



SOLUTION PAPER

SAP Job Scheduling

Seamless automation and management of SAP background processes utilizing Universal Automation Center

SAP® Certified
Integration with SAP NetWeaver*

SAP® Certified
Integration with Applications on SAP HANA*

Date: October 31, 2019

Table of Contents

Table of Contents	2
1. Introduction	3
2. Prologue	4
3. Why Use an Enterprise Job Scheduler?	5
4. Solution Description	11
4.1. <i>Overview</i>	11
4.2. <i>Self-Service Dashboard</i>	14
4.3. <i>Secure Connection to SAP</i>	15
4.4. <i>SAP Performance</i>	16
4.5. <i>Transition of Existing SM36 Defined Jobs</i>	17
5. Why Universal Automation Center for SAP Scheduling	18
6. References	19
7. About Stonebranch	20

1. Introduction

Stonebranch’s dynamic IT automation technology builds the foundation for enterprises to transform business IT environments from simple IT task automation into sophisticated, real-time business service automation, assuring that organizations achieve the highest possible Return on Automation. No matter the degree of automation, our technology is simple, modern and secure. Utilizing our universal automation platform enables you to seamlessly orchestrate workloads and data across technology ecosystems and silos.

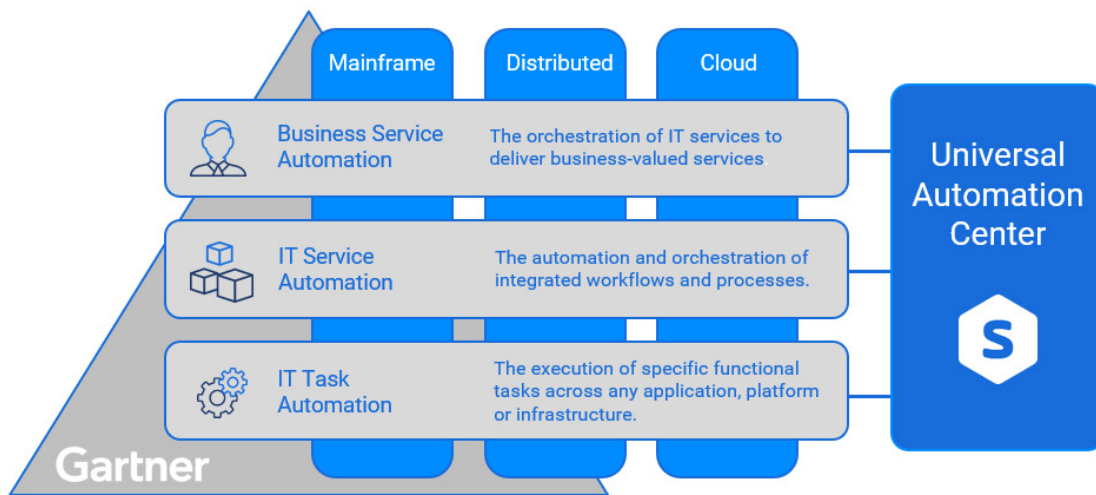


Figure 1: Dynamic IT Automation Layers Overview

Stonebranch offers an attractive automation solution portfolio that helps you build a roadmap to dynamic IT automation and beyond. Our digital transformation roadmap provides reliable and reusable automation building blocks that enable you to rely on one automation technology for all your static and dynamic IT automation needs.

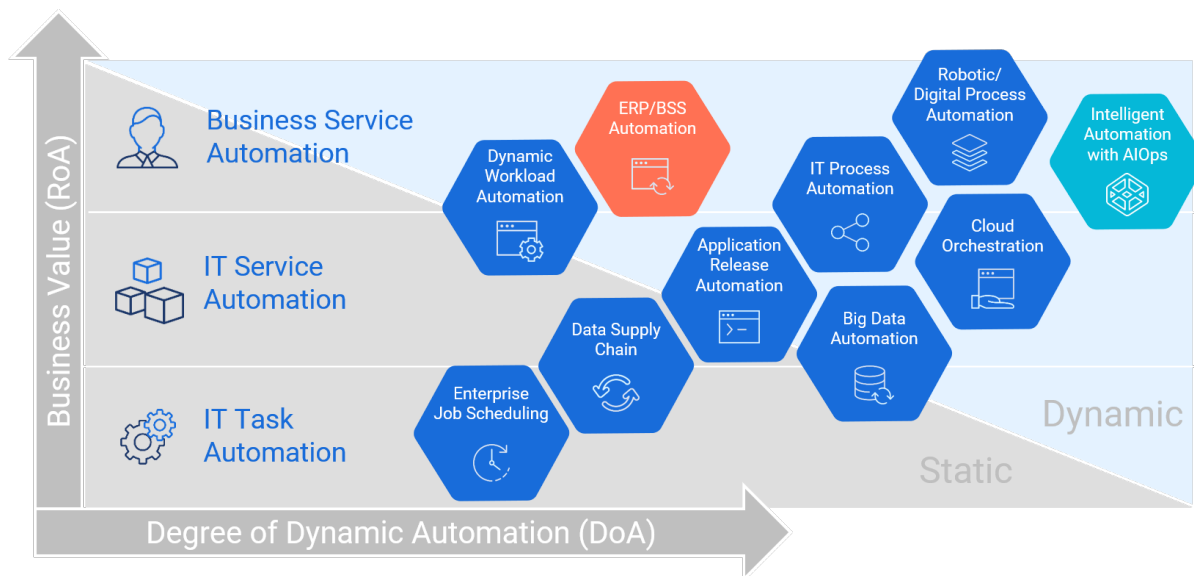


Figure 2: Solution Portfolio: Building Blocks

2. Prologue

Many companies rely on SAP to manage their entire suite of business processes, including financial, manufacturing, HR and many others. These processes often involve multiple applications and data sources—both SAP and non-SAP—residing on Windows-based or Unix/Linux servers, in the cloud, or even on mainframes. It often happens, therefore, that data needs to be transferred securely between enterprise headquarters and remote locations or business partners. Achieving the end-to-end visibility, accessibility, and manageability demanded by these diverse business processes requires integrating SAP with enterprise workload automation solutions.

The native SAP transactions SM36/37 for creating and monitoring background jobs require SAP consultants to log into the SAP GUI, lack event-based scheduling capabilities, and focus mainly on SAP-related jobs like running an ABAP report. The workflow capabilities for more complex SAP processes are additionally very limited and hard to maintain if, for example, an ABAP step were to fail. To enhance efficiency and free IT resources to work on more strategic tasks, a truly exceptional job scheduler should go beyond routine processes and support dynamic real-time and event-based processing.

With Universal Automation Center (UAC), you can automatically and autonomously monitor your environment and start or manage dynamically technical job processes, file transfers and process chains from a centralized, fully audit-proven web-GUI. No special SAP consultant is needed. Unexpected behaviors are displayed on the real-time dashboard, and an automatic alarm can be configured to inform you via e-mail or using your monitoring system via SNMP trap about any SAP or non-SAP job failure. Integrations with tools like ServiceNow, Zenoss or BMC Event Manager are also supported.

To improve job execution times for long running tasks, you can set up a load-balancing cluster across multiple servers, allowing you to simultaneously complete related tasks. By switching to an event-based and dynamic workload automation approach, you can significantly improve your business processing times and system performance, solving your background processing challenges in an SAP area—be it financial, logistics, manufacturing, HR or retail.

The following figure shows an event-based SAP process consisting of SAP and non-SAP tasks.

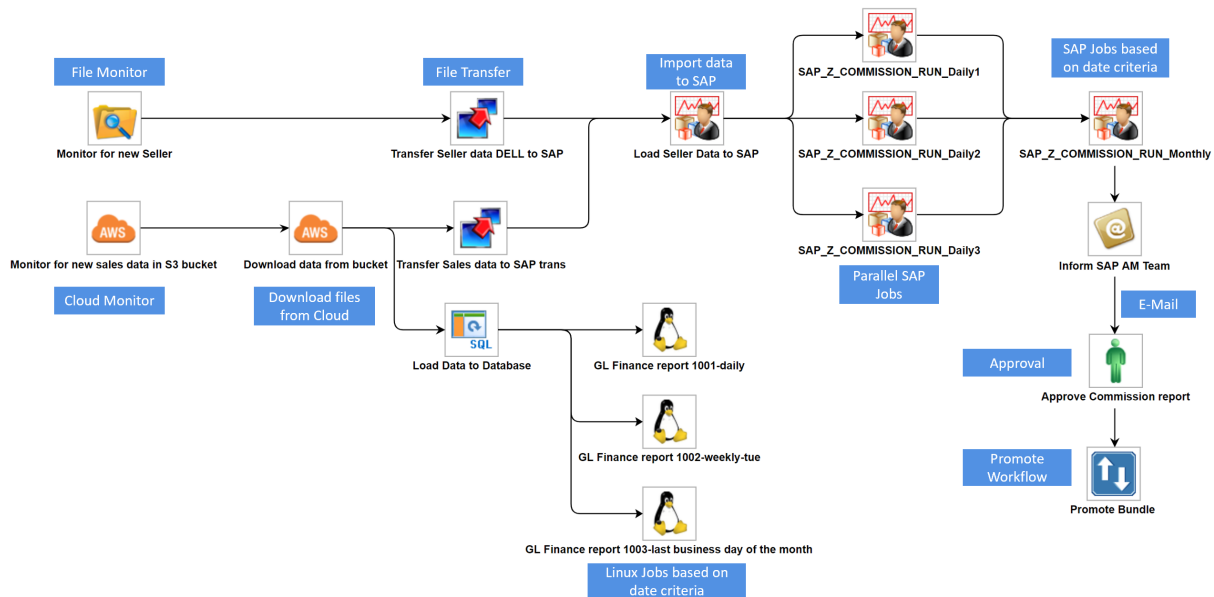


Figure 3: SAP Workflow Example – Containing SAP and Non-SAP Jobs

3. Why Use an Enterprise Job Scheduler?

Below are several key reasons to use an Enterprise Job Scheduler.

FREE UP TIME AND RESOURCES

By using an enterprise job scheduler, you can eliminate the drawbacks of your native SAP SM36/37-based scheduler and free up valuable time for your SAP and operations teams so they can focus on more valuable tasks by using a single, self-service enabled web GUI to set up and control your entire SAP process, including both SAP and non-SAP tasks. Increase error handling by gaining full control of the entire SAP process, and automatically react on incidents before they become critical.

FASTER PROCESSING

With the Universal Automation Center web GUI, users can orchestrate and automate every step of each business process as it runs across SAP and non-SAP systems, resulting in overall faster processing. Optimized parallel execution of SAP ABAP code also accelerates processing by dynamically controlling the number of parallel processes executed using virtual resources, and by fully leveraging the existing SAP load-balancing cluster.

INCREASED AUTOMATION

The automation of SAP processes will allow operational staff to focus on more valuable tasks, along with the reduction of operational efforts through central control of all applications.

SECURITY

Universal Automation Center uses the latest security standards, including:

- PKI infrastructure using X.509 certificates to perform peer authentication
- TLS 1.2 encryption for all communication data and control channels
- Multi-tenant role-based security concept supporting SAML, LDAP and Active Directory
- Individual security credentials for each SAP Job in a workflow—all centrally managed
- Secure connection to SAP supporting SAP Secure Network connect SNC via, e.g., native SAP and 3rd party security modules like Cybersafe

The efficacy of the solution's security is regularly verified by external security companies

AUDITABILITY

Fully automatic audit trails of the complete solution reveal the nature, time and source of each change.

- No more IT audit violations or exceptions.
- Any change is available, including before and after images.
- Auditing supports compliance with Sarbanes-Oxley requirements.
- All audit reports are automatically archived.

MANAGED FILE TRANSFER

A file transfer can be added like any other task into an SAP workflow. You can then use this function to transfer your sensitive SAP input data between your SAP application server and any other platform—even a mainframe—in a secure, fast and reliable way.

Here are some of the highlights of the built-in managed file transfer solution:

- Any-to-any/platform-independent transfer to and from z/OS, i5 (AS/400), Unix, Linux, Windows, and the Cloud (AWS, Azure, Google)
- An extensive script language for data transfer and a central script library for storing scripts
- Integrates into your existing scheduler landscape
- Part of the Universal Automation Center—a file transfer is a task like any other
- Restart functionality, automatic failover
- Authentication, encryption and compression that support highest security standards developed for many banking and healthcare customers

REAL-TIME CONTROL

The Universal Automation Center dashboard provides a real-time view of all SAP and non-SAP jobs. The drill down functionality allows job analysis up to the level of system log files (for example, an SAP job log), even while the ABAP script is executing in SAP.

The dashboard is 100% web-based and developed using the latest Google Web Toolkit (GWT). Users can customize the layout and provided functionality to suit their needs.

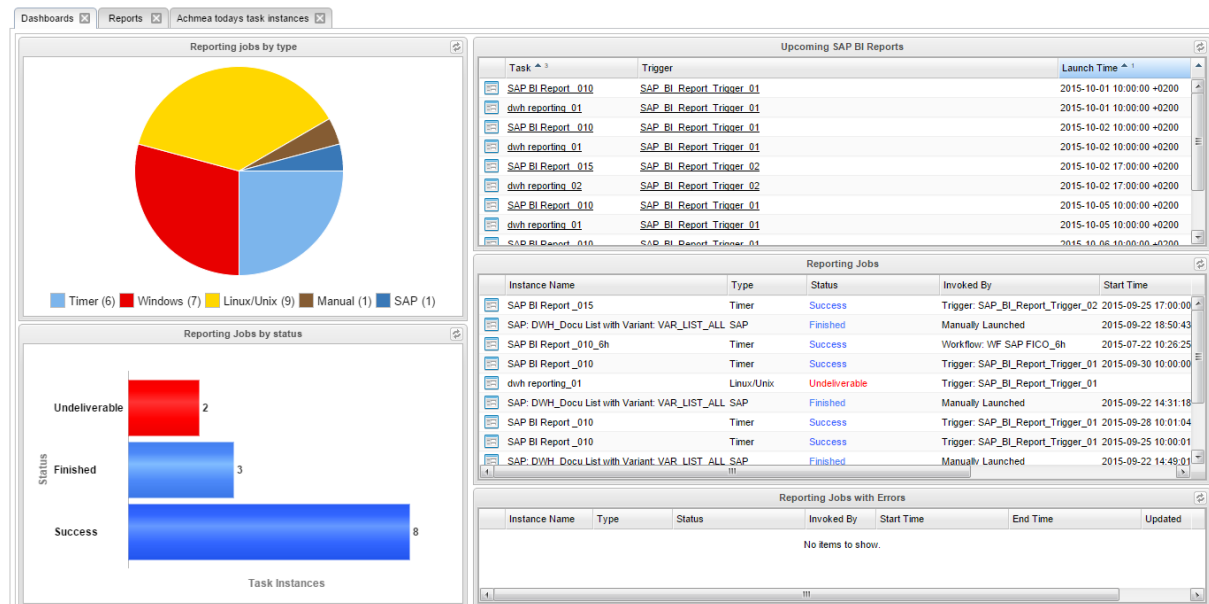


Figure 4: Universal Automation Center Dashboard

PERFORM ALL SCHEDULING-RELATED TASKS FROM THE CLOUD

Universal Automation Center is available as either an on-premise or high-available cloud-based solution in AWS.

All scheduling-related tasks, from the configuration of SAP and non-SAP jobs to daily operations and auditing, can be performed using a single Universal Controller web GUI. When using our cloud solution, UAC is immediately available. No agent is required on your local SAP system, as the connection to SAP is done in an agentless manner via SAP secure network. The cloud additionally supports the latest security standards, including SAML, SNC via, e.g. Cybersafe, and TLS1.2, and is used by some of world's largest enterprises.

CERTIFIED SAP INTERFACES INCL. LATEST SAP HANA

The Universal Connector for SAP is regularly certified for the latest SAP HANA and SAP NetWeaver versions:



CREATE AND MODIFY SAP JOBS

The Universal Automation Center web GUI allows you to define new SAP jobs or modify existing ones, either by using a job definition file or by copying an existing job, without any need to log into an SAP GUI.

You can also use your existing SAP calendar for scheduling and automatically sync them with UAC, or alternatively define your own calendar.

All jobs are under version and audit control, so you can always go back to an older version if required. Any changes made to a job definition are tracked in the audit log.

STARTING AND CONTROLLING SAP JOBS

Via the Universal Controller web-GUI you can start, query, and delete SAP jobs and check the status of a running SAP job in real-time. This includes querying of SAP job logs and spool lists.

Automatic alarms can be configured to inform you via e-mail, or with your own monitoring system via SNMP trap, about any SAP or non-SAP job failure. Integration with tools like ServiceNow, Zenoss or BMC Event Manager are also supported.

You can additionally configure automatic actions, such as re-starting a job automatically or applying a correction workflow beforehand.

Jobs can be monitored and controlled via the real-time dashboard or using the graphical real-time workflow monitor:

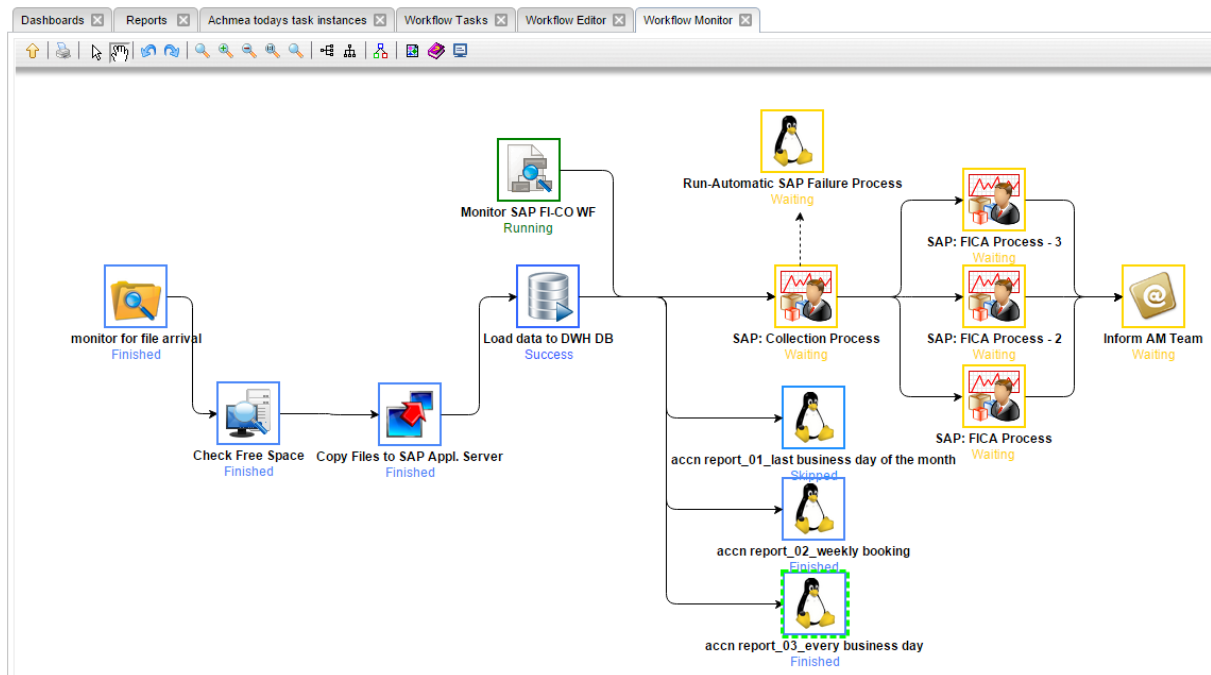


Figure 5: Universal Automation Center Dashboard

IMPORTING EXISTING SAP JOBS

The Stonebranch [Xpress Conversion Tool](#) allows you to self-sufficiently import and optimize all your existing SM36-defined jobs, including SAP calendar, into Universal Automation Center. Once imported, all jobs can be run directly from the Universal Automation Center.

Note: If you are using already an enterprise scheduler, the Xpress Conversion Tool also has conversion modules for all major schedulers on the market.

CLIENT FAULT TOLERANCE

If the [Universal Connector for SAP](#) terminates unexpectedly while processing an SAP job, the client fault tolerance restart capability allows Universal Connector to reconnect to a running (or completed) SAP job without losing track of work in progress (or already completed) on the SAP system. In addition, it prevents the unintended restart of the original SAP jobs.

AUTOMATIC SAP SYSTEM LOG RETRIEVAL FOR FAILED JOBS

When an SAP command fails, the Universal Connector for SAP will retrieve an excerpt of the SAP system log covering the period during which the failure occurred. This makes it easier to diagnose many problems without having to reach out to the SAP team or log into the SAP GUI. The automatic log retrieval can also be turned off if it is not needed.

PARENT/CHILD FUNCTIONALITY

Parent/child relationships between jobs are identified and monitored. Monitoring a submitted job can now be configured to take into account the activity of all child jobs. In addition, you can control the printing of job logs and spool lists, as well as the purging of child jobs.

SAP EVENTS

This feature allows you to trigger a specified SAP background processing event and to query the SAP system's event history. The SAP Event Monitor Universal Task allows you to monitor and confirm the occurrence of a specific SAP event. If an event is identified, an SAP or non-SAP task can then be automatically launched.

DYNAMIC VARIANT MANAGEMENT

SAP variants can be dynamically created and modified in Universal Automation Center using a variant definition file. There is no need to create the required variants in SAP before running an ABAP script. It is also possible to retrieve existing variants defined for a specific Job in SAP. When starting an SAP task from Universal Controller, the variant parameters can be dynamically set using Universal Controller variables.

PROCESS/MONITOR BATCH INPUT SESSIONS

With Universal Automation Center you can process and monitor batch input sessions. Any errors are immediately shown in the real-time dashboard (or an e-mail or SNMP notification is sent automatically). Further actions, such as restart after correction, can be taken directly from the web GUI.

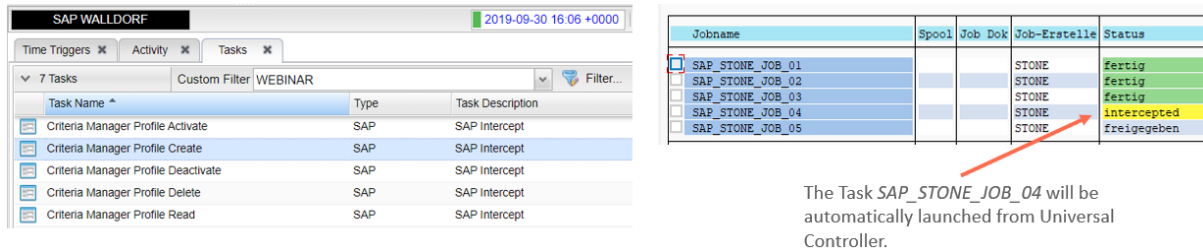
JOB INTERCEPTION

Universal Automation Center also supports both XBP 2.0 and XBP 3.0 styles of job interception.

For XBP 2.0, UAC provides the ability to create, modify, display, and delete the job interception table.

For XBP 3.0, it can use the criteria manager for job interception functionality (this is the same criteria manager that is used to set SAP criteria for event history and raised event.). Jobs that have been intercepted (XBP 2.0 or XBP 3.0) can also be displayed.

- To automatically identify and launch intercepted jobs you only need to enable the “SAP Intercept Monitor Trigger” trigger.
- In addition, Universal Automation Center allows to create, activate, de-activate, list and delete criteria profiles via a Universal Controller SAP Task



The Task SAP_STONE_JOB_04 will be automatically launched from Universal Controller.

Figure 6: Identify and launch automatically intercepted JOBS from Universal Controller

SAP BUSINESS WAREHOUSE FEATURES

Universal Connector for SAP is also certified to manage process chains and info packages.

- Process chain execution and monitoring
- Restart failed process chains
- Interrupt process chains
- Display list of process chains matching specified criteria
- Display list of info packages matching specified criteria
- Run and monitor info packages.
- Many additional supported functions

SCHEDULE SAP BUSINESS OBJECTS AND SAP DATA SERVICES JOBS

The Universal Task for SAP Business Objects allows web service-based scheduling of business objects entities like Crystal reports and WebI reports.

The Universal Task for SAP Data Services allows users to execute SAP Data Services ETL jobs. Both SAP BO and SAP DS jobs can be seamlessly integrated in an SAP business process containing SAP and non-SAP jobs, including file transfer tasks.

INTEGRATING WITH THE SAP SYSTEM AND THIRD-PARTY WORKLOAD AUTOMATION SOLUTIONS

Integrating with the SAP system can be done via z/OS, Windows, or Linux/Unix operating systems. As with other agent technology from Stonebranch, Universal Connector for SAP ERP can be integrated using any other vendor’s workload automation solutions (CA 7, CA AutoSys, UC4, Tivoli Workload Scheduler, BMC Control-M, ASG Zeke and other job scheduling or workload automation managers).

AUTOMATE YOUR SAP SYSTEM COPIES

The SAP System Copy solution from Libelle LSC (Libelle System Copy) has been integrated with Stonebranch Universal Automation Center. The solution thoroughly covers all aspects of SAP pre-processing (e.g. exports), complete database copy (e.g. snapshots or backup/restore), and SAP post-processing (e.g. imports, BDLS, TemSe). The solution also fully supports SAP HANA-based systems.

The SAP System Copy workflow can be operated by your existing scheduling team like any other SAP or non-SAP scheduling workflow. The operation of the automated System Copy workflow is done using the Universal Automation Center web GUI.

4. Solution Description

4.1. Overview

Universal Automation Center is a modern, 100% web-based, enterprise workload automation solution that allows end-to-end management of complex business processing. It includes a fully functional, web-based interface for both scheduling definition and administration. No thick client is needed.

When using our SaaS solution in the AWS cloud, no local installation is required.

Within Universal Automation Center, there are SAP tasks that allow you to:

- Initiate workloads on SAP systems
- Directly connect predecessor/successor relationships with non-SAP workloads
- Gain accessibility, visibility, and manageability of both SAP and other enterprise workload tasks, including file transfers

The SAP task uses the proprietary SAP certified Universal Connector for SAP ERP in order to communicate with SAP. The web user interface provides a simple fillable form that allows even novice users to define SAP workloads.

The following figures show an example of an SAP task which starts an ABAP with a VARIANT that retrieves the ABAP documentation Items from ABAPA to ABAPC.

- SAP JOB NAME: DOCU_LIST_JOB
- ABAP: ABAP_DOCU_LIST
- VARIANT: VAR_LIST_ALL with Parameters: HIGH=ABAPC, LOW=ABAPA
- SAP System: CNT_walldorf_aws with SAP credentials:
CRED_SAP_walldorf_aws_developer

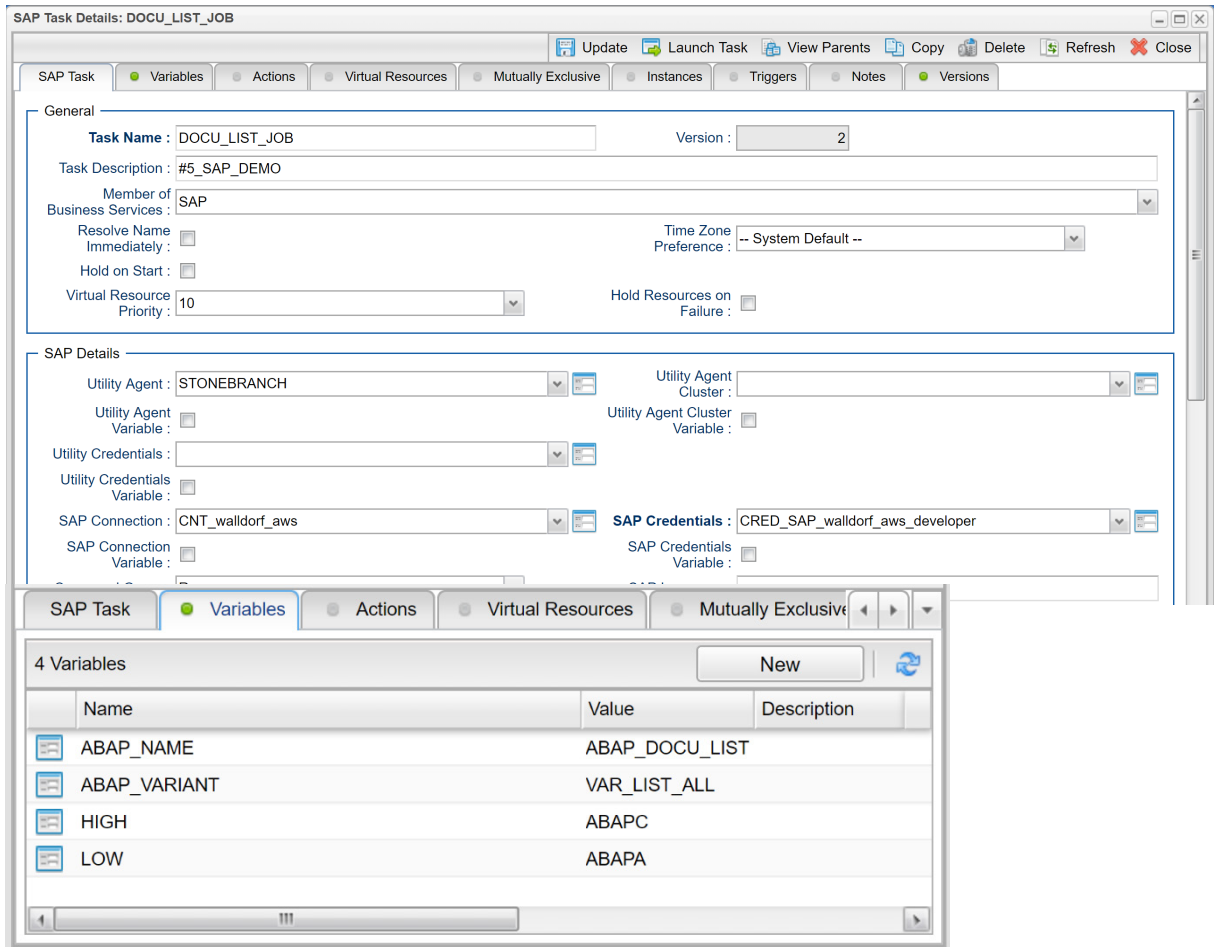


Figure 7: Universal Automation Center, SAP Task

UNIVERSAL AUTOMATION CENTER, ARCHITECTURE

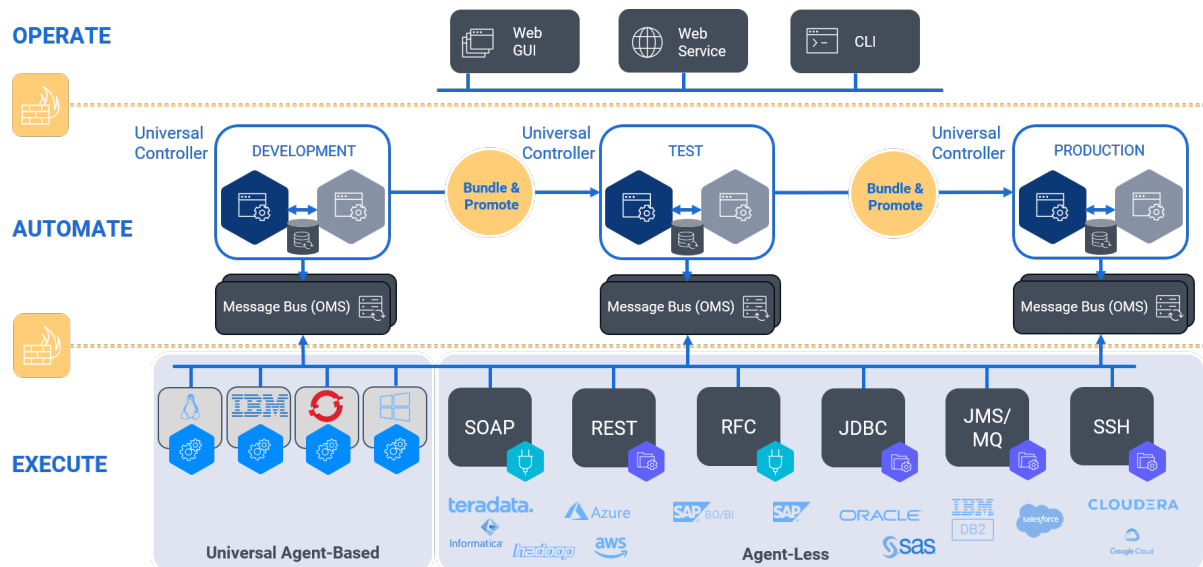


Figure 8: Universal Automation Center Architecture

Universal Automation Center's architecture is simple to implement and maintain, supports commodity hardware and infrastructure, and yet scales to support even the largest job scheduling environments. Our cutting-edge technology is built upon a highly portable architecture with built-in fault tolerance and failover capabilities.

The Universal Controller itself runs in an Apache Tomcat web application container, therefore supporting all operating systems with a Java runtime. It relies on a relational database. The Universal Agents are connected via a middleware message service called OMS, which provides fault-tolerant communication between the controller and agents.

DESCRIPTION:

From an architectural point of view, the UAC components fulfill the following roles:

Component

Universal Controller (UC)

- Web application with user and administration GUI
- Business logic to control workflows and processes
- Persist UAC system state
- Exposes RESTful APIs and CLI for headless operation
- agentless integration to orchestrate web services and DBs

Message Bus (OMS)

- Messaging middleware
- Inbound connections from clients

Universal Agent (UA)-Based Scheduling

- Executes and monitors workload
- Performs managed file transfer (MFT)
- Connects to Universal Controller via OMS
- Exposes CLI to execute workload from any scheduler
- Installed on wide variety of operating systems (MF, server, virtual server, container)
- Tight integration with SAP for full application automation

Agentless Scheduling

- Applications providing an API are scheduled agent-less using the provided protocol (SOAP, REST...)
- Opensource marketplace with many pre-integrated application connectors is available in GitHub
- Dedicated certified connector is provided For SAP and PeopleSoft

Bundle & Promote – Lifecycle Management

- Bundle and Promote allows for the automatic moving of tested configurations from DEV -> TEST -> PROD – Supporting any C:D DevOps scenarios.

Table 1: Description Components

4.2. Self-Service Dashboard

All scheduling-related tasks, including the configuration of SAP and non-SAP jobs, and daily operations and auditing, can be performed using the single Universal Controller web GUI.

Depending on the user's job role (admin, operations team member, reporting/auditing, etc.), the web GUI can be tailored in terms of visibility and permissions given to provided functionalities. The provided real-time dashboard additionally contains many free and configurable real-time widgets showing the information required for each user profile.

The dashboard screenshot below displays several widgets with functions such as:

- Forecasting data – which jobs are running in the future
- Predictive analysis data – critical path calculation, average run time, estimated end time etc.
- Manual task – manual approval steps
- System status
- Task with error

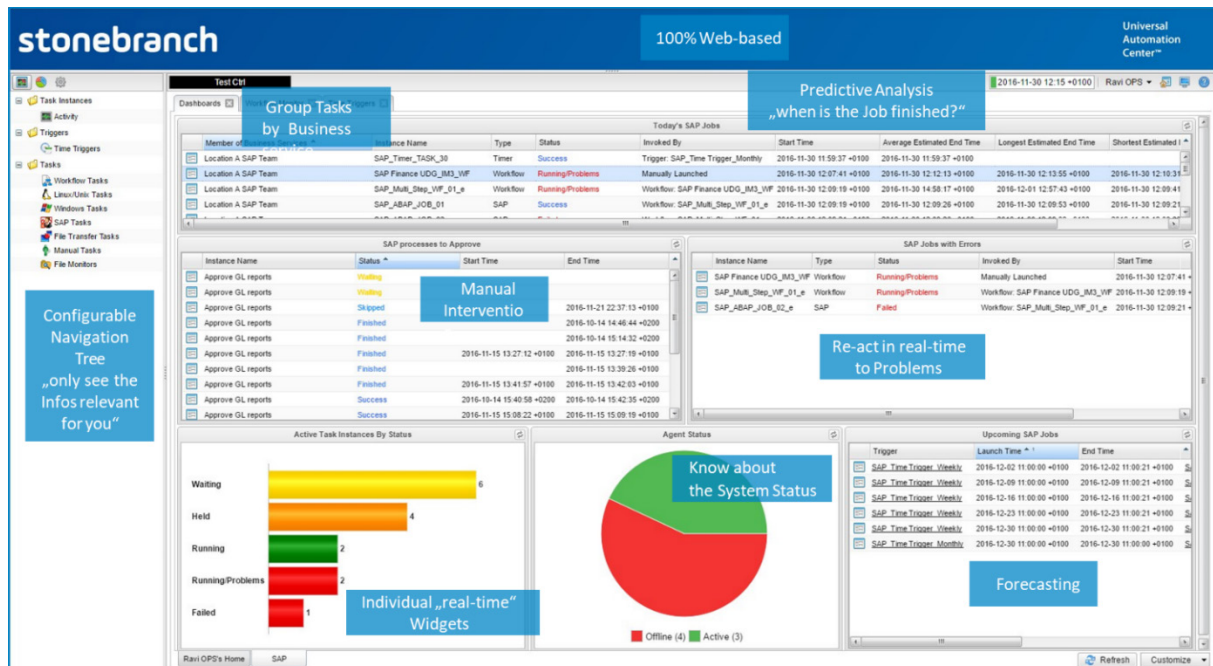


Figure 9: Self-Service Dashboard in Universal Controller

4.3. Secure Connection to SAP

One of this solution's key benefits is that you can configure and run your SAP jobs from the Universal Controller while it is deployed as a SaaS solution in an AWS VPC. Using this approach allows users to perform job scheduling independent of location. In such a scenario it is very important that the SAP RFC connection with the SAP system is highly secured.

To ensure this secured connection, the following security features have been implemented:

- User authenticate via SAML
- All communication is encrypted using TLS1.2
- Certificates to perform peer authentication between the SAP connector agent and the Universal Automation Center middleware OMS
- RFC connection secured via SAP SNC using 3rd party Cybersafe or native SAP encryption modules
- Only outbound connection from the SAP Connector agent towards the Universal Automation Center middleware OMS in the cloud

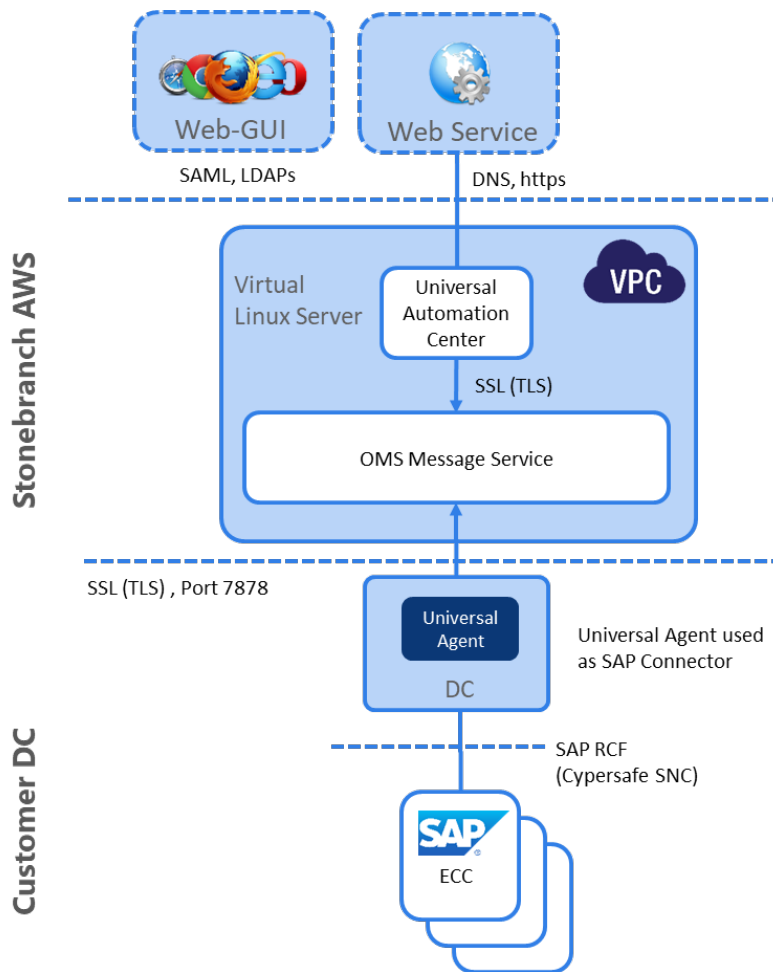


Figure 10: Connection of an On-Premise SAP System to the Stonebranch Cloud Controller

4.4. SAP Performance

Universal Automation Center's latest performance benchmarks on Dell PowerEdge servers from the Dell Performance Center in Walldorf delivered outstanding cost/performance ratio results, demonstrating Stonebranch's ability to deliver the high-performance solutions required to tackle the business challenges of today's and tomorrow's market.

Key Results of Benchmark Tests:

- 7.9 Million SAP function module calls per day with a single OMS server
- 4.6 Million ABAP jobs (read and write) per day
- The SAP HANA based system remained stable, 0% performance degradation
- System is horizontally scalable by adding additional OMS servers
- 9.4 Million Linux tasks per day using a single OMS server
- 15.9 Million Linux tasks per day using 2 OMS server on a shared SSD
- 23.0 Million Linux tasks per day using 3 OMS server on a shared SSD
- Universal Automation Center improved its performance by a factor of 7.0

For a detailed report on the performance test refer to [\[1\]](#).

4.5. Transition of Existing SM36 Defined Jobs

Stonebranch’s Xpress Conversion Tool (XCT) transitions all your existing SAP job definitions made through SM36 into Universal Automation Center. This also includes SAP Calendar.

Our XCT reads the existing SAP job definitions from the selected SAP system and converts them into Universal Controller SAP tasks, workflows and triggers. Multi-step ABAP jobs can be automatically transitioned towards Universal Controller workflows, allowing users to re-schedule a failed ABAP step at any point in the workflow.

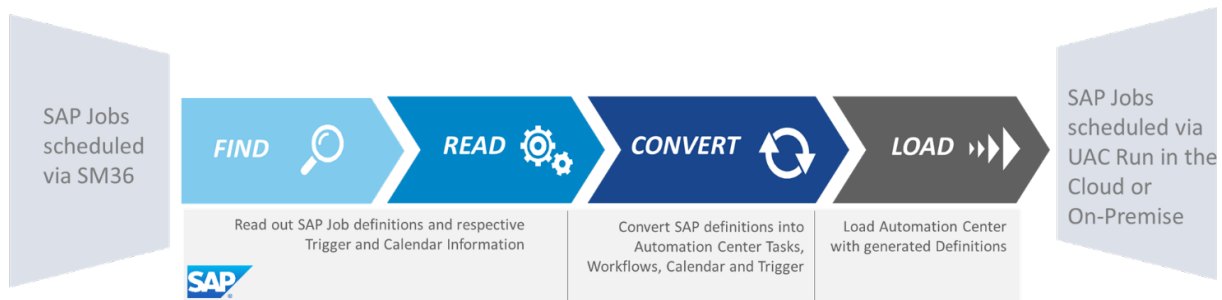


Figure 11: SAP Xpress Conversion Tool (XCT)

The following figure outlines some sample results after running the conversion tool. All SAP jobs in scope can be found as SAP tasks in Universal Controller.

Jobs defined in SAP

Job	Spool	Job doc	Job CreatedBy	Status
SAP_CONV_001_DAILY			BCUSER	Released
SAP_CONV_002_MULTI_STEP_DAILY			BCUSER	Released
SAP_CONV_003_JOB01			BCUSER	Released
SAP_CONV_004_JOB_WEEKLY			BCUSER	Released
SAP_CONV_005_JOB_110MIN			BCUSER	Released
SAP_CONV_015_EVERWINEVERYTHRD			BCUSER	Released
SAP_CONV_017_ELIMIN_ESD_SEMON			BCUSER	Released
SAP_CONV_022_EVERMONTH			BCUSER	Released
SAP_CONV_023_EVERYDAY			BCUSER	Released
SAP_CONV_024_EVERYWEEK			BCUSER	Released
SAP_CONV_201_DAILY			BCUSER	Released
SAP_CONV_202_WEEKLY			BCUSER	Released
SAP_CONV_203_MONTHLY			BCUSER	Released
*Summary				

Jobs transitioned to Universal Automation Center

Task Name	Task Description	Default Calendar
SAP_CONV_001_DAILY_LDATE_S(TRDATE)		Conversion_Calendar
SAP_CONV_002_MULTI_STEP_DAILY_LDATE_S(TRDATE)		Conversion_Calendar
SAP_CONV_003_JOB01_LDATE_S(TRDATE)		Conversion_Calendar
SAP_CONV_003_JOB02_LDATE_S(TRDATE)		Conversion_Calendar
SAP_CONV_003_JOB03_LDATE_S(TRDATE)		Conversion_Calendar
SAP_CONV_004_JOB_WD_LDATE_S(TRDATE)		FactCal_01
SAP_CONV_005_JOB_1STWDOFM_LDATE_S(TRDATE)		FactCal_01
SAP_CONV_006_JOB_WEEKLY_LDATE_S(TRDATE)		Conversion_Calendar
SAP_CONV_007_JOB_DATE_LDATE_S(TRDATE)		Conversion_Calendar
SAP_CONV_008_JOB_WD_LDATE_S(TRDATE)		FactCal_01
SAP_CONV_009_JOB_110MIN_LDATE_S(TRDATE)		Conversion_Calendar

Figure 12: SAP Xpress Conversion Results

Conversion Result Summary:

- After the conversion process, all jobs in scope can be scheduled via Universal Automation Center
- Multi-step ABAP jobs are converted automatically into Universal Automation Center workflows (optional)
- Highly optimized error handling, e.g. re-start at any point in the workflow, including re-starts at any ABAP step
- 100% web-based scheduling of all transitioned SAP jobs – No SAP GUI login required
- Workload Lifecycle Management (DEV->Test->PROD)
- Audit log of all SAP task executions

For details on Stonebranch XCT for SAP, watch the demonstration video on the Stonebranch homepage [\[2\]](#).

5. Why Universal Automation Center for SAP Scheduling

Below are a few key reasons to select Universal Automation Center for SAP Scheduling, as well as several customers who have benefitted from this solution.



Figure 13: Customer's Excerpt – SAP

SINGLE POINT OF CONTROL

- UAC real-time dashboard allows a centralized setup, control and monitoring of all business processes using a fully customizable web GUI
- Model your SAP process to consist of SAP, non-SAP and file transfer tasks in a single workflow
- Self-service-enabled configuration and operation - no SAP GUI login required

CLOUD-BASED SAAS SOLUTION WITH ZERO INSTALLATION REQUIRED

- Operate SAP scheduling from anywhere
- Unify all services, users and processes into a single, easy to manage solution.
- High available with geo redundancy
- Secure – SAML, SAP SNC via e.g. Cybersafe, TLS1.2

SELF-SERVICE CONVERSION

- No need for heavy migration projects: XCT supports a fully self- service conversion of all existing SAP SM36 job definitions.

DECREASED BATCH PROCESSING TIME

- Real-time resource control of event-based and time-based processes and tasks, including critical path handling.

SUPPORTS ALL SAP BUSINESS AREAS

- SAP ERP
 - ABAP Jobs Scheduling
 - BW Process Chains
 - SAP HCI, IBP
 - SAP System Copies
 - SAP Transport Management
 - Upload data to SAP (IDOC, BAPI, ALE, LDAP)
- Data Warehouse Processes
 - SAP Data Services – ETL
 - SAP Business Objects - Reporting
 - QLIK, Informatica etc.

SAP CERTIFIED

- The Universal Connector for SAP is regularly certified for the latest SAP HANA and SAP NetWeaver versions


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Integration with Applications on SAP HANA*

6. References

Ref-Id	Title	Filename	Remark
[1]	Dell Performance Benchmark	Dell Performance Benchmark_Final.pdf	Dell Performance Test 2019
[2]	XCT for SAP	https://www.stonebranch.com/services/xct-for-sap/	SAP Express Conversion to import SAP Job definitions to Universal Automation Center

7. About Stonebranch

Company	About
	<p>Stonebranch builds dynamic IT automation solutions that transform business IT environments from simple IT task automation into sophisticated, real-time business service automation, helping organizations achieve the highest possible Return on Automation. No matter the degree of automation, Stonebranch software is simple, modern and secure. Using its universal automation platform, enterprises can seamlessly orchestrate workloads and data across technology stacks and ecosystems. Headquartered in Atlanta, Georgia with points of contact and support throughout the Americas, Europe, and Asia, Stonebranch serves some of the world's largest financial, manufacturing, healthcare, travel, transportation, energy, and technology institutions.</p>



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