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Speed to Market with Open Source

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Point-of-View

Highlights

Businesses and organizations are expected to deliver up-to-date applications faster and more often than ever before. Meeting these expectations requires rapid dynamic development cycles and the confidence of knowing new and existing services are both secure and can sustain high availability, scalability, and performance.

This IBM Redbooks® Point-of-View publication shows the value of blending open source technologies and platform capabilities from initial conception through service delivery.

Delivering new services to your clients quickly and frequently

The emergence of the application programming interface (API) and app economy, smartphones, and other digital devices are forcing businesses and organizations to establish environments where reliable applications can be released faster and more frequently to the market. And new demands on IT are increasing daily. IT managers often have to make choices about how to meet service-driven deadlines while also:

- Prioritizing the needs of the development community for the latest open source tools, languages, and runtimes.
- Ensuring operational requirements for performance, availability, and security are satisfied.
- Assessing the impact on the user experience throughout the development and implementation phases.

Traditional software delivery practices are insufficient in achieving these goals. Instead, agile and lean principles are replacing existing development and deployment methods. At the core of these principles, wasted effort is eliminated by breaking down artificial barriers between application developers, testers, and IT operations. With this, comes a more aggressive service-driven approach called *DevOps*.

The DevOps approach is multi-platform, and the principles are the same whether the application runs on a virtual machine, in a clustered environment, or in the cloud. This approach can be applied to any development effort, from enterprise applications such as back-end banking systems, to more client facing products, such as smartphone apps. The DevOps approach allows for applications to be built, tested, and deployed in rapid cycles that are aimed at delivering continuous, incremental improvements. This fast-paced approach puts new demands on the IT infrastructure, especially the platform.

To be effective, DevOps requires a highly virtualized environment that provides developers, testers and deployers with the resources at their finger tips. The software tooling must be simple to use and effective. Open source technologies is collective power in action and provides tooling to assist with the rapid development, testing, and deployment of modern applications. In addition, there must be an operational layer of tools to deploy applications and to manage multiple environments. The IT platform must provide:

- Immediate provisioning of build, test and deploy environments
- High levels of integrated hardware and software virtualization to meet fluctuating demands

- Shorter paths to resources for improved performance
- A consistent securable method of protecting resources and data
- Resource management to share components across the entire service life cycle
- The ability to analyze data real-time

The right blending and balance of open source technologies, ISV tools, and IT platform is key to enable businesses and organizations to deliver change at a much quicker pace. And IBM® has created an ecosystem of clients, business partners, and ISVs who are engaging in an open source development community to bring the most important and most sought-after foundational open source technologies to its IT platforms. In addition, IBM is a member of many open-standard organizations and software governance consortia that help to shape the future of open source software.

Open source and platform blending

The complementary blending of a robust and securable hardware platform with the power of a Linux distribution can optimize the building, testing, and deploying of modern applications and is positioned to accommodate scale-out clusters and scalable clouds.

Ubuntu is a supported open source software Linux distribution that includes access to a wide range of software and packages to provide the appropriate tooling for the build, test, and deploy environments.

IBM LinuxONE is a platform that is designed for open source applications. It provides both upward and outward scaling, unparalleled levels of virtualization, and a large number of processing units, including specialized processors for cryptography, I/O, and performance related functions.

Blending the Ubuntu with LinuxONE can provide the following benefits:

- Speed to market
- Automated management and control of services
- Security layers to protect firmware, software, and data
- Availability, performance, and scalability of environments

Developers can access the virtual environments they need to build, test and deploy their applications. Each virtual environment can be provisioned to meet specific needs in minutes as opposed to days or weeks, as illustrated in Figure 1.

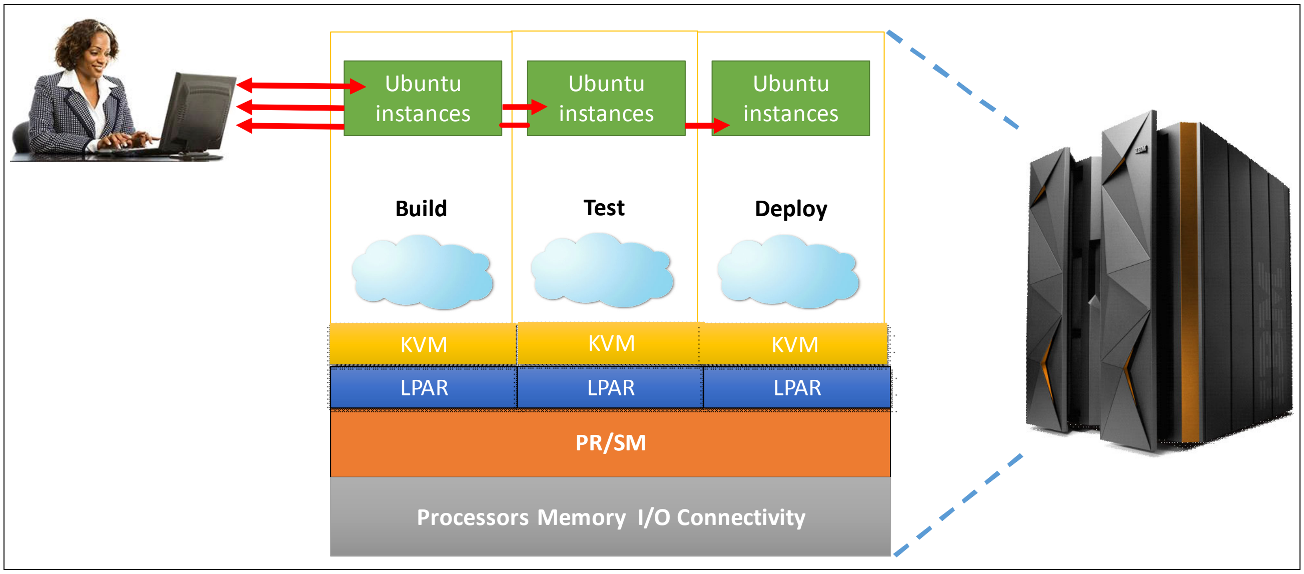


Figure 1   Developer access to environments

Speed to market with Ubuntu and LinuxONE

Businesses and organizations now require a broad range of services to meet the opportunities that are made possible through digital devices and open source applications to provide important services to customers, partners, and employees. The delivery time is crucial. Being second is a harder pill to swallow in a rapidly changing market of consumer expectations.

Ubuntu with LinuxONE can supply enablers to open up new opportunities, such as:

- Fast provisioning of virtual machines and on premises cloud environments for:
  - Agile single and parallel development containers
  - Multiple testing containers
  - Pre-production operational quality check
  - User training containers
  - Operational integration
  - Customer support
  - Test driving new technologies
- API exploitation
  - Easy to consume APIs
  - Full conversant with REST APIs
- Choice of integrated tooling

Open Source tooling is available across the build, test, and deploy environments.

Open source service orchestration

The speed and agility of resource provisioning is key to efficient DevOps. Projects that suffer delays waiting for hardware acquisition, software tooling, or set up of resources are not an option. These types of delays are unacceptable if agile iterations are to be met. Virtual machines and clouds must be readily available—and be easily modified—if projects are to deliver at speed to market.

A diverse and growing ecosystem enables developers to choose from a broad collection of tools to build applications and solutions and be confident the physical platform will support their choice of tools.

Tools such as Ubuntu Juju enable the deployment of entire workloads in just a few clicks. Juju works on public and private clouds built with OpenStack. Services can be configured and managed using Juju and deployed to public and private clouds with only a few commands. Hundreds of pre-configured services are available in the Juju store to save time and effort on implementing a service deployment. It’s a matter of choosing how many nodes the new service needs and then applying a pre-written *charm* to create the deployment. (*Charms* are sets of scripts that simplify the deployment and management tasks of specific services) As the needs change, the flexibility to monitor, scale, and adjust deployment parameters in real time is available, and when a service deployment is no longer required, Juju can remove it.

Continuous delivery for DevOps

The fast moving world of open source brings new applications and APIs daily. The challenge is to capture new and relevant offerings but to maintain the integrity and security of applications, APIs, and data at the same time. Ubuntu is frequently updated to keep pace with the fast moving open source community and potentially to offer further possibilities for optimizing development practices and service deployment.

Quality of service

Fast development and high performance require both the software and the platform to be available. Strong virtualization is the key to providing and sustaining the availability of robust production environments and ever-changing development environments. The open source software must complement the platform’s capabilities to achieve the demands on availability, scalability, and performance. LinuxONE is designed to accommodate all of these aspects.

Automated management and control of services

LinuxONE complements Ubuntu in meeting the DevOps approach through a highly virtualized environment that supports individual virtual machines, clustered nodes, and public, private, or hybrid clouds.

As shown in Figure 2, each layer of virtualization provides a level of flexibility that developers and testers use to deliver their applications quickly to market. The virtualized environments reduce the amount of physical resources necessary to connect multiple virtual machines, or nodes, and their associated resources.

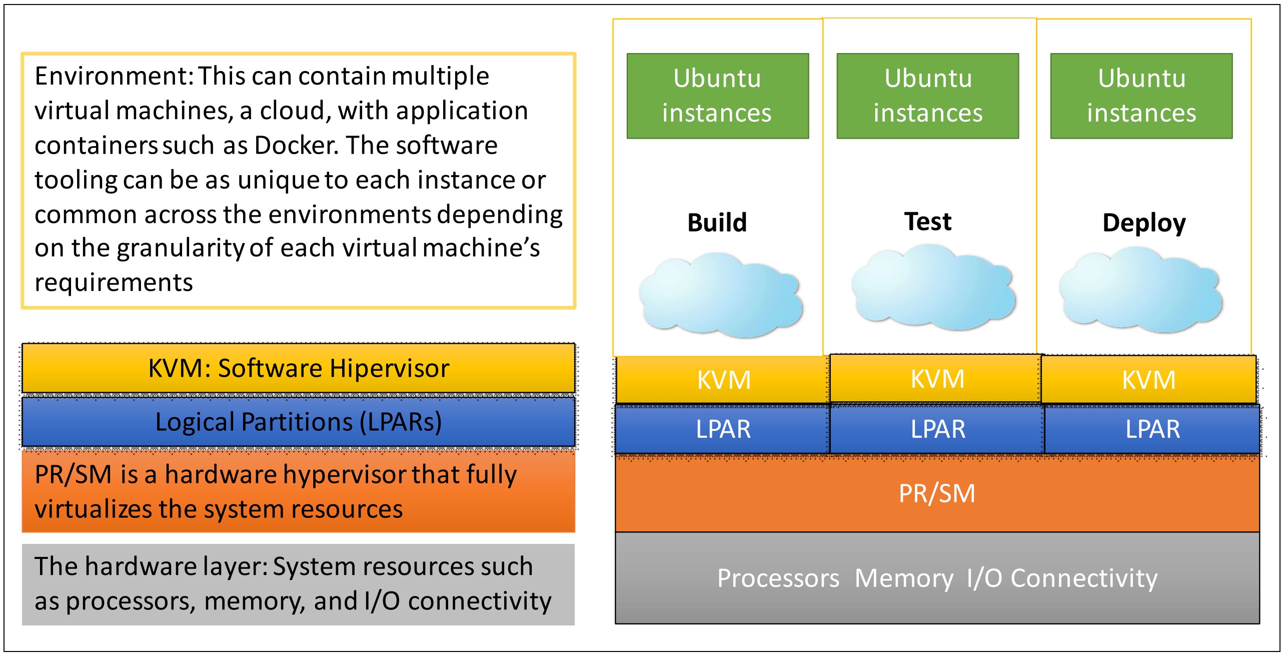

Environment: This can contain multiple virtual machines, a cloud, with application containers such as Docker. The software tooling can be as unique to each instance or common across the environments depending on the granularity of each virtual machine's requirements
KVM: Software Hipervisor
Logical Partitions (LPARs)
PR/SM is a hardware hypervisor that fully virtualizes the system resources
The hardware layer: System resources such as processors, memory, and I/O connectivity
Ubuntu instances
Ubuntu instances
Ubuntu instances
Build
Test
Deploy
KVM
KVM
KVM
LPAR
LPAR
LPAR
PR/SM
Processors Memory I/O Connectivity

Figure 2 Virtualized environments

Virtualized environments

Virtualized environments are created using hypervisors at the following levels:

- Hardware hypervisor
- Software hypervisor

Hardware hypervisor

IBM Processor Resource/Systems Manager™ (PR/SM™) is the LinuxONE hardware hypervisor. The physical layer is the hardware such as processing units, memory, and I/O devices. The physical machine can be divided into logical partitions (LPARs). Virtualization at the hardware level allows the systems administrator to overcommit certain resources to improve overall efficiency.

What does overcommit mean? Let us suppose there are four physical processing units on the LinuxONE platform. When defining the LPARs, we might define three LPARS and assign three logical processing units to each LPAR, which is a total of 3*3=9 logical processing units. The logical processing units are “mapped” against physical processing units. So, the total number of nine logical processing units is greater than the four physical processing units. However, each operating system will believe it has three processing units available to it.

Memory can be allocated to different LPARs and is managed and controlled to provide isolation for integrity and security purposes as required. I/O devices such as disks and tapes can be shared between LPARs and therefore data can pass from one LPAR to another. Fibre Channel (FC) is the standard protocol for communicating with SAN fabrics and accessing FCP/SCSI devices. Network connectivity can be shared across LPARs and support internal and external industry-standard LAN communications.

Software hypervisor

In addition to the virtualization at the hardware level there is an addional level of virtualization. The kernel-based virtual machine (KVM) is a software virtualization technology that enriches the LinuxONE hardware virtualization support. KVM runs in an LPAR and can schedule tasks, dispatch processing units, manage the allocated memory, and interact with I/O devices (storage and network) via PR/SM.

KVM creates Ubuntu instances as processes to provide I/O device emulation and device virtualization inside the Ubuntu instance. Table 1 summarizes KVM on LinuxONE key features.

Table 1 KVM on LinuxONE key features

Feature	Benefit
KVM hypervisor	Supports running multiple Ubuntu instances on a single LPAR
CPU sharing	Allows for the sharing of CPU resources by Ubuntu instances
I/O sharing	Enables the sharing of I/O resources among Ubuntu instances
Memory and CPU over-commitment	Supports the over commitment of CPU, memory, swapping and inactive memory
Live virtual machine relocation	Enables workload migration with minimal impact
Dynamic addition and deletion of virtual I/O devices	Reduces downtime to modify I/O device configurations for Ubuntu instances
Thin-provisioned virtual machines	Allows for copy-on-write virtual disks to save storage
Hypervisor performance management	Supports policy based, goal orientated management and monitoring of virtual CPU resources
Installation and configuration tools	Tools available to configure KVM for LinuxONE
Transactional execution use	Provides improved performance for running multi-threaded applications

Note: PR/SM can be used to allocate memory to LPARs. KVM can then be used to overcommit memory to the virtual machines running in the LPAR in much the same way as a processing unit might be used to maintain integrity and security.

Performance

Priorities can be assigned to LPARs with various weighting factors to achieve the right balance of resources at the right time in the right LPAR. Hypervisors can provide more granular performance control of Ubuntu instances. In addition to the standard processing units, LinuxONE includes dedicated processors for handling I/O, thus enhancing performance by allowing the standard processing units to continue work during I/O operations.

Applications deployed on LinuxONE can be designed to use simultaneous multithreading (SMT) to increase processing efficiency and throughput. Single-instruction, multiple-data (SIMD) encourages further performance enhancements in analytics where information is key to be predictive, real-time, or within a time period that provides the best insight for the application.

Network connectivity enters the LinuxONE platform physically but can then be securely directed to virtual environments making high use of the virtualization and minimizing physical paths from virtual machine to virtual machine and from LPAR to LPAR. A Hardware Management Console (HMC) is available to configure the platform.

Figure 3 illustrates the LinuxONE storage and network connections.

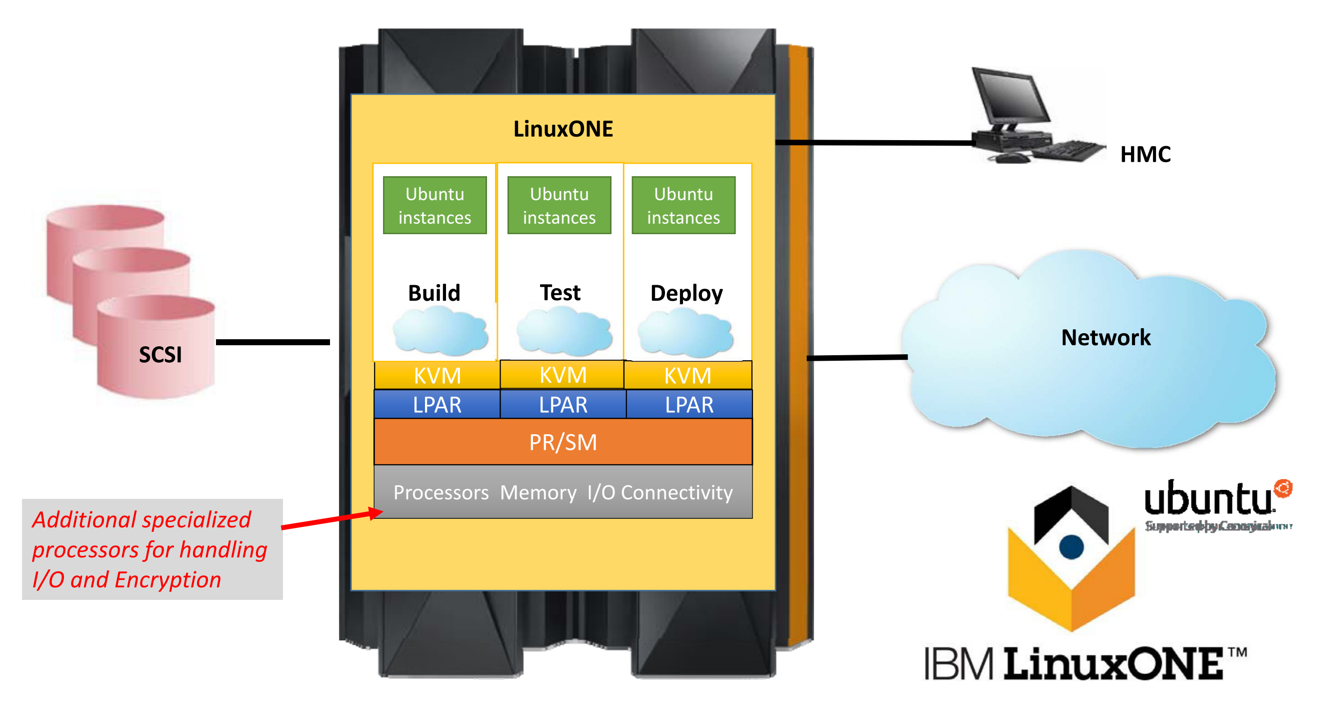


Figure 3 Storage and network connections

Dynamic Partition Manager

Dynamic Partition Manager (DPM) is a management infrastructure tool available for IBM LinuxONE™ that is available via the HMC. It is intended to simplify virtualization management through a guided management interface to define the LinuxONE hardware and virtual infrastructure, including integrated dynamic I/O management that runs the KVM hypervisor. Typical uses of DPM include:

- Create and provision an environment, including new partitions, assignment of processors and memory, and configuration of I/O adapters
- Manage the environment, including the ability to modify system resources without disrupting workloads
- Monitor the environments to maintain system stability and prioritized resource consumption

Security layers

LinuxONE can be configured to isolate or share data at different levels. Isolation can occur at different levels, such as the application, operating system, and hypervisor level.

Cryptography

The option to fully encrypt data is available by using dedicated cryptographic processors. These cryptographic processors are additional to the standard processing units that process the applications, thus gaining valuable performance throughput by off loading the encryption tasks onto these specialized cryptographic processors.

Architectural expansion, compatibility, and longevity

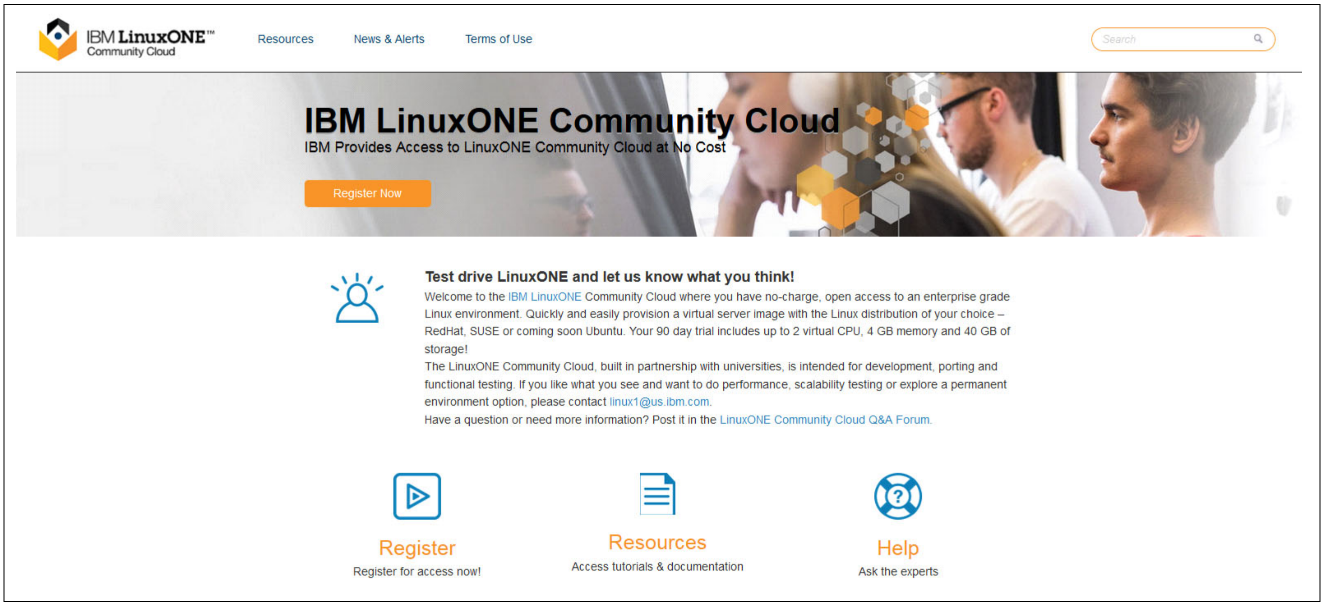
The architecture must allow for changes in both the hardware and software to continue meeting rapidly changing needs. If the hardware and software components reach functional saturation then the architecture itself must expand (not change) to allow the hardware and software to grow and still be compatible with previous iterations and deployments. LinuxONE is founded on a solid and proven architecture.

What's next: How IBM can help

Register with the IBM LinuxONE Community Cloud for access to lots more resources and give it a try! Simply go to:

`http://www.ibm.com/Linuxone/try`

Figure 4 shows to IBM LinuxONE Community Cloud welcome screen.



IBM LinuxONE Community Cloud

IBM Provides Access to LinuxONE Community Cloud at No Cost

Test drive LinuxONE and let us know what you think!

Welcome to the IBM LinuxONE Community Cloud where you have no-charge, open access to an enterprise grade Linux environment. Quickly and easily provision a virtual server image with the Linux distribution of your choice – RedHat, SUSE or coming soon Ubuntu. Your 90 day trial includes up to 2 virtual CPU, 4 GB memory and 40 GB of storage!

The LinuxONE Community Cloud, built in partnership with universities, is intended for development, porting and functional testing. If you like what you see and want to do performance, scalability testing or explore a permanent environment option, please contact linux1@us.ibm.com.

Have a question or need more information? Post it in the LinuxONE Community Cloud Q&A Forum.

Figure 4 IBM LinuxONE Community Cloud

Resources for more information

For more information about the concepts highlighted in the paper, see the following resources:

- IBM LinuxONE

  `http://www.ibm.com/LinuxONE/Ubuntu`

- IBM KVM for z Systems

  `http://www.ibm.com/systems/z/solutions/virtualization/kvm/`

- Ubuntu

  `http://www.ubuntu.com`

- JuJu

  `http://www.ubuntu.com/cloud/juju`

- IBM LinuxONE Juju blog

  `http://insights.ubuntu.com/2016/01/28/ibm-linuxone-gets-its-juju/`

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REDP-5354-00

ISBN 0738455245

Printed in U.S.A.