



CLABBY ANALYTICS

## Case Study

### KMD: Unix and Oracle Consolidation on System z

#### *Introduction*

When KMD, Denmark's largest locally-owned information technology (IT) service provider, ran out of capacity on its four, large Hewlett-Packard HP-UX/PA-RISC-based HP 9000 servers, it had four choices:

1. Upgrade to an HP Itanium-based Integrity server (because HP has ended development and manufacture of its HP 9000 PA-RISC servers — leaving KMD with no future upgrade path); or,
2. Move to a competing Unix server environment;
3. Move to Linux on distributed x86 servers or blades (an option that KMD did not see as viable); or,
4. Get creative — and find a way to exploit existing computing capacity elsewhere within its information systems environment.

KMD chose to get creative.

What KMD did was migrate its Perspektiv payroll/human resource applications environment off of the HP-UX operating environment over to Linux partitions running on an IBM mainframe. And by doing this, KMD was not only able to greatly increase its application processing capacity — but was also able demonstrate very significant cost-of-acquisition savings over a five year period.

In this *Case Study*, *Clabby Analytics* (that's me) examines KMD's HP 9000 “out-of-capacity” situation — and its corresponding action. And, based upon my observation of KMD's experience, *Clabby Analytics* suggests that moving to a mainframe architecture may be a better option for Hewlett-Packard (HP) customers who no longer have an upgrade path on their existing HP 9000s than moving to an HP Integrity-branded server.

#### *Background*

KMD is Denmark's largest locally-owned IT service provider. The company has close to 3,000 employees, and its annual revenues are approximately DKK 3 billion (@\$570 million, or €402 million). KMD operates 7 distinct datacenters; and operates approximately 3,000 Windows servers and 250 Unix/Linux servers. KMD also operates two IBM System z mainframes (that process 270,000,000 CICS transactions per month as well as handle batch jobs). The company's primary charter is to provide IT and consultancy services (hosted services) to public and private markets.

As a hosted service provider, KMD runs IT services on backend servers for its clients. But KMD is also an application service provider (ASP) and markets its own payroll and human

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resources application suite (known as “Perspektiv”) to government organizations as well as small, medium and large enterprises. (It also sells its Perspektiv independently, so some of its customers, who then host Perspektiv on their own equipment).

### *The Situation*

KMD projected that it would run into capacity problems on its HP 9000s as far back as 2004. And in that year, KMD systems engineers attended an IBM workshop in Amsterdam that explored Linux implementations on IBM’s S/390 architecture. At that seminar KMD learned that it might be possible to cleanly migrate their existing applications from HP’s PA-RISC architecture running to a mainframe running Linux.

At first, this idea went nowhere (other priorities were in play — so the idea came to life and died out several times). But, as the capacity problem became more acute on HP’s 9000 systems cluster, KMD needed to take action.

KMD studied the feasibility of moving applications to Linux on a mainframe — and concurrently studied the financial implications of doing so:

- With respect to porting to Linux, KMD determined that the way their Perspektiv program had been written was consistent with Linux conventions — so porting would be straightforward (according to KMD: “programs migrated and compiled without difficulties”).
- As for the financial implications of this move, KMD considered only three factors: 1) hardware costs; 2) software costs; and 3) the benefits of virtualization on a mainframe. The mainframe alternative won on these basis (KMD’s financial analysis will be explored in greater depth in the next section).

In June, 2006, the business case for moving Perspektiv from HP 9000s to IBM z9 mainframes was approved. Seven months later KMD had five of its Perspektiv customers up and running in Linux partitions on a mainframe; the remainder of its customers were migrated in November, 2007.

### *The Financial Case*

When comparing mainframe costs to costs for distributed servers, *Clabby Analytics* often advises IT buyers to consider not only the cost of acquisition for hardware, software, and networking components — but also the costs related to system operations (such as power/cooling costs, floor space, etc.) as well as human-related management costs.

Because KMD already had mainframe capacity available, KMD’s business case was far simpler than what *Clabby Analytics* usually recommends. What KMD did was:

1. Compare the incremental hardware cost for running Linux on specialized processors in its mainframes (these specialized processors are called Integrated Facility for Linux — or IFLs);

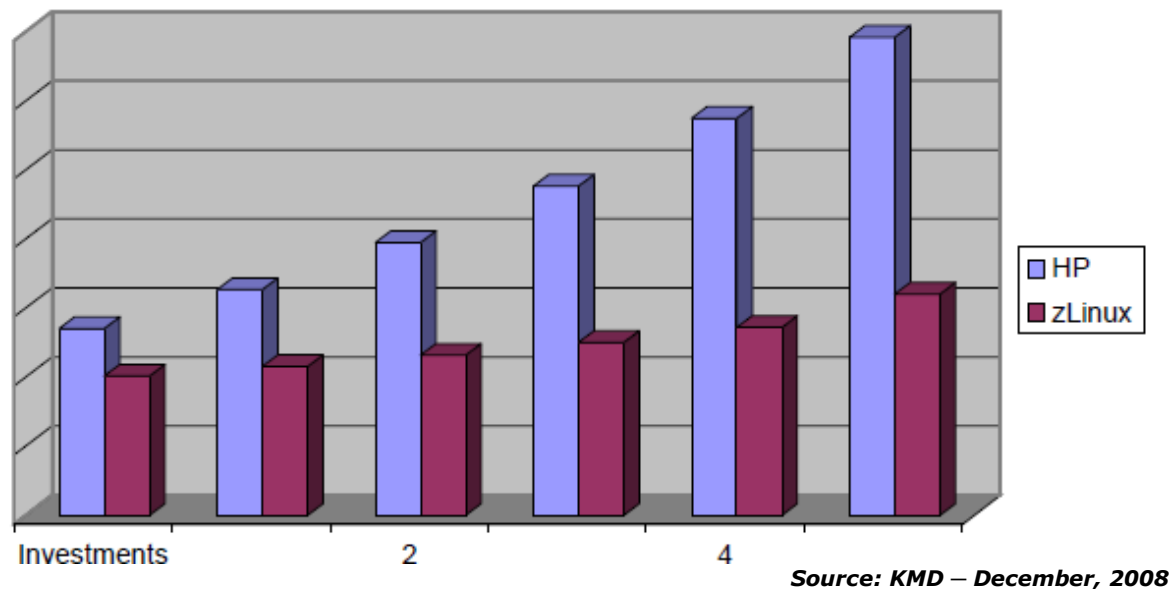
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2. Compare the licensing costs for running multiple instances of software on its distributed HP 9000 servers to the single license costs fees for running applications in a self-contained, singular mainframe environment; and then,
3. Roll-in the virtualization benefit delivered by the mainframe (mainframes, unlike distributed server environments, can consistently run at 100% utilization — versus an average of 15-30% utilization on distributed servers).

*Using just these three metrics, the mainframe thumped and trumped the HP9000 cluster in terms of projected cost savings.*

What KMD's analysis showed was that, by moving its Perspectiv application to a mainframe, it would realize substantial savings over a five year period (see Figure 1). Note: KMD's actual numbers are company confidential — but the graphic below does illustrate the savings KMD is achieving after moving off of its HP 9000 server cluster.

**Figure 1 — KMD Projected Cost Savings Moving From HP to an IBM Mainframe**



Of particular interest in this analysis are:

- KMD did not weigh network cost savings (from moving from a distributed cluster to a centralized mainframe), nor did it measure other potential datacenter cost savings (in power, cooling, real estate, maintenance, and the like). *Clabby Analytics* suspects that KMD's savings would have been even more substantial if these additional datacenter costs were tallied.
- The vastly superior virtualization capabilities available on IBM's mainframe played a huge role in this comparison. HP/UX can be virtualized — but HP has no further commitment to the virtualization of its HP 9000 servers.

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- People costs (IT administrator/manager costs) were not weighed in this comparison. IT salaries are generally high in Denmark — so taking people costs out of the equation can have a huge economic benefit. Distributed environments generally require more people to manage distributed resources and assets than centralized architectures. So weighing savings from having to employ fewer people to manage this environment could have an even greater positive impact that favors the move to mainframes.

### *The Deployment*

KMD was very forthcoming in its discussion of the actual porting and deployment processes. Although no substantial issues were reported in the porting of Perspektiv from HP-UX to Linux, KMD did run into a few performance-related problems in its initial deployment of Perspektiv on mainframe architecture. KMD indicated that IBM engineers were rapidly dispatched from France to their site to examine the actual Linux installation and deployment parameters — and the performance issues were rapidly overcome after tuning and adjustments.

Further, KMD did report that it “took some getting used to” when describing running the Linux operating environment from inside of IBM’s VM (virtual machine) operating environment (VM has responsibility for managing Linux instances in virtualized partitions on the mainframe — so both operating environment run simultaneously on the mainframe). KMD is now, however, used to running Linux in this manner.

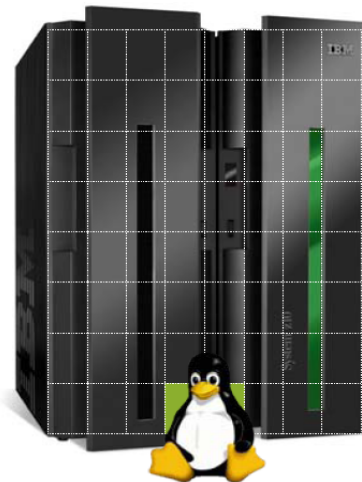
### *The Actual Environment Today*

To build its Linux environment on the mainframe, KMD bought two IFLs, additional storage, and installed new software modules (see Figure 2).

### Figure 2 — The Components KMD Used to Replace Its HP 9000 4-node Cluster

We bought 2 IFL to our mainframe  
and

- 15 GB central storage
- 5 GB expanded storage
- DASD pool: 470 emulated 3390-9
  - ~ 3 TB Linux Disk Space
  - EMC DMX3 emulating 2107
  - Connected via 8 Ficon channels, switched (shared with other systems)
  - Mirrored in another data centre
- Installed
  - z/VM
  - Linux SLES9 → SLES10
  - Oracle

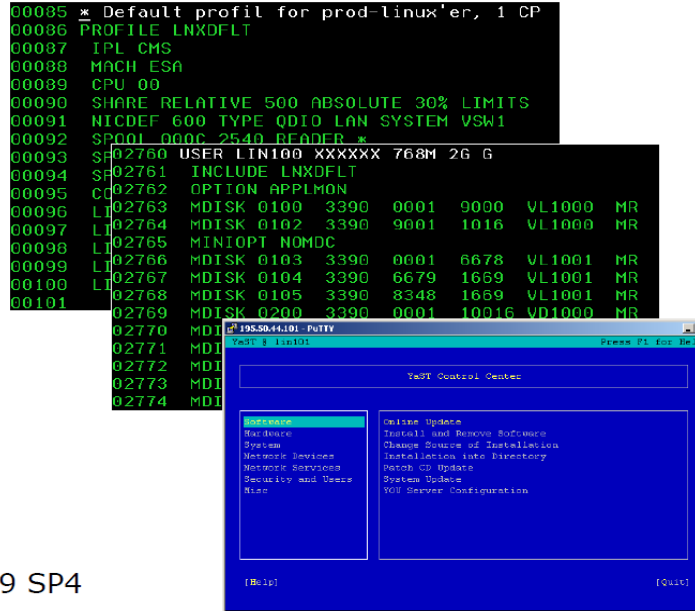


Source: KMD — December, 2008

Within this environment, KMD hosts its customers as Linux guests (see Figure 3). Customer applications run in virtual CPUs and use only a small amount of memory. Adding a second virtual CPU for processing introduces minimal overhead.

**Figure 3 — KMD Customers Hosted as Linux Guests**

- 1 virtual CPU
  - Workload mainly single-threaded
  - 2 CPUs introduces diag x'44 overhead
- 768 MB memory
- Connection to vswitch
  - Customer VLAN
- Minidisks (3390-9 based)
  - vdisk 100: Linux root disk / (6,3 GB)
  - vdisk 102: secondary swap (714 MB)
  
  - vdisk 103: Oracle 10 (4,7 GB)
  - vdisk 104: /MR appl. (1,1 GB)
  - vdisk 105: /MRTEST test appl. (1,1 GB)
  
  - vdisk 200-205: Oracle data, LVM, striped  
6 x ½ 3390-9 (21G) or 6 x 3390-9 (41G)
- SUSE Linux Enterprise Server 9 SP4



Source: KMD — December, 2008

Adding additional workloads (and activating more virtual machines) is easily accomplished simply by following the basic clone script advice provided in the SLES9 cookbook (as indicated above, this Linux deployment operates on Novel’s SUSE Linux Enterprise Server). Further customization scripts are used to provide formatting, to prepare additional minidisks/file systems, and in the creation of Linux virtual machines, Oracle table space, and users.

As for handling failures (a circumstance that has NEVER occurred in this environment), KMD backs-up its activities on tape. Should a failure occur someday, a new Linux clone will be created and the corresponding database dump can then be retrieved from tape and restored. KMD reports that this method has already been tested by its engineers (when moving guests from one disk system to another while simultaneously expanding a Linux file system).

As for disaster recovery, KMD is considering installing more IFLs on its second mainframe and then starting Linux from mirrored disks. But, in the meantime, Linux VMs and the controller can be restored from a full volume dump, then be cloned and restored.

*In other words, Linux on a mainframe operates just like Linux on other hardware platforms... This is not a “special” Linux for mainframe environments — this is Linux plain and simple.*

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### ***The Management Environment***

KMD pointed out that they prefer to run their organization's systems/network management environment using HP's OpenView product line — but OpenView does not run on mainframes. To bypass this issue, KMD long ago deployed IBM's Tivoli management environment on its mainframes — and with a few extensions, Tivoli can collect Linux activity data and report it back to OpenView.

From a monitor/control perspective, Tivoli can monitor free space in a file system, CPU overload (for instance, if problem looping is occurring), trashing (extensive swap usage) and more — and report these instances to OpenView using a Java-based Linux Agent. Should any of these conditions occur, incidents are automatically registered with OpenView.

KMD does report that Tivoli Monitoring does carry some detectable CPU overhead (as do most management products). But this overhead is minor — and well worth it in KMD's opinion to ensure that systems are running properly.

### ***Summary Observations***

KMD's Linux on the mainframe implementation is significant for a number of reasons:

- It proves that mainframes can run Linux (and Linux applications) in exactly the same way that other platforms run Linux;
- It demonstrates a viable way to rehost applications from other architectures on a highly-reliable, highly-scalable, highly-secure platform (the mainframe);
- It demonstrates that mainframes are viable platforms for the deployment and servicing of Software-as-a-Service (SaaS) applications (KMD sells Perspektiv as an independently available software product — but also makes it available as a hosted product. There is no reason that KMD cannot also sell this as a SaaS application); and,
- It provides a viable alternative to HP customers that have run out of capacity on their HP 9000s.

This final point is especially worth dwelling upon. KMD could have forklifted-out its HP 9000 servers and replaced them with HP Integrity servers running HP/UX. But moving to an IBM mainframe server made a lot more sense — both from an economic and capacity expansion point-of-view. KMD found a creative way to expand capacity without having to purchase another, completely different architecture (HP's Integrity [Itanium-based] server environment. And this saved KMD and its stockholders a lot of money.

Ultimately, what KMD did was rehost an application — moving from an HP 9000 cluster to Linux partitions on an existing IBM mainframe. More HP 9000 customers should consider this exact course of action...

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