The Case for Migrating from Sun SPARC to IBM System x-Linux

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Executive Summary

Following Sun Microsystems' acquisition by Oracle Corporation, enterprise customers on the Sun SPARC-Solaris platform face uncertainty in ongoing support and development of their computing environment, and should look for alternatives. They would do well to consider IBM System x-Linux as an alternative. System x is built on a philosophy of working in close collaboration with Intel and this enables IBM and Intel teams to jointly deliver solutions that are fully optimized for current and emerging processor technology. Additionally, IBM uses the X-Architecture approach to continually innovate and optimize systems design to improve the performance, reliability, energy efficiency, and TCO of the System x family. IBM also works with leading distributors of Linux such as Red Hat and Novell to help make Linux more scalable and robust for the enterprise computing environment. IBM and industry leading Linux distribution vendors also provide migration services that make the switch over to Linux straightforward. This comprehensive collaboration and innovation on all fronts -- semiconductor technology, hardware, software, middleware and operating systems ensures that the System x-Linux platform has a clear roadmap and has ongoing support. For customers this means that their investment is protected against changing market conditions.

Introduction

In April 2009, Oracle Corporation announced plans to acquire Sun Microsystems. Most analysts see this development as being disruptive to users of the Sun SPARC-Solaris platform since the roadmap for support and development of both Sun SPARC and Solaris is now uncertain. Sun's customers should – and are – exploring alternative platforms for their enterprise IT workloads. The most widely available alternative to SPARC is x86-based architecture.

Just as a migration from SPARC means moving away from Sun hardware lock-in for greater choice, moving to an x86-based architecture opens up the choice of the operating system. That choice increasingly is Linux both in terms of features and market acceptability and market share. Leading Linux providers such as Red

Hat and Novell today develop Linux to provide the operational flexibility to deploy across a broad range of industry-standard servers. Ten years ago, early adopters realized significant benefits in starting the migration from Solaris and SPARC to Linux and x86. Today, the rest of the information technology community is building on the success of the early adopters and accelerating the migration to Linux.

The case for moving away from Sun SPARC to IBM System x powered by Intel Xeon processors

In spite of assurances from Oracle, IT analysts and media are wary about Oracle's continued investment in Sun's hardware business[1]. This jeopardizes any IT strategy built around Sun SPARC. IBM System x is an excellent alternative.

System x is economical, flexible -- and meets or exceeds performance expectations
While the IBM Power System or IBM System z have traditionally been the preferred choices for migrating large enterprise workloads from Sun SPARC to IBM, interest in migrating from SPARC to Intel based servers is increasing since they offer an attractive price-performance value. IBM System x and IBM BladeCenter server performance continues to advance while the low end SPARC-based Sun servers have struggled to maintain a comparable price-performance.

Examples of potential benefits[2] of hardware migration:
- Replacing legacy SPARC with IBM x3850 M2 results in up to $4m annual savings and 50% reduction in TCO for new x3850 M2 vs. new T5440
- Up to 20:1 consolidation ratio from legacy SPARC to x3650 M2 or HS22 Blade
- Up to 65% greater performance with x3650 M2 and 57% greater performance with x3850 M2 over new SPARC systems

The difference is innovation
Such demonstrable performance and reliability gains are a result of the innovative IBM X-Architecture that encompasses IBM System x and IBM BladeCenter servers, IBM System x iDataPlex solutions, energy-efficiency and cooling via IBM Cool Blue technology and proactive management. The Systems and Technology Group at IBM is specifically tasked with driving innovation in the X-Architecture.

IBM has a long history of collaborating with Intel to design systems that incorporate processor features and optimize performance and capabilities. An example is the collaboration on blade technology starting in 2002

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[1] Sun Sparc's future unclear under Oracle, analysts say, Agam Shah, IDG News Service, 20 Apr 2009
[2] IBM benchmark tests

with the development of the first BladeCenter servers, and continuing in 2006 when IBM, Intel and other industry leaders formed Blade.org, the industry consortium driving open innovation in blade-based solutions that today has over 200 members. Similarly, IBM's strategy of working in joint teams with Intel during the evolution of the Intel Xeon processors positions it ideally to design and build systems that use current and emerging processor technologies in the shortest possible time.

Further, IBM has made sustained technology investments to enhance functionality, performance and reliability across its portfolio of systems and technology offerings. Investments in semiconductor processor technology and architecture, and RAS (reliability, availability, serviceability) features that are part of the mission-critical System z mainframes have been systematically implemented across the IBM portfolio and next generation energy-efficient data centers. A recent survey[3] -- which we believe to be the most comprehensive recently published study of high performance computing application workload performance, system utilization and system availability using a Linpack peak performance benchmark -- found that the x86 based IBM HS-21 based BladeCenter returned availability figures of 100% compared to a 95% availability for a SuperMicro based x86 system. This is an illustration of how IBM's approach of bringing mainframe inspired RAS features into x86 based servers helps enterprise computing at all levels.

Another example of how IBM innovates to achieve leadership in systems design is in its use of complex CFD (computational fluid dynamics) to optimize the thermo-electrical-mechanical properties when laying out components (processors, memory systems, and interconnect hardware) and cooling systems within servers. This helps achieve optimal energy efficiency within the power/cooling envelope for datacenters. The resulting efficiency gains are significant -- for a 1U configuration, the energy consumption has been reduced from about 19W to 6W for the IBM System x iDataPlex server. Each Watt saved translates to about $7 of customer savings/server/year. Lower energy consumption results in lower TCO (total cost of ownership) and higher reliability as components operate at lower temperatures.

IBM also innovates on server management to optimize the IT administrator experience for its System x servers. IBM Systems Director is a platform management foundation that streamlines the way physical and virtual systems are managed across a multi-system environment. Leveraging industry standards, IBM Systems Director supports multiple operating systems and virtualization technologies across IBM and non-IBM platforms. Through a single user interface, it provides consistent views for visualizing managed systems and determining how these systems relate to one another while identifying their individual status. This improves the IT staff efficiency as well and helps them to be more responsive to business needs.

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[3] Alan Simpson, Mark Bull, and Jon Hill, Identification and Categorization of Applications and Initial Benchmarks Suite, PRACE Consortium Partners, 2008.

The case for moving away from Sun Solaris to Linux

In the past, enterprise customers were wary about moving from UNIX variants such as Solaris to Linux. The concern was that Linux wouldn't match UNIX in scalability and reliability in enterprise computing environments. Those concerns are rapidly being put to rest.

The market share case for Linux

Since Solaris is considered to be the flavor of UNIX closest to Linux, porting applications from Solaris to Linux on the x86 architecture, in most cases, require only minor changes to the source and high-level changes to the build environment (makefiles, directory paths, complier, and linking switches). This is one of the reasons why Linux is increasingly gaining acceptance in the enterprise market.

The adoption rate of Linux in the enterprise server segment has been increasing at a rapid pace in recent years. A recent IDC study[4] estimates that worldwide revenue from Linux operating system software will grow at a compound annual growth rate (CAGR) of 16.9% from 2008 to 2013. Linux server operating system subscriptions are also expected to grow through 2013 (in spite of a contraction in 2009). IDC notes that in addition to brand new server deployments, Linux deployments will also be taking place aboard existing servers, a metric not directly considered in the predicted growth of net new subscriptions and deployments.

The TCO case for Linux

Over the last 15 years or so, UNIX (Solaris is a version of UNIX) has established a reputation for solid reliability in the data center. It is often used to run mission-critical applications including back-end databases, and has demonstrated good performance, high reliability, proven scalability and trustworthy security. But these benefits come at a relatively high total cost of ownership (TCO). UNIX generally requires proprietary software and hardware and involves significant annual maintenance costs. These expenses are a key factor in recent, widespread migrations to other platforms – in particular, Linux.

Studies[5] on total cost of ownership (TCO) have shown that Linux is 40% less expensive than a comparable x86-based Windows solution and 54% less expensive than a comparable SPARC-based Solaris solution. The comparison is built on a 3-year period of ownership for a system supporting 100,000 operations per second on the standard SPECjbb benchmark.

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[4] Linux Operating System Market Grows in 2008, IDC Press Release, 26 Aug 2009
[5] TCO for Application Servers, Robert Frances Group, Aug 2005

Customer Story - BMW Group

With its brands BMW, MINI and Rolls-Royce, the BMW Group concentrates exclusively on the premium segments of the international automobile and motorcycle markets. They recently migrated their SAP environment to an IBM-Intel Xeon processor-Linux platform.

Business Need: BMW wanted to simplify management and reduce the total cost of ownership of the server infrastructure powering its SAP enterprise software and business solutions.

Solution: Intel and BMW deployed 400 IBM System x3650 and IBM System x3850 rack-mounted servers powered by the Intel Xeon processors. The Intel Xeon processor-based platform runs on a Linux operating system and replaces its old proprietary RISC-based infrastructure.

Benefits: The open standard Intel, Linux and IBM based platform is easier to manage, has greater flexibility and is easier to consolidate than the old infrastructure. It is more energy efficient and offers even greater computing performance. Further, it is the ideal infrastructure for virtualization. Together, all these advantages lead to a much lower total cost of ownership.

"The Intel Xeon processor offers superior performance and much greater energy efficiency." *Danie Ventner, SAP ISM coordinator, BMW Group*

The scalability case for Linux

Making the decision to switch from Solaris on SPARC to servers running Linux on x86 doesn't mean accepting lower performance or scalability. Linux vendors have reported several benchmark test results to showcase scalability and performance. For example, Red Hat Enterprise Linux has reported results for the SPECweb2005 benchmark for evaluating the performance of web servers using three distinct workloads for banking, e-commerce, and support[6].

- The highest score of 71,045 was achieved on a Red Hat Enterprise Linux 5.3 (2.6.18-128.el5) system using Rock Web Server v1.4.7 (x86_64), Rock JSP/Servlet Container v1.3.2 (x86_64), in April 2009.
- As of April 2009, the top ten published SPECweb2005 results are based on Red Hat Enterprise Linux.
- In August 2008, Red Hat Enterprise Linux was used to host a DB2 database and achieved 1.2 million transactions per minute on the TPC-C benchmark at a cost of $1.99/tpmC. This was the first

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[6] Red Hat Enterprise Linux 5: Your Solaris Alternative, White Paper, Red Hat, Inc.

tpmC result on an x86 server that exceeded the one million tpmC result. The TPC-H benchmark is used to measure a platform's ability to host decision support systems that examine large volumes of data, execute queries with a high degree of complexity, and provide critical business intelligence.

- In November 2008, Red Hat Enterprise Linux achieved a record-setting score on the 2-Tier SAP SD benchmark by showing it could sustain a processing load of 5156 concurrent user connections and in turn delivering the best 24-core performance on x86_64 servers and beating Solaris x86 by more than 10% on comparable hardware.
- In February 2009, Red Hat Enterprise Linux running on a 96-core Intel Xeon processor-based server achieved the best SPEC JavaBlackBelt (JBB) score on an Intel Xeon processor-based server with 2,150,260 business operations per second (bops).

Customer Story - Palm Beach County Property Appraiser, Florida

The Palm Beach County Property Appraiser's office locates, identifies and values all residential, agricultural and commercial property in Palm Beach County.

Business Need: Currently running 16-processor/32 GB Open VMS Alpha GS160 configuration. Batch calculation of values for 600,000 parcels on the current system requires 30 hours. Migrate to Linux solution and calculate those same values in a 3-hour window. Environment based upon Oracle 10g RAC and custom application to calculate tax roll.

Solution: Five Node x366 cluster running Novell SLES 9 x86-64. Specialists from IBM RTP Benchmarking Center performed a POC (proof of concept) with the customer's data.

Benefits: POC successfully completed on 4-node x366. 18.36% better average performance than Unisys. $150K less expensive than Unisys. Additional 5-node run completed within 3 hours. The competition did not successfully complete the benchmark.

"We benchmarked our Oracle 10g based application running Linux on the IBM x366 servers in both a single node and multi-node configuration. The X3 Architected x366 exceeded our performance expectations! It clearly outperformed all other competitors systems we tested."
Woodie McDuffie, Manager of IT, Palm Beach County Property Appraiser Office

The reliability case for Linux

Operating systems acquire a reputation for robustness based on their perceived reliability and stability. When unpacked from its subjective shell, reliability is often measured in terms of the mean time between failure (MTBF) and the mean time to repair (MTTR), which factor into an overall percentage of uptime.

Measuring and comparing the reliability of platforms can be difficult because hardware choice and environmental conditions affect the results drastically. Stability is often characterized by the rate at which defects are found and fixed in the system, and this can be equally difficult to track.

Surveys by industry analysts show that CIOs, IT managers, and system administrators generally consider Linux to deliver the reliability needed for business-critical workloads. Industry-standard hardware running Linux has reached a level of maturity where one can configure fault-tolerant systems that are strong enough to match UNIX systems on proprietary hardware. For example, the Yankee Group *2007-2008 Global Server Operating System Reliability Survey*[7] found that the top Linux distributions Red Hat Enterprise Linux and Novell SUSE Linux notched the biggest reliability improvements in their most recent survey. Each of them decreased per server per annum downtime by an average of 75%.

In a study[5] comparing Linux deployments with Windows and Solaris, it was found that it is easier to lock down a Linux system and deploy patches and that Linux patch deployments reduced downtime. This also reduces security vulnerabilities and improves reliability and availability -- factors crucial to enterprise computing.

Customer Story - ConAgra Foods, Nebraska

ConAgra Foods is a leading branded value-added food company.

Business Need: As part of its business transformation program, ConAgra Foods wanted to consolidate, standardize and expand its SAP software environment to improve its financial reporting capabilities.

Solution: Worked with IBM and Intel to investigate a migration of the SAP software from a monolithic UNIX environment to Linux on the IBM System x platform using Intel Xeon 5100 processors. Following excellent benchmarking results, the migration was performed successfully.

Benefits: The infrastructure delivers a performance enhancement of around 600% at around 25% of the cost of the previous solution. Simple management of architecture helps keep systems online 24x7, supporting lean manufacturing operations. Intel Xeon processors provide high performance at low power consumption reducing electricity costs and cutting the carbon footprint.

"Running the SAP applications under SUSE Linux on the Intel-based System x platform has delivered a six-fold improvement in performance." *Chris Nitchals, SAP Principa,l ConAgra Foods*

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[7] Unix, Linux Uptime and Reliability Increase, Yankee Group, 18 Jan 2008

ISVs are increasingly adopting Linux

An operating system's success is linked with the number and quality of applications that run on top of it. As Linux becomes increasingly attractive because of open source, TCO, and reliability considerations, ISVs (independent software vendors) are moving to it in a big way. According to an IDC study[8], software spend in the Linux ecosystem – comprising Linux and open source services, application software and application development and deployment software – is predicted to grow from about $11 billion in 2007 to about $28 billion in 2012. One reason for this is that a traditional hindrance to applications development on Linux -- the multiplicity of Linux variants and distributions -- now has a technology fix. The Linux Standard Base created by the Linux Foundation (www.linuxfoundation.org), a non-profit consortium for promoting and standardizing Linux, has reduced the differences between different Linux distributions and helps ISVs to reduce their porting and testing costs. In addition, most ISVs with solutions running on SUN Solaris have been providing versions of their applications running on Linux for many years.

The Linux Standard Base (LSB) solution not only makes life easier for individual application developers and ISVs, it also makes a huge positive impact on the entire Linux ecosystem by allowing more applications to be widely introduced to the Linux operating system. The LSB directly helps vendors and community groups into two specific ways:

- Reduce the costs of porting an application from one Linux distribution to another
- Reduce the costs of supporting a Linux application

Migrating from SPARC-Solaris to x86-Linux is straightforward

Leading Linux vendors and several system vendors offer comprehensive migration services. The services from the two leading Linux distributions -- Red Hat and Novell -- and from IBM as presented here as examples.

Red Hat migration services

Red Hat offers a comprehensive migration service package[9] comprising tools and resources, training, and service offerings from Red Hat Consulting and Red Hat Training to help companies migrate from Solaris to Linux. The migration proceeds in five phases:

1. Examine existing Solaris architecture and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem.
2. Examine third-party functional and business applications and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem.

[8] The opportunity for Linux in a new economy, IDC, Apr 2009
[9] http://www.redhat.com/migrate/solaris_to_linux/

3. Measure organizational readiness and overall migration risk.
4. Develop a strategic migration plan, including a detailed road map and cost estimate.
5. Implement the strategic migration plan and employ implementation support strategies.

Novell migration services

Novell's migration approach[10] is based on their belief that Linux is sufficiently flexible to give many deployment options. Clients can start slowly at the edge of the enterprise, migrating basic infrastructure services like Web serving and DNS/DHCP. Or they can plunge in and deploy Linux to run enterprise applications and host databases just as thousands of companies already do. Whatever the choice, Linux is equal to the task. Novell offers the SUSE Linux Enterprise Server and offers a migration service that deploys Linux in a phased manner from the 'edge' of the enterprise – servers that connect users to the internet, email, storage, printers and other infrastructure services – to inside the enterprise in a progressive, step-by-step manner (see figure below).
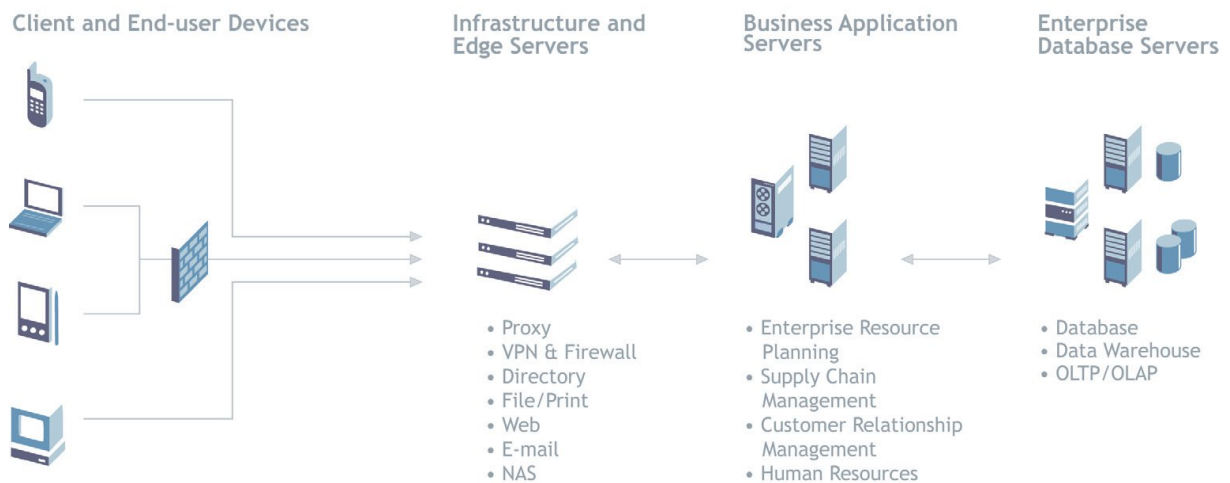
Novell's approach to Linux deployment in the enterprise

IBM migration services

IBM offers an integrated package of migration resources and services[11] to help customers migrate to Linux:

Migration Analysis Tool Kit. The Migration Kit for Solaris to Linux v2.0 is a no charge, "as is" set of software tools and porting/migration guides available to IT departments to assist in their evaluation of Solaris to Linux migration opportunities. These tools are designed to help customers quickly migrate or assess the technical issues they will face in moving applications from Solaris to Linux on IBM Systems x, Power, or System z. Features include:

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[10] Make the move from UNIX to Linux: Now is the time, Novell, Inc., 2009
[11] IBM migration kit for Solaris to Linux:
ibm.com/partnerworld/pwhome.nsf/weblook/pat_linux_migrate_solaris.html

- All tools run on Red Hat Enterprise Linux or Novell SUSE Linux Enterprise Server
- An endian-checking tool that checks C/C++ code for endian issues
- A C/C++ source code tool with a configurable editor that can check individual files or entire directories for common portability issues
- A GUI-based Solaris shell script and makefile testing tool with a configurable editor that can check for a broad range of issues, and make recommendations when paths to key system utilities need to be modified,

Migration Factory. IBM's Migration Factory offers services for ISVs and partners porting any type of code, database, storage, or other technologies from Sun or HP environments to Linux.
- Migration offerings in a box for SAP, Oracle, database and infrastructure migration/consolidation
- Expanded worldwide support from Application Management Services, Global Technologu Services(GTS), and Lab Services,

Solaris to Linux Migration: A Guide for Systems Administrators. This IBM Redbook provides a technical reference for IT systems administrators in organizations that are considering a migration from Solaris to Linux-based systems. IBM presents a systems administrator view of the technical differences and methods necessary to complete a successful migration.

IBM Support. IBM provides telephone or online access to IBM support specialists through IBM's Linux Support Line and Linux Advanced Support offerings. This is available for all users from small to medium businesses running just a few Linux servers or mission critical enterprise customers requiring highly customized and proactive support. The offering include options for 9x5 or 24x7 support, unlimited calls and callers, client customized response times, and support for IBM and non-IBM Servers.

System x-Linux investments are protected against obsolescence

As enterprise computing moves away from the Sun SPARC-Solaris lock in environment to the more flexible and economical open source System x-Linux environment, enterprise customers can rest assured that their investments are protected against market or technology changes. This is because IBM, Intel and other industry-leading vendors routinely collaborate at a fundamental level to ensure that hardware, software and platform changes are seamlessly incorporated into the System x-Linux environment.

Intel Xeon processors offers next gen capabilities -- and IBM System x is ready to tap it

In May 2009 Intel announced the release of its next generation of Intel Xeon processors for the expandable server segment, codenamed Nehalem-EX[12]. The new processor features up to eight cores inside a single processor supporting 16 threads and 24MB of cache. Ideal for server consolidation, virtualized applications, data demanding enterprise applications and technical computing environments, Nehalem-EX promises to offer up to nine times the memory bandwidth of the previous-generation Intel Xeon 7400 platform. IBM was the only systems manufacturer to showcase a server, IBM eX5, at the May 2009 announcement. When the Nehalem EX goes into production, IBM will be ready with a server incorporating the new processor -- another instance of IBM's strategy of working in joint teams with microprocessor manufacturers to take full advantage of emerging technologies.

Next generation virtualization with KVM

KVM (Kernel-based Virtual Machine) is a full virtualization solution for Linux on x86 hardware containing virtualization extensions. KVM enables users to run multiple virtual machines running unmodified Linux or Windows images -- in effect, KVM can turn the Linux kernel into a hypervisor. IBM is working closely with Red Hat, the owner of KVM, to help IBM System x customers reap the benefits of data center virtualization while enjoying the economies and flexibility of customization offered by open source solutions.

As cloud computing goes mainstreams, most delivery models will be on Linux

In many ways cloud computing is a logical evolution, building upon the industry's rapid adoption of Linux, open source solutions, SOA (service oriented architecture) and more recently, virtualization. Cloud computing provides dynamically scalable and often virtualized IT (hardware, software, and applications) resources as a service to a large set of users who may possess a broad but differing range of knowledge, expertise in, or control over the technology infrastructure.

While the evolution of public cloud adoption has been rapid, particularly with smaller businesses and individual developers, early adopters at larger enterprises are increasingly turning to private and hybrid clouds to address concerns (with public clouds) of security, regulatory compliance, governance, reliability, and IP protection.

Today, most large public cloud-service providers such as Google and Amazon use Linux in their large-scale, high-demand, extremely-elastic cloud environments. IBM also uses Linux for its private cloud offering, the IBM CloudBurst Appliance[13] based on the IBM BladeCenter for application deployment to cloud and virtualization environments.

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[12] intel.com/pressroom/archive/releases/20090526comp.htm
[13] IBM private cloud offering: ibm.com/software/webservers/cloudburst/

Further Reading

IBM System x:
ibm.com/systems/x/

IBM migration kit for Solaris to Linux:
ibm.com/partnerworld/pwhome.nsf/weblook/pat_linux_migrate_solaris.html

Intel Nehalem:
www.intel.com/technology/architecture-silicon/next-gen/

KVM (Kernel-based Virtual Machine)
http://www.ibm.com/developerworks/linux/library/l-linux-kvm/

IBM cloud computing:
ibm.com/ibm/cloud/