Borland's Family of Development Tools:
The Golden Gate Architecture for Bridging Client/Server and Internet Technologies Across the Enterprise

Zack Urlocker
Director of Product Management

1/24/97
Draft 0.80

I. Executive Summary

The Internet, with its ability to broadly disseminate information to a internal users, customers and suppliers, has become one of the most strategic technologies for IT organizations. Marketing organizations, sales groups and customers are all interested in getting information electronically from the corporate web site. But information means more than static text; information means making available sophisticated business applications that tie into corporate databases, departmental servers and existing midrange and mainframe systems.

Corporate Intranet applications span across many different divisions in an organization and serve many different needs. Not surprisingly, IT organizations need not just a single tool, but rather an architecture for building, maintaining and managing business-critical applications.

Borland International, with over 14 years of recognized technical innovation, is the largest independent tools vendor with operations worldwide. Borland has developed a family of interoperable tools and intelligent middleware that allows corporate IT developers to address the broadest range of corporate client/server and Intranet application development requirements with complete confidence. Borland's products combine state of the art object-oriented component architectures, the world's fastest optimizing compiler technology, scalable database technology and intelligent middleware in order to ensure that you have an open, scalable architecture that is scalable from the desktop to the enterprise. Borland's product line delivers the performance, reliability and security that you need to build departmental and enterprise business-critical applications that will improve decision making and increase efficiency in your organization.

Borland recognizes that IT solutions must leverage your existing investment in technology, people and infrastructure. That's why we've built our products on open architectures. Borland has developed strategic technology partnerships with leading IT providers including: IBM, DEC, Tandem, Sun, JavaSoft, Microsoft, Netscape, Cognos and others. Borland has also developed marketing partnerships with a wide range of corporate System Integrators, Value Added Resellers (VARs), consultants and training organizations, ensuring that your selection of Borland tools is supported by thousands of third party developers and add-on tools and libraries.

Borland's family of products fit into the Golden Gate architecture for bridging between client/server and Internet technologies to deliver the best solution for building business critical applications. This paper provides more details on how the Golden Gate architecture enables you to bridge between the competing Microsoft and Netscape platforms to reduce your risk in developing Internet applications and how the Borland family of products work together to deliver enterprise solutions.

II. Challenges of enterprise application development

Today's Information Technology (IT) departments face a dilemma: How do you create a competitive advantage for your company by developing, deploying and managing distributed applications that scale across the LAN, WAN and Intranet while preserving your investments in systems, applications, information and people? Simply put, IT organizations are asked to build the future without breaking systems that maintain the business today.

A multi-tier distributed computing architecture has the potential to provide better, more timely information across the enterprise at a lower cost than the current combination of PC LAN, two-tier client/server and mainframe applications that have been developed in most organizations. A key part of the improvement will be the development of an overall corporate computing architecture that enables IT to manage the integration of departmental applications into an overall enterprise system.

Given the rapid evolution of multi-tier architectures built around corporate Intranets, web servers and thin-client browser-based applications, its difficult to predict which technologies will become standards and which will fall by the wayside. IT managers must evolve their current systems one piece at a time and ensure that each application brings them one step closer to the desired multi-tier architecture.
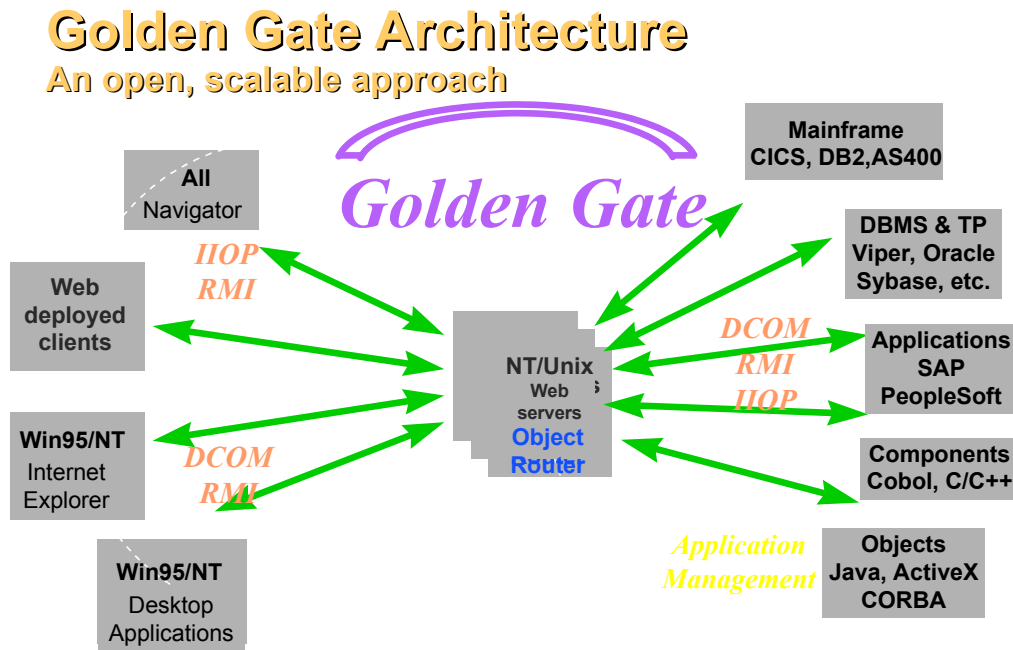

Figure 1 - Borland's Golden Gate architecture allows you to leverage existing systems

Corporate developers face a myriad of challenges along the way including:
- Integration: How do you integrate existing production applications, systems, skills and people?
- Development: How do you break through the application backlog to build applications more quickly?
- Scalability: How do you ensure that applications can deal with large volumes of data and users?
- Application Control: How do you combine the ease of Windows with the control of the mainframe?
- Management: How do you provide reliability and security over distributed data, objects and applications to ensure that systems are as robust, predictable and performant as existing mainframes?
  - Standards: How do you reduce the risk of technology without getting caught in a standards war?

III. Objectives of the Golden Gate Architecture

Borland, with its heritage in object-oriented compiler technology together with Open Environment Corporation's scalable Entera intelligent middleware, is in a unique position to fill the need for corporate client/server and Internet tools. Borland's Golden Gate initiative is a bridging strategy that focuses on helping IT developers combine the best of the client/server and Internet architectures for departmental and enterprise applications. The objective is to accelerate the creation of corporate Intranet applications without compromising the security and reliability of business-critical systems. Borland will provide a family of interoperable tools with an open, scalable architecture that reduces development and maintenance costs.

Borland is unique in offering a Scalable Architecture based on four key technologies:
- *World's fastest optimizing compiler technology:* Borland has developed the world's fastest optimizing native code compiler technology. This provides customers a competitive business advantage with the fastest applications and the best use of information in their organizations.
- *Reusable component technology:* Borland has delivered a highly reusable object component architecture that supports Rapid Application Development. This allows organizations to deliver applications more quickly and lower development and maintenance costs by reusing code.
- *Scalable database technology:* Borland has scalable high-performance relational database and connectivity technology for accessing corporate database servers and legacy systems. This ensures that organizations can take advantage of existing systems and integrate them across the enterprise.
  - *Cross-platform application server technology:* Borland is developign cross-platform application server and intelligent middleware technology that allows customers to create scalable multi-tier applications. This allows customers to broadly deploy applications with the highest performance and at the lowest cost.

These technologies provide Borland with a Scalable Architecture that spans from desktop application development, to two-tier client/server as well as to multi-tier enterprise wide Intranet applications.

With over 14 years of technical leadership in development tools, Borland understands what it takes for developers to deliver robust applications on time. Borland understands the need for corporate IT departments to rapidly build highly scalable and reliable business-critical applications. Borland's development tools are based on the Golden Gate architecture which provides a bridging strategy between today's client/server computing architecture and the emerging multi-tier Intranet architecture. The goal of the Golden Gate architecture is to give corporate IT developers a competitive advantage in building applications that can be more easily managed and controlled while improving the integration of information across the enterprise.

Bridging to the Future

Borland's Golden Gate initiative is designed to provide a bridge between:
- *Client/Server and Internet architectures:* to allow developers to build applications today that fit into multi-tier architecture of the future thereby preserving current investments in skills and technology
- *Departmental and Corporate:* so that organizations can integrate departmental applications into an overall enterprise information system providing better information flow and management control
  - *Microsoft and Netscape platforms:* to provide interoperability between competing technology standards thereby reducing the risk of platform selection

IV. Bridging between Platforms

As part of Borland's Golden Gate architecture, we are providing interoperability between the competing platforms from Microsoft and Netscape. Borland does not have a "platform agenda" to carry out so we are focused on providing the maximum value to our customers in protecting their investment in technology by ensuring interoperability between platforms. We recognize that many organizations will end up being in heterogeneous environments where there is an assortment of technologies that span a range of platforms on the client, the server or the middle tier.

By ensuring this interoperability between platforms, we reduce the risk for IT developers. As a result, developers can build applications that are independent of the underlying technologies and are insulated from the risk of the evolving standards. Borland will provide interoperability between communications protocols, infrastructure services, Web server APIs, Java Virtual Machines (VMs) and database architectures.   As the standards evolve, Borland will continue to work closely with all of our technology partners, including Microsoft, Netscape, Sun and others to play a leadership position in defining and implementing these standards.

Bridging Distributed Object Communication Protocols

As we move towards a multi-tier computing environment, distributed object communications protocols become a critical mechanism for ensuring that applications can be partitioned across the client, server and middle tiers independent of the underlying platforms or programming languages.

Microsoft has established DCOM (Distributed COM) as its underlying communications protocol and object model. ActiveX builds on DCOM with a set of additional interfaces to provide a higher level component model.   DCOM and ActiveX are strategic to Microsoft's Windows platform and are the basis for all new technology emerging from Microsoft including transaction management, queuing services, forms creation, database architecture and development repository.

Microsoft has not indicated any support for communications protocols or component object models proposed by competing platform vendors. Instead, even though DCOM and ActiveX were originally built as Windows operating system APIs, Microsoft has recently released these technologies to Xopen, an industry standards group to make them available on other platforms. Borland is a charter member of the ActiveX standards group and is working closely with other members to ensure that DCOM and ActiveX evolve to support other platforms.

Netscape, on the other hand, is supporting the Object Management Group's IIOP (Internet Inter-ORB Protocol) as its underlying communications protocol and has licensed ORB (Object Request Broker) technology from Visigenics for its object model and broker. Netscape has indicated that they will provide some level of interface to ActiveX, but this support remains unclear.

Both Microsoft and Netscape view their communications protocols and object models as the strategic basis for new technologies. Both companies are embedding their object models into their respective Java Virtual Machines in order to further leverage their position with customers. Although this may be good for the platform vendors, it casts doubt on the interoperability in heterogeneous environments.

Borland is committed to supporting the development of enterprise multi-tier applications which span heterogeneous platforms. In order to ensure complete platform interoperability, we will support all of the emerging communications protocols and component object models. Using Borland's family of interoperable development tools you will be able to create thin client applications that run inside the leading browsers including Microsoft's Internet Explorer as well as Netscape Navigator and can access middle tier and server tier objects and servers. Borland will provide an Object Router that will allow Java applications to interface with non-Java components, including ActiveX/DCOM objects, CORBA IIOP objects and RPC-based components. This will provide the broadest possible level of connectivity across the enterprise and allow people to develop applications that are completely platform independent.

Bridging Infrastructure Services

As the use of information becomes more strategic to businesses, both departmental and enterprise applications must fit into a coherent architecture with a consistent infrastructure for providing directory, security and management services.

Microsoft is developing directory and security services for Windows NT based on DCOM and ActiveX. Netscape is developing similar directory and security services that will use IIOP, though they will not be CORBA-compliant and will not interoperate with other CORBA vendors' services. In other words, there are two proprietary implementations of the underlying distributed computing infrastructure that will not interoperate in any way.

Borland supports both sets of emerging standards and goes further to provide support for the DCE (Distributed Computing Environment) standard today. DCE is already widely available as an open standard for directory and security services and is being readily adopted by corporate customers seeking an open standard. Borland will continue to support the DCE infrastructure and work with other vendors to extend DCOM, IIOP and RMI so that customers will be able to integrate application components that are developed with different tools and use different protocols. We will support both the Microsoft and the Netscape infrastructures in this effort, and make the underlying infrastructure transparent to the application developer and system administrator. This will ensure that corporate developers can deliver secure, reliable, manageable enterprise applications without needing to worry about compatibility of underlying infrastructure services.

Bridging Web Server APIs

Web servers with programmable extensions will become increasingly important way of providing corporate information to thin-client browser-based applications. In order to create web server extensions, for example, to allow a web server to draw data from a corporate database as a result of a user query, programmers must write code that interacts with a proprietary web server API.

Microsoft's Internet Information Server (IIS) web server runs only on the Windows 95 and Windows NT platforms and use Microsoft's proprietary ISAPI API. Netscape's Web servers are available on multiple platforms and use a different web extension API known as NSAPI.

Borland's development tools will support both the Microsoft and Netscape web servers and both the ISAPI and NSAPI web server extension APIs in a transparent fashion.

For example, IntraBuilder, Borland's Intranet database development tool supports both the Netscape and Microsoft browsers and servers. This gives developers the maximum flexibility to create high level, reusable web server applications without being tied to a proprietary interface. Whether the organization chooses the Netscape Web server, the Microsoft Web server, or a combination of both deployed across multiple platforms, no changes are necessary to the application code. All of Borland's tools are tested and certified to perform against all leading web servers.

Bridging Java Virtual Machines

One of the reasons Java has become of interest to centralized IT is because of its inherent cross-platform portability. Java code will run on any operating system that has a Java Virtual Machine or VM layer. However, Microsoft, Netscape, JavaSoft, IBM and Apple each have their own VM and extensions. There is no uniform development tool API to these VMs. This means that a customer will have to purchase separate development tools for each platform, seriously limiting the cross-platform capabilities of Java.

Borland's "Open VM" architecture allows alternative Virtual Machines to be used in the JBuilder Rapid Application Development (RAD) environment. Everything which is VM specific, including the forms system, the debugger, experts, and the run-time VM API, has been designed as a replaceable subsystem in JBuilder. Customers only have to buy one development tool that supports development, debugging, and deployment with any VM. In addition, JBuilder will allow any type of file to be added to a project. This

support allows us to have different editors, viewers or compilers for different file types, ensuring that JBuilder is completely open and can be extended to deal with new types of data.

Bridging Database Architectures

Both Microsoft and Netscape are working on technology to make HTML database applications easier to develop and higher performance. The Microsoft "dynamic HTML" architecture (codename Trident) addresses this with their ActiveDataFactory and ActiveDataControl subsystems.

Borland's "Open Database" architecture will provide an HTTP server-independent implementation of the ActiveDataFactory concept by using a combination of IntraBuilder and JBuilder technologies. This solution will provide a scalable application architecture that supports current HTML based database applications all the way to direct connect multi-tier applications without the need for application re-architecture. On platforms such as Windows that already support this infrastructure, we will sit on top of this support and not attempt to replace it. The benefit to the customer is a single tool and a single application architecture.

V. The Next Generation of Enterprise Development Tools

Borland has been very successful in the creation of two-tier client/server development environments such as Delphi Client/Server Suite. In fact, Delphi has sold over 500,000 units in just over 18 months giving it a larger market share than PowerBuilder according to IDC. However, for many applications, particularly in the enterprise area, a more advanced, multi-tiered architecture has additional advantages in scalability, security and reliability. Coupled with the ongoing growth of corporate Intranets, we saw a natural convergence of client/server and Internet computing to deliver a mature, enterprise architecture that provides distributed computing capabilities without sacrificing the productivity and maturity of tools that exist in the client/server arena. Hence, our Golden Gate architecture has been based on bridging the client/server and Internet architectures. As part of this strategy, we will be releasing Enterprise versions of our development tools that provide additional support for multi-tier application development and management. Borland will incorporate several new Enterprise technologies, as well as the multi-tier computing technologies of Open Environment in this effort.

A Family of Interoperable Tools

With the wide range of client/server and Intranet applications being developed in corporations, we have focused on creating a family of interoperable tools. All of the tools in the Borland family are built on a scalable object-oriented architecture that delivers high productivity Rapid Application Development (RAD) and lower cost development through reusable components for client/server and Internet application development. By having a family of tools, we're able to address the broadest range of application demands including support for Microsoft's Windows platform as well as cross-platform support for the Netscape/Sun platforms. All of our tools can be combined with the Entera middleware technology to deliver scalable multi-tier applications for the enterprise.
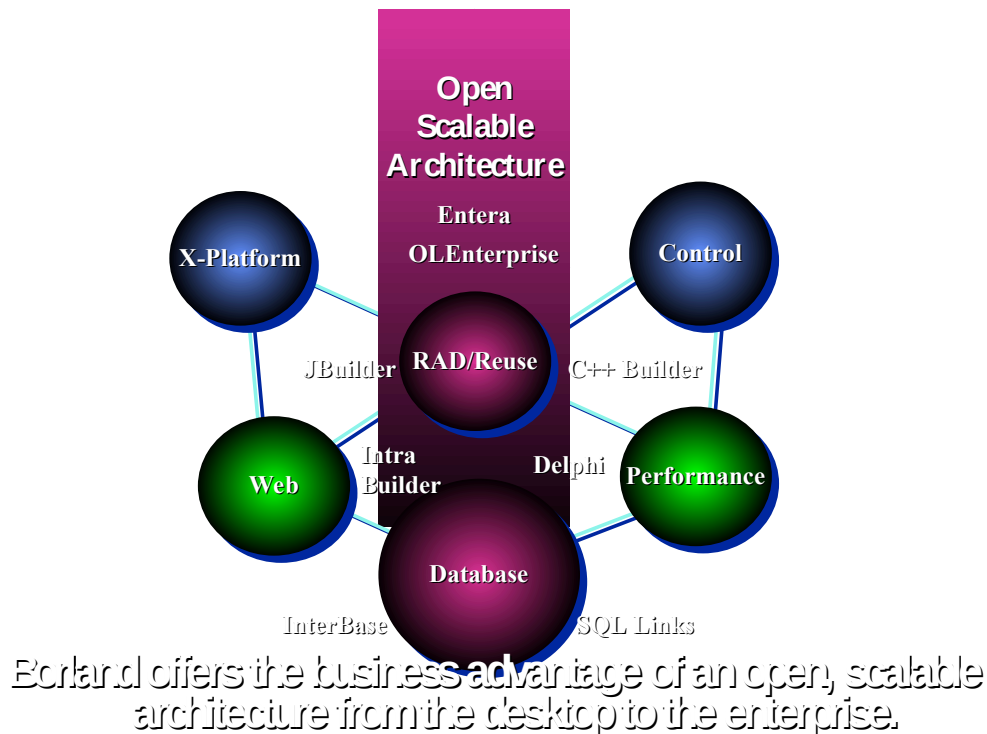
Figure 7 - Borland has a family of interoperable client/server and Internet development tools

9

For Windows client/server and Internet application developers:

- *Delphi:* **The most <u>productive</u> way to build scalable Windows client/server applications.**
  - **Combines RAD productivity of 4GL technology with optimizing compiler performance.**

  - Delphi Client/Server Suite is used to create departmental and corporate client/server applications that access databases including Oracle, Sybase, Informix, DB2 and InterBase.
  - Delphi has won over 30 awards for technical innovation based on its unique combination of the world's fastest optimizing native code compiler, high productivity object-oriented component architecture and scalable database technology.
  - Delphi has shipped over 500,000 units worldwide in just over 18 months ensuring widespread developer support with over 50 third party books, 6 magazines and thousands of third party components and tools.
  - Delphi/400 Client/Server Suite, scheduled for release in early 1997, gives midrange system developers the productivity and performance of Delphi for extending their investment in AS400 data and applications.
  - Delphi 97, the next major release, extends Delphi's use of components to support multi-tier development of client/server <u>and</u> Intranet applications. Its unique "One step ActiveX" technology enables Delphi to be the enterprise component foundry allowing you to create high-performance reusable components that can be shared with any development tool.
  - Delphi Enterprise, for high-end corporate developers, will combine Delphi 97 with the Entera intelligent middleware from Open Environment to deliver high-end scalability, reliability and security for enterprise applications as well as integration with existing enterprise applications and data on legacy systems.

- *C++Builder:* **The most <u>powerful</u> tool for building business critical applications on Windows.**
  - **Delivers the power and control of industry-standard ANSI C++ in a RAD environment.**

  - C++Builder Client/Server Suite has received widespread acclaim from beta testers and top ratings from magazines such as Byte, PC Magazine, ComputerWorld and InfoWorld.
  - C++Builder Client/Server Suite combines the innovative rapid application development client/server capabilities of Delphi with the performance of the award-winning Borland C++ compiler technology.
  - C++Builder Client/Server Suite comes with a complete range of client/server tools that enable you to easily manage corporate database servers, monitor the performance of queries, easily build new queries.
  - C++Builder leverages your skills and investment in ANSI C++ code, allowing you to more easily maintain and extend your existing C++ code.
  - C++Builder uses the same Interactive Development Environment as Delphi so that its easy to learn and become immediately productive. In addition, C++Builder provides even greater integration since you can immediately reuse existing Delphi components, forms and data modules.
    - C++Builder is currently available in a special trial version on our website.

For cross-platform Web application developers:

- *IntraBuilder:* **The <u>easiest</u> way to build and maintain corporate data-driven web applications.**
  - **Everything you need to build live web database applications accessible from any browser.**

    - IntraBuilder Client/Server is being used by departmental and corporate IT groups to build corporate Intranet applications that access and update corporate databases including Oracle, Sybase, Informix, DB2, SQL Server and Borland InterBase.
    - IntraBuilder Client/Server shipped in late 1996 and has received recognition from industry leading developers and press including Information Week, PC Magazine, Windows magazine, Software Development Magazine, and Internet & Java Advisor magazine.
    - IntraBuilder is completely interoperable with all emerging Internet standards including HTML, HTTP, CGI and the Microsoft and Netscape families of browsers and servers, thereby reducing your risk in platform selection for Intranet applications.
    - IntraBuilder includes a complete set of visual designers, pre-built business solutions and automated "Experts" that guide you through the creation of corporate Intranet database applications with advanced capabilities like interactive queries and live reports.
    - IntraBuilder uses JavaScript, the industry standard portable scripting language, which enables you to create script code for both the client and the server.
    - IntraBuilder is currently available in a special trial version on our website.

- *JBuilder:* **The most <u>scalable</u> way to create cross-platform web-delivered client/server and multi-tier applications.**
  - **Combines Java portability with a robust component architecture for enterprise scalability.**

    - JBuilder Client/Server delivers a java-optimized toolset for building cross-platform web-delivered applications that scale across the enterprise.
    - JBuilder Client/Server Suite has an open, extensible architecture that is completely standards based approach to application development for the enterprise.
    - JBuilder is built using the industry standard JavaBeans component model, ensuring a rich supply of components and tools.
      - JBuilder will be available in a special pre-release trial version on our website in early 1997.

By sharing common technologies across our product lines, Borland is able to deliver tools that are easy to learn and leverage your investment in training and code. For example, all of the Borland development tools are available in client/server versions which include high-performance SQL Links native drivers for connecting to corporate databases including Oracle, Sybase, Informix, Microsoft SQL Server, DB2 and InterBase as well as ODBC.

- *Shared technologies:* **Borland shared technologies reduce your development costs.**
  - Consistent, open development environments
  - Reusable component architectures and component libraries
  - High-performance native drivers to corporate databases
  - Advanced SQL tools for database management and performance monitoring
  - Award-winning debugger technology
    - Open, scalable architecture with Entera intelligent middleware

Enterprise Capabilities for Windows Developers

Delphi 97, the forthcoming version of Delphi Client/Server Suite, will include additional enterprise capabilities that leverage the Windows ActiveX and DCOM platform capabilities. This set of features will also become available for our C++ RAD environment C++Builder and other products through 1997. These features include:

- *Built-in DCOM support:* In addition to new language support that make interfaces as natural to Delphi as classes, type libraries are now managed as an integral part of a Delphi project. They can be edited or imported inside the IDE and are supported by automatic source generation of a Delphi class to implement the interfaces they describe. The OLEnterprise Object Explorer is fully integrated into the Delphi environment.
- *Distributed Datasets:* The new distributed dataset support allows Delphi data aware controls in a thin client application to acquire their data from a DCOM server across a network connection. Delphi can play on either or both sides of this connection and, in fact, Delphi is the easiest way to create remote DCOM data servers. Any DCOM server that supports the new data remoting format can also provide and resolve data to a Delphi client. In addition, Delphi's data aware controls can now display and edit data from any cursor-oriented data provider via the new virtual dataset interface.
- *Web-deployed Applications:* Support for web deployment is automatic and makes use of both Microsoft and Netscape browser support for CAB and INF files. In addition, to facilitate efficient downloading, a single Delphi library or application can now be packaged into separate DLLs without compromising execution performance. Using our standard VCL packages, a Delphi application or DCOM server can now be as small as 15K. When combined with Delphi's new automatic web deployment support, an entire distributed application can be stored in a repository on a centralized server and deployed on multiple machines with a single click in a net browser. Each time the application is subsequently launched by a user, automatic version checking is performed and only those packages and components that have changed, if any, will be re-deployed. These high performance, native code applications can run in a browser or as standalone desktop applications. The OLEnterprise Object Explorer is being extended to handle deployment of DCOM servers under development and for departmental use.
- *Application Management:* Delphi applications and libraries now support Open Environment's open DCOM interface for application management. This enables IS departments to provide a higher degree of application management.
- *Extend applications to the Web:* The new Web broker technology and components in Delphi 97 makes it easy to extend client/server applications to the web. Combined with distributed datasets, Delphi makes it easy to produce secure, high performance, HTTP-based database applications across the firewall.
- *Enterprise Component Foundry:* Because Delphi can be used to create industry standard compiled ActiveX, ActiveForm and DCOM objects, you can integrate your Delphi code beyond Borland's family of interoperable tools. So in addition to being able to share components with Borland C++Builder, you can also share components with PowerBuilder, Visual Basic, Visual J++, Microsoft Office and other Windows applications or development tools.
  - *Midrange connectivity:* Borland has a special version of Delphi Client/Server Suite for IBM's AS400 series of midrange systems. Delphi/400 Client/Server Suite includes high performance native drivers that connect to your existing systems to extend your investment without requiring costly upgrades while maintaining complete security and reliability.

VI. Integration of Borland and Open Environment technology

Borland's acquisition of Open Environment Corporation was done in order to further strengthen our technology and service offerings to corporate customers in both centralized IT and decentralized departmental organizations.   Open Environment's Entera and OLEnterprise products allow Borland to deliver an open, scalable architecture for its enterprise development tools with complete reliability and manageability. Because of their open architecture, these products work with the Borland development tools today. In 1997, Borland will begin announcing new versions of all of its client/server development tools. These tools will provide more integrated support for Open Environment's multi-tier scalable architecture and will support interoperability across development tools.

Borland is developing cross-platform application server and middleware technology based on its recent acquisition of Open Environment Corporation's Entera intelligent middleware. The Entera technology provides the linchpin in Borland's technical vision for a high-performance, scalable architecture that allows customers to use any client tool, any server tool and access any relational database on any platform. Entera technologies provide broad platform support and connectivity (IBM 3270, Open Edition MVS, AIX/6000, OS/2, Digital OSF/1, HP-UX, Unisys SVr4, Sun Solaris, Macintosh and Microsoft Windows 95, NT).
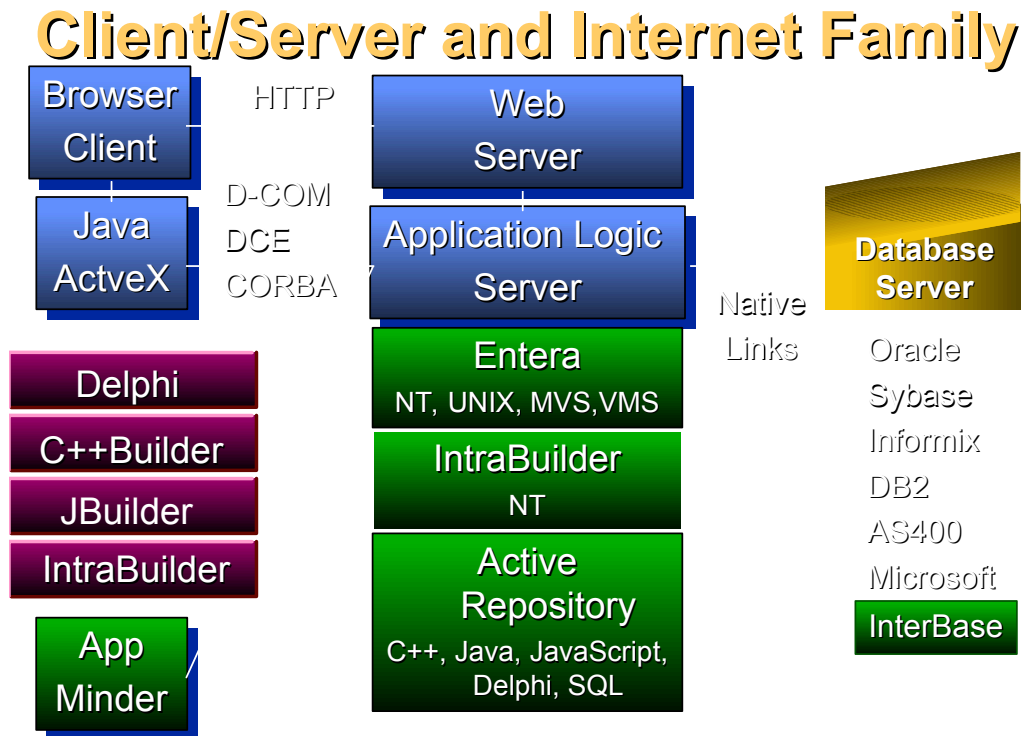

Figure 8 - Borland's products provide an open, scalable multi-tier architecture

Integration with Delphi Client/Server Suite

Borland is further integrating Open Environment's technology into Delphi 97, the forthcoming version of Delphi Client/Server Suite. Further integration will also be done with Borland C++Builder.

- *Integration of Tools:* Open Environment's Object Explorer will be integrated into the Delphi 97 environment and will display interfaces in Delphi syntax as well as C++. The Object Explorer

13

will also support copying a type library and help files to the client machine when an object has been imported. Object Explorer will also support deployment of DCOM servers.

- *Integration with Entera:* Current Entera customers will be able to generate Delphi stubs for easier integration with existing Entera applications and services from Delphi applications.
- *Integration of Application Management:* In the future, Borland will release Delphi components that provide integration with the AppMinder Event Management Interface (EMI).
  - *Integration of Object Broker:* Delphi 97 will be able to use the Entera Object Broker to provide directory name services that support location independence and automatic failover support.

Borland offers the most complete range of development technologies with a unique combination of high performance, object-oriented development tools and intelligent middleware. As a result, Borland delivers an open, scalable architecture for client/server and Internet development that enables you to deliver reliable, efficient business applications across the enterprise today.

XI. Conclusion

Building enterprise solutions that leverage Internet technologies is not just for "bleeding edge" firms; today its a requirement to stay competitive. IT organizations need to build enterprise client/server and Internet applications that leverage and extend their investments in technology, infrastructure and people. Borland's Golden Gate architecture and family of products ensures that the applications you build will be efficient, reliable and secure. Only Borland offers an open, scalable architecture that allows applications to extend from the desktop to the enterprise.

So whether you need to build a departmental client/server application for your sales organization, an interactive web customer tracking system or an enterprise business-critical order entry system that ties into your existing mainframe systems, Borland has the technology and partnerships to make you successful.

A range of technical, strategic and business whitepapers and customer case studies is available on the Borland web site www.Borland.com.