

TURBO LAMP WHITE PAPER

The LAMP Stack for Today's Demanding
Application Workload Requirements

Authors:

Amy Anderson, Zend
Roger Levy, MariaDB
Troy Peterson, IBM
Tim Robinson, IBM
Antonio Rosales, Ubuntu
Bruce Semple, IBM
Matthew Sheard, Mellanox
Idan Werpolder, Mellanox

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1 EXECUTIVE OVERVIEW

1.1 THE NEED FOR A TURBO STACK

The explosion in today's application market is almost exclusively around applications that deliver information from troves of data to a myriad of end users devices. The information is personalized, localized, and curated for the user. Businesses are retrieving data from their systems of record—the ERP, SCM, HRM applications that have long run the business—and delivering it through systems of engagement.

The de facto standard for building systems of engagement is the LAMP stack, which consists of Linux as the operating system, an Apache web server, an open source relational database like MySQL or MariaDB, and PHP as the development language. The dominant solutions across several application categories such as ecommerce, content management, and analytics are all built on a LAMP stack. The open source software LAMP stack has become popular because each component can be theoretically interchanged and adapted without overt lock in to a specific vendor software stack. These components bundle a web application and service componentry stack built on open source technologies that are portable between Linux operating systems and platforms.

Until now, the target hardware platform for LAMP stack solutions has been Intel processors. For years, Intel had a price advantage with low-end servers, where LAMP stack had its open source beginnings. But the POWER processor family has steadily improved its price performance, and entry-level Power Systems with POWER8 processors are affordable for any business. At the same time, LAMP stack solutions have grown to support many business critical systems of engagement, where more powerful, scalable, and reliable hardware systems are required.

An excellent case in point is ecommerce. Thousands of small and medium businesses have built web and mobile commerce applications using Magento, which is built on LAMP. While Magento provides the functionality and price point that works for many businesses, it often suffers from performance problems. If a simple rehosting exercise could enable Magento to run faster, millions of customers would enjoy a better online experience, and the thousands of businesses supporting them could drive more revenue and profit.

The goal, then, is to demonstrate that by simply re-hosting a PHP application like Magento from Intel to POWER8 running an optimized LAMP stack, the site will run faster and automatically leverage the advantages of POWER8. In this paper, we'll review the Proof of Concept we conducted to show the cost, performance, and maintenance advantages of LAMP on Power8.

1.2 SOLUTION OVERVIEW

The Turbo LAMP stack on IBM POWER8 processors is shown in figure 1 below and is a tight collaborative relationship with several key component providers. IBM and its OpenPOWER Foundation partners Ubuntu and Mellanox provide a perfect infrastructure to allow software stack vendors to take advantage of the new POWER8 line of processors. Power Systems with POWER8 from IBM, high speed data transfer capabilities from Mellanox, PowerKVM virtualization, Ubuntu or RHEL little endian Linux, database from MariaDB and PHP application engine from Zend make up the Turbo LAMP stack. This high

performance stack enables PHP applications such as Magento, HarrisData AppsInHD, OpenPro ERP and WordPress to be plugged in to create a supercharged web application platform.

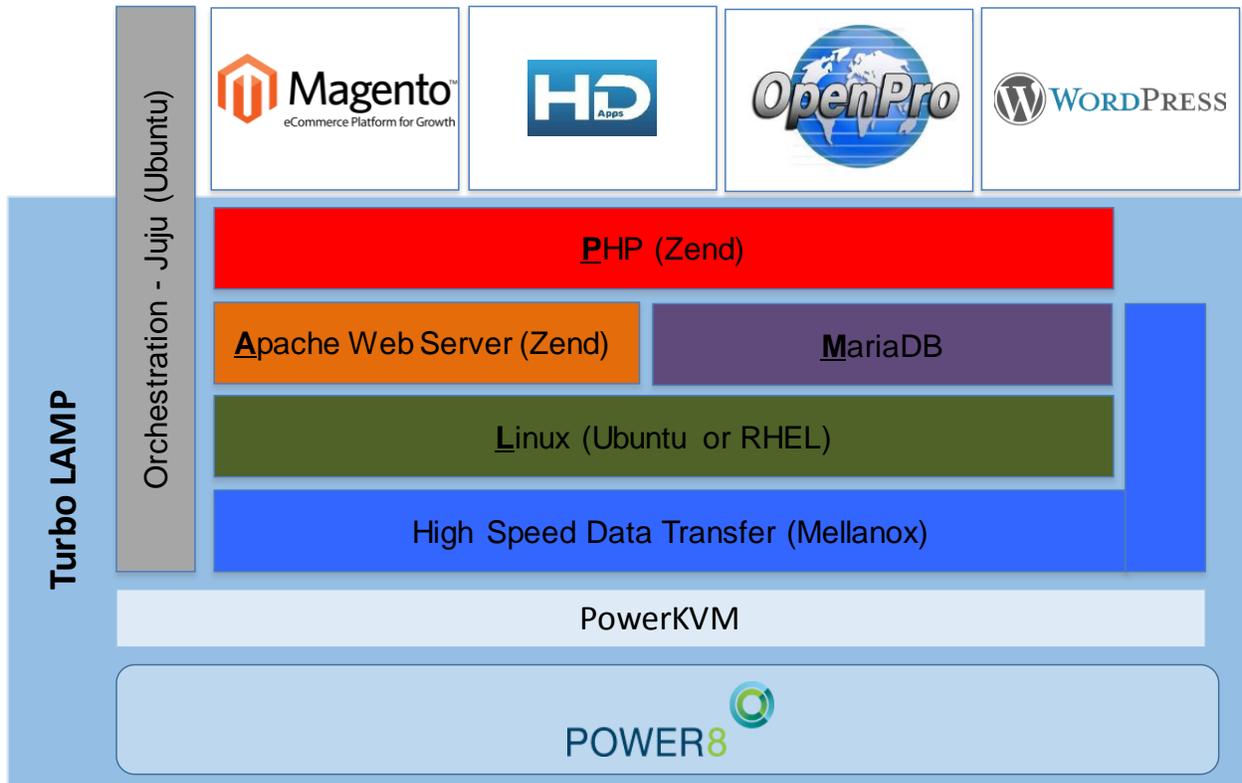


Figure 1: Turbo LAMP Solution Components

2 SOLUTION COMPONENT DESCRIPTIONS

The Turbo LAMP solution provides 2 major benefits. First, it improves time to value by automating the steps to deploy the solution. Second, it provides a much higher level of performance over a traditional x86 based LAMP stack. This section describes the components of the Turbo LAMP solution that make this possible.

2.1 POWER8

With the rise of cloud computing and mobile technologies the desire would be to have a LAMP stack that can be optimized for dynamic scale out as well as scale up virtualized infrastructures that can take advantage of the capabilities of the latest POWER8 architecture from IBM and its OpenPOWER partners. Building upon the collaboration gained with POWER8 and the OpenPOWER Foundation, IBM is uniquely positioned to deliver a more robust and high performing stack by working with key component providers while still allowing interchangeability of the components.

The POWER8 design has many performance advantages over x86 for a LAMP solution. The cores run at a higher speed than x86 processors and have 8 threads per core, 4 times the threads than x86 processors. These POWER8 cores have 16 execution pipelines, larger internal bandwidth and larger caches to efficiently handle massive data volumes. Additionally, the open interfaces of the POWER8 processor include up to 96 GBps of integrated Peripheral Component Interconnect Express (PCIe) Gen3.

IBM has introduced a line of Linux only scale-out servers with POWER8 processors such as the Power Systems S822L, optimized for Linux, delivering superior price-performance over x86 servers. These servers are priced competitively with commodity x86 servers yet provide higher performance, better reliability and superior security than x86 servers. IBM Power Systems are well known for their reliability, due to the servers Reliability, Availability and, Serviceability (RAS) features. These are some of the features available on IBM POWER8 server family:

- Redundant bits in the cache area
- Innovative ECC memory algorithm
- Redundant and hot-swap cooling
- Redundant and hot-swap power supplies
- Self-diagnoses and self-correcting errors during run time
- Automatic reconfiguration to mitigate potential problems from suspected hardware
- Self-heal to automatically substitute good components for failing components

Power System's integrated security architecture results in reduced number of intrusions and lower security related costs compared to x86. For more information about the IBM Power systems RAS and security features, see IBM Power System S812L and S822L Technical Overview and Introduction, REDP-5098 (<http://www.redbooks.ibm.com/abstracts/redp5098.html?Open>).

2.2 POWERKVM

PowerKVM provides an open virtualization option for Power servers. PowerKVM uses the same standard interfaces as KVM on x86. This allows using the same tools to manage PowerKVM that KVM administrators are accustomed to, including open stack tools.

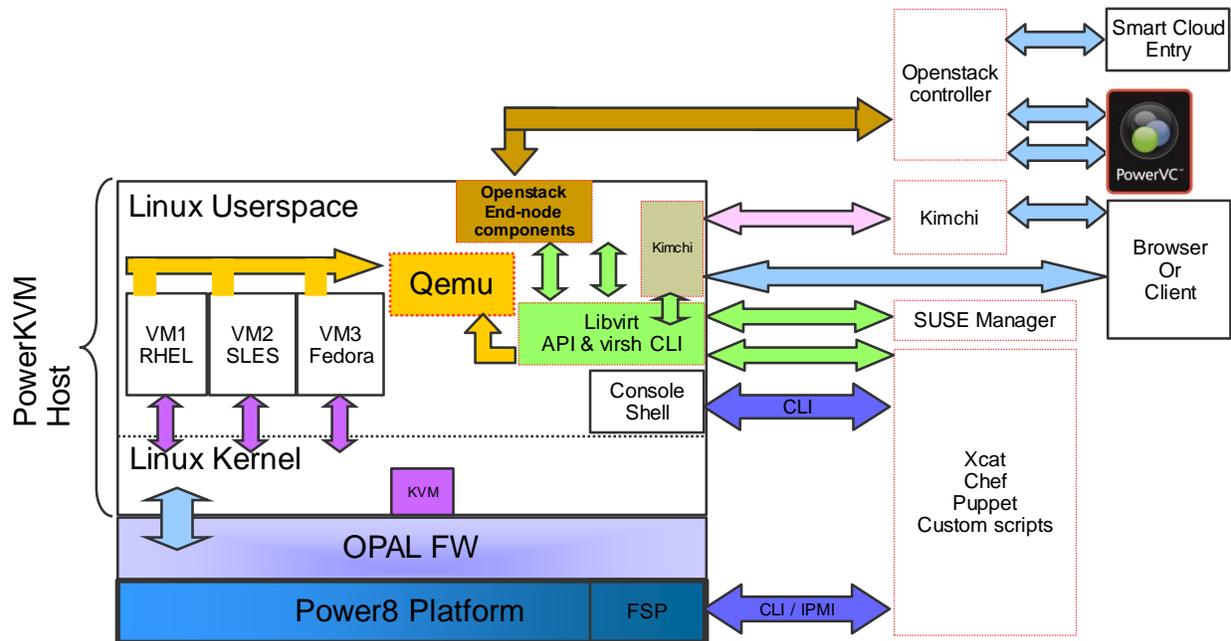


Figure 2: PowerKVM Architecture Overview

Turbo LAMP is leveraging PCI I/O Passthrough, which IBM has included as a technology preview in PowerKVM 2.1. This technology provides a PowerKVM guest direct and exclusive access to an I/O device. This isolation results in no sharing of CPU, memory or network interface. For Turbo LAMP we are using PCI I/O Passthrough to connect the VMs directly to the Mellanox adapters, maximizing the throughput and reducing the latency between LAMP components. This makes Turbo LAMP ideal for applications consuming high network bandwidth.

2.3 UBUNTU 14.04.

Ubuntu Server 14.04 is the latest Long Term Stable (LTS) release supported by Canonical for five years. Ubuntu is an OpenSource Linux distro based on Debian with support for POWER8 Little Endian. It is the leading platform for scale-out computing. Whether you want to deploy an OpenStack cloud, a Hadoop cluster, or a Turbo Lamp Stack, Ubuntu Server delivers the best value scale-out performance.

With complete toolchain and package support for POWER8 Little Endian, Ubuntu Server 14.04 LTS provides the software foundation for the Turbo Lamp Stack. Ubuntu Server 14.04 LTS runs as a Power KVM guest hosting MariaDB, Zend Server, and the latest Mellanox drivers all tuned for POWER8 Little Endian.

2.4 RHEL 7.1

Turbo LAMP provides choice in Linux distros. Turbo LAMP has been validated on Red Hat Enterprise Linux (RHEL) 7.1 Little Endian. With over 90% of Fortune Global 500 companies running Red Hat products and solutions, many enterprises are able to take advantage of the performance and scalability of Turbo LAMP.

2.5 MELLANOX SWITCHES & ADAPTERS

2.5.1 Adapters

IBM POWER8 PCIe3 LP 2-Port 40GbE NIC RoCE QSFP+ Adapter FC EC3A/EC3B

The Mellanox ConnectX-3 family of adapters provide the fastest bandwidth and lowest latency interconnect solutions. Built around the fastest interconnect technology of 10/ 40 Gb Ethernet. The Mellanox ConnectX-3 family of adapters enables network fabrics to provide the fastest data transfer and most effective utilization of compute and storage. This provides the most optimal environment for business application stacks with inter-component communications requirements.

2.5.2 Switches

MSX1036B-2SFS

The Mellanox Ethernet Switch Family delivers the highest performance and port density with a complete solution enabling converged data centers to operate at any scale while reducing operational costs and infrastructure complexity. This family includes a broad portfolio of Top-of-Rack (TOR) switches that range from 12 to 64 ports and support 10/40/56Gb/s per port. These switches allow IT managers to build cost-effective and scalable switch fabrics for small to large clusters up to 10's-of-thousands of nodes. Mellanox eases the scaling of the enterprise fabrics by providing the lowest latency and highest bandwidth. This allows IT managers to deal with serving the company's business needs, while solving typical networking issues such as congestion and addressing inefficiencies generated by adding unnecessary rules and limitations when the network resources are insufficient.

2.5.3 Cabling

Mellanox cables are a cost-effective solution for connecting high bandwidth fabrics, extending the benefits of Mellanox's high-performance InfiniBand and 10/40/56GbE adapters throughout the network. In addition to meeting or exceeding IBTA and IEEE standards, Mellanox Certified cables are tested on Mellanox equipment to ensure optimal signal integrity and the best end-to-end performance. Every cable and transceiver is cluster tested to BER -15 which translates to 1,000X fewer transmission errors than many competing products. Fewer transmission errors mean fewer "retries" and higher system performance.

2.6 ZEND SERVER

2.6.1 PHP and Web Server

Zend Server provides a complete, reliable and secure PHP stack, bundling over 80 of the most popular PHP extensions and libraries. Whether on Apache, nginx or IIS - Zend Server provides you with a

consistent PHP environment across all major operating systems, for both development and production. Zend Server allows you to easily manage your PHP configuration settings to fit the needs of your applications - whether on a single server or a large cluster.

2.6.2 Deployment

Streamline and automate the process of deploying applications using Zend Server Deployment. Eliminate key sources of deployment failures, and ensure consistency across development, staging and production, by using application packages containing your code, deployment scripts, dependencies, metadata and installation parameters. Code libraries can be abstracted out from apps and managed centrally, simplifying dependencies and updates.

2.6.3 Development – Z-Ray

Using Zend Server Z-Ray is akin to wearing X-Ray goggles, effortlessly giving you deep insight into how their code is running as you are developing it – all without having to change any of your habits or workflow. With Z-Ray, you can immediately understand the impact of their code changes, enabling you to both improve quality and solve issues long before your code reaches production. In addition to the obvious benefits of this ‘Left Shifting’ – better performance, fewer production issues and faster recovery times – using Z-Ray is also downright fun!

2.6.4 Performance and Troubleshooting

Installed on Zend Server, your apps are guaranteed to run faster than before. You can squeeze even more performance out of them using the following features:

Running jobs using Zend Job Queue allows executing time-consuming jobs asynchronously, removing application bottlenecks and improving end user experience.

Using Zend Page Cache speeds up recurring access to PHP pages, by caching the entire output of specific URLs. Can't cache the entire page? Use the Zend Data Cache API to avoid computing the same data again and again.

When something goes wrong with your apps, you need to know about it. Whether it's a slow page or a runtime error - Zend Server's monitoring helps you find out precisely what happened and when - as well as giving you all the information you need to fix it. When something does go wrong, Code Tracing provides you with the equivalent of a black-box containing the full function-by-function flow of the problematic PHP request.

2.6.5 Clustering

Need to scale up your website? A modern, robust and scalable architecture allows you to easily scale up your production environment and scale-out environments. Based on a de-centralized management system that is comprised of identical components, Zend Server ensures high availability and full support of cloud environments. With Zend Session Clustering, session data is shared between multiple servers in your cluster, ensuring session continuity in case of system failure, and high availability of your system.

2.6.6 Compliance and Integration

Zend Server helps you meet the governance and compliance standards of your organization. Use the Audit Trail to track changes made to your system configuration, whether made via the UI, API or directly on the file system.

The user management system allows you to control access to Zend Server, and enables developers to safely access production metrics and diagnostics, with read-only permissions. Use the built-in user management, or authenticate against an existing corporate LDAP server.

Zend Server is fully API-enabled, meaning you can automate all of its various management actions, and integrate with external systems - including your Continuous Delivery cycle.

2.7 MARIADB: THE DATABASE HEART OF TURBO LAMP

A high-performance, open source database has been a core component of the LAMP stack since it originated with MySQL back in the 1990s. MySQL was a pioneer in delivering a developer-friendly, easily deployed relational database well-suited to the demands of the web. Today's web-scale applications are the descendants of those first Internet sites. These applications need a highly reliable database that can handle multi-terabyte data volumes and millions of users, while guaranteeing transactional integrity and continuous availability. So it is only fitting that the Turbo LAMP stack features MariaDB, the direct descendent of MySQL, as its core data management solution.

MariaDB is application-compatible with MySQL, so your existing applications just work. With a vendor-independent community at the heart of its development and many of the original inventors of MySQL steering its course, MariaDB is a more advanced implementation of the world's most widely adopted RDBMS technology. It isn't surprising then, that many of the most famous web-scale companies and web sites make extensive use of MariaDB in their infrastructure. Now with Turbo LAMP and POWER8 technology, this mature database is ready to deliver cost-effective data management to a new class of mission-critical business applications.

2.7.1 OSS Relational Technology Refined

MariaDB is an ACID-compliant, transactional database that implements the proven relational data model embodied by the standard SQL query language. Its table-structured storage consisting of rows corresponding to business records, and columns representing the fields of those records is ideally suited to managing business data. Furthermore, MariaDB's transactional semantics guarantee the consistency of your vital data.

Consider the requirements of a high-performance enterprise ecommerce solution such as the Magento platform. Magento is built on industry standard open source infrastructure, and MariaDB fits right in. Magento supports high transaction volumes and large numbers of simultaneous visitors. It needs a high-performance, scalable database back-end like MariaDB to serve content, manage customer accounts and shopping carts, and process purchasing transactions. MariaDB's compatibility with MySQL, and its transactional data model insure that financially sensitive applications such as Magento process customer orders correctly and consistently.

2.7.2 MariaDB and POWER8: Complementary Architectures

MariaDB has been further optimized to fully leverage POWER8. The database brings a number of important capabilities to the Turbo LAMP platform, including:

- The ability to handle databases with 10s of terabytes of data efficiently, using an improved version of the standard InnoDB storage engine familiar to MySQL DBAs, as well as specialized

engines such as TokuDB with sophisticated compression and indexing, and Spider with table-based sharding for managing very large tables efficiently.

- Tuned multi-threading including an improved thread pool management system exclusive to MariaDB 10. Multi-threading advances take advantage of the large number of processor cores and concurrent thread capabilities of the POWER8 architecture.
- Memory management features designed to optimize database performance using efficient buffer pool and cache implementations. Servers such as Power Systems with POWER8 processors which can be configured with large amounts of DRAM enjoy dramatically faster performance by minimizing access to slow secondary storage.
- Exclusive parallel slave architecture which delivers nearly 10x better cluster replication performance than MySQL. MariaDB 10's advanced replication algorithms will likely deliver an even bigger boost when coupled with the speed and throughput of Mellanox networking in the Turbo LAMP architecture.

2.7.3 IBM and MariaDB: Partners In Turbo LAMP Performance Tuning

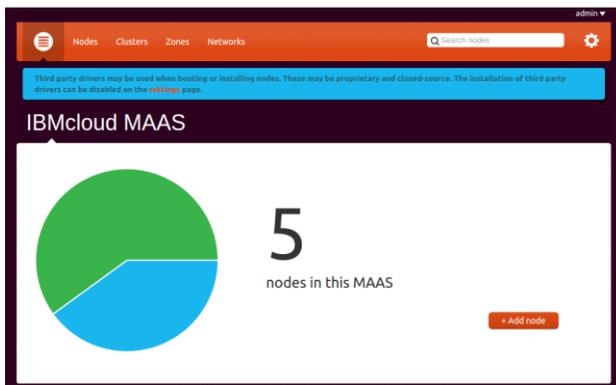
Porting MariaDB 10 to the POWER8 architecture has been a collaborative effort between the database experts at MariaDB, and IBM's system architects. The engineering teams have jointly tuned the database to optimize performance.

MariaDB 10 as a foundation for the Turbo LAMP platform is ideally suited to deploy mission critical applications at web-scale. IBM and MariaDB have worked together to harden and optimize the database, making Turbo LAMP even more ready to handle these advanced use cases.

2.8 MAAS

Metal as a Service (MAAS) is an OpenSource tool that brings the language of the cloud to physical servers. It makes it easy to setup the hardware on which to deploy any service that needs to scale-out dynamically. MAAS allows system administrations to treat their private bare metal hardware, such as POWER8 Little Endian servers, as an elastic cloud. MAAS enlists physical or virtual machines through which Juju can deploy workloads onto, be it on the bare metal or through a virtualization mechanism such as Linux Containers (LXC) or Kernel-based Virtual Machine (KVM).

In the Turbo LAMP Stack Solution MAAS was provisioned onto a "command-and-control" VM. Five other separate VMs were provisioned, and enlisted in MAAS as resources to deploy services onto by their MAC addresses.



Each VM was specifically configured to have resources needed for the corresponding workload. Specifically, the VMs that MariaDB and Zend would be deployed to had a Mellanox NIC attached to them, and the appropriate memory and CPU resources were also provisioned to meet the needs of the workloads.

When MariaDB, Zend-Server, and Mellanox services were ready to be deployed Juju would

make requests to MAAS server via the MAAS API. MAAS would then:

- Power on the PowerKVM
- Install a fresh Ubuntu 14.04 LTS image onto the target Power KVM
- Ready the environment for Juju to deploy services

2.9 JUJU ORCHESTRATION

Juju is an OpenSource service orchestration tool to configure, manage, maintain, deploy and scale solutions to any public, private, or hybrid cloud from a powerful GUI or the command-line. Juju describes how software should be deployed in software called “Charms.” Charms distill the development and operational knowledge needed to deploy a service. This includes configuration, deployment, connections [to other services], and scaling. Charms also embed the best practices and performance tuning for a given service operating in a specific environment. With this paradigm shift, now the environment can be tuned for optimal performance of the service. Furthermore, the deployment of the service can be repeated in different environments or the same environment and shared with colleagues. The Charm can also expose configuration parameters the user may want to set such as to install Magento or Wordpress in the Zend-Server charm. Thus a Juju user can focus on the solution and not worry about the operational aspects of the workload deployment as these are encapsulated in the Charm or bundle.

In the Turbo LAMP stack solution the experts at MariaDB, Zend, and Mellanox distilled their development, operational, best practices, and performance knowledge into the Charm to deliver an optimal deploy on POWER8 Little Endian. The goal being to create an “executable white paper” so users don’t have to replicate the expertise at MariaDB, Zend, or Mellanox and can repeat the Turbo LAMP solution in their local environment.

The MariaDB Charm installs an optimized binary for POWER8 Little Endian. Among other features the Charm provides a method for Zend to connect to and create databases most applicable to the Turbo LAMP stack solution.

The Zend Charm installs Zend Server which acts as a PHP framework to deploy and monitor PHP applications. The Charm also provides config options allowing the user to choose Magento and/or Wordpress to be installed at time of deploy. These config options are set to a default of true so on deploy of the Zend Server Charm Magento and Wordpress are served out by Zend Server. The Zend Charm also implements methods to connect to HAProxy load balancer to produce a Zend Server Cluster for scaling and methods to connect to MariaDB for a data warehouse.

The Mellanox Charm is a special type of Charm called a subordinate. A subordinate Charm is colocated on the same machine as another service and shares the same file system. The VMs that MariaDB and Zend are deployed on needed newer Mellanox drivers, and optimizations specific to Power. Thus, having Mellanox as a subordinate charm fit this need perfectly to install drivers and set performance tuning parameters.

To graphically represent the deployment topology the Juju GUI was also deployed as depicted in figure 3. It too is a Charm and provides a web based view of the deployed environment. In the default view one can see the services deployed and their connections.

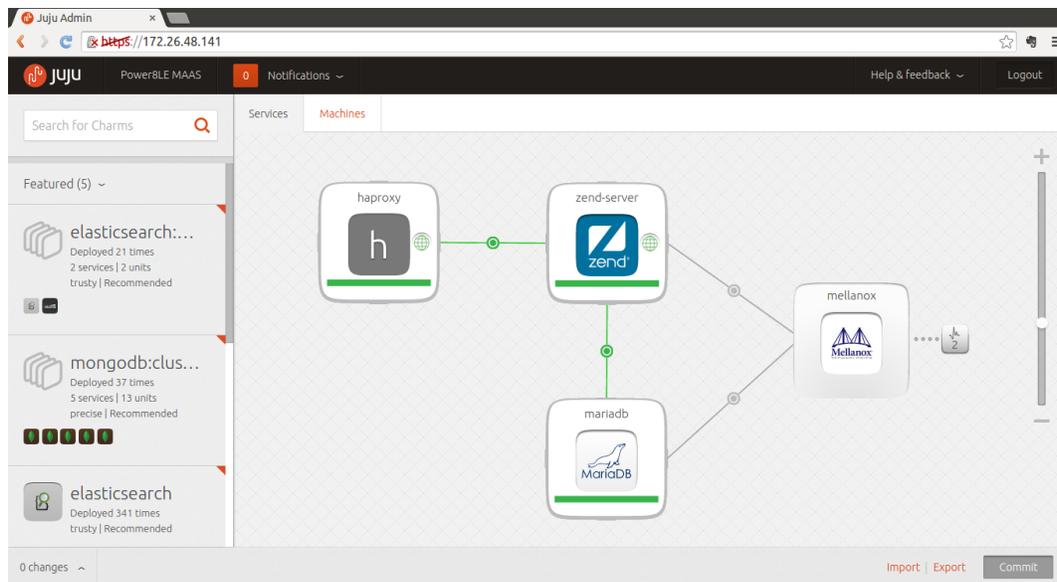


Figure 3- Juju Admin GUI

2.9.1 Deploy

This solution is optimized for deployment on POWER8 Little Endian with Mellanox ConnectX-3 NIC (IBM POWER8 PCIe3 LP 2-Port 40GbE NIC RoCE QSFP+ Adapter FC EC#A/EC3B) distributing traffic between Zend Server and MariaDB. A Mellanox card should be attached to both the Zend Server instance/machine and MariaDB instance/machine. This particular solution was designed with MAAS in mind but can also be deployed on any Juju supported cloud or where Ubuntu SSH access is available.

After setting up your hardware environment deploy the juju-gui:

```
juju deploy trusty/juju-gui
juju expose juju-gui
juju status
```

Look for the public-address for juju-gui.

Enter the address in your browser.

In the subsequent deploy Juju GUI search for "Turbo Lamp" in the Juju GUI.

Choose to deploy the bundle to the Juju GUI canvas.

3 APPLICATIONS ON TURBO LAMP

Most PHP Applications using MariaDB or MySQL database will run on Turbo LAMP with no modifications required. IBM has been working with various application partners to validate and optimize their PHP applications on Turbo LAMP. This section highlights a few of the applications available on Turbo LAMP.

3.1 MAGENTO

Magento is the leading ecommerce package for mid-market merchants and is used by many of the top e-retailers in the US and Canada. It is designed to scale to meet the demands of large ecommerce sites. With Magento workloads, Turbo LAMP has been demonstrated to deliver 2 to 3 times better performance at comparable acquisition costs vs. LAMP on x86 servers. This improved performance as

well as the superior reliability, serviceability and security of IBM Power Systems results in fewer disruptions and slowdowns for a better customer experience at lower operational costs.

3.2 OPENPRO

Enterprise Resource Planning (ERP) software is also used in Turbo LAMP technologies. Since 1998, OpenPro ERP software has been offering a complete business software package to small and mid-sized companies, and international enterprises looking for more features and value from their ERP solutions. OpenPro delivers a fully customizable software solution with six major modules including financials, distribution, manufacturing, CRM, E-commerce, and advanced system functions, such as workflow and document imaging.

OpenPro customers reflect almost every major market segment, from manufacturing to service, government to non-profit, and traditional to ecommerce retail. As a provider of manufacturing ERP software, OpenPro excels in its MES software and manufacturing inventory software. The financial accounting software supports a closed loop financial flow and offers government accounting software. Retail and Supply Chain distribution companies use OpenPro and the LAMP stack to quickly process transactions over the internet. OpenPro is built using open source LAMP technology and runs on any platform including IBM Power Systems and IBM z Systems and is now available on Turbo LAMP.

3.3 HARIS DATA

AppsInHD offers a suite of HRIS, ERP, and CRM applications offering simplicity of design, proactive automation, and an elastic cloud architecture. The simple user interface designed for touch-and-speak interaction identifies and focuses users on critical issues and tasks. Customized automation processes automatically and proactively perform tasks on behalf of users, identifying exceptions and notifying responsible users. An elastic cloud architecture facilitates deployment on the HarrisData cloud, on a private cloud, and/or on-premise, all for one low price. AppsInHD is developed from the ground up for web deployment, and leverages the TurboLAMP stack to deliver improved performance and reliability for cloud and on-premise deployments.

3.4 VALIDATING APPLICATIONS ON TURBO LAMP

Independent Software Vendors, MSPs and customers who wish to test their applications on Turbo LAMP have several options. SiteOx and IBM Power Development Platform offer Turbo LAMP platform as a service virtual machines, preloaded with Zend and MariaDB, ideal for validating an application on Turbo LAMP. Need a dedicated environment for performance testing or optimization of your application on Turbo LAMP, contact your IBM representative to discuss options or send a note to tlamp@us.ibm.com.

4 PHYSICAL DEPLOYMENT CONSIDERATIONS

IBM worked closely with Ubuntu, MariaDB, Mellanox and Zend to build, test and tune Turbo LAMP at an IBM Innovation Center. Figure 4 shows a single server deployment of Turbo LAMP at the Innovation Center with 2 business applications, Magento and WordPress. This deployment, including configuration and tuning parameters, can be easily reproduced using Ubuntu MAAS and Juju with Juju Charms

customized for Turbo LAMP deployment. A cookbook has also been developed to enable building and configuring Turbo LAMP manually.

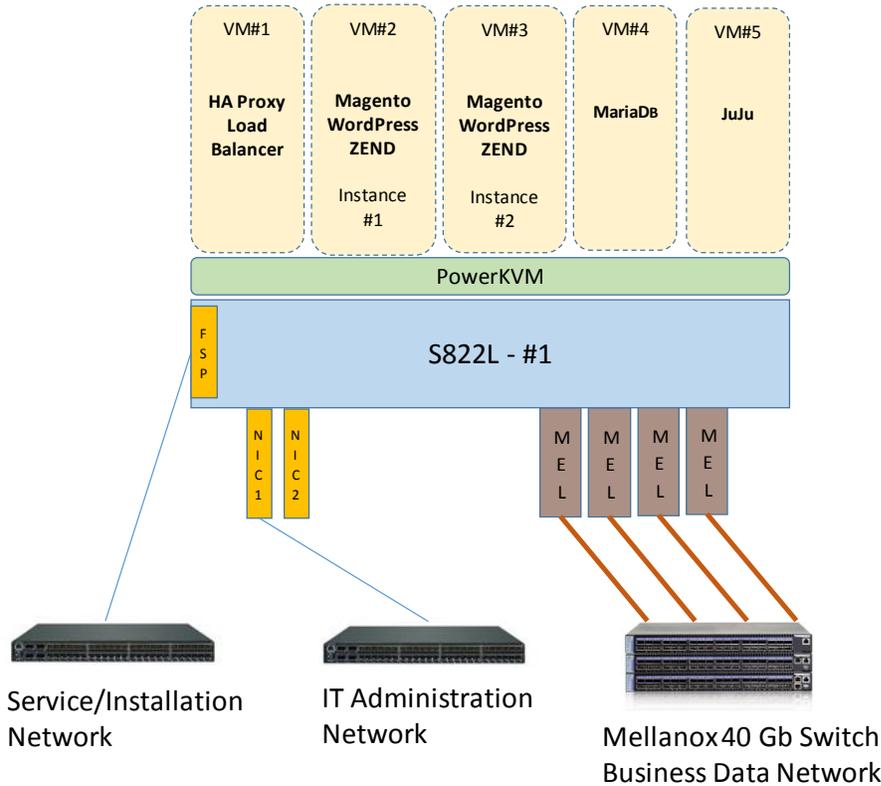


Figure 4: Sample Turbo LAMP Deployment Diagram

A second Turbo LAMP environment was built at the Innovation Center to validate Turbo LAMP on RHEL 7.1 Little Endian. This environment consists of 2 Zend servers and MariaDB in separate PowerKVM guests connected by Mellanox 40Gbps Ethernet networking.

4.1 IBM INNOVATION LAB SETUP

The IBM Innovation Center provides a secure collaboration space for building out the Turbo LAMP ecosystem. The solution is deployed in the Innovation Center data center using industry-standard enterprise rack equipment. IBM S822L servers with PowerKVM are configured in a cluster with Ethernet data networks for systems management and application data. Systems management cabling is built over 1Gbps Ethernet to all components in the topology. The systems management network allows a separation of the control interfaces available through Kimchi, MASS/Juju and ssh access to hypervisor and VMs in the Turbo LAMP stack. The Innovation Center infrastructure provides local NTP and DNS services to all components over the systems management network.

The application data for Turbo LAMP is carried across a dedicated 40Gbps Ethernet infrastructure implemented using the Mellanox MSX1036B-2SFS switch, Mellanox QSFP+ cables and the Mellanox ConnectX-3 40Gbps PCIe adapters for POWER8. The IBM S822L system is populated with 4 ConnectX-3 adapters in PCIe Gen3 16-bit slots. For the optimal performance on the application data network, each adapter is dedicated to a specific VM on the PowerKVM hypervisor using PCI-Passthrough.

In addition to using PCI-Passthrough, each VM configuration is tuned to provide the best performance in the Non-Uniform Memory Architecture (NUMA) implementation of the IBM S822L. To implement this tuning, the NUMA node proximate to the PCIe bus slot is determined. Then, the CPU and memory resources for the VM are mapped through the VM domain file attributes to resources on the same NUMA node. For the IBM S822L (two socket configuration) there are 4 NUMA nodes, allowing 4 optimally tuned VMs to host the components for the Turbo LAMP stack.

4.2 TURBO LAMP SETUP AND DEPLOYMENT

Instructions for setting up and deploying Turbo LAMP are maintained in the Turbo LAMP Wiki (<http://bit.ly/tlampwiki>). This includes a cookbook with instructions on using Juju charms to simplify deployment of a Turbo LAMP stack on Ubuntu and a cookbook with detailed instructions on building and configuring the environment manually on either Ubuntu or RHEL.

5 SUMMARY

IBM has teamed with OpenPOWER Foundation members Mellanox and Ubuntu, open source middleware leaders MariaDB, Zend and Ubuntu and Linux partners Red Hat and Ubuntu to produce Turbo LAMP, a high performance LAMP stack to meet the growing performance demands of today's business needs. IBM's Linux only scale-out servers provide exceptional performance at competitive pricing, resulting in faster response times and higher throughput at a lower total cost than x86 servers. Running PowerKVM and Ubuntu, traditional Linux administration skills can be leveraged. Mellanox 40 Gb networking infrastructure ensures Turbo LAMP can stand up to the most demanding data transfer requirements. Furthermore, leveraging PCI-passthrough, a PowerKVM technology, enables throughput of over 37 Gb/s between VMs. A robust middleware provides additional benefits to Turbo LAMP. MariaDB has been optimized to the POWER8 architecture to manage 10s of TB of data and process transactions at over twice the rate vs x86. Zend Server, the market leading PHP server, rounds out the stack enabling PHP applications to run on this high performance, reliable and secure infrastructure. To further the value of Turbo LAMP, Ubuntu MAAS is used to automate setting up the VMs and Ubuntu Juju to orchestrate deployment of the middleware and application components. This not only enables you to get Turbo LAMP up and running quickly, it ensures your implementation is configured for performance.

6 NEXT STEPS / CONTACT INFORMATION

6.1 ORDERING TURBO LAMP

This section provides information on ordering Turbo LAMP components.

6.1.1 Power S822L

To order Power System S822L servers, contact your IBM representative or IBM Business Partner or refer to the Contact IBM section of the product page:

<http://www-03.ibm.com/systems/power/hardware/s812l-s822l/>.

6.1.2 PowerKVM

PowerKVM is available as a subscription for 1 or 3 years, and typically ordered with the Power scale-out server. When bundled with the hardware order, it comes pre-loaded and ready to use. As well, PowerKVM can be added after the initial order.

For complete ordering information, see the RFA document on PowerKVM.

6.1.3 Mellanox

For information on ordering Mellanox Turbo LAMP components go to <http://bit.ly/tlamp-mellanox-order>.

6.1.4 MariaDB

For information on MariaDB Subscriptions go to <https://mariadb.com/products/subscription-plans>.

6.1.5 Ubuntu

For information on Ubuntu services go to <http://www.canonical.com/services>.

For Ubuntu Advantage professional support package go to <http://www.ubuntu.com/management/ubuntu-advantage>.

6.1.6 Zend

For information on Zend services go to <http://www.zend.com/en/support-center/support>.

6.2 NEXT STEPS

Additional optimization of key workloads on Turbo LAMP is planned. Also, Turbo LAMP will continue to be refined to add additional capabilities and incremental performance enhancements. The Turbo LAMP stack will also be validated against additional PHP applications benefiting from a high performance solution. To view performance results, keep up to date on the latest content or learn how we can work with you to validate your workload on Turbo LAMP, visit the Turbo LAMP Community (<https://www.ibm.com/developerworks/community/groups/community/turbolamp>). This community also has additional material to help understand the benefits of Turbo LAMP such as a demo (<http://bit.ly/tlampdemo>) and presentation deck (<http://bit.ly/tlampent2014>).

6.3 CONTACTS

Inquiries on Turbo LAMP can be sent to tlamp@us.ibm.com or feel free to post questions to a Turbo LAMP Forum (<http://bit.ly/tlamp-forum>).

7 FURTHER READING / REFERENCE INFORMATION

7.1 TURBO LAMP

Turbo LAMP Community

<https://www.ibm.com/developerworks/community/groups/community/turbolamp>

Turbo LAMP Wiki

<http://bit.ly/tlampwiki>

Turbo LAMP Demo

<http://bit.ly/tlampdemo>

Turbo LAMP Presentation Delivered at IBM Enterprise 2014 Conference

<http://bit.ly/tlampent2014>

Latest copy of this White Paper

[http:// bit.ly/tlampwhitepaper](http://bit.ly/tlampwhitepaper)

Turbo LAMP virtual server at SiteOx

<http://www.siteox.com/tlamp>

Turbo LAMP Functional Test Environment at IBM Power Development Platform

https://www-304.ibm.com/partnerworld/wps/servlet/ContentHandler/stg_com_sys_power-development-platform

7.2 POWER8 / POWERKVM

IBM Power System S812L and S822L Product Page

<http://www-03.ibm.com/systems/power/hardware/s812l-s822l/>

IBM Power System S812L and S822L Technical Overview and Introduction, REDP-5098

<http://www.redbooks.ibm.com/abstracts/redp5098.html?Open>

IBM POWER8 processor and memory buffer products: Leadership performance and open innovation for big data and cloud

http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=PM&subtype=BR&htmlfid=POB03049USEN&attachment=POB03049USEN.PDF&ap pname=STGE_PO_PO_USEN_BR#loaded

IBM PowerKVM Configuration and Use, Redbook SG24-8231

<http://www.redbooks.ibm.com/redpieces/abstracts/sg248231.html?Open>

IBM PowerKVM Redbook Solution Guide

<http://www.redbooks.ibm.com/abstracts/tips1205.html?Open>

Optimizing a PowerKVM guest using PCI passthrough

<http://bit.ly/PowerKVM-optimize-pcipassthrough>

7.3 MELLANOX

Adapter- ConnectX

http://www.mellanox.com/page/products_dyn?product_family=127&mtag=connectx_3_en

http://www.mellanox.com/oem/ibm/products_40gbe.php

Select Power section for OS and Server support.

Switch - SX1036

http://www.mellanox.com/page/products_dyn?product_family=115&mtag=sx1036

Cables – LinkX

http://www.mellanox.com/page/interconnect_overview

http://www.mellanox.com/page/cables?mtag=cable_overview

CloudX

<http://www.mellanox.com/cloudx/>

7.4 ZEND

Zend Server home page:

<http://www.zend.com/en/products/server>

Zend Server Z-Ray:

<http://www.zend.com/en/products/server/z-ray-top-7-features>

What customers think about Zend Server:

<http://www.zend.com/en/resources/case-studies>

Zend Server User Guide:

<http://files.zend.com/help/Zend-Server/zend-server.htm>

Zend Continuous Delivery:

<http://www.zend.com/en/solutions/continuous-delivery>

Zend Cloud Solutions

<http://www.zend.com/en/solutions/cloud-solutions>

7.5 MARIADB

For more Information On MariaDB please visit

<https://mariadb.com>

IBM Power Systems solution for MariaDB

HTTPS://MARIADB.COM/SITES/DEFAULT/FILES/IBM_POWER_SYSTEMS_SOLUTION_FOR_MARIADB.PDF

7.6 UBUNTU SERVER 14.04 LTS

General Information:

<http://www.ubuntu.com/server>

Server Management:

<http://www.ubuntu.com/server/management>

Ubuntu Server in the Cloud:

<http://www.ubuntu.com/cloud>

Download Ubuntu Server:

<http://www.ubuntu.com/download/server>

Installation Guide:

<http://www.ubuntu.com/download/server/install-ubuntu-server>

Ubuntu Server Guide:

<https://wiki.ubuntu.com/DocumentationTeam/SystemDocumentation/UbuntuServerGuide>

<https://help.ubuntu.com/14.04/serverguide/>

7.7 UBUNTU MAAS

MAAS General Information:

<http://www.ubuntu.com/cloud/tools/maas>

MAAS Home Page:

<http://maas.ubuntu.com/>

MAAS User and Development Documentation:

<http://maas.ubuntu.com/docs1.5/install.html>

7.8 UBUNTU JUJU

Juju General Information:

<http://www.ubuntu.com/cloud/tools/juju>

Juju Home Page:

<https://juju.ubuntu.com/>

Install Juju:

<https://juju.ubuntu.com/install/>

Juju User and Charm Author Documentation:

<https://juju.ubuntu.com/docs/>

Try the Juju GUI:

<https://jujucharms.com/>

Juju Core Source Code:

<https://github.com/juju/juju>

Download Charms Including Source Code in this Demo:

<https://code.launchpad.net/~ibm-demo/>

<https://code.launchpad.net/~ibm-demo/charms/trusty/zend-server/trunk>

Upstream:

<https://github.com/afroyd/Zend-Server-juju>

<https://code.launchpad.net/~ibm-demo/charms/trusty/mellanox/trunk>

<https://code.launchpad.net/~ibm-demo/charms/trusty/maria/trunk>

Upstream:

<https://launchpad.net/~dbart/charms/trusty/mariadb/trunk>

<https://code.launchpad.net/~ibm-demo/charms/trusty/haproxy/trunk>

<https://code.launchpad.net/~juju-gui-charmers/charms/precise/juju-gui/trunk>

7.9 RED HAT ENTERPRISE LINUX

About RHEL

<http://www.redhat.com/en/technologies/linux-platforms/enterprise-linux>

RHEL Download

<https://access.redhat.com/downloads>

7.10 OPENPRO

OpenPro ERP Solutions Version 8.0

http://openpro.com/pr_02172015.html

7.11 HARRIS DATA

For more information on HarrisData please visit

<http://www.harrisdata.com/>