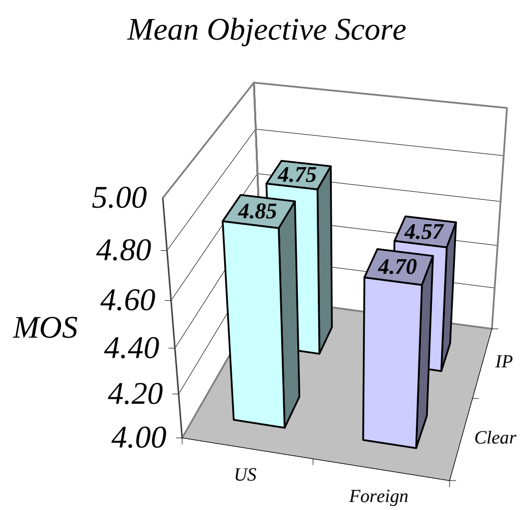
Performance Factor	*Value*
Call Blocking Rate Busy Hour	<5%
Call Set up Time	< 12 sec, 95% of the time
Call Set Up Failure Rate	<5%
Dropped call Rate	<3%
No Answer Rate	<5%
Echo Suppression	>20 dB
MOS Speech Quality	>3.8

These acceptances are determined by means of a set of detailed tests. The following Table depicts several of these tests, the objective of the tests that are generally performed, the procedures used, the desired results and the level of performance sought.

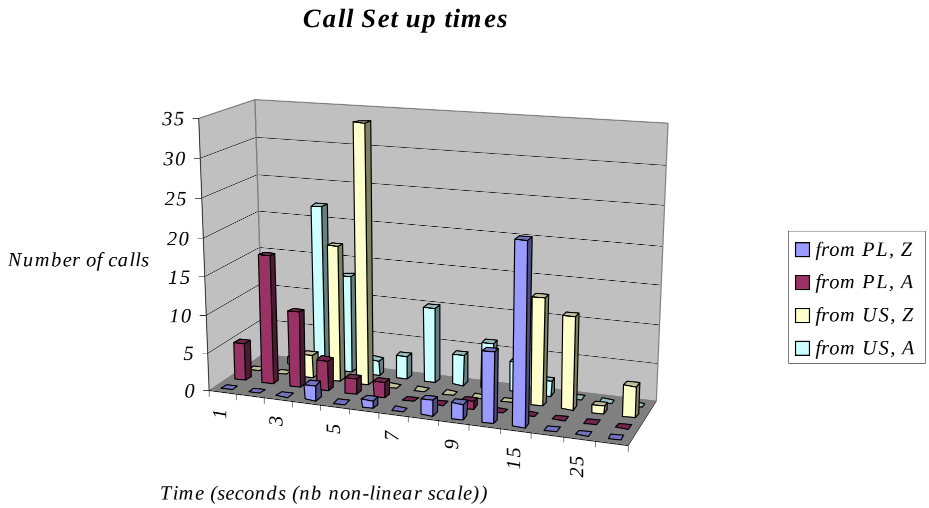
Test	*Objective*	*Procedure*	*Level of Performance*
Call Set Up Time	To test the time to set up a call measured from the time the last digit is entered until time end party ringing is commenced.	This will be an A/B test procedure using the circuit and a standard reference on a time of day basis. The Standard Reference shall be a US generated AT&T clear channel circuit. The test shall include the measurement of the time between the last digit dialed and the time of the commencement of end number ringing. The test shall include measurements for 50 calls of Type A and B.	<25% difference
Link Loading	To determine the maximum loading on each circuit to meet the Blocking Probability requirement.	This will include the loading of the circuit to its maximum handling capability by placing calls onto the circuit and determining the maximum number of simultaneous calls before blocking exceed the 5% level.	Maximum loading with blocking probability < 5%
Call Completion	To determine the fraction of calls that are terminated without problem.	This test shall consist of the placing of 100 calls in a row and determining the number which are terminated successfully. This shall be done on both ends of the circuit.	> 95% call completion
Call Blocking	To determine the call blocking probability on the circuit.	Calls shall be made at three levels of loading, 50%, 100% and 125% of maximum peak busy hour capacity and call completion shall be recorded.	< 5% call blocking at load
Voice Call Quality	To determine the voice quality of the circuit.	This will be an A/B test procedure using the circuit and a standard reference on a time of day basis. The Standard Reference shall be a US generated AT&T clear channel circuit. The procedure will be to place twenty calls on each end of the circuit in a double blind fashion. There will be a 50:50 mix of the Standard Reference and the company circuit. The caller will be asked to determine whether the quality was acceptable or not. Then the two will be compared for statistical significance of difference using a Student t Test.	<15% determining difference in average
Bit Error Rate	To determine the end to end bit error rate, BER, of the circuit.	Use a BER tester on the loop back circuit.	BER < 10^{-6}
Fax Quality	To determine if the fax transmissions are acceptable.	Transmit fax ten times.	Readable fax

Test	*Objective*	*Procedure*	*Level of Performance*
Modem Test	To determine if the modem transmissions are acceptable.	Try data modems up through 56 Kbps	Modem connection via synch.
Failure Reporting Tests	To determine if the failure reporting procedure is followed.	Failures will be generated at each end of the circuit. Calls will be placed to the NOC and the time to determine and report the trouble will be measured.	Time to Rep[ort < 15 min Failure to report rate < 5%
Trouble Tickets	To determine if Trouble Tickets are prepared properly and if the clearing process is commenced.	Trouble Tickets shall be prepared and circulated.	Time to issue shall be < 15 min.
Trouble Clearing	To determine if trouble clearing process is working.	This will entail the end to end clearing of the created trouble.	Time to clear shall be < 75 min.
Billing	To determine if billing system integrity is in operation.	Traffic shall be loaded for 48 hours from both ends of the circuit. Bills and CDRs shall be prepared.	< 1% billing errors.
Customer Care Test	To determine if customer care system integrity is working.	Calls shall be placed at random to customer care.	Time to answer shall be < 45 sec

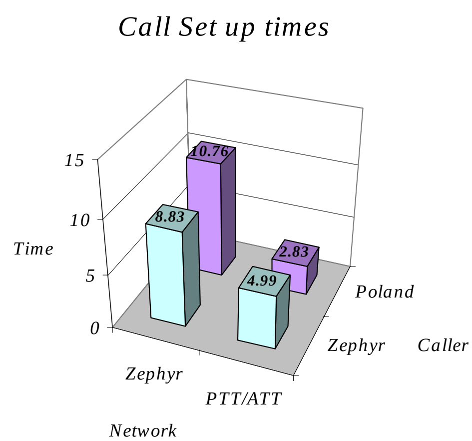
Results on voice quality are shown below for a link on a clear channel IP telephony system as measured by both ends. Note that on this link we compare IP to the clear channel AT&T links. There is no noticeable difference in voice MOS, mean objective score, QOS. Several carriers have achieved this QOS at this time and we further believe that few IP carrier has even begun to test for this factor no less achieve it.



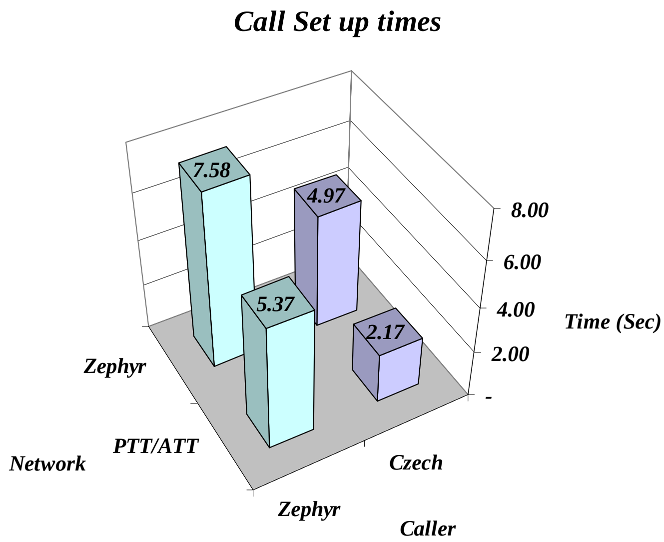
This above test shows that MOS scores for IP telephony clearly match those of the clear channel telephony whether they originate from the US or from a foreign country. There is at most a 10% difference which given the size of the sample makes its statistically insignificant. The following show results from call set up time measurements on an IP versus standard call set up procedure. Note the bi-modal characteristics.



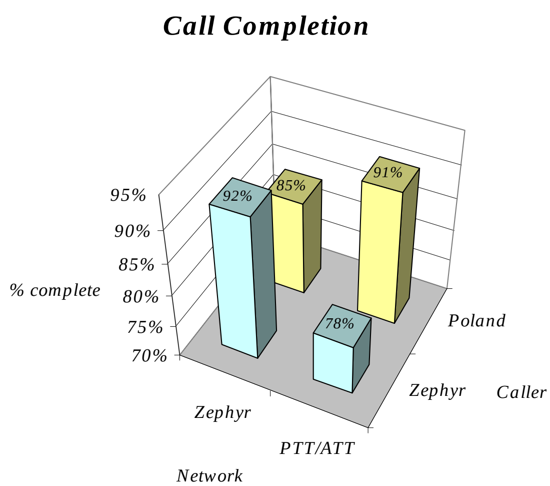
The following is the summary of these call set up tests. Namely that an IP network may have longer call set-up times. In actuality this was due to the process of having a non-PRI interface and in establishing a call by a second dial tone basis.



Calls, however, terminating via a C7 interface are shown below. Note the dramatic difference in call set up time. There are still some differences since the interface is a local switch, albeit with C7 and not an international tandem switch with C7.



The last measurement that can be shown is the call completion rates. The following Table depicts some of these rates. Note that they comparable but generally reflect the network configuration.



6. OPERATIONS PLAN

6.1 Operational Strategies

The following Table presents the areas discussed above, the recommended strategies, and the implications thereto.

Strategic Area	***Strategy***	***Implications***
Market Openings	Determine clearly those strategic market segments, establish clear boundaries for operations, stimulate reasonable competition in a timely fashion, while ensuring the competitors have adequate and committed resources and competencies, and regulate at a minimal level to assure commitments are met.	This will reduce the uncertainty presented to outside capital sources and help focus development in the most important areas.

Strategic Area	*Strategy*	*Implications*
International Investment	Establish a legal framework to ensure for the protection of property and the recourse to ensure surety of contracts. Establish an environment wherein investments have reasonable liquidity either within the Russian framework or in international financial markets.	This will allow outside investors as well as Russian companies to operate in a more defined regime of legal structure.
International Treaties	Enter into and participate in any and all international treaties and organizations as rapidly as possible taking leadership positions through contributions to develop sustainable credibility and reliance on the ability to deliver operations systems and services.	This will be critical to the acceptance of the Transit Switch Strategy or any similar position with Russia being a carriers carrier.
Strategic Alliances	Create as strong an environment as possible for the implementation of strategic alliances. Focus on those players who complement the existing entities, introducing new technologies, with a proven team, and with access to capital markets.	Russian companies are technically competent and generally well motivated. There is the issue however of international operating style and acceptance in capital markets which the strategic partners bring to the table.
Market Deregulation	Deregulate as much as possible in a stepped fashion. Establish a process for open competition of competent and accredited players and allow for the maximum set of competitors in as short as reasonable period as is practicable.	The market must have sensible and controlled deregulation. Total deregulation will lead to chaos and no deregulation will lead to a lack of capital and lost opportunities.

The Russian business environment presents a set of unique challenges and opportunities for investments in and the transfer of technologies from the technology available and the businesses that are being developed in the broad based communications sector. Russia today is one of the major developers of computer software and one of the major developers of certain key elements of computer, telecommunications and communications industry hardware. Russia has recently opened its borders for the importation of various suppliers of communications services, including paging and cellular, as well as the privatization and expansion of radio and television markets.

The concept of an investment Transit Switch Strategy proposed here is new and designed specifically to meet the above stated national needs. The Transit Switch Strategy will provide a secure and profitable opportunity for that; thus a large share of the profit will naturally stay in Russia. Given the above, it is expected that strong support for the Transit Switch Strategy from the government of Russian Federation and other CIS countries.

6.2 The Network

6.2.1 Coverage

The following Table presents the overall coverage of the network.

From	*To*	*Source or Deal*	*Capacity*	*Cost*	*Risks*
New York	London	Atlantic Crossing	STM3 155 Mbps	$6 million	
London	Copenhagen	Atlantic Crossing	STM 3	$1 million drop	
Copenhagen	Western Border	GTS	4 2 Gbps WDM?	NA	
Western Border	Moscow	GTS	4	$3 million	Interconnection with GTS

Moscow	Irkutsk	Rostelecom	Unknown	$12 million, $6 million in Rostelecom fiber	Structure of deal
Irkutsk	Khabarovsk	Power Companies	4 Strands		
Khabarovsk	Nahodka	Rostelecom	Unknown		
Nahodka	Pusan	RJK Dacom	Unknown		
Nahodka	Tokyo	RJK Dacom	Unknown		

6.2.2 Cost and Return

From	*To*	*Capacity Mbps*	*Cost $000,000*	*Monthly Costs $000*	*Unit Cost ($/Mbps/Mo)*
New York	London	155	$6	$120	
London	Copenhagen	155	$1	$20	
Copenhagen	Western Border	155		0	
Western Border	Moscow	155	$3	$60	
Moscow	Irkutsk	155	$6	$120	
Irkutsk	Khabarovsk	2000	$12	$240	
Khabarovsk	Nahodka	155		0	
Nahodka	Pusan	155	$4	$80	
Nahodka	Tokyo	155		0	
				$ 640	$4,000

The following section depicts the overall network. Namely it presents the coverage and capacity options as well as the options regarding the implementation of the overall capacity coverage.

6.2.3 Coverage

The following Table depicts the coverage options available.

From	*To*	*Source or Deal*	*Capacity*	*Cost*	*Risks*	*Comment*
New York	London	Atlantic Crossing	STM3 155 Mb/s [624Mb/s]	$6 [$24] million		keep the option of buying 624Mbps
London	Copenhagen	Atlantic Crossing	STM 3 [624Mb/s]	$1[$6] million		keep the option of buying 624Mbps
Copenhagen	Western Border at Ivangorod/ Narva (Estonia)	Danish Telecom?	4 (2?) strands	$1 million (?)	willingness to deal	GTS is likely doing their fiber from Copenhagen to the Russian border in partnership with the Danish. Can we buy our 2 or 4 strands from them?
Western Border at Ivangorod/ Narva (Estonia)	Kingisepp	ZV own built	full 32 strands of fiber	$150K		10 mile stretch to connect to the existing FinTeleCom hub; excess capacity likely be rentable to FinTeleCom*[2])
Kingisepp	Moscow	LenEnergo	4 (2?) strands	$3 million		Can be bought *now*. Aside from coming GTS fiber*) there is an offer

[2] Infotel is close to the Russian company laying all that fiber.

From	*To*	*Source or Deal*	*Capacity*	*Cost*	*Risks*	*Comment*
						to buy strands belonging to LenEnergo from the existing FinTeleCom fiber
Moscow	Novosibirsk	RosTeleCom	4 (2?) strands	capacity swap	structure of deal	
Novosibirsk	Blagoveschensk	Local electric utilities	4 (2?) strands	$12(6?) million		This part of RosTeleCom fiber is to be ready by October 1999*)
Blagoveschensk	Nakhodka	RosTeleCom	4 (2?) strands		structure of deal	This part exists. Included in the price of the total deal with RosTeleCom, see cell immediately above
Nakhodka	Pusan	RJK Dacom	Unknown			
Nakhodka	Tokyo	RJK Dacom	Unknown			
Total in million $$						$23.5 [*$46.5*] ($)

6.2.4 Cost and Return (155Mb/s)

Using these options the following Table depicts the results for an OC3 connection, or an STM 3.

From	*To*	*Capacity Mbps*	*Cost $000,000*	*Monthly Costs $000*	*Unit Cost ($/Mbps/Mo)*	*Unit cost per minute in cents[3]**)*
New York	London	155	$6	$120.00		
London	Copenhagen	155	$1	$20.00		
Copenhagen	Western Border at Ivangorod/Narva	155	$1 (?)	$20.00		
Western Border at Ivangorod/Narva	Kingisepp	20,000	$0.150	$3.00		
Kingisepp	Moscow	2,000	$3	$60.00		
Moscow	Novosibirsk	2,000	$12[4]*)	$240.00		
Novosibirsk	Blagoveschensk	2,000	$12	$240.00		
Blagoveschensk	Nakhodka	2,000	0	$0.00		
(Nakhodka	Pusan)[5]***	155	0	$0.00		
(Nakhodka	Tokyo)	155	0	$0.00		
	Total	*155*	*35.15*	*$703.00*	*$4,535.48*	*0.57*

6.2.5 Cost and Return (624Mb/s -- effectively, after the swap, 312Mbs)

The following Table depicts the higher rate of 624 Mbps capacity.

From	*To*	*Capacity Mbps*	*Cost $000,000*	*Monthly Costs $000*	*Unit Cost ($/Mbps/Mo)*	*Unit cost per minute in cents[6]*)*

[3] Assuming every Mbps carries 3E1 (compressed) and carries 800,000 minutes per month.

[4] Since with just 155 Mbps there is no out-of-Russia bandwidth to swap, I am assuming here the purchase cost.

[5] Only through Russia part of the network has been included since the nature of the Far Eastern deal is not clear to us yet.

[6] Assuming every Mbps carries three E1s and 800,000 minutes per month (compressed).

From	*To*	*Capacity Mbps*	*Cost $000,000*	*Monthly Costs $000*	*Unit Cost ($/Mbps/Mo)*	*Unit cost per minute in cents[6]*)*
New York	London	624	$24	$480.00		
London	Copenhagen	624	$4	$80.00		
Copenhagen	Western Border at Ivangorod/Narva	624	$4 (?)	$80.00		
Western Border at Ivangorod/Narva	Kingisepp	20,000	$0.150	$3.00		
Kingisepp	Moscow	2,000	$3	$60.00		
Moscow	Novosibirsk	2,000	0	$0.00		
Novosibirsk	Blagoveschensk	2,000	$12	$240.00		
Blagoveschensk	Nakhodka	2,000	0	$0.00		
(Nakhodka	Pusan)[7]**	624	0	$0.00		
(Nakhodka	Tokyo)	624	0	$0.00		
Total		*155*	*47.15*	*$943.00*	*$3,022.44*	*0.38*

6.2.6 Strategic Options

The following represent the strategic options available:

6.2.6.1 Rostelecom

- RosTeleCom has a 20Gbps ATM fiber network. It is not yet clear if they can provide us with dark fiber.
- Purchase option: RosTeleCom if properly motivated might sell bandwidth on its fiber but only to a Russian operator. InfoTel already applied for a license to lease channels.

6.2.6.2 Maintenance

- Hardware maintenance: contracts with Utilities (on our stretches of fiber) and with RosTeleCom (on swapped) will include that.
- Restoral – under such a maintenance contract recently took 3 hours to fix chopped of fiber – Infotel believes this is typical timing.
- Electronic control of the network is ours throughout.
- Back-up will be immediately purchased from satellite people and in 2-3 years swapped with competing National Rail and other networks.

6.2.6.3 Western border to Moscow situation:

LenEnergo has a deal with FinTeleCom for the same 4 strands as right-of-way payment. FinTeleCom fiber is operational. GTS fiber is simply another option. Let me repeat -- we can do completely without any

[7] Only costs of the Russian part of the network has been included since the nature of the Far Eastern deal is not clear to us yet.

interaction with GTS. Were the $3 million required available today, in two to three months the deal could be fully closed.

Border junction. If Zephyr could get hold of fiber from Copenhagen to Estonian border town of Narva, for some $150,000 we could lay 10 miles of fiber from Ivangorod (located across the river from Narva) to Kingisepp, a fiber hub to which FinTeleCom fiber laid using LenEnergo right-of-way is also connected.

At the Eastern end Rostelecom fiber is operational from Blagoveschensk to Nakhodka and by October 1999 will be finished on the last missing stretch from Novosibirsk to Blagoveschensk. Other technical details are being clarified.

6.3 Security Issues

Security is a key element in the deployment of any IP telecommunications service. Security falls into three categories:

Physical Security: This is also part of network management. It is the securing of the physical network to compromise, penetration, misappropriation, or similar compromise.

End to End Security: This is the security associated with the end user access. This is voice, data, or information security.

Logical Security: This is the security to penetration by an adversary who can cause errors or faults or otherwise compromise the system, end user, or information via access to the logical elements of the network.

There are may typical security functions that can be considered. These common functions are listed below.

Function	***Details***
Unauthorized Access Control	The system shall be designed so that there shall be no unauthorized access of any IVN, router, switch, or IntraNet backbone element. The IVN shall provide for total and complete firewall capabilities to insure secure access and shall not permit any unauthorized packet flow through any IVN connected router.
Billing Control	The IVN shall provide for a complete secure billing collection system with complete and full real time redundancy. It must also provide alarms for any attempt to penetrate the system in an unauthorized fashion and shall provide for a complete and secure keyed access system for company access.
Wiretapping Implementation	The system shall allow for any and all legally authorized wiretaps to be implemented on the system. The taps must be in a standard format and must be able to be obtained in a secure and compartmentalized format.
Remote Instantaneous Cutoff	The system must have the capability of remotely and instantaneously being cutoff to prevent any unauthorized breach of security.
Packet Streaming Control	The system must prevent packet streaming. Namely the system must prevent the unauthorized use of the routers, whether they are connected via an IntraNet or Internet, by others for the purpose of sending packets over the network or through the routers. The IVN must have the capability to authorize each and every packet before transmission.

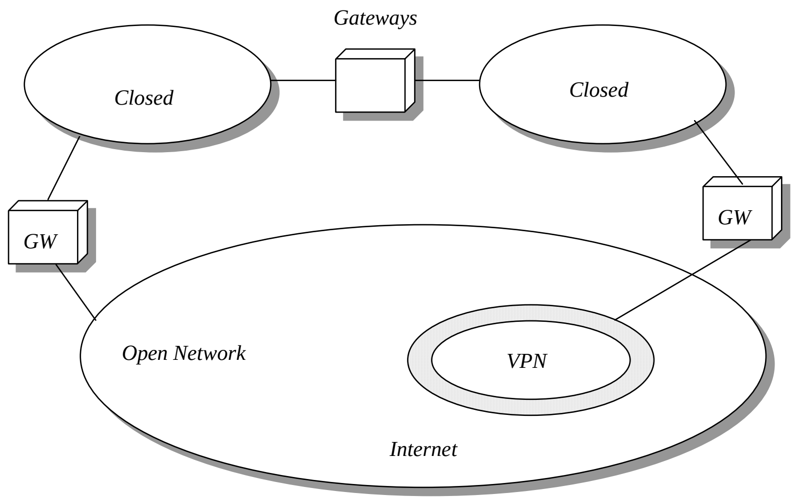
Function	***Details***
Network Management Compartmentalization	The network management system must be fully compartmentalized from the system. Any access to any voice channel must be monitored and must have a key control access capability. No user of the system may access any voice circuit in any fashion without having that access monitored.
Code Key Control	The system must use a secure code key access technique for any access to, modification of, reconfiguration of, or any material change to the system, its configuration, connections, or any other operational function.

The project hereunder is the analysis and determination of threats, compromise protocols, and similar security risks and what can architecturally be done to ensure a secure environment.

The overall issues of network security are at our levels; physical attach of resources, transport compromise between resources, logical attack at software in it broadest sense, and end user compromise. One can view the issues in an open and a closed network environment. The following Table presents an overview of these extremes.

Level	*Open Network*	*Closed Network*
Physical	Physical Breach	Uncontrolled Access
Transport	Intercept v Destruction	Intercept v Destruction
Logical	IP/TCP header swaps Delay/Intercept/Intrusion	Intrusion via compromise
User	Encryption & Authentication	Encryption & Authentication

The network alternatives are shown below. There are two Closed networks, the open Internet, and a Virtual Private Network, VPN, which is encapsulated by some form of security form the Internet. The VPN is constructed by and within the Internet construct. The Gateways are interfaces between the networks and it is at these points that protocols and techniques must focus on the security issues discussed above.



The network discussed in this section must use the security means in all three dimensions, Internet, Closed, and VPN, as a means to specify and evaluate the issues of network security.

7. FINANCIAL ANALYSIS

7.1 Revenue Model

The revenue projections are based upon the following methodology. The revenue methodology proceeds as follows:

- *The Regions are selected as per the methodology developed in the beginning of this section.*
- *The population per region is determined, its growth rate determined and other certain statistics are determined. All of these are obtained from available data sources.*
- *The penetration per region is based upon households not on population. Each region has a different population per household. The penetration is based upon the available telephone lines per hundred households, the demographics of the market and the corresponding demographics of the market. This data is obtained from both ITU and FCC data statistics.*
- *The market share is based upon an valuation of who may be similar price competitors in each market. The competition is detailed in the following section.*
- *The market segments are then separately detailed and the usage per segment is applied. Again this is taken from Company directed market research, analysts studies and government sources.*
- *The current per minute prices are determined as show above.*
- *The Company prices are set at 20% below the best market price. It is assumed that that will be a continually lowered level and is shown in the financials.*
- *The result of this process is the revenue model.*

7.2 Financial Statement Projections

The business analysis was performed for several cases. The following is the Income Statement and other financials for the business for Case 1 as described above.

7.2.1.1 Income Statement

Year	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Revenue	$73,080	$197,938	$351,792	$625,895	$910,889	$1,155,176
Cost of Service	$9,500	$27,589	$52,711	$101,642	$159,801	$218,799
Gross Margin	$63,580	$170,349	$299,081	$524,253	$751,088	$936,377
% Gross Margin	87%	86%	85%	84%	82%	81%
Operating Expenses	$22,496	$58,191	$101,780	$178,132	$256,052	$322,365
JV Fees	$5,318	$14,515	$25,542	$44,830	$64,157	$79,639
Oper Income	$35,766	$97,643	$171,759	$301,291	$430,879	$534,372
Margin %	49%	49%	49%	48%	47%	46%
Leases	$0	$0	$0	$0	$0	$0
EBITDA	$35,766	$97,643	$171,759	$301,291	$430,879	$534,372
Margin %	49%	49%	49%	48%	47%	46%
Depreciation	$8,962	$11,716	$15,082	$25,430	$34,412	$45,224
Profit Before Int	$26,804	$85,927	$156,677	$275,861	$396,467	$489,148
Margin %	37%	43%	45%	44%	44%	42%
Interest	$0	$0	$0	$0	$0	$0
Profit Before Tax	$26,804	$85,927	$156,677	$275,861	$396,467	$489,148
Margin %	37%	43%	45%	44%	44%	42%
Taxes	$10,722	$34,371	$62,671	$110,345	$158,587	$195,659
Dividends	$0	$0	$0	$0	$0	$0
Profit After Tax	$16,082	$51,556	$94,006	$165,517	$237,880	$293,489
Margin %	22%	26%	27%	26%	26%	25%

7.2.1.2 Cash Flows

Year	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
NOI	$35,766	$97,643	$171,759	$301,291	$430,879	$534,372
Interest	$0	$0	$0	$0	$0	$0
Taxes	$10,722	$34,371	$62,671	$110,345	$158,587	$195,659
Dividends	$0	$0	$0	$0	$0	$0
Capital	$44,810	$13,770	$16,830	$51,740	$44,910	$54,060
LTD Reduction	$0	$0	$0	$0	$0	$0
Chg WC	$8,687	$23,111	$25,242	$43,068	$48,643	$41,143
Cash Flow(Less LTD Red)	($28,453)	$26,391	$67,016	$96,139	$178,739	$243,510
Cum CF	($28,453)	($2,062)	$64,955	$161,094	$339,832	$583,342

7.2.1.3 Sources & Uses

Year	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Sources						
Beginning Cash	$0	($28,453)	($2,062)	$64,955	$161,094	$339,832
Net Oper Income	$35,766	$97,643	$171,759	$301,291	$430,879	$534,372
Senior Debt	$0	$0	$0	$0	$0	$0
Junior Debt	$0	$0	$0	$0	$0	$0
Equity(Common)	$0	$0	$0	$0	$0	$0
Equity(Prefrd)	$0	$0	$0	$0	$0	$0
Total Sources	$35,766	$69,190	$169,697	$366,246	$591,973	$874,204
Uses						
Purchase	$0	$0	$0	$0	$0	$0
Capital Req	$44,810	$13,770	$16,830	$51,740	$44,910	$54,060
Int Senior Debt	$0	$0	$0	$0	$0	$0
Int Junior Debt	$0	$0	$0	$0	$0	$0
Taxes	$10,722	$34,371	$62,671	$110,345	$158,587	$195,659
Dividends(Com)	$0	$0	$0	$0	$0	$0
Dividends(Pref)	$0	$0	$0	$0	$0	$0
Chg In JnDbt	$0	$0	$0	$0	$0	$0
Chng Work Cap	$8,687	$23,111	$25,242	$43,068	$48,643	$41,143
Chng In LTD	$0	$0	$0	$0	$0	$0
Total Uses	$64,219	$71,252	$104,743	$205,153	$252,140	$290,862
Net Cash	($28,453)	($2,062)	$64,955	$161,094	$339,832	$583,342