CASE STUDIES AND BEST PRACTICES

Deploying a Unified Storage Infrastructure for CATIA Design Environments

NetApp and INCAT International Ltd.
January 27, 2004 | TR-3299

ABSTRACT

In today's unforgiving business climate, product manufacturers and component suppliers face a number of critical business and operational challenges in their ongoing quest to design and manufacture products faster and at a lower cost than their competitors. These challenges include accommodating rapid data growth, managing complex IT environments, providing continuous data availability, improving data reuse, and enabling better collaboration between product design, development, and manufacturing groups. Product lifecycle management (PLM) solutions such as CATIA, combined with unified storage solutions from NetApp and specialized services and software from INCAT, can help manufacturers and suppliers meet these challenges and successfully grow their businesses.

This paper defines the business and operational challenges manufacturers and suppliers face, reviews the benefits associated with corresponding solutions and services offered by NetApp and INCAT, presents two real-world case studies (Britax Aircraft Seating and Renault F1 Team), discusses the deployment of NetApp storage solutions in CATIA environments, and presents a series of suggested best practices.

This paper is intended for mechanical engineers and IT staff members who are interested in learning more about NetApp® deployments in leading-edge CATIA PLM design and development environments.

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1 INTRODUCTION: THE CHANGING CATIA ENVIRONMENT

Dassault Systèmes is a world leader in advanced 3D PLM solutions. Its CATIA software product is an integrated suite of computer-aided design (CAD), computer-aided engineering (CAE), and computer-aided manufacturing (CAM) applications for digital product definition and simulation.

CATIA V4 is a solution based on UNIX® with a very large installed base. CATIA V5 is an entirely new, next-generation solution for both UNIX and Windows® environments. CATIA V5 forms the cornerstone of a true integration of people, tools, methodologies, and resources within the enterprise. It provides an advanced PLM solution for collaborative product design, development, and manufacturing.

Typically, engineering departments support CATIA V4 deployments because IT departments do not always have the required UNIX expertise. Now, because of its ability to support Windows, IT staff can support CATIA V5 deployments. This creates the opportunity to bring engineering and IT "closer together," free up engineering resources, and provide engineering staff with easier access to productivity based on Windows such as Microsoft® Office, e-mail, and Internet access.

2 BUSINESS CHALLENGES

2.1 Speed Time to Market

The primary business challenge that faces product manufacturers and component suppliers is how to get the finished product out the door faster and for less money than the competition can. Time-to-market pressures include increasing consumer demands, increased competition, and rapidly changing industry trends. Today's compressed product lifecycles mean that manufacturing companies have a much smaller window to research, design, test, and manufacture new products. In addition, increased competition is driving collaboration requirements for globally diverse design and development teams.

In the highly competitive automotive market, for example, 80% of the total revenue from a new car model is typically realized within the first seven months after release. What's more, approximately 80% of the market share goes to the first two manufacturers to release their new products into the marketplace.

Regardless of the industry, even a minor delay in product delivery can negatively impact ongoing revenues for years to come.

2.2 Reduce Costs

Today's global competitive landscape and difficult economic realities create downward pressures on product prices, which means that manufacturers must slash costs in order to maintain profitability. At the same time, IT budgets are dramatically reduced. The net result is that businesses in general—manufacturers in particular—are being asked to do more with less.

3 OPERATIONAL CHALLENGES

3.1 Manage Rapid Data Growth

As shown in Figure 1, the product design and development process typically includes five stages: concept, design, analysis, manufacturing, and field support. With each step in this process, the volume of complex design and manufacturing data grows exponentially—while the need for effective data access, sharing, capture, and protection becomes increasingly important.

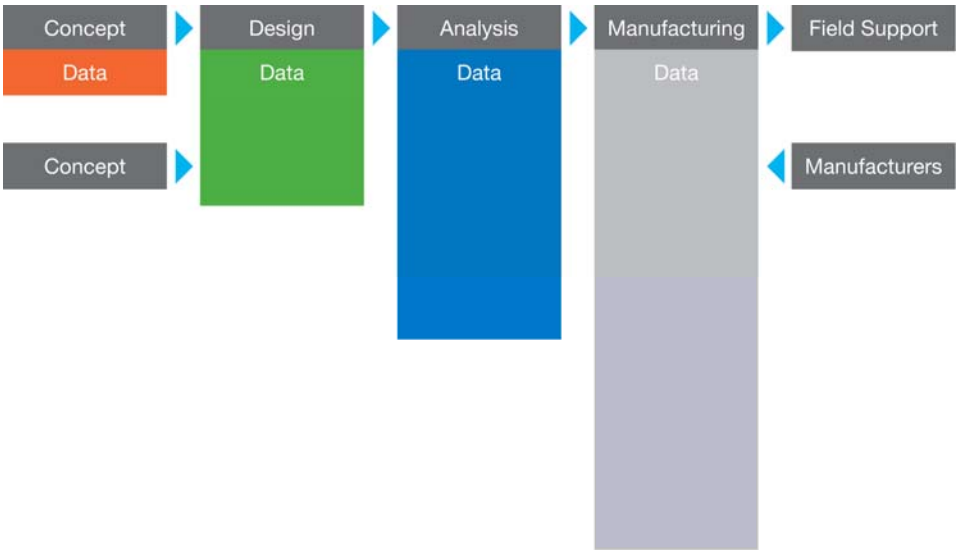

Figure 1) The design process drives exponential data growth.

3.2 Reduce Complexity and Enable Interoperability

Product development environments are extremely complex in their topology, administration, and use. They encompass multiple platforms, sophisticated application requirements, and increasing information availability needs for both dynamic and read-only data. Despite the environment's inherent complexity, design and engineering teams require seamless system accessibility and interoperability. For companies with such requirements, the ability to dependably share and access information is vital to the product design, development, and manufacturing process.

As CATIA customers migrate from a homogeneous UNIX environment to a heterogeneous V5 UNIX and Windows interoperability environment, the design and development process will grow even more complex. Diverse users will need to be able to seamlessly access the same data using different protocols.

3.3 Increase Data Availability

As mentioned earlier, data tends to grow exponentially with each successive step in the product design and development process. As data continues to grow, so does the overall risk associated with the potential loss of that data. Data sets and files associated with the design and analysis stages are especially mission-critical. The level and quality of data management have a direct effect on engineering performance and productivity—and ultimately on the company's time to product and time to market.

Data availability and management are further complicated by the remote and heterogeneous product design and manufacturing environments supported by CATIA V5. Comprehensive data protection to ensure the utmost data availability and accessibility is imperative. Time lost due to unplanned system outages, interoperability conflicts, or user error—as well as from planned downtime for backups or upgrades—hinders a company's profitability.

3.4 Improve Data Reuse

The concept of data reuse, which includes referring to older versions of design data or calling up sets of read-only data, was born of the manufacturing industry's process and regulatory requirements. Increasingly, government regulations and industry best practices call for manufacturers to maintain authentic design data in reference form over extended periods of time for safety, repair, and liability purposes. In addition, engineers need to reuse historic design data in the creation of new products and components to uphold design consistency, reduce product costs, and speed time to product and time to market. What's more,

legal, marketing, and other staff frequently seek access to read-only data sets, such as crash-test or simulation-run results, in coordination with their work.

In order to maintain the most efficient and cost-effective total data access, different types of data must be matched with different data storage solutions. The result is an ongoing dilemma concerning how much availability and performance should be sacrificed in the name of cost. Historically, manufacturers have been forced to store this class of data either on more expensive online storage or on less-expensive—but also less-accessible—optical and tape library archived storage.

3.5 Enable Design Collaboration

By nature, most CATIA V5 customers require large-scale, constant, and efficient data access and sharing across geographically distributed environments. These companies typically employ tens of thousands of mechanical engineers, designers, support staff, independent contractors, and business partners in order to complete sophisticated product concept, design, manufacturing, and field support tasks. Multiple specialty groups, such as finance, marketing, purchasing, manufacturing, partners, and even customers, are intimately involved in the product development process. These specialty groups all have different roles and are often located at different sites both inside and outside of the company's firewall.

As a result of this highly collaborative process, isolated islands of critical data reside on multiple servers at many different IT locations around the globe. Teams must be able to communicate and work ably and economically, regardless of where individual members and data physically reside. Each team member must be able to easily reach data locally, independently of the data's original source, or the entire organization loses valuable time to market.

3.6 Enable IT and Engineering Collaboration

In many product manufacturing companies today, the IT and engineering departments operate in separate functional silos. As a result, IT does not benefit from the company's inherent engineering expertise, while engineering does not benefit from the IT department's knowledge. It is not uncommon to see the engineering department having to maintain its own systems due to a lack of UNIX expertise in the IT group. What's more, this separation of expertise means that engineers are often not benefiting from easy access to basic Windows productivity tools such as Microsoft Office, e-mail, and Internet access.

From a storage standpoint, this functional separation means that storage solutions are often deployed in a piecemeal fashion. When the IT and engineering departments operate as functional silos, the company as a whole is not in a position to benefit from application-independent storage deployments that offer a unified repository for all types of company information.

4 MEETING THE CHALLENGES

4.1 Implement NetApp Unified Storage Solutions

While CATIA software provides for a more efficient product design and development process, NetApp storage solutions provide for the most efficient use of resources for data management, software distribution and upgrades, local and remote collaboration, data protection and backup, information lifecycle management, and disaster recovery. NetApp solutions address time-to-product and time-to-market needs by reducing idle time, rework time, and administrative time.

Highly available NetApp solutions guarantee that product manufacturing companies will achieve high-performance delivery of vital data when and where it is needed. NetApp offers scalable, flexible, and cost-effective storage solutions that incorporate a unified, multiprotocol storage platform with feature-rich data and resource management software. Storage capacity additions and data protection tasks can be performed with little or no downtime.

NetApp storage solutions meet the challenges faced by product manufacturers, including:

- Rapid data growth. Fully scalable NetApp storage solutions are ideally suited for the massive storage requirements inherent in CATIA product development environments. Supporting cohesive access to

both network-attached and storage area network data, NetApp solutions increase data availability, simplify data management, improve staff productivity, lower costs, and cut time to market.

- Complexity and interoperability. NetApp multiprotocol storage solutions unite complex, disparate systems, improving both interoperability and accessibility. Native support of NFS and CIFS eliminates the need for emulation software, such as PC-NFS or Samba, and allows Windows and UNIX clients to share the same copy of data.
- Data availability. NetApp delivers the ultimate security in multiplatform environments, offering manufacturers the highest levels of data availability. The unique NetApp Snapshot™ capability provides quick recovery of deleted or corrupted data files. In addition, online disk expansion can minimize planned downtime.
- Data reuse. NetApp offers efficient solutions that bridge the data reuse storage gap. Manufacturers sacrifice neither availability nor budgets because they match the right class of storage with the appropriate data.
- Design collaboration. NetApp storage solutions allow the most effective remote collaboration for product development via centralized data oversight, local file caching, and unique data replication software.
- IT and engineering collaboration. NetApp storage solutions provide complete interoperability between Windows and UNIX platforms, allowing IT and engineering groups the ability to fully collaborate and share resources, responsibilities, and expertise. NetApp application-independent storage deployments offer a unified repository for all types of company information.

In summary, NetApp unified storage solutions deliver increased staff effectiveness, reduced operating costs, faster time to product and time to market, and the benefits of innovative Dassault and NetApp and INCAT and NetApp business partnerships.

4.2 Deploy INCAT Services and Software

INCAT is a leading worldwide services and software provider specializing in development and manufacturing environments for the automotive, aerospace, and shipbuilding industries. INCAT has a long association with Dassault Systèmes and NetApp, providing customers with both professional services and products. The company designs and implements IT infrastructures to support computing and data management for product design, engineering, manufacturing, and supply chain collaboration. As a full-service consultancy, INCAT supports a complete range of implementation services.

INCAT works collaboratively with manufacturers and their suppliers to optimize the product design process. The company delivers competitive advantage by continuously improving the productivity of people, processes, and technologies, thereby helping manufacturers transform the way they design, produce, and support products throughout their entire lifecycle.

The INCAT Products Group has been creating software applications for over 10 years. Verifi is an INCAT verification and analysis system that allows manufacturing customers to identify the CATIA V5 compliancy level of their existing CATIA V4 data prior to the actual V4-to-V5 data migration. Verifi interrogates and, when applicable, resolves noncompliances in CATIA V4 models, individually or in batch mode (see Figure 2).

Verifi also produces thorough reports identifying significant issues that impede data migration (see Figure 3). And Verifi can be configured and customized for individual environments, allowing automatic clean-up of known compliancy issues and reporting of others, depending on customer specifications.

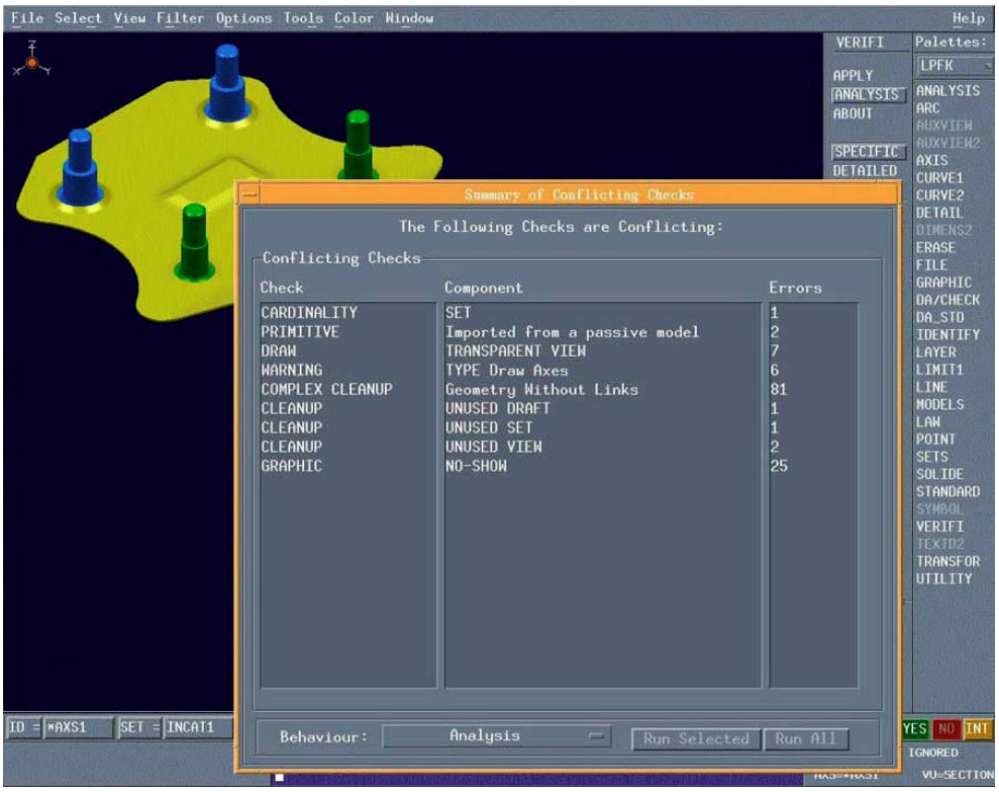

Figure 2) Verifi identifies CATIA V5 compliancy level of CATIA V4 data prior to V4-to-V5 migration.

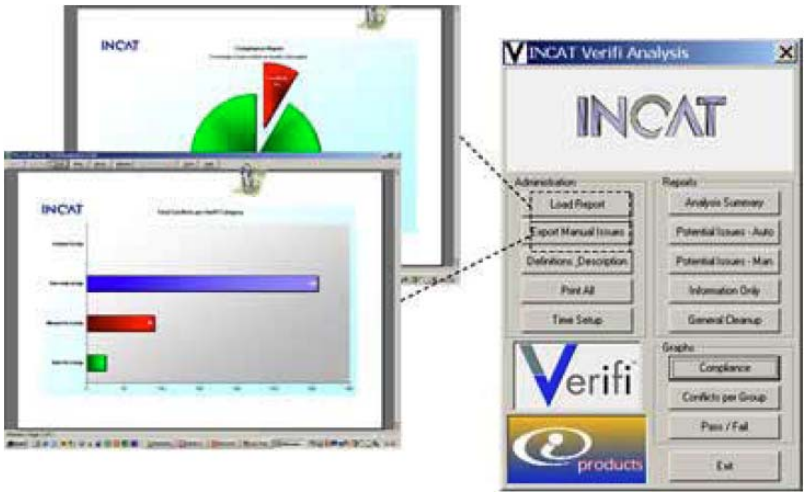

Figure 3) Verifi produces reports identifying significant issues that might impede data migration.

5 CASE STUDIES

5.1 Britax Aircraft Seating

Britax Aircraft Seating in Cwmbran, South Wales, is a subsidiary of Britax Premium Aircraft Interior Group (PAIG), one of the world's leading suppliers of innovative and premier quality aircraft interiors. Over 30% of all operating aircraft with more than 100 passenger seats have interior components from Britax PAIG, which has operations in the UK, Germany, and the United States.

With more than 70 CATIA seats at Cwmbran and at its second site at Camberley, Surrey, Britax Aircraft Seating was experiencing problems with server data storage space and with the performance of its IT systems. The company also needed to be able to service the demand for additional working hours and provide increased availability of its design systems. Britax partnered with INCAT, which was able to deliver a comprehensive IT solution based on hardware from NetApp and other leading vendors and backed by a support offering to all Britax sites globally.

5.1.1 Increasing Reliability and Availability

To achieve the resilience Britax required for its users, INCAT installed NetApp storage systems at both the Cwmbran and Camberley sites. The benefits for Britax included sufficient capacity for data growth over the next three to five years. The solution also delivered improvements in the availability and reliability of the IT system. Part of this solution included the installation of a gigabit storage area network (SAN), which improved speed and capacity for data transfer, significantly reducing data access times and therefore increasing productivity for Britax users.

5.1.2 Eliminating the Eight-Hour Backup Process

NetApp Snapshot technology installed by INCAT provides additional security and functionality by allowing multiple copies of the entire data set stored on the NetApp storage system to be created almost instantly. Recovery and backup of individual files or the full system are carried out using any of the Snapshot records created, with no interruption in service. Backing up against a Snapshot record increases system availability. The previous process would normally take eight hours, but by using one of the Snapshot copies, the system is continually live and still available to the users during the backup procedure, providing improvements in the system uptime and reducing the backup administration.

5.1.3 Reconfiguring Applications

INCAT then drew on its specialized knowledge of the CAD data management software Enovia VPM and the DB2 database as used by Britax to reconfigure these applications to complement the functionality of the hardware that was installed. It is now much easier to access, back up, and restore large volumes of design data and at the same time eliminate instances of corrupt data.

Easier operation, increased availability, and more resilience have greatly reduced the system administration load for Britax and provided reliable data management for its designers. INCAT supplied hands-on training for administration and formal training and support for the CATIA systems. Working remotely using secure Internet connections, INCAT engineers can resolve problems online and so provide remote monitoring.

5.1.4 Migrating from UNIX to Windows

Resulting from the successful deployment of NetApp storage systems for design applications, INCAT has also become involved in the next major project for the Britax IT department. This involved the migration of its Baan enterprise resource planning (ERP) system, which maintains business systems at three Britax organizations. The existing UNIX servers have since been replaced by units based on Intel®, with the INCAT-supplied NetApp storage systems providing additional terabytes of necessary high-speed storage space. This change provided considerable cost savings for Britax, as the Windows support costs and administration for the NetApp storage system are significantly less than they were for the previous UNIX systems.

Furthermore, Britax is using INCAT to help consolidate its 44 Windows servers. The vast majority of these are being phased out, as they are used solely for file serving. This function is now provided directly by the NetApp storage systems, greatly reducing the administration load, saving on licensing costs, and providing improvements in reliability, security, and availability.

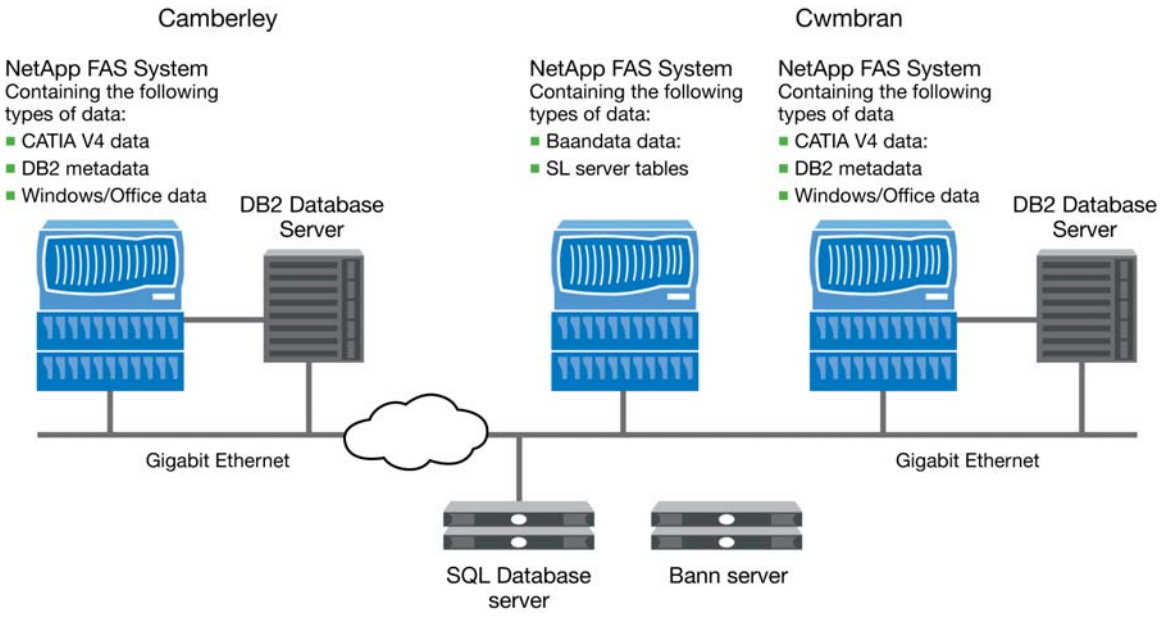

Figure 4) Britax Aircraft Seating storage infrastructure.

5.2 Renault F1 Team

The Renault F1 Team is a motor racing organization that competes in the Formula 1 world championship racing circuit—the pinnacle of motor racing. The team employs over 750 staff operating from two bases: the UK for the chassis and aerodynamics and France for engine development. Between March and October, the team travels to 17 Formula 1 races around the globe.

The Renault F1 Team is responsible for the design, manufacture, and sourcing of all parts, as well as the assembly, testing, and running of its race cars. Over the course of each season, the design of the high-performance car is continuously improved, and as much as one-third of the vehicle might be changed during the eight-month race season. When the racing finishes in the winter, the team concentrates its work on the following season's car, making this a year-round operation.

5.2.1 Managing Large Volumes of Data

Using CATIA V5, over 50 designers work full-time on vehicle development. During a single season, they will produce over 10,000 new technical drawings while accessing thousands of drawings from the previous three years. There are over 80,000 components on a race car, and the team logs each individual part—down to the last nut, bolt, and washer.

The sheer scale of this operation results in vast data requirements. Since its initial deployment of NetApp storage systems in 1999, the team had experienced considerable growth and infrastructure changes. And as their demands changed, they actively sought new ways to leverage the most up-to-date technology available.

Any solution considered by the team had to be one in which it could have 100% confidence. The team is a 24x7 operation working under constant deadlines, and to take systems offline could be very damaging. There are times when a part is designed, approved, manufactured, inspected, and shipped to the race circuit within hours. The team simply could not afford for IT infrastructure to negatively impact their race effectiveness or strategy.

5.2.2 The Solution: Reliable, Scalable NetApp Storage Systems

The Renault F1 Team reviewed five proposed solutions to its storage challenges. Two were not compatible with CATIA V5 and were immediately eliminated. The remaining solutions were subjected to a full evaluation and random performance testing over a two- to three-month period.

The final decision was made to deploy the highly scalable NetApp FAS960 storage system, the only solution to meet all of the team's requirements. The NetApp solution enables the Renault F1 Team to safely store all of its design data while providing rapid access to its CATIA, Oracle®, MCAD/PDM, and IBM databases.

5.2.3 High Data Availability for Maximum Productivity

The winter months are critical, as the pressure is always on to get the new car ready for testing prior to the season start. The new storage solution was scheduled to go live in January 2003, so it was vital that the installation go smoothly. The factory was still operating during the changeover weekend, with employees producing parts in the machine shop. When the designers returned to their desks on the Monday morning, the new system was live, and they could continue work as normal.

The design team is now benefiting from increased system performance—with some models showing a 60% improvement in loading speed. In addition, NetApp Snapshot capability allows fast, consistent, and transparent backups of databases without any impact to service availability. This functionality has given the Renault F1 Team the reliable, highly available solution that is essential to support and accelerate the development process.

Renault engineers also benefit from the multiprotocol capability of their NetApp storage solution, which eliminates interoperability issues and provides uniform, one-copy access to data. With CATIA software being used on both UNIX and Windows platforms, the NetApp ability to share data across heterogeneous platforms enables seamless data flow from conception to production.

5.2.4 Administrative Cost Savings

As a racing operation, the Renault F1 Team wanted to concentrate its resources on the cars, so cost savings on infrastructure were very desirable, provided that performance was not affected. After deploying the NetApp storage systems, Renault now reports that its administrative costs have been reduced by nearly 50%.

The team also viewed future expansion as a critical factor in making a data storage selection, so it was important to it that its NetApp storage solutions can be easily and rapidly expanded on the fly. The FAS960 storage system can be upgraded to 24TB and will be able to scale in line with expected future requirements.

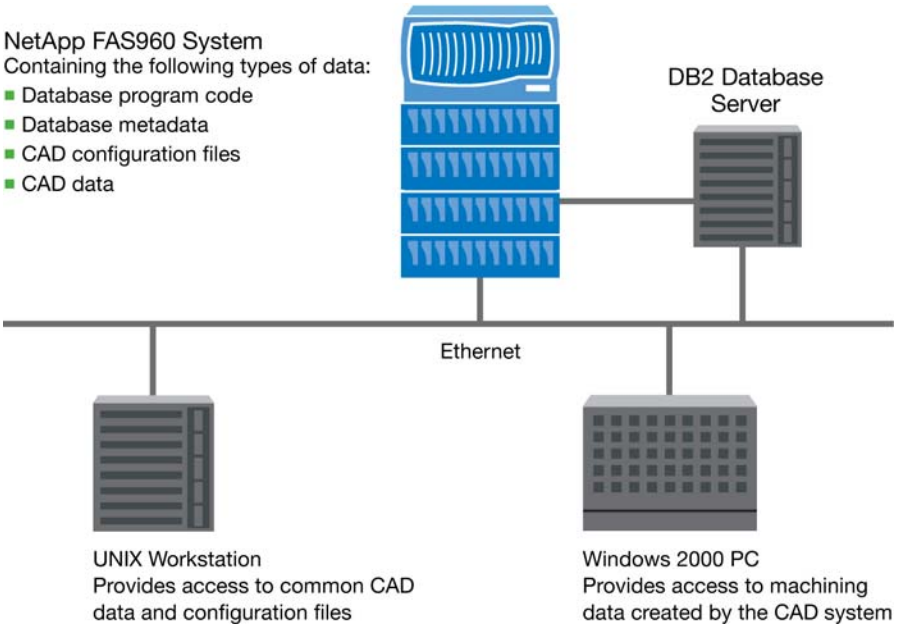

Figure 5) Renault F1 Team storage infrastructure.

6 DEPLOYING NETAPP IN CATIA ENVIRONMENTS

NetApp delivers a fast and efficient storage infrastructure for support of CATIA deployments. New installs or upgrades of CATIA are quickly and easily deployed on NetApp's storage infrastructure using a thin-client approach. NetApp Snapshot copies and SnapVault® software provide data protection to CATIA binaries, settings, and design data through online backups and near-line replication. NetApp solutions make CATIA infrastructure easy to deploy and manage, reducing costs, increasing IT and engineer efficiencies, and enabling faster time to market for product manufacturers.

6.1 Typical NetApp and CATIA Deployment

A typical NetApp and CATIA V5 deployment is shown in Figure 6. In this example, the CATIA binaries, environment settings, and design files are located on the NetApp storage system with the hostname "brain." Typical production deployments have multiple storage systems clustered in pairs for the highest levels of availability. The storage system is backed up to a NearStore near-line storage appliance with the hostname "150" using NetApp SnapVault software. The NearStore appliance also serves as an archive for older design files.

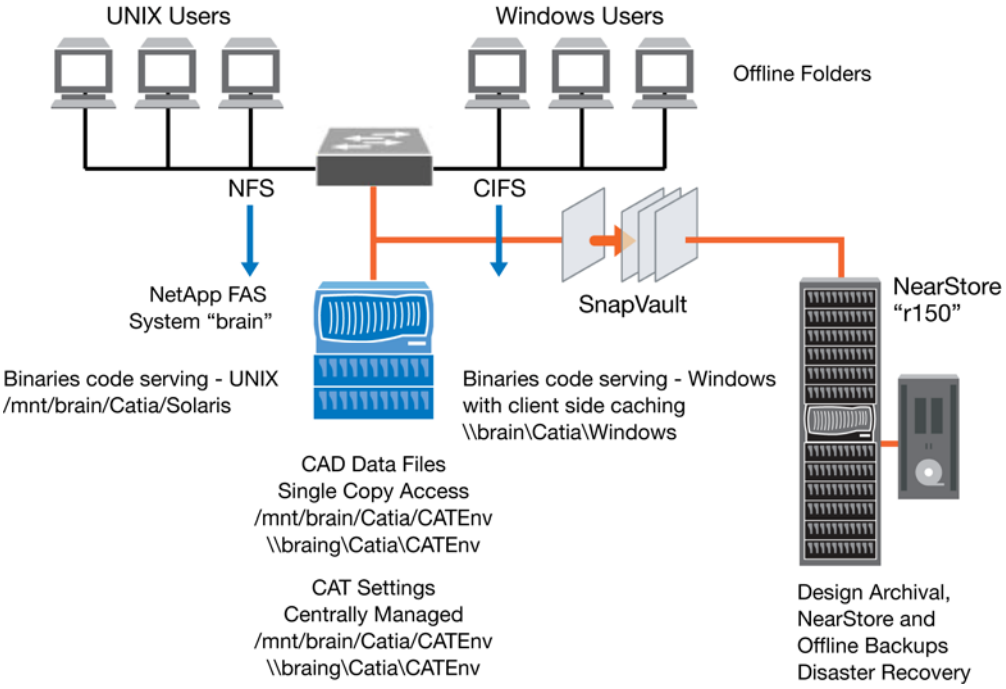

Figure 6) Typical CATIA V5 deployment.

6.2 Thin-Client Installation

Older versions of CATIA software were available only for UNIX platforms, which supported installation over an NFS-mounted partition from a NetApp storage system. CATIA V5 is available for both Windows and UNIX platforms. A network-based install is supported in CATIA V5 for both UNIX and Windows platforms and is covered in the CATIA Infrastructure Installation Guide (available on the CATIA V5 CD set).

The benefits of accessing CATIA software from a thin client include:

- Local file caching. The client-side caching feature of offline folders in Windows allows caching of binaries locally on the storage system. This approach reduces the load on network resources while eliminating the need for local installs on the clients.

- Reduction in administrative overhead. The approach allows workstations to become thin clients. This benefit is especially significant to Windows workstations.
- Faster local installations. The code and environment are installed only once to the NetApp storage system from a CATIA workstation. Thin-client workstations can access the code and environment from the storage system after the creation of a run-time environment on the client. The install process is now reduced to a small number of automated steps.
- Simplified service pack installations. The thin-client approach significantly simplifies the installation of CATIA service packs. Service pack updates are applied once to the installation on the storage system. Offline folders can be set to sync upon login or logout, so offline folder caches are updated whenever a service pack is installed.

6.3 Multiprotocol Access

A key benefit of storing CATIA V5 design files on a NetApp storage system is derived from the system's ability to allow multiprotocol access. A file saved from either a UNIX or Windows CATIA workstation can be accessed or modified from either a UNIX or Windows workstation using the Network File System (NFS) or the Common Internet File System (CIFS) protocol, respectively. Because of the native NetApp implementation of NFS and CIFS, users do not have to sacrifice performance for multiprotocol data access.

To allow heterogeneous platforms to securely access the same set of data, it is important to properly implement file locking. Using SecureShare®, NetApp storage systems allow UNIX clients using the NFS and Network Lock Manager (NLM) protocols and Windows clients using the CIFS or the (PC) NFS protocol to share files with a high level of data integrity.

SecureShare is a multiprotocol lock management facility that is integrated into the Data ONTAP® microkernel. SecureShare enables applications based on UNIX and Windows to concurrently access and update shared files, with the integrity and cache coherency of the shared data protected by system-enforced locking and file-open semantics. At the same time, SecureShare implements a multiprotocol extrapolation of the Windows networking performance optimization known as "opportunistic locks."

6.4 Maximizing Data Availability for Design Reuse

NetApp storage systems also allow access to older CATIA V4 design files. CATIA V4 files created over NFS can be accessed from a CATIA Windows workstation using CIFS. This legacy access simplifies CATIA V4-to-V5 conversion and promotes design reuse.

As older design projects terminate and new projects are started, older projects can be archived off to a NearStore® system (refer to Figure 6). The benefit of using a near-line appliance for design archival is that the appliance allows easy access to the design files whenever they need to be referenced—whether for reuse in a new project or for recall based on legal or regulatory needs.

Because of the design reuse tendency, to fully take advantage of the PLM features in V5, design centers upgrading from CATIA V4 to CATIA V5 need to be able to access CATIA V4 project files. Since CATIA V5 supports both Windows and UNIX, multiprotocol access to these older projects is important. Since NearStore runs Data ONTAP, it offers the same multiprotocol access to design data as the NetApp storage system. Both the NearStore system and the NetApp storage system provide significant operational benefits when upgrading from CATIA V4 to CATIA V5.

6.5 Additional Deployment Information

For further information and details on deploying NetApp storage solutions in CATIA environments, refer to the separate NetApp white paper entitled "CATIA V5 Deployments with NetApp Solutions" (available at www.netapp.com/tech-library/index.htm#reports).

For information about how NetApp can help you successfully migrate from CATIA V4 to CATIA V5, contact your local NetApp representative.

7 BEST PRACTICES IN CATIA V4 AND V5 ENVIRONMENTS

NetApp delivers a fast and efficient storage infrastructure for support of CATIA deployments. New installs or upgrades of CATIA can be quickly and easily deployed on NetApp storage infrastructure using a thin-client approach. NetApp Snapshot copies and SnapVault software provide data protection to CATIA binaries, settings, and design data through online backups and near-line replication. NetApp solutions make CATIA infrastructure easy to deploy and manage, reducing costs, increasing IT and engineer efficiencies, and enabling faster time to market for product manufacturers.

This section presents a series of recommended best practices for various CATIA environments.

7.1 CATIA V4 File-Based Environments

7.1.1 Gigabit Networking

For large design models (40MB to 60MB) and large assemblies (several hundred megabytes), gigabit networking is highly recommended. The network should also be optimized to handle large packets.

7.1.2 NetApp Storage System Tuning Tips (UNIX)

The following performance guidelines apply to all UNIX deployments:

- Manually balance NFS traffic to separate network interfaces on the storage system. Attach multiple interfaces on the storage system to the same physical network, each with its own interface name. For example, if two Ethernet interfaces (named toaster-0 and toaster-1) on the storage system are attached to the same network where four NFS clients reside, point half to one interface and half to the other. Specify in /etc/vfstab on client1 and client2 that these clients mount from toaster-0:/home. Specify in /etc/vfstab on client3 and client4 that these clients mount from toaster-1:/home. This method can balance the traffic among interfaces if all clients generate about the same amount of traffic. The storage system always responds to an NFS request by sending its reply to the interface on which the request was received.
- Add disks to a disk-bound volume. If you have a single-volume storage system, use the sysstat –u command on the storage system to determine the fraction of time that the busiest disk is active. If the fraction is greater than 80%, add disks to the volume using the vol add command.
- Maintain adequate free blocks and free inodes. If the percentage of free blocks or free inodes falls to less than 10% on any volume, the performance of writes and creates can suffer. Check free blocks and inodes using the df command and df -i command, respectively. If the percentage of used blocks is greater than 90%, increase blocks by adding disks or deleting Snapshot records. If the percentage of free inodes is less than 10%, increase inodes by deleting files or using the maxfiles command.
- Determine when to use UDP or TCP transport. The following are guidelines to determine when you should use the UDP transport or TCP transport to improve storage system performance. Use the TCP transport over a WAN network. Use the UDP transport over a LAN network. Use the TCP transport if you are using the UDP transport and you experience packet loss, especially during periods of heavy write traffic. You can specify the transport using the options nfs.tcp.enable command; you can also explicitly use TCP for transport by specifying the "proto=tcp" option in /etc/vfstab on the NFS clients.

The following performance guidelines apply to Sun™ Solaris™ deployments:

- Increase the size of STREAMS synchronized queues on the Sun client to increase network performance. Add the following code to its /etc/system file. Release notes for qfe card recommend setting this to 25 per 64MB of RAM in the system. It also prevents receive overrun on the Gigabit Ethernet interface.

  ```
  set sq_max_size=XX
  ```

  Note that a reboot is required after applying these changes.

- Increase size of UDP and/or TCP high-water marks.

  ```
  ndd -set /dev/udp udp_recv_hiwat 65535
  ndd -set /dev/udp udp_xmit_hiwat 65535
  ndd -set /dev/tcp tcp_recv_hiwat 65535
  ndd -set /dev/tcp tcp_xmit_hiwat 65535
  ```

The commands can be saved permanently by creating a control script in the client's /etc/rc2.d directory. Choose a unique file name, for example, S99netperf.

```
case "$1" in
'start')
        echo "Setting local kernel parameters...\c"
        ndd -set /dev/udp udp_recv_hiwat 65535
        ndd -set /dev/udp udp_xmit_hiwat 65535
        ndd -set /dev/tcp tcp_recv_hiwat 65535
        ndd -set /dev/tcp tcp_xmit_hiwat 65535
        echo " "
        ;;
'stop')
        echo "$0: No parameters changed."
        ;;
*)
        echo "Usage: $0 (start|stop)"
        ;;
esac
exit 0
```

- Install driver patch. The following driver patch should be installed for the Sun Gigabit/2.0 NIC. Among other things, the patch reduces erratic behavior in some applications such as the dd tool and improves performance, especially on the Sbus NIC.

```
106764-XX SunOS 5.6 / Solaris 2.6
106765-XX SunOS 5.7 / Solaris 2.7
108813-XX SunOS 5.8 / Solaris 8
```

Use the command showrev -p to display the installed patches.

7.2 CATIA V5 File-Based Environments

7.2.1 Gigabit Networking

For large design models (40GB to 60MB) and large assemblies (several hundred megabytes), gigabit networking is highly recommended. The network should also be optimized to handle large packets.

7.2.2 NetApp Storage Sytem Tuning Tips (UNIX)

For UNIX environments, please refer to section 7.1.2.

7.2.3 NetApp Storage System Tuning Tips (Windows)

The following performance guidelines apply to all Windows deployments:

- Enabling level I and level II oplocks for CIFS storage systems. Oplocks (opportunistic locks) allow CIFS clients to read ahead, write behind, and lock cache data locally. This reduces traffic to the storage system and improves performance. See http://support.microsoft.com/default.aspx?scid=KB;ENUS; Q129202& for a detailed explanation of level I and level II oplocks and how they might be relevant to your environment. Both level I and level II oplocks are on by default on the storage system. To ensure that level I oplocks are on, the command

```
options cifs.oplocks.enable on
```

is run on the storage system. Similarly, to ensure that level II oplocks are on, the command

```
options cifs.lvl2_opclocks_cap on
```

is used.

- Control the CIFS negotiated buffer size. The option cifs.neg_buf_size controls the negotiated I/O buffer size for clients. The recommended setting of this option is at least 33,028.
- Increase the TCP window size for CIFS. Increasing the TCP window size to its maximum setting on both the storage system and the CIFS client can improve performance for large transfers. The TCP window size controls the number of TCP messages that can be transmitted between the storage system

and CIFS client before an acknowledgement is received back from the destination. The storage system supports a maximum window size of 64,240.

- Maximize the TCP window size. Use the cifs.tcp_window_size 64240 command to maximize the TCP window size on a storage system running CIFS. Use the nfs.tcp.recvwindowsize 64240 command to maximize the TCP window size on a storage system running NFS. Change the window size in the Windows registry on a Windows NT® client by adding the DWORD value \\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters\TcpWindowSize and setting it to 64,240 (0xFAF0 in hexadecimal). A reboot is required before changes take effect.

7.2.4 Special Characters

If you are migrating from CATIA V4 to V5, be careful of special characters used in file names that might create incompatibilities. For example, CATIA V5 only accepts standard ISO646 characters in file names. Other characters will be replaced automatically, using the specified characters in the character-mapping user table in V4 Integration settings under:

```
Tools -> Options -> General -> Compatibility
```

This table will be considered each time a V5 document is created from V4 data in the following operations:

- Batch conversion
- File/open .session
- File/open .asm

If no user table is specified, a default table is used.

A related issue involves Windows file names containing characters that are not supported under UNIX and UNIX file names containing characters not supported under Windows. A batch program was created to allow a V4 document and its dependencies to be renamed so that they are Windows compatible. The batch program takes into account the Windows character-mapping table to rename the documents.

The batch program must be run under UNIX:

```
CATV4ToV5NTCompatibilityName –arg
```

The purpose of this batch program is to rename the CATIA file so that it is Windows compatible and to retain the links between any related documents. The batch program allows for the management of the level of dependencies between the documents. The links taken into account are:

- Session links
- SolidE import primitive links

7.3 CATIA V4/V5 UNIX and Windows Interoperable Environments

7.3.1 INCAT Verifi

INCAT Verifi software should be used to verify CATIA V4 data compliance prior to migration to CATIA V5 (refer to section 4.2). Verifi interrogates and, when applicable, resolves noncompliances in CATIA V4 models, individually or in batch mode. Verifi produces thorough reports identifying significant issues that impede data migration. Verifi can also be configured and customized for individual environments, allowing automatic clean-up of known compliancy issues and reporting of others, depending on user specifications.

7.3.2 Data Separation

UNIX and Windows data should be fully accessible and seamless through one qtree. The recommended practice is to use separate qtrees for CATIA V4 and CATIA V5, as CATIA V5 will read a V4 model, but a V4 model will not read a V5 model.

7.3.3 Consistent Access Rights

Many CATIA customers set up their data access model using UNIX groups. By creating a user group for each project, user access to the project can be controlled by granting access rights to the necessary groups. To make this security process seamless for both Windows and UNIX users, all groups and users existing on the UNIX server should be duplicated in the Windows domain or active directory. This setup ensures that

access and security are transparent for all users (for example, UNIX user John, who is a member of project 1, has the same access rights to data as PC user John, who is also a member of the PC group project 1).

7.3.4 Interoperability and File Names

Be careful not to use special UNIX characters in file names that Windows cannot read, and vice versa (refer to section 7.2.4).

7.3.5 NetApp Storage System Tuning Tips

For UNIX tips, refer to section 7.1.2. For Windows tips, refer to section 7.2.3.

7.4 CATIA in Database Environments

7.4.1 Virtual Product Modeler

CATIA V5 uses the Virtual Product Modeler (VPM), which runs on Oracle or DB2. VPM is a lifecycle management system. SMARTEAM is used for smaller deployments and runs on Oracle.

For further information on deploying NetApp storage solutions in Oracle or DB2 database environments, please refer to the comprehensive series of Oracle and DB2 white papers available at www.netapp.com/tech-library/index.html#reports.

7.4.2 Access Methods

VPM supports three main access methods:

- DBLFAIX. Stores models outside of the database, but the models can only be read back through VPM. This is also the only access method currently functioning for CATIA V5 data. These models can be renamed to reflect the VPM part name using the L2USERX trigger.
- DBLFCDM. Stores models in a long field inside the database.
- DBLFCAT. Stores models outside of the database in UNIX directory trees. These models can be renamed to reflect the VPM part name using the L2USERX trigger and can be read independently of VPM.

7.4.3 Separating Data Dependency

By using the DBLFCAT access method, the dependency of the data is separated from the database itself. This allows the use of Snapshot records to locate and recover individual files and to provide direct access to the CATIA models should a critical failure occur on the VPM server. This also enables CATIA clients to read the models directly from the NetApp storage system and not through the VPM server, ensuring the maximum benefit of NetApp storage system performance.

7.4.4 Oracle Tables

Oracle tables should be stored on a volume separate from that storing the CATIA models (bulk data).

7.4.5 Oracle on HP/UX

For HP/UX recommendations on deploying Oracle on NetApp storage systems, please refer to Oracle9i™ for UNIX: HP/UX 11.0 and 11*i* Best Practices with a NetApp Storage System, available at www.netapp.com/tech_library/3146.html.

8 CONCLUSION

NetApp unified storage solutions and INCAT software and services help product manufacturers and component suppliers remain competitive by accelerating time to market and lowering costs. Major manufacturers such as Britax Aircraft Seating and the Renault F1 Team have discovered that the consolidated, simplified NetApp storage solutions offer proven reliability, simple and fast configuration and deployment, and maximum uptime performance.

When used in conjunction with a 3D product lifecycle management application such as CATIA V5, these advanced storage solutions provide improved engineering productivity through superior access, performance, and availability. As an added benefit, CATIA V5's multiplatform support can serve as an impetus to bring engineering and IT departments closer together, free up engineering resources, and provide engineering access to common Windows-based productivity tools.