hp NonStop DCE software

a product description from hp

features at a glance

- The Distributed Computing Environment
- NonStop DCE Core Services
- Enhanced server model
- Enhanced Cell Directory Service (CDS)
- Security services
- Simplified application development
- Open framework for distributed computing

scalable DCE on NonStop parallel servers

HP NonStop™ Distributed Computing Environment (DCE) software provides a comprehensive suite of services for the development, use, and maintenance of applications for open, heterogeneous, and distributed computing environments for users and programmers.

NonStop DCE software is designed to assist end users and software developers in creating a vendor-neutral, enterprisewide computing environment that combines the hardware and software of many vendors. It enables applications and data to be distributed transparently across networks, platforms, and functional organizations.

NonStop DCE software Version 1.1 provides a robust implementation of the Open Software Foundation (OSF) DCE services Version 1.1, a standard for an open distributed environment.

Designed for the NonStop family of servers, NonStop DCE software exploits the scalability and reliability of the NonStop server architecture.

With NonStop DCE software, you can develop distributed heterogeneous client/server applications that incorporate interoperability standards, naming, and security, and that support your dynamic enterprise business model. You can build a full range of reliable, flexible, and interoperable distributed computing solutions that you can combine with heterogeneous hardware platforms and services.

In addition to providing a reliable, scalable platform for DCE-based applications, HP has added important enhancements to extend transparently the current OSF DCE capabilities. For example, HP provides the Cell Directory Service (CDS), which is based on the high-performance parallel relational database technology of the HP NonStop SQL/MP database, considerably extending the boundaries of a cell in terms of number of systems and users. Additionally, the new distributor-agent (DA) paradigm to the DCE

server model takes advantage of the parallel architecture of NonStop servers, provides load balancing of agents across the entire group and over multiple processors, and facilitates the development of concurrent server applications. These extensions are transparent to DCE users and are fully interoperable with other DCE implementations.

the distributed computing environment

As users move from applications running within a local computing environment to client/server applications running across several disparate machines, the industry needs a standards-based framework for multivendor operation.

DCE provides a comprehensive foundation that allows applications and data to be distributed transparently across networks, systems, and organizations, so that operating in the network computing environment is almost as simple as working on a single system.

A range of vendors offer DCE implementations—from PCs running the Microsoft® Windows® operating system to mainframes running the Multiple Virtual Storage (MVS) system—making DCE a standard open foundation for heterogeneous distributed computing.

The DCE framework (see figure 1) extends several benefits to distributed computing.

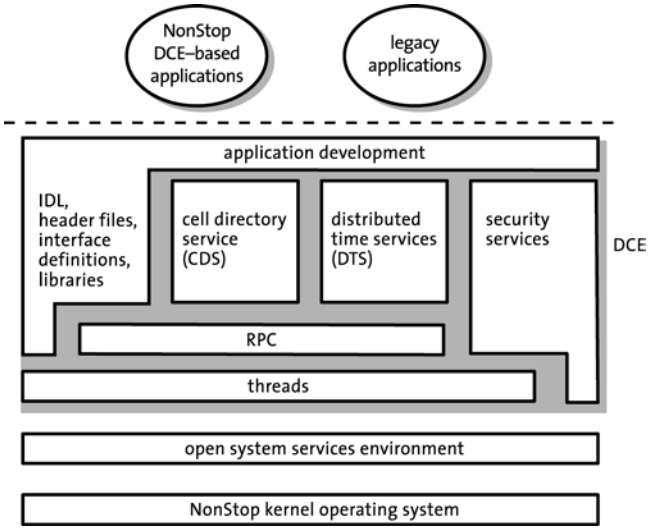

Figure 1. Distributed computing environment framework.

transparency

The network is perceived as a single system, not a collection of independent components. This characteristic is referred to as *transparency*. There are two distinct kinds of transparency—application transparency and location transparency:

Application transparency. Client/server applications can access local and remote services and data in an identical manner.

Location transparency. Users and client/server applications can access resources by referring to their logical names, without knowing their location. DCE directory services provide dynamic server identification and location within the network. Resources can be moved or reconfigured as required without affecting programs or the people who use those resources.

uniform and global access to resources
For large organizations deploying hundreds or thousands of systems across heterogeneous LANs and WANs, DCE provides reliable enterprisewide communications. Additional capabilities include global and consistent directory and name service, and the automatic routing of client requests to particular remotely located servers.

integrated security
The DCE environment provides users with a verified identity upon which all DCE applications can rely. The security service supports secure communications and controlled access to resources. It authenticates, authorizes, and encrypts messages, providing protection of critical data, applications, and communications links in the distributed environment.

interoperability
Interoperability standards allow client/server applications to provide up-to-date data anywhere, at any time, from any computer system within the enterprise. DCE, from the OSF, has become the accepted methodology for such standards. Interoperability benefits companies by allowing users to access and manipulate data without having to understand the complexities of the underlying network and platforms; it also allows access to a wider range of applications and information.

replication of resources
DCE services can be replicated (copied) to additional hosts in the network. Replication protects critical services and data availability in case of failure. Applications can also take advantage of replication for increased availability.

scalable and robust framework
Server replication increases application throughput. The directory service allows access to all available server resources. And DCE is architected for the kind of incremental growth required by expanding businesses.

The scalability and high performance of NonStop servers make them ideally suited for client/server distributed computing environments. DCE applications can exploit the advantages of NonStop servers—including the high-performance, distributed NonStop SQL/MP database system; NonStop Transaction Management Facility (NonStop TMF) software; and the HP Pathway online transaction processing (OLTP) monitor, NonStop Transaction Services/MP (NonStop TS/MP) software. With its NonStop servers, HP leads the industry in providing continuously available systems.

With these advantages, NonStop servers are the logical choice for running the critical naming, security, and time services on which all DCE systems depend. When given the choice, customers would prefer to have their critical DCE services on the server with the highest availability in the network.

NonStop DCE core services

NonStop DCE software includes three components: NonStop DCE Core Services, the NonStop DCE Cell Directory Service, and the NonStop DCE Security Service.

NonStop DCE Core Services comprise the following DCE components.

remote procedure call

The remote procedure call (RPC) makes distributed operations possible and provides programmers with a number of powerful tools that are necessary to build client/server applications. An RPC is a facility for calling a procedure on a remote machine as if it were a local procedure. All of the other services—including Directory, Time, Security, and Threads—support the RPC function.

The RPC facility shields the application programmer from the details of network communications between client and server. It accomplishes the following:

- Conceals construction and transmission of messages between client and server
- Performs data conversion between different data formats (for example, byte ordering between different machines)
- Locates invoked procedures using the directory service
- Provides secure communications through the use of the security service

Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) communications protocols are supported.

threads

NonStop DCE Threads is a user-level (nonkernel) threads library based on the POSIX Threads (Pthreads) interface specified by the POSIX 1003.4a standard (draft 4). It provides an interface to create, manage, and synchronize multiple streams of execution within a single process. Because the threads of a process share common address space, they can communicate easily. As a result, threads support parallel execution efficiently. Threads allow DCE applications to exploit parallelism in several ways:

- Servers can service multiple clients simultaneously.
- Clients can make multiple server requests simultaneously.

Using threads allows you to optimize performance through concurrent operations and simplifies management by reducing the number of processes.

distributed time services

Time management is important in distributed environments because proper sequencing of transactions must be guaranteed to protect data integrity. Computers that interoperate require a common time to perform operations such as transaction logging and event sequencing. For this reason, the DCE security service makes extensive use of time stamps internally.

The Distributed Time Service (DTS) synchronizes system clocks in a distributed network and keeps the time as close to Coordinated Universal Time as possible.

DCE DTS loosely synchronizes the clocks in a cell with each other and optionally with an external time source, such as the National Institute of Standards and Technology time service. DTS can also use the Network Time Protocol (NTP) as a time provider.

enhanced server model

A unique advantage of NonStop DCE software is the extension it offers to the RPC application server model.

The DCE RPC server model relies on multi-thread application servers. An application server is organized as a single process with multiple streams of execution (threads), each of which services a different user request. This execution model is well suited for a single processor or a shared-memory multiprocessor environment, but it is not optimized for a message-based multiprocessor architecture with linear scalability characteristics.

Although multi-threading provides the system benefits of management and processing efficiency (because fewer processes are required and threads can execute concurrent requests), it presents application writers with challenges. Many services required may not be available in thread-safe forms. Specifically, throughput can be reduced if a thread issues a call that blocks (waiting for data/status to be returned) the process in which it is executing (in many database systems, SQL calls are process blocking). Consequently, server response time may increase and become less predictable.

Additionally, in a multi-thread server, fault isolation is constrained because multiple threads to a process share the same address space, so they share all static and external data, as well as open files.

To address these considerations, HP has developed the distributor-agent (DA) extension to OSF DCE.

In the DA model, an application server consists of one distributor process and a group of agent processes. The distributor supports the standard RPC server protocol and routes each client request to a free agent. The DA allows application manager code to run single threaded. Clients are unchanged and may issue RPCs concurrently. Each RPC executes single threaded in its own address space. Using this extension eases programming complexity and improves application reliability and scalability. The DA approach allows agents to run in parallel by distributing agent processes across different processors. The distributor also tracks the completion of each request, ensuring, in this way, load balancing across the entire agent group (see figure 2).

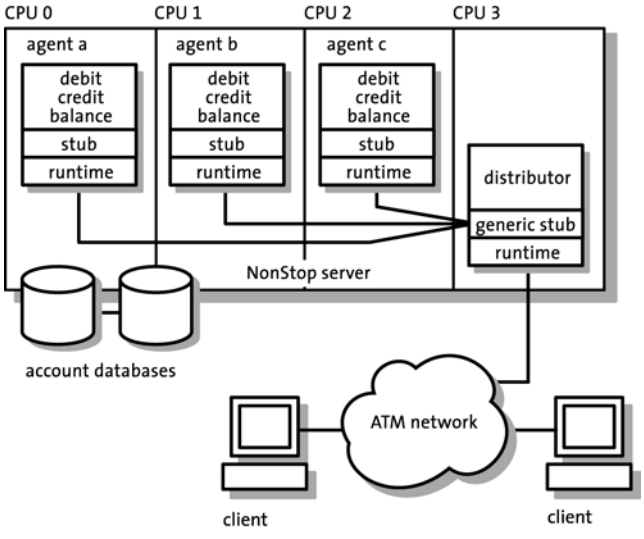

Figure 2. The distributor-agent architecture.

enhanced cell directory service

The NonStop DCE Cell Directory Service (CDS) is more reliable, available, and scalable, and performance has been enhanced over the basic OSF DCE CDS server design, which is a distributed, replicated database service that records the names and attributes of objects. It is used by RPCs.

- RPC servers are registered with the CDS.
- RPC clients locate servers using the CDS.

HP has implemented the CDS server database using the high-performance NonStop SQL/MP database rather than the in-memory database on which the OSF DCE CDS server is based; in this way, the CDS database is transaction protected by NonStop TMF software. The NonStop DCE CDS server is able to scale up to very large CDS name spaces because data can be partitioned over multiple disks; it treats each set of logically related updates as a single database transaction for increased robustness and sustained database consistency.

The NonStop DCE CDS improves concurrency by allowing multiple writers (via record level locking); it takes advantage of caching in the database manager; and it eliminates the blocking checkpoint mechanism as well as providing quick recovery for the CDS name space in case of failure.

This CDS enhancement is fully transparent and interoperable with DCE applications and other DCE implementations.

security services

The distributed computing environment allows users to access data and applications wherever they are stored in the network. With this access to distributed data, however, there are security risks, because data stored and transmitted on local or wide area networks is vulnerable to unauthorized access. Security services are key components of a distributed computing environment to ensure the integrity and confidentiality of data transported and applications accessed over the network.

The DCE Security Service provides secure communications and controlled access to resources. It authenticates, authorizes, and encrypts messages.

The Security Service includes

- An authentication service, which verifies the identity of the user making the request
- An authorization service, which grants access to the resources or data requested
- A registry service, which manages the security database containing security information such as user passwords, principals' encryption keys, and privilege attributes
- Procedures to enforce security
- Administrative tools

DCE security is based on the Kerberos security system. The U.S. version includes Data Encryption Standard (DES).

simplified application development

DCE offers distributed system developers higher-level facilities, abstractions, and application program interfaces (APIs) that hide the many underlying complexities they

must face when building heterogeneous distributed applications; they no longer have to be experts in multiple technologies. It is now possible to use the DCE building blocks to solve critical problems in a standard manner, as opposed to creating solutions anew.

Furthermore, DCE's Interface Definition Language (IDL) expedites development by making architecture specifications transparent to application developers. The interface definition is the root of the client/server relationship; it ties the client and server application code together using a formal method that describes the set of procedures and the parameters and data types the interface offers. A programmer writes the interface definition using IDL, a language and a compiler that simplify the development of distributed applications by producing portable and reusable source code.

DCE clients and servers express their interfaces (remote procedures and data types) using DCE IDL.

DCE supports a new client/server architecture, known as three-tier architecture, that splits the application into three layers: presentation, functionality (business logic), and data access. The layers can be distributed among different platforms, enabling users to select the appropriate system for the job. Development time is reduced because programmers can design or change the layers individually and concurrently without affecting the rest of the application.

Client/server lets programmers build applications in parallel. They can build the client view, the function, and data in parallel, as opposed to sequentially. This accelerates the development time.

For complex applications, especially those that need to connect multiple service providers to several users, extending applications by adding a new service is simpler with DCE. The application programmer updates the interface definition, created by using the standard DCE IDL, through which the two halves of client/server interact.

Applications built using DCE can be ported to other platforms running DCE. DCE promotes application programmer skill portability and advances portability of application program, third-party software, and middleware.

Additionally, the DA server model extension of NonStop DCE software allows an application programmer to develop application management code single threaded and without the complexities of multi-thread programming; OLTP and SQL services are easily encapsulated in agent groups, and wrappers used to integrate legacy applications can be supported easily via an agent.

open framework for distributed computing

DCE is evolving as a standard for an open distributed environment; its architecture definition is closely compatible with NonStop servers. In fact, NonStop servers have been using many similar features for years. HP's NonStop Enterprise Division brings to DCE years of expertise in perfecting distributed computing environments. NonStop servers also bring the continuous availability, linear scalability, and price/performance capabilities that are requirements for critical applications.

NonStop DCE software will allow many new solutions to be ported to NonStop servers, opening up the base of applications that can be offered to our customers.

NonStop DCE software enables users to distribute the benefits of sophisticated client/server applications that use computing resources throughout the network. Individual programs within an application can be distributed to computers that are optimal for the task. Tasks that can run in parallel are easily distributed to multiple

processors, providing higher performance and better utilization of computing resources across the network (load balancing using the DA model).

As an open industry standard, DCE lays the foundation for this type of development by providing a vendor-neutral interface, or middleware, that links the various applications, data, and communications transports. In this way, an application can, for example, pull data from a NonStop SQL/MP database and query a Sybase or DB2 relational database to answer a client's request.

DCE offers information system managers a way to improve on the legacy system without replacing it, as well as the ability to integrate personal computers into the DCE environment.

The standard components of DCE are transforming a wide range of products, including transaction monitors, network management tools, application development tools, and database connectivity software.

Many customers expect, via DCE standard security services, to streamline operations by enabling users to access a variety of systems using a single login.

RPCs, CDS, security, DTS, threads, and agent groups are the tools and services used to create distributed applications. Together these tools and services act as middleware, the software layer that supports interactions between clients and servers. By making a distributed heterogeneous network of systems look like and act like a single system, NonStop DCE software allows you to raise productivity, reduce costs, and reengineer information systems according to changes in business. Moreover, this needed reengineering could be accomplished in an incremental, evolutionary—instead of revolutionary—manner, enabling you to avoid costly and disruptive changes.

With NonStop DCE software, a distributed computing environment can operate as a single large computer complex. Figure 3 illustrates the NonStop DCE topology and how the DCE components interoperate with each other.

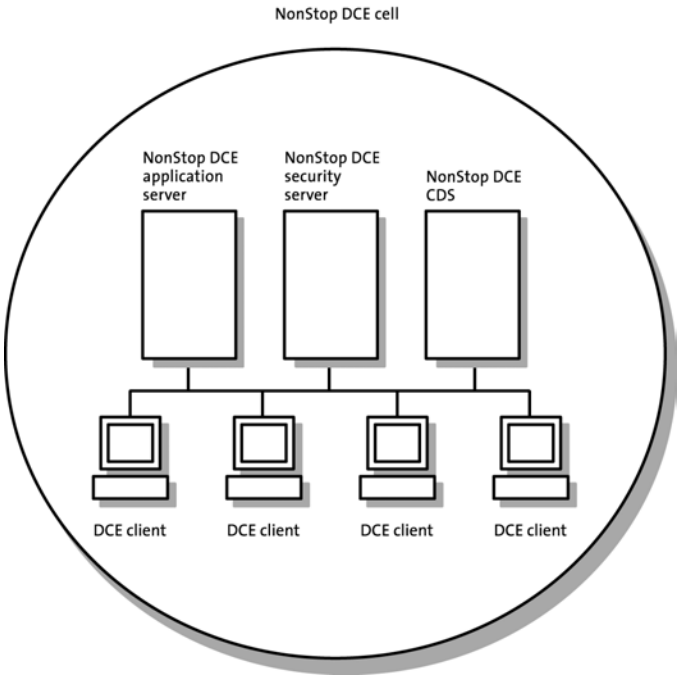

Figure 3. NonStop DCE topology.

ordering information

NonStop DCE software is delivered in four primary components: a Core Services component for export only; a Core Services component USA version, which includes the DES encryption software for use in the United States and Canada only; a Cell Directory Server component; and a Security Services component.

All of the components run on the server.

product ID	*description*
SM01	**NonStop DCE Core Services (Export):** Provides remote procedure call (RPC)—TCP and UDP versions; client services for CDS and security; POSIX 1003.4a Threads, a user space implementation; and Distributed Time Service (DTS).
SM02	**NonStop DCE Core Services USA version, includes DES:** Provides Remote Procedure Call (RPC) TCP and UDP versions; client services for CDS and security; POSIX 1003.4a Threads, a user space implementation; and DTS.
SM03	**NonStop DCE Cell Directory Server (CDS):** Provides information on resources and services available in local DCE cells. Requires either SM01 or SM02, and SA97 (NonStop SQL/MP runtime).
SM04	**NonStop DCE Security Services:** Provides authentication, authorization, and data privacy services. Requires either SM01 or SM02. When used with the USA version (SM02), DES encryption is included.

specifications

system requirements

Hardware	Any NonStop server
Software	NonStop Kernel operating system, Release Version D30.02 or later (T9050)
	NonStop Kernel Open System Services (OSS)
	TCP/IP
	NonStop SQL/MP runtime (required by CDS)

For more information, go to www.hp.com/go/nonstop.

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