



IN THE BUSINESS OF YOUR SUCCESSSM

ADP - Customer Experience with Virtualization on System z

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HR. Payroll. Benefits.

Agenda

- **ADP – Company Background**
- **Mainframe Environments**
- **Virtualization Project**
- **Benefits**
- **Challenges**
- **Open Source / Cloud Concepts**
- **Still Going and Growing...**

ADP – Company Background

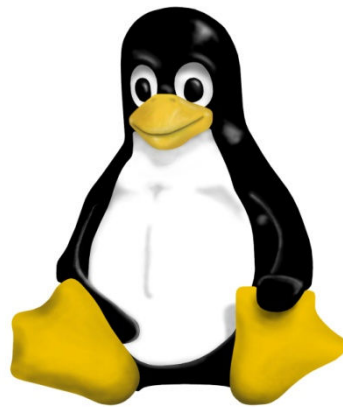
- \$11.3 Billion in annual revenue
- 57,000 Employees worldwide
- ADP pays 1 in 6 U.S. workers
- ADP pays 1 in 4 Canadian workers
- Processed nearly 48 million W-2's in 2012
- Well established in the Cloud before the term became fashionable
- Over 300,000 SaaS clients (18 million users) leveraging ADP's solutions for recruiting, talent management, time and attendance, HR, benefits, retirement services, and payroll
- Provide one or more services to 80% of the Fortune 500 and 90% of the Fortune 100 companies
- ADP serves over 620,000 clients across 125 countries
- Dealer Services groups provides fully integrated technology services and solutions to about 26,000 dealerships worldwide

Mainframe Environments

- Four data centers in North America
- 23 CEC's
 - Mix of z/EC-12's, z/196's and z/114
- 42 z/OS LPAR's
 - Consolidated into three data centers
 - Payroll processing, retirement services, tax services & more
 - 52,000+ Programs – almost 60 million lines of code (mostly COBOL)
 - 3 million batch jobs processed each month
 - Over 400 CICS regions supporting around 20 million transactions/day
- Over 1,500 TB of CKD DASD for z/OS and z/VM

Mainframe Environments – z/VM / LINUX Details

- **When we started... (*for the third time!*)**
 - Early 2008 POC
 - 2 IFL's and 32 GB of Memory across two z/9's
 - 2 z/VM LPAR's
 - 12 Guests – Engineering, CSL & WAS



Virtualization Project

- **Third time was a charm!**

- We first started “playing” with Linux on z in 1999/2000
 - No IFL’s, SLES 7 – Performed poorly, nobody really interested
- Second try came in 2004 with a loaner IFL
 - Similar results – Tried bringing up WAS to get some application interest, but no takers and no management buy-in

- **In 2006-2007 we had a significant management change**

- New CIO and SVP had mainframe backgrounds and understood value and RAS concepts that System z had to offer the hosted world
- Early 2008 POC - 2 IFL’s and 32 GB of Memory across two z/9’s
 - Started POC with some IT-internal servers (CSL & WAS)
 - Spent a lot of time with IBM, Novell *and friends* looking for best practices
 - Learned a lot about what we should and shouldn’t do!
 - ***By April of 2009, we were ready for the masses to join us***

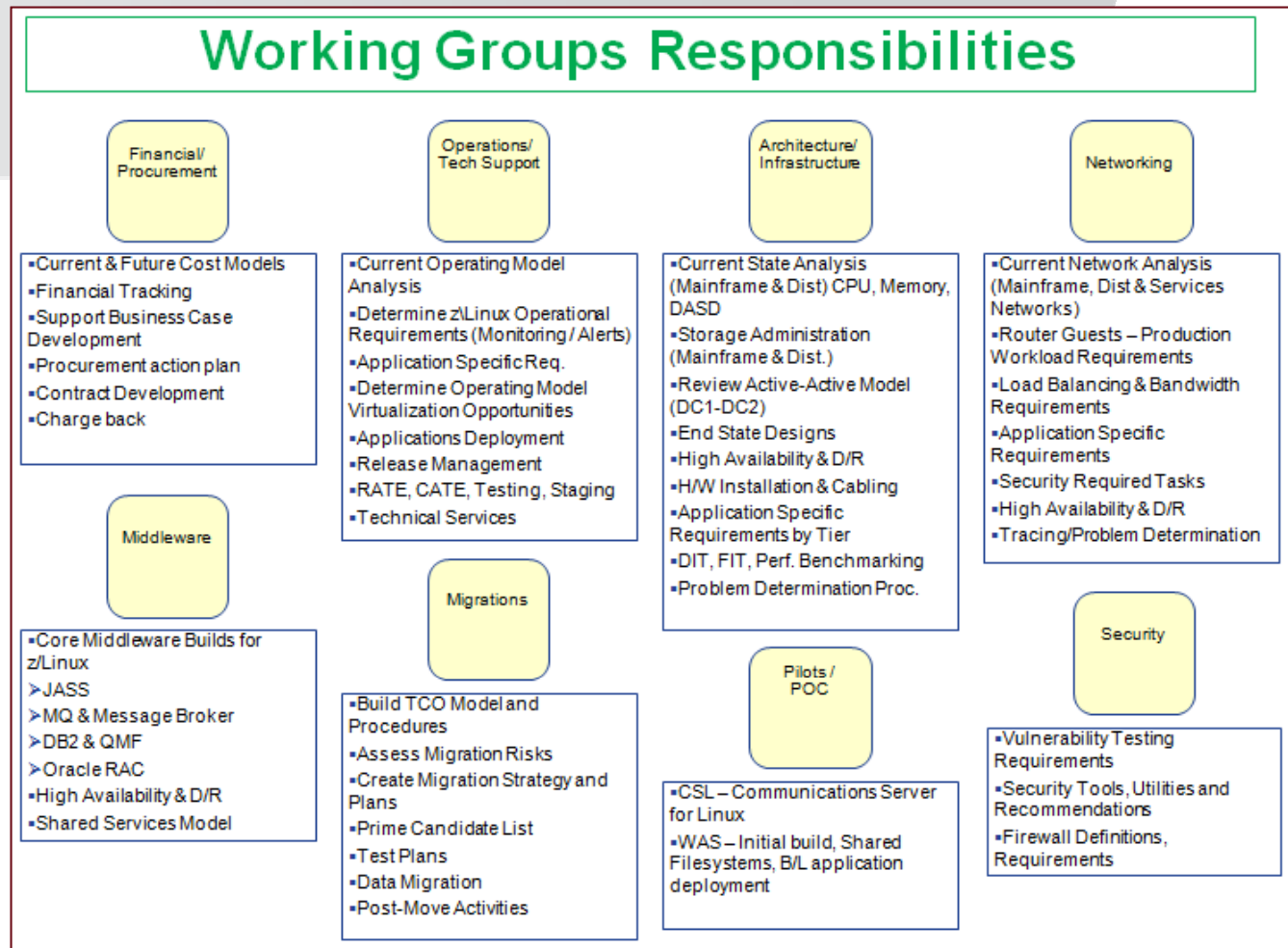
Project Overview & Scope

- **Overview**
 - Introduce and implement z/Linux as an effective TCO alternative for ADP products current and future
- **Approach**
 - Build system infrastructure for z/Linux
 - Complete and review proof of concepts with CSL and WAS
 - Establish cross – disciplinary teams to evaluate opportunities. Unix, Linux, z/VM, middleware, network, business, testing, finance, ptam, technical support and application teams to be represented
 - Include within technology governance, ARB and portfolio management processes to ensure and support adoption where appropriate
 - Create Total Cost of Ownership model for z/Linux
 - Create z/Linux product roadmap
- **Assumptions**
 - Plugs into current Hosting Support Model
 - Minimize re-engineering while leveraging System/Z capabilities
 - Not an all or nothing approach
 - Focus on tiers, products and platforms that leverage System/Z and provide best financial benefit to ADP
 - Optimize floor space, power and cooling
 - Simplify our DR models

▪ **Official Project Kick-off (April 2009)**

- By now, we had 6 IFL's with 38 guests on two z/10's and had a good story to tell
- Open communications with all groups and management
- Explained what a mainframe is and what we can (and can't) offer
- Minimize transition impacts as much as possible
 - Leverage existing standards and procedures

Virtualization Project



- **Did I mention communications...**
 - We tried to make sure all parties were ***actively*** involved in the project
 - Management really helped make sure everyone participated
 - Mapped out high level project plans, requirements, deliverables
 - **Each work group came back and presented their plans & support models**

Virtualization Project

z/Linux Project – Parallel Activities



Be careful what you ask for...
You just might get it!

- This is when the fun really started and the flood gates opened
 - Found a lot of (i)'s to dot and (t)'s to cross as more groups joined in
 - Had to level-set with a lot of groups on what sharing resources really means to them and how some things **have to** change

Virtualization Project – Success Factors

- TCO / TCA – “real” cost analysis (H/W, S/W, People, Environmental, D/R)
 - Need to use the **real** costs all the way through the process
 - IBM – Aggressive pricing for IFL’s and Memory (***this is a must!***)
- Management, Finance & Procurement - Knew what the “Hosted” spend was and how it was increasing each quarter
 - Recognized savings opportunities before we did
 - Negotiated fantastic deals with our vendors
 - Single organization responsible for all H/W and S/W orders
 - From thousands of cores down to hundreds – ***Think about the PVU costs!***

Virtualization Project – Success Factors

- Leveraged existing mainframe staff – Built up over time
 - Approached this as we would any other “mainframe” project
 - Utilize the resources fully, automate, monitor, support dynamic/redundant configurations, etc.
- Folded into existing standards and procedures whenever possible and provided enhancements when necessary
 - Secure builds, patching, monitoring/alerting
 - Single C/I/P management process – Tweaked workflows and groups

Virtualization Project – Success Factors

- Provided new features and solutions
 - Shared mini-disks for WAS Binaries – Install once and forget about it
 - Provisioning/Cloning, Automation, Scheduling – LPAR & Guest levels
 - Capacity on Demand
 - Enhanced D/R capabilities with LPAR/Guest replication and CBU
 - User ability to start/stop/recycle their own guests while having a view into the Guest, LPAR, CEC and Data Center resource utilization data
 - Velocity-zVPS & CSL-Wave
 - Shared RACF / DIRMAINT
- Technology Refreshes
 - In a single weekend, upgraded 800 guests from a z/10 to a z/196 providing a 20-25% performance improvement
 - Just did it again going to zEC-12's in a scheduled maintenance window!

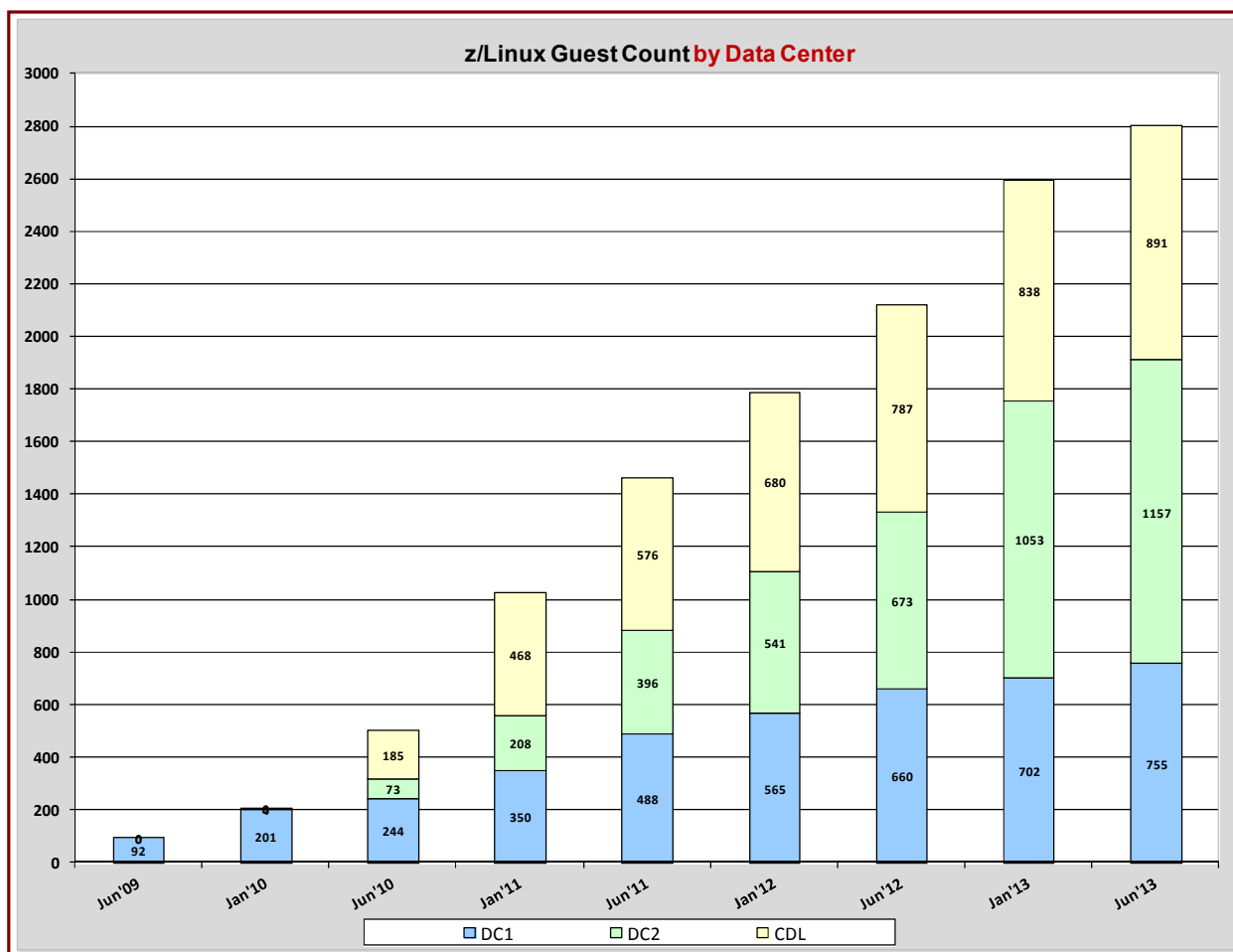
Mainframe Environments – z/VM / LINUX Details (Today)

Where we are today...

- Over **400** IFL's
- > **400,000** MIPS installed and growing...
- **30** z/VM LPAR's and growing...
- More than **30** TB of Memory across **14** CEC's (Active and Pre-planned)
- **2,900** Guests and growing each week
 - WAS, CSL, Oracle, Portal, Cognos, DB2 Connect, QMF, TEPS
- More than **7,200** JVM's
- Over **1,700** Oracle Databases
- **900+** TB of SAN attached disk
- Another **800+** TB of CKD disk
- Over **6,200** virtual CPU's and **17** TB of virtual RAM

Virtualization Project

■ This is true virtualization and not just consolidation



- ❑ Average Virtual to Real Memory over-commit is 1.8:1 (Max – 3.5:1)
- ❑ Average Virtual to Real CPU over-commit is 14:1 (Max – 37:1)
- ❑ Mixed applications sharing same resources – WAS, Oracle, CSL, Cognos, Portal, etc.
- ❑ Prod and Non-Prod LPAR's sharing resources

Benefits

- Software savings – Savings (**\$\$ millions**)
 - Core and PVU based software license fees
- Environmentals - Savings (**\$\$ millions**) and Cost avoidance (**\$\$ more millions**)
 - Power, Cooling, Cabling, Switches
 - Data Center expansion
- D/R capabilities
 - Followed z/OS design (Automated scripts to recognize D/R site and make changes at IPL/Boot time)
 - CBU and Pre-planned memory – Pay for what you use – No wasted resources
- Standards
 - Shared WAS binaries not only sped up guest turn over, but guarantees it's the same WAS across guests
 - Golden image used for all guests based on a single “secured” build - WAS, DB, Other...
 - Clustered WAS configurations – Applications split across LPAR's and CEC's

Benefits

- Capacity on Demand
 - We plan for peaks, but we still have times throughout the year, we need more
- Performance / Response times – A lot of good stories here – Helps get the word out that Z is “okay”
 - Authentication Application
 - Combination of WAS 6.1 to 7 and Solaris to Z migration
 - 50-500% response time and throughput improvement
 - JAVA-based Payroll Application
 - Benchmark testing without any tweaking of system or application
 - 2x throughput improvement on standard test
- **R.A.S.S.S.S.S.**
 - **Reliability, Availability, Security, Scalability, Supportability, Serviceability & Standardization**
 - It's not uncommon for our LPAR's supporting hundreds of guests to be up for 6-8 months without an IPL – *This does require a fair amount of pre-planning when you're growing like we have.*

Challenges

We were not prepared for the rate of growth when we started

Ran way too tight in the beginning and caused some bad impressions of Z

Releasing memory for
near-idle guests

CMDB

Training / Education
Across organization
Sharing / Scheduling



Bigger isn't always better!

- > 256 GB per z/VM LPAR
- > 3 TB per z/196 or zEC-12
- > 4 LPAR's in SSI Cluster
- > 32 Engines per LPAR

WWPN / LUN Management

Page Reordering (going away
with 6.3)

Vendor testing & support
capabilities

CLAM Anti-Virus (McAfee not supported)

Heap sizes / 31 vs. 64 bit

Debugging real *and* virtual issues

SLA requirements

CRON schedules

Guest/JVM recycles

Steal time / CPU Starvation

Native Linux tools in virtual world

TIME! – To work on our engineering “wish list”

Open Source / Cloud

- **z/VM has supported “open source” long before it became cool!**

- IPGATE
- HTTPD
- PIPEDDR
- SWAPGEN
- DRM
- VIR2REAL
- MTREXX
- TRACK
- XCOMPARE

Software companies
Universities
Individual contributors
... CBT Tape

- **NIST – Cloud Computing – Essential Characteristics...**

- Broad network access ✓ Available today based on application network requirements
- Resource pooling ✓ This is one of System z and z/VM’s specialties!
- Rapid elasticity ✓ Yup, we can do this too! Need to establish parameters
- Measured service ✓ Monitoring, measuring, reporting are BAU for System z environments
- On-Demand self-service ✓ Tools available (if you choose to put this in users hands)
 - Need to really think about what you want your users to do...

Still Going, Still Growing

- **Migration projects and new development continues**
 - Expect to have around 3,000 Oracle databases running by the end the project (March 2014)
 - Expect to have more than 8,500 JVM's active by June 2014
 - Workloads we're planning for has us running around 4,000 guests by June 2014
 - Just completed the last of the z/196's to zEC-12's upgrades – **25-30% Performance improvement**
 - Installing four more zEC-12's
- **Potential new workloads that could drive these numbers even higher**
 - Potential over the next two years to virtualize 300+ physical Portal servers
 - Cognos growth – Potential to increase IFL/Memory substantially
- **Expect to have z/Next Hardware and Software that can support our requirements!**

