

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

Cover

01



Problem

02

Federation

03

Vision

04

Solutions

05

Architecture

06

Demo

07

Q&A



Ali Aziri



Aamruth Shankar



Denis Koshelev



Filippa Leuckfeld



Georgiy Rudnev



Vuk Stojković

01

Team

02

 **Problem**

03

Federation

04

Vision

05

Solutions

06

Architecture

07

Demo

08

Q&A

Problems with centralized marketplaces

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

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

02

Does not provide
control and
flexibility

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

02

Does not provide
control and
flexibility

03

Relying on a
single platform
increases
vulnerability

Team

Problem

03 Federation

Vision

Solutions

Architecture

Demo

Q&A

What's a federated marketplace?

01

Team

02

Problem

03

Federation

04

Vision

05

Solutions

06

Architecture

07

Demo

08

Q&A

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

The image is a composite of two parts. On the left, a close-up photograph shows a person's hands, adorned with multiple rings, working on a brown Salomon running shoe. The shoe has white floral decorations on its laces. A blue banner with the text "Google Cloud" is overlaid on the top left of the photo. On the right, a screenshot of an e-commerce website for "ONLINEBOUTIQUE". The header includes the logo, the store name, a currency selector set to USD, and a search icon. Below the header, the text "Hot Products" is displayed above six pairs of shoes arranged in a grid. The products are: Arizona SFB VL (black sandals), Alpha Force 88 (white and red sneakers), Gel-NYC (tan and grey sneakers), Samba OG (black and white Adidas-style shoes), Chuck 70 Fall Tone (tan high-top Converse-style shoes), and 9060 (grey and black New Balance-style shoes). Each product has a small image, the name, and a price.

Product	Price
Arizona SFB VL	\$129.99
Alpha Force 88	\$140.00
Gel-NYC	\$128.99
Samba OG	
Chuck 70 Fall Tone	
9060	

01

Team

02

Problem

03

● Federation

04

Vision

05

Solutions

06

Architecture

07

Demo

08

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

Team

02

Problem

03

● Federation

04

Vision

05

Solutions

06

Architecture

07

Demo

08

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

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

01
Team

02
Problem

03
● Federation

04
Vision

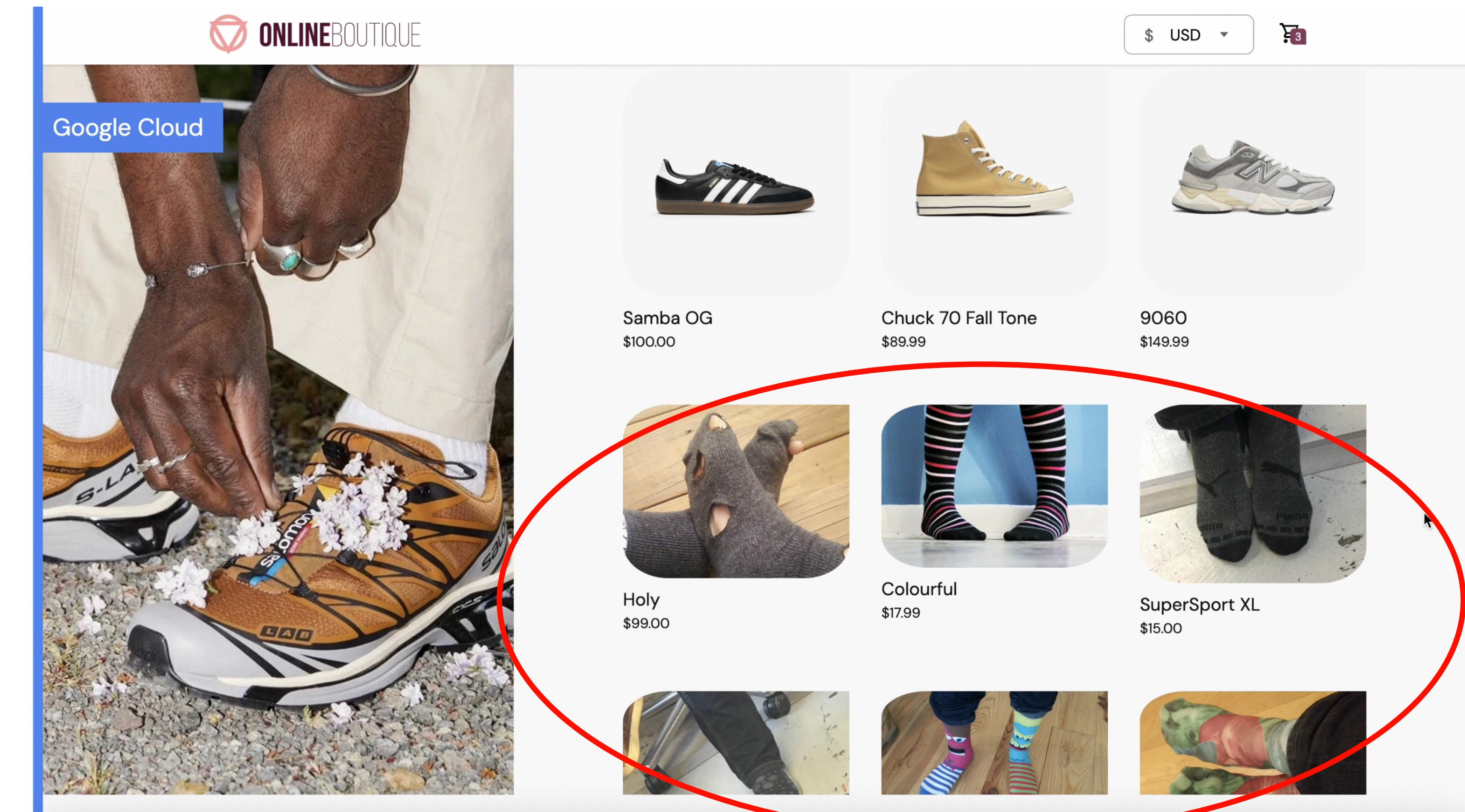
05
Solutions

06
Architecture

07
Demo

08
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**.”

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**.

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?

Vision

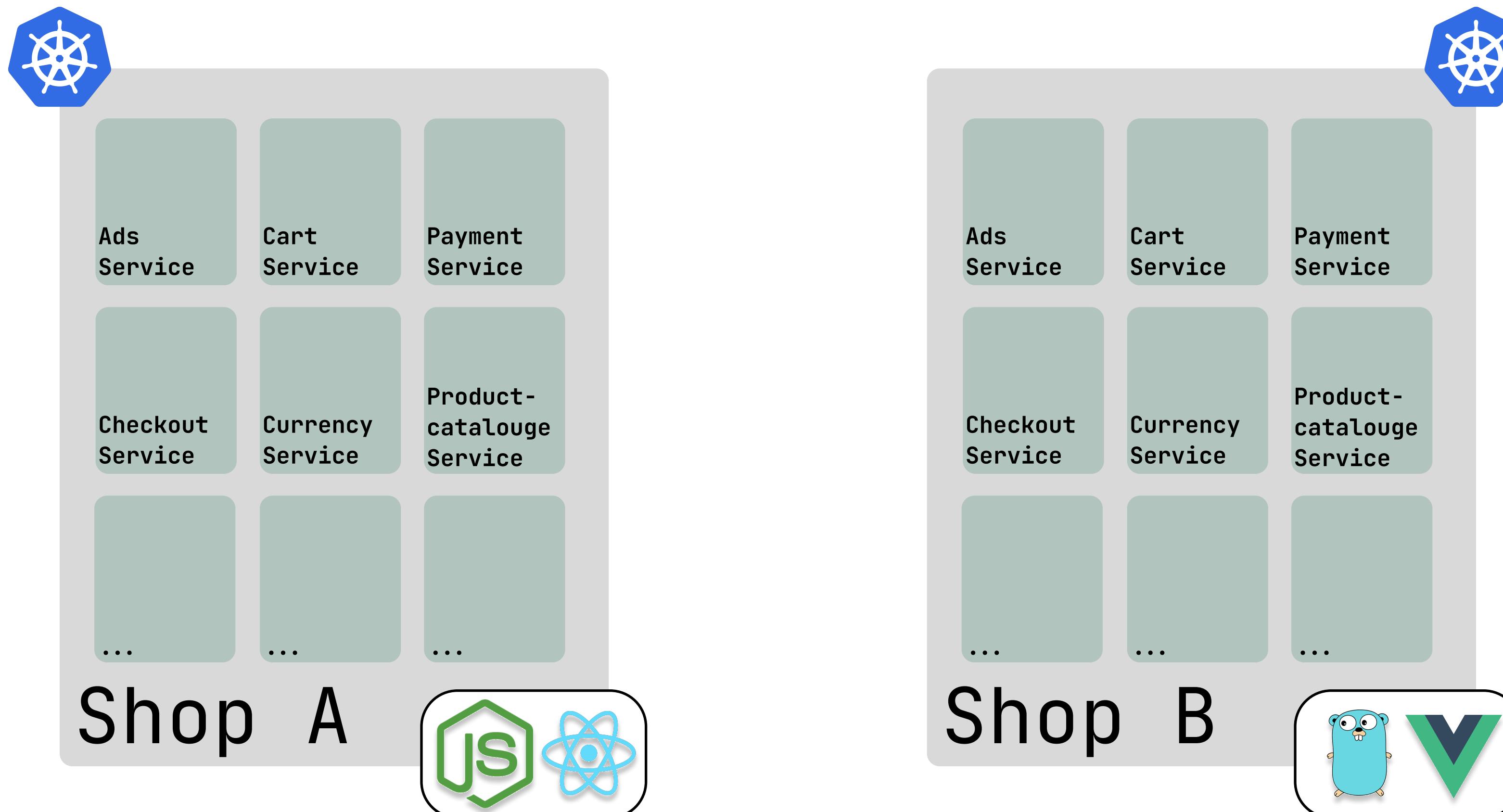
- **Solutions**

Working with **Microservices** is complex

Architecture

Demo

Q&A



01

Team

02

 Problem

03

Federation

04

Vision

05

Solutions

06

Architecture

07

Demo

08

Q&A

Challenges we faced of working with Microservices

01

High complexity

- Multiple services
- Different stacks
- Complex architecture

02

Teams Organization

- Team worked on different services
- A challenge to make them compatible
- Important with great communication

03

Development time

- Long development times due to many services
- Did not support apple M1/M2 architecture

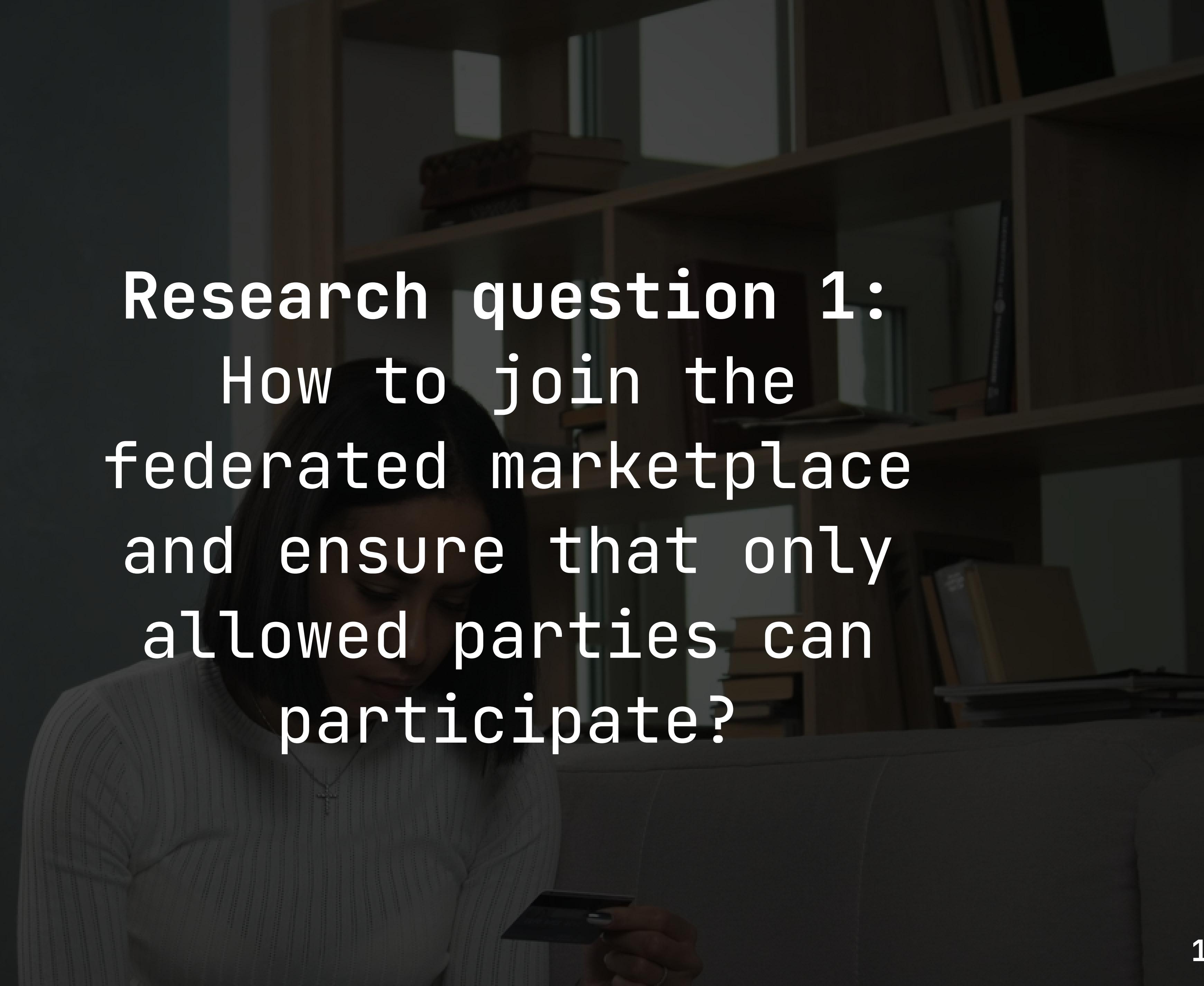
04
Vision

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?

Vision

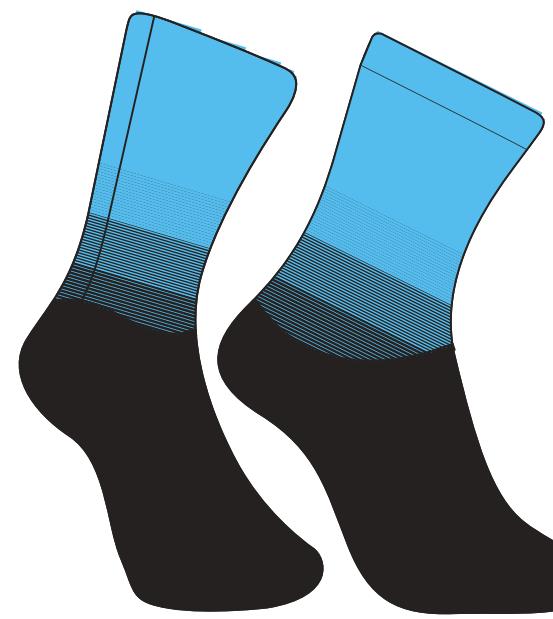
 Solutions

Architecture

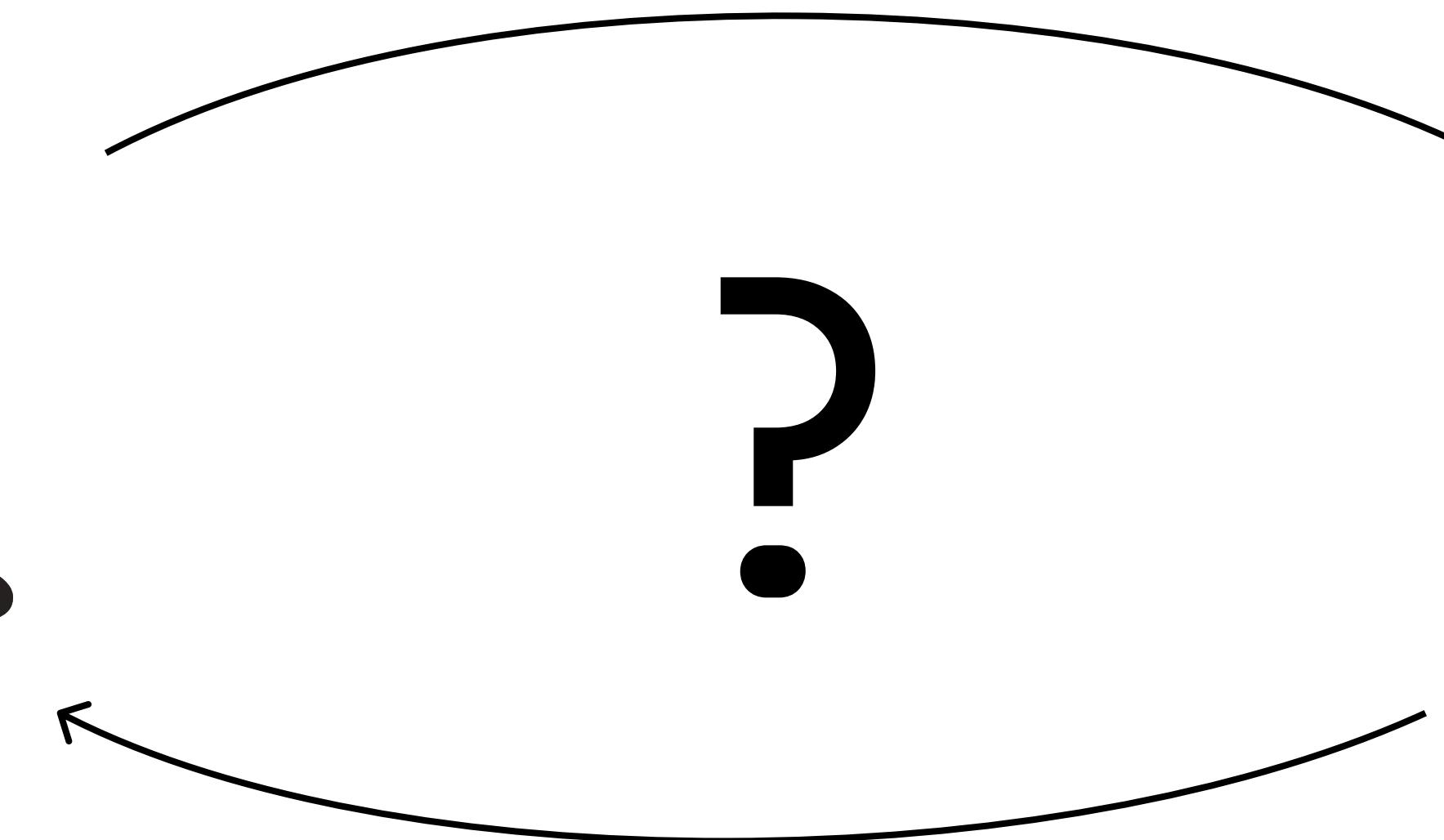
Demo

Q&A

How do stores find each other?



?



Vision

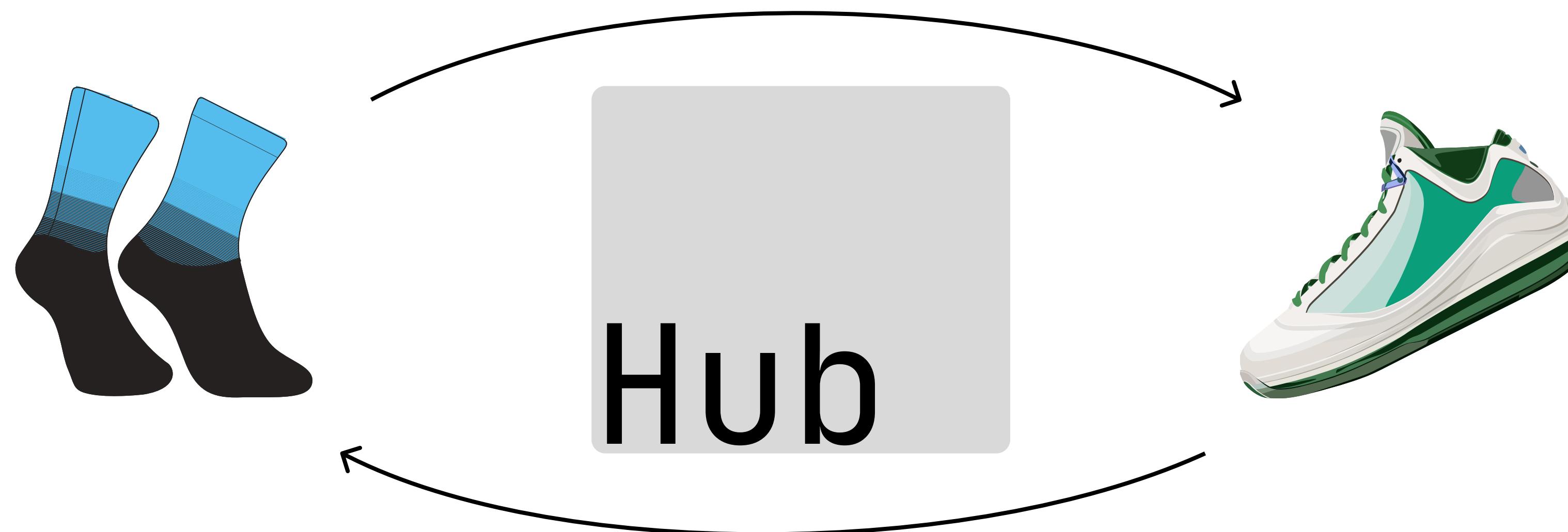
 Solutions

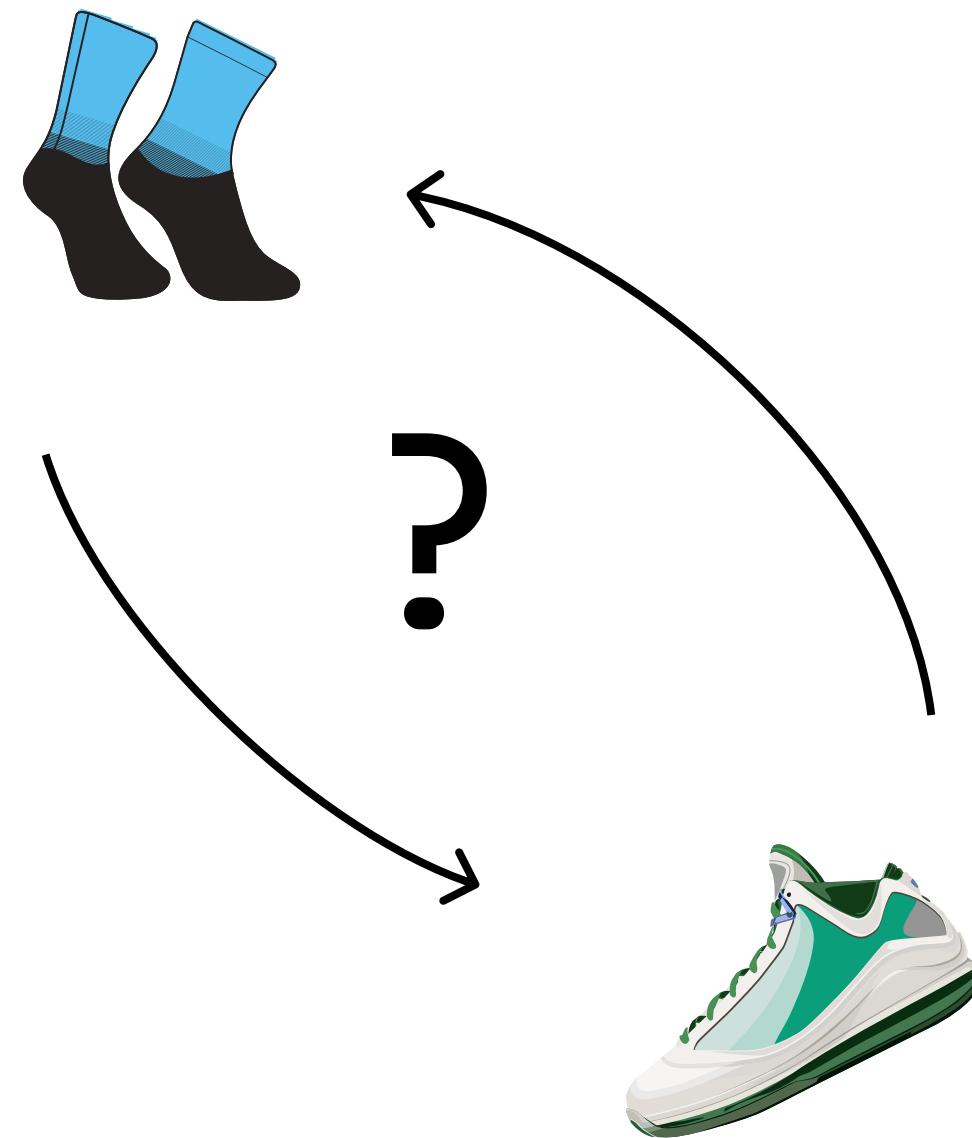
Architecture

Demo

Q&A

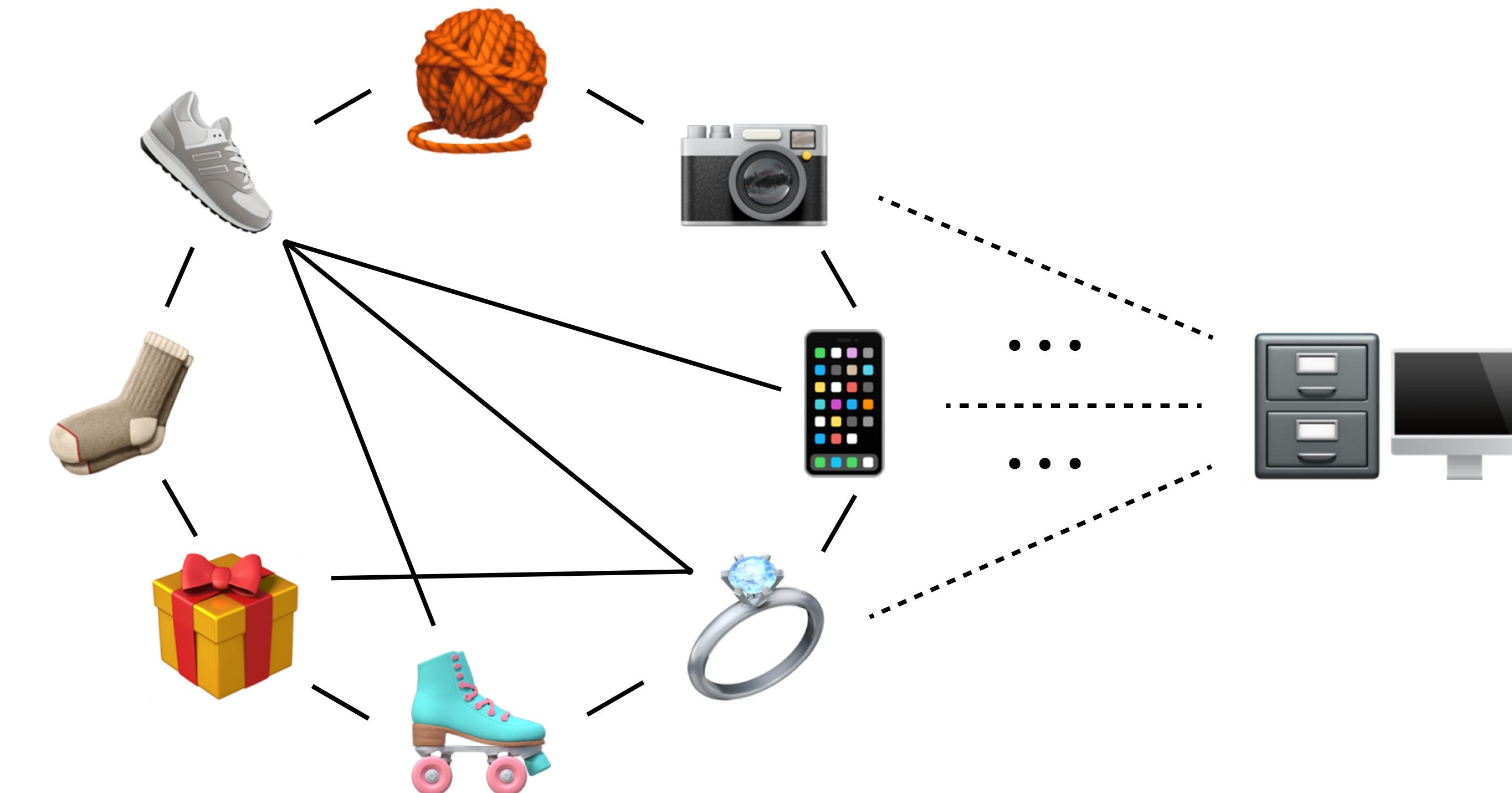
How do stores find each other?



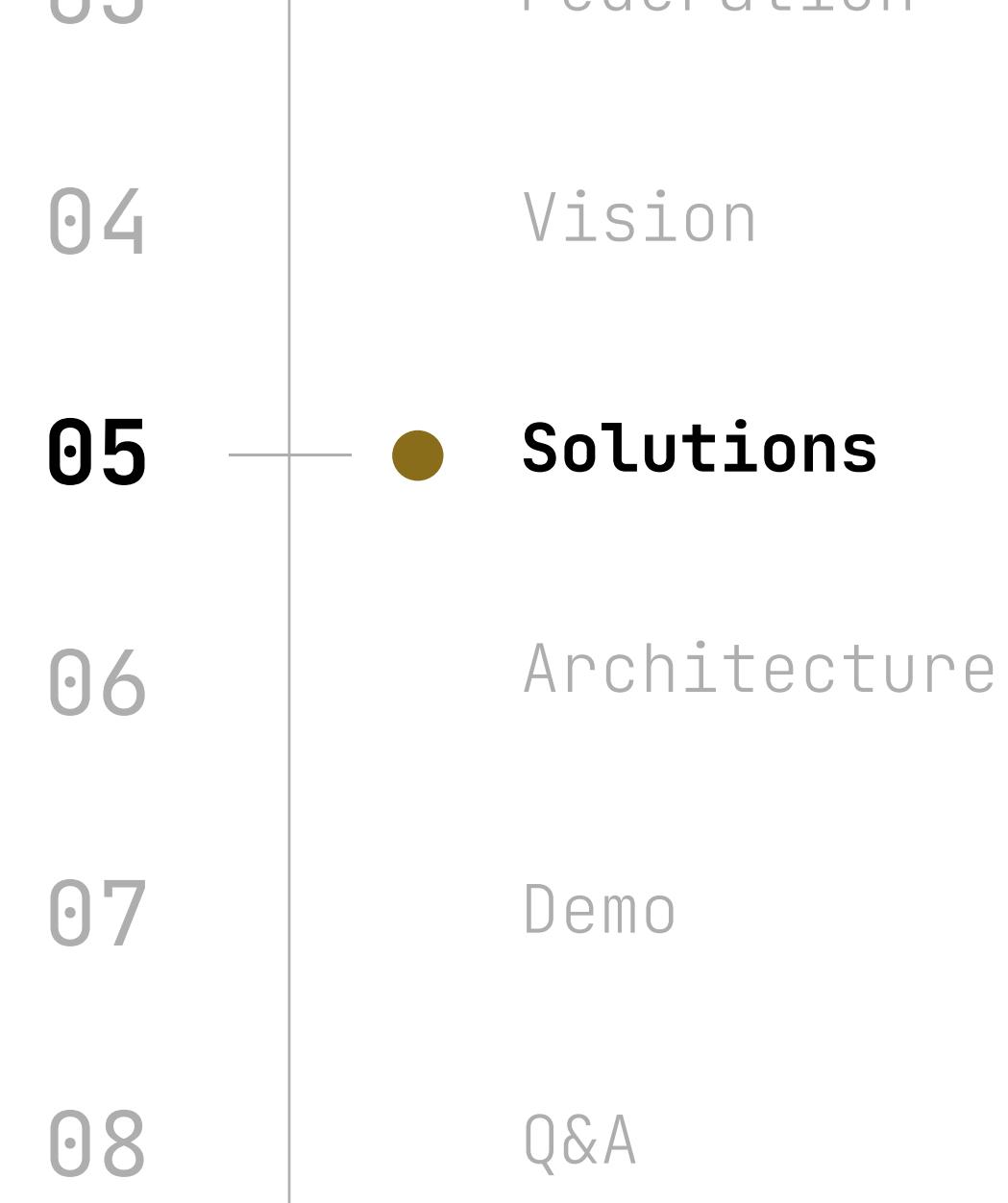


How do stores find each other?

Our choice: Federation Hub



Hub



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**

Hub

What does Federation Hub do?

- 01 Allows shops to join and leave federation

Solutions

Architecture

Demo

Q&A

Vision

05

06

07

08

03

04

05

06

07

08

04
Vision05
● Solutions06
Architecture07
Demo08
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



04
Vision05
● Solutions06
Architecture07
Demo08
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!**



Vision

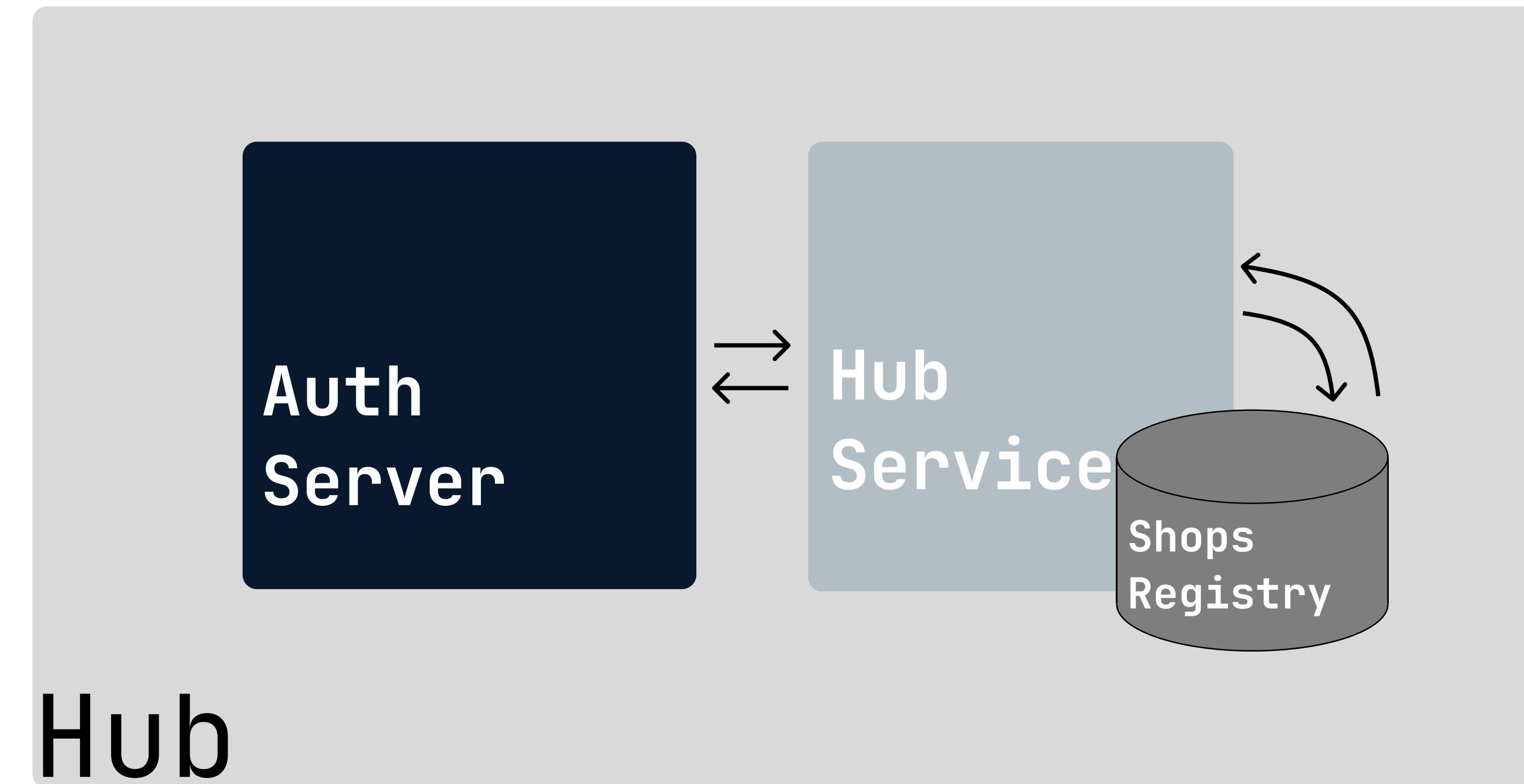
Solutions

Architecture

Demo

Q&A

What is under the hood?



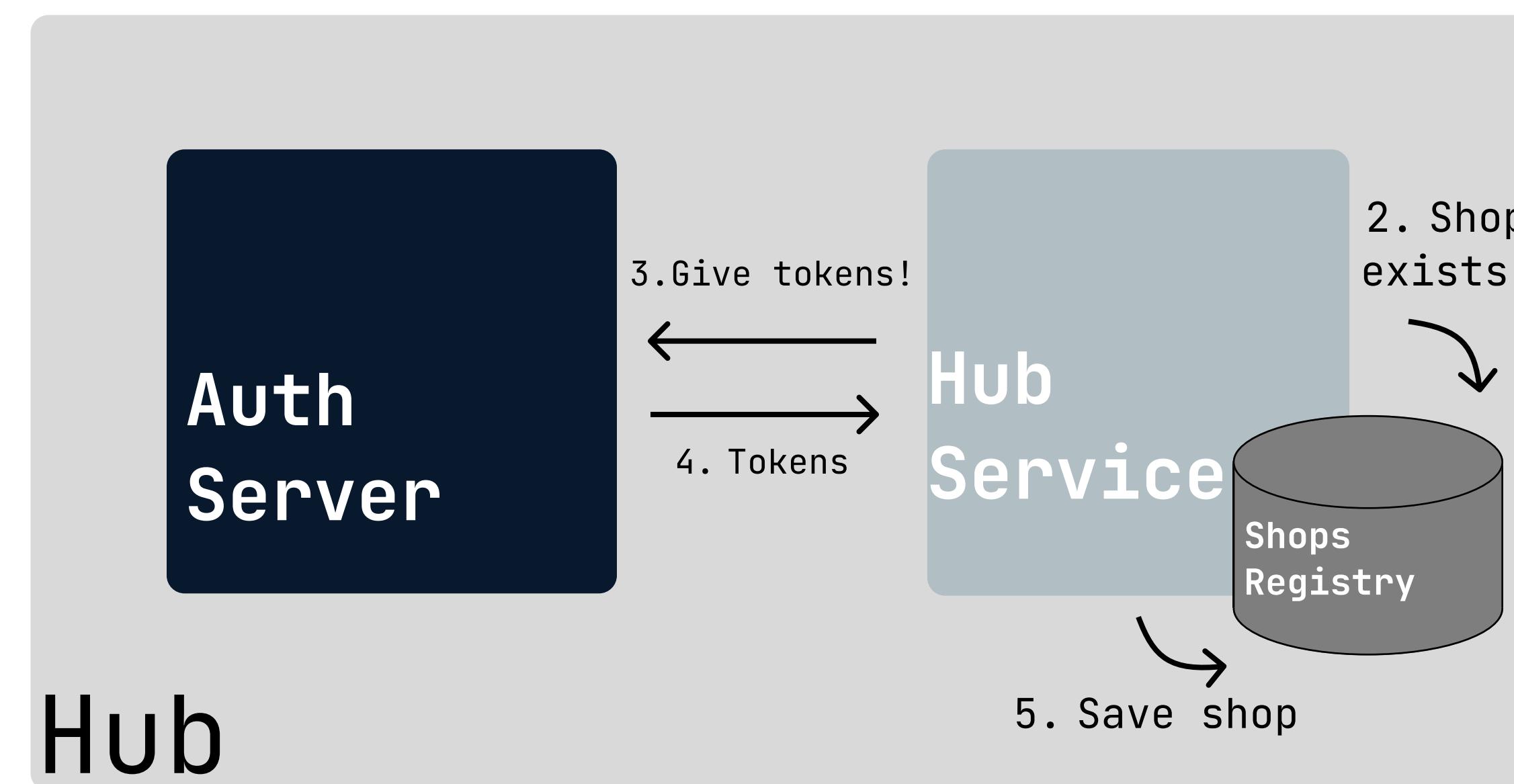
- Solutions

How does a shop join the Federation?

Architecture

Demo

Q&A



0. Generate
public and
private keys



Vision

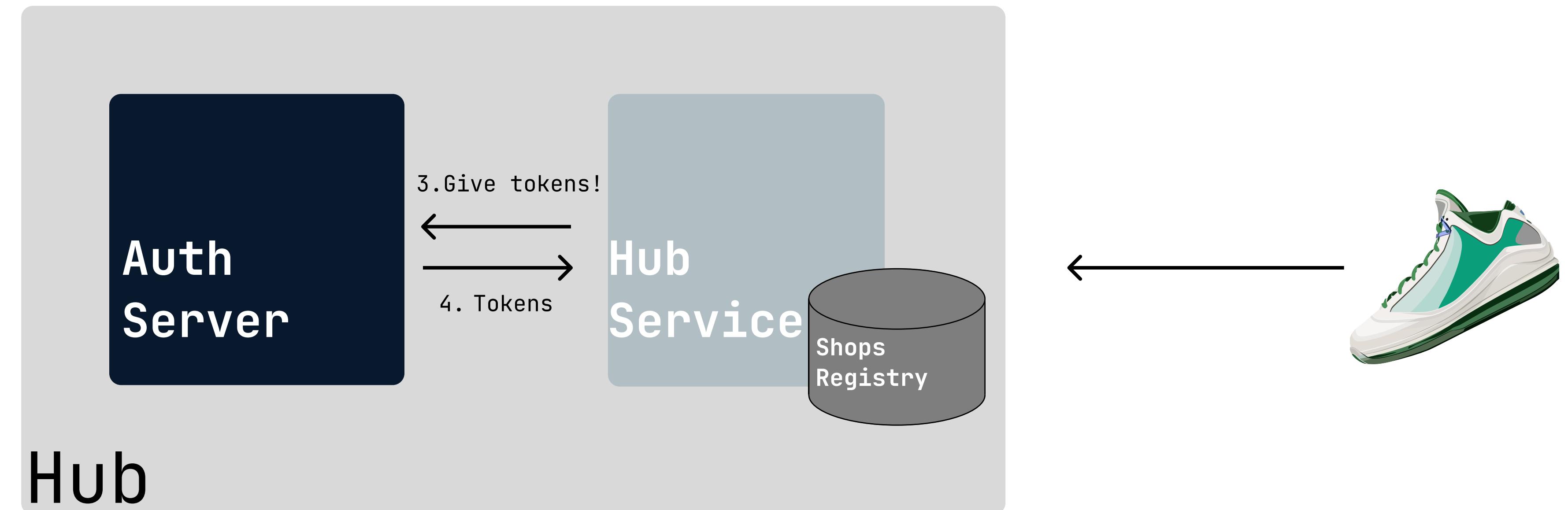
● Solutions

Architecture

Demo

Q&A

1. Ask authentication server for access / refresh tokens



Vision

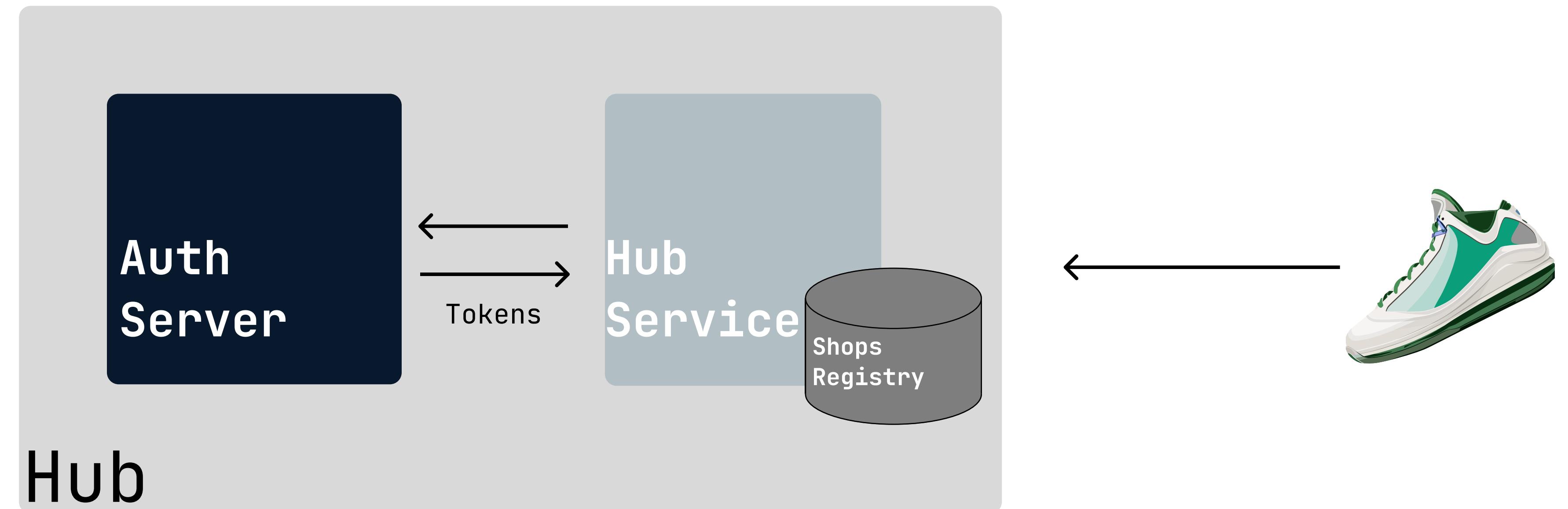
● Solutions

Architecture

Demo

Q&A

2. Get tokens for a shop



Vision

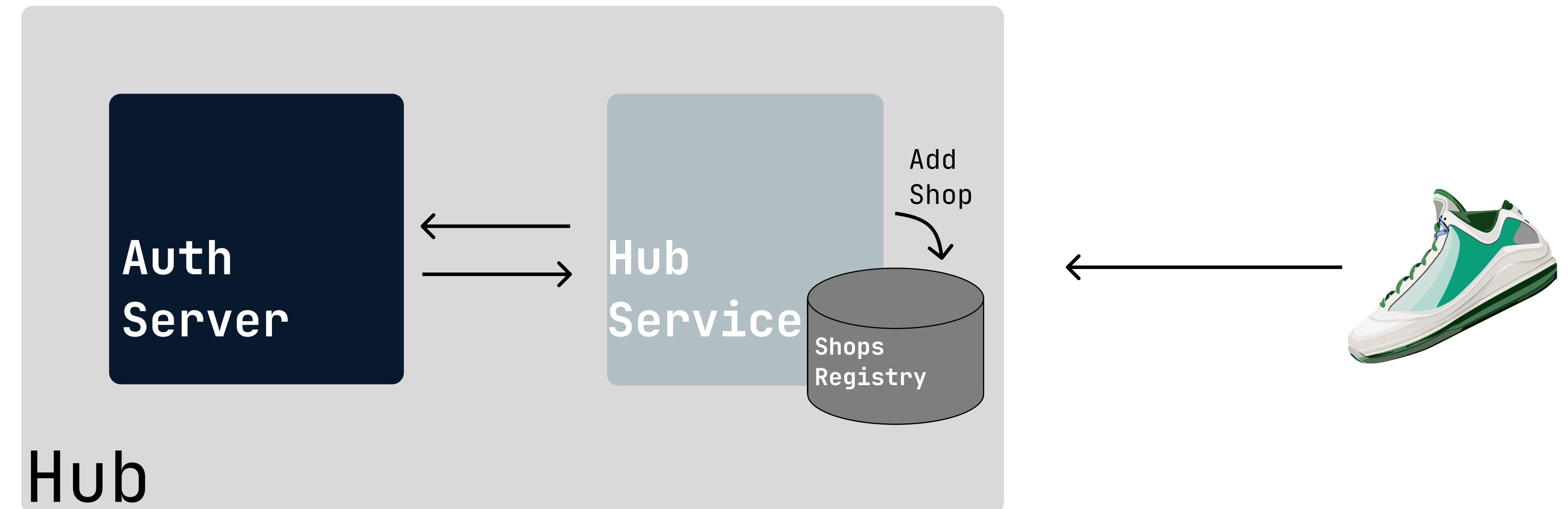
● Solutions

Architecture

Demo

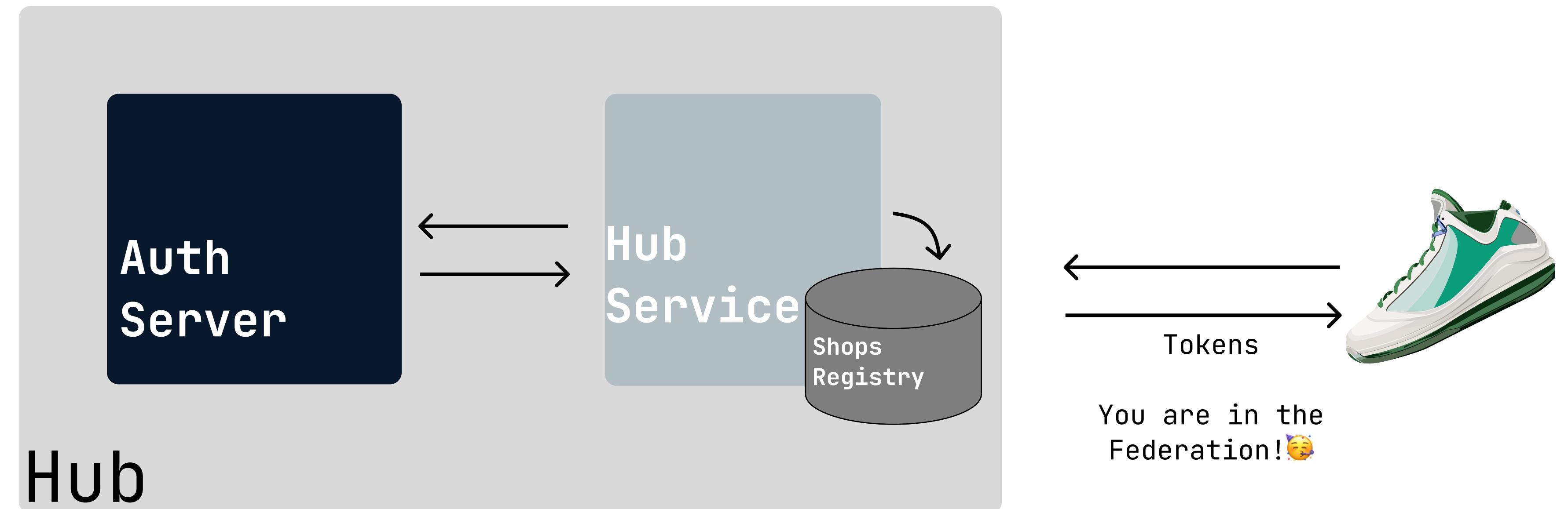
Q&A

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



- Solutions

4. Return tokens and celebrate new member!



Vision

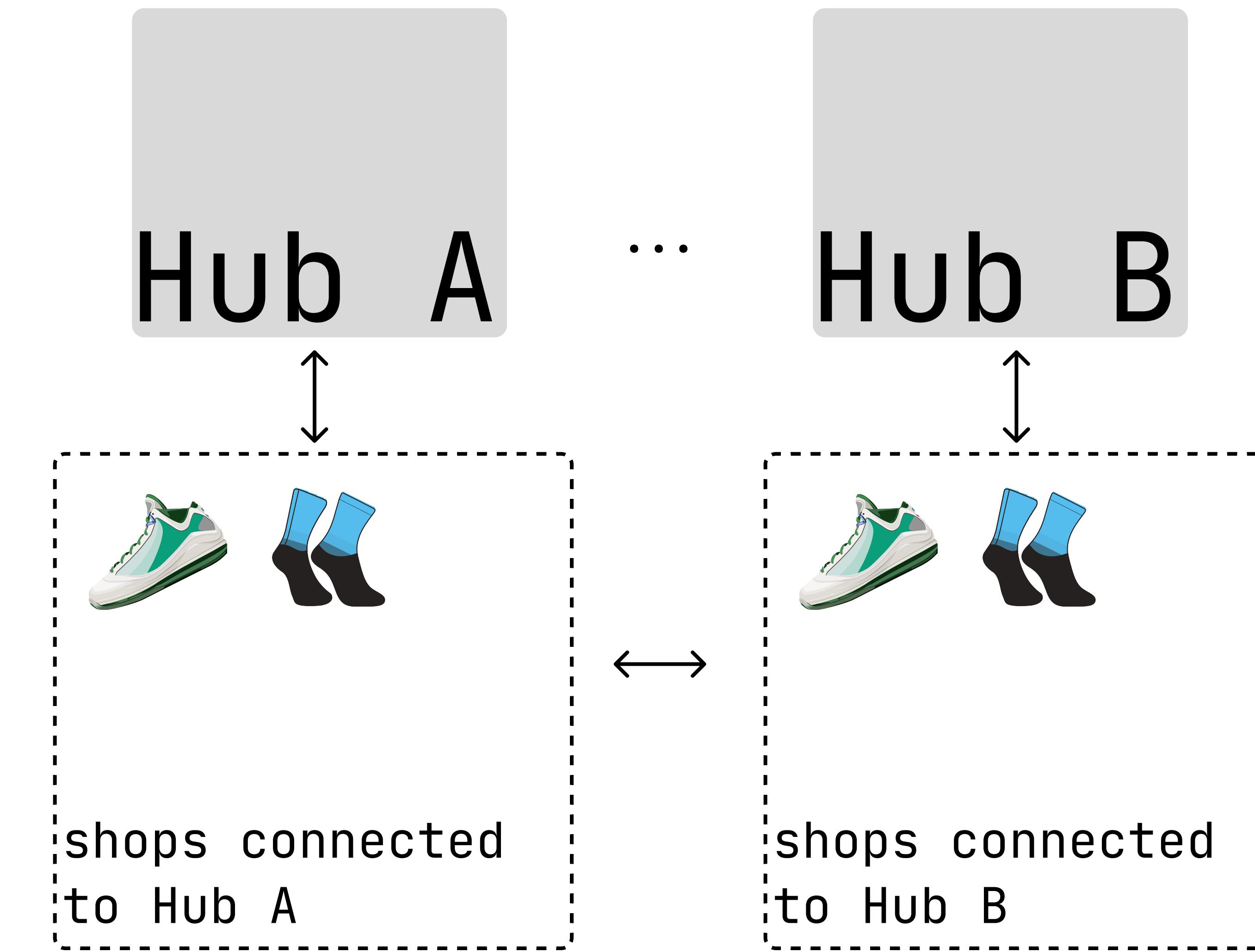
● Solutions

Architecture

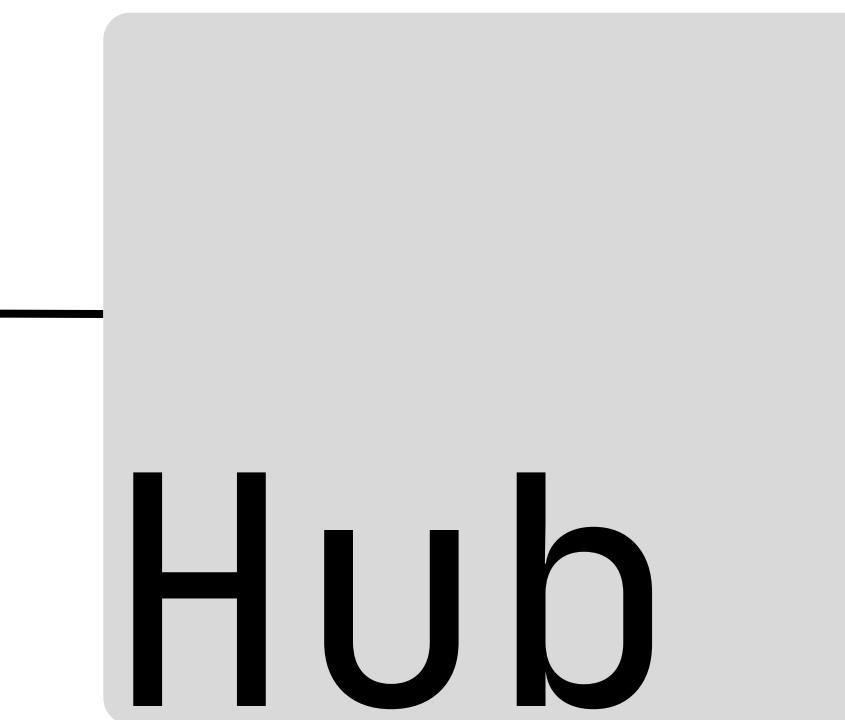
Demo

Q&A

How do shops know about each other?



Notify all shops in the Federation about new shop joined.



Notify all shops
about new shop

Tokens 😊



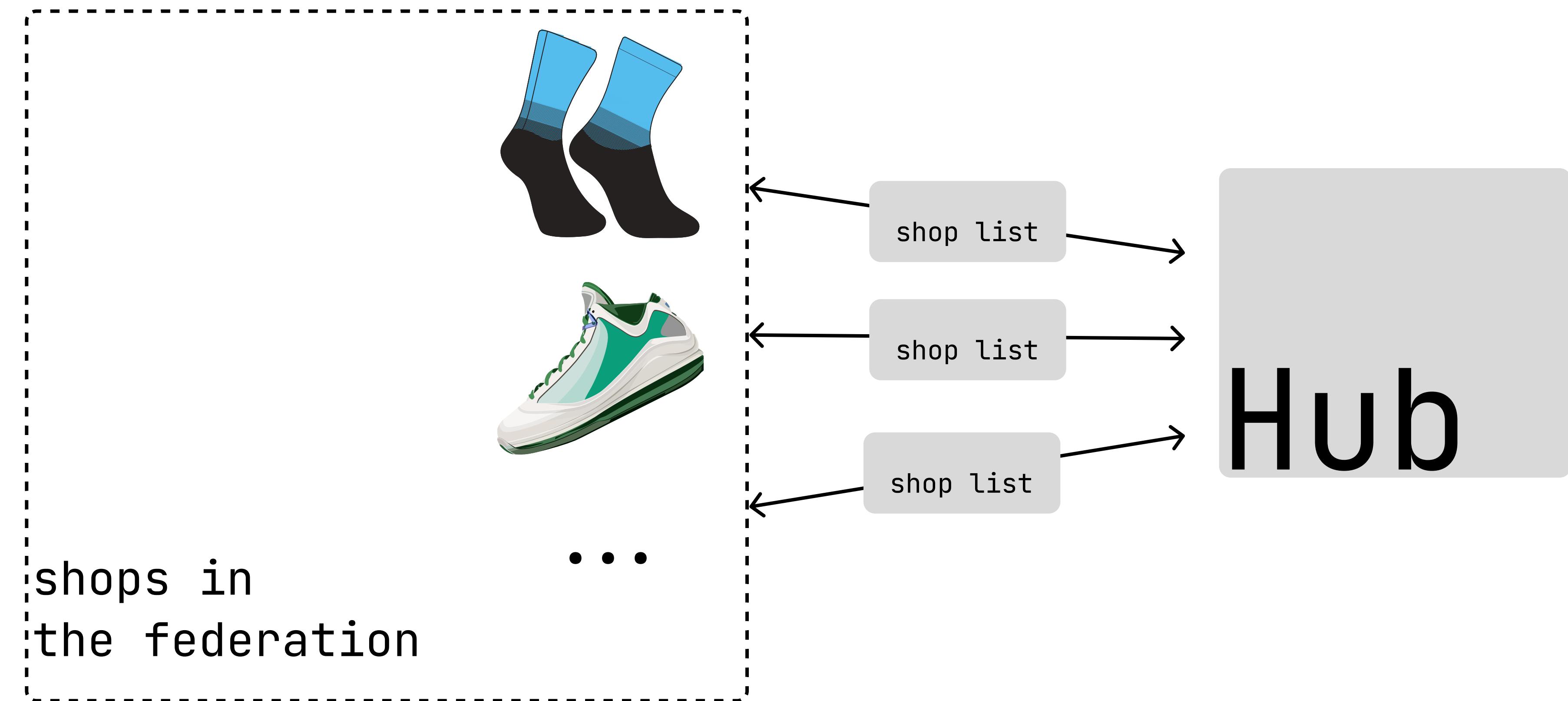
Solutions

Architecture

Demo

Q&A

Periodical polling of current shop list



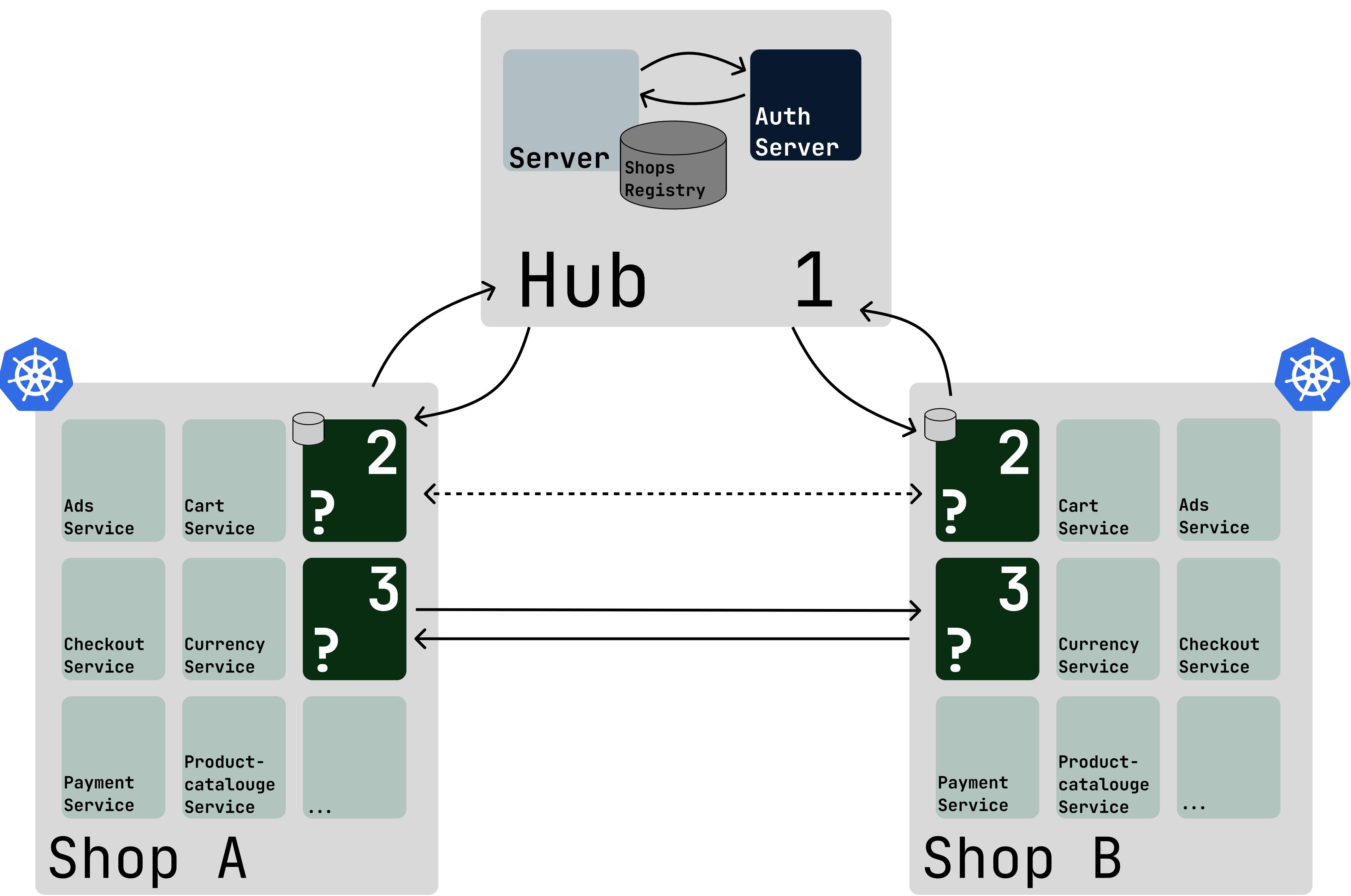
Vision

Solutions

Architecture

Demo

Q&A



Vision

● Solutions

Architecture

Demo

Q&A

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



?

Hub

Vision

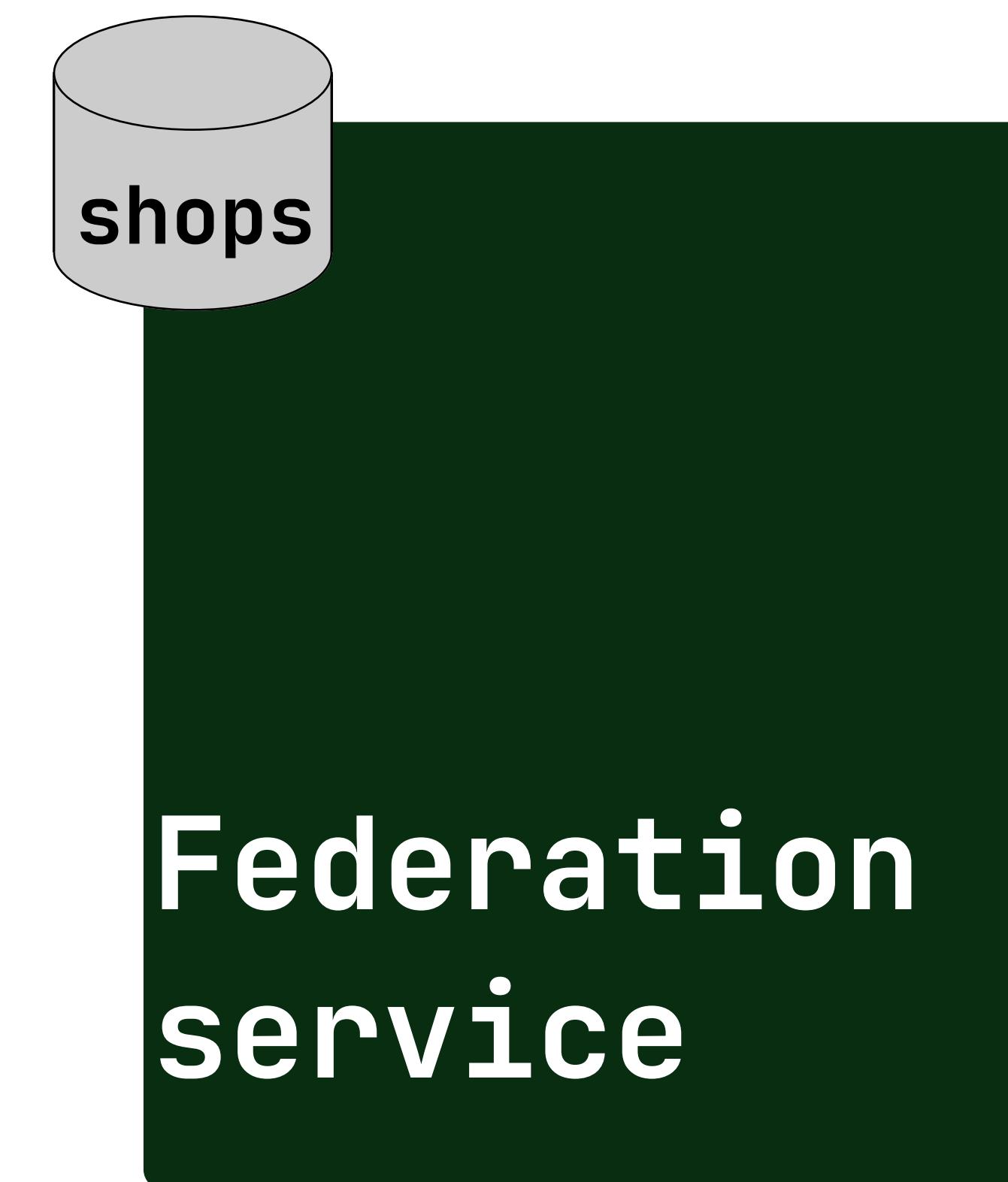
Solutions

Architecture

Demo

Q&A

How does a shop handle all this on its side?



Vision

 Solutions

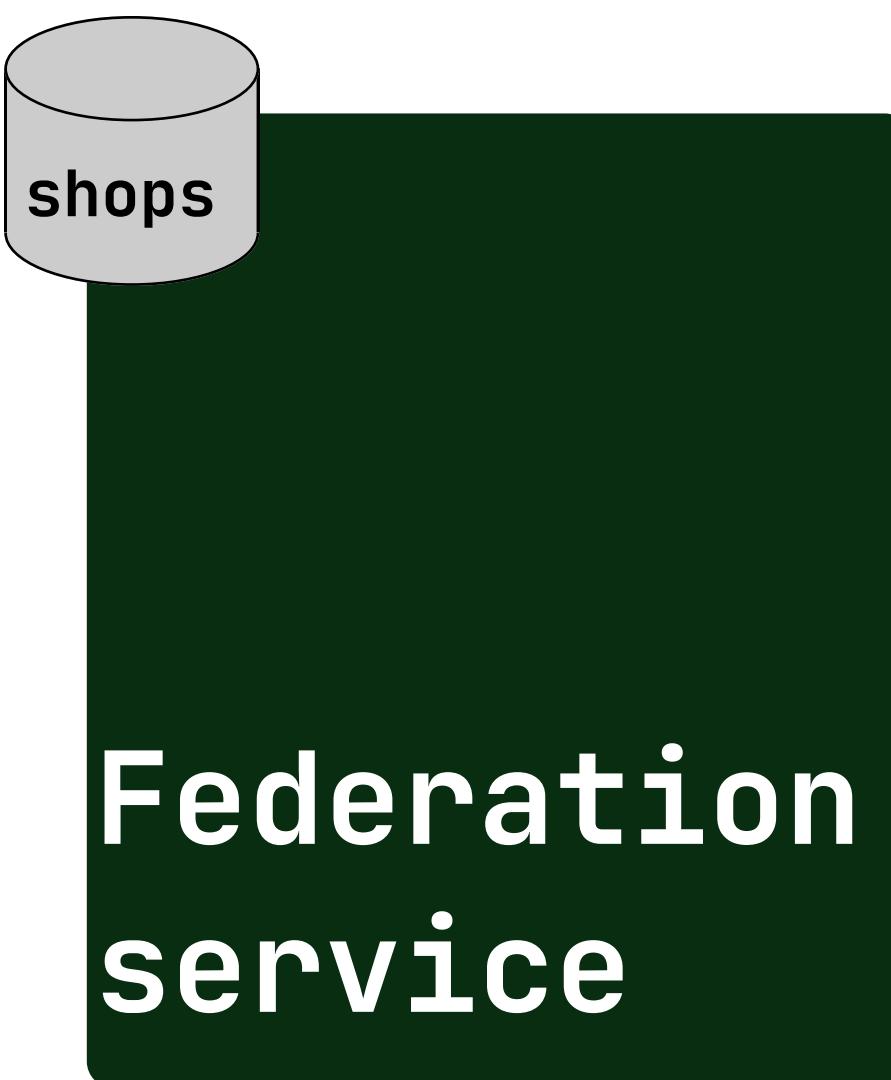
Architecture

Demo

Q&A

What is federation service?

- 01 Allows communication with **the Hub**



Vision

 Solutions

Architecture

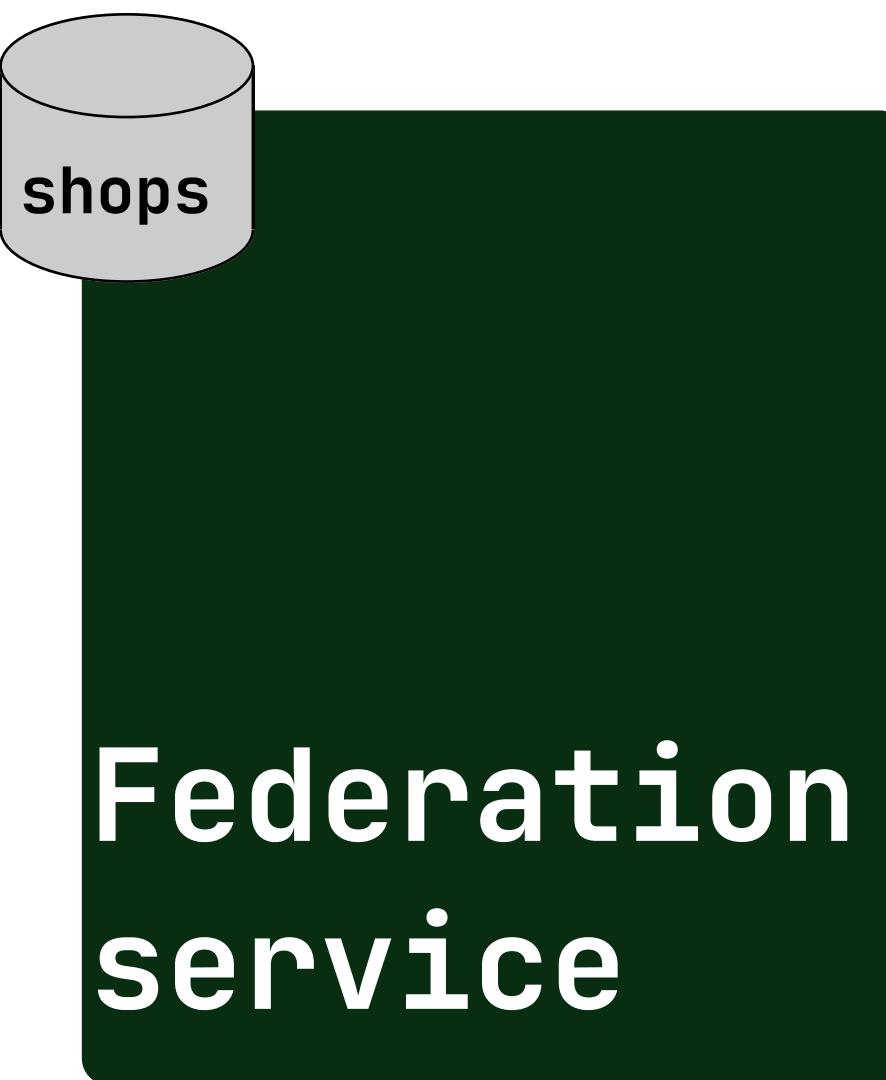
Demo

Q&A

What is federation service?

01 Allows communication with **the Hub**

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



Vision

 Solutions

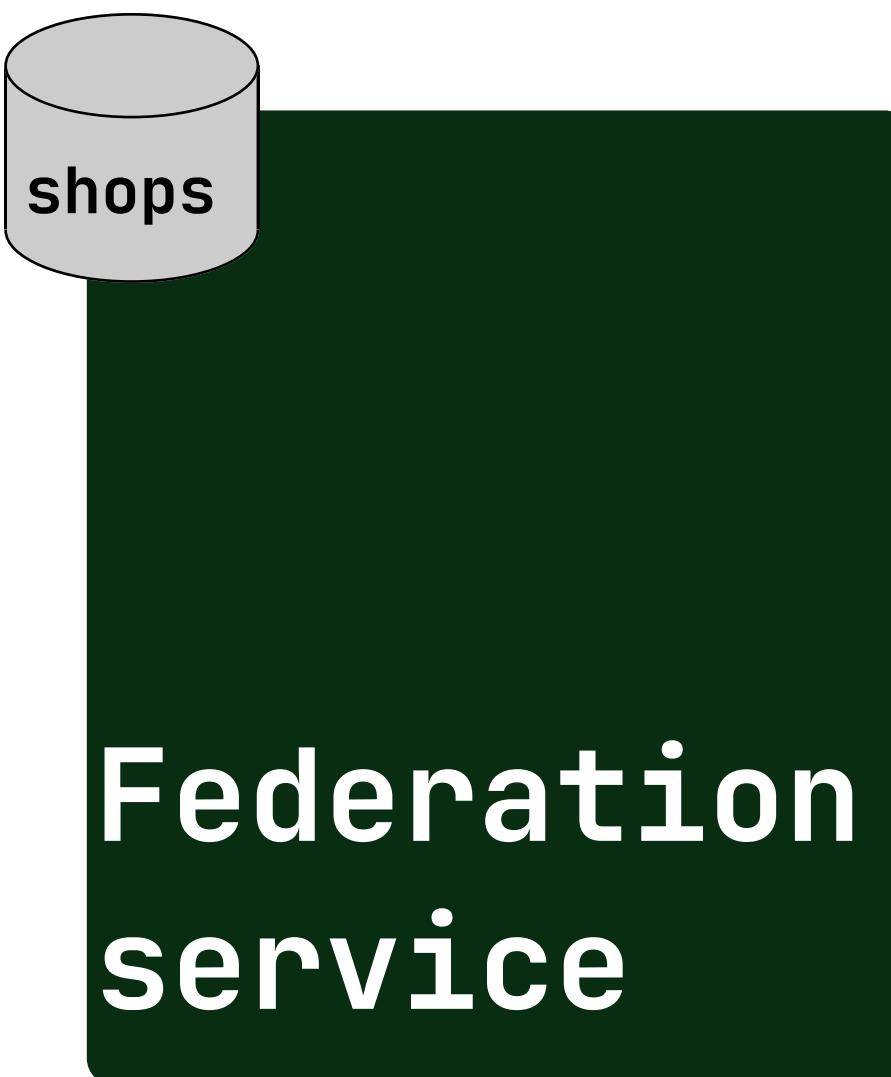
Architecture

Demo

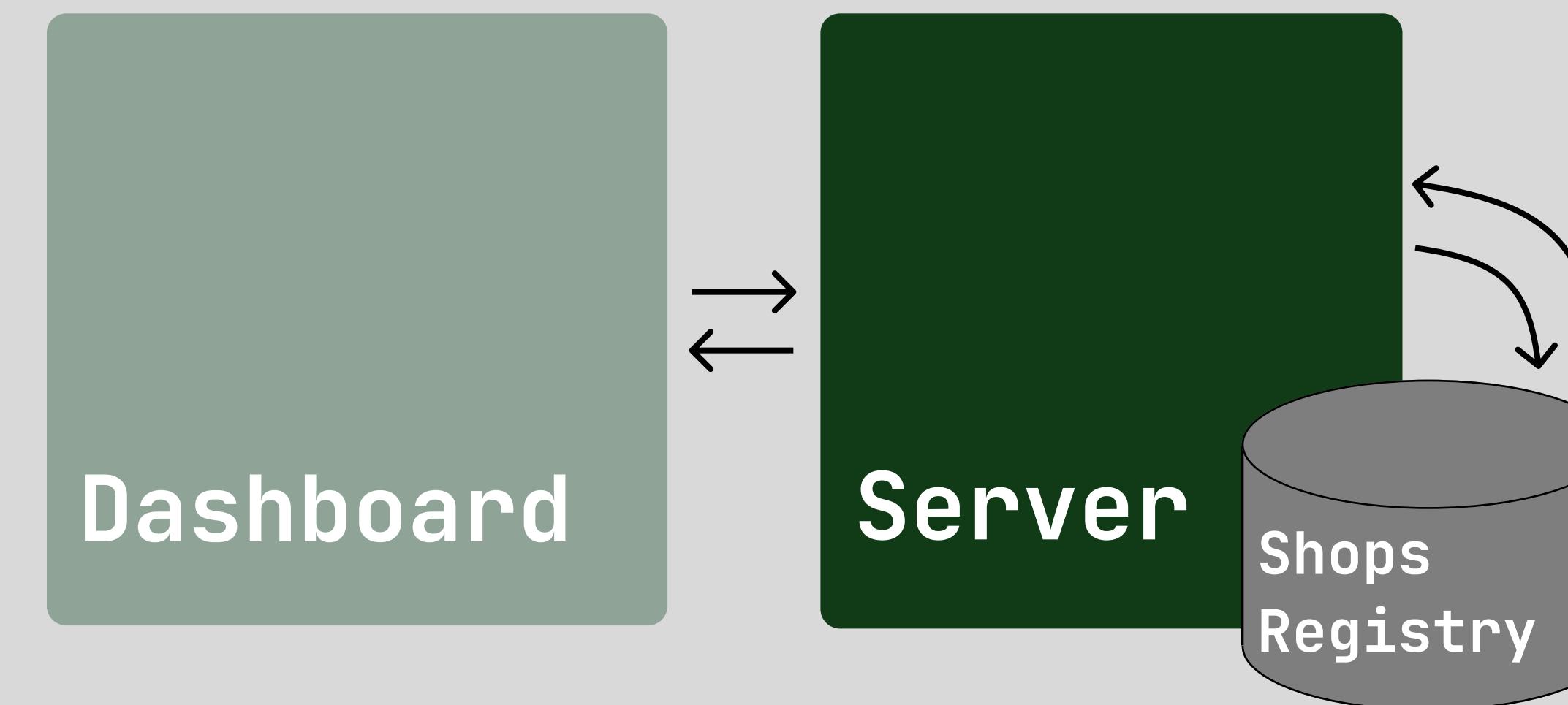
Q&A

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



What is under the hood?



Federation service

Vision

- Solutions

How can shops communicate directly?

Architecture

Demo

Q&A



?



04

Vision

05

Solutions

06

Architecture

07

Demo

08

Q&A

Let's see how stores are stored!



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		MIIIB0gI ...
2		odKAmV6 ...
...

04

Vision

05

Solutions

06

Architecture

07

Demo

08

Q&A

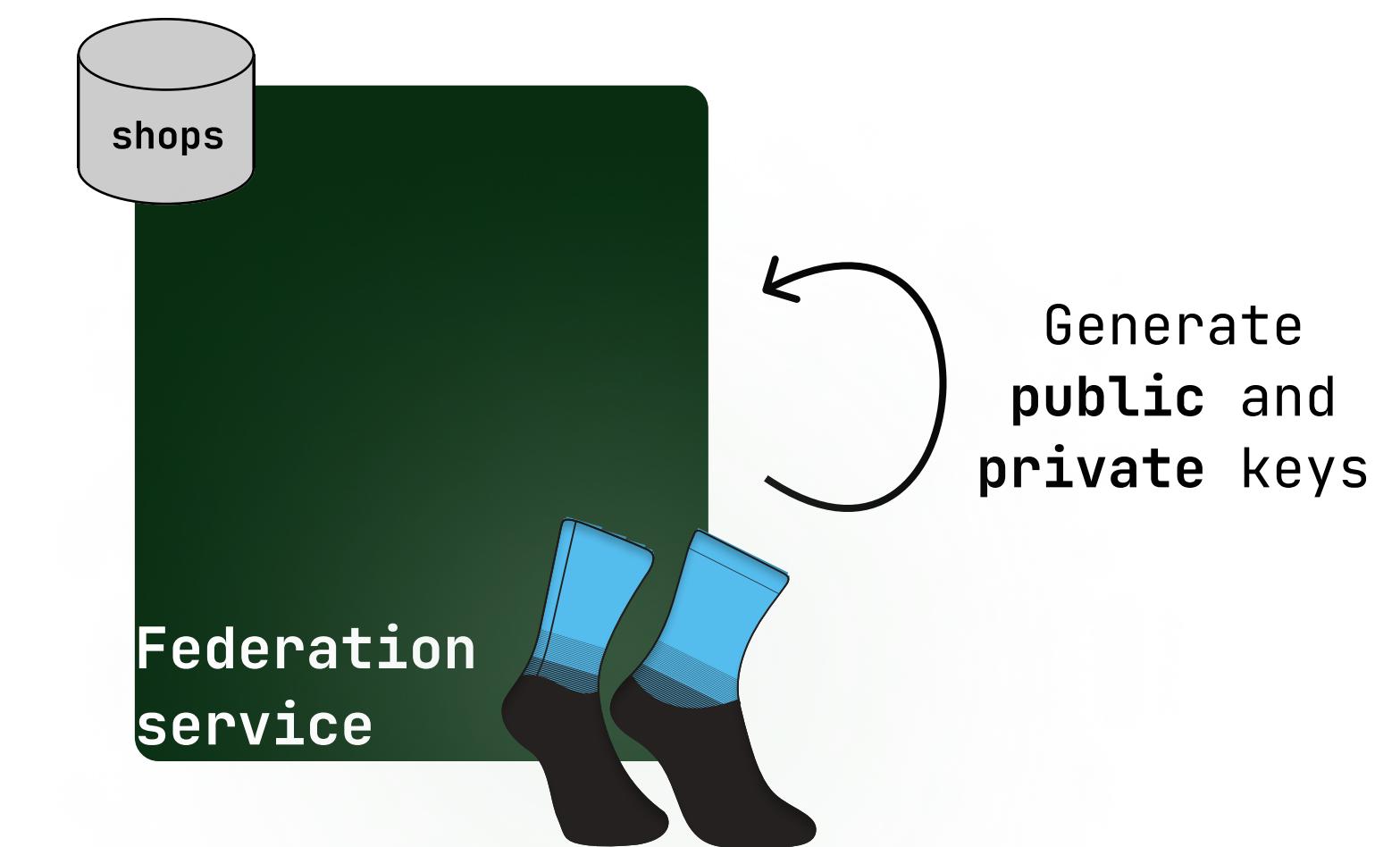


We store information about all shops
that are part of the Federation

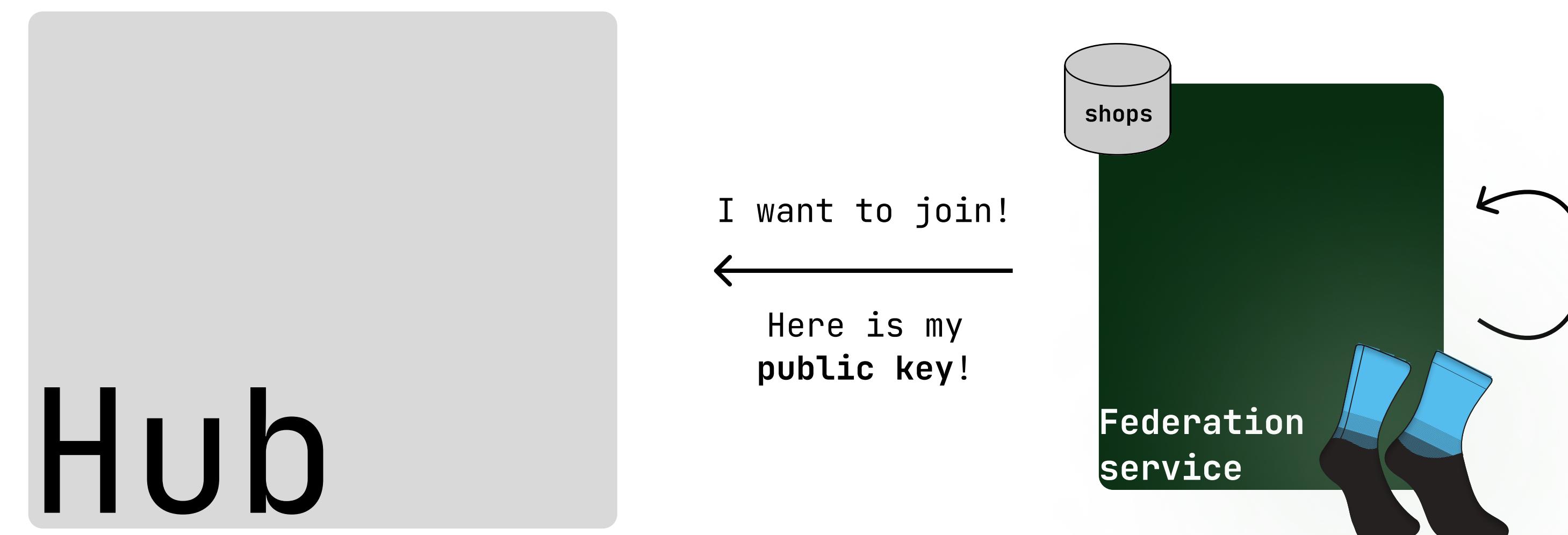
ID	SHOP	PUBLIC KEY
1		MIIB0gI... oCKAmV6...
2		***
***	***	***

?

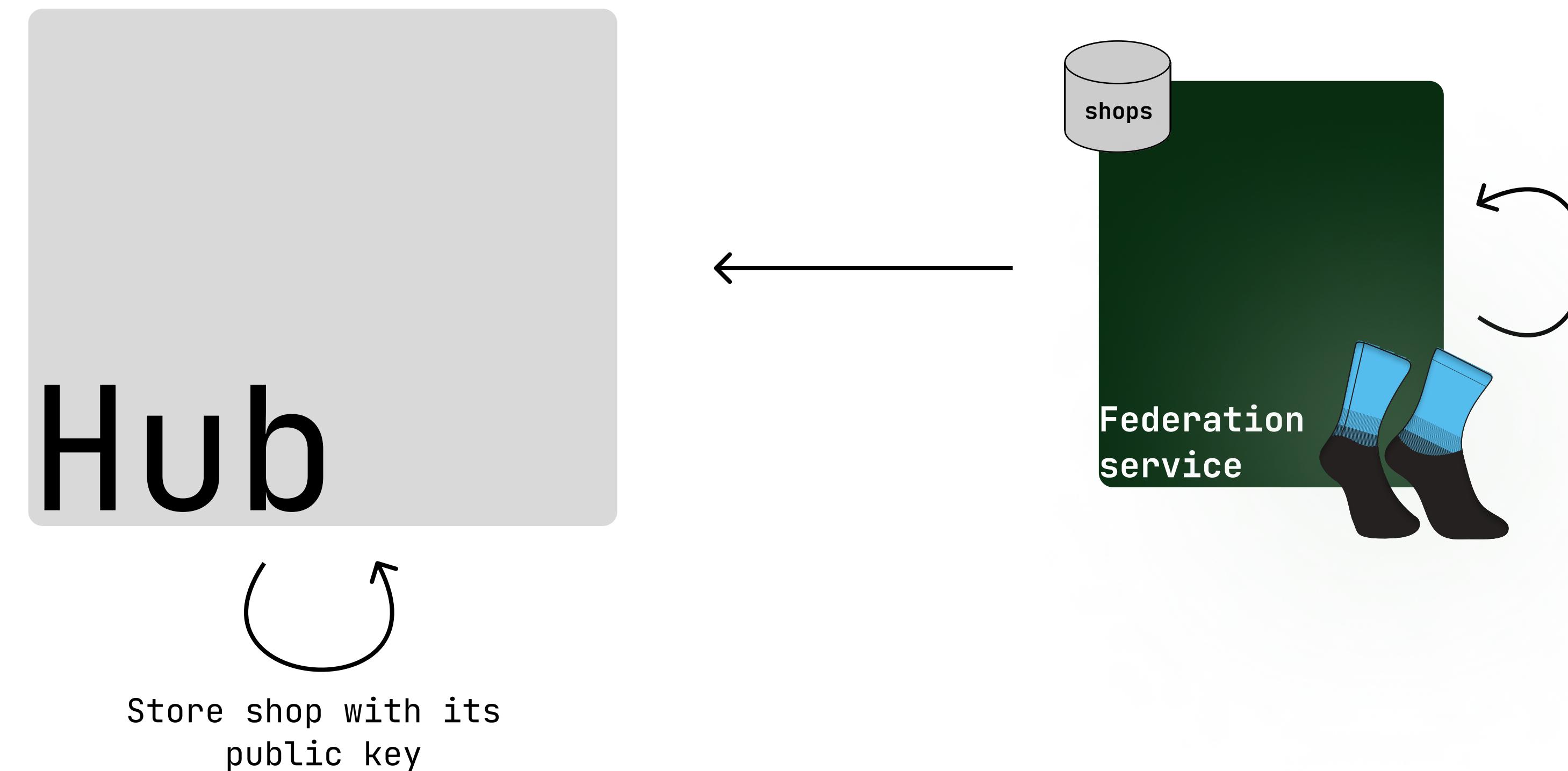
0. Before joining shop generates public and private keys



1. When joining also sends its public key



2. Hub stores all public keys for all shops



04

Vision

05

Solutions

06

Architecture

07

Demo

08

Q&A



How does direct communication look like?

?



04

Vision

05

Solutions

06

Architecture

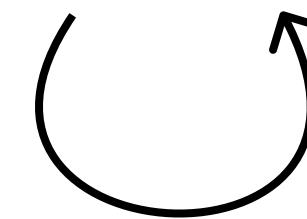
07

Demo

08

Q&A

One shop generates JWT token
with its private key



Generate JWT token



04

Vision

05

● Solutions

06

Architecture

07

Demo

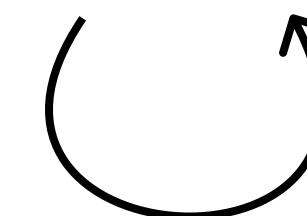
08

Q&A

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



partnership request
with JWT token



04

Vision

05

Solutions

06

Architecture

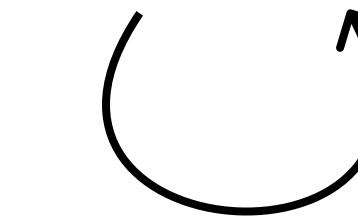
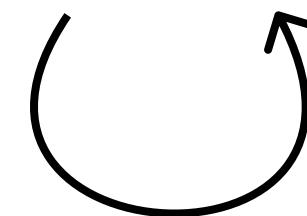
07

Demo

08

Q&A

Another shop verifies JWT token



Verify JWT token
with shop's
public keys

04

Vision

05

Solutions

06

Architecture

07

Demo

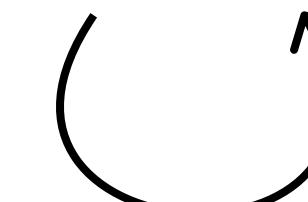
08

Q&A

Shop either accepts or denies partnership request



1. Generate JWT token

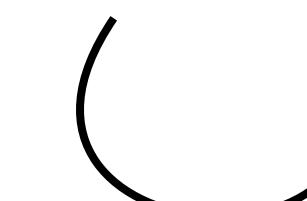


2. Send partnership request
with JWT token



4. Send a response

We are partners 😊
or
Nah, sorry 😞



3. Verify JWT
token with
shop's public
keys

04

Vision

05

 Solutions

06

Architecture

07

Demo

08

Q&A

Rights management



or

Earn CommisionShare InventoryShare DataCo-PromoteSell

Vision

● Solutions

Architecture

Demo

Q&A

Finally shops can communicate!

01

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



04
Vision05
● Solutions06
Architecture07
Demo08
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



04
Vision05
• Solutions06
Architecture07
Demo08
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!

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



04
Vision05
• Solutions06
Architecture07
Demo08
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

04
Vision05
Solutions06
Architecture07
Demo08
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**

Vision

• Solutions

Architecture

Demo

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](#) ^

POST [/v1/partnerships/request](#) Send partnership request

POST [/v1/partnerships/accept](#) Accept a partnership request

POST [/v1/partnerships/reject](#) Reject a partnership request

POST [/v1/partnerships/offer](#) Offer a partnership

POST [/v1/partnerships/acceptOffer](#) Accept a partnership offer

POST [/v1/partnerships/rejectOffer](#) Reject a partnership offer

POST [/v1/partnerships/leave](#) Leave a partnership

POST [/v1/partnerships/refresh](#) Refresh a partnership

POST [/v1/partnerships/refreshOffer](#) Refresh a partnership offer

POST [/v1/partnerships/refreshAccept](#) Refresh a partnership accept

POST [/v1/partnerships/refreshReject](#) Refresh a partnership reject

Federation Dashboard localhost:5173

Federation Hub Partners

Online Boutique
We simply sell everything that you need. And more.
[Join](#)

Tech Mart
Your one stop for all tech gadgets
[Join](#)

Garden Central
Everything you need for your garden
[Join](#)

A screenshot of a web browser window titled "Federation Dashboard" at "localhost:5173". The page displays the "Federation Hub" partners section. It features three cards: "Online Boutique" (described as selling everything you need), "Tech Mart" (described as a one-stop shop for tech gadgets), and "Garden Central" (described as having everything you need for your garden). Each card includes a "Join" button at the bottom.

04

Vision

05

Solutions

06

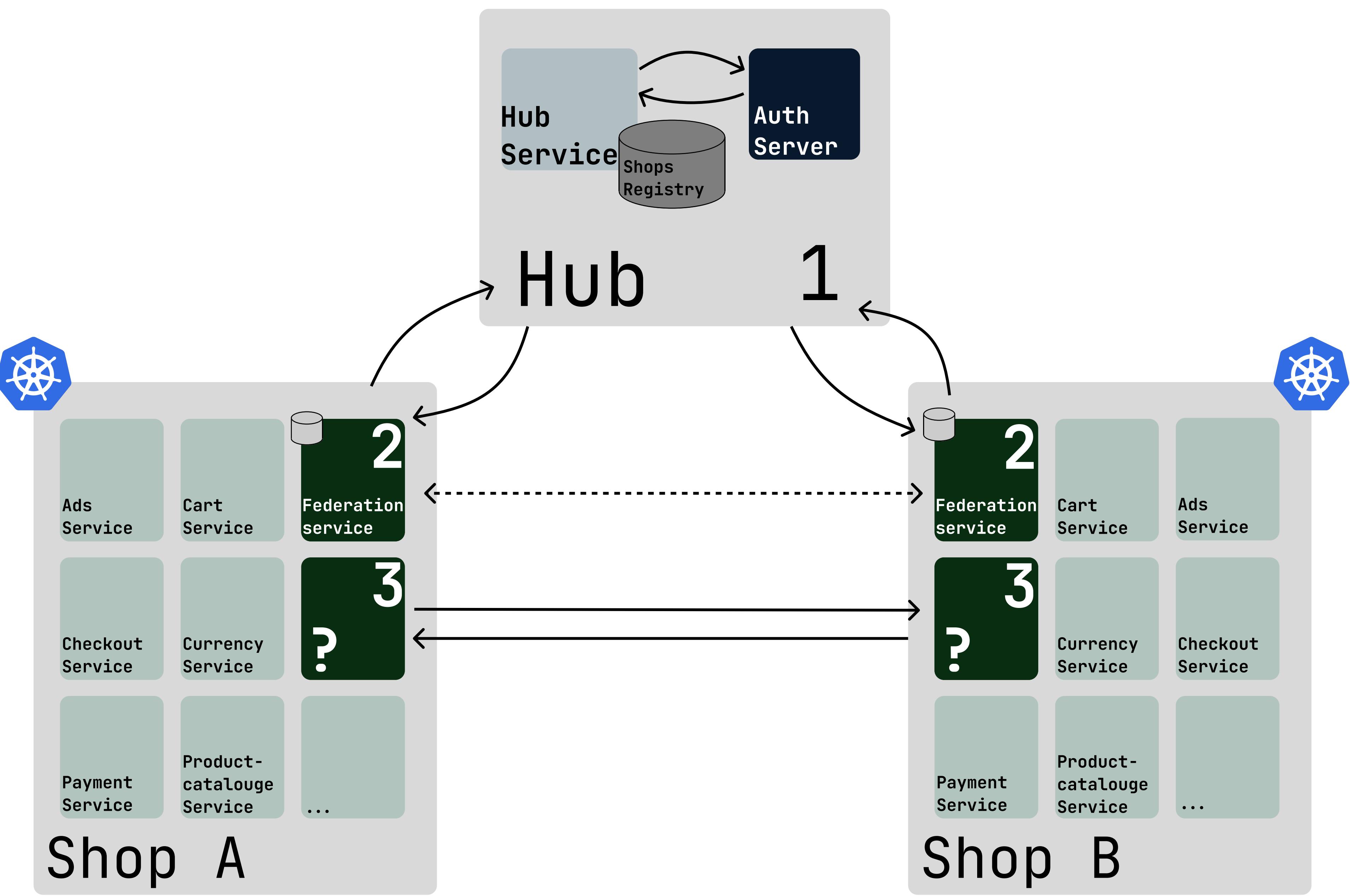
Architecture

07

Demo

08

Q&A



04
Vision05
Solutions06
Architecture07
Demo08
Q&A

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

Vision

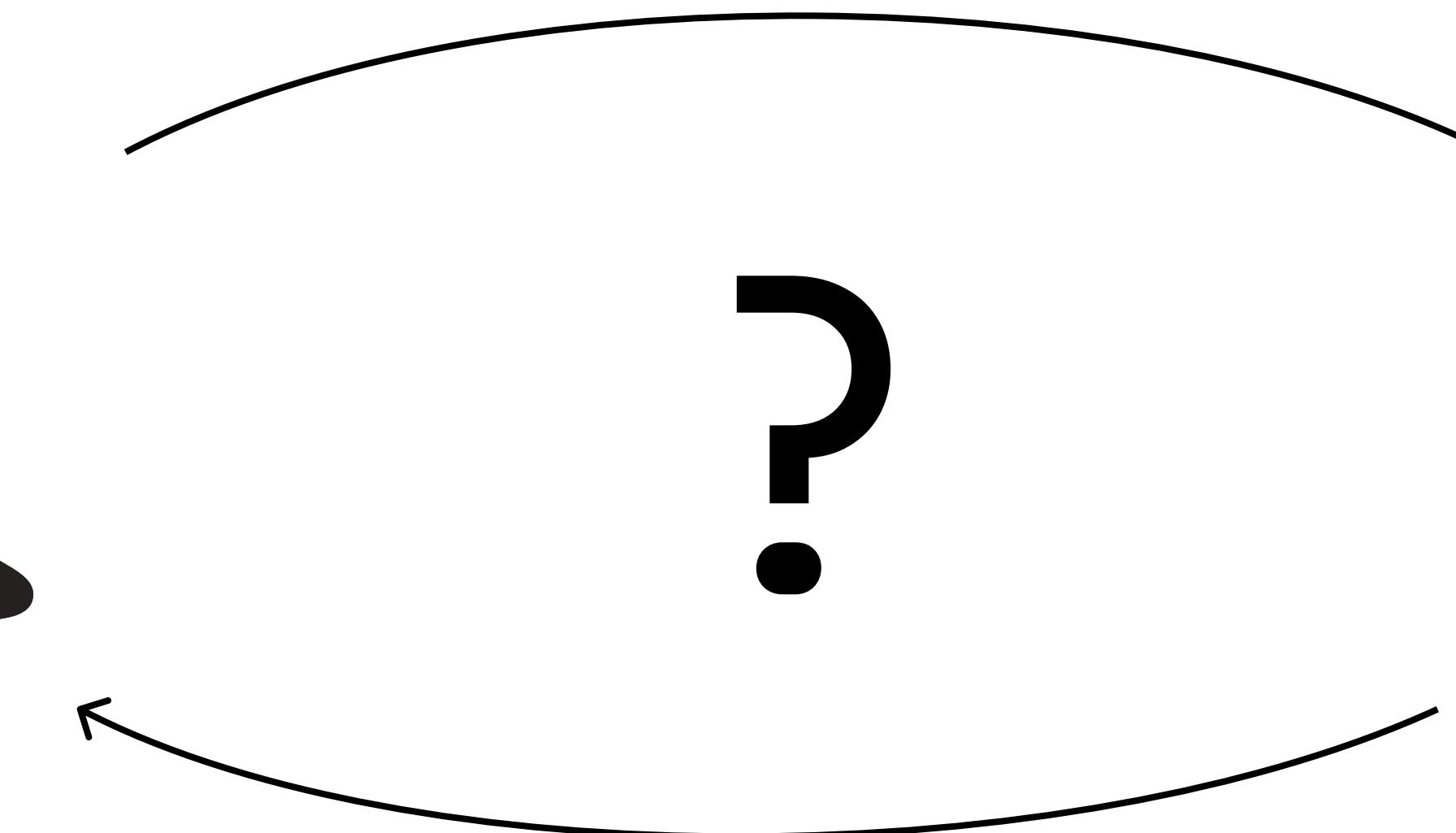
● Solutions

Architecture

Demo

Q&A

How do stores exchange inventory?



Vision

● Solutions

Architecture

Demo

Q&A

How do stores exchange inventory?



Vision

 Solutions

Architecture

Demo

Q&A

What does Inventory Exchange Service do?

01

Allowing shops to get products from its partners

**Inventory
Exchange
Service**

Vision

 Solutions

Architecture

Demo

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**

Inventory Exchange Service

Vision

• Solutions

Architecture

Demo

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
- 03 Letting stores exchange order information

Vision

Solutions

Architecture

Demo

Q&A

Inventory Exchange Service API



04

Vision

05

● Solutions

06

Architecture

07

Demo

08

Q&A

GET Products /api/v1/products

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



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.



04

Vision

05

● Solutions

06

Architecture

07

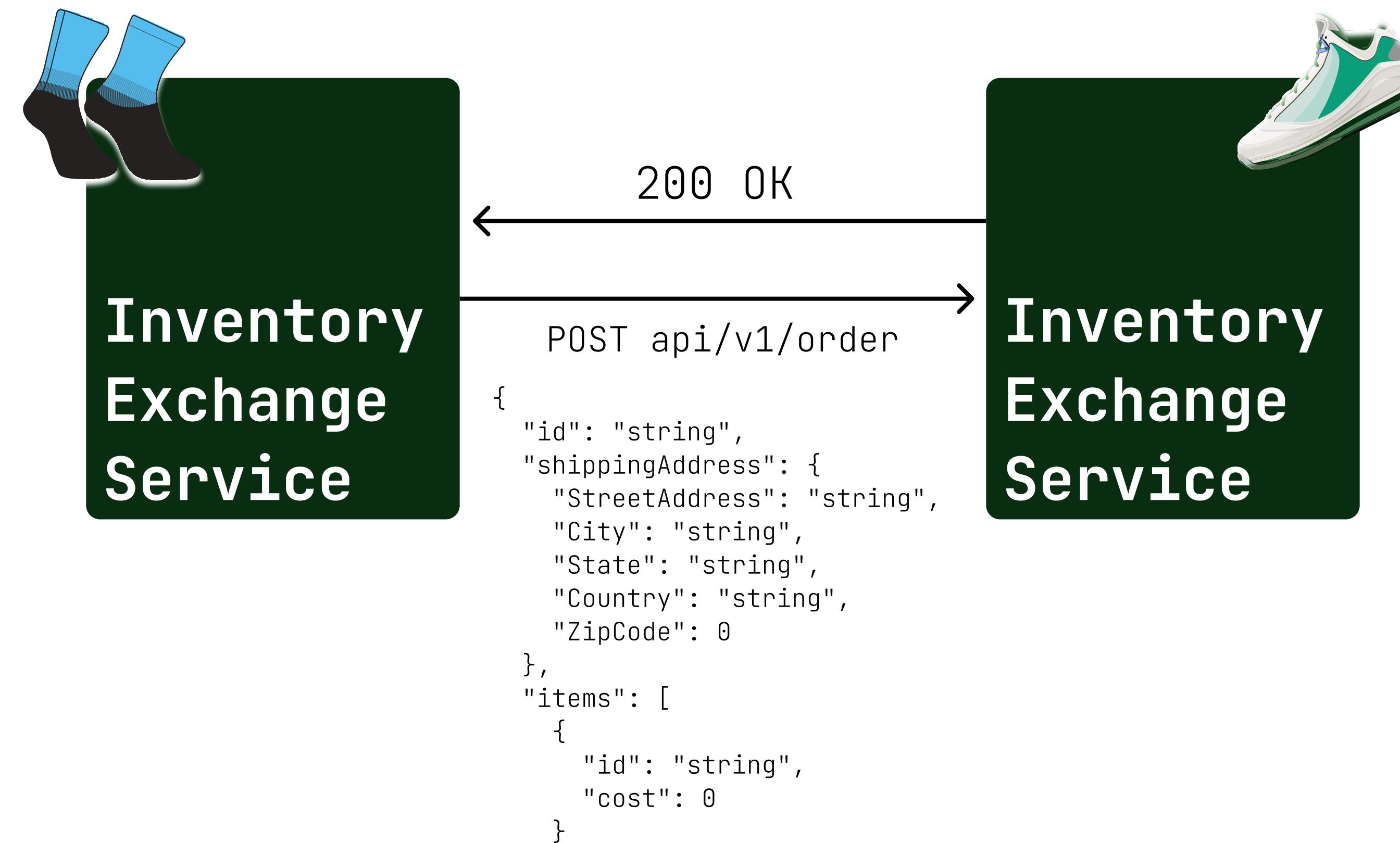
Demo

08

Q&A

POST Order /api/v1/order

Exchange order information between stores.



**Inventory
Exchange
Service**

Problems faced while working with the Inventory Exchange Service

Vision

• **Solutions**

Architecture

Demo

Q&A

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"  
 }  
 ]
```



Problem 02 ! Product ID handling between shops

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

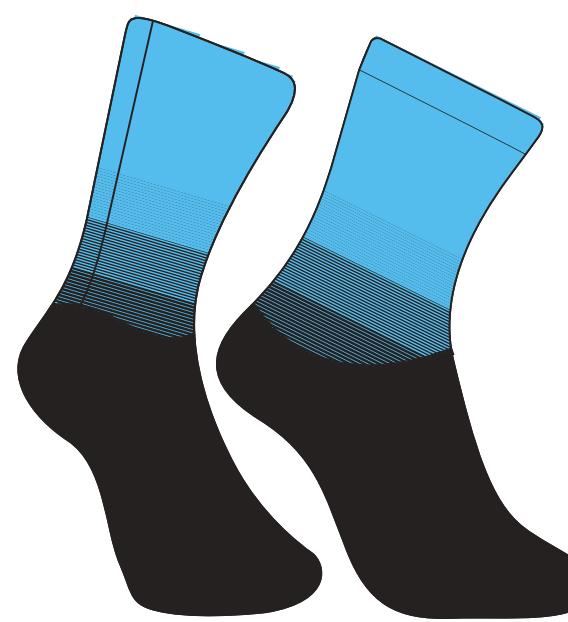
id="OLJCESPC7Z" → id="ONBQ:OLJCESPC7Z"

The diagram illustrates the transformation of a product ID. On the left, the text "id='OLJCESPC7Z'" is shown in a dark green font. An arrow points from the "OLJCESPC7Z" part to the label "product id" below it. In the center, there is a black arrow pointing from the green text to the black text "id='ONBQ:OLJCESPC7Z'". The black text is also in a dark green font. An arrow points from the "ONBQ:" prefix in the black text to the label "shop identifier" below it. Another arrow points from the "OLJCESPC7Z" part of the black text to the label "product id" below it.

04
Vision05
● Solutions06
Architecture07
Demo08
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



04

Vision

05

● Solutions

06

Architecture

07

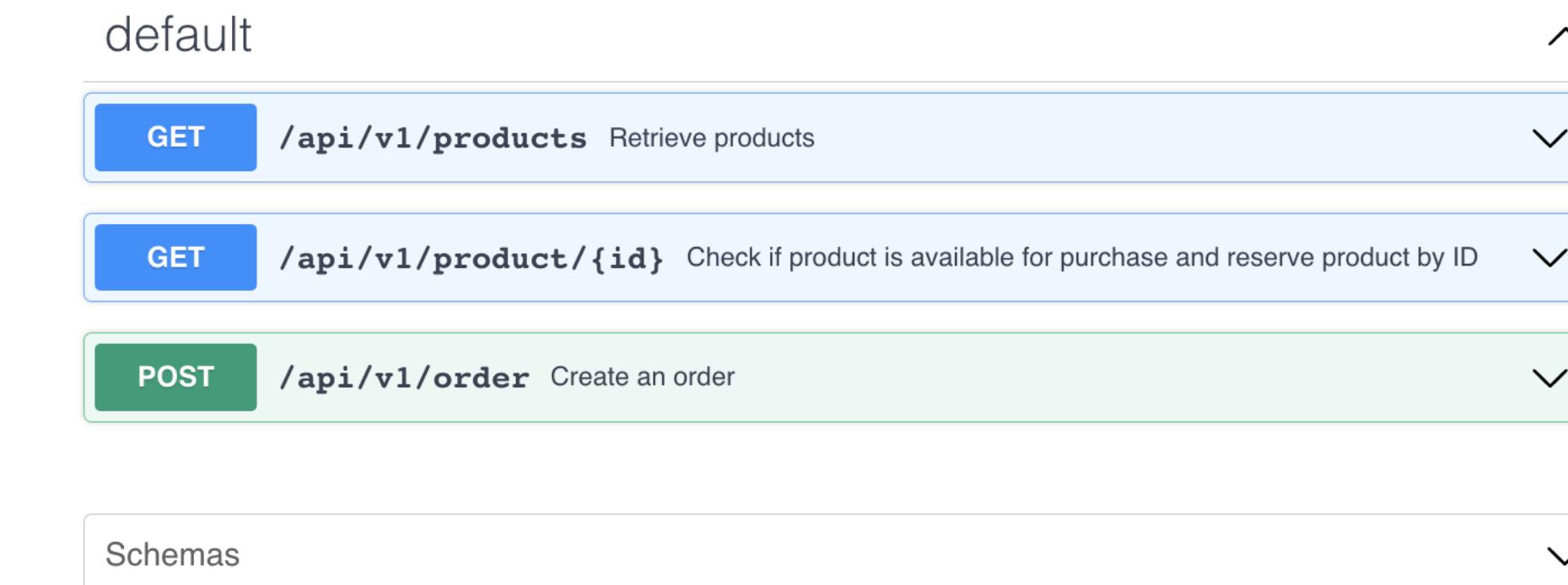
Demo

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.



Research question 3:

How to observe transactions across shops without sacrificing performance?

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

04 Vision

05 Solutions

06 Architecture

07 Demo

08 Q&A

How did we do it?



Prometheus for monitoring



Grafana for displaying data

Vision

 Solutions

Architecture

Demo

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.

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

04

Vision

05

● Solutions

06

Architecture

07

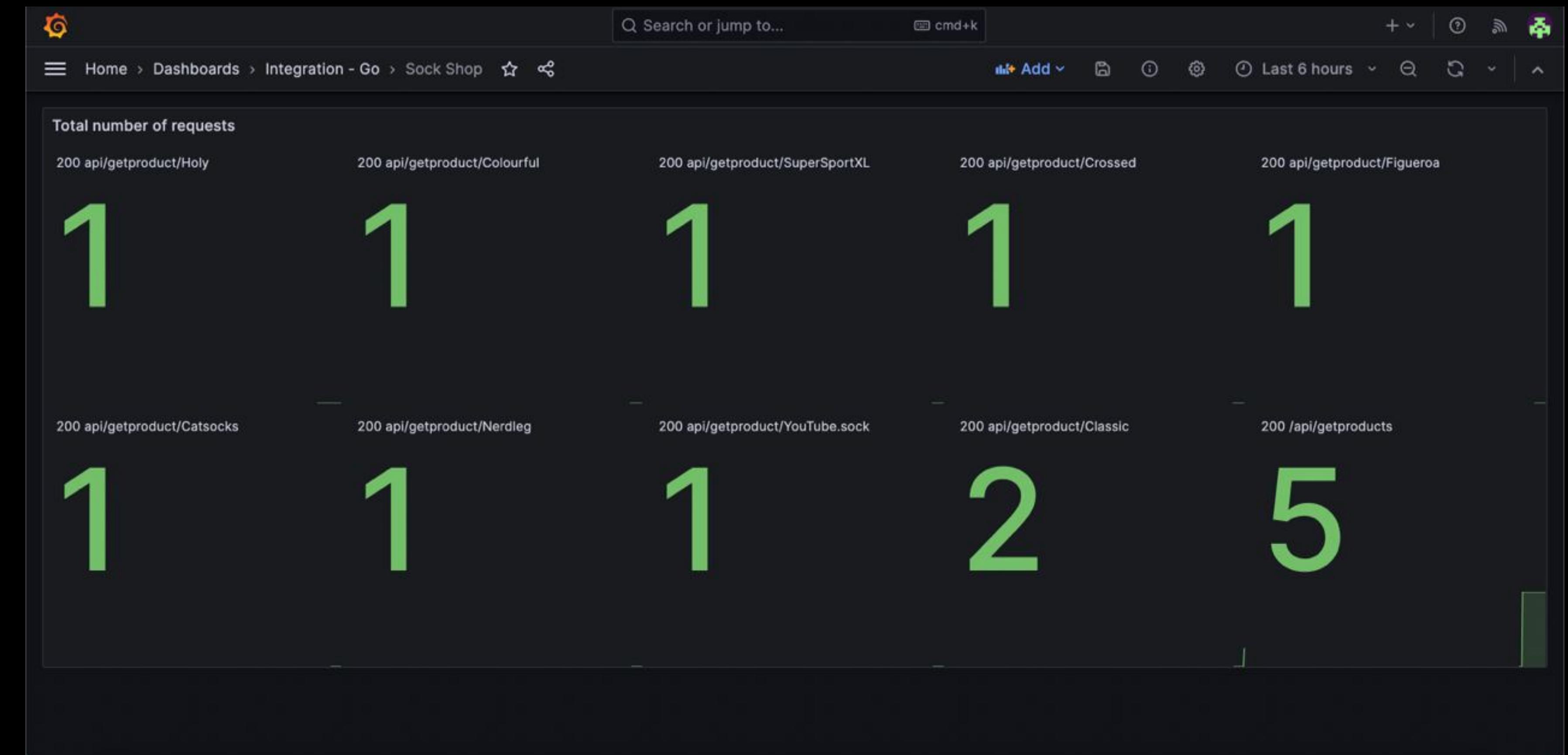
Demo

08

Q&A



Grafana Dashboard v1.0

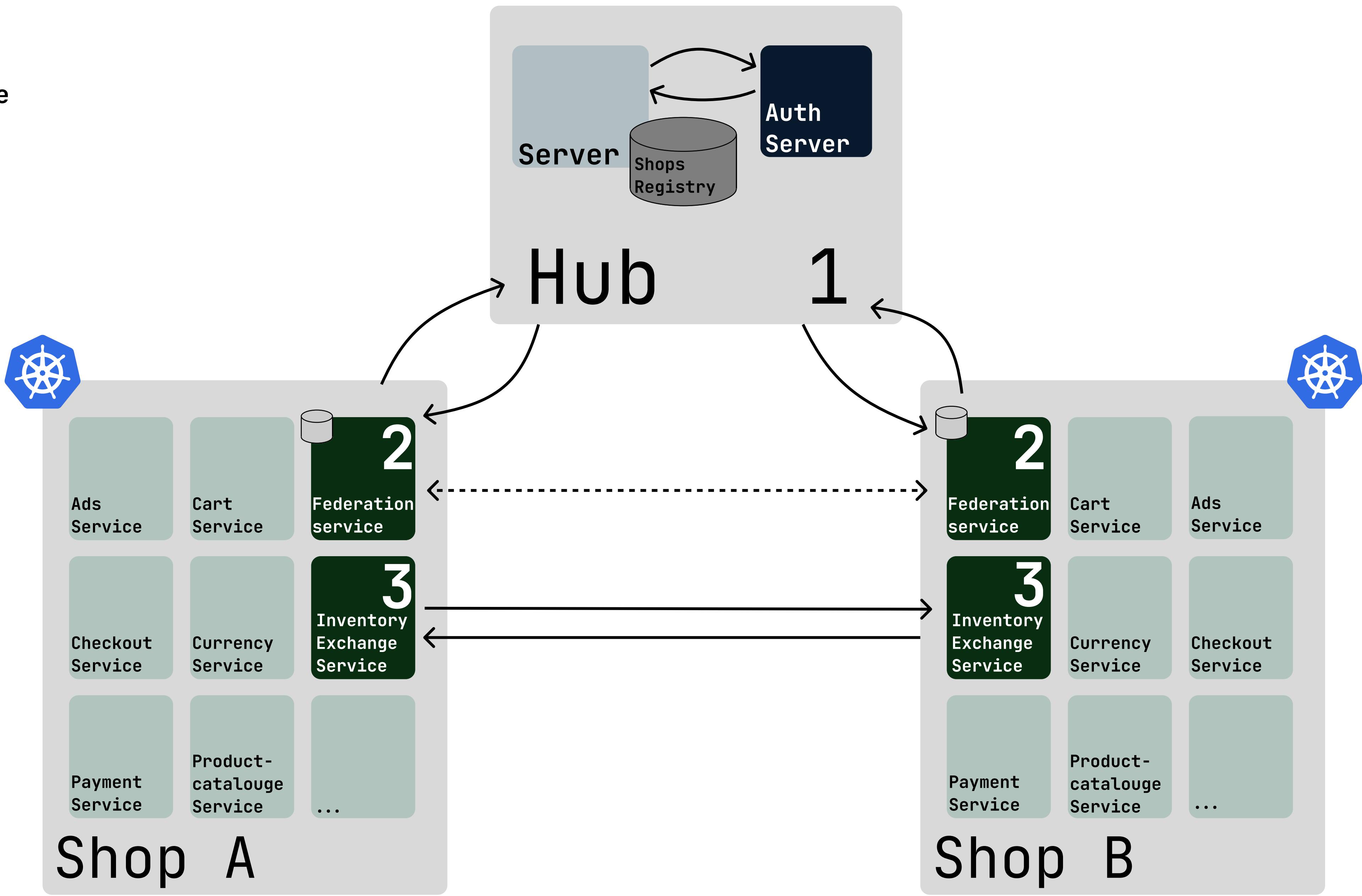


Solutions

Architecture

Demo

Q&A



06

Architecture

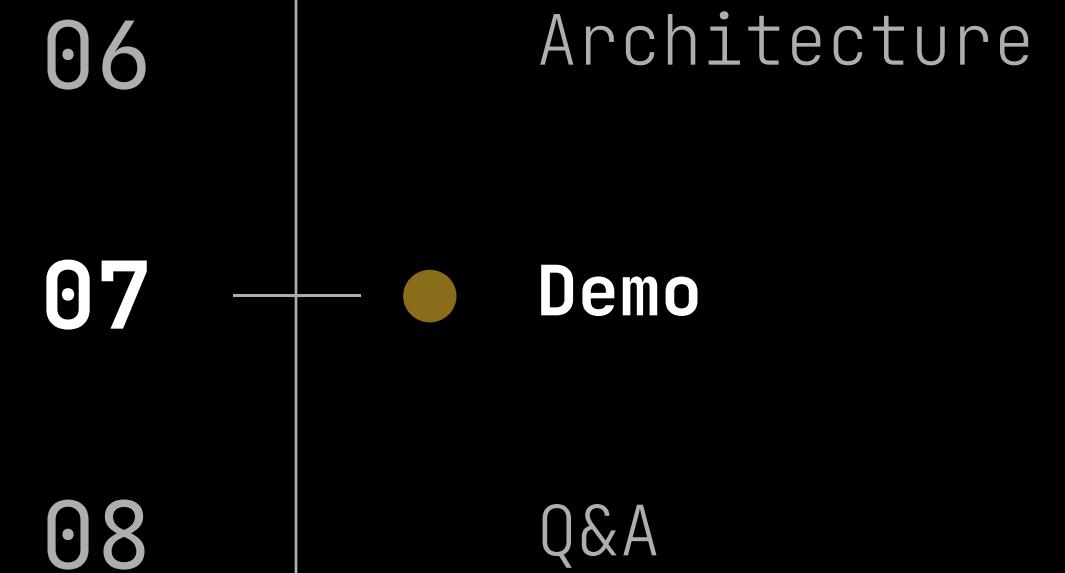
07

 Demo

08

Q&A

Demo



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

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

Demo

Q&A

Thank you!

Q&A