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OpenSSL in the Age of Hyperscale

How OpenSSL Enables Trust, Performance, and Efficiency in Oracle Cloud

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1 Building Trust: Oracle Cloud Infrastructure

2 Cloud Computing at Hyperscale

3 Security in the Cloud: Cryptography Everywhere

4 Operational Challenges: Driving Efficiency at Hyperscale

5 Moving Forward Together

OpenSSL in the Age of Hyperscale

Building Trust: Oracle Cloud Infrastructure

Oracle Cloud Infrastructure

Hyperscale cloud service provider (CSP)

- Next-gen architecture: faster, secure, lower cost
- Security built-in from silicon to service
- High-performance compute, network, storage
- Enterprise-ready: compliance, sovereignty, FedRAMP, FIPS

- Visionary in Gartner Magic Quadrant for Cloud Infrastructure
- Recognized for innovation, value, performance

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Cloud Computing at Hyperscale

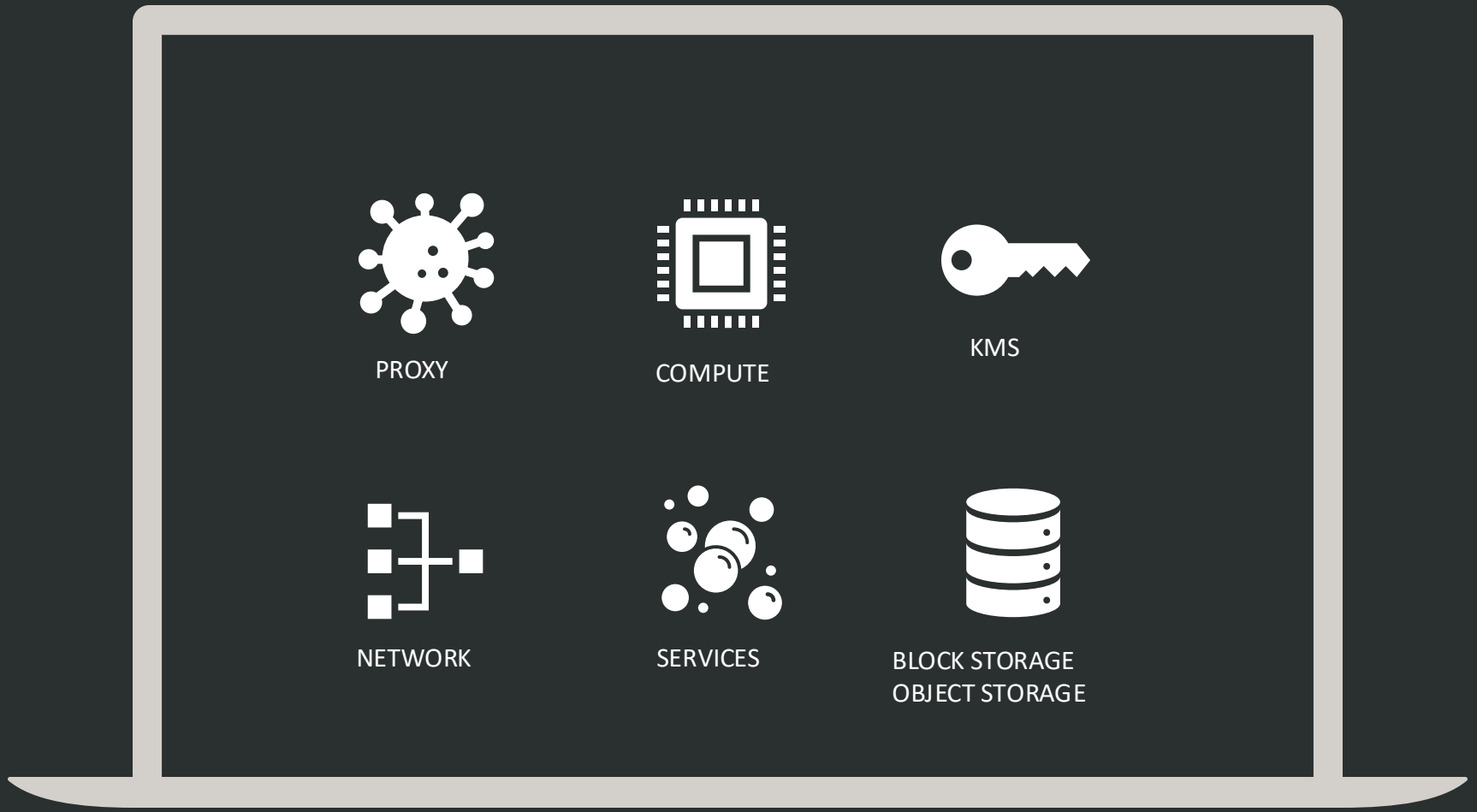
On-demand, Elastic, Globally Distributed

Choose the level of abstraction you manage: Infrastructure, Platform, and Software as a Service

Pay-as-you-go flexibility: Hyperscale architecture dynamically scales to meet demand

Cloud Computing

A Computer, Reimagined at Cloud Scale



OpenSSL in the Age of Hyperscale

Security in the Cloud: Cryptography Everywhere

Security in the Cloud

Cryptography Everywhere: The Foundation of Cloud Security

Every subsystem is a service, and every service depends on cryptography

Built with Cryptography

- Encryption at rest and in transit
- Disk, block, object, and file encryption
- Mutual TLS
- Signed API requests
- IAM, KMS, and VCN all rooted in crypto
- Hardware-backed key protection

Cloud Security

It’s about trust.

Would you keep *your* data in *my* pocket?

How much crypto are we talking?

Crypto Operations

1,000,000,000,000,000

In the order of a quadrillion ops per day

Over 10 billion operations every second

Most of it OpenSSL

That’s why we care about performance optimizations

“Performance is security
If it’s slow, it’s skipped
If it’s skipped, it’s vulnerable.”

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Operational Challenges: Driving Efficiency at Hyperscale

Operational Challenges

Scale Exposes the Cracks

- ~~Performance~~
- Quality
- Compliance
- Crypto agility
- Observability
- Post Quantum Cryptography

“Quality is not an act, it is a habit.”

Aristotle

Operational Challenges

More Quality, Less Patching

Every time you write a test:

```
THANK_YOU(10^15);
```

- Testing improves quality
- Every time we prevent a bug, it saves patches
- Please, Please, Please test everything

```
// Fails if we live in a simulation
ASSERT(1^16 != 10^15);
```

Operational Challenges

Observability - cryptographic inventory

- Every layer in the stack uses cryptography
- Massive cryptographic footprint requires visibility
- Automation depends on accurate runtime data from OpenSSL
- Built-in observability enables inventory, auditing, and compliance at scale
- A self-aware cloud can observe, report, and remediate — securely

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Moving Forward Together

Trusting each other is essential to our success

Collaboration helps us both

Built on Trust

Community

- Diverse contributions
- Independent assessment
- Alignment with Linus' Law
- Consistency with 3rd/4th parties

Open Source

- Truly open source, not “you can use my toothbrush” opensource
- Alignment with Kerckhoffs' Principle
- Transparency and auditability

Collaboration helps us both

Contributions to OpenSSL

- Upstream-first: We use OpenSSL, not a fork—our work lands upstream
- Compliance at scale: Drove FIPS 140-2/140-3 validations; broadened algorithm coverage
- Architecture & features: Co-shaped the 3.0 provider model; enabled PQC in 3.5 with a FIPS path
- High impact: OpenSSL publicly acknowledged Oracle engineers and contributions
- Community involvement:
  - Representing Committers in Advisory Committees
  - Participation in Security committee
  - Previously on OMC/OTC

Overlapping Mission and Values

Great minds…

OpenSSL

- We believe all our communities are important
- We believe in behaving in a manner that fosters trust and confidence

Oracle Cloud Infrastructure

- Put Customers First
- Innovate Together
- Earn Trust, Give Trust
- Challenge Ideas, Champion Execution
- Own Without Ego

Oracle takes pride in contributing to something greater

Being a good community member provides mutual benefit

Oracle is committed to a strong and enduring collaboration with the OpenSSL community

Thank you

OpenSSL rocks

It’s a pleasure to be part of this community

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