

The Benefits of Hardware-Software Co-Design/Convergence for Large-Scale Enterprise Workloads

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Required Benchmark Disclosure Statement

Must be in SPARC S7 or M7 Presentations with Benchmark Results

- Additional Info: <http://blogs.oracle.com/bestperf>
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- SPEC and the benchmark name SPECvirt_sc are registered trademarks of the Standard Performance Evaluation Corporation. Results from www.spec.org as of 10/25/2017. SPARC T7-2, SPECvirt_sc2013 3026@168 VMs; HP DL580 Gen9, SPECvirt_sc2013 3020@168 VMs; Lenovo x3850 X6; SPECvirt_sc2013 2655@147 VMs; Huawei FusionServer RH2288H V3, SPECvirt_sc2013 1616@95 VMs; HP ProLiant DL360 Gen9, SPECvirt_sc2013 1614@95 VMs; IBM Power S824, SPECvirt_sc2013 1371@79 VMs.
- SPEC and the benchmark names SPECfp and SPECint are registered trademarks of the Standard Performance Evaluation Corporation. Results as of October 25, 2017 from www.spec.org and this report. 1 chip results SPARC T7-1: 1200 SPECint_rate2006, 1120 SPECint_rate_base2006, 832 SPECfp_rate2006, 801 SPECfp_rate_base2006; SPARC T5-1B: 489 SPECint_rate2006, 440 SPECint_rate_base2006, 369 SPECfp_rate2006, 350 SPECfp_rate_base2006; Fujitsu SPARC M10-4S: 546 SPECint_rate2006, 479 SPECint_rate_base2006, 462 SPECfp_rate2006, 418 SPECfp_rate_base2006. IBM Power 710 Express: 289 SPECint_rate2006, 255 SPECint_rate_base2006, 248 SPECfp_rate2006, 229 SPECfp_rate_base2006; Fujitsu CELSIUS C740: 715 SPECint_rate2006, 693 SPECint_rate_base2006; NEC Express5800/R120f-1M: 474 SPECfp_rate2006, 460 SPECfp_rate_base2006.
- SPEC and the benchmark name SPEC OMP are registered trademarks of the Standard Performance Evaluation Corporation. Results as of October 25, 2017 from www.spec.org and this report. SPARC T7-4 (4 chips, 128 cores, 1024 threads): 27.9 SPECCompG_peak2012, 26.4 SPECCompG_base2012; HP ProLiant DL580 Gen9 (4 chips, 72 cores, 144 threads): 21.5 SPECCompG_peak2012, 20.4 SPECCompG_base2012; Cisco UCS C460 M7 (4 chips, 72 cores, 144 threads): 20.8 SPECCompG_base2012.
- Two-tier SAP Sales and Distribution (SD) standard application benchmarks, SAP Enhancement Package 5 for SAP ERP 6.0 as of 10/23/15: SPARC T7-2 (2 processors, 64 cores, 512 threads) 30,800 SAP SD users, 2 x 4.13 GHz SPARC M7, 1 TB memory, Oracle Database 12c, Oracle Solaris 11, Cert# 2017050. IBM Power System S824 (4 processors, 24 cores, 192 threads) 21,212 SAP SD users, 4 x 3.52 GHz POWER8, 512 GB memory, DB2 10.5, AIX 7, Cert#201701. Dell PowerEdge R730 (2 processors, 36 cores, 72 threads) 16,500 SAP SD users, 2 x 2.3 GHz Intel Xeon Processor E5-2699 v3 256 GB memory, SAP ASE 16, RHEL 7, Cert#2017033. HP ProLiant DL380 Gen9 (2 processors, 36 cores, 72 threads) 16,101 SAP SD users, 2 x 2.3 GHz Intel Xeon Processor E5-2699 v3 256 GB memory, SAP ASE 16, RHEL 6.5, Cert#2017032. SAP, R/3, reg TM of SAP AG in Germany and other countries. More info www.sap.com/benchmark

Safe Harbor Statement

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A New Era of Engineering Challenges

The Cost of Complexity



Attacks are Inevitable



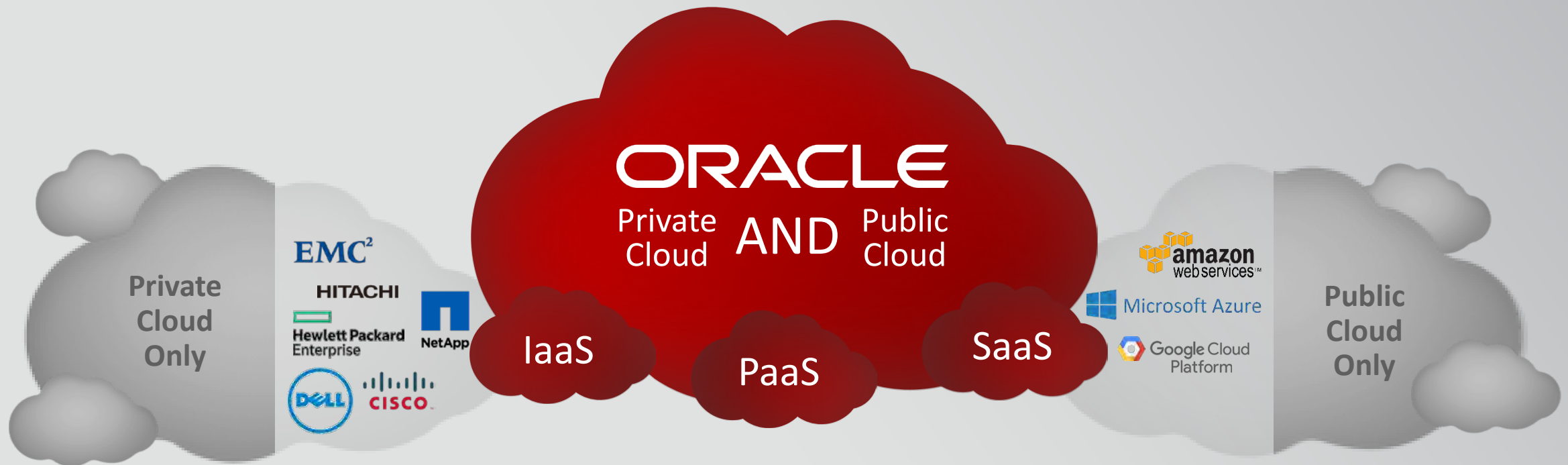
Get Less, Do More



Competitive Agility



Only Oracle Deeply Co-Engineers On-Premises and Cloud



Cloud Drives Engineering Strategy and Imperatives

Legacy Implementation

IT Integrates Disparate Components
On-Premises



Modern Strategy

Revolutionary Co-Engineering of
Processor, Storage, Networking, and OS



- Performance
- Efficiency
- Security
- Reliability
- Scalability
- ...and More

Unique Oracle HW/SW Co-Engineering From Chip to Cloud Delivers Better Results

Transformational Technologies YOU Want

On-Premises

Cloud Ready Systems:
Engineered Systems, Servers,
Storage, and more...



- Customer Data Center
- Purchased
- Customer Managed

Cloud@Customer

Cloud Machines



- Customer Data Center
- Subscription
- Oracle Managed

Oracle Cloud

IaaS, SaaS, PaaS



- Oracle Cloud
- Subscription
- Oracle Managed

Security



The Data Protection Lifecycle

Conceptually complex, computationally intensive and completely unforgiving

✓ Secure **Data at Rest**

- Encryption of both storage and archive

✓ Secure **Data in Use**

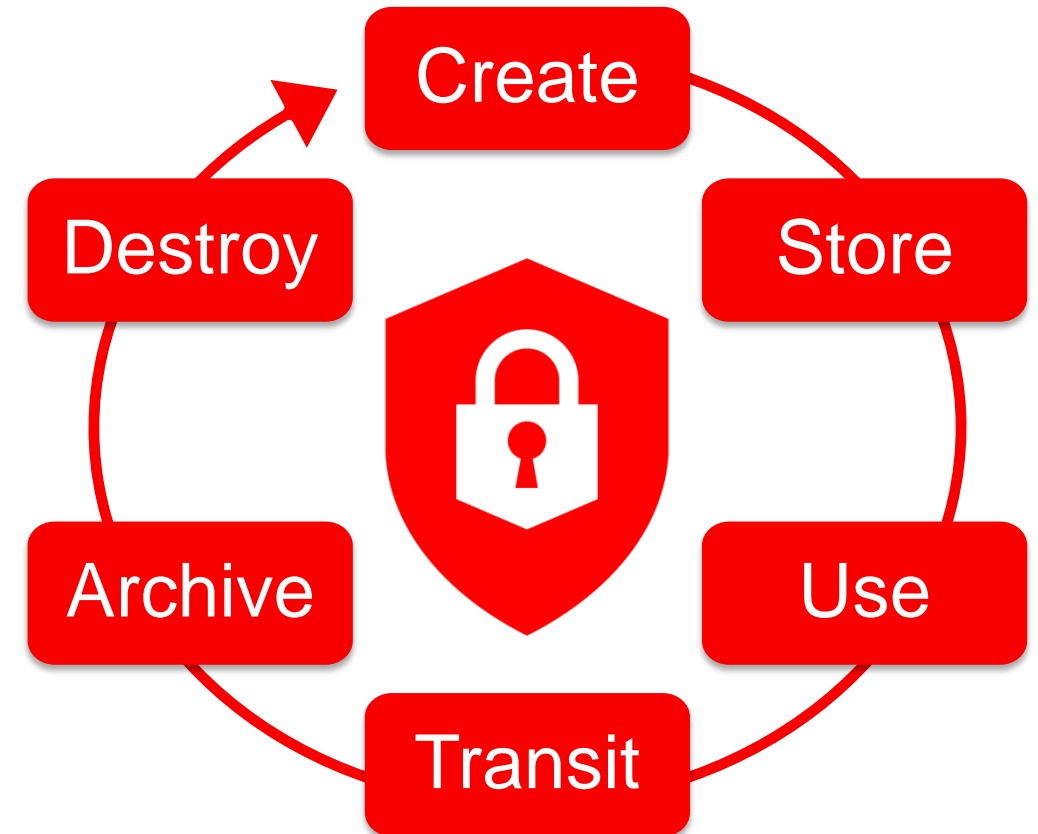
- Memory protection and corruption prevention

✓ Secure **Data in Transit**

- Encrypted data transport and crypto-isolated network boundaries

✓ Secure **Data Destruction**

- Assured data and key deletion



Microprocessors Designed for Cloud Security

Generic Cloud

No Offload

All core resources
consumed

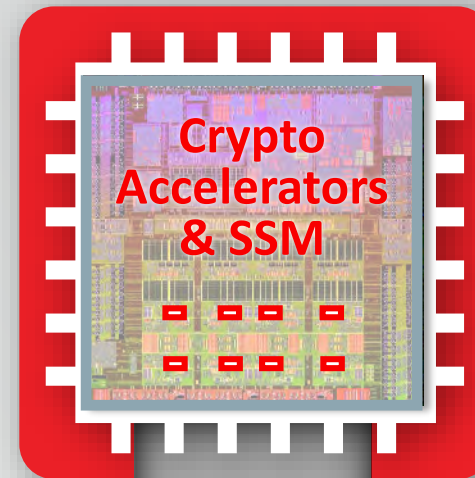
Slow
interconnect
robs performance



Half
Bandwidth

Memory

Oracle



Full
Bandwidth

Memory

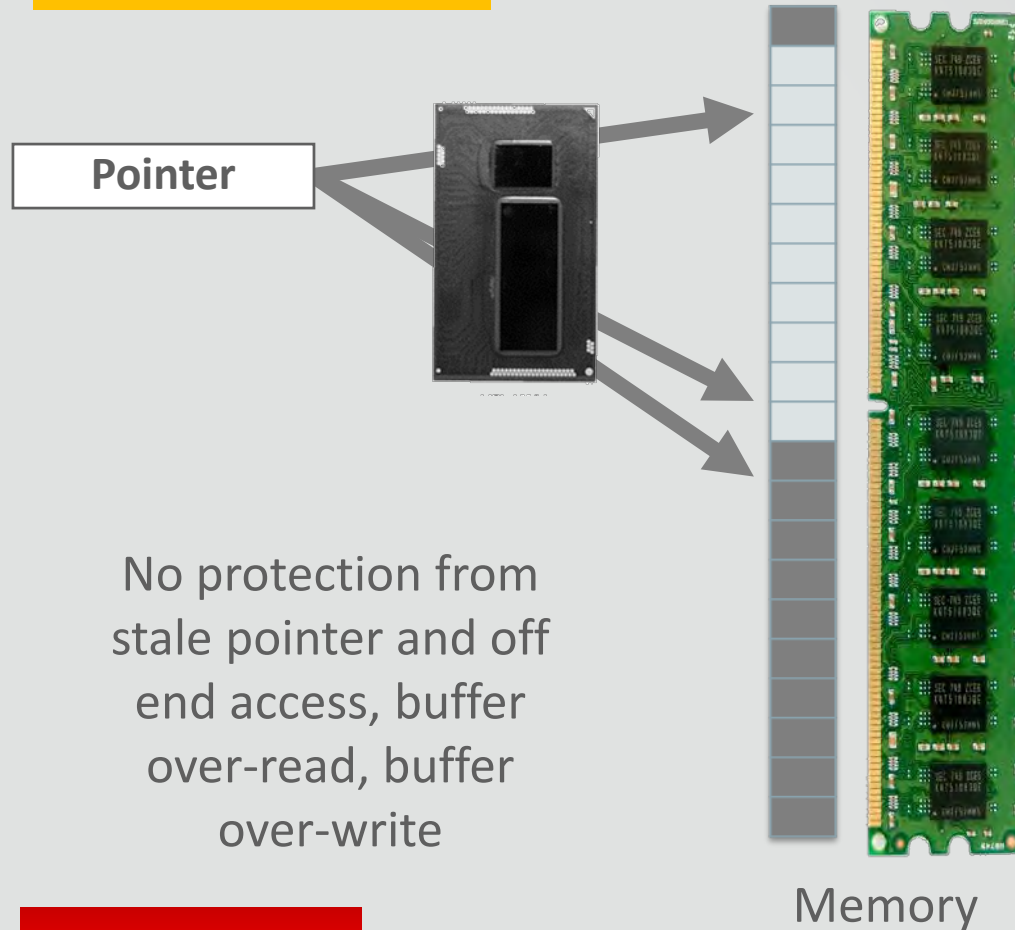
Integrated
Encryption
Offload &
Silicon
Secured
Memory



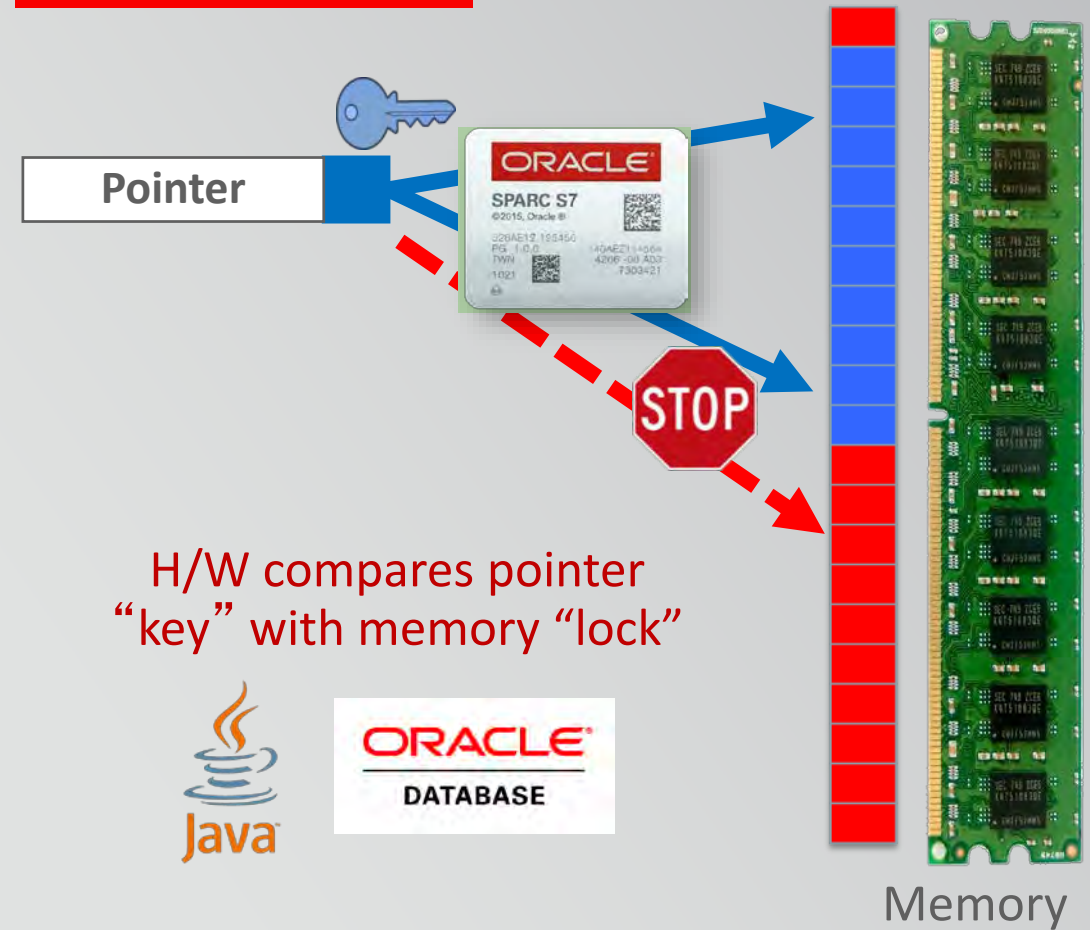
ORACLE®
DATABASE

More Secure and Reliable SW With Silicon Secured Memory

Generic Cloud



ORACLE



ORACLE®

Oracle Cloud End-to-End Encryption Advantage

AES-128-CBC: Data at rest, DB, Cloud,..

Oracle

63.4 GB/s

ORACLE

4x

Intel X86 E5 v3

18 cores, 2.3 GHz

16.0 GB/s

SHA512-1024: Secure Checksum, Banking,..

Oracle

83.8 GB/s

ORACLE

17.9x

Intel X86 E5 v3

18 cores, 2.3 GHz

4.7 GB/s

Transformational Encryption by Default

Database, Application, & Web Tiers

SPECjEnterprise Benchmark



ORACLE
SECURE



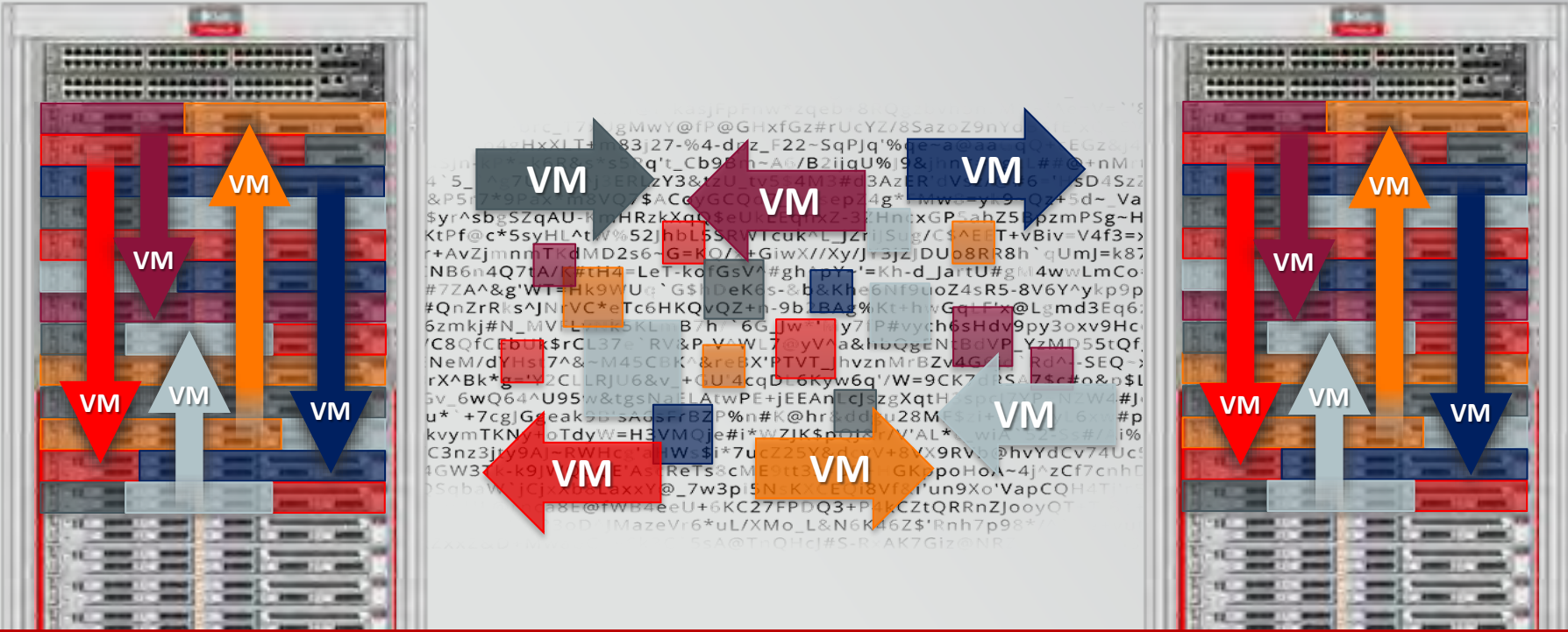
UNSECURE

Only 2%
Overhead with
Oracle SPARC



SPECjEnterprise2010 (see disclosure slide)

Hardware Accelerated Secure Live VM Migration



Live VMs in Transit are Fully Encrypted - No Service Loss - No Performance Loss



Engineered for Security and Compliance

Data Protection

Compliance Reporting

Key Management

Internal Audits

Activity Monitoring

External Audits by QSA

Password policies

Remediation

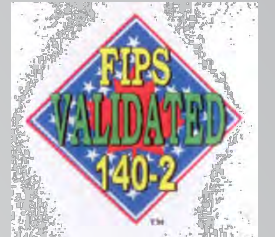
Access Controls

Audit Trails



Sarbanes-Oxley

FISMA



SOC-2

Cloud Readiness



NIST



Secure Database and Application Machines

ORACLE[®]
SUPERCLUSTER

ORACLE[®]
MINICLUSTER



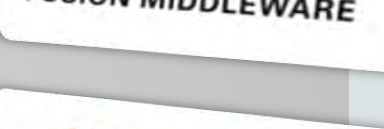
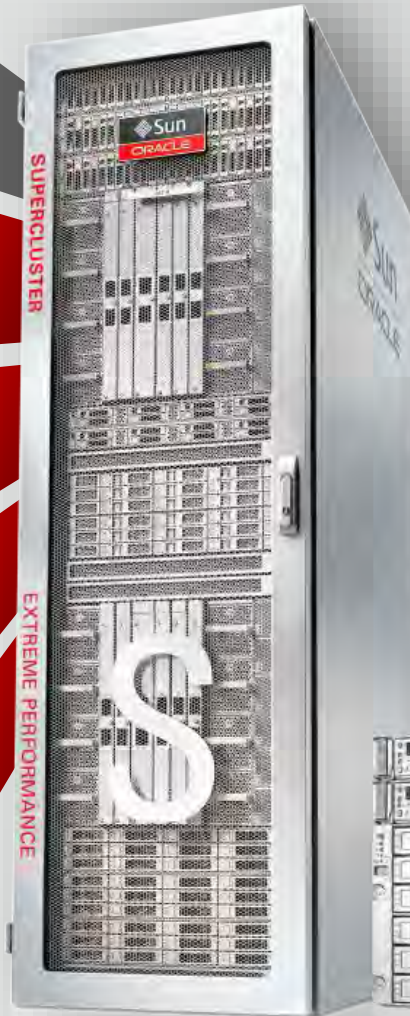
Secure Database & Applications

Virtual Assistant

Operating System

Virtualization

Compute & Storage



SuperCluster M7 and MiniCluster S7-2

Push-button Security Level Settings

Strong saecurity and compliance with

Security & Compliance Virtual Assistant

- Automated, pre-tested and verified security, from hardware and firmware to OS, Database and storage

The screenshot shows the Oracle MiniCluster web interface. The browser address bar displays 'https://mcmu/'. The page title is 'MiniCluster'. The main content area is titled 'Database Virtual Machine Group Profile Desc' and includes a 'Reset' button and progress indicators for 'Define Profile' and 'Define DB VM'. Below this, there is a section for 'Enter Database Virtual Machine Group Information'. A dropdown menu for 'Security Profile' is open, showing options: 'CIS Equivalent', 'PCI-DSS', 'CIS Equivalent', and 'DISA-STIG'. A red arrow points from the text on the left to this dropdown menu. To the right of the dropdown, there are fields for 'ASM Disk Group Redundancy' and 'Number of VM(s) on Node 2'. A tooltip on the right side of the screen provides descriptions for the security profiles: 'The PCI DSS profile satisfies organization to comply with the PCI-DSS standard defined by the Payment Card Industry Security Standards Council.', 'The CIS Equivalent profile satisfies organizations with stricter security requirements comparable and equivalent to benchmarks set forth by Center for Internet Security (CIS) and Security Technical Implementation Guidelines (STIG) assessments.', and 'The DISA-STIG profile satisfies the organizations requiring compliance with Security Technical Implementation Guides for Oracle Solaris 11 published by United States Defense Information Systems Agency.'

Compliance Readiness Checks at First Boot

Verify compliance before your applications and databases ever run



MiniCluster Virtual Assistant

- Instantly verify system-wide security controls
 - PCI-DSS 3.2
 - CIS Equivalent (HIPAA, FISMA, EU, SOC-2, CSA 3.0)
 - DISA-STIG with NIST approved FIPS 140-2 Level 1 Crypto controls

MiniCluster

https://mcmu/

Compliance Information

Assess and report security compliance scores for the virtual machines in the system.

Administration VMs: DISA-STIG

Application and Database VMs: DISA-STIG

Overall Compliance Score

Value 94.20

Update Reports

| Node | Virtual Machine Name | Benchmark Type | Compliance Score | Date & Time |
|--------|----------------------|----------------|------------------|-------------|
| Node 1 | | | | |
| | global | disa-stig | 89.50 | |
| | mc9dbzg1-vm1-mc9-n1 | disa-stig | 95.43 | |

Centralized, Encrypted Audit Store

Make life easy for your developers, operations team and auditors

MiniCluster Virtual Assistant

- Per-VM Audit policy
 - All administrative events/actions stored
 - Logs and audit data accessible only to Auditor roles
 - Encrypted audit data

The screenshot displays the MiniCluster Virtual Assistant web interface. The browser address bar shows 'https://mcmu/'. The main content area is divided into two sections:

Audit Pool Status

| hostname | used | available |
|----------|------|-----------|
| mc9-n1 | 69M | 795G |
| mc9-n2 | 2.6M | 798G |

Generate Audit Records

| hostname | user | generate |
|----------|------|--|
| mc9-n1 | | <input type="button" value="Generate Report for all users"/> |
| global | | <input type="button" value="Generate Report for all users"/> |

A red arrow points from the 'generate' column header to the 'Generate Report for all users' button for the 'mc9-n1' host.

Automated Security & Compliance Testing

Extensible compliance reporting allows automatic verification of security



MiniCluster Virtual Assistant

- View system security and compliance reports on-demand
- Schedule automatic compliance checks

The screenshot shows a web browser window titled 'MiniCluster' with the URL 'https://mcmu/'. The main content area is titled 'Compliance Information' and contains the text 'Assess and Report Compliance for the virtual machines in the system'. Below this is a table with columns: 'Hostname', 'Benchmark Type', 'Score', 'Date & Time', 'View Report', and 'Schedule'. The first row of the table is highlighted, and a modal dialog box titled 'Schedule Compliance Run' is open over it. The dialog box contains the following text: 'Scheduling compliance on Node 1/mc9dbzg2-zone-2-mc9-n1/pci-dss'. It has two input fields: 'Time to run compliance(in 24 hours format):' with the value '12:00' and 'Select a Frequency of run:' with a dropdown menu set to 'monthly'. At the bottom of the dialog are 'Cancel' and 'Start' buttons. A red arrow points from the 'View Report' column of the table to the dialog box.

Comprehensive Security & Compliance Reports

Extensible compliance framework with out-of-the-box standard profiles



MiniCluster Virtual Assistant

- Standard compliance report format
- Simple verification by auditors using existing tools and processes

The screenshot shows the MiniCluster web interface. The browser address bar displays 'https://mcmu/'. The main heading is 'Compliance and Scoring'. A red alert box states: 'The target system did not satisfy the conditions of 11 rules! Please review rule results and consider applying remediation.' Below this, the 'Rule results' section shows a progress bar with '183 passed' in green and '11 failed' in red. The 'Severity of failed rules' section shows a stacked bar chart: '1 other' (green), '4 low' (blue), '5 medium' (orange), and '1 high' (red). The 'Score' section contains a table with the following data:

| Scoring system | Score | Maximum | Percent |
|---------------------------|-----------|------------|---------|
| urn:xccdf:scoring:default | 92.832962 | 100.000000 | 92.83% |

The 'Rule Overview' section includes checkboxes for rule statuses: pass, fail, notchecked, fixed, error, notselected, informational, unknown, and notapplicable. There is also a search box for XCCDF rules and a dropdown menu for grouping rules by 'Default'.

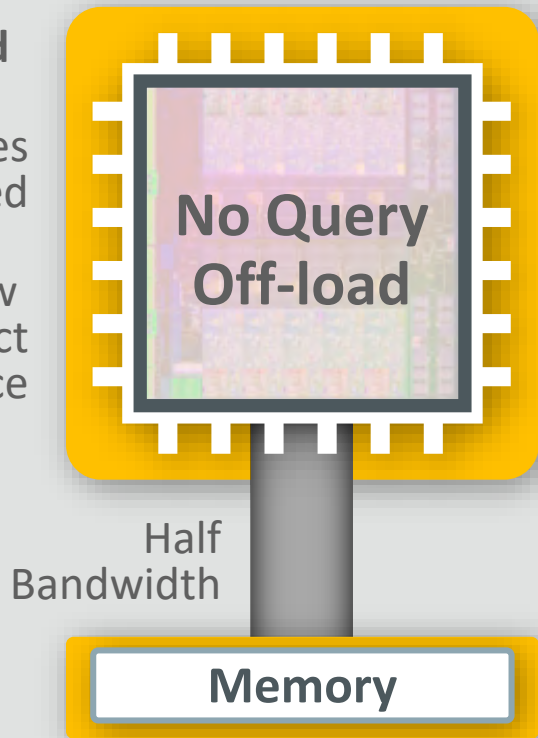
Performance



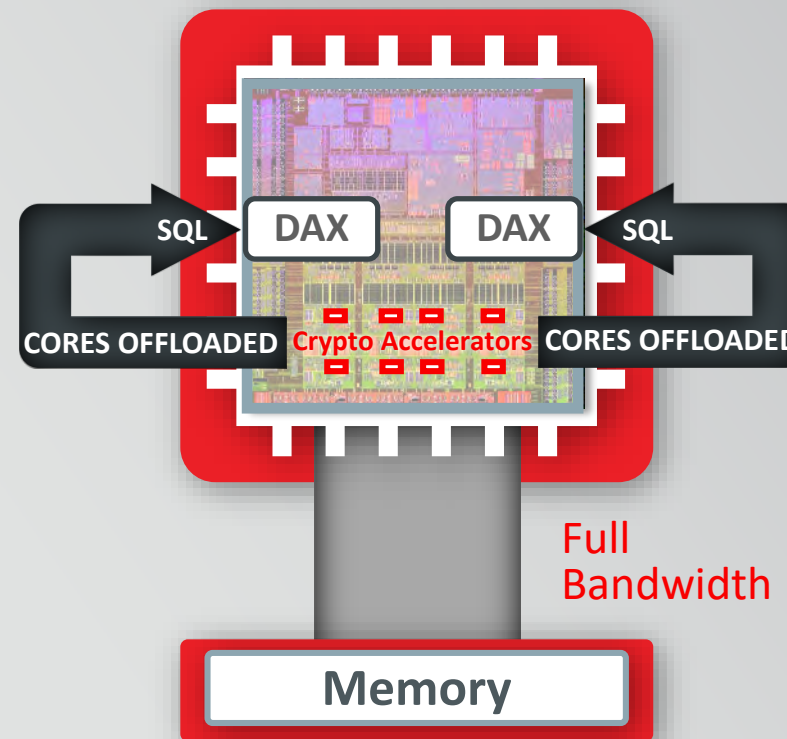
Oracle Cloud's Advantage for Database In-memory

Generic Cloud

No Offload
All core resources consumed
Slow interconnect robs performance



Oracle

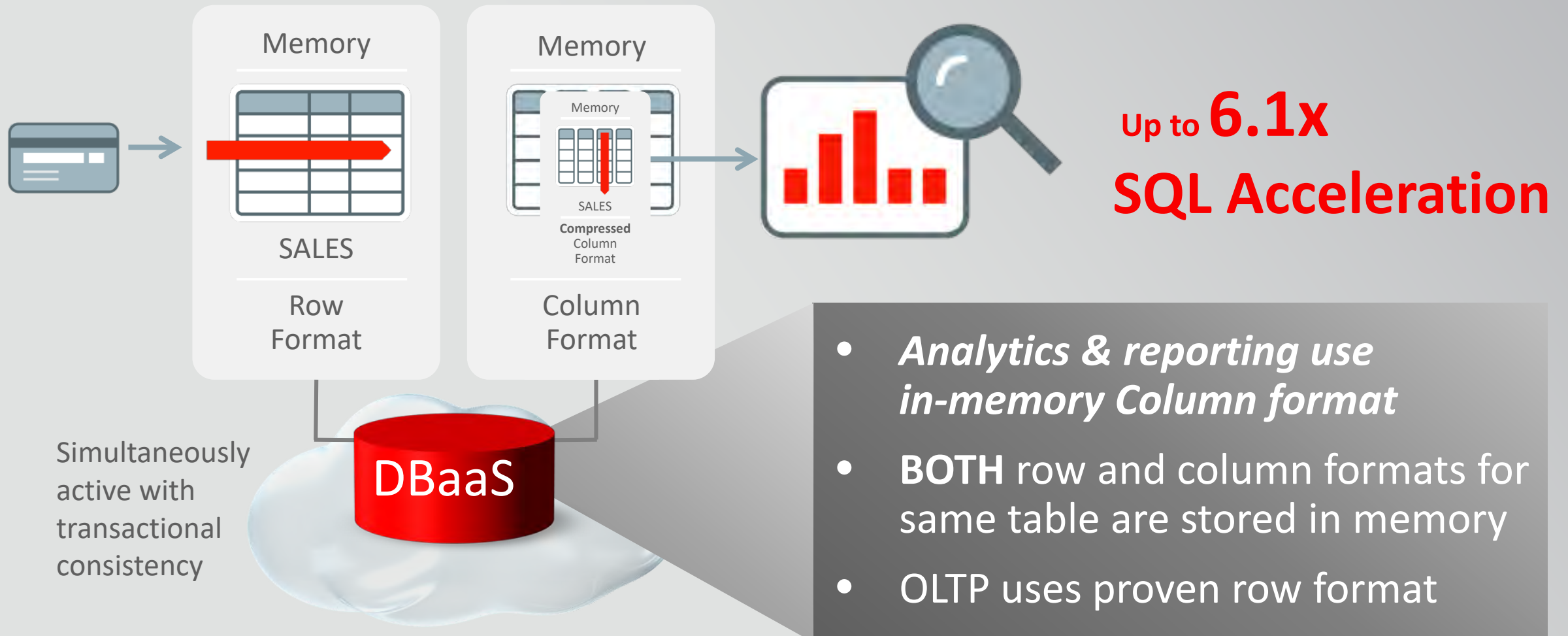


Integrated Offload

Data Analytics Acceleration (DAX)

Fast Network

Oracle Database 12c In-memory



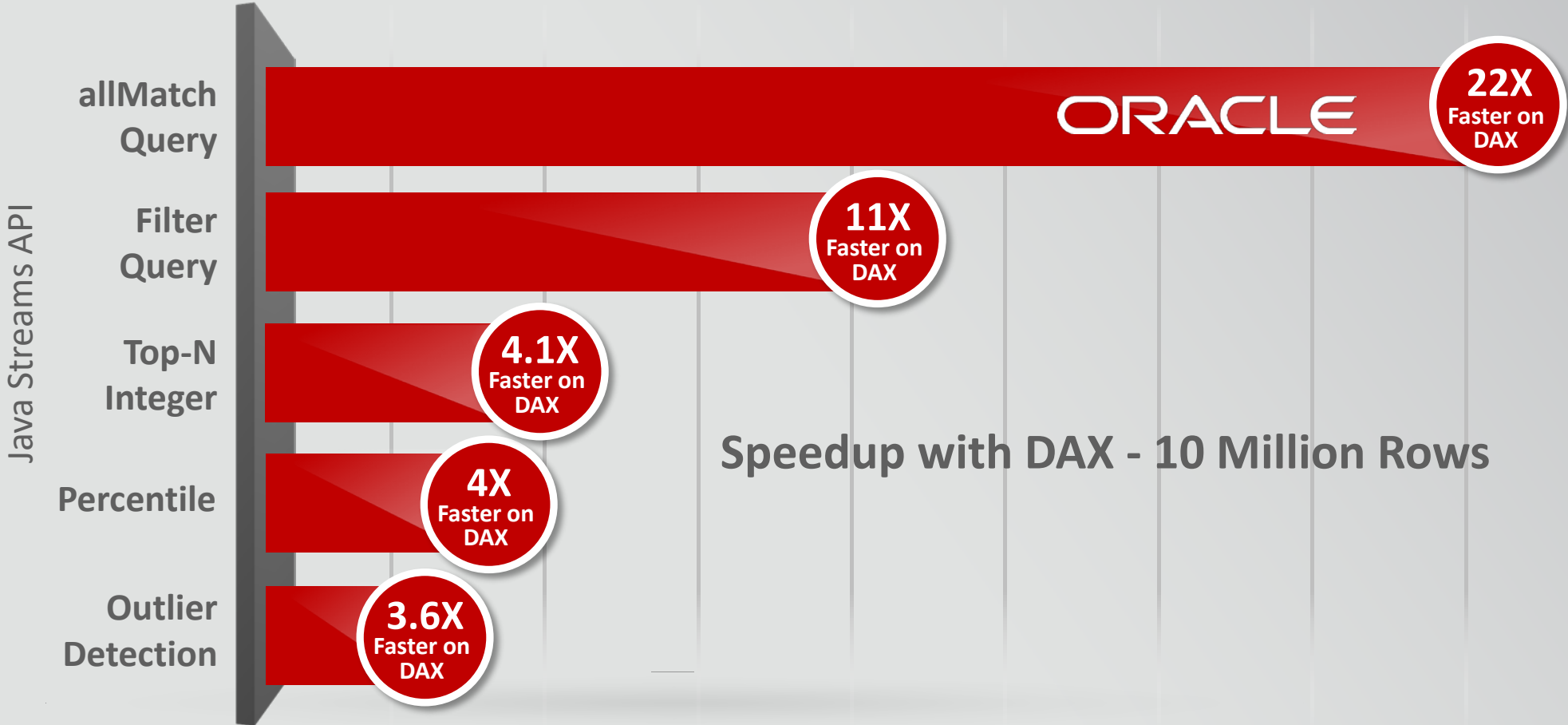
Co-engineering Database, OS and Processor for Cloud

- **2X Faster transaction processing** by reduction in log file latency
- **14% More efficient multi-instance resource management** with instance synchronization
- **11% Faster analytics** from compiler optimizations
- **10% Better backup efficiency** with *IMC capacity high, hybrid columnar, RMAN*
- **In-memory optimizations** extended to additional functions
- **1.6x faster TDE security on SPARC than x86**
- **Silicon Secured Memory:** SGA buffer cache, redo cache and entire PGA

The logo for Oracle Database 12.2. It features the word "ORACLE" in red, uppercase letters with a registered trademark symbol, followed by "DATABASE" in black, uppercase letters. A horizontal line is positioned below "ORACLE". To the right of this text is the version number "12.2" in a large, bold, black font.

Faster Analytics – Faster OLTP – More Efficient – More Secure

Preview: JDK 8 Streams Integration with DAX



Speedup with DAX - 10 Million Rows

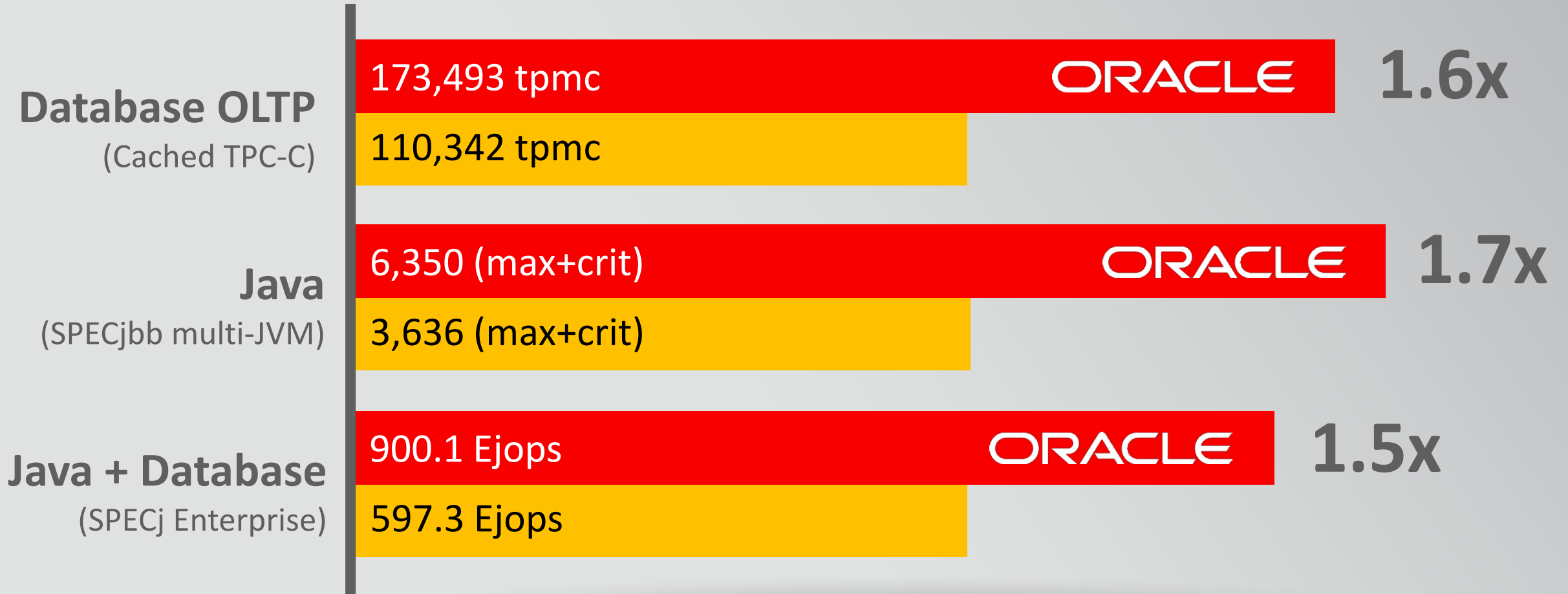
Use cases: SQL style Java, Eg: weather analysis, TopN integer, outlier detection, Cube building, KNN algorithm



Efficiency



Oracle Cloud is More Efficient



Oracle's Cloud Runs Better & Costs Less



Private Cloud or
Public Cloud Using
Commodity
Compute

24 x HPE DL360 G9
576 cores



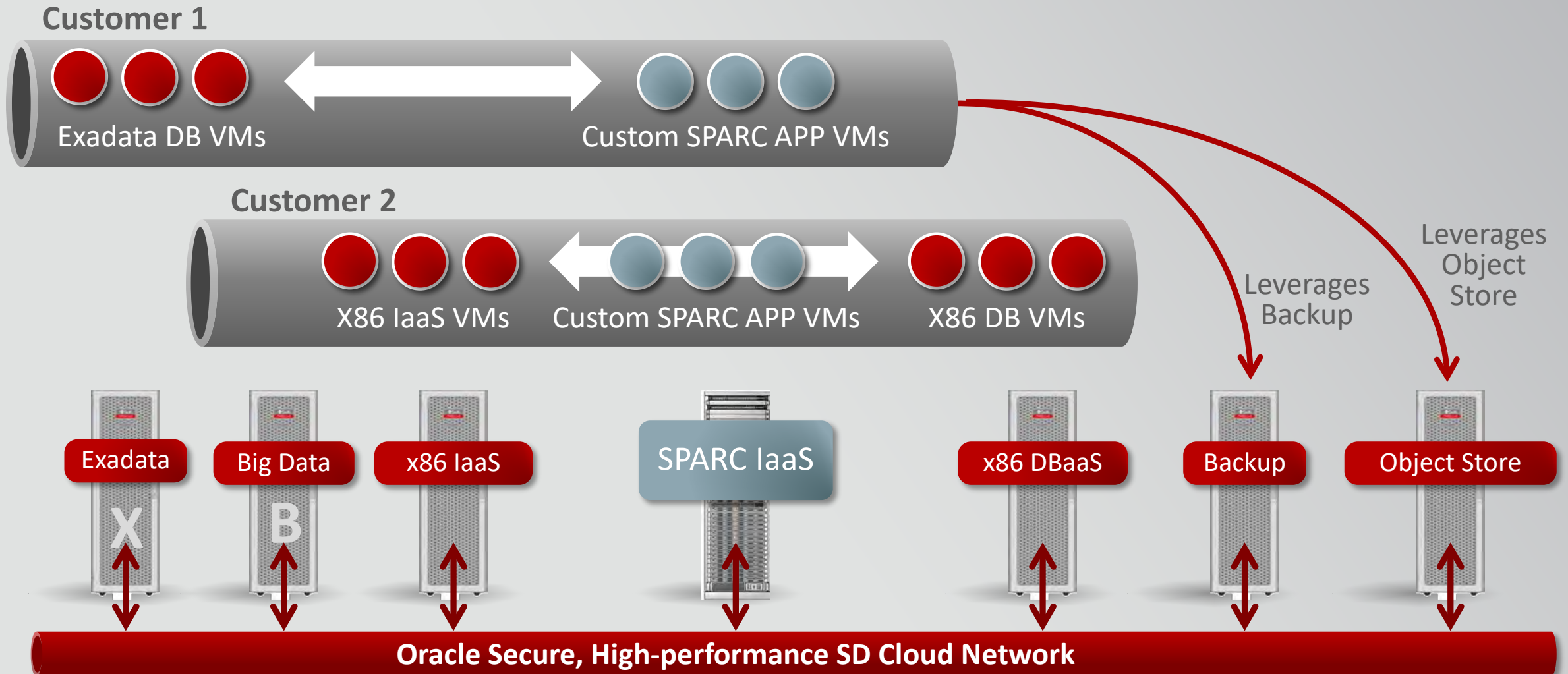
5x Faster In-Memory Analytics
2x Faster OLTP
3.5x More Efficient to Run
Both
72% Fewer Cores

10 x SPARC S7-2
160 cores

Running 1 TB Database compressed into 120 GB of memory



SPARC IaaS: Easy Access to the Full Range of Cloud Services



Transformational Technologies Where YOU Want Them

On-Premises



- Customer Data Center
- Purchased
- Customer Managed

Cloud@Customer

Cloud Machines



- Customer Data Center
- Subscription
- Oracle Managed

Oracle Cloud

IaaS, SaaS, PaaS



- Oracle Cloud
- Subscription
- Oracle Managed

Engineered Systems ● SPARC ● x86 ● Solaris ● Linux ● Storage ● Archive ● Network

ORACLE®