

## **Client/Server, from dBASE to JAVA: The Next Step**

by George Schussel

The tremendous interest in Internet technologies to distribute client/server capabilities across employees, customers and suppliers has been brought on by the public realization that Web technologies, particularly browsers, HTML and HTTP, can greatly simplify the navigation of the Internet. With the explosion in Internet access and browsers, companies are rapidly building systems to take advantage of this newly available technology.

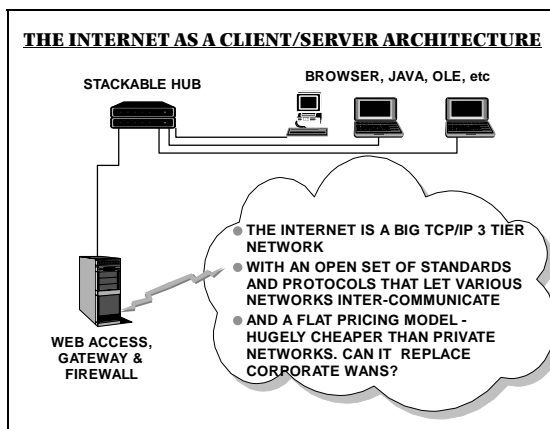
A very popular current application is for intellectual property distribution. For example software companies are replacing new release distribution with an Internet site. When a customer wants the new release, it can be downloaded from the vendor's home page. Such an approach can save \$100 to \$200 per release/customer.

Popular publishing activities like magazines and books are going to be affected by Internet based publishing in a major way. Self service access to information over the Web means that customer information will go the way of the gasoline service station - about half the business will become self-service. While it's not likely that newspapers, for example, will be replaced by the Internet, there will now be a new way for many to acquire information and that will have a ripple effect on current business practices. The Internet will provide a future of personalized, 3-dimensional and hot linked magazines. How will those real time magazines affect newspapers?

Another popular Internet use has been to replace private networks. Connecting to the Internet through an access provider is much faster and easier than arranging for private leased lines when you want to connect to a remote office. As the reliability of service and uniformity of response times improves, it's likely that the Internet will replace a great many private leased networks.

### **3-Tier and the Internet**

Of course, we haven't seen the last of innovative ideas in multi or 3 -tier architectures as client/server becomes the dominant computing paradigm of the 1990's. The recent hullabaloo about Java, the Internet, intranet's and such is, of course, simply about another manifestation of client/server computing. Some of this publicity has been caused by companies such as Sun and Oracle, who see Internet-based client/server as an emerging market that Microsoft doesn't dominate and (therefore) they can influence.



There has been an abundance of press on the thesis that the Internet with its standards and protocols and host based computing approach will replace client/server computing. Those arguing this don't understand that the Internet is itself a 3 to N-tier client/server network. Well known Internet applications like Gopher, FTP (File Transfer Protocol), the World Wide Web and SMTP (Internet mail) are client/server in architecture.

In the early 1990's many communications experts warned that because of all of the new fiber cable there would be more capacity in

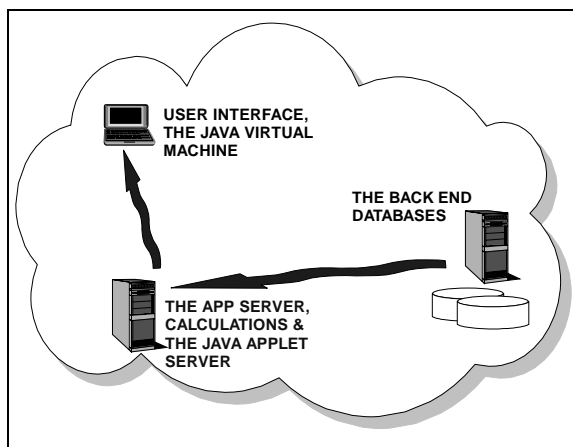
long distance transmission than foreseeable applications would need. They don't need to worry any more about excess capacity since the Internet promises as much demand for capacity as can be installed for the rest of this decade. Software will be the gateway that determines how fast that fiber capacity gets used up.

Much of the vision about implementing new client/server applications on top of Internet protocols and standards is about a vision of at least partially returning to the host computer as the source of application logic. In that sense the advocates of Internet applications are returning to a host based computing vision - "the return of the mainframe", but in a new guise, of course.

This vision of ubiquitous Internet computing as the next paradigm also implies an economic vision of wasting bandwidth instead of wasting transistors and storage media. Now, when a PC isn't being used the internal components of that machine are wasted and depreciating. For ubiquitous Internet, host based computing to dominate, we will probably make better use of the components in the Internet servers, but there will have to be enough bandwidth and connectivity to handle peak loads and that capacity will be wasted in off periods.

As we have already mentioned the Internet is a client/server network. It's a big wide area network (WAN) that uses TCP/IP as a transmission protocol. It is a network of networks. Regardless of what operating system and local network protocol you're running, if you can speak TCP/IP you can connect with strangers using other operating systems. Of course, you want to do more than just connect. Additional Internet standards such as HTTP and HTML and emerging standards like Java insure that not only can you connect but you can conversationally compute and interact with strangers that support the same standards.

The new generation of Internet/intranet applications that are being planned use a 3-tier



architecture as shown to our left here. The user interface runs on the desktop as the client. It is connected (through one or more intermediate server links) to a web server which may be a storehouse for Java applets. This web server, in turn, is supported by a database server which keeps track of information specific to the client's interests and history.

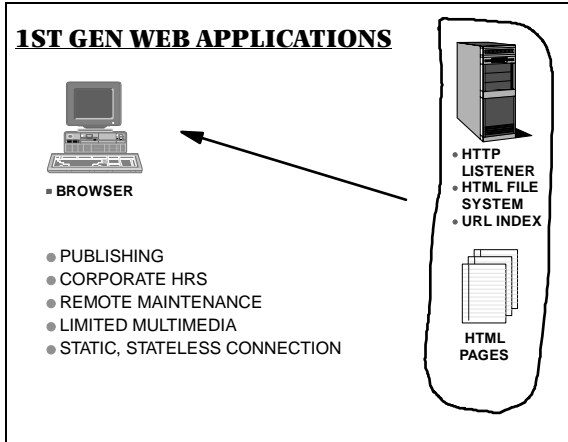
In the remainder of this article we'll explore a little about how access to the Internet adds richness and alternatives to client/server computing. One way to think about the Internet is as a large public TCP/IP network

based on packet switched technology. Access to this network is through a server(s) that converts your LAN's protocol into TCP/IP and arranges for proper billing for the services you use. Your Internet access gateway might run a firewall or other security services also.

One ultimate potential of the Internet is that as the security and capacity issues become resolved, it offers communications services that are much cheaper than private networks. Internet access providers are providing communications services at fixed prices. This means that if you use an ISDN line of 128Kbps service, the access provider charges a fixed price, say something like \$50 per month. That charge is very low for the communications capacity this provides and it's constant, regardless of usage. Reducing the costs of existing networks, is important, but of more impact is the opening up of inexpensive wide area communications to companies that can't afford the fixed costs of private lines.

## 1st Generation Web Applications

The applications that are available now are typified by the technology presented in the figure entitled 1ST GEN WEB APPLICATIONS. This might be characterized as a new form of electronic publishing, but it's richer in some ways than books because it's multimedia publishing. Today most home pages consist of text, photos, and graphics. By early 1997, however, it's likely that animation and 3D applications will be available.



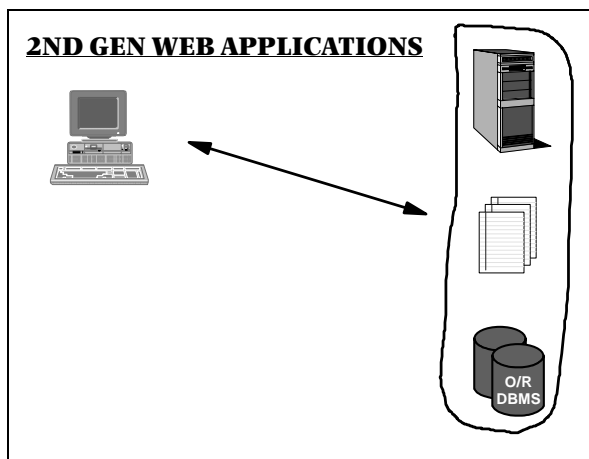
This technology is already very useful in information dissemination. Companies are replacing human resources manuals and maintenance manuals with browsers connected over intranets or the Internet to a server which contains the latest information sought.

A primary limitation of first generation applications is that there is no database management system connected to the web server and the software doesn't keep track of who is requesting information - or of the last request from that user. It's a "stateless connection". The addition of DBMS capabilities

to the HTML processes on the server will allow HTML servers to have memory. As the leading DBMS vendors add connections for Web servers, it becomes possible for that server to remember who you are and what you've done from page to page and from visit to visit. The interaction, then, becomes a lot more intelligent and useful.

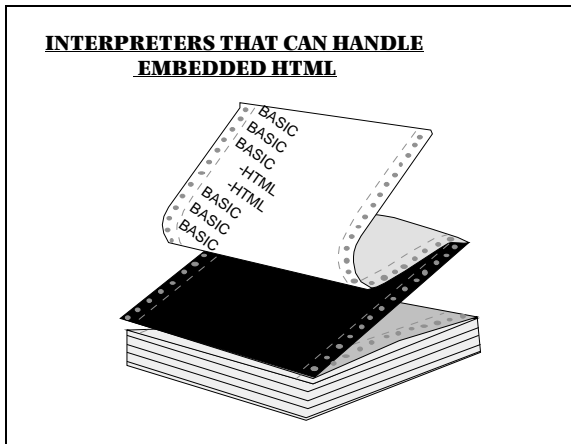
## 2nd Generation Web Applications

First generation Web applications are quickly going to be joined by newer more capable environments that perhaps we can call the second generation. Several things will define this newer generation - 1) support for active clients via down-loadable applets (software components), 2) live DBMS links that enable the server to know who you are from page to page and visit to visit and 3) true interactivity between the client and server (indicated by the two headed arrow).

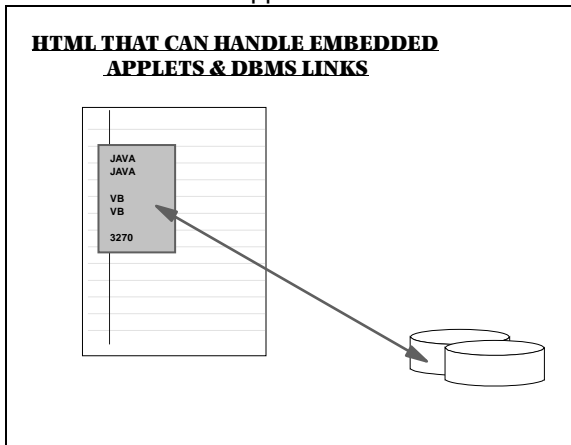


2nd generation Web applications have live DBMS connections on the server. Today what is mostly available for such support are SQL DBMS engines from companies like Sybase, Informix, IBM and Oracle. A problem with these engines is that SQL supports traditional business data types such as alphanumeric, date and time. No major SQL product supports extended and complex data types such as voice, maps or video at this time. That's a defect that will be remedied (probably) in the 1997 timeframe. All of the major DBMS vendors are making important strides in this direction.

This software component type of operation will be the first example of wide spread use for distributed object computing. Sun's Java technology is the best known example of this approach. Sun describes its HotJava browser/Java language technology as "simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multithreaded and dynamic". The way this will work is for your browser on the client to have a Java (or ActiveX or C++ or ...) interpreter that can activate a component that has been downloaded to your client from the Web server. Your browser, then, becomes event driven and can exhibit various types of behavior.



From a software point of view we will see both "inside/out" and "outside/in" approaches to writing the code to mix applets and normal programming environments. BASIC compilers, for example, will be extended to support embedded HTML code. And, HTML will be extended to handle embedded Java, ActiveX and other component technologies.



In the Java environment pointers aren't supported and that makes it impossible for any downloaded applet to address segments of memory outside the virtual Java machine that has been created inside your browser. This enforces security for your client and makes sure that any downloaded applets don't behave in a malicious fashion.

While talking heads and multimedia demos have been used to illustrate the operation of the Java/HotJava environment, the real

benefit to corporate users will come from a new type of application that hasn't been possible before - collaborative computing among strangers. Your server based applications are now available to everyone in the world; your programs can execute on their clients. If you want to do group scheduling, for example, until now everyone in the effort had to have the same client, something like Lotus Notes. With this new environment it will be easy to accomplish wide area, multi-platform group scheduling via the Internet. The scheduling applet can be downloaded and executed in the component enabled browser.

### **Problems and Issues**

Before Internet based applications become pervasive there are many issues that have to be addressed. Key among these points are performance, security, commerce over the Internet and monitor resolution.

Anyone who has used a browser understands the concern about performance. There are times when servers or communication links are overloaded and you simply can't get the access desired. The future is likely to bring much greater demand. A college student sending his mother a few minutes of digital video at 1m bit/sec may send more data packets over the 'net' than the entire faculty exchanging plain text email all day.

One response has been to develop a private implementation of Internet technologies and run it behind a firewall. You can control your own rate of traffic flow and match it to available bandwidth, something not achievable in the public arena. These internal Internets are known as "intranets". At the current time, as much as 90% of the effort companies are investing in Internet types of systems are in these "intranet" types of applications.

For the rest of this decade performance will remain a constraint on the functionality of the Internet. For example, bringing applets from the server to the client is great in theory, but quickly breaks down under real-world conditions of transfer times and server loads. Imagine downloading one megabyte every time you wanted to perform a common operation. Even with two ISDN channels at 128Kbps, you're looking at more than a one-minute delay. The search for improved performance will use both hardware (more fiber, faster switches, faster web and database servers) and software (object/relational databases, software compression).

Real-time video downloads off the Internet are another technology that has been frequently discussed. We believe that video rental stores don't need to worry about this new competition in this century, however. Even with MPEG data compression, bandwidth requirements for this type of application (megabit/sec to retail user) are still much beyond what will be widely available before the 21st Century. Arguments that cable modems can give the typical home this service ignore the fact that our existing cable infrastructure technology cannot support digital transmission and would have to be largely rebuilt. For the remainder of the 20th Century middleband (ISDN and its equivalents - 100 kilobits/second) are all we can expect.

For more realistic 1990's applications we should look to business uses in applications like video conferencing and replacing private networks. To support these types of applications the access providers need to provide a choice in "Quality of service". This refers to an ability to guarantee enough bandwidth by reserving capacity ahead of time.

Another point to consider is that broad based media and publishing businesses are all driven by advertising. The resolution of PC screens and TV's (the display for your Internet appliance) aren't comparable to magazine style advertising in visual quality or format. This situation won't change over the next two or three years, either.

Security in electronic payments is a requirement for commerce over the Internet. The ability to secure information is available now through a technology known as "public/private key". This coding scheme can be implemented at the secure sockets layer of browsers like Netscape Navigator. Security through this approach is much better than what you're afforded when a waiter takes a physical copy of your plastic credit card. Credit card based commerce, then, just awaits the appearance of software applications.

As of the time this was written two major competitive alliances were developing such software implementations. On one side is the combination of Netscape and MasterCard and a competitive group has formed around Microsoft and Visa. Each competing company is spending half the time designing their cryptography, and the other half trying to break into their competitor's. When flaws are found, they're published.

### **The Future**

As you think about the future of the Internet it's likely to have the following characteristics:

1. TV quality video and CD quality audio transmittable over HTTP and interpreted by your browser, regardless of operating system.
2. Browsers have become the next "killer application", joining spreadsheets and word processors. In addition, however, all desktop applications will get browser/Internet buttons.
3. The Internet itself becomes a universal and ubiquitous broadband digital dialtone. Cable companies, telephone companies and wireless operators all compete to provide that dialtone.

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George Schussel has been a CIO, consultant, industry analyst, writer and lecturer on computer topics for 30 years. His lectures are held before more than 20,000 professionals a year. He is the founder and Chairman of Digital Consulting, Inc. (DCI) in Andover, Massachusetts and Chairman of the *Database & Client/Server World* trade show. He has published over 50 technical and analytical articles and his latest book, Rightsizing Information Systems, co-authored with Steve Guengerich, was published by the SAMS Publishing Division of MacMillan. Reach him at 74407.2472@compuserve.com or <http://www.dciexpo.com/>.