

00	● Cover
01	Team
02	Problem
03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Federated Marketplaces

Empowering Stores to Exchange Products Effortlessly.

00
01
02
03
04
05
06
07
08

Cover

● **Team**

Problem

Federation

Vision

Solutions

Architecture

Demo

Q&A



Ali Aziri



Aamruth Shankar



Denis Koshelev



Filippa Leuckfeld



Georgiy Rudnev



Vuk Stojković

00	Cover
01	Team
02	● Problem
03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Problems with centralized marketplaces

00	Cover
01	Team
02	● Problem
03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Problems with centralized marketplaces

01

Monopolistic
Control Squeezing
out small
businesses

00
01
02
03
04
05
06
07
08

Cover
Team
● Problem
Federation
Vision
Solutions
Architecture
Demo
Q&A

Problems with centralized marketplaces

01

Monopolistic
Control Squeezing
out small
businesses

02

Does not provide
control and
flexibility

00
01
02
03
04
05
06
07
08

Cover
Team
● Problem
Federation
Vision
Solutions
Architecture
Demo
Q&A

Problems with centralized marketplaces

01

Monopolistic
Control Squeezing
out small
businesses

02

Does not provide
control and
flexibility

03

Relying on a
single platform
increases
vulnerability

01	Team
02	Problem
03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

What's a federated marketplace?

01
02
03
04
05
06
07
08

Team

Problem

Federation

Vision


Solutions

Architecture

Demo

Q&A

Let's say that you own an online store that sells shoes...




Google Cloud

ONLINEBOUTIQUE


\$ USD

1


Hot Products




Arizona SFB VL
\$129.99




Alpha Force 88
\$140.00




Gel-NYC
\$128.99



Samba OG



Chuck 70 Fall Tone



9060

01
02
03
04
05
06
07
08

Team

Problem

● **Federation**

Vision

Solutions

Architecture

Demo

Q&A

Let's say that you own an online
store that sells shoes...

01 You have gained a lot of traction
from customers recently and want
to expand your store

01
02
03
04
05
06
07
08

Team

Problem

● **Federation**

Vision

Solutions

Architecture

Demo

Q&A

Let's say that you own an online store that sells shoes...

01 You have gained a lot of traction from customers recently and want to expand your store

02 You would like to create value to your customers by increasing your product inventory

01
02
03
04
05
06
07
08

Team
Problem

● **Federation**

Vision

Solutions

Architecture

Demo

Q&A

Let's say that you own an online store that sells shoes...

01 You have gained a lot of traction from customers recently and want to expand your store

02 You would like to create value to your customers by increasing your product inventory

03 You value trust and transparency and would only like to work with known partners

Team

Problem

Federation

Vision

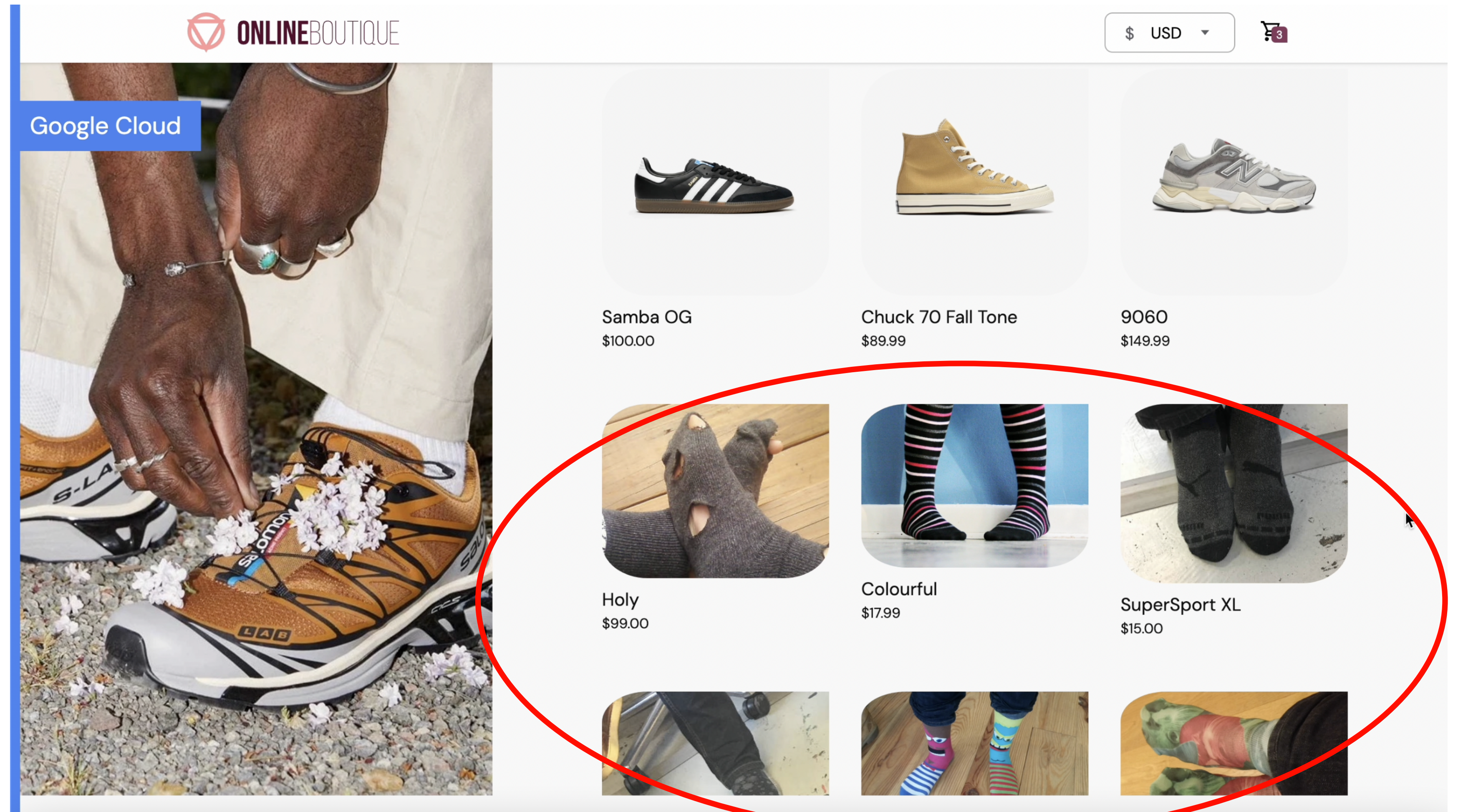
Solutions

Architecture

Demo

Q&A

What if you could partner with other online stores to sell their products?



01	Team
02	Problem
03	● Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

"A federated marketplace is a **decentralized** platform that enables multiple independent entities to **participate** and **collaborate, sharing resources** while maintaining **autonomy** and **interoperability**."

02
03
04
05
06
07
08

Problem
Federation
● **Vision**
Solutions
Architecture
Demo
Q&A

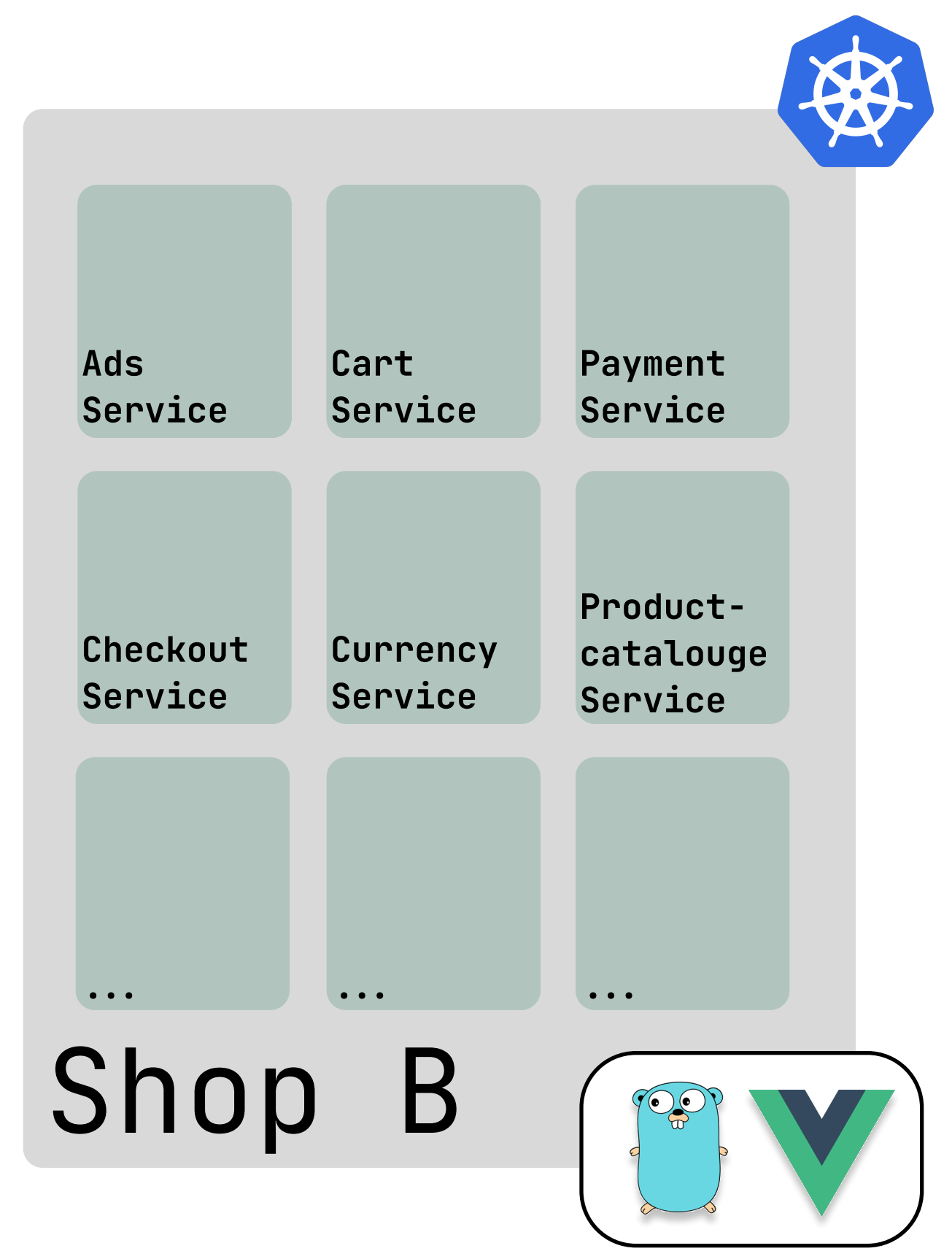
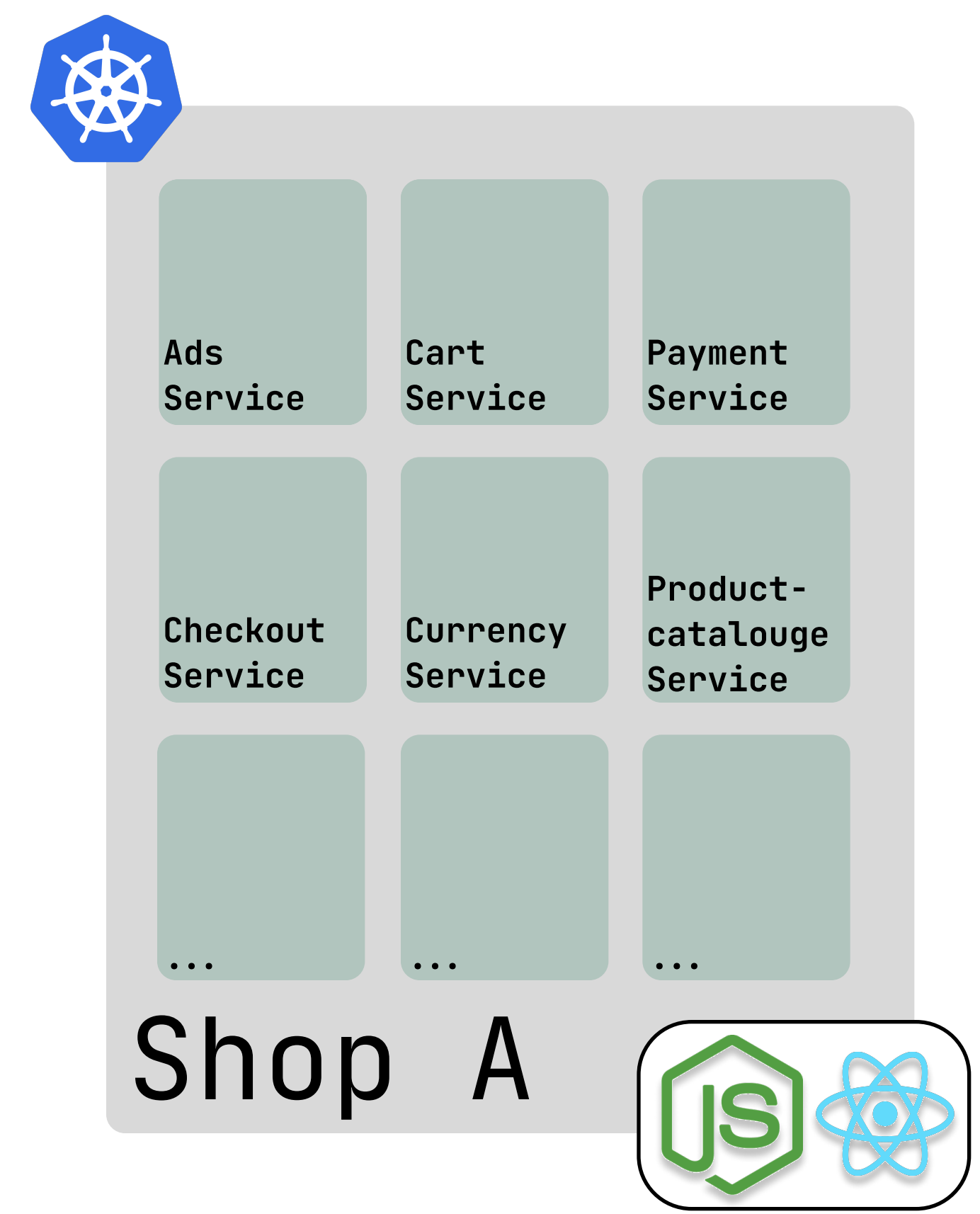
Our vision is to create
a federated marketplace
that **simplifies access**
and collaboration,
enhances security, and
builds trust with
transparency.

03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

What main **challenges**
did we face while
building federated
marketplace? And how
did we solve them?

03	Introduction
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

Working with **Microservices** is complex



00	Cover			
01	Team			
02	● Problem	Challenges we faced of working with Microservices		
03	Federation			
04	Vision			
05	Solutions	01	02	03
06	Architecture	High complexity	Teams Organization	Development time
07	Demo	<ul style="list-style-type: none">• Multiple services• Different stacks• Complex architecture	<ul style="list-style-type: none">• Team worked on different services• A challenge to make them compatible• Important with great communication	<ul style="list-style-type: none">• Long development times due to many services• Did not support apple M1/M2 architecture
08	Q&A			

03

Federation

04

Vision

05

● **Solutions**

06

Architecture

07

Demo

08

Q&A

Research question 1:
How to join the
federated marketplace
and ensure that only
allowed parties can
participate?

03

Recap

04

Vision

05

● Solutions

How do stores find each other?

06

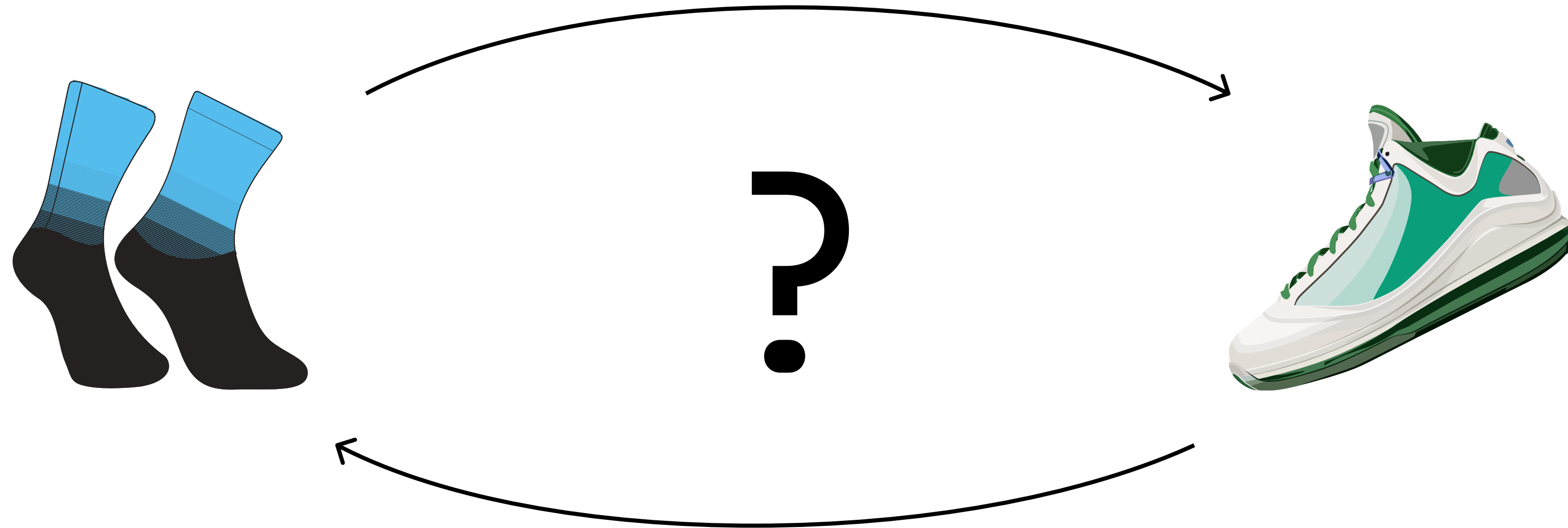
Architecture

07

Demo

08

Q&A



03

Recreation

04

Vision

05

● Solutions

How do stores find each other?

06

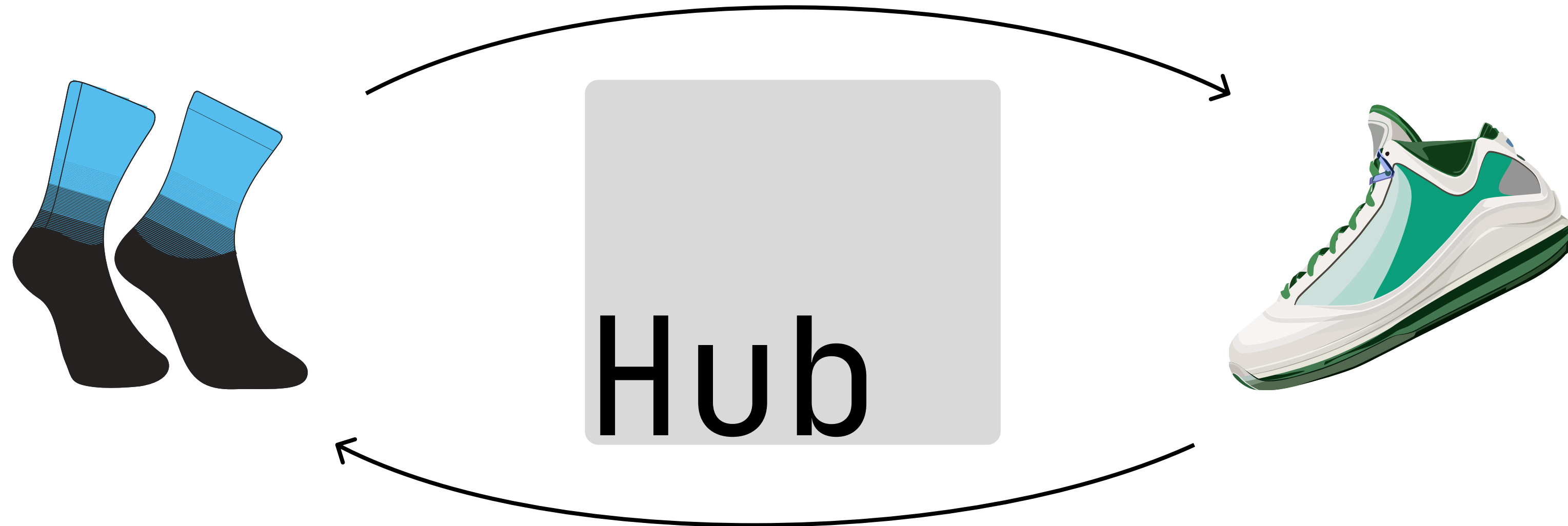
Architecture

07

Demo

08

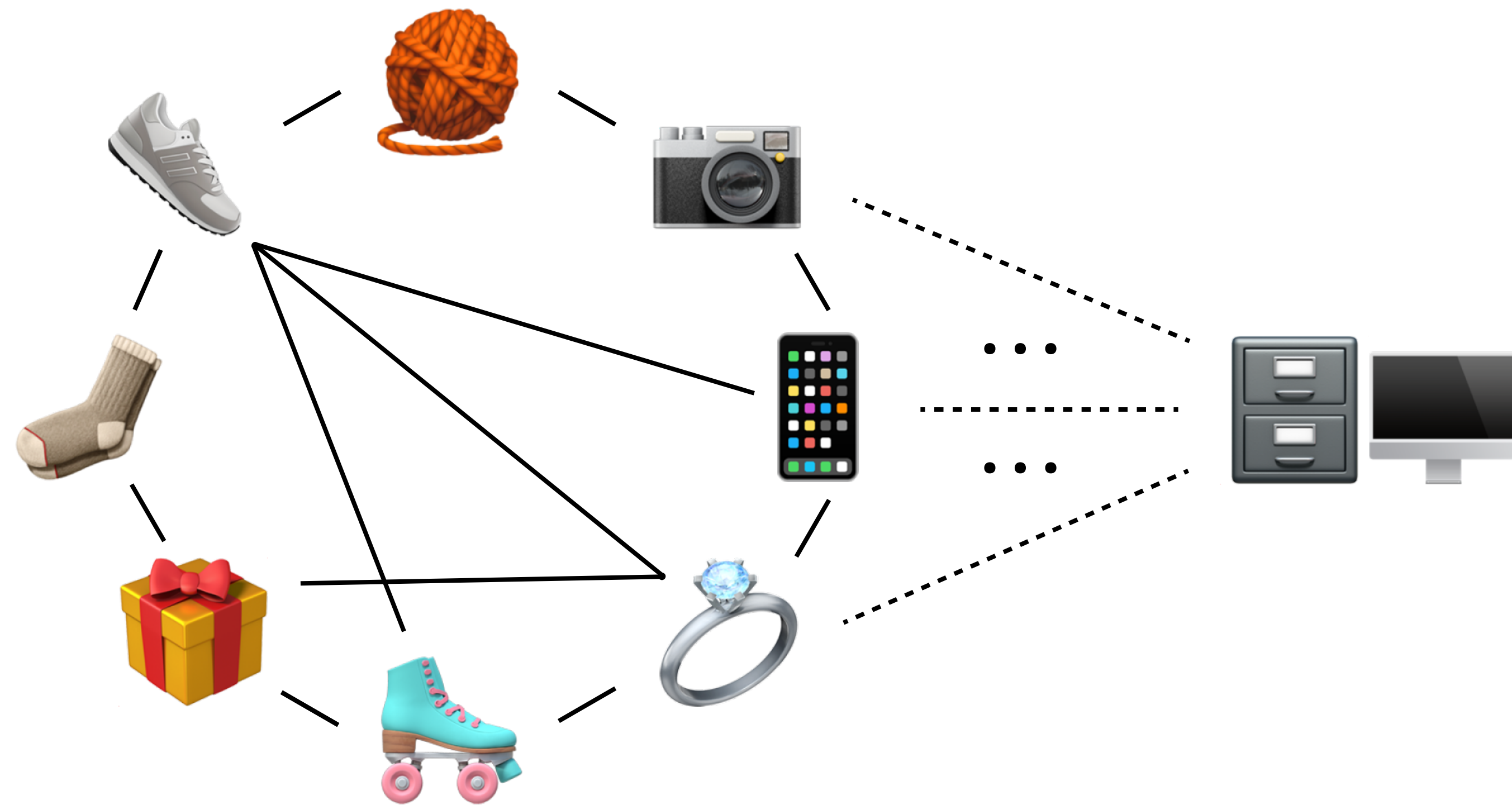
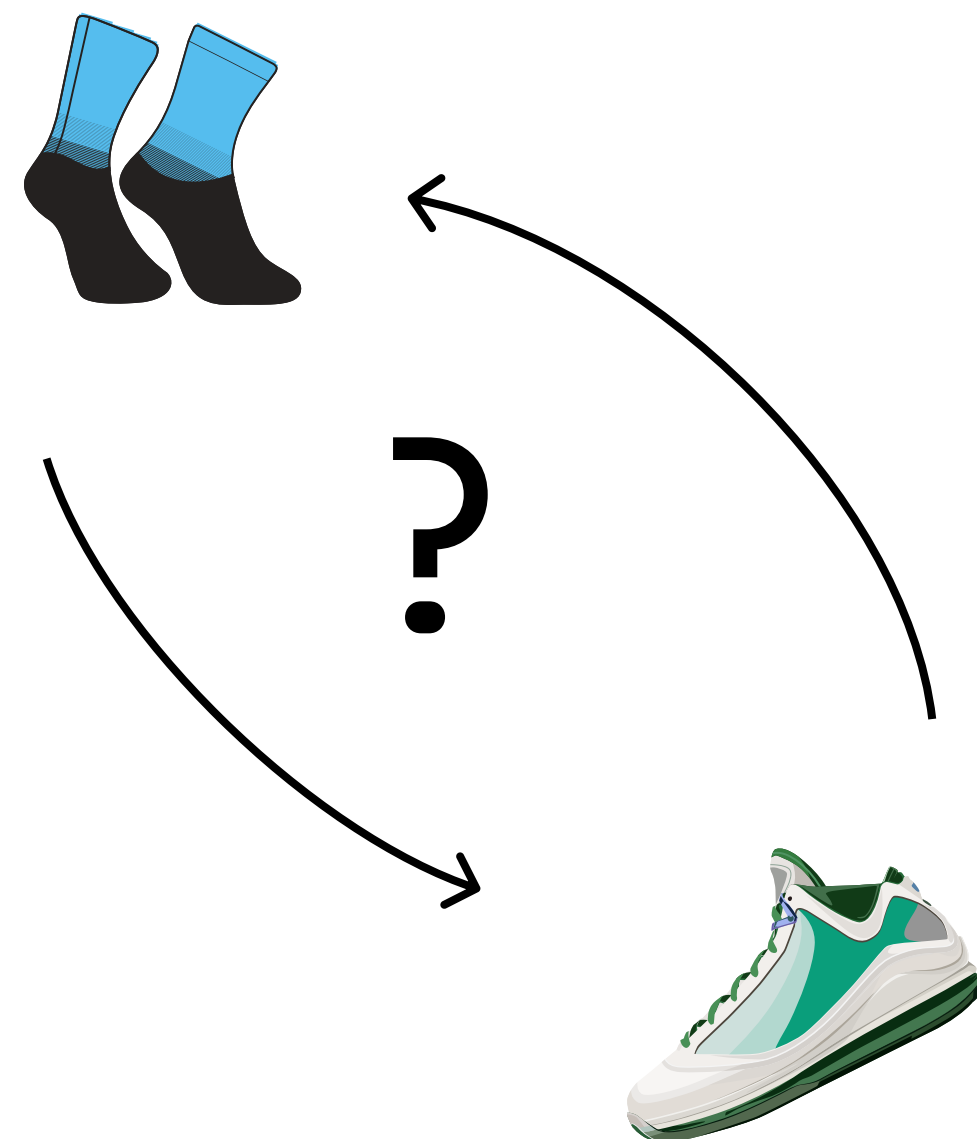
Q&A



03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

How do stores find each other?

Our choice: Federation Hub



03

Federation

04

Vision

05

● Solutions

06

Architecture

07

Demo

08

Q&A

Federation Hub combines best of the two worlds

01

Minimal role → allowing nodes to
communicate in **almost P2P manner**

02

Can be **easily scaled up** to
Mastodon-like architecture using
multiple Hub instances



03

Federation

04

Vision

05



Solutions

06

Architecture

07

Demo

08

Q&A

What does Federation Hub do?

01 Allows shops to join and leave federation



03

Federation

04

Vision

05

● Solutions

06

Architecture

07

Demo

08

Q&A

What does **Federation Hub** do?

01

Allows shops to join and leave
federation

02

Helps stores to find other shops
to collaborate with



03

Federation

04

Vision

05

● Solutions

06

Architecture

07

Demo

08

Q&A

What does **Federation Hub** do?

01

Allows shops to join and leave federation

02

Helps stores to find other shops to collaborate with

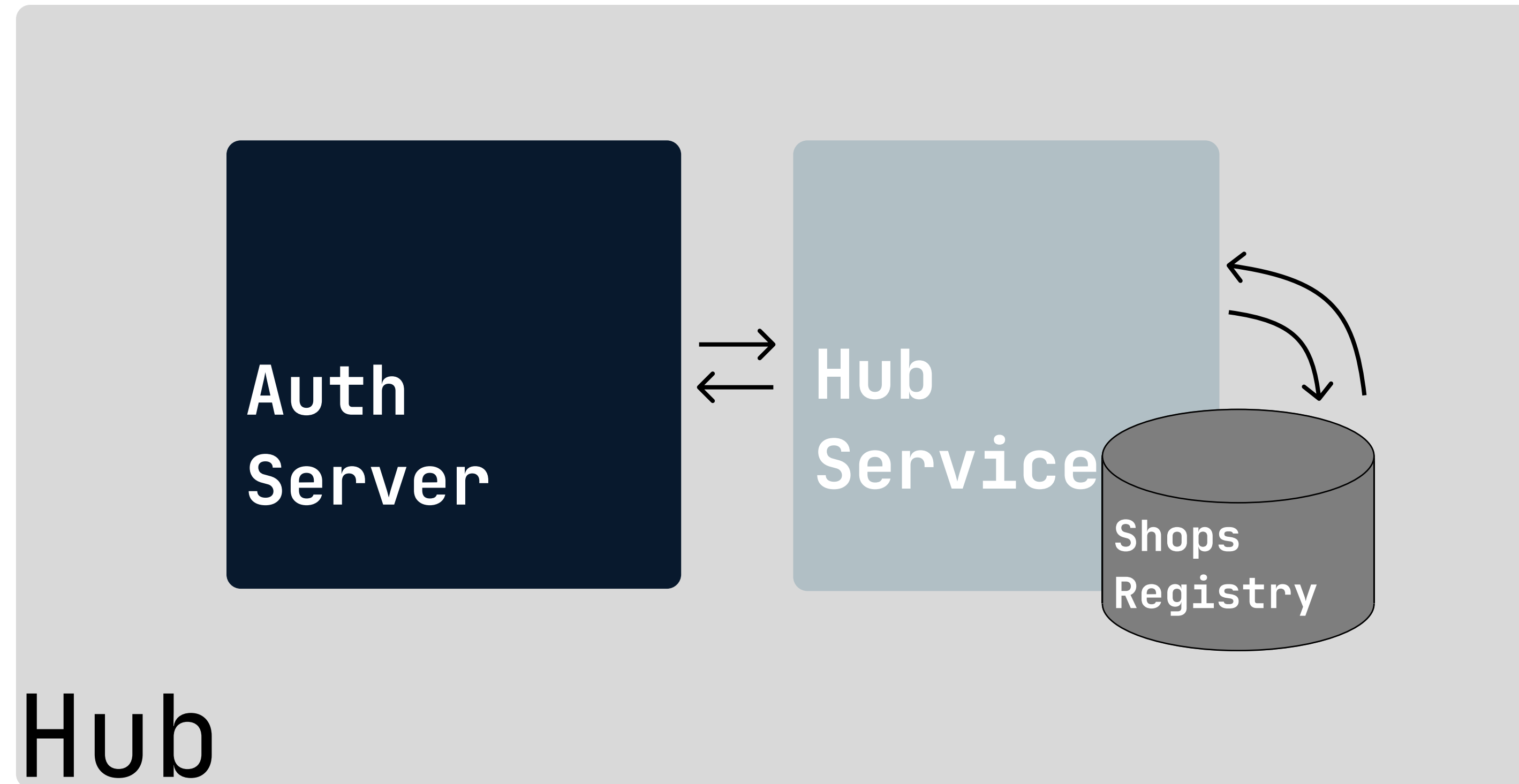
03

And **nothing** more!

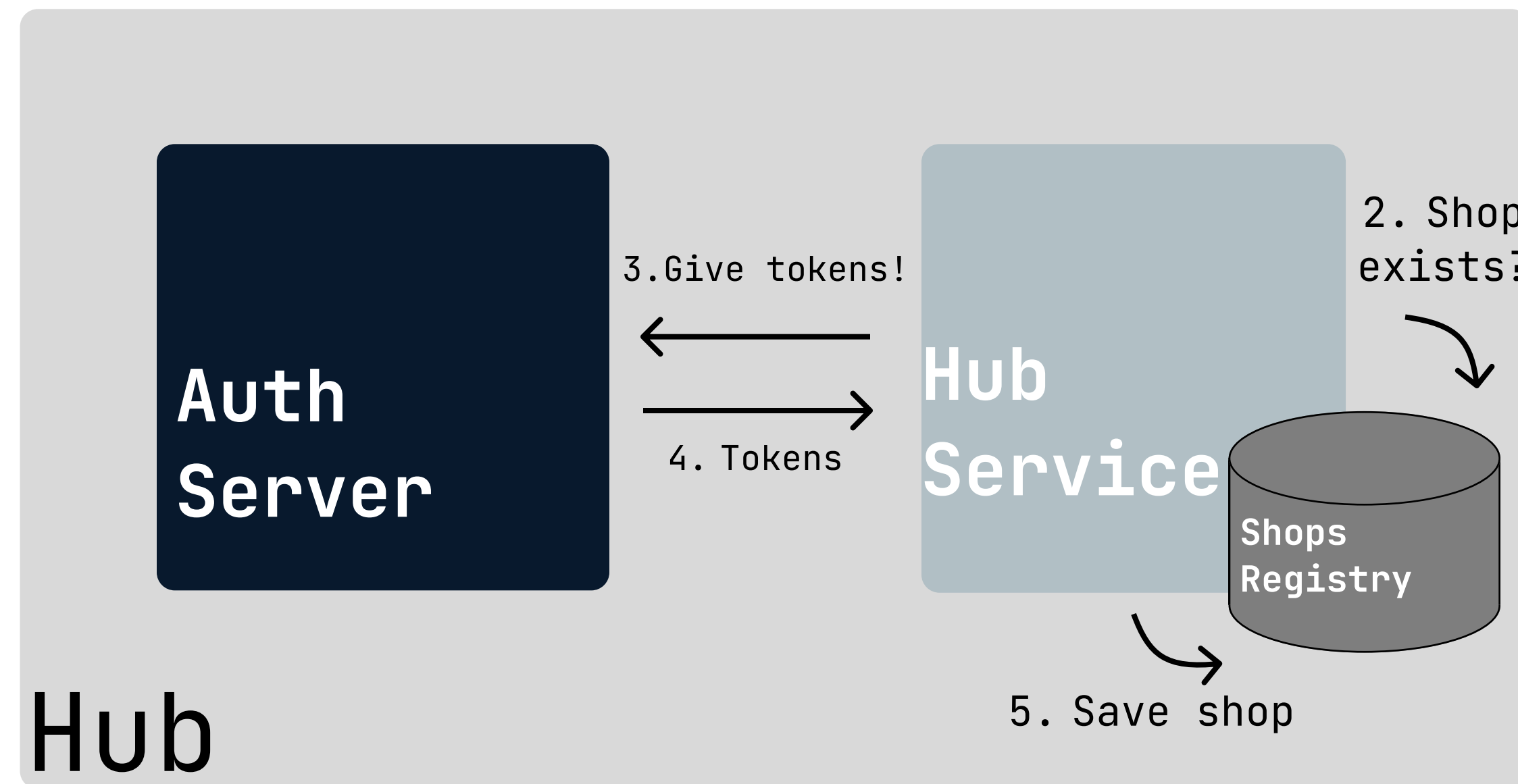


03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

What is under the hood?



How does a shop join the Federation?



0. Generate
public and
private keys



1. I want to join!

6. Tokens

You are in the
Federation! 🥳

03

Federation

04

Vision

05

● Solutions

1. Ask authentication server for
access / refresh tokens

06

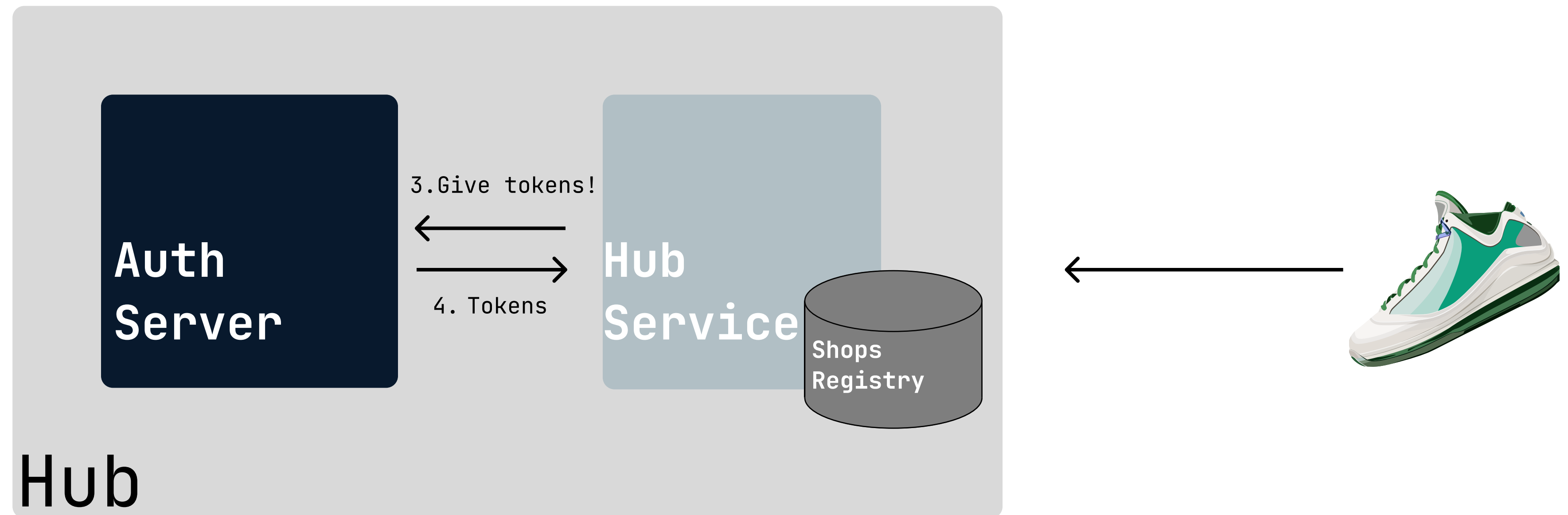
Architecture

07

Demo

08

Q&A



03

Federation

04

Vision

05

● Solutions

2. Get tokens for a shop

06

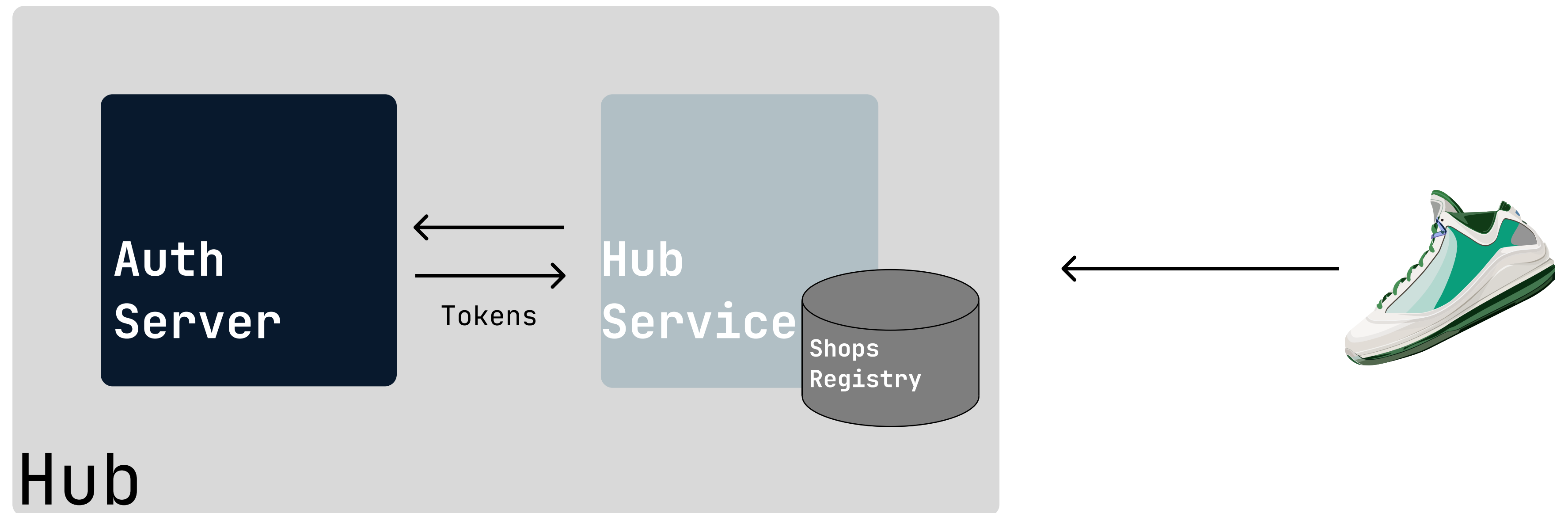
Architecture

07

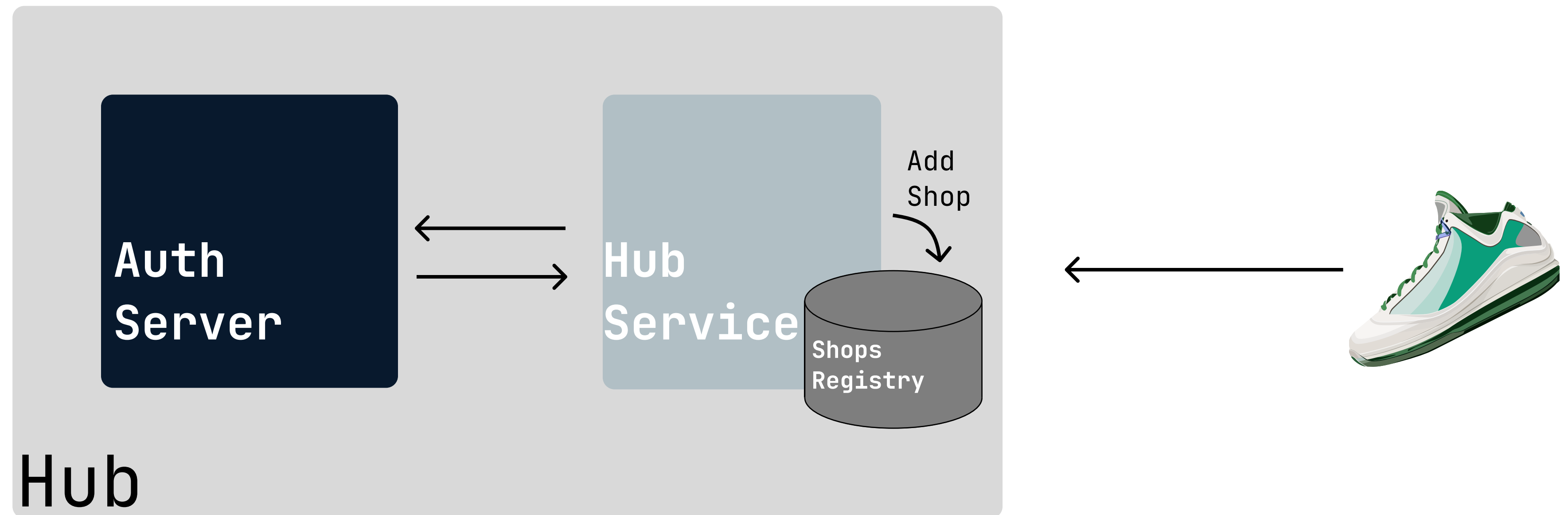
Demo

08

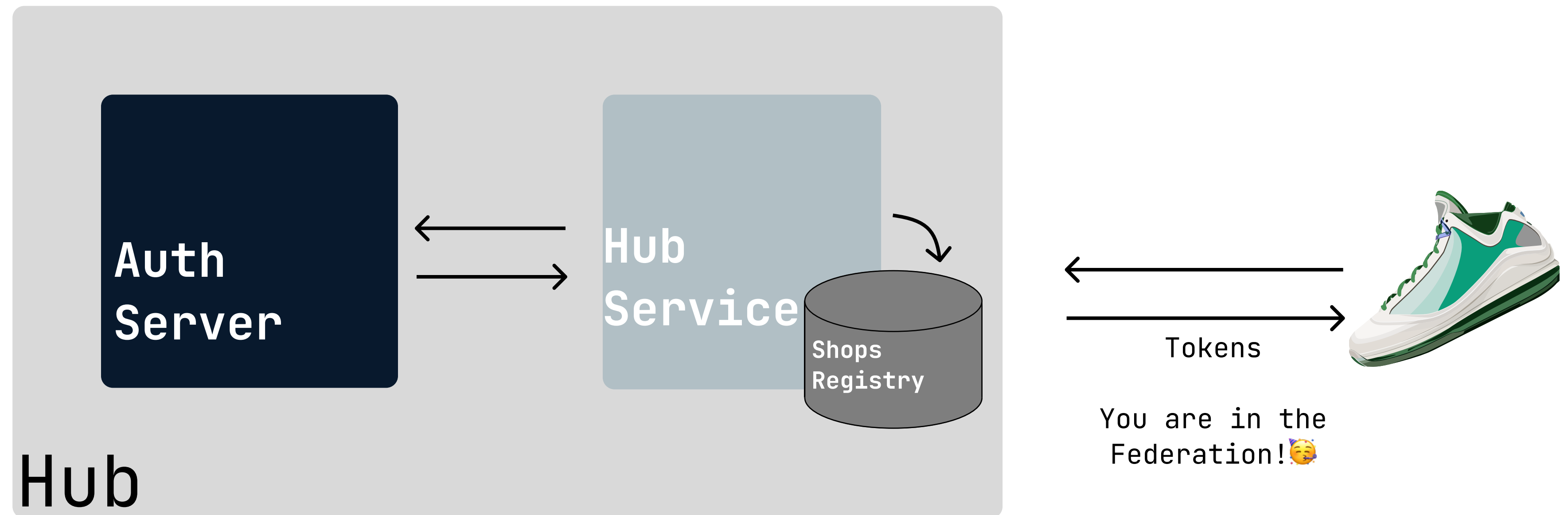
Q&A



3. Add shop to global shop registry that are part of the Federation



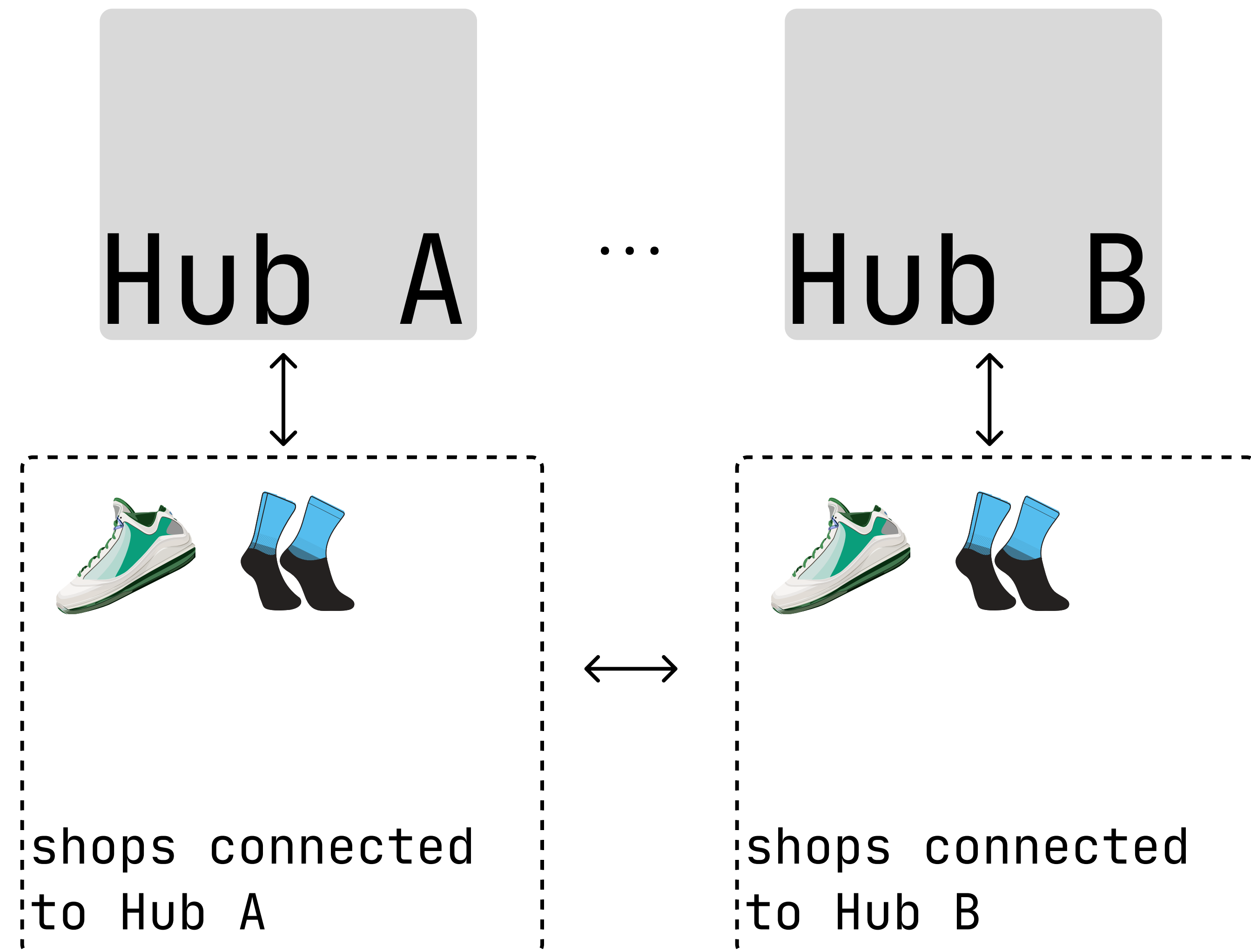
4. Return tokens and celebrate new member!



03
04
05
06
07
08

Federation
Vision
● Solutions
Architecture
Demo
Q&A

How do shops know about each other?



03
04
05
06
07
08

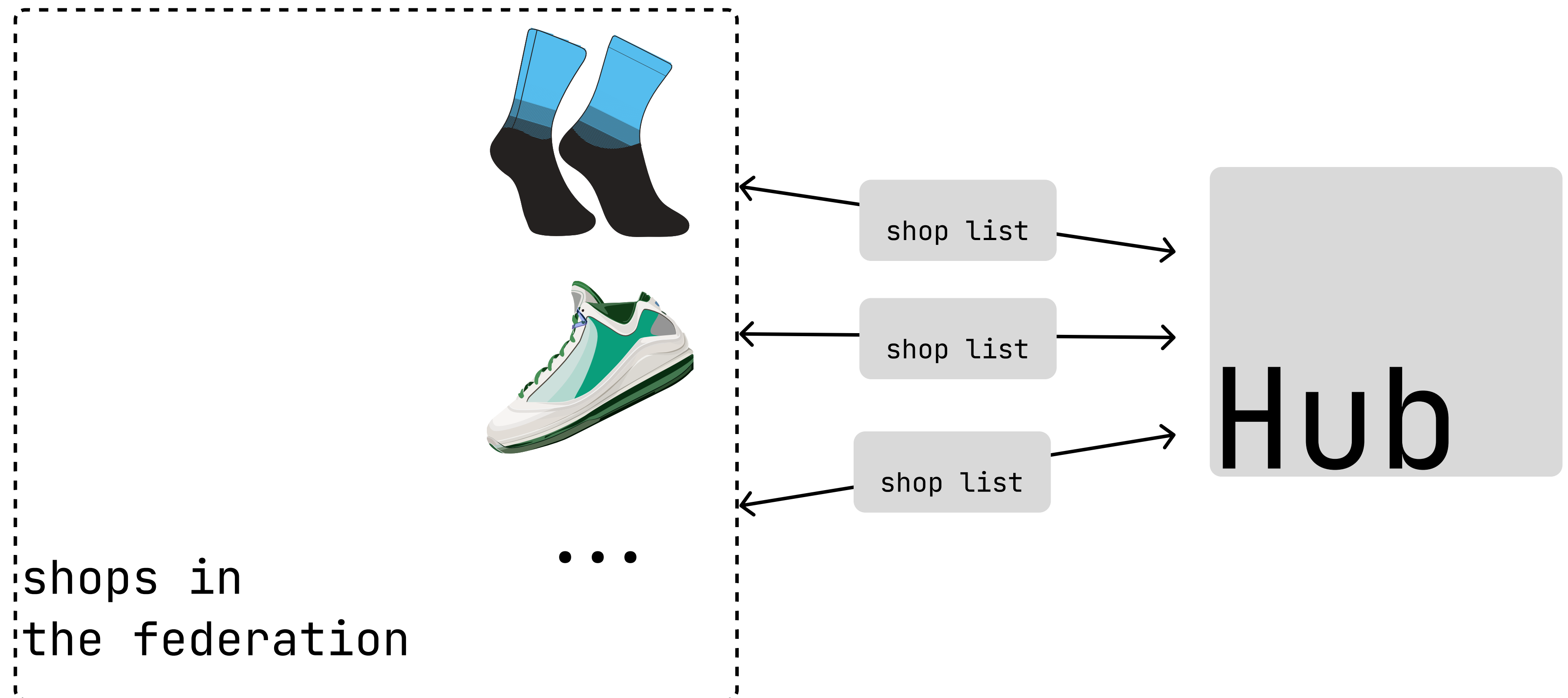
Federation
Vision
● Solutions
Architecture
Demo
Q&A

Notify all shops in the Federation
about new shop joined.

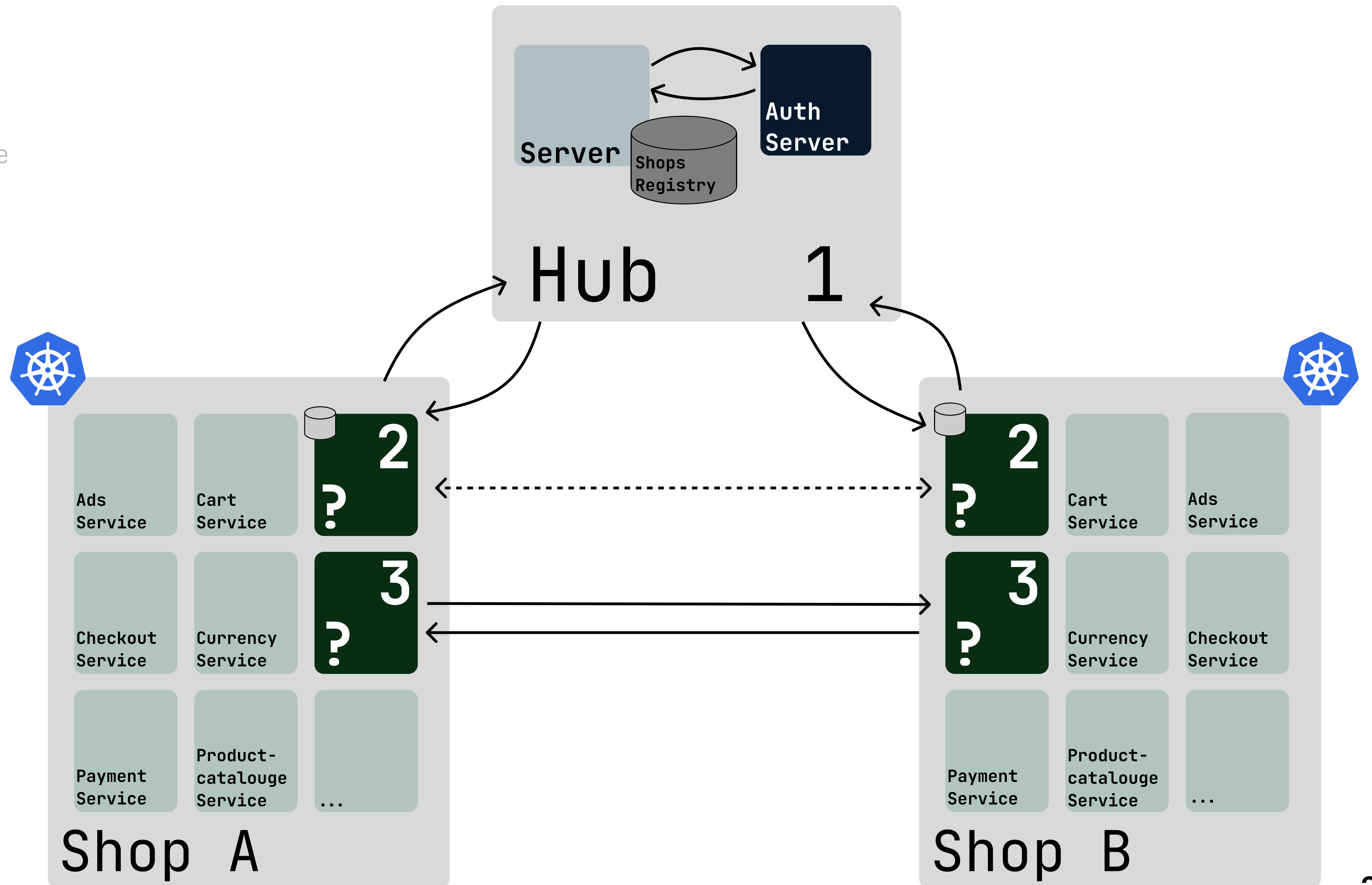


03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Periodical polling of current shop list



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A



03

Federation

04

Vision

05

● Solutions

How does a shop **actually** communicate with Hub?
Does it use **any** software?

06

Architecture

07

Demo

08

Q&A



?



03

Federation

04

Vision

05



Solutions

06

Architecture

07

Demo

08

Q&A

How does a shop handle all this on its side?



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

What is federation service?

01 Allows communication with **the Hub**



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

What is federation service?

01 Allows communication with **the Hub**

02 Stores all shops that are part of **the Federation**



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

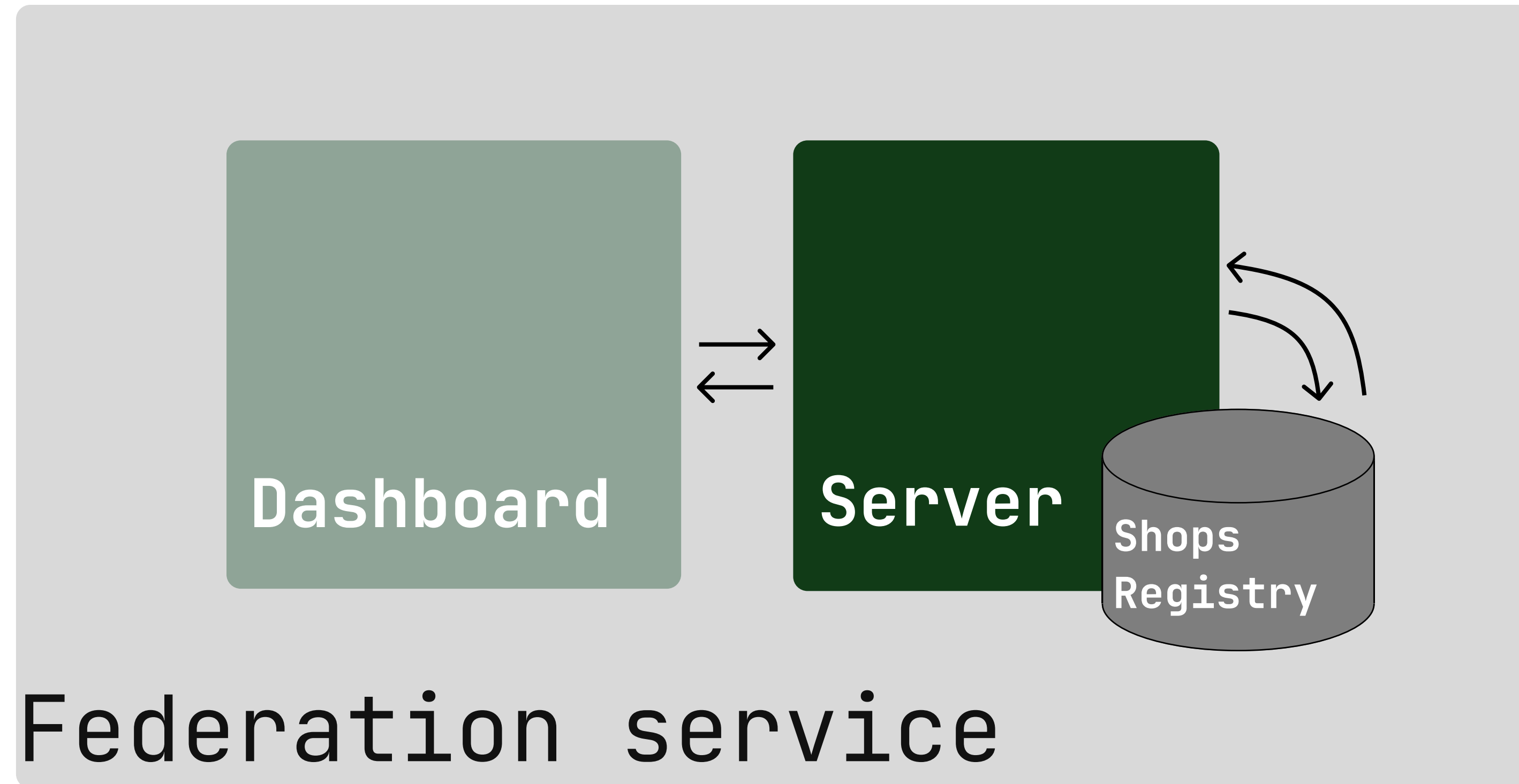


What is federation service?

- 01 Allows communication with **the Hub**
- 02 Stores all shops that are part of **the Federation**
- 03 Manages **partnerships** with other shops

03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

What is under the hood?



03
04
05
06
07
08

Federation
Vision
● Solutions
Architecture
Demo
Q&A

How can shops communicate directly?



?



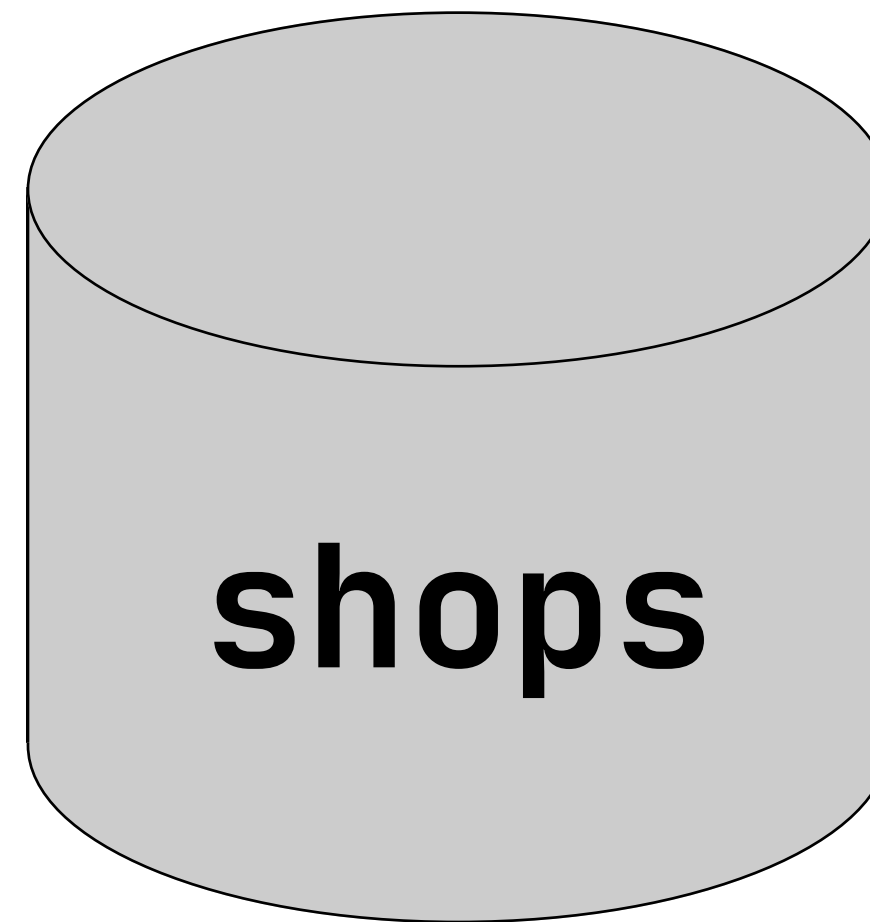
03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

Let's see how stores are stored!



03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

We store information about all shops that are part of the Federation



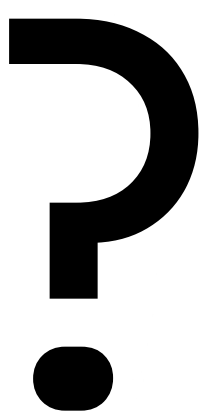
ID	SHOP	PUBLIC KEY
1		MIIB0gI...
2		odKAmV6...
...

03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

We store information about all shops that are part of the Federation



ID	SHOP	PUBLIC KEY
1		MIIBOgI...
2		odKAmV6...
...



03

Federation

04

Vision

05

● Solutions

06

Architecture

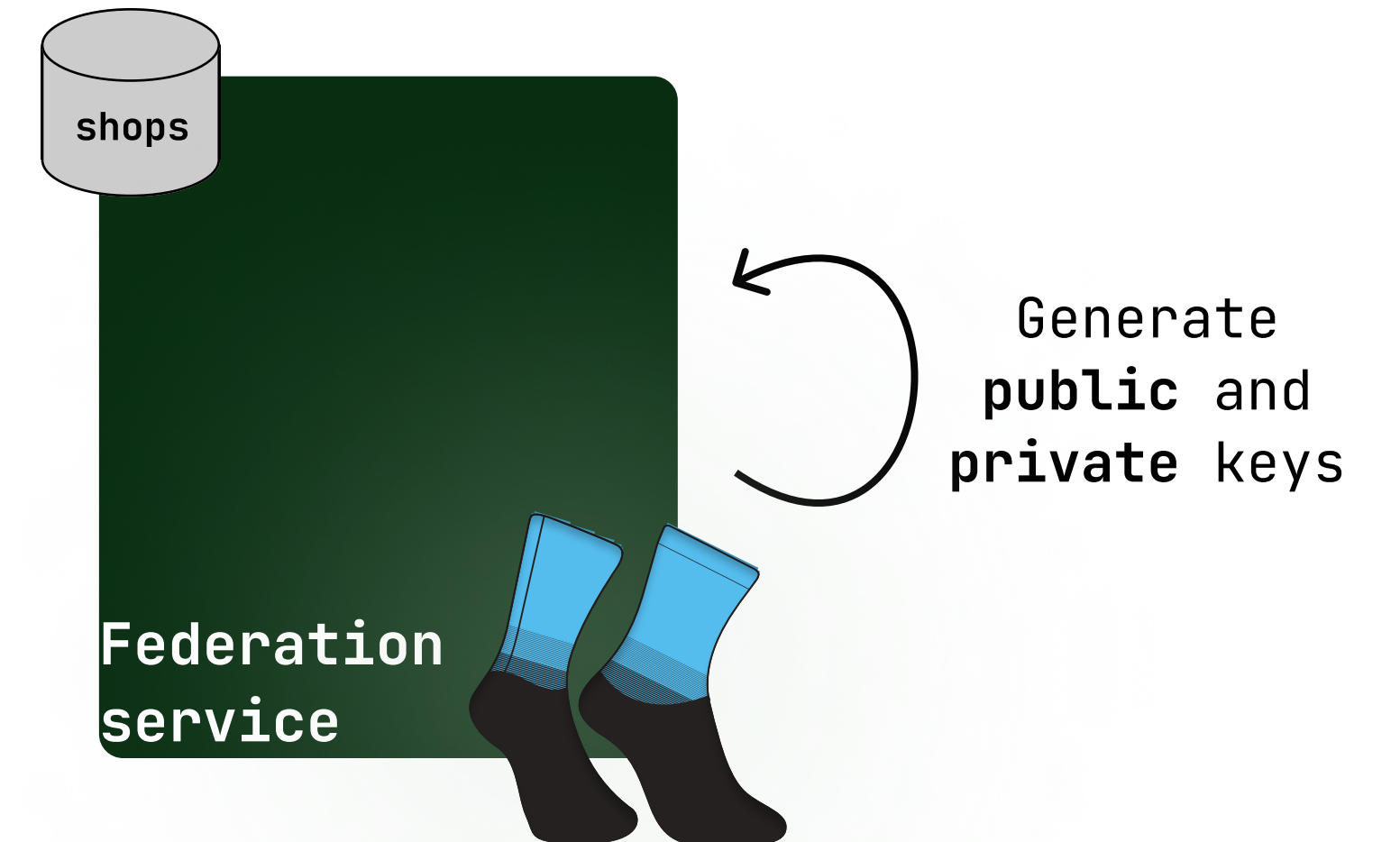
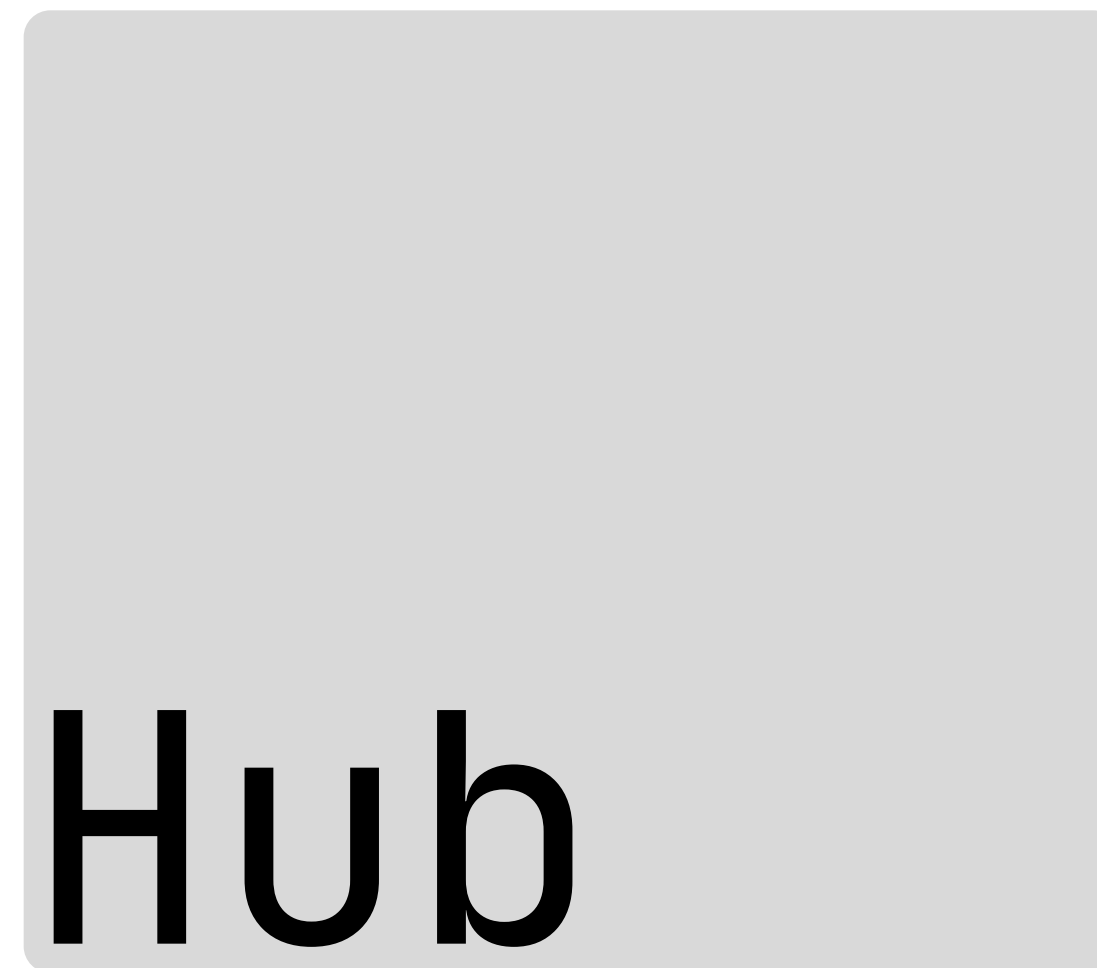
07

Demo

08

Q&A

0. Before joining shop generates
public and private keys



03

Federation

04

Vision

05

● Solutions

06

Architecture

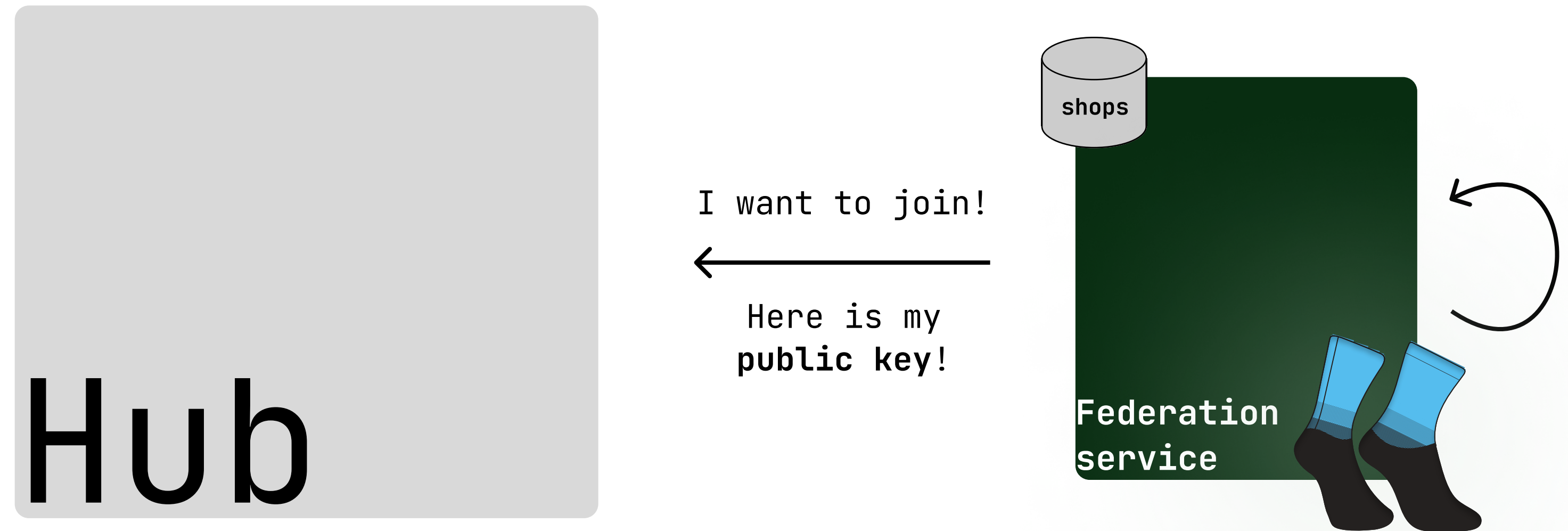
07

Demo

08

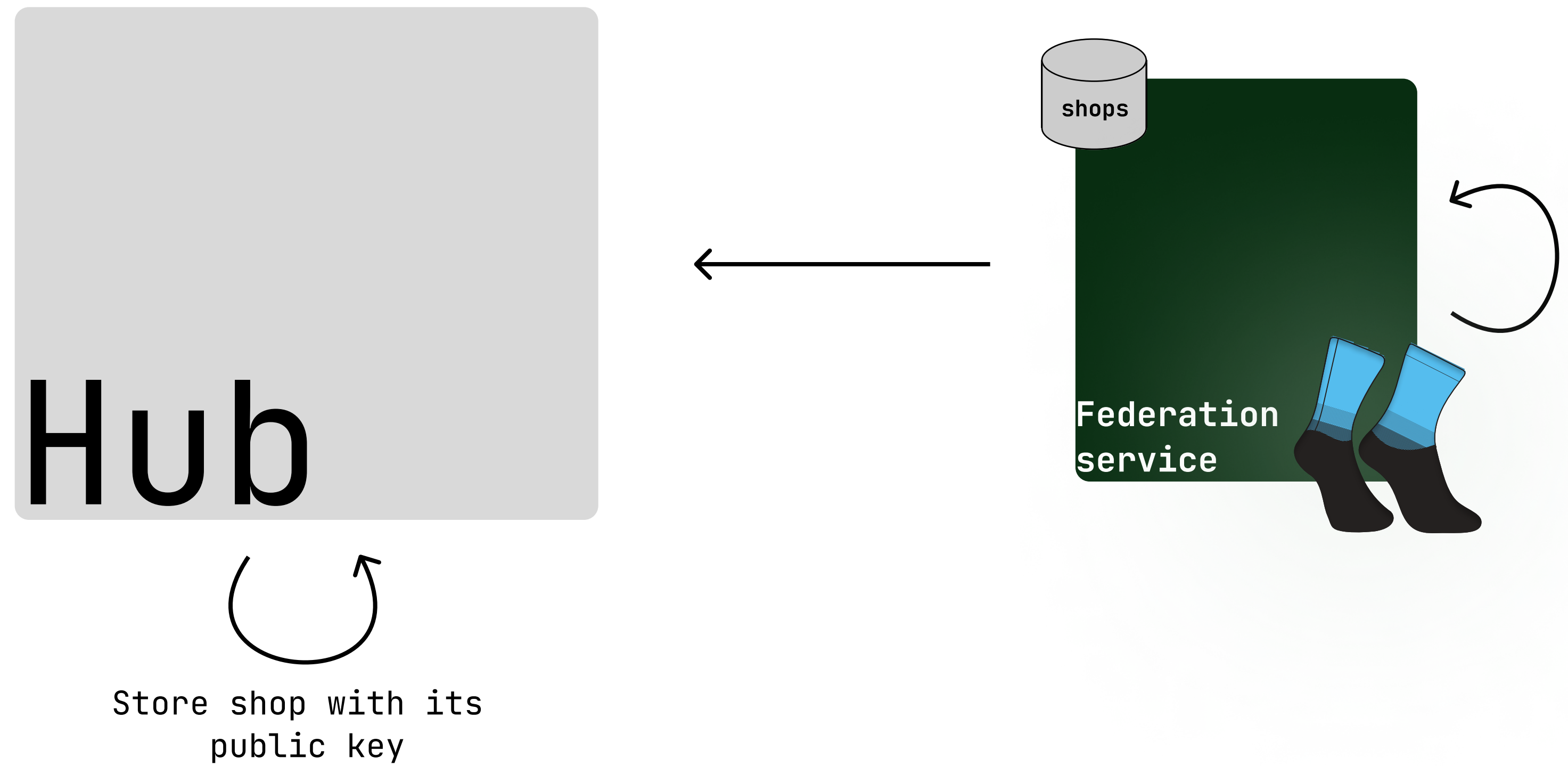
Q&A

1. When joining also sends its public key



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

2. Hub stores all public keys for all shops



03

Recreation

04

Vision

05

● Solutions

06

Architecture

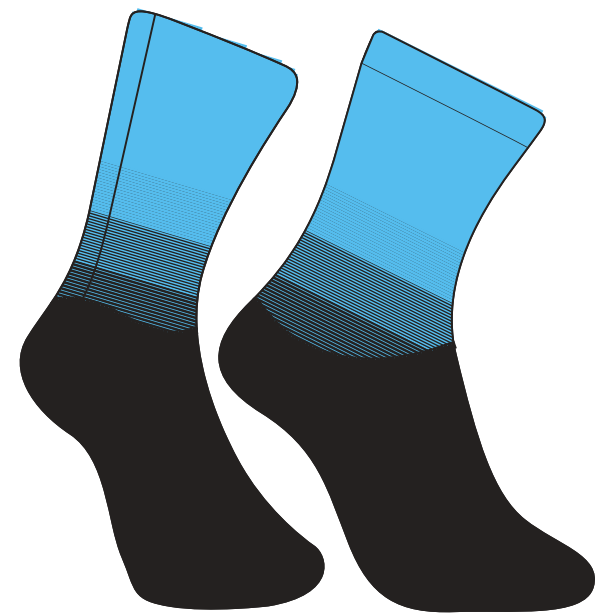
07

Demo

08

Q&A

How does direct communication look like?



?



03

Federation

04

Vision

05



Solutions

06

Architecture

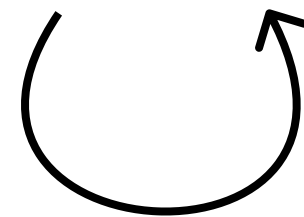
07

Demo

08

Q&A

One shop generates JWT token
with its private key



Generate JWT token



03

Introduction

04

Vision

05

● Solutions

06

Architecture

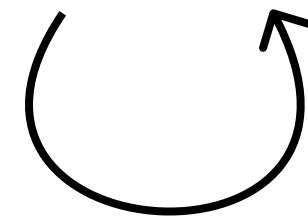
07

Demo


08

Q&A

Shop sends partnership request
with **specified rights** and **JWT token**

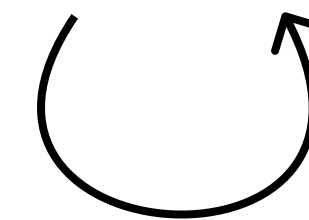
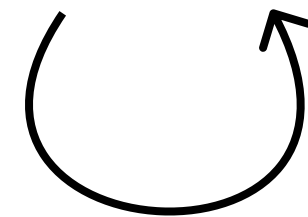


partnership request
with JWT token



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Another shop verifies JWT token



Verify JWT token
with shop's
public keys

03

Federation

04

Vision

05

● Solutions

06

Architecture

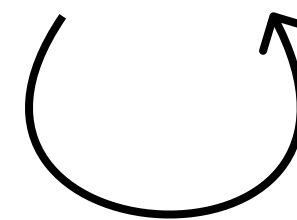
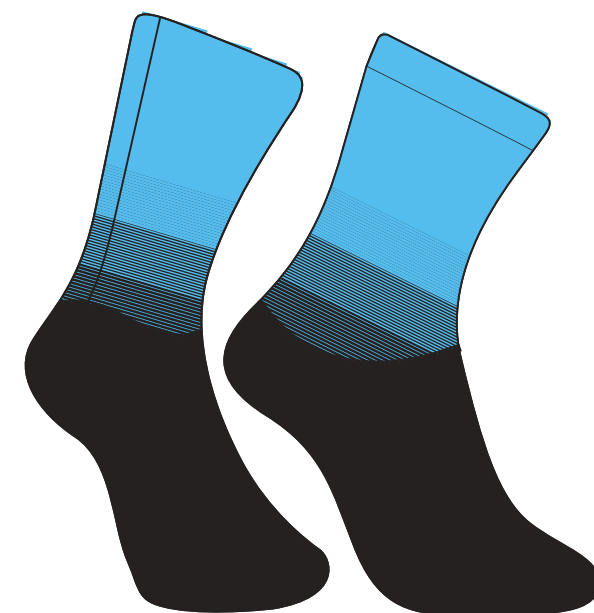
07

Demo

08

Q&A

Shop either accepts or denies partnership request



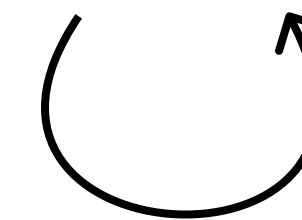
1. Generate JWT token

2. Send partnership request
with JWT token



4. Send a response

We are partners 🥳
or
Nah, sorry 🙄

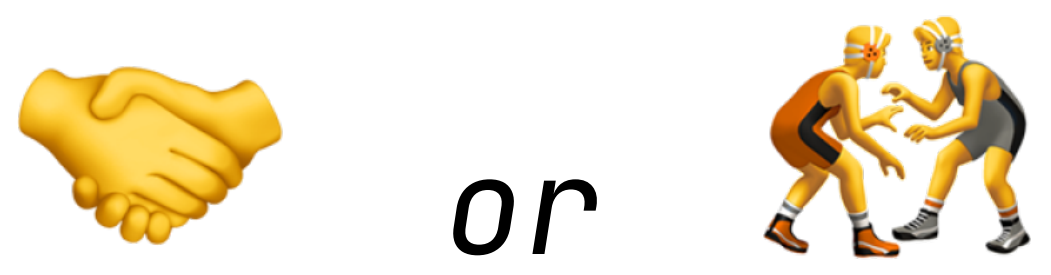


3. Verify JWT
token with
shop's public
keys

03
04
05
06
07
08

Introduction
Vision
● Solutions
Architecture
Demo
Q&A

Rights management



Earn Commision

Share Inventory

Share Data

Co-Promote

Sell

03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Finally shops can communicate!

01 Every shop **knows about other** shops in the Federation!



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Finally shops can communicate!

01 Every shop **knows about other** shops in the Federation!

02 Every shop **has all public keys** from other shops



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Finally shops can communicate!

01 Every shop **knows about other** shops in the Federation!

02 Every shop **has all public keys** from other shops

03 So they can **communicate directly** without involving the Hub!



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

How to ensure that only allowed parties
can participate in the federated marketplace?

Our answer:

01 Hub manages **public keys** for all
stores that joined the Federation



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

How to ensure that only allowed parties
can participate in the federated marketplace?

Our answer:

01 Hub manages **public keys** for all
stores that joined the Federation

02 Each shop can **verify** a future
partner with its public key



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

How to ensure that only allowed parties
can participate in the federated marketplace?

Our answer:

01 Hub manages **public keys** for all
stores that joined the Federation

02 Each shop can **verify** a future
partner with its public key

03 Each shop has opportunity to
terminate partnership at any time



03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

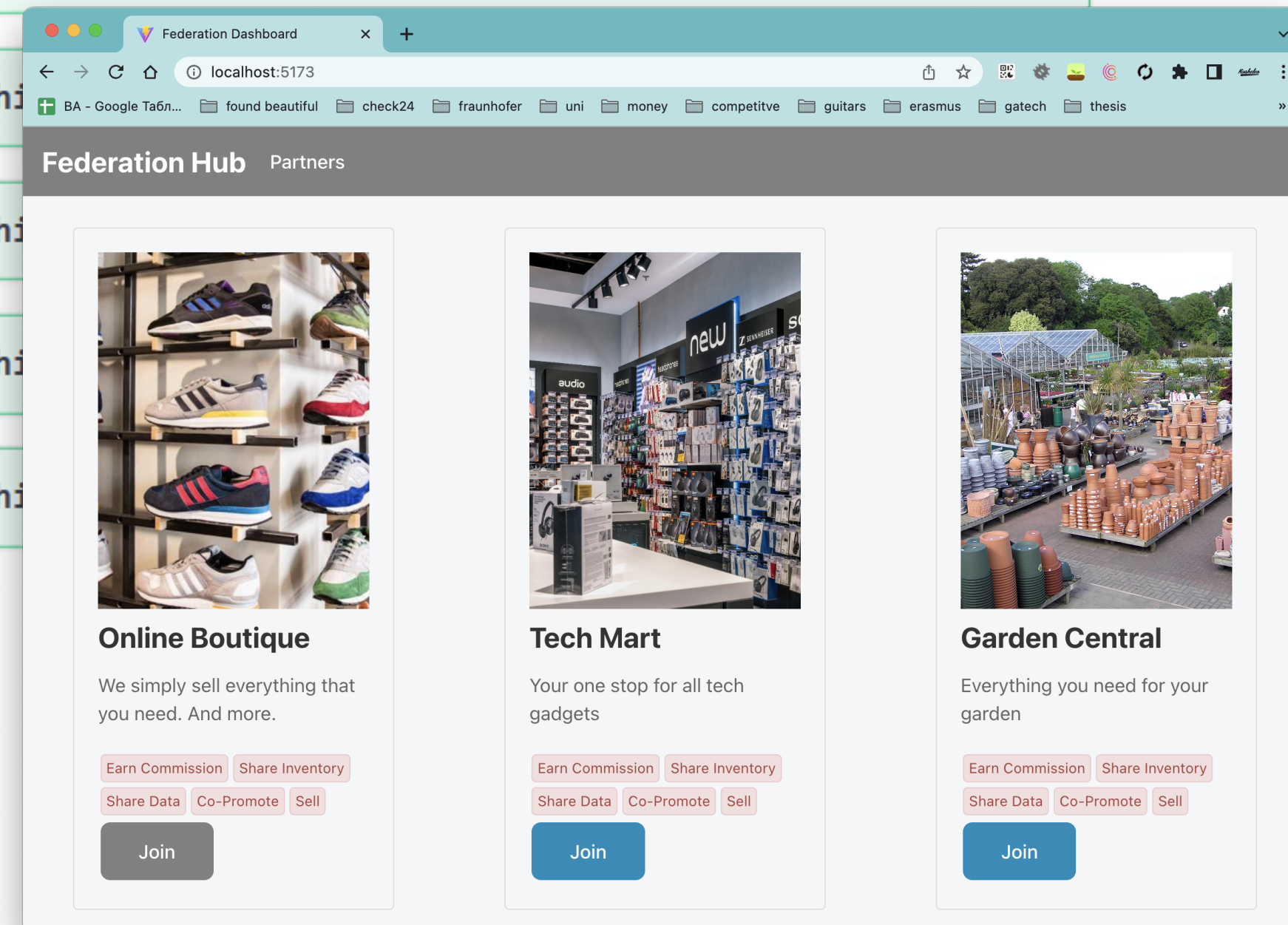
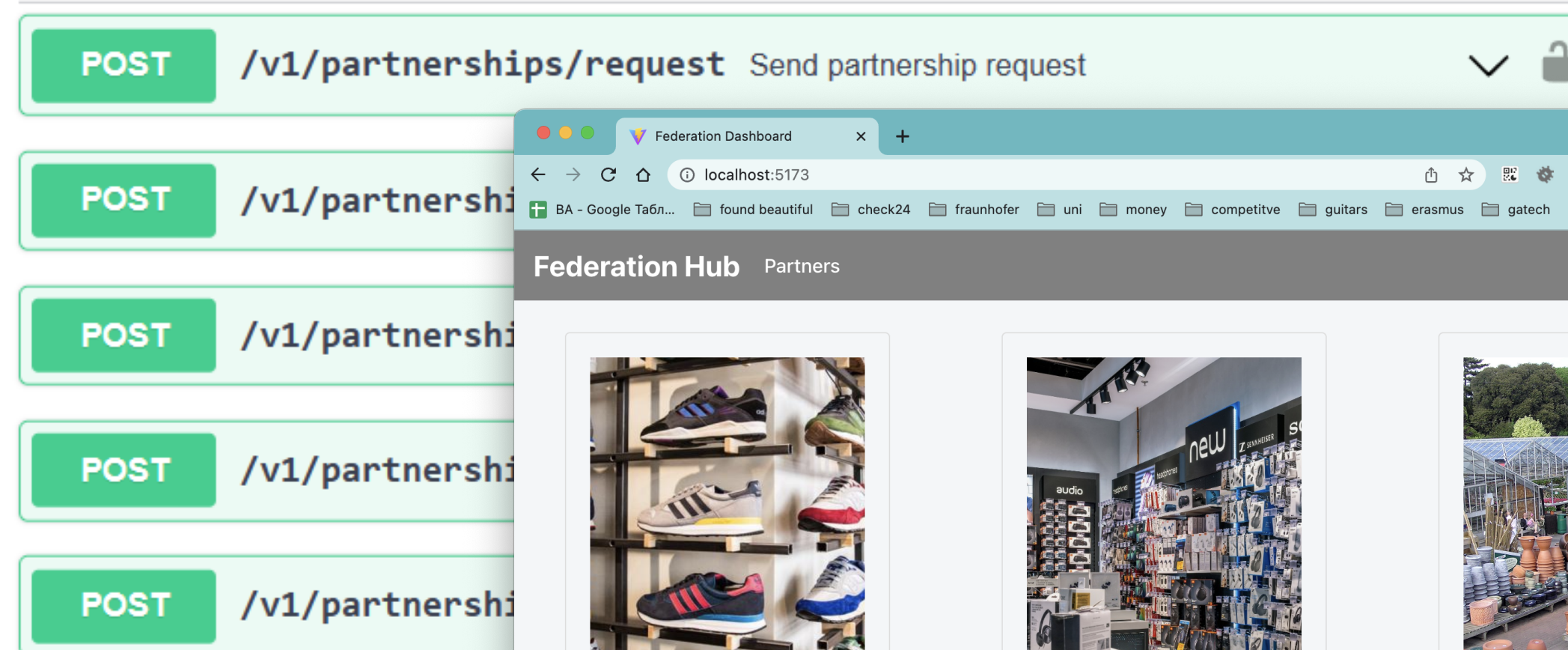


How to get started as a shop?

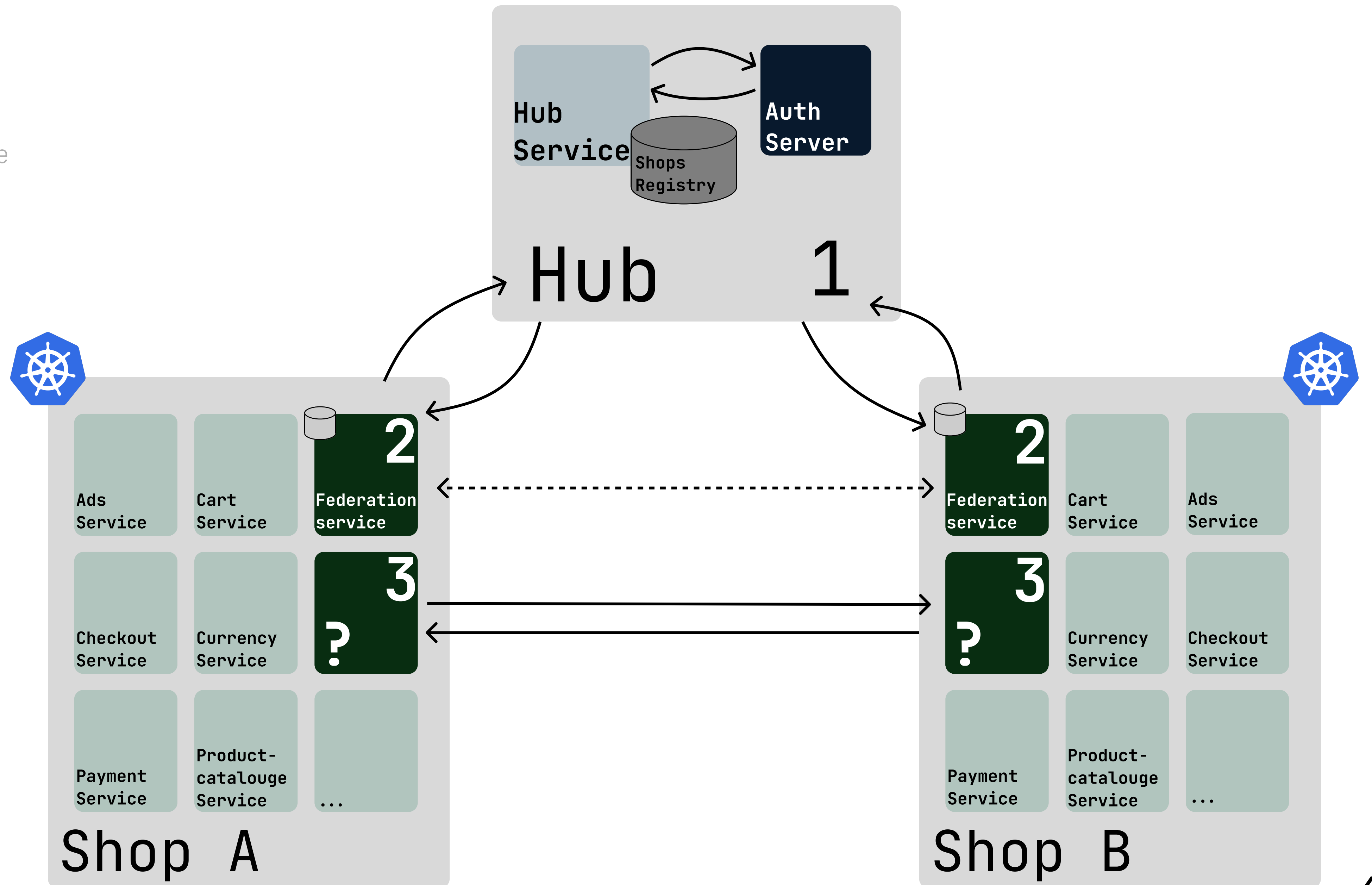
Download **the Federation Service** and add it to your cluster.

partnerships Partnership communication

[Find out more](#) ^



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A



03

Introduction

04

Vision

05

● **Solutions**

06

Architecture

07

Demo

08

Q&A

Research question 2:
How to enable stores
to exchange
inventory with each
other in an
efficient way?

03

Redirection

04

Vision

05

● Solutions

How do stores exchange inventory?

06

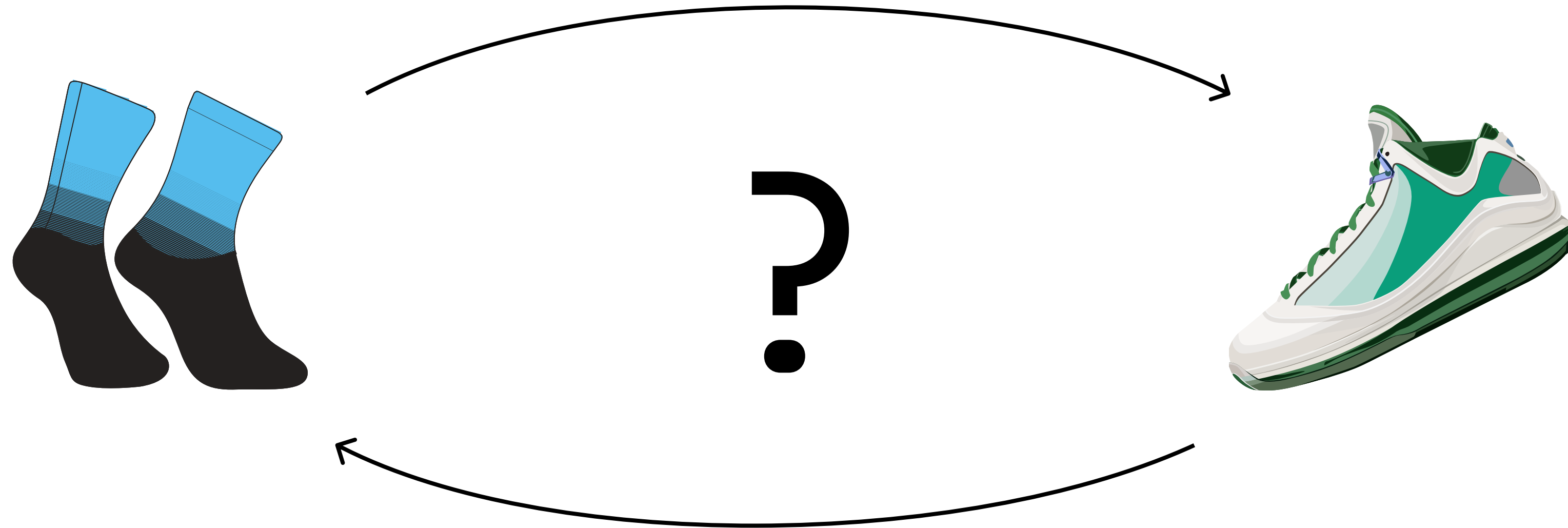
Architecture

07

Demo

08

Q&A



03

Redirection

04

Vision

05

● Solutions

How do stores exchange inventory?

06

Architecture

07

Demo

08

Q&A



03

Federation

04

Vision

05

● Solutions

06

Architecture

07

Demo

08

Q&A

What does Inventory Exchange Service do?

01 Allowing shops to get products from its partners

**Inventory
Exchange
Service**

03

Federation

04

Vision

05

● Solutions

06

Architecture

07

Demo

08

Q&A

What does Inventory Exchange Service do?

01

Allowing shops to get products from its partners

02

Enabling shops to check if an item is available for purchase

**Inventory
Exchange
Service**

03

Federation

04

Vision

05

● Solutions

What does Inventory Exchange Service do?

06

Architecture

07

Demo

08

Q&A

01

Allowing shops to get products from its partners

02

Enabling shops to check if an item is available for purchase

03

Letting stores exchange order information

**Inventory
Exchange
Service**

03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Inventory Exchange Service API

**Inventory
Exchange
Service**

GET Products /api/v1/products

Each shop will periodically call the other to receive product info. Want to keep the number of requests down.



03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

GET Product /api/v1/product/{id}

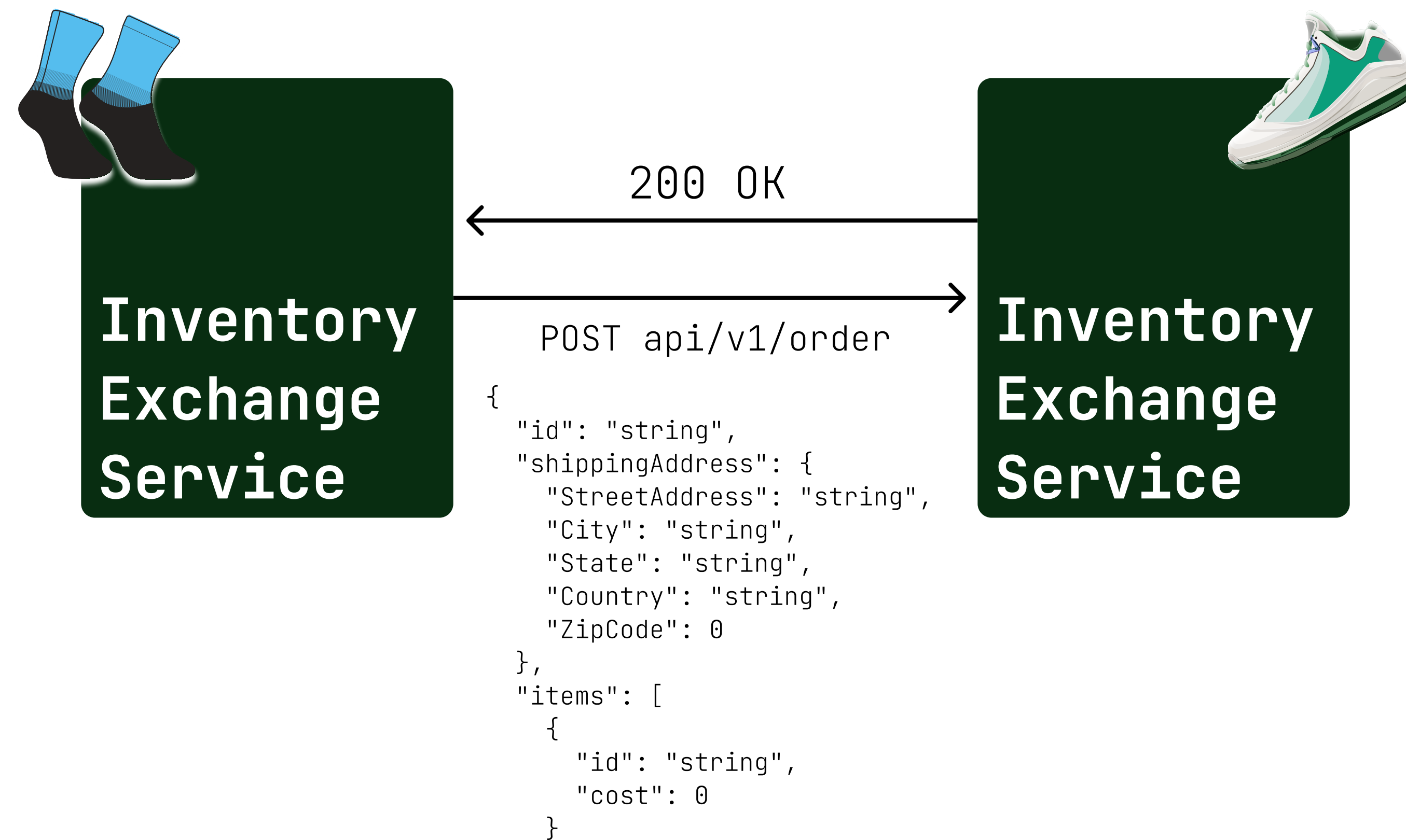
Check if there's enough inventory to make the purchase and reserve item.



03	Introduction
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

POST Order /api/v1/order

Exchange order information between stores.



03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Problems faced while working with the Inventory Exchange Service

**Inventory
Exchange
Service**

03	Introduction
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Problem 01 ! Standardizing all data exchanged

- Documenting data exchanges into schemas in an API protocol.
- Need to convert price to US dollars before sending it to partner shops.



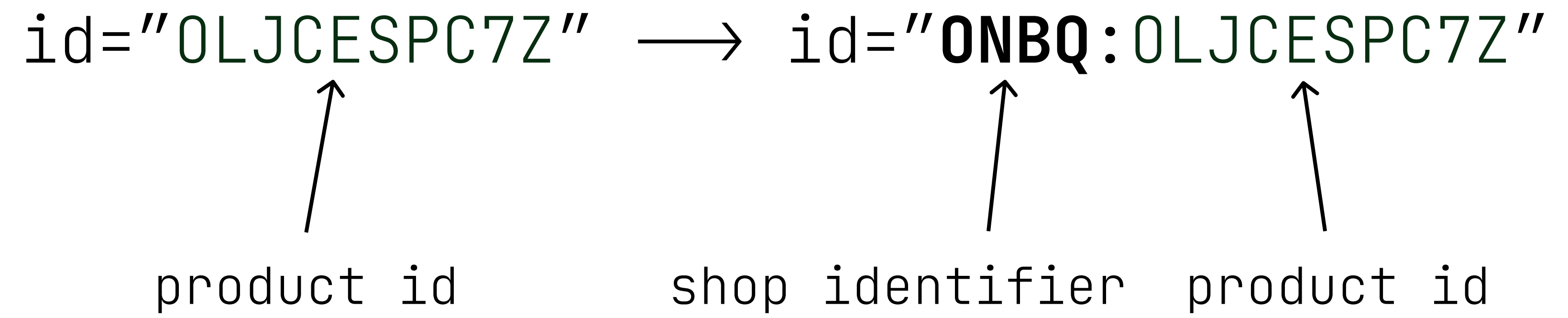
```
[  
  {  
    "id": "string",  
    "name": "string",  
    "description": "string",  
    "price": 0,  
    "imageUrl": "string"  
  }  
]
```

03
04
05
06
07
08

Introduction
Vision
Solutions
Architecture
Demo
Q&A

Problem 02 ! Product ID handling between shops

- Can cause conflicts
→ Add shop identifier in the beginning of product id



03	Introduction
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

Problem 03 ! Billing & Shipping

- Want to make it as convenient as possible for user
- Trust issues with payments
- Third party bank or other solution



03	Introduction
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

How to get started as a shop?

- Build the Inventory Exchange Service. Follow API documentation and protocol.
- Example service in Go that can be used as boiler plate.

default		^
GET	/api/v1/products Retrieve products	✓ ↩
GET	/api/v1/product/{id} Check if product is available for purchase and reserve product by ID	✓ ↩
POST	/api/v1/order Create an order	✓ ↩
Schemas		✓

03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

Research question 3: How to observe transactions across shops without sacrificing performance?

03	Federation
04	Vision
05	● Solutions
06	Architecture
07	Demo
08	Q&A

What are we monitoring?

- 01 We needed to prioritize and decided to start with monitoring **business metrics**
- 02 This basically means monitoring the Inventory Exchange Service to see how other stores interact with your products
- 03 There are many metrics that we could have tracked

03	Federation
04	Vision
05	Solutions
06	Architecture
07	Demo
08	Q&A

How did we do it?



Prometheus for monitoring



Grafana for displaying data

03

Federation

04

Vision

05

**Solutions**

06

Architecture

07

Demo

08

Q&A

Will running Prometheus sacrifice performance?

01

Running Prometheus itself does not sacrifice performance.

02

Prometheus collects metrics by periodically scraping targets

03

The scraping process involves making HTTP requests, which can introduce some overhead, but its impact is expected to be minimal.



03

Federation

04

Vision

05



Solutions

06

Architecture

07

Demo

08

Q&A

What metrics are we currently tracking

01

How many times a store polls your inventory

02

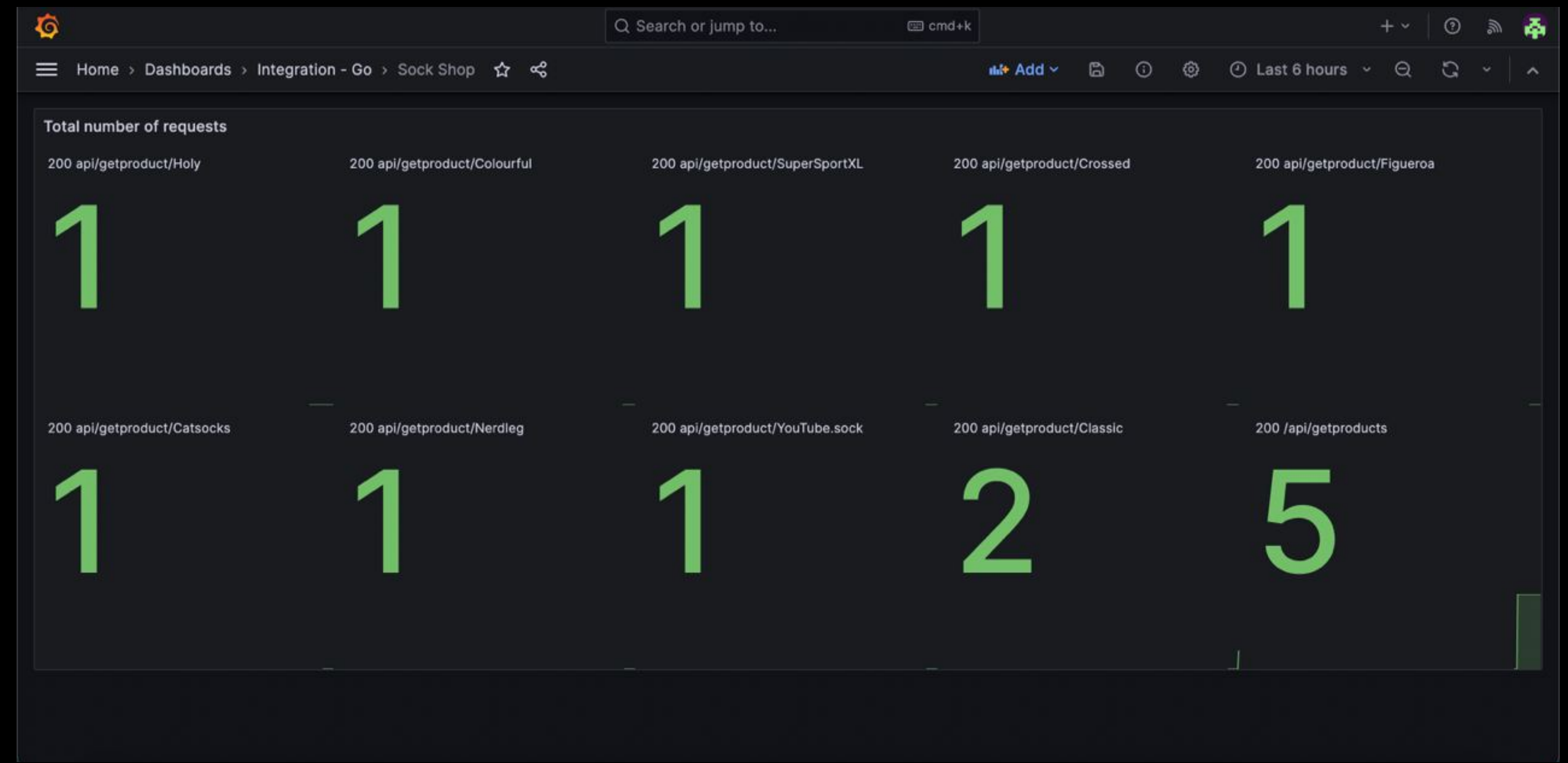
How many times someone has bought an item, also tracking if purchase fails due to lack of inventory

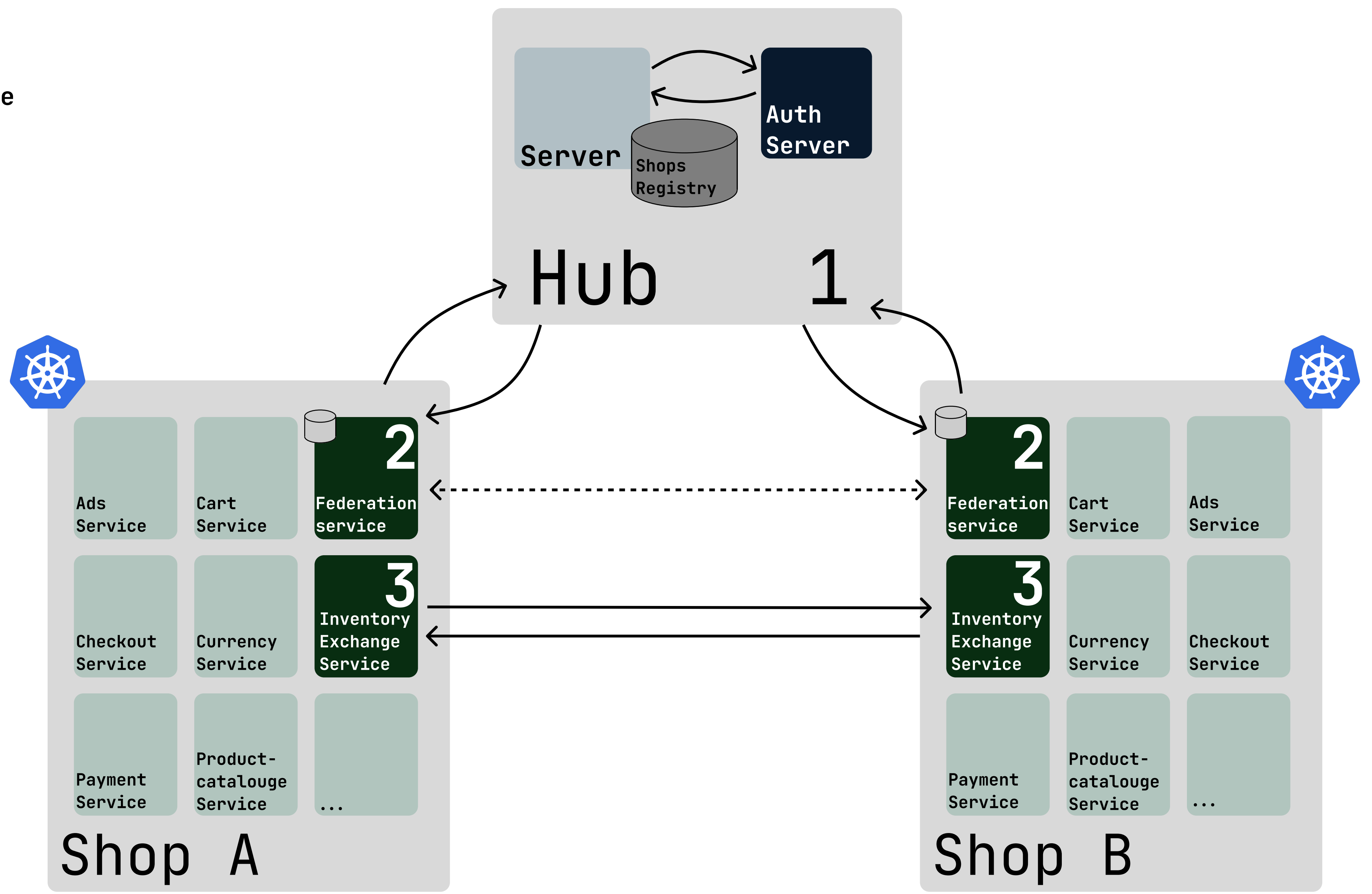
03

How many external orders you have received from partners



Grafana Dashboard v1.0





05	Solutions
06	Architecture
07	Demo
08	Q&A

Demo

05	Solutions
06	Architecture
07	Demo
08	Q&A

Recap: What do I have to
do to join the federation?

05

Solutions

06

Architecture

07



Demo

08

Q&A

What do I have to do to join the federation?

01

Download **Federation Service** and run it in your cluster

02

Implement and run the **Inventory Exchange Service** according to protocol

Thank you!

Q&A