

# Centralized vs Distributed Computing

White Paper Discussion, October 29, 2007.

## Introduction

The following white paper provides an overview discussion around the 2 primary types of computing solutions for businesses.

## Definitions to Understand

### Centralized Computing (CC)

All computing is controlled through a central terminal server(s), which centrally provides the processing, programs and storage. The workstations (ThinClients, PCs, appliances) are just used for input and display purposes. They connect to the server(s) where all tasks are performed. All server resources are purchased once and shared by all users. Security issues are far easier to coordinate and centrally nail down.

*Traditionally, this type of computing was only found in Enterprise Level Businesses. In more recent time, reduced server and network costs have seen this type of computing deployed in many smaller and medium sized businesses.*

### Distributed Computing (DC)

Every user has their own PC (desktop or laptop) for processing, programs and storage. Storage is often mixed over the network between the local PC, shared PCs, or a dedicated file server. Each PC requires the purchase of its own resources (operating system, programs, etc.).

*This is the more widely used computing configuration, because it has grown out of what most users and many IT people were used to, within the comfort zone of their home PCs. As a result, there has been extensive development of many business practices, systems and security products to help the distributed system fully function in a business environment.*

## Study of Computing Challenges and Considerations

It is important to identify the initial and ongoing challenges that must be addressed. Too many businesses just look at the initial purchase price and fail to factor in the ongoing 'cost of ownership'. In the computing world the ongoing challenges all cost money, and are often significant. The following chart identifies areas for consideration:

Initial	Ongoing	Challenge or Consideration
✓		Capital Purchase Price
✓		Clear IT goals... short term and long term... upgrades and dollars.
✓	✓	Trained People to provide the ongoing administration of 'the system'.
✓	✓	Coordinating with service providers.
	✓	Software and Operating System Life-Cycle Replacements and Upgrades.
	✓	Equipment Life-Cycle Replacements and Upgrades.
	✓	Equipment Repairs and Maintenance.
	✓	Identifying and Configuring for Internal Security and Access Concerns.
	✓	Protecting against External Threats. Eg. virus, Trojan, worm, etc.
	✓	Regular User Training

## How to Mitigate these Challenges

- #1 Have a well thought out, long term, IT plan.
- #2 Install commercial grade network infrastructure (this is the foundation of your IT house).
- #3 Avoid consumer IT products. Stick with proven commercial class products.
- #4 Find and consistently use a reputable IT business solution provider. Check their references. Avoid taking advice from friends who are 'experts' on consumer PCs.

## **Study of Computing Costs**

### Initial Capital Purchase

In any environment, there is an initial outlay to bring a business' technology on board. This is the best time to establish your long term IT goals. The right decisions, made early, will clearly affect the total dollars that you will end up spending.

### Clear IT Goals

Having clear goals as to where your IT requirements are and will be moving to will help the decision making process when choosing equipment and services.

### Trained People to Provide the Ongoing Administration of the System

The right IT company will help you plan both your goals and your progressive outlay to achieve those goals. Another option is to train a dedicated person internally; however, be mindful of continuity when staff change.

### Coordinating with Service Providers

At the outset, and ongoing there will be continuous coordination between many different providers. Rarely do you come across a credible company that can either provide all of the products and services you require, or be competent to coordinate multiple services and products to give you a sound, solid feeling of all of your IT flowing smoothly. Make careful decisions that will last for the long haul.

### Life-Cycle Replacement Cost

This is a major point to be understood. How long will your equipment and investment last?

Take into consideration:

- Mean-time before failure
- Upgraded/updated software applications
- Upgraded hardware needs
- Viable life until retirement

### Equipment Repairs and Maintenance

All computing equipment requires some level of support and maintenance. The larger the unit, the more units you have, and the number of moving parts they have influence the ongoing support and maintenance you will required.

Typical PCs will require, on average, 20 hours of support per year. This includes:

- Helpdesk support for user issues
- Troubleshooting systems to determine if a technician is needed
- User created challenges
- New software installation challenges

### Identifying and Configuring for Internal Security and Access Concerns

Security always starts at home. Thought and preparation should always be taken to ensure your IT plan identifies for potential internal leaks (intentional or otherwise.) Ensure the right people have access to the necessary resources when they need to, and protect against deliberate or unintentional loss or removal of secure information.

### Protecting against External Threats. Eg. virus, trojan, worm, etc.

Ensuring your environment is protected against the growing external threats that plague us is a huge concern. You should have peace of mind that your business is safe and secure, regardless of the constant barrage of hackers and viruses out there.

### Regular User Training

Keeping your staff informed and trained is key to efficient and productive use of your IT solutions. It is the first level of defence against internal security threats. Have a clear and disciplined new hire orientation.

### Appendix A

See the end of this white paper to see a generic 5 year comparison of CC and DC deployments. Also, at what size one may make sense over the other.

## Pro and Cons

### **Distributed Computing**

Also known as Peer-to-Peer (P2P). This environment is an ad-hoc network that is generally grown from a small group of independent computers that need to share files, resources such as printers and network/internet connections. These have allowed small business to improve some forms of productivity. If all is to run smoothly, this model usually needs internal technical skills, or access to outsourced technical support.

#### DC Advantages

- Each user has control of their own equipment, to a reasonable degree.
- Each user can add their own programs at their own leisure.
- Sometimes cheaper up front capital cost.

#### DC Disadvantages

- Typical lifespan of 3 years (maybe stretch to 5 with questionable results).
- Many moving parts (fans, hard drives) which are susceptible to failure.
- Larger vulnerability to security threats (both internal & external).
- Usually has higher cost of ownership, when measured over 3 + years.

### **Centralized Computing**

Centralized Computing takes some of the control and all of the parts easily susceptible to failure away from the desktop appliance. All computing power, processing, program installations, back-ups and file structures are done on the Terminal or Application Server.

#### CC Advantages

- Centralized Computing and file storage.
- Redundant technologies incorporated to ensure reduced downtime.
- Computer stations replaced with ThinClient appliances with no moving parts, improving meantime before failure.
- Centralized management of all users, processes, applications, back-ups and securities.
- Usually has lower cost of ownership, when measured over 3 + years.

#### CC Disadvantages

- User access to soft media drives are removed.
- In the rare event of a network failure, the ThinClient Terminal may lose access to the terminal server. If this happens, there are still means to use some resources from the local client

## **Cost Assessment Summary**

Challenge or Consideration	Centralized	Distributed
Capital Purchase Price	High	High
Clear IT goals... short term and long term... upgrades and dollars.	Medium	Medium
Trained People to provide the ongoing administration of 'the system'.	Low	High
Coordinating with service providers.	Low	Low
Software and Operating System Life-Cycle Replacements and Upgrades.	Low	Medium
Equipment Life-Cycle Replacements and Upgrades.	Low	High
Equipment Repairs and Maintenance.	Low	High
Identifying and Configuring for Internal Security and Access Concerns.	Low	High
Protecting against External Threats. Eg. virus, Trojan, worm, etc.	Low	High
Regular User Training	Low	High
<b>Total Cost of Ownership</b>	<b>Low-Med</b>	<b>High</b>

### **Appendix A Cost of Ownership Estimates**

These 2 scenarios give you actual numbers to compare, and evaluate which might be best in your business.

These scenarios are based upon price estimates.

Scenario #1 Peer to Peer (P2P) Network

Scenario #2 Microsoft Windows Server 2003 / Thin Client Environment

### **Appendix B Recommended Upgrades**

Recommendations of value added upgrades at time of purchase

## **Centralized Computing Specific Technologies**

### **Client Server Environment:**

- This environment is comprised of a server which provides system resources (processing power, storage, software, etc) to many separate clients.
- Microsoft Windows Server 2003 is the PC world's equivalent to AS/400 or mainframe environments. It is a graphical environment which can serve many PCs and/or ThinClients. It delivers a regular Windows look and feel to the desktop.
- The server controls what a user has access to. This includes both software and data. They can access their work from any ThinClient. The server contains all software.  
eg. If you want to upgrade to the most recent version of Word, you do it once on the server and then magically everyone can use it. Likewise with your main operating system, or internet software, etc...
- The server can hold and protect all data.
- Like in the AS/400 or main frame world, you can do major server upgrades and never touch your terminals.
- Active Directory - deploys user and group policies to control access to applications and systems.

### **ThinClient:**

A ThinClient in the PC world is 'kind of' like a dumb terminal in an AS/400 or mainframe world. An AS/400 or mainframe server does all the thinking and processing for dumb terminals. In a Windows world, the Windows Terminal Server does the thinking and processing for each ThinClient. Dumb terminals and ThinClients have no moving parts and are very cheap to maintain. They last for many years because they seldom require and upgrading. Upgrading is isolated to the server.

### **Raid Technology:**

Provides redundancy of hard drives. In a 'Raid 5' configuration, all data is simultaneous written to multiple hard drives. If one hard drive fails, everyone's work continues. When the failed drive is replaced, the other drives automatically rebuild the new drive, while all while work continues.

### **Redundant Power Supplies:**

Provides redundancy of power supplies. The server runs on 2 or 3 power supplies. If one power supply fails, everyone's work continues. The failed power supply is easily replaced without any downtime, while work continues.

### **Backup Imaging:**

The entire system state is backed-up to a hot swappable hard drive. One drive is kept in the system. Another drive is kept off site for extra protection. Once a week, the two drives are swapped. This provides multiple recovery options for the entire system in case of a catastrophic failure. eg. Lightning, fire, sprinkler head, etc.

### **Can you use ThinClients Exclusively?**

Usually yes, but sometimes no. The 3 possible reasons are:

- Regular Portability – in which case a laptop is the preferred solution.
- Certain applications that require very heavy use of graphics or very high data handling.
- Remote users who have an unstable internet connection.

If any of these scenarios exist, a hybrid solution maybe needed. With Centralized Computing for most of the solution, but strategically use Laptop or PC workstations (Distributed Computing), to cover the specific needs.

## Appendix A – Cost of Ownership Estimates

### Cost of Ownership

The cost of ownership for computing devices can be broken down to many items.

- Capital Costs
  - Initial new equipment
  - Initial configuration and installation
  - New infrastructure, cabling
  - Training and design of administration, security and backup routines
- Ongoing Costs
  - Repairs as equipment breaks down or wears down
  - Replacing units to keep current with industry standards/needs
  - Hardware upgrades
  - Software and Operating System upgrades
  - User created challenges
  - Resources (technical) to perform regular maintenance and support

### **Scenario #1 Peer to Peer (P2P) Network** (estimates)

#### **Ownership Costs:**

PCs (including cabling and network)	6 PCs	12 PCs	24 PCs
Initial Capital Costs	\$ 9,400	\$17,500	\$22,700
Ongoing costs over 5 years (see above)	\$10,800	\$21,600	\$43,200
<b>5 Year Total Cost of Ownership</b>	<b>\$20,200</b>	<b>\$39,100</b>	<b>\$65,900</b>

### **Scenario #2 Windows Server 2003 /ThinClient Environment** (estimates)

#### **Ownership Costs:**

Terminal Server with ThinClient workstations (including cabling and network)	6 TCs	12 TCs	24 TCs
Initial Capital Costs	\$15,130	\$24,570	\$43,290
Ongoing costs over 5 years (see above)	\$ 2,600	\$ 3,200	\$ 4,400
<b>5 Year Total Cost of Ownership</b>	<b>\$17,730</b>	<b>\$27,770</b>	<b>\$47,690</b>

<b>Estimated Cost Improvement in Scenario # 2</b>	<b>\$2,470</b>	<b>\$11,330</b>	<b>\$18,210</b>
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## Appendix B – Upgrade Recommendations

**UPS for server** (minimum Level 5)

**RAID Hard drive technology** (prefer RAID 5)

**Redundant Power Supply technology**

**Norton Anti-Virus**, Corporate Edition (needed if connected to the internet)

### **Hard Drive Back-up:**

Hard Drives (2 **IBM** SCSI hard drives and special software)

*This is used to create a 100% recoverable system state, which includes all user data.*

*This provides for a low pain recovery in the event of a major system failure, fire or sprinkler damage.*

*This significantly reduces support costs from service provider in the event of a failure.*

*One back-up drive is kept in the server. One back-up drive is kept in a fire safe. They are swapped weekly.*

### **Tape Drive Back-up Option:**

Large High Speed DAT Drive

*Having this as your only back-up option will protect your data, but will NOT allow for a quick recovery.*

*With this as the only back-up option significant rebuilding costs of the system state will be required from service provider.*

### **Maximum Back-up Protection:**

Full Combination of both Hard Drive and Tape Drive Options

#### **Note: Selecting a Back-up Option should be considered Mandatory.**

Not having a back-up and restore plan for your system and data is a dangerous gamble.

There are 2 global considerations when dealing with back-ups:

- Recover ability of the system state (operating system, software, server settings, etc.)
- Recover ability of data (user files, and some settings).

### **Other Upgrade Considerations:**

Firewall & Internet connection for ALL ThinClients

Remote High Speed Access to the server

Gigabit Network Switch, not hub (you require a min. of 100 mps)

Wireless Workstations