

International Studies -- Towards the Future

Strategic Response to Competition by Public Network Operators

Aine M. NiShuilleabhain

1. INTRODUCTION

This paper analyzes the rapid adaptation -- as of mid-decade -- of private networking capabilities to the public network environment by telecommunications operators (TOs) which are either privatized or facing this certain destiny. This is viewed in terms of strategic response at the line-of-business level to reciprocally-generated competition, where (ex)-monopoly providers enter formerly-protected domestic markets.

At the line-of-business level, strategic choice involves pricing the product line; selecting technology for production, marketing, and distribution; and investment in capacity, advertising, and product development. This paper focuses upon the portfolio choices of public-network operators in their capacity as value-added network service (VANS) providers, and on developments sector-wide where true convergence of voice, data, and video capabilities is well underway.

At the corporate level strategic decisions hinge upon the firm's financial structure, its capital allocation among existing and new lines of business, and the acquisition and divestiture of business units. Elsewhere¹ we have developed an asset-pricing model for valuing providers both of private and public networking capabilities. This anticipates a future of virtually complete ownership-privatization and ongoing technological innovation; hence continuing product/service differentiation including flexibility of use-privatization.

2. WHERE AND HOW TO COMPETE: DOMESTIC (US) DEVELOPMENTS

2.1. The Emerging Asynchronous Transfer Mode (ATM) Market

ATM offers a unique range of capabilities applicable to each architectural segment of data networks: on the private network side, from workgroup to enterprise backbone; on the public front, from the access segment to the core backbone. Figure 1 illustrates this architectural segmentation and associated business and implementation issues. Deployed end-to-end, the synergies involve traffic control, network management, and the ability to add voice and video to existing data networks. Anticipated economies of scale associated with traffic-aggregation from separate and thus inefficient overlays onto a single broadband conduit mean that this sector is of considerable strategic significance both for network operators and suppliers.²

Figure 1
Types of Vendors Entering the ATM Equipment Market

Vendor Segment	Interest in ATM Market	Vendors (Partial List)
LAN/WAN Networking Vendors	Offer customers new solutions for their growing bandwidth needs	<ul style="list-style-type: none"> ● Bay Networks ● Cisco
Fast Packet Companies	Exploit technological expertise to open new markets	<ul style="list-style-type: none"> ● Fore ● General DataComm ● Newbridge ■ Cascade ● StrataCom
Public Network Vendors	Retain carrier customers as they migrate from TDM to ATM technology	<ul style="list-style-type: none"> ● Alcatel ● AT&T ● Northern Telecom ● Fujitsu ● Siemens Stromberg-Carlson ● NEC
Computer System Vendors	Offer customers key networking technology as part of total solution for distributed computing environments	<ul style="list-style-type: none"> ● Digital Equipment ● IBM

Source:

Northern Business Information

2.2. Broadbanding Public and Private Network Components:

In the access segment, public carriers -- initially in the US but followed by some of their more aggressive European counterparts -- are deploying fast packet services (native LAN-interconnect, frame relay, ATM) to meet growing end-user demand as well as accelerate the shift from voice to more profitable value-added services. In 1995 US public network operators continued to trial multiservice switches supporting all cross service platforms and a limited number of supplier contracts were signed. As traffic increases on ATM overlay networks, carriers plan to add high-throughput core switches characterized by levels of redundancy and fault tolerance typical of traditional public network equipment.

On the private network side, LAN users of shared-media technologies (e.g. Ethernet, Token Ring) face increasing bandwidth constraints at the workgroup level. However, ATM to the desktop in the five-year timeframe is a niche market, because evolutionary technologies (LAN switching, Fast Ethernet) continue to extend the life of PC network-interface cards and other legacy equipment.³ At the enterprise level and across the same (1996-2001) period, however, ATM deployment will be accelerated both by congestion problems on LAN backbones -- where fiber-distributed-data-interface (FDDI) technology is the norm -- and by cost-amortization across multiple desktops.

2.3. The US Private Line and Virtual Private Line Sectors

Wideband and emerging broadband services dominate the horizon in the world's most advanced domestic market. However, interexchange carriers (IXCs) and some of the Regional Holding Companies (RHCs)⁴ focus increasingly upon developing low-speed data services as a prerequisite of end-to-end multinational service contracts. AT&T continues to dominate the hitherto robust, but intensely competitive, \$6.5 billion domestic private-line market; 1994 revenues in this sector generated close to ten percent of total long-distance domestic income.⁵ Nonetheless, this share is subject to continuing erosion by discount competitors and the proliferation of switch-based services (notably Switched 56, frame relay, and Fractional T services used for redundancy and videoconferencing).

Figure 2
Long Distance Private Line Revenues by Company, 1992-1997 (\$1000s)

Name	1992	1993	1994	1995	1996	1997*	CAGR*
AT&T	4,080,502	3,702,816	3,465,978	3,048,725	2,678,388	2,281,692	-11.0%
MCI	926,571	972,899	989,385	999,279	1,009,272	1,019,364	1.9%
Sprint	685,254	706,590	718,998	726,188	733,450	740,784	1.6%
ALC	47,961	48,154	48,194	48,047	47,976	47,978	0.0%
C&W	167,831	166,478	164,800	162,767	160,788	157,572	-1.3%
SP Tel	55,479	56,913	58,051	58,972	58,835	58,236	1.0%
WILTEL	369,317	412,756	422,859	431,316	430,886	424,229	1.7%
LCI	55,647	54,534	53,218	51,716	50,052	48,452	-2.7%
RCI	30,086	30,524	32,209	33,506	34,859	36,269	3.8%
LDOS	39,586	42,945	43,438	45,142	46,923	48,782	4.3%
Others	396,542	384,781	374,061	363,908	354,317	345,281	-2.7%
Total	6,874,775	6,579,390	6,371,191	5,969,568	5,605,745	5,208,641	-5.4%

Source:

Northern Business Information

*: Projected

During 1993-95 the market leader aggressively restructured private-line price tariffs and launched Fractional T-3 service. AT&T will continue to lose market share through the decade's close in the negatively-growing market (Figure 2). This pattern will be replicated in European, Asia-Pacific, and ultimately Latin American markets with lags ranging from five years (in the former case) to twenty (the latter scenario). Note that this trajectory distinguishes the typical domestic private-line business from the International Managed Private Line (IMPL) market, which must be characterized in terms of stability -- for reasons alluded to below -- rather than gradual decline.

The US domestic virtual private network (VPN) sector, on the other hand, remains the most dynamic of all IXC businesses. Market expansion during 1994 at over 20 percent -- on revenues exceeding \$1.5 billion -- reflects massive promotional efforts combined with service enhancements. Today the domestic market is dominated by those public operators (AT&T, MCI, Sprint, Cable & Wireless) whose domestic and international strategies for logical use-privatization of existing public infrastructure combined with recently-introduced overlays are inextricably interlinked. Their international data-networking alliances -- ultimately the springboard for penetration of domestic voice markets across Europe, Asia, and Latin America, as detailed below -- provide for replication of revenue-generating programs overseas.

The intent and inevitable consequence of this activity is to supplant the historic bilateral accounting-rates system by alternative inter- and intra-group revenue-transfer practices: among network-operator alliances such as Phoenix,⁶ Concert,⁷ and WorldPartners;⁸ and within each of these, among the domestic (typically former-monopolist) operators thus linked by joint equity-investment and revenue-sharing contracts. After more than a century of relative stagnation, the speed of the shift underway -- most clearly visible at the time of writing in Uniworld⁹ -- is first a matter of internationalizing use-privatization. In the longer term, this development is more radical than ownership-privatization, and at least as significant as mobility, where growth-trajectory synergies will surely be exploited.

3. WHERE AND HOW TO COMPETE: THE GLOBAL DATA NETWORKING BUSINESS

3.1. Strategic Response

Here we focus on the corporate profiles and competitive strategies of dominant international (I)VAN service providers and their primary regional competitors in the shared (private) networking market.¹⁰ By YE1994 the global VANS market had grown to US\$15.3 billion, representing over a 14% increase in revenues generated during the preceding 12 months.¹¹ Eight entities contributing 35% of this figure¹² shared three conventionally-accepted strategic concerns:

- the establishment of alliance partnerships so as to expand operations -- as margins erode in horizontal services, scale assumes paramount importance
- strategic positioning to exploit already-cultivated installed base
- diversifying the risk associated with launching expensive technology overlays and/or migrating to increasingly-sophisticated technologies

3.2. Public Operator Alliances vs. Distributed-Computing Service Providers

The eight market leaders in global data networking belong to two core groupings. The first comprises three supercarrier alliances linking former voice monopolists: AT&T's WorldPartners and Uniworld constructions, the pending amalgamation of Atlas¹³ with Phoenix, and comparatively advanced Concert (the latter two groups can be expected to add Asian partners).

The second defies easy classification since none involves the link-up of two or more sizable traditional telecommunications companies. Apart from C&W -- which fits the bill as a traditional operator but has not found a suitable partner -- these are the originators of

global private shared networking. SITA¹⁴ is perhaps the closest a VANS provider can come to full-fledged operator status (recall its history of near-monopoly service to a relatively stable customer base), but has likewise stayed independent. Other partnering arrangements will be developed by EDS and IBM Global Network¹⁵ in the short term; the latter expects its STET alliance to be one of several. Infonet's¹⁶ future clearly involves a change of ownership, though this is likely to be smooth so as not to alienate its customer base.

The market is evolving along oligopolistic lines, mirroring historical developments in the US long-distance market. However the well-established market-share balance among AT&T, MCI, and Sprint in US long-distance (64-17-9 percent; others 10%) cannot be expected to pertain in the more dynamic global VANS market.

3.3. Sector Overview: 1995 in Review

1994-95 was a year of partnering and reshuffling the main consortia. The year opened with AT&T talking to Deutsche Telekom and France Telecom about a joint venture with their jointly-owned managed data networking provider Eunetcom. AT&T ended the year by announcing it would form Uniworld with Unisource,¹⁷ and advancing its WorldPartners concept. British Telecom and MCI were pillars of relative stability as they developed the Concert portfolio; the former focused its empire-building attentions anew on Continental Europe. IBM and EDS were speculatively linked with carriers, but all that came out of the talks was a broad IBM alliance with STET. Likewise, C&W concluded no major alliance agreements beyond a first step into the German market. GEIS was purchased in part (30%) by Ameritech, and SITA's highly-publicized alliance with Unisource unraveled amid bad publicity.

Progress was relatively slow in some traditional sectors (notably messaging and packet switching) as the new alliance partners began the slow process of rebranding and revitalizing the commodity end of the market. Nonetheless, new lower-level services emerged: dial-IP services designed to support information service providers and mobile employees; LAN connectivity, messaging (Lotus Notes, GEIS' Global Document Access); and online products (Microsoft Network connectivity) integrating so-called shareware and information processing across the globally dispersed organization.

Simultaneous technical challenges involved increasing the acceptance of frame relay -- a ready proposition because the technology clearly offers more at similar pricing levels than do leased-line/X.25 arrangements or combinations of these¹⁸ -- and testing emergent ATM capabilities within the context of disparate installed data networking bases and highly divergent organizational capabilities. (Recall that Sprint International's Atlas partners still lie in public hands, although Deutsche Telekom can be expected to undergo fairly rapid transformation during 1996).

3.4. Market Developments, 1994-99

By 1999 the global VANS market is projected to increase to \$33.5 billion, reflecting CAGR of 17.2% over the five intervening years.¹⁹ Across this time period we expect a minor loss of aggregate market share by the eight global providers -- on the order of 1-1.5% -- with fastest regional growth in the Latin American (8.1%) and North American (5.1%) regions. Note that certain short-term shifts of global market power among providers (summarized as of year-end 1994 by Figure 3) can be anticipated. Although firms optimally invest at a common rate relative to capital -- and thus grow at a rate equal to that of their

Figure 3 Global VAN Provider Services by Sector 1994

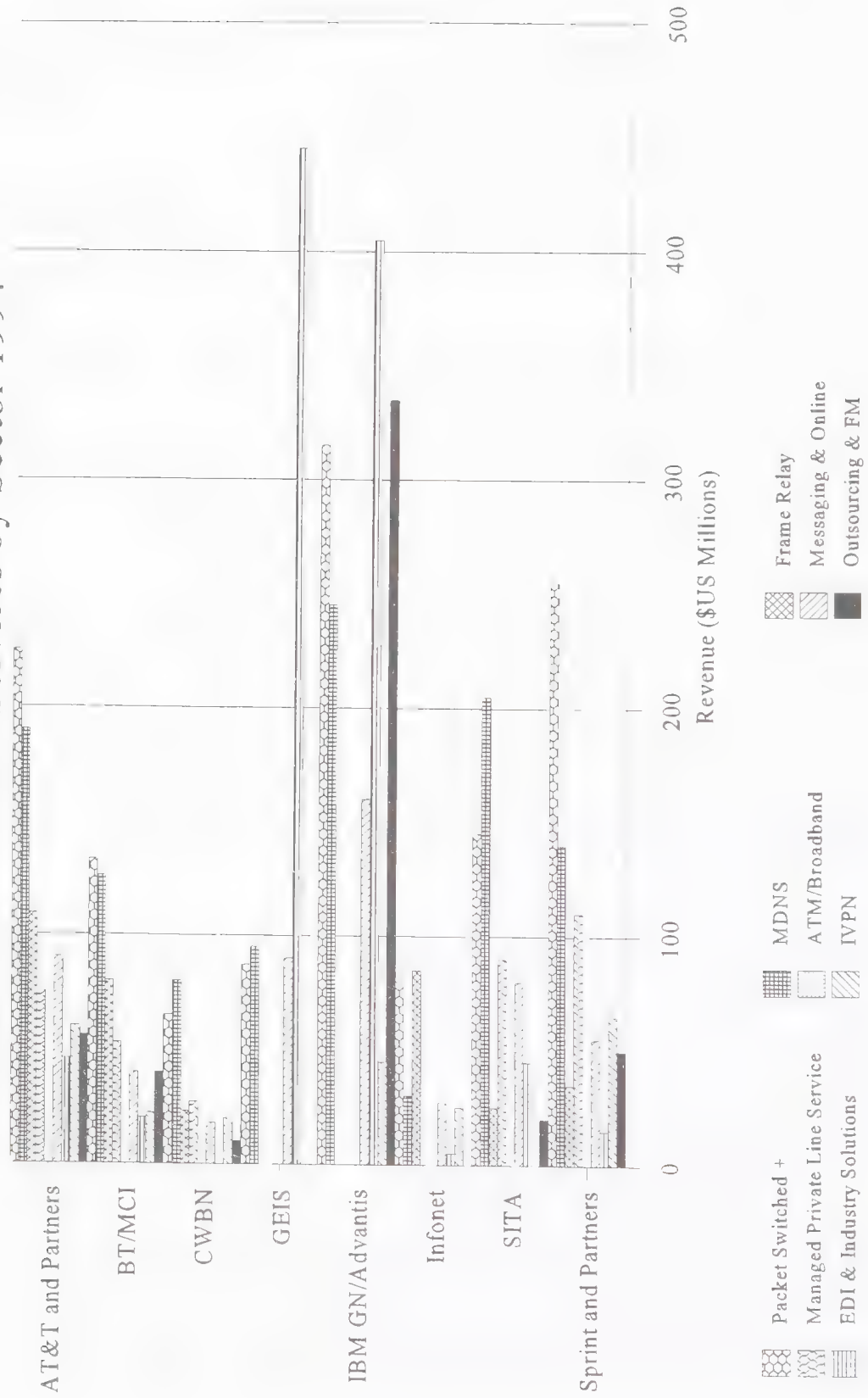
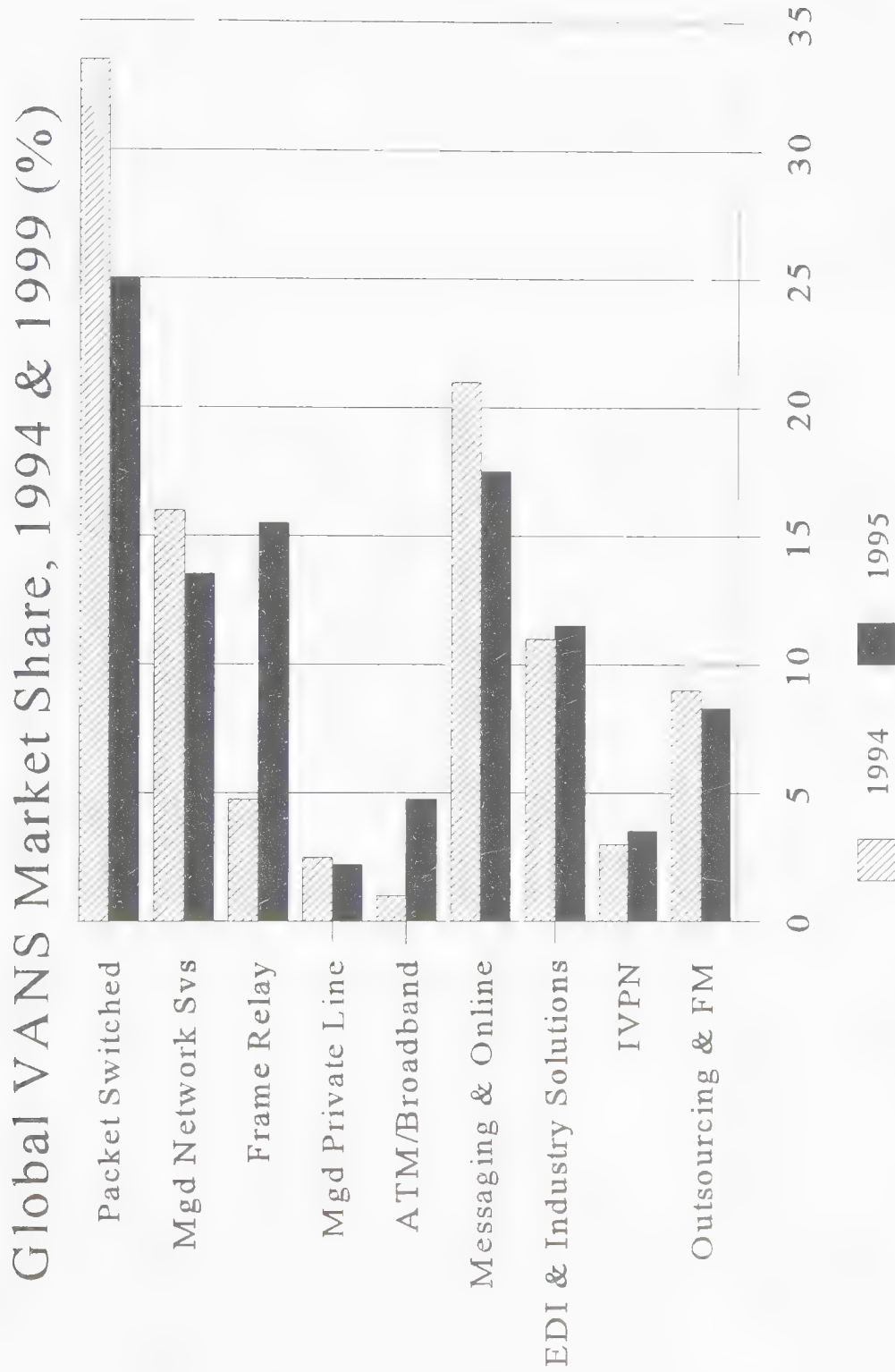


Figure 4



(converging telecommunications, computing, and media) industries as a whole -- differences of strategic position, installed base, and geographic coverage can be expected to alter somewhat the current balance of power.²⁰

Sectoral shifts will be more dramatic (Figure 4). For example, frame relay service -- which accounted for 5% of global VANS revenues at YE1994 -- should increase market share by 9.8% reflecting average CAGR across the North American, European, Asia-Pacific, and Latin American markets on the order of 47.2%. Growth in this sector, which has been slower to take off in the Pacific Rim and Latin American markets, will taper off thereafter. However, by the decade's close ATM and true broadband services will have supplanted this intermediate technology and assumed the dominant market-growth trajectory.²¹

4. A TAXONOMY OF VANS

4.1. Core and Periphery

As Figure 5 suggests, whereas core portfolio products change reflecting the latest technological developments, the migration path remains from data applications to voice, and from private- to public-usage environments. By 1994 64 kbps had become (even in Europe) the corporate standard access-speed in anticipation of 2 Mbps availability. Yesterday's generation of services -- and global managed data services (GMDS) by now have been relegated to this category -- moves from temporarily high added-value (with concomitant pricing potential) to permanent commodity. This dynamic is visible both in transport and application layers, and along the continuum extending from dedicated services to those provided on a virtual basis.

Figure 5
A Taxonomy of Value-Added Network Services

Taxonomy	Transport			Application		Virtual Services	Network Control
Portfolio Component	GMDS	Managed Bandwidth Service	Broad-band	Horizontal Services	Vertical Services	Virtual Network Services	Outsourcing
Service Sector	Public Switched and Related Services; Managed Network Services; Frame Relay	Managed Private Line	ATM	Messaging & Online Services	EDI & Industry Solutions	(I)VPN; (Intelligent Services, Int'l VPN)	All relevant
Medium	Data	Data	Data	Data	Data	Voice	Voice and Data
Service Availability	Public	Dedicated Private	Public	Public	Public	Virtual Public	Private
Economic Status	Commodity	Commodity	Value Added	Commodity	Value Added	Value Added	Value Added

Source:

author

Virtual private network (VPN) services in particular highlight the private-public trajectory. Thus centrex and VPN services introduced to the North American market 5-7 years ago are increasingly common in Europe and Asia (Figure 6 details globally available VPN services) but all of the larger European and Asian operators offer domestic counterparts: and router networks considered *de rigueur* since the early 1990s are increasingly managed, supplied, or owned by VANS providers as publicly-accessible infrastructure. Thus during 1994-95 the process of branding so-called Managed Router Services -- an MDS subcategory -- began.

Both dynamics originate in the corporate (private) networking sector which determines their evolutionary path. Prior to full convergence the basic shifts underway as of mid-1995 are implicit in Figure 5. They involve: (1) the migration of corporate voice from dedicated- to virtual-private capability; and (2) the shift from private to public of corporate data transport -- (G)MDS at the lower end, emerging broadband capabilities at higher levels of required sophistication -- even as Managed Private Line services continue to generate revenues from so-called mission-critical traffic. This is the mid-term (through 2005) future of the oldest of applications dichotomies. Convergence under the ATM rubric notwithstanding, there is every reason to anticipate continued (albeit declining) physical segmentation at the international transport level in the longer term.

This is not simply a matter of installed base. It is also a question of longstanding commitments to separate international handling of high-security traffic within some industry sectors (the obvious cases are banking, financial services, oil, and petroleum products), where cultural and marketing pressures will counterbalance efficiency arguments. Hence the expected short-run stability of the international Managed Private Line (MPL) sector²² -- valued at \$370 million of a total international private-line market generating slightly over \$1.3 billion in 1995 -- is documented by Figure 4.

4.2. Service Sector Trends

The strategic implications of developing experience curves, product life-cycles and portfolio balance within and among the various service sectors are essentially straightforward.

Basic network services undergo continuing commoditization although temporary niche markets exist. For example, Sprint International claims to handle 85% of international Internet traffic. However since there are few (if any) artificial restrictions on the number of entrants to this market, there exists little potential for durable windfall profits. Likewise SITA's lock on the airline networking business, while undoubtedly strong, cannot be taken as a *fait accompli*.

Generalized horizontal VANS (here we include messaging, transactional, and online services) stimulate demand for basic infrastructure but margins are slim. On the other hand so-called Industry Solutions -- commodity products/services designed for vertically-networked markets -- leverage control over switching, transmission, interconnect arrangements, distribution channels, licensing agreements, and pricing. Such commodity-level provision is distinct from that of project-oriented firms who customize solutions on a case-by-case basis. Market leaders GE Information Services GEIS and IBM Global Network, as well as France Telecom and Deutsche Telekom together under the small but strategic EUKOM²³ rubric, are aggressively pursuing Industry Solutions revenues.²⁴

Figure 6

IVAN	Packet Switched and Related Services	Managed Network Services	Frame Relay	Managed Private Line Service	ATM/Broadband	Messaging & Online Services	EDI & Industry Solutions	IVPN	Outsourcing & Facilities Management
AT&T BCS/HLS	CS/CS, AccuNet Packet Services Interspan Information Access Service	AccuNet Spectrum, Accumaster	Interspan Frame Relay	AT&T Managed Private Line	Interspan ATM service	AT&T Mail, AT&T E-Fax, Mobile messaging, Intomaster, Invest ANALYST, AT&T FYI, AT&T Fax Solutions, AT&T Network Notes	AT&T EDI, FORMS Solution, AT&T SALES Solution, TradeSystem		Accumaster, AT&T Customer Network Control Systems
AT&T Unworld	Unidata Packet Switched Unidata LAN Interconnect, Unidata SNA/SDLC Service Unistar, Unicast Unilink	Unistream Mngd Bandwidth, Unimaster Private Network Provisions	Unworld Frame Relay, Unidata Frame Relay, Interspan Frame Relay	PL-Standard PL- Switched Dig Backup PL-II Performance Svc		UnipPlus 400 Net, AT&T Mail, AT&T Fax Solutions, Intomaster, Invest ANALYST, AT&T FYI, AT&T Network Notes	AT&T EDI, FORMS Solution, AT&T SALES Solution, TradeSystem	Unworld VNS* International Virtual Private Network	Unimaster Outsourcing, Unimaster Communications Facilities Management Service, Unimaster Network Operations Management
AT&T World Partners		GSDS	WorldSource Frame Relay Service	WorldSource Private Line	Interspan ATM service	Mail400, Upfront 400, Custom Svcs, Message Handling Svc, NEWS-TAB, E-PUB, Cycloplan Gateway Svc, Videoconf.	AT&T EDI FORMS Solution, AT&T SALES Solution, TradeSystem	WorldSource Virtual Network Services	
BT	Global Connect Svc, Protocol Conv, GNS LAN interconnect	Managed Luks, ExpressLANE	Concert Frame Relay	Concert Private Line		Mail400, Upfront400, Custom Svcs, Message Handling Svc, NEWSTAB, E-PUB, Cycloplan Gateway Svc, Videoconf	EDI*Net, ETS, X 400 Gateway EDIPOST, Interbase PCTrans OFTP Int' connt		Synordia, Syntegra, Concert Data Manager
C&W		Global Managed Data Service	GMDS Frame Relay	Global Managed Private Line, Global City Voice	ATM (trunk)	SureFax, MultiMessage, ShipFax, Spectrum Intekey, Viewdata		GVPN, GVN	FHMS
GIS	MARK 3000, MARK III, MARK 3000 Session Manager MARK*Net	Med Network Svc, High Performance Network (HPN)				BusTalk-2000/OnLine Reader FORMS, Internet Gateway Connector, QUIK- COMM LAN Connect, Retail*Talk, Customized Svcs, Bus Intelligence Portfolio, QuikNews Xp/Newsletter, SMCs	EDI*EXPRESS*CT CS, BANCOR*EXP, CARGO*LINK, RETAIL*LINK, DESIGN EXPRESS, Ordex, EDISWITCH, PRIC*Intell, E, BUS*Intelligence, PETROLINE ECS		

IBM IN/ Advantis	AS/400 Comms, IBM Data Transfer Svc	Mgd Network Svs, NetView, End to End Network Mngmt, Solu- tionPac NetView, LAN Interconnect	Planned End 1995	IBM Business Port	IBM Mail Exchange, IBM Info Exchange, Financial Info Svc, IBM IN Videotex	IBM ExpEDite, Customized Svs/DataInterchan- ge/Communicator Series/Interconnect PC Quick EDI Professional, Consulting and Implementation Services, Electronic Marketplace, IVANS Quiklink, QuickResponse Service		Enterprise Network Svs, Advantis
Inonet	IBM SNA/SDLC, Switched Access Service, LAN WAN Connectivity	EDNS, Perspec- tion Vision/ Manager/Link	INFOLAN		EDMS, NOTICE/400/ 400PC/PC/Desktop/Private/ Exchange/Soft-Switch Central Service/Internet, OSTWARE Messenger 400, Orion, PC COMPLETE, NOTICE edit/PC	IGVN		Application Support Services, Development Support Services
Phoenix Funetcom		Managed Bandwidth Svs	Private Network Services	Private Network Service (suite)				Global Outsourcing Services, Tekecom Consultancy and Management Svs.
Phoenix Sprint Int I	Asyc Dial Svs, DataCall Plus, MultiDrop Plus, Peer Reach, Hybrid Nets, CLEARLINE	CustomLink Series, Basic Int VPN, Global VPN, Frame Relay, Global Data Connection	Clearline (Suite of Services)	Clearline Private Line Global SprintLink	SprintMail, Global SprintFax, SprintMail, FAX, Sprint InfoConnect, Sprint Info Connection, Sprint Meeting Channel	Sprint EDI		Partner in Alcatel Data Networks, Insite, Sprint Network Systems
Phoenix Transpac	LAN Interconnect	Corporate Network Svs, Frame Relay			ATLAS, ATLAS Poste, Teletel	ATLAS EDI		Joint Marketing with DEC
SITA/ Sector	X 25 Direct Access, SITA Actonet	SITA M/DNS SITAVISION	SITA Frame Relay		SITATEX, Intermail, SITAMAIL (Gateway, Sector	SITAEEDI, OTS, EDI Clearing House, EDI Software STX, SITA*EDI, Air- to-Ground Services, Computer Application Services		SITAVISION

Northern Business Information

Source

Facilities Management, Managed Data Network Services (MDNS) and Outsourcing are three stages along a network-control continuum characterized by volatile demand and rapidly-expanding industry supply.

5. WHY PUBLIC NETWORKS CHANGE: EVOLUTIONARY DRIVERS

The general features shaping emergence of a global data networking business from prior domestic and regional entities²⁵ -- ownership-privatization, supply-side competition, public- and private-network demand for emerging broadband capabilities, increased user demand for corporate network services (notably global enterprise-wide capabilities on a shared or proprietary basis) -- continue to generate more specific tendencies accelerating the trend. These apparently counterposed pressures are best understood in the context of broader cyclical forces:²⁶ the dynamics of network specialization versus integration and their market-inflected counterparts (premium versus commodity pricing, although no one-to-one correspondence exists).

The first involves development of a core portfolio of competences common to all international VANS providers (notably the ability to provide one-stop shopping services, thus integration of the portfolio); the second is a matter of escalating need for market differentiation of contenders. Both imply increased service heterogeneity as well as exploitation of software-defined use-privatizing capabilities. The logic is one of falling costs, hence more flexible critical-mass parameters determining the thresholds of virtual but viable network groupings.

5.1. Ownership Privatization

Despite legitimate concerns that world equity markets during 1996-98 will be unable to absorb privatizations scheduled for this period, the reputation of former state-owned telephone companies as highly profitable cash-cows tends to entice investors (outside the US they also typically dominate domestic VANS markets). By the end of this period all major European operators should be at least partly in private hands²⁷ whilst several Latin American TOs are the largest constituents of their local stock markets.²⁸

This is a matter of becoming market-oriented with significant workforce-reductions despite union pressures²⁹ and (for governments) a question of maximizing returns in a one-period game; later branches are typically sold at prevailing market prices. This in turn requires fine-tuning of regulatory environments prior to issuance (concrete assessment of the potential impact of competition is a precondition of investor interest) where the broader ground rules -- at least in Europe -- impose market liberalization. Thus market-opening will be accelerated by ownership-privatization prior to 1998, when competitors will barrage national monopolies with lawsuits over the ritual anticompetitive behavior pervasive to most domestic markets. Contemporaneously the ground rules circumscribing universal service obligations via proportional access deficit charges, social subsidies, and any number of other non-market distorting regulatory mechanisms will require national redefinition.

5.2. Technology Trends: Supply-Side Competition

Like mobility, ATM's long-term applicability across a broad range of markets (i.e. networking problems) erodes traditional market-segmentation criteria; this in turn positions equipment providers native to hitherto distinct information-technology sectors in direct

competition. Recall that Figure 1 summarizes the stakes involved in the US market, highlighting the distinction between vendors traditionally aligned with public versus private markets.

Traditional suppliers of transmission and time-division multiplexed (TDM) switching to the former group -- AT&T, Alcatel, Ericsson, Fujitsu, DSC, Hitachi, Nortel, Siemens Stromberg-Carlson, Tellabs -- aim to dominate the core-switch market as public carriers expand ATM overlay networks outward. In the short-term ATM switches offer high-growth revenues from the data-networking sector; in the longer term these will supplant existing central-office switches as public operators migrate voice networks from TDM to ATM over SONET. The interim challenge is to fund ongoing core-switch research and development but simultaneously exploit larger sales forces and budgets to develop a market-base in the more-competitive access market dominated by so-called fast-packet (i.e. ATM and frame relay) private network suppliers.

The latter group concentrated initially on early adopters -- private networkers deploying ATM at the wide-area network (WAN) level -- and enjoy important strategic advantages: faster time-to-market, superior technology, and the ability to establish relationships on both sides of the private/public network divide. Thus marketing has evolved to include public carriers as these expand their data networks and resell equipment to end-users. Similar technology deployment and vendors on both sides of the WAN link in turn erodes older private/public network distinctions, as does ATM's capability for network-wide - and independent of usage-parameters -- management and congestion-control routines.

5.3. Public and Private Fast-Packet Networking: Market Demand

In the less-regulated US environment, private users drive early adoption. The ATM Forum and Frame Relay Forum -- implementers' agreement bodies rooted in the private data communications community -- effectively define standards (which supplants traditional fora dominated by public network operators and suppliers) and redefine the process itself (advance shipments come with guarantees of retrospective software standardization).

However, early rollout of commercial ATM and frame relay services in the US contrasts sharply with market underdevelopment across Europe and Asia, where significant commercial service introduction is still hampered by pricing trade-offs with the impossibly lucrative leased-line business. In addition, European and important Pacific Rim operators are still wedded to the concept of ISDN. Having invested heavily in the technology over a decade for little return prior to 1993-94, they are in general reluctant to capitulate in favor of more advanced capabilities. British Telecom Concert (Figure 6) is one of the few European providers promoting frame relay; its ISDN investment cycle ended much earlier (not pushed by a national champion vendor), whilst heavy overcapacity on UK trunk networks exerts downward pricing pressure in the domestic leased-line business. Both ATM and frame relay have yet to penetrate the Asia Pacific market beyond international hubs; surely predictable, given the low level of penetration of basic telephony in several countries, and the managed industrial-policy bent typical of the remainder, excluding Hong Kong.

5.4. Global Enterprise Networking and Mass Customization

Emerging market availability of a range of multilateral VPN services is central to geography-independent enterprise-wide communication for the non-*Fortune 500* company. The size of a much-publicized European VPN Users Association (EVUA) contract awarded

in 1995, intended to secure both reduced voice costs and significantly-enhanced cross-border functionality for members, is also an important precursor of future revenue-sharing agreements among IVAN alliance partners.³⁰

However, most mission-critical traffic is data and multinationals appear increasingly unwilling to construct large networks of Cisco or Wellfleet routers. Thus the gradual and partial outsourcing of responsibility for enterprise-wide VANS is an inexorable trend. With reliability levels now guaranteed by the major VANS and cemented by fierce competition, few corporations claim a desire to supersede the standard 99% availability figure. This returns former dedicated infrastructure to availability on a shared public (e.g. where the outsourcer is Transpac) or (virtual) private basis (when IBM Global Network assumes control). Suggested examples notwithstanding, the network-access practices typical of both public operators and computing-services vendors under these circumstances are highly fungible. There are no obvious generalizations.

Beyond the large multinationals, enterprise-wide networking begins with group-level applications; hence Microsoft's recent commitment to joint-ventures with VANS as well as public network operators worldwide. Since PCs outside the US remain under-networked, the user interface presents a major barrier to expanded online-service usage. Thus such providers as Transpac -- experienced in developing relatively basic systems, with adequate functionality to meet short-term needs of the average consumer-user -- are beginning to translate these competencies into an expanded range of VANS products marketable across public data networks. At the same time traditional private-sector providers (IBM Global Network, EDS, GEIS) are increasingly oriented toward non-proprietary products, and masking problematic legacy (soft- and hardware) interfaces inherited from their own practices as well as those of competitors.

4.5. Core Portfolio Competencies

The ideal portfolio for a VANS supplier is still far from infrastructure-independence. The advanced public data-network operator requires five primary capabilities:

- end-to-end bandwidth control which remains a key differentiator (successfully exploited by MFS in Europe and London, and CWBN worldwide)
- network reach, which explains Scitor's success (Figure 3) in leveraging the SITA global network
- protocol-conversion, since the industry remains awash with multiple messaging and EDI systems notwithstanding the prevalence of X.25 and X.400 standards
- minimal competence in customer premises equipment (CPE) provision and maintenance³¹
- flexible marketing of shrink-wrap VANS. Customized applications targeting vertical markets will remain critical to the business of specialized providers (SITA, GEIS, IBM Global Network). However, public network operators in their capacity as basic VANS suppliers have rushed to market shrink-wrap packages such as Lotus Notes, because small and mid-sized users resist the steep learning curves preceding enterprise-wide implementation of customized (notably EDI) applications. As users migrate to richer versions of current LAN software, off-the-shelf functionality will be required network-wide. This is but one version of IBM's vision network-centric computing vision: a view tacitly endorsed by competitors seeking to sell more bandwidth-dependent services

The Internet model is another.³² Core skills required to provide Internet access are broadly comparable to those required by other online services. Lead times are short (since service redefinition becomes a purely promotional affair) and market advantages based upon new technologies and networking concepts -- apart from the most radical -- are increasingly transitory. The Internet in its current form foreshadows a highly-evolved online service market, which refracts the notion of electronic commerce from its vertical-market origins (as conceived by GEIS) through the lens of mass consumerism.

6. MARKET DIFFERENTIATION OF GLOBAL SERVICE PARTNERSHIPS: THE THREE PUBLIC NETWORK-OPERATOR CONSORTIA

The short lead-time for launch of new data networking and so-called multimedia products diminishes opportunities for competitive advantage based on service differentiation.³³ Much of this has to do with technology availability: managed router services based upon Cisco components, and fast-packet services dependent upon Stratacom, N.E.T., or Newbridge Networks switches render these products *de facto* standards. This is not an area of strategic choice for service providers, since customers run in the opposite direction from anything which bears a proprietary tag.

This increases the significance of geographic coverage as a market differentiator (Infonet and SITA's reach to the Latin American market, for example, has been leveraged in marketing). Regional competencies are far easier to develop than global ones:³⁴ one of the reasons for consolidation in the data networking industry is that few companies can afford to develop the broad set of worldwide competencies required to compete in the first tier.

However, competition at the transport layer -- excluding broadband -- tolerates market differentiation only at the most demanding service levels. (There is no lock-in to use of one or another service provider's bandwidth.) Hence the increased focus -- even within the public-operator based consortia (Figure 6) -- upon developing products tied to vertical markets, where an installed customer base can be developed via customized applications.³⁵ Services such as Phoenix and Uniworld will have to move beyond cheaper bandwidth and faster connectivity to meet these market requirements. The same logic will deepen the vulnerability of VANs, software providers, and systems integrators lacking a strong infrastructure position: managing the network of networks at the required quality levels will become increasingly difficult. Thus further partnering between and among owners of network capacity and/or software competence is inevitable.

The strategic issues faced by the three main consortia at YE1995 in market differentiation can briefly be summarized.

6.1. AT&T and Partners (UniWorld/WorldPartners)

AT&T's difficulty in establishing long-term European alliance partners was rendered insignificant with formalization (August 1995) of an equity-investment joint venture with Unisource. Some distance is required by both sides even as portfolios and technology-base integration proceeds: an obvious prerequisite to better exploitation of existing and potential customer groups. AT&T has conventionally been viewed as aspiring controller in those operator-led consortia which it has attempted to catalyze to date. Similar caution will be needed in deepening the (largely Asia-Pacific based) WorldPartners' commitment to a more fully shared equity-based consortia.

Short-term market differentiation follows from developing access to the rest of the world via the Uniworld European base, Telefonica's Latin American links and the WorldPartners' Asian hubs. WorldPartners -- unlike non-AT&T Uniworld members -- are free to serve as distributors of global networking products marketed by competing consortia. They will optimize positional advantage by avoiding the regional profit-&-loss model which is Uniworld until the tripartite global alignment of public operators in networking consortia stabilizes.

Despite collective stakes by Uniworld members in Infonet which amount to controlling interest, the older organization in the interim will remain an independent vehicle providing custom network services and applications.

6.2. Phoenix

At YE1995 this is still (fundamentally) a marketing concept. Phoenix gains strength from the partners' market dominance at home both in infrastructure and service provision, but faces considerable hurdles in managing the regulatory environment. (Users must factor political risk alongside technical ability in selecting Phoenix over rivals.) A strong Asia-Pacific partner must be committed. Phoenix also faces basic challenges in network integration and developing one-stop shopping capabilities across three large organizations.

On the technical front, the problem of interworking equipment provisioned by disparate X.25 and frame relay suppliers is mitigated for the short term by common precommitments to N.E.T. IDNX switches. However this threatens to become a more thorny problem as Nortel, Siemens, and Alcatel compete to be future suppliers. The other issue to be resolved is managing the global business. In this area the reconciliation of multiple legacies and styles of account management will present more difficulties than those experienced by Concert. Uniworld profits from the level of internetworking established by Unisource partners to date, but the European account base is the smaller. The venture must assist both Sprint and Transpac in regaining marketplace differentiation lost as rivals have broadened their own offerings.

6.3. Concert

The BT/MCI joint-venture continues to differentiate itself based on a headstart in network integration and in portfolio rationalization: the dust has settled around Concert at a level unlikely to be accomplished by Uniworld or Phoenix before 1997 at the earliest. The group remains inexperienced with industry-specific applications, although British Telecom's experience in the retail, manufacturing and finance sectors is an asset. However, Concert claims service quality with excellent North America-Europe connectivity, high-profile marketing capabilities, and expanding presence (albeit local) in several European markets. In the short term Concert must aggressively market services to AT&T's Asia-Pacific WorldPartners, from whose perspective two global wholesalers are surely better than one.

7. THE FUTURE: DYNAMIC USE-PRIVATIZATION

As ATM is introduced in critical network components -- both public and private -- the synergies for adoption throughout much of the remainder will increase.³⁶ The erosion of former technical, marketing, and service-based distinctions between traditional public and private networking sectors -- by technological progress and those organizational realignments (documented above) -- combined with enhanced logical control extending across entire

networks, bear important consequences. Among other properties networks of the future will be characterized by dynamic (re-)combination -- momentarily or temporarily -- of use-privatized and publicly-accessible components. Enterprise networking will extend mass customization to the desktop: individual users will be able to configure network interfaces with connectivity to other users as dictated by budget constraints. This offers briefly-interesting marketing angles well into the twenty-first century. (As historical materialism will record, it is a matter of ongoing refinement of the commoditization of time.)

This shifts the question of corporate strategy for telecommunications operators as well as other network-service and information technology providers to capital allocation among existing and new infrastructure components, to risk management in the face of geographic or line-of-business diversification, and the acquisition and divestiture of business units. By 2010 we can safely assume the emergence of a dynamic and relatively open market in service logic, with independent service providers developing subgroup-customized solutions. In such an environment, the dynamics of network development and virtual group formation will be increasingly difficult to predict. Part of the associated financial uncertainties will be reflected in stock-market returns as these reflect the expectations of more and less informed investors.

Measuring and forecasting volatility (intensity of random changes) of industry returns will thus underpin risk-management across the information technology sector which subsumes telecommunications. This positions it as a central component of future corporate strategy, nascent in the imperatives requiring AT&T's divestiture -- announced in September 1995 -- as well as France Telecom's financial modeling for the transatlantic Phoenix joint-venture with Deutsche Telekom and Sprint.

REFERENCES

- Arellano, M. and V. Mackall. *U.S. Broadband Equipment Market: 1995 Edition* New York: Northern Business Information/McGraw-Hill, 1995.
- Copeland, T.E. and Westland, J.F.. *Financial Theory and Corporate Policy. 3rd ed.* Reading MA: Addison Wesley, 1988.
- Cool, K. and D Schende. "Performance Differences Among Strategic Group Members." *Strategic Management Journal* 9:207-223, 1988.
- Elton, E.J. and M.J. Gruber. *Modern Portfolio Theory and Investment Analysis. 5th ed.* New York: John Wiley.
- Gort, M. and R. Singamsetti. "Concentration and Profit Rates: New Evidence on an Old Issue," *NBER: Explorations in Economic Research*. 3:1-20, 1976.
- Hansen, G. and B. Wernerfelt. "Determinants of Firm Performance: The Relative Importance of Economic and Organizational Factors." *Strategic Management Journal* 10:399-411, 1989.
- Jensen, M. and H. Meckling. "Theory of the Firm: Managerial Behavior, Agency Costs and Capital Structure," *Journal of Financial Economics*, 3:305-60, 1976.
- McGee, J. and H. Thomas. "Strategic Groups: Theory, Research and Taxonomy." *Strategic Management Journal* 7:141-160, 1986.
- Munroe, C. and M. Singh. *Long-Distance Markets: 1994 Edition*. New York: Northern Business Information/McGraw-Hill, 1994.
- NiShuilleabhain, A. *Global VANS Markets: 1995 Edition*. New York: Northern Business Information/McGraw-Hill, 1995.

- NiShuilleabhain, A. *An Information-Technology Capital-Asset Pricing Model*. Fontainebleau: INSEAD Working Paper, 1995a.
- Noam, E. M. *Telecommunications in Europe*. New York: Oxford University Press, 1993.
- Ravenscraft, A.D.J. "Structure-Profit Relationships at the Line of Business and Industry Level," *Review of Economics and Statistics* 65:22-31, 1983.
- Rumelt, R.P. "How Important is Industry in Explaining Firm Profitability?" Unpublished Working Paper, UCLA, 1982.
- Rumelt, R.P. "How Much Does Industry Matter?" *Strategic Management Journal*, 12:167-185, 1991.
- Scherer, F.M., and D.Ross, *Industrial Market Structure and Economic Performance*, 3rd ed. Boston: Houghton Mifflin, 1990.
- Weiss, L.W. "The Concentration-Profit Relationship and Antitrust," In Goldschmid, H. ed. *Industrial Concentration: The New Learning*. Boston: Little, Brown, 1974.

ENDNOTES

¹ See A. NiShuilleabhain, "An Information-Technology Capital-Asset Pricing Model." Fontainebleau: INSEAD Working Paper, 1995.

² The market for ATM public network switches alone was worth approximately \$41 million in 1994; Northern Business Information predicts market expansion to more than \$320 million by 1999. See M. Arellano and V. Mackall, *U.S. Broadband Equipment Market: 1995 Edition*, New York: Northern Business Information/McGraw-Hill, 1995, page 16 and ff.

³ M. Arellano and V. Mackall, *U.S. Broadband Equipment Market: 1995 Edition*, New York: Northern Business Information/McGraw-Hill, 1995.

⁴ Recall Ameritech's 1993 acquisition of a 30 percent stake in GE Information Services.

⁵ US long-distance traffic in 1993 generated \$65 billion, increasing to \$68.3 billion the following year. Sectoral breakouts were roughly as follows: Message Toll Service (MTS) 63.8 percent, Outbound 14 percent, Inbound 9.7 percent, Other 2.5 percent, C. Munroe and M. Singh, *Long-Distance Markets: 1994 ed.* New York: Northern Business Information/McGraw-Hill, 1994, page 3 and ff.

⁶ *Phoenix*. In June 1994, Deutsche Telekom and France Telecom announced their intentions to invest approximately US\$4.2 billion -- representing a collective 20 percent equity investment -- in Sprint over a two-year period. The partnership aims to market services worldwide via regional operating groups (home-country partners in the US, France and Germany); to compete in national long-distance markets where feasible; and to combine planning for global network facilities (existing correspondent bilateral relationships will remain in place). Phoenix anticipates merging most of the international assets of Deutsche Telekom and France Telecom (within the agreed scope of the Atlas global service portfolio), with most Sprint International assets. The option to add additional national partners -- notably in the Asia-Pacific region -- remains. Phoenix' launch awaits regulatory approval by the European Commission's Competition Directorate (DG IV, which is holding out on Atlas approval), the German Bundeskartellamt, and the US Department of Justice (DoJ).

⁷ *Concert*. Launched originally as a wholly-owned subsidiary of MCI, which contributed \$79 million to the cost of its establishment, MCI currently owns 25% of Concert. (In February 1994 MCI had announced the completion of its takeover of British Telecom North America's assets, which were integrated with MCI's Data Services Division.) Concert is responsible for managing both networks and their various capabilities, delivering seamless service. British Telecom and MCI serve as geographical distributorships covering Europe and North America respectively, market jointly-branded services and

products, and handle all sales and marketing issues. Basic services continues to be handled through correspondent relationships. MCI leverages Concert assets (including the increasingly-sophisticated VNet) to develop the North, Central, and South America markets. British Telecom retains responsibility for business development in the UK, Europe, and the rest of the world (Asia-Pacific and Africa). Future third-party deals brokered by British Telecom and MCI are not expected to alter Concert's structural role.

⁸*WorldPartners.* In May 1993, AT&T, KDD, and Singapore Telecom announced the WorldPartner association to provide WorldSource voice and data services to multinationals. The three founding members have equity investment and partner status. During 1993-94 membership expanded to include Telstra and the Telecom Corp. of New Zealand; in June 1994, Unisource acquired a 20% equity stake with European distribution rights to the WorldPartner portfolio and announced its intention to begin marketing WorldSource services. The Swedish-Dutch-Swiss joint venture company at that time was committed to invest US\$350 million and employ 650 people in Europe during 1994-97 to develop and market customized voice and data services to multinationals. WorldPartners are committed to distribution of WorldSource, the global product portfolio marketed by BCS and its partners worldwide. As of September 1995, core portfolio components will be rebranded as Uniworld offerings for the European market. At YE1995 the North America/Pacific Rim component of the AT&T BCS global service partnership program comprises: AT&T, Unitel, KDD, Singapore Telecom, Telstra, Telecom New Zealand International, Hong Kong Telecom, Korea Telecom, Phillippines Long Distance Telephone Company (PLDT), and Telkom South Africa.

⁹*Uniworld.* Announced in December 1994, this joint-venture company between Unisource (60%) and AT&T (40%) will provide liberalized voice and VAN services to multinational companies headquartered in Europe. The company will also supply direct communication via VSATs. However, as part of WorldPartners, Uniworld's reach will extend across North America and the Pacific Rim. After finalisation of definitive documentation and notification to the European Union, Uniworld is expected to be operational by 1 January 1996 with assets of approximately \$200 million and over 2000 employees at launch. AT&T's Communications Services Group will manage AT&T's 40% shareholding. This group includes four dimensions: Consumer Communications Services, Business Communications Services, AT&T Universal Card Services (which markets consumer credit cards for general purchases and long-distance calling), and AT&T American Transtech (which provides telephone-based services such as lead generation and sales programs, facilitating businesses expand). Control by the Communications Services Group facilitates portfolio expansion to include consumer voice services -- and other businesses too -- as these become liberalized across Europe. This of course is the longer-term strategic intent.

¹⁰Our analysis reflects interviews and revenue estimates from close to sixty service providers including the eight global market leaders whose fortunes are summarized in Figure 3.

¹¹At YE1994 IBM Global Network dominated with a 9.8% market share. The industry leader was followed by competing IVANs/global VAN service consortia in this order: AT&T and Partners (5.6%); GE Information Services and Sprint International with Partners (each of which controlled a 4.7% market share); SITA (representing a 3.9% worldwide share); and BT/MCI joint-venture Concert (3.4%). Each of these entities commanded worldwide revenues in excess of \$500 million during 1994. Smaller global providers Infonet (1.7%), and Cable & Wireless Business Networks (1.5%) earned \$252 million and \$235 million (estimate) respectively in global VANS during 1994.

¹²VANS service providers confined to the North American, European and Asia/Pacific markets in aggregate controlled 64.5%. Latin American VANS accounted for a mere 0.5% of this figure.

¹³*Atlas.* In December 1993 France Telecom and Deutsche Telekom signed a Memorandum of Understanding (MOU) to co-operate in VANS market expansion, following with the nomination of Jean Arnould and Norbert Knoppik to lead the proposed joint venture from Brussels. The proposed service portfolio will be provided by a dedicated backbone network with unified network management across all

operations. The joint venture will initially exploit existing France Telecom and Deutsche Telecom network service entities, notably Transpac's multinational capabilities, Datex-P and Eunetcom itself. From its inception the two partners had hoped that their co-operation be viewed as a contribution to Europe's overall economic development. Atlas was to operate in fully liberalized sectors and its activities would be pursued in complete uniformity with EC competition rules, i.e., would not involve the extension of a dominant position in one market to another. Following late-1995 approval by the European Commission's DG IV, a 1996 launch of X.25, frame relay, Internet Protocol, VSAT, international virtual private network (VPN), and international value-added voice is scheduled. However the challenges of launching Atlas cover considerably more ground: there are differing technical and operational systems to be integrated, and the two monopoly operator cultures will need to reconcile their approach to business development.

¹⁴ *Societe Internationale Telecommunications Aeronautique (SITA)*. This cooperative venture involves 550 members, most of which are airlines. In April 1990, SITA established the value-added service provider Scitor to sell industry-specific solutions and resell SITA network capacity. Scitor effectively was formed out of ITS (International Telecommunications Services), the SITA subsidiary created in 1972 to provide total solutions to SITA members and others outside the airline industry. In 1989 SITA divested ITS BV to market VANS beyond the airline sector; this became Scitor (since 1992) which claims to market a full range of managed network offerings across target industries. In December 1994, the SITA board approved a change in structure which involved the establishment of a holding company in the Netherlands and the transfer of ITS, Scitor, and Novus into a single entity with a new commercial structure. The second phase of the restructuring will welcome outside investors, a process which had been intended to include Unisource, but will require a new set of alliance partners given its 1995 rupture with SITA.

¹⁵ *IBM Global Network*. The integration of IBM's intra-organizational corporate data and voice network with a backbone network connecting regional processing bureaus supported the introduction of commercial network service to the US beginning in 1982. European service followed four years later; in 1995 the IBM Information Network was renamed the IBM Global Network. Currently one of the world's largest dedicated data networks, the IBM Global Network is managed worldwide by Advantis, a joint venture with Sears.

¹⁶ *Infonet*. Established by Computer Services Corporation in 1970, the Infonet Services Corporation had 11 shareholders until 1993 (when MCI Communications Corporation's 25% share was redistributed following MCI's alliance with Concert). Late in 1994 Singapore Telecom sold its 7.1% shareholding. Following this sale, member shareholdings were: Deutsche Telekom and Transpac, 23.3% each; Telstra 7.6%; Belgacom, Swiss PTT, PTT Telecom, Telefonica, and Telia International, 7.7% each; KDD 7.2%. During 2Q1995, a two-stage process of share redistribution began. The first phase involves reduction of Deutsche Telekom and France Telecom ownership - because of the Phoenix joint-venture with Sprint -- so that remaining shares are almost equally distributed among nine partners. The second phase during 1996 will involve the sale of remaining Deutsche Telekom and France Telecom shares in Infonet to new and/or existing owners.

¹⁷ *Unisource*. Originating in 1992 as a joint-venture partnership between PTT Telecom Nederland and Sweden's Telia (then Televerket), Unisource adopted PTT Swiss Telecom as a third and equal shareholder in mid-1993. Subsequent discussions led to the inclusion of Telefonica (noted below). In June 1994 Unisource bought a 20% stake in AT&T's WorldPartners -- jointly established with KDD and Singapore Telecom -- and thus earned exclusive distribution rights for WorldSource services in Europe. Thus was born Uniworld, a far-reaching market-sharing arrangement linking AT&T's European data-networking strategy tightly with that of the Unisource partners.

¹⁸ Most global providers claimed growth close to or exceeding 100% during 1994-95, and expectations for continued expansion at this rate through 1997.

¹⁹A. NiShuilleabhain, *Global VANS Markets: 1995 ed.* New York: Northern Business Information/McGraw-Hill, 1995.

²⁰For example, by 2000 Cable & Wireless Business Networks should increase global market share to 2.9% based upon compounded annual growth (CAGR) on the order of 13-14%. Smaller increases - on the order of 0.3% and 0.1% respectively - should be recorded by BT/MCI and AT&T with its partners. For details, see A. NiShuilleabhain, *Global VANS Markets: 1995 ed.* New York: Northern Business Information/McGraw-Hill, 1995.

²¹In the interim, Northern Business Information's *Global VANS Markets: 1995 Edition* database projects worldwide CAGR at 76.7% (on YE1994 North American revenues barely in excess of \$90 million) and thus a VANS market share gain just above 4%. All eight global providers are working toward multilateral Interational Virtual Private Network (IVPN, but note that 'Intelligent' will also be coopted by marketers in this context); thus slight market share expansion (below one percent). Aggregating across regional revenue streams and by sector, these expansions should occur at the expense of the Packet Switched and Related, Messaging and Online, and Managed Network Services (MNS) service classes (see Figure 4). Worldwide these horizontal and fundamentally commodity sectors will lose significant market share (on the order of 7.8%, 2.7%, and 2.5% respectively). EDI and Industry Solutions will lose slight market share (below 1%) based upon a longer market-penetration trajectory. The Managed Private Line category can be expected to retain a 2% global market share based upon cannibalization of existing leased-line revenue streams linking the four geographic regions (thus a CAGR close to 14 percent through 1999).

²²This remains dominated by AT&T, Sprint, CWBN, and BT/MCI.

²³*EUCOM*. Launched by France Telecom holding-company COGECOM -- the umbrella under which all France Telecom subsidiaries operate -- and Deutsche Telekom in November 1988, this limited-liability company is incorporated under German law. The holding-company Logiciels et Integration de Services (FTLIS) -- established by COGECOM in 1992 to control France Telecom interests in VANS, computer services, and facilities management -- owns the France Telecom share. COGECOM also controls 50% of the partners' outsourcing venture *EUNETCOM* and (through FTLIS) investment by Deutsche Telekom/France Telecom entities. Eucom initially targets the European market, seeking to pre-empt dominance of the industry-solutions sector by non-European service providers.

²⁴In contrast the Concert, WorldPartners/Uniworld, and SITA partnerships have yet to address this critical expansion path, intended by France Telecom/Deutsche Telekom (via Eucom) to exploit existing and committed future-network (SDH, GSM, B-ISDN, ATM) capabilities.

²⁵However transformed domestic entities appear to be continually replaced by new entrants to the national or sub-regional pool. The rate of introduction of new VAS providers in Europe is increasing -- albeit slowly -- in tandem with burgeoning growth of a regional internetworking sector. Pending effective infrastructure liberalization under European Commission (EC) guidelines, however, the possibility of rapid innovation characteristic of US hardware and software markets since AT&T's (1984) divestiture remains foreclosed.

²⁶See Eli M. Noam, *Telecommunications in Europe*, New York: Oxford University Press, 1993, and the same author's chapter in this volume.

²⁷The European process stretches back to flotation of British Telecom shares in 1983, followed by sales of Telefonica, STET, and SIP (now Telecom Italia), KPN in the Netherlands, TeleDanmark, and (in 1995), Telecom Portugal. The 1996 stock-market flotation of Deutsche Telekom (at YE1995 an incorporated entity wholly-controlled by the German government) will be Europe's largest equity offering to date.

²⁸ Notable among successful Asian launches were those of Singapore Telecom (1994) -- briefly capitalized more highly than IBM -- and NTT (in 1995 the world's most highly-capitalized company).

²⁹ In general this benefits both consumer/users and the privatized entities themselves. No longer a government department, there could be little of the traditional national champion justification for protecting British Telecom's interests. Despite the company's considerable market power, the level of choice afforded users in the competitive UK environment far exceeds that found elsewhere in Europe with the possible exception of Sweden. British Telecom itself has been a major beneficiary of this competition via efficiency improvements and operational streamlining. The Netherlands' PTT Telecom has emerged post-privatization as Europe's most efficient operator, benefiting in particular from exposure to new markets and partners via Unisource and Uniworld (the trans-Atlantic component of its alliance partnerships).

³⁰ *EVUA*. This group of 40 multinationals (including founder members ICI and Rank Xerox) negotiated separate telecommunications services contracts in April 1994 with AT&T/Unisource and British Telecom for pan-European voice and data services. The EVUA final contract -- scheduled for renegotiation late in 1995 among several bidders (including Cable & Wireless, Sprint/Eunetcom and Telstra) -- is worth an estimated 500 million ECU annually. AT&T/Unisource co-operation on this contract preceded Uniworld.

³¹ This stops short of a full outsourcing offering. Although EDS (for example) commands a powerful position with proven track-record in outsourcing as well as solving short-term employment problems for multinationals, this market is increasingly competitive. The former public monopolists have national market presence adequate to ensuring support-levels required by national and subregional businesses, and this in turn will boost confidence in outsourcing 'solutions' which they will inevitably introduce to market.

³² Revenues derived from providing Internet access are likely to be immaterial to international carriers excluding Sprint International, MCI Concert, and eventually AT&T. The wave of Internet access providers which emerged across Europe and Asia during 1993-95 will be followed by consolidation.

³³ Whereas the US IXCs compete to claim the first or widest commercial introduction of ATM service to a given region, most North American VANS providers introduced frame relay service rapidly.

³⁴ And few companies want to be in the position of trying to solve networking problems via a help-line call in Europe where the faulty node sits in Latin America or Asia.

³⁵ Such is not the case with EDI software widely adopted across an industry, where competitors, suppliers, and customers perpetuate usage. It would be difficult to value goodwill developed by SITA within the airline industry, by GEIS in the retail sector, or even CWBN in important financial-services markets.

³⁶ It is, of course, as a data networking technology that ATM finds first commercial application. Wide-scale deployment for voice and video will follow at several years lag in most markets.