
ippon
POSITIVE
TECHNOLOGY
#22
REST, gRPC,
GraphQL, Webhooks
Dans quelles situations ?


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VOXXED DAYS
LUXEMBOURG
REST, gRPC,
GraphQL, Webhooks
Dans quelles situations ?


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Sunny TECH
REST, gRPC,
GraphQL, Webhooks
In what situations?

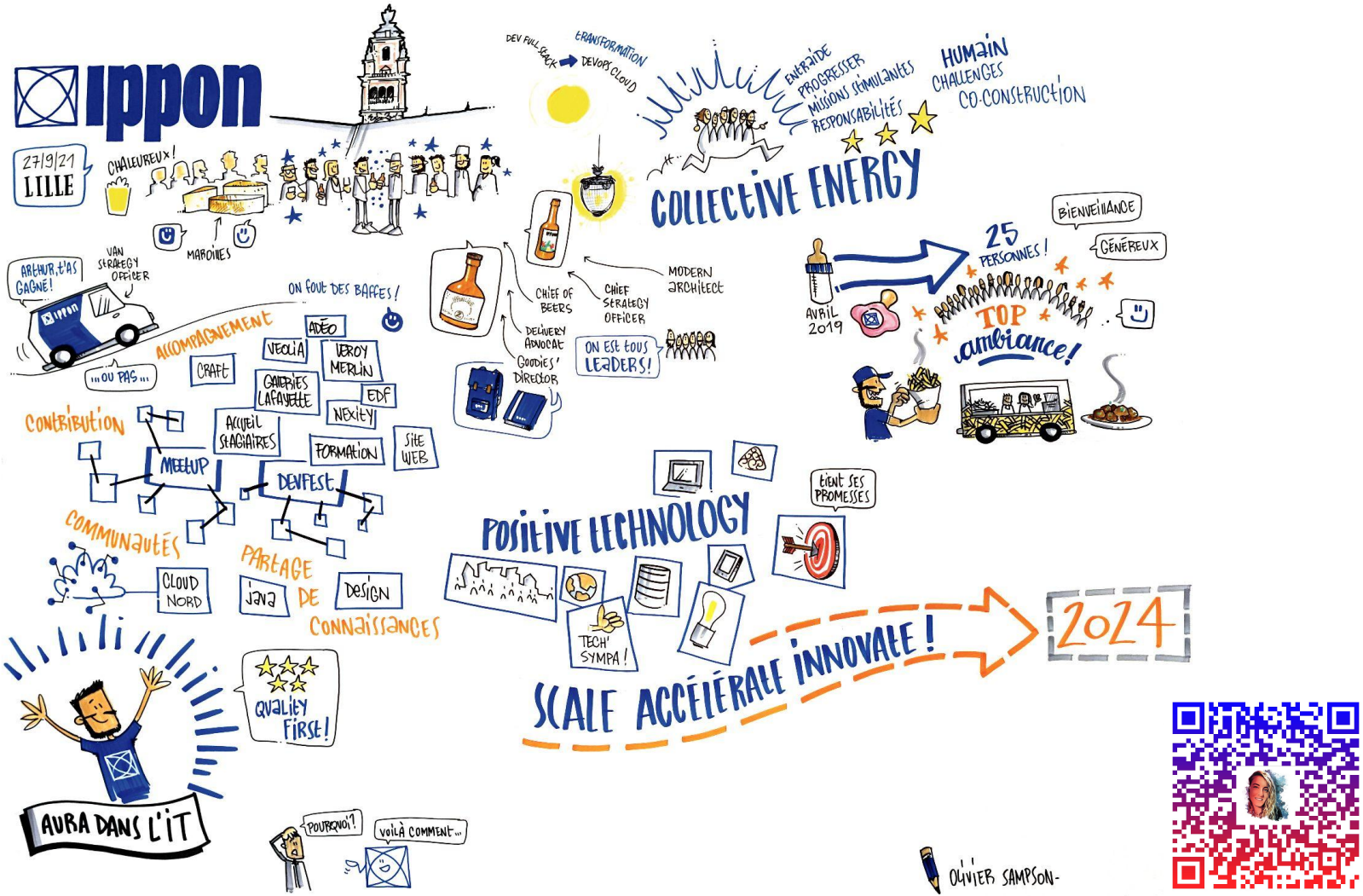
$ whoami

François Delbrayelle (@fdelbrayelle)

Cht'Ippon @ **Ippon** Lille since 2019

- ***Senior Software Engineer***
- ***Tech Community Ambassador***
- **Trainer**
- Blog Team Member (blog.ippon.fr)

Contributor @ OSS / **JHipster**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27/9/21
LILLE
CHALEUREUX!
MARQUES
DEV FULL STACK
TRANSFORMATION
DEVOPS CLOUD
ENERGIE
PROGRESSER
MISSIONS STIMULANTES
RESPONSABILITÉS
HUMAIN
CHALLENGES
CO-CONSTRUCTION
COLLECTIVE ENERGY
BIENVEILLANCE
GÉNÉREUX
25 PERSONNES!
AVRIL 2019
TOP ambiance!
ARTHUR, T'AS GAGNÉ!
VAN STRATEGY OFFICER
...OU PAS...
ACCOMPAGNEMENT
ON FOUT DES BAFFES!
ADEO
VECLIA
LEROY MERLIN
CRAFT
GALERIES LAFAYETTE
EDF
NEXITY
CONTRIBUTION
ACCUEIL STAGIAIRES
FORMATION
SITE WEB
MEETUP
DEVFEST
COMMUNAUTÉS
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PARTAGE DE CONNAISSANCES
JAVA
DESIGN
CHIEF OF BEERS
CHIEF STRATEGY OFFICER
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ON EST TOUS LEADERS!
POSITIVE TECHNOLOGY
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SCALE ACCÉLÉRALE INNOVALE!
2024
QUALITY FIRST!
AURA DANS L'IT
POURQUOI?
VOILÀ COMMENT...
OLIVIER SAMPSON-


The Fellowship of the Ring
J.R.R. TOLKIEN
THROUGH THE LOOKING-GLASS
Lewis Carroll
Illustrated by SIR JOHN TENNIEL
M
THE NEW FOREST
LONDON
JOHN MURRAY
ARTHUR RANSOME


I'M HEROIN
LAZARUS
COLOSSAL WAR
LOOSE SUTURES
Throwdown
OM
God is Good
DEVOTIONAL DOOM
marecages
DOOM
SESSIONS VOL2
1703
ACID MAMMOTH
HEAVY PSYCH SOUNDS
RECORDS
BLACK SABBATH
MASTER OF REALITY
Throwdown
Happiness
BASTARD LORD
LOSERFUR
ROBOT GOD
BLACK SABBATH
THE END
Birmingham
TEMPLE OF THE FIRE WITCH
Throwdown
BLACK SABBATH
PARANOID
ROBBERO BOBBERO
& THORSAKER
DEAD WAVE
Bobby
BLACK SABBATH
dazethrone
Pyro Weed
Vol 3
sahara
the light
BLACK SABBATH
SABOTAGE
DOOMSMOKER
ZERAIN
Waiting at the fuzzslaves
acid king
ACID
SEPULTURA
Sabbath
EGYPT
PANTERA
COWBOYS FROM HELL

Disclaimer

🛒 **Pas de mise en avant d'une techno par rapport aux autres**

🔍 **Pas une présentation détaillée de chaque techno**

📃 **Pas d'ordre logique entre les technos abordées**

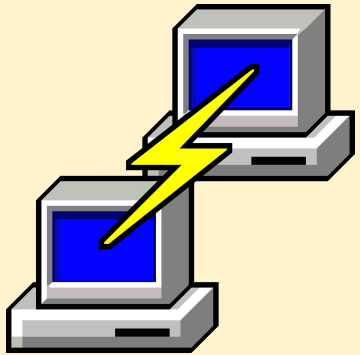
🧠 **Pas de biais cognitifs (au moins essayer)**

🔁 **Pas abordé : *pub/sub* et *queues***

🔫 **Pas de *silver bullets***

Make actors communicate

📜 A brief history of client / server communication



Client / Server Communication

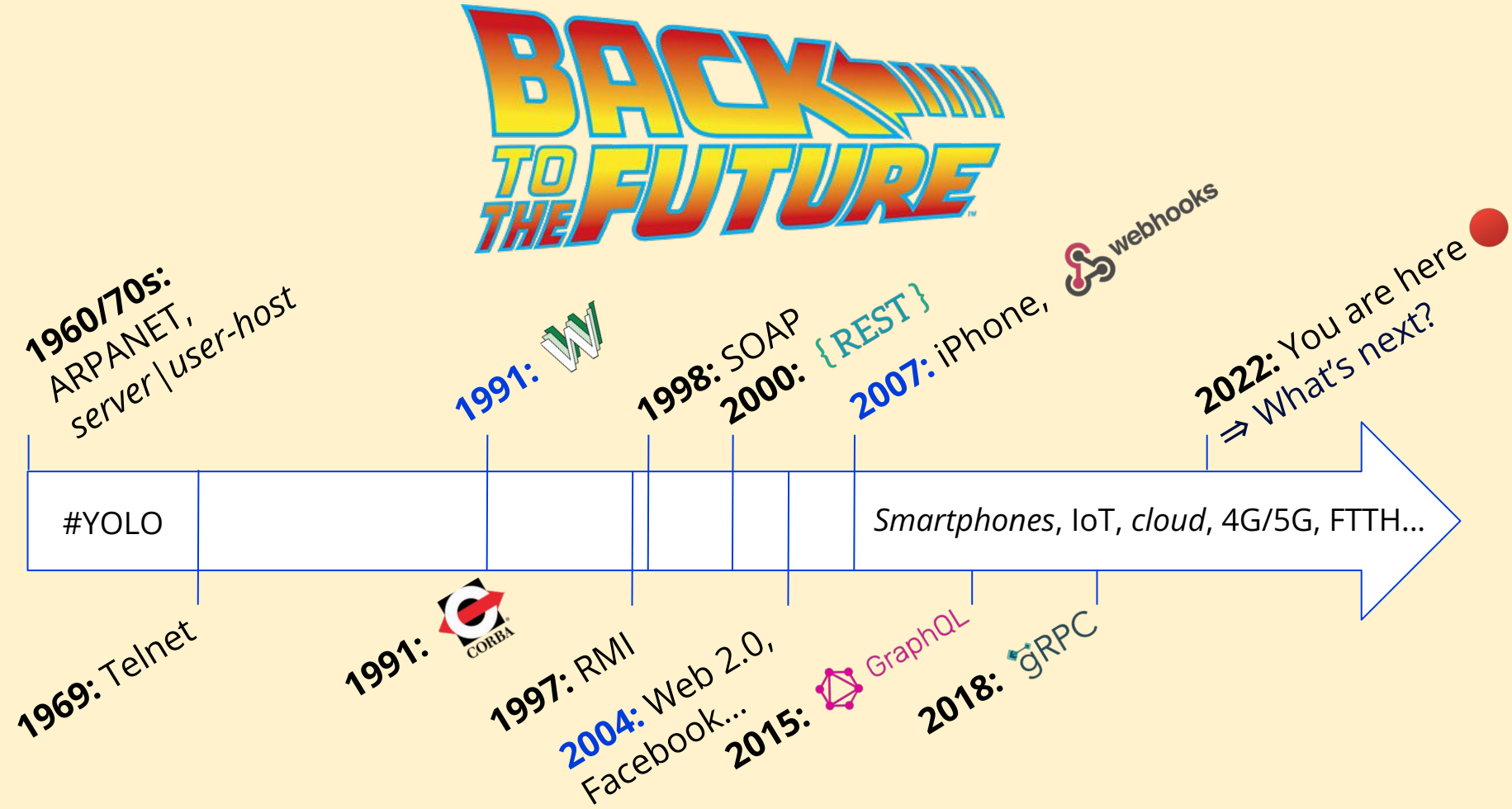
Client / Server: network architecture

Sockets

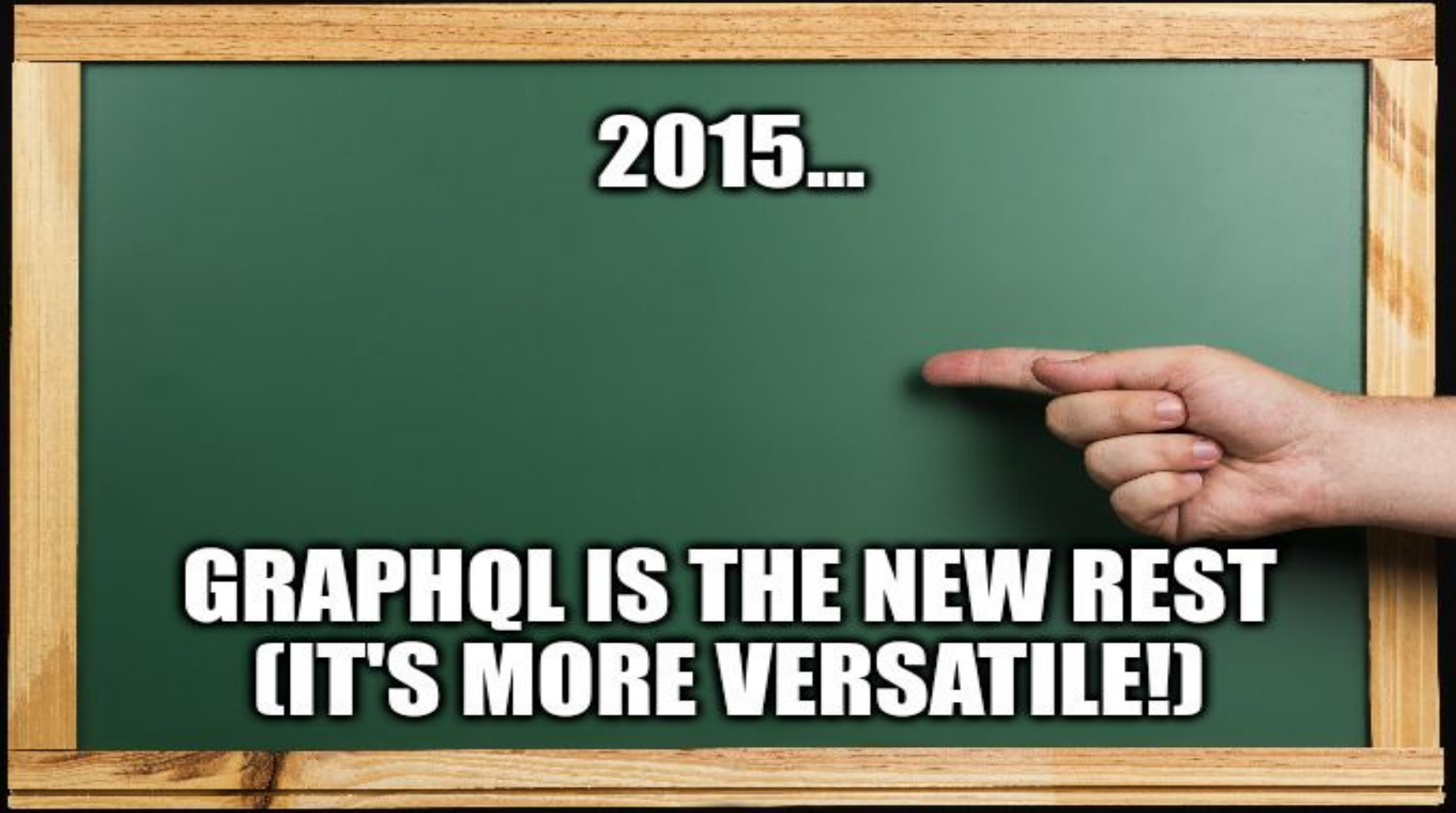
TCP/IP: common transport protocol

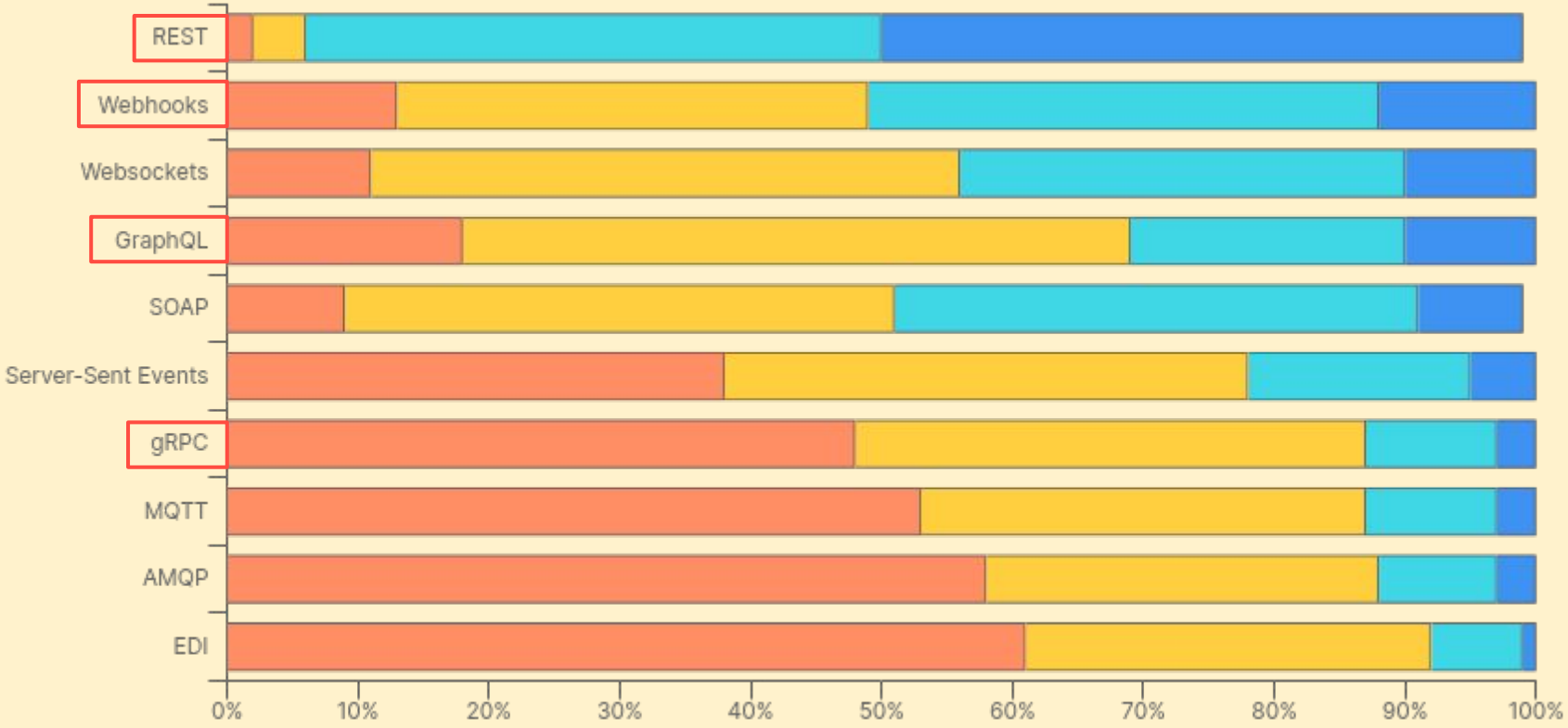
Inter-Process Communication (IPC)

Non-Functional Requirements


BACK TO THE FUTURE
1960/70s: ARPANET, server|user-host
1991:
1998: SOAP
2000: {REST}
2007: iPhone,
webhooks
2022: You are here
⇒ What's next?
#YOLO
Smartphones, IoT, cloud, 4G/5G, FTTH...
1969: Telnet
1991: CORBA
1997: RMI
2004: Web 2.0, Facebook...
2015: GraphQL
2018: gRPC

```
<?xml version="1.0"?>

<soap:Envelope
xmlns:soap="http://www.w3.org/2003/05/soap-envelope/"
soap:encodingStyle="http://www.w3.org/2003/05/soap-encoding">

<soap:Header>
...
</soap:Header>

<soap:Body>
...
  <soap:Fault>
  ...
  </soap:Fault>
</soap:Body>

</soap:Envelope>
```





Source : Postman's 2021 State of the API Report (https://www.postman.com/state-of-api)
Légende : uses and loves - = uses - = knows but doesn't use - = never heard


C'EST UNE BONNE SITUATION ÇA ?
imgflip.com

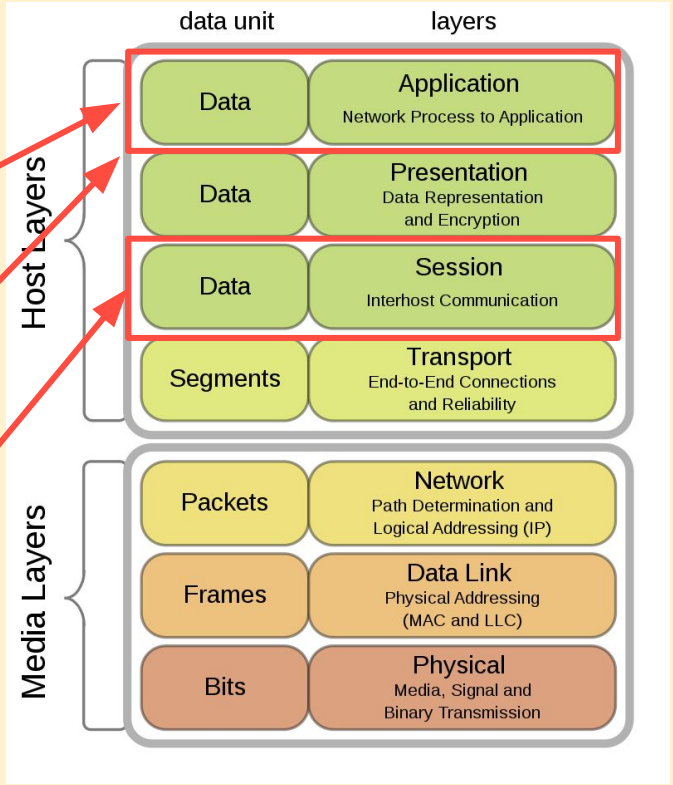
Different typologies

REST: architecture (often with **HTTP**)

GraphQL: language (**HTTP** POST)

Webhooks: HTTP POST

gRPC: *framework* based on **HTTP/2** et **RPC**



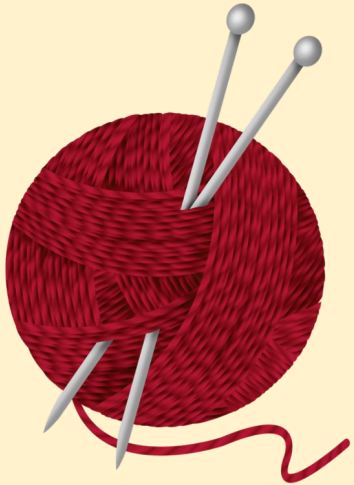
Source (picture): Wikipedia

Case Study

📦 **Extract from an e-commerce platform with:**

Web / Mobile Applications

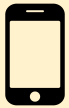
PIM *(Product Information Management)*



Vue.js

E-Commerce

Kotlin

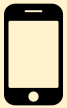


Mobile

React

Store Checkout

Swift



Store

Product API

Java

Price API

Kotlin

Stock API

Kotlin

Asset API

Java

What is an API?

***A**pplication **P**rogramming **I**nterface*

Client / Server

Exchange informations

Use standards

Own lifecycle


{ REST }

What is REST?

***RE**presentational **S**tate **T**ransfer*

Architecture for distributed hypermedia system

Thought by **Roy Fielding** in **2000**:
Architectural Styles and the Design of Network-based Software Architectures

Can be based on **HTTP/1.1 (RFC 2616)**

Key Concepts

Ressource

- Entity, model, identifiable concept, concrete or abstract
- URI (*Uniform Resource Identifier*) = identity
- REST Service binds URLs to URIs

HTTP Verb

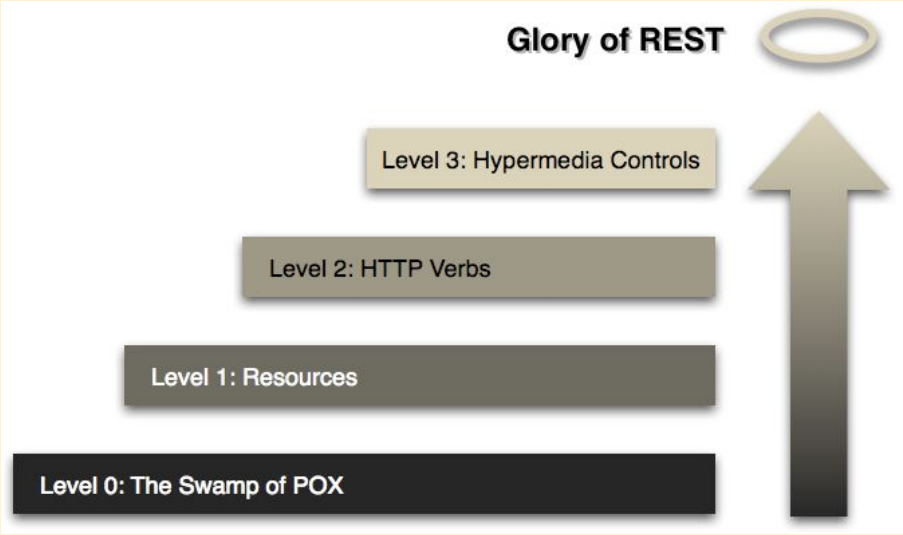
- Idempotent: GET, PUT, DELETE
- POST, PATCH…

Representation of resource state: exchange format (JSON, XML, HTML, raw text…)

Architectural Constraints

- Client / Server
- Stateless
- Cache
- Uniform Interface
- Layered System

Richardson Maturity Model



Source: https://www.martinfowler.com/articles/richardsonMaturityModel.html

💡 Expose business value with hypermedia

Business centric

Beware anemic APIs

Don’t expose directly databases

⇒ Use **hypermedia** (**HATEOAS** = *Hypermedia as the Engine of Application State*)

REST Call Example

```
GET /characters/42 HTTP/1.1
Host: api.h2g2.com
Content-Type: application/json
```

```
{
  "id": 42,
  "name": "Arthur Dent",
  "links": [
    {
      "href": "42/messages",
      "rel": "messages",
      "type": "GET"
    }
  ]
}
```

{ REST }

🟢 Pros

- Based on web standards
- Universal support (browsers)
- A lot of use cases
- Well-known by developers
- CRUD
- HATEOAS

🔴 Cons

- Over|underfetching
- 1 to 1
- HTTP/1.1 sometimes limited
- Payload size

🤔 Why choose REST?

Motivations

- Wide web browser support
- Business data / behaviors exposition
- Headless
- CRUD-based simple actions

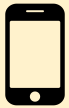
Use cases

- Resource-driven applications
- Web applications
- Mobile applications
- Microservices

Vue.js

E-Commerce

Kotlin



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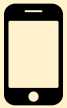


Store

Product API

Java

Price API

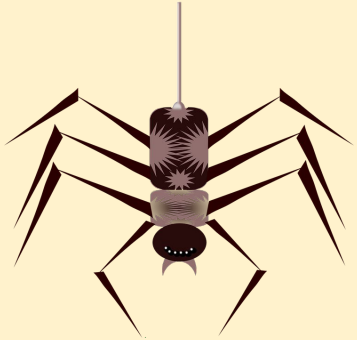
Kotlin

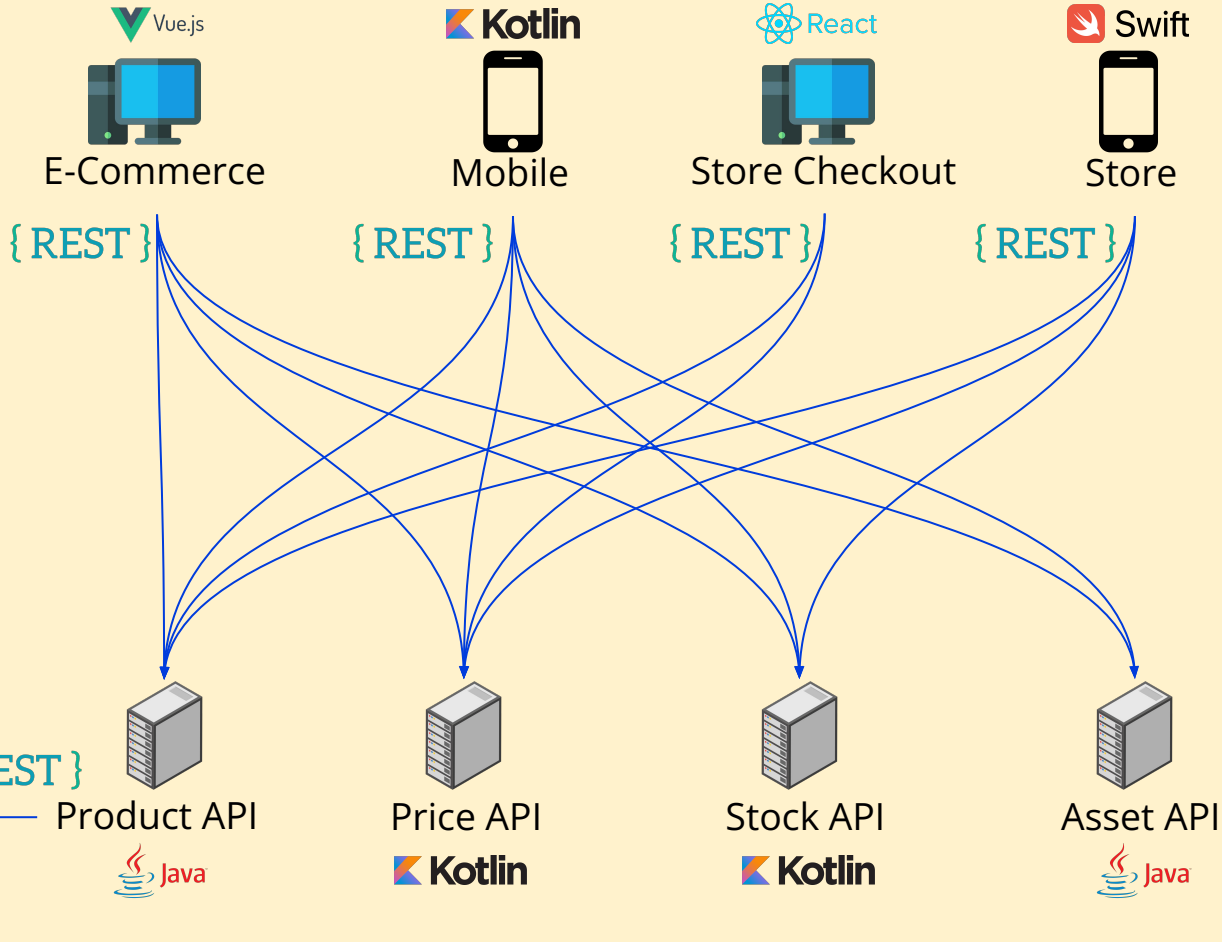
Stock API

Kotlin

Asset API

Java




Vue.js
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Store
{ REST }
{ REST }
{ REST }
{ REST }
Marketplace
{ REST }
Product API
Price API
Stock API
Asset API
Java
Kotlin
Kotlin
Java


gRPC

gRPC

What is gRPC?

Framework created by **Google** in **2016**
Open-sourced (Apache 2.0) : https://github.com/grpc/grpc
Part of the **CNCF Foundation**

Based on **RPC protocol (*Remote Procedure Call*)**

3 main implementations: GRPC-JAVA, GRPC-GO et GRPC-C (from which derive C++, Python, Ruby, Objective C, PHP and C# ones)

Java: https://github.com/grpc/grpc-java (through Maven/Gradle plugins)

💡 HTTP/2

Standard since 2015 (RFC 7540)

Used for transport

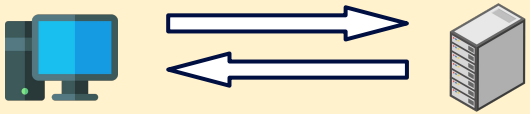
Streams composed of **frames** (with specific formats and sizes)

Multiplexing: Multiple frames in a request / connection

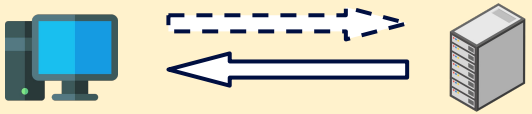
45,3 % of websites are using it in June 2022
https://w3techs.com/technologies/details/ce-http2

💡 Communication Modes

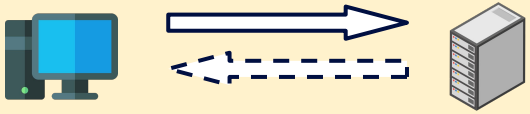
Unary



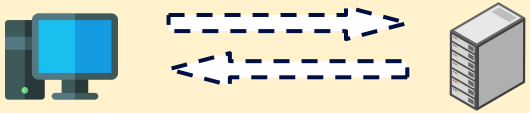
Client Streaming



Server Streaming



Bidirectional Streaming



💡 Protocol Buffers

Interface Description Language (IDL) to define **messages** and **services**

Agnostic

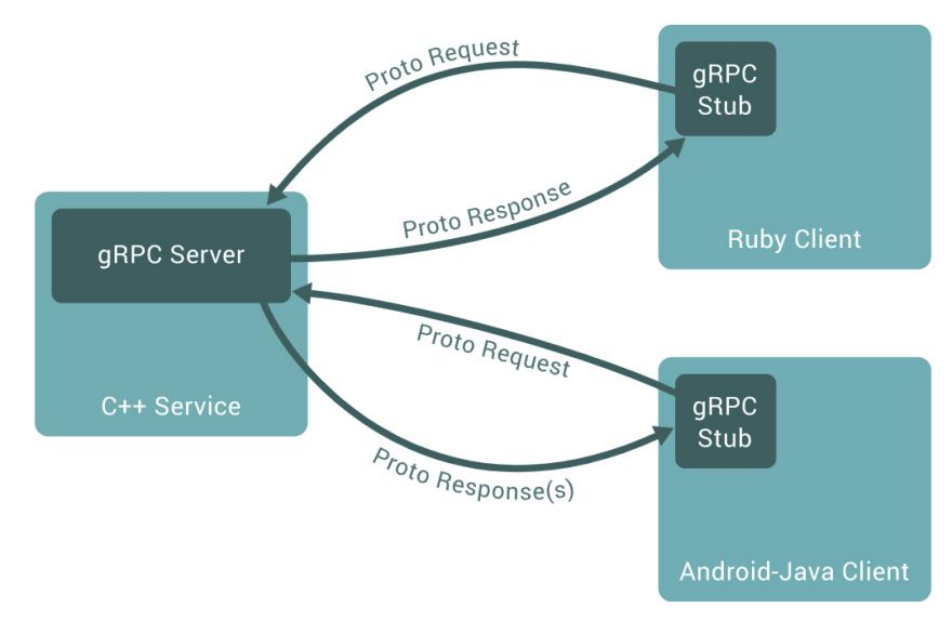
Interface independent from implementation

Binary data and (de)serialization (more efficient than JSON)

- less bandwidth (binary = small payloads)
- closer to the machine representation of the data
- less CPU intensive

gRPC

Client / Server Example



Source: https://grpc.io/docs/what-is-grpc/introduction/

gRPC

```
// todo.proto
syntax = "proto3";

package todoPackage;

service Todo {
   rpc createTodo(TodoItem) returns (TodoItem);
   rpc readTodos(voidNoParam) returns (TodoItems);
   rpc readTodosStream(voidNoParam) returns (stream TodoItem);
}

message voidNoParam {}

message TodoItem {
   int32 id = 1;
   string text = 2;
}

message TodoItems {
   repeated TodoItem items = 1;
}
```

gRPC

```
// server.js
const grpc = require("grpc");
const protoLoader = require("@grpc/proto-loader");
const packageDef = protoLoader.loadSync("todo.proto", {});
const grpcObject = grpc.loadPackageDefinition(packageDef);
const todoPackage = grpcObject.todoPackage;

const server = new grpc.Server();
server.bind("0.0.0.0:40000", grpc.ServerCredentials.createInsecure());
server.addService(todoPackage.Todo.service,
   {
       "createTodo": createTodo,
       "readTodos": readTodos,
       "readTodosStream": readTodosStream
   });
server.start();

const todos = [];
function createTodo(call, callback) {
   // Impl
}
```

gRPC

```
// client.js
const client = new todoPackage.Todo("localhost:40000",
grpc.credentials.createInsecure());

const text = process.argv[2];
client.createTodo({
   "id": -1,
   "text": text
}, (err, response) => {
   console.log("Received from server " + JSON.stringify(response))
});
```

💡 CRUD (REST) vs Actions (RPC)

```
POST /users/501/messages HTTP/1.1
Host: api.example.com
Content-Type: application/json

{"message": "Hello!"}
```

```
POST /SendUserMessage HTTP/1.1
Host: api.example.com
Content-Type: application/json

{"userId": 501, "message": "Hello!"}
```

🟢 Pros

- HTTP/2
- ProtoBuf
- Progressive feedback
- Actions oriented
- More complex procedures

🔴 Cons

- Schema
- ProtoBuf (hard to sniff on a network)
- Learning curve
- Not ready (yet) for the web

⚖️	{ REST }	gRPC
Protocols	**HTTP/1.1** HTTP/2 but… (request / response)	**HTTP/2** + RPC (client / response)
Schema	No but…	**Yes** (`.proto`)
Formats	**JSON | XML | PDF | HTML …**	**Binary (Protocol Buffers)**
Versioning	Yes	Yes
***Streaming*/bidirection**	No but…	**Yes**
Browsers Support	**Yes**	**No** but gRPC-web + proxy
Code Generation	Swagger / OpenAPI / Postman …	**protoc** (native in gRPC)
Security	JWT / OAuth	SSL/TLS / ALTS / JWT / OAuth

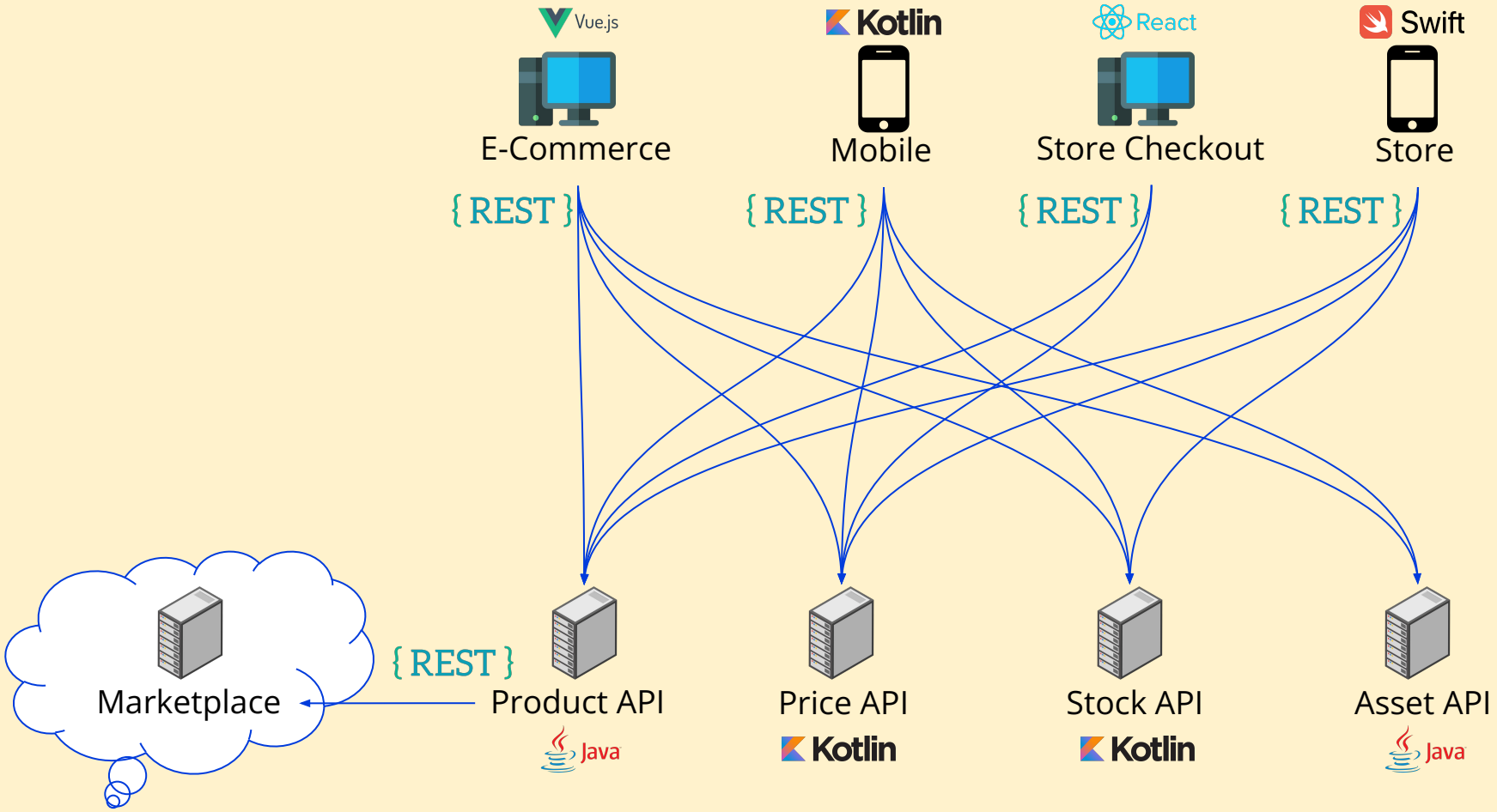
🤔 Why choose gRPC?

Motivations

- Performance
- Payloads size
- Bilateral communication and real-time streaming
- More complex actions

Use cases

- Microservices
- Mobile applications
- Internet of Things (IoT)
- Multi-languages systems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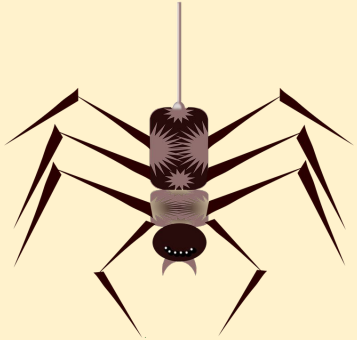

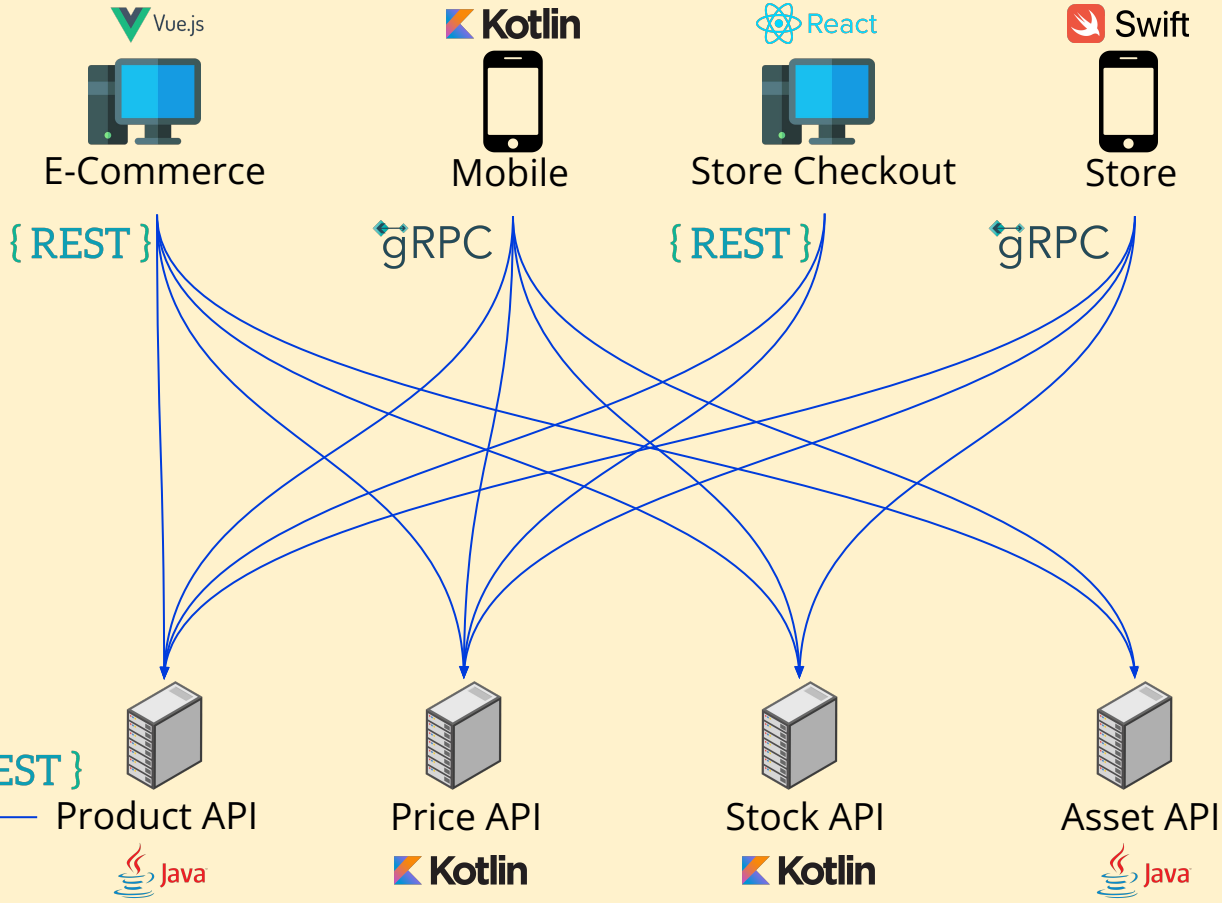
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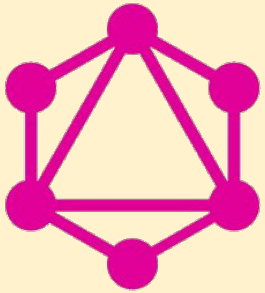


GraphQL

What is GraphQL?

Language created by **Facebook** in **2012**
Open-sourced in **2015**: https://github.com/graphql

Extension `.graphql(s)`

Responses in **JSON**

Specification: https://spec.graphql.org

Can be transported by **HTTP POST**

Client / Server (Apollo Server, Spring GraphQL…)

Key Concepts

Schema (+ introspection)

Type, interface, input, fields, arguments
Scalar type (`Int`, `Float`, `String`, `Boolean`, `ID`, `scalar Date`...), enum, fragment

Operation : **`query`** (parallel read), **`mutation`** (serial create/update/delete), **`subscription`** (streaming) + variables

Directives: `@include|skip(if: $isAwesome)`

Non-nullable with `!`

💡 Patterns

***Composite pattern*:** Compose multiple calls (API, external service, *in-memory*...) to aggregate data - API Gateway / BFF (*Back-end for Front-end*)

***Proxy pattern*:** Add features to an API (often an old legacy one)

***Facade pattern*:** Simplify call to an API

Graphs… Graphs everywhere!

« It's Graphs All the Way Down »

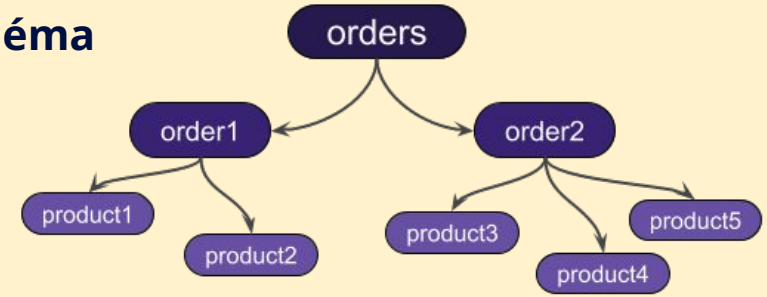
Domaine métier = **graphe** défini par un **schéma**

Différents types (de nœuds)

Connexions entre les nœuds

Références de types à types

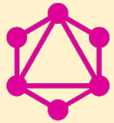
https://graphql.org/learn/thinking-in-graphs



GraphQL Call Example

```
# Query
{
  orders {
     id
     products {
       product {
        id
        name
       }
      quantity
     }
     amount
  }
}
```

```
{
  "data": {
    "orders": [
      {
        "id": 0,
        "products": [
          {
            "product": {
              "id": 1,
              "name": "Crème solaire"
            },
            "quantity": 62
          }
        ],
        "amount": 100.00
      }
    ]
  }
}
```



GraphQL

🟢 Pros

- No over|underfetching
- Composition
- Limit client perimeter
- Auto-generated documentation
- Most languages supported
- Operation registry

🔴 Cons

- Errors management
- Up|download not native
- 1 platform = 1 implementation
- Learning curve

	{ REST }	gRPC	GraphQL
Architecture	***Server driven***	***Server driven***	***Client driven***
Endpoints	**n**	**n**	**1**
Schema	No but…	**Yes**	**Yes**
Operations	*Create, Read Update, Delete*	Functions	*Query, Mutation, Subscription*
Formats	**JSON | XML | HTML…**	**Binary (ProtoBuf)**	GraphQL & JSON
Over|underfetching	**Yes**	**Yes**	**No**
Versioning	Yes	Yes	**No**
Cache	**GET et POST**	?	Yes but…
Security	JWT / OAuth	SSL/TLS / JWT / OAuth	Yes but…

🤔 Why choose GraphQL?

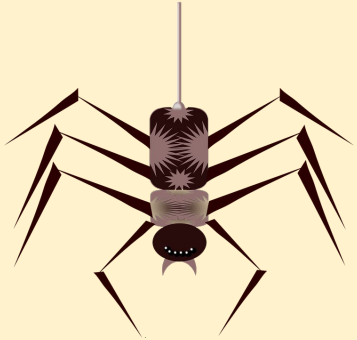
Motivations

- More control on retrieved data (client-driven)
- Use multiple data source
- Limited bandwidth

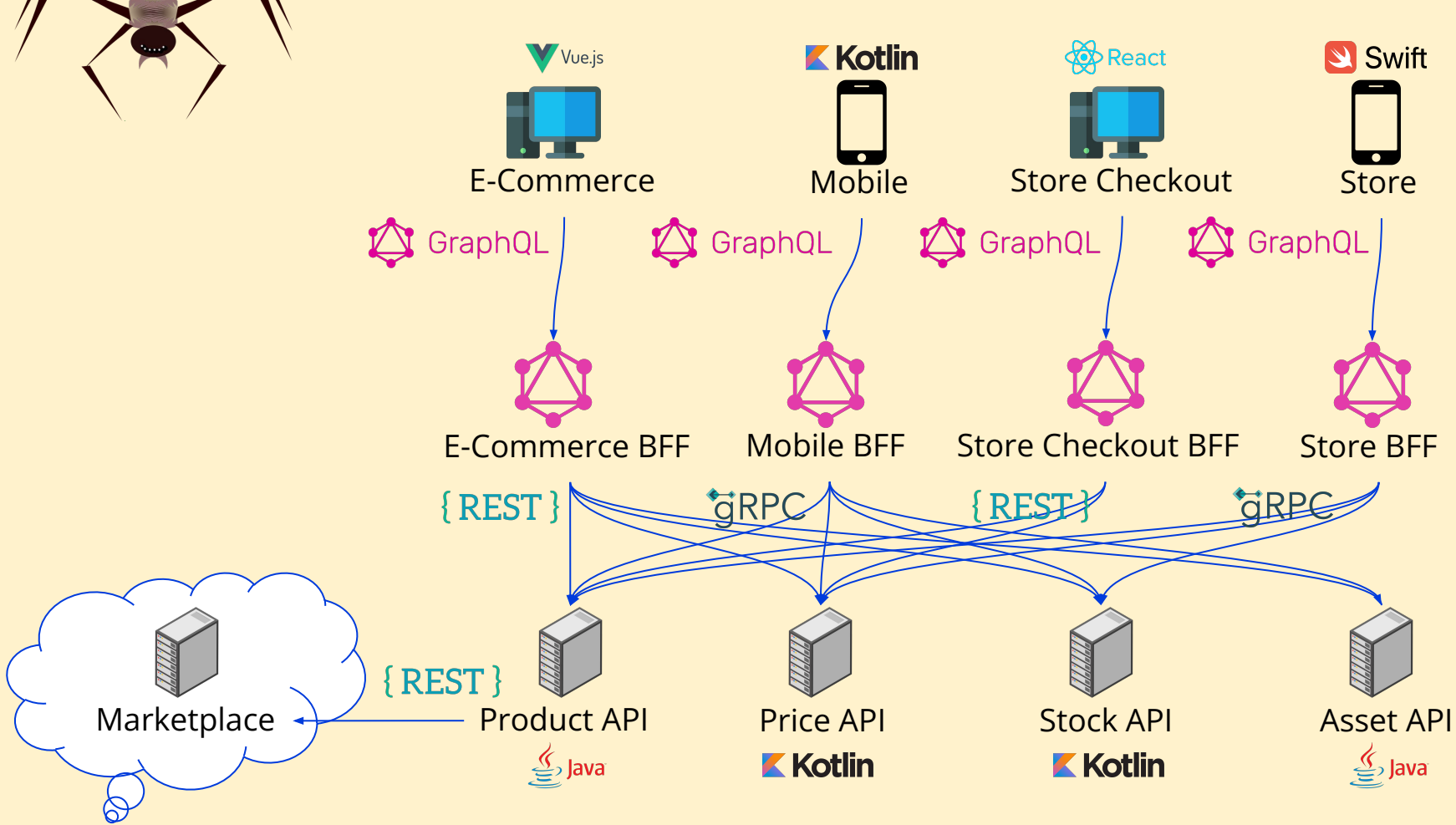
Use cases

- Big web applications (e-commerce…)
- Mobile applications
- Legacy applications with old and poor maintainability APIs

- Production use cases examples (GitHub…)



Vue.js
Kotlin
React
Swift
E-Commerce
Mobile
Store Checkout
Store
{ REST }
gRPC
{ REST }
gRPC
Marketplace
{ REST }
Product API
Price API
Stock API
Asset API
Java
Kotlin
Kotlin
Java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webhooks

What are Webhooks?

Coined in **2007** by **Jeff Lindsay**

NOT a standard

Event types (event-driven API)

(Un)subscription

Send data through HTTP POST to a **callback URL** in response to an **event type**

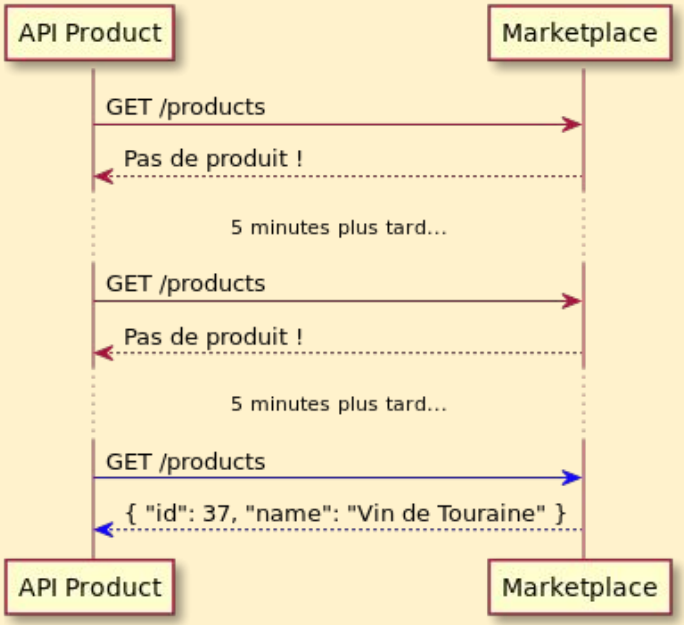
Do not mix up...

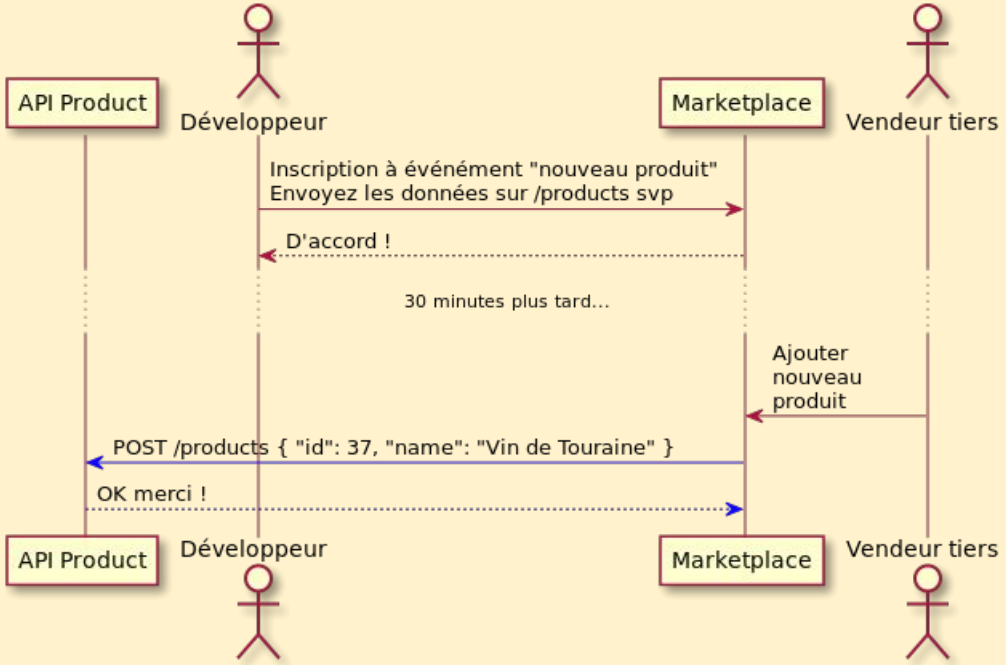
Webhooks: Send a message in response to a server event to a client through a callback URL containing a secret - One-way communication

Websockets: Two-way low-latency client/server communication, client opens a connection, scalability challenges, decrease HTTP requests amount...

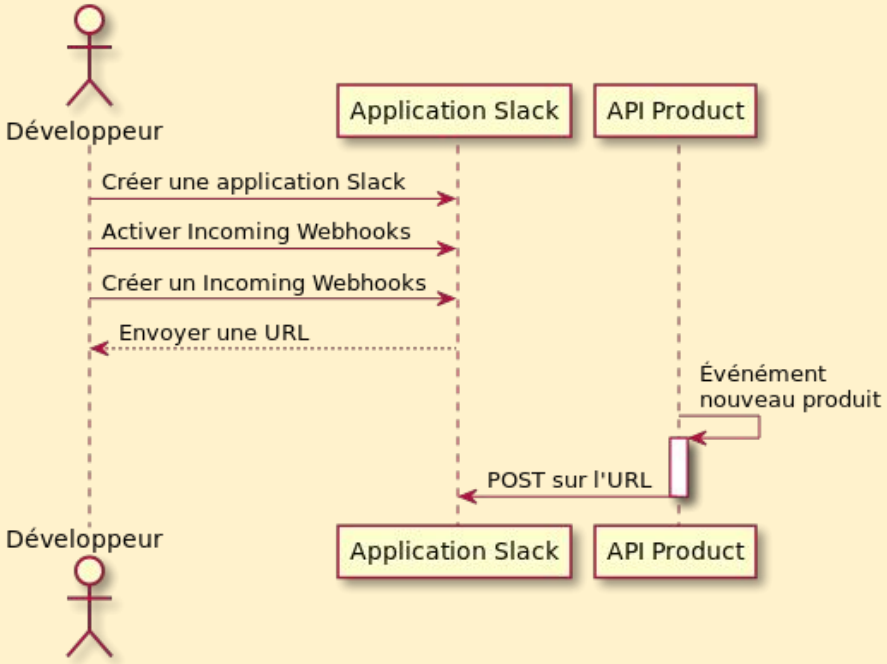
Server-sent events (SSE): Events transmissions to a web client from a server - One-way communication

Pull vs Push


API Product
Marketplace
GET /products
Pas de produit !
5 minutes plus tard...
GET /products
Pas de produit !
5 minutes plus tard...
GET /products
{ "id": 37, "name": "Vin de Touraine" }
API Product
Marketplace


API Product
Développeur
Marketplace
Vendeur tiers
Inscription à événement "nouveau produit"
Envoyez les données sur /products svp
D'accord !
30 minutes plus tard...
Ajouter nouveau produit
POST /products { "id": 37, "name": "Vin de Touraine" }
OK merci !
API Product
Développeur
Marketplace
Vendeur tiers

Webhooks Call Example




```
POST
https://hooks.slack.com/services/T00000000/B000
00000/XXXXXXXXXXXXXXXXXXXXXXXX
Content-type: application/json
{
  "text": "New product added!"
}
```

🟢 Pros

- Push instead of pull
- Send data outside a system

🔴 Cons

- External clients must subscribe
- 1 webhook = 1 event (“noise”)
- Server down = lost data
- Less control (data flow)

⚖️	{ REST }	webhooks
Mecanism	***pull*** data (*request based*)	***push*** data (*event based*)
Communication	**Two-way** (⚠️ not streaming)	One-way
Real-time	**No** but…	**Yes**
HTTP Verbs	GET | POST | PUT | DELETE | PATCH …	**POST**
Formats	**JSON | XML | PDF | HTML …**	JSON | XML
Payloads size	Can be huge	**Small, in general**

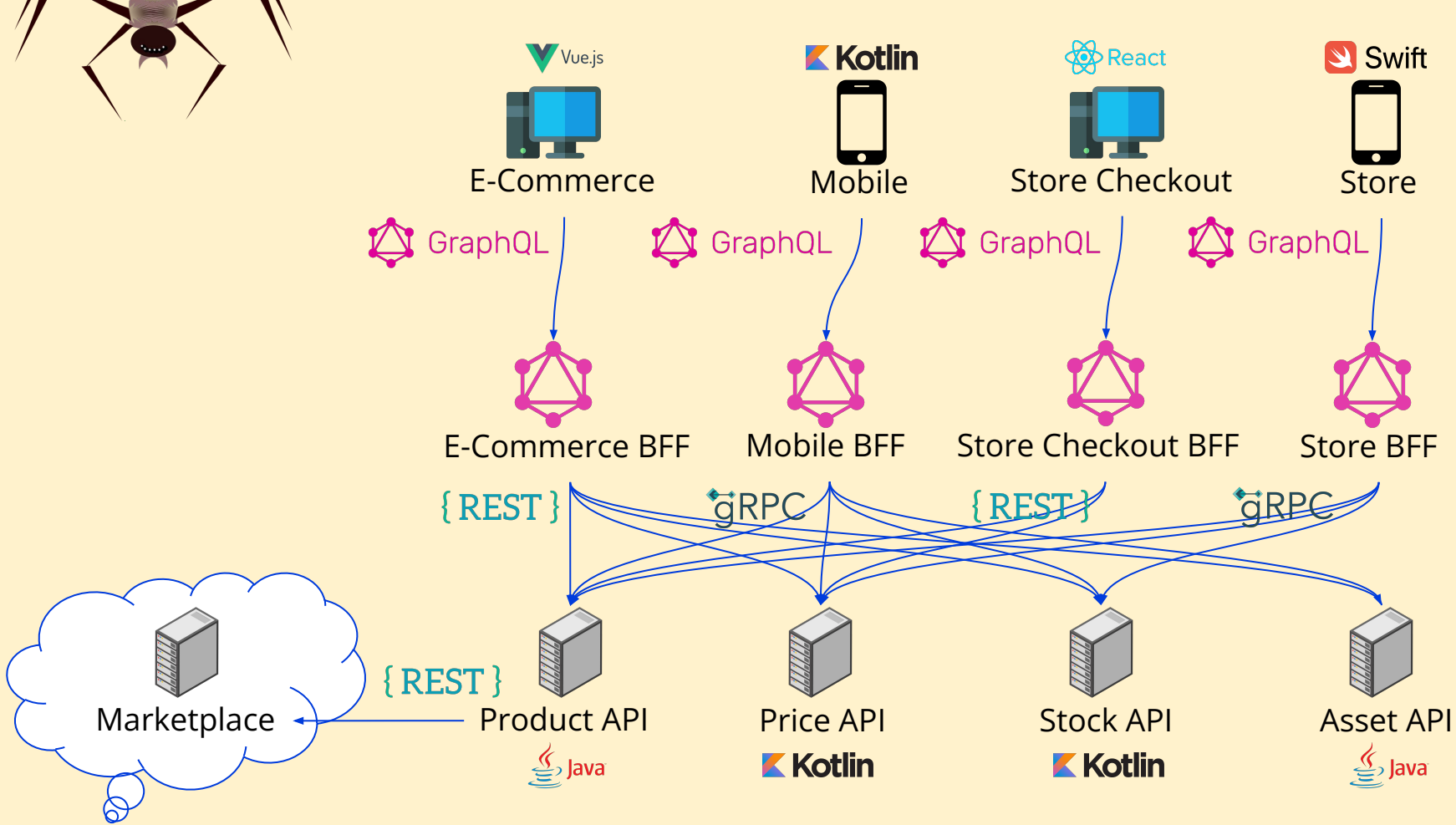
🤔 Why choose webhooks?

Motivations

- Need to push instead to pull
- Trigger punctual actions
- Open a system externally

Use cases

- Real-time systems synchronization
- Notifications (alerts, informations...)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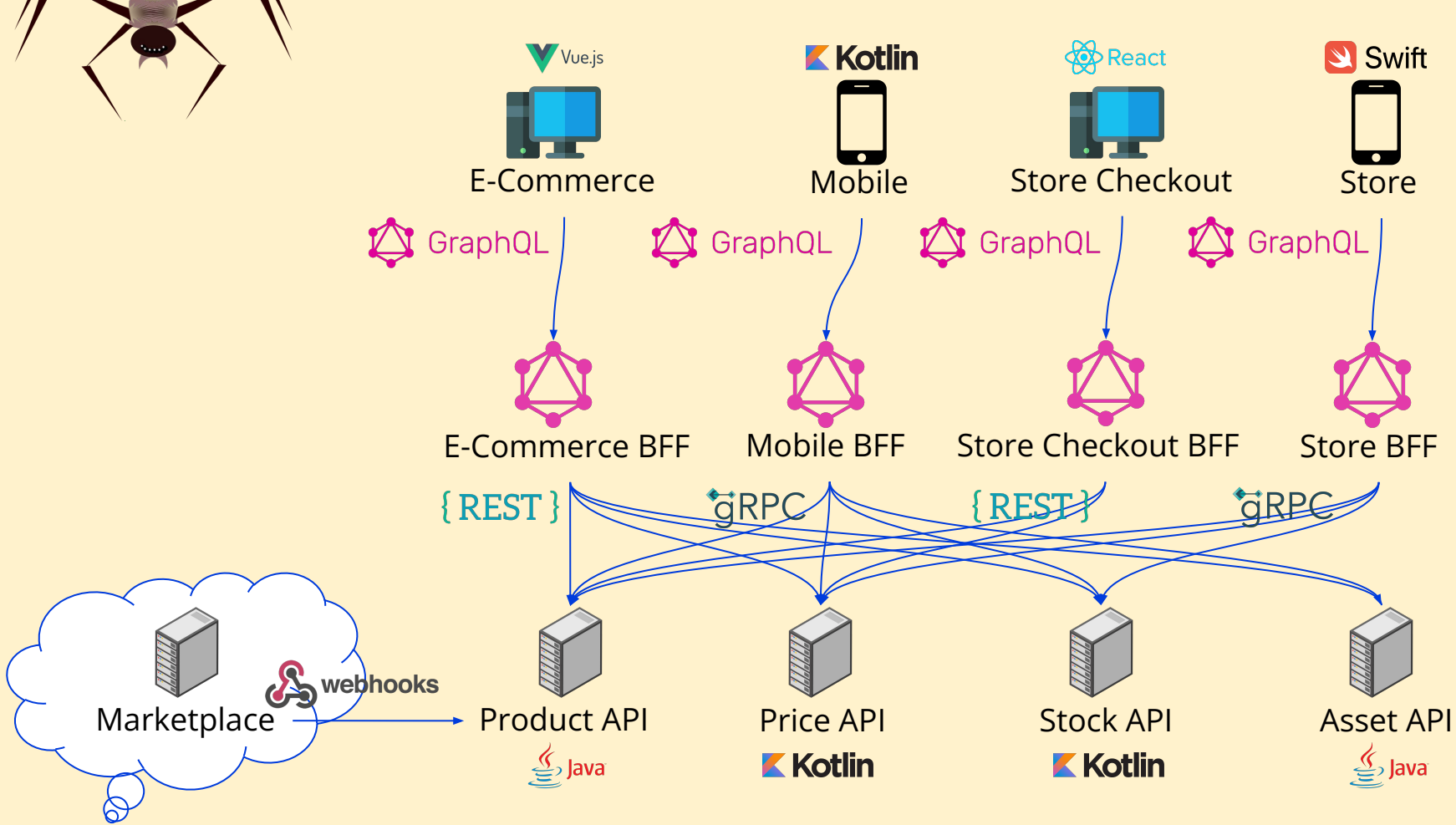
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So, is that a good situation?

🤔 It depends!™ There is no good or bad situation...

☎️ Diversity of communication modes

REST: Stateless Architecture - Business data transfer - Standards (HTTP, URI, JSON) - Need to iterate quickly - Web - CRUD - File up|download

gRPC: RPC Framework + HTTP/2 + ProtoBuf - Need a well defined data amount or a routine operation - Consumers with limited power and resources (mobile, IoT) or microservices

GraphQL: Query Language - Compose multiple data sources - Client-driven - Avoid over|underfetching

Webhooks: HTTP POST - Auto data updates in response to events - Push vs Pull

🗣️ The final word: stay pragmatic!

⚒️ **With the right tools,** you will work

🆘 **On communities**, you will rely on

❤️ **Multiple technologies at the same time**, you will consider

👨‍🎓 **That your team masters the chosen technologies**, you will ensure

🟢 **That the systems in place respond with the given parameters**, you will check

↔️ **Business needs with the appropriate approach**, you will align

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Thank you! 🙏

Do you have any questions?

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