SAP Leonardo Big Data
and the Digital Platform for the Intelligent Enterprise

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The Digital Era is evolving into The Intelligence Era

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<tbody>
<tr>
<td>Enabling Technologies</td>
<td>• Transistors &amp; silicon revolution • Large scale Mainframe Computing adoption • Emergence of PC’s • Plant floor automation</td>
<td>• Widespread PC adoption • Broadband Internet • ERP and business process technologies</td>
<td>• Mobile &amp; Smartphone ubiquity • Cloud Computing • Social Networks • Big Data</td>
<td>• Machine learning (ML) and artificial intelligence (AI) • Internet of things (IoT) and distributed computing • Blockchain</td>
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<td>Customer Value Creation</td>
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<td>Industrial Automation</td>
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<td>Business Process Automation</td>
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<td>Digital Transformation</td>
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<td>Intelligent Enterprise</td>
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Intelligent enterprises elevate employees to focus on higher-value tasks
SAP Strategy – Deliver the Intelligent Enterprise

THE INTELLIGENT ENTERPRISE features 3 KEY COMPONENTS:

1. Intelligent Suite
2. Digital Platform
3. Intelligent Technologies

The key components are:
- Manufacturing & Supply Chain
- Customer Experience
- Digital Core
- People Engagement
- Network & Spend Management
- Data Management
- Cloud Platform
- AI/ML
- IoT
- Analytics

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Intelligent Suite: Deliver intelligence across value chains

Intelligent applications for every line of business

SAP S/4HANA Cloud

SAP SuccessFactors

SAP Fieldglass

SAP Ariba

SAP Concur

Intelligent Suite

Integration | Business Objects | Master Data | Orchestration
25 Industries | 180+ Countries

Customer Experience

Manufacturing & Supply Chain

Digital Core

People Engagement

Network & Spend Management
Intelligent Technologies: SAP Leonardo everywhere
Digital Platform: Unlock data-driven intelligence and innovation

Unified data management to capture real-time value from different types of data

Best-in-class digital platform for new app development, extensions, and integration
SAP HANA Data Management Suite empowering SAP Leonardo

Leonardo

Products
- Products Insights
- Goods & Equipment
- Supply Networks

- Fixed Asset Insights
- Manufacturing Execution
- Manufacturing Networks

Fleet
- Mobile Asset Insights
- Logistics Safety
- Logistics Networks

Infrastructure
- Building Insights
- Construction
- Energy Grids

Markets
- Market Insights
- Rural Areas
- Urban Areas

People
- Work Health
- Sports Homes

Custom
- Custom IoT/ML
- Applications and Extensions

Pipeline Orchestration

Data Store & Compute

Data Ingestion & Onboarding
- Application Development
- Advanced Analytical Processing
- Data Integration & Quality
- Process Data In-Memory

Database Management

SAP Data Hub
- Data Discovery
- VORA
- Data Governance
- Data Refinery & Orchestration

SAP HANA Platform

Ingest & Refine

Batch
- Streaming
- Replication
- Remote Access

Sources

SAP S/4HANA

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SAP BIG DATA SERVICES
Big Data Is Complex, It Gets More Complex As You Scale

- Acquire/install hardware
- Get Spark/Hadoop running
- Run in production at scale
- ... and keep up to date

<table>
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<tr>
<th>Complexity</th>
<th>Time</th>
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<tr>
<td>Infrastructure-as-a-Service</td>
<td>Integration problem between tools</td>
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<tr>
<td>Procurement/Setup/Configuration</td>
<td>Resource contention</td>
</tr>
<tr>
<td></td>
<td>Hire administrator/Software setup/Configuration</td>
</tr>
<tr>
<td></td>
<td>Deal with users’ stack traces</td>
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<tr>
<td></td>
<td>Install and test new software, tools</td>
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<tr>
<td></td>
<td>Broken components and nodes</td>
</tr>
<tr>
<td></td>
<td>Additional nodes needed</td>
</tr>
<tr>
<td></td>
<td>Performance tune</td>
</tr>
<tr>
<td></td>
<td>Hung jobs</td>
</tr>
<tr>
<td></td>
<td>Rebalance capacity</td>
</tr>
<tr>
<td></td>
<td>Upgrade infrastructure</td>
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Big Data as a Service Removes Complexity, Makes Scaling Easy For You

Making Big Data simple

Acquire/install hardware | Get Spark/Hadoop running | Run in production at scale | ... and keep up to date

SAP Cloud Platform
Big Data Services

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SAP Big Data Services: Big Data that just works
Enterprise-ready Hadoop and Spark fully managed by SAP

Fast time to value
days not months

Easier, faster scalability
with elastic scaling

Operations support
so your jobs get done

Lower TCO
for fast investment payback

Enterprise ready
for business-critical applications

“White-glove service for Hadoop at a self-service price” – Forrester
Customer Use Case - 1
Marketing Analytics

Neustar MarketShare DecisionCloud

- Attribution analysis: measure, predict, and improve the impact of marketing on revenue
- Customers include retail, finance, hospitality, pharma, auto, and tech companies
- Massive, rapidly changing advertising data stored and analyzed in Hadoop

~2.5 PB of data provisioned on SAP Cloud Platform Big Data Services
Customer Use Case - 1
Marketing Analytics

Challenges due to inefficiencies of previous platform

- Job processing taking too long
- Poor service reliability
- Product development hampered
- Service costs driven up
- Number of customers limited

SAP Cloud Platform Big Data Services Benefits

- Greater client satisfaction due to higher performance and reliability
- More time to focus on analytics instead of Hadoop operations
- More effective resource allocation and cost management
- Increased solution competitiveness

50% Lower Cost

10x Performance
Customer Use Case - 1

Built for Performance

Superior reliability and efficiency drive performance

Big Data-optimized infrastructure
- HDFS, not object storage
- Data locality
- No virtualization overhead
- Transparently elastic

![Graph showing job completion time comparison between SAP Big Data Services and Amazon](image_url)

<table>
<thead>
<tr>
<th>Job Completion Time</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>SAP</td>
<td>EC2 Inefficiency</td>
</tr>
<tr>
<td>Amazon</td>
<td>100</td>
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Customer Use Case - 2
Big Data Warehouse with HANA and BDS

Enabling transparency between Retailers and Vendors

- Provides technology and expertise for retailers, suppliers and distributors to improve collaboration through data, payments, and analytics.
- Customer network includes over 30,000 retail outlets and over 3,000 distributors

Challenges due to inefficiencies of previous platform

- Poor service reliability – User applications running slow or timing out due to concurrency issues
- Data Velocity – Long nightly daily batch window. Often completed during business hours.
- Business units not having access to the most accurate and up-to-date information about their customers
- Rising Maintenance costs

Why SAP?

- Cost effective but also highly performant landscape: Use HANA for high performance reporting requirements for customers & use SAP BDS to collect and store high volume of data from 30,000 retail outlets
- Using Spark for the production pipeline will reduce the nightly batch window, thus business will be able perform analysis on the most recent data
SAP DATA HUB
How to accelerate Smart Infrastructure Development?

**Business Challenge**

- Municipalities need to create a more “green” environment but don’t necessarily have visibility to the most effective investment options and the infrastructure required.
- Grid Operators “know” energy production and consumption patterns & can recommend where and what to invest on renewable energy.
- Create new revenue streams by providing advisory services to Municipalities on enabling “Green Cities”.

**Solution**

- Create a unified view of all customers, assets, energy consumption & production values, grid load, energy price data and other related datasets across the country.
- Simulation capability on different renewable energy investment options using Machine Learning.

**How to…**

- Easily combine datasets from multiple different systems:
  - Customer & Energy Consumption (SAP Utilities)
  - Assets and Capacity (SAP ERP and non-SAP CRM)
  - Grid Load (Historian/Scada systems)
  - Energy Pricing, Weather, Finedust data (online - opensources).
- Predict Future Grid Load by running a Machine Learning algorithm on the combined data set.
- Provide E2E monitoring on the overall process, quickly identify errors.
Modern Landscapes

How Big Data is Transforming Landscapes

- Handling large volumes of data is not the main concern
  - Enable early insights on all levels of data
  - Ensure integrated analytics across the enterprise
  - Not just on-premise but distributed

- ETL or DWH are not the answer
  - Data formats, granularity, streams & flexible structures
  - Apply logic to the data, not data to the logic
  - Not just batch but also real-time
SAP Data Hub

Why is it Unique?

SAP Data Hub enables agile management of data in a diverse landscape across the organization.

This enterprise-ready solution provides governance and orchestration for data refinement and enrichment, using pipelining of many complex data processing operations, like machine learning (ML).
SAP Data Hub
Use Cases

Big Data Warehousing

- Data lakes
- Enterprise data warehouse
- connectivity
- integration
- SAP BW
- Hadoop/S3/Azure
- Data Preparation
- Metadata Explorer
- multiple systems

Internet of Things

- IoT apps (SAP Cloud Platform)
- Data processing and orchestration
- Big Data lakes
- Ingestion and stream
- IoT gateway and services
- Sensors
- streaming
- SCP
- IT/OT
- kafka
- events
- cloud
- IoT
- sensors

Data Science

- Python
- R
- Machine Learning
- CI / CD
- Script Automation
- Tensorflow

Scalability, Monitoring, Scheduling
Customer Use Case - 1
Value Added Advisory Services for Grid Operators

Business Challenge

- Municipalities need to create a more "green" environment but don’t necessarily have visibility to the most effective investment options and the infrastructure required
- Grid Operators “know” energy production and consumption patterns & can recommend where and what to invest on renewable energy
- Create new revenue streams by providing advisory services to Municipalities on enabling “Green Cities”

Solution

- Create a unified view of all customers, assets, energy consumption & production values, grid load, energy price data and other related datasets across the country
- Simulation capability on different renewable energy investment options using Machine Learning

Why Data Hub?

- Using data pipelines; easily combine datasets from multiple different systems:
  - Customer & Energy Consumption (SAP Utilities)
  - Assets and Capacity (SAP ERP and non-SAP CRM)
  - Grid Load (Historian/Scada systems)
  - Energy Pricing, Weather, Finedust data (online - opensources)
- Predict Future Data Load by running a Python script on the combined data set
- Provide E2E monitoring on the overall process, quickly identify errors
Customer Use Case - 1
High Level Solution Landscape

SAP Data Hub
- Data Refinery & Orchestration
- Data Ingestion & Onboarding

VORA
- Data Discovery
- Data Governance

SAP HANA
- Application Development
- Advanced Analytical Processing
- Data Integration & Quality

DATA LAKE
- Spark
- Hadoop
- Map Reduce
- Hive
- HDFS

Real Time
- Batch
- Streaming
- Remote Access

Data Sources
- Dynamics
- ERP
- CRM
- IS-U
- eMETER

Data Store & Compute

Pipeline & Orchestration

Consume
Customer Use Case - 1
SAP Data Hub Models

**Task Workflow:** Combine Energy Production, Customer, Location, Grid Load information and Predict Future Grid Load

**Pipeline:** Predict Future Grid Load
Customer Use Case - 2
Detect Quality Deviations in Manufacturing Moulding Process using ML

Business Challenge
• Proactively identify faults in manufacturing moulding process to reduce cost related to waste and re-work

Solution
• Use Machine Learning to detect quality deviations in end products
• 3 different data sets are used for the predictive model :
  • Pressure and Temperature values before and after moulding
  • IR Images before and after moulding
  • Logistics data from SAP ERP on suppliers

Why Data Hub ?
• Using data pipelines; easily combine datasets from 3 different systems :
  • Pressure and Temperature sensors (Kafka)
  • IR Images (Hadoop)
  • Logistics data from SAP ERP (HANA)
• Predict if the pressed material is faulty or not by feeding the combined dataset into a HANA Predictive Analytics Library procedure
• Provide E2E monitoring on the overall process , quickly identify errors
Customer Use Case - 2

Data Flows

SAP Data Hub
Orchestrate steps 1->2->3

Sensor Data
1. Stream Data

Image Data
2. Extract Features

SAP HANA Platform

Join

Business & logistics data

3. Classify

Predictive Analysis Library

Application Server (XSA)

ERP Data

Start execution

Browser

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Customer Use Case - 2
SAP Data Hub Models

Pipeline 1: Stream Data
- Kafka Consumer
- 1:2 Multiplexer
- ToSwing Converter
- Python2Operator
- Terminal
- Kafka Producer
- SAP HANA Client

Pipeline 2: Extract Features
- SAP HANA Client
- 1:2 Multiplexer
- Graph Terminator

Task Workflow: Combine Datasets and Run ML
QUESTIONS

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Useful Links
- SAP Intelligent Enterprise
- SAP Leonardo Technologies
- SAP HANA Data Management Suite
- SAP Big Data Services
- SAP Data Hub
Follow all of SAP

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