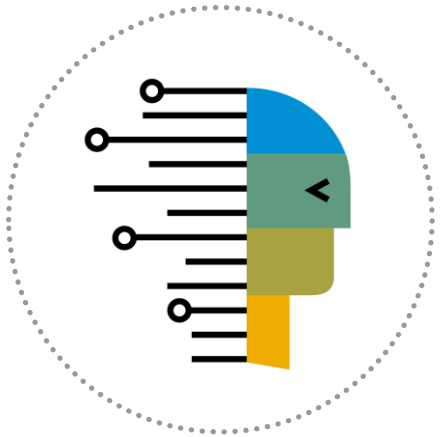
Week 4: Embedded Predictive and Machine Learning

Unit 1: Intelligent Processes in SAP S/4HANA – Overview

Why do we care so much about intelligence in SAP S/4HANA?

External challenges

- Dynamic environment and global competition
- Automation for differentiation vs. operation
- Talent scarcity and meaningful work



Why intelligent processes in SAP S/4HANA?

Internal challenges

- Quick fix for broken and legacy processes
- High maintenance of project patchwork
- Limited success scaling proof of concepts[1]

- Address common process challenges
- Designed with E2E business process in mind
- Defined models coming to life with your data

- Native integration into SAP S/4HANA
- Scale beyond proof of concept
- Expertise, trust, and reliability of SAP

- Increased automation and actionable insights
- Focus on higher value and expert tasks
- Built-in lifecycle management

[1] Accenture (2019) – AI: Built to Scale

Intelligent technologies assist, adapt, and automate end-to-end business processes

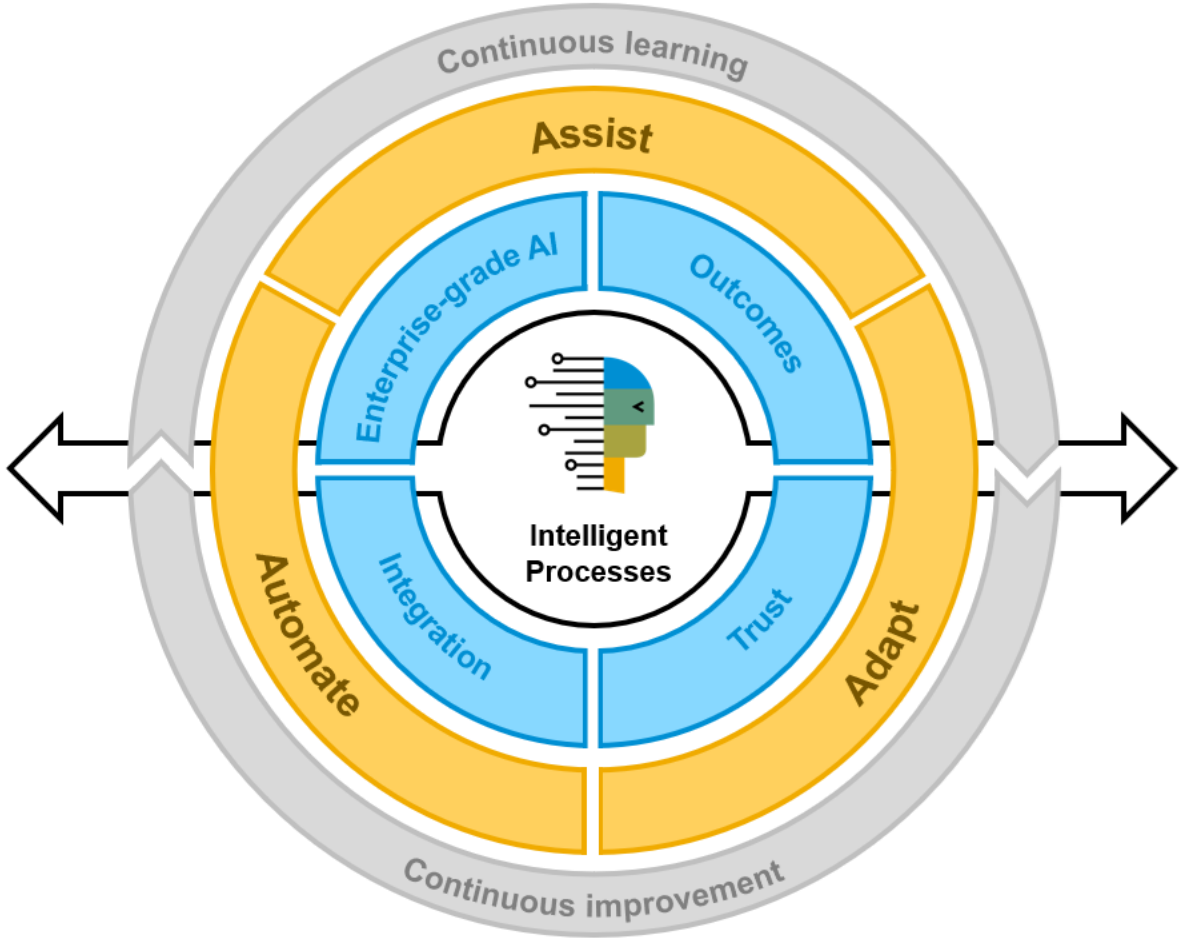
Continuous learning from business data leads to continuous improvement of business processes

Core capabilities

- **Assist** data-driven decision-making
- **Adapt** business processes in real time
- **Automate** processes within and between systems

Key principles

- Scalable **enterprise-grade AI**
- Tangible business **outcomes**
- **Trusted** data and intelligent recommendations
- **Integrated** technologies and processes



Machine learning in SAP S/4HANA

Embed in SAP S/4HANA

- **Embedded machine learning,** predictive analytics
- “Simple” cases like trending or forecasting
- Algorithms with low CPU–RAM–data demand such as regression, clustering, classification, time-series, and so on
- SAP HANA, SAP Analytics Cloud

Consume from SAP BTP

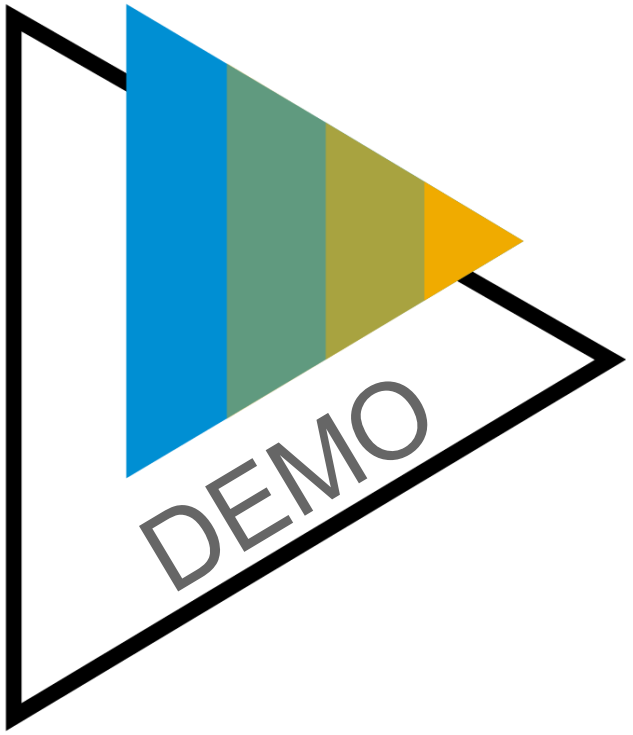
- **Side-by-side machine learning**
- Resource-intensive cases like image or language processing
- Neural networks with high CPU–RAM–data demand such as image recognition
- Based on SAP Business Technology Platform

Extend to SAP Analytics Cloud

- Explorative requirements for business users
- Predictions based on SAP S/4HANA CDS views can be achieved using smart services functionality of SAP Analytics Cloud

Learn from custom-specific history and exceptions to predict, support, automate, and optimize business user decisions

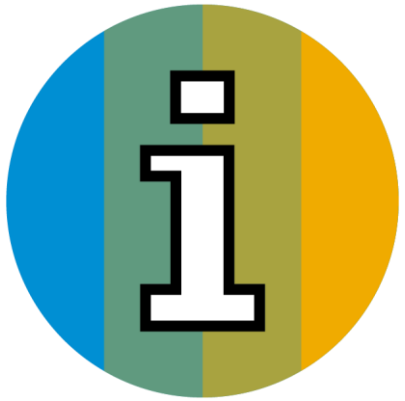
Demo



Resources to help you get started

Intelligent scenario lifecycle management (ISLM)

- ISLM in SAP S/4HANA Cloud
- ISLM in SAP S/4HANA
- ISLM Community



References

- SAP TechEd 2020 Replay
- SAP Community Webinar
- ISLM Blog Series

Trial options

- SAP S/4HANA Fully Activated Appliance
  (→ pilot extended ISLM features)

Intelligent ERP Community

- Intelligent ERP Community

Key takeaways

- SAP S/4HANA transforms end-to-end business processes into intelligent business processes
- Over 300 intelligent capabilities available for SAP S/4HANA (and that number is growing)
- Moderate machine learning requirements such as *forecasting* can be handled embedded in SAP S/4HANA (using PAL and APL)

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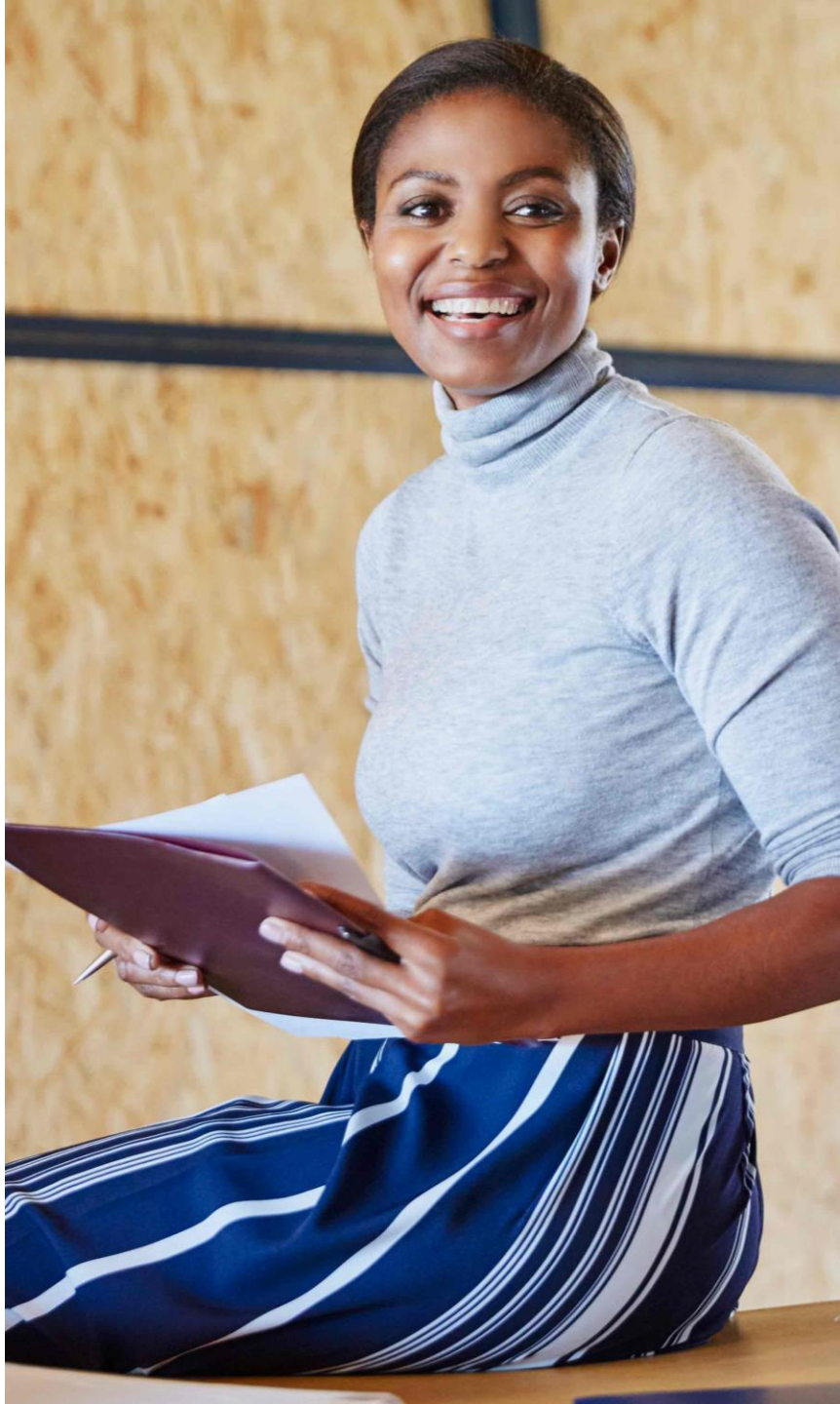
Week 4: Embedded Predictive and Machine Learning

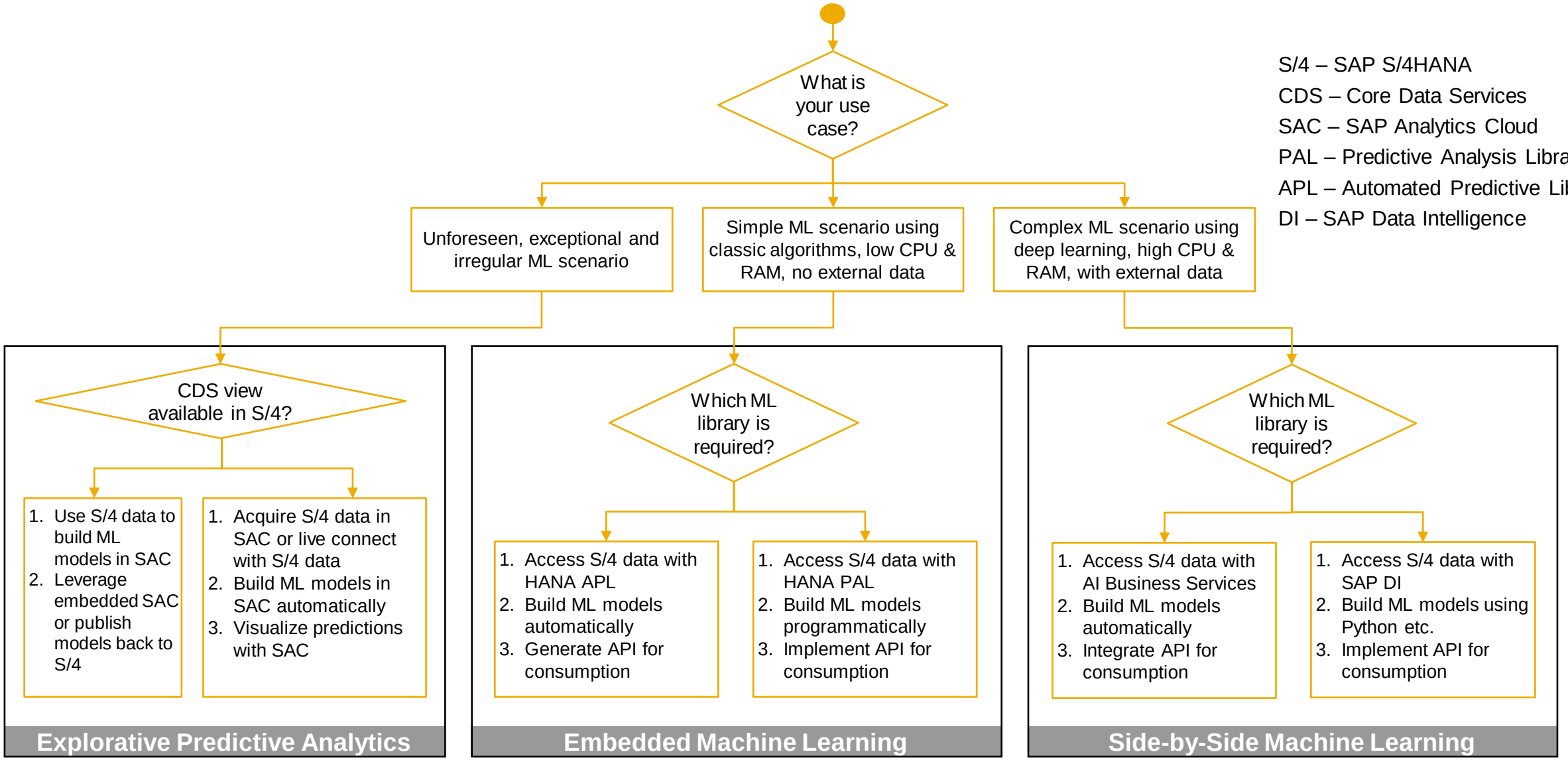
Unit 2: Machine Learning and Predictive Analytics: Architecture and Concepts

Agenda

1. Decision tree and approaches
2. Architecture overview
3. Embedded models
4. Side-by-side models



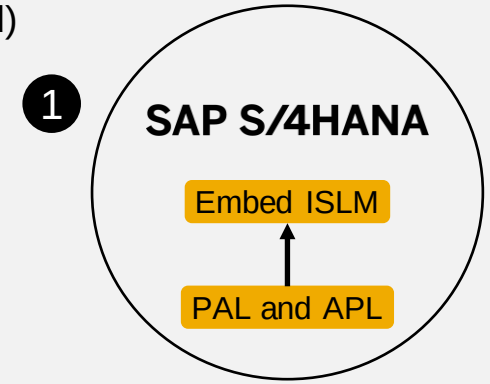
Decision tree – predictive analytics and machine learning with SAP S/4HANA



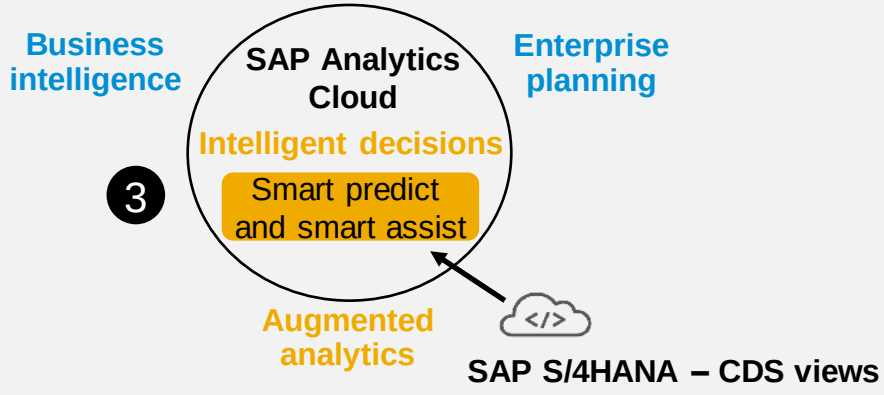
S/4 – SAP S/4HANA
CDS – Core Data Services
SAC – SAP Analytics Cloud
PAL – Predictive Analysis Library
APL – Automated Predictive Library
DI – SAP Data Intelligence

Approaches

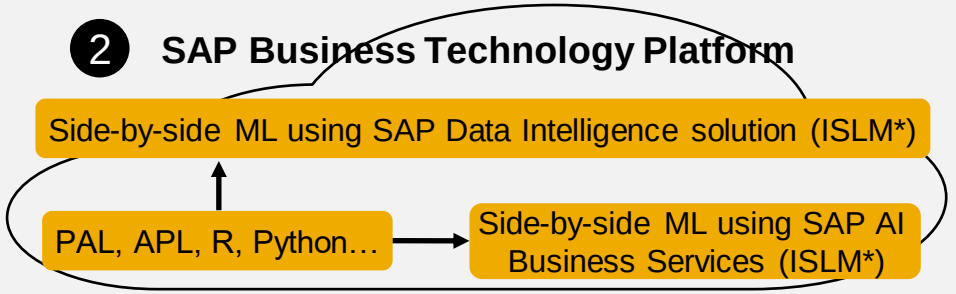
Embedding predictive algorithms in SAP S/4HANA (embedded)



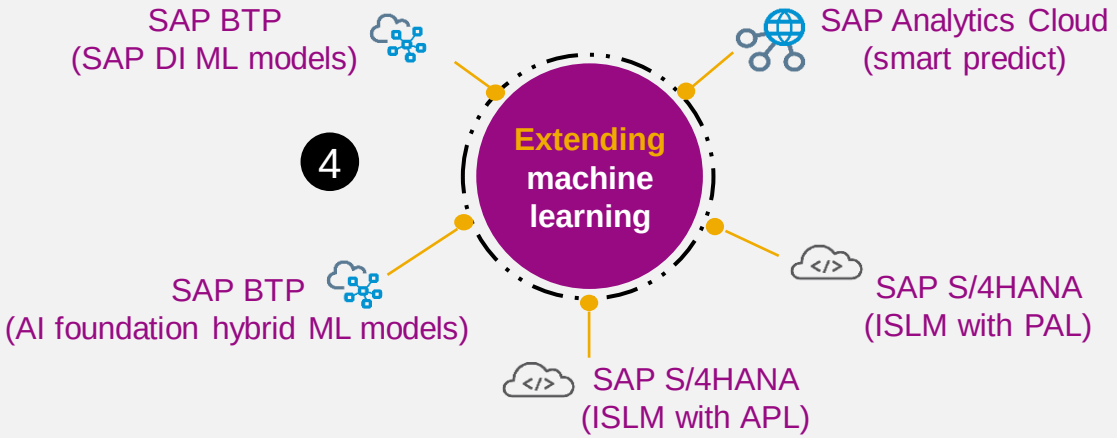
Leveraging predictive analytics with SAP Analytics Cloud (explorative analytics with side-by-side)



Consuming predictive and ML services from SAP Business Technology Platform (side-by-side)



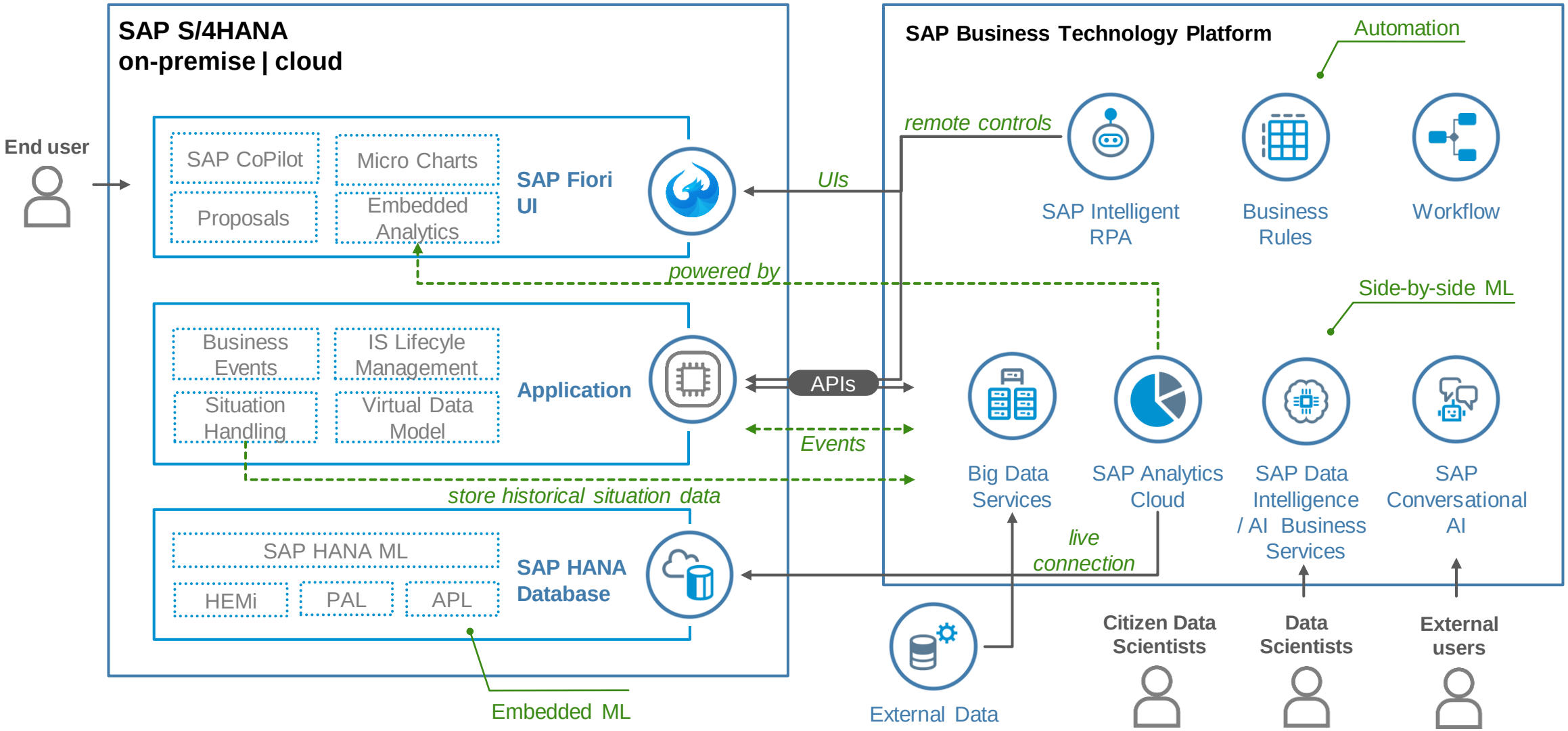
Enhancing and extending predictive analytics and ML services (extensibility of the models)



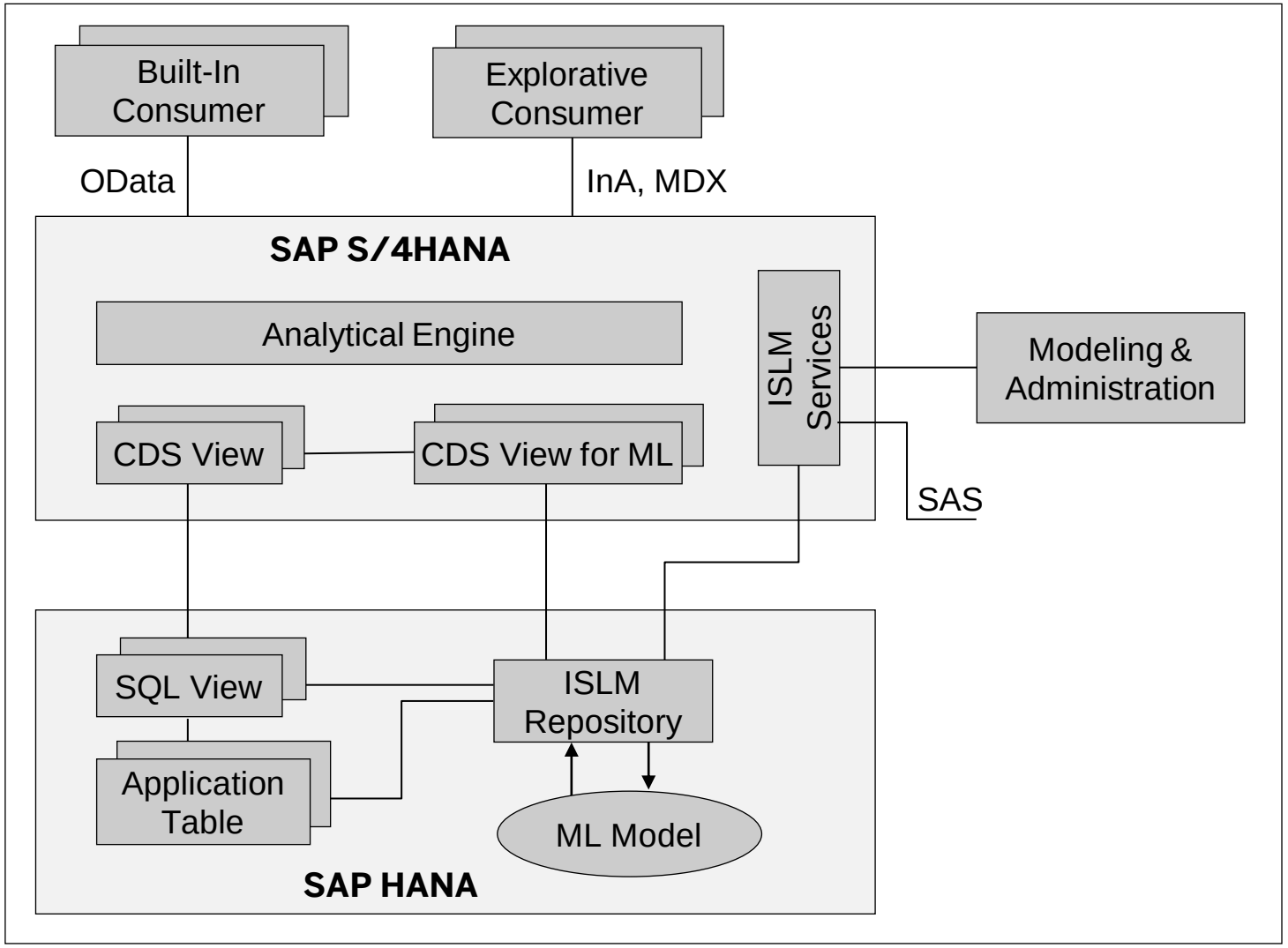
Best practices of leveraging predictive analytics and machine learning with SAP S/4HANA

ISLM – intelligent scenario lifecycle management; BTP – Business Technology Platform
PAL – Predictive Analysis Library; APL – Automated Predictive Library; CDS – core data services

Architecture overview: SAP S/4HANA, the intelligent ERP



Embedded predictive models in SAP S/4HANA



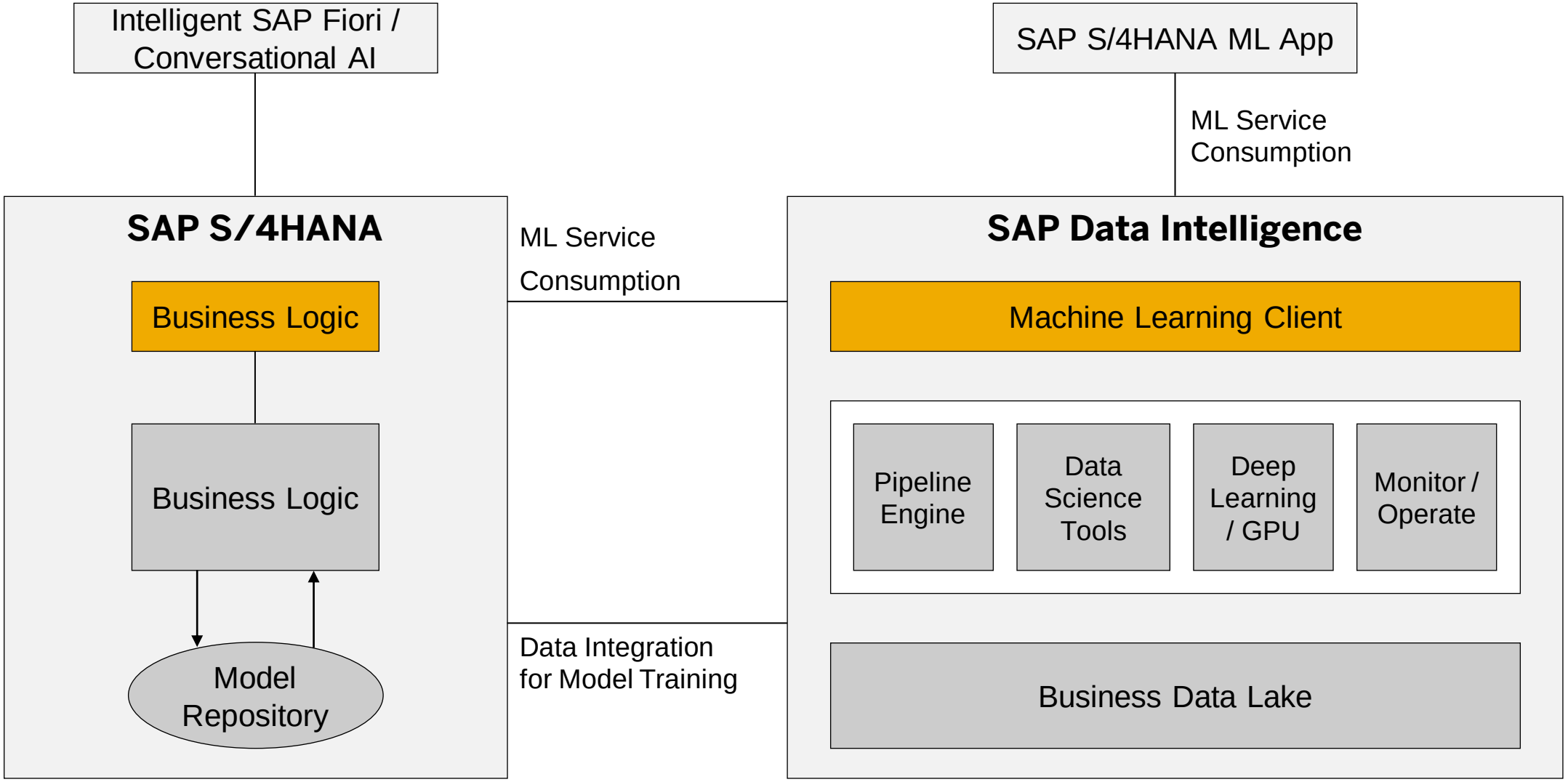
PROCESS THE ALGORITHMS WHERE THE DATA IS:

LOW TCO & OPTIMAL PERFORMANCE

LEAD BACK PREDICTIVE ANALYTICS TO CDS VIEWS:

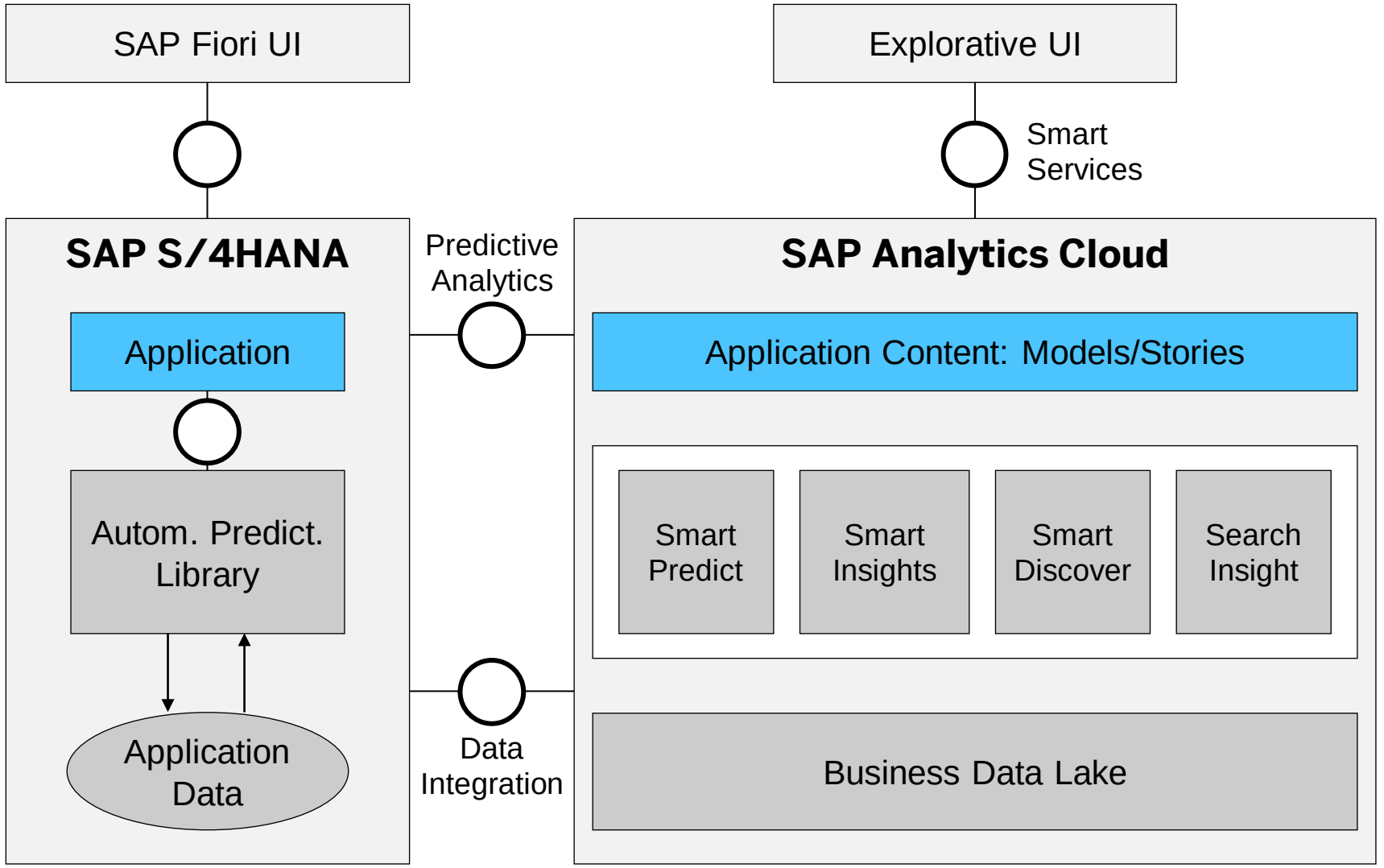
CONTENT & CONCEPT REUSE

Side-by-side ML models on SAP BTP



Side-by-side models with explorative predictive analytics on SAP Analytics Cloud

- Create BI dashboards with smart services
- Embed predictions into the planning dashboards
- Data acquisition or live connection from SAP S/4HANA
- Leverage SAP HANA APL algorithms



Key takeaways

- Bring the algorithms to the data to avoid data replication
- Model training is TCO-relevant
- Data model of SAP S/4HANA is based on core data services (CDS technology)
- SAP S/4HANA supports multiple deployment options – on-premise, private cloud and public cloud

Thank you.

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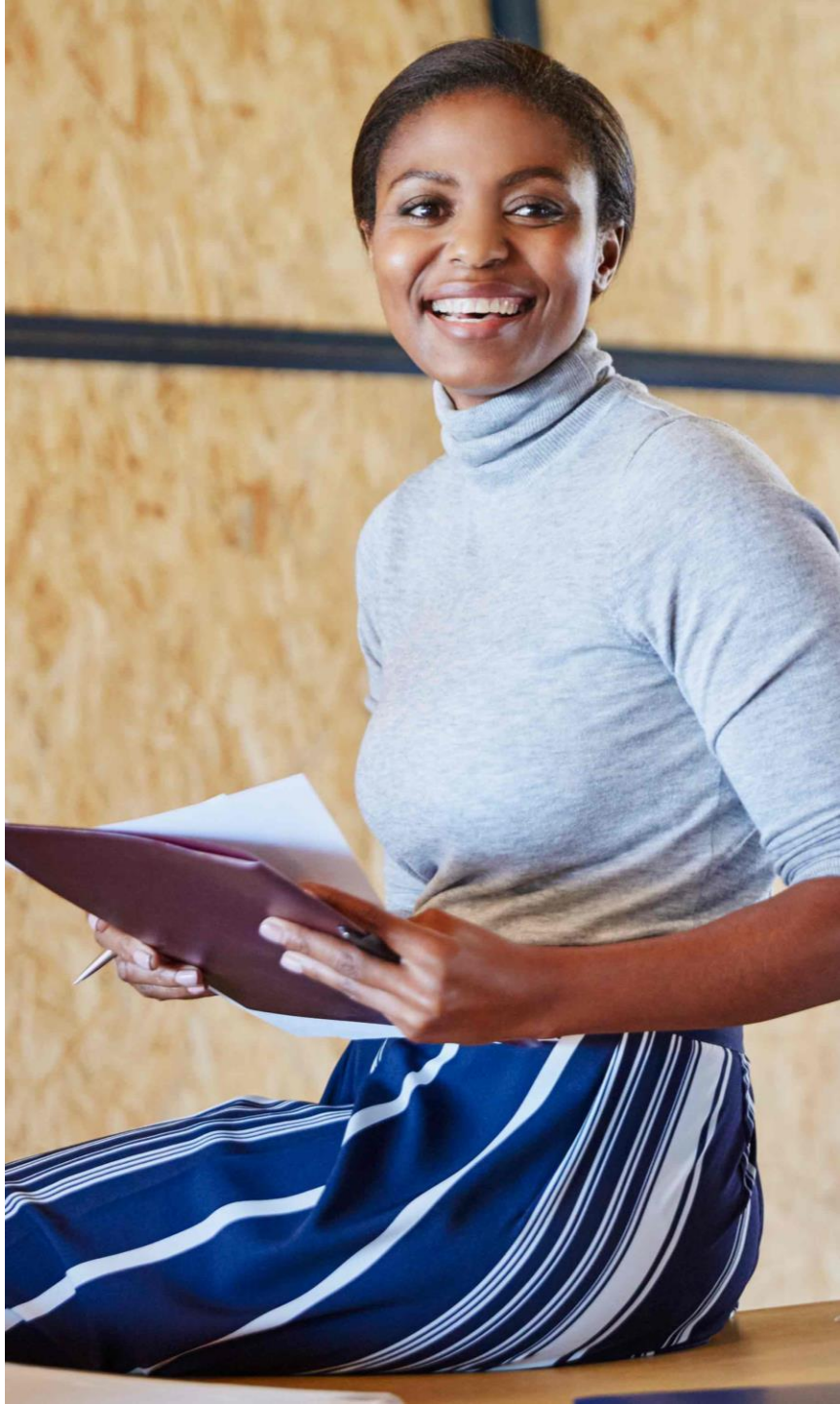
Week 4: Embedded Predictive and Machine Learning

Unit 3: Embedded Machine Learning with ISLM

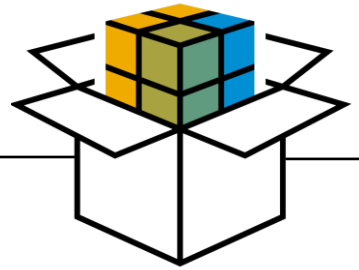
Embedded machine learning with ISLM

Agenda

1. Overview
2. Evolution of ISLM
3. Personas and ML models
4. Demo



Overview



Standardized consumption and operation of machine learning scenarios for both flavors

Embedded scenario:
Machine learning provider (for example, ML with Automated Predictive Library and Predictive Analysis Library in SAP HANA) runs in same stack as business application (SAP S/4HANA)

Side-by-side scenario:
Machine learning provider runs in different stack (for example, the SAP Data Intelligence solution) than the business application (SAP S/4HANA)

Embedded machine learning with ISLM

End-to-end lifecycle management

Harmonized framework in basis SAP software layer

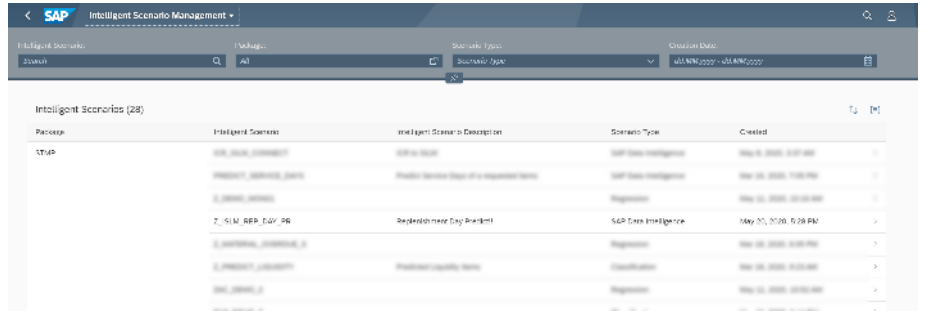
Successor of SAP Predictive Analytics integrator

Standard to train, deploy, activate even for remote ML providers

Support for all phases (readiness, first usage, life cycle operations, deletion, decommission

Lifecycle management of ML services provisioned as a service

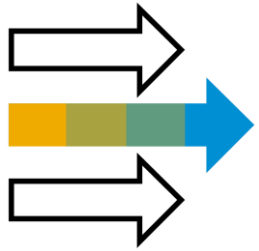
Common consumption model for application integration for SAP S/4HANA



Managing the lifecycle of SAP S/4HANA Machine Learning Scenarios

Intelligent scenario lifecycle management closes the gap between business app (e.g. SAP S/4HANA) and the used machine learning artifact as it offers lifecycle management of the machine learning artifact in the context of the intelligent application consuming it.

Customer segments are:

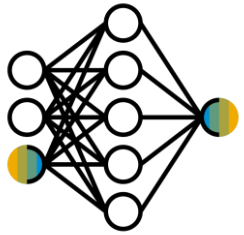


Migrated “PAi” scenarios

Approx. 20 shipped scenarios & partner/customer scenarios migrated to ISLM

New SAP S/4HANA Intelligent Scenarios integrated in business solution

Based on HANA ML (APL, PAL), SAP DI, AIF, AI BUS, …



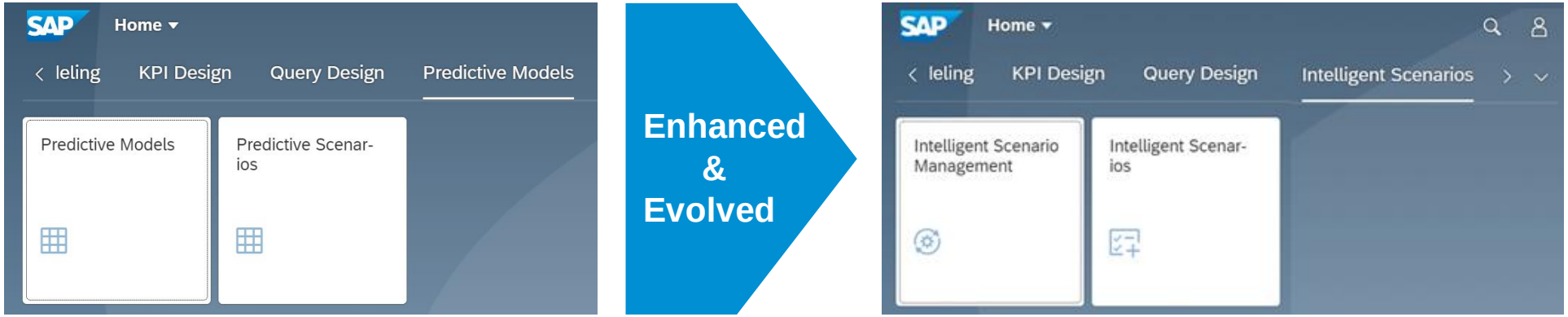
Custom developed scenarios based on side-by-side ML

ML offered in SAP DI,

Custom developed scenarios based on embedded SAP HANA ML

Predictive scenarios based on HANA ML (APL/PAL)

SAP Predictive Analytics integrator evolution into ISLM



ISLM offered as part of basis layer

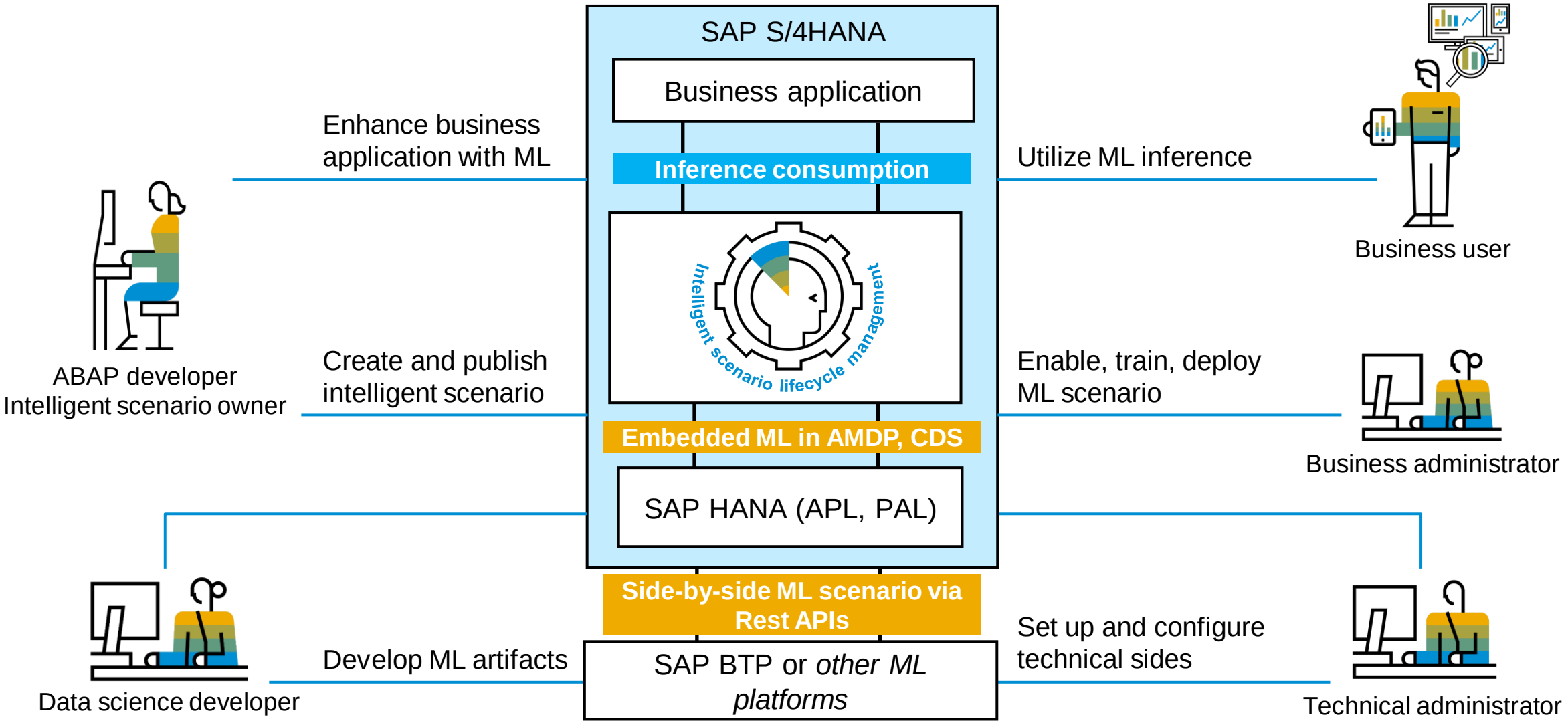
ISLM delivers feature compatibility with predictive analytics integrator functionality to support:

- Smooth migration for existing Predictive Analytics integrator use cases and artifacts
- Side-by-side use cases: AI API based, SAP DI, AI Business Services, AIF/AI core, Google AI (PoC)etc.
- Enhanced features: Creation of Intelligent scenarios of all types

One central cockpit to integrate

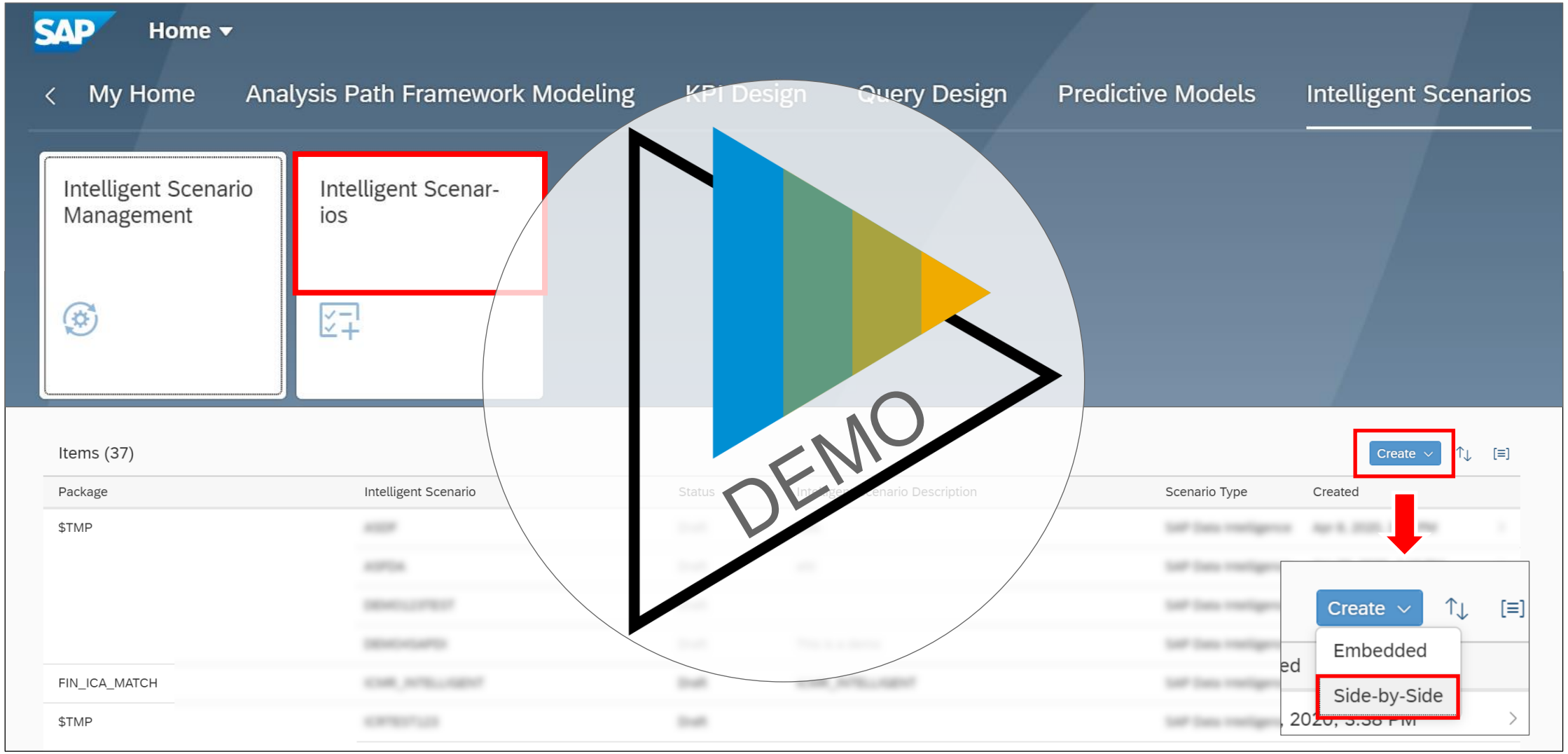
- Scenarios based on libraries provided by SAP HANA, such as Automated Predictive Library (APL) and Predictive Analysis Library (PAL)
- Remote scenarios based on SAP Data Intelligence

Personas involved in development, consumption, and operation



Embedded machine learning with ISLM

Create intelligent scenario



Embedded machine learning with ISLM

Key takeaways

- ISLM enabling efficient lifecycle management of machine learning scenarios in SAP S/4HANA
- New harmonized framework in basis SAP software layer (no additional license required)
- No ticket-based approach
- ISLM, the **successor** of Predictive Analytics integrator functionality
- New entity: **intelligent scenarios** (predictive scenarios + ML scenarios)
- Common consumption model for application integration of SAP S/4HANA – **to ensure stable APIs for developers**
- Management of remote models especially for **ML services provisioned as a service**
- Support for all phases (readiness, first usage, lifecycle operations, deletion, decommission)
- Released with **SAP S/4HANA 2020**
- First cloud shipment with **SAP S/4HANA Cloud 2011**

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Week 4: Embedded Predictive and Machine Learning

Unit 4: Leveraging Predictive Services from SAP Analytics Cloud

SAP Analytics Cloud

COMPLETE

Improve decision-making with all analytics capabilities in one place

CONTEXTUAL

Gain instant insights and take action in context of business processes

CERTAIN

Make smarter and faster decisions with artificial intelligence (AI)-driven insights

SAP Analytics Cloud – augmented analytics

Catalog
Centralized Portal

Mobile App
iOS & Android

Digital Boardroom | Stories | Analytic Applications | MS Office Integration

Business Intelligence

Data Exploration
Dashboards & Visualizations
Enterprise Reporting

Augmented Analytics

Conversational
Automated Analytics
Predictive Analytics

Enterprise Planning

Events & Workflows
Sharing & Simulation
Predictive Planning

PLATFORM SERVICES

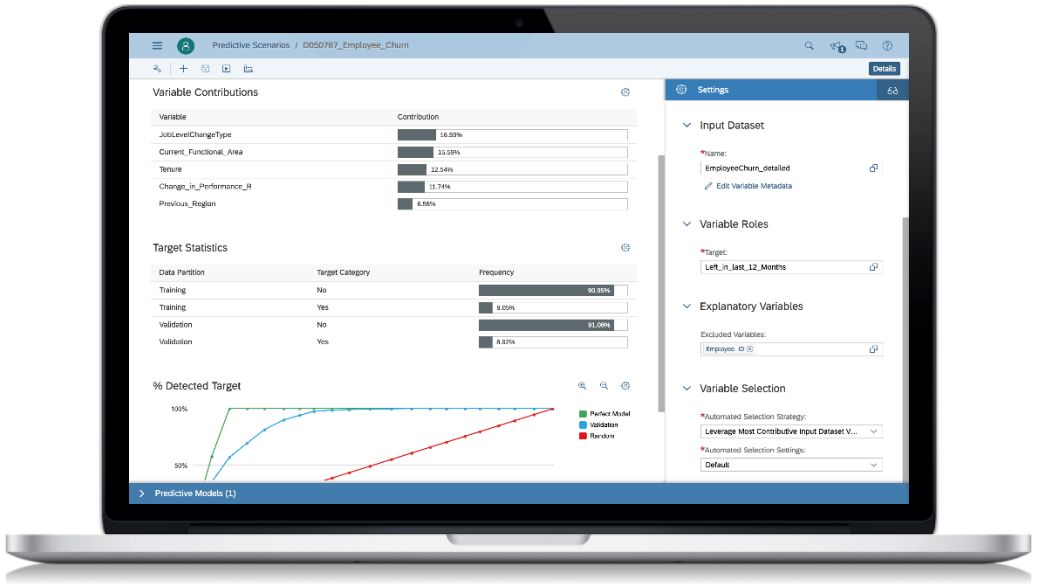
Data Connectivity
Data Preparation
Data Modeling

Content Translation
Lifecycle Mgmt
Auditing & Monitoring

Scheduling
Collaboration
APIs and SDKs

Leveraging predictive services from SAP Analytics Cloud

Make decisions faster with AI-driven insights



1. Conversational

Ask questions in a conversational manner with instant results explained in natural language

2. Automated

Detect drivers of a KPI and take the next best action using automated machine learning that discovers unknown relationships in data

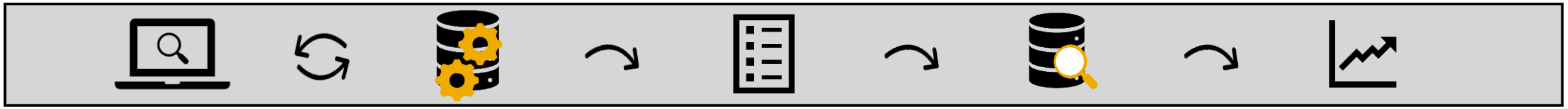
3. Predictive

Predict potential outcomes, generate forecasts, and automate predictive planning

A faster way to find better answers – conversational analytics

- Ask questions in natural language and instantly generate the best visualizations
- Enhance visualizations with in-context explanations
- Recognize important trends and drivers at the click of a button

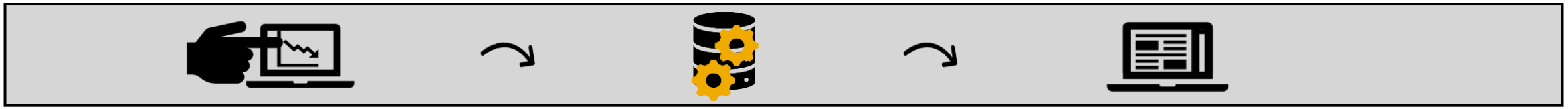
Search to insight = what's happening in my business?



User enters natural language search → **Auto-complete and NLP assist the user** → **User selects query from generated proposals** → **Query executes automatically** → **Automatically generated chart provides the results**

- As questions are easy to ask, analysis can happen on an ad-hoc basis in meetings, etc.
- Auto-complete and natural language processing aid you in finding the information you need
- Save time when building stories with automatically generated visualizations

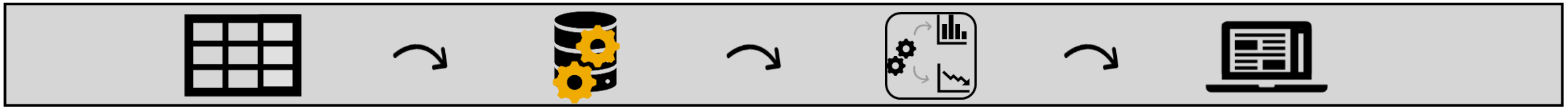
Smart insights = what's behind this number?



User selects data point → **SAP Analytics Cloud finds contributors** → **User can embed insight in chart or find additional insights**

- Find out what contributes to an interesting data point or variance
- The contributors often prompt you as to what question to ask next
- Answer follow-on questions with a single click
- Add depth to visualizations with contextual explanations

Smart discovery = why did this happen?



User selects a figure or outcome → SAP Analytics Cloud automatically analyzes the data → Predictive model reveals patterns and relationships → A story is generated to drive accelerated data exploration

- Automated story-building and data exploration
- Builds a story automatically that provides multiple perspectives on your data incredibly quickly
- Natural language and visualization explain the reasons behind key figures or outcomes

Smart predict in BI and planning workflows

Traditional Analytics

Augmented Analytics with Smart Predict

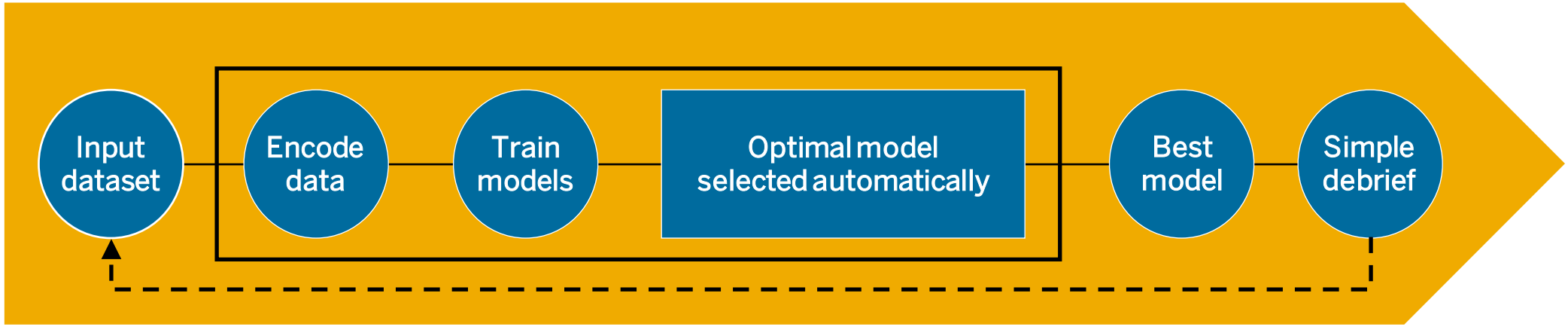
Prepare data with additional attributes

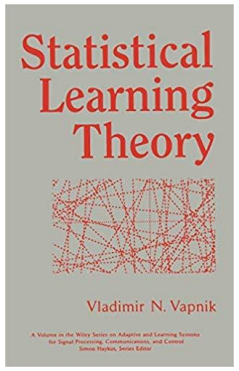
Build predictive model in a few clicks

Enrich BI and planning models with outcomes

Visualize new insights in BI and planning stories

No data science skills needed = automated ML process to choose the best model



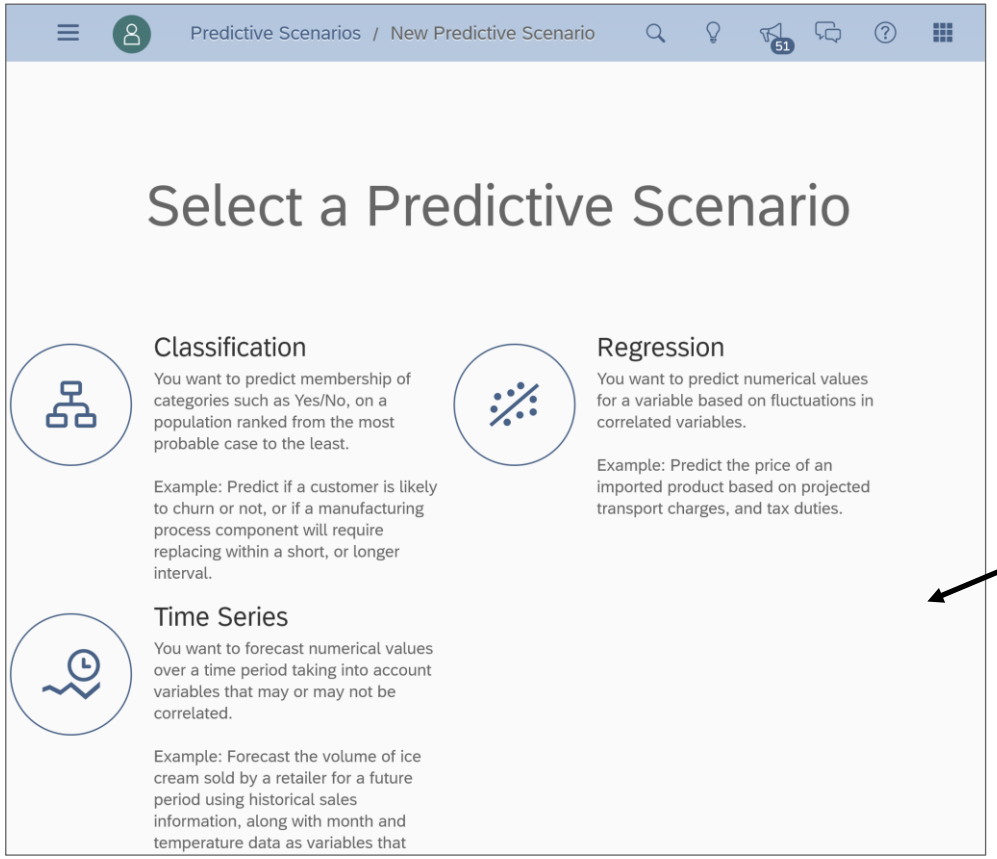


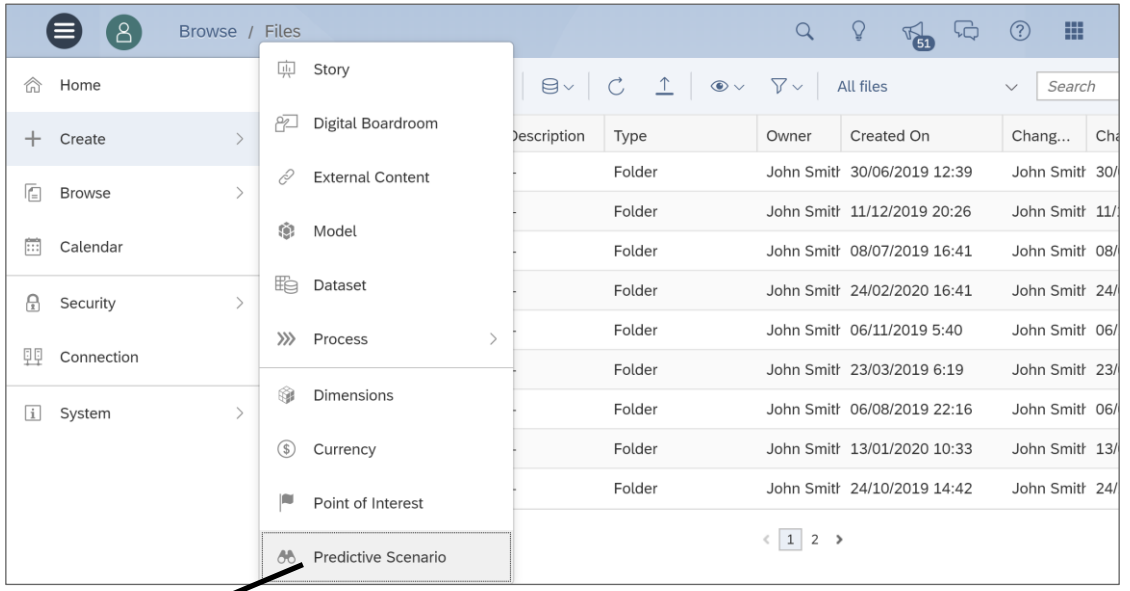
Vladimir Vapnik

Statistical Learning Theory

1998

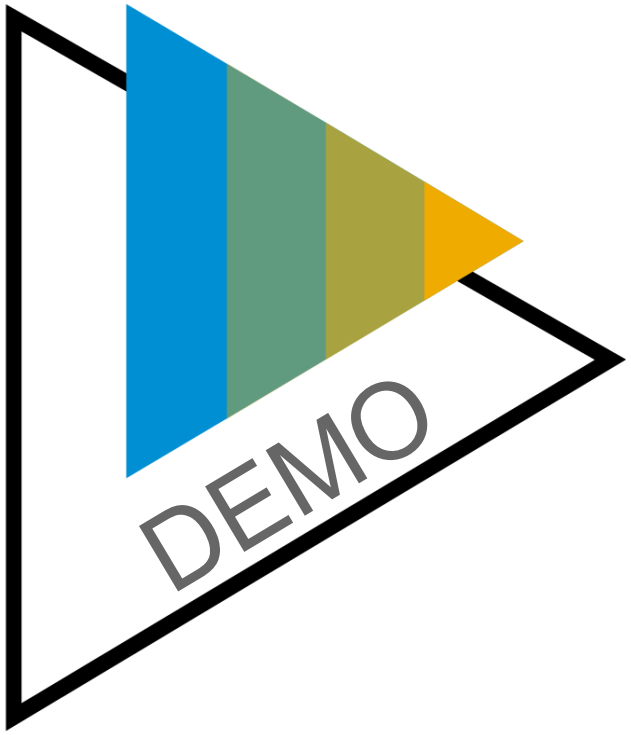
Explorative analytics using SAP Analytics Cloud – smart predict, smart assist





- Build predictive models using SAC smart predict and smart assist functionality
- Leverage the SAP S/4HANA whitelisted CDS views
- Acquire data into SAC
- Visualize in SAC

Demo



A quick overview of the smart predict functionality in SAC

Leveraging predictive services from SAP Analytics Cloud

Key takeaways

- Reduced time to benefit
- Lower costs with one integrated solution
- Scale to your needs with easy extensibility
- Rapid innovation with AI-driven insights

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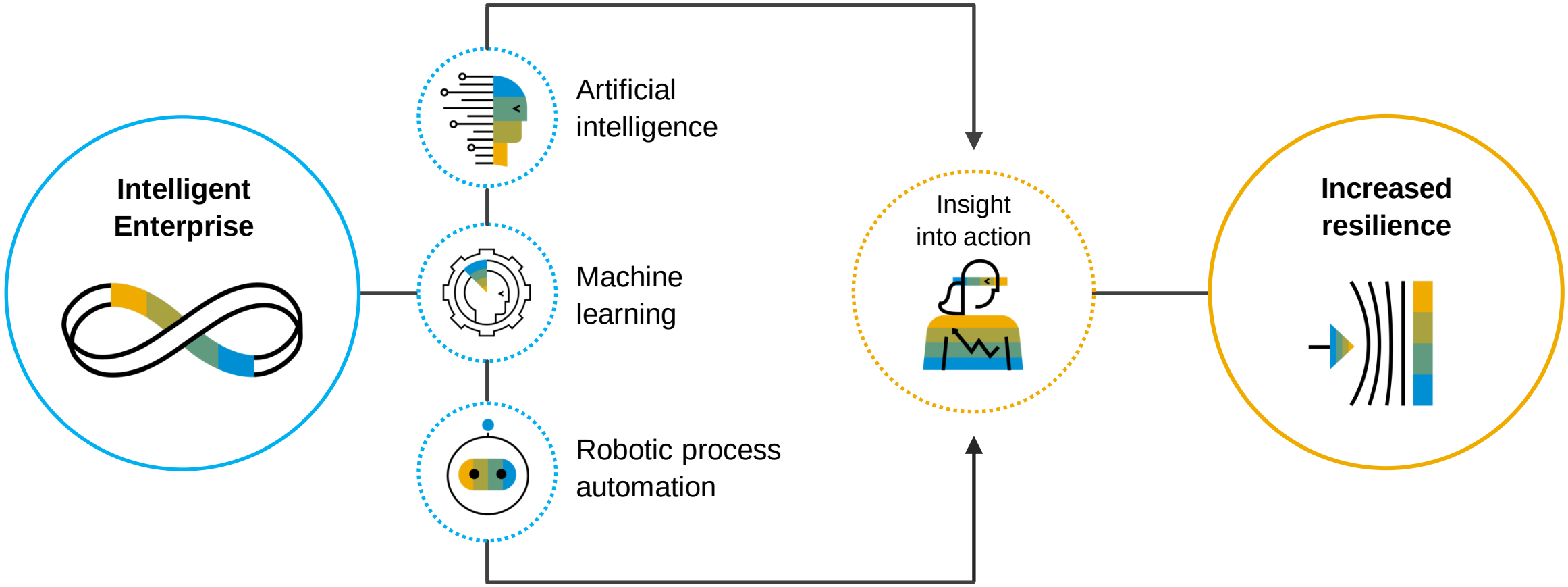
Week 4: Embedded Predictive and Machine Learning

Unit 5: Machine Learning Services Consumed from SAP Business Technology Platform

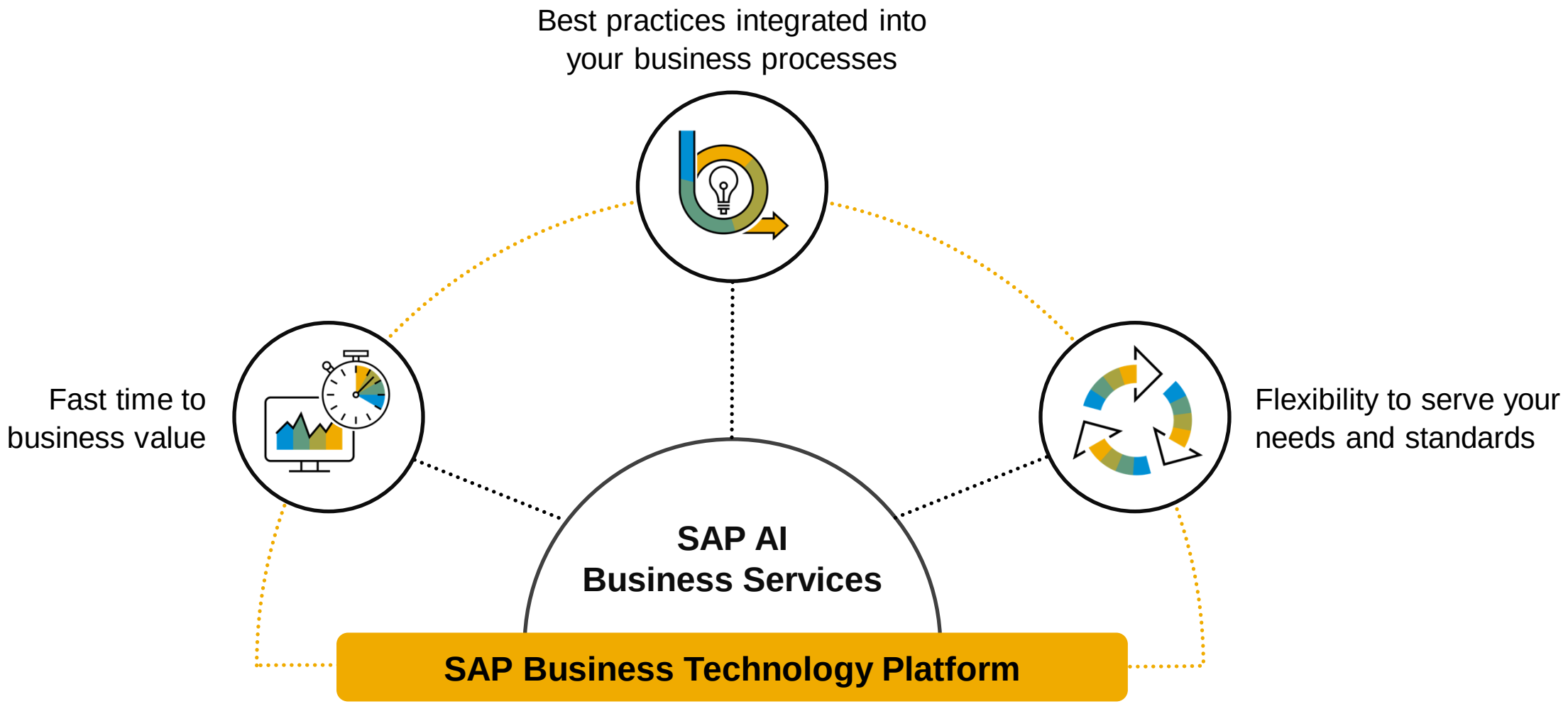
Machine learning services consumed from SAP Business Technology Platform

Intelligent Enterprise overview



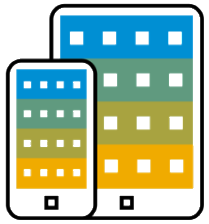
Machine learning services consumed from SAP Business Technology Platform

Overview



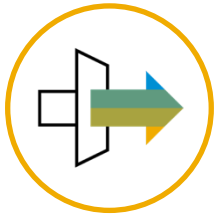
Machine learning services consumed from SAP Business Technology Platform

SAP AI Business Services overview



SAP AI Business Services provide strategic machine learning capabilities that help you automate and optimize processes while enriching the customer experience. These reusable services are available on SAP Business Technology Platform.

Business Document Processing



Business Entity Recognition

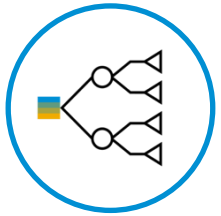
Detects and highlights named entities in unstructured text

Document Information Extraction

Automatically extracts information from unstructured documents

Document Classification

Classifies unstructured documents



Data Attribute Recommendation

Automates creation, maintenance, and management of structured data

Invoice Object Recommendation

Recommends general ledger accounts and cost centers for invoices without order reference

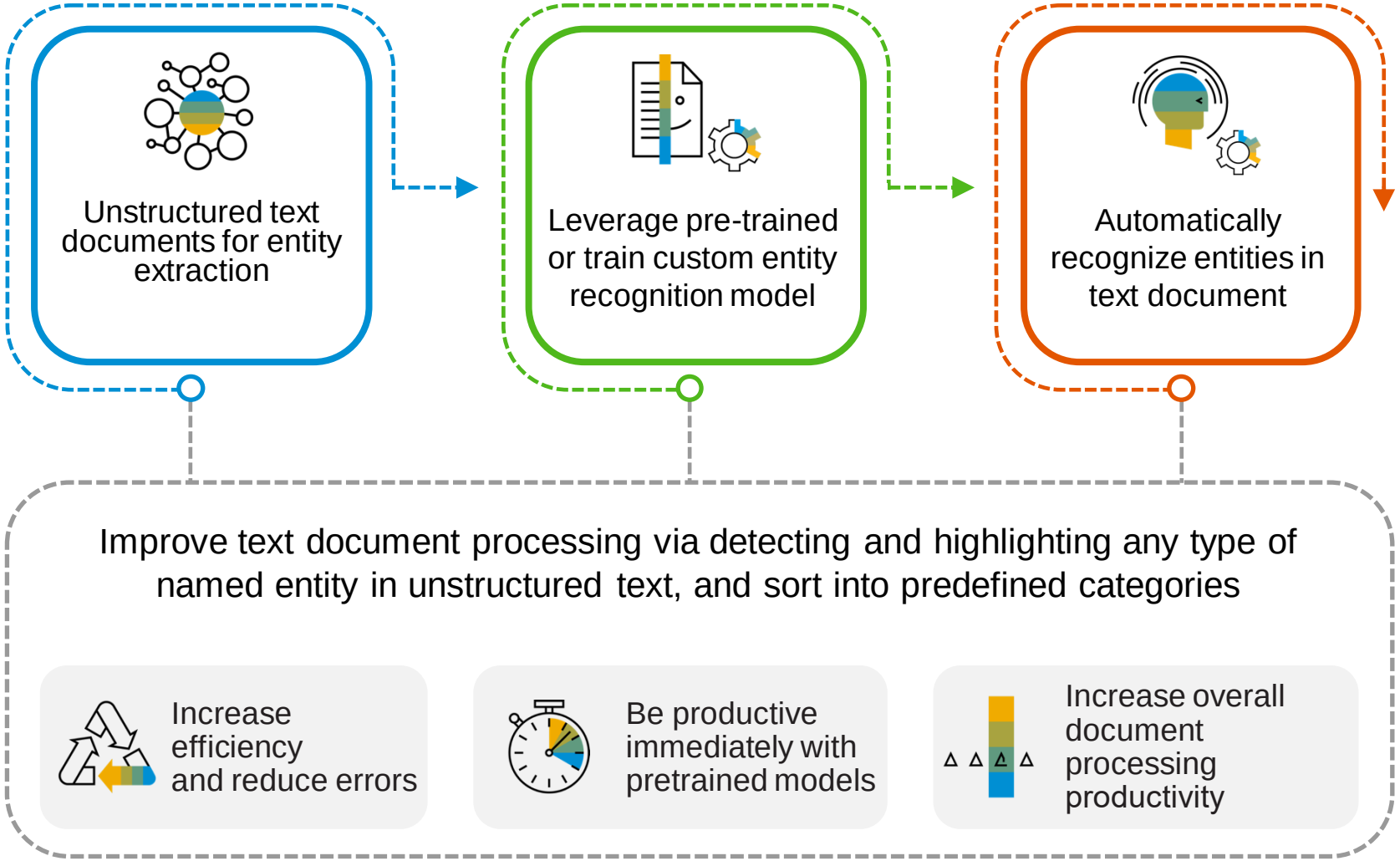
Service Ticket Intelligence

Classifies and recommends tickets automatically

Available via CPEA and SAP Store

Machine learning services consumed from SAP Business Technology Platform

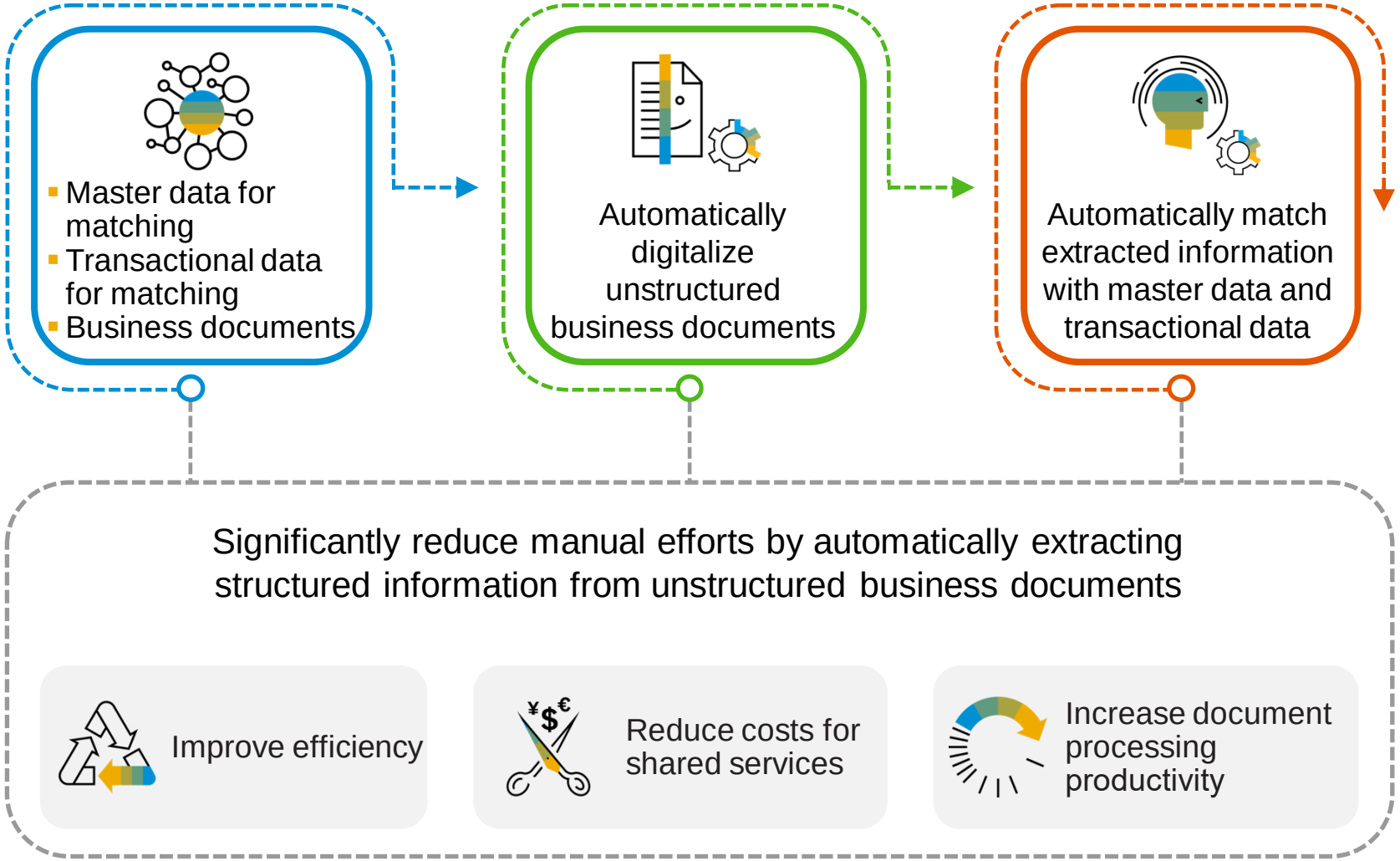
Business Entity Recognition



Detect and highlight any type of named entity in unstructured text

Machine learning services consumed from SAP Business Technology Platform

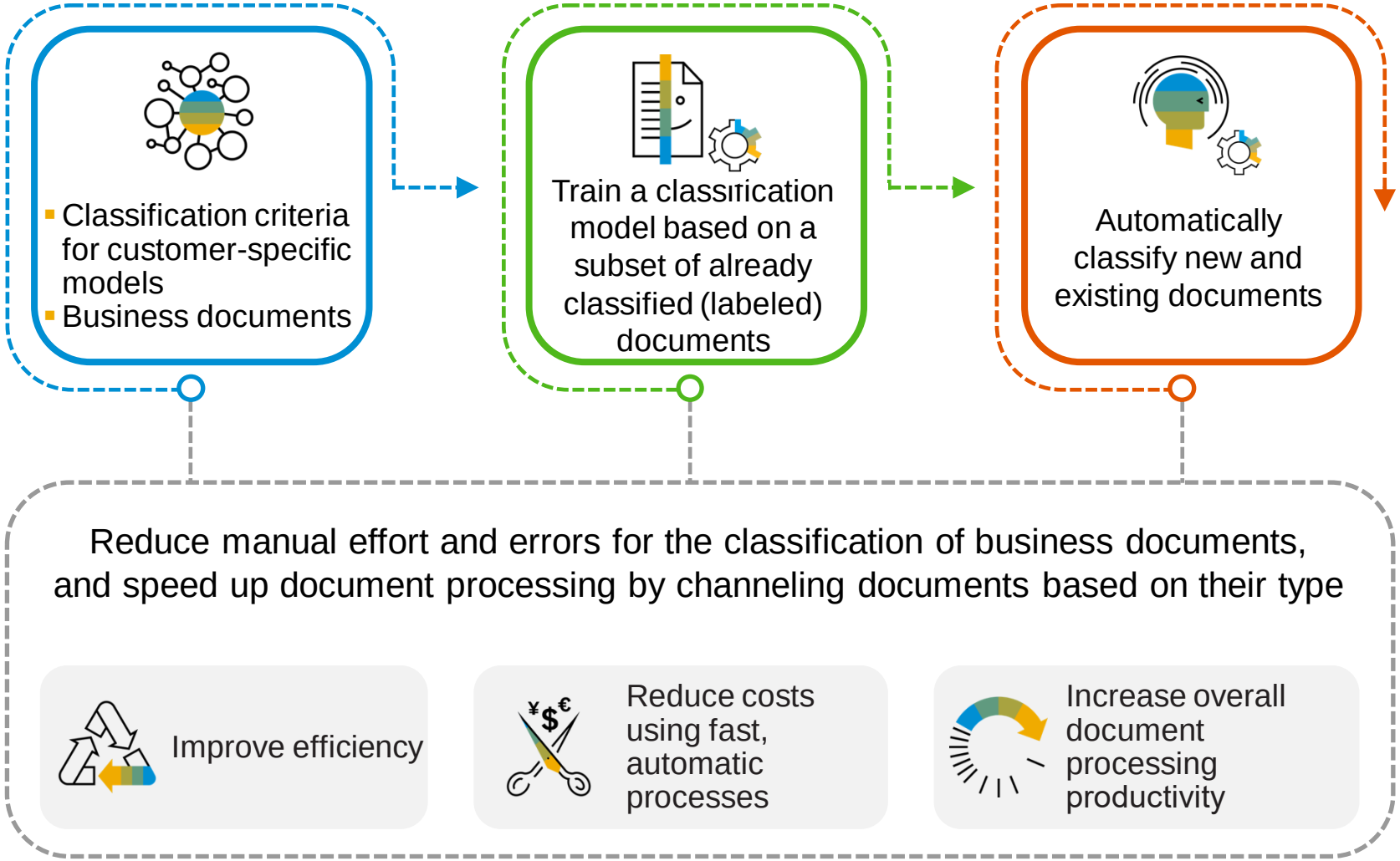
Document Information Extraction



Extract structured information from unstructured documents

Machine learning services consumed from SAP Business Technology Platform

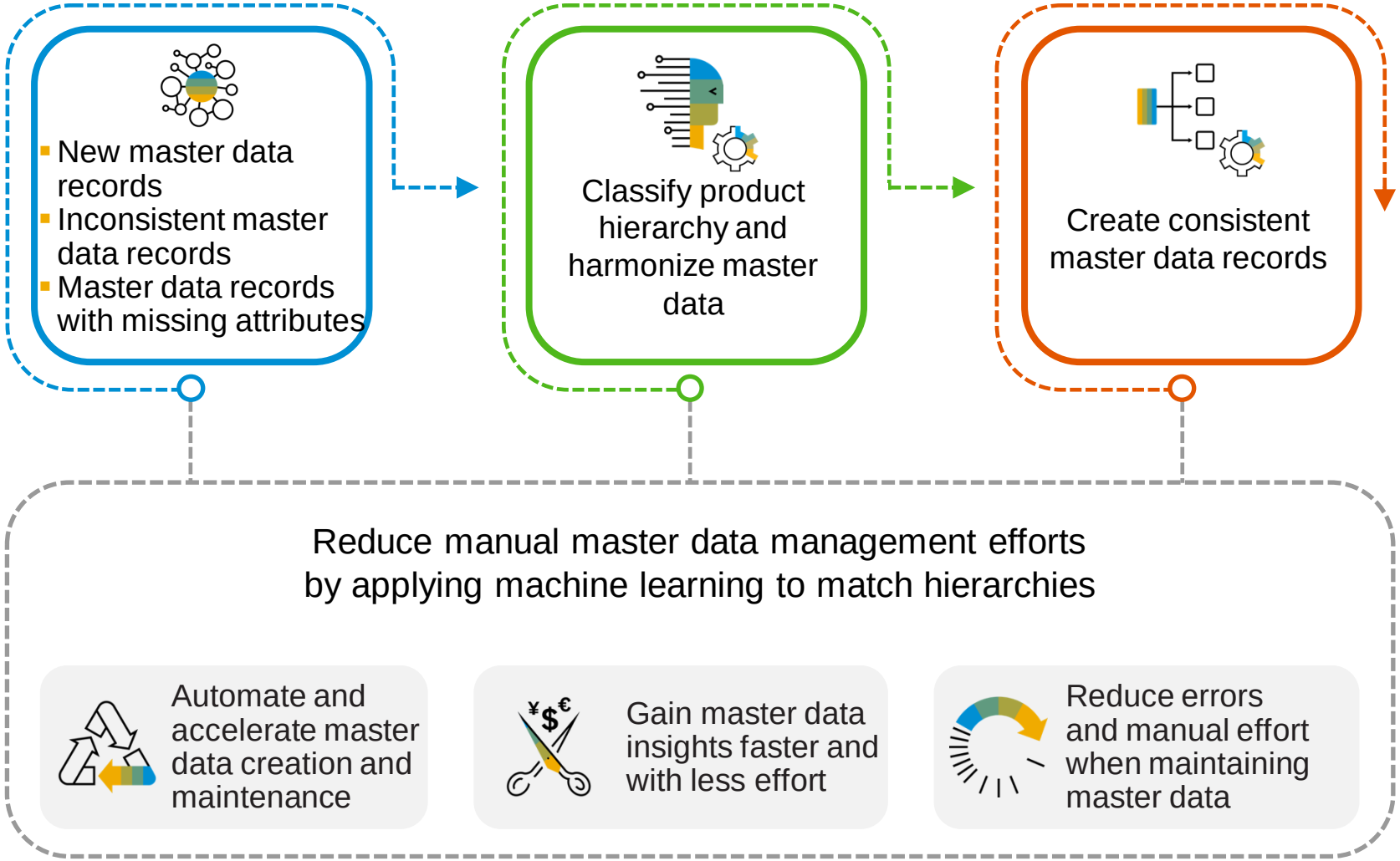
Document Classification Service



Classify documents based on customer-specific criteria

Machine learning services consumed from SAP Business Technology Platform

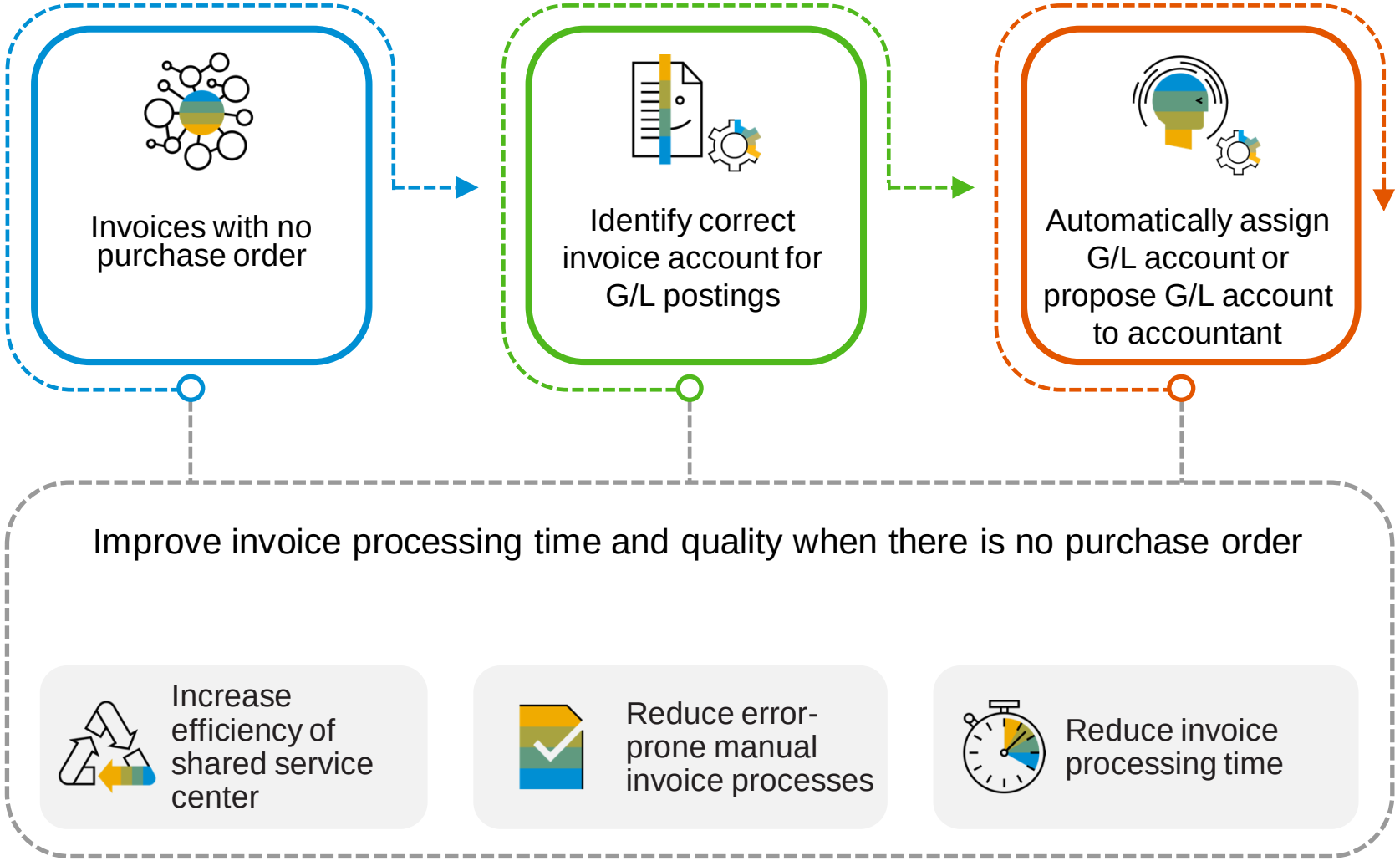
Data Attribute Recommendation



Automate master data management tasks

Machine learning services consumed from SAP Business Technology Platform

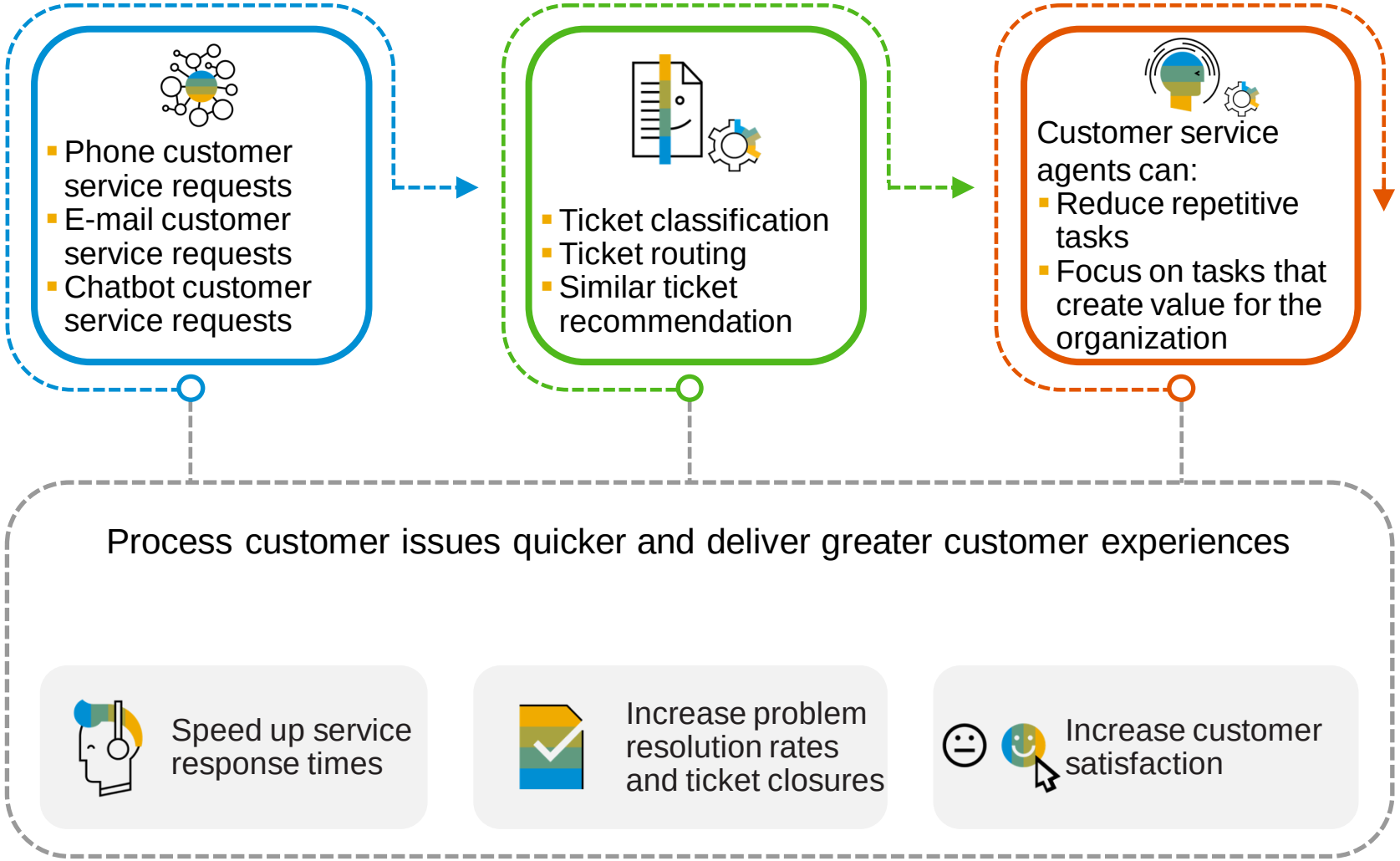
Invoice Object Recommendation



Automate Invoice Processing

Machine learning services consumed from SAP Business Technology Platform

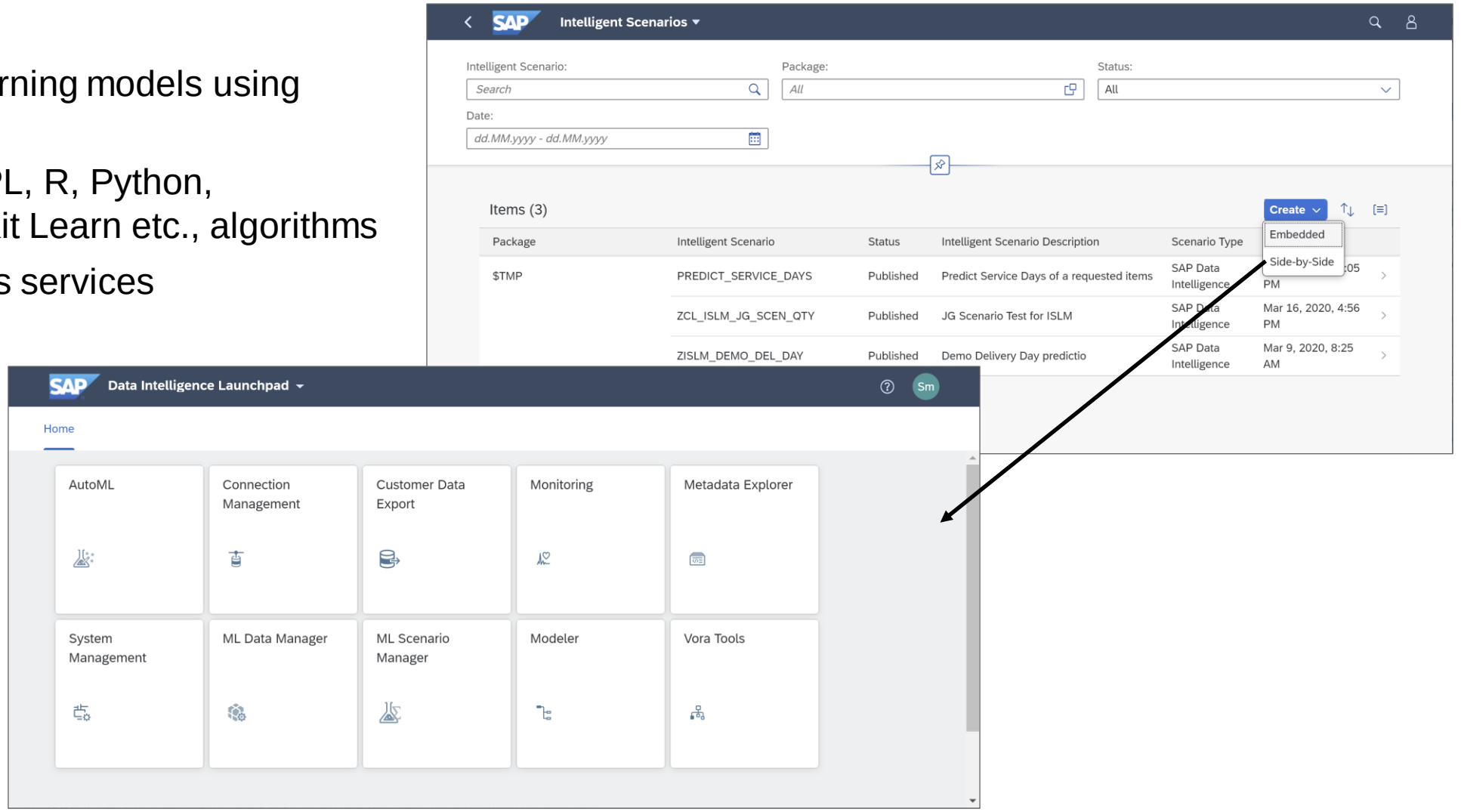
Service Ticket Intelligence



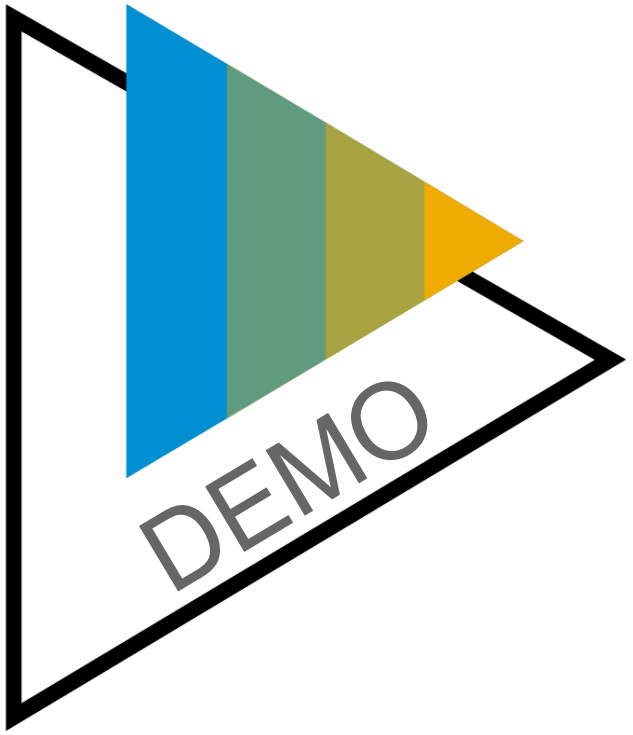
Reimagine customer service with automated processes

Intelligent Enterprise overview

- Build machine learning models using ISLM framework
- Leverage PAL, APL, R, Python, TensorFlow, Sci-Kit Learn etc., algorithms
- Reuse AI business services



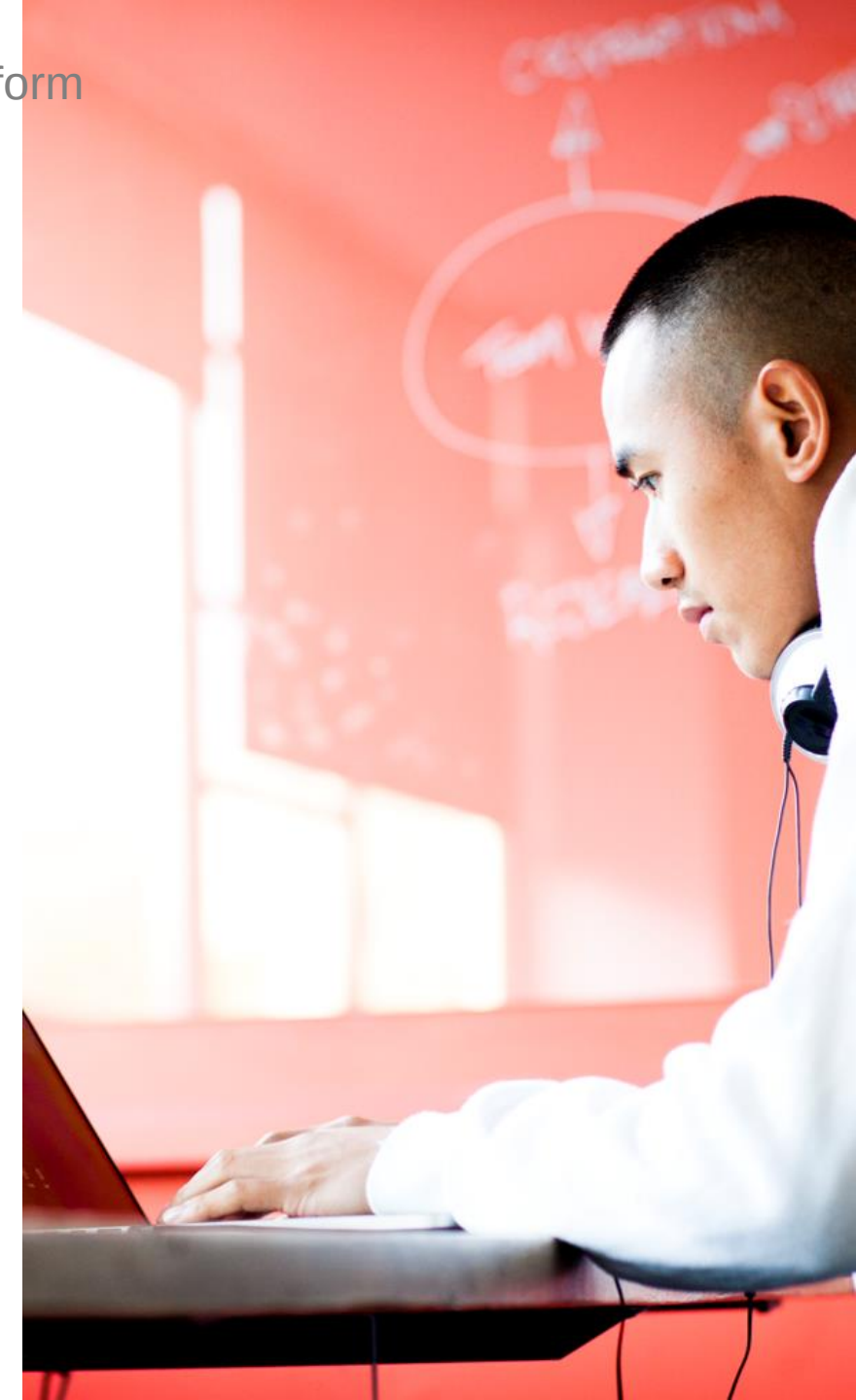
Demo



A quick overview of Sales Order Automation

Key takeaways – SAP AI Business Services

- Rapid time to value
- Innovation support
- First step on your machine learning-based journey
- Generic usability
- Powerful integration
- Expertise
- Simple access to a payment service – via CPEA credits and pay as you go!



Thank you.

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Week 4: Embedded Predictive and Machine Learning

Unit 6: Conclusion

The future

“Success in creating AI would be the biggest event in human history.

Unfortunately, it might also be the last, unless we learn how to avoid the risks.”

Stephen Hawking, 2014, in “The Independent”

Conclusion

The road ahead

SAP S/4HANA Intelligent Enterprise with AI-enabled scenarios

ISLM framework, the standard to embed AI into SAP S/4HANA

SAP AI Business Services integrated with the ISLM framework

Explainable machine learning with SAP S/4HANA processes

Automated machine learning with SAP S/4HANA processes

Conclusion

Key takeaways

- Availability of a CAL (Cloud Appliance Library) image with SAP S/4HANA intelligent processes
- Webinars from the SAP Community
- Continued engagement through the Podcast series
- Availability of a best practices package with knowledge support

Thank you.

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