Hybrid Integration

CIO Guide: Process and Data Integration in Hybrid Landscapes
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Executive Summary

SAP pursues the goal of making integration in the cloud and hybrid landscapes easy and simple. If this sounds familiar, you may have read “CIO Guide: SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments.” The document you are holding in hand is a step on the way toward that vision and a snapshot of where process and data integration in hybrid environments is now.

The integration strategy of SAP is based on three key building blocks. First, application programming interfaces (APIs) build the cornerstone of our strategy, including the alignment of APIs for new cloud integration scenarios for SAP® software. SAP offers prepackaged integration content – which is increasing quickly over time – based on public APIs to simplify the integration of processes and data spanning multiple applications. Both APIs and prepackaged integration content are delivered through SAP API Business Hub. Second, SAP Cloud Platform Integration is our strategic integration platform for process-centric integration scenarios in hybrid and cloud integration scenarios, which is complemented by the SAP Data Hub solution for data-centric integration scenarios. Third, with the integration solution advisory methodology, we provide a framework for enterprise architects that allows them to shape the integration strategy of their organizations.

This guide provides guidance on when to use which integration technology in a hybrid integration landscape. For process integration, it guides integration architects on when to use SAP Cloud Platform Integration, when to use SAP Process Orchestration software, and when to combine the two – either with each other or with related integration technologies, such as the SAP Application Interface Framework tool or SAP API Management technology.

These considerations extend from application-to-application (A2A) integration to the equally important field of business-to-business (B2B) integration. This document delivers a concise introduction to the SAP Ariba® Cloud Integration Gateway solution that is based on SAP Cloud Platform Integration. This guide also contains a detailed introduction to the integration content advisor for SAP Cloud Platform Integration. The advisor uses machine learning techniques to improve the efficiency of building B2B integrations by making intelligent proposals for customized interfaces and mappings.

A summary of data integration approaches and technologies serves as an introduction to SAP Data Hub. Existing customer investments in technologies are respected, including investments in SAP Data Services software, SAP Landscape Transformation Replication Server, SAP HANA® smart data integration, and the SAP Cloud Platform Smart Data Integration service. SAP Data Hub is able to build on these investments. This guide also gives integration architects explicit guidance on when to use SAP Cloud Platform Integration, when to use SAP Data Hub, and how to combine the technologies for scenarios that include process-and data-centric integration aspects.
Probably one of the most pressing topics for many customers is the integration and transition paths between SAP Business Suite applications, the on-premise version of SAP S/4HANA®, and SAP S/4HANA Cloud. This triangle and its relationship to cloud-based solutions such as SAP Concur® solutions or SAP SuccessFactors® solutions are dealt with in a separate section. The section provides clear guidance on how to integrate the different possible combinations and which transition path to take for which purpose.

Finally, the guide provides insights into the new Cloud Integration Automation service that aims to automate the configuration of prepackaged integration scenarios in a hybrid customer landscape. The service turns manual configuration steps into structured processes guided by semiautomatic workflows. It leverages all relevant information from all concerned integration targets, the customer system landscape, and the user roles involved.

As pointed out above, you should consider this document a snapshot of a step along the way toward the vision for integration advanced by SAP. It is planned that updates and additional documents marking next steps on the way will be provided.

The integration strategy of SAP is based on three key building blocks.
Introduction

Digital transformation is driving new business models, new ways of working, and new ways of collaborating and communicating with customers and partners. Full end-to-end integration among applications, processes, and people – as well as physical assets such as sensors or machines – is critical for the success of any business. Integration as the cornerstone for digital transformation is therefore a key pillar of the strategy for SAP offerings. “CIO Guide: SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments” outlines the long-term vision of SAP with a focus on SAP-to-SAP integration. To complement the CIO guide on SAP’s vision, this CIO guide gives enterprise and integration architects guidance on how to evolve their existing integration architectures based on SAP offerings available today. Figure 1 shows an overview of the key elements of the integration technology strategy of SAP.

SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments outlines the long-term vision of SAP with a focus on SAP-to-SAP integration. To complement the CIO guide on SAP’s vision, this CIO guide gives enterprise and integration architects guidance on how to evolve their existing integration architectures based on SAP offerings available today. Figure 1 shows an overview of the key elements of the integration technology strategy of SAP.

1. Among other things, the multicloud strategy of SAP – with Amazon, Google, and Microsoft as possible infrastructure providers for SAP Cloud Platform – is explained in this blog: https://blogs.sap.com/2017/05/16/sap-cloud-platform-a-positive-sum-game.
The integration technology strategy of SAP consists of the following building blocks.

**Integration styles:** To support the needs of digital transformation, the scope of the traditional integration discipline is constantly growing. Integration technology from SAP holistically covers this broader scope of integration by supporting a number of integration styles. The **process integration style** covers the chaining of distributed business processes between two applications. The **data integration style** covers the movement and synchronization of data between applications, databases, and data lakes outside a transactional context. The **business-to-business (B2B) style** deals with integration between business partners. The related **business-to-government (B2G) style** focuses on integration between companies and government agencies. The **user experience (UX) integration style** covers the rapid recombination of user interfaces (UIs), the consistent mashup of task-specific UIs, and, ultimately, the total integration of multiple user interfaces into one central user interface, ensuring a seamless user experience. With the emergence of the Internet of Things (IoT), the **IoT integration style** covers all scenarios where data from a device, asset, or machine must be integrated with business applications. SAP supports all integration styles, both for SAP-to-SAP integration as well as for SAP-to-third-party integration scenarios. In this document, we focus on process, B2B, and data integration.

SAP supports all integration styles, both for SAP-to-SAP integration as well as for SAP-to-third-party integration scenarios.
Methodology and governance: Besides the pure technology and product perspective, SAP provides the integration solution advisory methodology that supports enterprise architects in shaping their integration strategy. It includes an extensible set of integration styles and use-case patterns that are technology agnostic and can be mapped to integration technologies relevant to a specific customer context (for both integration technologies by SAP and third parties). The methodology can be used to assess and update your integration strategy or derive integration guidelines for your organization as a step toward systematically formalizing integration as a digital business enabler. Across various integration styles, the SAP solution portfolio targets multiple roles such as integration developers, citizen integrators, and business users. With SAP S/4HANA serving as the digital core, we also provide guidance on how to transition from SAP Business Suite to SAP S/4HANA and SAP S/4HANA Cloud.

APIs and prepackaged integration content: As outlined in the CIO vision guide mentioned above, our strategy is based on public APIs to ensure that our applications are open to custom integrations and extensions. Furthermore, prepackaged integration flows for hybrid and cloud-to-cloud scenarios are provided to accelerate the integration of business processes that are distributed across on-premise and cloud applications. These include SAP S/4HANA and SAP Business Suite as well as SAP Ariba, SAP SuccessFactors, SAP Fieldglass®, SAP Concur, and SAP Hybris® solutions. SAP API Business Hub is the central place to discover, explore, and test APIs from SAP and partners for building extensions and integrations. SAP API Business Hub is also the central place for prepackaged integration scenarios, consisting of graphical integration flows that can be configured and extended to enable the flow of messages between two or more participants using SAP Cloud Platform Integration.

The integration strategy of SAP is based on public APIs to ensure that our applications are open to custom integrations and extensions.
Integration technology portfolio: SAP provides a rich set of integration technologies that enable the implementation of the integration styles outlined above, including on premise, cloud, and hybrid. Our integration platform as a service (IPaaS) is built around SAP Cloud Platform Integration as the strategic integration technology for hybrid and cloud-based integration. It complements SAP Process Orchestration, the on-premise integration technology. Both also cover the B2B integration style. SAP Cloud Platform Integration and SAP Process Orchestration are complemented by SAP Application Interface Framework. This tool is an integral part of SAP S/4HANA and technically runs as an add-on for SAP Business Suite, supporting advanced interface monitoring, data validation, and error handling by business users. SAP API Management technology complements the IPaaS portfolio by enabling enterprise-grade security, traffic management, and performance-monitoring capabilities. Within the data integration style, SAP Data Hub serves as a data landscape management solution that enables agile data operations across the enterprise and provides capabilities to answer the challenges of Big Data. It uses existing data integration technologies such as SAP HANA smart data integration, SAP Landscape Transformation Replication Server, and SAP Data Services. It is planned that further integration technologies targeting the UX and IoT integration styles will be described in more detail in later updates to this paper or related documents.

SAP provides a rich set of integration technologies that enable the implementation of the integration styles, including on premise, cloud, and hybrid.

2. Information about all integration services of SAP Cloud Platform can be found at https://cloudplatform.sap.com/dmp/capabilities/us.
Flexible deployment models: The SAP products that constitute the integration technology portfolio from SAP are available for a broad range of deployment models to comply with your individual requirements. This ranges from on-premise and private cloud deployment (for example, for SAP Process Orchestration) to public cloud service offerings (for example, SAP Cloud Platform Integration). It can also include models where the integration component is embedded into an application system (for example, the SAP Application Interface Framework tool embedded in SAP S/4HANA or SAP Business Suite).

Setup and operations: The setup and operation of our integration scenarios is a key part of our strategy and includes monitoring, automation, and security capabilities. SAP Solution Manager provides integration administrators with centralized integration monitoring for both SAP Cloud Platform Integration and SAP Process Orchestration. The new Cloud Integration Automation service provides means to simplify and automate the configuration of prepackaged integration scenarios in hybrid landscapes. The SAP Identity Management component and the SAP Access Control application contribute to system integration in hybrid and cloud environments and make up the identity and access management (IAM) offering from SAP.

The products that constitute the integration technology portfolio from SAP are available for a broad range of deployment models to comply with your individual requirements.

3. Among other things, the multicloud strategy of SAP – with Amazon, Google, and Microsoft as possible infrastructure providers – is explained in this blog: https://blogs.sap.com/2017/05/16/sap-cloud-platform-a-positive-sum-game.
4. Identity and access management (IAM) is the generic industry term for this field of services. This topic is discussed in detail in “CIO Guide: Identity Lifecycle in Hybrid Landscapes.”
This CIO guide covers a subset of the building blocks introduced above as part of our overall integration strategy. The topics focused on are depicted in Figure 2.

**Figure 2: Scope of This Paper**

This document is structured into the following sections:

- **“Integration Solution Advisory Methodology”** provides an overview of relevant integration domains and use-case patterns in a hybrid system landscape. It also outlines how the integration solution advisory methodology can be used by enterprise architects to derive integration guidelines for their organizations.
- **“APIs and Integration Content in SAP API Business Hub”** outlines the key role of APIs in our integration strategy and gives an overview of the capabilities of SAP API Business Hub. This section also provides an overview of pre-packaged integration content for SAP Cloud Platform Integration as well as a pointer to the content road map.
- **“Process Integration”** provides guidance on using the process integration style and describes typical ways you can evolve an on-premise integration architecture into a hybrid integration platform. It contains information on the use of our core integration technologies. They include SAP Cloud Platform Integration and SAP Process Orchestration as well as a direct integration option. The section discusses the possibility of reusing integration content developed in SAP Cloud Platform Integration within the integration runtime of SAP Process Orchestration. It provides an outlook on how our prepackaged integration content will evolve over time through the increasing alignment of APIs between SAP applications. Finally, the section discusses integration technologies of SAP that complement our core integration technologies: SAP Application Interface Framework, SAP API Management, the SAP Cloud Platform Workflow service, and the cloud connector of the SAP Cloud Platform Connectivity service.

This CIO guide covers a subset of the building blocks that make up the overall integration strategy of SAP.
• “Data Integration” provides guidance for using the data integration style, with specific focus on SAP Data Hub and its relationship to SAP solutions for enterprise information management (SAP solutions for EIM). In addition, the section provides guidance on when to use SAP Cloud Platform Integration and when to use SAP Data Hub and how the two can be combined.

• “Transition Path to SAP S/4HANA and Cloud Integration” gives guidance on how to transition from SAP Business Suite to SAP S/4HANA and SAP S/4HANA Cloud and what this means from an integration perspective. The section also includes guidance on using integration protocols and APIs.

• “Integration Automation” provides insights into how our new Cloud Integration Automation service helps simplify and automate the configuration of prepackaged integration scenarios from SAP within a customer landscape.

This guide contains a section that provides guidance on how to transition from SAP Business Suite to SAP S/4HANA and SAP S/4HANA Cloud and what this means from an integration perspective.
Integration Solution Advisory Methodology

To support the digitalization of business processes, the scope of integration practices within customer organizations is constantly increasing. To tackle the broad scope of integration, customers need to evolve their integration architecture while leveraging existing investments and skill sets. Large organizations typically build on the principle of a hybrid integration platform, combining integration technologies and services that may come from different vendors. With the integration solution advisory methodology, we support enterprise architects on this journey. In this section, we give an overview of typical roles involved in integration, followed by use cases illustrating how customers can apply the integration solution advisory methodology. We then describe the general concepts of the methodology in more detail.

INTEGRATION ROLES
Integration typically involves different roles in an organization. The table “Sample Integration Roles and Responsibilities” summarizes frequently occurring integration roles in organizations, including their typical responsibilities. Examples for related activities within the context of SAP software are also provided. The concrete definition of integration roles depends on the customer context, for example, the general scope of integration, the integration maturity level of an organization, or the structure of the IT organization. These roles can help establish an integration competency center or a center of excellence for integration. Either one can play an important role in establishing integration as a recognized discipline within an organization, which will enable it to operate on a well-defined basis of best practices for integration. For further details on the different usage scenarios within an organization for the integration solution advisory methodology, please refer to the section “Use Cases.”

The concrete definition of integration roles depends on the customer context, for example, the general scope of integration, the integration maturity level of an organization, or the structure of the IT organization.

Sample Integration Roles and Responsibilities

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<th>Role</th>
<th>Responsibility</th>
<th>Sample Tasks in SAP® Software Context</th>
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| **Enterprise architect**      | • Definition, communication, and continuous improvement of an integration reference architecture based on an overall IT strategy  
                              | • Definition of integration standards and technology selection guidelines (cross-vendor)  
                              | • Evaluation of new integration technologies                                                                                                                                                                                                 |
|                               | **Integration architect**                                                                                                                                                                                                                                               | Definition and rollout of company-wide technology selection guidelines using the integration solution advisory methodology                                                                                                                                 |
|                               | • Definition of technical integration architectures with a focus on specific integration technologies  
                              | • Definition of technical specifications for integration scenarios based on business requirements  
                              | • Definition and communication of patterns, templates, and best practices                                                                                                                                                                                                 |
|                               | **Integration developer**                                                                                                                                                                                                                                              | **Integration administrator**                                                                                                                                                                                                                                                  |
|                               | • Implementation and test of integration scenarios based on technical specifications  
                              | • Implementation and extension of prepackaged integration scenarios                                                                                                                                                                                                                       |
|                               | **Integration administrator**                                                                                                                                                                                                                                          | • Implementation of integration flows in SAP Cloud Platform Integration or SAP Process Orchestration software  
                                                                                            | • Definition of best practices for integration flows for SAP Cloud Platform Integration, for example, based on enterprise integration patterns |
|                               | • Technical setup and operations of integration scenarios (for example, archiving or certificate management)  
                              | • Technical monitoring of interfaces, including root-cause analysis and technical error handling                                                                                                                                  | **Business domain expert**                                                                                                                                                                                                                                                     |
|                               | **Business domain expert**                                                                                                                                                                                                                                             | Definition of customized business-to-business interfaces and mappings in the integration content advisor for SAP Cloud Platform Integration                                                                                                                                  |
|                               | • Specification of business requirements for a specific business process domain or line of business  
                              | • Semantic definition of interface customizations and messages mapping (with an integration architect)                                                                                                                                                                                   |
|                               | **Business user**                                                                                                                                                                                                                                                   | Error correction, canceling, or restart of messages in the SAP Application Interface Framework tool as part of SAP S/4HANA® or SAP Business Suite applications  
                                                                                            | • Processing of workflow tasks in the SAP Cloud Platform Workflow service                                                                                                                                                               |
|                               | • Monitoring and error correction of messages in a specific business process domain or line of business  
                              | • Processing of workflow tasks  
                              | • Elimination of need for integration knowledge                                                                                                                                                                                                                                          |
|                               | **Citizen integrator**                                                                                                                                                                                                                                               | Implementation of simple integration scenarios by HR business users in the integration center for SAP SuccessFactors® solutions  
                                                                                            | • Integration of buyers and suppliers in the SAP Ariba® Cloud Integration Gateway solution based on a self-service wizard approach                                                                                     |
|                               | • Business user with the ability to perform some integration tasks independently (self-service)  
                              | • Elimination of need for deep integration knowledge                                                                                                                                                                                                                                        |
|                               | **Application or API developer**                                                                                                                                                                                                                                        | Customization of applications with SAP S/4HANA  
                                                                                            | Development of extension applications on SAP Cloud Platform                                                                                                                                                                           |
|                               | • Customization of enterprise applications  
                              | • Provisioning of customer-specific APIs  
                              | • Development of extension applications or mobile applications                                                                                                                                                                                                                     |

USE CASES

The goal of the integration solution advisory methodology is to help raise the integration maturity level of an organization by moving from ad hoc integration to a systematic approach based on well-defined integration standards. This shift supports the creation of self-services for integration specialists working independently (for example, in different lines of business) and citizen integrators.

The integration solution advisory methodology can be applied stepwise for the following use cases (see Figure 3):

- **Common terminology:** As a starting point, enterprise architects can build on a systematic classification scheme of integration domains, integration styles, and use cases that improves the communication between project teams, functional teams, and involved system integrators.

- **Integration strategy assessment and definition:** Enterprise architects can use the methodology to assess their current integration architecture and identify areas for future improvement. The integration solution advisory methodology can also be used to blueprint an integration reference architecture for an organization based on integration technologies from SAP as well as third parties.

- **Integration governance and standards:** Enterprise architects can derive integration standards and policies, giving project teams guidance on when to use which integration technology. This makes it possible to channel the integration demand through well-defined processes and systematically implement integration solutions based on company best practices.

- **Self-service integration:** Based on established integration standards, integration architects can identify areas where independent integration developers or even citizen integrators can implement simple integration scenarios on their own. Their work could be based on the boundary conditions and support of the central integration team. An example would be the implementation of simple integration scenarios by HR business users in an integration center for SAP SuccessFactors solutions.

The goal of the integration solution advisory methodology is to help raise the integration maturity level of an organization by moving from ad hoc integration to a systematic approach based on well-defined integration standards.
**METHODOLOGY IN A NUTSHELL**
The integration solution advisory methodology consists of a set of technology-agnostic integration patterns that can be mapped to integration technologies from both SAP and third parties. The methodology consists of three major steps depicted in Figure 4.

**Figure 4: The Integration Solution Advisory Methodology**

- **Integration domains**: Entry points of the methodology are integration domains that describe typical integration areas within a hybrid system landscape, such as on-premise-to-cloud or cloud-to-cloud integration. The methodology includes domains for the integration of user-centric applications (for example, user to cloud) and IoT devices (for example, thing to cloud). Integration domains are technology agnostic.

Entry points of the methodology are integration domains that describe typical integration areas within a hybrid system landscape, such as on-premise-to-cloud or cloud-to-cloud integration.
• **Integration styles:** Integration styles describe the different categories of integration: process, data, user, and IoT centric. Each integration style has specific characteristics and can be refined by use-case patterns. For example, the data integration style includes use-case patterns such as data replication and data virtualization. The integration solution advisory methodology includes an initial set of use-case patterns that can be extended by customers with additional use cases. Like integration domains, integration styles and use-case patterns are technology agnostic.

• **Integration technology mapping:** Finally, integration styles and use-case patterns can be mapped to integration technologies and services, including integration technologies from SAP and third parties. This allows enterprise architects to derive integration guidelines for their organizations. A sample integration guideline could state that SAP Cloud Platform Integration is the preferred integration technology for the process integration style within the on-premise-to-cloud integration domain. This mapping depends on the customer context, which takes into consideration aspects such as existing investments and available skill sets.

The integration solution advisory methodology has been successfully adopted in large organizations, and it is planned that it will be further enhanced based on community feedback. The blog and recording of the lecture given at the SAP TechEd conference, “**INT203: Integration Solution Advisory Methodology**,” provides more detail. It includes information on how to access the template that SAP offers customers and partners for the integration solution advisory methodology.

The integration solution advisory methodology has been successfully adopted in large organizations, and it is planned that it will be further enhanced based on community feedback.

7. For better readability of this paper, we have used B2B integration as a separate integration style. In the integration solution advisory methodology, it is part of the process integration style.
This section outlines the key role of APIs in the integration strategy of SAP. It gives an overview of the capabilities of SAP API Business Hub and the prepackaged integration content for SAP Cloud Platform Integration and provides a pointer to the content road map.

THE API STRATEGY OF SAP
The cornerstone of the integration strategy of SAP is an API-first approach. SAP offers access to most of the functionality in its services and solutions through APIs. Customers and partners use these APIs from SAP to adapt the provided functionality for their specific use, such as extensions. For example, you can create a new application on SAP Cloud Platform that caters to a use case not addressed by the standard functionality and integrate the new solution or service with other solutions or services. The challenge ahead is to provide this kind of API-based access to all – not just most – relevant solutions, services, and data.

To further the API-first approach, SAP is working on three aspects:
- SAP envisions an integration architecture based on aligned public APIs to ensure that all systems are open for integration and extension. It is planned that new applications will feature fully documented and aligned public APIs, with REST, OData, and SOAP being the preferred integration protocols. The purpose, structure, and primary use case of aligned APIs is agreed on beforehand by its consumers and the team building the API. This ensures that aligned APIs are built with an outside-in approach, involving the consumers in the definition process early, as opposed to the inside-out approach, where existing functionality is exposed as is.

The cornerstone of the integration strategy of SAP is an API-first approach. SAP offers access to most of the functionality in its services and solutions through APIs.

8. “List of Abbreviations” can be found at the end of the document.
SAP API Business Hub enables integration and application developers in the SAP ecosystem to discover, test, and use public SAP APIs and integration content for SAP Cloud Platform Integration (see “Use Cases and Capabilities”). The APIs are documented in the open API format, a vendor-neutral open-source format for REST API documentation (SAP joined the open API consortium in 2017).

While these public APIs facilitate broad and intense reuse, integration and application developers need assurance that these APIs are versioned to deliver the stability they require. SAP is currently extending the existing API lifecycle and version management with an API deprecation policy that defines API versioning, compatibility of changes, and their applicability for all SAP APIs.

To facilitate advanced integration use cases and enable sophisticated extensions, SAP plans to provide advanced API qualities on selected REST and OData APIs. It is intended that business and data change events will, for example, be exposed to subscribers to enable real-time integration capabilities. SAP is also considering enabling OData APIs to support consistent initial loading of large data sets and delta-load capabilities to support offline scenarios and data replication.

SAP’s strategy for new applications is to align coherent domain models, not just single APIs. A domain model defines an object model (data model, types, or values) and the set of possible actions and events not just for one application or use case but across an entire domain and its sub-domains. Please see “SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments” for more details about domain model alignment.

SAP’s strategy for new applications is to align coherent domain models, not just single APIs.
USE CASES AND CAPABILITIES
SAP API Business Hub (see Figure 5) is a public catalog of all SAP APIs and partner APIs. It helps integration and application developers – including our customers, partners, and ecosystem – to search, discover, experience, and consume the right APIs to build apps and integrations easily.

SAP API Business Hub has four main ingredients:
• A **public catalog** of SAP APIs from SAP Business Suite applications, line-of-business applications, SAP S/4HANA, and SAP Cloud Platform. Also included are business services, such as data quality, globalization services, and machine learning. These are provided with standardized documentation in the OpenAPI Specification (originally known as the Swagger Specification) for integration and application developers. The catalog also contains APIs from our partners and the ecosystem.

SAP API Business Hub is a public catalog of all SAP APIs and partner APIs. It helps integration and application developers search, discover, experience, and consume the right APIs to build apps and integrations easily.
• **An API sandbox** lets integration and application developers try out the APIs and learn how to use them without having to sign up for each individual application and solution. Developers can use the APIs to connect to their own environments from the sandbox and test against these environments.

• **Prepackaged accelerators**, such as packaged integration scenarios from SAP and partners, help accelerate integration projects. SAP API Business Hub provides policy templates and best-practice information for API projects. SAP API Business Hub includes adapters for SAP Cloud Platform Integration provided by SAP partners that support integration with third-party applications such as those from Salesforce.com Inc., several services within Amazon Web Services, and Microsoft Dynamics CRM.

• **Tool integration and easy consumption** are important design principles of SAP API Business Hub. Integration developers can consume pre-packaged accelerators in environments such as SAP Cloud Platform Integration or SAP API Management in a discover-deploy-consume experience. Application developers can consume APIs in SAP Web IDE to accelerate application development. They can consume APIs in SAP Cloud Platform Mobile Services to create mobile apps and in the SAP Build service to help integration developers and citizen integrators build apps and prototypes quickly.
The road map for SAP API Business Hub focuses on the following areas:

• **APIs from SAP and partners**: Currently, over 1,500 content items are available, including APIs, policy templates, and integration flows. SAP plans to deliver more APIs covering areas such as the SAP Business ByDesign® solution and the SAP Business One® application. Also planned are new platform services, such as machine learning and blockchain, and industry-specific services, for example, consent management. Partners also offer content, such as APIs for location-based services, supply chain management, and prepackaged integration content for payroll services.

• **API discovery**: SAP API Business Hub has a comprehensive search-and-discover capability to find the right API. Based on consumer feedback, we constantly improve the API discovery function. Results of this feedback include a scenario-based API discovery feature and a machine learning–powered hub assistant to help integration and application developers find the right content for their scenarios.

• **A business hub for customers (hub as a service)**: SAP is planning to offer customers the digital content delivery infrastructure that powers SAP API Business Hub. Customers will be able to manage the lifecycle of their own content, such as APIs, apps, and integration packages, and engage their developer ecosystems.

**ROAD MAP FOR INTEGRATION CONTENT**

To help customers integrate our cloud and on-premise applications, SAP offers predefined integration packages that can be configured, run, and monitored with SAP Cloud Platform Integration. Included is integration content for SAP S/4HANA and SAP SuccessFactors, SAP Ariba, SAP Hybris, SAP Fieldglass, and SAP Concur solutions. Predefined integration content is also available for third-party cloud applications and B2B and B2G integration scenarios on SAP API Business Hub. A detailed road map for planned cloud integration features can be found at [https://sap.com/roadmaps](https://sap.com/roadmaps) under SAP Road Map for Cloud Integration.

To integrate our cloud and on-premise applications, SAP offers predefined integration packages that can be configured, run, and monitored with SAP Cloud Platform Integration.
Process Integration

This section provides technology guidance for the process integration style. The first part discusses how to use the core integration technologies from SAP – SAP Cloud Platform Integration and SAP Process Orchestration – within the context of a typical hybrid system landscape. It outlines how the SAP Application Interface Framework tool, along with SAP S/4HANA and SAP Business Suite, complements the two core technologies with additional capabilities, such as error handling for business users. This combination makes it possible for integration architects to implement end-to-end integration scenarios across integration and application layers. This section then provides an overview of related integration technologies, such as SAP API Management technology and the SAP Cloud Platform Workflow service, that complement the core technologies for additional use cases.

SAP Application Interface Framework complements core integration technologies from SAP with additional capabilities, such as error handling for business users.
CORE INTEGRATION TECHNOLOGIES

SAP Cloud Platform Integration and SAP Process Orchestration build the foundation of SAP’s integration strategy for supporting A2A, B2B, and B2G integration as well as for use cases for master data synchronization. The technologies are complementary. SAP Cloud Platform Integration is SAP’s strategic integration technology for hybrid and cloud integration for both SAP-to-SAP integration as well as third-party integration. SAP Process Orchestration is on-premise integration software that bundles process integration, business process management, and business rules management capabilities. One subsection describes the evolution of prepackaged integration content for SAP Cloud Platform Integration, which follows SAP’s strategy for building new SAP-to-SAP integration scenarios based on public and aligned APIs (see “The API Strategy of SAP”). Described next is how SAP Cloud Platform Integration and SAP Process Orchestration can be used to complement each other in a typical hybrid system landscape. Focus is then given to how integration content developed for SAP Cloud Platform Integration can be deployed on SAP Process Orchestration (starting with release 7.5). The section concludes with a discussion on how, based on typical integration patterns, SAP Application Interface Framework can be combined with SAP Cloud Platform Integration and SAP Process Orchestration.


9. A detailed definition of the use cases is given in “SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments.”
EVOLUTION OF INTEGRATION CONTENT
SAP and its partner ecosystem provide a wide variety of prepackaged integration content to support the integration of SAP software as well as third-party applications based on SAP Cloud Platform Integration. SAP aims to simplify the integration with and between SAP solutions with the ultimate goal of zero integration effort for SAP-to-SAP integration in the cloud. SAP plans to develop new integration scenarios between applications where SAP controls all ends of the integration based on aligned APIs (see “The API Strategy of SAP”). This will minimize the integration efforts for new integration scenarios for SAP software, as no structure mapping between the standard API of a consumer and a provider will be required. SAP Cloud Platform Integration supports both types of integration scenarios – those for unaligned as well as aligned APIs (see Figure 6).

Figure 6: Evolution of Integration Content from SAP

SAP aims to simplify the integration with and between SAP solutions, with the ultimate goal of zero integration effort for SAP-to-SAP integration in the cloud.
• **Mediated integration flows** in SAP Cloud Platform Integration address SAP-to-SAP integration scenarios that are not based on aligned APIs (for example, integration flows of existing prepackaged integration scenarios). Integration mediated by SAP Cloud Platform Integration covers all integration scenarios that include third-party applications, business partners (B2B), or public authorities (B2G). Mediated integration flows typically make use of integration patterns, such as structure mappings, splitters, aggregators, and protocol adaptation (for example, from REST/OData to SOAP). They are executed on the runtime of SAP Cloud Platform Integration.

• **Route-through integration flows** in SAP Cloud Platform Integration are based on aligned APIs, have exactly one consumer and one provider, and do not change the message payload or the header. The customer has the choice to deploy a route-through integration flow on the runtime of SAP Cloud Platform Integration. Reasons could include complying with company standards, establishing central monitoring capabilities, or enabling extensions such as routing to multiple back-end applications. Optionally, the consumer and provider of an integration flow could be directly integrated during runtime for simple landscapes that do not require runtime governance. A route-through integration flow with SAP Cloud Platform Integration also provides the foundation to plug in customer extensions.

Examples could be for the enrichment of the standard flow with information from third-party applications, or the integration of an archiving system. A customer extension changes the route-through integration flow into one that is mediated by SAP Cloud Platform Integration. SAP plans to provide tool support to generate route-through integration flows for SAP Cloud Platform Integration based on aligned APIs from SAP or third parties in SAP API Business Hub.

Besides simplifying prepackaged integration scenarios from SAP using aligned APIs, SAP is currently investing in various areas to further simplify integration:

• The integration content advisor for SAP Cloud Platform Integration leverages machine learning and crowdsourcing techniques so B2B integration flows can be created more efficiently. The advisor helps reduce the expert domain knowledge required to mediate between interfaces (see “B2B Integration”).

• To streamline the technical configuration of integration content from SAP, the Cloud Integration Automation service simplifies and automates the configuration process for integration scenarios within a hybrid landscape based on the SAP Cloud Platform Workflow service (see “Integration Automation”).
SAP Process Orchestration offers B2B functionality with exhaustive capabilities to integrate business partners, leveraging industry standards such as EDIFACT and ANSI X.12.
On-premise-to-on-premise integration: When starting with a typical as-is customer landscape, SAP Process Orchestration is the recommended approach for integrating on-premise software such as SAP S/4HANA, SAP Business Suite, third-party applications, and legacy applications (see Figure 7, path 1). In addition, SAP Process Orchestration offers B2B functionality with exhaustive capabilities to integrate business partners, leveraging industry standards such as EDIFACT and ANSI X.12 (see “B2B Integration”). SAP Process Orchestration is also available in SAP HANA Enterprise Cloud and can be used to connect on-premise applications in the customer landscape with applications hosted in a private cloud environment.

Hybrid integration: If a customer with a major on-premise footprint and existing investments in SAP Process Orchestration wants to integrate a single cloud solution from SAP (for example, an SAP SuccessFactors solution), SAP Process Orchestration can be used (see Figure 7, path 2a). For customers with an increasing need to integrate cloud applications, for example, due to a dedicated cloud strategy, SAP Cloud Platform Integration is the recommended integration platform. It provides a rich set of prepackaged integration scenarios that is being continually increased. Following SAP’s integration strategy as introduced above, SAP Cloud Platform Integration supports mediated integration for SAP application scenarios that are not based on aligned APIs (see Figure 7, path 2b). Aligned APIs between two SAP applications may provide route-through content for SAP Cloud Platform Integration. In that case, the customer can choose to deploy the route-through integration flow on the runtime of SAP Cloud Platform Integration, for example, to comply with company standards or if point-to-point integration should be used. The point-to-point (direct) option may be considered for simple landscapes (see Figure 7, path 2c). Customers with a policy to route all communication to and from the cloud through their local SAP Process Orchestration can integrate SAP Process Orchestration with SAP Cloud Platform Integration. However, this leads to the necessity of maintaining routing rules in both technologies. In addition to SAP-to-SAP integration scenarios, SAP Cloud Platform Integration can be used to integrate cloud-based software from third parties, business partners, business networks, and public authorities. Examples are the integration of SAP applications with SAP Information Collaboration Hub for Life Sciences to track pharmaceutical products at every stage in the supply chain. Another example is the integration of SAP applications with the systems of tax authorities (e-documents).

In addition to SAP-to-SAP integration scenarios, SAP Cloud Platform Integration can be used to integrate cloud-based software from third parties, business partners, business networks, and public authorities.
Cloud-to-cloud integration: SAP Cloud Platform Integration is the recommended approach for integrating between cloud applications (see Figure 7, path 3). SAP-to-SAP scenarios can be managed by SAP or by the customer. For scenarios managed by SAP, configuration and operation is performed by SAP, which gives the customer maximum speed to value and lowest project risk. In the customer-managed case, prepackaged integration content is provided by SAP and configured by the customer while SAP still operates the SAP Cloud Platform Integration service. This provides the customer with the highest flexibility and the ability to implement custom extensions. SAP Cloud Platform Integration can also be used to integrate cloud applications from third parties, business partners (B2B), and public authorities (B2G).

SAP Cloud Platform Integration and SAP Process Orchestration are complementary offerings. The following table summarizes key criteria for integration architects to consider when deciding which integration technology to use. For additional technology guidance for the B2B integration style, see “B2B Integration.”

### SAP® Cloud Platform Integration and SAP Process Orchestration

<table>
<thead>
<tr>
<th>Deployment</th>
<th>SAP® Cloud Platform Integration</th>
<th>SAP Process Orchestration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Data centers owned and run by SAP</td>
<td>• Customer landscape</td>
<td>• Private cloud (for example, SAP HANA® Enterprise Cloud)</td>
</tr>
<tr>
<td>• Multicloud</td>
<td>• Private cloud</td>
<td>• Full control over integrations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operations</th>
<th>SAP</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>License model</td>
<td>Monthly subscription fee, pay per use</td>
<td>Product license</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Architecture</th>
<th>• Multitenancy with data isolation</th>
<th>• Single-tenant solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Virtualization with automated failover</td>
<td>• Fails to be configured by customer</td>
</tr>
<tr>
<td></td>
<td>• Rolling software updates</td>
<td>• Near-zero downtime maintenance for updates through support packages or enhancement packages</td>
</tr>
</tbody>
</table>

| Prepackaged integration content          | Availability for a wide variety of cloud solutions from SAP, third-party applications, and business-to-business and business-to-government scenarios | Availability for a wide variety of on-premise SAP® software and third-party software |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | • Runtime of the SAP Cloud Platform Integration service (starting from SAP Process Orchestration software, release 7.5) for reuse of cloud integration content | • Runtime of the SAP Process Orchestration software (starting from SAP Process Orchestration software, release 7.5) for reuse of cloud integration content |

<table>
<thead>
<tr>
<th>Preferred integration domains</th>
<th>• Cloud to cloud</th>
<th>• On premise to on premise (for customers with cloud focus)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• On premise to cloud</td>
<td>• On premise to on premise (for customers with an on-premise focus)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Decision criteria</th>
<th>• Center of gravity – deployment of most or leading applications – in the cloud</th>
<th>• Center of gravity – deployment of most or leading applications – on premise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• No need to invest in on-premise middleware (installation, operation, upgrades)</td>
<td>• Interest in leveraging an existing investment in SAP Process Orchestration</td>
</tr>
<tr>
<td></td>
<td>• Fast innovation cycle</td>
<td>• Customer interest in having full control over integration (installation, operation, upgrades)</td>
</tr>
<tr>
<td></td>
<td>• Flexible license model</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Scenarios with a need for compliance, such as e-invoicing or payroll, to integrate with legal authorities</td>
<td></td>
</tr>
</tbody>
</table>

10. See the road map for [SAP Cloud Platform Integration](#).
Reuse of Integration Content

Prepackaged integration content is built and released by SAP following a cloud-first strategy: new content is built on SAP Cloud Platform Integration, leveraging fast innovation cycles in the cloud, and shipped through SAP API Business Hub. With release 7.5, SAP Process Orchestration has been extended to support a variant of the runtime of SAP Cloud Platform Integration. As per the release schedule of SAP Process Orchestration, dedicated versions of the runtime of SAP Cloud Platform Integration are planned to be released for SAP Process Orchestration. This is intended to enable compatibility of the corresponding content versions of SAP Cloud Platform Integration and SAP Process Orchestration. This content compatibility allows customers to continue to leverage their investments in SAP Process Orchestration while benefiting from the capability to run pre-packaged cloud integration content on SAP Process Orchestration (see Figure 8).

Customers and partners can use the Web tooling of SAP Cloud Platform Integration to create and configure cloud integration content. In the discover area of their SAP Cloud Platform Integration tenant, they can browse integration content packages provided by SAP and partners and copy them to their workspace. In the design area of SAP Cloud Platform Integration, they can modify and configure the content. Within the cloud integration content management cockpit of SAP Process Orchestration, customers can connect to their tenant of SAP Cloud Platform Integration, select the relevant integration flow, and deploy, run, and monitor it on the local runtime of SAP Cloud Platform Integration.

Figure 8: Reuse of SAP Cloud Platform Integration Content on SAP Process Orchestration

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SAP introduced product profiles to make sure that cloud integration content modeled in the workspace of SAP Cloud Platform Integration is compatible with a specific release of SAP Process Orchestration. A specific product profile restricts the configuration of an integration flow to the set of adapter types and integration flow steps supported by a particular release and support package stack of SAP Process Orchestration. Based on the common cloud-based design time, including the integration flow concept, SAP follows a common modeling paradigm. This gives customers the flexibility to decide where to deploy their integration flows – in the cloud or on premise. This can, for example, be useful in cases when the customer wants to run some integration flows on premise during migration phases and later deploy them in the cloud.

**SAP Application Interface Framework**

SAP Application Interface Framework is an interface management tool that is embedded in SAP S/4HANA and serves as an add-on to SAP Business Suite. It complements SAP Cloud Platform Integration and SAP Process Orchestration with a deep integration capability in the application layer (see **Figure 9**). SAP Application Interface Framework provides an efficient way to implement, monitor, and analyze inbound and outbound application interfaces from a central location within the application. It provides full access to the relevant data and functions of the underlying SAP applications. This, for example, makes it possible to implement data validation checks as well as value mappings that rely on application data and business logic.

SAP Application Interface Framework provides an efficient way to implement, monitor, and analyze inbound and outbound application interfaces from a central location within the application.
In addition, SAP Application Interface Framework enables business users to monitor interfaces, trigger alerts, and manage errors without IT support, which drastically reduces the time needed for error handling. Integration messages that run into application-level errors can be efficiently corrected by business users in a way that complies with the General Data Protection Regulation (GDPR). It eliminates the need to return the message to the sending application and ask for a resend. SAP Application Interface Framework improves governance through role-based access to interface data and through its capability to hide sensitive fields from monitoring and error handling.

Figure 9: The SAP Application Interface Framework

SAP Application Interface Framework complements SAP Cloud Platform Integration and SAP Process Orchestration with a deep integration capability in the application layer.
The combination of SAP Application Interface Framework with SAP Cloud Platform Integration or with SAP Process Orchestration (with both being part of the integration layer) has great potential. Available with either SAP S/4HANA or SAP Business Suite, it provides integration architects with a powerful combination for integrating external applications, business partners, and public authorities. The management of process integration becomes simpler, because integration patterns can be distributed ideally in the integration layer or close to the application.

Figure 10 gives an overview of typical integration patterns best implemented in the integration layer or the application layer and provides guidance for integration architects on best practices for each integration pattern.

<table>
<thead>
<tr>
<th>Integration Pattern</th>
<th>Integration Layer</th>
<th>Application Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure mapping</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Routing</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Splitter</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Aggregator</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Protocol adaptation</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Value mapping – static code list</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Value mapping – dynamic code list</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Data validation</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Forward error correction (business user)</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

The combination of SAP Application Interface Framework with SAP Cloud Platform Integration or with SAP Process Orchestration (with both being part of the integration layer) has great potential.
It is recommended that the following integration patterns be implemented in the integration layer either in SAP Cloud Platform Integration or SAP Process Orchestration, as reflected in Figure 10:

- **The structure mapping pattern** maps message fields between two interfaces. Structure mappings can mediate between different structures of the same format (for example, two different XML structures) or even change the format (for example, from JSON to XML).
- **The routing pattern** is used to determine, for a given message, a set of receivers based on static settings (technical routing) or message payload data (content-based routing). Logical receiver destinations define a message receiver within the sending application. The determination of logical receiver destinations within an application is usually tightly coupled with the application data and process model and hence is part of the application layer. An example is the configuration of the distribution model in the ABAP® programming language.
- **The splitter pattern** creates multiple messages out of a received message by fragmenting the payload by a splitter rule. By then applying the routing pattern, split message parts might be routed to different receivers.
- **The aggregator pattern** collects multiple inbound messages until a modeled threshold is reached. A single payload is then constructed out of all aggregated payloads by applying a certain aggregation rule. Finally, this single message is forwarded to the receivers.
- **The protocol adaptation pattern** handles the mediation between two different protocols used by the sending and receiving applications (for example, Java Message Service, REST, or SOAP).

For further integration patterns related to the integration layer, refer to the book *Enterprise Integration Patterns* published in 2003 by Gregg Hohpe and Bobby Woolf.

The splitter pattern creates multiple messages out of a received message by fragmenting the payload by a splitter rule. By then applying the routing pattern, split message parts might be routed to different receivers.
The following patterns can be implemented either in the integration layer or the application layer.

- The **value mapping pattern** transforms field values that are exchanged between two applications. Since this pattern is tightly coupled with business application data, business users must be able to maintain value mappings in a dynamic way. This is a typical pattern that is covered by SAP Application Interface Framework, as business users may detect application errors, such as incomplete value mappings, due to unforeseen values coming up. They then must extend these mappings in an agile way close to the application. Static code list value mappings (for example, country code mappings) can be best implemented in the integration layer, as they can be reused across multiple integration scenarios between various applications.

- The **data validation pattern** checks a received message with respect to schema correctness or data correctness. This pattern can be applied in the integration layer as well as in the application layer. SAP Application Interface Framework particularly supports this pattern, as it provides full access to application data and functions.

- The **forward error correction pattern** handles an application error during message processing by forwarding it to the receiver. One key capability of SAP Application Interface Framework is error correction and resolution by business users.

One key capability of SAP Application Interface Framework is error correction and resolution by business users.
RELATED INTEGRATION TECHNOLOGIES
This section gives an overview of related technologies for specific use cases that complement the core technologies: SAP API Management technology and the SAP Cloud Platform Workflow service as well as the SAP Cloud Platform Connectivity service.

SAP API Management
SAP API Management provides a solution for the full lifecycle management of APIs. This technology complements SAP Cloud Platform Integration. APIs provide a hinge between “mode 1” IT, the on-premise ERP software, databases, and legacy systems, and “mode 2” IT, the agile and innovative solutions offered mostly in the cloud. Our enterprise customers from different lines of business (HR, procurement, finance) and different industries (retail, telecommunications, media, public sector, banking, and utilities) leverage managed APIs with SAP API Management in the following archetypical scenarios:

• Omnichannel and mobile access – In retail and media, omnichannel access has become the new reality, as most consumers today use mobile devices rather than PCs or laptops to access Web-based services. Retail mobile apps use product catalogs, order management, and transportation information and processes. APIs provide omnichannel access across mobile apps, kiosks, and retail outlets. The use of APIs is further intensified by the fact that many mobile initiatives are driven by external agencies and application developers who have limited knowledge of enterprise systems and their platforms. Therefore, they often rely on APIs that serve their specific purpose.
• **Open real-time integration** – In B2B, business collaborations are often driven through APIs. In the banking industry, the rise of numerous FinTech startups and some legal regulations – such as the Revised Directive on Payment Services (PSD2) in Europe – require banks to expose basic account and transaction details through APIs. SAP Concur solutions provide a travel business network by exposing APIs, so partners such as Uber Technologies Inc., Airbnb Inc., Marriot International Inc., and The Hertz Corporation can integrate with the network. This trend is technically supported by the microservices architectural style that leads to well-defined business capabilities that are exposed through APIs for open A2 integrations.

• **Data access governance and monetization** – Organizations in the fields of telecommunication and utilities curate Big Data in their data lakes and expose it in a governed fashion to their ecosystems, sometimes even monetizing this data. In some cases, regulatory compliance requires exposing enterprise data to regulators and governmental agencies or to citizens in the public sector. In these cases, APIs help to expose data with the necessary governance. Sometimes, even other internal departments gain access through APIs.

Regulatory compliance may require exposing enterprise data to regulators and governmental agencies or to citizens in the public sector. In these cases, APIs help to expose data with the necessary governance.
SAP API Management complements SAP Cloud Platform Integration and SAP Process Orchestration by allowing you to manage the full lifecycle of APIs – from design, development, management, and usage analytics to engaging with the developer community. Figure 11 shows a typical hybrid system landscape consisting of four logical layers: the API consumption layer, the API management layer, the integration layer, and the application layer, including the relevant roles.

Integration of SAP API Management with cloud and on-premise applications can be established through SAP Cloud Platform Integration or SAP Process Orchestration. Or it can be established through a direct integration link if no mediation or runtime governance through a central hub is required. Integration with back-end applications can also be achieved by using, for example, the OData provisioning service of SAP Cloud Platform or SAP Gateway technology.

Figure 11: SAP API Management

Figure 12 gives an overview of some typical API policies and integration patterns that are best implemented in the API management layer or the integration layer. It provides guidance for integration architects on how to combine the capabilities of both offerings optimally.

Policies define a set of rules that are applied to an API to customize its behavior. It is recommended that the following policies and patterns be implemented in the API management layer, represented by SAP API Management:

- **API traffic management policies** – This group of policies helps control traffic quotas and spikes and can set concurrent rate limits for an API. For example, the quota policy helps API providers restrict the number of calls made to an API, for example, in a specific time frame. It also supports the definition of cache policies for an API.
• **API security policies** – This group of policies lets you control security-related aspects of an API. For example, the access control policy makes it possible to limit access to APIs to a specific IP or group of IPs (whitelisting, blacklisting). Another example is the verify API key policy, which enforces verification of the application key to access certain APIs. SAP API Management automatically generates API keys on behalf of applications. It enables API providers to view, approve, and revoke API keys.

• **API analytics and monetization** – SAP API Management provides analytics to understand API usage as well as errors. Custom reports can be created in the platform. Metering APIs help to obtain metering information for integrations with billing software systems, such as the SAP Hybris Billing solution. SAP API Management provides a built-in rating and monetization capability for simple API monetization use cases.

SAP API Management supports basic structure mappings. Forty built-in policies help manage and secure API end points. SAP ships support for best-practice policies in SAP API Business Hub to be copied to and reused in the customers’ tenants of SAP API Management. Engaging with developer ecosystems is an important part of SAP API Management. The technology allows API developers and product managers to create API products by packaging several APIs, define rate plans, and publish these API products to the developer portal included in SAP API Management. Customers can create their own branded developer portals using the SAP Cloud Platform Portal service.

Engaging with developer ecosystems is an important part of SAP API Management. It lets API developers and product managers create API products by packaging several APIs, define rate plans, and publish these API products to a developer portal.
As mentioned in “SAP Application Interface Framework,” it is recommended that the following patterns be implemented in the integration layer – either in SAP Cloud Platform Integration or SAP Process Orchestration: structure mapping, routing, splitter, aggregator, protocol adaptation, and value mapping. For additional integration patterns related to the integration layer, refer to the book *Enterprise Integration Patterns*. The API policies and integration patterns listed are only a sample of typically used policies and patterns.

**SAP Cloud Platform Workflow**

For customers with an on-premise focus, SAP Process Orchestration provides the capabilities for business rules management, business process management, and process integration. It supports processes running across different third-party and SAP solutions as well as the involvement of disparate business users in a single solution. The possibility of creating net-new processes as well as extensions of existing processes provides more flexibility. In these use cases, SAP Business Process Management software focuses on human-centric processes and orchestrates system-centric ones running on the SAP Process Integration offering – both essential parts of SAP Process Orchestration.

In the cloud, SAP Cloud Platform Workflow covers human-centric processes, while system-centric processes are covered by SAP Cloud Platform Integration. In supporting new workflow-based applications and extensions of standard cloud application workflows, SAP Cloud Platform Workflow uses SAP Cloud Platform Integration to connect to other applications, services, and systems. In other words, the “power couple” of integration and business process management now also provides its strengths in the cloud.

The workflows in SAP Cloud Platform Workflow are modeled within SAP Web IDE using the industry-standard Business Process Model and Notation (BPMN) 2.0.
Different task types are available for modeling workflows. For example, user tasks can be linked to a user interface designed with the SAP Fiori® user experience to involve the business user and trigger his or her required action. Service tasks are meant to read and write data to and from other services provided by external or internal applications. This could occur directly through REST APIs or mediated through the integration capabilities of SAP Cloud Platform Integration. You can select available services directly from SAP API Business Hub or integrate business rules built with the SAP Cloud Platform Business Rules service for flexible and agile decision management. With the available gateways (for example, split or XOR), it is possible to control the flow of the designed process and let the system decide which course to take in a process based on defined conditions. With the REST APIs provided, integrating these workflows into custom-built applications is straightforward.

The user tasks mentioned can be managed with the “My Inbox” app, an SAP Fiori app. It serves as the central in-box for the SAP Business Workflow tool, SAP Process Orchestration, and SAP S/4HANA.

Besides design and execution, an integration administrator, business user, or a user in a similar role must ensure that the workflows are running smoothly and respond in case of any issues. For this purpose, SAP Cloud Platform Workflow comes with the “monitor workflow” app, also an SAP Fiori app. With it, the integration administrator can access, monitor, and – in case of any errors – work on all deployed and running workflows.

SAP Cloud Platform Workflow comes with the “monitor workflow” app, also an SAP Fiori app. With it, the integration administrator can access, monitor, and – in case of any errors – work on all deployed and running workflows.
The use cases supported by SAP Cloud Platform Workflow are quite diverse. Examples include process extensions for SAP S/4HANA, adaptation of procurement processes, development of custom marketing campaign approval processes, and tailoring manufacturing change-management processes to support business requirements. Other common use cases include the extension of line-of-business solutions from SAP – such as the SAP Hybris Cloud for Customer solution, SAP Ariba solutions, SAP Concur solutions, and SAP SuccessFactors solutions (see Figure 13) – to handle more complex workflow requirements.

In the future, it is planned to enhance the service to further strengthen the core workflow and task management capabilities. Other planned goals are to simplify the development of user interfaces and integrations with other services and applications.

**Figure 13: Employee Onboarding Scenario As an Extension of SAP SuccessFactors Solutions**
The Cloud Connector for SAP Cloud Platform Connectivity
The cloud connector comes as a standard part of SAP Cloud Platform Connectivity. It establishes secure technical connectivity between cloud solutions from SAP and protected on-premise networks that cannot be accessed directly from the Internet. The cloud connector is used in hybrid scenarios in which cloud applications must access or extend on-premise software. It can be combined with SAP Cloud Platform Integration when process integration is needed (see “SAP Cloud Platform Integration and SAP Process Orchestration”).

The cloud connector acts as a reverse invoke proxy component that is installed and runs on an on-premise network. It establishes a tunnel using the Transport Layer Security protocol – which replaces Secure Sockets Layer – from the on-premise network to its counterpart in the cloud, the SAP Cloud Platform Connectivity service. SAP Cloud Platform Connectivity is integrated in SAP Cloud Platform and SAP S/4HANA Cloud. Once a tunnel from the cloud connector to SAP Cloud Platform Connectivity has been established, cloud applications authorized to use SAP Cloud Platform Connectivity can access whitelisted, on-premise systems through the tunnel. From an application perspective, the connectivity service and its tunnel act like an HTTP- SOCKS5 proxy, that is, they can be used in a programming-language-agnostic way. The cloud connector administrator has full control over which on-premise systems are exposed to the cloud. The administrator can restrict access to on-premise systems to explicitly configured resources when using HTTP or RFC. The administrator can also switch the tunnel on or off at any given time. A single cloud connector instance can be connected to multiple subaccounts of SAP Cloud Platform and vice versa. For scenarios in which principal propagation is needed – for example, when forwarding the identity of the cloud user to an on-premise system – trust must be configured between the cloud connector and the targeted on-premise system. Apart from this, on-premise systems do not need to be touched or modified to expose them to cloud applications over the cloud connector.
The SAP offering for B2B integration is based on the B2B functionality for SAP Process Orchestration and the B2B capabilities of SAP Cloud Platform Integration. This section starts with technology guidance on when to use which technology. An overview of the SAP Ariba Cloud Integration Gateway solution follows, which discusses how to use SAP Cloud Platform Integration in an environment managed by SAP for supplier and buyer integration. The section’s third part introduces the integration content advisor for SAP Cloud Platform Integration. The advisor leverages machine learning algorithms to improve the efficiency of B2B interface development and mappings.

**OVERVIEW AND TECHNOLOGY GUIDANCE**

B2B and B2G integrations refer to processes interlinking business partners in the private and public sector. In addition to the requirements of A2A integration within an organization, this use case must support a variety of industry standards in electronic business document exchange. These include UN/EDIFACT, ASC X12, and, at a communication level, AS2. With B2B functionality for SAP Process Orchestration and SAP Cloud Platform Integration, SAP offers two options to build and run B2B integration scenarios.

The **B2B functionality for SAP Process Orchestration** lets customers create, manage, enhance, and secure their B2B connections between internal enterprise systems and trading partners through multiple channels. The customer is responsible for the system, all operation activities, and the B2B content. SAP Process Orchestration with its support for B2B scenarios should be the preferred solution for an enterprise with an on-premise B2B strategy. The technology can help the enterprise retain full control of its system and all traffic passing through it, for example, to conform to security or data privacy policies. Another tactical reason to choose SAP Process Orchestration may be that specific features, such as trading partner management, are not yet available on SAP Cloud Platform Integration.

The B2B functionality lets customers create, manage, enhance, and secure their B2B connections between internal enterprise systems and trading partners through multiple channels.

The key decision criteria for using the B2B functionality of SAP Cloud Platform Integration are:
- Minimize effort and cost for operation and maintenance
- Benefit from the innovation speed of the cloud
- Connect easily to several cloud-based business applications
- Locate the B2B business network in a neutral environment “in the middle” between the business partners, potentially allowing easier integration of business partners

SAP plans to provide all required B2B capabilities with both deployment variants – SAP Cloud Platform Integration and SAP Process Orchestration. This will allow customers to choose between the cloud and on-premise solutions with no limitations posed, while offering support for a wide variety of B2B and B2G scenarios. Furthermore, SAP plans to enable SAP Cloud Platform Integration and SAP Process Orchestration to use the same B2B integration content by employing content reuse between them. This will reduce errors, costs, and maintenance efforts and will enable easy migration from cloud to on premise and vice versa.
SAP Ariba Cloud Integration Gateway is an integration offering managed by SAP and based on SAP Cloud Platform Integration. It provides an efficient way to integrate buyer and supplier systems through one gateway to Ariba Network and SAP Ariba solutions in the cloud. SAP Ariba Cloud Integration Gateway offers self-service tools built on SAP Cloud Platform Integration that includes integration wizards, a self-testing framework, and reporting and monitoring capabilities, all tailored for the integration use case by SAP Ariba solutions.

Figure 14 gives an overview of the integration options for buyers and suppliers with SAP Ariba Cloud Integration Gateway.

SAP Ariba Cloud Integration Gateway is based on SAP Cloud Platform Integration and provides an efficient way to integrate buyer and supplier systems through one gateway to Ariba Network and SAP Ariba solutions in the cloud.
Buyers can integrate SAP S/4HANA or SAP Business Suite by leveraging their existing integration technologies. They might use SAP Process Orchestration or SAP Cloud Platform Integration (managed by the customer), or integrate directly through the cloud connector. As a foundation, SAP provides an add-on for SAP S/4HANA and SAP Business Suite that covers all application-related artifacts, such as application configuration and interface data. This allows suppliers to connect once to Ariba Network to integrate with many customers without having to deal with buyer-specific mappings or customized configurations. As shown in Figure 14, SAP Ariba Cloud Integration Gateway supports multiple B2B standards and can integrate with the existing supplier infrastructure through, for example, SAP Process Orchestration or SAP Cloud Platform Integration.
The process to connect to SAP Ariba Cloud Integration Gateway and use it in an SAP software environment is simple:

1. **Configure** – The account setup wizard lets you identify, download, and install the add-on for the SAP ERP application or the add-on for SAP S/4HANA for the SAP Ariba Cloud Integration Gateway solution. The add-on then automatically synchronizes its configuration data with SAP Ariba Cloud Integration Gateway. The gateway then matches this configuration information with built-in integration content for SAP ERP and SAP S/4HANA. The built-in content supports more than 20 business scenarios and more than 100 standard integration interfaces, mostly in the fields of procurement and supply chain.

2. **Extend** – SAP Ariba Cloud Integration Gateway centrally manages customizations of SAP solutions to meet industry, location, and business needs. For example, it supports adding customer-specific fields to the standard integration scenario by SAP Ariba solutions.

3. **Use integration developer tools** – Work-saving integration developer tools expedite formerly resource-intensive processes, accelerating time to value. An integration wizard automates complex integration tasks by guiding business domain experts through a series of simple steps to complete the configuration.

4. **Test** – Test and validate the connectivity, transformation, and content of documents you configured in SAP Ariba Cloud Integration Gateway. This lowers overall testing and setup time, allowing you to go live with the integration quickly. You can select and run a variety of mandatory, optional, and custom test cases to test and perfect these scenarios. This includes simulation of test data for buyers and suppliers.

5. **Validate** – Business rule validation checks your test scenario transactions against the buyer’s business rules and alerts you to any issues so you can resolve them up front to ensure posting of your documents.

6. **Operate** – Integration with SAP Solution Manager, the support infrastructure of SAP, and basic platform services inherited from SAP Cloud Platform ensure that the integrations run smoothly and are highly secure. (Basic platform services include single sign-on, real-time monitoring, persistence, centralized upgrades, and enterprise-grade security.)

Further information about SAP Ariba Cloud Integration Gateway can be found at [SAP Ariba Cloud Integration Gateway](https://www.sap.com/products/sap-ariba-cloud-integration-gateway.html).

Test and validate the connectivity, transformation, and content of documents you configured in SAP Ariba Cloud Integration Gateway to lower testing and setup time and go live with the integration quickly.
INTEGRATION CONTENT ADVISOR FOR SAP CLOUD PLATFORM INTEGRATION

Defining and implementing standards for business document exchange involve complex processes. For each specific business need, a B2B standard must be chosen out of the many that exist, its interface must be customized, and both require agreement between partners. A detailed analysis must be made, and the required customization of the B2B standard interfaces involved must be specified. Most of these interfaces allow millions of different expressions of information on the semantic level, whereas just a few are usually required. Those few must be mapped to the other individually customized B2B interfaces at the business partner sites. The comparison and negotiation involved require deep business domain knowledge. This complexity cannot be reduced by prepackaged content, which cannot anticipate all possibilities, or by experts, whose expertise is usually in only one of the involved domains.

The integration content advisor for SAP Cloud Platform Integration is a cloud-based solution that addresses these challenges. As shown in Figure 15, the advisor unifies the required tasks for creating B2B integration content based on intelligent proposals derived from a comprehensive knowledge base through a machine learning approach. With this technology, it is possible to accelerate the process of building integration content by more than 60%.

Implementing standards for business document exchange involves complex processes. For each specific business need, a B2B standard must be chosen, an interface must be customized, and both require agreement between partners.
For creating customized B2B interfaces, the integration content advisor provides a comprehensive library of the documentation and code lists of all frequently used B2B standards and de facto standards (for example, ASC X12 and UN/EDIFACT). The integration content advisor has a unified design time view. The machine learning algorithms provide high-quality proposals on how interfaces should be customized and mappings based on practices learned from “the crowd.” The crowd refers to the central knowledge graph, where all interface customizations, mappings, and changes made by experts are anonymously registered. These are used for the calculation of proposals.

Figure 15: The Basis for Semiautomatic B2B Integration
The integration content advisor supports business domain experts who need to specify and document the interfaces and mappings. These customized interfaces and mappings are used to automatically generate the required runtime artifacts for validation, conversion, transformation, preprocessing, and postprocessing. Technically, these artifacts can immediately be used in the integration flows of SAP Cloud Platform Integration\textsuperscript{12} (see Figure 16).

**Figure 16: Integration Flows of SAP Cloud Platform Integration**

As in the A2A use case, business users should always be able to handle failed messages in their application context. The content generated by the integration content advisor guarantees precise validation of incoming messages as well as the generation of error messages. These can be used for internal error handling or for submission to business partners through functional acknowledgements,\textsuperscript{13} which is supported by SAP Cloud Platform Integration.

12. In the future, it may be the case that ICA-generated artifacts will also be available for SAP Process Orchestration.
13. UN/EDIFACT: CONTRL and ASC X12: 997
SAP Cloud Platform Integration thus makes it possible to create individually customized integration flows in a semi-automatic manner, which serve as the technical adapters for external communication. The service also supports tracking and handling failed messages, and should be used for all B2B communication scenarios to take full advantage of this combination. Using application-specific implementations or third-party solutions would significantly lessen this benefit.

SAP Cloud Platform Integration with the integration content advisor lets customers expose their digital assets, either within or outside their organizations. For example, they would be able to submit their B2B interface requirements to business partners.

SAP Cloud Platform Integration with the integration content advisor lets customers expose their digital assets, either within or outside their organizations.

14. For example, through AS2, SFTP, HTTP/S, or SOAP
SAP DATA HUB AND SAP SOLUTIONS FOR EIM

SAP Data Hub is a data landscape management solution. It serves as the integration layer for all data-driven processes across heterogeneous landscapes and their individual data management tools. It enables agile data operations across the enterprise – including the design, execution, orchestration, and monitoring of end-to-end data processing – and orchestrates these interdependent tasks for heterogeneous engines from one place. SAP Data Hub speeds up data pipeline execution with a “push-down” distributed processing approach at each step. It provides enterprise-ready services that meet the governance and security needs of the enterprise, ensuring that appropriate policy measures are in place to meet regulatory and corporate requirements.

SAP Data Hub supports the following use cases:

• **Enterprise information management (EIM):**
  In today’s world, the proliferation of new data sources and consumption end points as well as the nature of Big Data overwhelm traditional tools, which are unable to scale to meet EIM needs. SAP Data Hub orchestrates other SAP solutions for EIM, such as SAP Data Services software, SAP HANA smart data integration, and SAP Landscape Transformation Replication Server. It adds value to these solutions by processing data where the data resides – with no data movement necessary – and by embracing a distributed runtime (the SAP Vora™ engine) to execute data-processing pipelines in highly scalable cluster environments.

• **Big Data warehousing:** A key benefit of SAP Data Hub is its ability to expand beyond traditional data warehouses by incorporating Big Data stores and other aspects of modern data landscapes and to combine them with enterprise data.

• **Internet of Things (IoT):** Organizations often need to combine real-world information from IoT-enabled devices such as appliances with, for example, customer demographics or supply chain information. SAP Data Hub unites this data with other data management software from SAP and various enterprise apps. For more information, see “CIO Guide to Using SAP Technology for Big Data.”
SAP Data Hub provides all of the following data integration and processing capabilities – either itself or through technologies it orchestrates (see Figure 17):

- **Data discovery** to understand visually the value of data in the landscape
- **Data ingestion** and processing for data lakes, supporting unstructured and structured data and files or streams
- **Data processing** across data lakes and object stores (based on, for example, Apache Hadoop or S3), cloud and on-premise databases and data warehouses, and cloud or on-premise enterprise applications
- **Orchestration** of complex processes and data flows across system boundaries
- **Control, management, operationalization, and productization** of complex data landscapes

For more details about the capabilities of SAP Data Hub and how to employ it in conjunction with other data management technologies, see the following:

- [What is SAP Data Hub? and Answers to Other Frequently Asked Questions](#)
- [CIO Guide: SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments](#)
- [CIO Guide to Using SAP Technology for Big Data](#)
EXISTING CUSTOMER INVESTMENTS
SAP understands that customers have made significant investments in SAP solutions for EIM and helps to protect those investments. To leverage existing data integration jobs defined in those tools, SAP Data Hub integrates with SAP Data Services, SAP Landscape Transformation Replication Server, SAP HANA smart data integration, and SAP Cloud Platform Smart Data Integration.15

SAP advocates an open solution that recognizes and reduces the complexity and diversity of today’s enterprise data landscapes. It leverages open-source Big Data technologies, such as Python, Scala, Apache Kafka, Hadoop, and Apache Spark, and combines them into productive end-to-end scenarios. SAP Data Hub is also open on the enterprise side, allowing data to be shared no matter the source, through a tight integration with SAP Data Services.

Outlook
Future plans at SAP include the release of SAP Data Hub to SAP Cloud Platform and to the public clouds Amazon Web Services (AWS), Google Cloud Platform, and Microsoft Azure.16 It is planned to continue to enhance the connectivity framework with embedded data-loading capabilities and integration with key open-source technologies, such as Apache Ranger or Apache Atlas. It is also the goal to enhance metadata governance, cataloging capabilities, and integration with the IoT and SAP S/4HANA.

15. For more detailed guidance about the different data integration tools, see “CIO Guide: SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments.”
16. The multicloud strategy from SAP – with a view toward Amazon, Google, and Microsoft as possible infrastructure providers – is explained in the blog https://blogs.sap.com/2017/05/16/sap-cloud-platform-a-positive-sum-game.
SAP CLOUD PLATFORM INTEGRATION AND SAP DATA HUB

SAP Cloud Platform Integration and SAP Data Hub are complementary offerings that address two different integration styles, as depicted in Figure 18. Based on typical usage scenarios and characteristics of both integration technologies, this section gives enterprise and integration architects guidance on when to use which integration technology. It also discusses how to combine the technologies in an end-to-end integration scenario.

Figure 18: SAP Cloud Platform Integration and SAP Data Hub – Complementary Offerings

SAP Cloud Platform Integration addresses the process integration style with the goal of linking business processes that are distributed across multiple applications within a hybrid system landscape. As outlined in “Process Integration,” SAP Cloud Platform Integration supports A2A, B2B, and B2G integration use cases. Typically, the focus of SAP Cloud Platform Integration is on the secure and reliable API-based integration of applications.\(^\text{17}\) SAP Cloud Platform Integration leverages a message-based processing paradigm that allows queuing, transforming, routing, and monitoring (including error handling) of exchanged business data on a message level. A key requirement of the process integration style is to guarantee the transactional integrity of an integration scenario that, for example, is ensured by reliable messaging capabilities. Furthermore, SAP offers a broad range of prepackaged integration scenarios for SAP Cloud Platform Integration.

\(^{17}\) Table access is also possible with the data service of SAP Cloud Platform Integration, but it’s not a key focus.
In contrast, SAP Data Hub is focused on the data integration style, making it possible to share, pipeline, govern, and orchestrate (mass) data in complex landscapes. It provides the ability to expand traditional data warehousing by incorporating Big Data stores and to ingest and process IoT data. SAP Data Hub enriches existing software, such as SAP Data Services or SAP HANA smart data integration, by modernizing data flows and leveraging new functionality and algorithms, including machine learning and image processing. Typically, data from enterprise applications is accessed on the database level (table/view) outside a transactional business context. The following table summarizes the key characteristics of both integration technologies.

### Features of SAP® Cloud Platform Integration and SAP Data Hub

<table>
<thead>
<tr>
<th>Objective</th>
<th>SAP® Cloud Platform Integration</th>
<th>SAP Data Hub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chaining distributed business processes in hybrid landscapes</td>
<td>Pipelining and orchestrating Big Data in hybrid landscapes</td>
<td></td>
</tr>
</tbody>
</table>

| Use cases | • Application to application  
• Business to business, business to government  
• Master data synchronization | • Big Data warehousing  
• Internet of Things ingestion  
• Enterprise information management (for example, batch or streaming) |

| Coupling to application | API focused (synchronous, asynchronous, business events) | Data focused (table, table views, storage, technical events) |

| Integration content | Available for a broad range of integration scenarios for SAP® applications (hybrid, cloud, third party) | Available as predefined templates for operations and pipelines |

| Specific capabilities | • Message-based processing (monitoring, alerting, error handling)  
• Transactional integrity (reliable messaging)  
• Process-centric integration flows | • Distributed data processing  
• High-frequency event processing  
• Advanced data transformations and processing (for example, machine learning, predictive, code)  
• Data-centric integration flows |

---

18. API-level access is also possible with SAP Data Hub, but not the key focus.
As shown in Figure 18, both integration technologies are complementary and can be used in combined scenarios. For example, transactional data can be passed from SAP Cloud Platform Integration to SAP Data Hub. Conversely, SAP Data Hub can integrate with SAP Cloud Platform Integration when a deep transactional integration with enterprise applications is required.

Figure 19: SAP Cloud Platform Integration and SAP Data Hub – An Integration Scenario

In the sample scenario in Figure 19, an invoice received as an image is read by an image processing service orchestrated by SAP Data Hub, and the invoice is converted into structured data. The structured data is then converted into the target format for SAP S/4HANA by SAP Cloud Platform Integration and routed to the target system of SAP S/4HANA. In case of errors in the inbound processing for SAP S/4HANA, business users can correct the invoice message with SAP Application Interface Framework. The information on the corrected parts of the invoice is sent back to SAP Data Hub and stored in the data lake. This is used to train the machine learning algorithms to improve the image processing.

19. Currently, the mechanism is a message-based data exchange (REST, OData) in proof-of-concept status.
Transition Path to **SAP S/4HANA and Cloud Integration**

SAP S/4HANA is the next-generation digital core business suite that provides innovative and tightly coupled solutions. This section gives guidance on how to transition from SAP Business Suite to the online version of SAP S/4HANA and to SAP S/4HANA Cloud, and what it means from an integration perspective. Guidance is also given with regard to integration protocols and APIs.

**TRANSITION PATHS TO SAP S/4HANA**

SAP is committed to supporting customers in their transition from SAP Business Suite to SAP S/4HANA and SAP S/4HANA Cloud. There are three possible paths along which this transition can occur. Each path has possible advantages and disadvantages that customers should evaluate in light of their needs, goals, and preferences.

As a start, you should consider the following aspects of the three paths shown in Figure 20.

1. **FROM SAP BUSINESS SUITE (SAP ECC) TO ON-PREMISE SAP S/4HANA**

   a. In the **in-place system conversion scenario**, the existing SAP Business Suite system is converted to SAP S/4HANA. The system ID (SID) and its existing customizations, data, and integrations are retained.

   • In general, you can convert with no impact on existing integration scenarios and can continue to use previous investments in integration technologies, such as SAP Process Orchestration, and existing integration scenarios.

   • Any exceptions, for example, due to simplification or alignment of interfaces in SAP S/4HANA, are described in the **simplification item catalog** (S-user required). This resource provides a description of all relevant changes that might have an impact when converting from SAP ECC to SAP S/4HANA. Within each topic, referred to as a “simplification item,” corresponding notes in the SAP Notes tool and mitigation possibilities are documented.

   b. In the **side-by-side installation scenario**, a new installation of SAP S/4HANA with a new SID is set up in parallel to the existing SAP Business Suite system. Integrations with the new SAP S/4HANA system are set up new.

   • You can continue to use previous investments in integration technologies, such as SAP Process Orchestration, and existing integration scenarios. However, existing integration scenarios must be migrated to the new system and adjusted to new destinations (SIDs, URIs). Any other effects inherent in the new side-by-side installation must also be attended to.

   • Any exceptions to this principle of “may have to be newly set up, but can be set up the same way as before” are described in the **simplification item catalog**.

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20. Where the text refers to “SAP S/4HANA” without additions, the on-premise software is meant.
2. FROM ON-PREMISE SAP S/4HANA TO SAP S/4HANA CLOUD

- It is planned that the integration scenarios delivered for SAP S/4HANA Cloud will be delivered for the on-premise version of SAP S/4HANA in the very next release.
- All public APIs and integration packages and their feature scope are listed and documented in SAP API Business Hub (see “APIs and Integration Content in SAP API Business Hub”).
- SAP S/4HANA Cloud provides best-practice information for many integration scenarios. You can choose to build customer-driven integration using public APIs.
- In SAP S/4HANA Cloud, integrations built on on-premise interface technologies must be rebuilt with cloud technologies over time.
- In many scenarios, the business user experience may remain the same even though the integration scenarios must be set up anew during the transition.

3. FROM SAP BUSINESS SUITE (SAP ECC) TO SAP S/4HANA CLOUD

- With SAP S/4HANA Cloud, you will be the first customer of all new integration scenarios.
- All public APIs and integration packages and their feature scope are listed and documented in SAP API Business Hub (see “APIs and Integration Content in SAP API Business Hub”).
- SAP S/4HANA Cloud provides best-practice information for many integration scenarios. You can choose to build customer-driven integration using public APIs.
- In SAP S/4HANA Cloud, integrations built on on-premise interface technologies must be rebuilt with cloud technologies over time.

The on-premise version of SAP S/4HANA supports all integration technologies and interfaces originally released with SAP ECC. This simplifies the integration of SAP S/4HANA with existing landscapes, such as SAP ECC or the SAP Customer Relationship Management application. For some scenarios, SAP S/4HANA Cloud supports the same integration technologies and interfaces as SAP S/4HANA. However, SAP plans to gradually replace these interfaces with equivalent Web technologies.

The on-premise version of SAP S/4HANA supports all integration technologies and interfaces released with SAP ECC. This simplifies the integration of SAP S/4HANA with existing landscapes, such as the SAP Customer Relationship Management application.
The side-by-side transition from SAP ECC to SAP S/4HANA is explained in point B under “1. From SAP Business Suite (SAP ECC) to On-Premise SAP S/4HANA” above. This transition lets you replace integration scenarios in a phased or selected approach instead of the big bang of the in-place system conversion described in point a. If you set up a side-by-side scenario, the business downtime for integration scenarios can be minimized because existing integration scenarios will be switched over only after the newly set up integration scenarios are up and running. Existing middleware content logic can be reused. Additionally, the side-by-side approach allows you to keep a fallback solution and to validate integration processes and results better.

APIs for SAP S/4HANA are largely compatible with those for SAP ECC and can be used. Only APIs that are the target of simplification or become incompatible due to simplification will be disabled for external use. A simplification item catalog for SAP S/4HANA has been set up. It explains in detail how the conversion from SAP Business Suite applications to SAP S/4HANA will affect specific transactions and application functionality. Also, it provides recommendations for necessary adaptations. SAP plans to keep traditional capabilities available as a “compatibility scope” to support their migration on a predominantly technical basis.

APIs in the cloud will generally be based on Web technologies such as REST, OData, and SOAP. It is planned that these new interfaces will first be available in SAP S/4HANA Cloud, following the cloud-first approach. Later releases will include support for the on-premise version of SAP S/4HANA. OData services are recommended for synchronous communication, such as direct business object manipulation (CRUD – create, read, update, delete), as an alternative to objects written for the BAPI® programming interface. SOAP services for asynchronous message-based communication are the cloud alternative to IDOC (for example, for A2A and B2B scenarios). Technologies used by SAP ECC – IDOC, BAPI and RFC, and ABAP proxies – can still be used in SAP S/4HANA. In select cases, they can be used through the cloud connector to integrate SAP S/4HANA Cloud with on-premise SAP solutions.

A side-by-side transition from SAP ECC to SAP S/4HANA lets you replace integration scenarios in a phased or selected approach instead of the big bang of an in-place system conversion.
With SAP S/4HANA, you can install and use integration add-ons (for example, SAP Ariba Cloud Integration Gateway, add-on for SAP S/4HANA) to connect to standard SAP software. In some cases, this is even required to connect to cloud solutions, such as SAP Ariba solutions (see “SAP Ariba Cloud Integration Gateway”) or SAP SuccessFactors solutions. For SAP S/4HANA Cloud, add-ons are embedded. There is no need to install them.

INTEGRATION SCENARIOS FOR SAP S/4HANA CLOUD
SAP provides prepackaged integration scenarios to integrate the on-premise version of SAP S/4HANA with cloud solutions from SAP. These include SAP Ariba, SAP SuccessFactors, SAP Fieldglass, SAP Concur, and SAP Hybris solutions as well as the SAP Hybris Cloud for Customer solution, the SAP Analytics Cloud solution, and the SAP Multi-Bank Connectivity solution (see Figure 21). These integration scenarios consist of public APIs and integration content for SAP Cloud Platform, both available from SAP API Business Hub. Around 140 APIs covering more than 1,400 operations have been made available. It is planned to continue the growth of API coverage every quarter. SAP has committed to delivering new integration content for SAP S/4HANA Cloud first.

SAP also provides APIs to help you integrate with other cloud solutions from SAP, on-premise SAP software, and third-party solutions, as well as to build your own cloud apps on SAP Cloud Platform. SAP S/4HANA Cloud offers different types of APIs based on Web technologies, such as OData, REST, and SOAP. It also provides the option to expose core data service views as custom OData services. Figure 21 shows the SAP-to-SAP integration scenarios for SAP S/4HANA Cloud.

SAP provides prepackaged integration scenarios to integrate the on-premise version of SAP S/4HANA with cloud solutions from SAP.

21. Core data services (CDS) is a modeling environment for applications powered by SAP HANA. SAP S/4HANA is based on CDS models. It is planned to release a cloud-based version of CDS to be used for purposes outside SAP S/4HANA. For a general summary of CDS, see https://blogs.sap.com/2016/09/26/core-data-services-cds-in-sap-s4-hana.
Further information is provided in the blog “SAP S/4HANA Cloud Integration Checklist.” It gives guidance on finding the best approach and includes related technical content and best-practice information for cloud integration scenarios in the context of SAP S/4HANA Cloud.
Integration Automation

Setting up the technical configuration for integrating cloud solutions with other cloud or on-premise solutions is often a complex process. This section describes the Cloud Integration Automation service. It simplifies the integration of different solutions by automating the steps involved in setting up the technical configuration in the customer landscape.

CHALLENGE
Usually, the integration of two or more solutions means far more than setting up a directional or bidirectional connection between two applications. Multiple players must be configured and set up. Currently, the process of setting up such an integration is often a manual process involving distributed documentation and several experts. These experts must align closely to execute the appropriate configuration steps in the corresponding components. Otherwise, permissions may be missing, configuration targets may be incompatible, and performance of similar steps may result in redundant effort. Although the overall process is time-consuming, very little automation of such configuration tasks has been available.

SIMPLIFYING THE PROCESS WITH INTEGRATION AUTOMATION
SAP is offering a central service that is used by SAP solutions to define and automate integration scenarios in a standardized way. These scenarios are executed from a single execution engine, which is available as a cloud service, plugging into all the components involved.

SAP is offering a central service to define and automate integration scenarios. Integration scenarios are executed from a single execution engine available as a cloud service that plugs into all the components involved.
The approach provides a consistent user experience and central entry point to integration scenarios delivered by SAP. A structured, tailored, customized description of the customer-specific configuration steps is intended to streamline and standardize the integration configuration processes. For integration scenarios enabled for the service, it is also intended that large parts of the setup will run automatically.

“Customized” here means that every description will point to the actual end points within the customer’s on-premise and cloud software landscape. These hyperlinks and other configuration values derived from the customer landscape can be used throughout the integration process. While the Cloud Integration Automation service provides the infrastructure, each cloud solution will deliver integration content and the respective configuration APIs.

The Cloud Integration Automation service runs on SAP Cloud Platform and is populated by the integration configurations of the various cloud solutions from SAP. It is planned that it will be enhanced to facilitate future extensibility and options for third-party contributions. Figure 22 shows the two services that make up the Cloud Integration Automation service on the customer side.

22. For integration scenarios that are technically possible but not fully enabled for the service, only documentation will be offered.
From the customer point of view:

- The **maintenance planner** service is available to all customers with an SAP support contract. The maintenance planner allows users to select an integration scenario for the automation process. The process will have access to the configuration content and to information about the customer’s software landscape and cloud tenants. In this way, the generic information for an integration scenario will be combined with the available customer-specific configuration data, such as system IDs.

- The **execution service provider** offers a customer-specific integration workflow that helps customers set up the configuration for their integration scenarios. It guides customers through the workflow that was created based on the results of the maintenance planner and enables automatic integration setup.

The execution service provider offers a customer-specific integration workflow that helps customers set up the configuration for their integration scenarios.
The cloud-based maintenance planner of SAP Solution Manager is a well-established cloud-based service used to plan maintenance events – such as installations, upgrades, and updates – for on-premise system landscapes. With the extension of the Cloud Integration Automation service for the maintenance planner service, the scope has been extended to cloud solutions. The service now also serves as the user interface and central entry point for integration planning. Cloud-only customers should consider this a preliminary solution for delivering integration automation quickly. It is planned that in the future, other tools for this purpose may be added as alternatives to the maintenance planner service.

The planning solution (see Figure 22) guides you through the planning phase with wizard-like dialogs, enabling you to:

1. Select an integration scenario along with some key options, for example, for integration without a middleware solution
2. Verify version interdependencies between products, required add-ons, and related cloud solutions and services; identify version conflicts; and receive suggestions for maintenance steps to resolve them
3. Select the relevant systems and tenants from within your landscape

Once the scenario and systems have been defined, a workflow is created. This workflow consists of all steps that have been defined as part of the integration scenario by SAP. Individual users are assigned to certain integration roles (for example, integration administrator) that group tasks per responsibility. Global parameters to be reused throughout the process can also be provided. The SAP Cloud Platform Workflow service (see “SAP Cloud Platform Workflow”) executes the workflow and guides users who need to contribute to the configuration through the appropriate steps. This corresponds to the user mapping (for example, the administrator for SAP S/4HANA or for SAP SuccessFactors solutions) previously performed.

The SAP Cloud Platform Workflow service executes the workflow and guides users who need to contribute to the configuration through the appropriate steps.
The workflow service provides an overview of the overall progress and guides users through the workflow step-by-step. It sends items to the users involved through the “My Inbox” app on SAP Cloud Platform. For those users, processing the workflow items is easy, with individual configuration steps presented to them with personalized instructions. The workflow uses the landscape information to insert into the instructions hyperlinks (for example, to administration UIs) or values for required parameters.

If the corresponding SAP solution has provided the necessary content for automated configuration of the integration, the user will have a button to trigger the automatic execution of the step. The technical configuration of the integration scenario is complete when all steps of the workflow have been processed.

Complete plug-and-play functionality may not be possible due to some constraints, notably security barriers. Nevertheless, it is planned that the personalized workflow, including automated configuration steps, will be a significant enhancement to the process of setting up the technical configuration of integration scenarios.
Summary, Outlook, and Finding Out More

This CIO guide marks a step on the way toward the “CIO Guide: SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments.” It provides important updates in many aspects of integration, such as positioning and guidance on using process and data integration technologies. It covers the role of APIs, the services around them, and new technologies to assist you in future integration projects. It provides updated guidance for specific integration areas, such as B2B and SAP S/4HANA.

It is planned to provide updates of this guide on technologies, methodologies, and approaches and possibly additional documents marking the next steps in this area. The following resources provide more detailed information about the topics covered.

- **SAP’s vision for integration:** [CIO Guide: SAP Vision for Integrating SAP Applications in Cloud and Hybrid Environments](#)
- **Identity and Access Management:** [CIO Guide: Identity Lifecycle in Hybrid Landscapes](#)
- **Integration solution advisory methodology**
- **Integration services of SAP Cloud Platform**
- **Documentation for SAP Cloud Platform**
- **SAP Cloud Platform Integration**
- **SAP Process Orchestration**
- **SAP Data Hub**
- **SAP API Business Hub**
- **SAP S/4HANA Cloud**
- **Data access and virtualization capabilities of SAP HANA**
- **SAP Ariba Cloud Integration Gateway**
- **Integration Content Advisor for SAP Cloud Platform Integration**
- **SAP’s Orchestration Overview**, SAP white paper, October 2013.
- **SAP Cloud Platform API Management**
- **SAP Cloud Platform Integration (Documentation)**
- **SAP Application Interface Framework**
- **Modeling Guide for SAP HANA Smart Data Integration and SAP HANA Smart Data Quality**
- **Maintenance planner**
- **Related topic – Extending SAP S/4HANA**
## LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>A2A</td>
<td>Application to application</td>
</tr>
<tr>
<td>API</td>
<td>Application programming interface</td>
</tr>
<tr>
<td>AS2</td>
<td>Applicability Statement 2</td>
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<tr>
<td>B2B</td>
<td>Business to business</td>
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<tr>
<td>B2G</td>
<td>Business to government</td>
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<tr>
<td>CIO</td>
<td>Chief information officer</td>
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<tr>
<td>cXML</td>
<td>commerce eXtensible Markup Language</td>
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<tr>
<td>EANCOM</td>
<td>European Article Number Communication</td>
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<tr>
<td>EIM</td>
<td>Enterprise information management</td>
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<tr>
<td>GUSI</td>
<td>Global upstream supply initiative</td>
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<tr>
<td>HTTP</td>
<td>Hypertext transfer protocol</td>
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<tr>
<td>IDoc</td>
<td>Intermediate document</td>
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<tr>
<td>IPaaS</td>
<td>Integration platform as a service</td>
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<tr>
<td>IoT</td>
<td>Internet of Things</td>
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<tr>
<td>LoB</td>
<td>Line of business</td>
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<tr>
<td>OAGIS</td>
<td>Open Application Group Integration Specification</td>
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<td>OData</td>
<td>Open data protocol</td>
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<tr>
<td>PIDX</td>
<td>Petroleum Industry Data Exchange</td>
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<tr>
<td>REST</td>
<td>Representational state transfer</td>
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<tr>
<td>RFC</td>
<td>Remote function call</td>
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<tr>
<td>SAP ECC</td>
<td>SAP ERP Central Component or SAP Business Suite</td>
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<tr>
<td>SOAP</td>
<td>Simple object access protocol</td>
</tr>
<tr>
<td>SOCKS5</td>
<td>Socket Secure (protocol)</td>
</tr>
<tr>
<td>UX</td>
<td>User experience</td>
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<tr>
<td>UN/EDIFACT</td>
<td>United Nations/Electronic Data Interchange for Administration, Commerce, and Transport</td>
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<tr>
<td>X12</td>
<td>ANSI ASC X12 (American National Standards Institute Accredited Standards Committee)</td>
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<tr>
<td>xCBL</td>
<td>XML Common Business Library</td>
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