

Virtualized Time from TANDsoft

January 2009

You want to run an application on your New York-based NonStop server but need the application to think that it is running in Paris on Paris time. At the same time, other applications on your New York server need to run in New York time. But why would you want to do this?



There are many reasons. One is the consolidation of many applications serving worldwide locations onto a set of servers at a single site. Another is the ability to avoid have to change the system clock in order to test time-sensitive applications that are currently running with other applications.

The OPTA2000 Clock and Time-Zone Simulator from TANDsoft (www.tandsoft.com) provides this capability with no application modification for all NonStop programming languages and process types.

The History of OPTA2000

OPTA2000, as its name implies, was born out of the Y2K problem. As the millennium changed on January 1, 2000, there were great concerns that programs would fail. This was due in large part to the early days of computing, in which storage was very expensive. Thus, any effort possible was made to use it efficiently.

Specifically, it was common practice to store all years in a two-digit format. "1965" was stored as "65." After all, it was clear that the first two digits would always be "19," at least through the careers of the programmers at that time. Let the rollover of the millennium be someone else's problem. Let someone else worry that "05" – "98" was 7 (2005 – 1998), not -93. Let someone else worry that a birth date of "03" meant 2003, not 1903.

In the 1990s, the pressure to fix this problem mounted. Boards directed management to upgrade the company's systems for Y2K compliance. Auditors demanded tests. Regulatory agencies established regulations with tough penalties. As a result, a lucrative short-term carriage industry was born, which purported to provide a variety of tools to automatically scan application programs and fix them.

But would the tools work? The ultimate arbiter was thorough testing of the modified programs. However, testing required that a program be run and tested just as the date changed from 1999 to 2000. Clearly, testing couldn't wait until that time. Applications had to be tested months in advance. But one could not easily change the system time and make these tests, even during off-hours. Licenses would suddenly expire, end-of-month and end-of-year batch updates would be launched, and the list went on.

Thus was born OPTA2000. It provided the facilities to run these corrected programs under a simulated time without affecting normal system operation.

Uses for Time Simulation

There are two primary uses for time simulation – consolidation and testing.

Consolidation

As systems grow more powerful, the ability to run several applications on a common server becomes more attractive. This is the driving force behind today's move to data-center virtualization. HP NonStop systems have always provided virtualized environments that can support several processing environments simultaneously.

Consolidation of applications within a data center onto just a few servers is today a common practice. Consolidation has now been extended to bringing applications from all over the world to a common data center. Significant savings can be realized with respect to facilities, staff, hardware, and software licenses.

However, unless these applications were written to use GMT (Greenwich Mean Time), they expect to run under their own local clock, not the clock of the consolidated data center. If several of these applications are to run on a single large server, the processing environment must be able to respond to system time calls within the time zone expected by the application.

Consolidation is a powerful tool to reduce costs not only for production systems but for disaster-recovery systems as well. A single hardened data center can act as a backup site for data centers around the world if its servers can morph into the local time of applications that fail over to it. If a single large server is backing up several remote data centers, it must be able to act as a backup simultaneously to applications running in different time zones.

OPTA2000 provides *time-zone simulation* that allows existing production and backup systems to support world-wide consolidated environments.

Testing

Time simulation is also useful for development, testing, and quality assurance. Many applications are time-sensitive. Examples include month-end and year-end processing and reporting, interest accrual, fee assessment, payment processing, and inventory and receivables aging.

In order to develop, test and certify these applications, it is important to be able to change the dates and times under which they are currently operating. Furthermore, any of these systems might be used to develop or exercise many applications simultaneously, each with its own date/time requirements. Therefore, it is important that the processing environment be able to provide each application with its own clock and calendar.

To satisfy this need, OPTA2000 provides *clock simulation* that allows development and testing activities to be carried out in the same system with different clocks.

Clock simulation is different from time-zone simulation. Rather than providing an offset from GMT, clock simulation provides a system time that is arbitrarily offset, typically in the future but in some cases in the past.

OPTA2000 Clock and Time-Zone Simulator

TANDsoft's OPTA2000 Clock and Time-Zone Simulator provides time-zone and clock simulation for NonStop servers. Using DLLs (dynamically linked libraries), it requires no application modifications and supports virtually all NonStop environments.

Supported are user-developed applications, third-party applications such as Base24, NonStop utilities such as FUP and TACL, within the Guardian and OSS environments. All NonStop programming languages are supported, including Java, C++, C, COBOL, TAL, SQL/MP, and SQL/MX, among others. It is certified for NonStop S-series, Itanium, and Blade servers. It supports all program types (100, 700, 800) and runs under the Guardian operating system.

Daylight Saving Time Table (DST)

The OPTA2000 Time-Zone Simulator is driven by user-supplied Daylight Saving Time tables. Each table represents time-zone information for a particular location. It includes the offset from GMT for that location and the dates and times on which the location changes between Daylight Saving Time and standard time.

Because the DST parameters are specified by the user, there is great flexibility. For instance, some countries (for example, China) do not observe Daylight Saving Time. Even worse, some U.S. states (such as Arizona and Hawaii) and some portions of Canadian provinces (Saskatchewan and British Columbia) remain on standard time all year.

GMT offsets must also be flexible. India's time offset is GMT+5.5 (it is five and half hours ahead of GMT). China spans five time zones, but the time zone for all of China is GMT+8.

Application Groups

OPTA2000 provides its services on an application-group basis. The definition of an application group is quite flexible. Using grouping and wild cards, an application group can consist of a specified set of programs, a specified set of processes, a specified set of users, the descendants of a common ancestor, a subvolume, and so on. If an application is not defined within an application group, it is always given the local date and time.

A system can host many application groups. For time-zone simulation, OPTA2000 determines from its configuration information the time zone for an application group when that group makes its first time call. It associates a particular DST table with that application group so that it knows the GMT time offset to use. For instance, if the application is to run under UK standard time, the offset is zero. If it is to run under New York standard time, the offset is -5. If it is to run under Paris standard time, the offset is +1.

Furthermore, from the DST table, OPTA2000 knows when a transition between standard time and Daylight Saving Time is to occur and can adjust the offset appropriately at that time.

For clock simulation, the date and time can be set into the future or into the past for an application group. The application group will then operate under that new date and time. For instance, if an end-of-year report is to be tested, the simulated clock may be set to December 31st at 11:45 PM.

The OPTA2000 DLL

Via its DLLs,¹ OPTA2000 accomplishes time simulation by intercepting system-time calls. No matter the application, the programming language, the system type, the program type, or the operating environment, all time calls ultimately generate a NonStop Kernel (NSK) system call to a handful of procedures:

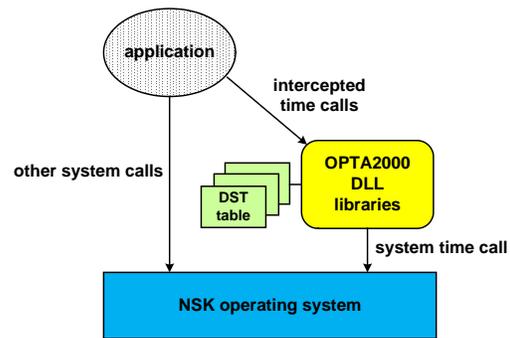
- TIME
- TIMESTAMP
- JULIANTIMESTAMP

¹ OPTA2000 is also available as user libraries or as NSK operating-system libraries.

- CONVERTTIMESTAMP

For time-zone simulation, on each time call by a process, OPTA2000 accesses the DST table for the application group in which the process resides. It fetches the system time via an NSK system call, modifies that time according to the DST table, and returns that time to the process making the call.

For clock simulation, the user can enter a date and time that is to be used by the application group. Then whenever a process in the application group makes a time call, OPTA2000 will intercept it and return a time that is appropriately offset from the system clock.



OPTA2000 Clock and Time-Zone Simulator

Configuration and Control

OPTA2000 is managed by the OPTAcom command interface. The functions that it provides to the user include:

- grouping (with wild cards) and filtering objects (processes, programs, users, CPUs, etc.).
- creating, listing and modifying DST tables.
- defining application groups for time simulation.
- associating application groups with DST tables for time-zone simulation.
- specifying date/time offsets for application groups for clock simulation.
- listing processes with their current simulated times.
- listing application groups with their current simulated date/time values.
- listing processes, CPUs, and other objects by time zone.
- OPTA2000 operating statistics.

All OPTAcom functions are dynamic and can be performed without affecting other operations of the system.

Some Usage Examples

Time simulation is actively being employed by scores of OPT2000 users around the world. Some examples follow.

Disaster Recovery

A major global computer manufacturer has consolidated all of its disaster-recovery systems into one data center in the U.S. Its backup systems are flexible and can be assigned dynamically to take over the processing of one or more failed systems anywhere in the world. By using OPTA2000's time-zone simulation capabilities, the backup of a failed application can be given an operating environment that has the same time zone as the failed application. In this way, only a few backup systems are needed to protect many systems deployed world-wide.

Consolidation

A major U.S. East Coast bank uses OPTA2000's Time-Zone Simulation to run multiple NetBatch environments in its central data center. Each NetBatch environment runs in its own simulated time zone and is conscious of the GMT offset and standard time/Daylight Saving Time transition schedules for its time zone. The NetBatch jobs are responsible for preparing market-closing reports that must represent the local time with which the reports are associated. Though

NetBatch jobs are run in their respective remote time zones, system operators can monitor the NetBatch job schedules according to the operator's local clock.

Another bank, a major Canadian bank, has consolidated its smaller West Coast operation into its East Coast data center. By doing so, it has eliminated the costs of the separate data center, its staff, and much hardware and software. The consolidated systems support back-office and online banking applications that must be run in the application's local time. OPTA2000 provides the time-zone simulation to do this. Not only does OPTA2000 support the bank's applications, but it also supports third-party applications, including Base24 and Interac, the Inter-Member Network(IMN) debit-card processing product.

Development, Testing, and Quality Control

The User Acceptance Testing (UAT) group of a major enterprise comprises five test groups. Each group is responsible for ensuring the functionality of new applications or application upgrades before they are put into production. Applications include custom applications and third-party applications such as Base24.

Until recently, each of the five groups had its own NonStop S-series server for acceptance testing and quality control. Recently, the company consolidated the five NonStop S-series servers into two NonStop Itanium servers to be shared by all five test groups. Many of the applications being tested are time-sensitive and must be tested under different date/time scenarios. The clock-simulation capabilities of OPTA2000 are used to facilitate acceptance testing of multiple applications requiring different test date/time environments being run simultaneously on the same server by the various UAT groups.

TANDsoft

TANDsoft is located in Beaconsfield, Quebec, Canada. It has distributors in North America, Europe, the Middle East, and Asia.

TANDsoft is a member of the HP DSPP (Developer and Solution Partner Program) and specializes in the development and marketing of HP NonStop tools for time simulation, system-call interception, availability, and disaster recovery. As with the OPTA2000 Time Simulator, its other products require no application modification. They include the following:

- *FileSync* synchronizes application and system environments across NonStop servers.
- *FileSync-Audit* synchronizes Enscribe file modifications between NonStop servers.
- *OPTA* enables the interception of NSK system calls with no application modifications.
- *OPTA-RecycleBin* saves deleted files so that they may be later restored.
- *OPTA-Alert* provides additional application startup and termination processing.
- *OPTA-LowPin* Optimizer ensures that low-pin system resources are used efficiently.
- *OPTA-Trace* allows the user to view NSK procedure calls made by applications.
- *ASAP Reporter* maintains a database of ASAP performance and availability data.
- *AutoASAP* provides ASAP capabilities to customer, HP, and third-party applications.
- *BusinessLink* adds transaction monitoring and data replication to existing applications.

Summary

The virtualization of time services is a powerful tool for consolidating backup resources for disaster recovery as well as for data-center consolidation and time-sensitive test environments. By providing a simulated time, TANDsoft's OPTA2000 Time Simulator allows multiple processing environments to be run on the same system while using different clocks.

OPTA2000's time-simulation capabilities can be used in two ways. They can provide virtual time zones in which application groups can perform their processing. Alternatively, OPTA2000 can provide a virtual date/time at any point in the past or future for development and test purposes.

Without time simulation, an application must rely on the system clock; and all applications running on that system must use the same date and time. OPTA2000 breaks this barrier and allows applications on a single system to be run under their own virtualized clocks.