Red Hat Enterprise Linux 9

Installing Identity Management

Getting started using Identity Management
Getting started using Identity Management
Abstract

This documentation collection provides instructions on how to install Identity Management on Red Hat Enterprise Linux 9 (RHEL) and how to upgrade to it from Red Hat Enterprise Linux 8.
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MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright’s message.

In Identity Management, planned terminology replacements include:

- **block list** replaces **blacklist**
- **allow list** replaces **whitelist**
- **secondary** replaces **slave**
- The word master is being replaced with more precise language, depending on the context:
  - **IdM server** replaces **IdM master**
  - **CA renewal server** replaces **CA renewal master**
  - **CRL publisher server** replaces **CRL master**
  - **multi-supplier** replaces **multi-master**
PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

We appreciate your input on our documentation. Please let us know how we could make it better.

- For simple comments on specific passages:
  1. Make sure you are viewing the documentation in the *Multi-page HTML* format. In addition, ensure you see the **Feedback** button in the upper right corner of the document.
  2. Use your mouse cursor to highlight the part of text that you want to comment on.
  3. Click the **Add Feedback** pop-up that appears below the highlighted text.
  4. Follow the displayed instructions.

- For submitting feedback via Bugzilla, create a new ticket:
  1. Go to the [Bugzilla](https://bugzilla.redhat.com) website.
  2. As the Component, use **Documentation**.
  3. Fill in the **Description** field with your suggestion for improvement. Include a link to the relevant part(s) of documentation.
  4. Click **Submit Bug**.
PART I. INSTALLING IDENTITY MANAGEMENT
CHAPTER 1. PREPARING THE SYSTEM FOR IDM SERVER INSTALLATION

The following sections list the requirements to install an Identity Management (IdM) server. Before the installation, make sure your system meets these requirements.

1.1. PREREQUISITES

- You need root privileges to install an Identity Management (IdM) server on your host.

1.2. HARDWARE RECOMMENDATIONS

RAM is the most important hardware feature to size properly. Make sure your system has enough RAM available. Typical RAM requirements are:

- For 10,000 users and 100 groups: at least 4 GB of RAM and 4 GB swap space
- For 100,000 users and 50,000 groups: at least 16 GB of RAM and 4 GB of swap space

For larger deployments, it is more effective to increase the RAM than to increase disk space because much of the data is stored in cache. In general, adding more RAM leads to better performance for larger deployments due to caching.

NOTE

A basic user entry or a simple host entry with a certificate is approximately 5–10 kB in size.

1.3. CUSTOM CONFIGURATION REQUIREMENTS FOR IDM

Install an Identity Management (IdM) server on a clean system without any custom configuration for services such as DNS, Kerberos, Apache, or Directory Server.

The IdM server installation overwrites system files to set up the IdM domain. IdM backs up the original system files to /var/lib/ipa/sysrestore/. When an IdM server is uninstalled at the end of the lifecycle, these files are restored.

1.3.1. IPv6 requirements in IdM

The IdM system must have the IPv6 protocol enabled in the kernel. If IPv6 is disabled, then the CLDAP plug-in used by the IdM services fails to initialize.

NOTE

IPv6 does not have to be enabled on the network.

1.3.2. Support for encryption types in IdM

Red Hat Enterprise Linux (RHEL) uses Version 5 of the Kerberos protocol, which supports encryption types such as Advanced Encryption Standard (AES), Camellia, and Data Encryption Standard (DES).

List of supported encryption types
While the Kerberos libraries on IdM servers and clients might support more encryption types, the IdM Kerberos Distribution Center (KDC) only supports the following encryption types:

- `aes256-cts:normal`
- `aes256-cts:special` (default)
- `aes128-cts:normal`
- `aes128-cts:special` (default)
- `aes128-sha2:normal`
- `aes128-sha2:special`
- `aes256-sha2:normal`
- `aes256-sha2:special`
- `camellia128-cts-cmac:normal`
- `camellia128-cts-cmac:special`
- `camellia256-cts-cmac:normal`
- `camellia256-cts-cmac:special`

**RC4 encryption types are disabled by default**

The following RC4 encryption types have been disabled by default in RHEL 9, as they are considered less secure than the newer AES-128 and AES-256 encryption types:

- `arcfour-hmac:normal`
- `arcfour-hmac:special`

For more information on manually enabling RC4 support for compatibility with legacy Active Directory environments, see [Ensuring support for common encryption types in AD and RHEL](#).

**Support for DES and 3DES encryption has been removed**

Due to security reasons, support for the DES algorithm was deprecated in RHEL 7. Single-DES (DES) and triple-DES (3DES) encryption types were removed from RHEL 8 and are not used in RHEL 9.

### 1.3.3. Support for system-wide cryptographic policies in IdM

IdM uses the **DEFAULT** system-wide cryptographic policy. This policy offers secure settings for current threat models. It allows the TLS 1.2 and 1.3 protocols, as well as the IKEv2 and SSH2 protocols. The RSA keys and Diffie-Hellman parameters are accepted if they are at least 2048 bits long. This policy does not allow DES, 3DES, RC4, DSA, TLS v1.0, and other weaker algorithms.

**NOTE**

You cannot install an IdM server while using the **FUTURE** system-wide cryptographic policy. When installing an IdM server, ensure you are using the **DEFAULT** system-wide cryptographic policy.
1.3.4. FIPS compliance

You can install a new IdM server or replica on a system with the Federal Information Processing Standard (FIPS) mode enabled.

To install IdM with FIPS, first enable FIPS mode on the host, then install IdM. The IdM installation script detects if FIPS is enabled and configures IdM to only use encryption types that are compliant with FIPS 140-2:

- `aes256-cts:normal`
- `aes256-cts:special`
- `aes128-cts:normal`
- `aes128-cts:special`
- `aes128-sha2:normal`
- `aes128-sha2:special`
- `aes256-sha2:normal`
- `aes256-sha2:special`

For an IdM environment to be FIPS-compliant, all IdM replicas must have FIPS mode enabled.

Red Hat recommends that you enable FIPS in IdM clients as well, especially if you might promote those clients to IdM replicas. Ultimately, it is up to administrators to determine how they meet FIPS requirements; Red Hat does not enforce FIPS criteria.

Support for cross-forest trust with FIPS mode enabled

To establish a cross-forest trust with an Active Directory (AD) domain while FIPS mode is enabled, you must authenticate with an AD administrative account. You cannot establish a trust using a shared secret while FIPS mode is enabled.

**IMPORTANT**

RADIUS authentication is not FIPS compliant. Do not install IdM on a server with FIPS mode enabled if you require RADIUS authentication.

Additional Resources

- To enable FIPS mode in the RHEL operating system, see [Switching the system to FIPS mode](#) in the [Security Hardening](#) guide.

- For more details on FIPS 140-2, see the [Security Requirements for Cryptographic Modules](#) on the National Institute of Standards and Technology (NIST) web site.

1.4. TIME SERVICE REQUIREMENTS FOR IDM
The following sections discuss using `chronyd` to keep your IdM hosts in sync with a central time source:

### 1.4.1. How IdM uses `chronyd` for synchronization

This section discusses using `chronyd` to keep your IdM hosts in sync with a central time source.

Kerberos, the underlying authentication mechanism in IdM, uses time stamps as part of its protocol. Kerberos authentication fails if the system time of an IdM client differs by more than five minutes from the system time of the Key Distribution Center (KDC).

To ensure that IdM servers and clients stay in sync with a central time source, IdM installation scripts automatically configure `chronyd` Network Time Protocol (NTP) client software.

If you do not pass any NTP options to the IdM installation command, the installer searches for `_ntp._udp` DNS service (SRV) records that point to the NTP server in your network and configures `chrony` with that IP address. If you do not have any `_ntp._udp` SRV records, `chronyd` uses the configuration shipped with the `chrony` package.

**NOTE**

Because `ntpd` has been deprecated in favor of `chronyd` in RHEL 8, IdM servers are no longer configured as Network Time Protocol (NTP) servers and are only configured as NTP clients. The RHEL 7 NTP Server IdM server role has also been deprecated in RHEL 8.

Additional resources

- Implementation of NTP
- Using the Chrony suite to configure NTP

### 1.4.2. List of NTP configuration options for IdM installation commands

This section discusses using `chronyd` to keep your IdM hosts in sync with a central time source.

You can specify the following options with any of the IdM installation commands (`ipa-server-install`, `ipa-replica-install`, `ipa-client-install`) to configure `chronyd` client software during setup.

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<th>Behavior</th>
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<td><code>--ntp-server</code></td>
<td>Use it to specify one NTP server. You can use it multiple times to specify multiple servers.</td>
</tr>
<tr>
<td><code>--ntp-pool</code></td>
<td>Use it to specify a pool of multiple NTP servers resolved as one hostname.</td>
</tr>
<tr>
<td><code>-N, --no-ntp</code></td>
<td>Do not configure, start, or enable <code>chronyd</code>.</td>
</tr>
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Additional resources

- Implementation of NTP
1.4.3. Ensuring IdM can reference your NTP time server

This procedure verifies you have the necessary configurations in place for IdM to be able to synchronize with your Network Time Protocol (NTP) time server.

Prerequisites

- You have configured an NTP time server in your environment. In this example, the hostname of the previously configured time server is ntpserver.example.com.

Procedure

1. Perform a DNS service (SRV) record search for NTP servers in your environment.

   ```
   [user@server ~]$ dig +short -t SRV _ntp._udp.example.com
   0 100 123 ntpserver.example.com.
   ```

2. If the previous `dig` search does not return your time server, add a `_ntp._udp` SRV record that points to your time server on port 123. This process depends on your DNS solution.

Verification steps

- Verify that DNS returns an entry for your time server on port 123 when you perform a search for `_ntp._udp` SRV records.

   ```
   [user@server ~]$ dig +short -t SRV _ntp._udp.example.com
   0 100 123 ntpserver.example.com.
   ```

Additional resources

- Implementation of NTP
- Using the Chrony suite to configure NTP

1.4.4. Additional resources

- Implementation of NTP
- Using the Chrony suite to configure NTP

1.5. HOST NAME AND DNS REQUIREMENTS FOR IDM

This section lists the host name and DNS requirements for server and replica systems. It also shows how to verify that the systems meet the requirements.

The requirements in this section apply to all Identity Management (IdM) servers, those with integrated DNS and those without integrated DNS.
DNS records are vital for nearly all IdM domain functions, including running LDAP directory services, Kerberos, and Active Directory integration. Be extremely cautious and ensure that:

- You have a tested and functional DNS service available
- The service is properly configured

This requirement applies to IdM servers with and without integrated DNS.

Verify the server host name

The host name must be a fully qualified domain name, such as `server.idm.example.com`.

IMPORTANT

Do not use single-label domain names, for example `.company`: the IdM domain must be composed of one or more subdomains and a top level domain, for example `example.com` or `company.example.com`.

The fully qualified domain name must meet the following conditions:

- It is a valid DNS name, which means only numbers, alphabetic characters, and hyphens (-) are allowed. Other characters, such as underscores (_), in the host name cause DNS failures.
- It is all lower-case. No capital letters are allowed.
- It does not resolve to the loopback address. It must resolve to the system’s public IP address, not to `127.0.0.1`.

To verify the host name, use the `hostname` utility on the system where you want to install:

```
# hostname
server.idm.example.com
```

The output of `hostname` must not be `localhost` or `localhost6`.

Verify the forward and reverse DNS configuration

1. Obtain the IP address of the server.
   a. The `ip addr show` command displays both the IPv4 and IPv6 addresses. In the following example, the relevant IPv6 address is `2001:DB8::1111` because its scope is global:

   ```bash
   [root@server ~]# ip addr show
   ... 2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qalen 1000
   link/ether 00:1a:4a:10:4e:33 brd ff:ff:ff:ff:ff:ff
   ```
2. Verify the forward DNS configuration using the `dig` utility.
   a. Run the command `dig +short server.idm.example.com A`. The returned IPv4 address must match the IP address returned by `ip addr show`:
      
      ```
      [root@server ~]# dig +short server.idm.example.com A
      192.0.2.1
      ```
   b. Run the command `dig +short server.idm.example.com AAAA`. If it returns an address, it must match the IPv6 address returned by `ip addr show`:
      
      ```
      [root@server ~]# dig +short server.idm.example.com AAAA
      2001:DB8::1111
      ```

   **NOTE**

   If `dig` does not return any output for the AAAA record, it does not indicate incorrect configuration. No output only means that no IPv6 address is configured in DNS for the system. If you do not intend to use the IPv6 protocol in your network, you can proceed with the installation in this situation.

3. Verify the reverse DNS configuration (PTR records). Use the `dig` utility and add the IP address.
   If the commands below display a different host name or no host name, the reverse DNS configuration is incorrect.
   a. Run the command `dig +short -x IPv4_address`. The output must display the server host name. For example:
      
      ```
      [root@server ~]# dig +short -x 192.0.2.1
      server.idm.example.com
      ```
   b. If the command `dig +short -x server.idm.example.com AAAA` in the previous step returned an IPv6 address, use `dig` to query the IPv6 address too. The output must display the server host name. For example:
      
      ```
      [root@server ~]# dig +short -x 2001:DB8::1111
      server.idm.example.com
      ```
NOTE

If `dig +short server.idm.example.com AAAA` in the previous step did not display any IPv6 address, querying the AAAA record does not output anything. In this case, this is normal behavior and does not indicate incorrect configuration.

WARNING

If a reverse DNS (PTR record) search returns multiple host names, `httpd` and other software associated with IdM may show unpredictable behavior. Red Hat strongly recommends configuring only one PTR record per IP.

Verify the standards-compliance of DNS forwarders (required for integrated DNS only)

Ensure that all DNS forwarders you want to use with the IdM DNS server comply with the Extension Mechanisms for DNS (EDNS0) and DNS Security Extensions (DNSSEC) standards. To do this, inspect the output of the following command for each forwarder separately:

```
$ dig +dnssec @IP_address_of_the_DNS_forwarder . SOA
```

The expected output displayed by the command contains the following information:

- **status:** NOERROR
- **flags:** ra
- **EDNS flags:** do
- **The RRSIG record must be present in the ANSWER section**

If any of these items is missing from the output, inspect the documentation for your DNS forwarder and verify that EDNS0 and DNSSEC are supported and enabled. In the latest versions of the BIND server, the `dnssec-enable yes;` option must be set in the `/etc/named.conf` file.

Example of the expected output produced by `dig`:

```
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 48655
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 2, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
;; EDNS: version: 0, flags: do; udp: 4096

;; ANSWER SECTION:
. 31679 IN SOA a.root-servers.net. nstld.verisign-grs.com. 2015100701 1800 900 604800 86400
. 31679 IN RRSIG SOA 8 0 86400 20151017170000 20151007160000 62530 . GNVz7SQs [...
```

Verify the `/etc/hosts` file

Verify that the `/etc/hosts` file fulfills one of the following conditions:
The file does not contain an entry for the host. It only lists the IPv4 and IPv6 localhost entries for the host.

The file contains an entry for the host and the file fulfills all the following conditions:
- The first two entries are the IPv4 and IPv6 localhost entries.
- The next entry specifies the IdM server IPv4 address and host name.
- The FQDN of the IdM server comes before the short name of the IdM server.
- The IdM server host name is not part of the localhost entry.

The following is an example of a correctly configured `/etc/hosts` file:

```
127.0.0.1   localhost localhost.localdomain \ 
            localhost4 localhost4.localdomain4 
::1         localhost localhost.localdomain \ 
            localhost6 localhost6.localdomain6 
192.0.2.1 server.idm.example.com server 
2001:DB8::1111 server.idm.example.com server
```

### 1.6. PORT REQUIREMENTS FOR IDM

Identity Management (IdM) uses a number of ports to communicate with its services. These ports must be open and available for incoming connections to the IdM server for IdM to work. They must not be currently used by another service or blocked by a firewall.

**Table 1.2. IdM ports**

<table>
<thead>
<tr>
<th>Service</th>
<th>Ports</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTP/HTTPS</td>
<td>80, 443</td>
<td>TCP</td>
</tr>
<tr>
<td>LDAP/LDAPS</td>
<td>389, 636</td>
<td>TCP</td>
</tr>
<tr>
<td>Kerberos</td>
<td>88, 464</td>
<td>TCP and UDP</td>
</tr>
<tr>
<td>DNS</td>
<td>53</td>
<td>TCP and UDP (optional)</td>
</tr>
<tr>
<td>NTP</td>
<td>123</td>
<td>UDP (optional)</td>
</tr>
</tbody>
</table>
NOTE

IdM uses ports 80 and 389. This is a secure practice because of the following safeguards:

- IdM normally redirects requests that arrive on port 80 to port 443. Port 80 (HTTP) is only used to provide Online Certificate Status Protocol (OCSP) responses and Certificate Revocation Lists (CRL). Both are digitally signed and therefore secured against man-in-the-middle attacks.

- Port 389 (LDAP) uses STARTTLS and Generic Security Services API (GSSAPI) for encryption.

In addition, ports 8080, 8443, and 749 must be free as they are used internally. Do not open these ports and instead leave them blocked by a firewall.

### Table 1.3. `firewalld` services

<table>
<thead>
<tr>
<th>Service name</th>
<th>For details, see:</th>
</tr>
</thead>
<tbody>
<tr>
<td>freeipa-ldap</td>
<td>/usr/lib/firewalld/services/freeipa-ldap.xml</td>
</tr>
<tr>
<td>freeipa-ldaps</td>
<td>/usr/lib/firewalld/services/freeipa-ldaps.xml</td>
</tr>
<tr>
<td>dns</td>
<td>/usr/lib/firewalld/services/dns.xml</td>
</tr>
</tbody>
</table>

### 1.7. OPENING THE PORTS REQUIRED BY IDM

**Procedure**

1. Make sure the `firewalld` service is running.
   - To find out if `firewalld` is currently running:
     ```bash
     # systemctl status firewalld.service
     ```
   - To start `firewalld` and configure it to start automatically when the system boots:
     ```bash
     # systemctl start firewalld.service
     # systemctl enable firewalld.service
     ```

2. Open the required ports using the `firewall-cmd` utility. Choose one of the following options:
   a. Add the individual ports to the firewall by using the `firewall-cmd --add-port` command. For example, to open the ports in the default zone:
      ```bash
      # firewall-cmd --permanent --add-port=
      ```
   b. Add the `firewalld` services to the firewall by using the `firewall-cmd --add-service` command. For example, to open the ports in the default zone:
      ```bash
      # firewall-cmd --permanent --add-service=[freeipa-ldap,freeipa-ldaps,dns]
      ```
For details on using `firewall-cmd` to open ports on a system, see the `firewall-cmd(1)` man page.

3. Reload the `firewall-cmd` configuration to ensure that the change takes place immediately:

```
# firewall-cmd --reload
```

Note that reloading `firewalld` on a system in production can cause DNS connection time outs. If required, to avoid the risk of time outs and to make the changes persistent on the running system, use the `--runtime-to-permanent` option of the `firewall-cmd` command, for example:

```
# firewall-cmd --runtime-to-permanent
```

4. Optional. To verify that the ports are available now, use the `nc`, `telnet`, or `nmap` utilities to connect to a port or run a port scan.

**NOTE**

Note that you also have to open network-based firewalls for both incoming and outgoing traffic.

### 1.8. INSTALLING PACKAGES REQUIRED FOR AN IDM SERVER

The following procedure shows how to download the packages necessary for setting up the IdM environment of your choice.

**Prerequisites**

- You have a newly installed RHEL system.
- You have made the required repositories available:
  - If your RHEL system is not running in the cloud, you have registered your system with the Red Hat Subscription Manager (RHSM). For details, see Registration, attaching, and removing subscriptions in the Subscription Manager command line. You have also enabled the BaseOS and AppStream repositories that IdM uses:
    ```
    # subscription-manager repos --enable=rhel-9-for-x86_64-baseos-beta-rpms
    # subscription-manager repos --enable=rhel-9-for-x86_64-appstream-beta-rpms
    ```
    For details on how to enable and disable specific repositories using RHSM, see Configuring options in Red Hat Subscription Manager.
  - If your RHEL system is running in the cloud, skip the registration. The required repositories are already available via the Red Hat Update Infrastructure (RHUI).

**Procedure**

- Choose one of the following options, depending on your IdM requirements:
  - To download the packages necessary for installing an IdM server without an integrated DNS:
    ```
    # dnf install ipa-server
    ```
- To download the packages necessary for installing an IdM server with an integrated DNS:
  
  ```
  # dnf install ipa-server ipa-server-dns
  ```

- To download the packages necessary for installing an IdM server that has a trust agreement with Active Directory:

  ```
  # dnf install ipa-server ipa-server-trust-ad samba-client
  ```
CHAPTER 2. INSTALLING AN IDM SERVER: WITH INTEGRATED DNS, WITH AN INTEGRATED CA AS THE ROOT CA

Installing a new Identity Management (IdM) server with integrated DNS has the following advantages:

- You can automate much of the maintenance and DNS record management using native IdM tools. For example, DNS SRV records are automatically created during the setup, and later on are automatically updated.

- You can have a stable connection with the rest of the Internet by setting up global forwarders during the installation of the IdM server. Global forwarders are also useful for trusts with Active Directory.

- You can set up a DNS reverse zone to prevent emails from your domain to be considered spam by email servers outside of the IdM domain.

Installing IdM with integrated DNS has certain limitations:

- IdM DNS is not meant to be used as a general-purpose DNS server. Some of the advanced DNS functions are not supported.

This chapter describes how you can install a new IdM server with an integrated certificate authority (CA) as the root CA.

NOTE

The default configuration for the ipa-server-install command is an integrated CA as the root CA. If no CA option, for example --external-ca or --ca-less is specified, the IdM server is installed with an integrated CA.

2.1. INTERACTIVE INSTALLATION

During the interactive installation using the ipa-server-install utility, you are asked to supply basic configuration of the system, for example the realm, the administrator’s password and the Directory Manager’s password.

The ipa-server-install installation script creates a log file at /var/log/ipaserver-install.log. If the installation fails, the log can help you identify the problem.

Procedure

1. Run the ipa-server-install utility.

   # ipa-server-install

2. The script prompts to configure an integrated DNS service. Enter yes.

   Do you want to configure integrated DNS (BIND)? [no]: yes

3. The script prompts for several required settings and offers recommended default values in brackets.

   - To accept a default value, press Enter.
To provide a custom value, enter the required value.

Server host name [server.idm.example.com]:
Please confirm the domain name [idm.example.com]:
Please provide a realm name [IDM.EXAMPLE.COM]:

**WARNING**

Plan these names carefully. You will not be able to change them after the installation is complete.

4. Enter the passwords for the Directory Server superuser (cn=Directory Manager) and for the Identity Management (IdM) administration system user account (admin).

Directory Manager password:
IPA admin password:

5. The script prompts for per-server DNS forwarders.

Do you want to configure DNS forwarders? [yes]:

- To configure per-server DNS forwarders, enter **yes**, and then follow the instructions on the command line. The installation process will add the forwarder IP addresses to the IdM LDAP.
  - For the forwarding policy default settings, see the **--forward-policy** description in the *ipa-dns-install*(1) man page.
  - If you do not want to use DNS forwarding, enter **no**.

   With no DNS forwarders, hosts in your IdM domain will not be able to resolve names from other, internal, DNS domains in your infrastructure. The hosts will only be left with public DNS servers to resolve their DNS queries.

6. The script prompts to check if any DNS reverse (PTR) records for the IP addresses associated with the server need to be configured.

Do you want to search for missing reverse zones? [yes]:

If you run the search and missing reverse zones are discovered, the script asks you whether to create the reverse zones along with the PTR records.

Do you want to create reverse zone for IP 192.0.2.1 [yes]:
Please specify the reverse zone name [2.0.192.in-addr.arpa.]:
Using reverse zone(s) 2.0.192.in-addr.arpa.

**NOTE**

Using IdM to manage reverse zones is optional. You can use an external DNS service for this purpose instead.
7. Enter **yes** to confirm the server configuration.

    Continue to configure the system with these values? [no]: yes

8. The installation script now configures the server. Wait for the operation to complete.

9. After the installation script completes, update your DNS records in the following way:

   a. Add DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is **idm.example.com**, add a name server (NS) record to the **example.com** parent domain.

   **IMPORTANT**
   
   Repeat this step each time after an IdM DNS server is installed.

   b. Add an **_ntp._udp** service (SRV) record for your time server to your IdM DNS. The presence of the SRV record for the time server of the newly-installed IdM server in IdM DNS ensures that future replica and client installations are automatically configured to synchronize with the time server used by this primary IdM server.

### 2.2. NON-INTERACTIVE INSTALLATION

The **ipa-server-install** installation script creates a log file at `/var/log/ipaserver-install.log`. If the installation fails, the log can help you identify the problem.

**Procedure**

1. Run the **ipa-server-install** utility with the options to supply all the required information. The minimum required options for non-interactive installation are:

   - **--realm** to provide the Kerberos realm name
   - **--ds-password** to provide the password for the Directory Manager (DM), the Directory Server super user
   - **--admin-password** to provide the password for **admin**, the Identity Management (IdM) administrator
   - **--unattended** to let the installation process select default options for the host name and domain name

   To install a server with integrated DNS, add also these options:

   - **--setup-dns** to configure integrated DNS
   - **--forwarder** or **--no-forwarders**, depending on whether you want to configure DNS forwarders or not
   - **--auto-reverse** or **--no-reverse**, depending on whether you want to configure automatic detection of the reverse DNS zones that must be created in the IdM DNS or no reverse zone auto-detection

   For example:
# ipa-server-install --realm IDM.EXAMPLE.COM --ds-password DM_password --admin-password admin_password --unattended --setup-dns --forwarder 192.0.2.1 --no-reverse

2. After the installation script completes, update your DNS records in the following way:

   a. Add DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is *idm.example.com*, add a name server (NS) record to the *example.com* parent domain.

      ![IMPORTANT]

      Repeat this step each time after an IdM DNS server is installed.

   b. Add an *_ntp._udp* service (SRV) record for your time server to your IdM DNS. The presence of the SRV record for the time server of the newly-installed IdM server in IdM DNS ensures that future replica and client installations are automatically configured to synchronize with the time server used by this primary IdM server.

Additional resources

- For a complete list of options accepted by *ipa-server-install*, run the *ipa-server-install --help* command.
CHAPTER 3. INSTALLING AN IDM SERVER: WITH INTEGRATED DNS, WITH AN EXTERNAL CA AS THE ROOT CA

Installing a new Identity Management (IdM) server with integrated DNS has the following advantages:

- You can automate much of the maintenance and DNS record management using native IdM tools. For example, DNS SRV records are automatically created during the setup, and later on are automatically updated.

- You can have a stable connection with the rest of the Internet by setting up global forwarders during the installation of the IdM server. Global forwarders are also useful for trusts with Active Directory.

- You can set up a DNS reverse zone to prevent emails from your domain to be considered spam by email servers outside of the IdM domain.

Installing IdM with integrated DNS has certain limitations:

- IdM DNS is not meant to be used as a general-purpose DNS server. Some of the advanced DNS functions are not supported.

This chapter describes how you can install a new IdM server with an external certificate authority (CA) as the root CA.

3.1. INTERACTIVE INSTALLATION

During the interactive installation using the `ipa-server-install` utility, you are asked to supply basic configuration of the system, for example the realm, the administrator’s password and the Directory Manager’s password.

The `ipa-server-install` installation script creates a log file at `/var/log/ipaserver-install.log`. If the installation fails, the log can help you identify the problem.

This procedure describes how to install a server:

- with integrated DNS
- with an external certificate authority (CA) as the root CA

Prerequisites

- Decide on the type of the external CA you use (the `--external-ca-type` option). See the `ipa-server-install(1)` man page for details.

- Alternatively, decide on the `--external-ca-profile` option allowing an alternative Active Directory Certificate Services (AD CS) template to be specified. For example, to specify an AD CS installation-specific object identifier:

```
[root@server ~]# ipa-server-install --external-ca --external-ca-type=ms-cs --external-ca-profile=1.3.6.1.4.1.311.21.8.8950086.10656446.2706058.12775672.480128.147.7130143.4405632:1
```

Procedure
1. Run the `ipa-server-install` utility with the `--external-ca` option.

   ```
   # ipa-server-install --external-ca
   ```

   If you are using the Microsoft Certificate Services CA, use also the `--external-ca-type` option. For details, see the `ipa-server-install(1)` man page.

2. The script prompts to configure an integrated DNS service. Enter `yes` or `no`. In this procedure, we are installing a server with integrated DNS.

   ```
   Do you want to configure integrated DNS (BIND)? [no]: yes
   ```

   **NOTE**

   If you want to install a server without integrated DNS, the installation script will not prompt you for DNS configuration as described in the steps below. See Chapter 5, *Installing an IdM server: Without integrated DNS, with an integrated CA as the root CA* for details on the steps for installing a server without DNS.

3. The script prompts for several required settings and offers recommended default values in brackets.

   - To accept a default value, press **Enter**.
   - To provide a custom value, enter the required value.

   ```
   Server host name [server.idm.example.com]:
   Please confirm the domain name [idm.example.com]:
   Please provide a realm name [IDM.EXAMPLE.COM]:
   ```

   **WARNING**

   Plan these names carefully. You will not be able to change them after the installation is complete.

4. Enter the passwords for the Directory Server superuser (**cn=Directory Manager**) and for the Identity Management (IdM) administration system user account (**admin**).

   ```
   Directory Manager password:
   IPA admin password:
   ```

5. The script prompts for per-server DNS forwarders.

   ```
   Do you want to configure DNS forwarders? [yes]:
   ```

   - To configure per-server DNS forwarders, enter `yes`, and then follow the instructions on the command line. The installation process will add the forwarder IP addresses to the IdM LDAP.
• For the forwarding policy default settings, see the `--forward-policy` description in the `ipa-dns-install(1)` man page.

• If you do not want to use DNS forwarding, enter `no`. With no DNS forwarders, hosts in your IdM domain will not be able to resolve names from other, internal, DNS domains in your infrastructure. The hosts will only be left with public DNS servers to resolve their DNS queries.

6. The script prompts to check if any DNS reverse (PTR) records for the IP addresses associated with the server need to be configured.

   Do you want to search for missing reverse zones? [yes]:

   If you run the search and missing reverse zones are discovered, the script asks you whether to create the reverse zones along with the PTR records.

   Do you want to create reverse zone for IP 192.0.2.1 [yes]:
   Please specify the reverse zone name [2.0.192.in-addr.arpa.]:
   Using reverse zone(s) 2.0.192.in-addr.arpa.

   **NOTE**
   Using IdM to manage reverse zones is optional. You can use an external DNS service for this purpose instead.

7. Enter `yes` to confirm the server configuration.

   Continue to configure the system with these values? [no]: yes

8. During the configuration of the Certificate System instance, the utility prints the location of the certificate signing request (CSR): `/root/ipa.csr`:

   ...  
   Configuring certificate server (pki-tomcatd): Estimated time 3 minutes 30 seconds 
   [1/8]: creating certificate server user 
   [2/8]: configuring certificate server instance 
   The next step is to get `/root/ipa.csr` signed by your CA and re-run `/sbin/ipa-server-install` as: 
   `/sbin/ipa-server-install --external-cert-file=/path/to/signed_certificate --external-cert-file=/path/to/external_ca_certificate`

   When this happens:

   a. Submit the CSR located in `/root/ipa.csr` to the external CA. The process differs depending on the service to be used as the external CA.

   b. Retrieve the issued certificate and the CA certificate chain for the issuing CA in a base 64-encoded blob (either a PEM file or a Base_64 certificate from a Windows CA). Again, the process differs for every certificate service. Usually, a download link on a web page or in the notification email allows the administrator to download all the required certificates.

   **IMPORTANT**
   Be sure to get the full certificate chain for the CA, not just the CA certificate.
c. Run `ipa-server-install` again, this time specifying the locations and names of the newly-issued CA certificate and the CA chain files. For example:

```
# ipa-server-install --external-cert-file=/tmp/servercert20170601.pem --external-cert-file=/tmp/cacert.pem
```

9. The installation script now configures the server. Wait for the operation to complete.

10. After the installation script completes, update your DNS records in the following way:

a. Add DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is `idm.example.com`, add a name server (NS) record to the `example.com` parent domain.

   **IMPORTANT**

   Repeat this step each time after an IdM DNS server is installed.

b. Add an `_ntp._udp` service (SRV) record for your time server to your IdM DNS. The presence of the SRV record for the time server of the newly-installed IdM server in IdM DNS ensures that future replica and client installations are automatically configured to synchronize with the time server used by this primary IdM server.

**NOTE**

The `ipa-server-install --external-ca` command can sometimes fail with the following error:

```
ipa : CRITICAL failed to configure ca instance Command '/usr/sbin/pkispawn -s CA -f /tmp/configuration_file' returned non-zero exit status 1
Configuration of CA failed
```

This failure occurs when the `*_proxy` environmental variables are set. For a solution of the problem, see Troubleshooting: External CA installation fails.

### 3.2. TROUBLESHOOTING: EXTERNAL CA INSTALLATION FAILS

The `ipa-server-install --external-ca` command fails with the following error:

```
ipa : CRITICAL failed to configure ca instance Command '/usr/sbin/pkispawn -s CA -f /tmp/configuration_file' returned non-zero exit status 1
Configuration of CA failed
```

The `env|grep proxy` command displays variables such as the following:

```
# env|grep proxy
http_proxy=http://example.com:8080
ftp_proxy=http://example.com:8080
https_proxy=http://example.com:8080
```

**What this means:**

The `*_proxy` environmental variables are preventing the server from being installed.
To fix the problem:

1. Use the following shell script to unset the 
   \_proxy environmental variables:

   ```bash
   # for i in ftp http https; do unset ${i}_proxy; done
   ```

2. Run the \texttt{pkidestroy} utility to remove the unsuccessful certificate authority (CA) subsystem installation:

   ```bash
   # pkidestroy -s CA -i pki-tomcat; rm -rf /var/log/pki/pki-tomcat /etc/sysconfig/pki-tomcat /etc/sysconfig/pki/tomcat/pki-tomcat /var/lib/pki/pki-tomcat /etc/pki/pki-tomcat /root/ipa.csr
   ```

3. Remove the failed Identity Management (IdM) server installation:

   ```bash
   # ipa-server-install --uninstall
   ```

4. Retry running \texttt{ipa-server-install --external-ca}. 
CHAPTER 4. INSTALLING AN IDM SERVER: WITH INTEGRATED DNS, WITHOUT A CA

Installing a new Identity Management (IdM) server with integrated DNS has the following advantages:

- You can automate much of the maintenance and DNS record management using native IdM tools. For example, DNS SRV records are automatically created during the setup, and later on are automatically updated.

- You can have a stable connection with the rest of the Internet by setting up global forwarders during the installation of the IdM server. Global forwarders are also useful for trusts with Active Directory.

- You can set up a DNS reverse zone to prevent emails from your domain to be considered spam by email servers outside of the IdM domain.

Installing IdM with integrated DNS has certain limitations:

- IdM DNS is not meant to be used as a general-purpose DNS server. Some of the advanced DNS functions are not supported.

This chapter describes how you can install a new IdM server without a certificate authority (CA).

4.1. CERTIFICATES REQUIRED TO INSTALL AN IDM SERVER WITHOUT A CA

This section lists the certificates required to install an Identity Management (IdM) server without a certificate authority (CA) and the command-line options used to provide these certificates to the `ipa-server-install` utility.

**IMPORTANT**

You cannot install a server or replica using self-signed third-party server certificates because the imported certificate files must contain the full CA certificate chain of the CA that issued the LDAP and Apache server certificates.

The LDAP server certificate and private key

- `--dirsrv-cert-file` for the certificate and private key files for the LDAP server certificate
- `--dirsrv-pin` for the password to access the private key in the files specified in `--dirsrv-cert-file`

The Apache server certificate and private key

- `--http-cert-file` for the certificate and private key files for the Apache server certificate
- `--http-pin` for the password to access the private key in the files specified in `--http-cert-file`

The full CA certificate chain of the CA that issued the LDAP and Apache server certificates

- `--dirsrv-cert-file` and `--http-cert-file` for the certificate files with the full CA certificate chain or a part of it
You can provide the files specified in the `--dirsrv-cert-file` and `--http-cert-file` options in the following formats:

- Privacy-Enhanced Mail (PEM) encoded certificate (RFC 7468). Note that the Identity Management installer accepts concatenated PEM-encoded objects.
- Distinguished Encoding Rules (DER)
- PKCS #7 certificate chain objects
- PKCS #8 private key objects
- PKCS #12 archives

You can specify the `--dirsrv-cert-file` and `--http-cert-file` options multiple times to specify multiple files.

**The certificate files to complete the full CA certificate chain (not needed in some environments)**

- `--ca-cert-file` for the file or files containing the CA certificate of the CA that issued the LDAP, Apache Server, and Kerberos KDC certificates. Use this option if the CA certificate is not present in the certificate files provided by the other options.

The files provided using `--dirsrv-cert-file` and `--http-cert-file` combined with the file provided using `--ca-cert-file` must contain the full CA certificate chain of the CA that issued the LDAP and Apache server certificates.

**The Kerberos key distribution center (KDC) PKINIT certificate and private key (optional)**

- `--pkinit-cert-file` for the Kerberos KDC SSL certificate and private key
- `--pkinit-pin` for the password to access the Kerberos KDC private key in the files specified in `--pkinit-cert-file`
- `--no-pkinit` for disabling pkinit setup steps

If you do not provide the PKINIT certificate, `ipa-server-install` configures the IdM server with a local KDC with a self-signed certificate.

**Additional resources**

- For details on what the certificate file formats these options accept, see the `ipa-server-install`(1) man page.
- For details on PKINIT extensions required to create a RHEL IdM PKINIT certificate, see this article.

### 4.2. INTERACTIVE INSTALLATION

During the interactive installation using the `ipa-server-install` utility, you are asked to supply basic configuration of the system, for example the realm, the administrator’s password and the Directory Manager’s password.

The `ipa-server-install` installation script creates a log file at `/var/log/ipaserver-install.log`. If the installation fails, the log can help you identify the problem.
Procedure

1. Run the `ipa-server-install` utility and provide all the required certificates. For example:

   ```bash
   [root@server ~]# ipa-server-install \
   --http-cert-file /tmp/server.crt \
   --http-cert-file /tmp/server.key \
   --http-pin secret \
   --dirsrv-cert-file /tmp/server.crt \
   --dirsrv-cert-file /tmp/server.key \
   --dirsrv-pin secret \
   --ca-cert-file ca.crt
   
   See Certificates required to install an IdM server without a CA for details on the provided certificates.

2. The script prompts to configure an integrated DNS service. Enter yes or no. In this procedure, we are installing a server with integrated DNS.

   Do you want to configure integrated DNS (BIND)? [no]: yes

   **NOTE**

   If you want to install a server without integrated DNS, the installation script will not prompt you for DNS configuration as described in the steps below. See Installing an IdM server: Without integrated DNS, with an integrated CA as the root CA for details on the steps for installing a server without DNS.

3. The script prompts for several required settings and offers recommended default values in brackets.

   - To accept a default value, press Enter.
   - To provide a custom value, enter the required value.

   Server host name [server.idm.example.com]:
   Please confirm the domain name [idm.example.com]:
   Please provide a realm name [IDM.EXAMPLE.COM]:

   **WARNING**

   Plan these names carefully. You will not be able to change them after the installation is complete.

4. Enter the passwords for the Directory Server superuser (`cn=Directory Manager`) and for the Identity Management (IdM) administration system user account (`admin`).

   Directory Manager password:
   IPA admin password:
5. The script prompts for per-server DNS forwarders.

Do you want to configure DNS forwarders? [yes]:

- To configure per-server DNS forwarders, enter yes, and then follow the instructions on the command line. The installation process will add the forwarder IP addresses to the IdM LDAP.
  - For the forwarding policy default settings, see the --forward-policy description in the ipa-dns-install(1) man page.
- If you do not want to use DNS forwarding, enter no. With no DNS forwarders, hosts in your IdM domain will not be able to resolve names from other, internal, DNS domains in your infrastructure. The hosts will only be left with public DNS servers to resolve their DNS queries.

6. The script prompts to check if any DNS reverse (PTR) records for the IP addresses associated with the server need to be configured.

Do you want to search for missing reverse zones? [yes]:

If you run the search and missing reverse zones are discovered, the script asks you whether to create the reverse zones along with the PTR records.

Do you want to create reverse zone for IP 192.0.2.1 [yes]:
Please specify the reverse zone name [2.0.192.in-addr.arpa.]:
Using reverse zone(s) 2.0.192.in-addr.arpa.

NOTE
Using IdM to manage reverse zones is optional. You can use an external DNS service for this purpose instead.

7. Enter yes to confirm the server configuration.

Continue to configure the system with these values? [no]: yes

8. The installation script now configures the server. Wait for the operation to complete.

9. After the installation script completes, update your DNS records in the following way:

   a. Add DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is idm.example.com, add a name server (NS) record to the example.com parent domain.

   IMPORTANT
   Repeat this step each time after an IdM DNS server is installed.

   b. Add an _ntp._udp service (SRV) record for your time server to your IdM DNS. The presence of the SRV record for the time server of the newly-installed IdM server in IdM DNS ensures that future replica and client installations are automatically configured to synchronize with the time server used by this primary IdM server.
CHAPTER 5. INSTALLING AN IDM SERVER: WITHOUT INTEGRATED DNS, WITH AN INTEGRATED CA AS THE ROOT CA

This chapter describes how you can install a new Identity Management (IdM) server without integrated DNS.

NOTE

Red Hat strongly recommends installing IdM-integrated DNS for basic usage within the IdM deployment: When the IdM server also manages DNS, there is tight integration between DNS and native IdM tools which enables automating some of the DNS record management.

For more details, see Planning your DNS services and host names.

5.1. INTERACTIVE INSTALLATION

During the interactive installation using the `ipa-server-install` utility, you are asked to supply basic configuration of the system, for example the realm, the administrator’s password and the Directory Manager’s password.

The `ipa-server-install` installation script creates a log file at `/var/log/ipaserver-install.log`. If the installation fails, the log can help you identify the problem.

This procedure installs a server:

- Without integrated DNS
- With integrated Identity Management (IdM) certificate authority (CA) as the root CA, which is the default CA configuration

Procedure

1. Run the `ipa-server-install` utility.

   ```
   # ipa-server-install
   ```

2. The script prompts to configure an integrated DNS service. Press `Enter` to select the default `no` option.

   ```
   Do you want to configure integrated DNS (BIND)? [no]:
   ```

3. The script prompts for several required settings and offers recommended default values in brackets.

   - To accept a default value, press `Enter`.
   - To provide a custom value, enter the required value.

   ```
   Server host name [server.idm.example.com]:
   Please confirm the domain name [idm.example.com]:
   Please provide a realm name [IDM.EXAMPLE.COM]:
   ```
4. Enter the passwords for the Directory Server superuser (cn=Directory Manager) and for the IdM administration system user account (admin).

Directory Manager password: 
IPA admin password: 

5. Enter yes to confirm the server configuration.

Continue to configure the system with these values? [no]: yes 

6. The installation script now configures the server. Wait for the operation to complete.

7. The installation script produces a file with DNS resource records: the /tmp/ipa.system.records.UFRPto.db file in the example output below. Add these records to the existing external DNS servers. The process of updating the DNS records varies depending on the particular DNS solution.

... 
Restarting the KDC 
Please add records in this file to your DNS system: 
/tmp/ipa.system.records.UFRBto.db 
Restarting the web server 
...

**IMPORTANT**

The server installation is not complete until you add the DNS records to the existing DNS servers.

Additional resources

- For more information about the DNS resource records you must add to your DNS system, see IdM DNS records for external DNS systems.

5.2. NON-INTERACTIVE INSTALLATION

This procedure installs a server without integrated DNS or with integrated Identity Management (IdM) certificate authority (CA) as the root CA, which is the default CA configuration.

**NOTE**

The ipa-server-install installation script creates a log file at /var/log/ipaserver-install.log. If the installation fails, the log can help you identify the problem.
Procedure

1. Run the `ipa-server-install` utility with the options to supply all the required information. The minimum required options for non-interactive installation are:

   - `--realm` to provide the Kerberos realm name
   - `--ds-password` to provide the password for the Directory Manager (DM), the Directory Server super user
   - `--admin-password` to provide the password for `admin`, the IdM administrator
   - `--unattended` to let the installation process select default options for the host name and domain name

   For example:

   ```
   # ipa-server-install --realm IDM.EXAMPLE.COM --ds-password DM_password --admin-password admin_password --unattended
   ```

2. The installation script produces a file with DNS resource records: the `/tmp/ipa.system.records.UFRPto.db` file in the example output below. Add these records to the existing external DNS servers. The process of updating the DNS records varies depending on the particular DNS solution.

   ```
   ... 
   Restarting the KDC
   Please add records in this file to your DNS system:
   /tmp/ipa.system.records.UFRBto.db
   Restarting the web server
   ...
   ```

   **IMPORTANT**
   The server installation is not complete until you add the DNS records to the existing DNS servers.

Additional resources

- For more information about the DNS resource records you must add to your DNS system, see IdM DNS records for external DNS systems.
- For a complete list of options accepted by `ipa-server-install`, run the `ipa-server-install --help` command.

5.3. IDM DNS RECORDS FOR EXTERNAL DNS SYSTEMS

After installing an IdM server without integrated DNS, you must add LDAP and Kerberos DNS resource records for the IdM server to your external DNS system.

The `ipa-server-install` installation script generates a file containing the list of DNS resource records with a file name in the format `/tmp/ipa.system.records.<random_characters>.db` and prints instructions to add those records:
Please add records in this file to your DNS system: /tmp/ipa.system.records.6zdjqxh3.db

This is an example of the contents of the file:

```plaintext
_kerberos-master._tcp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos-master._udp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos._tcp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos._udp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos.example.com. 86400 IN TXT "EXAMPLE.COM"
_kpasswd._tcp.example.com. 86400 IN SRV 0 100 464 server.example.com.
_kpasswd._udp.example.com. 86400 IN SRV 0 100 464 server.example.com.
_ldap._tcp.example.com. 86400 IN SRV 0 100 389 server.example.com.
```

**NOTE**

After adding the LDAP and Kerberos DNS resource records for the IdM server to your DNS system, ensure that the DNS management tools have not added PTR records for *ipa-ca*. The presence of PTR records for *ipa-ca* in your DNS could cause subsequent IdM replica installations to fail.
CHAPTER 6. INSTALLING AN IDM SERVER: WITHOUT INTEGRATED DNS, WITH AN EXTERNAL CA AS THE ROOT CA

This chapter describes how you can install a new Identity Management (IdM) server, without integrated DNS, that uses an external certificate authority (CA) as the root CA.

NOTE

Red Hat strongly recommends installing IdM-integrated DNS for basic usage within the IdM deployment: When the IdM server also manages DNS, there is tight integration between DNS and native IdM tools which enables automating some of the DNS record management.

For more details, see Planning your DNS services and host names.

6.1. OPTIONS USED WHEN INSTALLING AN IDM CA WITH AN EXTERNAL CA AS THE ROOT CA

You may want to install an Identity Management IdM certificate authority (CA) with an external CA as the root CA if one of the following conditions applies:

- You are installing a new IdM server or replica by using the ipa-server-install command.
- You are installing the CA component into an existing IdM server by using the ipa-ca-install command.

This section describes the options for both commands that you can use for creating a certificate signing request (CSR) during the installation of an IdM CA with an external CA as the root CA.

--external-ca-type=TYPE

Type of the external CA. Possible values are generic and ms-cs. The default value is generic. Use ms-cs to include a template name required by Microsoft Certificate Services (MS CS) in the generated CSR. To use a non-default profile, use the --external-ca-profile option in conjunction with --external-ca-type=ms-cs.

--external-ca-profile=PROFILE_SPEC

Specify the certificate profile or template that you want the MS CS to apply when issuing the certificate for your IdM CA.

Note that the --external-ca-profile option can only be used if --external-ca-type is ms-cs.

You can identify the MS CS template in one of the following ways:

- <oid>:<majorVersion>[::<minorVersion>]. You can specify a certificate template by its object identifier (OID) and major version. You can optionally also specify the minor version.

- <name>. You can specify a certificate template by its name. The name cannot contain any : characters and cannot be an OID, otherwise the OID-based template specifier syntax takes precedence.

- default. If you use this specifier, the template name SubCA is used.

In certain scenarios, the Active Directory (AD) administrator can use the Subordinate Certification Authority (SCA) template, which is a built-in template in AD CS, to create a unique template to better suit the needs of the organization. The new template can, for example, have a customized validity period.
and customized extensions. The associated Object Identifier (OID) can be found in the AD Certificates Template console.

If the AD administrator has disabled the original, built-in template, you must specify the OID or name of the new template when requesting a certificate for your IdM CA. Ask your AD administrator to provide you with the name or OID of the new template.

If the original SCA AD CS template is still enabled, you can use it by specifying --external-ca-type=ms-cs without additionally using the --external-ca-profile option. In this case, the subCA external CA profile is used, which is the default IdM template corresponding to the SCA AD CS template.

6.2. INTERACTIVE INSTALLATION

During the interactive installation using the ipa-server-install utility, you are asked to supply basic configuration of the system, for example the realm, the administrator’s password and the Directory Manager’s password.

The ipa-server-install installation script creates a log file at /var/log/ipaserver-install.log. If the installation fails, the log can help you identify the problem.

This procedure describes how to install a server:

- Without integrated DNS
- With an external certificate authority (CA) as the root CA

Procedure

1. Run the ipa-server-install utility with the --external-ca option.
   - If you are using the Microsoft Certificate Services (MS CS) CA, also use the --external-ca-type and --external-ca-profile options. For example, to install an IdM server with a CA whose signing certificate is issued using the 1.3.6.1.4.1.311.21.8.8950086.10656446.2706058.12775672.480128.147.7130143.4405632:1 Object Identifier (OID) template:

   ```bash
   [root@server ~]# ipa-server-install --external-ca --external-ca-type=ms-cs --external-ca-profile=1.3.6.1.4.1.311.21.8.8950086.10656446.2706058.12775672.480128.147.7130143.4405632:1
   ```

   For more information about the --external-ca-type and --external-ca-profile options, see Options used when installing an IdM CA with an external CA as the root CA.

   - If you are not using MS CS to generate the signing certificate for your IdM CA, no other option may be necessary:

   ```bash
   # ipa-server-install --external-ca
   ```

2. The script prompts to configure an integrated DNS service. Press Enter to select the default no option.

   ```bash
   Do you want to configure integrated DNS (BIND)? [no]:
   ```
3. The script prompts for several required settings and offers recommended default values in brackets.
   - To accept a default value, press **Enter**.
   - To provide a custom value, enter the required value.

   Server host name `[server.idm.example.com]`:
   Please confirm the domain name `[idm.example.com]`:
   Please provide a realm name `[IDM.EXAMPLE.COM]`:

   **WARNING**
   Plan these names carefully. You will not be able to change them after the installation is complete.

4. Enter the passwords for the Directory Server superuser (`cn=Directory Manager`) and for the IdM administration system user account (`admin`).

   Directory Manager password:
   IPA admin password:

5. Enter **yes** to confirm the server configuration.

   Continue to configure the system with these values? [no]: **yes**

6. During the configuration of the Certificate System instance, the utility prints the location of the certificate signing request (CSR): `/root/ipa.csr`:

   ```
   ...  
   Configuring certificate server (pki-tomcatd): Estimated time 3 minutes 30 seconds
   [1/8]: creating certificate server user
   [2/8]: configuring certificate server instance
   The next step is to get /root/ipa.csr signed by your CA and re-run /sbin/ipa-server-install as:
   /sbin/ipa-server-install --external-cert-file=/path/to/signed_certificate --external-cert-file=/path/to/external_ca_certificate
   ```

   When this happens:
   a. Submit the CSR located in `/root/ipa.csr` to the external CA. The process differs depending on the service to be used as the external CA.
   b. Retrieve the issued certificate and the CA certificate chain for the issuing CA in a base 64-encoded blob (either a PEM file or a Base_64 certificate from a Windows CA). Again, the process differs for every certificate service. Usually, a download link on a web page or in the notification email allows the administrator to download all the required certificates.
IMPORTANT

Be sure to get the full certificate chain for the CA, not just the CA certificate.

c. Run `ipa-server-install` again, this time specifying the locations and names of the newly-issued CA certificate and the CA chain files. For example:

```
# ipa-server-install --external-cert-file=/tmp/servercert20170601.pem --external-cert-file=/tmp/cacert.pem
```

7. The installation script now configures the server. Wait for the operation to complete.

8. The installation script produces a file with DNS resource records: the `/tmp/ipa.system.records.UFRPto.db` file in the example output below. Add these records to the existing external DNS servers. The process of updating the DNS records varies depending on the particular DNS solution.

```
... Restarting the KDC
Please add records in this file to your DNS system: /tmp/ipa.system.records.UFRRto.db
Restarting the web server
...
```

IMPORTANT

The server installation is not complete until you add the DNS records to the existing DNS servers.

Additional resources

- For more information about the DNS resource records you must add to your DNS system, see [IdM DNS records for external DNS systems](#).
- The `ipa-server-install --external-ca` command can sometimes fail with the following error:

```
ipa : CRITICAL failed to configure ca instance Command '/usr/sbin/pkispawn -s CA -f /tmp/pass:quotes[configuration_file]' returned non-zero exit status 1
Configuration of CA failed
```

This failure occurs when the `_proxy` environmental variables are set. For a solution of the problem, see [Troubleshooting: External CA installation fails](#).

6.3. NON-INTERACTIVE INSTALLATION

This procedure installs a server:

- Without integrated DNS
- with an external certificate authority (CA) as the root CA
NOTE

The `ipa-server-install` installation script creates a log file at `/var/log/ipaserver-install.log`. If the installation fails, the log can help you identify the problem.

Prerequisites

- Decide on the type of the external CA you use (the `--external-ca-type` option). See the `ipa-server-install(1)` man page for details.

- Alternatively, decide on the `--external-ca-profile` option allowing an alternative Active Directory Certificate Services (AD CS) template to be specified. For example, to specify an AD CS installation-specific object identifier:

  ```
  [root@server ~]# ipa-server-install --external-ca --external-ca-type=ms-cs --external-ca-profile=1.3.6.1.4.1.311.21.8.8950086.10656446.2706058.12775672.480128.147.7130143.4405632:1
  ```

Procedure

1. Run the `ipa-server-install` utility with the options to supply all the required information. The minimum required options for non-interactive installation of an IdM server with an external CA as the root CA are:

   - `--external-ca` to specify an external CA is the root CA

   - `--realm` to provide the Kerberos realm name

   - `--ds-password` to provide the password for the Directory Manager (DM), the Directory Server super user

   - `--admin-password` to provide the password for `admin`, the IdM administrator

   - `--unattended` to let the installation process select default options for the host name and domain name

   For example:

   ```
   # ipa-server-install --external-ca --realm IDM.EXAMPLE.COM --ds-password DM_password --admin-password admin_password --unattended
   ```

   If you are using the Microsoft Certificate Services CA, use also the `--external-ca-type` option. For details, see the `ipa-server-install(1)` man page.

2. During the configuration of the Certificate System instance, the utility prints the location of the certificate signing request (CSR): `/root/ipa.csr`:

   ```
   Configuring certificate server (pki-tomcatd). Estimated time: 3 minutes
   [1/11]: configuring certificate server instance
   The next step is to get /root/ipa.csr signed by your CA and re-run /usr/sbin/ipa-server-install as:
   /usr/sbin/ipa-server-install --external-cert-file=/path/to/signed_certificate --external-cert-file=/path/to/external_ca_certificate
   The ipa-server-install command was successful
   ```
When this happens:

a. Submit the CSR located in /root/ipa.csr to the external CA. The process differs depending on the service to be used as the external CA.

b. Retrieve the issued certificate and the CA certificate chain for the issuing CA in a base 64-encoded blob (either a PEM file or a Base_64 certificate from a Windows CA). Again, the process differs for every certificate service. Usually, a download link on a web page or in the notification email allows the administrator to download all the required certificates.

   **IMPORTANT**

   Be sure to get the full certificate chain for the CA, not just the CA certificate.

c. Run `ipa-server-install` again, this time specifying the locations and names of the newly-issued CA certificate and the CA chain files. For example:

   ```bash
   # ipa-server-install --external-cert-file=/tmp/servercert20170601.pem --external-cert-file=/tmp/cacert.pem --realm IDM.EXAMPLE.COM --ds-password DM_password --admin-password admin_password --unattended
   ```

3. The installation script now configured the server. Wait for the operation to complete.

4. The installation script produces a file with DNS resource records: the `/tmp/ipa.system.records.UFRPto.db` file in the example output below. Add these records to the existing external DNS servers. The process of updating the DNS records varies depending on the particular DNS solution.

   ```
   ... Restoring the KDC
   Please add records in this file to your DNS system:
   /tmp/ipa.system.records.UFRBto.db
   Restarting the web server
   ...
   ```

   **IMPORTANT**

   The server installation is not complete until you add the DNS records to the existing DNS servers.

Additional resources

- For more information about the DNS resource records you must add to your DNS system, see [IdM DNS records for external DNS systems](#).

### 6.4. IDM DNS RECORDS FOR EXTERNAL DNS SYSTEMS

After installing an IdM server without integrated DNS, you must add LDAP and Kerberos DNS resource records for the IdM server to your external DNS system.

The `ipa-server-install` installation script generates a file containing the list of DNS resource records with a file name in the format `/tmp/ipa.system.records.<random_characters>.db` and prints instructions to add those records:
Please add records in this file to your DNS system: `/tmp/ipa.system.records.6zdjqxh3.db`

This is an example of the contents of the file:

```
_ldap._tcp.example.com. 86400 IN SRV 0 100 389 server.example.com.
_ldap._udp.example.com. 86400 IN SRV 0 100 389 server.example.com.

_kerberos-master._tcp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos-master._udp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos._tcp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos._udp.example.com. 86400 IN SRV 0 100 88 server.example.com.
_kerberos.example.com. 86400 IN TXT "EXAMPLE.COM"
_kpasswd._tcp.example.com. 86400 IN SRV 0 100 464 server.example.com.
_kpasswd._udp.example.com. 86400 IN SRV 0 100 464 server.example.com.
```

**NOTE**

After adding the LDAP and Kerberos DNS resource records for the IdM server to your DNS system, ensure that the DNS management tools have not added PTR records for `ipa-ca`. The presence of PTR records for `ipa-ca` in your DNS could cause subsequent IdM replica installations to fail.
CHAPTER 7. INSTALLING AN IDM SERVER OR REPLICA WITH CUSTOM DATABASE SETTINGS FROM AN LDIF FILE

You can install an IdM server and IdM replicas with custom settings for the Directory Server database. The following procedure shows you how to create an LDAP Data Interchange Format (LDIF) file with database settings, and how to pass those settings to the IdM server and replica installation commands.

Prerequisites

- You have determined custom Directory Server settings that improve the performance of your IdM environment. See Adjusting IdM Directory Server performance.

Procedure

1. Create a text file in LDIF format with your custom database settings. Separate LDAP attribute modifications with a dash (-). This example sets non-default values for the idle timeout and maximum file descriptors.

   ```
   dn: cn=config
   changetype: modify
   replace: nsslapd-idletimeout
   nsslapd-idletimeout=1800
   -
   replace: nsslapd-maxdescriptors
   nsslapd-maxdescriptors=8192
   ```

2. Use the --dirsrv-config-file parameter to pass the LDIF file to the installation script.

   a. To install an IdM server:

      ```
      # ipa-server-install --dirsrv-config-file filename.ldif
      ```

   b. To install an IdM replica:

      ```
      # ipa-replica-install --dirsrv-config-file filename.ldif
      ```

Additional resources

- Options for the ipa-server-install and ipa-replica-install commands
CHAPTER 8. OPTIONS FOR THE `ipa-server-install` AND `ipa-replica-install` COMMANDS

The `ipa-server-install` and `ipa-replica-install` commands have numerous arguments you can use to supply additional information that is not requested during an interactive installation. You can also use these options to script an unattended installation. The following table displays some of the most common options. For an exhaustive list of options, see the `ipa-server-install(1)` and `ipa-replica-install(1)` man pages.

Table 8.1. Options for the `ipa-server-install` and `ipa-replica-install` commands

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-a <code>&lt;ipa_admin_password&gt;</code></td>
<td>The password for the <code>admin</code> IdM administrator account to authenticate to the Kerberos realm.</td>
</tr>
<tr>
<td>-d, --debug</td>
<td>Enables debug logging for more verbose output.</td>
</tr>
<tr>
<td>--dirsrv-config-file <code>&lt;LDIF_file_name&gt;</code></td>
<td>The path to an LDIF file used to modify the configuration of the directory server instance.</td>
</tr>
<tr>
<td>--hostname=<code>server.idm.example.com</code></td>
<td>The fully-qualified domain name of the IdM server machine. Only numbers, lowercase alphabetic characters, and hyphens (-) are allowed.</td>
</tr>
<tr>
<td>--idmax=&lt;number&gt;</td>
<td>Sets the upper bound for IDs which can be assigned by the IdM server. The default value is the ID start value plus 199999.</td>
</tr>
<tr>
<td>--idstart=&lt;number&gt;</td>
<td>Sets the lower bound, or starting value, for IDs which can be assigned by the IdM server. The default value is randomly selected.</td>
</tr>
<tr>
<td>--ip-address 127.0.0.1</td>
<td>Specifies the IP address of the server. This option only accepts IP addresses associated with the local interface.</td>
</tr>
<tr>
<td>-n example.com</td>
<td>The name of the LDAP server domain to use for the IdM domain. This is usually based on the IdM server’s hostname.</td>
</tr>
<tr>
<td>-p <code>&lt;directory_manager_password&gt;</code></td>
<td>The password for the superuser, <code>cn=Directory Manager</code>, for the LDAP service.</td>
</tr>
<tr>
<td>-P <code>&lt;kerberos_main_password&gt;</code></td>
<td>The password for the KDC administrator. If you do not specify a value, this is randomly generated.</td>
</tr>
<tr>
<td>-r <code>&lt;KERBEROS_REALM_NAME&gt;</code></td>
<td>The name of the Kerberos realm to create for the IdM domain in uppercase, such as <code>EXAMPLE.COM</code>.</td>
</tr>
<tr>
<td>Argument</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>--setup-ca</td>
<td>Install and configure a CA on this replica. If a CA is not configured, certificate operations are forwarded to another replica with a CA installed.</td>
</tr>
<tr>
<td>--forwarder=192.0.2.1</td>
<td>Gives a DNS forwarder to use with the DNS service. To specify more than one forwarder, use this option multiple times.</td>
</tr>
<tr>
<td>--no-forwarders</td>
<td>Uses root servers with the DNS service instead of forwarders.</td>
</tr>
<tr>
<td>--no-reverse</td>
<td>Does not create a reverse DNS zone when the DNS domain is set up. (If a reverse DNS zone is already configured, then that existing reverse DNS zone is used.) If this option is not used, then the default value is true, which assumes that reverse DNS should be configured by the installation script.</td>
</tr>
<tr>
<td>--setup-dns</td>
<td>Tells the installation script to set up a DNS service within the IdM domain. Using an integrated DNS service is optional, so if this option is not passed with the installation script, then no DNS is configured.</td>
</tr>
<tr>
<td>-U, --unattended</td>
<td>Enable an unattended installation session that does not prompt for user input.</td>
</tr>
</tbody>
</table>

Additional resources

- [ipa-server-install(1) man page](#)
- [ipa-replica-install(1) man page](#)
CHAPTER 9. TROUBLESHOOTING IDM SERVER INSTALLATION

The following sections describe how to gather information about a failing IdM server installation, and how to resolve common installation issues.

9.1. REVIEWING IDM SERVER INSTALLATION ERROR LOGS

When you install an Identity Management (IdM) server, debugging information is appended to the following log files:

- `/var/log/ipaserver-install.log`
- `/var/log/httpd/error_log`
- `/var/log/dirsrv/slapd-INSTANCE-NAME/access`
- `/var/log/dirsrv/slapd-INSTANCE-NAME/errors`

The last lines of the log files report success or failure, and the `ERROR` and `DEBUG` entries provide additional context.

To troubleshoot a failing IdM server installation, review the errors at the end of the log files and use this information to resolve any corresponding issues.

Prerequisites

- You must have `root` privileges to display the contents of IdM log files.

Procedure

1. Use the `tail` command to display the last lines of a log file. The following example displays the last 10 lines of `/var/log/ipaserver-install.log`.

   ```
   [user@server ~]$ sudo tail -n 10 /var/log/ipaserver-install.log
   [sudo] password for user: 
   value = gen.send(prev_value)
   File "/usr/lib/python3.6/site-packages/ipapython/install/common.py", line 65, in _install
   for unused in self._installer(self.parent):
   File "/usr/lib/python3.6/site-packages/ipaserver/install/server/init.py", line 564, in main
   master_install(self)
   File "/usr/lib/python3.6/site-packages/ipaserver/install/server/install.py", line 291, in decorated
   raise ScriptError()
   2020-05-27T22:59:41Z DEBUG The ipa-server-install command failed, exception:
   ScriptError:
   /var/log/ipaserver-install.log for more information
   ```

2. To review a log file interactively, open the end of the log file using the `less` utility and use the ↑ and ↓ arrow keys to navigate. The following example opens the `/var/log/ipaserver-install.log` file interactively.

   ```
   [user@server ~]$ sudo less -N +G /var/log/ipaserver-install.log
   ```
3. Gather additional troubleshooting information by repeating this review process with the remaining log files.

```
[user@server ~]$ sudo less -N +G /var/log/httpd/error_log
[user@server ~]$ sudo less -N +G /var/log/dirsrv/slapd-INSTANCE-NAME/access
[user@server ~]$ sudo less -N +G /var/log/dirsrv/slapd-INSTANCE-NAME/errors
```

Additional resources

- If you are unable to resolve a failing IdM server installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the server.
- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

### 9.2. REVIEWING IDM CA INSTALLATION ERRORS

When you install the Certificate Authority (CA) service on an Identity Management (IdM) server, debugging information is appended to the following locations (in order of recommended priority):

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>/var/log/pki/pki-ca-spawn.$TIME_OF_INSTALLATION.log</code></td>
<td>High-level issues and Python traces for the pkispawn installation process</td>
</tr>
<tr>
<td><code>journalctl -u pki-tomcatd@pki-tomcat</code> output</td>
<td>Errors from the pki-tomcatd@pki-tomcat service</td>
</tr>
<tr>
<td><code>/var/log/pki/pki-tomcat/ca/debug.$DATE.log</code></td>
<td>Large JAVA stacktraces of activity in the core of the Public Key Infrastructure (PKI) product</td>
</tr>
<tr>
<td><code>/var/log/pki/pki-tomcat/ca/signedAudit/ca_audit</code> log file</td>
<td>Audit log of the PKI product</td>
</tr>
<tr>
<td>- <code>/var/log/pki/pki-tomcat/ca/system</code></td>
<td>Low-level debug data of certificate operations for service principals, hosts, and other entities that use certificates</td>
</tr>
<tr>
<td>- <code>/var/log/pki/pki-tomcat/ca/transactions</code></td>
<td></td>
</tr>
<tr>
<td>- <code>/var/log/pki/pki-tomcat/catalina.$DATE.log</code></td>
<td></td>
</tr>
</tbody>
</table>
NOTE

If a full IdM server installation fails while installing the optional CA component, no details about the CA are logged; a message is logged in the `/var/log/ipaserver-install.log` file indicating that the overall installation process failed. Red Hat recommends reviewing the log files listed above for details specific to the CA installation failure.

The only exception to this behavior is when you are installing the CA service and the root CA is an external CA. If there is an issue with the certificate from the external CA, errors are logged in `/var/log/ipaserver-install.log`.

To troubleshoot a failing IdM CA installation, review the errors at the end of these log files and use this information to resolve any corresponding issues.

Prerequisites

- You must have root privileges to display the contents of IdM log files.

Procedure

1. To review a log file interactively, open the end of the log file using the less utility and use the ↑ and ↓ arrow keys to navigate, while searching for ScriptError entries. The following example opens `/var/log/pki/pki-ca-spawn.$TIME_OF_INSTALLATION.log`.

   ```bash
   [user@server ~]$ sudo less -N +G /var/log/pki/pki-ca-spawn.20200527185902.log
   ```

2. Gather additional troubleshooting information by repeating this review process with all the log files listed above.

Additional resources

- If you are unable to resolve a failing IdM server installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the server.

- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

9.3. REMOVING A PARTIAL IDM SERVER INSTALLATION

If an IdM server installation fails, some configuration files can be left behind. Additional attempts to install the IdM server fail and the installation script reports that IPA is already configured.

Example system with existing partial IdM configuration

```bash
[root@server ~]# ipa-server-install

The log file for this installation can be found in /var/log/ipaserver-install.log
IPA server is already configured on this system.
If you want to reinstall the IPA server, please uninstall it first using 'ipa-server-install --uninstall'.
The ipa-server-install command failed. See /var/log/ipaserver-install.log for more information
```

To resolve this issue, uninstall the partial IdM server configuration and retry the installation process.
Prerequisites

- You must have root privileges.

Procedure

1. Uninstall the IdM server software from the host you are trying to configure as an IdM server.
   
   [root@server ~]# ipa-server-install --uninstall

2. If you continue to experience difficulty installing an IdM server because of repeated failed installations, reinstall the operating system. One of the requirements for installing an IdM server is a clean system without any customization. Failed installations may have compromised the integrity of the host by unexpectedly modifying system files.

Additional resources

- For additional details on uninstalling an IdM server, see Uninstalling an IdM server.

- If installation attempts fail after repeated uninstallation attempts, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the server.

- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

Additional resources

- For additional details on uninstalling an IdM server, see Uninstalling an IdM server.

- If installation attempts fail after repeated uninstallation attempts, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the server.

- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

9.4. ADDITIONAL RESOURCES

- To troubleshoot installing an IdM replica, see Troubleshooting IdM replica installation.

- To troubleshoot installing an IdM client, see Troubleshooting IdM client installation.
CHAPTER 10. UNINSTALLING AN IDM SERVER

As an administrator, you can remove an Identity Management (IdM) server from the topology.

This procedure describes how you can uninstall an example server named server.idm.example.com.

Prerequisites

- Before uninstalling a server that serves as a certificate authority (CA), key recovery authority (KRA), or DNS server, make sure these services are running on another server in the domain.

**WARNING**

Removing the last server that serves as a CA, KRA, or DNS server seriously disrupts the Identity Management (IdM) functionality.

Procedure

1. On another server, enter the `ipa server-del` command to delete server.idm.example.com from the topology:

   
   ```
   [root@another_server ~]# ipa server-del server.idm.example.com
   ```

2. On server.idm.example.com, use the `ipa-server-install --uninstall` command:

   ```
   [root@server ~]# ipa-server-install --uninstall
   ...
   Are you sure you want to continue with the uninstall procedure? [no]: yes
   ```

3. Make sure all name server (NS) DNS records pointing to server.idm.example.com are deleted from your DNS zones. This applies regardless of whether you use integrated DNS managed by IdM or external DNS.
CHAPTER 11. RENAMING AN IDM SERVER

You cannot change the host name of an existing Identity Management (IdM) server. However, you can replace the server with a replica of a different name.

Procedure

1. Install a new replica that will replace the existing server, ensuring the replica has the required host name and IP address. For details, see Installing an IdM replica.

   **IMPORTANT**

   If the server you are uninstalling is the certificate revocation list (CRL) publisher server, make another server the CRL publisher server before proceeding.

   For details on how this is done in the context of a migration procedure, see the following sections:
   - Stopping CRL generation on a RHEL 8 IdM CA server
   - Starting CRL generation on the new RHEL 9 IdM CA server

2. Stop the existing IdM server instance.

   ```
   [root@old_server ~]# ipactl stop
   ```

3. Uninstall the existing server as described in Uninstalling an IdM server.
CHAPTER 12. UPDATING AND DOWNGRADING IDM

12.1. UPDATING IDM PACKAGES

You can use the `dnf` utility to update the Identity Management (IdM) packages on the system.

- To update all IdM packages that are relevant for your profile and that have updates available:
  ```
  # dnf upgrade ipa- *
  ```

  **IMPORTANT**
  Before installing an update, make sure you have applied all previously released errata relevant to the RHEL system.

- Alternatively, to install or update packages to match the latest version available for your profile from any enabled repository:
  ```
  # dnf distro-sync ipa- *
  ```

After you update the IdM packages on at least one server, all other servers in the topology receive the updated schema, even if you do not update their packages. This ensures that any new entries which use the new schema can be replicated among the other servers.

**WARNING**

When updating multiple IdM servers, wait at least 10 minutes after updating one server before updating another server. However, the actual time required for a server’s successful update depends on the topology deployed, the latency of the connections, and the number of changes generated by the update.

When two or more servers are updated simultaneously or with only short intervals between the upgrades, there is not enough time to replicate the post-upgrade data changes throughout the topology, which can result in conflicting replication events.

12.2. DOWNGRADING IDM PACKAGES

Downgrading IdM packages manually is not supported. Use `dnf distro-sync` to update and downgrade packages.

**IMPORTANT**

Do not run the `dnf downgrade` command on any of the `ipa- *` packages.

Additional resources

- `dnf(8)` man page
CHAPTER 13. PREPARING THE SYSTEM FOR IDM CLIENT INSTALLATION

This chapter describes the conditions your system must meet to install an Identity Management (IdM) client.

13.1. DNS REQUIREMENTS FOR IDM CLIENTS

Client installer by default tries to search for `_ldap._tcp.DOMAIN` DNS SRV records for all domains that are parent to its hostname. For example, if a client machine has a hostname `client1.idm.example.com`, the installer will try to retrieve an IdM server hostname from `_ldap._tcp.idm.example.com`, `_ldap._tcp.example.com` and `_ldap._tcp.com` DNS SRV records, respectively. The discovered domain is then used to configure client components (for example, SSSD and Kerberos 5 configuration) on the machine.

However, the hostnames of IdM clients are not required to be part of the primary DNS domain. If the client machine hostname is not in a subdomain of an IdM server, pass the IdM domain as the `--domain` option of the `ipa-client-install` command. In that case, after the installation of the client, both SSSD and Kerberos components will have the domain set in their configuration files and will use it to autodiscover IdM servers.

Additional resources

- For details on DNS requirements in IdM, see Host name and DNS requirements for IdM.

13.2. PORT REQUIREMENTS FOR IDM CLIENTS

Identity Management (IdM) clients connect to a number of ports on IdM servers to communicate with their services.

On IdM client, these ports must be open in the outgoing direction. If you are using a firewall that does not filter outgoing packets, such as firewalld, the ports are already available in the outgoing direction.

Additional resources

- For information about which specific ports are used, see Port requirements for IdM.

13.3. IPV6 REQUIREMENTS FOR IDM CLIENTS

Identity Management (IdM) does not require the IPv6 protocol to be enabled in the kernel of the host that you want to enroll into IdM. For example, if your internal network only uses the IPv4 protocol, you can configure the System Security Services Daemon (SSSD) to only use IPv4 to communicate with the IdM server. You can do this by inserting the following line into the `/etc/sssd/sssd.conf` file:

```plaintext
lookup_family_order = ipv4_only
```

Additional resources

- For more information on the `lookup_family_order` option, see the `sssd.conf(5)` man page.

13.4. INSTALLING PACKAGES REQUIRED FOR AN IDM CLIENT
Installing the **ipa-client** package automatically installs other required packages as dependencies, such as the System Security Services Daemon (SSSD) packages.

**Procedure**

- Install the **ipa-client** package:

```bash
# dnf install ipa-client
```
CHAPTER 14. INSTALLING AN IDM CLIENT: BASIC SCENARIO

The following sections describe how to configure a system as an Identity Management (IdM) client by using the `ipa-client-install` utility. Configuring a system as an IdM client enrolls it into an IdM domain and enables the system to use IdM services on IdM servers in the domain.

To install an Identity Management (IdM) client successfully, you must provide credentials that can be used to enroll the client.

14.1. PREREQUISITES

- You have prepared the system for IdM client installation. For details, see Preparing the system for IdM client installation.

14.2. INSTALLING A CLIENT BY USING USER CREDENTIALS: INTERACTIVE INSTALLATION

This procedure describes installing an Identity Management (IdM) client interactively by using the credentials of an authorized user to enroll the system into the domain.

Prerequisites

- Ensure you have the credentials of a user authorized to enroll clients into the IdM domain. This could be, for example, a `hostadmin` user with the Enrollment Administrator role.

Procedure

1. Run the `ipa-client-install` utility on the system that you want to configure as an IdM client.

   ```
   # ipa-client-install --mkhomedir
   ```

   Add the `--enable-dns-updates` option to update the DNS records with the IP address of the client system if either of the following conditions applies:

   - The IdM server the client will be enrolled with was installed with integrated DNS
   - The DNS server on the network accepts DNS entry updates with the GSS-TSIG protocol

   ```
   # ipa-client-install --enable-dns-updates --mkhomedir
   ```

   Enabling DNS updates is useful if your client:

   - has a dynamic IP address issued using the Dynamic Host Configuration Protocol
   - has a static IP address but it has just been allocated and the IdM server does not know about it

2. The installation script attempts to obtain all the required settings, such as DNS records, automatically.

   - If the SRV records are set properly in the IdM DNS zone, the script automatically discovers all the other required values and displays them. Enter `yes` to confirm.

   ```
   Client hostname: client.example.com
   ```
Realm: EXAMPLE.COM
DNS Domain: example.com
IPA Server: server.example.com
BaseDN: dc=example,dc=com

Continue to configure the system with these values? [no]: yes

- To install the system with different values, enter no. Then run `ipa-client-install` again, and specify the required values by adding command-line options to `ipa-client-install`, for example:
  - `--hostname`
  - `--realm`
  - `--domain`
  - `--server`
  - `--mkhomedir`

**IMPORTANT**
The fully qualified domain name must be a valid DNS name:

- Only numbers, alphabetic characters, and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
- The host name must be all lower-case. No capital letters are allowed.

- If the script fails to obtain some settings automatically, it prompts you for the values.

3. The script prompts for a user whose identity will be used to enroll the client. This could be, for example, a **hostadmin** user with the Enrollment Administrator role:

   User authorized to enroll computers: **hostadmin**
   Password for **hostadmin**@EXAMPLE.COM:

4. The installation script now configures the client. Wait for the operation to complete.

**Client configuration complete.**

Additional resources

- For details on how the client installation script searches for the DNS records, see the **DNS Autodiscovery** section in the `ipa-client-install(1)` man page.

**14.3. INSTALLING A CLIENT BY USING A ONE-TIME PASSWORD: INTERACTIVE INSTALLATION**

This procedure describes installing an Identity Management (IdM) client interactively by using a one-time password to enroll the system into the domain.
Prerequisites

- On a server in the domain, add the future client system as an IdM host. Use the `--random` option with the `ipa host-add` command to generate a one-time random password for the enrollment.

```
$ ipa host-add client.example.com --random
-------------------------------
Added host "client.example.com"
-------------------------------
Host name: client.example.com
Random password: W5YpARl=7M.n
Password: True
Keytab: False
Managed by: server.example.com
```

**NOTE**

The generated password will become invalid after you use it to enroll the machine into the IdM domain. It will be replaced with a proper host keytab after the enrollment is finished.

Procedure

1. Run the `ipa-client-install` utility on the system that you want to configure as an IdM client. Use the `--password` option to provide the one-time random password. Because the password often contains special characters, enclose it in single quotes (').

```
# ipa-client-install --mkhomedir --password='password'
```

Add the `--enable-dns-updates` option to update the DNS records with the IP address of the client system if either of the following conditions applies:

- The IdM server the client will be enrolled with was installed with integrated DNS
- The DNS server on the network accepts DNS entry updates with the GSS-TSIG protocol

```
# ipa-client-install --password 'W5YpARl=7M.n' --enable-dns-updates --mkhomedir
```

Enabling DNS updates is useful if your client:

- has a dynamic IP address issued using the Dynamic Host Configuration Protocol
- has a static IP address but it has just been allocated and the IdM server does not know about it

2. The installation script attempts to obtain all the required settings, such as DNS records, automatically.

- If the SRV records are set properly in the IdM DNS zone, the script automatically discovers all the other required values and displays them. Enter yes to confirm.

```
Client hostname: client.example.com
Realm: EXAMPLE.COM
DNS Domain: example.com
IPA Server: server.example.com
```
BaseDN: dc=example,dc=com

Continue to configure the system with these values? [no]: yes

- To install the system with different values, enter no. Then run ipa-client-install again, and specify the required values by adding command-line options to ipa-client-install, for example:
  - --hostname
  - --realm
  - --domain
  - --server
  - --mkhomedir

**IMPORTANT**

The fully qualified domain name must be a valid DNS name:
- Only numbers, alphabetic characters, and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
- The host name must be all lower-case. No capital letters are allowed.

- If the script fails to obtain some settings automatically, it prompts you for the values.

3. The installation script now configures the client. Wait for the operation to complete.

Client configuration complete.

Additional resources
- For details on how the client installation script searches for the DNS records, see the DNS Autodiscovery section in the ipa-client-install(1) man page.

14.4. INSTALLING A CLIENT: NON-INTERACTIVE INSTALLATION

For a non-interactive installation, you must provide all required information to the ipa-client-install utility using command-line options. The following sections describe the minimum required options for a non-interactive installation.

Options for the intended authentication method for client enrollment

The available options are:
- --principal and --password to specify the credentials of a user authorized to enroll clients
- --random to specify a one-time random password generated for the client
- --keytab to specify the keytab from a previous enrollment

The option for unattended installation
The `--unattended` option lets the installation run without requiring user confirmation.
If the SRV records are set properly in the IdM DNS zone, the script automatically discovers all the
other required values. If the script cannot discover the values automatically, provide them using
command-line options, such as:

- `--hostname` to specify a static fully qualified domain name (FQDN) for the client machine.

**IMPORTANT**

The FQDN must be a valid DNS name:

- Only numbers, alphabetic characters, and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
- The host name must be all lower-case. No capital letters are allowed.

- `--domain` to specify the primary DNS domain of an existing IdM deployment, e.g.
example.com. The name is a lowercase version of the IdM Kerberos realm name.

- `--server` to specify the FQDN of the IdM server to connect to. When this option is used, DNS
autodiscovery for Kerberos is disabled and a fixed list of KDC and Admin servers is
configured. Under normal circumstances, this option is not needed as the list of servers is
retrieved from the primary IdM DNS domain.

- `--realm` to specify the Kerberos realm of an existing IdM deployment. Usually it is an
uppercase version of the primary DNS domain used by the IdM installation. Under normal
circumstances, this option is not needed as the realm name is retrieved from the IdM server.

An example of a basic `ipa-client-install` command for non-interactive installation:

```bash
# ipa-client-install --password 'W5YpARl=7M.n' --mkhomedir --unattended
```

An example of an `ipa-client-install` command for non-interactive installation with more options
specified:

```bash
# ipa-client-install --password 'W5YpARl=7M.n' --domain idm.example.com --server server.idm.example.com --realm IDM.EXAMPLE.COM --mkhomedir --unattended
```

Additional resources

- For a complete list of options accepted by `ipa-client-install`, see the `ipa-client-install(1)` man
page.

### 14.5. REMOVING PRE-IDM CONFIGURATION AFTER INSTALLING A CLIENT

The `ipa-client-install` script does not remove any previous LDAP and System Security Services Daemon
(SSSD) configuration from the `/etc/openldap/ldap.conf` and `/etc/sssd/sssd.conf` files. If you modified
the configuration in these files before installing the client, the script adds the new client values, but
comments them out. For example:
To apply the new Identity Management (IdM) configuration values:

1. Open `/etc/openldap/ldap.conf` and `/etc/sssd/sssd.conf`.
2. Delete the previous configuration.
3. Uncomment the new IdM configuration.
4. Server processes that rely on system-wide LDAP configuration might require a restart to apply the changes. Applications that use `openldap` libraries typically import the configuration when started.

### 14.6. TESTING AN IDM CLIENT

The command-line interface informs you that the `ipa-client-install` was successful, but you can also do your own test.

To test that the Identity Management (IdM) client can obtain information about users defined on the server, check that you are able to resolve a user defined on the server. For example, to check the default `admin` user:

```
[user@client ~]$ id admin
uid=1254400000(admin) gid=1254400000(admins) groups=1254400000(admins)
```

To test that authentication works correctly, `su` to a root user from a non-root user:

```
[user@client ~]$ su -
Last login: Thu Oct 18 18:39:11 CEST 2018 from 192.168.122.1 on pts/0
[root@client ~]#
```

### 14.7. CONNECTIONS PERFORMED DURING AN IDM CLIENT INSTALLATION

**Requests performed during an IdM client installation** lists the operations performed by `ipa-client-install`, the Identity Management (IdM) client installation tool.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Protocol used</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNS resolution against the DNS resolvers configured on the client system</td>
<td>DNS</td>
<td>To discover the IP addresses of IdM servers; (optionally) to add A/AAAA and SSHFP records</td>
</tr>
<tr>
<td>Requests to ports 88 (TCP/TCP6 and UDP/UDP6) on an IdM replica</td>
<td>Kerberos</td>
<td>To obtain a Kerberos ticket</td>
</tr>
</tbody>
</table>
14.8. IDM CLIENT’S COMMUNICATIONS WITH THE SERVER DURING POST-INSTALLATION DEPLOYMENT

The client side of Identity Management (IdM) framework is implemented with two different applications:

- the **ipa** command-line interface (CLI)
- (optional) the browser-based Web UI

**CLI post-installation operations** shows the operations performed by the CLI during an IdM client post-installation deployment. **Web UI post-installation operations** shows the operations performed by the Web UI during an IdM client post-installation deployment.

**Table 14.2. CLI post-installation operations**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Protocol used</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNS resolution against the DNS resolvers configured on the client system</td>
<td>DNS</td>
<td>To discover the IP addresses of IdM servers</td>
</tr>
<tr>
<td>Requests to ports 88 (TCP/TCP6 and UDP/UDP6) and 464 (TCP/TCP6 and UDP/UDP6) on an IdM replica</td>
<td>Kerberos</td>
<td>To obtain a Kerberos ticket; change a Kerberos password; authenticate to the IdM Web UI</td>
</tr>
<tr>
<td>JSON-RPC calls to the IdM Apache-based web-service on discovered or configured IdM servers</td>
<td>HTTPS</td>
<td>any <strong>ipa</strong> utility usage</td>
</tr>
</tbody>
</table>

**Table 14.3. Web UI post-installation operations**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Protocol used</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requests over TCP/TCP6 to ports 389 on IdM servers, using SASL GSSAPI authentication, plain LDAP, or both</td>
<td>LDAP</td>
<td>IdM client enrollment; identity retrieval by SSSD processes; Kerberos key retrieval for the host principal</td>
</tr>
<tr>
<td>Network time protocol (NTP) discovery and resolution (optionally)</td>
<td>NTP</td>
<td>To synchronize time between the client system and an NTP server</td>
</tr>
<tr>
<td>JSON-RPC calls to the IdM Apache-based web-service on discovered or configured IdM servers</td>
<td>HTTPS</td>
<td>IdM client enrollment; retrieval of CA certificate chain if LDAP method fails; request for a certificate issuance if required</td>
</tr>
</tbody>
</table>
### 14.9. SSSD COMMUNICATION PATTERNS

The System Security Services Daemon (SSSD) is a system service to access remote directories and authentication mechanisms. If configured on an Identity Management IdM client, it connects to the IdM server, which provides authentication, authorization and other identity and policy information. If the IdM server is in a trust relationships with Active Directory (AD), SSSD also connects to AD to perform authentication for AD users using the Kerberos protocol. By default, SSSD uses Kerberos to authenticate any non-local user. In special situations, SSSD might be configured to use the LDAP protocol instead.

The SSSD can be configured to communicate with multiple servers. The tables below show common communication patterns for SSSD in IdM.

#### Table 14.4. Communication patterns of SSSD on IdM clients when talking to IdM servers

<table>
<thead>
<tr>
<th>Operation</th>
<th>Protocol used</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNS resolution against the DNS resolvers configured on the client system</td>
<td>DNS</td>
<td>To discover the IP addresses of IdM servers</td>
</tr>
<tr>
<td>Requests to ports 88 (TCP/TCP6 and UDP/UDP6), 464 (TCP/TCP6 and UDP/UDP6), and 749 (TCP/TCP6) on an Identity Management replica and Active Directory domain controllers</td>
<td>Kerberos</td>
<td>To obtain a Kerberos ticket; to change a Kerberos password</td>
</tr>
<tr>
<td>Requests over TCP/TCP6 to ports 389 on IdM servers, using SASL GSSAPI authentication, plain LDAP, or both</td>
<td>LDAP</td>
<td>To obtain information about IdM users and hosts, download HBAC and sudo rules, automount maps, the SELinux user context, public SSH keys, and other information stored in IdM LDAP</td>
</tr>
</tbody>
</table>
In case of smart-card authentication, requests to the Online Certificate Status Protocol (OCSP) responder, if it is configured. This often is done via port 80, but it depends on the actual value of the OCSP responder URL in a client certificate.

**Table 14.5. Communication patterns of SSSD on IdM servers acting as trust agents when talking to Active Directory Domain Controllers**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Protocol used</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNS resolution against the DNS resolvers configured on the client system</td>
<td>DNS</td>
<td>To discover the IP addresses of IdM servers</td>
</tr>
<tr>
<td>Requests to ports 88 (TCP/TCP6 and UDP/UDP6), 464 (TCP/TCP6 and UDP/UDP6), and 749 (TCP/TCP6) on an Identity Management replica and Active Directory domain controllers</td>
<td>Kerberos</td>
<td>To obtain a Kerberos ticket; change a Kerberos password; administer Kerberos remotely</td>
</tr>
<tr>
<td>Requests to ports 389 (TCP/TCP6 and UDP/UDP6) and 3268 (TCP/TCP6)</td>
<td>LDAP</td>
<td>To query Active Directory user and group information; to discover Active Directory domain controllers</td>
</tr>
<tr>
<td>(optionally) In case of smart-card authentication, requests to the Online Certificate Status Protocol (OCSP) responder, if it is configured. This often is done via port 80, but it depends on the actual value of the OCSP responder URL in a client certificate.</td>
<td>HTTP</td>
<td>To obtain information about the status of the certificate installed in the smart card</td>
</tr>
</tbody>
</table>

**Additional resources**

- **IdM client’s communications with the server during post-installation deployment**

### 14.10. CERTMONGER COMMUNICATION PATTERNS

Certmonger is a daemon running on Identity Management (IdM) servers and IdM clients to allow a timely renewal of SSL certificates associated with the services on the host. The Table 14.6, "Certmonger communication patterns" shows the operations performed by IdM client’s certmonger utility on IdM servers.

**Table 14.6. Certmonger communication patterns**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Protocol used</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>(optionally) In case of smart-card authentication, requests to the Online Certificate Status Protocol (OCSP) responder, if it is configured. This often is done via port 80, but it depends on the actual value of the OCSP responder URL in a client certificate.</td>
<td>HTTP</td>
<td>To obtain information about the status of the certificate installed in the smart card</td>
</tr>
<tr>
<td>Operation</td>
<td>Protocol used</td>
<td>Purpose</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DNS resolution against the DNS resolvers configured on the client system</td>
<td>DNS</td>
<td>To discover the IP addresses of IdM servers</td>
</tr>
<tr>
<td>Requests to ports 88 (TCP/TCP6 and UDP/UDP6) and 464 (TCP/TCP6 and UDP/UDP6) on an IdM replica</td>
<td>Kerberos</td>
<td>To obtain a Kerberos ticket</td>
</tr>
<tr>
<td>JSON-RPC calls to the IdM Apache-based web-service on discovered or configured IdM servers</td>
<td>HTTPS</td>
<td>To request new certificates</td>
</tr>
<tr>
<td>Access over port 8080 (TCP/TCP6) on the IdM server</td>
<td>HTTP</td>
<td>To obtain an Online Certificate Status Protocol (OCSP) responder and certificate status</td>
</tr>
<tr>
<td>(on the first installed server or on the server where certificate tracking has been transferred) Access over port 8443 (TCP/TCP6) on the IdM server</td>
<td>HTTPS</td>
<td>To administer the Certificate Authority on the IdM server (only during IdM server and replica installation)</td>
</tr>
</tbody>
</table>

**Additional resources**

- IdM client’s communications with the server during post-installation deployment
CHAPTER 15. INSTALLING AN IDM CLIENT WITH KICKSTART

A Kickstart enrollment automatically adds a new system to the Identity Management (IdM) domain at the time Red Hat Enterprise Linux is installed.

15.1. INSTALLING A CLIENT WITH KICKSTART

This procedure describes how to use a Kickstart file to install an Identity Management (IdM) client.

Prerequisites

- Do not start the `sshd` service prior to the kickstart enrollment. Starting `sshd` before enrolling the client generates the SSH keys automatically, but the Kickstart file in Section 15.2, “Kickstart file for client installation” uses a script for the same purpose, which is the preferred solution.

Procedure

1. Pre-create the host entry on the IdM server, and set a temporary password for the entry:

   ```
   $ ipa host-add client.example.com --password=secret
   ```

   The password is used by Kickstart to authenticate during the client installation and expires after the first authentication attempt. After the client is successfully installed, it authenticates using its keytab.

2. Create a Kickstart file with the contents described in Section 15.2, "Kickstart file for client installation". Make sure that network is configured properly in the Kickstart file using the `network` command.

3. Use the Kickstart file to install the IdM client.

15.2. KICKSTART FILE FOR CLIENT INSTALLATION

This section describes the contents of a kickstart file that you can use to install an Identity Management (IdM) client.

The `ipa-client` package in the list of packages to install

Add the `ipa-client` package to the `%packages` section of the kickstart file. For example:

```
%packages
...
ipa-client
...
```

Post-installation instructions for the IdM client

The post-installation instructions must include:

- An instruction for ensuring SSH keys are generated before enrollment
- An instruction to run the `ipa-client-install` utility, while specifying:
  - All the required information to access and configure the IdM domain services
The password which you set when pre-creating the client host on the IdM server. in Section 15.1, "Installing a client with Kickstart".

For example, the post-installation instructions for a kickstart installation that uses a one-time password and retrieves the required options from the command line rather than via DNS can look like this:

```bash
%post --log=/root/ks-post.log

# Generate SSH keys; ipa-client-install uploads them to the IdM server by default
/usr/libexec/openssh/sshd-keygen rsa

# Run the client install script
/usr/sbin/ipa-client-install --hostname=client.example.com --domain=EXAMPLE.COM --enable-dns-updates --mkhomedir -w secret --realm=EXAMPLE.COM --server=server.example.com
```

 Optionally, you can also include other options in the Kickstart file, such as:

- For a non-interactive installation, add the `--unattended` option to `ipa-client-install`.

- To let the client installation script request a certificate for the machine:
  - Add the `--request-cert` option to `ipa-client-install`.
  - Set the system bus address to `/dev/null` for both the `getcert` and `ipa-client-install` utility in the Kickstart chroot environment. To do this, add these lines to the post-installation instructions in the Kickstart file before the `ipa-client-install` instruction:

    ```bash
    # env DBUS_SYSTEM_BUS_ADDRESS=unix:path=/dev/null getcert list
    # env DBUS_SYSTEM_BUS_ADDRESS=unix:path=/dev/null ipa-client-install
    ```

### 15.3. TESTING AN IDM CLIENT

The command-line interface informs you that the `ipa-client-install` was successful, but you can also do your own test.

To test that the Identity Management (IdM) client can obtain information about users defined on the server, check that you are able to resolve a user defined on the server. For example, to check the default admin user:

```
[user@client ~]$ id admin
uid=1254400000(admin) gid=1254400000(admins) groups=1254400000(admins)
```

To test that authentication works correctly, `su` to a root user from a non-root user:

```
[user@client ~]$ su -
Last login: Thu Oct 18 18:39:11 CEST 2018 from 192.168.122.1 on pts/0
[root@client ~]#
```
16.1. REVIEWING IDM CLIENT INSTALLATION ERRORS

When you install an Identity Management (IdM) client, debugging information is appended to /var/log/ipaclient-install.log. If a client installation fails, the installer logs the failure and rolls back changes to undo any modifications to the host. The reason for the installation failure may not be at the end of the log file, as the installer also logs the roll back procedure.

To troubleshoot a failing IdM client installation, review lines labeled ScriptError in the /var/log/ipaclient-install.log file and use this information to resolve any corresponding issues.

Prerequisites

- You must have root privileges to display the contents of IdM log files.

Procedure

1. Use the grep utility to retrieve any occurrences of the keyword ScriptError from the /var/log/ipaserver-install.log file.

   [user@server ~]$ sudo grep ScriptError /var/log/ipaclient-install.log

   [sudo] password for user:

   2020-05-28T18:24:50Z DEBUG The ipa-client-install command failed, exception:
   ScriptError: One of password / principal / keytab is required.

2. To review a log file interactively, open the end of the log file using the less utility and use the ↑ and ↓ arrow keys to navigate.

   [user@server ~]$ sudo less -N +G /var/log/ipaclient-install.log

Additional resources

- If you are unable to resolve a failing IdM client installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the client.

- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?.

16.2. RESOLVING ISSUES IF THE CLIENT INSTALLATION FAILS TO UPDATE DNS RECORDS

The IdM client installer issues nsupdate commands to create PTR, SSHFP, and additional DNS records. However, the installation process fails if the client is unable to update DNS records after installing and configuring the client software.
To fix this problem, verify the configuration and review DNS errors in `/var/log/client-install.log`.

**Prerequisites**

- You are using IdM DNS as the DNS solution for your IdM environment

**Procedure**

1. Ensure that dynamic updates for the DNS zone the client is in are enabled:

   ```bash
   [user@server ~]$ ipa dnszone-mod idm.example.com. --dynamic-update=TRUE
   ```

2. Ensure that the IdM server running the DNS service has port 53 opened for both TCP and UDP protocols.

   ```bash
   [user@server ~]$ sudo firewall-cmd --permanent --add-port=53/tcp --add-port=53/udp
   [sudo] password for user:
   success
   [user@server ~]$ firewall-cmd --runtime-to-permanent
   success
   ```

3. Use the `grep` utility to retrieve the contents of `nsupdate` commands from `/var/log/client-install.log` to see which DNS record updates are failing.

   ```bash
   [user@server ~]$ sudo grep nsupdate /var/log/ipaclient-install.log
   ```

**Additional resources**

- If you are unable to resolve a failing installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the [Red Hat Customer Portal](https://access.redhat.com/csa) and provide an `sosreport` of the client.

- The `sosreport` utility collects configuration details, logs and system information from a RHEL system. For more information on the `sosreport` utility, see [What is an sosreport and how to create one in Red Hat Enterprise Linux?](https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/9/html/Resolving_Issues_Guides/sosreport.html).

**16.3. RESOLVING ISSUES IF THE CLIENT INSTALLATION FAILS TO JOIN THE IDM KERBEROS REALM**

The IdM client installation process fails if the client is unable to join the IdM Kerberos realm.

Joining realm failed: Failed to add key to the keytab
child exited with 11

Installation failed. Rolling back changes.

This failure can be caused by an empty Kerberos keytab.

**Prerequisites**

- Removing system files requires `root` privileges.
Procedure

1. Remove `/etc/krb5.keytab`.

   ```bash
   [user@client ~]$ sudo rm /etc/krb5.keytab
   [sudo] password for user:
   [user@client ~]$ ls /etc/krb5.keytab
   ls: cannot access '/etc/krb5.keytab': No such file or directory
   ```

2. Retry the IdM client installation.

Additional resources

- If you are unable to resolve a failing installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the client.

- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

16.4. ADDITIONAL RESOURCES

- To troubleshoot installing the first IdM server, see Troubleshooting IdM server installation.

- To troubleshoot installing an IdM replica, see Troubleshooting IdM replica installation.
CHAPTER 17. RE-ENROLLING AN IDM CLIENT

17.1. CLIENT RE-ENROLLMENT IN IDM

This section describes how to re-enroll an Identity Management (IdM) client.

If a client machine has been destroyed and lost connection with the IdM servers, for example due to the client’s hardware failure, and you still have its keytab, you can re-enroll the client. In this scenario, you want to get the client back in the IdM environment with the same hostname.

During the re-enrollment, the client generates a new Kerberos key and SSH keys, but the identity of the client in the LDAP database remains unchanged. After the re-enrollment, the host has its keys and other information in the same LDAP object with the same FQDN as previously, before the machine’s loss of connection with the IdM servers.

IMPORTANT

You can only re-enroll clients whose domain entry is still active. If you uninstalled a client (using ipa-client-install --uninstall) or disabled its host entry (using ipa host-disable), you cannot re-enroll it.

You cannot re-enroll a client after you have renamed it. This is because in IdM, the key attribute of the client’s entry in LDAP is the client’s hostname, its FQDN. As opposed to re-enrolling a client, during which the client’s LDAP object remains unchanged, the outcome of renaming a client is that the client has its keys and other information in a different LDAP object with a new FQDN. Thus the only way to rename a client is to uninstall the host from IdM, change the host’s hostname, and install it as an IdM client with a new name. For details on how to rename a client, see Renaming IdM client systems.

What happens during client re-enrollment

During re-enrollment, IdM:

- Revokes the original host certificate
- Creates new SSH keys
- Generates a new keytab

17.2. RE-ENROLLING A CLIENT BY USING USER CREDENTIALS: INTERACTIVE RE-ENROLLMENT

This procedure describes re-enrolling an Identity Management (IdM) client interactively by using the credentials of an authorized user.

1. Re-create the client machine with the same host name.

2. Run the ipa-client-install --force-join command on the client machine:

   # ipa-client-install --force-join

3. The script prompts for a user whose identity will be used to re-enroll the client. This could be, for example, a hostadmin user with the Enrollment Administrator role:
Additional resources

- For a more detailed procedure on enrolling clients by using an authorized user’s credentials, see Installing a client by using user credentials: Interactive installation.

17.3. RE-ENROLLING A CLIENT BY USING THE CLIENT KEYTAB: NON-INTERACTIVE RE-ENROLLMENT

Prerequisites

- Back up the original client keytab file, for example in the /tmp or /root directory.

Procedure

This procedure describes re-enrolling an Identity Management (IdM) client non-interactively by using the keytab of the client system. For example, re-enrollment using the client keytab is appropriate for an automated installation.

1. Re-create the client machine with the same host name.

2. Copy the keytab file from the backup location to the /etc/ directory on the re-created client machine.

3. Use the ipa-client-install utility to re-enroll the client, and specify the keytab location with the -keytab option:

```
# ipa-client-install --keytab /etc/krb5.keytab
```

**NOTE**

The keytab specified in the --keytab option is only used when authenticating to initiate the enrollment. During the re-enrollment, IdM generates a new keytab for the client.

17.4. TESTING AN IDM CLIENT

The command-line interface informs you that the ipa-client-install was successful, but you can also do your own test.

To test that the Identity Management (IdM) client can obtain information about users defined on the server, check that you are able to resolve a user defined on the server. For example, to check the default admin user:

```
[user@client ~]$ id admin
uid=1254400000(admin) gid=1254400000(admins) groups=1254400000(admins)
```

To test that authentication works correctly, su to a root user from a non-root user:
[user@client ~]$ su -
Last login: Thu Oct 18 18:39:11 CEST 2018 from 192.168.122.1 on pts/0
[root@client ~]#
CHAPTER 18. UNINSTALLING AN IDM CLIENT

As an administrator, you can remove an Identity Management (IdM) client from the environment.

18.1. UNINSTALLING AN IDM CLIENT

Uninstalling a client removes the client from the Identity Management (IdM) domain, along with all of the specific IdM configuration of system services, such as System Security Services Daemon (SSSD). This restores the previous configuration of the client system.

Procedure

1. Enter the `ipa-client-install --uninstall` command:
   
   ```bash
   [root@client ~]# ipa-client-install --uninstall
   ```

2. Optional: Check that you cannot obtain a Kerberos ticket-granting ticket (TGT) for an IdM user:
   
   ```bash
   [root@client ~]# kinit admin
   kinit: Client 'admin@EXAMPLE.COM' not found in Kerberos database while getting initial credentials
   [root@client ~]#
   ```

   If a Kerberos TGT ticket has been returned successfully, follow the additional uninstallation steps in Uninstalling an IdM client: additional steps after multiple past installations.

3. On the client, remove old Kerberos principals from each identified keytab other than `/etc/krb5.keytab`:
   
   ```bash
   [root@client ~]# ipa-rmkeytab -k /path/to/keytab -r EXAMPLE.COM
   ```

4. On an IdM server, remove all DNS entries for the client host from IdM:
   
   ```bash
   [root@server ~]# ipa dnsrecord-del
   Record name: old-client-name
   Zone name: idm.example.com
   No option to delete specific record provided.
   Delete all? Yes/No (default No): yes
   ------------------------
   Deleted record "old-client-name"
   ```

5. On the IdM server, remove the client host entry from the IdM LDAP server. This removes all services and revokes all certificates issued for that host:
   
   ```bash
   [root@server ~]# ipa host-del client.idm.example.com
   ```

**IMPORTANT**

Removing the client host entry from the IdM LDAP server is crucial if you think you might re-enroll the client in the future, with a different IP address or a different hostname.
18.2. UNINSTALLING AN IDM CLIENT: ADDITIONAL STEPS AFTER MULTIPLE PAST INSTALLATIONS

If you install and uninstall a host as an Identity Management (IdM) client multiple times, the uninstallation procedure might not restore the pre-IdM Kerberos configuration.

In this situation, you must manually remove the IdM Kerberos configuration. In extreme cases, you must reinstall the operating system.

Prerequisites

- You have used the `ipa-client-install --uninstall` command to uninstall the IdM client configuration from the host. However, you can still obtain a Kerberos ticket-granting ticket (TGT) for an IdM user from the IdM server.

- You have checked that the `/var/lib/ipa-client/sysrestore` directory is empty and hence you cannot restore the prior-to-IdM-client configuration of the system using the files in the directory.

Procedure

1. Check the `/etc/krb5.conf.ipa` file:
   - If the contents of the `/etc/krb5.conf.ipa` file are the same as the contents of the `krb5.conf` file prior to the installation of the IdM client, you can:
     1. Remove the `/etc/krb5.conf` file:
        ```
        # rm /etc/krb5.conf
        ```
     2. Rename the `/etc/krb5.conf.ipa` file into `/etc/krb5.conf`:
        ```
        # mv /etc/krb5.conf.ipa /etc/krb5.conf
        ```
   - If the contents of the `/etc/krb5.conf.ipa` file are not the same as the contents of the `krb5.conf` file prior to the installation of the IdM client, you can at least restore the Kerberos configuration to the state directly after the installation of the operating system:
     1. Re-install the `krb5-libs` package:
        ```
        # dnf reinstall krb5-libs
        ```
        As a dependency, this command will also re-install the `krb5-workstation` package and the original version of the `/etc/krb5.conf` file.

2. Remove the `/var/log/ipaclient-install.log` file if present.

Verification steps

- Try to obtain IdM user credentials. This should fail:
  ```
  [root@r8server ~]# kinit admin
  kinit: Client 'admin@EXAMPLE.COM' not found in Kerberos database while getting initial credentials
  ```
The `/etc/krb5.conf` file is now restored to its factory state. As a result, you cannot obtain a Kerberos TGT for an IdM user on the host.
CHAPTER 19. RENAMING IDM CLIENT SYSTEMS

The following sections describe how to change the host name of an Identity Management (IdM) client system.

**WARNING**

Renaming a client is a manual procedure. Do not perform it unless changing the host name is absolutely required.

Renaming an IdM client involves:

1. Preparing the host. For details, see Preparing an IdM client for its renaming.
2. Uninstalling the IdM client from the host. For details, see Uninstalling a client.
3. Renaming the host. For details, see Renaming a client.
4. Installing the IdM client on the host with the new name. For details, see Reinstalling a client.
5. Configuring the host after the IdM client installation. For details, see Re-adding services, re-generating certificates, and re-adding host groups.

19.1. PREPARING AN IDM CLIENT FOR ITS RENAMING

Before uninstalling the current client, make note of certain settings for the client. You will apply this configuration after re-enrolling the machine with a new host name.

- Identify which services are running on the machine:
  - Use the `ipa service-find` command, and identify services with certificates in the output:

```
$ ipa service-find old-client-name.example.com
```

  - In addition, each host has a default *host service* which does not appear in the `ipa service-find` output. The service principal for the host service, also called a *host principal*, is `host/old-client-name.example.com`.

- For all service principals displayed by `ipa service-find old-client-name.example.com`, determine the location of the corresponding keytabs on the `old-client-name.example.com` system:

```
# find / -name "*.keytab"
```

Each service on the client system has a Kerberos principal in the form `service_name/host_name@REALM`, such as `ldap/old-client-name.example.com@EXAMPLE.COM`.

- Identify all host groups to which the machine belongs.
# ipa hostgroup-find old-client-name.example.com

## 19.2. UNINSTALLING AN IDM CLIENT

Uninstalling a client removes the client from the Identity Management (IdM) domain, along with all of the specific IdM configuration of system services, such as System Security Services Daemon (SSSD). This restores the previous configuration of the client system.

**Procedure**

1. Enter the `ipa-client-install --uninstall` command:

   ```
   [root@client ~]# ipa-client-install --uninstall
   ```

2. Optional: Check that you cannot obtain a Kerberos ticket-granting ticket (TGT) for an IdM user:

   ```
   [root@client ~]# kinit admin
   kinit: Client 'admin@EXAMPLE.COM' not found in Kerberos database while getting initial credentials
   [root@client ~]#
   ```

   If a Kerberos TGT ticket has been returned successfully, follow the additional uninstallation steps in [Uninstalling an IdM client: additional steps after multiple past installations](#).

3. On the client, remove old Kerberos principals from each identified keytab other than `/etc/krb5.keytab`:

   ```
   [root@client ~]# ipa-rmkeytab -k /path/to/keytab -r EXAMPLE.COM
   ```

4. On an IdM server, remove all DNS entries for the client host from IdM:

   ```
   [root@server ~]# ipa dnsrecord-del
   Record name: old-client-name
   Zone name: idm.example.com
   No option to delete specific record provided.
   Delete all? Yes/No (default No): yes
   ------------------------
   Deleted record "old-client-name"
   ```

5. On the IdM server, remove the client host entry from the IdM LDAP server. This removes all services and revokes all certificates issued for that host:

   ```
   [root@server ~]# ipa host-del client.idm.example.com
   ```

**IMPORTANT**

Removing the client host entry from the IdM LDAP server is crucial if you think you might re-enroll the client in the future, with a different IP address or a different hostname.
19.3. UNINSTALLING AN IDM CLIENT: ADDITIONAL STEPS AFTER MULTIPLE PAST INSTALLATIONS

If you install and uninstall a host as an Identity Management (IdM) client multiple times, the uninstallation procedure might not restore the pre-IdM Kerberos configuration.

In this situation, you must manually remove the IdM Kerberos configuration. In extreme cases, you must reinstall the operating system.

Prerequisites

- You have used the `ipa-client-install --uninstall` command to uninstall the IdM client configuration from the host. However, you can still obtain a Kerberos ticket-granting ticket (TGT) for an IdM user from the IdM server.

- You have checked that the `/var/lib/ipa-client/sysrestore` directory is empty and hence you cannot restore the prior-to-IdM-client configuration of the system using the files in the directory.

Procedure

1. Check the `/etc/krb5.conf.ipa` file:
   - If the contents of the `/etc/krb5.conf.ipa` file are the same as the contents of the `krb5.conf` file prior to the installation of the IdM client, you can:
     i. Remove the `/etc/krb5.conf` file:
        ```
        # rm /etc/krb5.conf
        ```
     ii. Rename the `/etc/krb5.conf.ipa` file into `/etc/krb5.conf`:
        ```
        # mv /etc/krb5.conf.ipa /etc/krb5.conf
        ```
   - If the contents of the `/etc/krb5.conf.ipa` file are not the same as the contents of the `krb5.conf` file prior to the installation of the IdM client, you can at least restore the Kerberos configuration to the state directly after the installation of the operating system:
     i. Re-install the `krb5-libs` package:
        ```
        # dnf reinstall krb5-libs
        ```
        As a dependency, this command will also re-install the `krb5-workstation` package and the original version of the `/etc/krb5.conf` file.

2. Remove the `/var/log/ipaclient-install.log` file if present.

Verification steps

- Try to obtain IdM user credentials. This should fail:
  ```
  [root@r8server ~]# kinit admin
  kinit: Client 'admin@EXAMPLE.COM' not found in Kerberos database while getting initial credentials
  [root@r8server ~]#
  ```
The `/etc/krb5.conf` file is now restored to its factory state. As a result, you cannot obtain a Kerberos TGT for an IdM user on the host.

19.4. RENAMING THE HOST SYSTEM

Rename the machine as required. For example:

```
# hostnamectl set-hostname new-client-name.example.com
```

You can now re-install the Identity Management (IdM) client to the IdM domain with the new host name.

19.5. RE-INSTALLING AN IDM CLIENT

Install an client on your renamed host following the procedure described in Installing a client.

19.6. RE-ADDING SERVICES, RE-GENERATING CERTIFICATES, AND RE-ADDING HOST GROUPS

On the Identity Management (IdM) server, add a new keytab for every service identified in the Preparing an IdM client for its renaming.

1. Generate certificates for services that had a certificate assigned in the Preparing an IdM client for its renaming. You can do this:
   - Using the IdM administration tools
   - Using the `certmonger` utility
2. Re-add the client to the host groups identified in the Preparing an IdM client for its renaming.
CHAPTER 20. PREPARING THE SYSTEM FOR IDM REPLICA INSTALLATION

The following links list the requirements to install an Identity Management (IdM) replica. Before the installation, make sure your system meets these requirements.

1. Ensure the target system meets the general requirements for IdM server installation.

2. Ensure the target system meets the additional requirements for IdM replica installation.

3. Authorize the target system for enrollment into the IdM domain. For more information, see one of the following sections that best fits your needs:
   - Authorizing the installation of a replica on an IdM client
   - Authorizing the installation of a replica on a system that is not enrolled into IdM

20.1. REPLICA VERSION REQUIREMENTS

An IdM replica must be running the same or later version of IdM as other servers. For example:

- You have an IdM server installed on Red Hat Enterprise Linux 9 and it uses IdM 4.x packages.
- You must install the replica also on Red Hat Enterprise Linux 9 and use IdM version 4.x or later.

This ensures that configuration can be properly copied from the server to the replica.

For details on how to display the IdM software version, see Methods for displaying IdM software version.

20.2. METHODS FOR DISPLAYING IDM SOFTWARE VERSION

You can display the IdM version number with:

- the IdM WebUI
- ipa commands
- rpm commands

Displaying version through the WebUI

In the IdM WebUI, the software version can be displayed by choosing About from the username menu at the top-right.
Displaying version with `ipa` commands

From the command line, use the `ipa --version` command.

```
[root@server ~]# ipa --version
VERSION: 4.8.0, API_VERSION: 2.233
```

Displaying version with `rpm` commands

If IdM services are not operating properly, you can use the `rpm` utility to determine the version number of the `ipa-server` package that is currently installed.

```
[root@server ~]# rpm -q ipa-server
ipa-server-4.8.0-11.module+el8.1.0+4247+9f3fd721.x86_64
```

20.3. AUTHORIZING THE INSTALLATION OF A REPLICA ON AN IDM CLIENT

When installing a replica on an existing Identity Management (IdM) client by running the `ipa-replica-install` utility, choose Method 1 or Method 2 below to authorize the replica installation. Choose Method 1 if one of the following applies:

- You want a senior system administrator to perform the initial part of the procedure and a junior administrator to perform the rest.
- You want to automate your replica installation.

**Method 1: the `ipaservers` host group**

1. Log in to any IdM host as IdM admin:

   `$ kinit admin`

2. Add the client machine to the `ipaservers` host group:

   `$ ipa hostgroup-add-member ipaservers --hosts client.idm.example.com`

   Host-group: ipaservers
   Description: IPA server hosts
Member hosts: server.idm.example.com, client.idm.example.com

Number of members added 1

NOTE
Membership in the `ipaservers` group grants the machine elevated privileges similar to the administrator’s credentials. Therefore, in the next step, the `ipa-replica-install` utility can be run on the host successfully by a junior system administrator.

Method 2: a privileged user’s credentials
Choose one of the following methods to authorize the replica installation by providing a privileged user’s credentials:

- Let Identity Management (IdM) prompt you for the credentials interactively after you start the `ipa-replica-install` utility. This is the default behavior.

- Log in to the client as a privileged user immediately before running the `ipa-replica-install` utility. The default privileged user is `admin`:

```sh
$ kinit admin
```

Additional resources

- To start the installation procedure, see Installing an IdM replica.

- You can use an Ansible playbook to install IdM replicas. For more information, see Installing an Identity Management replica using an Ansible playbook.

## 20.4. AUTHORIZING THE INSTALLATION OF A REPLICA ON A SYSTEM THAT IS NOT ENROLLED INTO IDM

When installing a replica on a system that is not enrolled in the Identity Management (IdM) domain, the `ipa-replica-install` utility first enrolls the system as a client and then installs the replica components. For this scenario, choose Method 1 or Method 2 below to authorize the replica installation. Choose Method 1 if one of the following applies:

- You want a senior system administrator to perform the initial part of the procedure and a junior administrator to perform the rest.

- You want to automate your replica installation.

Method 1: a random password generated on an IdM server
Enter the following commands on any server in the domain:

1. Log in as the administrator.

```sh
$ kinit admin
```
2. Add the external system as an IdM host. Use the \texttt{--random} option with the \texttt{ipa host-add} command to generate a random one-time password to be used for the subsequent replica installation.

\begin{verbatim}
$ ipa host-add replica.example.com --random

Added host "replica.example.com"

Host name: replica.example.com
Random password: W5YpARl=7M.n
Password: True
Keytab: False
Managed by: server.example.com
\end{verbatim}

The generated password will become invalid after you use it to enroll the machine into the IdM domain. It will be replaced with a proper host keytab after the enrollment is finished.

3. Add the system to the \texttt{ipaservers} host group.

\begin{verbatim}
$ ipa hostgroup-add-member ipaservers --hosts replica.example.com

Host-group: ipaservers
Description: IPA server hosts
Member hosts: server.example.com, replica.example.com

Number of members added 1
\end{verbatim}

\textbf{NOTE}

Membership in the \texttt{ipaservers} group grants the machine elevated privileges similar to the administrator's credentials. Therefore, in the next step, the \texttt{ipa-replica-install} utility can be run on the host successfully by a junior system administrator that provides the generated random password.

\textbf{Method 2: a privileged user's credentials}

Using this method, you authorize the replica installation by providing a privileged user's credentials. The default privileged user is \texttt{admin}.

No action is required prior to running the IdM replica installation utility. Add the principal name and password options (\texttt{--principal admin --admin-password password}) to the \texttt{ipa-replica-install} command directly during the installation.

\textbf{Additional resources}

- To start the installation procedure, see Installing an IdM replica.
- You can use an Ansible playbook to install IdM replicas. For more information, see Installing an Identity Management replica using an Ansible playbook.
CHAPTER 21. INSTALLING AN IDM REPLICA

The following sections describe how to install an Identity Management (IdM) replica. The replica installation process copies the configuration of the existing server and installs the replica based on that configuration.

Prerequisites

- Ensure your system is prepared for IdM replica installation.

**IMPORTANT**

If this preparation is not performed, installing an IdM replica will fail.

**NOTE**

Install one IdM replica at a time. The installation of multiple replicas at the same time is not supported.

Procedure

For the individual types of replica installation procedures, see:

- Section 21.1, “Installing an IdM replica with integrated DNS and a CA”
- Section 21.2, “Installing an IdM replica with integrated DNS and no CA”
- Section 21.3, “Installing an IdM replica without integrated DNS and with a CA”
- Section 21.4, “Installing an IdM replica without integrated DNS and without a CA”
- Section 21.5, “Installing an IdM hidden replica”

To troubleshoot the replica installation procedure, see:

- Chapter 22, *Troubleshooting IdM replica installation*

After the installation, see:

- Section 21.6, “Testing an IdM replica”

21.1. INSTALLING AN IDM REPLICA WITH INTEGRATED DNS AND A CA

This procedure describes installing an Identity Management (IdM) replica:

- With integrated DNS
- With a certificate authority (CA)

You can do this to, for example, replicate the CA service for resiliency after installing an IdM server with an integrated CA.
**IMPORTANT**

When configuring a replica with a CA, the CA configuration of the replica must mirror the CA configuration of the other server.

For example, if the server includes an integrated IdM CA as the root CA, the new replica must also be installed with an integrated CA as the root CA. No other CA configuration is available in this case.

Including the `--setup-ca` option in the `ipa-replica-install` command copies the CA configuration of the initial server.

**Prerequisites**

- Ensure your system is prepared for an IdM replica installation.

**Procedure**

1. Enter `ipa-replica-install` with these options:
   - `--setup-dns` to configure the replica as a DNS server
   - `--forwarder` to specify a per-server forwarder, or `--no-forwarder` if you do not want to use any per-server forwarders. To specify multiple per-server forwarders for failover reasons, use `--forwarder` multiple times.

   **NOTE**

   The `ipa-replica-install` utility accepts a number of other options related to DNS settings, such as `--no-reverse` or `--no-host-dns`. For more information about them, see the `ipa-replica-install(1)` man page.

   - `--setup-ca` to include a CA on the replica

   For example, to set up a replica with an integrated DNS server and a CA that forwards all DNS requests not managed by the IdM servers to the DNS server running on IP 192.0.2.1:

   ```bash
   # ipa-replica-install --setup-dns --forwarder 192.0.2.1 --setup-ca
   ```

2. After the installation completes, add a DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is `idm.example.com`, add a name server (NS) record to the `example.com` parent domain.

   **IMPORTANT**

   Repeat this step each time after you install an IdM DNS server.

**21.2. INSTALLING AN IDM REPLICA WITH INTEGRATED DNS AND NO CA**

This procedure describes installing an Identity Management (IdM) replica:

- With integrated DNS
• Without a certificate authority (CA) in an IdM environment in which a CA is already installed. The replica will forward all certificate operations to the IdM server with a CA installed.

Prerequisites

• Ensure your system is prepared for an IdM replica installation.

Procedure

1. Enter `ipa-replica-install` with these options:
   
   - `--setup-dns` to configure the replica as a DNS server
   
   - `--forwarder` to specify a per-server forwarder, or `--no-forwarder` if you do not want to use any per-server forwarders. To specify multiple per-server forwarders for failover reasons, use `--forwarder` multiple times.

   For example, to set up a replica with an integrated DNS server that forwards all DNS requests not managed by the IdM servers to the DNS server running on IP 192.0.2.1:

   ```
   # ipa-replica-install --setup-dns --forwarder 192.0.2.1
   ```

   **NOTE**
   
   The `ipa-replica-install` utility accepts a number of other options related to DNS settings, such as `--no-reverse` or `--no-host-dns`. For more information about them, see the `ipa-replica-install(1)` man page.

2. After the installation completes, add a DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is `idm.example.com`, add a name server (NS) record to the `example.com` parent domain.

   **IMPORTANT**
   
   Repeat this step each time after you install an IdM DNS server.

21.3. INSTALLING AN IDM REPLICA WITHOUT INTEGRATED DNS AND WITH A CA

This procedure describes installing an Identity Management (IdM) replica:

• Without integrated DNS

• With a certificate authority (CA)
When configuring a replica with a CA, the CA configuration of the replica must mirror the CA configuration of the other server.

For example, if the server includes an integrated IdM CA as the root CA, the new replica must also be installed with an integrated CA as the root CA. No other CA configuration is available in this case.

Including the --setup-ca option in the ipa-replica-install command copies the CA configuration of the initial server.

Prerequisites

- Ensure your system is prepared for an IdM replica installation.

Procedure

1. Enter ipa-replica-install with the --setup-ca option.

   ```
   # ipa-replica-install --setup-ca
   ```

2. Add the newly created IdM DNS service records to your DNS server:

   a. Export the IdM DNS service records into a file in the nsupdate format:

   ```
   $ ipa dns-update-system-records --dry-run --out dns_records_file.nsupdate
   ```

   b. Submit a DNS update request to your DNS server using the nsupdate utility and the dns_records_file.nsupdate file. For more information, see Updating External DNS Records Using nsupdate in RHEL 7 documentation. Alternatively, refer to your DNS server documentation for adding DNS records.

21.4. INSTALLING AN IDM REPLICA WITHOUT INTEGRATED DNS AND WITHOUT A CA

This procedure describes installing an Identity Management (IdM) replica:

- Without integrated DNS
- Without a certificate authority (CA) by providing the required certificates manually. The assumption here is that the first server was installed without a CA.

**IMPORTANT**

You cannot install a server or replica using self-signed third-party server certificates because the imported certificate files must contain the full CA certificate chain of the CA that issued the LDAP and Apache server certificates.

Prerequisites

- Ensure your system is prepared for an IdM replica installation.

Procedure
Enter **ipa-replica-install**, and provide the required certificate files by adding these options:

- `--dirsrv-cert-file`
- `--dirsrv-pin`
- `--http-cert-file`
- `--http-pin`

For details about the files that are provided using these options, see Section 4.1, “Certificates required to install an IdM server without a CA”.

For example:

```
# ipa-replica-install \
  --dirsrv-cert-file /tmp/server.crt \ 
  --dirsrv-cert-file /tmp/server.key \
  --dirsrv-pin secret \  
  --http-cert-file /tmp/server.crt \ 
  --http-cert-file /tmp/server.key \ 
  --http-pin secret
```

**NOTE**

Do not add the `--ca-cert-file` option. The **ipa-replica-install** utility takes this part of the certificate information automatically from the first server you installed.

### 21.5. INSTALLING AN IDM HIDDEN REPLICA

A hidden (unadvertised) replica is an Identity Management (IdM) server that has all services running and available. However, it has no SRV records in DNS, and LDAP server roles are not enabled. Therefore, clients cannot use service discovery to detect these hidden replicas.

For further details about hidden replicas, see The hidden replica mode.

**Prerequisites**

- Ensure your system is prepared for an IdM replica installation.

**Procedure**

- To install a hidden replica, use the following command:

```
ipa-replica-install --hidden-replica
```

Note that the command installs a replica without DNS SRV records and with disabled LDAP server roles.

You can also change the mode of existing replica to hidden. For details, see Demotion and promotion of hidden replicas.

### 21.6. TESTING AN IDM REPLICA
After creating a replica, check if the replica replicates data as expected. You can use the following procedure.

**Procedure**

1. Create a user on the new replica:
   
   ```
   [admin@new_replica ~]$ ipa user-add test_user
   ```

2. Make sure the user is visible on another replica:
   
   ```
   [admin@another_replica ~]$ ipa user-show test_user
   ```

21.7. CONNECTIONS PERFORMED DURING AN IDM REPLICA INSTALLATION

*Requests performed during an IdM replica installation* lists the operations performed by *ipa-replica-install*, the Identity Management (IdM) replica installation tool.

**Table 21.1. Requests performed during an IdM replica installation**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Protocol used</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNS resolution against the DNS resolvers configured on the client system</td>
<td>DNS</td>
<td>To discover the IP addresses of IdM servers</td>
</tr>
<tr>
<td>Requests to ports 88 (TCP/TCP6 and UDP/UDP6) on the discovered IdM servers</td>
<td>Kerberos</td>
<td>To obtain a Kerberos ticket</td>
</tr>
<tr>
<td>JSON-RPC calls to the IdM Apache-based web-service on the discovered or configured IdM servers</td>
<td>HTTPS</td>
<td>IdM client enrollment; replica keys retrieval and certificate issuance if required</td>
</tr>
<tr>
<td>Requests over TCP/TCP6 to port 389 on the IdM server, using SASL GSSAPI authentication, plain LDAP, or both</td>
<td>LDAP</td>
<td>IdM client enrollment; CA certificate chain retrieval; LDAP data replication</td>
</tr>
<tr>
<td>Requests over TCP/TCP6 to port 22 on IdM server</td>
<td>SSH</td>
<td>To check if the connection is working</td>
</tr>
<tr>
<td>(optionally) Access over port 8443 (TCP/TCP6) on the IdM servers</td>
<td>HTTPS</td>
<td>To administer the Certificate Authority on the IdM server (only during IdM server and replica installation)</td>
</tr>
</tbody>
</table>
CHAPTER 22. TROUBLESHOOTING IDM REPLICA INSTALLATION

The following sections describe the process for gathering information about a failing IdM replica installation, and how to resolve some common installation issues.

22.1. REVIEWING IDM REPLICA INSTALLATION ERRORS

This procedure describes how to troubleshoot a failing IdM replica installation.

When you install an Identity Management (IdM) replica, debugging information is appended to the following log files on the replica:

- /var/log/ipareplica-install.log
- /var/log/ipareplica-conncheck.log
- /var/log/ipaclient-install.log
- /var/log/httpd/error_log
- /var/log/dirsrv/slapd-INSTANCE-NAME/access
- /var/log/dirsrv/slapd-INSTANCE-NAME/errors
- /var/log/ipaserver-install.log

The replica installation process also appends debugging information to the following log files on the IdM server the replica is contacting:

- /var/log/httpd/error_log
- /var/log/dirsrv/slapd-INSTANCE-NAME/access
- /var/log/dirsrv/slapd-INSTANCE-NAME/errors

The last line of each log file reports success or failure, and ERROR and DEBUG entries provide additional context.

To troubleshoot a failing IdM replica installation, review the errors at the end of these log files on both hosts (replica and server) and use this information to resolve any corresponding issues.

Prerequisites

- You must have root privileges to display the contents of IdM log files.

Procedure

1. Use the tail command to display the latest errors from the primary log file /var/log/ipareplica-install.log. The following example displays the last 10 lines.

```
[user@replica ~]$ sudo tail -n 10 /var/log/ipareplica-install.log
[sudo] password for user:
func(installer)
File "/usr/lib/python3.6/site-packages/ipaserver/install/server/replicainstall.py", line 424, in
```
decorated
func(installer)
File "/usr/lib/python3.6/site-packages/ipaserver/install/server/replicainstall.py", line 785, in
promote_check
ensure_enrolled(installer)
File "/usr/lib/python3.6/site-packages/ipaserver/install/server/replicainstall.py", line 740, in
ensure_enrolled
raise ScriptError("Configuration of client side components failed!")

2020-05-28T18:24:51Z DEBUG The ipa-replica-install command failed, exception: 
ScriptError: Configuration of client side components failed!

2. To review the log file interactively, open the end of the log file using the less utility and use the ↑ and ↓ arrow keys to navigate.

   [user@replica ~]$ sudo less -N +G /var/log/ipareplica-install.log

3. (Optional) While /var/log/ipareplica-install.log is the primary log file for a replica installation, you can gather additional troubleshooting information by repeating this review process with additional files on the replica and the server.

   On the replica:

   [user@replica ~]$ sudo less -N +G /var/log/ipareplica-conncheck.log
   [user@replica ~]$ sudo less -N +G /var/log/ipaclient-install.log
   [user@replica ~]$ sudo less -N +G /var/log/httpd/error_log
   [user@replica ~]$ sudo less -N +G /var/log/dirsrv/slapd-INSTANCE-NAME/access
   [user@replica ~]$ sudo less -N +G /var/log/dirsrv/slapd-INSTANCE-NAME/errors
   [user@replica ~]$ sudo less -N +G /var/log/ipaserver-install.log

   On the server:

   [user@server ~]$ sudo less -N +G /var/log/httpd/error_log
   [user@server ~]$ sudo less -N +G /var/log/dirsrv/slapd-INSTANCE-NAME/access
   [user@server ~]$ sudo less -N +G /var/log/dirsrv/slapd-INSTANCE-NAME/errors

Additional resources

- If you are unable to resolve a failing replica installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the replica and an sosreport of the server.

- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

22.2. REVIEWING IDM CA INSTALLATION ERRORS
Installing the Certificate Authority (CA) service on an Identity Management (IdM) replica appends debugging information to several locations on the replica and the IdM server the replica communicates with.

Table 22.1. On the replica (in order of recommended priority):

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/var/log/pki/pki-ca-spawn.$TIME_OF_INSTALLATION.log</td>
<td>High-level issues and Python traces for the pkispawn installation process</td>
</tr>
<tr>
<td>journalctl -u pki-tomcatd@pki-tomcat output</td>
<td>Errors from the pki-tomcatd@pki-tomcat service</td>
</tr>
<tr>
<td>/var/log/pki/pki-tomcat/ca/debug.$DATE.log</td>
<td>Large JAVA stacktraces of activity in the core of the Public Key Infrastructure (PKI) product</td>
</tr>
<tr>
<td>/var/log/pki/pki-tomcat/ca/signedAudit/ca_audit</td>
<td>Audit log of the PKI product</td>
</tr>
<tr>
<td>● /var/log/pki/pki-tomcat/ca/system</td>
<td>Low-level debug data of certificate operations for service principals, hosts, and other entities that use certificates</td>
</tr>
<tr>
<td>● /var/log/pki/pki-tomcat/ca/transactions</td>
<td></td>
</tr>
<tr>
<td>● /var/log/pki/pki-tomcat/catalina.$DATE.log</td>
<td></td>
</tr>
</tbody>
</table>

On the server contacted by the replica:

- /var/log/httpd/error_log log file

Installing the CA service on an existing IdM replica also writes debugging information to the following log file:

- /var/log/ipareplica-ca-install.log log file

**NOTE**

If a full IdM replica installation fails while installing the optional CA component, no details about the CA are logged; a message is logged in the /var/log/ipareplica-install.log file indicating that the overall installation process failed. Red Hat recommends reviewing the log files listed above for details specific to the CA installation failure.

The only exception to this behavior is when you are installing the CA service and the root CA is an external CA. If there is an issue with the certificate from the external CA, errors are logged in /var/log/ipareplica-install.log.

To troubleshoot a failing IdM CA installation, review the errors at the end of these log files and use this information to resolve any corresponding issues.

**Prerequisites**
• You must have root privileges to display the contents of IdM log files.

Procedure

1. To review a log file interactively, open the end of the log file using the less utility and use the ↑ and ↓ arrow keys to navigate, while searching for ScriptError entries. The following example opens /var/log/pki/pki-ca-spawn.$TIME_OF_INSTALLATION.log.

   [user@server ~]$ sudo less -N +G /var/log/pki/pki-ca-spawn.20200527185902.log

2. Gather additional troubleshooting information by repeating this review process with all the log files listed above.

Additional resources

• If you are unable to resolve a failing IdM server installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the server.

• The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

22.3. REMOVING A PARTIAL IDM REPLICA INSTALLATION

If an IdM replica installation fails, some configuration files may be left behind. Additional attempts to install the IdM replica can fail and the installation script reports that IPA is already configured:

Example system with existing partial IdM configuration

[root@server ~]# ipa-replica-install
Your system may be partly configured.
Run /usr/sbin/ipa-server-install --uninstall to clean up.

IPA server is already configured on this system.
If you want to reinstall the IPA server, please uninstall it first using 'ipa-server-install --uninstall'.
The ipa-replica-install command failed. See /var/log/ipareplica-install.log for more information

To resolve this issue, uninstall IdM software from the replica, remove the replica from the IdM topology, and retry the installation process.

Prerequisites

• You must have root privileges.

Procedure

1. Uninstall the IdM server software on the host you are trying to configure as an IdM replica.

   [root@replica ~]# ipa-server-install --uninstall

2. On all other servers in the topology, use the ipa server-del command to delete any references to the replica that did not install properly.
   -
3. Attempt installing the replica.

4. If you continue to experience difficulty installing an IdM replica because of repeated failed installations, reinstall the operating system.
   One of the requirements for installing an IdM replica is a clean system without any customization. Failed installations may have compromised the integrity of the host by unexpectedly modifying system files.

Additional resources

- For additional details on uninstalling an IdM replica, see Uninstalling an IdM replica.
- If installation attempts fail after repeated uninstallation attempts, and you have a Red Hat Technical Support subscription, open a Technical Support case at the Red Hat Customer Portal and provide an sosreport of the replica and an sosreport of the server.
- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see What is an sosreport and how to create one in Red Hat Enterprise Linux?

22.4. RESOLVING INVALID CREDENTIAL ERRORS

If an IdM replica installation fails with an Invalid credentials error, the system clocks on the hosts may be out of sync with each other:

```
[27/40]: setting up initial replication
Starting replication, please wait until this has completed.
Update in progress, 15 seconds elapsed

[error] RuntimeError: Failed to start replication
Your system may be partly configured.
Run /usr/sbin/ipa-server-install --uninstall to clean up.
```

ipa.ipapython.install.cli.install_tool(CompatServerReplicaInstall): ERROR Failed to start replication
ipa.ipapython.install.cli.install_tool(CompatServerReplicaInstall): ERROR The ipa-replica-install command failed. See /var/log/ipareplica-install.log for more information

If you use the --no-ntp or -N options to attempt the replica installation while clocks are out of sync, the installation fails because services are unable to authenticate with Kerberos.

To resolve this issue, synchronize the clocks on both hosts and retry the installation process.

Prerequisites

- You must have root privileges to change system time.

Procedure

1. Synchronize the system clocks manually or with chronyd.
Synchronizing manually

Display the system time on the server and set the replica’s time to match.

[user@server ~]$ date
Thu May 28 21:03:57 EDT 2020

[user@replica ~]$ sudo timedatectl set-time '2020-05-28 21:04:00'

- **Synchronizing with chronyd:**
  
  See [Using the Chrony suite to configure NTP](#) to configure and set system time with chrony tools.

2. Attempt the IdM replica installation again.

**Additional resources**

- If you are unable to resolve a failing replica installation, and you have a Red Hat Technical Support subscription, open a Technical Support case at the [Red Hat Customer Portal](#) and provide an sosreport of the replica and an sosreport of the server.

- The sosreport utility collects configuration details, logs and system information from a RHEL system. For more information on the sosreport utility, see [What is an sosreport and how to create one in Red Hat Enterprise Linux?](#).

**22.5. ADDITIONAL RESOURCES**

- To troubleshoot installing the first IdM server, see [Troubleshooting IdM server installation](#).

- To troubleshoot installing an IdM client, see [Troubleshooting IdM client installation](#).
CHAPTER 23. UNINSTALLING AN IDM REPLICA

As an IdM administrator, you can remove an Identity Management (IdM) replica from the topology. For more information, see Uninstalling an IdM server.
CHAPTER 24. MANAGING REPPLICATION TOPOLOGY

This chapter describes how to manage replication between servers in an Identity Management (IdM) domain.

24.1. EXPLAINING REPLICATION AGREEMENTS, TOPOLOGY SUFFIXES AND TOPOLOGY SEGMENTS

When you create a replica, Identity Management (IdM) creates a replication agreement between the initial server and the replica. The data that is replicated is then stored in topology suffixes and when two replicas have a replication agreement between their suffixes, the suffixes form a topology segment. These concepts are explained in more detail in the following sections:

- Replication agreements
- Topology suffixes
- Topology segments

24.1.1. Replication agreements

When an administrator creates a replica based on an existing server, Identity Management (IdM) creates a replication agreement between the initial server and the replica. The replication agreement ensures that the data and configuration is continuously replicated between the two servers.

IdM uses multiple read/write replica replication. In this configuration, all replicas joined in a replication agreement receive and provide updates, and are therefore considered suppliers and consumers. Replication agreements are always bilateral.

Figure 24.1. Server and replica agreements

IdM uses two types of replication agreements:

Domain replication agreements

These agreements replicate the identity information.

Certificate replication agreements

These agreements replicate the certificate information.

Both replication channels are independent. Two servers can have one or both types of replication agreements configured between them. For example, when server A and server B have only domain replication agreement configured, only identity information is replicated between them, not the certificate information.
24.1.2. Topology suffixes

Topology suffixes store the data that is replicated. IdM supports two types of topology suffixes: **domain** and **ca**. Each suffix represents a separate server, a separate replication topology.

When a replication agreement is configured, it joins two topology suffixes of the same type on two different servers.

**The domain suffix: dc=example,dc=com**

The domain suffix contains all domain-related data. When two replicas have a replication agreement between their domain suffixes, they share directory data, such as users, groups, and policies.

**The ca suffix: o=ipaca**

The ca suffix contains data for the Certificate System component. It is only present on servers with a certificate authority (CA) installed. When two replicas have a replication agreement between their ca suffixes, they share certificate data.

An initial topology replication agreement is set up between two servers by the **ipa-replica-install** script when installing a new replica.

**Example 24.1. Viewing topology suffixes**

The **ipa topologysuffix-find** command displays a list of topology suffixes:

```
$ ipa topologysuffix-find
---------------------------
2 topology suffixes matched
---------------------------
Suffix name: ca
Managed LDAP suffix DN: o=ipaca

Suffix name: domain
Managed LDAP suffix DN: dc=example,dc=com
---------------------------
Number of entries returned 2
---------------------------
```
24.1.3. Topology segments

When two replicas have a replication agreement between their suffixes, the suffixes form a **topology segment**. Each topology segment consists of a *left node* and a *right node*. The nodes represent the servers joined in the replication agreement.

Topology segments in IdM are always bidirectional. Each segment represents two replication agreements: from server A to server B, and from server B to server A. The data is therefore replicated in both directions.

**Figure 24.3. Topology segments**

![Topology segments diagram]

**Example 24.2. Viewing topology segments**

The `ipa topologysegment-find` command shows the current topology segments configured for the domain or CA suffixes. For example, for the domain suffix:

```
$ ipa topologysegment-find
Suffix name: domain
-----------------  
1 segment matched  
-----------------
Segment name: server1.example.com-to-server2.example.com
Left node: server1.example.com
Right node: server2.example.com
Connectivity: both
-----------------
Number of entries returned 1
-----------------  
```

In this example, domain-related data is only replicated between two servers: `server1.example.com` and `server2.example.com`.

To display details for a particular segment only, use the `ipa topologysegment-show` command:

```
$ ipa topologysegment-show
Suffix name: domain
Segment name: server1.example.com-to-server2.example.com
Segment name: server1.example.com-to-server2.example.com
Left node: server1.example.com
Right node: server2.example.com
Connectivity: both
```
24.2. USING THE TOPOLOGY GRAPH TO MANAGE REPLICATION TOPOLOGY

The topology graph in the web UI shows the relationships between the servers in the domain. Using the Web UI, you can manipulate and transform the representation of the topology.

Accessing the topology graph

To access the topology graph:

1. Select IPA Server → Topology → Topology Graph.
2. If you make any changes to the topology that are not immediately reflected in the graph, click Refresh.

Interpreting the topology graph

Servers joined in a domain replication agreement are connected by an orange arrow. Servers joined in a CA replication agreement are connected by a blue arrow.

Topology graph example: recommended topology

The recommended topology example below shows one of the possible recommended topologies for four servers: each server is connected to at least two other servers, and more than one server is a CA master.

Figure 24.4. Recommended topology example

Topology graph example: discouraged topology

In the discouraged topology example below, server1 is a single point of failure. All the other servers have replication agreements with this server, but not with any of the other servers. Therefore, if server1 fails, all the other servers will become isolated. Avoid creating topologies like this.
Customizing the topology view

You can move individual topology nodes by dragging the mouse:

You can zoom in and zoom out the topology graph using the mouse wheel:
24.3. SETTING UP REPLICATION BETWEEN TWO SERVERS USING THE WEB UI

Using the Web interface of Identity Management (IdM) you can choose two servers and create new replication agreement between them.

Prerequisites

- You have the IdM administrator credentials.

Procedure

1. In the topology graph, hover your mouse over one of the server nodes.
2. Click on the **domain** or the **ca** part of the circle depending on what type of topology segment you want to create.

3. A new arrow representing the new replication agreement appears under your mouse pointer. Move your mouse to the other server node, and click on it.

4. In the **Add topology segment** window, click **Add** to confirm the properties of the new segment.

The new topology segment between the two servers joins them in a replication agreement. The topology graph now shows the updated replication topology:
24.4. STOPPING REPLICATION BETWEEN TWO SERVERS USING THE WEB UI

Using the web interface of Identity Management (IdM) you can remove a replication agreement from servers.

Prerequisites

- You have the IdM administrator credentials.

Procedure

1. Click on an arrow representing the replication agreement you want to remove. This highlights the arrow.

   Figure 24.12. Topology segment highlighted

2. Click Delete.

3. In the Confirmation window, click OK.
IdM removes the topology segment between the two servers, which deletes their replication agreement. The topology graph now shows the updated replication topology:

Figure 24.13. Topology segment deleted

24.5. SETTING UP REPLICATION BETWEEN TWO SERVERS USING THE CLI

You can configure replication agreements between two servers using the `ipa topologysegment-add` command.

**Prerequisites**

- You have the IdM administrator credentials.

**Procedure**

1. Use the `ipa topologysegment-add` command to create a topology segment for the two servers. When prompted, provide:

   - the required topology suffix: `domain` or `ca`
   - the left node and the right node, representing the two servers
   - optionally, a custom name for the segment
   
   For example:

   ```bash
   $ ipa topologysegment-add
   Suffix name: domain
   Left node: server1.example.com
   Right node: server2.example.com
   Segment name [server1.example.com-to-server2.example.com]: new_segment
   ---------------------------
   Added segment "new_segment"
   ---------------------------
   Segment name: new_segment
   Left node: server1.example.com
   Right node: server2.example.com
   Connectivity: both
   ```

   Adding the new segment joins the servers in a replication agreement.
2. Optional. Use the `ipa topologysegment-show` command to verify that the new segment is configured.

```
$ ipa topologysegment-show
Suffix name: domain
Segment name: new_segment
Segment name: new_segment
Left node: server1.example.com
Right node: server2.example.com
Connectivity: both
```

24.6. STOPPING REPLICATION BETWEEN TWO SERVERS USING THE CLI

You can terminate replication agreements from command line using the `ipa topology_segment-del` command.

Prerequisites

- You have the IdM administrator credentials.

Procedure

1. To stop replication, you must delete the corresponding replication segment between the servers. To do that, you need to know the segment name.
   If you do not know the name, use the `ipa topologysegment-find` command to display all segments, and locate the required segment in the output. When prompted, provide the required topology suffix: `domain` or `ca`. For example:

```
$ ipa topologysegment-find
Suffix name: domain
------------------
8 segments matched
------------------
    Segment name: new_segment
    Left node: server1.example.com
    Right node: server2.example.com
    Connectivity: both
...
------------------
Number of entries returned 8
------------------
```

2. Use the `ipa topologysegment-del` command to remove the topology segment joining the two servers.

```
$ ipa topologysegment-del
Suffix name: domain
Segment name: new_segment
```
Deleting the segment removes the replication agreement.

3. **Optional.** Use the `ipa topologysegment-find` command to verify that the segment is no longer listed.

```bash
$ ipa topologysegment-find
Suffix name: domain
-----------
7 segments matched
-----------
Segment name: server2.example.com-to-server3.example.com
Left node: server2.example.com
Right node: server3.example.com
Connectivity: both
...
-----------
Number of entries returned 7
-----------
```

### 24.7. REMOVING SERVER FROM TOPOLOGY USING THE WEB UI

You can use Identity Management (IdM) web interface to remove a server from the topology.

**Prerequisites**

- You have the IdM administrator credentials.
- The server you want to remove is **not** the only server connecting other servers with the rest of the topology; this would cause the other servers to become isolated, which is not allowed.
- The server you want to remove is **not** your last CA or DNS server.

**WARNING**

Removing a server is an irreversible action. If you remove a server, the only way to introduce it back into the topology is to install a new replica on the machine.

**Procedure**

To remove a server from the topology without uninstalling the server components from the machine:

1. Select **IPA Server → Topology → IPA Servers**.
2. Click on the name of the server you want to delete.
24.8. REMOVING SERVER FROM TOPOLOGY USING THE CLI

You can use the command line interface to remove a server from the topology.

Prerequisites

- You have the IdM administrator credentials.

- The server you want to remove is not the only server connecting other servers with the rest of the topology; this would cause the other servers to become isolated, which is not allowed.

- The server you want to remove is not your last CA or DNS server.

**IMPORTANT**

Removing a server is an irreversible action. If you remove a server, the only way to introduce it back into the topology is to install a new replica on the machine.

Procedure

To remove server1.example.com:

1. On another server, run the `ipa server-del` command to remove server1.example.com. The command removes all topology segments pointing to the server:

   ```
   [user@server2 ~]$ ipa server-del
   Server name: server1.example.com
   Removing server1.example.com from replication topology, please wait...
   ----------------------------------------------------------
   Deleted IPA server "server1.example.com"
   ----------------------------------------------------------
   ```

2. Optional: on server1.example.com, run the `ipa server-install --uninstall` command to uninstall the server components from the machine.

   ```
   [root@server1 ~]# ipa server-install --uninstall
   ```
24.9. VIEWING SERVER ROLES ON AN IDM SERVER USING THE WEB UI

Based on the services installed on an IdM server, it can perform various server roles. For example:

- CA server
- DNS server
- Key recovery authority (KRA) server.

For a complete list of the supported server roles, see IPA Server → Topology → Server Roles.

**NOTE**

- Role status **absent** means that no server in the topology is performing the role.
- Role status **enabled** means that one or more servers in the topology are performing the role.

Figure 24.15. Server roles in the web UI

<table>
<thead>
<tr>
<th>Role name</th>
<th>Role status</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD trust agent</td>
<td>absent</td>
</tr>
<tr>
<td>AD trust controller</td>
<td>absent</td>
</tr>
<tr>
<td>CA server</td>
<td>enabled</td>
</tr>
</tbody>
</table>

24.10. VIEWING SERVER ROLES ON AN IDM SERVER USING THE CLI

Based on the services installed on an IdM server, it can perform various server roles. For example:

- CA server
- DNS server
- Key recovery authority (KRA) server.

You can view which servers perform which roles in the topology using the following commands.

- The **ipa config-show** command displays all CA servers and the current CA renewal server:

  ```
  $ ipa config-show
  ...
  IPA masters: server1.example.com, server2.example.com, server3.example.com
  IPA CA servers: server1.example.com, server2.example.com
  IPA CA renewal master: server1.example.com
  ```

- The **ipa server-show** command displays a list of roles enabled on a particular server. For example, for a list of roles enabled on server.example.com:
$ ipa server-show
Server name: server.example.com
...
Enabled server roles: CA server, DNS server, KRA server

- The `ipa server-find --servrole` searches for all servers with a particular server role enabled. For example, to search for all CA servers:

```bash
$ ipa server-find --servrole "CA server"
---------------------
2 IPA servers matched
---------------------
   Server name: server1.example.com
   ...
   Server name: server2.example.com
   ...
---------------------
Number of entries returned 2
---------------------
```

24.11. PROMOTING A REPLICA TO A CA RENEWAL SERVER AND CRL PUBLISHER SERVER

If your IdM deployment uses an embedded certificate authority (CA), one of the IdM CA servers acts as the CA renewal server, a server that manages the renewal of CA subsystem certificates. One of the IdM CA servers also acts as the IdM CRL publisher server, a server that generates certificate revocation lists. By default, the CA renewal server and CRL publisher server roles are installed on the first server on which the system administrator installed the CA role using the `ipa-server-install` or `ipa-ca-install` command.

Prerequisites

- You have the IdM administrator credentials.

Procedure

- Change the current CA renewal master.
- Configure replica to generate CRLs.

24.12. DEMOTING OR PROMOTING HIDDEN REPLICAS

After a replica has been installed, you can configure whether the replica is hidden or visible.

For details about hidden replicas, see The hidden replica mode.

If the replica is a CA renewal server, move the service to another replica before making this replica hidden.

For details, see Changing and resetting IdM CA renewal server.

Procedure
To hide the replica, enter:

```
# ipa server-state replica.idm.example.com --state=hidden
```

Alternatively, you can make the replica visible with the following command:

```
# ipa server-state replica.idm.example.com --state=enabled
```
CHAPTER 25. INSTALLING AND RUNNING THE IDM HEALTHCHECK TOOL

This chapter describes the IdM Healthcheck tool and how to install and run it.

25.1. HEALTHCHECK IN IDM

The Healthcheck tool in Identity Management (IdM) helps find issues that may impact the health of your IdM environment.

NOTE
The Healthcheck tool is a command line tool that can be used without Kerberos authentication.

Modules are Independent
Healthcheck consists of independent modules which test for:

- Replication issues
- Certificate validity
- Certificate Authority infrastructure issues
- IdM and Active Directory trust issues
- Correct file permissions and ownership settings

Two output formats
Healthcheck generates the following outputs, which you can set using the **output-type** option:

- **json**: Machine-readable output in JSON format (default)
- **human**: Human-readable output

You can specify a different file destination with the **--output-file** option.

Results
Each Healthcheck module returns one of the following results:

SUCCESS
configured as expected

WARNING
not an error, but worth keeping an eye on or evaluating

ERROR
not configured as expected

CRITICAL
not configured as expected, with a high possibility for impact
25.2. INSTALLING IDM HEALTHCHECK

This section describes how to install the IdM Healthcheck tool.

Procedure

- Install the **ipa-healthcheck** package:

  ```
  [root@server ~]# dnf install ipa-healthcheck
  ```

Verification steps

- Use the **--failures-only** option to have **ipa-healthcheck** only report errors. A fully-functioning IdM installation returns an empty result of `[]`.

  ```
  [root@server ~]# ipa-healthcheck --failures-only
  []
  ```

Additional resources

- Use **ipa-healthcheck --help** to see all supported arguments.

25.3. RUNNING IDM HEALTHCHECK

Healthcheck can be run manually or automatically using **log rotation**.

Prerequisites

- The Healthcheck tool must be installed. See [Installing IdM Healthcheck](#).

Procedure

- To run healthcheck manually, enter the **ipa-healthcheck** command.

  ```
  [root@server ~]# ipa-healthcheck
  ```

Additional resources

For all options, see the man page: **man ipa-healthcheck**.

25.4. ADDITIONAL RESOURCES

- See the following sections of the [Configuring and managing Identity Management](#) guide for examples of using IdM Healthcheck.
  - Checking services
  - Verifying your IdM and AD trust configuration
  - Verifying certificates
  - Verifying system certificates
- Checking disk space
- Verifying permissions of IdM configuration files
- Checking replication

- You can also see those chapters organized into a single guide: *Using IdM Healthcheck to monitor your IdM environment*
CHAPTER 26. INSTALLING AN IDENTITY MANAGEMENT SERVER USING AN ANSIBLE PLAYBOOK

The following sections describe how to configure a system as an IdM server by using Ansible. Configuring a system as an IdM server establishes an IdM domain and enables the system to offer IdM services to IdM clients. The deployment is managed by the ipaserver Ansible role.

Prerequisites

- You understand Ansible and IdM concepts:
  - Ansible roles
  - Ansible nodes
  - Ansible inventory
  - Ansible tasks
  - Ansible modules
  - Ansible plays and playbooks

26.1. ANSIBLE AND ITS ADVANTAGES FOR INSTALLING IDM

Ansible is an automation tool used to configure systems, deploy software, and perform rolling updates. Ansible includes support for Identity Management (IdM), and you can use Ansible modules to automate installation tasks such as the setup of an IdM server, replica, client, or an entire IdM topology.

Advantages of using Ansible to install IdM

The following list presents advantages of installing Identity Management using Ansible in contrast to manual installation.

- You do not need to log into the managed node.
- You do not need to configure settings on each host to be deployed individually. Instead, you can have one inventory file to deploy a complete cluster.
- You can reuse an inventory file later for management tasks, for example to add users and hosts. You can reuse an inventory file even for such tasks as are not related to IdM.

26.2. INSTALLING THE ANSIBLE-FREEIPA PACKAGE

This section describes how to install the ansible-freeipa roles.

Prerequisites

- On the managed node:
  - Ensure that the managed node is a Red Hat Enterprise Linux 9 system with a static IP address and a working package manager.

- On the controller:
  - Ensure that the controller is a Red Hat Enterprise Linux system with a valid subscription.
this is not the case, see the official Ansible documentation installation guide for alternative installation instructions.

- Ensure that you can reach the managed node over the SSH protocol from the controller. Check that the managed node is listed in the /root/.ssh/known_hosts file of the controller.

**Procedure**

Run the following procedure on the Ansible controller.

1. Enable the required repository:

   ```bash
   # subscription-manager repos --enable rhel-9-for-x86_64-appstream-rpms
   ```

2. Install the IdM Ansible roles:

   ```bash
   # dnf install ansible-freeipa
   ```

   The roles are installed to the /usr/share/ansible/roles/ directory.

26.3. ANSIBLE ROLES LOCATION IN THE FILE SYSTEM

By default the ansible-freeipa roles are installed to the /usr/share/ansible/roles/ directory. The structure of the ansible-freeipa package is as follows:

- The /usr/share/ansible/roles/ directory stores the ipaserver, ipareplica, and ipaclient roles on the Ansible controller. Each role directory stores examples, a basic overview, the licence and documentation about the role in a README.md Markdown file.

  ```bash
  [root@server]# ls -1 /usr/share/ansible/roles/
  ipaclient
  ipareplica
  ipaserver
  ```

- The /usr/share/doc/ansible-freeipa/ directory stores the documentation about individual roles and the topology in README.md Markdown files. It also stores the playbooks/ subdirectory (see below).

  ```bash
  [root@server]# ls -1 /usr/share/doc/ansible-freeipa/
  playbooks
  README-client.md
  README.md
  README-replica.md
  README-server.md
  README-topology.md
  ```

- The /usr/share/doc/ansible-freeipa/playbooks/ directory stores the example playbooks:

  ```bash
  [root@server]# ls -1 /usr/share/doc/ansible-freeipa/playbooks/
  install-client.yml
  install-cluster.yml
  install-replica.yml
  install-server.yml
  uninstall-client.yml
  ```
26.4. SETTING THE PARAMETERS FOR A DEPLOYMENT WITH AN INTEGRATED DNS AND AN INTEGRATED CA AS THE ROOT CA

Complete this procedure to configure the inventory file for installing an IdM server with an integrated CA as the root CA in an environment that uses the IdM integrated DNS solution.

**NOTE**

The inventory in this procedure uses the INI format. You can, alternatively, use the YAML or JSON formats.

**Procedure**

1. Open the inventory file for editing. Specify the fully-qualified domain names (FQDN) of the host you want to use as an IdM server. Ensure that the FQDN meets the following criteria:
   - Only alphanumeric characters and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
   - The host name must be all lower-case.

2. Specify the IdM domain and realm information.

3. Specify that you want to use integrated DNS by adding the following option:
   - `ipaserver_setup_dns=yes`

4. Specify the DNS forwarding settings. Choose one of the following options:
   - Use the `ipaserver_auto_forwarders=yes` option if you want the installer to use forwarders from the `/etc/resolv.conf` file. This option is not recommended if the nameserver specified in the `/etc/resolv.conf` file is the localhost 127.0.0.1 address or if you are on a virtual private network and the DNS servers you are using are normally unreachable from the public internet.
   - Use the `ipaserver_forwarders` option to specify your forwarders manually. The installation process adds the forwarder IP addresses to the `/etc/named.conf` file on the installed IdM server.
   - Use the `ipaserver_no_forwarders=yes` option to configure root DNS servers to be used instead.

   **NOTE**

   With no DNS forwarders, your environment will be isolated, and names from other DNS domains in your infrastructure will not be resolved.

5. Specify the DNS reverse record and zone settings. Choose from the following options:
- Use the `ipaserver_allow_zone_overlap=yes` option to allow the creation of a (reverse) zone even if the zone is already resolvable.

- Use the `ipaserver_reverse_zones` option to specify your reverse zones manually.

- Use the `ipaserver_no_reverse=yes` option if you do not want the installer to create reverse a DNS zone.

**NOTE**

Using IdM to manage reverse zones is optional. You can use an external DNS service for this purpose instead.

6. Specify the passwords for `admin` and for the **Directory Manager**. Use the Ansible Vault to store the password, and reference the Vault file from the playbook file. Alternatively and less securely, specify the passwords directly in the inventory file.

7. (Optional) Specify a custom **firewalld** zone to be used by the IdM server. If you do not set a custom zone, IdM will add its services to the default **firewalld** zone. The predefined default zone is **public**.

**IMPORTANT**

The specified **firewalld** zone must exist and be permanent.

Example of an inventory file with the required server information (excluding the passwords)

```ini
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=yes
ipaserver_auto_forwarders=yes
[...]
```

Example of an inventory file with the required server information (including the passwords)

```ini
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=yes
ipaserver_auto_forwarders=yes
ipaadmin_password=MySecretPassword123
ipadm_password=MySecretPassword234
[...]
```
Example of an inventory file with a custom firewalld zone

```ini
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=yes
ipaserver_auto_forwarders=yes
ipaadmin_password=MySecretPassword123
ipadm_password=MySecretPassword234
ipaserver_firewalld_zone=custom zone
```

Example playbook to set up an IdM server using admin and Directory Manager passwords stored in an Ansible Vault file

```yaml
---
- name: Playbook to configure IPA server
  hosts: ipaserver
  become: true
  vars_files:
    - playbook_sensitive_data.yml
  roles:
    - role: ipaserver
      state: present
```

Example playbook to set up an IdM server using admin and Directory Manager passwords from an inventory file

```yaml
---
- name: Playbook to configure IPA server
  hosts: ipaserver
  become: true
  roles:
    - role: ipaserver
      state: present
```

Additional resources

- For the forwarding policy default settings, see the `--forward-policy` description in the `ipa-dns-install(1)` man page.
- For more information about DNS variables used by the `ipaserver` role, see the DNS Variables section in the `README-server.md` file in the `/usr/share/doc/ansible-freeipa` directory.

### 26.5. SETTING THE PARAMETERS FOR A DEPLOYMENT WITH EXTERNAL DNS AND AN INTEGRATED CA AS THE ROOT CA

Complete this procedure to configure the inventory file for installing an IdM server with an integrated CA as the root CA in an environment that uses an external DNS solution.
NOTE

The inventory file in this procedure uses the INI format. You can, alternatively, use the YAML or JSON formats.

Procedure

1. Open the inventory file for editing. Specify the fully-qualified domain names (FQDN) of the host you want to use as an IdM server. Ensure that the FQDN meets the following criteria:
   - Only alphanumeric characters and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
   - The host name must be all lower-case.

2. Specify the IdM domain and realm information.

3. Make sure that the ipaserver_setup_dns option is set to no or that it is absent.

4. Specify the passwords for admin and for the Directory Manager. Use the Ansible Vault to store the password, and reference the Vault file from the playbook file. Alternatively and less securely, specify the passwords directly in the inventory file.

5. (Optional) Specify a custom firewalld zone to be used by the IdM server. If you do not set a custom zone, IdM will add its services to the default firewalld zone. The predefined default zone is public.

   IMPORTANT

   The specified firewalld zone must exist and be permanent.

Example of an inventory file with the required server information (excluding the passwords)

```
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=no
[...]
```

Example of an inventory file with the required server information (including the passwords)

```
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=no
ipadmin_password=MySecretPassword123
```
Example of an inventory file with a custom `firewalld` zone

```
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=no
ipaadmin_password=MySecretPassword123
ipadm_password=MySecretPassword234
ipaserver_firewalld_zone=custom zone
```

Example playbook to set up an IdM server using admin and Directory Manager passwords stored in an Ansible Vault file

```yaml
---
- name: Playbook to configure IPA server
  hosts: ipaserver
  become: true
  vars_files:
    - playbook_sensitive_data.yml

  roles:
    - role: ipaserver
      state: present
```

Example playbook to set up an IdM server using admin and Directory Manager passwords from an inventory file

```yaml
---
- name: Playbook to configure IPA server
  hosts: ipaserver
  become: true

  roles:
    - role: ipaserver
      state: present
```

## 26.6. Deploying an IdM Server with an Integrated CA as the Root CA Using an Ansible Playbook

Complete this procedure to deploy an IdM server with an integrated certificate authority (CA) as the root CA using an Ansible playbook.
NOTE

The inventory in this procedure uses the **INI** format. You can, alternatively, use the **YAML** or **JSON** formats.

**Prerequisites**

- You have set the parameters that correspond to your scenario by choosing one of the following procedures:
  - Procedure with integrated DNS
  - Procedure with external DNS

**Procedure**

1. Run the `ansible-playbook` command with the name of the playbook file, for example `install-server.yml`. Specify the inventory file with the `-i` option:

   ```
   $ ansible-playbook -v -i <path_to_inventory_directory>/hosts <path_to_playbooks_directory>/install-server.yml
   ```

   Specify the level of verbosity by using the `-v`, `-vv`, or `-vvv` option.

   You can view the output of the Ansible playbook script on the command-line interface (CLI). The following output shows that the script has run successfully as 0 tasks have failed:

   ```
   PLAY RECAP
   server.idm.example.com : ok=18   changed=10   unreachable=0   failed=0   skipped=21   rescued=0   ignored=0
   ```

2. Choose one of the following options:

   - If your IdM deployment uses external DNS: add the DNS resource records contained in the `/tmp/ipa.system.records.UFRPto.db` file to the existing external DNS servers. The process of updating the DNS records varies depending on the particular DNS solution.
     ```
     ... Restarting the KDC
     Please add records in this file to your DNS system:
     /tmp/ipa.system.records.UFRBto.db
     Restarting the web server
     ```

   - If your IdM deployment uses integrated DNS:

     - Add DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is `idm.example.com`, add a name server (NS) record to the `example.com` parent domain.

   **IMPORTANT**

   The server installation is not complete until you add the DNS records to the existing DNS servers.
IMPORTANT

Repeat this step each time after an IdM DNS server is installed.

- Add an _ntp._udp service (SRV) record for your time server to your IdM DNS. The presence of the SRV record for the time server of the newly-installed IdM server in IdM DNS ensures that future replica and client installations are automatically configured to synchronize with the time server used by this primary IdM server.

Additional resources

- For instruction on how to deploy an IdM server with an external CA as the root CA, see Deploying an IdM server with an external CA as the root CA using an Ansible playbook

26.7. SETTING THE PARAMETERS FOR A DEPLOYMENT WITH AN INTEGRATED DNS AND AN EXTERNAL CA AS THE ROOT CA

Complete this procedure to configure the inventory file for installing an IdM server with an external CA as the root CA in an environment that uses the IdM integrated DNS solution.

NOTE

The inventory file in this procedure uses the INI format. You can, alternatively, use the YAML or JSON formats.

Procedure

1. Open the inventory file for editing. Specify the fully-qualified domain names (FQDN) of the host you want to use as an IdM server. Ensure that the FQDN meets the following criteria:
   - Only alphanumeric characters and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
   - The host name must be all lower-case.

2. Specify the IdM domain and realm information.

3. Specify that you want to use integrated DNS by adding the following option:

   `ipaserver_setup_dns=yes`

4. Specify the DNS forwarding settings. Choose one of the following options:
   - Use the `ipaserver_auto_forwarders=yes` option if you want the installation process to use forwarders from the `/etc/resolv.conf` file. This option is not recommended if the nameserver specified in the `/etc/resolv.conf` file is the localhost 127.0.0.1 address or if you are on a virtual private network and the DNS servers you are using are normally unreachable from the public internet.
   - Use the `ipaserver_forwarders` option to specify your forwarders manually. The installation process adds the forwarder IP addresses to the `/etc/named.conf` file on the installed IdM server.
- Use the `ipaserver_no_forwarders=yes` option to configure root DNS servers to be used instead.

**NOTE**

With no DNS forwarders, your environment will be isolated, and names from other DNS domains in your infrastructure will not be resolved.

5. Specify the DNS reverse record and zone settings. Choose from the following options:

- Use the `ipaserver_allow_zone_overlap=yes` option to allow the creation of a (reverse) zone even if the zone is already resolvable.

- Use the `ipaserver_reverse_zones` option to specify your reverse zones manually.

- Use the `ipaserver_no_reverse=yes` option if you do not want the installation process to create reverse a DNS zone.

**NOTE**

Using IdM to manage reverse zones is optional. You can use an external DNS service for this purpose instead.

6. Specify the passwords for `admin` and for the **Directory Manager**. Use the Ansible Vault to store the password, and reference the Vault file from the playbook file. Alternatively and less securely, specify the passwords directly in the inventory file.

7. (Optional) Specify a custom `firewalld` zone to be used by the IdM server. If you do not set a custom zone, IdM will add its services to the default `firewalld` zone. The predefined default zone is **public**.

**IMPORTANT**

The specified `firewalld` zone must exist and be permanent.

Example of an inventory file with the required server information (excluding the passwords)

```ini
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=yes
ipaserver_auto_forwarders=yes
[...]
```

Example of an inventory file with the required server information (including the passwords)

```ini
[ipaserver]
server.idm.example.com
```
Example of an inventory file with a custom `firewalld` zone

```
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver.realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=yes
ipaserver_auto_forwarders=yes
ipaadmin_password=MySecretPassword123
ipadm_password=MySecretPassword234

[ipaserver_firewalld_zone=custom zone]
```

8. Create a playbook for the first step of the installation. Enter instructions for generating the certificate signing request (CSR) and copying it from the controller to the managed node.

```yaml
---
- name: Playbook to configure IPA server Step 1
  hosts: ipaserver
  become: true
  vars_files:
    - playbook_sensitive_data.yml
  vars:
    ipaserver_external_ca: yes

  roles:
    - role: ipaserver
      state: present

  post_tasks:
    - name: Copy CSR /root/ipa.csr from node to "{{ groups.ipaserver[0] + '-ipa.csr' }}"
      fetch:
        src: /root/ipa.csr
        dest: "{{ groups.ipaserver[0] + '-ipa.csr' }}"
        flat: yes
```

9. Create another playbook for the final step of the installation.

```yaml
---
- name: Playbook to configure IPA server Step -1
  hosts: ipaserver
```
become: true
vars_files:
- playbook_sensitive_data.yml
vars:
  ipaserver_external_cert_files: "/root/chain.crt"

pre_tasks:
- name: Copy "{{ groups.ipaserver[0] + '-chain.crt' }}" to /root/chain.crt on node
copy:
  src: "{{ groups.ipaserver[0] + '-chain.crt' }}"
  dest: "/root/chain.crt"
  force: yes

roles:
- role: ipaserver
  state: present

Additional resources

- For the forwarding policy default settings, see the \texttt{--forward-policy} description in the \texttt{ipa-dns-install(1)} man page.

- For more information about DNS variables used by the \texttt{ipaserver} role, see the DNS Variables section in the \texttt{README-server.md} file in the \texttt{/usr/share/doc/ansible-freeipa} directory.

26.8. SETTING THE PARAMETERS FOR A DEPLOYMENT WITH EXTERNAL DNS AND AN EXTERNAL CA AS THE ROOT CA

Complete this procedure to configure the inventory file for installing an IdM server with an external CA as the root CA in an environment that uses an external DNS solution.

\textbf{NOTE}

The inventory file in this procedure uses the \texttt{INI} format. You can, alternatively, use the \texttt{YAML} or \texttt{JSON} formats.

Procedure

1. Open the inventory file for editing. Specify the fully-qualified domain names (\texttt{FQDN}) of the host you want to use as an IdM server. Ensure that the \texttt{FQDN} meets the following criteria:
   \begin{itemize}
   \item Only alphanumeric characters and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
   \item The host name must be all lower-case.
   \end{itemize}

2. Specify the IdM domain and realm information.

3. Make sure that the \texttt{ipaserver_setup_dns} option is set to \texttt{no} or that it is absent.

4. Specify the passwords for \texttt{admin} and for the \texttt{Directory Manager}. Use the Ansible Vault to store the password, and reference the Vault file from the playbook file. Alternatively and less securely, specify the passwords directly in the inventory file.
5. (Optional) Specify a custom `firewalld` zone to be used by the IdM server. If you do not set a custom zone, IdM will add its services to the default `firewalld` zone. The predefined default zone is `public`.

**IMPORTANT**

The specified `firewalld` zone must exist and be permanent.

Example of an inventory file with the required server information (excluding the passwords)

```ini
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=no
[...]
```

Example of an inventory file with the required server information (including the passwords)

```ini
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=no
ipaadmin_password=MySecretPassword123
ipadm_password=MySecretPassword234
[...]
```

Example of an inventory file with a custom `firewalld` zone

```ini
[ipaserver]
server.idm.example.com

[ipaserver:vars]
ipaserver_domain=idm.example.com
ipaserver_realm=IDM.EXAMPLE.COM
ipaserver_setup_dns=no
ipaadmin_password=MySecretPassword123
ipadm_password=MySecretPassword234
ipaserver_firewalld_zone=custom zone
[...]
```

6. Create a playbook for the first step of the installation. Enter instructions for generating the certificate signing request (CSR) and copying it from the controller to the managed node.
To configure a server:

```yaml
---
- name: Playbook to configure IPA server Step 1
  hosts: ipaserver
  become: true
  vars_files:
    - playbook_sensitive_data.yml
  vars:
    ipaserver_external_ca: yes
  roles:
    - role: ipaserver
      state: present
  post_tasks:
    - name: Copy CSR /root/ipa.csr from node to "{{ groups.ipaserver[0] + '-ipa.csr' }}"
      fetch:
        src: /root/ipa.csr
        dest: "{{ groups.ipaserver[0] + '-ipa.csr' }}"
        flat: yes
---
```

7. Create another playbook for the final step of the installation.

```yaml
---
- name: Playbook to configure IPA server Step -1
  hosts: ipaserver
  become: true
  vars_files:
    - playbook_sensitive_data.yml
  vars:
    ipaserver_external_cert_files: "/root/chain.crt"
  pre_tasks:
    - name: Copy "{{ groups.ipaserver[0] + '-chain.crt' }}" to /root/chain.crt on node
      copy:
        src: "{{ groups.ipaserver[0] + '-chain.crt' }}"
        dest: "/root/chain.crt"
        force: yes
  roles:
    - role: ipaserver
      state: present
```
NOTE

The inventory file in this procedure uses the **INI** format. You can, alternatively, use the **YAML** or **JSON** formats.

Prerequisites

- You have set the parameters that correspond to your scenario by choosing one of the following procedures:
  - Procedure with integrated DNS
  - Procedure with external DNS

Procedure

1. Run the **ansible-playbook** command with the name of the playbook file that contains instructions for the first step of the installation, for example **install-server-step1.yml**. Specify the inventory file with the **-i** option:

```
$ ansible-playbook -v -i <path_to_inventory_directory>/host.server
<path_to_playbooks_directory>/install-server-step1.yml
```

Specify the level of verbosity by using the **-v**, **-vv** or **-vvv** option.

You can view the output of the Ansible playbook script on the command-line interface (CLI). The following output shows that the script has run successfully as 0 tasks have failed:

```
PLAY RECAP
server.idm.example.com : ok=18   changed=10   unreachable=0   failed=0   skipped=21
rescued=0   ignored=0
```

2. Locate the **ipa.csr** certificate signing request file on the controller and submit it to the external CA.

3. Place the IdM CA certificate signed by the external CA in the controller file system so that the playbook in the next step can find it.

4. Run the **ansible-playbook** command with the name of the playbook file that contains instructions for the final step of the installation, for example **install-server-step2.yml**. Specify the inventory file with the **-i** option:

```
$ ansible-playbook -v -i <path_to_inventory_directory>/host.server
<path_to_playbooks_directory>/install-server-step2.yml
```

5. Choose one of the following options:

- If your IdM deployment uses external DNS: add the DNS resource records contained in the `/tmp/ipa.system.records.UFRPto.db` file to the existing external DNS servers. The process of updating the DNS records varies depending on the particular DNS solution.

```
...  
Restarting the KDC  
Please add records in this file to your DNS system:  
```
IMPORTANT

The server installation is not complete until you add the DNS records to the existing DNS servers.

- If your IdM deployment uses integrated DNS:
  - Add DNS delegation from the parent domain to the IdM DNS domain. For example, if the IdM DNS domain is `idm.example.com`, add a name server (NS) record to the `example.com` parent domain.

  IMPORTANT
  Repeat this step each time after an IdM DNS server is installed.

  - Add an `_ntp._udp` service (SRV) record for your time server to your IdM DNS. The presence of the SRV record for the time server of the newly-installed IdM server in IdM DNS ensures that future replica and client installations are automatically configured to synchronize with the time server used by this primary IdM server.

Additional resources

For instruction on how to deploy an IdM server with an integrated CA as the root CA, see Deploying an IdM server with an integrated CA as the root CA using an Ansible playbook

Additional resources

- Inventory basics: formats, hosts, and groups

- You can see sample Ansible playbooks for installing an IdM server and a list of possible variables in the ansible-freeipa upstream documentation.
CHAPTER 27. INSTALLING AN IDENTITY MANAGEMENT REPLICA USING AN ANSIBLE PLAYBOOK

Configuring a system as an IdM replica by using Ansible enrolls it into an IdM domain and enables the system to use IdM services on IdM servers in the domain.

The deployment is managed by the ipareplica Ansible role. The role can use the autodiscovery mode for identifying the IdM servers, domain and other settings. However, if you deploy multiple replicas in a tier-like model, with different groups of replicas being deployed at different times, you must define specific servers or replicas for each group.

Prerequisites

- You have installed the ansible-freeipa package on the Ansible control node.
- You understand Ansible and IdM concepts:
  - Ansible roles
  - Ansible nodes
  - Ansible inventory
  - Ansible tasks
  - Ansible modules
  - Ansible plays and playbooks

27.1. SPECIFYING THE BASE, SERVER AND CLIENT VARIABLES FOR INSTALLING THE IDM REPLICA

Complete this procedure to configure the inventory file for installing an IdM replica.

Prerequisites

- You have installed the ansible-freeipa package on the Ansible control node.

Procedure

1. Open the inventory file for editing. Specify the fully-qualified domain names (FQDN) of the hosts to become IdM replicas. The FQDNs must be valid DNS names:
   - Only numbers, alphabetic characters, and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
   - The host name must be all lower-case.

   Example of a simple inventory hosts file with only the replicas' FQDN defined

```
[ipareplicas]
replica1.idm.example.com
replica2.idm.example.com
```
If the IdM server is already deployed and the SRV records are set properly in the IdM DNS zone, the script automatically discovers all the other required values.

2. Optionally, provide additional information in the inventory file based on which of the following scenarios is closest to yours:

**Scenario 1**

If you want to avoid autodiscovery and have all replicas listed in the [ipareplicas] section use a specific IdM server, set the server in the [ipaservers] section of the inventory file.

**Example inventory hosts file with the FQDN of the IdM server and replicas defined**

```plaintext
[ipaservers]
server.idm.example.com

[ipareplicas]
replica1.idm.example.com
replica2.idm.example.com
replica3.idm.example.com
[...]
```

**Scenario 2**

Alternatively, if you want to avoid autodiscovery but want to deploy specific replicas with specific servers, set the servers for specific replicas individually in the [ipareplicas] section in the inventory file.

**Example inventory file with a specific IdM server defined for a specific replica**

```plaintext
[ipaservers]
server.idm.example.com
replica1.idm.example.com

[ipareplicas]
replica2.idm.example.com
replica3.idm.example.com ipareplica_servers=replica1.idm.example.com
```

In the example above, `replica3.idm.example.com` uses the already deployed `replica1.idm.example.com` as its replication source.

**Scenario 3**

If you are deploying several replicas in one batch and time is a concern to you, multitier replica deployment can be useful for you. Define specific groups of replicas in the inventory file, for example [ipareplicas_tier1] and [ipareplicas_tier2], and design separate plays for each group in the `install-replica.yml` playbook.

**Example inventory file with replica tiers defined**

```plaintext
[ipaservers]
server.idm.example.com
```
The first entry in `ipareplica_servers` will be used. The second entry will be used as a fallback option. When using multiple tiers for deploying IdM replicas, you must have separate tasks in the playbook to first deploy replicas from tier1 and then replicas from tier2:

Example of a playbook file with different plays for different replica groups

```yaml
---
- name: Playbook to configure IPA replicas (tier1)
  hosts: ipareplicas_tier1
  become: true

  roles:
  - role: ipareplica
    state: present

- name: Playbook to configure IPA replicas (tier2)
  hosts: ipareplicas_tier2
  become: true

  roles:
  - role: ipareplica
    state: present
```

**Scenario 4**

If you want the replica to use a specified `firewalld` zone instead of the default one, you can specify it in the inventory file. This can be useful, for example, when you want to use an internal `firewalld` zone for your IdM installation instead of a public zone that is set as default. If you do not set a custom zone, IdM will add its services to the default `firewalld` zone. The predefined default zone is `public`.

**IMPORTANT**

The specified `firewalld` zone must exist and be permanent.

Example of a simple inventory hosts file with a custom `firewalld` zone

```ini
[ipaservers]
server.idm.example.com

[ipareplicas]
replica1.idm.example.com
replica2.idm.example.com
replica3.idm.example.com
[...]
```
Scenario 5

If you want the replica to host the IdM DNS service, add the `ipareplica_setup_dns=yes` line to the `[ipareplicas:vars]` section. Additionally, specify if you want to use per-server DNS forwarders:

- To configure per-server forwarders, add the `ipareplica_forwards` variable and a list of strings to the `[ipareplicas:vars]` section, for example:

  ```
ipareplica_forwarders=192.0.2.1,192.0.2.2
  ```

- To configure no per-server forwarders, add the following line to the `[ipareplicas:vars]` section: `ipareplica_no_forwards=yes`.

- To configure per-server forwarders based on the forwarders listed in the `/etc/resolv.conf` file of the replica, add the `ipareplica_auto_forwards` variable to the `[ipareplicas:vars]` section.

Example inventory file with instructions to set up DNS and per-server forwarders on the replicas

```
[ipaservers]
server.idm.example.com

[ipareplicas]
replica1.idm.example.com
replica2.idm.example.com
replica3.idm.example.com
[...]

[ipareplicas:vars]
ipareplica_setup_dns=yes
ipareplica_forwarders=192.0.2.1,192.0.2.2
```

Additional resources

- For more information on the `ipareplica` variables, see the `/usr/share/ansible/roles/ipareplica/README.md` Markdown file.

27.2. SPECIFYING THE CREDENTIALS FOR INSTALLING THE IDM REPLICA USING AN ANSIBLE PLAYBOOK

Complete this procedure to configure the authorization for installing the IdM replica.

Prerequisites

- You have installed the `ansible-freeipa` package on the Ansible control node.

Procedure
1. Specify the **password of a user authorized to deploy replicas** for example the IdM **admin**.

   - Red Hat recommends using the Ansible Vault to store the password, and referencing the Vault file from the playbook file, for example **install-replica.yml**:

     **Example playbook file using principal from inventory file and password from an Ansible Vault file**

     ```yaml
     - name: Playbook to configure IPA replicas
       hosts: ipareplicas
       become: true
     vars_files:
       - playbook_sensitive_data.yml

     roles:
     - role: ipareplica
       state: present
     ```

     For details how to use Ansible Vault, see the official Ansible Vault documentation.

   - Less securely, provide the credentials of **admin** directly in the inventory file. Use the **ipaadmin_password** option in the `[ipareplicas:vars]` section of the inventory file. The inventory file and the **install-replica.yml** playbook file can then look as follows:

     **Example inventory hosts.replica file**

     ```
     [...]  
     [ipareplicas:vars]  
     ipaadmin_password=Secret123
     ```

     **Example playbook using principal and password from inventory file**

     ```yaml
     - name: Playbook to configure IPA replicas
       hosts: ipareplicas
       become: true
       roles:
       - role: ipareplica
         state: present
     ```

   - Alternatively but also less securely, provide the credentials of another user authorized to deploy a replica directly in the inventory file. To specify a different authorized user, use the **ipaadmin_principal** option for the user name, and the **ipaadmin_password** option for the password. The inventory file and the **install-replica.yml** playbook file can then look as follows:

     **Example inventory hosts.replica file**

     ```
     [...]  
     [ipareplicas:vars]  
     ipaadmin_principal=my_admin
     ipaadmin_password=my_admin_secret123
     ```

     **Example playbook using principal and password from inventory file**
---
- name: Playbook to configure IPA replicas
  hosts: ipareplicas
  become: true

  roles:
  - role: ipareplica
    state: present

Additional resources

- For details on the options accepted by the ipareplica Ansible role, see the /usr/share/ansible/roles/ipareplica/README.md Markdown file.

27.3. DEPLOYING AN IDM REPLICA USING AN ANSIBLE PLAYBOOK

Complete this procedure to use an Ansible playbook to deploy an IdM replica.

Prerequisites

- You have configured the inventory file for installing an IdM replica.
- You have configured the authorization for installing the IdM replica.

Procedure

- To install an IdM replica using an Ansible playbook, use the ansible-playbook command with the name of the playbook file, for example install-replica.yml. Specify the inventory file with the -i option:

  ```
  $ ansible-playbook -v -i <path_to_inventory_directory>/hosts.replica <path_to_playbooks_directory>/install-replica.yml
  ```

  Specify the level of verbosity by using the -v, -vv or -vvv option.

  Ansible informs you about the execution of the Ansible playbook script. The following output shows that the script has run successfully as 0 tasks have failed:

  ```
  PLAY RECAP
  replica.idm.example.com : ok=18 changed=10 unreachable=0 failed=0 skipped=21 rescued=0 ignored=0
  ```

  You have now installed an IdM replica.
CHAPTER 28. INSTALLING AN IDENTITY MANAGEMENT CLIENT USING AN ANSIBLE PLAYBOOK

The following sections describe how to configure a system as an Identity Management (IdM) client by using Ansible. Configuring a system as an IdM client enrolls it into an IdM domain and enables the system to use IdM services on IdM servers in the domain.

The deployment is managed by the ipaclient Ansible role. By default, the role uses the autodiscovery mode for identifying the IdM servers, domain and other settings. The role can be modified to have the Ansible playbook use the settings specified, for example in the inventory file.

Prerequisites

- You have installed the ansible-freeipa package on the Ansible control node.
- You understand Ansible and IdM concepts:
  - Ansible roles
  - Ansible nodes
  - Ansible inventory
  - Ansible tasks
  - Ansible modules
  - Ansible plays and playbooks

28.1. SETTING THE PARAMETERS OF THE INVENTORY FILE FOR THE AUTODISCOVERY CLIENT INSTALLATION MODE

To install an Identity Management client using an Ansible playbook, configure the target host parameters in an inventory file, for example inventory/hosts:

- the information about the host
- the authorization for the task

The inventory file can be in one of many formats, depending on the inventory plugins you have. The INI-like format is one of Ansible’s defaults and is used in the examples below.

NOTE

To use smart cards with the graphical user interface in RHEL, ensure that you include the ipaclient_mkhomedir variable in your Ansible playbook.

Prerequisites

- You have checked the deployment instructions on the control node, see Checking the parameters in the install-client.yml file.

Procedure
1. Specify the fully-qualified hostname (FQDN) of the host to become an IdM client. The fully qualified domain name must be a valid DNS name:

   - Only numbers, alphabetic characters, and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
   - The host name must be all lower-case. No capital letters are allowed.

If the SRV records are set properly in the IdM DNS zone, the script automatically discovers all the other required values.

**Example of a simple inventory hosts file with only the client FQDN defined**

```
[ipaclients]
client.idm.example.com
[...]
```

2. Specify the credentials for enrolling the client. The following authentication methods are available:

   - **The password of a user authorized to enroll clients**. This is the default option.
     - Red Hat recommends using the Ansible Vault to store the password, and referencing the Vault file from the playbook file, for example `install-client.yml`, directly:

```
Example playbook file using principal from inventory file and password from an Ansible Vault file
```

```
- name: Playbook to configure IPA clients with username/password
  hosts: ipaclients
  become: true
  vars_files:
    - playbook_sensitive_data.yml
  roles:
    - role: ipaclient
      state: present
```

   - Less securely, provide the credentials of `admin` using the `ipaadmin_password` option in the `[ipaclients:vars]` section of the `inventory/hosts` file. Alternatively, to specify a different authorized user, use the `ipaadmin_principal` option for the user name, and the `ipaadmin_password` option for the password. The `inventory/hosts` inventory file and the `install-client.yml` playbook file can then look as follows:

```
Example inventory hosts file
```

```
[...]
[ipaclients:vars]
ipaadmin_principal=my_admin
ipaadmin_password=Secret123
```

```
Example Playbook using principal and password from inventory file
```

```
- name: Playbook to unconfigure IPA clients
  hosts: ipaclients
```
become: true
roles:
  - role: ipaclient
state: true

- The **client keytab** from the previous enrollment if it is still available. This option is available if the system was previously enrolled as an Identity Management client. To use this authentication method, uncomment the `#ipaclient_keytab` option, specifying the path to the file storing the keytab, for example in the `[ipaclient:vars]` section of `inventory/hosts`.

- A **random, one-time password** (OTP) to be generated during the enrollment. To use this authentication method, use the `ipaclient_use_otp=yes` option in your inventory file. For example, you can uncomment the `ipaclient_use_otp=yes` option in the `[ipaclients:vars]` section of the `inventory/hosts` file. Note that with OTP you must also specify one of the following options:
  - The **password of a user authorized to enroll clients** for example by providing a value for `ipaadmin_password` in the `[ipaclients:vars]` section of the `inventory/hosts` file.
  - The **admin keytab**, for example by providing a value for `ipaadmin_keytab` in the `[ipaclients:vars]` section of `inventory/hosts`.

Additional resources

- For details on the options accepted by the `ipaclient` Ansible role, see the `/usr/share/ansible/roles/ipaclient/README.md` README file.

28.2. SETTING THE PARAMETERS OF THE INVENTORY FILE WHEN AUTODISCOVERY IS NOT POSSIBLE DURING CLIENT INSTALLATION

To install an Identity Management client using an Ansible playbook, configure the target host parameters in an inventory file, for example `inventory/hosts`:

- the information about the host, the IdM server and the IdM domain or the IdM realm
- the authorization for the task

The inventory file can be in one of many formats, depending on the inventory plugins you have. The **INI-like** format is one of Ansible’s defaults and is used in the examples below.

**NOTE**

To use smart cards with the graphical user interface in RHEL, ensure that you include the `ipaclient_mkhomedir` variable in your Ansible playbook.

**Prerequisites**

- You have checked the deployment instructions on the control node, see Checking the parameters in the `install-client.yml` file.

**Procedure**
1. Specify the fully-qualified hostname (FQDN) of the host to become an IdM client. The fully qualified domain name must be a valid DNS name:
   - Only numbers, alphabetic characters, and hyphens (-) are allowed. For example, underscores are not allowed and can cause DNS failures.
   - The host name must be all lower-case. No capital letters are allowed.

2. Specify other options in the relevant sections of the inventory/hosts file:
   - the FQDN of the servers in the [ipaservers] section to indicate which IdM server the client will be enrolled with
   - one of the two following options:
     - the ipaclient_domain option in the [ipaclients:vars] section to indicate the DNS domain name of the IdM server the client will be enrolled with
     - the ipaclient_realm option in the [ipaclients:vars] section to indicate the name of the Kerberos realm controlled by the IdM server

   Example of an inventory hosts file with the client FQDN, the server FQDN and the domain defined
   ```
   [ipaclients]
   client{idm}.example.com

   [ipaservers]
   server{idm}.example.com

   [ipaclients:vars]
   ipaclient_domain=idm.example.com
   [...]
   ```

3. Specify the credentials for enrolling the client. The following authentication methods are available:
   - The **password of a user authorized to enroll clients** This is the default option.
     - Red Hat recommends using the Ansible Vault to store the password, and referencing the Vault file from the playbook file, for example `install-client.yml`, directly. Example playbook file using principal from inventory file and password from an Ansible Vault file

   ```yaml
   - name: Playbook to configure IPA clients with username/password
     hosts: ipaclients
     become: true
     vars_files:
     - *playbook_sensitive_data.yml*
     roles:
     - role: ipaclient
       state: present
   ```

   - Less securely, provide the credentials of **admin** using the **ipaadmin_password** option in the [ipaclients:vars] section of the inventory/hosts file. Alternatively, to specify a different authorized user, use the **ipaadmin_principal** option for the user name, and the
The `ipaadmin_password` option for the password. The `install-client.yml` playbook file can then look as follows:

Example inventory hosts file

```yaml
[...]
[ipaclients:vars]
ipaadmin_principal=my_admin
ipaadmin_password=Secret123
```

Example Playbook using principal and password from inventory file

```yaml
- name: Playbook to unconfigure IPA clients
  hosts: ipaclients
  become: true

  roles:
  - role: ipaclient
    state: true
```

- The `client keytab` from the previous enrollment if it is still available: This option is available if the system was previously enrolled as an Identity Management client. To use this authentication method, uncomment the `ipaclient_keytab` option, specifying the path to the file storing the keytab, for example in the `[ipaclient:vars]` section of `inventory/hosts`.

- A random, one-time password (OTP) to be generated during the enrollment. To use this authentication method, use the `ipaclient_use_otp=yes` option in your inventory file. For example, you can uncomment the `#ipaclient_use_otp=yes` option in the `[ipaclients:vars]` section of the `inventory/hosts` file. Note that with OTP you must also specify one of the following options:
  - The password of a user authorized to enroll clients, for example by providing a value for `ipaadmin_password` in the `[ipaclients:vars]` section of the `inventory/hosts` file.
  - The admin keytab, for example by providing a value for `ipaadmin_keytab` in the `[ipaclients:vars]` section of `inventory/hosts`.

Additional resources

- For details on the options accepted by the `ipaclient` Ansible role, see the `/usr/share/ansible/roles/ipaclient/README.md` README file.

28.3. CHECKING THE PARAMETERS IN THE INSTALL-CLIENT.YML FILE

The `install-client.yml` playbook file contains instructions for the IdM client deployment.

Procedure

- Open the file and check if the instructions in the playbook correspond to what you are planning for your deployment. The contents typically look like this:

---
- name: Playbook to configure IPA clients with username/password
  hosts: ipaclients
  become: true

  roles:
  - role: ipaclient
    state: present

This is what the individual entries mean:

- The hosts entry specifies the section of the **inventory/hosts** file where the ansible script searches the FQDNs of the hosts on which the **ipa-client-install** script shall be run.

- The **become: true** entry specifies that root’s credentials will be invoked during the execution of the **ipa-client-install** script.

- The **role: ipaclient** entry specifies the role that will be installed on the host: in this case, it is the ipa client role.

- The **state: present** entry specifies that the client should be installed rather than uninstalled (**absent**).

### 28.4. AUTHORIZATION OPTIONS FOR IDM CLIENT ENROLLMENT USING AN ANSIBLE PLAYBOOK

This referential section presents individual authorization options for IdM client enrollment with examples of inventory and playbook files.

**Table 28.1. Authorization options for IdM client enrollment using Ansible**

<table>
<thead>
<tr>
<th>Authorization option</th>
<th>Note</th>
<th>Example inventory file</th>
<th>Example install-client.yml playbook file</th>
</tr>
</thead>
</table>
| Password of a user authorized to enroll a client: Option 1 | Password stored in Ansible vault | [ipaclients:vars] [...] | - name: Playbook to configure IPA clients with username/password
  hosts: ipaclients
  become: true
  vars_files: 
  - playbook_sensitive_data.yml
  roles:
  - role: ipaclient
    state: present |
<table>
<thead>
<tr>
<th>Authorization option</th>
<th>Note</th>
<th>Example inventory file</th>
<th>Example <code>install-client.yml</code> playbook file</th>
</tr>
</thead>
</table>
| Password of a user authorized to enroll a client: Option 2 | Password stored in inventory file | `[ipaclients:vars] ipaadmin_password=Secret123` | - name: Playbook to configure IPA clients  
hosts: ipaclients  
become: true  
roles:  
- role: ipaclient  
state: true |
| A random, one-time password (OTP): Option 1 | OTP + administrator or password | `[ipaclients:vars] ipaadmin_password=Secret123 ipaclient_use_otp=yes` | - name: Playbook to configure IPA clients  
hosts: ipaclients  
become: true  
roles:  
- role: ipaclient  
state: true |
| A random, one-time password (OTP): Option 2 | OTP + an admin keytab | `[ipaclients:vars] ipaadmin_keytab=/tmp/admin.keytab ipaclient_use_otp=yes` | - name: Playbook to configure IPA clients  
hosts: ipaclients  
become: true  
roles:  
- role: ipaclient  
state: true |
| The client keytab from the previous enrollment | | `[ipaclients:vars] ipaclient_keytab=/tmp/krb5.keytab` | - name: Playbook to configure IPA clients  
hosts: ipaclients  
become: true  
roles:  
- role: ipaclient  
state: true |

### 28.5. DEPLOYING AN IDM CLIENT USING AN ANSIBLE PLAYBOOK

Complete this procedure to use an Ansible playbook to deploy an IdM client in your IdM environment.
Prerequisites

- You have set the parameters of the IdM client deployment to correspond to your deployment scenario:
  - Setting the parameters of the inventory file for the autodiscovery client installation mode
  - Setting the parameters of the inventory file for when autodiscovery is not possible during client installation
- You have checked the parameters in install-client.yml.

Procedure

- To install an IdM client using an Ansible playbook, use the `ansible-playbook` command with the name of the playbook file, for example `install-client.yml`. Specify the inventory file with the `-i` option:

  ```bash
  $ ansible-playbook -v -i inventory/hosts install-client.yml
  ```

  Specify the level of verbosity by using the `-v`, `-vv` or `-vvv` option.

  Ansible informs you about the execution of the Ansible playbook script. The following output shows that the script has run successfully as no tasks have failed:

  ![PLAY RECAP](image)

  ```text
  PLAY RECAP
  client1.idm.example.com : ok=18 changed=10 unreachable=0 failed=0 skipped=21 rescued=0 ignored=0
  ```

  **NOTE**

  Ansible uses different colors to provide different types of information about the running process. You can modify the default colors in the `[colors]` section of the `/etc/ansible/ansible.cfg` file:

  ```text
  [colors]
  [...] # error = red
  # debug = dark gray
  # deprecate = purple
  # skip = cyan
  # unreachable = red
  # ok = green
  # changed = yellow
  [...] 
  ```

  You have now installed an IdM client on your host using an Ansible playbook.

28.6. TESTING AN IDENTITY MANAGEMENT CLIENT AFTER ANSIBLE INSTALLATION

The command-line interface (CLI) informs you that the `ansible-playbook` command was successful, but you can also do your own test.
To test that the Identity Management client can obtain information about users defined on the server, check that you are able to resolve a user defined on the server. For example, to check the default admin user:

```
[user@client1 ~]$ id admin
uid=1254400000(admin) gid=1254400000(adms) groups=1254400000(adms)
```

To test that authentication works correctly, `su -` as another already existing IdM user:

```
[user@client1 ~]$ su - idm_user
Last login: Thu Oct 18 18:39:11 CEST 2018 from 192.168.122.1 on pts/0
[idm_user@client1 ~]$
```

### 28.7. UNINSTALLING AN IDM CLIENT USING AN ANSIBLE PLAYBOOK

Complete this procedure to use an Ansible playbook to uninstall your host as an IdM client.

**Prerequisites**

- IdM administrator credentials.

**Procedure**

- To uninstall the IdM client, use the `ansible-playbook` command with the name of the playbook file, for example `uninstall-client.yml`. Specify the inventory file with the `-i` option and, optionally, specify the level of verbosity by using the `-v`, `-vv` or `-vvv` options:

```
$ ansible-playbook -v -i inventory/hosts uninstall-client.yml
```

**IMPORTANT**

The uninstallation of the client only removes the basic IdM configuration from the host but leaves the configuration files on the host in case you decide to re-install the client. In addition, the uninstallation has the following limitations:

- It does not remove the client host entry from the IdM LDAP server. The uninstallation only unenrolls the host.
- It does not remove any services residing on the client from IdM.
- It does not remove the DNS entries for the client from the IdM server.
- It does not remove the old principals for keytabs other than `/etc/krb5.keytab`.

Note that the uninstallation does remove all certificates that were issued for the host by the IdM CA.

**Additional resources**

- For more information on how to remove the IdM client configuration from both the host and the IdM environment completely, see the manual procedure for [Uninstalling an IdM client](#).