THE DIFFUSION OF THE INTERNET IN THE REPUBLIC OF TURKEY

Peter Wolcott
University of Nebraska at Omaha

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Introduction

OVERVIEW OF TURKEY

For thousands of years, the land now part of the Republic of Turkey (Figure 1) has been at the crossroads of major trends and forces of civilization. Straddling the boundary between Europe and Asia both geographically and culturally, Turkey is a land of dramatic contrasts. While 98% of the population is Muslim, its government is a secular democracy with a parliamentary system similar to that of many European countries. While its cultural roots are Middle Eastern, this NATO country is currently seeking membership into the European Union. The western portion of the country, centered around Istanbul, offers a cosmopolitan, urban life for over half of Turkey's population. Most of the country's geography, however, consists of pastoral agricultural regions, barren wastelands, serene coastlines, and harsh, mountainous regions.

Figure 1 The Republic of Turkey

History

Today's Istanbul was established as Constantinople, the Eastern capital of the Roman Empire, in AD 324, nearly a thousand years after its founding by Greek colonists. For almost a thousand years the city was the greatest city in the western and near-eastern worlds. In its prime, this capital of Byzantium boasted an order of magnitude greater population than the next largest city in Europe, and a volume of trade that probably exceeded all of Europe put together.

The city fell into decline during the first centuries of the second millenium and was captured by Ottoman Turks in 1261. Over the next four hundred years, the Ottoman Empire expanded rapidly, reaching at its zenith in 1600 as far east as Hungary and as far west as today's Iraq.

The Ottoman Empire established a legacy of government dominance of all aspects of the economy. Highly bureaucratic and protective of the power of the Sultan, the Ottoman Empire checked the emergence of a class of hereditary nobility, and managed the economy in minute detail. Prices of all goods, shipping procedures, the quality of yogurt, the ingredients used in making candles, and the hazard posed by chickens in flourmills were all subject to government decree and regulation [25]. Not surprisingly, such detailed control had a stifling effect on innovation. The Ottoman Empires contribution to the arts and the sciences was minimal. The sense that the government should take care of all the needs of the people was strong.

The Ottoman Empire declined from the late 17th century through the start of the 20th century. Dragged into World War I on the site of the Central Powers, the Ottoman State barely battled the Allied Powers seeking to capture the Dardenelles to a stalemate. Following the armistice at Mudros in 1918, an allied fleet began a military occupation of Istanbul.

In May 1919, Greece landed an army in today's Izmir to re-establish Greek control over lands of classical civilization. Within days, Mustafa Kemal, the country's war hero, organized a nationalist resistance with headquarters in Ankara. One of the first measures by the successful resistance was to separate the temporal power from the religious power, banishing the Sultanate and later the Caliphate from the land.

The Republic of Turkey was founded in 1923 by Kemal, known as Atatürk, the "Father of Turks." Until his death in 1938, Atatürk introduced a number of social, political, linguistic and economic reforms that form the ideological basis for modern Turkey. Known as "Kemalism," the ideology integrates secularism, nationalism, and modernism and views the West as a source of inspiration and support. During World War II, Turkey fought on the side of the Allies. As part of an effort to stem Communist expansion in the countries bordering the Turkish Straits, Turkey joined the North Atlantic Treaty Organization (NATO) in 1952. [55].

Politics

The Republic of Turkey has had a tempestuous political environment which, while democratic, has been characterized by frequent periods of instability and authoritarian rule. From 1923 through 1950, Turkey was governed under one-party rule by the Republican People's Party (CHP) established by Atatürk. The Democratic Party ruled until 1960, when it was overthrown by a military coup. A new constitution was written and civilian rule reinstated in 1961. Between 1961 and 1965 coalition governments ruled Turkey. In 1965 and 1969, the Justice Party (JP), led by the current President of Turkey, Suleyman Demirel, won sizeable majorities in the General National Assembly and ruled alone. Political agitation and violence by left- and right-wing extremests in the late 1960s and early 1970s led to a "coup by memorandum" in 1971. Demirel's government resigned and for the following two years a succession of "above party" governments. Although the CHP emerged as the largest party under the leadership of today's Prime Minister Bulent Ecevit in the 1973 elections, Turkey was ruled by a succession of unstable coalitions from 1973-1980, led alternately by Demirel and Ecevit.

By 1980, Turkey's economy was in steep decline, and domestic political violence was claiming 20 victims per day. The Council of National Security (CNS) forcibly restored order on September 12, banning political activity, dissolving political parties, capturing thousands of terrorists and confiscating large volumes of weapons and ammunition. The CNS began work crafting an

economic austerity program authored principally by Turgut Ozal, Deputy Prime Minister from 1980-1982.

A national referendum approved the current constitution on November 7, 1982 and simultaneously elected the leader of the CNS, General Kenan Evren, to a seven-year term as President. Under this constitution, the Turkish political system is a secular, parliamentary democracy with executive legislative, and judicial branches. The executive branch includes a President who is the chief of state, the Prime Minister who heads the government, and the Council of Ministers (or Cabinet). The legislative branch is the Turkish Grand National Assembly, which consists of 550 deputies elected in national elections. Membership in the GNA is by proportional representation. To participate in the distribution of seats, a party must win at least 10% of the votes cast at the national level [58].

In 1983, political parties were once again permitted to form, provided that none of their leaders had been leaders before 1980. In 1983, the Motherland Party (ANAP), founded by Turgut Ozal obtained a majority in the Grand National Assembly and began implementation of the austerity program. The 1980s were a period of uncharacteristic political stability, as Ozal's party maintained a comfortable majority in the Grand National Assembly until 1989.

Since the late 1980s, governments have changed frequently, including a parliamentary crisis in 1995-6 in which: the leading parties (True Path Party under Tansu Çiller and the CHP under Deniz Baykal) failed to form a coalition; a minority government under Çiller lost a no confidence vote; national elections gave nearly equal representation to the True Path Party, the Motherland Party, and the emerging Islamic-oriented Welfare Party (RP); the mainstream True Path and Motherland Parties failed to form a stable coalition. The current government consists of a coalition between the Democratic Left Party (DSP), the Nationalist Movement Party (MHP) and the Motherland Party (ANAP). Bulent Ecevit is the Prime Minister, and Suleyman Demirel is the current President. A July 25, 1999 headline summarized the state of affairs: "Domestic Politics in Tatters" [24].

Turkey continues to struggle with a number of internal and external issues. Since the mid-1980s, the Kurdistan Workers' Party (PKK) has been trying to establish an independent Kurdish state in southeastern Turkey. Terrorist attacks have been a prominent tool of the organization. In recent years, the government has engaged in a counter-insurgency operations that have reduced violence in the region's urban areas, and resulted in the capture of leading PKK officials, including Abdullah Öcalan and Cevat Soysal.

In 1974, Turkey sent troops to Cyprus to protect the Turkish Cypriot community following the overthrow of the Cypriot Government by mainland Greek officers in the Cypriot national guard. In the fighting that followed, Turkey occupied the northern part of the island, which is now known as the Turkish Republic of Northern Cyprus. The unresolved partitioning of the island remains point of disturbance in Turkey's relationship with the United States and the European Union as well as with Greece.

Economy

In 1923, Atatürk established Turkey's economy as one that was state-directed, near autarkic, and oriented towards import substitution. The economy remained based on these principles until the coup in 1980. In this year the government began to implement an austerity program architected

by Turgut Ozal that was based on a philosophy of greater reliance on market forces, decentralization, export-led development, lower taxes, foreign investment, and privatization. During the 1980s, the Ozal administration was able to rule without coalition partners and made economic reform its priority. These reforms brought Turkey substantial gains, with the gross national product (GNP) enjoying the highest growth rate of any OECD country.

During the 1990s, however, weak and uncertain governments and strong entrenched interests have prevented the country from following through on many of the reforms initiated in the previous decade. The Turkish government's inability to limit expanding fiscal deficits and high transfers to inefficient state economic enterprises led to an economic crisis in 1994 in which the Turkish Lira depreciated 135% against the U.S. dollar in four months, and inflation rose to 33% per month. From 1993 to 1994, the Turkish economy contracted by 11% [54]. An austerity program implemented in April, 1994 helped the economy grow in 1996 and 1997.

Turkey's economy has recovered somewhat during the latter half of the 1990s, although structural reform efforts have had only partial success. The principal economic problem remains inflation, which, in 1998 was 75% annually. The government has failed to seriously improve the efficiency of tax collection and the streamlining of the social security system, both of which are necessary to relieve pressure on the state budget [55].

An area of recent success has been privatization. Although sales of state economic enterprises have been below the targets set for the privatization program, Turkey did sell $3.2 billion in public assets in the first half of 1998, almost as much as in the year 1986-1997 combined [55]. One of the most important enterprises currently in the process of being privatized is Türk Telekom, the state telecommunications company.

Metric	*Value*	*Remarks*
Population	64.57	Million (July 1998 estimate)
Population growth rate	1.6%	1998 Estimate
GDP	190.7	Billions of dollars (1997 est.)
GDP per capita	3,051	Dollars (1997 est.)
Inflation rate	99%	Consumer price index, per annum
Telephones	14.3	Million (1995 est.)
Teledensity	24.11	Main telephone lines per 100 inhabitants (1998)
Cellular subscribers	3,050,000 6,000,000	Subscribers (1998) Subscribers (1999) (expected)
Cellular density	4.7% 8.4%	1998 Estimate 1999 Estimate
Personal computers (PC)	1,114,000	(1997 est.) [20]
PC density	1:56	One PC per 56 individuals.
Literacy rate	82.3%	Age 15 and over can read and write
Infant mortality	38.27	Deaths per 1000 live births (1998 est.)

Table 1Turkey in Statistics. Sources: [20,35,59,61]

Geography and demographics

The Republic of Turkey occupies over 296,000 square miles, slightly more than the state of Texas. Over 60% of its population of 64,566,511 (July 1998 est.) lives in urban areas, chiefly in Istanbul (6.82 million), Ankara (3.69 million), and Izmir (2.61 million) [55,61]. The population is overwhelmingly Muslim (98.8%, mostly Sunni). Eighty percent of the population is ethnically Turkish, while approximately 20% are Kurdish. The latter live predominantly in eastern portion of the country.

Turkey is divided between Europe and Asia. The small European portion, called Thrace, lies to the West of the straits that separate the two continents: the Bosphorous, Sea of Marmara, and Dardanelles. The Asian portion of Turkey is known as Anatolia. It consists of a large, dry Central Plateau which rises to mountains in the East, many of which exceed 10,000 feet in height. The East Black Sea Mountains lie along Turkey's northern Black Sea coast. To the south, the Taurus range parallels the Mediterranean Sea.

Turkey is divided into an unusually large number (80) of first-tier administrative subdivisions, called provinces (iller). These are listed in Table 2.

Adana	Adiyaman	Afyon	Agri	Aksaray
Amasya	Ankara	Antalya	Ardahan	Artvin
Aydin	Balikesir	Bartin	Batman	Bayburt
Bilecik	Bingöl	Bitlis	Bolu	Burdur
Bursa	Çanakkale	Çankiri	Çorum	Denizli
Diyarbakir	Edirne	Elazig	Erzincan	Erzurum
Eskisehir	Gazi Antep	Giresun	Gümüshane	Hakkari
Hatay	Içel	Igdir	Isparta	Istanbul
Izmir	Kahraman Maras	Karabük	Karaman	Kars
Kasttamonu	Kayseri	Kilis	Kirikkale	Kirklareli
Kirsehir	Kocaeli	Konya	Kütahya	Malatya
Manisa	Mardin	Mugla	Mus	Nevsehir
Nigde	Ordu	Osmaniye	Rize	Sakarya
Samsun	Sanli Urfa	Siirt	Sinop	Sirnak
Sivas	Tekirdag	Tokat	Trabzon	Tunceli
Usak	Van	Yalova	Yozgat	Zonguldak

Table 2 Turkish Provinces (iller).

KEY ORGANIZATIONS

Telecommunications Service Providers

Türk Telekom. Türk Telekom is the national telecommunications services provider. It holds a monopoly on the provision of both domestic and international telecommunications lines and services. When it lacks the capability or resources to develop infrastructure, it has entered into licensing or revenue sharing agreements which permit other companies (e.g. GSM cellular phone providers) to build some infrastructure. Until it was reorganized as a private (but solely government owned) company, Türk Telekom was a division of the Ministry of Transport and Telecommunications.

Satko, ComSat, Erenet. Satko, ComSat, and Erenet are three companies licensed by Türk Telekom as Intelsat Business Service providers. They provide international leased lines via satellite in partnership with MCI/WorldCom (ComSat), Sprint (Satko), and Digex (Erenet).

TurkCell & TelSim. In 1993, Türk Telekom signed a contract with two consortia for the provision of GSM cellular phone service: TurkCell (Telekom Finland, Ericsson, Penta, Çukurova) and TelSim (Detecom, Alcatel, Siemens, Teletas, Simko). TurkCel currently enjoys about 67 percent of the cellular market; TelSim, 33 percent.

Government organizations

Ministry of Transport and Telecommunications (MTT). MTT is the Ministry responsible for a broad collection of infrastructure issues, including roads, maritime infrastructure, and telecommunications. Until 1994, the postal and telecommunications services were provided by the Post, Telegraph, and Telephone (PTT) company, which was a state economic enterprise under the control of the Ministry. In 1994, the parliament passed a law that split the post and telecommunications functions, incorporating the telecommunications division as Türk Telekom A.S., a joint stock company whose shares are 100% owned by the government. MTT is responsible for sector policies and regulation through two offices: 1) General Directorate of Communications is the regulatory body for wired communications. 2) General Directorate of Radio Communications is the regulatory body for spectrum management. MTT does not have direct control over the policies (including pricing) and budget of Türk Telekom. The law that provided for the incorporation of Türk Telekom also give MTT the power to transfer Türk Telekom's monopoly privilege to private operators, or to grant licenses for Value Added Network Services (VANS) through the Privatization Administration, an office of the Prime Ministry. The power to evaluate and finalize licensing procedures was cancelled by the Constitutional Court, however [7].

State Planning Office. The State Planning Office is an office of the Prime Ministry responsible for, in particular, setting policies for state spending. It is responsible for reviewing and approving the annual investment programs and five year plans of state, and state owned, organizations, like Türk Telekom. In the mid-1990s, the need to reduce government spending and concurrently to move the Telecommunications regime in the direction of privatization and open markets, the State Planning Office has limited investment allocations to Türk Telekom, forcing it to find alternative funding arrangements, chiefly through revenue sharing arrangements [7].

Turkish Scientific and Technical Research Council (TÜBITAK). TÜBITAK is organization principally responsible for funding scientific and technical research in Turkey. In this respect it is comparable to the United States' National Science Foundation. Unlike the NSF, however, it has its own research centers. TÜBITAK was an early partner with the Middle East Technical University (METU) in setting up the initial Internet connections in Turkey. TÜBITAK got out of the Internet business in 1996, although it continues to fund university connections through one of its research centers, the National Institutional Network and Information Association (ULAKBIM).

National Institutional Network and Information Association (ULAKBIM). ULAKBIM was formed as a TÜBITAK research center in 1996 with responsibility for (a) creating and maintaining a Turkish national academic network, and (b) managing the Central Library of the Higher Education Council at a time when libraries are making increasing use of electronic information technologies. ULAKBIM's goal has been to provide basic connectivity to all Turkish universities, a goal that it reached within three years of its inception through the ULAKNET network [65].

Electronic Trade Commission (ETKK). The Electronic Trade Commission was formed in 1997 to serve as a central coordination point for a number of studies on electronic commerce that were being carried out in Turkey. Technical, legal, and financial working groups coordinated studies in each of these areas and made consolidated recommendations in 1998 [26].

Academic organizations

Middle East Technical University (METU). Located in Ankara, METU played a leading role in the establishment of the Internet in Turkey, for many years serving as the nascent networks main Internet Service Provider. For a short time it was a member of the consortium chosen by Türk Telekom to build Turkey's first Internet backbone. By design, its role has been decreasing in recent years as commercial providers, Türk Telekom, and government organizations assume responsibility for both the operation and planning of the Internet. METU continues to hold responsibility for the country's Domain Name Service, managing the .tr domain. Many Internet Service Providers (ISPs) employ former METU students.

Bilkent University. Located in Ankara, Bilkent University has been prominent in the planning, implementation, and promotion of the Internet in Turkey. One of the principal champions of the Internet in Turkey, Mustafa Akgül, is affiliated with Bilkent and is the organizer of the annual INET-TR conference, which focuses on Turkish Internet issues.

Ege University. Located in Izmir, Ege University was particularly instrumental in establishing Turkey's first wide area network with links to the international community. From this university, the Turkish BITNET (TUVAKA) had its international connection to EARN.

Istanbul Technical University. Istanbul Technical University played a leading role in connecting Turkish universities to the Turkish BITNET. Later, as TCP/IP emerged as a leading protocol, individuals at ITU worked on converting the Turkish BITNET over to TCP/IP protocol suite, experimenting with TCP/IP over IBM's Systems Network Architecture (SNA).

Other

Internet Executive Council. The Internet Executive Council is a body that was organized by the Undersecretary of the Ministry of Transport and Telecommunications, H. Tahir Dengiz. Formed in 1997, it had its first meeting in January, 1998. The council consists of representatives from key government, commercial, and academic organizations. Meeting every month, the council conducts and sponsors detailed discussions and reports about every aspect of the Internet in Turkey. On a regular basis it makes recommendations regarding such matters as pricing, backbone architecture, cyber law, and so forth. In general, it provides a forum where all voices can be heard. The quasi-public nature of the forum makes organizations like the ministries and Türk Telekom more accountable to the public.

Networks in Turkey

A BRIEF HISTORY OF TELECOMMUNICATIONS
The growth of networking in Turkey is closely associated with the expansion of telecommunications services, which began a rapid advance during the 1980s. From the installation of the first telephone exchange in Turkey in 1909 through 1980, telephone line density had grown to only approximately 2.5 lines per 100 inhabitants. There were nearly as many people waiting for telephone lines as there were lines (1.5 million), yet the number of lines was growing at the very modest rate of 50,000 lines per year. Over 72% of Turkey's 40,000 villages had no telephone service [6].

Growth of telephone subscriber lines

The austerity program crafted by Turgut Ozal and later implemented by his administration during the 1980s placed a high value on expansion of telecommunications services, which the authors viewed as a vital foundation to support the expanded and vibrant economy envisioned. This emphasis on telecommunications was motivated from three principal quarters. First, the Army demanded a strong telecommunications infrastructure. The second largest army of NATO did not have a reliable communication infrastructure. Second, the open economy espoused by Ozal and others required a quality telecommunications infrastructure. Third, during the early 1980s, the instability in Lebanon was causing many companies to look for safer havens in the Middle East. The lack of a good telecommunications infrastructure was a barrier to attracting these companies [18].

A Master Plan for Telecommunications was drawn up, which emphasized the following themes [6]:

- Turkey should expand its telecommunications network in the shortest possible time in order to realize rapid economic development.
- New services and the latest technologies should be introduced as quickly as possible.
- The telephone network should be converted from an analog system to a completely digital system.
- To speed up the expansion of telecommunications services, the local telecommunications sector should be pushed towards a genuinely competitive environment.

The effects of the Master Plan and its implementation soon became evident. Between 1982 and 1986, the total capacity of telephone exchanges increased by 83%. The number of telephone subscribers grew by 80%, and the number of villages having telephone service grew by 162%. At the same time, the telephone company began deploying a variety of new communications services. In 1986 alone Türk Telekom introduced an experimental packet switched (X.25) data network, cellular mobile radio telephone system-NMT, radio paging, and fiber optic cable [4]. To facilitate the connection of rural villages far removed from existing lines, Türk Telekom in 1984 began installing rural-type multi-access microwave radio systems through a contract signed with Canada's SRT Company, which also provided a license to Turkish manufacturer TELETAS to produce the necessary equipment [6].

To continue this expansion, Turkey formulated, in 1986, a Network Expansion Plan, which proposed substantial efforts over only a two year time to decrease the time customers had to wait for new lines, increase to 100% the number of villages with telephone service, and increase the telephone density to 99%. Between 1984 and 1993, annual increases in the capacity of telephone exchanges was typically between 15-20%. In 1987, the year of most rapid expansion, the capacity of Turkish telephone exchanges increased by 44.7% [5]. By 1988, all Turkish villages had telephone service.

Satellite communications

Turkey makes significant use of satellite communications for international telephone, TV broadcast, and data communications. Not only is Turkey a shareholder member of the International Satellite Telecommunications Organization (INTELSAT) and European Telecommunications Satellite Organization (EUTELSAT), but it also is one of sixteen nations of the world with its own national satellite communications system [6].

The first INTELSAT earth station AKA-1 went into service in 1979. In 1985, the EUTELSAT earth station AKA-2 begain operation with a capacity of 1920 telephone circuits and three TV channels. In 1988, the third earth station, AKA-3 (INTELSAT) enabled communications service between Turkey and Australia, Japan, the United Arab Emirates, People's Republic of China, South Korea, Singapore, Taiwan, and forty other countries under the primary beam paths in the Indian Ocean. Turkey's maritime communications takes place to a large extent via INMARSAT earth stations ATA-1 and ATA-2 [6].

On August 11, 1994, Turkey's first satellite, TURKSAT-IB, was successfully placed into orbit at 42 degrees East by Türk Telekom's partner, Aerospatile Company. The launch was the outcome of Türk Telekom's *Satcom Master Plan for the First Generation National Communications Satellites*, drafted in 1990. The Plan was driven by a number of objectives:

- Increase the availability of data communications systems, slow scanned TV programs, and remote control of certain systems to a larger segment of the economy, including hotels, airline reservation agents, large stores, and newspapers' remote printing offices;
- Enable Turkish embassies and consulates to set up connections with Ankara;
- Provide high quality communications facilities for the armed forces and security organizations;
- Expand communications services to the Eastern and Southeastern areas of the country.

- Support the broadcast of Turkish TV programming to Turkish citizens living in European and Central Asian countries.

In 1996, Turkey launched TURKSAT-1C, designed to provide Western Coverage to Central Europe and Turkey, and Eastern Coverage to Central Asia and Turkey. Following this success, Türk Telekom formed a joint venture in 1996 with the Aerospatiale Company (now Alcatel Space Industries) to launch a new generation of TURKSAT satellites. The first result of the joint venture, Eurasiasat-1 (formerly called TURKSAT-2A) is to be launched in early 2000 [29,47,48]. The satellite provides fixed coverage to two fixed coverage zones in Europe, the Middle East, and Asia, and two mobile coverage zones [28,57].

International communications and fiber optic cable systems

Turkey uses a number of undersea cable systems that link the East with the West, including: MAT-2, ODIN, TIOJA, TAT-8, P TAT-1, TAT-9, TAT-10, TAT-12/13, CATAT-3, COLOMBUS-2, APC, TPC-5, PAC RIM West. It is also a termination point for a number of submarine cables. KAFOS and ITUR are two submarine fiber optic cables who creation arose out of a cooperative arrangement between countries bordering the Black Sea, called the Black Sea Economic Cooperation (BSEC), which places great emphasis on the development of telecommunications infrastructure. Turkey also has capacity reserved on the SEA-ME-WE 3 and FLAG submarine fiber optic cable projects. The international terrestrial and submarine cables terminating in Turkey are shown in Figure 2.

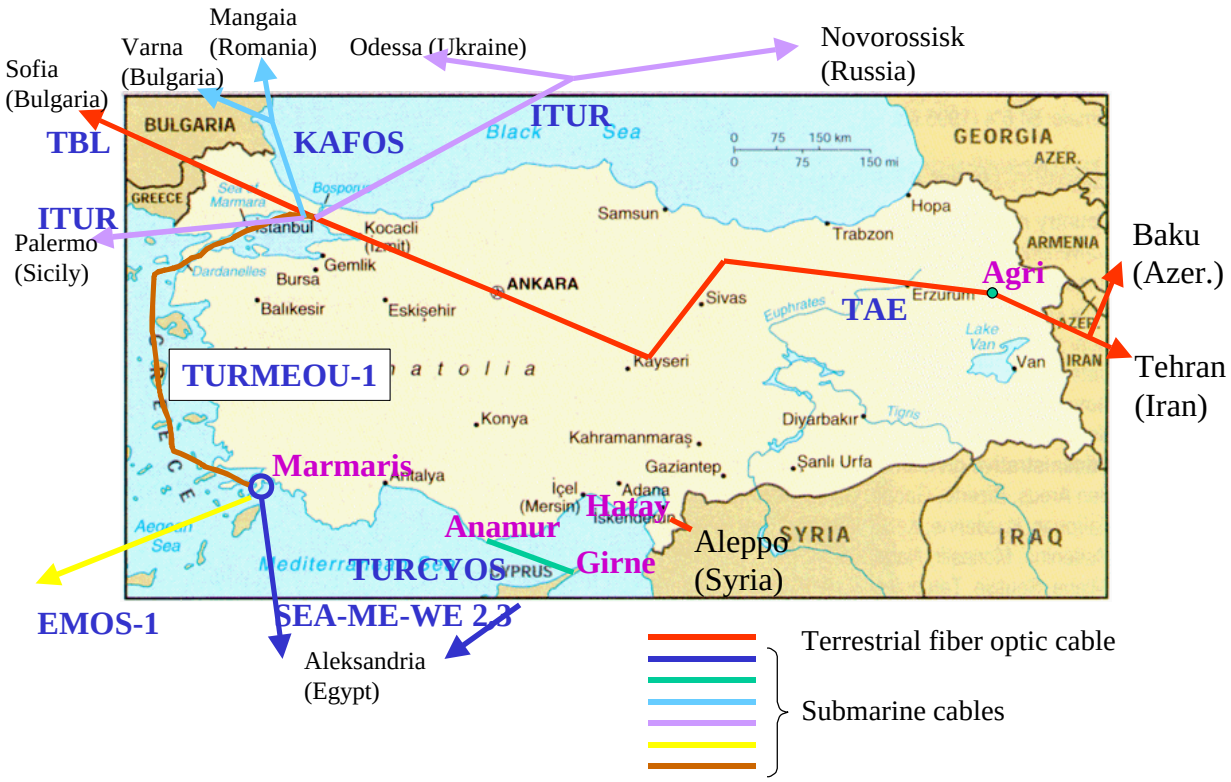

Figure 2 Terrestrial and Submarine Cables Terminating in Turkey.
Source: [2,3,39]

Mobile Telephone Systems

While mobile telephone use dates back to 1986 in Turkey, the market has experienced astounding growth within the last 2-3 years in particular. The analog Nordic Mobile Telephone (NMT) network was introduced in Turkey in 1986. From the initial 2000-line capacity, this network grew to 150,000 customers in 79 provincial centers and towns in 1997. The greatest dynamic in the mobile phone market began, however, when Turkey chose in 1990 GSM as its mobile phone standard, and licensed two consortia, TurkCell and TelSim, to offer services. GSM service became available in 1993 [31]. TurkCell, which today enjoys approximately 67% of the Turkish market, is owned by Çukurova Holding (51%), Telecom Finland (34%), and Ericsson (15%). TelSim is owned by Rumeli Holding (89%), and Siemens, Detecom, and Alcatel (11%). The choice of GSM was closely tied to Turkey's efforts to become a member of the European Union. Thanks to the Turkish love of verbal communication, quality infrastructure, favorable pricing policies including charges only for outbound calls, and the emergence of cellular phones as a "must have" accessory for a growing fraction of the population, the number of GSM subscribers in Turkey has grown exponentially since 1994 (Figure 3) [35].

The legal arrangements under which organizations other than Türk Telekom could provide cellular phone service were not easy to establish. In order to preserve the Constitutional mandate that the government provide and operate telecommunications services, Türk Telekom established a revenue-sharing agreement under which TurkCell and TelSim could offer GSM service. Only after constitutional and security issues were resolved were the companies formally licensed, on

April 27, 1998 [6,19]. The position of Türk Telekom was that, although the Constitution required the government to provide communications services, it was not a violation for other organizations to provide services provided they did so under license from the government. Under this license, the GSM providers are permitted broad leeway in providing service and in pricing. However, when they need to build terrestrial infrastructure, for example to lay an E1 cable between two ground stations, they must obtain permission from Türk Telekom. Turk Telekom is likely to grant that permission only if it is unable to provide the line itself.

In 2000, the Ministry of Transport and Telecommunications is likely to award two additional GSM licenses in the 1800 MHz frequency. The Ministry plans to award one of these to Türk Telekom as a way of increasing its value prior to being privatized [19].

From the perspective of the Internet, the growth and dynamic of the cellular phone market is significant for at least three reasons. First, it is indicative of a general enthusiasm among the Turkish population for new communications technologies that offer increased capability, flexibility, and, in many cases, make a fashion statement. Second, the competitiveness and technological capability of the existing companies makes it likely that they will assimilate technologies with greater capacities and features, as they are developed throughout the GSM world at large. In particular, it is likely that in the near future Turkish companies will be offering services of up to 2 Mbps GSM connections. With this capacity, not only do video pagers and advanced telephone services become practical, but so also do wireless connections to the Internet. It would not be at all surprising to see close partnerships between the GSM providers and Internet Service Providers, or perhaps the expansion of GSM providers' services directly into the Internet market.

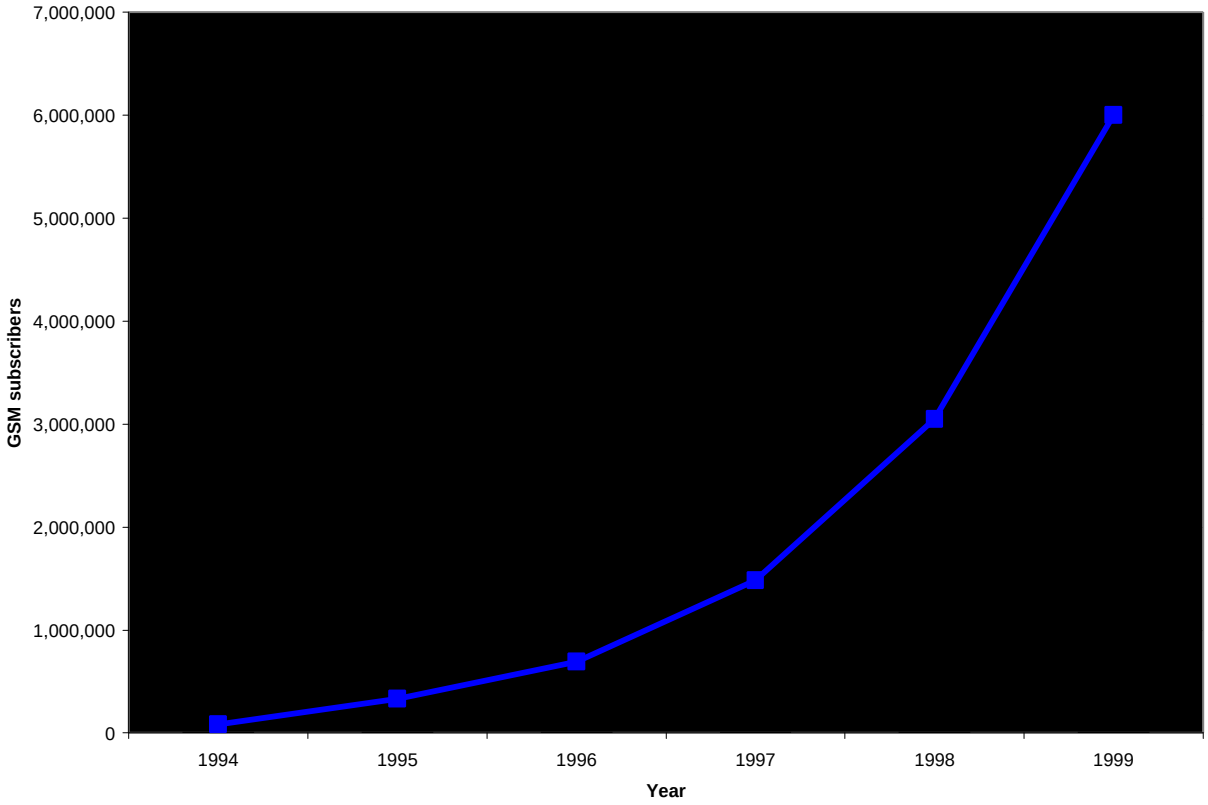

Figure 3 GSM Subscribers in Turkey.
Sources: [6,35]

Pre-Internet data networks

The growth of data networks has been driven by many of the same factors that fueled the growth in telephone and broadcast communications networks. The economic policies crafted after the 1980 coup established the importance of creating an infrastructure to support the flow of information, both voice and data, throughout the economy. In 1985, Türk Telekom introduced the first switched data network (X.21), with a capacity of 2000 subscribers. In 1986, an experimental X.25 packet-switched data network was built with one node in Istanbul with four Packet Assemble/Disassemble (PAD) devices [6]. This packet switched network provided a gateway to GTE's Telenet, establishing for the first time commercial data communication network for Turkish users.

In 1986, Türk Telekom opened a tender for the creation of an X.25 packet-switched network called TURPAK. The number of TURPAK users grew from 2100 in 1992 to 9100 in 1998 [6].

At the same time Türk Telekom was developing its packet-switched network, Turkish universities were establishing a wide area network support data communications among Turkish universities and academic institutions in Europe. In 1986, a BITNET connection was established between Ege University in Izmir and the European Academic and Research Network (EARN) via Pisa, Italy, through a 9600 bps leased line [44,45,50]. The network was named the Turkish Network of Universities and Research Institutes (TÜVAKA) and was administered by a committee

consisting of representatives of each participating organization. Yildiz Technical University (Istanbul) and Anatolia University constituted the main nodes on the TÜVAKA backbone. All together, twelve universities were connected through one of these three backbone nodes, including the Middle East Technical University (Ankara), Bosphorous University (Istanbul), and TÜBITAK (Turkish Scientific and Research Council). By 1992, membership had grown to 30 universities and research institutes. Most of the members were universities, although the Higher Education Council and four research institutes were also connected The network supported numerous listserves on topics ranging from networking to poetry with perhaps 3,000 members (both Turkish and foreign) subscribed [50]. By early 1995, nearly half of Turkey's 52 universities were connected, as shown in Figure 4. Most of the connections were 19.2-28.8 leased lines or X.25 lines. Although it continued to be used and expanded until superceded by ULAKNET (see below) in 1997-1998, TÜVAKA was experiencing serious technical and administrative difficulties. The organization was a volunteer one, with a lack of funds for bandwidth and equipment, lack of widely-deployed know-how, and no mechanism by which to establish standards regarding the hardware and software to be used. Moreover, the technologies themselves were older and proprietary hardware and software such as the NJE protocols [41,45]. The connection from Ege University was changed and upgraded to a 64 Kbps link to Bonn, Germany, but as in other parts of the world, BITNET was giving way to the Internet.

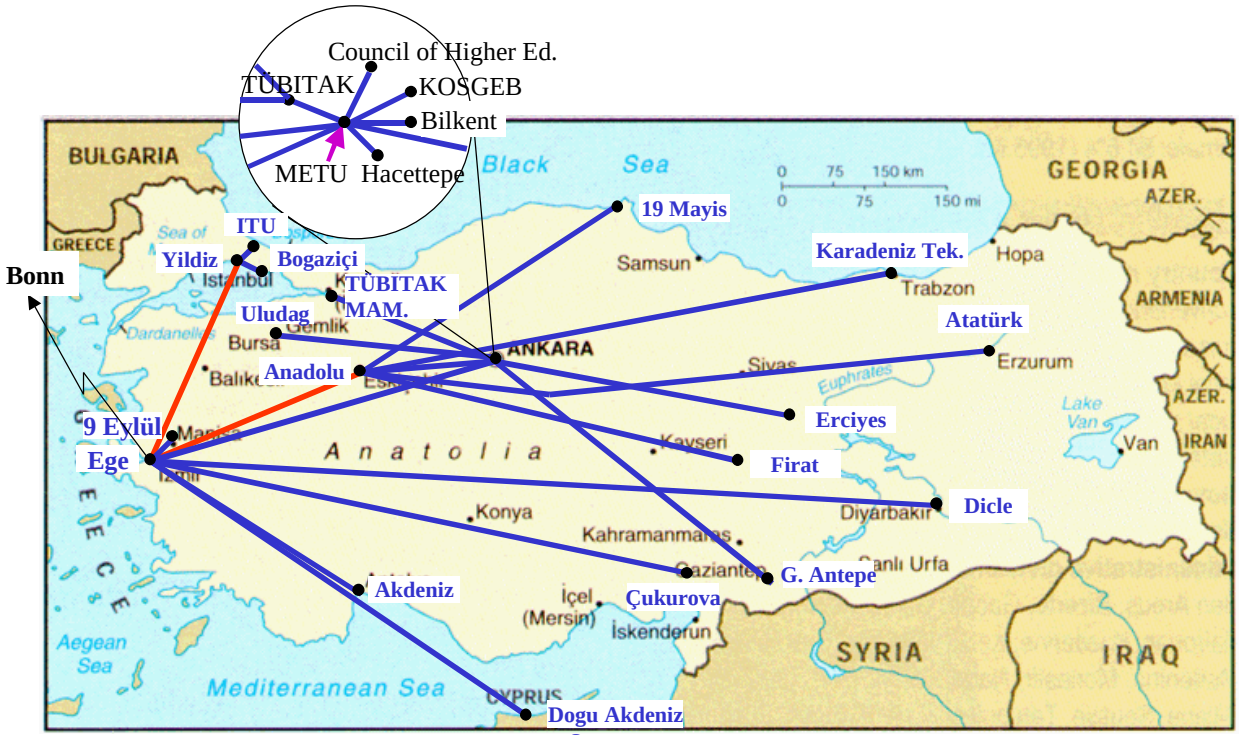

Figure 4 TUVAKA topology (March, 1995).
Source: [45]

THE ORIGIN OF THE TURKISH INTERNET

The first activities to establish an IP based network started in 1989. The group of network managers of TÜVAKA nodes, which was called NAD-TR (Node Administrators of Turkey), first

proposed such a network instead of BITNET in the Fall of 1989 during an Istanbul meeting. The decision of the technical group was proposed to TÜVAKA and the first pilot studies were initiated between METU and Bilkent University in 1990. During this time, the structure of the IP based naming system was also determined by the TUVAKA. Among three or four proposals, TÜVAKA accepted one proposing the use of a second-level domain system similar to the generic top-level domains. Initially, five second level domains were established (com.tr, edu.tr, gov.tr, mil.tr, org.tr). Later, five more second level domains were added (k12.tr, net.tr, bbs.tr, gen.tr, nom.tr).

In 1991, Mustafa Akgül of Bilkent University began a discussion list on TÜVAKA on the topic of the TCP/IP protocols. The list generated a great deal of discussion regarding protocols, topologies, etc. In 1991 the initial request for connection to the Internet was sent to NSFNET. By 1992, five universities (Ege University, Bilkent University, Istanbul Technical University, Middle East Technical University (METU), and Yildiz Technical University) had sufficient TCP/IP connectivity to communicate amongst themselves, but no international link to the Internet had been established [50]. The first international connection was a short-lived IP connection over X.25 to RIPE in October, 1992.

In 1993, METU and TÜBITAK established a dedicated 64 Kbps Internet connection between METU and NSF with funding from the State Planning Organization. The decision to connect to NSF rather than CERN was based on traffic analysis of the EARN/BITNET connection, which showed that about 80% of the traffic entering Turkey came from the United States, and most of the international traffic originating in Turkey also terminated in the United States. The connection with NSF marked the official birth of the Internet in Turkey. At the same time, METU and TÜBITAK also formed an informal organization known as TR-NET to promote the use of Internet technologies throughout Turkey [45]. Over time, this name has been used also for the first Internet network in Turkey, as well as for an Internet Service Provider currently operating in Ankara.

Users and user organizations could connect to TR-NET through leased lines, X.25 connections, and dial-up. The leased line topology is shown in Figure 5. In 1994, TÜBITAK and METU began issuing accounts. The number of users grew rapidly. By early 1995, the number of hosts had grown to nearly 3,000 and the total number of daily users was estimated to be between 10-15,000. Of these users, more than 1300 had individual connections; others access TR-NET through more than 100 connected institutions. Personal applications were being received at the rate of about 200 per month [45]. At these levels of usage, the international link to NSF was saturated. The link was later upgraded to 128 Kbps.

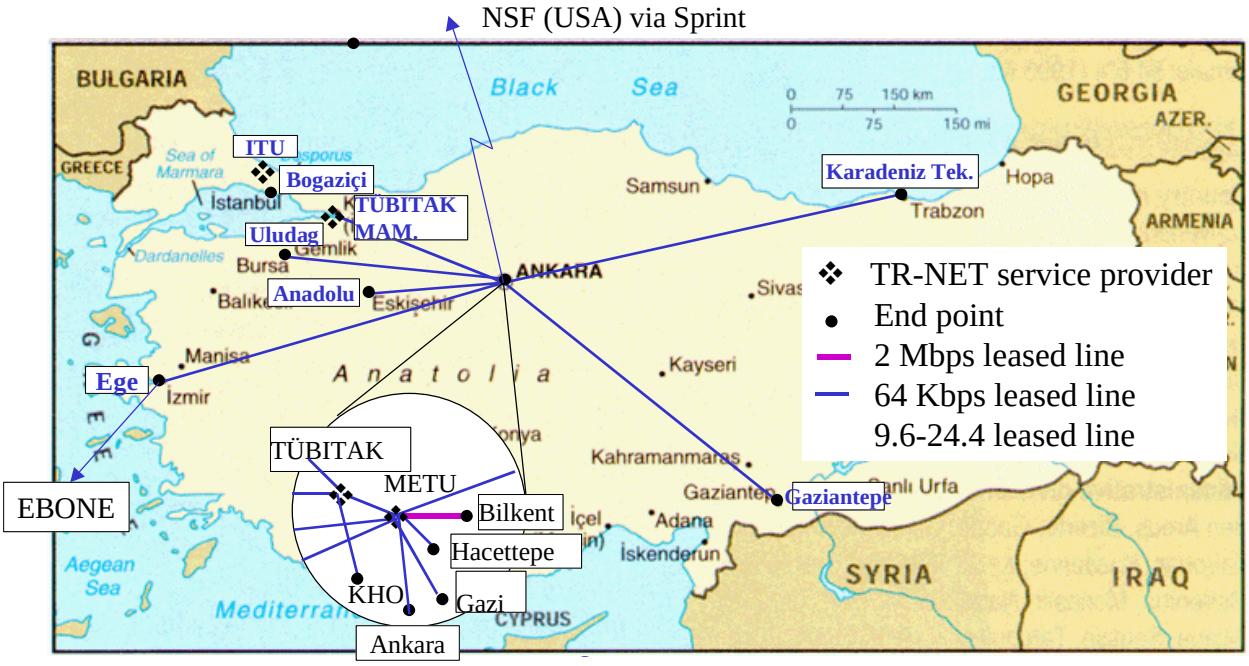

Figure 5 Leased-Line Connections to TR-NET (March 1995).
Source: [45]

It was clear that the informal association between TÜBITAK and METU was an insufficient foundation on which to build broader diffusion of the Internet in Turkey. Although TR-NET was charging institutions and individuals for their connections, these charges were low. Major funding for TR-NET's infrastructure came from the METU and TÜBITAK annual budgets.

To address the growth issues, individuals at TR-NET in 1995 proposed a plan consisting of technical, organizational, and funding components [45]. The technical component envisioned a triangular backbone, connecting Ankara, Istanbul, and Izmir. The organizational component envisioned a layer of service providing organizations at each of the three backbone nodes who would provide Internet information, connectivity, and consulting services to both institutional and individual end users. Users would not connect directly to the backbone. At the core of the system would be a National Computer Networks Center to provide a central point at which to operate and maintain the backbone, plan future developments, and coordinate international representation and relations.

The funding model envisioned government support to build the backbone and provide operating funds in the short term. Service provider organizations would charge users and, in turn, would be charged for the use of the backbone. As the volume of use, and hence income, increased, the government would gradually reduce its funding until the entire network became self supporting. Özgit and others envisioned that this would take 2-3 years.

As METU and TÜBITAK approached government funding organizations and Türk Telekom with this plan, matters became complicated. Seeking to gain a portion of the anticipated revenue from the Internet model TÜBITAK and METU were proposing, some companies from Istanbul approached TÜBITAK and convinced TÜBITAK to form a corporation with several of them.

Meanwhile, individuals at METU maintained their position that TR-NET should receive the official designation as the National Computer Networks Center [45].

Until 1995, Türk Telekom had taken a rather relaxed attitude towards the Internet, even though one might argue that the Internet represented a new form of communications that should be under Türk Telekom's jurisdiction. This attitude was in part a result of a lack of awareness on Türk Telekom's part of the significance of the Internet, and part a function of the embryonic, experimental nature of the networks in Turkey. When TÜBITAK and METU approached Türk Telekom in 1995, however, the company began to take a more serious interest in the Internet. Questions were raised about the constitutionality of having organizations other than Türk Telekom provide services; moreover, the previous 15 years of telecommunications development had created a precedent of Türk Telekom's expanding services into emerging areas.

Faced with divergence of opinion between the two principal TR-NET organizations from which it was getting guidance, Türk Telekom had to define a course for itself. One requirement was that the backbone should be provided under an arrangement that would preserve Türk Telekom's mandate to be the sole provider of communications services. At the same time, Türk Telekom did not have in-house the resources or expertise to manage a large Internet service provider operation to hundreds of thousands of end-users. The model that emerged was one in which Türk Telekom owned the backbone; end-users would be served by service provider organizations that would be required to connect to the backbone. Türk Telekom's universal service philosophy further drove its interest in being both a wholesale and a retail provider of Internet services. Internet service providers would have to route their international traffic through TURNET's international gateways, however; independent satellite links were not permitted.

The prospects of finding the funds within its own budget to build a backbone were almost non-existent, however. Because it is a government organization, Türk Telekom returns all of its annual revenue to the government. In turn, Türk Telekom receives an annual budget from the state treasury, as outlined by the State Planning Organization. In short, any money to be used for investment must be approved by the Treasury and the State Planning Organization and be explicitly included in Türk Telekom's budget. The company is not permitted to borrow money or sell equity to finance investments as private companies do [14]. In 1995, the year following the introduction of a government austerity program, the prospects of coaxing funding for was what still a technology virtually unknown to policy-makers, the press, and the general population were vanishingly small.

Given the circumstances, Türk Telekom fell back on the only alternative model it knew for financing new development: revenue sharing. Under a revenue sharing model, Türk Telekom partners with an organization to undertake a development project. The partner provides all of the investment capital, and often a portion of the expertise. Türk Telekom and the partner divide the revenue from the project in negotiated proportions. The revenue portion Türk Telekom receives is very attractive because it does not need to be passed along to the state treasury. Türk Telekom has control over these funds and, for the most part, spend them as it wishes.

On September 28, 1995, Türk Telekom announced a tender for the creation of an Internet backbone for Turkey. An auction followed in October and November, and the winner was announced at the annual Internet conference on November 16 same year [18] . Initially, there were four bidders:

1. MCI, partnering with Likom, a Turkish software company, and Nurol
2. IBM
3. ITD Laserex, an Israeli company
4. A consortium consisting of Satko, METU, and GlobalOne, the international consortium between Sprint, Deutsche Telekom, and France Telecom.

The events of the spring of 1995 had left METU in an awkward position. While it had been one of the drivers of the Internet, it was playing no direct role in the direction Türk Telekom was heading. At the same time, it certainly did not have the resources to bid for the backbone construction project. It could either get out of the Internet business, or join with a partner to place joint bid on Türk Telekom's tender. It joined with GlobalOne and Satko.

TURNET

The tender was to be awarded through a two-stage process. First, the participating companies would submit closed bids, which would be opened at the same time. Second, Türk Telekom would conduct an open auction, beginning with a revenue-sharing level equal to the most favorable bid. IBM did not accept some of the conditions of Türk Telekom and was eliminated from the tender. The most favorable bid offered Türk Telekom 50% of revenue from the new network.

Türk Telekom conducted the auction by requiring the remaining participants, in each round, to drop out, or offer .1% more than the current leading offer. Once initiated, the auction moved very quickly. Within hours, the leading bid raced from 50% to 70%. MCI/Likom dropped out first; ITD dropped out second. At the Internet conference at Bilkent, the consortium of GlobalOne, Satko, and METU was announced as the winner, with an offer of 70.2%. The TURNET contract was signed on March 1, 1996 for a seven year term. Each year, Türk Telekom's share was to increase, reaching 79.6% at the end of the seventh year [18].

In the spring of 1996, the consortium began to unravel. The consortium had been created with the understanding that the three partners would split the revenue evenly. Once the award had been granted, however, GlobalOne and Satko sought to change the terms of the agreement. During the spring of 1996, METU left the consortium. GlobalOne and Satko carried out the project alone. The consortium initially invested $1.5 million. TURNET began offering service in October, 1996.

TURNET topology

Once the award was made to the GlobalOne consortium, discussions began on topology. METU had been included in the consortium for its technical expertise. Not surprisingly, the topology proposed by METU in the spring of 1995 [45] was chosen. The topology was simple, laid out as a triangle with corners in Istanbul, Ankara, and Izmir, as shown in Figure 6. The backbone itself consisted of three 2 Mbps links, and two international connections, each 512 Kbps.

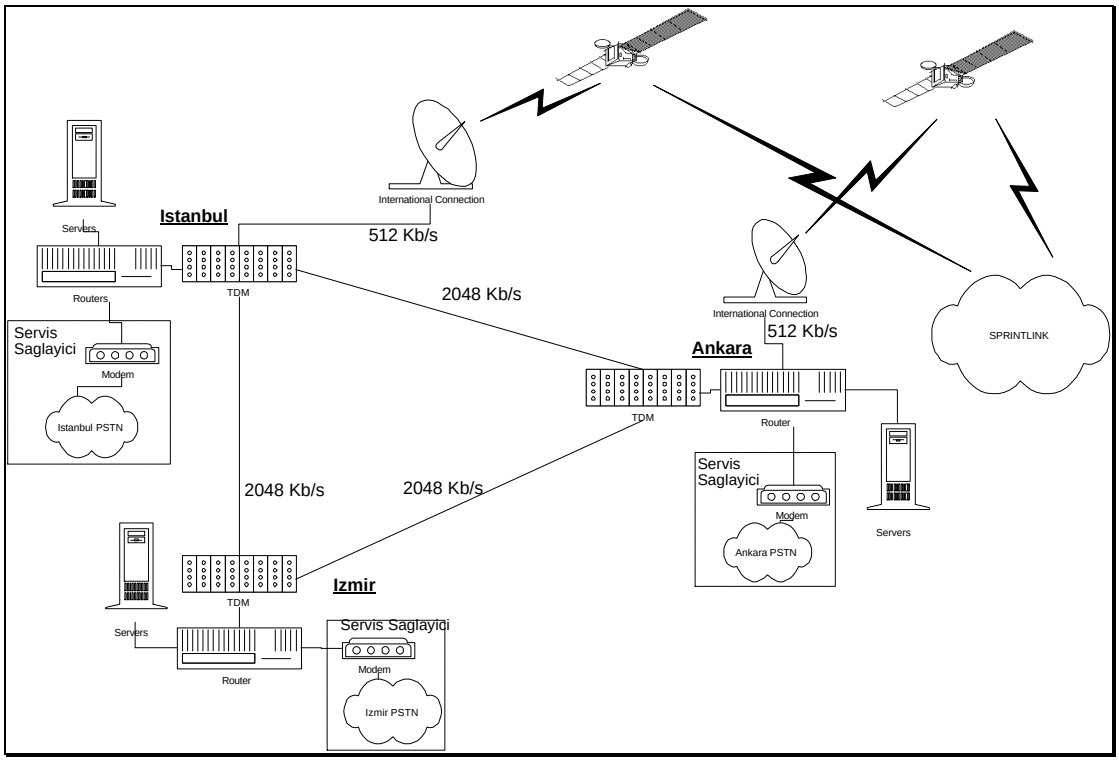

Figure 6 TURNET Topology (Oct. 1996)

Since TURNET's inception, the backbone has been upgraded, but not significantly. In 1997, Ankara's link to Sprint was upgraded to 2 Mbps, and an additional 2 Mbps link to Sprint was established from Istanbul. A review of TURNET routers in September, 1999, reveals the domestic and international backbone links and capacities shown in Figure 7. While the backbone links terminating in Izmir have the same capacity as they did three years ago (even though traffic regularly reaches maximum capacity from about 9am until 4pm), the capacity between Istanbul and Ankara has been increased by 300% through the addition of two new frame relay lines, with 2 Mbps and 4 Mbps capacity. The international capacity has also increased substantially so that now Istanbul and Ankara each have three 2 Mbps fiber optic links to AT&T, Sprint, and MCI/Worldcom, all terminating in the United States.

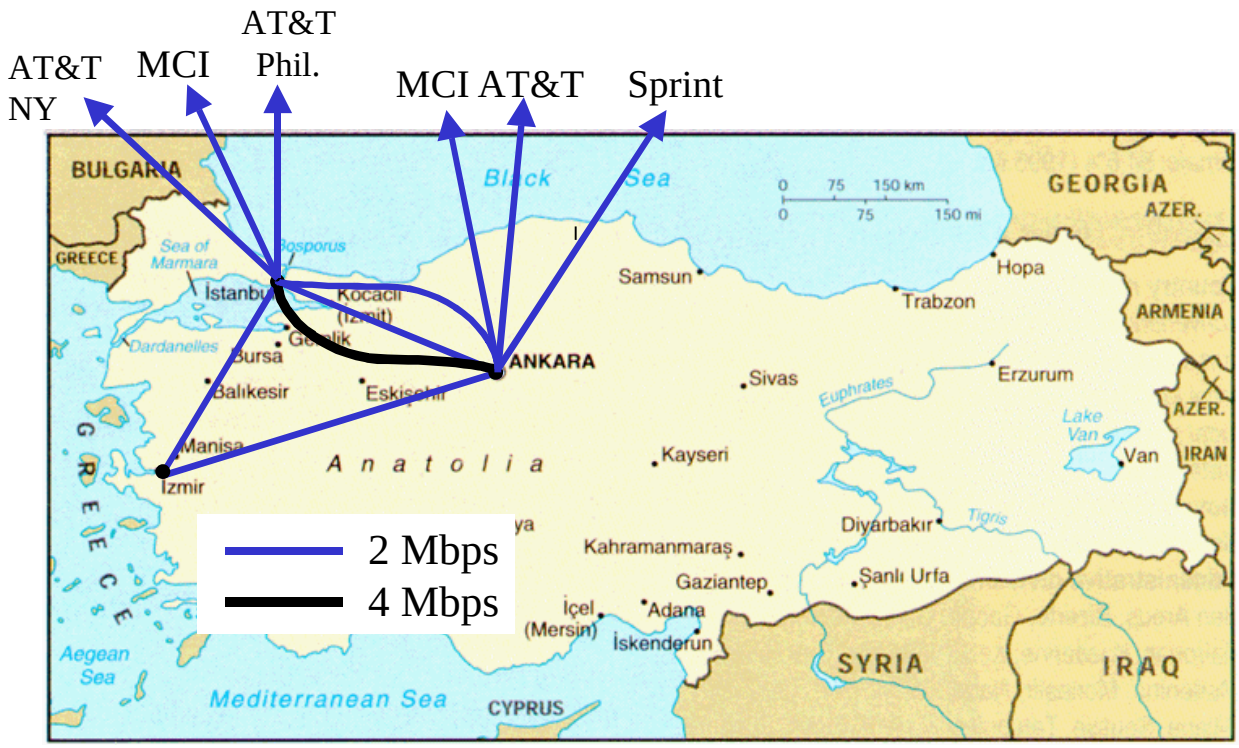

Figure 7 TURNET Backbone (Sept., 1999). Source: [64]

Emergence of Internet service providers

Once TURNET went on-line in the fall of 1996, the Internet Service Provider (ISP) market exploded. By some accounts, 1997 was "chaotic." The media aired many (sometimes heated) panel discussions and interviews by and with individuals involved in developing the Internet in Turkey. Many ISPs formed and began operations. A number of ideas were floated for managing and promoting the Internet in Turkey. One of those that became a reality was the creation of the Internet Executive Council, described earlier. Whatever term one applies, 1997 marked the emergence of the Internet in Turkey as a widely available service. By the end of the first year of operation, the total number of ISPs leasing connections to TURNET was 69. They connected to TURNET via one of the three backbone nodes, as shown in Appendix B and in Table 3.

Between September, 1997 and May, 1999, the dynamism of the ISP market and some constraints were apparent. The aggregate capacity of connections to the backbone increased by 164%, but the number of ISPs increased by only 16%. Of the 69 ISPs in operation after TURNET's first year, 15 (22%) failed to survive until May, 1999. During the same period, 26 new ISPs came into existence.

The barriers to entry for ISPs are low. There are no licensing fees to speak of. The costs are in hardware, connection fees, personnel, and operating costs. The technical barriers to entry are in fact lower in Turkey than in other countries because of the requirement that all ISPs must connect to TURNET. A new ISP does not need to acquire for itself an international connection; it merely needs to obtain a leased line from Türk Telekom to TURNET, a much simpler and cheaper proposition. Because the ISP market is unregulated, ISPs are free to offer whatever services they

wish and charge whatever price they can. The market is as dynamic in Turkey as in any other country. Competition for customers is intense and has led to some creative marketing strategies. For example, VestelNet, the ISP owned by a leading manufacturer of electronic equipment, in May, 1999 began offering users a free personal computer when they sign up for three years of service at $30/month. The company has been signing up new users at the rate of 50,000 per month.

TURNET node	Number of ISPs (Sept. 1997)	Number of ISPs (May, 1999)
Ankara	17	25
Istanbul	45	49
Izmir	7	6
Total	**69**	**80**[8]

Aggregate Connectivity (Mbps)	**12.5**	**33**
Aggregate Domestic Bandwidth (Mbps)	**6**	**12**
Aggregate International Bandwidth (Mbps)	**1**	**12**

Table 3 ISPs Connecting to TURNET

There remain two principal constraints on ISPs. First, the backbone capacity of TURNET has not increased at a rate commensurate with the growth in ISP connectivity. While the overall capacity of the backbone doubled from 1996 to 1999, the aggregate capacity of ISP connections increased by 300% from 1997 to 1999 alone.

Second, ISPs have been restricted in their ability to acquire additional infrastructure, particularly international connectivity. For one thing, international connections had to be acquired through Türk Telekom. For another, Türk Telekom had clear policies prohibiting a company from using the links to carry third-party data. At the outset of TURNET, ISPs had little choice but to rely on the international connectivity provided by TURNET. In 1996 the company became involved in some lawsuits that sought to prevent companies from establishing international links of their own. As Internet services have became more popular, however, Türk Telekom has eased some of these restrictions. In 1997, Türk Telekom opened up an avenue through which many Turkish organizations have obtained international links for Internet traffic. It licensed three companies as

[8] Two ISPs (AKBANK T.A.S. and RAKSNET Iletisim Teknoloji ve Tic. A.S.) have ISPs in all three backbone node cities. If these are counted once, instead of three times, the total is 76. All other ISPs connect to only one of the three backbone nodes.

so-called International Business Service (IBS) providers. These companies provide satellite connectivity to some of the major international connectivity providers (e.g. Superonline, TurkNoktaNet, EscortNet). The links terminate in the United States. The companies are:

- Comsat (connects to MCI/Worldcom)
- Erenet (connects to Digex)
- Satko (connects to Sprint)

There is no legal reason why other companies couldn't be licensed as IBSs, and some companies are apparently able to work out arrangements outside of the IBS framework. GlobalOne, for example, has more recently become a provider of international links in Turkey outside of the TURNET links. These companies are licensed under an agreement in which a substantial fraction of the cost of the link goes to Türk Telekom. While these were the only licensed private providers of international links, during the last two years there have been numerous illegal providers of satellite connectivity who have undercut the prices of legitimate providers by not paying Türk Telekom a share of the revenue. Today, all of the largest ISPs and several universities have their own international satellite links, in addition to their connection to TURNET. Some ISPs have direct international capacity that is nearly equivalent to TURNET's total international capacity. The total international connectivity through direct satellite links is, by some estimates, about 50 Mbps.

In spite of the relaxation of restrictions on international connectivity, the international lines remain a bottleneck for ISPs. Not only is the TURNET bandwidth limited, the cost is high. The cost of a 1 Mbps link from Turkey to the United States costs 3-8 times as much as a comparable link from Europe to the United States.

Costs to ISPs remain higher than they might be. Türk Telekom has a monopoly over connectivity. However, it is sensitive to political and popular pressure in its pricing. Oddly enough, the initial cost of access to TURNET ($4,000/month for a 64 Kbps line) was lower than that originally proposed by Turk Telekom ($6,000/month), which was lower than that originally proposed by the GlobalOne consortium, which was seeking to compensate for the lower percentage of revenue it would receive. When word of the price was leaked to the press, popular and political pressure resulted in a price change.

The creation of the ISP market marked a significant shift in the way communications and related services are offered in Turkey. While the legal framework did not changed substantially, policy and practice permitted, for almost the first time, private companies to offer communications services under something other than a revenue sharing arrangement. ISPs paid a fixed monthly fee for their lease line(s). Other than this, no additional revenue went to Türk Telekom, and Türk Telekom placed no restrictions on the kinds of services that could be offered or the prices that would be charged for these services. Thanks in part to the ease with which ISPs could connect to TURNET and thus become part of the international Internet, the market for ISPs flourished and the market for Internet services became highly dynamic. For those companies and individuals who participate in the Internet, the new market has created a new set of expectations for such matters as customer service and quality. To compete, ISPs have had to offer a steady stream of new and improved services. They have reduced subscription fees to users. They have had to set up 24-hour call centers to support users. They have had to offer guarantees to users that are

completely new to Turkish telecommunications. The ISP market is one of the leading examples of markets in which the buyers have growing influence over the sellers. The trend is spreading to other parts of the Turkish economy.

Operational issues

While the winning TURNET bid of 70% of revenue to Türk Telekom seemed incredibly favorable to the company, it turned out to be seriously flawed. First, any investment in the network had to be paid for by the winning consortium. Since the consortium was receiving only 30% of TURNET revenue, it could not spend a great deal on the network and still realize a profit. In practice, the financial arrangements created disincentives to investment, and under the terms of the agreement, Türk Telekom was not permitted to invest any money in TURNET. Second, Türk Telekom had no operational control over the network and could not, therefore, compensate for shortcomings in the consortium's operating of the network. The consortium was legally committed to provide certain levels of service, but these were not written in operational terms in the agreement. For example, the agreement state that the consortium was to increase the backbone capacity "when line capacity was 70% full." However, the term "70% full" is not defined precisely.

As a result of the shortcomings of the legal and financial arrangement under which TURNET was organized, the capacity of TURNET did not keep up with demand. An sampling of traffic along the backbone and international links on a typical day (September, 1999) shows that four of the six international lines (Ankara-Sprint, Ankara-AT&T, Istanbul-MCI, Istanbul-AT&T (Philadelphia)) are completely saturated (for inbound traffic) between about 10am and 8pm. A fifth (Ankara-MCI) is running at about 60% of capacity during these hours. The sixth (Istanbul-AT&T (New York) appears to not be fully functional, exhibiting low or zero traffic for long periods of time.

0822 SERVICE

The TURNET backbone provides local access service to only a very limited geographic area, albeit one that is home to nearly half of the country's population. The 0822 service is one of the indicators of the eagerness of policy-makers within Türk Telekom and the Ministry of Transport and Telecommunications to make the Internet accessible throughout the country. 0822 is an access code (similar to Area Codes in the United States). Internet Service Providers may be given an 0822 number that subscribers may use to establish a dial-up connection to their ISP. What is distinctive about this number is that the per-minute rates are lower than local telephone calls.[9] This is true even for long distance calls from the far eastern portion of the country. Although the quality of connections is occasionally problematic, the 0822 access service provided for the first time, at Türk Telekom's expense, Internet access in all provinces and villages in the country.

TTNET

By 1997 the technical and operational shortcomings of TURNET had become severe enough that a significant change, or upgrade had to be made to the network. In this year the government of Turkey changed, and a new minister was appointed to the Ministry of Transport and Telecommunications, Necdet Menzir. At the encouragement of H. Tahir Dengiz, the Undersecretary of MTT who is the leading Internet advocate within the Ministry, he became the

[9] In Turkey, all telephone calls, whether local or long distance are charged by the minute.

first MTT minister to take an active interest in the Internet. Recognizing the potential of the Internet, he accepted recommendations to invest heavily in infrastructure.

The question of how to fund development of a new national infrastructure was a pressing one. By 1997, awareness of the Internet in policy-making circles was substantially greater than in 1995. Efforts by leading advocates within Turkey had succeeded in convincing many policy makers of the importance of the technology. They, the populace and the press could not fail to see the attention being paid to the Internet in international circles. The new environment coupled with the failure of the organizational arrangements on which TURNET was based convinced Türk Telekom to seek direct funding for the new backbone. The government agreed to allocate $35 million for the purchase of equipment and expertise to build a national ATM network, called TTNet. The contract was awarded to Alcatel after a competitive bid [23] .

The topology of TTNet is shown in Figure 8. Appendix C contains a listing of the individual POPs and indicates the connectivity services (to be) provided at each.

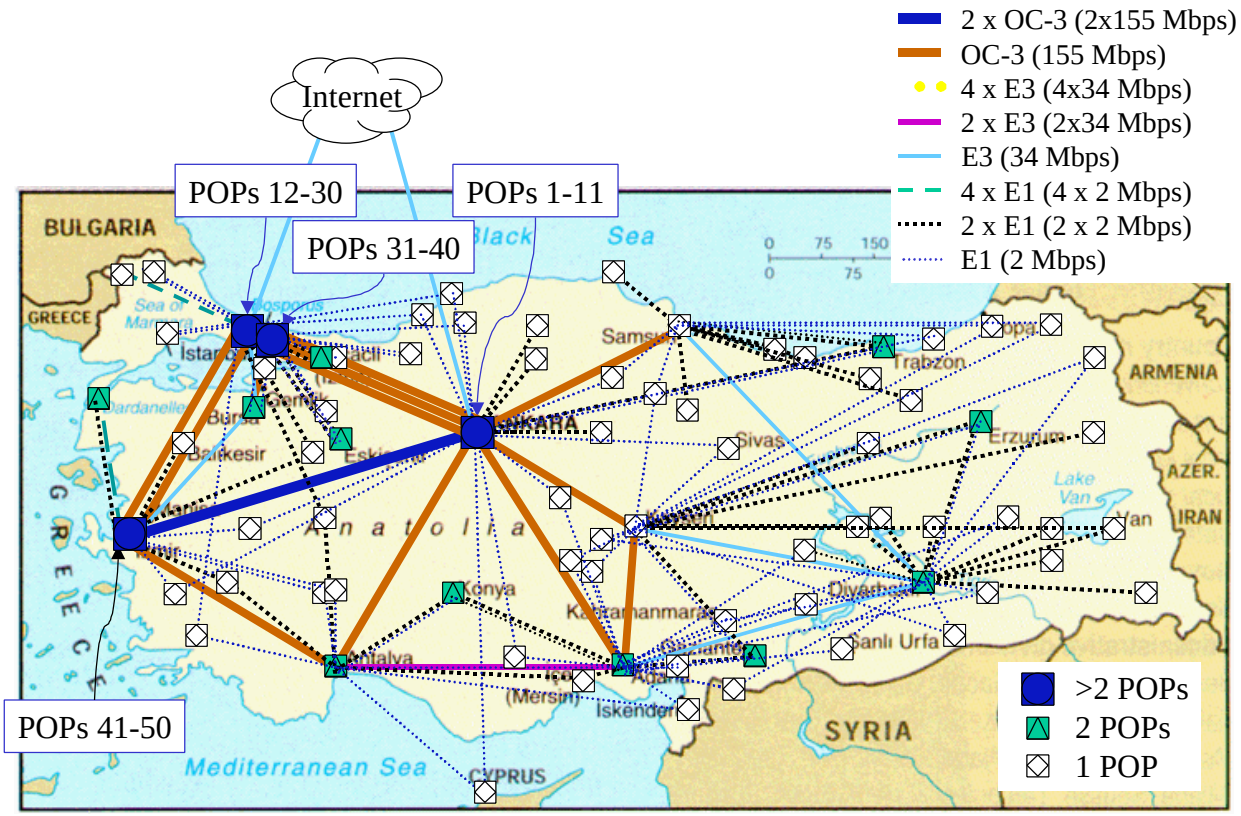

Figure 8 TTNet Topology. Source: [33]

Figure 8 shows two E3 (34 Mbps) connections to the international Internet, a fiber optic link from Ankara, and a TÜRKSAT connection from Istanbul. While this is rather small compared to the bandwidth of the domestic backbone, which consists of multiple OC3 (155 Mbps) connections, Türk Telekom has taken a more conservative approach to international connectivity than towards domestic connectivity, largely because of the costs involved. When the Columbus3 international cable becomes available, TTNet will be expanded with a third connection, a T3 line via fiber optic

cable from Istanbul. After that, international connections will be added as soon as demand for capacity requires bandwidth upgrades.

TTNet is a quantum improvement over TURNET for a number of reasons. First, it offers a huge increase in both domestic and international capacity. The aggregate capacity around the Istanbul-Izmir-Ankara triangle is increasing by nearly two orders of magnitude. International capacity is increasing more than five times (nearly nine times when an additional E3 of international capacity is added in the near future.) Second, the geographic scope of the Internet is expanding far beyond the Istanbul-Izmir-Ankara triangle. While very basic dial-up connectivity at reasonable rates has been available nationwide for some time, TTNet will offer the first multi-Mbps access to the southern and eastern portions of the country. The availability of access through the backbone itself will reduce the load on inter-city PSTN, further improving the quality and availability of the latter service. Third, because much of the backbone is based on a fiber, ATM network, TTNet provides a foundation for offering to customers various value added services, including quality-of-service levels such as priority routing, security, etc. Since TTNet has only just begun operations (September, 1999), it may be some time before the envisioned services are available. Fourth, because it offers much enhanced capacity, TTNet is likely to cause the demand for international satellite connections to decrease, causing price reductions.

By 1999, the year in which TTNet would become operational, Türk Telekom took measures to terminate its revenue-sharing agreement with the GlobalOne consortium. The claim that some of the requirements of the agreement had been unfulfilled led to fines levied on the consortium. Both parties sought for a way to terminate the agreement, which ended in mid-1999, when Türk Telekom assumed full responsibility for all aspects of TURNET. Türk Telekom plans to turn off TURNET around October, 1999.

There are some who argue that with TTNet Türk Telekom has taken on a project that exceeds its capabilities. An alternative approach to achieving the same result, the argument goes, would have been to spend the money and effort on improving the availability of basic infrastructure such as time-division multiplexed leased lines and frame relay lines throughout the country. One of the reasons that the Internet has been limited to the triangle of Istanbul-Ankara-Izmir is the lack of available TDM and frame relay lines in other parts of the country. Once such services were readily and widely available, private ISPs would complete the task of investing in such lines and establishing a truly national infrastructure. Such a view, however, discounts Türk Telekom's perceived need to offer not only connectivity, but also a foundation for enhanced (e.g. quality-of-service) services in the future.

The TTNet roll-out has taken longer than anticipated. Through much of 1999, Türk Telekom announced that TTNet would begin offering services "next month" [52]. By July/August, traffic finally began moving across some TTNet links in a trial capacity. By November, 1999, only nodes at Istanbul and Ankara were reportedly functioning.

One of the unknowns at present is whether Türk Telekom has the resources and expertise to keep a large, complicated network like TTNet running well on a 24x7 basis. Time will tell.

ULAKNET

In 1995, as TURNET was being established, the Turkish Scientific and Technical Research Council (TÜBITAK) decided to get out of the business of directly supporting the Internet in Turkey. The decision paralleled a similar decision by the National Science Foundation in the

United States. However, recognizing the growing importance and visibility of the Internet, TÜBITAK formed a working group to examine the issue of a national network. The group met during 1995 and early 1996 and produced a report that called for the development of a national education network. At the same time, TÜBITAK was being asked to assume responsibility for the Central Library managed by the Higher Education Council. By the mid-1990s, it was clear that a growing portion of scientific information was electronic, or would be in the future. Some sort of focused effort was needed to adapt the document management functions to the new electronic age. TÜBITAK agreed to assume responsibility for the library, provided it also obtained responsibility for establishing a national educational network. On June 1, 1996, the National Institutional Network and Information Association (ULAKBIM) was created as a center of the Turkish Scientific and Technical Research Council (TÜBITAK) [69].

ULAKBIM's mission is to give technical help for the national information system by creating connections between information centers. To accomplish this, it carries out the following duties [65]:

1. Connecting organizational users to each other through the Internet
2. Connecting this national network to the international network
3. Keep the network updated
4. Keep the network upgraded
5. Collect information about this network to improve productivity

As soon as ULAKBIM was founded, work began on the creation of a national academic network, called the Ulusal Akademik Ag (Net) (ULAKNET). One of the guiding principles of the network was that if tradeoffs had to be made, providing all universities *some* level of connectivity was a higher priority than providing some universities the amount of capacity they wanted. Understandably, this has led to some complaints about how ULAKBIM develops and manages the network. When network issues arise that no one else seems to be addressing (e.g. web hosting), then ULAKBIM may address it itself.

ULAKNET topology

ULAKNET's backbone topology looks a great deal like TURNET. It consists of a triangular loop linking Istanbul (Gayrettepe), Ankara (Ulus), and Izmir (Konak). Unlike TURNET, however, ULAKNET consists of much higher capacity, E3 (34 Mbps) ATM links using Cisco 7505 routers between these three cities. Each university connects to the backbone through one of these three points via a frame relay connection of between 64 Kbps and 2 Mbps.

ULAKNET is connection to the international Internet through three asymmetric connections that offer greater capacity for traffic to Turkey than for traffic from Turkey. Initially, ULAKNET had two connections: a 512 Kbps connection to UUNET from Ankara, and a 512 Kbps EBONE connection. In the last year, however, ULAKNET international capacity has expanded by a factor of 10. In 1998, the EBONE connection was replaced by a 512 Kbps connection from Istanbul to UUNet [67]. In late October, 1998, the UUnet connection from Ankara was upgraded to 2 Mbps inbound and 2 Mbps outbound (2/2) [13]. In January, 1999, a second connection was added from Ankara: 4/1 Mbps to Digex [12]. Finally, in July, 1999, the Istanbul connection was replaced

with a 4/1Mbps connection to Satko (Sprint) [38]. The ULAKNET backbone and international connections are shown in Figure 9. Each of the international connections terminates in the United States. Negotiations for another leased line, to Europe, of at least 2 Mbps are taking place with Türk Telekom.

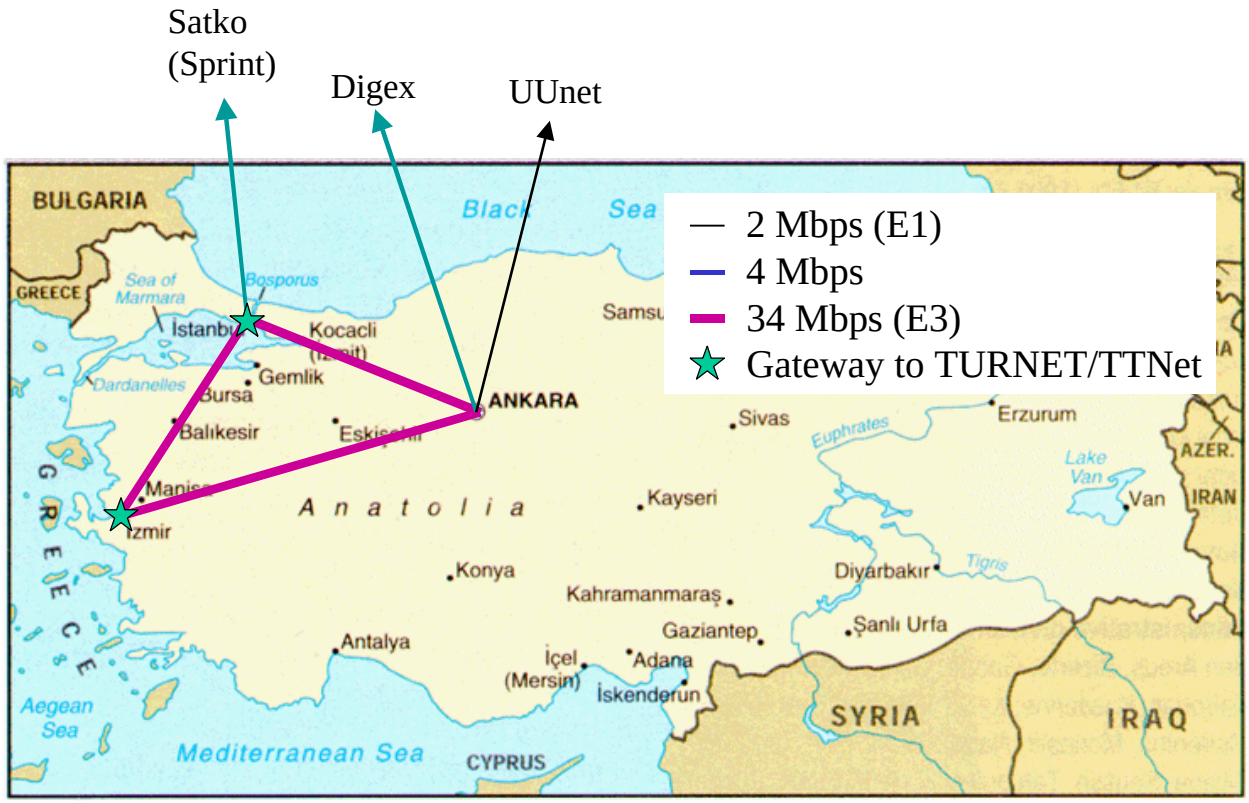

Figure 9 ULAKNET Backbone

Growth of ULAKNET

Once the first node (Ege University) was connected to the ULAKNET backbone on February 14, 1997, expansion of the network was rapid. Figure 10 shows the dramatic increase in the number of university nodes connected to the backbone, particularly during the first year of operation. These figures, do not represent all nodes, however. There are some government institutions that are connected but not considered part of the university system. For example, a number of research centers, the police academy, and military schools are connected to ULAKNET [68]. ULAKBIM data and conversations with ULAKNET personnel indicate that the number of nodes connected to the network had grown to 120 by July, 1999 and was anticipated to reach 160 by the year 2000 [68,71]. At present, of the approximately 70 Turkish universities there are only a half dozen universities that are not connected. In most of these, the problems are local and not with ULAKNET. There are approximately 40,000 static IP addresses in use within ULAKNET, mostly within student laboratories. The IP addresses belong to the seven B-class networks that constitute ULAKNET. Four of the seven are devoted to single universities: Bilkent, METU, ITU, and Bosphorous. The IP addresses of the remaining institutions belong to one of the three remaining B class blocks, which are shared by several institutions. While METU retains

responsibility for managing the .tr domain, ULAKBIM is acquiring responsibility for managing the .edu.tr subdomain.

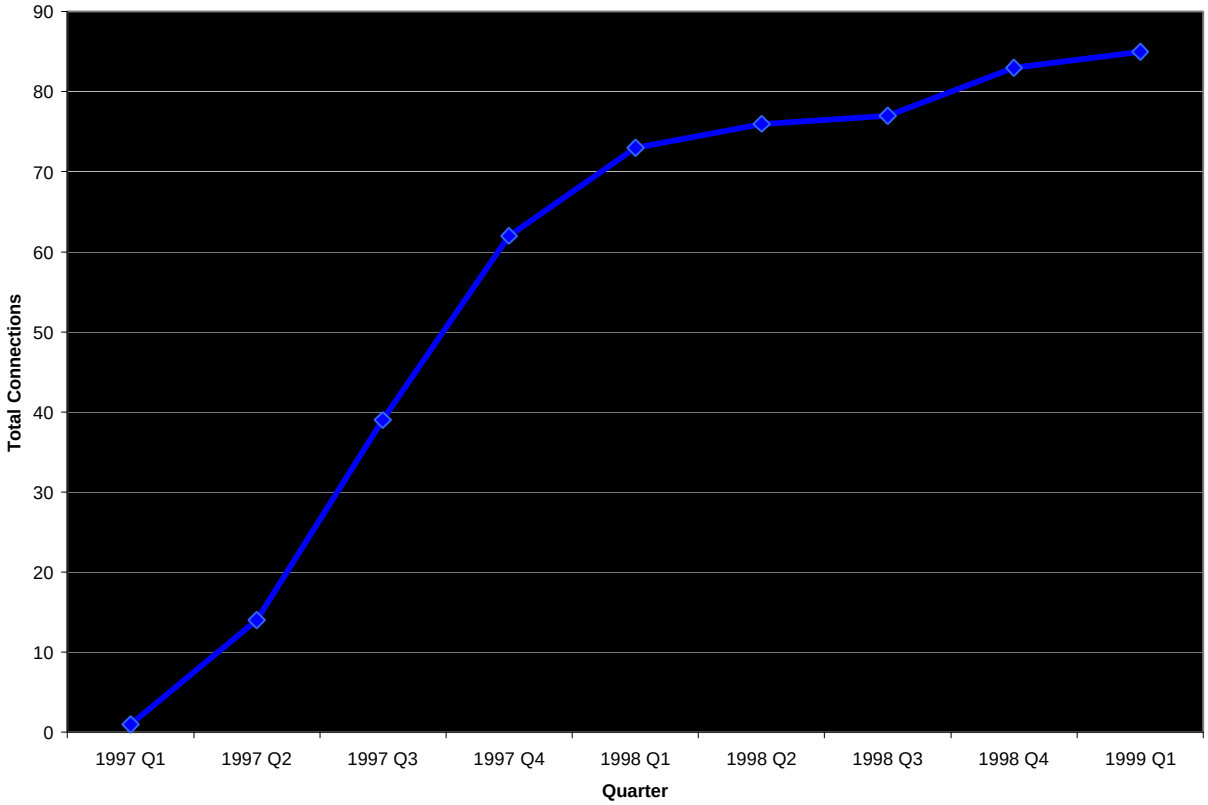

Figure 10 Growth of ULAKNET (University nodes). Source: [66]

Operational arrangements

Much of the cost of ULAKNET is covered through ULAKBIM's budget. Universities wishing to connect to ULAKBIM must pay for the terminating equipment on their campus, but ULAKBIM pays all costs to Türk Telekom for the lines. Non-university organizations must pay for their own leased lines. In addition, ULAKBIM maintains a network operation center that provides a single point of management and control for the entire network. This center is located at the ULAKBIM building at Bilkent University in Ankara.

ULAKNET prospects

While it was designed with minimal input from the community that had given the Internet its start in Turkey, ULAKNET is a solid and significant accomplishment. ULAKBIM has done a good job of creating a relatively advanced infrastructure in a rather short period of time, and has been successful in its mission to connect the nation's universities to the Internet. There remain, however, some difficulties and some unresolved issues. First, the internal backbone bandwidth and the international bandwidth are significantly out of balance, especially when one considers that there is *more* traffic with universities and sites outside Turkey than there is among universities

inside Turkey. During the summer of 1999, 50% of ULAKNET traffic terminated outside of Turkey; 22% terminated in Turkey, but at some site on the other side of the TURNET gateway; only 24% of the traffic stayed within ULAKNET completely [71]. Not surprisingly, therefore, the E3 links of the backbone are underutilized. They experienced a maximum utilization of less than 10%, while the international links are a bottleneck, used to capacity during business hours of each day. To be sure, ULAKNET has increased its international capacity by an order of magnitude within the last year, but more needs to be done. ULAKBIM offers the high cost of international connections and the limited organizational budget as the reason for the inadequate international bandwidth, but some individuals within the Internet community attribute the problem to misplaced priorities.

Second, in Turkey many universities are not located on a single, integrated campus. A single university may have a number of campus separated by several kilometers. To say that a given university is 'connected' to ULAKNET is to say that at least one of the campuses has a connection. While ULAKBIM may eventually connect other campuses, its primary responsibility is to create one connection per university first.

Third, ULAKBIM is at a crossroads. In June, 1997, the director of ULAKBIM resigned to take a position at a private university. A challenge for whomever the new director may be will be to define the unique role for the organization and for ULAKNET. There are those who might argue that with TTNet coming online, why does there need to exist a separate network for academic traffic? Why couldn't universities simply use TTNet. Arguments about cost are not compelling. If the government is going to subsidize academic connections to the Internet, it could equally well do so by paying part of the cost of University connections to TTNet. One alternative being discussed is the use of ULAKBIM to support a variety of activities requiring high network capacity. Some possibilities include distance education (including video data feeds), telemedicine, or supercomputing. However, to date ULAKBIM has taken a passive approach to such applications. It is willing to support academics who take initiative in these areas, but has done little to encourage individuals to pursue them. Content provision is not currently part of the mission of ULAKBIM. A great deal depends on the direction the new director takes.

Analysis Framework Dimension

In the last six years, the Internet has not only taken root in Turkey, but has begun to flourish. In this section we present the quantitative aspects of this evolution, captured in six analytic dimensions of an analytic framework for studying the diffusion of the Internet, shown in Figure 11. The following section, a discussion of the Determinants, provides a deeper analysis of why the Internet has the metrics it does, and how it might be changing in the future.

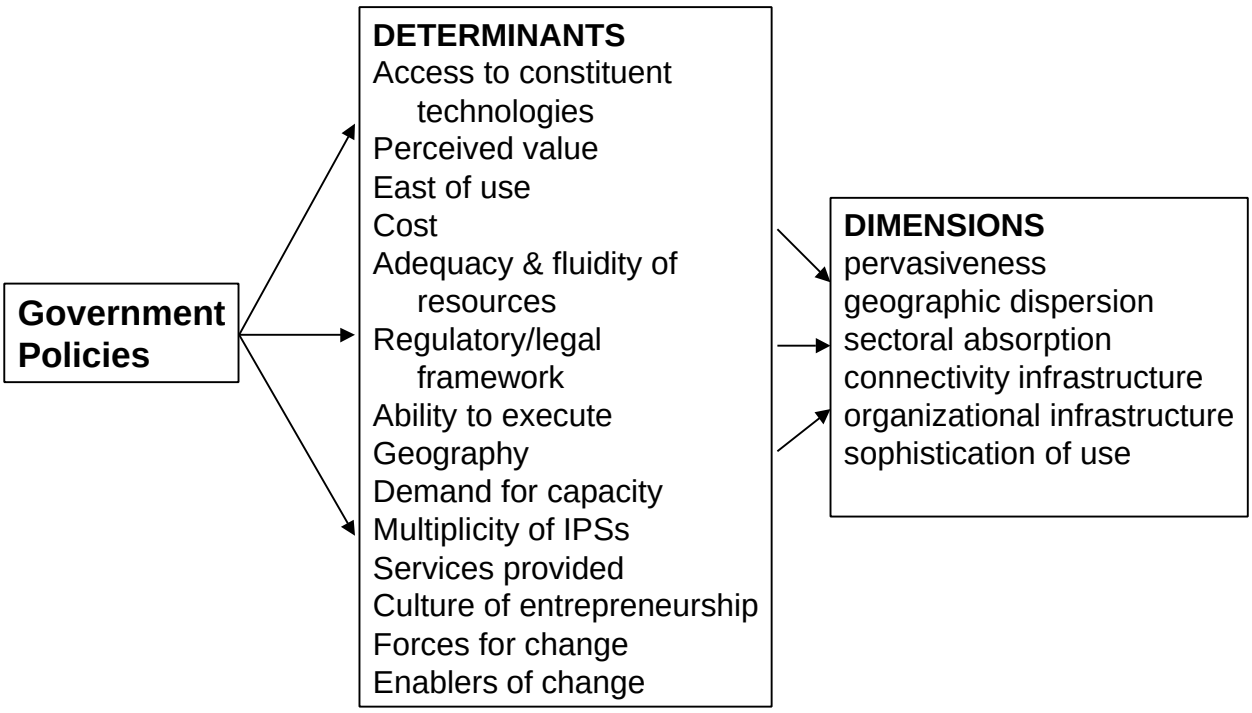

Figure 11 An Analytic Framework for the Diffusion of the Internet

PERVASIVENESS

Pervasiveness is a function principally of the number of subscribers and hosts per capita. It differs from commonly used Internet growth metrics only in that the final measure of pervasiveness is not an absolute number, but a ranking of that number in one of five levels. The intent is to depict the fraction of a population that uses the Internet regularly. A determination of the number of users of the Internet is always problematic. A basic difficulty is the confusion between Internet users and Internet subscribers. The latter are those who have an account with an Internet Service Provider. While individual ISPs may have precise data on the number of accounts they have, they may not publish accurate figures. Furthermore, in some contexts, such as at Universities and at Internet Cafes, the concept of a "subscriber" may have little direct correspondence with the number of individuals accessing the Internet through the provider. Even in the case where an identifiable individual subscribes to an ISP's service, that individual may share his or her account with a number of friends or members of the family.

Nevertheless, tracing the numbers which are available over time provides clear indications of the trends. The order of magnitude difference between dimension levels within the analytic framework means that in most cases differences of a factor of two or three are unlikely to result in different dimension values.

Although wide area network were in use in Turkey before 1993, only in this year did the first Internet users come on-line. These users were the technical "inner circle" of individuals who were working to establish the Internet in Turkey. In 1994, METU and TÜBITAK began offering accounts to a broader circle of users.

In the course of this study, the author collected the following estimates of the numbers of subscribers and users:

Date	Subscribers	Users (% of population)	Source
mid-1993		<1,000[10] (<0.0015%)	[16]
mid-1994		10,000[10] (0.015%)	[16]
Early-1995		>15,000 (0.02%)	[45]
mid-1995		35,000[10] (0.05%)	[16]
mid-1996		100,000[10] (0.15%)	[16]
mid-1997		250,000[10] (0.4%)	[16]
mid-1998		150,000 (0.2%)	[63]
Late-1998		300,000 (0.5%)	[11,48]
May, 1999		700,000 (1.1%)	[15]
July-1999	300,000	6-700,000 (1.0%)	[49]
July, 1999		850,000 (1.3%)	[16]

Table 4 Estimates of Numbers of Internet Users

The figures from [15,16] are based on an analysis of the Domain Name Server at METU. The analysis calculates the number of computers connected to the Internet through an analysis of unique IP addresses, and assumes that there are ten users for each such computer. These are the largest figures quoted, and, as such, represent something of an upper bound on the number of users. While all such figures are estimates and subject to critique, they show an explosion of growth of the Internet over the last year, pushing Turkey from a Level 2 (*Established*) to a Level 3 (*Common*) in 1999, shown in Table 5.

During the late Spring of 1999, Vestelnet introduced a program in which new subscribers who signed a contract to subscribe to Vestelnet's service for three years at $30/month would receive the free lease of a television set. This offer reportedly generated approximately 50,000 new subscribers a month, with a total of 200,000 new users by the end of 1999.

ULAKNET has contributed a sizable pool of Internet users. Each of the major urban universities provides free Internet access to students through the computer labs. For example, at Istanbul Technical University there are 19,200 students with computer accounts and 1300 computers available to them [21]. Nationwide, there are approximately 600,000 students and 40,000 Internet-connected computers for them to use in university computer laboratories [10,71]. ULAKBIM estimates that the ratio of ULAKNET computers to users during 1999 was approximately 1:5. If this is true, then there are 200,000 users of ULAKNET alone.

[10] Based on a graph of the growth of number of computers connected to the Internet in Turkey, assuming the 10:1 ratio between the number of users and the number of computers connected. While this assumption is, in all likelihood, wrong, it establishes something of an upper bound on the number of users.

Level 0	*Non-existent*: The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	*Embryonic*: The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	*Established*: The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	*Common*: The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	*Pervasive*: The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least one in 10 (10% or greater).

Table 5 Pervasiveness of the Internet in Turkey

GEOGRAPHIC DISPERSION

Geographic Dispersion describes the physical dispersion of the Internet within a country, there being benefits to having multiple points-of-presence, redundant transmission paths, and multiple international access points. As currently defined in the analytic framework, geographic dispersion is a function of the fraction of first-tier political subdivisions with an Internet point-of-presence. Turkey is an unusual country in this regard because it has an unusually large number of first-tier political subdivisions (80 provinces) for a country of its geographic area and population. Nevertheless, Turkey is characterized by a rather dramatic jump from a very low degree of geographic dispersion to a very high degree, with a short transitional period consisting of an unusual means of achieving ready access throughout the country.

In 1993, METU and TUBITAK connected to the Internet in Ankara. Through 1994, these organizations, through TR-NET were the sole providers of Internet connectivity. All other nodes connected to them via leased lines. By 1995, access to TR-NET was also available throught ITU in Istanbul. With the creation of TURNET, in 1996, the number of cities with Internet points of presence expanded to three, leaving Turkey at between Level 1 (*single location*) and Level 2 (*moderately dispersed*) (See Table 6). By 1999, ISPs had expanded their coverage through leased lines to the backbone to a total of 19 cities. Outside of the 'Big Three' (Istanbul, Ankara, and Izmir), the cities with the greatest number of POPs were: Bursa (13), Antalya (7), Adana (6), Gaziantep (2), Samsun (2), Konya (2). The following cities each had one ISP POP: Erzurun, Diyarbakir, Denizli, Iskenderun, Yalova, Kayseri, Sanliurta, Afyon, Eskisehir, Trabzon, and Kutahya.

In 1997, ULAKNET began offering services. However, it offered points of presence only in Istanbul, Ankara, and Izmir. All universities connected to Istanbul, Ankara, or Izmir, and none of the universities was itself a commercial Internet service provider. The geographic dispersion remained unchanged.

In 1997 Türk Telekom began offering ISPs 0822 access numbers. Users could dial their ISP using this access code from anywhere in the country and pay metered rates that were less than

those for local telephone calls. While ISP POPs were located in only three cities, Internet access became available in small cities and villages at costs that were no greater than for users in the major cities. In effect, the Internet became readily available throughout the country.

In 1999, TTNet began offering service, with 140 points of presence throughout the country. By design, TTNet includes points of presence in every, or nearly every province in the country. By any metric, Turkey has reached *nationwide* geographic dispersion.

Level 0	*Non-existent*. The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country.
Level 1	*Single location*: Internet points-of-presence are confined to one major population center.
Level 2	*Moderately dispersed*: Internet points-of-presence are located in at least half of the first-tier political subdivisions of the country.
Level 3	*Highly dispersed*: Internet points-of-presence are located in at least three-quarters of the first-tier political subdivisions of the country.
Level 4	*Nationwide*: Internet points-of-presence are located in all first-tier political sub-divisions of the country. Rural access is publicly and commonly available.

Table 6 Geographic Dispersion of the Internet in Turkey

SECTORAL ABSORPTION

Sectoral Absorption recognizes the differing impacts of the degrees to which four major Internet-using sectors of society have taken up the technology: the academic, commercial, health, and public (government) sectors. The absorption of the Internet in various sectors of the Turkish economy is very uneven. In some subsectors, tertiary education in particular, nearly all institutions are connected. In other sectors, such as health care and government, Internet use is more the exception than the rule. The commercial sector lies between the extremes. While the Internet is not common among Turkish companies as a whole, it is penetrating this sector at a rapid rate. Figure 12, taken from [17] shows the number of domain names in each of the principal .tr subdomains for the months June-August, 1999.

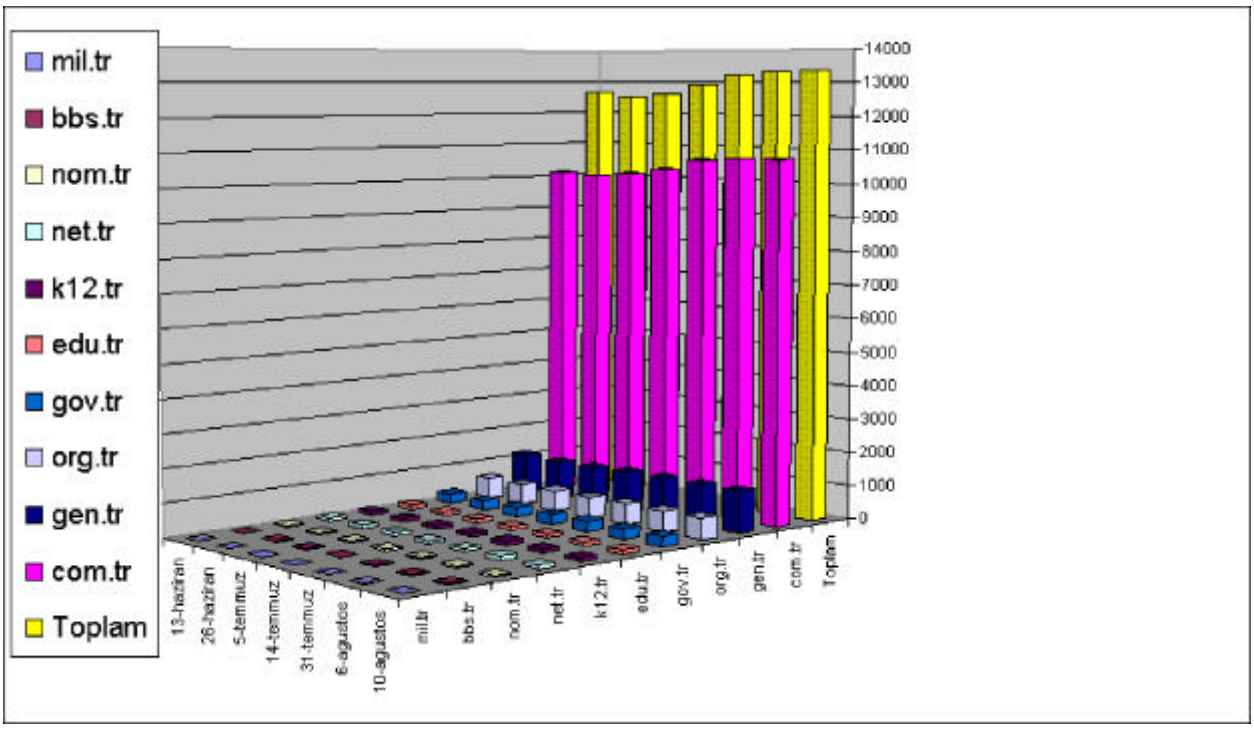

Figure 12 Number of Domain Names in Turkish Top-Level Subdomains (May-August, 1999). Source: [[17]]

Sector	*Rare*	*Moderate*	*Common*
Academic - primary and secondary schools, universities	>0-10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Commercial-businesses with more than 100 employees	>0-10% have Internet servers	10-90% have Internet servers	>90% have Internet servers
Health-hospitals and clinics	>0-10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Public-top and second tier government entities	>0-10% have Internet servers	10-90% have Internet servers	>90% have Internet servers

Table 7 Absorption of the Internet in Sectors of the Turkish Economy

The sectoral absorption of the Internet in a country is determined by first evaluating the absorption of the Internet in four principal segments of the countries economy, as shown in Table 7. Based on these ratings, an aggregate score is given, assigning one point for each sector that rates at *rare*, two points for each *moderate* sector, and three points for each *common* sector.

Overall, we estimate that sectoral absorption was at Level 1(Rare) from 1993-1995, and Level 2 (Moderate) since then (Table 8). Rapid growth in Internet use in the commercial sector, and the introduction of TTNet services to all areas of the country could result in Turkey's moving to Level 3 within 1-2 years.

Sectoral point total	Absorption dimension rating	
0	Level 0	*Non-existent*
1-4	Level 1	*Rare*
5-7	Level 2	*Moderate*
8-9	Level 3	*Common*
10-12	Level 4	*Widely used*

Table 8 Sectoral Absorption of the Internet in Turkey

Education

As in many countries, the academic community pioneered the Internet in Turkey. Thanks to sustained interest, activity, and support from both individual organizational champions, the Internet has progressed steadily among Turkish universities. While more than 10% of universities were connected through TR-NET, ULAKNET has pushed the penetration of the Internet to nearly all universities, over 90%. As of June, 1999, only seven universities out of 96 had not been connected [69]. This does not mean, however, that all campuses of each university have been connected.

The situation in K-12 education is quite different. First, there are 70,000 K12 schools in Turkey, nearly three orders of magnitude more than the number of universities. Connecting a substantial fraction of these schools to the Internet would be a substantial undertaking under the best of circumstances. In Turkey, efforts to bring the Internet to primary and secondary educational facilities is hampered by a number of factors: low wages make it difficult to attract technically skilled individuals into the teaching profession; leased lines require good copper connections, which are lacking in many parts of the country.

By 1999, approximately 100 k12.tr domain names had been registered [11].

The Ministry of Education has succeeded in obtaining World Bank funding to bring the Internet to K12 schools, however [62]. The first phase of the project would bring 50,000 personal computers to 2500 K12 schools and connecting them to the Internet. Subsequent phases would connect most of the remaining schools. Even with the necessary funding, achieving widespread absorption of the Internet in public schools is a colossal undertaking that goes far beyond providing hardware and software. To establish just one expert in each school would require nearly 70,000 trained, or self-taught teachers.

While sectoral absorption at the university level would be ranked as 'Common', Internet connectivity in K12 is 'Rare.' While in absolute terms the K12 situation dominates the sectoral

absorption equation, we feel that the importance and progress of the university community justifies ranking sectoral absorption in Turkish education as 'Moderate.'

Commercial

The commercial sector now boasts one of the fastest growing Internet communities in Turkey. As shown in Figure 13, between 1995 and 1997 the number of com.tr domain names grew from less than 100 to over 4000, with a more than seven-fold increase between 1996 and 1997 as commercial ventures flocked to TURNET. Between 1997 and 1999, the number of commercial domain names rose to nearly 11,000 [8,17]. While these numbers still represent only 10-20% of the commercial firms in Turkey, there is little doubt that the number will continue to grow rapidly.

The number of commercial users of the Internet has reached a critical mass, in which it has become a known and acceptable, and even customary, element in a company's marketing strategy. While there remain relatively few examples of more sophisticated use than just static "web brochures" (see "Sophistication of Use", below), web and e-mail addresses appear regularly on television advertisements and business cards. For many companies, the Internet has become both "fashionable" and a practical tool for carrying out the company's business.

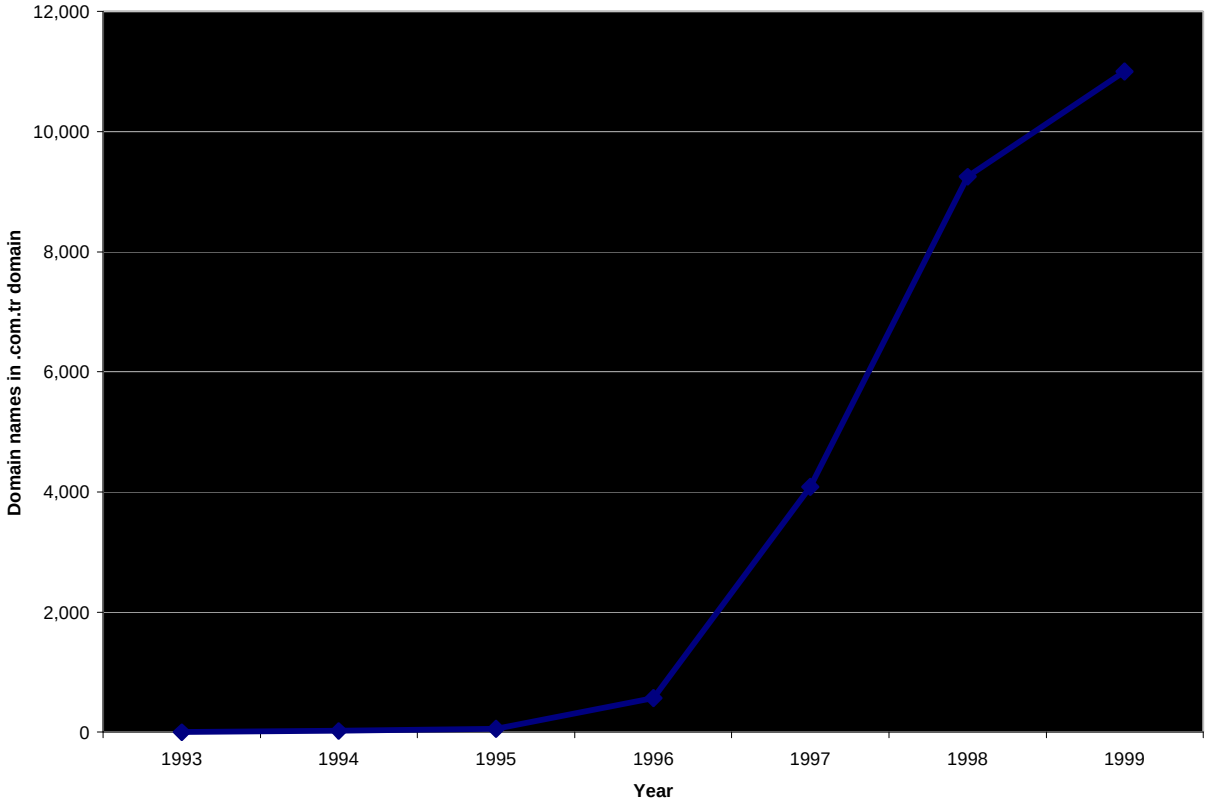

Figure 13 Growth in .com.tr Domain Names. Source: [8,11,17]

One of the distinctive elements of the Internet in Turkey is the role that banks are playing in drawing both companies and individuals to the Internet. Turkish banks typically charge a commission for any transaction carried out, such a making a funds transfer from one account to

another. Individuals and companies alike rely heavily on such mechanisms for paying bills and invoices. If the transaction is carried about by a bank representative, the average cost to the bank is estimated at $1.80 per transaction, a cost which is the justification for the transaction fees. If that same transaction is carried out on the Internet, however, the cost to the bank is estimated at $.10. Furthermore, if customers carry out their transactions over the Internet, they do not have to physically go to a branch office or send a fax requesting service which must be handled by a bank employee. This reduces the congestion of customers at branch offices and improves the quality of service for those who do do business there. In addition, the Internet makes it easier for banks to record all transactions in a centralized system. In the past, banks have had difficulty keeping computing systems at branches synchronized. The cost, quality of service, and profitability benefits of customer use of the Internet are so compelling that banks are waiving transaction fees if customers use the Internet. The cost savings to companies is drawing many to begin using the Internet.

The Internet is complementing another trend in Turkish business. The growing competitiveness of domestic and international markets is helping to fuel efforts at many companies to establish computing systems that will provide a more integrated view of all of the company's operations. Many are installing Enterprise Resource Planning (ERP) packages like SAP's R/3. These distributed systems require a networking infrastructure. For a small but growing number of companies, that infrastructure consists of virtual private networks supported by the Internet, rather than privately owned networks of leased lines from Türk Telekom.

Health Care

The Internet has made little penetration into the Turkish healthcare system. Two hospitals in Istanbul, Florence Nightingale and American Hospitals, are connected and have been pursuing some telemedicine applications. However, these are the exception. By one estimate, there is an upper bound of 50 health care facilities in Turkey connected to the Internet. Over all, far fewer than 10% of health care facilities are connected to the Internet. Health care facilities do use computers, and many have local area networks. However, members of the healthcare profession apparently perceive the Internet to have little value in their ability to provide care for the populace.

Public

The public sector has not been quick to assimilate the Internet, and the progress that has been made has usually come through the determined efforts of a few persistent individuals. For many public institutions, such as local and regional governments, the costs of leased line connectivity to the remote TURNET backbone have greatly exceeded whatever small perceived benefit there may have been. The central government in Ankara has no such excuse. Here the slow absorption has to do with issues of the relationship between the government and the governed, the level of awareness of the Internet by politicians, the availability of skilled technical support, and other factors addressed below. At the same time, the number of central government ministries with at least one connection to the Internet has increased substantially within the last two years. Figure 14 shows the overall growth of the number of .gov.tr domains. There are just a handful of .mil.tr domains [17]. But while TÜBITAK was one of the initiators of the Internet in Turkey, use by government remains rare (<10%) to this day.

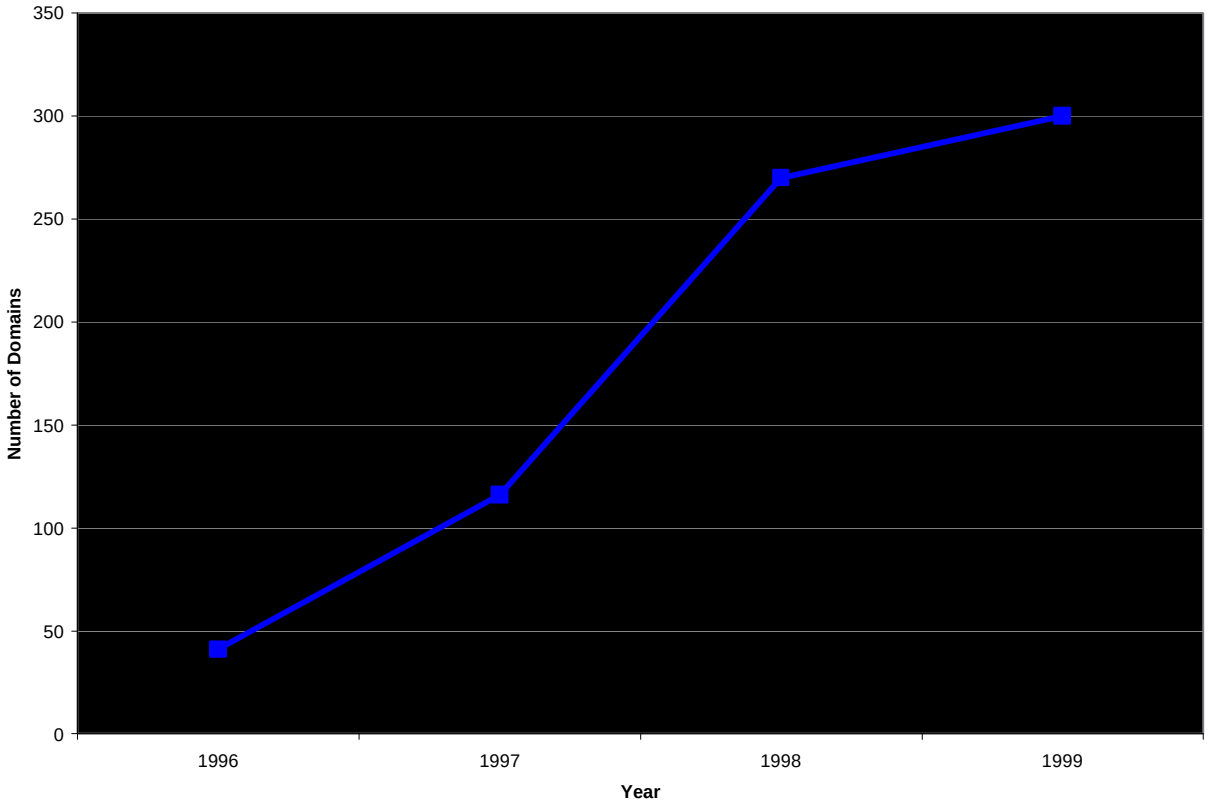

Figure 14 Growth of Number of .gov.tr Domains. Source: [8,11]

Mustafa Akgül, who has single-handedly installed servers in many government ministries, reports the following about the use of the Internet by government ministries [10]. There are approximately 20-25,000 accounts throughout the national government, among about 300 .gov.tr domains. The Department of Education, the Department of Justice, the Undersecretary for Sea Management, and the Department of Treasury share one physical connection to the Internet, with multiple virtual domains. The State Planning Office may have 3-400 accounts. The Foreign Ministry has Internet connections with the Turkish Embassies abroad. Parliament has 550 members, of which a tenth have accounts.

There are a number of large network-related projects underway in Turkish public institutions. For example, Police 2000 is a $100 million project to link all towns in the country. The Agriculture and Credit Cooperative (a financial institution serving the agricultural sector and small businesses) is trying to link 15,000 offices. The Department of Revenue has a $80-100 million project to connect its offices. The Department of the Interior has a large project to keep track of birth records using for the first time a nationally unique identifying number analogous to the Social Security Number in the United States.

While the level of awareness of the potential of computing systems in general has grown, the projects mentioned here are independent of each other. An initiative seeking to integrate these efforts, reduce duplication of information, and provide a common information backbone among government agencies is called KamuNet (government net). This initiative, spearheaded by the

Ministry of Transport and Telecommunications would use TTNet as the network, and provide firewalls to each ministry to protect information that was not to be shared among the ministries. The effort has not been very successful to date, for both technical, resource and political reasons [9]. One of the organizational entities created to provide a shared oversight and point of integration among the various projects is a committee of undersecretaries, which has a technical subcommittee under it. This committee had, as of July, 1999, met only once, even though it was mandated to meet once every two months.

CONNECTIVITY INFRASTRUCTURE

Connectivity infrastructure comprises four components: the aggregate bandwidth of the domestic backbone(s), the aggregate bandwidth of the international IP links, the number and type of inter-connection exchanges, and the type and sophistication of local access methods being used. Table 9 depicts how these factors are related to the assessment of the infrastructure's level of development, with Level 0 assigned to a country with no Internet presence (and hence, no infrastructure) and Level 4 assigned to a country with a robust domestic infrastructure, multiple high-speed international links, many bilateral ("peering") and open Internet exchanges--facilities where two or more IP networks exchange traffic, and a variety of access methods in use. This table also shows Turkey's ranking in late 1999.

		Domestic backbone	*International Links*	*Internet Exchanges*	*Access Methods*
Level 0	*Non-existent*	None	None	None	None
Level 1	*Thin*	≤ 2 Mbps	= 128 Kbps	None	Modem
Level 2	*Expanded*	>2 -- 200 Mbps	>128 Kbps -- 45 Mbps	1	Modem 64 Kbps leased lines
Level 3	*Broad*	>200 Mbps -- 100 Gbps	>45 Mbps -- 10 Gbps	More than 1; Bilateral or Open	Modem > 64 Kbps leased lines
Level 4	*Immense*	> 100 Gbps	> 10 Gbps	Many; Both Bilateral and Open	< 90% modem > 64 Kbps leased lines

Table 9 Internet Connectivity Infrastructure in Turkey

International links

International connectivity has been the main bottleneck of the Turkish Internet since its inception. The costs of international connections and restrictions in the past on ISPs having direct international connections has kept aggregate bandwidth low. Only in the last two years has the aggregate bandwidth increased significantly. The expansion has come from three quarters: sharp increases associated with TTNet, upgrades to TURNET and ULAKNET, and growth in direct international lines leased by ISPs. The latter have almost come to dominate the equation in the last two years, accounting for more than half of the international connectivity in 1998, and over a third in 1999. Figure 15 shows the rapid recent growth in international connectivity. Nevertheless, Turkish international connectivity is still below OC-3 levels, although a third

connection at E3 from TTNet to the Internet will make it slightly above. It is likely that in the year 2000 the aggregate international connectivity of Turkey will exceed 200 Mbps on the strength of TTNet connections and ISPs' direct leased lines. This would push Turkey into Level 3 (*Broad*) for this component of the Connectivity Infrastructure dimension.

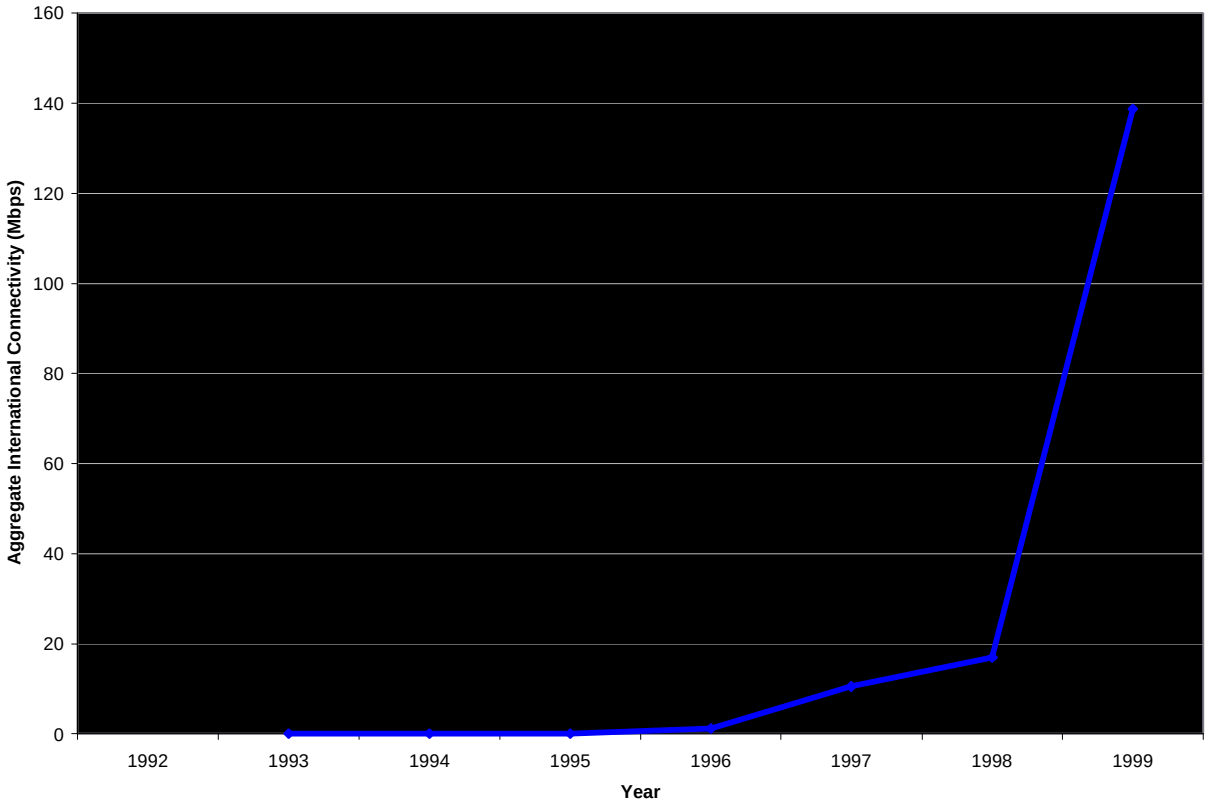

Figure 15 Aggregate International Bandwidth

Domestic backbone

The growth in aggregate bandwidth of the domestic backbone is shown in Figure 16. The growth in backbone bandwidth has come almost exclusively from the introduction of new networks. Domestic bandwidth rose from 128 Kbps to over 6 Mbps when TURNET began offering service. When ULAKNET was introduced in 1997, backbone capacity jumped from 6 Mbps to 109 Mbps. Backbone capacity will take another huge jump as TTNet is rolled out. Once a backbone is installed, it is upgraded infrequently. TURNET's 2 Mbps triangle remained unchanged from 1996 until 1999. ULAKNET's domestic links are not likely to be upgraded in the near future since they are greatly underutilized.

The introduction of TURNET was enough to move Turkey from Level 1 (*Thin*) to Level 2 (*Expanded*) for the domestic backbone component of Connectivity Infrastructure. The introduction of TTNet is pushing it into Level 3 (*Broad*).

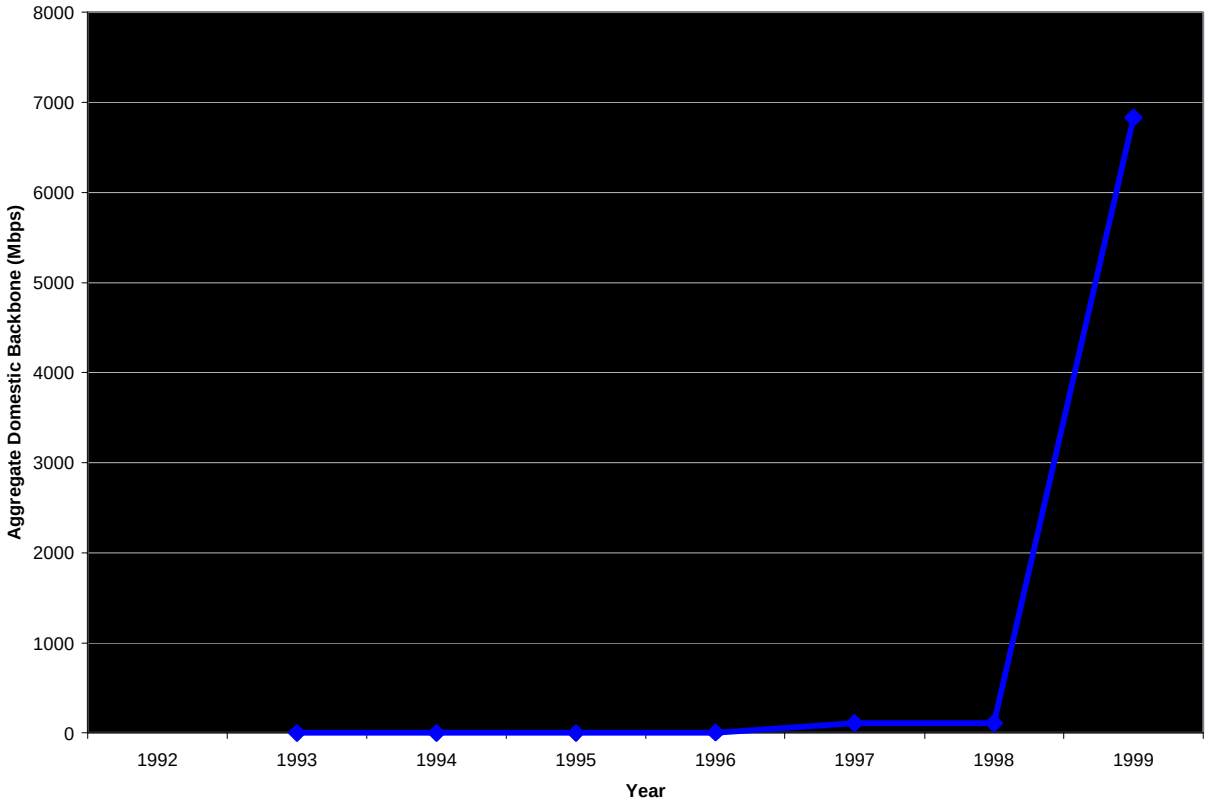

Figure 16 Aggregate Domestic Backbone Bandwidth

Internet exchanges

Unlike some other countries, Turkey has never had a time when Internet Service Providers could only exchange traffic by routing traffic out of the country to the global Internet. However, the ISPs also have never had a traditional Internet Exchange Point (IXP) for exchanging traffic. Rather, ISPs have exchanged traffic by connecting to the national backbone. Initially, TR-NET served in this capacity. TURNET became the government's official Internet backbone, and TTNet will continue this tradition. One of the factors motivating Türk Telekom to create TURNET was the desire not to have ISPs route internationally traffic which was both originated and terminated in Turkey [1]. ISPs who have leased their own satellite connections also have the option of exchanging traffic with other ISPs who share the connection. As long as each ISP has a connection to TURNET (soon TTNet), they are permitted to create separate exchanges amongst themselves. There have reportedly been efforts to create an IXP between ISPs, but these discussions have not been successful. Part of the reason has been that the low amount inter-ISP traffic has not made the issue a terribly pressing one. If TTNet lives up to its promises, then the capacity for inter-ISP exchange should be sufficient, again easing the pressure on ISPs to create their own.

We rate Turkey at Level 2 (*Expanded*) for the IXP component of Connectivity Infrastructure, which it has been since the inception of TURNET in 1996.

Access methods

Turkey has been at least at Level 2 (*Expanded*) with regard to access methods since the first Internet links went live. The initial link between METU and TÜBITAK was a 64 Kbps link. While Türk Telekom has not always provided leased lines in a timely manner, it has offered 64 Kbps service and better for many years. By the time TURNET began offering service, ISPs like SuperOnline were leasing 1 Mbps line. The ability to access the Internet via modem, or via a leased line with greater than 64 Kbps rates as Level 3 (*Broad*) in this component of the Connectivity Infrastructure dimension.

The more interesting question, perhaps, is whether of not less than 90% of Internet access is via modem. At present, few ISPs and few points of presence offer high-speed Internet access services such as ISDN, or xDSL. Of the approximately 139 TTNet points of presence, only nine offer ISDN service, and none of these is outside of Istanbul, Izmir, and Ankara. Only 26 will offer Asynchronous Digital Subscriber Line (ADSL) service (see Appendix C).

While a very small fraction of users accessing the Internet from home use anything other than modems, a significant fraction of Internet users do not access the Internet from home. Students have access through their universities. Internet cafes which attract large numbers of customers have begun accessing ISPs through leased lines, although most Internet cafes still access their ISPs using dial-up connections.[11]

Connectivity infrastructure rating

Table 10 shows changes in the connectivity infrastructure as reflected in the Levels (0-4) of the Analytic framework. The data show steady improvement, with relatively slower improvement in the areas of international connectivity and internet exchanges. The former has been a perennial bottleneck of the Turkish Internet. The latter reflects the role of the telecommunications monopoly in providing the backbone shared by all ISPs.

	1992	1993	1994	1995	1996	1997	1998	1999
International Connectivity	0	1	1	1	1	2	2	2
Domestic backbone	0	1	1	1	2	2	2	3
Internet Exchanges	0	1	1	1	2	2	2	2
Access Methods	0	2	2	2	3	3	3	3
Overall	**0**	**1**	**1**	**1**	**2**	**2**	**2**	**2.5**

Table 10 Evolution of Connectivity Infrastructure

[11] One individual who has a side business setting up Internet cafes recommends using one modem per four systems, although he notes that many cafes use one modem per eight systems. Perhaps the international links have been so sluggish that slow dial-up connections do not degrade service appreciably!

ORGANIZATIONAL INFRASTRUCTURE

Introduction

Just as the connectivity infrastructure assessed the extent and robustness of the physical structure of the network, organizational infrastructure, derived from the number of ISPs and the competitive environment, assesses the robustness of the market and services themselves. The organizational infrastructure existing today in Turkey reflects a somewhat unusual mixture of free market and monopolistic policies. At one extreme, the basic telecommunications regime established by the Turkish Constitution mandates that communications services should be provided by government employees, i.e. by a government monopoly. At the other extreme, the ISP market today is highly dynamic and competitive. In the middle is Türk Telekom, a government-owned joint stock company struggling to define its role while being pushed from all directions by a host of stakeholders with often conflicting demands. During the mid-1990s, the Turkey moved quickly from a Level 1 (*Single*) through Level 2 (*Controlled*) to Level 3 (*Competitive*), where it stands today (Table 11).

Level 0	*None*: The Internet is not present in this country.
Level 1	*Single*: A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	*Controlled*: There are only a few ISPs because the market is closely controlled through maintenance of high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	*Competitive*: The Internet market is competitive and there are many ISPs due to the existence of low barrier to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	*Robust*: There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. The provision of international links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

Table 11 Organizational Infrastructure of the Internet in Turkey

Regulatory Regime

The foundation of the regulatory regime for telecommunications is the Turkish Constitution, which requires that communications services be provided only by a government organization, by government employees. Until 1994, the government organization was the Turkish PTT, a division of the Ministry of Transport and Telecommunications. In 1994, telecommunications portion was separated out from the Ministry as a joint-stock company, Türk Telekom, whose stocks were 100% owned by the government.

Under a literal interpretation of the constitutional requirement, the government has a complete monopoly over the creation and provision of domestic and international communications lines and services. While end users could obtain leased lines from the Türk Telekom, they would be forbidden to carry third-party traffic and charge independently for it.

Bending the rules

During the first two years of its existence, the Internet existed as a non-commercial entity. The cost of leased lines for the Internet covered by TÜBITAK and the network was operated largely through voluntary efforts of institutions like METU, BILKENT, and ITU which provided operational costs out of their own budgets. Until 1995 the Internet was viewed by Türk Telekom as something of an experimental technology rather than a commercial source of communications services.

In 1995, however, as efforts to establish TURNET moved forward, the issue of who could provide Internet services had to be resolved. Under a strict interpretation of the Constitutional guidelines no commercial ISPs could exist. One of the more interesting aspects of the Internet in Turkey is the lengths to which the government has gone to enable the Internet to flourish, without completely running afoul of the Constitution.

The most restrictive time in Türk Telekom's relationship with providers of Internet services was 1995. In 1993-1995 a few organizations such as IBM, DorukNet, and a few universities were providing Internet services on a small scale in Istanbul and Ankara. Among other measures, they sought their own international satellite links for carrying Internet traffic. Türk Telekom did lease such lines initially; but when it focused its attention on the Internet in 1995, the company's reaction was to restrict commercial ISPs, invoking the prohibition against carrying third-party traffic. At this point, provision of domestic and international links for Internet purposes was a complete monopoly.

In the years that followed, however, Türk Telekom relaxed some of these proscriptions, albeit often in a way that preserved some semblance of monopoly. For example, with TURNET, Türk Telekom encouraged the creation of commercial, independent ISPs as long as they connected to TURNET. Türk Telekom also began permitting private companies to offer international satellite lines to ISPs and other companies, the so-called International Business Services companies, provided they were licensed to do so by Türk Telekom, and paid Türk Telekom a percentage of the proceeds. The most curious semantic twist was a redefinition of the services ISPs were providing. The argument was made that ISPs were not providing fundamental communications services at all, but rather were providing some value-added services (computer applications). Even voice-over-Internet, which is permitted in Turkey, is considered data communications, rather than voice, and thus a value-added service.

One more sticking point remains. Turkish law requires that value added service providers be licensed. However, Türk Telekom is reluctant to license ISPs and has, to date, not licensed any. For a license to be given, a legal model must be worked out, and so far this has not been done, in spite of pressure from the Ministry of Transport and Telecommunications on Türk Telekom to do so. ISPs continue to operate in something of a legal limbo.

In short, Turkey has employed in no small measure a sleight of hand to permit the Internet to flourish. As one official put it, "So as to not cut the Internet in Turkey, we are not seeing them [the ISPs]"!

Future

One obvious solution to the dilemma of government provision of a largely unregulated service would be to change the Constitution. However, there does not appear to be the political will in Turkey to do this. Such a change would require the support of two thirds of the parliament.

The issue of changing the Constitution is very closely tied to the issue of privatization of Türk Telekom. In this case, privatization means that 20% will be sold to a strategic partner; 14% will be sold to other private investors; 5% will be set aside for employees of the Post Office and Türk Telekom; the postal service will receive 10%; and the government will retain 51% [60]. Although efforts have been underway since 1994 to privatize the company, progress has been slow, government proclamations notwithstanding [56] [46] [32]. First, Türk Telekom is the largest taxpayer in the country, and a major source of revenue to the State Treasury. Since Turkey suffers from perpetual budget deficits, many politicians are reluctant to lose this direct contribution to State revenue. Second, it is a large employer with extensive patronage. Third, there exist unresolved issues with regard to national security. Would the government be able to monitor calls placed through a private telecommunications company? Fourth, the stake to be sold to private investors is small enough that there are few international telecommunications companies who are deeply interested in the company. Furthermore, those that have expressed an interest have done so on the condition that the company would retain its monopoly position in Turkey!

By 2005, Türk Telekom will be privatized, however. Turkey has signed the World Trade Organization agreement, which mandates the privatization of telecommunications by the year 2005 [1,22]. In the meantime, although ISPs and others love to complain about Türk Telekom, the relationship between the government monopoly and the ISPs is a positive and mutually beneficial one that has done a great deal to promote the Internet in Turkey.

SOPHISTICATION OF USE

To truly understand the Internet capability of a country, it is necessary to understand not only how many and where people use the services, but also how the Internet is employed. Of particular interest is the "elbow" reached when the service is mature enough to attract interest and use outside the narrow community of technicians. A second major milestone is reached when the user community transitions from only using the Internet to creating new applications, sometimes eventually having an impact on the Internet elsewhere.

The data on Pervasiveness and Sectoral Absorption indicate that the vast majority of Turkish citizens and companies are not using the Internet. For those that are, however, the last year or two have witnessed a few companies making use of the Internet in ways that are transforming their businesses and personal interactions, although not necessarily in ways that advance the state of the art worldwide. At the same time, the number of companies and individuals who have made the Internet part of their daily activities in some fashion has grown to the point where they are no longer considered novelties. The rapid expansion of the Internet user community means, however, that there continue to be many users who have only begun to use the technologies.

Overall, Turkey's user community is probably at Level 2 (*Conventional*), with a few, but growing number of, users at Level 3 (*Transforming*). The Internet has clearly "taken hold," but the number of companies or individuals using the Internet to change significantly their processes and practices remains small.

Level	***Organizational Use***
Level 0 *None*	No use of the Internet
Level 1 *Minimal*	E-mail is available, but is not used as an alternative to traditional inter-personal communications (memos, telephone, meetings). Web sites consist of a small number of static pages reflecting a "minimalist brochure."
Level 2 *Conventional*	E-mail is widely used for both official and unofficial communication. Listservs or their equivalent are used to disseminate information or solicit feedback. Web sites are largely static, but are extensive and provide customers with in-depth information about products and services, utilization of those services, comparative information, etc. The content is more than just advertisement.
Level 3 *Transforming*	Web sites are dynamic, becoming an alternative distribution channel. On-line ordering is possible. Customer service functions expand to permit customers to conduct transactions that formerly involved employees (e.g. home banking, FedEx package tracking, etc.) International companies use the Internet as a substitute for business trips, enabling round-the-clock collaborative product development. E-Commerce has taken hold.
Level 4 *Innovating*	The fundamental structure of organizations and their external relations with other organizations is altered. Examples include Egghead Software, which no longer has a bricks-and-mortar presence, and Amazon.com, the on-line bookseller. Companies pioneer new uses of the Internet, such as IP Telephony, data mining of Web customers' "click-histories".

Table 12 Internet Sophistication of Use in Turkey

For individuals, anecdotal evidence suggests that the principal uses of the Internet are 1) games[12] 2) Internet Chat, and 3) web surfing (especially pornography). Each of these reflects a user community that is comfortable with the medium, yet not one which is using the Internet to create new and enduring social networks, for example. ICQ is used by some, but is eclipsed by the tremendous popularity of on-line chat.

Most of the companies using the Internet are establishing a rudimentary presence on the Web, and perhaps beginning to learn about electronic commerce. The set of companies making transformative use of the Internet is, at present, rather circumscribed. In conversations with industry observers in Turkey, the same examples of leading Internet use are repeated again and again. They include:

[12] The computer games that people play are not usually Internet-enabled. However, this is one of the applications that draws people to Internet cafes. Use of e-mail and web surfing follows quickly.

- Banks. Since 1997, banks have been offering so-called "Internet branches" where customers can carry out many of the kinds of transactions they would normally do in a physical branch office. Banks have strong incentives to move customers from the branches to the Internet: First, they can cut costs. A transaction carried out in a branch costs 18 times more than one carried out on the Internet. Second, by reducing the number of customers in the branches, queues are shortened and quality of service improves. Third, branch employees can spend more time providing customized service to the most profitable customers, improving profitability. To encourage customers to use the Internet, banks are waiving the customary transaction fees. Such efforts have encouraged many users and business to use the Internet for the first time. Banks are also using the Web to accept loan and other applications.

  Banks are also playing a significant role in pushing E-Commerce in Turkey. Garanti Bank, the first user of SET (Secure Electronic Transaction) in Turkey, has established outreach programs designed to help customers understand E-Commerce possibilities and make the arrangements necessary to become active in conducting on-line business. Banks have technology departments that are working vigorously to introduce virtual checks, chip-wallets, and a variety of other services. Some investment banks are now e-mailing reports rather than faxing them and some will refuse to fax!

- Migros Supermarket. Migros allows you to place your supermarket order over the Internet. If you place an order of more than 10 million TL ($23 in July, 1999), the store will deliver your order at no extra charge.
- SuperOnline. As part of its effort to create a portal that will draw customers repeatedly, SuperOnline has placed a financial simulation game on its Web site. The simulation permits people to invest "virtual money" in the financial markets and track the value of the "portfolio."
- Newspapers. Nearly all Turkish newspapers are provide content on the Internet, playing a particularly important role in informing Turks living abroad.
- Some ISPs are partnering with cellular phone companies to provide integrated services, such as the ability to send a web-page to a pager.

ANALYTIC FRAMEWORK DIMENSIONS

Table 13 describes the dimensions of the Internet analytic framework at the time of this writing (September, 1999). Figure 17 illustrates the changes in the Internet dimensions since 1992, the year before the Internet was first established. In spite of significant absolute gains during 1998, the changes of that year were not great enough to result in a change in any dimension. The years 1997 and 1998 are identical in the figure.

Dimension	Level	Explanation
Pervasiveness	(3) *Common*	Explosive growth in the number of Internet users in Turkey in 1998-1999 has pushed the number to more than 1 person in 100 for the first time.
Geographic Dispersion	(4) *Nationwide*	In 1999, TTNet rollout puts 140 Internet points of presence throughout the country. Even before this, however, the Internet was accessible nationwide at less than local-call rates through a special access

		code.
Sectoral Absorption	(2) *Moderate*	Internet use has reached essentially all universities, but only a fraction of grade schools. Internet use in the commercial sector is expanding rather rapidly, but use in Health Care and at all Government levels lags. However, relatively modest advances in the latter two could bring Turkey to a Level 3 (Common) in the near future.
Connectivity Infrastructure	(2.5) *Expanded*, nearly *Broad*	In 1999, Turkey has, or will soon, experience tremendous increasing in both domestic and international bandwidth related in part to the rollout of TTNet. Most user access is by modem. The national backbone is a substitute for direct ISP-ISP exchanges.
Organizational Infrastructure	(3) *Competitive*	The ISP market is highly dynamic and competitive. Domestic infrastructure is provided by the state monopoly. However, provision of international links is competitive, being offered by multiple companies licensed by Türk Telekom.
Sophistication of Use	(2) *Conventional*	The Internet has certainly "taken hold" in Turkey, but number of examples of usage changing fundamentally how people or businesses conduct their business is small. However, the number of such examples is growing.

Table 13 Current Values of Internet Dimensions in Turkey.

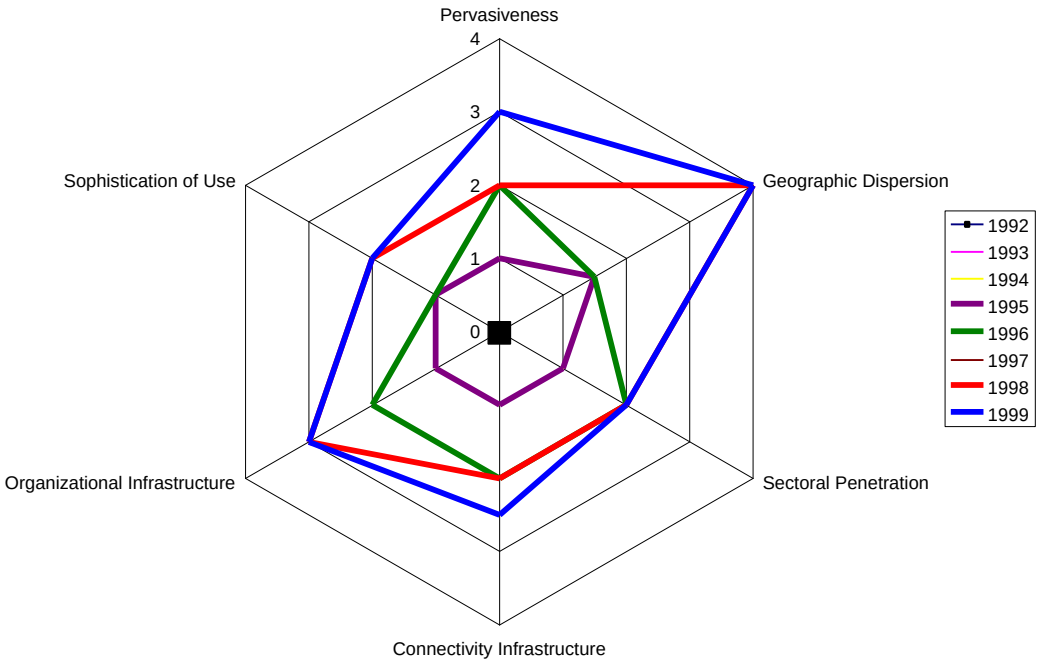

Figure 17 The Internet in Turkey: Analytic Framework Dimensions

Analysis Framework Determinants

While the "state" of the Internet at a given point in time within a given country can be captured using the dimensions outlined above, it is perhaps more important to understand the factors that have caused the Internet to evolve to the state it has. Understanding these factors not only has explanatory utility, but also can indicate the principle mechanisms, factors, and policies that may be applied to promote (or hinder) the Internet's development.

The previous section painted a picture of an Internet in Turkey that has taken root in Turkey and is growing steadily in all dimensions. Yet Turkey remains a country of contrasts. While exhibiting particularly strong growth in the numbers of individual and commercial users, the Internet is evolving much more slowly in some sectors than others. Moreover, the Internet is more vibrant and dynamic than one might have expected given that communications services are provided by a single, strong government-owned monopoly.

In the current section we will examine a number of key factors that have emerged as particularly strong determinants of the extent and nature of growth of the Internet within a country. These determinants were listed in Figure 11. Not only will the determinants provide insight into why the Internet in Turkey has evolved as it has, they can also yield insights into the factors that offer the greatest leverage for policy-makers who wish to promote (or discourage) Internet development.

We will step through each of the determinants. Table 14 shows the relationships of the determinants to the dimensions. In the next section, we integrate the discussion of dimensions with that of determinants to better understand the prospects for the Internet in Turkey and the measures policy makers might take to promote it.

	Dimensions					
Dimensions / **Determinants**	Pervasiveness	Geographic Dispersion	Sectoral Absorption	Connectivity Infrastructure	Organizational Infrastructure	Sophistication of Use
Access to Internet	X	X	X		X	X
Perceived value	X	X	X	X	X	X
Ease of Use of the Internet	X		X		X	X
Cost of Internet Access	X		X	X	X	
Adequacy & fluidity of resources		X	X	X	X	X
Regulatory/ legal framework		X	X	X	X	X
Ability to Execute		X		X		
Geography		X				
Demand for capacity				X		
Multiplicity of ISPs				X		
Services provided				X		
Culture of entrepreneurship						X
Forces for change	X	X	X	X	X	X
Enablers of change	X		X		X	X

Table 14 Integration of Internet Dimensions and Determinants

ACCESS TO THE INTERNET

Access to the Internet (or Internet backbone for ISPs) is not possible without the following elements: Communications lines of sufficient quality to carry a connection (or a suitable wireless substitute), access to an Internet Service Provider (or backbone), and the hardware and software necessary to establish the connection.

Individual Access to the Internet

Since 1988, all Turkish villages and cities have had telephone service. With some exceptions, the quality of the telephone lines have been sufficient to support conventional dial-up connections. Access to dial-up lines is not a barrier today.

In the year following the introduction of TURNET, a host of ISPs have offered customers a wide choice. Although ISPs have had POPs in only nineteen cities, since 1997, the 0822 has brought reasonably priced Internet access to the entire country. Access to ISPs is not a barrier any longer.

Access to a personal computer has been one of the most problematic aspects of access. Although personal computer prices have been dropping in Turkey as they have throughout the world, a personal computer is still too expensive for most Turks. The per capital GDP is only $6,100. For the "middle class," however, a personal computer is now considered affordable. Although it is unlikely that the per capita GDP of Turkey will rise substantially in the near future, improvement in access to personal computers has come from at least four quarters. First, the cost of the PCs themselves has been dropped. Second, Internet Cafes have become plentiful, offering individuals the opportunity to use the Internet without having to purchase their own computer. Third, Universities offer Internet access to students in their computer labs. Fourth, and most interesting, is the efforts of ISPs like Vestelnet. Vestelnet, a manufacturer of electronics equipment like radios, televisions, and some computers, will provide a personal computer to a user in exchange for a three-year commitment to Vestelnet's internet service at $30/month. While the monthly rate is considerably higher than most other ISPs, the ability to get a PC without paying hundreds of dollars has attracted tens of thousands of new user to Vestelnet's service each month.

ISP access to the Internet backbone

Since 1996, ISPs have had ready access to the Internet in Istanbul, Ankara, and Izmir. Outside of these cities, companies have had great difficulty getting leased lines or frame relay circuits. Stories are told of companies purchasing the DXX terminating equipment used for leased lines, and giving it to Türk Telekom so that they could get a leased line. Until TTNet was introduced, ISPs had access, but not nationwide.

Where the Internet backbone infrastructure has existed, ISPs have had little difficult in gaining access. Bureaucratic and financial hurdles have been nominal.

All in all, barriers to accessing the Internet have fallen substantially for both individuals and Internet service providers.

COST OF INTERNET ACCESS

One of the factors that has most directly fueled the recent growth of the Internet in Turkey is the drop in costs to provide, and access service. ISPs have experienced significant reductions in the rates they pay to access the Internet backbone, and, because of their highly competitive market, have passed these reductions on to their customers.

A fundamental cost carried by ISPs has been the monthly charge for the connection to TURNET. When TURNET first began offering services, the cost of a 64 Kbps leased line was $4,000./month. The GlobalOne/Satko consortium had originally wanted a higher rate, but political pressure pushed the rate down. The rates remained relatively constant (in US$) for two years. Then, in mid-1998 Türk Telekom dropped the price of its leased lines by over 50%, in part at the suggestion of the Internet Executive Council. Figure 18 diagrams the price change. Prices posted on Türk Telekom's web page further indicate that the cost of one and two Mbps lines are less than one fourth the cost of the most favorable leased line connections to TURNET. With its

ATM services, Türk Telekom is offering an E3 (34 Mbps) connection that is only slightly more expensive than the TURNET E1 (2 Mbps) connection!

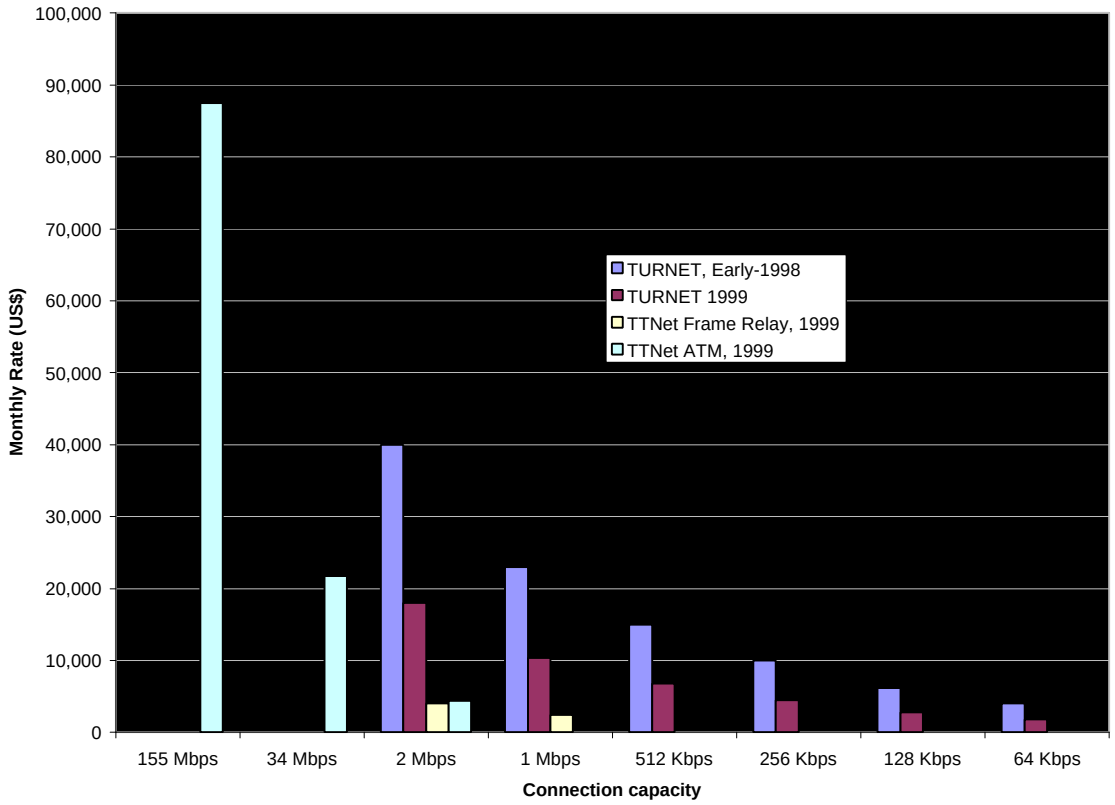

Figure 18 Monthly Rates for ISP Access to Internet Backbone. Source: [37,51,53]

Some ISPs have their own satellite links to the Global Internet. The cost of a 1 Mbps/512 Kbps asymmetric international line ranges between $12,224-$26,960 per month for a satellite link, and $15,280-$33,700 for a digital circuit [40]. While the International Business Services (IBS) providers (Erenet, Comsat, and Satko) compete with each other for customers, the rates they charge must reflect the relatively high cost of revenue to Türk Telekom which is included in the license agreement. Even though the current prices are 50% lower than prices two years ago, they are still 3-8 times higher than comparable links from Europe to the United States.

The reduced cost to ISPs of connecting to the Internet backbone has had a tremendous impact on the pervasiveness of the Internet in Turkey, for it has enabled ISPs to substantially reduce the monthly fees they charged end users. In 1998, ISPs were typically charging $40-50. Per month for unlimited connect time. A survey of ISPs conducted during the summer of 1999 showed monthly connect fees ranging from $10/month (with two year contract) to $32/month. The average monthly fee was approximately $21. Price competition for users is intense. Several ISP will offer a lower rate if the user commits to a long-term contract. GarantiNet, an ISP affiliated with GarantiBank, will offer GarantiBank account holders discounts, depending on the volume of banking activity they carry out [70]. One ISP operating in Izmir, Unimedya Turknet Elektronik

Endustri <www.unimedya.net.tr> was even offering free Internet access between midnight and 8:00am!

The cost of connectivity for occasional users, or users without their own ISP account is affordable as well. Internet cafes offer Internet connectivity for between $.70 and $1.20 per hour. In comparison, a movie ticket costs students about $2.30. The Internet therefore is comparable with what individuals might expect to pay for an hour or two of entertainment.

Even before the rollout of TTNet, users not located in Istanbul, Ankara, or Izmir could access ISPs by using the 0822 access codes. The metered rate for the telephone call is a third of the rate for a conventional call.

Although Türk Telekom is a monopoly and its prices are not subject to market pressures as in a competitive economy, pressure for price reductions has come through other quarters. The drop in prices in 1998 was, in part, a result of such a recommendation by the Internet Executive Council [10]. As usage of the Internet in Turkey increases, the political pressure that can be brought to bear by the public, the press, the ISPs, and the major investors in those ISPs increases.

EASE OF USE

The Web browser was designed to be easy to use, and the experience of millions of individuals throughout the world is that with minimal training a literate individual can use the Internet for at least electronic mail and Web surfing. Turkey has a high level of literacy, so the technical demands of Internet use are not a significant barrier.

However, only a small percentage of Turks can speak or read English. Consequently, the ability of Turks to use the Internet productively is shaped in part by the amount of interesting Turkish-language content. Fortunately, the volume of Internet content in Turkish is growing. Companies like SuperOnline have made a priority of the creation of a "Turkish Internet" with content tailored to the Turkish-speaking population [49]. According to the Ministry of Transport and Telecommunications Master Plan for Information Technology (TUENA) in 1998, 80% of Web pages in Turkey were in Turkish [20].

PERCEIVED VALUE OF THE INTERNET

Perceived value by individuals

Why are individuals in Turkey drawn to the Internet? While no formal surveys have been conducted, individuals intimately involved with Internet Cafes, ISPs and other facets of Internet use in Turkey suggest that chat and pornography are two of the dominant uses. In this respect, Turkish users appear to be similar to other user communities. Entertainment and social interaction are what people find most engaging.

As usage of the Internet grows, however, the phenomenon is carried by its own momentum. What is significant about Internet use over the last 1-2 years in Turkey is that it has become *fashionable* to access the Internet. Whether or not actually using the Internet is viewed as beneficial, there is benefit to being perceived as an Internet user.

At the same time, the ISPs and companies like banks are working very hard to increase the perceived value of the Internet by exploring new content and services. For example, one of SuperOnline's major strategies at the moment is to create Turkish content that will make the Internet a part of the daily life of individuals. The content includes local travel, cinema, news, and

investment features. SuperOnline supports an investment simulation game in which users can track the progress of fictitious portfolios against actual stock prices [49]. Garanti Bank took the unusual step of establishing its own Internet Service Provider operation to offer lower ISP subscription rates to its account holders [70].

However, there are some cultural elements that may make the Internet less attractive to Turks than some other media. According to some observers, Turks place relatively higher value of oral or interactive communication and lower value on written expression than do some of the Western European cultures. The Ottoman Empire's chief "literary contribution" was the volumes of official writing of the empire which published and tracked the smallest detail of official functions. Today, electronic or written communication does not carry the same importance as oral communication. As one individual put it, "if you wish to invite someone to a conference, you must call them and talk to them. Writing a letter or e-mail message alone may be insulting." The explosion of cellular phone use, and the preference of Internet chat over e-mail are perhaps indicators of such a cultural trait. This view is not universally held, however [18].

The exposure the Internet offers to a variety of morally unacceptable content makes many families in Turkey reluctant to purchase personal computers and become connected. We do not have data that would indicate whether such reluctance is more prevalent in Turkey than in other countries. Certainly Turkey is a country of contrasts. Both the conservative and liberal ends of the social spectrum are well represented.

Finally, given the economic state of the country, most Turks are much more concerned with the day-to-day issues of making a living and providing for their families. To them, the Internet is a luxury for those with more money and leisure time.

Perceived value by organizational users

Among organizational users, the perceived value varies from sector to sector, as described earlier in the section on sectoral absorption. Within the academic community, access to the Internet is perceived as critical to the educational and research missions of the universities [21].

In the commercial sector, interest in the world wide web and electronic commerce is growing rapidly. One ISP reports that the web-hosting business is growing by 25% per year [43]. As the number of companies using the Internet grows, Internet use increasingly becomes an obligatory accessory, even if the company has not examined in detail the most appropriate use of the medium. Here also, the Internet has become fashionable.

The sense that the Internet is important is driven also by the publicity and financing efforts of some of the major Turkish conglomerates. Dogan Holding, Yapi Kredi Group, Show Market and others have or reportedly soon will make multi-million dollar investments in Internet related companies. Their desire to "play the game" is in no small part driven by the attention and money Internet stocks have attracted in the United States.

But commercial users *are* beginning to recognize the tangible values of using electronic mail, electronic commerce, and the world wide web for reaching and interacting with customers and suppliers. The cost savings of conducting financial transactions over the Internet has been mentioned earlier. Some companies are taking advantage of the Internet to offer new kinds of services. A company called Aktif Dagitin offers a billing service to companies that permits the

companies to go on-line to check on the status of any bill that has been sent out. Companies that are trying to integrate their computing systems an implement ERP systems are finding the Internet is a viable option for their wide area network, or virtual private network (VPN) infrastructure.

Perceived value by government entities

How is the Internet perceived from the perspective of government entities who are responsible for such matters as government administration, policy-making, or national security? While the attitude of government entities as a whole has been one of disinterest or ignorance, this is changing. Pockets of the government have taken a serious interest in the Internet and, as a whole, the Internet has caught the notice of legislators and policy makers in at least a minimal fashion.

The low level of interest in the Internet as an enabler of government administrative functions has been discussed in the section on Sectoral Absorption. While this reluctance is certainly partly a result of lack of awareness and lack of technical know-how to begin using the Internet, the historical relationship between the government and the governed may play a role here as well. Some observers claim that Turks have viewed the government as serving the role of a remote, usually benevolent parent. The Sultans of old worked very hard to establish a regime free of a strong class of nobility in which the people were directly beholden to the Sultan, who provided for them. Mustafa Kemal, the patriot who crafted the modern Turkish state, is referred to as Atatürk, the Father of Turks. In recent decades, politics in Turkey has been strongly shaped by powerful blocks of interests, such as the major holding companies, who control a large proportion of Turkey's economy. Under such conditions, there is less perceived value in transparency and openness in the governance process. The projects underway to use networking technology in the government are usually focused on improving internal efficiency and effectiveness rather than relationships with the governed [11].

Policy-makers have become much more aware of the Internet since 1995; compared with persistent economic and political upheavals, and humanitarian issues following the August, 1999 earthquake, however, the Internet remains low on the legislative agenda. In 1995, policy makers and funding agencies did no value to Internet to fund any infrastructure creation. By 1997, thanks to the growth of the Internet worldwide and a great deal of public press on the topic, the perceived value of the Internet had growth to the point where finding $35 million was not difficult.

While there are groups examining various aspects of electronic commerce, and privacy and security matters, the Turkish parliament has not passed legislation that deals specifically with the Internet. Whether by default or design or both, the current approach is to cope with Internet-related issues as much as possible within the context of existing laws. For example, only Internet Cafes that serve alcohol are to be prohibited in proximity to Mosques. The publication of pornography on the Internet is illegal not because there is a law specifically against Internet pornography, but because the law already limits the sale of pornographic material in print.

Politically, the Internet is not a significant issue and is not viewed as a major factor shaping public opinion. Turkish public opinion is strongly shaped by the handful of corporations that own the principal media outlets. Although these companies are also investing substantial funds in developing a presence on the Internet, the sense among politicians is that the Internet is not a threat as an alternative information source. As one individual put it, "No one is going to start a

revolution via e-mail." While this sentiment may change with a growing Internet user population, the Internet and, in particular, the negative aspects of the Internet have relatively low visibility.

In the national security area, three major viewpoints seem to be at work: First, telecommunications is viewed as an enhancer of national security. Second, the Internet has some qualities that affect national security negatively. Third, one should control that which one can but not try too hard to control that which one can't. The Internet has been a cause for concern, but the upshot appears to be that the national security community recognizes the limitations of its own ability to control Internet use and has backed off of active measures to do so.

Traditionally, Turkey's telecommunications regime has been shaped against the backdrop of three major areas of concern: (a) national security, (b) Cold War/public security, (c) "export-led economy" concerns [30]. The national security and Cold War/public security concerns, coupled with NATO interests in seeing a strong domestic telecommunications infrastructure played a strong role in shaping the push to expand and upgrade Turkey's telephone infrastructure during the 1980s. NATO was interested in preventing the Soviet bloc from eavesdropping on NATO communications. Domestically, the Kurdish separatist movement which began in 1983 created the impetus to expand communications services to all villages.

When the Internet first began to take root in Turkey, the national security community, aware of some of the possible uses of the network for terrorist and other socially harmful activities, investigated whether it should, or could, control its development and use. At one point the Interior Ministry tried to shut down Internet Cafes because of the potential for users to access information on pornography, terrorist propaganda and expertise (like building bombs), and drug dealing. A small number of members of the Turkish parliament, perhaps ten out of 550, were promoting the idea of creating a closed Turkish Internet, with strict controls over the flow of information to and from the international Internet. In the end, such measures lacked public support and the support of key individuals in the Ministry of Transport and Telecommunications; the Council of National Security realized that it did not have the human resources necessary. The national security community has decided to let the Internet flourish with intervention only when necessary to enforce existing laws.

Perceived value by service providers

Until 1995, Türk Telekom and the Ministry of Transport and Telecommunications paid little attention to the Internet. Although it has been sometimes been viewed as a barrier to the growth of the Internet in Turkey, there is little question that Türk Telekom is eager to see an expansion of the Internet in Turkey and is even willing tolerate some inconsistencies between the law and existing practice to see it thrive. Certainly Türk Telekom does not have the kind of hostile relationship with users and Internet service providers that other countries' monopolies have.

Obviously, Internet service providers favor an expansion of the Internet in Turkey. However, most of these companies are motivated by the same factors that motivate companies in competitive technology environments throughout the world: profit, the thrill of the game, or the joy of pushing the bounds of the technologies. Some ISP founders may be motivated by a sense of duty to country, but ISPs do not typically have the same commitment to concepts like universal service that Türk Telekom or ULAKBIM have. When the Turkish backbone was being established, ISPs and potential ISPs worked hard to open up the market for Internet services.

They are not, however, beyond pushing for a less competitive regime if it would appear to be to their advantage.

Balance of Interests

Overall, there are very few interest groups and influential individuals who strongly oppose the Internet's presence in Turkey. In contrast, there are many who actively support it. At the present, the balance of interests in Turkey tends rather strongly towards favoring the expansion of the Internet. However, the basic reality is that the vast majority of citizens and politicians do not interact with the Internet regularly, and do not view it as a priority item.

RESOURCES

The resources needed to expand Internet use at the organizational, local, and national levels fall into five broad categories: financial, informational, human, technological or capital, and material. Material resources--raw materials, energy--are usually not a major issue in the development of the Internet, although there are countries with rather unstable and inconsistent power grids.

Technological Resources

Technological resources are, in the case of the Internet, the hardware and software components that constitute the infrastructure: routers, cables, switches, and so forth with the software to make it function. Traditionally, Turkey has pursued a two-track policy with regard to telecommunications technology. During the 1960s the Turkish Council of National Security issued a report that called for the development of local production capability in telecommunications technology. Netas, a subsidiary of Northern Telecom, was established as a joint venture between Northern Telekom, the Turkish PTT and a military foundation [30]. Teletas, a joint venture between the Belgian arm of the ITT and the former Research and Development arm of the Turkish PTT, was formed in 1983. Both of these companies have manufactured a great deal of the exchanges, multiplexers and other long distance transmission equipment used in the Turkish telephone system. When Turkey has not had indigenous capability, however, it has not been reluctant to acquire it from foreign sources through revenue sharing agreements or, as in the case of TTNet, through direct purchase. Like their counterparts in other countries, ISPs purchase routers, servers, etc. from well known Western vendors like Cisco, Sun Microsystems and many others. The availability of necessary hardware and software is not a limiting factor in the development of the Turkish Internet.

Human Resources

Human resources refers to the quantity and quality of know-how necessary not only to install an infrastructure but also to keep it operating over time. Universities like METU, ITU, and Bilkent have produced many technically skilled individuals who have gone on to found, or work at, Internet-related companies. However, the availability of skilled human resources remains one of the critical limiting factors in the growth of the Turkish Internet. Shortages are found everywhere, from commercial companies seeking to establish Web sites and get involved with electronic commerce to Türk Telekom's working to hire network-savvy employees to schools trying to connect to the Internet. Government organizations, including Türk Telekom, are particularly disadvantaged because they are legally limited in the amount of money (inadequate) that they can pay employees. Human resources has been cited by several leading proponents of

the Internet as *the* most critical problem limiting growth of the Internet [21]. Fortunately, Turkey does not suffer significantly from the 'Brain Drain' that other countries experience. As a rule, Turkish students studying abroad return to Turkey to live.

In 1997 The Council of Turkish Higher Education decided to open more than 20 new Instructional Technology departments in the Schools of Education at various universities. The Internet plays an important role in these departments' curriculum. The graduates of these departments will work in K12 schools and the private sector [18].

Informational Resources

Informational resources consists largely of the documentation relevant to all the tasks that are part of building and maintaining an infrastructure. Increasingly available on the Internet or from vendors, a lack of necessary information regarding Internet technologies is not a major issue.

Financial Resources

Financial resources make come through government allocations, domestic private investment, or foreign investment. Fluidity of resources refers to the ease with which resources can flow from where they are to where they are needed. While financial resources have been available, they have often not been available in the quality, or with the fluidity necessary. First, Turkey's heavy foreign debt and Türk Telekom's sizable revenue stream into the state treasury have made it difficult at times for the company to receive the funds needed for the development of new infrastructure. However, telecommunications has been a Turkish priority since the early 1980s, so Türk Telekom has been able to accomplish much in basic infrastructure development.

TURNET provides an example of some of the financial constraints facing Türk Telekom. Since Türk Telekom was unable in 1995 (the year after a financial crisis in the government) to acquire the funds to develop an Internet backbone itself, it had to enter into a revenue sharing agreement. The final agreement stipulated that approximately 70% of the revenue would go to Türk Telekom. However, the agreement further stipulated that Türk Telekom could not invest in TURNET infrastructure development! In 1998, the government did agree to pay $35 million to Alcatel for the creation of TTNet [23].

One of the principal sources of financial resources for Internet-related development throughout the work is private capital, including venture capital and foreign investment. Both sources are in short supply in Turkey. Because of high rates of inflation and high levels of national debt, the government pays high rates of interest on securities to attract investment. This investment opportunity decreases the attractiveness of riskier, start-up ventures. Organizations that do have a great deal of money, such as the major Turkish holding companies, prefer to create their own companies rather than invest in other companies. SuperOnline, for example, is owned by the Yapi Kredi holding group.

Although Turkey's foreign investment policies have created a streamlined, transparent foreign investment climate, among the most liberal among OECD nations , foreign investment remains relatively scarce in Turkey [36]. However, investments are subject to the political uncertainties, bureaucratic red tape, and occasionally unclear legal environment of Turkey. In the telecommunications arena, the government is trying to sell Türk Telekom to a strategic partner; but the uncertain investment and regulatory climate in Turkey makes this very difficult [63].

LEGAL AND REGULATORY FRAMEWORK

IP Address and Domain Name allocation

Although many aspects of the Internet are inherently distributed, the whole system dependents on coordinated approaches to assigning Internet Protocol (IP) addresses and domain names, and managing the association between the two. In Turkey, both of these tasks have been managed in a clear and efficient fashion since the first days of the Internet. In 1993, the Middle East Technical University was given responsibility for Turkey's Domain Name Service (DNS), including the responsibility of allocating domain names under the .tr domain. METU continues to maintain the DNS, even though as a whole METU is not playing as active a role in promoting the Internet in Turkey as it did during the early days. METU is delegating responsibility for the .edu.tr subdomain to ULAKBIM.

Allocation of IP addresses is somewhat less coordinated, but has taken place in a manner that has been free of serious difficulty. METU does allocate some IP addresses, but in principle any organization is free to obtain an IP address directly from RIPE or any other comparable authority. ISPs have been given blocks of IP addresses over which they have responsibility.

Provision of Telecommunications Services

The Turkish Constitution mandates that the Turkish government alone provide basic communications services. Consequently, most wireline and a good deal of wireless infrastructure is created by Türk Telekom. While Türk Telekom has licenses a small number of companies (which compete against each other) to provide international satellite connectivity, domestic telephone and leased line services are provided exclusively by this monopoly provider.

However, companies are permitted to build infrastructure for their own use. SuperOnline is one ISP that has been building its own infrastructure. By the end of 1999, it had planned to have ATM capacity into over 19 nodes [34].

Over the years, Türk Telekom has done a fair job of providing infrastructure. While the scarcity of available leased line and frame relay connections is an on-going source of complaint among companies, Türk Telekom has invested a great deal of money since 1980 on the improvement of the telecommunications infrastructure.

Licensing of ISPs

The licensing of ISPs is, legally speaking, a large gray area. While some countries use the lack of a firmly established legal framework as a tool to inhibit ISP proliferation, Turkey has taken the opposite approach. The Turkish government has encouraged the proliferation of ISPs under these uncertain conditions, preferring to overlook inconsistencies or irregularities in the legal framework for the sake of promoting a vigorous ISP market. While it is likely that some sort of licensing arrangement will be established, currently no ISPs are formally licensed.

Internet-specific legislation

To date, Turkey has not established a framework of "cyberlaw" oriented towards the Internet. In part, this is a reflection of the relatively low priority that the Internet has on the agenda of the Turkish Parliament and the rather chaotic state of that body (see section below). The most

generous rationalization is that Turkey is taking a conservative approach, watching cyberlaw developments in other countries, and planning its legal moves carefully. A less generous interpretation is that the country can't pass controversial legislation.

To say that no Internet-specific laws have been passed is not to say that there aren't groups working on the issue. In particular, the Electronic Trade Coordination Committee released a report in May, 1998, calling for measures to create the legal infrastructure necessary for electronic commerce [27]:

- Regulation of electronic bookeeping
- Making changes in tax law, trade law, banking law, etc. to support electronic commerce
- Making foreign electronic commerce documents valid in Turkey
- Establish laws regarding confidentiality
- Establish laws recognizing electronic signatures as legitimate
- Establish the organizations (certificate authorities) to regulate the issuing of digital certificates
- Etc.

ABILITY TO EXECUTE

The ability to execute reflects an ability to develop a sound strategy and a suitable design given the opportunities and constraints, and the ability to manage plans through to completion. The ability to execute may be compromised by political infighting or instability, red tape, historical legacies (e.g. existing but inadequate infrastructure or legacy hardware/software systems), or simply a mismatch between the scope of the project and the organizations' expertise.

Türk Telekom

Türk Telekom's ability to execute must be rated as 'moderate.' While the projects that it has undertaken have been generally successful, the company has frequently had difficulty carrying out the project in a timely fashion. The perennial shortage of leased lines is one example. The seven-month delay in TTNet rollout is another. The target rollout date for TTNet was January, 1999. Through July, the company made periodic announcements that the network would be ready "next month."

There are a number of factors that diminish Türk Telekom's ability to execute. First, the Turkish government is in a generally chaotic state. When the government changes, there are position changes among top-level government appointees, including the Minister of Transport and Telecommunications and top executives at Türk Telekom. It is sometimes difficult to maintain continuity of vision, or any vision at all. Moreover, the uncertainty of their position causes top Türk Telekom executives to leave periodically. Second, because it is a government organization, Türk Telekom must abide by regulations governing such matters as wage rates and limits on number of hours per week an employee can work. Because wage rates are low relative to the private sector, Türk Telekom finds it difficult to employ and retain qualified individuals. Third, like most government monopolies, Türk Telekom has a lax attitude towards customer service, leading to long delays and frustrations for its customers. It is highly bureaucratic [11].

When Türk Telekom does not have the in-house expertise, funding, or capacity to provide a new service, it has entered into an agreement with an organization that can. Many times, as in the creation of TURNET and some switch replacement, the agreement is based on a revenue sharing model. Other time, as with TTNet, the investment comes directly from Türk Telekom's budget. While the incentive structures and operational frameworks may not always be properly tuned, e.g. with TURNET, the private organizations are often major participants in the international telecommunications markets and bring with them an ability to plan and execute projects successfully. However, such projects are not always operated well.

Türk Telekom is regularly criticized for its quality of service. In March of 1998, the Internet Executive Council issues a draft report that included a long list of criticisms of TURNET, Türk Telekom, and TTNet including [34]:

- TURNET did not expand infrastructure
- TURNET's structure was created without a good plan for future capacity increases
- TURNET did not provide 24x7x365 technical support
- TURNET did not inform ISPs of testing and upgrades. Some were done during the middle of the day, causing ISP shutdowns
- Türk Telekom phone lines support all of the Internet. When they fail, ISPs have technical problems
- Türk Telekom's ISDN service has taken longer to implement than expected
- Türk Telekom may not be able to handle the TTNet project
- Etc.

Turkish Government

The Turkish government is not a model of efficiency. Political parties in continuous flux, a host of entrenched special interests, and an entrenched bureaucracy make the organization and execution of new initiatives difficult. The interaction of these forces pushes public policy in directions that can often not be predicted. One observer gave the example of a 1998 law that raised the number of years of mandatory education from five to eight, and established a period of tax amnesty intended to draw hidden revenue into the open. The 1998 ruling coalition was proud of the law and promoted it during its campaign. In July, 1999, the law was abruptly overturned by the (now slightly different) ruling coalition with little explanation and no advanced warning.

There are bright spots in the formulation of Internet-related policy formulation in Turkey. The Internet Executive Council, which met for the first time in January, 1998, provides a forum in which all the leading Internet-related voices can discuss issues and work through difficult issues affecting them all. The IEC has membership from government ministries, from commercial organizations, and academia. Reports are that discussion is substantial, open, and effective. The IEC has made recommendations that have been acted on and had a positive impact on the Turkish Internet. The principal contributions of the IEC appear to be:

- Recommendations regarding pricing, legislation, backbone architecture and so forth which are acted on by the responsible parties.

- The establishment of a forum where all voices can be heard.
- The establishment of a pseudo-public area that makes organizations like the ministries and Türk Telekom more accountable to the public.
- The establishment of a body that can provide an element of continuity in policymaking even when individuals come and go.

Another positive measure taken by the government is the development of TUENA, the Turkish Information Master Plan. The effort to formulate a master plan was carried out by the TUENA project office, established in 1997 within TÜBITAK under the coordination and responsibility of the Ministry of Transport and Telecommunications. "The basic vision is to maximize social and economic benefits of the information infrastructure, while optimising local value-added by informatics industries including telecommunication and informatics equipment manufacturers, software and communication service industries and content industries with a view to raise their global competitiveness in order to capture a bigger share of the world informatics market and to become an important regional actor" [20].

Internet Service Providers

As in any open market with many players and relatively low barriers to entry, the ability of Turkish ISPs to formulate and execute a successful business plan covers the spectrum from very good to dismal. Since TURNET was established, many ISPs have been created and have experimented with a variety of business plans ranging from the full-service provider model to a highly niche-oriented one. Some ISPs have failed, some have been purchased by other ISPs, and some have succeeded. What is important is not that any particular ISP has or has not an ability to execute, but that collectively the ISP market has enough dynamic and robustness that *some* ISP will be able to take advantage of any market opportunity that presents itself. Overall, the ISP market has a rather strong ability to execute.

GEOGRAPHY

Turkey is a country of modest size, with a well proportioned, integrated land mass. While parts of the country are hot, dry, and barren, the terrain does not pose any unusual costs or difficulties to the establishment of infrastructure.

DEMAND FOR CAPACITY

Since TURNET was established, there has always been greater demand for capacity, especially international capacity, than supply. Demand pull has been a constant force for greater expansion of the Internet in Turkey. It remains to be see to what extent Turkish users will use the capacity becoming available with TTNet.

MULTIPLICITY OF ISPS

One of the elements of Organizational Infrastructure is the extent to which the market for Internet service is a competitive one. Earlier discussion established that the Turkish ISP market is highly competitive.

SERVICES PROVIDED

Backbone Services

Under TURNET, ISPs could connect to the backbone through 64 Kbps - 2 Mbps leased line connections. Under TTNet, the range of services has expanded considerably. Türk Telekom has published tariffs for connections up to 155 Mbps. The use of ATM opens up the possibility of quality of service as a key variable. It is not clear to what extent TTNet will over variable quality of service or at what price.

End User Connection Services

Nearly all end users, including Internet Cafes, access the Internet through dial-up connections of up to 56 Kbps. A survey of Turkish ISPs conducted during the summer of 1999 indicated that only one advertised DSL access, and seven offered ISDN access.

Even when TTNet is fully on-line, only nine of 139 POPs will offer ISDN service, and none of these is outside of Istanbul, Izmir, and Ankara. Only 26 will offer Asynchronous Digital Subscriber Line (ADSL) service (see Appendix C).

CULTURE OF ENTREPRENEURSHIP

While the Internet service provider market is quite dynamic, there are so far very few examples in Turkey of Internet-related activities that are involved in the creation of distinctly new products or services reflecting strong innovative activity. One possible explanation for this is what appears to be a rather low culture of entrepreneurship. In countries like the United States and Israel, start-up companies abound, following a now-familiar life cycle: The founding individuals develop a bright idea, create a rudimentary product, attract venture capital, establish a company to commercialize the product, sell the company or hold an initial public offering (IPO), repeat the process. The wild success stories inspire many to look for and develop new, exciting ideas.

In Turkey the start-up life cycle typically gets short circuited. First, there are very few success stories along these lines in Turkey, so a young person sees little in his or her experience to inspire him/her to start a new company. Second, some have indicated that as a whole Turks do not have a risk-taking mentality in which failure is an acceptable outcome. Third, there is little venture capital to fund start-up companies. Given the inflation rate and the enormous debt the Turkish government carries, the interest rates on government securities is quite high. Money in Turkey is more likely to be attracted to well-paying, safe investments than to highly speculative ventures. Fourth, it is virtually impossible to survive as a software company in Turkey. Software piracy is rampant.

This state of affairs may certainly change, but it will depend on a growing number of success stories, and the existence of venture capital.

FORCES FOR CHANGE

While much of the motivation for change in Internet development and use may come from high perceived value of the medium, some motivation comes from external forces for change. While the two -- perceived value and forces for change -- are closely related, it is nevertheless helpful to identify some of the principal forces or agents who are playing a role in driving the development of the Internet in Turkey. Such forces can be categorized into agents of change, competitive forces, external mandates, and cultural predisposition to change.

Agents of Change

One of the changes in the Internet landscape in Turkey is the growing number of individuals and organizations who are actively promoting the Internet. Among the most persistent proponents have been academics such as Mustafa Akgül at Bilkent University and Atilla Özgit at Middle East Technical University. Akgül, for example, has organized numerous conferences and sometimes single-handedly brought connectivity to many organizations, particularly in the government.

Within the government, A. Tahir Dengiz, Deputy Undersecretary of the Ministry of Transport and Telecommunications, has been the leading activist. An avid Internet user, he has been the force behind the creation of the Internet Executive Committee, and many of the initiatives the Ministry has taken with respect to the Internet.

In Academic circles, TÜBITAK and its research center ULAKBIM have been strong proponents of the Internet.

More generally, the Council of National Security has been a force behind the expansion and improvement of the telephone infrastructure

Among commercial entities, the principal drivers of changes are the Internet Service Providers. Seeking to expand their markets, ISPs are vigorous promoting the Internet through any means they can think of.

Turkish banks in particular see opportunities in the electronic commerce arena and have organized programs to educate businesses about the value of e-commerce and the steps they might take to become conducting business on the Internet [70]. Banks' efforts to reduce their costs, and improve their quality of service and profitability by encouraging Internet banking has been discussed earlier.

Some holding companies and media groups, attracted by the attention the Internet has received elsewhere in the world are beginning to push change through financial levers.

Competitive Forces

The Internet should be seen within the broader context of the Turkish economy. Since the 1980s Turkey has taken many steps to open its economy and make it more competitive. While certainly the number of organizations viewing the Internet as a key component of a competitive strategy is still small, it is growing. Among the non-commercial sectors of society, however, competitive forces are not strongly felt.

External Mandates

At present, there are few formal mandates, government or otherwise, pushing the use of the Internet.

ENABLERS OF CHANGE

Enablers of change are those elements that help a change take hold in a community. While forces for change push change into a community, the enablers of change are those conditions that enable a community to embrace the change and that affect that rate of change. One of the more significant enablers include what Nelson calls the 'National Innovation Systems,' which encompasses the educational system and organizations involved in research and development

[42]. Other factors may include historical strengths (e.g. Israeli expertise in security issues), the legal framework for creating of new companies, and cultural elements that may influence a society's willingness to embrace new technologies.

In Turkey, there are few distinctive enablers of change that would make Turkish society particularly receptive (to this author's knowledge). The educational system is good, but is not producing enough technically skilled graduates. While Turkey has great diplomatic assets, given its geo-political position in the world, it has few inherent technology strengths. While creating new company is not difficult, companies of all kinds may struggle at times with bureaucracy and political change. The Turkish people are very social, and are quick to embrace technologies that support social interaction. Overall, Turkey may be compared, perhaps, to soil that is suitable for farming, but not fertile as some.

Prospects for the Internet in Turkey

We can now integrate the discussion of the two preceding sections on the Dimensions and Determinants of the Internet, according to the analytic framework. The results reveal some of the trends for the Internet in Turkey, and suggest measures or changes that might be most effective in promoting the Internet's growth.

DETERMINANTS OF PERVASIVENESS

Table 15 illustrates the determinants of Pervasiveness.

Pervasiveness: Level 3 (Common)		
Determinant	*State of the Determinant*	*Impact on Pervasiveness*
Access to Internet	Internet access can now be obtained throughout the country. Telephone lines in most areas support dial-up access adequately. The price of PCs is dropping rapidly although is still to high for the majority of Turkish families, and Internet Cafes abound.	**Good** and rapidly improving
Perceived value of the Internet	The Internet has become fashionable in social and economic circles. Companies are beginning to see the business benefit it can bring. There is no significant organized opposition to Internet use, and ISPs are vigorously promoting the Internet. However, most citizens have other concerns of much higher priority.	**Good** and rapidly improving
Ease of Use of the Internet	While the Internet is technically not difficult to use for Turkey's literate population, there is a need to create additional Turkish-language content for the non-English speaking members of the population.	**Fair** and improving
Cost of Internet	Sharp decreases in backbone connection fees and a	**Good** and

Access	highly competitive ISP market have caused end-user prices to drop by 50-75% in the last year. Internet Cafes offer access at hourly prices comparable to movies. While much lower than they were, the per capita GDP of Turkey indicates that Internet access is a luxury many cannot afford.	improving
Forces for change	Vigorous competition among ISPs results in many efforts to make the Internet more attractive to individual users.	**Excellent** and rapidly improving
Enablers of change	Turks are rather social, and have embraced technologies that enhance social interaction. Otherwise, there appear to be few distinct enablers of change.	**Fair** and slowly improving

Table 15 Determinants of Internet Pervasiveness in Turkey

What we can see from Table 15 that although Turkey has only recently reached Level 3 in pervasiveness, the conditions are present for continued strong growth in the number of users. Only one of the determinants currently has an 'Excellent' rating, meaning that more could be done in each to promote Internet pervasiveness. For example, under Access to Internet, the Internet is available throughout the country, but the ability to acquire a personal computer remains something of a limiting factor. A strong economy and rising per capital GDP would have a substantial impact.

DETERMINANTS OF GEOGRAPHIC DISPERSION
Table 16 illustrates the determinants of Geographic Dispersion.

Prior to TTNet, Turkey had taken a low-cost approach, the 0822 access code, to achieving the highest level of geographic dispersion. While most determinants of a more robust form of Internet service provision are positive, Table 16 shows that there are a number of factors that are preventing geographic dispersion from being even more firmly grounded than it is. Resources and an unclear legal framework are two of the most limiting factors. The ability of Türk Telekom to manage the new national network remains to be seen.

Geographic Dispersion: Level 4 (Nationwide)		
Determinant	*State of the Determinant*	*Impact on Geographic Dispersion*
Access to Internet	With the rollout of TTNet, the Internet backbone reaches every province. There should be little difficulty in offering local Internet access in each city. Larger ISPs may create additional infrastructure.	**Excellent** and improving

Perceived value of expanded geographic scope	ISPs, Türk Telekom, the Ministry of Transport and Telecommunications, the Council of National Security (presumably), and a growing body of companies and citizens favor expansion of Internet service throughout Turkey. There is no significant organized opposition to Internet use, and ISPs are vigorously promoting the Internet. However, most politicians have other concerns of much higher priority.	**Good** and improving
Adequacy & fluidity of resources	While it has financed expansion of the telephone system and the establishment of TTNet, the Turkish government has many budget pressures and is not likely to increase support in the near future. Private domestic and foreign investment in the Internet is low, but increasing. There are numerous technically skilled individuals, but not nearly enough to support broad and rapid expansion of Internet services.	**Fair** and slowly improving, if at all
Regulatory/ legal framework	The legal model under which ISPs provide services and build infrastructure remains a grey area. In particular, it is not clear if ISPs can build capacity and sell it to other ISPs. If not, the market may be too fragmented to support broad private-sector construction of infrastructure. Nevertheless, the government has been encouraging ISP activity.	**Fair** and slowly improving, if at all
Ability to Execute	To its credit, Türk Telekom identified and implemented a low-cost solution to providing nationwide Internet service through its 0822 access code. The creation of TTNet appears to be nearly complete, but the rollout schedule has slipped significantly and there remain doubts about Türk Telekom's ability to manage the network.	**Good** and slowly improving
Geography	While some parts of Turkey are hot, dry, and mountainous, the country is of modest size, well integrated, and has few barriers to physical expansion of the network.	**Good** and not changing
Forces for change	The Internet Executive Council and ISPs favor expansion of the domestic backbone and expanded Internet services market. Political and economic realities dampen their impact, however.	**Good** and improving

Table 16 Determinants of Geographic Dispersion

DETERMINANTS OF SECTORAL ABSORPTION

Sectoral Absorption: Level 2 (Moderate)

Determinant	*State of the Determinant*	*Impact on Sectoral Absorption*
Access to Internet	Internet access can now be obtained throughout the country. The availability of leased lines and frame relay circuits to end-user organizations may still be a limiting factor, however. ULAKNET provides access to nearly all universities.	**Good** and rapidly improving
Perceived value of the Internet	The perceived value of the Internet varies from one sector to another. It is strong among universities, and rapidly getting stronger in the commercial sector. The healthcare and public sectors, however, appear to see only limited value in the Internet. Networks may be used for internal efficiency, but broad use of the Internet to disseminate information among the general public does not appear to be a priority. Concerns about security and privacy exist, but at present do not appear to be a significant barrier.	**Fair** and improving
Ease of Use of the Internet	While using the Internet is a fairly simple task, sectoral absorption must involve creation of an Internet presence by organizations, which is a considerably more difficult task. Many ISPs now offer Web hosting and design services, lowering barrier to entry.	**Fair** and improving
Cost of Internet Access	Sharp decreases in backbone connection fees and a highly competitive ISP market have caused end-user prices to drop by 50-75% in the last year. The costs of connections and qualified personnel remain beyond the budgets of cash-strapped government and healthcare organizations. Costs for universities are limited to hardware acquisition.	**Good** and improving
Adequacy & fluidity of resources	Of all resources, human resources appears to be the principal bottleneck. Financial resources are adequate in much of the commercial sector. World Bank financing is helping connect K-12 schools. Some government organizations have funding for computerization programs, but many do not.	**Fair** and slowly improving, if at all
Legal and Regulatory Framework	A good deal of work needs to be done to establish the proper legal framework for electronic commerce, including the creation and management of digital signatures, adaptation of tax and accounting laws to	**Fair** and slowly improving

	property handle electronic transactions, creation of additional guidelines regarding security and privacy.	
Forces for change	ISPs are promoting the Internet not only among individuals, but also among organizations, especially commercial organizations (which have money). Banks are educating companies in the benefits and techniques of electronic commerce. The increasingly competitive commercial environment in Turkey is causing many business to seek competitive advantage in non-traditional ways. There exist champions (e.g. A. Tahir Dengiz & Mustafa Akgül) of bringing the government on-line.	**Good** and improving
Enablers of change	The extent to which change is taken advantage of varies greatly from one sector to another. University education and the commercial are most open to change, and have the financial and human resources necessary to carry it out. Government agencies are hampered by the general lack of a service attitude and a tendency to hoard information and use it as a level of influence.	**Fair** and slowly improving

Table 17 Determinants of Sectoral Absorption

Table 17 provides some clues to the difficult job ahead in raising the level of sectoral absorption in Turkey. First, there is no single factor that contributes to weakness in this area. Rather, it is a combination of such varied factors as a lack of resources (human in particular), low levels of interest, and a (governmental) culture that does not greatly value transparency and dissemination of information. What is encouraging is that physical access to the Internet is becoming much less of a problem than it used to be, and there are forces at work to encourage various sectors to embrace the Internet. The question is probably not whether they will be sufficient to overcome the barriers, but when.

DETERMINANTS OF CONNECTIVITY INFRASTRUCTURE

Connectivity Infrastructure: (2.5) Expanded, nearly Broad		
Determinant	*State of the Determinant*	*Impact on Connectivity Infrastructure*
Perceived value of extensive connectivity	Many ISPs perceive value to having domestic and international connections that are not dependent on TURNET or TTNet. Türk Telekom and other players in the Internet market have clearly placed a value on the expansion of backbone capacity and services. ISPs have not apparently seen enough benefit in creating an Internet Exchange Point separate from TURNET/TTNet to have created one.	**Good** and improving
Cost of connectivity	The cost of providing connectivity has decreased throughout the world, but the cost of International connections, both to Türk Telekom, to ULAKBIM, and to ISPs remains rather high.	**Good** and improving
Adequacy & fluidity of resources	While it has financed expansion of the telephone system and the establishment of TTNet, the Turkish government has many budget pressures and is not likely to increase support in the near future. Private domestic and foreign investment in the Internet is low, but increasing. There are numerous technically skilled individuals, but not nearly enough to support broad and rapid expansion of Internet services.	**Fair** and slowly improving, if at all
Legal and Regulatory Framework	ISPs are permitted to create domestic links and purchase international connections. It is not clear that they may resell such capacity, which could limit the effective market of any cable laid. ISPs are permitted to create Internet exchange points (IXP).	**Good** and slowly improving
Ability to Execute	The creation of TTNet appears to be nearly complete, but the rollout schedule has slipped significantly and there remain doubts about Türk Telekom's ability to manage the network. Adding incremental capacity, especially international capacity is no longer a question of ability but of cost and demand.	**Good** and slowly improving
Demand for capacity	Demand for capacity along international connections remains high. ULAKNET domestic connections are greatly underutilized, and the high capacity domestic TTNet lines (E3 and OC-3) may also be underutilized	**Good** and improving

	in the near future. However, the need for capacity continues to grow, and Turkey may see a 'Turnpike' effect of growing usage as the capacity of domestic and international lines improves. It is not clear how strong the demand for advanced Internet services is at present.	
Multiplicity of ISPs	There exist multiple ISPs, so an Internet Exchange Point could be created, if it were desirable.	**Excellent**
Services provided	Leased lines of 64 Kbps and above have been available for some time, but have not been plentiful in many areas of the country. Provision of high-speed Internet access services (e.g. cable modems, ISDN, xDSL) has begun, but is not widely available and not widely used.	**Fair** and improving
Forces for change	Multiple actors, including the Ministry of Transport and Telecommunications, the Internet Exchange Council, ISPs, and Türk Telekom have pushed for expanded capacity and services. What remains to be seen is what kind of demand will develop for additional capacity and services.	**Good** and improving

Table 18 Determinants of Connectivity Infrastructure

DETERMINANTS OF ORGANIZATIONAL INFRASTRUCTURE

Organizational Infrastructure: Level 3 (Competitive)		
Determinant	*State of the Determinant*	*Impact on Organizational Infrastructure*
Access to Internet Backbone	Internet service providers appear to have little difficulty accessing the national backbone, although the terms may not always be to their liking. Gaining access to leased lines in the Eastern and Southeastern portions of the country is more difficult.	**Excellent** and improving
Perceived value	Support from the Internet Executive Council, the Ministry of Transportation and Telecommunications, the National Security Council (probably), and Türk Telekom is (now) strong. The earliest ISPs may not have appreciated the competition of later entrants, but support a robust market. The detractors of robust organizational infrastructure are those in the government and the workplace who do not see competitive domestic communications markets as in the best interests of the state Treasury or themselves.	**Good**
East of use	The creation of a national backbone in Turkey (TURNET) reduced barriers to entry for ISPs because they did not have to negotiate and establish their own international connections. They only needed to connect to TURNET.	**Good**
Cost of Internet Access	Sharp decreases in backbone connection fees have lowered barriers to entry for ISPs	**Good** and improving
Adequacy & fluidity of resources	Creating an ISP is not necessarily a high-capital venture. The last two years have demonstrated clearly that there is sufficient capital and human resources in Turkey to create a multitude of ISPs.	**Excellent**
Legal and Regulatory Framework	The legal and regulatory framework surrounding the Internet services market is among the more interesting elements of the Turkish Internet. Today Internet services and international connectivity are provided competitively, but only because the government has done some creative interpretation of the constitution, or "looked the other way" as commercial companies provide services. Legal frameworks and the Turkish	**Good** and slowly improving

	Constitution continue to leave this area a bit unsettled.	
Forces for change	While there is no shortage of individuals and organizations who are pushing for the changes to make the organizational infrastructure even more open and competitive than it is, the body that must make the changes, the Parliament, is quite divided on the issue and unlikely to make dramatic changes before 2005.	**Fair**
Enablers of change	The experience of Internet Service Providers shows clearly that there are numerous individuals willing to pursue opportunities in commercial markets, and there exists an economic infrastructure that is conducive to the creation and growth of new companies.	**Good**

Table 19 Determinants of Organizational Infrastructure

Most of the conditions for robust organizational infrastructure exist in Turkey. As Table 19 indicates, the principal barriers lie chiefly in the legal and regulatory area, and the legal and political interests that may prevent change. What is perhaps most significant is that the organizational infrastructure is much more robust that it might be under the existing regime, thanks to liberal interpretation and selective enforcement of existing laws.

DETERMINANTS OF SOPHISTICATION OF USE

Sophistication of Use: Level 2 (Conventional)		
Determinant	*State of the Determinant*	*Impact on Sophistication of Use*
Access to Internet Backbone	The Internet can be accessed from nearly anywhere in Turkey, although high-speed, high-quality access is limited to major cities, and certain providers within those cities. TTNet promised not only expanded service, but expanded capacity and quality of service.	**Good** and improving
Perceived value	Although still relatively small, the number of individuals and companies who understand the ways in which the Internet can transform an organization and a society is growing.	**Fair** and improving
East of use	International developments in application development tools, and third party software continue to lower the barriers to use of the Internet in sophisticated and transformative ways.	**Good** and improving
Adequacy & fluidity of resources	While there is some capital being invested by the major holding companies in Internet activities, there is a dearth of venture and investment capital for undertaking the development of novel Internet-based technologies and applications. There is a shortage of technically skilled, creative individuals.	**Fair** and improving
Legal and Regulatory Framework	The legal system adequately supports such things as the creation of start-up companies and foreign investment. However, bureaucratic red tape remains a constant problem	**Good**
Culture of Entrepreneurship	The Internet services market is perhaps one of the most entrepreneurial in Turkey, but as a whole, Turkey has a low culture of entrepreneurship. ISPs, or people associated with that culture have some potential for developing some rather sophisticated and uses for the Interent.	**Fair** and improving
Forces for change	The Commercial market is experiencing the strongest forces for increasing sophistication of use. As Turkey's economy becomes more competitive the prospect of using the Internet and electronic commerce applications to improve or transform business	**Fair** and improving

	processes becomes more pronounced. Other sectors are not experience the same kinds of imperatives.	
Enablers of change	One of the enabling factors is the "demonstration effect." As the number of organizations and individuals demonstrating a particular level of sophistication grows, the amount of 'copycating" grows as well. At present, the 'demonstration effect' is primarily causing companies to establish some sort of Web presence. In the future, we expect the level to rise.	**Good**

Table 20 Determinants of Sophistication of Use

GOVERNMENT POLICY AND THE DETERMINANTS OF INTERNET DIFFUSION

The most important determinant, government policy, belongs in a category by itself, since the policies of government overlay all other determinants, affecting both their nature and their effectiveness, based upon a government's ability to exercise coercive power. The policies created by a government are generally intended to achieve the fulfillment of that government's goals, which may be more of less closely related to the goals of those governed, depending upon the form of government. The government's policies may also appear to be more or less rational, depending upon how well the policy reflects the realities of its milieu, but governments can--and all too often do--create policies that reflect a lack of awareness or understanding of its environment, or an excessive optimism regarding the government's ability to overcome obstacles to its policies. The most important levers are:

1. passage of legislation and directives that shape the legal environment within which a society functions;
2. enforcement of laws and the wishes of those in control of security forces;
3. taxation, fees and other forms of revenue generation;
4. allocation of resources: financial, informational, technical, human, and material.

Governments' ability to apply the levers of power to shape determinants is by no means uniform across determinants. Some determinants, e.g. geography, are, for the most part, outside the realm of influence of the government. Other determinants, e.g. resources and legal/regulatory environment, lie firmly within the reach of governments' levers of power. Still other determinants lie somewhere in-between. While governments may over time work to create an entrepreneurial culture within a country, for example, this is usually a slow and uncertain process.

The following table illustrates some of the ways in which Turkish government policy has influenced the determinants discussed above. The table also can be used to suggest ways in which the government can impact the development of the Internet in Turkey. Each of measures can be classified according to whether it is likely to be a high impact or a low impact measure. High impact measures are those that are likely to have a strong and relatively quick impact on one or more of the Internet dimensions. Each measure can also be classified according to whether it is easy or difficult to implement. Spending a lump sum of money is easy; bringing about a shift in popular opinion is more difficult; changing the geography of a country is practically impossible.

Determinant	*Measures taken by government*	*Measures that might be taken by government*	*Impact/Difficulty*
Access	Creation of TURNET, Creation of TTNet, Improvement of telephone system	Tolerance of private-sector investment in infrastructure; subsidization of access to schools, public institutions; improve economy	Moderate / Moderate - Difficult
Perceived value	Evangelism by National Security Council, Min. Transport & Telecom, Prime Minister, etc.	Policies promoting openness of government information & processes	Moderate / Difficult
Ease of Use of the Internet	Creation of Turkish language content on government Web pages		Moderate / Moderate
Cost of Internet Access	Reduction of tariffs	Reduction of international connection rates	High / Easy
Adequacy & fluidity of resources	Investment in TTNet, investment in telephone infrastructure	Expand education in computing; continue investment in infrastructure	High / Moderate-Difficult
Regulatory/ legal framework	Permission given for provision of Internet services	Permit greater competition in provision of all services; promote changes in legislation to facilitate e-commerce	High / Moderate
Ability to Execute	Creation of Internet Executive Council	Stabilize government	Moderate / Difficult
Geography			Low / Difficult
Demand for capacity			Moderate / Moderate
Multiplicity of ISPs	Permission given for multiple ISPs to exist		High / Easy
Services provided	Creation of national backbone, introduction of services by Türk Telekom	Expansion of TTNet services provided; streamlined processes supporting private sector	High / Moderate
Culture of entrepreneurship	Creation of conditions to attract foreign investment and venture capital	Stabilization of economy to make investment in private sector more attractive	Moderate / Moderate-Difficult
Forces for change	Cultivation of champions of the Internet in policy-making circles (e.g. IEC)	Encourage promotion of Internet within Parliament, including change to Constitution	Moderate / Moderate

		change to Constitution	
Enablers of change		Cultivate technology curriculum in education; smooth process of new company creation; reduce bureaucracy & red tape	High / Moderate

Table 21 Selected Internet-Enhancing Options for Government Policy Makers

Table 21 suggests a possible prioritization of measures the Turkish government might take to promote the Internet. A subset of those with relatively high impact are shown in Figure 19. Those that are likely to have a high impact and are relatively easy to implement should be given highest priority.

- dropping rates for international connectivity
- promotion of legislation establishing a proper framework for electronic commerce
- continued investment in infrastructure

Somewhat more difficult to implement because of the scope of the problem or the legislative and political tangles involved include will be an expansion of IT education and the promotion of a competitive environment for all communications services, including basic ones.

Other measures, such as overall stabilization of the economy, increased openness of government can have a large impact, not limited to the Internet. However, these measures, if achieved, are likely to be achieved only through a protracted and difficult process whose proscription is well beyond the scope of this study.

Figure 19 Selected Policy Options for Promoting the Internet in Turkey

Table 21 also illustrates the wide array of measures the Government of Turkey has already taken to promote the Internet. In fact, at this juncture it may be the case that the best thing that can be done for the Internet in Turkey is to let processes in motion continue on their present course, with at most a light touch from the policy-makers.

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Appendix A Chronology of Internet-Related Events in Turkey

1909	First manual telephone exchange with a 28-line capacity is put into service %%2102(Akbalik, 1998)%%.
1926	The first automatic telephone exchange is established in Ankara %%2102(Akbalik, 1998)%%.
1979	First satellite earth station %%2102(Akbalik, 1998)%%.
1983	The Master Plan for Telecommunications is drawn up, initiating broad expansion of the telecommunications infrastructure %%2102(Akbalik, 1998)%%.
1984	Digital telephone exchange
1985	▪ Turkish University and Research Association Network (TÜVAKA) established.
1986	▪ (Telephone) Network Expansion Plan implemented ▪ Second satellite earth station ▪ Experimental packet-switched data network ▪ Cellular mobile radio telephone system NMT ▪ Video conference service ▪ Radio paging service ▪ Fiber optic cable system %%2102(Akbalik, 1998)%% ▪ (October) TÜVAKA connected to EARN via a link between Ege University and Montpellier, France. %%2103(Tonta and Kurbanoglu, 1993)%% %%2104(Ozgit et al, 1995)%%.
1988	▪ Experimental videotex service ▪ Third satellite earth station %%2102(Akbalik, 1998)%%
1989	▪ Packet-switched data network ▪ INMARSAT satellite earth station %%2102(Akbalik, 1998)%%
1990	▪ SoftCom (Software & Computing Club) formed at Bosphorus University, and soon established one of the first BBS. ▪ Teletex service introduced %%2102(Akbalik, 1998)%%
1991	Cable TV service introduced.
	FidoNet connection established.
	UUCP e-mail connection to the United States established %%2101(Yurderi, 1997)%%.
1992	▪ Aegean, Bilkent, Istanbul Technical, Middle East Technical and Yildiz Technical Universities are connected amongst themselves by TCP/IP %%2103(Tonta and Kurbanoglu, 1993)%%. ▪ (October) Internet connection to RIPE by using IP over X.25 %%2104(Ozgit et al, 1995)%%.
1993	▪ Turkey's first international Internet connection established by a 64 Kbps line to NSFNet in the United States %%2104(Ozgit et al, 1995)%%.
1994	▪ Turkish Parliament passes a law that splits the post and telecommunications functions. The telecommunications division is incorporated as Turk Telekomunikasyon A.S. and retains monopoly power over provision of

	telecommunications services %%2099(Akemir, 1996)%%. ▪ Cellular GSM system introduced ▪ TurkSat 1B %%2102(Akbalik, 1998)%% ▪ TUVAKA connection to EARN re-routed from Monpellier, France to Bonn, Germany %%2104(Ozgit et al, 1995)%%.
1995	▪ Separation of telecommunications and postal services completed %%2099p2102(Akemir, 1996); 2102(Akbalik, 1998)%%. ▪ VSAT service introduced %%2102(Akbalik, 1998)%%.
1996	▪ TURNET ▪ TurkSat 1C ▪ CCITT No. 7 %%2102(Akbalik, 1998)%%
1997	▪ ISDN service introduced %%2102(Akbalik, 1998)%%. (According to %%2103(Tonta and Kurbanoglu, 1993)%%, ISDN was available before 1993.)
	▪

Appendix B Turkish Internet Service Providers

TURNET Connection Point	ISP	Connectivity to TURNET (Kbps)	
		Sept., 1997	May, 1999
Ankara	TR-NET / Orta Dogu Yazilim Hizmetleri A.S.	512	2048
	ADA-NET Internet ve Iletisim Hizmetleri Tic.Ltd. A.S.	128	1024
	FIDAN Fiyat ve Danisma Hizmetleri A.S.	128	512
	ASELSAN Askeri Elektronik Sanayi A.S.	128	128
	ATAC Bilgisayar Hizmetleri San.ve Tic. Ltd. Sti	128	128
	DOMI Bilisim Teknolojileri Ltd. Sti.	128	128
	UNIVERSITELER	128	128
	BIMEL Elek. Mamül Paz. Ltd.	128	
	RAKSNET Iletisim Teknoloji ve Tic. A.S	128	
	BIRNET Bilgi Sistemleri Tic. Ltd. Sti	64	512
	ATO Ankara Tabip Odasi	64	128
	NETCOM Bilgisayar Sis. San. Tic. A.S.	64	128
	Surf Computer Technolojies Co.	64	128
	FutureNET, Hi-TECH Bilgisayar Ltd. Sti.	64	64
	HERIS Seramik ve Turizm A.S.	64	64
	TSE Turk Standartlari Enstitusu	64	64
	AVC Bilgi Islem Müm. Taahut San. Tic. Ltd. Sti.	64	
	ISBANKASI A.S.		1024
	Çelik NET Internet Hizmetleri Ltd. Sti		512
	GEDIKNET Iletisim Teknoloji ve Tic. A.S		256
	Maya Ticaret ve Taahhüt Ltd.Sti.		256
	AKDENIZ KOLEJI		128
	HAYNET Internet Sist. A.S		128
	AKBANK T.A.S		64
	FARMANET Iletisim Hizmetleri A.S		64
	Gülkom Müh.Bil.Elk.San.ve Tic.A.S.		64
	T.C. BASBAKANLIK		64

	ZIRAAT BANKASI		64
Istanbul	SUPERONLINE	1024	2048
	DORUK Iletisim ve Otomasyon San. ve Tic. A.S	1024	1024
	Liste 2000 Bilisim Teknolojisi San. Tic. A.S.	1024	64
	TÜRK NOKTA NET Bilgi Hizmetleri Ltd. Sti.	512	2048
	GLOBAL-ONE Turkiye	512	512
	SIMKO Siemens A.S	512	512
	ATLAS ON-LINE Iletisim Sis. Ve Tic. A.S	256	2048
	COMNET Iletisim Hizmetleri ve Tic.A.S	256	1024
	FORNET Fornet Elektronik A.S	256	1024
	HÜRRIYET Gazetecilik ve MatbacilikA.S	256	1024
	RAKSNET Iletisim Teknoloji ve Tic. A.S	256	512
	PRIZMANET Elektronik Yay. Hiz. San. ve Tic.A.S	256	256
	ALNET	256	
	GORDION Gordion Bilgi Islem Yaz.ve Don	128	1024
	IHLASNET Ihlas Holding	128	1024
	GARANTI BANKASI T.A.S	128	512
	VERISOFT Bilgi Islem Tic. ve San. Ltd. Sti.	128	512
	YÖRENET Yöre Elektronik Yayincilik A.S	128	512
	ESCORTNET Ltd. Sti.	128	256
	BILTAM Mümessillik Dis.. Tic. San ve Tic. A.S	128	128
	BIYA Birlesik Yazilimcilar Ltd. Sti.	128	128
	MAGNET Elektro. Bil. Isl-Hab.Tek.San.veTur.Ltd.Sti	128	128
	ORION Bilgisayar San. ve Iletisim Ltd. Sti.	128	128
	OSMANLI BANKASI A.S	128	128
	TEKLAN Internet Erisim Hiz. Komünikasyon Ltd. Sti.	128	128
	BOGAZIÇI Bilgisayar Programcilik Tic. ve San. A.S	128	
	AKBANK T.A.S.	64	128
	INTERTECH Bilgi Islem ve Paz. Tic. A.S.	64	128
	KILIMNET Bilisim ve Iletisim Teknolojileri Ltd Sti	64	128
	TAM Bilgi Iletisim A.S	64	128

	ARTINET Arti Applecenter	64	64
	BENTAS Bilgisayar End. Müh. ve Tic. A.S.	64	64
	BIS Bilgi Islem Sis. San. ve Tic. Ltd. Sti	64	64
	DATATEKNIK Bilgisayar Sistemleri Tic. San. A.S.	64	64
	MAM / Marmara Arastirma Merkezi	64	64
	PERFORMANS Internet Erisim Hiz.A.S.	64	64
	SETRA Uluslararasi Servis Tic. ve Paz. A.S.	64	64
	ARNIL-NET Bilgisayar ve Ilet. Hiz. Tur. San ve Tic Ltd. Sti	64	
	BDP Yayincilik Haber Ajansi A.S.	64	
	DUTNET Dut Bilgi Teknolojileri San. ve Tic. A.S	64	
	FUZUL Dis Ticaret A.S.	64	
	ICAFE Data Iletisim Yayin. ve Kafeterya Islt. A.S.	64	
	PLANET Bilgisayar Bilisim ve Reklam Ltd Sti.	64	
	SABAH Elektronik Yay. Ilet. A.S.	64	
	TELENET Iletisim Hiz. Reklamcilik ve Tic. Ltd. Sti	64	
	BILGIN Elektronik Yay. Ilet. A.S.		2048
	VESTELNET Elektronik Iletisim ve Bilgilendirme A.S		2048
	IBM Türk Ltd. Sti		1024
	ANET Iletisim Sistemleri ve Bilgi Hizmetleri Ltd. Sti		512
	TRADENET Istanbul Ticari Bilgisayar Agi		512
	RUMELI Telekom A.S.		256
	BM NET Bilgi Teknolojileri San. ve Tic. A.S.		128
	BÜROMAKINA Tic. ve San. Ltd. Sti.		64
	BUTON Elektrik Bilgisayar ve Iletisim Sistemleri San. Tic. A.S.		64
	CENAJANS		64
	Data Iletisim Yayin. ve Kafeterya Islt. A.S.		64
	Gedik Yatirim		64
	MAIS Motorlu Araçlar A.S.		64
	SÜMERBANK A.S.		64
Izmir	RAKSNET Iletisim Teknoloji ve Tic. A.S	512	512
	EFESNET Yesil Ege Bilisim ve Internet Hiz. A.S	512	128

	UNIMEDYA Türknet Elektronik Endüstri ve Tic. A.S	128	256
	UNIPA Universite Pazarlama A.S.	128	128
	ISPRO Iletisim. Hizmetleri. ve Yazilim San. Tic.. A.S.	64	256
	MOZAIK Bilgisayar-Reklam Pazarlama San. Tic. A.S	64	
	ANT-NET Antalya Net Bilgisayar Iletisim Tic. Ltd. Sti	19.2	
	AKBANK T.A.S.		64

Appendix C TTNet Points of Presence (POP) and (Planned) Connection Services

Province	POP	Township	Frame relay	ATM	PSTN	ISDN	ADSL
			Leased Line				
Ankara	POP-1	Ank-Ulus	X	X	X		X
	POP-2	Balgat	X	X	X		X
	POP-3	Incesu	X	X	X		X
	POP-4	Küçükesat	X	X	X	X	X
	POP-5	Yenisehir	X	X	X		X
	POP-6	Çebeci	X		X		
	POP-7	Çankaya	X		X		
	POP-8	Dikmen	X		X		
	POP-9	Etimesgut	X		X		
	POP-10	Iskitler	X		X		X
	POP-11	Kavaklidere	X		X	X	
Istanbul European Bank	POP-12	Ist-Gayrettepe	X	X	X		X
	POP-13	Ataköy	X	X	X	X	X
	POP-14	Ayazaga	X	X	X	X	X
	POP-15	Bahçelievler	X	X	X		
	POP-16	Beyoglu	X	X	X		X
	POP-17	Fatih	X	X	X		X
	POP-18	Levent	X	X	X	X	X
	POP-19	Sisli	X	X	X		X
	POP-20	Tahtakale	X	X	X		X
	POP-21	Avcilar	X		X		
	POP-22	Bakirköy	X		X	X	
	POP-23	Bebek	X		X		
	POP-24	Besiktas	X		X		
	POP-25	Günesli	X		X	X	
	POP-26	Esenler	X		X		

Province	POP	Township	Frame relay	ATM	PSTN	ISDN	ADSL
			Leased line				
Istanbul European Bank (cont.)	POP-27	Bayrampasa	X		X		
	POP-28	Kasimpasa	X		X		
	POP-29	Yesilköy	X		X		
	POP-30	Okmeydani	X		X		
Istanbul Anatolya Bank	POP-31	Ist-Acibadem	X	X	X		X
	POP-32	Kadiköy	X	X	X		X
	POP-33	Kartal	X	X	X		X
	POP-34	Ümraniye	X	X	X		X
	POP-35	Beylerbeyi	X		X	X	
	POP-36	Bostanci	X		X		X
	POP-37	Erenkoy	X		X		
	POP-38	Küçükyali	X		X		X
	POP-39	Pendik	X		X		
	POP-40	Üsküdar	X		X		
Izmir	POP-41	Izm-Konak	X	X	X	X	X
	POP-42	Bornova	X	X	X		X
	POP-43	Güzelyali	X	X	X		
	POP-44	Karsiyaka	X	X	X		X
	POP-45	Çigli	X		X		X
	POP-46	Aliaga	X		X		
	POP-47	Alsancak	X		X	X	
	POP-48	Buca	X		X		
	POP-49	Kemalpasa	X		X		X
	POP-50	Gaziemir	X		X		

Province	**POP**	**Frame relay**	**ATM**	**PSTN**	**ISDN**	**ADSL**
		Leased line				
		X.25				
Adana	POP-51	X		X		
	POP-52	X		X		
Afyon	POP-53	X		X		
Antalya	POP-54	X		X		
	POP-55	X		X		
Bursa	POP-56	X		X		
	POP-57	X		X		
Çanakkale	POP-58	X		X		X
	POP-59	X		X		
Denizli	POP-60	X		X		
Diyarbakir	POP-61	X		X		
	POP-62	X		X		
Edirne	POP-63	X		X		
Elazig	POP-64	X		X		
Erzurum	POP-65	X		X		
	POP-66	X		X		
Eskisehir	POP-67	X		X		
	POP-68	X		X		
Gaziantep	POP-69	X		X		
	POP-70	X		X		
Içel	POP-71	X		X		
Izmit	POP-72	X		X		
	POP-73	X		X		

Province	POP	Frame relay	ATM	PSTN	ISDN	ADSL
		Leased line				
		X.25				
Kayseri	POP-74	X		X		
Konya	POP-75	X		X		
	POP-76	X		X		
Kütahya	POP-77	X		X		
Samsun	POP-78	X		X		
Trabzon	POP-79	X		X		
	POP-80	X		X		
Van	POP-81	X		X		
Adapazari	POP-82	X		X		
Adiyaman	POP-83	X		X		
Agri	POP-84	X		X		
Aksaray	POP-85	X		X		
Amasya	POP-86	X		X		
Ardahan	POP-87	X		X		
Artvin	POP-88	X		X		
Aydin	POP-89	X		X		
Balikesir	POP-90	X		X		
Bartin	POP-91	X		X		
Batman	POP-92	X		X		
Bayburt	POP-93	X		X		
Bilecik	POP-94	X		X		
Bingöl	POP-95	X		X		
Bitlis	POP-96	X		X		
Bolu	POP-97	X		X		

Province	POP	Frame relay	ATM	PSTN	ISDN	ADSL
		Leased line				
		X.25				
Burdur	POP-98	X		X		
Çankiri	POP-99	X		X		
Çorum	POP-100	X		X		
Erzincan	POP-101	X		X		
Giresun	POP-102	X		X		
Gümüshane	POP-103	X		X		
Hakkari	POP-104	X		X		
Hatay	POP-105	X		X		
Igdir	POP-106	X		X		
Isparta	POP-107	X		X		
Kahraman Maras	POP-108	X		X		
Karabük	POP-109	X		X		
Karaman	POP-110	X		X		
Kars	POP-111	X		X		
Kastomonu	POP-112	X		X		
Kilis	POP-113	X		X		
Kirikkale	POP-114	X		X		
Kirklareli	POP-115	X		X		
Kirsehir	POP-116	X		X		
Lefkose	POP-117	X		X		
Malatya	POP-118	X		X		
Manisa	POP-119	X		X		
Mardin	POP-120	X		X		
Mugla	POP-121	X		X		

Province	**POP**	**Frame relay**	**ATM**	**PSTN**	**ISDN**	**ADSL**
		Leased line				
		X.25				
Mus	POP-122	X		X		
Nevsehir	POP-123	X		X		
Nigde	POP-124	X		X		
Ordu	POP-125	X		X		
Osmaniye	POP-126	X		X		
Rize	POP-127	X		X		
Siirt	POP-128	X		X		
Sinop	POP-129	X		X		
Sivas	POP-130	X		X		
Sanli Urfa	POP-131	X		X		
Sirnak	POP-132	X		X		
Tekirdag	POP-133	X		X		
Tokat	POP-134	X		X		
Tunceli	POP-135	X		X		
Usak	POP-136	X		X		
Yalova	POP-137	X		X		
Yozgat	POP-138	X		X		
Zonguldak	POP-139	X		X		

Appendix D University Connections to ULAKNET

N: Mini Node terminated

M: Modem terminated

R: Router terminated

University	Campus	Connection Speed (Kbps)	N	M	R	Connection Date
Abant Izzet Baysal		256	X	X		7/4/97
Adnan Menderes		256		X		9/8/97
Afyon Kocatepe		128	X	X		5/26/97
Adeniz		256	X	X	X	6/25/97
Anadolu		1024	X			5/16/97
Ankara	Cebeci	256		X		1/7/98
Ankara	Besevler	64		X		10/27/97
Ankara	Tandogan	2048		X		9/18/97
Ankara	Diskapi	128		X		3/5/98
Atatürk		512		X		7/7/97
Balikesir		256		X		12/18/97
Baskent	Baglica	2048	X	X		10/2/97
Baskent	Bahçeli	128		X		12/19/98
Beykent		128		X		12/1/98
Bilgi		512		X		8/19/97
Bilkent		2048	X	X		5/1/97
Bogaziçi	Bebek	1024		X		10/3/97
Celal Bayar		64		X	X	11/20/97
Cumhuriyet		256		X	X	1/8/99
Çankaya		128		X	X	12/21/98
Çukurova		1024	X	X		6/6/97
Dicle		256	X	X	X	10/23/97
Dokuz Eylül	Buca	64		X		2/17/98

University	Campus	Connection Speed (Kbps)	N	M	R	Connection Date
Dokuz Eylül	Alsancak	2048	X	X		8/20/97
Dokuz Eylül	9 Çesmeler	64		X		2/17/98
Dokuz Eylül	Inciralti	256		X		11/26/97
Dokuz Eylül	Kaynaklar	128	X	X		11/28/97
Dumlupinar		64	X	X		8/25/97
Ege		2048		X		2/14/97
Erciyes		128	X	X		3/17/98
Fatih	Bestepe	64		X		10/27/97
Firat		256	X		X	5/1/98
Galatasaray		128		X		7/9/97
Gazi	Maltepe	64		X		8/28/97
Gazi	Teknik Okullar	1024		X		9/30/97
Gazi	Emek	64		X	X	10/14/97
Gaziantep		1024	X	X		8/26/97
Gaziosmanpasa		64	X	X	X	6/26/97
Gebze YTE		64		X		6/2/98
Hacettepe	Beytepe	2048	X		X	2/16/98
Hacettepe	Merkez	128		X		6/17/97
Harran		64	X	X	X	12/19/97
Inönü		64	X	X	X	11/28/97
Istanbul	Bahçeköy	64	X	X		3/27/98
Istanbul	Beyazit	64		X		4/3/98
Istanbul	Cerrahpasa	256		X		11/20/97
Istanbul	Çapa	128		X		11/20/97
Istanbul	Avcilar	1024		X		12/9/97
Istanbul Teknik	Gümüssuyu	128		X		11/18/97
Istanbul Teknik	Ayazaga	2048		X		7/7/97
Istanbul Teknik	Taskisla	128		X		12/16/97

Istanbul Teknik	Tuzla	128		X		10/1/98
Isik	Ayazaga	128		X		8/20/97
Izmir YTE	Konak	256		X		12/17/97
Izmir YTE	Basmane	512		X		5/21/97
K.Maras Sütçü		256	X	X	X	8/29/97
Kafkas		64	X	X	X	7/7/97
Karadeniz Teknik		512	X	X	X	12/18/97
Kocaeli		256		X		6/27/97
Koç		2048	X	X		7/6/97
Kültür		128	X	X		7/6/98
Marmara	Anadoluhisari	64		X		3/13/98
Marmara	Göztepe	2048		X		10/1/98
Mersin		64		X		1/28/99
Mimar Sinan	Besiktas	64		X		8/21/97
Mimar Sinan	Findikli	2048		X		8/21/97
Mugla		64		X		4/16/97
Mustafa Kemal		64	X	X		7/7/97
Nigde		64	X	X	X	9/17/97
Ortadogu Teknik		2048	X	X		4/29/97
Ortadogu Teknik	Erdemli	64	X	X	X	2/13/98
Osmangazi		256	X			12/12/97
On Dokuz Mayis		64	X			12/12/98
Pamukkale		256	X	X	X	2/17/98
Sakarya		256	X	X		11/23/97
Selçuk		512	X	X		7/18/97
Sülleyman Demirel		256	X	X	X	6/27/97
Trakya		256	X	X	X	10/30/97
TÜBITAK		2048		X		9/8/97
TÜBITAK-TBAE	Kandilli	64		X		1/16/98
TÜBITAK-MAM		1024		X		
Uludag		256	X	X		6/2/97

Yildiz Teknik	Sisli	64		X		9/15/97
Yildiz Teknik	Yildiz	512		X		7/11/97
Yüzüncü Yil		64	X	X	X	7/8/97
Zonguldak Karaelmas		64	X	X	X	11/11/97

Appendix E Glossary

ANAP	Motherland Party
BSEC	Black Sea Economic Cooperation
CERN	Center for European Nuclear Research
CHP	Republican People's Party
CNS	Council of National Security
DSP	Democratic Left Party
EARN	European Academic and Research Network
ETKK	Electronic Trade Commission
EUTELSAT	European Telecommunications Satellite Organization
FLAG	Fiber Link Around the Globe
GNA	Grand National Assembly
GNP	Gross National Product
GSM	Global System for Mobile Telecommunications
IEC	Internet Executive Council
INMARSAT	International Mobile Satellite Organization
INTELSAT	International Telecommunications Satellite Organization
ISP	Internet Service Provider
ITU	Istanbul Technical University
IXP	Internet Exchange Point
JP	Justice Party
METU	Middle East Technical University
MHP	National Movement Party
MTT	Ministry of Transport and Telecommunications
NAD-TR	Node Administrators of Turkey
NATO	North Atlantic Treaty Organization
NMT	Nordic Mobile Telephone
NSF	National Science Foundation
OECD	Organization for Economic Cooperation and Development
PAD	Packet Assemble/Disassemble
PKK	Kurdish Workers' Party

PTT	Post, Telegraph & Telephone
RIPE	Réseaux IP Européens
RP	Welfare Party
SNA	Systems Network Architecture
SPO	State Planning Office
TCP/IP	Transport Control Protocol/Internet Protocol
TÜBITAK	Turkish Scientific and Technical Research Council
TÜVAKA	Turkish Network of Universities and Research Institutes
ULAKBIM	National Institutional Network and Information Association
VANS	Value-Added Network Services
VPN	Virtual Private Network
DNS	Domain Name Service