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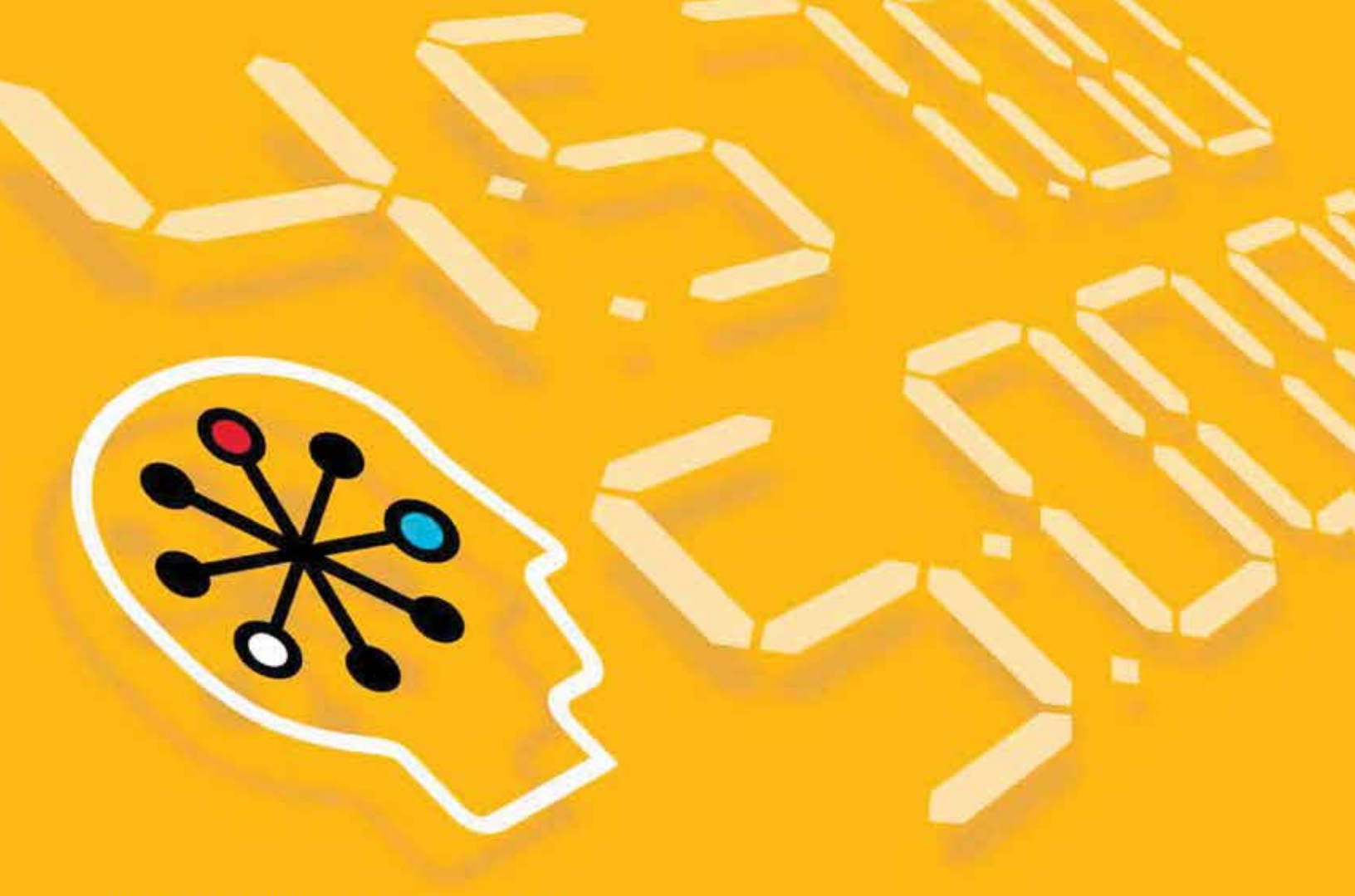

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A Note from Connect Leadership

Welcome to 2017! It is looking like another great year for NonStop.

It is winter here in the northern hemisphere. And that means we have lots of time indoors with shorter days and colder nights to sit around and think deep thoughts about how we are going to improve our NonStop infrastructure! Considering we all come from a NonStop background, I would like to think we all enjoy plenty of spare cycles sitting around pondering the wonders of the NonStop universe. We don't have to worry about down time, so we must have plenty of time to work on things like performance, modernization and really neat new technologies coming our way!

Unfortunately, we all know life isn't that simple. We continue to run some of the biggest, most critical infrastructure in the enterprise with a handful of people. And we make it look easy!

When (if) you have even a few minutes, do yourself a favor and actually READ the articles in this issue. I know, it is time you can barely afford, but do it anyway! This issue is all about the transformation of the HPNS platform from the old system that sits in the corner and handles everything you throw at it without any attention into the same system that everyone can use and leverage for their NEXT application.

Think about the way your NonStop is going to gain a LOT of attention in the near future! When the Linux community is looking for a database platform for a transaction system and they realize that they can use RDMA via NSADI to access the NonStop at memory speeds with complete availability! And, when that HPNS server is a vNonStop sitting in the same cabinet with their stuff they won't know what hit them.

HPE is taking the HPNS to a new level. They are rebuilding it. Better, stronger, faster. Let us all ensure that it gets all the attention it deserves!

Now update that photo in the organization chart, you may get a lot of looks this year.

Rob Lesan

Thanks.
Rob Lesan
XYPRO Technology
Connect Worldwide President

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The Connection

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News from HPE's NonStop Enterprise Division

The NonStop business finished our fiscal 2016 year with a bang, and 2017 is off to a strong start. Our business continues to grow year-over-year, and we're happy to see many more of you rolling out NonStop X servers in production. Back in Palo Alto, our partners have been getting bored beta testing vNonStop systems, continuing to prove that "It Just Works", and the development teams are pushing hard to get vNonStop out the door so the rest of you can get your hands on it too. Of course, that's just the beginning of the virtualization part of our journey. I keep coming up with new "can you do this?" challenges for them, so you can expect that there are many more cool features in the future.

This is probably the last time that you'll see or hear me say "vNonStop", by the way. vNonStop was our internal project name. The official name will be Virtualized NonStop. So you're all the first to know! vNonStop demos are continuing to attract a lot of attention worldwide from both NonStop customers and prospects, including at HPE Discover in London last December. By the time you read this letter we also will have shown a demo of vNonStop running CMS Mobility Management software to HPE's Board of Directors in Houston and taken it to the Mobile World Conference in Barcelona. In addition, we will have started customer betas at the ATC and will have launched our first on-site customer beta at a major Telco in Europe.

As much as I love vNonStop, it's far from the only cool product that we have under development. We're working across the entire NonStop software stack to build out its capabilities for your digital core for real-time business. Much of our focus is on database, and if you were at November's Technical Boot Camp you were able to get a sneak preview of several elements of our strategy.

In today's enterprises, a major contributor to agility in offering new solutions is the ability to self-provision database services through a portal rather than having to wait for weeks or months in your IT organization's request queue. Our SQL/MX team is adding self-provisioning support and enhancing elasticity so you can spin up new applications quickly and have them easily scale to meet increasing customer demand. We also will support tenant isolation at the SQL/MX catalog level, with either private or shared tenant data. The combination of vNonStop and these database services makes it easy for you to prototype and launch new solutions – no additional systems required!

Application portability is key to continuing to grow the NonStop business, and database compatibility is one of its primary components. We have stepped up our pace in adding database compatibility features to SQL/MX. Features under development include support for PL/SQL, User Defined Functions, materialized views, key Oracle datatypes, and additional Oracle built-in functions. If you're tired of paying hefty database license and support fees, I encourage you to take a close look at what it would take to start migrating those applications to SQL/MX.

Another primary component of application portability is operating system functionality. Our growing team of OS and open source developers are continuously adding APIs, tools and utilities to the OSS environment to minimize the effort required to port applications developed for Linux to NonStop. The list of possible enhancements is long, so if you have an application that you want to port and are running into barriers please let them know about it.

How can you keep your applications running smoothly once they're in production? There are many tools available already, but I'm excited about one that we currently have under development. NonStop Database Analyzer (NSDA) will provide a browser-based user interface oriented toward the needs of each class of SQL/MX users – operations, IT management, database administrators, developers and end users. Its performance-based monitoring and management will include dashboards with drill-down capabilities, health monitoring, heatmaps and analytics for isolating application problems, workload management, reports, data visualization and analytics and many other features.

We'll be hosting the next Partner Technical Symposium in our Palo Alto headquarters in March, where we can both share information on our plans and get on-the-spot feedback from our partners. We also will spend the day before and after meeting with many partners individually for more in-depth discussions on where they and we see new opportunities for both vNonStop and our growing database services offering.

You'll find interesting articles in this issue on topics ranging from security to availability improvements to use of NSADI in a Guardian environment, Dr. Bill Highleyman's article on a follow-on discussion with Dr. Timothy Chou at TBC, vNonStop musings by Richard Buckle, and a bit of user group history. As a reminder, the Connection is published six times a year and the Connect team welcomes your contributions. Want to learn more about contributing? Contact Stacie Neall (sneall@connect-community.org).

I'm pleased to announce that I've accepted the position of HPE liaison on the Connect Board of Directors. I'm looking forward to working with the Connect Board and staff to ensure that we all are working together to share NonStop knowledge and expand the universe of NonStop customers, partners and solutions. And there's so much new to share. As Jimmy Treybig would say, "It's excitin'!".

Andy Bergholz

Andy Bergholz
Senior Director of Development of HPE NonStop

DUST CELEBRATES 30 YEARS!

Kathy Wood >> BlackWood Systems, Inc

The Desert Users of Tandem celebrated its 30th Anniversary in 2016. We come together 3-4 times per year to hear presentations from HPE and Partners. We have approximately 25 regular participants representing 5 local customer companies in the Phoenix area. Our meetings have been held for many years at CVS Caremark. We keep the meetings short for convenience – 8:30am to 1pm. Our generous speakers provide breakfast and lunch onsite so we can network and learn from each other.

As with many other long-time groups, we have lasting relationships within our NonStop family. We are a friendly group! Don't be surprised if a presentation becomes a conversation toward education... Everyone is welcomed and encouraged to participate. DUST has a history of activities. We meet during the great Phoenix weather of Spring Training (March), have participated in NASCAR events, and join in the CVS Health Annual Toy Drive as a Thank You for using their facilities.

It takes dedication to keep a User Group running through 30 years. We applaud Cathy Meurer (US Foods) and Don Lutes (CVS/Caremark) on keeping us together! We've seen a lot of corporate name changes, new faces, retiring faces, and faces associated with new/old companies. There is a lot of communication and cooperation in our commitment to our NonStop family and we look forward to the next 30 years!

Desert USers of Tandem

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The NonStop Under 40 SIG

Navid Khodayari >> **Director of Business Development** >> Idelji

Another successful TBC is in the books. We saw new product releases, new technologies presented, and Special Interest Groups (SIG's) were in full force. This year, in addition to the usual technology SIG's, there was another non-technical SIG that stood out to many, as it hadn't ever been held before; the NonStop Under 40 SIG.

At first glance, the SIG may have looked like an excuse for some of the younger folks in the community to sit around and drink beer. In reality it was an exclusive opportunity for the next generation of NonStop talent to meet each other and discuss their opinions on the industry, and share ideas for the future. Of course, we drank beer too!

So how did this come to be? Well, when I attended my first NonStop meeting in the late 90's (back then it was ITUG), I found myself to be the youngest person there. As we got into the 2010's, after several massive changes had taken place in NonStop and Technology as a whole, one thing remained the same; I was still the youngest person there. This was a little unnerving as you really started to wonder about the future (but it made me feel ageless which was great!). In the next few years, however, I started to notice more new faces, and after a little while it finally looked like there may actually be enough of these new faces to fill a room. With the support of the wonderful team at Connect, a meeting was placed on the 2016 TBC Agenda for these people to meet and discuss.....well, I didn't really know what we were going to discuss, but I figured once this group was in the same room the conversation would find itself.

Heading into the meeting was a little concerning; would anyone show? Would people contribute? Does anyone care? I'm happy to say, all reservations were placed to rest. We had a standing room only turnout of people ready to express ideas, criticism, and everything in between.

So what did we talk about? Well, knowledge and awareness mostly. After going around the room with introductions, a lot of the critique that was brought up was focused on awareness. It turns out that nearly all of the new generation was unaware of NonStop before their current job, and are hard-pressed to find anyone outside of NonStop that is aware of the technology. Along the same lines, many people expressed their desire for a simplified knowledge base, as finding information in the NonStop world had proven to be burdensome for them ("why can't I just google it?").

The best part about this meeting, however, was the enthusiasm of the group as a whole to contribute to its success. The meeting wasn't a room full of complaints about what's wrong in the industry. It was about identifying problems, discussing solutions, setting action items, and having a superfluous amount of volunteers take responsibility for those items. The level of willingness to work together to create solutions was excellent, and many of the partner companies have since offered their resources to get our solutions moving. Also impressive was the commitment shown by HPE of having a corporate liaison sit in on the meeting and take notes. It was quite refreshing to know that HPE is giving attention and offering services to this group as well. We very much look forward to working with HPE in this capacity.

So what now? Knowledge and awareness were identified as areas for improvement and the first step we collectively identified to solving these is to continue the momentum of the meeting by creating a forum for us all to regularly contribute to. We are currently developing our own online forum where we can all register and contribute with the goal of creating an easy to use NonStop knowledge base, as well as a place to share ideas and action items for raising awareness. This forum will also be available to all the other SIG participants that were unable to attend the in-person meeting as well. In short, we are turning our 50-minute SIG in San Jose to an around the clock worldwide knowledge base and forum.

As we enter a brave new NonStop world, it's reassuring to know there is a brave new breadth of NonStop talent ready to take the march down the bright and exciting path. The NonStop Under 40 SIG is just a small first step. A step in the right direction.

Navid began his journey in NonStop in a small Los Angeles garage while still a college student. Since then, he has witnessed many changes in the NonStop world. As Director of Business Development for Idelji, Navid travels the world for all things NonStop and is excited about the integration of new technologies on the platform.

2016 NSTBC SIGs

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

The 2016 NonStop Technical Boot , held from November 13 to November 16 at the Fairmont Hotel in San Jose, California, U.S.A., was a resounding success for the over 450 attendees. The program featured almost 100 breakout sessions offered by HPE, customers, and vendors. Included in the sessions were four SIGs (Significant Interest Groups). SIG attendees listed issues and concerns they have with HPE products and services. Popular concerns are escalated by Connect to HPE for requested action.

The four SIGs available at Boot Camp were the Open SIG, the SQL SIG, the Security SIG, and the NonStop Under 40 SIG. The discussions that were held are summarized below.

Open SIG

The Open SIG deals with all issues that open up the NonStop Platform. The SIG was run by Bill Honaker from XID, with Wendy Bartlett representing HPE. Nine people were in attendance.

There were no current issues to review nor any new issues to submit.

Bill gave an update on the progress the ITUGLIB team was making to get ITUGLIB online. The current web site is accessible via the Connect web site, with plans ongoing to use a Git repository for user access. The build process for the Open Source tools includes automating updates via Jenkins, a Git plugin. Public access will be available via 'git clone.' The team is coming up with a contributions strategy for interested participants to make contributions. The Legacy Technical Library (the Guardian utilities) still are included within ITUGLIB. There is another project in development to make the Legacy Technical Library accessible via Git, although that will require the use of a third-party product that provides Guardian access to the Git repositories.

SQL SIG

Bill Honaker chaired the SQL SIG in Scott Randall's absence. Roland Lemoine represented HPE. Thirteen attendees participated.

Issues from 2015 included:

- Materialized Views – HPE is working on this, and it is accessible under controlled availability for development use only. It is currently unsupported. This issue had eight votes from the 2015 SIG meeting. It received two votes at this year's meeting.
- Maintain a registry of queries existing on the system with a unique start ID, start/end timestamp, query text, etc. – This topic had six votes from the 2015 SIG meeting but received no votes this year. HPE is planning to work on this problem.
- MERGE, INSERT logic – Include Grant/Revoke access in the command level. This issue had three votes from the 2015 SIG meeting. It received two votes this year. HPE plans to address the concern.
- Do not close cursors on a commit transaction – Having received three votes from the 2015 SIG meeting attendees. it gained six votes at the 2016 SIG meeting. HPE currently has no plans to work on this problem.
- Offload MX modules to reduce memory pressure – This topic had two votes in 2015 and three votes in 2016. HPE is investigating shared query plans per CPU.
- Moving modules/files to production without a SQL compile – This issue had two votes at the 2015 SIG meeting and two votes this year. The use of the MXRPM tool was suggested. Users may need to extend similarity checks.
- Perl support – This topic received two votes at the 2015 SIG meeting and one vote at this year's meeting. DBD and DBI were removed due to the Linux driver now being generally available. A standard solution for "on platform" still is needed via scripting.
- Disallow update of primary key – This issue received two votes at the 2015 SIG meeting. The topic arose when MX was changed by HPE to allow the update of the primary key, which changed the contract with software developers that had relied on the operation to fail. The request by SIG members is to allow the 'new' default to be overridden so that existing applications will work correctly. Four votes were received in 2016.

One new issue was raised:

- Providing visibility into the temporary tables created by triggers – This issue garnered two votes.

Security SIG

The Security SIG was chaired by longtime NonStop specialist Mark Chapman. Wendy Bartlett represented HPE. There were twelve attendees. Issues left over from 2015 included the following:

- Better OSS audit filtering.
- SUDO (now on the HPE roadmap).
- SAMBA integration (Version 4) now on the HPE roadmap. Version 3 security fixes aren't easy. Futures include Active Directory Support, among others.

New issues that were raised included:

- NonStop X Infiniband consideration.
- NASDI (previously the YUMA project) cross-O/S security issues and vulnerabilities.
- MX as a service (is being used internally by HPE). A lot of work going on so far, as HPE IT has been in support of multi-tenancy.
- vNonStop and vCLIM:
- Linux O/S security. Active Directory integration?
- KVM security. Open Stack or Helion OpenStack?
- Interaction between security layers.
- Internet of Things. This is a future consideration, 4-5 years at least.

Discussion and questions followed. HPE was asked about the Hardening Guide, and Wendy gave an update. A question was posed to the Security Partners, who were encouraged to update their manuals. Some attendees felt that the manuals were out-of-date.

NonStop Under 40 SIG

The NonStop Under 40 SIG was formed to bring focus to the task of making it easy for newcomers to the NonStop platform to get up-to-speed. There were 28 attendees, 6 of whom were end users (the rest were employees of partners). In addition, Bill Honaker was there to represent the Advocacy Committee, Kelly Luna represented Connect, and Bobbi Gibson attended from HPE's Information Experience group.

This was the first meeting for the SIG, so everyone introduced themselves and discussed what they had experienced while learning about everything NonStop.

One attendee noted that when trying to encourage others in his company to learn NonStop, he found that people didn't see NonStop skills as being marketable in the job market. Another person raised the issue of Training and Certification in general. This issue sparked a lot of conversation in the group. One of the more interesting suggestions was to create task-based videos (for example, on YouTube), and many expressed willingness to help create them. This suggestion is one of many things the group felt would be helpful in marketing the NonStop experience to younger technical people.

Summary

Connect SIGs provide opportunities for members to share best practices, learn from subject matter experts, and connect on areas of special interests via online discussions, webcasts, magazine articles and face-to-face sessions at Connect events. The SIGs also serve as a means to advocate the needs/interests/challenges of Connect member companies to HPE or HPE partners. Find additional information at www.connect-community.org/special-interest-groups/.

Dr. Bill Highleyman is the Managing Editor of The Availability Digest (www.availabilitydigest.com), a monthly, online publication and a resource of information on high- and continuous availability topics. His years of experience in the design and implementation of mission-critical systems have made him a popular seminar speaker and a sought-after technical writer. Dr. Highleyman is a past chairman of ITUG, the former HP NonStop Users' Group, the holder of numerous U.S. patents, the author of Performance Analysis of Transaction Processing Systems, and the co-author of the three-volume series, Breaking the Availability Barrier.

NonStop: The Next Generation

Mandi Nulph >> **Marketing Coordinator** >> NuWave Technologies

The HPE NonStop server has been around for a long time. Originally brought to market in 1974 as Tandem, NonStop boasts a long history of providing exceptional reliability to the industries it serves. But behind the hardware and software is a community of people who have been in the game since the Tandem days; a crew that has tirelessly supported and worked with NonStop throughout all its phases since the beginning, bringing a unique culture to the industry as a result. But lately, many of the people who have been around from the start have found themselves winding down for retirement and looking to pass the torch to a younger generation.

In many cases, however, hiring young workers into NonStop has proven to be a challenge. People in college studying computer science have countless options for where to take their talents and how to build their careers when they enter the job market, so how do you make an industry like NonStop stand out in an endless sea of technology?

Gravic's Paul Holenstein is one of many NonStop professionals who understands the importance of recruiting young talent in the field:

"We are HUGE advocates of a strong internship program, and try to have several in each of our departments, across all of our product lines, from technical to business functions. Not only does this give back to the wonderful educational system we have in this country by providing opportunity to up-and-coming students, it helps us identify a nice stream of future talent from which to draw.

Whereas it is true that finding people experienced with NonStop can be hard, we aren't often hindered by that issue. What is hard is finding individuals who are experienced in the unique and different technologies that we offer. That is why we spend so much time and energy on hiring the 'right' people, those who can quickly learn what we do, who can adapt to new technologies, and who want to work in a vibrant, often demanding, mission-critical environment. We often find this attitude in those who have recently graduated, as they love to learn new things and embrace rapidly evolving technologies. And, sometimes, they teach us a thing or two about new and evolving methods that they picked up along the way!"

Jim McFadden of NTI echoes Paul's thoughts that it is often about hiring the right people over trying to find new hires with experience in the industry:

"When hiring, we look to the person and not the CV. Personal references are more than what someone sends us in the mail. We start with referrals from our engineers, and then it all comes down to the interview. How you interact in the interview is critical.

In an interview I would ask a recent grad two things:

> #1 - Tell me about your Data Structures class. DS teaches critical design concepts and it's important to what we do.
>
> #2 - In kindergarten, what grade did you get in "works and plays well with others"? Seems a bit amusing, but everything we do happens in a team. You need to be able to communicate, express yourself, work to support the team. No team... no results."

This year at the Connect NonStop Technical Boot Camp, a special "Under 40" special interest group (SIG) was formed. People under the age of 40 from vendor and customer companies,

and HPE, came together to discuss the challenges the industry faces in recruiting a new generation and to brainstorm ways to make working with NonStop systems, from a technical standpoint, more appealing. But for those young people already working in the NonStop space, the opportunity and community they have found has far exceeded their expectations.

Casey Krasner of XYPRO is one of those young people working in the NonStop space who couldn't imagine working in any other industry:

"I don't think any young person plans on working in the HPE NonStop server industry, I would guess it's not all that high on the job search keywords. At first, I was unsure what the industry really was. For the first few months I could hardly even tell what a NonStop was or did. When I would ask, the answer I got was 'it's a server that is for mission-critical computing.' To someone just coming into the IT industry this meant nothing.

Through my time with XYPRO that sentence, 'mission critical computing', had started to mean something. The NonStop is more than just a computer and some software, it is an essential part of everyday life and our lifestyle. Can you imagine going into a store, swiping your card at the checkout and the machine coming up with 'we will process your payment in the order it was received, 155,442 of 1,000,000,000. Estimated wait time – 56 minutes'? The NonStop platform ensures the efficiency and security of transactions for many of the Fortune 500 companies and knowing that I am a part of that gives me a great sense of pride in my work."

NuWave Technologies is another company that understands the importance of continuously bringing in and retaining young employees. Not only are more than 40% of NuWave's employees under 40, but so is the new CEO. Ernie Guerrera, the founder and former president, is one of those original Tandem guys, and it has always been his plan to pass on the role to his daughter, Gabrielle.

"Tandem and NuWave have always been things that my father has shared with the family, because he is so passionate about the industry, the community, and his company. When I was a kid, he would bring me and my sister model tandem bicycles, toys from other vendors' booths, and tokens from his travels around the globe. And now, getting to work at the family business for the last eight years has really opened my eyes to what a special place the NonStop world is, and it is much more interesting than I had imagined as a child. It has been a pleasure to work alongside my dad, and now to be able to carry on his legacy," says Gabrielle.

Recently, NuWave also hired a new sales manager for the Americas who is under 40, and although he is also a Guerrera, Vincent was not hired for that reason. Vince was the most highly qualified for the position, having studied computer science and excelling in sales successfully for many years. After graduating, like many college grads in the under 40 crowd, he did not end up in the same field after graduation. Other opportunities took him into real estate and pharmaceutical sales, but he is now coming back into the technology fold and bringing with him his years of sales experience. "Vince has the intelligence, drive, and character to succeed in his new role," Gabrielle explained.

Vince is optimistic about his new role at the family business:

"I chose NuWave because it is a great company to work for and I see the potential in NuWave's middleware to modernize legacy applications and allow companies to implement new functionality to better user experiences."

"NuWave is known for providing its customers with the best service possible, but what most people don't know is that NuWave is also focused on making sure their employees are happy as well, no matter what age they are" Gabrielle said. "We are always working to find that balance between what the older and younger employees want in terms of the office environment, perks, benefits, activities, and so on."

With a renewed focus on recruiting young workers, the NonStop space is sure to continue to see an influx of fresh faces and ideas. It's these young minds that will help take NonStop from the industry standard that it has become to the next level.

Mandi Nulph is NuWave's marketing coordinator. NuWave specializes in HPE NonStop middleware, including their newest product, LightWave Server™, which allows you to expose your existing Guardian or Pathway servers as industry-standard REST services. 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.

Who are The Middleware Guys?

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At NuWave, we know middleware.

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- ✓ *LOW TCO*
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Transparent Data Protection

Branislav Meandzija >> **Technology Leader** >> HPE Security - Data Security
Andrew Price >> **VP Technology** >> XYPRO Technology Corporation

Overview

A transparent data protection solution is often the only way to retrofit data protection into existing applications. Data is protected on ingress/egress to the application without requiring any application changes. As such, it is also the easiest data protection solution to implement and deploy. The implementation consists of 3 major steps:

- Designing the appropriate data protection model
- Defining the level of access that each application will have to different types of data
- Configuring the transparent data protection solution.

On the HPE Nonstop server, transparent data protection is commonly implemented through I/O intercept libraries. Multiple data protection solutions are available. In this article we look more closely into the **HPE SecureData Transparent Data Protection** solution and how it enables and facilitates *enterprise wide data protection*.

Data-centric Security

Data-centric Security refers to a type of data security where all sensitive data is protected all of the time except when used by authorized applications that have the necessary access rights to see only the plain data they are explicitly authorized to see. This level of data protection can only be achieved if *data is protected at the field level* (not volume or other macro level) from the moment of first-time entry/creation and throughout the data lifetime.

Data-centric Security is necessary for achieving data protection in any information systems that consists of multiple processing entities collaborating while using parts or elements of the data. This is illustrated in Figure 1.

Any insular data protection systems will expose vulnerabilities as they introduce points at which the data is not protected. Data may be revealed before being channel protected (for instance, with SSL encryption) or at the other end of the connection, before it is encrypted for the next hop. Data-centric security protects the sensitive data throughout the enterprise, regardless of the underlying transport or storage mechanism.

Enterprise Data Protection Challenges

Enterprise-wide data protection invariably relies on data-centric security. Within a large enterprise the number of platforms, systems, and applications needing access to enterprise data is frequently very large. This creates two unique challenges:

1. The availability of the data protection solution on ALL the enterprise platforms. This includes: HPE NonStop, z/OS, HP-UX, Solaris, AIX, various versions of Windows, Linux, various web platforms, embedded and mobile platforms, etc. A large variety of applications on those platforms have to obey the same data-access and data protection policies.
2. Any data protection solution requires high-availability and high-performance access to the protection artifacts, be it encryption keys, a tokenization database or a tokenization table. Typically, encryption keys are stored in key vaults which need to be synchronized and replicated for high-availability access. This significantly complicates the data protection solution for several reasons caused by the

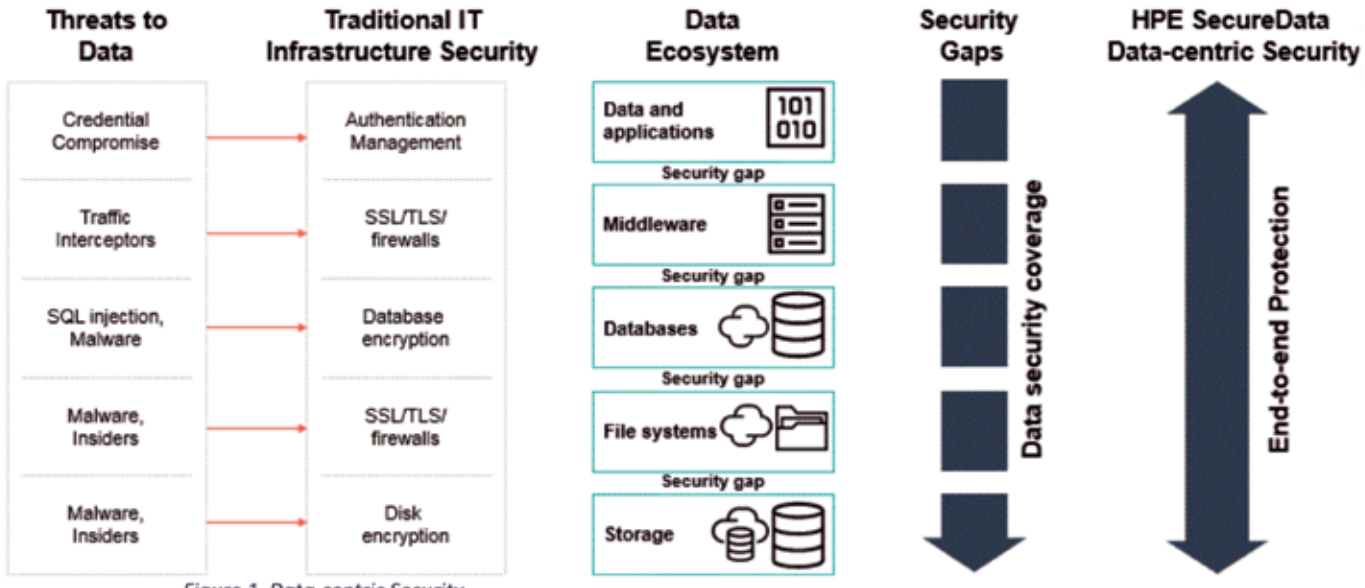


Figure 1 Data-centric Security

need to have all keys being stored in all key vaults used physically. This may amount to millions of keys being replicated across vaults which creates challenges such as:

- distributed state synchronization
- resource availability
- high availability
- security
- and performance

HPE SecureData Transparent Data protection meets these challenges with the following technologies:

1. Stateless key management which allows the elimination of key vaults.
2. Standards based format-preserving encryption.
3. Standards based stateless tokenization.
4. Enterprise-wide protection format enforcement.
5. State-of-the art HPE Nonstop transparent data protection using I/O Intercept.

The remainder of this articles provides an overview of these technologies in the context of the overall solution.

Stateless Key Management

HPE SecureData stateless key management uses the concept of canonical user identities in conjunction with crypto district base derivation keys to remove the need for storing keys in key vaults and instead deriving keys on demand just-in-time for use by protect/reveal operations of authorized entities. HPE SecureData stateless key management is illustrated in Figure 2.

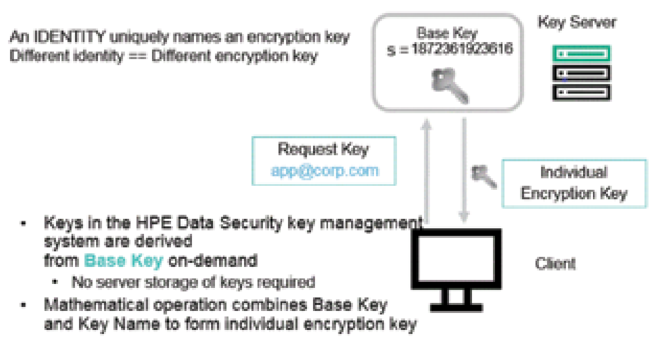


Figure 2 HPE SecureData Stateless Key Management

Management consoles of key servers allow creation of crypto districts which include creation of base keys for different crypto algorithms supported such as AES, FFX, TDES, IBE BB, IBE BF, etc.[1] These base keys are created on an HSM utilized by the key server. The base key can only be used in an HSM associated with the key server. Once the key server receives a request to derive a key for an identity by a client, it authenticates the client and then requests the HSM to derive the client key.

The only key related state in the HPE SecureData stateless key management system are the sets of base keys for the configured crypto districts. This state is manually replicated in minutes at the time key servers are first configured which allows the simple high-availability key management architecture shown in Figure 3.

HPE SecureData stateless key management eliminates the issues associated with statefull key management using key vaults such as distributed state synchronization, key replication resource, performance, and security issues due to the need to synchronize key stores across key vaults.

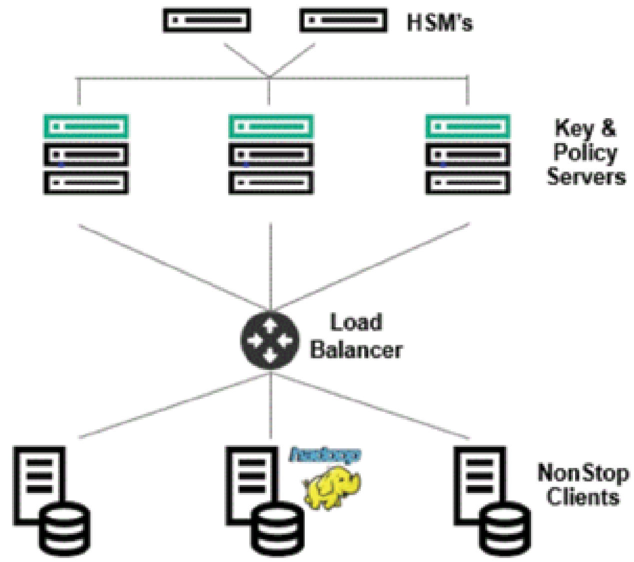


Figure 3 HPE SecureData Stateless Key Management HA Architecture

Standards Based HPE Format-Preserving Encryption and Tokenization

HPE Format-Preserving Encryption (FPE) and HPE Secure Stateless Tokenization enables in-place substitution of plaintext with ciphertext using standard crypto algorithms such as AES. Figure 4 shows some of the formats supported:

Name	SS#	Credit Card #	Street Address	Customer ID
James Potter	385-12-1199	37123 456789 01001	1279 Fairland Avenue	G8199143
Ryan Johnson	857-64-4190	5587 0806 2212 0139	111 Grant Street	S3626248
Carrie Young	761-58-6733	5348 9261 0695 2829	4513 Cambridge Court	B0191348
Brent Warner	604-41-6687	4929 4358 7398 4379	1884 Middleville Road	G8888767
Anna Berman	416-03-4226	4556 2525 1285 1830	2893 Hamilton Drive	S8298273

is transformed by FPE to

Name	SS#	Credit Card #	Street Address	Customer ID
Kwfdv Cqvzgk	161-82-1292	3712 3488 7865 1001	2890 Ykzbpoi Clpppn	S7202483
Veks Iounfo	200-79-7127	5587 0876 5467 0139	406 Cmdo Ofdalu	B0928254
Pdnme Wntob	095-52-8683	5348 9212 3456 2829	1498 Zejpfbbx Pqkag	G7265029
Eskdw Gzhqlv	178-17-8353	4929 4356 7432 4379	Yotv	G3951257
Jsfk Tbluhm	525-25-2125	4556 2598 7643 1830	8412 Wbbhalhe Uayqg	B6625294

Figure 4FPE - Plain and Cyphertext

The use of standards based cryptography is essential. Open standards are vendor agnostic and remove risks. Non-standard and unpublished crypto has security and liability implications, e.g. organizations cannot claim safe harbor exceptions in the case of a breach.

HPE Format-Preserving Encryption is standardized as a mode of AES in NIST SP800-38G. HPE Security – Data Security contributed the framework to all modes of Format-preserving Feistel-based Encryption (FFX) – X indicates that the framework can be instantiated in different ways.

HPE's Secure Stateless Tokenization (SST) falls under the ANSI X9.119 part 2 standard, which is still in draft status.

Enterprise-wide Policy Based Security

HPE SecureData Enterprise Policy management system enables fine-grained data-protection and controlled data-access across the enterprise. It also enables application of uniform security policies across the enterprise, application of key-management policies across the enterprise such as:

[1] AES stands for Advanced Encryption Standard; FFX stands for Format-preserving, Feistel-based Modes of AES- both AES and FFX are NIST standards; TDES stands for Triple Data Encryption Standard and is an ANSI standard; IBE stands for Identity Based Encryption, both IBE BB and BF are ISO standards

- key rollover
- key revocation
- adaptability to connectivity issues

Distributed entities in a heterogeneous environment use policy information to protect/reveal a data item without having to synchronize with each other.

All HPE SecureData clients pull the *clientPolicy.xml policy information* from the HPE SecureData Policy Server which is hosted on the same systems as the key server.

The clientPolicy.xml needs to be loaded by any native client before any protection/reveal operations can be performed. The policy defines:

- crypto parameters, policy, and key hard/soft refresh settings which enable a highly-available solution configured to sustain maximum equipment replacement timeframes,
- default values for parameters such as the default identity time stamp and default crypto districts
- key number tables and protection format definitions

HPE NonStop Transparent Data Protection Using I/O Intercepts

HPE SecureData Transparent Data Protection for HPE NonStop is based on XYPRO's XYGATE Data Protection (XDP) product. Figure 5 illustrates the HPE NonStop solution.

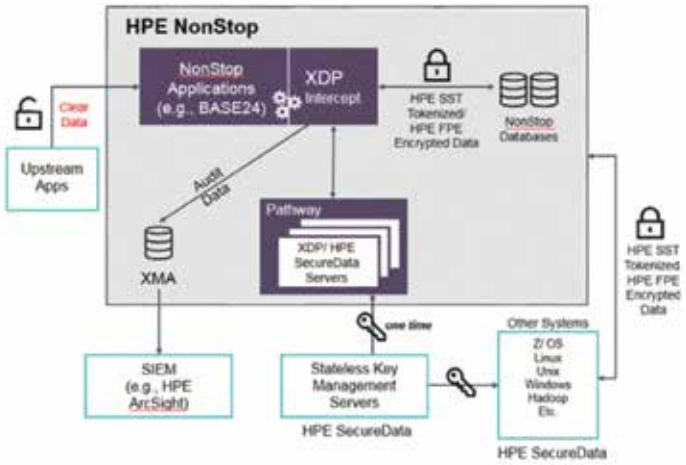


Figure 5 Transparent Data Protection on HPE Nonstop

XDP was designed and engineered to integrate with HPE SecureData Enterprise on HPE NonStop. XDP integrates seamlessly with HPE SecureData and allows for simple, comprehensive data protection with minimal impact on your applications and databases.

Figure 5 shows a common implementation of HPE SecureData Transparent Encryption. An existing application such as BASE24, has the XDP intercept library linked to it. From that point onwards, all I/O's performed by that application are intercepted by XDP. When the intercept occurs, XDP determines whether that I/O includes any sensitive data. If so, that data is encrypted (for write operations) or decrypted (for read operations) based on access rights granted to that application. All sensitive data written to disk is now protected using HPE SecureData technologies. Once written to disk, the data can be shared with applications on other platforms in the enterprise, where it can be decrypted/detokenized using the same underlying HPE SecureData functionality.

XDP's transparent data protection:

- Allows HPE SecureData implementation with no application changes
- Supports both Guardian and OSS
- Supports all types of HPE NonStop executable, from older non-native (code 100), to newer native (code 800 and 500) types
- Adds multiple language support, including TAL, COBOL, C and Java
- Provides a distributed architecture and packaged functionality out of the box
- Includes comprehensive access control and auditing, including integration with XYGATE Merged Audit, and HPE ArcSight
- Provides nowaited/non-blocking encryption/tokenization

Within HPE SecureData Transparent Data Protection, the XDP intercept seamlessly provides both HPE SecureData Payments and HPE SecureData Enterprise functionality. This deep integration includes configurability of various fine-tuning mechanisms, such as:

- Persistent and non-persistent caching which enables various HPE Nonstop standalone modes in case of failures, at cold-start, or for performance reasons;
- Entropy-source selection for use in SSL and otherwise;
- Use of payments and enterprise formats;
- Field-level authorization group mapping to different HPE SecureData crypto districts with distinct authentication/ authorization rules;
- Field-level protection mapping to protection servers.

The intercept itself supports various modes of the Enscribe native hierarchical database as well as SQL databases with sensitivity to peculiarities of in place-substitution of the role of various record filed values.

Summary

Transparent data protection closes the data protection gap in cases where API level protection is not an option. It also provides the fastest and easiest data protection integration for many use cases.

HPE SecureData Transparent Data Protection is unique in its ability to provide a surprising simple, complete data-centric solution for any size system or enterprise.

Dr. Branislav Meandzija is a Technology Leader at HPE Security - Data Security. Branislav joined HP/HPE in 2015 as part of the Voltage Security Inc. acquisition. At Voltage since 2008, he was the engineering manager responsible for all of SecureData from 2008 through 2011, and Core Crypto, SecureData Payments and all SecureData NonStop platform engineering efforts from 20011 to 2015. Since 2015 Branislav spearheads the technology side of different HPE Data Security projects including the HPE SecureData Transparent Data Protection effort on NonStop.

Andrew Price is VP of Technology at XYPRO. He joined XYPRO in 2011, and has over 25 years' experience in the mission-critical IT industry. Prior to joining XYPRO, Andrew was with ACI Worldwide for over 11 years, where he held roles in Product Management, Development and Architecture. At XYPRO, Andrew has engineering and product management responsibility for the XYGATE suite of products, ensuring that they continue to meet XYGATE users' stringent requirements for security and compliance on the HP NonStop. He can be reached at andrew.price@xypro.com

DR. TIMOTHY CHOU

Speaks at the 2016 NSTBC on the Internet of Things

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

Dr. Timothy Chou presented a keynote address at the recent NonStop Technical Boot Camp, held last November in San Jose, California, U.S.A. His topic was the Internet of Things (IoT). While a Thing could be a toaster or a Fitbit, Dr. Chou focused his talk on the machines that are the backbone for the planet's power, water, food, and healthcare infrastructures – things like combine-harvesters, wind turbines, submergible pumps, or blood analyzers.

Dr. Chou has published numerous books. His first, "The End of Software: Transforming Your Business for the On Demand Future," discusses Software as a Service (SaaS), in which software and the services that support it are moved to the Cloud. Dr. Chou emphasizes the point that every business-application software company that has gone public since 1999 has used the SaaS model. Prior to the model's acceptance, the customer was responsible for installing the software and for managing its security, availability, and performance. Under SaaS, it is the software vendor who now performs all these functions.

Another book, "Cloud: Seven Clear Business Models," focuses on models that underlie most of the business and consumer technology industries. It is based on Dr. Chou's lectures at Stanford University. He dwells deeply into the Internet of Things in "Precision: Principles, Practices, and Solutions for the Internet of Things." https://amzn.com/1329843568 In the first part, "Precision: Principles and Practices," he introduces a vendor-neutral IoT framework and discusses how this framework is put into practice. The second part, "Precision: Solutions," uses his IoT framework to highlight fourteen real-world solutions for manufacturers that are building precision machines. If you're interested, an online course is being made available at www.precisionstory.com/class. It will take you less than a morning to complete, and it's free for now.

Dr. Chou received his PhD in Electrical Engineering from the University of Illinois. Before striking out on his own, he worked at Tandem Computers, Oracle, and Reasoning, Inc. Tandem was his first job out of University. He began as a programmer, left as a director twelve years later, and earned the following praise from his boss Jimmy Treybig: Tim has "always been at the cutting edge of technology." From 1999 to 2005, Dr. Chou served as President of Oracle on Demand. The company focused on enterprise applications delivered as a cloud service.

Dr. Chou is a worldwide keynote speaker and teaches at Tsinghua University in Beijing, China, and at Stanford University, where he has been active since 1982. He started Stanford's first course on cloud computing.

Dr. Chou is on the Board of Directors of Blackbaud, a NASDAQ-listed company.

Following his NSTBC keynote address, a group of us had the privilege to interview Dr. Chou. The following discussion addresses the highlights of our interview.

Dr. Chou's Consulting Activities

Most of Dr. Chou's consulting is at a very high business level. He focuses on an enterprise's use of cloud strategy from a software distribution perspective. Dr. Chou noted that although corporations have been outsourcing all of their software needs, they are beginning to appreciate the fact that software sits at the hub of their enterprise operations. With that realization has come a reality check. Many of these companies have insufficient in-house staff devoted to their software applications; and those individuals now are more in demand than ever. Who, then, will fill these in-house positions? According to Dr. Chou, it will be a challenge. Nowadays, students from Stanford and other top schools are going to Google, Facebook, Amazon, and new startups - in other words, the "cool" places to work.

Companies also are having trouble attracting recruits if corporate campuses are not located properly. This is why General Electric recently moved its headquarters to Boston, Massachusetts, from Fairfield, Connecticut, which GE had called home for 42 years. New recruits do not want to move to Connecticut, nor do they want to move to Palo Alto for that matter. They want to live in active hubs such as San Francisco, Chicago, Brooklyn, or Boston where they don't need a car, are near to their friends, and can walk to restaurants for dinner.

Dr. Chou tells his Stanford students that if they lived in a community of 100 people, they would all be generalists. They would bake their own bread and fix their own cars. But in a world of five billion people, one must be a specialist. But of what? Dr. Chou recommends a ten-year career cycle – two years to learn and eight years to work. Then respecialize. His advice to older people is to go back and hit the books to find a new specialty. He counsels

young people not to sit still either. "Think of your career in ten-year cycles, 2 to learn, 8 to execute, and start all over again,"

His own career is an example of ongoing respecialization. As an electrical engineering student, he focused on VLSI design in graduate school. VLSI, Very Large Scale Integration, is the process of creating an integrated circuit by combining thousands of transistors into a single semiconductor chip. As he approached graduation, Dr. Chou took fourteen interviews, which resulted in thirteen job offers. Twelve were for engineering jobs – right up his alley. One was for a software job. Even then, he sensed that the future would hold only limited opportunities for computer architects. So he took the software job at Tandem Computers and worked on the NonStop operating system.

After Tandem, Dr. Chou went to Oracle. He initially was there for two years, helped to deliver Oracle 8, and then moved on to another company. Several years later, he returned to Oracle as President of Oracle on Demand, which provides software applications via the cloud as Software as a Service. To Dr. Chou, this was a case of respecializing. Now he was a cloud specialist.

The Hardware Manufacturers' Syndrome

Dr. Chou noted that hardware manufacturers like Dell, HPE, and Huawei are facing a predicament. Fewer customers are buying and managing their own servers. Instead, they are moving applications to the public cloud, where they can rent server space for as little 12¢ USD per hour. Some hardware manufacturers even have attempted to implement their own public clouds, but they have found that they cannot compete with large cloud providers like Amazon, Google, and Microsoft Azure.

Therefore, hardware manufacturers are targeting cloud providers for server sales. Unfortunately, the large cloud providers are building their own servers. They go directly to the parts manufacturers like Flextronics, which builds servers to each provider's specifications.

Support is easier for large cloud providers than it is for large organizations that buy hundreds or thousands of servers and distribute them throughout their enterprise offices. The large cloud providers do not deploy their thousands of servers to hundreds of buildings. Rather, they are housed in a small number of data centers, where they are easily manageable. Furthermore, if the cloud provider is a Software-as-a-Service company such as Facebook, which has hundreds of thousands of servers, the hardware can be optimized to support the company's specific applications.

Consequently, hardware manufacturers are targeting companies that are setting up their own private clouds or hybrid clouds (private clouds that interact with one or more public clouds). Availability is typically not an issue since the applications running in the clouds are not transaction-processing applications. They are context-free. If an application fails, it simply can be restarted.

Also, many private clouds run in a global active/active configuration. The processing load is balanced across the multiple systems around the world, thus smoothing out the peaks and valleys in traffic. This also provides a high degree of availability. There are no passive systems sitting in the dark that may or may not prove to be operational when needed to take over processing from a failed production server.

The Chinese Culture

Every year, Dr. Chou lectures at Tsinghua University in China. Tsinghua is one of the country's top schools for studying sciences. It is often referred to as "China's MIT," and every Chinese leader for the last thirty years has studied at Tsinghua. Only the best and the brightest are admitted. China administers extensive college entrance exams, and the students who get the highest grades get first choice as to the university they wish to attend. Tsinghua is everyone's first choice. It was rated first among 250 universities ranked by U.S. News (MIT ranked second).

Dr. Chou noted that one significant difference between Chinese students and students at schools like Stanford is that the Chinese students do not ask questions. It is a cultural phenomenon. The teacher stands up and teaches, and the students listen. The teacher then hands out an exam, and the students hope they do well on it. Chinese students need help to encourage them to be more curious and to participate in classroom discussions. There is gradual movement in this direction.

With respect to information technology, China may be well ahead of the United States on the consumer side. While the U.S. put computers to work in businesses first and focused next on social networks like Facebook, the Chinese focused initially on the consumer. Two examples are Alibaba and WeChat.

Alibaba is a Chinese e-commerce company that provides consumer-to-consumer, business-to-consumer, and business-to-business sales services via web portals. It also provides electronic payment services, a shopping search engine, and data-centric cloud services.

WeChat is a free cross-platform and instant messaging service application developed by Tencent, Inc. It is one of the world's largest standalone messaging applications and currently has almost 900 million active users, including Dr. Chou.[1] Facebook is not allowed in China.

According to Dr. Chou, two major systems are running – Amazon in the West and Alibaba in the East. Both are trying to figure out how to expand to the rest of the world.

What's Next?

In addition to his consulting with large, existing corporations, Dr. Chou invests both time and money in small start-ups. Having begun his career with a start-up called Tandem Computers, he is an adherent to the concept of supporting upcoming technologies. He is the Chairman, IoT, at Alchemist Accelerator. The company provides seed funding for startups whose revenue comes from enterprises rather than consumers. As part of this company's activities, Dr. Chou has become acquainted with another company, UniquID, whose focus is on security without passwords. The technology is based on block chains, a technology Dr. Chou admits he is still trying to understand.

As for his belief in the need for technologists to continually reinvent themselves, Dr. Chou is now trying to determine his own next area of pursuit. As he told us, "All the stars are lined up for IoT." He recently cofounded a new company, Lecida, with one of his former Stanford students. Lecida is focused on machine learning for the Industrial Internet of Things, bringing artificial intelligence to deep learning for the IoT.

What's the next focus for Dr. Chou? Stay tuned. We thank him for his presentations at NSTBC and for the time he took for our interview.

[2] See Alibaba, Tencent in Wikipedia.

Dr. Bill Highleyman is the Managing Editor of The Availability Digest (www.availabilitydigest.com), a monthly, online publication and a resource of information on high- and continuous availability topics. His years of experience in the design and implementation of mission-critical systems have made him a popular seminar speaker and a sought-after technical writer. Dr. Highleyman is a past chairman of ITUG, the former HP NonStop Users' Group, the holder of numerous U.S. patents, the author of Performance Analysis of Transaction Processing Systems, and the co-author of the three-volume series, Breaking the Availability Barrier.

Beyond NonStop Encryption:

Protecting your Entire Information Value Chain with HPE Security – Data Security

Nathan Turajski >> **Senior Product Manager** >> HPE Security - Data Security

In the world of NonStop, we may take for granted as truth that high availability matters. But so does scalability—and that includes the ability to scale protection of data at-rest beyond NonStop to include the broader enterprise storage ecosystem where data may be in motion and in use. Because if data isn't protected and trusted, does it matter if it's always available to your applications? Probably not.

The reality is, your sensitive, mission-critical data not only sits at-rest in NonStop, but may be accessed, used or stored throughout interrelated applications and systems where value is added or can be taken away if that data is compromised. How do you know if data was kept safe while outside of the NonStop environment? What if it was compromised and returns in an untrusted state? Effectively, the information's value needs to be protected both inside and outside of NonStop as it is used and transformed in order to maintain complete information lifecycle integrity.

Today, the server itself is no longer a reliable border control, as sensitive data moves throughout its lifecycle. Whether at-rest in archives, nearline storage, or somewhere in-between with applications, it's critical to take a holistic approach to how that data is governed. Minimizing risk exposure from data misuse or attack means closing gaps in protection and control. No system administrator wants to tell an auditor that their NonStop data was encrypted and presumably safe from a security breach, but something strange happened on its way to and from another system, application or archive. And with today's hybrid infrastructure, there's even more risk exposure if relying on cloud applications and storage that IT teams must address by considering information risks beyond purely NonStop.

So, How Do I Get There?

There is good news. For years NonStop users have trusted and relied upon HPE Enterprise Secure Key Manager (ESKM) to centrally control encryption by interfacing with NonStop Cluster I/O Modules (CLIMs) to enable volume level encryption. Based on a centralized approach to automate key management, HPE ESKM helps simplify security policy and auditing by protecting encrypted data at-rest on NonStop systems, while encryption keys are separated, centrally-located and kept safe within the HPE ESKM high-assurance security appliance.

But did you know that the HPE ESKM appliances you may already have in place can also control encryption outside of proprietary NonStop systems? Let's discuss this aspect a bit further...

HPE ESKM today can simply plug key management into existing NonStop systems, but it was designed for much more, and IT administrators may only be touching the tip of the iceberg, when only managing a single NonStop application. HPE ESKM supports the OASIS Key Management Interoperability Protocol (KMIP) standard, which means it can easily extend encryption key management across many more infrastructure systems that are KMIP-compatible. This consistent management framework supports security officers and compliance teams for enabling enterprise-wide, global, security policy.

Much like a standard way of plugging toasters and lamps into the same type of power socket, HPE ESKM allows storage, servers, hybrid cloud systems, networked devices and more to plug into it for key management by using KMIP as the common key management language. Not only is this a great message to tell the CISO that you can now extend data protection with the same HPE ESKM appliances already running operationally, but the business can quickly realize increased ROI and the consistency of a single pane of glass approach to managing data security risk that meets compliance mandates with an existing solution.

But Hold on a Sec—What if my IT Systems Can't Support Native Data Encryption?

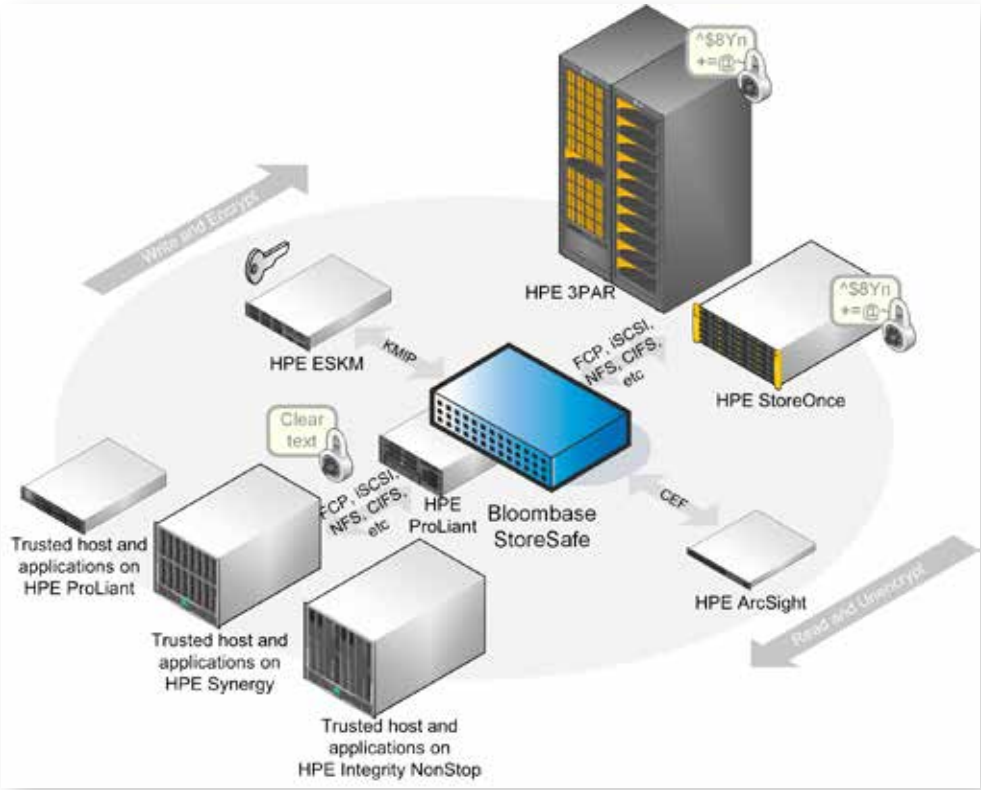
What good is a centralized key management system without the encryption? KMIP is the "glue" that can enable HPE ESKM to plug into virtually any storage or server system, but it assumes those systems are encryption-ready and can communicate using the same language. Fortunately, HPE maintains the largest IT vendor supported ecosystem of encryption-ready storage and server infrastructure products today.

The same key management that automates security controls for NonStop can now easily be extended for StoreEver tape libraries or 3PAR disk storage, or ProLiant servers, and even Connected MX cloud-based backup at the desktop level. The list goes on. HPE ESKM can help break down silos of encryption and simplify how security is deployed across extended storage and sever estates with a unified approach. However, those systems need to support encryption, such as self-encrypting drives, LTO tape, controller-based encryption, and so on. Or do they?

HPE recently introduced a new HPE ESKM encryption solution with Bloombase called StoreSafe that can transparently encrypt data moving over standard storage network protocols (Fibre Channel, iSCSI, NFS, CIFS, REST, etc.) and using a proxy-based approach, before data is written to storage. By encrypting on the fly using standard network protocols, StoreSafe extends data encryption to IT infrastructure beyond NonStop, even to legacy and proprietary systems that are not capable of native encryption. And by using KMIP, StoreSafe centrally manages its encryption keys using HPE ESKM, separate from the data and encryption runtime, for greater security assurance.

So what are the benefits? When no native encryption capability is present with the IT system, StoreSafe addresses this using an encryption proxy approach. In addition, StoreSafe can support proprietary systems where vendors don't allow open interoperability. The combination of HPE ESKM plus StoreSafe is similar to NonStop CLIM integration, however with these differences:

- StoreSafe uses standard storage protocols for encryption interoperability to protect data in-line between applications and target storage systems, while managing keys with HPE ESKM using KMIP



- Legacy storage systems that don't already have native encryption capabilities can proxy the encryption with StoreSafe prior to writing the data at-rest, and
- Proprietary systems that force users into adopting locked-in approaches can be circumvented with StoreSafe and HPE ESKM as a standards-based offering.

Designed for NonStop, built for extensibility

Offering standards-based solutions for NonStop means existing investments in key management using HPE ESKM can now be extended for wider protection of data across IT systems, without compromising a unified approach to security policy enforcement and auditing. NonStop users need to think outside the server box by addressing today's threats holistically, as information moves throughout the organization and must remain trusted at every step.

Using an existing HPE ESKM deployment to enable encryption across additional storage and servers, and using StoreSafe to address legacy and proprietary IT systems, helps ensure the same controls over NonStop data can now apply universally. IT administrators, already comfortable managing encryption for NonStop, will find that extending HPE ESKM to new encryption applications comes easily with the ability to segregate applications to use specific pools of keys, providing reliable separation as required.

And yet, this is not the end of the story. HPE ESKM key management, while easy to plug in to your storage and server systems, can also operate alongside the HPE SecureData encryption solution for key management at the application layer for a data-centric approach that provides multi-layered protection, no matter if data is in use, in flight or at-rest. The combination of infrastructure, application and data-centric solutions delivers comprehensive protection for the NonStop environment and beyond.

What's Next?

If you already have HPE ESKM key management deployed with NonStop using Clustered I/O volume-level encryption, you may have what you need to now test encryption across similar HPE and ESKM partner ecosystem storage and server applications. Just be sure to check if they support KMIP interoperability for key management. If you do not have HPE ESKM, your HPE rep can provide a demonstration of NonStop encryption and key management to offer an overview of how easy it is to enable data protection.

Don't be the next hacker statistic by allowing your trusted NonStop data to become another news headline when IT systems that use that data across the organization remain unprotected and at risk of a data breach. HPE ESKM and the ecosystem of HPE Security - Data Security solutions can help your data at-rest "rest assured" and protected with an extensible approach to protecting sensitive data that maximizes your security investment.

Nathan Turajski is a Senior Product Manager for HPE Security - Data Security, responsible for enterprise key management solutions that support HPE storage and server products, and techology partner encryption applications based on open interoperability standards.

Prior to joining HPE, Nathan's background includes over 15 years launching Silicon Valley data security start-ups and solutions within product management and marketing roles including Securant Technologies (acquired by RSA Security), Postini (acquired by Google), and NextLabs. More recently, he has lead security product lines at Trend Micro and Thales e-Security.

FIVE GREAT TAKE AWAYS

NONSTOP TECHNICAL BOOTCAMP 2016

Steve Tcherchian >> **CISO** >> XYPRO Technology

NonStop Technical Bootcamp 2016 - Five Great Take Aways

Since I started with XYPRO over 10 years ago, I've been to a few NonStop events. This year's NonStop Technical Bootcamp was big. Nearly 500 attendees crowded the hallways, conference rooms and lobby bar at the Fairmont in San Jose. The atmosphere felt electric and immersive. There was a lot going on over the 5 days of festivities, so I'll boil it down to the 5 key takeaways I found the most exciting.

XYPRO Announces OEM Partnership with HPE Security – Data Security

One of the first highlights of the event was XYPRO's major announcement of a strategic OEM partnership with HPE Security – Data Security, formerly known as Voltage Security. XYPRO unveiled the newly evolved partnership during the Sunday beer bust. This was followed up throughout the week with multiple sessions describing the importance of the relationship and the extended benefits to NonStop customers and others wishing to protect data at the source. The OEM relationship now engineers XYPRO Data Protection (XDP) with HPE SecureData, making HPE SecureData a solution called "Transparent Data Protection" the pre-eminent solution for protecting your sensitive data on your HPE NonStop servers, as well as seamlessly across the enterprise.

Actionable Insights through Intelligent Data

A year ago, at NonStop Technical Bootcamp 2015, XYPRO revealed XYGATE SecurityOne® (XS1), our vision and new product line for providing real-time, intelligent and actionable security information to the industry. This year we were able to update progress and new features such as data trending and CLIM Risk Monitoring. We also discussed how XS1 has been deployed at customers to meet stringent requirements and how they are already extracting value.

Using patent pending technology, XS1 gathers data from multiple, disparate HPE NonStop server sources; including application and system data, subsystems, user behavior, file operations, network data, command input and other sources and uses specialized security intelligence algorithms to correlate, contextualize and analyze events to paint a detailed security incident picture in real time. This enables users to detect security events before they culminate into an incident or breach.

With its newly introduced trending capabilities, XS1 leverages what it has learned about the past to help crystalize what is happening in the present and warn you may happen in the future. It's no secret - everyone wants a better understanding of their data to make quicker and more accurate decisions. Being able to understand what happened in the past helps you better understand how it will affect the future.

To go from concept to deployment in less than a year was no small feat. This was mostly due to a lot of hard work and late hours from our engineering team, a lot of market research and close relationships and feedback from our customers using the solution. This ensures XS1 fits the needs of today's mission critical environments.

Customer Presentations

HPE NonStop Technical Boot Camp was bookended by two important – not to miss - customer sessions.

Paul Freeman, Information Security Manager at TSYS presented how TSYS began a major effort to migrate away from a legacy and no longer supported security system that was deeply integrated into their HPE NonStop environment. TSYS had to deal with a slew of requirements including limiting internal disruption, maintaining current capabilities, the ability to add new functionality to their applications, meet some very demanding internal and external compliance regulations and of course, budget. This was a multi-year process that included evaluating a variety of potential solutions from both internal and external sources. TSYS ultimately chose the XYGATE Suite of products from XYPRO to protect their HPE NonStop environment. Paul described in detail how the TSYS requirements were met by the XYGATE suite and how XYPRO's technical team was able to deliver and implement the new solutions on a tight deadline.

One Wednesday, Chris Draper – AVP at Wells Fargo Bank, presented Wells Fargo's experience as an early adopter of XYPRO's newest solution, XYGATE SecurityOne® (XS1). Chris laid out the bank's requirements, which included proactive monitoring, intelligent and actionable data and behavior analysis of their applications and environment. Wells Fargo, as is the case with most organizations today, wanted insight on the data they already have to allow them to make quicker decisions earlier in the process. At the same time, they need context applied to the data to determine which events are actionable and which are benign. This knowledge allows them to focus their efforts and resources on items that warrant action. XS1 has allowed them to meet those requirements. Chris described specific use cases in which they've been able to leverage the solution internally.

In Chris's words, "XYGATE SecurityOne fulfills the vision of where we want to be with security. It's the right solution at the right time". Chris is a fantastic presenter and needless to say, this created a lot of buzz at our booth and in the hallways. Chris's presentation is available on www.nonstopbootcamp.com.

The Under 40 SIG

I started working at XYPRO when I was 23. For the next several years, I remained the youngest person at the company. Over the last few years, I've seen the culture at our company get younger and hungrier. New ideas, new methods, and new ways of thinking. When I heard Navid Khodayari of Idelji was organizing an Under 40 SIG, I was all over it. I was interested to see how the others were addressing the challenge of introducing NonStop to a new generation. To keep the industry viable long term. Needless to say, we weren't the only ones with this issue on our radar. The SIG had about 50 participants, from both vendors and customers. The discussion circled around finding a new crop of talent, onboarding and training younger folks and capturing that large repository of NonStop knowledge that exists with the seasoned veterans of the NonStop industry. There is a lot of work to be done and we had some great ideas to put into place over the next few months. It was refreshing to see the industry as a whole has taken notice and given us youngsters the opportunity to showcase our talents to catapult NonStop into the next generation.

vNonStop

In early 2016 at Mobile World Congress in Barcelona, HPE demonstrated the virtual NonStop (vNonStop) concept. vNonStop is HPE's advance in virtualizing the NonStop operating system. vNonStop enables customers to take full advantage of all the fault tolerant capabilities of a NonStop server, without the upfront investment in hardware. This allows users to create a NonStop guest VM, similar to how you would stand up a Windows or Linux VM using KVM (think of KVM as a VMWare or Hyper-V alternative) as the hypervisor. This technology and its vision was front and center at this year's NonStop Technical Bootcamp. HPE even had a fully functional demo unit on the show floor. Andy Bergholz, Director of HPE NonStop Engineering, laid out a detailed vision and the advantages of the vNonStop and the importance of it to HPE's future. The advantages of this technology are profound. Virtualizing the NonStop core allows for faster deployment of systems and applications, massive scalability, flexibility in sizing up and sizing down your infrastructure as needed and much more. I've seen Andy present on this topic multiple times now and he does as fantastic job of articulating the importance and relevance of this technology. The advancements in 2017 are going to be fun.

It really was a whirlwind week. We got to meet some terrific people, attended excellent sessions and had some amazing fun. But now that we're back and have had a chance to unwind and decompress, the real excitement starts. Everything picked up from the week in San Jose gets put in motion for 2017 and the list is big. XYPRO is well into our vNonStop validation efforts, with our newest OEM announcement, the HPE Security - Data Security partnership is stronger than it has ever been, XS1 is taking off like a rocket ship and new product innovation is happening at a feverish pace in our R&D department. 2017 looks brighter than ever for XYPRO and for the NonStop community as a whole.

Finally, a couple of short notes of appreciation from the XYPRO team to Connect for organizing another extremely valuable event. Thank you to all the customers and partners involved well as to the HPE staff who dedicated so much of their time to pull the schedule and content together. It was a blast.

We're all looking forward to seeing everyone again next year!

Steve Tcherchian, CISSP, PCI-ISA, PCI-P is the CISO and SecurityOne Product Manager for XYPRO Technology. Steve is on the ISSA CISO Advisory Board and a member of the ANSI X9 Security Standards Committee. With almost 20 years in the cybersecurity field, Steve is responsible for XYPRO's new security intelligence product line as well as overseeing XYPRO's risk, compliance, infrastructure and product security to ensure the best security experience to customers in the Mission-Critical computing marketplace.

High-Speed Data Transfer with NSADI: What it Can Mean to Your Organization

Brad Poole >> Solution Architect >> comForte

Thomas Gloerfeld >> VP Marketing >> comForte

Challenges: Streamlining Communications in Hybrid Environments

While a lot has changed in recent years, one constant has been the insatiable demand for more data—and the increasing volumes of it that need to be stored, accessed, and transmitted. As data use and volumes grow, so too does the need to accelerate and streamline communications and connectivity.

Addressing demands for higher bandwidth and lower latency has proven challenging, however. These challenges are particularly pronounced in hybrid environments, which have traditionally presented significant performance constraints and complexity. This is very much the case for organizations running Hewlett Packard Enterprise (HPE) NonStop platforms alongside open systems like Linux.

Too often, efforts like application recoding and recompiling have been required to facilitate the integration necessary between these two environments. Underlying networks typically relied on approaches like traditional TCP/IP transmissions, which introduced fundamental performance limitations. Further, most NonStop transmissions needed to go through the NonStop CLIM (Cluster I/O Module), which also added application latency.

Opportunity: Leveraging NSADI to Gain Breakthrough Performance

The NonStop Application Direct Interface (NSADI) has been introduced to help alleviate some of the challenges of streamlining communications in hybrid environments. NSADI delivers low-latency, direct data connectivity between NonStop-based applications and Linux servers.

The NSADI infrastructure offers support for the use of InfiniBand and remote direct memory access (RDMA) over Converged Ethernet (RoCE). HPE has employed InfiniBand within the NonStop X platform, and will increasingly be moving to leverage RoCE in the future. Following is more information on each of these technologies:

- **InfiniBand**. InfiniBand is a networking standard used in high-performance computing, offering high throughput and low latency. HPE chose InfiniBand to support internal communications for the latest generation of Integrity NonStop X platforms. In doing so, HPE staff came to realize that there was an opportunity to enable end users to harness InfiniBand as well, and so exposed this functionality to customers. Today, customers can have their applications capitalize on the advantages of InfiniBand.
- **RoCE**. This network protocol enables RDMA over Ethernet networks. There are two versions of RoCE. RoCE version 1 allows communication between any two hosts in the same Ethernet broadcast domain; RoCE version 2 is an Internet layer protocol that can be routed. The RoCE standard can take advantage of converged networks, but it can also run on traditional Ethernet.

NSADI: Key Features

By leveraging the NSADI standard, organizations can realize a number of advantages:

- **Direct memory access.** InfiniBand and NSADI enable a remote application to gain direct access to memory on remote systems, without any involvement of the underlying operating systems. By enabling memory-to-memory transmissions, NSADI facilitates much faster transmission performance. Further, it makes much more efficient use of system resources because processing at the kernel level is bypassed.
- **Reduced latency.** With NSADI, organizations can establish communications between NonStop applications and Linux platforms, without incurring the latency associated with routing transmissions through the CLIM.
- **Fault tolerance.** NSADI features an architecture that enables failover, so that if one system within a fabric fails, processing can be moved to another. (While the solution doesn't feature automated failover, it does provide the infrastructure required.)
- **Interoperability.** The NSADI standard enables organizations to gain enhanced interoperability with Linux platforms. The NSADI standard enables communications via InfiniBand, simply through selecting "User Mode InfiniBand." The same technologies and protocols employed in NonStop are also within RedHat Enterprise Linux, streamlining the effort required to integrate existing applications. Ultimately, these hybrid communications can be enabled without any code changes to applications in NonStop or Linux.
- **Flexibility.** NSADI doesn't require an either/or approach. Companies can continue to use traditional standards like TCP/IP, while employing NSADI where it makes most sense.

Benefits of NSADI and High-Speed Protocols for File Transfers

By leveraging NSADI standards, organizations will be able to realize a number of benefits:

- **Enhanced security.** By adopting NSADI, organizations can enjoy improved security, fostering an enhanced ability to address security policies and regulatory mandates. NSADI communications are defined from end to end, leaving fewer intermediary steps that may be exposed to attacks. Also, when employing InfiniBand, communications don't run over a general IP circuit, so they're less exposed.
- **Improved SLA compliance.** NSADI enables IT organizations to see significant gains in throughput and response times, so they can reduce the risk of potential SLA penalties.
- **Improved performance.** By leveraging InfiniBand, organizations can see much faster transmission of

large files, particularly those 1GB or larger. These communications can go much faster than traditional TCP/IP-based transmissions, which are inherently constrained by Ethernet limits.

- **Enhanced scale and cost efficiency.** By leveraging RDMA and high-speed protocols like InfiniBand, organizations can realize much higher bandwidth and lower latency. Because data spends less time in transit, it means existing networking infrastructures can accommodate more data and transmissions.

NSADI: Deployment Limitations

When working with NSADI and InfiniBand, organizations can opt to do integration with the following APIs:

- **InfiniBand verbs.** These are low-level, relatively complex transport services.
- **RSockets.** RSockets are higher-level protocol interfaces that are geared toward socket-based NonStop applications.

The challenge is that these APIs can only be employed in NonStop Open System Services (OSS) environments, while many NonStop applications today are running in Guardian. These factors leave many organizations significantly constrained in their ability to take advantage of NSADI.

The Solution: comForte and DataExpress Perform Proof of Concept

The team at comForte recognized the challenges confronting customers running applications in Guardian, and sought to deliver a solution.

comForte has a long history of working with legacy environments and modernizing them by performing intercepts. For example, the comForte Client Server Link (CSL) solution provides middleware that allows clients running any platform to access Pathway applications running on NonStop servers.

comForte has been working with NSADI for some time. In early 2015, comForte was invited to be part of the HPE Yuma Project (the original project name of NSADI). Initially, comForte focused on using NSADI to "InfiniBand-enable" its CSL product. CSL can now be used to easily build distributed applications between a Linux system and the NonStop platform. This enables customers to harness the reduced latency and improved throughput of InfiniBand.

More recently, the team at comForte set out to bring the benefits of NSADI to Guardian applications. The goal was to enable existing Guardian applications to harness the high performance of NSADI-based communications, without requiring customers to change or recompile code. To pursue this objective, comForte partnered with DataExpress and HPE to develop a proof of concept.

The team at DataExpress has been working with NonStop since 1985, and has continued to modernize its technologies and approaches. DataExpress delivers solutions for doing file transfers, offering a centralized communications hub that functions as a gateway to internal systems. The company's portfolio features DXNS, which runs on NonStop platforms, and DXOP, which runs in open environments, including Linux, Unix, and Windows systems.

How it Works

comForte introduced two solutions to support this effort:

- comForte GSOCKDLL intercept library
- comForte RSD component

To use NSADI and InfiniBand, DataExpress ran their managed file transfer solution on NonStop via comForte interfaces. At a high level, here's how the approach is implemented:

- The GSOCKDLL library intercepts an application's TCP/IP calls and routes them via IPC to RSD, which is an OSS PUT64 daemon process.
- RSD accepts requests from GSOCKDLL on $RECEIVE and routes them to NSADI rsockets calls.
- RSD also acts to resolve differences between Guardian TCP/IP socketlib calls and NSADI rsockets.

Solution Advantages

This solution offers these significant advantages:

- **Streamlined implementation.** This solution only requires configuration changes, namely using XLD linker to bind the intercept library with the current application object file. No application source changes or recompilations are required.
- **Performance.** This solution capitalizes on the benefits of InfiniBand, providing especially significant advantages in environments running parallel transfers of large files.

Sample Use Case: Backup

The solution offers significant advantages in a number of scenarios. Backup and archival represent one optimal use case. In most organizations, backups typically entail moving multiple files that are large, often 2GB or more. By leveraging InfiniBand to move backup files between NonStop and Linux, organizations will be able to achieve a number of benefits, including freed up TCP/IP bandwidth, reduced host workloads, and enhanced performance.

To illustrate, in the proof-of-concept project's benchmarks, parallel transfers of four 1GB files were executed on TCP/IP and InfiniBand with the DataExpress managed transfer solution. In these tests, the file transfers completed in 10 seconds over InfiniBand—three times faster than the TCP/IP-based environment.

Conclusion

Leveraging NSADI, organizations will be able to establish high-performance, low-latency transmissions in hybrid environments. However, those organizations running their applications in Guardian environments currently face significant obstacles in capitalizing on the benefits of NSADI. comForte and its partners have established a solution that enables organizations to run their Guardian applications over InfiniBand. With the solution, organizations can streamline communications in hybrid environments and enjoy significant improvements in throughput and resource efficiency—and do so without having to make any code changes.

To learn more, call us or visit our website at www.comforte.com.

Thomas Gloerfeld, VP Marketing at comForte, has been associated with the NonStop community for over 20 years. Before joining comForte, he held various management positions at ACI Worldwide both in Germany and the UK. Thomas Gloerfeld can be contacted at t.gloerfeld@comforte.com.

Brad Poole has been a Solutions Architect with comForte since 2007, and has over 25 years' experience with Tandem systems. Prior to joining comForte, Brad was with Insession/ACI Worldwide for 12 years (Director focusing on Web services and security) and with Tandem for eight years (Software Development Manager in the Distributed Systems Management group). Brad can be contacted at b.poole@comforte.com

Virtual World Beckons – vNonStop is the only ticket we need!

Richard Buckle >> Pyalla Technologies, LLC

The virtual world has now thrown its doors wide open and beckons everyone to come on in – and this invitation is now being extended to include NonStop. The relationship between software and hardware is being altered in ways that will allow even NonStop to derive the full performance capabilities hardware offers today. Multi-sockets and multi-cores are being isolated in a manner where applications will care little for what is physical and what is virtual – the overriding concern of these applications is that there will be enough resources on hand to meet the demands being made by them.

In many ways the opportunity to join the virtual world has been long overdue. Virtual machines have been available for decades, almost from the time of the arrival of the first mainframe. And yet, for the NonStop community for all of this time it was the understanding that the placement of anything between the NonStop kernel and the metal supporting the kernel was an anathema to any promise of fault tolerance. How would it be possible to maintain fault tolerance atop virtual systems in the same fashion as was maintained with physical systems if the alarms and alerts were being filtered by intermediaries? And yet, virtual NonStop (vNonStop) is targeted to begin shipping this year with no lessening in the level of fault tolerance it supports.

However, when it comes to the key message of HPE concerning the transformation to hybrid infrastructure, the move to a virtual world is becoming inescapable and the question now for the NonStop doesn't have so much to do with any perceived marginalization of the fault tolerance message as it has to do with how best to capitalize on all that is now on offer. And embracing the Intel x86 architecture was a major first step towards passing through those doors to the virtual world.

The options for running virtual machines directly on top of x86 servers are many and the decision taken by NonStop development was to begin with OpenStack whereby KVM became the hypervisor of record for the initial inroads made into the virtual world. KVM? This is Kernel-based Virtual Machine (KVM), and in reality, is a virtualization infrastructure for the Linux kernel that turns it into a hypervisor. Simple enough to remember, simple enough to understand and a good example of hardware virtualization!

Just to be clear and to quote Wiki, "In hardware virtualization, the host machine is the actual machine on which the virtualization takes place, and the guest machine is the virtual machine. The words host and guest are used to distinguish the software that runs on the physical machine from the software that runs on the virtual machine. The software or firmware that creates a virtual machine on the host hardware is called a hypervisor or Virtual Machine Manager."

It may be a minor point but this new role for NonStop being a guest machine is crucial in terms of understanding that fault tolerance can, in principle, be maintained as for all sakes and purposes guest machines can be clustered and networked to provide the same level of massively parallel processing as can be provided today with physical systems running without any hardware virtualization. A NonStop virtual system still conforms to the basics of there being 2 to 16 virtual machines in exactly the same way as traditional NonStop real systems require discrete CPUs. In other words, vNonStop will continue to play by the basic rules we all have come to associate with NonStop systems.

Perhaps the best illustration of how this can be created was demonstrated by HPE NonStop development at the most recent NonStop Technical Boot Camp. Utilizing a pair of off-the-shelf ProLiant DL 380 Gen 9 physical servers, each with a pair of Xeon processors, each with 14 cores (way beyond the limit of 6 cores as is supported today by NonStop), where each Xeon processor was running the KVM hypervisor supporting four guest machines – four discrete virtual machines if you prefer. One guest machine with 2 cores in support of vNonStop; another guest with 2 cores in support of Linux; a further 2 cores in support of a storage vCLIM (yet another Linux guest); and 4 cores in support of a communications vCLIM - and yes, there are still cores left unused.

The elegance of this approach in support of NonStop running as a guest of KVM is that customers can take full advantage of the ever increasing number of cores per processor. Even as I anticipate little need to go much beyond 8 cores per NonStop CPU, should more powerful Xeon chips come to market with 24, 32, 64 or whatever number of cores, then these additional cores are available to run other OSes or even, depending on fault zone considerations, parts of other vNonStop systems. This is just the latest example of the value that comes from NonStop embracing standards and open computing. However, the question still remains. What is driving IT to pass through the gates of the virtual worlds that beckon?

When you consider what the message of transformation to a hybrid infrastructure really covers it's anchored on the fundamental belief within HPE that enterprises everywhere

will gradually take on the appearance of cavernous, lights-out, server farms. The racks of servers will be x86 servers and the relationship between individual x86 servers, and what's running on them, will be a moot point. However, this is the "end game" and to get there, recognition is being made of what exists today – traditional servers oftentimes associated with separate workloads in support of the enterprises' business.

It's a model for IT that has been in place for more than five decades and even though we have seen several swings of the pendulum, as IT has toyed with distributed computing, client / server computing and more recently, services-oriented architectures, each swing of the pendulum has done little to impact the way we associate applications with systems. Indeed, throw into this mix the penchant we all once had to pursue best-of-breed solutions that eventually led to the establishment of silos (or islands) of technology and the news that there is an opportunity to enjoy a new found flexibility of running applications on the basis of whatever resource is on hand is as refreshing as it is illuminating.

The insertion of hybrid into this transformation to ubiquitous servers that are disassociated from applications happens to have come about as we recognize that traditional servers will play a role for many years to come. While we consider the latest family of NonStop X systems as being part of Converged Systems and as such, likely to share rack space with other Converged Systems, most notably Linux and Windows, the arrival of vNonStop means that there will be a period where both are present in the data center

The work done in support of NSADI throws light on efforts already under way to better support communications between Converged Systems and server farms and in so doing, once you look deeper into the product roadmap for NSADI and see that shortly, RDMA over Converged Ethernet will be a reality, there will be a smooth transition path for all those enterprises looking to rely solely on x86 server farms. Combinations of NonStop Converged Systems with Linux and Windows servers are simply a step along an inevitable path to a bigger role for NonStop in something else entirely.

However, any discussion about the imminent arrival of server farms without reference to the growing popularity of cloud computing perhaps misses one fundamental reason why server farms are being erected. Cloud computing – private and public – differs considerably from any previous model IT has toyed with over the years. The key element is the elasticity of provisioning that comes with cloud computing – resources can be allocated and then torn down via software. Sudden demands on capacity that we might associate with a "Black Friday" trading day for retailers will be readily met following just a couple of simple keystrokes. Boundaries between resources associated with different applications blur as unused resources formerly associated with CRM or HR are reassigned to Order Entry.

It wasn't all that long ago when talking at a regional user group event that Randy Meyer, Vice President & General Manager, Mission Critical Systems at Hewlett Packard Enterprise, made the observation about a time coming where he could walk into any x86 server farm and with the wave of his hands, explain that NonStop was running somewhere within the farm. Indistinguishable by the hardware it was running on and only visible to operations staff as a series

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We're very pleased to announce the long-anticipated launch of **Hilton Elevated Discussions**, a growing collection of short videos of customers and Hilton Worldwide subject experts sharing insights on specific topics that are relevant to the Connect+ audience. Currently we have 25 clips that include the ROI of meetings and events, procuring grants and sponsorships, negotiating Wi-Fi, effective contracting, planning hybrid live/virtual meetings, and much more.
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of guest systems. The work NonStop development has done to first migrate NonStop to where it runs on commodity hardware yet still packaged uniquely as a NonStop systems to where it will run on commercial, off-the-shelf, hardware with no unique packaging involved is guaranteeing NonStop remains relevant and indeed, beneficial to all mission critical applications, it is what ensures NonStop will find a home in cloud computing.

A single vNonStop may leverage the processors distributed across one cloud but then it can be networked to processors in a different vNonStop system in another cloud in a manner not too different from how many NonStop users leverage Expand networks today. Conventional wisdom suggests that, despite the ease with which server farms can be populated, in all likelihood enterprises will break these down into a series of clouds and for a single, multi-node, NonStop system to span two or more clouds simply doesn't seem an unreasonable proposition in situations where the additional latency is acceptable. Perhaps not in the initial releases of vNonStop, but then again, Expand networks gained a new lease on life after Expand/IP began shipping.

Whether it's in its most primitive form with a vNonStop of just two vNonStop systems deployed across two x86 servers or a massive configuration spanning tens of clouds, what NonStop's entry into the virtual world promises its users is a level of availability unmatched by any other means at a time where the biggest of the server farms is comprised of the lowest-cost option of off-the-shelf hardware! From commodity hardware to off-the-shelf hardware and from physical systems to virtual systems, the story of NonStop is not just as refreshing as it is illuminating not to mention being a story of unimaginable resilience. When you consider the numerous, really good computing architectures, that are no longer with us, few would have imagined Tandem Computers to be reinvigorated in such a manner.

There are many NonStop users wondering about the future of NonStop within their enterprises. There are many NonStop users wondering too about what they would run on vNonStop, indeed, whether there really is a need for vNonStop. Rest assured the fundamental reason why NonStop remains the force it does today in finance, retail, communications, manufacturing, telco and distribution isn't changing. Mission critical applications running on real systems today will migrate to virtual systems and won't the presence of NonStop as guests of virtual systems make any such transition happen a lot more smoothly? CIOs everywhere are never comfortable with strategies based on "rip-and-replace" and now their most important mission critical applications can painlessly participate in the transformation that these CIOs are contemplating doing today.

Even as Randy Meyer waved his hands around to signify the retreat of NonStop from any prescribed hardware configuration I am not sure he fully anticipated just how rapidly NonStop would embrace the virtual world. Nor am I sure that the bulk of the NonStop community believed it would happen as fast as it has – even as the acceptance of NonStop X was being absorbed, along came something completely different that simply took our breath away. However, the doors to the virtual world have been thrown open and are beckoning us all to pass through and in vNonStop we not only have the ticket that will allow us safe passage but a technology that will allow NonStop to remain the premier, out-of-the-box, choice for all those applications that simply cannot fail. Or, to borrow a line from a popular musical, as NonStop makes an entry, there will be welcoming voices extolling NonStop to "be our guest, be our guest!"

Richard Buckle is the founder and CEO of Pyalla Technologies, LLC. He has enjoyed a long association with the IT industry as a user, vendor, and more recently, as an industry commentator. Richard has over 25 years of research experience with HP's NonStop platform, including eight years working at Tandem Computers, followed by just as many years at InSession Inc. and ACI Worldwide.

Well known to the user communities of HP and IBM, Richard served as a Director of ITUG (2000- 2006), as its Chairman (2004-2005), and as the Director of Marketing of the IBM user group, SHARE, (2007-2008). Richard provides industry commentary and opinions through his community blog and you can follow him at www.itug-connection. blogspot.com, as well as through his industry association and vendor blogs, web publications and eNewsletters. The quotes come from some of Richard's clients including HP, Integrated Research, comForte, DataExpress, Striim, Inc., InfraSoft, and OmniPayments, Inc.

Improving Availability via Staggered Systems

Part 2: Mitigating Redundant Failures via System Staggering

Dr. Bruce D. Holenstein >> **President & CEO** >> Gravic, Inc.
Dr. Bill Highleyman >> **Managing Editor** >> Availability Digest
Paul J. Holenstein >> **Executive Vice President** >> Gravic, Inc.

In Part 1 of this series, we introduced the concept of Mean Time To Failure, MTTF, to replace the commonly used measure, MTBF. MTBF is the Mean Time Between Failures and is constant. It is memoryless. If MTBF is 1,000 hours and 500 hours have passed, MTBF is still 1,000 hours. The probability that the system will fail in the next 1,000 hours is still the same.

Mean Time To Failure (MTTF)

However, this is not the real world. As time passes, the probability of failure grows nearer. This is what MTTF measures. As time goes on, the mean time to failure gets shorter in most real-life scenarios. This is illustrated in Figure 1 and Figure 2. In these figures, a typical failure probability distribution for a system, $p_i(t)$, is shown. Its value at time t_1 is p_1. The probability that the system will fail in some small interval, Δt, around time t_1 is $p_1\Delta t$. The MTTF is the average of these probabilities starting from some particular time. As shown in Figure 1 starting at time zero, the MTTF is

$$MTTF = \sum_{i=0}^{\infty} t_i p_i \Delta t \qquad (1)$$

However, if we wait a time T as shown in Figure 2, the MTTF is now

$$MTTF = \frac{\sum_{i=T}^{\infty} (t_i - T) p_i \Delta t}{\sum_{i=T}^{\infty} p_i \Delta t} = \frac{\sum_{i=T}^{\infty} t_i p_i \Delta t}{\sum_{i=T}^{\infty} p_i \Delta t} - T \qquad (2)$$

Comparing Equations (1) and (2), it is clear that MTTF has become smaller as time goes on.

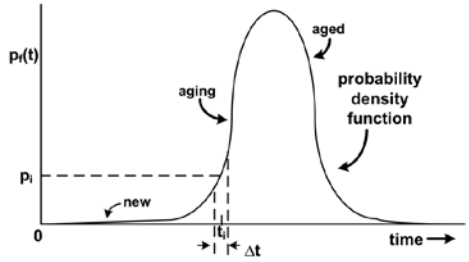

Figure 1: MTTF at Time 0

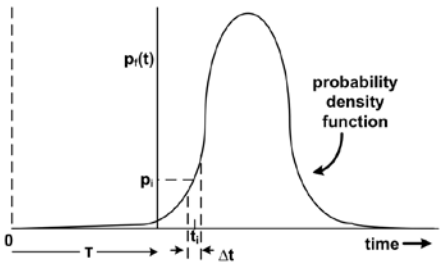

Figure 2: MTTF at Time T

System Staggering

We also introduced in Part 1 the concept of staggering system starting times in a redundant system to improve reliability. If the systems are started at the same time, their peak failure probabilities are aligned and the probability that they will fail at the same time is high. However, if they are started at different times (staggered starting times), the peak failure probability of one system likely will be aligned with a much smaller probability of failure of the other system. Therefore, the probability that both systems will fail at the same time is significantly less.

In this Part 2, we analyze the improvement in availability that can be obtained via staggered starts.

MTTF for Staggered Starts

The staggered redundant system we will be analyzing comprises System 1 and System 2. Let s be the amount of stagger time. That is, System 2 has been started after System 1 by a time of s.

The failure probability distribution for System 1 is $p_{f1}(t)$. The failure probability distribution for System 2 is $p_{f2}(t\text{-}s)$ since it was started at a time s after System 1.

Should System 1 fail, it will take an average time of MTR (mean time to repair) to return it to operation. The probability that system 1 will still be failed at time *t* is

probability that System 1 will still be failed at time $t = \int_{t-MTR}^{t} p_{f1}(t')dt'$ (3)

The probability that System 2 will fail by time T while System 1 is still down is

probablility that System 1 and System 2 will fail by time $$T = \int_0^T \left[p_{f2}(t-s) \int_{t-MTR}^{t} p_{f1}(t')dt' \right] dt \quad [4]$$

The MTTF of the staggered system is

$$MTTF(s) = \int_0^{\infty} t \left[p_{f2}(t-s) \int_{t-MTR}^{t} p_{f1}(t')dt' \right] dt \quad [5]$$

For small MTR, Equation (5) can be simplified since $p_{f1}(t)$ will be almost constant over the time MTR. Thus,

Probability of a dual-system failure as MTR ➔ 0 =

$$\lim_{MTR \to 0} \int_0^T \left[p_2(t-s) \int_{t-MTR}^{t} p_1(t')dt' \right] dt = MTR \int_0^T p_2(t-s)p_1(t)dt \quad [6]$$

MTTF is a function of the stagger time, *s*. To determine the optimum value for s (that is, the value that will yield the maximum MTTF value), differentiate MTTF(s) with respect to s and set the result to zero:

$$\frac{d}{ds} MTTF(s) = 0 \quad [7]$$

Solving for s will enable one to pick the optimal value of the stagger time to reduce the mean time to failure.

Software Failures

Software has different failure modes than hardware. Software bugs lurk in areas that seldom get executed and typically go undetected until the erroneous code is executed. When this happens, the system typically fails.

As an example, consider a software counter overflow. The program includes a transaction counter that is incremented on every transaction. However, if the transaction counter should reach its limit, the next transaction will cause a counter overflow that, in our example, will cause the system to crash.

The probability of failure of the system, $p_f(t)$, is shown in Figure 3. $p_f(t)$ is normally zero (the system is operational). However, when the counter overflows, $p_f(t)$ jumps to one (the system is down). The system will remain down until it is rebooted, at which time the system is again operational and $p_f(t)$ returns to zero. The availability of the system is shown in Figure 4.

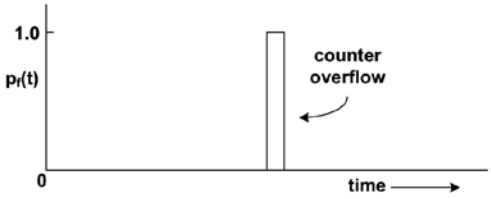

Figure 3: Software Counter Overflow Failure

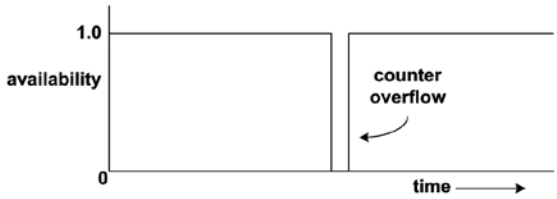

Figure 4: Availability Due to a Software Counter Overflow Failure

In a redundant system, if the two systems are started simultaneously or are not sufficiently staggered, the software fault will occur at the same time in both systems, as shown in Figure 5 and Figure 6. When both systems fail, the capacity of the redundant systems falls to zero.

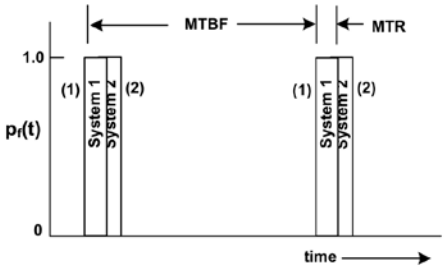

Figure 5: Insufficiently Staggered Software Systems

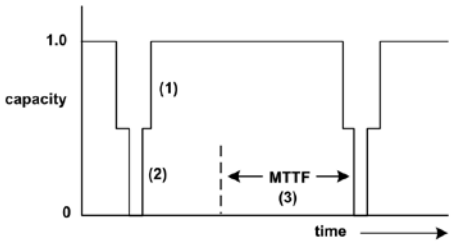

Figure 6: Availability of Insufficiently Staggered Software Systems

However, if the two systems are sufficiently staggered, as shown in Figure 7 and Figure 8, one system will always be operational; and the redundant system capacity will not fall below 0.5.

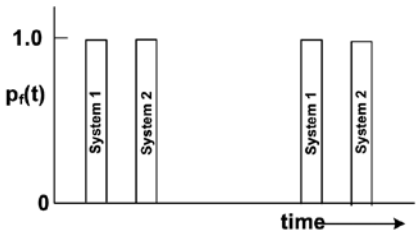

Figure 7: Staggered Software Systems

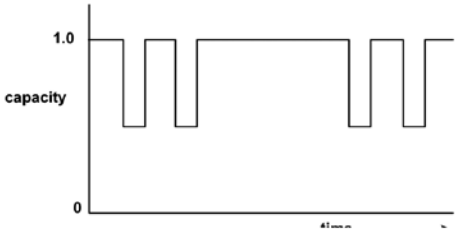

Figure 8: Availability of Staggered Software Systems

Correlation

A primary goal in choosing the proper stagger time s is to minimize the correlation between the failure probability distributions of System 1 and System 2. If the two distributions are highly correlated, then the peak of one distribution likely aligns with the peak of the other distribution. The probability of a dual system failure is higher than if the peaks of each distribution are not aligned.

The correlation between the two failure probability distributions can be measured by the correlation coefficient. Let there be two data sets, $\{x_1 \ldots x_n\}$ and $\{y_1 \ldots y_n\}$. The degree to which these two data sets are correlated is given by the correlation coefficient, r:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}} \quad (8)$$

where $\bar{x}$ and $\bar{y}$ are the means of the data sets.

The meaning of the correlation coefficient can be seen more clearly graphically, as shown in Figure 9 and Figure 10. Figure 9 shows two highly correlated distribution functions, x(t) and y(t). Note that at each point in time, $(x_i - \bar{x})$ and $(y_i - \bar{y})$ are either both positive or negative. Therefore, the correlation coefficient, *r*, is positive since the summation in the numerator, $(x_i - \bar{x})(y_i - \bar{y})$, is always positive.

Similarly, Figure 10 shows two distribution functions that are poorly correlated. At many points in time when $(x_i - \bar{x})$ is positive, $(y_i - \bar{y})$ is negative and vice versa. Therefore, the numerator in r can approach zero.

Note that for a pair of perfectly correlated functions, $(x_i - \bar{x}) = k(y_i - \bar{y})$, and r is equal to 1. For a pair of functions that are exactly anti-correlated, $(x_i - \bar{x}) = -k(y_i - \bar{y})$, and r is equal to -1. Therefore, the correlation coefficient, r, ranges from +1 for perfectly correlated functions to -1 for perfectly anti-correlated functions. If r = 0, there is no correlation between the functions.

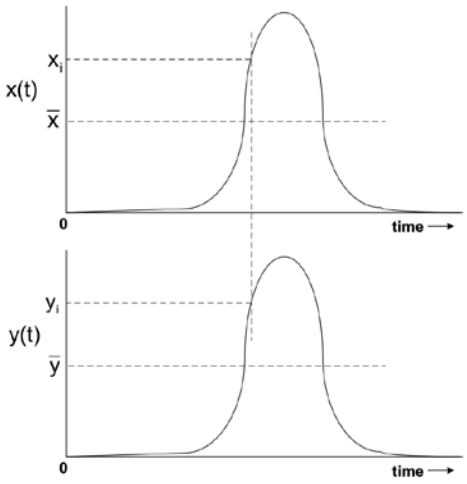

Figure 9: Highly Correlated Distributions

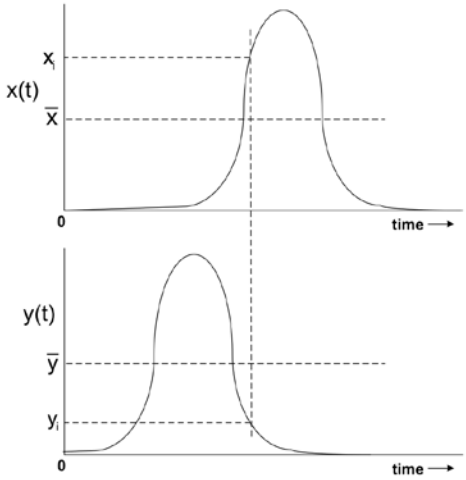

Figure 10: Poorly Correlated Distributions

As previously discussed, Equation 7 yields the optimal value for the stagger time s as it takes into consideration MTR. However, a close approximation that is useful in practice is to simply use the stagger value that minimizes the correlation between the failure probability distribution for System 1 and System 2. As stagger time is varied, the correlation coefficient between the two probability distributions will look something like that shown in Figure 11.

Assuming that the failure probability distributions for System 1 and System 2 are nearly identical, the correlation coefficient, r, will be +1.0 when they are started simultaneously (s = 0). As their starting times are staggered, the correlation coefficient will decrease. Ultimately, it will increase as the starting times become once again coordinated. The stagger time at which the correlation coefficient reaches its minimum value is the stagger time that will lead to the maximum redundant system reliability.

Figure 11: Correlation Coefficient *r* as a Function of Stagger Time *s*

Methods for Improving the Availability of Redundant Systems

The availability of a redundant system can be improved by incorporating a Failure Analysis Engine that continually monitors the current MTTF of the system and a Failure Prevention Engine that performs one or more appropriate actions to increase the availability of the system should its MTTF fall below an acceptable value as determined by the Failure Analysis Engine.[1]

Failure Analysis Engine

Typical functions for a Failure Analysis Engine include:

1. Determine the probability distribution of failures for each subsystem in the redundant system.
2. Determine the stagger time that leads to the lowest MTTF.
3. With the distributions of the two systems appropriately staggered, determine the probability distribution of failures for the redundant system by multiplying the probability of failure at each instant of time for the two independent systems.
4. Determine the MTTF of the redundant system via the summation methods described in the Section entitled "Mean Time to Failure."
5. Periodically recalculate the MTTF from the current time.
6. If the MTTF falls below a critical threshold, issue a warning message; and inform the Failure Prevention Engine.
7. When the Failure Prevention Engine completes whatever actions it is going to take, return to Step 1.

Failure Prevention Engine

When the Failure Prevention Engine is notified by the Failure Analysis Engine that the system MTTF has fallen below an acceptable threshold, it will take actions to improve the availability of the system by lengthening its MTTF. Typical actions include:

1. Restart a node if it is about to fail due to a software problem.
2. Replace a critical hardware component if hardware failures happen after some period of time (such as a solid-state disk drive).
3. Dispatch a repairman if manual intervention is required.
4. Replace a system in its entirety if it is nearing end-of-life.
5. Restart the nodes according to a staggering schedule if both nodes are apt to fail simultaneously from a software or hardware problem.

[1] Note that the functions of the described Engines may be accomplished by operator inspection and intervention until a product becomes available that automates and makes them transparent.

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6. Reroute users to the node with the lowest probability of failure (i.e., the longest MTTF).
7. Add another node to the cluster or network of nodes such that the overall probability of failure of the cluster is reduced.
8. Move to an active/active configuration (in which both nodes are processing transactions) or to a sizzling-hot-takeover configuration (an active/active system in which only one node is processing transactions) to lower the recovery time (Recovery Time Objective, or RTO) and the amount of data loss (the Recovery Point Objective, or RPO).

Summary

The prior art for calculating estimated availability from any point in time is flawed because it is based on memoryless random variables. The calculation of the average time to the next failure is always the same regardless of how long a system has been in service. Rather, an alternative term, Mean Time To Failure (MTTF), provides an estimate of the expected time of failure that decreases as time goes on.

The reliability of a redundant system is optimized by minimizing the probability that both systems will fail simultaneously. If they both have the same failure probability distribution, then when one system is most likely to fail, so is the other system.

By staggering the system starting times so that their probability distributions are not aligned, the time that the two systems are most likely to fail are different. When one system is most likely to fail, the probability that the other system will fail is significantly reduced. Therefore, the probability of a dual system failure is reduced. Redundant system reliability can be greatly enhanced by staggering the starting times of the two systems. This strategy applies both to hardware failures and to software failures.

A method for estimating the remaining availability of a system is to use a Failure Analysis Engine to calculate the system's MTTF from the current time based on the known failure probability distribution of the system. This can be accomplished by sampling the failure probability distribution and summing the probabilities of failure at each of a series of small time intervals. If the MTTF falls below a critical threshold, actions can be taken via a Failure Prevention Engine to mitigate the potential failure based on the expected cause of the failure.

Dr. Bruce D. Holenstein, President and CEO. Dr. Holenstein leads all aspects of Gravic, Inc. as President and CEO. He started company operations with his brother, Paul, in 1980, and is presently leading the company through the changes needed to accommodate significant future growth. His technical fields of expertise include algorithms, mathematical modeling, availability architectures, data replication, pattern recognition systems, process control and turnkey software development. Dr. Holenstein is a well-known author of articles and books on high availability systems. He received his BSEE from Bucknell University and his Ph.D. in Astronomy and Astrophysics from the University of Pennsylvania.

Dr. Bill Highleyman is the Managing Editor of The Availability Digest (www.availabilitydigest.com), a monthly, online publication and a resource of information on high- and continuous availability topics. His years of experience in the design and implementation of mission-critical systems have made him a popular seminar speaker and a sought-after technical writer. Dr. Highleyman is a past chairman of ITUG, the former HP NonStop Users' Group, the holder of numerous U.S. patents, the author of Performance Analysis of Transaction Processing Systems, and the co-author of the three-volume series, Breaking the Availability Barrier.

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Back*for*More

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

As we herald in the New Year it's once again time to take a quick look over our shoulder at all that transpired for the year that has ended, even as we take a much longer look at what lies ahead in 2017. When it comes to 2016 there was ample evidence that the NonStop development team is moving quickly to ensure the growth of NonStop continues and the choice available to customers and prospects meets their business needs. Very soon there will be NonStop products on hand capable of meeting a diverse mix of requirements, whether customers are looking for a complete solution right off the dock or for just the best software platform on the planet!

Messages resonating from major HPE events, such as 2016 HPE Discover, the most recent held in London just a short time ago, are still very much focused on the transformation to a hybrid infrastructure as we brace for the impact from software-defined-everything. Clouds, virtual machines, containers, convergence and hyper-convergence references are being pulled into many conversations and it's apparent to even the most conservative of enterprises that the complexity of the data center is only going to continue for the immediate future.

Transformation to a hybrid infrastructure however isn't solely about our infrastructure as it is being driven by external forces that will affect every application we run. This was perhaps best summed up in the keynote presentation, ***Precision Planet***, Dr. Tim Chou gave at this year's NonStop Boot Camp. Whereas previously our applications were developed in support of the Internet of People (IoP) in which transactions accommodated a simple request / response model we now face the Internet of Things (IoT) where there are many more things than people and they have a lot to say. And sorting through, and indeed discarding the "Digital Exhaust", before any business gems reveal themselves is only going to add to data center complexity and challenge even the most experienced CIOs about how best to ensure our interactions with people don't suffer as a result.

Data center complexity was the topic of the ***Back for more*** ... column this time last year where I noted how HPE executives were really promoting that HPE was making huge bets on the combination of existing data center solutions and private clouds. Unpredictable scale out was being positioned as the forte of clouds – their inherent ability to support an elasticity of provisioning simply not possible with existing data center infrastructure. Traffic from IoT, free of any so-called digital exhaust, will expand the need for resources where the only practical solution will be clouds and for enterprises where NonStop has traditionally found a home, private clouds will become a reality. "You need it? You got it!" being the mantra of data center managers with early-stage private cloud deployments that were accessible by applications on traditional data center servers.

However, this is about as much looking over our shoulders as I want to do – what's coming from NonStop development is not only going to help NonStop become a factor in the transformation to a hybrid infrastructure but has the potential to play important roles at both ends of the transformation spectrum. NonStop X systems will provide levels of performance data center servers require even as vNonStop will provide levels of availability needed of key infrastructure running within private clouds, the most significant being NonStop SQL/MX as a DBaaS, something we all have heard HPE's own IT will likely deploy sometime in the very near future. And to sweeten the deal for today's CIOs and help cut costs as they pursue a transformation to a hybrid infrastructure, NonStop SQL/MX delivered as DBaaS will provide Oracle compatibility minimizing any effort required to reconfigure existing applications to leverage such deployments.

Looking ahead to 2017 I am anticipating a continuation in the help the NonStop team is providing the NonStop community on just how best to use the NonStop that is most appropriate for the community's business needs, whether its NonStop X or vNonStop. As 2016 came to an end, one example of the help on hand was how NonStop product management and development help me correctly articulate an updated message on NonStop for a blog post to the NonStop community blog, Real Time View. With their input I certainly have completed a more compelling post when I published ***Will "The Machine" be everywhere? Is there a plan for NonStop?*** And I am aware I am not the only commentator who has been encouraged by the support coming from the NonStop team.

What I also anticipate is reading more about "new logos" being added to the NonStop community as more wins for NonStop are revealed. This has been a long-running concern of the NonStop community, dating back to ITUG times, could HPE find new markets for NonStop and could there be new solutions brought to NonStop systems? Even following all the M&A activity that has taken place within financial institutions, transaction volumes have continued to grow and the pent-up demand for NonStop systems has only recently began to be satisfied.

And finally, I am expecting to see an upward growth in managed services providers. With so much emphasis over the past decade on products, 2017 represents a turning point where many more skilled NonStop personnel will be required and with a new generation of developers and operators arriving on the scene, businesses will be looking to complement the staff they have with skilled outside resources. Not the same model that led to outsourcing decades ago, but managed services on a partnership basis, where the Internet itself becomes the delivery fabric not only of products but services.

There will be SLAs and security issues in the near term, of course, but these are all quite manageable and I fully anticipate even the biggest NonStop users turning to the managed service providers for longer term engagements. The NonStop team will continue to move quickly as the diverse mix of requirements will spur the team on to become even more competitive in terms of choice over the NonStop best suited to the needs of the enterprise. Real and virtual, products and services, converged systems and clouds, hybrid infrastructures taking flight, IoT and yes, analytics – NonStop will see it all and the coming year will have many surprises install for us all. And all I can add at this time is, ***bring it on!***

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