

Achieve greater sustainability with IBM LinuxONE and IBM Cloud

Surya V Duggirala, IBM Cloud Platform Engineering Guild Leader

Seongwook Park, Senior Product Manager -LinuxONE Bare Metal, LinuxONE VSI, IBM Z on VPC

Stefan Schmitt, STSM, Solution Architect LinuxONE

Sustainability is one of the key areas of focus for many industries embarking on digital transformation. Sustainable computing focuses on how to make computing more efficient with an end goal of reducing the impact on the environment. Enterprises are looking for serving the existing and future needs of their business through sustainable computing. Sustainable computing spans across many aspects of computing from energy consumption of computer hardware to efficient software practices.

IBM is committed to environmental leadership in all its business activities, right from its operations to the design of its products and use of its technology. The IBM LinuxONE platform is helping clients address their needs for sustainable computing. IBM Cloud is joining this effort making IBM LinuxONE virtual servers available in its data centers.

The sustainability solution architecture described here will help enterprises develop solutions and deploy them both on-premises and on cloud that will enable them to reduce the carbon footprint and save energy costs and software licensing costs as well.

IBM LinuxONE Platform for Sustainable Computing

The IBM LinuxONE platform is designed for sustainable computing. It is uniquely architected and built to handle the multi-workload needs of a modern scalable digital business with the highest qualities of service (QoS) and upmost efficiency. The IBM LinuxONE Emperor 4 delivers massive scalability to support hundreds of workloads in a single system, capable of doing the work of up to 2000 compared x86 coresⁱ.

An IBM LinuxONE Emperor 4 system can significantly reduce your carbon footprint and reduce costs as it is built for energy efficiency. It can reduce the CO2e footprint by approximately 75% each year versus compared x86 servers running the same Linux workloads under similar conditionsⁱⁱ. More details can be found [here](#).



The IBM LinuxONE is an engineered scale-out-scale-up system designed to grow your workloads on the platform and add advanced IT functionality with a minimal increase in energy usage. The LinuxONE Emperor 4 provides better performance with fast cores (5.2 GHz) and larger caches, and more of them. It has many design features like on-chip acceleration for compression, encryption, and AI, hardware optimizations for Java™, and specialized I/O processors. It reduces complexity and supports query optimization by enabling large databases to be deployed on a single server without creating shards.

IBM LinuxONE platform’s ability to dynamically scale resources on demand in the virtualized environment allows partners and customers to use the optimal number of resources needed for efficient business processes. This is the reason why many enterprises focusing on sustainable computing prefer IBM LinuxONE platform for their digital transformation initiatives and why the IBM LinuxONE Emperor 4 has been named a winner of the 2022 SEAL [Sustainable Product Award](#), honoring innovating and impactful products that are “purpose-built” for a sustainable future.

Another reason why 67 out of the [Fortune](#) Top 100 trust their critical workload on IBM zSystems and LinuxONE is its unmatched security, reliability, and availability features. IBM LinuxONE is designed to deliver 99.999% availability and beyond, with redundancy in internal components, including Redundant Array of Independent Memory (RAIM), which detects and recovers from memory failures.

In addition to providing these foundational enterprise features, IBM LinuxONE also provides strong benefits from a sustainability perspective. It’s ability to run more applications, databases in one environment, without impacting performance, throughput, or availability of the overall system, enables enterprises to reduce the used floorspace, cooling and power consumption to a significant extent. These capabilities are recognized by many as seen in this [Forbes’s post](#) on how IBM LinuxONE platform is helping in customers sustainability journey.

Enterprise Workloads most suited for IBM LinuxONE Servers

Even though IBM LinuxONE platform is suitable for many enterprise workload deployments, there are two types of workloads this platform is heavily used for. One use case is consolidation of databases of both SQL (PostgreSQL, DB2, Oracle) and NoSQL (MongoDB) to improve the total cost of ownership (TCO) and benefit from the Qualities of Service (QoS) the platform provides.

A second use case enterprises benefit most is deployment of cloud native container workloads running on RedHat OpenShift platform (OCP). Running container-based workloads fits perfectly into the consolidation of applications and exploiting the advanced resource usage of the IBM LinuxONE platform as shown in Figure 1. The Kubernetes based workload and scaling capabilities combined with the superior hardware consumption and acceleration abilities of IBM LinuxONE will bring even more possibilities to save energy and further reduce the day-to-day costs.

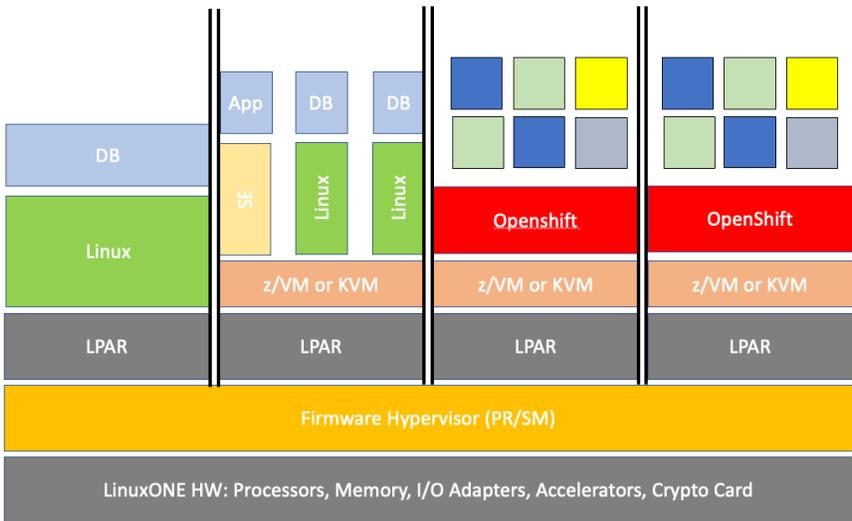
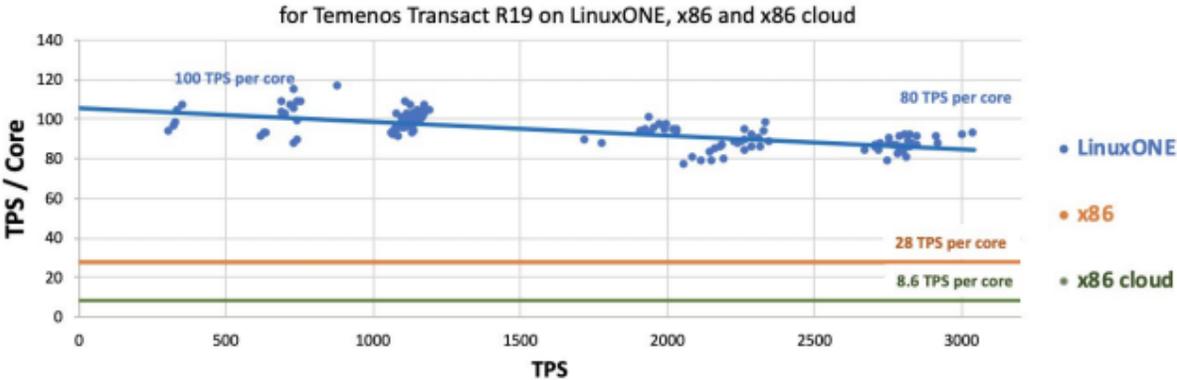


Figure 1. IBM LinuxONE workload deployment reference architecture
 Enterprises can leverage the capabilities of IBM LinuxONE on their private cloud environment as well, to consolidate workloads of different kind on a single compute platform. Enterprises preferring private cloud to deploy their traditional and cloud native container workloads, can benefit immensely by collocating these cloud native workloads with large databases on IBM LinuxONE servers. The IBM Z [collocate applications pattern](#) can help guide here. With its accelerators and hypervisors, IBM LinuxONE architecture provides a perfect fit for large databases or database as a service environment.

Citibank for example consolidates their MongoDB environment on LinuxONE and you can [listen](#) to Martin Kennedy, Managing Director of Citigroup on how this is benefiting their sustainability goals

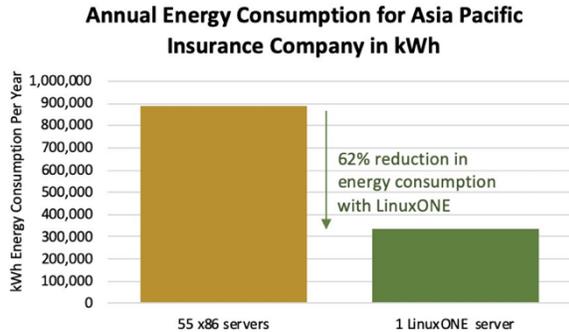
Financial service providers, like Temenos, see the benefit of the platform as well. Temenos Transact, one of Temenos’s larger financial applications shows significantly better per core transaction performance on IBM LinuxONE compared to x86. Using IBM LinuxONE as platform for Temenos Transact results in 2.8 times more transactions per core as compared to an x86 based platform.

Application Server Transactions Per Second (TPS) Per Core



Because of the better per core performance and the resulting consolidation of floorspace and other factors, it is possible to gain TCO savings of up to 56% if Temenos Transact is operated on IBM LinuxONE environment ^{iii iv}. Enterprises can leverage IBM LinuxONE platform in their application modernization journey with these additional TCO savings without losing the benefits of the existing platform, like strong security, hardware acceleration of IO and dynamic allocation of resources.

IT organizations worldwide need solutions to reduce greenhouse gas emissions. A concrete example of this is a large Asia Pacific Insurance company focused on decreasing data center costs and carbon emissions. Figure 3 shows an analysis that discovered that workloads running on 55 x86 servers could



be consolidated onto one IBM LinuxONE system, saving 86% in floor space and 62% in annual energy consumption^v. More examples of how IBM LinuxONE enables customers to consolidate applications like databases or applications on single hardware platform and reduce the need for power, cooling, floorspace, which not only provide a financial benefit of the operations costs, but can benefit from a sustainability point of view too, can be found [here](#).

Figure 3. x86 and LinuxONE Energy and Floor Space Comparisons for Asia Pacific Insurance Company

IBM Cloud Platform for Sustainability

IBM Cloud is committed for reducing carbon emissions and increasing overall energy efficiency across all global data centers. IBM Cloud's first step to achieve this is through selecting renewable energy to power its data centers. IBM Cloud is working towards procuring 75% of its electricity needs for the data centers through renewable energy sources by 2025. IBM Cloud partners with many communities on sustainability initiatives and working on developing a set of tools to help clients measure the carbon footprint for their applications. More details around IBM Cloud centric sustainability initiatives can be found [here](#).

IBM Cloud partners with IBM LinuxONE team in the sustainability initiatives. The benefits of IBM LinuxONE platform can also be available on IBM public cloud via the IBM Cloud LinuxONE Virtual Servers for VPC offering.

As IBM cloud offers LinuxONE platform in the public cloud, we are offering customers options to remove their footprint from their data centers and adopt sustainability of IBM Cloud. Also, we are offering LinuxONE platform options in IBM Cloud, we are offering industry-lead sustainable platform deployment options via IBM Cloud.

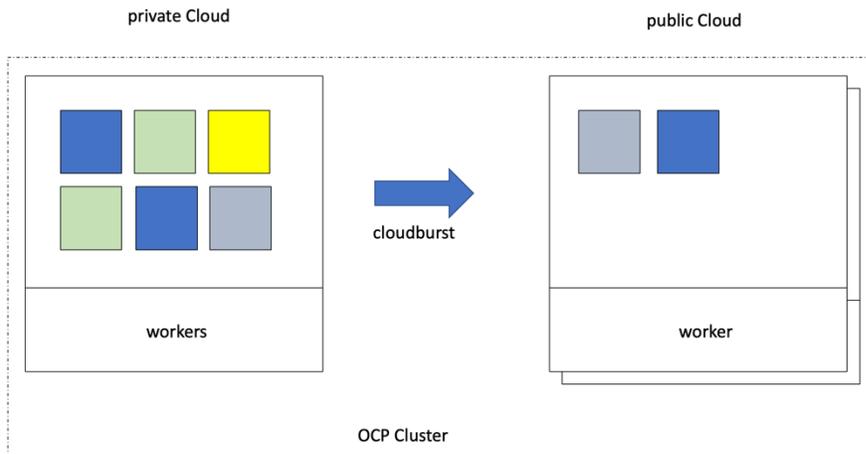
IBM Cloud LinuxONE virtual servers for VPC gives fast-provisioning compute capacity with the highest network speeds and most secure, software-defined networking resources available on the IBM Cloud. This offering is built on IBM Cloud Virtual Private Cloud (VPC) and IBM LinuxONE processors.

There are many options unfolding themselves. Talking about classical setups where development, integration environments would be spun up in the public cloud to provide usage of the resources only when they are needed and use the private cloud resources for production workloads. It will as well enable efficient usage of the private cloud resources, as development, integration systems are not used that heavy as production workload systems.

Another option is shown in Figure 3 below, in the form of cloudburst reference architecture. This architecture will enable enterprises to extend their workload to the cloud based on performance, and workload demand. This can be used to provide additional capacity to existing workloads or it can as well be used to support new workloads. Extending capacity into the cloud will enable enterprises to assess the future growth needs and plan for long term workload growth projections.

Figure 3 below shows applications deployed on a private cloud based RedHat OpenShift cluster deployed on traditional on-premises data center. By extending this cluster into public cloud through IBM LinuxONE Bare Metal Servers, it is possible to increase the capacity on demand and help. It is also possible to have the databases running in the public cloud and private cloud, depending on the regulatory needs and still benefit from the sustainability characteristics of the platform.

Figure 3. Cloudburst Reference Architecture



Some of the potential use cases for IBM Cloud centric offerings around LinuxONE Virtual Servers include the following:

1. Mission critical data serving workloads running on LinuxONE on-premises and development/test/backup/disaster Recovery environment on public cloud
2. Application Modernization with OpenShift Container Platform
 - a. LinuxONE based container life-cycle management
 - b. Extended IBM CloudPaks deployments on IBM Cloud running on LinuxONE
3. Hybrid cloud solutions between on-premises and IBM Cloud
 - a. Own your virtualization with zVM to maximize resource consolidation
 - i. Create 2nd level Linux guest by IBM Z friendly hypervisor to provision Linux with more granular resource allocation to maximize consolidation

IBM LinuxONE and IBM Cloud can help you to define and reach your sustainability goals by using the knowledge and [work IBM](#) put into its products over many years. Like Rural Services Informaticos (RSI) and others describe [here](#) how they benefit from the new IBM mainframe generation and Linux on their digital and sustainability journey. IBM provides an easy-to-use tool to get your own answer to the question “How can I benefit from this?”. The [IBM LinuxONE™ TCO and CO2e Calculator](#) is available to estimate the savings after answering a few simple questions.

Conclusion

Enterprises will benefit from sustainability, scalability, security, reliability, and availability features of IBM LinuxONE platform in their application modernization initiatives. IBM LinuxONE servers are also available in IBM public cloud. Many enterprises will achieve their sustainable computing goals at the same time save on TCO by deploying the workloads on IBM LinuxONE platform.

To learn more:

1. [Sustainability computing through LinuxONE Emperor 4](#)
2. [IBM LinuxONE TCO calculator](#)
3. <https://www.ibm.com/sustainability>

ⁱ This is an IBM internal study designed to replicate a typical IBM customer workload usage in the marketplace. Results may vary. The core consolidation study targeted comparison of the following IBM LinuxONE and x86 servers: IBM LinuxONE Emperor 4 Max 125 system consists of three CPC drawers containing 125 configurable processor units (IFLs) and two I/O drawers to support both network and external storage. Lenovo Think System SR650 (2U) with two 2nd Gen Intel® Xeon® Platinum processors 2.1 GHz, 16 cores per CPU. Both the x86-based and LinuxONE solutions had access to the same storage array. The workloads consisted of a transactional application running on WebSphere Application Server and IBM DB2 simulating core online banking functions. The actual test results were extrapolated to the stated above x86 servers using IDC QPI metrics and IBM sizing methodology using the following assumptions on a typical IT environment of a banking client using x86 servers. The production IT environment has 16 x86 servers running at 50% average utilization. There are 48 x86 servers in the non-production IT environments: development (4 environments with 2 servers each, 8 servers total), development test environment (4 servers), system integration test environment (8 servers), performance test environment (16 servers), user acceptance test environment (4 servers), production fix test environment (8 servers). A typical average CPU utilization is 7% across all non-production environments. An equivalent LinuxONE Emperor 4 solution requires a single Max 125 server running at 85% average utilization across all IT environments separated using LPAR technology

ⁱⁱ IBM Machine Type 3931 Max 125 model consists of three CPC drawers containing 125 configurable cores (CPs, zIIPs, or IFLs) and two I/O drawers to support both network and external storage. 39 Cascade Lake and Ice Lake x86 servers configured to provide same performance. Annual energy required for server operations was 143,962 KW for IBM Machine Type 3931 with 125 cores and 566,448 KW for 39 x86 servers with 2072 cores, so the CO2e footprint would be 62.5 metric tons for IBM Machine Type 3931 and 245 metric tons for x86 servers. CO2e and other equivalencies that are based on the EPA GHG calculator (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>) use U.S. National weighted averages. Results may vary based on client-specific usage and location

ⁱⁱⁱ Choosing a platform for the Temenos Transact banking solution

<https://www.ibm.com/downloads/cas/MJDPLD24>

^{iv} Temenos on strategic partnership <https://www.temenos.com/news/2022/05/26/temenos-announces-expanded-relationship-with-ibm-to-help-tier-one-banks-modernize-with-ibm-linuxone/>

^v Energy savings are based on a workload consolidation assessment conducted by the IBM IT Economics team for an Asia Pacific insurance company running Linux workloads on 55 x86 servers with 3,264 x86 cores versus one LinuxONE Emperor II system with 170 IFLs. Analysis estimates total cost of ownership costs such as hardware, software, labor, floorspace and energy with 38.3 KW for the sized LinuxONE versus 101.6 KW for the x86 environment. The KW numbers are calculated using IBM and vendor published server KW rates and multiplied by 2 for networking and cooling energy consumption based on the client's data center power utilization effectiveness (PUE) of 2, resulting in an estimated reduction from 335K kWh for LinuxONE versus 5.54M kWh for x86. Floor space in use for the 55 x86 servers in the assessment is 42.57 square meters versus an estimated 6.11 square meters for the LinuxONE server. Findings will vary according to individual client environments.