Solaris Engineering Cloud
Built on OpenStack on Oracle Solaris

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Safe Harbor Statement

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Oracle Solaris Strategy

• Security, speed, simplicity
• One engineering team
• Secure to the core
• World class SPARC performance
• Secure OpenStack IaaS

✓ Secure and Compliant
✓ Simple
✓ Efficient
✓ Open
✓ Affordable
Protects Hypervisor and Guest Environments

- Locked down hypervisor and guests
- Stop malware before it gets in
- Prevent administrator mistakes
- Update and patch but unwritable by users, applications, or hackers
- Simple on/off with ready made security levels
Makes Encryption Everywhere Affordable

End-to-End, Always on Cryptography

- **No performance loss**
- **Automatically** accelerates Java, Oracle Database, OpenSSL, and custom applications
- Protection of *data at rest and in motion*
- Meet compliance with high performance *disk encryption*
- Integrates with Oracle Key Manager

No Compromise
Much Faster End-To-End Encryption

M7 Advantage Increases on Highest Security Ciphers

Oracle M7
32 cores

Intel X86 E5 v3
18 cores

IBM Power8
6 cores

AES 128-CBC: Popular for Cloud, DB

83 GB/s

4X Faster vs. X86

22 GB/s

11X Faster vs. IBM Power

8 GB/s
Much Faster End-To-End Encryption

M7 Advantage Increases on Highest Security Ciphers

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Secure OpenStack-Based IaaS, PaaS and DBaaS

- Secure Services
  - Minimum privileges
- Data at Rest
  - ZFS Encryption
- Data in Motion
  - Secure Migration
- Application
  - Read only VM
- Network
  - Data link Protection
Simple and Seamless Cloud Updates

Havana

Juno, Kilo, Liberty

ORACLE
OPENSTACK
What Solaris Brings to OpenStack – Today

• One integrated, OpenStack package of all required components, downloadable from a secure repository
• Solaris Boot Environments allow seamless updates and roll back
• Immutable VMs for multitenant data security and zero overhead
• Modern, efficient ZFS storage on backend
• Fault resilience at all levels
• Both SPARC and x86 in one cloud
What Solaris Brings to OpenStack – In Progress

- Secure live migration of VMs
- Open Virtual Switch to manage Solaris and Linux nodes
- OpenStack installer automatically configures all services across nodes
  - Integration and support of Puppet OpenStack modules
- Open Daylight for fully interoperable SDN
Oracle OpenStack Database Cloud
Global financial and banking services

- Started with Linux but Solaris reached their goals more quickly
- Simplified support through end-to-end Oracle OpenStack solution:
  - Oracle DB, compute, networking and storage
- Enterprise-class DBaaS
- Zero overhead virtualization
- 10x faster self-provisioning of DBs
OpenStack on Oracle Solaris IaaS
Global telecommunication services

• Leverage existing infrastructure
• Secure live migration of VMs
Cloud Ready Data Retention
Large US Web Technology Provider

- Reliable storage for 7 billion images
  - Scales 50X for growth
  - Increases capacity to 850 PB
- Low cost storage for additional copies required for data protection
  - OpenStack Swift on Solaris 11.2 integration with Oracle HSM
OpenStack for Solaris Engineering Cloud

- OpenStack APIs are de-facto standard for compute, network and storage products
- OpenStack integrated into Solaris 11.2
- Started running dev cloud in mid-2014
- Based on initial success, building out as primary Solaris development environment for all teams within Oracle
General Goals: Phase 1

• Fly our own plane - Build and operate a OpenStack cloud that results in product improvements
  – Modernize our environment by providing on-demand compute resources
  – Improve resource utilization through virtual environments

• Develop recommendations and best practices for customers implementing OpenStack clouds
General Goals Past Phase 1

• Fly our own airline
  – Increase scale to shake out enterprise-level issues
  – One integrated cloud for all, not separate smaller clouds
  – Specialized requirements of some groups are opportunities to improve the product

• Increase Oracle Solaris developer productivity
  – Oracle app and DB dev teams get easy access
  – Includes Solaris 11, Solaris 12, both SPARC and x86
Resource Management and Tenancy Plan

• Each user is a tenant and gets 48 GB memory and 400 GB block storage
• Users run self-registration process (currently CLI, eventually BUI) to create tenant, set up quotas
• Additional project/consolidation tenants for long-term usage, created & managed by cloud operations staff
Sizing and Resource Requirements: Phase 1

- Current cloud capacity: 1.8 TB memory, 23 TB storage; 8 compute nodes + 4 infrastructure
  - Hosting 180 instances, average usage = 8 GB memory + 60 GB block storage
- Memory is primary resource limit, can’t over-commit
- For a 350 user environment (initial design goal):
  - 32 GB memory for each user => 11.2 TB memory – 24x512 GB compute nodes (50/50 SPARC & x86)
  - 200 GB block storage for each user => 70 TB block storage – 1 ZS-3 cluster
Current Cloud Configuration

- openstack-x4-2 controller node
- openstack-x4270 cinder-volume
- openstack-ai glance node
- openstack-LDOM-1
- openstack-x4-2-1 neutron-server
- openstack-x410 nova-compute
- openstack-t52-2 nova-compute
- openstack-t52-1 nova-compute
- openstack-t52 nova-compute

Oracle ZS3
Overall OpenStack on Solaris Cloud Architecture

USA Region

- SCA Cell(s)
- BRM Cell

Other Cells

BUR Cell

OpenStack Development Region

Asian Region

European Region
What’s an OpenStack Development Region?

• Provide smaller scale region to testbed in advance of main region upgrades

• Run as region rather than separate cloud to get experience with regional operations, leverage centralized Keystone, Glance

• Resources generally available and not quota’ed so can handle overflow/burst needs

• Goal of implementing continuous upgrades with nightly builds
Building Out Past Phase 1

• Each region/cell requires
  – Small number of control plane systems; cluster and load balance for HA and scale. Roughly 10% of region resources for control plane
  – At least 1 ZFS SA cluster
  – 10+ GbE network infrastructure
  – Compute nodes for anticipated workload

• Convert existing systems and redirect future system purchases for compute nodes

• Add Ironic bare metal support for non-virtual uses
Operational Environment

- Deploy nodes automatically using Solaris Automated Installer and Image Packaging System (IPS)
- Solaris Unified Archives for disaster recovery and system cloning
  - UAs also used by Solaris OpenStack to deploy guests
- Puppet (currently 3.6.2) for operations management
  - Solaris RBAC manages administrative access
- Fast, safe upgrades using IPS and Boot Environments
Results from First Year

• Approximately 200 users, 1000s of VMs recycled
• 125+ Solaris and OpenStack bugs filed, most fixed
• 10 upgrades, including Havana to Juno
  – One upgrade failed, rolled back in less than 1 hour
• One significant unplanned outage
• 99.84% availability running development builds, no HA, ad-hoc monitoring
• Apply what we’ve learned to support customer deployments
What’s Next

• **Go BIG!**
  • Implement HA and scale-out architecture:
    – Solaris Cluster
    – Solaris Integrated Load Balancer
    – Memcached
  • Centralized logging and monitoring
  • Ironic bare-metal provisioning support
  • Add Linux compute nodes
More Details, Further Adventures

• [http://blogs.oracle.com/dminer](http://blogs.oracle.com/dminer)
Integrated Cloud
Applications & Platform Services
Required Benchmark Disclosure Statement

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• Two-tier SAP Sales and Distribution (SD) Standard Application benchmarks SAP Enhancement package 5 for SAP ERP 6.0 as of 3/26/14-SPARC M6-32 (32 processors, 384 cores, 3072 threads) 140,000 SAP SD users, 32 x 3.6 GHz SPARC M6, 16 TB memory, Oracle Database 11g, Oracle Solaris 11, 0.58 resp time, Cert# 2014008. IBM Power 780 (12 processors, 96 cores, 384 threads) 57,024 SAP SD users, 12 x 3.72 GHz IBM POWER7+, 1536 GB memory, DB210, AIX7.1, 0.98 resp time, Cert# 2012033. Fujitsu PRIMEQUEST 2800E (8 processors, 120 cores, 240 threads) 47,500 SAP SD users, 8 x 2.8 GHz Intel Xeon Processor E7-8890 v2, 1024 GB memory, SQL Server 2012, Windows Server 2012 Standard Edition, 0.97 resp time, Cert# 2014003. SPARC T5-8 (8 processors, 128 cores, 1024 threads) 40,000 SAP SD users, 8 x 3.6 GHz SPARC T5, 2 TB memory, Oracle Database 11g, Oracle Solaris 11, Cert# 2013008. IBM Power 760 (8 chips, 4 cores, 192 threads) 25,488 SAP SD users, 8 x 3.41 GHz IBM POWER7+, 1024 GB, DB210, AIX7.1, Cert# 2013004. IBM Power S824 (4 processors, 6-cores/chip 24cores, 192threads) 21,212 SAP SD users, 4x 3.52GHz Power8, 512 GB memory DB2 10.5, AIX 7.1, Cert# 2014016. Two-tier SAP Sales and Distribution (SD) Standard Application benchmarks SAP Enhancement package 4 for SAP ERP 6.0 as of 4/30/12. IBM Power 795 (32 processors, 256 cores, 1024 threads) 126,063 SAP SD users, 32 x 4 GHz IBM POWER7, 4 TB memory, DB2 9.7, AIX7.1, Cert# 2010046. SPARC Enterprise Server M9000 (64 processors, 256 cores, 512 threads) 32,000 SAP SD users, 64 x 2.88 GHz SPARC64 VII, 1152 GB memory, Oracle Database 10g, Oracle Solaris 10, Cert# 2009046. SAP, R/3, reg TM of SAP AG in Germany & other countries. info www.sap.com/benchmark SPEC & benchmark names.

• SPEC and the benchmark name SPECvirt_sc are registered trademarks of the Standard Performance Evaluation Corporation. Results from www.spec.org as of 3/5/2014. SPARC T5-2, SPECvirt_sc2010 4270 @ 150 VMs; HP ProLiant DL380p Gen8, SPECvirt_sc2010 2442 @ 150 VMs; IBM x3850 X5, SPECvirt_sc2010 3824 @ 234 VMs; IBM Flex System x240, SPECvirt_sc2010 2741 @ 168 VMs; HP Proliant BL620c G7, SPECvirt_sc2010 1878 @ 120 VMs. TPC Benchmark C, tpmC, and TPC C are trademarks of the Transaction Processing Performance Council (TPC). SPARC T5-8 (www.tpc.org/1792) 8,552,523 tpmC at $0.55 USD/tpmC available 9/25/2013. Oracle Sun Server X2-8 (www.tpc.org/1787) 5,055,888 tpmC at $0.89 USD/tpmC, available 7/10/12. Oracle SPARC SuperCluster (www.tpc.org/1780) 30,249,688 tpmC at $1.01 USD/tpmC, historical result. IBM Power780 Cluster (www.tpc.org/1789) 10,366,254 tpmC at $1.38 USD/tpmC, historical result. HP ProLiant BL620c G7 (www.tpc.org/3288) 409,721 tpmC at $0.41 USD/tpmC, historical result. HP ProLiant BL620c G7 (www.tpc.org/3262) 386,478 tpmC at $0.37 USD/tpmC, historical result. IBM Power780 Server (www.tpc.org/1779) 2,010,011 tpmC at $0.69 USD/tpmC, historical result. Cisco UCS C240 M3 (www.tpc.org/1789) 1,609,186 tpmC at $0.47 USD/tpmC, available 9/27/12. Results as of 8/22/14. Source: http://www.tpc.org/tpcc

• TPC Benchmark C, tpmC, and TPC-C are trademarks of the Transaction Processing Performance Council (TPC). Results as of 8/22/14, prices are in USD. SPARC T4-4 (www.tpc.org/3378) 205,792 QphH@3,000GBP at $4.10 USD/QphH@3,000GBP available 5/31/12, SPARC Enterprise M9000 (www.tpc.org/3262) 386,478 QphH@3,000GBP, $18.19 USD/QphH@3,000GBP, historical result; SPARC Enterprise M9000 (www.tpc.org/3258) 198,907 QphH@3,000GBP at $15.27 USD/QphH@3,000GBP, historical result; IBM Power 780 (www.tpc.org/3277) 192,001 QphH@3,000GBP at $6.37 USD/QphH@3,000GBP, available 11/30/11.


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