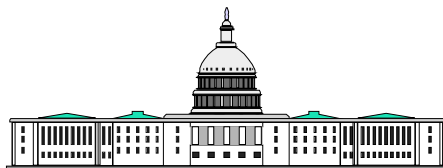


VM and VSE Technical Conference



Setting Up A Web Server On VM/ESA Summer, 2000 Orlando Session # M20

Richard Lewis
Chuck Morse



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Trademarks

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DB2

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OS/390

Parallel Sysplex

S/390

VM/ESA

IMS/ESA

Trademarks - Other Companies

EnterpriseWeb/VM

EnterpriseWeb Secure/VM

Shadow VM Web Server

VM:Webgateway

ESAWEB

Web390

RP/Web

Beyond Software, Inc.

Beyond Software, Inc.

Neon Systems

Sterling Software, Inc.

Velocity Software

Information Builders

Aonix

Agenda

Overview of the World Wide
Web

Strengths of S/390 as a
WWW server

Planning

- **Choosing a web server**
- **Server file structure**
- **Network**
- **Security**
- **Change management**
- **Backup**
- **Organizing data to serve**
- **Multiple systems**
- **Administration**

Installation Overview

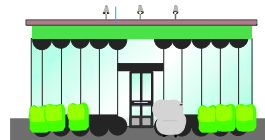
- **Shadow VM Web Server**
- **VM:Webgateway**
- **WEBSHARE**

Performance
considerations

Overview of World Wide Web

What is the Internet?

- 100,000 networks
- 40 million users
- 10-15% growth per month
- E-mail
- Telnet
- TCP/IP
- World Wide Web



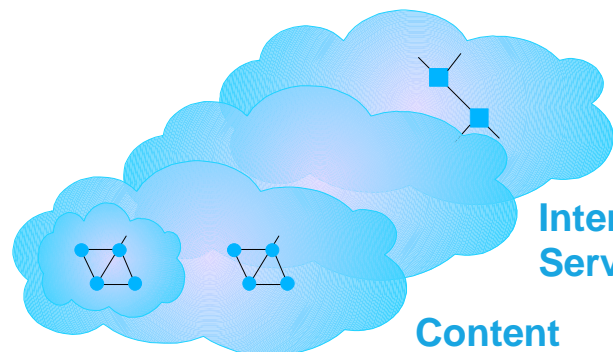
Shopping



Health Care



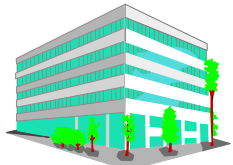
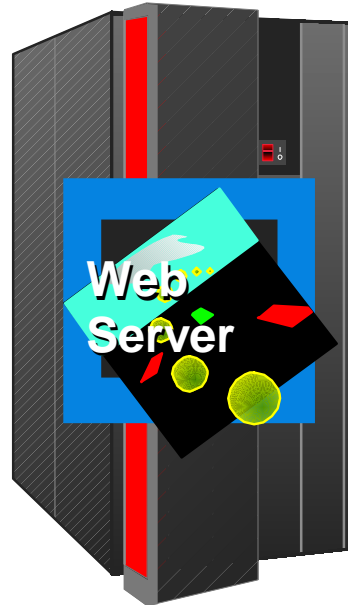
Home



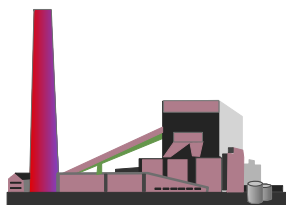
Network

Internet Service

Content



Insurance



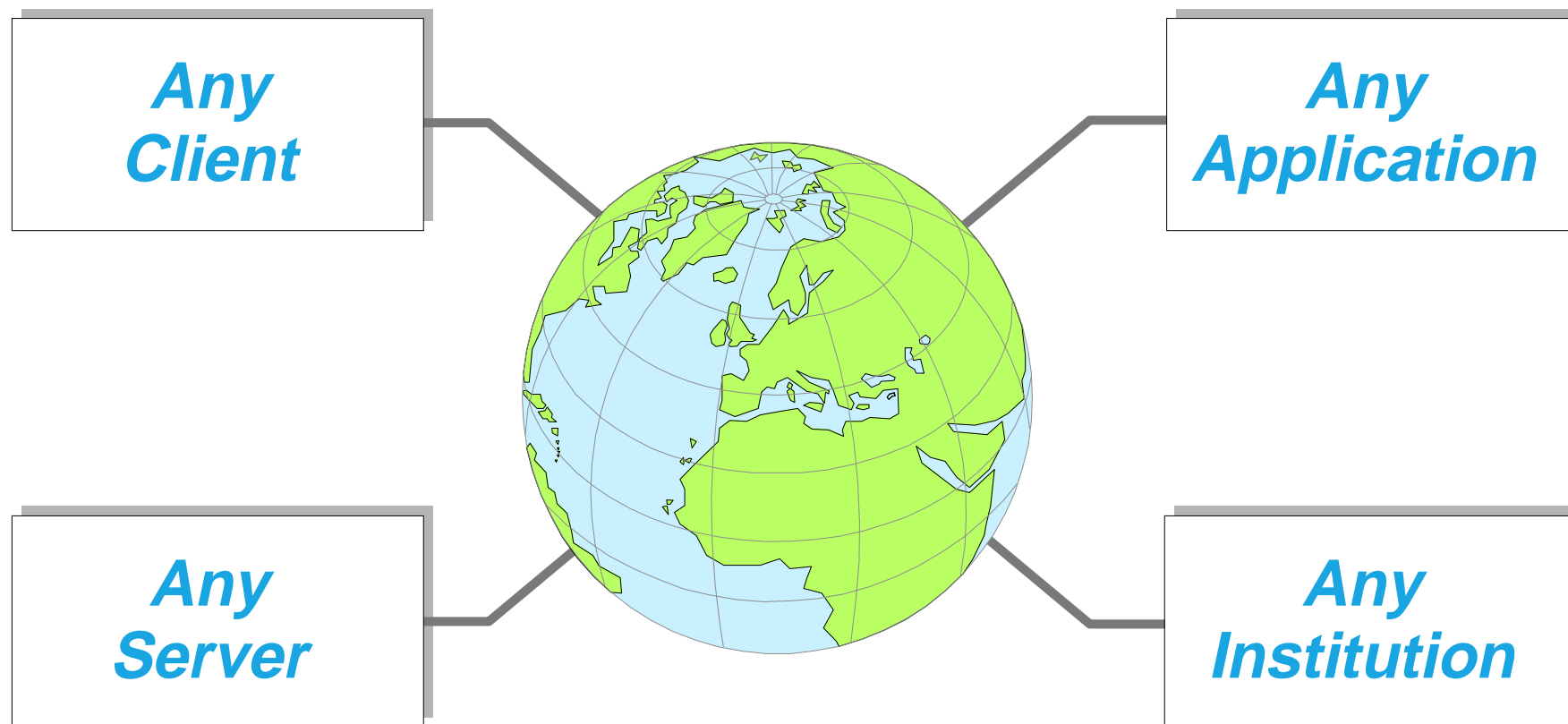
Manufacturing



Banking

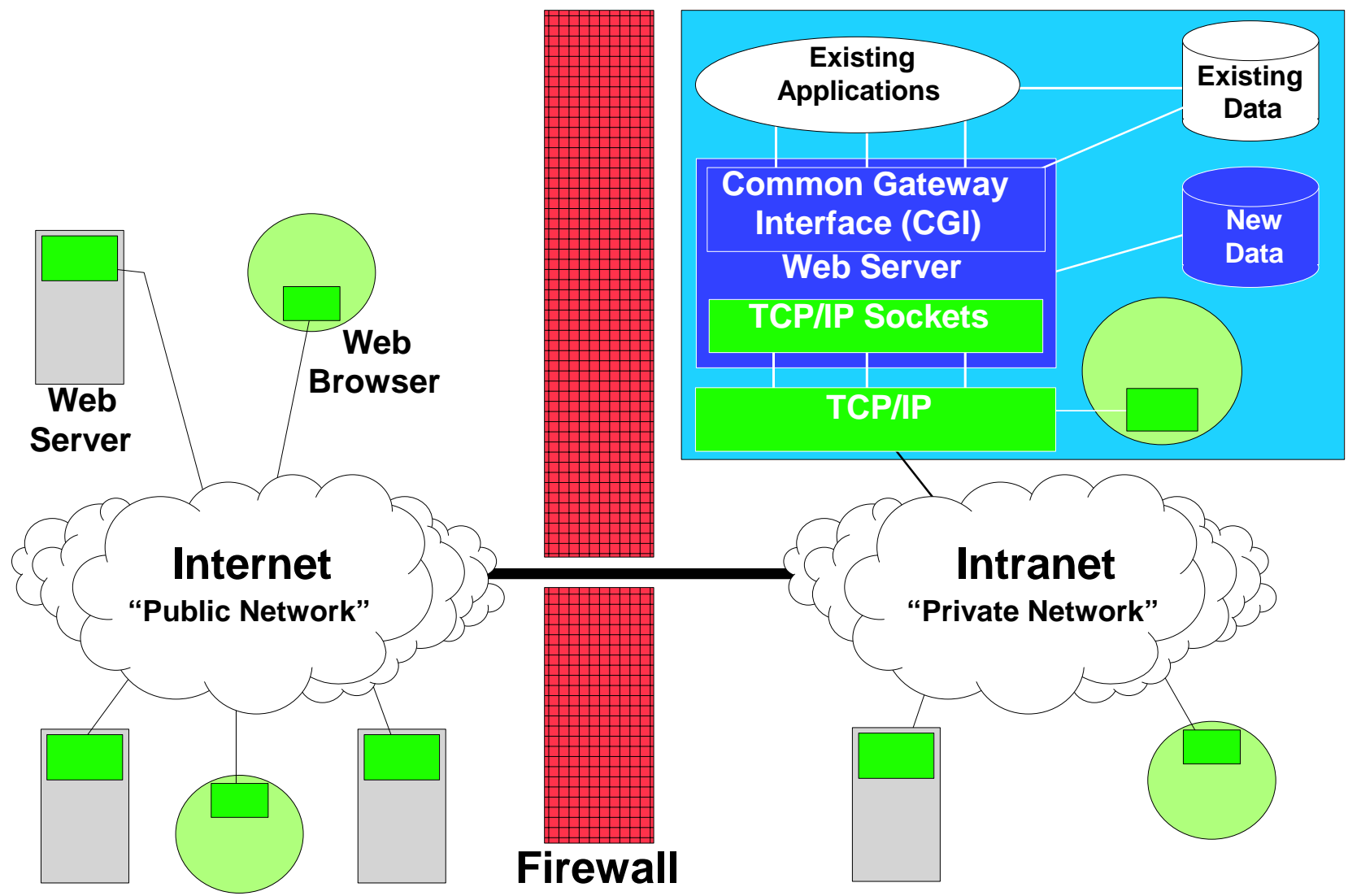
What is the World Wide Web?

An easy to navigate vast source of hypertext-linked information that supports all types of data

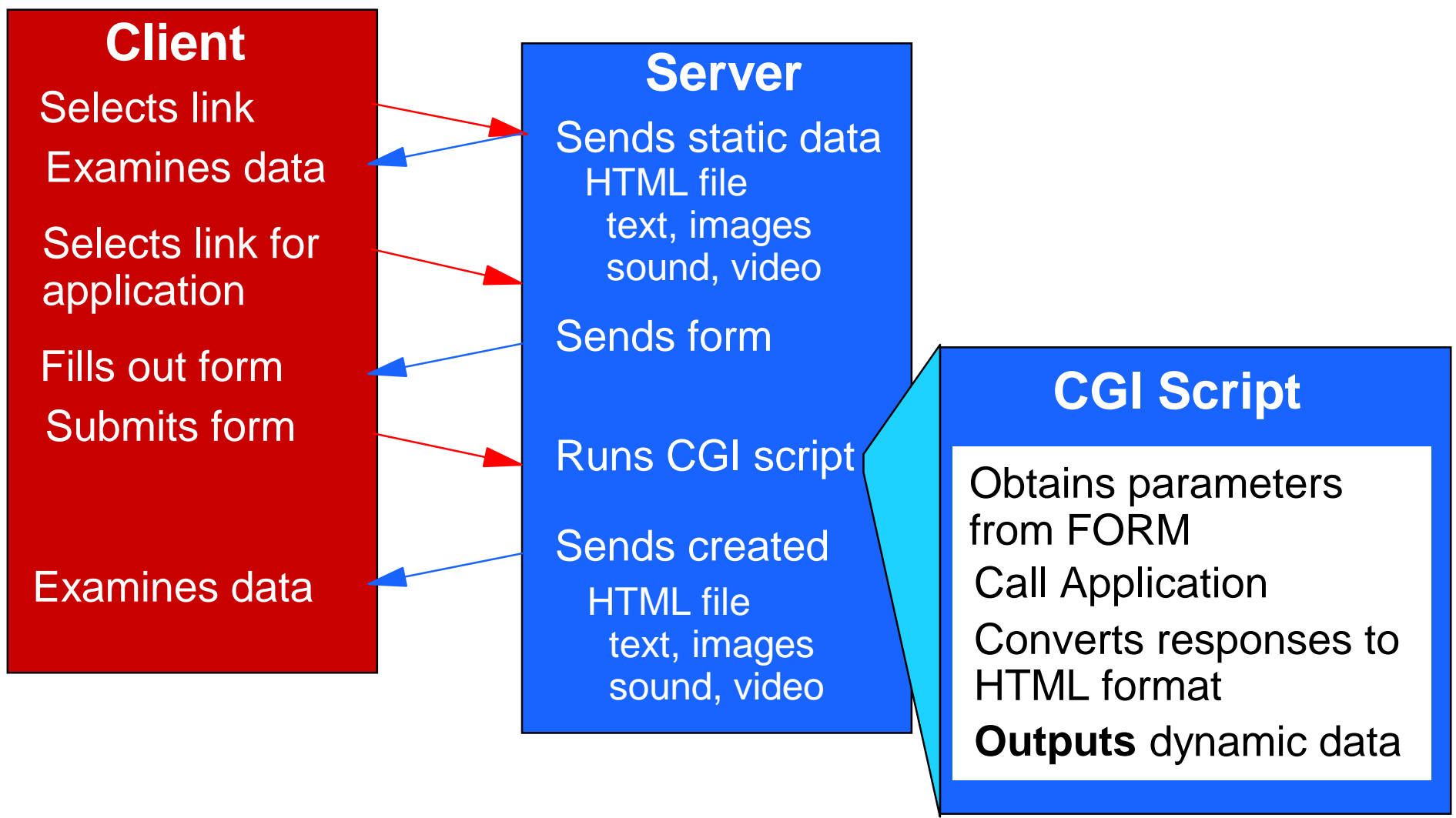


I's all about Information
Making information readily available and
presenting it in a graphical and easy-to-use format

The Big Picture



What Does a Web Server Do?



S/390 As A WWW Server

System/390 Strengths

- **Most business data resides on S/390**
- **High capacity**
 - transaction volumes
 - data storage
- **High reliability and availability**
- **Easier, centralized administration**
- **Mature systems management facilities**
- **Proven security facilities**
- **Can grow as business needs grow**
 - Highly scalable
- **Wide connectivity options for VM/ESA**
- **Natural server architecture of VM/ESA**



Planning

Choosing A Web Server

Choices for a VM/ESA system

- Shadow VM Web Server from Neon Systems (formerly EnterpriseWeb/VM from Beyond Software Inc.)
- VM:Webgateway from Sterling Software
- WEBSHARE - freeware downloadable from
 - <http://www.beyond-software.com>
- ESAWEB from Velocity Software
- Web390 from Information Builders Inc.

- RP/Web from Aonix

Considerations

- **Exploitation of VM facilities**
 - Shared file system / Byte File System
 - REXX, CMS Pipelines
 - CMS multitasking
 - Virtual machine communication facilities
 - VM directory, or external security manager
 - VM's virtual machine environment (i.e. segment tasks between virtual machines, admin automation...)
 - Install and service tool

Choosing A Web Server

More considerations

- **Security capabilities**
- **Ease of installation, administration, and maintenance**
- **Support of accepted and emerging protocol standards**
- **Similarity to servers on other platforms**
- **Logging capability**
- **Pre-built applications (i.e. access via CGI's, gateways, to other applications such as DB2, OV/VM...)**
- **Programming support - support of CGIs**
- **Server extensibility through provided APIs**

Server File Structure

Hierarchical structure on Minidisk vs Shared File System

- **Minidisk support implemented with (FILELISTS, DIRMAPs, or path statements)**
 - Additional administration and maintenance task
 - Difficult to distribute responsibility for data to other people
 - Very limited sharing capability (multi-write problems, limited to single VM system)
 - Can lead to path navigation problems
 - Becomes very difficult to manage with large systems
- **SFS/BFS support implemented without FILELISTS**
 - Filelists can be used within directories if needed
 - Natural mapping with URL path hierarchy
 - Possible to distribute responsibility for data to other people
 - Extensive sharing capability (single system, and remote systems, alias capability)
 - Easier to manage when site becomes large

Server File Structure

Non-hierarchical file structure Minidisk vs Shared File System

- **Requires special configuration capability in Web Server**
 - Bypasses path processing
 - Allows access to very large scale systems without administration of filelists, dirmaps, etc.
 - Minidisks or SFS directories must be accessed
- **Minidisk**
 - Best performance
 - No additional server for file I/O
 - Can share read/only on a single system
 - Eligible for minidisk cache
- **SFS**
 - DIRCONTROL directory emulates minidisk file system
 - VM dataspace for best performance (close to minidisk)
 - Can share within single system or between systems

Server File Structure

More on minidisk vs shared file system

- **SFS file space limited to single storage group**
- **Use of SFS introduces a second server into the picture**
 - Use of DIRCONTROL directories and Data spaces helps
- **WEBSHARE requires CGIs to be listed in filelist file**
 - Small modification can eliminate this requirement

Need to map out data hierarchy

- **Server root**
- **Subdirectory structure**
- **User web spaces**

Coordinate data hierarchy with network and security scheme

- **Multiple servers for multiple network interfaces?**

Network

Access to public network only, private network only or both?

Intranet (private network only)

- **Most likely single network interface**
- **TCP/IP installation**
 - Decide on what services to install
 - Will people need 3270 interface to maintain the site?
 - Will file transfer capability be needed to maintain the site?

Internet (public network) and Intranet (private network)

- **Need multiple network interfaces to allow for public access, private access, and internal maintenance**
- **TCP/IP installation**
 - Multiple stacks for multiple interfaces (isolate public and private networks)
 - Decide on services to install for each stack

Network

Separate firewall software?

Remote SFS access

- **WAN**
 - TSAF for non-SNA
 - AVS and VTAM for SNA
- **Local**
 - TSAF for non-SNA
 - ISFC for channel to channel connections (3088, CTC, ESCON)
 - AVS and VTAM for SNA connection
- **Userid and directory considerations depending on choice of connectivity for remote SFS**

Security

Consider how access to site will be safeguarded in general

- **General filtering of access to server by IP address or domain name**
- **Firewall software**

Consider whether data served requires explicit protection

Consider whether transactions need to be secure

- **Secure sockets needed?**
- **Data encryption needed?**

Consider how authentication will be accomplished

- **Server processing of userid and password**
- **Use of CP directory**
- **Use of external security manager**

Security

Consider whether to allow

- **User directories to be served**
- **CGI scripts from user directories**
 - Script under control of user
 - Executes in server virtual machine rather than user machine
 - Runs with authority of server virtual machine
(VM:Webgateway addresses these server issues with dynamic worker machines, other web servers accomplish this through use of separate dedicated web server virtual machine)

Consider whether to use web server facilities (filelists, dirmaps) for controlling access to objects served

Consider whether to create user groups, and access control lists

Change Management

If production web server

- **Need to manage changes to server software, networking software, and underlying VM base**
- **Develop procedures to test and place new software into production**
- **Need to manage changes to CGI programs**
 - They function as extensions to server
 - Can significantly disrupt server operation
- **Need to manage changes to data served**
 - Data creates an image of your company
 - Minimize changes to URL paths that people may have saved
 - Ensure when URL paths change that appropriate measures are taken to guide people to new location

Do not create bureaucracy that impedes natural flexibility of web server

Backup

WEB server will quickly become service people depend on
Need to ensure that system is available

Develop strategy to automatically backup

- **System components (VM, TCP/IP, saved segments)**
- **Spool files (if appropriate)**
- **Service machine minidisks**
- **SFS filepools for server code, and server data filespace**

For SFS need capability to restore

- **Storage groups, directories, individual files**

Create stand alone dump tape for diagnosis capability

Maintain alternate nucleus on separate parm disk

Maintain alternate emergency directory for quick recovery

Consider whether to use DFSMS facilities

Organizing Data To Serve

Create directory hierarchies that separate major application areas

Create directories for different types of objects within application groups

- **CGIs, images, sound, static html pages, java applets...**

Determine if server side includes will be supported

- **Create directories for include files**
- **Provide include files for common header and trailer information on pages**
- **Provide include files for other common information**

Create files that can be used by CGIs to maintain common header and trailer information on dynamic pages

Use meaningful names for path components (dir names)

Organizing Data To Serve

Use relative URL addressing whenever possible

- In HTML documents
- In CGI scripts
- Reduces maintenance/administration requirements
- Provides portability

Examples

- Specify nothing - inside current path
- Specify ../ - a subdirectory one level up from current
- Specify ./subdir/ or subdir/ - a subdirectory one level down from current
- Specify ../beside/ a subdirectory beside the current

Watch portability issues for CGIs

Multiple Systems

Situations:

- **WEB servers on multiple systems**
 - Reduce need to replicate data
 - Isolate system specific data, and update requirements
- **WEB server on single system serving data from multiple systems**
 - Ensure server authorized to directories on remote systems
 - Ensure controls are in place to provide stability for remote data

Ensure communication links between systems are sufficient to minimize delays

Ensure servers on remote systems have priority to be insulated from load fluctuations

Provide backup systems to keep data available when remote system is down

Administration

Automate as much as possible using SFS and service machines

- **Create user directories under root filespace rather than allow serving of directories owned by user**
- **Automate process to create user directories under server root**
 - Include sample INDEX.HTML
 - Ensure correct authorizations for server(s), and remote maintainer
- **Automate process to provide/maintain content security**

Limit users who logon to WEB system to a minimum

Automate log file processing/reporting

Installation Overview

Note: the web servers discussed in the following sections are not all of the web servers available for VM/ESA systems. The ones discussed are jointly marketed by IBM, or are free.

Shadow VM Web Server

Shadow VM Web Server Formerly EnterpriseWeb/VM

Commercial web server from Neon Systems (formerly Beyond Software Inc.)

Marketed by IBM and Neon Systems Inc.

Product	IBM Product	IBM Announcement Number	IBM Announce Date
EnterpriseWeb/VM	5758-BYA	296-158	5/5/96
EnterpriseWeb Secure/VM	5758-BY8	298-294	8/25/98

Support

- One year maintenance included
- World wide 24x7 service hotline provided

Requisite Software

- TCP/IP for VM
- Supported version of VM/ESA

Source code available for a fee

OV/VM support provided by EnterpriseWeb Mail

Installation Summary

Install requisite software if necessary

- **TCP/IP for VM**
- **REXX Sockets (Can be installed with web server)**

Determine how many servers to run

- **Production use typically requires multiple servers**
- **Start with 2 to 4, and evaluate performance**

Determine whether to install into SFS or minidisk

- **SFS recommended using DIRCONTROL directories**
- **Install filepool if necessary**
 - Ensure name is one that can be remotely accessed

Determine whether to perform logging

- **Recommended**

Perform ESM authorizations for servers if ESM used

Installation Summary

Define administrator service machine

- **Default is EWEBADM**
- **Target for all install components**
- **If use SFS**
 - **Enroll server in a filepool**
 - **Add PARM FILEPOOL filepool: to IPL CMS statement in CP directory**
 - **Create SFS directories before running install**
 - **Permit WEB server machines to EWEBADM sfs directories**
- **Mdisks/SFS directories**
 - **191 A-disk (EWEBADM.)**
 - **193 REXX Socket Installation (EWEBADM.RXSOCKET)**
 - **194 Sample HTML definitions (EWEBADM.HTML)**
 - **195 EnterpriseWeb/VM code (EWEBADM.EWEBCODE)**
 - **291 Server B-disk (EWEBADM.SERVER)**

Installation Summary

Define WEB server virtual machines

- **Default names EWEBnnn (001 to 999)**
- **Enroll servers in filepool (IPL CMS PARM FILEPOOL...)**
- **Sample profile exec from EWEBADM.SERVER**
 - **Accesses EWEBADM.SERVER as B**
 - **Accesses all other directories required**
- **Ensure CP privileges consist with CGI needs**

Define Log server virtual machine

- **Default name is EWEBLOG**
- **Can install into SFS**
 - **Permit EWEBADM to directories before running install EXEC**
- **Log to mdisk or SFS directory**

Load tape

- **From EWEBADM userid**
- **Load first tape file to a work disk (accessed as C)**

Installation Summary

Load tape (Cont.)

- **Enter command EWSETUP**
 - Installation EXEC

Decide whether to use shared segments for EWEB code

- **Recommended with multiple service machines**
- **Find memory location for segment (1 megabyte above or below 16mb line)**
- **Issue DEFSEG command for EWEBSEG**
- **Access the EWEBCODE directory (or 195 mdisk)**
- **SEGEN EWEBSEG**
- **Copy updated SYSTEM SEGID file to CMS S-disk**

Recommend **OPTION QUICKDSP** for servers and log virtual machine

Installation Summary

Customize TCP/IP

- **PROFILE TCPIP**

- Create PORT entry for server virtual machines
- Add server virtual machines to AUTOLOG section

Customize sample profile exec on EWEBADM.SERVER for each WEB server (move to server root directories)

Activate ESM code if needed

Ensure WEB server machines have access to

- **REXX run time library**
- **TCPMAINT 592 (public disk/dir for TCP/IP)**

Verify installation using IVP config file

- **Logon to WEB server**
- **Enter EWEB port# CONFIG IVP CONFIG ***

Installation Summary

Customize configuration file

- **Default name is \$EWEB CONFIG**
- **Allocate root directory for site data content**
 - Recommend directory owned by EWEBADM
 - Authorize all servers to root directory

Create security authorization files

Setup the log server

- **Customize log profile exec**
- **Ensure CP class B for MSGNOH use**
- **Customize \$EWEBLOG CONFIG file**
- **Ensure log server autologged when system is IPLed**

VM:WEBGATEWAY

VM:Webgateway 3.0

Commercial web server from Sterling Software, Inc.

- **Web server component**
- **CGI extension**
- **Office Vision Interface**

Marketed by IBM and Sterling Software

- **IBM product number - 5758-SLM**
- **IBM Announcement Letter - 298-293, 8/25/98**

Support

- **World-wide service provided via**
– hotline, email, web site & PC bulletin board

Requisite products

- **TCP/IP for VM**
- **VM/ESA 1.2.2+**

Secure Socket Layer support provided by web server component

Installation Summary

Install requisite software if necessary

- **TCP/IP for VM**

Installation to minidisks only

Determine whether security will be provided by

- **Server registry files**
- **CP directory**
- **External security manager**

Create installation and maintenance userid

- **Default name is VMRMAINT**
- **Target for all install components**
- **Sample directory entry (for all supported DASD types available from second file of first installation tape)**
 - **Note: the install program requires access to the CP object directory**

Installation Summary

More on installation and maintenance userid

- **Minidisks**

- 1A0 Link to minidisk containing CP object directory (RR)
- 191 VMRMAINT A-disk
- 192 VMSI minidisk (for install tool)
- 193 PUBLIC minidisk (for install tool)
- 196 VMSI minidisk - VM Software News Files
- 160 VM:Webgateway system administrator
- 161 VM:Webgateway OfficeVision Interface system administrator
- 162 VM:Webgateway CGI Extensions administrator

Logon to VMRMAINT

- **Attach tape drive with first install tape mounted**
- **Format A-disk**
- **Load first tape file from first install tape to A-disk**
- **Run VMIBOOT EXEC**

Installation Summary

From VMRMAINT

- **VMIBOOT loads the automated install and maintenance tool (AIM), and then invokes the tool (VMIMAIN menu)**
 - You may at this point need to stop the VM:Webserver install and load maintenance for the AIM tool
- **Run Install Phase One from VMIMAIN menu**
 - Select VM:Webgateway and optional components
 - AIM will scan all minidisks in your system at this point to enable allocating minidisks for product virtual machines
 - You can manually place the directory entries into your CP directory
 - Default service machine names are VMWEBSRV, VIGVMY
- **After creating CP directory entry for VMWEBSRV**
 - Run Install Phase Two from VMIMAIN menu
 - Install phase two loads server code

Installation Summary

Optionally load CMS help files when phase 2 completes
VMWEBSRV minidisks

- **191 A-disk**
- **192 HTML help files, and configuration dialogs**
- **193 VM:Webgateway OfficeVision Interface program material**
- **194 VM:Webgateway CGI Extensions program material**
- **1B0 VM:Webgateway configuration database**
- **1A0 Read only link to minidisk containing CP object directory (only needed if using CP directory security)**

Configure TCP/IP

- **PROFILE TCPIP**
 - Add VMWEBSRV to PORT section using port 80
 - Add VMWEBSRV to Autolog section

Installation Summary

Perform initial server configuration

- Logon to VMWEBSRV
- Update PROFILE EXEC to access 1FE at a free file mode
- Define tcp port, and root domain
 - config socket add * port 80 root sfs vmsysu:vmwebsrv.vmwebserver
 - By default server will listen on port 80, use replace verb to update root

Optionally create shared segment for VM Software REXX utility

Verify installation

- Run profile exec, enter y when prompted to start server
- Use web browser to enter following URL
 - <http://hostname:port/vm:webgateway/server>

Move public files from VMRMANT 193 minidisk to system wide public disk

- Modules that allow users to communicate with VMWEBSRV virtual machine
- Use VMIMANT Copy to Public Minidisk option

Installation Summary

Add segment reserve statements to PROFILE EXEC

- Reserve segments for applications run on VMWEBSRV

Set up VM:Webgateway Worker Machines

- Optional step
- Allow off-loading of CGI programs

Continue configuring VM:Webgateway

- Most configuration can be done through browser interface
- Need to specify VM userid to be given SYSADMIN authority (by default VMRMAINT has SYSADMIN)
 - config sysadmin add webadmin
 - Use this userid and associated vm password when prompted by your browser
- Implement security scheme

WEBSHARE

Introduction

Written by Rick Troth while at Rice University
Available free from Beyond Software web site

- <http://www.beyond-software.com/>

Requisite software

- **REXX sockets (available for download from same site)**
- **TCP/IP for VM**
- **Supported version of VM**

No formal documentation

- **Limited help files**
- **No html based documentation**
- **Several CGI script samples, and HTML samples**
- **Sample config file**

No formal support

Source code included with package

Installation Summary

Install requisite software if necessary

- **TCP/IP for VM**
- **REXX Sockets**

Determine how many servers to run

- **Production use typically requires multiple servers**
- **Start with 2, and evaluate performance**

Determine whether to install into SFS or minidisk

- **SFS recommended using DIRCONTROL directories**
- **Install filepool if necessary**
 - Ensure name is one that can be remotely accessed

Determine whether to perform logging

- **Recommended**

Installation Summary

Define administrator service machine

- **Suggest WEBSADM**
- **Target for all install components**
- **If use SFS**
 - Enroll server in a filepool
 - Add PARM FILEPOOL filepool: to IPL CMS statement in CP directory
 - Create SFS directories before installing code
 - Permit WEB server machines to WEBSADM sfs directories
- **Suggested mdisks/SFS directories**
 - 191 A-disk (WEBSADM.)
 - 193 REXX Socket Installation (WEBSADM.RXSOCKET)
 - 195 Webshare code (WEBSADM.CMSHTTPD)
 - 198 mdisk/dirid for logs (WEBSADM.LOG)

Installation Summary

Define WEB server virtual machines

- Define names such as WEBS001, 002...
- Create profile exec to access all needed directories
 - Most important is WEBSADM.CMSHTTPD
- Ensure CP privileges consist with CGI needs

Obtain VMARC module and WEBSHARE

- Download both files from
 - <http://www.beyond-software.com/>

Upload packages from your PC to the WEBSADM vm id

Reblock packages

- PIPE < VMARC MODULE A | DEBLOCK CMS | > VMARC MODULE A
- PIPE < CMSHTTPD VMARC A | FBLOCK 80 80 | > CMSHTTPD VMARC A F 80

Installation Summary

Access WEBSADM.CMSHTTPD as G

Unpack webshare code into the SFS directory

- **VMARC UNPK CMSHTTPD VMARC A = = G**

Customize WEBSHARE config file

- **Sample name is HTTPD CONFIG**
 - Add PORT statement if not using port 80
 - Update LOGPIPE statement if want to log to a file (e.g. LOGPIPE >> HTTPD LOG X, assuming log directory is accessed by profile at mode X)
 - Update CGIUSERS statement if want to allow CGI scripts in user web pages
 - Place updated config on each server A-disk/directory

Define root directory under each WEBSnnn virtual machine

- **Must be named .WEBSHARE**
- **Use file aliases to avoid duplicating data**

Installation Summary

CGI scripts must be listed in a filelist file in order to use

- E.g. **.WEBSHARE** directory contains **HTBIN FILELIST**
- **CPQ CGI** is listed in the **HTBIN FILELIST**
- Execute **CPQ CGI** with following URL path
 - `http://www.xxx.yyy/htbin/cpq?user`
- **HTBIN FILELIST** defines a subdirectory of the root directory (**.WEBSHARE**)
- Possible to eliminate this need with small mod to **WEBSHARE** code

Customize TCP/IP

- **PROFILE TCPIP**
 - Create **PORT** entry for **WEB** server virtual machines
 - Add server virtual machines to **AUTOLOG** section

Place index html file into **.WEBSHARE** directories to test servers

Performance Consideration

VM System Performance

Treat web server as a typical server virtual machine

- **Allocate a higher share than normal users**
 - May want to consider an absolute share
 - Share should be less than TCP/IP virtual machine
- **Designate as a QUICK DISPATCH virtual machine**
- **Use data in memory techniques**
 - May want to serve static read only data from a vdisk (preload when server starts)
 - Utilize VM dataspace where possible
 - Tune VM system minidisk cache for server mdisk (OPTION NOMDCFS)
- **Don't forget other servers web server is dependent upon**
 - SFS filepool server
 - Log server

Web Server Settings

EnterpriseWeb/VM

- **Utilize multiple server virtual machines**
 - Begin with between 2 - 4, and monitor performance
 - Place code in shared segment
- **Use/define Fastdisks/Fastpaths in config file**
- **Minimize authorization calls/checks**
- **Use network routers for filtering instead of IPFILTER or ENTRYFILTER configuration statements**
- **IDENT off**
- **Add high usage files to \$EWEB PRELOADS**
- **Pretranslate html files to ascii, store with ft of htmla**

Webshare

- **IDENT off**

Web Server Settings

VM:Webgateway

- **Database cache size, and size of virtual machine**
 - Reduce disk I/O to database
- **Multiple servers for severe performance problems**
- **Minimize authorization checks/calls**
- **IDENT OFF**
- **Ensure adequate virtual machine size**
 - Multitasking server

SFS Performance

Allocate SHARE greater than general users

- **Consider absolute share setting**
- **Designate as a QUICKDSP virtual machine**

Place data in DIRCONTROL directories where possible

Use VM dataspace for DIRCONTROL directories

- **dataspace assign vmsysu:mydir.subdir**

Modify BUFFSIZE parameter of EDFNUC macro in DMSNGP

- **BUFFSIZE=64 recommended if storage not constrained**

Be sure to install and start the CRR server file pool

OPTION NOMDCFS for each filepool server

- **Ensure mdc available for use**

Use CMSFILES shared segment for code

SFS Performance

Log minidisks

- **Make ineligible for minidisk cache**
- **Use 3990 Dasd Fast Write if possible (MINIOPT CACHE)**
- **Place on separate real devices that have low utilization**

Spread storage group 1 minidisks across real volumes

- **Low use volumes**
- **Do not mix with mdisks from other storage groups**

Avoid catalog fragmentation with catalog reorgs

Monitor filepool counters with QUERY FILEPOOL COUNTERS command

- **Monitor buffers, such as catbuffers...**

TCP/IP Performance

Give TCP/IP service machine highest share on VM system

- Designate as a QUICKDSP virtual machine
- Consider reserving number of pages equal to average working set size
 - Reduce likelihood TCP/IP will be in a page wait
- Consider increasing number of SCBs, TCBs, databuffers
- Ensure using optimum MTU size on gateway statements
- Ensure domain name server is given sufficient resources to avoid any delays
 - If do not need client user ID and domain information in CGI comment out NSINTERADDR statements in TCPIP DATA
 - If do need DNS information make sure RESOLVERTIMEOUT setting in PROFILE TCPIP is much lower than default 30 seconds
- Do not use IDENT protocol (IDENT OFF in web config)

CGI Performance

Use good REXX and Pipelines coding techniques

- **Use pipelines facilities as much as possible**
- **Compile rexx if possible**

Avoid commands that may be long running, or block the entire virtual machine

- **Certain diagnose codes**
- **Virtual machine communication**
- **CP or CMS commands**

Minimize dependencies on other virtual machines

Be careful not to change server environment

- **Minidisks accessed**
- **CP or CMS settings**
- **Contents of global variables**