Riser Project

I. Goals of Riser Project - Stop and take a look at how we are providing services today. Suggest new methods, services, and efficiencies for the future.

II. Today
- Strengths, weaknesses and order of operations
- Existing riser inefficient (Weakness)
- Conduits are full and unorganized (Weakness)
- What is the true cost? Does one exist?
- NO plan for the Future

III. Tomorrow
- DIRT FT. (Do It Right The First Time!)
- True costs
- Hybrid riser cost
- POP costs
- Closet costs
- Desktop costs

IV. Benefits of Hybrid Riser under new plan:
- Efficient riser saves money and time
- Closet and desktop presence
- Manageable, scaleable, modular desktop

V. Opportunities for the new services and new efficiencies:
- Hybrid architecture to the desktop
- Better serviceability and future growth.
- Summary of the benefits

VI. Technology
- ATM to the Desktop
- ISO-Ethernet and SDC
- Future technologies

VII. Summary

I. Goals of Riser Project

- Strategic goals are to minimize costs and provide enough wiring at strategic locations to accommodate future needs to the extent that we can predict them. Sufficient cabling conduit and amounts of outlets need to be anticipated five years in advance.
- As people move around buildings they should not require new cabling.
- If people move locations on the same floor - - only a plug in the computer closet should be changed. If they move from one floor to another, some shuffling of electronics may be required but running new wiring through the building should not be required.
- Buildings must be homogeneous. This will make life much easier for the staff.

<u>Some facts to consider:</u>

- Infrastructure cannot be overstated. Over 70% of all network downtime is caused by problems stemming from inferior cabling systems. The other 30% are power related.
- The average system crashes 23.6 times a year and is down for an average of 4.9 hours. Downtime costs range from $1000/hr to $50,000/hr
- 40% of all employees within a building move every year. Adds, moves and changes on an unstructured cabling system can cause serious work flow disruptions.
- The initial cost of a structured riser cabling system may be slightly higher, but it will save money over the life of the system.
- One of the smallest component costs of a network is the structured cabling system, a mere five percent. Considering that 70 percent of all system problems can be solved by five percent of the system investment, it makes absolute sense to invest in the very best structured cabling systems available.
- A structured cabling system will, on average, out-live all other networking components. Because of this fact, choosing the proper cabling system is a critical aspect of network design.

II. Today Strengths, weaknesses and order of operations

- Bandwidths needed for future growth are accommodated by fiber.
- Fiber is immune to interference in elevator shafts.
- If a firewall is cut open by an installer or contractor and not sealed properly. You have code violations.
- Users don't notice the 364 days that a network is running. They notice the one day of the year it is down.
- Copper will not disappear.

II. Today Existing riser inefficient (Weakness)

- Costs of cable is minimum compared to cost of installations.
- Planning is the most crucial step. Re-cabling an existing building is more complicated that designing a new one.
- Inventory existing cable media and physical structure such as conduit.
- Pulling cable costs the most, so why not pull for the future?
- Existing infrastructures are ill prepared to handle the future explosion of interactive services and bandwidth hungry multimedia applications.

II. Today Conduits are full and unorganized (Weakness)

- A non standard cabling system does not guarantee poor functionality, but you will be taking a serious gamble.
- More pairs going to outlets need bigger conduits.
- Re-cabling is often more of an art that a design function.
- Do we have "wire maps"?
- Neatness counts and makes troubleshooting easier.

II. Today What is the true cost? Does one exist?

II. Today NO plan for the Future

- Cabling is usually the last thing considered in the building design phase.
- When planning for the future always pull plenty of cable.
- It makes sense to buy ahead of the curve.
- Running new wiring on a case by case basis is very expensive

III. Tomorrow DIRT FT. (Do It Right The First Time!)

- Structured cabling systems in a building premise cabling project involves considering the entire system rather than just the wiring between your LAN hub and the workstation.
- (BICSI) Building Industry Consulting Service Intl. The structured approach.
- Warranties help win customers who purchase networks.
- Avoid a rats nest in the riser.
- It's no longer the computer that is the source of an organizations productivity. It is the network with its ability to transport information wherever it is needed.
- Cabling should last 10 years longer than equipment. Don't skimp!

III. Tomorrow True costs

III. Tomorrow Hybrid riser cost

- Cat 5 must be installed for fast Ethernet and ATM. Cat 5 accounts for 70.5% of horizontal cabling and 31.9% of vertical cabling.
- Multimode fiber accounts for 52.9% of vertical cabling.
- On the average fiber installation was estimated at $18,000 per T1 circuit.
- Vertical infrastructure is 1/4 of the network cost (closet renovation, cabling and equipment racks, and system integration) at UC Berkeley's Cory Networking Project ($225,000). This is separate from the $850,000 to $1,060,000 bid for a horizontal installation.

UC Berkeley's current operation level is $180 per user. This lower operational cost coupled with the cost of future upgrades and rearrangements is dramatically lowered compared to previous systems.

* See Matrix: "Desktop Costs" (next page)

III. Tomorrow POP costs

III. Tomorrow Closet costs

- Formula: Approximate cost of server room: Take the basic price tag of building a standard office space of similar size to your server room and multiply it by 4.
- Fire system (NFP-2001) cost $20,000.
- Air conditioning

III. Tomorrow Desktop costs

Single / Multi-Station LAN Switch Costs:

Description	Single Station	Multi Station	Multi Station	Multi Station
Cost per port	$500	$1000	$1000	$1000
Stations per port	1	10	20	40
Cost per 100 Stations	$50,000	$10,000	$5000	$3000

- A 9 port LAN switch costs well under $10,000 . The addition of 8 new segments in a router could cost an excess of $30,000.
- E-mail in a large organization cost $300/ yr. Per desk. Includes: price, installation maintenance, infrastructure, maintaining , and operations costs.

  The US Market for client / server data bases will increase from 3.7 billion in 1994 to 10.4 billion in 2000.

10 BASE T

- 10 Base T Ethernet adapters & hubs are appearing that cost $158.00 per unmanaged port.

100 BASE T

- Although one of the benefits of 100 Base T is its capability to operate over "existing" CAT 3 or CAT 5 Cabling, few sites will be able to do so without re-cabling. 100 Base T4 requires four cable pairs to operate with category 3 cable. Single 10 Base T requires only 2 pairs, many sites have used the remaining pairs for other purposes, or may not have wires with unused pairs to the wall plate. These sites must either re-terminate their cable or pull new cable to accommodate the additional pair needed.
- Secondly, although 100 Base T allows cable lengths of 100 meters from a concentrator to a network node, distances between concentrators are limited, only two concentrators may be placed between any two nodes. By contrast 10 Base T allows up to 100 meters between concentrators, and allows up to 4 concentrators between any 2 nodes. Existing network users who have deployed their 10 Base T cable in a distributed layout may face costly re-cabling as a result of 100 Base T's more limited layout rules. Finally 100 Base T's network span of 205 meters may require re-cabling in sites that have been cabled to take advantage of 10 Base- T's span of 2500 meters.

100 VG - ANY LAN

- Many sites must re-cable to support 100 VG - Any LAN architecture.

TCNS

- TCNS - TCNS topology does not restrict the number of hubs between nodes.
- Connection costs for adapters & hubs are less than $650.

FDDI

- Fiber based adapters range from $1500 to $3500 and hubs connections are $700 to $2000 per port. STP adapters intended for desktop use are less expensive ranging from $900 to $2000. FDDI is considered difficult to install, and the additional overhead associated with SMT management minimizes FDDI's cost effectiveness to the desktop. In addition, many users believe FDDI will be surpassed by other high speed technologies.

ATM

- ATM- Network adapters currently cost $1000 to $4000, and switches cost between $5000 and $12,000. Prices are expected to drop as the technology matures but will remain expensive related to other desktop oriented high speed solutions. ATM technology is unlikely to see widespread LAN use until 1997.
- ATM workgroup switches cost $1000 to $1500.

Costs

UC Berkeley's summary of cost for its 1700 user "Cory" network is as found: (1700 users financed for 5 years).

*NAF surcharge	$250.00 per year	per NAF payer for next 5 years
Basic shared Ethernet service	$120 one-time charge	per connection
Switched Ethernet at 10Bm/s	$280 one-time charge	per connection
Switched Ethernet at 100 Mbs	$560 one-time charge	per connection (possibly need additional hardware on workstation side as well)

* NAF (Network Access Fee)

DO NOT TYPE THIS!

Strategies to Control Distributed Computing's Exploding Costs

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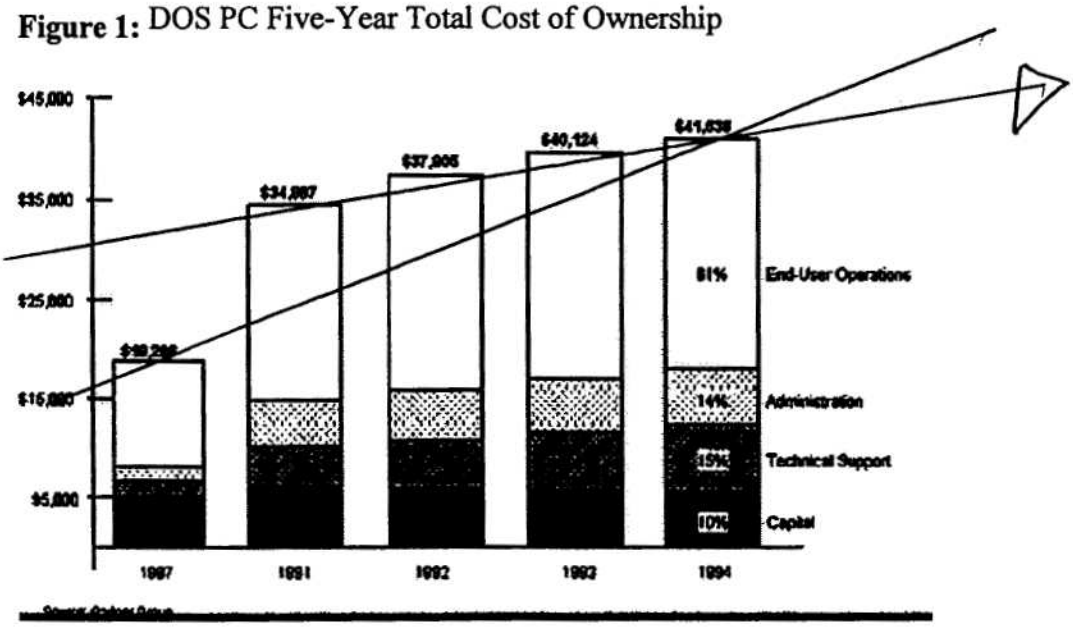
This article is a management summary of a recently published Strategic Analysis Report entitled "Management Strategies to Control the Rapidly Escalating Costs of Distributed Computing." The report (MDC R-TCO-101, April 3, 1995) was published by Gartner Group's new Managing Distributed Computing service.

In 1987, Gartner Group conducted its first analysis of PC ownership costs for corporate computing environments. Since that time, the five-year total cost of ownership (TCO) of a DOS-based PC has soared to $41,536 from $19,296 - an increase of 153 percent (see Figure 1). Improvements in hardware and software costs have been buried by massive increases in labor costs. For example, administrative costs have quadrupled and end-user operations costs have doubled. Gartner Group estimates that an enterprise with 2,500 Windows 3.x systems will incur a five-year PC TCO of more than $103 million, of which capital costs represent only $14 million, and $89 million is attributable to labor costs - administration, end-user operations and technical support. ***Although the strategic value of PC technology is increasing, the cost of the technology may become prohibitive if enterprises do not take aggressive cost-reduction actions.***

Figure 1: DOS PC Five-Year Total Cost of Ownership



A Holistic Analysis of Costs

When managed at the enterprise level, the cost of end-user computing (EUC) can be reduced by 50 percent or more. Systematic planning requires a holistic view of computing costs for the enterprise - including hidden or underground costs that lie outside the IS organization. A range of strategic elements related to cost have been analyzed by Gartner Group, including:

TCO models for the major desktop platforms: DOS, Windows 3.1, Windows 95, and Macintosh System 7.1 and System 7.5.

Major cost components of the TCO model, including end-user operations and technical support.

Use of next-generation technology to reduce EUC costs, including help- desk automation, electronic software distribution and training.

Planning for the impact of Microsoft's Windows 95.

Managing the costs of client/server computing and LAN environments.

The roles of IS and corporate management in cost control.

The Gartner Group TCO Models

The TCO models are founded on years of work with Gartner Group clients to assess the cost impact of all aspects of IT. Much has changed since 1987:

In 1987, the average PC was a stand-alone machine running one or two applications. In 1994, the average PC was connected to a network, and it ran at least four applications.

In 1987, a representative number of machines in the average enterprise was 600. In 1994, the number increased to 2,500.

All IT investments should be reviewed considering the impact on TCO. Gartner Group has developed TCO models for the major desktop platforms: **DOS.** The DOS platform has become the most expensive desktop environment (see Figure 2). Although the capital cost of an "average system" has declined, its five-year TCO has soared to $41,536. The key metric is the labor-to-capital ratio. In 1994, the ratio was 90 percent labor to 10 percent capital, and annual labor costs average about $7,500 per user. The bulk of the cost increase is in end-user operations, largely because DOS has been pushed well beyond its design limitations, making it unstable and difficult to support. DOS is now a severely disadvantaged legacy operating system with no practical future. ***DOS users should adopt a graphical operating system immediately; productivity improvements will quickly compensate for the cost of hardware upgrades.***

Figure 2

	DOS		Windows 3.1		Windows 95		Macintosh 7.1		Macintosh 7.5	
Capital Cost	$4,004	10%	$5,870	14%	$5,994	17%	$6,738	19%	$6,738	19%
Labor Costs										
Technical Support	6,313	16%	7,045	17%	6,277	17%	6,393	17%	5,736	16%
Administration	5,916	14%	5,832	14%	4,896	14%	5,579	14%	5,537	16%
End-User Operations	25,300	61%	22,692	55%	18,692	52%	19,877	51%	17,113	49%
Five-Year Total Cost	$41,536	100%	$41,439	100%	$35,859	100%	$38,387	100%	$35,124	100%
Labor-to-Capital Ratio	90:10		86:14		82:17		82:18		81:19	
Avg. Annual Labor Cost	$7,508		$7,154		$5,973		$6,390		$5,877	
No. of Applications	Four		Eight		Eight		Eight		Eight	

Source: Gartner Group

1994 Five-Year TCO Comparison of Major Platforms

Windows 3.1. During a five-year period, a Windows 3.1 system with eight applications costs $41,439, which is virtually the same cost as a DOS system with four applications. The chief benefit is in end-user operations. Even when running twice the number of applications, Windows 3.1 reduces by 44 percent the amount of formal and casual learning required by end users. However, because Windows troubleshooting is more complex, technical-support demand typically increases by 15 percent, or about two additional hours per user per year. ***With adequate support, Windows users get twice as much function from their systems for about the same total outlay.***

OS/2. The TCO of IBM's OS/2 is slightly lower than that of Windows 3.1. Most OS/2 users run Windows 3.1 applications, but OS/2 is a more stable platform than DOS, which underlies Windows. Therefore, expenses related to troubleshooting, system management and help desks are lower. However, the release of Microsoft's Windows 95 platform will largely nullify OS/2's advantages.

Windows 95. Microsoft's new 32-bit operating system, Windows 95, promises a substantially lower five-year TCO than Windows 3.1: $35,859 vs. $41,439. Unlike Windows 3.1, which rides on top of DOS and inherits its disadvantages, Windows 95 is a complete break with DOS, bringing significant improvements in stability, ease of use and functionality. It will reduce costs of technical support, administration and end-user operations. Analysis indicates that a Windows 95 environment will have an average annual cost per user that is $1,116 less than that of a

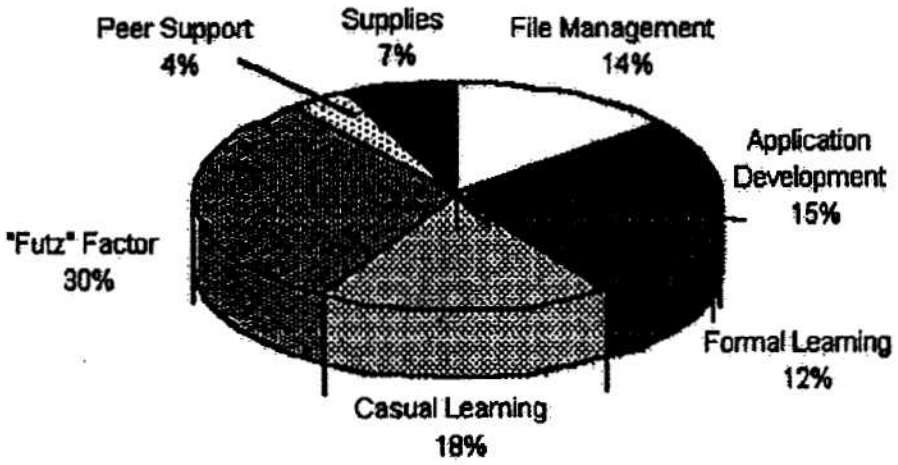
Windows 3.x environment. System software migration costs will typically be recouped within three to six months. ***Enterprises with a Windows environment should plan to migrate to Windows 95. Besides reduced TCO, its payback will be improved use of application features and improved user productivity.***

Macintosh. The five-year TCO of Apple Computer's Macintosh System 7.5 is $35,124 - the lowest of all systems analyzed. Even the older System 7.1, with a TCO of $38,387, is more cost-effective than Windows 3.1. Macintosh users typically require less technical-support time. End-user operations costs of System 7.5 are projected to average $3,423 per user per year, 25 percent less than that of Windows 3.1 ($4,578). System 7.5's greatly improved user guidance and help features make it the winner in the TCO race. ***Macintosh 7.1 users should upgrade to System 7.5 to take advantage of its benefits in end-user operations.*** Because System 7.5 provides just-in-time training (JITT) with AppleGuide, the platform will cause training to shift toward less-expensive casual training, and it will reduce the number of hours required for a user to achieve nominal proficiency in a given application.

Major Cost Components of the TCO Model

Significant EUC costs: end-user operations and technical support. The major cost component of desktop computing is end-user operations. For a Windows 3.x platform, the five-year end-user operations cost is $22,892 (see Figure 3), which is 55 percent of the TCO. In an enterprise with 2,500 Windows 3.x systems, the end-user operations cost generally exceeds $11 million annually.

Figure 3



Windows 3.1 end-user operations cost: $22,892 over five years

Source: Gartner Group

End-User Operations Cost Breakdown

The constant shrinking of IS budgets is actually increasing the cost of computing. The IS technical-support head count may decrease, but the need for end-user technical support does not disappear. Much of the IS downcosting movement has merely shifted costs to the business units or to "underground" support groups. ***Consequently, more than 60 percent of IT expenses are outside the IS organization.***

The cost of end-user operations. A holistic view of computing costs for the enterprise must include the following end-user operations:

File management. Any manipulation of files, including printing, copying, finding, archiving, backing up, deleting and opening. A 1992 study by the 3M Corp. estimated that 24 million work days per year are wasted in the United States trying to re-create data that was not backed up.

Application development. End users have shouldered more of the application development burden for report

generation, data analysis and workgroup and departmental systems.

Formal learning. Includes classroom instruction and learning-laboratory training. Retention is typically as low as 10 percent after 30 days.

Casual learning. The effort of an end user to learn-while-doing. Traditional methods include reading manuals, soliciting information from co-workers, using help screens, or trial-and-error. Advanced methods use hypertext and multimedia-based JITT tools.

Futz factor. Time spent using the PC for personal activities, or spending excessive amounts of time on cosmetic changes to documents.

Peer support. Underground technical support provided by co-workers. Informal support is particularly expensive, because it is less efficient than help desk support. However, *encouraged* peer support, when coordinated by the IS organization, can be used to augment the IS technical-support program.

Supplies. Consumables such as diskettes, paper and printer ribbons or cartridges.

The cost of technical support. For a Windows 3.x platform, the five-year technical support cost is $7,045, which

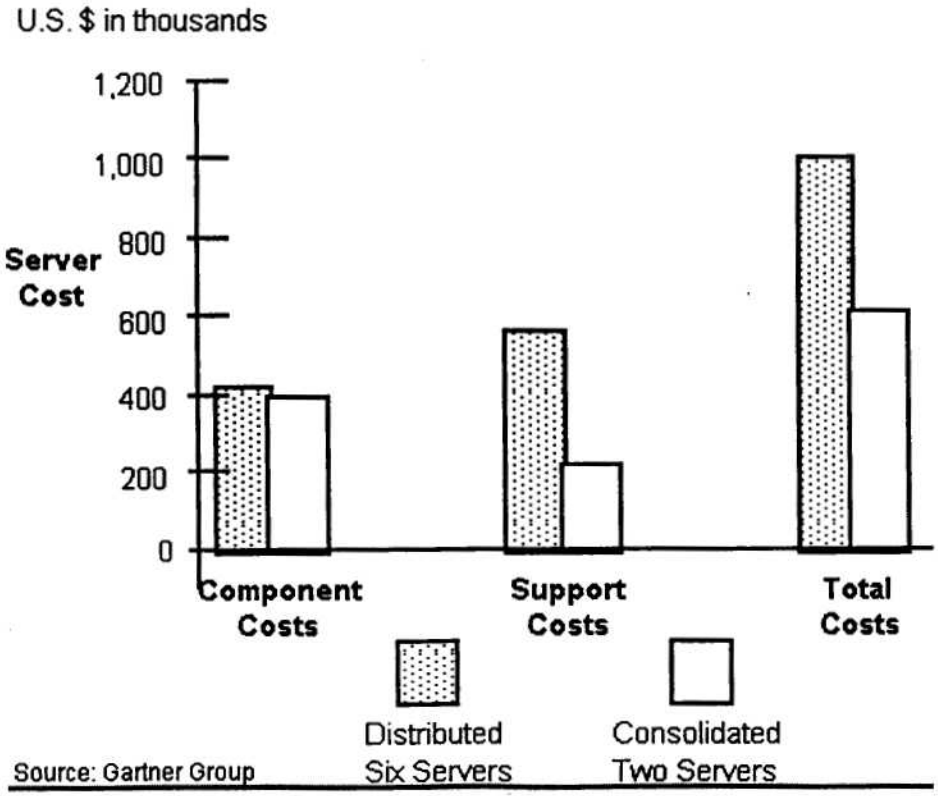
Server Consolidation: A Cost Evaluation Model

As the price and complexity of LAN computing continue to escalate, consolidation of server environments could become a financially and organizationally viable option.

In an attempt to understand the financial benefits of moving from many small distributed server environments to larger consolidated servers, we have developed a cost model that looks at both component costs and personnel costs (see Figure 12). All results shown are based on a comparison of a six-server distributed environment moving to a two-server environment. We assumed between 800 and 1,000 users, but the feasibility of doing this level of consolidation is based on many factors, including available bandwidth, NOS selection, response time goals, applications diversification, existing support structure and the political climate within an organization. The last item might be the most crucial, as wresting control of someone's LAN can be a daunting task.

Figure 12

Three-Year Costs: Distributed vs. Consolidated Server Environments (800 to 1,000 users)



The largest impact in a consolidation exercise is in support costs. The figure below breaks out our projected impact on these costs over three years if a consolidation effort takes place (see Figure 13). From a cost perspective, the

largest reductions included storage management and backup services. We project that this gap will continue to widen as more storage is added to systems at current growth rates.

Figure 13

Support Costs and Total Cost Comparison:

Server Support	Distributed Six Servers	Consolidated Two Servers	Change
Storage Management	103,936	43,307	–58.3%
Backup Services	187,264	62,421	–66.7%
Administration	77,952	28,373	–63.6%
Hardware Activity	25,984	17,323	–33.3%
Troubleshooting	51,968	17,323	–66.7%
Performance Tuning	45,472	30,315	–33.5%
Monitoring	77,952	30,315	–61.1%
Support Total	**570,528**	**229,377**	**–59.8%**
Component Total	427,160	393,813	–7.8%
Total Cost Comparison	**997,688**	**623,190**	**–37.5%**

Source: Gartner Group

Distributed vs. Consolidated Servers (in U.S. dollars)

We caution readers that these numbers reflect our expectations when consolidation occurs in a campus environment, where response time goals will not be affected. Additionally, support costs were based on projected hourly workload expenditures for both technical and administrative employees. Salaries, with the automation level, will change the impact of consolidation.

Bottom Line: Server consolidation should neither be blindly accepted as "good" nor dismissed out of hand. But in the right circumstances, a reduction in cost of more than 37 percent over three years can be reached. For larger organizations, this can translate into huge savings.

Network & Connectivity Strategies K-LAN-015 Feb. 15, 1995

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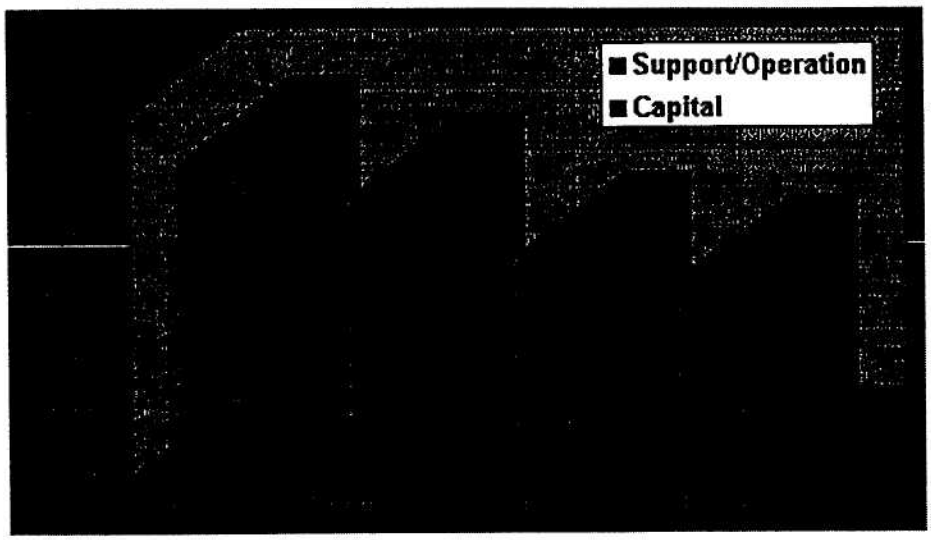
digital

Cost-effective desktop solution

In a true client-server application environment, Multia offers a significantly lower cost of ownership compared to other similarly equipped desktop devices - up to a **60 percent savings** after five years. When you total up the savings in support costs, Multia is the price/performance leader.

Five-year cost comparison



Figures are based on a Digital study.

Updated: *Wednesday, November 22, 1995*

TM

ENTEX
Information Services

The CIO Help Desk

AN APPROACH FOR DETERMINING THE TOTAL COST OF PC OWNERSHIP:--

Understanding Cost Factors and Complexity

INTRODUCTION

For each of the past five years, based on industry averages and input from studies conducted by many of the nation's largest companies, the Gartner Group has released reports estimating the average costs of PC ownership for the typical business organization. While these reports have certainly raised the consciousness of corporate business and IS managers regarding the potential scope of their company's overall PC investment, they are also widely criticized as being inherently subjective. Consequently, many corporate managers question the validity of the Gartner Group estimates in relation to their company's own "unique" business and PC environment.

Regardless of the perceived validity of the Gartner Group estimates, why is determining costs of PC ownership such a hot topic today? Why are more and more companies undertaking dedicated efforts to evaluate costs of PC ownership? The answers seem to fall into two general categories: those that focus on the cost reduction and productivity improvement components of the return on investment equation; and those that focus on the efforts of the central IS group to justify breaking down barriers of organizational autonomy so that the control of PC management practices and the corresponding services infrastructure can be centralized.

However, deciding to undertake an internal analysis of costs of ownership and actually doing it with any degree of credibility are two very different things. Evaluating PC-related "costs" is an extremely subjective exercise. Most of the cost factors are tied directly to mantime costs, and some degree of opportunity loss costs must also be considered. Not surprisingly, these are some of the same reasons the relationship of information technology to individual productivity is so difficult to measure.

Nevertheless, this is not to say that a valid and credible costs of ownership analysis cannot be effectively accomplished. The key is to develop a logical argument similar to the way an attorney builds a court case. As many of the pertinent facts must be built into the analysis as possible -- thus minimizing the subjective nature of the assumptions that are made. Once the audience agrees to the cost factors and logical equations used to calculate the costs, the final results generated by their input of variables is certain to have credibility.

The purpose of this paper, therefore, is to 1) recommend a basic approach to conducting a costs of ownership analysis; and 2) provide insight into the PC-related cost factors that should be considered in the analysis process.

BASIC APPROACH TO ANALYZING COSTS OF PC OWNERSHIP

The actual approach to determining the costs of PC ownership are relatively easy. Simply add up the total costs of the hardware and software in the installed base. Add to that the total fully-loaded costs of the full-time equivalent people directly associated with PC acquisition, operation, support and training. Add in some percentage to represent the intangibles associated with the "shadow" organization and peer support. Divide by the total number of machines, and there's the answer.

Sounds simple until the complexity of the cost factors is taken into account. The logic behind the approach, however, is sound. The challenge here is to minimize the effort and time while maximizing the credibility of the results.

One approach that has proven successful is to conduct the analysis for a representative group within the organization, and then extrapolate the results across the entire enterprise. This approach minimizes time and risk while providing reasonable results. The difficulty is in determining the percentage of shared costs that should be attributed to the organization being evaluated.

COST FACTORS

The costs of PC ownership fall into two basic categories: equipment (including software) and mantime. To conduct an effective costs of ownership analysis, all costs associated with these two categories must be collected. This section of the document will describe each category in detail so that the proper scope of information can be collected.

EQUIPMENT COSTS

Equipment costs include all hardware and software procured during a system's productive life cycle. Since the actual cost differential between types of PCs is relatively insignificant in the overall cost analysis, use of a standard system configuration is sufficient for most analysis efforts. If multiple system configurations (e.g. basic Intel desktop platform, basic Mac platform, laptop) are to be considered, it is recommended that a limited number of general classifications be defined. This will greatly simplify the evaluation effort.

Equipment-related costs should be collected for:

System Hardware (including shipping, taxes, etc.)

Original system components
Hardware upgrades acquired over the system's productive life cycle

System Software

Original system software (OS, application, telecommunications, etc.)
Software upgrades acquired over the system's productive life cycle

Technical Infrastructure Hardware

Network hardware, servers and shared peripherals

Technical Infrastructure Software

Network, server (NOS, applications, databases, etc.) and peripheral software

MANTIME COSTS

Determining even reasonably accurate mantime costs is what makes the analysis effort so difficult. This is the area where a lot of assumptions are usually required.

Mantime costs typically fall into several categories. These categories are:

managing the infrastructure
providing services
end-user activities

Managing the Infrastructure

This category encompasses all the management practices associated with the PC environment. Costs include the fully-loaded mantime costs (salaries, benefits, space, equipment, training, etc.) for people conducting the following activities:

- Corporate technology management
  - Technology assessment
  - Defining technology standards
- Corporate financial management
  - Defining corporate policies regarding PC procurement
  - Budgeting & budget management
  - Lease program management
  - Procurement forecasting
  - Purchasing/Accounting Systems -- operation & maintenance
  - EDI operation & maintenance
- Product management
  - Product evaluation
  - Standards selection & compliance monitoring
  - Manufacturer liaison
  - Product "catalog" maintenance
  - Information dissemination
  - Onsite inventory management
  - Warranty administration
  - Returns management
  - Redeployment/disposal management
- Assets management
  - Fixed assets accounting
  - Asset location & "ownership" tracking (including audits)
  - Software licensing programs management
  - Upgrade programs management -
  - Electronic software distribution management
- Sourcing management
  - Sourcing evaluation & selection
  - Contract/SLA negotiation & management
  - Performance compliance monitoring
- Services infrastructure management
  - Services management (acquisition & support)
  - Service provider performance management
  - Customer satisfaction monitoring
  - Status monitoring
  - Support systems operations & maintenance
  - Statistical reporting
- Security management

- Data security
- Physical security & protection

Training management
- End-user training management
- Services provider training management

Internal "marketing" management

The challenge is in determining the percentage of each of these people's time that should be attributed to the PC environment.

Providing Services

"Services" include all the activities associated with the acquisition (including redeployment and disposal), operation, and support of PCs. Training is also considered a service. Again, costs for these activities can be directly attributed to the fully-loaded mantime costs of the individuals managing the processes and providing the services. Additional costs that should be taken into account are service-related supplies and the development/maintenance of supporting systems (e.g. acquisition systems, purchasing/accounting systems, help desk systems, EDI, automatic call distributors, etc.)

Another consideration when evaluating services costs is that independent business units often establish their own, often clandestine, service operations. These "hidden" acquisition and support processes often add substantial costs to the overall services infrastructure since resources cannot be leveraged as effectively. Some estimation of the scope of the "shadow" services organization should be added to the cost analysis.

Activities associated with each of the services that should be evaluated include:

Acquisition
- Solution Determination
  - Contact technical support resource
  - Technical solution determination
  - Product selection
  - Services determination (e.g. configuration/installation)
- Sourcing Decision
  - Identification of potential sources
  - Quote request
  - Quote generation
  - Quote review
  - Sourcing selection
- Request Generation
  - Funds verification
  - Request generation
  - Submission of request for approval
  - Request review by approval authority
  - Request approval
  - Submission of approved request
- Purchase Order Generation
  - PO generation
  - PO delivery to provider
- Product Receipt & Consolidation
  - Product receipt
  - Order consolidation
- Site Preparation
  - Site preparation coordination

- Site preparation
- Local Service Fulfillment
  - System configuration
  - Software load
  - System test
  - Asset tagging
  - Warranty information collection
  - Installation coordination
  - Product delivery to end-user site
  - Product installation
  - Product test
  - Product familiarization
  - User acceptance
- Service Billing
  - User acceptance reporting (to close service transactions in purchasing system)
  - Service billing generation (e.g. when charge-backs used)
  - Service billing delivery
- Invoice Processing
  - Invoice receipt
  - Invoice matching
  - Invoice payment
- Service Billing Processing
  - Service billing receipt (if service billing from external provider)
  - Service billing matching
  - Service billing payment
- Exception Processes
  - Amendments/Cancellations
  - Returns Processing
  - Invoice/Service billing error processing

Education/Training

- Course development
  - End-user training
  - Service provider training
- Training coordination, scheduling & record keeping
  - End-user
  - Service providers
- Training time
  - End-user
  - Service providers
  - Training space, equipment, operations & resources
  - End-user time spent reading manuals or otherwise researching PC-related questions due to lack of adequate training

Operations

- Power

Support

- Call management (Help Desk level 1 support)
- Hardware dispatch
- Hardware maintenance
  - Onsite
  - Depot
- Software support
  - Remote
  - Onsite

LAN support
LAN administration
Adds/moves/changes
Backup/Disaster Recovery programs

End-Users

End-user costs are often the most nebulous. The challenge is to define the portion of the end-user's time that can be attributed to PC ownership. To ease this evaluation, end-user costs can be viewed from five perspectives:

Process time -- time spent conducting formal processes to acquire, operate or obtain support for the user's system.
Training time -- formal and informal training. Includes classroom training, computer-based training, reviewing tutorials and manuals.
Opportunity loss time -- time lost due to the lack of resources, equipment downtime or the inability to use tools effectively.
"The Futz Factor" -- time spent "messing around with the neat features of the hardware and software."
Peer support -- time spent by peers providing PC-related support that takes them away from the regular job function.

CONCLUSION

If nothing else, this paper should provide the reader with some insight into the complexity of conducting a full-scale cost analysis. For the results to be of any use, they must have credibility. To build credibility, the analysis process must take into account all pertinent cost factors. Although many of these factors are extremely subjective in nature, an effective analysis can be accomplished if conducted in a logical manner. The benefits of the resulting evidence, if used to better manage infrastructure-related costs and substantially improve the corporate return on its PC investment, are well worth the effort. Of course, the same objectives can be achieved if the Gartner Group numbers are viewed as having any degree of credibility.

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IV. Benefits of Hybrid Riser under new plan -- Efficient riser saves money and time

- A structured cabling system creates order. It allows moves, adds, and changes in the system to be completed inexpensively.
- Once horizontal and vertical cable runs are installed in the structured system -- you should never have to change these runs; they should not be tampered with after installation. All moves, adds and changes are confined to closet.
- Easy repair!
- Investment and reconfiguring network and information sources will help achieve complete, standardized and seamless interoperability as quick as possible. This approach minimizes the incremental cost of supporting future growth of inter-network information flows.
- Today's information hungry market place needs to provide voice and data networks over a single universal structured cabling system.

IV. Benefits of Hybrid Riser under new plan -- Closet and desktop presence

- A company with 1000 employees has an average of 50 to 70 servers.
- Locate servers in the most central location. This reduces cost.
- Plan 5 - 10 years ahead - make sure closet is big.

IV. Benefits of Hybrid Riser under new plan -- Manageability, scaleable, modular desktop.

V. Opportunities for the new services and new efficiencies: Hybrid architecture to the desktop

- 43% of companies planning cable changes will install fiber to desktop.
- 62% of companies plan to use video conferencing and they need expanded bandwidth.

V. Opportunities for the new services and new efficiencies: Better serviceability and future growth.

V. Opportunities for the new services and new efficiencies: Summary of the benefits

VI. Technology -- ATM to the Desktop

- ATM requires new cabling, software, adapters, and switches . . . high costs.
- Network applications will be developed that expect higher performance to the desktop. This is not only for highly touted applications like multimedia, but for the creation of an entirely new class of network applications.

VI. Technology -- ISO-Ethernet and SDC

- Only when users have become comfortable with local "pretty" video and are confident that it will serve as an alternative to physical meetings, will they commit longer distance video collaborative relationships.
- The best solution to desktop video conferencing is almost surely to match ISO Ethernet with ATM.
- Building the right network and application framework is the biggest challenge that we face in bringing video collaboration to the market.
- Much of the multimedia benefits of switching are really benefits of ATM switching. ATM is more future proof.

VI. Technology -- Future technologies

- The problem with fiber to the desktop is not cost. It is cost of the NIC cards.
- Bandwidth required by desktop PC's increase in orders of magnitude as processors become more powerful.
- Multimedia is a potential $200 Billion Market which has created a flurry of competitive forces frantically working to leverage exiting communications infrastructures and build new ones to handle the ever increasing amounts of Data, Voice, And Video information that need to be accommodated.
- A key element in the future multimedia market is ownership of the information delivery infrastructure.
- 16 megabit token ring will become dead end technology by the end of this century. It will be replaced either by 10 megabit Ethernet or 100 + megabit networks. Networks will become more complex more heterogeneous and more difficult to debug, maintain and kept running at high service levels. We will have more operating systems to support, more variations in topologies and switches, and more variety in services and network services.
- 10 years from now over half the new investments in internetworking will be in switching.

VII. Summary Review advantages of riser project

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