Reduce your IT costs with IBM LinuxONE

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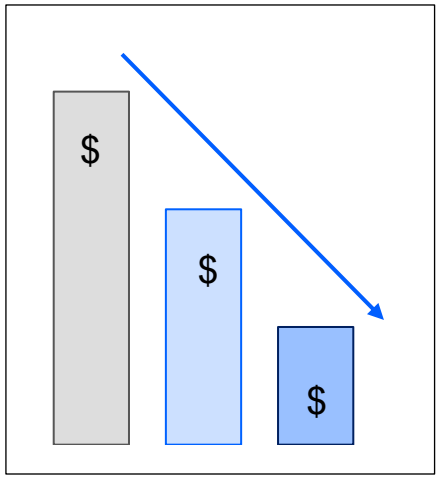
Lower the cost of IT

As your enterprise grows and IT requirements increase, IT spend continues to rise

Some significant IT costs are…

- Software
- Hardware
- Disaster recovery
- Server administration
- Facility costs (energy, floor space)



Understanding your organization's IT charges can help you **lower costs** and optimize IT operations

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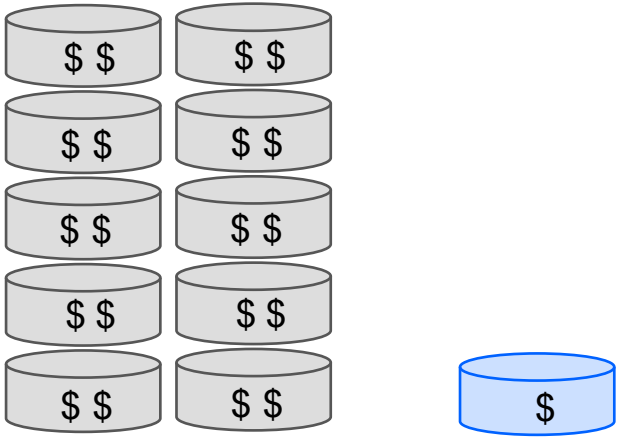
Why software tends to be a major cost driver

Many software offerings are sold by core

The amount of charged cores is determined by the server's maximum number of physical cores, whether activated or used by the software

x86 to LinuxONE core ratios vary per workload but x86 will invariably require more cores than LinuxONE servers

The same WebSphere workload on **x86** that requires **10 - 12 cores** may require only one LinuxONE core[1]



[1]20 IT Economics assessments involving analysis of x86 workloads for consolidation onto IFLs on IBM Z or LinuxONE were selected from diverse industries (35% financial, 25% government, 5% healthcare, 10% retail, 10% technology, 10% transport, 5% utilities), and different geographies (5% North America, 15% Latin America, 30% Europe, 20% Asia Pacific, and 30% Greater China Group). The assessments included were performed for clients with business critical workloads running in production and non-production environments. The workloads targeted for consolidation from x86 and distributed servers were IBM and third party proprietary and open source databases, application server middleware and industry specific solutions running on different types of x86 and distributed servers. Each client engaged the IT Economics team to evaluate the distributed workloads and the proposed IFL or LinuxONE environment for the consolidation. For each assessment, IT Economics consultants met with the client to discuss consolidation planning and execution, analyzed the client's current total cost of ownership, and provided a projected total cost of ownership with workload consolidation based on estimated core consolidation ratios for the client's workloads. Consolidation analysis identified potential financial savings and IT efficiencies that enabled the client to move their workloads to IFLs or LinuxONE. For additional information on x86 workload analysis contact the IBM IT Economics team, IT.Economics@us.ibm.com.

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Mitigate software costs through choice of hardware

Consolidation of workloads onto fewer physical servers reduces core usage

x86 servers

LinuxONE III

Large, centralized servers with shared resources enable **lower cost per workload** and **lower total cost of ownership**

*IBM workload consolidation testing shows LinuxONE requires up to **23 times less cores** on LinuxONE compared to x86 servers*[1]

* This is an IBM internal study designed to replicate a typical IBM customer workload usage in the marketplace. Results may vary. The workloads consisted of an airline flight reservation system (running MongoDB and node.js) and a transactional core banking application (running WAS and Db2). Four instances of the airline system were run, one instance simulating a Dev/QA environment, and three instances simulating a Production environment. Seven instances of the core banking application were run, one instance simulating a Dev/QA environment and six instances simulating a Production environment. Dev/Test and Production environments were differentiated by their CPU utilization levels. Intel servers are generally run at an average of 10-30% utilization per IT Economics data. For the x86 environment, the applications ran on a range of standard model, 2-processor x86 system, with speeds ranging from 2.4-3.2 GHz. The total number of cores needed to deliver the workloads on the x86 servers was 648. On z15, the airline system ran on Ubuntu 16.04 in an LPAR with z/VM 7.1, 4GB-8GB memory and 4 virtual CPs. The banking application ran on RHEL 7.6 in an LPAR with z/VM 7.1, with 4GB-16 GB memory and 4 virtual CPs. The total number of IBM Z cores needed to deliver the workloads was 28. Both the x86 and z15 environments had access to the same storage array. Total Cost of Ownership is defined here to include hardware, software, labor, networking, floor space and energy costs over a period of 5 years. IBM internal hardware list prices were used. x86 server prices were acquired from IDC. IBM software pricing was standard list prices with 20% discount applied.

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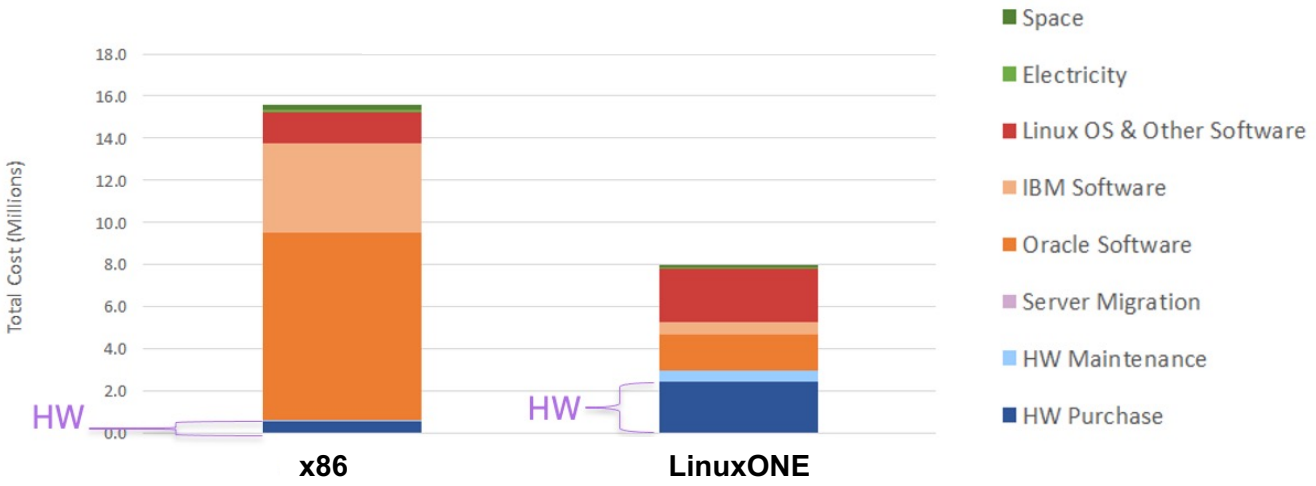
LinuxONE server efficiencies lower overall total cost of ownership

In some cases, server acquisition cost can be higher, but **overall TCO will be lower**

5-year TCO accumulated cost comparison of x86 versus LinuxONE for a U.S. federal government agency



- Server data based on customer specific actuals
- Pricing based on vendor published numbers and/or customer data
- Projections provided by IBM
- Contact IT.Economics@us.ibm.com for additional information

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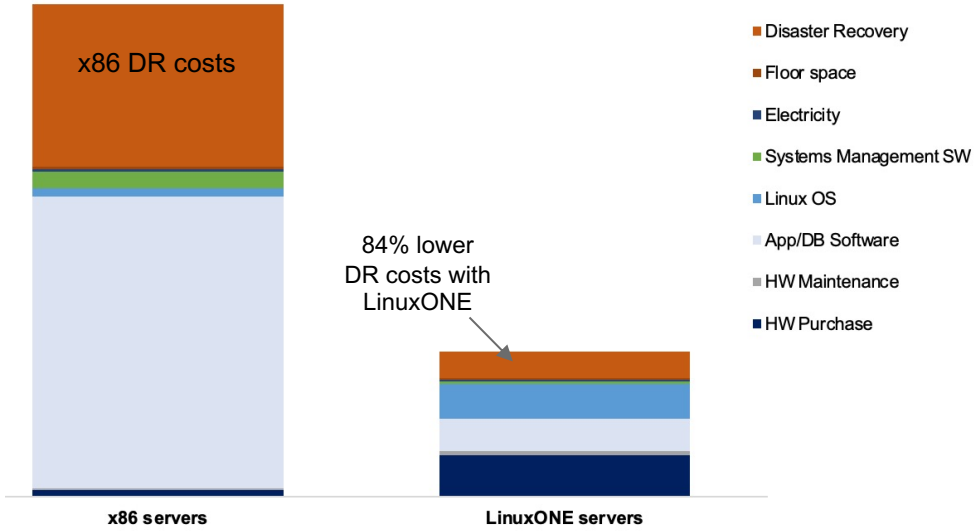
Disaster recovery for x86 production workloads can be 2x or more the cost for LinuxONE workloads

x86
DR environment[1] requires replication of all production SW and HW

LinuxONE
CBU offers lower LinuxONE hardware and z/VM pricing, ranging from 25% for smaller systems to 40% for larger systems

LinuxONE DR server can have only one active core[2], and SW charges are applied for only one core of per core priced software

5-year Total Cost of Ownership for WebSphere Application Server workloads with disaster recovery[3]



[1] Assumes a hot DR environment to achieve an RTO of one hour or less
[2] Assumes a warm DR environment to achieve an RTO of one hour or less
[3] Preliminary TCO based on customer costs

- Server data based on customer specific actuals
- Pricing based on vendor published numbers and/or customer data
- Projections provided by IBM
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Administration of x86 servers can be 2x greater than LinuxONE

Data from client assessments show that labor efforts[1] to manage **x86 environments** can be **twice** that of LinuxONE environments

- HW and SW procurement
- Server deployment
- Maintenance (patching, repairs)
- Networking
- Server refreshes
- Server disposal

IBM

Labor observations for LinuxONE

IT infrastructure analysis

The IBM IT Economics team is a worldwide group of technical and financial consultants who work with clients to optimize their IT operations. The team focuses on identifying areas for efficiencies, cost reductions and increased business value for client business objectives.

Clients ask the team to find infrastructure and solution improvements to minimize overhead and maximize qualities of service. Areas of analysis include hardware and software purchase and maintenance costs, disaster recovery, security, datacenter costs such as networking, floorspace, energy, and labor.

Labor observations

The following paper summarizes labor efforts observed by the team in client environments using IBM LinuxONE® and distributed servers. These observations are based on IBM IT Economics studies for clients either running or considering LinuxONE as an alternative for their business critical workloads on distributed servers.

While each client's IT environment was different due to organizational structures, server types and workloads, one or more of the following practices were found to drive two behaviors 1) use of more distributed servers than actually required and 2) use of more labor for distributed servers than for LinuxONE servers.

Common practices in distributed server environments

- Some applications or lines of business do not allow sharing with other departments. Clients adhering to this practice indicated they require a higher aggregate number of servers than for a shared resource topology in which all users consume common resources as needed.
- Most clients confirmed development and test are rarely run on the same distributed server with production, and deploy additional physical servers dedicated to development and test use only.
- Multiple clients indicated that they have up to five duplicated environments with some combination of production, development, test, high availability, quality assurance, and disaster recovery.
- Most clients stated that they host their application and database workloads on separate servers.
- In some accounts the lines of business create separate copies of data to run analytics, each hosted on its own servers.
- For tier one applications, many clients indicated they adhere to a three year server upgrade cycle to leverage the latest technology as well as to mitigate potential hardware failures.
- In some cases the client's procurement department negotiates advantageous terms with a vendor for a specific server type (same number of cores and fixed amount of memory). Yet the same client's IT department indicated that a 'one size fits all' server profile does not satisfy all core to memory ratio requirements. Depending on the workload, a server can run out of memory before exhausting CPU capacity. To mitigate resource constraints, their staff deploys one or more additional servers to support the workload.
- Some clients indicated that new server purchases can be challenging. If more than a year has elapsed since their last purchase, they may not find the same type of server with the same supported version of operating system. As these differences proliferate, more planning and deployment efforts are required.
- For some clients with larger networking environments, full-time dedicated specialists are required for capacity planning and the physical effort of router and switch management.
- A few clients with exceedingly intricate and large distributed server centers expressed challenges diagnosing and resolving outages.

IBM IT Economics Consulting & Research

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[Labor observations for LinuxONE]

[1] Labor costs do not include application support, development or test effort

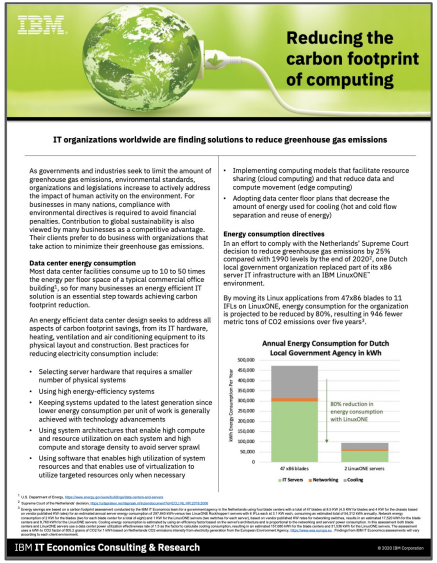
LinuxONE lowers energy costs and green house gas emissions

An IBM LinuxONE III LT2 can save

on average 59% per year

in power consumption than compared x86 systems running workloads with the same throughput[1]

Energy savings can be as high as **80%**[1] depending on your infrastructure, workloads and energy costs



[Reducing the carbon footprint of computing]

Carbon Footprint Requirements
Video 2:06 min

[1] Compared LinuxONE III LT2 model consists of two CPC drawers containing 64 IFLs, and one I/O drawer to support both network and external storage versus 49 x86 systems with a total of 1,080 cores. LinuxONE III LT2 power consumption was based on 40 power draw samples for workloads on 64 IFLs running at 90% CPU utilization. x86 power consumption was based on 45 power draw samples for three workload types running from 10.6% to 15.4% CPU utilization. x86 CPU utilization rates were based on data from 15 customer surveys representing Development, Test, Quality Assurance, and Production levels of CPU utilization and throughput.
Each workload ran at the same throughput and SLA response time on LinuxONE and x86. Power consumption on x86 was measured while each system was under load. LinuxONE III LT2 performance data and number of IFLs was projected from actual LinuxONE Rockhopper II performance data. To estimate LinuxONE III LT2 performance, a 3% lower throughput adjustment based on the LinuxONE III LT2 / LinuxONE Rockhopper II MIPS ratio was applied. Compared x86 models were all 2-socket servers containing a mix of 8-core, 12-core and 14-core Xeon x86 processors. External storage is common to both platforms and is not included in power consumption. Assumes LinuxONE and x86 are running 24x7x365 with 42 Development, Test, Quality Assurance, and Production servers and 9 High Availability servers. Power consumption may vary depending on factors including configuration, workloads, etc. Energy cost savings are based on a U.S. national average commercial power rate of $0.10 per kWh based on U.S Energy Information Administration (EIA) data, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a. Individual rates may vary. Savings assumes a power usage effectiveness (PUE) ratio of 1.66 to calculate additional power for data center cooling. PUE is based on IBM and the Environment - Climate protection - Data center energy efficiency data, https://www.ibm.com/ibm/environment/climate/datacenter_energy.shtml

[2] 80% savings anticipated for Dutch government agency, https://www.ibm.com/downloads/cas/GYR3MWQN

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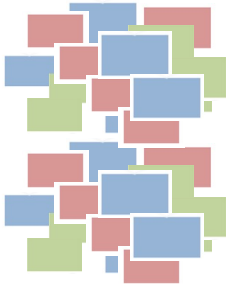
LinuxONE can reduce facility costs using less floor space

A LinuxONE III LT2 single frame system requires **75% less floor space** than compared x86 2U servers in racks, running the same workloads and throughput[1]



55 x86 servers

versus

1 IBM LinuxONE server

For a large insurance company in Asia Pacific consolidating workloads onto LinuxONE resulted in **86%** less floor space[2]

Data Center Requirements	x86	LinuxONE	Savings
Floor space	42.57 meters^2	6.11 meters^2	86%

[1] Actual floor space covered by the systems includes doors and covers. The LinuxONE III LT2 consists of two CPC drawers containing 64 IFLs, and one I/O drawer containing 7 FCP and 3 OSA adapters versus 4 x86 racks, each occupying 16 2U slots to run the comparable workloads, consisting of a mix of databases and application servers. Each workload ran at the same throughput and SLA response time on LinuxONE and x86.
x86 systems ran at various CPU utilizations according to 15 customer surveys, representing Development, Test, Quality Assurance, and Production levels of CPU utilization and throughput. 16 x86 2U form factor servers populated a standard 32U rack. Other 10 2U slots contained PDU, network switches, SAN switches and allowed space for air circulation. External storage floor space is not included.
LinuxONE III LT2 performance data and number of IFLs was projected from actual LinuxONE Rockhopper II performance data including a 3% lower throughput using MIPS ratio on LinuxONE III LT2 versus LinuxONE Rockhopper II with high availability.
Assumes LinuxONE and x86 are running 24x7x365 with 42 Development, Test, Quality Assurance, and Production servers and 9 High Availability servers.
Compared x86 models were all 2-socket servers containing a mix of 8-core, 12-core and 14-core Xeon x86 processors.

[2] 86% savings in floor space, https://www.ibm.com/downloads/cas/GYR3MWQN

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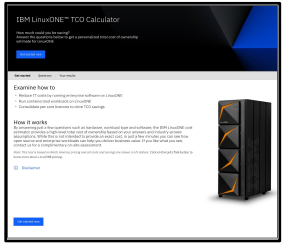
How much can you save with LinuxONE?

See how LinuxONE can reduce costs for your organization

IBM LinuxONE TCO Calculator

- Tool on ibm.com
- Provides preliminary view of potential savings



IBM LinuxONE TCO Calculator

IBM IT Economics Assessment

- No-charge custom analysis based on client data
- Conducted by IBM IT Economics consultants

No-charge IBM IT Economics assessment
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LinuxONE TCO calculator on ibm.com

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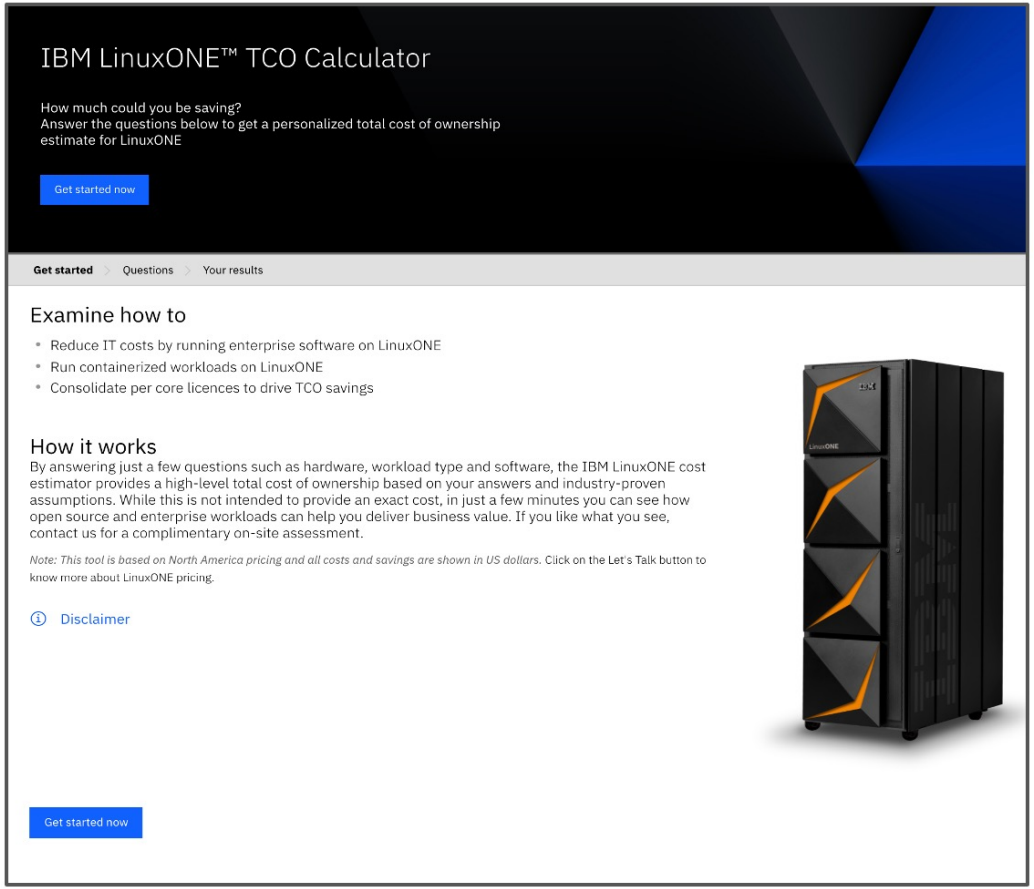
LinuxONE TCO calculator on ibm.com

Examine the savings of LinuxONE and LinuxONE III Express

https://ibm.biz/linuxone-tco-calc



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Savings estimate for x86 workloads on LinuxONE in five simple steps

User inputs

1. New or existing workloads
2. Workload type (db, app, open source, mix)
3. x86 servers (quantity, type, processors and cores)
4. Environment (production, disaster recovery)
5. Time period (3, 4 or 5 years)

Results

Output page

- Key savings areas (SW, energy, floor space)
- TCO, ROI, payback period, IRR
- Bar chart and graph
- Platform sizing (required production and non-production cores)

Detailed report

- All costs by category, platform and year
- Break out of workload costs
- Advantages of IBM LinuxONE

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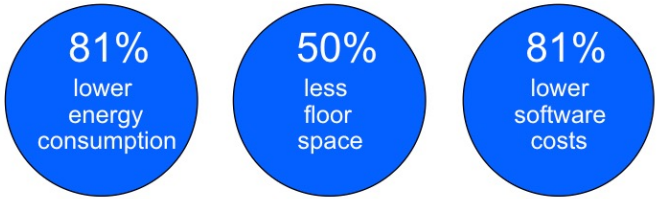
Output page without registration

Your Results

Based on your inputs when comparing to x86, LinuxONE could lower the cost of your workloads with



Based on your inputs when comparing LinuxONE to x86:

5 Year Category Cost Comparison

Cost Category	x86 Solution	LinuxONE Solution
Application/Database SW	$21,155,904	$1,864,364
Linux OS SW	$477,400	$2,433,750
Systems Management and Virtualization SW	$1,381,968	$151,474
Electricity	$254,390	$49,216
Space	$100,000	$50,000

LinuxONE could lower the cost of your workloads over five years by $17.56M with

- Investment payback in 1 month
- TCO reduced by 70.1% in 5 years
- IRR = 311.0%
- ROI = 549.0%

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Your x86 server inputs

Servers	Type of servers	Workload	Processors per server	Cores per x86 server	# of physical production servers	# of physical non-production servers[1]	Total DR servers[2]	Total x86 servers	Total x86 cores
1 year old	Rack	Application	2	24	20	20	0	40	960

1. For each set of production workloads is an additional 100% of corresponding physical servers for the DevTest and Quality Assurance non-production environment. A production workload environment of 100 cores, for example, is assumed to require another 100 cores for supporting non-production DevTest and QA work.

2. The DR environment is assumed to replicate the production environment only, so corresponding non-production workloads are not included for DR.

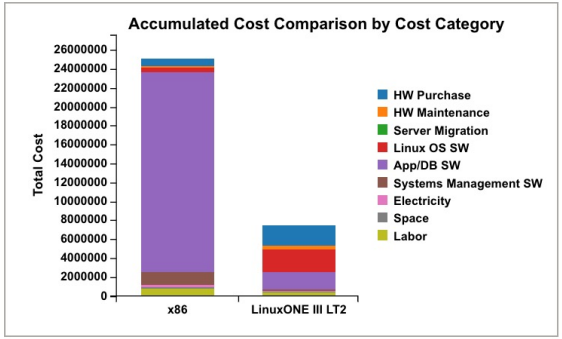
LinuxONE alternative

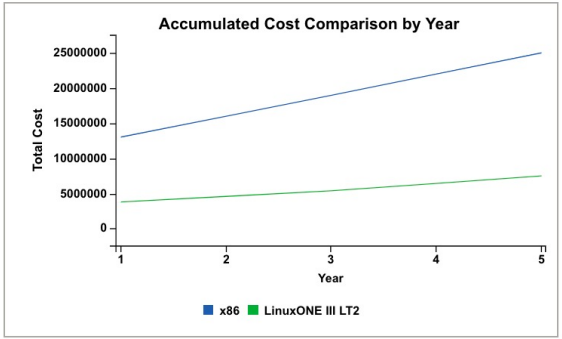
IBM LinuxONE model	Type of servers	Workload	# of LinuxONE servers	# of LinuxONE production cores	# of LinuxONE non-production cores[1]	Total DR servers[2]	Total DR cores[2]	Total LinuxONE servers	Total LinuxONE cores[3]
LinuxONE III LT2	Frame	Application	1	34	25	0	0	1	59

1. For each set of production workloads are an additional 75% corresponding DevTest and Quality Assurance non-production environments that can reside within the same physical LinuxONE server. A production workload environment of 10 cores, for example, is assumed to require another 7.5 cores for supporting non-production DevTest and QA work.

2. The DR environment is assumed to replicate the production environment only, so corresponding non-production workloads are not included for DR.

3. Total required LinuxONE cores are rounded up to the next whole number of cores.





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Detailed report with registration

IBM LinuxONE

This report includes your detailed total cost of ownership (TCO) comparison between running workloads on IBM LinuxONE versus compared x86 servers. The data in the report is an estimate™ based on inputs you provided in the LinuxONE TCO calculator.

The savings documented here in your report are just part of the story. In addition to better economics, LinuxONE is a highly secure, scalable data serving platform available for Linux® workloads:

- Independently certified with EAL5+ and FIPS 140.2 Level 4 security certifications
- Designed for 99.999 percent availability with minimum latency
- Vertical scalability for uninterrupted growth

After reviewing your report, if you're ready for a no-charge onsite assessment or would like more information, please email IT.Economics@us.ibm.com and we will contact you.

Your Results

Based on your inputs when comparing to x86, LinuxONE could lower the cost of your workloads with

81% lower energy consumption

50% less floor space

81% lower software costs

LinuxONE could lower the cost of your workloads over five years by $17.56M with

- Investment payback in 1 month
- TCO reduced by 70.1% in 5 years
- IRR = 311%
- ROI = 549%

Your x86 server inputs

Servers	Type of servers	Workload	Processors per server	Cores per x86 server	# of physical production servers	# of physical non-production servers[1]	Total DR servers [2]	Total DR cores [2]	Total x86 servers	Total x86 cores
New	Rack	Application	2	24	10	10	0	20	20	480

1. For each set of production workloads are corresponding DevTest and Quality Assurance non-production environments. A production workload environment of 100 cores, for example, is assumed to require another 100 cores for supporting non-production work - 50% of production cores for DevTest and 50% of production cores for QA.
2. The DR environment is assumed to replicate the production environment only, so corresponding non-production workloads are not included for DR.

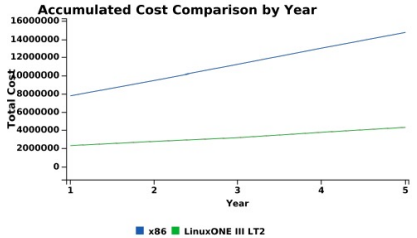
LinuxONE alternative

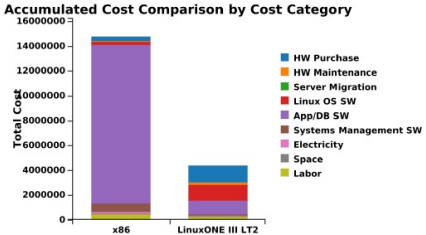
IBM LinuxONE model	Type of servers	Workload	# of LinuxONE systems	# of LinuxONE production cores	# of LinuxONE non-production cores[1]	Total DR servers [2]	Total DR cores [2]	Total LinuxONE servers	Total LinuxONE cores[3]
LinuxONE III LT2	Frame	Application	1	17	13	0	0	1	30

1. For each set of production workloads are an additional 75% corresponding DevTest and Quality Assurance non-production environments that can reside within the same physical LinuxONE server. A production workload environment of 10 cores, for example, is assumed to require another 7.5 cores for supporting non-production DevTest and QA work.
2. The DR environment is assumed to replicate the production environment only, so corresponding non-production workloads are not included for DR.
3. Total required LinuxONE cores are rounded up to the next whole number of cores.

5 Year Cost Comparison

Cost Category	x86 Solution	LinuxONE Solution
App/DB SW	$12,773,376	$1,125,780
Linux OS SW	$238,700	$1,237,500
Systems Management SW	$690,984	$102,301
Electricity	$127,195	$26,668





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Detailed report with registration

	Year 1	Year 2	Year 3	Year 4	Year 5	Total Savings
x86 Solution	$7,741,479	$9,469,098	$11,196,717	$12,961,506	$14,726,295	
LinuxONE Solution	$2,297,519	$2,725,439	$3,153,360	$3,734,176	$4,314,991	$10,411,304

5 Year Category Cost Comparison

	x86 solution	LinuxONE solution
HW purchase	$371,700	$1,369,252
HW maintenance	$74,340	$203,490
Server migration	$0	$0
App/DB SW	$12,773,376	$1,125,780
Linux OS SW	$238,700	$1,237,500
Systems Management SW	$690,984	$102,301
Electricity	$127,195	$26,668
Space	$50,000	$50,000
Labor	$400,000	$200,000
Totals	$14,726,295	$4,314,991

x86 Costs By Year

	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total Cost
HW purchase	$371,700	$0	$0	$0	$0	$371,700
HW maintenance	$0	$0	$0	$37,170	$37,170	$74,340
Server migration	$0	$0	$0	$0	$0	$0
Application/Database SW	$7,096,320	$1,419,264	$1,419,264	$1,419,264	$1,419,264	$12,773,376
Linux OS SW	$47,740	$47,740	$47,740	$47,740	$47,740	$238,700
Systems Management and Virtualization SW	$110,280	$145,176	$145,176	$145,176	$145,176	$690,984
Electricity	$25,439	$25,439	$25,439	$25,439	$25,439	$127,195
Space	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Labor	$80,000	$80,000	$80,000	$80,000	$80,000	$400,000
Totals	$7,741,479	$1,727,619	$1,727,619	$1,764,789	$1,764,789	$14,726,295

LinuxONE Costs By Year

	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total Cost
HW purchase	$1,369,252	$0	$0	$0	$0	$1,369,252
HW maintenance	$0	$0	$0	$101,745	$101,745	$203,490
Server migration	$0	$0	$0	$0	$0	$0
Application/Database SW	$625,434	$125,087	$125,087	$125,087	$125,087	$1,125,780
Linux OS SW	$247,500	$247,500	$247,500	$247,500	$247,500	$1,237,500
Systems Management and Virtualization SW	$0	$0	$0	$51,151	$51,151	$102,301
Electricity	$5,334	$5,334	$5,334	$5,334	$5,334	$26,668
Space	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Labor	$40,000	$40,000	$40,000	$40,000	$40,000	$200,000
Totals	$2,297,519	$427,920	$427,920	$580,816	$580,816	$4,314,991

x86 Application/Database SW

App/DB SW	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total Cost
Commercial Application OTC	$7,096,320	$0	$0	$0	$0	$7,096,320
Commercial Application S&S	$0	$1,419,264	$1,419,264	$1,419,264	$1,419,264	$5,677,056

LinuxONE Application/Database SW

App/DB SW	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total Cost
Commercial Application OTC	$625,434	$0	$0	$0	$0	$625,434
Commercial Application S&S	$0	$125,087	$125,087	$125,087	$125,087	$500,347

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No-charge IT Economics Assessments

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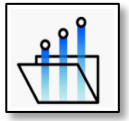
IT Economics Assessments

Use an assessment to quantify business values, technical requirements and financials

Total Cost of Ownership (TCO)



Workload Placement

Consolidate, offload, and place workloads on LinuxONE, IBM Z, Power Systems and x86 both on-prem and in the cloud

Leverage fit for purpose to determine platform requirements for workloads

Oracle consolidation

Examine Oracle cost reduction through workload consolidation on highly scalable enterprise servers (IBM Z, LinuxONE or Power Systems)

Evaluate on-prem versus in the cloud options

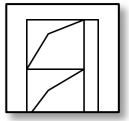
Hybrid Multicloud

Analyze enterprise requirements for hybrid and multi-cloud solutions

Compare existing environments to IBM and vendor cloud solutions

SAP HANA

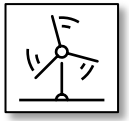
Analyze requirements to move traditional SAP landscapes to SAP HANA on Power and Cloud



IBM LinuxONE

Assess Linux workload requirements with LinuxONE platform attributes

Find savings for Linux x86 workloads



Carbon Footprint Optimization and Corporate Responsibility

Determine current infrastructure carbon footprint and identify sustainability improvements

Power Systems

Assess x86 Linux workload requirements for Linux on Power

Optimize efficiencies for AIX and IBM i

IT Best Practices Benchmarking

Compare actual IT environment with best practices in the IT industry

Business Value Assessment (BVA)

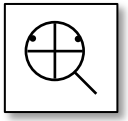
Cloud Paks ROI

Evaluate business efficiencies from the adoption of containerized software

Quantify business value and ROI

SW Portfolio Analysis and Application Rationalization

Review software currency and examine potential replacement with other products to optimize SW license costs



Tailored Fit Pricing for Z software pricing optimization

Develop Tailored Fit Pricing cost forecast based on historical data

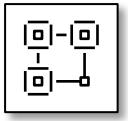
Evaluate IBM Z partition usage to optimize costs

Cloud, Data and AI Solutions

Business value assessments for Data and AI, Integration, Automation SW Solutions that quantify ROI and benefits

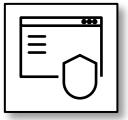
Chargeback Analysis

Align chargeback policies to actual IT costs Increase deployment flexibility



Enterprise Modernization

Business value assessments for a hybrid multicloud enterprise



Security and Confidential Computing

Evaluate pervasive encryption, Hyper Protect, Data Privacy Passports and other security features to minimize risk

Use risk analysis to calculate value and exposure of assets

Enterprise DevOps

Analyze challenges in existing application development and delivery practices (CD/CI)

Map DevOps capabilities to business outcomes by quantifying financial impact

IT Economics studies are available at no-charge to IBM clients and Ecosystem Partners
Visit www.ibm.com/iteconomics or https://www.ibm.com/partnerworld/iteconomics

Contact the IBM IT Economics Team
IT.Economics@us.ibm.com

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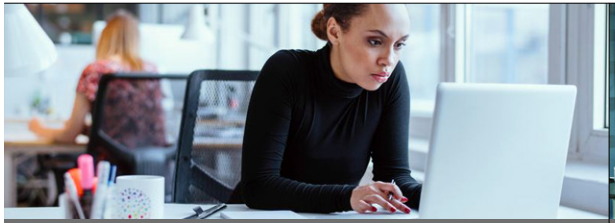
How an IT Economics assessment works

Use a no-charge assessment to increase IT efficiencies and reduce costs

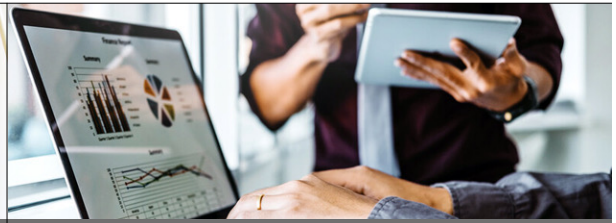


Request

- Ask your IBM focal, IBM Business Partner or contact us at: IT.Economics@us.ibm.com
- A local IT Economics consultant will contact you to discuss your situation

Workshop

- Participate in a two-hour meeting with stakeholders from your organization to define your objectives and business metrics for the assessment
- Your consultant will gather information about your IT environment and share best practices



Findings

- Analysis and report preparation are usually complete in two to four weeks
- Your IT Economics consultant will meet with you to discuss findings and provide recommendations
- You will receive a report with detailed analysis, a business case, and an executive summary

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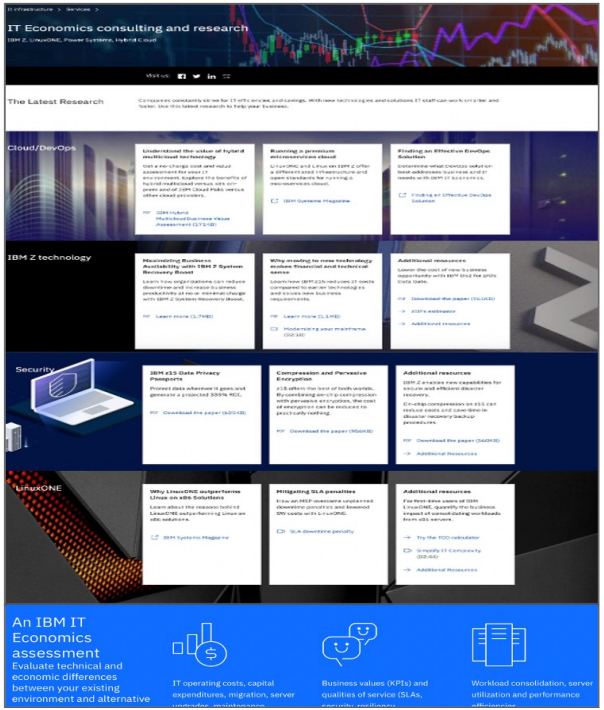
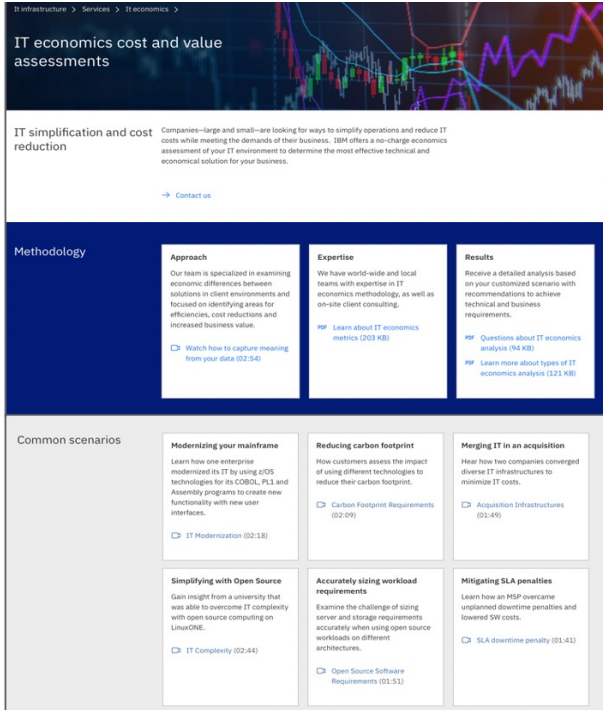
More IT Economics information

Papers, videos and more on ibm.com
http://www.ibm.com/iteconomics



No-charge IT Economics assessments on ibm.com
https://www.ibm.com/it-infrastructure/services/it-economics/assessments



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