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**VANS Role in the Advanced
Network Infrastructure**

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A wave of telecommunications service deregulation and rising technology and market undercurrents is rapidly repositioning value-added network services (VANS) and their providers in the gulf between public communications infrastructures and end-user networking solutions. Early VANS operators like GE Information Services (GEIS), CompuServe, Tymnet, IBM, Computer Sciences Corporation (CSC) and other firms, which bundled their investments into host computer facilities and packet switches with leased lines and enhanced applications such as electronic mail and protocol conversion to sell reliable network alternatives to corporate users, now face rising competition from emerging integrated global carriers such as AT&T, Sprint, and MCI.

This competition is redefining the boundaries between "basic" and "value-added" services in the corporate environment. A growing split between "integrators" and "specialists" hints at the path for VANS differentiation in the future. Common carriers and VANS providers are expanding traditional VANS mainstays in two distinct directions: toward integrated management of multiple networks, applications, and perhaps even infrastructures and toward increasingly customized, industry-specific applications. The task of this study is to explore these growth trajectories and role or roles which VANS will play within the web of evolving telecommunication infrastructures.

I. Current VANS

Shifting regulatory boundaries coupled with the globalization of VANS and their providers have created a thorny definitional dilemma. Traditionally, VANS providers have represented a collection of alternative data network operators which interconnected differing network protocols, provided access to remote computing facilities, and offered a range of messaging and information services that were outside the regulatory domain of the Bell System. These regulatory boundaries also attempted to shield dominant public network operators and their customers from potentially destabilizing competition by separating basic telephony from various corporate-oriented network and service enhancements.

The falling cost of end-user processing technology, the liberalization of telecom service markets, and growing displacement of telephone-as-utility with network-as-strategic infrastructure demands in vertical markets has fed a growing pool of VANS providers with varying degrees of overlap in network technologies, configurations, applications, and market segments.

In many cases, recent VANS definitions have either been too general as in the case of the OECD's Telecommunication Network Services (TNS) concept, or dangerously static, thereby ignoring actual market dynamics with fixed categories of providers and services.¹ Similarly, layered VANS descriptions often fail to document both degrees and directions of service and provider overlap. While the chief purpose of this overview is not to refine a VANS definition or establish specific categories for telecommunication services, hopefully an examination of the evolving VANS dynamic and its possible outcomes may help shape future definitions.

The VANS Marketplace

Estimates of the VANS market vary at least as much as VANS definitions. Calculations of total 1991 VANS revenues among leading U.S.-based operators range from \$1-2 billion.² Core VANS product lines such as X.25 packet switched services continue to account for at 70% or more of these revenues. However, industry analysts see strong growth in newer applications such as EDI and X.25 alternatives like switched T1, frame relay, and switched multi-megabit data service (SMDS).³

¹. Telecommunications Network-based Services: Policy Implications, (Paris: OECD, 1989), p. 7. The OECD seeks a broad, dynamic, and forward-looking definition, placing VANS under an all-embracing mantle of "Telecommunication network-based services" (TNS) which it classifies as "all services that combined information production, manipulation, storage and/or distribution with the use of telecommunication facilities and software functions."

². "An Overview of Value-added Networks," published by Datapro Information Services Group, May 1991, estimates total revenues of 11 leading VANS providers at \$1.96 billion. Market forecasts by International Data Corporation (IDC) published in Network World, January 20, 1992, estimate a \$1.031 billion VANS market in 1991.

³. "An Overview of Value-added Networks," Datapro Information Services Group, May 1991. Datapro estimates that the EDI market is growing by 30% per year and X.25 alternatives will begin to capture an increasing share of the data transport market after 1993.

VANS Market Share, 1989-1991		
VANS Provider	1989	1991
AT&T ⁴	3%	13%
BTNA	37%-40%	30%-37%
CompuServe	5%	7%-8%
GEIS	2%-5%	8%-18%
IBM ⁵	2%	3%-4%
Infonet	2%-10%	7%-11%
Sprint	38%-43%	20%-31%
Total VANS Revenues (US\$ million)	\$623-\$1,000	\$1,000-\$2,000

Source: Datapro, IDC.

Increasing stratification in vertical markets has accompanied the growth in VANS demand. Both integrated common carriers and global VANS firms have begun packaging product menus which include flexible combinations of managed leased lines, virtual private networks (which, themselves range from segmented billing arrangements to outsourced hybrid networks), as well as a growing pool of specialized EDI, messaging, transaction, and information applications.

Applications, whether offered by a specialist VANS firm or a division of a common carrier or global VANS operator, are becoming increasingly industry-specific. Banking, securities, insurance, airline, distribution, and transportation industries have emerged as important niche markets for EDI, EFT/POS, and information services. In some cases, the emerging VANS market requires VANS providers to total invert their traditional, often complaisant, view that technology-driven network services deliver a menu of application possibilities to their users, and instead respond to real market demands.⁶

⁴. Datapro calculations refer to AT&T ACCUNET Packet Services revenues.

⁵. All revenue estimates refer to IBM Information Network revenues.

⁶. Often under the stewardship of engineers-turned-salesmen of managers, BOCs and other public network providers have been slow to shift from strategies that pump costly, leading-edge technologies into the network and hope for a market to those that tailor services to actual customer demand. For further comments see, Steven E. Permut, "RHC Success in the Marketplace hinges on Meeting Marketing Challenges," Telephony, June 15, 1992, p. 94, 96.

VANS Providers

The marketplace for VANS remains highly fragmented. To some extent, VANS providers can be segmented into three general categories: common carriers including both long-distance carriers as well as the BOCs; alternative data carriers such as BT North America, GEIS, CompuServe, and Infonet as well as more specialized non-voice service providers such as SWIFT, Reuters, and others; and large systems integrators including IBM, CSC, and EDS. However, examination of individual VANS providers reveals tremendous overlap in service offerings, target markets, and roles in the broader telecom infrastructure.

[see attached appendix for profiles of major VANS]

II. VANS Dynamic

A complex interplay of numerous and often concurrent regulatory, technological, and market dynamics continues to shape both the definition and position of VANS in the telecommunications infrastructure landscape. Whether identified as a specialist firm, itself, or as a category of services provided by a range of firms, VANS are the products of three distinct dynamics: (a) a national regulatory regime, (b) a demand for alternative services and service providers to compensate for deficiencies in public and private network infrastructures, and (c) a need to re-integrate and manage fragmented network technologies and service choices.

Rather than emerging from any single dynamic, VANS are increasingly molded by the simultaneous interaction between all three of these forces. That is, within the unregulated segment of the telecommunications services market, certain carriers are concentrating their efforts on providing specialized information content and transaction applications while others are emerging as managers of increasingly integrated networks. Still others are selling both highly integrated managed networks and a range of specific applications to fill their pipes.

At the same time, the long-held regulatory dichotomy between "basic" and "enhanced" or value-added services is rapidly deteriorating as policy makers begin to realize that "it is exceedingly difficult to define the point at which the operation of a transmission network ends and enhancement of it begins."⁷ The increasingly global reach of network

⁷ Robert R. Bruce, Jeffrey P. Cunard, & Mark D. Director, *From Telecommunications to Electronic Services*, (U.S.A.: Butterworths, 1986), p. 215.

infrastructures, user organizations, and the information that they transmit has raised additional questions about the wisdom and viability of traditional regulatory schemes.

VANS Regulation

Government regulatory agendas and network and technology standards are two central components of a dynamic that has shaped and, to a certain extent, created VANS. Of the two, Federal Communication Commission (FCC) and federal and state court-guided regulatory policy has played the principal role in separating VANS as a specific class of unregulated service providers and determining the types of applications they can provide and their relationship with the public network infrastructure.

Evolution of VANS Regulation	
Date	Regulatory Action
1934	<i>Communications Act, 1934</i> : defines common carriers as monopoly service providers obligated to provide non-discriminatory public network service. ⁸
1966	<i>Computer I</i> : FCC declines to regulate data processing services but establishes categories for regulation of switched message services and bars AT&T from direct competition in data processing market. ⁹
1970/71	<i>Specialized Common Carriers</i> : FCC provision permitting competition in certain private line services. ¹⁰
1980	<i>Computer II</i> : imposed "basic" and "enhanced" service distinction in place of Computer I communications/data processing dichotomy. FCC declined to regulate enhanced services but imposed structural separation requirements on AT&T enhanced services. ¹¹

⁸ . Robert Bruce, Jeffrey Cunard, & Mark Director, *From Telecommunications to Electronic Services*, (U.S.: Butterworths, 1986), pp. 156-58.

⁹ . Bruce, Cunard, & Director, 1986, pp. 198-201. Categories for regulation defined under FCC's Computer I include:

Data processing: use of computer for processing information, including storing, retrieving, and manipulation of content and data.

Message-switching: computer-controlled transmission of messages without the alteration of message content.

Local data processing: data processing service which does not involve the use of communication facilities.

Remote data processing: data processing service which requires the use of communication facilities to connect customer terminals and central computers.

Hybrid service: combination of remote data processing and message switching in a single integrated service.

¹⁰ . Bruce, Cunard, & Director, 1986, pp. 172-75. FCC's *Establishment of Policies and Procedures for Consideration of Applications to Provide Specialized Common Carrier Services in the Domestic Point-to-Point Microwave Radio Service* (29 F.C.C. 2d 870, 1971) and the *Execunet I* court ruling assumed that new specialized services would exclude switched voice services, yet at the same time upheld the existing FCC policy that permitted carriers to provide any service physically accommodated by their networks.

¹¹ . Bruce, Cunard, & Director, 1986, pp. 202-207. Structural separation requirements bar cross-subsidies between regulated and unregulated subsidiaries and prohibit un-regulated subsidiaries from owning or operating transmission facilities.

Evolution of VANS Regulation	
Date	Regulatory Action
1984	<i>Modified Final Judgement: divested AT&T organization and imposed seven-year restriction on AT&T participation in electronic publishing. Barred BOC participation in non-regulated services including information and enhanced services.</i> ¹²
1986	<i>Computer III: replaced Computer II structural separation requirements with non-structural safeguards. AT&T and BOCs permitted to integrate regulated and unregulated services in accordance with non-structural provisions.</i> ¹³
1988?	BOCs permitted to provide information gateway services including vidcotex, e-mail, and voice messaging. ¹⁴
1991	BOCs permitted to provide information services.
1992	Common carriers permitted to provide CATV service.

In many countries, government regulatory agendas have traditionally focused on protecting dominant carriers, which are often state-run post and telecommunication organizations (PTOs), from destabilizing competition. Under this type of regulatory regime, national economic policy and related political priorities often play a critical role in separating the provision of universal plain old telephone service (POTS) from the development and promotion of specialized network enhancements. In these cases, regulatory mandates which are designed to hinder cross-subsidization and enforce strict line-of-business divisions serve to protect the sizable labor, manufacturing, R&D, and maintenance institutions which support basic telecommunication infrastructure monopolies.¹⁵

In the U.S., many of the earliest regulatory measures also intended to shelter the "natural monopoly" of the Bell System from premature competition.¹⁶ However, the evolving distinction between regulated and competitive service provision, as Eli Noam argues, has centered on curbing monopoly abuses rather than shielding dominant carriers. He

¹². Bruce, Cunard, & Director, 1986, pp. 177-82. "Information services," including data processing, electronic publishing, and other enhanced services.

¹³. Federal Communications Commission Record, CC Docket N. 90-623., and Walter Saprionov, "The Telecom Regulatory Agenda for the 1990s," Business Communications Review, December 1990, pp. 19-24. Computer III "non-structural safeguards" center on: (a) comparatively efficient interconnection (CEI), an open network architecture scheme (ONA) which provides competing carriers and service providers with equal access to network service components, (b) protection of customers' proprietary network information, (c) regulatory accounting to address possible non-competitive cross-subsidies among subsidiaries, (d) technical disclosure requirements under which carriers must inform enhanced service providers of changes to the network which might effect their services.

¹⁴. Saprionov, Business Communications Review, December 1990, p. 26.

¹⁵. Thailand and Malaysia provide two recent examples where PTO labor organizations have had a strong influence on service liberalization or privatization policy. Moreover, U.S. regulators could not have overlooked the implications of service deregulation for related manufacturing and R&D efforts.

¹⁶. Bruce, Cunard, & Director, 1986, pp. 170-172.

notes, "The U.S. distinguishes between "basic" and "enhanced" service in order to prevent the dominant carriers' exercise of market power -- not to protect those carriers from competition."¹⁷

At the same time, persistent efforts to separate non-discriminatory public telecommunications from competitive, specialized services divided computer and communications development trajectories.¹⁸ The FCC's 1966 Computer I decision re-asserted the distinction between unregulated data transport and processing activities and regulated switched voice service. This legislation preserved the commission's authority over AT&T's public network monopoly while assuring a stable niche market for new "value-added" computer processing applications.

Arguably, U.S. defense technology interests played a significant role in promoting a category of alternative data carriers, and perhaps, barring regulatory interference in the early computer networking industry. In its efforts to accelerate development of strategic computer processing facilities, the U.S. Defense Advanced Research Projects Agency (DARPA) backed early packet-switched system R&D in the late 1960s.¹⁹ Packet-switching technology similar to that used in DARPA's ARPANET formed a central value-added transmission component in early computer timesharing and remote processing services offered by early VANS.

Traditional forbearance in the regulation of data communications and the careful restriction of AT&T's entry into these activities fostered relatively unhindered development of computer processing technology and related inter-machine communication. In addition to meeting Cold War defense priorities, unregulated computer communications created a competitive and flexible pool of VANS contractors for government and industry data processing applications.

Early VANS such as Tymshare, Inc., GEIS, ADP, CSC, and Telenet Communications Corporation concentrated on developing and providing unregulated remote data processing services. Outside of the anti-trust scrutiny that had begun to splinter the Bell System, these VANS were free to invest in the design and manufacture of network processing equipment that would define much of their near-term role in the national communications infrastructure.²⁰ Marketing their packet switch equipment along with remote processing and

¹⁷ Eli Noam, "International Telecom in Transition," in Crandall & Flamm (eds), 1989, p. 273.

¹⁸ Robert B. Cohen and Kenneth Donow, Telecommunications Policy, High Definition Television, and U.S. Competitiveness, (Washington: Economic Policy Institute, 1989), p.1.

¹⁹ Vinton Cerf, "Networks," Scientific American, September 1991, P. 44-45.

²⁰ Bruce, Cunard, and Director, 1986, pp. 177-181. The authors note consistent antitrust efforts against AT&T sought to separate service from manufacturing facilities.

protocol conversion services, VANS such as Tymnet and Telenet could provide a category of "value-added" X.25 data transmission free from threats of regulation or AT&T competition.

Without the threat of regulatory infringement, non-common carrier VANS providers such as GEIS, CompuServe, Infonet, and numerous others have positioned themselves to serve different segments of the VANS markets. For example, ADP has developed its Autonet VAN as a delivery vehicle for its own industry-specific information services. CompuServe and GEIS offer both their own and other third-party on-line information. Nearly all major commercial VANS providers include protocol conversion as an integral element of their service menu.

However, until recently, the regulatory separation between "basic" and "enhanced" services prevented these commercial VANS from expanding their selection of network management functions. Lacking direct access to many of the control elements in the underlying transmission network, non-regulated VANS could offer a certain degree of network monitoring but were restricted in their ability to dynamically reconfigure or manage the lines which they leased and resold.

At the same time, the FCC's regulatory agenda critically shaped the types of VANS provided by AT&T and other regulated carriers as well as the carriers' strategies for offering them. One important example of the impact of regulation on common carrier VANS development was the FCC's decision to impose Computer II separate subsidiary requirement on protocol conversion functions.²¹ Since protocol conversion represented a core service element of most X.25 VANS backbones, AT&T responded to these restrictions by forging an alliance with Control Data Corporation to develop and operate its REDI-ACCESS service. More important, the FCC's structural separation requirements effectively barred the integration of protocol conversion and related enhanced services with circuit-switched telephone service by the carrier perhaps most equipped to pioneer these innovations.

In addition, Computer II provisions restricted any software development collaboration between regulated and unregulated subsidiaries.²² Separate software development efforts are likely to hinder both service integration and the application innovations.

Instead, AT&T turned to its strategic billing and accounting resources as the principal vehicle for "adding value" to its regulated services. Customized billing, accounting, and dialing features formed the much of the basis for its early Software Defined Network (SDN).

²¹ . Bruce, Cunard, and Director, 1986, pp. 202-212. According to the authors, the FCC's Computer II required that any "enhanced services" offered by "those carriers with sufficient market power to engage in a significant degree of anti-competitive conduct or cross-subsidization," may only provide enhanced services through a separate subsidiary, as defined in Computer I.

²² . FCC Record, CC Docket No. 90-623, I sec. 4-6.

Competitors, MCI and Sprint, have also built their virtual private network services around the customized administration of basic voice services.

AT&T has strengthened its strategy for entering VANS competition by leaning on a weak point in the regulatory argument. The high degree of competition for interexchange traffic has aided AT&T in justifying the customized discounts offered under its Tariff 12 contracts. The ability to offer individualized volume discounts for basic services to their largest customers provides dominant carriers with an important complement to their existing VPN features. Built around regulated services, these emerging virtual network arrangements serve as platforms for introducing subsequently deregulated enhanced services. Not only does the promise of these stable, long-term revenue streams shelter the introduction of new enhanced services by dominant carriers, but it serve as a more palatable solution to cross-subsidy concerns.

All three carriers have expanded overseas through strategic acquisitions after regulatory amendments in the U.S. began to point toward integrated long-distance services. Sprint purchased Telenet, giving it not only a datacom equipment manufacturing subsidiary, but also a global X.25 network and internationally installed based of Telenet X.25 nodes. AT&T acquired Western Union's messaging subsidiary, Easylink and U.K.-based Istel. Meanwhile, MCI bought RCA Global and Western Union International.

In the case of AT&T, the company is building its EasyLink global messaging service around enhanced PBX nodes rather than an X.25 processor.²³ Through its acquisition of Western Union's EasyLink services, AT&T immediately inherited a large global messaging network. Still, the company's menu of global messaging services is based on a switched message network. This choice of processing node technology may also reflect the direction in which AT&T's R&D and manufacturing resources were channeled under a traditional regulatory structure.

As federal regulators retrench from guiding many aspects of VANS development, technology and network standards have emerged as increasingly important "rules of the road" for assembling and navigating today's multi-infrastructure telecommunications landscape. In this regulatory void, the evolution of current VANS applications and provider strategies strongly suggests that standards, whether proprietary or "open," now lay the main regulatory blueprint for network access, service interconnection, and application development.

Proprietary standards have played perhaps the most pivotal role in directing the early development of the unregulated computer industry. Commercial standards created by industry leaders IBM, DEC, Xerox, and even more recent PC manufacturers such as Apple

²³ . Mr. Monty Hoyt, AT&T EasyLink Services, August 30, 1991, interview.

have provided many of the basic design criteria for a broad range of multi-vendor application and networking software.²⁴ arguably, IBM has built much its dominance in both the computer and networking industries on its proprietary SNA design. The company has already begun to extend the reach of its standards well into the network and network management environment with products like its Token Ring LAN and NetView management platform.²⁵ Moreover, manufacturers and network operators have relied on their unique proprietary protocols and standards to regulate access to, use and modification of, and revenues from their own technologies and services.

Equally important, many of the proprietary standards which were designed to restrict the use of private information processing facilities, technology, and applications have also played a critical role in carving out a niche for VANS as interconnection intermediaries in a sea of incompatible and protected commercial standards. Although many VANS providers readily adopted the X.25 standard to create a relatively common network transmission environment, early efforts to standardize value-added applications met with more resistance.²⁶ As Besen and Saloner note, early VANS such as Telenet and IBM resisted adopting the X.400 messaging standard because it threatened to facilitate migration among e-mail services.²⁷

Now, an increase in competitive service offerings as well as customer demands for added control and flexibility in selecting, monitoring, and managing their VANS choices is promoting more open and universal network standards. A growing number of VANS providers have committed themselves to various open network initiatives that appear to maximize user access to applications and equipment.

²⁴ . Specific examples of proprietary networking technologies include Xerox Network System, DECnet Network Architecture, and Systems Network Architecture (SNA) and Systems Network Interconnection developed by Xerox Corporation, Digital Equipment Corporation, and IBM respectively. Vinton G. Cerf, "Networks," *Scientific America*, September 1991, p. 50.

²⁵ . Michael Finneran, "Data Networks in the '90s," *Business Communications Review*, February 1990, p. 83. Finneran argues that IBM's early and pervasive SNA standard continues to provide the template for the evolution major business and government data networks. He suggests that IBM will resist the growing acceptance of open systems and broader network compatibility and continue to evolve its SNA-based technology.

²⁶ . Andrew Burroughs, U.S. Sprint, "Packet Networks Internationally," presented at ComNet conference, Washington, D.C., January 29, 1992. (transcript, sec. 5512). X.25 was ratified by the CCITT in 1976 and by the late 1980s had become a widely accepted standard for data network transmission. X.75 was established as a data network interconnection standard in 1978.

²⁷ . Stanley Besen & Garth Saloner, "Economics of Telecom Standards," in Crandall & Flamm (eds), *Changing the Rules. Technological Change, International Competition, and Regulation in Communications*, (Washington, D.C.: Brookings, 1989), p. 177.

Open Networks

The non-structural safeguards imposed by Computer III have both expanded, or at least assured, access to central components of the public network infrastructure and reinforced the role of proprietary standards in mediating use of enhanced services. Computer III's Open Network Architecture (ONA) and Comparatively Efficient Interconnection (CEI) requirements prohibit common carriers from imposing proprietary network standards which bar or inhibit access by potential VANS competitors while protecting the proprietary network information of their customers²⁸. These open network provisions also include provide customers with access to a range of basic network elements.

This protection of customer and third-party proprietary network information is designed to provide a secure environment for the proprietary applications and services developed by users and VANS competitors. At the same time, open access to public network components suggests the need for a new of guidelines, whether market- or policy-driven, to mediate VANS provision and access.

Architectures and Applications

Standards, to a far greater extent than formal regulations or telecom policy, are determining network architectures and ultimately the many of the VANS applications which will support. Despite the rising demand for system and network compatibility, VANS continue to evolve in a multi-standard environment. Although Finneran and others see OSI and IBM as defining the two dominant directions for standards evolution in the future, a range of current service innovations suggest that the basket of standards is likely to remain somewhat more diverse.²⁹

Equally important, these different standards support significantly different network architectures. IBM's SNA, for example, is hierarchical, linking user terminals to secondary computers or processing nodes which are, in turn, joined to a primary network node. In contrast, TCP/IP and DEC net protocols center on the interconnection of mainframe units and network processing nodes while terminal access is secondary.³⁰ Designed less as a commercial standard, TCP/IP is not as adaptive for many accounting and billing applications, a feature which would make it less attractive for supporting VPNs.³¹

²⁸. Walter Saproonov. "The Telecom Regulatory Agenda for the 1990s," *Business Communications Review*, December 1990, p. 19.

²⁹. Finneran, *Business Communications Review*, February 1990, p. 78.

³⁰. Richard J. Solomon. "New Paradigms for Future Standards." *Communications & Strategies*, No.2, 1991, p. 70.

³¹. Malcolm Laws. "LAN Interconnection Frontier," *Communications Week International*, October 7, 1991.

Further dissecting the economic and functionality of these differing standards, Richard Solomon notes:

The SNA functions are philosophically different than OSI layers. Since SNA represents a commercial set of delivered products from one vendor as compared to OSI which is a model for product interconnection, the upper layers of SNA for applications are much more thoroughly defined than the upper layers of the OSI model or TCP/IP. SNA's downside is that it brings with it the baggage of IBM proprietary design, making it difficult to interconnect with non-IBM products.³²

OSI and TCP/IP-standard network architectures are geared toward multi-vendor, multi-protocol flexibility, lending themselves well to international and inter-enterprise applications.³³ These open network standards often require the user to pay more for network performance with the possibility of greater choice and, therefore, savings in computer/CPE procurement. At the same time, access to the full benefits of OSI-based flexibility may also require concurrent changes in the user organization.

IBM's SNA architecture standards concentrate on cost-saving.³⁴ However, SNA-type architecture is also intended to engage users in long-term hardware/software and arguably, service supply relationships. This type of proprietary standard also presumes relatively seamless communication among all components of the network, requiring either system uniformity through a common vendor or a VANS-type intermediary to integrate disharmonious network elements.

In line with the global connectivity priorities of their users, major VANS providers are working to develop frame relay architectures that can bridge both X.25 and SNA networks.³⁵ At the same time, integrated carriers like Sprint are implementing their next generation of enhanced service in anticipation of the continued demand for multiple standards. (See chart from Gartner Group on next page.)

³² . Solomon, in *Communications & Strategies*, No.2, 1991, p. 72.

³³ . Jeremy Frank, *ComNet*, January 29, 1992, (transcript, p. 8).

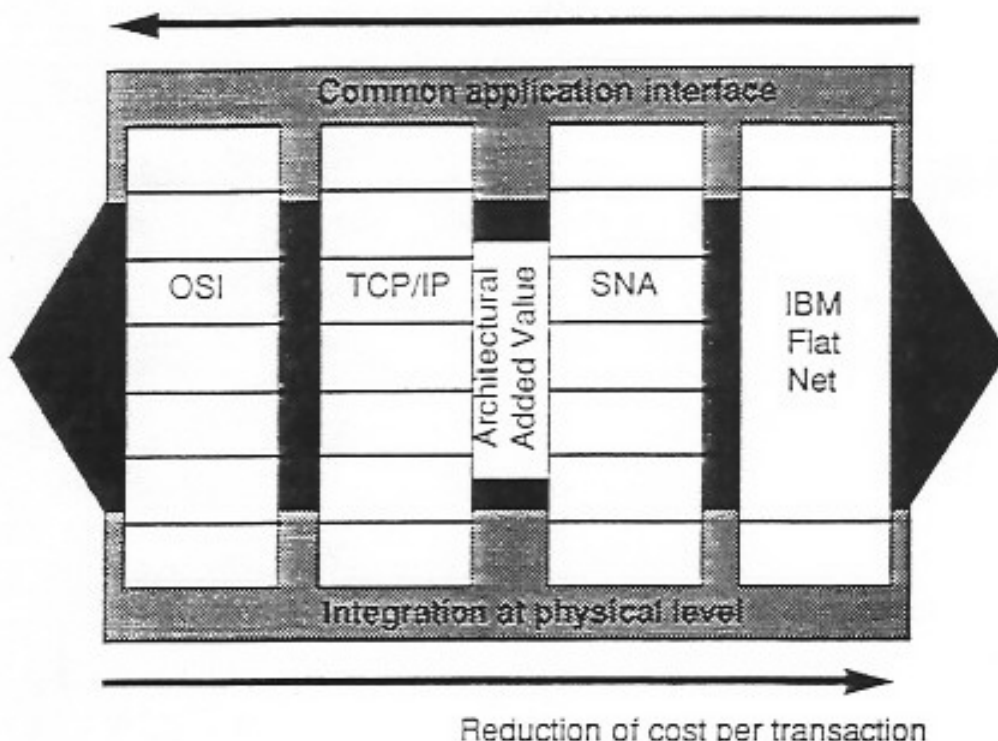
³⁴ . Jeremy Frank, January 29, 1992, (transcript, p.8).

³⁵ . Burroughs, January 29, 1992, (transcript, sec. 5520).

No Networking Architecture Will be Able to Satisfactorily Handle All Enterprise, Interenterprise and Intraenterprise Networking Requirements. Most Companies Will Implement Heterogeneous Networks to Suit Different Needs (0.9 Probability)

Reader Notes

Increase in Flexibility



Source: Gartner Group

GG Notes:

Key Issue: *What networking architecture strategies will users employ in response to increased networking costs?*

The old, traditional networking architectures, such as SNA, DECnet and TCP/IP, are neither open, well-structured nor cost-effective. Users should view new networking architectures as an opportunity to reduce costs and/or to increase flexibility. Unfortunately, the new networking architectures are unable to meet both objectives at the same time. We see two different groups of networking architectures that target different, almost mutually exclusive user environments. One group is inspired by the idea of leaving users free choice for their computing and networking resources. The vision of these is that networks will be comprised of a variety of heterogeneous computers, voice and data carriers and data link-level protocols. OSI is a good example of this type of architecture. OSI's layered applications are targeted for heterogeneous environments, especially in the interenterprise and international intraenterprise sector. The second group of developing architectures focuses on cost, as opposed to flexibility and freedom of computing. IBM's new Flatnet architecture is probably the most radical example of a cost-saving networking architecture. By concentrating on local and wide-area transport services based on the OSI global address definitions, e.g., FDDI, DQDB and SDH, architects can assume that all resources in a network will be able to communicate with each other as peers. As routing and other functions are not required, the networking model can be reduced to three layers, thereby cutting the protocol overhead by half. We believe that cost-constraint architectures will have major influence in all areas where the network can be limited to the new transport offerings. However, we do not believe that the new technologies will be commonly available before 1997.

Virtual Networks: Access, Features, and Management

The global expansion of virtual network through international carrier alliances is likely to emphasize standardization of access technology, network management elements, and feature sets to regulate network connection and to guarantee control, application performance, and security at all points on the network. Already, bilateral agreements have established the legal basis for U.S. carriers to expand their VANS offerings overseas, standards differences have held back the implementation of many service options. As a result, many global VPN services offer only abbreviated dialing, billing, and transmission discounts all of which hinge largely on VANS providers' corporate relationships with foreign PTTs.³⁶

Standardized network management systems such as those being developed by BTNA, AT&T, MCI, Sprint, IBM and others will become critical for developing specific applications and exploiting carriers' billing facilities. Efforts by the C&W/Sprint global VANS alliance to develop common signaling and network management standards to support uniform feature sets on their "global digital highway" point strongly in this direction. AT&T, British Telecom, France Telecom, and KDD are working toward similar uniform VPN intelligence in their current Joint Network Initiative.³⁷

These developments that dominant VANS providers, mainly those of which are, or have been absorbed by integrated global carriers will continue to determine where, how, and by whom enhanced services are developed and sold.

VANS: an Alternative Services Trajectory

Continuous innovation of network and CPE technologies and the concurrent market demands for increasingly specialized applications are two principal forces which have propelled the evolution of VANS as alternative telecommunications services. From the regulatory vacuum that fostered the earliest data processing and remote computing services, VANS operators have carved out a niche as providers of a range of technology and service choices not included in the standard menu of public network services. Previously, these alternative services have centered around network and service enhancements such as X.25 transmission, shared PAD services, protocol conversion, and on-line information, or lines of business from which telephone utilities were barred. As public network operators gain progressively freer access to earlier "value-added" market segments, specialist VANS firms

³⁶ . Schenker, Communications Week International, October 7, 1991.

³⁷ . Jennifer Schenker, "AT&T Drives Global Virtual Private Networks," Communications Week International, October 7, 1991.

and divisions of integrated common carriers are differentiating themselves with new industry-specific applications and management features.

Technology Drivers

The demand for data rather than voice transmission among decentralized computing facilities created a foundation for a class of unregulated, alternative carriers. During the 1970s, early VANS providers such as Tymnet and Computer Science Corporation invested in large computer facilities which marketed remote data processing services. These timesharing arrangements split the cost the computing power needed for routine functions like file storage/retrieval and payroll processing without requiring individual users to invest in mainframes, programming expertise, and facilities maintenance.³⁸ However, the delivery of data to range of incompatible user operating systems required a transmission network designed to accommodate economical data transport and protocol conversion. Consequently, VANS providers constructed extensive packet switched networks built around leased lines and regional processing nodes.

Forming the core of most VANS through the 1980s, these packet switched facilities provided a more reliable and economical alternative for long-distance data transmission than was permitted on the public circuit-switched telephone network. First, packet technology proved more effective for data transmission among multi-protocol, multi-program terminals than the circuit-switched network.³⁹ Second, packet transmission allows the creation virtual circuits by dynamically allocating leased line capacity, providing an economical alternative to maintaining sporadically used private circuits. Along with packet-switched network facilities, VANS provided a high degree of network security with their centralized network monitoring, management, and maintenance operations.

However, the falling cost of processing power has eroded much of the demand for centralized timesharing facilities. Since the 1970s, the cost of mainframe MIPS (millions of instructions per second) has fallen from \$6 million to \$90,000 with PC-based MIPS now available for as little as \$900.⁴⁰ With most processing functions firmly in the hands of the user, many VANS providers have shifted their focus to engineering flexible alternatives for connecting increasingly distributed, user-owned data centers.

Now, VANS providers are racing to introduce a variety of "fast-packet" transmission innovations to meet the demands of emerging network architectures, applications, and

³⁸ . Tesler, Scientific America, September 1991, p. 56.

³⁹ . Cerf, Scientific America, September 1991, p. 44.

⁴⁰ . Timothy G. Zerbic, "Private Network Challenges and Opportunities for the '90s," Telecommunications, January 1991, p.34.

increased terminal intelligence. Frame relay and SMDS technologies offer enhanced transmission alternatives for specifically for data transmission. Frame relay applications include "bursty" high-capacity transmissions for high-quality video conferencing, sporadic demand for bandwidth as in financial or medical image processing, and bulk transfers between distributed LANS.

While frame relay transmission, itself, may represent a "value-added" data transport alternative to common carriers' circuit-switched facilities, deregulation has allowed common carriers to develop this service in direct competition with those firms which have, in the past, differentiated themselves as alternative data carriers. The continued evolution of integrated network services by global carriers like AT&T, Sprint, MCI, British Telecom, and others is likely to make these "alternative" network technologies a standard component of future service menus.

The second technological force which has driven the evolution of VANS along an alternative services trajectory is largely software-based network applications. More important, while the underlying network technology may fuse earlier data transport functions with integrated high-performance public networks, application technology is likely to lend itself to specialist VANS outside of the public telecommunications infrastructure.

These specialist VANS concentrate on providing applications which are uneconomical, either in terms of development or management costs, for both integrated carriers and private networks. Examples of these applications technologies include industry-specific EDI, on-line reservation systems, financial/securities information and transaction services. In many cases, these systems center on common and coordinate formats for specific information distribution, access, and manipulation.

In some cases, control of the application technology such as an ATM network, a brokerage trading service, or a airline reservation system enable specialized VANS firms to continue to capitalize on their industry-specific timesharing facilities. Tesler notes that timesharing of common processing centers is still an important feature of VANS for banking, credit rating, and airline reservation applications.⁴¹

Market Drivers

⁴¹ . Tesler, Scientific America, September 1991, p. 56.

Employing these enhanced transmission and specialized application technologies, VANS have met the demand for a range of messaging, transaction, and information services that extend well beyond the menu of services provided by public telephone utilities. Early X.25 networks provided platforms for delivering fairly generic electronic mail services, on-line information, and third-party database retrieval. The X.25 packet protocol offers an effective means of connecting multi-vendor terminals and multiple baud rates.⁴² However, rising competition among VANS has led to growing specialization and customization in applications.

Emerging integrated network providers like AT&T, Sprint, and MCI are differentiating their "commodity" applications such as e-mail, information retrieval, and to a lesser extent, EDI, by extending their global reach and introducing a broad range of customized features. Simple "off-the-shelf" customization of these messaging applications includes the development of e-mail-to-LAN interconnection, as AT&T EasyLink is doing, integration with corporate e-mail and office automation systems, and customized information services like GEIS' QuikNews.

However, demand for increasingly industry-specific applications is forcing a schism in VANS provision. Those VANS providers which seek to position themselves as network integrators are offering more user-customized services. Other carriers are securing niches as specialized VANS, dedicating their resources to developing applications for particular industries.

A number of current EDI initiatives clearly illustrate this point of divergence between network managers and applications specialists. Emerging integrated networks operated by MCI, AT&T, and Sprint have introduced global EDI products such as MCI's EDI 400, an X.400 standard EDI, which are intended for fairly standardized international trade and transaction applications. In most cases, users are able to modify a basic EDI framework to their specific correspondence needs. However, unlike e-mail, EDI is likely to be more difficult to market as a global "commodity" service and industry analysts see significant barriers to widespread inter-firm, international EDI applications in the near future. Likely difficulties include cultural and language differences, inconsistent standards, legal uncertainties, and lack of international support.⁴³

On the other hand, VANS providers such as GEIS and Infonet appear to have grasp onto the industry-specific complexities of EDI applications as a means of further

⁴². Cerf, *Scientific America*, September 1991, p. 44.

⁴³. Cheryl Snapp, "EDI Aims High for Global Growth," *Datamation*, March 1, 1990, p. 77-78. Snapp cites Datapro and Link Resources analysts who both see significant barriers to near-term global EDI implementation.

differentiating themselves in the face of rising and increasingly competition to provide integrated managed networks. After developing a number of generic EDI service elements with individual functions such as payment, document exchange, and product coding, GEIS has begun to assemble these EDI building blocks into EDI packages for specific industry groups. In one case, the U.S. VANS provider has formed a joint-venture with European partners to develop an extensive vehicle tracking EDI. This alliance may help GEIS assemble a critical mass of industry-specific expertise necessary to implement flexible transportation EDI services on a global basis.

Infonet is forging alliances with PTTs to interconnect emerging public EDI services. The company's focus on public and PTT-operated services gives it an strong global platform to introduce a range of industry-specific EDI packages as they prove viable. These PTT partnerships may also enable Infontet to specialize in early public sector (transportation, customs service, government, etc.) EDI applications.

In addition to these first-tier VANS providers, a growing number of smaller, specialist firms are introducing industry-specific applications. Demand for information and transaction applications in financial services and airline industries have fueled some the earliest VANS specialization. Reuters remains one of the most prominent providers of on-line financial information and transaction and trading services. ADP and Telerate have also introduced on-line financial information. Meanwhile, SWIFT has distinguished itself by providing international inter-bank funds, information, and bulk data transfers. Numerous other banks have spun off data processing subsidiaries to operate ATM networks.

Major airlines have also established specialist subsidiaries and joint-ventures to handle reservation and ticketing applications. Covia Technologies, a subsidiary of a United Airlines-led consortium, provides reservation and luggage tracking services. Meanwhile, Easy Sabre, a reservation venture owned by American Airlines, and PARS Travel Information Service, a joint venture between Northwest Airlines and TWA, distribute their specialized applications through consumer-oriented VANS such as Dialcom, GENie, Prodigy, and CompuServe.

The relatively low-cost of developing specific VANS applications and the growing competition among first-tier VANS and integrated networks to distribute them is expanding the pool to specialist VANS into a broader range of industry niches. In another example of this trend, a consortium of retailers including The Gap, Inc., Spencers Gifts, Inc., the Summit Group, and Barnes & Noble Bookstores have formed SpecNet, a VANS venture designed to serve the specialty retail industry. SpecNet is likely to concentrate on industry-wide applications such as EDI, POS, and disaster recovery services while leveraging its members'

market power to secure competitive, long-term volume discounts from integrated common carriers. The group has already signed a contract of this nature with MCI.⁴⁴

VANS: Re-integrating Network Fragments

In addition to their role as alternative telecom services, a handful of leading VANS providers have begun to specialize in integrating the fragments of networks which embrace multi-vendor systems and services and even cross multiple infrastructure boundaries. Recent deregulation of information service provision and open network initiatives have presented users with an even broader choice of applications and service features. Coupled with falling costs and competitive innovation of front-end and CPE processors, this growing VANS menu promises to raise potential user flexibility by orders of magnitude. However, users now face the challenge of translating this flexibility into tangible and sustainable productivity gains.

Recent studies suggest that the expansion of corporate networking facilities, whether adding or upgrading multi-site networks or introducing new applications software into existing offices, corresponds with an incremental increase in the complexity of the network.⁴⁵ Slower response time to orders, deliveries, and operations changes and duplication of effort within an organization can quickly quantify the costs of poor network management and link these costs to the firm's bottom line.

As budding network integrators, VANS provider strategies have begun to attack the costs of two major facets of this increased network complexity. First, integrated VANS are positioning themselves as a managed network medium for multi-vendor equipment and services, thereby reducing the costs associated with long-term single-vendor supply relationships. Second, in the same way that early VANS reduced per-user investment in mainframe processing power, network integrators are cutting the cost of network management by exploiting significant economies of scale and scope involved in assembling network management expertise and applying that expertise to increasingly complex networks.

Technology Drivers

The distribution of processors and processing activities has begun to change the network architectures and traffic patterns, creating an increasingly strategic niche for the

⁴⁴ . Bob Brown, "Retailers Band Together for Larger Net Discounts," Network World, October 14, 1991, pp. 27, 29.

⁴⁵ . Jeremy Frank, Vice President - European Telecom Strategies, Gartner Group, ComNet conference presentation, (transcript, p. 1-3).

network manager. Distributed processing and database technology are both a product and a facilitator of corresponding trend in organization decentralization. Financial service firms like Merrill Lynch have responded to rising operating costs in metropolitan locations by transplanting their headquarters away from their marketplace. Meanwhile, many global manufacturers have moved in the opposite direction, locating distribution, marketing, and in some cases product development activities much closer to the actual consumer. As the basis for competitive advantage has shifts from scale-based production runs of uniform designs to flexible production of quantities and varieties matched more closely to local market demand, distributed product design, market research, and component sourcing information will play a much bigger role in the actual management of the firm.

In many cases, many users are opting for low-cost PC-based MIPS arranged in client/server architectures in place of centralized mainframe facilities.⁴⁶ Competition among long-distance carriers has also cut the cost of high-speed, high-capacity T1 and T3 circuits, a factor which further encourages decentralized "mesh" network architectures in place of the more traditional "host/hierarchical" networks. LAN technology allows easy local management and installation, high transmission rates, and a growing degree of connectivity. As a result, low-cost LANs and LAN-based client/server architectures are becoming the primary vehicle for distributing processing power. LAN-based network intelligence has now created a niche for VANS' LAN inter-networking applications.⁴⁷

The diffusion of distributed database facilities and the economies associated with parallel processing through distributed networks has also propelled the evolution of intelligent terminal and sub-network integration. Distributed databases such as those found in bank ATM networks and airline reservation systems allow data to be stored closer to points of frequent access thereby trimming transaction throughput. Integrated management of distributed database facilities can also cut processing costs and transaction time by simultaneously processing portions of a single transaction at different sites.⁴⁸ Moreover, smaller distributed databases can allow users to build onto their data processing facilities in economical increments, a factor that can also lower the costs of specializing segments of their networks.

⁴⁶ Timothy G. Zerbiec, "Private Network Challenges and Opportunities for the '90s," *Telecommunications*, January 1991, p.34.

⁴⁷ Zerbiec, *Telecommunications*, January 1991, p. 36. Zerbiec cites a study conducted by Timplex which found that 80% of the firms surveyed viewed LAN interconnection as a "very important" or "moderately important" priority in their network expansion plans.

⁴⁸ Mark Blakey, "Distributed Databases in Public Networks," *The Telecommunications Journal of Australia*, Vol. 38, No. 3, 1988.

The distribution of processing power and shifts in network architecture have had a direct effect on traffic patterns and the type of network needed to support them. Dispersed network sites increase the quantity of "thin-stream" traffic composed of light, sporadic volumes of often multi-protocol transmissions. Frank notes that "the problem of . . . the 'thin stream' part of the network has been exacerbated by the growing need for trading partners, for sales forces with portable PCs, and for vendors and customers to access core (corporate network) resources."⁴⁹

These emerging "LAN/mesh" architectures often require more dynamic management. While earlier SNA-style, host/hierarchical network architectures supported lower-speed, predictable patterns of data transfer, LAN/mesh networks carry fast, bursty traffic. This type of network architecture and traffic raises the demand for high bandwidth on demand, multiple protocol support, rapid connectivity, and perhaps most of all, integrated network management.⁵⁰ Dynamic bandwidth configuration is also an increasingly important feature when users need rapid response time for image transmission and processing.⁵¹

Frame relay technology which a growing number of VANS providers are installing is emerging as one solution to the costs and transmission requirements associated with networking wide-area distributed processors.⁵²

Frame Relay Implementation Schedules	
BTNA	3Q91
CompuServe	4Q91
Sprint	4Q91
AT&T	2Q92
MCI	2Q92
C&W North America	2Q92
Infonet	3Q92
GEIS	NA

Source: Communications Week⁵³.

Network architectures reflect organizational structure and consequently establish a direct link between corporate management and network management choices. Those firms with few large offices often opt for private networks which economically accommodate heavy traffic flows of data, voice, and image transmissions. In contrast, organizations built

⁴⁹ . Frank, ComNet conference presentation, January 29, 1992, Washington, D.C. (transcript, p. 4).

⁵⁰ . Sitko, ComNet conference presentation, January 29, 1992.

⁵¹ . Zerbiec, Telecommunications, January 1991, p. 36.

⁵² . Ethem, Business Communications Review, ???, p. 32.

⁵³ . Communications Week, January 27, 1992, p.43.

around multiple small sites frequently have more sparse and erratic traffic patterns. For these distributed organizations, virtual networks can provide an economical networking option.⁵⁴

As users' processing power becomes more distributed, it also becomes more heterogeneous, adding a steady stream of new vendors, new protocols, proprietary standards, and incompatible hardware to an already fragmented network landscape. Now, the lure of low-cost pipes and off-the-shelf, do-it-yourself CPE solutions has begun to fade as many users face the cost of coordinating jigsaws of network pieces.

Increasingly intelligent terminal equipment including LANs, packet exchanges, and sophisticated multiplexes complicate the task of inter-networking inter-enterprise and intra-enterprise networks. Inter-networking has become even more taxing as networks extend across national boundaries and interconnect with multiple public networks.

At the same time, multiple transmission standards often support different applications on different networks for the same user. For example, a multinational firm may require conventional circuit-switched service with an abbreviated dialing plan for its voice service, X.25 service between regional data centers, and frame-relay lines to inter-network the LANs in its sub-regional sales offices. These changing data network architectures and the growth in bandwidth-intensive applications is driving demand for multiple network standards, rapid connectivity, and integrated systems for managing it all.⁵⁵

Market Drivers

In addition to the growth in distributed, fragmented networks, the expanding market for competitive, specialized applications is also driving demand for network re-integrators. Global VANS operated by integrated common carriers such as AT&T, MCI, and Sprint as well as alternative service providers CompuServe, GEIS, IBM, Infonet, and others are becoming important distribution platforms for applications ranging from EDI and POS to messaging and on-line information services. In their role as applications distributors, VANS can leverage their investments in high performance transport networks and protocol

⁵⁴ . Mel R. Ethem, "Strategies for LAN Interconnection," Business Communications Review, ????, p. 26.

⁵⁵ . Mark Sitko, Senior Manager -- Data Services Marketing, MCI, "Data Strategies of the 1990s," (presented at ComNet conference, Washington, D.C., January 29, 1992). Sitko reinforces his argument for a multiple standards outcome with the following comments evaluation of currently available data network standards:

X.25- Allows international connectivity, but very limited speed.

Frame Relay - Suitable for certain applications, but addressing functions are limited to local and virtual networks.

SMDS - High performance but limited connectivity.

Broadband IDSN - Optimal bandwidth, application, integration, and potential connectivity, but timing of widespread implementation remains unclear.

conversion technology to provide economical, centralized access points for increasingly integrated packages of multi-vendor applications.

In many cases, common carriers such as AT&T, MCI, and Sprint have introduced their own messaging, EDI, and information service applications along with access to competing third-party services. The thrust of this applications strategy appears to be the flexibility offered by the carriers' integrated network management. This fosters symbiosis rather than competition between carriers and specialized applications providers as the carriers position themselves to capture long-term revenues from the sale of comprehensive network management and use of underlying transmission facilities while specialist firms dedicate resources to industry-specific applications. IBM is also positioning its Information Network Services as an integration medium rather than developing specific applications.⁵⁶

Unable to compete with common carrier transmission facilities, VANS such as CompuServe and GEIS have moved to capitalize on their access to and expertise in specialized applications and information services to deliver managed menus of business and consumer-oriented services. Both CompuServe's Information Services division and GEIS' GENie have tailored many of their applications to the lower end of the user spectrum. Most services are geared to small business and PC users and include features such as POS, airline reservation, on-line shopping, e-mail, CLUG bulletin boards and a range of information services. These VANS have invested in the development of applications such as e-mail, EDI, and POS. However, to a great extent, their own messaging and transaction functions integrate and market the information content of third-party specialist firms like Dow Jones, DIALOG, and Sabre.

However, demand among corporate users to lower costs and streamline management of increasingly complex multi-site, multi-vendor, integrated networks remains the strongest force behind VANS' evolution as network integrators. Although outsourcing network operations, maintenance, and management is becoming an increasingly attractive alternative for large users, many remain highly reluctant to transfer entire control of strategic telecommunications and information management resources to outsiders. As a result, the demand for flexibility, network performance, and cost-effective network management has positioned VANS not as a alternative infrastructure, but as management intermediaries between public and private infrastructures.

VANS divisions of integrated common carriers as well as specialist VANS providers are preparing to sell multiple levels of service control, capitalizing on strategic learning economies that increase with each new transmission enhancement of application feature

⁵⁶ Interview with IBM service representative, ComNet conference, Washington, D.C., January 29, 1992.

brought to market. The function of network management has rapidly expanded from monitoring and control offered by standard products and software to embrace the comprehensive management of all network operations and assets, including dynamic design evolution, integration, and maintenance.⁵⁷

This network integration function is expected to become especially important for global carriers which can provide integrated management of billing, transmission, and multi-layer application and service features. Cutthroat price competition for volume contracts under Tariff 12 and similar arrangements as well as progressive discounting of speed and bandwidth is likely to make integration expertise across a global network even more important for differentiating common carriers. As one noted industry analyst observes, "while price was the principal tool for product differentiation during the 1980s, network-based management capabilities that provide added value to raw transmission will be the key differentiator during the 1990s."⁵⁸

Three additional factors which have placed VANS in this position are the global expansion of corporate networks, the cost and complexity of managing and upgrading private network technology, and the need to adapt communication and information resources to radically restructured corporations.

Integrated common carriers AT&T, MCI, Sprint, British Telecom, and Cable & Wireless as well as VANS specialists such as Infonet, GEIS, and IBM are working to build end-to-end global networks which will meet user demands for "one-stop shopping", a catch phrase for seamless uniformity of features, management, and network quality provided by a single vendor. In the Asia-Pacific region, for example, Sprint has established SprintNet nodes in South Korea, Japan, Taiwan, Hong Kong, Australia, and New Zealand which enable multinational customers to maximize network control. Against global competitors, Sprint's global network gains value with each new country node.⁵⁹

The expansion of wide-area computing and communication facilities within an organization is likely to significantly raise the cost of comprehensive network management. Research by the Gartner Group finds that the networking and coordination of heterogeneous computer facilities has become the most rapid growing portion of most large European user's electronic data processing budgets, in some cases rising at an annual rate of 30% over the past three years.⁶⁰ VANS-managed networks are likely to enable users to economically

⁵⁷ . Howard Frank, "Network Management Products of the Future," *Network Management*, February 1991, p. 43.

⁵⁸ . Mary Johnston-Turner, "Network Management Services from MCI and AT&T," *Business Communications Review*, May 1991, p. 56.

⁵⁹ . From interview with Jim Thomas, Vice President -- South Asia, Sprint International, August 30, 1991.

⁶⁰ . Frank, ComNet conference presentation, Washington, D.C., January 29, 1992, (transcript, p. 2).

deploy the latest generation network and application technology in appropriate segments of VPNs or hybrid networks, thereby reducing or eliminating investments in private network upgrades and the related management costs of procuring, installing, and coordinating a stream of new network pieces.

The changing dimensions of user organizations also fuel demand for third-party network integrators. Mergers and acquisitions may encourage users to look to VANS as a means of reconfiguring diverse network pieces of newly combined company's. This type of "outsourced" network re-design and management approach also offers obvious advantages where combining firms wish to avoid the politics surrounding control over strategic information infrastructure. Inter-networked LANs are likely outcome of the combination of many small divisions or subsidiaries which must join multiple, heterogeneous network architectures. Ethem also notes that this type of LAN inter-network strategy is common among newer firms and among those with a large portion of "knowledge workers."⁶¹

Emerging network integrators are developing three central functions to define and market their management facilities and expertise: billing and accounting, virtual networks, and integrated network management systems INMS.

Customized billing and accounting features remain the core of most VPN services such as AT&T's Software Defined Network (SDN), MCI's VNET, C&W's VNS, and others.⁶² More important, carrier's efforts to exploit their strategic billing assets also represent some the earliest moves to re-package and sell information generated by the network. Briere suggests that access to this information will become an increasingly valuable element of VPN packages and that "good billing (is) tantamount to control over service costs."⁶³

In the 1980s, common carriers began to use their billing and dialing plan facilities to assemble private network (VPN) packages for their largest customers. VPNs generally offer large users a usage-based pricing structure in place of fixed monthly fees for private network leased circuits. Virtual networking also enables users to outsource both network management and maintenance, eliminating the cost of leased back-up circuits while guaranteeing high-quality seamless connections. Under a VPN arrangement, the network integrator, whether a common carrier or VAN, assumes responsibility for managing the underlying network architecture. This is likely to increase call set-up speed and minimize

⁶¹ . Ethem, *Business Communications Review*, ???, p. 28.

⁶² . Briere, January 29, 1992, (transcript, p. 18).

⁶³ . Briere, January 29, 1992, (transcript, p. 9).

faulty circuits, features particularly important to transaction applications and sporadic bulk transfers between LANs.⁶⁴

While VPNs have evolved as heavily voice-based service packages which often encompass multi-year, volume discounts, integrated services are an increasingly important competitive variable among this class of VANS provider.⁶⁵ However, common carriers' integrated network initiatives may reveal an important point of divergence among network re-integrators. Briere has already begun to identify the segmentation of first-tier integrated network providers dominated by AT&T, MCI, and Sprint, and a second-tier VPN providers. The first-tier network integrators assemble customized VPN "partnerships" geared to their largest users. These arrangements include co-development of applications, outsourcing of specific network operations, and heavily-discounted volume transmission contracts. Second-tier VPN providers, which are likely to include regional inter-exchange carriers as well as BOCs, will offer fixed-price pre-packaged VPN services geared to smaller customers.⁶⁶

First-tier network integrators are transforming basic VPNs into comprehensive, long-term managed network arrangements. Within service packages such as AT&T's Tariff 12 and MCI's Global Communications Service (GCS), service features have begun to extend beyond voice-based dialing plans and administrative features of VPNs but now offer centrex, intelligent processing, advanced data services, network-based CPE functionality, and integrated network management platforms.⁶⁷

As these multi-year customized service plans and outsourcing arrangements become intricately imbedded in firms' organizational, operations, and management infrastructures, the costs of change-overs and migration among competing network integrators will likely become prohibitive.⁶⁸ Joint development of applications will crystallize alliances and the customized network management solutions will become the basis of carrier-user relationship. These considerations will determine which, and to what extent large users turn over their strategic network resources to outside management. Conversely, this will also influence VANS providers' strategies for developing appropriately flexible packages of integrated

⁶⁴ Donald Heath, "Virtual Networking/Telecommunications," *Telecommunications*, January 1991, p. 25.

⁶⁵ Interview with Seth Blumenthal, President, MCI International, August 30, 1991. MCI's VPN development is an example of the evolution from billing-oriented voice service to integrated global services. First launched in the U.S., MCI's VNET provides primarily customized billing and dialing plans for large corporate users. The company's more recently Global Communications Service (GCS) integrates these features with capabilities for data and image transmission.

⁶⁶ Briere, January 29, 1992, (transcript, p. 8).

⁶⁷ Daniel Briere, "The Status of U.S. and Global Virtual Network Services," presented at ComNet conference, Washington, D.C., January 29, 1992, (transcript, p. 4).

⁶⁸ Briere, January 29, 1992, (transcript, p. 12).

services. To some degree, these long-term contracts assure a revenue stream necessary to support the development of particularly industry-specific applications.

However, users' reservations concerning long-term control of network evolution and management, recent surveys indicate that a rising segment of the corporate network market is preparing to outsource network management and operation functions.⁶⁹ This market for virtual networks is likely to generate the following near-term outcomes:

- Fierce competition among network integrators to win and keep VPN accounts, as the loss of a long-term "relationship" will have serious competitive ramifications in a rather limited market of "largest users."⁷⁰ Competition against both other network integrators as well as users' in-house resources is likely to drive innovation and flexibility in network management and service integration.
- Users are likely to first outsource "non-essential", non-dynamic, or more routine network management functions. Competent and competitive performance in the handling of these services will aid carriers and VANS providers in selling more comprehensive network integration packages.
- Public sector (federal, state, and local governments & agencies) are particularly good candidates for more comprehensive outsourcing arrangements given their budget structures, shared resources and interconnection requirements, and lower strategic or "competitive" importance of network resources.⁷¹
- Hybrid networks are likely to become a general solution for many global user needs. This will establish those carriers and VANS providers with seamless global facilities as the integrators of a broad range of multi-vendor hardware, protocols, and applications and a combination of private and virtual networks.⁷²

Meanwhile, pre-packaged VPN options will offer a different variety of flexibility to smaller users. While individual VPN packages may provide less customization than those delivered to large users, a broader pool of VPN providers promises a greater and more competitive selection of products.

Global carriers are developing integrated network management systems (INMS) as the keystones of their network integration strategies. The initial phase of NMS development for most carriers chase concentrated designing products for the management of rather narrow

⁶⁹ Johnson-Turner, *Business Communications Review*, May 1991, pp. 55-61. In recent interview with 40 large carrier accounts, Johnson-Turner finds that roughly half the user organizations were actively considering outsourcing some of their network management. Most indicate they are more likely to farm out voice services while more strategic LAN and data networks are kept in-house.

⁷⁰ Briere, January 29, 1992, (transcript, p. 12).

⁷¹ . Dennis Livingston, "Hot Market: State & Local Government." *Systems Integration*, June 1991, pp. 30-35.

⁷² . Jeremy Frank, Gartner Group, presented at ComNet conference, January 29, 1992, (transcript, p. 7).

sets of functions of a single layer of the OSI model. However, as Frank observes, that trend in innovation should progress toward systems that handle multiple protocols and functions within a network layer and that coordinate multiple layers simultaneously, allowing the integrated control of traffic, network access, and applications.⁷³ Current network management product lines offered by AT&T, MCI, and others center on discreet NMS "elements" for VPNs. These element management systems (EMS) originally concentrated on diagnostics and network monitoring, however more recent enhancements allow for activation/deactivation of services and configuration management.⁷⁴ This EMS approach positions potential network integrators to sell elements of the network management equation while retaining control of much its overall integration. For integrated carriers, the desired result is likely to be alliances of user-managed services riding on top of carrier-managed VPNs.⁷⁵

III. VANS in the Future

The VANS provided by integrated common carriers and specialized VANS are clearly evolving along two general trajectories which position them either as network re-integrators, responsible for coordinating multiple infrastructures, or as alternative telephone companies, providing specialized menus of applications. These two trajectories are likely to yield four distinct outcomes:

- (a) Global carriers which concentrate on integrating disparate (in terms of technology, ownership, and management) services and infrastructures through customized yet flexible management solutions.
- (b) Local VANS providing specialized applications (including management applications) to compensate for inadequacies in the dominant public (or private) telecom infrastructure. Interconnection of these local VANS would be administered by and through global carriers.
- (c) Local or regional carriers which provide a mix of network integration and specialized services. Many of these firms will fall into the "second-tier" of network integrators, offering relatively standard VPN packages at fixed prices.

⁷³ . Frank, *Networking Management*, February 1991, p.44.

⁷⁴ . Johnson-Turner, *Business Communications Review*, May 1991, pp. 55-61.

⁷⁵ . Interview with MCI spokesperson, January 29, 1992.

(d) Global operators of specialized services which tailor the service to specific local demands.

Table 1: VANS Application/Service Matrix

	Specialized	Integrated
Local	INFO POS EDI GATE ATM MON DB MESS	OUT INMS LAN PROT VPN
Global	EDI ATM/POS INFO MON GATE MESS	LAN OUT PROT VPN INMS
	<= Greater Specialization	Less => <= Greater Integration Less =>

KEY:

ATM banking automatic teller network
 POS point-of-sale network
 EDI industry-specific EDI
 MON remote monitoring & tracking
 DB database retrieval (including image & full-text
 databases)
 INFO on-line information service

GATE information gateway (specialized)
 MESS messaging
 INMS integrated network management
 OUT complete network outsourcing
 VPN virtual private network
 LAN LAN interconnection
 PROT protocol conversion

Table 2: VANS Provider

	Specialized	Integrated
Local	BOC SP VANS CATV	BOC SI rIXC
Global	SWIFT REUT DUN COMP	GEIS INFT BTNA AT&T Sprint MCI IBM EDS
	<= Greater Specialization	<= Greater Integration

KEY:

BOC Bell Operating Companies

SP specialized local applications providers

VANS local VANS (providers of multiple applications to a specific industry)

CATV cable TV operators

SI local systems integrators

rIXC regional inter-exchange operators (e.g. Metromedia, C&W N.Amer)

SWIFT SWIFT

REUT Reuters plc

DUN Dun & Bradstreet

COMP CompuServe

INFT Infonet

GEIS GEIS

IBM IBM

EDS Electronic Data Systems

MCI MCI

Sprint

BTNA British Telecom N. America

AT&T AT&T

Competition among both global and local VANS providers will center on connectivity. One facet of the connectivity equation will focus on technical connectivity with end-user and end-user applications (e.g. e-mail standards, EDI, LAN interconnection, etc.) Another major facet will concentrate on connectivity among networks and infrastructures (e.g. global network alliances, local VANS joint-ventures, multi-vendor service provision).

VANS also may be forced to accommodate or compete with new infrastructures such as CATV. Until recently, few VANS have extended services specifically to the residential user market. Perhaps because of the large sunk investment in production facilities and off-

shore production arrangements, manufacturers have been equally slow to modify the most universal "terminal" device, the television set. Moreover, BOCs and their local public network subsidiaries have retained a deadlock on the "last mile" delivery infrastructure. BOCs have retained a steadfastly utility-style approach to providing plain dial-tone to a largely captive market.

As regulatory barriers recede, BOCs face the opportunities to differentiate themselves within the VANS market as either providers (or at least distributors) of industry-specific, and region-specific information services and network applications or local network integrators. However, BOCs face a number of formidable entry barriers.

First and perhaps most fundamental, BOCs must transform their service delivery strategies from those that address a rather uniform mass-market, to those geared toward increasingly sophisticated and specialized needs of an increasingly segmented market.⁷⁶ To accomplish this, many BOCs will have to forsake the more traditional arms-length relationship between public utility provider and user to pursue collaborative solutions.

Second, BOCs are likely to confront a prohibitively steep learning curve in any efforts to industry-specific information content or applications independently. Strategic alliances will become essential to provide services such as electronic claims processing, medical image database retrieval, and on-line entertainment. Successful collaborations could give BOCs important first-mover advantages and specialized services and accompanying technologies which they then could offer on a national or even global scale. Abortive attempts to develop these services on their own could drain investment away from other critical network enhancements.

Third, global VANS will have an early edge over BOCs in providing network integration and out sourcing, though BOCs may be able to retain a competitive position with lower-cost, off-the-shelf networking and management solution. However in a more liberal regulatory climate, BOCs' ability to take advantage of both niche manufacturing (such as specialized, intelligent VANS terminal equipment) and niche VANS applications and information services could provide an important dynamic for linking and guiding network and applications evolution.

Moreover, a number of recent regulatory, manufacturer, and service provider initiatives suggest that pay TV may become a more viable information and VANS delivery medium in the future. Among terminal manufacturers, AT&T and Nintendo have reportedly discussed adapting the Japanese suppliers video game terminals to permit TV viewers access to a variety of interactive services. More recently, Hewlett Packard announced terminal

⁷⁶ . Permut, *Telephony*, June 15, 1992, p. 94, 96.

innovations that will permit interactive applications on pay TV. At the same time, emerging mobile data and wireless communication services present yet another infrastructure on the horizon.

At the same time, the FCC has begun to loosen its grip on local network competition, providing bypass alternatives to BOC networks. Cable television operators have begun eyeing these entry points into high-performance telecom service. In February 1992, two of the largest Cable operators, Cox Enterprises and Tele-Communications, purchased the Teleport Communications Group, a competing local network provider with sizable installations in New York, Los Angeles, and Chicago. Meanwhile, cable operators have already built an alternative transmission infrastructure which surrounds 90% of U.S. residences⁷⁷.

While cable operators present a serious threat to common carriers' information services and VANS, this emerging infrastructure could present an important opportunity for other VANS firms. Service alliances between cable operators and specialized VANS could provide a competitive delivery medium for the VANS, which so far have relied on leased common carrier infrastructures. Like common carriers, cable operators have developed extensive billing systems and networks well-suited for consumer applications such as home-banking, shopping, information services, and consumer-oriented EDI.⁷⁸

Conversely, these partnerships could offer cable operators a critical mass of networking, application, and information programming expertise. Entertainment provision and programming have shaped most current cable providers' service strategies, and few if any have developed expertise in interactive service management, marketing, or applications.⁷⁹ VANS firms such as GEIS, CompuServe, and the Sears/IBM venture, Prodigy, could offer important applications and network management expertise.

Although the four possible VANS outcomes presented above are likely to splinter into a far greater number of service niches and overlapping network domains, the evolving VANS dynamic does point to a mesh of networks, applications, and providers which are built as much upon an intricate overlay of organizational arrangements and alliances as it is upon the underlying Infrastructural fabric. While first-mover initiatives are likely to be important in determining which services specific BOCs specialize, the largest global players like AT&T, IBM, and BTNA will be able to participate in the VANS market at multiple levels, as they

⁷⁷. "Cable TV Battling Phone Companies." New York Times, March 29, 1992, pp. A1, A16.

⁷⁸. "Consumer-oriented EDI" might include banking, shopping/order entry, application processing, bill payment, and tax filing applications.

⁷⁹. "Cable TV Battling Phone Companies." New York Times, March 29, 1992, p. A16.

simultaneously provide corporate network management, specialized network and terminal hardware, and software-based applications deliverable over a range of infrastructures.

APPENDIX: VANS PROFILES

AT&T

AT&T is gradually integrating and enhancing its basic voice and data services to compete in the VANS market. AT&T's VANS service development appears to be focused on specialized applications, managed virtual networks, and global end-to-end connectivity.

AT&T's ACCUNET packet and digital data network has provided the basis for AT&T's initial entry into the VANS market. Until recently, FCC regulations had limited ACCUNET to a strictly data transport function. Although ACCUNET could accommodate a variety of closed user group (CLUG) service options within these regulatory boundaries, AT&T was not able to integrate packages of transmission and services. As a result, AT&T could not directly offer EDI or remote processing applications as part of its ACCUNET package¹.

To circumvent regulatory obstacles to providing end-to-end management, PAD, and protocol conversion features that would enable the carrier to compete against alternative data carriers for X.25 traffic, AT&T teamed up with Control Data Corporation to offer REDI-ACCESS.

AT&T has now expanded ACCUNET to offer digital data service up to 1.5 Mbps, X.25 transmission, protocol conversion, and delivery of applications such as e-mail and transaction services.

AT&T has consolidated the bulk of its individual VANS applications under its AT&T EasyLink Services business unit. Formed in January 1991 following AT&T's acquisition of the global messaging assets of Western Union's EasyLink division, AT&T EasyLink is expanding its array of global messaging and information services. Combining EasyLink and AT&T Mail operations has given AT&T EasyLink the largest domestic e-mail network, totaling close to 300,000 mailboxes². AT&T EasyLink also offers enhanced fax, telex, EDI, and bulletin boards.

AT&T has also begun to explore VANS applications beyond EasyLink. In mid-1989, AT&T began discussing a joint venture with Japanese computer and video game manufacturer Nintendo that would provide users with access to AT&T TV-based

¹. "AT&T ACCUNET Packet Service," Data Networking, April 1991, Datapro Information Services Group.

². PC Computing, June 1991.

information services through their Nintendo game equipment³. In addition, AT&T has established a business unit specializing in remote security and monitoring services.

AT&T has developed both comprehensive managed network packages geared to its largest customers while at the same time introducing network management features which give users a high degree of control of individual services. AT&T has leveraged its position as a dominant long-haul carrier to wean large users onto virtual network packages which are built around multi-year Tariff 12 service contracts. Tariff 12 arrangements enable AT&T to offer large, customized discounts and billing programs for its largest customers. As of 1991, AT&T had 88 Virtual Telecom Network Service (VTNS) arrangements in operation, representing more than 70% of the carrier's Tariff 12 contracts⁴. VTNS offers users customized integration and management of services such as AT&T's Software Defined Network, ACCUNET, as well as standard voice and digital data services.

AT&T's SDN also provides a range of VPN features that compete with the global VPNs offered by Sprint, BTNA, MCI, Infonet, and others. Like many of its competitors, AT&T based its early SDN around customized calling and billing plans and is now expanding it into a user-managed virtual network service⁵. AT&T has enhanced its SDN's traffic reports and cost/accounting management features with its Service Management System which allows for user-controlled configuration and routing based on real-time network information. AT&T has also introduced a second version of SDN, its Software Define Data Network (SDDN) which provides additional services such as switched T1 and fractional T1.

AT&T has also enhanced user management of its ACCUNET services. AT&T has introduced customer-controlled configuration, and more recently, its Bandwidth Management Service-Extended (BMS-E) which allows end-to-end circuit reconfiguration by the user⁶. AT&T's network management systems offer the virtual network user flexibility to select and manage its own mix of component services while AT&T manages much of the underlying physical network.

Through its Bell Labs and AT&T Network Systems, AT&T has access to some of the industry's leading R&D and manufacturing facilities. In theory, this should enable

³. Wall Street Journal, ????

⁴. "AT&T ACCUNET Packet Service," Data Networking, April 1991, Datapro Information Services Group.

⁵. Business Communications Review, May 1991.

⁶. Business Communications Review, May 1991.

AT&T to respond quickly to demands for new or modified software and hardware products.

Global connectivity is clearly an growing priority for AT&T. Through alliances with overseas PTTs and VANS operators, AT&T EasyLink is working to expand end-to-end service. AT&T EasyLink's end-to-end service is based on enhanced PBX technology which is installed in local nodes of the carrier's global network. End-to-end messaging will allow AT&T to offer more uniform feature sets, service quality, and network management. AT&T has also expanded EasyLink connectivity with addition of X.400 service and e-mail-to-LAN links.

Recent moves to establish these end-to-end connections include a joint venture with Hong Kong VANS operator, Hutchison Telecom and the expansion of the services offered through its 50%-owned Japanese VANS operator, Japan ENS Corporation. Japan ENS also provides end-to-end service for AT&T's ACCUNET services.

In addition to EasyLink's global operations, AT&T has also begun extending SDN internationally. The combination of EasyLink and SDN will enable AT&T to offer hybrid network solutions for global private networks.

US Sprint

US Sprint entered the VANS market by absorbing the GTE Telenet organization when GTE Corporation and United Technologies launched Sprint in 1986. The original Telenet Public Data Network and related network equipment manufacturing facilities were purchased by GTE in 1979. Under Sprint management, Telenet's X.25 backbone became SprintNet, the foundation for most of US Sprint's VANS. In 1990, US Sprint reorganized its domestic VANS, including SprintNet under its Sprint Data Group business unit. International VANS including SprintNet service outside the U.S. were turned over to US Sprint subsidiary, Sprint International. Sprint has concentrated recent VANS development efforts on VPN and LAN-interconnection applications.

Current Sprint VANS applications focus on LAN-interconnection services and the global messaging services. Along with its international SprintMail e-mail service, Sprint International also offers enhanced fax, telex, information services, and EDI.

LAN-interconnection has become a top priority among Sprint's planned VANS innovations. In 1991, Sprint introduced frame-relay service on its SprintNet backbone with the intention of using the higher network capacity to promote new LAN-LAN and subnetworking applications. Prior to introducing frame-relay service, Sprint had already begun offering its LAN Reach Service though which users could use a broad range of third-party bridge, router, and gateway products to connect remote LANs over SprintNet.

Sprint is now preparing to unveil SprintLink, a LAN interconnection service designed for TCP/IP rather than frame-relay transmission. Scheduled to go into service in March 1992, SprintLink is well suited to serve government network users such as NASA, the National Science Foundation, and others that have built large TCP/IP networks.

Sprint is also trying to increase customer flexibility and management features on its SprintNet. SprintNet now allows customers to split leased T1 facilities to permit customized combinations of VPN, 800-, Switched 56, and other enhanced services⁷. Like an increasing number of its competitors, Sprint is permitting users to choose from a broad menu of transmission and application features which are then integrated into a single virtual network package. Currently, SprintNet carries at least 3,000 virtual networks⁸.

Through the former Telenet R&D and manufacturing facilities in New Jersey, Sprint has access to its own data network technology. The company continues to develop its TP-series packet switches and has recently introduced its TP4900 switch is being installed in SprintNet to provide simultaneous X.25 and frame-relay transmission. Along with its role as a network equipment supplier, Sprint has also inherited a worldwide installed base of Telenet packet switches which provide potential connection points for extending end-to-end SprintNet service.

Sprint's end-to-end global connectivity is likely to become increasingly important for defining its slot in the international VANS market. Sprint has teamed up with Cable & Wireless (C&W) to develop a "global digital highway", using undersea optical cable networks, Sprint's trans-American fiber network, and C&W's collection of operating companies which span from Hong Kong to the Philippines and the Caribbean. The C&W/Sprint alliance could provide the basis for a seamless global network capable of providing common service and network management feature sets throughout.

MCI Communications

MCI has opted for a two-pronged approach to VANS provision. The carrier is developing its VANS including managed virtual network services and messaging services and at the same time, has acquired a 25% stake in Infonet Services Corporation, a major domestic and international VANS provider.

MCI's VANS applications center around its MCI Mail global messaging service. In addition to e-mail and telex service, MCI has also introduced its MCI EDI 400, an

⁷. "US Sprint Communications Co., SprintNet," *Datanetworking*, August 1991, Datapro Information Services Group.

⁸. "US Sprint Communications Co., SprintNet," *Datanetworking*, August 1991, Datapro Information Services Group.

X.400 standard international EDI. MCI continues to work on expanding the connectivity of its messaging applications. In 1991, the carrier acquired Lotus Express, originally a joint venture between MCI and Lotus Development Corporation which was formed to create PC-based e-mail software.

Recognizing that VANS competition is focusing increasingly on network management, MCI has segmented its customers into categories of network management demand: (a) those customers who require only basic network maintenance, (b) those customers who require management information for a single type of service, (c) those customers who require a single network management interface to monitor and control a variety of service provided by MCI, (d) those customers who require a single interface to permit management an integrated combination of MCI services, private network services, and/or services provided by a third-party VAN, and (e) a completely outsourced network in which all operations are transferred to MCI⁹.

Managed virtual networking remains the core component of MCI's VANS strategy. MCI's VNET was the company's first VPN product which offered largely administrative management features such as abbreviated dialing and segmented billing for MCI's major domestic long-distance customers.

However, MCI has extended VNET's network management emphasis from customized accounting to customer-controlled integrated voice and data service. Recent service enhancements appear allow customers to integrate MCI services as well as services provided by MCI and other networks. MCI has introduced its Integrated Network Management Service (INMS) in which MCI customizes a network management packages to meet the specific needs of a particular bundle of MCI services. MCI's FocusNet offers the same type of customized network management for a hybrid network using a mix of MCI, private network, and third-party VANS.

Unlike AT&T and Sprint, MCI does not maintain direct access to hardware and software technology with its own R&D and manufacturing facilities. Instead, much network equipment is supplied by outside vendors competing for long-term, volume contracts¹⁰.

MCI has extended its VPN service overseas with its Global Communications Service (GCS). GCS provides a "one-stop-shop" package of services including bulk data, customized billing, integrated voice/data, and others for multinational customers. MCI's acquisition of RCA Global and Western Union International operations have provided

⁹. Business Communications Review, May 1991.

¹⁰. Interview with MCI representative, November 1991.

connections with numerous public data networks and PTTs overseas. However, MCI does not offered the same level of end-to-end connectivity provided by the in-country hardware installations of competitors AT&T, Sprint, and BTNA.

BOCs

Post-divestiture regional Bell operating companies (BOCs) had been barred from providing most VANS until a March 1988 court decree opened information gateway and information storage services to BOC competition. While BOCs were now permitted to develop gateway-type services such as videotex access to third-party information services, federal regulations still prohibited local carriers from generating or altering the content or format of the information delivered.

In the face of widespread objection from emerging electronic information providers such as newspapers and wire services, Judge Greene's July 1991 ruling has now pave the way for the seven regional BOCs to introduce a much broader range of information services.

Despite the optimistic market projections and the new freedom to create and manipulate the content and format of their transmission pipes, BOCs have moved cautiously into a young market. A number of BOCs have begun to venture into established VANS market segments such as e-mail and EDI. Bell Atlantic, for example, has introduced local e-mail, e-mail-to-fax, and EDI services.

However, the thrust of much BOC VANS development appears to be concentrated on value-added enhancements to existing services or highly specialized VANS catering local niche markets. Pacific Telesis has begun to exercise its freedom in information provision to integrate new information services with existing local and mobile services. In one case, Pacific Telesis subsidiary, PacTel Paging has introduced its "Page Line News", which delivers news and information to paging subscribers. Pacific Bell has also introduced a voice messaging service available to basic network subscribers.

Pacific Telesis' vehicle tracking service, Teletrac, is an example of a specialized VAN with a specific application in a regional market. Teletrac was established in 1988 as a joint venture with a small San Diego-based firm. Initial Teletrac efforts concentrated on software development, as PacTel was still barred from active participation in VANS. PacTel has also formed a new division to develop and market wireless enhanced services such as cellular-based packet-switched service, EDI, database retrieval, and e-mail.

However, a far more significant move may be the possible divestiture of the Pacific Telesis organization to unharness non-regulated business units from more restrained local network subsidiaries, Pacific Bell and Nevada Bell. PacTel is reportedly considering

spinning off PacTel Cellular, PacTel Paging, PacTel Teletrac, PacTel Cable, and PacTel International as separate and independent subsidiaries.¹¹ This could accelerate PacTel's diversification into long-distance, VANS, or manufacturing competition.

Bell Atlantic is also working to develop specialized VANS applications including image database retrieval services which will be marketed to local and regional law enforcement agencies, hospitals, and insurance firms and personal health monitoring services. Other specialized VANS in Bell Atlantic's planning pipeline include electronic claims processing, remote energy management, and residential and commercial security monitoring.

At the same time, Bell Atlantic has begun to pull ahead of its other BOC counterparts in ISDN deployment. Bell Atlantic plans to increase ISDN penetration from 38% of its subscriber base in 1991 to at least 87% of its network by 1994.¹² This suggests that Bell Atlantic is not only channeling its investment into customer-focused applications but also into the quality and intelligence of the network that delivers them.

¹¹. "Pacific Telesis Mulls 'Mini' Divestiture," Telecommunications, June 1992, p. 14.

¹². See "RBOC ISDN Plans," Telecommunications, March 1992, p. 11.

	1991		1992		1993		1994	
	lines (mil)	%	lines	%	lines	%	lines	%
Bell Atl.	6.9	38	14.8	79	15.8	82	17.8	87
Ameritech	2.2	13	3.4	31	8	51	11.2	70
USWest	3.7	29	6.7	43	7.6	NA	8	39
BellSouth	3.1	17	5.6	30	8	41	10.3	32
PacBell	4.1	30	4.7	33	5.8	39	7.5	50
Nynex	1.3	8	3.9	23	5.3	32	5.3	33
S. WestBell	1.6	13	2	16	2.1	16	2.2	16

Telecommunications, March 1992, p. 11.

Note: "%" represents percentage of total network.

J.P. Sprafkin, July 20, 1992

British Telecom North America

British Telecom North America (BTNA) is a wholly-owned U.S. subsidiary of the U.K. public carrier. British Telecom established BTNA as its U.S. VANS platform after acquiring the Tymnet global packet switched network from McDonnell Douglas in 1989. The Tymnet network was originally built by Tymshare, Inc. to connect users to the company's computer timesharing facilities. McDonnell Douglas then purchased the network from Tymnet, Inc., an earlier outcrop of the Tymshare organization.

With 4,500 network processing nodes worldwide, 3,500 of which are in the U.S., BTNA's Tymnet network provides the backbone of its global VANS. Tymnet's manufacturing facilities, "Engine" packet switch product line, and global installed base of Tymnet-owned and managed network nodes enables BTNA to provide three distinct levels of service: (a) end-to-end service on BTNA owned and operated nodes which currently provide seamless connectivity and uniform service options to 20 countries, (b) enhanced service whereby BTNA supplies only the packet switch technology while facilities are owned and operated by the local PTT or service provider, and (c) a X.75 interconnection which interconnects public or private X.25 networks with BTNA's global VAN¹³.

From its outset, BTNA directed its efforts toward developing integrated global VANS. The company has introduced its Global Network Service (GNS), a "one-stop-shop" service which attempts to integrated various VANS features into a customized VPN for multinational customers. However, industry analysts estimate that these and other international services accounted for only some 10% of BTNA revenues in 1990¹⁴. Recent efforts to expand VPN service on its GNS include a five-year \$25 million outsourcing contract signed with JP Morgan in early 1992. Under this contract, BTNA will take over operation of the X.25 portion of the bank's global private network by migrating traffic to a virtual network on GNS.

Individual VANS applications offered by BTNA include EDI*Net, a public EDI service which currently has some 1,000 users; XLINK Express, a bundled synchronous X.25 service for volume customers; and Telenet's OnTyme and BT's Dialcom e-mail services. BTNA also offers e-mail access to additional on-line information services such as AP, UPI, and Dow Jones news services, OAG, SABRE, and a variety of commercial databases.

¹³. Interview with British Telecom North America representative, August 29, 1991.

¹⁴. "BT Tymnet Public and Private Data Network Services," *Data Networking*, December 1990. Datapro Information Services Group.

Until recently, information services appear to have been secondary emphasis for BTNA. Now, BTNA has teamed up with Telebase Systems Inc. to develop and information gateway service, Cyclopean Gateway Service (CGS)¹⁵. Provided over Dialcom and will boost on-line information offered by BTNA.

BTNA also established itself as one of the earliest providers of POS and credit card authorization services. Commands a vary large share of that market according to industry analysts¹⁶. Outside of EDI and credit card verification, for which BTNA has special marketing teams and programs, the VAN has developed few specialized services¹⁷. However, one move in this direction has been BTNA's partnership with Swissair and Tandem Computers to build and operate the Cargo Community System, a transportation EDI.

Like other VANS, BTNA expanding its network management services to deliver a higher degree of service integration and customization to corporate users. BTNA had based its initial network management services on a system inherited from McDonnell Douglas. The Douglas-designed systems allowed users to monitor their own network and service operations.

However, BTNA introduced its CONCERT Integrated Network Management System, an OSI-based system developed by BT which could redefine BT's VANS role. CONCERT is designed to permit integrated management of multi-vendor equipment and network services. MCI and AT&T network management innovations have both moved in a similar direction. However, MCI's system is based on an IBM standard, thus lacking the global connectivity of BTNA's OSI system, and AT&T has not matched BTNA's global reach¹⁸.

BTNA's CONCERT does not accommodate customers own network management and applications interfaces. The VANS provider its reportedly working with DEC, IBM, and others to establish customer interfaces with specific products, particularly those with large global installed bases.

¹⁵. "BT Tymnet Public and Private Data Network Services," Data Networking, December 1990. Datapro Information Services Group.

¹⁶. "BT Tymnet Public and Private Data Network Services," Data Networking, December 1990. Datapro Information Services Group

¹⁷. Interview, British Telecom North America representative, August 28, 1990.

¹⁸. Business Communications Review, December 1990.

Like MCI, AT&T, and others, BTNA seeks to operate and manage customer networks while selling the customer's the capability of managing individual service performance, service combinations, and network configuration¹⁹.

CompuServe

Unlike many VANS competitors, CompuServe has concentrated heavily on consumer-oriented applications. Through its flagship Information Services division, the H&R Block subsidiary has melded a broad range of information services developed both in-house and by third-party providers with enhanced delivery over its 1,300-node national X.25 network and extensive e-mail system²⁰. However, CompuServe's recent efforts have directed more investment toward expanding the presence of its Network Services division in the corporate VANS market. CompuServe Network Services has introduced frame-relay service and is now aggressively expanding its LAN interconnection applications. So far, the VANS has not directly integrated its third major business unit, Software Products, into either is consumer or corporate VANS.

CompuServe's Information Services continues to define its position in the VANS market. The company provides one of the world's largest on-line information services for PC users, including services such as airline reservations, database access, and e-mail. Industry analyst's estimate that these small-user dial-up services accounted for nearly 40% of total CompuServe revenues in 1990²¹.

Specific business applications such as point-of-sale/point-of-service (POS) transaction processing remain an important component of CompuServe's Network Services. Such services have targeted banks, retailers, and credit card issuers such as VISA.

CompuServe's approach to network management reflect the company's niche in providing application-oriented VANS to small-and medium-sized corporate customers which do not maintain large in-house network management teams. Although CompuServe's Host Administrative Program does permit customers to control certain functions such as security codes and passwords, much of the VANS' overall NMS

¹⁹. Business Communications Review, December 1990.

²⁰. "CompuServe Network Services," Data Networking, August 1991, Datapro Information Services Group.

²¹. "CompuServe Network Services," Data Networking, August 1991, Datapro Information Services Group.

offerings tend to emphasize user friendliness over customer-control²². The company handles much network management itself through centralized NMS facilities. Customer service is then handled by fleet of representatives and local offices. Effective marketing CompuServe information services and new service features for small and mid-sized customers but less effective for real-time NMS demands of larger corporate and hybrid network users. Similarly, menu-driven service access appears to have a priority over CompuServe's more limited range of network monitoring features.

However, CompuServe early introduction of its FRAME-Net frame-relay service may be an attempt to bridge the gap in competition with more corporate-oriented VANS competitors like GEIS and BTNA. Like most other VANS providers, CompuServe Network Services is using its new frame-relay service to address increased demand for LAN interconnection among geographically distributed corporate network users.

Still, CompuServe appears to be developing new network services relatively independently. The company has yet to focus on integration of various network and information services or the development of flexible, modular NMS choices to compete with those offered by Sprint, MCI, and others.

Also, not expanded internationally like other VANS, instead international connections handled through its gateway on BTNA global network.

Although CompuServe manufactures its own MicroNode network processors, the company has begun expanding its access to new network and application technologies through strategic partnerships and alliances. Recent technology alliances have focused on CompuServe's new LAN interconnection services. CompuServe is working with Eicon Technology Corp. to develop gateway and router products to expand the VANS' ability offer LAN-LAN and LAN-network interconnection. Compuserve also acquired MicroSolutions, Inc., a LAN systems integrator and another systems integrator, SEARA Information Strategies Corp. in 1991. The VANS provider is now in the process of folding both systems integration subsidiaries into its Network Services unit in an effort to develop a broader range of customized LAN interconnection solutions on its frame-relay network²³. CompuServe has also formed an alliance with Telepartners, Inc., to market products to join PCs and mainframes over CompuServe's network.

In addition, CompuServe has acquired or allied with a number of software houses to gain access to both VANS and non-VANS technology. The company's acquisition of

²². "CompuServe Network Services," Data Networking, August 1991, Datapro Information Services Group.

²³. "CompuServe Network Services," Data Networking, August 1991, Datapro Information Services Group.

accounting software developer Collier-Jackson has not yet translated into a specific VANS, but the relationship does give CompuServe access to software needed to explore accounting industry VANS in the future. More recently, CompuServe entered an alliance with Sterling Software's Ordernet division to gain access to EDI technology developed by the company²⁴.

GE Information Services

General Electric subsidiary, GE Information Services (GEIS) has evolved from the timesharing operations of GE's diversified industrial organization into a global VANS provider. Like many early VANS, GEIS began its remote computer processing business in the mid-1960s and developed various VANS applications around the MARK*NET packet switched data network which it introduced in 1984. GEIS had estimated revenues of \$500 million in 1990²⁵.

GEIS is concentrating its service evolution in two directions: toward integrated management of global virtual networks and industry-specific VANS applications, particularly EDI.

GEIS has developed a range of e-mail, POS, EDI, and information services on which it delivers over its MARK*NET network. Like many competitors, GEIS e-mail innovations have focused on increased connectivity with both in-house corporate systems and X.400 networks. GEIS introduced X.400 service on its QUIK-COMM global e-mail system in 1990. So far, the company has interlinked QUIK-COMM with MCI Mail, AT&T Mail, and EasyLink services. In addition, GEIS has developed BusinessConnect a QUIK-COMM feature that permits interconnection with most corporate e-mail networks²⁶.

Similar to CompuServe or more recent entrant, Prodigy, GEIS has developed a consumer-oriented portfolio of on-line travel, financial, shopping, and news information and database access under its GENie service. However, GEIS has also begun to add customized information delivery with its QuikNews service, which was introduced in early 1990²⁷.

²⁴. "CompuServe Network Services," Data Networking, August 1991, Datapro Information Services Group.

²⁵. Forbes...???

²⁶. "GE Information Services, Network Services," Data Networking, August 1991, Datapro Information Services Group.

²⁷. "GE Information Services, Network Services," Data Networking, August 1991, Datapro Information Services Group.

However, EDI and transaction services are clearly the thrust of GEIS current service development. GEIS has introduced five generic EDI applications features which include payment, document exchange, and product coding systems as well as two user software packages. The company has also begun to develop customized EDI systems for transportation, retail, petroleum, and automotive industries. GEIS had more than 7,600 companies linked to its EDI services at the end of 1990²⁸.

GEIS has sought out industry partnerships to launch early EDI ventures. In mid-1990, GEIS entered a joint-venture with STET subsidiary, SARITEL, and Germany's Transpotel which will implement the EC's IMPACT vehicle tracking project. The three partners are developing the Open System Integrated Roadway Freight Information Service (OSIRIS), an EDI which is likely to form an important component of GEIS' global transportation EDI.

In another move into industry-specific transaction applications, GEIS introduced its MANOR reservation system. Brought into service in 1990, MANOR provides reservation services for the hotel industry as well as interconnection with airline reservation systems²⁹.

GEIS is also steering its network management development toward integrated management of virtual networks. The company's Managed Network Services offer customized design and configuration, billing, and multivendor product integration features for global virtual data networks. Evolution of network management features has moved in the direction of real-time monitoring and application management. GEIS added its Session Manager to its Managed Network Services in 1990, allowing user-controlled dynamic configuration and routing of virtual networks. The company's MARK*MANAGER option permits PC-based real-time network monitoring of MARK*NET-based services³⁰.

GEIS' MARK*NET operated on 7,500 access ports³¹. The company does not develop or manufacture its network hardware, though it does use a proprietary PAD product which it installs on customer premises to permit network access.

²⁸. "GE Information Services, Network Services," Data Networking, August 1991, Datapro Information Services Group.

²⁹. "GE Information Services, Network Services," Data Networking, August 1991, Datapro Information Services Group.

³⁰. "GE Information Services, Network Services," Data Networking, August 1991, Datapro Information Services Group.

³¹. "GE Information Services, Network Services," Data Networking, August 1991, Datapro Information Services Group.

GEIS' emphasis on global connectivity has also been important in positioning the company in the emerging VANS market. GEIS has established end-to-end service to 35 countries and interconnection with public data networks in at least 70 countries³². Although GEIS' MARK*NET supports a broad range of user protocols, its services have been strongly geared to IBM SNA connectivity.

Infonet

Infonet Services Corporation is the outcrop of a VAN started by Computer Sciences Corporation (CSC) in 1971. Like other early VANS, CSC intended built Infontet to provide international access to its time-shared computer facilities. In the late 1980s, CSC began selling off its 30% stake in the VAN. MCI purchased 25% of Infontet in 1990 for \$27.5 million and the remaining 5% of the VAN is held by 10 PTTs in Asia and Europe. Infontet's international ownership has crystallized the company's role as an international service provider and service innovation is now directed toward global virtual networks and industry-specific applications.

EDI and e-mail messaging remain Infontet's major network applications. In 1990, Infontet introduced X.400 service on its NOTICE international e-mail system and X.400 connectivity has now leads the company's e-mail development. Infontet has expanded its NOTICE 400 X.400 service to interconnect with EasyLink, MCI Mail, Transpac's Atlas 400 services as well as private network e-mail systems provided by DEC, IBM, and Retix.

Infonet is also concentrating much of is application development on global EDI. However, the company has used its equity relationships with international PTT's to forge initial alliances with public network EDI operators rather than specific industry groups. In late 1989, Infontet launched its Global EDI Alliance, joining local EDI service operated by Telecom Australia, Hong Kong Telecom International (formerly Cable & Wireless Hong Kong), Singapore Network Services, Telefonica of Spain, Association of American Railways' subsidiary, Railinc. More recently, Infontet has expanded the EDI partnership to include a Swiss service provider and PTTs from Ireland, the Netherlands, and Sweden. By interconnecting public EDIs, Infontet may be able to focus on transportation, customs, and government applications which often involve greater public sector involvement.

Although Infontet offers network management features on its X.25 network, the company's Virtual Private Data Network introduced in 1990 and its Enterprise Defined Network Service (EDNS) represent Infontet's efforts to develop more comprehensive

³². "GE Information Services, Network Services," Data Networking, August 1991, Datapro Information Services Group.

network management packages. Infonet's VPDN provides a variety of seamless, end-to-end data transmission. However, like Infonet's other services, VPDN does not offer any voice features. The company's EDNS allows the user to outsource all data network operation and is designed to serve as a hybrid solution for large corporate networks³³.

Infonet is not directly involved in development or manufacture of its network technology. However, the company has sought access to applications technology through the inclusion of EDI software developer, Supply Tech, Inc. in its global EDI partnership.

Global connectivity is Infonet's strength in the VANS market. Infonet provides end-to-end service in 27 countries and interconnection to public data network facilities in a total of 115³⁴. Infonet has also concentrated heavily on promoting IBM SNA connectivity to serve large corporate users. In mid-1991, the company's Belgian subsidiary announced plans to launch InfoLan, a TCP/IP service designed for global LAN interconnection.

IBM

In addition to its role as a premier designer and manufacturer of computer and communication hardware and software, IBM has also extended its reach and expertise into systems integration and VANS markets. Under the mantle of its Communication Systems Group, IBM operates its Information Network, a VAN providing dial-up and leased line connections for data transport, EDI, e-mail, on-line information and DB access, and remote processing applications. Like counterparts, Tymshare, GEIS, and CSC, IBM's Information Network has also served as a delivery vehicle for the companies remote computing services.

IBM's Information Network is build around the formats and protocols for data networking within its widely used Systems Network Architecture (SNA). Distributed management processors within the Information Network enable the separation of network and application management³⁵. Could have long-term implications for bundling and selling various network management packages.....

IBM's VANS applications include messaging services such as store-forward e-mail, EDI, and data record archiving at IBM's remote storage facility. IBM is a major

³³. "Infonet International Network Services," Data Networking, May 1991, Datapro Information Services Group.

³⁴. "Infonet International Network Services," Data Networking, May 1991, Datapro Information Services Group.

³⁵. "IBM Information Network," Data Networking, June 1991, Datapro Information Services Group.

thrust of IBM's current VANS application development. The company is working to integrate EDI with other messaging and transmission applications. Current services all for inter-company EDI to permit seamless data and e-mail transfers in a common, customized format.

IBM has increased the interconnection capabilities of its IBM Mail service. IBM Mail now connects with X.400 systems, IBM office automation systems such as OfficeVision and PROFs, as well as non-IBM systems³⁶.

In an effort to extend its information services into small business and consumer market segments, IBM and Sears launched their Prodigy joint venture. However, Prodigy's uptake has reportedly failed to meet many expectations, and the service remains under relentless assault from consumer-oriented competitors like GENie and Compuserve as well as specialized information services. Apart from Prodigy, IBM's Information Network also addresses smaller-user market segments by distributing a broad range of third-party online information, catering to specific industries including finance, law, healthcare, and retail.³⁷

IBM has also developed a number of industry-specific VANS application packages. One of the largest is its Insurance Value-added Network Service which designed to serve intra-industry communication demands.

Now, the Information Network is being positioned as a network integrator rather than applications developer. Information Network will develop end-to-end service and management features to connect SNA installed base³⁸. IBM's large global installed base of SNA mainframes will aid the company in expanding its global connectivity. The strategic importance of the SNA architecture in the corporate environment has also led other VANS providers such as GEIS and Sears to support SNA protocols, creating additional points of Information Network interconnection.

To compete effectively against the increasingly open networks of global carriers like MCI and BTNA, IBM has begun turning more attention toward interconnectivity. The company introduced its network services in the early 1980s as a means of integrating differing protocols. IBM initially targeted only IBM and IBM-compatible equipment,

³⁶. "IBM Information Network," Data Networking, June 1991, Datapro Information Services Group.

³⁷. "IBM Information Network," Data Networking, June 1991, Datapro Information Services Group.

³⁸. Interview with IBM representative, January 29, 1992.

however the company has since expanded its range of connectivity in an attempt to compete as a multivendor network integrator³⁹.

The size, scope, and strength of IBM's production development and distribution apparatus can position the company to pursue a number of simultaneous VANS service trajectories. The company's position in computer hardware and LAN network market should enable IBM to evolve its global LAN interconnection and end-to-end high speed-data services in step with user needs. Meanwhile, as a formidable force in PC markets, IBM exerts tremendous influence on popular software development and modification, through both formal and informal alliances. This position could aid IBM in steering the evolution of user-friendly VANS and on-line interfaces while monitoring market feedback on user needs and experimentation.

IBM has implemented ISDN on portions of its Information Network⁴⁰. The VANS provider has targeted these advanced network services at the growing bandwidth requirements of applications such as bulk data transfer (e.g. LAN interconnection), or CAD/CAM image transmission, or telecommuting. IBM's ISDN initiative may also represent a move to outbid the growing pool of frame-relay providers with yet a broader menu of enhanced transmission services.

IBM is also moving internationally, anchoring itself in Japan, Korea, Malaysia, and Europe through partnerships (or wholly-owned ventures in the case of Japan) with leading VANS competitors. More recently, IBM has introduced a fixed price structure and global X.25 support in an attempt to extend its international reach.⁴¹

Other VANS

Automated Data Processing, Inc. (ADP)

Started as a time-sharing provider in the 1960s, ADP operates AUTONET, a packet-switched data network primarily serving subscribers to ADP Network Services. As of 1991, ADP AUTONET had 250 processing nodes and 9,000 access ports in operation nationwide.

³⁹. "IBM Information Network," Data Networking, June 1991, Datapro Information Services Group.

⁴⁰. "IBM Information Network," Data Networking, June 1991, Datapro Information Services Group.

⁴¹. "IBM VAN Service Gets New Pricing and Broader Reach," Network World, June 1, 1992, p. 25, 27.

ADP's major business units, ADP Network Services, ADP Automotive Claims Service, and ADP Brokerage Information Service Group are primarily dedicated to providing on-line information, and in some cases information processing. ADP Network Services delivers financial, investment, statistical, and news information and data provided by third-party information sources. ADP Network Services provides customer software for accessing and managing information. Value-added features of the service also allow users to assemble customized data reports from multiple on-line information sources.

ADP's Brokerage Information Service Group offers real-time financial information and securities quotes, access to third-party online information services such as Dow Jones News Retrieval, Standard & Poor's, and Moody's, as well as communications, data processing, and office automation applications for the brokerage industry.

ADP Automotive Claims Service specializes in providing on-line information on auto parts pricing, repair estimates, and insurance claims.

Sears Communications Company

A subsidiary of Sears Technology Services, SCC is the telecommunications management subsidiary of Sears, Roebuck & Co. Sears established SCC to manage the private network facilities for its multi-divisional organization, which includes Allstate Insurance, Dean Witter, and Coldwell Banker among others.

SCC has opted for single-vendor supply alliance with IBM and has based its network around its supplier's SNA architecture. This allows SCC direct interconnection with IBM's Insurance Value-added Network. However, SCC's IBM-based network will also hinder any efforts to compete as a first-tier network integrator.

Instead, SCC appears to be engineering a more focused menu of services. The company has begun developing and promoting a EDI and financial EDI which can capitalize on the Sears organization's expertise in financial services and merchandising. One of the SCC's EDI services automates payments and receivables. Another service has interconnected a network of banks including Bank of America, Continental Bank, CoreStates Financial Corp., First Wachovia, Harris Bank, Mellon Bank, NBD Bank, and Northern Trust Bank.

To broaden the distribution of its EDI services, SCC has signed an interconnection agreement with Infonet. SCC is also reportedly pursuing a joint

venture with Philips' communications subsidiary that could further expand the international reach of SCC's applications expertise.

DIALOG Information Services, Inc.

Originally established by Lockheed Corporation, DIALOG was purchased by Knight-Ridder, Inc., a major newspaper and electronic publishing concern, in 1988. DIALOG now forms an important component of Knight-Ridder's Business Information Services Division. DIALOG's DIALNET telecommunications network serves as a delivery and distribution conduit for its more than 370 databases. DIALNET also provides access to third-party databases and allows users to develop customized data retrieval commands. In addition DIALOG's databases are accessible through SprintNet, BT Tymnet, and other VANS.

Reuters Holdings P.L.C.

IP Sharp Associates Ltd. a Toronto-based subsidiary of Reuters Holdings, plc. IP Sharp operates Reuternet, a private packet data network which was formerly IP Sharp's own IPSANET. Reuternet provides a delivery medium for IP Sharp and Reuter financial information services. Other applications include e-mail, data management, and financial software.

Reuters also operates its Reuters Integrated Data Network. Reuters' integrated network provides Reuters' real-time financial information, on-line transaction and trading services, and database retrieval.

General Videotex Corporation (GVC)

The Cambridge, MA-based firm operates the DELPHI videotex gateway. DELPHI offers access to DIALOG, Easys Sabre, OAG, and other third-party on-line information services as well as e-mail. DELPHI is accessible through SprintNet, Tymnet, and other X.25 networks.

In addition, GVC develops customized information and communication services for CLUGs. Examples of GVC's CLUG services include information services for non-profit associations and on-line shopping and transaction services for business groups.

Society for Worldwide Interbank Financial Telecommunication (SWIFT)

SWIFT is a member-owned network to handle interbank EFT among some 7,800 members worldwide. The SWIFT network is built on leased lines and uses standardized formats. Currently, SWIFT is developing new services such as inter-bank bulk data transfer and various EDI applications.

Covia Technologies

Covia is a subsidiary of a partnership led by United Airlines. The company operates a large on-line reservation service and luggage tracking system.

ShipNet Systems Inc.

The company provides real-time information enhancements for transportation and retail EDIs (industry-specific). ShipNet does not provide actual EDI, but instead additional management enhancements such as logistics tracking and network monitoring. ShipNet seeks to improve efficiency of commercial EDI services provided by larger third-party vendors or those operating on private networks. In many cases ShipNet complements more general VANS.⁴²

Systems Integrators

In addition to global service integrators and specialist VANS, a fleet of systems integrators such as Electronic Data Systems (EDS), Digital Equipment Corporation (DEC), Computer Science Corporation (CSC), and others are straying into traditional (and much non-traditional) VANS turf.

Major systems integrators have begun consolidating their large networking expertise to provide complete managed network packages for corporate customers. Some of these network outsourcers such as EDS, DEC, and even IBM also act as large hardware and software distributors.

Many systems integrators' outsourcing arrangements extend turnkey network design and construction to on-going network management, maintenance, and modification. In many cases, the systems integrator actually acquires the

⁴² , Information Week, January 27, 1992.

customer's data processing facilities and personnel as part of multi-year network management contracts. For companies like EDS and CSC, the customer's skilled networking personnel enable the systems integrator to assemble and synthesize a critical mass of expertise and learning in specific industry segments. EDS, for example, has organized its systems integration teams into specialized divisions to target industries segments such as retail, finance, government, energy, and telecommunications.