

Terminal Server at HP

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Tips, Tricks and Traps
when evaluating the
potential for Terminal
Server in the Enterprise





Contents of this presentation are based upon...

- HP sponsored investigation into the potential use of Terminal Server (we called it Server-Based Computing or SBC) as a lower-cost replacement for the average user's desktop PC.
- Two pilots launched over the period of a year to determine SBC's value in various geographical locations and with various types of users.

Target Audience for this presentation

- This Is

- A guide to help you identify the pros and cons involved in potentially utilizing an SBC environment.
- A list of best practices, areas we learned to avoid, and key findings for utilizing Terminal Server in an enterprise.

- This Is Not

- A technical presentation on the ins and outs of installing, configuring and administrating Terminal Server.
- A recommendation for you to install and use Terminal Server.
- A recommendation for any type of hardware or software.

Symbols Used Throughout



Best Practice



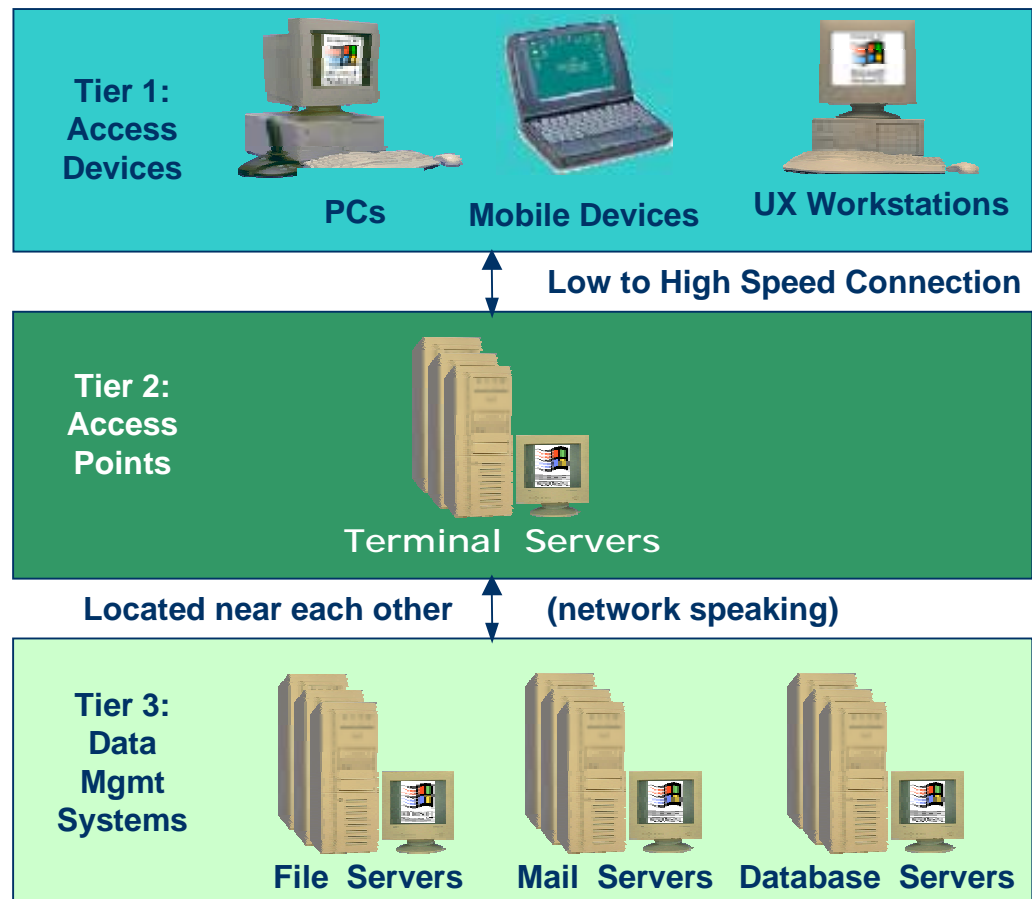
Important!



Learned the Hard Way

What Is Server-Based Computing?

- Enables any device to have access to Win32 applications.
- Only keystrokes, mice movements and video updates are sent across the network.
- All processing occurs at the server.



Benefits of Server-Based Computing

- Application Development
- Telecommuting and Mobile Users
- Mergers, Acquisitions and Divestitures
- Network Bandwidth and Wireless LAN
- Time to Market
- Deskside Support and Help Desk calls
- Platform Independence
- Reliability
- Hardware Lifecycle
- Number of machines per person

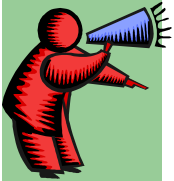


SBC Benefits Are Available Only...

With Proper Implementation!

- Must look at SBC from an *Enterprise Point of View*.
- This presentation's goal is to point you in the right direction based on experiences within HP.

Preparation: So You Think You Want To Use SBC, eh?



- This is a BIG deal.
- It will require significant management backing.
- SBC is not a fit for a whole organization, especially to begin with.
- It will require both technical and political expertise to be successful.



“SBC works, the only problem is political”

Preparation: Things to begin thinking about

- Obtain management support.
- Determine your test users and pilot groups.
- Design your architecture.
- Choose your operating system.
- Build the servers and operating system.
- Build and test the software image.
- Understand performance and any technical issues.
- Get feedback from your users.
- Publish your financial review and risk analysis.

Preparation: Getting Ready to Start

- Need to clearly define the reasons that you are looking at implementing an SBC environment.
 - Not getting enough out of your existing platforms?
 - Need quicker delivery of applications?
 - Need a way to manage legacy apps?
 - Support costs becoming unmanageable?
- Know (or learn) the limits and best fit for SBC in your enterprise.
- Clearly define the limits and scope of your testing and implementation. Scope creep can kill!



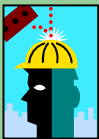
Preparation: Management Support

- SBC implementations tend to have a political flavor.
- Need to have your IT management's support.
- Need to have the Business Management's support.
- Need to know how the final decision will be made to use (or not to use) SBC
 - Will your test users have a say in the decision?
 - Will the rollout be by management directive?

Preparation: Four Laws of Finding Test Users

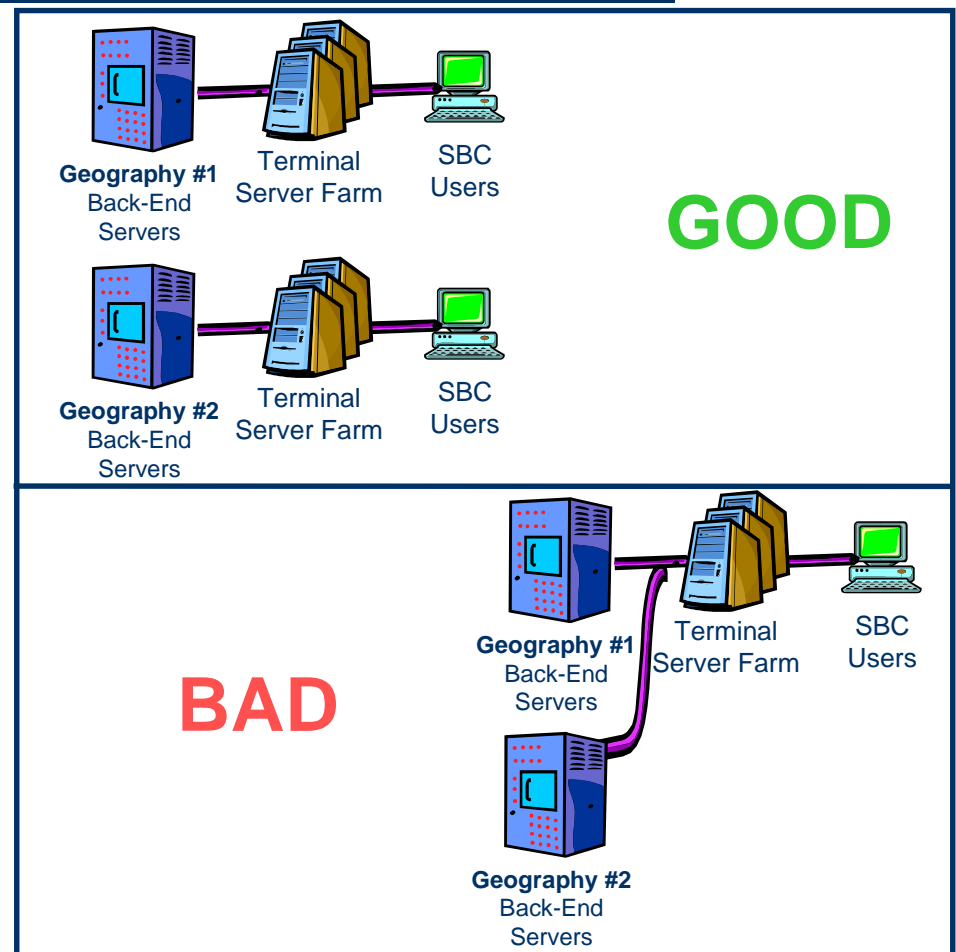


- Law #1: Your users must WANT to help you.
 - Corollary: You need to have a reason that the users would want to help you.
- Law #2: Shoot Low, not High.
- Law #3: Past users of Terminal Server are not always the best choice for test users.
- Law #4: Only test in one physical area at a time.



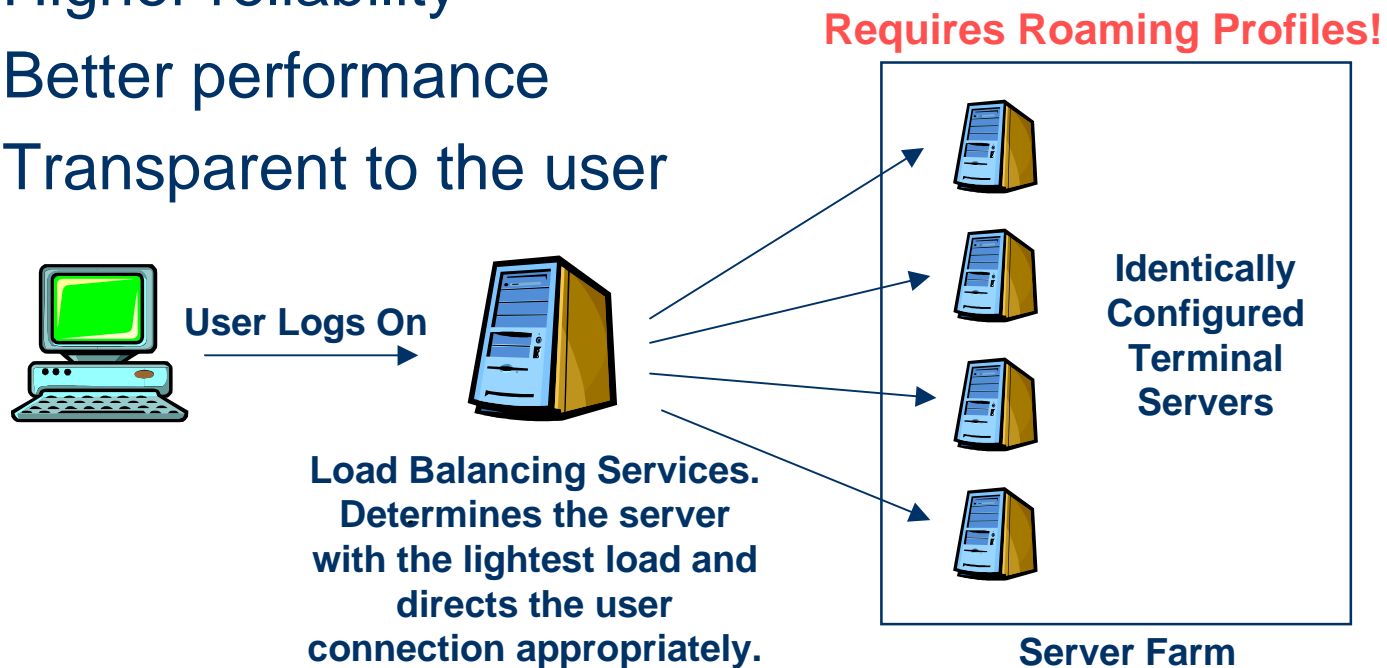
Architecture: Server Location

- Rule of Thumb
 - Focus on minimizing the network distance between the Terminal Server farm and the back-end data servers that its users communicate with.
- Goal
 - Reduce latency between Terminal Server farm and back-end data servers.

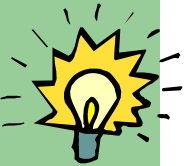


Architecture: Load Balancing

- Load Balancing allows you to create Terminal Server Farms.
 - Higher reliability
 - Better performance
 - Transparent to the user



Architecture: User Profiles



✓ Roaming Profiles

- Allows users to switch from one server to another without having to manage their profiles.



● Local Profiles

- Easy to implement, but require a LOT of system management and provide a very poor user experience.



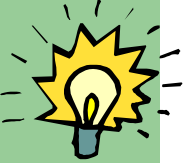
● Mandatory Profiles

- Very limiting. Unless management is 100% dedicated to system lockdown, this is a BAD idea. Can create a lot of extra work and a very bad user experience.

Architecture: Network Capacity

- **Bandwidth:** Amount of data that can be passed between two systems during a specific period of time.
- **Latency:** The amount of time for data to get from point A to point B.
- ✓ **Latency** is the enemy of Terminal Server, not bandwidth.
 - 250ms or less round trip for data is acceptable.
 - Any more will impact user experience.

Architecture: User Data Storage



- Don't store user data on the Terminal Servers.
- Don't store data on the local system.
- Common misperceptions of local data storage.
 - Local storage is cheap, fast and always available.
 - Data is personal.
 - Local data is secure.
- Data should be stored remotely in an SBC environment
 - Available from anywhere with any device that can connect to the Terminal Server.
 - Data is backed up and is protected by company firewalls.

Architecture: What can be done to decrease latency

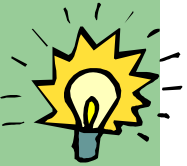
- Focus on the network.
 - Reduce the amount of “hops” between Terminal Servers and its points of data access.
 - Improve network performance with QoS tools.
- Smoke and mirrors
 - “Fake” a reduction in latency.
 - For instance: Echo keystrokes to the screen rather than send them to the server only to be resent back to the user’s screen to be redrawn.

Server Building: Processors

- Don't implement on servers with only one processor!
 - Will create a major bottleneck.
- Recommendation
 - HP recommends two processors minimum for user counts less than 50.
 - HP recommends four-six processors for systems supporting more than 50 users.
- All servers in our tests had four processors

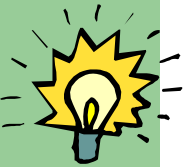
Server Building: Disks

- Create separate disk subsystems for:
 - Operating System
 - Swap space
 - Applications
- Don't store user's data on the Terminal Server's disks.
 - No server backups are required.
 - It is faster to re-image server than to restore via backups.
- Do everything to increase reliability and decrease user perception of latency
 - Mirror each disk to enhance reliability.
 - Utilize RAID to increase performance (we used RAID 10)
 - Utilize hot-swap hard disk components



Server Building: Memory

- Types of memory
 - Physical Memory – amount of physical RAM installed in the server
 - Virtual Memory – additional storage space on hard disk used as memory (pagefile.sys)
- 1 GB RAM per processor
- Pagefile should be 2X the amount of physical memory in the server.
 - Less disk space and the CPUs become busy with kernel mode processes that are trimming the working storage of the user processes because the OS believes that it is running out of virtual memory.



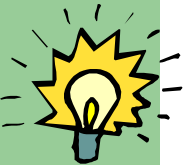
Server Building: Operating System



- Doesn't require "Advanced Server" capabilities
 - In SBC, the operating system includes more than traditional OS
 - Windows 2000
- AND**
- User Application Suite
 - Avoid Windows NT if at all possible
 - Legacy support might be the only reason

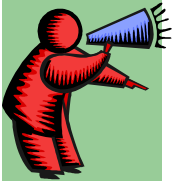
Server Building: Printers

- Printers can be VERY difficult to manage
- Local printers can be used
- In the enterprise, server-based printers are critical, but time consuming to implement
 - Don't add printers ad hoc to your environment
 - Each printer must be certified to work during your testing phase. Unreliable servers will result if testing is not performed
 - Printer access can be inconsistent between sites. SBC printing must take that into account
- Best idea is to have a standardized print architecture that is utilized by SBC.



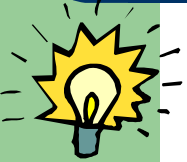
Server Building: Datacenter

- Duh!



- Don't be fooled into thinking that you can roll out an enterprise release of SBC with the servers sitting under your desk.
- Start talking with your own datacenter managers to find space and the appropriate power required.
- Contract for support of the servers, operating system, and application management.
- Make sure your datacenter admins have Terminal Server support experience.

Server Building: Windows NT 4.0



- Reboot the server every night
 - Yeah, I know, it bites, but it works! You WILL experience fewer BSOD as a result.
 - Not as necessary with Windows 2000, but if you can (not in a ‘follow-the-sun’ configuration), it is still not a bad idea.

Terminal Server Software: Generic versus Enhanced

- Generic = MS Terminal Services
 - Windows NT 4.0 Terminal Services Edition
 - Windows 2000 Server w/ Terminal Services enabled
 - Clients – All Windows-based Operating Systems
 - Protocol - RDP
- Enhanced - Citrix MetaFrame
 - Clients – All processing platforms
 - Protocol - ICA
 - Enhanced – additional tools for server management, load balancing, performance monitoring, increased client functionality.

Terminal Server Software: Client Protocols

- ICA

- Citrix owned protocol (Independent Computing Architecture)
- Supports all major network protocols.
- Supports all major hardware and software platforms.
- More Details at:
<http://download2.citrix.com/FI/LES/en/products/client/ica/current/docs/ica32.pdf>
- MetaFrame is an additional cost.

- RDP

- Microsoft owned protocol (Remote Desktop Protocol)
- Supports TCP/IP.
- Supports all *Windows* OS starting at W4W 3.11
- More Details At:
<http://www.microsoft.com/windows2000/docs/rdpfandp.doc>
- Included with Windows 2000 Server at no additional cost.

Terminal Server Software: Server Management Tools

- Windows 2000 w/ Terminal Services
 - Load Balancing occurs through the use of Windows 2000 Advanced Server.
 - Performance Monitoring through Windows 2000 Server Performance tools.
- MetaFrame
 - Load Balancing occurs through the use of Citrix Load Balancing Services.
 - Performance monitoring occurs through the use of Citrix Remote Management Services (RMS).

Software Image: 16-bit versus 32-bit applications

- Don't mix them if at all possible
 - Huge impact to server performance with 16-bit applications.
 - System reliability WILL be impacted with 16-bit applications.
 - The only reason we could see for putting 16-bit apps on a Terminal Server is to help with the transition of legacy apps to modern apps.
 - Will require very close system monitoring.



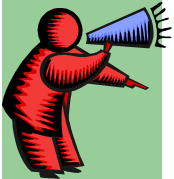
Software Image: Virus Checking



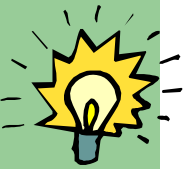
- No Terminal Server Compatible virus checkers at the time of the 2 pilots.
 - Heavy performance issues
 - 20%-25% of CPU is utilized with a load of 80 users.
 - Runs within the user context rather than the server context.
 - Each user has an instance of the program, rather than one instance running at the server level.

Software Image: Creating a Software Image

- Install first onto a test server (that mirrors the hardware and configuration of your production servers).
- Perform at least 1 week worth of testing with specific users to “debug” the installation.
 - Best users here are support personnel, not end users.
- Document all tweaks to the installation you make.
- Build a final image, using all documented tweaks, and then test again!
- Finalize the image creation process and move to production .
 - ALWAYS USE THE PROCESS!
 - Ad hoc installations are very unstable.

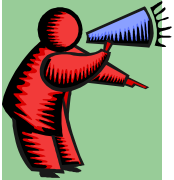


Software Image: Maintaining a Software Image



- Always retain a test server that mirrors the hardware and configuration of your production environment, even after you have gone into production.
- Make changes to your test server and go through the process as though it was your first installation.

Server Performance Monitoring



- Requires a baseline
 - You can't identify performance issues unless you have something to compare against.
 - Identify your baseline performance measurements representing normal usage.
- Think “trend” versus “snapshot”
 - Measurements need to be viewed over time, not as a snapshot of time.
 - Identifying trends and averages is the goal.

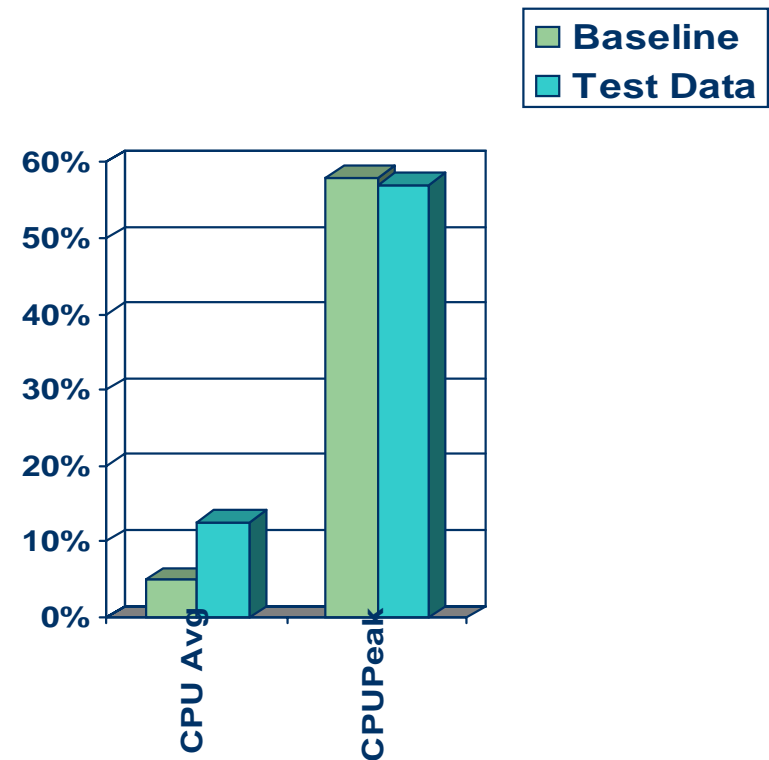
Server Performance Monitoring: System Configuration

- Baseline measurements resulted from statistics collected over one week on 4 servers populated with 40-60 users per server.
- Server Information
 - 550Mhz Pentium III Xeon Processor (4-way)
 - 2.3GB RAM
- Test data was collected with 100 users per server.
- Application mix during test (# of instances).

– IE 5.0 (216)	– MS Excel (124)
– MS Outlook (140)	– MS Word (110)
– MS File Explorer (136)	– Notepad (30)
– Norton Anti-Virus (136)	– Windows Media Player (19)
	– MS PowerPoint (7)

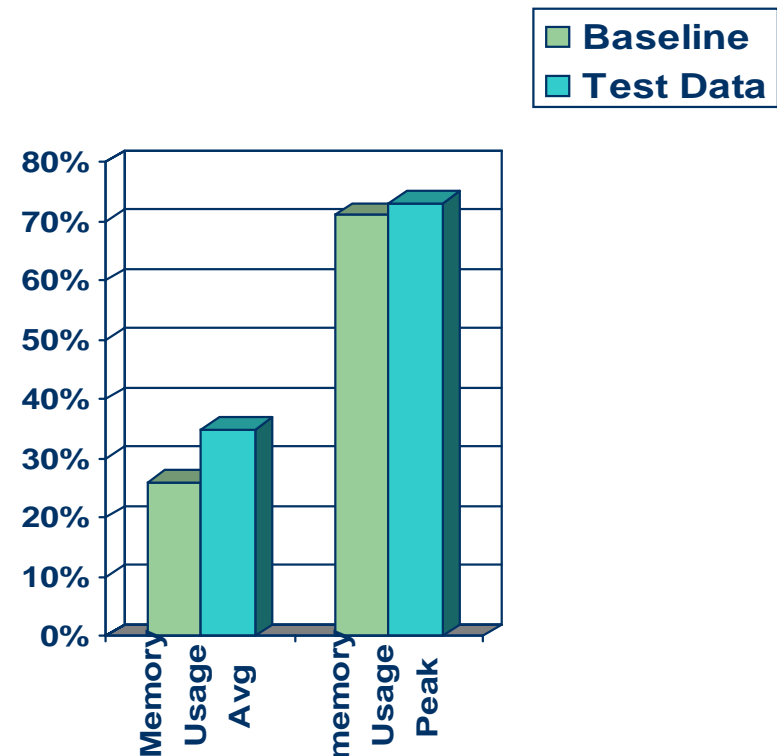
Server Performance Monitoring: CPU Utilization

- Identifies how busy the server's processors are.
 - Very little impact to the server between baseline and test case of 100 users.



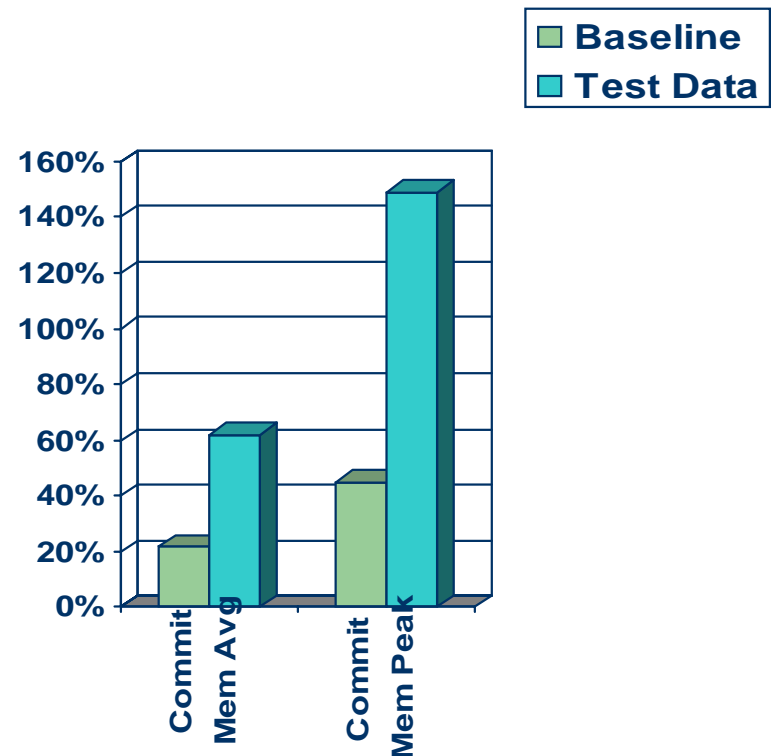
Server Performance Monitoring: Physical Memory

- Amount of physical memory currently allocated to processes.
 - The system attempts to keep virtual memory free by swapping out to physical memory.
 - Virtual memory (disk) is MUCH slower than physical memory, and decreases system performance.



Server Performance Monitoring: Commit Ratio

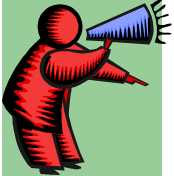
- Percentage of virtual memory used against all virtual memory available.
 - Once over 100%, all available physical memory is used up, requiring the utilization of virtual memory.
 - If commit ratio goes over 100% often, more physical memory is needed.
 - Adding memory requires increasing swap file size.



Server Performance Monitoring: Our Results

- No reports from users of negative experiences during test period.
- 4 processors were sufficient to support 100 users per server. In fact, more users could probably have been added without negative impact to the user experience.
- Physical memory statistics look good on their own, but must be taken into account with Commit Ratio results.
- Commit Ratio was above 100% on approximately 25% of the test readings. This indicates that the servers require more memory during peak usage (feedback from the production environments continue to indicate that more memory is required).

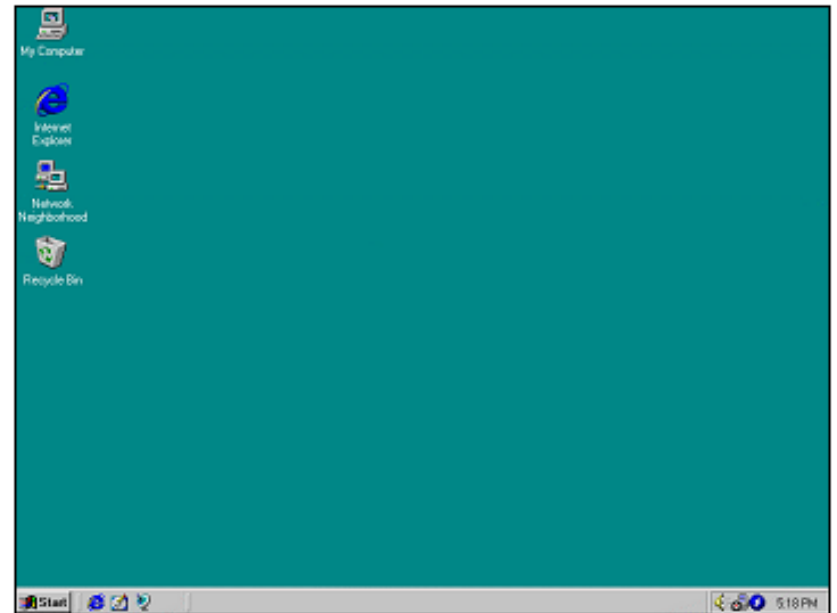
Server Performance Monitoring: Your Results May Vary



- Performance results are specific to a mix of indicators.
 - Server configuration (processors, memory, architecture)
 - Network architecture
 - Applications installed on the server
 - Type of applications (client/server vs. productivity)
 - Hybrid 16-bit/32-bit environment or pure 32-bit
 - Number of users
 - User type
- Type of Application deserves special attention
 - A server that hosts a client/server application (such as SAP) would typically support far more than 100 users as the Terminal Server is simply acting as another terminal.

User Experience: Published Desktop

- Creates a new window that provides access to all SBC applications.
- Available via either TSE or MetaFrame.
- Required for Non-PC platforms (UX, WinCE, etc).
- Simplest Implementation
- User Experience
 - Can reduce confusion
 - Can increase confusion



User Experience: Published Desktop

● Pros

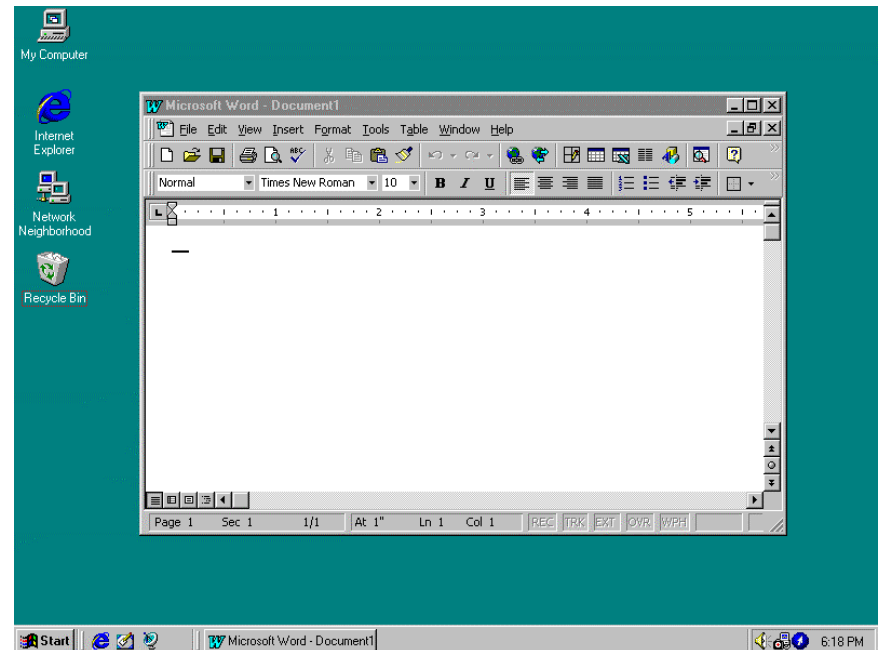
- Available via both TSE and MetaFrame.
- Simpler to use for novice users.
- Allows for a complete desktop experience.
- Simpler to troubleshoot when problems arise.
- Allows for remote disconnecting without losing session.

● Cons

- Didn't provide "value" for power users.
- Required more user training to help them understand how the published desktop was different than their local desktop.
- Allowed for increased user interaction with the environment.

User Experience: Seamless Windows

- Provides icons on the normal Windows desktop that initiate SBC applications rather than local applications.
- Available with MetaFrame users on Windows PCs only.
- User Experience
 - Looks just like a regular Windows desktop, which can reduce user resistance to SBC.
 - Issues exist in interoperability between SBC and non-SBC applications (drag and drop, clipboard between apps, printing, etc.).



Is it Local or SBC?

User Experience: Seamless Desktop

● Pros

- Easy transition for reluctant users from local to remote apps.
- Very little user training required as it just added new icons to the existing desktop.

● Cons

- Created confusion among novice users.
- Required multiple logons (this might not be necessary anymore).
- Difficult to keep local and remote applications in context.
- Increased complexity in troubleshooting.

User Experience: Overview

- Another Duh!
 - People who lost functionality didn't like SBC.
 - People who gained functionality loved SBC.
- Best Experiences
 - People with low-powered or out-dated computers
 - Mobile users.
 - Non-MS users requiring access to MS applications.
 - Unix and Linux users.
- Worst Experiences
 - Users with a high level of competency on their computer.
 - Users with very powerful systems.
 - Users accessing SBC environments that were unstable.

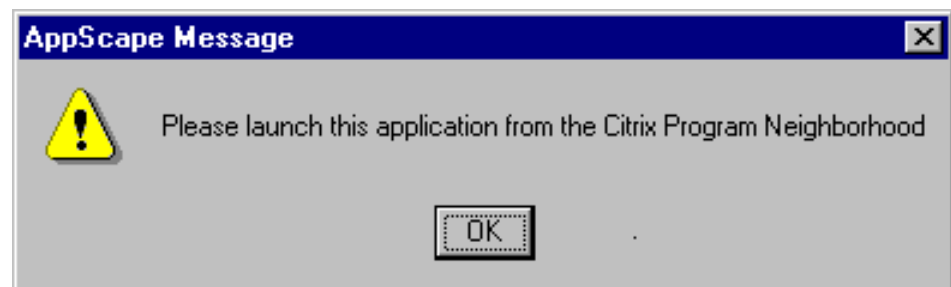
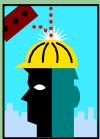
User Experience: User Recommendations

- Red and Blue markers represent overall evaluation of SBC by pilot users.
- Red line are those who would not recommend using SBC in the enterprise.
- Blue line are those who would recommend SBC in the enterprise.



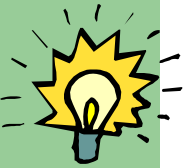
User Experience: Lockdown

- SBC can provide you with more control over the environment.
 - A lot of responsibility comes with this control.
 - If users are losing functionality because of the lockdown, be prepared for rebellion!
 - Is your environment bullet-proof enough to be standalone?
 - Can your support team respond fast enough and with enough knowledge to repair the problem?
 - Requires absolute management support or you WILL fail.

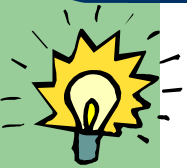


Financial Analysis: Overview

- Critical component to selling Terminal Services and SBC to management
- There are soft costs though that are hard to quantify, but still equally valuable.
 - Reduction of PC crashes or hardware failures.
 - Data is remotely stored, which is then actually backed up.
 - Provides platform independence (UX, Linux, Windows, etc.).
 - Greatly increases time to market for new application or OS releases.
 - Supports quick turnaround for mergers, acquisitions or divestitures.
 - Positions an enterprise for a remote workforce.
 - Common platform for application development in the enterprise.
 - Can reduce the need to upgrade network bandwidth.
 - Enables a controlled asset management process.



Financial Analysis: KISS



- Keep It Simple Stupid

- We performed two cost analysis over a period of one year.

- First Analysis

- Hundreds of variables – everything we could think of.
- No one could agree on the final cost because there were so many variables that we being considered.

- Second Analysis

- Six variables total.
- Pre-analysis provided ways to cancel out many of the variables between a “thin” desktop and a “fat” desktop.

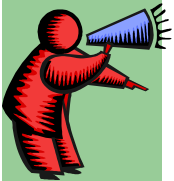


Financial Analysis: Six Key Variables

- # of users each server can support.
- # of users involved.
- Concurrency factor of users (if using MetaFrame).
- Support reduction factor in helpdesk support.
- Cost of additional support required for servers.
- Cost of hardware and software.

* Not a variable, but still important to note:
There is a difference in spending between *expensed* and *capitalized* hardware (i.e. PCs versus Servers)

Risk Factors To Consider



- Is your help desk properly trained and ready to support you?
 - Different point of view on support than from normal desktops.
 - Additional effort associated with user account management.
- Is your datacenter properly trained and ready to support you?
 - Can they keep your servers up and running 24/7?
 - Is their Release-To-Production process solid?
- Reduced number of points of failure.
 - If a server goes down, everyone on that server goes down.
 - If the server farm goes down, **everyone** is down!
- Increased dependence on the network.

A Few Gotchas

- Single IP address per server, shared among ALL of the users on that server.
 - NetMeeting requires an IP address per user, so only one NetMeeting session per Terminal Server.
- Multimedia streaming
 - Bandwidth intensive unless extensive work is performed with additional servers beyond the core SBC Terminal Servers.
- Disable screen savers
 - Requires video images to be sent over the network

Additional Resources

- HP SBC Sizing Guide
 - Hardcopy available at the HP Booth
 - Includes SBC testing across full line of HP NetServers.
 - Online sizing utility available at:
- HP Server-Based Computing Homepage
 - http://netserver.hp.com/netserver/products/highlights_sbc.asp
 - NetServer Analysis
 - Configuration Guide
 - Information Library