



Open for the Digital Business — IBM Announces LinuxONE Systems

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Management Summary

Ties go from skinny to wide and now they are back again. Skirt lengths go up and down and now, well it's hard to tell. The sweet spot for cars go from really big to small and back to big once again. One of the benefits of having been in the IT industry for more than 45 years is getting to see that trends and tendencies often repeat themselves, nevertheless youthful observers and participants may see the latest trend as something truly new, since it was “before their time” when it last occurred. Going back to define the future often means that the circumstances of the past may have returned in some way.

The IBM System 360 mainframe was conceived and designed to unify all of IBM's customers' workloads onto a common architecture with a wide-range of capacity. This was done as the most rational means of lowering the overall costs of computing. While the vocabulary may have changed and many applications and data now run on open source derived operating systems such as Linux, some things haven't changed, as the focus still is on running workloads in the most effective and economically efficient manner. The IBM mainframe has emerged and evolved through many generations into a multi-user, multi-application, be it commercial or scientific, the home of all enterprise data, or the transaction engine that drives daily business operations. While the mainframes of the 1960s and 1970s were quite limited in computing capacity (even in comparison to today's smartphones), they were perceived as monoliths because they were relatively expensive and physically large, and secured in a “glass house”. Given the perceived high costs, the primary goal was to keep the system fully utilized. Either a system was shared by many users and departments within the same business entity or the user “bought time” on a publicly-shared system offered by entities known as a “service bureau”. Today, we call them “cloud providers”. In general terms, users could pay for only the resources their application used, often simplified as a measure of CPU time. Today, we call this “pay-for-use”, which is in contrast to “pay-for-it-all”. Today, most larger systems fall into the “pay for it all” category; the burden falls on the user (or, more likely, the user's IT department) to optimize its use. Buying too much or buying too little usually leads to unacceptable economic or operational problems. The challenge for many data center managers is to procure just the right amount of resources and, as a result the emergence of several large and dominant public clouds is due in no small part to the need to alleviate that conundrum of not having quite the right capacity at the right time.¹

In parallel, and if probed beneath its surface and hype, as a response to the same

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¹ The Clipper Group has made the argument that today's IBM z Systems are de facto cloud infrastructures. See *IBM zEnterprise is Enterprise Cloud Infrastructure* in **The Clipper Group Navigator** dated April 29, 2014, and available at <http://www.clipper.com/research/TCG2014008.pdf>.

market forces driving lowering costs and optimizing resources, is the emergence of “open systems”, which today is dominated by the *Linux* operating system and its derivatives. Over several decades as the industry matured, the many competitive hardware and software vendors plunged the IT world into a plethora of differing “standards”, even within the same vendor’s domain. The costs of handling the many environments, including the burden of staffing and understanding how all the pieces fit together to achieve optimal efficiency, proved to be extremely challenging for most and unachievable for many. This led to the emergence of the open-source communities and such entities as the former *Open Software Foundation* and, more recently, the *Open Group*² and the *Linux Foundation*³, among others.

For the purposes of this paper, let us describe open systems as a set of standards that enables a high degree of inter-communications and interchangeability for hardware (servers, networking, peripheral devices) and software (operating systems, hypervisors, languages, user interfaces, development tools, database managers, security, system management tools) that are freely available in the market, though not necessarily free of charge. *How has IBM Systems responded to this combination of market requirements? With the launch of LinuxONE.*

At Clipper, we believe that many mid-sized and larger data centers really want a scalable open solution with all of the open environments and tools that are commonly used plus a reasonable pay-as-you-go economic model. Add to that the need to be able to run applications and protect data in a highly-secure way. IBM answers the call with the announcement of the *IBM LinuxONE System*.

- **Offering the most popular Linux environments and tools** for development, deployment and administration.
- **And a scalable Linux solution** capable of handling large, diverse and often interrelated workloads and getting the work done in short order (i.e., via a lot of Linux virtual machines).
- **With enough proven security and protection** to satisfy the most

stringent requirements of the largest enterprises.

- **With pay-as-you-go and pay-for-what-you-use financial terms** that reduce the cost of running applications and databases (in comparison to what you now are doing).

Please read on to learn more about LinuxONE and how it satisfies these requirements.

IBM LinuxONE – An Open System Portfolio for Business-Critical Applications

LinuxONE systems are based on proven technology from IBM’s z Systems line and can run the most popular open-source software and tools that work as seamlessly as they would on the most popular distributed servers.

- **In the operating environment domain** – *SUSE* and *Red Hat* enterprise-editions of Linux and *Canonical’s Ubuntu* now are offered as operating systems, the latter of which is well recognized for its scale-out capabilities, and its performance, security, and robust set of management tools. *SUSE Linux* under KVM is now available on LinuxONE; it is expected under KVM in 2016 on *Ubuntu*, and *Red Hat (RHEL)* under KVM seems likely.
- **In the language domain** *Python*, *Pearl*, *Ruby*, *Rails*, *Erlang*, and *Node.js*, as well as *Java*, are available.
- **In the database domain** – *MongoDB*, *MariaDB*, and *PostgreSQL* with demonstrable performance gains compared to Intel-based servers. Also, *IBM DB2LUW* and *Oracle DB* are available.
- **In the analytics domain** – *Apache Spark*⁴ and *Tools with Hadoop*, as well available *IBM Big Insights*, and *IBM DB2BLU*.
- **In the simplified management and development ops domains** – several significant happenings. In a landmark demonstration of open-source support,

² See <http://www.opengroup.org/aboutus>.

³ See <http://www.linuxfoundation.org/about>.

⁴ Additionally, IBM will offer Apache Spark as a service on IBM’s *Bluemix* integrated development platform and will be making investments to drive Spark into the core of its analytics and commerce platforms.

IBM and VMware will provide the capability to provision and orchestrate LinuxONE as a part of a cloud through the *VMware vRealize* cloud management platform, linking through the open-source *OpenStack* cloud operating system. In addition, *Docker* containers⁵ are supported. Additional system management and deployment tools available include *IBM WAVE*⁶, *IBM Cloud Manager*⁷, *IBM Urban Code*⁸, *Chef*⁹, and *Puppet*¹⁰.

Landmark IBM Open Contributions Make the Difference

In collaboration with the Linux Foundation, IBM, as well as a number of other academic, government, and corporate partners, is supporting the *Open Mainframe Project*. This is a direct response to the critical mass of users and vendors that need to work together to advance Linux tools and technologies, the goal of which is to foster the increase of enterprise innovation. IBM's contribution is the largest single contribution of mainframe code from IBM to the open source community. A key part of the code contributions are IT predictive analytics that constantly monitor for unusual system behavior and help prevent issues from turning into failures. Essentially, IBM is handing over one of its mainframe jewels to the open-source

community in the form of the *zAware*¹¹ capabilities that were announced in August 2012. IBM already had declared its intention to port this tool to Linux on z Systems and, thus, this is the fulfillment of that promise, albeit in a context that would have been difficult to imagine earlier. The code can be used by developers to build similar sense and respond resiliency capabilities on other system platforms.

To get the ball rolling, IBM is creating the *LinuxONE Community Cloud* to provide open access to the LinuxONE. This is a cloud instance for the creation, testing, and piloting of applications spanning mobile, hybrid cloud, and high performance analytic solutions. This service will be available through multiple university sites *at no cost*. IBM also has created a special cloud for independent software providers (ISVs) hosted at IBM sites in Dallas (U.S.), Beijing (China), and Boeblingen (Germany), that will provide application vendors access and a free trial to LinuxONE resources to port, test and benchmark new applications for LinuxONE.

Why Does All This Matter?

Arguably, today's IBM LinuxONE is among the most open systems platform available today. There are virtually no barriers to the deployment of any Linux-enabled application, tool, database, or any other software you can imagine on a LinuxONE system. More choice is enabled and much more scale-up (and down) is enabled. This provides a huge opportunity for server consolidation at much higher levels of security and resilience. And here is the deal-closer – your sys admins, data managers, developers, and operations staff does not need to be retrained because they will be using all the same tools that support your enterprise's distributed Linux systems with which they are intimately familiar. This translates into very tangible cost savings and an opportunity to expand the horizons of your enterprise's IT portfolio and services. Moreover, by virtue of the broad spectrum of membership in the Open Mainframe Project, IBM is not the only vendor that is part of

⁵ Docker containers enable wrapping all the software an application needs to run guaranteeing that it will always run the same regardless of the environment in which it is running. See <https://www.docker.com/whatisdocker>.

⁶ See *Why the IBM Mainframe is the Right Place for Enterprise Systems of Engagement and Insight* in **The Clipper Group Navigator** dated February 17, 2015, and available at <http://www.clipper.com/research/TCG2015002.pdf>.

⁷ See *IBM Enterprise Cloud Server — A Faster and Better On-Ramp to Cloud Infrastructure* in **The Clipper Group Navigator** dated June 12, 2014, and available at <http://www.clipper.com/research/TCG2014014.pdf>. The Enterprise Cloud Server offering is no longer available.

⁸ Urban Code Deploy orchestrates and automates the deployment of applications, middleware configurations and database changes into development, test and production environments as often as needed, on demand or on a schedule. See <https://developer.ibm.com/urbancode/>.


⁹ Chef "codes" the underlying infrastructure, automating the build, deployment, and management of the infrastructure. See <https://www.chef.io/chef/>.

¹⁰ Puppet automates the software delivery process, including provisioning, orchestration, and reporting from the beginning of development, through testing, production release, and updating. See <https://puppetlabs.com/puppet/what-is-puppet>.

¹¹ For more detail on zAware, see **The Clipper Group Navigators** entitled *The IBM zEnterprise EC12 - Bigger, Better, Faster*, dated August 28, 2012, and available at <http://www.clipper.com/research/TCG2012019.pdf> and *Addressing New Business Analytics Challenges - When the IBM zEnterprise Really Makes Sense*, dated December 21, 2012, and at <http://www.clipper.com/research/TCG2012030.pdf>.


Exhibit 1 — Meet the IBM LinuxONE Platforms

THE MOST TRUSTED, EFFICIENT AND HIGH PERFORMANCE ENTERPRISE-GRADE LINUX PLATFORM



IBM LinuxONE Emperor™

The ultimate flexibility, scalability, performance and trust for business critical Linux applications. With a huge capacity range you can grow with virtually limitless scale to handle the most demanding workloads



IBM LinuxONE Rockhopper™

An entry point into the LinuxONE Systems family offering all the same great capabilities, innovation and value of LinuxONE with the flexibility of a smaller package

LinuxONE™

Source: IBM

this commitment to Linux-based systems¹². There is an enormous amount of talent and resources being put into this effort, not to speak of its enthusiasm; this will be something that will be hard to ignore, whether you are already on the mainframe bandwagon or not.

IBM LinuxONE – A System That Fits

Befittingly, and with a bit of whimsy, IBM has named the two LinuxONE systems after penguin species. (See Exhibit 1 above.) The largest system is called *Emperor*, which is based on the *IBM z13* technology¹³, and the midsize system is named *Rockhopper*, and is based on the *IBM zBC12* technology¹⁴. (Although there are 16 other known penguin species, because of the scalability and granularity of these two systems, we are not likely to see many more systems “hatched” from the current templates.)

The simplest way to describe each of these systems is to see the z13 and the zBC12, as donor systems and the LinuxONE manifestations with the capability to only run Linux with

1-to-141 LinuxONE cores in the Emperor and 1-to-13 LinuxONE cores in the Rockhopper – but with the same memory and networking options that are available on their donor systems. Virtualization and hypervisor support is provided by *PR/SM*, along with *z/VM*, and *zKVM*¹⁵, thus providing the capability to concurrently host up to 8000 Linux virtual machines on a maximum configured Emperor¹⁶. (This is workload dependent and your results may vary.)

It is not feasible to state the capacity of each of the LinuxONE systems in absolute terms, but those familiar with the z13 or the zBC12 can make their own judgment based on the range of LinuxONE cores that are available. And based on the origin of their technology, all the qualities of service that is expected and provided by IBM mainframe systems will carry over into the LinuxONE systems – including security, resource allocation, workload management, dynamic scaling, and continuous operations availability. For instance, *GDPS*¹⁷ in-transaction recovery for Linux-only environments is offered for high availability environments. **Your data center is in no way compromised when you include a LinuxONE system.**

¹² For more information on Open Mainframe Project membership, see <https://www.openmainframeproject.org/news/announcement/2015/08/linux-foundation-brings-together-industry-heavyweights-advance-linux>.

¹³ For more detail on the z13, see [The Clipper Group Navigator](http://www.clipper.com/research/TCG2015001.pdf) entitled *The IBM z Systems and the New IBM z13 - Ready to Transform Your Enterprise*, dated January 26, 2015, and available at <http://www.clipper.com/research/TCG2015001.pdf>.

¹⁴ See [The Clipper Group Navigator](http://www.clipper.com/research/TCG2013013.pdf) entitled *IBM's zEnterprise BC12 - More of What You Need*, dated August 16, 2013, and available at <http://www.clipper.com/research/TCG2013013.pdf>.

¹⁵ zKVM is IBM's z Systems implementation of the Kernel-based Virtual Machine hypervisor. zKVM does not replace z/VM but has been optimized by making use of the same hardware features. It has also been released for the IBM z13 and the zEC12 and will be available for future versions of the mainframe.

¹⁶ According to IBM.

¹⁷ GDPS = Geographically Dispersed Parallel Sysplex, which allows multiple mainframes, whether all in one data center or in multiple locations, to work together.

IBM LinuxONE – The Pay-As-You-Grow Solution

IBM is attacking the ever-present total-cost-of-acquisition (TCA) concern by introducing a new pricing model, one based on charging - for what is used. The LinuxONE solutions will be offered optionally¹⁸ with a utility-pricing model that is based on “pay-for-use” and known as *Elastic Pricing*. Importantly, there is no upfront payment required and the customer has the right to return all the assets after only one year, making this a very low-risk proposition. The contract has a 36-month fixed-leased component and a 36-month variable-usage component. The variable component has a base utilization rate that, depending on the model, is based on the capacity of the installed LinuxONE cores. Above this threshold, additional charges will apply – on a pay-as-you-go, pay-as-you-grow manner. This model has further been endorsed by SUSE’s recent announcement to offer their Linux Distribution on the same basis solely on LinuxONE platforms.

Capacity Commitment Levels Provides Flexibility and Lowers Risk

LinuxONE Rockhopper TCO

In the case of the Rockhopper model¹⁹, the variable component is based on a capacity commitment level of 50% of the installed LinuxONE cores capacity over the three-year lease period. For instance, if the server is configured with five LinuxONE cores, then the enterprise’s commitment would be for the capacity of 2.5 LinuxONE cores. For the first year at 50% capacity, the total lease payment would be \$56,554, or \$4,713 per month. However, the payment would be proportionally greater if the average utilization over the twelve month period exceeded 50%. Over a three year period the total lease cost at 50% utilization would be less than \$170,000. Compare this to the capital cost of just under \$278,100 for the same equipment. In this example, IBM has priced this offering so that the three-year lease cost, at an average of 70% capacity utilization, is within a short putt of the capital cost, only \$221 per month higher. The key differences here are that the leased platform (with a 50% capacity equal to 2.5 LinuxONE cores) can be cancelled any time after the first year, while the purchased

platform (with full use of all 5 LinuxONE cores at any time), requires paying for the full capacity (of 5 cores), whether they are used, or not.

LinuxONE Emperor TCO

The Emperor model²⁰ is offered with two capacity commitment options. The first is graduated – 25% in the first year, 30% in the second, and 40% in the third. This provides flexibility to manage costs with the expectation of growing needs in the future. As an example, an Emperor model configured with 51 LinuxONE cores over three years using the 25/30/40% graduated commitment would be \$251,244 for the first year and \$965,310 for three years (with an average of 32% utilization across the three years). Compare this to a capital cost of \$2,153,536.²¹ The second option is for a 40% capacity commitment, the equivalent capacity of 20 LinuxONE cores. The three-year lease would cost \$33,404 per month for a total of \$1,202,528, 44% lower than the capital cost. Both models became generally available (GA) on August 17, 2015.

Financial Terms

Payments are monthly and are inclusive of all hardware, one-time charge software with respective three years of support and service. This pricing model is designed for OpEx accounting treatment²² and, after the three-year term, the data center has the choice of returning, buying, or replacing the equipment. If not satisfied or if it is clear that the requirements are much larger than expect, customers have the right to return the system after only one year. The title remains with IBM throughout this period unless, of course, the customer chooses to purchase the assets from IBM during this time.

Linux Software Stack TCO

The IBM Linux software stack is available on a monthly per-core rental basis.²³ Order what is needed, when it is needed, and order additional licenses as needed. Licenses may be decreased or cancelled with thirty days’ notice. These flexible terms and conditions reflect the strong intention to have the customer pay for only what

¹⁸ LinuxONE systems also are available for purchase or lease through IBM Global Financing.

¹⁹ The Rockhopper is designated as Type 2828, with Models H06 and H13.

²⁰ The Emperor is designated as Type 2964, with Models N30, N63, N96, NC9, and NE1.

²¹ The elements of the LinuxONE package include either of the Rockhopper or Emperor servers, z/VM or KVM hypervisor, and zAware with the Emperor model only.

²² The accounting treatment and life-cycle procurement decisions are the responsibility of the procuring enterprise.

²³ PPA and zOTC software are available on monthly licenses; both require implementation of IBM Licensing Management Tool for compliance.

is used. For non-IBM software, it is the customer's responsibility to select, order, install, and maintain that portfolio in the same way that most are already accustomed to doing for their distributed Linux systems.²⁴

Competitively Priced

On the basis of TCO, LinuxONE systems with comparable software configurations will compete very favorably against an equivalent x86 configuration, as well as typical public cloud offerings, and with comparable if not better performance. As a bonus, it will deliver the enhanced security, reliability, and flexibility of an on-premises enterprise-class cloud solution that easily scales to meet an enterprise's needs.

Conclusion

LinuxONE Rockhopper and Emperor are not the first systems based on the z architecture to be offered as a Linux-only platform; the earliest date back to January 2002.²⁵ The 2014 announcement of an entry level zBC12-based ELS²⁶ brought significantly greater scale and improved price-performance to the Linux environment compared to previous offerings.

What is most significant about the LinuxONE announcement is that it signals an unprecedented commitment to:

- Linux on Enterprise Platforms from IBM.
- Open-source software at the breadth and depth equivalent to distributed systems (i.e., Linux on x86).
- A new pay-as-you-go pricing model that simplifies software costs and as a consequence the risks and uncertainty of adopting this solution.
- An invigorated reach toward developing new markets for IBM Systems business.

There are several environments for which LinuxONE systems should be strongly considered.

- **Linux server consolidation** – any data center with more than 200 Linux virtual machines will greatly benefit by lower TCO, environmental costs,

and manpower compared to typical x86 distributed implementations.

- **Non-mainframe data centers** – those desiring mainframe qualities of service, reliability, availability, scalability, and particularly security which their current systems lack.
- **On-premises cloud implementation** – preferring to keep enterprise data managed and secured in-house delivered in an open source framework for maximum flexibility for its developers and application owners.
- **Hosting new technology ventures and sandboxes** considered unsuitable for the current systems of record and where close control of costs and risk is required.

Given the increasing need for performance, availability, security and scale in enterprise applications and the increased popularity and growth in open source implementations, coupled with the pressing need for enterprise agility while still managing tight budgets, there are very few data centers that would not fall into one or more of the examples above. IBM has provided an innovative option, LinuxONE systems, for you to consider now. Are you ready to make your move today?



²⁴ Software pricing models from non-IBM sources may differ in their terms and conditions. Service and support is provided by each vendor, respectively.

²⁵ The first IFL-only mainframe was the *z800 Model OLF*.

²⁶ The Enterprise Linux Server (ELS) solution also included the zEC12, z196, and the z114. See footnote 7 above.

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