Patricia Seybold Group

Editor-in-Chief
Michael A. Goulde

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Why won't it work? The promise of open information systems is to make information widely available. In order to accomplish that mission, they have to be accessible as well. That means that they must work, and they must be usable by ordinary people.

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Migration and conversion are major headaches in a changing industry. **Bristol Technology's** Wind/U takes applications written to Microsoft Windows interfaces and converts them into Unix/Motif applications. Could this be the solution for high-volume Unix applications? **Echo Logic**, on the other hand, promises to convert Macintosh Motorola binaries into PowerPC binaries with just a few days work!

OPEN INFORMATION SYSTEMS

Guide to Unix and Other Open Systems

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European Open Systems Architectures

Europe's Vendors Strike out for Open Distributed Systems.

By Joshua M. Greenbaum

IN BRIEF: The European marketplace has been an important focal point for the evolution of open systems. As a result, the major European vendors, Groupe Bull, ICL, Olivetti, and Siemens Nixdorf, have had to take a leadership role in providing open systems solutions to their customers. While the open systems architectures of these vendors bear many similarities, the business philosophies and strategies that underlie these architectures are what really differentiates them. Each brings a different legacy to the open systems world, and, therefore, each brings a unique solution. The ability of these vendors to survive as independent entities will depend on their offering products that are are world class, and not just the best indigenous solutions. Otherwise, the U.S. vendors, many of which have strategic partnerships with various of the European vendors, will be more than happy to further increase their penetration of the European market.

Report begins on page 3.

Why Won't It Work?

For E-mail to Be Ubiquitous, It Has to Work!

I AM NOT sure how many readers of *Open Information Systems* have tried sending me electronic mail to the E-mail address listed on the masthead over to the right, but, if you have, I haven't received any of it. No one is quite sure why, but the only times I have been able to receive E-mail have been on those occasions when I have sent mail to an MCI user and he or she has used the reply feature to respond.

First, let me explain the mail architecture here at the Patricia Seybold Group. Internally, we use Lotus Notes mail as our E-mail system because we use Lotus Notes for everything from editorial review, forum planning, and internal discussions to electronic publishing of all our newsletters as a service called *Notes On Information Technology* (NOIT). As a part of a long-term evaluation, we have a VAX running DECnet and Pathworks.

There is a gateway from Lotus Notes mail to VMSmail. From VMSmail, messages can go to the internal All-In-1 mail (for routing to Macintosh users) or externally to MCImail. This is done over the MAILbus Message Router gateway (called MRGATE), which has interfaces to VMSmail, All-In-1 mail, and MCImail. For historical reasons, mail coming in from MCImail is sent to a user's All-In-1 mailbox and then routed over the MAILbus to VMSmail and finally into his or her Notes mailbox. When I send E-mail to an MCI user, the message goes from Notes mail across the gateway to VMSmail and over MAILbus to MCImail.

The way I have to address this is:

CHIBA::MRGATE::"MCI_GATEWAY::MCI Mail::0005559999::John Doe" @ VAXMAIL
(The VAX's name is CHIBA)

The gateway between MCImail and the Internet is at MCImail, which means that we get no notification if a problem arises there, nor does the Internet user.

I am sure that, at some point, we will solve the problem. Then I expect the readers of *Open Information Systems* to flood me with their questions and concerns. In the meantime, this situation has made me realize that two basic requirements have to be met in order for a technology to become pervasive and ubiquitous: It must work, and it must be usable by ordinary people.

One goal of open information systems has to be to make information easily accessible to mere mortals. One shouldn't have to be a member of the technological elite to have access to information. Somehow, whenever vendors describe how easy they are going to make things for users, the technology gets turned over to a "developer," which is code for "The one technological wizard in the organization who understands how this stuff works." Some vendors are beginning to realize that this requirement is market limiting. The concept of the "Forehead Install" (you put the disk in and rest your forehead on the keyboard while the software installs itself) is being increasingly adopted as a measure of how easy things need to be if they are going to become widely used.

In the long run, my mail problem will get resolved. I am pushing to replace DECnet with TCP/IP and finally use the Internet domain name and IP address that we have had registered for years. I will advocate getting everyone at the Patricia Seybold Group on the Internet. This way, I know that if we ever have a problem, there will be thousands of wizards out there who can help. Interestingly, those wizards are aggressively working at making the Internet easily accessible, and books aimed at ordinary people are now available to help guide the rest of us.

Open information systems will never become a reality if they have to be cobbled together with gateways, interfaces, and other glue. Our mail situation is a perfect example of the complexity that creeps in and begs Murphy's law ("whatever can go wrong will") to take over in an exponential fashion.

OPEN INFORMATION SYSTEMS

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European Open Systems Architectures

Europe's Vendors Strike out for Open Distributed Systems.

Europe's Gang of Four: Bull, ICL, Olivetti, SNI

Europe's four principal hardware vendors—Groupe Bull, ICL, Olivetti, and Siemens-Nixdorf Informationssysteme (SNI)—have christened the 1990s as the decade of distributed, open systems. Over the last two years, they have been busy refining elaborate architectures that describe their respective visions of how new systems can be built and old ones maintained. France's Groupe Bull has its Distributed Computing Model (DCM); UK-based, but Fujitsu-owned, ICL has its Openframework; Italy's Olivetti is pushing what it calls Open System Architecture (OSA); and Germany's Siemens-Nixdorf calls its strategy Open Systems Direction (OSD).

These architectures have become the strategic focus of each company's efforts across both Unix and proprietary product lines, and they are used to win over customers looking for solutions, ISVs looking for platforms to support, systems integrators looking for problems to solve, and an increasingly perplexed internal sales and support staff dazzled by the rapid evolution in product lines. The message of open distributed computing has become the gospel of European information technology.

Success Critical to Survival

Success in these new strategic efforts is absolutely critical to each company's long-term survival, both individually in Europe and collectively against an increasing U.S. domination of the market. In Europe, open distributed systems will provide the complete solutions that customers need within an increasingly interdependent European market, and the models serve to unite each vendor's potentially competitive product lines in an overarching strategy. Against U.S. vendors, these architectures are intended to promote local Unix sales while helping to stave off the defection of proprietary customers to foreign Unix vendors.

Common Environment—Similar Directions

The rationales behind distributed open systems architectures—fiercely driven by falling revenues in proprietary product lines and shrinking margins in open product lines—are the same for the four European vendors, and their basic offerings bear a striking resemblance to one another. This is no accident, but rather the direct result of the body of de facto and de jure standards that has emerged in recent years with the active participation of the European vendors.

However, despite agreement on most base-level technologies, there are strong philosophical, technical and strategic differences among the four approaches and a different set of products and services to back up each, largely theoretical, model. For now, the newness of the models precludes drawing any definitive conclusions about future success. But a close examination reveals weaknesses and strengths that could impact each company's ultimate capability as a purveyor of open distributed systems and their collective success against U.S. vendors.

Historical Connections

The Gang of Four are hardly neophytes in an admittedly nascent market. Their mutuality of interests dates from the formation of an industry group called BISON, its name taken from the initials of what were five major European vendors prior to the merger of Siemens and Nixdorf in 1990. In 1984, BISON became X/Open Company Limited, with the European vendors playing lead roles in its formation. The Gang of Four also figured in the formation of the Open Software Foundation (OSF) and, eventually, of Unix International as well. Despite their lack of success on a worldwide scale, they have been sincerely committed to Unix and open systems.

Broad Unix-Based and Proprietary Offerings

All four have strong Unix product lines, with offerings ranging from PCs to workstations to multiuser servers, that have largely kept pace with the technological leapfrogging that characterizes the market. With the exception of Olivetti, each vendor also maintains a significant mainframe customer base. Although these proprietary system customers represent no real potential for market growth, they are widely courted with open systems architectures. The objective is to at least keep them as mixed Unix/proprietary customers and then capture as much of their pure Unix business as possible when they downsize or migrate their systems.

Europeans Push for Open Systems

Starting in the 1980s, market forces helped fan the flames for Unix and open systems in Europe. While individual governments had their own open systems mandates, the growth of the European Commission's (EC's) influence on open systems procurement—enshrined in a 1987 document called 87/95/EEC—helped push a rapidly growing European market led by the powerful government sector. Direct efforts from within the EC, such as the European Strategic Programme for Research in Information Technology (ESPRIT), also contributed to seeding the market. Commercial users, reading the tea leaves, began to jump on the open systems bandwagon in the late 1980s, and the race was on.

Intense Competition in a Slow Market

But the race has been made difficult by a team of faster horses and a muddy track. That team comprises the U.S. vendors—particularly Hewlett-Packard Company, Sun Microsystems Incorporated, and, most recently, IBM—which have taken leading positions in both public and private procurement in Europe. According to most estimates, the U.S. Gang of Three accounted for over one third of the European Unix workstation market in 1991, while the European Gang of Four came in at less than a quarter of the market overall.

The muddy track has been the global recession, which has deadened sales and put the overall European IT market into low single-digit growth. Propelled by diminishing demand for proprietary products and shrinking margins in both the still-emerging workstation market and the more mature PC market, the financial success of the Gang of Four, with the exception of ICL, has been poor in recent years. (See Table 1.) And all have turned in varying degrees to foreign capital and/or know-how—from the United States and Japan—in an effort to escape from the cycle of losses. The large system and minicomputer heritages of these companies also put them at a disadvantage when they were faced with competition from PC LANs, particularly for departmental and workgroup applications. Perceived by customers as being just as open as Unix, but also cheaper and easier to manage, PC LANs have been a threat to these vendors' Unix-based open systems strategies.

Comparative Financial Performance

	Groupe Bull	ICL	Siemens-Nixdorf Informationssysteme AG	Ing. C. Olivetti & Co. S.p.A
Headquarters	Paris, France	Bracknell, UK	Munich and Paderborn, Germany	Ivrea, Italy
1991 Revenue	$6.8 B	$3.18 B	$8.7 B	$ 6.6 B
Net Profit (Loss)	($660 M)	$66.3 M	($561 M)	($354 M)
First-Half 1992 Revenue	$2.7 B	N/A	$9.25 B	$2.8 B
Net Profit (Loss)	($340 M)	N/A	N/A	($72 M)
1991 Hardware Revenue percent	58%	48.5%	70% (approximate)	70% (approximate)
1991 Software Revenue percent	10%	51.5% (includes services)	30% (approximaie)	30% (approximate)
1991 Services Revenue percent	30%	N/A	N/A	N/A

Table 1. With the exception of ICL, which receives half its revenue from software and services, the financial performance of the four European vendors has been disheartening. NOTE: Conversions to dollars based on October 9, 1992, exchange rates.

Strategic Overviews: Commonalities Abound

Groupe Bull: RISC to the Rescue?

Groupe Bull, headquartered in Paris, has suffered more than most in a market awash in red ink, having posted billions of francs in losses over the last three years. While a host of problems have contributed to its losses, the dissolution of a RISC partnership agreement with MIPS left a gaping hole in its Unix strategy.

IBM FILLS THE GAP. The key to Bull's revitalized RISC strategy is IBM, which, at the beginning of the year, made a symbolic $100 million investment in the ailing French giant and lent the company its Power RISC technology. The fruit of that alliance is a new Bull RISC line that appeared this summer, essentially an OEM-ed version of the RS/6000 that does little to distinguish Bull in the market. Bull hopes to remedy that when it ports its DCM software to the RISC products this fall. But the real weight of the agreement won't come to bear until Bull uses its expertise to develop a multiprocessor RISC system that IBM, in turn, will OEM. That product is due out sometime next year.

The IBM agreement reaches deep into Bull's software offerings as well. Behind this joint RISC effort is the adoption by Bull of AIX as its RISC operating environment. Bull's current Unix implementation, BOS, will be merged to become AIX compatible, and the two partners' RISC lines will remain, at least in the short term, binary compatible.

MANAGEMENT TRANSITION. Bull has also suffered from the recent loss of Francis Lorentz as chairman. Lorentz has been replaced by Bernard Pache, a former coal and aluminum industry executive whose experience is more as an end user than as head of a computer company. Lorentz was well-liked by Bull's senior managers, but, when the state-owned company showed repeated losses, he had no choice but to step aside. The accession of Pache, which came as a result of action by the French government, Bull's majority stockholder, has put the company in a restructuring mode while Pache learns his new job. Pache plans to keep a low public profile until 1993.

Strategic Overviews: Commonalities Abound

ICL: Profits and Japanese Capital

ICL, headquartered in the United Kingdom, has two major points of distinction from its European brethren: the question of whether or not it should be considered a purely European vendor, and the fact that it has shown continuing profitability. Many Europeans don't see the 80 percent Japanese-owned company as European, despite its very English accent and long history as the United Kingdom's dominant domestic supplier. This has led to no end of controversy in an increasingly xenophobic Europe, with ICL frequently called upon to defend its "Europeanness." And even the EC has trouble taking a consistent approach with ICL. On the one hand, ICL is free to participate in and make use of funding for pan-European projects like ESPRIT. On the other hand, a vendor organization called TEIS, which was set up this year to coordinate Siemens-Nixdorf's, Bull's, and Olivetti's response to public sector bids, pointedly excludes ICL for the same reason that it excludes IBM, Sun, and HP—that is, foreign ownership. ICL plans to remedy this problem by floating 25 percent of its stock on the open market in 1995, a move intended to give it a degree of European ownership.

But, in some ways, ICL has the last laugh, at least for now. The Anglo-Japanese company was the only member of the Gang of Four to turn a profit in 1991: £39 million on revenues of 1.87 billion—$66. 3 million and $3.18 billion, respectively, at current exchange rates. There is no mystery about why this has happened. ICL has a particularly strong non-hardware side of the business: Half its revenues come from software and services. This is an exceptionally large figure in the computer industry, and ICL's ability to capture the higher margins in software and services has resulted in remarkable profitability. This makes ICL well-positioned financially as well as giving it a solid track record in the critical software side of the open systems game.

Olivetti: Can Digital Help? Or Microsoft?

Olivetti, headquartered in Ivrea, Italy, started out the 1990s in the black but slipped into the red in 1991. Its recent mid-1992 numbers show both revenues and profits continuing to shrink. Until this summer, the company's Unix and open systems strategies were marked by two major strategic partnerships. The first, in the mid-1980s was with AT&T, which had promised Olivetti a fast track into the Unix world. AT&T's foray into computers stumbled, however, and Olivetti no longer had such a fast track position. However, the AT&T agreement was instrumental in making Olivetti one of the earliest and strongest proponents of Unix in Europe. The second strategic linchpin in Olivetti's plans was the failed ACE initiative, on which Olivetti had been betting heavily as a way to help furnish the next generation of low-cost RISC workstations.

KEY U.S. ALLIANCES. Now Olivetti has two other alliances that should be more significant over the next few years. It has based the client side of its applications strategy on adding value on top of Microsoft productivity applications while supporting Microsoft's networking strategies. It also began a strategic partnership this June with Digital Equipment Corporation. The ailing American giant, whose European Unix revenues and market share fell from 1990 to 1991, while the overall market growth rate was above 10 percent, has acquired 10 percent of Olivetti, partly in exchange for an agreement that Olivetti would evaluate strategies for including Digital's Alpha 64-bit processor as a strategic platform. The result of these alliances has also been the ascendancy of Microsoft's Windows NT at Olivetti, and the company has striven to market its new R4000 MIPS workstation as the platform of choice for Windows NT development.

AVOIDING THE LEGACY ENTANGLEMENT. Olivetti's position is unique among the Gang of Four in that it carries little of the legacy systems baggage with which the other companies are burdened. The company's old proprietary system, the Motorola-based LSX series that ran

the MOS operating system, is not part of OSA, and, while the company continues to support its user base, it has a single-purposed commitment to Unix that its European rivals do not share. MOS-based systems have not been marketed in quite a long time.

Olivetti has recently suffered image problems due to the legal entanglements of Chairman Carlo De Benedetti, even though he has never run the company day-to-day. De Benedetti appointed top lieutenant Corrado Passera as joint chief executive at the end of September, following the announcement of losses for the first half of 1992. Passera can be expected to be a high-visibility leader in Olivetti's future.

SNI: Too Many Platforms?

Siemens-Nixdorf Informationssysteme (SNI), headquartered in Paderborn, Germany, is the largest of the European vendors in terms of sales and market share, due to its position as the number one vendor in Europe's largest country market. But behind those large sales numbers lurks a continuing string of losses and problems with an overlarge architecture and operating system base.

The two problems have one event in common: the merger of Siemens and Nixdorf in 1991. Like the joining of East Germany and West Germany, the merger has resulted in a high price for cost and redundancies.

The result is that SNI has a product base that includes six operating systems—three Unix-based and three proprietary—and four processor architectures—Intel x86, Motorola 680X0, MIPS R3000, and its proprietary BS2000 line. Also, the company's commitment to move to a single Unix System V.4 base and to do away with its Motorola line has an attendant migration cost for both users and developers, but these moves are necessary to rationalize its offerings.

These factors weigh heavily on the design and implementation of Open Systems Direction and give SNI the dubious distinction of having the most difficult row to hoe when it comes to converting its user base to Unix and open systems.

Strategic Underpinnings of Europe's Open Systems Architectures

The basic distributed open systems models of the four vendors look very much alike. They are represented as a layered set of blocks that fit together like the pieces in a boxy jigsaw puzzle. For ICL's Openframework and Olivetti's OSA, hardware is the base level; Bull starts at the bottom of its DCM with Communications and Systems Services; and SNI generally eschews the block model for a software solutions-focused image of Open Systems Direction, although, overall, the pieces of its model map closely to those of the other vendors. In reality, the vendors acknowledge that, at the basic technological level, the distinctions are of little importance. In each model, the world of open systems is defined to be an interlocking combination of hardware systems, operating systems, networking and communications services, distributed processing services, application development services, and user interfaces.

Within each of the these categories are a lot of products and standards familiar to the open systems world: Unix, obviously, as well as Motif, Windows, MS-DOS, SNA, TCP/IP, OSI, XPG/3, and relational databases all figure as common building blocks for all four vendors. But, while the base technologies look alike, each model starts off with a fundamentally different philosophy. Therefore, although the solutions that can eventually be built will be largely similar across all four companies' architectures, the way in which a user arrives at a required solution will be determined by its basic philosophical approach.

Strategic Underpinnings of Europe's Open Systems Architectures

Bull's Distributed Computing Model: A Socket for Every Plug

Bull's Distributed Computing Model (DCM) starts out with a heavy philosophical emphasis on business change. Its practical application makes receptiveness to the outside world the cornerstone of DCM. This receptiveness means that DCM guidelines could result in the construction of a system that has absolutely no Bull products. It's a curious position to take unless product sales are not the only goal in life, which, as we shall see, is very much the case at Bull.

FROM USERS' VARIOUS PERSPECTIVES. Bull looks at DCM as providing a perspective on open distributed systems for three important users: the end user, the systems administrator, and the application developer. Illustration 1 shows Bull's DCM. The end-user perspective is from the top down; i.e., all that end users see of DCM is the user interface to their applications programs, and they are expected to have a very minimal interaction with the applications development and network services sides of the model. To service this type of user, Bull provides literally every major user interface technology, with the possible exception of OpenLook.

Bull's Distributed Computing Model

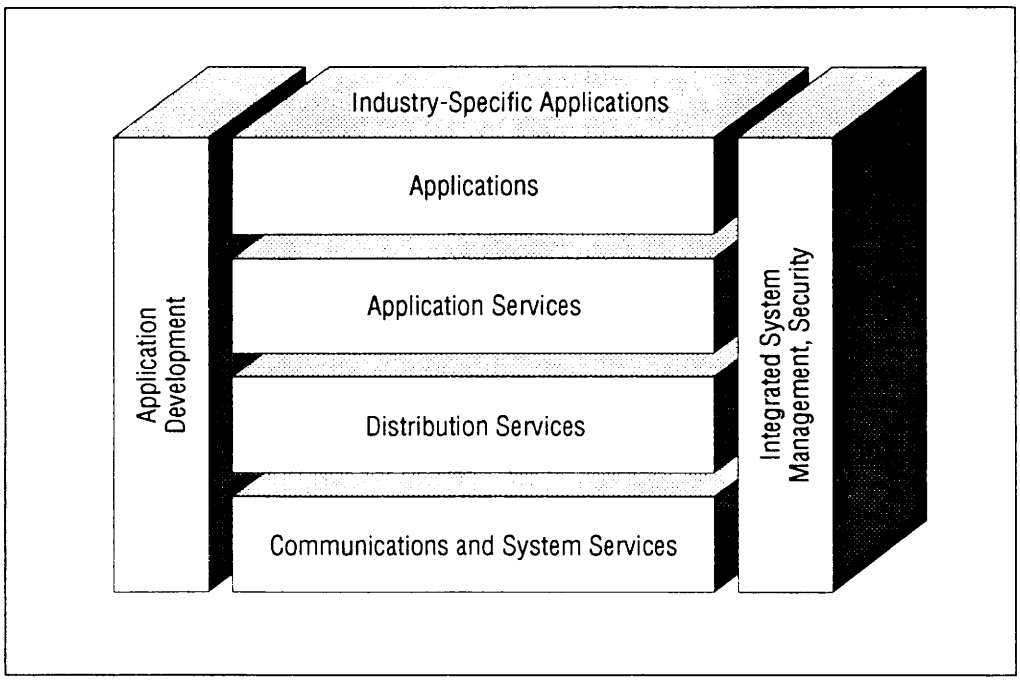

Illustration 1. Bull's Distributed Computing Model (DCM) has multiple perspectives, including the administrator's, developer's, and end user's.

SYSTEMS ADMINISTRATORS. Systems administrators approach DCM from the right side of the model via a set of services labeled "integrated systems management/security" and understandably take a more three-dimensional approach to the model. The main product for administrators is called Integrated System Management, a network resource management system that has its equivalent in the other vendors' offerings for systems administration.

APPLICATIONS DEVELOPERS. Applications developers, who approach DCM from the left side, will quickly run into the weak link in the DCM chain. The application development component, which prescribes the same three dimensional approach to DCM, offers little more than connectivity for existing tools within a non-integrated, non-CASE environment. While there is a repository under development at Bull, applications developers working

within the DCM model are not as well-served today by products as the model's requirements would indicate. This is not necessarily a handicap in the short term.

In fact, software is not meant to be a strong point for DCM. DCM's philosophy is more to provide universal sockets into which third-party products can plug. This is evident in Bull's ongoing development of an object-oriented data repository that will include support for the Portable Common Tool Environment (PCTE) specification for integrating CASE tools, of which Bull has been a primary developer.

In each interior block in the DCM model, Bull provides the sockets, and, in a few instances, the software as well. Within Applications, it provides not just interfaces but OfficeTeam, an office automation system; and Imageworks, a modular, office automation product that can be tailored to specific business needs. One level down in the model, Applications Services, directory, mail, database access, transaction processing, and other underlying services are provided, again using a set of standard interfaces. Below that lie the Distribution Services, which handle the minutiae of file-naming, remote procedure call, timing, and distributed file services, to be based eventually on DCE from the Open Software Foundation. At the bottom layer are communications and systems services, which integrate OSI, TCP/IP, and SNA, while providing support for X/Open's XTI transport interface and its CPI-C common programming interface.

CUSTOMERS ALSO. Bull has one final perspective on DCM, which it shares in varying degrees with its three counterparts: vertical market strategies. For key markets like banking, retail, and insurance, Bull has assembled a basket of hardware and software tailored for each particular environment. Vertical market bundling, a practical purpose for the largely theoretical models, has become of great importance to all four vendors.

SYSTEMS INTEGRATION STRATEGY. Finally, Bull has an important trump card that is not easily extracted from its DCM message: systems integration (SI). As one of Europe's top systems integrators, Bull has a unique collection of talent to call on when assembling these complex distributed open systems for their clients. Over $200 million in systems integration sales in 1991 give it an important leg up in the race to provide distributed open systems, one that its European rivals are scrambling to emulate.

ICL's Openframework: Build Your Own Architecture

ICL stands out among the Gang of Four as having the most open of the open architectures, almost to a fault. While its Openframework division has produced a veritable mountain of background, strategic, and technical information, the overall message is that anything the user wants can be incorporated into ICL's model. In practical terms, ICL is no more open than any other vendor, and its model has the familiar building-block approach common to all four companies. But ICL prefers that the user, developer, or partner look at Openframework in a more abstract manner than they look at other models, the result being that ICL provides a very top-heavy theoretical environment with few prescriptive choices.

A case in point are the four perspectives of Openframework (see Illustration 2), which are similar to those in Bull's DCM. Thus, in Openframework, one finds the user perspective, the service provider perspective, the application developer perspective, and the enterprise manager's perspective. Whereas DCM quickly moves into a discussion of available technologies, Openframework's "Technical Overview" document goes no further than to define what it calls responsibilities, benefits, and processes for each perspective. The developer or user or system administrator looking for a specific technical acronym will have to go beyond Openframework to find it. Openframework is, in effect, a blueprint for making more blueprints.

ICL's Openframework Architecture

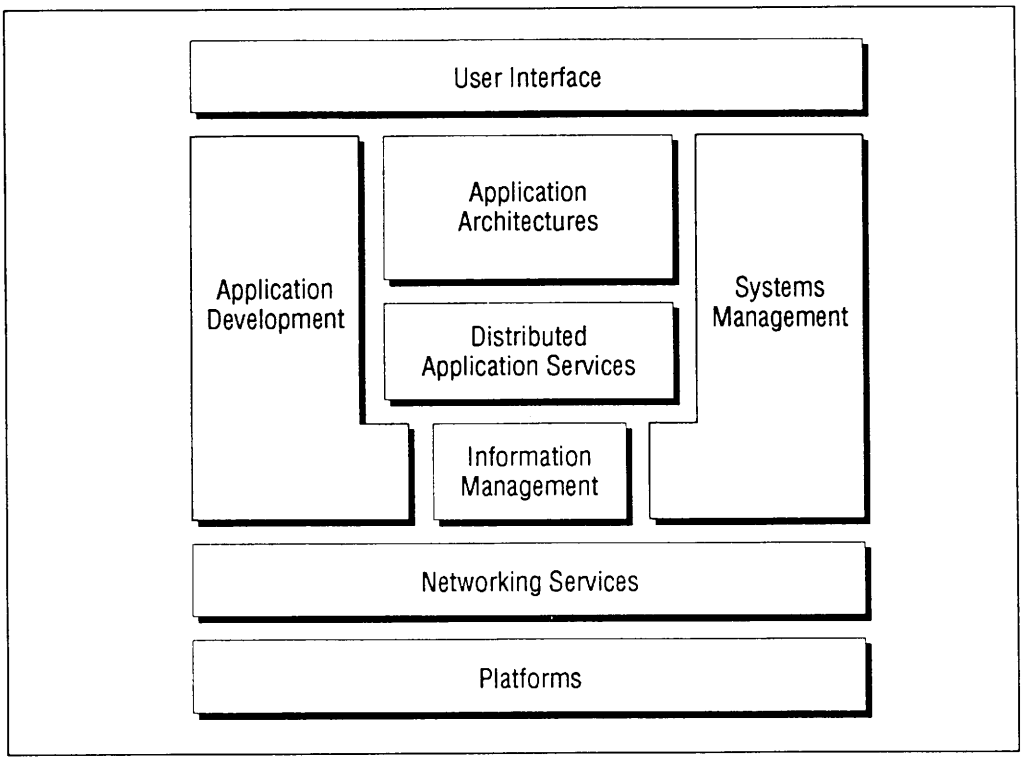

Illustration 2. ICL's Openframework is meant to provide an overall structure, not specific implementations.

OPENFRAMEWORK NOT PRODUCT FOCUSED. There is no comprehensive CASE environment that comes along with this abstract view, though the company has a limited offering in its QuickBuild workbench and data dictionary and its extensive proprietary VME-based products. ICL is also working on an object-oriented open systems repository that will probably be based more on the CASE Data Interchange Format (CDIF) than on the European Manufacturers' Association/Portable Common Tools Environment (ECMA/PCTE). Openframework has an Open Systems Management Center, OSMC, that acts as a network monitor, and ICL also provides two office automation products: OfficePower for Unix and open VME, and the Teamware suite of applications for the PC/LAN environment. But, with the exception of OSMC, these software products are more in the background than the forefront of Openframework.

FLEXIBILITY RISKS CONFUSION. Like Bull, ICL prefers to offer the glue for third-party software and hardware. But ICL pursues this with a vengeance, and the overall impression extends beyond free choice into what is potentially an overly complex message. For the extremely well-informed consultant or ISV, the free choice approach allows for considerable self-determination. For the less open systems aware, something else is needed beyond what the model provides.

ICL's solution to the void it has created is to enshrine choice in the services it provides to the prospective customer. Instead of saying explicitly, "Here are my solutions to fit your problems," an approach favored in varying degrees by its competitors, ICL wants users to bring problems to the company's consulting and integration services, which can then provide solutions.

INTEGRATION BECOMES VALUE-ADDED. To this end, ICL is well-equipped. The Openframework division is set up as a "competitive advantage division," meaning that its function—an information clearinghouse and center for integration expertise on Openframework—cuts across company lines. Staffed with over 250 people, the division runs two verification centers in the United Kingdom where compatibility and other open systems issues can be tested for current and prospective customers. The division also maintains a database, the Integration Knowledge Base (IKB), that is a collection of solutions to various open systems problems. That database will become available to outside customers starting next year under the name Systemwise, and a CD-ROM service based on IKB is expected to be offered next year as well.

ICL has one particular architectural feature that distinguishes it from the rest of the Gang of Four. Its distributed systems solution, Distributed Application Integration Services (DAIS), is not based on OSF's DCE, but on a technology called ANSA, which came out of an ESPRIT research program and is the principal basis for the Harness project's distributed services. (For more information on Harness, see *Unix in the Office*, March 1992.) While ICL promises to support DCE within DAIS, striking out on its own in favor of a nonstandard solution may complicate its ability to integrate non-ICL systems in the future.

Olivetti's Open System Architecture: Vertical Market Push

The core of Olivetti's Open System Architecture is very similar to Bull's model, with the exception that Olivetti omits the outer wrapping of network services and applications development services. (See Illustration 3.) Both areas are well-developed conceptually and are fully described in the model, though each still requires additional products and technologies to make it live up to its promise. In general, though, under the hood, OSA provides connectivity and interoperability similar to those of its counterparts.

Olivetti's Open System Architecture

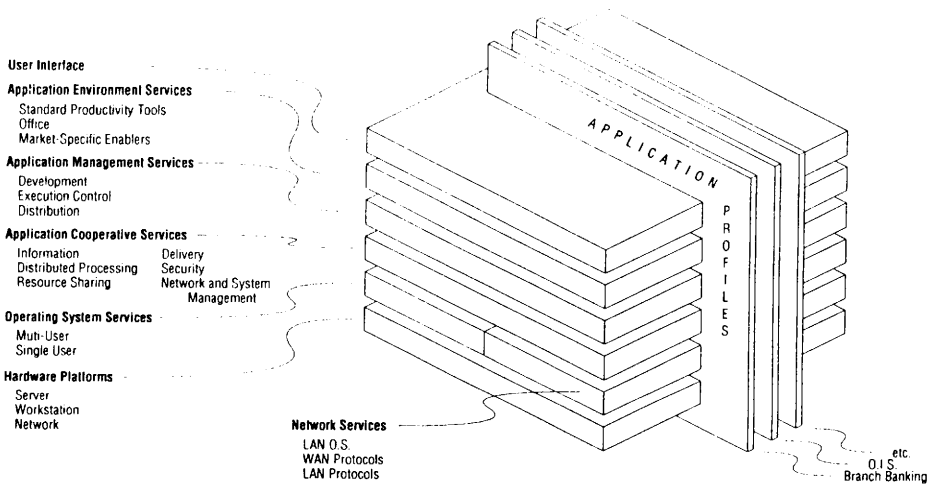

Illustration 3. The Open System Architecture of Olivetti.

PROFILES FOR VERTICAL MARKETS. Olivetti presents its model as a series of profiles—based on platform selections, application environments, and vertical markets—that cut across the

stacked layers of OSA. The profiles both provide conceptual points of entry into the model and help define product packages that are fitted to each profile. Olivetti is careful to note that the profiles are neither prescriptive nor meant to be used by themselves: A real-world system—built around software described in a vertical market profile—could include some but not all of the Hardware Platform, CASE, Office Information System, Network and System Management, and OLTP profiles.

DEVELOPMENT ENVIRONMENT. The Hardware Platform profile is exactly as described, a collection of PCs, workstations, and servers that can be combined in the pursuit of open systems solutions. The CASE profile offers third-party upper and lower CASE tools, Microfocus Cobol, and a proprietary repository that is based on the PCTE/ECMA standards. The CASE profile also includes application generators for Olivetti's key banking market. OSA's CASE profile promises coexistence with Digital's Cohesion and IBM's AD/Cycle; the company plans to add further levels of integration in order to be able to call it a fully-featured profile.

IBISYS BASED ON OIS PROFILE. The Office Information System (OIS) profile, is the basis for IBIsys, a modular office automation system that the company describes as an "enabling environment" for open systems. IBIsys builds on base-level X.400 mail and SQL database access functions and allows the integration of Windows applications. Olivetti plans to include links between OIS and the OLTP profile in order to support a wider transaction processing environment.

BANKING-ORIENTED OLTP. OLTP is a key profile for Olivetti, containing many of its hopes for both its technology and its key markets, like banking and retail. Based heavily on USL's Tuxedo, OLTP also requires either the Oracle Version 7 or Informix 5.0 database. Unlike Bull, but in concert with the rest of the Gang of Four, Olivetti offers a preferred database architecture while promising openness to all.

MANAGEMENT PROFILES. Network and systems management have been well-constructed to include connectivity within the Olivetti line and to partner Digital Equipment Corporation's DECnet architecture and major proprietary systems. But Olivetti still has part of the model to complete, in particular its Departmental Management Center (DMC), the portion of the profile that manages multivendor networks. Management software for OSI networks, as well as modules for software distribution and resource management, will be added at a future date. This deficiency has not held back Olivetti's networking capabilities, and the company has numerous major clients using all or part of the available DMC architectures.

VERTICAL MARKETS DRIVE THE MODEL. Vertical market profiles are the key elements in Olivetti's Open System Architecture. They provide the hooks into Olivetti's primary market strengths in banking, retail, and government systems. These profiles provide specific hardware and software combinations, which, in the case of banking, include specialized CASE software, teller terminals, and other industry-specific technologies tied into the larger Open System Architecture. While the company is not alone in possessing these vertical market profiles—Bull released, this September, a banking profile called DCM Banking—Olivetti's emphasis on bringing OSA into specific vertical markets is the company's *primary* focus.

And its systems integration focus reflects this vertical emphasis. While the company has a separate profit center called Olivetti Software Business, that is dedicated to company-wide integration and consulting support, its major raison d'être is as an adjunct to the sales effort, with none of the visions of wider market glory that obsess Bull and SNI. Olivetti's service

efforts account for some 10 percent of revenues, compared to Bull's 30 percent, though it is hard to attach a precise figure to the number of staff working in this area. Over 100 employees are dedicated to solving specific integration problems, but most of the field work is decentralized, with centers of expertise located in different operating companies depending on the specific markets they serve. Olivetti also attaches consulting and integration staff to the sales staff working in an individual vertical market.

Siemens-Nixdorf's Open Systems Direction: Give Users Everything

Behind SNI's Open Systems Direction are its plans to migrate to a two-operating system world made up of Sinix and BS2000. Nixdorf has bequeathed to SNI three Motorola 680X0-based operating systems: its DIPOS and NIROS proprietary systems, and its SVR4-based TOS Unix operating system. Add to this SNI's responsibilities for an existing Sinix V.5.2 base, which is only source-code compatible with its new SVR4- based Sinix V.5.4, and the task of migrating to just two environments begins to look daunting.

This explains, in part, why SNI takes the interface-rich general model of open distributed computing and adds an even richer layer of software products that, while not presented as absolute choices, are strongly advised for the OSD user (see Illustration 4). It allows SNI to present to its varied user base a set of solutions that are wrapped up a little more neatly or completely than those offered by its rivals.

OSD HAS DISTRIBUTED ORIENTATION. SNI often presents OSD schematically as a network-centric model, with modules for client interface, applications, and operating systems attached to the top of the network, and server applications and operating systems modules attached at the bottom. On the left side are the systems management services, which provide technological support for the client and server elements, and a set of network management services. On the right side is the application development system, bound to an SNI-proprietary CASE environment. The remaining components, while organized in a more functional way relating to SNI's vision of client/server computing, are essentially the same as in the other models.

One important exception is that SNI prescribes products or classes of products in each area, offering, of the four companies, the largest scope of specific or recommended products. The result is that the preferred choices users and developers start with in OSD have the effect of being more limiting, though, as a result, they appear to be better integrated.

AN OPENING DEVELOPMENT ENVIRONMENT. Domino, SNI's CASE environment, is a good example of its integration. Its major purpose is to provide a common applications development environment for Sinix and BS2000 applications, particularly OLTP applications, with plans to add development support for MVS applications at a later date. Domino, which has its own data dictionary, requires the developer to use the Graphical Programming Environment System (GRAPES) for applications development. The result is, essentially, a proprietary method for developing open systems within OSD—today. This spring, Domino will expand with a release called Open System Case Environment, which will be a toolbus architecture for SNI, and third-party applications based on Hewlett-Packard's SoftBench.

SNI's Open Systems Direction

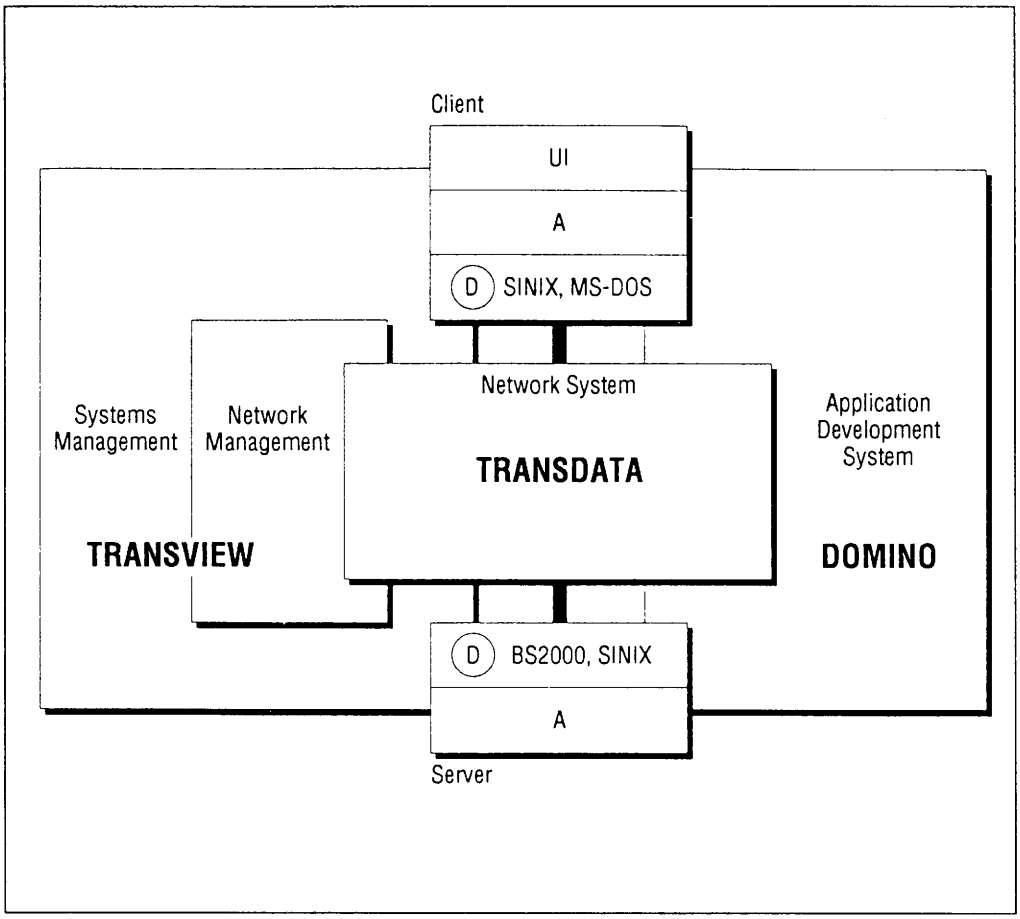

Illustration 4. Siemens-Nixdorf's Open Systems Direction emphasizes interfaces in order to assist the migration from multiple operating systems and platforms to a simpler line.

The tie to SoftBench shows that SNI is not planning to present monolithic solutions to the problems OSD is trying to solve, and the company is careful not to force every application development project to rely on products like Domino or Transview, its network management product. But there remains a strong sense that, within OSD, Siemens-Nixdorf prefers to call the shots when it comes to most software environments.

FULL-FUNCTION OA OFFERING. Office automation is another area where SNI takes pains to offer a fully-functional solution. In the case of SNI's OCIS office automation package, that functionality only extends within the SNI product line, however; the software is not supported on other vendors' Unix product lines. But, within the confines of Sinix and BS2000, SNI offers an integrated office environment that runs under Windows and can mix in third-party applications.

INTERNAL INTEROPERABILITY CHALLENGE. SNI's major problem in organizing its user base into an open systems network is the lack of binary compatibility in its product base. This necessitates an enormous quantity of communications and network management resources, which SNI has wisely organized into two product umbrellas: Transview and Transdata. The effect is a clear two-product message to a market confronting the enormous task of actually making all these systems talk to one another.

Transdata gathers together an impressive list of protocols and technologies under its umbrella, all promoting some rendition of what SNI loosely calls client/server computing. "Loosely" because the models of interaction that Transdata is designed to cover under the rubric of client/server range from dumb-terminal communications to fully distributed applications and databases. The effect on a practical level, however, rises above the marketing hype: SNI has anticipated virtually all possible combinations of communications options for its overlarge portfolio and has either already provided for them in Transdata or committed to adding them in the near future. SNI's promised implementation of DCE will fit under the Transdata umbrella.

Riding herd over this internetwork of platforms is Transview, an as-yet-incomplete network monitor and administrator that is intended to support SNI's Network Architecture proprietary protocols as well as standard protocols. The product will undergo a major upgrade in 1993 to include a network management center and support for the Simple Network Management Protocol (SNMP), which allows heterogenous systems to identify themselves and be managed on the network. Future support for the Open Software Foundation's Distributed Management Environment (DME) is also planned.

MOVING TOWARD SYSTEMS INTEGRATION. While SNI is well underway to building a product base that can genuinely help its users move to an open, distributed world, the key problem of who will do the implementation is only just beginning to be addressed. In a move that closely emulates Bull, SNI has undertaken a radical restructuring of its internal consulting unit, which was formerly an adjunct to the sales team. The company has promised to have a quasi-independent systems integration division by the end of the year in order to respond directly to the need for quasi-independent systems integration. It's a move that's being watched closely as a bellwether of SNI's organizational skills. So far, an internal deadline of October 1 has come and gone without the expected public announcement.

Comparative Analysis

For prospective users of OSD, DCM, OSA, and Openframework, whether they are ISVs or end users, the application of these open systems architectures hinges on four critical capabilities: support for legacy and client/server computing, support for network administration, support for CASE environments, and competency in systems integration. A comparison of how each company treats these areas reveals important lessons for the future viability of each model. Table 2 provides an overview of the key software components of each vendor's strategies.

Legacy and Client/Server Connectivity

Open systems in Europe, just as in the rest of the world, require strong links to proprietary environments, and each vendor has satisfied the connectivity needs of its respective proprietary bases as well as having provided close connectivity to the IBM SNA world. The vendors also place enormous store in MS Windows as the popular choice for a client architecture. Their models rely heavily on support for the Windows environment, and their PC lines reflect this approach.

On the Unix side of the connectivity issue, the picture is more complex. Each vendor's Unix offering includes both generic connectivity through TCP/IP and RPC support and hooks into specific U.S. vendors' products, either through strategic partnerships or OEM agreements. These hooks provide additional components in the client/server offerings of each vendor, and, when added to PC client support, provide each vendor's customers with a wide range of

clients running both Windows and Unix as well as a wide range of Unix and, in most cases, NT-ready servers.

Strategic Software Components

	Groupe Bull	ICL	Siemens-Nixdorf Informationssysteme AG	Ing. C. Olivetti & Co. S.p.A
Unix Operating Systems	BOS (SVR3 and BSD), BOS/X (AIX)	SVR4, SCO Unix, Solaris	Sinix (SVR4), TOS	SVR4, SCO Open Destkop
PC Operating Systems	MS DOS, MS Windows, OS/2	MS DOS, MS Windows, OS/2, NetWare	MS DOS, MS Windows	MS DOS, MS Windows, MS Windows NT*, OS/2
Proprietary OS	GCOS	VME, OpenVME	BS2000, DIPOS, NIROS	(MOS - not part of OSA)
User Interfaces	Motif, MS Windows, PM	MS Windows, Motif, Open Look	Motif, MS Windows	Motif, MS Windows, PM
Connectivity	OSI, SNA, TCP/IP	OSNET/CP with OSI support, SNA, TCP/IP	Transdata (OSI-based), SNA, TCP/IP	OSI, TCP/IP, SNA for PCs
Network Management	Integrated System Management	Open Systems Management Center	Transview	Network Management System (LAN Manager networks), Departmental Management Center (TCP/IP networks)
Transaction Processing	BOS TP (Tuxedo-based)	OSTM (Tuxedo-based), OSI-TP planned for VME/Unix TP	KDCS-UTM Transaction Monitor	Tuxedo
Strategic Database	Many - Open SQL interface	Ingres, Oracle, Informix	Oracle	Oracle, Informix
CASE	Not productized - will be based on PCTE	Limited tools for Unix, tools and repository supplied for VME	Domino CASE Environment	Upper and lower CASE tools, OSA Repository, supports ECMA/PCTE
Office Automation	OfficeTeam, ImageWorks	OfficePower	OCIS	IBIsys

Table 2. Vendor software offerings. * *Upon availability.*

Strategic Partnerships Are a Key Component

In Bull's case, sharing an operating system and RISC architecture with IBM means binary compatibility in workstation and forthcoming multiprocessor lines, and source-level compatibility across the rest of the IBM AIX and Bull BOS/X product lines. At ICL, a manufacturer and reseller of SPARC RISC-based systems, the ties to Sun Microsystems' product line are close, though the need to recompile SunOS applications to run under Solaris 2.0 raises a barrier to binary compatibility. ICL also ties in quite closely to the Fujitsu mainframe world, though that is not reflected in its Openframework strategy.

The other two vendors' partnerships are equally strategic but less technologically close. Olivetti's ties to the Digital product line are growing, and its partnership with Pyramid is

key to its OLTP strategy. SNI's strategic partners include Silicon Graphics, Pyramid, and Tandem. In both cases, though the technological ties might not be as close, the experience gained from working with U.S. partners gives Olivetti's and SNI's customers important consulting and engineering expertise on which to depend for development in these environments.

These strategies are both inclusive and exclusive, and they form a key part of the positioning of open systems products and services offerings. The presence of the U.S. vendors is an incontrovertible fact of life, and the ability to offer a U.S. vendor's product on at least one side of the client/server offering is expected to have a strong positive residual effect for the local partner. The outlier to this theory is Olivetti's partnership with Digital, a relatively minor player in Unix. But Digital remains in command of a large VAX VMS market in Europe, and Olivetti is already reaping some rewards from joint integration work in DEC environments.

The strategies are also significant for those they exclude. Hewlett-Packard, which was the loser in the bidding war for a piece of Bull, has no such close ties to the European market. Other, smaller vendors, such as Sequent, are also left out of the European vendor loop, a fact that may encumber their European marketing efforts.

CASE Strategy and Products

In looking at each vendor's CASE strategies, we consider the holes as revealing at times as the products that are available. But while only SNI pretends to offer a complete CASE environment today, the real question about CASE strategies is the relative importance of message versus product.

THE RIGHT MESSAGES. On the message side, the European vendors are saying all the right things. Integrated CASE and open, object-oriented repositories figure in the plans of all four vendors. Ties to the command and control of the overall system, ties to the transaction processing world, and ties to third party tools are all promised, and work is underway at each vendor to refine CASE offerings in the coming years.

The messages are not unanimous on one key point. ECMA/PCTE is favored by Bull, Olivetti, and SNI, with ICL holding out for CDIF. These differences are part of a larger battle within the industry and will have to be resolved within the market at large.

EVOLVING PRODUCT OFFERINGS. On the product side, with the exception of SNI, the CASE offerings fall short of being able to design the complex, distributed OLTP applications that are at the apex of each vendor's model. The remaining three vendors offer parts of the equation and leave the rest to third parties and future products.

But is this paucity of robust solutions a real problem? In the short term, no. The lack of good integrated CASE solutions is the norm in the industry and is hardly unique to the European vendors. And, for the most part, those applications sitting at the very top of the technological pyramid are rarely, if ever, undertaken and are left to third parties. The compelling market need is not evidenced in the number of truly high-end installations. But that world is quickly coming, led by the aggressive marketing policies of hardware and software vendors alike and the needs of users. While integrated CASE is not a universal customer requirement today, it promises to become the only way to develop complex applications in the near future. And the Gang of Four does well to stay very much in the ball game.

Comparative Analysis

Network Administration

Network administration is a key element in providing complex distributed systems, and there is an obvious consensus on the need for such technology, with each vendor providing essential elements today and working feverishly to boost the scope of its offerings, particularly in order to service heterogeneous networks. All four vendors have promised to support a full implementation of DME, though the exact offerings await OSF's development efforts. Again, as with CASE, it is important to note that a great many systems are being installed using only subsets of each vendor's offerings, and the requirement for extensive networking administration and monitoring is limited to the pioneer users of the market. But the message is important, and the market will readily absorb these technologies as end-user development begins to make full use of the each model's capabilities.

Systems Integration and Open Architecture

Making full use of each model requires no skill more acutely than systems integration, and, while each vendor acknowledges the need—and the profits to be had—their responses reveal a lot about the different ways this slippery term is defined.

INTEGRATOR AS DEVELOPER. In its purest form, the systems integrator is an "objective" developer who thinks in terms of solutions and to whom "best of breed" is the only criterion for product selection. In the nonvendor SI world, this goal is limited by human expertise, and most independent integrators have some product lines in which they are more expert than others. Nonetheless, a key criterion in becoming the prime contractor in a large systems integration contract—the top money-making spot in the SI food chain—is at least the semblance of objectivity, and in this lies the dilemma for Bull and SNI. The question of "pure" objectivity—defined as the ability to respond credibly to a bid to integrate other vendors' product lines—has to be difficult to resolve for an SI group with a hardware vendor's name on the door. Bull's well-established SI division and the still-to-be-created SNI offering have this built-in market prejudice, and, while Bull has already engaged in some limited non-Bull integration work, many users will be tempted to call on an independent integrator to put together a heterogeneous environment.

INTEGRATION AS DILEMMA. The other side of the dilemma is more internal but no less daunting for the companies to face. As systems integration becomes more and more a profit-making endeavor separated from the slim-margin hardware world, the role of the sales force, not to mention their compensation and incentive packages, must change drastically. The actual cost of hardware as a percentage of the total sale has been diminishing for some time in favor of software and services. The slope becomes even more steep when the total sale includes systems integration: the more control and profits accorded to the contractor, the more hardware recedes in importance. And, in a world where hardware was the center of the sales model, these changes have meant not just educating the sales force but also finding a way to motivate them to push the new service offerings.

SNI and Bull Leverage the SI Model

This has been a major issue at SNI, which is combining systems expertise from the sales force and an internal systems house, and it has also been occupying Bull for some time. Bull's experience shows that hardware often makes up only 30 percent of the total sale, and the company is still in the process of revising its compensation package to account for the new reality.

SI Secondary at Olivetti and ICL

Olivetti and ICL have a simpler model to follow in that their efforts are seen as an adjunct to sales instead of part of an independent source of revenue. It's a lower revenue-producing model, but it carries with it the benefit of a simpler message to both customers and internal salespeople. And it has an inherent lower overhead for the vendor: Being a full-service

integrator means carrying a large staff whose only real value is when they are on call to a client, a dangerous expense when business is slow.

Finally, plans to expand systems integration capabilities in the desperate hope of tapping a rich revenue lode will meet considerable competition in the market. Systems integration has become the most-favored source of black ink in the 1990s for a whole range of potential service suppliers, from hardware vendors like IBM to software suppliers like Oracle Corporation—both major presences in Europe—to telecommunications suppliers like France Telecom and British Telecom. Large end users are also in the market, like Germany's Daimler-Benz, which spun out its internal integration unit last year into a joint venture with France's CAP Gemini Sogeti, the number one indigenous integrator in Europe. Add to these arrivistes the likes of EDS and Andersen Consulting, whose profitable operations dwarf those of the European hardware vendors, and systems integration becomes a daunting market to pursue. Even if the Gang of Four has a better overall architectural strategy and more expertise in supplying open end-user solutions—which is often the case—its members hardly have the field to themselves.

Conclusion: Software and Services Provide Differentiation

On the way to using an open, distributed computing paradigm to solve their technical and marketing problems, Europe's vendors are also forced to confront a fundamental paradox: the more open a system, the less distinguishable the hardware product lines. Given a set of highly similar approaches to the issue of open systems architectures and products, how do these increasingly pan-European companies allow users and partners across Europe to make an intelligent, well-differentiated choice among the four approaches? This paradox has made software and services the fundamental level of analysis in looking at the four models.

Similar Foundations

An analysis of the software offerings of the four vendors shows clearly that the base-level technologies are largely the same, a collective tip of the hat to the arduous industry-wide standardization efforts that have been actively supported by the Gang of Four. But it is equally clear that, at the upper levels of the software model, and particularly when it comes to end-user applications, the truly open and distributed solutions are both scarce and difficult to develop. There exist a myriad of applications that satisfy parts or subsets of each model, but there are still few applications brewed from the full complement of open architecture offerings.

Too Far Ahead?

These applications await some forthcoming technology, but they are also waiting for the users to catch up with the technological promise of each vendor's model. It is almost axiomatic to say that technology pulls more than pushes the market; it is even more the case with open systems architectures.

Open Systems: Gateway to U.S. Market

A final word on the relevance of these models to the U.S. market. With the exception of Bull, the Gang of Four has little presence in the United States, and ICL has little outside its home market. Olivetti has a U.S. banking subsidiary, ISC Bunker Ramo, that makes some use of Open System Architecture, but its overall efforts are not directed at specifically satisfying this user base.

BULL'S STRONG U.S. TIES. Bull on the other hand, has a relatively large presence in the United States, thanks to its acquisitions of Honeywell and Zenith Data Systems. Over 20 percent of Bull's revenues in 1991 came from the United States and Canada, with France and the rest of Europe accounting for 35 and 36 percent, respectively. Its activities in

Conclusion: Software and Services Provide Differentiation

systems integration include a recently formed, independent SI arm in the U.S. called Integris, as well as the HFSI, which used to be Honeywell's federal SI unit. Bull is actively promoting its Distributed Computing Model in the U.S. market.

WILL TEIS LEAD TO CONFLICT? DCM, Olivetti's OSA, and SNI's OSD will also have a direct impact on the vendor side of the U.S. market. Despite close ties to the American vendors, these three companies' recently-formed TEIS development and marketing arm has a very fortress-Europe flavor. Granted, the fact that European vendors (this in the narrow definition that excludes ICL) have only 30 percent of their own government market gives them every right to gang up on the market leaders from the United States. And the goals of TEIS are modest: They only hope to gain an additional 5 percent market share over the next three or four years. But the lines are being drawn along national borders, and vendors like Hewlett-Packard as well as smaller companies could be disadvantaged in a government market that is mandated to only buy open systems.

The final status of the four architectures will be decided by the marketplace, and the companies' current financial difficulties—ICL excepted—have little predictive value for how well they will do as sellers of open distributed systems and services. By and large, all four approaches are on target. What remains to be seen is when the remaining software components will be developed and when the users will buy.

Next month's *Open Information Systems* will address
The Unix Data Center: Fact or Fiction?

For reprint information on articles appearing in this issue,
please contact Donald Baillargeon at (617) 742-5200, extension 117.

Open Systems: Analysis, Issues, & Opinions

FOCUS: PORTABILITY

Bristol Technology Takes Windows Applications to Unix

Microsoft is claiming that there are 10,000 MS Windows applications. This is a huge number compared to the number of graphical applications for Motif or OpenLook that are available on any Unix platform. The gap is evidenced not just by the number of graphical applications available, but by the quality of the applications available on each platform as well. It exists for several reasons:

- The market for MS Windows software is larger than the markets for Motif and OpenLook combined. Therefore, MS Windows attracts more developers.
- Keeping up with the intense competition in the crowded MS Windows applications market consumes resources that ISVs cannot afford to divert in order to develop for Motif.
- The Motif environment has less functionality than the MS Windows environment.
- Motif is X Window-based, requiring a different programming model than the MS Windows model. Program structure, let alone source code, cannot be leveraged across Motif and MS Windows.

While some PC software companies do, or plan to, provide their graphical applications on Unix, others dismiss Unix development as costly, wasteful, and not worth the return. On the one hand, Lotus Development is moving some of its graphical applications, like 1-2-3, cc:Mail, and Notes over to Unix, and WordPerfect has its word processor running graphically on Unix. On the other hand, Microsoft, Borland, and many other MS Windows developers have no plans for graphical Unix applications.

Wouldn't It Be Nice?

Considering the fragile underpinnings DOS provides for the Windows API, wouldn't it be nice if all those Windows applications could be moved over to a more robust operating system? At first glance, the task of providing a library on Motif that would present a Windows-compatible API to developers so they could recompile their applications to run on Unix seems simple.

It is, however, far from simple. Many features of Windows are not present in Motif, or in OpenLook either for that matter, such as Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE), context-sensitive help, consistent printer support, and Dynamic Link Libraries (DLLs), as well as many widgets that do not exist in either Unix GUI toolkit.

There are additional challenges to portability. Byte-ordering differences between Intel and RISC platforms have to be taken into account, making portability difficult. Another problem that crops up is the difference in the ways that Unix and Windows perform multitasking. Unix provides preemptive multitasking with protected address spaces, while MS Windows applications are non-preemptive and often share global resources with other applications. Porting a Windows application to Unix requires modifications to protect shared resources. Windows applications that fall in this category include those that use DDE or that share files or memory objects.

Enter Bristol Technology with Wind/U

Bristol Technology, Incorporated, has tackled this challenge and has demonstrated Wind/U, a set of tools that allows Microsoft Windows applications to be compiled to run on OSF/Motif. Wind/U confronts the differences between Windows and Motif head-on and provides facilities that essentially allow all the functionality in a Windows application to be supported under Motif. Although the product is in beta test, according to users, it is already yielding production-quality ports.

Wind/U is not a virtual toolkit like Neuron Data's Open Interface (See *Open Information Systems*, Vol 7., No. 7, July 1992) but a library that actually supports the full set of APIs provided in the Microsoft Software Development Kit (MS SDK). Applications written with

the MS SDK can have their source code recompiled and then executed in a native Unix/Motif environment.

Wind/U IS THE KEY. The core technology for Wind/U is the Wind/U Library, which is essentially a Windows SDK for Unix but with many extremely critical extensions. Source for an MS Windows application is linked to the Wind/U library instead of to the MS SDK library, using just about any standard C compiler. All of the functionality in the MS SDK is translated into equivalent X Window and Motif function calls, thereby providing a complete mapping of MS Windows functionality onto the Motif look and feel. The application can then be run on any platform that supports X Window and Motif toolkits. One source tree can then cover both Windows and Motif environments.

Wind/U, therefore, has to do extensive mapping of low-level X Window events to equivalent Windows messages. Wind/U relies on Motif widget set translations and on callbacks to implement higher-level Windows messages that are not supported in the Xlib layer. Examples of this are menu item selections, button selections, edit controls, and clipboard operations.

OTHER PORTING ISSUES. The programming paradigm used by Windows is different from that used by Motif. The Windows API is remarkably clean, while the Motif API actually consists of Motif, X Intrinsics, X Window itself, and the C library layers. To the extent that Windows programmers have adhered to the Windows API, porting is straightforward. (Incidentally, conformance is less than 100 percent according to Microsoft—creating problems for some 16-bit Windows applications trying to run under Windows NT on the 16-bit Windows subsystem. (See *Open Information Systems* Vol. 7, No. 8, August 1992.)

Because of the way Windows applications allocate memory, Wind/U has to provide its own critical region locking of memory and enforce single-threaded access to shared files.

Extending Motif

Even with Motif Version 1.2 (See *Open Information Systems*, Vol. 7, No. 8, August 1992), there are many features in MS Windows that are not available in Motif. Interface widgets such as the multiple document interface (MDI), combo boxes, data exchange protocols such as DDE, and even DLLs have been added to the Wind/U library in the form of specialized widgets and code that provide these Windows features under Motif.

The Wind/U Resource Compiler. The Wind/U Resource Compiler uses existing MS Windows resource files to specify layouts for menus and dialogues, as well as bitmap, icon, and cursor resources.

Wind/U HyperHelp. Wind/U HyperHelp uses existing MS Windows input files to give Motif applications online help, allowing developers to maintain only one set of help files. It provides a hypertext-based help facility analogous to that found in Windows 3.x, including hypertext branching, definition boxes, graphics, key-word searches, and browsing.

Wind/U Xprinter Printing. Because X Window knows nothing about printed output, one of the major efforts in accomplishing a Windows-to-Motif port is to provide support for PostScript printing. Bristol's solution to the lack of a standard Unix printing mechanism is Xprinter, which, working along with the Wind/U Graphics Device Interface (GDI), provides transparent access both to the display and to PostScript printers. A developer makes calls to the Xprinter library without having to deal with PostScript language. Bristol is about to release Version 2.0 of Xprinter, which will include support for HP PCL page description language in addition to PostScript.

Portability Issues Remain

Porting Windows applications with Wind/U is not without its challenges. Several issues must be confronted:

- Byte-ordering differences between little-endian Intel chips and big-endian RISC architectures, SPARC, PA RISC, Power Architecture, and PowerPC. MIPS and Alpha are little endian, so this isn't an issue with those architectures. These can be handled through conditional compiles in the source code.

- The difference between the 16-bit MS Windows environment and the 32-bit Unix environment will require some modifications to the way variables are declared. Wind/U has tools that help identify non-portable declarations. Correcting these will have additional benefits in converting to the Win32 API for NT.

- Bugs don't port well. Even though bugs may not appear on MS Windows, when moved to Unix, or to NT for that matter, they are more likely to raise their ugly little faces. Of course, this can be viewed as a benefit of doing the port, not a negative characteristic.

In general, developers will face many of the issues involved in using the Wind/U tools when they start using the Win32 API as well (See *Open Information*

Systems, Vol. 7, No. 8, August 1992), since Unix and NT share more similarities than do Unix and MS Windows. In fact, once an application has been ported to the Win32 API, it becomes much easier for Wind/U to take it over to Motif. Bristol plans to make Win32 support available next year as an upgrade.

Why Wind/U?

The potential value of Wind/U lies in the fact that it provides an easy way for developers of Windows applications to make their applications available on Unix and other Motif platforms. The cost of taking the Wind/U approach is relatively small compared to that of developing an entirely different source for a Motif version from the ground up. The availability of popular Windows applications on Unix platforms should be very exciting for Unix users as well as Unix vendors. In fact, Unix vendors should offer to help defray the porting costs for any Windows developer who chooses to go this route.

Making Win32 a Unix Standard? In addition to helping to bring popular Windows applications to Motif, Wind/U could provide developers with the basis for an entire cross-platform development strategy. By making the Windows API, in effect, a de facto standard GUI programming interface, it brings developers the promise of having just a single API, the Windows API, to write to in order to deliver applications to any Windows or Motif platform.

Wind/U is currently in beta testing, although one beta tester has already started shipping its application on Motif. Full-scale availability is expected by the end of the year. While pricing for Wind/U is not absolutely final, it is expected to be around $20,000 per developer's seat. There are no run-time fees or royalties.

Giving Back Something to Motif

Some of the work that Bristol has done to provide Windows-like functionality on Motif could be rolled back into Motif. This could happen either with widgets distributed in a form like ICS's Widget Book or by licensing through the OSF. Other capabilities, like DDE and OLE support, would require wide industry support, but open systems have ever shied away from basing standards on products.

Microsoft Reaction?

And what about Microsoft? Would it sue over look and feel? Although there is no overt support from Microsoft, the company is clearly pleased that the Windows API, the "family jewels," is being propagated to platforms with which it would never directly get involved. Unlike some software companies, Microsoft understands the value of owning a de facto standard. Anything that promotes widespread adoption of its API is a win in Microsoft's eyes. —*M. Goulde*

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FOCUS: CROSS-PLATFORM TRANSLATION

Echo Logic Performs Binary Magic

Motorola and IBM recently announced that work on their PowerPC processor was progressing on schedule and that they had "first silicon"—a major milestone in the microchip business. One of the implications of this is that Apple Computer is likely to be able to introduce its new RISC systems, based on the PowerPC 601 chip, in accordance with its original time frame, early 1994. There is one major challenge, however, that Apple must face in making a transition in architectures from the Motorola 68K to the PowerPC. It is identical to the one that was faced by Hewlett-Packard when it moved to the PA architecture from its earlier CISC architecture, and to that being faced by Digital Equipment Corporation as it moves from the VAX CISC processor to the Alpha RISC processor. That challenge is to ensure that as many applications as possible are available on the new architecture when systems ship.

Changing architectures has been more of a problem for vendors of proprietary operating systems than for Unix vendors. Sun weathered the transition from Motorola to SPARC, and HP the transition from Motorola workstations to PA RISC, because Unix provided a reasonable measure of source-level portability. When the transition is from a proprietary operating system—HP's MPE, Digital's VMS, or Apple's System 7—the path is not so easy. Changing architectures means that binary compatibility is broken, even if the entire run-time environment has been ported over.

The typical option is to recompile the application using the original source code and a compiler for the new architecture. However, many typical Macintosh applications use substantial 68K assembly language code in order to get acceptable performance. The

assembler cannot be recompiled, and converting to another architecture's assembler is very labor intensive. Another problem that could be encountered is that a compiler doesn't exist for the language in which the program was originally written. Or, worse yet, source code or documentation may be missing or incomprehensible. Starting over is neither cheap nor easy.

Emulation has always been an option. Emulators run as environments on the new host platform and create the appearance of the original environment. Calls have to be mapped, however, and service requests from the applications have to be turned around by the emulator into service requests to the host operating system. The overhead involved generally slows performance of the application by a very significant amount. Emulation has been the traditional way of overcoming architectural differences, but it is a poor compromise at best. Even worse, none of the additional features in the new architecture is available to an application running in emulation mode.

Apple's Operating System Migration

Although the work that is being done by Taligent on an object-oriented operating system to run on the PowerPC is supposed to be ready for the market sometime around 1995, Apple needs to provide a smooth migration path to the new architecture in a much earlier time frame. To accomplish this, it will provide as a development platform A/UX 4.0 for the PowerPC with support for System 7. A/UX 4.0 will be based on IBM's AIX technology, which is migrating to OSF/1. Production PowerPC Macintoshes will have a full native Macintosh operating environment. Apple will probably continue to offer an A/UX option for the PowerPC Mactinoshes.

Today, Macintosh System 7 applications run on A/UX 3.0 because A/UX is still running on a Motorola 68K processor. The new PowerPC environment will be a new processor that is not binary compatible with the current Macintosh, System 7, and A/UX 3.x. Applications will have to be ported, and the challenge is to find a way to do it cheaply and quickly.

Meeting the Challenge

Porting applications from one windowing system to another, even with source code, is a challenge for the technologist. Bristol Technology (see above) is working at the source-code level to take MS Windows applications to Motif. Porting application binaries from one architecture to another, however, lies somewhere between magic and voodoo. Echo Logic, a New Jersey-based startup founded by some AT&T computer jocks, has developed a technology called FlashPort which converts Macintosh Motorola binaries to PowerPC Macintosh binaries.

The rationale behind the market for this technology is that, in most cases, redeveloping existing applications to run on the new PowerPC-based Apple Macintoshes (or whatever they will be called) will be expensive and will delay time to market beyond what Apple can tolerate. In order to stave off continued encroachment of machines based on Intel Pentium/Digital Alpha/MIPS R4000/Microsoft Windows NT, Apple needs to have its new machines on the market as soon as possible along with as much software as can possibly be ready. Having the hardware available in the first half of 1994 is not going to do Apple any good if the great Macintosh applications take another year or two to get to market.

Echo Logic, a majority-owned subsidiary of AT&T, is bringing FlashPort and the Analyzer to market, which may lead to instant availability of Macintosh applications on the PowerMAC.

FlashPort Origins

The history of FlashPort is interesting because it shows how technology and the marketplace sometimes take time to converge. In the mid to late 1980s, some researchers at Bell Labs were working on advanced RISC workstation technology for AT&T's Computer Systems Group. One of the first products from this group had been the UnixPC, but that machine attracted little native software and its hardware DOS emulator didn't provide a compelling reason for anyone to buy the product. This group knew that no one would buy a new RISC system from AT&T, either, unless a significant base of software existed, and they began exploring the notion of binary translation to see if an entire application base could be moved over from another architecture.

THE FIRST SPARCINTOSH. At the time, there were a variety of emulator products available for doing DOS on Unix. The Computer Systems Group wanted to do something that would catch more attention than another DOS emulation, and so they looked into doing a translation of the Macintosh. None of them had ever seen the Mac OS source, which was tightly coded in Motorola 68K assembler. But in 1988, four people, working nine months, did a translation that allowed them to put together a demonstration that showed the Macintosh environment and three applications running on a Sun SPARCstation.

CONVINCING THE SKEPTICS. The group showed the technology to the AT&T computer systems management team, which was impressed. It was then taken to the AT&T internal technology audit team, which verifies new technologies. The story goes that, when team members saw the demonstration, they didn't believe it, and they started looking for hidden cables and Macintoshes inside the SPARCstation cases. There was a big hubbub for a while about doing something with this technology. But AT&T had just purchased 20 percent of Sun and, knowing that it wouldn't be entering the RISC workstation market with its own offering, made no immediate plans for doing anything with SPARC.

A DEAD END? Further market evaluation was done, and it looked like the most likely outcome would be a giant lawsuit from Apple if AT&T went ahead with the technology. This would have been the result of putting the proprietary Macintosh ROM on the target platform.

The technology almost found a niche with the AT&T Federal Systems Group. It needed to manage a transition from the Digital PDP 11 architecture to MIPS. (Remember, early Unix development was all done on the PDP 11.) What impressed Federal Systems members in particular was that both the endian conversion and data structure conversions they were facing could be handled by the translator. They also saw that maintenance could be done on the target platform and that modular replacement over time would be a good strategy. Unfortunately, changing priorities resulted in their not using the technology.

GOING MASS MARKET. Brad Burnham, a manager of Business Development for AT&T and now president of Echo Logic, eventually came across the technology in 1990, considered what was going on in the industry at the time, and went out to talk to Apple in October of 1990 to see if the company was interested. A technical team from Apple took a look at the technology early in 1991, while Apple was evaluating strategies for migrating to RISC technology. Apple's software group had committed to go to RISC but had expected it to be Motorola 88000 and 88110. When the commitment to adopt IBM's PowerPC was made in October of 1991, getting software ported over quickly and with better performance than emulation would provide became a high priority.

In 1991, Echo Logic showed a number of Apple engineers HyperCard running on a SPARCstation, which led to an exploratory agreement to prove the ability to maintain code size and performance after translation. When they were able to that, Echo Logic and Apple inked an agreement to develop a commercial product. That product is FlashPort.

Binary Translation without Emulation

FlashPort translates most compiled code from the binary image for one architecture to a binary image for a second architecture, in a process that normally takes just a few days. Binaries produced from assembler are tougher to translate than those produced from higher level languages, and they can take a few weeks to translate. Programmer intervention is required, but it is minimal, limited to those occasions when the translator gets stumped and needs a hint about jumps, branches, etc., that it cannot figure out on its own.

The translation process involves making several passes through the binary code using the Analyzer. During this process, code paths are analyzed along with register contents, memory locations, and condition codes. Data are tracked from origin to use, and loops, recursions, and expressions are analyzed. The information gleaned from the Analyzer is used to create a call graph, a flow graph, and an assembly listing of the input object code. If the Analyzer fails to solve a flow-of-control problem, needs a human review of some heuristic decision, has discovered an obvious bug in the input program, or encounters some other problem that cannot be dealt with automatically, it requests intervention from the user.

The information from the Analyzer is fed to an Intermediate Language (IL) Generator. The IL Generator produces an architecturally neutral, low-level register-transfer language in an intermediate representation, solving a myriad of tricky problems that crop up when generalizing from an architecture-specific to an architecturally neutral format. The IL code is then run through an optimizer and a target-specific back-end code generator. The code generator produces a target-specific binary as well as an assembly code source-listing. The same intermediate representation can be run through any number of different back ends, as long as the same APIs are supported on the platform.

A developer may run an entire application through the translator or through just selected modules. This latter capability allows code to be maintained and gradually ported over to a new native source.

FlashPort Benefits

The rationale behind using FlashPort is that Macintosh developers can have their applications running on the PowerPC virtually immediately while investing very little time in the porting effort. More importantly, those

applications will run at native speed, not emulation speed. This is critical for Apple in order for it to sell the benefits of the new RISC machines. In the meantime, developers can be working on future native versions of their applications which take advantage of new features on the PowerPC Macintoshes, and can still be making money in what Apple hopes will be a rapidly growing market.

Looking beyond the PowerPC Macintosh, we see FlashPort as an attractive alternative to OSF's approach to Architecture Neutral Distribution Format (ANDF) (See *Unix in the Office*, Vol. 6, No. 10) because it avoids the necessity of having installers on each target platform and it also eliminates the installation of the gargantuan intermediate representations that ANDF produces. Another advantage over ANDF is that the application source code doesn't have to be rewritten into an intermediate representation.

Another application of Echo Logic's technology is as an analysis tool. With some additional tools, the Analyzer and FlashPort could provide the means for taking old Cobol, RPG, or PL/1 applications and breaking them up into pieces that can be migrated in small steps to more contemporary development environments. CASE tools aren't applicable to this task because CASE knows nothing about the original structure of the code.

FlashPort could also be a useful tool for systems integrators whose customers need to move old applications from outdated minicomputer environments to contemporary RISC platforms. Configurability in the front ends is key to getting into these environments, and Echo Logic will be working on those tools over the next couple of years. —*M. Goulde*

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