Replicate your identity management

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Highly available infrastructure

- Ability to obtain service, without experiencing components down.
- Minimizing access and thus the load, for example via caching.
- Adding redundancy to the system, ensuring failover to the good component.

Identity management

- Resolution of identities — users, groups, hosts, services, ...
- Verification of identities (authentication).
- Evaluation of access requests and attempts (authorization), based on centrally managed policies.
- For example: `ls -l` on POSIX systems
  - It can make number of NSS (Name Service Switch) calls resolving owner and group identities.
  - Identities can be stored on external identity source, not in `/etc`.

FreeIPA

- Integration of multiple identity-management tools.
  - directory server (LDAP), Kerberos key distribution center, one-time password (OTP) daemon
  - optionally DNS server, certification authority, vault
  - WebUI, command-line interface
- Built-in replication using 389 Directory Server replication functionality.
  - Multi-master.
- Client machines get IPA-enrolled to one of the servers.
  - Typically via `ipa-client-install` which configures all subsystems.
    - Often using one-time password for the host identity.
  - They can do a lot of caching.

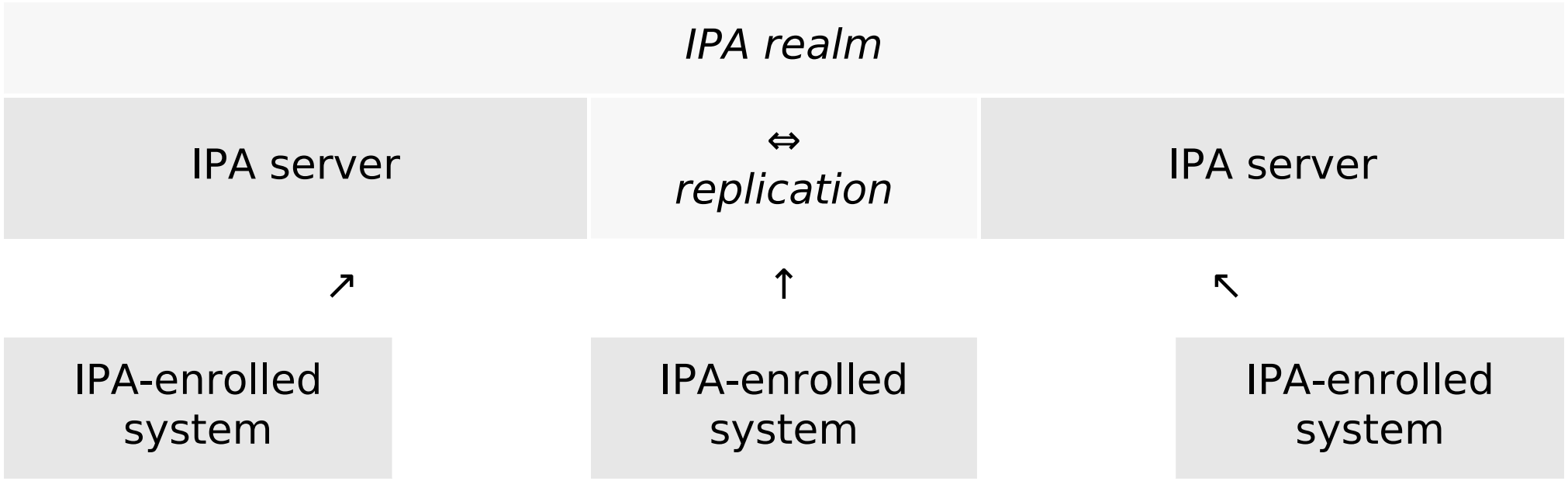
IPA-enrolled systems

- SSSD (System Security Services Daemon):
  - NSS service;
  - PAM (Pluggable Authentication Module) service;
  - plugs to other subsystems — sudo, Kerberos, ...
  - DNS records can prioritize IPA servers used:

```
# /etc/sssd/sssd.conf
[domain/example.com]
ipa_server = _srv_, ipa1.example.com
...
```

  - KDC's IP address cached in `/var/lib/sss/pubconf/kdcinfo.*`.

FreeIPA replication



- IPA servers get found via DNS or with their hostname hardcoded on clients.

Replication and topology enhancements

Three areas of replication improvement:

- Replica promotion which simplifies setup of new replicas.
- Topology plugin for central control over replication agreements.
- DNS-based locations for central management of client priorities.

Replica promotion

- Promotion of any IPA-enrolled client to FreeIPA replica.
  - Can also start with unenrolled host.
- GPG-encrypted replica information files no longer needed.
- The `ipa-replica-install` tool still used.
- Standard Kerberos authentication.
- With host OTP and `ipaservers` host group, admin credentials do not need to be used on the replicas.

Example workflow

- Create host record for the future replica, give the host ability to make itself a replica with the `ipaservers` host group.

```
client$ kinit admin
Password for admin@EXAMPLE.COM:
client$ ipa host-add replica.example.com --random
----------------------------
Added host "replica.example.com"
----------------------------
  Host name: replica.example.com
  Random password: ImgXN_VxNC,B
  Password: True
  Keytab: False
  Managed by: replica.example.com
client$ ipa hostgroup-add-member ipaservers --hosts=replica.example.com
  Host-group: ipaservers
  Description: IPA server hosts
  Member hosts: master.example.com, replica.example.com
-------------------------
Number of members added 1
-------------------------
```

Example workflow (cont)

- On the replica machine:

```
replica# ipa-replica-install --password 'ImgXN_VxNC,B'
Configuring client side components
Client hostname: replica.example.com
Realm: EXAMPLE.COM
DNS Domain: example.com
IPA Server: master.example.com
...
Enrolled in IPA realm EXAMPLE.COM
Created /etc/ipa/default.conf
...
  Configuring directory server (dirsrv). Estimated time: 1 minute
...
  [28/43]: setting up initial replication
Starting replication, please wait until this has completed.
Update in progress, 6 seconds elapsed
Update succeeded
  [29/43]: adding sasl mappings to the directory
...
  [2/2]: configuring ipa-otpd to start on boot
Done configuring ipa-otpd.
```

Replica promotion of IPA-enrolled client

- Check `/etc/ipa/default.conf` points to the master.

```
[global]
server = master.example.com
xmlrpc_uri = https://master.example.com/ipa/xml
```

- After replica promotion, it gets updated to point to itself.

```
xmlrpc_uri = https://replica.example.com/ipa/xml
```

- Domain level at least 1 (important for upgrades).

```
ipa1# ipa domainlevel-get
-----------------------
Current domain level: 1
-----------------------
```

Topology information

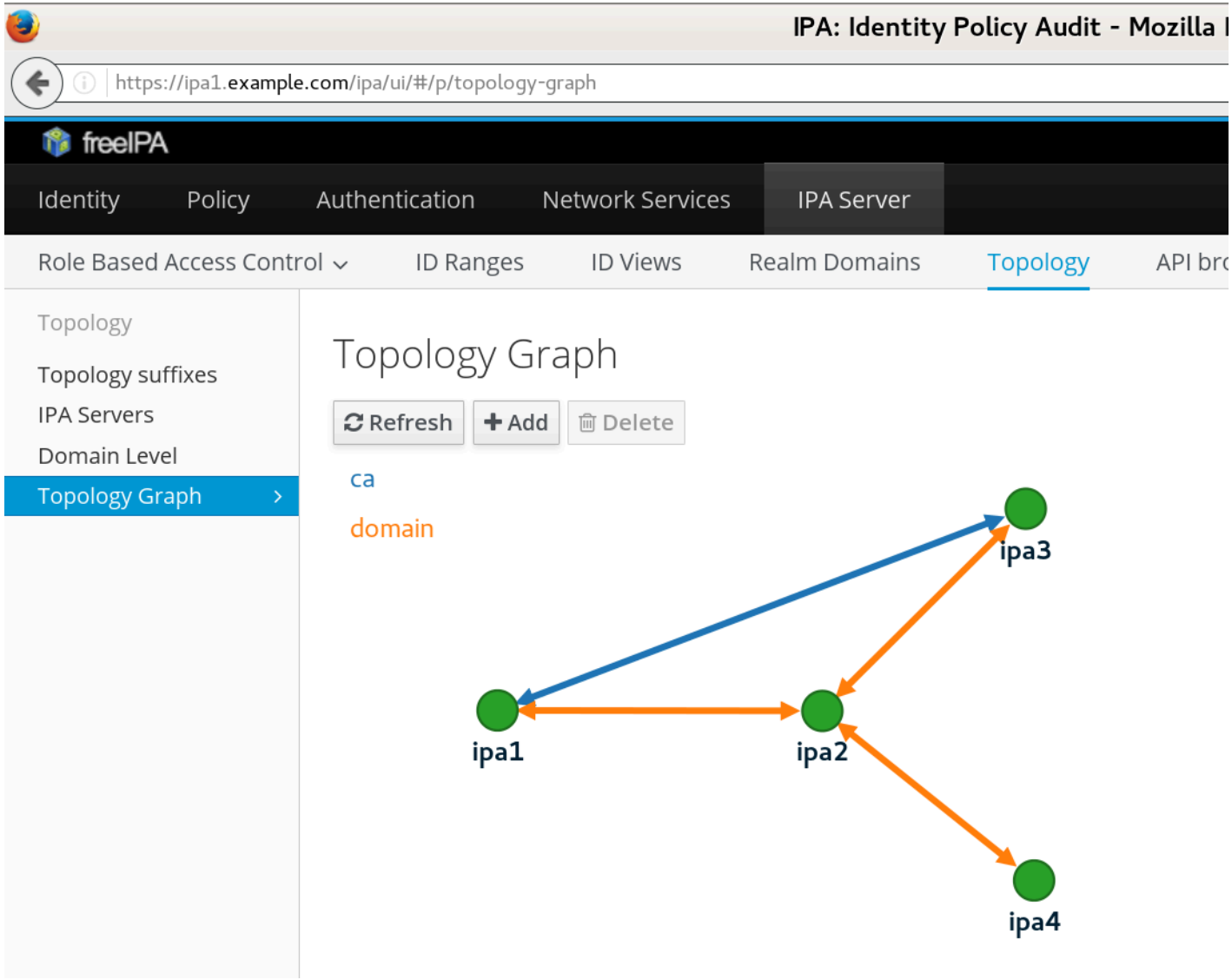
- Topology info is now replicated across all replicas.

```
ipa1$ ipa topologysegment-find domain
------------------
3 segments matched
------------------
  Segment name: ipa1.example.com-to-ipa2.example.com
  Left node: ipa1.example.com
  Right node: ipa2.example.com
  Connectivity: both

  Segment name: ipa2.example.com-to-ipa3.example.com
  Left node: ipa2.example.com
  Right node: ipa3.example.com
  Connectivity: both

  Segment name: ipa2.example.com-to-ipa4.example.com
  Left node: ipa2.example.com
  Right node: ipa4.example.com
  Connectivity: both
----------------------------
Number of entries returned 3
```

Topology graph



Managing topology

- Segment is added by creating it in directory server.

```
ipa1$ ipa topologysegment-add domain ipa3.example.com-to-ipa4.example.com \
    --leftnode=ipa3.example.com --rightnode=ipa4.example.com
----------------------------------------------------
Added segment "ipa3.example.com-to-ipa4.example.com"
----------------------------------------------------
  Segment name: ipa3.example.com-to-ipa4.example.com
  Left node: ipa3.example.com
  Right node: ipa4.example.com
  Connectivity: both
```

- Via command-line or WebUI.
- Information gets replicated to the target nodes.
- New replication agreement is established.
- The ca suffix is used for the certification authority.
- Can only add segment between nodes that already have the role installed and configured.

DNS-based locations

- With easy way to set up replicas and segments, complex network topologies are possible.
- Clients should be able to seamlessly fail over.
- With DNS SRV records, no need to hardcode a particular FreeIPA server on clients.
- But different clients need different servers resolved, for “cheapest” operation.
- Traditionally, mix of hardcoded and SRV was used:

```
[domain/example.com]
ipa_server = ipa1.example.com, _srv_
```

  - Problem: configuration on every client.
- New DNS-based location feature allows grouping of FreeIPA servers and managing their priorities.

DNS-based locations operation

- FreeIPA server with embedded DNS server running in every location.
- Clients are configured to use that DNS server.
  - E.g. via DHCP in given subnet — handled outside of FreeIPA.
  - Can also resolve through that DNS server recursively.
- Locations defined, FreeIPA servers assigned to them.
- The DNS servers in each location will autogenerate SRV records as CNAMEs to given location.

Location definition

```
$ ipa location-show emea
  Location name: emea
  Servers: ipa1.uk.example.com, ipa2.uk.example.com
  Advertised by servers: ipa1.uk.example.com, ipa2.uk.example.com
  Servers details:
    Server name: ipa1.uk.example.com
    Service weight: 10
    Service relative weight: 25.0%
    Enabled server roles: CA server, DNS server, NTP server
    Server name: ipa2.uk.example.com
    Service weight: 30
    Service relative weight: 75.0%
    Enabled server roles: DNS server, NTP server
$ ipa location-show us
  Location name: us
  Servers: ipa1.houston.example.com
  Advertised by servers: ipa1.houston.example.com
  Servers details:
    Server name: ipa1.houston.example.com
    Service weight: 10
    Service relative weight: 100.0%
    Enabled server roles: CA server, DNS server, NTP server
```

Location resolution

```
$ dig +short @ipa1.uk.example.com. _kerberos._tcp.example.com SRV
_kerberos._tcp.emea._locations.example.com.
0 10 88 ipa1.uk.example.com.
0 30 88 ipa2.uk.example.com.
50 10 88 ipa1.houston.example.com.
$ dig +short @ipa1.houston.example.com. _kerberos._tcp.example.com SRV
_kerberos._tcp.us._locations.example.com.
50 10 88 ipa1.uk.example.com.
0 10 88 ipa1.houston.example.com.
50 30 88 ipa2.uk.example.com.
```

- Only SRV configuration is needed on clients.

```
[domain/example.com]
ipa_server = _srv_
```

- Works for any service which can resolve SRV, not just SSSD.
- No more hardcoding server names on clients.
- Ideal for roaming clients (laptops).

Conclusion

- Replicas can be created in more automated manner.
- No admin password needed on the replica machine.
- No manual action needed on the master.
- Replication topology information is now replicated.
- It is possible to manage segments without having direct network connection to the nodes.
- Partitioning servers to locations removes need for hardcoding server names on clients for priority purposes.

References

- www.freeipa.org/page/V4/Replica_Promotion
- www.freeipa.org/page/V4/Manage_replication_topology
- www.freeipa.org/page/V4/DNS_Location_Mechanism