





Reading Sample

This sample chapter helps you understand cloud, on-premise, and hybrid operating models and introduces the deployment options within the SAP S/4HANA product family. It describes the differences between the various models so that you can make a fact-based decision for the best deployment model. Because you need to consider adaptability to your own operational specifics when planning the migration to SAP S/4HANA, you will also learn about the available adaption and enhancement options.

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Migrating to SAP S/4HANA

Operating Models, Migration Scenarios, Tools, and Implementation

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Chapter 3

Cloud, On-Premise, and Hybrid Scenarios

You can use SAP S/4HANA in various cloud-based and on-premise editions. This chapter discusses the differences between these operating models, as well as the differences between the individual SAP S/4HANA editions.

When migrating to SAP S/4HANA, you'll have to make some basic decisions. You'll have to select the type of system landscape, decide which SAP S/4HANA functions you want, and choose how they are supposed to be used (see Figure 3.1). First, you'll need to choose whether you want to run SAP S/4HANA *on-premise* (i.e., the software is utilized on your enterprise's hardware), in the *cloud* (i.e., the software is leased and hosted by a provider), or as a *hybrid scenario* (i.e., some parts of the business scenarios are outsourced to the cloud while other parts are kept on-premise). Furthermore, you'll have to decide whether you want to leverage the migration process to redesign your own business processes (*greenfield approach*) or whether to keep existing business processes (*brownfield approach*).

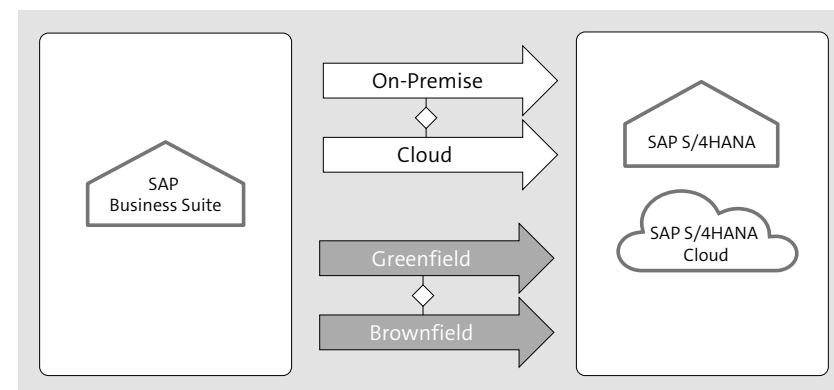


Figure 3.1 Strategic Decisions for Migrating to SAP S/4HANA

This chapter covers the basic options for and differences between the various operating models and provides you with the basic information required to make these necessary decisions. First, we'll provide an overview

of the operating models and define critical concepts. Then, we'll introduce and compare the individual editions of the SAP S/4HANA product family.

Usually, an enterprise wants to customize its business processes. In addition to business configuration settings, individual enhancement options can be an essential way for an enterprise to differentiate itself from competitors. The last section of this chapter describes in detail SAP S/4HANA's enhancement concepts.

3.1 Overview of Operating Models

To enable you to choose an SAP S/4HANA operating model, the following section describes the basic characteristics of the different operating models. Later, Section 3.3 compares the operating models.

3.1.1 On-Premise Operating Model

Full control of hardware and software

Usually, the on-premise operating model refers to using software that a customer has purchased and then runs and manages on hardware it owns. As a result, the company is in full control of the hardware and software, of mission-critical application data, and of software maintenance schedules. This means that a customer using an on-premise system can decide whether to update the software or not. In the *Product Availability Matrix* (PAM), you can see when SAP's maintenance for this product ends. Moreover, the company achieves maximum flexibility with regard to custom enhancements and integration with other systems (in-house solutions or external systems). Depending on the product, this may involve modifications, although the complete responsibility lies with the company. If the company has decided on a modification, the company is also responsible for maintaining the functionality or scheduling necessary adjustments in case of updates. In addition, the company is also fully responsible for the availability of the software as well as access, security, and system stability. In addition to the costs for hardware and software, powerful and complex ERP systems incur further costs for the IT experts needed to introduce, manage, and maintain the software.

3.1.2 Cloud Operating Model

Leasing software and services

In cloud operating models, the customer doesn't operate or manage the software, but rather it engages a service provider for this purpose. The software and the corresponding services are leased for a defined period of time in the cloud operating model. Hardware and operating system software aren't required on-premise. The enterprise's IT staff can thus focus on other tasks.

Internet access is usually necessary to access the solution, and users can access the cloud software from anywhere and in most cases also via mobile end devices. One of the major benefits of the cloud operating model is the associated cost transparency. The infrastructure of cloud-based software is usually shared by multiple companies.

However, to ensure efficient operation, individual companies can only impact the maintenance cycles and schedules of the cloud software to a limited extent. Thus, usually the customization options in the cloud operating model are more limited than in the on-premise operating model. Another issue that needs to be analyzed specifically in each case is data security (*cloud security*). In general, the data security standards and processes of trustworthy cloud providers are higher or more extensive than the security infrastructure of the average enterprise.

How to evaluate the cloud operating model, however, also significantly depends on the service and deployment models used. Figure 3.2 provides an overview of these service and deployment models, which are based on the definitions from the National Institute of Standards and Technology (NIST, www.nist.gov).

Limited scope for intervention

Service and deployment models

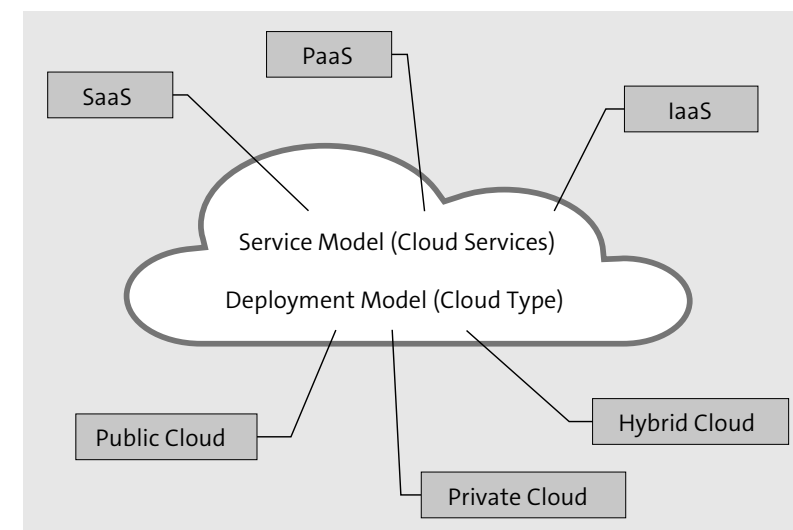


Figure 3.2 Service and Deployment Models in the Cloud

For service models, the following three categories are differentiated:

Service models

■ Software as a service (SaaS)

In the SaaS model, companies use the applications of a provider, which are operated on a cloud infrastructure. Typically, companies access these applications via the internet using a web browser. In the SaaS model, the provider is responsible for managing and controlling the cloud infrastructure.

Companies don't have any functions for managing or controlling the software that go beyond user-specific configuration settings.

In addition to SAP S/4HANA Cloud, the following SAP solutions also fall into this category: SAP SuccessFactors, SAP Cloud for Customer, SAP Ariba, SAP Concur, and SAP Fieldglass.

- **Platform as a service (PaaS)**

In the PaaS model, application developers are provided with programming languages and tools as a service. As in the SaaS model, the provider is responsible for managing and controlling the underlying cloud infrastructure. The companies manage their applications, which they have built on the basis of the development environment provided. One representative of this model is SAP Business Technology Platform (SAP BTP; Section 3.5). In this model, the companies have control over the schedule and maintenance of their own application, but not over the tools and services used by this application.

- **Infrastructure as a Service (IaaS)**

In the IaaS model, a service provides users with access to computing power, data storage, and network capacity. The companies control the applications and operating systems used and usually also install them. Nevertheless, the provider is again responsible for controlling and managing the cloud infrastructure. Examples include hyperscalers such as Amazon Web Services (AWS), Google Cloud Services (GCS), and Microsoft Azure.

Deployment models For the *cloud deployment models*, we differentiate between three types:

- **Public cloud**

In the case of public clouds, services and applications are publicly available and can generally be used by everyone. Usually, users share the resources of the cloud infrastructure, which is provided by a provider. SAP S/4HANA Cloud, public edition, belongs to this category.

- **Private cloud**

In a private cloud, the cloud infrastructure is deployed for specific companies or only one company. The cloud infrastructure can be deployed internally or by an external provider. The same applies to operating a private cloud. The transition should take into account how flexible and scalable you need the IT infrastructure to be, how business applications will be accessed via the internet, or how regularly programs should be updated automatically. SAP S/4HANA Cloud, private edition, is in this category.

- **Hybrid cloud**

A combination of public cloud and private cloud is referred to as a hybrid cloud. In this case, part of the IT infrastructure is operated on-premise, while other services are provided by an external public cloud provider.

3.1.3 Hybrid Operating Model

In hybrid operating models, some parts of the business scenario are operated on-premise, and some parts are operated in the cloud. Hybrid operating models enable you to combine the characteristics of the on-premise operating model and the cloud operating model. For example, core areas of your enterprise, where you want a high degree of control and a high level of flexibility, can be operated on-premise, while other enterprise areas can be operated in the cloud because common industry standards are sufficient.

Hybrid Structures in Human Resources

An example of an enterprise area in which business processes are largely outsourced to the cloud is human resources (HR). SAP sees the target architecture for HR business processes in the cloud. With the SAP SuccessFactors solution portfolio, SAP enables HR departments to outsource to the cloud functions such as workforce administration or managing job candidates and applications, employee performance, and talent.

Hybrid scenarios can also be advantageous due to a company's organizational structure. For example, you might want to run global business processes at headquarters on-premise, while the regional business processes at your subsidiaries can be standardized and outsourced to the cloud.

With regard to technology and content, a combination of on-premise processing and cloud-based processing poses specific requirements for integrating the various solutions used, as outlined in Figure 3.3.

Integration requirements

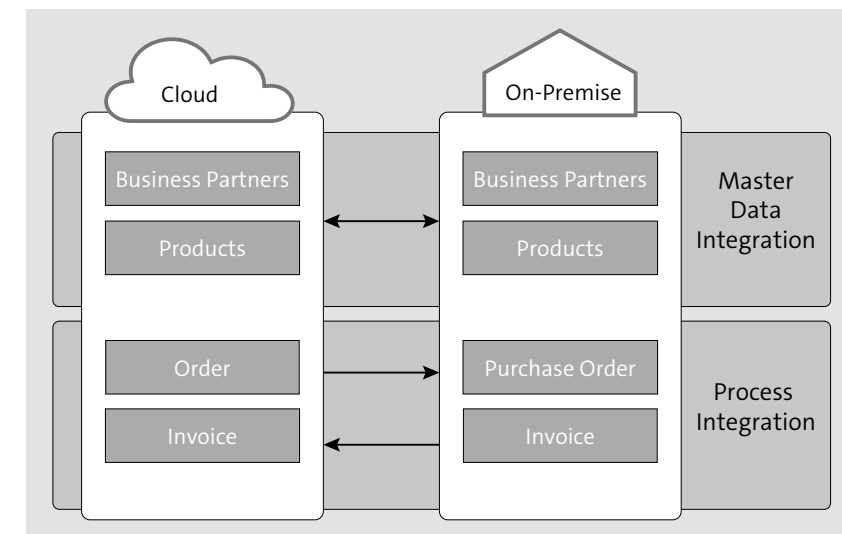


Figure 3.3 Integration in Hybrid Scenarios

Therefore, when choosing an operating model, you should consider your specific requirements regarding master data and process integration.

3.2 The SAP S/4HANA Product Family

With SAP HANA and the associated opportunities in business processes and the possibilities to significantly simplify the data model, SAP launched SAP S/4HANA as a new product on February 3, 2015. It was the beginning of a new product family. In the following year, 2016, SAP launched the SAP S/4HANA Cloud operating model. SAP S/4HANA is available in three operating models—on-premise, public cloud, and private cloud—each with a different solution scope.

When migrating, the decision to use one of the SAP S/4HANA operating models is not only a technical one (cloud or on-premise) but also one based on which functional scope is required. As described in Section 3.1, on-premise SAP S/4HANA also enables enhancement methods that aren't offered in SAP S/4HANA Cloud.

In this section, we'll first present the operating models themselves in detail. For a comprehensive comparison, see Section 3.3.

3.2.1 SAP S/4HANA

In the on-premise edition of SAP S/4HANA, the company has the most options for implementing business processes but is responsible for the landscape and implementation. SAP S/4HANA supports processes in 64 countries or regions in 39 languages in 31 industries. The areas of SAP S/4HANA include the following:

- Asset management
- Human resources
- Procurement
- Sales
- Supply chain
- Finance
- Production
- R&D/engineering
- Service

Operation and maintenance

The company is independently responsible for the purchase of the hardware and for the installation and administration of the software. In on-premise SAP S/4HANA, you can define the landscape for the implementation yourself. The

classic approach here is a development system with a client for various extensions, a test system, and a production system. The definition and creation of clients are the responsibility of the company. SAP Activate provides a detailed description for new implementations or system conversions and migrations with selective data.

More Information about the Areas of SAP S/4HANA

For details on the areas of SAP S/4HANA, see the SAP S/4HANA Help Portal at <http://s-prs.co/v581610> and a series of reference books from SAP PRESS, as follows:

- *SAP S/4HANA: An Introduction*, www.sap-press.com/5232/
- *SAP S/4HANA Finance: An Introduction*, www.sap-press.com/5606
- *Controlling with SAP S/4HANA: Business User Guide*, www.sap-press.com/5282
- *Group Reporting with SAP S/4HANA*, www.sap-press.com/5151
- *Materials Management with SAP S/4HANA: Business Processes and Configuration*, www.sap-press.com/5132

Maintenance tasks also include the import of corrections and updates (upgrades). Companies can decide for themselves when and if they want to use them at all. You can find the runtime of SAP maintenance in the PAM (see also SAP Note 1648480). For example, Enhancement Pack 1 (EHP 1) for SAP ERP 6.0 is only in mainstream maintenance until the end of 2025. All corrections will then also be the responsibility of the company.

System updates (upgrades) will be provided by SAP every two years in the future. You'll find the respective new version as a new entry in the PAM.

Upgrades

New Maintenance Strategy for SAP S/4HANA

The new maintenance strategy can be found as a press release at <http://s-prs.co/v581611>.

During the two-year upgrade cycle, SAP delivers Feature Pack Stacks (FPS) during the year. These are updates, but they are only *updates* and not *upgrades*.

For using classic solutions in SAP S/4HANA, the on-premise version will continue to offer compatibility packages for a while. The purpose of these compatibility packages is to ease the transition from SAP ERP 6.0 with EHPs to the SAP S/4HANA product family. The packages make it possible to migrate to on-premise SAP S/4HANA in the first step without converting the business processes, and only in a downstream second step to convert the business processes to new intelligent processes from on-premise SAP S/4HANA.

Compatibility packages

Compatibility packages provide functions with the traditional design you're familiar with from SAP ERP—functions, for example, for human capital management (SAP ERP HCM), for warehouse management (Warehouse Management), or for transport management (Transportation [LE-TRA]). However, these functions aren't the target architectures from the technological perspective. For example, the target architecture for human capital management is SAP SuccessFactors; for warehouse management, SAP Extended Warehouse Management (SAP EWM); and for transport management, SAP Transportation Management (SAP TM). The functions of the compatibility packages are available until the end of 2025, with the exception of Customer Service (CS), Transportation (LE-TRA), and Process Industry (PP-PI), which you can use longer. SAP Note 2269324 provides more detailed information.

Note that some packages only partially cover the classic solution. You can find it in the appendix of SAP Note 2269324.

Compatibility packages aren't updated, instead these business processes are developed in an innovative way with intelligent technologies in the SAP S/4HANA family.

Gradual Migration to the Target Architecture

Fixed-term compatibility packages enable you to choose whether you want to migrate directly to the target architecture in these subareas or whether you'd rather continue using the traditional functions.

The useful life of the functions covered by the compatibility packages is restricted. For most packages, it's possible to continue using these functions unchanged until the end of 2025. After 2025, the license for their usage in SAP S/4HANA will no longer be valid. For details and a listing of which packages are affected, see SAP Note 2269324 and its appendix.

More Information on On-Premise SAP S/4HANA Editions

For a complete list of the functions that are mapped as part of the compatibility packages, see the SAP S/4HANA Compatibility Scope Matrix in the appendix of SAP Note 2269324.

Partner add-ons There are a number of apps and add-ons from SAP and partners that are only available in the on-premise operating model. These add-ons allow you to customize the solution scope according to local and industry-specific requirements without having to develop extensions yourself. SAP has a very wide international network of partners offering local and global add-ons.

Some of these partner add-ons are certified by SAP. You can find them in the SAP Certified Solutions Directory, where you can search by product, country, and certification. That platform also provides an overview of the extensions as well as details about the certification.

More Information about the Partner Add-Ons

Certified partner apps and add-ons can be found in the SAP Certified Solutions Directory at <http://s-prs.co/v581612>.

In the on-premise edition of SAP S/4HANA, however, the company can also use noncertified add-ons, so you can also develop your own extensions.

SAP offers add-ons for numerous lines of business and industries. You'll find these in the portfolio descriptions for the respective line of business.

SAP also offers solution extensions in many lines of business industries. You can find more information on SAP's website at <http://s-prs.co/v581613>.

You can start the processes with preconfigurations from SAP and from partners. SAP and its partners offer solution packages for many business areas, industries, and countries or regions. Updating the packages isn't possible after the first use. SAP Activate offers a road map for on-premise SAP S/4HANA for implementation.

Add-ons

Solutions extensions

Preconfiguration

3.2.2 SAP S/4HANA Cloud, Public Edition

SAP S/4HANA Cloud, public edition, is one of the two cloud operating models in the SAP S/4HANA family. There are technical and business-related differences with SAP S/4HANA Cloud, private edition. In many areas and also in some chapters of this book (e.g., in Chapter 11), the public edition is referred to as SAP S/4HANA Cloud. SAP S/4HANA Cloud, public edition, supports processes in 48 countries or regions in 32 languages. The areas include the following:

- Asset management
- Procurement
- Sales
- Supply chain
- Finance
- Production
- R&D
- Service
- Industries: service industries and product industries

Operation and maintenance In SAP S/4HANA Cloud, public edition, the software is operated and maintained by SAP. It's a public cloud solution as described in Section 3.1.2. The systems are regularly updated (upgraded) by SAP on a quarterly basis (when the book was written). Corrections are imported by SAP as *hotfix collections* once every two weeks. You can find the link to the update data in the service level agreement (SLA) for SAP Cloud Services under Item **3: Changes to Windows** (see <http://s-prs.co/v581614>). Search for "SAP S/4HANA Cloud Edition" on this page under **SAP Cloud Services**.

The release sequence is indicated in each case with the year and month number, for example, 2311 stands for November 2023. Updates will update functionalities and preconfigurations. Figure 3.4 shows the update schedule at the time this book was written (spring 2023).

SAP S/4HANA Cloud, public edition, offers a wide range of preconfigurations for business processes (see also Chapter 11).

SAP Cloud Services									
The table below lists the Maintenance and Major Upgrade windows for the applicable SAP Cloud Services. It provides the start times and maximum scheduled downtime duration for the following regions:									
<ul style="list-style-type: none"> ✓ MENA - Middle East and North Africa ✓ APJ - Asia-Pacific and Japan ✓ Europe ✓ Americas 									
Maintenance and Major Upgrade Windows for vendor-branded cloud services, i.e. services provided by a third party, are listed in a separate table.									
All times are specified in Coordinated Universal Time (UTC).									
Search: S/4HANA Cloud Edition									
MAINTENANCE WINDOWS					MAJOR UPGRADE WINDOWS				
Cloud Service	MENA	APJ	Europe	Americas	Frequency	MENA	APJ	Europe	Americas
SAP S/4HANA Cloud edition	FRI 7 pm (4 hrs)	SAT 3 pm (4 hrs)	SAT 10 pm (4 hrs)	SUN 4 am (4 hrs)	Up to 4 times per year	FRI 1 am (24 hrs)	FRI 9 pm (24 hrs)	SAT 4 am (24 hrs)	SAT 10 am (24 hrs)

Figure 3.4 Maintenance and Upgrade Windows for SAP S/4HANA Cloud, Public Edition

Implementation With SAP S/4HANA Cloud, public edition, a standard system landscape with three systems (called a *three-system landscape*) is provided. It consists of a development system, a test system, and a production system. In addition, a starter system, a demo system, and a sandbox system can be purchased. Business processes are configured via SAP Central Business Configuration. Customers themselves can't create additional tenants on the systems. For

this reason, implementations of SAP S/4HANA Cloud, public edition, are always new implementations. SAP S/4HANA Cloud enables access via SAP Fiori.

More Information about SAP for Me

Detailed information about SAP for Me and access to a demo landscape can be found here: <https://me.sap.com>.

An extension with partner apps or modifications of the SAP code as in the on-premise version isn't possible here. As for the other operating models, SAP Activate provides a road map for implementation. This can be used in SAP Cloud ALM. For the implementation of SAP S/4HANA Cloud, public edition, you use SAP Central Business Configuration.

The implementation of the business processes is based on solution packages, which are also called scenarios (SAP Best Practices), that include pre-configurations. Customizations can be made by means of configurations and extensions. Key-user extensibility, developer extensibility, and side-by-side extensibility are available for extensions. Modifications of the existing code, on the other hand, aren't permitted.

Companies can access their SAP S/4HANA Cloud systems and tenants from any network with internet access using a browser and a unique, customer-specific URL. Multiple types of end devices are supported. SAP S/4HANA Cloud enables access via SAP Fiori.

System access

Sophisticated security procedures such as the *Transport Layer Security* (TLS) encryption procedure secure the communications between companies and the SAP S/4HANA Cloud system. In addition to this technical procedure, the following security and quality principles apply to SAP S/4HANA Cloud:

- Business data is stored in data centers according to the highest security standards. These standards include local data regulations such as General Data Protection Regulation (GDPR), California Consumer Privacy Act (CCPA), and General Data Protection Law (*Lei Geral de Proteção de Dados* [LGPD]).
- Users requiring access to business data have to authenticate themselves, and their identity needs to be verified by user and access management.
- Companies always remain the owners of their respective company data.

Additional Information

For more information about SAP S/4HANA Cloud, public edition, visit www.sap.com/erp.

3.2.3 SAP S/4HANA Cloud, Private Edition

Private cloud option SAP S/4HANA Cloud, private edition, is the second of the two cloud operating models in the SAP S/4HANA family. There are technical and business-related differences with SAP S/4HANA Cloud, public edition.

The solution scope without extensions is comparable to that of the on-premise operating model. SAP S/4HANA Cloud, private edition, supports processes in 64 countries or regions in 39 languages and 31 industries. The areas of SAP S/4HANA Cloud, private edition include the following:

- Asset management
- Human resources
- Procurement
- Sales
- Supply chain
- Finance
- Production
- R&D/engineering
- Service

SAP S/4HANA Cloud, private edition, is operated by SAP. Note, however, that you can define with restrictions when updates (updates and upgrades) should take place. An upgrade will be made available on a two-year cycle, as with the on-premise version, including feature packs during this time. However, you must upgrade the application after five years at the latest to remain in SAP’s standard maintenance. SAP S/4HANA Cloud, private edition, enables access via SAP Fiori and SAP GUI.

With SAP S/4HANA Cloud, private edition, you can define the implementation landscape, which is especially important as SAP allows all three options of implementation: new implementation, system conversion, and migration with selective data.

For an implementation, it’s recommended to have several clients on the development system and the test system, so that all processes and all extensions can be tested sufficiently. You can also use an SAP Activate road map with the SAP Cloud ALM option for this operating model. This operating model also enables the use of compatibility packages (see also Section 3.2.1).

You can start the processes with preconfiguration from SAP and from partners. SAP and partners offer solution packages for many lines of business, industries, countries, and regions.

3.3 Comparing the Operating Models

This section describes the individual characteristics of the respective operating models in detail and compares how the corresponding editions of the SAP S/4HANA product family meet these criteria.

3.3.1 Hardware, Software, Operation, and Maintenance

The most obvious difference between the on-premise and cloud editions is the fact that you operate, maintain, and manage the on-premise SAP S/4HANA editions yourself, while SAP carries out these tasks in the public cloud editions. Public cloud editions are available as SaaS operating models. All SAP S/4HANA Cloud editions are operated at different data centers located in various countries and regions around the world. Table 3.1 lists the differences in detail.

Operation

	On-Premise SAP S/4HANA Version	SAP S/4HANA Cloud, Private Edition	SAP S/4HANA Cloud, Public Edition
Hardware, installation, maintenance, and operation	The customer owns and maintains the hardware. The customer is responsible for installing, operating, maintaining, and managing the applications.	SAP or selected service partners provide the hardware and infrastructure. Depending on the SLA, the company and SAP or selected service partners install the applications. Depending on the SLA, the company and SAP or selected service partners operate and maintain the applications.	Hardware and infrastructure are located at SAP. When the system is handed over, the applications are fully installed. SAP operates, maintains, and manages the applications.
Upgrade	Optional	Schedule defined by customer; at least every five years	Quarterly
Implementation of the upgrade	Customer	Customer, partner, or SAP, depending on the SLA	SAP

Table 3.1 Overview of Hardware, Software, Operation, and Maintenance of the SAP S/4HANA Editions

Hardware in the public cloud For each public cloud edition, the hardware can be obtained in different packages, depending on the number of users and the required size of the SAP HANA database storage. When the cloud system is handed over, the applications are fully installed. For the public cloud editions, SAP is responsible for operating, monitoring, and maintaining the system (implementing enhancements and upgrades).

Maintenance cycles in the public cloud You should weigh whether you always want to have your SAP S/4HANA system up to date without having any influence on the upgrade time, or whether you want to determine the time of the upgrade yourself, but this means that innovations won't be available to you until much later. SAP S/4HANA Cloud, public edition, is automatically updated on a quarterly basis. This means that you have innovations available immediately, but SAP doesn't allow any exceptions when updating, so you can't postpone the update dates. With SAP S/4HANA Cloud, private edition, you can decide when you want to upgrade the system as long as you stay within the maintenance period.

Company staffing is also a significant difference between the operating models. With the on-premise variant, the company is responsible for maintenance and operation, so it must also provide the resources for maintenance and operation. With SAP S/4HANA Cloud, private edition, SAP takes over operation and maintenance. This allows you to use the resources in your company for other tasks.

The implementation of the upgrade is intended here as just one example of how the three business models are structured. In the on-premise variant, you perform the upgrade yourself; in the public edition, this is done by SAP. In the private edition, upgrades are regulated in the SLA with SAP, so both variants are possible, even a variant where you order the upgrade from a partner company.

Additional Information

You can find further information on this topic in the SAP Agreements at <http://s-prs.co/v581615>.

3.3.2 User Interfaces

UI technology In all SAP S/4HANA editions, the role-based approach of SAP Fiori is the basic target user interface (UI) technology. The public cloud edition is consistently aligned with this target architecture. In individual cases, public clouds also use other web-based SAP technologies, such as Web Dynpro, in addition to SAP Fiori. In the on-premise edition and the private cloud edition, you can

also use SAP GUI for Windows in addition to the web-based UI technologies (see Table 3.2). SAP GUI-based transactions that can no longer be executed in on-premise SAP S/4HANA are included in the simplification list for SAP S/4HANA (see Chapter 7, Section 7.2.3). You should use the SAP Fiori launchpad as the central entry platform for end users in all SAP S/4HANA editions.

On-Premise SAP S/4HANA	SAP S/4HANA Cloud, Private Edition	SAP S/4HANA Cloud, Public Edition
Web technologies	Web technologies	Web technologies
SAP GUI for Windows	SAP GUI for Windows	

Table 3.2 UI Technologies of the SAP S/4HANA Editions

Gradual Migration to the SAP Fiori Target Architecture

Because traditional UIs are still supported, gradual migration to SAP S/4HANA is feasible.

3.3.3 Functional Scope and Supported Country Versions

The SAP S/4HANA product family is based on a common program code line. Consequently, the same data models and product innovations are available. However, the editions vary significantly with regard to their functional scope, the supported country versions, and the options for customizing the business processes, for example, via add-ons (see Table 3.3).

On-Premise SAP S/4HANA	SAP S/4HANA Cloud, Private Edition	SAP S/4HANA Cloud, Public Edition
64 countries/regions	64 countries/regions	48 countries/regions
39 languages	39 languages	32 languages
Compatibility packages possible	Compatibility packages possible	Compatibility packages not possible
Variety of add-ons possible, from SAP, from partners, certified and noncertified	Add-ons possible without operating system level access	–

Table 3.3 Functional Scope and Supported Country Versions of the SAP S/4HANA Editions

On-Premise SAP S/4HANA	SAP S/4HANA Cloud, Private Edition	SAP S/4HANA Cloud, Public Edition
Preconfiguration for initial implementation of SAP (SAP Best Practices) and partners	Preconfiguration for initial implementation of SAP (SAP Best Practices) and partners	Implementation—initial and subsequent—through preconfiguration with SAP Best Practices

Table 3.3 Functional Scope and Supported Country Versions of the SAP S/4HANA Editions (Cont.)

On-premise version and private cloud The on-premise versions and the private cloud edition have the same business functions and support the same country versions. The complete functional ERP scope is supported in 64 countries with the standard SAP localization in 39 languages. You can use the compatibility packages for both operating models and also extend the scope with add-ons.

Public cloud The functional ERP scope provided in the public cloud editions differs partially from the functional scope of the on-premise edition. For example, compatibility packages (Section 3.2.1) aren't available in the public cloud edition. The supported functional scope is based on the SAP Best Practices content of the public cloud edition, which has been deployed as preconfigured. SAP S/4HANA Cloud, public edition, supports 48 countries with corresponding localization in 32 languages. The functional scope and localizations are extended continuously.

Additional Information

For more details on the functional scope and supported country versions, click on **Feature Scope Description** on the SAP Help Portal (<http://help.sap.com/s4hana>) and in the globalization area (<http://s-prs.co/v581616>) as well as in SAP S/4HANA Cloud. The product road map is available at <http://s-prs.co/v581617>.

3.3.4 Options for Enhancement

You can use the following enhancements in all members of the SAP S/4HANA product family:

- Key user extensibility through integrated functions
- Side-by-side extensibility to extend the product with other products, such as SAP SuccessFactors or developments on SAP BTP
- Developer extensibility through the ABAP environment

In the on-premise variant and in the private edition, enhancements are also available to you by modifying SAP code, but in the SAP S/4HANA Cloud, private edition, with the proviso that you only add code. Keep in mind that modifications of any kind always mean increased effort for updates and upgrades. Therefore, always check whether the extension of the process can't be realized with configurations or at least with a loosely coupled extension. Details about the extension methods can be found in the next section.

3.3.5 Payment Model and Runtime

Variants of on-premise SAP S/4HANA still offer the traditional license and maintenance model, while the public cloud editions are provided via a cloud subscription model with flexible runtimes (see Table 3.4). The actual costs for the subscription model depend on the number of users, the application scope used, and the hardware packages selected.

License vs. subscription

On-Premise SAP S/4HANA	SAP S/4HANA Cloud	
License and maintenance fee	Flexible model (license and maintenance fee or subscription) Companies can contribute existing SAP licenses	SAP S/4HANA Cloud, private edition
Subscription with flexible runtimes	SAP S/4HANA Cloud, public edition	

Table 3.4 The Payment Models and Runtimes of the SAP S/4HANA Editions

3.3.6 Model for Migration to SAP S/4HANA

For on-premise SAP S/4HANA and for SAP S/4HANA Cloud, private edition, a company has the choice of a new implementation, a system conversion, or a migration with selective data. In other words, you can convert an existing SAP ERP system into an SAP S/4HANA system, install a completely new SAP S/4HANA system, or even transfer only part of your data.

Brownfield or greenfield approach

Migrating to SAP S/4HANA Cloud always entails a new installation of the system. Based on the solution packages provided, this involves implementing the business processes supported in SAP S/4HANA Cloud and transferring the necessary master and document data to the cloud system (see Table 3.5).

On-Premise SAP S/4HANA	SAP S/4HANA Cloud, Private Edition	SAP S/4HANA Cloud, Public Edition
New installation	New installation	New installation
System conversion	System conversion	
Migration with selective data	Migration with selective data	

Table 3.5 Migration Scenarios for the SAP S/4HANA Editions

For more information on new implementations or on converting single systems, see Part II of this book, “Preparing for Migration to SAP S/4HANA.”

3.4 RISE with SAP

Business Transformation as a Service

The *RISE with SAP* offering is an SAP S/4HANA commercialization model that includes the core SAP S/4HANA system as well as other SAP assets, all offered through the same software and SLA via a single subscription. SAP refers to this model as a *business transformation as a service*, and it’s designed to help companies move their SAP solutions to the cloud in the long term. Specifically, this can involve moving an in-house data center to a hyperscaler cloud, for example.

At its core, the subscription-based RISE with SAP is SAP S/4HANA running in a private cloud. The offer is characterized by the fact that, per contract, everything is provided by SAP as a single source. The hyperscaler can be freely chosen by the customer but is already part of the contract. For this reason, there is no need to enter into a separate contract with the hyperscaler. All SLAs are standardized with SAP being the responsible party.

SAP with RISE provides companies with all the tools they need and has great flexibility in implementation with all contract-based components standardized. This approach is relevant not only for a migration to the cloud but also a migration to SAP S/4HANA in general because SAP BTP, among other things, is part of the bundle. Also included are the Custom Code Analyzer and SAP Readiness Check for analyzing existing enhancements and custom developments, and the SAP Learning Hub with all the necessary knowledge for a successful transition to SAP S/4HANA.

GROW with SAP

In addition to RISE with SAP, SAP also offers a similar program tailored to the midmarket called *GROW with SAP*, which provides comparable add-on offerings to SAP S/4HANA Cloud, public edition, including SAP BTP. This

offer is aimed primarily at new companies to enable them to get off to a quick start with SAP in the cloud.

A large number of SAP companies don’t yet feel ready to move completely to the cloud. This is mainly due to geopolitical developments and macroeconomic uncertainties following the pandemic in the early 2020s. These companies could benefit from this simple and flexible offering, as the focus is on business transformation rather than a pure SAP S/4HANA operating model. The offering enables companies to quickly and easily adopt the latest innovations from SAP by providing access to an extensive library of pre-built content such as workflows, automations, and other solutions that can be used to accelerate the digital transformation. Training and support services are also included to help users get started quickly.

Following are the core components of RISE with SAP:

Core components

- SAP S/4HANA
- Choice of infrastructure from four different hyperscalers (Microsoft Azure, AWS, GCP, and Alibaba Cloud), SAP data centers, or, for regulated industries, your dedicated data centers
- Provision of SAP BTP (Section 3.5) to complement, extend, and integrate SAP, partner, or third-party solutions that use the same data model and business services
- Business process intelligence in the form of SAP Signavio to perform industry benchmarks and define starting points for the transformation
- SAP Business Network Starter Pack to accelerate the procurement process and connect with your trading partners
- Additional tools and services to support the transformation of business processes

The objective of RISE with SAP is to lead companies easily and efficiently into the digital future. Most SAP companies want to modernize and transform their company’s business processes. Business process intelligence tools that identify opportunities for transforming existing business processes can help. Because SAP BTP plays a central role in the implementation of the SAP Intelligent Enterprise Framework, it’s also part of RISE with SAP, along with all of its platform services. SAP BTP is discussed in the following section.

Additional Information

For more information about RISE with SAP, please visit the following website: www.sap.com/products/rise.html.

3.5 SAP Business Technology Platform

SAP BTP Like many other cloud providers, SAP offers a platform, *SAP Business Technology Platform* (SAP BTP), which has been around for more than three years. More than 15,000 companies now have SAP BTP in production operation, with a network of more than 1,500 SAP partners helping with the implementation. Wasn't there something before, and what's the deal with these platforms anyway? Today, we can say that a versatile technological platform acts as the basic framework for any cloud provider. This section will inform you about this and all included functionalities.

3.5.1 Overview

In addition to its business software portfolio, SAP is also active in the platform business. While other providers, such as Amazon (with AWS), Microsoft (with Microsoft Azure), and Google (with GCP) are players in the IaaS space, SAP offers SAP BTP as a PaaS solution tailored to SAP products.

SAP isn't new to the platform environment and had already occupied the more technical segment 20 years ago with SAP NetWeaver, although at that time there was no talk of the cloud, but it was a technical SAP installation by itself. In a way, you could say that SAP BTP is a kind of successor to SAP NetWeaver in the cloud. Of course, the whole thing goes hand in hand with further development in terms of technologies and features. SAP BTP is thus something like SAP NetWeaver++ in the cloud, and it can replace older SAP NetWeaver-based systems. For example, there is now also an ABAP environment again, the ABAP Cloud (Section 3.5.3). Another example is SAP Process Integration or SAP Process Orchestration, which became the Integration Suite built into SAP BTP via what was known as SAP Cloud Platform Integration (CPI) before.

SAP BTP today, just like SAP NetWeaver in the past, is the foundation and technology for all SAP products; everything will either build on it or can be extended with it. SAP ERP software has always been a pioneer in offering comprehensive industry functionality. This is also the case with SAP S/4HANA, but some of these functions don't run within SAP S/4HANA, but rather as extensions on the SAP BTP platform. SAP BTP therefore also plays an important role here, as it enables industry-specific extensions that can be developed by SAP, its partners, or companies themselves. These extensions also support the migration of legacy processes to SAP BTP that would otherwise be lost during a migration to SAP S/4HANA. Thus, in the age of modern modular enterprise software, such a platform will become increasingly important.

SAP BTP and migration SAP BTP is crucial for a successful migration to SAP S/4HANA because by means of the possibilities to move problematic custom code that isn't com-

patible with the SAP HANA database to this independent platform already before the migration of the ERP system, the separate code line of the ABAP system can be kept clean and compatible. For this reason, SAP recommends implementing SAP S/4HANA enhancements in SAP BTP, a feature that was available in SAP NetWeaver back then.

This way, your system will be ready now for a future move to the cloud: SAP BTP makes it possible to extend the clean concepts of SAP S/4HANA in a way that works within a cloud model. Data management and integration as a core competency of SAP BTP is offered by many other platform providers, but because these capabilities are of utmost importance for systems interoperating with SAP S/4HANA via predefined processes such as SAP Ariba and SAP SuccessFactors, the added value of SAP BTP comes from SAP offering end-to-end processes with prebuilt integration content for its own software. This is where the "Business" part in the name of SAP BTP comes in. Indeed, SAP BTP provides just such integration tools and application programming interfaces (APIs), as well as data management tools to implement process integration and meet SAP's business network requirements.

SAP BTP is therefore a platform optimized for SAP applications that brings together business processes and innovative technologies. This includes a unified application development environment, data and analytics capabilities, integration tools, and everything you need to take advantage of the latest developments in machine learning and artificial intelligence (AI). The platform enables you to support new business processes and workflows and gain better insight into existing data and applications, whether you're a professional developer or a tech-savvy business user. In addition, SAP partners with decades of experience in various industries and lines of business offer ready-made integrations, data models, intelligent services, and applications developed using SAP BTP.

3.5.2 Tools

Approaching SAP BTP like a comprehensive toolbox, the following functions are particularly noteworthy:

■ Application development

- SAP Build Apps
- SAP Build Work Zone
- SAP Business Application Studio (SAP Mobile Services, SAP Document Management service)
- ABAP Cloud (SAP BTP, ABAP Environment)

Overview of tools

■ Automation

- SAP Build Process Automation (workflow management, robotic process automation [RPA], Process Visibility)
- SAP Task Center

■ Integration

- SAP Integration Suite (cloud integration, API management, SAP Event Mesh)
- SAP Master Data Integration

■ Data and analytics

- SAP Analytics Cloud
- SAP Datasphere (formerly SAP Data Warehouse Cloud)
- SAP Data Intelligence Cloud
- SAP Master Data Governance
- SAP HANA Cloud

■ AI

- SAP AI Services
- SAP AI Core

The following subsections provide a brief summary of the most important tools.

SAP BTP Cockpit

The *SAP BTP cockpit* is a web-based UI that provides access to all functions and services available in SAP BTP. It thus serves as a central management console for SAP BTP, allowing users to manage their cloud accounts, configure settings, deploy applications, monitor system performance, and more. Administrators can manage various services on the platform, such as configuring access permissions, monitoring system performance, and managing users and subscriptions. It also provides insights into the usage of various services and allows users to create custom dashboards and configure notifications to proactively identify and resolve issues. The SAP BTP cockpit is thus an important component of SAP BTP that facilitates the management and monitoring of services and enables better control over the applications and processes running on the platform. Figure 3.5 shows the SAP BTP cockpit with the configuration in the free SAP BTP trial account.

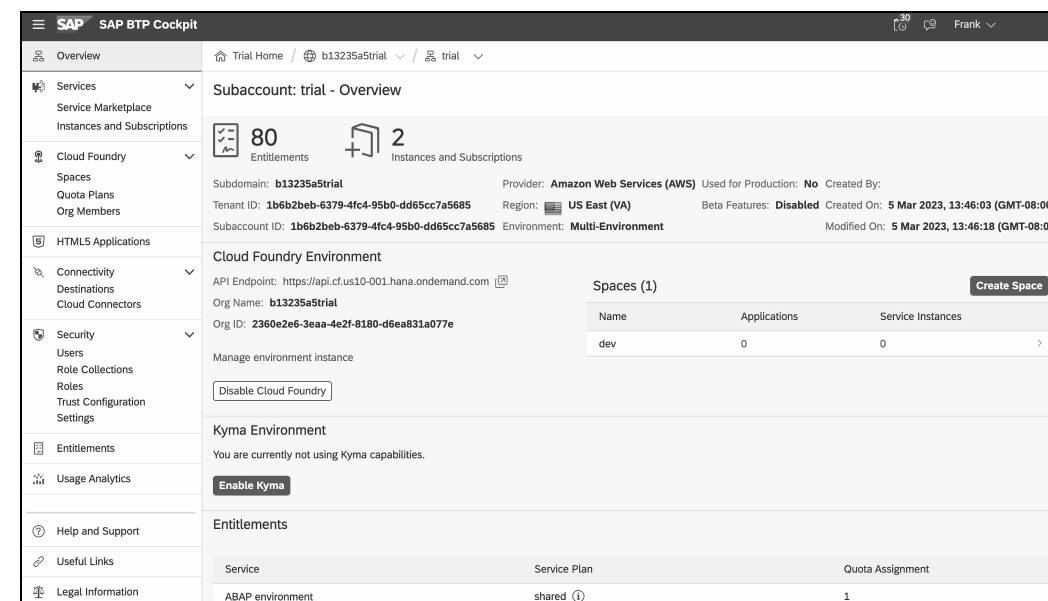


Figure 3.5 The SAP BTP Cockpit in the SAP BTP Trial System

SAP Build Apps

SAP AppGyver was a low-code solution that was part of SAP's portfolio and is now, after further development, offered as *SAP Build Apps*. SAP Build Apps is thus the follow-on product to SAP AppGyver and has powerful new features aligned with the SAP portfolio. It allows users to create apps and extensions using modeling based on templates and industry best practices, leveraging visual programming, without any coding knowledge.

SAP Build Work Zone

SAP Build Work Zone is an integrated low-code portal development solution for building modern business websites that enable employees to work faster and more efficiently. It also includes the SAPUI5-based applications known as SAP Fiori and the SAP Fiori launchpad. Along with the other SAP build solutions, SAP Build Work Zone shares common SAP BTP destinations and access to the in-app content store.

SAP Build Process Automation

SAP Build Process Automation is a low-code/no-code tool suite that enables business process experts to create automated processes or process enhancements, as well as automation for manual tasks by leveraging RPA technologies; it also includes SAP Workflow. It has the ability to bring together workflows, business rules, decisions, and process automations, as well as gain visibility into ongoing process instances and take action.

SAP Task Center

SAP Task Center is a central service (kernel service) that provides users with an inbox for all their tasks from various applications and process automations. It helps streamline workflows and make it easier for users to keep track of their tasks.

SAP Business Accelerator Hub

SAP Business Accelerator Hub is a platform where you can find all pre-defined integration suite content from SAP, such as integration flows and APIs. It also provides access to community content based on real company examples.

SAP Integration Suite

SAP Integration Suite is an integration platform that supports a wide variety of use cases such as process integration, event-based integration, and API management. The suite allows you to run your process integration, event integration, and API management scenarios. SAP Integration Suite offers almost all integration styles such as application-to-application (A2A), business-to-business (B2B), and business-to-government (B2G), APIs, and event-based integrations. It also includes API management to securely manage, monitor, and monetize APIs internally or externally.

SAP Event Mesh

SAP Event Mesh is a message and event broker that supports event and messaging technologies for asynchronous and event-based scenarios. It enables the seamless exchange of events from all SAP BTP runtime environments and programming models.

SAP Master Data Integration

SAP Master Data Integration is a technology that helps synchronize data processing in heterogeneous application landscapes. This technology enables the integration of master data across multiple systems, enabling consistent and accurate data sharing between applications.

SAP Analytics Cloud

SAP Analytics Cloud is a cloud-based dashboarding tool that can be used to create analytics solutions based on SAP. It provides data visualization and application creation features and enables business users to create stories with drag-and-drop capabilities, low-code scripting and custom widgets. It also enables developers to create advanced analytics applications.

SAP Data Intelligence Cloud

SAP Data Intelligence Cloud is a comprehensive data management solution. It transforms distributed data collections into key data insights that support innovation and business growth.

SAP Datasphere

SAP Datasphere is a comprehensive data service that provides data integration, data cataloging, semantic modeling, data warehousing, data federation, and data virtualization in a unified tool. It enables data experts to easily distribute mission-critical enterprise data with business context and logic, as well as improves enterprise data retention practices to make better decisions. This is the evolution of *SAP Data Warehouse Cloud*, which was a multicloud, multisource business semantics service for enterprise analytics and planning. In the future, SAP Datasphere will also include more and more of the SAP Data Intelligence Cloud functionalities.

SAP Master Data Governance

SAP Master Data Governance is a tool that helps ensure consistent master data across multiple systems. It provides an integrated platform for managing and monitoring master data in SAP applications and connecting to non-SAP sources. With SAP Master Data Governance, organizations can maintain a single source of truth for their master data and improve the accuracy, consistency, and quality of their business processes.

SAP HANA Cloud

SAP HANA Cloud is a cloud-based data platform with multimodal processing capabilities. It includes database and analytics capabilities based on in-memory technology. Data can be processed and analyzed in real time to make faster, more informed decisions. The solution is capable of integrating data from multiple sources, including relational databases, unstructured data, and big data sources. SAP HANA Cloud also supports developing and running applications in the cloud, as well as providing APIs and tools for developers to build applications quickly and easily. Along with unique capabilities for data masking and anonymization, SAP HANA Cloud provides security standards for encryption, user management, authentication, and authorization.

Other Components

Other important tools and solutions include the following:

- **SAP Business Application Studio**

This is a modern development environment designed specifically for efficient business application development.

- **SAP Cloud Application Programming Model**

This is a development model for Java and JavaScript developers that includes libraries and tools for building enterprise-grade services and applications.

- **SAP BTP, Kyma runtime**

This is a Kubernetes-based runtime environment that can be used to develop cloud-based applications in SAP BTP.

- **Cloud Foundry**

This is an open-source PaaS that gives you a choice of clouds, developer frameworks, and application services. It enables developers to efficiently deploy and scale applications on cloud infrastructures.

- **ABAP RESTful application programming model**

This allows ABAP developers to define, generate, or capture events.

- **SAP AI Services**

This is a portfolio of several products that solve complex business problems and provide a simple way to use them. Services include Business Entity Recognition, Document Information Extraction, SAP AI Core, and SAP AI Launchpad, which are also relevant for generative AI use cases.

- **SAP Cloud Identity Services**

This is SAP's identity provider (IdP), a service that provides authentication and authorization services for users to access various applications in a harmonious manner. It offers components such as a public cloud IdP that can be used to authenticate users, federation services to integrate with an existing single sign-on (SSO) infrastructure, and an identity directory store.

3.5.3 ABAP Cloud

When planning the migration to SAP S/4HANA, users have so far been faced with a difficult dilemma: If they wanted to reduce the interaction of their custom extensions with SAP maintenance events, an SAP BTP extension had to be completely reimplemented in Java, for example. If they wanted to implement the applications in ABAP, usually only the on-premise SAP S/4HANA version qualified, whereby a link to SAP maintenance events still existed.

Fortunately, a new option provides additional alternatives for planning custom ABAP code: *ABAP Cloud*. This is a development model for creating upgrade-stable enhancements for SAP S/4HANA (see Figure 3.6). It uses public SAP APIs to access SAP S/4HANA data and functions, as well as the strong tooling support of ABAP Development Tools (ADT), and can be used

to develop side-by-side extensions and cloud solutions. ABAP Cloud provides the latest, cloud-optimized version of the ABAP design and runtime (Section 3.5.3) and has been referred to as *embedded steampunk* before.

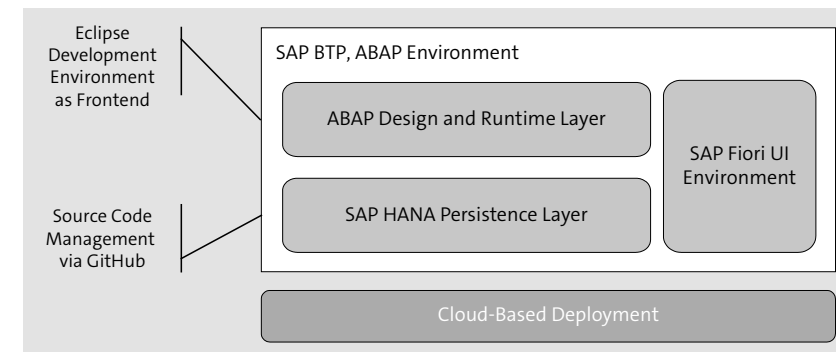


Figure 3.6 Overview of the ABAP Cloud

It offers numerous advantages—not only with regard to the migration of existing SAP ERP systems to SAP S/4HANA:

- **Utilization of the existing ABAP knowledge base**

The enterprise's ABAP expertise that has been established over the years can still be utilized. Of course, other services from SAP BTP can also be integrated. The original extensibility of SAP S/4HANA Cloud can be supplemented with comprehensive side-by-side enhancements.

- **Independent innovation cycles**

The innovation cycles for custom coding can be specified independent of the SAP application system. As a cloud product, ABAP Cloud receives the latest functional enhancements at short intervals, while still providing full compatibility with existing implementations. Therefore, the speed of innovation in custom developments can be increased considerably.

- **Custom SAP HANA database**

ABAP Cloud includes its own SAP HANA database. This enables you to use the advantages of the SAP HANA database without your SAP application systems having been migrated to SAP HANA yet.

Custom enhancements are future-proof: as side-by-side enhancements, they aren't included in the SAP source code, but they communicate with the SAP application using stable interfaces. For these interfaces, a contract against modifications exists. Therefore, they don't need to be synchronized when the SAP application is maintained. Their enhancements are located in a separate system in the cloud and thus become independent of version changes.

The application core of the SAP systems remains largely unchanged, as only interfaces need to be implemented. This is another advantage with regard to complying with security requirements.

System
management
by SAP

The system is managed by SAP because ABAP Cloud is a native cloud application. This reduces the workload of the enterprise's IT department. It also results in easy scalability because you don't need to take care of hardware procurement.

Considered as a whole, the approach of implementing custom enhancements via ABAP Cloud enables you to use the advantages of the cloud without having to complete the migration of all your application systems to the cloud.

Possible Migration Scenarios

New migration
concepts

Chapter 4 discusses the basic scenarios for migrating to SAP S/4HANA Cloud. If you include ABAP Cloud in your considerations, interesting new approaches for project planning arise as you'll see in this chapter.

The starting point for migrating to SAP S/4HANA is the general decision for this target scenario—for example, SAP S/4HANA or SAP S/4HANA Cloud—and the planning and realization of the technical and content-related conversion project. This conversion project can be developed in more detail using SAP S/4HANA Cloud.

Utilization of SAP HANA

If your SAP application system isn't yet operated on the SAP HANA database, you might want to gain experience with SAP HANA to enable better planning of the migration effort. In this case, you have the option of migrating the existing SAP application system to SAP HANA. However, this may also entail unnecessary additional effort because the conversion to SAP HANA takes place anyway together with the planned migration to SAP S/4HANA.

SAP HANA-based
cloud environment

ABAP Cloud offers a cloud environment that is already based on SAP HANA. You can replicate selected data to ABAP Cloud. This enables you to immediately investigate how you must optimize your code for SAP S/4HANA and which additional options arise through SAP HANA. The side-by-side approach ensures that the application system remains completely unaffected.

Similarly, you can start to supplement your production system(s) with SAP HANA-based enhancements to bridge the time until the full conversion to SAP S/4HANA takes place.

Alternative Check of Custom Code

The migration to SAP S/4HANA includes the check and adaptation of custom codes. As described in Section 3.6.3, custom codes must be checked for their compatibility with SAP S/4HANA. Adjustments may be necessary.

So, if you check and adapt your codes within the scope of the SAP S/4HANA migration project, ABAP Cloud offers you two interesting approaches:

■ Architectural decoupling

Depending on the scope of your existing enhancements, it may be advisable to decouple the architecture. If you have comprehensive custom codes, you may want to decouple the software lifecycle of your code from the application system's lifecycle in the future. In this case, it's advisable to separate the code in a side-by-side approach.

Unfortunately, SAP no longer offers any further developments of SAP NetWeaver. This eliminates the option to run this decoupling through an (on-premise) SAP NetWeaver system. This gap is filled by ABAP Cloud. You can separate your applications in this cloud-based system.

■ Time-wise decoupling

Thanks to the independent lifecycles of the SAP application system and your enhancement system, you can immediately start to migrate your applications. You don't require an SAP S/4HANA system for this purpose. You also don't have to synchronize in terms of time when converting the applications.

SAP offers supporting services for transferring your existing codes to ABAP Cloud, which are described in the next section.

3.5.4 Migration of Custom ABAP Code to ABAP Cloud

The migration of your existing code to ABAP Cloud comprises several steps:

1. Analyzing the existing code
2. Estimating the modification effort
3. Creating a road map
4. Performing technical migration
5. Adapting the migrated code
6. Testing
7. Converting

Fortunately, SAP offers various tools that facilitate several of these steps. This minimizes the effort for migrating the code to ABAP Cloud. The following sections provide an insight into the processes for the individual steps.

Analyzing the Existing Code

The migration to ABAP Cloud also involves a code scan using special checks. This process is similar to the one described in Chapters 7 and 8. In this special

Decoupled lifecycle

case, in addition to the adaptation to SAP S/4HANA described in those chapters, you must also identify adaptations required for the adaptation to the ABAP Cloud environment. For this purpose, you can already use an ABAP Cloud system as the check system. Your current application system doesn't need to be upgraded to a specific SAP version to get the latest checks. However, the checks must be made against a functional combination of code and content. We therefore recommend a check against your current source system.

Duplicate Check

You require two checks for the migration of custom code to ABAP Cloud (discussed in this chapter) within the scope of a migration to SAP S/4HANA:

- One check for compatibility of the code against the new version of the SAP S/4HANA application because functions from SAP ERP releases are no longer available in the same form due to simplification
- One check for compatibility on the modified ABAP language scope in ABAP Cloud

Custom code check For this purpose, you provision an appropriate cloud system at SAP using your cloud cockpit. This system establishes a remote connection to your current application system, for example, your development system. ABAP Test Cockpit (ATC) will be used for the actual checks. For this purpose, you run the readiness check using the Remote Function Call (RFC)-enabled `SAP_CP_READINESS` check variant. You can check systems as of SAP Basis version 7.00.

Check using your own ATC system As an alternative, you can also use your own ATC system on-premise. However, this scenario requires the availability of an ATC system with SAP Basis 7.52 SP1 or higher. Additionally, you must first implement the following SAP Notes in this scenario:

- SAP Note 2682626: Code Inspector Check for Restricted Language Scope Version 5 (ABAP for SAP Cloud Platform)
- SAP Note 2684665: Custom Code Checks for SAP Cloud Platform ABAP Environment
- SAP Note 2830799: Custom Code Checks for SAP Cloud Platform ABAP Environment (2)

The technical prerequisites in the target system are identical in both cases. You'll find more details in SAP Note 2364916. In both cases, you configure the target systems to be checked using Transaction SM59.

Estimating the Modification Effort

Once the checks are complete, you receive a list of any abnormalities detected. Based on this, you can estimate the resulting efforts in detail.

Note that SAP offers so-called *quick fixes* for numerous adaptations. The list of available quick fixes is updated continuously. If a quick fix is available, it's highlighted in the result list, and you can select it in the context menu of the check result. Therefore, these results can be repaired in a mechanized way, so to speak.

Partially automated adaptations via quick fixes

3

Creating a Road Map

Similar to the migration project to SAP S/4HANA, we recommend considering several dimensions when planning your adaptations:

- **Effort of adaptations**
Are "mechanical" adaptations possible using the quick fixes, or is there extensive use of outdated technologies such as screens that need to be converted to SAP Fiori UIs?
- **Urgency**
Which functions must or should be updated first?
- **Importance for future operating processes on SAP S/4HANA**
How important is this functionality for the planned target business processes?

If you use an older version of an SAP ERP system, some of your enhancements may no longer be required in the current scope because they can be covered through a modified default functional scope. When you estimate the modification effort, consider both the adaptations to the language scope of ABAP Cloud and the adaptations to SAP S/4HANA.

Performing Technical Migration

ABAP Cloud supports the current source code management system Git. The sources are no longer processed using SAP transactions such as Transaction SE80 or the like. Instead, they are processed using the ABAP Developer Toolkit for Eclipse.

From the technical point of view, this means sources that reside in the current ABAP systems must be transferred to Git. For this purpose, we assume that you already have a Git account. For the transfer, you can use open-source program `ZABAPGIT`, which is available in the repository at <https://github.com/abapGit/abapGit>. This utility program is maintained by an open-source community and isn't provided by SAP.

Git repository

You must ensure that the appropriate ABAP Git enhancement is installed on the Eclipse frontend used. This enhancement should appear in the feature list under the name **abapGit for ABAP Development Tools (ADT)**. You can also use the following URL: <http://eclipse.abapgit.org/updatesite>. Additional information on installing ABAP Git is available on the SAP Help Portal: <http://s-prs.co/v581618>.

Transferring the code

The code is transferred at the package level. We recommend the following procedure:

1. Create a list of packages whose objects are to be transferred from the source system.
2. Add these packages to your GIT repository in program ZABAPGIT.
3. In the target system project, create the packages in the development environment using the same name.
4. In the target system project, connect the newly created packages with your ABAP Git repository.

Separating code lines

Your objects are now available in the target system project. Note that the code lines are separated from this point on. Because objects of the source system usually can't be run without making adaptations in the target system, the implementations of your objects differ. Corrections to the source system objects should be made manually. It's not recommended to replicate them.

Adapting the Migrated Code

You must remedy any incompatibilities that were found in the analysis step for the code that you want to use in the planned business scenario. Many conversions can be made mechanically thanks to the support of quick fixes.

Adapting outdated UI technologies

When planning your project, you should take into account that only a small number of the adaptations can be made partially automated. In some areas, new implementations might be necessary. Outdated UI technologies, such as SAP List Viewer (ALV) or Web Dynpro, are no longer supported. Therefore, UIs must be created completely anew in the form of SAP Fiori UIs. Only this technology enables the intended user experience (UX).

Integration via interfaces

Due to the side-by-side approach, the application system's data must be accessed via interfaces. Direct access to tables of the target system is no longer possible. We recommend migrating to remote OData accesses. In addition, in this model, note that the persistency of your enhancements and their data, for example, custom data elements or tables, reside in the provided ABAP Cloud system and not in the tables of the application system.

If your enhancements make runtime-critical accesses to the database, these accesses should be optimized for SAP HANA. Although existing selects can usually be transferred, they don't provide the desired runtime benefits. In this context, also refer to the descriptions provided in Chapter 2, Section 2.3.

SAP HANA optimization

Testing and Converting

These steps don't differ from the procedure of further developments or conversion of your code in on-premise systems. They are based on your processes for code modifications.

3.5.5 Business Functionalities of SAP Business Technology Platform

SAP BTP offers various functionalities for the technical implementation of business-relevant requirements, such as the extensibility of business processes, end-to-end process integration, and the processing and analysis of different data. In addition to extensibility, you can also create your own applications and use them to implement new business processes. This functionality extends the application areas of the platform to the implementation of new competencies in the company. An example of this is the development of additional services for an existing product portfolio with SAP BTP to expand the business model with digital offerings. As markets and industry conditions change, new requirements arise that necessitate such enhancements or additions to company-specific processes. Companies can meet these requirements by enhancing standard SAP business processes or by developing complete, domain-specific applications to complement standard functionality.

In general, it's possible to implement company-specific requirements for business processes provided by standard SAP solutions such as SAP S/4HANA by modifying the standard solution. In contrast to enhancements, modifications are changes to the source code or metadata of the standard SAP solution. Modifications have an impact on the lifecycle of the application and entail additional effort when installing updates and a new version. However, modifications can't be made if the standard SAP solution is deployed in the public cloud. The extension of business processes is possible with SAP BTP without destabilizing or modifying standard SAP processes and is covered in Section 3.6. The extensions developed on the platform are additions to the scope of standard SAP solutions with a stable lifecycle.

Modifying standard applications

Decoupling standard SAP solutions from company-specific enhancements is a prerequisite for enabling rapid innovation cycles without having side effects on the use of the latest version of the standard solution. In addition,

Decoupling

the decoupling of the enhancements from the standard functionality of the SAP solution is a technical prerequisite for the cloud deployment model because fast innovation cycles are the goal here, and there must be no dependencies between the enhancement and the standard solution.

Enhancements with SAP BTP The requirements of the business departments for enhancements to standard processes can be grouped into different categories:

- Customization of the UI
- Adaptation of the process logic
- Adaptation of the data model

Customization of the UI Customization of the UI of a business process is usually done to improve the UX. For example, a department may express the need to change the input template for data entry within a business process. Optimization of processes for mobile devices is also common. In some use cases, it's necessary to make data available offline and synchronize it when reconnected, for example, for service employees who are outside a wireless network.

Adapting the process logic Requirements for adapting a standard process can also be in the area of process logic. This may require implementing new user interactions, checking additional conditions in the process flow, or introducing automatic validations of data or conditions. One example is the extension of the standard process for creating and changing company data with an option that allows companies to confirm changed data. Here, the changed data can be checked by an internally developed SAP BTP application and written back to the SAP S/4HANA system by the specialist department.

Implementing new business processes Furthermore, entirely new business processes can be requested by specialist departments, which then have to be implemented. One example is the printing of shipping labels in a company's logistics department. When goods are picked at the storage location and packed for shipping, such an application based on SAP BTP can retrieve the corresponding delivery information from the SAP S/4HANA system.

Adapting the data model In addition, requirements from the business department can lead to an extension of the data model to implement advanced analyses to control the process flow. An extension of the data model is often accompanied by an extension of the process logic to control process flows automatically with the help of additional data.

When customizing a business process, it's often unclear where the line is between an enhancement and creating a new application. At what point a process extension becomes an application depends on how complex it is and how much the UI, process logic, and data management need to be changed. In contrast to the extension of an existing

process, a new application aims at implementing additional functionality through new processes. A new application usually affects all three levels: the UI, logic, and data management. If the UI of the new application follows the concept of UIs of an existing process, it can be seamlessly integrated into the existing business process.

SAP BTP is the underlying technology for the implementation of intelligent processes and is responsible for both the integration of the corresponding subprocesses executed by different IT applications and the integration of the associated data from SAP, partners, and third-party providers. The platform enables end-to-end integration of business processes across different companies and organizations as well as departments within a company. To efficiently integrate SAP applications to implement end-to-end business processes, SAP BTP provides predefined **integration flows** (*iFlows*) in SAP Integration Suite. To integrate process data, transformations and mappings are required based on the data exchanged between processes. The SAP Business Accelerator Hub serves as a central catalog that provides access to all available iFlows and preconfigured content that can be used via SAP BTP. The integration of processes and their IT applications is technically achieved by exchanging messages in real time with the predefined iFlow containing a processing logic of the exchanged messages.

In the next section, we'll specifically address the enhancement of SAP S/4HANA. In general, the integration functionalities described previously can be used to connect SAP S/4HANA not only with SAP Ariba and SAP SuccessFactors for integrated business processes of a smart enterprise but also with third-party systems. All of this can be tried out via the free trial version of SAP BTP.

Trial Version

With SAP BTP Free Tier, SAP offers a free trial version of SAP BTP, which we'll discuss further in Chapter 6. In addition to the free tier service plan, there is also a basic SAP BTP trial account that offers a restricted use of the platform resources and services for 90 days and mainly serves learning purposes.

You can start at the following link to try SAP BTP for free: <http://s-prs.co/v581619>. More information about the free service plans can also be found at <http://s-prs.co/v581620>.

The task of SAP BTP is to fulfill the technical requirements necessary for the implementation of intelligent enterprise modules. For this purpose, the platform provides scalable services in the application areas of enhancement,

Summary

integration, and value creation from data. The services are used to functionally extend and optimize existing business processes, to integrate them consistently into complete end-to-end processes, and to use the data in optimizing the processes. Complete IT applications for specialist departments are also provided via the platform or can be developed independently to implement new business processes and incorporate them as an additional competence within the company.

3.6 Extensibility of SAP S/4HANA

Every enterprise is unique, not just in the specifications for its products or services but also in its employees, its goals, and thus its business process structures. In the ideal case, business software supports such uniqueness and the resulting differences because these details differentiate the enterprise from its competitors.

Previous SAP enhancement options

To date, SAP has supported differentiation to the greatest extent possible with its software: SAP provided released interfaces and disclosed the source code of the entire application. Moreover, SAP offered SAP NetWeaver Application Server ABAP (SAP NetWeaver AS ABAP), which is a development environment in the application system. SAP provided several options for integration with other applications, for example, using SAP Process Orchestration. With this portfolio, SAP has created an optimally customizable solution with scalable enhancement options. Third-party providers also appreciate this extensibility and can deliver supplementary functions for standard SAP solutions. When planning your migration to SAP S/4HANA, you should always pay attention to the solution's *extensibility*.

Extensibility put to test

In SAP S/4HANA, SAP emphasized this extensibility, which has been adapted according to SAP's simplification philosophy for products. Particular attention was paid to allowing customization without comprehensive programming knowledge while also providing the flexibility required for significant enhancements. Those concepts were improved that minimized disadvantages coming from extending the standard software to individual requirements. In the past, the high degree of flexibility in SAP ERP could lead to risks that had to be considered individually in each specific case. Comprehensive enhancements entailed projects involving several parties within the enterprise and sometimes implementation partners as well. Thus, an enhancement could take some time before it could actually be used. When enhancements were implemented, the next risk was in the operation of the software. During the lifecycle of the software, hotfixes and

planned updates to the default software are usually installed. Testing modified and custom developments in this constantly updating software lifecycle can involve a great deal of effort.

Consequently, the extensibility in SAP S/4HANA has been adapted to accelerate the implementation of enhancements and reduce the costs of these enhancements. In particular, modifying the default SAP code can be avoided in most cases. For this purpose, SAP S/4HANA provides tool-based enhancement options in the applications themselves, as well as platform-based enhancement options outside the software product. These functions support the following characteristics:

■ Scaled extensibility

The default software can be customized at various levels. For example, end users can personalize their UIs and implement their own (restricted) enhancements. Selected experts can be authorized to implement further enhancements that affect the processes of multiple users. At the top level, you can customize the entire application in an implementation project.

■ Scaled lifecycle

The extensions can be loosely coupled. While enhancements can exchange data with SAP S/4HANA and are merged on the UI, they can also perform independent software maintenance cycles.

■ Openness

SAP S/4HANA includes a vast array of open interfaces, so partners can implement existing enhancements or offer their own enhancements.

Extensibility of SAP S/4HANA

You can customize SAP S/4HANA using various enhancement procedures.

To implement this extensibility, SAP follows two approaches:

- Side-by-side enhancements
- In-app enhancements

Both approaches complement each other and can be combined. Figure 3.7 compares the two enhancement approaches. These approaches are described in detail in the following sections.

The in-app and side-by-side approaches involve various levels. The deeper the level, the greater the impact on the software lifecycle. Not all options are available in all deployment options (Section 3.3.4).

New extensibility concepts

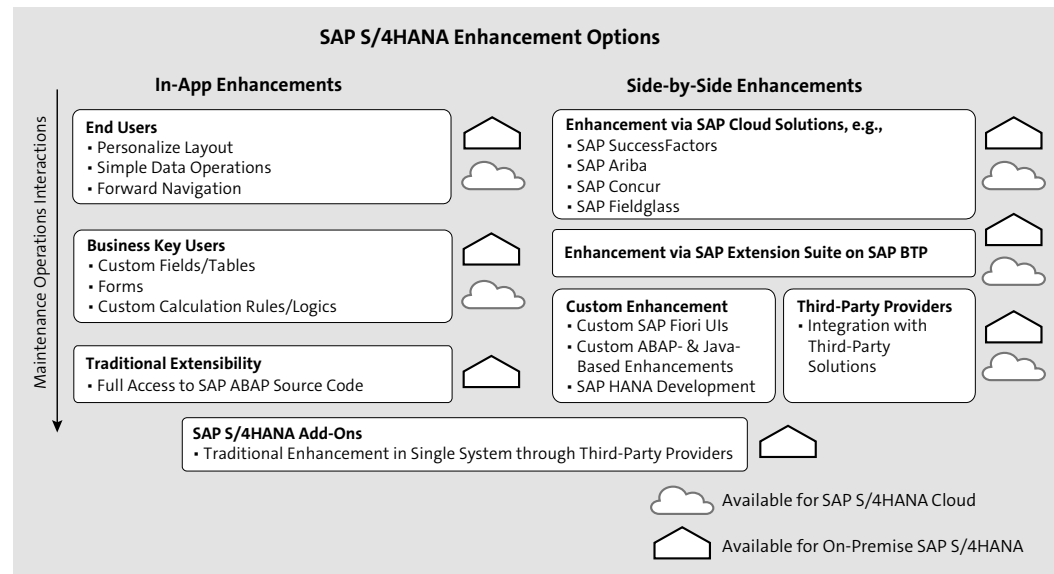


Figure 3.7 Enhancement Options in SAP S/4HANA

3.6.1 Side-By-Side Enhancements

SAP BTP The differentiating characteristic of side-by-side enhancements is that they use SAP BTP, which is a PaaS solution. In addition to the SAP HANA database, this solution contains comprehensive tools for developing, testing, integrating, and operating the software. As a PaaS product, the technical operation of SAP BTP is ensured by SAP, which reduces the workload on the internal IT department. By default, each new release of SAP software is ready for integration with SAP BTP.

Enhancements on this platform can be carried out using various implementation approaches, such as Java code, HTML5 commands, and SAP HANA database queries. Consequently, this enhancement approach is particularly suited to developing custom UIs easily and integrating additional steps into SAP standard business processes.

ABAP Cloud SAP also offers a cloud-based ABAP development and runtime environment in SAP BTP, now called ABAP Cloud, which was introduced in Section 3.5.3. Using this product for side-by-side enhancements, you can efficiently utilize existing ABAP know-how for creating future-proof enhancements—both for SAP S/4HANA and for SAP S/4HANA Cloud.

Side-by-Side Enhancements

The enhancement options based on SAP BTP are ideal for creating custom UIs or additional business process steps.

User Interfaces

The SAP Fiori UIs are written with HTML5 and are based on central SAP libraries (SAPUI5). The software development process for HTML5 applications differs from the development in ABAP, which is the language used to implement the SAP S/4HANA application logic. Therefore, SAP S/4HANA doesn't contain a development environment for HTML5. Instead, SAP provides these tools in an optimized development environment via SAP BTP. In addition to development tools such as an editor, this also includes tools for packaging and deploying the UIs developed. SAP Web IDE is this environment (see <http://s-prs.co/v5816126>).

SAPUI5
Development
Environment:
SAP Web IDE

Business Processes

SAP S/4HANA enables you to supplement existing business processes with your own business logic and data. In most cases, you'll only need to adjust the SAP standard processes to your specific business requirements. In some cases, however, your processes deviate so much from the processes of your competitors that this deviation can no longer be mapped by in-app enhancements. SAP BTP is the ideal enhancement solution here, allowing you to build complex custom applications side by side and then integrate them with SAP S/4HANA. Communication takes place via web services, and the extension logic itself can be created either in Java or in ABAP, as explained in Section 3.5.3.

Additional Java
applications

The PaaS solution already provides the required integration infrastructure for both cases: a central integration middleware with SAP HANA cloud connector and SAP Gateway for integration with SAP Fiori. Consequently, SAP BTP is the optimal basis for enhancements—not only for SAP S/4HANA but also for other applications in the landscape.

Integration
infrastructure

Extending SAP S/4HANA via SAP BTP uses the following APIs:

Released interfaces

- **New SAP S/4HANA interfaces:**
 - Representational State Transfer (REST) web services
 - Simple Object Access Protocol (SOAP) web services
 - Open Data Protocol (OData) web services
- **Traditional SAP interfaces:**
 - Business Application Programming Interfaces (BAPIs)
 - Intermediate Documents (IDocs)

The traditional interfaces are included for compatibility reasons and only released for the enhancement of on-premise SAP S/4HANA. The number of interfaces released is continuously increasing.

Leveraging SAP Business Accelerator Hub

In some cases, it's a challenge to find the right interfaces for a planned enhancement. In addition to finding the interface and interpreting the interface parameters, you also need to consider for which application cases the interfaces were released by SAP. For this reason, SAP provides SAP Business Accelerator Hub as a central repository for APIs. This repository doesn't cover all available SAP APIs, but instead focuses on the interfaces and core data services (CDS) views that are recommended for cloud-oriented enhancements. The usage of interfaces is described respectively. SAP Business Accelerator Hub also offers an option for testing. You can find SAP Business Accelerator Hub at <https://api.sap.com>. In the **SAP S/4HANA Cloud** or **SAP S/4HANA** category, you'll find the interfaces that are relevant for the enhancement of SAP S/4HANA.

3.6.2 In-App Enhancements

In-app enhancements are striking because of their simplicity. These enhancements are implemented in the same system, connections to other systems aren't necessary, and latency is reduced. Furthermore, you can use the existing application as a base and use the powerful ABAP Dictionary, which contains the CDS, to create table views, for example.

You don't necessarily need any development know-how for enhancements as the following enhancement options for users (in ascending power) are also available:

- End-user extensibility
- Key-user extensibility

The key-user extensibility in particular provides the options shown in Figure 3.8.

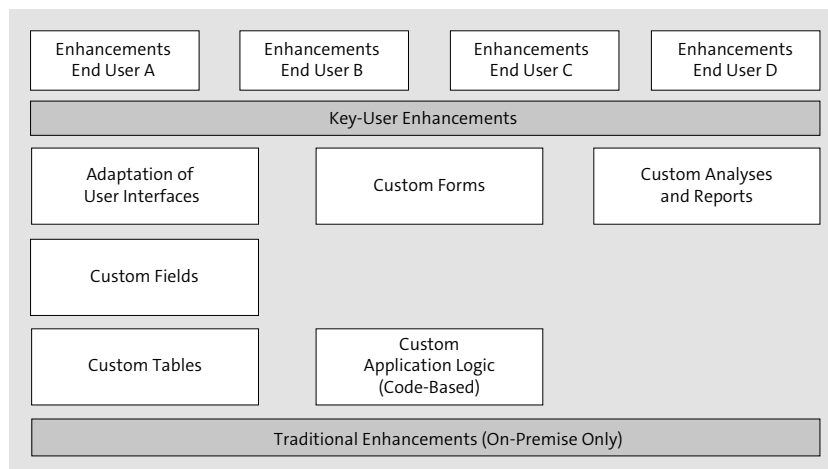


Figure 3.8 In-App Extensibility

Enhancements carried out by central key users impact all users of the system, who can in turn make specific adaptations. The traditional extensibility of the ABAP source code is only available on-premise and is mainly included for compatibility reasons.

End-User Enhancements

End-user enhancements can be implemented directly in SAP Fiori apps. These enhancements are user-specific and don't affect other users of the SAP S/4HANA system. Simple enhancements include customizing screen layouts or selection fields, simple column operations, and basic settings for object-based navigation. These enhancements can only be carried out in specifically prepared applications, and you can access enhancements via the cogwheel icon in the application (see Figure 3.9). You can even customize the cogwheel icon in most SAP Fiori screens.

User-specific customization

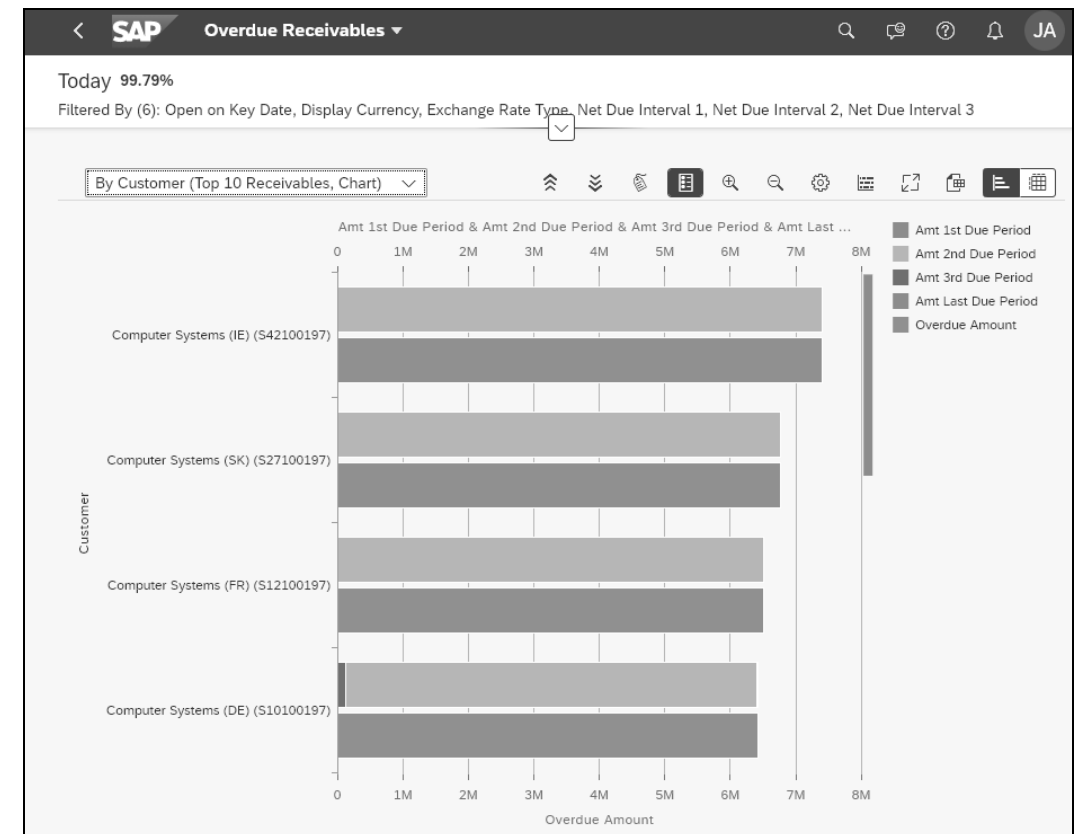


Figure 3.9 End-User Enhancements for User Interfaces

Enhancements without developer knowledge

Key-User Enhancements

Modeling SAP also provides enhancement options that can partially be implemented using modeling procedures, which is useful when customizing UIs or supplementing custom fields or tables. In a new enhancement mode, you only need basic development know-how to modify the calculation logic without directly changing the application code. One of the advantages of this method is that you don't have to adapt enhancements manually when maintaining your SAP software. As a result, operating costs are reduced compared to traditional, code-based enhancements. In contrast to end-user enhancements, key-user enhancements affect all system users. Remember that a specific authorization is required for these key-user enhancement options. This authorization needs to be defined in application catalog `SAP_CORE_BC_EXT` and assigned in accordance with the application role.

Advantages of Key-User Enhancements

Key-user enhancements use modeling rules that won't need subsequent adaptations for maintenance operations.

Enhancement options Key-user enhancement options are selected via SAP Fiori tiles, which are predefined by SAP. Among others, the following options are provided:

- **Customizing UIs**

Similar to end-user customization, you can change the layout of SAP Fiori apps. Examples include hiding fields, renaming identifiers, rearranging blocks, and creating selection variants. These activities don't require any development know-how. To customize a UI, in the application that you want to change, select the user icon in the upper left of the screen first. You can then change the UI using the **Adjust UI** icon.

- **Field extensibility**

In the business contexts provided for that purpose, you can define additional fields for the application to use (see Figure 3.10). Select the **User-defined fields and logic** tile in the **Extensibility** group in the SAP Fiori launchpad. These fields not only are displayed on the UI but can also be stored in the SAP data model and are thus available for database views, searches, and other operations.

- **Table extensibility**

Besides new fields, you can also define and use custom tables in SAP S/4HANA. Similar to custom fields, custom tables are created within SAP S/4HANA and integrated into UIs. The application then exchanges data with the tables. A custom table is a special kind of user-defined business object.

Figure 3.10 Field Extensibility

- **Business objects**

You can define specific business objects for your enhancements. Business objects are sets of tables between which you define relationships. In addition, you can point an interface to access this newly created business object. Doing so enables you, for example, to access these business objects when specifying calculation logic. To access business objects, select the **User-defined business objects** tile in the **Extensibility** group.

- **Adjusting the calculation logic**

You may often find it necessary to check the meaning of entered or displayed data, to specify defaults, or to trigger exception handling. Another example of calculation logic adjustments are specific calculation procedures that aren't provided in the SAP standard. In these cases, additional logic can be inserted in the relevant applications.

The logic is defined in a code-based implementation via a web editor (see Figure 3.11).

In the editor, the syntax is simplified in comparison to traditional ABAP, so that detailed ABAP know-how isn't required. For this adaptation, use the **User-defined fields and logic** tile in the **Extensibility** section and then the **User-defined logic** tab. However, you'll require some development knowledge to do so. Compared to traditional enhancement options, you'll be provided with numerous commands and instructions in this tile. You can also save these enhancements and export them to other systems.

Transport of Enhancements

In general, key-user enhancements should be implemented and tested in a quality assurance system first. To transport verified enhancements to the production system, you can follow this export and import procedure: After

developing your enhancement, select the **Export software collections** tile in the **Transport management** group. Here, assign your extension to a software collection. This can then be exported.

Now, in the target system, select the **Import collection** tile in the **Transport management** group where you can import the previously exported enhancement. Note that export and import are usually performed by a software logistic administrator, so this activity requires specific roles with access to the application catalogs SAP_CORE_BC_SL_EXP (for exporting) and SAP_CORE_BC_SL_IMP (for importing).

The screenshot shows the SAP ABAP development environment. At the top, there are tabs for 'Available Fields' and 'BAdI Documentation'. Below that is a 'Select Variant' dropdown and a search field for 'timeentry:' with a 'Click to add value' button. There are buttons for 'Draft', 'Published', and 'Example'. The main area is titled 'Draft Logic' and contains ABAP code with line numbers 1 through 32. The code includes comments and a table for fallback approver determination. At the bottom, there is a 'Test Results: Draft Logic' section with a table showing parameter values.

Parameter	Description	Value	Type
approverperson	Personnel Number	<input type="text"/>	num(8)
isautoaprvtmeshhtrecreqd		<input type="text"/>	char(1)

Figure 3.11 User-Defined Fields and Logic

Additional Information on Enhancement Options

Further options are available in addition to the described enhancement options. For more details, see the section on *Extensibility* in the product documentation.

Traditional Extensibility

In on-premise SAP S/4HANA, you can still enhance or even modify the ABAP source code using the tools from the traditional SAP Business Suite, such as the ABAP Workbench. While this approach offers the maximum freedom to develop your own custom enhancements, interactions regarding maintenance operations in the system will often be necessary. When implementing new SAP corrections, you'll always have to adjust your enhancements to the SAP Notes. As a result, you need to install corrections in close cooperation with your development department. When migrating to SAP S/4HANA, you should also consider how custom enhancements can be implemented using the new options. You don't have to do this for all existing enhancements; it's subject to individual consideration.

In addition to these more formal enhancement options, SAP S/4HANA also provides comprehensive applications for defining custom data analyses or creating custom forms.

ABAP
enhancements

3.6.3 Checking Custom Enhancements When Migrating to SAP S/4HANA

When you plan to migrate to SAP S/4HANA, you should analyze existing adaptations to the current system:

Analyzing existing
adaptations

- **End-user customization**

Individual end-user adaptations are lost when you migrate to SAP S/4HANA. Users will have to then customize the new product again, as described in Section 3.6.2.

- **Generic enhancements for all users**

Generic enhancements that are effective for all system users can also be implemented when migrating to the new product. The appropriate procedure for this implementation depends on the operating model selected for SAP S/4HANA. You should generally implement these enhancements using the key-user enhancement options, which will result in fewer follow-up costs and simplify the maintenance of the enhancements.

If the source system is an SAP source system, you should run SAP's *custom code check* first. This check identifies custom code in the existing system and generates a task list. Chapter 7, Section 7.2.6, discusses this check in detail.

3.7 Summary

This chapter dove into the different deployment options for SAP S/4HANA Cloud and on-premise SAP S/4HANA. Whereas SAP S/4HANA gives you all controls in when and how solutions can be extended and updated, SAP S/4HANA Cloud helps you stay up-to-date by using a solution managed by SAP. We outlined the options you can leverage to tailor SAP S/4HANA Cloud or SAP S/4HANA to your company's needs via the extensibility options in all members of the SAP S/4HANA product family. We also dove into the SAP program RISE with SAP. This program provides companies with all the tools they need and has great flexibility in implementation with all contract-based components standardized. In addition, we've introduced SAP Business Technology Platform (SAP BTP).

Based on this information, you can scope your migration project. In the next chapter, we'll discuss the detailed preparations with your scope in mind.

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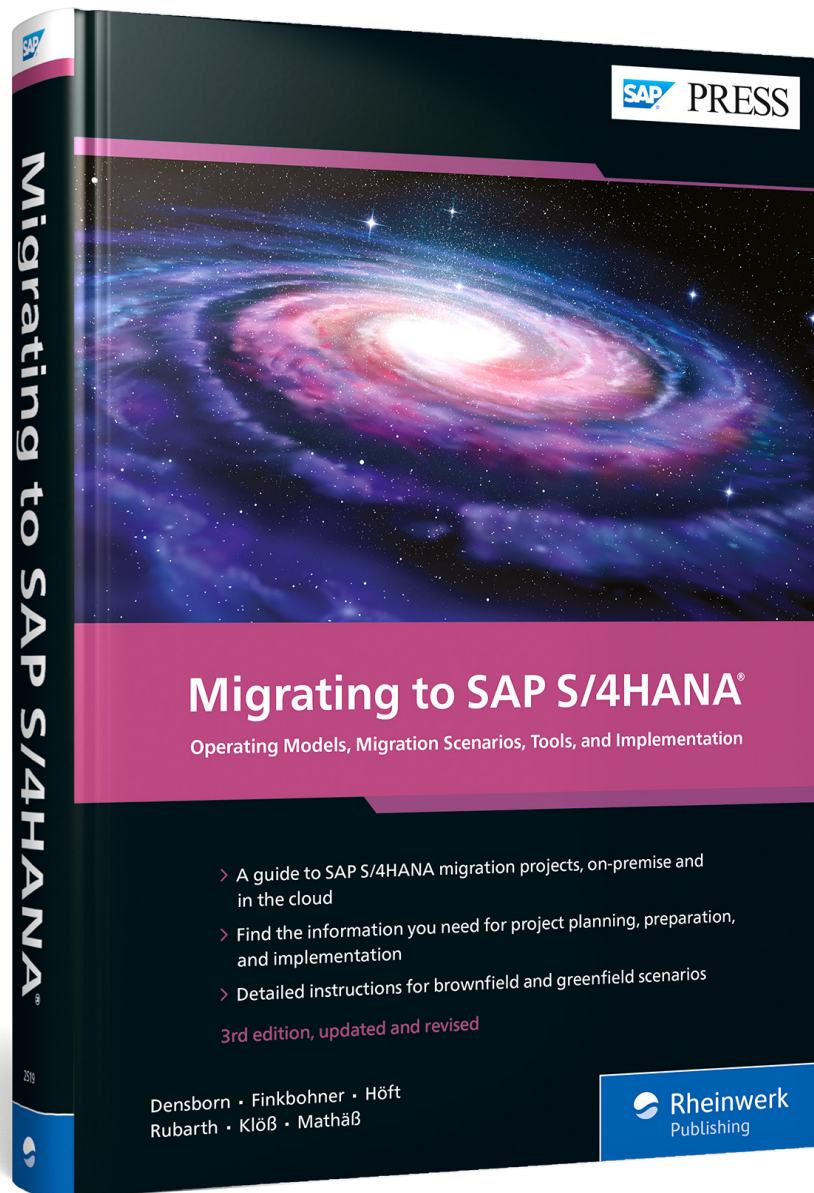
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