Towards the Economic Sociology of the Internet – Layers of Coordination in the Hungarian Internet Market[1]

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1 Introduction

Internet is a well studied topic in social sciences, there are numerous research projects and theoretical writings in computer science, economics, management science, sociology, anthropology etc. on topics related to it. In computer science we should mention the graph-theoretical approaches to map the structure of the World Wide Web on different levels (from the patterns of individual users' behavior to the macrostructure made up by hundreds of millions of websites and billions of hyperlinks). In economics we can think of the studies on the economics of networks (interconnection), the studies on network externalities, pricing and market of information goods. In management science we could mention the studies on the effects of electronic communication on organization. In the are of sociology and anthropology we could refer to the studies on the social effects of Internet, its effects on social isolation or possibilities to form new (virtual) communities, the new forms of e-consumption. In this paper I would like to outline a possible economic sociological approach to the Internet. This means that I would propose an approach that instead of looking at the social consequences of the Internet would rather focus on a model of the Internet economy. In doing so I try to integrate the findings of the disciplines mentioned above.

Why would there be a need for an economic sociological model of the Internet economy? The Internet economy (or the Internet market) is in change. The classical economic theories picture market change within a market, an institution that is imagined as fix and ever existing. Most

1 This is a beta version – it might contain bugs! The paper is a first draft research paper based on the interviews made by David Stark on the summer of 2000 in Hungary and some auxiliary data. It might look as a picture book – there are many figures in it. In many cases the best ideas were compressed in figures (or I have compressed them into one) – sorry for long downloads. Comments are very welcome – this is the reason why I've sent the paper to you in this early stage.

changes we experience today in the Internet as a market are profoundly different from images of market change in economic theories: these market changes include the change (or the birth) of the market itself. Maybe this is what is reflected in the uncertainty to give an exact name of the market (or multiple markets). It is not only that this market is formulating today, but even the coordinational form itself seems to be evolving. So we can not really tell whether *a market* is emerging out of organizing forces, or a new coordinational form, or a new blend of coordinational forms.

Our approach in this paper to the changing or formulating Internet market is that of relational sociology. The applicability of a theory to diverse phenomena is a function of the "building blocks" of a theory. If it is built of largely specific and complex conceptual building blocks (like market, supply, demand, equilibrium, profit optimization) it is less likely to be applicable to model profound changes than a theory built of smaller, more universal blocks (like relation, actor, dyad, position, groups and isolates). On the other hand a relational view presents itself in a way a common denominator of the various studies in diverse disciplines: the graph theoretical mapping of the Web, the study of electronic communication, network externalities, the effects on isolation or virtual community formation all suggest that a relational approach would be appropriate.

The basic question of our paper is: how can we describe and model the coordinational forms of the Internet market in Hungary. Sociological accounts of coordinational forms usually follow the logic of the accounts in economics. A market in economics is a coordinational form revolving around a single product and (in equilibrium) a single price. Sociological accounts of coordinational forms replace the market by different logics, but mostly remain bounded to the single layer coordination perspective. Another sociological approaches aim at reconceptualizing market coordination itself, but these attempts usually also picture the market as a single network (i.e. the network of economic transactions). In this paper we try to picture the Internet market as a multiple coordination space, where the actors can be present on more than one coordination layer. They can participate in more than one logic of coordination at the same time, and the cooperation of these coordinational forms together keep up the operation of the Internet market.

First the views on coordination is introduced, then we go on to give an overview of a possible relational reconceptualization of coordination, especially in the case of the Internet market. Then we try to apply the ideas presented to the case of the Hungarian Internet market – a small market that can be mapped more easily than e.g. the market in the United States. The other advantage of the Hungarian case is that the multiple layer coordination is more apparent than in a large market.

2 Views of Coordination

2.1. Defining Coordination – Market Coordination

One possible definition for coordination is that it is managing dependencies between activities(Malone and Crowston 1994). Its purest form is best conceptualized by game theory. A coordination game is presented in the following payoff table:

		Actor 2 (or everyone else) Do A	Do B
Actor 1	Do A	5,5	0, 0
	Do B	0, 0	5, 5

1. Table: Coordination game

In this pure coordination game the best strategy for each actor is to follow the same strategy. We can think of examples to fill the table with life such as the problem whether to keep left or right on the road. If some actors (drivers) were keeping left, some right, it would be a disaster. Keeping right or left is only a matter of convention, none of them is superior to the other, the important is the universality of the convention. The following table also shows a coordination problem:

		Actor 2 (or everyone else) Do A	Do B
Actor 1	Do A	5,5	10, 10
	Do B	10, 10	5, 5

2. Table: Coordination game

In this coordination game the best strategy for each actor is to follow a different strategy than the fellow. We could think of a market situation, where two key players can decide which area or market segment to enter. If they choose the same area or segment, they have to share the incomes, so the best is to divide the market between themselves. In this case interaction could help in deciding what option to choose. (This can be an agreement or visible commitment to one option.)

Market coordination in general – in the original sense – is a coordination problem where owners of goods try to find the potential customers who would value their goods most highly (on the other hand customers attempt to find the goods they value for the lowest price) (Satterthwaite and Williams 1999). Although classical economics (the marginalist school) does not give a coordinational conceptualization to market coordination in the sense of taking strategies into account, but it is implicit in their works (Marshall 1991). Instead of conceptualizing the mechanisms that would provide a solution to the coordination problem they start off with assuming equilibrium (Huyck and Battalio 1998). Market coordination is conceptualized in game theoretical concepts later (Roth 1991; Ochs 1990). These approaches focus on the coordination mechanism rather than assuming equilibrium. On decentralized markets the sellers and buyers face a coordination problem to find each other.

2.2. Economic sociology's contribution: the trinity

Economic sociology' s contribution to the study of coordination could be outlined as an ongoing effort to come up with alternative coordination mechanisms to market coordination. The idea of the embeddedness of economic action was originally a reconsideration of the fundamental assumptions in economic an economic-sociological theories (Granovetter 1985). This line of research (mostly under the label of new economic sociology) was later diverted into a direction of showing up network coordination as an independent coordination mechanism that might operate parallel to-, or in place of market coordination. Typical studies of this sort were case studies of special industries (small firms, special regions, borderlines of the economy) where interpersonal networks were shown in place of a market coordination. The original idea of embeddedness was conceptualized by Mark Granovetter in an argument with the transaction cost approach (Williamson 1981). Thus, the later works on coordination in economic sociology incorporated the dichotomy of Williamson (market and hierarchy) to add networks to it. This is how we have arrived at the odd trinity of markets, hierarchies and networks (forms mentioned in the plural usually).

2.3. Beyond the trinity: the economic sociology of market coordination

It would be unjust to reduce economic sociology to works on the trinity of markets, hierarchies and networks. There were attempts to formulate market coordination in economic sociological terms. Harrison White gave a reconceptualization to network coordination, where producers are members of cliques of producers, where they can watch the tangible actions of the other producers (White 1981). Ronald Burt took another approach to include networks structures into the study of market coordination. He has analyzed the network of aggregated economic transactions to find the boundaries of markets (Burt and Debbie S. Carlton 1989). A market is defined here as a cluster of structurally equivalent elementary markets. In his further work on coordination he introduced the notion of structural autonomy and constraint (Burt 1992). Another way to conceptualize markets in network terms is to be found in Wayne E Baker's work on financial markets (Baker 1984). Baker analyzes the personal trading relations on the stock exchange trading floor, focusing on the effect of group size on prices.

2.4. New conceptualizations: the elements of coordination

We should take a closer look on how the trinity-approach is oversimplifying economic coordination. In this approach the idea of networks is put into the theoretical lego as an alternative coordinational mechanism aside by markets and hierarchies. This is done without taking a closer look to what market coordination might be, or how hierarchies function. It is difficult to estimate the importance and function of network coordination if the other coordinational mechanisms are not conceptualized by the same concepts.

A theoretically justifiable approach would be a coherent conceptualization of all coordinational mechanisms. (E.g. to have a relational concept of market coordination and hierarchies that can be analyzed in the same way as network coordination is analyzed.) This would mean dismantling coordination forms to more universal elements. One such approach is the one of boundary objects (Star and Griesemer 1989). The article of Star and Griesemer start from the assumption that there is a possibility for coordination across heterogeneous social worlds. In such cases a system of translations keeps up coordination. The social worlds have different tasks to accomplish, different visions, and consist of mutually exclusive sets of individuals. The translation between these groups are accomplished by boundary objects, that travel across these groups, though each group attaches a different importance to the object. This approach to coordination is a multi-layer one: if we consider the social worlds as layers of coordination, there are translations connecting them.

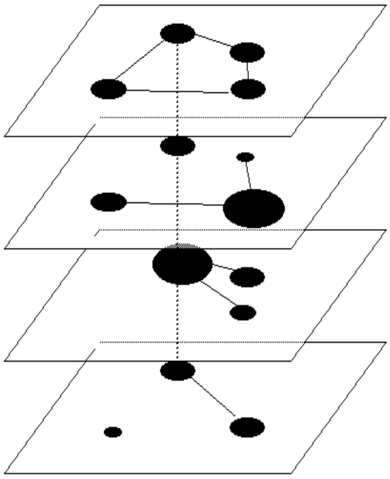
There is a possibility to understand coordination better if we look at it from an interdisciplinary perspective. In the article The Interdisciplinary Study of Coordination Thomas Malone and Kevin Crowston tries to bring the coordinational problems of computer science, organization theory, management science, economics, linguistics, and psychology to a common denominator (Satterthwaite and Williams 1999). They distinguish the major dependencies of activities. They outline four types of dependencies: shared resources, producer-consumer relationships, simultaneity constraints and task-subtask dependencies.

In the following we try to put these approaches together into a conceptual framework about the coordination system of the Internet market.

3 Conceptualizing market coordination on the Internet market

When we talk about the Internet market, we use the term market as a location, rather a coordinational form. In this paper by Internet market we mean primarily a collection of actors and products or services. There can be multiple coordinational mechanisms governing the action of these actors, and there can be more than one products that they deliver or use. The term product is also to be meant in a broad sense – it is often not clear who delivers and who receives something. The drawing of the boundary of the Internet market is somewhat arbitrary. The only justifiable principle here to draw a boundary for a market is to define it as a cohesive subgroup in the network of market relations. However, market relations are not only transactions, but rather a multiple network of diverse relations in diverse coordination planes. In this sense the Internet market can be imagined as a medieval city marketplace, where diverse kinds of products are exchanged besides gossips about producers and buyers exchanged and social connections maintained. The boundaries of such a marketplace is the collection of actors.

The Internet market is not a single market – this idea is apparent for the financial investors, who try to find homogenous markets, where performance is predictable (Bulchandani 2000). We define the Internet market as a set of actors operating on a set of coordination layers. The dependencies of different activities can be aggregated in principle, but coordination can not be accomplished in an aggregated manner (the layers can not be aggregated by the actors). The main reason for the impossibility of aggregation is that each layer has its measure of value, and some translations of these values. In this sense our approach is close to the approach of Star and Griesemer (1989), the difference is that we don't think in terms of exclusive social worlds, on the Internet market layers the actors can be present on more than one layer. The following figure is an illustration to this point.



1. Figure.: The multiple layers of coordination with different sets of actors. The actors have different qualities in each layer.

Each layer can be characterized by the following:

- measures of value
- actors participating
- relations between the actors
- coordination problem they face
- solution to this coordination problem
- translations between values during the solution of the coordination problem.

The multi-layer approach from a methodological viewpoint is similar to the multiple network approach in SNA. The main difference is that while in analyzing multiple networks the actor profiles are defined and compared across all networks, here the constellation in a layer can only be compared as a whole to another layer's constellation. It is difficult to estimate the overall structural similarity of actors compared to the multiple network approach, where this similarity can be expressed in a single index of structural similarity between two actors.

3.1. Multiple layers of coordination and translations on the Internet market

In the following we try to identify the most important layers of coordination. First we give a general overview of each layer, then we describe each layer with the criteria described in the previous chapter. The layers that we analyze are the following: ISP peering, dialup service providing, web hosting, content providing, advertisers and e-commerce, owners and investors.

1. Peering network

The peering network is a set of broadband relations between ISPs. The rationales for ISP peering can be demonstrated by the following example (Huston 1999). If all ISPs are just hierarchically connected, then when two users of two different ISPs that are physically close together would like to exchange data, the data would travel an unnecessarily long path. In the worst case, when the two local ISPs are clients of different regional and national ISPs, it would pass from one local ISP to regional, national and the transit ISP, then to another transit ISP, national and regional ISP, and finally reaching the another local ISP. This worst case scenario is presented on figure 1.

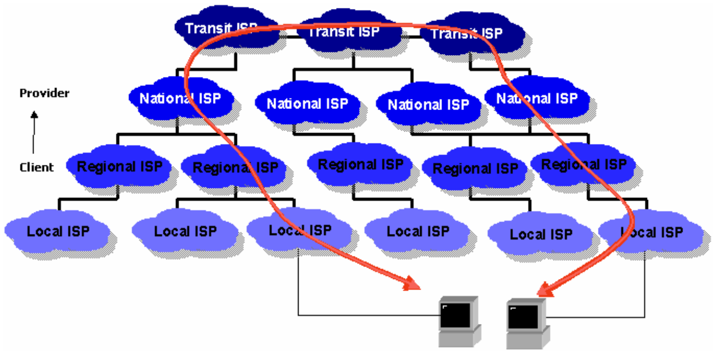
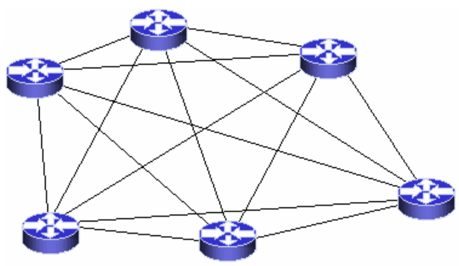
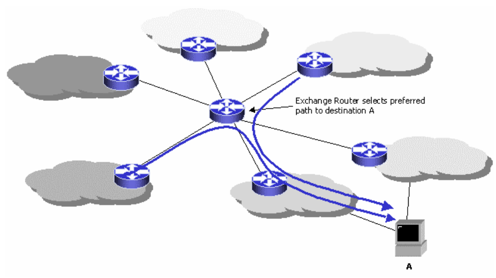


Figure 2.: The path of data without ISP peering connections – the worst case scenario. Source: (Huston 1999)

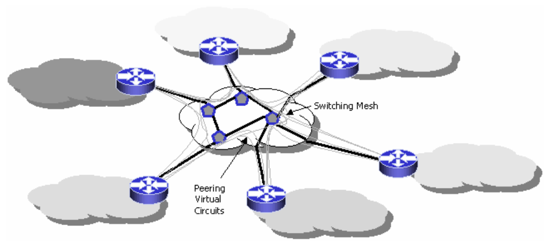
To overcome this problem (to reduce the cost of data travel) the two local ISPs can build a broadband path to one another. This path would be favorable for both local ISPs. There are many ways to build these connections. The most simple is to build bilateral connections. The problem with this simple setup is that it gets increasingly costly for new ISPs to enter the peering network, since they have to build connections to all the other ISPs (Figure 2, A). This inefficiency can be overcome by the exchange router setup, where the ISPs operate a common router, and they only need to build connections to the router (Figure 2, B). However, this model lacks flexibility, the ability for ISPs to prefer certain routes where they have more traffic. The distributed exchange setting helps to increase flexibility. In this model we see the replication of the fully meshed exchange in a central exchange area, while the ISPs connect to this exchange environment as to an exchange router (Figure 2, C). The exchange are can develop into exchange located service platforms, where the exchange have additional services to the ISPs (like a web-cache). This setting is otherwise (structurally) identical to the distributed exchange (Figure 2, D).



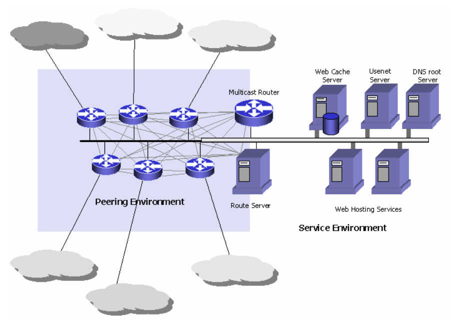
A) Fully meshed peering



A) Exchange router



C) Distributed exchange



D) Exchange-located service platforms

Figure 3.: The typical ISP peering settings. Source: (Huston 1999)

One thing we could observe in the brief introduction of peering settings is that the exchange gradually became an independent entity. From a mesh of broadband wires it evolved to be a service center, that is in fact can be an independent enterprise. The following self-description is from the website of the New York Internet Exchange:

> “The NYIIX (New York Internet Exchange) is one of the largest and fastest growing neutral exchange points on the US East coast and is operated by TELEHOUSE. Its mission is to provide the Internet community with a neutral and scalable peering infrastructure and to assure reliable and stable Internet connectivity.
>
> The following are key features of the NYIIX:
>
> - Carrier selection is left to the customer. As a carrier neutral facility TELEHOUSE Internet infrastructures support any and all carriers who wish to serve our clients.
> - Modular space availability for servers, points of presence, etc. TELEHOUSE will aid in "best fitting" you in our environment.
> - Modern LAN switch technology used for peering services. NYIIX is currently based on the CISCO Catalyst 5509. We are committed to keeping the platform state of the art.

The NYIIX is located at the TELEHOUSE "BROADWAY CENTER" which features:

- Fiber optic communications facilities provided by the local major carriers
- UPS, battery and generator power protection
- Pre-action sprinkler fire protection
- 24x7 security, customer access, environmental monitoring and technical support”

Source: http://www.nyiix.net

This exchange presents itself as a service company with the ISPs as customers. The exchange is no longer the bilateral initiation of ISPs. Let us summarize the peering layer of coordination:

The measure of value: data traffic, data travel time and cost; compatibility (of protocols, equipment), neutrality (of the exchange towards each ISP), equality (of the data exchanged).

Actors and relations: The peering layer consists of the ISPs as actors, in some cases we should add the exchange as well. The relation is broadband data flow and physical connection between ISPs (through the exchange).

The coordination problem: Internet service providers can decrease the time and cost needed for their customers reaching data by interconnection: establishing broadband connections to other ISPs. The problem to be solved is to find the ISPs to peer with (or to find the exchange to peer with), and to decide whether to peer or not.

The coordination problem can be solved by bilateral, multilateral agreements or establishing exchanges.

Translation: visits to the websites hosted by the ISP and the downloads and uploads by the customers of the ISP is translated into mass data flow in bits (megabits, gigabits).

2. Internet access providing

Internet access providing is the layer that most closely resembles a commodity market. In this layer there are usually many actors competing on the price.

The measure of value: on the side of the customer: bit per second download speed, universal reachability (to be able to reach all parts of the Internet), reachability at all times. The measure of value on the side of the provider: number of users, data traffic.

Actors and relations: ISPs and dialup users are the actors, plus the telephone company between them. The relation is the contract on service; and data flow – mediated by the phone company.

The coordination problem is customers finding service providers, which is solved by a market mechanism. ISPs advertise their services offline (TV, billboards – to get new customers) as well as online (for customers of other ISPs, or to promote upgrading to another package). Product bundling is general (web access, e-mail, website hosting in one package).

Translation: The individual contractual relations between individual customers and the ISP is translated into number of users.

3. Hosting

Hosting in contrast to access is a high-margin market layer, where price discrimination is possible. There are several levels for the provided service from the simple storage of a website on a server to full service (Cisco Systems 1999). The following table presents the major types of hosting services.

Types of hosting	Features	Monthly fee
Simple hosting	simple sites, basic e-commerce	50-1500$
Collocation Hosting	collocation, multiple data centers, applications, system integration	1000-20 000$
Managed Hosting	design, implementation of complex sites, site mirroring, hot sites support, consulting	10 000-30 000$
Full-Service Hosting	creative web design, systems integration, custom web sites, consulting	20 000$+

3. Table. Major types of hosting services.

ISPs who offer hosting services need to have considerable bandwidth.

The measure of value: uptime, universal reachability (to be reached by everyone)

Actors and relations: ISPs and content providers are the actors, the relation is hosting between them. The hosting relation – unlike the dialup relation – can be of various strength. Strength here means the distance various levels of hosting service.

The coordination problem is website owners (companies, nonprofits, individuals etc.) finding service providers. The coordination problem is either solved by market mechanisms (where site owners compare hosting services and prices, and choose the suitable service), or network mechanisms (where site owners choose hosts based on trust developed in prior personal relations). There is a possibility to price discrimination, to offer personalized services. Unlike the dialup market, on the hosting market all customers are different. The various purposes of a site, the level of sophistication of the content and the number of visitors to a site require different hosting services. market The hosting service can be considered as a kind of outsourcing. Content providers (or anyone with a website) have to decide whether they run their own web servers (in which case they might need to lease broadband lines), or pay for a host.

Translation: bits, storage place on a server into a site, a plot on the web

4. Content

The content on the Internet market is mainly located on the World Wide Web. The WWW is a huge network of pages connected by hyperlinks. However, this system is different from the hyperlink system as imagined originally by the computer scientists who gave inspiration to the HTML language (Jackson 1997). In the original conception users were able to modify links (create or break), while in HTML users are passive: they can not modify the system of links. This creates the division of users and content providers, where only providers are able to manipulate hyperlinks.

The spontaneous formation of the web led to some emergent properties. The diameter of the web is quite stable despite the rapid growth of the web (Barabási, Albert, and Jeong 1999). The Web as a huge graph has a peculiar shape: a central part with interlinked sites and two peripheral parts (one only with in-links, one with only out-links) (Broder et al. 2000). The existence of highly central (prestigious) sites can be useful in search algorithms: using the number of in-links besides a mere string search can improve search results (Kleinberg 1998).

The measure of value: on the side of the content consumer: 1. Interesting, tasty, cool, hot; useful tools, useful information, 2. Coordination, orientation to the interesting things, overview, guide or map (like a portal). Value on the side of the provider: number of visits, prestige (e.g. the number of hyperlinks on other pages to that site).

Actors and relations: on one side we find website owners, on the other visitors or consumers of content.

The coordination problem: the users, potential visitors want to find the content they are interested in. The content providers want to find the interested potential visitors.

The solution for the coordination problem: 1. search engines. 2. the hyperlink structure of the web.

Translation: The basic translation of the Internet market is the translation of content into bits (digitalization) and the translation of bits into content in the users' browser. Another translation is that the relation of the viewer and the content (a visit) is also translated into the number of visitors (hits). The web-presence is also translated into communication – the visitors downloading the files of the site on one hand, using its contents on the other.

5. Outsiders coming in: advertisers, e-commerce

The measure of value: number of "impressions" (visitors clicking the banner), number of visitors with a favorable profile, revenue from items sold.

Actors and relations: the main actors are the content providers and advertising firms.

The coordination problem in the case of banner ads: advertisers seek sites with many visitors, or sites with many visitors with a suitable profile.

The coordination problem is solved by referring to official visitor counts, surveys of user profiles.

Translations: visitor count is translated into an advertisement fee.

6. Further outsiders: ownership, capital investment

The evaluation principles of the forms on the Internet market are different from the principles applied to offline companies (Bulchandani 2000) The discounted cash flow approach is difficult to apply: the future cash flow is difficult to predict and the rate of return is not known. There are some alternative valuation ideas: equity value per subscriber (user), equity value per revenue and valuation using real options[2]. The real options approach is flexible enough to incorporate the fast changing nature of the market. This approach enables the evaluator to incorporate option premiums also.

The measure of value: discounted future cash flow, profit, some other measure of financial success.

Actors and relations: on one side investors (funds, venture capitalists), on the other ISPs, content providers.

Coordination problem: the investor with a certain risk preference finding an ISP with that risk.

The coordination problem is solved by the evaluation of firm data, or by the use of symbols that are "sure" signs of a certain risk and future success. (The firm story that sounds like a future Yahoo or Amazon.) The allies of a firm can also be a readable sign.

Translation: the number of users, number of visitors, traffic, websites hosted, allies and symbols are translated into future cash flows, risk and expected profit.

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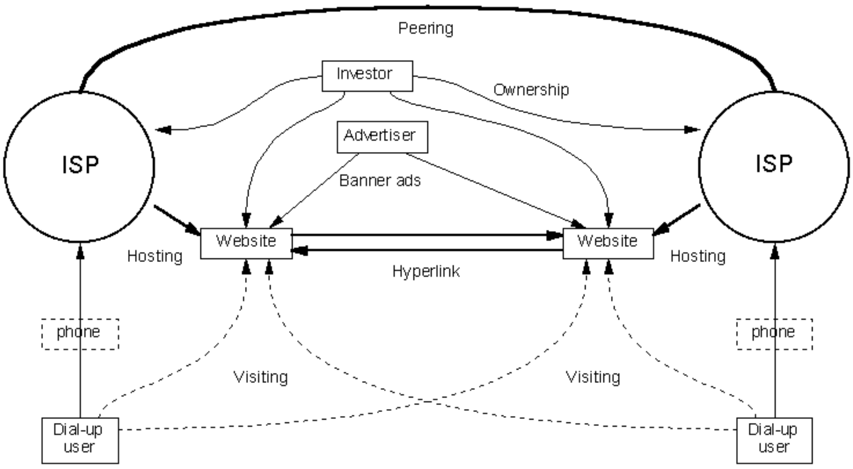
[2] Real options are similar to stock or currency options: with certain projects firms can "buy" an option to engage in a certain activity later. Real options can be evaluated the same way as stock or currency options (Brealey and Myers 2000).

3.2. The Interdependence of layers – ways for reducing of complexity

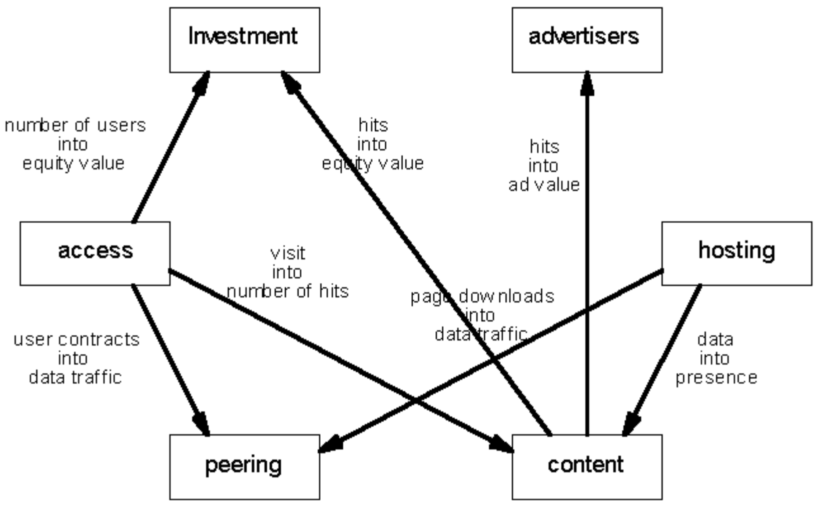
After outlining the properties of coordination layers we should ask the question how the layers as a system of translations can be put together. The system as a scheme of interrelations is presented on figure 4 and 5.

We can draw a diagram of the interrelations in the layers as a network of actors. In this figure the layers are mostly pictured as relations. This figure demonstrates that the system of the coordination layers form a unity – it is not adequate to slice it into independent markets.



4. Figure.: The interrelatedness of the layers as relations between actors.

Another way to picture the interrelatedness of the layers is to draw the system of translations (that is presented on the next figure).



5. Figure.: The interrelatedness of the layers as a system of translations.

On this figure we can see the cooperation of the layers: the inputs and outputs of the translations.

The interrelations of the layers are quite complex, we might ask the question how the actors in the system can manage this complexity – if they manage it at all. One possible way how the complexity is reduced is the use of symbols. Symbols can be used to unify actors (to reduce the “feel” of complexity) They can be used as symbols of distinction, to make valuations easier by transforming metric scale valuations (like number of visitors to a website) into lexicographical valuations (no matter how many visitors you have, if your site is not a portal, it is not valuable; no matter how many dial-up users you have if your ISP is a second-tier).

4 The Hungarian Internet Market – Analysis

In this part we try to make use of the concept of the multi-layered Internet market in the Hungarian case. We will try to outline the layers of coordination, the overall position of actors and the symbols that help reducing complexity. Before turning to the layers of coordination we will present an overview of the market.

4.1. What is special about the Hungarian Internet market?

The Hungarian Internet market is special in many ways if we look at some statistics of the Eastern European and other markets worldwide. The number of hosts is the fourth highest after Russia, Poland and the Czech Republic. The number of hosts per population is the third after Estonia and the Czech Republic. The most striking number is the number of ISPs. Maybe 155 is a bit of an overestimation, but the 44 member ISPs in ISZT, the Council of Internet Service Providers is still the highest number in the region.

Country	Estimated No. of Hosts	No of Hosts per 10,000 Inhabitants	No. of Backbone ISP's	Total International Connectivity (Mbps)	Internet Users per 10,000 Inhabitants
Albania	223	0,67	1	0,500	Nodata
Armenia	3,500	9	6	3,128	78
Azerbaijan	100	0,1	7	2,000	10
Belarus	1,000	1	2	9,512	8
Bosnia&Herzegovina	70	0,02	4	4,500	16
Bulgaria	30,000	36	7	3900	176
Croatia	14757	33	3	40,500	180
CzechRepublic	120136	114	14	309,000	299,3
Estonia	28,674	196	7	249,000	1739,7
Georgia	1100	2,4	4	2,000	41
Hungary	**115000**	**111**	**155**	**83,128**	**475**
Kazakhstan	8,000	5	4	8,000	33
Kyrgyzstan (Dec1998)	1,500	3	3	0,814	22.2
Latvia	18711	76	5	20,128	406
Lithuania	25660	42	5	80,000	116
Macedonia	1400	7	3	10,000	79
Moldova	600	1,3	5	7,064	35,5
Mongolia	4000	16	2	4,000	16,8
Poland	171217	43	6	339.000	217
Romania	30000	13	8	21,000	37
Russia	370000	25	14	115,000	543?
Slovakia	35000	66	14	48,000	641
Tajikistan	0	0	0	0,000	0
Turkmenistan	1,000	2	1	0.250	3.5
Ukraine	27698	5	6	16,000	42
Uzbekistan	1100	0,44	5	0.467	1
Yugoslavia	7,000	6	1	Nodata	71.4

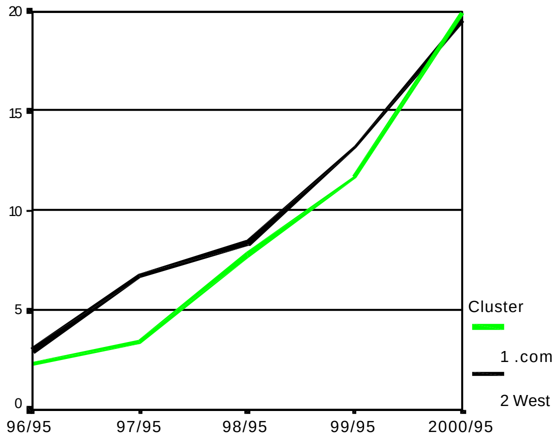
Source: Central and Eastern European Networking Association, http://www.ceenet.org

4. Table. Some statistics of Eastern European Internet economies.

The growth trajectory of the number of hosts can tell something about the features of Internet markets. Markets in early stages probably show different growth trajectories than in more “mature” stages. The following graph shows the map based on the similarities of the growth trajectory of the host count in each domain. We have collected data on the numbers of hosts each year from 1995 to 2000 in each domain. We have assembled a database, where we have used the domains with more than 25 000 hosts in the year 2000. We have excluded 3 outlier cases with extreme growth patterns (Austria, Columbia and Mexico – all of them with extreme high growth). We have analyzed the growth of the hostcount in 47 domains in the end. We have applied hierarchical cluster analysis to sort out groups of growth[3]. The result of clustering was two quite dissimilar groups. One could be titled as the “dot-com” group, where growth is accelerating in the

[3] We have used Pearson correlation to measure the similarities of growth rates (five variables: 96/95, 97/96, 98/97, 99/98, 2000/99), the clustering method was furthest neighbor (or complete linkage) clustering.

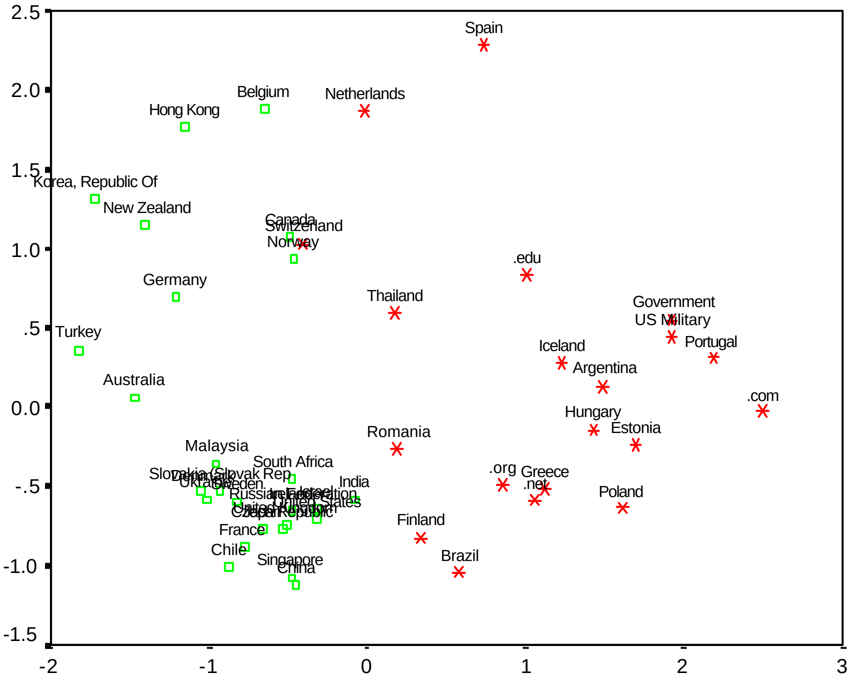
recent years, and the "West" group, where there was a slowdown of growth in 98, then a new momentum in 99-2000. The average growth patterns in the two groups are presented in the next figure.



6. Figure. The average growth in the two clusters of growth trajectory patterns of host counts.

We have applied another analysis to find out where the Hungarian domain (.hu) and the other Eastern European domains are in relation to the others. We have used multidimensional scaling[4] to produce a map of growth trajectory similarities. The next figure presents the resulting map.

[4] We have used the MINISSA algorithm to scale the correlations between the growth rates of domains.



7. Figure. The similarities of domains according to the shape of the growth trajectory of the number of hosts. The .com cluster is marked by stars, the western cluster is marked by squares.

The map shows Hungary in the dot-com cluster close to other domains that represent new Internet markets. Estonia, Poland and Rumania are the countries nearby from Eastern Europe. So Hungary can be characterized as a market with recent high growth, a similar momentum as the dot-com domain has.

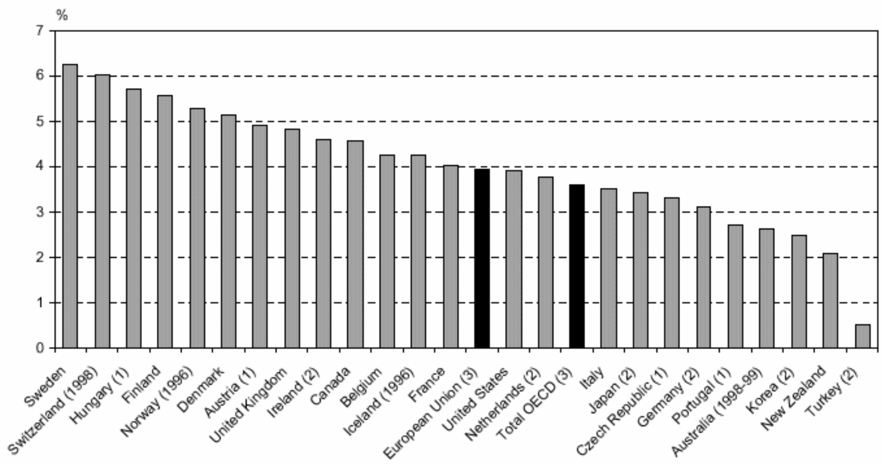
The OECD publishes regular statistics about the ICT intensity (Information and Communication Technology). According to the latest OECD report (Pattinson 2000), Hungary is in the “high ICT intensity countries” – group (see table 2), that might be surprising.

High ICT intensity countries	Medium ICT intensity countries	Low ICT intensity countries
Finland	Austria*	Australia
Hungary	Canada	Belgium
Ireland*	Denmark*	Czech Republic
Korea	France	Germany
Sweden	Greece*	New Zealand*
United Kingdom	Iceland*	Poland
United States	Italy	Portugal
	Japan	Spain*
	Mexico*	Turkey*
	Netherlands	
	Norway	
	Switzerland*	

* Not all data items are available.

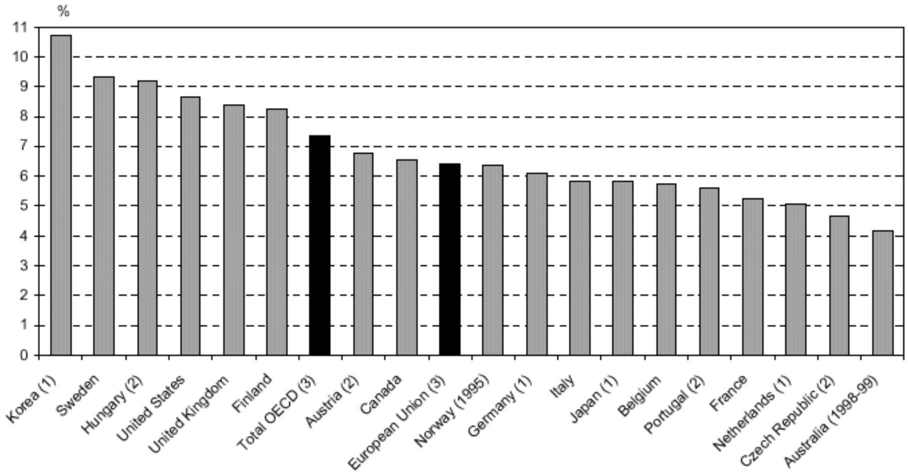
5. Table. The three ICT country-groups according to the OECD survey *Measuring the ICT Sector*. Source: (Pattinson 2000)

The report relies on the statistics about employment, sector revenues, R&D expenditures etc. The most positive of the statistics (that might have pushed Hungary into the high intensity group) is the statistics about employment an value added in the ICT sector. The following chart shows that Hungary has an ICT industry with an outstanding value added.



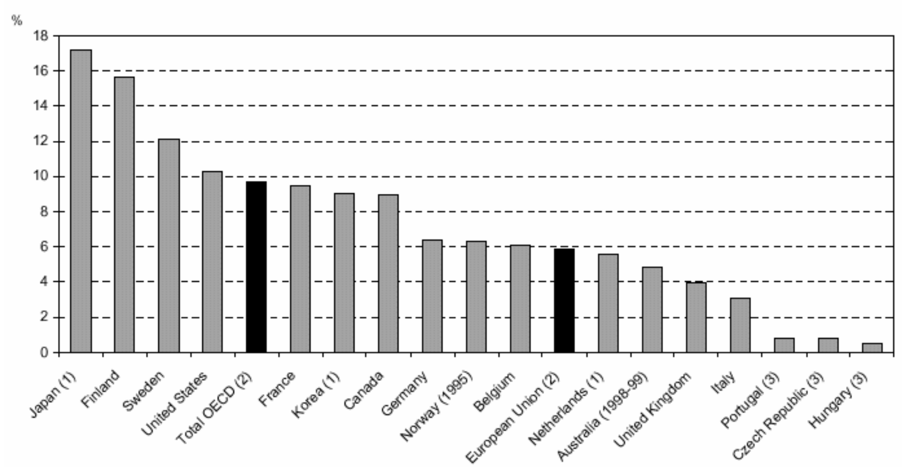
8. Figure. Value added in the ICT sector as a share of the total business sector. Source: (Pattinson 2000)

The following chart shows the share of the ICT sector in the total employment in the business sector. Hungary is the third among the OECD countries.



9. Figure. Employment in the ICT sector as a share of the total business sector. Source: (Pattinson 2000)

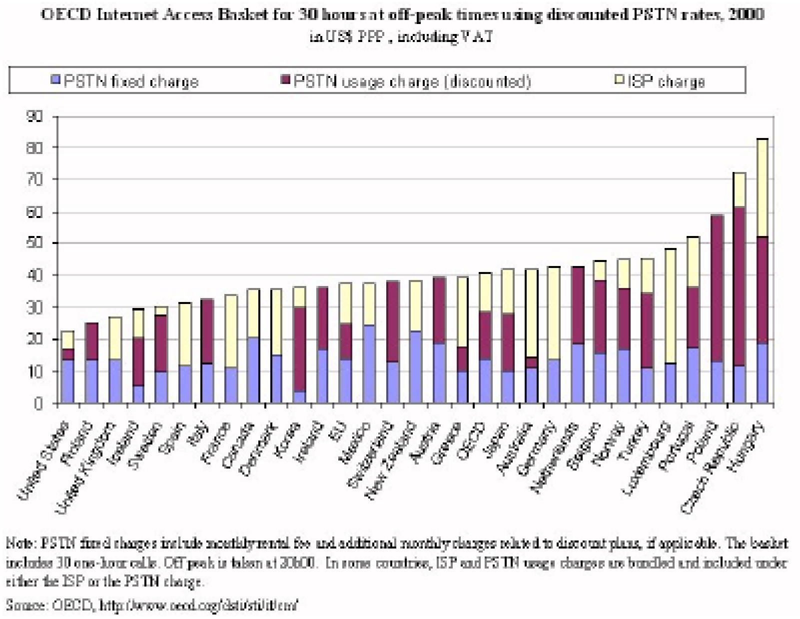
So far we have seen some positive features about the Hungarian Internet market. However there are less favorable parts in the total image of the Hungarian Internet market. The research and development expenditures in the ICT sector compared to the value added in the sector is the lowest in Hungary.



10. Figure. Ratio of research and development to value added in the ICT sector in OECD countries. Source: (Pattinson 2000)

Maybe the worst statistic regarding the market is the cost of Internet access (OECD 2000). Let us take a package that the majority of the dial-up users have (30 hours online a month, off-hours dial-up access). The following chart presents the prices of such a package in purchasing power parity in US dollars. By far the most expensive country is Hungary. The other Eastern

European countries are all nearby (Poland and Czech Republic). The high cost of Internet access in this region is due to the high telephone prices.



11. Figure. The cost of 30 hour per month Internet access in the off-hours, usng purchasing power parity. Source: (OECD 2000)

The most reported statistic in international comparisons is penetration (number of Internet user persons) and the growth of penetration. If we look at the Hungarian growth rate in international comparison, it is impressive (table 5). The penetration is still low. A 42% growth from a 5,0% penetration is still only a 7,1% penetration.

	Penetration		Growth each year	
Year	Hungary[1]	USA[2]	Hungary[1]	USA[2]
1997	1,1	27,4	-	-
1998	3,0	37,6	166%	37%
1999	5,0	44,9	66%	19%
2000	7,1	51,5	42%	15%

[1] Carnation Consulting

[2] The Standard

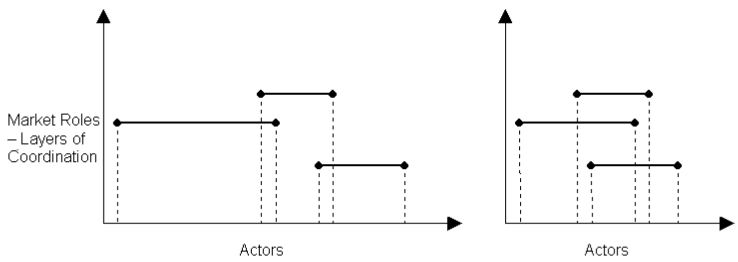
6. Table. Comparison of penetration and the growth of penetration in Hungary and the USA.

So the picture that we can put together from al this is that telecommunications are important in Hungary in a merchant-sense: the value added and the number of employees are high, but the R&D expenditures are low. The prices are high, making this sector a “milking cow”. The market structure is concentrated: the previous socialist enterprise, Matav, is still a state-guaranteed monopoly in stationery phone lines (until 2001). Its monopoly is feature that grants the firm considerable power on the Internet market as well. The company 100% owns one of the largest ISPs, MatavNet, that runs the most visited website in Hungary. Matav is also the owner of one of the largest mobile phone companies. Matav's power is usually enough to bend the government's intentions to limit the use of monopoly in other areas. There is considerable competition on the ISP market (both in dial-up and leased lines provision), but Matav's shadow is there as the largest owner of Internet infrastructure.

After a general introduction we will proceed with the introduction of the Hungarian Internet market along the coordination layers outlined in the previous chapters.

4.2. The layers of coordination on the Hungarian Internet market

One question before we introduce the layers in Hungary is that whether the Hungarian Internet market has all the same layers as the other markets, or as the American market. There is one basic feature stemming from the size difference of the two markets: the Hungarian Internet market is much smaller and compressed compared to the American: the market layers are populated by fewer actors, and the actors are usually present on more layers than in the US.



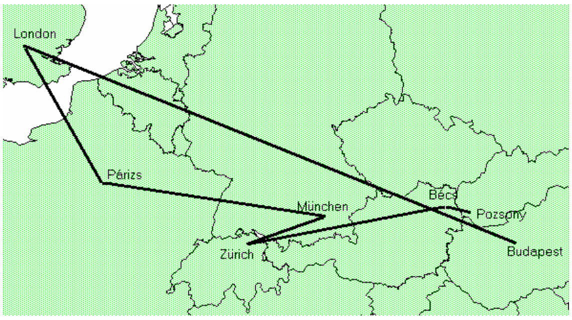
12. Figure: The compression effect of the small market

1. Peering network

The peering layer in the Hungarian Internet market is in the form of the commercial internet exchange, an exchange that is somewhat a separate entity. However it is not an active service center, but rather an association of ISPs. The location of the BIX is not a single center, but rather a collection of four nodes. These nodes are connected by broadband peering connections. The main reason of the peering network is the following:

> "The fundamental purpose of BIX (Budapest Internet Exchange) is that the Hungarian Internet traffic among the service providers is not to use the service providers international links (a link is international if through that link an Internet root name server is accessible from Hungary)." Source: http://goliat.c3.hu/bix/bix_charter.htm

This statement of purpose shows the small size of the market, where there is one national peering network. The lack of regional peering connections beyond the national level is apparent in the following figure: a traceroute path from Budapest to Bratislava. For Hungary there is little interest in connecting to other semi-periferic Eastern European countries. The traffic is from Hungarian websites or highly central international websites.

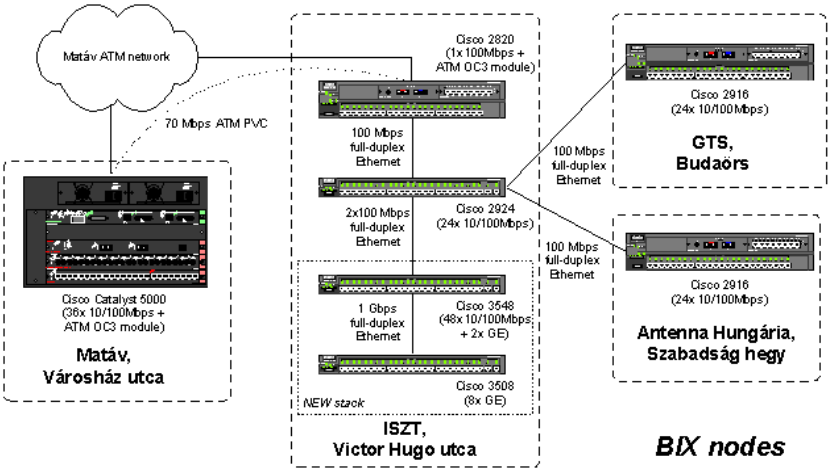


13. Figure: The effect of the lack of peering relations with Slovakia: a path to a Slovakian website. Source: (Nyírõ András and Turi László 2000)

The criteria for entering BIX as a member is to have at least 256K guaranteed international bandwidth. Beyond this criteria the members of BIX have to pay according to the data traffic sent through BIX. This fee is quite low, almost symbolic (150-300 $ per month).

In the following we will try to map the coordination in the BIX peering network. The first question is the measures of value. The BIX peering coordination layer has the foreign bandwidth as the most important value. This is in what the ISPs are paying when they join BIX, this is what is optimized by BIX. The BIX charter leaves to the peering parties to decide on how wide bandwidth they would peer with one another, and that they should consider the exchange equal.

The second question we should address is the actors and relations: in what shape the ISPs are organized. The exchange is organized in four nodes. One of these – the ISZT Node (the node of the association of ISPs) is the most populated with the highest amount of data exchanged. The following figure shows the four nodes.



14. Figure: The Budapest Internet Exchange (BIX) nodes. Nodes are bordered by dashed lines. Source: http://goliat.c3.hu/bix.

The topology of the exchange resembles the distributed exchange: there is a central network of backbones in the exchange. However, the four nodes are not equal: there is a highly populated node with high traffic: the ISZT node. The other three nodes are operated by three ISPs: Matav, Antenna Hungaria and GTS. These BIX members have special status: they are BIX providers (besides ISZT).

The coordination problem in BIX is simplified by the one centralized exchange in the country. The ISPs have little choice but join BIX. The top players – the BIX providers – are the only ones that can shape the exchange: form new nodes where ISPs would join as BIX members. Besides ISZT Matav is the most important BIX provider. Matav's role goes beyond being a BIX provider: it also operates the BIX route server and allocates the BIX IP addresses. The other BIX providers are GTS and Antenna Hungaria, both companies have an alternative infrastructure of a national backbone network.

ISZT Node Members	Bandwidth
Pantel	1100
Interware	1100
Externet	1000
Telnet	1000
Kibernet	1000
Banknet	102
Euroweb	100
TVNet	100
GTS BIX node	100
Alarmix	100
Externet	100
Vivendi Telecom	100
Index.hu	100
Hungarnet	100
Elender	100
Novacom	100
Westel 900	100
UPC	100
MARKETORG	100
Victor - Varoshaz ATM link (Matav)	100
Route server and ISZT office router	100
TVK	10
BT	10
Qwertynet	10
C3	10
hureg.nic.hu	10
ns.nic.hu	10
Pronet / Nextra	1

Matav Node Members	Bandwidth
Matáv	100
Elender	30
Pannon GSM	10
Route server	10
Datanet	8
GTS 1.	4
IBM	2
Westel	2
Westel 900	2
C3	0.512
GlobalOne	0.256
Satrax-Net (Titász)	0.128
Synergon	0.128

Antenna Hungaria Node Members	Bandwidth
Antenna Hungária	100
Drávanet	?

GTS Node Members	Bandwidth
Datanet	100
GTS	100
Covysoft	10

7. Table. The BIX nodes and the members connected to the nodes. The bandwidth is shown in megabits per second.

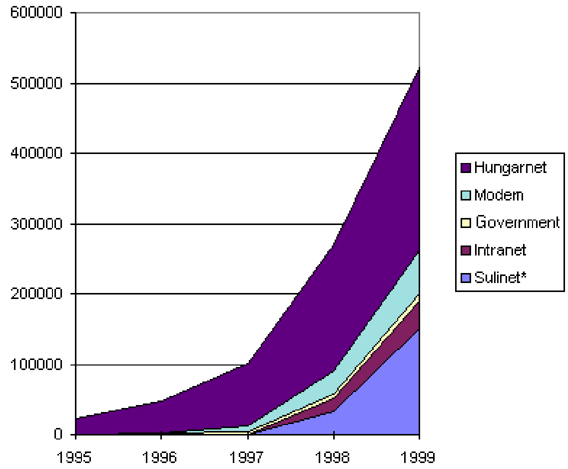
2. ISP dialup network service

The dialup layer is dominated by three ISPs. Their market shares are shown in the following table:

ISP	Market share
MatavNet	40%
Elender	25%
Datanet	20%
~20 other	15%

8. Table. The market shares of the most important dial-up service provider ISPs.

Matav's Internet provider is the most important player in this layer. However we should not ignore the fact that in Hungary most of the Internet users are not dial-up users, but connecting to the network at the workplace or the school. The following figure shows the share of each in time:

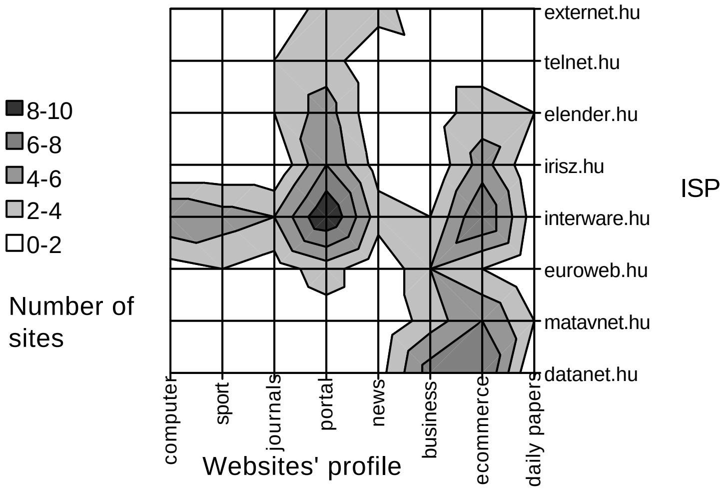


15. Figure. The profile of the most important Hungarian websites hosted by ISPs.

The most important way to connect to the net is over Hungarnet: the network of the academic sector. This was the first network n Hungary, and in fact the ISPs were selling its bandwidth at the first time, before they have moved to private networks. Another network that is getting important is the “Sulinet”, the school network. Despite its dynamic growth the number of users will not grow in this segment (most of the schools are connected).

3. Hosting

We don’t have detailed data on the hosting arrangements in Hungary. The only idea we have about this layer up to now is the mere existence of the relation of hosting between ISPs and content sites. This relation was determined using a population of the most important Hungarian websites (that is quite difficult to determine, the description of the selection procedure is outlined in the next section). Then we have used a traceroute program to find the last step to the site in the travel of data, that is the host of the site. The following diagram shows the websites aggregated into categories by the most important hosts.



16. Figure. The profile of the most important Hungarian websites hosted by ISPs.

We have used cluster analysis to find an information-rich ordering of the hosting ISPs and website categories. The entities on both axes are organized that the neighboring ones are similar regarding their patterns. The figure is a map of elevations: darker regions show more sites. It is interesting to start reading the figure from the middle. There is a “hilltop”, a large number of portals hosted by Interware. This ISP also hosts e-commerce sites and some sites in each category. The most important ISPs regarding the dial-up layer seem to be less important here. Datanet and MatavNet both host mostly e-commerce and business sites. Elender has a similar profile to the most central Interware.

4. Content

The users access Hungarian or international websites, but nothing regional (e.g. other Eastern European - that was reflected in the peering network). We might a sk the question: why is there a place for Hungarian content, if anybody can access the best sites in the world? The answer is the following: Hungarian content is easier to access because of the language. Hungarians are interested in Hungarian news, not in global news. Hungarian content is better matched to the Hungarian culture than global content.

The content-layer is dominated by two sites (portals): Origo and Index in a sense that these have the most visitors. Origo has the most visitors, around 200 000 in the weekdays, 100 000 a day in the weekends. Index has around a 100 000 visitors a weekday, 50 000 in the weekend. In the summer of 2000 the two portals had around equal number of visitors, while a year ago Index was the most popular. Origo is operated by MatavNet, while Index is an independent content provider company. Index is now starting to become an ISP also (you can find it on the BIX ISZT node list).

For analyzing the content layer of the market we started a data collection about the most important Hungarian sites. It is difficult to find a unified list of the top sites regarding the number of visitors – that would be a list with the most valuable sites by one measure of value in this layer. Even if we would have found one, we might wonder if it is a fair procedure to leave the other measure of value – the "interestingness" of a site – out of consideration. Our procedure was a compromise: we have scanned some of the most popular web directories, and tried to pick the sites that seemed the most prestigious in terms of the number of references to them. This way we had a population of websites of 170.

The idea for analyzing the content layer is the following: by analyzing the network of hyperlinks between these sites and the hyperlinks that go out of the population, we can have an idea how the coordination in the layer is taking place. The possible questions are: what are the most prestigious sites regarding the number of links on other pages? What are the websites with unique portfolio of links regarding the links to pages inside the population and links going outside? How uniqueness and prestige is correlated? (This part of the research is on the way.)

You might wonder why there is no unified toplist of all the Hungarian websites. This probably has something to do with difficulties in translating: there is a conflict between the measure of values. The owners of websites are uncomfortable with the idea of using the number of hits as a measure of value for their websites: they should rather use the value dimension of interesting, information-rich, useful. The following quote is an illustration:

> "We don't want to see our site we have created by sweating so much among sex and gaming sites in a hysteria of ranks (according to the number of hits)." (The leader of an online newspaper.) Source: (HVG 99)

In this case the metric logic of the number of visitors as a measure of value is in conflict with the qualitative logic of the interestingness of the content as a measure of value.

5. Outsiders coming in: advertisers, e-commerce

The advertising revenues from websites are highly concentrated: out of the several thousands of domains 95% of the advertisement revenue is going to the top twenty websites (HVG 1999). (Research is still ongoing in this area.)

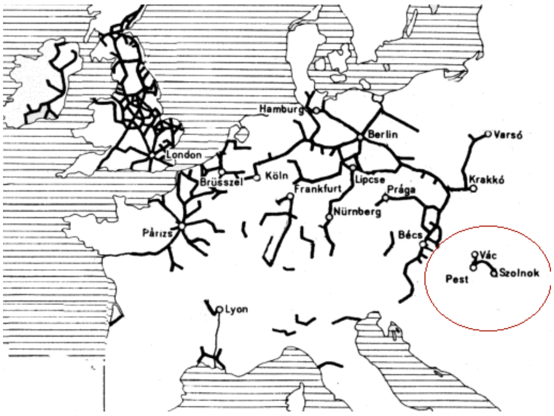
6. Further outsiders: ownership, capital investment

The current situation on the investments side is described as "gold fever" by one of our interviewee. The year 2000 was when foreign investors appeared on the Internet market. The most important investment was into Index.hu. This investment was quite sizeable, and Index is a content provider, that probably made entrepreneurs feel, that with a good idea they can make money fast, without considerable investment from their side (HVG 2000). (Research is still ongoing in this area.)

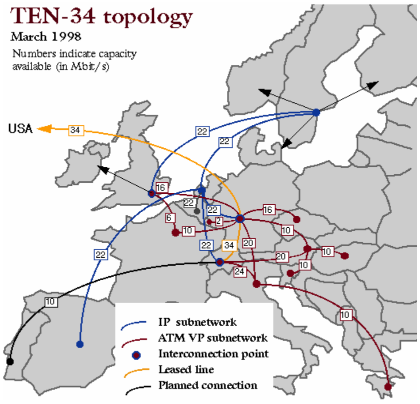
4.3. Reoccurring attitudes towards development

It is a usual commonplace that you can frequently read in excited magazine articles on the Internet market that it is comparable to the industrial revolution. I think there is some use of such comparison if we go beyond the journalistic discussion. The Internet revolution in Eastern Europe is similar to the industrial revolution in terms of the attitudes towards development and the role structure of innovation. Alexander Gerschenkron's observations about the industrial revolution can be replicated to a large extent if we look at the Internet-revolution in Hungary (Gerschenkron 1992). Gerschenkron have observed that the roles in development were quite different in Europe during the industrial revolution. England was where development started from the individual actions of entrepreneurs. In continental Europe the leading role was taken by investment banks. In Eastern Europe (in Russia) the key actor was the state and aristocrat-intellectuals. In Hungary one of the national heroes (who is labeled as the "greatest Hungarian") was Istvan Szechenyi, an aristocrat who offered part of his income to build bridges, steamboat lines, the academy. He had also written books about the way of the country to become a developed industrial state.

The present situation of the Internet market in Hungary is similar to the industrial revolution in many ways. Although the development process was not initiated by the state, the role of intellectuals is quite similar: they are looking at the "West" (the USA) and urging the state to do something for development.



A) Europe's railroads in 1850



B) The TEN-34 Internet backbone topology in 1998

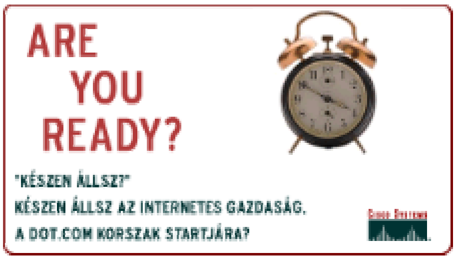
17. Figure. A geographical comparison between the networks of the industrial revolution and the Internet revolution: Hungary at the semi-periphery. Source: (Nyírõ András and Turi László 2000)

4.4. The Role of Symbols in Coordination

In the case of the Hungarian Internet market we could observe many ways in which symbols contribute to reduce the complexity of the multiple-layer system. The most fundamental is maybe the work of intellectuals to translate the complex and technical world of servers, routers, IP packages and HTML into a coherent discourse on virtual reality, new communities, netizen, information age. This translation enable the intellectua ls to ac upon this vision, to urge the state to achieve the cyber-goals.

> "The information society is not a distant promise anymore – it is tangible reality. The Hungarian society – as well Europe – already partly live in it. The big question is not that what we will need to do for it in the distant future, but what the state, the industry and the universities have to do. The questions of a vision are already is the problem of today. The new channels and platforms made possible by the Internet and other broadband technologies created a new digital culture. Our task on this day is to examine the social-historical and cultural consequences of this turn. What does it all mean for the cultural canon, for access. How could we achieve that the information society is not limited to the few but evident for many? What does it mean to evade the digital divide. How could we sustain our culture in this new medium." Source: the welcome -text of Peter Gyorgy, the chief ideologist of MatavNet on an Internet conference, www.internetkonferencia.hu

Besides the cyber-language, that is a system of symbols, there are single symbols that help reducing complexity n various ways. The most important is the symbol " *the market will be booming in the next few months* ", shared by the entire Internet market for almost two years now. The role of this symbol is to unite the market, to make sure everyone is playing on the "hausse", the going up of the market. The other use of the symbol is that it reduces complexity by legitimizing investments that would otherwise be difficult to judge by a discounted cash flow approach. You have to invest otherwise you will not be ready when the market boom arrives.



18. Figure. An ad about the coming market boom.
“Are you ready for the start of the Internet economy and the dot -com age?”

Besides unifying symbols there are symbols that are used to make distinctions. Making a distinction is reducing complexity, because it reduces a metric scale into a categorical, usually dichotomous scale. The most important symbol of this sort is the “*portal site*”. A portal site is a type of content that helps the visitor in orientation on the Web. On the Hungarian Internet market the concept is used for distinction in the following way:

> “Origo (the site operated by MatavNet) – it is a real portal site. It has a search engine, free email, 24 hour news, databases, categorized link collection. Others say they have a portal site, but they don’t. They don’t have some of the necessary features.” Source: interview with a MatavNet leader.

Another quote from one of the leaders of Index.hu:

> “The problem is that even a site with a few links calls itself a portal.” Source: conference discussion, www.internetkonferencia.hu

4.5. The role of social networks in coordination

The bulk of the engineers that constitute the elite of the Hungarian Internet market come from the same floor of the Schonhertz Collegium dormitory of the technical university. These connections make it easier to understand each other and have trust.

Another example of the use of social networks is a consulting firm embedded in Matav networks: the firm’s young CEO is the son of a high rank Matav executive. The consulting firm is always in the spotlights at conferences on the Internet – organized mostly by Matav. The largest project of the consultng firm was taking part in the start of Origo.hu, the portal of MatavNet. It was mentioned in several interviews, that the firm is living of the Matav connection.

5 Conclusion

In this paper we proposed a multiple layer approach to economic coordination. The paper should be considered a proposal, rather than an argument. The empirical analysis of the concept is still to be worked out, as well as the theoretical justifications that the multiple layer system of coordination can not be substituted by an approach of several interdependent buyer-supplier markets. Another theoretical point to investigate is whether the multiple layers phenomenon is a prelude to the formation of markets, a step in institutionalization that should not be considered a coherent and stabile system.

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