



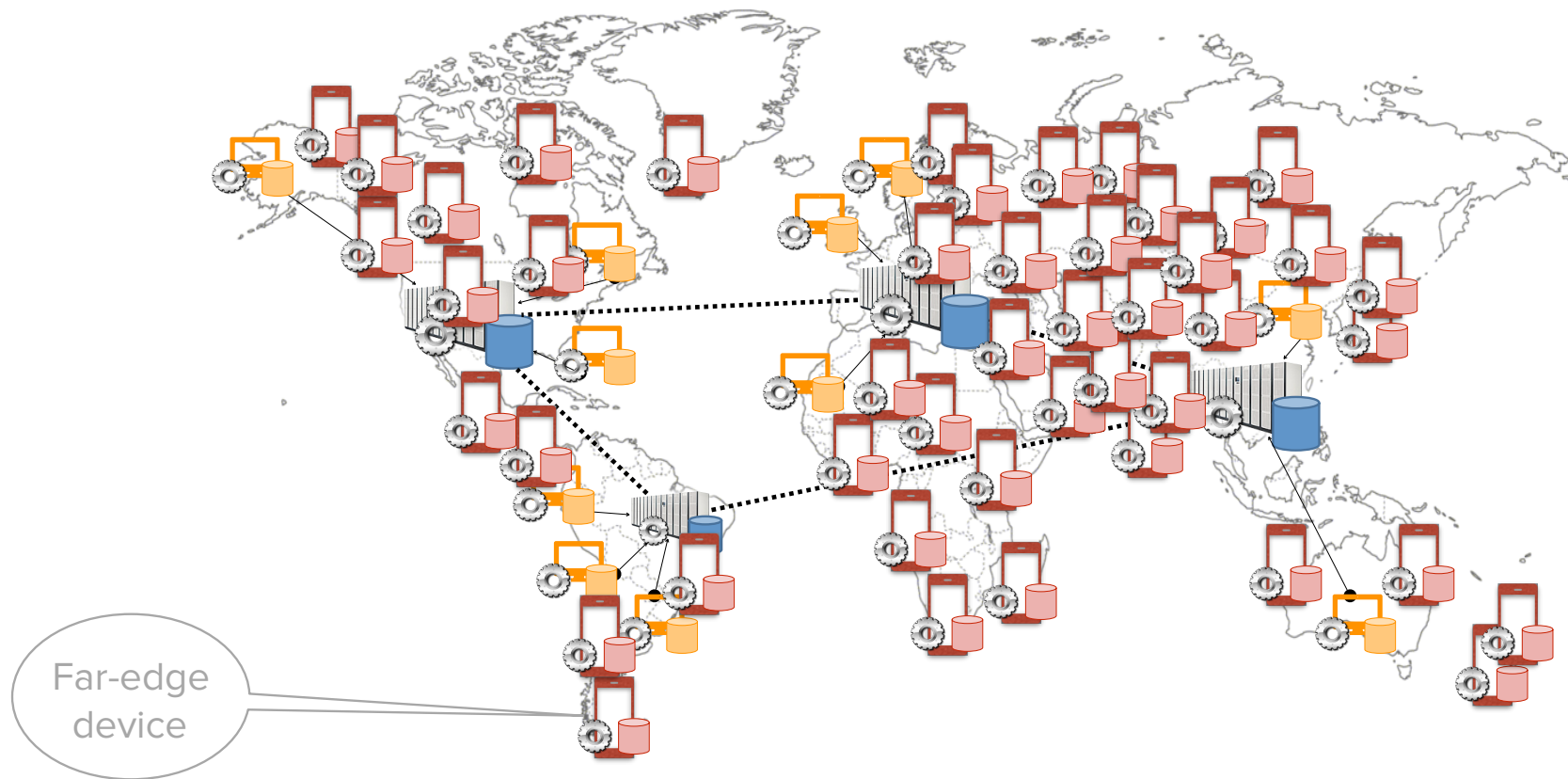
CONCORDANT

Power to the edge

Ilyas Toumlilt — *Chief Technical Officer & Standing CEO*

Marc Shapiro — *Chief Scientific Officer*

Local-first data



Replicate
Collaborate
Reads++
Updates?

BASF chemistry lab: Collaborative Editing

Students + instructor

- Share spreadsheets
- No internet in lab
- Continue from home

Pain points

- Cloud latency
- Conflicts
- Online—offline—online continuity



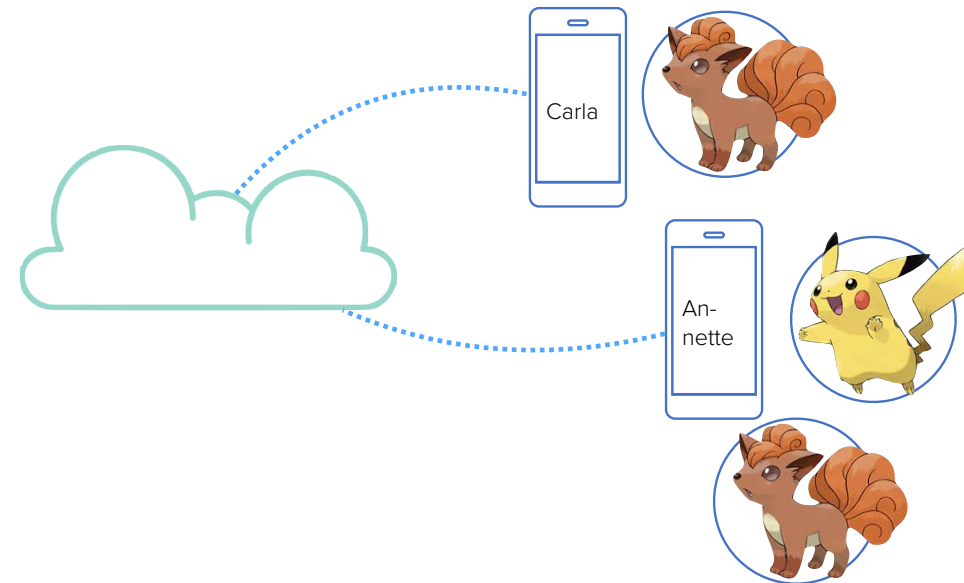
Mixed-reality multiplayer game

e.g. Pokémon Go, Metaverse

- Synchronises through the cloud

Pain points

- Latency, bandwidth, availability
- Blockchain: poor scalability, rollbacks
- Consistency anomaly:
 - Duplicated character, violates $0 \leq \text{number of owners} \leq 1$



Concordant — the platform

Concordant concepts

API

System topology

Replication & caching

Concordant

Edge-first: store & execute on device

- Fast, available
- Seamless online—offline

Self-reliant but leverage cloud

Empower user

- At-edge share, collaborate
- Mobility
- Security

Empower dev

- Data, not network
- Consistency
- Simple API
- Simple, automated deployment
- Efficient, scalable

Concordant concepts & API

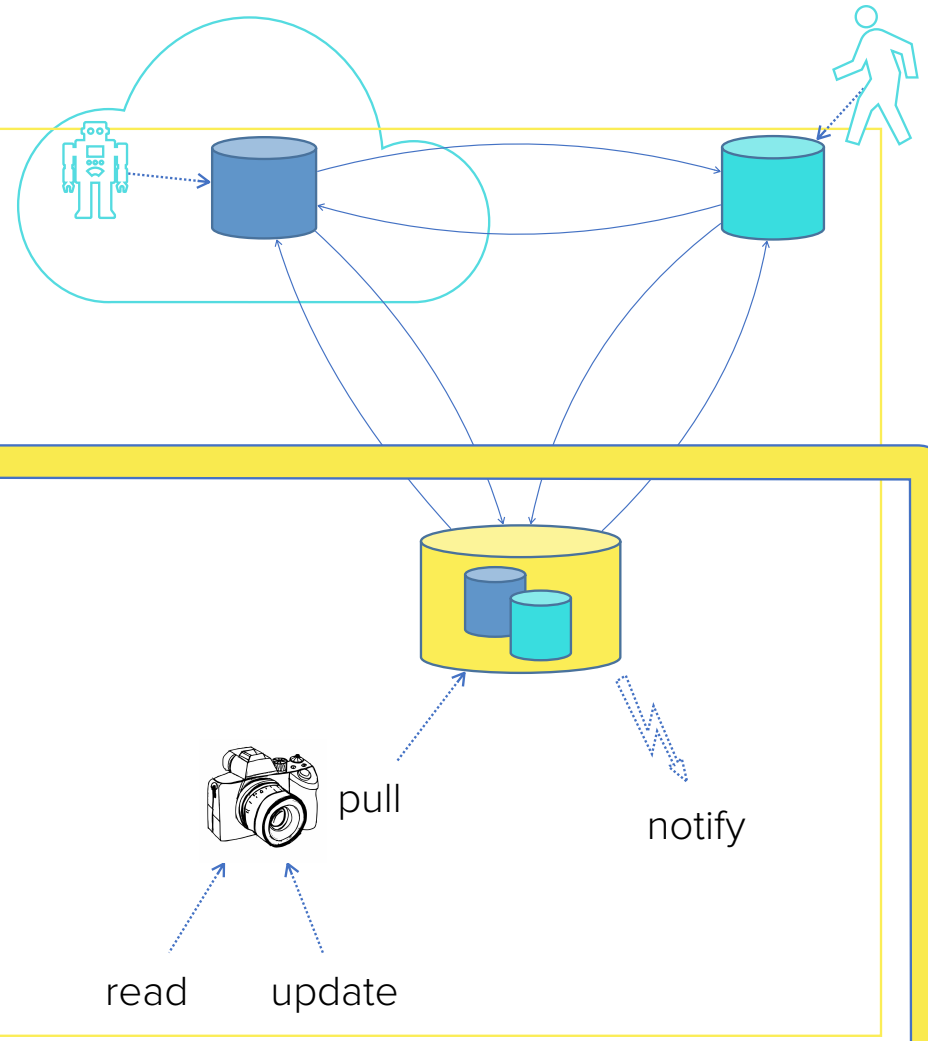
Replicate/cache data on device

Transmit, persist

CRDTs merge concurrent

Consistent snapshot

- *available n TCC+ n policy*



Conflict-free replicated data types

Concordant objects are CRDTs:

- Mathematically sound
- Widely adopted in industry
- Invented by our founders

Compatible with standard language objects

- Same sequential semantics
- Well defined, mergeable concurrent behaviour



Conflict-free replicated data type

From Wikipedia, the free encyclopedia
(Redirected from [CRDT](#))

In [distributed computing](#), a **conflict-free replicated data type (CRDT)** is a [data structure](#) which can be [replicated](#) across multiple computers in a [network](#), where replicas can be updated independently and [concurrently](#) without [coordination](#) between the replicas, and where it is always mathematically possible to resolve inconsistencies that might come up.^{[1][2][3][4][5][6][7][8]}

The CRDT concept was formally defined in 2011 by Marc Shapiro, Nuno Preguiça, Carlos Baquero and Marek Zawirski.^[9] Development was initially motivated by [collaborative text editing](#) and [mobile computing](#). CRDTs have also been used in [online chat](#) systems, [online gambling](#), and in the [SoundCloud](#) audio distribution platform. The [NoSQL](#) distributed databases [Redis](#), [Riak](#) and [Cosmos DB](#) have CRDT data types.



Objects and collections

A database contains any number of *collections*

Collections are disjoint

The collection is the *unit* of caching and of consistency
(Future work: dependencies between collections)

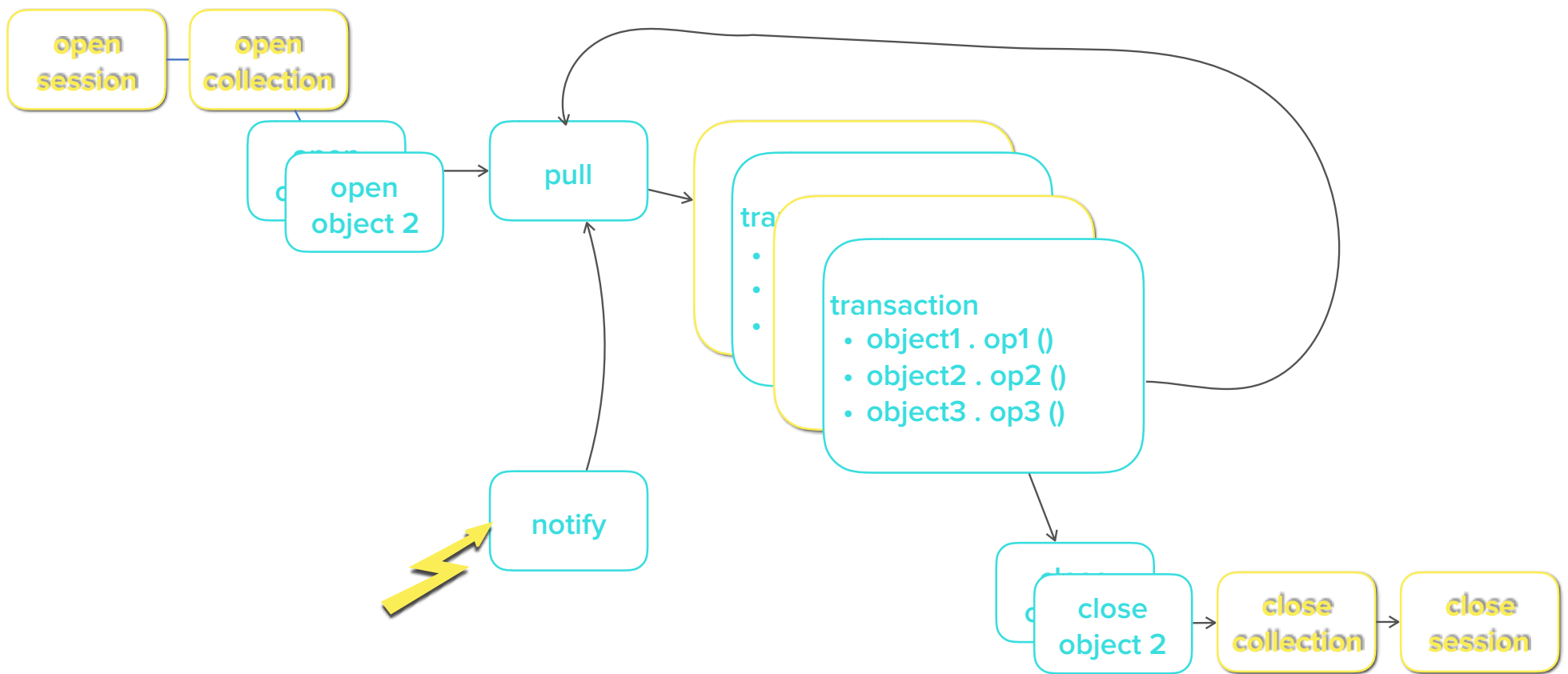
A collection contains any number of *objects*

- Identified by a key
- Restricted to Concordant CRDT library
- Once opened: Ordinary language objects

my_collection

x	y
z	t

c-client API: application lifecycle



Consistency

Stronger consistency \Rightarrow fewer bugs

TCC+

- Strongest available under partition
- No ordering anomalies
- Transactional
- Concurrent, convergent

Current status

Open source: gitlab.inria.fr/concordant

Full CRDT library, stable API

Prototype applications: Collaborative Sudoku, text editor

Details:

- TypeScript, Kotlin → Java, Javascript
- Star topology
- PouchDB/CouchDB storage and communication

In progress:

- TCC+
- Security
- Deltas

Concordant — the start-up

The founders

World-class team

Developing Deep Tech for > 10 years

Inventors of CRDTs, AntidoteDB,
Colony



Ilyas Toumlilt

CHIEF TECHNICAL OFFICER, STANDING CEO



Marc Shapiro

CHIEF SCIENTIFIC OFFICER



Nuno Preguiça

SENIOR TECHNICAL ADVISOR



Annette Bieniusa

SENIOR TECHNICAL ADVISOR

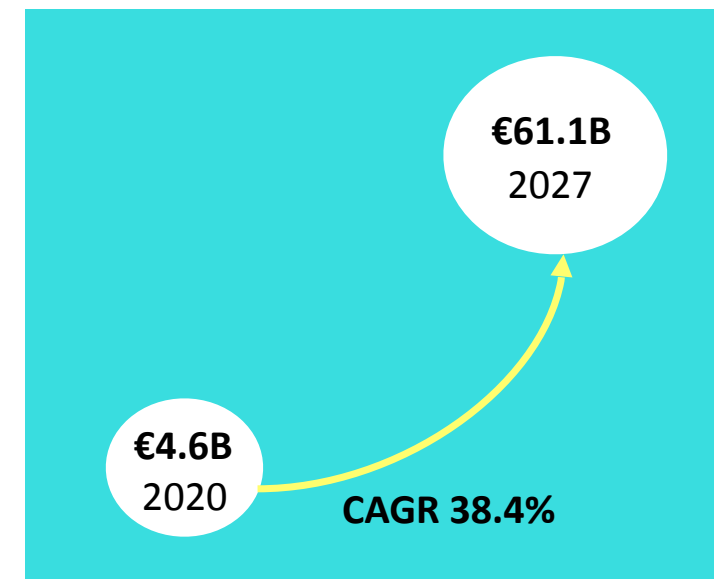


[RainbowFS Workshop — March 2022]

The Edge Computing market

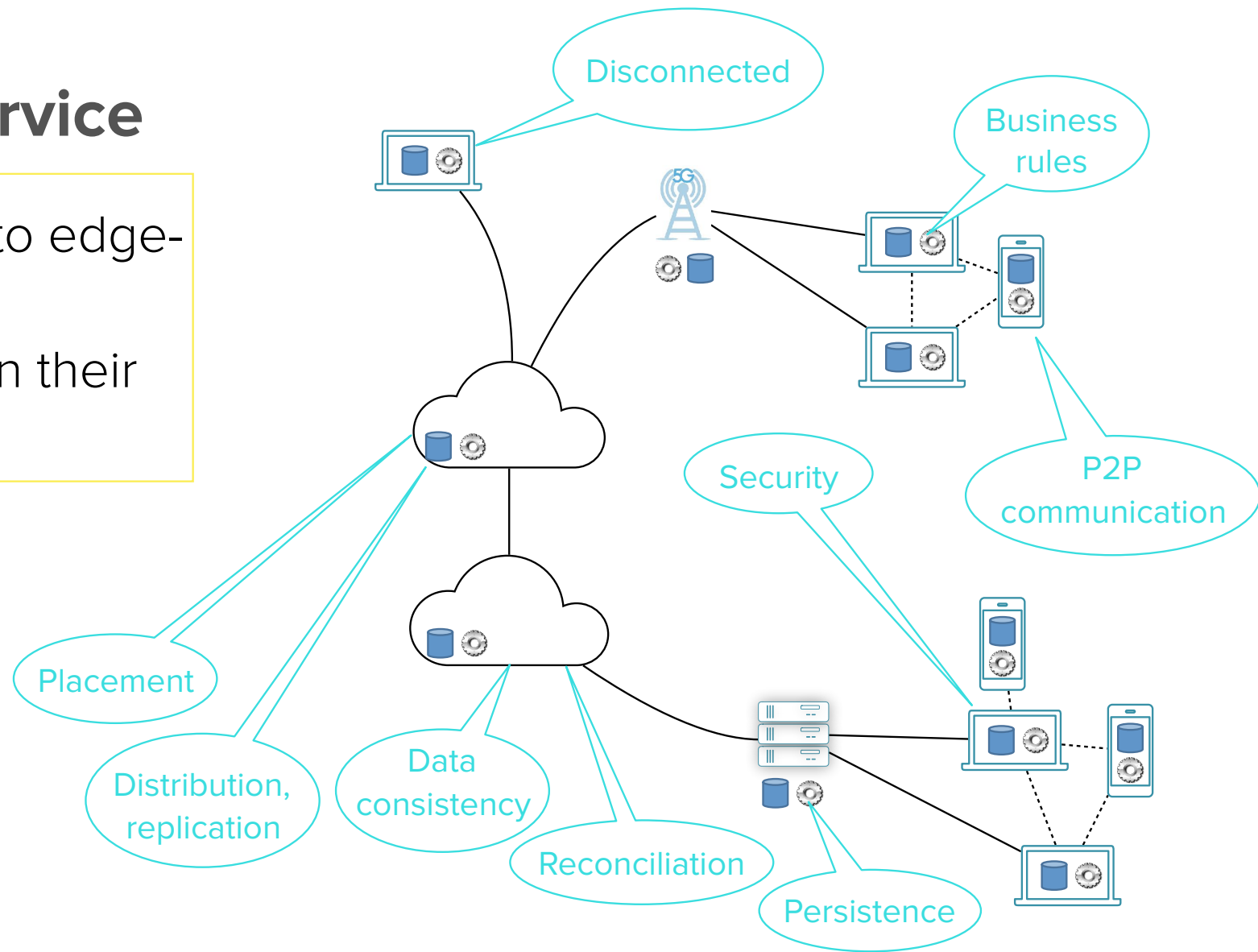
Exponential growth, multi-industry

“Edge Computing is actually being implemented today in many of our clients’ environments, [...] enabling entirely new applications and data models. Simply put, Edge has moved from concept and hype into successful vertical industry implementations, with general purpose platform status approaching rapidly.” [Bob Gill, Gartner, oct. 2021]



Concordant service

From cloud-centric to edge-centric
Developers focus on their business



Competition

	Ggl Docs	CoreKit	AntidoteDB	Macrometa	PouchDB	Ditto	YJS	Concordant
Local first								
Seamless online-offline								
P2P collaborate								
Data API								
Consistency, integrity								
Far edge								
Ease of deployment								
Open source								

Developer value

Power your apps

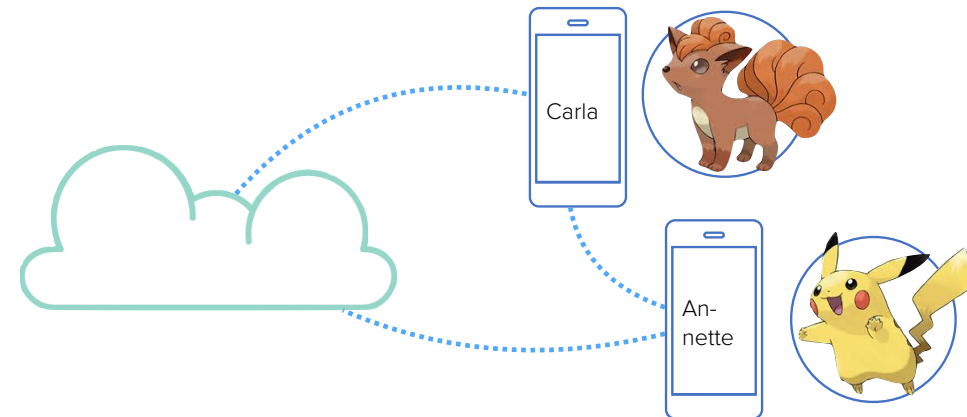
Local first: immediate response,
seamless online/offline

Application-level consistency enforced

Data stored (encrypted) in the cloud

Open source, independent of cloud
provider

Ease of deployment



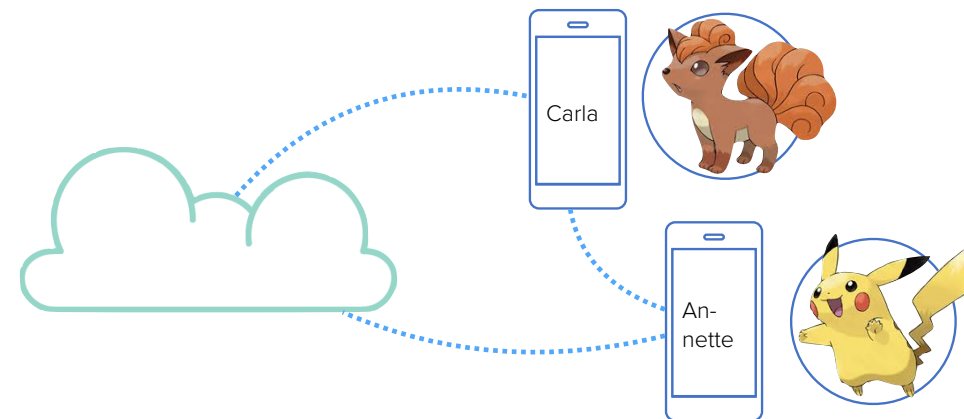
User value

Local first: seamless, mobile, trust

Liberated from the cloud

Update, co-operate @edge

Security: Data encrypted end-to-end,
access control



Business value

Free Community Edition

- Try it out
- Fully functional
- Your data is yours

Enterprise features: simple, proportional invoicing

Expert team



	C E	E E	
CRDTs	✓	✓	free
Edge database	✓	✓	free
Deltas, transactions, sync	✓	✓	free
Authentication, security	✓	✓	free
Packaging, deployment, monitoring	✓	✓	free
Cloud connection, analytics, backup		✓	#servers
Causal consistency		✓	#servers
JRC tooling, total-order consistency		✓	#servers
e2e encryption, dynamic access control		✓	#devices
Management, automation, devops tooling		✓	#devices

Market approach

Engage with open-source developer communities

- Slate, Quill
- Unity
- Elrond, Solana

Enterprise Edition add-on to

- Cloud marketplaces
- Game engines

Self-hosting SDK

As-a-service hosting