Oracle: Database and Data Management Innovations with CERN

Public Day

Kevin Jernigan, Oracle
Lorena Lobato Pardavila, CERN
Manuel Martin Marquez, CERN

June 10, 2015

Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Program Agenda

1 ▶ Introduction

2 ▶ Oracle openlab IV achievements

3 ▶ Oracle strategic direction

4 ▶ Oracle openlab V projects

5 ▶ Conclusions

Oracle Confidential –

ORACLE®

Program Agenda

1 Introduction

2 Oracle openlab IV achievements

3 Oracle strategic direction

4 Oracle openlab V projects

5 Conclusions

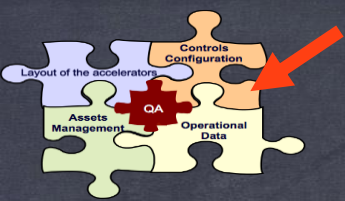Oracle Confidential –
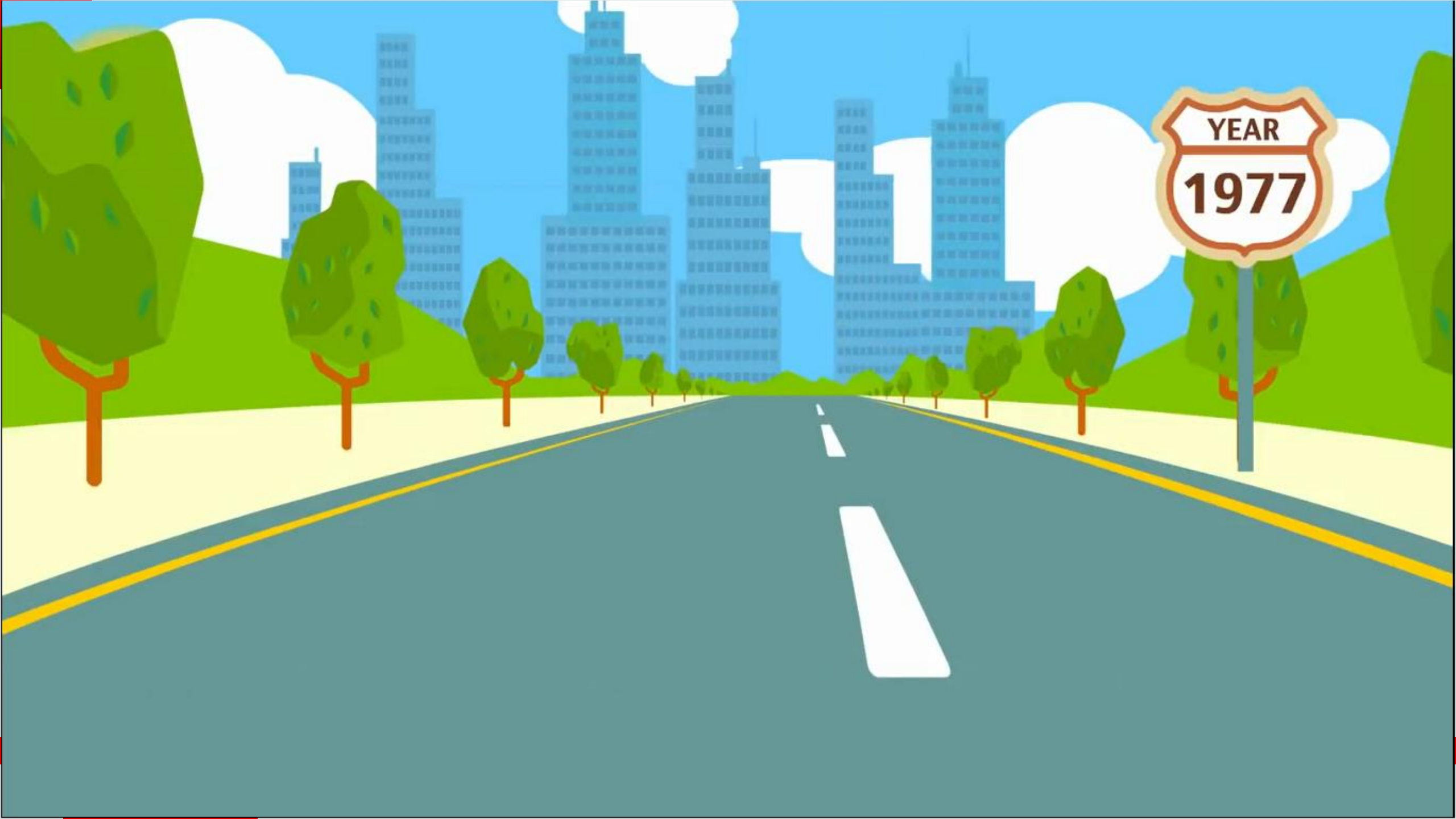
ORACLE®

YEAR
1977

Oracle Begins as SDL
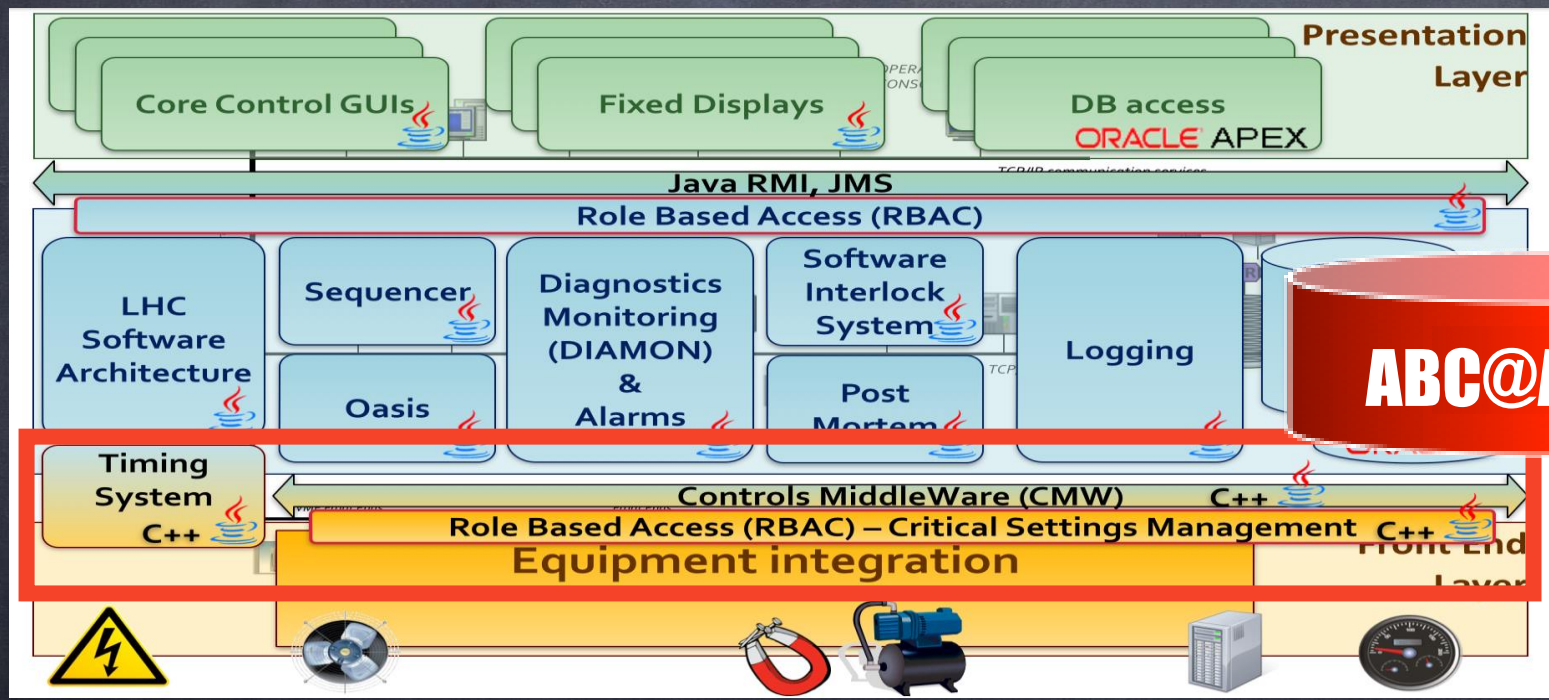
Software Development Laboratories

"About five years into the company, it became pretty clear that the horizons were unlimited. The only limitations were us" – Larry Ellison

Accelerator Controls Configuration

configuration of:

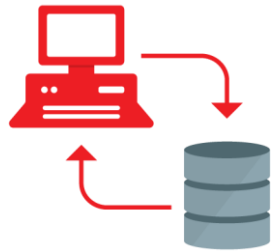ALL Control System Entities & their relationships

Since 1985!

ABC@ACCCON

Heterogeneous Entities

Credit: Chris Roderick (CERN)

Market Leader from Continuous Innovation

Changing dynamics

Client-Server   **Internet**   **Big Data & Cloud**

Release	1985 – 1997: 6, 7 and 8	1998 – 2012: 8i, 9i, 10g, 11g	2013-2014: 12c

Developer

Java   .NET   PHP   XML   APEX

Stored Procedures & Triggers
Referential Integrity
Distributed Transactions
AQ
LOBs
Spatial

R
Pattern Matching
OpenSource Drivers
JSON
REST Data Services
NoSQL Database
Application Continuity
Migration Framework

Engine

Online Operations   Automatic Storage Mgmt
RAC   Encryption
Data Guard   Real Application Testing
Flashback   Row Compression
Self-Managing Database   Columnar Compression
Enterprise Manager   Smart Scans
Resource Management   Flash Cache

OLTP throughput
Parallel Query, Partitioning

Multitenant Database   In-Memory Column Store

Market Leader from Continuous Innovation

Responsive to customer demands and industry trends

Internet

Cloud

1993	2001	2004	2007	2013	Tomorrow
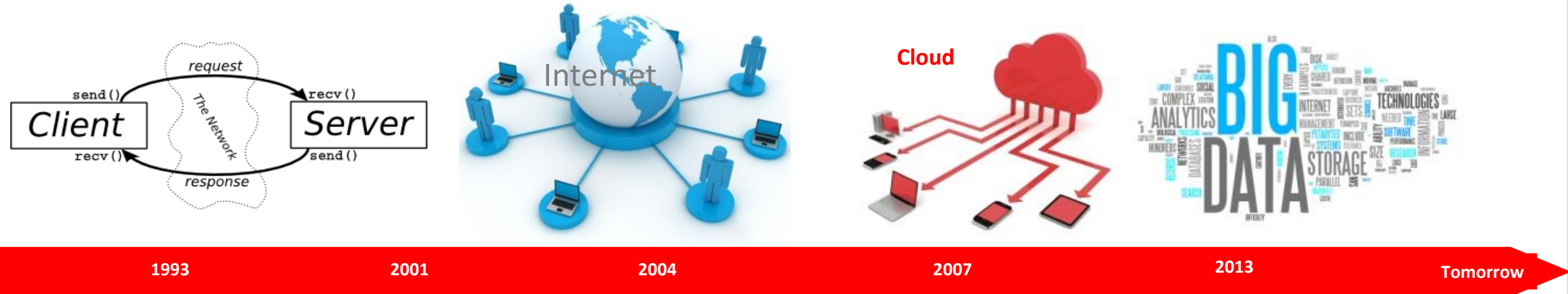
Oracle Database 10g

Oracle Database 12c

- Declarative Referential Integrity
- PLSQL Triggers and Stored Procedures
- Two Phase Commit
- Parallel Operations
- Object Relational Support
- Multimedia Support

- Real Application Clusters
- Materialized Views
- XML Database
- Data Guard
- Flashback Query
- Virtual Private Database
- Built in Java VM

- Automatic Storage Management
- Transparent Data Encryption
- Self Managing Database
- Automatic Workload Repository
- SQL Tuning Advisor and ADDM
- Flashback Table and Database
- Application Express

- Active Data Guard
- Advanced Compression
- Real Application Testing
- Hybrid Columnar Compression
- Exadata Smart Scans
- Exadata Smart Flash Cache
- Exadata I/O Resource Management

- Multitenant
- Heat Map & Automatic Data Optimization
- Data Redaction
- Pattern Matching
- Global Data Services
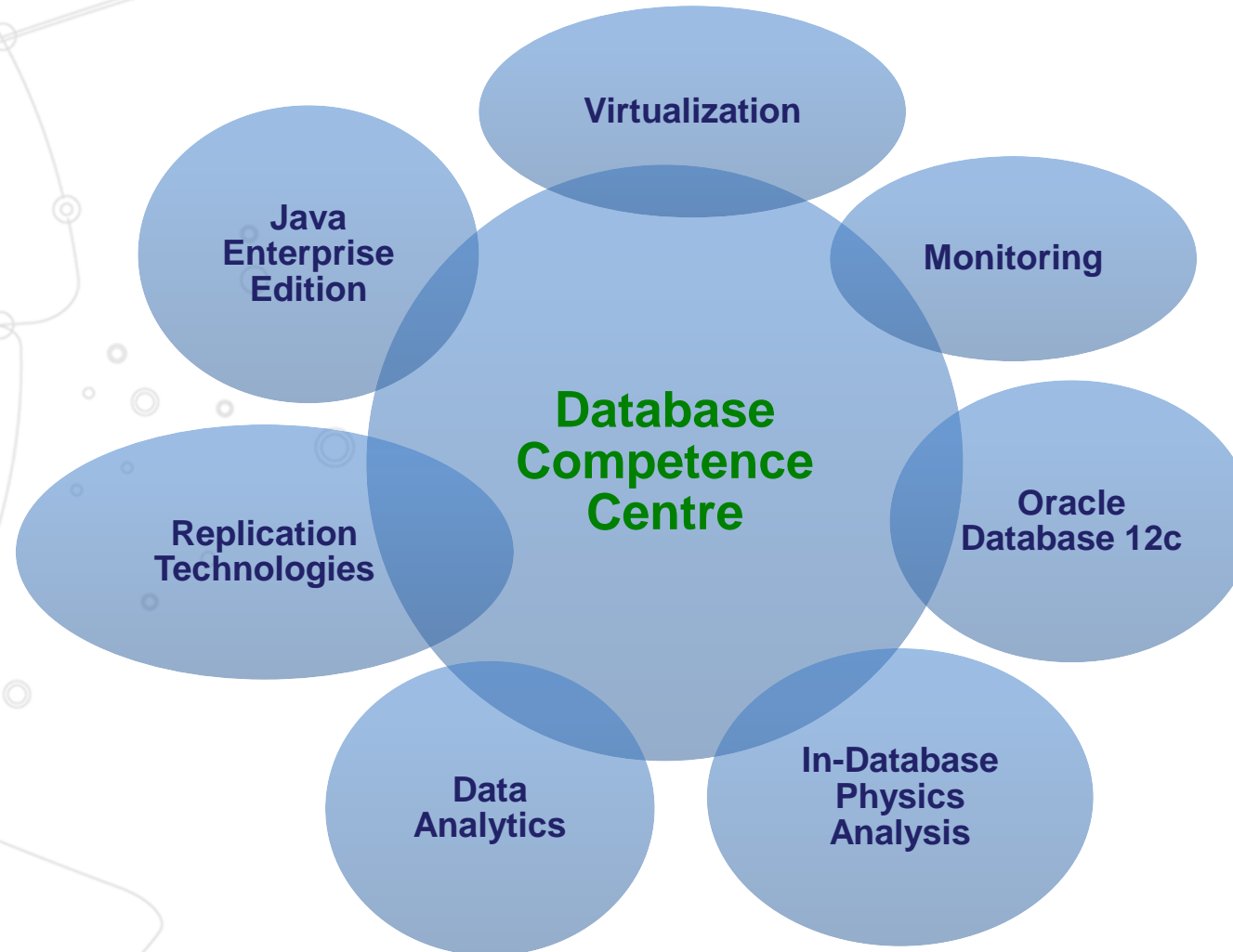- Application Continuity

Program Agenda

1 Introduction

2 Oracle openlab IV achievements

3 Oracle strategic direction

4 Oracle openlab V projects

5 Conclusions

ORACLE®

Oracle Confidential –

Database Competence Centre

› **Lorena Lobato Pardavila**
› **Andrei Dumitru**
› **Ignacio Coterillo Coz**
› **Antonio Romero Marin**
› **Manuel Martin Marquez**
› **Luis Rodriguez Fernandez**
› **Maaike Limper**
› **Stefano Russo**

Background image: Shutterstock

Openlab IV projects

Virtualization

Monitoring

Java Enterprise Edition

Database Competence Centre

Replication Technologies

Oracle Database 12c

Data Analytics

In-Database Physics Analysis

Database Competence Centre Achievements

Virtualization
- Performance tests of Intel SR-IOV network cards on Oracle virtual platforms
- Integration of the Oracle VM hypervisor as a compute provider on the OpenStack Cloud Operating System

Monitoring
- Migrated from Oracle Enterprise Manager 11g to version 12c
- Integrated with CERN Agile Infrastructure (Active Directory)

Oracle Database 12c
- Early validation of new functionalities thanks to involvement in Beta program
- Oracle Database 12c being deployed in production

In-Database Physics Analysis
- Proven for a subset of the SQL-based queries
- Better understanding of Oracle Database In-Memory

Database Competence Centre Achievements

Java Enterprise Edition
- Java Web Hosting Service (Middleware on Demand)
- Upgrade 500 Oracle Weblogic Servers to 12c
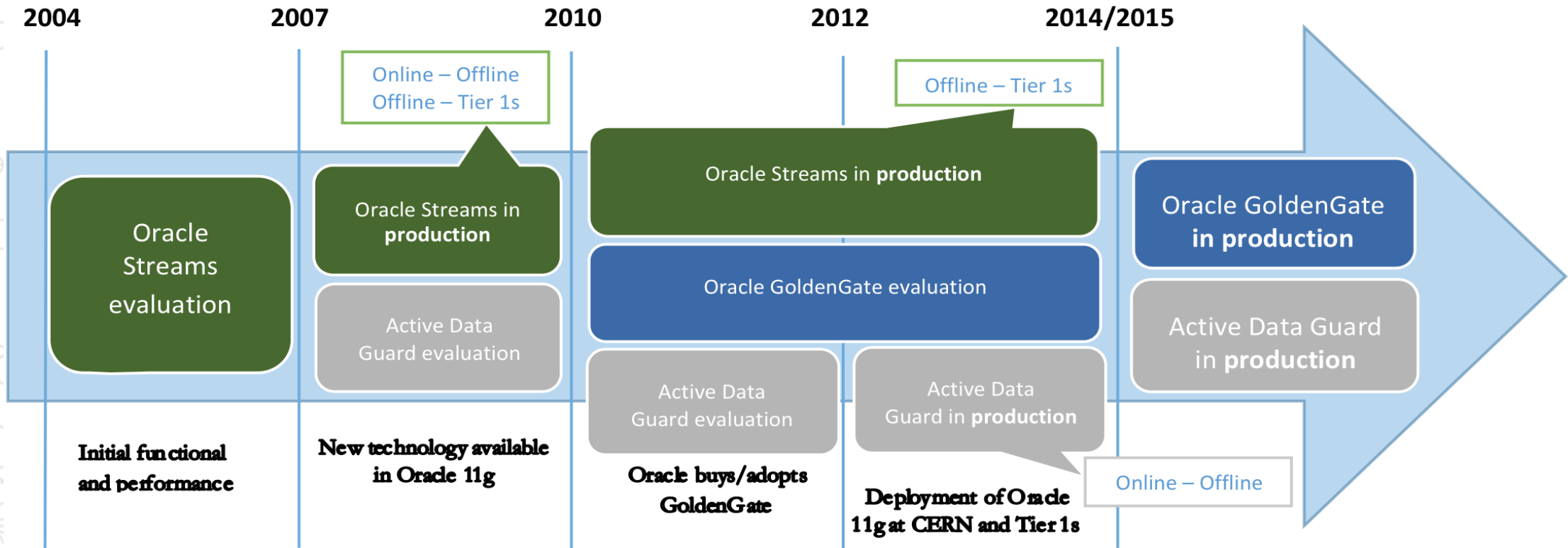- Oracle Weblogic and APEX SSO integration

Data Analytics
- Oracle R Enterprise added new functionalities proposed by CERN
- Applied Oracle Endeca Information Discovery to explore future possibilities in control and monitoring improvement

Replication Technologies
- Oracle GoldenGate evolution to fulfill CERN needs
- Smooth migration from Oracle Streams to Oracle GoldenGate

Replication Technologies Evolution

| 2004 | 2007 | 2010 | 2012 | 2014/2015 |

Online – Offline
Offline – Tier 1s

Offline – Tier 1s

Oracle Streams evaluation

Oracle Streams in **production**

Active Data Guard evaluation

Oracle Streams in **production**

Oracle GoldenGate evaluation

Active Data Guard evaluation

Active Data Guard in **production**

Oracle GoldenGate **in production**

Active Data Guard in **production**

Online – Offline

Initial functional and performance

New technology available in Oracle 11g

Oracle buys/adopts GoldenGate

Deployment of Oracle 11g at CERN and Tier 1s

Replication Technologies Evolution

Feedback to Oracle GoldenGate development team

- Oracle GoldenGate 11g did not fulfill CERN needs
- Oracle GoldenGate 12c contained new functionalities as suggested by CERN

Oracle GoldenGate 12c fit in CERN use cases

- Improvements in transactions dependencies (including DDL)
- Data Filtering based on session tagging
- Offloading primary system with downstream capture database
- Native DDL support (Table creation, granting of user privileges)

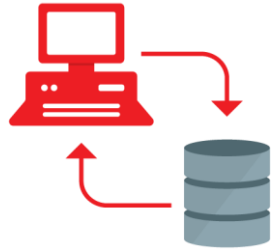**Replication Technologies Environment**

- Migration completed from Oracle Streams to Oracle GoldenGate in our productions databases during 2014
- Centralized system at CERN for physics data distribution in WLCG

Background image: Shutterstock

Program Agenda

1 ▶ Introduction

2 ▶ Oracle openlab IV achievements

3 ▶ **Oracle strategic direction**

4 ▶ Oracle openlab V projects

5 ▶ Conclusions

Oracle Confidential –

Oracle Database Innovations for each Computing Era

Now innovating for big data and the cloud

Client-Server   **Internet**   **Big Data & Cloud**
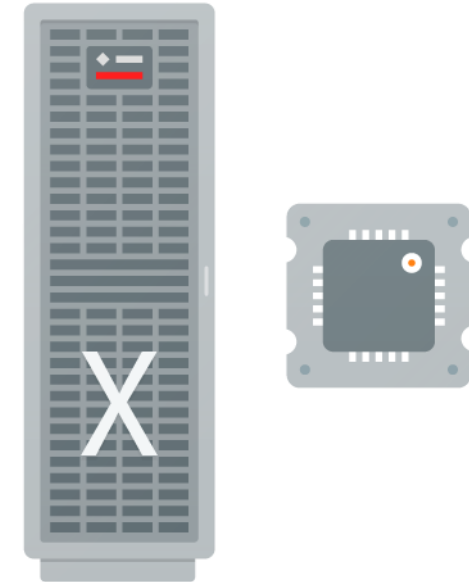
Release	1985 – 1997: 6, 7 and 8	1998 – 2012: 8i, 9i, 10g, 11g	2013-2014: 12c

Developer

Java   .NET   PHP   XML   APEX

Stored Procedures & Triggers
Referential Integrity
Distributed Transactions
AQ
LOBs
Spatial

R
Pattern Matching
OpenSource Drivers
JSON
REST Data Services
NoSQL Database
Application Continuity
Migration Framework

Engine

Online Operations   Automatic Storage Mgmt
RAC   Encryption
Data Guard   Real Application Testing
Flashback   Row Compression
Self-Managing Database   Columnar Compression
Enterprise Manager   Smart Scans
Resource Management   Flash Cache

OLTP throughput
Parallel Query, Partitioning

Multitenant Database   In-Memory Column Store

Cloud Services

Apps

Software as a Service (SaaS)

Platform

Platform as a Service (PaaS)

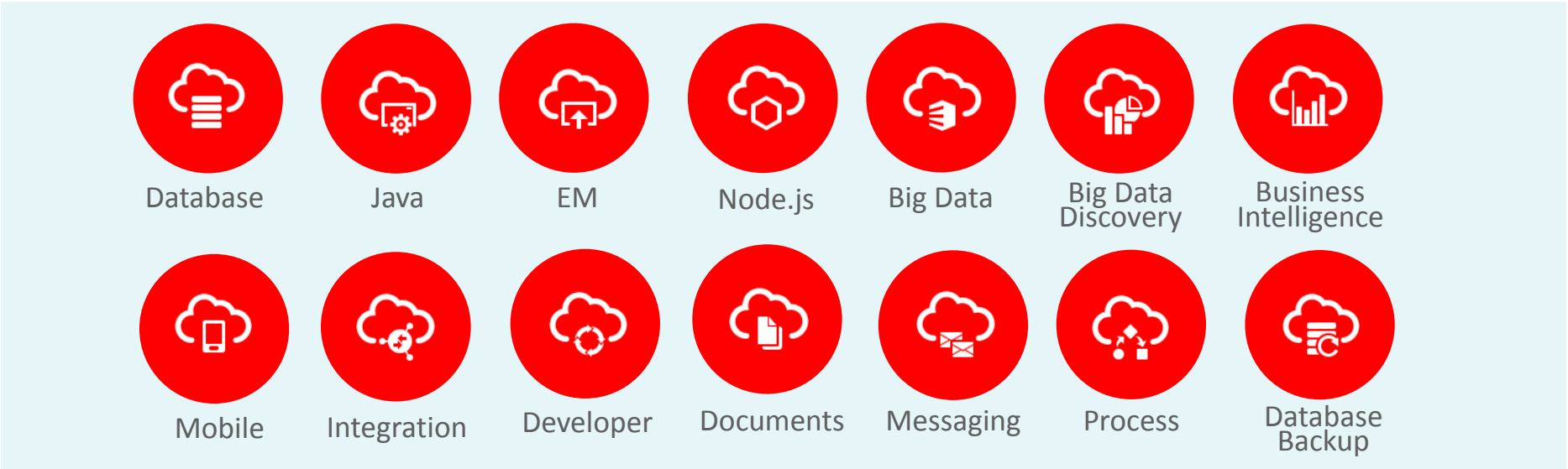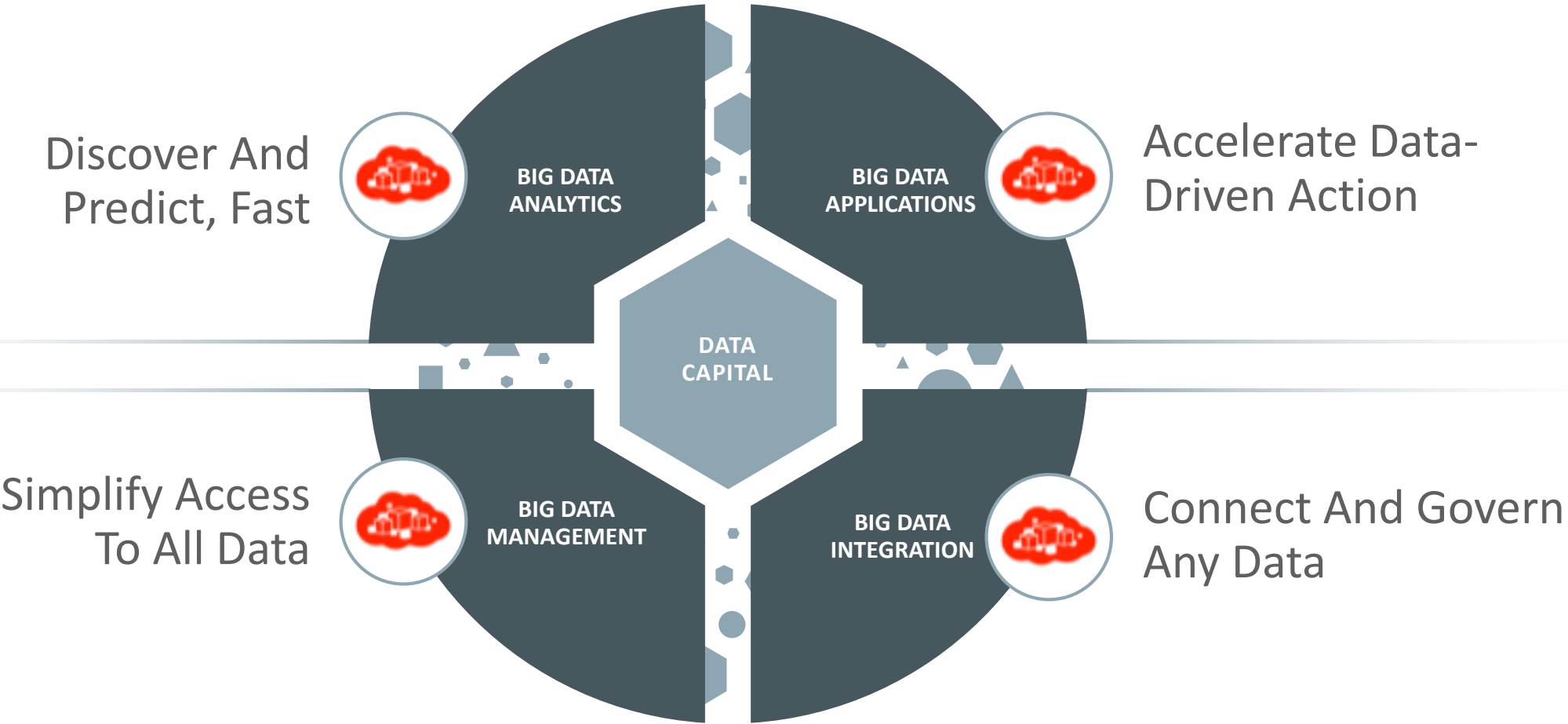## Infrastructure

Infrastructure as a Service (IaaS)

Oracle Cloud
Full stack enterprise cloud services SaaS + PaaS + IaaS

CX HCM ERP SCM EPM Analytics Social Data

Database Java EM Node.js Big Data Big Data Discovery Business Intelligence

Mobile Integration Developer Documents Messaging Process Database Backup

Compute

Storage

https://cloud.oracle.com

Enterprise Big Data Architecture

Discover And Predict, Fast

BIG DATA ANALYTICS

BIG DATA APPLICATIONS

Accelerate Data-Driven Action

DATA CAPITAL

Simplify Access To All Data

BIG DATA MANAGEMENT

BIG DATA INTEGRATION

Connect And Govern Any Data

Oracle Big Data Discovery. The Visual Face of Hadoop

Oracle Confidential –

Program Agenda

1 ▶ Introduction

2 ▶ Oracle openlab IV achievements

3 ▶ Oracle strategic direction

4 ▶ Oracle openlab V projects

5 ▶ Conclusions

Oracle Confidential –

CERN openlab V Continuous Innovation

Java Web

- Exploit new Java and WebLogic features for improving Java Infrastructure
  - Developer Productivity
  - Improve application consolidation density

Cloud Services

- Private, Hybrid and Public
  - Cloud Database back-up and recovery
  - Transparent application deployment between CERN and public Cloud

Database Evolution

- CERN's and High Energy Physics Oriented
  - RAC evolution
  - In-memory, data "sharding"
  - High availability monitoring

Data Analytics

- Data Analytics as a Service Infrastructure
  - Joint effort between CERN and openlab members

Background image: Shutterstock

Data Analytics as a Service Feature and Challenges

Centralize and standardize Data Analytics requirement
- Flexible platform for CERN and external institution
- Different actors and Data Analytics requirements

**Provide Storage for large data volume**
- Extremely Heterogeneous data environment
- Structured and unstructured

Integration with existing data repositories
- Large number of mission-critical data systems need to be integrated
- Logging, fault tracking, major events, etc.

Deliver real-time, batch analytics and information discovery
- Batch predicted models deployed for real time monitoring and control
- Deliver self-service Information Discovery

FCC
hh ee he
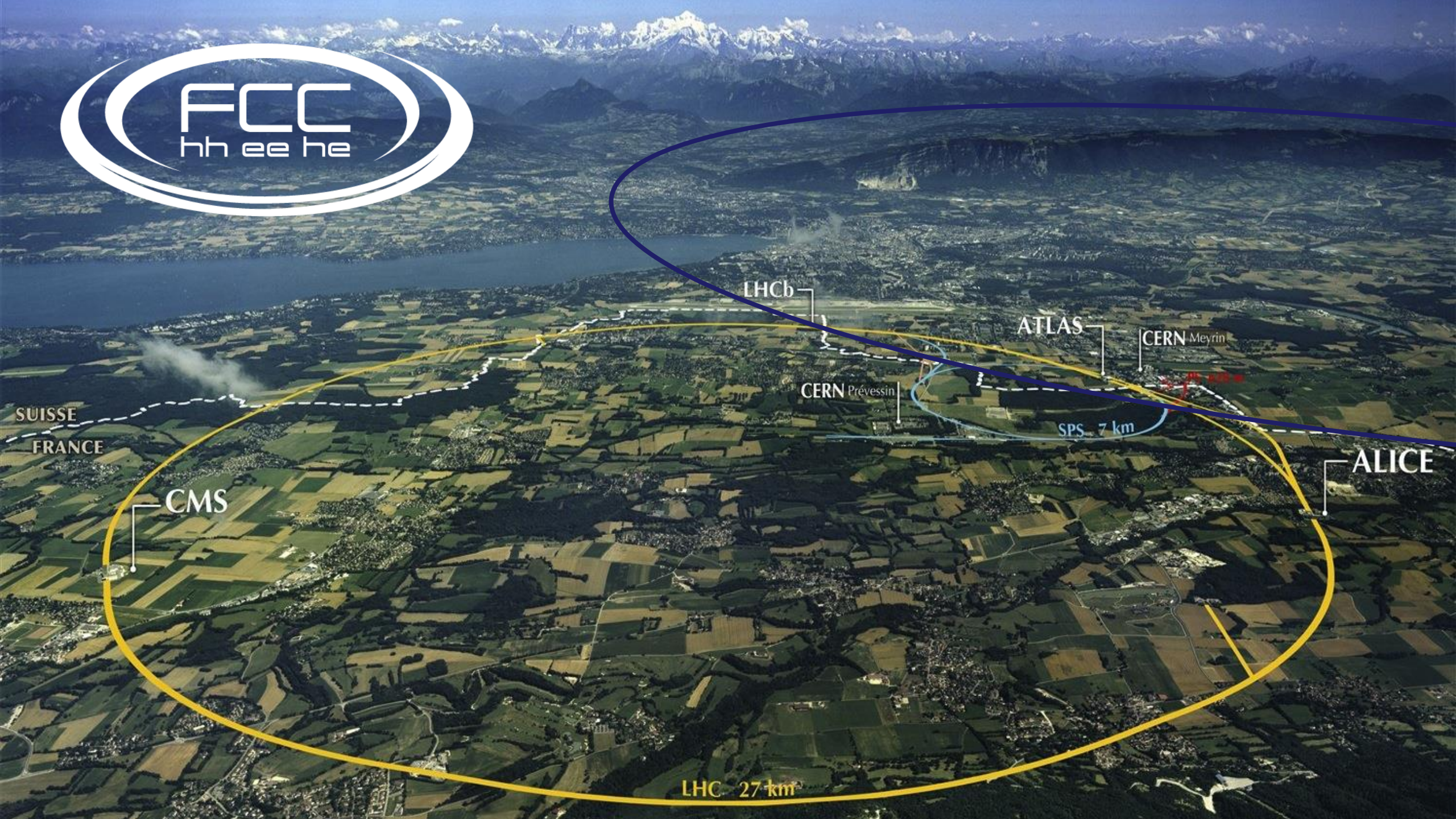
LHCb

ATLAS

CERN Meyrin

CERN Prévessin

SPS 7 km

SUISSE
FRANCE

ALICE

CMS

LHC 27 km

Future Circular Collider Study
Reliability, Availability & Maintainability

Model the accelerator complex and to simulate the particle acceleration process.

- FCC RAMS studies will be needed to assess the feasibility of such a large scale project

Reliability and Availability Study

- Key indicators for the performance of circular colliders
- For the HL-LHC availability will be one of the fundamental

Collaboration project

- FCC, Tampere University of Technology and CERN openlab

Program Agenda

1 Introduction

2 Oracle openlab IV achievements

3 Oracle strategic direction

4 Oracle openlab V projects

5 Conclusions

Oracle Confidential –

Hardware and Software
Engineered to Work Together

Oracle Confidential –

ORACLE®