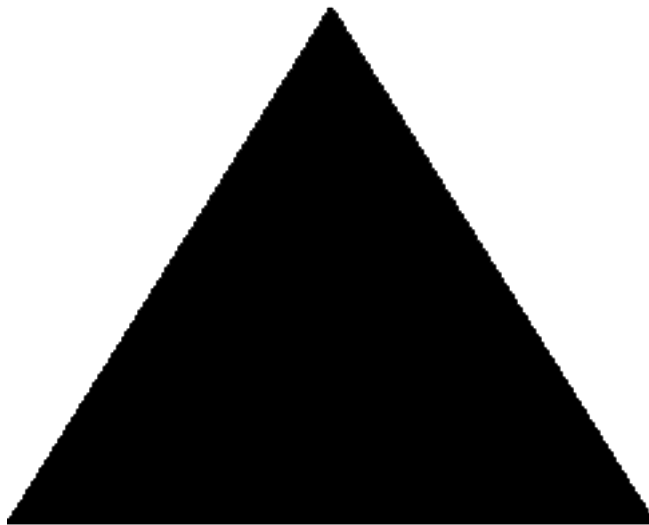




DIGITAL UNIX[®]: The Storage Advantage



Enhancing our ability to understand our environment and make smart, efficient decisions is *the* fundamental motivation for information technology (IT). IT's raw material, data, must be acquired, organized, stored, retrieved, and processed. This activity—*storage management*—is therefore fundamental to all computing.

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The Challenge of Storage Management

Every year business operations depend more completely on information technology. Whether it's making a profitable stock pick, optimizing crop yields, identifying superior customers, or simply supporting ever-growing user populations, storage management is critical. Virtually every application utterly depends on reliable, efficient data management.

Organizations must deploy the highest levels of data availability, accessibility, and performance. A system manager need only allow a system to lose some critical data to be sharply reminded of this by angry users. Data loss, while rightfully a nightmare, is hardly the only risk. Temporarily unavailable data can stymie business operations, as can data that arrives too slowly, impeding applications and user activities.

As system designers and system managers plan to meet their users' spiraling demands, they must also consider IT's need: storage that doesn't break the bank, that is easily assembled and configured, and that can be efficiently managed over time. Storage is crucial, but it cannot demand heroic support from either the CFO or the system management staff.

DIGITAL: The Storage Advantage

Storage management requirements may be as individual as the data and applications they support, but there is one simple solution: DIGITAL.

DIGITAL's renowned engineering talent and resources have been invested, yielding the best storage management tools available anywhere. From sector-level disk access through client/server access of sophisticated multi-terabyte storage farms, DIGITAL technologies effectively solve users' pressing data management problems.

Whether you're building a data warehouse, an on-line transaction processor, an Internet/intranet server, or "just" supporting a few thousand of your most important users, DIGITAL UNIX and DIGITAL StorageWorks products provide swift performance, continuous availability, easy management, and low cost-of-ownership—the superior capabilities to meet your needs.



Scenario One: Your Data Warehouse

The quest to improve the quality and timeliness of business decisions is constant. Every day executives ask themselves: What can we do better? How can we close sales faster? How efficient are we? What are our biggest sources of defects? How can we cut 20% off our production cost? What's the best stock or bond to purchase? For many of these questions, a comprehensive database mapping current conditions against historical data and trends can provide a better answer than was available—using any technique, at any price—just a few years ago.

That certainly has been the experience of American Airlines. It's bringing in approximately *200 million dollars* more revenue per year based on the superior seat pricing and allocation decisions afforded by just one yield-management application. While this may be a prime example, companies in virtually all industries report excellent return on investment from advanced decision support technologies such as data warehousing and data mining.

The problem, from a system design point of view, is that data warehouses expect and demand enormous repositories of data to scan for clues. Fifty or one hundred gigabytes—somewhat large for many operational applications—is just the starting point. Warehouses can run hundreds of gigabytes, even multiple terabytes. Within a few years, experts predict that 100 terabyte warehouses will be commonplace.

Company executives may be excited about the breakout possibilities, but those responsible for designing and maintaining such systems recognize the genuine challenge involved. This is particularly true considering two additional facts: *One*: Whatever the nominal size of the active warehouse, you'll need at least three to five times that much storage to accommodate load-unload operations, database indices, and other "incidental" uses. *Two*: Once implemented, there's no going back. Requirements tend to grow rapidly as warehouse-derived information and analysis becomes part and parcel of users' daily routines.

Clearly, users must implement world-class storage hardware and software. DIGITAL meets this challenge with a combination of high-performance, low-maintenance StorageWorks equipment and DIGITAL UNIX software.

Great Packages

A dozen years back, pundits discussed magnetic disks as though they were about as good as they could ever get. Technical barriers were said to be at the point where disks could improve no more. How funny that now seems! Today's drives hold 10 GB or 20 GB of data—more than yesteryear's entire data center—and they offer excellent performance and reliability. Mean time between failure (MTBF), an important statistical measure of

Many of the world's largest consumer-oriented companies turn to *Acxiom Corporation* for marketing data. Acxiom turns to *DIGITAL* for the compute power needed to turn its data into successful marketing campaigns.

Acxiom's 50 AlphaServers running *DIGITAL UNIX* drive *ten terabytes* of data. StorageWorks disk subsystems do the heavy lifting.

“DIGITAL has the technological advantage.”

reliability, ranges between 500,000 and 1,000,000 hours—between fifty and one hundred years. And they get better, by leaps and bounds, every year.

Subsystem

But even as good as individual disk drives have become, user requirements have grown even faster. Given a 10 GB disk, users will demand a 1,000 GB data warehouse, with a near-term extension to 10,000 GB. For servers, packaging many disks together into flexible, high-density, highly manageable subsystems is as valuable as ever. This is where StorageWorks, DIGITAL's multi-billion-dollar storage business, really shines.

StorageWorks is a master of high-impact storage engineering. The first organization to field a commercial RAID system, it revolutionized the storage world in 1994 with the first modular storage subsystem based on open SCSI standards. In recent years, even while some competitors refocused on proprietary interfaces, StorageWorks pragmatically improved the standard. It developed UltraSCSI, then in the true spirit of open standards donated the specifications and know-how back to the industry. StorageWorks has also helped develop the Fibre Channel standard, an innovation that's evolving simple storage channels into full-fledged storage networks.

Whether you're building multi-TB storage farms, increasing cluster availability with RAID subsystems, or just looking for the highest manageability in a JBOD (just a bunch of disks) configuration, StorageWorks is your first, best resource.

Great Interconnects

Move that data!

The very word "storage" sounds static, as though data were being put into an attic where it will lie unnoticed and unused for many years. Nothing could be further from the truth! Storage management in IT is as much about moving data from place to place, so that they can be processed in various ways. Data aren't just stored, but indexed and cross-indexed, moved to main memory and CPUs for processing then moved back, queried and correlated, and periodically copied to backup media. Stored data are data in motion.

This constant input/output activity can become a performance bottleneck. After all, the interconnections between individual disks, storage modules, and systems have limited bandwidth. When bandwidth is constrained, it should be made as large as possible, and used as efficiently as possible. In StorageWorks devices, it certainly is.



The SCSI storage interconnect—particularly the latest UltraSCSI implementation—is the workhorse. It moves data at up to 40 megabytes per second per channel. Many channels can work independently of, and in parallel to, one another. With multiple channels, virtually any required I/O bandwidth can be supplied.

As its inventors, we at DIGITAL are particularly proud of UltraSCSI. But UltraSCSI is just one of many technical refinements and practical innovations you will find throughout our product line. A highly modular enclosure supporting the hot-swapping of disk units was also a DIGITAL first. This pattern of innovation gets useful, sometimes downright essential, capabilities into your shop early, delivering value to you.

The pattern of open innovation makes our products maximally effective in your environment. Take for example StorageWorks Command Console, our PC-based tool that helps managers configure, adapt, and continuously monitor hundreds of terabytes of data distributed across multiple servers. It would be easy to provide this unified console feature solely for DIGITAL UNIX. Instead we've also made it work servers running HP, IBM, SGI, and Sun versions of UNIX, not to mention OpenVMS and Windows NT.

DIGITAL also supports another high-bandwidth interconnect, Fiber

s t o r a g e w o r k s

Channel (FC). Over the next few years, FC will become the industry-wide standard storage interconnect. Its achievable bandwidth, starting near 100 megabytes per second and climbing from there, is exceptionally good. Fiber Channel is also admirably flexible. It can form not just point-to-point links, but general networks. Users of OpenVMS Clusters will recall the star-couplers or CI networks DIGITAL delivered first in 1983. (Another DIGITAL innovation!)

While Fiber Channel enjoys notable advantages, it remains in its early days. During the 1998 and 1999 transitional period, the more mature UltraSCSI technology is likely to retain an edge in price/performance and device selection. But whether you choose UltraSCSI, Fibre Channel, or a combination of the two, DIGITAL stands ready with best-in-class storage products, supported through a world-wide, world-class services division. We'll help you pragmatically evolve your storage assets.

Easy Management

A logical approach

In applications such as data warehousing, a database management system (DBMS), a specialized package for on-line analytical processing (OLAP), or data mining software from a third party will control most high-level data operations. But DIGITAL UNIX does not just hand them an unstructured grab-bag of disk drives and say, “good luck!” No. DIGITAL UNIX provides a logical, ordered mechanism for coordinating the hundreds or thousands of individual disk units. Whether it’s for file systems, databases, system swap areas, or raw I/O, Logical Storage Manager (LSM) helps system managers efficiently manage their entire storage asset.

A database, for example, might require a 175 GB area. While you can’t yet buy a single 150 GB disk drive, LSM can make one for you by combining a number of 18 GB drives into a contiguous 180 GB “logical disk.” It can do the same trick with any combination of disks, of any size. Alternatively, if you have a 15 GB disk, LSM can partition it into a handful of smaller areas. LSM molds “what you have” into “what you need.” DIGITAL UNIX’s 64-bit addressing then ensures that programs can easily access any of it.

While it’s tailoring storage to fit, LSM also improves its quality. Striping data across multiple I/O controllers and disk spindles, for example, improves performance. Mirroring (sometimes called shadowing) stores data on several disks in lock-step. If a disk or controller goes bad, the inherent redundancy keeps storage available. The automatic management of multiple I/O paths means system managers don’t have to sweat the details. Beyond today’s RAID Level 0 and Level 1 features, LSM’s next release will integrally provide the RAID Level 5 favored in many transaction processing applications. For customers wanting to maximize efficiency in hardware implementations of RAID, LSM works just as well with RAID devices as with simple disks.

Small Scale: LSM Nice.



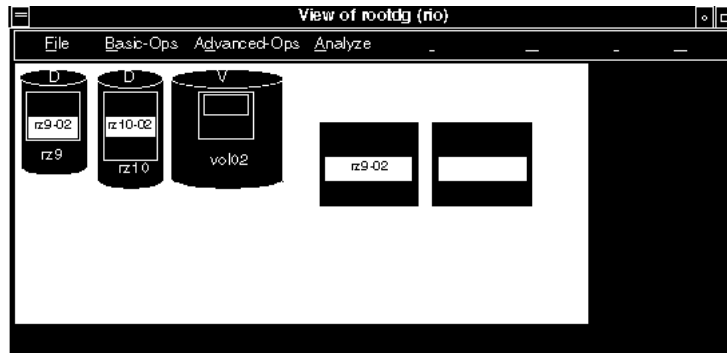
Large Scale: LSM Essential!



With small systems and a few disks, managers can get by with no special tools. But keeping track of hundreds of disks or more in a large system, much less changing their configuration over time, can be a nightmare without end. As a part of ongoing DIGITAL UNIX system operation, LSM is a system manager’s best friend. It allows managers to dynamically configure and tune storage, without getting in the way, without taking storage off-line or requesting low-level operations, and without adding any hassles to the already-overburdened manager’s day.

LSM’s goal in life is making things not only easier, but *much* easier. Consider its interface, which graphically maps the “big picture” layout and shows real-time updates. Color-coded areas show what is happening from second to second. Disk hot-spots are highlighted. Detailed break-out

data are just a mouse click away. Managers needing to rearrange storage or tune performance characteristics can do so, in real time, with just a few mouse clicks and drags. Such power makes coordinating even very large numbers of disks not only feasible, but straightforward. It's just one way DIGITAL UNIX makes your job easier.



LSM is a good example of DIGITAL UNIX's overall philosophy. It upgrades configurability and manageability, but in a sensible, low-overhead way. Just one powerful tool works with the entire range of hardware devices, be they individual disks or independent disk arrays. There is no mixing and matching of "this tool for that kind of disk" or "sorry, no tools available for that workstation or that kind of storage." It's DIGITAL. It just works.

The Right Database Server

The crowning achievement in many data-centered configurations is the database server itself. DIGITAL partners with the leaders in the database field to optimize AlphaServers for the highest-throughput, largest-capacity databases. World-beating benchmark runs—on both industry-standard benchmarks and customer applications—are the result. Whether your choice of DBMS provider is Informix, Oracle, Sybase, or some other, we've got you covered!

Scenario Two: Your *net Server

Whether you call it client/server, the Internet, an intranet, an extranet, or just a 'net, the value of network-based computing is now widely recognized. Its flexibility and power comes as no surprise to DIGITAL, which has been helping customers build and improve their networks for nearly *twenty years*.

*DIGITAL knows
networks!*

Ethernet, DECnet, stackable hubs, ISO/OSI, FDDI, and gigabyte-per-second switches represent just a few of our early innovations. Whether the protocol is NFS, Kerberos, X Windows, or the Web, DIGITAL helped develop it, then delivered great products early and often. Recent years have seen particular wins in Internet-based technologies, including our world-leading AltaVista™ search engine, encrypting packet tunnels, and world-beating NFS and Web benchmarks.

A Fast Engine

The first thought when building a network server is, well, networking prowess. How efficiently does the platform support large amounts of data constantly in transit from applications through network protocol stacks? How does it handle the frequent interrupts and high throughput that inundate servers in packet-driven networks? If it's DIGITAL UNIX, the answer is: Very well indeed.

DIGITAL UNIX was designed from the ground up to be a great application engine. Its SMP-tuned, highly multithreaded, 64-bits everywhere design easily handles thousands of independent concurrent activities with no problems, no hiccups, and no throughput glitches. Its highly-optimized TCP/IP networking stack combines with its ability to support gigabytes of physical memory and hundreds of PCI I/O cards to make it a fast, rock-solid network server.

Keeping Track of Data

A fast, efficient HTTP or NFS server is of course essential, but it's hardly the whole story. Often overlooked is that you also need an efficient, easily managed way of keeping track of the files being served.

AdvFS: a fundamentally better design

DIGITAL UNIX steps up to this task particularly well with its Advanced File System (AdvFS). Though AdvFS uses familiar UNIX interfaces, DIGITAL engineers have completely rethought how filesystems should work. The result is superior availability, flexibility, and manageability. Industry analysts Illuminata, Inc. call it "the best UNIX filesystem, bar none." We think that says it pretty well!

Practically Infinite Scalability - AdvFS, a 64-bit file system running on a 64-bit processor, completely erases the 2 GB limit imposed by older 32-bit UNIX file systems. If the difference isn't immediately obvious, consider that 64-bits is over *four billion* times larger than 32-bits. If a 32-bit store can hold the name, address, and other personal information for everyone within a city block, 64-bits could hold the same information for everyone in the entire world since the beginning of time. This has an enormous practical impact: whether it's a 50 gigabyte animation sequence, a 300 gigabyte engineering simulation, or a 6 terabyte database file, AdvFS can handle it. You don't have to worry about it, or indeed about any size limitations. AdvFS can manage terabytes of on-line storage—as much as any organization can afford.

Highly Manageable, Always On-line - AdvFS allows system administrators to respond to changing system requirements. While Windows NT and other UNIX implementations often require users to be kicked off the system for routine updates, AdvFS can be configured or reconfigured on-the-fly. Disks can be added or removed, file systems can be enlarged or reduced, filesystems can be moved among disks, files can be consolidated for contiguous allocation, and backups can be performed—all on-line. There is no need for single-user maintenance mode, and no "file-out-to-backup-tape, then reconfigure, then file-it-all-back-in" cycles. AdvFS works on root disk volumes or secondary disks, without gratuitous restrictions. This process saves time and money, and keeps system managers from tearing out their hair.

A Superior Approach - Other UNIX implementations tightly bind directory structures to physical storage layout. While simple to implement, this approach severely limits scalability, flexibility, and manageability. DIGITAL UNIX does it better. By separating the logical appearance of a file from the details of its physical storage, AdvFS transforms the storage problem. Instead of making striping, data placement, and other optimization decisions on a coarse disk by disk basis, managers can make them on a precise file-by-file basis. Have only a few files that would benefit from striping? Fine—stripe only those files. Are just a handful of constantly accessed files—your *index.html* or your

database index—the bottleneck? Fine—move them to your fastest disk drives, or to solid-state disks. Most file systems make these changes invasive, visible to users, and likely to break applications. With AdvFS, it's simply a system manager's business where and how a file is physically allocated. That implementation can be changed over time to meet changing needs, with users and applications none the wiser.

Extraordinary Flexibility - AdvFS can put whatever kind of storage you have, today or tomorrow, to coordinated use. Different makes of disks? Some large ones and some small ones? Some fast ones and some slow ones? Some older ones and some new ones? Different recording technologies (magnetic, magneto-optical, and solid-state)? Some RAID storage and some “plain storage”? Whatever! Diversity is not a problem. AdvFS eliminates the typical constraints of homogenous storage, easily integrating different devices and recording technologies. Whatever units you have, AdvFS allows you to use them together in a coordinated way.

Rapid Startup and Restart - Other UNIX implementations, as a part of their startup operations, must exhaustively scan disk storage using the oft- and rightly-maligned `fsck` utility. They search for structures that may have been damaged in the power-down, and then try to repair them. The larger the storage configuration, the longer `fsck` runs—tens of minutes is not uncommon for large file systems, even longer when using slow optical storage. AdvFS, in contrast, always restarts in seconds, regardless of the size or speed of storage used. Like DBMS engines, DIGITAL UNIX always updates on-disk data structures in well-defined transactional units. Should a sudden power outage or hardware failure shut the system down, the next time AdvFS starts up it need only scan the most recent entries in its transaction log. Incomplete updates are rolled back, quickly bringing storage to a consistent, ready-to-use state. Even after problems, AdvFS can always rapidly return to useful work.

Maximizing Performance - AdvFS helps maximize application performance. One unique way is its ability to mix and match different kinds of storage with different performance characteristics, then migrate files between these implementations without changing the file's user-visible organization. Depending on an organization's data access patterns, an optional Hierarchical Storage Management (HSM) module may be used to automate the migration of files among different classes of storage. This is particularly valuable for those with many files of varying age and usage patterns—file servers and web servers, for example.

Another performance win is the ability to “defragment” files. Defragmentation makes the data blocks constituting each file physically contiguous on disk. This reduces disk head motion—a slow mechanical operation—yielding much higher data transfer rates. Like all other AdvFS operations, files can be defragmented on-line.

AdvFS provides exactly what system managers need for high-performance, high-availability, commercial-grade storage configurations. It out-classes the competition at every turn.

Clustered Storage

DIGITAL knows clusters. We pioneered the approach and are the leading champions of combining multiple systems into a coordinated team. As you would expect, DIGITAL UNIX's storage management accommodates cluster configurations at all levels. The world's largest file servers are in fact clusters of AlphaServers. Both file and DBMS sharing understands clustering, so that if one node for whatever reason goes down, another stands ready to assume its work—access to your data is not only preserved, hardly anyone notices that anything has happened. This level of attention extends to backup/restore and other areas that, while not necessarily the first thing one thinks of making cluster-savvy, are critically important to those operating clusters day-in and day-out.

In the same way that we set the bar today with LSM, AdvFS, TruCluster, and related tools, DIGITAL UNIX's already excellent storage management will soon make another leap. A coming TruCluster release includes a new Cluster File System (CFS) that builds upon AdvFS to give users completely transparent file access across a highly available cluster configuration. The benefits are many:

Lycos, Inc. operates one of the Internet's most popular search and retrieval services. Millions of users rely on it as the cornerstone of their Web experience. Lycos in turn relies on *DIGITAL* technology to support its fantastic volume of on-line activity—*over 100 million requests each month.*

“the power and expandability to keep up with the exponential growth companies like ours derive from the Internet.”

Simple Cluster Configuration - DIGITAL's TruCluster software has greatly increased application availability, providing uptimes comparable to proprietary mainframes and fault-tolerant systems at a small fraction of the cost. CFS and other TruCluster features provide what is known as *single system image*, the illusion that all parts of the cluster are just one machine. As a result, CFS makes configuring and managing a cluster no more difficult than managing a single system!

Transparent, Highly Available Access - Should either a problem or planned hardware maintenance take down one clustered server, users need never see a disruption. Other servers on the team jump in to handle the down server's file access responsibilities. Whether it's a web server, a database server, or a file server, this is one basket in which all your eggs will be quite safe.

Transparent Load Balancing - When access is transparent across a cluster, a number of valuable optimizations are quite simply deployed. System managers can organize content for Web and file servers, for example, so that the load is spread across multiple servers. Because users need not see what server is actually responsible for retrieving information, managers can easily reorganize to meet changing access patterns. All users know is good performance and the standard interface.

AdvFS Advantages - The Cluster File System is a major advance. Better yet, in a way that seems all too rare in computing, CFS doesn't ask you to

abandon what you installed last year, or the year before that. CFS builds on DIGITAL's Advanced File System, yielding all of AdvFS's optimizations, ease of use, and ease of management in addition to CFS's own cluster enabling capabilities.

*You are never satisfied.
Nor are we! Continuous
improvement is a part
of the DIGITAL culture.*

And More to Come - Just like our users, DIGITAL's engineers are never satisfied. No matter how good our existing product, we can make it better, and we intend to. Clustering is our pride and joy, and definitely an area where we'll innovate rapidly, just as we've done from the industry's inception. Advanced capabilities such as the node-to-node migration of running processes are already in the works.

Scenario Three: Your IT Department

IT departments are pressured from all sides. *Keep costs down!* competes with *Provide excellent service!* A heterogeneous network, rapidly evolving applications and requirements, disparate client departments and the need for rapid deployment complicate the job further. You'll be glad to know that DIGITAL doesn't add to the complexity. We make it easier.

Safe Data, Wherever They are Found

DIGITAL is widely known for its exceptional product development capabilities. DIGITAL UNIX, AdvFS, and TruCluster software are excellent examples. But DIGITAL is equally committed to making the buy-not-build decisions that deliver crucial economies in today's IT marketplace. If another vendor offers to license a high-quality capability, it makes sense to adopt that rather than building our own unique product. (This is an attitude from which the competition could learn much!) A good example comes in the area of backup and restore. In addition to supporting products such as Spectralogic's Alexandria and Veritas' NetBackup, DIGITAL has partnered with Legato Systems to develop its NetWorker product.

NetWorker handles backup, restore, and archiving functions for a huge variety of UNIX and non-UNIX systems. It supports magnetic disk, optical disk, tape (4mm, 8mm, 0.25", or DLT—your choice, in any combination), automatic tape changers, optical disk jukeboxes, or virtually any other backup mechanism. Backup devices can be either directly attached or available across a network. NetWorker advantages are many:

Set-and-Forget - Managers specify backup policies, not micro-details. Just specify how and when backup operations should occur, then leave the work up to the software. Managers need not be involved in executing the detailed steps. NetWorker automatically invokes desired backup events at pre-defined times.

Smart Recovery - Backing data up is relatively easy. Restoring files once something has gone wrong, on the other hand, is often harder. Just finding the right tape and the right file among a billion gigabytes is a tremendous hassle! But not with NetWorker. It maintains an on-line index of all backed-up files. Using a graphical interface, managers or users can easily restore individual files, groups of files, or whole disk volumes. Again, the software does the hard work.

Client/server Coordination - NetWorker protects many systems simultaneously, running from a single server. This client/server design means that managers need master only one program in order to protect a range of UNIX systems, PCs, and other platforms. Centralization reduces training costs and makes for better utilization of backup devices and other

Find out why organizations such as *Best Western International* are finding success with *DIGITAL* solutions driving their IT operations.

“With our new AlphaServer, we’re delivering subsecond response time to users even during peak periods.”

resources. By backing up many clients in parallel, NetWorker writes enough data to enable full-speed streaming operation, where tape devices are most efficient.

On-line - In keeping with all of DIGITAL's storage devices, systems can be backed up while users and applications continue working, without disruption. This works particularly well in concert with AdvFS, a filesystem designed for on-line backup.

Full support for AdvFS and TruCluster Software - All AdvFS 64-bit files and extended attributes are perfectly preserved. Combined with AdvFS's cloning and split-mirror features, on-line backups are efficiently made. In a clustered or network server environment, even if the server on which a backup is executing goes down, the backup job is not corrupted, and it can be picked up where it left off on another server after application failover. Backup configurations and storage assets can be redefined on the fly, making save and restore operations totally compatible with the day-to-day needs of clustered operation.

Advanced Features, Simple Interface - A unique feature of DIGITAL's NetWorker, Save Set Consolidation makes network backups particularly effective. Managers can consolidate a single full backup plus a number of incremental backups into a full backup. This little bit of magic means that exhaustive backups need be done only once. Over time this eliminates enormous amounts of network traffic and drastically reduces backup times. But advanced features don't require a complex interface. Even novices can easily navigate NetWorker's simple graphical interface to access backed-up data or configure backup parameters.

DBMS Integration - DIGITAL's NetWorker offers direct support for online backup of Oracle and Informix databases. Combined with high-performance AlphaServers and StorageWorks subsystems, you can expect data to be protected at a rate of hundreds of gigabytes per hour.

Data Where You Want Them

DIGITAL UNIX provides multiple ways of accessing data in a networked world. The World Wide Web (WWW) has revolutionized how data are presented to users. Traditional file-based mechanisms are also much needed. DIGITAL UNIX servers provide high-quality access to both UNIX and non-UNIX clients through the Network File System (NFS) and Advanced Server for UNIX.

Network File System - NFS is the *de facto* standard for distributed file access in the UNIX world. Many vendors support NFS, but few as well as DIGITAL. DIGITAL UNIX systems can be servers, clients, or both in the

NFS world. They can use the customer's choice of the older NFS V2 protocol or the current NFS V3. V3 is preferred, having a much more efficient "over-the-wire" protocol, more aggressive client-side data caching, and more asynchronous operation. Overall the new protocol significantly reduces the wait times associated with network-connected storage. Just as important as the speedup seen by individual clients, NFS V3 lowers the load on network servers. Reducing the per-client load allows networks to scale to more clients. These advantages are why DIGITAL implemented the newer protocol—in 1994, long before HP, IBM, or even NFS's original developer, Sun.

Prior investments are respected and protected.

Compatibility with past investments is an imperative at DIGITAL, so of course we also support older NFS V2 servers and clients. The principle is simple: provide advanced capabilities where possible, but support installed systems well. A related instance is our continuing support for Prestoserve, a hardware accelerator for NFS clients restricted to the NFS V2 protocol.

If your needs are truly large, TruCluster software can couple multiple AlphaServers and storage devices into the world's largest NFS-serving clusters for organizations fielding hundreds or thousands of workstations. DIGITAL has a long history of expertly configuring the network infrastructure required for large-scale deployment.

Distributed File System - NFS is the *de facto* standard, but some organizations prefer DCE's Distributed File System. DFS introduces an architecture, naming scheme, caching strategy, and hierarchical management structure optimized for very large networks spread over great physical distances. The larger and more geographically dispersed an organization is, the more helpful DFS features become. DFS thus appeals most to those building integrated nation-wide or world-wide networks.

Personal computers and PC LANs are a vital part of the picture.

Advanced Server for DIGITAL UNIX - Personal Computers are the ubiquitous information appliance. They represent a natural client for UNIX servers. Some customers choose to implement NFS on their PCs, making them regular clients in TCP/IP networks. Most clients will benefit from a PC-centric approach. DIGITAL UNIX does this with Advanced Server. Advanced Server provides data to DOS, Windows 3.x, Windows 95, OS/2, Windows NT, and Macintosh desktops in their native formats and using their native protocols. The Advanced Server for DIGITAL UNIX also offers cluster support for highly available file and print resources. Organizations can consolidate not only file storage, but backup, performance optimization, and data integration atop high-performance, easily-managed UNIX servers without sacrificing the PC's familiarity and simplicity.

Conclusion

DIGITAL UNIX's 64-bits-everywhere design yields the safe, efficient, highly scalable environment required by today's IT professionals. It provides the industry's best storage management software, building upon award-winning, high performance, flexible, densely-packaged StorageWorks subsystems.

Whether you are building a multi-terabyte data warehouse, running thousands of transactions or web hits every minute, or rapidly providing data to thousands of users, DIGITAL's storage management solutions and know-how are the superior choice. Whatever your application, DIGITAL *is* the storage advantage.