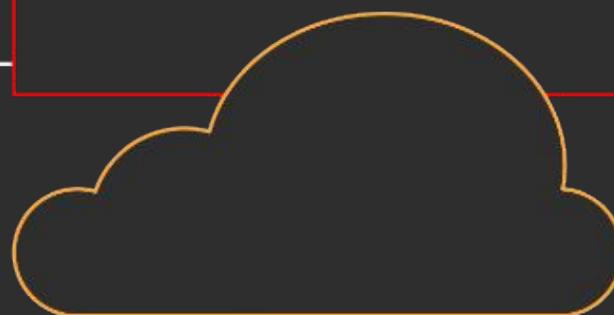
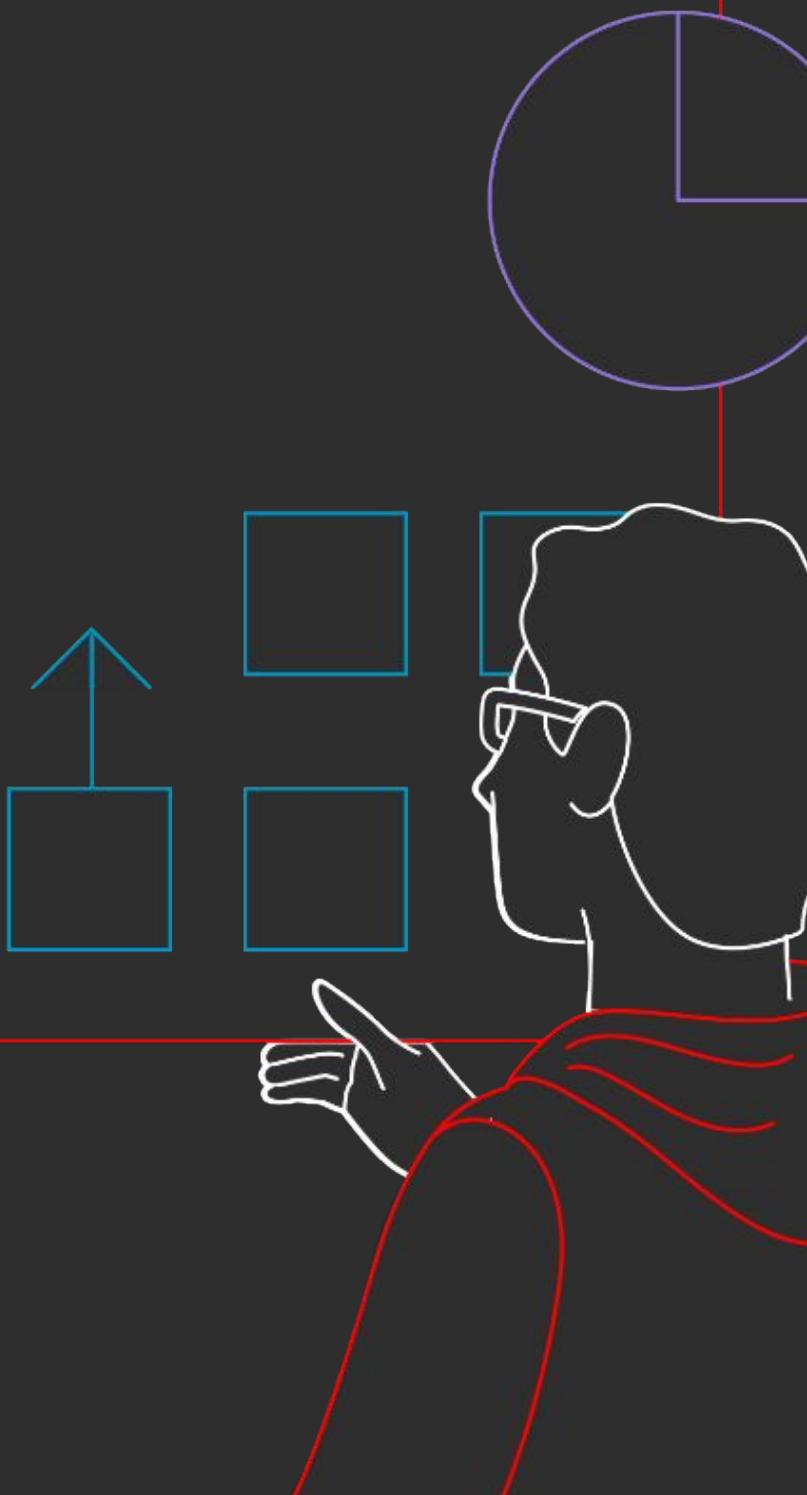


**Technical enablement**

# Technical Introduction to SAP Automation with **Ansible**

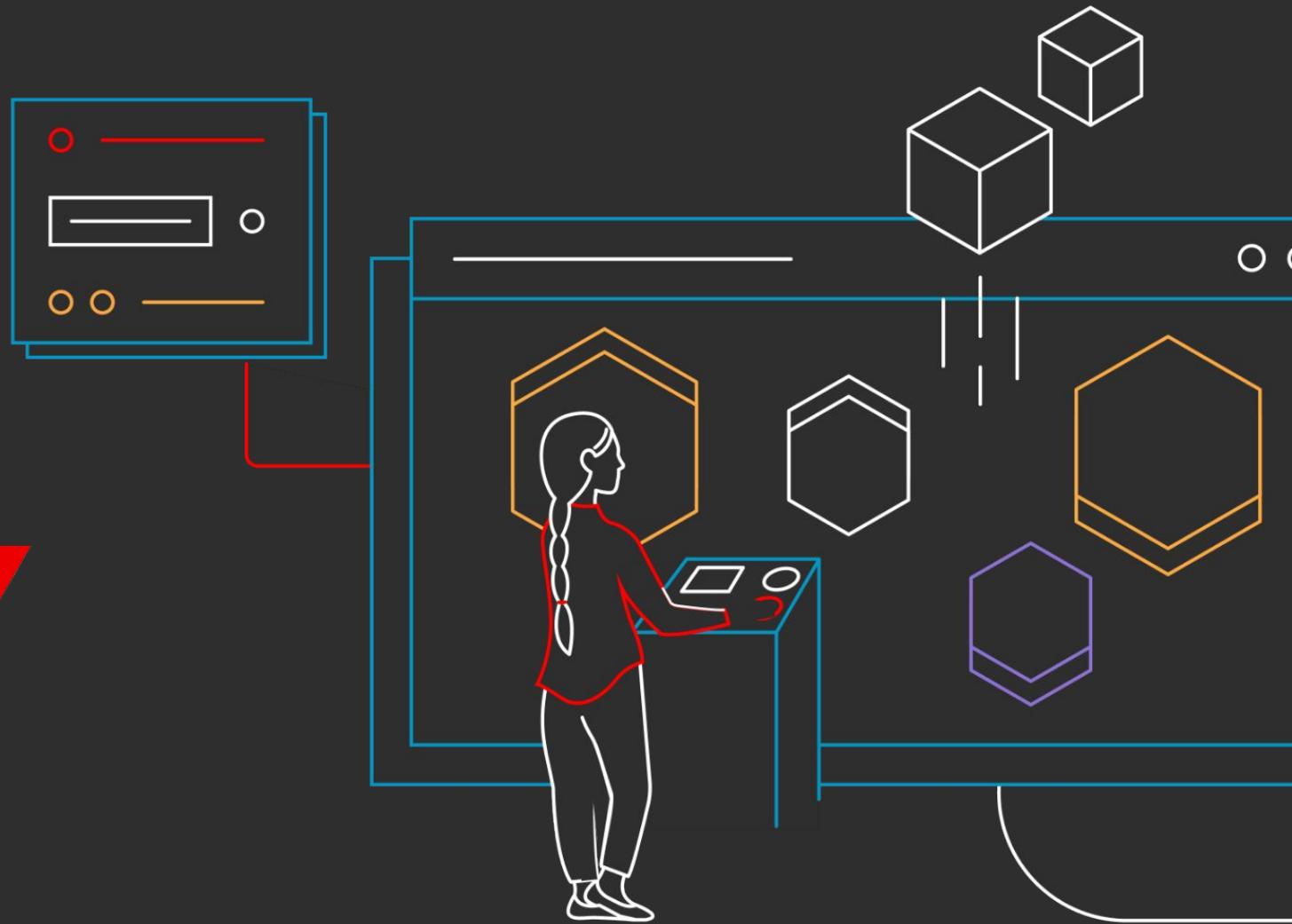


Markus Koch  
Partner Enablement Manager EMEA

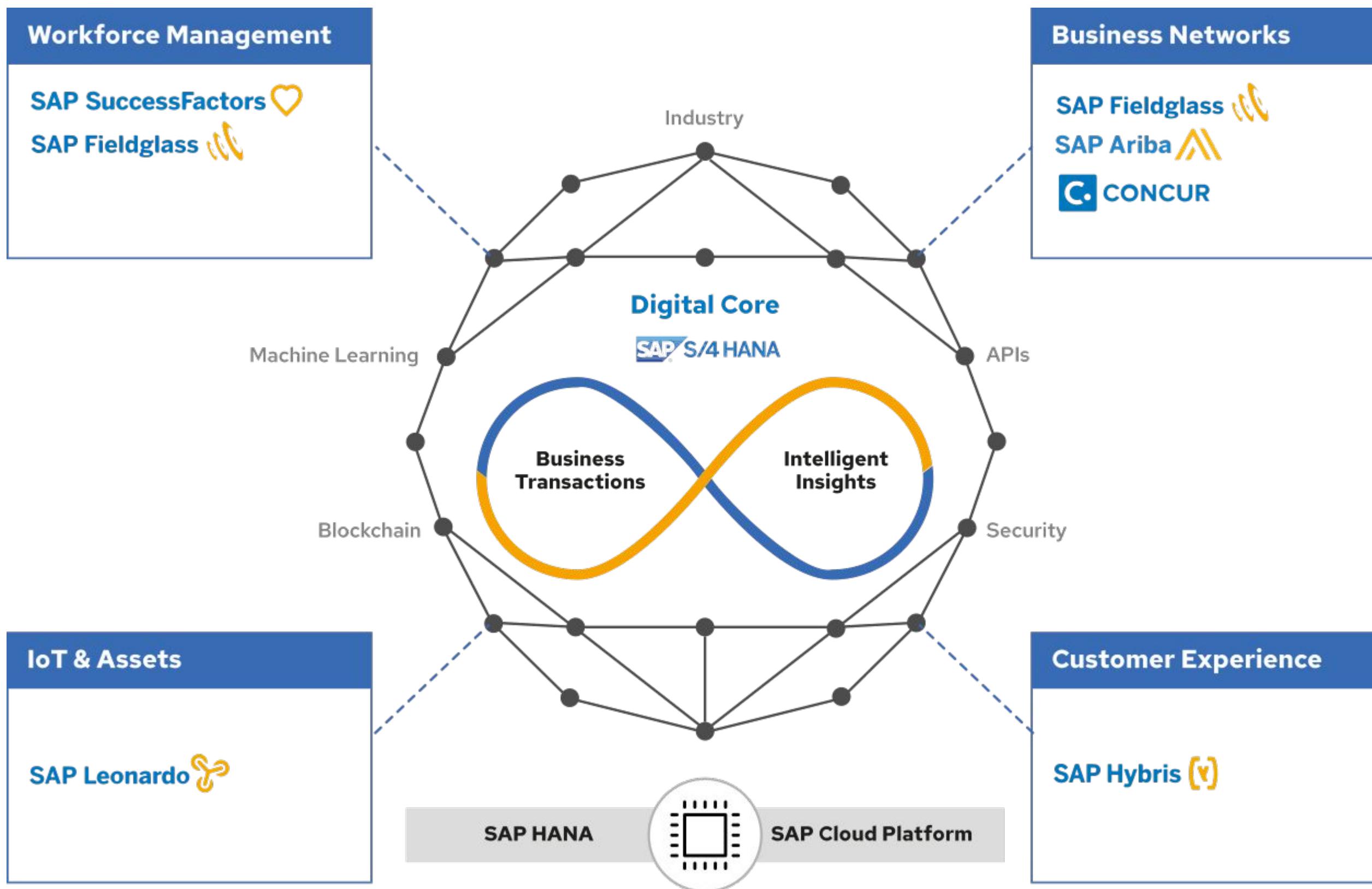




# Red Hat for SAP. Open. For business.

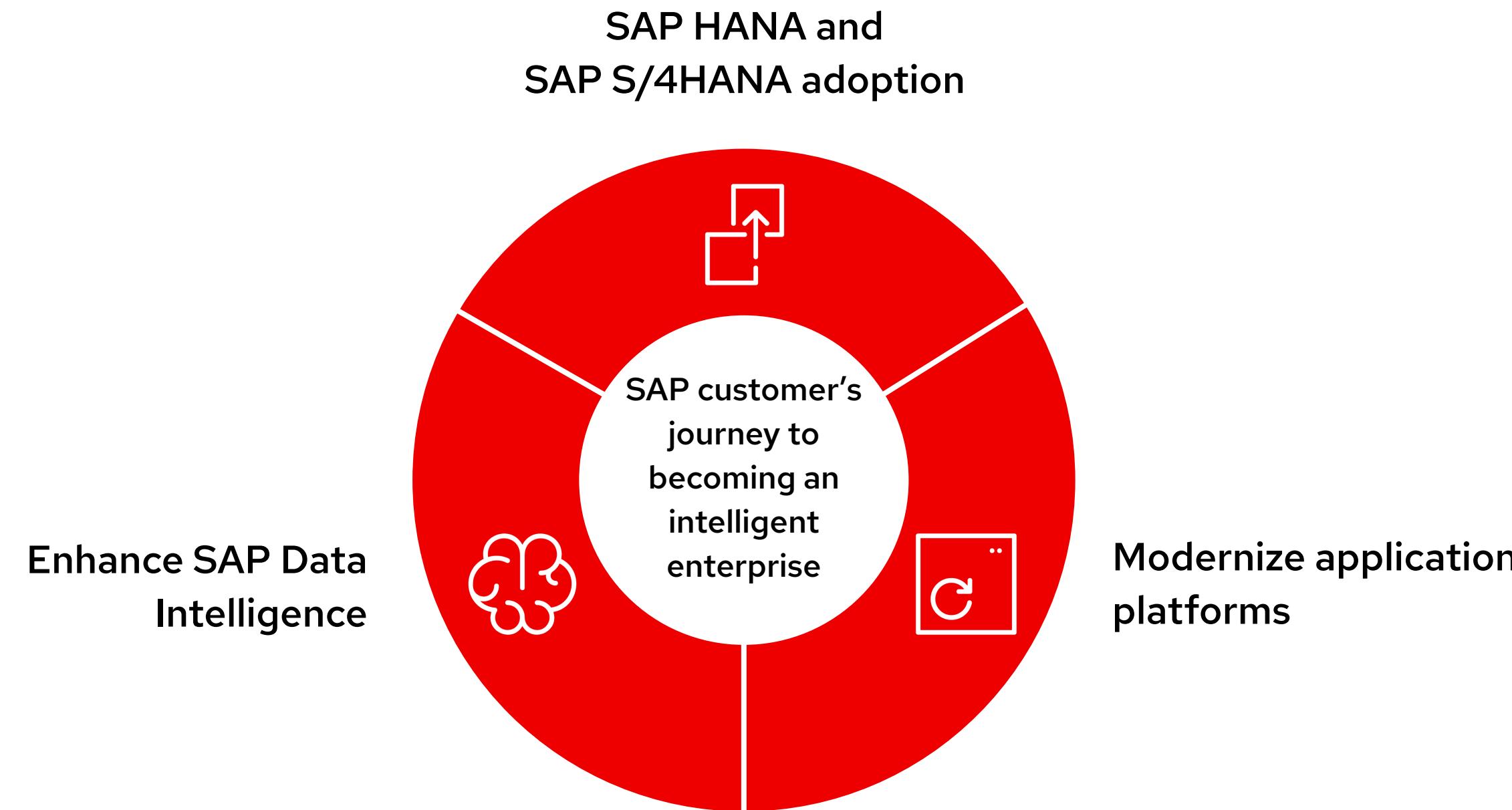


# SAP Portfolio Overview



# Red Hat solutions for SAP:

## *Where we can help you*



# Red Hat for SAP. Open. For business.

Open source solutions  
to run, simplify, and  
extend SAP  
environments

## Adopt SAP HANA & SAP S/4HANA

Infrastructure with  
management and automation



Red Hat  
Smart Management

Red Hat  
Insights    Red Hat  
Satellite

## Modernize your application platform

Modernization  
and integration



Red Hat  
Integration

Red Hat  
OpenShift

Red Hat  
Ansible Automation Platform

Red Hat  
Enterprise Linux

Red Hat  
Services

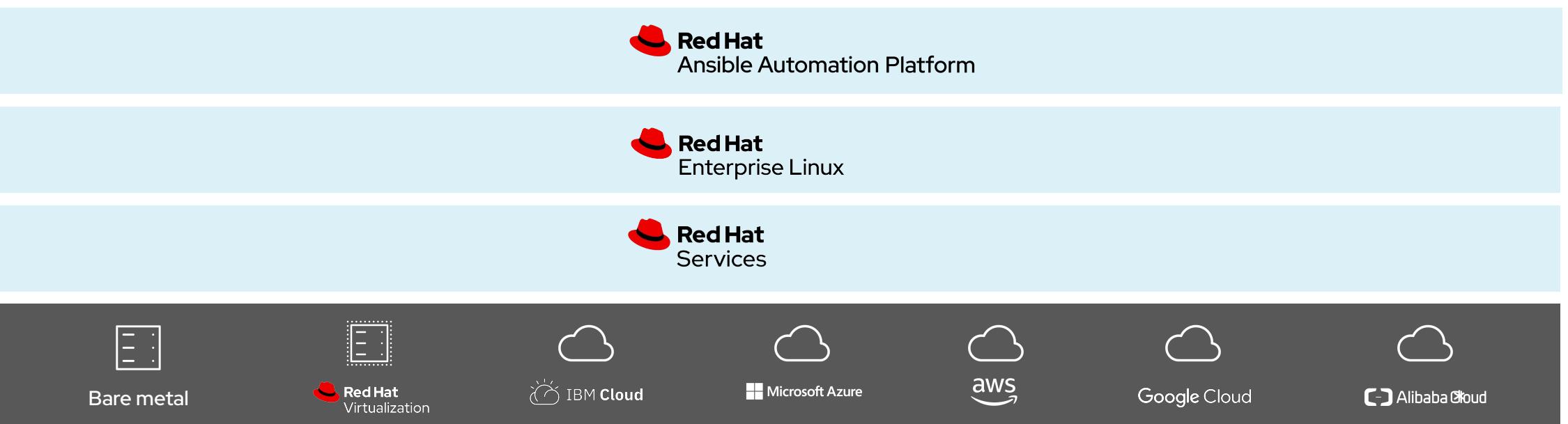
## Enhance SAP Data Intelligence

Innovation through  
data and analytics



Red Hat  
Integration  
 Red Hat  
OpenShift

Red Hat  
OpenShift  
Container Storage



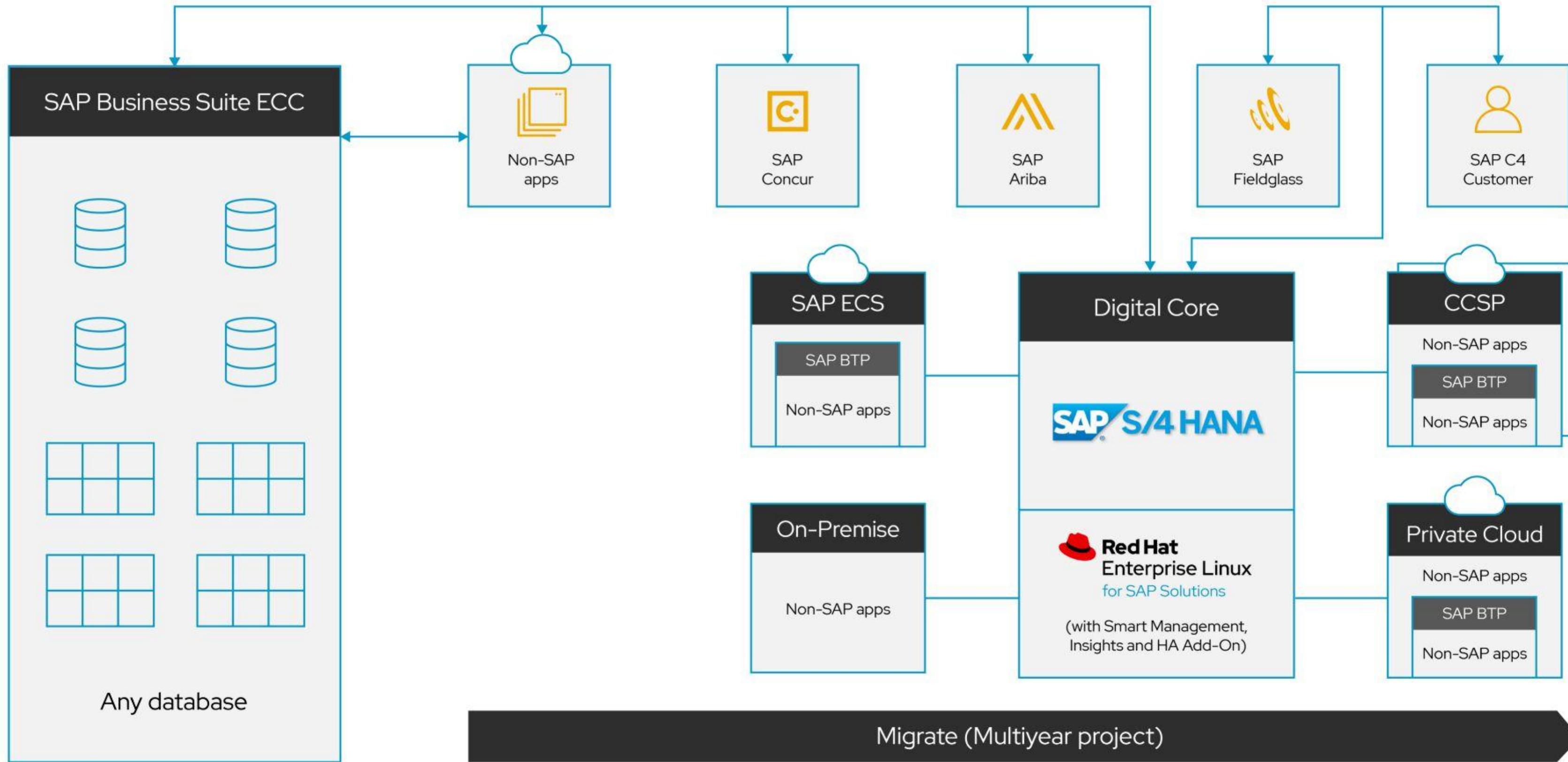
# Your SAP customer's landscape

Red Hat  
OpenShift

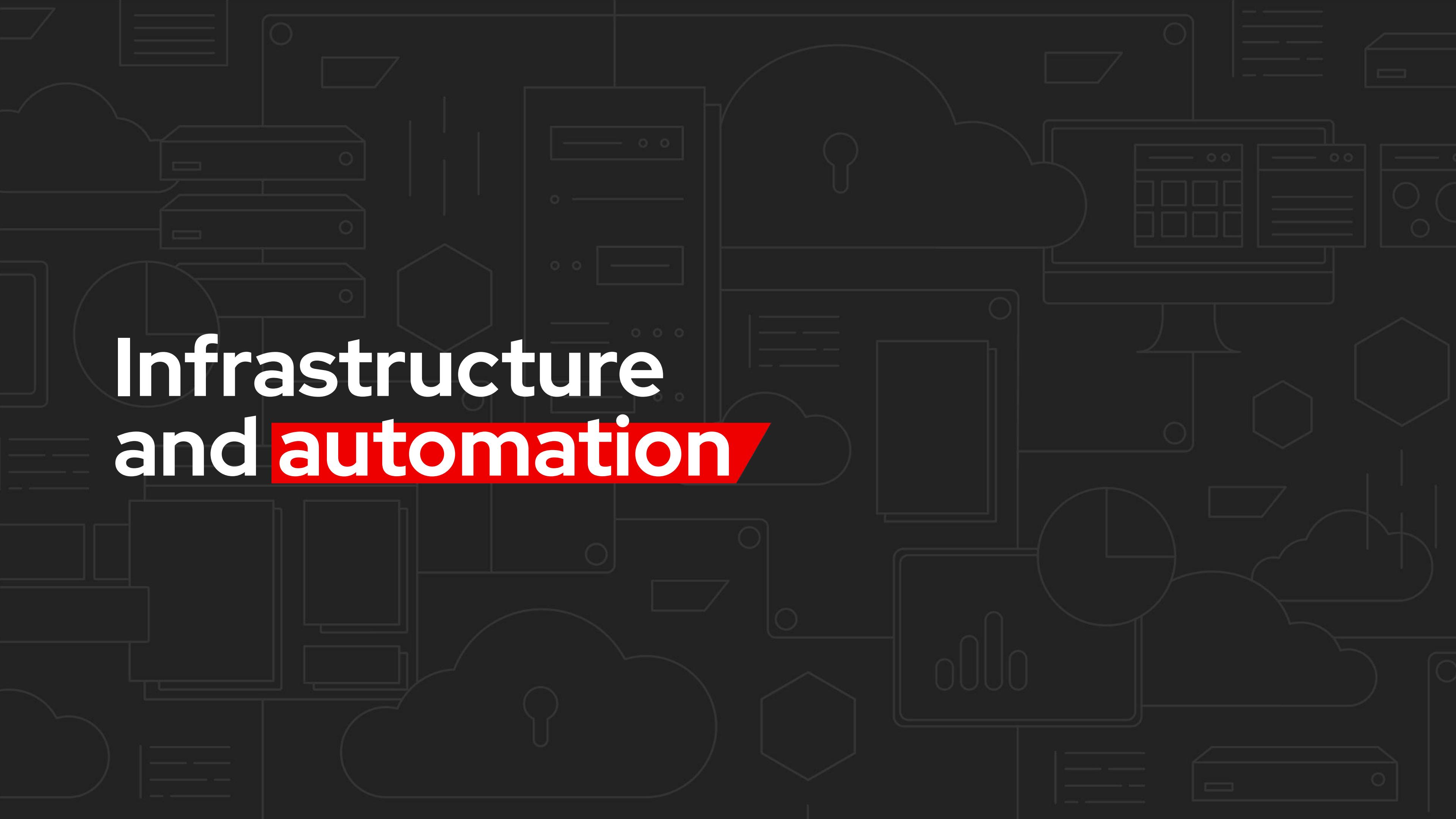
Red Hat  
Integration  
(Fuse, 3Scale,  
AMQ, Runtimes)

Modernize & consolidate

Integrate



# Infrastructure and automation





## Why automating with ansible?

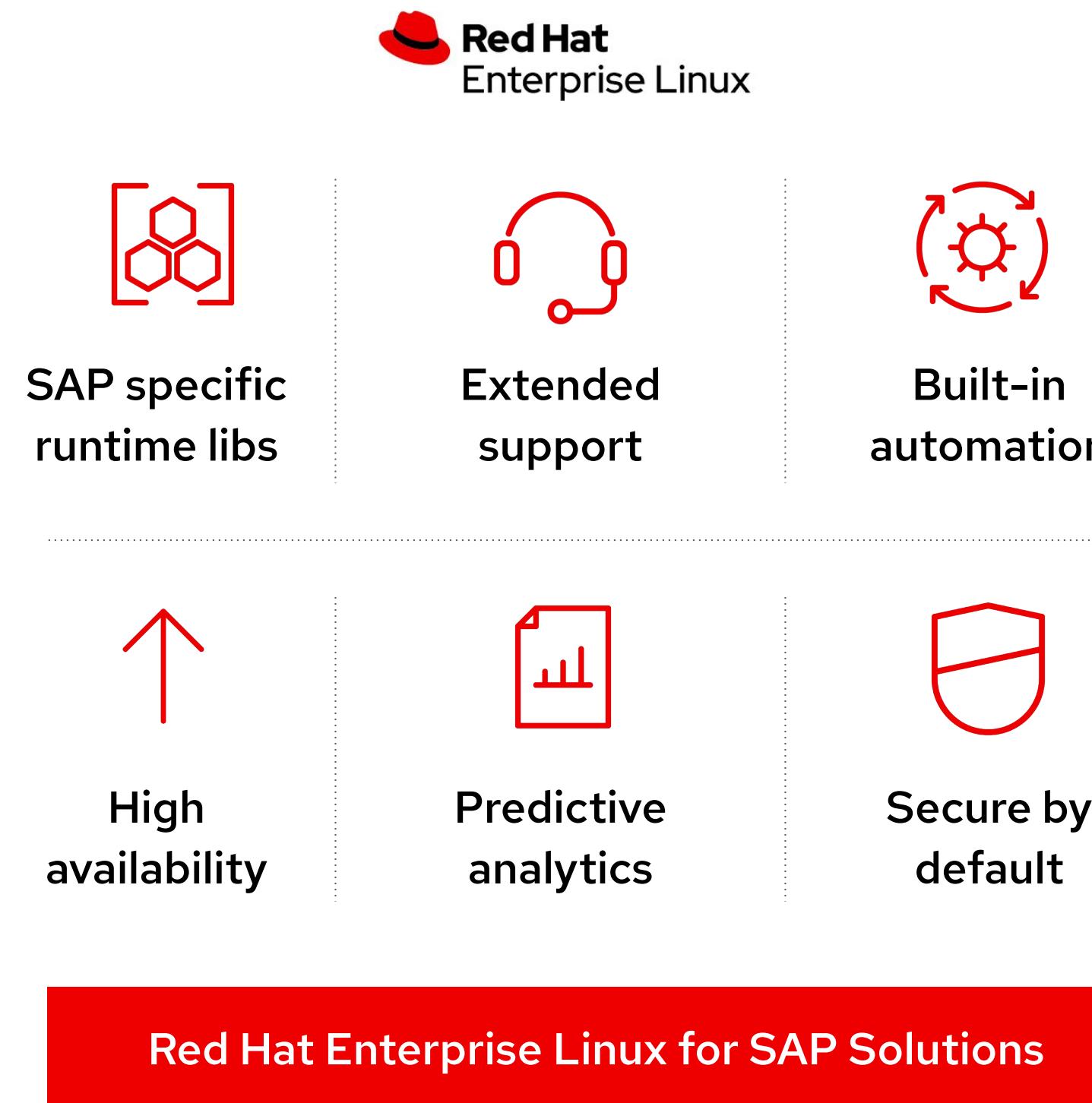
Documentation: ~ 80 Pages

Ansible roles sap-preconfigure and sap-hana-preconfigure are supported by RedHat and should be used

Configuration problems are often found in wrong preconfiguration  
e.g. wrong /etc/hosts entries

# Fundamentals of Red Hat Enterprise Linux for SAP Solutions

Operational efficiency



# Built-in automation - RHEL system roles for SAP



ANSIBLE



## sap-hana-preconfigure

- Does all configuration steps according to SAP Note 2009879
- Can be used prior to updates or environment checks as well



## sap-preconfigure

- Configures system local and hostname and checks DNS according to SAP Note 2369910
- Required for all SAP systems



## sap-netweaver-preconfigure

- Ansible role derived from the sapconf shell script
- Configures Red Hat Enterprise Linux ready for SAP NetWeaver installation, such as R/3 and S/4
- Does everything required to install SAP NetWeaver and/or classical DB

Tailored for  
**SAP HANA and NetWeaver**

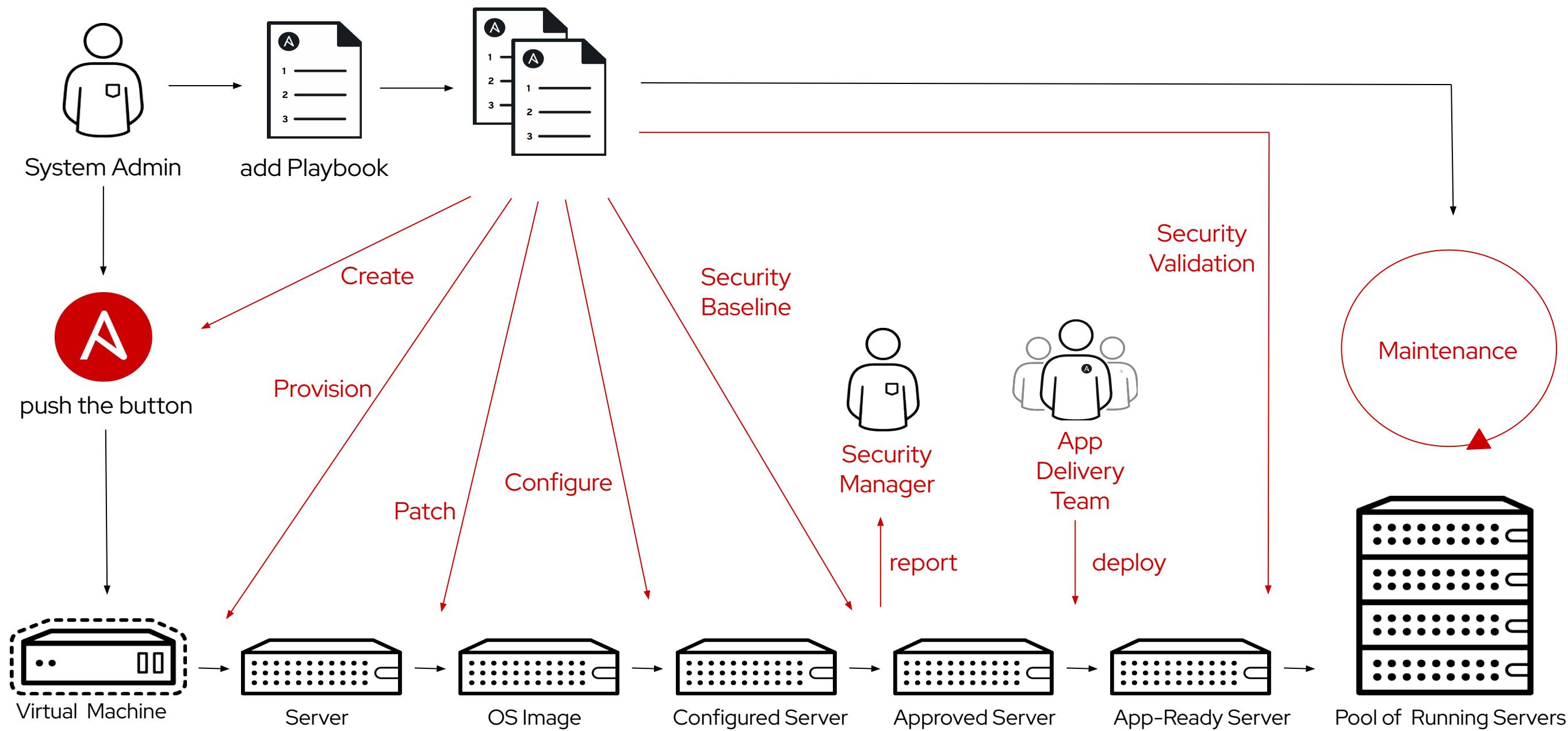
RHEL system roles are the primary mechanism for breaking Ansible Playbooks into smaller reusable components.

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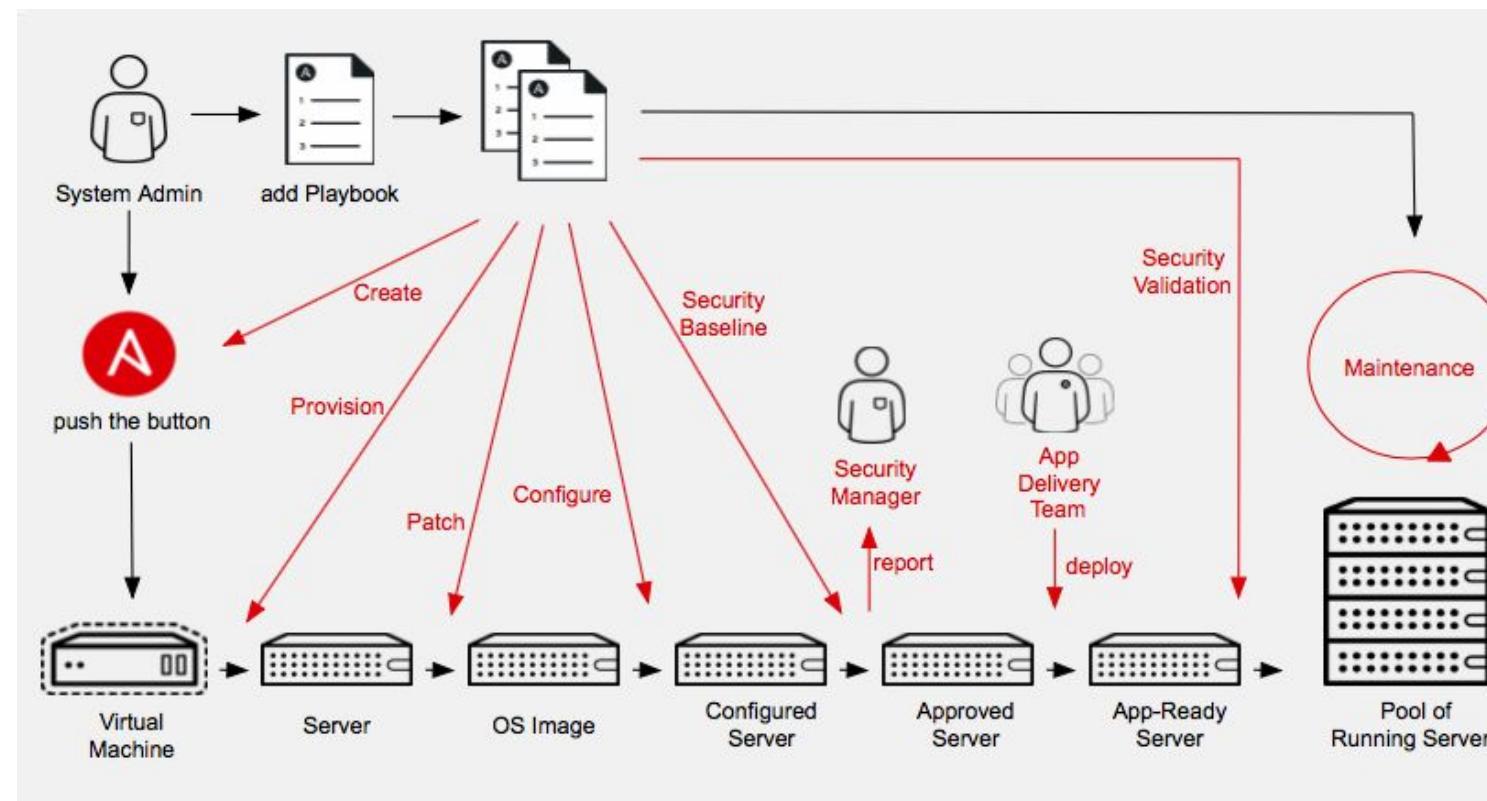


# Nothing routinary should be done manually



# End-to-end automation workflow for SAP

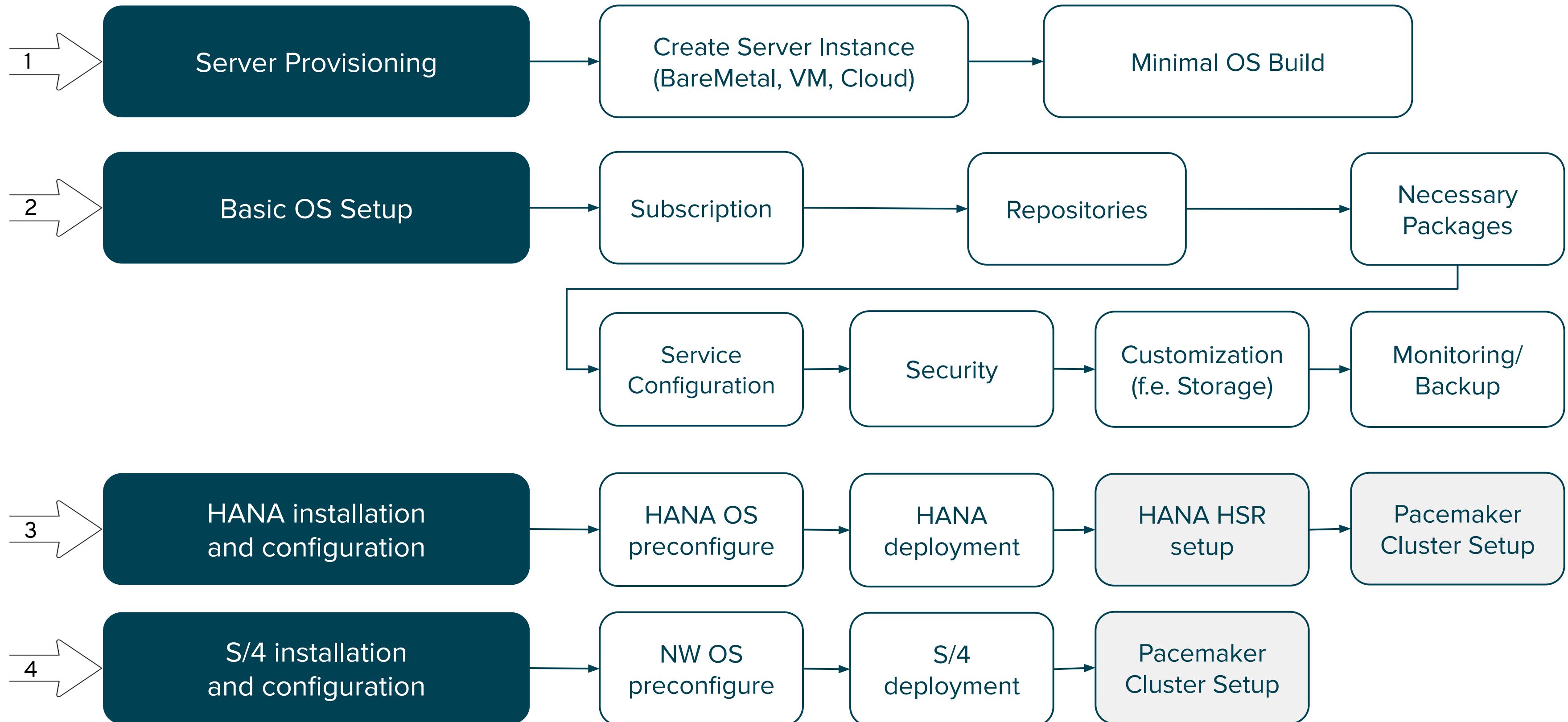
Self service enabled, DevOps ready with Red Hat Ansible playbooks for SAP



Standardize, automate and modernize SAP implementations with Ansible Automation to deploy the entire SAP solution running RHEL for SAP applications.

*"Best of breed infrastructure and software having Red Hat Ansible as an automation tool, being able to tie it all together, enabled us to deliver the solution at a record pace." Advent One, Australia*

# The SAP S/4 HANA deployment process breakdown



# Central Upstream repository

## SAP Linuxlab



A place for open source software that helps to make creating and managing SAP environments on Linux easier

 View on GitHub

<https://sap-linuxlab.github.io/>  
<https://github.com/sap-linuxlab>

- Terraform templates for simple use cases
- Ansible collections for
  - Software Download
  - Initial Install
  - Maintenance (Day 2 ops)
- Sizing Tools
- Reference Architectures



IBM Lab for SAP Solutions



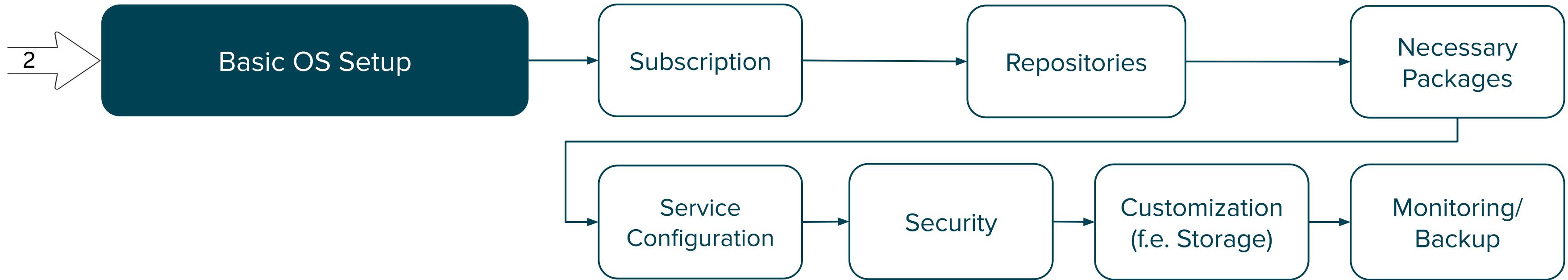
# The SAP S/4 HANA deployment process breakdown



- Provision can be solved in various ways
  - Bare Metal rack mounting and cabling + Satellite kickstart
  - Virtual environments with kickstart + image provisioning
  - public/private cloud with image provisioning
- multiple ways to reach this initial phase
  - ansible
  - terraform
  - custom scripts
  - manual process
- always ends up at least with a minimal RHEL system
  - with fully attached resources (Disk, CPU, memory)
  - reachable via ssh from ansible host

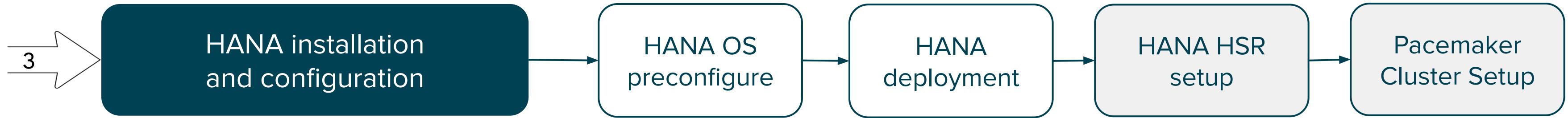
Phase 1 will not be covered  
in detail in this course

# The SAP S/4 HANA deployment process breakdown



- typically already in place “Corporate Standard Build”
- modules and roles exist in `rhel_system_roles` collection on Automation Hub (`linux_system_roles` on Galaxy)
- modules and roles to do these primary tasks, e.g.
  - `community.sap_operations`
    - [sap\\_rhsm](#)
  - `rhel_system_roles` / `linux_system_roles` (available also as RPM package)
    - [network](#)
    - [timesync](#)
    - [storage](#)
  - Ansible Galaxy or self-created collections for Monitoring and Backup

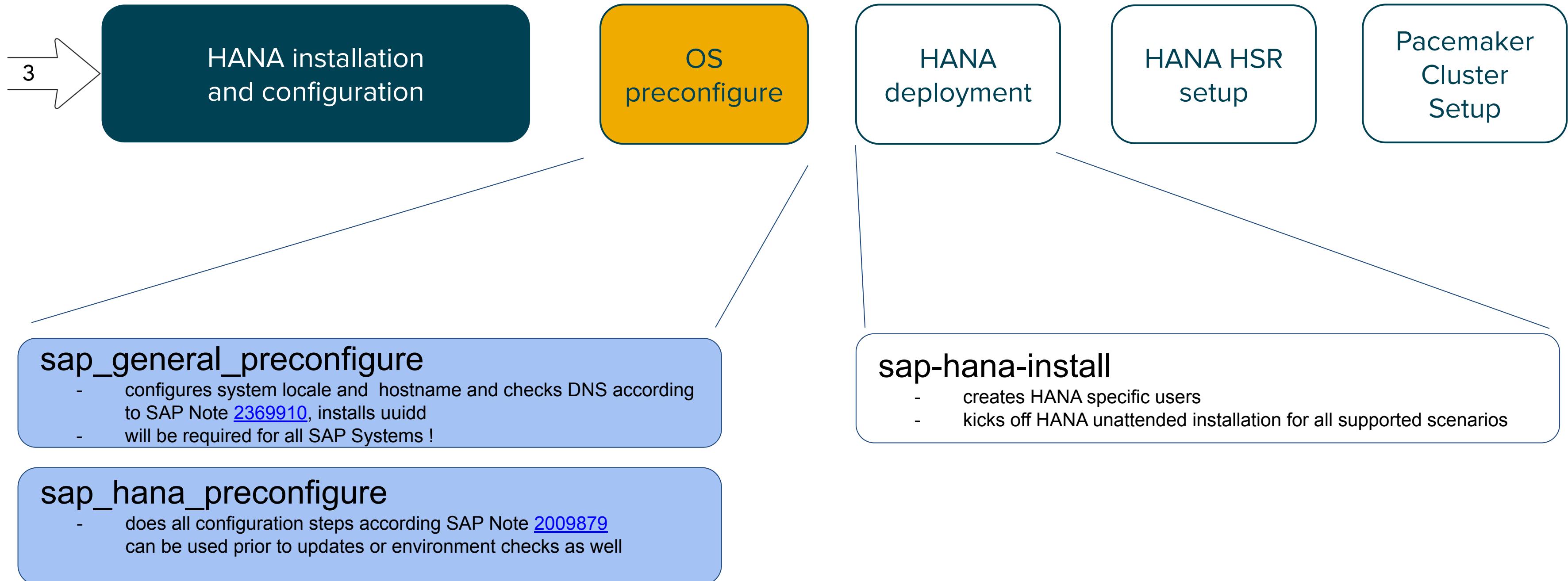
# The SAP S/4 HANA deployment process breakdown



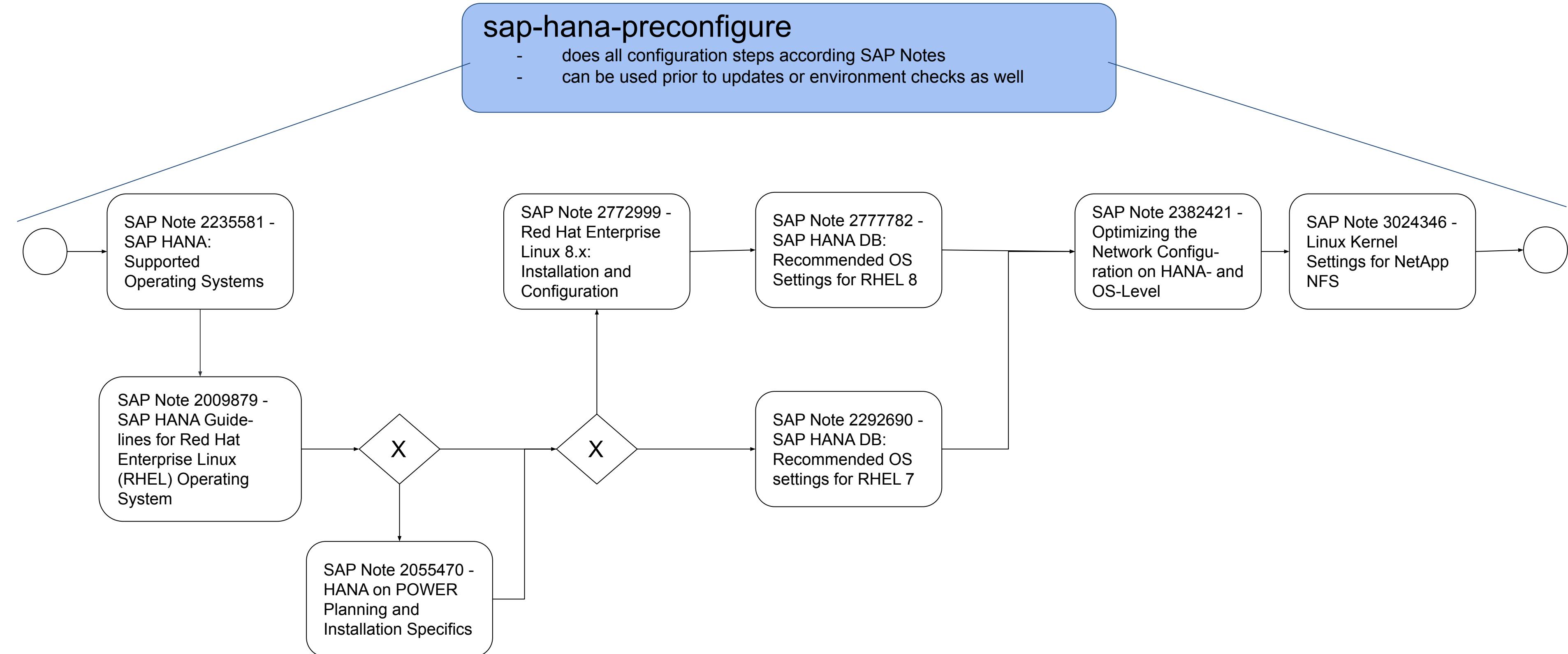
- roles are available in [community.sap\\_install](#) collection
- HANA OS preconfigure
  - [sap\\_general\\_preconfigure](#)
  - [sap\\_hana\\_preconfigure](#)
- HANA deployment:
  - [sap\\_hana\\_install](#)
- HANA HSR setup
  - [sap\\_ha\\_install\\_hana\\_hsr](#)
- Pacemaker Cluster Setup
  - [sap\\_ha\\_install\\_pacemaker](#)
  - [sap\\_ha\\_set\\_hana](#)

# The SAP HANA deployment process breakdown: A deeper look

Define Ansible Roles for each step



## A deeper look in a the role



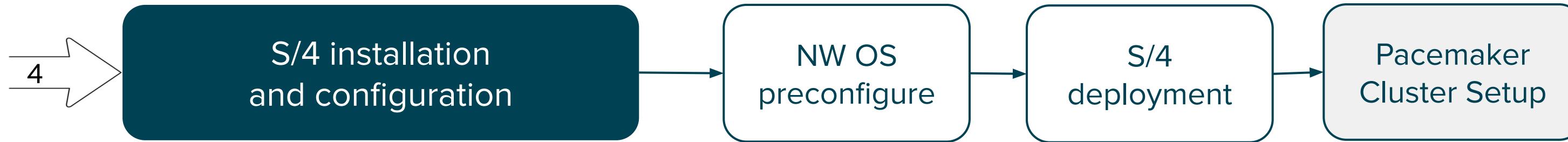
# Directory structure

- Exclusive Red Hat Recommendations
- One file for each SAP Note
- Variable Definition for each OS version

```
.  
  defaults  
    └── main.yml  
  example.yml  
  files  
    └── etc  
      └── tmpfiles.d  
        └── sap.conf  
  handlers  
    └── main.yml  
  LICENSE  
  meta  
    └── main.yml  
  README.DEV.md  
  README.md  
  tasks  
    ├── configuration.yml  
    ├── installation.yml  
    ├── main.yml  
    ├── RedHat6  
    │   └── recommendations.yml  
    ├── RedHat7  
    │   └── recommendations.yml  
    └── sapnotes  
      ├── 1275776.yml  
      ├── 1944799.yml  
      ├── 2009879_7.yml  
      ├── 2009879_8.yml  
      ├── 2009879.yml  
      ├── 2013638.yml  
      ├── 2055470.yml  
      ├── 2136965.yml  
      ├── 2235581.yml  
      ├── 2247020.yml  
      ├── 2292690.yml  
      ├── 2382421.yml  
      ├── 2455582.yml  
      └── 2777782.yml  
  vars  
    ├── main.yml  
    ├── RedHat_6.5.yml  
    ├── RedHat_6.6.yml  
    ├── RedHat_6.7.yml  
    ├── RedHat_7.yml  
    └── RedHat_8.yml
```



# The SAP S/4 HANA deployment process breakdown



- roles are available in [community.sap\\_install](#) collection
  - Netweaver OS preconfigure
    - [sap\\_general\\_preconfigure](#)
    - [sap\\_netweaver\\_preconfigure](#)
  - S/4 deployment:
    - [sap\\_swpm](#)
  - Pacemaker Cluster Setup (Optional)
    - [sap\\_ha\\_install\\_pacemaker](#)
    - [sap\\_ha\\_set\\_netweaver](#)

# Overview of sap\_install collection

## sap\_ha\_\*

Roles for configuring HA setups  
(still under heavy development)

## sap\_hana\_install

instals SAP HANA on the server

## sap\_install\_media\_detect

Checks and extracts installation media

## sap\_swpm

Runs the fully automated installation of e.g. SAP S/4HANA with an existing SAP HANA installation

## sap\_hostagent

Installs SAPHOSTAGENT on the server

## sap\_hana\_preconfigure

Installs and activates tuned-profiles-sap-hana, and configures the server according to SAP best practices

## sap\_netweaver\_preconfigure

Installs & activates tuned-profiles-sap-netweaver

## sap\_general\_preconfigure

Installs required packages and configures server based on general best practices for all kind of SAP deployments

## other linux system roles for network, ntp, subscription mgmt, etc.

- [RHEL System Roles for SAP](#) - General Available starting with RHEL 8.3
- [Community-driven Ansible roles](#) - maintained by SAP LinuxLab members

redhat supported roles: <https://access.redhat.com/articles/3050101>

## Tailored for

## SAP HANA and NetWeaver

RHEL system roles are the primary mechanism for breaking Ansible Playbooks into smaller reusable components.

Red Hat Enterprise LInux for SAP Solutions contains a number of such roles, specific to SAP.

- Automated RHEL system preparation for SAP HANA or SAP NetWeaver systems
- Verification of required packages, kernel parameters, network parameters, etc.

## Role Details: Register system to satellite or RHN

redhat\_sap.sap\_rhs

The first step is to make sure a system is registered and can access the correct repositories

This role is used to register against Satellite or RHN and configure the SAP repositories

### Example:

- Playbook:

```
- hosts: servers
  roles:
    - role: redhat_sap.sap_rhs
```

- Variables

```
sap_rhs_server_hostname: 'sat.example.com'
sap_rhs_org_id: 'my-org'
sap_rhs_activationkey: 'my-org-key'
```

# Role Details: Register system to satellite or RHN

**redhat\_sap.sap\_rhsm**

variable	info	required?
sap_rhsm_username	Username used to register to access.redhat.com	yes if username/password is used
sap_rhsm_password	Password used to register to access.redhat.com	yes if username/password is used
sap_rhsm_server_hostname	The Red Hat Satellite hostname/FQDN used for registration	yes if Satellite registration is used
sap_rhsm_activationkey	The Red Hat Satellite activation key used for registration	yes if Satellite registration is used
sap_rhsm_org_id	The Red Hat Satellite organization ID used for registration	yes if Satellite registration is used
sap_rhsm_pool_ids	The subscription pool IDs to consume	no
sap_rhsm_repos	A list of repositories to enable	no
sap_rhsm_force_register	Set to 'yes' to force a unregister/clean + re-registration	no
sap_rhsm_proxy_hostname	Specify a HTTP proxy hostname	no
sap_rhsm_proxy_port	Specify a HTTP proxy port	no
sap_rhsm_proxy_user	Specify a HTTP proxy user	no
sap_rhsm_proxy_password	Specify a HTTP proxy password	no
sap_rhsm_register_insights	Register the system to Red Hat Insights	no (default true)
sap_rhsm_register_insights_retries	Number of times Insights will retry to upload metadata info	no (default 10)
sap_rhsm_use_e4s	Whether to use 'e4s' repositories or not	no (default true)

## Role Details: Configure Timeserver

`rhel-system-roles.timesync`

SAP requires proper time synchronisation.

So the linux system role is an easy way to set the time correctly

### Example:

- Playbook:

```
- hosts: servers
  roles:
    - role: rhel-system-roles.timesync
```

- Variables

```
timesync_ntp_servers:
  - hostname: 0.rhel.pool.ntp.org
    iburst: yes
timesync_ntp_provider: chrony
```

# Role Details: Networking Setup

`rhel-system-roles.network`

In most automatically deployed environments the network setup is done properly.

You could use `rhel-system-roles.network` to configure a more complex network preconfiguration. Simple configurations can also be done with `nmcli` module

## Example:

- Playbook:

```
- hosts: servers
  roles:
    - role: rhel-system-roles.network
```

- Variables

```
network_provider: nm
network_connections:
  - name: eth0
    #...
network_allow_restart: yes
```



## Role Details: Storage Setup

This role is very useful to configure complex disk setups

On the right side you see an example configuration of a HANA disk setup

```
storage_pools:  
  - name: sap  
  
disks:  
  - xvdf  
  
volumes:  
  - name: data  
    size: "128 GiB"  
    mount_point: "/hana/data"  
    fs_type: xfs  
    state: present  
  - name: log  
    size: "64 GiB"  
    mount_point: "/hana/log"  
    fs_type: xfs  
    state: present  
  - name: shared  
    size: "256 GiB"  
    mount_point: "/hana/shared"  
    fs_type: xfs  
    state: present  
  - name: sap  
    size: "50 GiB"  
    mount_point: "/usr/sap"  
    state: present
```

**rhel-system-roles.storage**

# Role Details: Storage Setup

`rhel-system-roles.storage`

This role is very useful to  
configure complex disk setups

On the right side you see an  
example configuration of a  
S/4HANA disk setup

```
storage_pools:  
  - name: sap  
    disks:  
      - xvdf  
    volumes:  
      - name: sap  
        size: "50 GiB"  
        mount_point: "/usr/sap"  
        state: present  
      - name: sapmnt  
        size: "20 GiB"  
        mount_point: "/usr/sapmnt"  
        state: present  
      - name: swap  
        size: "21 GiB"  
        fs_type: swap  
        mount_options: swap  
        state: present
```

## Role Details: Generic SAP settings

`community.sap_install.  
sap_general_preconfigure`

SAP requires a couple of base settings that are described in [SAP Note 2369910](#) and other SAP notes which are required for all SAP systems. The role sap-preconfigure will set the parameters that have to be set for all SAP software.

The role is designed to be used without parameters to produce a valid output nad has an assert mode, which can be used to verify the configuration

```
sap_general_preconfigure_modify_etc_hosts: true  
sap_general_preconfigure_update: true  
sap_general_preconfigure_fail_if_reboot_required: false  
sap_general_preconfigure_reboot_ok: true  
sap_hostname: myserver  
sap_domain: example.com  
sap_ip: 192.168.2.3
```

## Role Details: configure SAP HANA Settings

`community.sap_install.  
sap_hana_preconfigure`

This role performs the configurations according to the necessary SAP Notes

This role can be used without any additional parameters, although there are some that might be tweaked in production. e.g. some kernel parameters.

[SAP NOTE 2382421](#) defines a lot of kernel parameter options, that can be set, in the variable `sap_hana_preconfigure_kernel_parameters`.

```
sap_hana_preconfigure_set_minor_release: true  
sap_hana_preconfigure_update: true  
sap_hana_preconfigure_reboot_ok: true  
sap_hana_preconfigure_fail_if_reboot_required: false
```

## Role Details: configure SAP Netweaver Settings

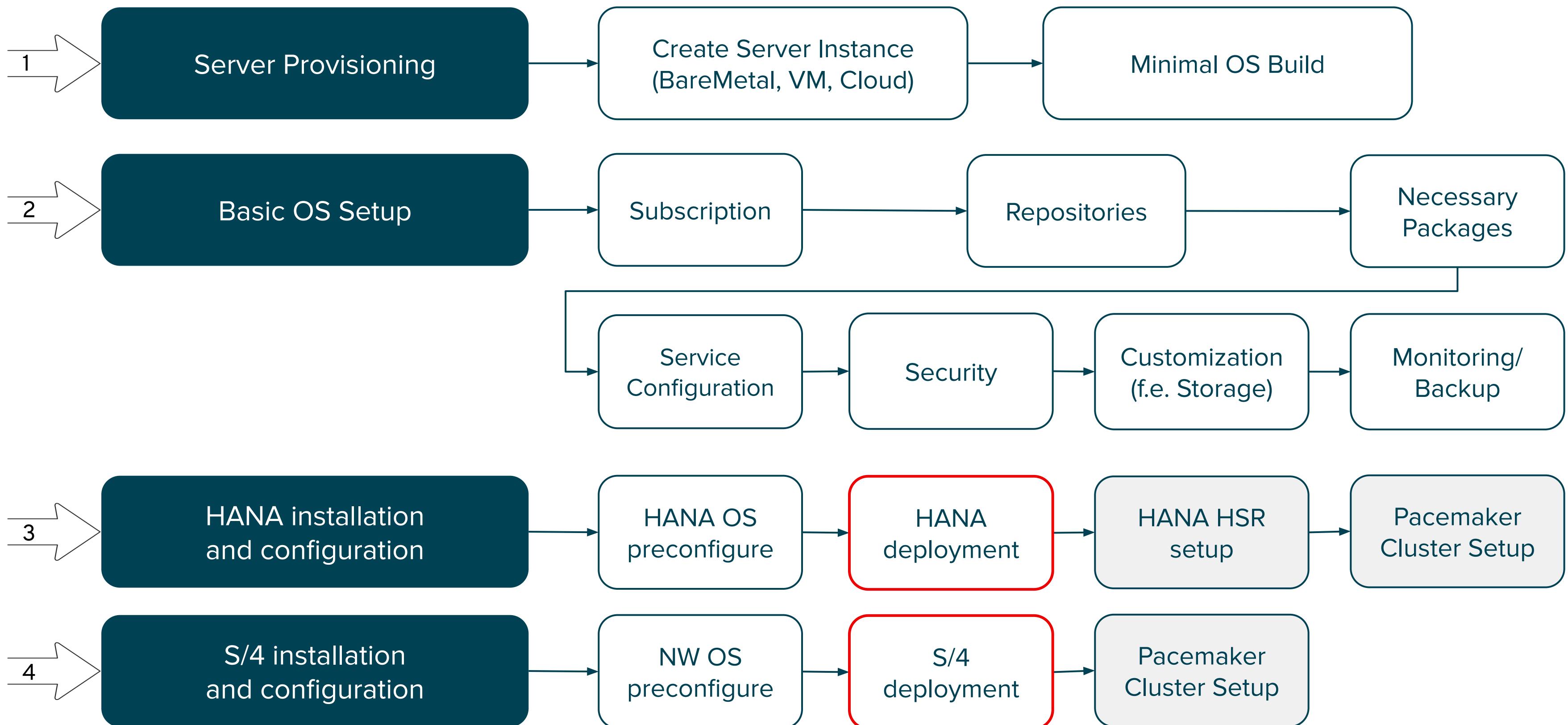
`community.sap_install.  
sap_netweaver_preconfigure`

This role does all preconfiguration steps for SAP Netweaver which are described in SAP Note 2772999 for RHEL8.

It can be used without any additional parameters. It automatically fails, if not enough swap space is configured.

If you require different swap space than the recommended, you have variables to influence this setting.

# The SAP S/4 HANA deployment process breakdown



# Overview of sap\_install collection

## sap\_ha\_\*

Roles for configuring HA setups  
(still under heavy development)

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instals SAP HANA on the server

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Checks and extracts installation media

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## Tailored for

## SAP HANA and NetWeaver

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- Verification of required packages, kernel parameters, network parameters, etc.

# Overview of sap\_launchpad collection

## **sap\_launchpad.maintenance\_planner**

Lookup and download files from an existing 'New Implementation' MP Transaction and Stack, using SAP software center's download basket

## **sap\_launchpad.software\_center\_download**

searches for files and downloads software from SAP software center

Tailored for

**SAP HANA and NetWeaver**

RHEL system roles are the primary mechanism for breaking Ansible Playbooks into smaller reusable components.

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- Automated RHEL system preparation for SAP HANA or SAP NetWeaver systems
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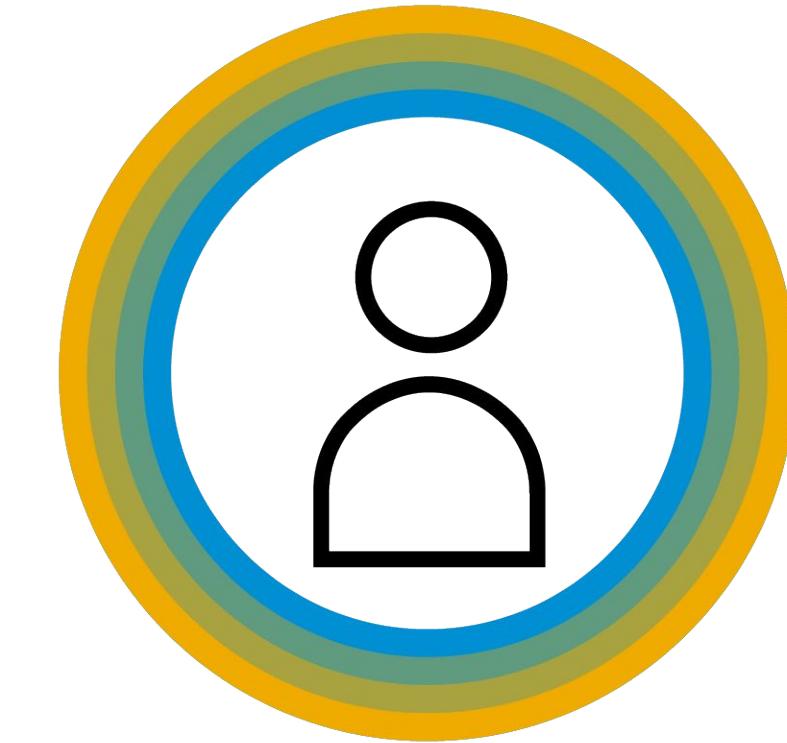
## module details: download files from SAP Software Center

community.sap\_launchpad.  
software\_center\_download

Search and download files from SAP Software Center:

### Example Playbook snippet:

```
- name: download sapcar
  community.sap_launchpad.software_center_download:
    suser_id: "{{ suser_id }}"
    suser_password: "{{ suser_password }}"
    softwarecenter_search_query: SAPCAR_1010-70006178.EXE
    dest: "{{ sap_swpm_software_path }}"
```



## module details: get files from maintenance planner

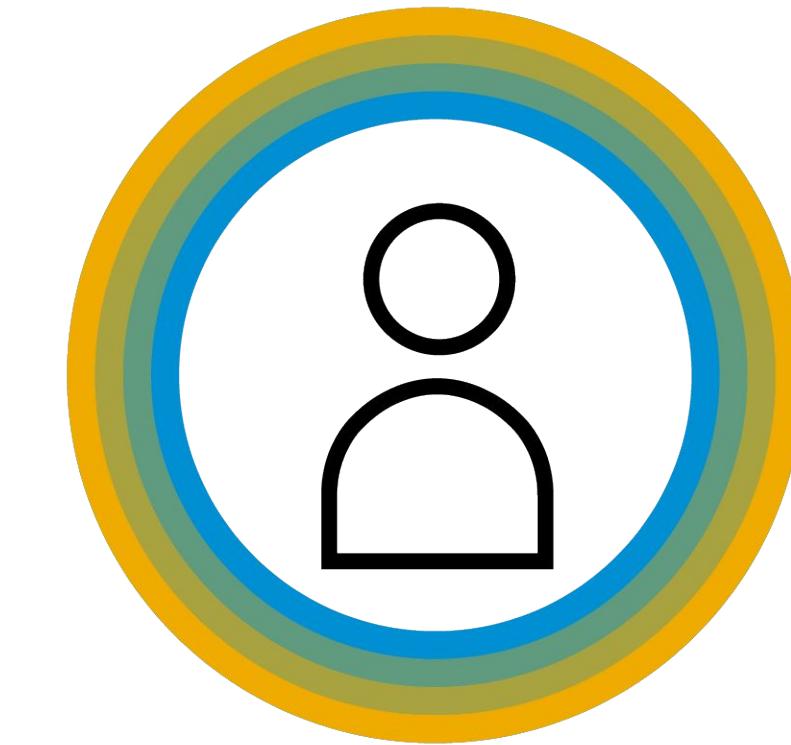
community.sap\_launchpad.  
maintenance\_planner

Lookup and download files from an existing 'New Implementation' MP Transaction and Stack, using SAP software center's download basket

### Example Playbook snippet:

```
- name: Execute Ansible Module 'maintenance_planner' to get files from MP
  community.sap_launchpad.maintenance_planner:
    suser_id: "{{ suser_id }}"
    suser_password: "{{ suser_password }}"
    transaction_name: "{{ mp_transaction_name }}"
  register: sap_maintenance_planner_basket_register

- name: Execute Ansible Module 'software_center_download' to download files
  community.sap_launchpad.software_center_download:
    suser_id: "{{ suser_id }}"
    suser_password: "{{ suser_password }}"
    download_link: "{{ item.DirectLink }}"
    download_filename: "{{ item.Filename }}"
    dest: "{{ sap_swpm_software_path }}"
  loop: "{{ sap_maintenance_planner_basket_register.download_basket }}
```



## Role details: install or update SAP Host Agent

`community.sap_install.  
sap_hostagent`

In an initial installation, this role can be used to deploy SAP Host Agent in a defined way and makes sure it uses the same UID/GID across your systems. It can also be used to update running SAP Host Agents to a newer version.

It can handle RPM, SAR, and installation bundle files

```
sap_hostagent_installation_type: "rpm"  
sap_hostagent_rpm_remote_path: "/software/SAPHOSTAGENT"  
sap_hostagent_rpm_file_name: "saphostagentrpm_44-20009394.rpm"
```



## Role details: install SAP HANA

This role creates the configuration file for an unattended install of SAP HANA with hdblcm and kicks off the installation process.

It automatically detects the hdblcm binary or the installation files in the given installation directory

A minimal configuration example is on the right.

More information about configuration options can be found in the documentation

**community.sap\_install.  
sap\_hana\_install**

```
sap_hana_install_software_directory: /sap-software  
sap_hana_install_common_master_password: "*****"  
sap_hana_install_sid: 'RHA'  
sap_hana_install_instance_number: "00"
```

## Role details: install SAP S/4HANA

**community.sap\_install.  
sap\_swpm**

The role automatically unpacks the SAP software and runs the swpm installer with a preconfigured configuration file.

In this example we prepare a single node SAP S/4HANA instance.

For more options, see the README.

```
# Software
sap_swpm_software_path: /sap-software
sap_swpm_product_catalog_id: NW_ABAP_OneHost:S4HANA2020.CORE.HDB.ABAP
sap_swpm_sapcar_path: "{{ sap_swpm_software_path }}"
sap_swpm_swpm_path: "{{ sap_swpm_software_path }}"

# NW Passwords
sap_swpm_master_password: "*****"
sap_swpm_ddic_000_password: "{{ sap_swpm_master_password }}"

# HDB Passwords
sap_swpm_db_system_password: "{{ sap_swpm_master_password }}"
sap_swpm_db_systemdb_password: "{{ sap_swpm_master_password }}"
sap_swpm_db_schema_abap_password: "{{ sap_swpm_master_password }}"
sap_swpm_db_sidadm_password: "{{ sap_swpm_master_password }}"

# NW Instance Parameters
sap_swpm_sid: S4H
sap_swpm_pas_instance_nr: "01"
sap_swpm_ascs_instance_nr: "02"
sap_swpm_ascs_instance_hostname: "{{ ansible_hostname }}"
sap_swpm_fqdn: "{{ ansible_fqdn }}"

# HDB Instance Parameters
sap_swpm_db_host: "rha-hana"
sap_swpm_db_sid: RHA
sap_swpm_db_instance_nr: "00"
```

## Role details: configure SAP HANA system replication

[redhat\\_sap.sap\\_hana\\_hsr](#)

If you have used the `sap_hana_install` role to set up two identical instances, you can use this role to easily set up SAP HANA system replication between these instances.

### Example:

Common variables that need to be used on both hosts:

```
sap_hana_hsr_hana_sid: "RHE"  
sap_hana_hsr_hana_instance_number: "00"  
sap_hana_hsr_hana_db_system_password: "R3dh4t123!"  
sap_hana_hsr_hana_primary_hostname: "hana1"
```

To be used for the primary:

```
sap_hana_hsr_role: "primary"  
sap_hana_hsr_alias: "DC1"
```

To be used for the secondary:

```
sap_hana_hsr_role: "secondary"  
sap_hana_hsr_alias: "DC2"
```



## Role details: configure pacemaker for SAP HANA

redhat\_sap.  
sap\_hana\_ha\_pacemaker

This role configures pacemaker on two SAP HANA systems that have properly configured SAP HANA system replication deployment on a RHEL 8.x systems.

```
└── sap_hana_ha_pacemaker
    ├── sap_hana_ha_pacemaker_hana_sid: RH1
    ├── sap_hana_ha_pacemaker_hana_instance_number: "00"
    ├── sap_hana_ha_pacemaker_vip: 192.168.47.100
    ├── sap_hana_ha_pacemaker_hacluster_password: "Mysecretpassword"
    ├── sap_hana_ha_pacemaker_node1_fqdn: hana-node1.test.local
    ├── sap_hana_ha_pacemaker_node2_fqdn: hana-node2.test.local
    ├── sap_hana_ha_pacemaker_node1_ip: 192.168.47.21
    └── sap_hana_ha_pacemaker_node2_ip: 192.168.47.22
```



# Ansible automation for SAP

Faster & more secure deployments



## Red Hat Ansible Automation

### CENTRALIZE AUTOMATION GOVERNANCE

Centralized Control

Team & User Delegation

Audit Trail

Automated system provisioning using configuration management

- Set up SAP HANA instance including best practices and tuning within less than 10 min.
- Reduce implementation time e.g. for 6 node HANA scale-out environment from 7 to 3 days

Fast, controlled and reproducible roll out of changes into production

- CI/CD and SOE for SAP HANA Infrastructure enables regular security updates in production environment
- Avoid configuration drifts between staging / production environments

Integrated into Hybrid Cloud – this is where the magic happens

- with over 500 modules for hyperscalers
- with over 2000 modules in total

(Near) Zero - Maintenance Downtime

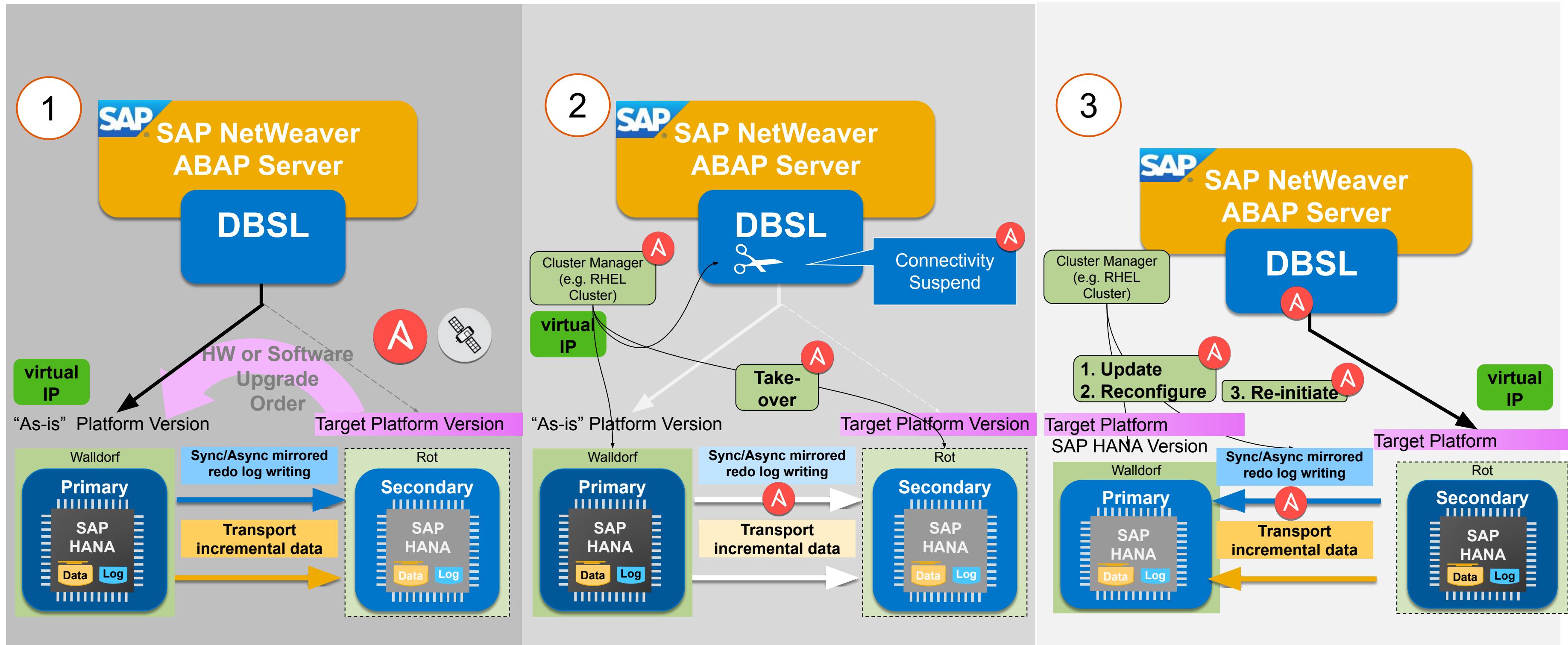
- Make the complex process trustworthy
- Reduce planned downtime from 100 h to less than 1 min

Integration with existing management tools

- Bare-Metal-as-a-Service

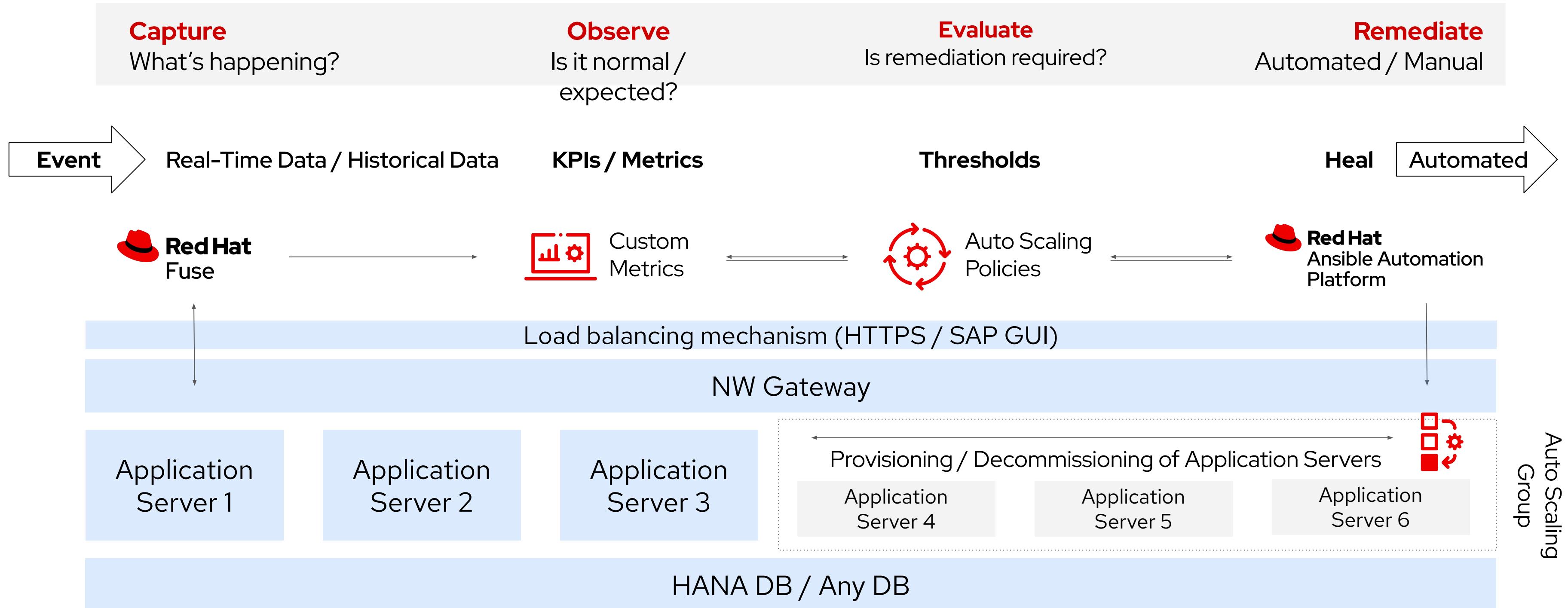
# Near Zero Downtime Maintenance for SAP HANA and SAP Netweaver

Revision Update using Ansible Playbooks, Satellite Provisioning



# Self healing Use Case

Fully automated provisioning and decommissioning of SAP Application Servers



# Ansible Automation Platform for SAP HANA Deployment

The image displays two screenshots of the Ansible ecosystem. On the left, the Ansible Galaxy interface shows a list of Ansible roles for SAP HANA deployment, including:

- sap\_base\_settings**: Configures RHEL hostname and locale according SAP Note 2369910. (0 Downloads, 0 Stars)
- saphana-deploy**: deploys SAP HANA on a proper defined RHEL system. (86 Downloads, 3 Stars)
- saphana-hsr**: configures SAP HANA SR on a properly deployed HANA on RHEL servers. (38 Downloads, 2 Stars)
- saphana-preconfigure**: Configures a RHEL OS to be ready for SAP HANA installation. (2.3 / 5, 101 Downloads, 3 Stars)
- setup\_nfs\_server**: configures a simple NFS Server. (0 Downloads, 0 Stars)
- setup-repository**: setup repository server for use with subscribe-repos role. (3 Downloads, 0 Stars)

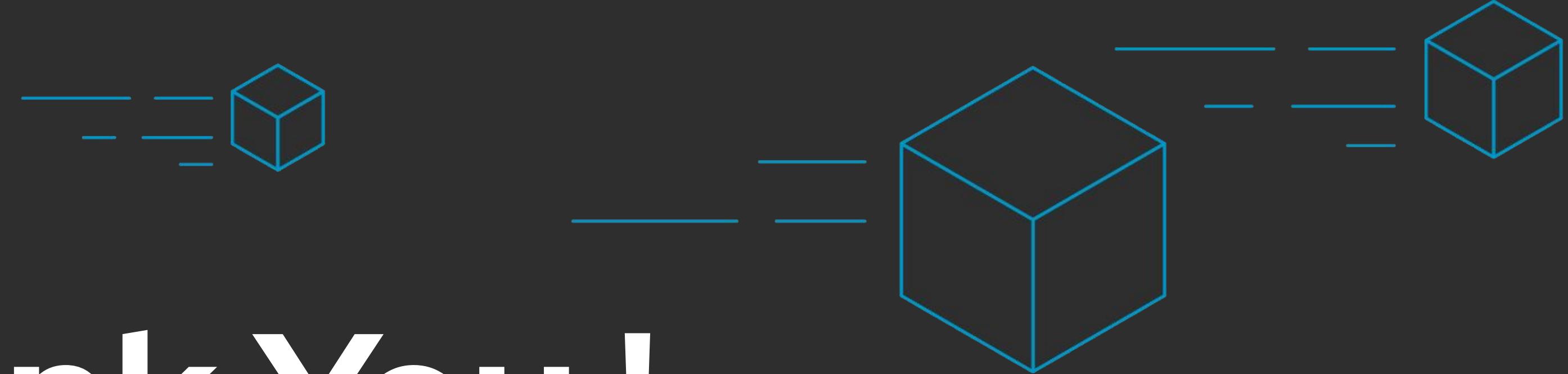
On the right, the Tower interface shows a deployment workflow titled "hana - complete deployment". The workflow consists of the following steps:

```
graph LR; A[mkoch - hana tom VM delete] --> B[mkoch - hana tom VM create]; B --> C[mikoch - hana deploy with su...]; C --> D[mkoch - hana tom VM delete]
```

The workflow details are as follows:

- DETAILS**
  - STATUS: Running
  - STARTED: 20.6.2018 17:36:25
  - FINISHED: Not Finished
  - TEMPLATE: hana - complete deployment
  - LAUNCHED BY: admin
- EXTRA VARIABLES**
  - 1 hana\_instance: '23'
  - 2 hana\_sid: CRG
  - 3

The Tower interface also shows a summary of the deployment: TOTAL JOBS 5, ELAPSED 00:05:01.



# Thank You !



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