US Army Civilian Personnel Regionalization Project

LIFECYCLE REPLACEMENT

Architecture for the Future

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CIVILIAN PERSONNEL REGIONALIZATION
LIFECYCLE REPLACEMENT

PURPOSE

From the outset of the Civilian Personnel Regionalization Project, the hardware was anticipated to have a useful life of five years. Accordingly most hardware was purchased with a five-year warranty after which time, it would be replaced. The first replacement cycle is to commence in FY00 and includes the Southeast and Army National Capital Regions.

Some have suggested that rather than a wholesale replacement of equipment in two regions per year for five years, that the Lifecycle Replacement program fund a 20% replacement annually in all regions. The purpose would be to ensure that all ten regions are upgraded together and at the end of the 5-year period, all of the regions would essentially be equivalent. To some extent, this type of incremental approach has been occurring with upgrades and additions since initial fielding. Examples include SMS/SQL, Exchange 5.5, WinFrame/MetaFrame, Training Rooms, etc. However, the fact remains that the regions were fielded over time and that the ones fielded earlier have far less capable equipment overall than those fielded later. To use an incremental approach places the first two regions at a continuing disadvantage for the next 5 years. Moreover, some system components are far more costly than others are and budgeting for their replacement throughout the 10 regions in a single year could be difficult financially. Consequently, the two-regions-per-year concept continues to be the recommended approach at this time, albeit with some significant deviations to be discussed in detail later.

The purpose of this document is to establish the general architecture for and policies to be used in acquiring and deploying the lifecycle replacements. This white paper is intended to be a "living document" and, as a consequence, everything in this document should be viewed as subject to change based on technological advances and operational imperatives. The overarching goal to ensure sustainable and capable functionality to accomplish the mission of Army civilian personnel management remains unchanged—modification of the plan set forth herein to respond to unanticipated needs will occur.

HISTORICAL BACKGROUND

Technical planning and engineering for the Civilian Personnel Regionalization (CPR) Project began in May 1995 with the first sites brought on-line in October 1995. Initial fielding was completed on 17 December 1998. One of the core philosophies of the CPR Project has been to standardize the architecture across the entire installed base to the greatest extent possible. To this end, changes to the baseline were avoided unless there was a demonstrable overwhelming need and, when made, extended across the whole of the installed base. The basic architecture is client-server utilizing a Windows NT network with an interface to an Oracle database operated under UNIX. The major components of the system are briefly discussed below:

- **UNIX:** Began with basic Oracle database and HP-UX running on a HP K-series server and utilizing the X-Windows protocol for the interface between UNIX and NT at both CPOCs and CPACs. Resumix and web-enabled Oracle were added later at the CPOCs.
- **Windows:** CPOCs started with 5 NT servers (PDC, BDC, Mail, Print/File, & Applications) and CPACs with 1 NT server containing the same functions. Since then, X-Windows has been eliminated; SMS/SQL, WinFrame/MetaFrame and stand-alone applications servers have been added to the CPOCs; FASCLASS has been deployed; printers have become LAN-based, and the post office functions at many CPACs have migrated to the local DOIM. Servers began with 32MB RAM and now have 128MB at CPOCs and 64MB at CPACs. The OS on workstations and servers has moved from NT 3.51 to NT 4.0 (SR5).
- **Communications:** Internal CPOC Communications is covered in significant detail in a separate white paper that recommended moving from MMAC Plus hubs to the SmartSwitch 6000 and SmartSwitch Router with a capacity to provide switched 10/100 to the desktop and ATM unlinks. This transition is now occurring. Externally, the NIPRNET (DDN) has been the communications backbone since the

beginning of the project. As the NIPRNET itself has improved, and particularly as the individual local DOIM connections to the NIPRNET have improved, so too has the overall communications picture. However, demand for bandwidth has tended to increase at a faster rate than that of improvements, so there are still a number of communications bottlenecks—most, however, outside the purview of this project. CPACs were all installed on a hub-based Cat 5 Ethernet LAN, typically with a fiber backbone to the DOIM.

- **Managers:** The original system definition (for planning purposes to CPOR) was for 5 managers at a site to be connected into the system. Began with a client-server approach utilizing either an existing garrison LAN or remote dial-up via a modem nest. It soon became evident that manager workstation and garrison LAN configurations are entirely out of the project's control and there is a large variance in desktop performance and OS usage among managers. Moreover, DA has decided that virtually all managers should be connected. The infrastructure is wholly inadequate to the task. Consequently, the project has turned to thin client (server intensive) solutions for manager connectivity problems.

FEEDBACK FROM FIELD

As previously noted, Lifecycle Replacement has been occurring for some time (ever since initial deployment). The engineering staff constantly considers technical advances that are developing and may be applicable to the CPR program. Over the past several months however, additional focus has been given to this effort and the IM community has been asked to provide input.

Three means of obtaining input were used—a formal survey, group discussion at VTCs, and informal participation in meetings and conferences.

What follows is a synthesis of the input received:

- Change is the only constant. As such, standardization, consistency and flexibility are the attributes most preferred by IM managers.
- Managing the infrastructure is a piece of cake compared to managing the people who use the infrastructure. CPOC and CPAC employees are human beings that have an inherent need to achieve some degree of control over their working environment, including "their" workstations and cubicles. The current client-server architecture with relatively capable workstations facilitates this. When looking at TCO, do not forget the human factors and that the salaries and benefits of staff far exceed the cost of hardware and software.
- Consolidate, but have no single points of failure.
- Fewer, more powerful servers are generally preferred, but with necessary redundancy and fast automatic storage/back-up devices.
- If necessary, pay more for hardware to ensure the "3R's"—reliable, robust, and rugged.
- Faster is ***always*** better. Time and productivity are the measures on which CPOC and CPAC staffs are evaluated—the IM infrastructure must be designed to maximize productivity.
- Need more extensive fault tolerance and fail-over options built into the system.

In addition, limited preliminary discussion and testing has occurred on the concept of Windows Terminal Computers (WinTerms) *vs.* Desktop Workstations. There are some concerns about this concept in the IM community:

- Places a greater load on the LAN and servers. Any cost savings associated with the desktop may be more than overcome by added server costs.
- Will users react positively or negatively to the perceived loss of control and flexibility? For example, any solution must include the ability to run applications locally, or flexibility is breached.
- Two possible single points of failure are created—the server and the network.
- Is this a step forward or backward?
- Long-term network performance is likely to suffer unless significant and costly network upgrades are undertaken.

- TCO appears to be a wash unless primary concern is absolute security—in the CPOR world, productivity is far more important than security.
- Experience of other non-intelligence government agencies has been uneven and many that have started down the WinTerm path have subsequently reversed course.

The consensus from the survey of IM Chiefs was that Network Computers should not be considered during this replacement cycle, at least in any great numbers. The primary reasons cited were that the performance requirements of the Modern System are almost entirely unknown at this point in time, PCs provide far more flexibility, and that IM Chiefs do not have adequate resources to manage a mixed environment of WinTerms and PCs. In any case, WinTerms are but a subset of the total solution to the desktop. They will never be the ONLY solution. At this point in time, it appears that the Staffing Clerks would be the only group that clearly could use WinTerms in their production environment. However, a long-term full-scale test of WinTerms in the ANCR CPOC environment with specific timing comparisons on both PPI and non-PPI applications will be undertaken to document and analyze what the performance, maintenance, and operational characteristics and requirements truly are. CPOCMA also has been suggested as a potential test bed for this technology. No productivity degradation from the fully capable desktop would be acceptable. For the purposes of this document, WinTerms are not being considered except to establish a test bed. Deployment within the larger system is not recommended until after substantial testing with the full-production release Modern System (post PPU). Furthermore, Network Computers should not be considered for application in CPACs because of the lack of network expertise at the CPAC level and the "generalist" nature of the staff.

An additional thought with respect to the Network Computer concept. Since the WinTerm is primarily a "dumb terminal" the existing desktop PCs could be reutilized as WinTerm desktops. This would save capital outlay, however would somewhat reduce the economies expected in network management and a storage area where spares could be stockpiles would need to be secured.

The survey documents are included in the Appendix for reference purposes.

GOALS

There are six goals to be achieved from lifecycle replacement:

1. Improve the capability of the overall system and every component portion thereof.
2. Reduce the complexity of system management and maintenance.
3. Provide fault tolerance throughout the system.
4. Position the system to incorporate and exploit technology improvements, as they become relevant to our operations.
5. Decrease the footprint required in computer rooms, both at CPOCs and CPACs.
6. All hardware will be well known, tested, from an established manufacturer and purchased with a "Lifetime" warranty.

CPOC ARCHITECTURE CONCEPT

The overall concept for CPR is a client-server system with substantial thin-client capability. For purposes of this document, the architecture is broken into 7 parts—UNIX Servers, Windows Servers, Storage, Communications Hardware, Workstations, Peripherals and Network Management. Although broken apart for discussion purposes, it is recognized that all seven parts must be fully integrated.

UNIX Servers

The UNIX side is driven by the needs of the DCPDS system and the Civilian Personnel Regionalization Project has little or no control over it. There is an effort underway (led by PO-CPR) to re-arrange the Unix servers in the system to, among other things, accommodate the 3-tier Oracle structure introduced in release 11. The Oracle Database and Resumix Application reside on the UNIX server.

The following are the design goals for the Lifecycle system, to the extent that the project can exercise control over the UNIX side:

- Prepare to move to HP-UX 11.x and Oracle 8.x once the CDA authorizes it.
- Fully deploy and use HP OpenView
- Increase actual and potential server capability through scalability and modularity; pre-plan server capacity increases
- Provide redundant power supplies
- Provide "hot swap" capabilities
- Rack-mount servers and UPS; use KVM switch and single keyboard, monitor, and mouse to reduce footprint

Other than the DCPDS host, other UNIX applications running or anticipated at each CPOC include:

- Oracle web application server
- Resumix
- Report server
- Hot COOP site
- Discover tool application server
- Back-up system

In order to reduce the number of UNIX boxes in each CPOC and simplify the system administration, the following will be provided under Lifecycle Replacement:

- Two rack-mounted HP Prelude (N-class) servers, each with 4 processors, 4GB Memory, 4-18GB disk drives, Fibre-Channel adapter, redundant power supplies, AutoRAID
- Rack mounted UPS
- KVM switch

The existing K-460 is to remain in place while the other UNIX boxes would be removed. The Modern System, provided it is ports to HP-UX 11.x without significant performance degradation, will reside on one of the N-class boxes. Since the K-460 is a very capable computer, the web server function of the Oracle Thin-Client would be placed on it; the net result will be a significant improvement in performance. The N-class boxes are Merced-ready, which provides a path to an in-place upgrade, should that be necessary. Moreover, the configuration purchased will allow the N-class servers to be arranged in a cluster in the future if it is desirable to do so or if the costs are substantially reduced. In this way, virtually all contingencies are covered, maintaining an exceptionally capable environment for the customer.

The Modern System will be rolled out prior to the end of Lifecycle Replacement, perhaps as early as the end of CY2000. In order that all regions have identical UNIX architectures for the deployment of the Modern System, a pair of HP N-class servers will be acquired for and deployed to each CPOC in FY00. As a cost savings measure, one of the N-class servers will likely be acquired with only 2 processors and 2GB RAM and will be upgraded during the regular Lifecycle Replacement cycle.

Windows Servers

It is the Windows environment, and especially within the server room, that is envisioned as the major focus of lifecycle replacement (from the PO-CPR standpoint). As with the UNIX side, the overall concept is to reduce the number of individual servers to operate/maintain, while providing a clear path toward adding server capacity and capability, should system changes necessitate it. One way that this is to be accomplished is by clustering exceptionally capable server systems, leaving sufficient rack space and network drops to add more over time.

The server design is based on migrating to the Windows 2000 Advanced Server which, among other key upgrades, supports clustering and includes a Hierarchical Storage Management (HSM) system to enable

offloading seldom used data to inexpensive media, thus saving hard drive space. In addition, Windows 2000 (originally called NT 5.0) includes a number of potentially important NSM tool sets including:

- Auto Install (provides server-based installation to the desktop)
- Windows Installation Service (provides automated file fixing)
- Zero Administration Windows (automatically finds and loads needed drivers for the action requested)
- Group Policy Editor (used to control user applications on the desktop)

Finally, Windows 2000 ships with Terminal Server as a service out of the box. This supports the various thin-client architectures currently in use or envisioned, including WinTerms.

The current architecture at the CPOCs and CPACs will not support Windows 2000. Consequently, upgrades in the Operating System will be tied to the hardware replacements in this program.

There appear to be 11 distinct server functions currently or expected to be required within the CPOC:

1. Primary Controller/Active Directory (domain support)
2. Mail
3. MetaFrame/Terminal Server
4. SMS/SQL
5. HEAT
6. OCSM (or its follow-on)
7. FASCLASS Application
8. OPF Tracker Application
9. Resumix Application
10. Intranet/Web Applications
11. Office/PPI/other applications

These could be arranged into server systems such as this:

I. OS/OCSM/HEAT } Clustered
Mail
II. SQL
III. Terminal Server/MetaFrame ("stand-alone"2-server cluster)
IV. Cluster: RAID/Intranet/all applications

A server system may or may not be a single box, however it is configured to operate as a single server transparent to the user. Clustering provides scalability and fault tolerance and allows for channeling to occur.

All Windows servers (e.g.: HP LHr 4 or LXr 8xx0) are to support, as a minimum, 4-8 processors, Fibre-Channel backplanes/adapters, redundant power supplies, "hot swap" capabilities, and dedicated UPSs with an auto-paging feature. In addition, the hardware items are all to be rack-mounted with a KVM switch to reduce monitors, keyboards, and mice. Finally, server clusters will have at least 4-15+GB Hard Disks to meet RAID 5 standards.

All HP LH-series and better servers purchased and deployed in the past eighteen months will be reutilized in CPACs (upgraded if necessary with 15+GB HDs and a minimum 256MB RAM per processor) as a part of Lifecycle Replacement. To the extent practical, the HP LD-series servers deployed will also be upgraded and reutilized. Six new LXr8xx0 servers will be deployed to each CPOC and, with the reutilized servers, will be configured into four clusters. In this manner, fault tolerance and RAID 5 will be part of the architecture for all Windows-based operations and applications.

It is strongly recommended that the CPR Project purchase and position the capability to Web-enable as much as possible and reasonable. This can be accomplished through the use of Office 2000's built-in

Intranet capability. It is believed that ultimately, this will dramatically improve workforce productivity and flexibility assuming that bandwidths are sufficient.

Storage

Storage or more specifically *managing* storage can be the Achilles heel of advanced systems such as in the CPOR environment. Over time, even entirely legitimate storage demands always seem to outstrip capacity. Since initial fielding began, many of the discussions at IM Conferences have centered on storage and the need to buy ever-larger hard disks. Under Lifecycle Replacement, it is proposed that the system move toward a more managed storage regime, perhaps eventually some kind of Storage Area Network (SAN).

As a first step in that direction, Fibre-Channel will be used as a migration glide path to the SAN concept. Fibre-Channel offers exceptional bandwidth (at least 200 Mbps) and channel connectivity that would allow migration to SAN and ultimately could feed a COOP solution for each region including eventual cross-platform storage solutions. The Lifecycle architecture includes the use of Fibre-Channel hubs; these will provide management capabilities and hot-pluggable storage. At such time as a decision would be made about migrating to a SAN, some of the hubs would have to be upgraded to switches. At the present time, however, Fibre-Channel switches are still one or two generations away from complete reliability and they are cost-prohibitive. However, with respect to Fibre-Channel, because it represents leading-edge technology, all of the hardware required to fully exploit its advantages may not be available and tested prior to deployment of the first two regions. If this indeed occurs, storage and RAID will initially be deployed using SCSI (Ultra Wide/Ultra Fast) connections, then upgraded to Fibre-Channel in FY01.

Meanwhile optical storage (CD-RW and/or DVD-RAM) jukeboxes will be installed to provide archival capability, as well as a modular and hierarchical expandable storage capability in the most cost efficient manner. The optical storage jukeboxes to be used at CPOCs will service in excess of 400 disks each and have two read heads and two write heads. Management will be the key to effective deployment and use, but there are not any "silver bullets" in that arena as yet so each CPOC will have to experiment with what works best in their particular environment with their group of users. However, the media are cheap and virtually limitless in supply. The initial concept is to provide jukebox carousel storage equal to the number of employees on the LAN plus 100.

However, the unabated exponential growth of storage requirements must be eliminated through more effective management as well as archival storage hardware. The Hard Drives will be sized to satisfy the requirements of RAID 5. It is not anticipated that there will be any expansion beyond that level, now or in the future.

In addition to networked storage, each CPOC will be provided with 10 CD-RW and 1 DVD-RAM disk writers for both storage needs and to be able to produce multiple copies of data for distribution within the CPOC or to external sites. The existing TAC towers will remain in place as well to provide access to disks in the manner deemed appropriate by the local systems administrator, however it is suggested that help disks and the like reside there.

A sub-set of storage is back up. Back up cannot wait for Lifecycle Replacement in entirety. Consequently, while a more permanent solution, a dedicated DVD jukebox array will be provided with the Lifecycle equipment, either a DAT or DLT solution will be offered earlier.

Communications Hardware

The CPR Project is currently installing SmartSwitch technology in all of the CPOCs. The Lifecycle Replacement process will add redundant controllers to the SmartSwitch Router. Together, this should be sufficient to carry the foreseeable communications requirements of the CPOCs through this round of Lifecycle Replacements, especially with the capability to add Gigabit Ethernet or ATM uplinks in the future. However, during the individual surveys, if any communications equipment is found to not be compliant with the current SNMP, it will be replaced.

One of the communications goals for Lifecycle Replacement is to ensure switched 100Mbps connectivity to each workstation at CPOCs. The current SmartSwitch effort will leave somewhere between 20%-40% of the workstations short of this goal, albeit still on a switched 10Mbps LAN connection. In the second year of Lifecycle Replacement (FY01), it is expected that more densely populated switched 100Mbps cards will become available for the SmartSwitch 6000 chassis that form the current CPOC communications backbone. At that time, all ten regions will be upgraded so that all workstation connections will be switched 100Mbps. PO-CPR will provide ports for all of the DA authorized networked servers, workstations and peripherals plus 5 ports for interns plus 25% spares.

With respect to the larger communications infrastructure, PO-CPR and CPOCMA should continue to push hard for backbone system upgrades to the NIPRNET. ThinClient solutions and special dedicated lines may be useful in addressing persistent communications problems where we have no control over the backbone infrastructure. However, everyone benefits from NIPRNET improvements so this should always be the ultimate objective, albeit one beyond our control.

Dial-up service will be exclusively through TSACS and it is recommended that all staff have TSACS accounts.

Wherever possible, the US Robotics modem banks will be reutilized to provide outgoing Fax capability from the desktop. This likely will involve reutilizing one of the desktop workstations being replaced to establish a small Fax server. The system will be metered to permit only outgoing Fax capability—incoming Faxes would still be directed to Fax machines to ensure proper handling and to reduce the possibility of the Fax being used as a backdoor into the otherwise secure system.

On a somewhat different communications track, it is recommended that an appropriately sized Video Switch be investigated for each CPOC to permit universal desktop video conferencing within the CPOC, to also include the Training Room. Moreover, facilitating desktop video conferencing between CPOCs and "their" CPACs should also be investigated. Such a system will improve productivity and enhance personal responsibility. A demonstration of a system providing such capabilities occurred at the last IM conference, and as system improvements are made, and prices decrease, this type of technology should continue to be pursued. This technology is required for more than long-distance VTC capabilities; it also lends itself well to local domain use. It is the local use that could provide the more dramatic productivity enhancements with its "instant meeting" potential. It does not appear at this time that there will be sufficient funding to acquire the switched technology desired as a part of Lifecycle Replacement; as such it is recommended that this be pursued along a parallel, but separate track.

Workstations

Workstations will continue to play a role in the CPR program, regardless of how network computers ultimately are utilized. The basic rule-of-thumb will be to purchase the most capable workstation available within budget and from a well-known manufacturer. To accomplish this, we hope to be able to wait until the last possible moment to purchase. This will result in obtaining the best available technology.

At a minimum, however, workstations should include the following:

- Pentium III processor at 500 MHz
- 256 MB RAM
- 15+ GB HDD
- Multi-read capable CD-ROM/DVD Drive
- 200 MB Floppy Drive or Internal ZIP Drive (or similar high capacity read/write drive with removable media)
- 10/100 NIC
- 4 or more USB ports
- 1+ Fire Wire port(s)

- Multimedia video and sound, including microphone compatible with voice recognition typing systems
- 21" anti-glare monitor
- Ergonomic input devices
- "Lifetime" warranty

All workstations will be from well-known respected manufacturers utilizing only OEM specified parts and components. All Lifecycle Replacement workstations in a region, both CPOC and CPACs will be purchased at the same time to identical specifications. As a caveat to this, however, a relatively large number of workstations are currently being deployed to each of the ten CPOCs to support Resumix. These approximately 40 workstations at each CPOC will **not** be replaced under Lifecycle Replacement. Moreover, the training room workstations (and server) will not be replaced under Lifecycle Replacement.

Peripherals

As with workstations, the evolution in peripheral capability occurs rapidly and dramatically. For this reason, it is strongly recommended that a "just in time" procurement approach be used to ensure that the best reasonably available technology that can be afforded is acquired.

The following peripherals are to be provided at the ratios given:

- Full color flat-bed OCR scanner (with software) at a ratio of 1:50 users (minimum 2/CPOC)
- Production printers at a ratio of 1:8 users as follows:
  - High-speed printers (laser, b/w, full duplex, letter & legal, PostScript, bi-directional data transfer, maximum memory, 10/100 NIC, 24+ppm) at a ratio of 1:25 users
  - Medium-speed printers (laser, b/w, full duplex, letter & legal, PostScript, bi-directional data transfer, maximum memory, 10/100 NIC, 16ppm) to cover the difference
- Color laser (full duplex, PostScript, letter & legal, full range of media types and weights, 256+ MB memory, bi-directional data transfer, 10/100 NIC, 6ppm full color) at a ratio of 1:100 users

In using the above ratios, all fractions are rounded up. So, a 100-user installation would receive the following newly purchased equipment under Lifecycle Replacement:

- 2 Scanners
- 4 High-speed printers
- 9 Medium-speed printers
- 1 Color printer

Similarly, a 101-user installation would receive the following newly purchased equipment under Lifecycle Replacement:

- 3 Scanners
- 5 High-speed printers
- 8 Medium-speed printers
- 2 Color printers

The existing low-speed lasers and high-speed line printers should still have some useful life and can remain deployed within the CPOC to support printing needs. Centrally funded maintenance would continue on the existing color and 16+ppm b/w lasers and dropped on everything else. The reutilized line, 16+ppm and color printers would be provided network ports; the remainder would not and could be connected directly to workstations.

Network Management

Windows 2000 provides a rich suite of network management tools built directly into the Operating System. The Fibre-Channel hubs and storage jukeboxes ship with management software. Spectrum Element

Manager was provided to each CPOC as a part of the SmartSwitch upgrades. SMS 2.0 has been acquired by PO-CPR and already has been sent to CPOCs for their use in some form or fashion, almost certainly at least for internal use. The UNIX servers will come with HP OpenView (Top Tools and Network Node Manager). CA UniCenter is available through an Army-wide site license. It appears that all of the network management tools necessary will be in place and it will be a matter of learning how to most effectively implement and use them. It is recommended, however, that the cross platform HP OpenView modules be licensed for use on the Windows side.

Power Management

The CPR program remains committed to the concept of using intelligent power management tools (SmartUPS) that will allow for the automatic and graceful shut-down of servers in the case of power failures and which condition the power flowing to the servers. To the extent that room-wide UPS devices provide such services, they will be considered, however the preferred approach will be a single UPS for each cluster mounted directly in the cabinet with the servers. Existing UPS units that can be reutilized will be after ensuring that the batteries inside are refreshed.

In addition, surge protecting power strips must be used at each workstation. It is anticipated that existing surge protectors can be reutilized.

CPAC ARCHITECTURE CONCEPT

The goals that apply to CPOCs also apply to CPACs, just at a smaller scale. The major difference is that the UNIX servers are not required for CPACs. Accordingly, the lifecycle replacement architecture concept for CPACs includes only 5 components—Windows Servers, Storage, Communications Hardware, Workstations and Peripherals. Although broken apart for discussion purposes, it is recognized that all five parts must be fully integrated and must integrate with both the CPOC systems and those of the host command. Consequently, the site survey and the advice of the local DOIM will be critical prior to finalizing decisions with respect to fielding lifecycle replacement hardware.

A diagram of the notional CPAC architecture is in the Appendix.

Windows Servers

There will be two distinct CPAC architectures—one for CPACs with 10 or more staff members or running on their own domain and another for CPACs with 9or fewer staff members or running on the DOIM domain.

In the first case, the Windows server architecture design concept is based on migrating to Windows 2000 Server and Workstation at each CPAC (assuming that this is compatible with the host command infrastructure and architecture). The server must accommodate 5, perhaps 6, functions:

1. Primary Controller Active Directory
2. SMS secondary site (perhaps, perhaps not)
3. MetaFrame/Terminal Server
4. Intranet/Web applications
5. Office/PPI/other applications
6. Mail (not all sites—many use the DOIM post office)

To accommodate these functions, plus provide adequate capacity for application and processing growth, a cluster of two LXr8xx0 servers will be used, each with redundant power supplies, “hot swap” capabilities and a dedicated “Smart” UPS having auto-page and graceful shut-down capabilities. This will allow the same range of fault tolerance as at the CPOC and will support RAID 5.

For the smaller CPAC or the one operating on the DOIM’s domain, a single file/intranet server will be provided, either a newly acquired LH4 or, in the case of very small CPACs, a reutilized LH or LD.

Additional fault tolerance would not be provided in either of these cases; nevertheless the CPAC would still have far more capability than currently. "Smart" UPSs will be used under both scenarios. Where reutilized servers are to be used, they will be upgraded to have a minimum of 512 MB RAM and 16 GB of hard disk storage.

The servers and UPSs will be rack-mounted in CPACs with a separate computer "room" and the racks should be sized to permit the addition of 1 additional server and UPS if necessary in the future. Where a computer room does not exist, or where the CPAC/DOIM requests otherwise, stand-alone floor models will be provided. Because of the myriad of possibilities at the smaller CPACs, early coordination with local DOIM/IMO during site surveys will be critical.

Storage

CPACs of both configurations could potentially have Fibre-Channel to support a small optical storage jukebox solution. While not as critical for CPAC operations as at the CPOC, the optical storage jukebox solution for CPACs appears to be the most appropriate path for a number of reasons. It standardizes the architecture across the system and allows for both hierarchical and archival storage. Moreover, it allows the sharing of huge data files (such as electronic OPFs) in identical formats at both the CPOC and CPAC utilizing a very inexpensive media.

One CD-RW disk writer will be placed in each CPAC.

The single server configuration in the small CPACs will have an internal DLT to provide back-up capability.

Communications Hardware

All CPACs will be transitioned to SmartSwitch technology during the Lifecycle Replacement with a minimum switched bandwidth of 10Mbps to each workstation and 100Mbps to the server(s). PO-CPR will provide ports for all of the DA authorized networked servers, workstations and peripherals plus 25% spares.

Existing dial-up access will be eliminated and all users encouraged in obtaining a TSACS account. If, however, the capability to Fax from the desktop is desired and meets with the approval of the local DOIM, the existing modem banks can be configured for these dial-out requirements utilizing one of the workstations being replaced as a Fax server. Only outgoing Fax capability will be permitted. Incoming Faxes will continue to be forwarded to stand-alone Fax machines.

Finally, PO-CPR and CPOCMA should continue to work with the ANSOC to identify and recommend potential LAN and NIPRNET improvements to the appropriate entities.

Workstations

The same workstations specified for the CPOCs should be deployed to the CPACs and should include the following:

- Pentium III processor at 500 MHz
- 256 MB RAM
- 15+ GB HDD
- Multi-read capable CD-ROM/DVD Drive
- 200 MB Floppy Drive or Internal ZIP Drive (or similar high capacity read/write drive with removable media)
- 10/100 NIC
- 4 or more USB ports
- 1+ Fire Wire port(s)

- Multimedia video and sound, including microphone compatible with voice recognition typing systems
- 21" anti-glare monitor
- Ergonomic input devices
- "Lifetime" warranty

All workstations will be from well-known respected manufacturers utilizing only OEM specified parts and components.

One workstation will be acquired and installed for the Equal Employment Opportunity Office at each CPAC, whether co-located or not.

Peripherals

The following peripherals are recommended at the ratios given:

- Production printers at a ratio of 1:8 authorized users and comprised as follows:
  - High-speed printers (laser, b/w, full duplex, letter & legal, PostScript, bi-directional data transfer, 10/100 NIC, 24+ppm) at a ratio of 1:25 users with a minimum of 1 per CPAC with ten or more users.
  - Medium-speed printers (laser, b/w, full duplex, letter & legal, PostScript, bi-directional data transfer, 10/100 NIC, 16ppm) filling the difference plus 1 printer for the EEOO.
- Color ink jet (PostScript, letter & legal, full range of media types and weights, bi-directional data transfer, 10/100 NIC, 3ppm full color) at a ratio of 1 per CPAC

The existing lasers and line printers should still have some useful life and can remain deployed within the CPACs to support printing needs. However, only the existing 16+ppm lasers would be networked by PO-CPR or continue to be covered under centrally funded maintenance agreements.

COST FACTORS

From the outset, it has been the intent to have good engineering design drive this program, not costs. However, it is entirely naïve to assume that there is an unlimited source of funds to pay for lifecycle replacement. Consequently, it was necessary to analyze the recommended approach in light of the $5.5 million/year budget. At this point in time, it appears that the funds will be sufficient to cover most, and possibly all of the recommendations. The team believes that the highest priority should go to the servers and operating systems, both Windows and UNIX based. The next highest priority is the storage solutions. After that, the communications upgrades at CPACs, followed by workstations, the office automation software upgrades, then high-speed printers. The remaining peripherals fall to the bottom because in most cases, there is already some serviceable item that can continue to be used. The VTC switches are clearly beyond the program's ability to pay under current budget scenarios.

A preliminary cost estimate for the first two regions is included in the appendix.

PROPERTY ACCOUNTABILITY/REUTILIZATION

All new equipment purchased and deployed under Lifecycle Replacement will be bar coded for property inventory purposes. The preferred method is to have CPOR-unique bar codes affixed and coded into a centralized database by the vendor, then verified and read into the installation Property Book during site installation.

Among the outcomes of Lifecycle Replacement will be a large number of surplus hardware items. The disposition of this equipment will have to be determined in advance, most likely during site surveys. Any equipment that will no longer remain on site must be removed from the local Property Book. Once removed from the Property Book, disposal will need to occur.

With respect to the disposal of the existing UNIX assets, the following is the order of priority:

1. Reutilize within the overall system for different functions, test-bed or lab machines, to support CPOCMA, training, etc.
2. Trade-in if possible
3. If no trade-in opportunities exist or if the cost of shipping exceeds the trade-in value, offer to the local DOIM
4. If local DOIM does not want it, offer to the MACOM
5. If the MACOM refuses it, PO-CPR will arrange its removal and find a use for it.

The Windows Servers follow a similar path:

1. Re-deploy—the LD and LH series boxes at CPOCs will most likely be upgraded and moved to CPACs.
2. Reutilize as test-bed or lab machines at PO-CPR, CPR-West, CPOCMA or CPOCs.
3. Offer to local DOIM.
4. Offer to MACOM.
5. Scrap.

Workstations will be handled as follows:

1. Keep some as spares.
2. Reutilize in test-bed or lab at CPOCMA or CPOCs.
3. Offer to local DOIM.
4. Scrap.

Peripherals will largely remain in place until they die at which time they will be scrapped. Centrally funded maintenance would expire (however locally-funded maintenance is encouraged) except on the TAC Towers, Fujitsu scanners, MT line printers, color laser printers, and 16+ppm b/w lasers.

NEXT STEPS

The concepts in this document continue to be fully staffed by PO-CPR and ISEC. Conceptual agreement, after the document was briefed to the IM community and ASA (M&RA), occurred at the April 1999 IM Conference. Ultimately, this document should be formally adopted by the TRB as the policy guidance to be used in acquiring and deploying systems for Lifecycle Replacement.

In many ways, Lifecycle Replacement takes everyone back to the beginning of the initial fielding and the processes that worked well there should be refined, but kept in place. This includes a rigorous work program of performing individual on-site surveys followed by EIPs for each site based on the agreements reached with the various on-site actors. During this cycle, extra emphasis will be placed on consistency and transferability in developing written reports and plans. Each site will have a fully documented written plan approved before anything is ordered for that site. Moreover, a Memorandum of Agreement (MOA) will be executed between RCPO and each site. Until a fully executed MOA is in place, no equipment will be ordered for a site.

A change in methodology will be to group all of a region into a single batch order. This will guarantee as best that we can that everything within a region is identical. It is PO-CPR's responsibility to ensure that the system is consistent and that it works. It is also PO-CPR's responsibility to devise a plan and timetable for each site that maintains site operations while the changeover to new hardware and software occurs. This will likely require coordinated after-hours work and a specific plan for each site tailored to the specific local circumstances. This too will be a part of the EIP.

Much as they were initially, SE and ANC regions will be the test beds for the concepts and methods used to install and bring up the new systems. The remaining regions will benefit from the knowledge base developed there.

The current schedule for Lifecycle Replacement is as follows:

YEAR	REGION
FY00	Southeast
FY01	Army National Capital
	Southwest
	Northeast
FY02	Pacific
	Europe
FY03	Korea
FY04	North Central
	South Central
	West

The annual template after the first year looks like this:

MONTH	ACTION
June	Survey 1st replacement region for following FY
July	Prepare detailed deployment documents for 1st region
August	Survey 2nd replacement region for following FY
September	Prepare detailed deployment documents for 2nd region
October	Submit BOM's for 1st & 2nd regions
Oct-Dec	Order hardware, software, etc. as soon as funds are released
February	Install 1st replacement region for FY
April	Install 2nd replacement region for FY

The critical dates in this process are:

DATE	ACTION
1 December 98	Formal process initiated
17-18 February 99	Lifecycle Replacement IPR
17 February 99	Lifecycle Replacement VTC with CPOC IM Chiefs
1 April 99	Lifecycle Replacement Complete Draft available
12 April 99	Lifecycle Replacement VTC with CPOC IM Chiefs
21 April 99	Brief ASA (M&RA) on recommendations
27-29 April 99	IM Conference—TRB decision on Lifecycle Replacement
3 May 99	Final Report published and distributed
30 June 99	Draft Revised ISDP released for comment
12 July-3 September 99	Surveys of SE Region
1 August 99	Revised ISDP published and distributed
13 September-19 November 99	Surveys of ANC Region
24 September 99	All SE BOMs prepared and submitted
1 October 99	SE Region Purchase Requests submitted
15 December 99	All ANC BOMs prepared and submitted
20 December 99	ANC Region Purchase Requests submitted
10 January-17 March 00	Installs in SE Region
27 March-23 May 00	Installs in ANC Region

CONCLUSION

The Lifecycle Replacement strategy outlined in this document will work. It provides a highly sustainable and flexible architecture capable of responding to almost any foreseeable exigency. Fault tolerance is dramatically improved and while nothing can be 100% guaranteed, this system will be highly available and highly reliable within the scale of the budget available. The architecture responds in a positive manner to the requests of the user community and, based on the planning level cost estimates prepared to date, will fit into the budget that is available.

APPENDICES

A. Notional CPOC Architecture

B. Notional CPAC Architecture (Large/Own domain site)

C. Notional CPAC Architecture (Small/DOIM domain site)

D. CPOC Lifecycle Replacement List

E. Large CPAC Lifecycle Replacement List

F. Small CPAC Lifecycle Replacement List

G. Very Small CPAC Lifecycle Replacement List

H. CPOC UNIX Server Configuration

I. CPOC Windows Server Configuration

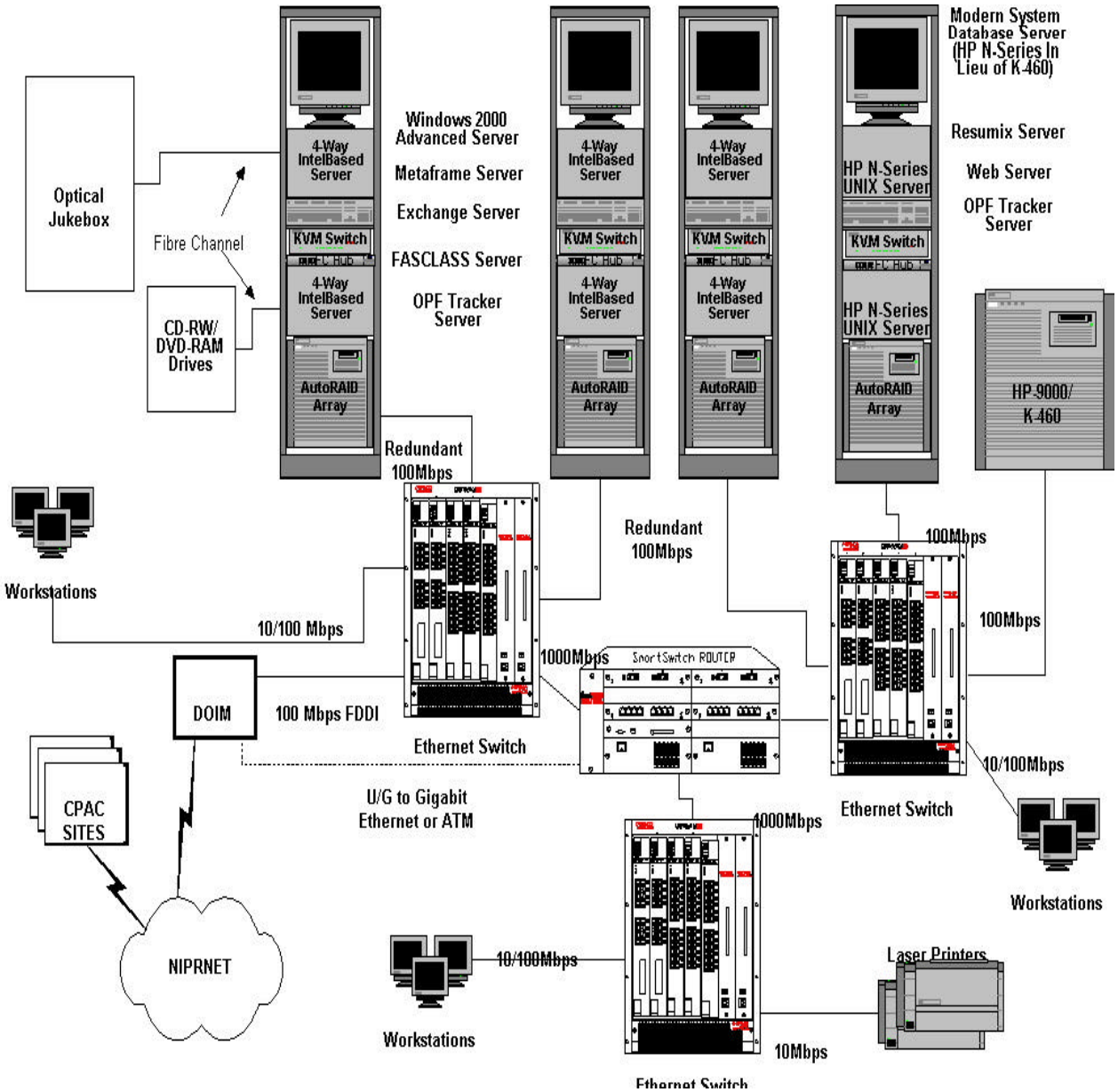
J. Large CPAC Windows Server Configuration

K. Small CPAC Windows Server Configuration

L. DA Authorized Strength FY00 Lifecycle Replacement

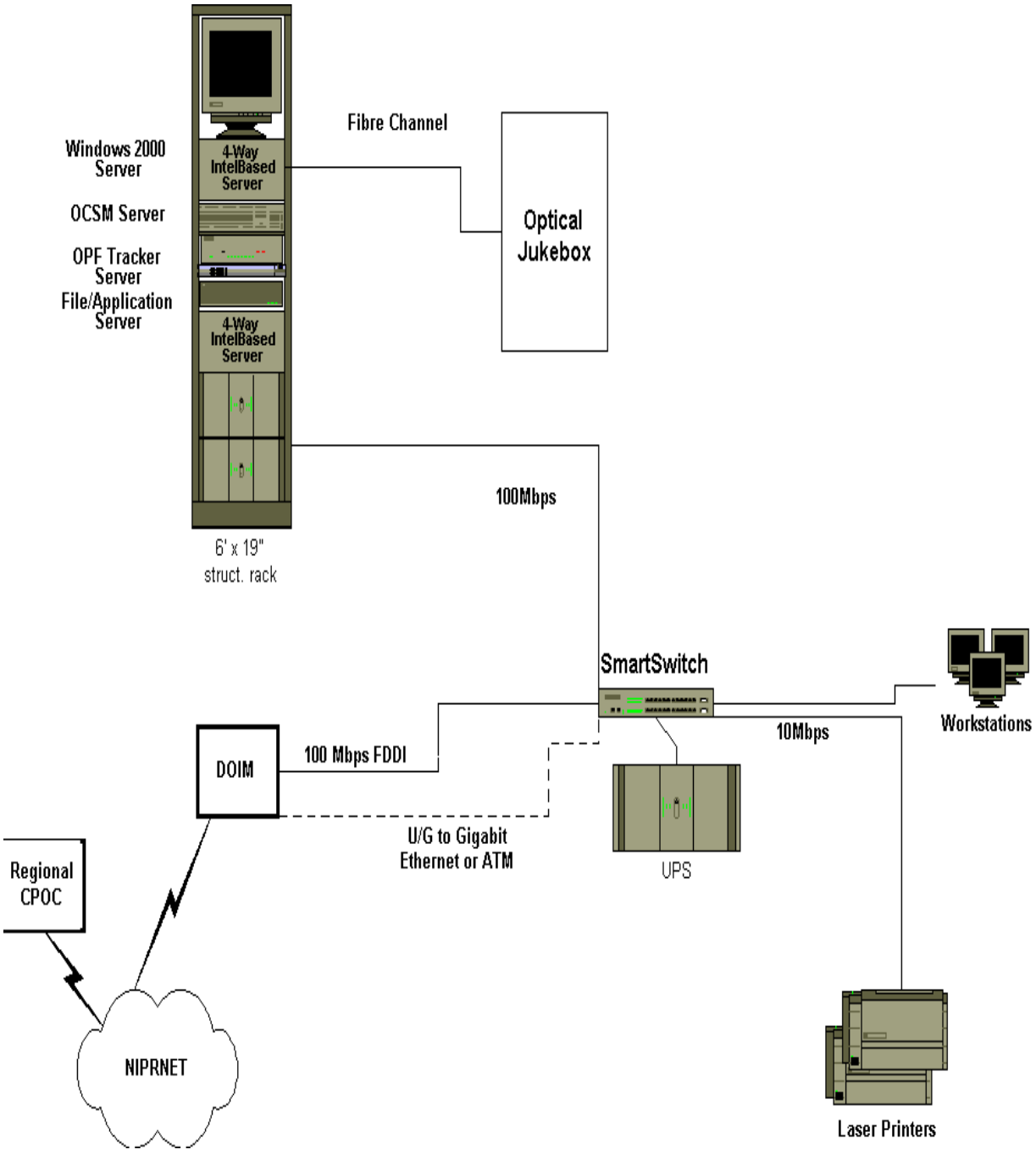
M. Preliminary Cost Estimates FY00 Lifecycle Replacement

Notional CPOC Architecture



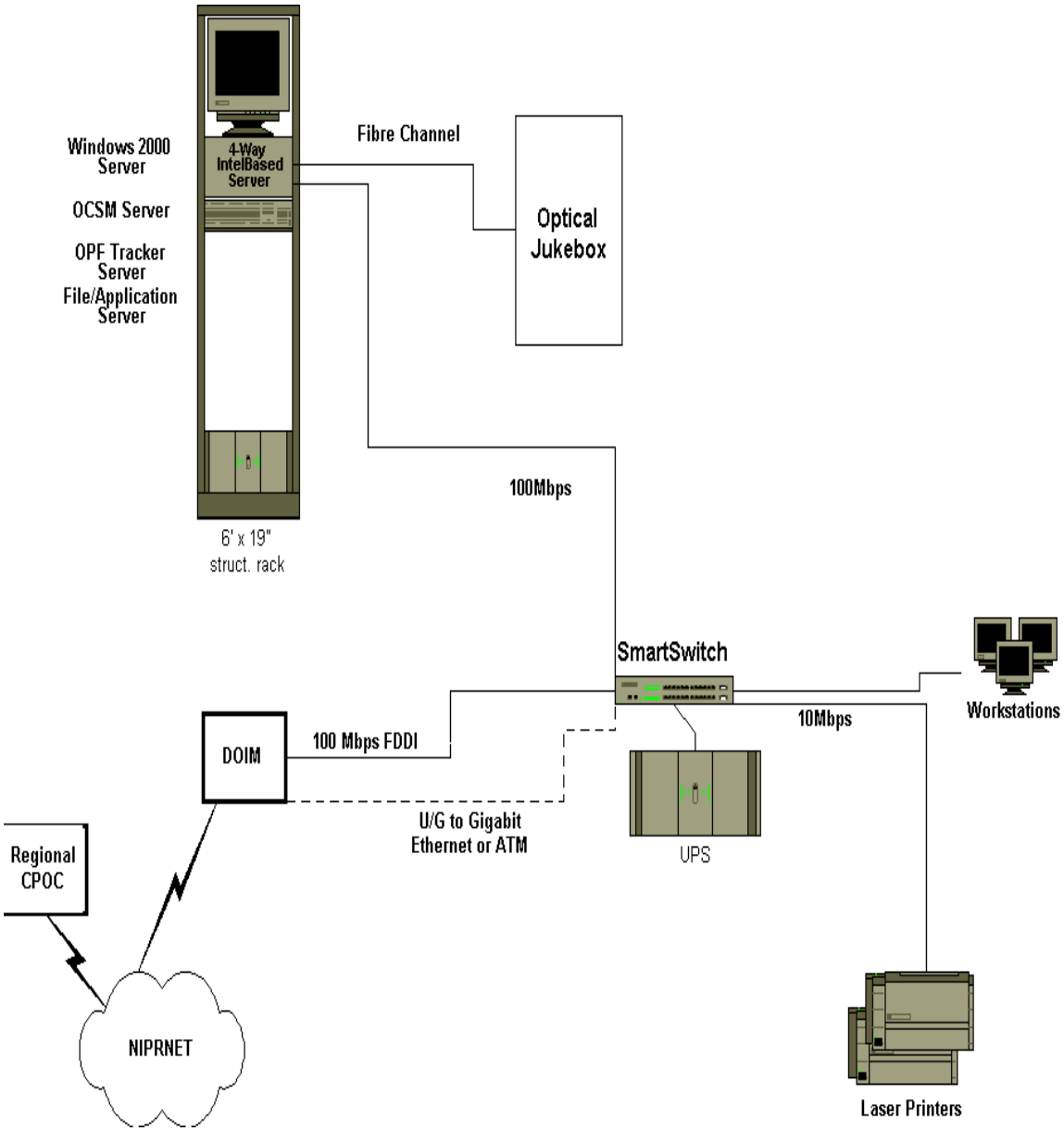
Notional CPAC Architecture

Large Site



Notional CPAC Architecture

Small Site



CPOC LIFECYCLE REPLACEMENT LIST

Component	Item	Quantity	Source
UNIX Server	HP K-460	1	Reutilized
	HP N-class	2	New
	Auto-RAID	1	Reutilized
	Auto-RAID	2	New
	DLT	1	Reutilized
	UPS	1	Reutilized
	UPS	1	New
Windows Server	HP LXr8xx0	6	New
	Auto-RAID	3	New
	UPS	3	New
	Windows 2000 Advanced Server	8	New
End User Workstation	HP Vectra 8 with CPR configuration	1 per DA auth position less 1999 Resumix	New
	Windows 2000 Professional	1 per EUW	New
	Office 2000 Professional	1 per EUW	Upgrades
	Surge Protector	1 per EUW	New
Printer	Color LaserJet	1 or 2	Reutilized
	Color Laser	1:100 users	New
	HP 5si	All	Reutilized
	Lexmark Optra (=16ppm)	All	Reutilized
	High Speed Laser (=24ppm)	1:25 users	New
	Medium Laser (16ppm)	1:8 users (less the HS lasers above)	New
	MT Line Printer	All	Reutilized
Storage	CD/DVD Jukebox (400± disks)	1	New
	TAC Tower	1	Reutilized
	CD-RW Drives	10	New
	DVD-RAM Drive	1	New
Scanner	Color OCR flat-bed	1:50 users	New (reutilize old EUW to make scanning station)
FAX Server	WinFAX Pro (outgoing only)	1	New software; reutilize modem bank and old EUW
Mail	Exchange 5.5	1	Reutilized

LARGE CPAC LIFECYCLE REPLACEMENT LIST

Component	Item	Quantity	Source
Windows Server	HP LXr8xx0	2	New
	Auto-RAID	1	New
	UPS	1	New
	Windows 2000 Advanced Server	2	New
End User Workstation	HP Vectra 8 with CPR configuration	1 per DA auth position plus 1 for EEOO	New
	Windows 2000 Professional	1 per EUW	New
	Office 2000 Professional	1 per EUW	Upgrades
	Surge Protector	1 per EUW	New
Printer	Lexmark Optra (=16ppm)	All	Reutilized
	High Speed Laser (=24ppm)	1:25 users 1 if =10 users	New
	Medium Laser (16ppm)	1:8 users (less the HS lasers above) plus 1 for EEOO	New
	MT Line Printer	All	Reutilized
	Color Ink Jet	1	New
Storage	CD/DVD Jukebox (50± disks)	1	New
	TAC Tower	1	Reutilized
	CD-RW Drives	1	New
FAX Server	WinFAX Pro (outgoing only)	1	New software; reutilize modem bank and old EUW
Mail	Exchange 5.5	1	Upgrade
LAN	SmartSwitch 2200/6000	1/bldg	New

SMALL CPAC LIFECYCLE REPLACEMENT LIST

Component	Item	Quantity	Source
Windows Server	HP LH4	1	New or Reutilized
	UPS	1	Reutilized
	Windows 2000 Advanced Server	1	New
End User Workstation	HP Vectra 8 with CPR configuration	1 per DA auth position plus 1 for EEOO	New
	Windows 2000 Professional	1 per EUW	New
	Office 2000 Professional	1 per EUW	Upgrades
	Surge Protector	1 per EUW	New
Printer	Lexmark Optra (=16ppm)	All	Reutilized
	High Speed Laser (=24ppm)	1 if =10 users	New
	Medium Laser (16ppm)	1:8 users (less the HS laser above) plus 1 for EEOO	New
	MT Line Printer	All	Reutilized
	Color Ink Jet	1	New
Storage	CD/DVD Jukebox (50± disks)	1	New
	TAC Tower	1	Reutilized
	CD-RW Drives	1	New
FAX Server	WinFAX Pro (outgoing only)	1	New software; reutilize modem bank and old EUW
Mail	Exchange 5.5	1	Upgrade
LAN	SmartSwitch 2200	1	New

VERY SMALL CPAC LIFECYCLE REPLACEMENT LIST

Component	Item	Quantity	Source
Windows Server	HP LD/LH	1 (if used today)	Reutilized
	UPS	1	Reutilized
	Windows 2000 Advanced Server	1	New
End User Workstation	HP Vectra 8 with CPR configuration	1 per DA auth position plus 1 for EEOO	New
	Windows 2000 Professional	1 per EUW	New
	Office 2000 Professional	1 per EUW	Upgrades
	Surge Protector	1 per EUW	New
Printer	Lexmark Optra (=16ppm)	All	Reutilized
	Medium Laser (16ppm)	1:8 users plus 1 for EEOO	New
	MT Line Printer	All	Reutilized
	Color Ink Jet	1	New
Storage	CD/DVD Jukebox (50± disks)	1	New
	TAC Tower	1	Reutilized
	CD-RW Drive	1	New
FAX Server	WinFAX Pro (outgoing only)	1	New software; reutilize modem bank and old EUW
Mail	Exchange 5.5	1	Upgrade
LAN	SmartSwitch 2200	1	New

CPOC UNIX Server Configuration

Two paired Hewlett-Packard 9000 N440 Rack Optimized Servers. Each Server in the pair would have the following:

- Two 440 MHz PA-RISC 8500 CPU w/1.5 MB cache
- 2 GB RAM
- Two 9GB HotPlug Ultra2 SCSI Low Profile Hard Disk
- 2 Hot-Swap Power Supplies plus Redundant System

HP AutoRAID in Rack Mount Enclosure

- 8 – 9.1 GB Hot-Swap Ultra2 SCSI Hard Drives
- 2 – 96 MB Disk Array Auto RAID
- 2 Standard Hot-Swap Power Supplies plus Additional Redundant Power Supply
- Ultra-Wide SCSI Host Interface

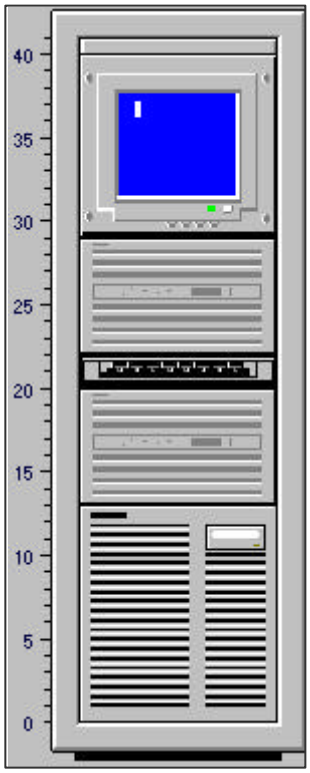
77.5-Inch HP "SMART" Rack System

- Cabinet with Standard 19-Inck Rack, Removable Panels, Casters, and Ventilated Roof Panel. 41U Height
- 19-Inch Rack Mount Monitor
- HP 4-Port KVM Switch
- Rack Mount Retractable Keyboard and Mouse

5.5 kVA rack-mount PowerTrust UPS

Cost of Paired Configuration is Approximately $240,000

CPOC Windows Server Configuration



Three clusters, each consisting of:

Two clustered Hewlett-Packard NetServer LXr8x00 Rack Optimized Servers. Each Server in the Cluster would have the following:

- 4 – 500 MHz Pentium III Xeon Processors with 1MB L2 Cache per processor
- Upgradeable to 8 Processors
- 1 GB RAM
- 2 – 4GB 10,000 RPM Hot-Swap Ultra2 SCSI Hard Drives operating at RAID 5 (for Win 2000 OS only)
- 3 Standard Hot-Swap Power Supplies plus Additional Redundant Power Supply

HP SureStore E Disk Array Model 12H (formerly AutoRAID) in Rack Mount Enclosure

- 4 – 18.2 GB Hot-Swap Ultra2 SCSI Hard Drives
- 2 Standard Hot-Swap Power Supplies plus Additional Redundant Power Supply
- Ultra-Wide SCSI Host Interface for both LXr8x00 Servers

77.5-Inch HP Rack System

- Cabinet with Standard 19-Inck Rack, Removable Panels, Casters, and Ventilated Roof Panel. 41U Height
- 19-Inch Rack Mount Monitor
- HP 4-Port KVM Switch
- Rack Mount Retractable Keyboard and Mouse

Cost of Cluster Configuration is Approximately $90,000 each or $270,000 per CPOC.

UPS not included yet.

Large CPAC Windows Server Configuration

NetServer Cluster on Left

Two (2) Clustered Hewlett-Packard NetServer LXr8x00 Rack-Optimized Servers.

Each Server in the Cluster would have the following:

- 2 – 500 MHz Pentium III Xeon Processors with 1MB L2 Cache Per Processor
- Upgradeable to 8 Processors
- 768 MB RAM
- 2 – 4GB 10,000 RPM Hot Swap Ultra2 SCSI Hard Drives operating at RAID 5 (for Win 2000 OS only)
- 3 Standard Hot-Swap Power Supplies plus additional redundant Power Supply

HP SureStore E Disk Array Model 12H (formerly AutoRAID) in Rack Mount Enclosure

- 4 – 18.2GB Hot-Swap Ultra2 SCSI Hard Drives
- 2 Standard Hot-Swap Power Supplies plus additional redundant Power Supply
- Ultra-Wide SCSI Host Interface for both LXr8x00 Servers

77.5-Inch HP Rack System

- Cabinet with Standard 19-Inch Rack, Removable Panels, Casters, and Ventilated Roof Panel. 41U Height
- 19-Inch Rack Mount Monitor
- HP 4-Port KVM Switch
- Rack Mount Retractable Keyboard and Mouse

Cost of this server is approximately $68,000

Small CPAC Windows Server Configuration

NetServer Pedestal Model on Right

Hewlett-Packard NetServer LH4 Server, Pedestal Configuration.

- Two (2) 500MHz Pentium III Xeon Processors with 1MB L2 Cache Per Processor
- Upgradeable to 4 Processors
- 768 MB RAM
- 4 – 9.1 GB Hot-Swap Ultra2 SCSI Hard Drives
- Integrated Dual-Channel NetRAID Controller with I_2O Technology
- Internal DLT Backup Tape Drive
- HP M700 17-Inch Color Monitor
- Keyboard and Mouse
- APC SmartUPS 1400

Cost of This Server is approximately $24,000

DA Authorized Strength
FY00 Lifecycle Replacement Regions

CPAC/Installations	FY 00 Proj Total Svd Population*	Authorizations at Share of 1:80*	5% OH	EEO	Additional RESUMIX	Buy Number**
SE CPOC	29607	222	11.1		4	**238**
Anniston	2631	13		1		**14**
Benning	3546	18		1		**19**
Bragg	4159	21		1		**22**
Buchanan	529	3		1		**4**
Eustis	2488	12		1		**13**
Gordon	1856	9		1		**10**
Jackson	1420	7		1		**8**
Lee	1804	9		1		**10**
McPherson	1714	8		1		**9**
Monroe	1265	6		1		**7**
Rucker	1908	10		1		**11**
Stewart	1857	9		1		**10**
Sunny Point	538	3		1		**4**
USACE Charleston / Atlanta	298	1		1		**2**
USACE Jacksonville	846	4		1		**5**
USACE Mobile	1363	7		1		**8**
USACE Savannah	999	5		1		**6**
USACE Wilmington	386	2		1		**3**
ANCR CPOC	21124	159	7.95		4	**171**
Belvoir	3959	20		1		**21**
HQ AMC	976	5		1		**6**
HQ COE / Winchester Transatlantic	1761	9		1		**10**
HQ MTMC	712	4		1		**5**
Meade	1529	8		1		**9**
Myer	1699	8		1		**9**
P&ESW / Hoffman / Charlottesville NGIC	7951	40		1		**41**
WRAMC	2537	13		1		**14**
Total						**689**
Notes: - Target Ratios: 1:80, CPAC: 1:200, CPOC: 1:133, Printers: 1:8.						
- Fort McClellan not listed: BRAC 9/30/99.						
- Interns to use laptops (total 50), managed by CPOCMA.						

Source: RPMO, 30 June 1999

Preliminary Cost Estimate
FY00 Lifecycle Replacement Regions

Cost Component	Southeast Region	ANC Region
UNIX Servers	$ 228,415	$ 228,415
Windows Servers	462,000	318,000
Workstations	821,484	581,284
CPAC LAN Switches	106,000	58,000
Storage Jukeboxes	135,000	175,000
Printers	175,750	77,250
Scanners	1,000	1,000
TOTAL	**$1,929,649.00**	**$1,438,949.00**

Notes:

- Estimates based on saving sufficient resources to allow purchasing HP N-class servers for all 10 regions in first year. Consequently, cost savings that might not otherwise be recommended are included.
- Cost figures include reutilization of all current HP Windows servers, but do not include cost of upgrading those servers to level recommended to achieve full benefits from Windows 2000 NOS.
- Costs for Fibre Channel were not available and therefore are not included.
- Deployment costs are not included.
- Shipping costs for new equipment are typically included, however the costs associated with moving reutilized servers are not.
- Cost of ensuring switched 100Mbps LAN connectivity to 100% of workstations at the two CPOCs is not included in above estimates because it will be a FY01 expense when high-density switched port cards become available.