Introduction to
ABAP Core Data Services (CDS)

ABAP Platform Product Management, SAP
January 2022

PUBLIC

THE BEST RUN SAP

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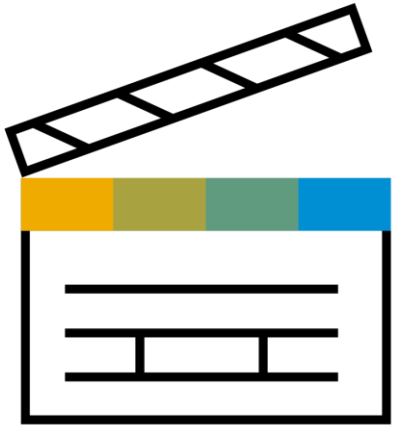
Agenda

MODERN ABAP DEVELOPMENT

ABAP CORE DATA SERVICES (CDS) OVERVIEW

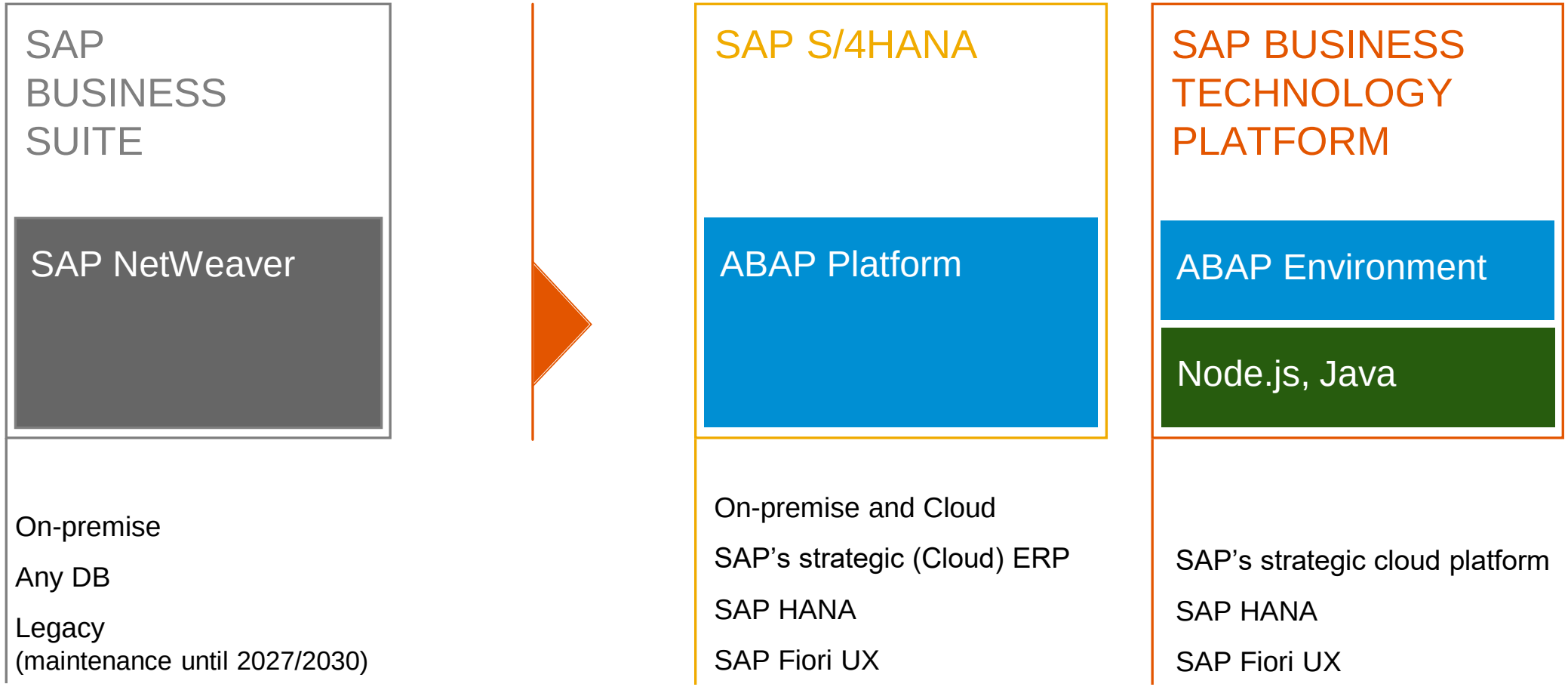
CDS IN ABAP APPLICATION PROGRAMMING

SUMMARY



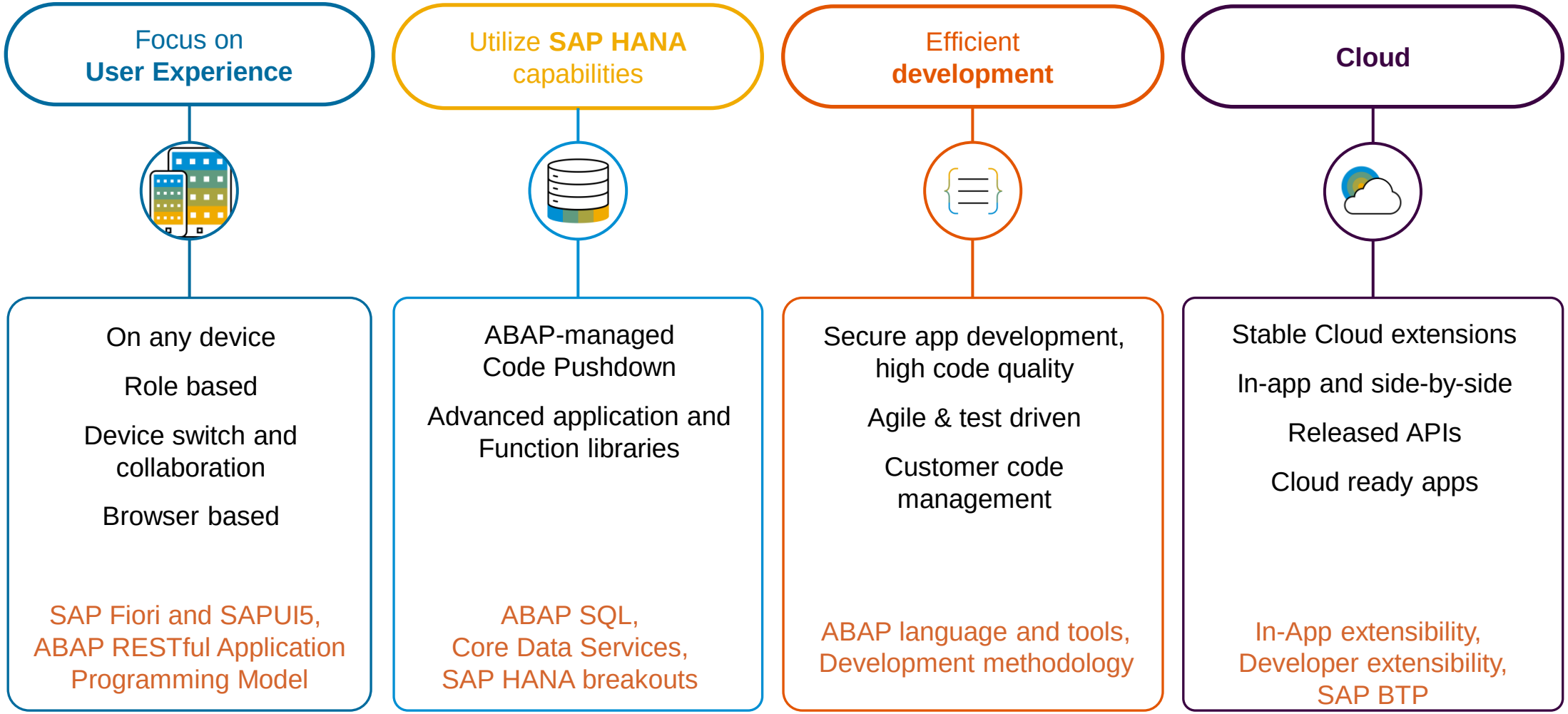
MODERN ABAP DEVELOPMENT

ABAP Platform – Transformation to SAP S/4HANA and SAP BTP



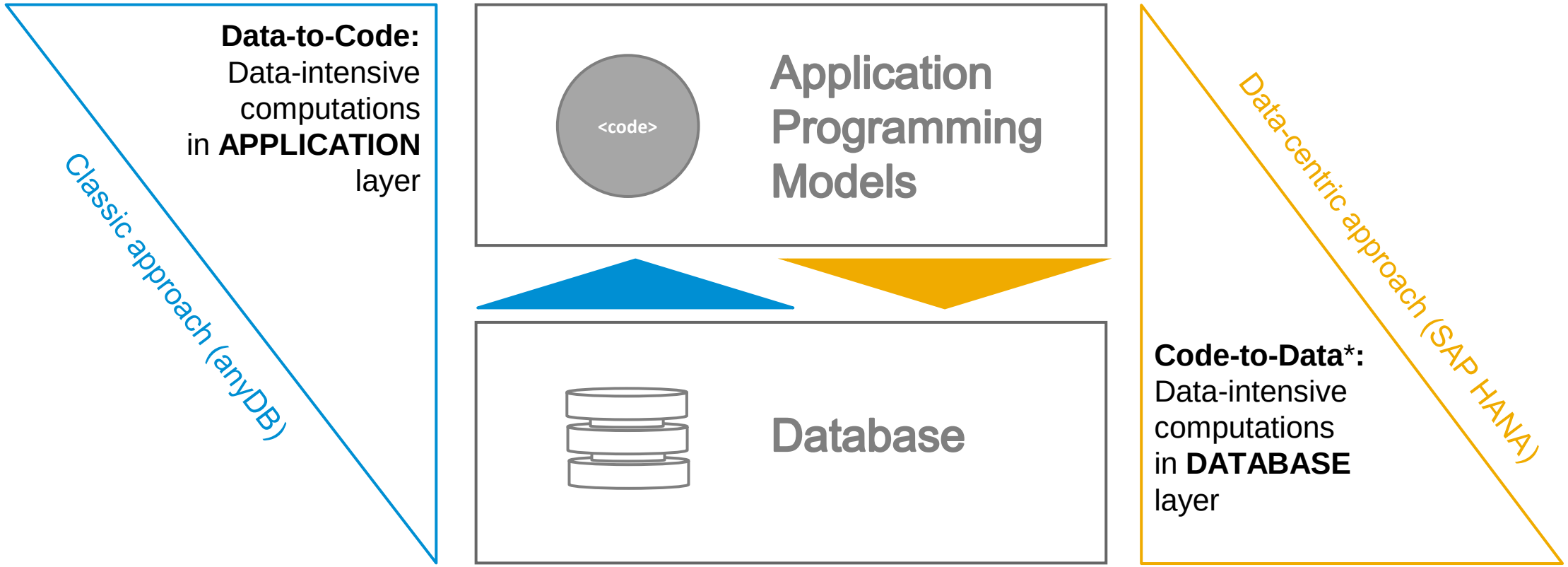
Modern ABAP application development

Must learn topics: UX, SAP HANA, state of the art development, Cloud



Modern ABAP application development

Programming paradigm shift powered by SAP HANA

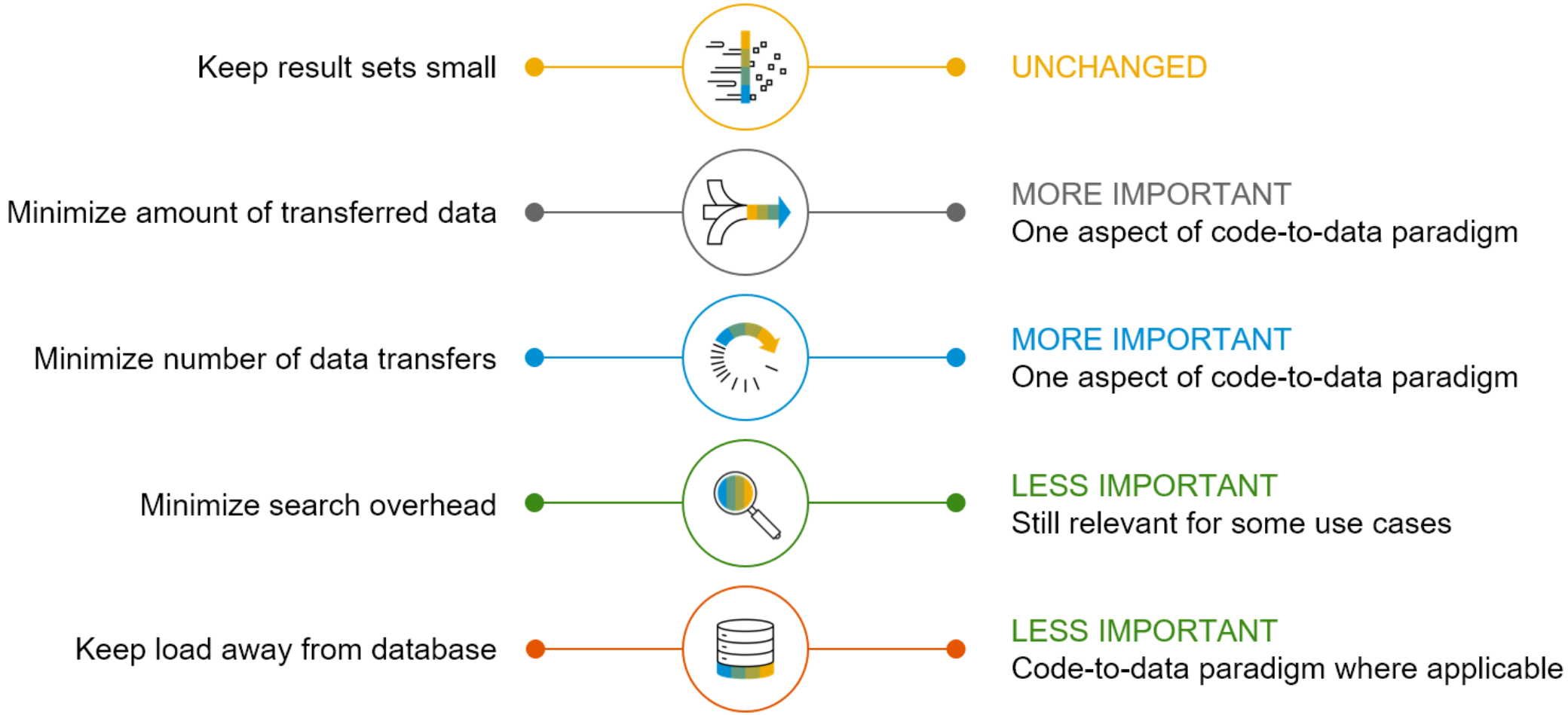


(*) aka Code Pushdown

More in this blog

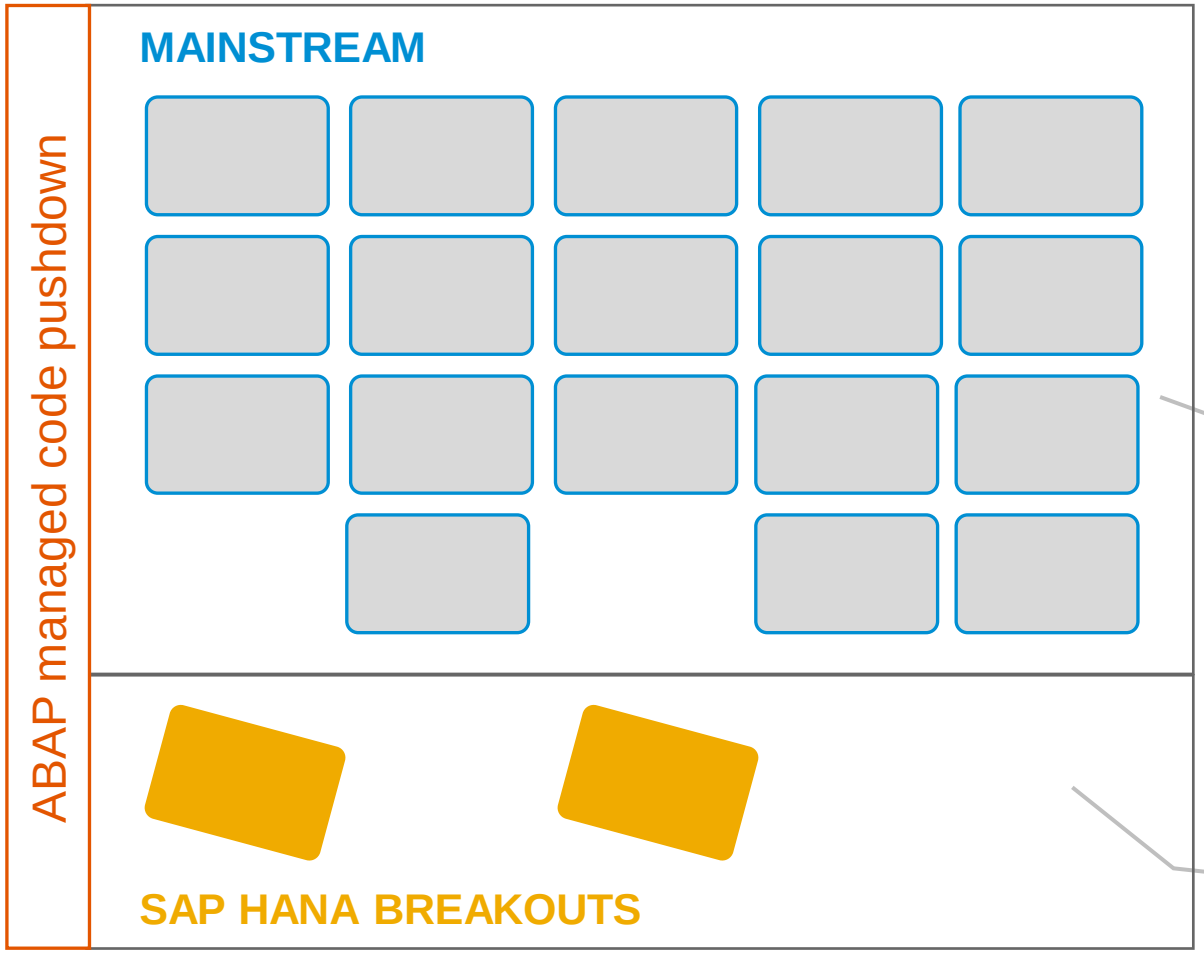
Modern ABAP application development

Golden rules for SQL programming – Priority shift on SAP HANA



More in this blog

Modern ABAP application development on SAP HANA



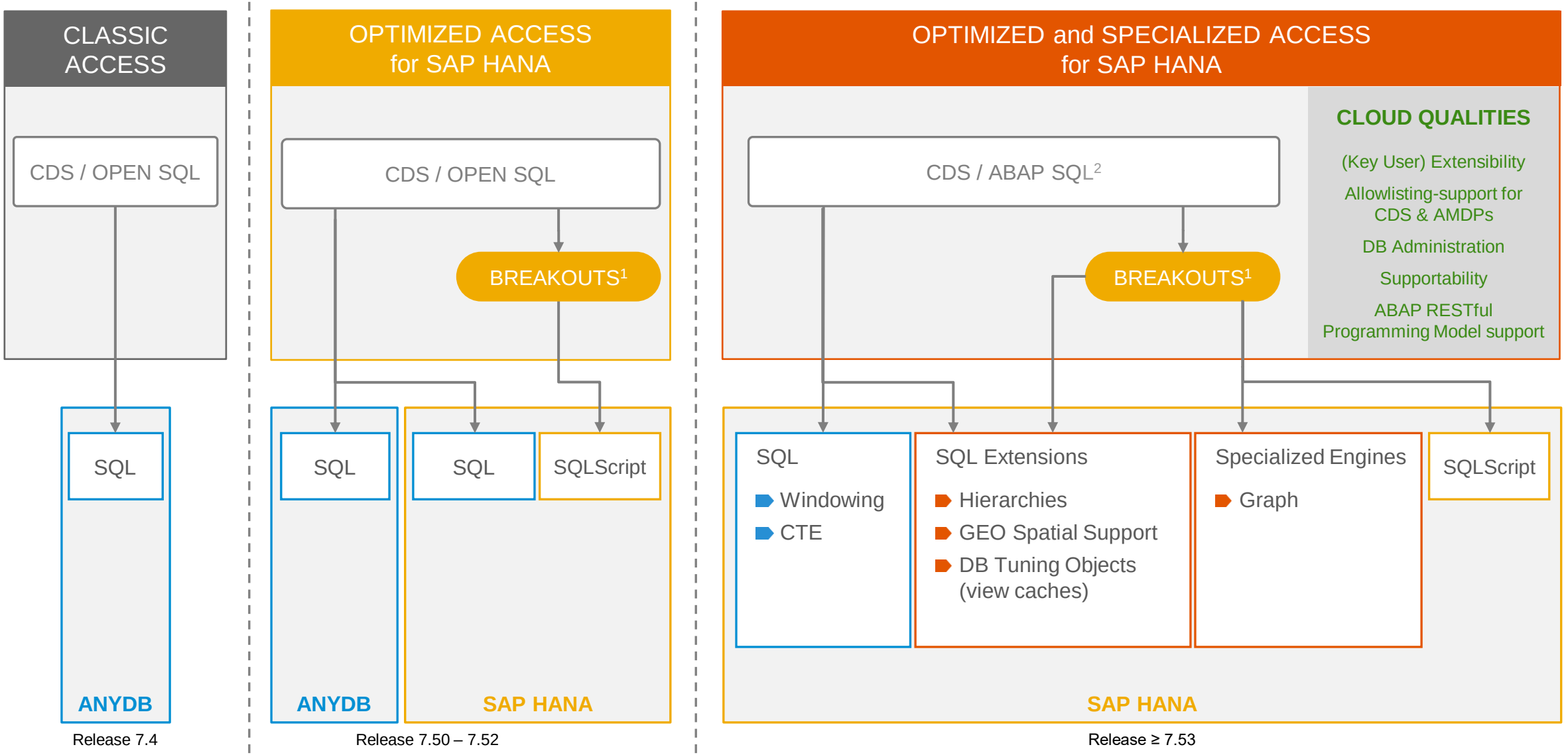
ABAP Core Data Services (CDS)

ABAP SQL (fka Open SQL)

ABAP Managed Database Procedures (AMDP) – Procedures and Functions

CDS Table Functions

Evolution of ABAP CDS and Open/ABAP SQL



[1] AMDP procedures and functions, CDS table functions, and CDS hierarchies

[2] Open SQL was renamed to ABAP SQL starting with ABAP Platform 1809

Efficient ABAP development in Eclipse

HIGH DEVELOPER PRODUCTIVITY WITH THE ABAP DEVELOPMENT TOOLS (ADT)

MODERN DEVELOPMENT TOOLSET

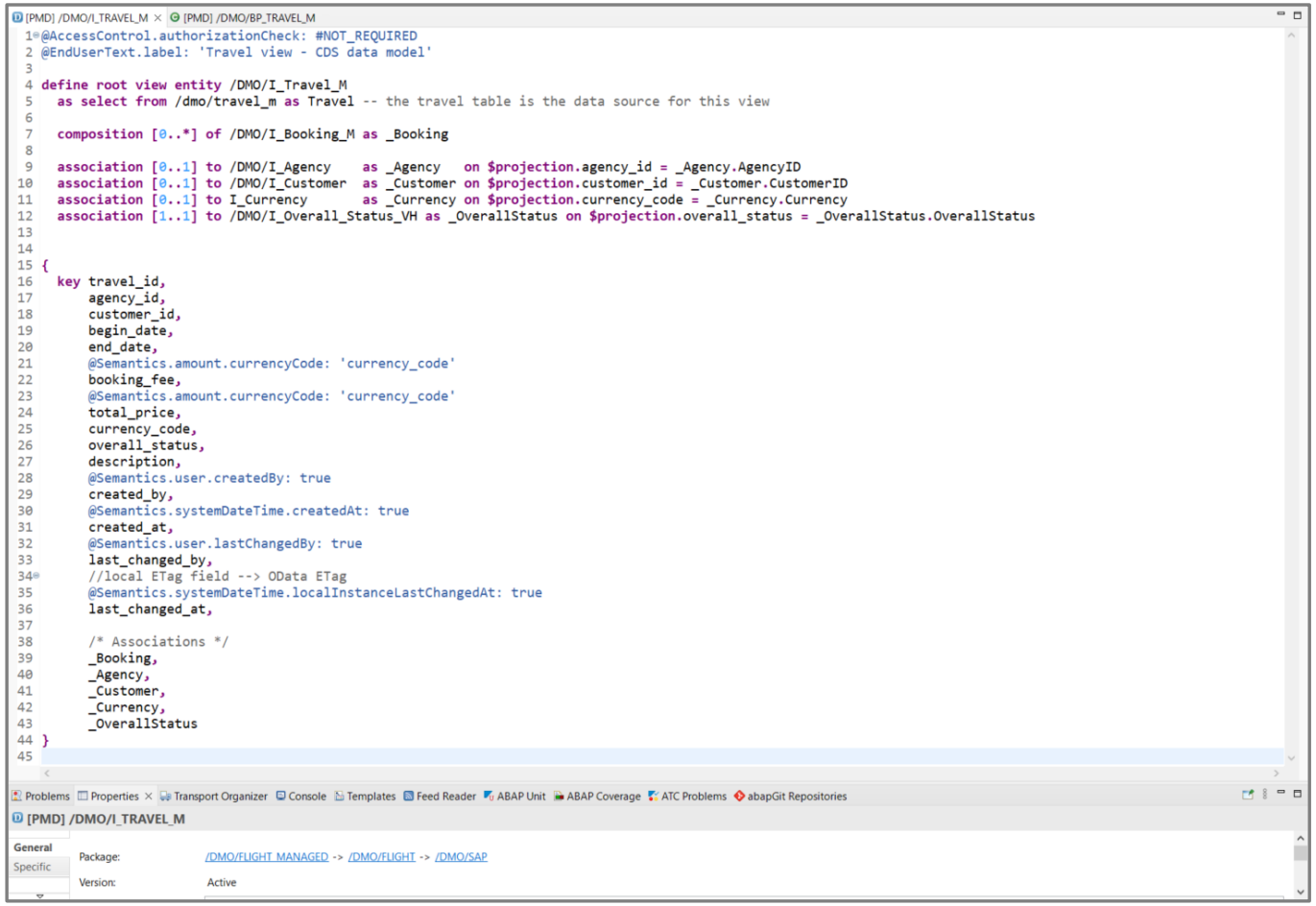
Fully eclipse-based
Syntax check, Code completion
Syntax highlighting, Pretty printing
Navigation, Search, Quick Fixes

QUALITY ASSURANCE

Static code checks (ATC, CVA) with remote and local scenarios
Unit testing incl. isolation frameworks
Test seams and injections

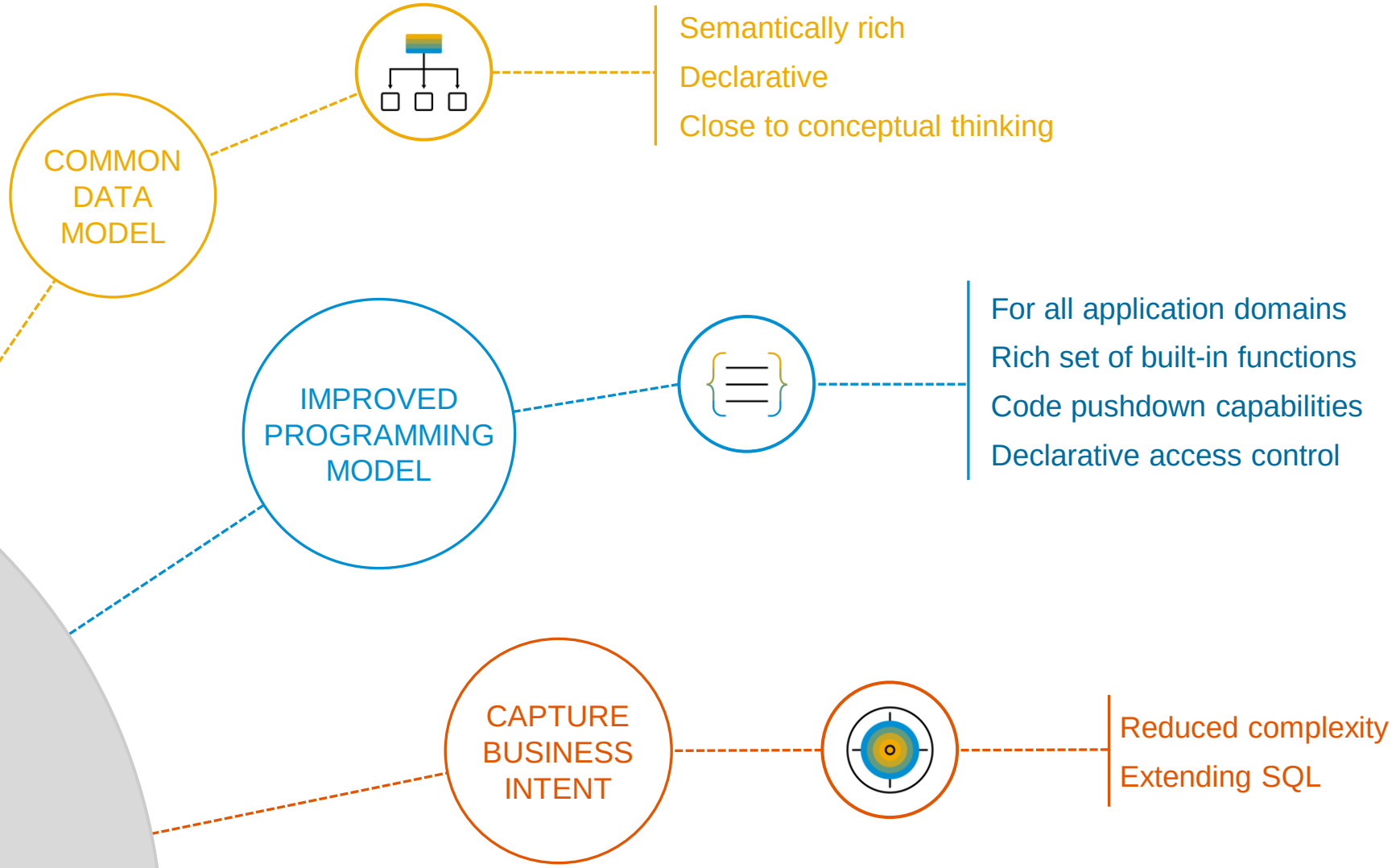
SUPPORTABILITY

Debugging, profiling
Static and dynamic logging
Runtime monitoring and analysis



ABAP CORE DATA SERVICES (CDS) – OVERVIEW

Next generation data modeling and access



CORE DATA SERVICES

Combine the best of both worlds with ABAP CDS

VIEW BUILDING
SQL views with restricted feature set for SAP HANA capabilities

LIFECYCLE MANAGEMENT

ABAP lifecycle management e.g. transports

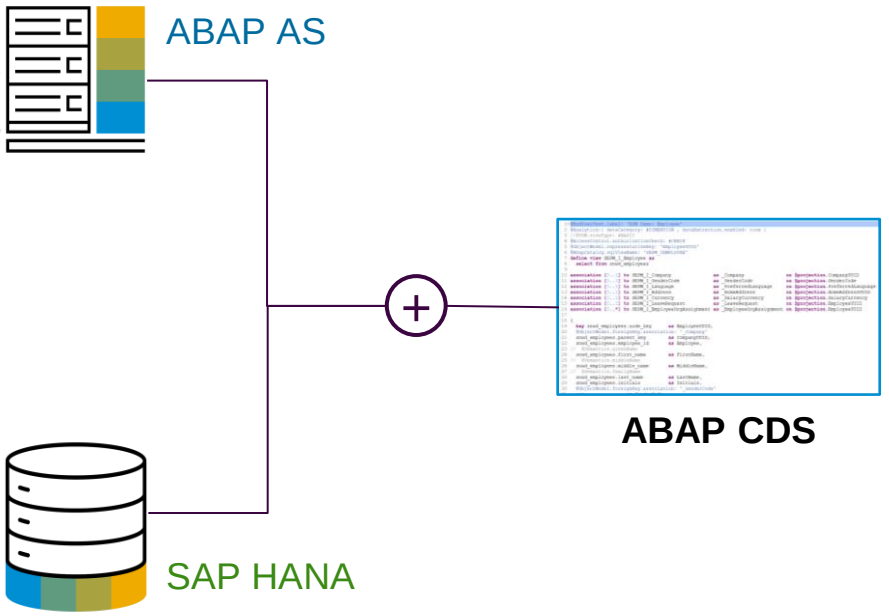
ABAP type system

VIEW BUILDING
Specialized views (analytical views, attribute views, calculated views, …)

LIFECYCLE MANAGEMENT

Non ABAP lifecycle management e.g. transports

Non ABAP type system



VIEW BUILDING

Advanced data modelling leveraging DDIC semantics

Code pushdown with various built-in SQL functions and expressions

Code breakouts to utilize native SAP HANA features and capabilities via CDS Table Functions

LIFECYCLE MANAGEMENT

Proven and consistent **ABAP** lifecycle management e.g. transports

ABAP type system

Consumption in ABAP SQL and ABAP frameworks

Overview of ABAP CDS entity types[1]

CATEGORY	CDS ENTITY TYPE	ABAP CDS STATEMENT

Standard view building	CDS View Entity[2]
	CDS Projection View
	CDS DDIC-based View
		`DEFINE VIEW ENTITY`
		`DEFINE VIEW ENTITY AS PROJECTION`
		`DEFINE VIEW`

Transactional behaviour definition of business objects within the ABAP RESTful Application Programming Model (RAP)	CDS Behavior Definition CDS Behavior Projection	`DEFINE BEHAVIOR`

Modification-free extension	CDS Metadata Extension
	CDS View Extension
	CDS View Entity Extension
	CDS Abstract Entity Extension
		`ANNOTATE VIEW`
		`EXTEND VIEW`
		`EXTEND VIEW ENTITY`
		`EXTEND ABSTRACT ENTITY`

SAP HANA breakout	CDS Table Function CDS Hierarchy	`DEFINE TABLE FUNCTION` `DEFINE HIERARCHY`
External implementation	CDS Custom Entity CDS Abstract Entity	`DEFINE CUSTOM ENTITY` `DEFINE ABSTRACT ENTITY`
Access control	CDS Access Control	`DEFINE ROLE`

[1] State of Q1 2022 [2] Successor of CDS DDIC-based view

ABAP CDS view entity – Example

View annotations

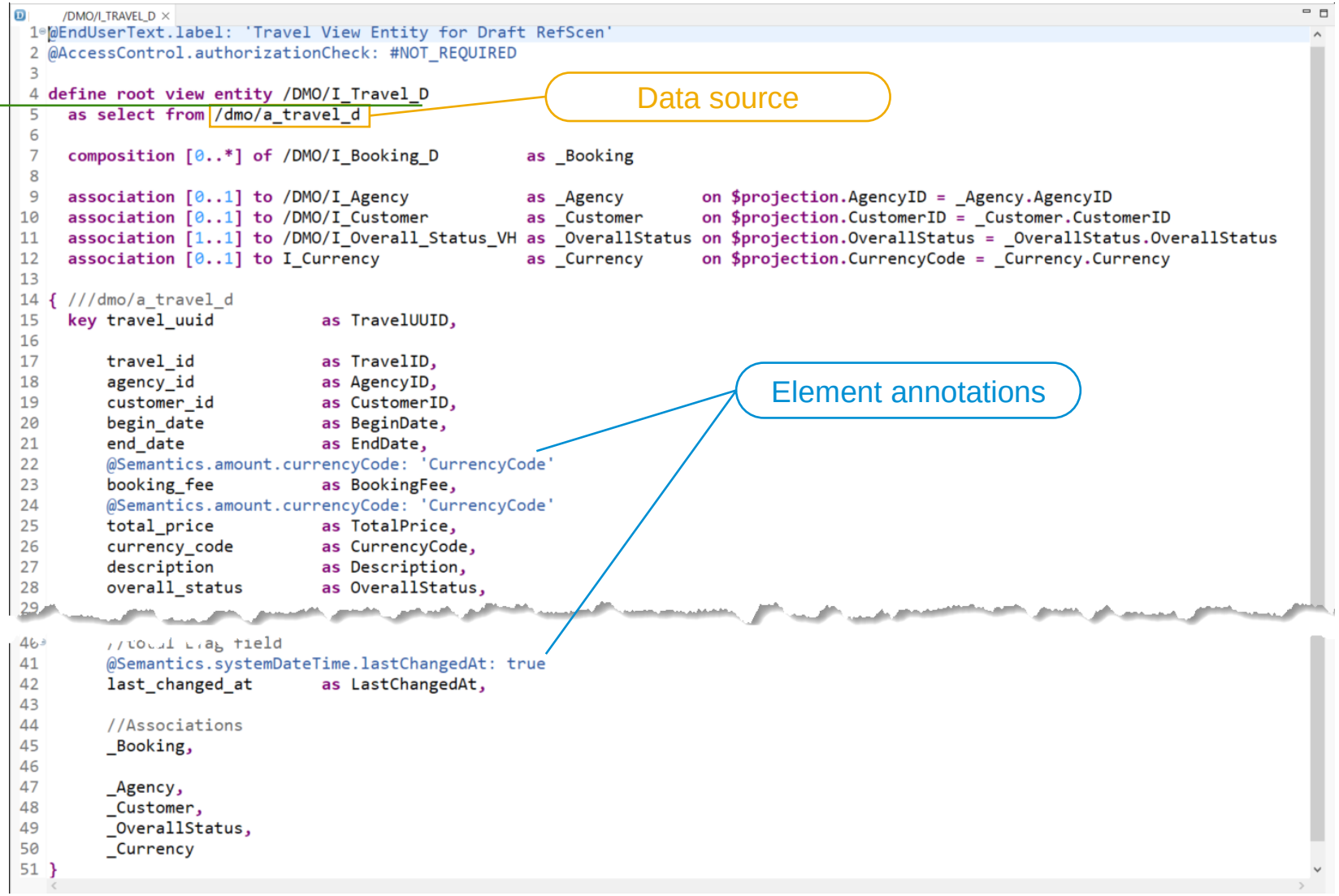
View definition

Associations

selection

Data source

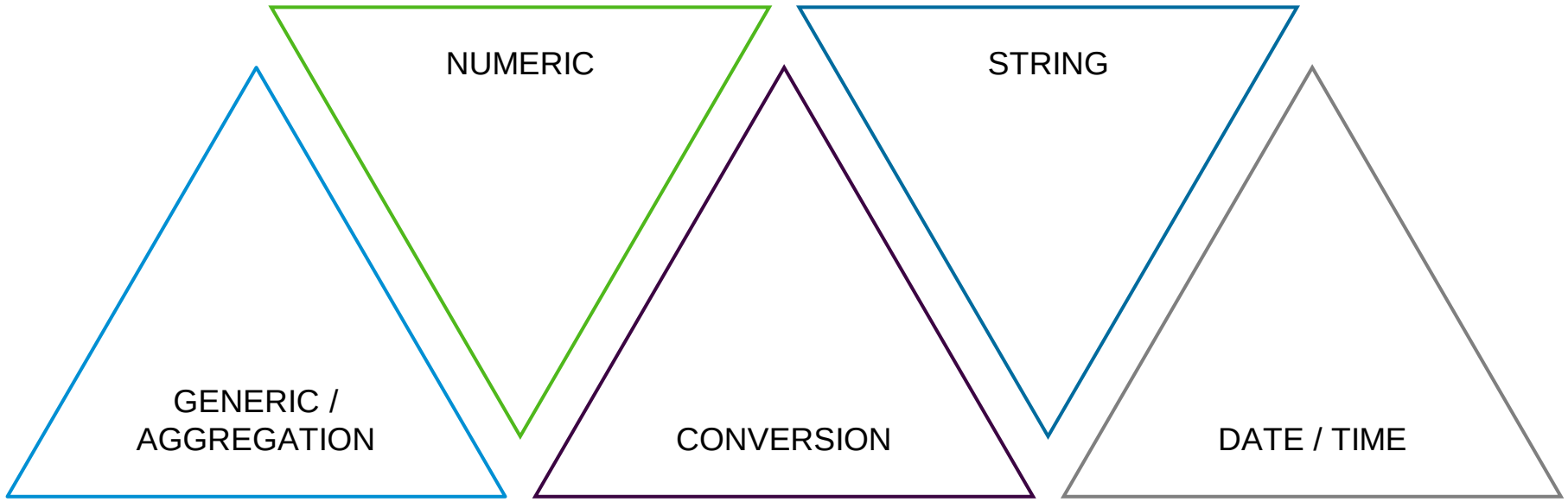
Element annotations



```
/DMO/I_TRAVEL_D
@EndUserText.label: 'Travel View Entity for Draft RefScen'
@AccessControl.authorizationCheck: #NOT_REQUIRED

define root view entity /DMO/I_Travel_D
  as select from /dmo/a_travel_d

  composition [0..*] of /DMO/I_Booking_D        as _Booking

  association [0..1] to /DMO/I_Agency           as _Agency        on $projection.AgencyID = _Agency.AgencyID
  association [0..1] to /DMO/I_Customer         as _Customer      on $projection.CustomerID = _Customer.CustomerID
  association [1..1] to /DMO/I_Overall_Status_VH as _OverallStatus on $projection.OverallStatus = _OverallStatus.OverallStatus
  association [0..1] to I_Currency              as _Currency      on $projection.CurrencyCode = _Currency.Currency

{ ///dmo/a_travel_d
  key travel_uuid           as TravelUUID,

      travel_id             as TravelID,
      agency_id             as AgencyID,
      customer_id           as CustomerID,
      begin_date            as BeginDate,
      end_date              as EndDate,
      @Semantics.amount.currencyCode: 'CurrencyCode'
      booking_fee           as BookingFee,
      @Semantics.amount.currencyCode: 'CurrencyCode'
      total_price           as TotalPrice,
      currency_code         as CurrencyCode,
      description           as Description,
      overall_status        as OverallStatus,
      //total etag field
      @Semantics.systemDateTime.lastChangedAt: true
      last_changed_at       as LastChangedAt,

      //Associations
      _Booking,

      _Agency,
      _Customer,
      _OverallStatus,
      _Currency
}
```

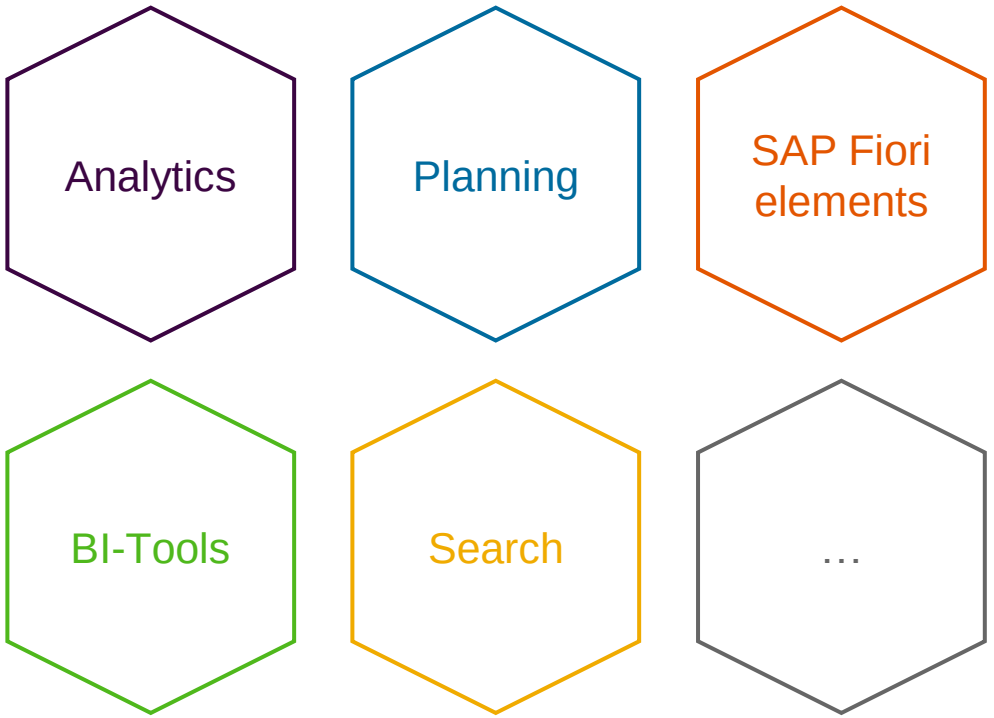
ABAP Flight Reference Scenario -
Example available in package /DMO/FLIGHT_DRAFT

Built-in SQL functions and expressions



CDS annotations for domain-specific frameworks

CDS ANNOTATION DOMAINS



Enrich meta model with consumer-specific vocabularies

Reusable and unified view model for all use cases

Enabling flexible usage in different contexts

Separation of concern using CDS metadata extensions for UI-specific annotations

Vital part of new ABAP programming models

CDS associations

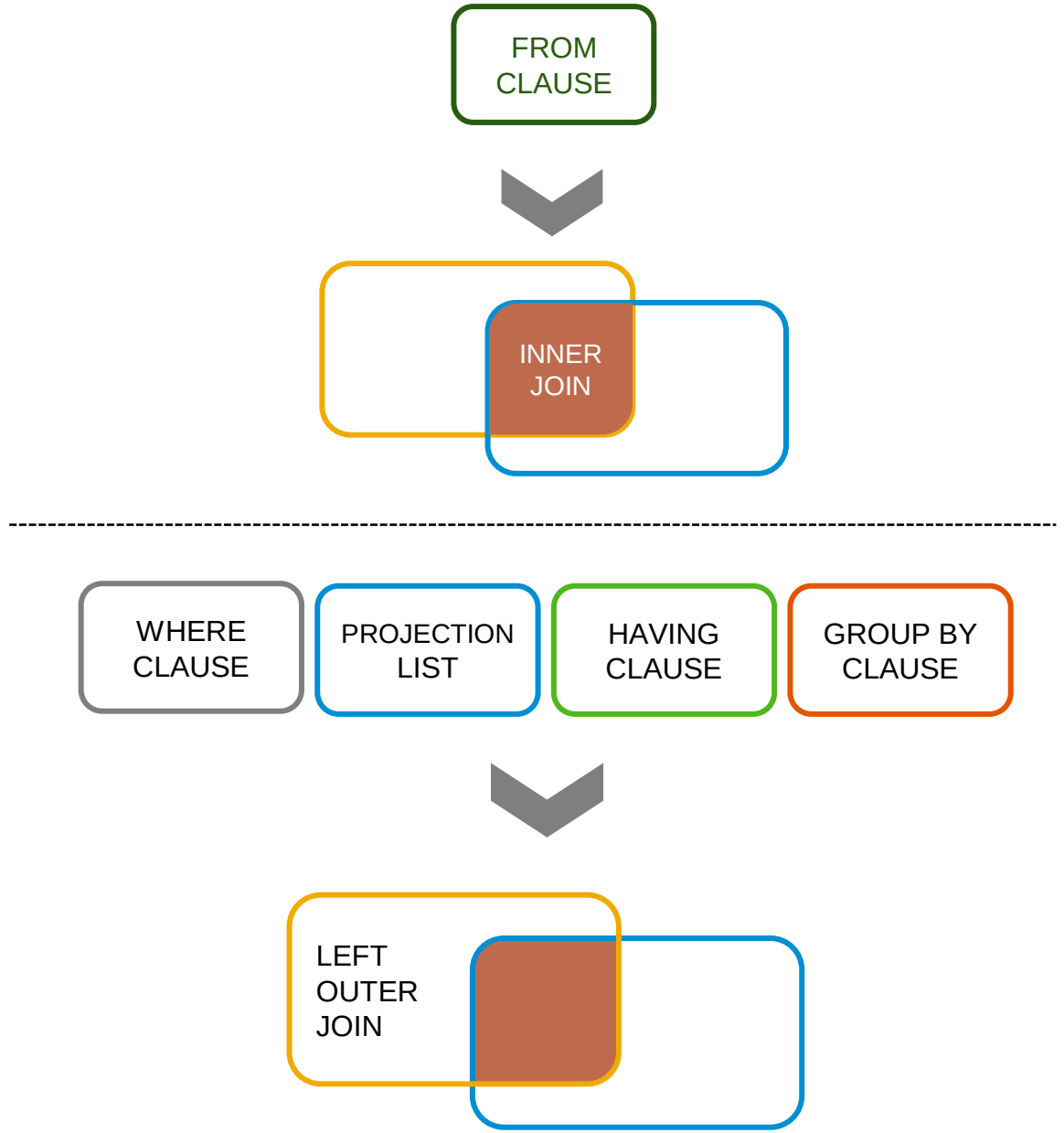
Capturing the relationships between entities in the data model

Used associations are implicitly translated into SQL joins

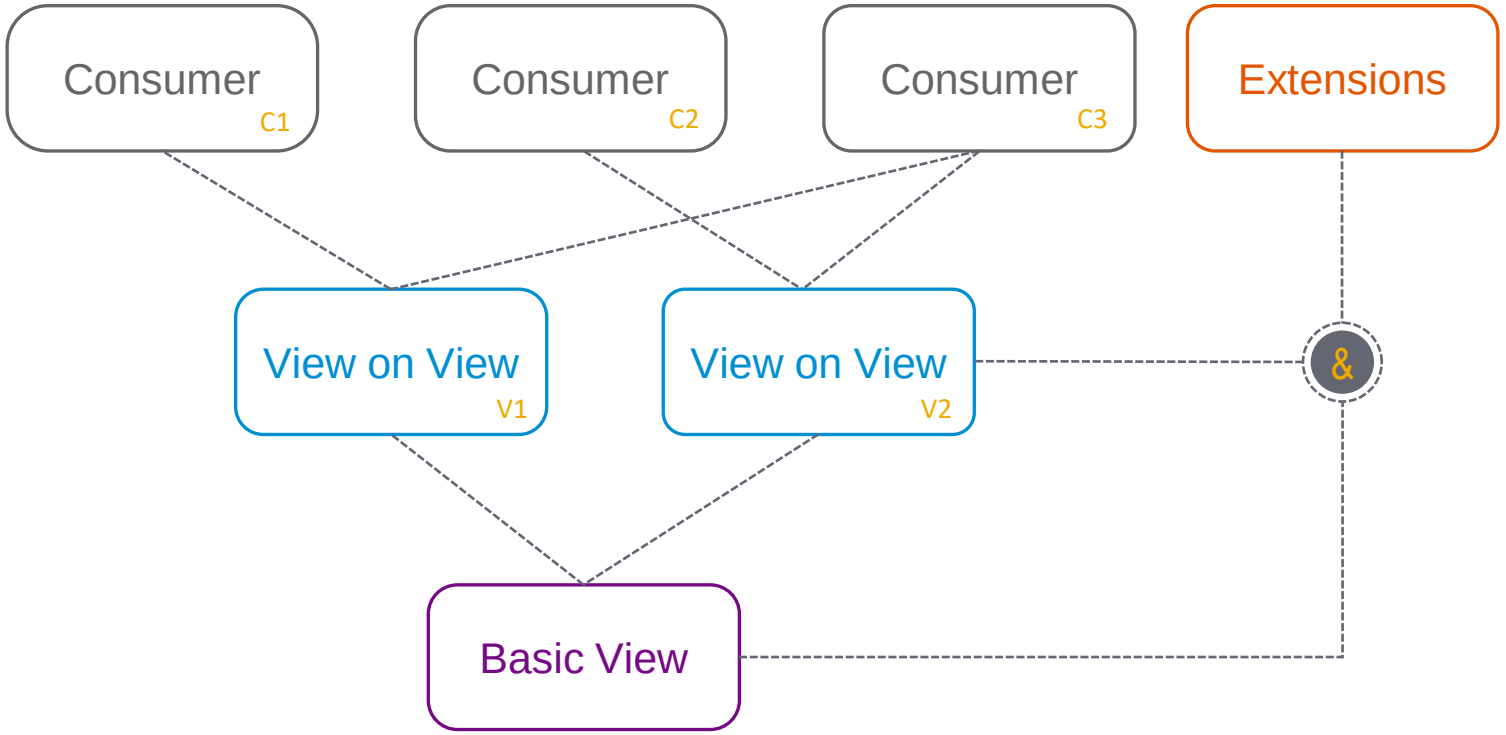
Reuse of generated joins when semantically identical

Can be queried in CDS views and Open SQL

- Navigate thru entity using path expressions



Nested CDS views and extensibility



Hierarchical view-on-view concept

Optimized result sets with minimum data transfer

Modification-free append of additional columns, arithmetic expressions or literals to result set

CDS hierarchies – Build hierarchies on SAP HANA

CDS Hierarchy defines a CDS entity as a hierarchy in the CDS DDL

A CDS hierarchy has a tabular results set whose rows construct parent-child relationships from hierarchical data sets

A CDS hierarchy can be accessed as the data source of an ABAP SQL query, and it is handled like a hierarchy in which additional hierarchy columns can be selected

```
define view CDS_SOURCE_VIEW
  as select from hierarchy_table_sp
  association [1..*] to CDS_SOURCE_VIEW as _Parent
//child to parent association (Mandatory)
  on  $projection.manager = _Parent.employee
 {
   key employee,
   key  manager,


 _Parent // Make association public


}
```

CDS source view

Self association

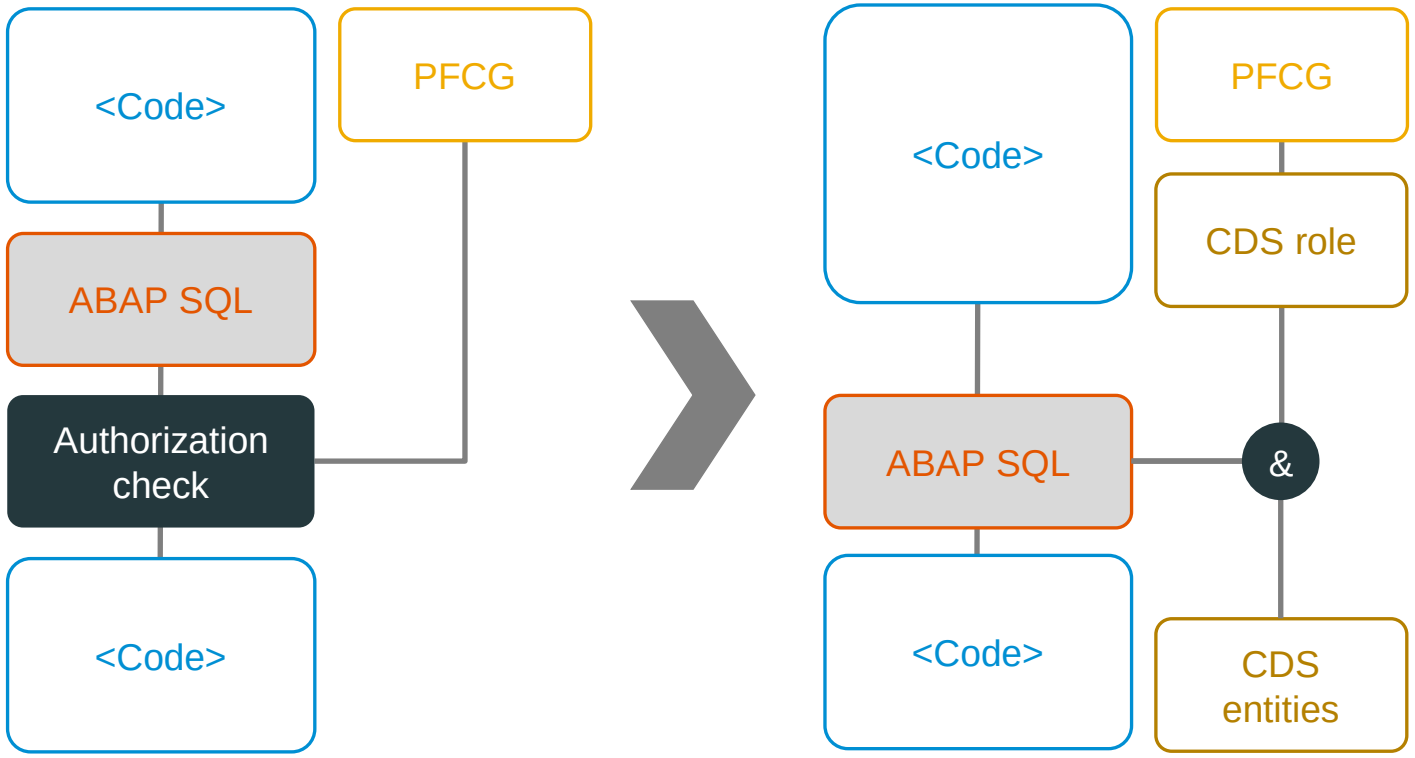
```
define hierarchy CDS_HIERARCHY
  as parent child hierarchy(
    source CDS_SOURCE_VIEW
   child to parent association _Parent
    start where
      SOURCE_CDS_VIEW.cost_center = 100
    siblings order by
      SOURCE_CDS_VIEW.employee
    multiple parents not allowed
  )
{
   key employee,
   key manager,
  _Parent
}
```

ABAP CDS hierarchy

CDS source view

Filter results

Declarative access control with CDS roles



Declarative instead of coded approach

- Using CDS Data Control Language (DCL)
- Explicitly defined for each CDS entity
- Based on PFCG conditions, literal conditions, user conditions, and inheritance conditions

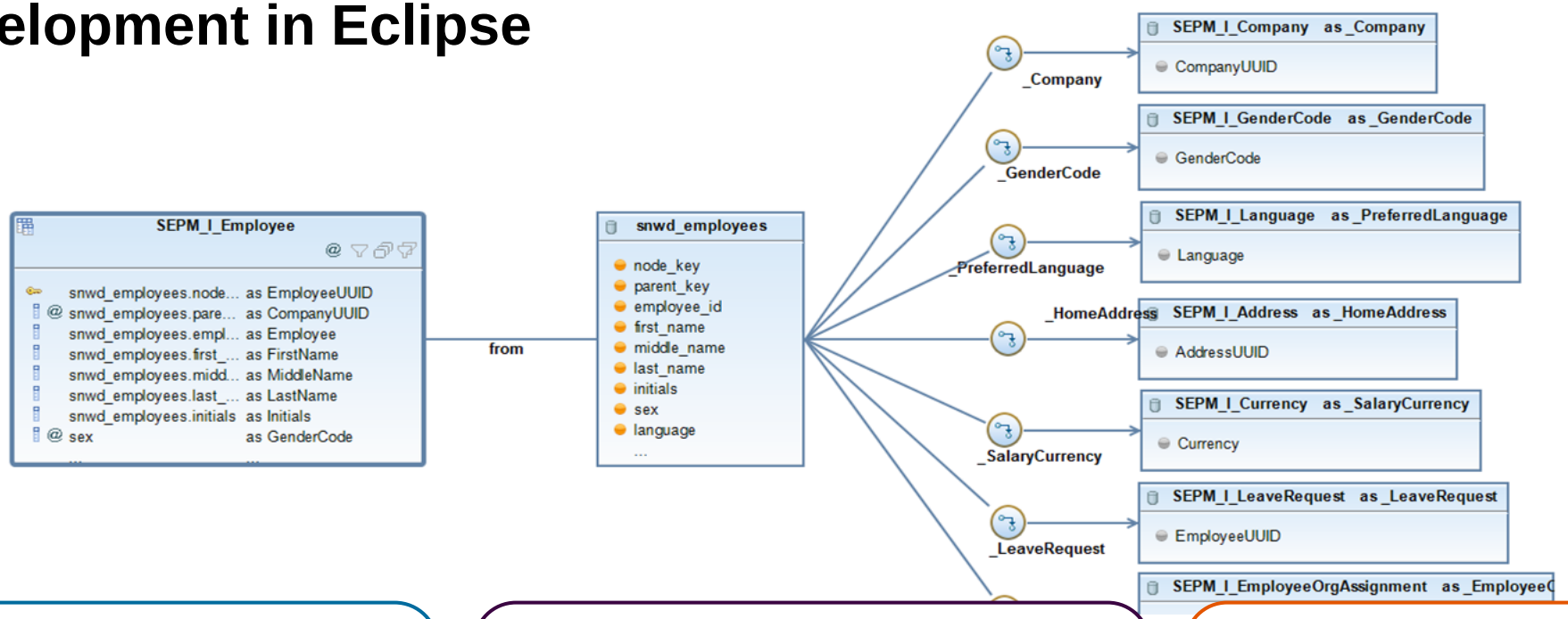
Defined once and automatically used everywhere

Authorizations pushed down to the database

Classical approach

Declarative approach

CDS development in Eclipse



01

Eclipse-based CDS Tooling

Source-based editor

Part of ABAP Development tools

02

Development support

Syntax check

Code completion

Syntax highlighting, pretty printing

Element info and navigation

Quick fixes

03

Supportability

Enhanced data preview

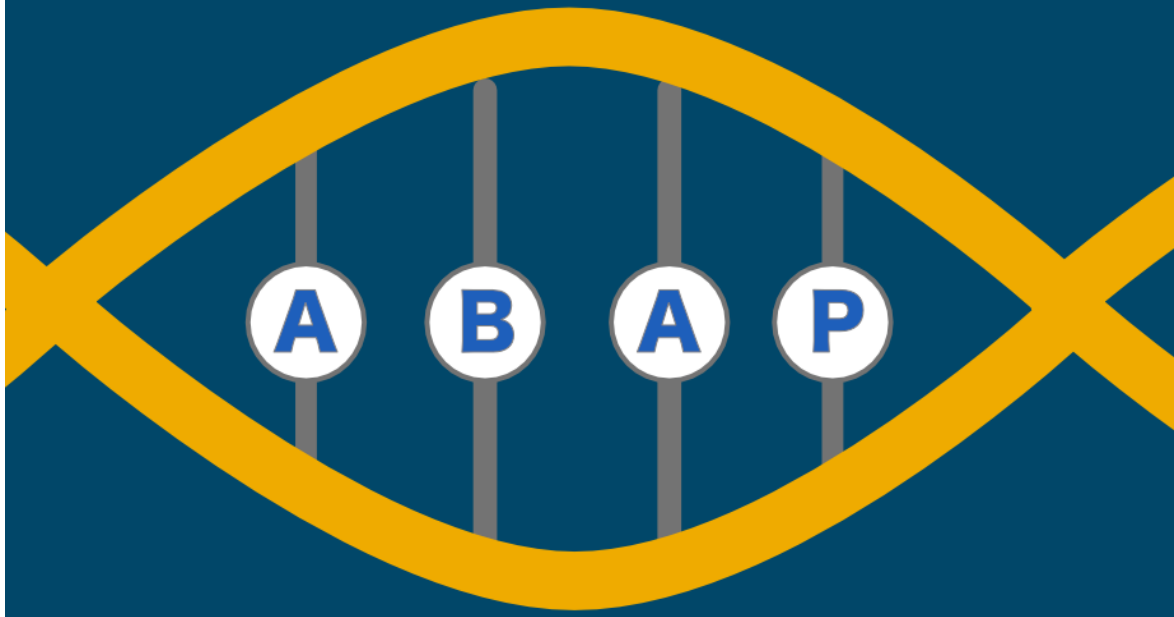
Dependency analyser

Activation graph / Dictionary log

Active annotations view

Unit testing

SAP HANA Breakouts



Why code breakouts for SAP HANA make sense …

UNLEASH THE FULL POTENTIAL OF YOUR SAP HANA DATABASE

Some scenarios require selective measures

Highest performance requirements e.g. with complex calculations

Use of database / analytical engine specific functions required

ABAP SQL and plain CDS views are not sufficient to solve problem efficiently

RESTRICTIONS

Database-specific

SAP HANA only

No automatic fallback for anyDB

ABAP managed database procedures (AMDP) for SAP HANA

UTILIZE NATIVE SAP HANA ENTITIES

Stored procedures, database functions and scalar functions supported

Expression of complex logic

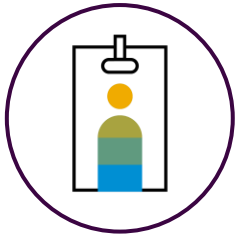
Parameterized requests and multiple result sets

INTEGRATED IN THE ABAP INFRASTRUCTURE

Development, runtime error analysis, enhancement, transport

SAP HANA SQLScript coding embedded in ABAP classes

Seamless integration into CDS via CDS table functions



EASY ACCESS TO SAP HANA ADVANCED ENGINES / LIBRARIES

Like predictive analysis, financials, text mining, calculation engine

CDS table functions – Seamless AMDP integration into CDS

CDS table function definition

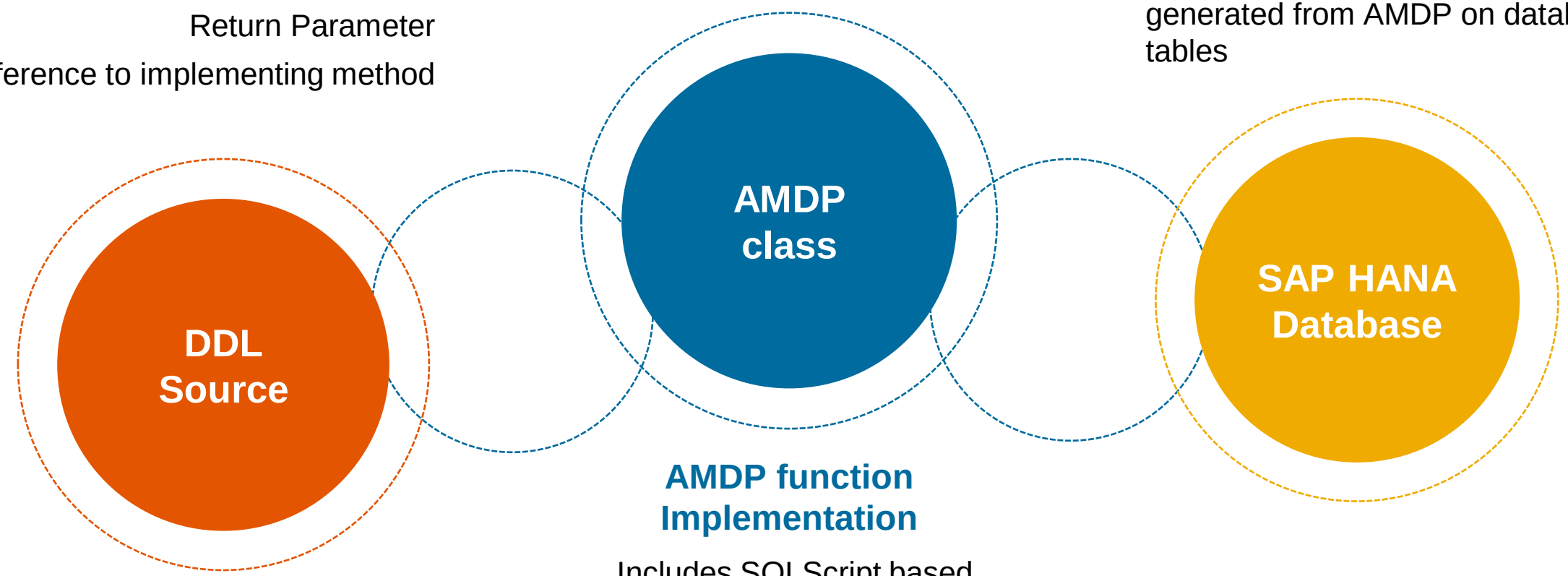
Parameter list

Return Parameter

Reference to implementing method

Runtime for table function

Runs stored SQLScript procedure generated from AMDP on database tables



AMDP function Implementation

Includes SQLScript based database function body

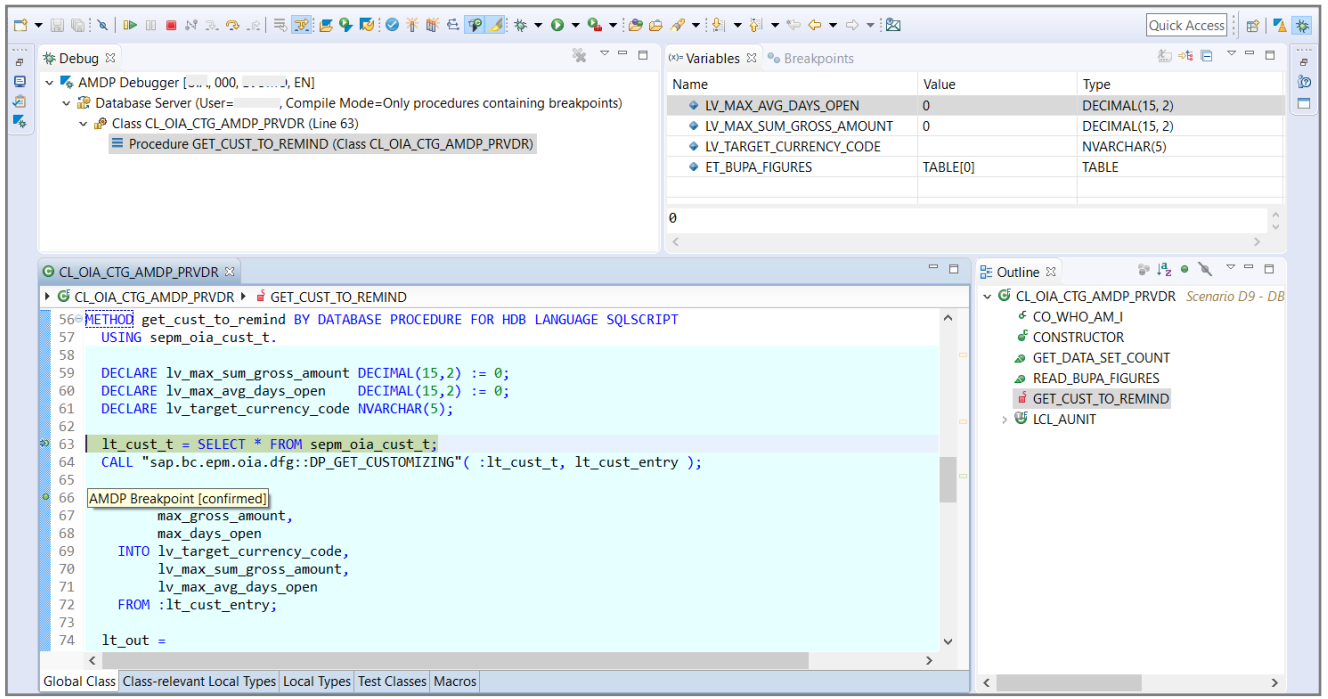
AMDP development in Eclipse

DEVELOPMENT

Eclipse-based source code editor
SQLScript syntax highlighting
Static syntax check
Error handling via class-based exceptions
Modification-free extension via AMDP BAdIs

SUPPORTABILITY

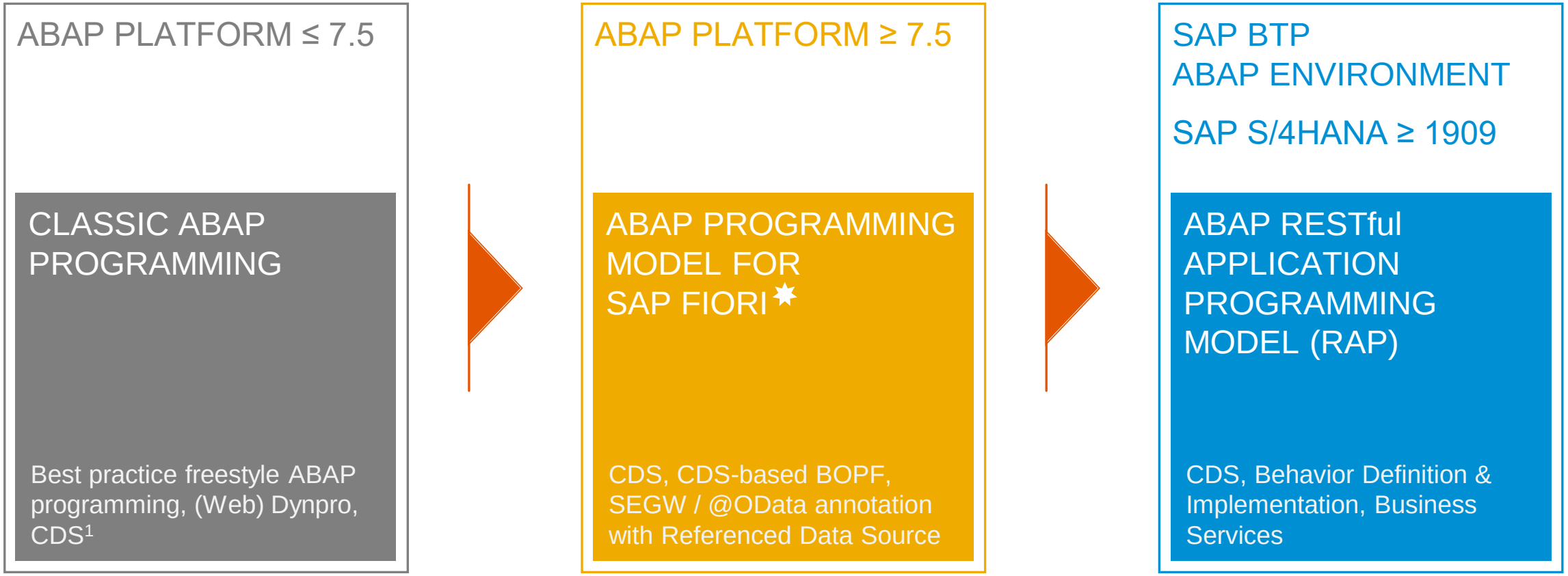
Autonomous AMDP debugger in ADT
Detailed runtime errors integrated in ST22 dumps



CORE DATA SERVICES IN ABAP APPLICATION PROGRAMMING

Evolution of the ABAP programming model

CDS as vital part of SAP S/4HANA and SAP BTP ABAP Environment



[1] starting with release 7.4 SPS05

Safe investments!

CDS in the ABAP RESTful Application Programming Model (RAP)

CONSUMPTION

DATA INTEGRATION
Consume SQL based services

WEB APIs
Consume OData based services

SAP FIORI UIs
Consume OData based UI services

SAP ANALYTICS CLOUD
Consume InA based UI services for live data access

BUSINESS SERVICE PROVISIONING

SERVICE BINDING – Bind to protocol version and scenario

SERVICE DEFINITION – Define scope to be exposed

BUSINESS OBJECT PROJECTION

CDS: BO projection views


BDEF: Behavior projection


ABAP: Behavior implementation

ANALYTICAL PROJECTION

CDS: Analytical projection views

DATA MODELING & BEHAVIOR

CDS ENTITIES

CDS: Data modeling

BUSINESS OBJECTS

CDS: Data modeling


BDEF: Behavior definition

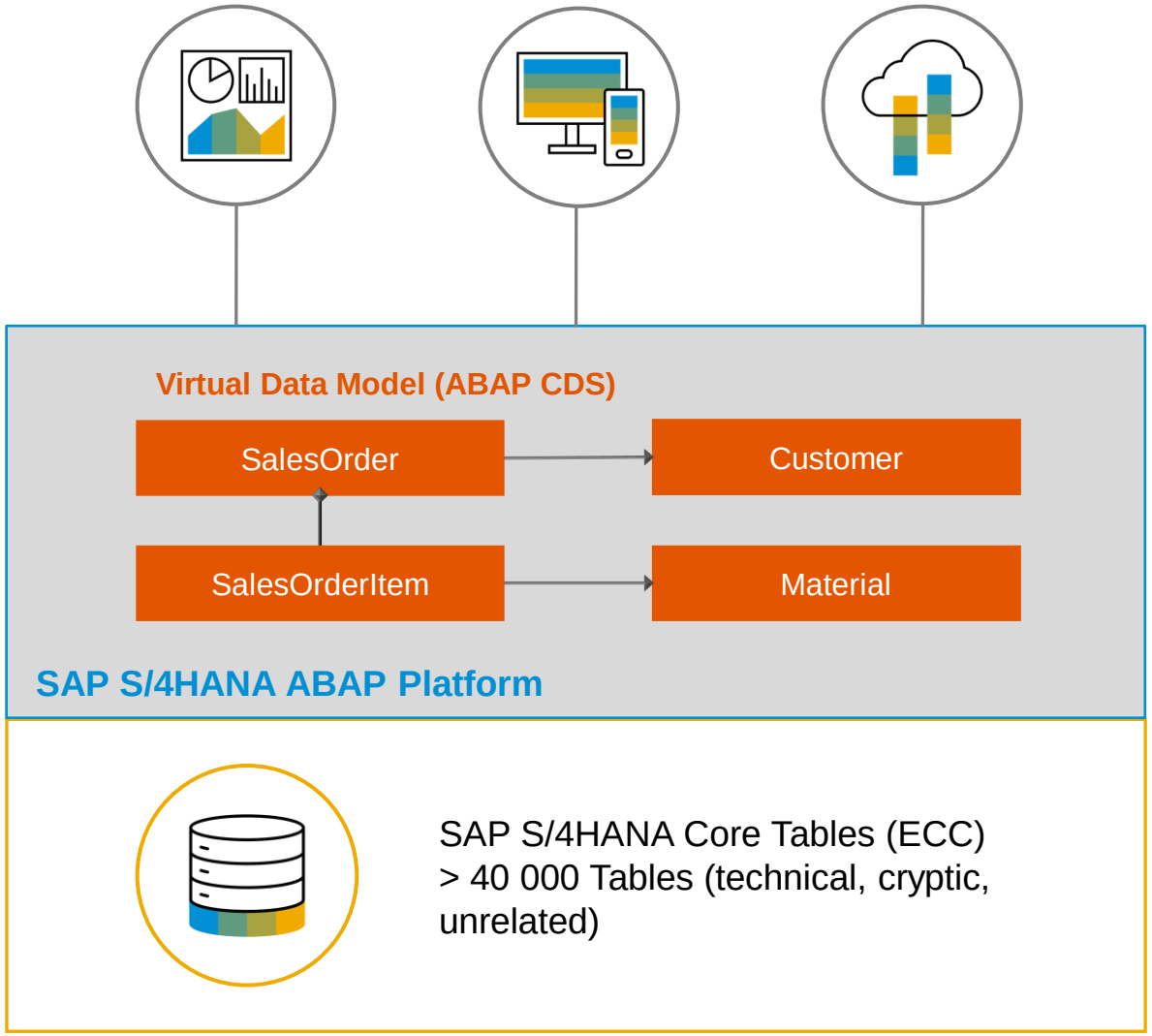

ABAP: Behavior implementation

ANALYTICAL MODEL

CDS: Analytical cubes


CDS: Analytical dimensions

Virtual Data Model (VDM) for application data in SAP S/4HANA



VDM is a set of views on SAP S/4HANA application data

- Business-oriented
- Understandable & semantically rich
- Reusable & stable
- Executed on SAP HANA
- Implemented as ABAP CDS views

VDM is the data model and source for all types of apps

- Transactional
- Analytical
- External interfaces

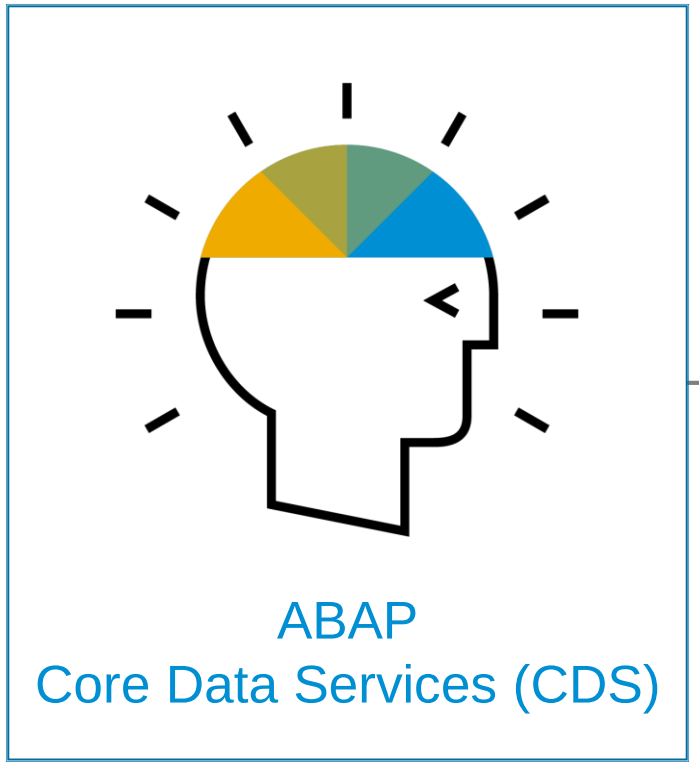
Customers and partners can develop on released VDM views

CDS in SAP S/4HANA – Recommendations

- When implementing your own CDS views, follow the SAP S/4HANA's Virtual Data Model (VDM) implementation pattern for best reuse and interoperability
- Clarify your data model before starting your implementation
- Start with the implementation of basic interface views
  Adapt names and add semantical information already on this level

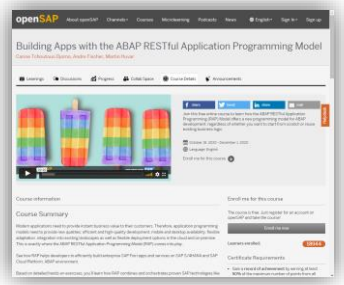
SUMMARY

Key takeaways



- Code pushdown is the ABAP programming paradigm on SAP HANA
- CDS offers advanced capabilities to fully leverage SAP HANA's power in ABAP applications
- CDS is the next generation data modelling infrastructure on the ABAP platform
- CDS is the cornerstone of the ABAP RESTful Application Programming Model (RAP)
- CDS plays a vital role in SAP BTP ABAP environment and SAP S/4HANA on-premise as well as in the cloud
- Further enhancements and optimizations will be delivered with future ABAP platform releases

FREE openSAP COURSE



Building Apps with the ABAP RESTful Application Programming Model (RAP)

Self-paced mode

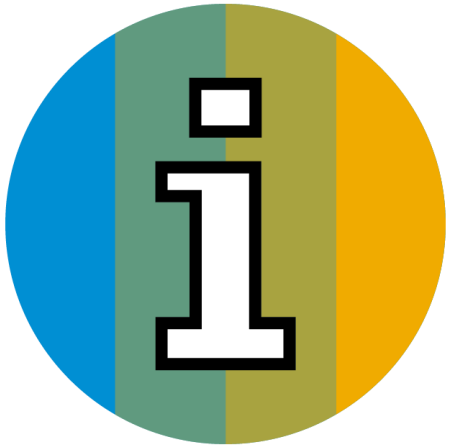
Week 1: Introduction
Week 2: Developing a Read-Only List Report App
Week 3: Enabling the Transactional Behavior of an App
Week 4: Dealing with Existing Code
Week 5: Service Consumption and Web APIs
Week 6: Final Exam

ENROLL NOW!
https://open.sap.com/courses/cp13

Further information

SAP Community

- ABAP Development Community
- Landing pages: ABAP Platform 2021 | ABAP Platform 2020 | ABAP Platform 1909 | ABAP Platform 1809 | AS ABAP 7.52 | AS ABAP 7.51 | AS ABAP 7.50
- Getting started with ABAP development for SAP HANA
- Getting started with ABAP Core Data Services (CDS)
- Getting started with the ABAP RESTful Application Programming Model (RAP)
- Developer center: https://www.sap.com/developer/topics/abap-platform.html



SAP Help Portal

- ABAP Platform 2021 | ABAP CDS Developer Guide | ABAP Keyword Documentation

SAP training and certification opportunities

- www.sap.com/education – e.g. S4H430, HA400

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