A New Approach to Verifying SAP Data Integrity

SAP Enterprise Data Integrity Testing(EDIT) by Tricentis

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Tricentis Summary

Capabilities

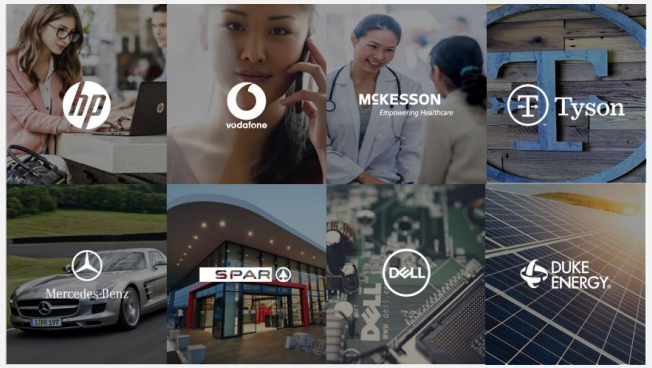
Enterprise Continuous Testing
Change Impact Analysis
Enterprise Performance Testing
Enterprise Data Integrity Testing

Tricentis SAP Solution Extension

Key Objectives

Tricentis technologies and how they can support change in the SAP and non-SAP context

Customer Success



Total Economic Impact Report

FORRESTER

NPV	ROI	Payback
$6.0M	334%	<6 months

Application release increase	Production errors reduced	Testing scope reduced
300%	78%	85%

Forrester TEI Report Link

Tricentis Summary

Founded in 2007 by Wolfgang Platz

Over 300,000 teams use Tricentis software

SAP chose Tricentis as the default Quality Assurance Solution in Sept. 2020

Why SAP Chose Tricentis

Global Leader in Enterprise Testing Solutions

Enterprise-Grade Platform for SAP Testing and Beyond

Modern, AI-Driven Technology for Easy Adoption

Tricentis-SAP Partnership Value

Ensuring successful business outcomes together

Partnership OEM | Premium Support
Co-Development | Product Reselling

SAP Application Testing Solutions by Tricentis

SAP Solution Extension

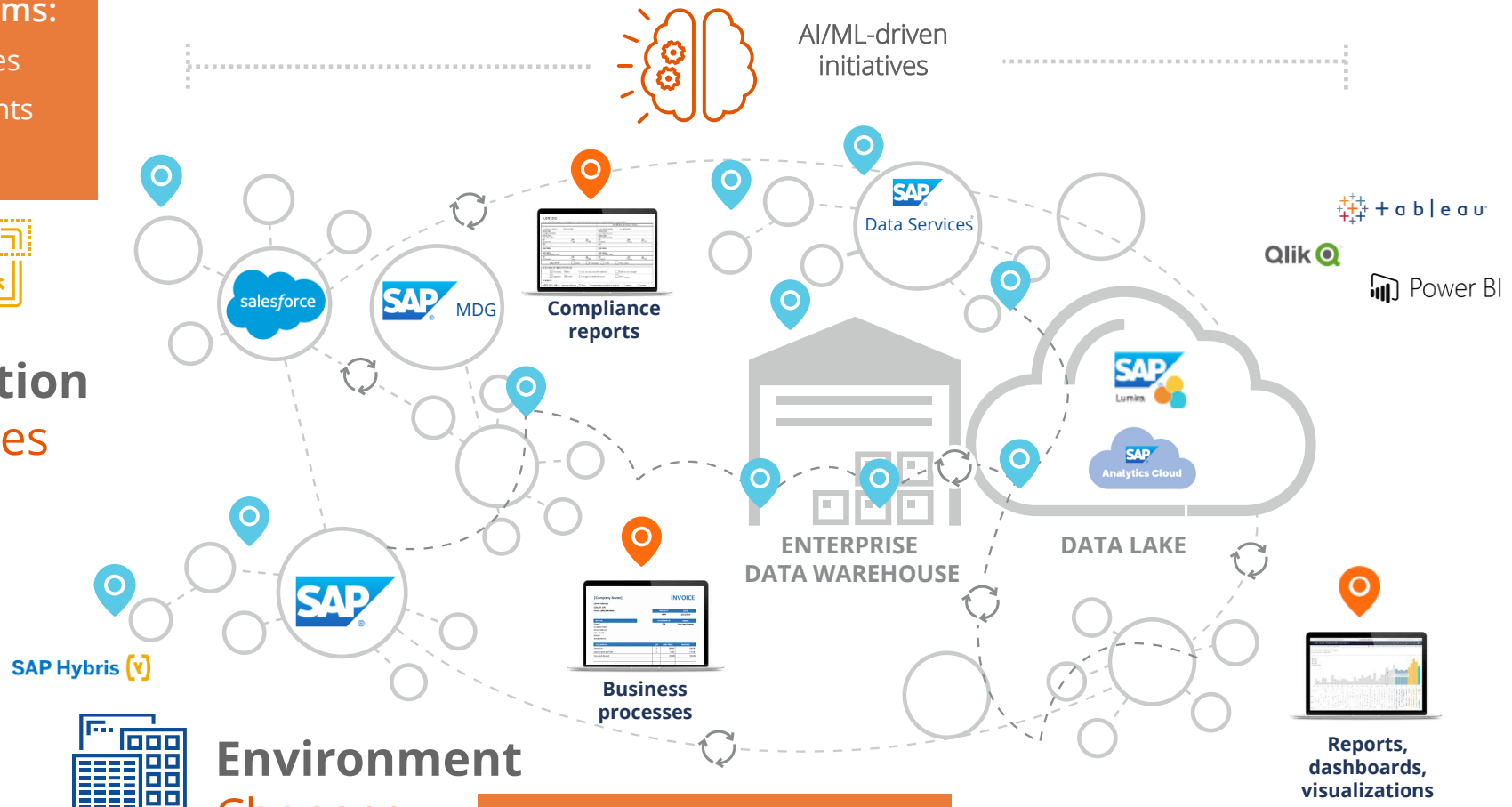
	SAP Change Impact Analysis Tricentis CIA	SAP Enterprise Continuous Testing Tricentis ECT	SAP Enterprise Data Integrity Testing Tricentis EDIT	SAP Enterprise Performance Testing Tricentis EPT
Capabilities	▪ Risk AI – identifies most at-risk objects ▪ Risk-based test optimization (Hits & Gaps) ▪ Risk assessments and test plans for packaged app changes	▪ AI-powered, codeless automation ▪ Test data & environment provisioning ▪ End-to-end automation at the UI, API & data layer (SAP & 3rd party technology)	▪ Automated, end-to-end testing for any type of data and every data journey ▪ Tests tailored to catch errors on each step of the data journey ▪ Model-based test automation	▪ No code approaches for fast test design & maintenance ▪ Built-in CI pipeline integrations ▪ One click conversion of functional into performance tests
Benefit	▪ Achieve 90%+ business risk coverage ▪ 85% test scope reduction ▪ Deliver zero-defect updates for only 15% of traditional test effort	▪ Accelerate release cycles and reduce test cycles times by 80% ▪ Achieve 90%+ test automation rates ▪ Boost release confidence with business risk coverage >85%	▪ Catch more data errors upfront ▪ Test at high volume and velocity ▪ Deliver higher quality analytical and operational data at scale	▪ Up to 80% faster test design & maintenance ▪ Keeps pace with releasing fast decreases production issues by up to 90%

Today, your data is always on the move

through increasingly complex landscapes

Application problems:
Technical/UI changes
Business requirements
Customizations

Application Changes



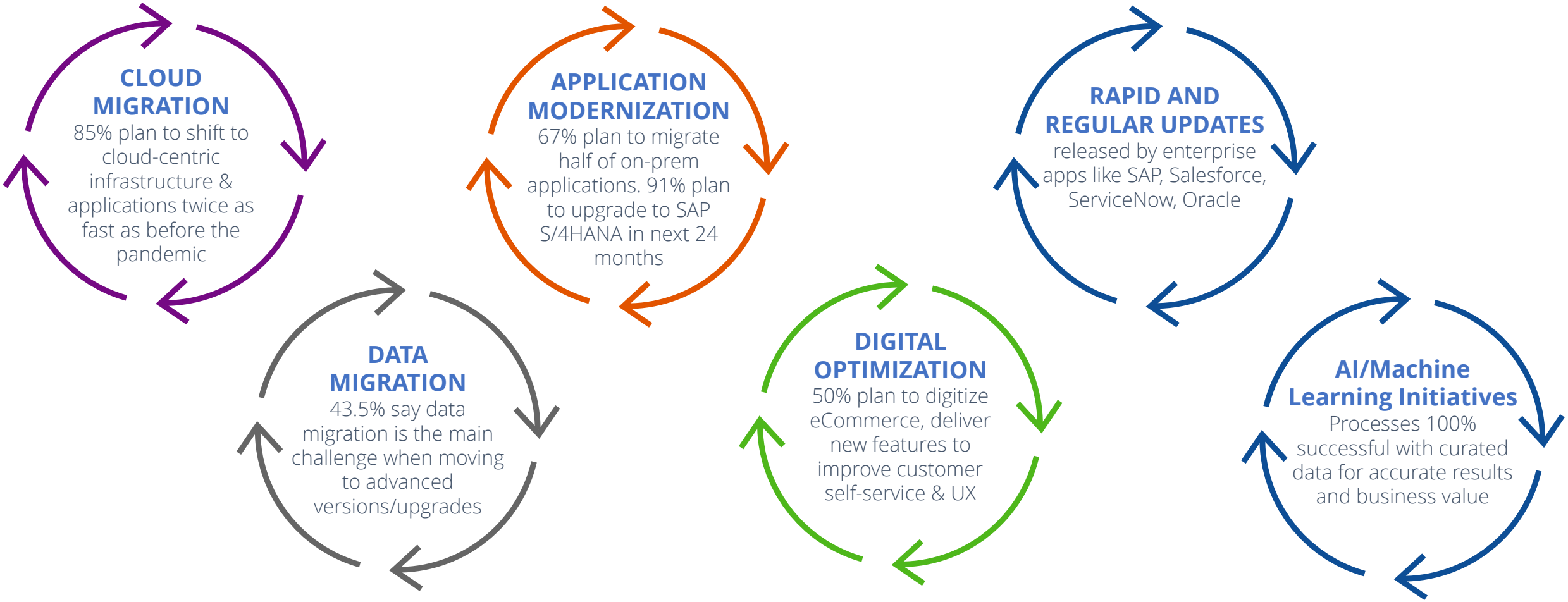
Data Changes

Data problems:
Incorrect data
Duplicate data
Missing data

Environment Changes

Environment problems:
System / desktop updates
Integrations
Network changes

Accelerated Digital Change Introduces Risk



**Sources*: Mayfield CXO Survey – Post COVID-19 Impacts to IT, IDC FutureScape IT Industry 2021 Predictions, ASUG Tricentis Survey 2021 – Future of SAP Delivery

Top Business Value Use Cases

M&A – Mergers and Acquisitions (and Divestitures)– Require a solid Data Reconciliation and Validation Strategy	• By offering a unique ability to validate against regression, data can now be moved in a consistent and trusted process ensuring data integrity during the migration and ongoing • **ROI Impact: $10's million in projected sales to properly migrated customers** • Cause: Without properly migrated customer data marketing of acquiring bank's services would not be correct or compliant
AI/ML – AI and Machine Learning	• Compliance and Innovative Data Learning Model Success • **ROI Impact: A $100million Time-To-Market delay. With compliance pressure, manual testing of data was not able to perform to regulatory standards and without properly curated data to train model, innovation fails.** • Cause: Datasets in Azure were too big to cover more than 1% with manual scripts and comparison (Manual Stare and Compare)
Compliance AML/KYC+	• **ROI Impact: $50m in KYC fines stopped. Cost Avoidance that is predictable.** • Cause: Timing, Bank could only test a sample (1K) of the 70K scenarios to be covered end to end in the teller (mainframe) to audit data reporting process
DATA Migrations during and AFTER in the New Migrated Cloud Environments	• On-prem to Snowflake • **ROI Impact: Netezza to Snowflake migration EFFICIENCY saved $1m using data reconciliation from DI** • Cause: Production errors in the new Snowflake environment, as they added new Netezza data it would break the already migrated data and reporting without our regression testing
General Data Reconciliation and Validations for Accurate business decisions	• Data Analytics Data from Payroll, Payments, ERP, Logistics, etc… • **ROI Impact: $24 million lost in trading decisions for Oil off by 1,000th of a percent.** • **ROI Impact: $10's millions spent on data warehousing and analytics NOT BEING USED as NO TRUST in the numbers**. • Note: Ability to perform this reconciliation in the Cloud in crucial (DataBricks/Azure 10-minute Demo Video)

Top Business Value Use Cases

Snowflake Support	• By offering a unique ability to validate against regression, data can now be moved in a consistent and trusted process ensuring data integrity during the migration and ongoing. • **Snowflake** support for Time Travel other Snowflake D&A paradigms

SAP Datasphere & SAC - Validation and reconciliation	• SAP Heterogenous Ecosystem support
	  • HANA the new ecosystems are hybrid (SAP and non-SAP) and complex. Ability to ensure quality, efficiency and trust across the entire environment is critical to success of the SAP data warehouses.
	  • **Mercedes**
	  • **ExxonMobil**

SAP Utilities reliant on trustworthy data	• Strict regulatory demands, including new standards such as NERC CIP • Field Response & Prioritization • Emissions Control • Smart meters & distributed grid management

Health Payors and Providers	• **Regression** – Taking this load off the data and platform team for efficiency and TTM
	• **Compliance** – Audit changes regulator (i.e. HEDIS) and SOX requirements
	• **Test across ALL Data Processes with Automation**
	• **Data Accuracy** – CMS ratings can have an 85% gap = Millions of members = ~5+ terabytes of data
	  • **Data Integration from Physicians, Hosp Providers -> process depends on Data as truth**
	  • $10's to 100 of Millions in Reimbursements at stake

Driving Public Sector with Disciplined Data	• **Organization Decisioning:** End-to-End data integrity provides trustworthy data decisioning. • **Compliance:** Ability to ensure data integrity from data owners and stewards through the compliance and audit processes to delivery. • **Operational Data Pipelines**: Delivers automated data integrity across hybrid ecosystem's pipelines to expand data observability and monitoring.

Data Integrity In-Demand Business Use Cases

Driving Enterprises with Disciplined Data

- **Business Decisioning:** End-to-End data integrity provides trustworthy data decisioning.
- **Compliance:** Ability to ensure data integrity from data owners and stewards through the compliance and audit processes to delivery.
- **Operational Data Pipelines**: Delivers automated data integrity across hybrid ecosystem's pipelines to expand data observability and monitoring.
- **AI/ML Innovation:** Being 100% Driven by data, curation of data for models and their deployments is critical for success in building and implementing successful AI/ML processes into your data workflows.
- **Data Migrations:** By offering a unique ability to validate against regression, data can now be moved in a consistent and trusted process ensuring data integrity during the move and going forward.
- **SAP:** As SAP ECC is moved to HANA the new ecosystems are hybrid and complex. Ability to ensure quality, efficiency and trust across the entire environment is critical to success of the SAP migration.

Data Errors can cause costly consequences for your business:

- Compliance & regulatory reports
- Financial reporting
- Customer 360
- AI initiatives
- IoT projects
- Mergers & acquisitions
- Analytics & dashboards
- Core business processes

Data Integrity – Cost Savings Targets by Business Case we prove out:

Impact of Data Integrity Expansion on the Bottom-line

1. Overall Automation v. Manual Reconciliation **Efficiency Gains**
2. Defects **Cost Avoidance** and resulting TTM gains
3. Business Unit **Data Failure Avoidance**

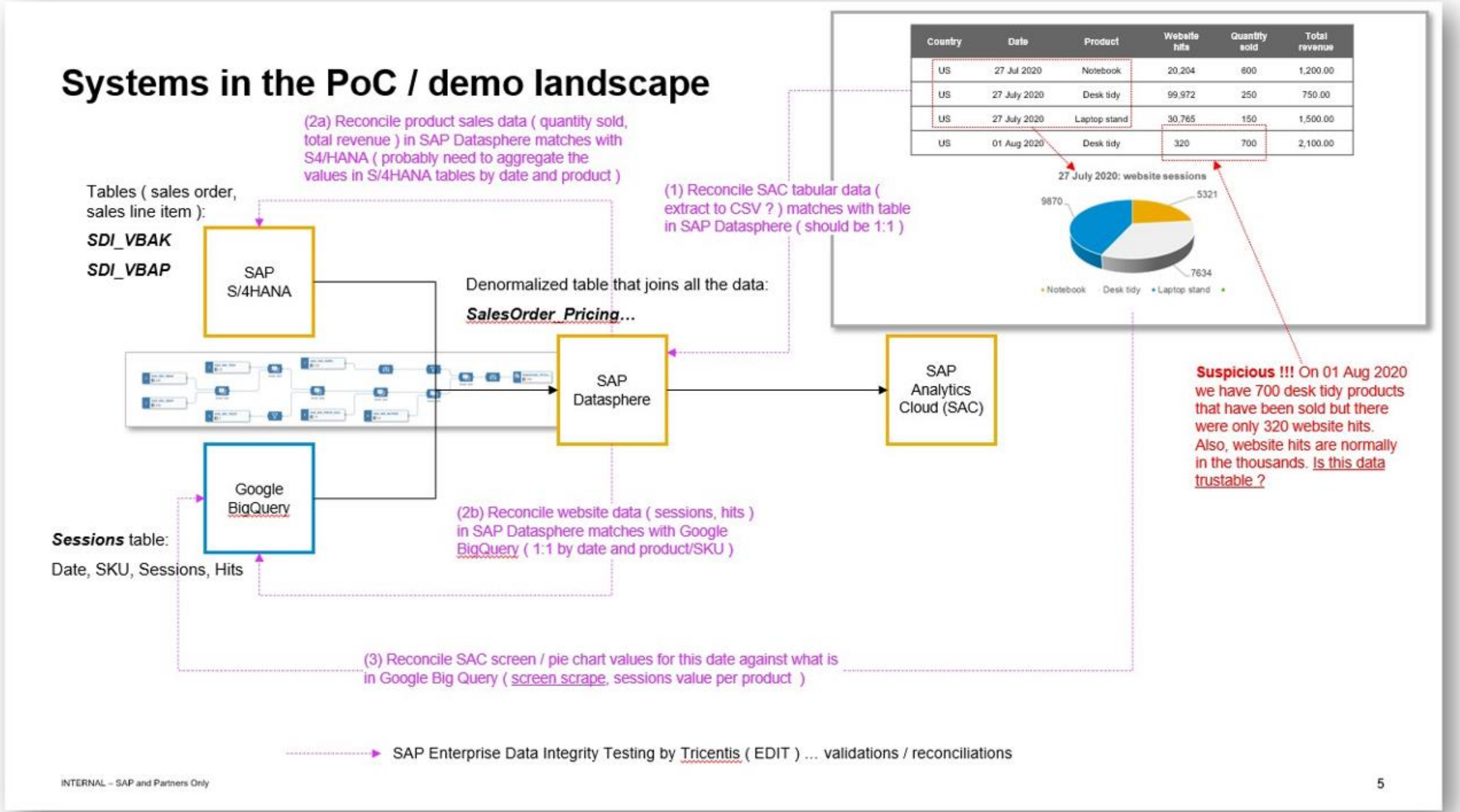
Common Verticals:

SAP DataSphere Use Case

SAP –> GCP or Azure

The race is on to find data errors (Example in New SAP Datasphere…)

To **TRUST** data in production, you **MUST** validate end-to-end in the test environment



Automated Data Integrity

Only solution in the market for Automation and End to End Testing across the EDW

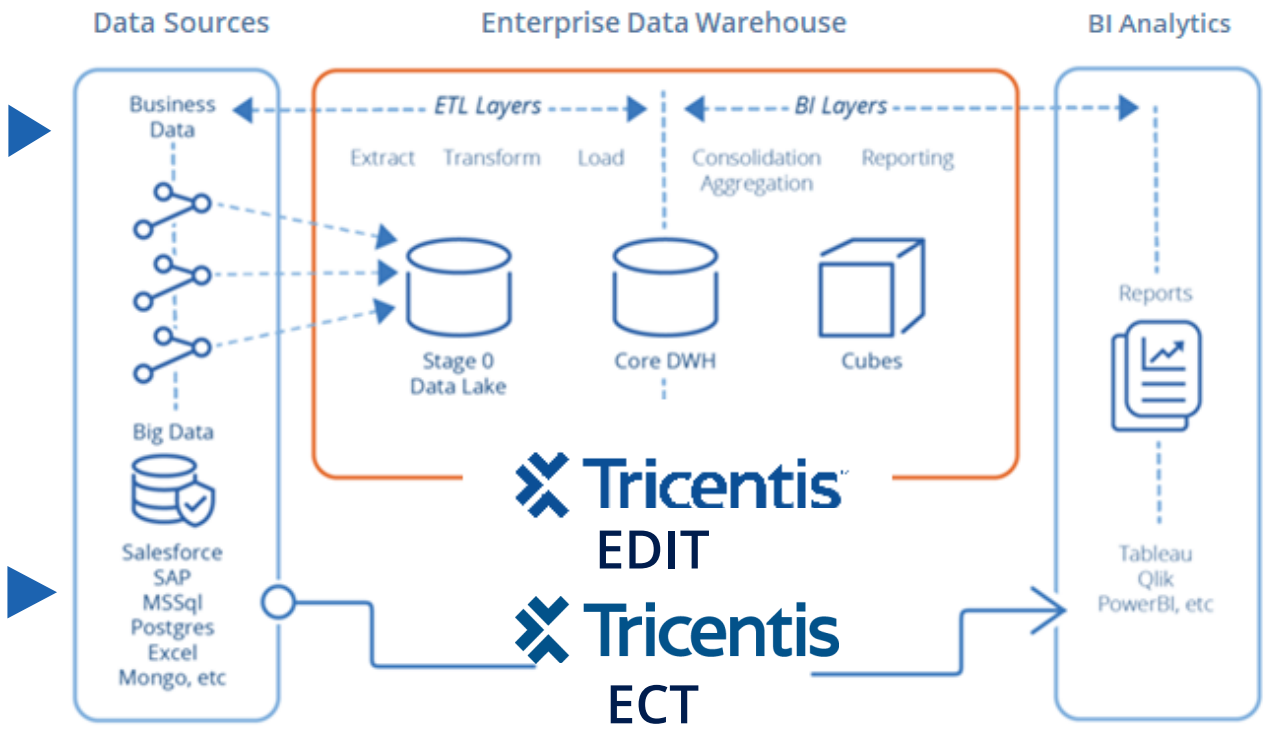
Move from Manual SQL Scripting to Scripless Model Based Test Automation

Covers all Reconciliation and Validation Tasks across the EDW from Sources to Stores to Reporting and Visualizations

Wizards for Ease of Use by any BA, Data Steward, DA, Data Engineer and others

Eliminates Manual Testing of High Impact Data Use Cases such as PDFs, Structured, Unstructured, and Message Data

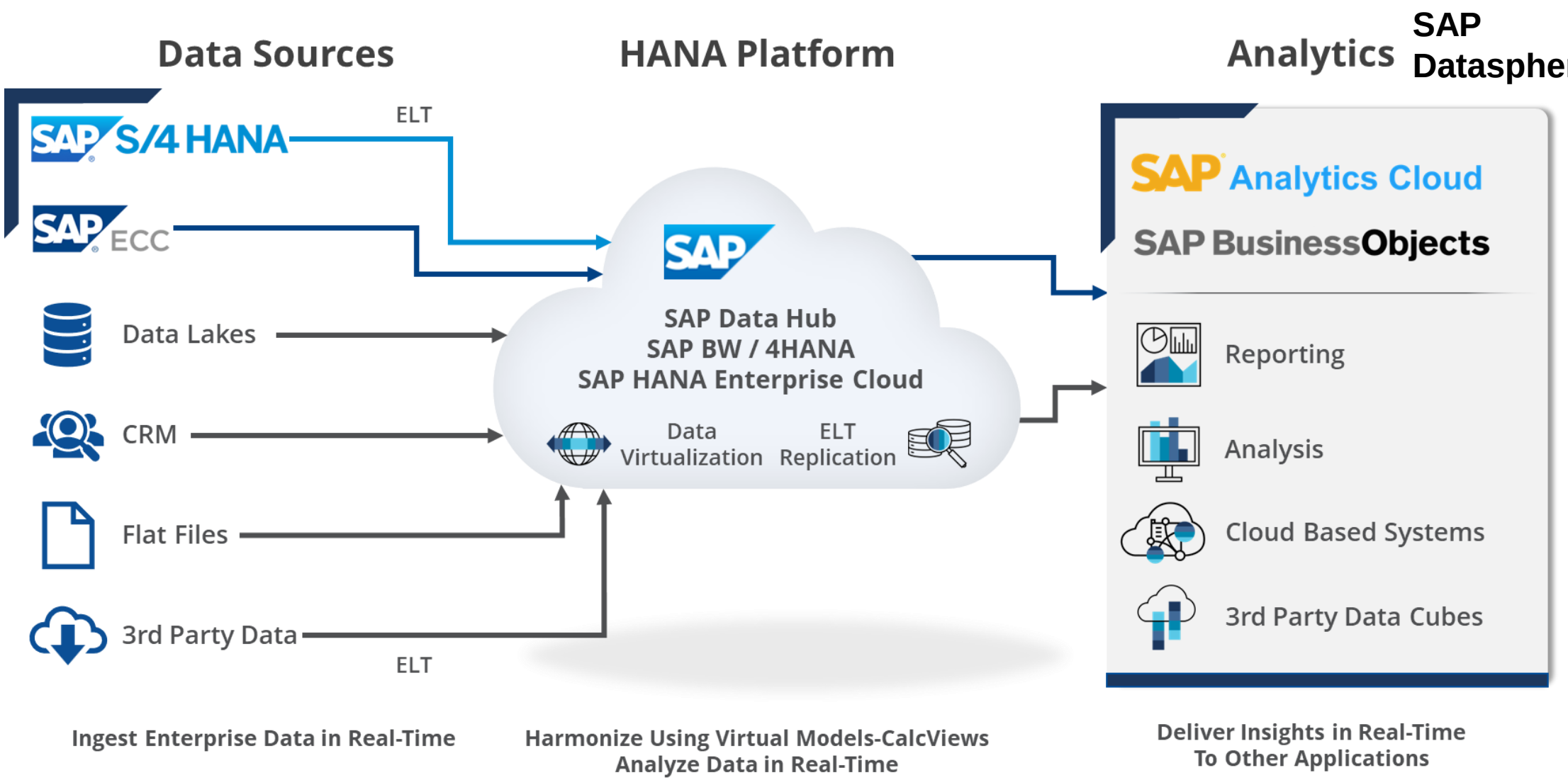
Tricentis



Full Tosca/ECT Functionality included with each EDIT / Data Integrity!

The race is on to find data errors

To **TRUST** data in production, you **MUST** test end-to-end in the test environment



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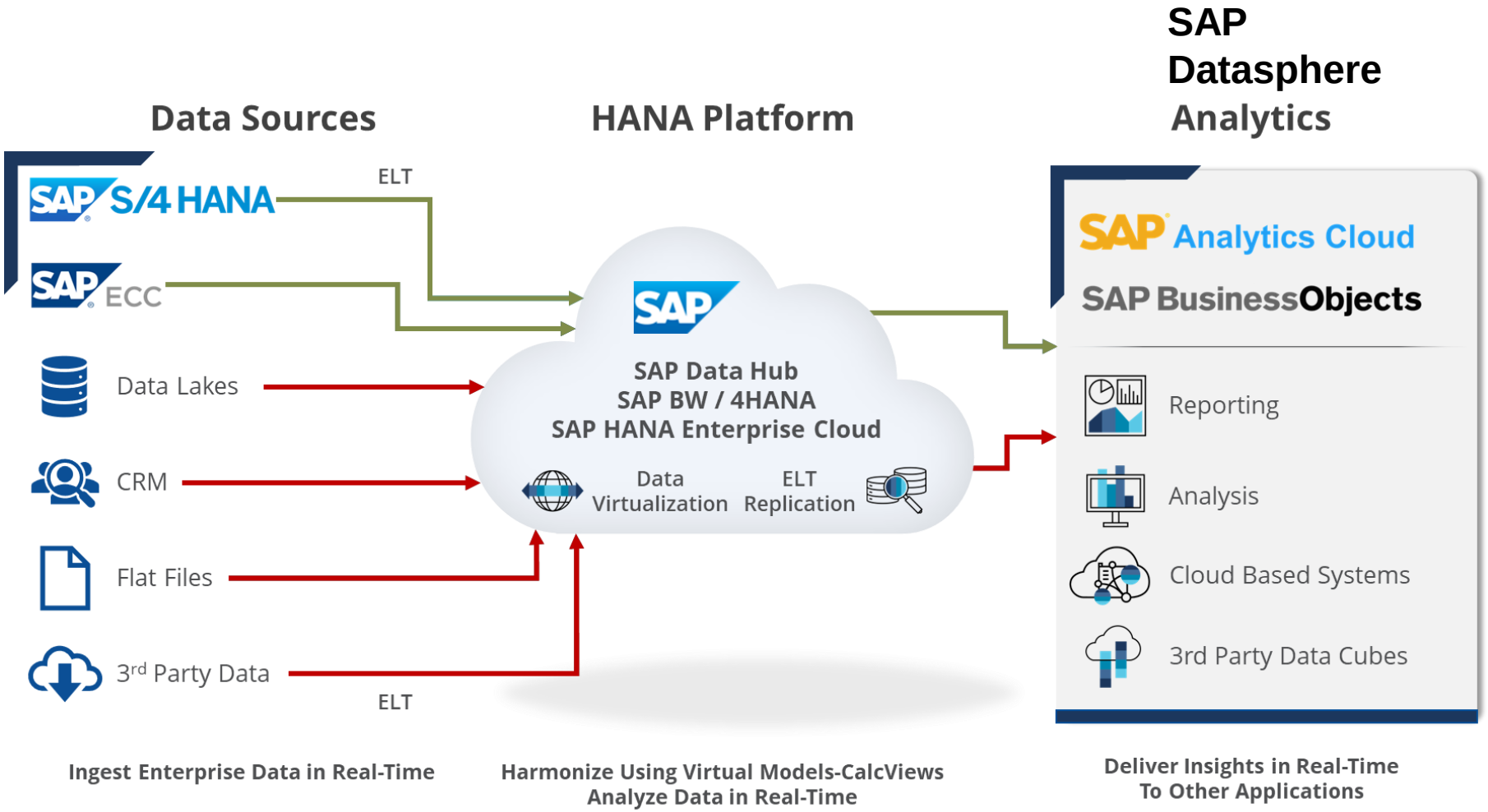


1 Pre-Screening

- Metadata checks
- Format Checks

2 Vital Field Checks & Field Tests

- Completeness: Row count, min/max, avg, sum, checks
- Correctness: Uniqueness, not null, hash-comparisons, data ranges
- Integrity: Relation, domain

3 Reconciliation

- Row by row comparison
- Comparison of 2 data sets

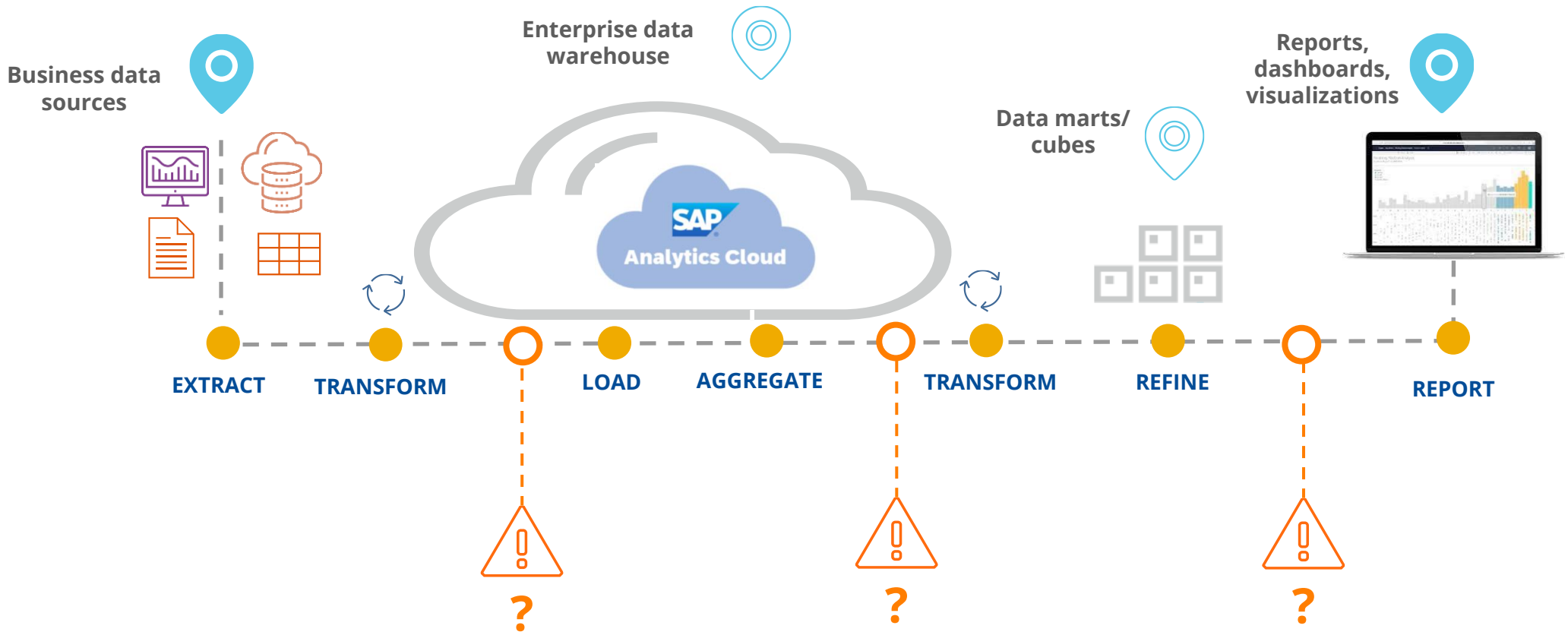
4 Report Testing

- UI Automation
- Visual checks
- Content check for dimensions
- Security

5 Monitoring

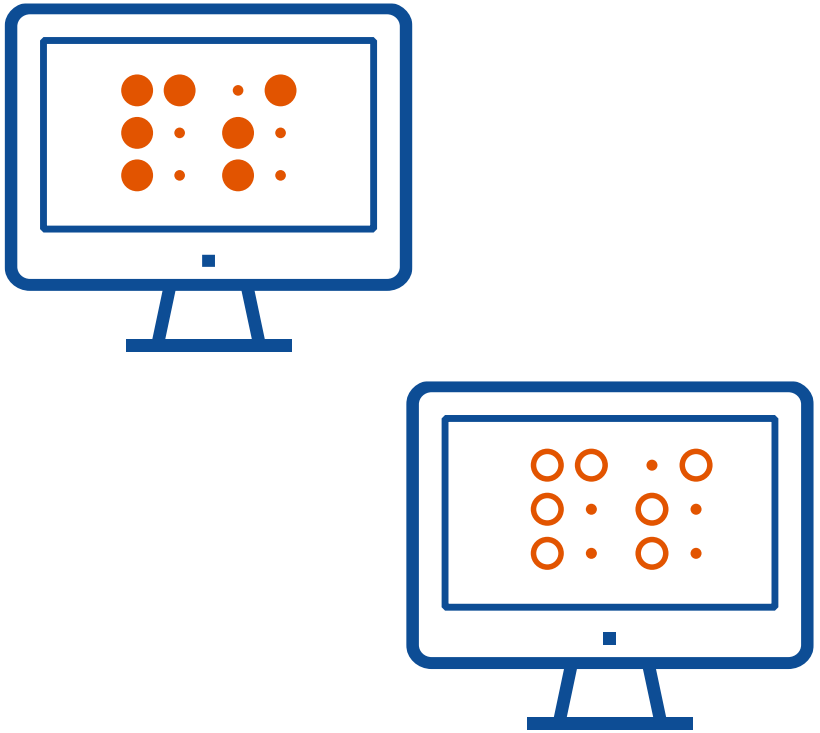
- Track row counts
- Job run times
- Data distribution per column over time

The race is on to find the data errors



Manual “stare and compare” **is slow and doesn’t scale.**

And is not a great use of your team’s brainpower.



Manual Stare and Compare does not work

Actual Large SAP Client Example!

Screen Shots	Data Covered	Total Cumulative Time
1	100Kb	6sec
10	1Mb	60sec
1,000	1Gb	16.6hrs
1,000	1Tb	16,667hrs (~8 man-year)
10X steps in process	10Tb	80 Man-years
50X Different processes	500Tb	4,000 man-years

- Impossible to do! You are only checking a subset of the data. < 1%

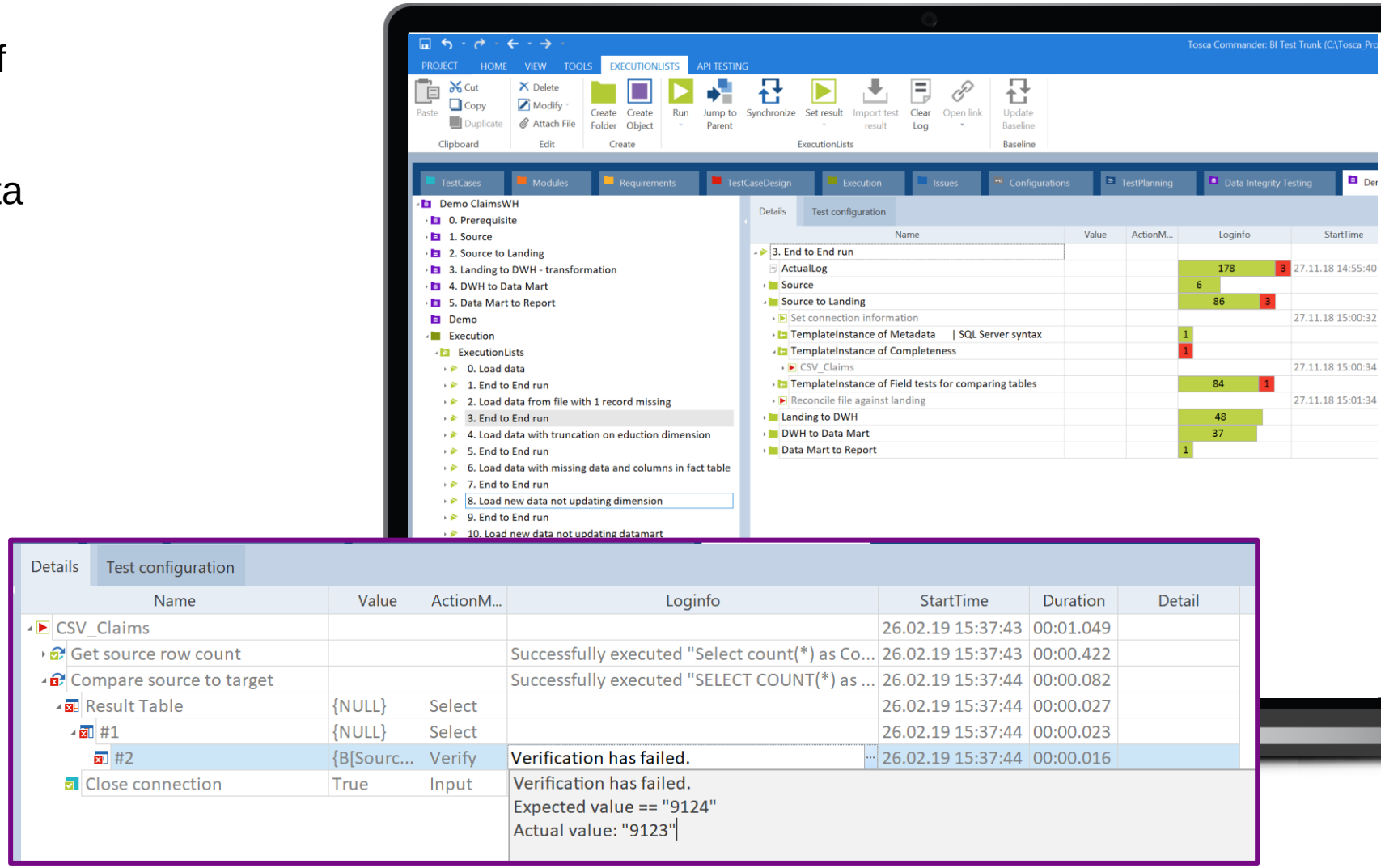
- Hoping your **“sample”** is good enough for your RISE/**cloud migration, production, innovation data projects (ex. AI) and AUDITORS**

SAP Enterprise Data Integrity Testing
Key Capabilities

- Comprehensive data testing across SAP and 3rd-party technologies
- Actionable reporting
- Customizable risk thresholds
- Low-code/no-code automation
- Integration with DataOps and DevOps tools

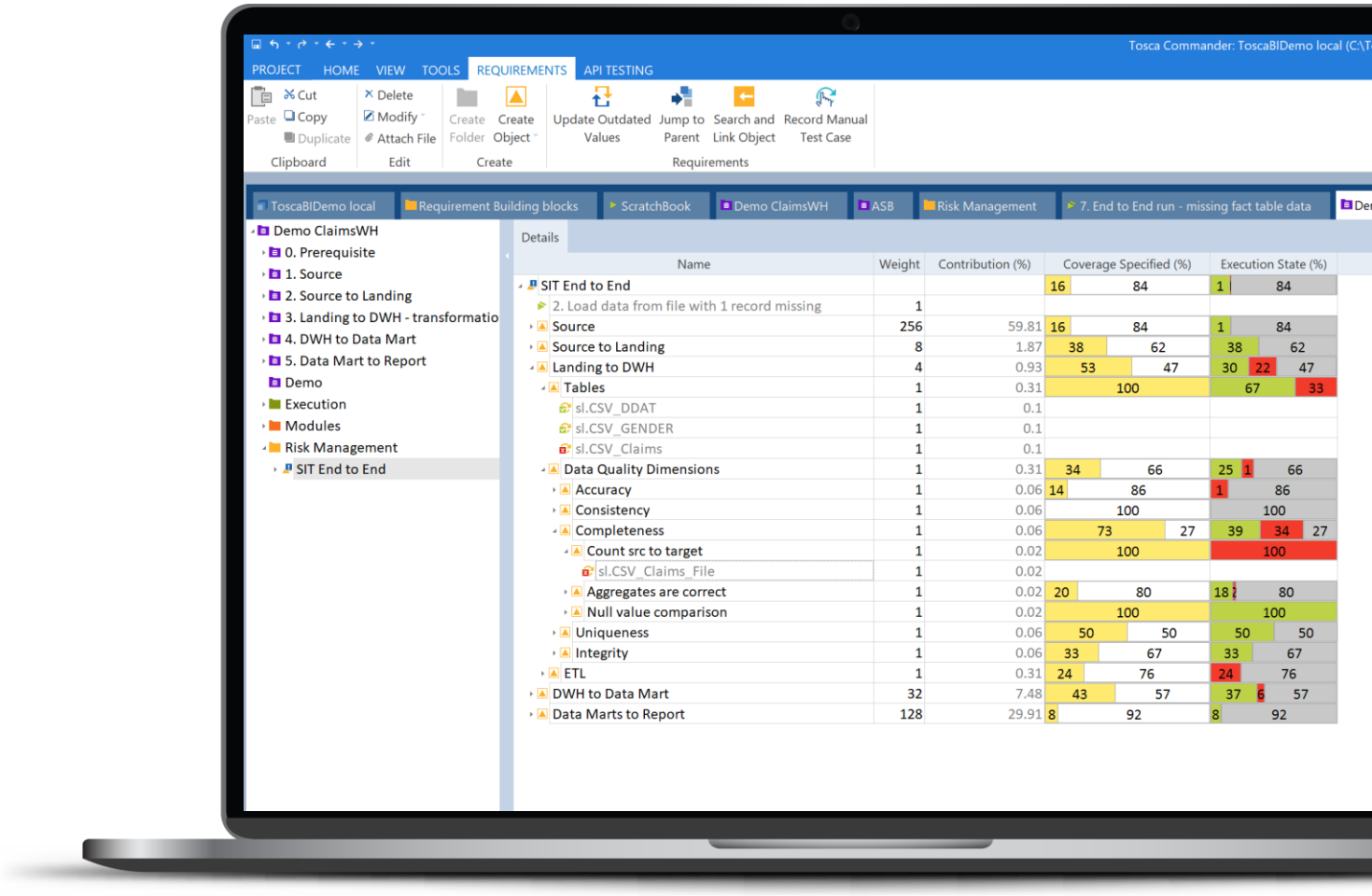
Actionable reporting

- Pinpoints specific root causes of data errors
- Enables swift remediation of data issues found



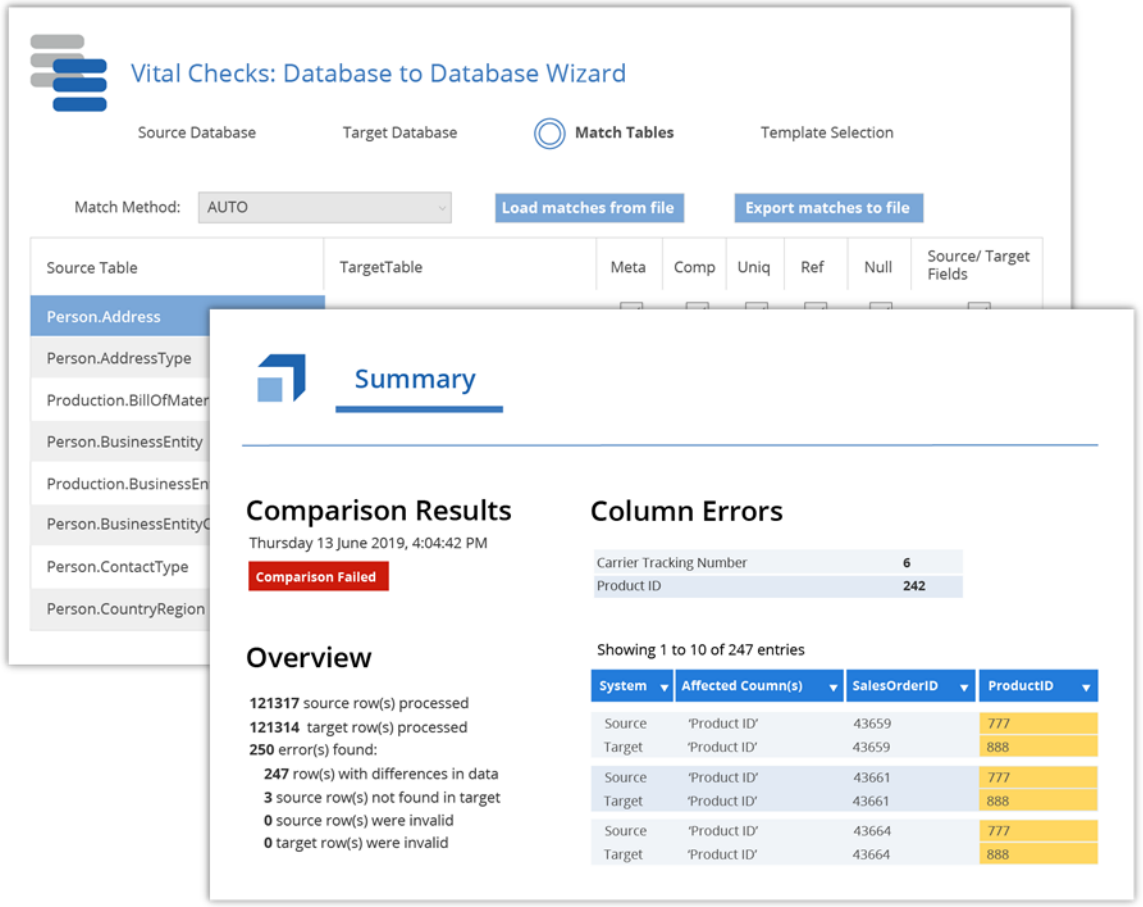
Customizable risk thresholds

- Minimizes “noise” from insignificant issues
- Focuses attention on business-critical data errors



Low-code/no-code automation

- No SQL skills required
- Enables developers, QA, and data teams to collaborate on data testing
- Results in better tests that catch more data errors



Integration with DataOps and DevOps tools

- Seamlessly integrates continuous data testing into your existing practices and toolsets
- Provides audit trails for your data tests

Case study

Mercedes - A large European automotive company drives better customer experiences and higher revenue through better data

About

- Their sales division is responsible for selling their entire range of light commercial and passenger cars
- Their legal entity in Turkey is also an IT base and a solution delivery center for over 40 countries

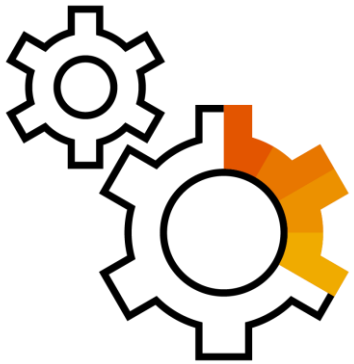
Business drivers

Drive better customer experiences across touchpoints and unlock new revenue potential by creating a centralized place for trusted customer 360 data.

Challenges

Project IDA—Integrated Data Architecture

- Complex transformation rules
- Large data volumes
- Frequent changes expected with source systems and new requirements to the IDA solution
- Lack of resources with advanced SQL and SAP BW skills



Initial manual test plan could not:

- Provide end-to-end coverage
- Handle volume
- Keep up with changing environment

Solution

Ingest customer master and transactional data from dealer, internal, and external systems

Issues flagged

Customer names being cut off due to data type mismatches

Consolidate into an EDW

Event

Data transformation

Transform into a sales data mart

Issues flagged

- Incorrect vehicle history for customers
- Wrong revenue numbers for certain customers

Provide access to trustworthy customer 360 data:

- Dealers and internal teams via web portal
- Systems via data feeds

Issues flagged

API calls using fuzzy logic return wrong customers

Solution

Solution metrics

Billions
of rows tested

400k+
rows tested in < minute

1 test type
25 flexible test cases
250+ variations

“ It’s impossible for humans to test billions of rows of data. We can now test nearly half a million rows in just one minute. There’s just no comparison.”

Test Automation Engineer,
Major European Automotive Manufacturer

Results

Business results

220
Testing days saved

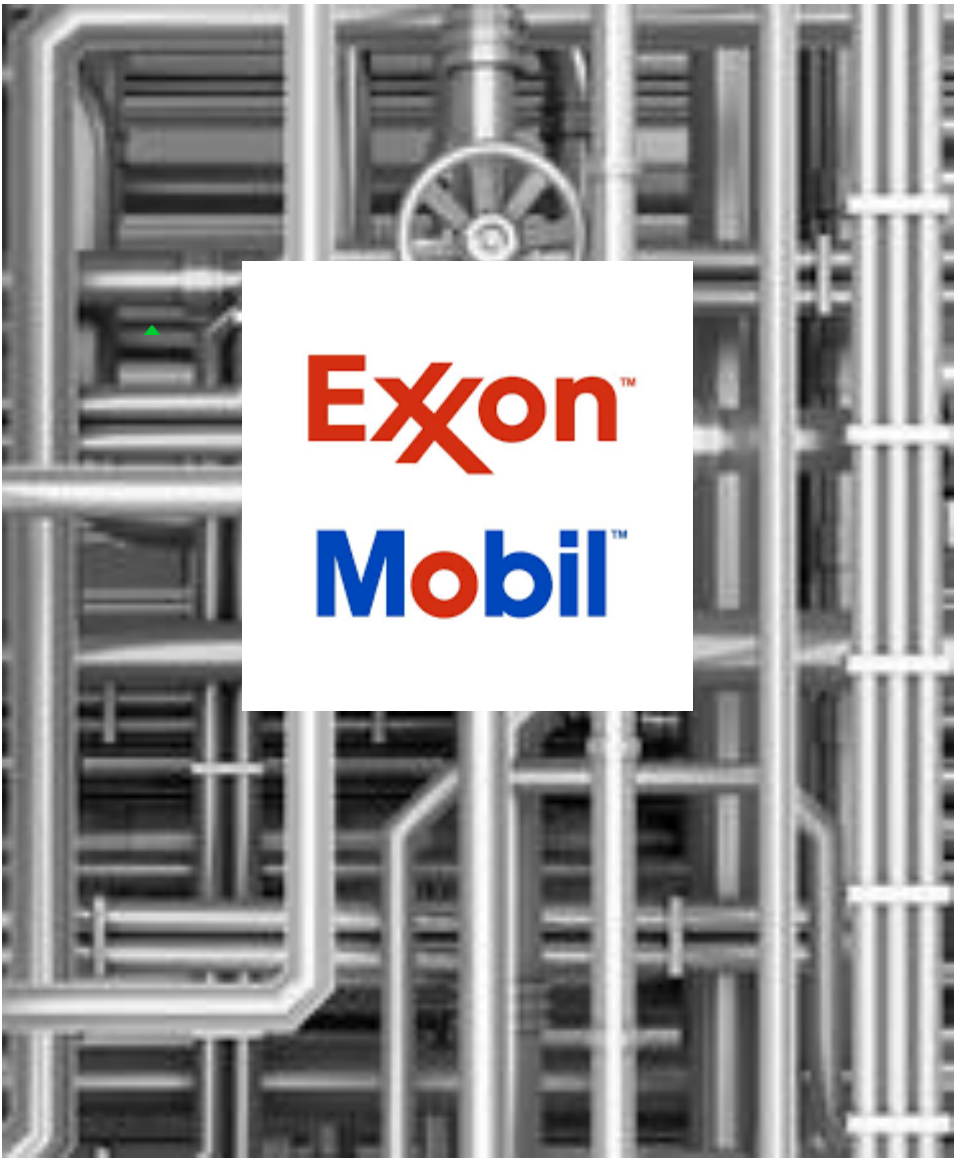
Errors pinpointed for faster fixes

Compliance

Higher quality customer data at speed and scale

ExxonMobil –

Data Warehouse and CFIN



Combining the Mobil and Exxon Data Warehouses under the S4 Hana Upgrade

24 million
Reports on Oil Reserves

Nigeria reserves were 1,000 of a percent off costing 2.2 million a month in inaccurate reporting. ExxonMobil manages the federal oil reserve and must report to the US Government monthly
3 rd Party

Combination of Central Finance (CFIN) under the S4Hana migration

Multi-Millions
Losses per each failure (days down) per Year

SAP merged processes cause huge Manual testing requirements
Down time was growing, and the financial team was under huge delivery pressure closing the books

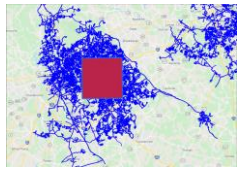
Compliance reporting K1 partnership challenge. Oil royalties

100M+
Accurate Data and regulatory pressures

ExxonMobil has 1000's of partners that they must report to the federal Government, these are Royalty partners with multiple legal requirements

Satellite & Methane Emissions Platform

Identify Area of Interest



- Duke Energy/Satelytics Coordinate Date/Time of Capture
- All Natural Gas Asset Buffers Provided for Area of Interest

Satellite Capture & Data Processing

Satelytics

- Satellite data captured on regular frequency
- Weather dependent

Methane Emissions Platform

E-MISSION CONTROL

- Data Delivered and processed through platform
- Classification of New/Known Methane Indications
- Prioritization Algorithm risk ranks methane indications

Field Response

PAR

- Platform generates Work Orders for Field Response
- Field technicians respond to Work Orders by Priority

Response Time (by priority)
~48 Hour Response (High)
~1 Week (Medium)
1-3 Months (Low)

Leak Repair

- Leak Repaired
- Site Level Measurement of Flow Rate at Time of Repair (Sampling)
- Measure Emissions for Life-cycle of Leak

Goal in 2022 – Fix All Confirmed Leaks Within 6 months of detection

Timeline

1X Month — *1-4 Days for Tasking* — *~48 Hour Data Delivery*

Duke Energy

Duke delivers on transforming customer experience with the move to SAP S/4HANA

Project Background

- Transform the customer experience starting with streamlining internal billing systems for a universally optimized customer experience
- Duke's leadership knew testing would be a critical component to the project's success

Complications | Challenges

- Consolidating 4 different billing applications into a single system
- Ensure the S/4HANA project did not negatively impact critical business processes
- Automating testing for multiple SAP applications –SAP for Utilities, SAP Marketing, SAP commerce cloud, ICU, C4C, Fiori and Customer recommendation engine

Successful Business Outcomes

- Test automation is viewed as high quality, high business value
- Advanced from waterfall to weekly SAP releases
- Defects discovered earlier, enabling faster and more efficient defect resolution

250
End-to-End Tests Run Weekly

0
Defect Releases

150
Unattended Tests Run Nightly (under 12 Mins)

SAP Specific Data Coverage Examples…

SAP Migration (RISE) End to End Process validation

SAP Enterprise Continuous Testing, Change Impact Analysis, Enterprise Data Integrity Testing

Prepare
Pre-Migration

Validation of E2E Business Outcome

SAP ECT
by Tricentis

SAP CIA
by Tricentis

SAP EDIT
by Tricentis

Move
Migration

De-Risk and Accelerate Migration

SAP DS

SAP ADM

DMLT

Run
Post-Migration

Ongoing Validation of E2E Business Outcome

SAP ECT
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SAP CIA
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SAP EDIT
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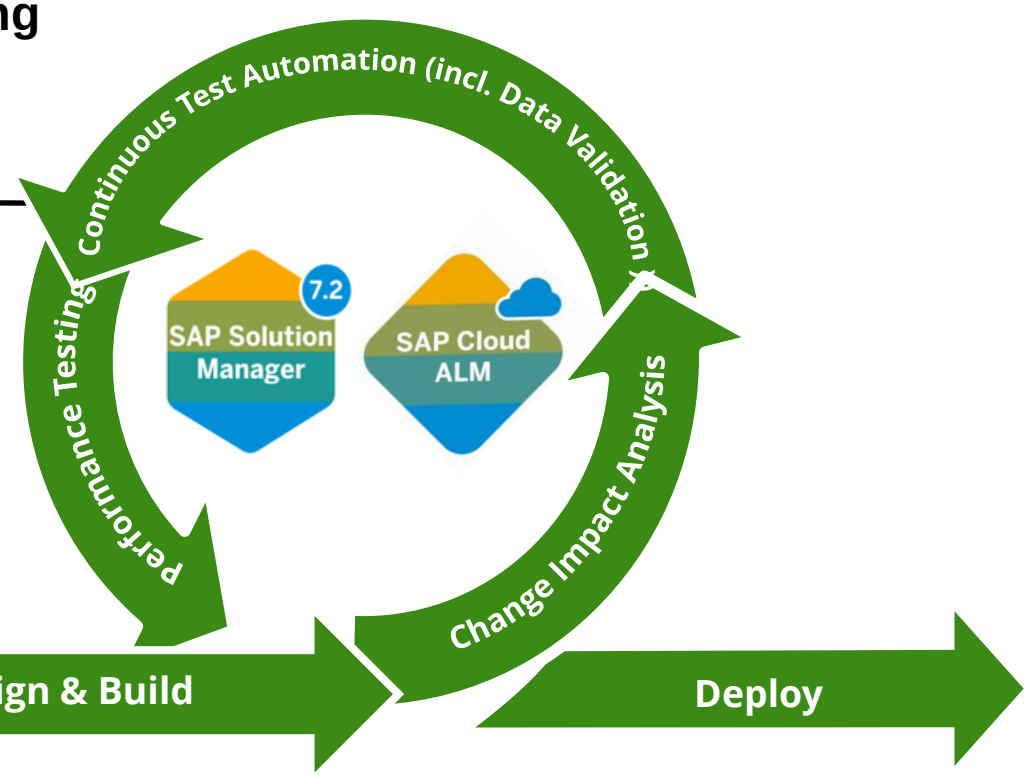


SAP S/4HANA

Tricentis

Classic SAP

UI

WinGUI

Business Logic

ECC

Data

ORACLE
etc.

SAP Data (BW)

*

* ... with many enterprise customers, databases for SAP data hold data of other systems as well

Modern SAP

Fiori

S/4

SAP HANA

SLT + Other Integrations i.e., Excel....

Finance, Ariba, Other Externals..

PowerBI, Tableau, Webi...

BW/ BOBJ

BW/ODW + Others i.e. Snowflake...

SAC

Data of connected systems

Tricentis ECT

SAP WinGUI | SAP Netweaver | SAP Business Client | SAP Fiori | SAP on Mobile

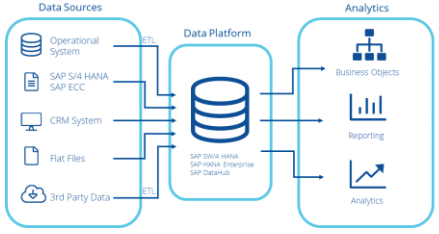
UI Technologies
API Testing

oData
RFC, SOAP RFC
IDOCs
REST/HTTP(S)/JSON/XML

Change Impact Analysis

Tricentis CIA

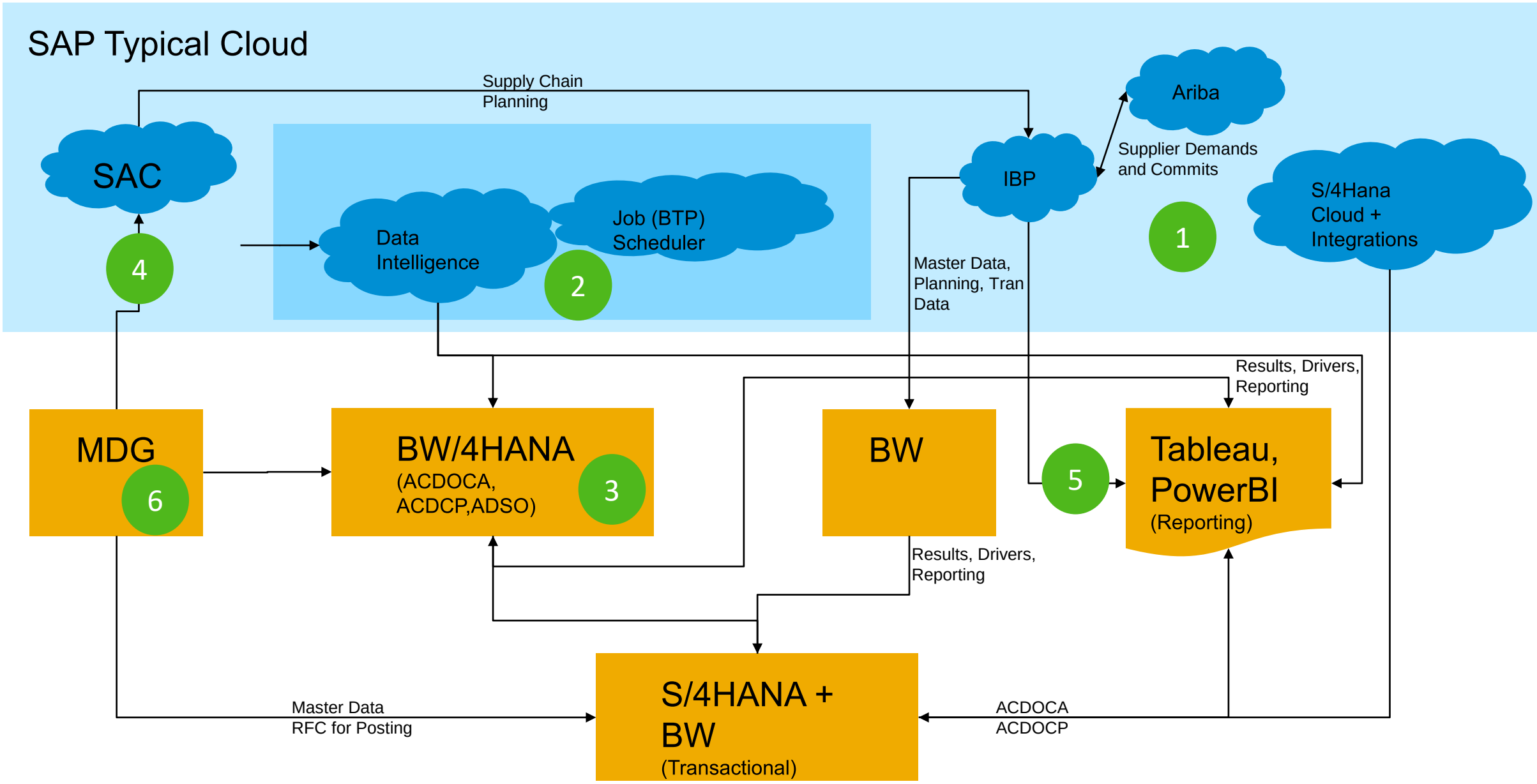
Change Intelligence



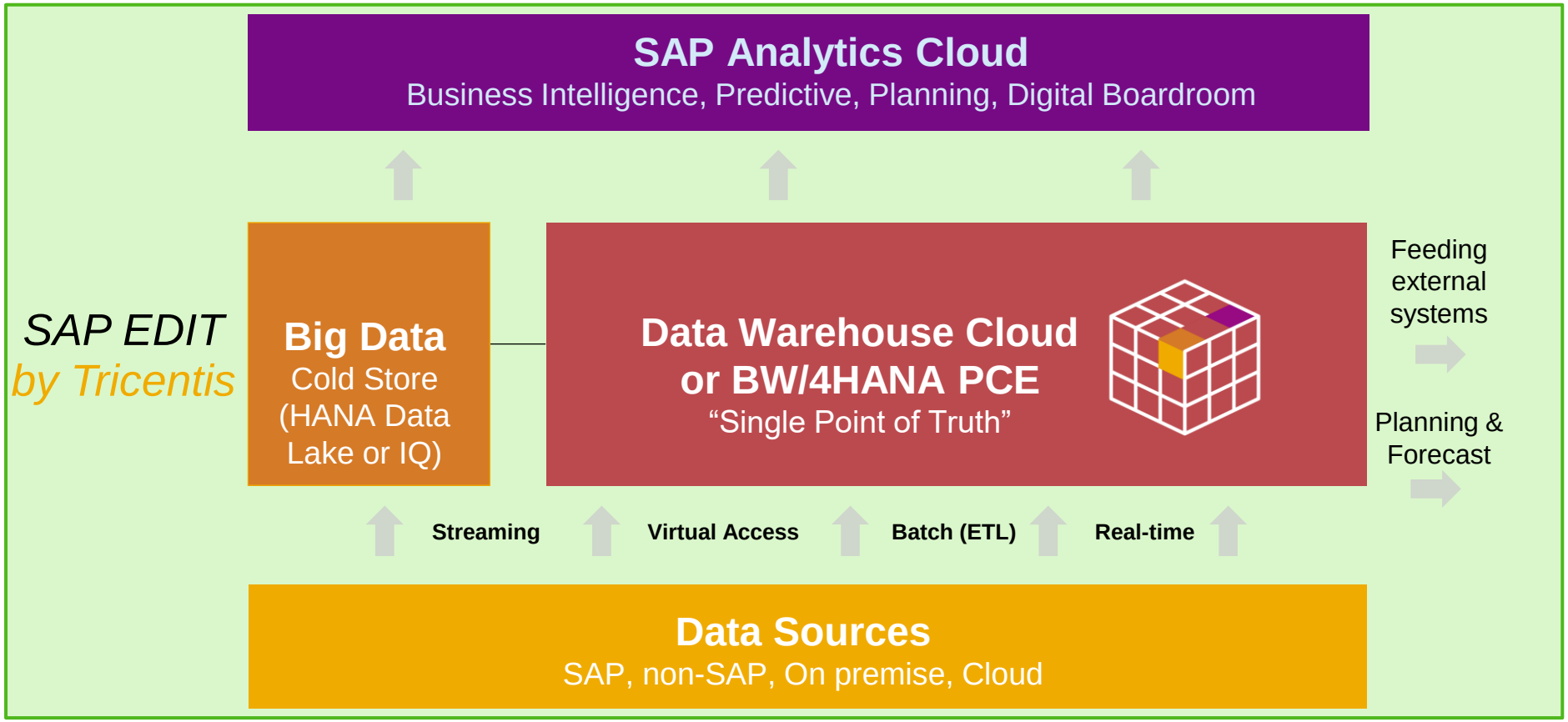
Data Reconciliation

Tricentis EDIT

SAP Typical Cloud



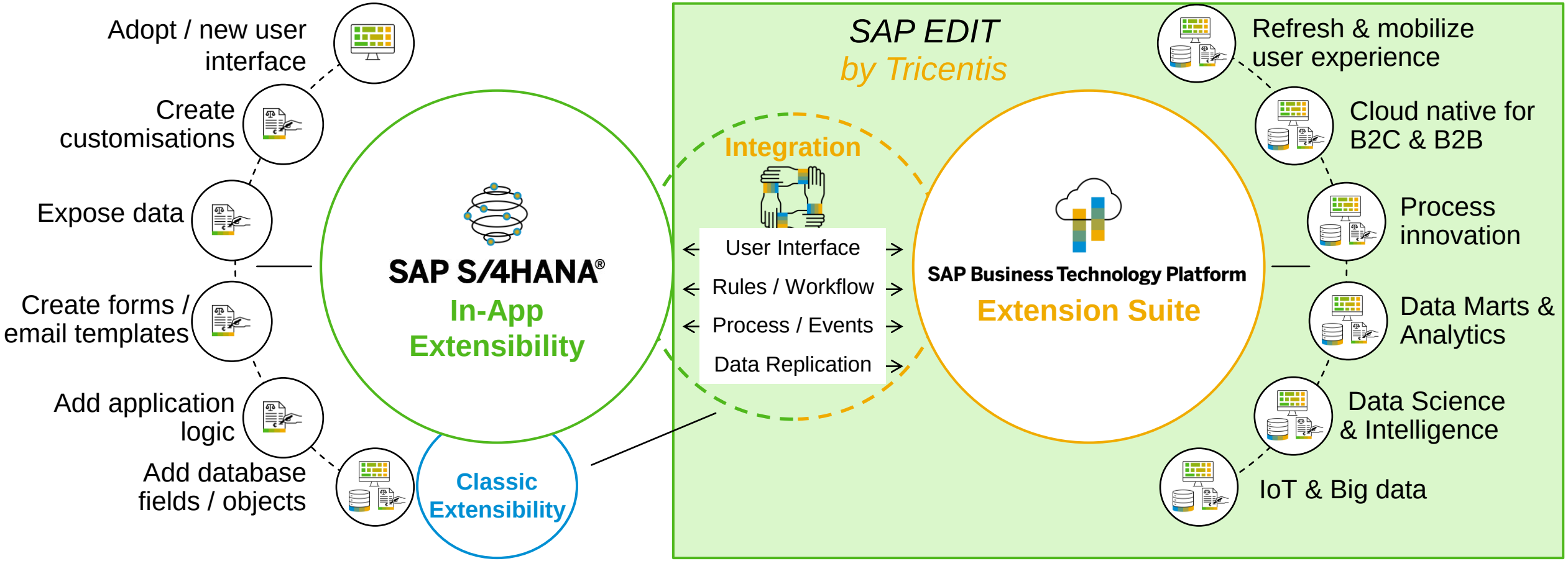
SAP Data Warehousing and Data Lake – EDIT for Trustworthy Data



EDIT benefits for a SAP Data Warehouse

- Validation of Cloud Integrations to SAP and Non-SAP based data sources
- Validate and Reconcile SAP Dimensional Data and Master Data processes
- Trust in the implementation of all business content

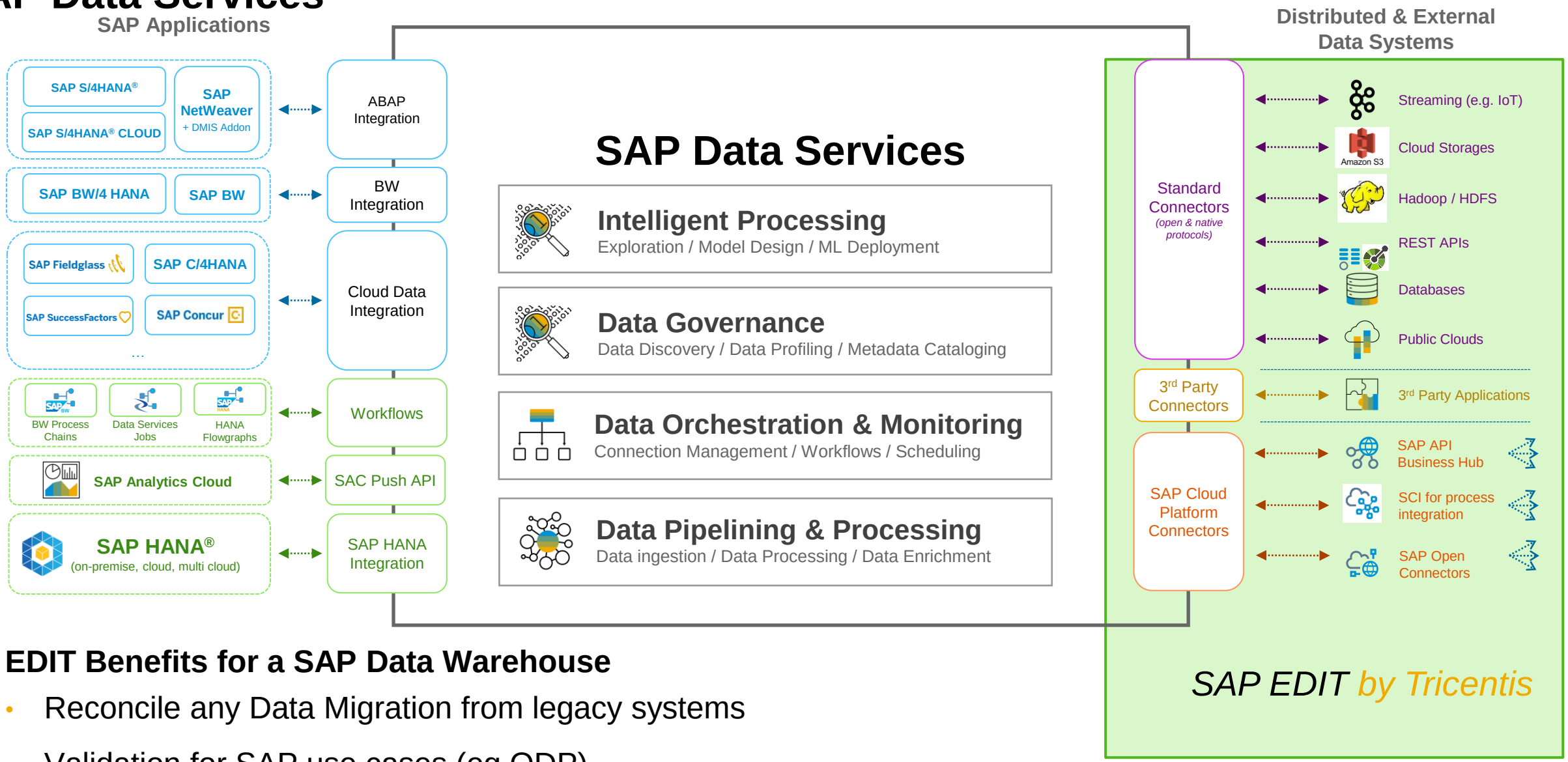
SAP BTP Extension Suite – EDIT for Trustworthy Data



EDIT Benefits for SAP Extension Suite

- Ability to validate processes with SAP Data seamlessly to other systems
- Included API testing for process interconnection and automation
- Accurately checking data processes Lowers legal and GDPR risks
- Validate processes are streamlined and integrated accurately

SAP Data Services

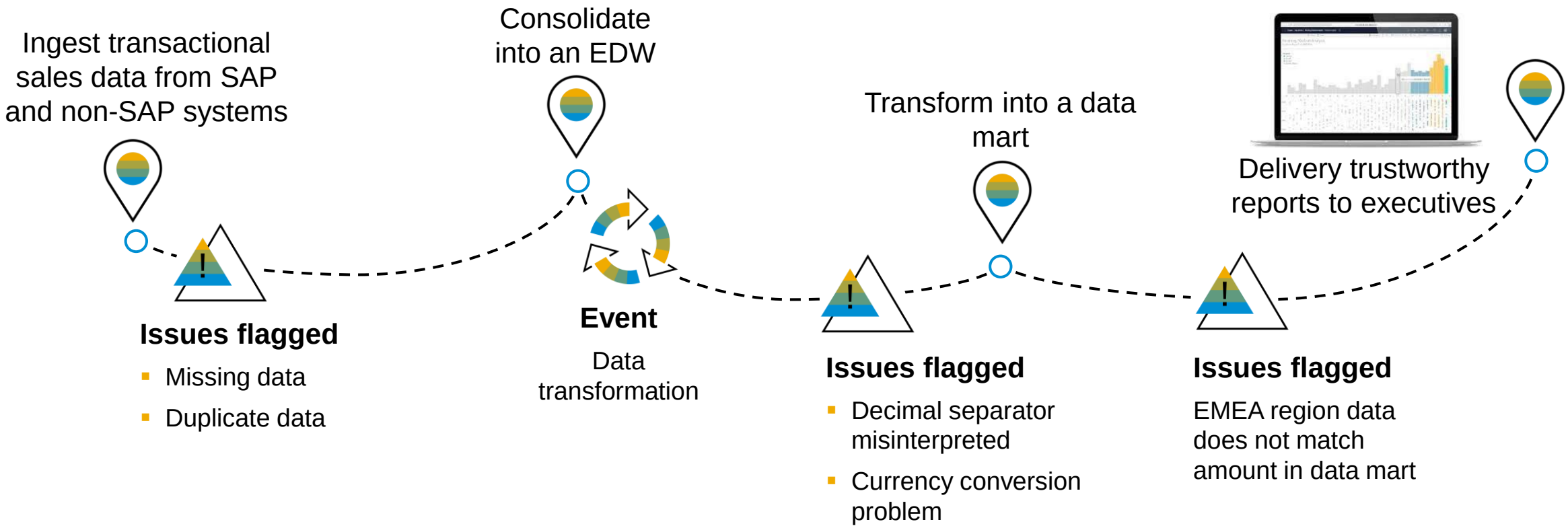


EDIT Benefits for a SAP Data Warehouse

- Reconcile any Data Migration from legacy systems
- Validation for SAP use cases (eg ODP)
- Testing for the accuracy of real time information or Cloud data

Deliver trustworthy data

Example scenario—data analytics



Keep operations running smoothly

Example scenario—Finance AR invoicing

Ingest raw invoicing data from multiple ERP and accounting systems—SAP and non-SAP

Issues flagged

- Missing data
- Duplicate data
- Data not following business rules
  - Not matching metadata
  - Out of bounds, ranges

Consolidate into an EDW

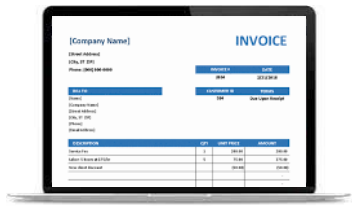
Event

Data transformation

Transform data into finance data mart

Issues flagged

- Transposition of amounts and other data elements
- Truncation of data
- Incorrect calculations



Send accurate consolidated invoices to B2B customers in PDF form

Issues flagged

Outputs (Invoice PDFs) are incorrect to source data