INDIGO-IAM: sviluppi futuri e federazioni OIDC

Roberta Miccoli
INFN-CNAF

Workshop sul Calcolo nell'I.N.F.N.
Loano (Savona) 22 - 26 maggio 2023

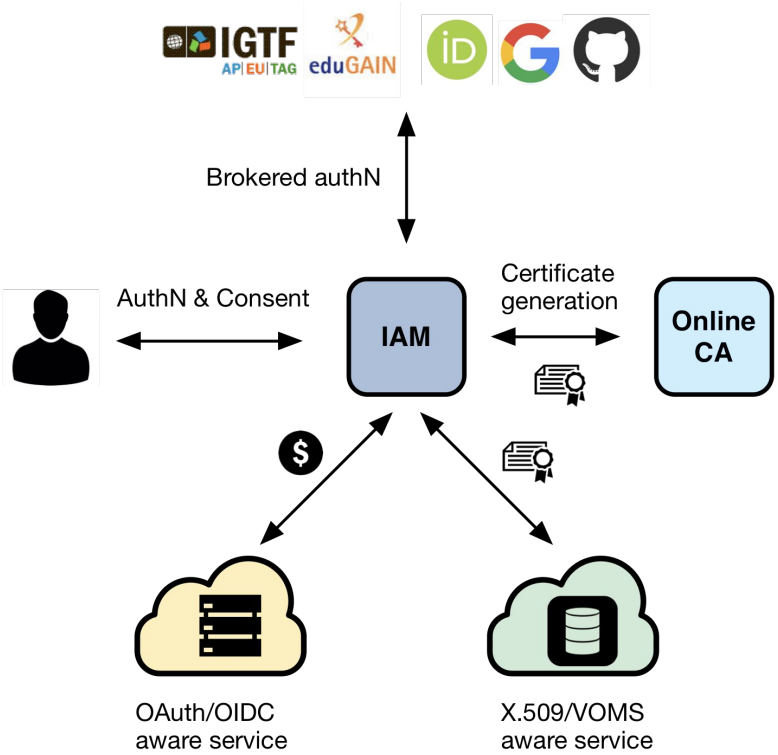
INDIGO Identity and Access Management Service

First developed in the context of the **H2020 INDIGO DataCloud** project

~7 years since 1st INDIGO IAM release v0.3.0 (2016-07-12)

Allows consistent authentication and authorization technologies/policies at all Cloud levels (IaaS, PaaS, SaaS) in the context of **INFN Datacloud**

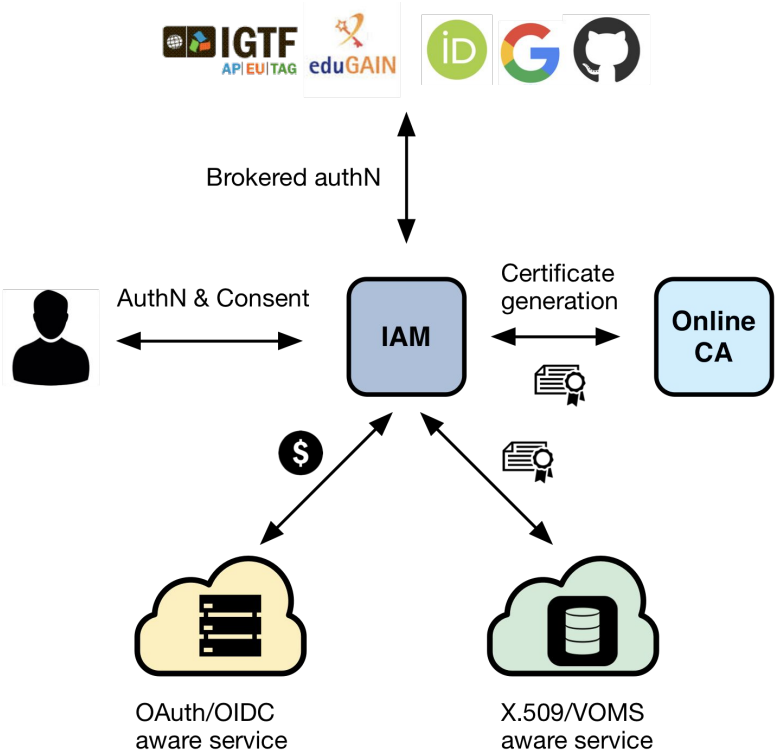
Selected by the WLCG management board to be the core of the future, token-based WLCG AAI



INDIGO Identity and Access Management Service

An authentication and authorization service that:

- supports **multiple authentication mechanisms**
- provides users with a **persistent, organization scoped** identifier
- exposes **identity information**, **attributes** and **capabilities** to services via **JWT** tokens and standard **OAuth & OpenID Connect** protocols
- can integrate existing **VOMS**-aware services
- supports **Web** and **non-Web access**, **delegation** and **token renewal**



Latest release: IAM v1.8.1

Released on: **2023-02-28**

Major **highlights**:

- Scopes management interface added to IAM dashboard
- Group Manager interface added to IAM dashboard
- Support for AARC-G069 guideline (groups and roles membership information can be requested with the `entitlements` scope and appears in the `entitlements` claim of the access token) to increase conformance to AARC Blueprint Architecture

Scopes management interface

IAM for **dev**

Roberta Miccoli

Roberta Miccoli
dev

Account Management

Home

Organization Management

Users 16

Groups 31

Requests

AUP

Clients

Tokens 166

Scopes 26

Client management

MitreID Dashboard

Scopes

Scopes

+ New Scope

	Scope	Description
	openid	log in using your identity
	profile	basic profile information
	email	email address
	address	physical address
	phone	telephone number
	offline_access	offline access
	scim:read	read access to SCIM user and groups
	scim:write	write access to SCIM user and groups
	registration:read	Grants read access to registration requests
	registration:write	Grants write access to registration requests
	scim	Authorizes access to IAM SCIM APIs

This page replaces the functionality of the old *System Scopes* page of the MitreID dashboard and it is only visible by IAM Admins

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scim	Authorizes access to IAM SCIM APIs

Scope creation form

Scope Scope name

Single string with no spaces

Description Description

Human-readable text description

Default Scope

Newly-created clients get this scope by default?

Restricted

Restricted scopes are only usable by system administrators and are unavailable to dynamically registered clients and protected resources

Create Reset Form Cancel

Scopes management interface

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Edit Scope

Scope **openid**

Description log in using your identity

Human-readable text description

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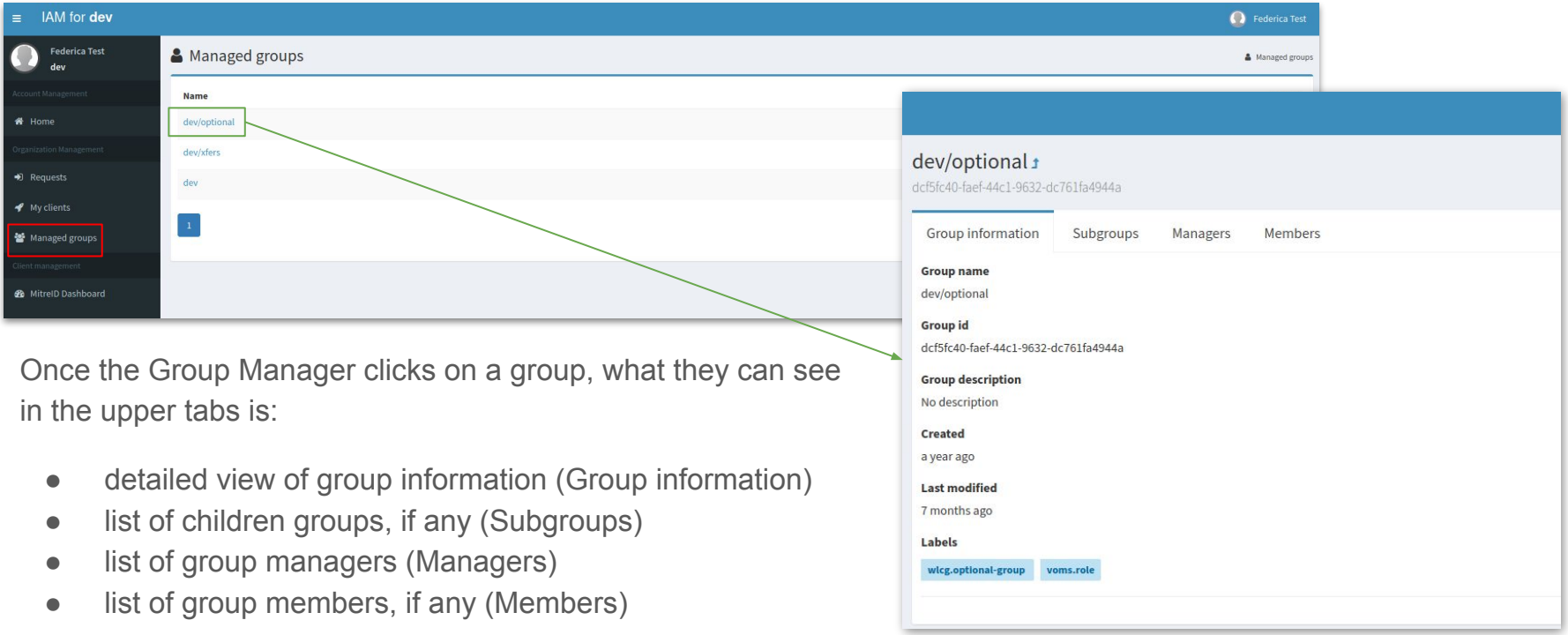
Save Cancel

Group Manager interface



Once the Group Manager clicks on a group, what they can see in the upper tabs is:

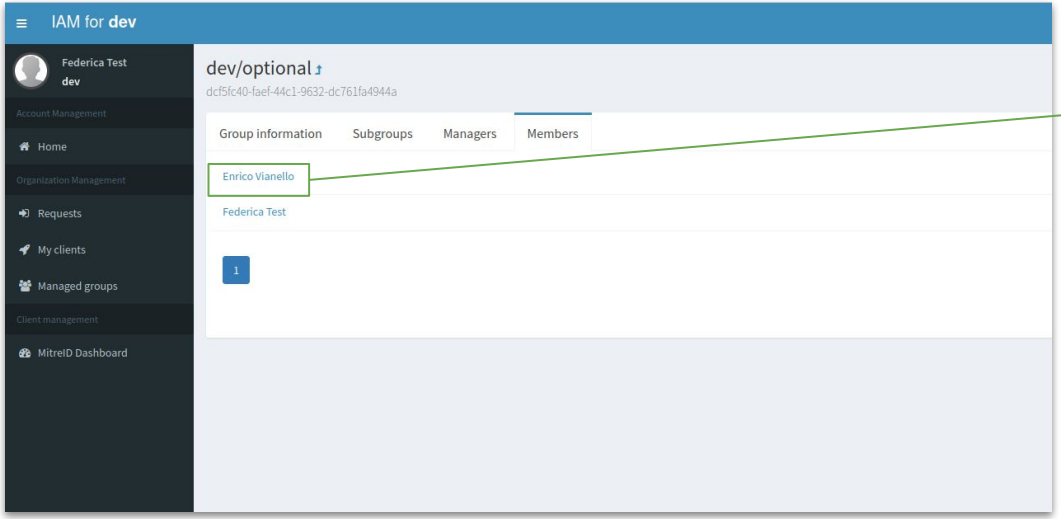
- detailed view of group information (Group information)
- list of children groups, if any (Subgroups)
- list of group managers (Managers)
- list of group members, if any (Members)

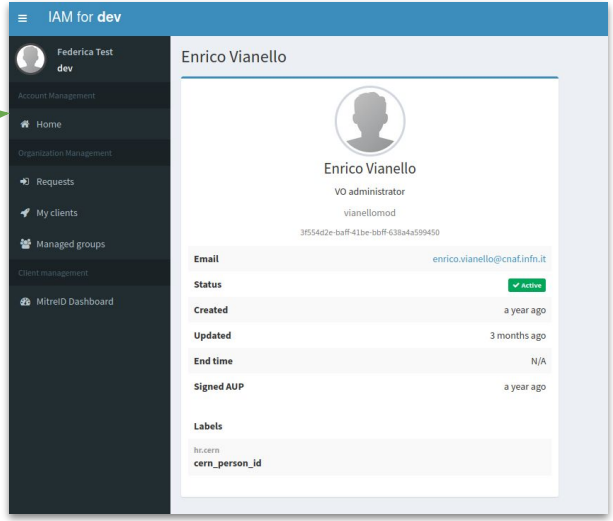
Group Manager interface

A Group Manager in IAM does not have the same privileges as the IAM Admin in managing groups. Currently, they can:

- approve/reject membership requests
- delete users from their managed groups

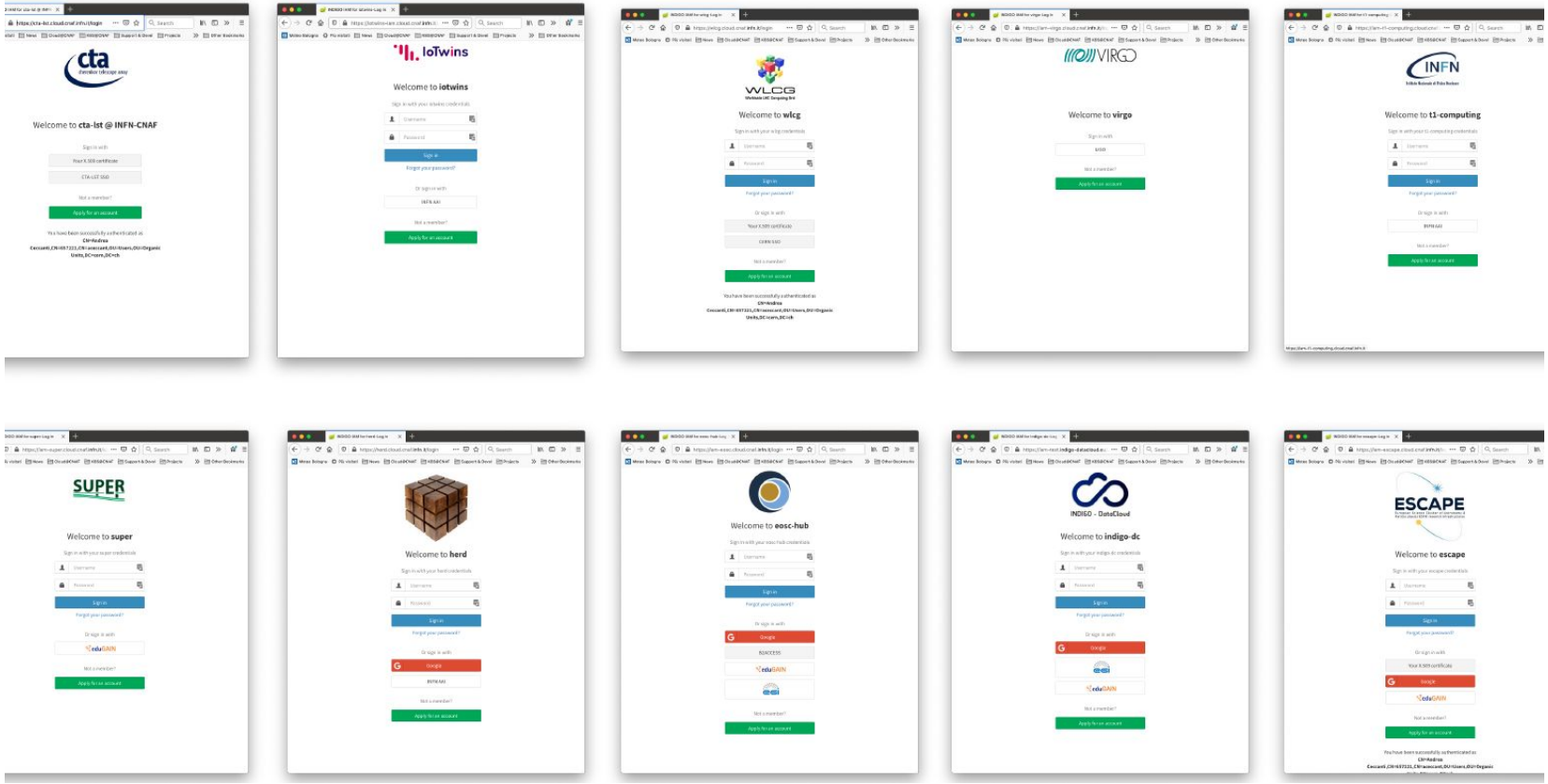
The Group Manager has also the possibility to click on group members, where a limited view of user information (including name, surname, uuid, username, email, status, created, updated, end time and labels) is shown.





IAM deployment, performance and HA

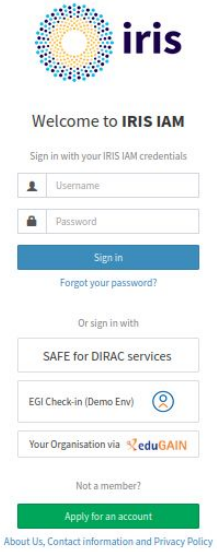
IAM deployments at CNAF



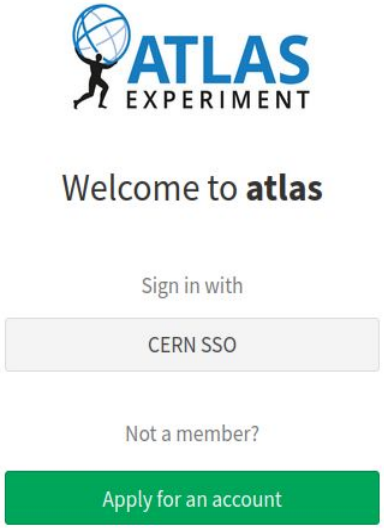
~ 20 IAM instances

IAM deployments outside CNAF

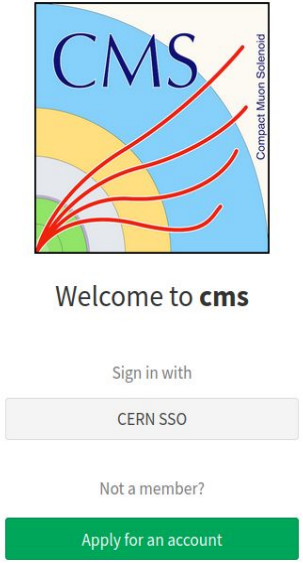
~ 10 IAM instances



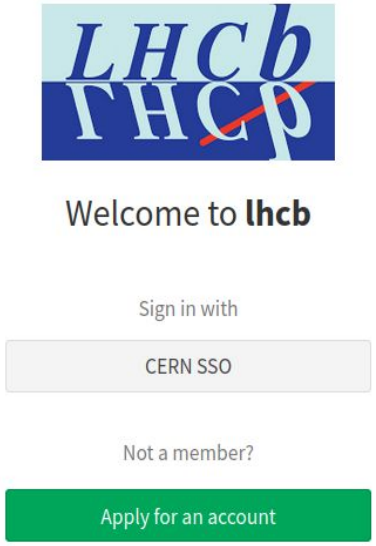
iris-iam.stfc.ac.uk



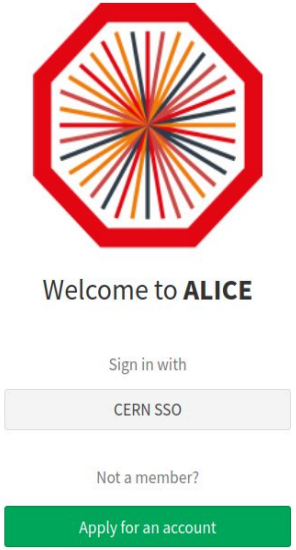
atlas-auth.web.cern.ch



cms-auth.web.cern.ch



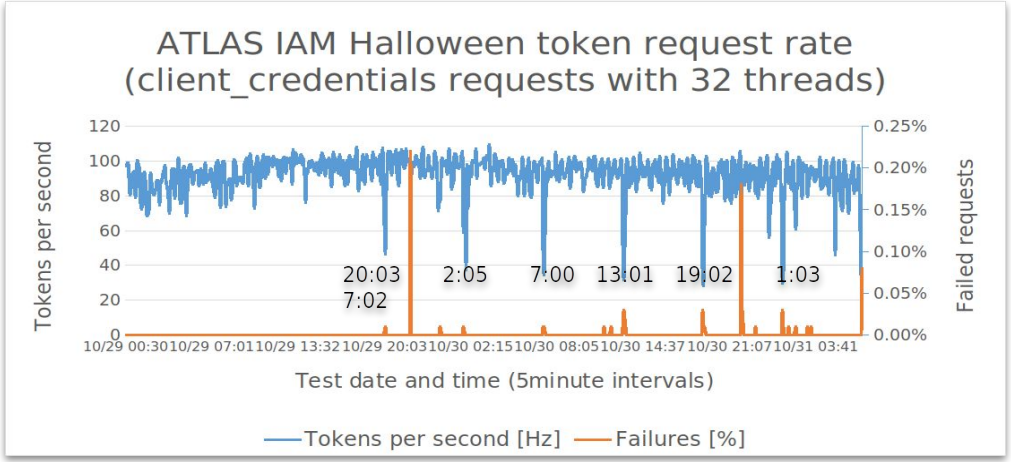
lhcb-auth.web.cern.ch



alice-auth.web.cern.ch

IAM performance: a goal to be achieved

- Unannounced stress tests have been performed on the Atlas IAM instance hosted at CERN
  - `vegeta attack` with 100 Hz token request rate using client credentials grant
- ~100 Hz sustained for more than two days (300 ms response time, 0% error rate)
- then, IAM showed some degradation and it became unavailable afterwards
  - the k8s liveness probe took IAM down because it was not responding to the `/health` endpoint within the timeout
- **Scalability and performance tests are planned for the next [IAM Hackathon]**



IAM core technologies

IAM is a **Spring Boot** application

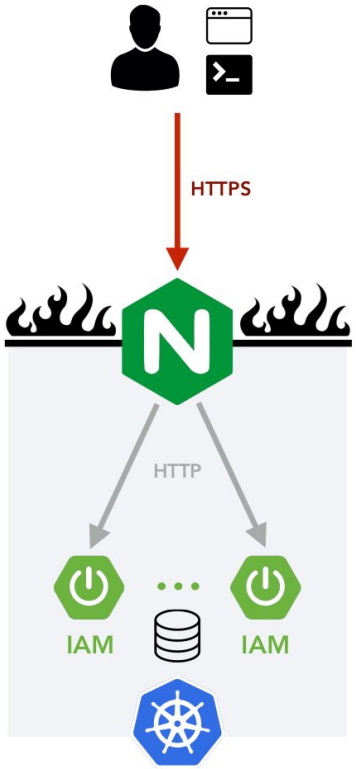
- currently based on the MitreID Connect
- deployed behind an **NGINX**
- stores data in a **MariaDB/MySQL** database

Horizontally scalable

- all state persisted in the database

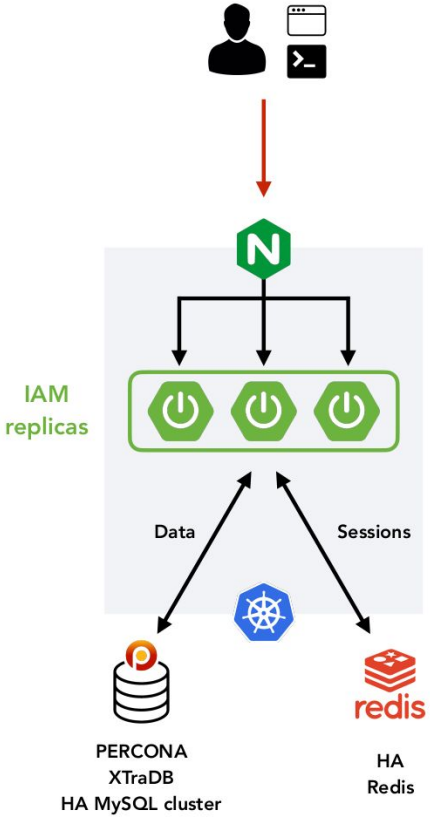
We deploy IAM as a **containerized** service on top of **Kubernetes**

- autoscaling, zero downtime rolling updates



IAM in High Availability

- Starting from version 1.8.0, the IAM service can be deployed in **High Availability** mode
  - IAM supports session data externalization
  - IAM becomes a completely stateless application
- About externalized sessions: IAM relies on redis as external component used to store session data
- Tests in progress: IAM has been deployed with 3 replicas on the dev IAM instance (at CNAF)
  - we faced some cluster limits
  - we planned to use a testbed hosted at CERN



Future IAM developments

Planned release: IAM v1.8.2

Done:

- Spring dependency version update
- CERN HR suspended status synchronization #530
- Invalid request error when the AuthZ request is modified during the user approval step #554

and other minor fixes

In progress:

- Any token created by IAM admin have full access to IAM API #543
- Token column in database is a limited index and can lead to a "Duplicate entry" error #579

We are almost ready for a release; it will be available soon.

Our roadmap

In progress:

- Add scope policy management into IAM dashboard #382
- IAM username update blocked by case insensitive "is username available" check #434
- Case sensitivity confusion between MySQL unique fields and JPA equals comparisons #550

To do:

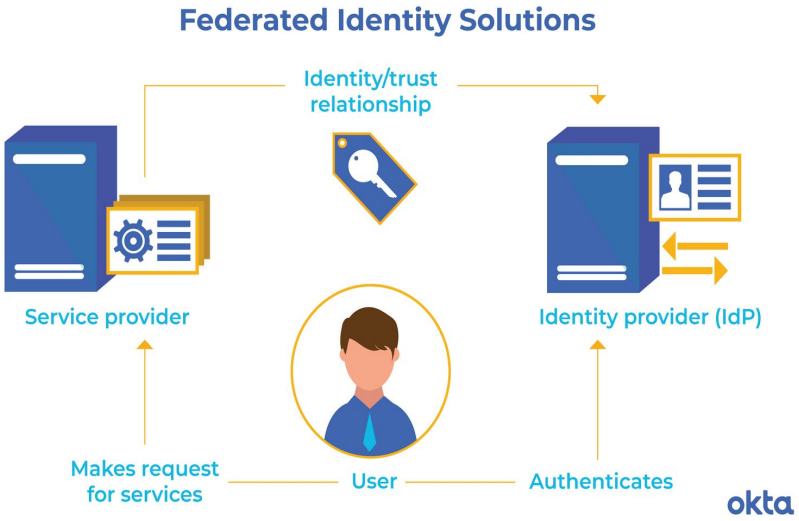
- Local accounts: check password quality #544
- Support for AARC guidelines #467, #466, #469
- Can't add certificate with same subject and different issuer #454
- Client problems due to unsupported response types #601
- IAM should allow users to request account removal #362
- Support for Multi-factor Authentication #418
- **Scalability/availability assessment**
- **Overall security assessment**
- **Support for OIDC Federation model**

…

Introduction to Federations

Identity Federations

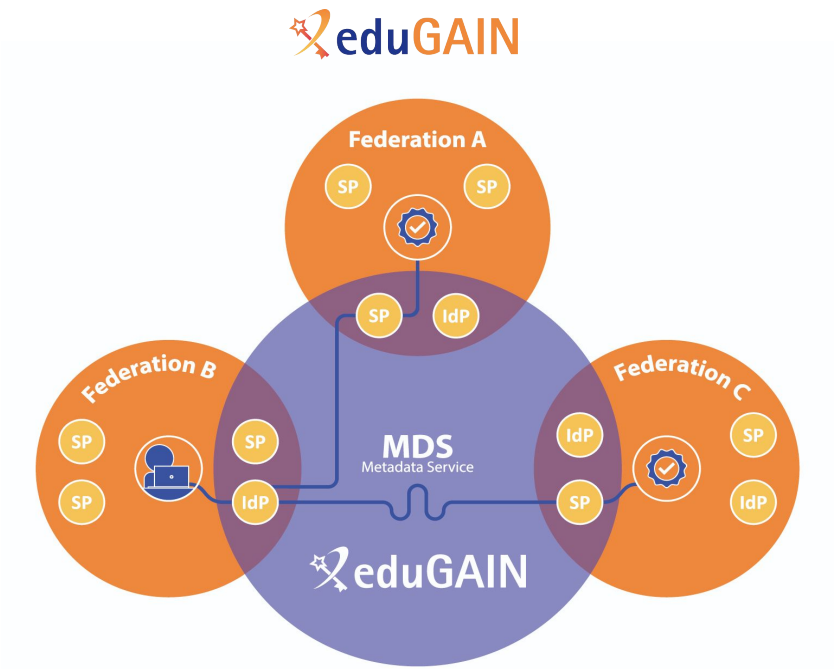
- A method of linking a user's identity across multiple separate identity management systems used by a group of institutions and organisations
- Extended range of services offered to the users
- A Web Single Sign On (SSO) is provided
- Only one account and password are required within the federation
- Common technologies used in federated identity management
  - SAML
  - OAuth/OpenID



SAML Federations

eduGAIN

- eduGAIN is an efficient, flexible way for participating federations, and their affiliated users and services, to interconnect at an international level
- eduGAIN technology involves a *metadata service* that aggregates all the Service and Identity Providers information, and makes this information available to federations
- eduGAIN coordinates necessary elements of the federations' technical infrastructure and provides a policy framework controlling the exchange of this information between Identity Federations
- An Indigo IAM instance can join a SAML federation (e.g. eduGAIN) as a Service Provider

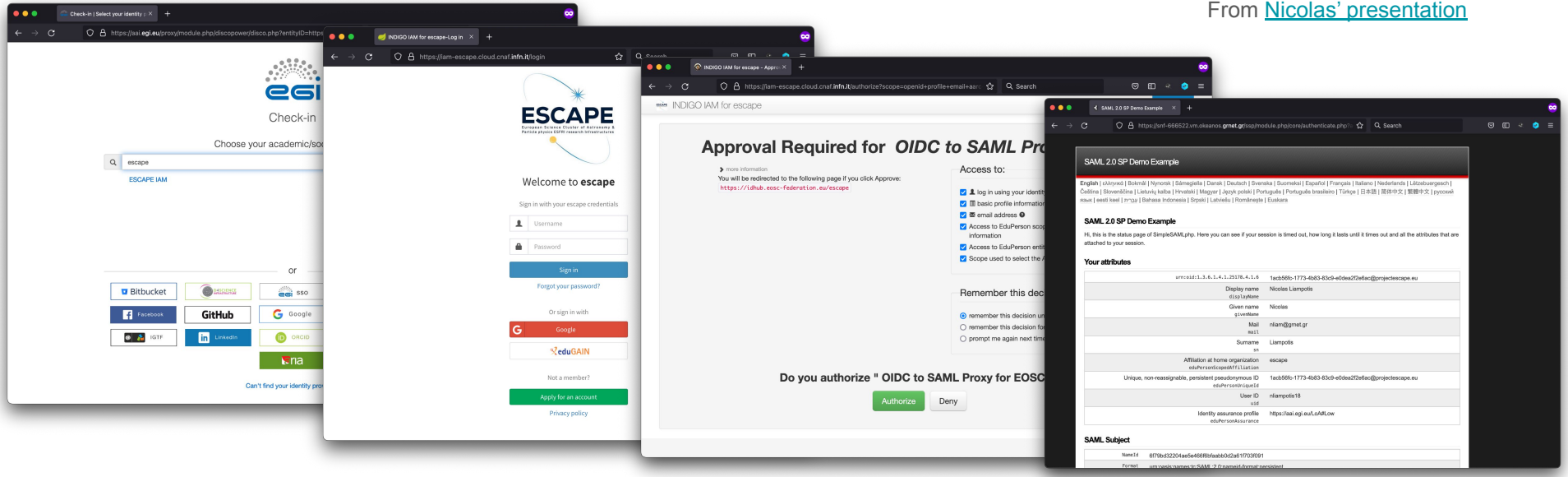


Source: https://edugain.org/

EOSC AAI Federation

- Check-in acts as SAML Service Provider
- The ESCAPE IAM instance acts as SAML Identity Provider
  - since IAM can only act as SP, in order to integrate the ESCAPE IAM into the EOSC AAI federation an OIDC-to-SAML proxy has been deployed

From Nicolas' presentation



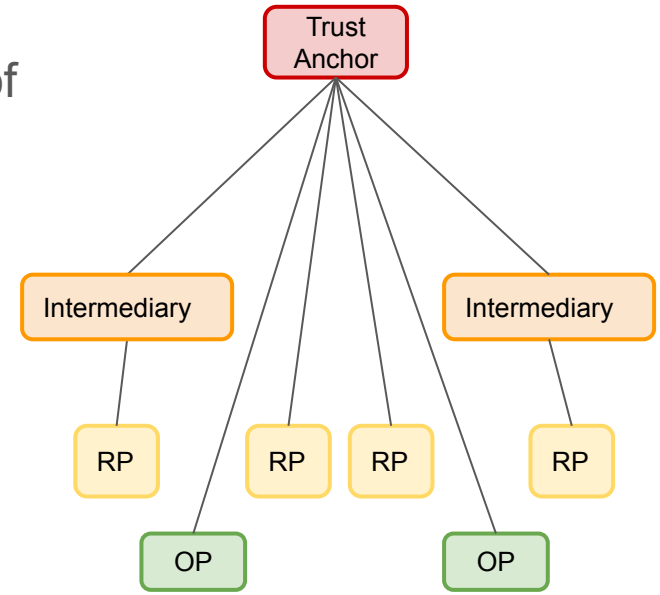
OpenID Connect Federation

OIDC Federation as a solution

- Issue: for participants in an Identity Federation, the onboarding process of the OpenID Connect (OIDC) standard is not sufficient to dynamically establish trust in the information exchanged
- Solution: the OpenID Connect Federation 1.0 specification, being finalised, describes how two entities wishing to interact can **dynamically** retrieve and resolve trust and metadata for a given protocol using a third-party *Trust Anchor*

OIDC Federation entities

- **Trust Anchor** (TA): publishes the configuration of the Federation and the claims of recognition of the parties belonging to the Federation
- **Intermediary**: Soggetto Aggregatore (SA) in Spid, facilitates entry into the Federation, publishes its configuration within the Federation and claims of recognition by its descendants
- **Leaf**: Relying Party (RP) and OpenID Provider (OP)

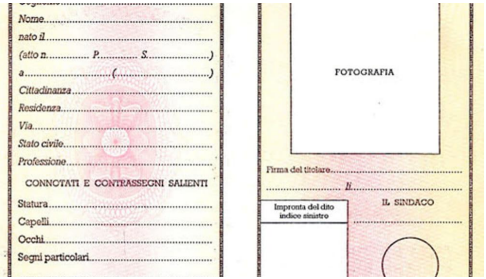


SAML vs OIDC Federation

SAML	OIDC Federation
A participant in several federations must create ad hoc metadata for each federation	All federation participants publish their own federation metadata (Entity Configuration), which is the same for all federations to which the participant belongs; the final dynamically produced metadata is the result of the various policies acquired by the trust anchors applied to the Entity Configuration

SAML vs OIDC Federation

SAML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FOTOGRAFIA
Firma del titolare.....
Impronta del dito indice sinistro
IL SINDACO

OIDC Federation

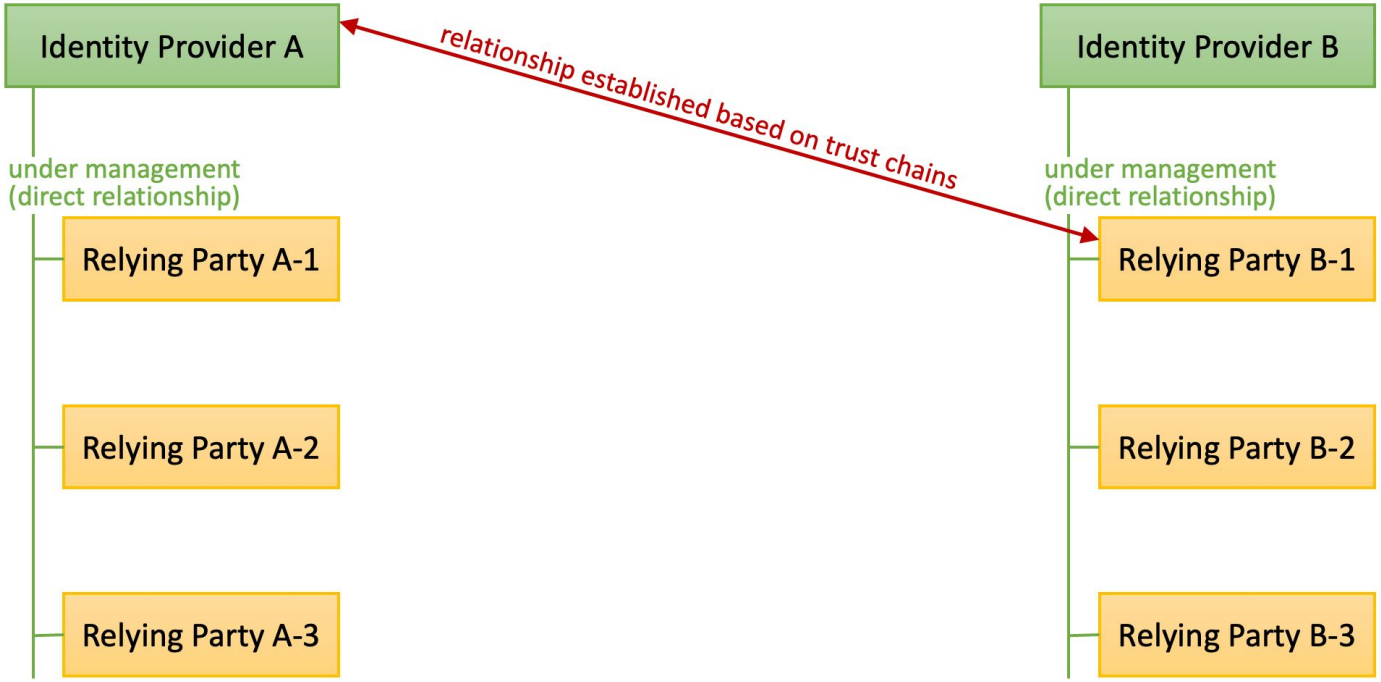
DICHIARAZIONE SOSTITUTIVA DI ATTO NOTORIO
(art. 19 e art. 47 D.P.R. 28 dicembre 2000 n. 445)

La/Il sottoscritta/o .....Mario Rossi.....
C.F. ..... nata/o a ..... (...)
il ..... e residente a ..... (...) in via ..... n. ..... di cittadinanza .....,
consapevole della responsabilità penale e delle con-seguenti sanzioni cui può andare incontro in caso di dichiarazioni mendaci, falsità negli atti, uso di atti falsi, ai sensi dell'art. 76 del D.P.R. n. 445/2000 nonché della decadenza dai benefici eventualmente conseguiti in seguito a provvedimenti emessi sulla base di dichiarazioni non veritiere, così come previsto dall'art. 75 del D.P.R. n. 445/2000

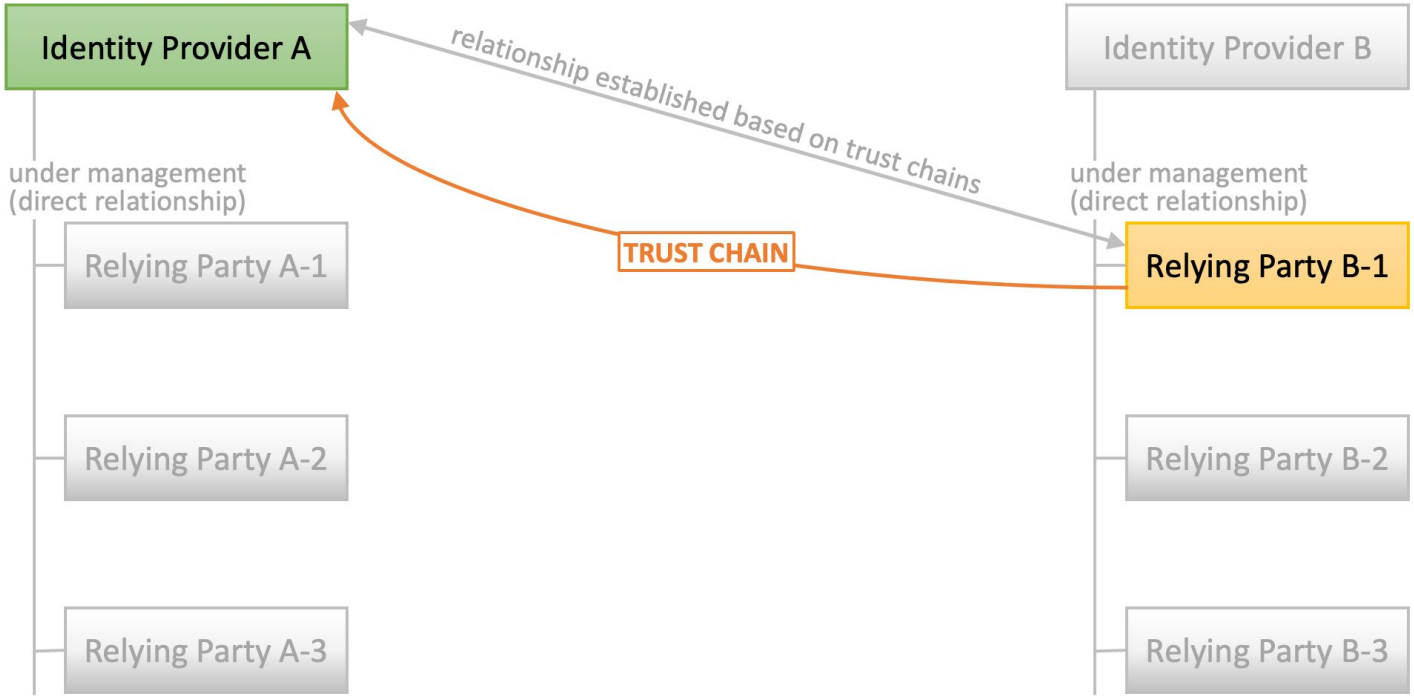
DICHIARA
i seguenti stati, qualità personali o fatti[1]

- **SPID-SAML**
  - the SAML metadata can be compared to the identity card of a Service Provider (SP)
  - the characteristic information of a service is certified by AgID (Agenzia per l'Italia Digitale)
- **SPID-OIDC Federation**
  - the Trust Anchor guarantees the identity of the federation members
  - federation member declares their characteristics
  - e.g. in the declaration in lieu of affidavit, Mario Rossi declares and signs his characteristics

OIDC Federation overview



OIDC Federation overview



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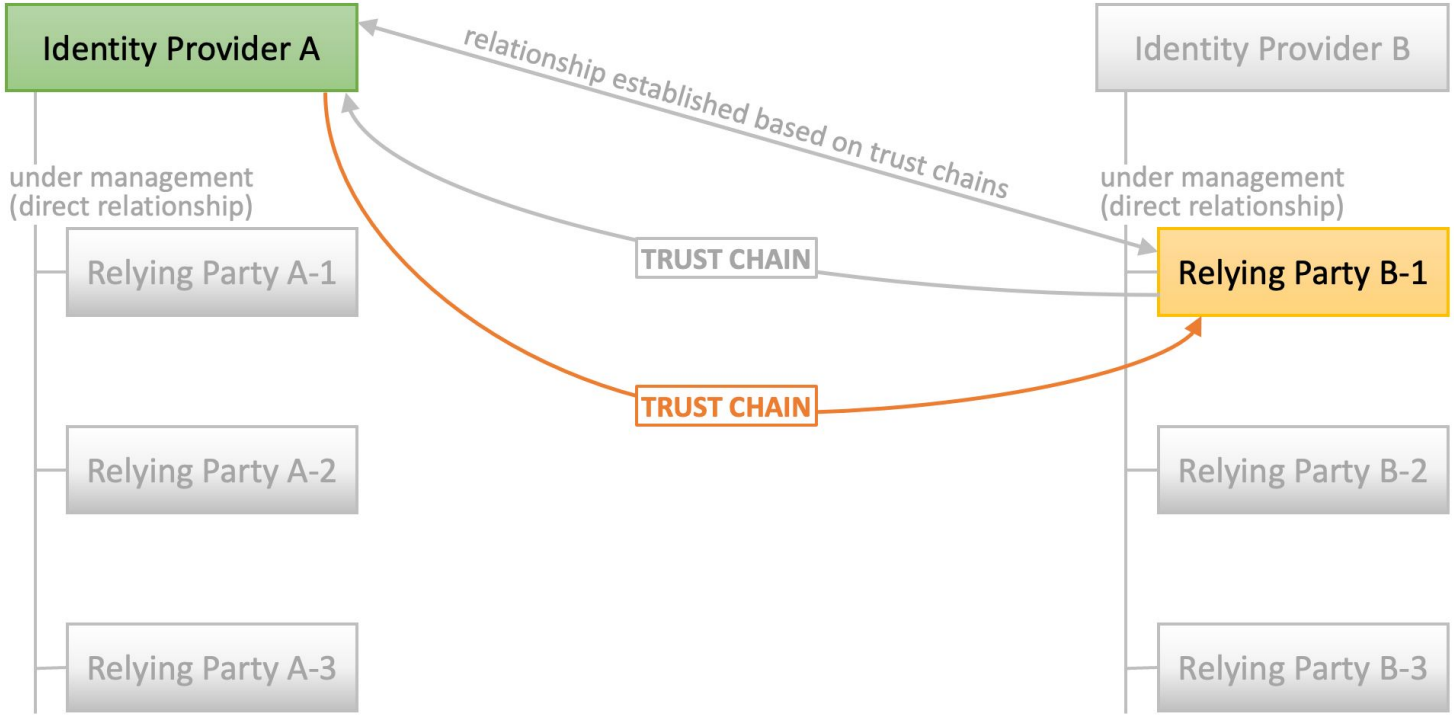

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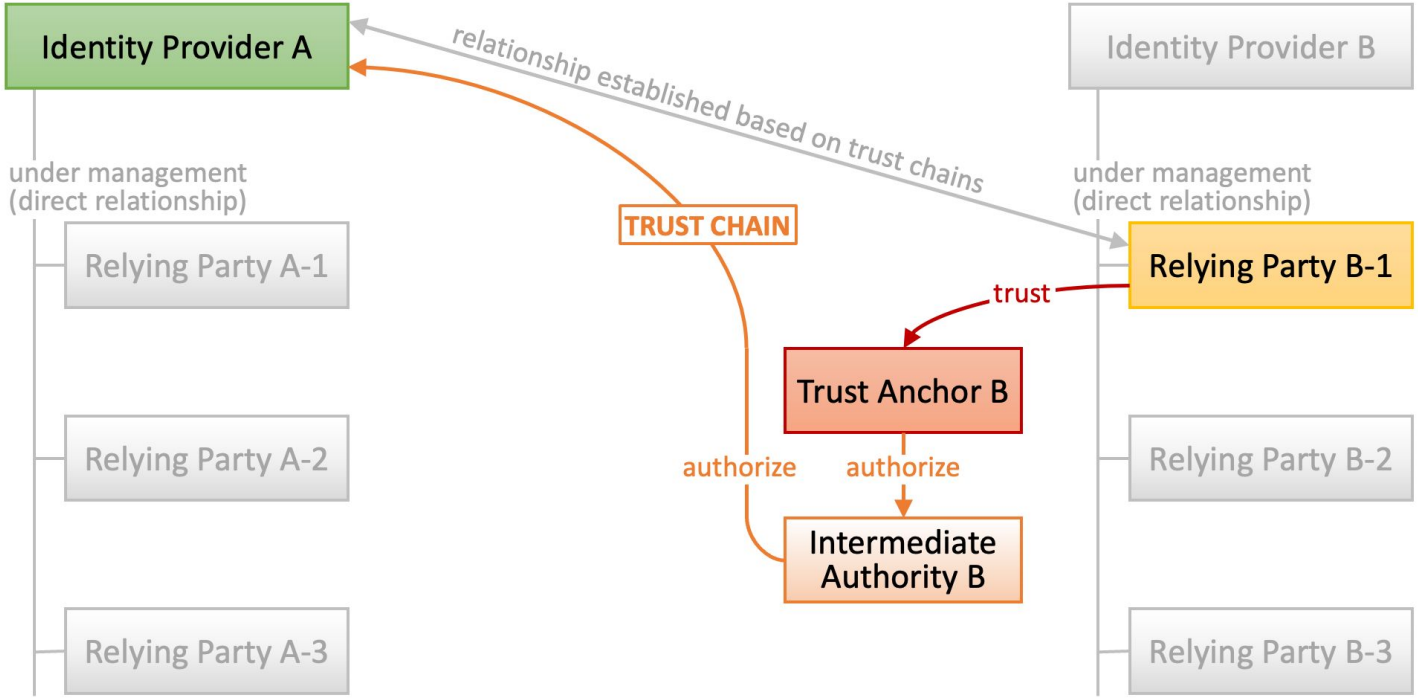

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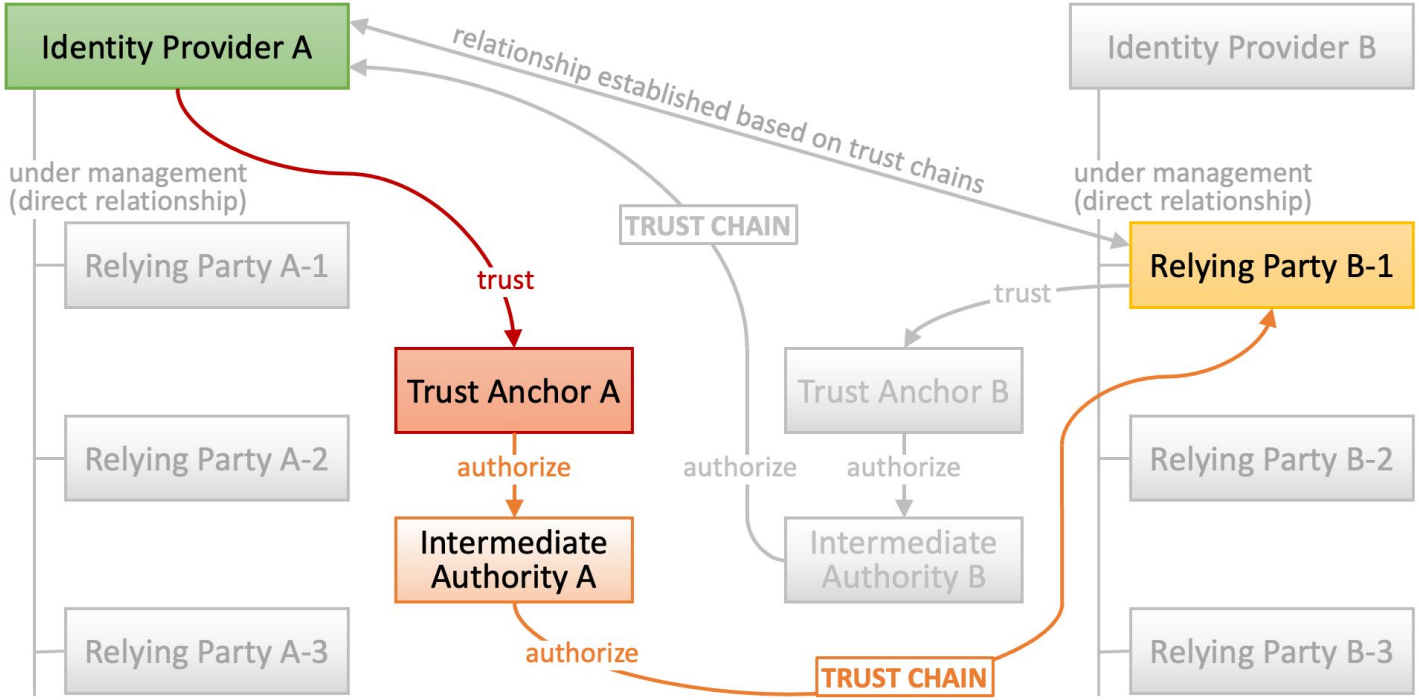

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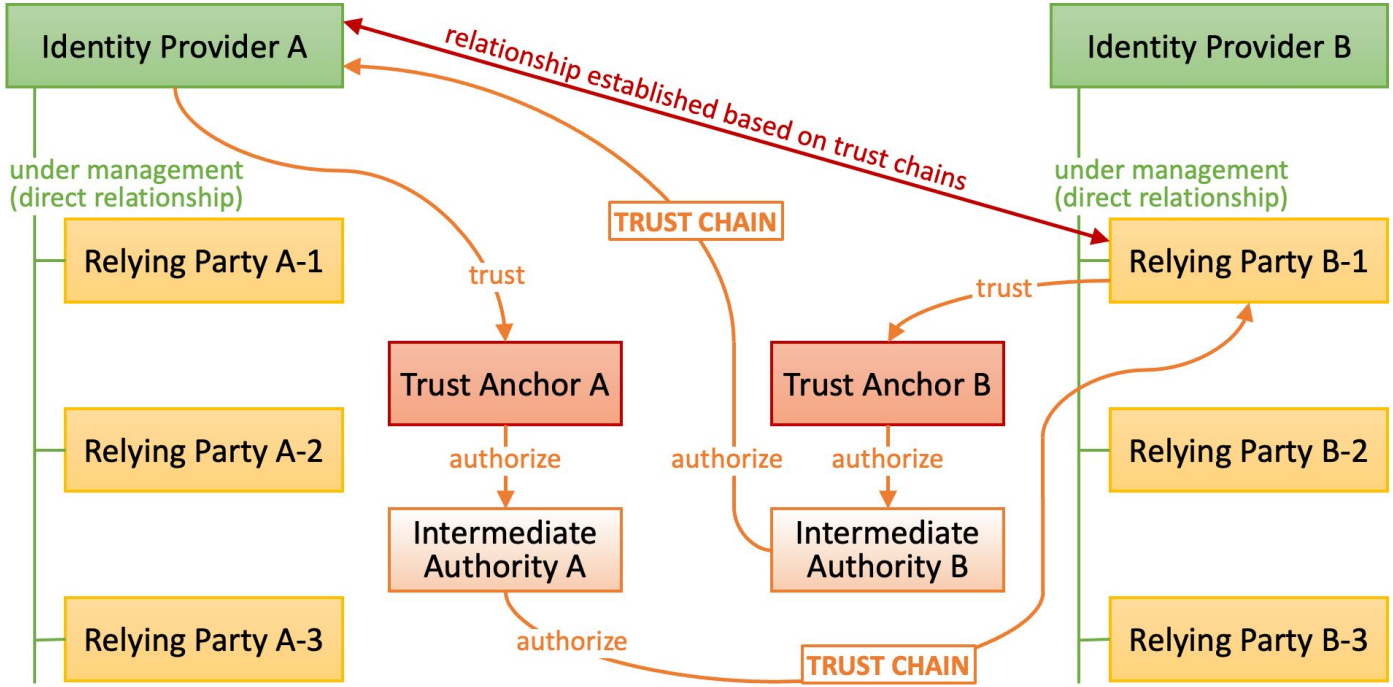
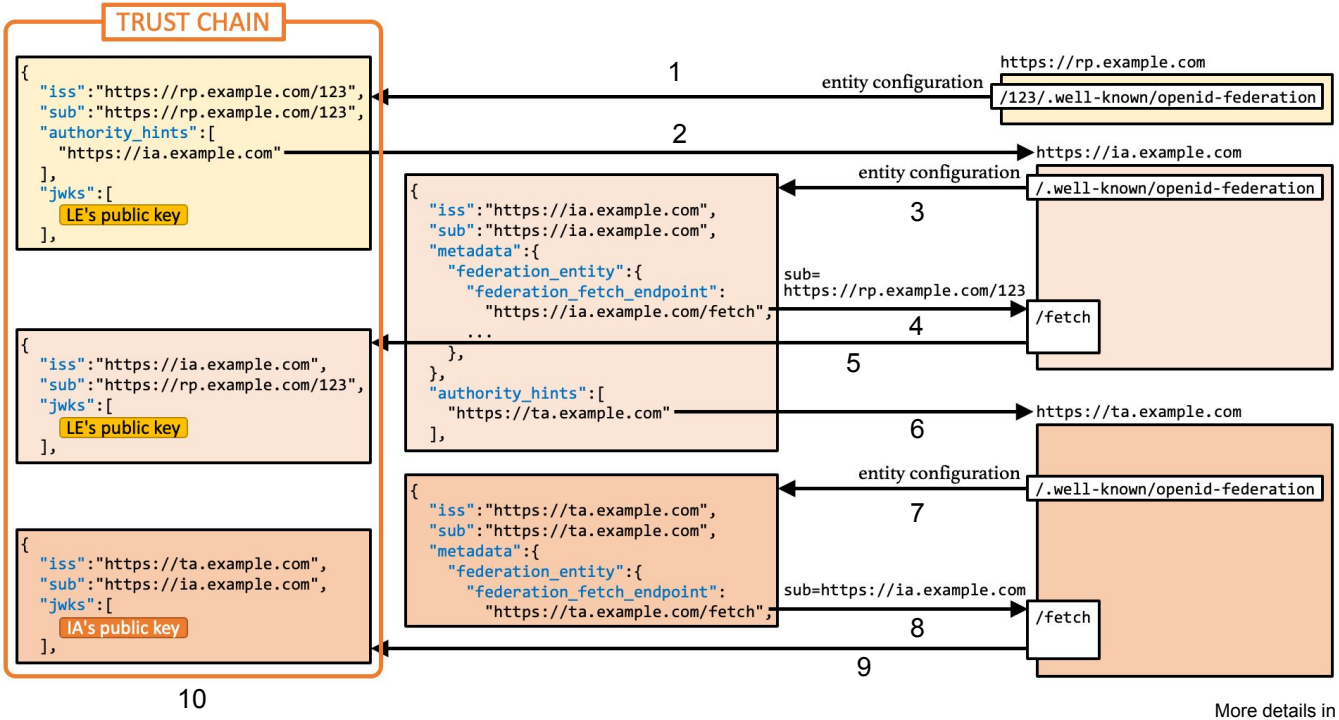


Trust Chain resolution flow



More details in the backup slides

Thanks for your attention!

INFN CNAF

Useful references

IAM on GitHub: https://github.com/indigo-iam/iam

IAM documentation: https://indigo-iam.github.io/docs

IAM in action video: https://www.youtube.com/watch?v=1rZlvJADOnY

For general information:

- OAuth 2.0: https://oauth.net/2/ and OAuth 2.1: https://oauth.net/2.1/
- OpenID Connect: https://openid.net/connect/
- OpenID Connect Federation: https://openid.net/specs/openid-connect-federation-1_0.html

Contacts:

- iam-support@lists.infn.it

Questions?

Backup slides

Terminology

- **Entity Statement**: a signed JWT issued by a superior entity (TA or SA) concerning a descendant entity (RP, OP or SA) and containing the descendant's public key, the Trust Marks issued and the metadata policy to be applied to the subject metadata
- **Entity Configuration**: an Entity Statement issued by an Entity about itself, in self-signed JWT format; it contains the Entity's signing keys and further data used to control the Trust Chain resolution process, such as authority hints
- **Trust Mark**: statement of conformance to a well-scoped set of trust and/or interoperability requirements as determined by an accreditation authority, in signed JWT format; the Leaf that acquires the trust mark during the onboarding phase must include this in its EC as a recognition badge
- **Metadata**: document describing an implementation of an OpenID Connect entity

Terminology

- **Metadata policy**: the Trust Anchor publishes the rules and policies to be applied on descendant metadata
- **Authority hint**: an array of url values corresponding to the identifiers of the superior entities (TA or SA) issuing an ES for their descendants
- **Federation Entity Discovery**: collection of EC and ES; starts from a Leaf entity until the TA is reached
- **Trust Chain**: validation procedure of the EC and ES sequence collected through Federation Entity Discovery, the successful outcome of which is a final metadata related to an entity and the expiry date by which it must be updated

Federation API Endpoints

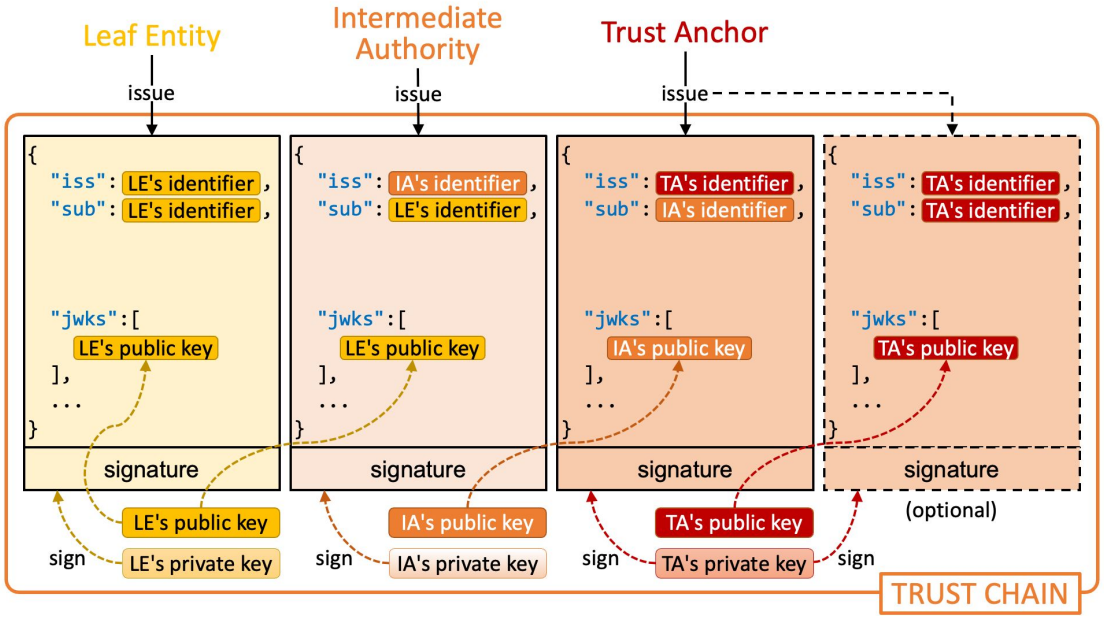
All participants:

- **.well-known/openid-federation**: well known web path where the EC is located
- **federation_resolve_endpoint**: url where the ES can be obtained with pre-processed Trust Chains

Trust Anchor and intermediaries:

- **federation_listing_endpoint**: url where the list of descendants can be obtained in JSON format
- **federation_fetch_endpoint**: url where the ES in JWT format of the descendants are published
- **federation_trust_mark_status_endpoint**: url where it is possible to check whether a Trust Mark is still active or not
- **federation-historical-jwks**: url where the list of historicised TA keys can be obtained

Trust Chain



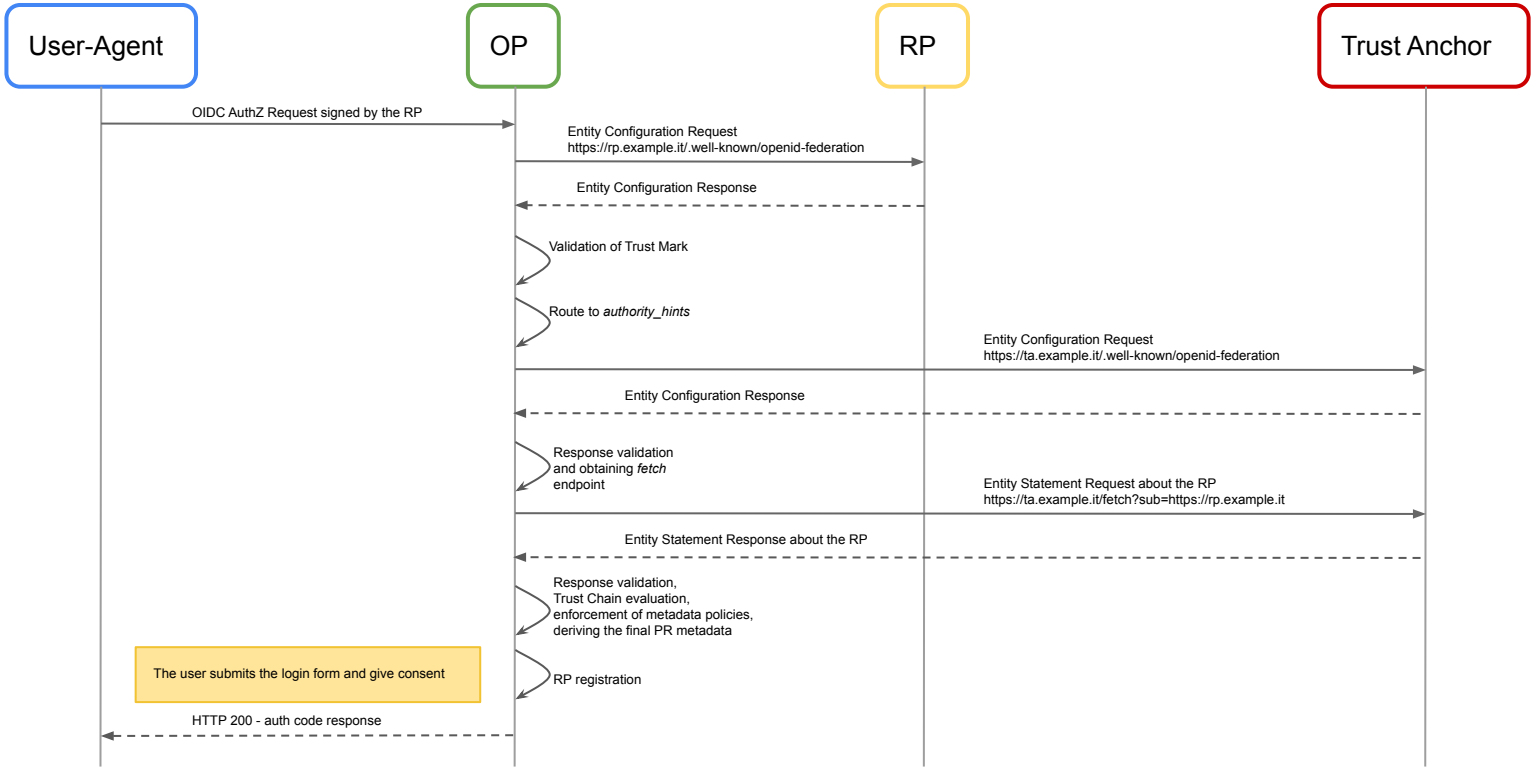
The **Trust Chain** is a sequence of JWTs that are issued by a leaf entity, zero or more intermediate authorities, and a trust anchor.

The Trust Chain linking the declarations to each other can be verified by signing each declaration. Once verified, the metadata policy is applied and the resulting final leaf metadata is saved with an expiry date

Trust Chain resolution flow

1. The first step is to get the EC of a leaf entity by querying its *.well-known/openid-federation* endpoint
2. The EC contains the *authority_hints* claim, a JSON array listing entity IDs of intermediate authorities or trust anchors
3. The EC of the intermediate authority is needed to know the URL of its federation fetch endpoint
4. An HTTP request with the *sub* request parameter is sent to the federation fetch endpoint (e.g. `https://ia.example.com/fetch?sub=https://rp.example.com`)
5. The federation fetch endpoint returns a JWT (ES) that indicates that the intermediate authority authorizes the leaf entity
6. The upper authorities of the intermediate authority are listed in the *authority_hints* claim in the EC of the intermediate authority
7. The EC of the trust anchor is needed to know the URL of its federation fetch endpoint
8. An HTTP request with the *sub* request parameter is sent to the federation fetch endpoint (e.g. `https://ta.example.com/fetch?sub=https://ia.example.com`)
9. The federation fetch endpoint returns a JWT (ES) that indicates that the trust anchor authorizes the intermediate authority
10. The entity configuration of the leaf entity and the JWTs issued from the federation fetch endpoints consist of a Trust Chain

The perspective of an OpenID Provider



OpenID Connect communication

- In a typical implementation of identity provider, identifiers of relying parties (clients) are under the management of the identity provider
  - The identifiers are unique only in the realm of the identity provider
- In the OIDC Federation world, every federation entity has a globally unique identifier
  - The globally unique identifiers, i.e., entity IDs, can be used as a client ID in OAuth/OIDC requests
  - An authorization request like below can be made

```
https://idp.example.com/authorize?request_uri=...& client_id=https://rp.example.com
```

OpenID Connect communication

There are two alternative approaches to establish trust between a RP and an OP

- **Automatic Registration**: enables a RP to make Authentication Requests without a prior registration step with the OP; the OP resolves the RP's EC from the Client ID in the Authentication Request, following the process defined in the previous slide
- **Explicit Registration**: involves performing an explicit registration step for a new client before the RP interacts with an OP for the first time, similar to the process specified by OpenID Connect Dynamic Client Registration 1.0, but where the client registration request contains the Entity Configuration or an entire Trust Chain