Strategic Response by Public Network Operators to Private Networking in Europe

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I. Theoretical: The Evolution of Networks

The ways in which players - among them European telecommunications operators (TOs) - strategically operate within the global telecommunications environment must be understood first as the product of market forces. The industry restructuring which we are witnessing exhibits structurally-ordered determinants within which economic forces are ultimately determinant. (This is what a certain class of political economist would consider the basis of a materialist argument, although we shan't explore the intellectual ramifications here).

Thus within the economics/technology/regulation triad of influences driving the telecommunications sector, the first occupies the base. The other two domains are superstructural (many observers disagree with this conceptual pyramid). Furthermore, the problem is historically specific: the evolutionary dynamics are particular to today. (This is what would launch a historical-materialist argument.) The relationship between these analytically distinct levels is constantly shifting: any exploration must acknowledge this historical reality. This makes it very difficult to come up with a valid 'theory' of network evolution. The rug is forever being pulled from beneath one's feet.

For example, Noam's basic argument concerning the formation and alleged demise of shared telecommunications network facilities (1992) is that specialization produces fragmentation. The growth of differentiated options undercuts economies of realm and scope underpinning the centralized network arrangement:

> ...the dynamics of expansion and redistribution lead to a divergence in the interests of its participants that can no longer be reconciled within one network. The results are exit, formation of new networks, and the emergence of a federation of subnetworks. The network has progressed to its "tipping point," where its cohesion breaks up and a multinetwork system emerges (Noam, 1992).

The argument is intelligent and couched at an admirable level of generality. The mistake lies in the static counterposition of a homogeneous and 'unified' network (the range of variation to be tolerated within this class of network is unclear), and a heterogeneous federation of subnetworks. Economists have traditionally been fond of biological analogies: hence the evolutionist ideal of 'pure' competition, which has no counterpart in the real world. But physics offers significant but to date untapped resources. Every action exerts an equal and opposite reaction.

What if the ancestral and unitary organism - assumed here to be a static entity - responds to threat by differentiation, variation, specialization - thus "tipping" the balance in the opposite direction? Following re-entry by parties which had formerly exited - when (invoking the model) marginal private benefit of renewed membership outweighs

marginal private cost - may the traditional PTT complex yet be considered a unified network? (For if the menu has expanded, the same chefs are in control: the institutions - the very term connotes unity - have undergone transformations no more radical than the addition of a corps of sous-chefs, busboys, or large customer account managers.) Or, alternatively, a more unified federation of subnetworks than that which catalyzed change? Or neither of these two?

The next stage within the developmental trajectory is never considered. (Among advocates of fragmentation and competition, the tendency toward reductionism - simplifying arguments so as to highlight perceived benefits - is commonplace.) Yet this is precisely what we are witnessing today as the traditional 'public' network assumes increasingly hybrid forms. The Network Tipping analysis needs to be revisited and extended. Reconsideration might also jolt the memory (a fringe benefit) with recognition that participants in network arrangements - today but also in previous eras - have always had diverging interests and heterogeneous needs. It was political will and technological underdevelopment which produced past collaborations, which is why a Schumpeterian (rather than neoclassical) point of departure might serve the analytical purpose better.[1] And the equipment industry continues to be a significant force of change within the telecommunications sector.

As Marx (1973) pointed out, every economy is an economy of time. This is more true of the telecommunications and information sector than all others, which is what sets it apart. Where goods and services can be acquired via the public network at lower cost than alternative arrangements offer, the participatory incentives are obvious (savings in labor time). Radical shifts in the cost of network construction and operation dramatically change the incentives for non/membership, and consequently the character of networks themselves (leaving them - for the moment - more public than private or vice versa, more integrated than fragmented, and so forth).

II. Analytical: A Matrix of Network Functions

The following paragraphs describe a conceptual scheme for discussing networks as separate and separable bundles of services and functions. Here we seek to move beyond the usual dichotomies (public versus private, switch- vs CPE-based, hierarchical or distributed processing, etc.) which prove inadequate for dealing with the number of necessary distinctions. We find three analytically distinct, but interrelated levels - dimensions of underlying value which differentiate among telecommunications markets. They are Access, Service Specialization and Connectivity.

- Arguably, users want *access* to separable bundles of goods and services or functions: this remains

[1]Alain de Fontenay suggested this at a January (1992) C.I.T.I. conference.

the primary logic underpinning ONA/ONP. It is functionalities bought and sold which separate network markets. Furthermore, functionality varies with proximity to the system's core.

Each dimension presents a range of options. Access may be publicly and generally available, as in the case of X.25 networks throughout Europe or X.400 worldwide. It may be shared - i.e. based upon commonly owned facilities to which access is restricted, as in the case of hybrid (part-public, part-private) enterprise networks and virtual private networks (VPNs). It may be dedicated, both in terms of facilities deployed and service availability, as in the case of many corporate networks and certain closed-user groups.

- *Service specialization* ranges from basic - i.e. the 'reserved' of CEC parlance and/or the obverse of FCC 'enhanced services': leave aside for the moment the definitional fog which hovers - through generic value-added (as in the case of Infonet, Tymnet, and numerous others) toward customized value-added service (when access arrangements are often more limited: see, for example, the offerings of Amadeus, SITA, BT Tymnet and Telenet).

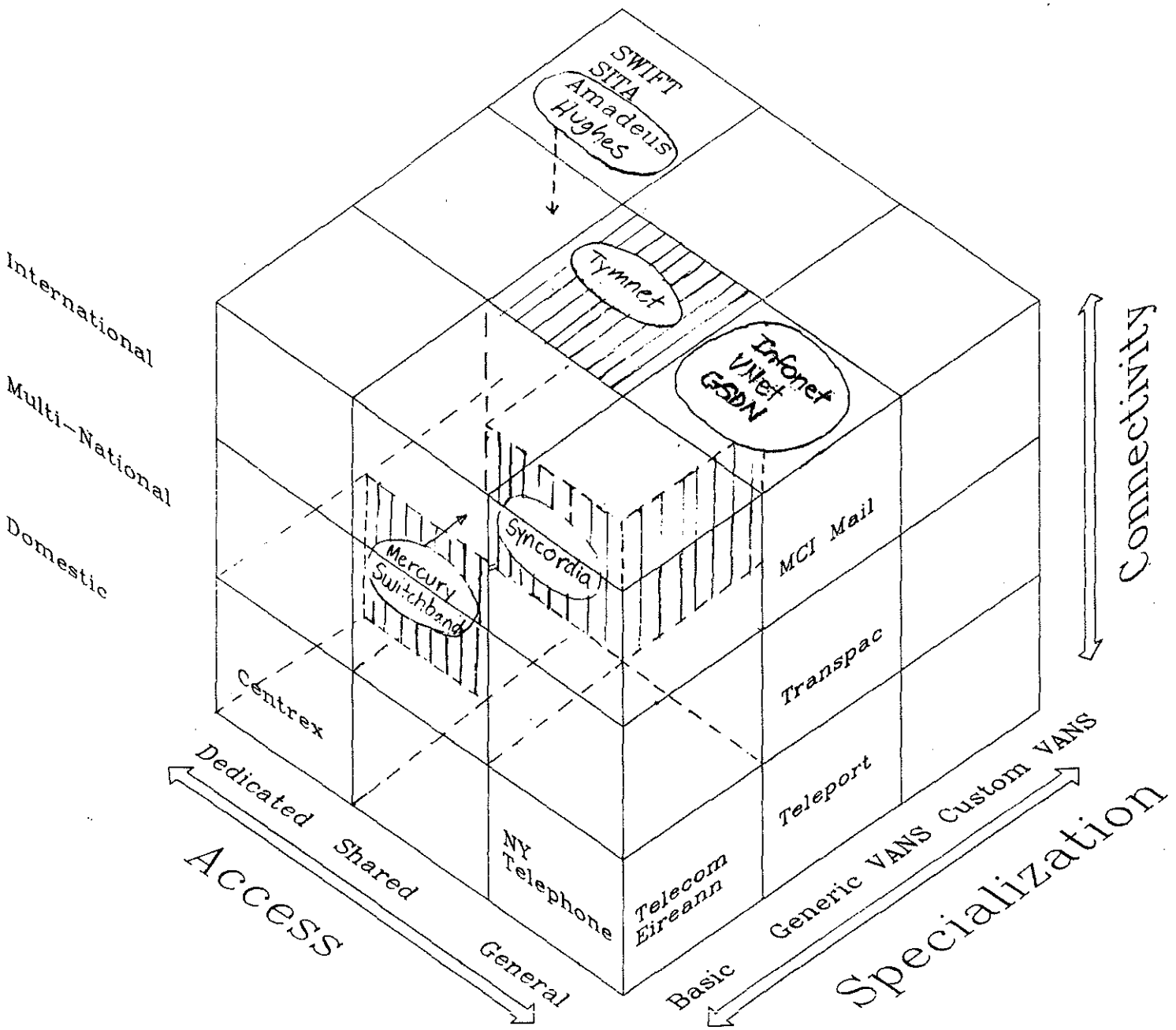
- *Connectivity* is easily segmented into domestic (such as France's 'generic' VAN Transpac); bilateral/multilateral (for example, IBM Information Network - a generic, shared-access VAN); and international (e.g. SWIFT's customized VAS). Of course, the latter distinction between multinational and international is never clear. (For example, Syncordia is properly considered a bi/multinational affair at present. But the globalizing thrust is such that its status may well become international within two years of launch.)

For the purposes of this discussion, the target market for services constitutes the differentiating principle. Toward the International pole we find network functions and services intended to connect users across continents. The Bilateral/Multilateral category refers to more regional arrangements, where trade issues tend in general to be resolved by single bodies such as the CEC. Here the provider's business interest is a key determinant. We see a clear difference between carriers with global ambitions and those seeking to maintain domestic/regional positions following traditional linkages. (Thus Telefónica's ambitions in Latin America would be considered multinational, while France Télécom's acitivites in the same region reflect an internationalizing strategy.)

Figure 1 presents a matrix of international telecommunications submarkets, and an organizational framework for

Figure 1

A Matrix of Network Functions



discussion. Since visible shifts in European public network operator (TO) cultures constitute responses to a whole range of economic, technological, political and regulatory forces, an analysis of this sort must be broad-ranging.

III. Private Networks, Public Networks

This brings us to the question of public and private network taxonomy: which type of network should properly be assigned to one category, and which to the other. Definition along these lines must ultimately be based upon access conditions. This is both an intellectual and practical matter. Attempts to qualify the dichotomy by focusing upon such additional properties as ownership, usage conditions, and financing arrangements[2] inevitably produce elision (so that important matters are ignored), terminological confusion (so the definitional problem is exacerbated), or classes and categories which would never enter industry parlance (too complicated). Between pure public (the pole denoted 'general access' in Fig. 1) and pure private (the 'dedicated access' extreme) lie numerous hybrid forms, and whether they are to be considered more public than private (or vice versa) depends upon the classificatory criteria employed, and popular consensus. What is relevant is the pole toward which these forms tend.

IV(a). Access

Virtual private networks (VPNs) define the most significant interval between the extremes of wholly-open and wholly-closed access. VPNs involve migration from private networking toward software-customized (with hardware ramifications) public network services. Several factors have contributed to the development of virtual private networking into a $2 billion industry within the US[3]: extensive network digitization and the adoption of Signaling System 7; intense long-distance competition; improved network management offerings; a trend toward single- rather than multi-carrier networks to gain volume discounts; and the perceived advantages of efficiency, attractive pricing, and network reliability offered by VPNs. The overarching issue here is the presence of funtionality within the network: via 'evergreen' strategies, network upgrade through line-card replacement makes services available at marginal cost both to users and TOs.

Pre-existing Conditions

On the one hand, migratory trends in European telecommunications traffic (determined to a significant extent by US developments) are a function of pre-existing regulatory, infrastructural and economic

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[2]See Rutkowski (1991) for a particularly useful starting point.

[3]Estimates of growth to $5 billion by 1995 are by now standard. See *Network Management*, January 1992, p.30.

constraints. On the other, they reflect the presence of adaptive players within network operator (TO) environments. The range of options available to each so as to increase revenue streams and protect positions of market power or dominance is unique.

It is not simply a question of migrating users from private to public: the stakes are already far higher within the highly-developed US private networking sector. Here the challenge of migrating users onto any number of 'public' networks is being pursued by several carriers in a complex set of industry restructurings (see, for example, TCI's recently-acquired and Cox's more longstanding interests in Teleport, or the recent exchange of shares between Sprint and Centel). More importantly, the effort to capture users involves market positioning in the face of increased competition (a tendency which will accelerate throughout the foreseeable future), of emerging operator alliances (and concomitant threat to the non-strategically aligned), and of rapid technological development. This last is of particular importance: the economic consequences of path(s) chosen toward B-ISDN may escalate at any point throughout developmental cycles.

Figure 2 highlights trends in European network digitization as well as variations in development of network transmission and switching functions. It portends several of the patterns which follow in the discussion ahead. These numbers must not be taken out of context, however. The fact that Ireland's network digitization is four times higher than that of Germany does not imply that the latter's service-provider environment lags. (It does indicate, however, that Telecom Eireann (TE) has the capacity to generate more revenues at marginal cost than it does at present.)

The growth of private networks which underdevelopment might be expected to produce has historically been inhibited by high leased-line tariffs. Beyond the UK (as seen in Figure 3, where penetration of 2Mbps leased-lines is also substantially higher than elsewhere), the only private networking markets of any significance are in France, Germany and Italy (**Figure 3**). Here such development correlates closely with the presence of a historically significant high-technology sector and larger more advanced trade-oriented economies.

The rationale underpinning lack of correlation between those private circuit charges levied by TOs and actual costs of leased-line provision is (predictably) that of maximizing public voice-and data-network usage. Furthermore, high international tariffs were in the past intended to discourage cross-border traffic, because of the limited capacity of international gateways and because of the perceived small markets for

Figure 2

European Network Digitization, 1990

	Tramsission	Trunk Switching	Local Switching	Index
United Kingdom	100	90	42	0.73
Netherlands	95	15	35	0.43
Denmark	85	40	23	0.44
France	70	75	70	0.72
Ireland	70	85	65	0.73
Belgium	50	75	29	0.50
Sweden	50	50	33	0.43
Germany	50	22	10	0.24
Italy	45	36	25	0.34
Portugal	70	20	20	0.33
Spain	47	45	5	0.30
Luxembourg	35	10	8	0.15
Greece	30	40	8	0.25

Index weightings as follows

Transmission x .25
Trunk Switching x .35
Local Switching x .4
Total = 1.0

Sources: OECD Data, Author

Figure 3

European Private Data Networks & 2Mbps Leased Lines

Country	Private Networks	2Mbps Leased Lines
Portugal	100	N/a
Greece	200	N/a
Iceland	200	N/a
Austria	300	N/a
Norway	300	N/a
Denmark	400	N/a
Finland	450	N/a
Netherlands	450	301
Switzerland	500	1381
Belgium	550	475
Sweden	600	53
Spain	800	110
Italy	1400	114
Germany	1500	525
France	2000	1377
UK	4500	42600

Source: Gartner Group, 1991

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such services.

Figure 4 shows European leased-line charges over a five-year period, from 1986 to 1991. Three basic patterns are distinguishable: high on both national and international fronts (Spain, Switzerland, Germany, Italy); moderate on both counts (Norway, Finland, Benelux countries); and low (UK, Sweden, Denmark). Pricing tactics have been mixed in the cases of Portugal, Greece, France and Austria, for reasons peculiar to each national situation. (The former two may offer cheap domestic service to foster penetration, and to assuage criticisms regarding service quality. By contrast, France Télécom has pursued pricing strategies specifically calibrated toward promoting increased network usage since the early 1980s.)

Figure 5 compares private circuit costs (national and international baskets); it confirms these trends. Most recently, competitive pressures have catalyzed tariff reductions by TOs in Belgium, Switzerland, Germany and France (long-distance only), as well as moderate cuts in Italy and the Netherlands. Charges in Denmark and the UK were already among Europe's lowest, which is why recent months have seen no further reduction. At the other extreme, DBP Telekom's proposal early in 1991 for radical tariff rebalancing - halving long-distance line rental but doubling costs over short spans[4] - produced an outcry among large users and VANs providers.

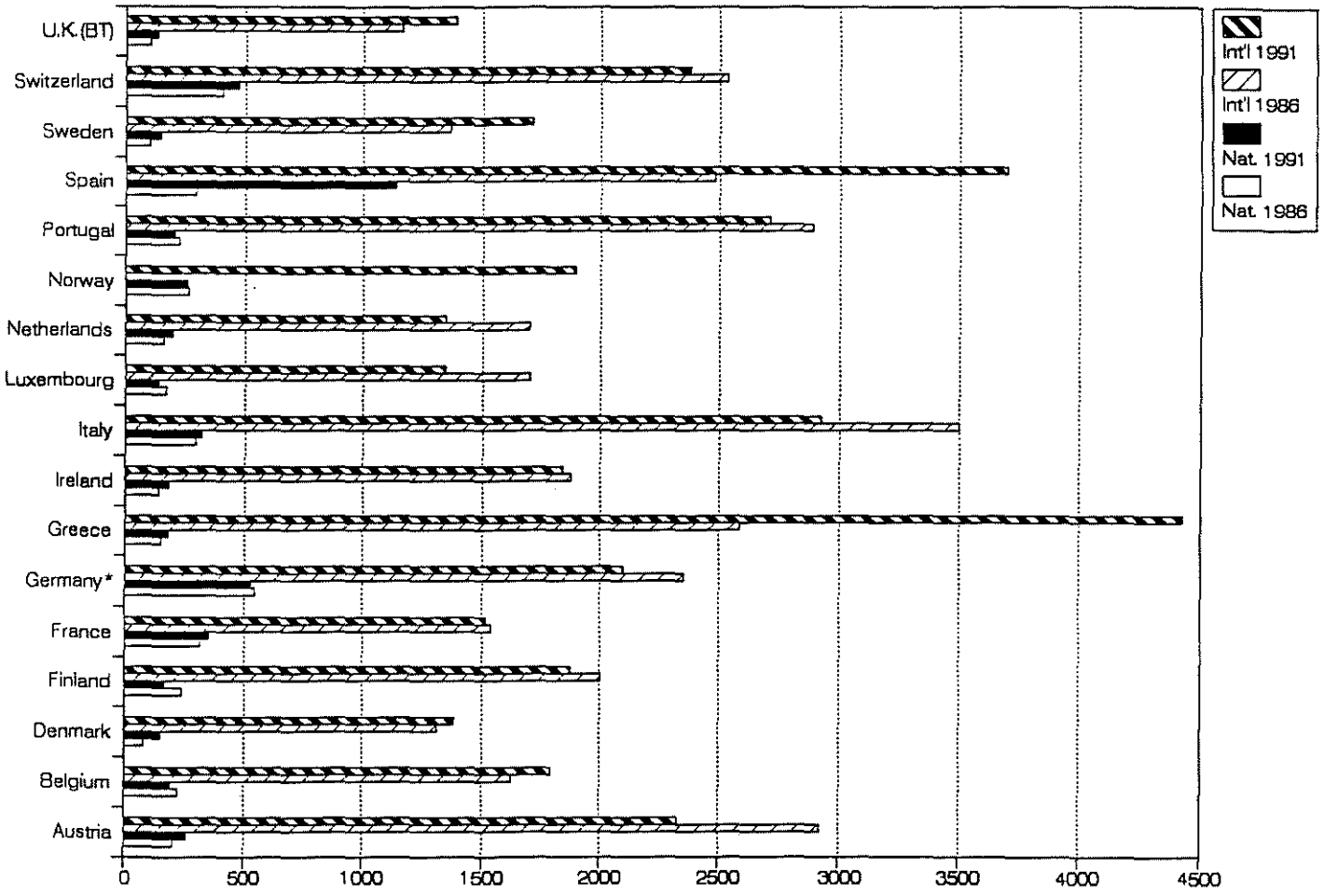
Here a critical point emerges. In Germany, as elsewhere, corporate networking cultures have evolved within the parameters of available services and options, and their respective costs. Investment has been channeled to exploit lower service tariffs. This is but one of several factors shaping TO initiatives, both current and future, intended to produce tariff structures more closely aligned with costs (a regulatory imperative from without, in the case of many TOs). Existing enterprise networking arrangements will also play a dominant role in future developments: forward-compatibility to protect corporate investment in established internal telecommunications and information technology systems becomes critical. It is politically unfeasible to radically change the rules of the game and render obsolete the more recent of these arrangements.

Despite the situation just alluded to, Germany at present has the highest digital leased-line penetration in Europe (more than double that of the UK, which ranks in second place: **Figure 6**). If one compares Figures 5 and 6 (ignoring in the latter case the relative weights of analog and digital), the relationship

[4]In general, an increasing proportion of circuit-provision costs are concentrated at either end. Logically, minimum charges for leased-line rental should be high, but prices should be almost distance-independent.

Figure 4

Monthly Charges for Leased Lines
National and International



Price for analogue circuits, in US dollars
Source: Data Communications, October 1991.

Figure 5

Cheapest Private Circuits

Country	National (US$)	International Index (3) (2) (US$)	
Denmark	114	1164	100
U.K.	109	1283	104
Luxembourg	163	1803	111
Belgium	131	1703	133
Ireland	159	1567	137
Sweden	129	1842	138
Netherland	170	1717	148
France	245	1374	161
Norway	234	1716	173
Finland	182	2218	177
Portugal	170	2442	183
Switzerland	396	1982	250
Greece	151	3995	250
Italy	320	3011	268
Germany	514	1793	286
Spain	953	2853	507

Source: Logica, 1991

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Figure 6

Leased Line Penetration: Analog and Digital

Country	Public network operator	1990 revenue ($ billions)	Main lines	Total connections to analog leased lines	Total connections to digital leased lines[1]
Austria	PTV	2.8	3,103,000	20,500	8,330
Belgium	RTT	3.1	3,700,000	79,300	2,390
Denmark	TeleDenmark	2.0	2,850,000	34,100	1,300
Finland	Telecom Finland HTC	1.1	2,582,000	57,600	2,660
France	France Télécom	16.8	26,540,000	236,000	31,900
Germany	DBP Telekom	21.0	29,400,000	3,870	203,000
Greece	OTE	1.0	3,936,000	8,320	N/a
Ireland	Telecom Eireann	1.0	916,000	8,450	150
Italy	SIP, STET	12.8	21,226,000	170,000	11,100
Luxembourg	P&T	.1	176,000	4,630	90
Netherlands	PTT Nederland	7.0	6,700,000	60,400	1,050
Norway	Norwegian Telecom	2.1	2,070,000	18,600	10,400
Portugal	TLP, CTT, CPRM	3.8	2,080,000	11,200	10
Spain	Telefónica	8.7	11,800,000	70,300	1,100
Sweden	Swedish Telecom	5.4	5,716,000	73,400	5,430
Switzerland	PTT	3.9	3,785,000	38,900	28,500
U.K.	BT Mercury	15.9 1.2	26,000,000 367,000	500,000	122,000

1. Jan. 1, 1990 figures

SOURCE: Logica, Author

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between distance penetration and costs of usage proves predictably linear. Private circuit costs - national and international - are exorbitant in Spain; extremely high in Switzerland, Greece, Germany and Italy; and cheapest in the UK, Ireland, Sweden, Denmark, and the Benelux countries.

Regulatory

Beyond tariff structures, a second primary component of the public/private tradeoff from the user perspective relates to conditions of leased-line usage: whether or not simple resale and public network interconnection are permitted. These degrees of flexibility become particularly important where costs of both public and private network services, voice and/or data, tend in the same direction. Each national combination of regulatory decision-making and pricing strategy, taken in tandem, must be understood in terms of broader national concerns. Throughout the late 1980s, for example, the Netherlands was promoted via liberal licensing and pricing laws as an international hub. In the face of PTT Telecom's desire to integrate transport and communications sectors (necessitating a broader industrial policy encompassing electronic trading networks (ETNs), management of such facilities as ports and customs agencies, and panEuropean tracking systems), this priority has receded in significance.

Figure 7 suggests the relative openness of national markets for would-be value-added service (VAS) providers. Opportunities remain extremely limited in Portugal, Greece and Luxembourg (although deregulation elsewhere - mandatory as of January 1993 - has not eliminated the various practical barriers impending VAN implementation in national markets). Lack of options for amortizing leased-line costs, either through resale of spare capacity or VAS provision to third parties, is an obvious disincentive. Those key regulatory constraints (**Figure 7**) which limit national private networking and (relatedly) VANs provision are summarized in the matrix which follows: **Figure 8**. By these standards, operator environments in the UK, Sweden and Denmark are most pro-competitive. The relative positions of the remaining countries appear (at this stage in the discussion) almost as predictable.

Three Ages of Networks

If one considers these elements together, it is plausible to position Europe's TOs relative to one another, and according to the telecommunication era in which each is living (see **Figure 9**). Some are still fighting the battles of the 1970s - building the network base, fostering universal service, correcting severe quality problems, and so forth. This group includes operators which have made major modernization efforts but still betray (not necessarily

Figure 7

VANs & Leased Lines

Country	Public network operator	1990 revenue ($ billions)	VANs deregulated	Third-party VAS on leased lines	Simple resale of leased lines	Leased line interconnection to public network
Austria	PTV	2.8	Yes	No	No	No
Belgium	RTT	3.1	Yes	n/a	No	Yes
Denmark	TeleDenmark	2.0	Yes	Yes	Yes	Yes
Finland	Telecom Finland	1.1	Yes	Yes	Yes	Yes
France	France Télécom	16.8	Yes	Yes	Planned 1992	Yes
Germany	DBP Telekom	21.0	Yes	Yes	Yes	Yes
Greece	OTE	1.0	No	Yes	No	No
Ireland	Telecom Eireann	1.0	Yes	Yes	No	Yes
Italy	SIP, Italcable	12.8	Yes	No	No	No
Luxembourg	P&T	.1	Planned	No	Planned	Yes
Netherlands	PTT Nederland	7.0	Yes	Yes	Yes	Yes
Norway	Norwegian Tel.	2.1	Yes	Planned	No	Yes
Portugal	TLP/CTT/CPRM	3.8	No	Planned	No	No
Spain	Telefónica	8.7	Yes	Yes	No	Yes
Sweden	Swedish Tel.	5.4	Yes	Yes	Yes	Yes
Switzerland	PTT	3.9	Yes	Yes	Yes	Yes
U.K.	BT Mercury	15.9 1.2	Yes	Yes	Yes	Yes

SOURCE: Logica PLC, Author

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Figure 8

Pro-Competitive Networking Environments

Tariffs

		Low	Moderate	High
VANs and Leased Line Liberalisation	**HIGH[5]**	**UK Sweden Denmark**	**Finland Netherlands[1]**	**Switzerland[1] Germany**
	MODERATE[2]		Belgium[1] Ireland Norway France[1]	Spain *Germany*[1]
	LOW[6]		Austria Greece[3] Portugal Luxembourg[4]	Italy *Belgium* *Spain* *Greece* *Portugal*

Italics indicate current practice, as opposed to legal status

1. Recent Tariff Reductions
2. Simple Resale Prohibited
3. 3rd Party VANs Only
4. Leased Line Interconnection to Public Network Only
5. VANs Deregulated; 3rd Party VAS, Simple Resale, and Leased Line Interconnection to Public Network.
6. Regulated VANs, 3rd Party VAS, Simple Resale, and Public Network Interconnection of Leased Lines Prohibited (except where specified).

Source: Author

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Figure 9

Three Ages of Network Development

	1970s	1980s	1990s
Name	Building the Base	Enhanced Functionality	Network Platforms
Country	Spain Italy Greece Portugal	Norway Germany[2] Austria[1] Switzerland[1] Ireland Belgium[1] Finland Luxembourg	UK Netherlands Denmark Sweden France[1]
Concern	Universal Service Infrastructure	Competition at the margins	Transparency Interoperability
	Still building service universality, quality, network reach	Beyond universal service; lacking infrastructure development and/or political will to ensure network transparency and interoperability	Creation of a network platform for enhanced VANs, unbundling of functionality, CPE-based services
Regulatory Schema	PTO/State Partnership	Liberalization, Interconnection	Deregulation, Price Caps
Service Environment	POTS	VANs	Intelligence Bundles

1. Regulatory restrictions in France, Austria, Switzerland and Belgium impede acceleration.
2. Germany in the East is a decade behind (POTs provision). This constrains Deutsche Telekom's efforts to foster interoperability on a national scale.

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through choice) a POTS mindset: Italy, Spain, Portugal, and Greece. The next cohort - Norway, Germany, Austria, Luxembourg, Switzerland, Belgium, and perhaps Ireland - has graduated to the 1980s. Here we see a liberalised VANs sector developing without seriously challenging TO dominance, either in infrastructure provision or in the TOs chosen specialities in enhanced network functionality and services.[5] Only a handful of countries - the UK, Sweden, Denmark, the Netherlands and (to a great extent) France - reflect the telecommunications zeitgeist. Here the TO is busy transforming an integrated and formerly-hierarchical network into an unbundled and interoperable platform or platform-series. In addition to transmission capacity, logical functions of increasing differentiation may be bought and sold.

This discussion of market and network development begs the question of liberalization. Which factors are critical to competition in telecommunications at a given point in time? A few stand out. First, reasonable regulatory provision for a second provider of infrastructure and/or services. In the second case, VANs liberalisation: this implies access provisions which limit the ability of a dominant provider to behave anti-competitively. Third, the relationship between service tariffs and costs. In theory, the possibility of entry by a new supplier serves as a check upon monopolistic or oligopolizing tendencies.)

Figure 10 compares corporate operating costs (public voice traffic) in national markets. These are highest in Spain, Portugal, Greece, Luxembourg, Italy and Ireland; moderate in Austria, Switzerland, Germany, France and Belgium (although declining in the case of the latter two); and lowest in Scandinavia, the Netherlands, and the UK. Note that this table omits the most recent trends toward tariff rebalancing. Nations which have reached universal levels of penetration have every incentive to increase network traffic via lowering usage charges. The rebalancing which this implies, with access (rental and connection) costs correlatively increased so as to protect revenue streams, has occurred over the past year in the UK, Spain, Italy and France.

Development of public data networks by the various TOs - current (1990) and planned[6] - is indicated in **Figure 11.** Industry projections indicate that the current leaders in this domain - France, Spain, Germany (Switzerland and the UK occupy the second tier) - will be joined by Luxembourg in 1995, and that moderate progress will be made by Greece's OTE, Telecom Eireann and Norwegian Telecom. Where usage of public data networking capacity has been encouraged through service development, charges have nevertheless peaked. For example, packet-switching costs are highest in France, Germany, Italy and Spain. X.25 charges which are relatively low reflect (in general)

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[5]Here, however, less liberalizing regulatory regimes (Belgium, Austria, Switzerland) or new challenges - the East German situation - may inhibit progress.

[6]Logica estimates regarding developments by the various TOs through 1995 are shown in **Figure 11.**

Figure 10

European Telephone Costs, 1986 vs. 1991*

Country	1986 ($)	May 1991 ($)	Percent Change
Austria	2,140	1,576	-26 %
Belgium	2,640	1,355	-49
Denmark	943	1,114	18
Finland	1,564	1,162	-26
France	1,653	1,371	-17
Germany	1,512	1,698	12
Greece	1,901	1,922	n/c
Ireland	1,969	1,964	n/c
Italy	2,175	2,189	n/c
Luxembourg	1,651	1,849	11
Netherlands	1,439	1,264	-12
Norway	1,374	1,120	-18
Portugal	2,129	2,137	n/c
Spain	2,202	2,402	9
Sweden	1,087	1,111	2
Switzerland	2,357	1,429	-39
U.K.(BT)	1,008	1,143	13
U.K.(Mercury)	—	1,060	n/a

* Monthly cost of 200 minutes telephone calls: [30% local
10% long-Distance
30% adjacent countries
30% transatlantic
plus monthly rental and installation.]

N/a = Not applicable

N/c = No significant change

Source: Logica, Author

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Figure 11

PSDN Development in Europe

Country	Public network operator	Service Name	Year of Introduction	PSDN as % of total data connections[1]	PSDN as % of total data connections[2]
Austria	PTV			10	26
Belgium	RTT	DCS-Net	1982	8.6	15.5
Denmark	TeleDenmark	Datapak	1983	1.6	3.2
Finland	Telecom Finland HTC			1.7	2.9
France	France Télécom	Transpac	1978	17	12.5
Germany	DBP Telekom	Datex-P	1981	12.2	24
Greece	OTE	Helpak	1983	1.2	5.2
Ireland	Telecom Ireland	Eirpac	1984	.9	7.4
Italy	SIP, Italcable	ReteFonia Dati, Itapac	1984	1.7	4
Luxembourg	P&T	Luxpac	1983	10	24
Netherlands	PTT Nederland	Datanet	1982	7	7
Norway	Norwegian Tel.			3	6.4
Portugal	TLP, CTT	Telepac	1984	15.4	27
Spain	Telefónica	Iberpac	1981	35	33
Sweden	Swedish Tel.			2	4.7
Switzerland	Swiss PTT			5.2	5.7
U.K.	BT, Mercury	PacketSwitch Stream	1981	4.3	8.1

1. Jan. 1, 1990 figures
2. Jan. 1, 1995 estimated

SOURCE: Logica, Author

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service underdevelopment and/or service-quality limitations.

Toward the Future

From this barrage of numbers one gains a sense of the range of options characteristically offered users by the various European TOs. The avant-garde stands out, as does the rearguard. Historically the growth of private networks in Europe has been inhibited by high tariffs, by a shortage of high-bandwidth lines, and by regulatory constraints. This situation is ripe for change. It is clear that hybrid public-private network architectures will become the norm for video and data applications during the 1990s. Most organizations are moving in this direction to optimize usage of facilities and service-provision, and to avail of those enhanced features (off-net calling, integrated billing, and so forth) proposed by vendors. For operators both in the US and in Europe, VPNs allow reclamation of revenues previously lost to private network providers. It is generally estimated that 80-90% of the (roughly) 300 US corporations which built private networks throughout the 1990s have since moved voice traffic to virtual networks. Since the expected shift of data traffic to increasingly sophisticated VPN offerings will be smaller than that of voice over the next five years, dedicated networking will remain an important market sector.

For European operators, the marketing of VPN services offers distinct advantages. With traditional protections disintegrating, a primary and shared concern is to maintain business position. It is the relative maturity of virtual networking within the US which has focused European VPN development initially toward the international market[7]. TOs are competing first to position themselves as hubs for US and global users, and secondarily to win large-user accounts on the home front (**Figure 12**), allegedly providing the platform (that word again) for varied, integrated and uniformly billed services[8].

As for the hybridization of so-called 'private' and 'public' network arrangements alluded to earlier[9], the implication of viable bandwidth-on-demand services ('pay as you go') is the rapid extinction of the classically-conceived 'private' network. Hence (pace Noam, 1991) one posits the 'Tragedy of the Common [Private] Network,' which

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[7]At present, companies using such applications as local area network (LAN) interconnect, videoconferencing and transaction processing involving 2-3 hours of international communications daily are considered prime users of international VPNs.

[8]Facsimile, store-and-forward, text-to-speed conversion, voice mail, paging, calling cards, private lines. But a variety of such 'platforms' are under development, reflecting marketing efforts by various telecoms sectors.

[9]Where leased circuits — for example — are complemented with public ISDN and dial-up X.25 service.

Figure 12

VPN Services: Europe & the US

Country	Service Availability	Service Name
Belgium	3Q1992	
Denmark	1991-92	
France	1 1975(D) 2 1Q1991(I) 3 2Q1992	Colisée To be decided To be decided
Germany	2Q1992(D)	
Italy	2Q1992	
Netherlands	1 1Q1991(D) 2 2Q1992(M)	IVPN GVPN
Portugal	1992	
Spain	1992	
Switzerland	1992	
Sweden	1 1992(D) 2 1992(M)	
UK Mercury BT Intl	 1 Sept. 1990(D) 2 Sept. 1990(M) 3 Sept. 1990(B) Nov. 1990	 VPN Intl FeatureNet
USA AT&T MCI US Sprint World Comms FRT/FTC Comms Corp C&W Metromedia Comms Corp	 1985(D) 1989(I) 1991(I) 1 1985(D) 2 1985(I) 1 1985(M) 2 1985(B) 3 4Q1991(I) 1990(D) 1991(I) 4Q1991 4Q1991	 Software Defined Network(SDN) GSDN SDNI VNet Global FON Enhanced Private Network (EPN) IVPN FON

(D): Domestic
(I): International
(M): Multilateral
(B): Bilateral
Source: Carrier information and various others
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is pretty much where our argument began:

> In the future, the ultimate user may no longer be able to tell if the network being used is a private or public network, or a VPN provided on either public or in-house private networks, or just a loose aggregation of public, private, shared, and temporary bandwidth services masquerading as an integrated whole (Duckett, 1992).

In other words, one might posit several replacements for the traditional 'public network' concept. As services become increasingly transparent to users, tipping of the network occurs on a daily basis in both the public and private directions.

V. The Technological Factory

Infrastructure investment (the promotion of one technology over another) and tariffing decisions (pricing differentials among raw transmission bandwidth, virtual private, and public network services) are key determinants of these private/public fluctuations. Adoption of emerging technologies - at least in the case of larger markets - becomes a strategic move of considerable financial consequence. The problem is to select technologies which are compatible backwards (thus readily integrated with existing infrastructural hardware and applications) as well as and forwards (i.e. strategically positioned along a plausible migratory path toward B-ISDN). Such technological choices must facilitate new service applications, ones which significantly outweigh the value of those displaced and exploit developing market sectors. (**Figure 14** indicates the suitability of various broadband technologies for primary user applications.)

Furthermore, one must understand the present and future plans of TO counterparts. Although these are increasingly becoming competitors - although almost entirely on the international front so far, - collaboration in development and standardization may be crucial to the success of technology-deployment strategies.

The challenge for all operators is clear, though this may come from other TOs, from within, or from a failure simply to move with the times. TO strategists are faced with a dynamic set of firms, of markets, of technology paths, and (by virtue of influence) of regulatory regimes, the latter of which are never imposed from above without consultation. Thus, one must choose allies (and here, in particular, old habits die hard). One must cast off old technological and institutional shackles. Figure 9 suggests, at a very general level, the range of TO responses to their various environments: from aggressive to defensive or rearguard.

One emerging technology, frame relay, will illustrate the range of behaviors and constraints which must be

Figure 14

Suitability of Broadband Technologies for Primary User Applications

	Videoconferencing (high-definition)	LAN interconnect	PABX interconnect
Synchronous digital transmission	X	X	X
MAN-SMDS[1]	Not initially	X	Not initially
MAN-QPSX[2]	X	X	X
B-ISDN	X	X	X
Frame Relay	X	X	Some prototype products
FDDI	X	X	Only FDDI-II

1. Bellcore's datagram-based PDNs
2. CCITT standard, and datagram-based PDNs

Source: *Communications International*, February 1992, p.42

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considered. The worldwide market for frame relay equipment and services was worth US $8 million in 1991. For 1995 the projected figure (are these estimates always inflated?) is US $845 million.[10] Since rapidly-growing markets cannot be ceded to competitors, the more aggressive carriers already offer frame relay service. (Rapid market growth, however, is balanced by costs of provision, requiring concerted effort, expertise and resources.) This technology offers a range of service possibilities,[11] as well as a backbone for the public LAN-interconnect and VANs services now being offered across Europe. Operators may market more precise handling of bursty traffic, attracting users via flat-rate charges (hence predictable costs incurred and budgetary control) rather than the volume-sensitive tariffing arrangements characteristic of most existing X.25 services.

Part of the challenge of frame relay concerns the bigger picture: it may be viewed as an interim step toward universal cell-based communications founded on asynchronous transfer mode (ATM) operating at 150 Mbps[12]. Yet from another perspective, Metropolitan Area Networks (MANs) - particularly those found on Switched Multimegabit Digital Service (SMDS) - will displace frame relay. In the meantime, however, several of the aggressive TOs (notably the Dutch, Scandinavian and British) have begun service introduction with uncharacteristic haste, for (depending upon one's market intentions), either or both public and private network revenue streams are under siege. And there are other reasons for haste; pressure from suppliers who have promised the availability of switching capabilities; a desire to anticipate and influence the standards process; pressure to be first-to-market, and to fill evolutionary gaps. (The latter point is discussed in detail below.)

At least four international VANs - among these, AT&T Istel, BT North America, and Compuserve - had announced extension of US frame relay services to Europe by March 1992. This development presents an obvious threat to highly-profitable leased-line businesses: existing X.25 switches are being upgraded to maintain public data network traffic. Consortia interconnecting frame relay services are being formed even as members' technological visions

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[10]See, for example, *Communications International*, March 1992, p.24.

[11]Frame Relay may function as part of a private packet switched network (supporting X.25, SNA, or other data services); as a virtual private data network (i.e. a public network serving a single customer's X.25, SNA, and other needs); as a PTO-run public frame relay network service; or as part of a hybrid network (supporting both private and virtual private services, depending on location: Rickard, p.48).

[12]A high-conductivity, low-delay, packet-based switching and multiplexing technology. ATM and SONET-the standard for fiber optic-based circuits operating in multiples of 51.840 Mbps up to 48 Gbps - are the fundamental building blocks of B-ISDN.

Figure 13

Bandwidth on Demand:
Switched Digital Service in Europe

Country	Service Name	Operator	Status	Number of Switches	Intl. Links
Belgium	N/a	Belgacom	Development	2	Not yet
Denmark	MegaNet	Telecom Denmark & Jutland Telephone Co.	Commercial	20	Yes
Finland	MegaNet	Telecom Finland & Helsinki Telephone Co.	Commercial (only 1 customer)	2	Yes
Netherlands	MegaSwitch	Netherlands PTT	Pilot	2	Yes
Norway	MegaNet	Norwegian Telecom	Commercial	4	Yes
Sweden	MegaNet	Swedish Telecom	Commercial	10	Yes
Switzerland	Megacom	Swiss PTT	Commercial	15	Yes
UK	Switchband	Mercury Comm. Ltd.	Commercial	2	Yes

Source: Data Communications, Dec. 1991, p.117, updated

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stand opposed.[13] The availability of digital services locally (supporting global bandwidth-on-demand) is currently fostering network interconnection and collaboration among European operators (**Figure 13**). Yet the strategic technological vision of each carrier (to the extent that this exists: many continue to operate in a purely reactive mode) is unique. So also will be the TO's solutions to the problem of planning service life-cycles, coordinating market segments, and - as always - subsidizing unprofitable voice and local services with the revenues generated by enhanced and toll services.

Above all, the challenge remains B-ISDN: the next generation TO-provided wide-area network offering integrated transport and switching of multiple broadband and (where required) high-speed services. By consensus both in Europe and the US, the target B-ISDN architecture involves migration of all services toward a network platform based upon SONET/SDN transport and ATM switching. If it is Monday it must be frame relay. By Tuesday it will be SMDS: the high-speed, connective, public packet-switching service proposed to extend LAN-like performance across a metropolitan or wide area. It is B-ISDN which will connect these MANs or WANs. For the moment, what is particularly relevant is the relationship between these evolutionary stages and older technological forms. Most of the latter have characteristically served more as public than private (or vice versa) networking tools. The technological phase at which each TO enters this broadband race - but also the flexibility built into developmental paths pursued - will bear important consequences for both sectors. (**Figure 15** offers some basic pointers.)

But this is the ten-year scenario, and we have ignored quotidian constraints. Prospects for mass ISDN implementation within the next 3-5 years are poor (See **Figure 16**). Limiting factors to date are well known[14]. After a decade of effort, the brave new world of Euro-ISDN - characterized by development of a uniform pan-European telecommunications network (to the extent that such a notion is plausible, in view of the enormous variation in infrastructural development alluded to earlier) - has fallen upon hard times. Despite Memoranda of Understanding (198, 1989) committed to harmonized introduction by December 1993, TOs have pursued different approaches, and with obvious strategic intent. (Note **Figure 17**, especially various TO commitments to perpetuation

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[13]For example, Telecom Finland's primary focus — and also that of Infonet — lies in providing the equivalent of private data networks: the goal is router configuration for individual corporate customers to support tailor-made virtual networks handling TCP/IP and other protocols. On the other hand, Swedish Telecom and Sprint offer the equivalent of a public telephone service for computers. Only TCP/IP traffic is supported on the network. Customers must encapsulate other traffic types in IP packets before transmission.

[14]These include lack of mass-market applications, high equipment costs, minimal geographical coverage, competition from existing networks and services, costs of network upgrade, unclear TO marketing strategies, and - inevitably - standards incompatibilities.

Figure 15

Data Services in Transition: 1991-95

	Circuit Switched	Packet Switched	Leased Lines
Also known as	Telephone calls	X.25 VANs	SNA, 3270
Characteristic	Give each customer a circuit for a few minutes or hours, charge by the minute or by the second	Multiplex several customers onto a network of leased lines, charge for time/packet	Give each customer a permanent circuit from one place to another, charge by the month and the mile
Top speed, 1991	14,400 bps max?	56,000 bps	T3 = 45 Mbps
Moving to next generation high bandwidth service	ISDN	Frame Relay SMDS (1.5-4.5 Mbps)	SONET/SDH transmission ATM switching ——— B-ISDN
Top speed, 1995	1.5 Mbps per line	1.5 Mbps/line(T1)	2.5 Gbps+

Source: *Business Communications Review*, Dec. 1991, and Author

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Figure 16

ISDN Penetration

Country	Public network operator	First ISDN Trials/Pilots	Starting date, commercial ISDN (BRA)	Starting date, commercial ISDN (PRA)	ISDN as percentage of total data connections[1]	ISDN as percentage of total data connections[2]
Austria	PTV		1992/3	1992/3	N/a	3.50%
Belgium	RTT	1984	1989	1989	0.17%	8.70
Denmark	TD KTAS JTAS	1989	1992	1992	N/a	4
Finland	Telecom Finland HTC		1989	1989	0.50	13.10
France	France Télécom	1983	1987	1989	0.47	19
Germany	DBP Telekom	1987	1989	1989	0.28	14.40
Greece	OTE	1990	1993	1993	N/a	1.80
Ireland	Telecom Ireland	1989	1993	1993	N/a	1.40
Italy	SIP Italcable	1989	1992/3	1992/3	N/a	4.30
Luxembourg	P&T		1992	1992	N/a	2.60
Netherlands	PTT Nederland N.V.	1988	1992	1992	N/a	5.20
Norway	Norwegian Telecom		1992	1992	N/a	2
Portugal	Telecom Portugal TLP	1989	1992	1992	N/a	1.50
Spain	Telefónica	1988	1991	1991	N/a	8.10
Sweden	Swedish Telecom		1991	1992	N/a	6.80
Switzerland	PTT		1989	1992	0.03	13.80
U.K.	BT MCL	1985	1990	1992	0.06	5.30

1. Jan. 1, 1990 figures
2. Jan. 1, 1995 estimated

SOURCE: Logica
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Figure 17

European ISDN

Belgium	25	800	1992 startup; all ISDN public switches by mid-1993. Existing service (Belgian standard) to continue
Denmark	0	700 (pilot)	January 1992, nationwide
France	500	5,000	1993 startup; all ISDN public switches late 1994. Existing service (French standard) to continue
Germany	640	7,615	Mid-1993 startup; all ISDN public switches late 1993. Existing service (German standard) to continue
Ireland	0	0	Commercial service late 1993: Available to 70% of business customers
Italy	0	0	1Q1993 startup: In Rome, Turin, Milan, Naples by late 1993
Netherlands	0	100 (pilot)	Mid-1993 startup: 30 major cities by late 1994. Existing service (German standard) to continue through 1998
Spain	0	40 (pilot)	1993 startup: 30-40% of 62 largest cities by Dec. 1993
UK	1,700 (BT, 1000; Mercury, 700)	500 (BT only)	Primary-rate launch by late 1993; national coverage a few months later. (Basic-rate ISDN is currently very close to Euro-ISDN.) Mercury launch of primary-and basic-rate ISDN, 1992

Source: Data Communications, February 1992, p.74
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of national standards in parallel with a common European offering.) This development comes as no surprise: European cooperation - at least rhetorically - is never better than in the face of a commonly perceived enemy. Absent this, comparative national advantage is the rule, although this may be broadened to include bi-lateral or regional interests as in the case of Eunetcom or Nordframe. There are few oppoenents of protectionism among its beneficiaries. (This is a point to which we shall return.)

Arguably, markets in which private networking is underdeveloped should be particularly conducive to ISDN growth. For example, Deutsche Telekom should enjoy more flexible ISDN pricing conditions than do some of its counterparts, since Germany's dominant alternative (digital leased lines) remains prohibitively expensive for small to medium-sized users. At the other extreme, BT's promotion of digital private circuits during the 1980s is expected (in certain quarters) to dampen the impact of public ISDN (cf **Figure 16**). Industrial policy factors are also at play. The only two nations to achieve significant penetration of ISDN circuits by 1992 were France and Germany, both of which had poured large sums into subsidizing access, sponsoring applications development and encouraging user experimentation by pricing ISDN below comparable service offerings. However, in the face of the gulf separating developed and underdeveloped national markets (see Section IV), one suspects that the differences of strategic choice alluded to here are trivial.

This brings us to another question, not at all inconsequential. Which operators will serve as market leaders; which will follow? Despite a shared history of engineering excellence, and public service operation, the Scandinavian TOs do not have the resources to develop alone such leading-edge services as frame relay. Even STET and Telefonica are forced to make deals to purchase off-the-shelf technology packages. Only BT, Deutsche Telekom and France Télécom are in the position to support ongoing, broad-ranging research in software engineering as well as transmission. This has helped shift the impetus for product development towards equipment manufacturers, who - like the smaller TOs - may find it increasingly difficult to lead such changes, as margins are squeezed and the industry consolidates.

VI. Service Specialization

We will now discuss basic and value-added, both generic and customized/customizable. These terms were inadequate to begin with (this is a truism), and technological progress is rendering them increasingly obsolete. Yet they are the tools with which we must work, for the moment: industry discourse continues to evolve within these parameters.

The distinction between the terms of the modifying clause ('generic' and 'customized') should be obvious from **Figure 1.** It is clear, however, that the relationships among these three classes (basic, generic value-added and customized) are constantly shifting, and not simply because of accelerated user demand. It arises also because of the need to protect market share in an increasingly competitive supplier environment, one which imposes common pressures upon carriers and equipment manufacturers. Services once discretionary are later considered essential, as in the case of such enhanced functions as call-waiting, caller-ID, three-way dialing, and so forth. Furthermore, VAS are never enhanced in linear fashion, but on the basis of interoperability (technical) intersections among market segments (economic), and regulatory constraints. For example, law firms are eager to link Calling Line ID services to internal computerised billing for clients.

Market-oriented TOs must supply more than just larger capacity pipes in response to user demand for high bandwidth. Simply put, they must add intelligence: though this is where the high profit margins are, though also the lion's share of risk. The underlying market logic is essentially clear. If charges levied for high-speed services err on the high side, this will thwart potential uptake. Low-cost offerings, on the other hand, will invite resellers to undercut tariffs in other TO market segments. The obvious solution for operators therefore, involves not simply provision of high-capacity private circuits, but their bundling with high-performance, integrated services.

The latter strategy is nicely congruent with efforts by larger firms to consolidate and rationalise company-wide systems, and has driven ventures like Syncordia and Infonet (another situation where smaller TOs find strength in numbers). It offers the significant advantages of limiting resale, and provides added-value so as to increase the proportion of customer expenditures entering TO revenue streams. It also addresses problems of increasing complexity associated with network management providing additional migratory incentives for users back to the public system.

In fact, the gradual introduction of advanced functionality, bundled with increased bandwidth, is currently a central strategic thrust on the parts of European TOs. The more competitive of these are rapidly diversifying so as to increase network profitability, even if they still have considerable institutional baggage to unload. Such enterprises as British Telecom, France Télécom, Cable & Wireless, and Telefónica are undergoing radical transformations, of managerial culture and market orientation.

Three types of transborder offerings have emerged which position operators and their customers on a migration path toward B-ISDN: managed data network services - MDNS (whereby users outsource data networking requirements); full outsourcing services (where responsibility for all network requirements is passed to a third party); and VPNs (by which users return parts of voice business - for the moment - to the public system).

To date European MDNS has been confined to data traffic which is international in focus. National TO monopolies over voice (local and long-distance) and infrastructural provision have defined these parameters. Since the first class of constraint (monopolistic long-distance markets) is currently under CEC review, and also because technological development will probably have rendered the second unsustainable by the century's close,[15] the prospects for Infonet, Unisource, IBM Information Solutions and others are excellent. (**Figure 18** indicates the current business status of some of these players).

Service provision is clearly oriented toward international and global markets. European virtual private networking, by contrast, has begun as an essentially national affair. It is simply a question of creating and cultivating such opportunities. (One of the standard trade-press potboilers of the moment discusses the unquantifiable barriers - lack of user confidence in operators' abilities to deliver the promised goods, confused service-provider marketing strategies, and so forth - impeding developments on the international front. The attention which these 'soft' issues have commanded should not be ignored, since it shapes the perceptions of telecommunications managers and those who control their budgets.) Those TOs which have aggressively entered the VPN business predictably the British, French, German, Dutch and Swedish carriers: those with trade-oriented economies and many multinational firms to serve - do so in response to the anticipated expansion of private networking within their markets. For example, the British market research firm Intelidata forecasts an eleven percent annual growth rate for European private voice networks over the next six years. Though they are currently rare outside the UK, PBX networks are expected to increase rapidly in key European markets, notably those of Germany and Italy.

But regulatory undercurrents, in particular, portend substantial market upheaval on other fronts. International and long-distance tariffs are falling, partly in response to CEC and US FCC pressures[16]. International voice resale, when permitted, will dramatically escalate the process: the possibility for public network users to shift to resellers' leased lines may critically undermine the global accounting rate system. Anticipated losses may perhaps be recouped from large international users. The largest TOs have a head-start in this field. But metamorphosis on the parts of smaller TO players is also underway. (See, for example, Telecom Eireann's efforts to position itself as an outpost hub for entrants to the European market: this has been Ireland's trade game since the Industrial Revolution.)

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[15]Except in cases of national telecommunications underdevelopment: Spain, Portugal, Greece, Italy, Ireland, and potential East European newcomers.

[16]These are likely to escalate, although counteractive political forces - especially national - will assert themselves to force carriers in the direction of cost-oriented tariffing. (This is, of course, a different matter altogether from cost-based charging practices, but let this rest....)

Figure 18

Global Service Providers:
TOs & Independent TO Consortia

Company	*Outsource offerings*	*International VPN offerings*	*International coverage*	*Main joint ventures*
AT&T	Yes	Global Software Defined Network (GSDN; also SDNI)	Offices in 15 countries	AT&T JENS (Japan)
BT	see Syncordia	Global Network Service	Service in 20 countries; gateway services in another 73	Digital, IBM (Concert), and various network initiatives See Syncordia
Cable & Wireless	International Data Network Services 900	Global VPN	Offers MDNS in USA, Europe, Far East	Shares in many TOs; Sprint International (Global Fon)
Deutsche Telekom	Yes(national)	Yes	Offices in France, USA, UK, Japan, Belgium; 38 countries through Infonet	Eunetcom (JV with France Télécom); Shareholder in Infonet
Eunetcom	Yes	Yes	?	JV between France Télécom and DBP Telekom
France Télécom	Yes	Yes (name to be decided)	Offices in 14 countries; 38 countries through Infonet	Shareholer in Infonet via Transpac; shares in many TOs
Infonet	Enterprise-Defined Network Services	Vstar, Vstream, Vmesh	Access from 115 countries, local support in 38, own nodes in 28	Andersen Consulting, Siemens, Digital
MCI International	Global Communications Services (GCS)	Vnet International	Offices in 50 countries	25% Infonet share; GCS to make alliances with 15 carriers, Pacific Rim and Europe
PTT Telecom BV	Yes see also Unicom	Yes	Value-added services in 21 countries	Swedish Telecom (Unisource); shareholer in Infonet
Syncordia	Managed Private Network Services		70 major business centres in Europe, N.America, Japan by end 1992	
Unisource	Global Managed Network Service	No	Local presence in 10 countries; nodes in 2	Unisource is JV between Dutch PTT and Swedish Telecom, Sprint may join
Sprint International	SprintNet	Global VPN	Data services in 80 countries; voice services in 150	Belgium, Japan, Spain, Germany, Switzerland, USSR, C&W (Global FON)

Source: Analysys, 1991 and Author
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Figure 18, cont'd

Global Service Providers:
TOs & Independent TO Consortia

Company	*Outsource offerings*	*International VPN offerings*	*International coverage*	*Main joint ventures*
Digital	Yes	Yes	Operates in 70 countries; offers support services in 20	BT (Concert) and various networks initiatives
GE Information Systems	No	Managed Network Service	Local access in 33 countries and to packet-switched network in 100+	Dentsu (Japan)
IBM Information Network	NetReview International; IBM Information Solutions	No	SNA access provided in 34 countries	BT (Concert) and various network initiatives

Source: Analysys, 1991 and Author

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In such a deregulated environment - or so the story sometimes goes - new service providers would emerge as customized retailers, leaving established operators to wholesale bandwidth. Yet this is not at all the scenario envisaged by the TOs, which is fortunate. They are busily positioning themselves in an expanding European VANs market. (EDI revenues, for example, are expected to increase significantly during the next few years: see **Figure 19.**) But a whole host of new players - value-added resellers (VARs), systems integrators, former enterprise networkers diversifying into MDNS and outsourcing lines of business[17] - are competing for the same corporate accounts. These are, at the same time, being squeezed by recessionary cost pressures.

Perhaps the most significant threat to TOs however, consists in mutual encroachment upon one another's turf (see, for example, the case of Transpac's recent entry to the British, Italian and German data-communications markets). At the moment this game must be handled with circumspection: allies within the TO family are more useful than enemies. This brings us to the final stage of discussion.

VII. Connectivity

Despite several initiatives, efforts by European TOs to supply a coordinated panEuropean network have thus far failed[18]. In the case of the international public X.25 network, harmonization of such nationally-available offerings as reverse charging has proven elusive, and one-stop shopping and billing are only now being discussed. What has deflected attention from such concerns is the rapid emergence of market cooperation among TO subgroups - patterned along the predictable lines of historical allegiance (Eunetcom), and/or comparable market size and infrastructure development (see, for example, Nordframe and also the seven TO members of Infonet). Furthermore, alliance with one or more of the three US carriers confers a global presence. This same direction is being pursued by the three carriers (BT, France Télécom, Cable & Wireless) enjoying sufficient resources and market power to operate largely independent of their European counterparts.

The net consequence is the emergence of a twin-tiered oligopoly in both global and intra-European markets (with the dynamics of the latter reflecting, to a large extent, those of the former). What is the life-expectancy of current and planned alliances (**Figure 18**)? The upper rung will see market consolidation and perhaps service specialization on the parts of so-called supercarriers. (One or more of these will offer multinational common-carrier service; others will market individually-tailored global carriage). Regional cooperation among less-powerful TOs, on the other hand, will remain the key to these players' survival on the international front. Within such arrangements, the present movement among carriers to shift to single-vendor technology platforms may prove a stabilizing force.

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[17]See recent announcements by Ford of Europe, Siemens, and a somewhat equivocal Daimler-Benz.

[18]See Patel (1992) for a good overview.

Figure 19

Projected Revenues:
EDI Products and Services

Country	1988	1994	Percent Growth
France	$ 17.7	$ 78.7	450%
Germany	11.1	72.8	660
Italy	4.7	32.4	690
Netherlands	8.7	41.3	690
Spain	0.7	10.0	490
Sweden	7.8	18.8	1,430
U.K.	52.8	126.0	240
Others	9.5	24.5	260
TOTAL:	$112.7	$404.5	360%

Source: Frost & Sullivan
From Data Communications, March 1991

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VIII. Between The Idea and The Reality (Falls The Shadow)

What of the future?

Rather than being an overlay/subset of existing networks, the Intelligent Network (IN) will become the network of networks itself. As mentioned above, tipping will occur regularly between so-called public networks and private, closed systems. Logic will be readily bought and sold in flexible bundles.

Customization of services for decreasing user subgroups will ultimately become uneconomic for TOs. (Here the traditional 'infrastructure monopoly' concept, and its basis in reality reappears - this time wearing a new dress...)

A dynamic and relatively open market in service logic will emerge, as will independent 'service providers' to develop Spring fashions (intelligence bundles) - and subsequently customized collections for Summer and Fall. As in other consumer markets, interested and technologically-literate individuals will design their own packages.

As IN capability extends network-wide, the costs of development and implementation will increase. Demand-and competition-led environments will promote development (see **Figure 20**), exacerbating the rift between TO leaders and followers. OTE and BT exist today in the same chronological time, but in different *telecommunications* time. By 2020 three telecommunications generations will have intervened between them, instead of the present two (see **Figure 9**).

Among the more unimportant consequences of this: the currency of private and public networking will still be viable in one domain (the more primitive network environment). As for the other territory

> the dead still act for a little while as if they were living. For a little while, a year, ten years, perhaps fifty years; at any rate, a *finite* period; and then they are buried a second time (Sartre, p.238).

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Figure 20

IN Systems Ordered as of 1991

Country/Operator	Order year	Service Control Point (SCP) supplier	Service independence[1]	Multi-vendor[2]
USA/AT&T	1984	AT&T	No	No
UK/BT	1984, 1990	AT&T, GPT	No	No
Sweden	1988	Ericsson	Yes	No
Ireland	1988	Ericsson	Yes	No
France	1989	Alcatel	No	No
Spain	1989	AT&T	No	No
Italy	1989	AT&T	No	No
USA/Ameritech	1989	Ericsson	Yes	Yes
USA/BellSouth	1990	AT&T	No	No
Norway	1990	Ericsson	Yes	No
Denmark	1990	Ericsson	Yes	Yes
Finland	1990	Ericsson	Yes/No	Yes
Germany	1991	Northern Telecom	No	Yes

1. Service-independence systems offer potential to create or modify a range of new services.
2. Muli-vendor INs, Service Switching Points (SSPs), and Service Control Points (SCPs) provided by different vendors.

Source: *Communications International*, October 1991, p.115