Concept of Decentralized Access Control for Open Network of Autonomous Data Providers

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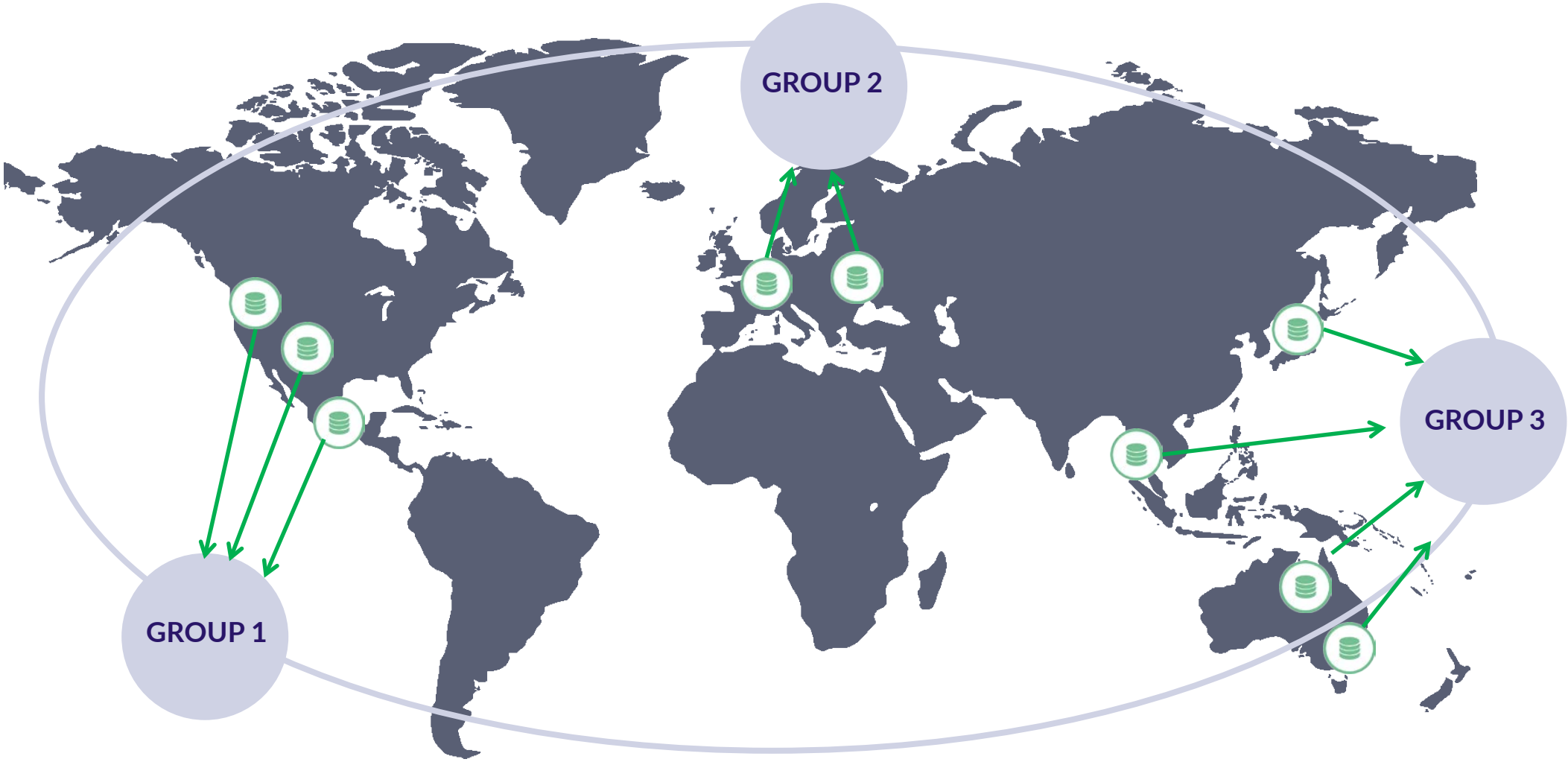
Agenda

1. Data access requirements of modern science
2. Challenges of global data access
3. Our vision of global data access
4. **Proposed concept of decentralized data access control**
5. Conclusions

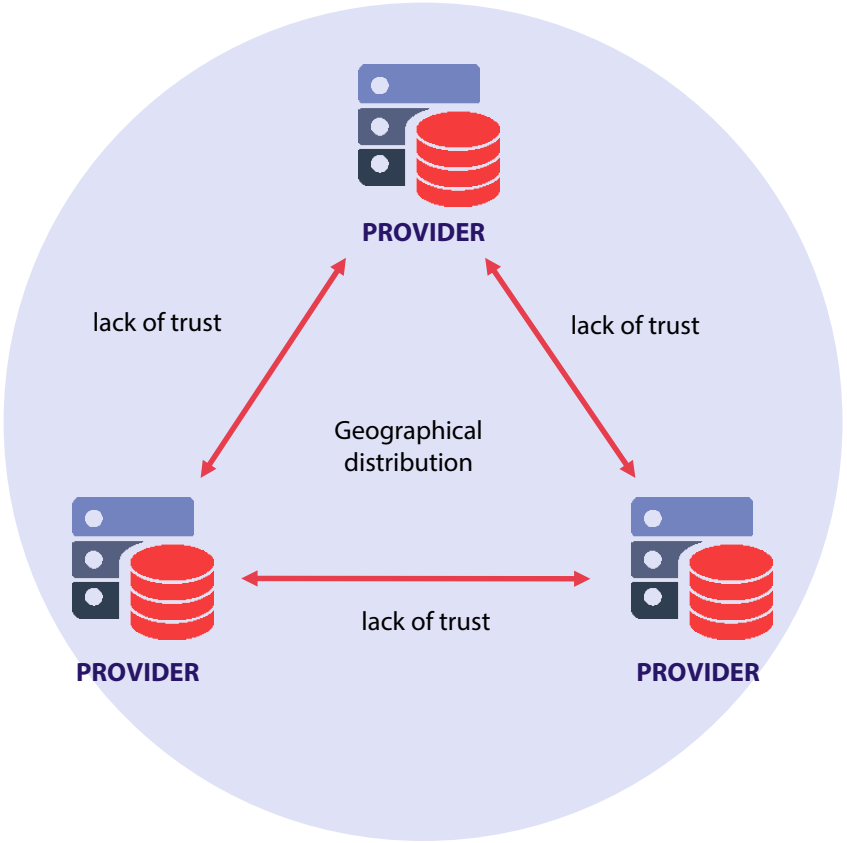
DATA ACCESS REQUIREMENTS OF MODERN SCIENCE



GLOBAL DATA ACCESS

- Effective access to large data sets
  - Data sets are distributed among many institutions
  - Data is stored on heterogeneous storage systems
  - Complete download before processing is not always possible due to sheer data size
- Transparent data access
- Cross-border collaboration
- Secure and easy data sharing

CHALLENGES OF GLOBAL DATA ACCESS



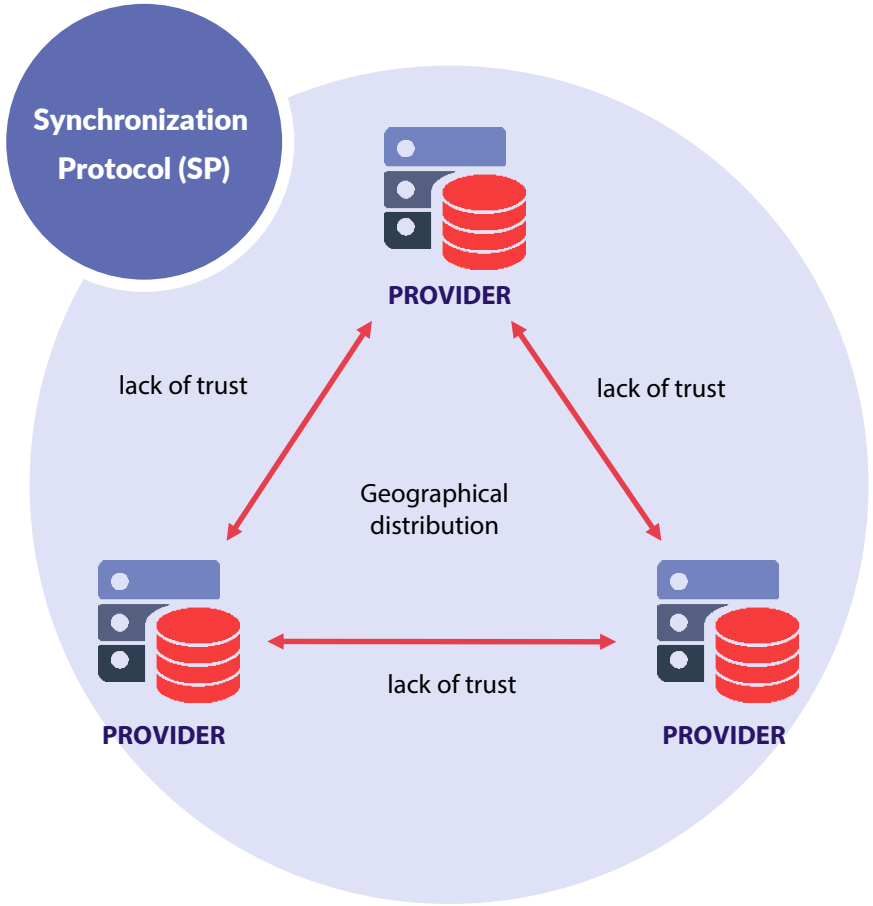
Goal: a network of cooperating providers

- Autonomy must be retained
- Inherent lack of trust
- Openness and discovery on demand

Our focus: decentralized data access control

- Metadata exchange between providers
- Metadata consistency across the system
- Secure metadata exchange
- Authority delegation

CHALLENGES OF GLOBAL DATA ACCESS



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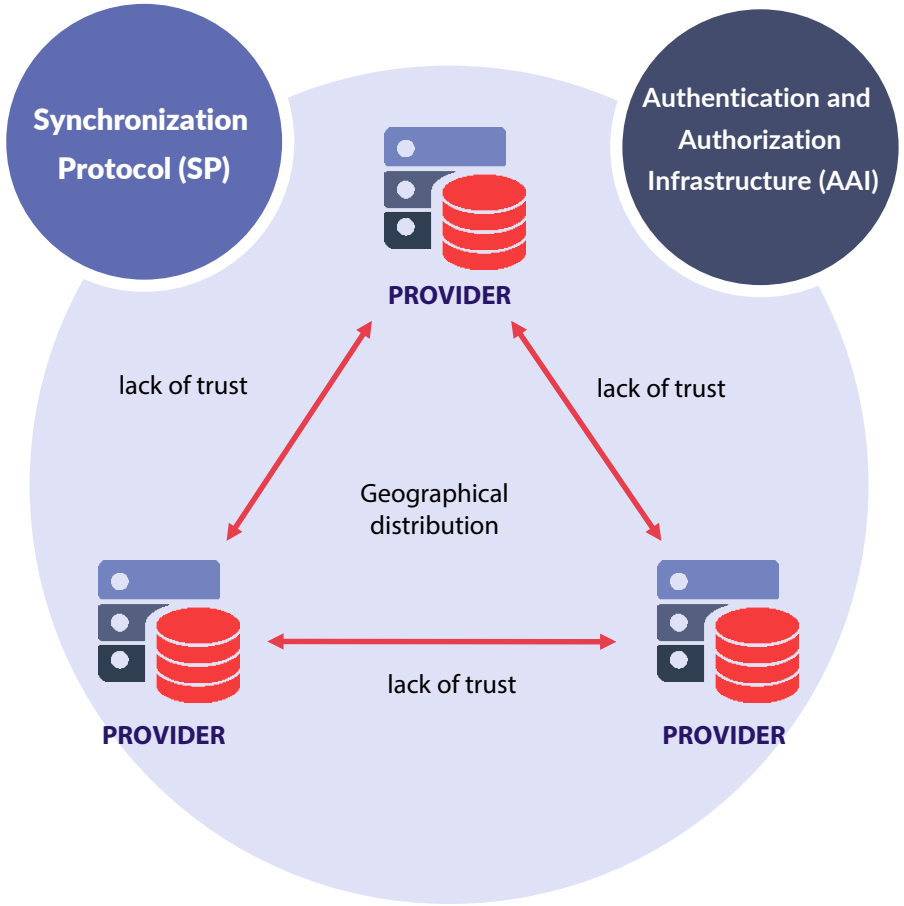

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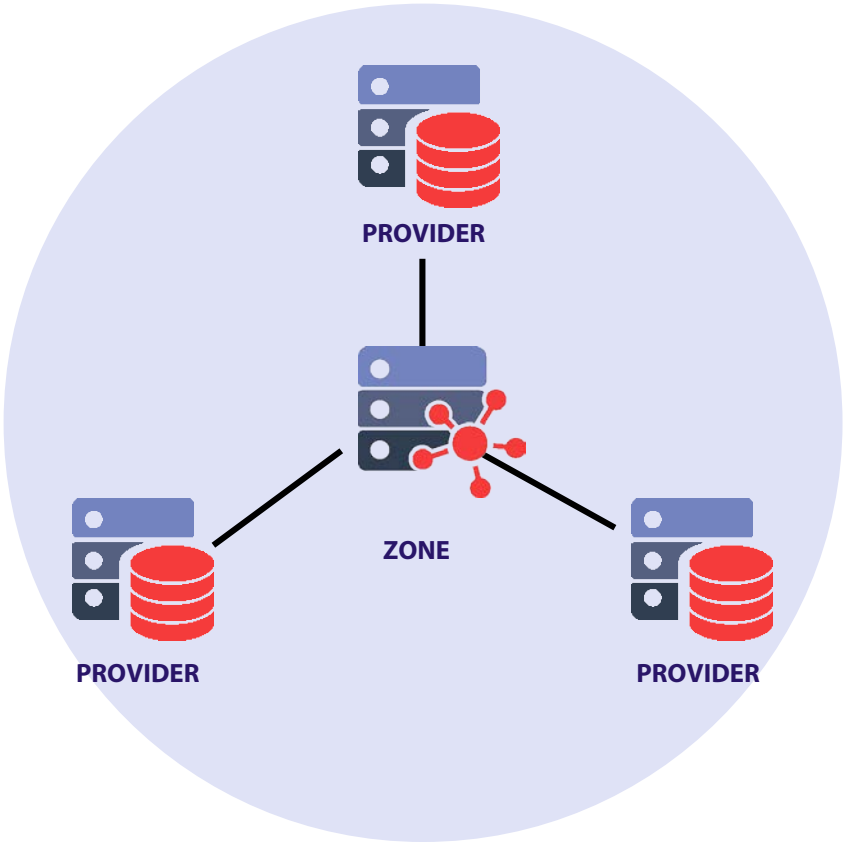
PROPOSED CONCEPT OF DECENTRALIZED DATA ACCESS CONTROL

1) Introducing zones



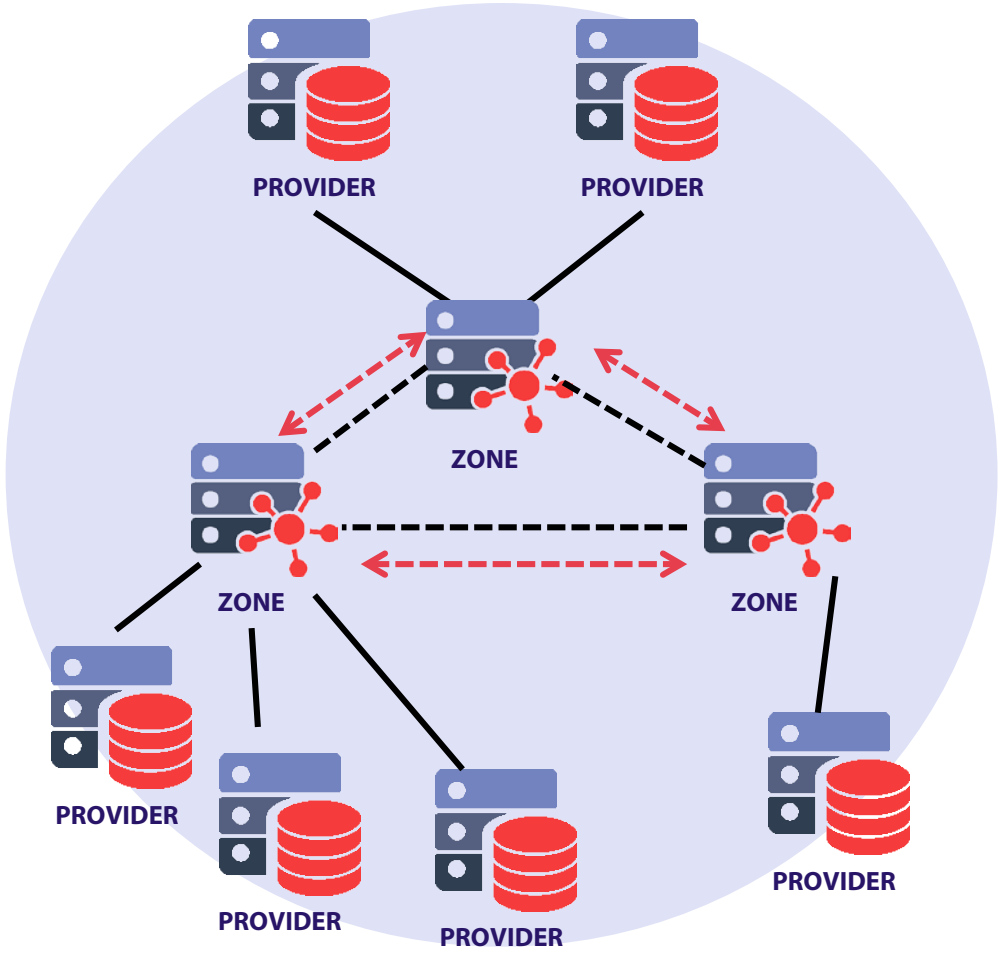
The purpose of a zone:

- Organizes providers into a cooperating group
- Serves as AuthN & AuthZ center (AAI)
- Holds the metadata of users and data sets
- Provides metadata synchronization API (SP)
- Entry point to the system

Note: every provider trusts its chosen zone

PROPOSED CONCEPT OF DECENTRALIZED DATA ACCESS CONTROL

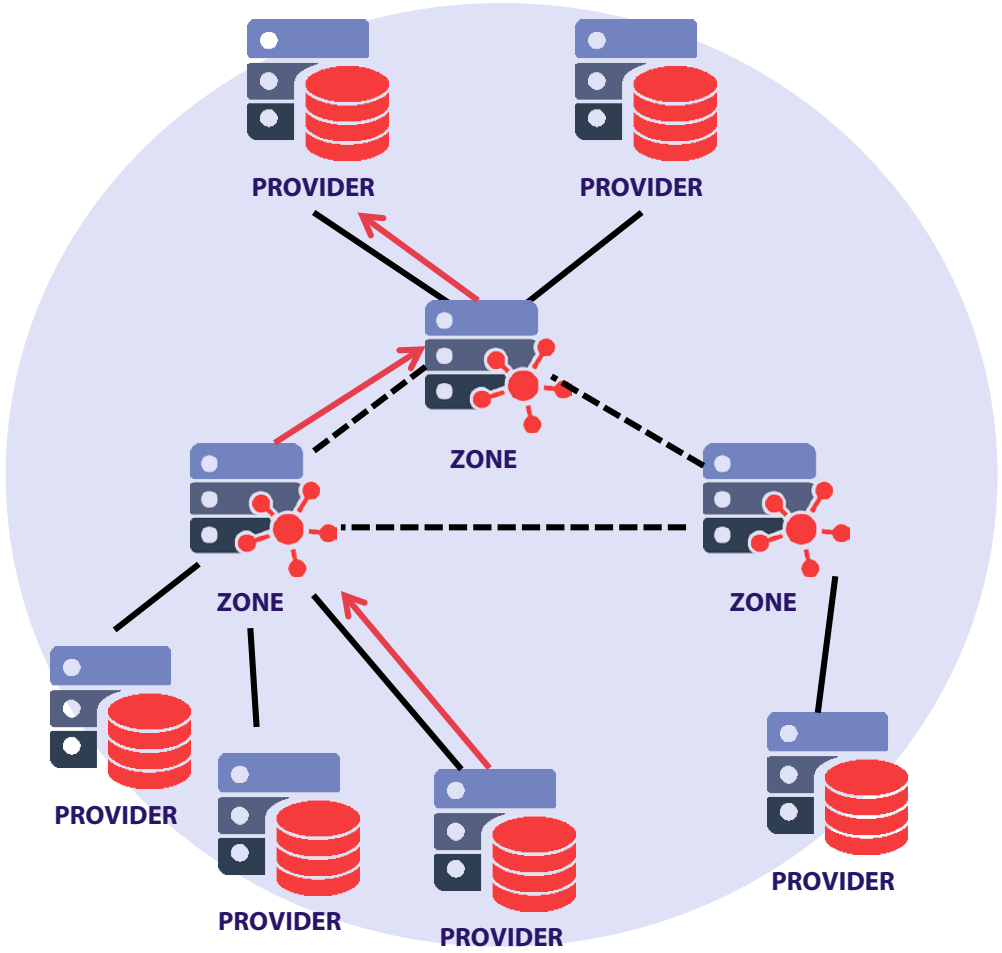
2) Cross-zone cooperation



- Zones can cooperate with each other
- Discovery on demand as required
- The network is open and scalable
- Each zone is an authoritative AAI and SP center for its providers
- Decentralization – P2P network of zones

PROPOSED CONCEPT OF DECENTRALIZED DATA ACCESS CONTROL

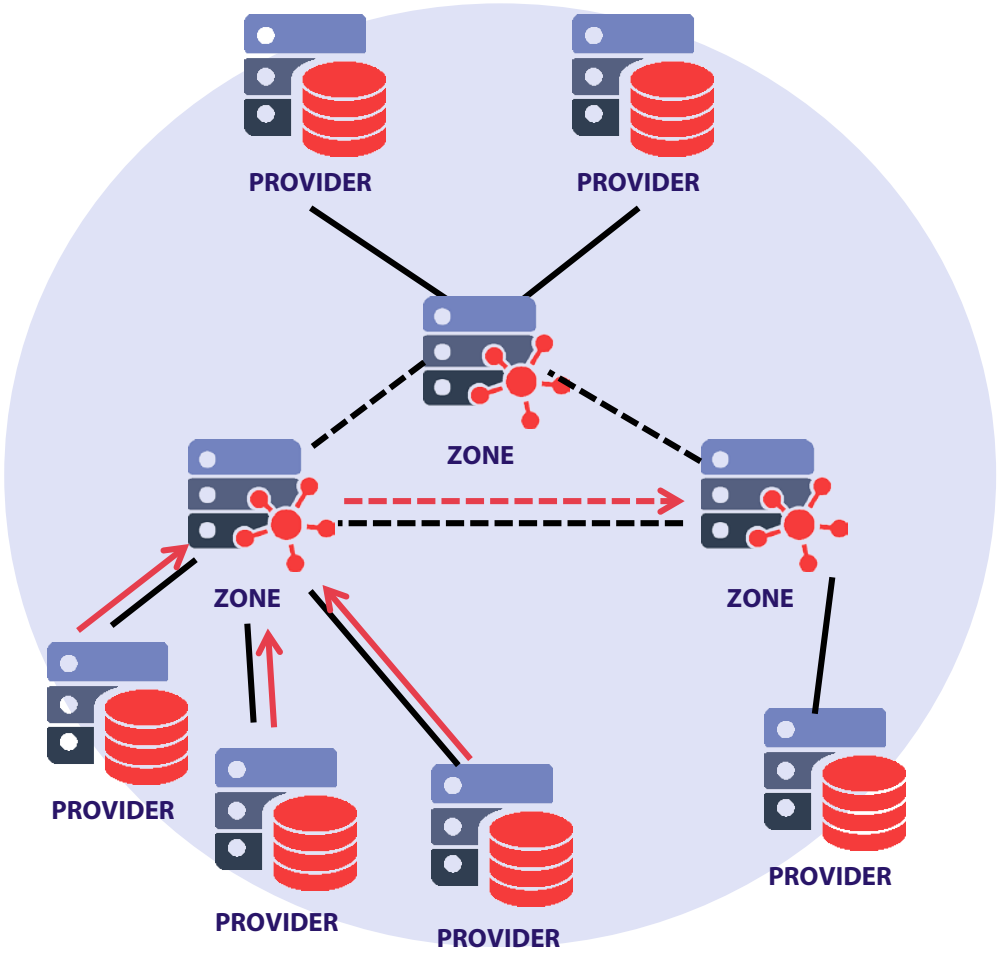
3) Authentication and Authorization Infrastructure (AAI)



- Based on macaroon tokens (by Google)
- Each zone verifies tokens that it issued
- Tokens can be passed around for delegation and confined as required
- Providers rely on their zone to securely connect to others
- Users can sign in to other zones using OpenID Connect (single, global account)

PROPOSED CONCEPT OF DECENTRALIZED DATA ACCESS CONTROL

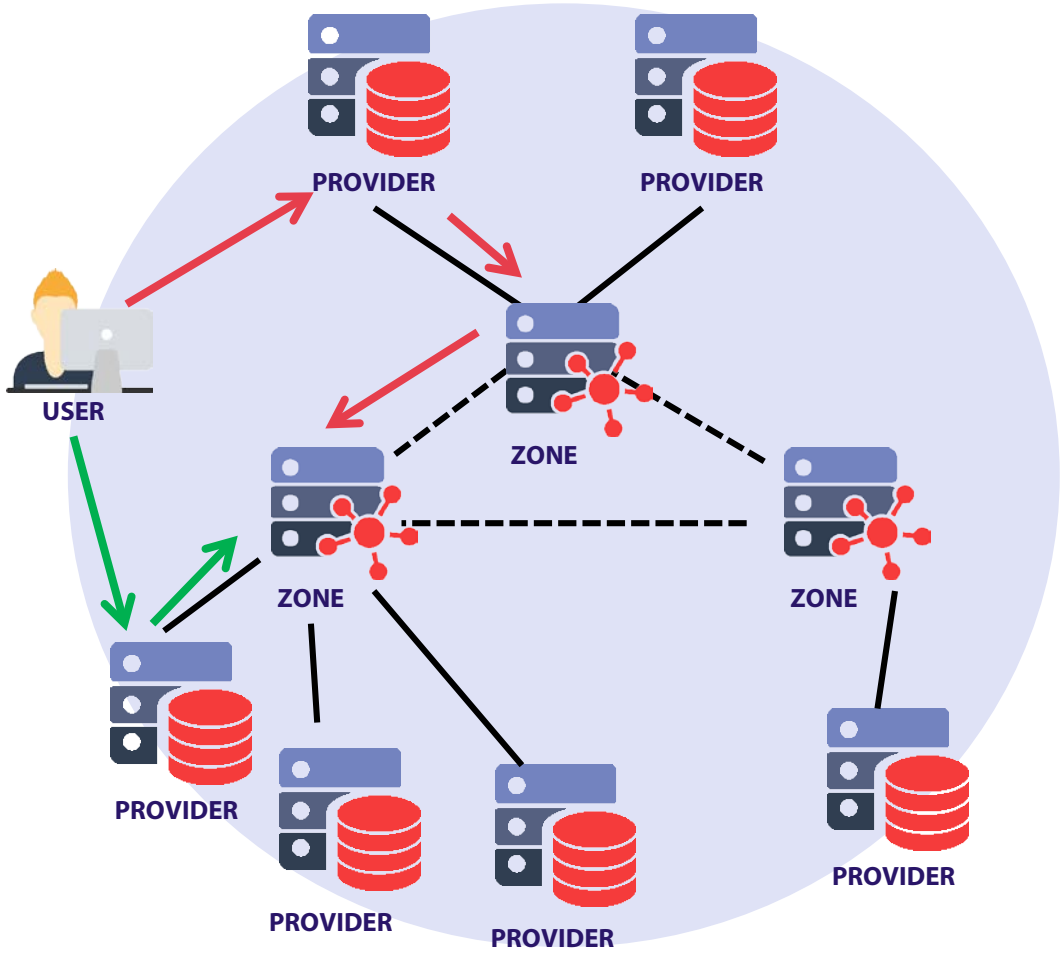
4) Synchronization Protocol



- Each zone is authoritative for given metadata subset
- Other zones act as clients in synchronization
- All SP connections are based on authorization tokens

PROPOSED CONCEPT OF DECENTRALIZED DATA ACCESS CONTROL

5) Users as carriers of trust



- Users choose their zones and providers
- Asking for services is an implicit act of trust
- User presents authorization (token) to chosen provider, which contacts its zone:
  - **User's home zone** – authorization is verified locally
  - **Another zone** – the token is delegated to issuer zone for verification

USE CASE – CROSS-ZONE DATASET SHARING

USER A

USER B

ZONE A

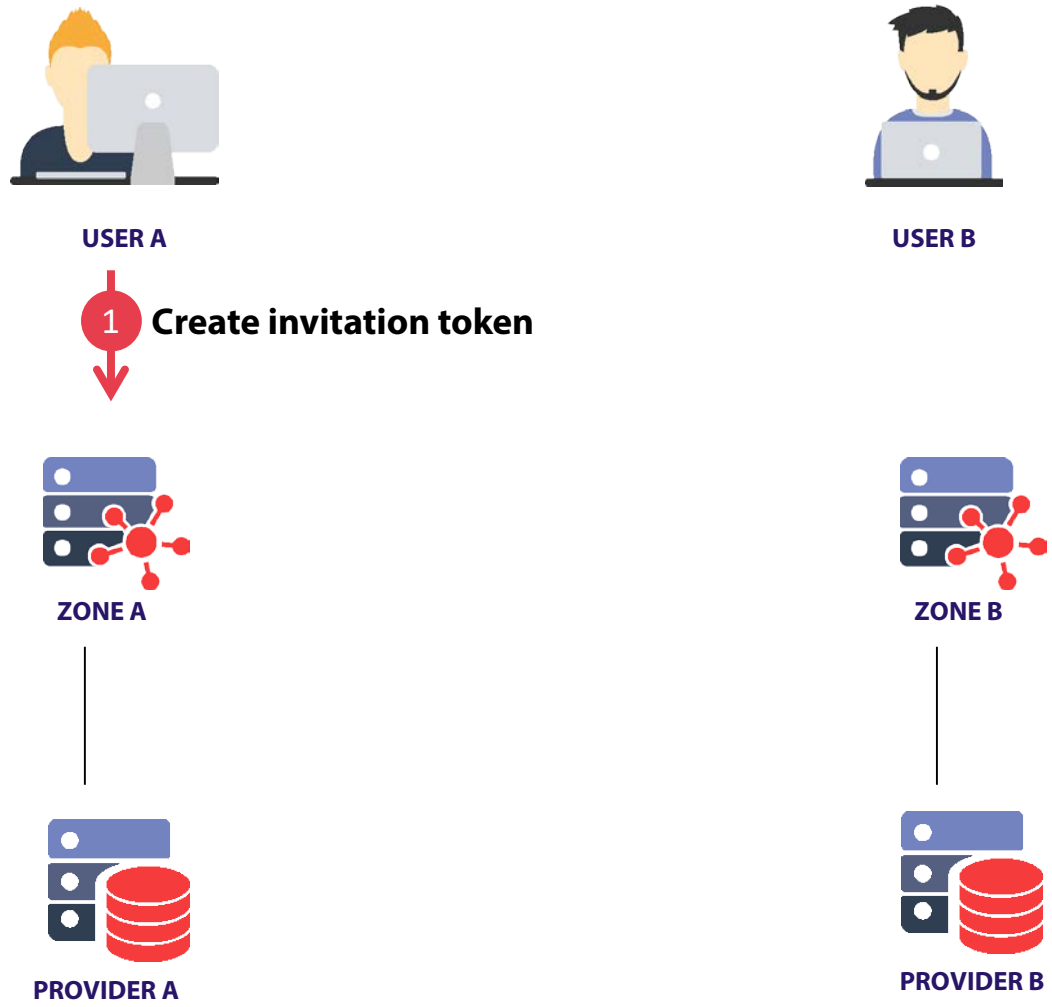
ZONE B

DATASET

PROVIDER A

PROVIDER B

USE CASE – CROSS-ZONE DATASET SHARING



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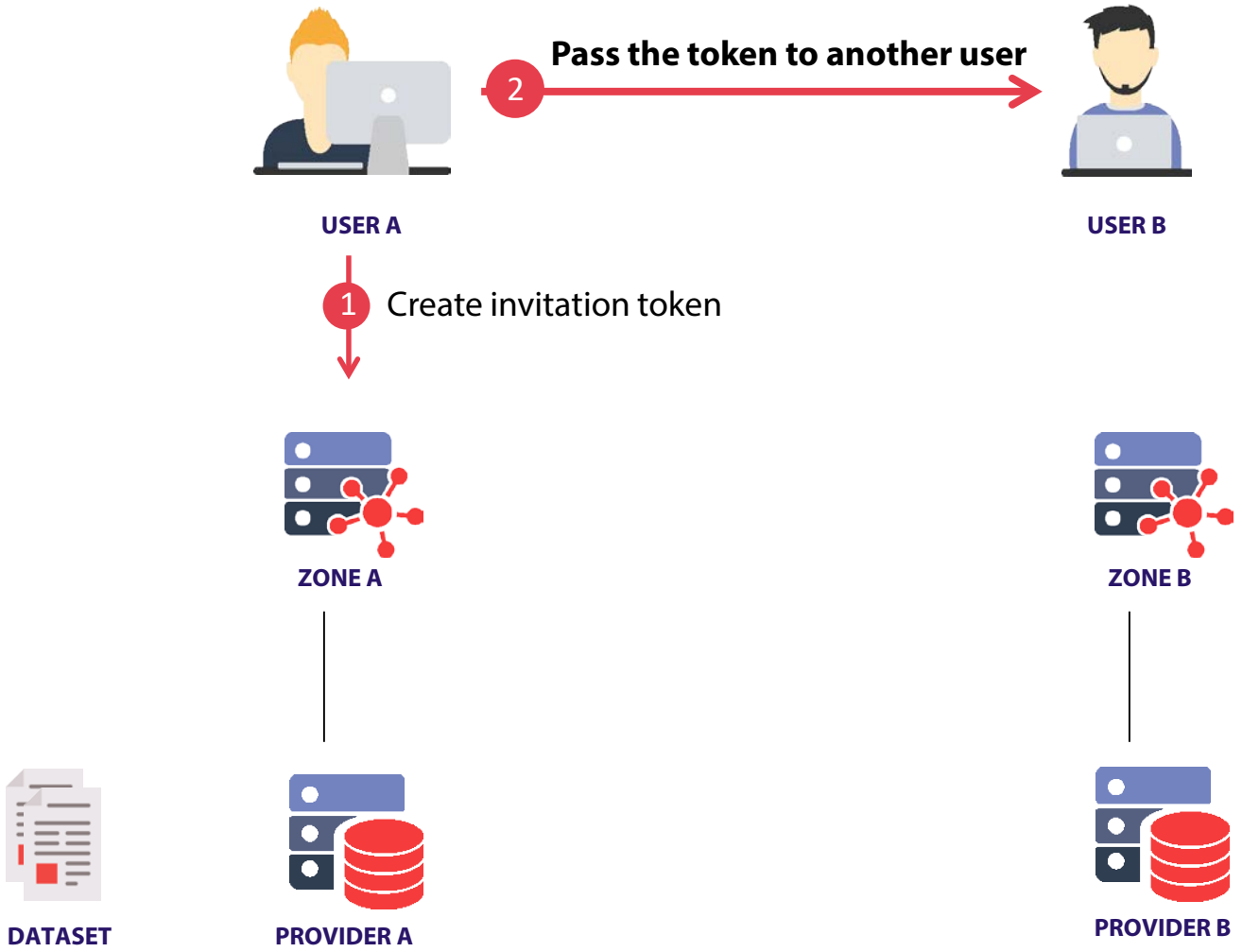

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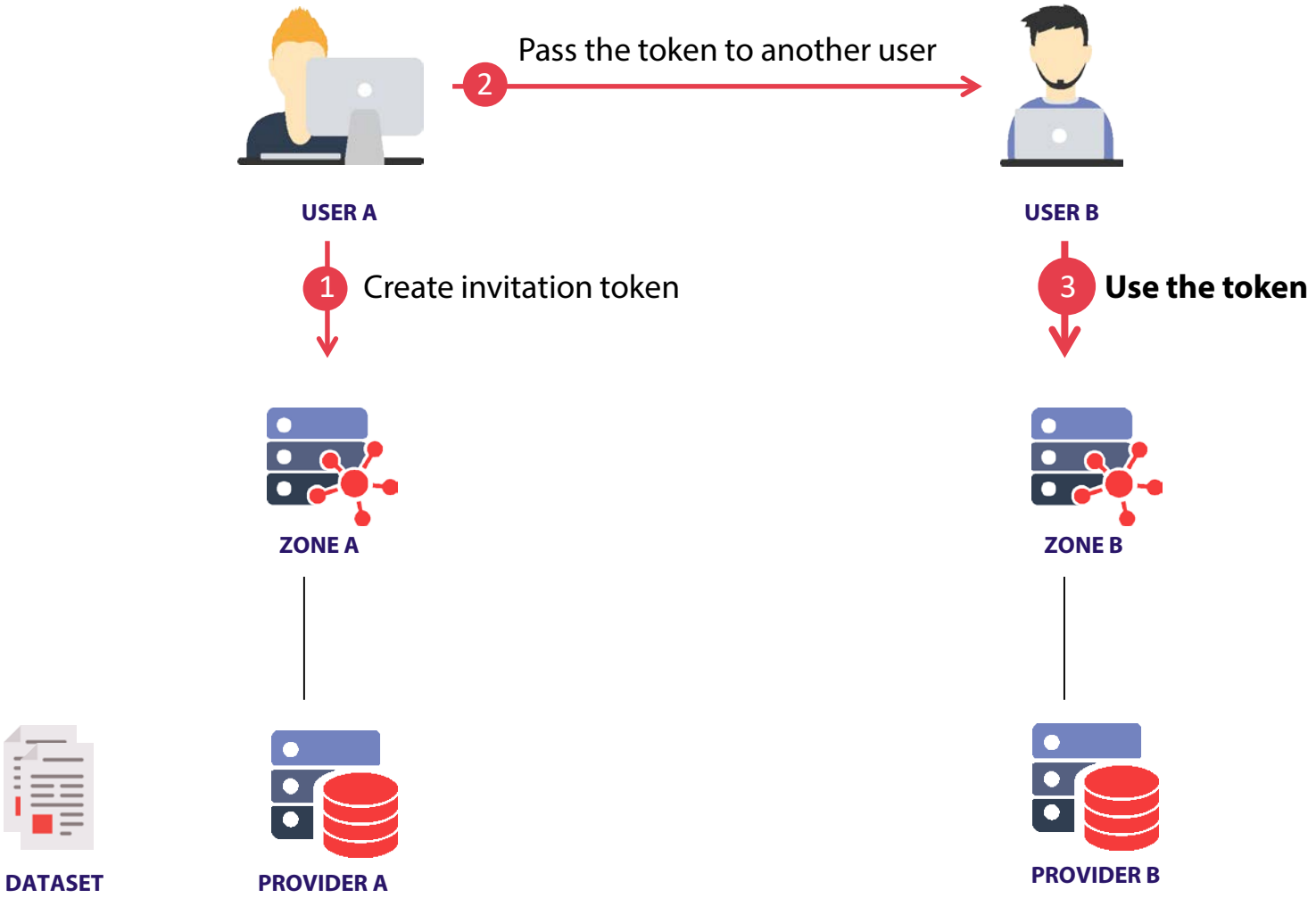

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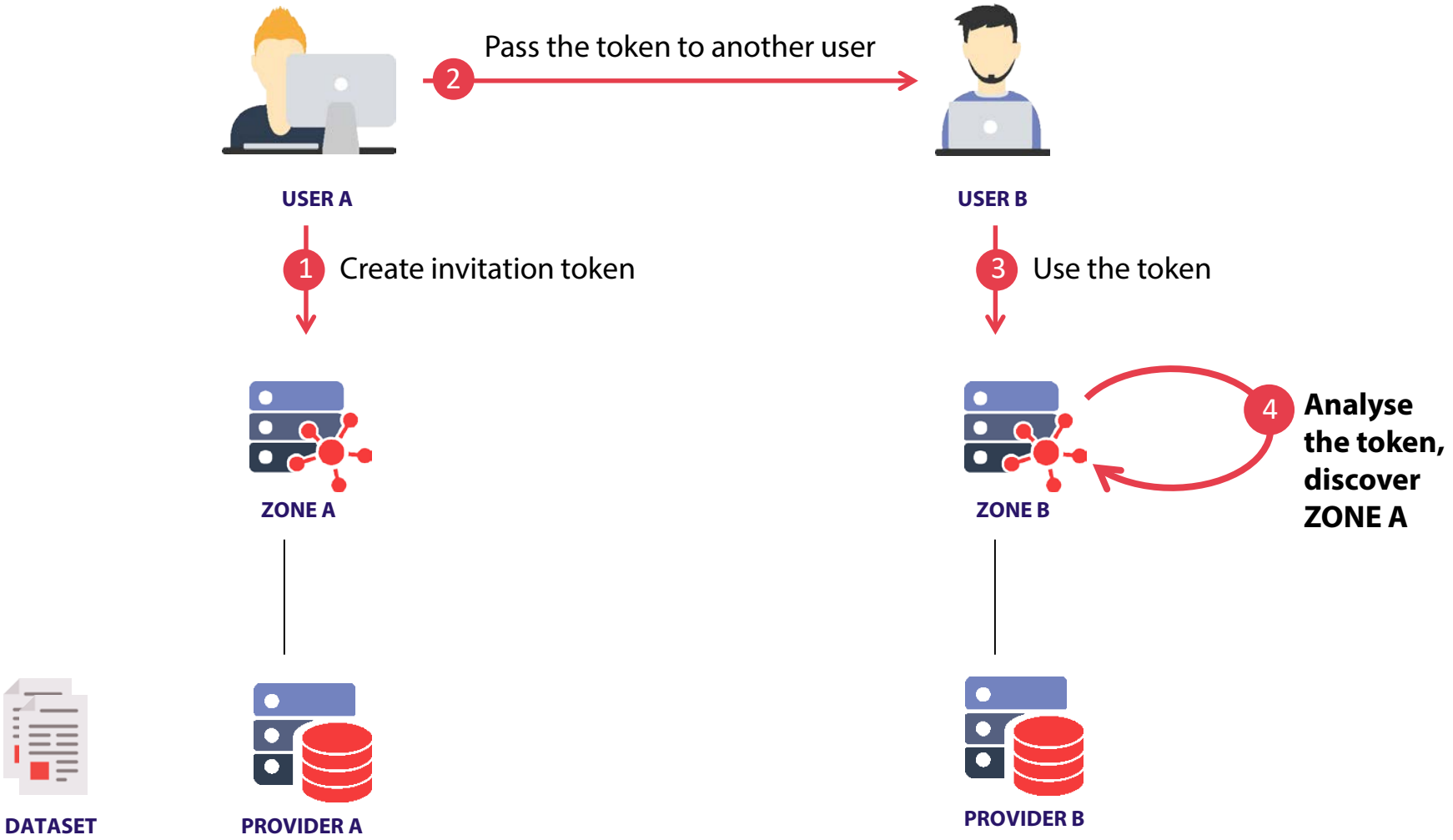

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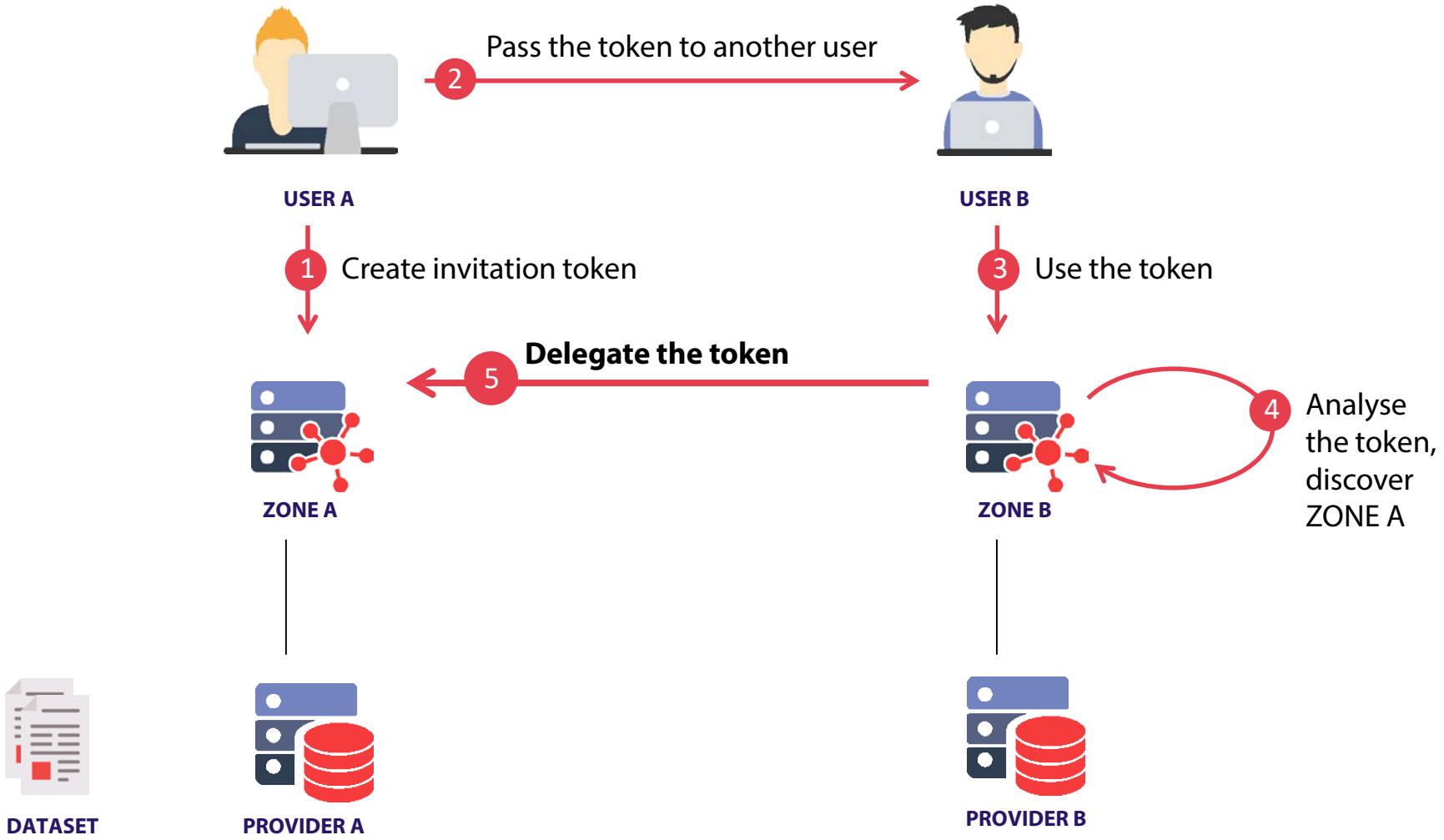

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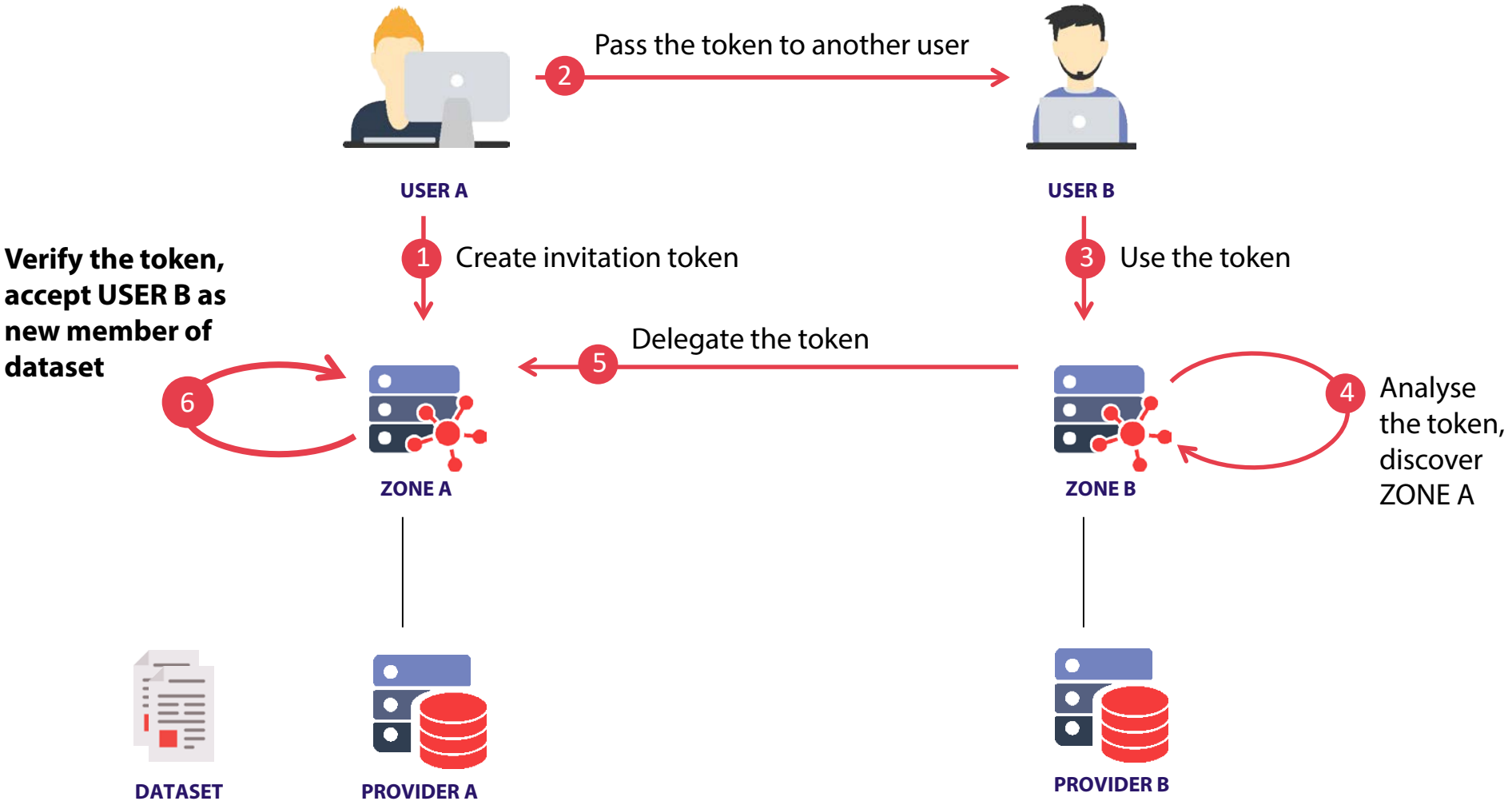

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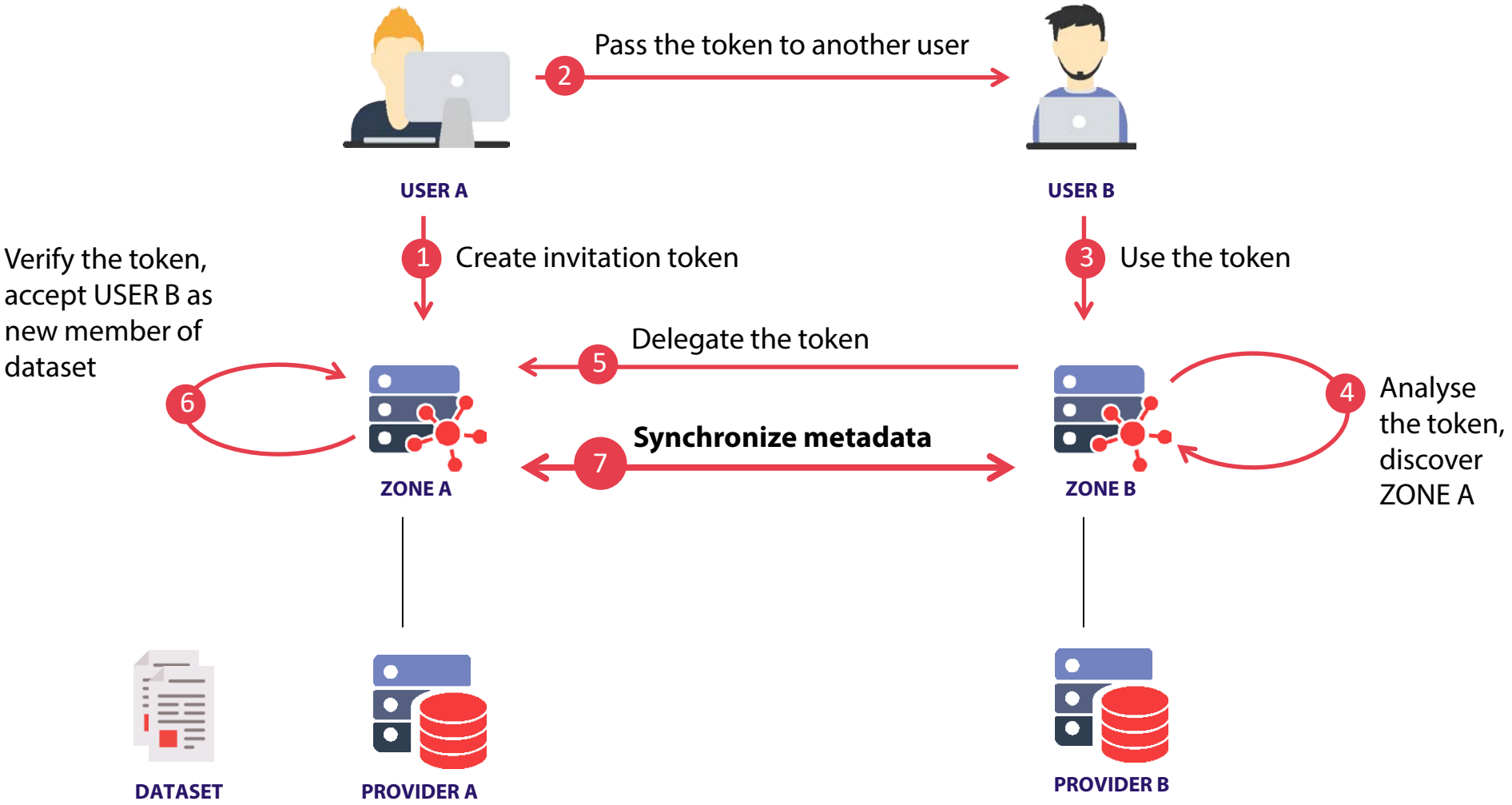

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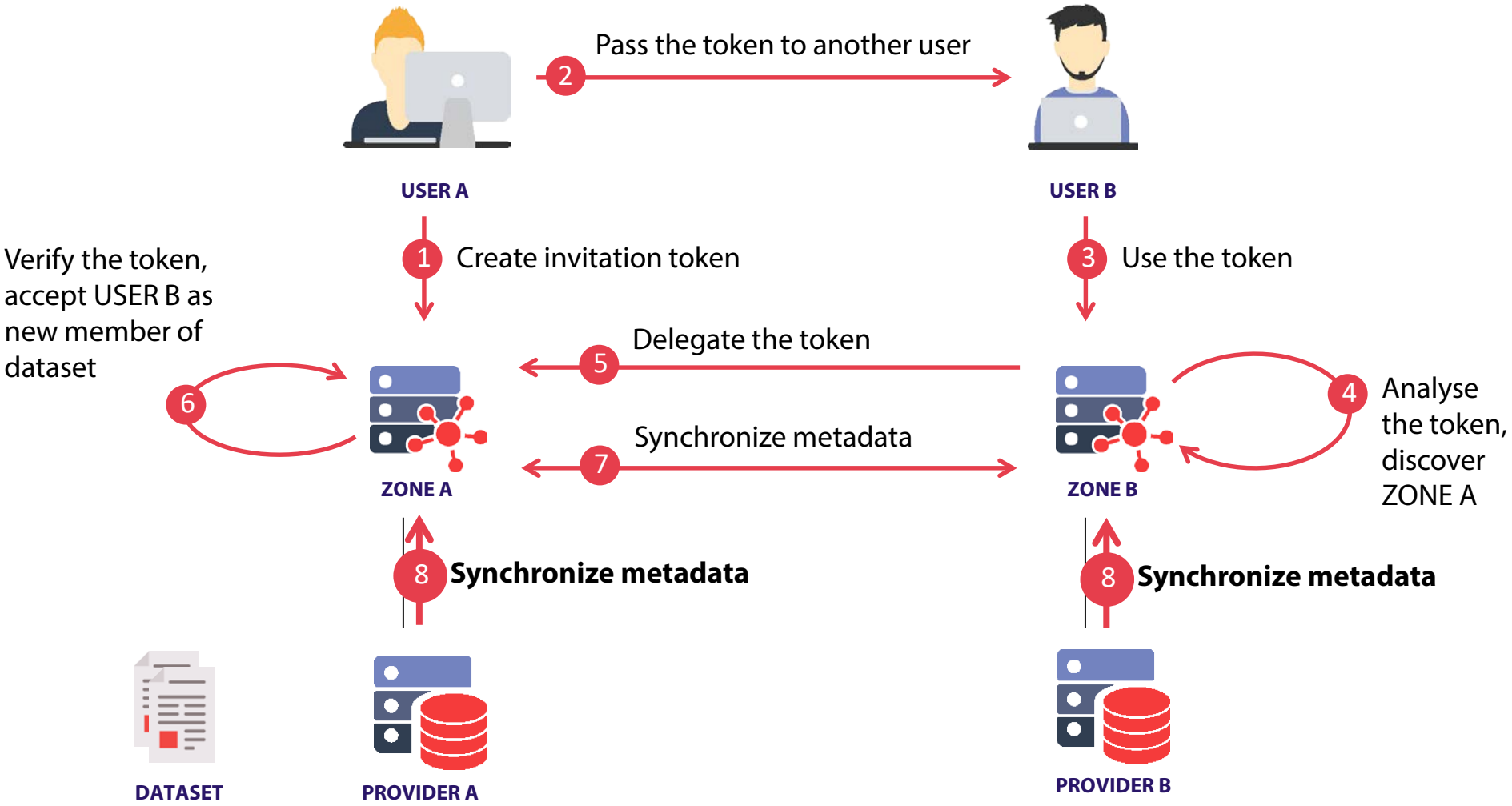

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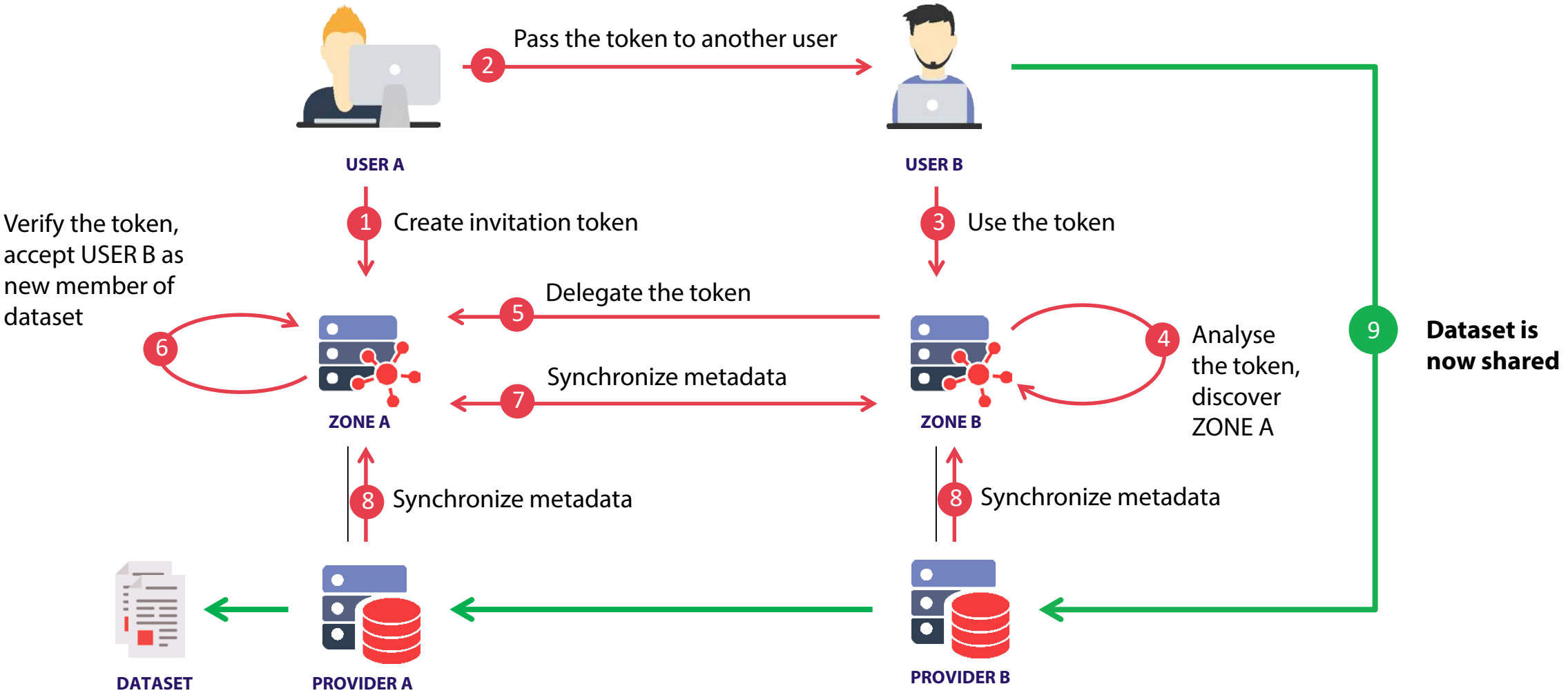
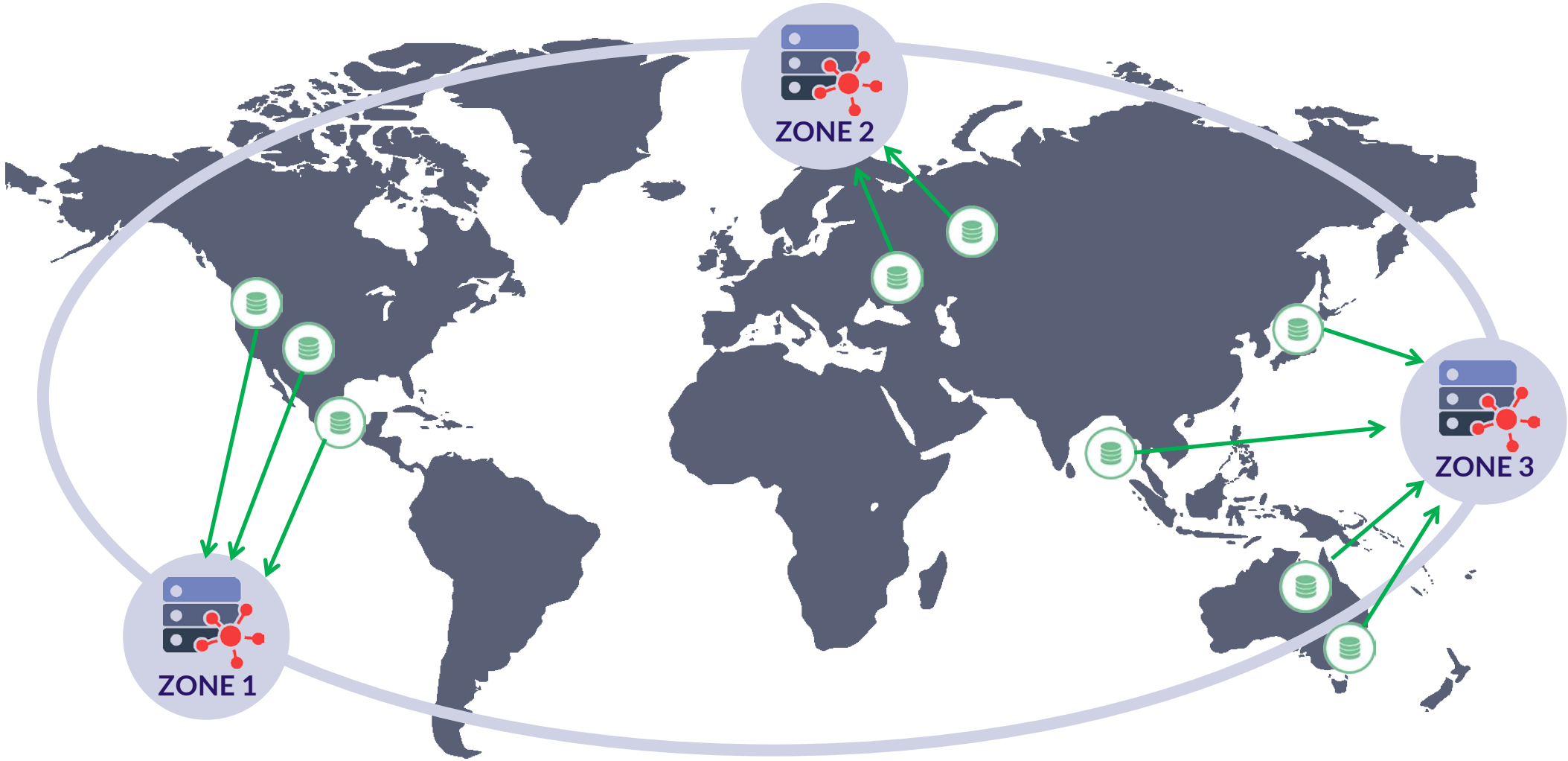


OUR VISION OF GLOBAL DATA ACCESS



Conclusions

- Global data access can be achieved by creating an open network of data providers
- We propose a concept of **decentralized data access control** for such network
- Proposed concept is being implemented in Onedata, a distributed virtual file system

- ✔ Zone server acting as an entry point as well as SP and AAI center
- ✔ Synchronization Protocol for single zone scope
- ✔ Macaroon based AAI for single zone scope
- ✔ Data provider server with cooperation mechanisms
- 🚧 Cross Zone cooperation support
- 🚧 SP and AAI supporting global, cross zone scale

Onezone

Oneprovider

(candidate)

THANK YOU