Manage Data Access for Analytics

databricks

Introduction to Unity Catalog

Module Agenda

Manage Data Access for Analytics with Unity Catalog

Introduction to Unity Catalog

DE 6.1a – Managing principals in Unity Catalog (demo)

DE 6.1b – Managing Unity Catalog metastores (demo)

DE 6.1c – Creating compute resources for Unity Catalog access (demo)

DE 6.4 – Creating and governing data objects with Unity Catalog

DE 6.5 – Create and Share Tables in Unity Catalog

DE 6.6 – Create external tables in Unity Catalog (demo)

DE 6.7 – Upgrade a table to Unity Catalog

DE 6.8 – Create views and limit table access (demo)

Course Objectives

By the end of this course, you will be able to:

1. Describe Unity Catalog key concepts and how it integrates with the Databricks platform
2. Manage groups, users and service principals
3. Create and manage a Unity Catalog metastore

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Overview of Data Governance

Data Governance Overview

Four key functional areas

Data Access Control

Control who has access to which data

Data Access Audit

Capture and record all access to data

Data Lineage

Capture upstream sources and downstream consumers

Data Discovery

Ability to search for and discover authorized assets

Data Governance Overview

Four key functional areas

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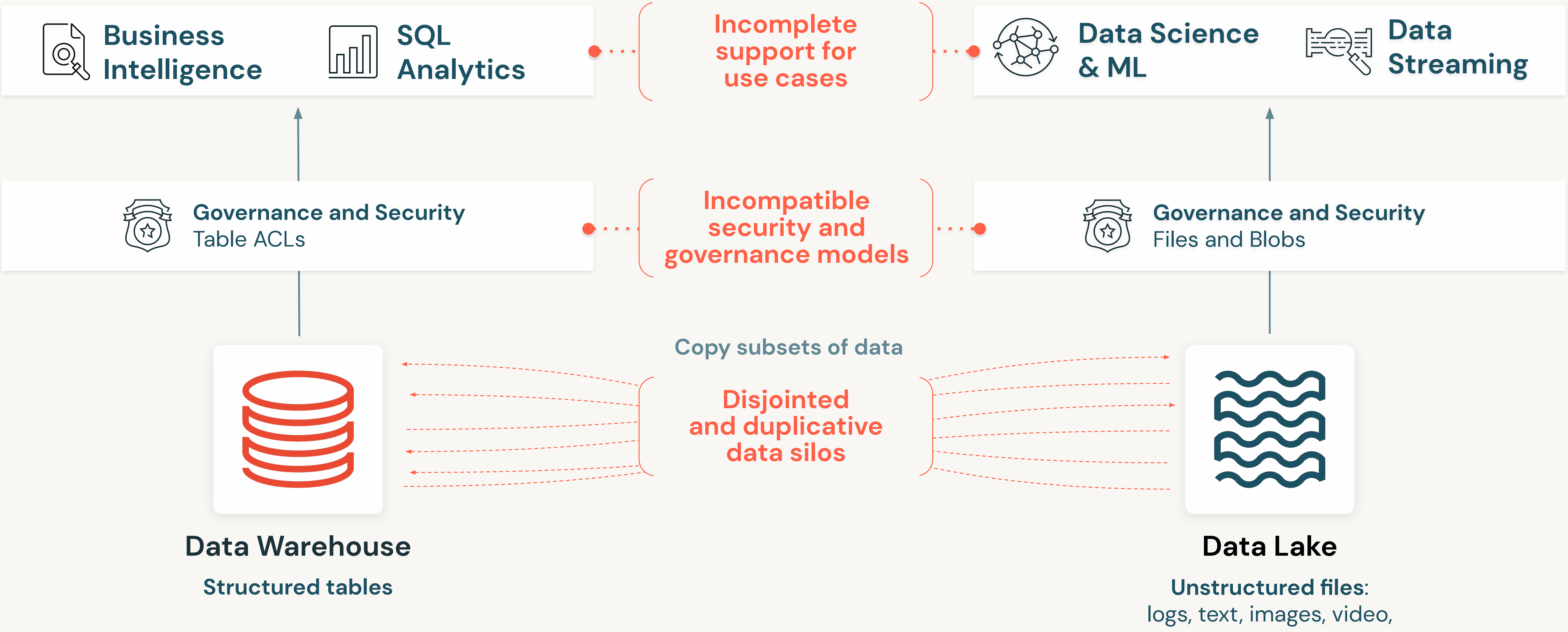
Data Governance Overview

Challenges in the Data Lake



Business Intelligence

SQL Analytics

Incomplete support for use cases

Data Science & ML

Data Streaming

Governance and Security
Table ACLs

Incompatible security and governance models

Governance and Security
Files and Blobs

Copy subsets of data

Disjointed and duplicative data silos

Data Warehouse

Structured tables

Data Lake

Unstructured files:
logs, text, images, video,

Data Governance Overview

Challenges in the Data Lake

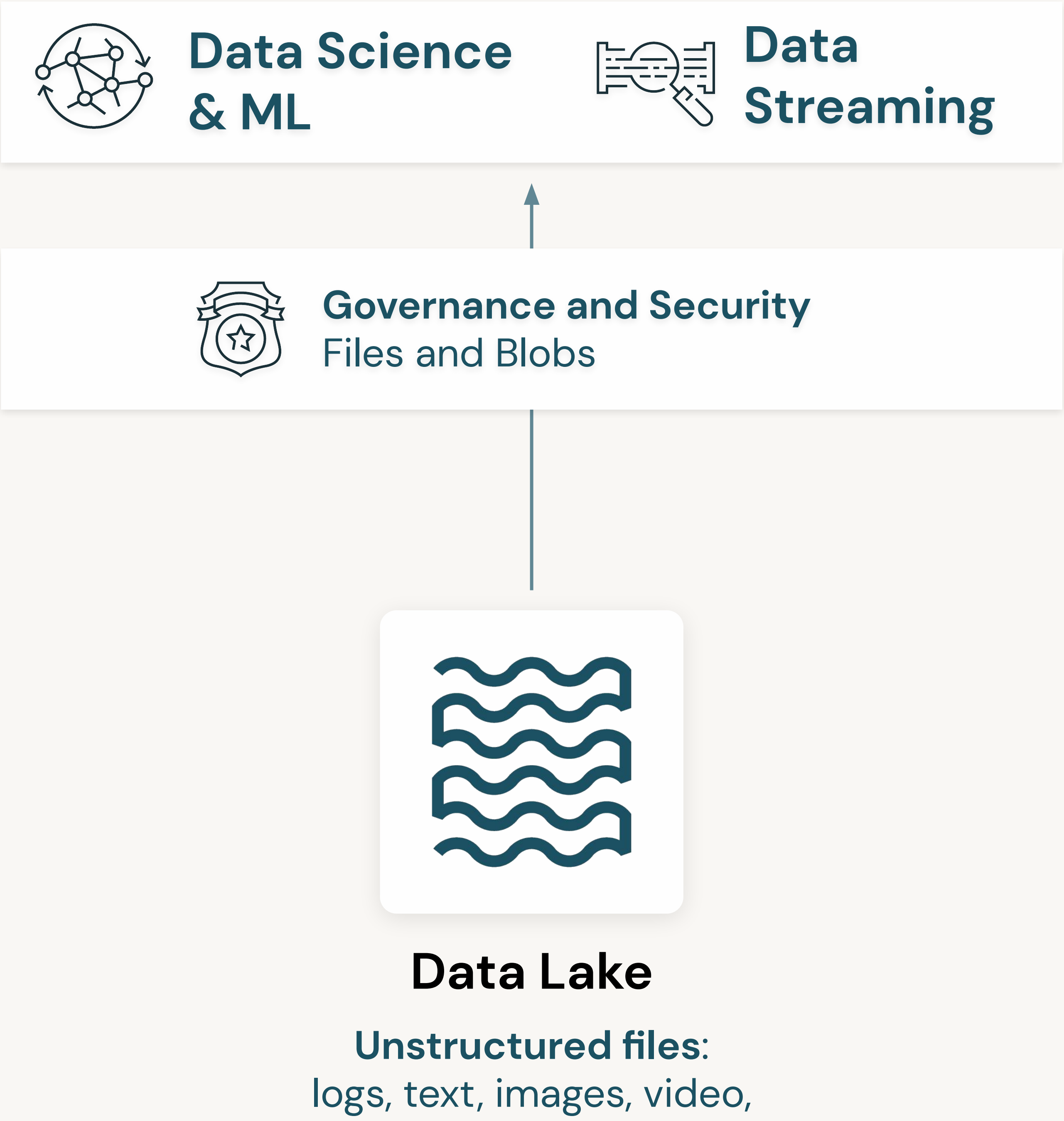
No fine-grained access controls

No common metadata layer

Non-standard cloud-specific governance model

Hard to audit

No common governance model for different data asset types



Data Science & ML

Data Streaming

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logs, text, images, video,

Databricks Unity Catalog

Overview

Unify governance across clouds

Fine-grained governance for data lakes across clouds - based on open standard ANSI SQL.

Unify data and AI assets

Centrally share, audit, secure and manage all data types with one simple interface.

Unify existing catalogs

Works in concert with existing data, storage, and catalogs - no hard migration required.

Databricks Unity Catalog

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Databricks Unity Catalog

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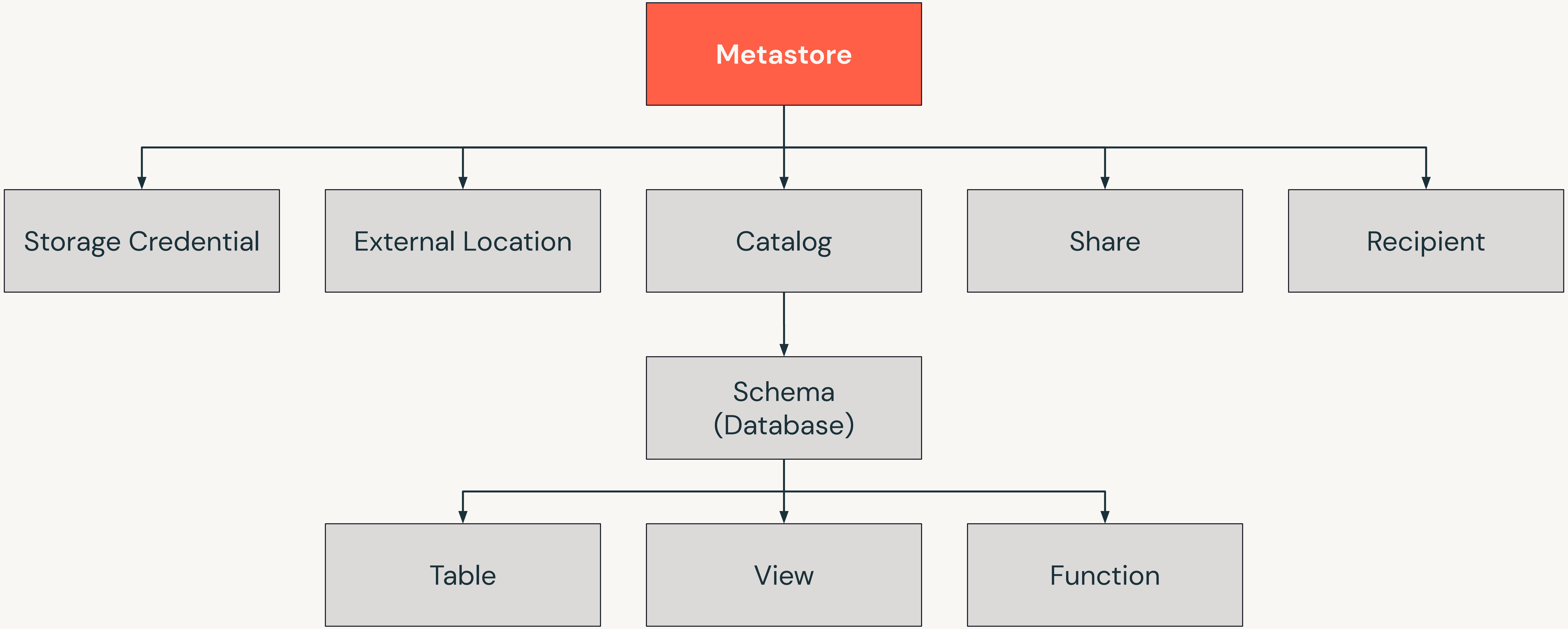
Unity Catalog Key Concepts

Key Concepts



Metastore

Storage Credential

External Location

Catalog

Share

Recipient

Schema (Database)

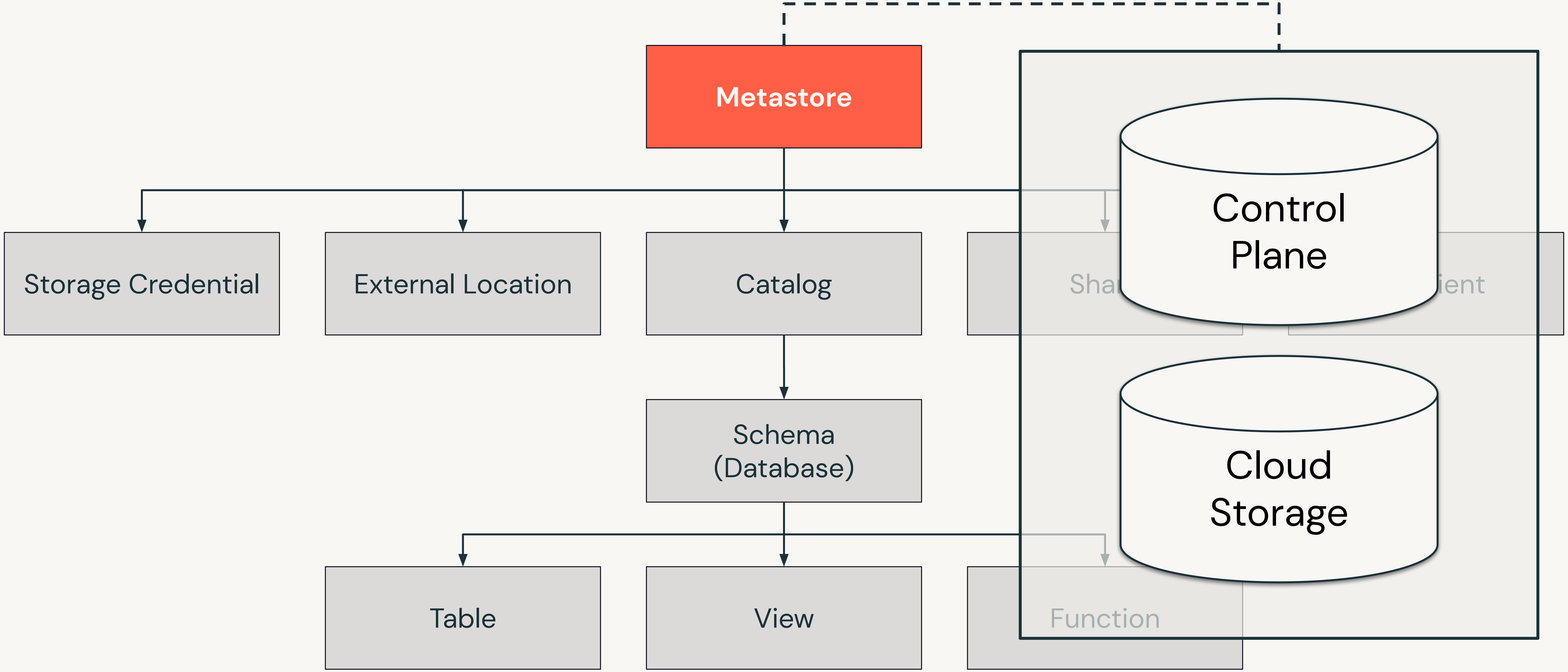
Table

View

Function

Key Concepts

Metastore elements



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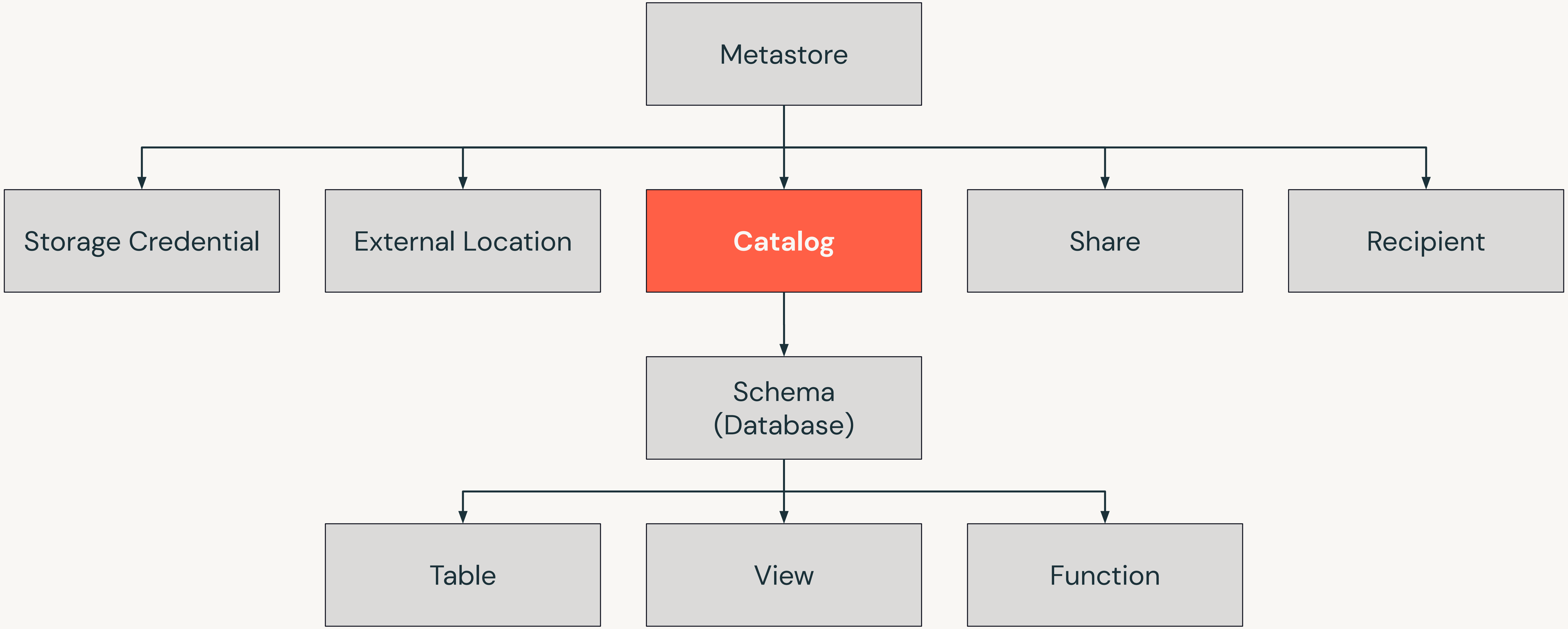
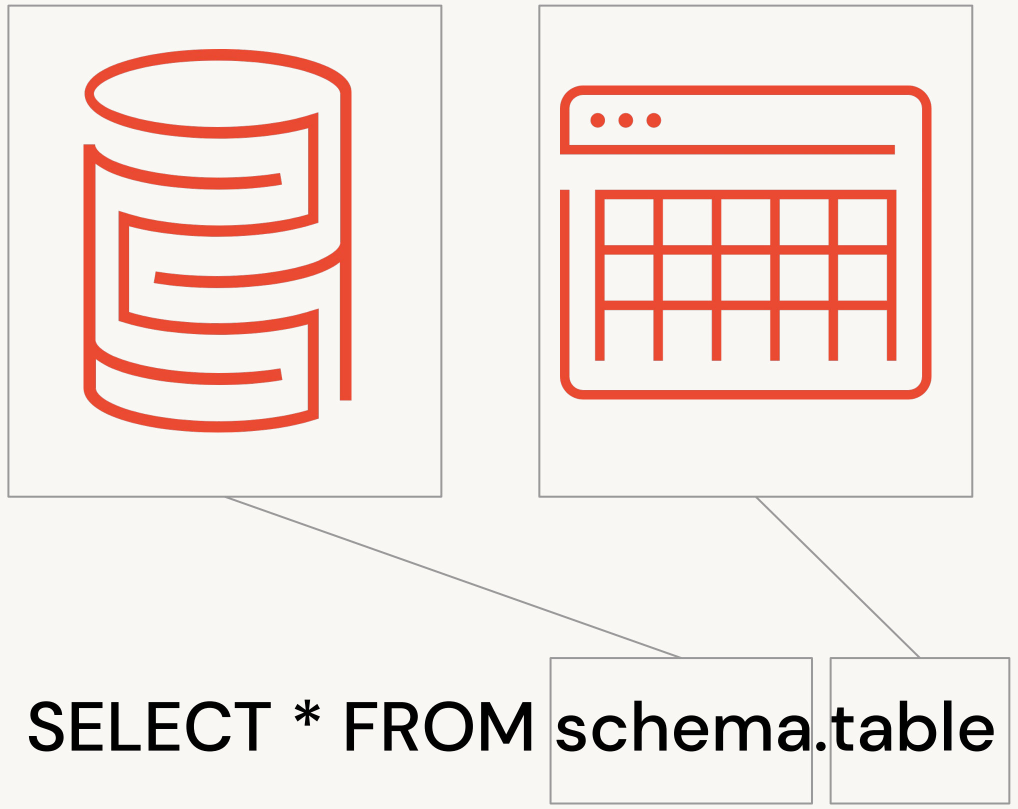


Key Concepts

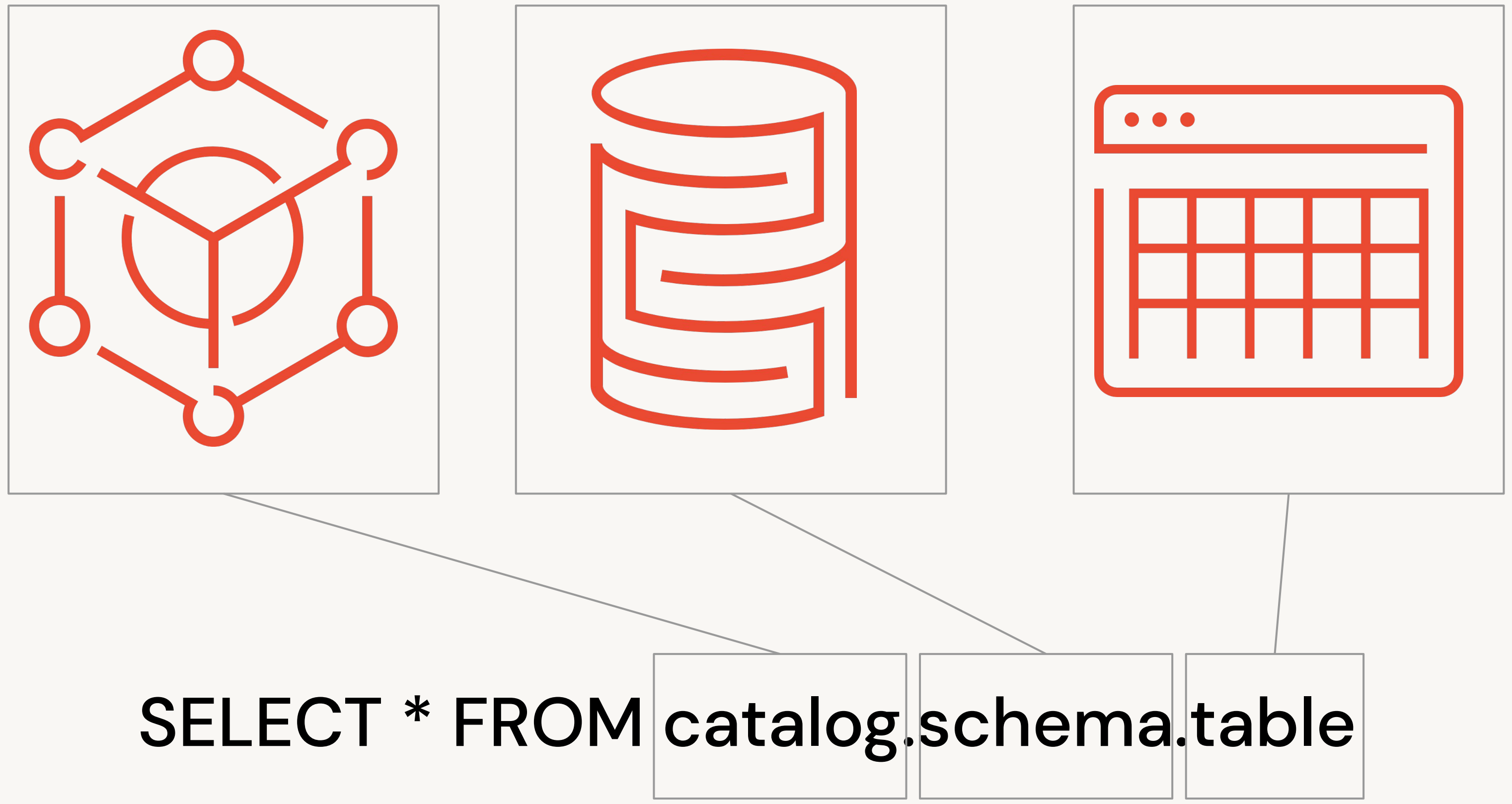
Three-level Namespace

Traditional SQL two-level namespace



SELECT * FROM schema.table

Unity Catalog three-level namespace



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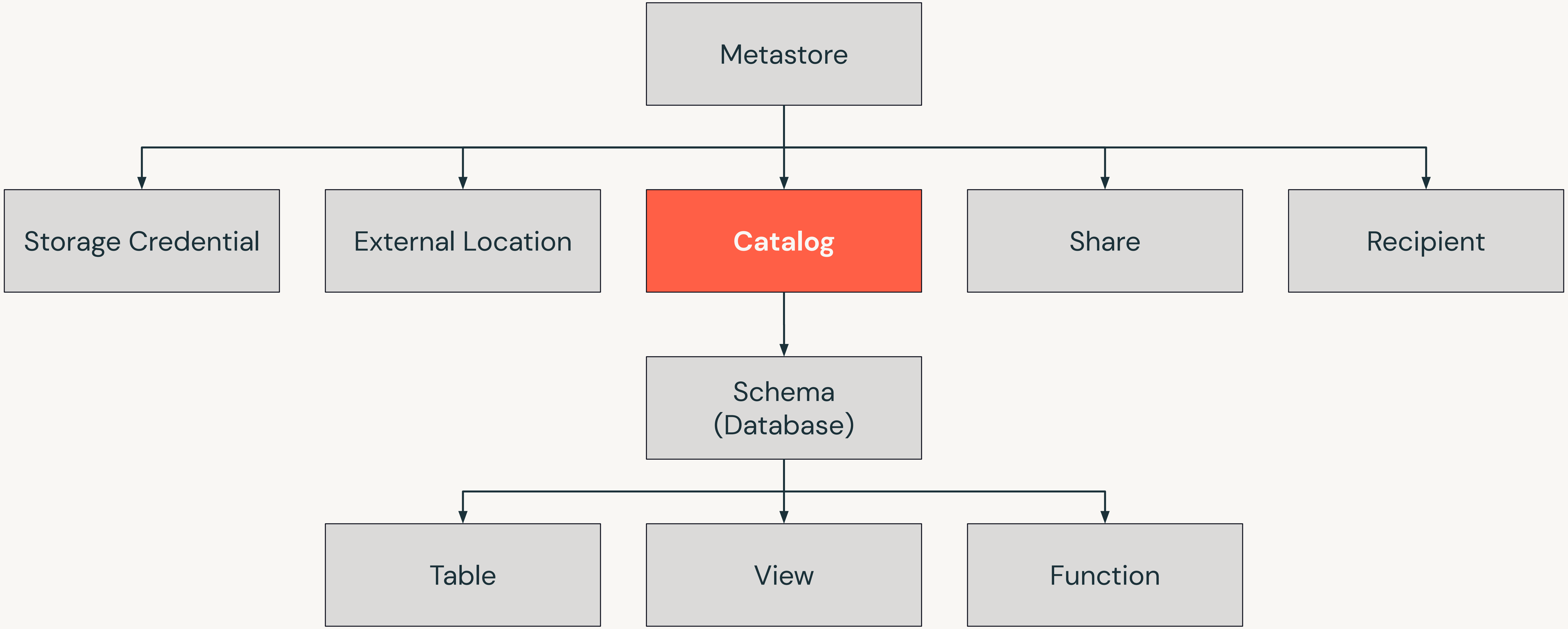

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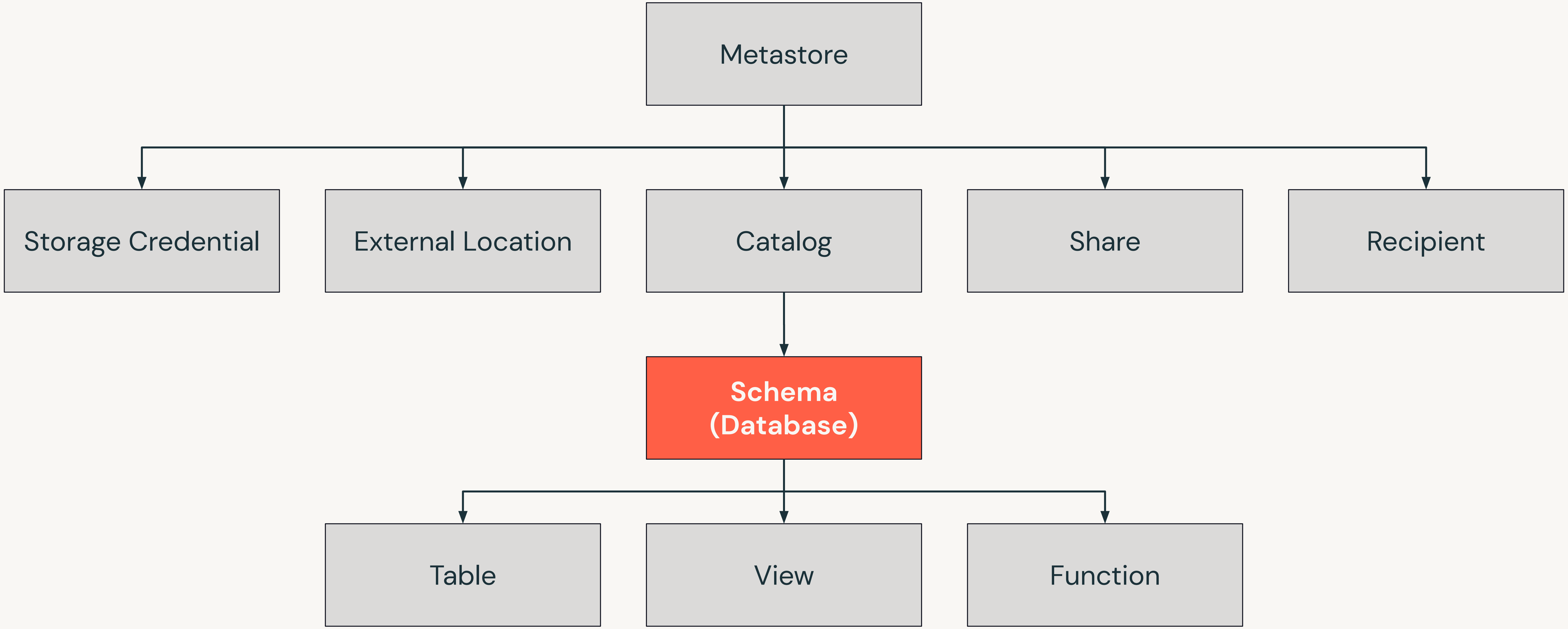

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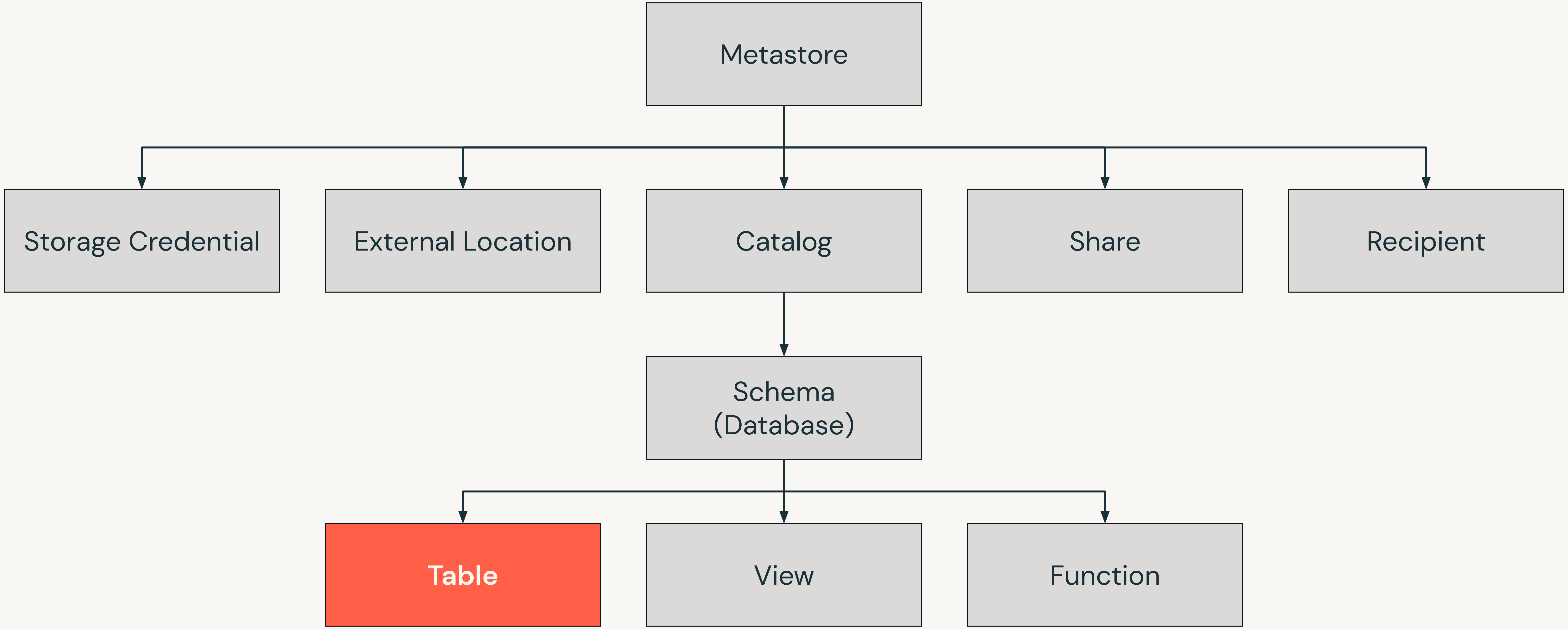

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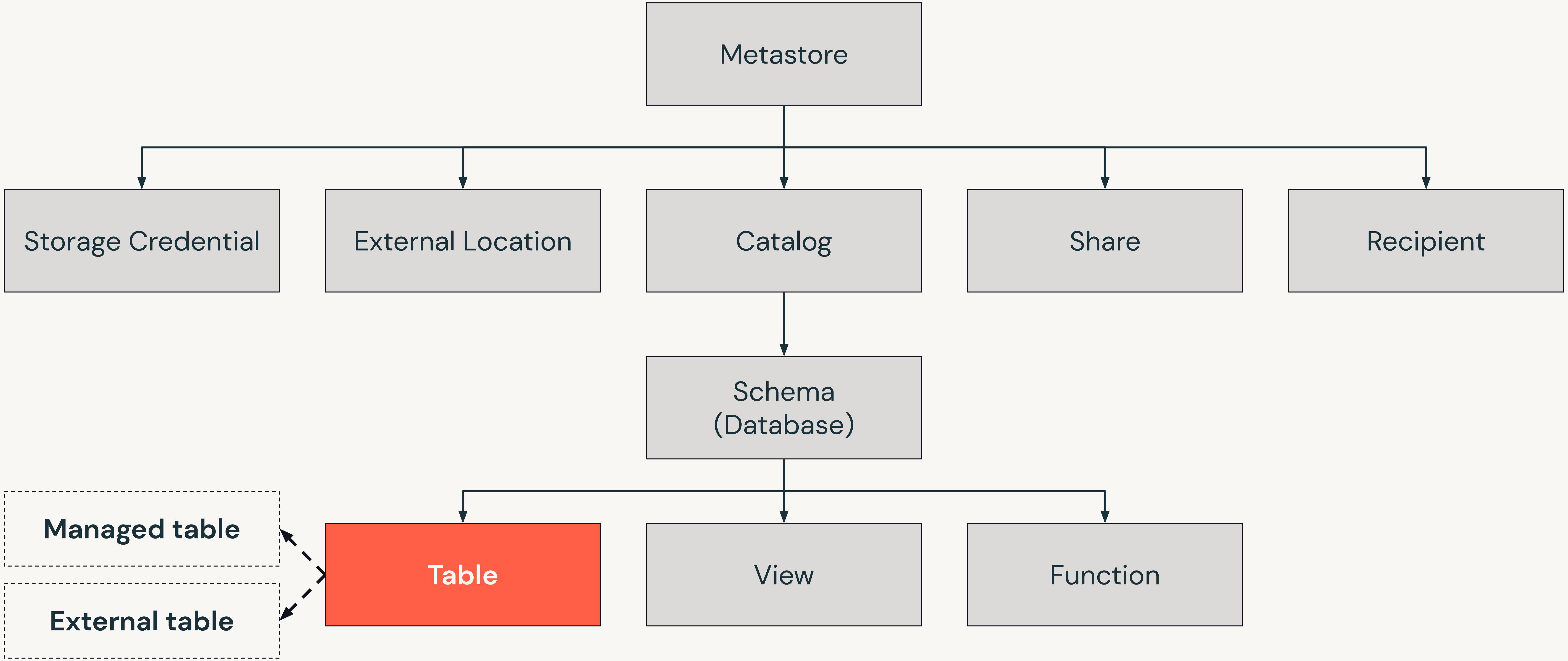

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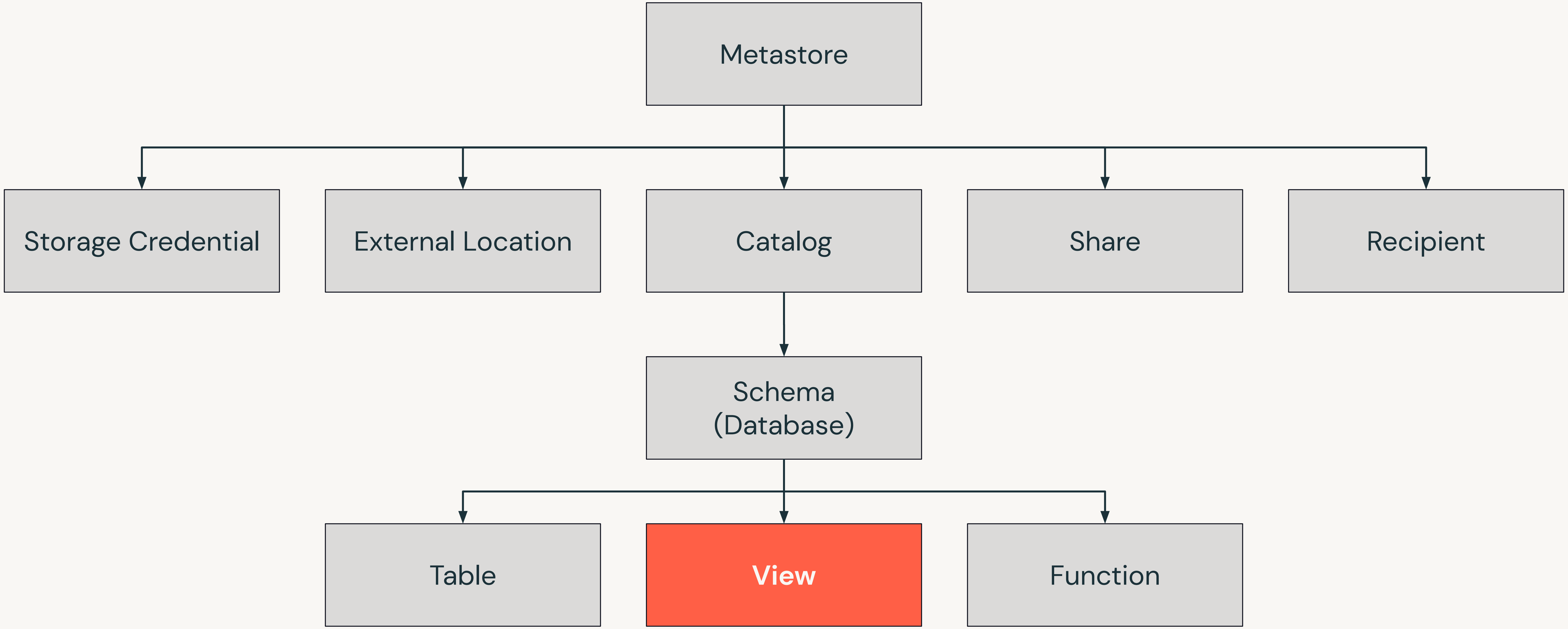

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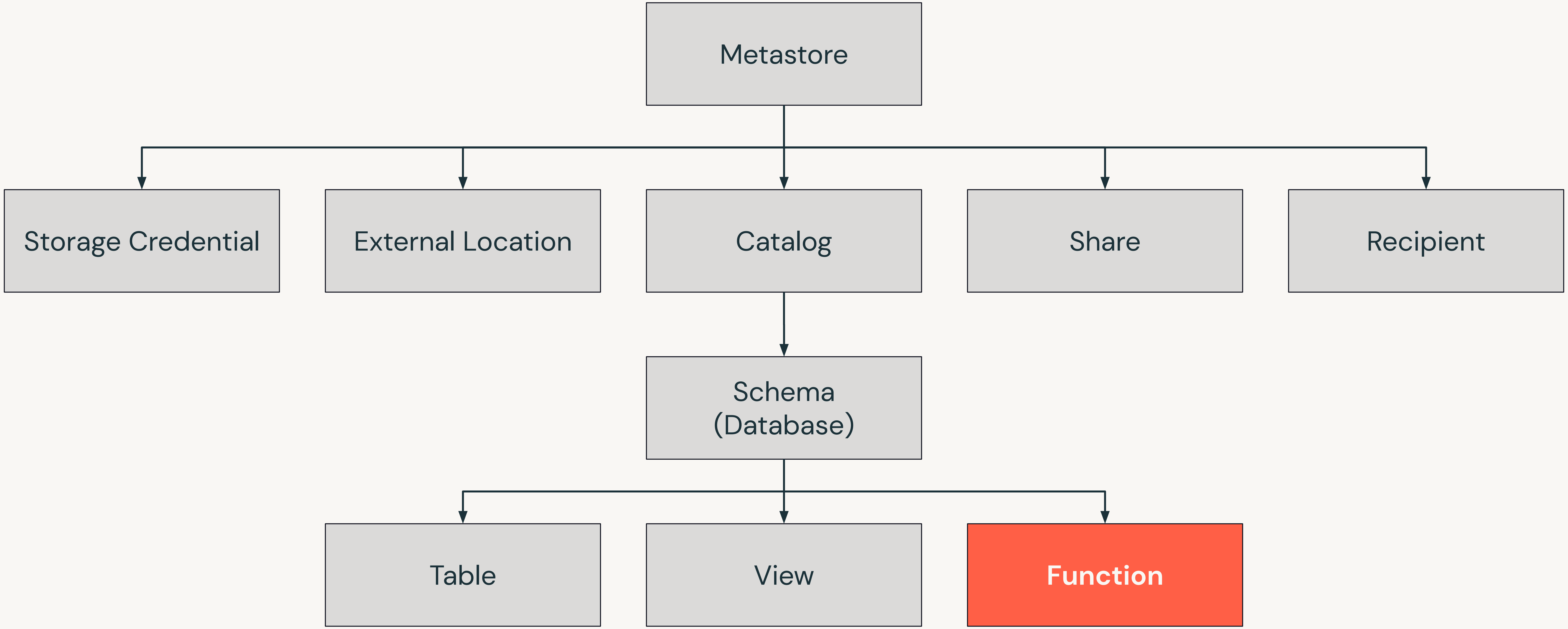
Key Concepts



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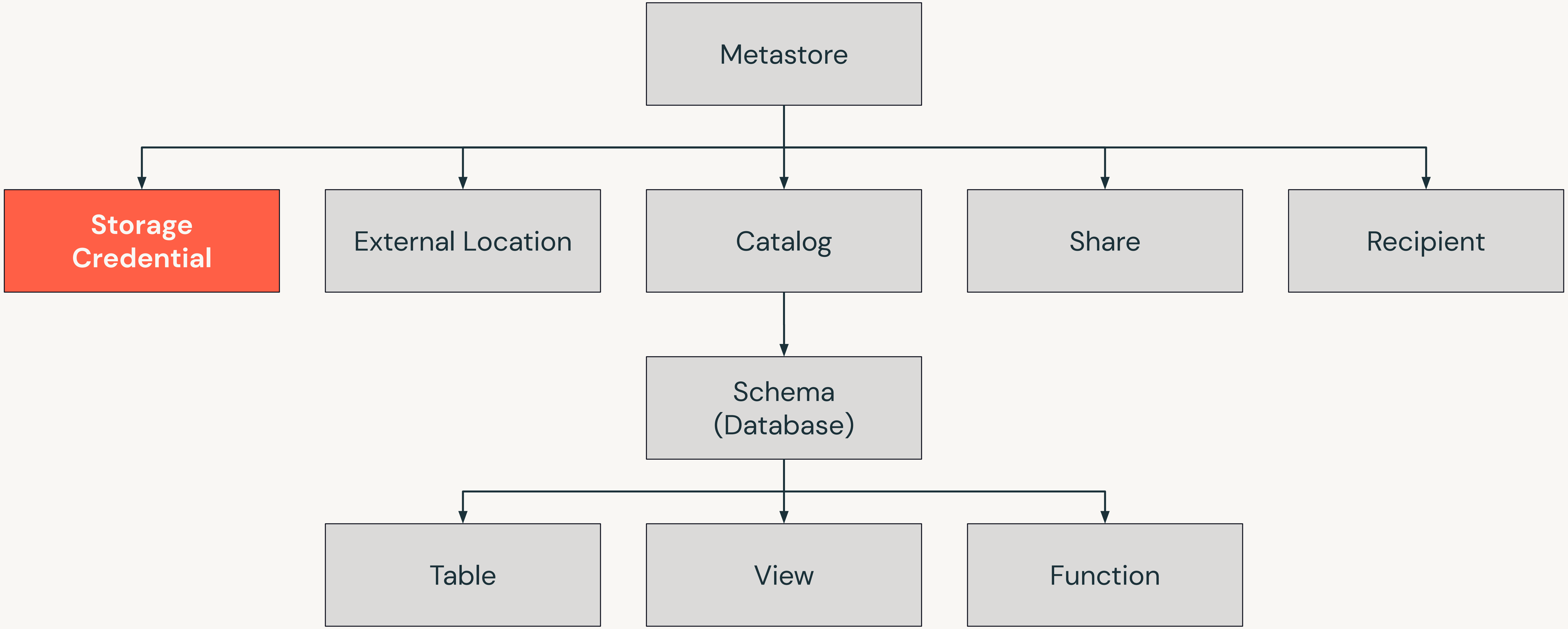

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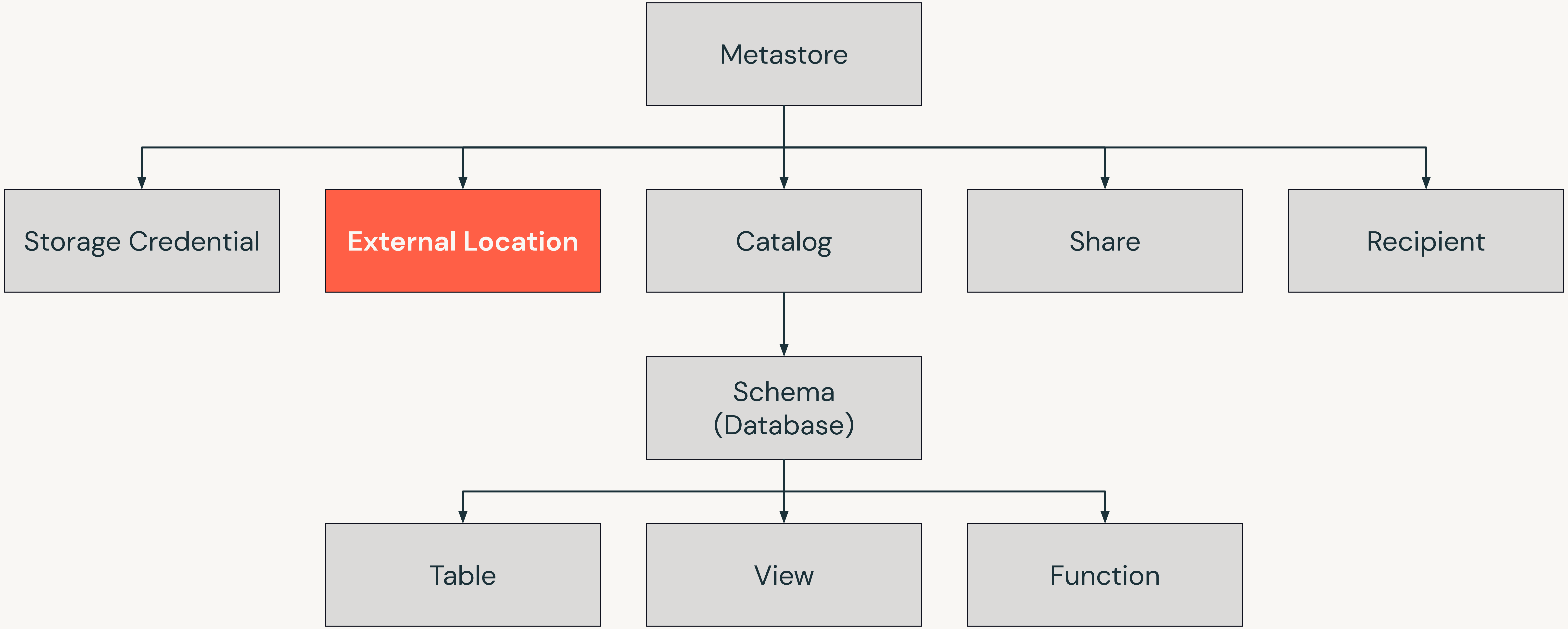

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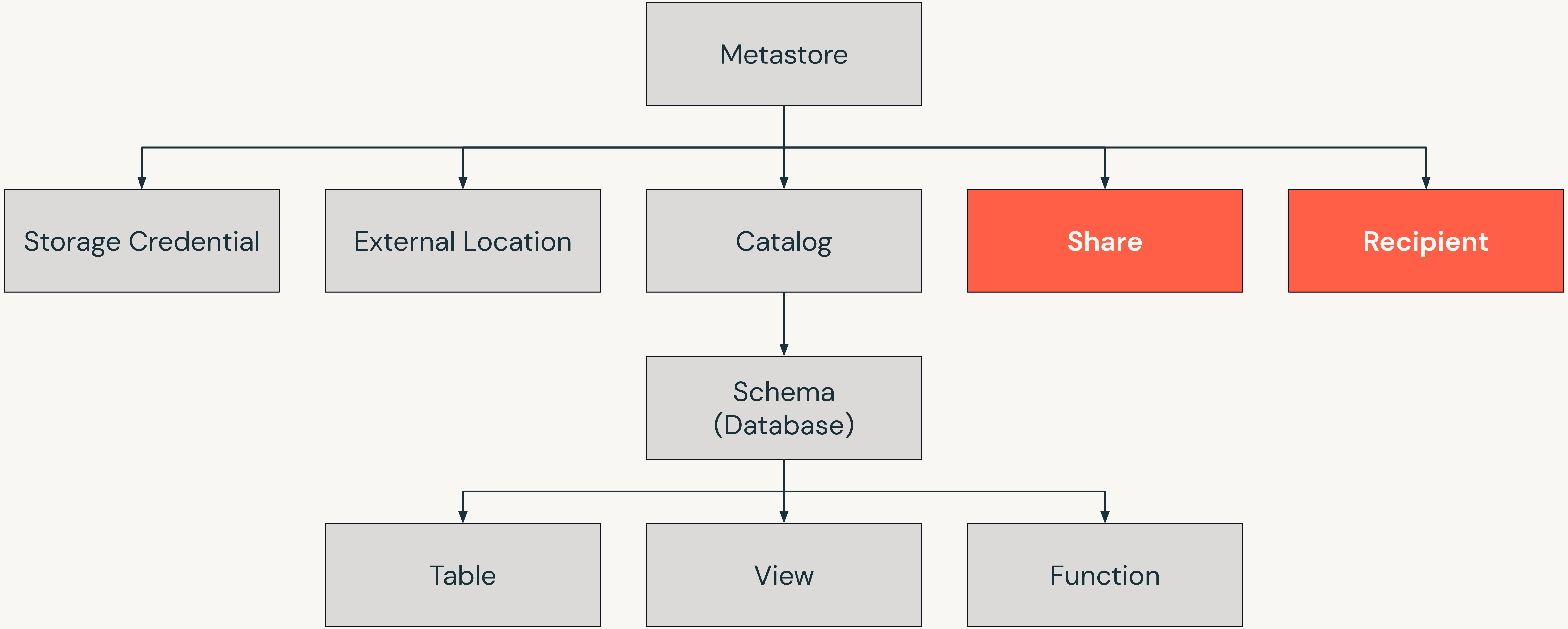

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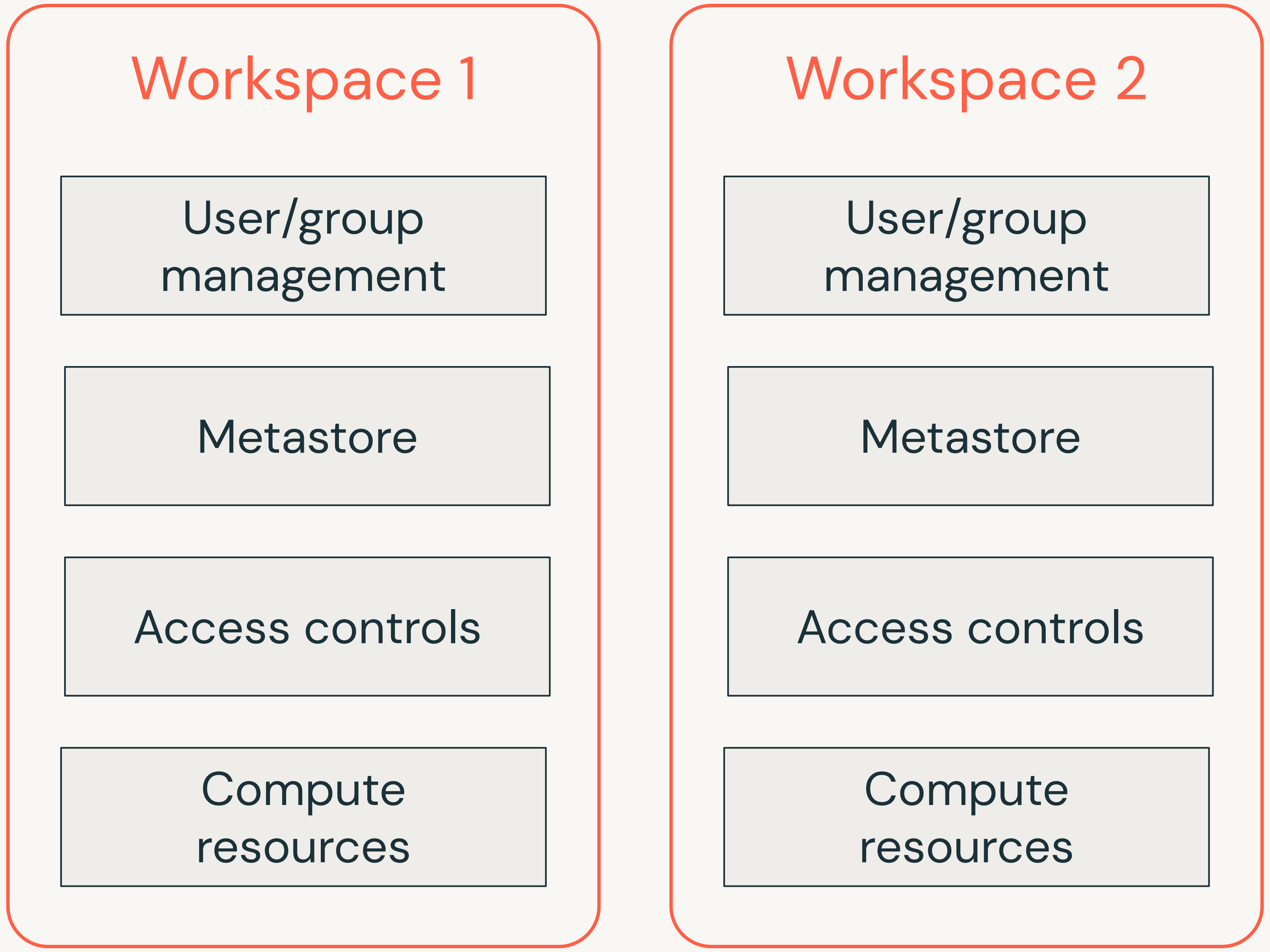
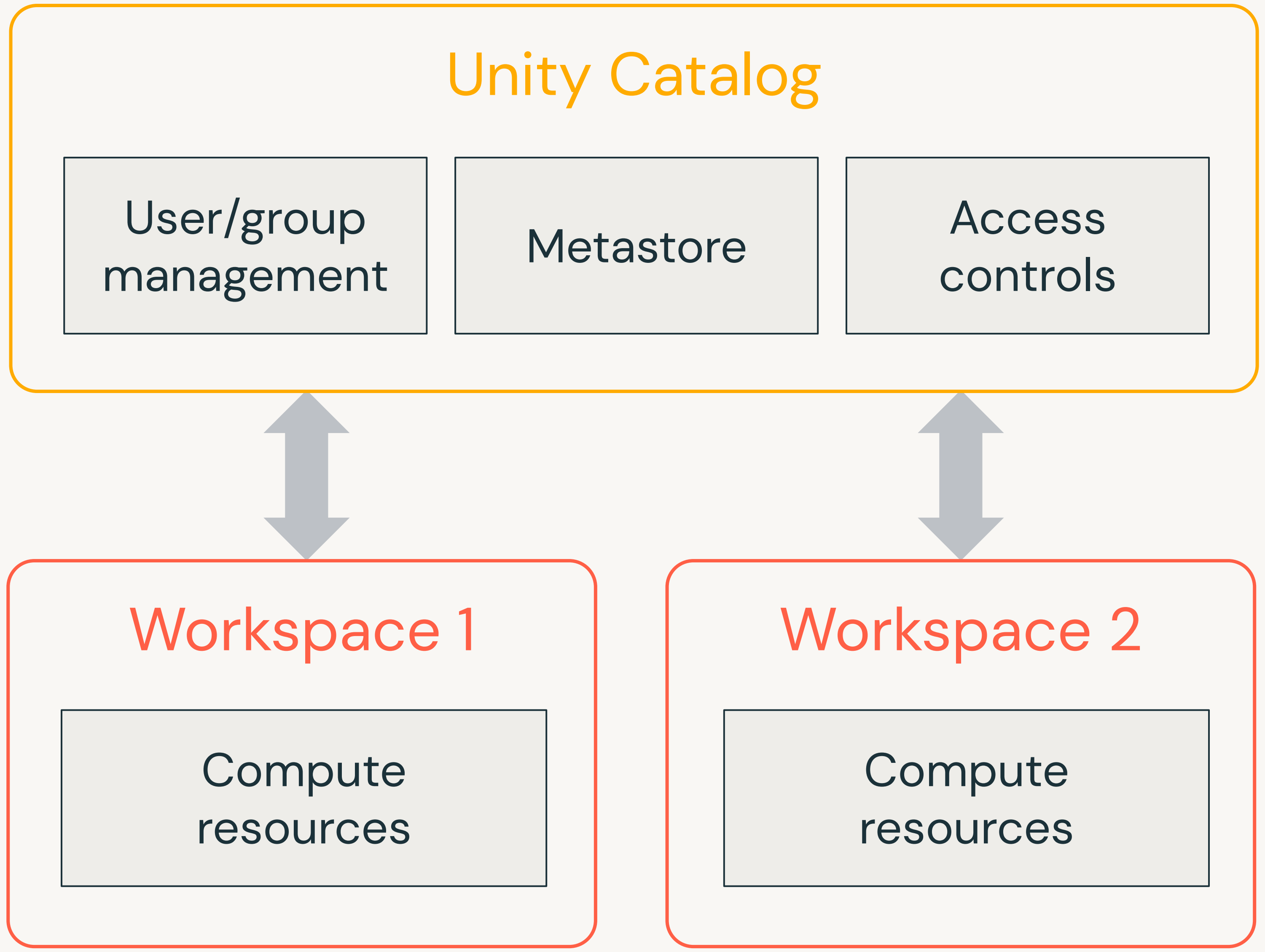
Unity Catalog Architecture

Architecture

Before Unity Catalog

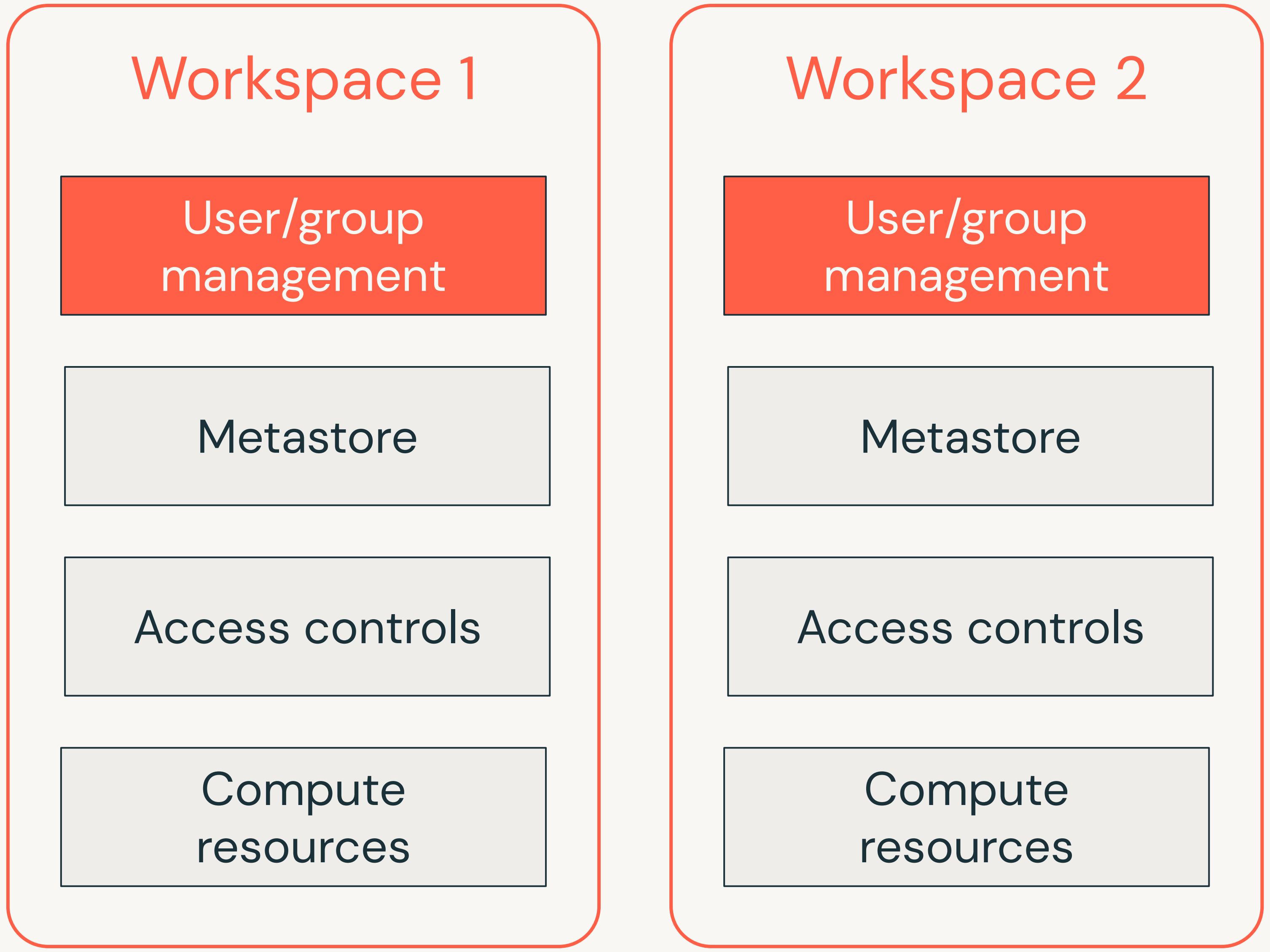


With Unity Catalog



Architecture

Before Unity Catalog



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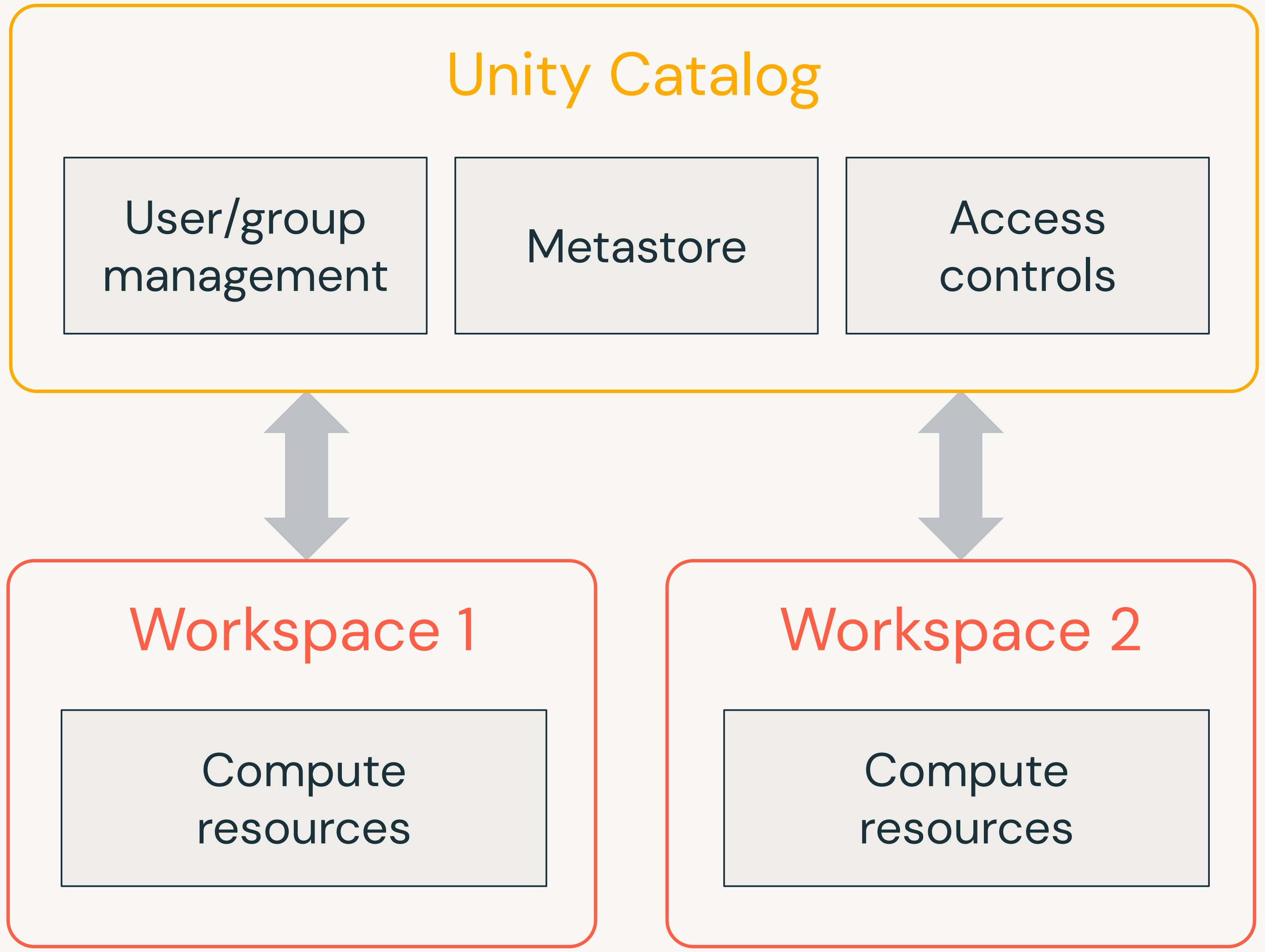

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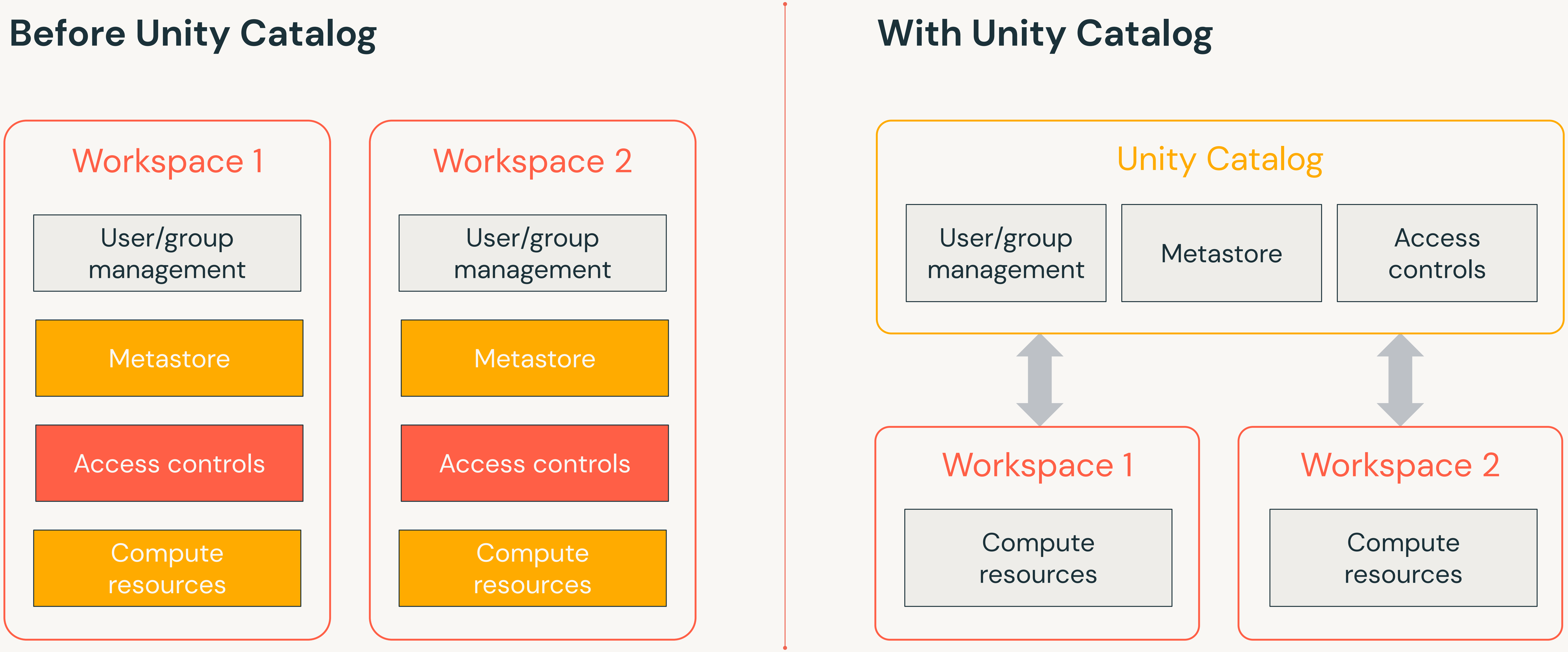

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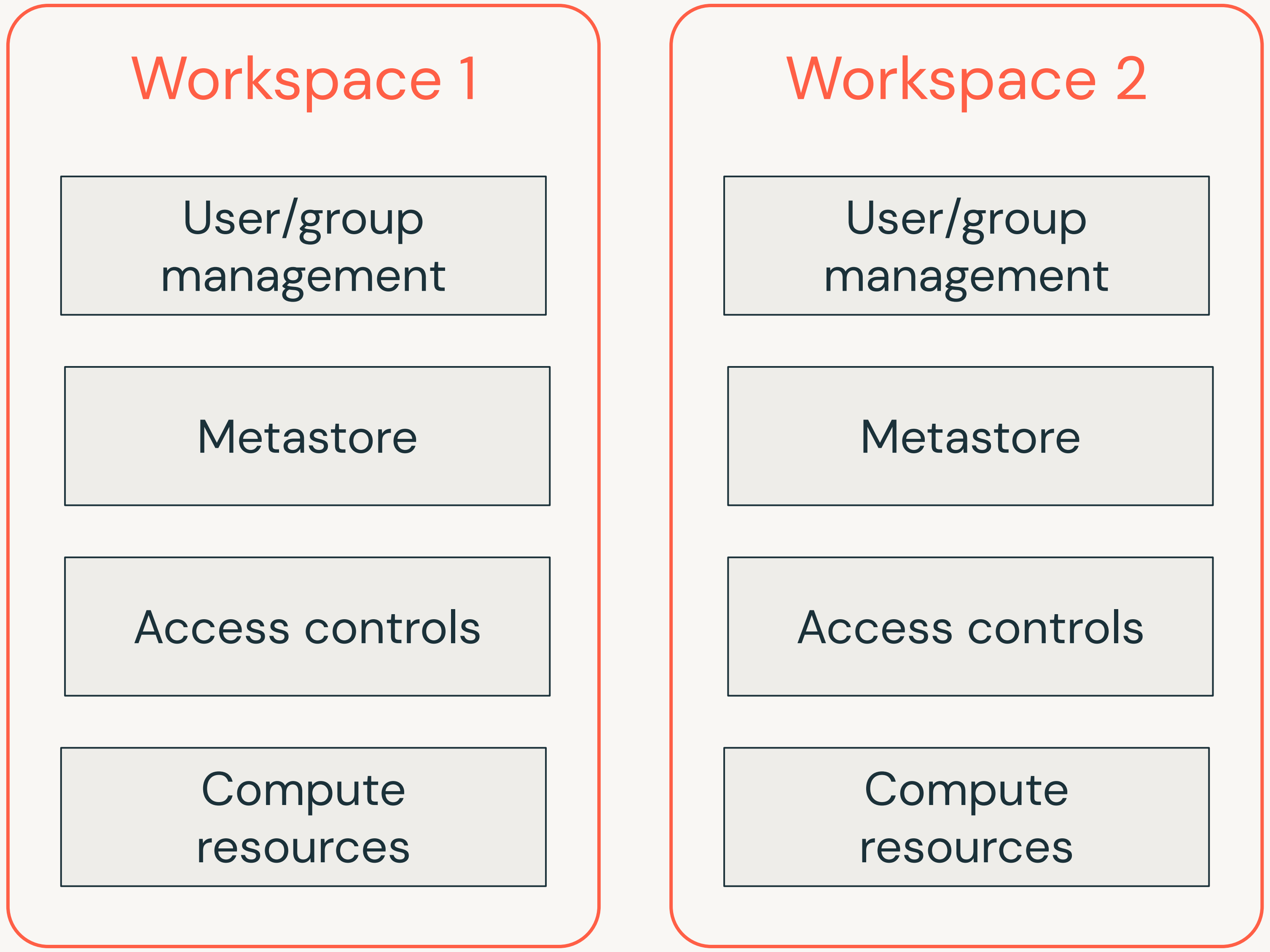

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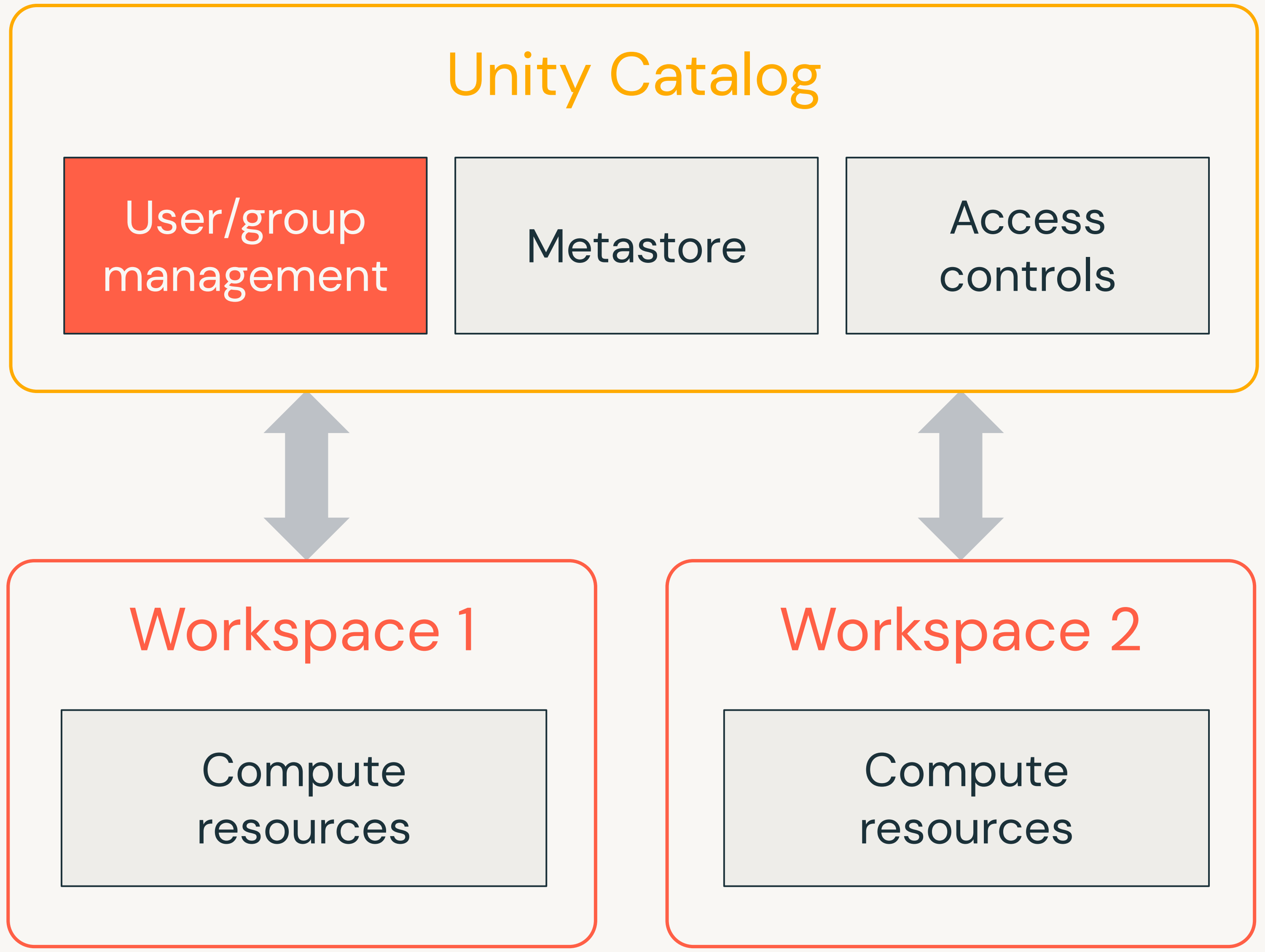

Architecture

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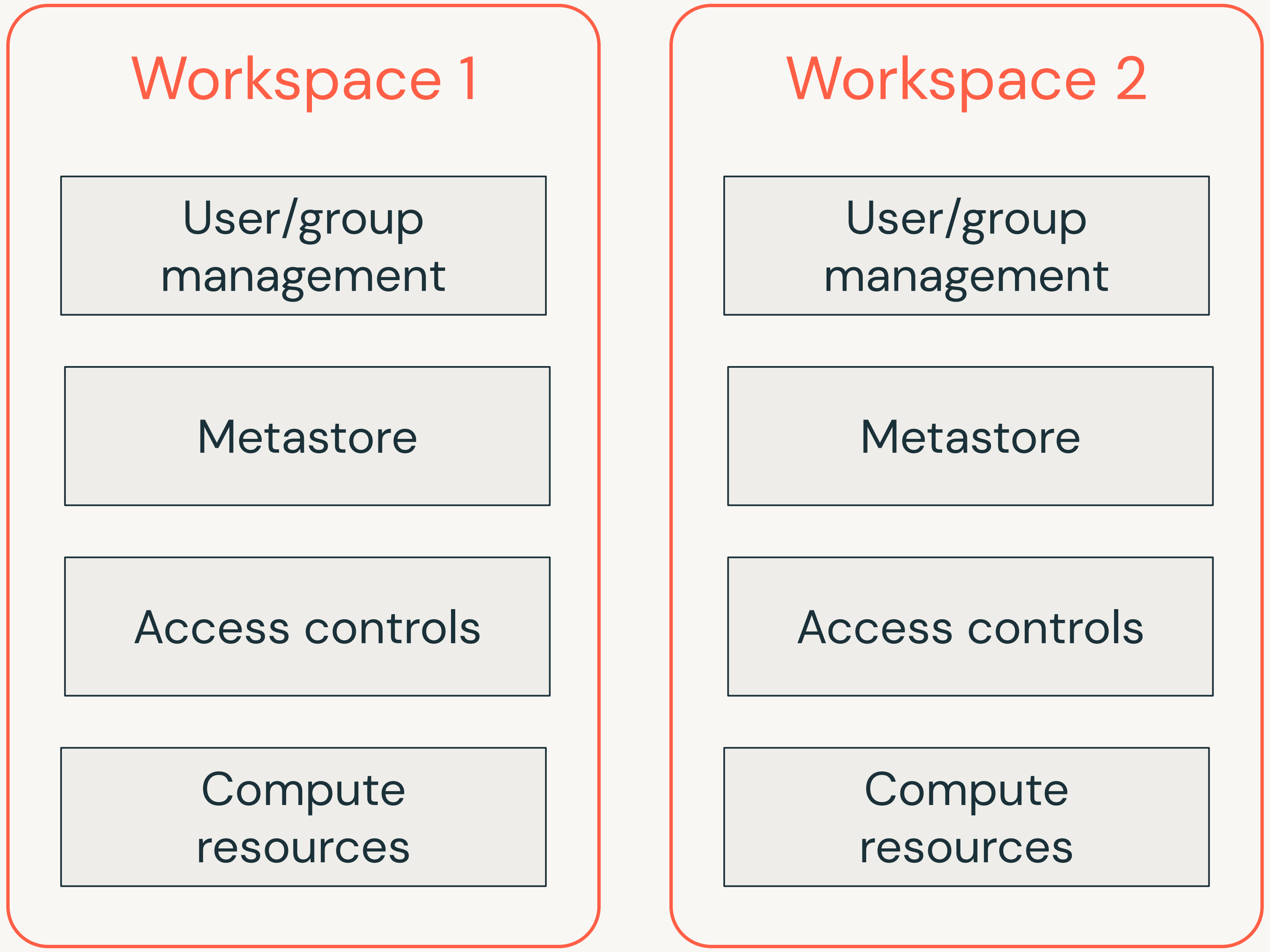

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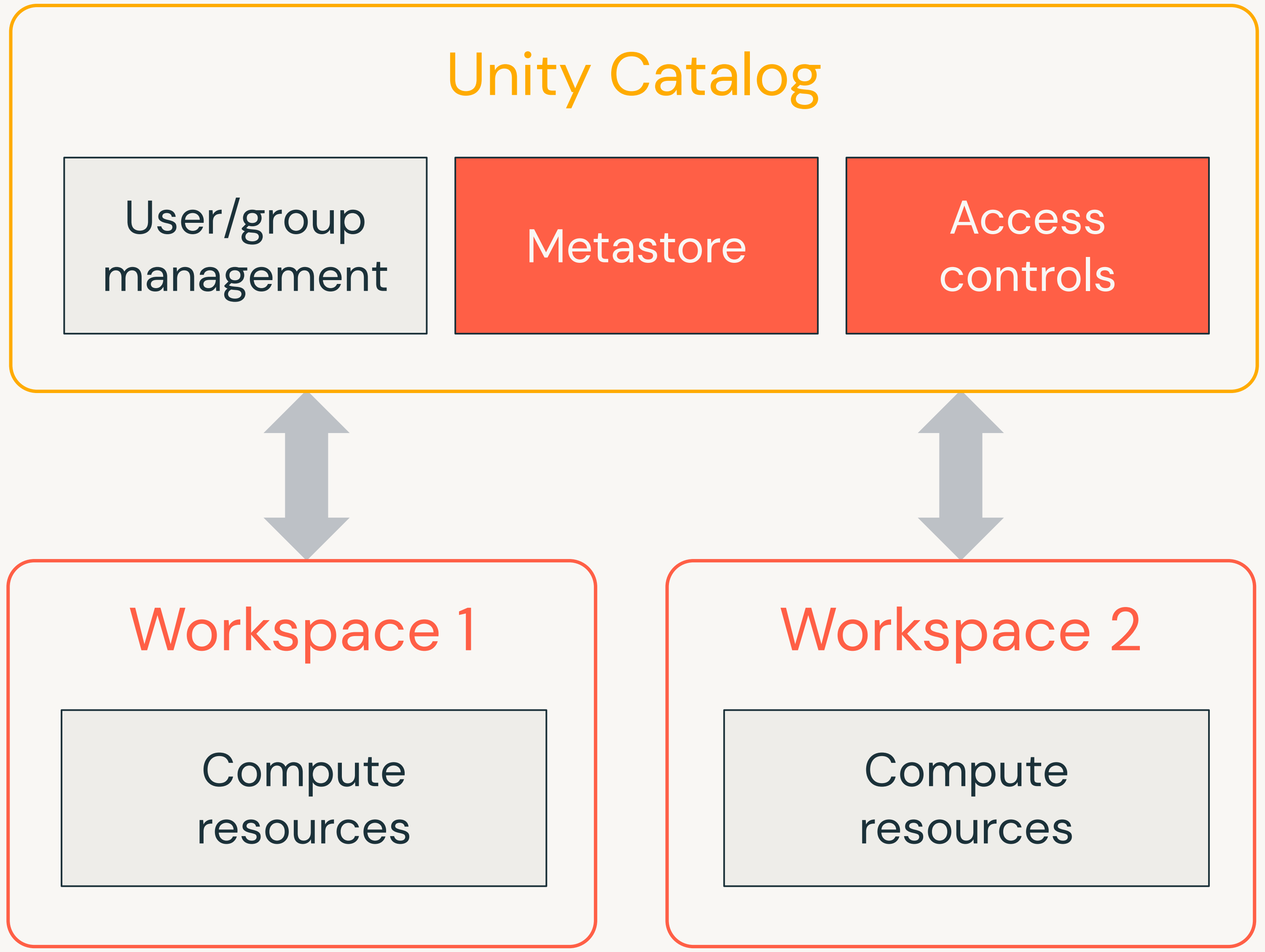


Unity Catalog Roles

Roles

- Cloud Administrator
- Identity Administrator
- Account Administrator
- Metastore Admin
- Data Owner
- Workspace Administrator

Administers underlying cloud resources

- Storage accounts/buckets
- IAM role/service principals/Managed Identities

Roles

- Cloud Administrator
- **Identity Administrator**
- Account Administrator
- Metastore Administrator
- Data Owner
- Workspace Administrator

Administers underlying identity provider service (when in use)

- Identity provider provisions users and groups into the account
- Avoids need to manually create and manage identities

Roles

- Cloud Administrator
- Identity Administrator
- **Account Administrator**
- Metastore Administrator
- Data Owner
- Workspace Administrator

Administers the account

- Creates, deletes, and assigns metastores to workspaces
- Creates, deletes, and assigns users and groups to workspaces
- Integrates account with an identity provider
- Full access to all data objects

Roles

Cloud Administrator

Identity Administrator

Account Administrator

Metastore Administrator

Data Owner

Workspace Administrator

Administers a metastore

- Creates and drops catalogs and other data objects
- Grants privileges on data objects
- Changes ownerships of data objects
- Designated by an account administrator

Roles

- Cloud Administrator
- Identity Administrator
- Account Administrator
- Metastore Administrator
- **Data Owner**
- Workspace Administrator

Owns data objects they created

- Creates nested objects
- Grants privileges to others on owned objects
- Changes ownership of owned objects

Roles

- Cloud Administrator
- Identity Administrator
- Account Administrator
- Metastore Administrator
- Data Owner
- **Workspace Administrator**

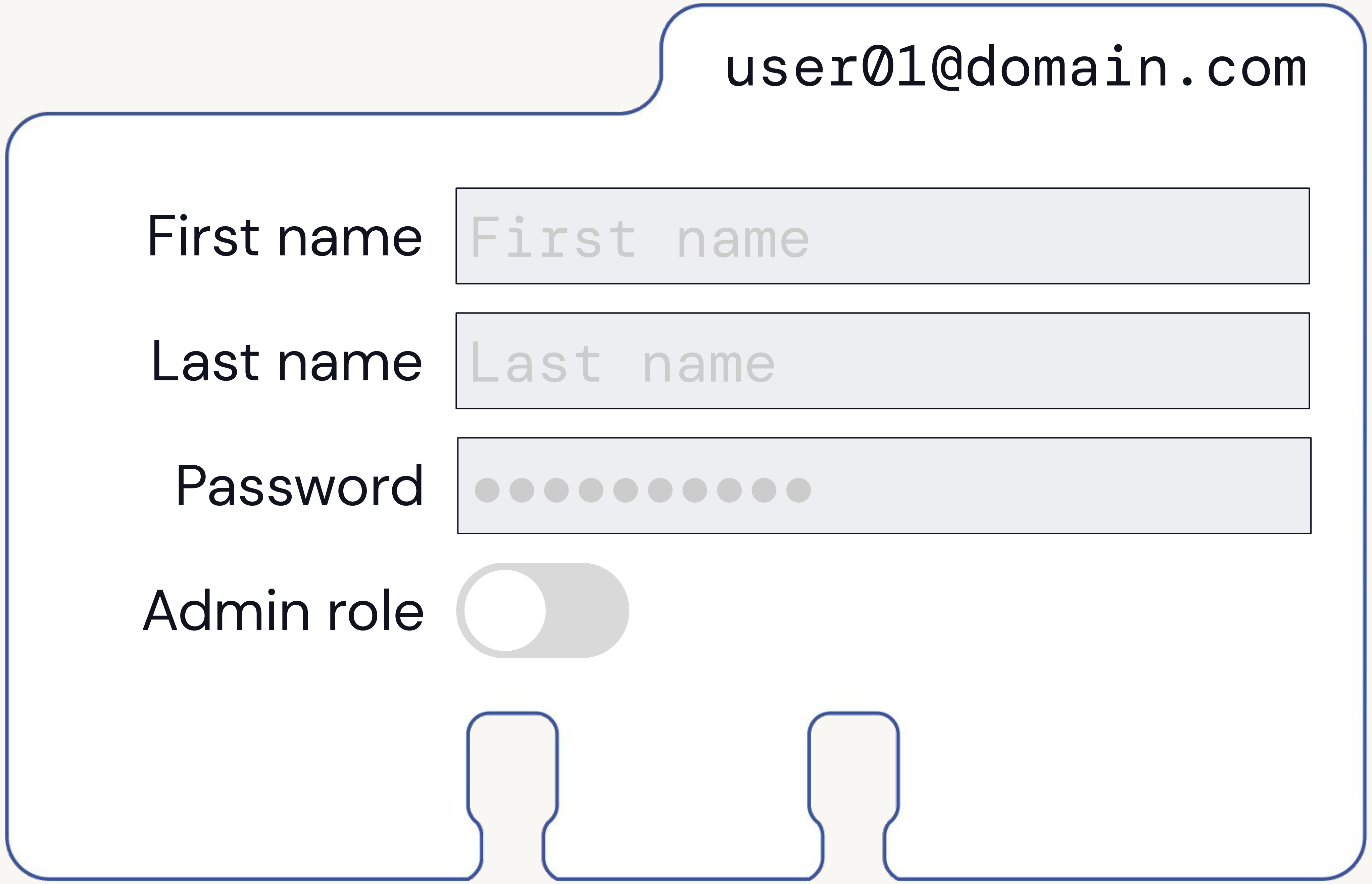
Administers a workspace

- Manages permissions on workspace assets
- Restricts access to cluster creation
- Adds or removes users
- Elevates users permissions
- Grant privileges to others
- Change job ownership

Unity Catalog Identities

Identities

User

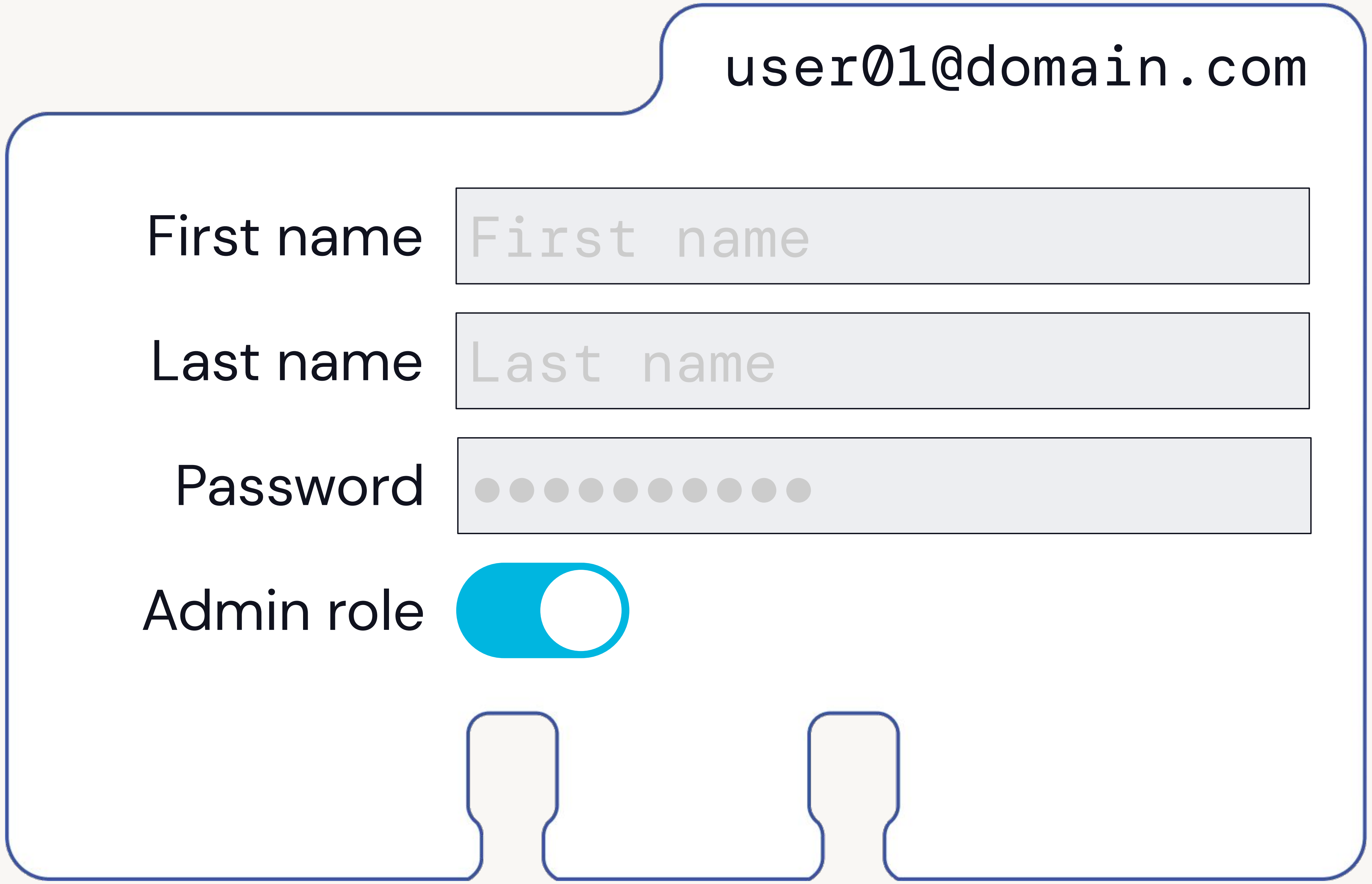


user01@domain.com

First name	First name
Last name	Last name
Password	●●●●●●●●●●
Admin role	○

Identities

Account administrator



user01@domain.com

First name: First name

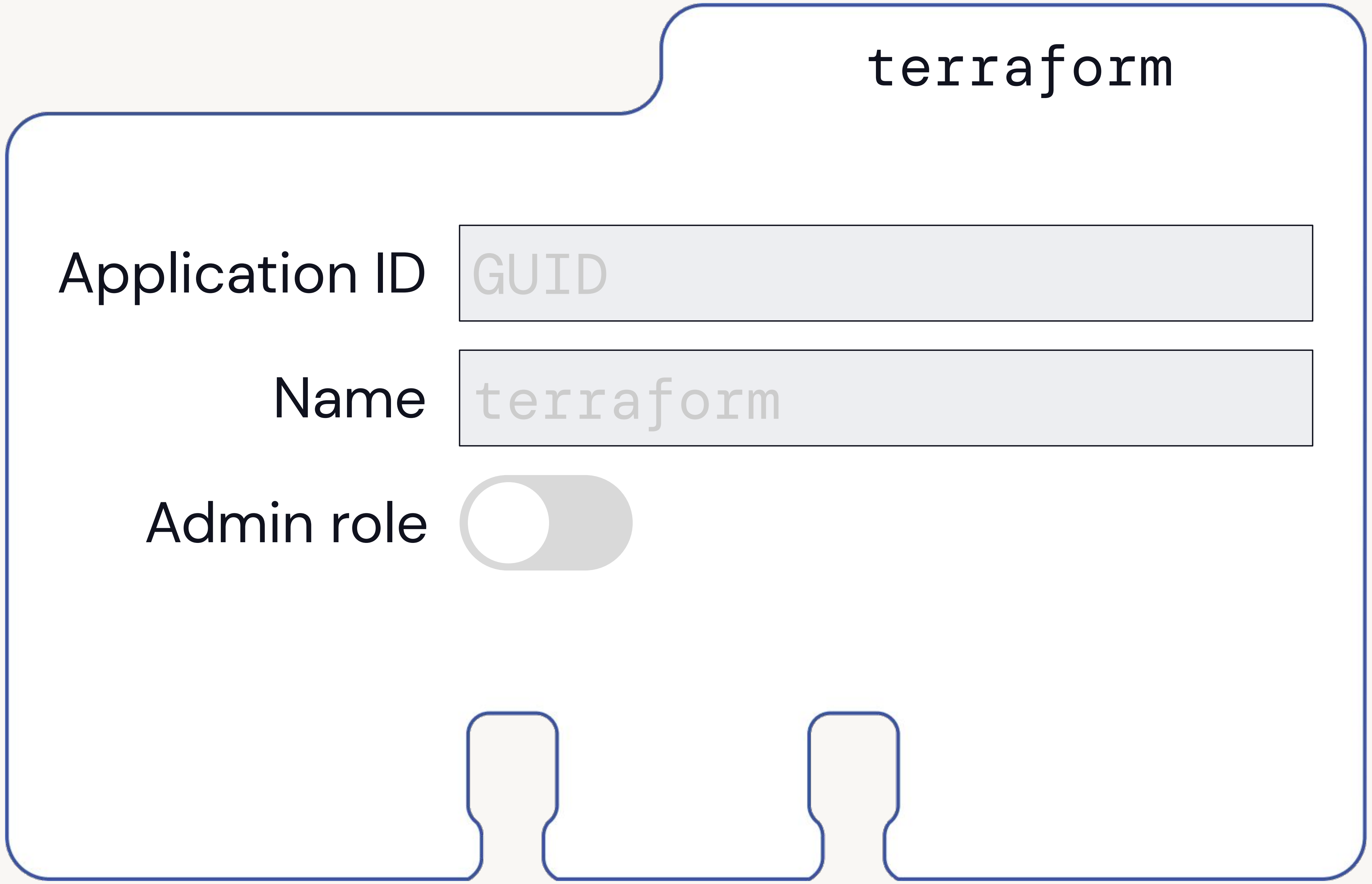
Last name: Last name

Password: ●●●●●●●●●●

Admin role

Identities

Service Principal



terraform

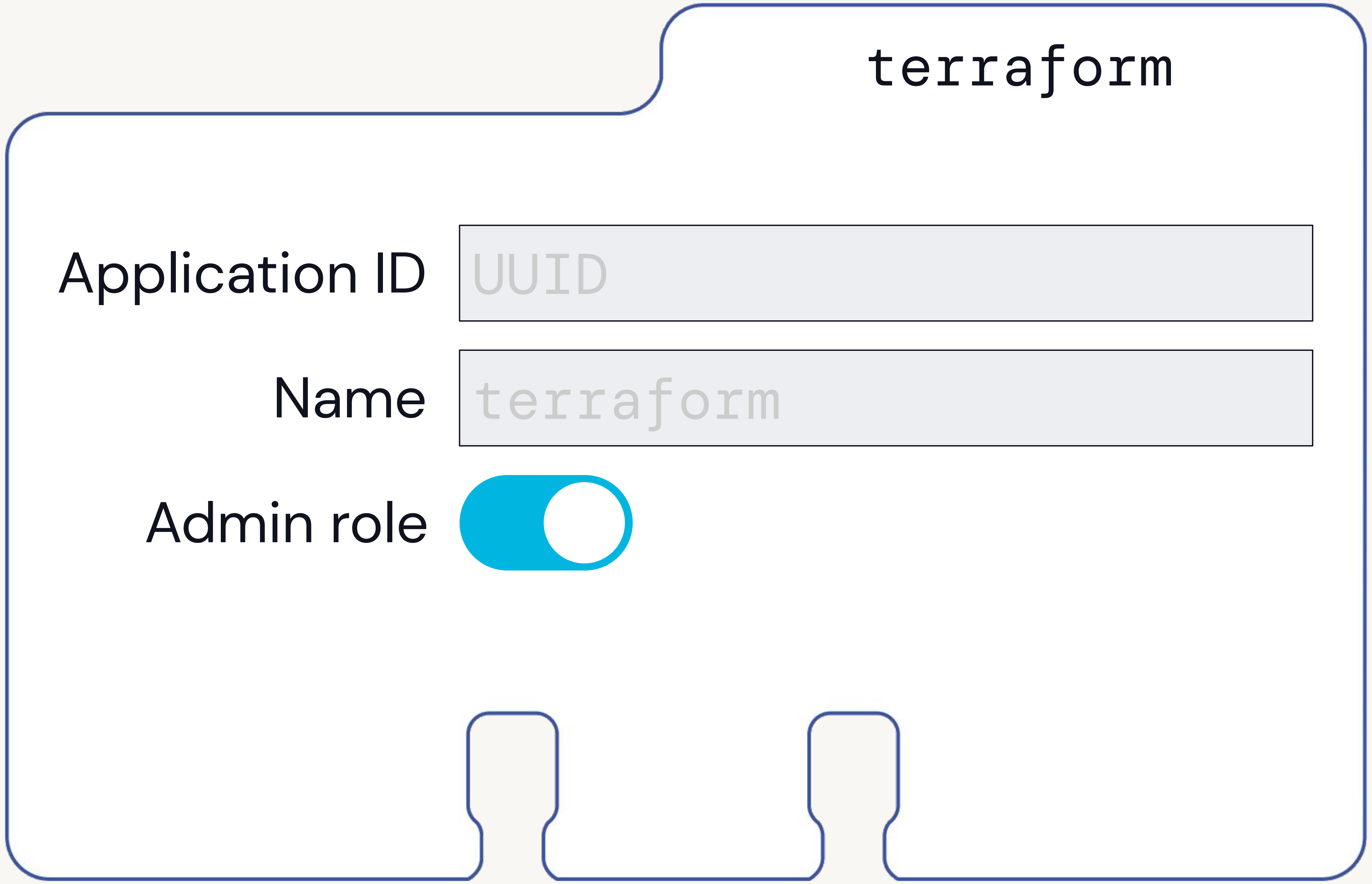
Application ID: GUID

Name: terraform

Admin role

Identities

Service Principal with administrative privileges

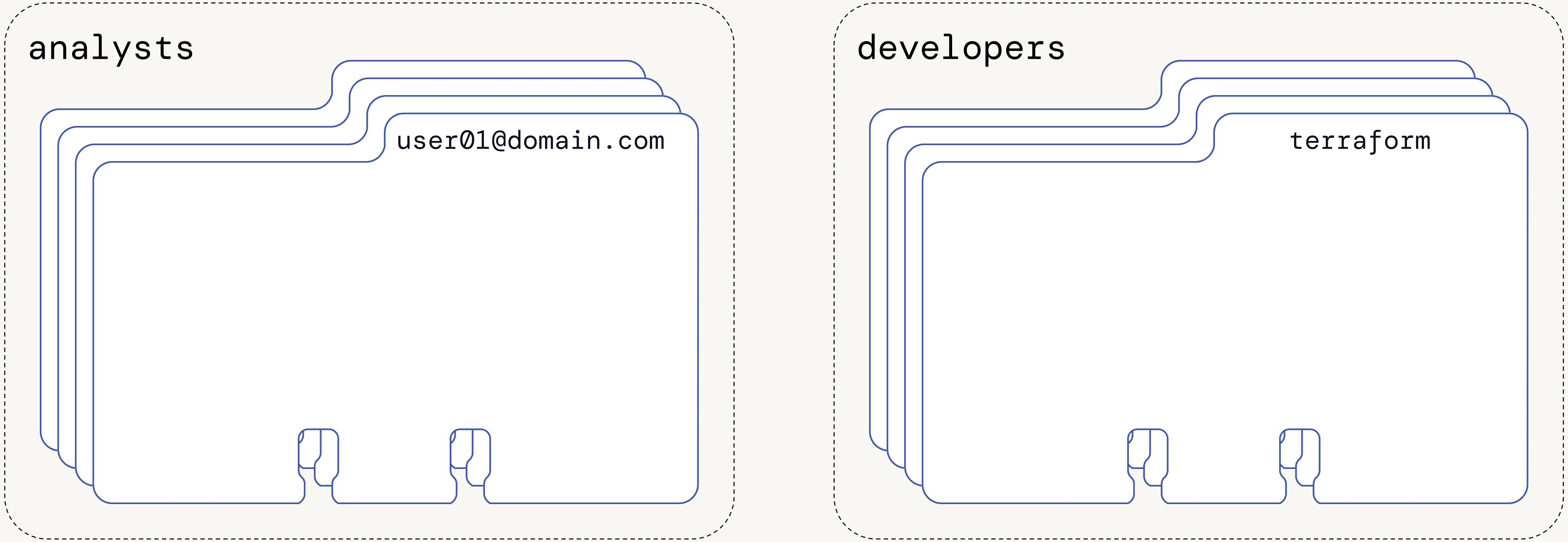


terraform

Application ID	UUID
Name	terraform
Admin role	●

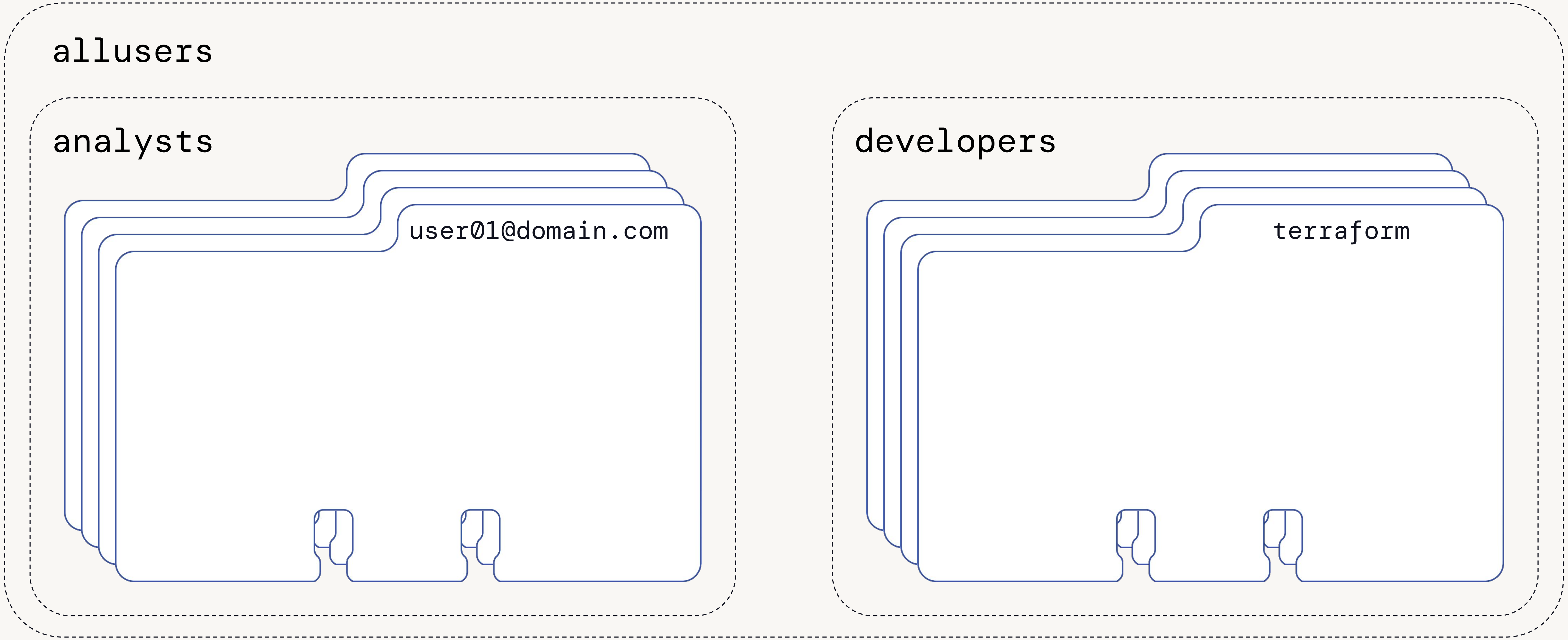
Identities

Groups



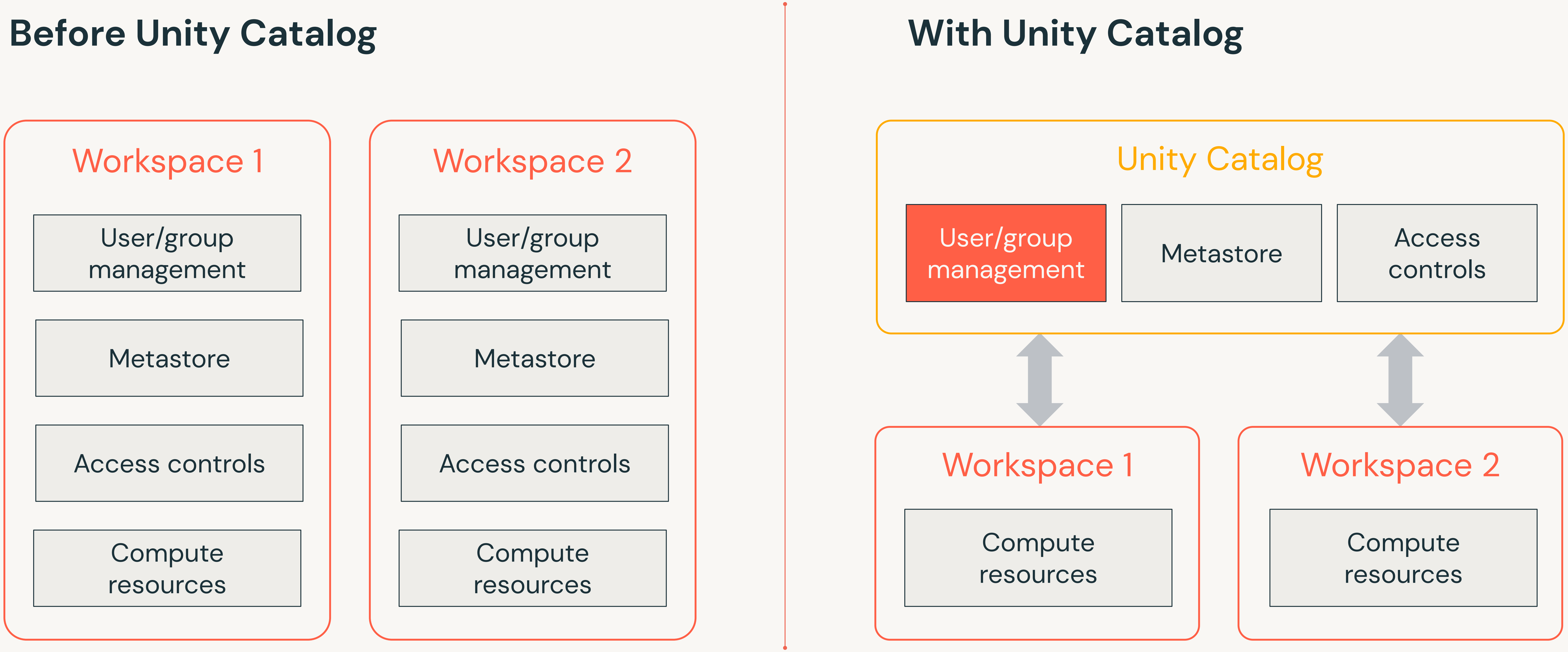
Identities

Nesting groups



Identities

Recap



Before Unity Catalog

Workspace 1

User/group management

Metastore

Access controls

Compute resources

Workspace 2

User/group management

Metastore

Access controls

Compute resources

With Unity Catalog

Unity Catalog

User/group management

Metastore

Access controls

Workspace 1

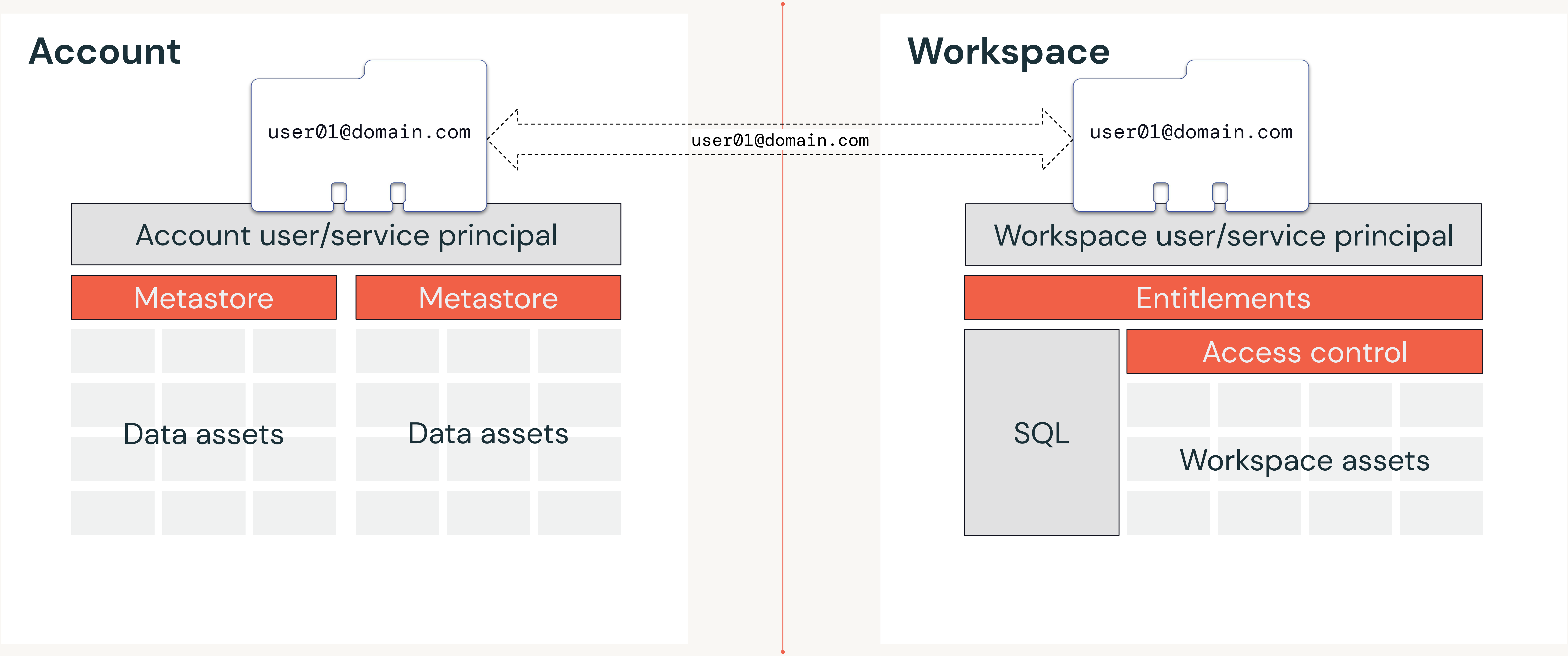
Compute resources

Workspace 2

Compute resources

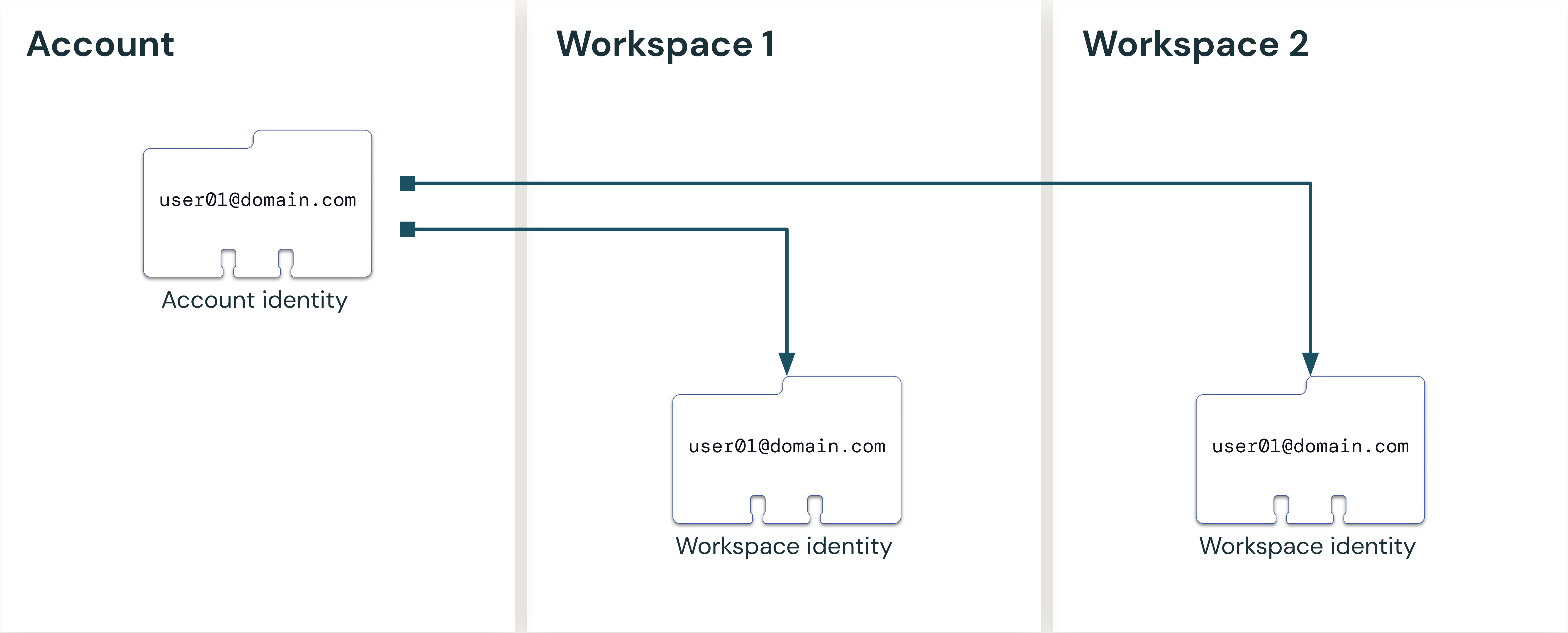
Identities

Relating account and workspace identities



Identities

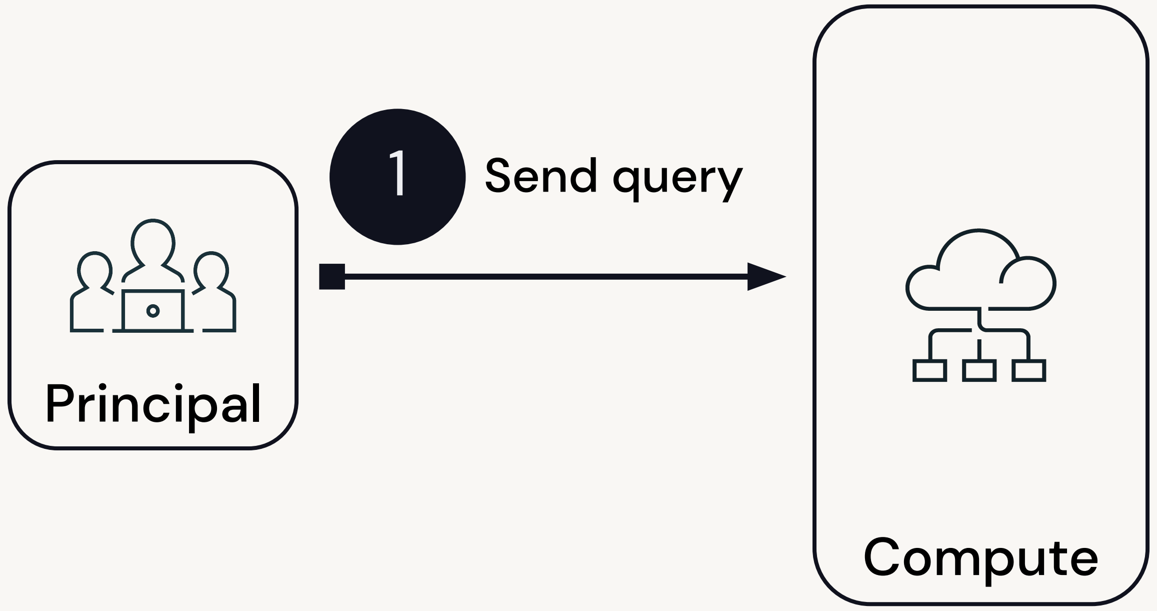
Identity federation



Unity Catalog Security Model

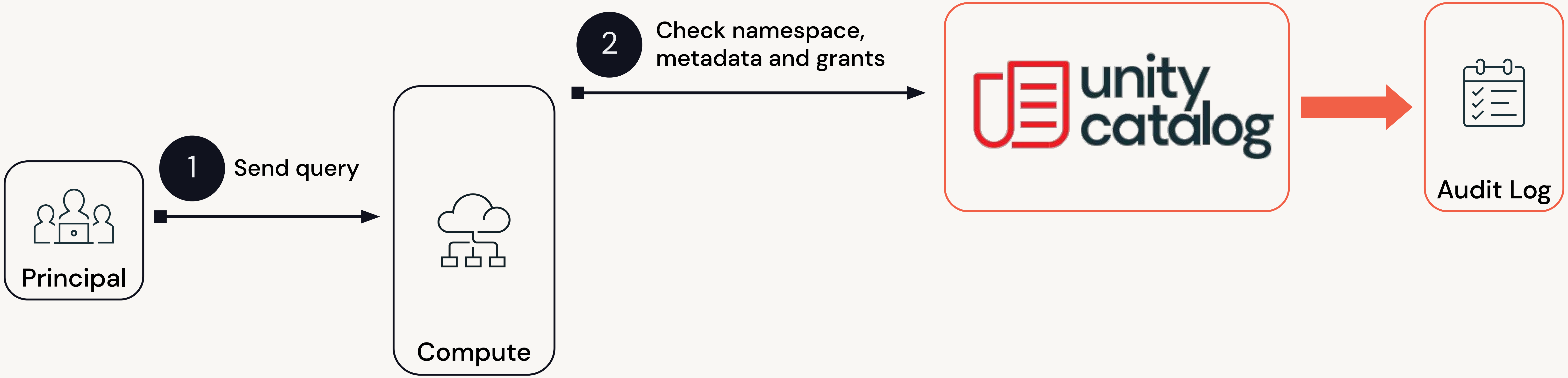
Security Model

Query Lifecycle



Security Model

Query Lifecycle



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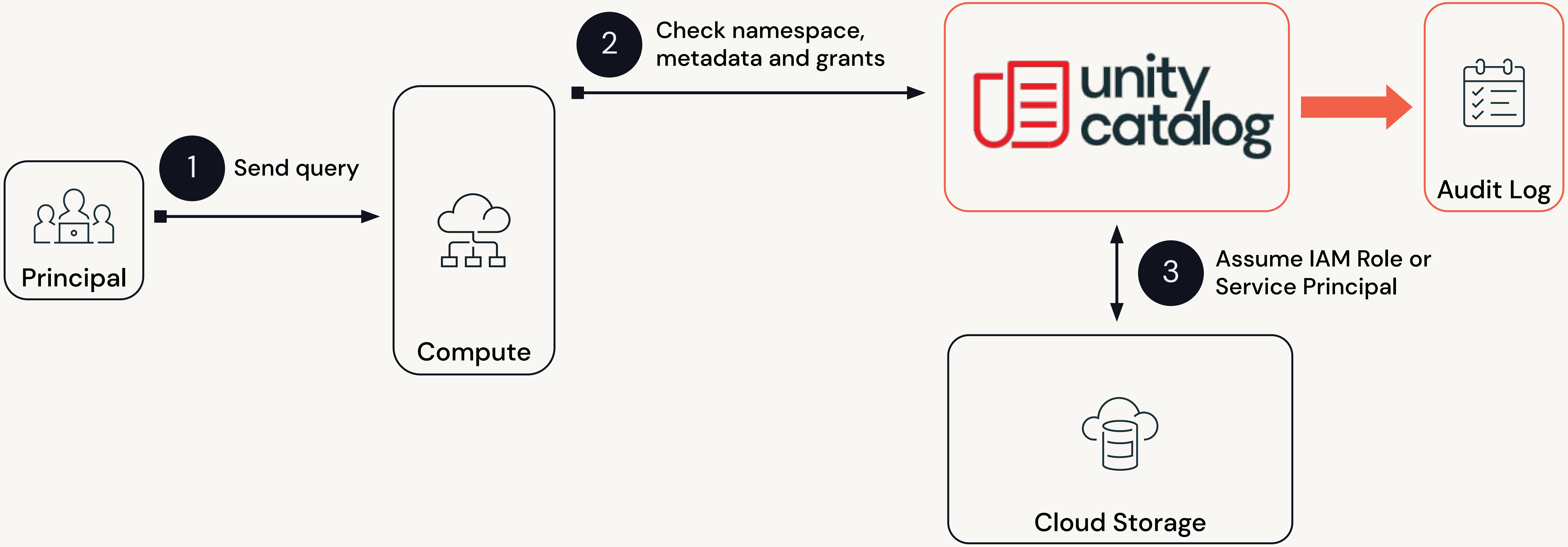
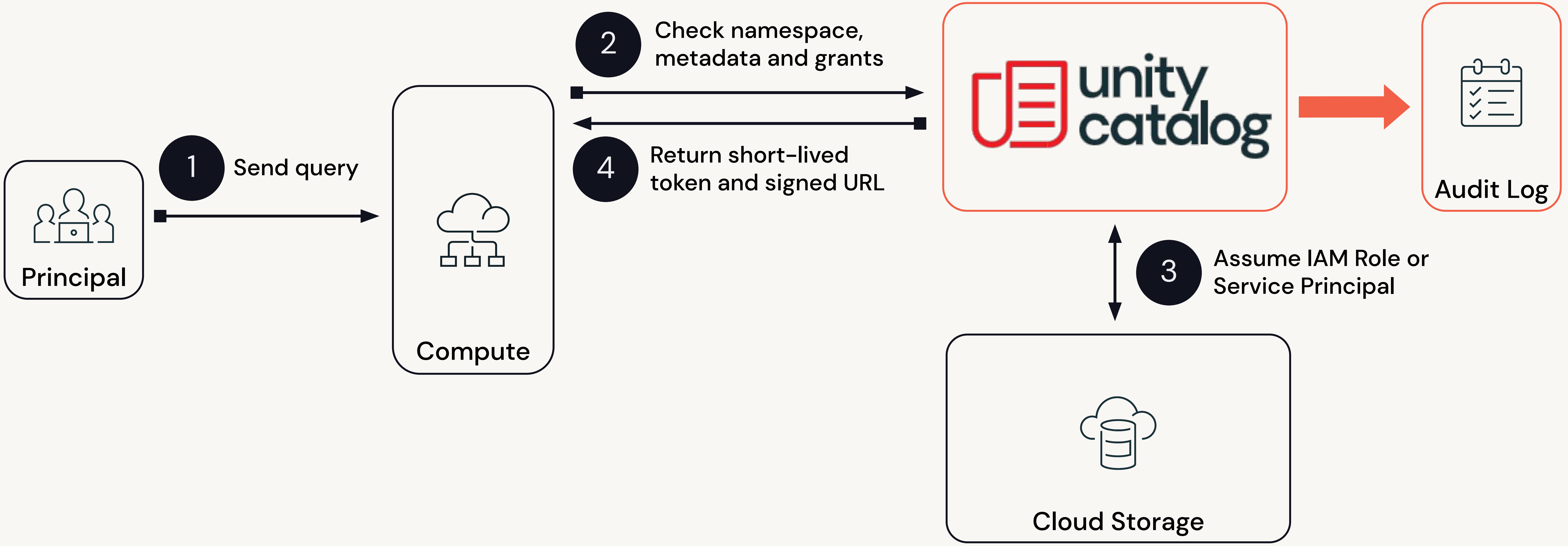


Principal
1
Send query
Compute
2
Check namespace, metadata and grants
unity catalog
Audit Log
3
Assume IAM Role or Service Principal
Cloud Storage

Security Model

Query Lifecycle



Principal
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unity catalog
Audit Log
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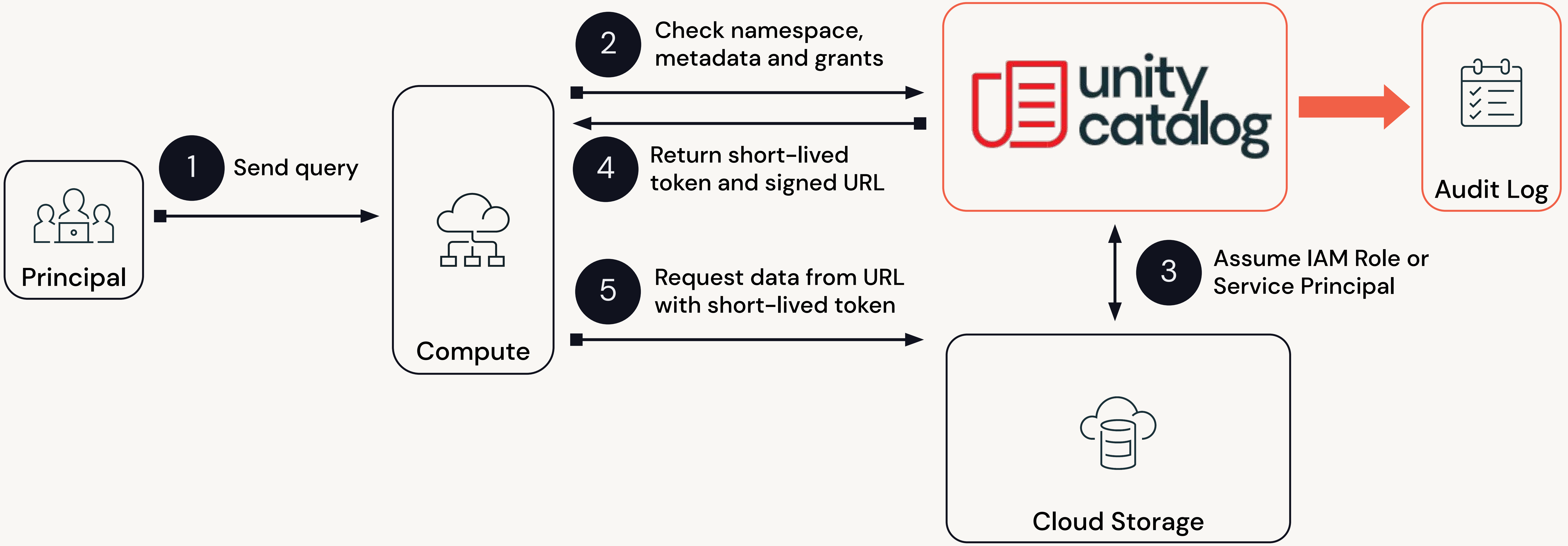
Security Model

Query Lifecycle



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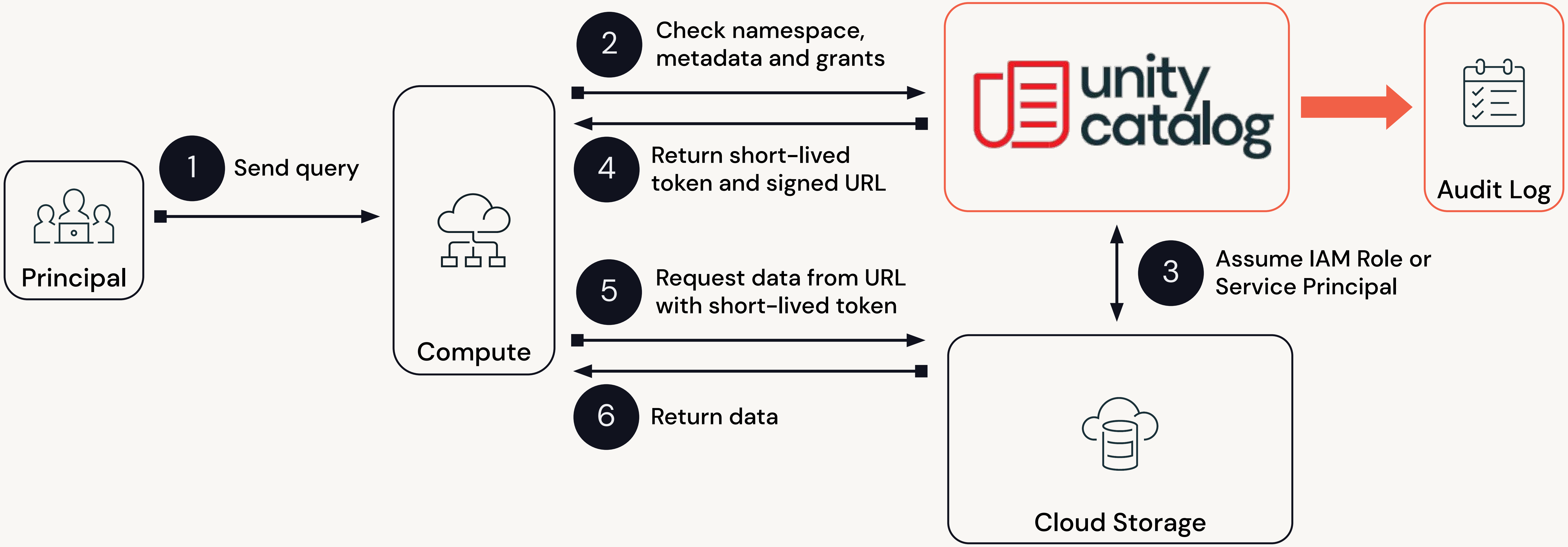
5
Request data from URL with short-lived token
Cloud Storage

Security Model

Query Lifecycle



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Return data
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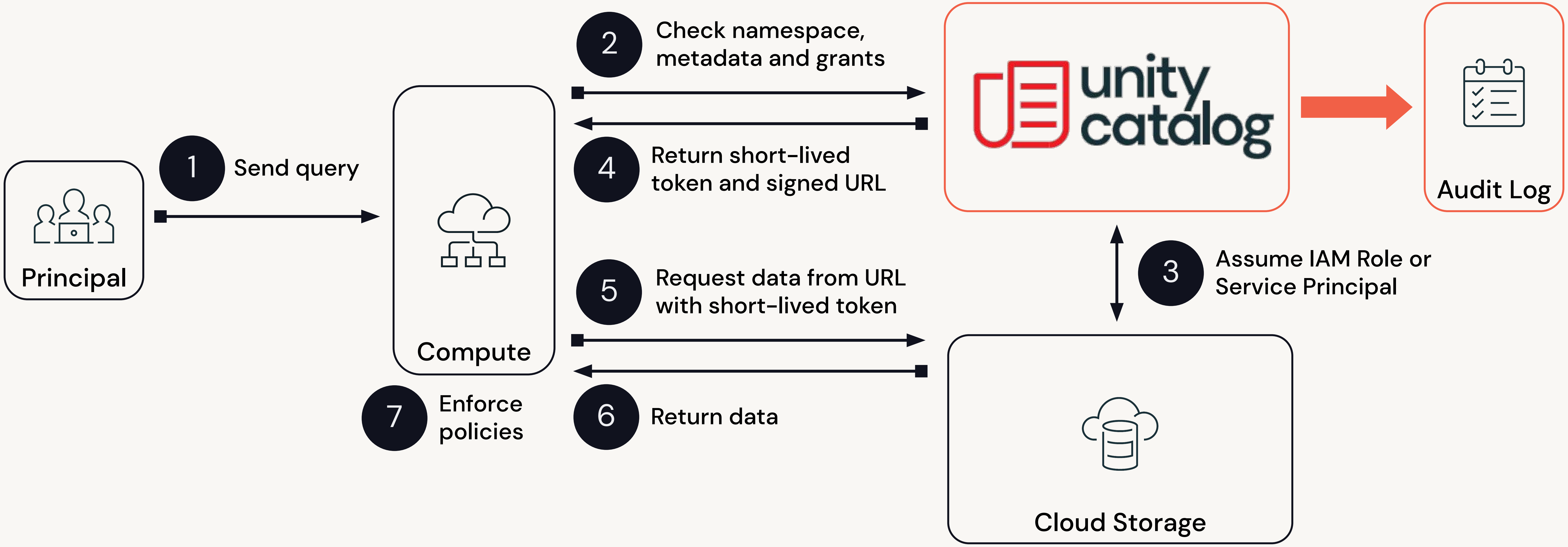
Security Model

Query Lifecycle



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Assume IAM Role or Service Principal
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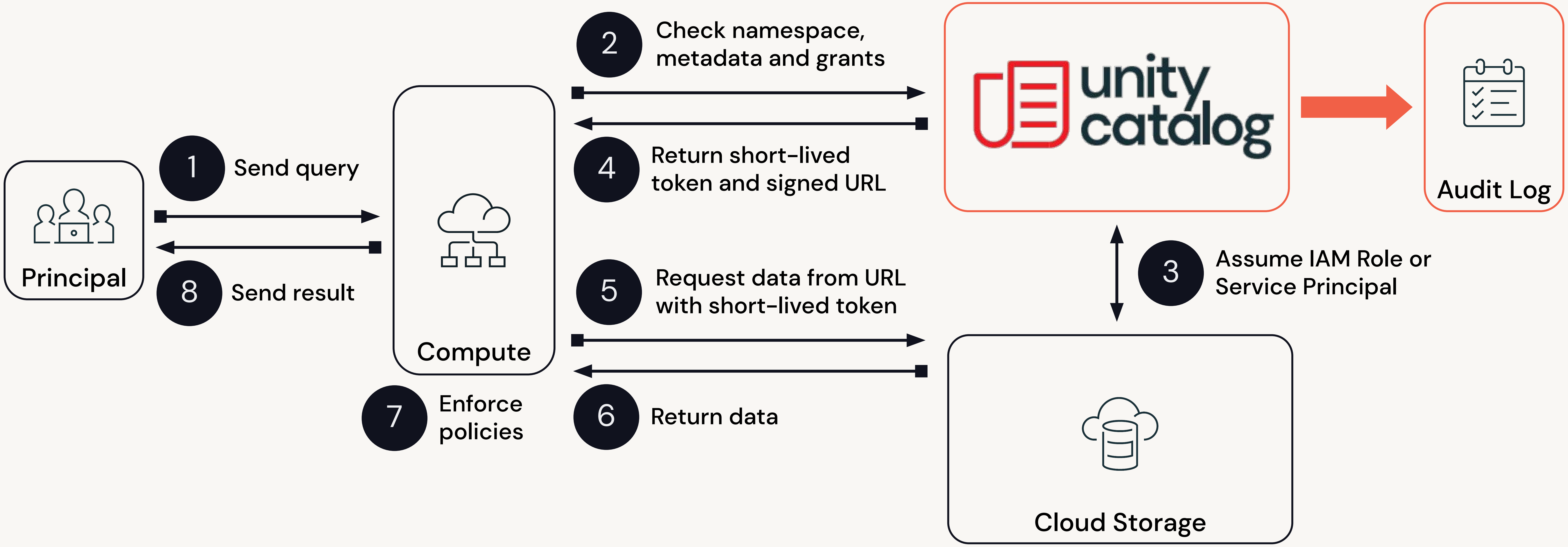
Request data from URL with short-lived token
6
Return data
7
Enforce policies
Cloud Storage

Security Model

Query Lifecycle



Principal
1
Send query
8
Send result
Compute
7
Enforce policies
2
Check namespace, metadata and grants
4
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6
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unity catalog
Audit Log
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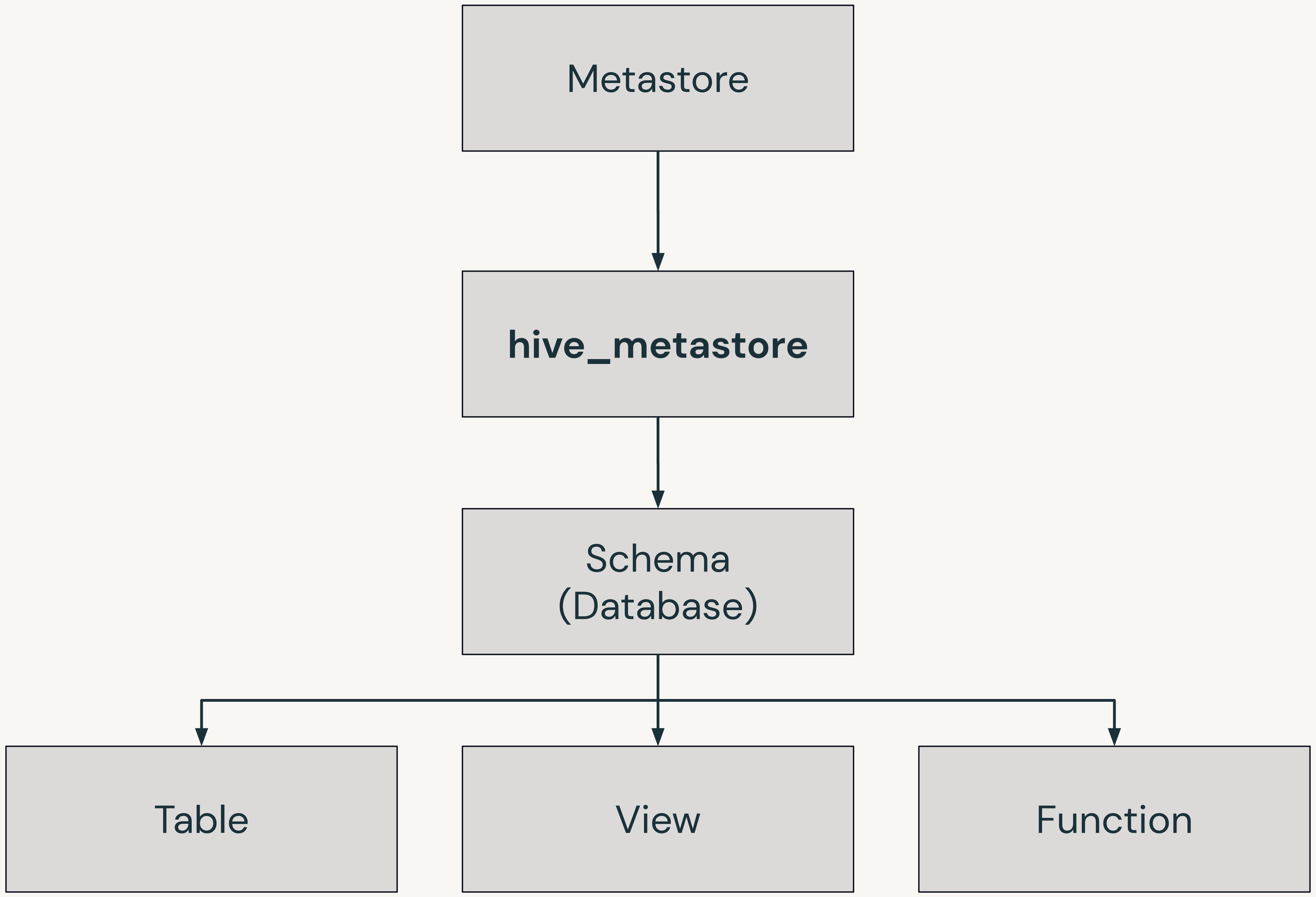
Assume IAM Role or Service Principal
Cloud Storage

Security Model

Accessing legacy metastore



Compute Resources and Unity Catalog

Course Objectives

By the end of this course, you will be able to:

1. Describe how to access Unity Catalog through Databricks compute resources
2. Create a Unity Catalog enabled cluster
3. Access Unity Catalog through Databricks SQL

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Cluster Security Mode

Clusters

Security modes

Modes supporting Unity Catalog

Single user
Multiple language support, not shareable

User isolation
Shareable, Python and SQL, legacy table ACLs

Modes not supporting Unity Catalog

None
No security

Table ACL only
Legacy table ACLs, multiple languages, shareable

Passthrough only
Credential passthrough, multiple languages, shareable

Clusters

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Clusters

Security mode feature matrix

Security mode	Supported languages	Legacy table ACL	Credential passthrough	Shareable	RDD API	DBFS Fuse mounts	Init scripts and libraries	Dynamic views	Machine learning
None	All			●	●	●	●		●
Single user	**All**				●	●	●		●
User isolation	**SQL Python**	●		●				●	
Legacy table ACL	SQL Python	●		●			●		
Legacy Passthrough	SQL Python		●	●	●	●	●		

Clusters

Security mode feature matrix

Security mode	Supported languages	Legacy table ACL	Credential passthrough	Shareable	RDD API	DBFS Fuse mounts	Init scripts and libraries	Dynamic views	Machine learning
None	All			●	●	●	●		●
Single user	**All**				●	●	●		●
User isolation	**SQL** **Python**	●		●				●	
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databricks

Data Access Control in Unity Catalog

Course Objectives

By the end of this course, you will be able to:

1. Describe the security model for governing data objects in Unity Catalog
2. Define data access rules and manage data ownership
3. Secure access to external storage

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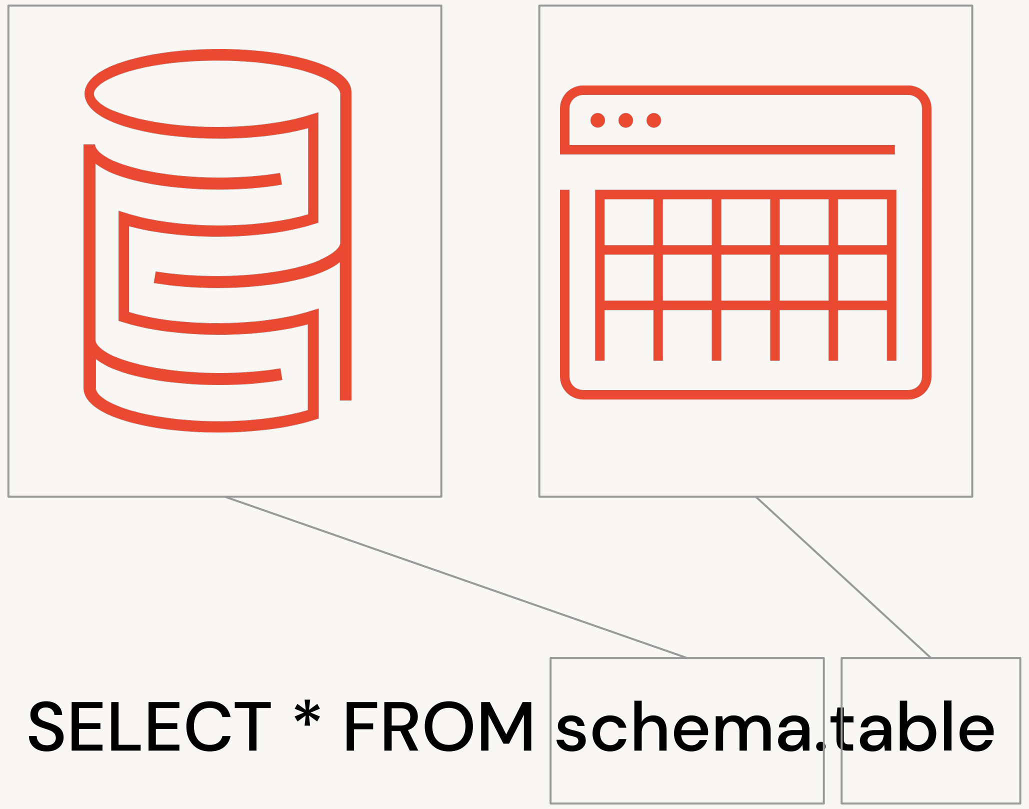
Unity Catalog Three-level Namespace

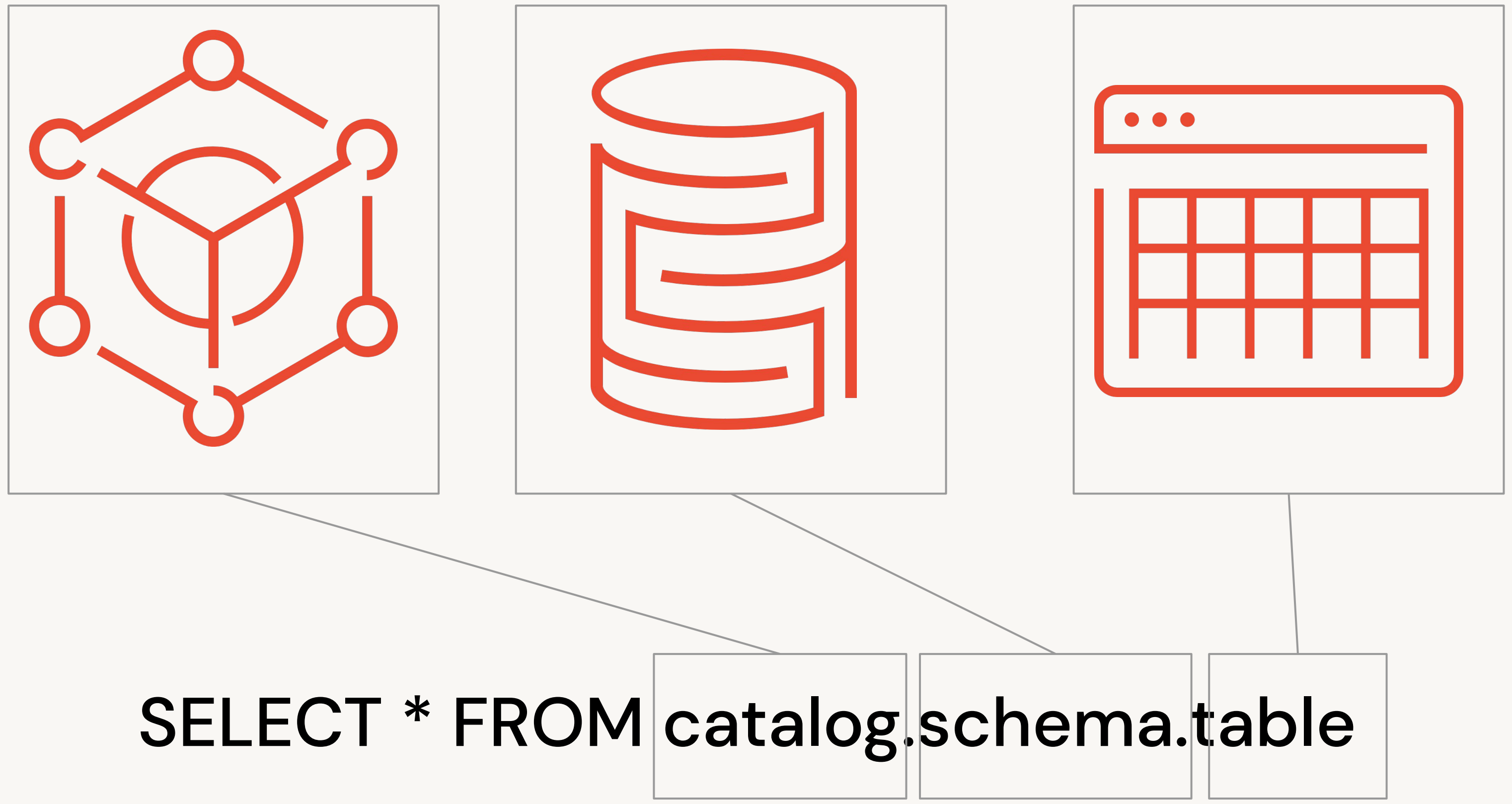
Three-level Namespace

Traditional SQL two-level namespace



SELECT * FROM schema.table

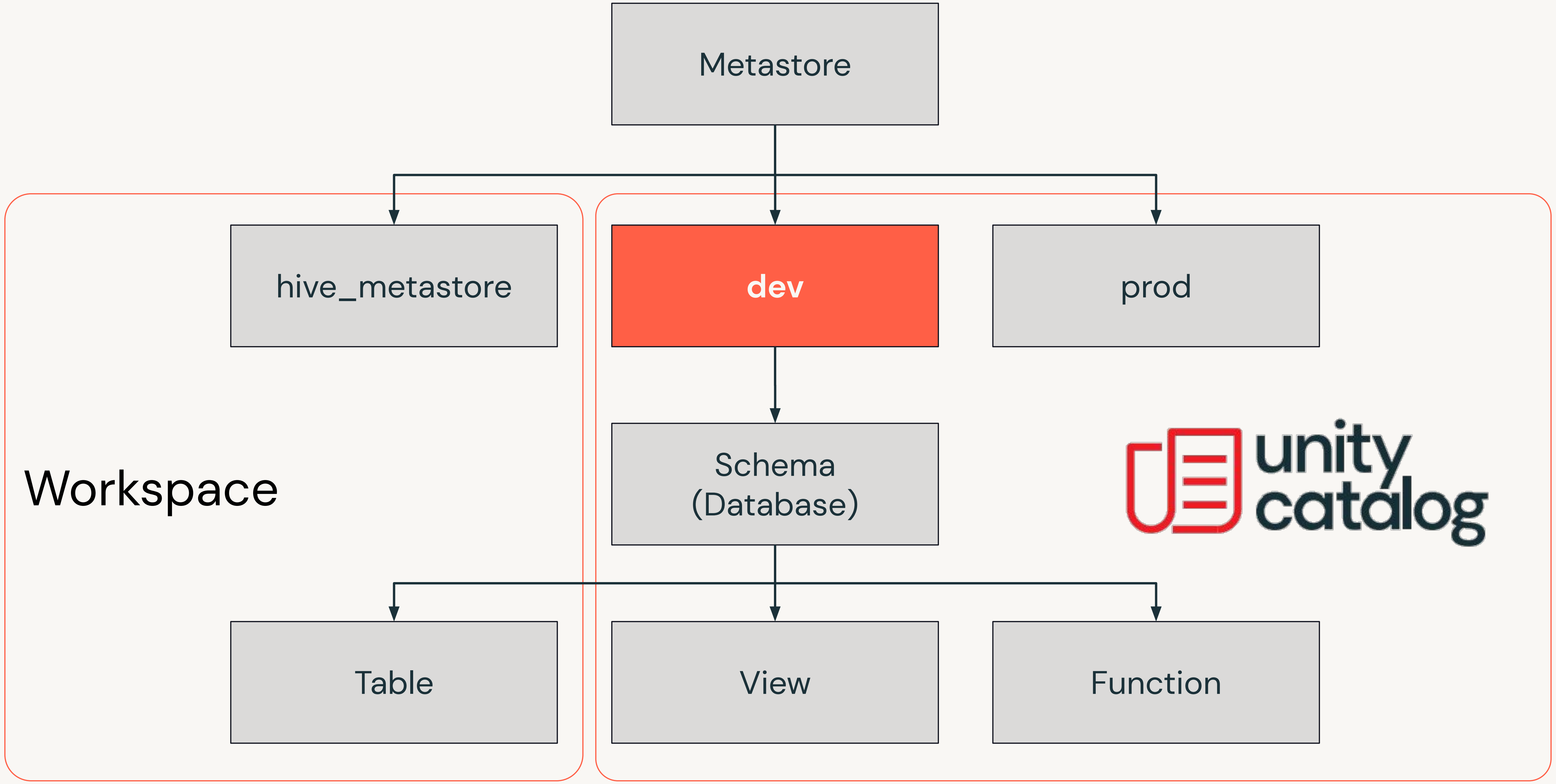
Three-level namespace with Unity Catalog



SELECT * FROM catalog.schema.table

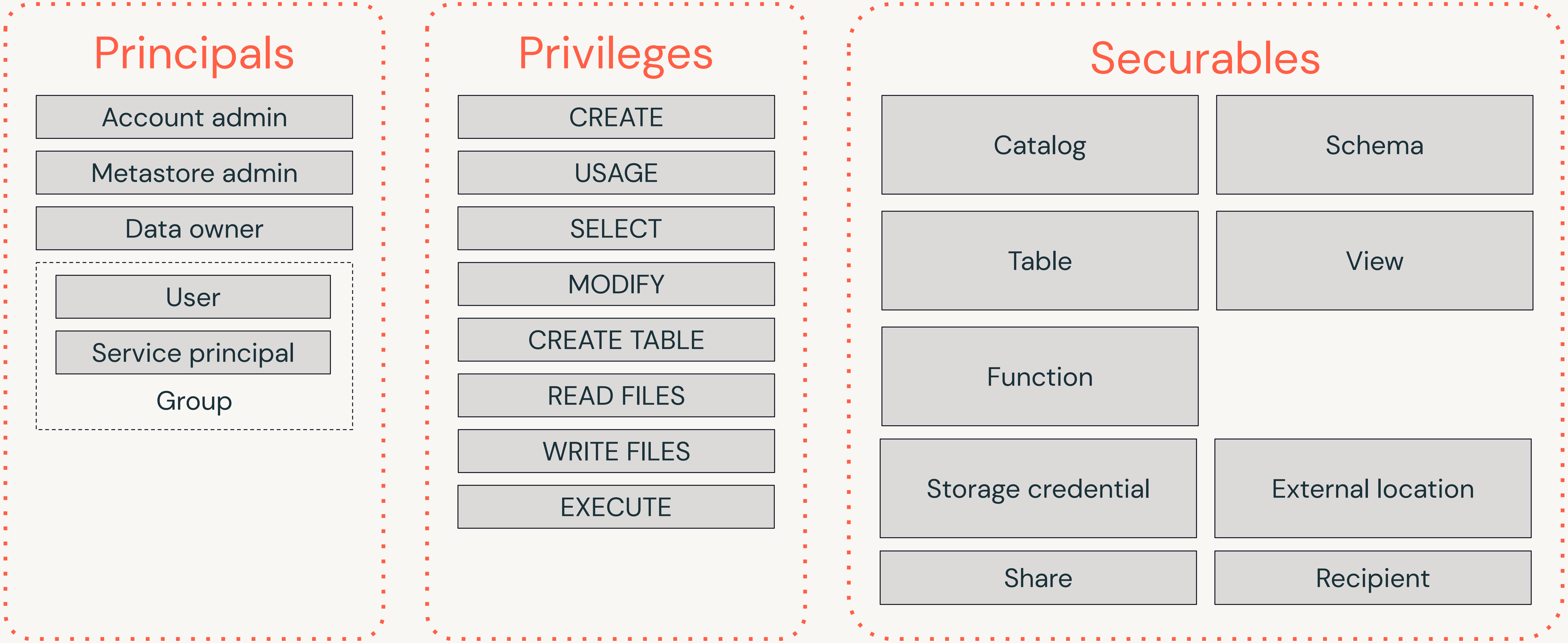
Three-level Namespace

Accessing legacy Hive metastore



Unity Catalog Security Model

Security model



Principals

Account admin

Metastore admin

Data owner

User

Service principal

Group

Privileges

CREATE

USAGE

SELECT

MODIFY

CREATE TABLE

READ FILES

WRITE FILES

EXECUTE

Securables

Catalog

Schema

Table

View

Function

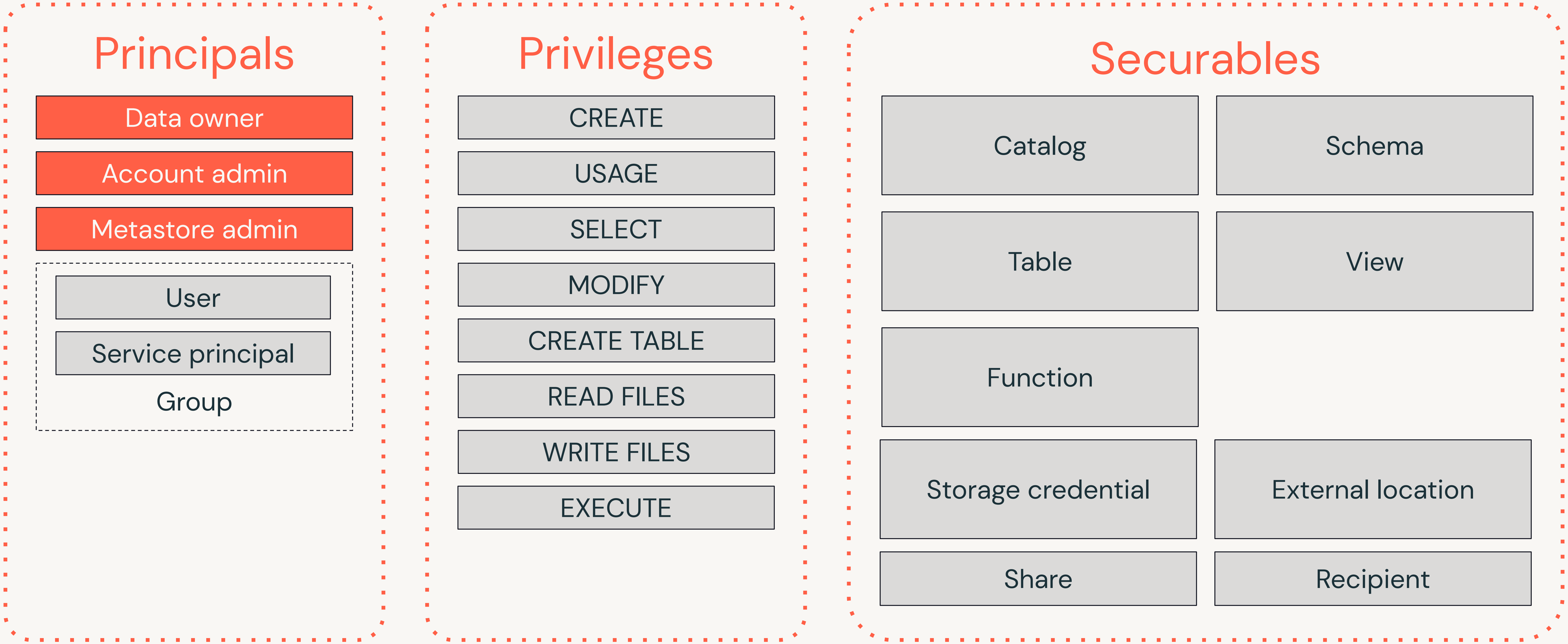
Storage credential

External location

Share

Recipient

Security model



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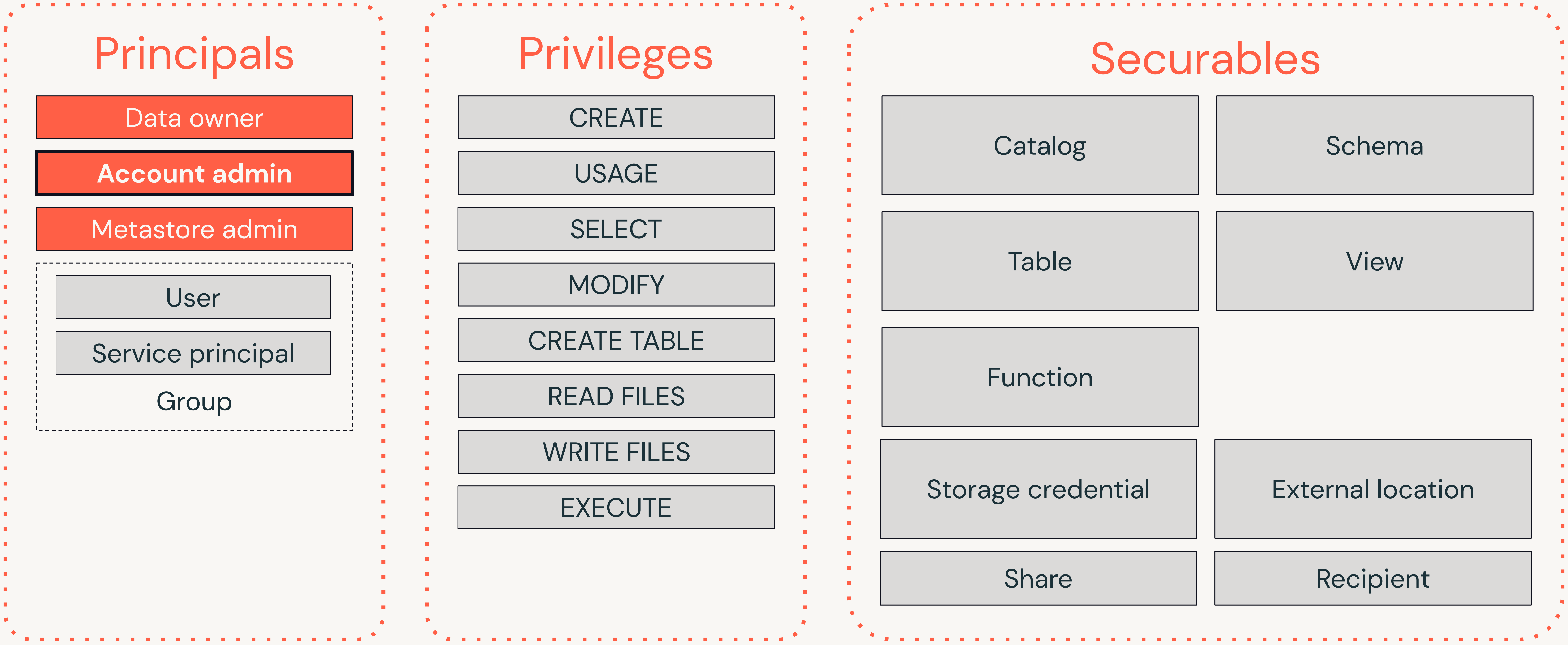

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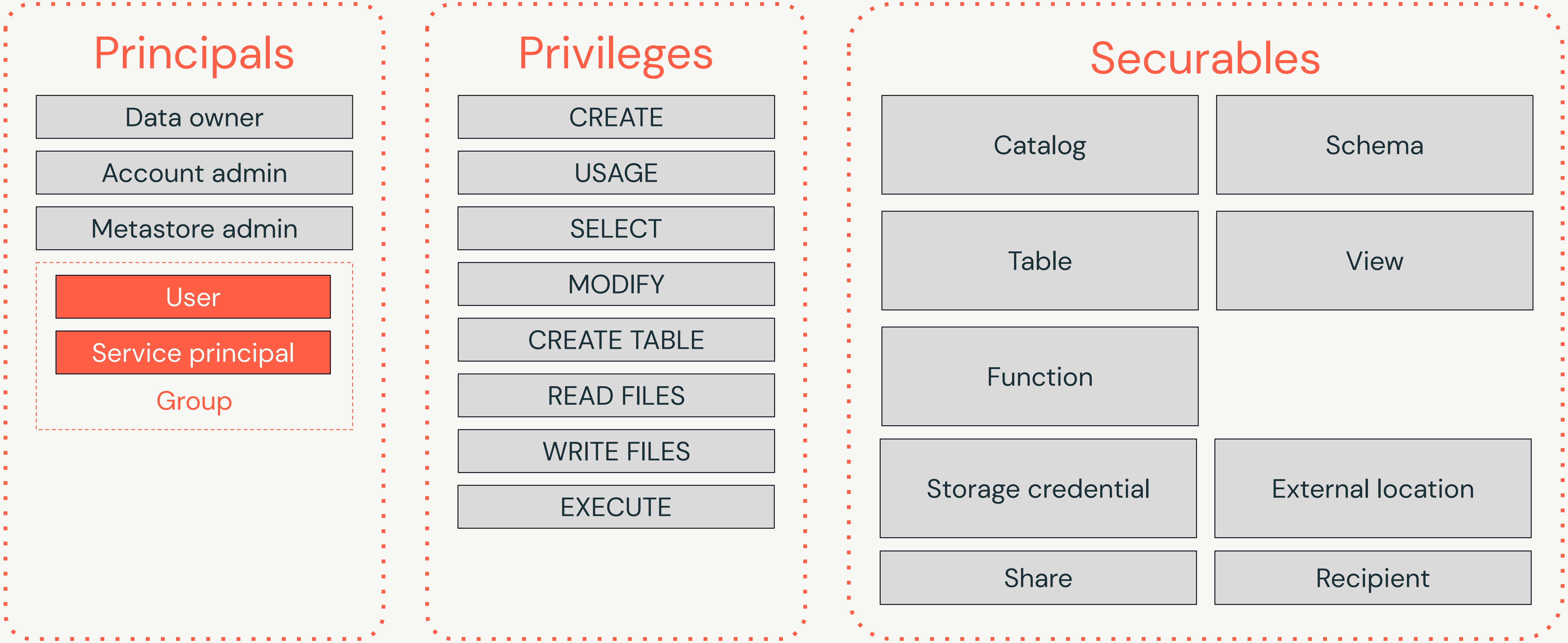

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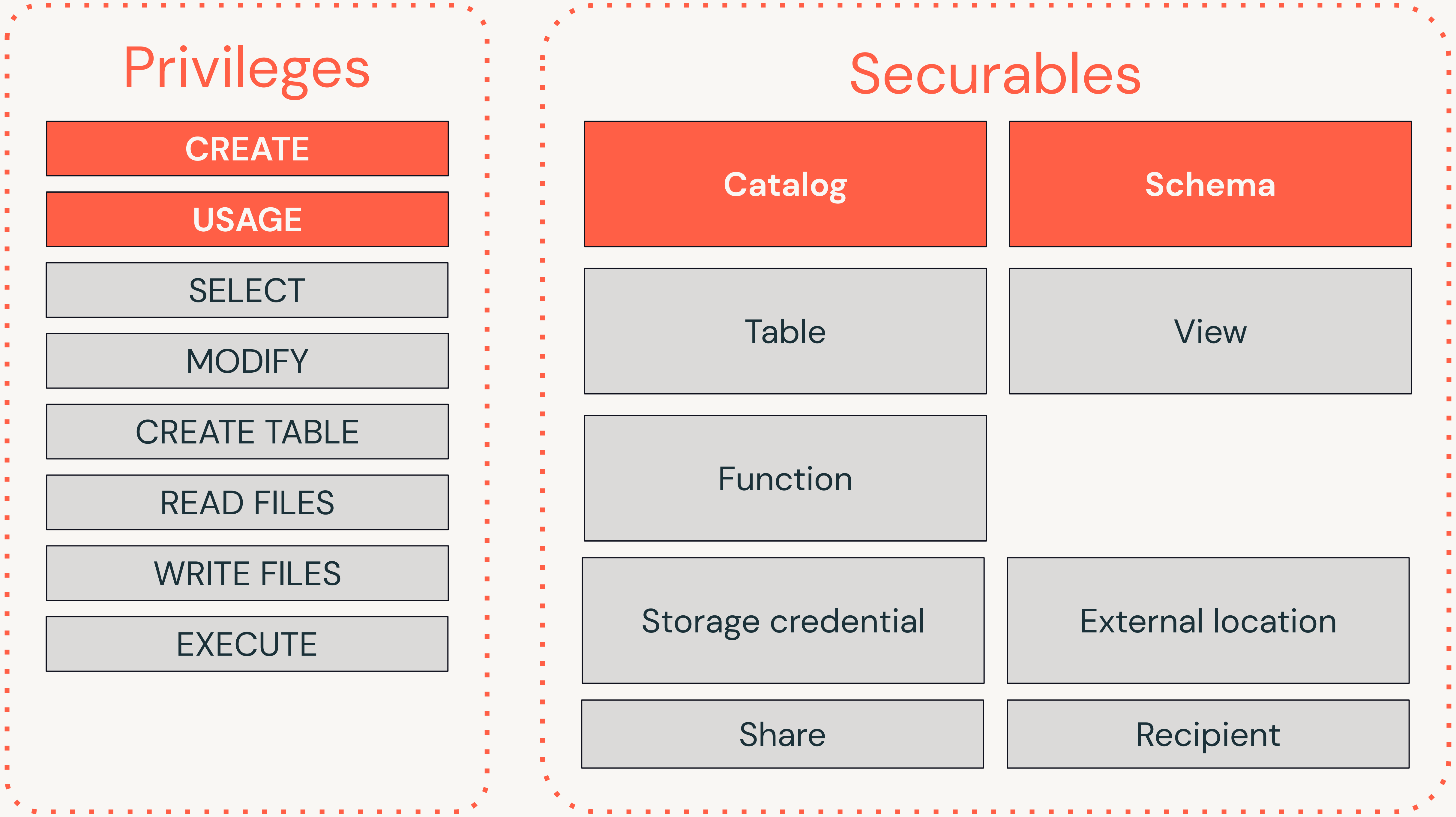

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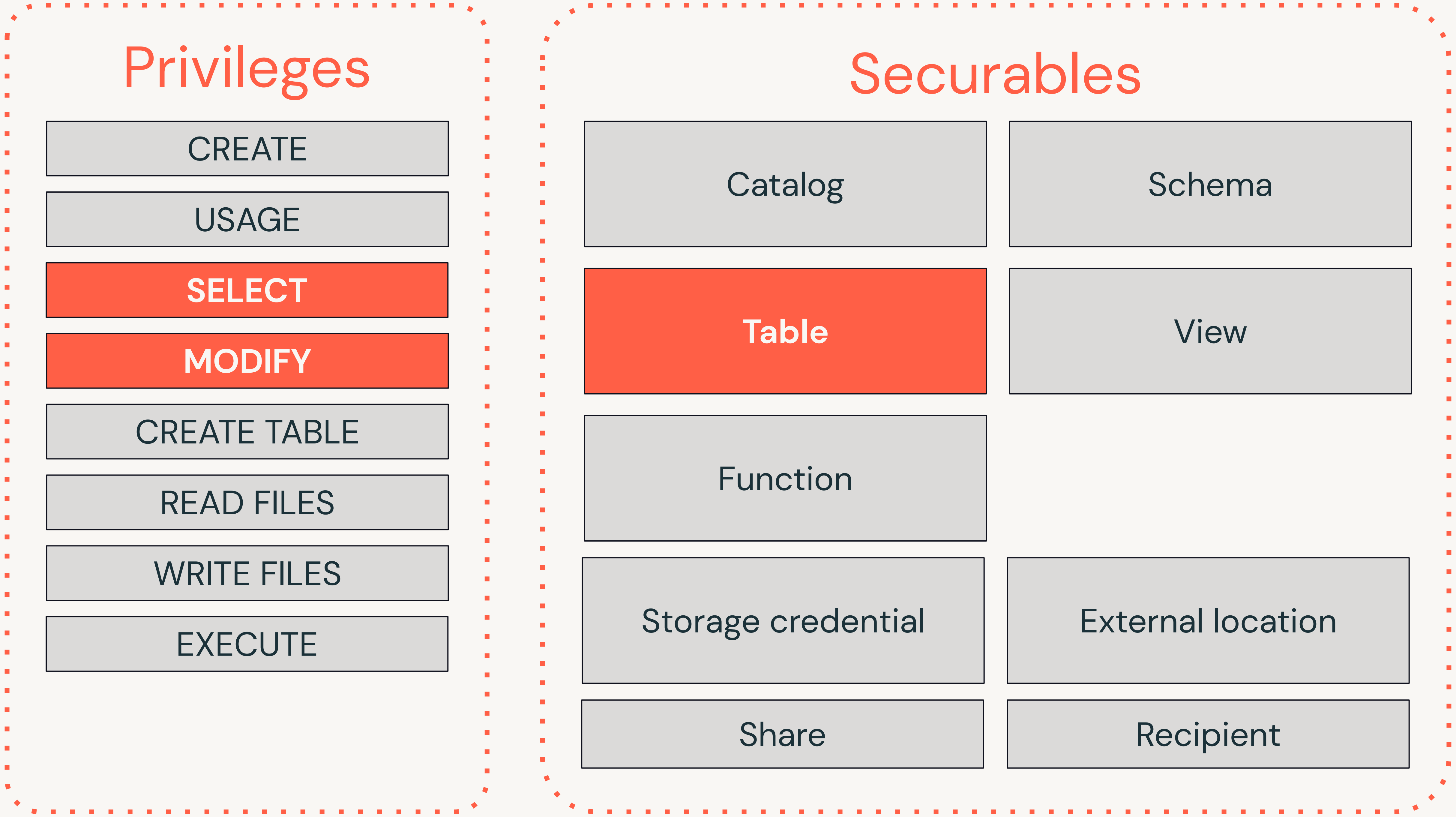

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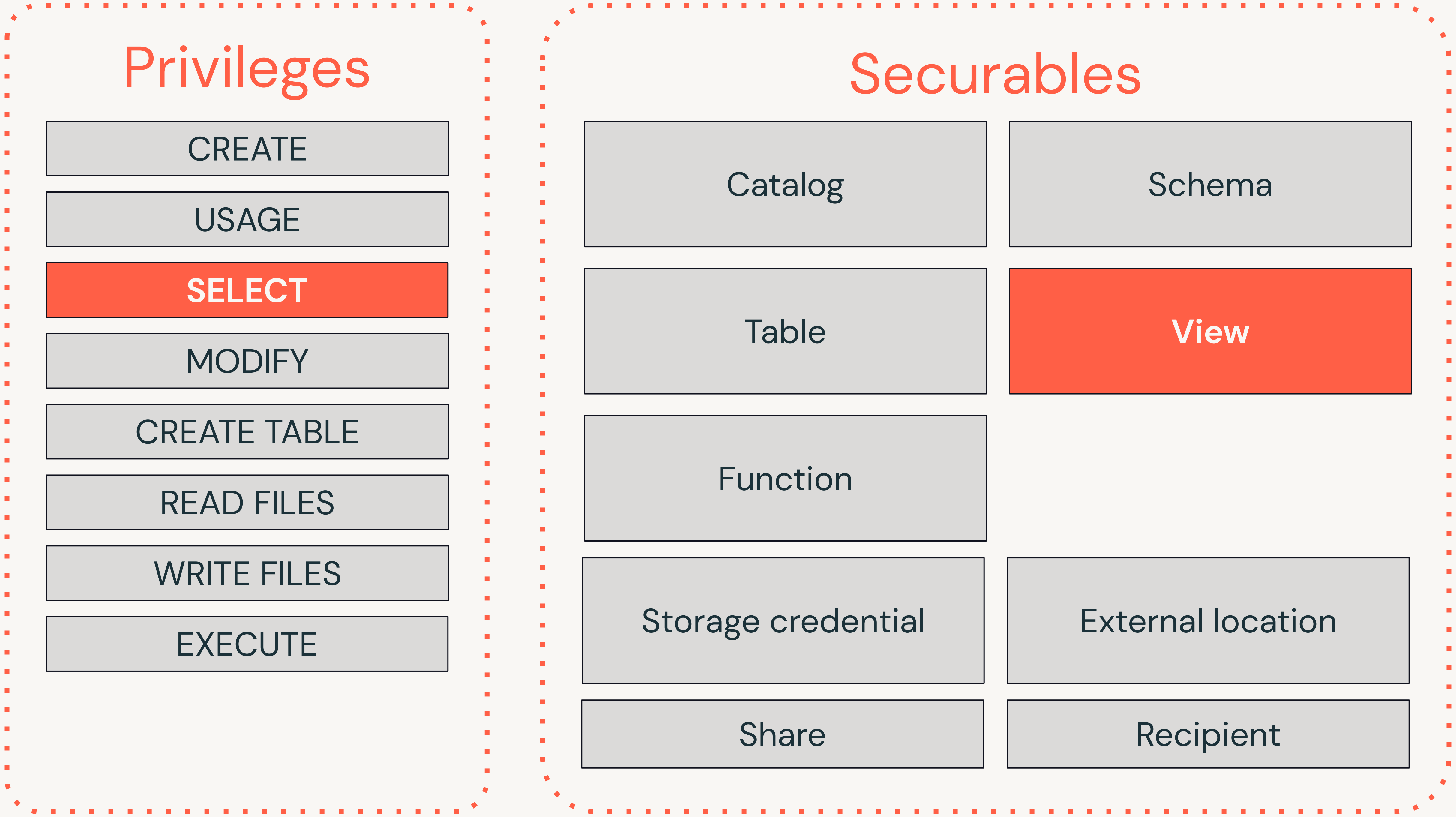

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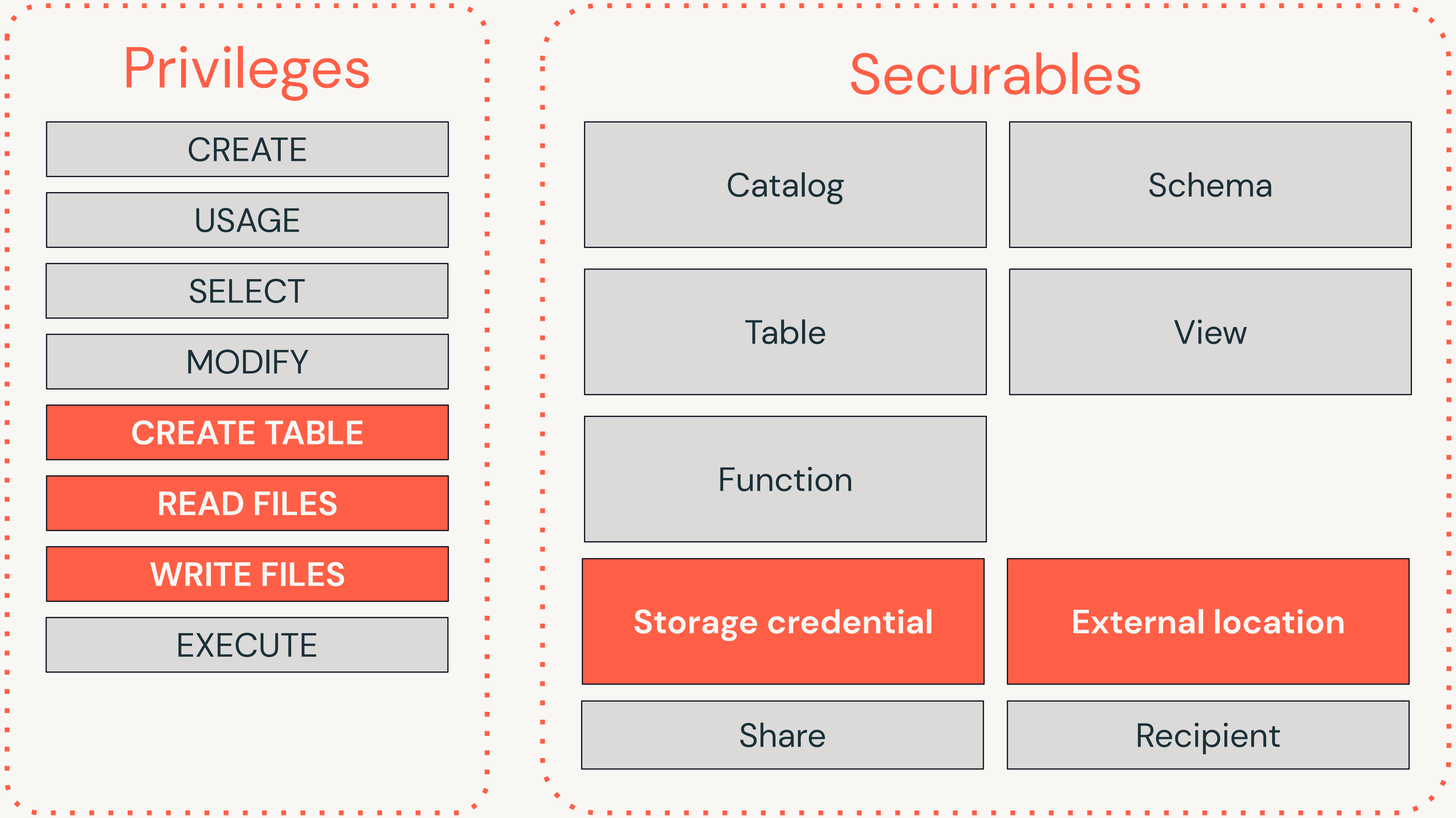

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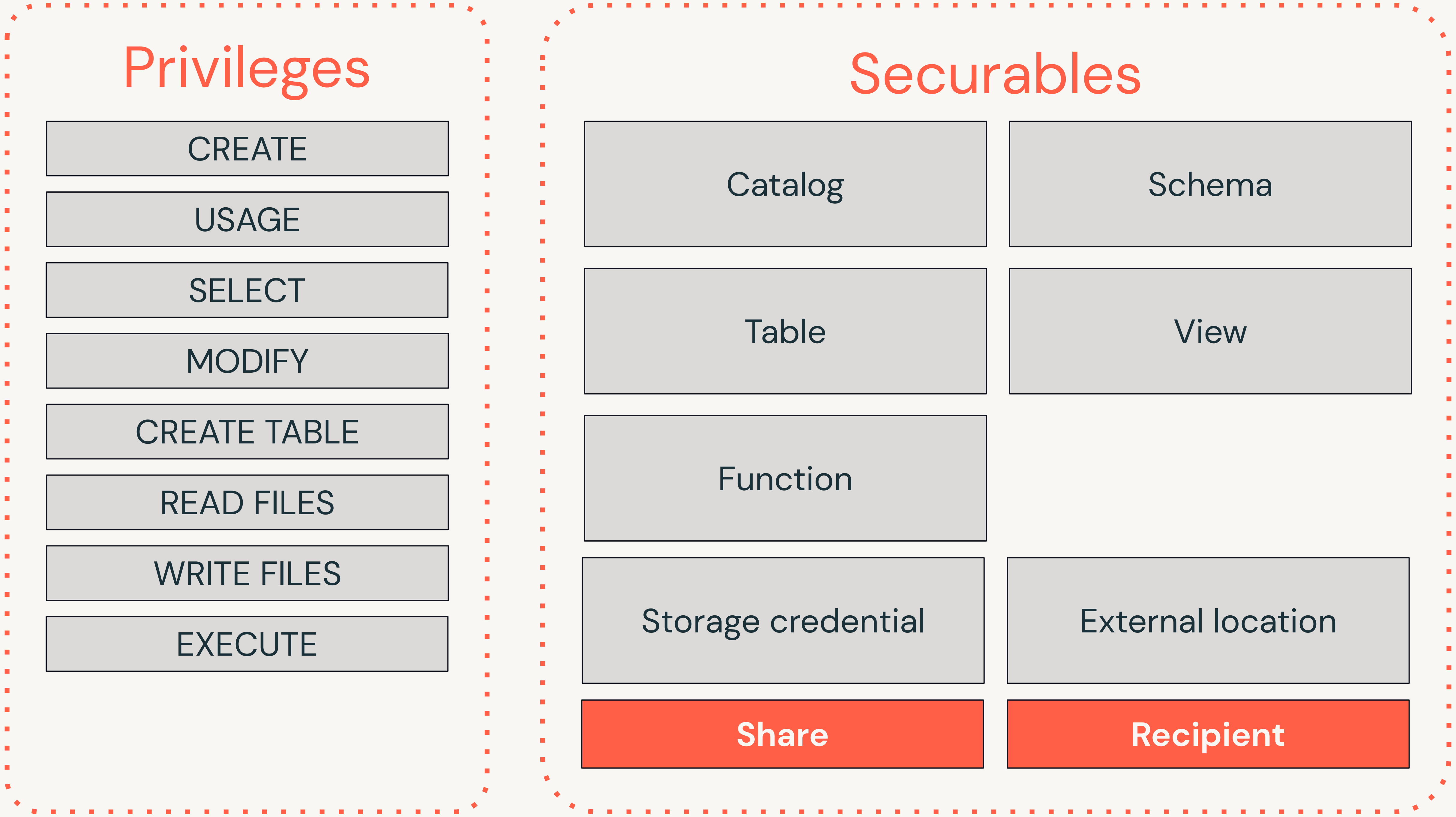

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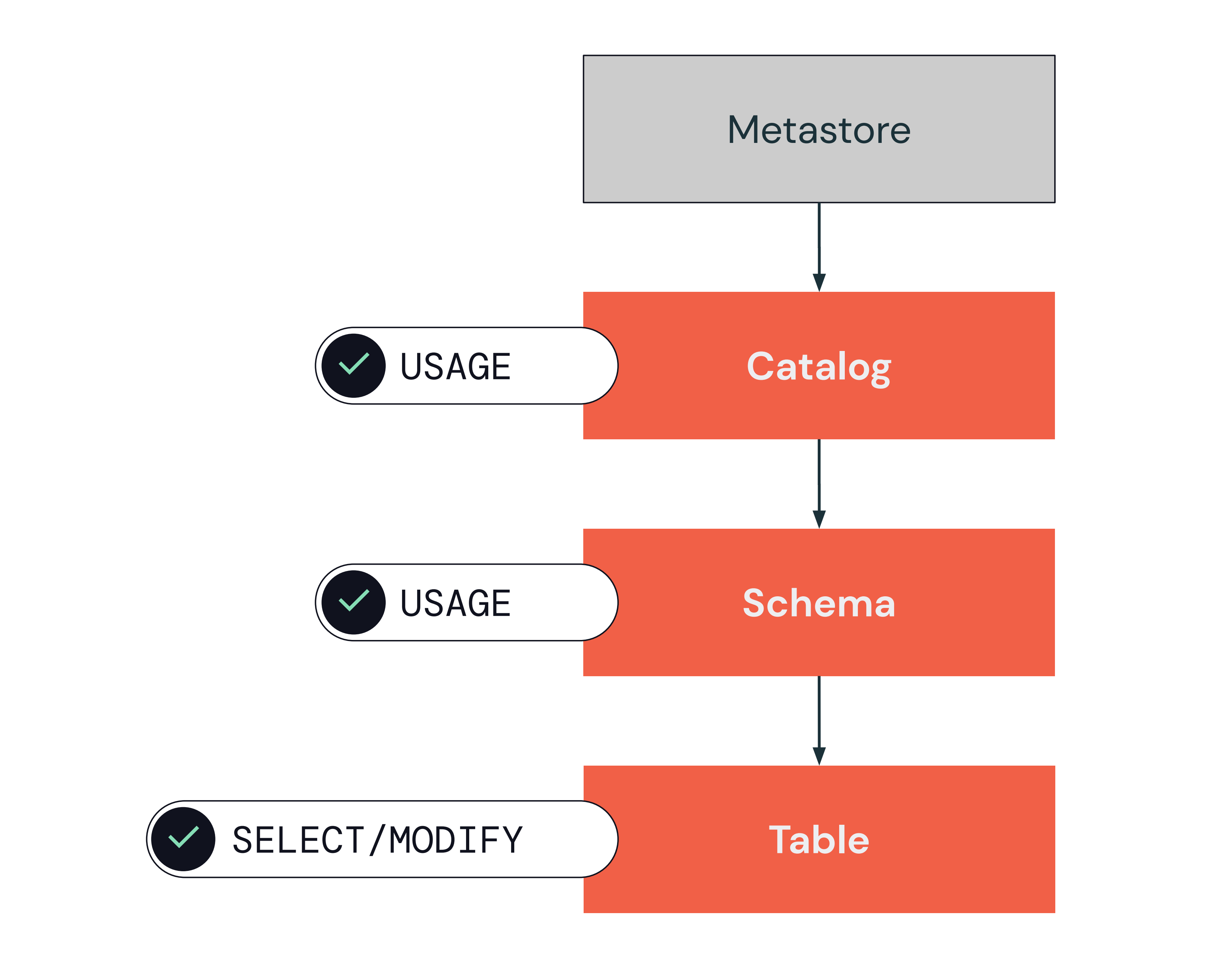
Privilege Recap

Tables



Querying tables (**SELECT**)

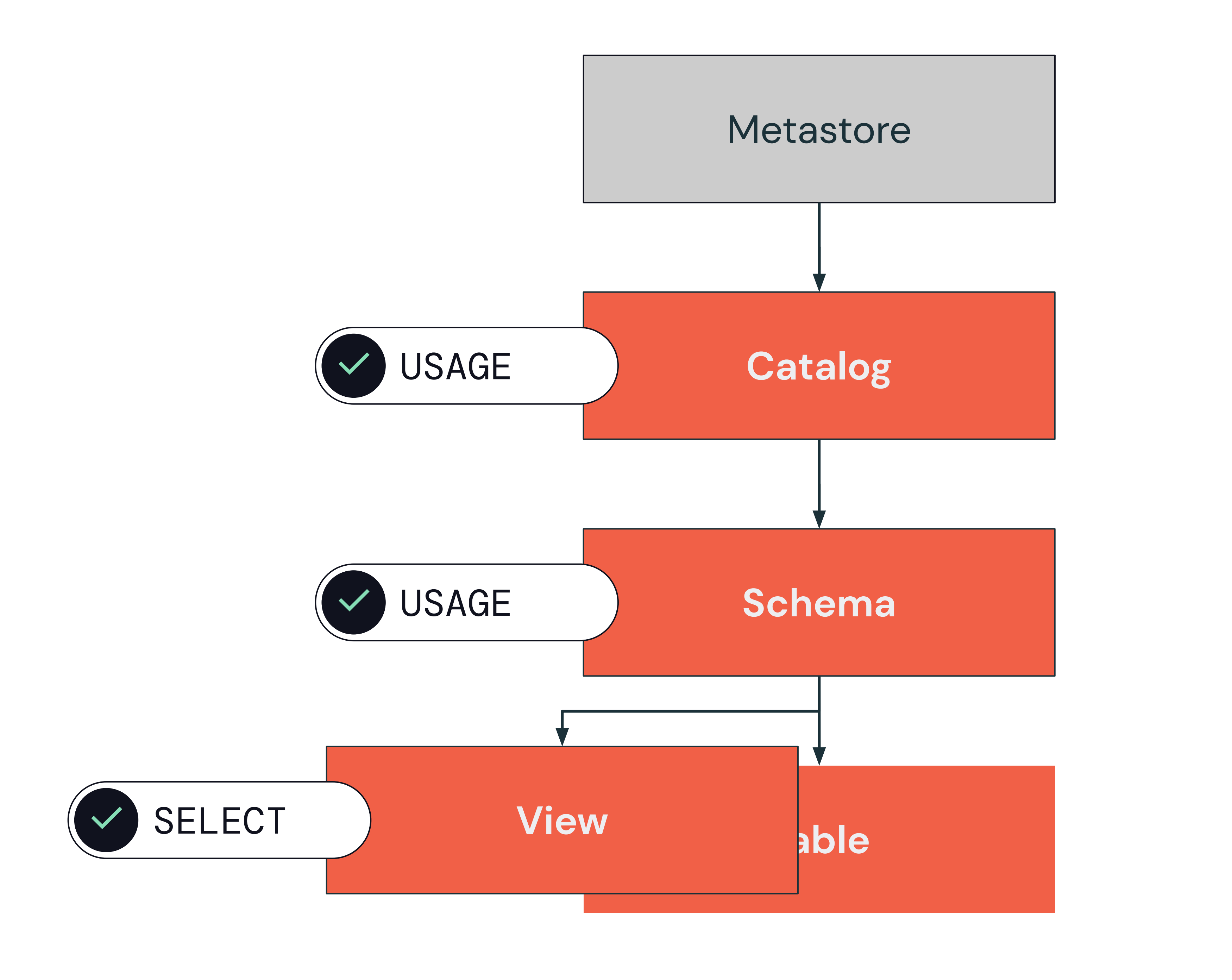
Modifying tables (**MODIFY**)

- Data (INSERT, DELETE)
- Metadata (ALTER)

Traverse container (**USAGE**)

Privilege Recap

Views



Abstract complex queries

- Aggregations
- Transformations
- Joins
- Filters

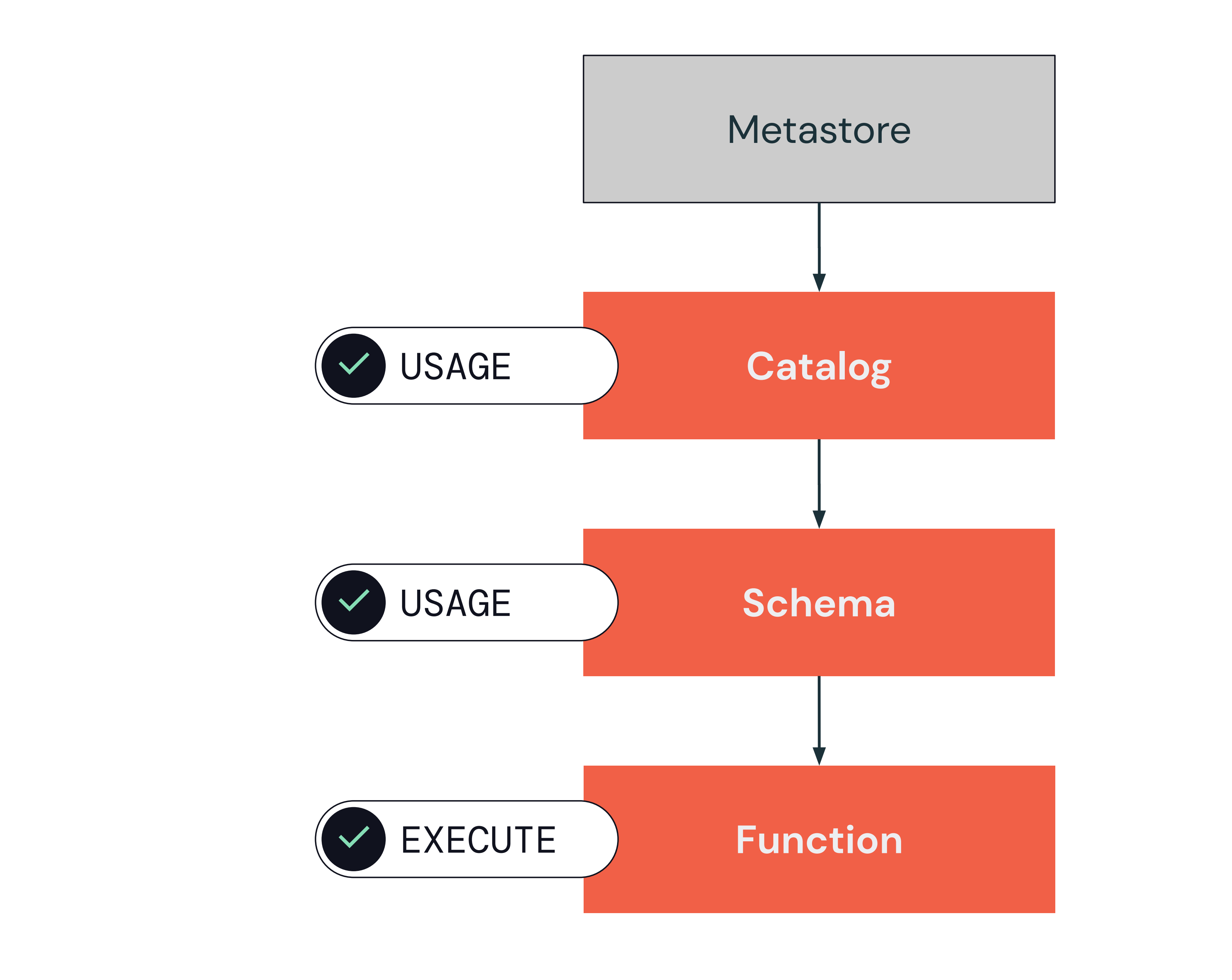
Enhanced table access control

Querying views (**SELECT**)

Traverse container (**USAGE**)

Privilege Recap

Functions



Provide custom code via user-defined functions

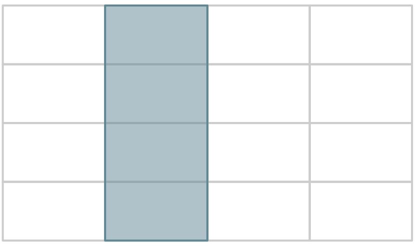
Using functions (**EXECUTE**)

Traverse container (**USAGE**)

Dynamic Views

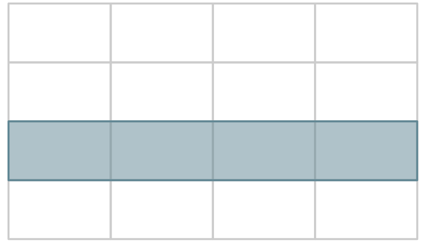
Limit access to columns

Omit column values from output



Limit access to rows

Omit rows from output



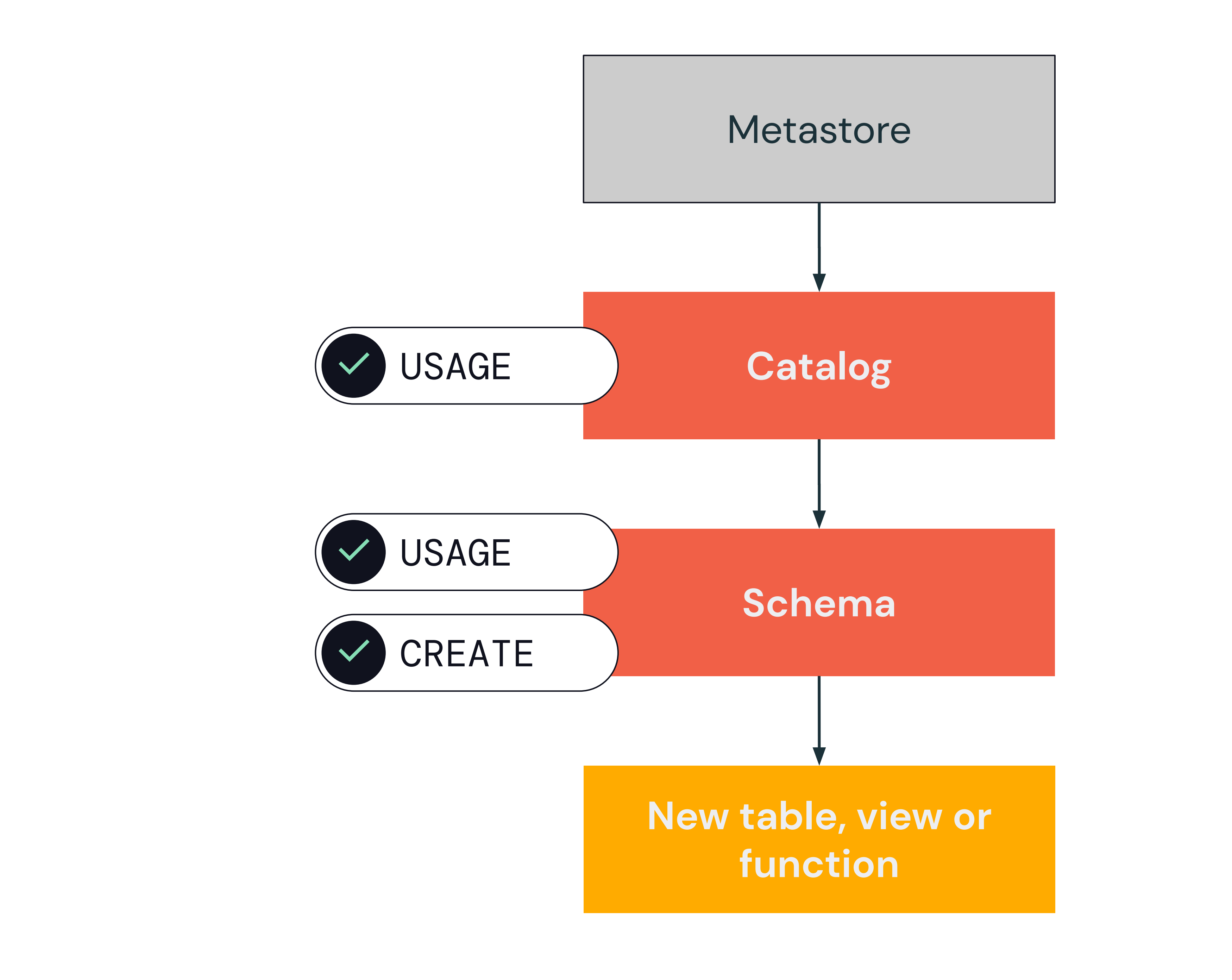
Data Masking

Obscure data

`●●●●●●@databricks.com`

Can be conditional on a specific user/service principal or group membership through Databricks-provided functions

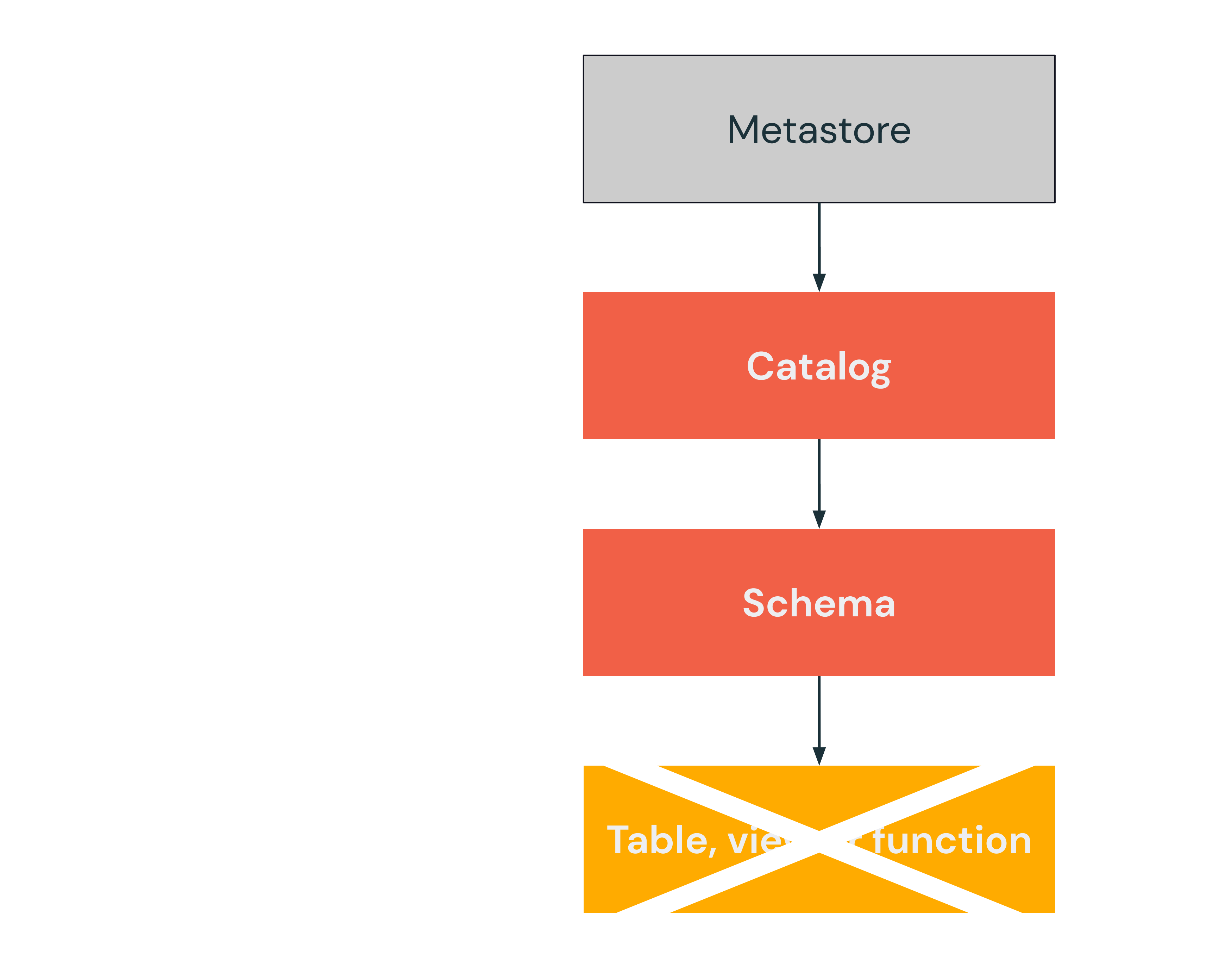
Creating New Objects



Create new objects (**CREATE**)

Traverse container (**USAGE**)

Deleting Objects



DROP objects

Unity Catalog External Storage

Storage Credentials and External Locations

Storage Credential

Enables Unity Catalog to connect to an external cloud store

Examples include:

- IAM role for AWS S3
- Service principal for Azure Storage

External Location

Cloud storage path + storage credential

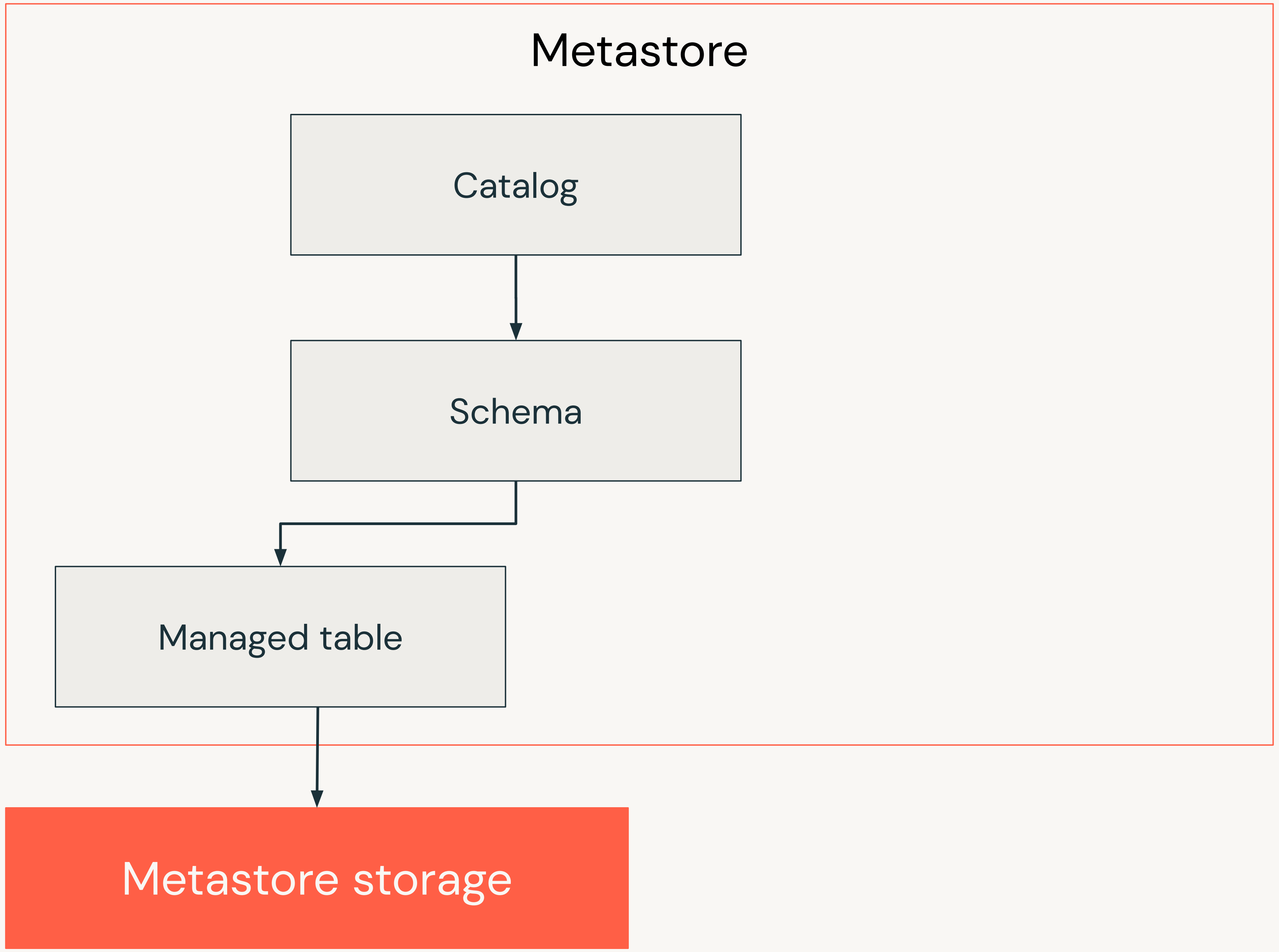
- Self-contained object for accessing specific locations in cloud stores
- Fine-grained control over external storage

Storage Credentials and External Locations

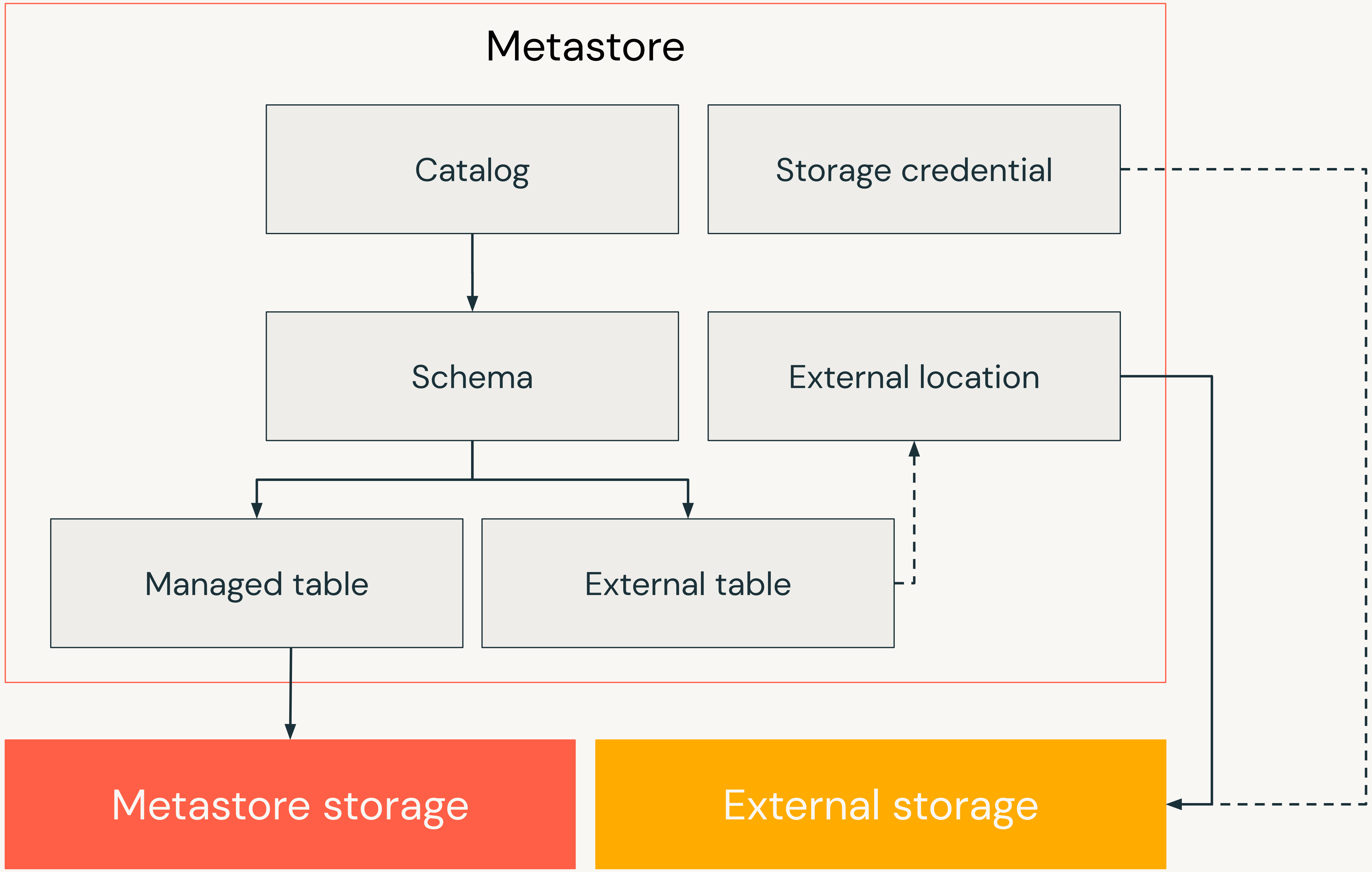
Access Control

	CREATE TABLE	READ FILES	WRITE FILES
Storage Credential	Create an External Table directly using this Storage Credential	Read files directly using this Storage Credential	Write files directly using this Storage Credential
External Location	Create an External Table from files governed by this External Location	Read files governed by this External Location	Write files governed by this External Location

Managed Tables



External Tables



Unity Catalog Patterns and Best Practices

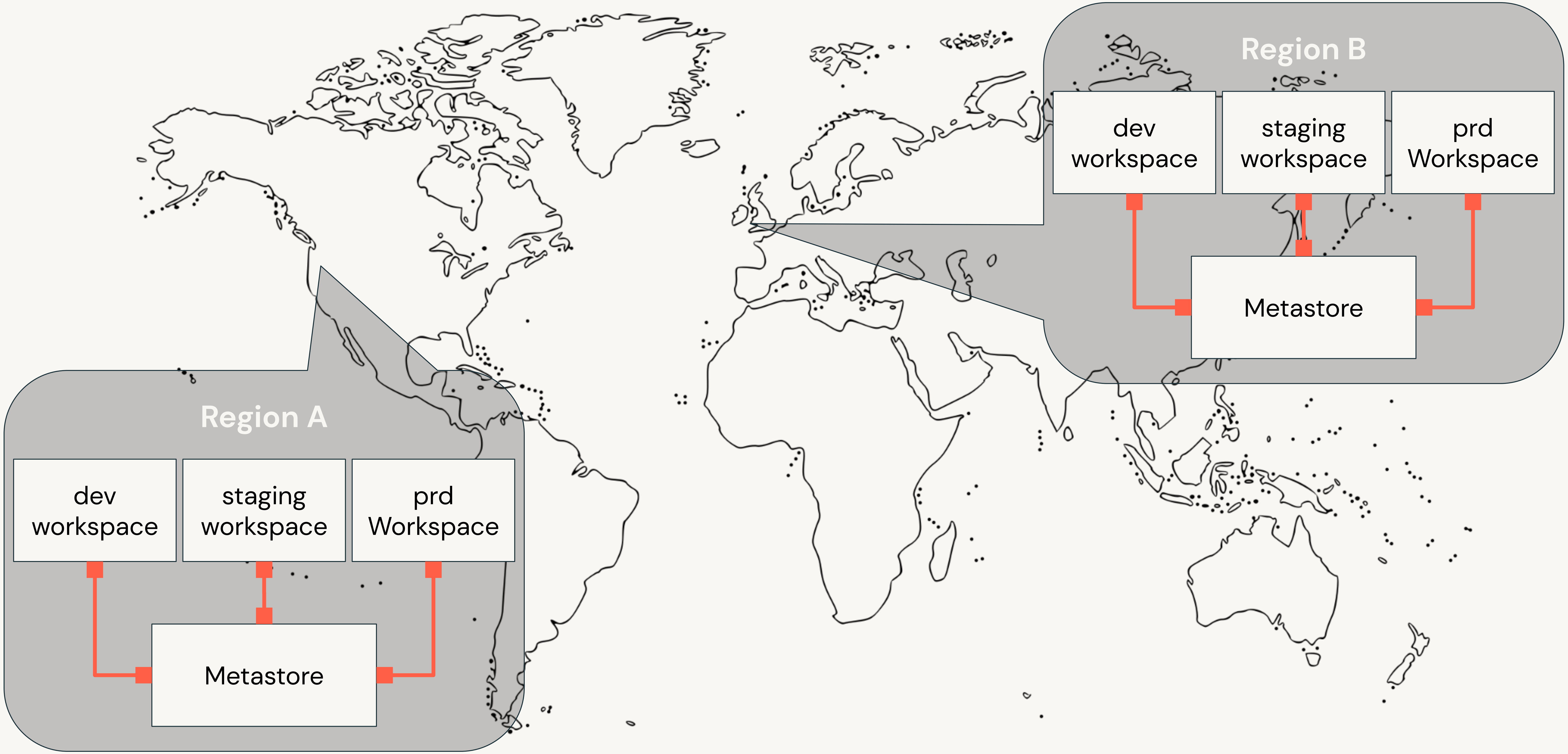
Course Objectives

By the end of this course, you will be able to:

1. Adopt Databricks recommendations into your organization's Unity Catalog based solutions

Metastores

Metastores


Region B
dev workspace
staging workspace
prd Workspace
Metastore
Region A
dev workspace
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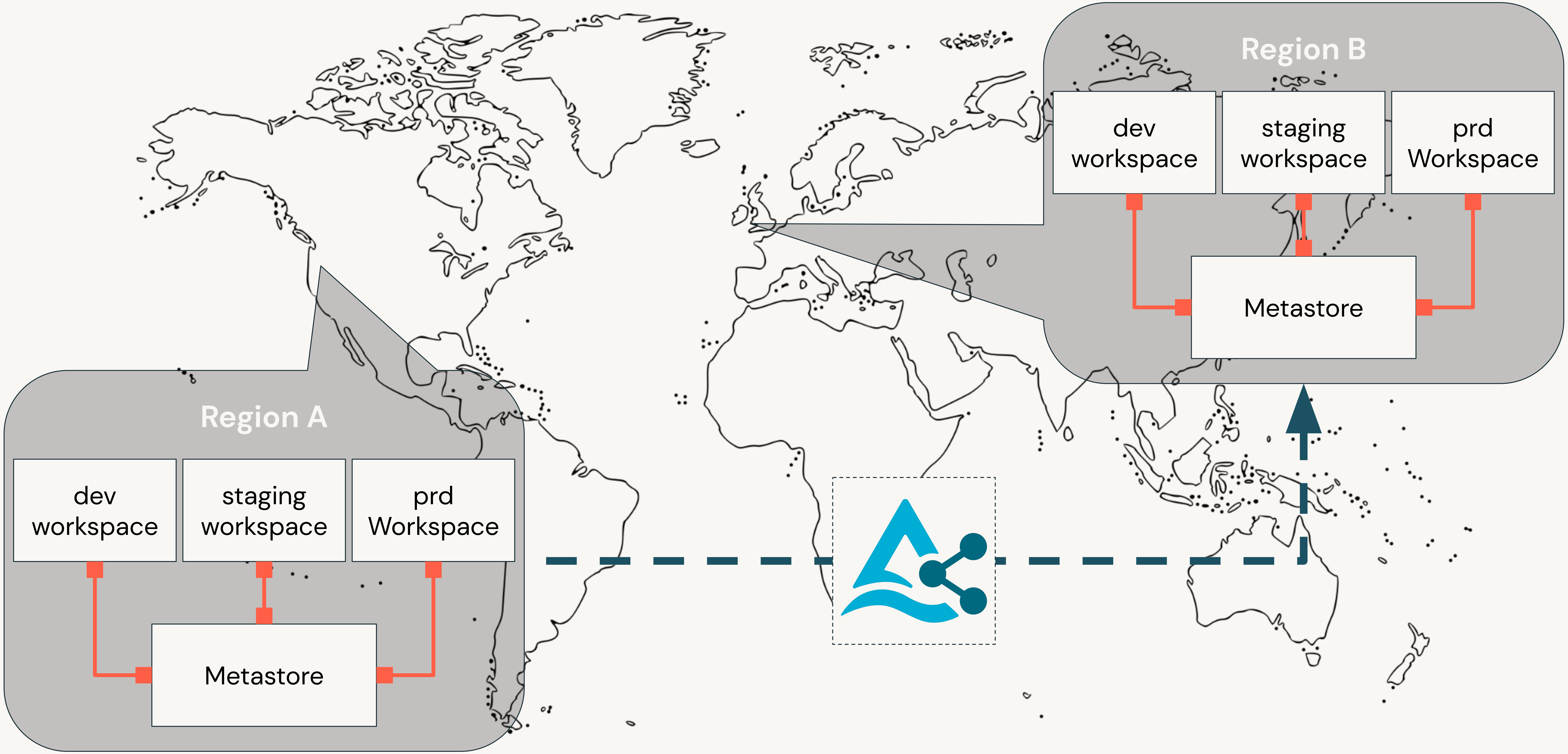
Metastore

Metastores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Data Segregation

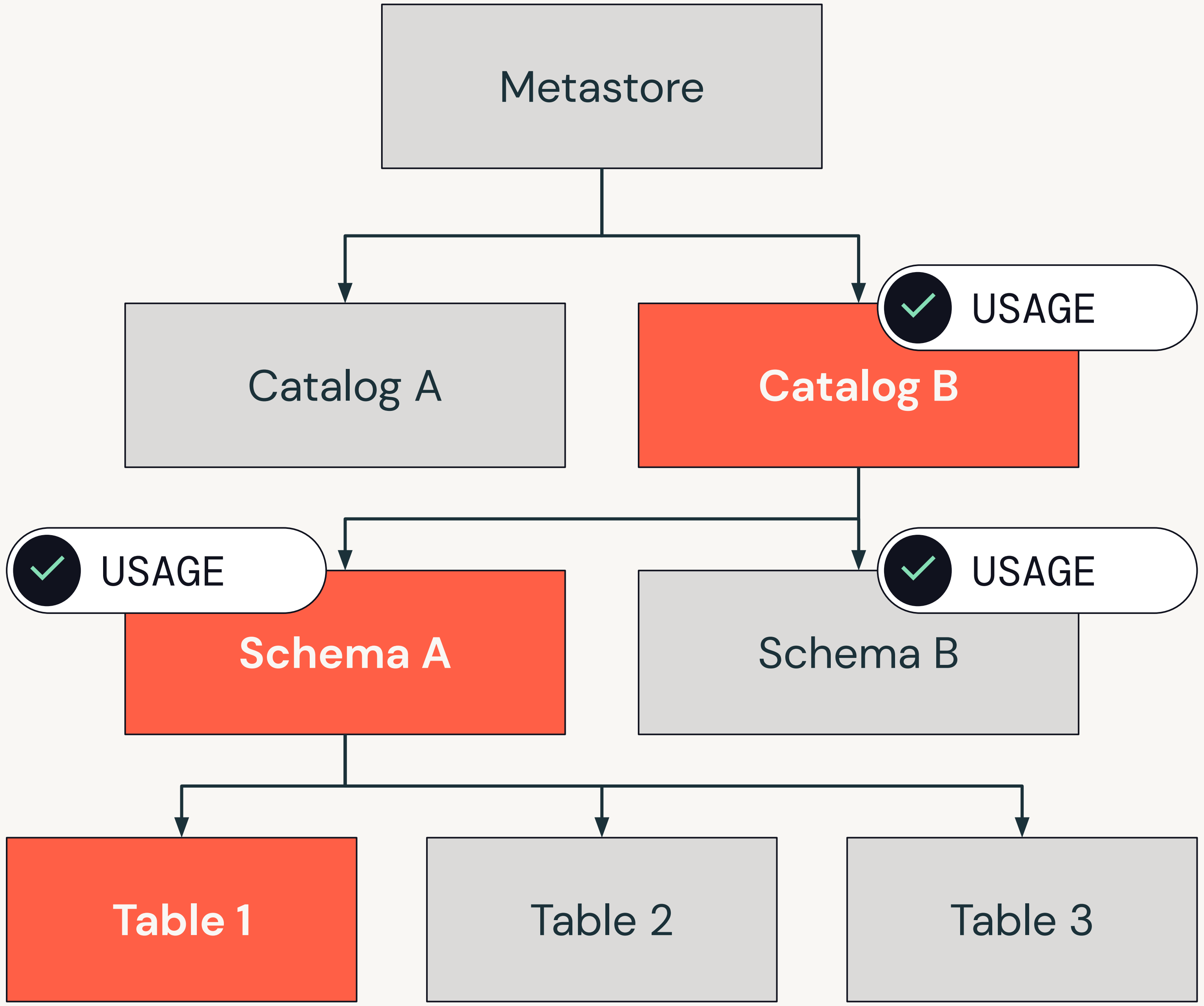
Data Segregation

Use catalogs to segregate data

Apply permissions appropriately

For example group B:

- **USAGE** on catalog B
- **USAGE** on all applicable schemas in catalog B
- **SELECT/MODIFY** on applicable tables



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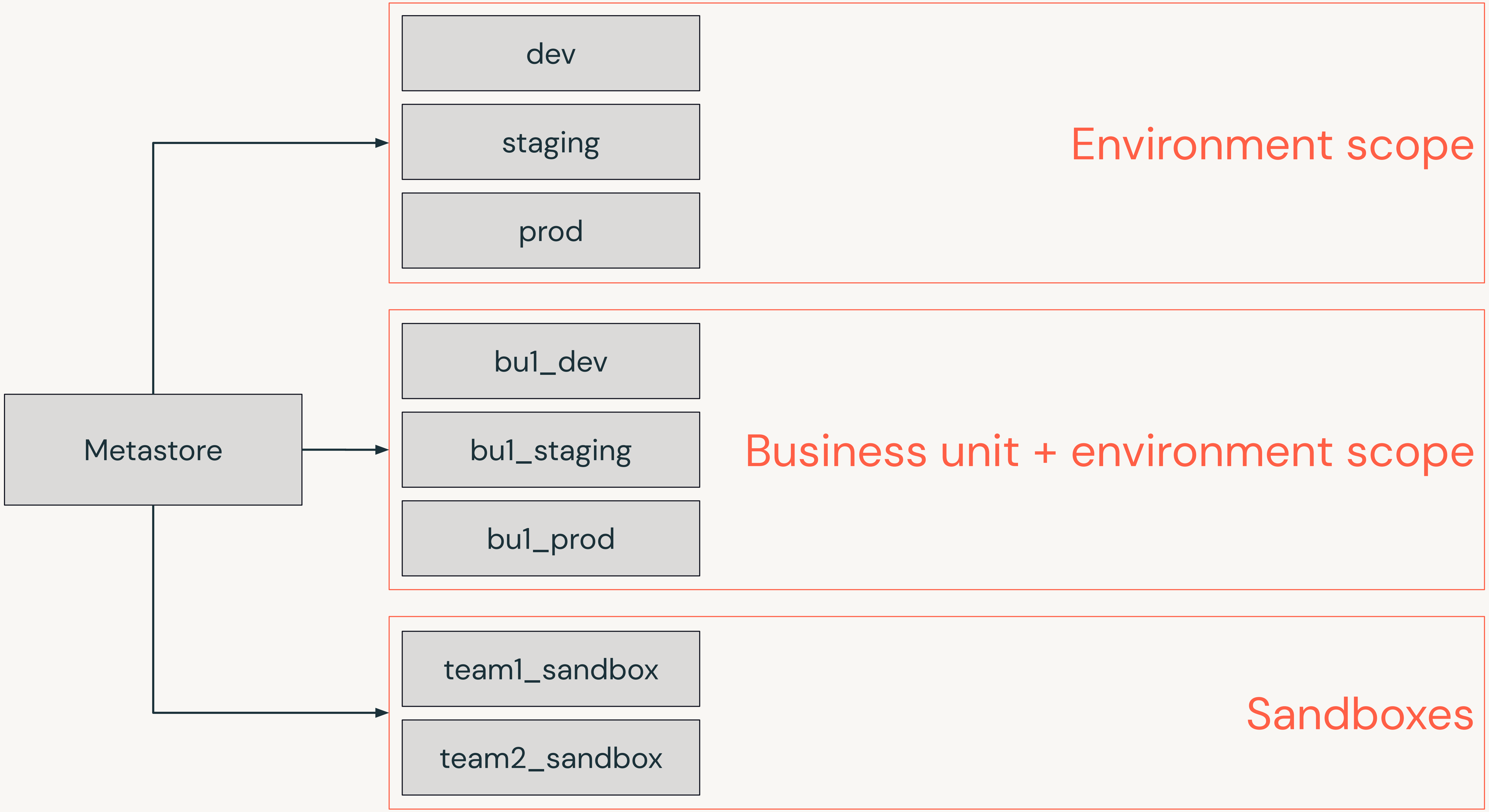
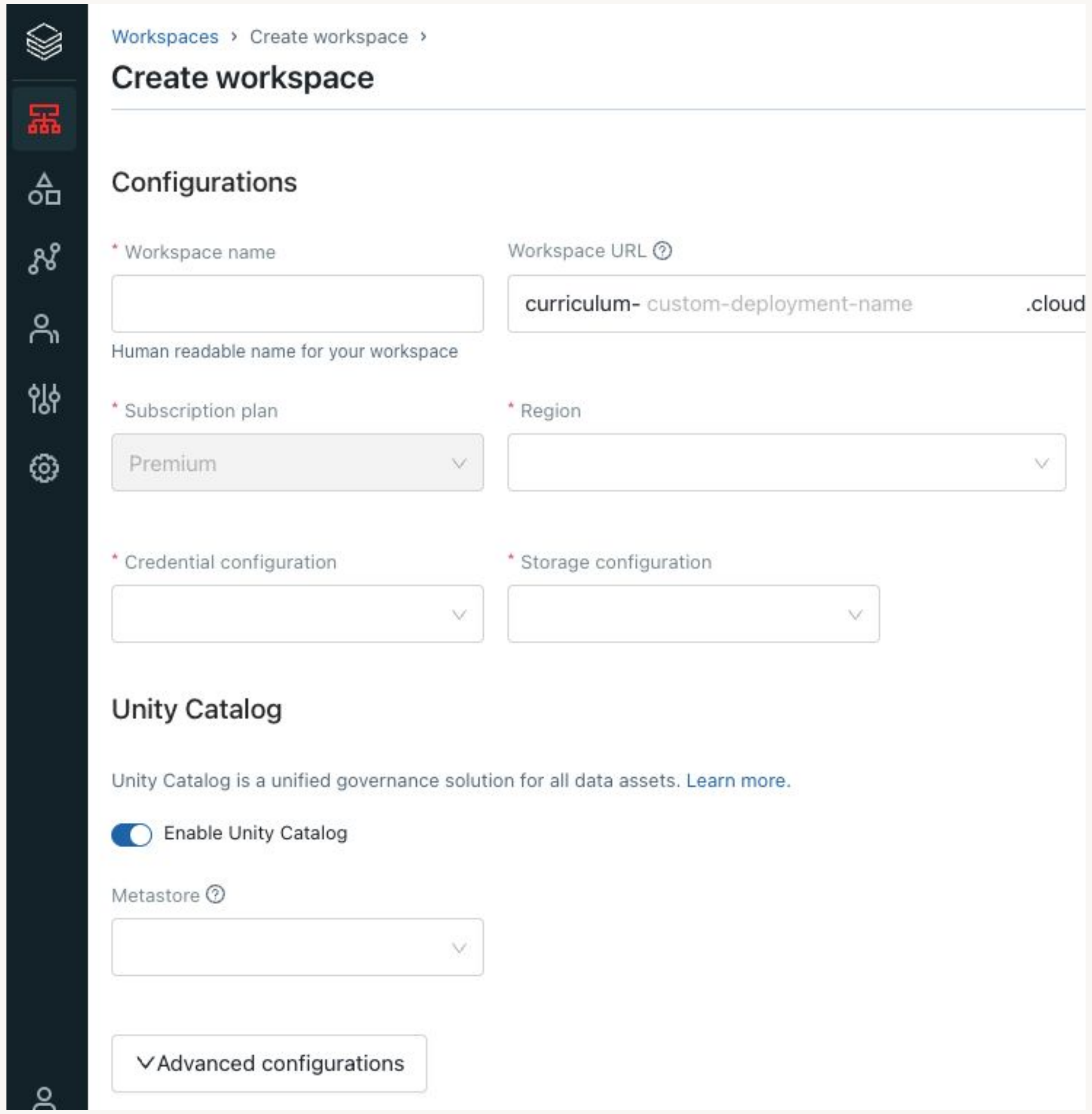


Identity Management

Account-level Identities

- Principals must live within accounts
- Databricks has automatically promoted Workspace-level principals to their respective accounts
- All identities should be managed at the account level moving forward
- Enable Unity Catalog for workspaces to enable identity federation



Create workspace

Configurations

* Workspace name

Human readable name for your workspace

Workspace URL

curriculum- custom-deployment-name .cloud

* Subscription plan: Premium

* Region

* Credential configuration

* Storage configuration

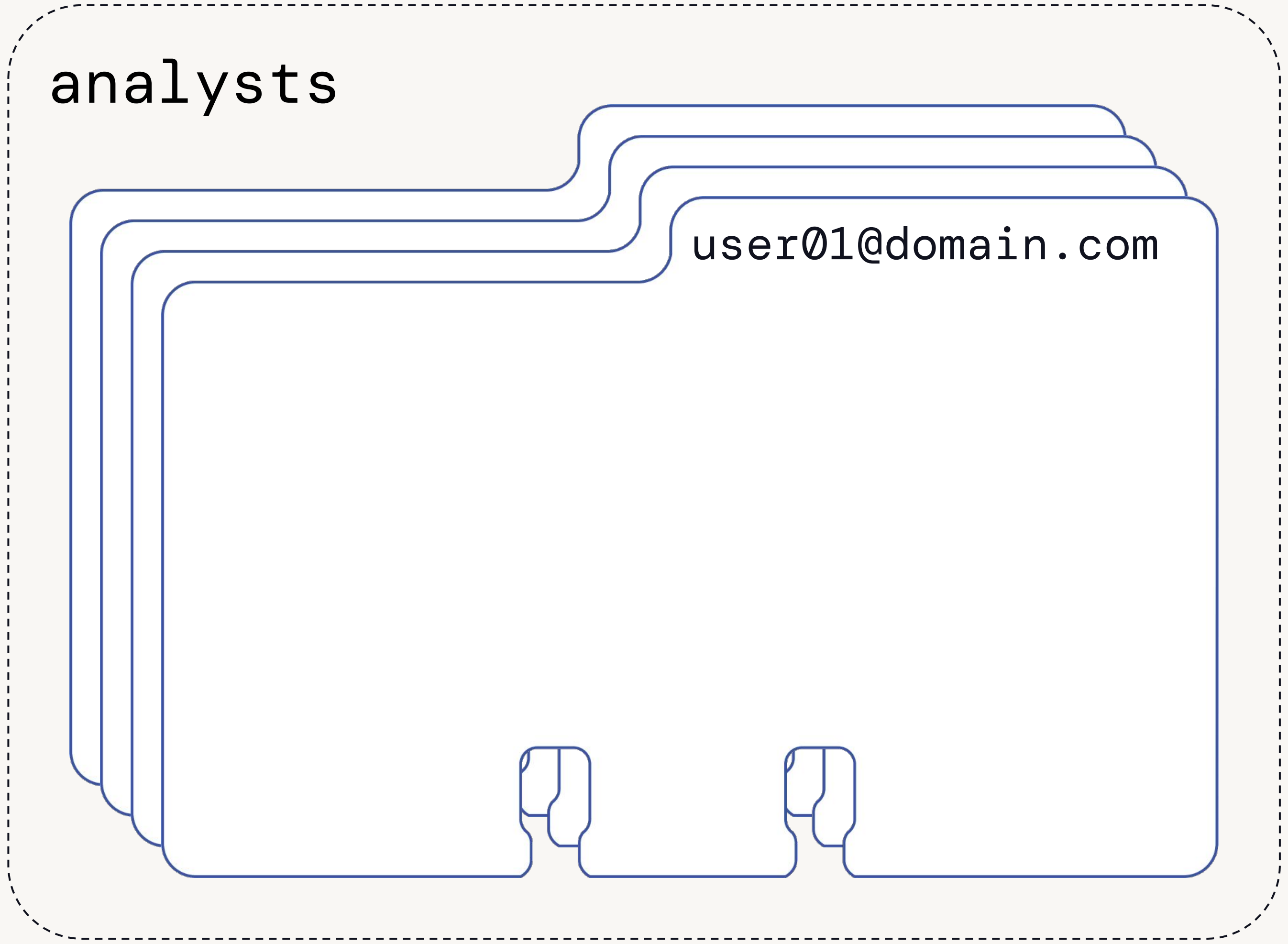
Unity Catalog

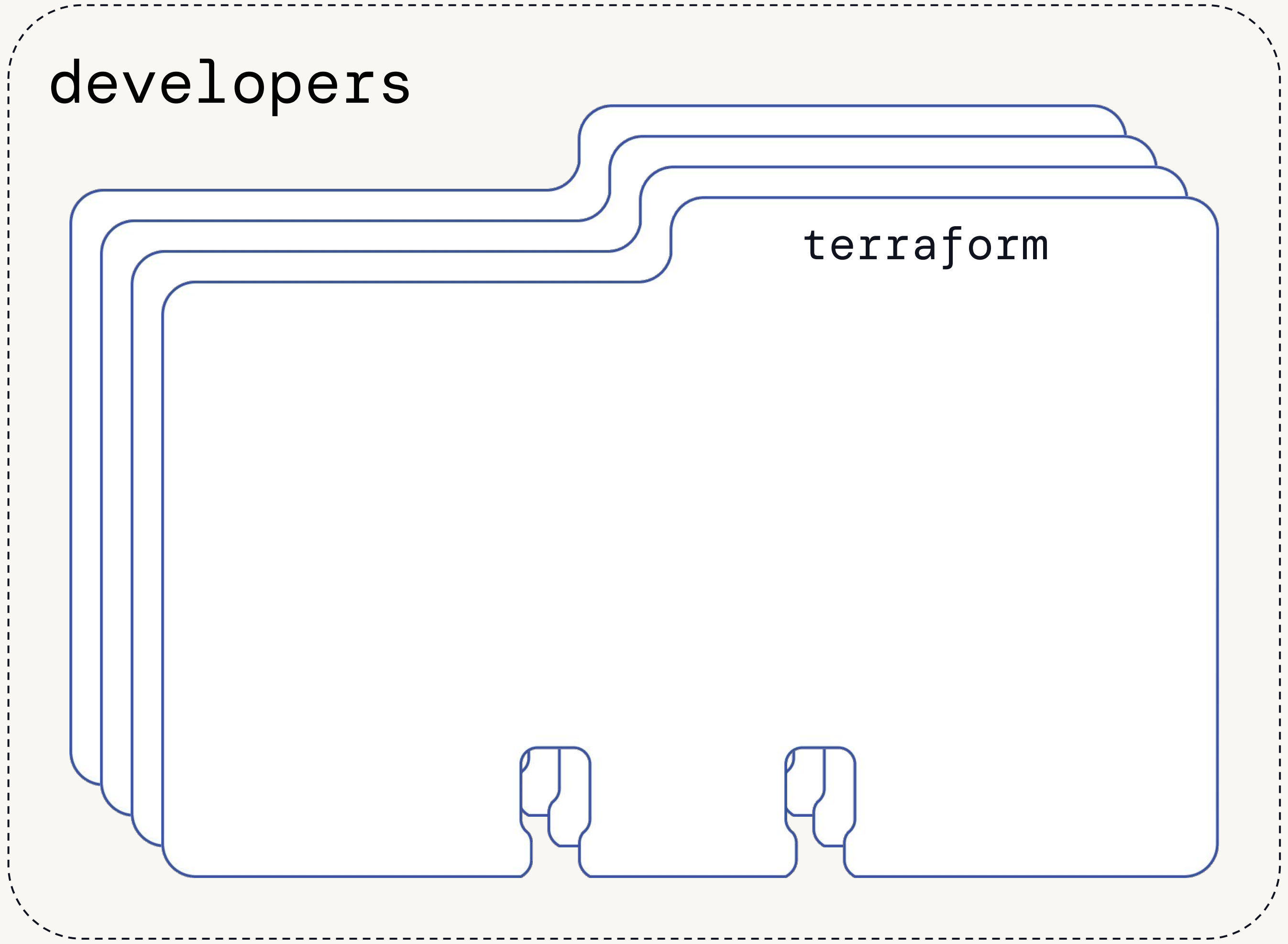
Unity Catalog is a unified governance solution for all data assets. Learn more.

Enable Unity Catalog

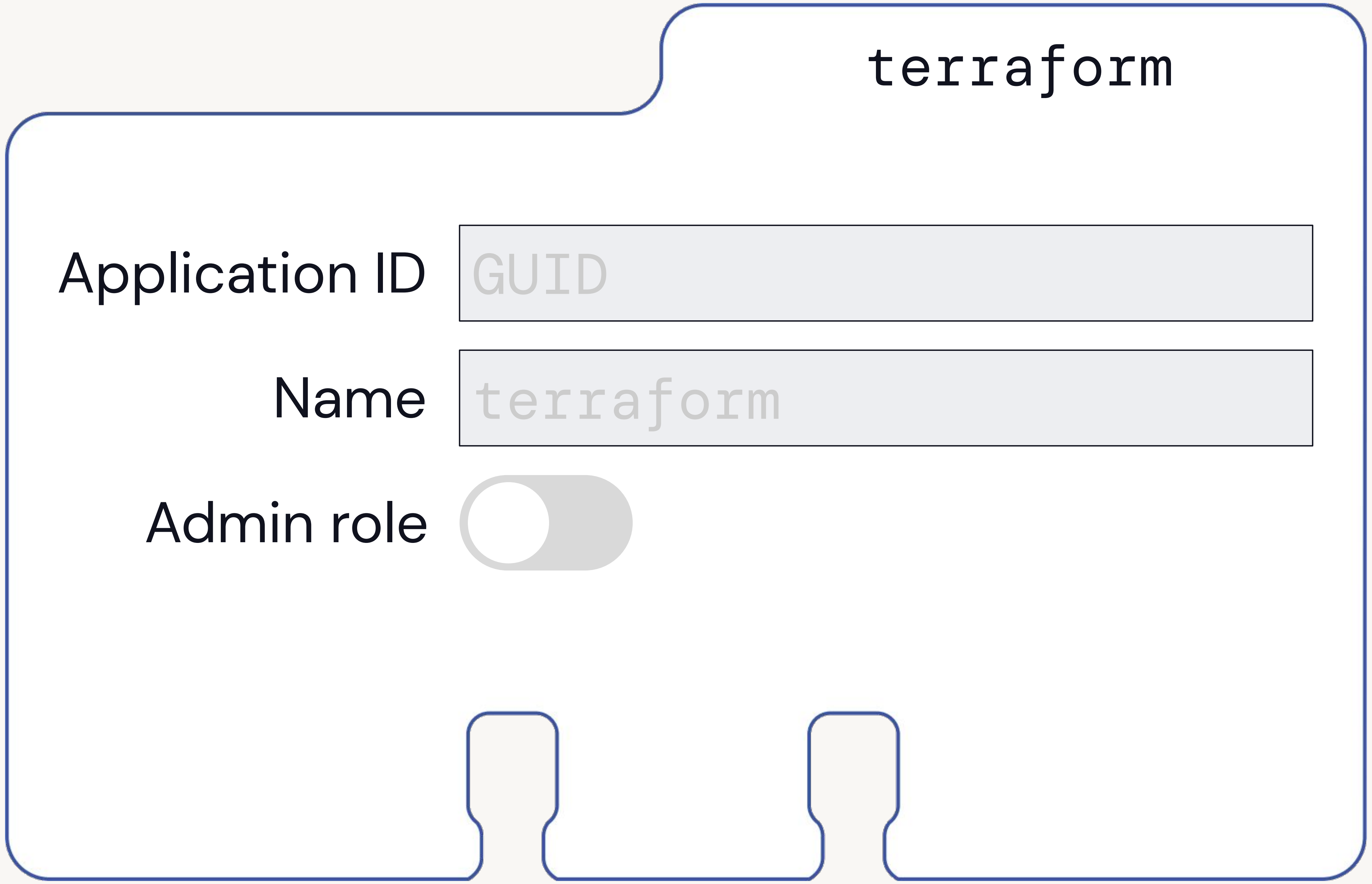
Metastore

Groups





Service Principals



terraform

Application ID	GUID
Name	terraform
Admin role	○

External Storage

Storage Credentials and External Locations

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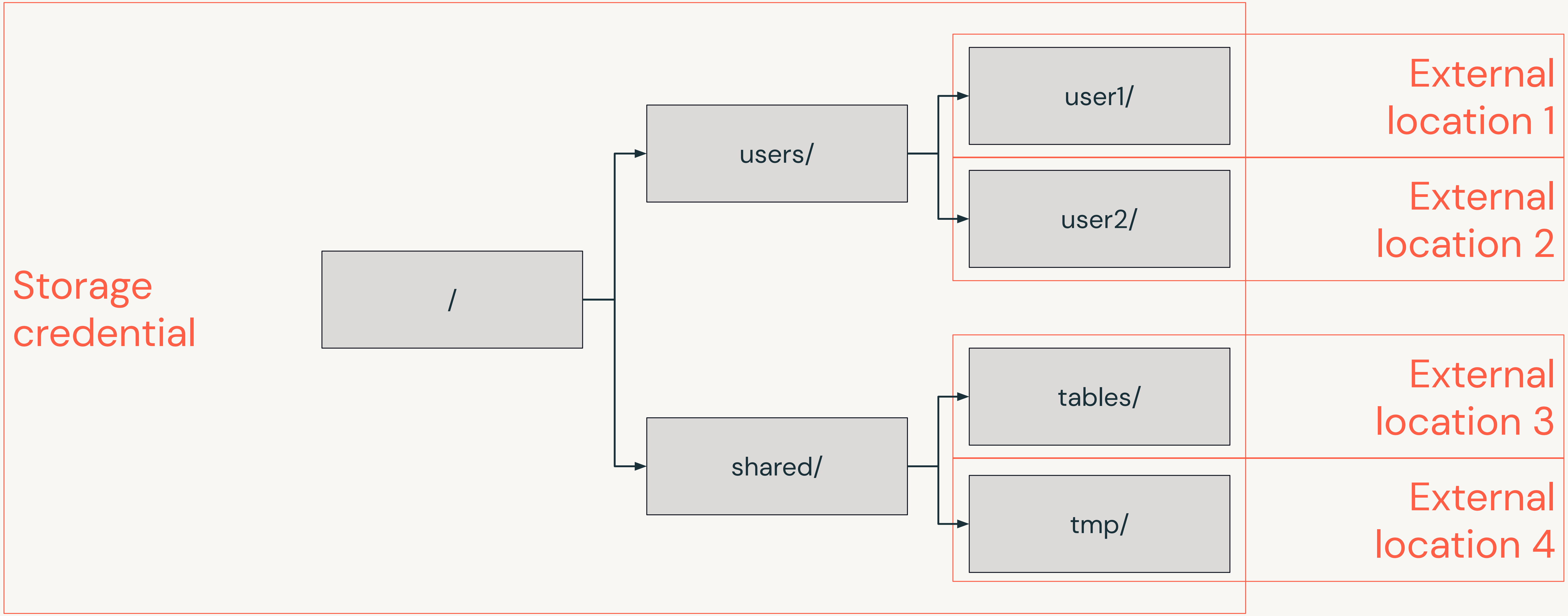

Managed versus External Tables

Managed Tables	External Tables
Metadata lives in control plane	Metadata lives in control plane
Data lives in metastore managed storage location	Data lives in user-provided storage location
DROP discards data	DROP leaves data intact
Delta format only	Several formats supported

External Tables

When to use?

Quick and easy upgrade from external table in Hive metastore

External readers or writers

Requirement for specific storage naming or hierarchy

Infrastructure-level isolation requirements

Non-Delta support requirement

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