the Availability Digest

HP NonStop for Dummies
October 2014

Finally! A Dummies book for HP NonStop systems is here. Authored by Werner Alexi, Thomas Burg, and Bill Sempf and published by Wiley for comForte 21 GmbH, "HP NonStop for Dummies" is a high-level but educational view of all things that make NonStop servers nonstop. NonStop servers recover automatically from any single fault and even from multiple unrelated faults. Consequently, these self-healing systems experience uptimes measured in years.
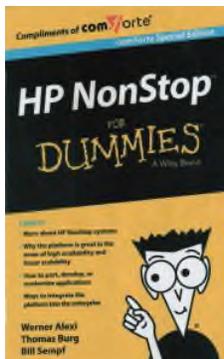
The NonStop hardware and software architectures that lead to this level of availability are described in the book, followed by the ease with which applications can be developed for such systems. The ability to integrate NonStop systems with other enterprise systems is an important attribute, and these capabilities are summarized. Finally (as in all Dummies books), a list of further references is given.

This book is for those companies considering NonStop systems for their mission-critical applications, for those users new to the NonStop servers, for those responsible for managing or operating NonStop systems, and even as enjoyable reading for those expert in this technology.

The book is organized into five chapters:

1. What is HP NonStop?

In Chapter 1, the authors present the demands for IT systems with extraordinary availability capabilities. Many mission-critical systems require the NonStop fundamentals of data integrity, reliability, availability, and serviceability (RAS). Data integrity means that the database is always consistent and correct. A reliable system is one that will not return any result rather than return a wrong result or corrupt the database. Availability requires that application downtime be measured as seconds or minutes per year. A serviceable system is one that can be managed easily even in an environment of other interoperating systems. In many definitions, the "S" in RAS is for scalability, also an important characteristic of NonStop servers, which are linearly scalable over hundreds of processors.

NonStop systems were born as Tandem systems in the mid-1970s, fathered by Jimmy Treybig, an entrepreneur from HP. Tandem Computers was acquired by Compaq in 1997, which in turn was acquired by HP in 2002. Having returned home, Tandem servers were renamed NonStop servers by HP.

The high availability of NonStop systems results from close cooperation between hardware and software. Every component in an HP NonStop server is duplicated with instantaneous failover to a backup component should one fail. This includes not only hardware components such as processors, memory, I/O channels, power supplies, and cooling but also all software components such as system and application processes. As a consequence, a NonStop server is self-healing in the presence of any single

1

fault and many multiple faults. If a component fails, no one notices (except for the IT staff that must correct the fault).

A major factor in creating high availability is that the entire NonStop environment is a tightly integrated suite. There is no need to merge and manage separate hardware, operating system, database, cluster management, and system management components.

2. A Platform Overview

The architectural concepts behind NonStop systems are explored in Chapter 2.

Share-Nothing Architecture

A fundamental design concept in NonStop systems is *share-nothing*. No hardware or software component shares a common subcomponent with any other facility. Therefore, the failure of any component in the system will not affect the integrity of any other component.

The two core concepts behind share-nothing are processes and messages. A process is a program running in a computer. A program may be running as several named processes.

In most applications, processes must communicate with each other. This is often accomplished via pointers to buffers in shared memory or by API (application programming interface) calls. However, these techniques link processes tightly together so that the failure of one may cause the failure of another. In NonStop systems, system and application processes are loosely coupled. They communicate with each other via messages.

Messaging

A process has a mailbox, called $RECEIVE, into which other processes may place messages requesting service. A process reads messages from its mailbox, provides the appropriate service, and responds to the message initiator. For instance, an application process may send a message to a system disk process asking it to read a specific record from the database. The disk process will perform the read and will return the record to the requesting process.

Process Pairs

Critical system processes are implemented as process pairs. One of the processes in the process pair is the active process, and the other is the backup process. Each runs in a different CPU so that the process pair survives a CPU failure. If the active process fails, the backup process instantly assumes responsibility for processing any messages sent to the process pair.

Advantages of Messaging

The core messaging infrastructure brings many advantages to NonStop systems:

- The two processes can be in different CPUs or even in different systems separated by hundreds of miles.
- A backup process of a process pair can instantly start processing request messages should the primary process fail.
- Faults in either the sending or receiving process will not cause corruption of the other process.
- Performance problems can be identified easily by monitoring the resource consumption of individual processes.

The NonStop Operating System

Guardian

The heart of the NonStop operating system is called Guardian. Guardian supports all modern programming languages, including COBOL, C, C++, and Java.

OSS

OSS (Open System Services) is a Unix-like personality that runs on top of Guardian. Most Unix open-source applications and tools that are available in the Unix world run on OSS. To the experienced Unix user, OSS appears to be Unix. However, it is Unix with all of the underlying availability characteristics of the NonStop system.

The NonStop Databases

NonStop supports three databases – Enscribe, NonStop SQL/MP, and NonStop SQL/MX.

Enscribe

The Enscribe database was introduced long before SQL became a standard. It supports several file types:

- Key-sequenced files containing variable-length records accessible by keys.
- Relative files containing fixed-length records accessible by record number.
- Entry-sequenced files containing variable-length records appended to the end of the file.
- Unstructured files that are organized by the application.

Enscribe file names are very limited. They are eight characters in length with some optional qualifiers. OSS files use the Enscribe facility but add the lengthy and flexible Unix file and directory naming conventions.

Though SQL databases have generally replaced old database systems such as Enscribe, Enscribe is still used extensively in the NonStop world, especially by older applications.

SQL/MP

SQL/MP (massively parallel) was the first truly relational database on the NonStop platform. Using NonStop's message-based architecture, SQL/MP allows disk processes and files to be distributed over multiple disks, multiple processors, and even multiple systems.

SQL/MP is still in heavy use, though it is not fully compatible with the ANSI SQL standard. For instance, it does not enforce referential integrity; and it does not provide triggers or stored procedures.

SQL/MX

SQL/MX is the current and most highly supported database on the NonStop platform. It provides highly increased compatibility with the ANSI SQL standard and makes full use of the OSS personality.

TMF

The NonStop Transaction Management Facility (TMF) is responsible for managing transactions being written to any of the NonStop databases. TMF provides an audit trail of all database changes that can be used to roll back transactions or to recover the database in the event of a failure. The audit trail also

provides a source of changes for replication of files and tables to other systems. TMF guarantees the ACID properties of all transactions.

Pathway

Pathway is the NonStop transaction monitor. It is fundamental to the NonStop capability of linear scalability over hundreds of processors in dozens of systems. Pathway manages server classes. A server class is a group of identical processes spread over several CPUs or even systems. Clients make requests to Pathway services that require the use of a particular server class. Pathway will pass each request to a server-class process that at the time is in the best position to rapidly respond.

Pathway automatically will increase the number of processes in a server class as load increases and will decommission processes as the load diminishes.

NonStop Active/Active Systems

The ultimate in continuous availability is achieved by running two (or more) geographically separated NonStop systems in an active/active configuration. Both systems are running the same application and are sharing the transaction load. Their databases are kept synchronized via data replication. Should one system fail, all that needs to be done is to reroute all transactions to the surviving system. Recovery from a system failure can be accomplished in seconds.

Active/active NonStop systems have supported mission-critical applications around the world with no downtime over decades of operation.

Key Benefits of HP NonStop Systems

HP NonStop systems offer common standards with uncommon advantages, especially in the area of high- and continuous availability. When the cost of downtime is considered, NonStop systems offer low total cost of ownership (TCO) for mission-critical systems. Their use can be found in cloud/hybrid configurations, where they provide a fault-tolerant database for applications running in the cloud.

HP plans to extend the standardization of NonStop servers by porting NonStop to their x86 Blades. Coupled with HP's excellent customer support via their global support centers, HP NonStop servers are the choice for mission-critical systems that simply cannot fail.

3. Developing Software for HP NonStop

The development life cycle for NonStop systems is much like that for other systems and is described in Chapter 3. Application development and maintenance can be accomplished with modern languages, cross-compilers, and debuggers that are commonly used on Linux, Unix, and Windows systems.

IDEs

Program development can be performed on a NonStop system, or it can be done on a PC with cross-compilers. Compilers and linkers are available for C, C++, COBOL, and even the original Tandem programming language, TAL (Tandem Application Language).

The developer's IDE (integrated development environment) of choice can be used to code, cross-compile, and debug applications. Supported IDEs include the Microsoft IDE and Eclipse. Eclipse is the current IDE of choice and is actively supported on NonStop by HP. Consequently, Windows, Linux, and Unix developers can easily become productive NonStop application developers.

Java

Java has been supported on NonStop for quite some time. In one form, HP offers the SASH stack – **S**pring, **A**xis2, MyFace**s**, **H**ibernate – that is the same as that found on Unix boxes. Also, a NonStop version of JBoss is available. JBoss replaces sockets with Pathway interfaces to take advantage of all of the NonStop fundamentals, including TMF transaction management.

The Development Team

A good NonStop development team is like any other because commonly available languages and tools are supported. In addition to seasoned developers, the team should include one or two NonStop specialists to manage the architecture of the application so as to take most advantage of the NonStop fundamentals.

Writing efficient code for NonStop systems means optimizing throughput, response time, and resource consumption. It does not require platform-specific features such as creating process pairs or invoking no-waited programming. This is all addressed by Pathway.

Maintaining Existing Applications

Modernizing Applications

Many existing applications were written decades ago and use green screens. They lack a modern GUI, contemporary security features, and integration capabilities with other enterprise servers and applications. There are many third-party products to help the development team add these capabilities to legacy applications.

Porting Applications to NonStop

In the past few years, many applications have been ported from other systems to NonStop. These migrations required both database and application migrations. HP and its independent software vendors (ISVs) provide a wealth of expertise and tools to do this efficiently.

4. HP NonStop as Part of Enterprise IT

Chapter 4 covers the integration of NonStop systems with other enterprise systems. With the growing dependence of organizations on their IT infrastructures, it has grown imperative that all systems within the enterprise be able to interoperate with each other.

Security

Today, the protection of a system's database and logic assets are of paramount importance given the increasing incidence of hacking attacks. This is especially true of NonStop applications because they very often deal in extremely sensitive data such as credit-card transactions and medical information. The NonStop platform provides several services to guarantee the security of these assets.

Interestingly, one of these services is not a virus scanner. There are no known cases of a NonStop server being infected with malware.

Safeguard is a security framework closely integrated into the NonStop operating system. It provides user management and the capability to create and manage Access Control Lists (ACLs). However, many desirable features are not provided by Safeguard. They are offered instead by a plethora of third-party tools.

Additional security features available from NonStop ISVs include in-place and in-transit encryption, two-party authentication, checking the integrity of system and application object files, and checking a system for PCI and HIPAA compliance.

Integrating NonStop with Other Systems

Communicating with Other Systems

NonStop systems lend themselves very nicely to multitier applications involving other systems. This is due to their architecture, which isolates user interfaces, application logic, and database functions into loosely coupled subsystems that interact via messaging.

NonStop supports SOAP (Simple Object Access Protocol), which allows NonStop server-class functions to be bundled and made available to external systems via standard interfaces using XML message passing.

REST (Representational State Transfer) uses HTTP as a lighter-weight method for integrating systems. It has become the de facto standard for integrating mobile applications, important in the NonStop world for mobile payment services and telecommunications. REST frameworks for NonStop are available from several ISVs.

Operations Management

Several products help manage a NonStop system in a mixed environment. EMS (Event Management Subsystem) is the main system event-message hub that reports all problem and status messages to a common log. EMS can feed HP's ArcSight, a SIEM (security information and event management) system, to integrate EMS with event messages from other systems in the enterprise. This is useful when monitoring for security breaches.

Several other products are available to monitor a NonStop system along with other enterprise systems under a single umbrella. They include Nagios, an open-source monitoring tool, and Tivoli.

File Transfer

NonStop supports the venerable Internet File Transfer Protocol (FTP) as well as the secure file transfer protocols SFTP and SFTP/SSL.

Messaging

Asynchronous messages may be sent between NonStop systems and other systems via JMS (the Java Messaging System), by IBM's WebSphere, and by many third-party products.

5. Ten Resources for More Information

"HP NonStop for Dummies" winds up in Chapter 5 with a set of additional resources for NonStop deep dives. Topics include:

- NonStop terminology
- TACL (Tandem Advanced Command Language)
- Open-source tools
- Development tips
- No-waited programming

- Modernizing legacy applications
- Securing NonStop systems
- The NonStop ISV Ecosystem
- HP NonStop web site
- The user community

Summary

This brief overview of "HP NonStop for Dummies" captures only a high-level synopsis of the information contained in the 44-page book. The full book is a quick and easy read and is recommended for anyone with an interest in NonStop systems and with the technology that allows them to implement their highly desirable capabilities.

A complimentary copy of "HP NonStop for Dummies" can be obtained by contacting comForte at http://www.comforte.com/ns4dummies. For any feedback to the book, please go to http://www.comforte.com/resources/nonstop-for-dummies/feedback