Advancements with Open Virtualization & KVM

Michael Day
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Open Systems Development, IBM

Thursday, February 21, 13

Discussion

- ## KVM's unique role as a Linux, Bare-metal Hypervisor

  - Pressuring Proprietary Hypervisors, Offering Choice, Gaining Unique Workloads

- ## IBM's Active KVM Development Program - 2005 and continuing

- ## Emerging Uses of KVM

  - Areas where KVM has a clear advantage

- ## Challenges ahead

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KVM Leverages Linux

As a Linux developer, it's hard for me to be that interested in Xen... When you think about it, it is really quite silly. We advocate Linux for everything from embedded systems to systems requiring real-time performance, to high-end mainframes. I trust Linux to run on my dvd player, my laptop, and to run on the servers that manage my 401k. Is virtualization so much harder than every other problem in the industry that Linux is somehow incompatible of doing it well on its own? Of course not.
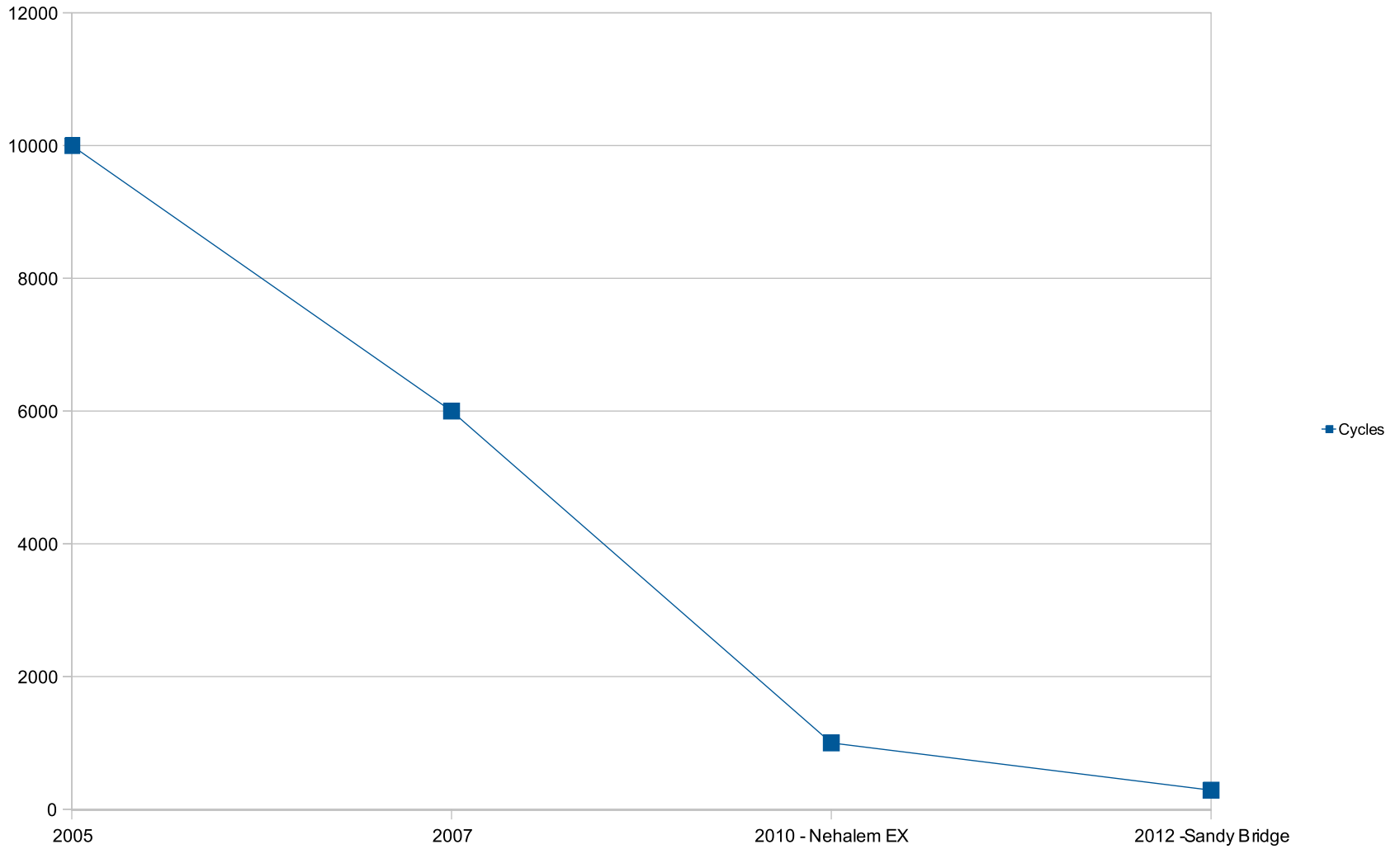
-- Anthony Liguori, Qemu maintainer

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Scalability

- "With this patchset, -smp 64 flies... Amazing work!"
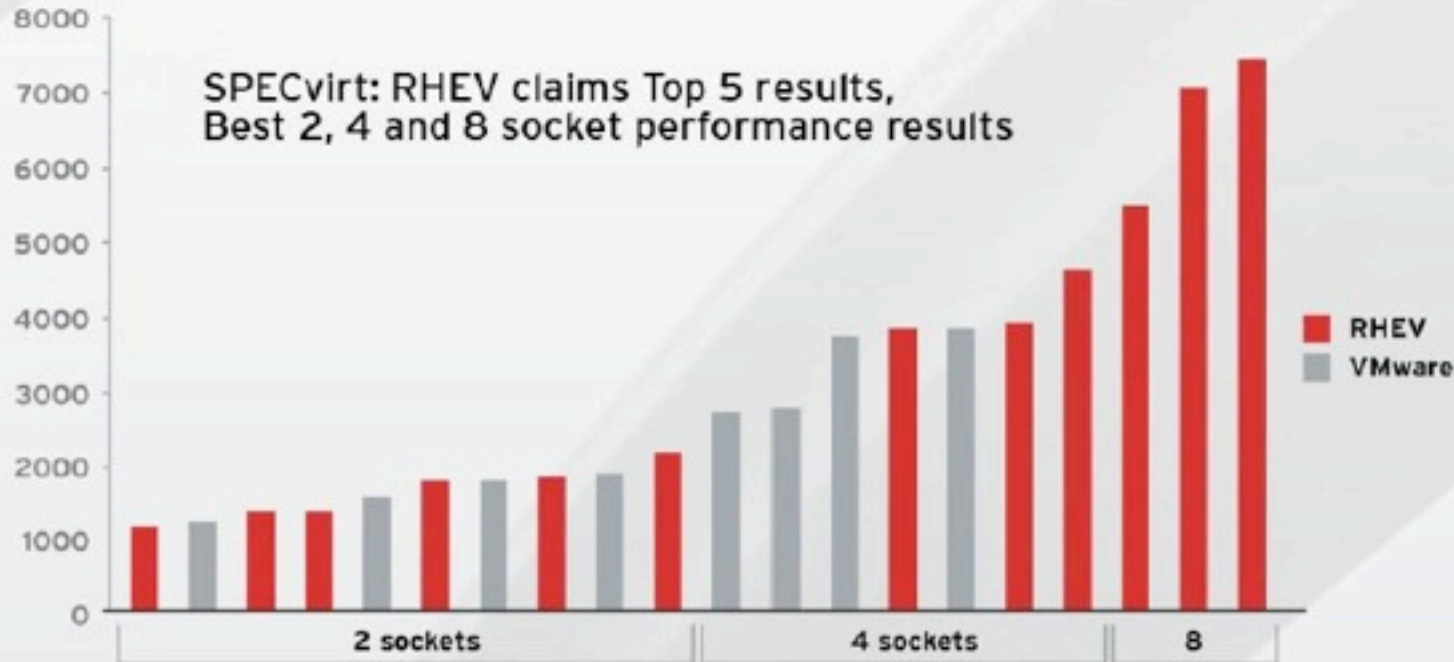 -- Avi Kivity, commenting on 64-way SMP guest performance, December 27, 2009

  Supported:

- 160 Cores, 4 TB RAM Per Host

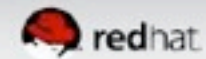- 64 Guest vCPUs, 512 GB Guest RAM

- 200 Hosts per Cluster

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VMExit Latency and Performance

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Note: IBM and HP have published KVM results

IBM Corporation

IBM Corporation x3850 X5

Processor: Intel Xeon E7-4870 (80 cores, 8 chips, 10 cores/chip, 2 threads/core)

Memory: 2 TB (128 x 16 GB, Quad Rank x4 PC3-8500 CL7 ECC DDR3 1066MHz LP RDIMM)

Red Hat Enterprise Linux 6.0 (KVM)

Full result disclosure: HTML

Unprocessed data: RAW

Supporting documentation: TGZ

7067@432

Application Server
Database Server
Mail Server
Web Server
Infrastructure Server
Idle Server

| IBM Corporation | –IBM Corporation x3850 X5
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+Database Server +Infrastructure Server
+Mail Server +Idle Server |

http://www.spec.org/virt_sc2010/results/specvirt_sc2010_perf.html

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Unprecedented I/O Performance

- ## September 2012:

  - 800k IOPS in a single KVM guest

  - 1.4M IOPs in 4 guests KVM

  - (ftp://public.dhe.ibm.com/linux/pdfs/
    2012RHEL_KVM_Hypervisor_Performance_Brief_19_v4.pdf)

- ## February 2013:

  - **1.2M IOPS** in a single KVM guest

  - IBM System X 3850 X5, QLogic QLE 256x HBAs, RHEL 6.4 (host and guest), virtio-blk-data-plane.

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KVM Cost Analysis by Guest Workload

◆ KVM   ■ VMWare ESX   ▲ Hyper-V
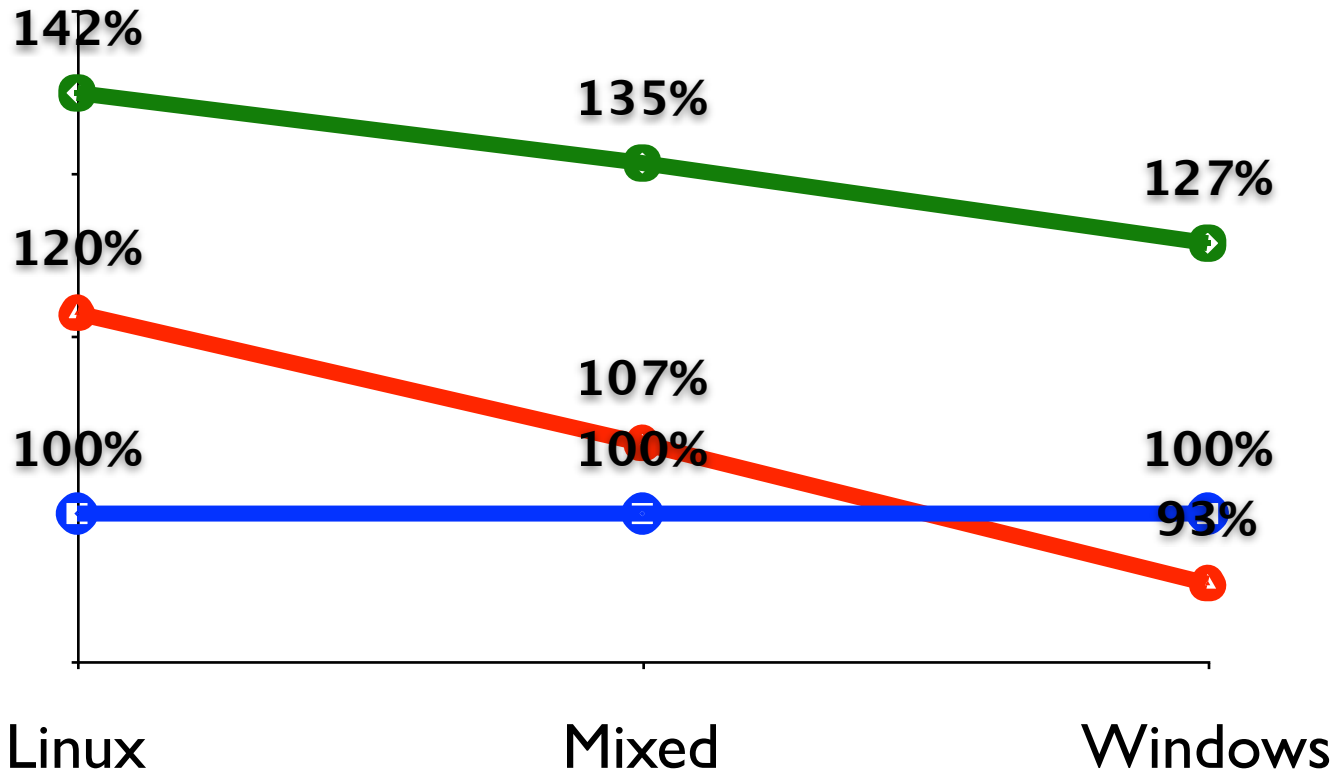
https://www.ibm.com/developerworks/mydeveloperworks/blogs/ibmvirtualization/entry/taking_the_sting_out_of_virtualization_licensing_costs_with_kvm

(David Hsu)

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VMware kills vRAM licensing, pledges more support for OpenStack, multi-cloud world

Summary: *It's safe to say VMware is feeling the heat from its open source rivals.*

By Paula Rooney for Virtually Speaking | August 27, 2012 -- 17:22 GMT (10:22 PDT)

Follow @PaulaRooney1

VMware's decision to kill its vRAM licensing model and expand its OpenStack support illustrates the significant power the open source model has amassed in the virtualization industry.

In his first official keynote as VMware's next CEO, effective Sept 1, Pat Gelsinger announced the end VMware's confusing and pricing vRAM licensing model and said the company will expand its support f OpenStack and the multi-cloud world.

Gelsinger said a survey of 13,000 customers revealed that pricing was the most unpopular aspect of VMware's business and that he was happy to announce the end of vRAM. There will be "no VRAM or Core entitlements," said Gelsinger, who is currently president and chief operating officer of EMC

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We are seeing marked increase in production usage of KVM among our customers

- Drivers
  - Technical progress of KVM Solutions
    - Improvements in RHEL 6.x over RHEL 5.x
    - Improvements in RHEV-M 3.0 over v2.2
  - Derivation of trust and maturity as characteristics of KVM due to time in the marketplace
  - Emerging View that KVM is a fundamental feature of the Linux Operating System
  - Economic Factors
  - Cloud computing

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Enterprise Linux Users

- KVM is an integrated feature of Enterprise Linux

- Existing Licensees already have it and already know how to use it

- KVM's administration tool-chain is integrated with the Linux tool-chain

- We see large enterprise Linux customers deploying virtual machines onto existing Linux servers rather than purchasing new VMware licenses

  – For both Linux and Windows workloads

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# Scavenging/Grid

- This use case monitors Linux servers for under-utilized hosts and deploys VM images to hosts selected according to some policy

  – Energy usage

  – Time of day, workload completion

  – Dev and test

  – Distributed batch processing

- Creates an ad-hoc grid of KVM hypervisors out of dynamically selected Linux hosts

- Multiple Financial Customers

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Cloud Computing

- ## KVM is a natural infrastructure for Cloud Data Centers

  - ### KVM is efficient

    - Drives higher densities

  - ### KVM is secure, and has specific features that simplify multi-tenancy deployment

    - sVirt - seLinux based mandatory access control
    - Linux process control
    - cgroups hard and soft resource limits

  - ### KVM out-scales the competition

  - ### KVM is economical

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KVM and Public Clouds

- **IBM's Smart Cloud Enterprise**
  - Built using KVM
  - Tivoli Services Automation Manager
  - Custom integration toolkit

- **Google Compute Engine**
  - Built using KVM
  - Google's infrastructure
  - Custom Integration toolkit

- **HP's Public Cloud**
  - Build using KVM
  - OpenStack

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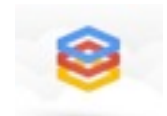
KVM and Private Clouds

- Large Financial Customers are building private clouds using Moab with xCAT and KVM

- Moab and xCAT have become fully-featured cloud infrastructures, while maintaining their scalability and performance as HPC cluster managers

- These tools support VMware and KVM equally well and make them plug-compatible

  – Customers are using this to phase-in more KVM usage over time

  – Postponing or canceling new VMware license purchases

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KVM and Large Enterprises

- The largest enterprises can save tens-of-millions of dollars per year just by reducing growth in new VMware licenses, or by slowing the renewal of existing VMware licenses

- They are finding it easy to identify Virtual Machine use cases on the margin to deploy to KVM instead of VMware

- This allows them to phase in more KVM over time

- Over three years the savings can be very significant
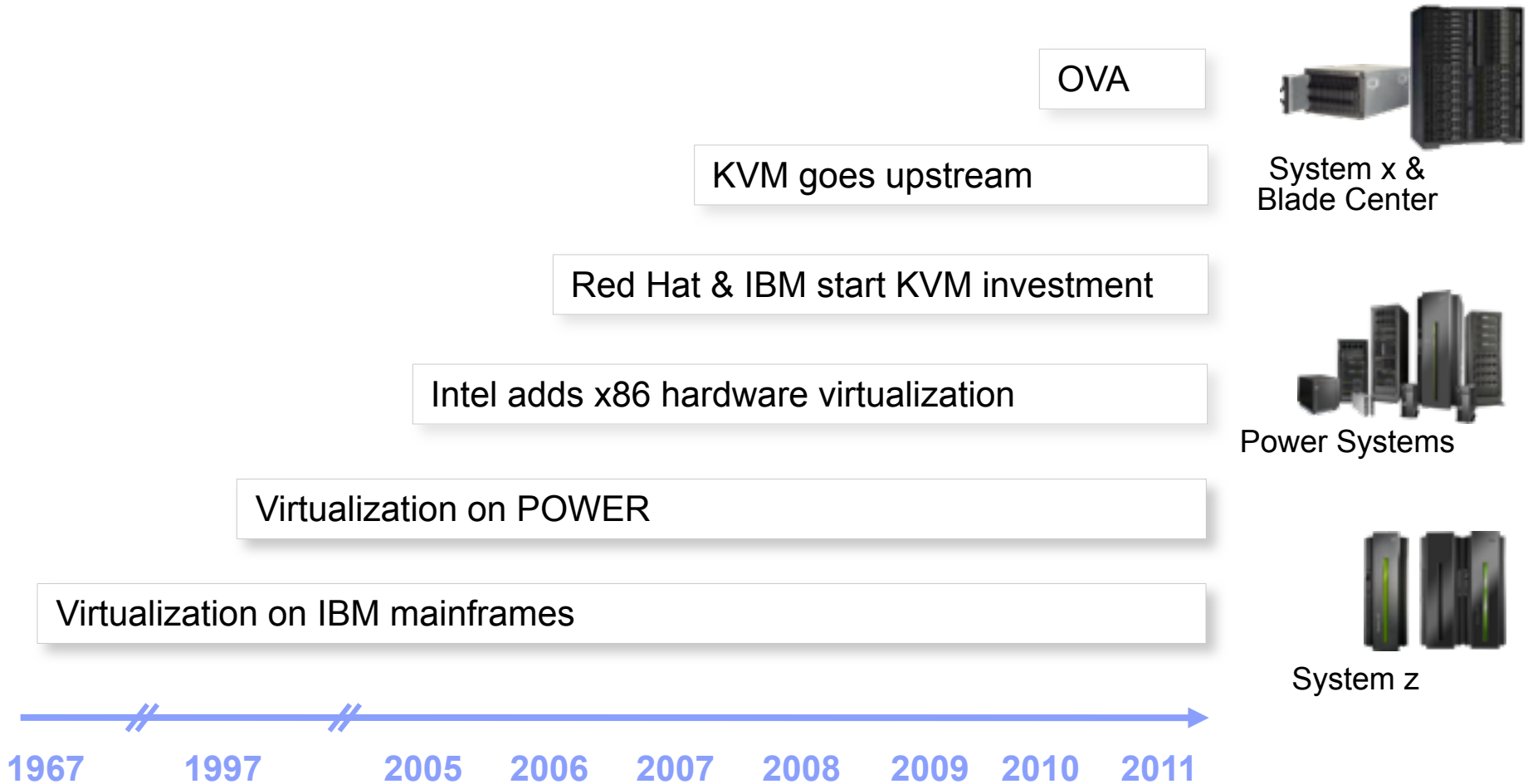
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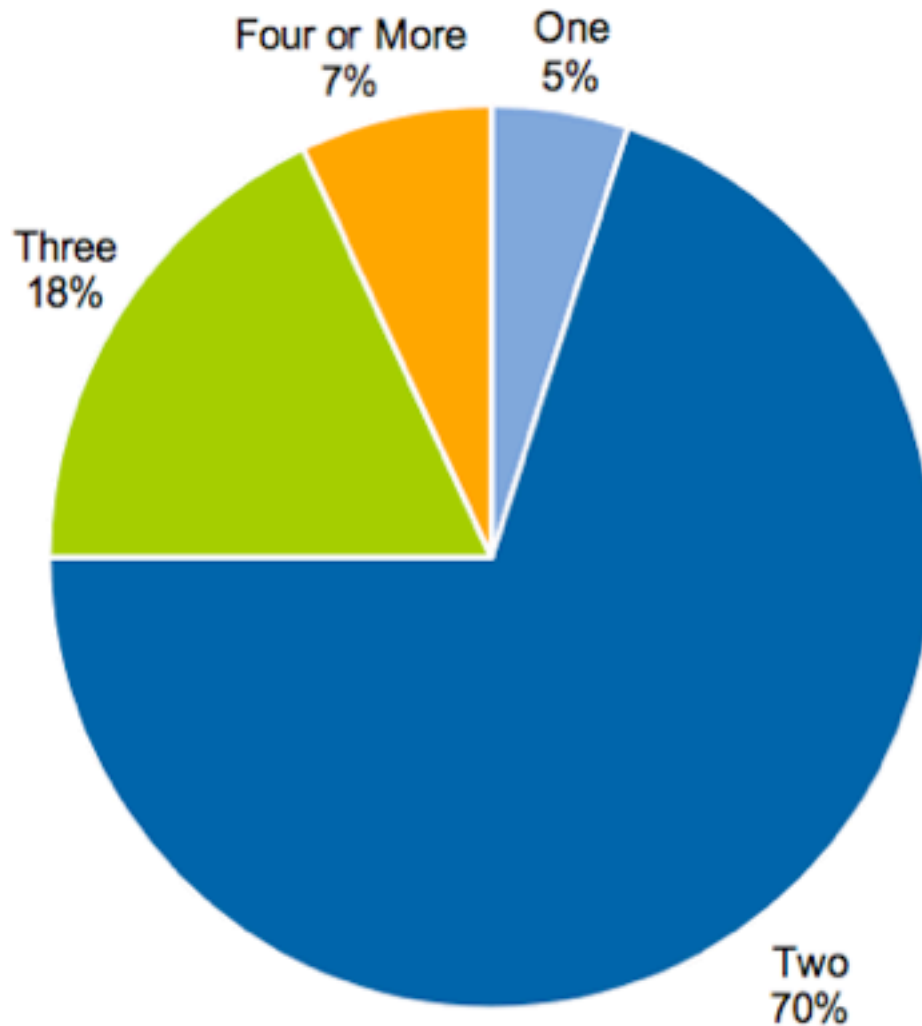
Gartner - Reconsidering Heterogeneous x86 Server Virtualization, Sept. 2012

In fact, KVM is the only hypervisor in our last two surveys to notch gains in both the number of overall users **and** in the number of users adopting it as their standard go-to hypervisor. - Gabriel Consulting Group - "Hyperversity Rages On"

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IBM and Virtualization
A brief history of virtualization

OVA

KVM goes upstream

System x &
Blade Center

Red Hat & IBM start KVM investment

Intel adds x86 hardware virtualization

Power Systems

Virtualization on POWER

Virtualization on IBM mainframes

System z

| 1967 | 1997 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |

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IBM's Market Goals for KVM

- IBM would like for KVM to be a significant presence in the marketplace

- To provide a technically excellent hypervisor and overall competitive open-source solution stack to the market

- To influence the direction of hypervisor development in a positive way

- To leverage our hardware platforms in a timely manner

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IBM's Linux Technology Center
Enhancing Linux Capabilities, Driving Linux Adoption

IBM Contributes to the Community

- IBM developers contributing to 100+ Linux and Open Source projects
- Develop closely with Red Hat and Novell
- Developers sharing technical knowledge on http://planet-ltc.org

IBM Supports Linux as a Tier 1 OS

- All IBM Systems, SW, and Middleware run on and are certified for Linux
- Driving performance parity with IBM's own operating systems
- Making contributions in security, RAS, scalability, performance, management

Make Linux Better

Enable IBM Products
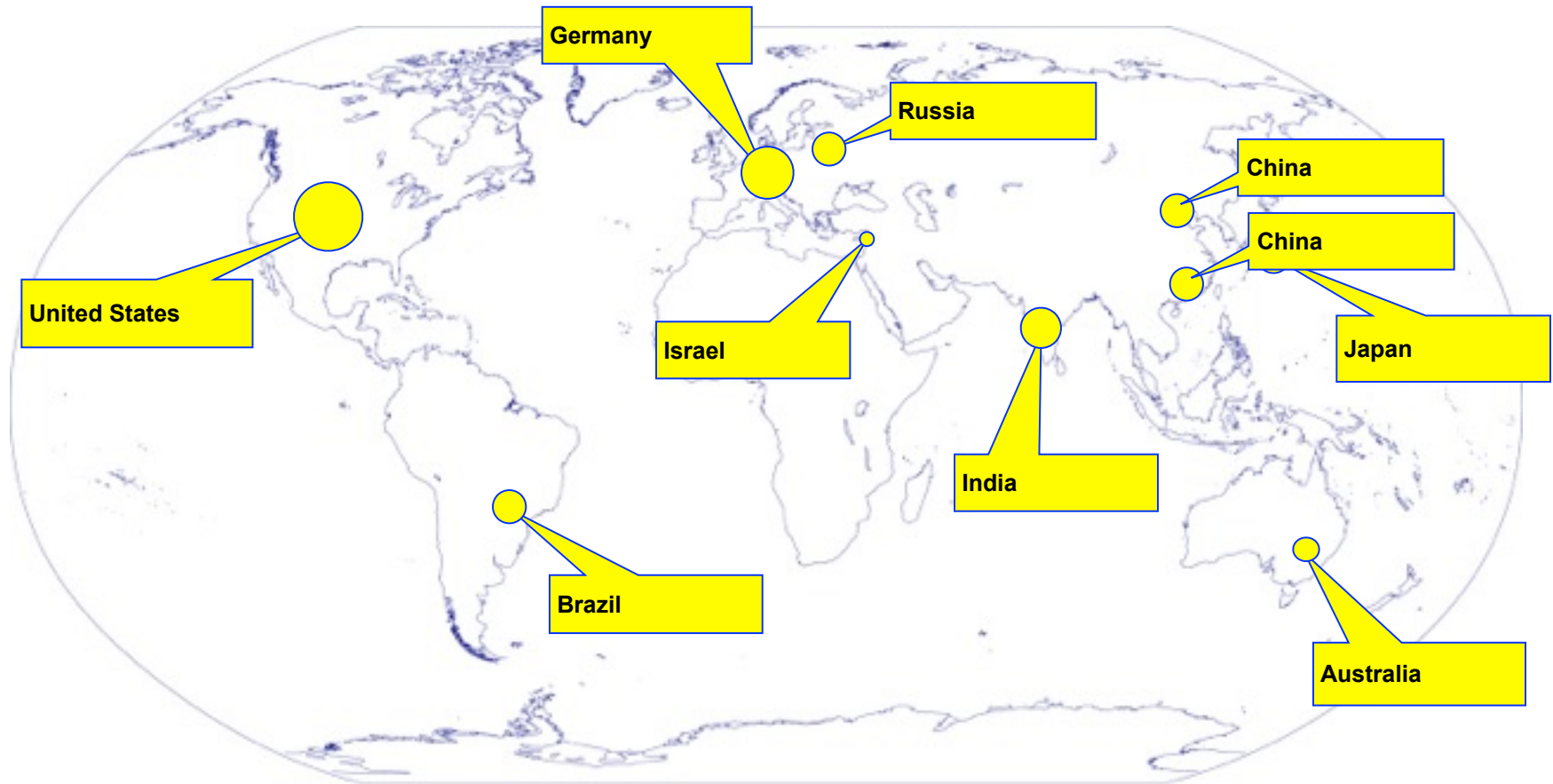
Customer Collaboration

Expand Linux Reach

IBM Collaborates with Customers

- Specialized and very detailed knowledge of IBM Systems and Software
- The LTC works with customers on unique proof of concept projects
- Scale Out File Services (SoFS)
- Real Time Linux and Java for Raytheon

IBM Enables Linux for New Markets

- Working with groups such as the Linux Foundation to address new workloads
- Expanding and providing leadership in:
- Blue Cloud Computing
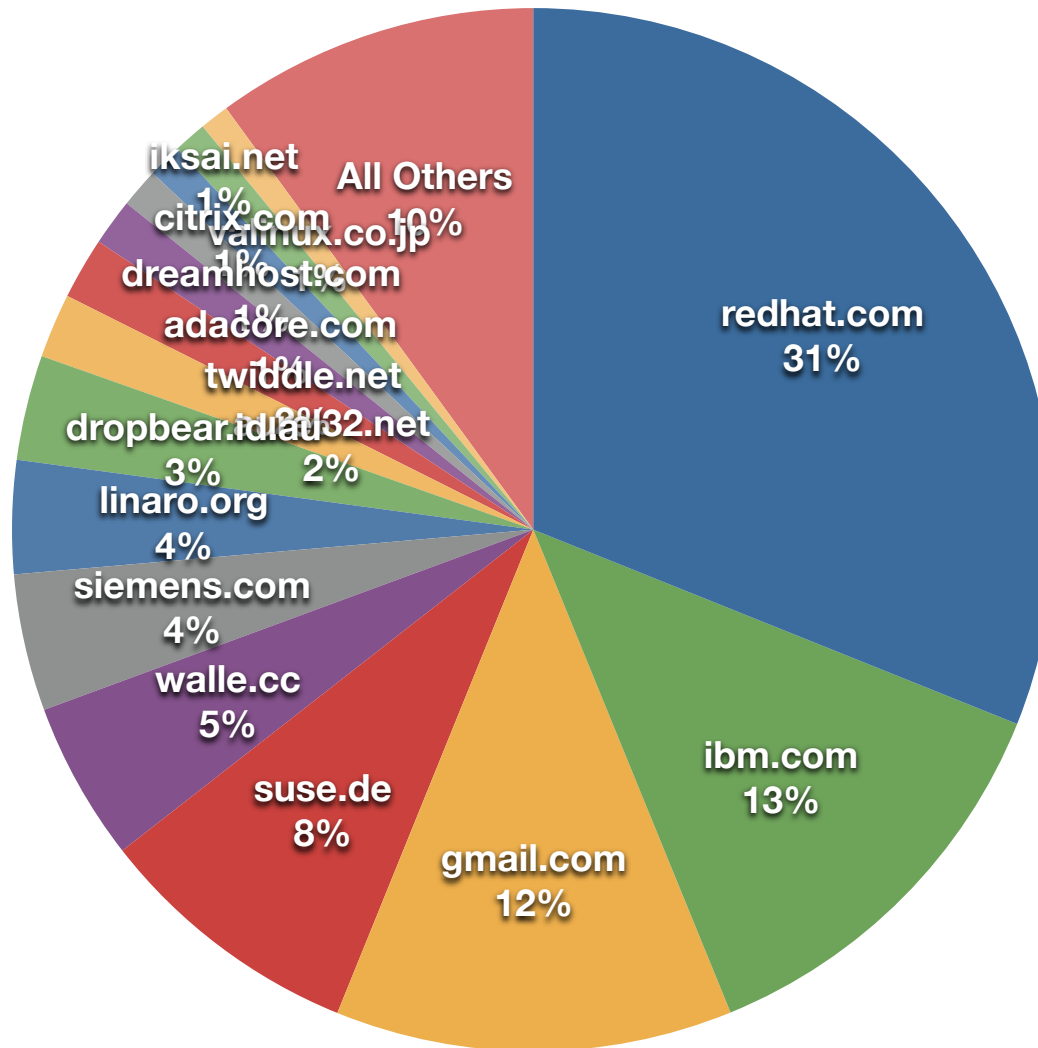- SOA / Web 2.0 / SaaS
- Distributed computing and HPC

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LTC Worldwide Staffing – Country Locations*

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IBM's KVM Development Focus

- Support for IBM's Public Cloud

- Platform Support

- Security

- Performance

▪ oVirt

▪ OpenStack

▪ Qemu

▪ I/O Performance

IBM has more than 65 developers dedicated to KVM

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2011 QEMU Source Changes by Domain

- redhat.com 31%
- ibm.com 13%
- gmail.com 12%
- suse.de 8%
- walle.cc 5%
- siemens.com 4%
- linaro.org 4%
- dropbear.id.au 3%
- id32.net 2%
- twiddle.net 2%
- adacore.com 1%
- dreamhost.com 1%
- vallinux.co.jp 1%
- citrix.com 1%
- iksai.net 1%
- All Others 10%

http://code.ncultra.org/2012/10/148/

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2011 KVM Source Code Changes by Domain

http://code.ncultra.org/2012/10/148/

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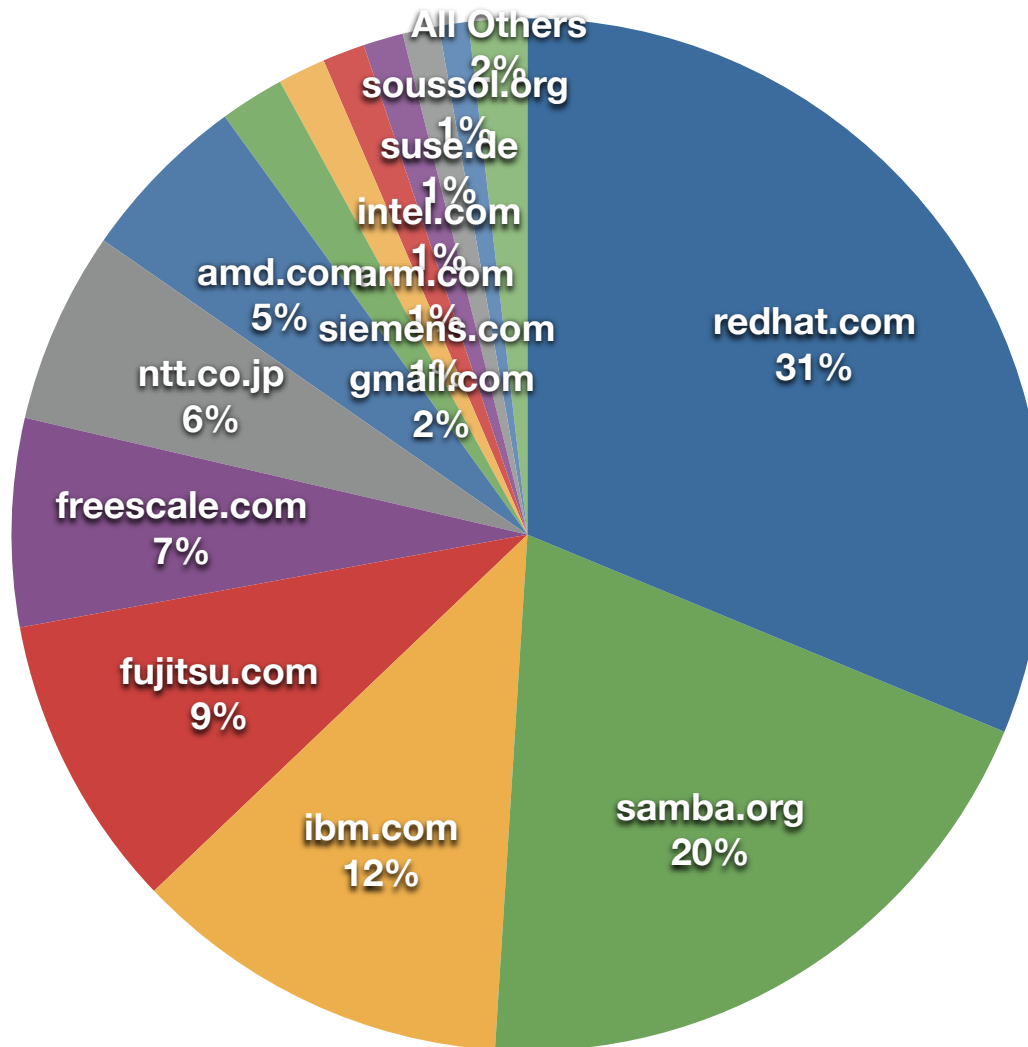
2008-11 Source Code Changed Lines

http://code.ncultra.org/2012/10/148/

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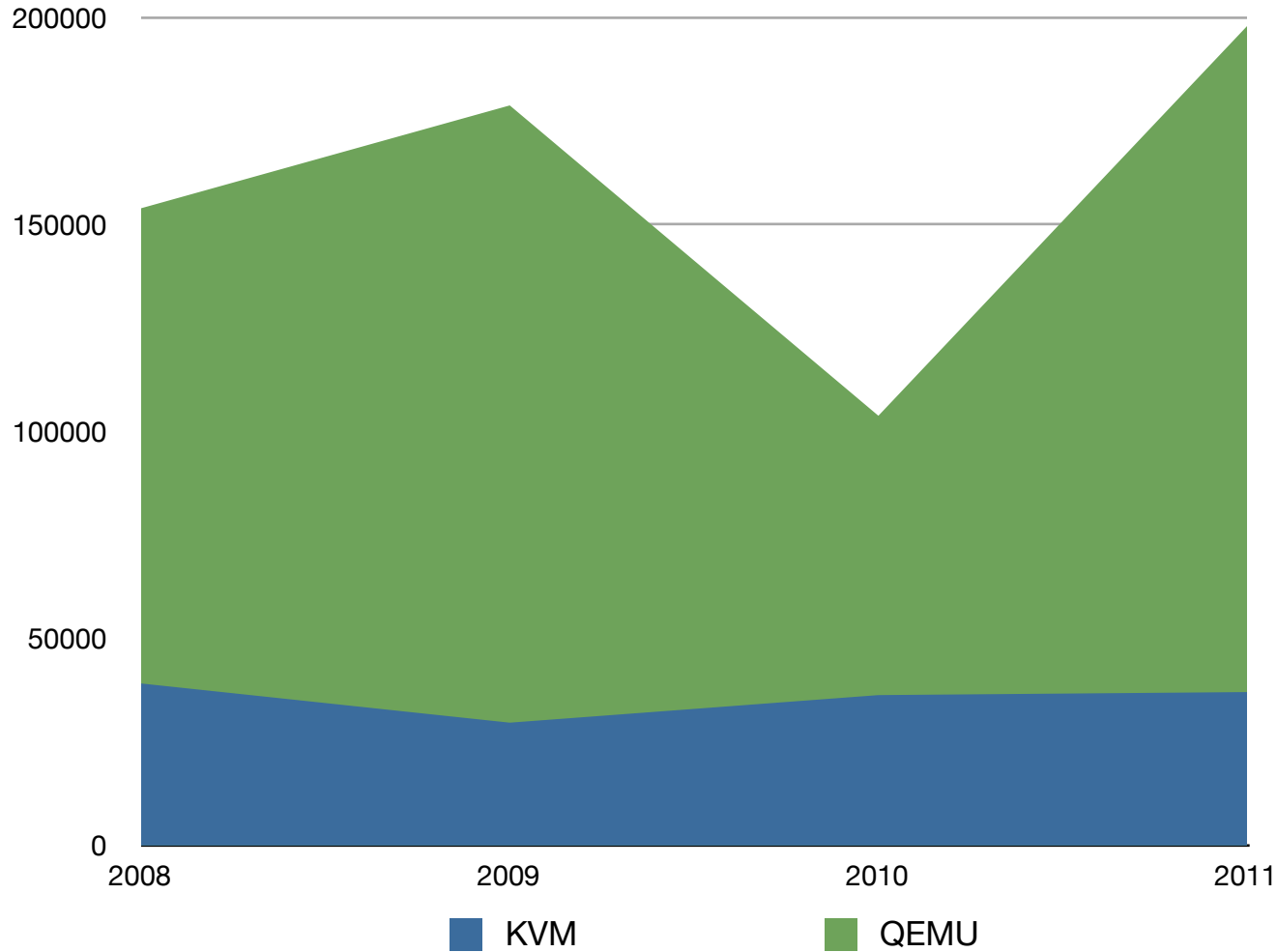
2008-11 Development Email Traffic

http://code.ncultra.org/2012/10/148/

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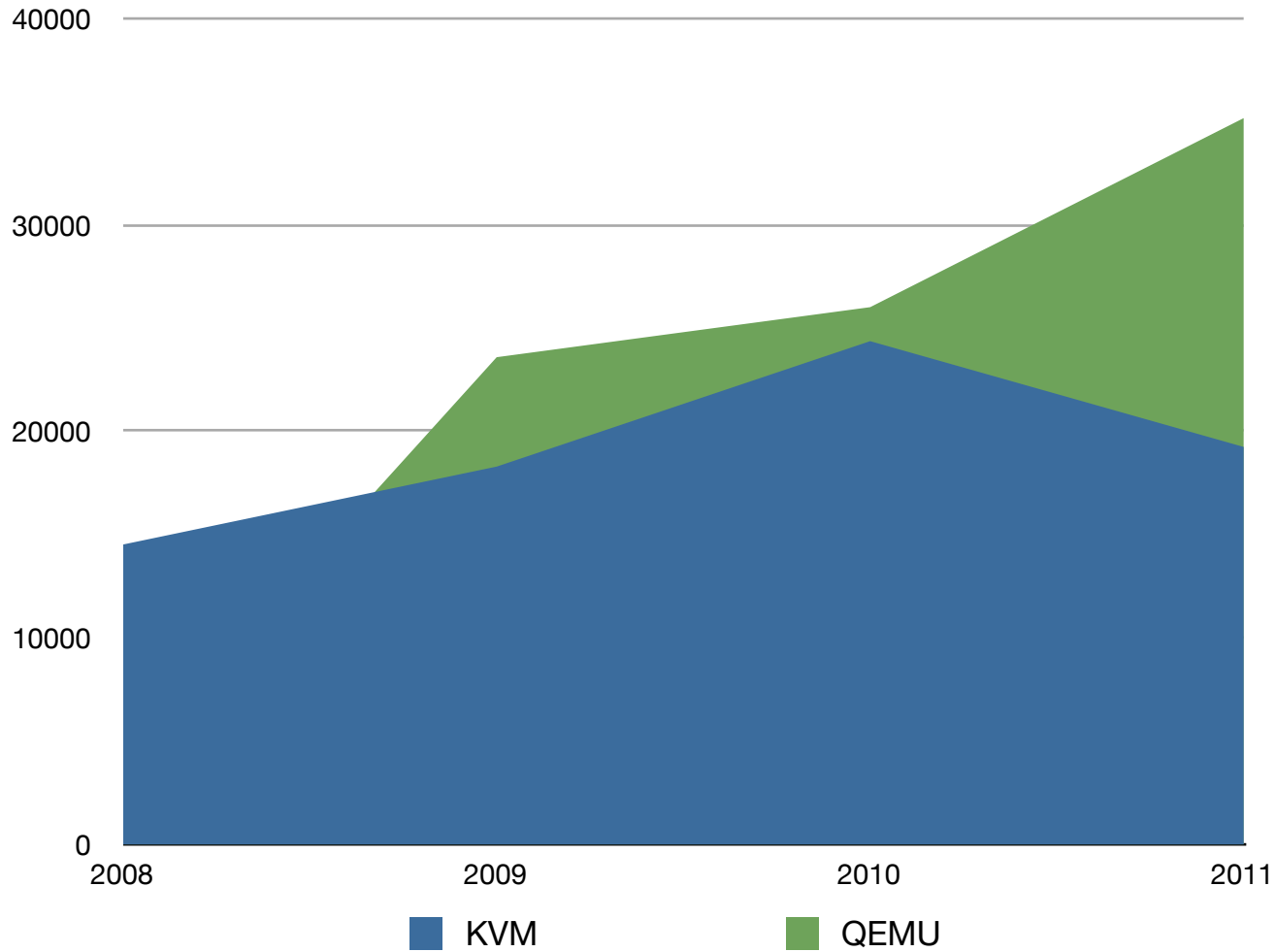
KVM for Power and s390 Platforms

- Increased upstream development activity from IBM

- Reflects lessons learned from Linux and KVM

```
[mdday@shoshone arch]\ $ pwd
/Users/mdday/src/kvm/arch
[mdday@shoshone arch]\ $ ls
Kconfig          blackfin       h8300        m68k         openrisc      score       um
alpha            c6x            hexagon      microblaze   parisc        sh          unicore32
arm              cris           ia64         mips         powerpc       sparc       x86
avr32            frv            m32r         mn10300      s390          tile        xtensa
[mdday@shoshone arch]\ $
```

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Challenges - we "pretty much" know where they are

Thank You

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Virtualization @ IBM Blog
https://www.ibm.com/developerworks/mydeveloperworks/blogs/ibmvirtualization/

Life in Code
http://code.ncultra.org

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NOTES:
Linux penguin image courtesy of Larry Ewing (lewing@isc.tamu.edu) and The GIMP

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