



Sun Server Consolidation Case Study: British Telecom

EXECUTIVE SUMMARY

British Telecom (BT) is the largest telecommunications supplier in the United Kingdom. Thousands of employees – including 22,000 field engineers alone – were supported by an aging UNIX system that offered no room for growth. BT executives knew their cost of ownership was high. The IT infrastructure included more than 100 servers and ran multiple platforms. IT managers saw performance slowing down. Adding new functions was difficult given the condition of the equipment.

This report, one of a D. H. Brown Associates, Inc. (DHBA) series on server consolidation, reviews the planning and implementation process BT followed. Beginning with a feasibility study, BT defined the current situation, identified future scenarios and spelled out costs and benefits. This step proved critical in gathering senior-level support to move forward.

Implementation was equally thorough. Thanks to careful planning, the cutover involved only 12 hours of downtime and business operations were not affected.

MAJOR BENEFITS ACHIEVED

Results are dramatic. The server hardware shrank from more than 100 to six. These six machines – Sun Enterprise 10000s – offer greater scalability than the older equipment. Failover recovery and availability are much improved as well. Average failover time is now five minutes; it used to be one hour. Availability is promised at 99.95%, but BT has maintained 99.97%. Greater partitioning capability and no single point of failure in the new servers provide confidence that this is the best solution.

D.H. Brown Associates, Inc.

www.dhbrown.com

A summary of this report is available to all of our subscribers. Sponsors of our collaborative program Server Consolidation receive the full report as part of our comprehensive services. Those interested in the program should contact marketing@dhbrown.com.

This document is copyrighted © by D.H. Brown Associates, Inc. (DHBA) and is protected by U.S. and international copyright laws and conventions. This document may not be copied, reproduced, stored in a retrieval system, transmitted in any form, posted on a public or private website or bulletin board, or sublicensed to a third party without the written consent of DHBA. No copyright may be obscured or removed from the paper. All trademarks and registered marks of products and companies referred to in this paper are protected.

This document was developed on the basis of information and sources believed to be reliable. This document is to be used "as is." DHBA makes no guarantees or representations regarding, and shall have no liability for the accuracy of, data, subject matter, quality, or timeliness of the content.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
MAJOR BENEFITS ACHIEVED	1
BRITISH TELECOMMUNICATIONS.....	3
WORKFORCE SCHEDULING APPLICATION	3
THE COMPUTING INFRASTRUCTURE	4
<i>Financial Considerations</i>	4
<i>Performance Considerations</i>	4
<i>Reliability</i>	4
BT DECIDED TO STAY WITH A UNIX PLATFORM.....	5
WHY BT CHOSE THE SUN ENTERPRISE10000	5
<i>The Sun Enterprise 10000 Enabled BT to Significantly Reduce Costs</i> <i>While Improving Reliability and Performance</i>	5
HOW THE SYSTEMS WERE CONSOLIDATED	7
100+ SERVERS REDUCED TO SIX SUN ENTERPRISE10000S	7
HOW BT APPROACHED THE CONSOLIDATION	7
<i>Feasibility Study</i>	7
<i>Assessment, Architect, and Planning</i>	8
<i>Porting the Application</i>	8
<i>Business Operations Were Not Affected</i>	9
<i>Availability Is Extraordinary</i>	9
BENEFIT SUMMARY	9
LESSONS LEARNED.....	10

BRITISH TELECOMMUNICATIONS

British Telecommunications plc (BT) is the largest supplier of telecommunications services in the United Kingdom. Through its various business units, the company provides a broad range of telephone and networking services. These include,

- **BT Ignite** – a data and broadband network business that targets corporations and wholesalers in Europe.
- **BT Openworld** – provides broadband Internet-based networking services.
- **BT Retail** – provides communications services to small businesses and residential customers
- **BT Wholesale** – provides network services and solutions to communications companies, network operators, and service providers, including BT Retail, BT Wireless, and BT Ignite.

The business, as well as a large part of the company's profitability, depends on the efficient installation and maintenance of land lines and telecommunications equipment at customer premises, coupled with BT offices and switching centers.

This paper was developed from an interview with John Bayle, manager of the server consolidation project at BT.

WORKFORCE SCHEDULING APPLICATION

In the early '90s, BT invested over 1,000 C++ programmer years to develop a dynamic workforce-scheduling application known as Work Manager, which was used to optimize the workloads of the 22,000 field engineers who install, upgrade, and maintain telephone and networking equipment. (Overall, 30,000 people actually used Work Manager including managers and staff.)

The application analyzes inbound, real-time information to schedule the daily activities of each engineer. It includes a jeopardy-management capability that schedules and prioritizes planned activities, emergency work, and other critical work requirements. It can reschedule work instantly to cover emergencies, unforeseen circumstances, or high-priority requests from customers. The application also ensures that stand-alone jobs, and even interrelated work orders, are completed in the right sequence.

By eliminating unnecessary idle and travel time within each engineer's workday, Work Manager has been saving the company approximately £100 million (\$150 million) per year, through heightened efficiencies in the engineer workforce.

Thus, the application is essential to the daily business operations and profitability of the company.

THE COMPUTING INFRASTRUCTURE

The original application ran on Hewlett-Packard (HP) UNIX servers. By 1998, the server environment that supported Work Manager had grown to 43 distributed HP 9000 T520s, each configured with a maximum of 12 CPUs including 1.5 or 2.0 GB of memory and 60 GB of storage. The environment also included a combination of 52 Sun Ultra 10s and 20s.

The application was hosted in predominantly unattended sites located in various geographic regions throughout the United Kingdom.

In the mid-90s, BT recognized that the IT infrastructure had to be revamped. Problems in several major areas pointed to the need to consolidate the servers:

FINANCIAL CONSIDERATIONS

- **Total cost of ownership was excessive.** The sheer operational cost of running multiple platforms, including backups, monitoring, handling of alerts, patches, database upgrades, and so forth was immense. (When you have that many platforms, costs are going to be unnecessarily high.)
- **The HP 9000 T520s were fully depreciated.** These units had reached the end of their useful life. Newer, more efficient hardware could be acquired at reduced cost and greater overall benefit.

PERFORMANCE CONSIDERATIONS

- **System performance was slowing down,** as the systems became saturated and incapable of taking on additional workloads.
- **The HP 9000 T520's were fully configured.** Whenever BT wanted to add functions, performance tuning was a problem. There was no room for future growth.

RELIABILITY

- **Failover procedures took too much time and were extremely costly.** When a system went down, the engineers served by that system would become idle when they finished the current job. They would have to wait for the system to come back up to identify the next job.
- **System failures would affect large segments of the workforce.** When there was a failure, it required at least an hour to carry out a failover.

Therefore, an effort was begun to refurbish the infrastructure that supported Work Manager.

BT DECIDED TO STAY WITH A UNIX PLATFORM

As a first step, BT decided to stay with UNIX, based on the following criteria:

- **No investments would need to be made to modify the application**, since the application was UNIX-based.
- **The major UNIX vendors** could compete for the business. This would foster competition and therefore make “best pricing” models available to BT.
- **There were no trained MVS personnel in Work Manager**. A move to mainframes was out of the question.

BT then evaluated technology offerings from HP, Sun Microsystems, IBM, Compaq, and Sequent. The company then chose the Sun Enterprise 10000 as the platform for the consolidated environment.

WHY BT CHOSE THE SUN ENTERPRISE 10000

BT concluded that the Sun Enterprise 10000, with its Dynamic System Domain capability, offered the best route to revamping the infrastructure that supported its Work Manager application. The reasons BT selected the Sun Enterprise 10000 include:

- **Sun Enterprise 10000 systems can be configured to eliminate single points of failure**, a considerable advantage over conventional UNIX systems.
- **The Sun Enterprise 10000 can be partitioned into as many as 16 domains**, each meeting the requirement of the regions and number of engineers they would serve.
- **Dynamic resource allocation permits the Sun Enterprise 10000 to run at much higher usage rates** than could be provided within the previous IT environment.
- **The Sun Enterprise 10000 is a mainframe-class system, priced at a fraction of the cost of a mainframe**. The 64 processors on as many as 16 boards offer unprecedented scalability and inexpensive upgrades as capacity requirements increase.
- **Less space and power configurations are required**. Having one physical platform that supports multiple operating systems was key, in terms of footprint and power availability.
- **When a successor technology is announced, upgrade and maintenance parts for the Sun Enterprise 10000 server will be available for at least seven years**.

THE SUN ENTERPRISE 10000 ENABLED BT TO SIGNIFICANTLY REDUCE COSTS WHILE IMPROVING RELIABILITY AND PERFORMANCE

BT realized significant benefits as a result of deploying the Sun Enterprise 10000.

- **The Sun Enterprise 10000 dramatically reduced operational costs and business risks** by providing a centrally managed platform for its Work Manager application.
- **The server has shared disks, partitioned memory modules, and multiple processors arranged in system domains, which provide “logical partitioning,”** (a capability previously only associated with mainframes), as well as “physical partitioning” capabilities. These capabilities are the basis for numerous efficiencies and cost reductions, and projected savings.
- **When software or hardware failures occur in a domain, they are confined to that domain.** They do not affect other applications serving other groups of engineers.
- **Better performance and resource usage was achieved at a lower cost of ownership.** Computing resources can now be dynamically reallocated based on workload requirements, which may shift due to emergencies or national disasters.
- **The Sun Enterprise 10000 is highly scalable** (up to 16 domains and 64 processors), obviating the need to purchase more boxes. BT could begin with a smaller number of processors and domains and then add more processors and domains as its requirements dictated.
- **BT opted to use Sun’s Professional Services.** The Sun team played a major role in streamlining the transition from a mixed environment to a more flexible and efficient one based on the Sun Enterprise 10000. Sun Professional Services architected and produced the detailed design documentation for the platform and cluster configurations as well as custom scripts, all of which were used to integrate the Work Manager application into the overall architecture and operational design.
- **Commensurate with the criticality of this application to BT,** each document was subjected to thorough peer reviews from BT and Sun. Additionally, Sun consultants produced detailed work instructions (for Sun and BT IT engineers) for any implementation activity associated with the designs – the work instructions themselves went through the same rigorous peer review and sign-off process.
- **BT is taking advantage of the SunSpectrum Platinum Support Contract.** This special service includes a full-time proactive Sun technical advisor assigned to the BT account – a service BT has come to rely on. The Sun technical advisor is housed at BT. The technical advisor works closely with IT to understand what applications and system changes are planned. The technical advisor also keeps BT abreast of Sun’s intent to develop and ship patches, long before they would otherwise affect the environment. This enables BT to play a proactive role in developing guidelines for patch management policies.
- **Compared with the alternatives, BT found the price of the Sun solution to be very attractive.**

HOW THE SYSTEMS WERE CONSOLIDATED

100+ SERVERS REDUCED TO SIX SUN ENTERPRISE 10000s

BT consolidated the 100+ HP and SPARC servers to six operational Sun Enterprise 10000s, each having two or three operational domains, with one standby domain. These four domains were clustered using Sun Cluster software.

Each domain was originally configured with two Sun Enterprise 10000 system boards. The initial systems were based on two boards. Each board contained four CPUs, eight CPUs per domain, with the 336 MHz series of CPUs. BT has since upgraded to the 400 MHz series.

Essentially, each system had 32 CPUs, across eight system boards, using three pairs of boards. Three domains were operational and one of them was fully configured to take the workload from one of the production domains in the event of a failure of one of the production domains.

The cutover was completed by November 1999, with a total investment of between 15 and 20 person years for the entire procedure – planning, porting, and testing. The only real problem encountered concerned the assignment of too many engineers from the same business division to specific domains. The original design had concentrated all the engineers in a business division into a single cluster. A cluster failure therefore would have brought the assignment of engineers in a region to a halt. While this was a rare event, the potential for this outage was easily corrected by reassigning the engineers to separate, less concentrated clusters.

HOW BT APPROACHED THE CONSOLIDATION

FEASIBILITY STUDY

An initial study reviewed the practicality of the overall concept. There was a central program established to manage the project. An analysis of the existing and planned environment was conducted. This included an inventory of the current environment, and a problem and business risk assessment. The new infrastructure (platforms, architectures, and components) was designed; a migration plan was developed; and a cost/benefit analysis was drawn up.

Sun Professional Services conducted an initial assessment to identify service-level requirements. The consultants then followed up with a proposed architectural design. Sun worked with BT to develop the project plan for the consolidation.

Through a proof-of-concept stage, Sun was able to prove to BT that the system would scale, perform, and integrate into the BT operational environment. The tests used for this proof were defined by the BT team and Sun consultants. The

proof of concept had to be completed in order for the project to proceed to the next stage.

Presentations of the plan and the associated business and technical benefits were made to senior executives, with approval for funding of the consolidation project authorized soon thereafter.

ASSESSMENT, ARCHITECT, AND PLANNING

BT's centralized IT organization led the project. The server-infrastructure tasks were outsourced to application development and data center professionals within BT.

There were five BT project managers, whose work was partitioned into weekend work versus a standard workweek, so as not to affect overall system availability and reliability. There were three developers, with some doing systems integration and others tackling development at various stages of the project. There were also people involved in cutover activity; and four UNIX technical specialists.

Initially, with help from Sun Professional Services, BT sized how many HP T520s and SPARC servers could actually be consolidated onto a Sun Enterprise 10000.

The BT team decided to consolidate logical groups of servers into logical groups of Sun Enterprise 10000 domains. The Sun Enterprise 10000 domains were configured to support a maximum of 2,000 engineers and a minimum of 700. Working with Sun consultants, BT was able to consolidate the workload from two to three HP T520s into a single Sun Enterprise 10000 domain.

Another goal of the project was to ensure scalability, so that the boxes could be grown in line with the demands of the application. The initial goal of deploying 50% configurations as a maximum for all of the Sun Enterprise 10000s was met. This meant that the customers (BT's users) were able to get better performance and higher usage along with substantial room for growth.

PORTING THE APPLICATION

Sun technical consultants from the Sun Porting Center worked closely with three technical professionals from BT to port the application. The most critical and difficult element of the porting phase of the project involved managing the customer data. Typically, data from up to three applications serving specific engineering workforces had to be combined into one application database.

The application, written in C++, uses an Oracle database. The Oracle segment went straight across with practically no issues at all since Oracle supports both the HP-UX environment and the Solaris operating environment.

BUSINESS OPERATIONS WERE NOT AFFECTED

In preparation for the cutover, Sun built the Sun Enterprise 10000 platforms for BT in advance. Application testing took place by the time of each cutover. A duplicate of the live databases was also created a week in advance of the actual cutover.

On the night of the cutover, BT took the applications down, transferred the databases to the new platforms, and switched over. In the end, there was a total outage of only 12 hours. Most of the transitions started on Friday night around 8:00 PM and were completed by 7:00 AM the next morning.

Since 1999, BT has added to the original application. As one might expect, there is latent demand for application growth and most of the systems are now fully configured with three or four boards in the domains.

Most of the systems are running between 60% and 70% of usage. One node is actually running at 85%. An application change is chartered to keep that node under control.

AVAILABILITY IS EXTRAORDINARY

BT's IT has committed to 99.95% availability over the entire operation. This includes the complete stack – applications, databases, platforms, and network. To date, BT is experiencing a 99.97% availability rate.

When there is a failure, the Sun clustering technology takes the application and database across to its operational (replacement) domain. If there is a CPU failure or a system-board failure, there is only five minutes of outage, compared with the minimum of one hour that was required by the HP 9000 T520 environment.

BENEFIT SUMMARY

In addition, the following benefits were realized by BT as a result of moving to the Sun Enterprise 10000 environment:

- **Break-even financials were achieved in only 18 months.** Major savings will be achieved during the life of the Sun Enterprise 10000.
- **Availability exceeded expectations.** The Service Level Agreement is 99.95% availability; to date, 99.97% has been achieved.
- **Failover improved from one hour to five minutes.** The clustering and failover technologies that connect the Sun Enterprise 10000 domains enabled this remarkable reduction in failover time.

LESSONS LEARNED

There were certain lessons learned in this consolidation. The major one was that, “one should not put all one’s eggs in one basket,” or, more appropriately, “BT should not have put all its engineers from one business division in one cluster.” When the domains were configured to serve all the engineers in a division, the engineers all got their assignments from the same cluster. As a result, a minor glitch in the cluster would cause difficulty for the whole region.

Bayle’s advice to anyone considering consolidation is, “Make sure you get a complete list of what you are consolidating and make sure you get a complete list of what you are consolidating to.”

BT also learned the importance of conducting a comprehensive analysis of the planned environment up front, thus helping to ensure no single point of failure for the system as a whole.

BT considers this consolidation a complete success, financially and technically. The Sun Enterprise 10000s have performed beyond the expectations of the IT staff that managed this project.