THE CLIENT – SERVER COMPUTING – A BRIEF STUDY

Dr. V. Nagaraju

Abstract:-The modern World is dominated by computers and their related tools. In the post globalization scenario one may say that one is totally illiterate, but no one can afford to say that he/she is totally in compute rate. For the knowledge of computers is more and more essential and demanding than the knowledge of alphabet. In this paper an attempt is made to touch upon various aspects of client – server computing and its diverse operating systems.

Keywords:-Client – Server computing, integration, customers, host systems, personal computer key components, distributed database, cost effectiveness referential integrity, client initiated request, base services, semaphores.

I. INTRODUCTION

The relationship between client and server is the same as the relationship between a seller and a buyer. It is also the same as that of between entrepreneur and a customer.

The Chief feature of a computer is that it is operation able through a personal computer with a host system. Client – Server computing provides the integration of personal computers with the host systems. The Client – Server computing is a method of computing by which the organizations respond to their customers while still maintaining the security and integrity to manage their business effectively.

It is a model where two or more computers interact in order to provide service from one to the other. It allows customers to access information resources and services located anywhere within the customers’ information network.

II. HOW THE CLIENT – SERVER COMPUTING WORKS

The Client – Server computing has two basic components – a client and a server.

The client asks for a service to be performed. This service may be to meet diverse needs such as

- To run an application
- To query a database
- To print a document

To perform a backup for recovery procedure

The Server is the resource that attends to the Client’s request. Clients are typically thought of as personal computers but a client can be a midrange system or even a main frame. A Server is typically thought of as a midrange or a main frame system as it can be another personal computer or the network.

Latest networks have computers for file serving, database serving, application serving and communications serving, these servers are dedicated devices. They provide a specific service to all authorized users within a network.

These servers also allow some of the processing to be handled on each user’s personal computer and some on a centralized server as shown in the figure given here under.

Figure 1: The Client/Server Computing

The client – server computing is an open system environment. It has the advantages mentioned here under.

Inter-operability- Key components (Client – Network – Server) work together.

Scalability-Any of the key elements can be replaced when the need to either grow or reduce processing for that element dictates without major impact on the other elements.

Adaptability-New Technology like multimedia, broad
band networks, distributed database, pen computing etc. can be incorporated into the system.

**Affordability**-Cost effectiveness is ensured by using less expensive MIPS available on each platform.

**Data Integrity**-Entity, domain and referential integrity are maintained on the database server.

**Accessibility**-Data may be accessed from WAN’s and multiple client applications.

**Performance**-Performance may be optimized by hardware and process.

**Security**-Data Security is centralized on the server.

### III. CLIENT – SERVER AND THE NEW INFORMATION SYSTEM (IS)

- The development of Client – Server Application demands such skills as
  - Transaction processing
  - Experience in communications
  - Database designing
  - Graphical user interface designing
  - Internet connectivity

Some more advanced applications also require knowledge of component infrastructures and distributed objects. At present most client server applications are PC LAN implementations which are personalized for a group. The users themselves have to configure properly everything from LAN Directories to security requirements.

Information Systems (IS) departments have skills to manage and deploy large networks and to provide interoperability standards. IS departments are also able to fine-tune applications and ensure data integrity. The key for them is to do what they do well in a distributed Client – Server environment where they share the power, computing knowledge, financial budgets and responsibility with the end users.

**a) Two-tiered information system**

There are two-tiered information systems which serve the client - server computing industry.

**b) A line information system**

It is used for managing and deploying departmental systems.

**c) An enterprise information system**

It is used for managing the global network, intra and intercompany applications and for setting the inter operability and component infrastructure standards.

This type of aligned federation will preserve departmental autonomy and also allow the local departmental LANS to be a part of the multivendor and multi server global network.

### IV. COMPETITION IN THE CLIENT – SERVER MARKET

The Client – Server environment promotes openness. It ensures that a wide variety of client and server platforms can be a part of it. The open Client – Server environment serves as a catalyst for commoditizing hardware and software system. A good example of a computer commodity is the PC which can be obtained from multiple suppliers and it is sold in a very competitive market situations. On the hardware side, Modems, LAN adapters, communication protocol stacks, bridges and network routers are all commodities. PC operating systems, SQL Database Management Systems, Web Servers and browsers, ERP applications and LDAP directories on software side are approaching commodity status.

Distributed object base infrastructures which are built on CORBA and COM are widely used. Computer Vendors, by the power of the Super – Servers they provide, will differentiate themselves and will last until commodity operating systems start to support routinely multiprocessor clustered hardware platforms. The most sustained differentiation will also be in the area of new client – server software and not hardware platforms. A massive new wave of computerization will be unleashed by PCs and Client – Server solutions. Multimedia enhanced Client – Server solutions require more network band width, storage capacity and processing power.

Clients will be in all forms and shapes including desktops, pen tablets, network computers, intelligent devices, mobile personal communicators, Internet appliances, Java cards, smart books, T.V. Set-top boxes, automobile dashboards, robots and a platter of yet-to-be-invented information devices. These clients will be able to obtain the services of millions of other servers from any location.

### V. THE INTERNET AND INTRANET

The ‘INTERNET’ which connotes the system of internationally operative Networks is the NETWORK composed of inter connected networks. It is a meta network. It is connected around the world through special computers called routers and hubs which are connected to a grid called the backbone. Traffic is channeled into the backbone via NETWORK ACCESS POINTS (NAPs) making it the largest decentralized computer network in the world. Internet protocol is Transmission Control Protocol or Internet Protocol (TCP/IP) and uses packet switching Hot Potato Routing (HPR) to communicate.
VI. ENTERPRISE RESOURCE PLANNING (ERP)

The Enterprise Resource Planning (ERP) applications from companies like SAP, Oracle, PeopleSoft, Baan, Intentia and J.D. Edwards are generally based on the Client – Server model. The vendors provide packaged Client – Server Solutions for back office enterprise functions such as accounting human resources, manufacturing, pay rolls and financials. Presently these vendors are expanding their client – server suites to the vertical application space and front office. They are also offering Client – Server Solutions for the automotive and consumer goods industries, Online Catalogs, Sales force automation, Oil and gas, supply chain management, electronic commerce, health care and banking. The ERP System is good, if it is able to manage from a single user interface many of the key functions of an enterprise. This type of integration is possible only when all the pieces are purchased from the same ERP Vendor. The new ERP Products are built on top of an open distributed object infrastructure such as COM/Active X or OCRBA/JAVA BEANS. These products are also being integrated with massaging systems, workflow engines, data ware houses and the web.

a) Intranet

The INTRANET is the implementation of internet-based Client-Server technology within an organization rather than for global connectivity. In other words the INTRANET is a network that is contained within an enterprise. Sometimes it consists of many interlinked Local Area Networks LANs. Sometimes it also uses leased lines in the wide area Network (WAN). It may or may not include connections through one or more gateways to the internet outside. The Chief purpose of an INTRANET is to share company information and computing resources among employees. The INTRANET can also be used to facilitate working in groups and for conducting Teleconferences.

The Client – Server model is one of the Central ideas of network Computing. Most of the business applications being written to-day use the Client – Server model. Typically, multiple Client Programs share the services of a common server program. Both client programs and server programs are often a part of a larger program or application. Relating to the INTERNET, there is another client program called ‘Web Browser’ which requests services i.e. the sending of web pages or files from a web server which is technically called HYPERTEXT TRANSPORT PROTOCOL or HTTP Server in another computer somewhere on the INTERNET. Similarly, the computer with TCP/IP installation allows the users to make Client requests for files from File Transfer Protocol (FTP) servers on the INTERNET.

VII. CLIENT-SERVER USERS

The client-server model has three building blocks, a client, a server and the slash (/) that ties the client to the Server. The Client building block runs the Client side of an application. It provides the Object – Oriented user Interface (OOUI) element and some form of distributed system management (DSM). The middle ware building block (/) runs on both the client and server sides of an application.

The Server building block runs applications that manage shared resources. The block shows the four contending server application models. SQL databases, TP monitors, group ware, and distributed objects. The Server side also contains a DSM element. The three blocks can run on the same machine, because any node can be both a client and as a server.

a) Client-Server for small businesses

It is easy to run the client and the server portion of an application on the same machine. For example, the client-server application at a dentist’s office can be sold...
in a multi-user package or at offices with many dentists. The same Client-Server application covers both cases. The only caveat is that there is no need to use an operating system that is robust enough to run both the client and the server sides of the application.

The example of the small dentist’s office also works for the small in-home business office and the mobile user on the road. In all cases, the business – critical client – server application runs on one machine and does some occasional communications with the outside servers to exchange data, refresh a database, and send or receive a mail and taxes. For example, the one person dentist’s office may need to communicate with the outside servers such as insurance company billing computers.

b) Client-Server for departments

The Client – Server establishment is particularly very much suitable for the LAN – based single server establishments. This is the ‘archetypical’ Ethernet model of Client – Server it contains multiple clients communicating to a local server. This model is used in small departments. For example, a multi-user dentist office and the departments of large corporations like the branch offices of a bank.

The single server maintains the simple middleware. The client refers to the configuration file to determine its server’s name. Security is arranged at the machine level and maintained. There won’t be any complex interactions between servers and so it is easy to identify failures. Which are present on the Client or on the local Server.

Some users may use their server to interact in a very loosely coupled manner with some enterprise servers. For example, data like a price list may be downloaded once a day to refresh the local server or an inventory data may be uploaded to an enterprise server using a WAN or the public INTERNET. Fax and mail can be sent or received any time through the mail server gateway. So the software that interacts with remote servers will reside on the departmental server.

c) Client – Server for enterprises

The Client – Server is used for enterprises too. This model addresses the needs of establishments with different types of heterogeneous servers. This is an area that is attracting a lot of industry attention as solutions move from large computers to multiple servers that live on the INTERNET, INTRANETs and corporate back bone networks. Its great advantage is that it is upwardly scalable. When more processing power is needed for various intergalactic functions, more servers can be added or the existing server machine can be improved or the latest generation of super server can be used.

The Servers can be divided based on the functions they provide, the resources they control, or the database they own. Replication of Server can also be selected for fault tolerance or to boost an application’s performance. There can be as many combinations of servers as the enterprise can afford to spend its budget. When multi-server capability is properly used, it will provide a large amount of computer power and flexibility. To capture the full power of multi-servers, low-cost, high-speed band width and large amount of middleware features are required including network called single system image. New systems can be created on a Client-Server Platform when memory and hardware become affordable. Every machine is both a client a full function Server, which includes a file server, database server, work flow agent object transaction monitor, and a web server, all connected thru an ORB. This is in addition to all the client software and middleware.

d) Middleware

Middleware can be classified into

i. Transport Stacks

ii. Network Operating Systems (NOS)

iii. DSM

iv. Service Specific Middleware (SSM)

NOS and Transport stacks provide the basic communications foundation for all middleware. DSM runs on every node in a Client-Server Network, it requires its own middleware on the top of the NOS to carry messages between managing stations and managed Stations. The Service – Specific Middleware (SSM) depends on the application model. Database applications use some form of SQL middleware along with such defacto standards as Open Data Base Connectivity (ODBC), Distributed Relational Database Architecture (DRDA), Remote Database Access (RDA), Oracle Glue (OG) and X/Open’s Call – Level Interface (CLI) TRANSACTION Processing (TP) monitors use some form of transactional Remote Procedure Call (RPC) or Peer-to-Peer middleware (PPM). Groupware applications typically use e-mail and distributed Object Request Broker (ORB).

e) Server-to-Server middleware

Server-to-Server Middleware includes the Software that is used for coordinating inter-server interactions. The Server-to-Server Middleware infrastructure is shown in the figure 2. Server-to-Server interactions are usually Client-Server in nature i.e. Servers are clients to others servers. However, some server-to-server interactions require specialized server middleware. For example, a two-phase commit protocol may be used to co-ordinate a transaction that executes on multiple servers.

f) Client – Server environment

The Client – Server Environment provides the relationship between two computer programs in which one program, the client, makes a service request to
another program, the server.

Figure 2: Server-to-Server Middleware

It fulfills the request. Though programs within a single computer can use the Client-Server idea, it is a more important idea in a network. In a network, the Client-Server model provides a convenient way to interconnect programs that are distributed efficiently across different locations. Computer transactions which use the Client – Server model are a very common feature at present.

**g) The characteristics of client-server systems**

The Client – Server Systems have the characteristics as mentioned here under.

**Service**: Client – Server is basically a relationship between processes running on separate machines. The Server process is a provider of services while the client is the consumer of services.

**Shared resources**: A Server can extend its service to many clients at the same time and regulate their access to shared resources.

**Asymmetrical protocols**: A many-to-one relationship exists between clients and server. Clients ever request a service and the Servers wait for the Clients' requests. In some cases, a client may pass a reference to a call back object when it invokes a service. This allows the server call back the client. So the Client becomes a Server.

**Transparency of location**: The Server is a process that can reside on the same machine as the Client or on a different machine across the network. A program can be a client, a server or both.

**Mix and match**: The ideal Client-Server Software is independent of hardware or OS.

**Message based exchange**: Clients and Servers are loosely couples systems that interact through a message-passing mechanism.

**Encapsulation of services**: The Server is a “Specialist”. A message tells the Server what Service is requested. It is then up to the server to determine how to get the job done.

**Specialty**: Client-Server Systems can be scaled horizontally or vertically. Horizontal scaling means adding or removing client workstations where as vertical scaling means migrating or distributing the server machine.

**Integrity**: The Server code and server data is centrally managed which results in cheaper maintenance and guarding the integrity of shared data.

---

**VIII. TYPES OF SERVERS**

A computer specially designed to provide ‘Services’ to other computers or users is generally known by the name of ‘SERVER’. The main purpose of a SERVER is to make it ‘dedicated’. In other words the SERVER is not merely used to write word documents or surf the INTERNET but to dedicate it to one task. But it does not mean that the server only serves one thing. Most of the servers are designed to provide multiple services like e-mail, web and FTP. Diverse servers run various types of hardware and software. There is a large number of hardware and software servers. Each type is designed to perform specific tasks efficiently. They are used for commercial applications such as:

- Online transaction Processing
- Decision support systems and Data Mining
- Batch Processing
- Finance and Administrative Applications
- World Wide Web Servers
- Video and Document Servers

There are diverse types of Servers used for different applications based on functional requirements. They are mentioned here under.

- File Server
- Database Server
- Transaction Server
- Groupware Server
- Object Application Server
- Web Application Server
- Fat Server

**a) File server**: A Computer and Storage device dedicated for storing the files is called a FILE SERVER. Any user on the network can store files on the server. The client passes request for files or records over a network to the file server. This form of data service requires considerably large hardware. It can slowdown a network with many users down considerably. Traditional LAN computing allows users to share resources, such as data files and peripheral devices, by moving them from standalone CPUs onto a Networked File Server (NFS). The Client – Server along with File Server is shown in Figure 3 given here under.
b) Database server: The Servers in which Clients pass Structured Query Language (SQL) requests as messages to the server and the results of the query are returned over the network are called DATABASE SERVERS. The code processes the SQL request and the data resides on the server. It allows using its own processing power to find the requested data rather than pass all the records back to a client and allow it to find its own data as is the case for the file server. Database servers provide the foundation for decision-support systems that require adhoc queries and flexible reports. Database servers play an important role in data warehousing. The Client – Server along with Database Server is shown in the Figure 4 as given here under.

c) Transaction server:

The Server in which clients invoke remote procedures that reside on servers containing an SQL database engine is called transaction Server.

There are procedural transactions on the Server to execute a group of SQL transactions either succeeding or failing as a unit. The applications based on transaction Servers are called On-line Transaction Processing (OLTP).

The Client-Server with Transaction Server is shown in the Figure 5 as given here under.

d) Groupware server: Software designed to enable users to collaborate irrespective of location thru the internet or a corporate intranet and to work together in a virtual atmosphere is called Groupware Server.

Specialized groupware server can be built on top of vendor’s canned set of Client-Server APIs. Many Groupware Products now use e-mail as their standard messaging middleware.

The Client – Server with groupware server is shown in Figure 6 as given here under.

e) Object application server: The software in which the Client-Server application is written as a set of communicating objects with an object server is called Object Application Server. OAS uses an Object Request Broker (ORB) to communicate with the server objects. The ORB locates an instance of that object server class invokes the requested method and returns the results to the Client Object. Server Objects Provide Support for Concurrency and sharing. The ORB and a new generation of COBRA application servers bring it all together. The Client – Server with OBJECT APPLICATION SERVER is shown in Figure 7 as given here under.

f) Web application server

A Web Server which serves static content to a web browser by loading a file from a disk and serving it across the network to a user’s web browser is called Web Application Server. The browser and the Server mediate this entire exchange talking to each other using HTTP. The Web Server returns documents when clients ask them by name. The clients and the servers communicate using an RPC like protocol called HTTP which defines a set of commands; parameters are passed as strings with no provision for typed data. Web Application Server is a new kind of internet Software. The Client-Server with Web Application Server is shown in Figure 8 as given here under.
g) **Fat servers**: Software designed for a Client that performs the bulk of the data processing operations is called FAT SERVER. Fat Server applications are easier to manage and deploy on the network because most of the code runs on the servers. A Fat Server locates business logic within RDBMS on the server. The advantage of the Fat Server is the Centralized control and decreased net work traffic. Fat servers are well suited for structured and consistent business logic like On-line Transaction Processing (OLTP). Modern RDBMS products supports fat servers through stored procedures, column rules, triggers etc.

**IX CONCLUSION**

In the post globalization scenario, the world is contracted into a global village. With the advancement of Science and Technology man is telescoped into a robot with all the super human powers at his command. So he is performing miracles, wonders, all very difficult to comprehend. All these awes being performed can be brought under control just at the button of a computer. The Client – Server computing brings all these developments to be at the door step of peoples of the world. It is a long way for Client-Server computing to serve the world of technology in still a move meaningful way than we anticipate.

**REFERENCES**


