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A Journal for the Hewlett Packard Enterprise Business Technology Community

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Sept - Oct 2017 { Volume 38, No. 5 }

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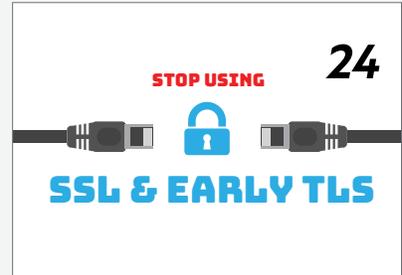
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A Note from Connect Leadership

This month's issue has me kind of laughing. It is all about enabling productivity on the NonStop. I know the topic isn't intended to be humorous, but it just tickled my funny bone too much to pass up. I have worked in this industry, and on the NonStop platform, for quite some time. I know there are others out there with a lot more experience, but I think I have been around long enough to see how projects and applications get implemented on different platforms. There is no such thing as a perfect platform as there are any number of ways to address a project or requirement. As such, there are just as many ways to implement a solution. Today's development and support ideologies tend to lean towards rapid change. From agile development to dev/ops support, the current mentality is to try and keep up with the constantly evolving needs of the user. I get that, but didn't most of us live most of our careers with a different point of view where we designed systems for availability and stability? We spend the majority of our time architecting solutions that were intended to (and have) last longer than most internet companies have been around. We spent the bulk of any project planning and architecting rather than changing and updating. But that was then and this is now. To this day, I have yet to see a project on ANY platform that matches our productivity and efficiency. NonStop servers just do more, with less. How much productivity do we need to enable here? Besides all that, the point is still to make the NonStop more accessible to today's mainstream developer and HPE and the partners are doing that really, really well.

We can all learn to do more with less, it's just that some of us have been doing it for a while! Take a look at this month's articles and hopefully you will learn something you didn't know. I always do.

Please do NOT forget to register for the NonStop Technical Boot Camp! As always, this is the PREMIER NonStop technology and personal networking event for technologists worldwide. Join us, November 13 - 15th at the Hyatt Regency San Francisco Airport.

Education, networking with colleagues, updates from HPE and more fun than you can imagine. 

Register at: <http://bit.ly/NonStopTBC17>

Thanks.

Rob Lesan

Rob Lesan

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The Connection

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News from HPE's NonStop Enterprise Division



Karen Copeland
Manager, WW NonStop
Product Management
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Fall in love with NonStop all over again at this year's NonStop Technical Boot Camp...

2017 continues to speed along. Here at HPE many changes are in the works across the company and new opportunities continue to rise up. As the kids head back to school in the United States, and everyone in Europe is returning from vacation, NonStop servers keep running businesses around the world without fail, and of course at this time of year we're busily working on plans for our next Technical Boot Camp event

This year, the NonStop Technical Boot Camp (TBC) is again in the San Francisco Bay area, but instead of being in the South Bay at the Fairmont in San Jose, we'll be meeting further North at the Hyatt Regency near the San Francisco airport. This is a new location for the TBC. The hotel has a recently remodeled convention center and we are planning to offer between 70 to 80 breakout sessions this year as we have in recent years. The Boot Camp will focus on the latest enhancements and offerings across the NonStop product lines, a new server in the works, Blockchain and many other topics.

This year at the TBC, we've added three NonStop Education courses for customers and partners attending the TBC. This is a return to the past when we used to offer training alongside ITUG in the early days of Tandem. The classes include:

Fast Track Concepts and Facilities for HPE NonStop Systems
11/11 and 11/12 from 8 to 5pm

Securing HPE NonStop Servers using IPSec
11/12 from 8-12pm

Securing HPE NonStop using IP Tables (CLIM)
11/12 from 1-5pm

All three classes will be held at the hotel for the convenience of participants. If you've already registered for the TBC, you can go back and add these courses to your registration if you'd like to attend. Attendees will receive the full materials for the classes electronically and a certificate of completion for attending the course. You will need to travel with your laptop and use it in the class.

We're trying this out as a new way to make Educational courses more readily available to customers in conjunction with NonStop Events. HPE Education teams for NonStop will also be one hand in person at the TBC this year to hear from you about the training your teams are looking for and how you want to receive NonStop education in the future.

This issue of The Connection Magazine focuses on Productivity with articles on SQL Database secrets that can improve your ability to share data or generate data for testing.

"SQL/MX DBS Not Only for the Cloud" by Frans Jongma at HPE, gives you advice on how to set up NonStop SQL as a Database as a Service (DBaaS) internally and share data across multiple teams within a company. The other article, "Generate Test Data Easily Using SQL/MX TRANSPOSE", by Paul Denzinger at HPE, explains how to use the SQL/MX Transpose clause to help you generate simple test data for database tables without a lot of work.

Also in this edition you'll find Security articles, one from Sheryl Wharff at Micro Focus on how to "Enable Productivity and Security in Your NonStop Environment" where she talks about how to securely encrypt data you are storing without expensive hardware upgrades and an article from XYPRO called, "PCI 3.2 Are You Ready?" which outlines what the new requirements for PCI now mean to your current security practices and future audits. Keith Evans and Paul J. Holenstein from Gravic have provided a really interesting article called, "Real-time Data Replication for Prescription Drug Fraud Prevention at a Large Government Healthcare Agency", which describes how a Government agency is using Business Continuity tools to replicate data and prevent fraud. Rounding things out we're also back with another Women in NonStop interview, this time with Connect's own Kristi Elizondo who was once the voice of Texas!

Although it's looking like another good year for the NonStop business, it has not been a good year so far for the country in terms of weather and natural disasters. From heatwaves, to massive fires, to the devastation of Hurricane Harvey in the Houston area of Texas, followed by Hurricane Irma which caused the evacuation of nearly the entire state of Florida, people have faced a harrowing time losing loved ones and properties. Our hearts go out to everyone impacted by these disasters especially those in our NonStop family and we stand behind you as you pick up the pieces and begin rebuilding your homes and your lives. [CS](#)

Best wishes

Karen

Karen Copeland

Manager, WW NonStop Product Management
Mission Critical Solutions
Hewlett Packard Enterprise



Dark DR

Avoid Its Costs with Active/Active

Dr. Bill Highleyman >> Managing Editor >> Availability Digest

Traditional disaster recovery (DR) methods utilize an active/passive architecture, one in which there are two redundant servers. One server is actively processing the application, and the other acts as a backup system ready to take over should the production system fail. The two systems typically are located remotely from each other to avoid a dual failure due to some local disaster. From an operations viewpoint, the backup server remains ‘dark’ until it is needed. As such, this architecture is commonly called “Dark DR.”

In contrast, the servers in an active/active system both are processing transactions. Should one server fail, all transactions are simply routed to the surviving server. Of course, both servers must have sufficient capacity to accommodate the full operational load; but in normal operation, the reduced workload on each server results in performance improvement.

Some applications cannot run in a distributed environment such as an active/active configuration. These applications must run in their own server. It is these applications that give rise to Dark DR to provide redundancy to protect against a production-server failure.

Dark DR

The majority of organizations face considerable loss of revenue and/or reputation if their services to customers go down. Companies expect that at some time they will face a disaster that will take down their production systems. Therefore, organizations turn to redundant systems to provide ongoing services to users, even in the event of a system failure. The classic redundant architecture utilizes an active system and a

backup system, typically separated by geography.

In this architecture, the active production system processes the application workload and replicates database changes to the backup system to keep it synchronized with the production system. The backup system sits by idly, ready to take over should the production system fail. Because the backup system is not performing any work, it is ‘dark’. That is why active/backup architectures are called “Dark DR.”

Limitations of Dark DR

A major issue with Dark DR is that switching over from a failed production system to the dark backup system can take minutes to hours. During this time, users have no access to their applications. Even worse, the switchover may fail and is known as a ‘failover fault.’

‘Configuration drift’ is yet another concern when the need arises to switch to the backup system. Should the primary server fail, the backup server may lack all of the information it requires to take over. Often this occurs because IT staff overlook the backup server when they apply updates to the production server. These missing pieces must be identified and migrated to the backup server to restore operations, a process that can take hours.

If the backup server is brought online successfully, the primary server’s normal workflow must be redirected to the backup site. This may require a significant amount of manual reconfiguration requiring two IT teams – one at each site. The effort seriously can impede the activities of the primary site’s IT staff, whose job it is to return the primary site to operation.

Costs of Dark DR

In order for a failover to be successful, it is essential to know that the backup system is fully operational. Thus, running a full-capacity redundant system in a secondary site represents a necessary yet considerable expense. In addition to the hardware and software costs of the otherwise idle system, there are several additional expenses:

- Extra maintenance – IT staff must ensure that the backup site is always operational. Best practices recommend to staff that they periodically switch production to the backup site to make sure it is working and that there will be no failover fault if the backup is needed. During the switchover time, which could be minutes to hours, users will have no access to the application and are down. If there is a failover fault (i.e., the backup system will not come online), users may be down even longer.
- Extra staffing – IT staff is required at both sites to support upgrades, one set of staff to make upgrades to one system and one to keep the other system running.
- Downtime costs – downtime creates a potentially huge cost for organizations, both in terms of immediate business loss and long-term reputation.
- Lost business – slower application performance due to overloaded servers can result in lost revenues as shoppers abandon their shopping carts due to long lag times.

Active/Active

Rather than build DR structures that must fail over to a backup system if the production system fails, organizations need to design for continuous availability. If a system fails, the failure should be transparent to the users of the applications. Active/active systems fulfill this requirement.

What is an Active/Active System?

An active/active system utilizes two or more servers that all are actively processing transactions. Whenever a transaction changes the database, that change is replicated to the

other servers in the application network so that all databases remain synchronized. As such, a transaction can be routed to any server in the application network and can be processed in the same way that it would have been had it been routed to another server.

Active/active architectures provide many advantages to an organization:

- Improved asset utilization because each server is providing application processing.
- Seamless scalability because additional servers can be added easily to the active/active network.
- Dramatically higher uptime because if a server fails, all that needs to be done is to route transactions to surviving servers.
- Improved end-user experience because of the absence of user downtime and because of the faster response due to reduced server utilization.

Other Advantages of Active/Active

Technical Advantages

Active/active systems enable a smooth failover. Operations transition from the failed server to the other server with no interruption in service. Server failures are transparent to the users.

Maintenance can be provided on one server while the other continues in operation.

Businesses can cut costs by moving workloads between servers in different locations in response to changing cost factors (energy, rent, etc.).

Applications can handle more traffic by adding servers to the active/active system.

Cutting workload levels in locations creates more capacity for serving traffic growth.

Security improves because IT can patch a vulnerability on demand rather than having to wait for the next maintenance window.

Economic Advantages

By spreading traffic load across multiple systems, organizations put less strain on servers, thereby extending their functional lives.

Reduced site use means lower expenses. An organization does not need as much hardware in each location.

Increased application performance often leads to enhanced revenues. By speeding up performance on e-commerce sites, customers are less likely to abandon their shopping carts.

Maintenance costs are lower because tasks can be performed during work hours rather than in the middle of the night. One server in the active/active system can be taken down for maintenance while the other server continues to provide application services to the users.

With little to no downtime required for maintenance, organizations can increase revenues that otherwise would have been lost during the maintenance downtime.

Where Does HPE Stand?

With all the disadvantages of Dark DR, it remains a necessary architecture to provide redundancy for critical applications that cannot run in an active/active environment. These applications run in a production server that is backed up by a passive server, ready to take over application processing should the production server fail. Since the passive server is undertaking no application processing, it is a dark disaster recovery system. In addition, an active/

passive architecture is simpler to implement when compared to the relative complexity of running applications in active/active's distributed environment.

HPE supports Dark DR via several data replication products, including its own RDF replicator and HPE Shadowbase from Gravic, DRNet from NTI, and GoldenGate from Oracle. Some of these products also support active/active architectures, thus avoiding Dark DR if so desired.

Summary

Active/active systems have many advantages over active/passive systems. The primary difference is that there is no 'dark' server sitting idly by, waiting to fill in for a failed primary server. Both (or all) servers are actively processing transactions, leading to greater capacity and faster response times. 

Acknowledgement

Some information for this article was taken from the following source:

"The hidden cost of Dark DR: The economic argument for active/active operations," ITProPortal; *June 14, 2017*.

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Dr. Bill Highleyman brings years of experience to the design and implementation of mission-critical computer systems. As Chairman of Sombers Associates, he has been responsible for implementing dozens of real-time, mission-critical systems - Amtrak, Dow Jones, Federal Express, and others. He also serves as the Managing Editor of The Availability Digest (availabilitydigest.com). Dr. Highleyman is the holder of numerous U.S. patents and has published extensively on a variety of technical topics. He also ghostwrites for others and teaches a variety of onsite and online seminars. Find his books on Amazon. Contact him at billh@sombers.com.

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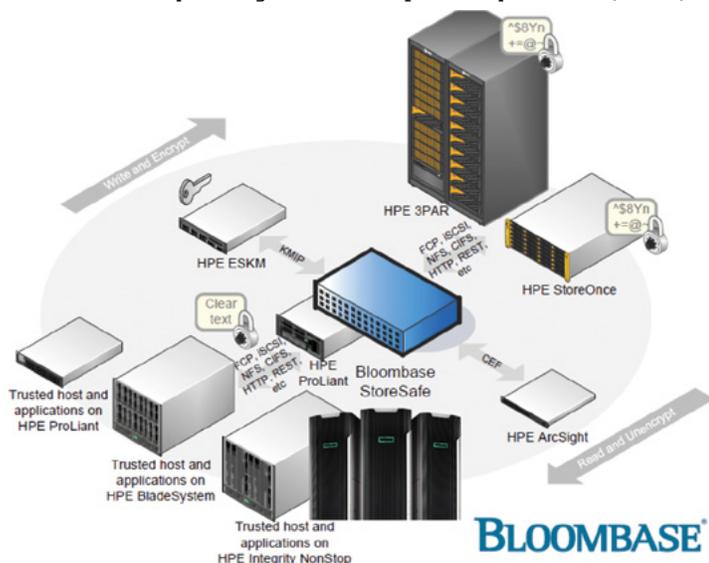
Sheryl Wharff >> Global Product Marketing >> HPE ESKM >> Data Security

It's no secret. All companies I encounter are trying to get the most efficiency, productivity and protection from their existing computing infrastructure. Sometimes that means massive upgrades or new systems. Sometimes that means leveraging their current technology and finding new ways to extend its life and capabilities. As you consider your NonStop systems in-house today ask yourself:

- Do you have legacy storage that doesn't support encryption—but you still want to encrypt?
- Is it too costly to retrofit your storage with encrypting capabilities natively?
- Do you think you are locked out of using open standards-based solutions due to proprietary systems you own?

As we look at security of our sensitive and high-value data, we know that unencrypted sensitive information is the easiest and most obvious target for hackers. While data storage in clear text remains the fundamental cause of data exposures, the addition of inbound threats adds a serious dimension to the data risk profile: sponsored espionage, data theft, disgruntled employees, insider threats, hardware theft, leakage caused by malware and viruses, various vulnerabilities as result of outsourcing, 3rd party MSPs, off-premise cloud etc. As a universally-accepted best practice, there is no substitute for encryption of data-at-rest as the last line of defense.

So – what are your options? What's the best solution? A certified interoperable HPE Enterprise Secure Key Manager (ESKM) and Bloombase StoreSafe solution using the OASIS standard Key Management Interoperability Protocol (KMIP).



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An HPE ESKM and Bloombase StoreSafe solution help customers:

- Create an encryption proxy when a storage system can't support it natively
- Avoid costly upgrades in new hardware such as SED [Self Encrypting Drives]
- Work around vendor applications that have created a proprietary lock-out situation

Think about it. If data is valuable to an organization, then it is valuable to an internal or external threat actor. Intentionally leaving data unencrypted is naïve and negligent. So ask yourself:

- What regulatory pressures are you under?
- How are those pressures driving new security requirements?
- Are there international or regional issues to consider?
- Do you need geographic separation or redundancy in certain areas, due to physical separation of IT?

Check out an HPE ESKM/Bloombase StoreSafe solution to encrypt data and provide enterprise key management from a single GUI. We can help you get the most from your NonStop systems and overall computing environment. Our solution advantages include:

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- Single pane of glass key management with FIPS 140-2 Level 2 appliance; proven, simple
- Future proof using open standards for vendor interoperability (KMIP)
- Fully automated key management to lower cost of maintenance
- Expert services from the proven solution architect teams

To learn more review this HPE ESKM and Bloombase StoreSafe solution brief at: <https://www.voltage.com/resource/delivering-transparent-data-encryption-while-centrally-managing-keys/>. You too can enable productivity and security in your NonStop environment starting today!



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Women in NonStop:

Kristi Elizondo of Connect Worldwide Shares Her Background and Hopes for the Future of NonStop

Mandi Nulph >> Marketing Coordinator >> NuWave Technologies

In this edition of Women in NonStop, we had the opportunity to chat with Connect's own Kristi Elizondo about her background, her role models, and what she hopes for the future leaders in NonStop.



Kristi Elizondo
CEO Connect Worldwide

Mandi: Let's start with who you are and what your role is in the NonStop community.

Kristi: I'm the CEO of Connect Worldwide, which is HPE's user group. I've been doing this job for about nine years now, and I fell into the job through my volunteer position on the Board of Directors. I was a customer of HP for many

years, and I'm going to say HP because that's what it was at the time. I was working primarily in the semiconductor industry, so I spent several years at Motorola, which is where I first got my exposure to NonStop. I was Director of Global Infrastructure for Motorola Semiconductor. Tandem owned the cellular infrastructure that Motorola sold.

I was in transition and looking for a position in Austin at a startup company. I received a call from a Connect board member about the position of Executive Director. It appealed to me because it was similar to launching a startup and I became employee number one.

I thought I'd be here for only a couple years. I would do this launch, I would love it, and then leave it and pass it on to someone else! Here I am, nine years next February. It just got to where it was too much fun to leave, so I guess I decided to love it and stay.

Mandi: What did you think you would have as a career when you were younger versus what you ended up doing with HPE?

Kristi: My first degree from the University of Texas is in radio, television, and film. I thought I was going to end up being a sports broadcaster. When I graduated from the University I found out that the first job you get is mopping studio floors if you want to do anything in the industry, and I was a little overwhelmed by that. I ended up going to work for the Highway Department here in the state of Texas. It was a travel counselor job for the state of Texas and I greeted tourists coming into the capitol. I also did work in

publications and audio tracks for travel films for the state. I used my radio broadcast voice and became known as the "voice of Texas". "Hi ya'll, welcome to Texas!" It was a fun job, but not really what I wanted to do in the long term. I became interested in computers and at that point I went back to the University of Texas and earned degrees in computer science and marketing. That was the best move I could've made in my career. As a kid, that wasn't the choice I thought I'd make. I thought I would be a lawyer.

Mandi: What do you like best about working in the NonStop Space?

Kristi: I would have to say, this isn't any job. I love the technology. Anything that is high-availability is appealing to anyone that comes from my background, because you can sleep at night. I always chose high-availability solutions in the data centers. When you run a 24/7 operation maintaining uptime is critical. Downtime is loss of productivity and dollars. There's only a few players out there that can honestly call themselves a high-availability solution. Even though the world has gone to Windows, and to Linux, I think there's still that space requires that a 24/7 high-availability, no down time, easy upgrade, environment.

Mandi: Did you have any mentors or role models that have helped you along your professional journey?

Kristi: Professionally, as far as the person who most influenced me in my life in terms of being a woman in business, is my mother. She was from a Depression-era background and she was a self-made business person. She was the first woman president of the Austin Better Business Bureau. She owned several clothing stores that catered to professional women employees in downtown Austin. She had a significant amount of influence on my life. I don't know if she influenced me as much in my role as a mother as she did in my role in business. She had an extremely strong work ethic, and instilled that in all her employees. I worked for her for several years because that was the job available to me as a young kid. She opened her doors to many women in the Austin community and created that drive in individuals.

As far as my professional career as an IT person, when I worked at Motorola there was a gentleman there who was extremely intelligent that I followed around for roughly ten years. When he would move, I would move with him. He

eventually became the CIO of the semiconductor division of Motorola, and then he went to work for the CIO at HP. I didn't follow him to HP. He worked at HP for about three and a half years and now he's the CIO of OnStar at General Motors. He had a tremendous amount of influence on me and he was probably the first person I met that didn't see any kind of boundaries between men and women. I had worked in an extremely male-dominated field with lots of people with military backgrounds. There weren't that many women engineers and not that many women in IT. He never seemed to think that there was any difference between me and the guy with whom I shared a cubicle. He promoted me several times within the company and I will always appreciate his trust and support of me. I still am in touch with him.

Mandi: What has your experience been as a woman working in the NonStop space since then?

Kristi: My experience has been good. I believe your experience is what you create it to be. I have not been one to think of myself as different because I am a woman. I think, "I have a job to do and I'm going to do it, whatever it takes." That goes back to my mother teaching me to do whatever it takes to get the job done.

I've also, as a leader, taken the opportunity to seek out many women who I think have the potential to be mentored into leaders, and that's primarily because I think the industry needs it. I've got a few people who, over the years, have followed me to a few companies and they're now leaders of their own companies. When I first started, I remember a young lady who was 27 years old and I promoted lead an all-male team of fifteen network engineers. At first, she was intimidated that she had fifteen guys that were under her leadership and they tried to take advantage of her. I said, "Don't let them take advantage. You're just as smart, if not smarter, than they are and they need to recognize it. Just because you're not doing the hands-on work doesn't mean you don't know what they're talking about. Don't let them bully you." She took that advice and she's been very successful over the years.

From a leadership perspective, I never thought of myself as being any different than one of the guys. I certainly never thought that I had to act different. I believe that if women become too assertive, they get a different name assigned to them than if men become assertive. I've always been very careful about how I phrase things, but I also try to constantly make sure that people understand that I'm in this to win with them. It's not a competition in a company, it's about the company winning. Years ago, people were loyal to companies. You worked for a company for forty-five years and got your badge of honor and retired. Nowadays, that's not the way most companies are run. I think that people are no longer loyal to companies, people are loyal to people. If you develop good relationships with the people you work with, then I believe you can be successful in any career, whether it's IT or anything else. Regardless of if you're a man or woman, if it's in your DNA to build relationships with people, then you'll be successful.

Mandi: Do you have any advice for young people, men or women, coming into the NonStop space?

Kristi: I read about this a lot. I have challenges being in charge of a user group and I have to understand what it takes to keep people engaged that are the next generation. I think that we have to adjust to the style of communication for the next generation. Usually what happens, and what happened to me when I younger and starting my career, was that I didn't participate face-to-face in communications. We did have the internet when I was young and it was a lot easier to go look something up online or pick up the phone and call support. I didn't realize I needed that face-to-face interaction. I think as people get older, they need that community and personal interaction. No matter if it is a company, user group, or anything else, they need to make sure the next generation of leaders will talk to each other in person. I think that's going to create overall success for whatever the business is. Learning from other people by talking face-to-face with somebody that's been around in the industry for a long time, mentoring and pairing up people in the company, having the over-forty/under-forty pairing up of people, will help create that next generation skill set. We have a Connect board member that has taken this to task and created a special interest group for technologists under 40. Why 40? We had pick somewhere to start. He has meetings with this group at our boot camps and we take their feedback and implement change.

Again, I think that companies in the NonStop industry need to remind technologists why you do NonStop; so, you can sleep at night and you can have a life. And that's one thing that is very different about the Baby Boomers and the Millennials and younger, is that they want more free time. The Baby Boomers didn't care about free time, all they cared about was work and making enough money to build a house and put the kids through college. I think that when you look at the up-and-coming generation, they want quality of life and they want time. You better run NonStop because you're going to have more time on your hands to be able to do other things. And you need to get your friends involved so that there's enough of you around so that you can keep it going. You don't want to be the only one left in the room when everybody's retired or gone off to something else. You want to make sure there's a room of support people with you, that are doing the same thing as you.

Mandi: Thank you for your time, Kristi! We appreciate everything you do at Connect and we look forward to your upcoming events! 

Read our follow-up with Kristi at www.nuwavetech.com/blog to learn more about what Connect has planned for the upcoming Boot Camp.

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Mandi Nulph is NuWave's marketing coordinator. NuWave specializes in HPE NonStop middleware, including their newest product, LightWave Client™, which allows applications running on NonStop servers to securely access REST Web services on any platform. With a degree in Mass Communication and Journalism, she boasts 10 years of professional experience writing and editing for a variety of publications, as well as an extensive career in marketing. She volunteers to help interview companies making innovations in the NonStop space for a variety of trade publications.



Generate Test Data Easily Using SQL/MX TRANSPOSE

Paul Denzinger >> NonStop Enterprise Solutions & Architecture Team

Have you ever wanted to generate simple test data for database tables but did not have the time or inclination to write a proper load program? Did you know that the SQL/MX TRANSPOSE clause has the ability to do this for you?

Read on to learn how to use this simple yet powerful tool in SQL/MX for simple data generation without writing any procedural code.

TRANSPOSE is an optional clause of the SQL/MX SELECT statement that is used in various ways to simplify query processing. It transforms multiple columns of a row into a single column, in effect, pivoting the values of multiple columns into one. This form of TRANSPOSE is commonly used for creating cross-tabulation tables for statistical analysis and single-pass aggregation queries.

In this article, we will examine a lesser known use of TRANSPOSE to generate simple test datasets quickly and easily, and all within a single SQL/MX SELECT statement.

Materialized tables and TRANSPOSE

TRANSPOSE is normally used with an existing database table. But since we wish to generate data without relying on an existing table, we will start by using a materialized table¹.

Consider the following statement:

```
SELECT t FROM (VALUES(0)) T(t);
```

This statement materializes a table in the memory of the executing process². The table is named "T" and it contains one row, with a single column, "t", which is assigned the value of 0³. This is our starting point.

The query can be executed in mxci without setting a catalog or schema. Go ahead, try it.

By using the above statement we avoid the need to create a permanent table and the effort to construct the DDL. The materialized table will only exist for the execution of the statement. It is not backed by a permanent table and cannot be referenced by another process⁴.

The materialized table is the basis for generating data. We will take that one step further and combine a materialized table with the TRANSPOSE clause. This is where the real magic occurs. And it is easiest to just look at a few examples...

¹ In this context, a materialized table is not to be confused with a SQL Materialized View.

² The executing process is also known as the "Master" process. For interactive access this process is typically mxci, rmxci, or an MXCS server process. The materialized table will only exist in the memory of this process. It cannot be shared with another process.

³ You can define the materialized table with additional columns and rows. For example, this statement generates two rows with three columns; one numeric, one character, and one date.

```
SELECT t1, t2, t3 FROM (VALUES(0,'a',null),(1,'b',date'2017-06-30')) T(t1,t2,t3);
```


But for our purposes, a single row/column will suffice.

⁴ You can view the explain plan for this query to see that the materialized table is in the memory space of the Master process, which for our examples, is mxci. Just issue:

```
EXPLAIN SELECT t1, t2, t3 FROM (VALUES(0,'a',null),(1,'b',date'2017-06-30')) T(t1,t2,t3);
```

Let's add the TRANSPOSE clause to the above statement...

```
SELECT *
FROM [VALUES(0)] T(t)
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c1;
```

The TRANSPOSE clause supplies a list of 10 values (0...9) and assigns them to a column named 'c1'.

With this form of TRANSPOSE, column 't' will be combined with each value in the TRANSPOSE list. In other words, it does a cross-join between the row in the materialized table and the values in the TRANSPOSE list. The result is 10 rows.

You can run this in mxci and view the results yourself. You will see the result contains two columns, 't' and 'c1'. Column 't' is the column that was defined in the materialized table and contains the constant value of 0. Column 'c1' came from the TRANSPOSE list ("AS c1") and contains the values 0...9.

If we define the materialized table with multiple columns:

```
SELECT *
FROM [VALUES(0,1,2,3)] T(t1,t2,t3,t4)
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c1;
```

The results will look like this:

As you can see, the entire row of the materialized table is joined with each of the values in the TRANSPOSE list.

To generate more rows, we could increase the values in the TRANSPOSE list. Or, we could just add another TRANSPOSE clause, as follows:

```
SELECT *
FROM [VALUES(0)] T(t)
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c1
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c2;
```

The second TRANSPOSE clause will be cross-joined with the results of the first TRANSPOSE join. So, 10 values from the first result times 10 values from the second TRANSPOSE clause will produce 100 values. Run it and see.

There is now a second column generated for the results, column 'c2', which came from the second TRANSPOSE clause.

With its multiplicative effect, you should now see that generating a large volume of data simply requires additional TRANSPOSE clauses.

Following the example above, each additional TRANSPOSE clause in the query below will effectively act as a multiplier of 10⁵. So if you want to generate 1M rows, just use 6 TRANSPOSE clauses, as follows...

```
SELECT COUNT(*)
FROM (
SELECT *
FROM [VALUES(0)] T(t)
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c1
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c2
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c3
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c4
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c5
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c6
) Z;
```

So that is the basis for how we can generate a volume of data starting with a very simple statement.

But what else can you do with this? Well, quite a lot...

T	C1
0	0
0	1
0	2
0	3
0	4
0	5
0	6
0	7
0	8
0	9

10 rows generated

T1	T2	T3	T4	C1
0	1	2	3	0
0	1	2	3	1
0	1	2	3	2
0	1	2	3	3
0	1	2	3	4
0	1	2	3	5
0	1	2	3	6
0	1	2	3	7
0	1	2	3	8
0	1	2	3	9

10 rows generated

T	C1	C2
0	0	0
0	1	...
0	2	9
0	3	0
0	4	...
0	5	9
0	6	...
0	7	0
0	8	...
0	9	9

100 rows generated

⁵ There is nothing special about using 10 values in the TRANSPOSE list. It is simply a convenient means for calculating the output dataset size. You can use different sizes in the TRANSPOSE list and multiple TRANSPOSE clauses can each have a different number of elements.

Manipulating data generated from TRANSPOSE

Each additional TRANSPOSE clause introduces a new column to the query. The above examples just use 'SELECT **' to retrieve all columns⁶. But you can select any of the columns in the query and you can manipulate the data in any way you wish. Here is just one example...

```
SELECT
    c1                                AS a1,
    2*PI()*c1                          AS a2,
    SQRT(POWER(c2,2) + POWER(c3,2))    AS a3,
    POWER(c1,2) + POWER(c2,2) - 2*c1*c2*COS(c3*10) AS a4,
    CHAR_LENGTH(CAST [(c1*c2)/(C3+1) AS VARCHAR(100)]) AS a5
FROM (VALUES(0)) T
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c1
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c2
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c3
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c4
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c5
    TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c6;
```

A few things to note:

The materialized table, "T" does not name the column as in the previous example. That is optional, and only required if you want to refer to its value.

The columns in the select list, a1, a2, ..., a5, can be named differently from the column names in the TRANSPOSE clauses (c1...c6).

The select list does not have to use all of the columns from the TRANSPOSE clauses - yet those unused columns will still be used to generate data.

You can do any type of data manipulation that is correct for a column's datatype, and you can cast a column or value to a new datatype.

Using TRANSPOSE to generate CHARACTER data types

The above examples have all generated numeric data. But can you use TRANSPOSE to generate other types of data?

Sure. Consider the following statement:

```
SELECT a || b1 || b2 || CAST(b3 AS CHAR) AS col1
FROM (VALUES('x')) A(a)
    TRANSPOSE 'a', 'b', 'c' AS b1
    TRANSPOSE 'x', 'y', 'z' AS b2
    TRANSPOSE 0, 1, 3 AS b3;
```

This query produces 27 rows (3 x 3 x 3), using a mixture of character and numeric data in the TRANSPOSE clauses, producing a single column of output that is a character data type. Note that the values of the last TRANSPOSE clause are cast to CHAR and are concatenated together with the other character values.

Here's another example, this time generating a set of names from two TRANSPOSE lists:

```
SELECT fn || a || ls AS full_name
FROM (VALUES(' ')) A(a)
    TRANSPOSE 'Sam','Tom','Paul' AS fn
    TRANSPOSE 'Jones','Miller','Yoder' AS ln;
```

Note how the value (a space) of column 'a' from the materialized table is used as a character separator between the first and last names.

⁶You can add the "SELECT COUNT(*)" around the query statement as shown above to more easily prove it generates 1 M rows.

COL1
xax0
xax1
xax3
xay0
xay1
xay3
xaz0
xaz1
xaz3
...

27 rows generated

FULL_NAME
Sam Jones
Sam Miller
Sam Yoder
Tom Jones
Tom Miller
Tom Yoder
Paul Jones
Paul Miller
Paul Yoder

9 rows generated

Using TRANSPOSE to generate DATE data types

Generating DATE (or TIMESTAMP) data types with TRANSPOSE requires just a little more effort.

The queries below generate all of the dates for the years 2016 and 2017. Multiple queries are used to handle the differences in the number of days per month. When UNIONed together, these queries populate the full range of dates for the years, 2016 and 2017.

```
-- Generate all 31-day months
SELECT CAST (y || t || m || t || d AS DATE) AS dt
FROM (VALUES('-')) T(t)
      TRANSPOSE '2016','2017' AS y
      TRANSPOSE '01','03','05','07','08','10','12' AS m
      TRANSPOSE '01','02','03','04','05','06','07','08','09','10',
                '11','12','13','14','15','16','17','18','19','20',
                '21','22','23','24','25','26','27','28','29','30','31' AS d

UNION ALL

-- Generate all 30-day months
SELECT CAST (y || t || m || t || d AS DATE) AS dt
FROM (VALUES('-')) T(t)
      TRANSPOSE '2016','2017' AS y
      TRANSPOSE '04','06','09','11' AS m
      TRANSPOSE '01','02','03','04','05','06','07','08','09','10',
                '11','12','13','14','15','16','17','18','19','20',
                '21','22','23','24','25','26','27','28','29','30' AS d

UNION ALL

-- Generate all 29-day months
SELECT CAST (y || t || m || t || d AS DATE) AS dt
FROM (VALUES('-')) T(t)
      TRANSPOSE '2016' AS y
      TRANSPOSE '02' AS m
      TRANSPOSE '01','02','03','04','05','06','07','08','09','10',
                '11','12','13','14','15','16','17','18','19','20',
                '21','22','23','24','25','26','27','28','29' AS d

UNION ALL

-- Generate all 28-day months
SELECT CAST (y || t || m || t || d AS DATE) AS dt
FROM (VALUES('-')) T(t)
      TRANSPOSE '2017' AS y
      TRANSPOSE '02' AS m
      TRANSPOSE '01','02','03','04','05','06','07','08','09','10',
                '11','12','13','14','15','16','17','18','19','20',
                '21','22','23','24','25','26','27','28' AS d;
```

One advantage of casting the concatenated result values as DATE is that SQL/MX will produce an error if any of the generated values do not conform to a valid date for the corresponding year and month. Of course, SQL/MX will not detect if you accidentally fail to include a date. So check your work.

Storing data generated from TRANSPOSE

So you have seen how data can be generated using TRANSPOSE. Suppose you want to store the data to populate a physical table. How would you do that?

The simplest way is to use the CTAS statement – that is, CREATE TABLE AS SELECT. Here's an example⁷:

```
CREATE TABLE trans_1 AS
SELECT a || b1 || b2 || CAST(b3 AS CHAR) AS col1,
       b4 AS col2
FROM (VALUES('x')) A(a)
     TRANSPOSE 'a', 'b', 'c' AS b1
     TRANSPOSE 'x', 'y', 'z' AS b2
     TRANSPOSE 0, 1, 3 AS b3
     TRANSPOSE DATE '2016-01-01', DATE '2017-01-01' AS b4;
```

CTAS creates a simple table based on the data types of the columns in the result set. In the above example, table 'trans_1' will contain one CHAR column and one DATE column.

CTAS can be used only for relatively small tables because there is no provision to specify extent or partition information. Furthermore, the resulting table contains no primary key.

If those constraints are not suitable for your purposes, you can still use CTAS to generate the table for a subset of the output data and then use it as a template to create the DDL – and the actual table – according to your requirements.⁸ Or, you can use the more traditional method of creating the DDL from scratch. Either way you create the table, you can then use an INSERT/SELECT statement to populate it, as follows:

```
INSERT INTO trans_1
SELECT a || b1 || b2 || CAST(b3 AS CHAR) AS col1,
       b4 AS col2
FROM (VALUES('x')) A(a)
     TRANSPOSE 'a', 'b', 'c' AS b1
     TRANSPOSE 'x', 'y', 'z' AS b2
     TRANSPOSE 0, 1, 3 AS b3
     TRANSPOSE DATE '2016-01-01', DATE '2017-01-01' AS b4;
```

Generating unique data sets

Sometimes it is important to generate data sets that have a unique key. Several possibilities exist to accomplish that requirement.

For some tables, combining the values from each TRANSPOSE clause to form a single primary key column will suffice. Below are two examples. The first one generates a unique character key while the second one generates a unique numeric key:

```
SELECT b1 || b2 || CAST(b3 AS CHAR) AS pk,
       b1 AS col1,
       b2 AS col2,
       b3 AS col3
FROM (VALUES('x')) A(a)
     TRANSPOSE 'a', 'b', 'c' AS b1
     TRANSPOSE 'x', 'y', 'z' AS b2
     TRANSPOSE 0, 1, 2 AS b3;
```

PK	COL1	COL2	COL3
ax0	a	x	0
ax1	a	x	1
ax2	a	x	2
ay0	a	y	0
ay1	a	y	1
ay2	a	y	2
...

⁷Remember to set your catalog and schema since you are now creating a physical table.

⁸Use SHOWDDL <table> to generate the DDL. Save the output to a file or copy it into a text editor and modify it as needed for your table.

```

SELECT b1*100 + b2*10 + b3 AS pk,
       b1 AS col1,
       b2 AS col2,
       b3 AS col3
FROM (VALUES('x')) A(a)
     TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS b1
     TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS b2
     TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS b3;

```

PK	COL1	COL2	COL3
0	0	0	0
1	0	0	1
2	0	0	2
3	0	0	3
4	0	0	4
5	0	0	5
...

Both of these examples will produce data sets with a primary key that is comprised of all generated values from the TRANSPOSE clauses. Another method for generating a unique value for a primary key is to use a sequence generator. For example, create a sequence as follows:

```
CREATE SEQUENCE seq_trans LARGEINT;
```

And use it in the query to obtain a unique value:

```

SELECT seq_trans.NEXTVAL pk,
       b1 AS col1,
       b2 AS col2,
       b3 AS col3
FROM (VALUES('x')) A(a)
     TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS b1
     TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS b2
     TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS b3;

```

PK	COL1	COL2	COL3
0	0	0	0
1	0	0	1
2	0	0	2
3	0	0	3
4	0	0	4
5	0	0	5
...

The sequence can be altered prior to executing the query to set the value range to generate keys as desired. For example, the statement below will change the generated values to use increments of 100.

```
ALTER SEQUENCE SEQ_TRANS INCREMENT BY 100;
```

The TRANSPOSE list can also specify sets of multiple values. This option can be used to generate custom primary keys.

In the query below, each element in the TRANSPOSE list consists of two values which represent a custom key and an associated name. When executed, the keys associated with the first and last names will be used to generate a unique key which can then be used for the output table's primary key. The names will be used for the first and last name columns.

```

SELECT fk*100 + lk AS pk,
       fn AS first_name,
       ln AS last_name
FROM (VALUES(0)) A
     TRANSPOSE (1,'Sam'), (2,'Tom'), (3,'Paul') AS [fk,fn]
     TRANSPOSE (41,'Jones'), (52,'Miller'), (63,'Yoder') AS [lk,ln];

```

PK	FIRST_NAME	LAST_NAME
141	Sam	Jones
152	Sam	Miller
163	Sam	Yoder
241	Tom	Jones
252	Tom	Miller
263	Tom	Yoder
...

9 rows generated

Generating long running query workloads

There are times when you just need to generate long running queries for various testing scenarios. Of course, TRANSPOSE can be helpful in this regard, as well.

You already have seen how easy it is to generate large volumes of data. These types of queries may be sufficient for your needs. But remember that the results from a series of TRANSPOSE operations is simply another data set that can be represented as a table in SQL. And if it can be represented as a table, then it can be treated in the same manner, with regards to using join and other operations.

Here is one last example that uses a set of subqueries that include TRANSPOSE lists in a series of cross-product joins:

```

PREPARE Q FROM
SELECT COUNT(*) AS count_val,
       MAX[Z.c0] AS max_val,
       MIN [Z.c0] AS min_val,
       AVG [Z.c0] AS avg_val
FROM (
SELECT c0 AS c0
FROM (VALUES(0)) A
     TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c0

```

```

TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c1
...
] Z
CROSS JOIN
[
SELECT c0 AS c0
FROM [VALUES(0)] A
TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c0
TRANSPOSE 0,1,2,3,4,5,6,7,8,9 AS c1
...
] X
CROSS JOIN
...

```

Such a query can rapidly generate a very large result set and execute for an extended time. However, you will have to make some adjustment to the TRANSPOSE lists to calibrate the query for your specific elapsed time objectives.

Remember that the EXPLAIN utility is used to examine query plans, and this includes queries used in the above examples. Similarly, you can use CQD (Control Query Default) statements and Optimizer hints to modify such plans to produce specific execution characteristics. Execution statistics can be gathered (along with Measure data) to examine performance behaviors at run time. The typical actions you have taken with disk-based tables are also applicable to queries using materialized tables and TRANSPOSE clauses.

By using a combination of these facilities you can create a variety of workloads to address a number of application testing requirements. For example, you can generate datasets simply for functional and volume testing during the application life cycle. Or, you can craft datasets specifically for “edge-case” testing, such as generating skewed data patterns to expose possible design weaknesses. You can apply these techniques to performance validation exercises by developing workloads having specific concurrency, longevity and intensity characteristics. You can even incorporate these techniques into the training procedures of operations and support staff for problem identification and resolution.

Summary

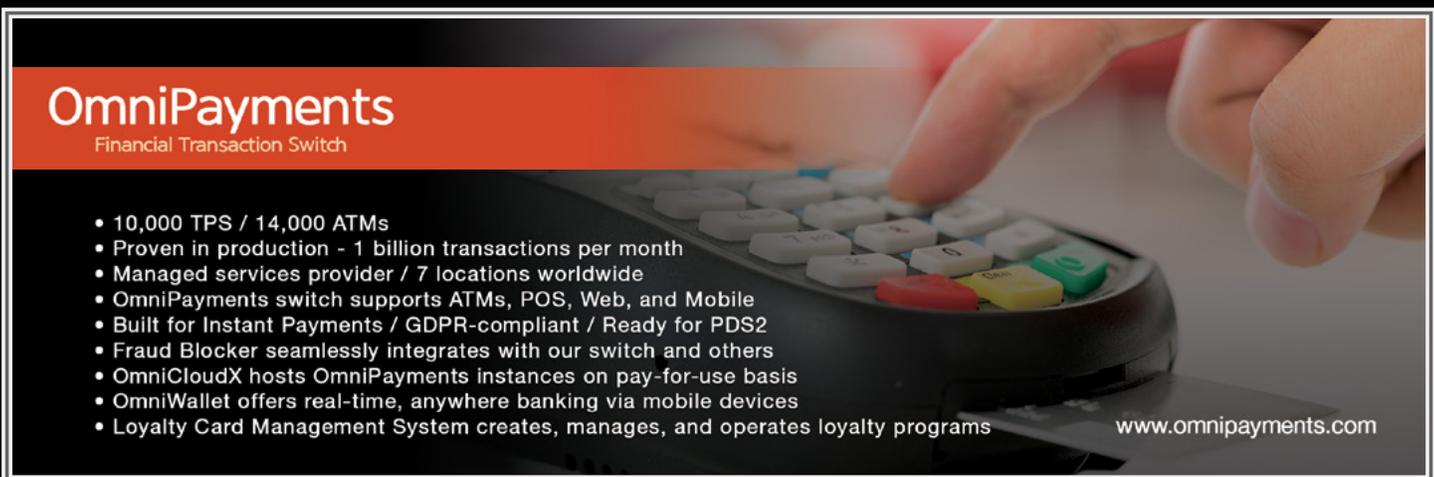
As you can see from the above examples, the SQL/MX TRANSPOSE clause is a very powerful mechanism for manipulating data. Combined with materialized tables, TRANSPOSE becomes a simple and fast means of populating database tables, or for generating long running queries and intense workloads.

TRANSPOSE requires no programming effort. You literally can spin-up data within moments. With a little creativity on your part, various data types and patterns can be produced to satisfy your needs. You can generate data for testing purposes or even for use in production tables, without the burden of writing complex programs.

While not as capable of producing the complex and varied data patterns that exist in production databases, these methods are important productivity tools, and should become part of every DBA's technical toolkit. 

.....

Paul Denzinger began his career with Tandem in 1985 and worked in various capacities throughout his tenure at Tandem through Hewlett Packard Enterprise. As a Distinguished Technologist, Paul has provided architectural consulting and technical support to customers worldwide for applications as diverse as high-performance trading systems as well as very large database systems. In addition to his focus on relational DB technology, Paul worked several years with no-SQL big data products in HPE's Business Critical Systems unit. Most recently, Paul has been involved with the HPE Blockchain initiative. He currently is a member of the HPE NonStop Enterprise Solutions and Architecture Team, focusing mainly on NonStop database solutions. paul.denzinger@hpe.com



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PCI 3.2 | ARE YOU READY?

DECEMBER 15, 2004 PCI DSS 1.0

PCI DSS Version 1.0 is released. This is the first time that all five major credit card brands have come together to create a comprehensive standard for all merchants in the payments cycle.

OCTOBER 2010 PCI DSS 2.0

Reinforces the need for thorough scoping before an assessment and promotes more effective log management. It also broadens validation requirements for the assessment of vulnerabilities in a merchant environment.

APRIL 2015 PCI DSS 3.1

Calls for merchants to deprecate the Secure Sockets Layer (SSL) and "early" Transport Security Layer (TLS) protocols immediately, as these encryption protocols put payment data at a high level of risk.

FEB 2018 PCI DSS 3.2

PCI 3.2 takes effect

- Eliminate use of SSL and early TLS version
- MFA will be required for ALL administrative access to cardholder data – not just consoles.
- Maintain detailed documentation of cryptographic architecture



SEPTEMBER 2006 PCI DSS 1.1

PCI DSS Version 1.1 is released. Calls for the professional review of all web applications and the placing of virtual firewalls as a security measure.

NOVEMBER 2013 PCI DSS 3.0

Updates made as a result of shifting needs in the payments industry: Weak passwords and authentications by merchants and service providers; Third-party security challenges; Inconsistency in assessments

APRIL 2016 PCI DSS 3.2

Centered on a reformed change-management process, multi-factor authentication, service provider regulations and primary account number (PAN) masking.

PCI 3.2 | ARE YOU READY?

Robert Klein >> XYPRO Technology

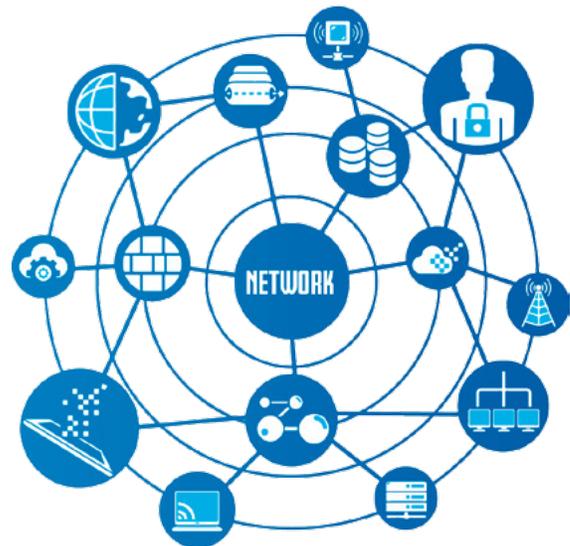
As a citizen of the HPE NonStop community, it is sometimes hard to believe how much my work has changed over 25 years. Compliance frameworks such as PCI DSS now demand as much of my attention as robust performance or maintaining the five nines. Consciously, I realize that adhering to standards isn't a chore to be marginalized. But I must admit that I've allowed this focus to wander. The transformation of this platform combined with the "do more with less" doctrine has influenced me to prioritize higher visibility projects. I am re-considering those priorities. Boosting database performance, patching memory leaks, and leveraging virtualization are terrific, but what will happen to support for these worthy endeavors if we fail audits, lose compliance, or worst of all, suffer a breach?

According to a recent report by SecurityMetrics:

NONE OF THE BREACHED MERCHANTS INVESTIGATED IN 2016 WERE FOUND TO BE FULLY PCI DSS COMPLIANT¹

It ain't that way no more...

The HPE NonStop Server traditionally considers itself a castle: An impregnable island fortress granting access only to a select few. If you didn't belong inside, you didn't get in. There was never a need to test the castle walls for weaknesses.



That was arguably true - prior to increased inter-platform communication, widespread acceptance of the internet, WANs, wireless networking, high speed clusters, distributed databases, disaster recovery/business continuity, remote access, BYOD and migration from proprietary to open standards. All of the above introduced NonStop to the possible security vulnerabilities inherent in these constructs. We are reluctantly forced to allow ongoing vulnerability testing - internal and external.

So as a vigilant NonStop sentry, I'd like recommend two things to reclaim fortress stature:

1. Implement what many security pros agree are three essential PCI DSS 3.2 standard aspects which are soon to graduate from best practice status to requirement
2. Leverage tools which meet the requirements that are already available to all NonStop users.

STOP USING



SSL & EARLY TLS

Actually, this touches three PCI DSS requirements:

- A. Requirement 2.2.3: Implement additional security features for any required services, protocols, or daemons that are considered to be insecure.
- B. Requirement 2.3: Encrypt all non-console administrative access using strong cryptography.
- C. Requirement 4.1: Use strong cryptography and security protocols to safeguard sensitive cardholder data during transmission over open, public networks.

This issue has been well-known for some time. In fact, PCI 3.1 set a deadline for SSL/TLS mitigation by June 30, 2016. Since then, Heartbleed, POODLE, DROWN, FREAK and SWEET32 vulnerabilities forced a re-evaluation of the requirement for PCI DSS 3.2. Current practice is to disallow all SSL versions as well as TLS 1.0x and move towards TLS 1.2. TLS 1.2 supports AES ciphersuites in 128 and 256 bit key lengths.

The difficulty for most implementations will likely be the TLS level on the remote endpoints. Session negotiations are determined by the highest ranked protocol available on both sides.

If one side's latest available TLS version is 1.0, then the other side will be forced either to allow non-compliant TLS sessions or not connect at all.

SSL/TLS vulnerabilities are being taken so seriously that many organizations are scanning their internal networks to identify SSL/early TLS traffic - some are even blocking such traffic!

Perimeter defenses like firewalls and trusted zones do not exempt servers from Requirement 4.1. Authorized access must protect data in motion with strong cryptography - period.

Req 4.1 permits TLS 1.1 on existing implementations, but new implementations must use TLS 1.2.

Current NonStop OS RVUs are capable of supporting TLS versions through 1.2 and suppression of SSL so we can control our side of the implementation.

One survey of SSL/TLS usage for VPNs as of December 2016 show 77% still allow SSL and/or early TLS, and fewer than 3% are PCI DSS compliant.²

Considering 40% of attacks involve so-called "encryption abuse"² - meaning attackers usurp victims' encryption to hide their activities - a quick migration of both endpoints to TLS 1.2 would be a worthwhile effort.

One quick final note on this: SSH is a good alternative, particularly for NonStop. Recent RVUs include SSH capability which is based upon openSSH 7.2p2 or later.

Implementation of Multi Factor Authentication for ALL non-console remote access by February 1 2018 (Requirement 8.3.1)



Right now, this is considered by most security and compliance experts as the best tool for preventing intrusion and subsequent malicious activity. Multi-factor authentication (MFA) offers the best bang for the buck. Every entry point from phones (pardon me – mobile devices) to PCs to web sites to servers either requires MFA or will require it very soon. The Reason: Higher reliability of correctly authenticating access requests. Identity thieves may steal passwords or even fingerprints, but it's less likely that they can steal 2 or more factors. Even better are factors which are single-use and /or valid for very short durations.

The change from PCI DSS 3.1 to 3.2:

Expanded Requirement 8.3 into sub-requirements, to require multi-factor authentication for all personnel with non-console administrative access, and all personnel with remote access to the Card Data Environment (CDE). New Requirement 8.3.2 addresses multi-factor authentication for all personnel with remote access to the CDE (incorporates former Requirement 8.3). **New Requirement 8.3.1 addresses multi-factor authentication for all personnel with non-console administrative access to the CDE. Requirement 8.3.1 effective February 1, 2018**

In summary, as of February 1 2018, MFA will be required for ALL administrative/remote access to cardholder data – not just consoles.

I envision many heated discussions regarding where the cardholder data environment (CDE) perimeters are and which users have access to it. Perhaps these could be better described as re-heated discussions. Not only has this issue been the subject of previous debates, but the CDE may have changed since the last time this battle has been fought.

The PCI council foresaw this and has published a document which, along with network segmentation, offers recommendations on how to determine PCI's definition of CDE in your organization: https://www.pcisecuritystandards.org/documents/Guidance-PCI-DSS-Scoping-and-Segmentation_v1.pdf

User acceptance will also be a major issue related to MFA. More affected users mean higher support call volume, lower

productivity, and potentially user/customer dissatisfaction and lost revenue. This is why CDE definition and access are contentious topics.

The temptation will be to reduce the number of MFA-required circumstances as much as possible – applying to only those that strictly adhere to the latest PCI DSS defined requirements.

I would counter propose that more MFA – not less – would yield the greatest returns:

- A. MFA processing consumes very few system resources – network, disk, and cpu
- B. As mentioned earlier, most users are already experiencing MFA and are quickly adapting, accepting, even demanding MFA for access to sensitive information
- C. Future PCI DSS standards likely will expand MFA requirements to all access by all users

XYGATE User Authentication (XUA), which is bundled in all current NonStop OS RVUs, provides the necessary functionality for MFA when teamed with RSA or RADIUS security solutions. Once configured, this is as close to “set it and forget it” as there is.

More statistics: Depending on which source you consult, between 63 and 91% of all data breaches involve weak authentication (i.e. passwords/phrases).^{3 4}

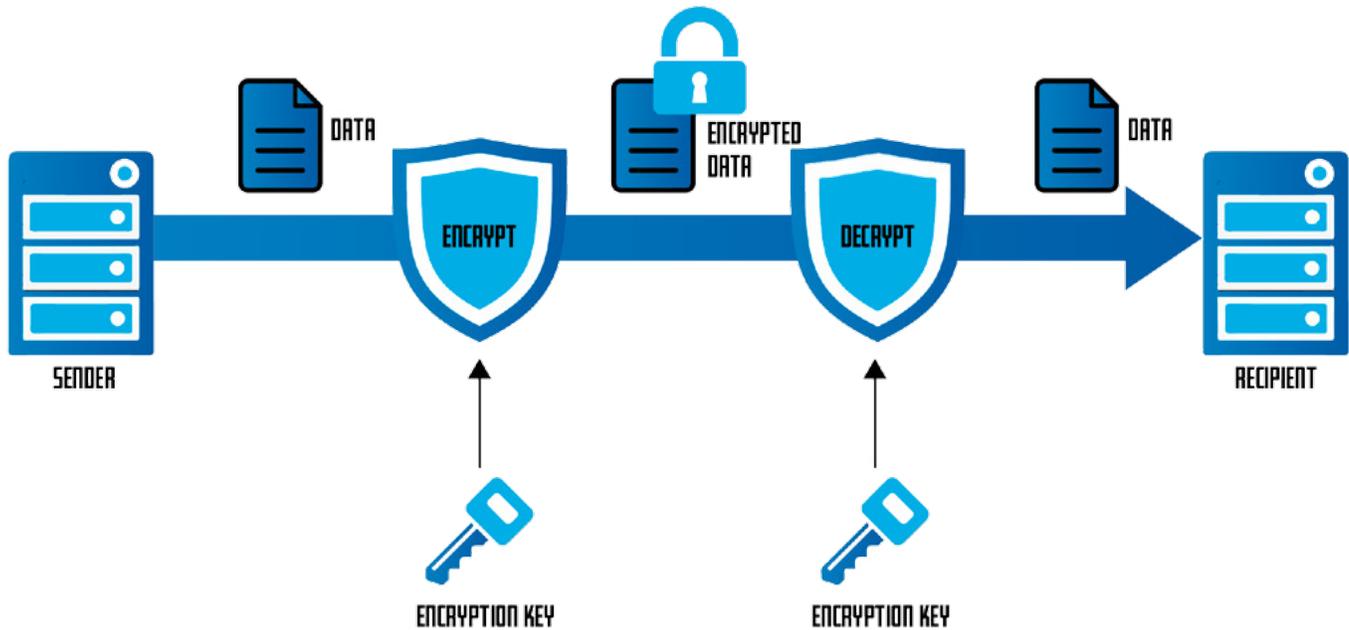
MFA is an inexpensive and readily available countermeasure against intrusion.

Two important items to consider regarding your MFA implementation:

Engage your RSA/RADIUS team as early as possible. Corporate RSA teams are going to become overwhelmed very quickly as everyone scrambles to meet the February 1 2018 deadline.

As of this writing, Feb. 1 2018 is 5 months from now. You may want to start developing your strategy now – most MFA implementations take at least 4-6 months to deploy organization-wide before going into production.

Maintain detailed documentation of cryptographic architecture (Requirement 3.5.1)



This requirement is different than the other two. Req 3.5.1 actually applies only to service providers and refers to documentation:

New requirement for service providers to maintain a documented description of the cryptographic architecture.

Effective February 1, 2018

If you don't have a cryptographic architecture, you can't meet Req 3.5.1.

Requisite 3 is concerned with protecting stored cardholder data, meaning data at rest. Primary Account Numbers (PANs) are the most common data grab; therefore, they garner most of the Req 3 attention. The scope of CDE tends to expand as payment processing gets more complex and interrelated with other sensitive data.

Once again, we can get mired in the CDE jurisdiction argument.

My experience in NonStop has fostered a need to explore worst-case scenarios and how to deal with them. In the case of cardholder data, theft is the worst-case scenario (alongside destruction or deletion of said data).

Cardholder data theft cannot be totally prevented. But we can make the stolen goods useless to the thief. This is the intent of Requirement 3.

This can be accomplished one of two ways: Encrypting data within the CDE or exempting data from the CDE.

Encryption is a well-established and reasonably trusted method of data obfuscation. Most enterprises use a shared encryption engine across all its platforms, thus making the solution simpler and more affordable.

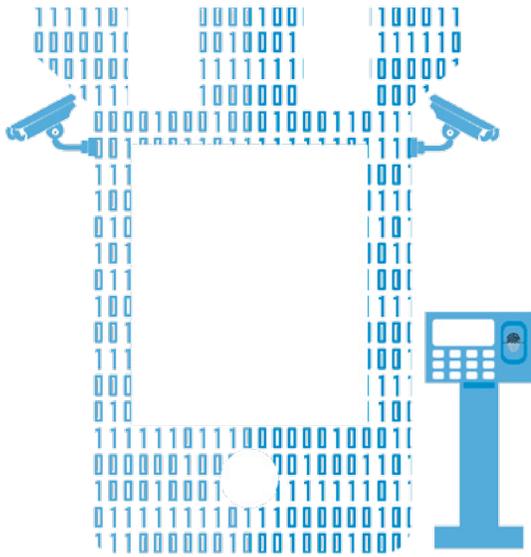
For PCI DSS compliance, encryption does NOT exempt data from being classified as part of the CDE and thus is subject to Requirement 3 scrutiny.

Data tokenization is an increasingly popular way of excluding PAN data from the CDE. Tokenization supplants PANs or other surrogate data with tokens. These tokens have no intrinsic value and cannot be traced to the corresponding source without authorized de-tokenization and authentication.

Under PCI DSS 3.2, tokenized data IS excluded from the CDE, which is why it is becoming so popular.

While encryption or tokenization are not currently required to meet PCI DSS Req 3 standards, Req 3.5.1 is an indication that such a requirement will occur in the future - probably the near future. Not necessarily just for service providers.

HPE SecureData Transparent Data Protection for HPE NonStop offers both encryption and tokenization services without any coding changes.



Re-invent the fortress

Three major PCI DSS requirements. Three readily available tools; HPE SSH, XYGATE User Authentication and HPE Data Security's SecureData for NonStop allow you to meet those requirements.

XYPRO, along with HPE have dedicated extensive time and resources in evaluating how PCI DSS 3.2 will affect the HPE NonStop Server ecosystem and its customers. These requirements become mandatory in 2018. We recommend the activities to become compliant with the new standard start before the mandatory deadline dates in 2018. This will ensure your organization has enough time for testing and deploying to production. Please visit the www.XYPRO.com to download the latest version of the PCI DSS 3.2 White Paper which describes how to make your NonStop servers PCI DSS Compliant. [↪](#)

¹ <https://www.securitymetrics.com/static/resources/orange/2017-securitymetrics-pci-guide.pdf>

² <https://www.darkreading.com/vulnerabilities---threats/more-than-40--of-attacks-abuse-ssl-encryption/d/d-id/1326789>

³ Verizon 2017 Data Breach Investigations Report

⁴ http://www.verizonenterprise.com/resources/report/rp_pci-report-2015_en_xg.pdf

I've been an IT serf since 1989. Worked on Tandem/NonStop since 1993 as an operator, application support tech, system administrator, and security administrator. Currently I am a Security Solutions Specialist for XYPRO. I graduated from the University of South Florida with a B.A. in US History. During downtime I perform with trumpet/trombone jazz and brass ensembles, indulge in car restoration and enhancement, and dabble in screenwriting / playwriting. Upcoming hobbies: motorcycling, bicycling, off-road trucking, diesel powered vehicles, and do voiceover freelancing for fun and profit. My primary port-of-call is Columbus, Ohio robert.klein@xypro.com



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SQL/MX DBS NOT ONLY FOR CLOUD

Frans Jongma >> HPE >> Advanced Technology Center


Hewlett Packard
Enterprise



This is a short introduction to NonStop SQL/MX Database Services for existing customers. It discusses how they might set up a DBaaS (Database as a Service) in their environment. It answers the question, “How to make a NonStop Database available to internal teams that require access to a database without having to spend sysadmin time to hold their hands”.

Introduction

One of the many features that was released with NonStop SQL/MX 3.5 is the DBS functionality. DBS is the acronym for Database Services and with these services SQL/MX allows customers or service providers to create NonStop SQL database “as a Service”, also known as DBaaS.

This might make you think of Clouds, virtualized systems, hypervisors and all the other cool stuff you read in the industry press. When I presented DBS at eBITUG in London [“NonStop SQL DBS Explained”, May 2017], I explained that HPE development had been looking for ways to provide cloud capability to SQL/MX. However, to take advantage of these capabilities one does not require a Cloud solution to be present. It would be a mistake to think “This is not for us, until we move to a virtualized NonStop”. This article will help you understand how existing NonStop X users can benefit.

Benefits of Database Services

What makes “Everything as a Service” so appealing is that everything seems so easy. The expectation is that services are easy to define, easy to consume, do not require upfront investments and you only pay for what you use and only as long as you use the service.

That sounds great, and it is. However, you will need to share resources with others to make it affordable to the service provider and you may have to place your data outside your control in the provider’s data center. But what if you could get most of the benefits without requiring an external party? Your datacenter is already providing services to your users so what is new?

With SQL/MX DBS you will be able to get some cloud capabilities from your existing NonStop X servers that run SQL/MX 3.5 or higher without actually having to use cloud technology. The capabilities are:

- **Easy provisioning**
- **Self Service**
- **Fast deployment**
- **Multi-tenant**
- **Self Service**

Self-service is everywhere, from supermarkets to ATMs where you can conduct your banking business, internet banking systems and online shopping where you fill your virtual shopping cart and pay with your credit card. This is all made possible by the work from your IT development groups. But think what happens if someone from those groups requires a new database on a NonStop system? How much involvement will there be from the systems group?

Just think about what all needs to be set up in order to provide someone access to a NonStop system and provide an environment they can work in. Just think about Guardian user IDs, user aliases to these IDs, Guardian subvolumes, OSS home directories, the setup of environment variables, setup Safeguard permissions to allow access to some resources and restrict it to other resources. In addition, system administrators don’t like to give people who may not have much NonStop knowledge access to a command prompt on their NonStop system.

It may be reassuring to know that this is a problem that exists across the industry. An Oracle survey from 2014 showed that 67% of the DBAs experienced more than 10 days to deploy a database. However, neither Oracle users nor the rest of the industry is accepting this slow response.

And neither are we at HPE NonStop, so self-service deployment of a NonStop SQL/MX is a main feature that comes with DBS.

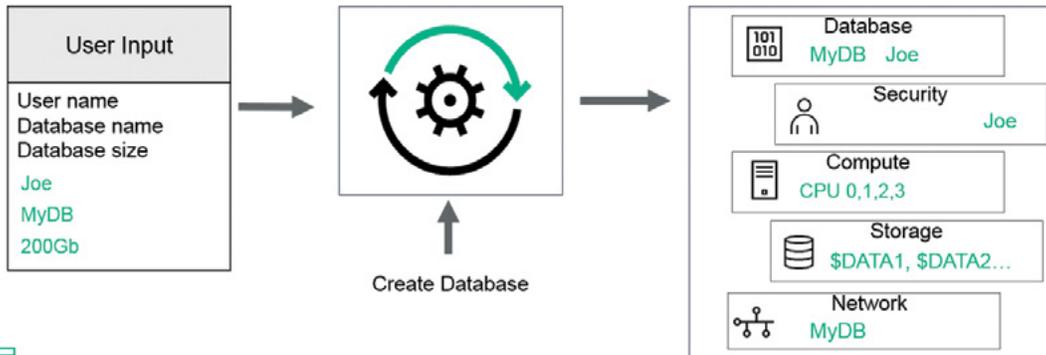
SQL/MX 3.5: Database Services

Self Service: End users get what they want simply, when they need it, in a few minutes

Simple, vendor agnostic, thin provisioning exposed to the end user

DBS

Fully featured, scaled out, highly available and secure database automatically provisioned along with storage, network, security and compute resources



Multi-tenant

Database servers can be provided as virtualized servers with database software, where multiple servers share the resources of a single physical server. For example, when you request a popular database from a cloud service provider, a virtual machine running Linux or Windows will be created first and on that OS instance, the database software is installed, you get root access, and good luck wishes. This leads to a database sprawl which puts a lot of management burden on the systems groups who are responsible of making database backups, applying patches to the Operating system and database software and so on.

A more appealing method is a multi-tenant model, where multiple, isolated users share database hardware and software. This makes it easier for systems management to maintain database backups and the system software. Examples are Oracle 12c Pluggable databases and the Microsoft SQL Server Shared database. With DBS, NonStop SQL/MX uses this model as well. DBS users share the hardware, either a traditional NonStop X system or a virtualized NonStop system, and the NonStop SQL/MX software. The tenants have exclusive access to their data volumes, which includes database lock space and database cache, so there will be no IO contention between tenants. Their databases automatically inherit the NonStop fundamentals of availability (all volumes are mirrored, and each volume has a backup in another processor) and scale-out scalability by adding volumes to their configuration.

The NonStop SQL/MX DBS components

To keep this article short, the key parts of DBS are described below.

The Database

A user catalog is equivalent to a user database. Therefore, when someone requests a database, a catalog with the requested database name will be created, along with a few schemas, such that the database is ready for the user to start creating tables.

The Database Instance

Because NonStop SQL is an integral part of the NonStop OS, there is not an instance as you may know from other DBMS products. You cannot bring down NonStop SQL/MX like you can stop an Oracle or a SQL server instance. However, clients that access a NonStop database go through the MX Connectivity Service (MXCS) subsystem. This is the same subsystem that you may already use to allow access via JDBC and ODBC. The access via MXCS can be controlled by starting and stopping data sources, and to a client this looks the same as starting and stopping a database instance.

In SQL/MX DBS, there will be an MXCS data source with the same name as the database it represents. Only the requesting tenant and possibly other users created by that tenant will be allowed to access the data source.

This user access to specific data sources is different for DBS users than it is for traditional NonStop Guardian and OSS platform users that access the regular MXCS data sources. These only validate user credentials against the Safeguard database whereas the DBS data sources only allow users that have been added to a specific database.

SQL/MX DBS data sources can co-exist with those that are managed by the common MXCS subsystem.

The User

SQL/MX DBS keeps track of its own users. The DBS users have access to the database through MXCS, but not to other resources that are present on the NonStop system. For example, they will not have access to a TACL or OSS shell. Traditional users of NonStop SQL have a Guardian user-ID in the form of group and user or an alias to such an ID. DBS users assign their own user ID which often depends on the user names that are common in their organization, for example an email address [fransj@hpe.com] or a Windows user (ASIAPAC\KUMAR_ANIL). These users will need a database password which may be different from their domain password. Multiple users can be created by the database owner and these users can be granted the common ANSI access rights using SQL GRANT/REVOKE.

The Database Storage

As NonStop users know, data is organized by volumes which in turn are managed by DP2 processes or Disk Access Managers (DAMs). To hide the NonStop specifics from tenants they only need to specify the desired space for their data and an appropriate number of volumes will be assigned to this user. The minimum database size is therefore one volume, which size is defined by the system administrator when the DBS environment is created.

More experienced users still have the capabilities to use SQL/MX specific attributes such as the LOCATION clause, the number of partitions and the table sizes.

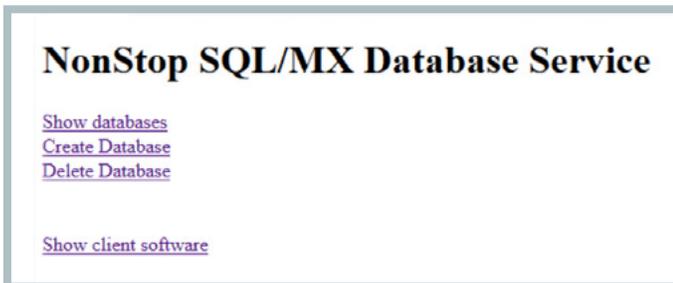
Isolation

Users that have access to a DBS database are isolated from other users in the system. They have no access to system or user metadata other than their own. This is different from traditional SQL/MX. Users can only access the system through their own MXCS service and they have only access to their dedicated data volumes. These data volumes are protected by Safeguard, and users will not be able to create objects on other volumes even if they know which volumes exist on a system.

Example deployment lifecycle

SQL/MX DBS comes with a thin provisioning interface called mxdbms which resides in the SQL/MX bin directory. It is a command interface and typically, this interface will be called from a management tool such as HPE Operations Orchestration or a home-grown website that you might use to allow your internal users to take NonStop SQL for a test drive.

An example of such a setup was shown at eBITUG. For this purpose we created a few simple pages on iTP Webserver that invoked the mxdbms interface. The purpose of the demo was to show how a system administrator, not the end-user, could quickly provision a database for an end-user. Real self-service requires user authentication on a portal and was not the objective of the demo.



The page showed only a few interface functions. Other commands are present to share a database with other users, to add and delete users, to add storage to the database, to change a password and so on.



The create database screen requires only the name of the database, which is unique to the system, the required size in GB, the database owner and a chosen password. The schema name is optional; a DEFAULT_SCHEMA can be created automatically. A user can add additional schemas, which share the assigned storage. When the create button is clicked, the magic will happen and about one minute later you can log in to this database using a client tool like DbVisualizer, Squirrel or for the command-level geeks: remote mxci [rmxci] for NonStop SQL/MX. The above tools require a JDBC type 4 driver. ODBC tools can access using the ODBC driver for NonStop SQL/MX.

Volume specifications for database objects are optional: they will be created on the volumes that are assigned to this database, and if more than one volume is available, tables and indexes are automatically hash partitioned across these volumes.

Removal of a database is done with one single mxdbms command: delete-database <database_name>, which drops the database, frees the volumes, removes the users from this database and stops and deletes the database service.

Conclusion

The demo that was shown at eBITUG took three and a half minutes. In this time we created a NonStop SQL/MX database including users and the MXCS service, created a few database tables, loaded data into them from a workstation and showed that the data was there. We then cleaned up the environment.

As preparation, we had set aside a set of volumes for DBS use on an existing NonStop development system that was used for other purposes as well. We demonstrated the speed of deployment, the fact that one does not require NonStop skills to get productive on SQL/MX. But let's be fair, to get the most out of the system, one needs more than just knowing the SQL language. The experts now have time on their hands to spend it where it is needed. [🔗](#)

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Frans Jongma is a Master Technologist for the NonStop Advanced Technology Center (ATC) and is based in Europe in The Netherlands. Frans has worked in several consulting positions for the NonStop Enterprise Division since 1989. His main areas of expertise are: NonStop SQL (MP as well as MX), application design, performance analysis and high-availability. Prior to joining Tandem, Frans has worked on the design and implementation of database management systems and developer productivity tools for UNIX and proprietary systems. Over the years he has been advocating the use of new technologies that operate in the HP Open Systems Services (OSS) environment, such as NonStop Server for Java and NonStop SQL/MX software.

The HPE Partner Ready for Technology Partner Program

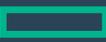


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REAL-TIME DATA REPLICATION FOR PRESCRIPTION DRUG FRAUD PREVENTION AT A LARGE GOVERNMENT HEALTHCARE AGENCY

Paul J. Holenstein, Executive Vice President, Gravic, Inc.

Introduction

In most developed countries, managing the prescription drug process is one of the largest components of healthcare, regardless if it is run by a socialized or private agency. Every aspect of the process, from pharmaceutical drug manufacturing, to doctors writing prescriptions, to pharmacies dispensing prescriptions, to patient, doctor, pharmacy, and manufacturer reimbursement, requires constant oversight and control. This distributed process quickly becomes very complex, with many interactions between varying parties, as each prescription ultimately makes its way from the prescribing doctor to the patient receiving the medication.

Managing this process crosses many functional areas, including:

- **healthcare information management** (record, track, and secure private patient medical information)
- **finance** (match the payment for the drug and various reimbursements)
- **verification** (confirm that the right medication is given to the correct patient)
- **accounting** (check that proper statistics are generated for analysis and reporting purposes)
- **fraud prevention** (ensure that the correct patient uses the medication properly and not for illicit activity)

It is critical to put checks and balances in place and to integrate each functional area, or a shortcoming in one process could lead to a host of societal impacts, such as unwarranted side effects, disease, or even death.

Prescription fraud is a growing worldwide problem. In the U.S., one fraudulent scheme involved 243 people and 46 health professionals and defrauded Medicare of \$21.2 million (USD)¹. In Canada, one pharmacist cheated taxpayers \$471,000 (USD) in an elaborate methadone-billing scheme². In England, patient prescription fraud costs the country about \$6.7 billion (USD) per year³. According to the World Health Organization, \$415 billion (USD) is lost to healthcare fraud worldwide every year.⁴

In large healthcare agencies, the problem is often exacerbated by the absence of standardized case reporting and information sharing between various jurisdictions. In many instances, the fraud goes undetected until a later date, feeding the addiction problem, costing the government large sums of money in improper reimbursements, and creating a difficult, involved investigation of who did what, and when. In many cases, the perpetrators often are long-gone and cannot be found by the time the fraud is detected.

As the sheer amount of prescriptions proliferate, the complexity in tracking and protecting this sensitive information increases exponentially, opening the door to fraud and even waste that needs to be uncovered and eliminated⁵. For the largest agencies, billions of dollars (USD) change hands daily.

Two primary issues are avoiding processing fraudulent prescriptions and reimbursements, and eliminating narcotic addiction and abuse. As the current opioid crises overwhelms the healthcare sector, agency administrators know that immediate action must be taken.

Prescription Claims Adjudication System - Overview

A publicly funded healthcare agency is handling all medical insurance claims for a large and diverse population. The systems track key components as prescriptions are written, filled, and money changes hands. There are numerous IT applications involved in the management of this agency. More specifically, an application running on a pair of HPE NonStop servers processes prescription drug claims. The pair are located in geographically separated datacenters (DC1 and DC2). These servers run in an active/passive disaster recovery configuration, and run HPE NonStop RDF for transactional data replication between them, keeping both active and passive databases synchronized. If the active system fails, a failover is performed and online processing is switched to the backup (passive) system. In normal operation, the backup system is used for read-only query and reporting type activities.

In order to attack the prescription fraud problem, administrators and systems analysts implemented a centralized claims adjudication application to consolidate and analyze all claims throughout the country's regional jurisdictions to flag suspicious activity. Typical types of suspicious activity the system is designed to detect include:

- Multiple claims for the same drug and patient over a short period of time [either from the same or different doctors/pharmacies]
- Multiple claims for similar drugs and patient over a short period of time [either from the same or different doctors/pharmacies]
- Multiple claims for the same or similar drug for the same patient address over a short period of time [either from the same or different doctors/pharmacies]
- A doctor or pharmacy receiving healthcare reimbursements for prescriptions that do not match those that they prescribed
- A doctor or pharmacy receiving manufacturer reimbursements for prescriptions that do not match those that they prescribed
- A doctor or pharmacy submitting for reimbursements for the same prescriptions through multiple [regional] jurisdictions
- A doctor or pharmacy prescribing/dispensing an atypical amount of controlled substances or receiving an atypical amount of reimbursements for their size

This new claims adjudication application runs on a remote system while it collects all of the pertinent data from the existing NonStop-based prescription drug processing system and accesses a new decision support database containing all current and historical claims.

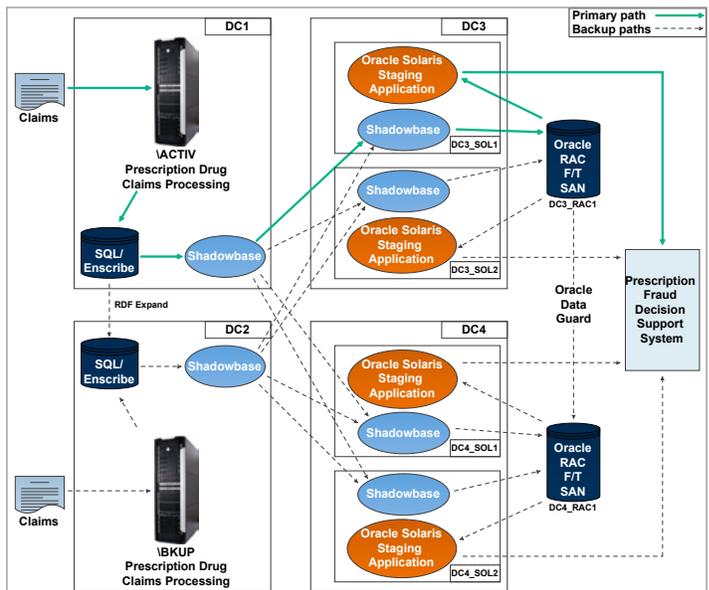


Figure 1 - Prescription Fraud System Architecture

One of the project requirements for this new application is to keep the decision support database current with all active claims being processed, while continuously maintaining high availability for the application and data. This requirement is further complicated by the fact that the NonStop system pair is managed by a service provider, and the new claims adjudication application is managed by the government healthcare agency, with neither party having direct control of the other. Additionally, the new claims adjudication application must have minimal impact on the existing claims processing environment, because the government does not want to upgrade its existing infrastructure or systems to handle any additional material load.⁶ Consequently, the fault tolerant characteristics of the whole application required automation with the least minimal impact. HPE Shadowbase software was key in meeting the project's goals.

Prescription Claims Adjudication System - Detailed Architecture

Figure 1 illustrates the application configuration where claims are sent to the active NonStop server running in datacenter 1, DC1 (\VACTIV system), with HPE RDF replicating over Expand to a backup NonStop server running in DC2 (\BKUP system). The government agency installed intermediate staging systems [comprised of Oracle Solaris servers with an Oracle RAC database], which feed the new decision support system and run the claims adjudication application.

- For local fault tolerance, i.e., to provide localized “high availability”, the government agency installed two Solaris servers, each accessing the same Oracle RAC database via a shared fault tolerant SAN. At any one time, only one of the Solaris servers is actively processing requests, with the other acting in a passive backup role.
- For geographic fault tolerance, the Solaris staging systems are duplicated, running in two different datacenters [DC3 and DC4].

Oracle Data Guard maintains synchronization on the two Oracle RAC databases running on duplicated staging systems (DC3_RAC1 and DC4_RAC1). At any one time, only one of the Solaris systems is active, with the other three basically acting as local and

remote backups. The government agency also developed a private application to feed data from the staging system into the support system for adjudication decision processing.

Prescription drug claims transactions are processed by applications running on the active NonStop server, which writes the necessary claims information into TMF audited NonStop SQL and Enscribe databases. The NonStop maintains the “database of record.” HPE Shadowbase software is installed and operates on both NonStop servers and all four Solaris systems. The software is configured for uni-directional replication from each NonStop system to each Solaris system and its Oracle RAC database (with only one path being active at a time). Shadowbase architecture replicates change data as it is generated by the NonStop claims processing application to the primary active Solaris/Oracle RAC system (DC3_SOL1), thereby keeping the database of record and the staging database synchronized.

Highly Available, Secure System Architecture

Shadowbase transmission paths are configured between both of the NonStop systems and all four Solaris systems. The staging database is continuously synchronized with the database of record for the following failure scenarios, all of which were rigorously tested and passed the agency’s acceptance criteria.

- 1. Failure of the active NonStop system – Shadowbase software on the backup NonStop system detects this condition and takes over, continuing replication to the primary Solaris system (DC3_SOL1). During normal operation, Shadowbase software on the backup NonStop system recognizes when RDF is replicating to the configured files and tables, and therefore does not replicate such changes to the Solaris staging database until it detects a failover. As a result, it is possible to have Shadowbase software up and running on both NonStop systems simultaneously. As soon as an RDF takeover performs and the backup NonStop system becomes the active system, Shadowbase software recognizes that RDF replication has stopped, and automatically begins replicating data changes from the backup to the target Solaris system.**
- 2. Failure of active Solaris system (local) – Shadowbase software detects this condition and switches to the standby local Solaris system (DC3_SOL2 or DC4_SOL2, as appropriate). At all times, Shadowbase software is running in standby mode on the alternate/backup Solaris systems. When the primary Solaris system fails, an automatic switchover activates via the use of an intelligent network aliasing method, and the IP address of the target system switches to the alternate/backup Solaris system. Consequently, Shadowbase source replication automatically switches to the alternate/target Solaris system. Whenever replicated data appears on the alternate Solaris system, Shadowbase software will automatically begin applying it to the Oracle RAC database.**
- 3. Failure of staging system pair (e.g., whole target datacenter outage) – Shadowbase replication switches to the remote staging system (DC4_SOL1), which takes place the same way as a local system failover – leveraging the intelligent network router. In this approach, the actual failure is transparent to the Shadowbase software running on the source environment.**

The claims data being processed contains sensitive information (patient names, addresses, medical history, etc.), and must be protected against unauthorized disclosure. For this reason, all of the data at rest and in motion is encrypted as it moves across this entire application chain. This process includes the data:

- **from entry into the active NonStop system,**
- **to the data replicated by RDF to the backup NonStop system,**
- **to Shadowbase replication to the staging systems,**
- **to the forwarding of the data to the decision support system.**

For additional protection, once the data is replicated to the decision support system, it is deleted from the staging database. This requirement greatly increases the project’s complexity as multiple layers of encryption and key management are in effect.

Initial Database Load with No Application Outage

Before the new claims adjudication application is deployed, all of the historical and current data residing in the NonStop database of record needs to be made available on the staging system, to load the empty Oracle RAC database instances. This initial load has to be done while the claims processing application is active (i.e., the initial load and online replication has to be performed in parallel, with no outage of the claims processing application running on the NonStop systems).

HPE Shadowbase Online Loading (SOLV) software is designed for this very task. SOLV supports online loading of a source database into a target database, meaning that the source and/or target databases can be open for reading and updating while the load occurs. There is no need to take either the source or target databases offline and make them inaccessible to applications while the load proceeds. SOLV automatically handles the merging of the data being loaded with the data being replicated. Thus, by using SOLV, the staging database is fully loaded while the claims processing application on the active NonStop system remains available and processing transactions.

SOLV achieves zero application outage while the load synchronizes by tight integration with the Shadowbase data replication engine (Figure 2). SOLV is reading and replicating data from the source application database itself (the database of record on the active NonStop system). Meanwhile, the Shadowbase data replication engine is replicating change data from the audit trail (the data actively being updated by the claims processing application). The key transactions happen when the SOLV data and the change data are merged together and applied to the target database (one of the Oracle RAC staging databases). Any changes made to the SOLV data while it was in transit are identified and applied. Hence, the data in the target database is a current and consistent copy of the source database, even as it is being updated by the online claims processing application.

This approach is powerful as there is no ‘outage’ of the target environment required, and the target data is fully consistent with the source data as it loads. There is no large queue of change data that builds up while the load takes place (that must later be replayed) to bring the target consistent, because the queue of change data is actually consumed while the load occurs.

Additionally, the SOLV approach can run in parallel with full source (and target) application processing for a continuous (and extended) timeframe, meaning that the load/merge operation can be set up and run in parallel until the load completes. Massive quantities of data can be loaded, and there is never an outage of the application environment required during this process.

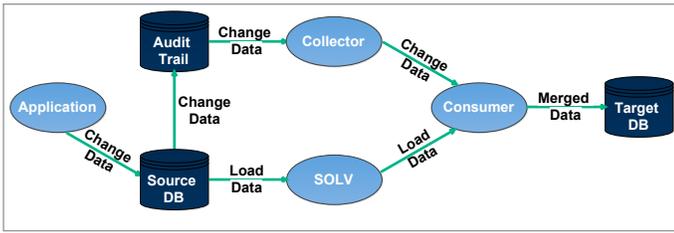


Figure 2 – Shadowbase SOLV Architecture

Summary

Prescription drug claims fraud is big business, costing the country billions of dollars. To help stem the losses, a centralized claims fraud adjudication and prevention decision support system is implemented. This system utilizes various analytical techniques to identify, prevent, and recover payments for fraudulent claims, as well as provide evidence to support criminal proceedings against fraudulent claimants.

The decision support system relies upon data gathered from a primary claims processing application running on an HPE NonStop system. This data is required for real-time replication from the NonStop system to an intermediate Solaris/Oracle RAC staging database, in preparation for being loaded into the decision support system. The country’s government healthcare agency chose HPE Shadowbase data replication software to provide this functionality.

The system architecture also requires data protection via multiple levels of encryption at every point in processing the data, and high availability so that any one component’s failure would not prevent claims processing from occurring. In order to support this requirement, HPE Shadowbase SOLV is used to perform the initial load of the staging system. SOLV allows loading of the Oracle RAC staging database without any outage of the claims processing application. In addition, multiple Shadowbase replication paths are established between the various redundant systems so that if an active system or path fails, processing and replication can continue using alternate/standby systems and paths, keeping the claims data current on the fraud adjudication and prevention decision support system at all times.

Now that the new fraud adjudication and prevention decision support system is in place, the agency is looking at improving its overall NonStop and Oracle database availability by leveraging the HPE Shadowbase Sizzling-Hot-Takeover (SZT) architecture. This architecture improves overall system availability more than the RDF and Oracle Data Guard active/passive model to eliminate failover fault risk and dramatically improve recovery time if a failure occurs.

The updated system now assures the government agency that its important healthcare data is fault tolerant, highly available, decreases costs, and allows law enforcement to monitor and investigate fraudulent claims activity. [CS](#)

¹ Ornstein, C. (2015, June 23). [Fraud Still Plagues Medicare's Prescription Drug Program](#), npr.org
² Howlett, K. and Andreatta, D. (2013, December 23). [Rampant Canadian Pharmacy Fraud Sign of a Broken System](#), theglobeandmail.com
³ Agency (2015, September 24). [NHS Losing Billions to 'Fraud by Doctors and Dentists'](#), telegraph.co.uk
⁴ World Health Organization (December, 2011). [Prevention Not Cure in Tackling Health-Care Fraud](#), who.int
⁵ The entire agency also realized unforeseen project benefits of reduced waste and optimized efficiency.
⁶ We appreciate management’s requirement that the new claims adjudication function cannot cost (much) to implement or require any significant investment in additional hardware or software. This request is fairly standard and is not new to cost-constrained IT departments. Fortunately, the solution is efficient, and there was sufficient headroom available to accommodate the new processing and data flows.

Paul J. Holenstein is Executive Vice President of Gravic, Inc. He is responsible for the HPE Shadowbase suite of products. The HPE Shadowbase replication engine is a high-speed, unidirectional and bidirectional, homogeneous and heterogeneous data replication engine that provides advanced business continuity solutions as well as moves data updates between enterprise systems in fractions of a second. It also provides capabilities to integrate disparate operational application information into real-time business intelligence systems. Shadowbase Total Replication Solutions® provides products to leverage this technology with proven implementations. HPE Shadowbase is built by Gravic, and globally sold and supported by HPE. Please contact your local HPE account team to answer any questions about the product. For further information regarding Shadowbase data integration and application integration capabilities that can assist in solving big data integration problems, please refer to the companion documents [Shadowbase Streams for Data Integration](#) and [Shadowbase Streams for Application Integration](#), or visit [www.ShadowbaseSoftware.com](#) for more information. To contact the author, please email: SBProductManagement@gravic.com.

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The Early Days of Pattern Recognition

Dr. Bill Highleyman >> Managing Editor >> Availability Digest

Previously published in Availability Digest

During my tenure at Bell Telephone Laboratories in the early 1960s, the Labs was kind enough to send me for my Doctorate in Electrical Engineering (DEE) at Brooklyn Polytechnic Institute (now the New York Institute of Technology). My work at Bell Labs involved an effort to build a system that would read handwritten numbers. At the time, long distance calls were recorded by an operator on a handwritten ticket and then were transcribed manually onto punch cards for processing by a billing program. This required a great deal of labor, and Bell Labs wanted to automate the process. My assignment was to build a system that could automatically read the operators' tickets and create the punch cards.

This was an ideal task for a doctoral thesis and led to my 211-page "Linear Decision Functions, With Application to Pattern Recognition." Recognize that back then, there were no PCs. The only computer the Labs had was a monstrous IBM 7090, IBM's first transistorized scientific computer (the IBM 7070 was its first transistorized computer for business functions). Therefore, the system that I had to implement could not use a computer.

As a reference, Hewlett-Packard in 1960 reported net sales of USD \$60.2 million; and the company was first listed on the New York Stock Exchange in 1961.¹ HP entered the computer market in 1966 with the HP 2100 / HP 1000 series of minicomputers. HP Labs was formed in 1967.²

A pattern recognition machine consists of two principal parts - a receptor and a categorizer. The receptor makes certain measurements on the unknown pattern to be recognized. The categorizer determines from these measurements the particular allowable pattern class to which the unknown pattern belongs.

Building the Receptor

In my attempt to read hand-printed numbers, the first step was to build a receptor to convert a number to a machine-readable format. I built a simple scanner that could scan a hand-printed number and convert it to a 12 x 12 matrix of ones and zeros. Next, I recorded the matrix on a punch card (this was the reason that I used a 12 x 12 matrix - a punch card has twelve rows).

Each number then could be considered a point in a 144-dimensional space. Presumably, points representing the same number were bunched together in this space. Thus, there would be ten clusters of points in the 144-dimensional space, each representing one of the numbers 0 to 9.

Implementing the Categorizer

The concept of linear decision functions is to define within the 144-dimensional space a set of hyperplanes that separate the clusters of numbers. Then, given an unknown sample, its position relative to each hyperplane can be calculated. Based on which side of each hyperplane the sample lies, the sample can be determined to be a particular digit, as shown in Figure 1.

For instance, the point represented by the asterisk in Figure 1 is on the "2" side of hyperplane 1-2. Therefore, it cannot be a "1." It is on the "1" side of hyperplane 1-3 and therefore cannot be a "3." It is on the "2" of hyperplane 2-3 and therefore must be a "2."

Given that I undertook this research in the early 1960s when no compute time was available, it was important that the linear decision functions be implemented with independent circuitry. This turned out to be quite straightforward. An n-dimensional hyperplane is given by the equation

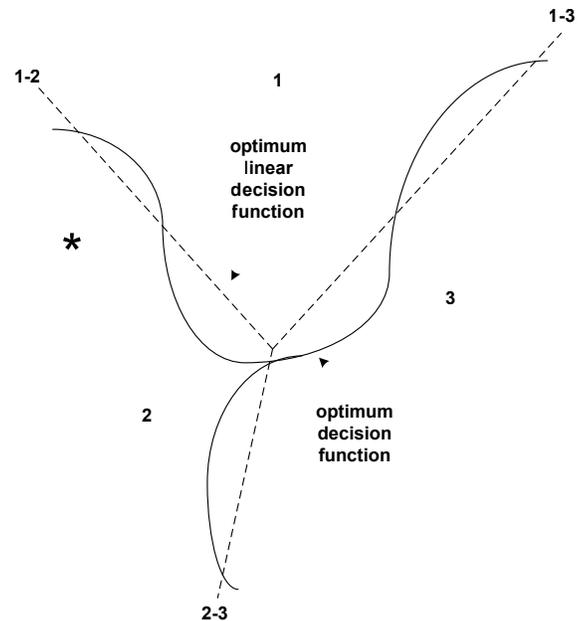
$$\sum_{i=1}^n a_i x_i + a_0$$

In order to classify a point m, it is only necessary to determine on which side of each hyperplane the point m lies. This is determined by the sign of the quantity

$$\sum_{i=1}^n a_i m_i + a_0$$

In fact, the magnitude of this quantity is proportional to the distance of the point m from the hyperplane.

This calculation can be accomplished with an inexpensive resistive adder, as shown in Figure 2. The voltage and resistor values are chosen to represent the terms in the above equation.



Domains of Three Pattern Classes in Measurement Space
Figure 1

¹ A Decade of Steady Growth, HP Memory Project; http://hpmemoryproject.org/wb_pages/wall_b_page_00.htm
² Hewlett-Packard, Wikipedia; <https://en.wikipedia.org/wiki/Hewlett-Packard#1960s>

My thesis proved several theorems relating to linear decision functions:

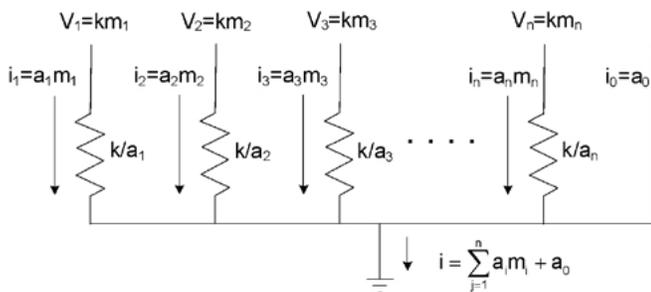
Theorem 1: For any categorizer based upon minimizing a Euclidian distance to a set of reference points, there exists a categorizer based on a linear decision function which is at least as good.

Theorem 2: For n pattern classes, a linear decision function comprises n(n-1)/2 hyperplanes.

Theorem 3: A complete linear decision function will classify any measurement into no more than one allowable pattern class.

Theorem 4: In a measurement space, the points that are identified with a particular class by a linear decision function comprise a convex set (i.e., a line joining any two points in the set is contained within the set).

Theorem 5: The categorization defined by a linear decision function is invariant under a nonsingular affine transformation on the measurement space. (My wife asked me what this meant. I told her I had no idea because I wrote my thesis fifty-five years ago. Sorry.)



Implementation of a Hyperplane
Figure 2

The next step was to determine the set of hyperplanes that would optimize the recognition of the hand-printed digits. To determine this, I obtained a set of hand-printed digits from fifty different people. Half of the samples were used to determine an optimum set of hyperplanes, and the other half were used to test the result.

Given ten digits, the number of hyperplanes that had to be determined was $n(n-1)/2 = 45$. A hyperplane was chosen for each pair of digits by incrementally adjusting the coefficients a_i of the hyperplane to minimize the number of digits that were incorrectly identified.

Testing the Pattern Recognition Machine

When all hyperplanes had been implemented using this procedure, a test of the resulting categorizer was made with the other half of the samples. The result was a 73% accuracy of identification.

This result clearly was not acceptable for commercial use. Therefore, Bell Labs terminated the project with the determination that linear decision functions were not appropriate for the recognition of hand-printed numbers.

A Second Attempt

In conjunction with a co-worker, Lou Kaminsky, we implemented a flying-spot scanner that broke handwritten numbers into closures, cusps, and lines. For instance, a 'six' is a closure on the bottom and a cusp to the right on top. A 'three' is two cusps to the left on top of each other. This improved the recognition results, but they still were not up to being commercially acceptable.

Fast Forward Six Decades

It is now almost six decades later. Computers are readily available, including those on microchips that can be embedded into special equipment. A great deal of research has gone into character recognition using the power of these computers. Now, not only can handwritten numbers be reliably recognized, but so can handwritten alphanumeric and even script. What a difference six decades can make.

Hewlett-Packard has been active in optical character recognition (OCR) for many years. Back in 1985, HP developed an OCR package named Tesseract. Tesseract outputs analyzed text into plain text, PDF, and HTML formats. In 2005, Tesseract was open-sourced by HP. Since 2006, Tesseract has been supported by Google.

HP also once offered OCR under HP IDOL (Intelligent Data Operating Layer) via IDOL's Worksite OCR Module. This offering was part of the Autonomy software suite. Autonomy was a company purchased by HP in 2011. Autonomy recently was acquired by Micro Focus as part of a larger software spinoff by HPE to Micro Focus.

Summary

My thesis was one of the early attempts at recognizing hand-printed text. Although it was accepted as legitimate research by Brooklyn Polytechnic Institute, the thesis did not achieve its goals because of a lack of computer resources and reliable categorization algorithms. As time has gone on and after a great deal of further research, these limitations have been overcome. Now, even machine reading of handwritten alphanumeric script is common.

.....
 Dr. Bill Highleyman brings years of experience to the design and implementation of mission-critical computer systems. As Chairman of Sombers Associates, he has been responsible for implementing dozens of real-time, mission-critical systems - Amtrak, Dow Jones, Federal Express, and others. He also serves as the Managing Editor of The Availability Digest (availabilitydigest.com). Dr. Highleyman is the holder of numerous U.S. patents and has published extensively on a variety of technical topics. He also ghostwrites for others and teaches a variety of onsite and online seminars. Find his books on Amazon. Contact him at billh@sombers.com.

BackforMore

Richard Buckle >> CEO >> Pyalla Technologies, LLC.

It is no secret that, like many of my NonStop peers, when it comes to cars I really look forward to track days. For me, this is a time when all the regular rules of the road can be ignored as you are encouraged to drive as hard and as fast as your abilities allow. Everyone drives in the same direction and everyone around you is typically at the same skill level. What could be safer and what could be more enjoyable if you really like to see just how well your car performs? These days, turning up for track days usually involves loading up the company command center, our RV, and preparing for the entertaining that tends to follow any outing onto the track and then connecting the trailer onto which the track car is loaded. Finally, it is a mad dash around the garage to ensure all the tools that might be needed are loaded into the RV's "garage."

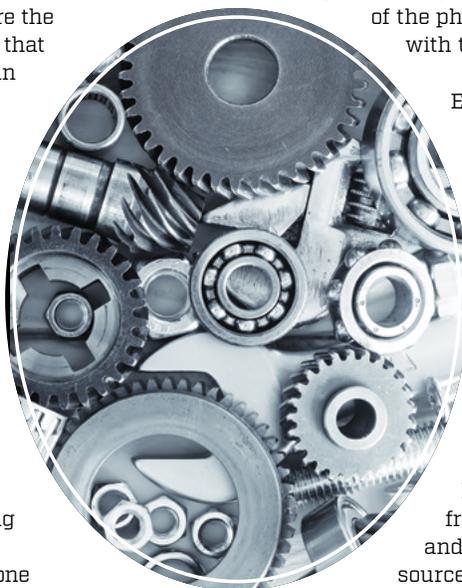
Talk to anyone else participating and the conversation turns to our preference for tools. Sometimes these are the tools we grew up with and are just so familiar that we would be lost without them; then there is an array of power tools that somehow we simply couldn't live without. Other times, these are the tools we accumulated over time based on various projects we undertook on the track car. And then there are a few participants who have to do everything by hand. Tools, after all, are what keep any track car track-worthy and the sound of wrenches ratcheting noisily, hammers banging away, and powered lug guns can be heard at all hours of the night.

When it comes to IT and the systems we work with, the number and type of tools each data center deploys can be as diverse as the personalities of those involved in programming and operations. For one group of operators, the system monitoring tools can be from just one vendor and support just the system being managed. For programmers, the development frameworks are the all-important ingredient when it comes to their productivity. Take them away from a familiar environment and they are lost; I recall my first day on the job as a programmer after moving from one company to the next and being shown a development environment that was totally alien. At this site there was a computerized library for all the source and object decks and I had to learn a third-party tool to interact with my own code!

Today, take a developer away from their Eclipse environment and drop them into something completely different with frameworks and languages unfamiliar to them and they are lost. At least until they have time to absorb the changed environment that greets them on their PC or Mac. Fortunately for everyone involved, I no longer program anything these days. Long gone are my own interactions with languages and frameworks. I wrote my last lines of code, in IBM 370 Assembler back on June 1979, a date I will always remember. At the time I was sitting at a terminal in the

Sydney office of the Reserve Bank of Australia knocking together additional lines of code to better support a data entry system being installed on a Fujitsu IBM plug-compatible mainframe, a FACOM M160 or thereabouts, as I recall.

Productivity has come on in leaps and bounds since those days and no developer would ever wish to return to those environments many of us experienced first-hand during our industries teenage years. I refer to this as the teenage era for good reason, as in the infancy of our industry it was very much a case of physically entering instructions via a console and where even the most rudimentary of paper tape readers was viewed as a huge productivity boost. At least in its teenage era there were punch cards and listings and yes, the earliest of terminals with screens capable of displaying 24 lines of 80 characters. However, productivity improvements came not only with the nature of the physical interactions we had with systems but with the way code itself was produced.



Enter the world of open source! In my last days working at ACI Worldwide I had an opportunity to give serious consideration to bringing into ACI development a fully-supported generic LAMP stack - Linux, Apache (HTTP Server), MySQL and PHP/Perl/Python. The key here was productivity, but for a vendor like ACI, getting another party committed to fully supporting the stack, 24 x 7, was the real problem that eventually led to the project being abandoned. However, today the world has changed yet again. There are very few developers who still write every line of code themselves; code stubs, libraries, frameworks, etc. are all available, off-the-shelf and, for the most part, are free. The world of open source has opened the door to productivity boosts the likes of which I never saw coming. And for NonStop developers, passage through this door and into this new world is open to them as well.

As a community we are now so attuned to what we can do versus what we cannot do that we have become rather blasé over the progress that has been made this century. In the past we wore our skills as a NonStop programmer on our sleeves for all to see, but today, the pendulum has arced across to where many programmers developing for NonStop systems wouldn't even know what a NonStop system is, let alone its high-profile attributes of availability, scalability and data integrity. When was the last time any of us stepped away from the middleware provided by NonStop development and wrote our own checkpointing code? And for that, all I can add at this point is that looking ahead at what will likely transpire in the future to further aid productivity I would have to guess it would be greater usage of AI but about that, I will leave further commentary to another column! [CS](#)

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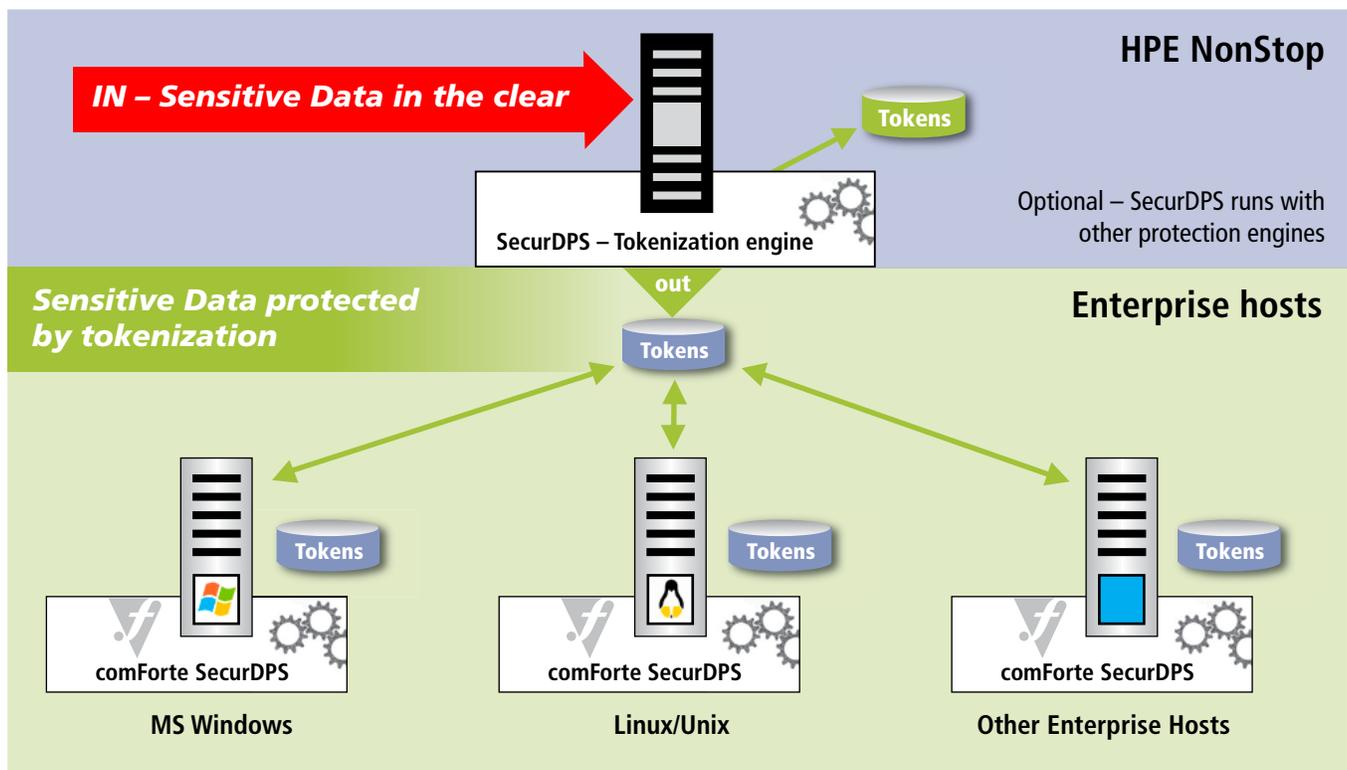
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