✨ UNIVERSAL HOSTLESS

SUBSTRATE

FOR A POST-SERVERLESS FUTURE 🚀

A UNIVERSAL HOSTLESS SUBSTRATE

BROOKLYN ZELENKA, @expede

fission

A UNIVERSAL HOSTLESS SUBSTRATE

BROOKLYN ZELENKA, @expede

- Cofounder/CTO at Fission
  - `https://fission.codes`
- PLT & VMs
- Previously an Ethereum Core Dev
  - EIPs 615, 902, 1066, 1444
  - ECIP 1050
- Now spending a lot of time with IPFS & DIDs
- Lots of R&D (but still have to deal with segfaults, &c)

fission

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TALK GOALS

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- Be as fringe as this track gets 😛🤭
- Expose you to a lot of ideas in broad strokes
- Nothing that’s science fiction!
- A peek at what's coming in the next 2-5 years

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PARADIGM WAVES

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CONTAINERS

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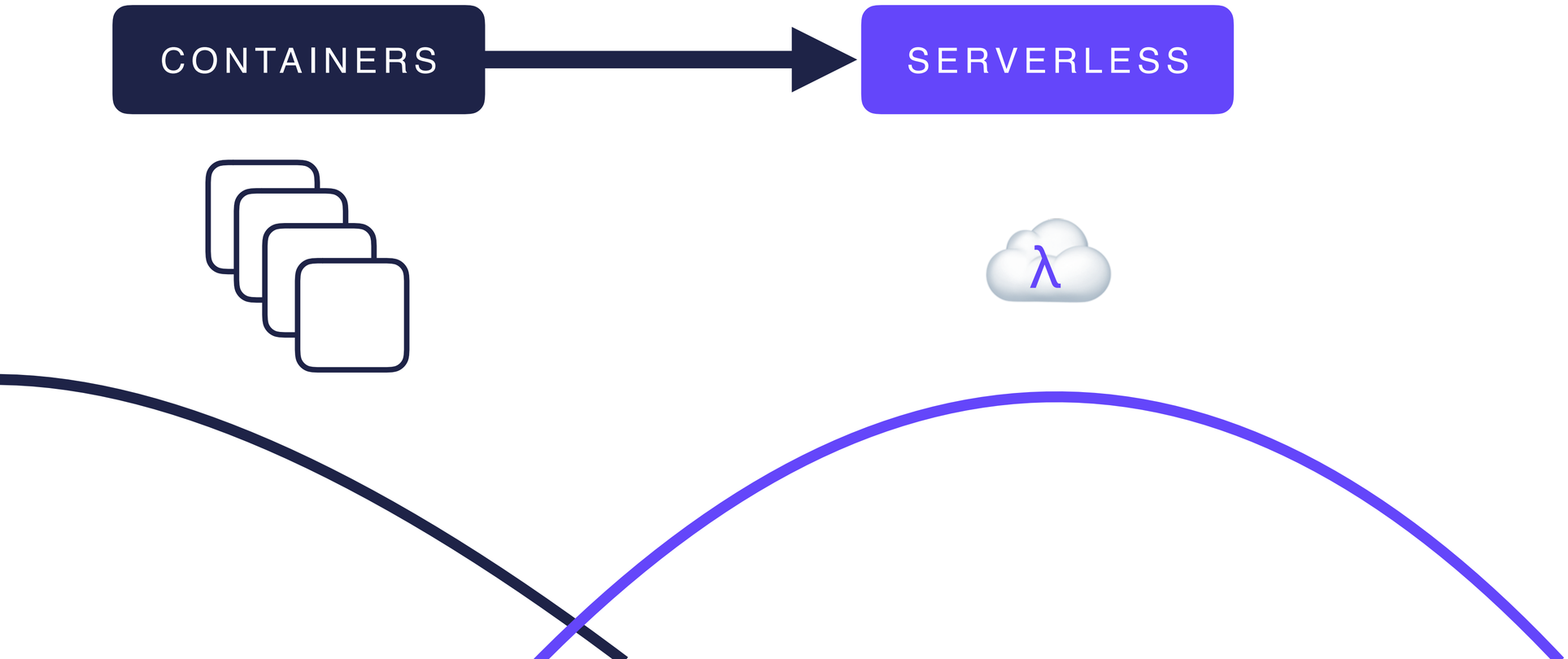
PARADIGM WAVES



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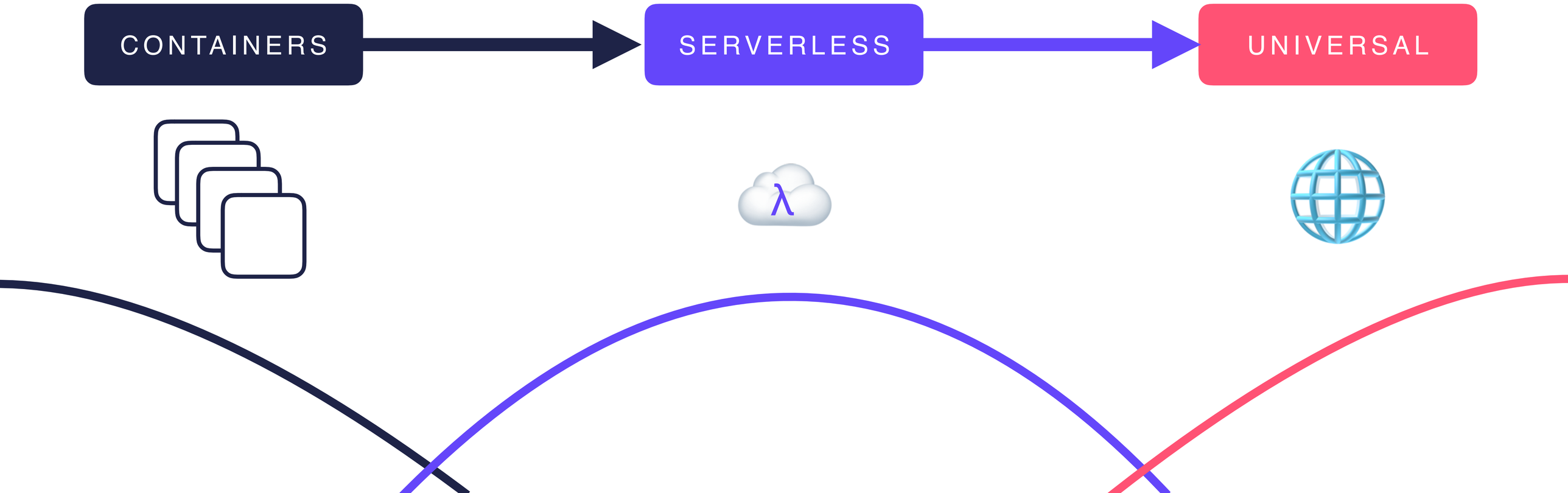

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NATIVE SDK FOR THE WEB

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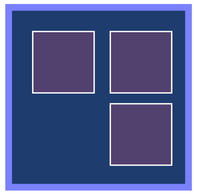

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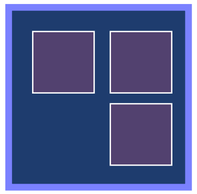

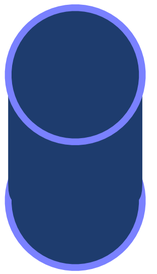

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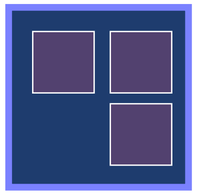

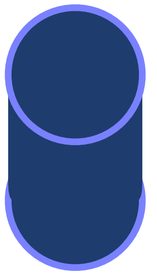

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UPSHOT?

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UPSHOT?

- Go from zero to production on a plane ✈️
- Move data to compute and vice versa 🔄
- Scale linearly 📈
- Serve areas that lack sufficient cloud hardware 🖥️
- Anyone can be a service provider (lower bar to entry) 💁‍♀️💁‍♂️

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WHY NOW?

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Social & Business

- Licensing innovation (yes, really)
- Data ethics
- Platform lock-in & profiteering

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Technical

- Commons infrastructure
- Content addressing
- Cryptographic advancements
- Distributed computing advancements
- Universality (location, provider, & time independence)

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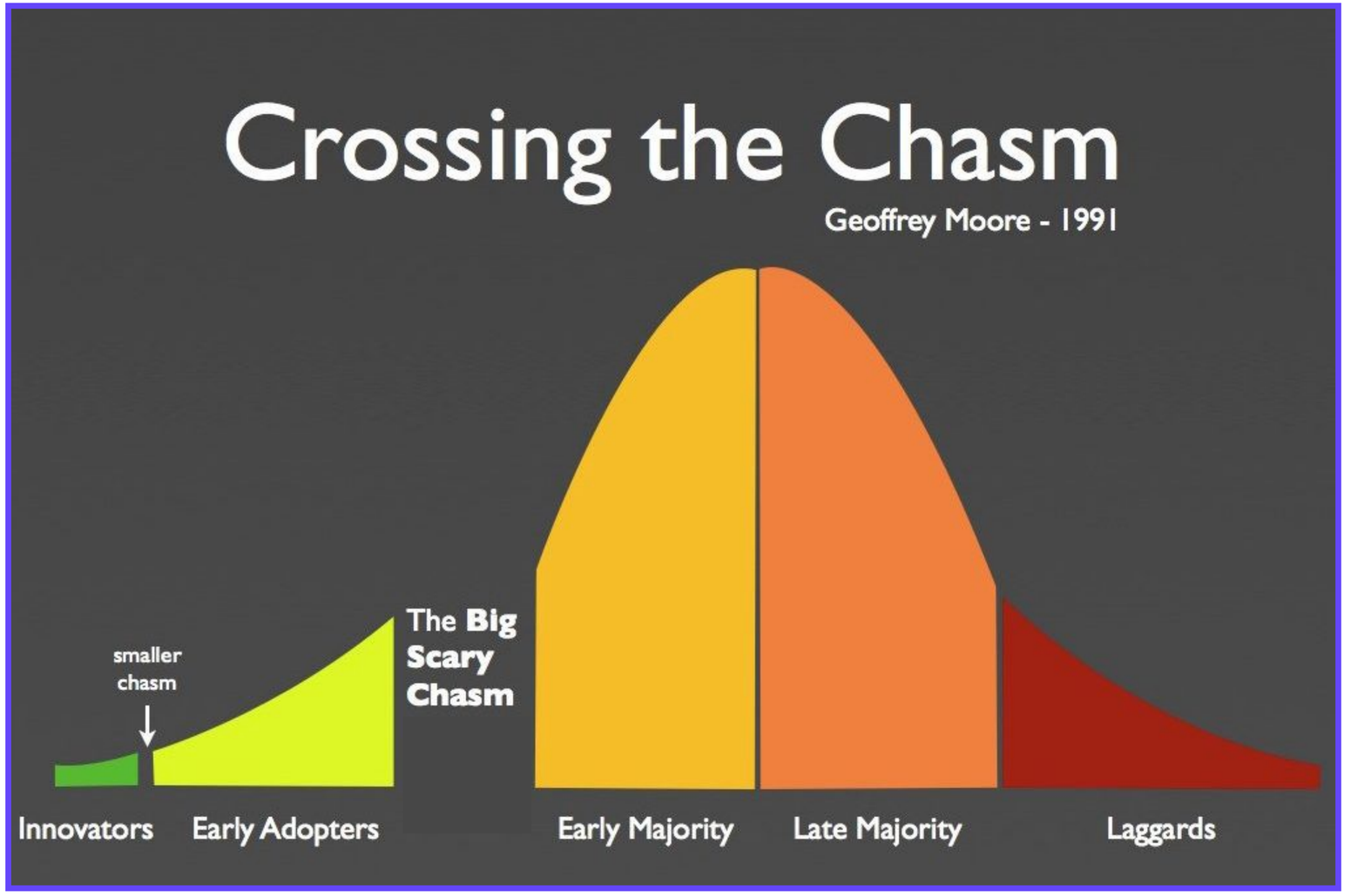

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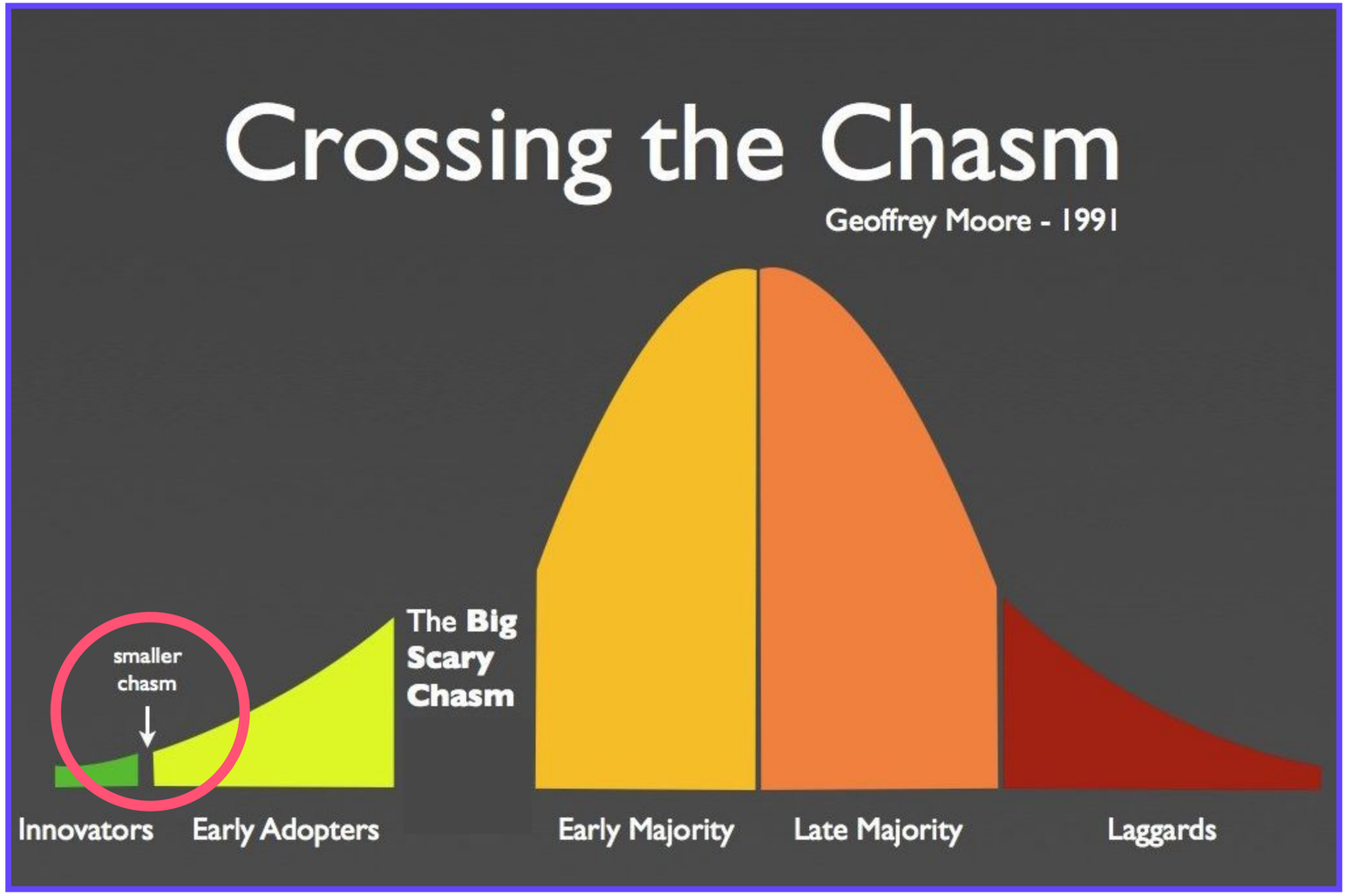

COMMONS INFRASTRUCTURE

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🤝 A SUBSTRATE FOR EVERYONE 🌍

COMMONS INFRASTRUCTURE

OPEN SOURCE

Lots of people work on it, everybody benefits from it, and then people can build upon it (even in a revenue generating fashion)

TED LEUNG (2005)

COMMONS INFRASTRUCTURE

OPEN NETWORKS

Lots of people work on it, everybody benefits from it, people can build upon it (even in a revenue generating fashion),
and it's "owned" by everyone.

By participating — even with competitive goals — you are cooperating by serving the content and running compute of others.

IPFS PRIMER

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MEET THE CONTENT-ADDRESSABLE WEB 👋

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INTERPLANETARY FILE SYSTEM

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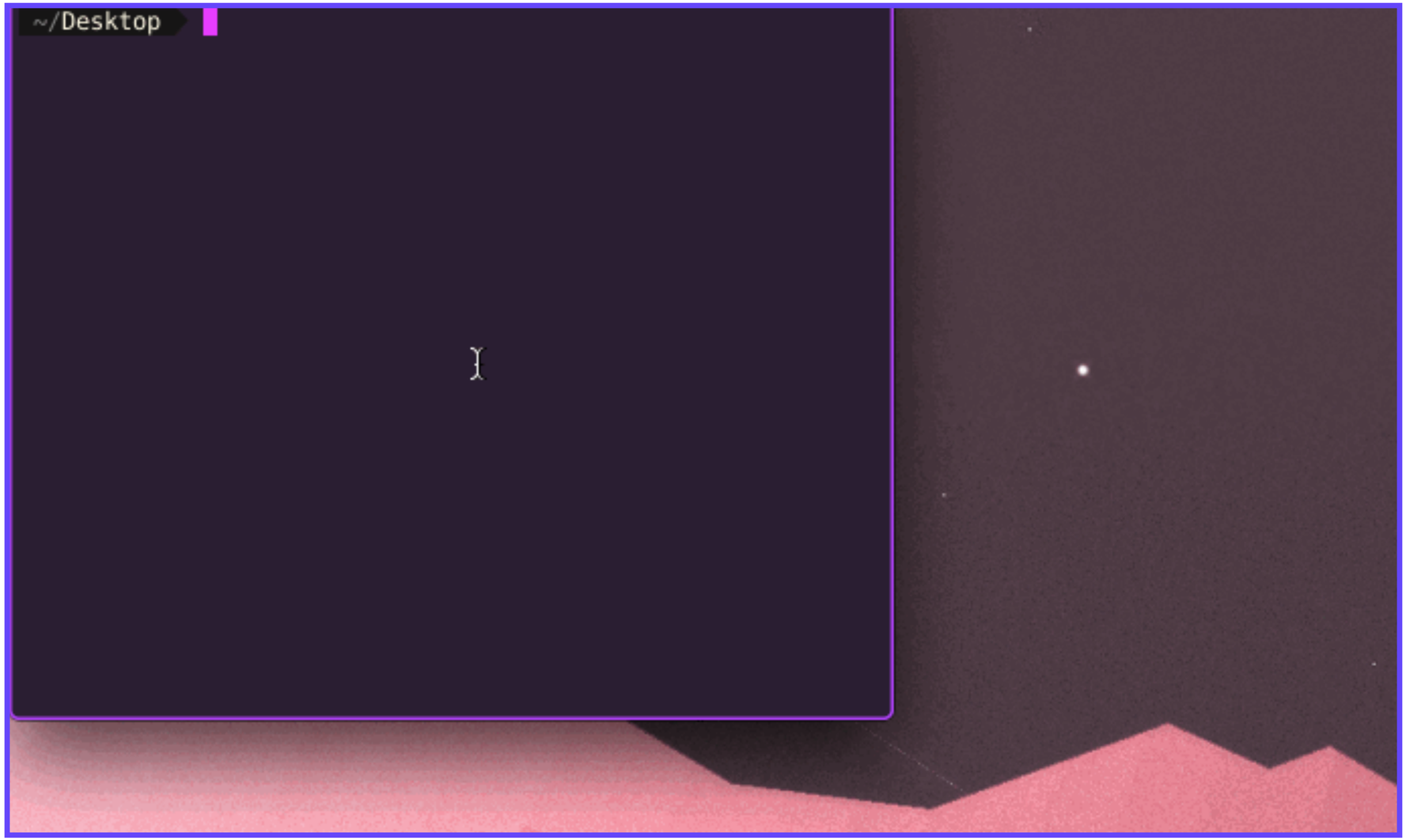

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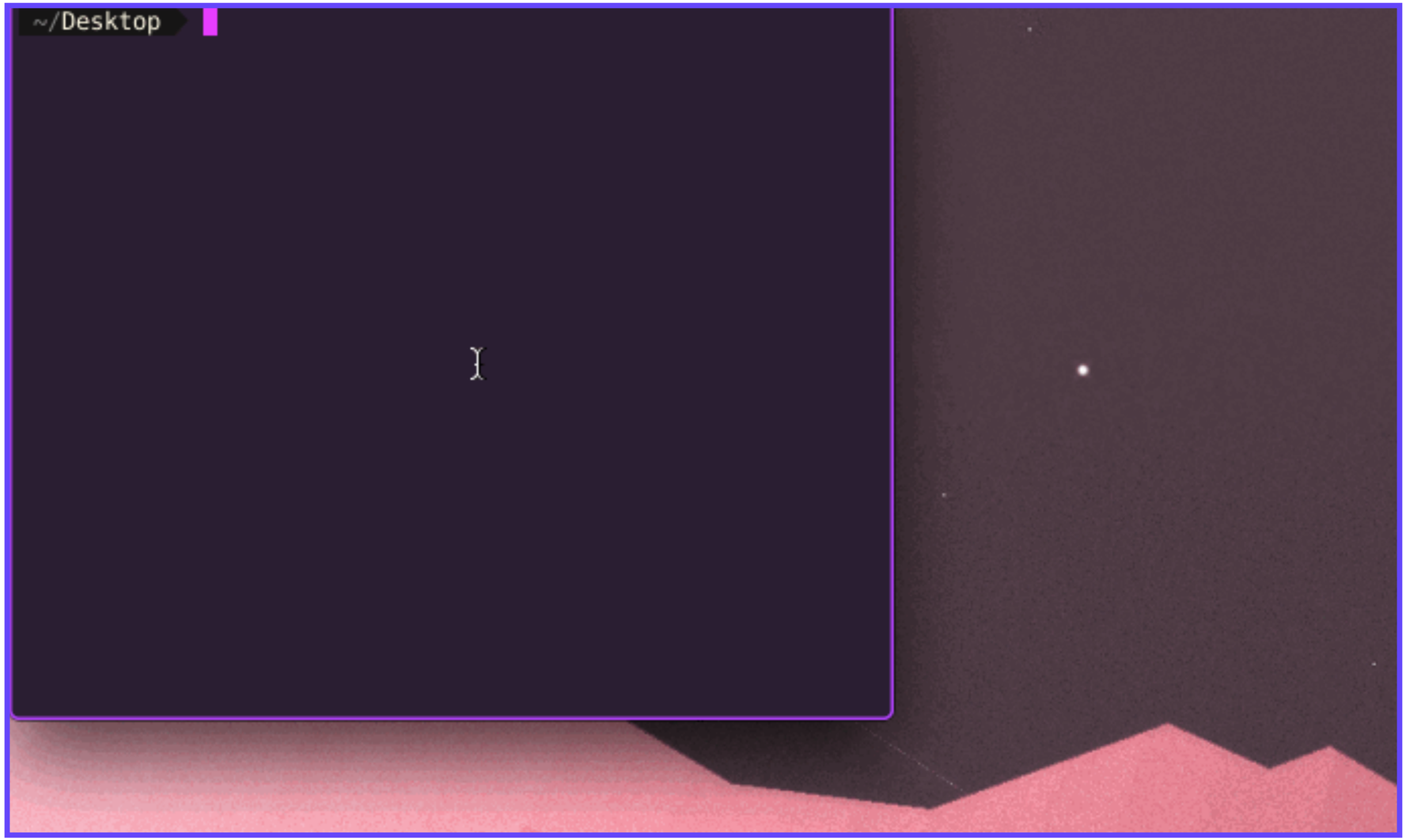

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- Predominantly single-source (per file) server/client

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- “Location addressing”
  - DNS maps names to IP addresses
  - Focused on the physical network

VIRTUAL ADDRESS

PHYSICAL LOCATION

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THE WEB TODAY

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- Like a key/value store **`{ip => {path => content}}`**
- “Location addressing”
  - DNS maps names to IP addresses
  - Focused on the physical network
- Mutable addressing
  - `www.foo.com/baz` may be JSON today, but a video tomorrow
  - …or altered content

VIRTUAL ADDRESS

PHYSICAL LOCATION

IPFS PRIMER

CONTENT ADDRESSING

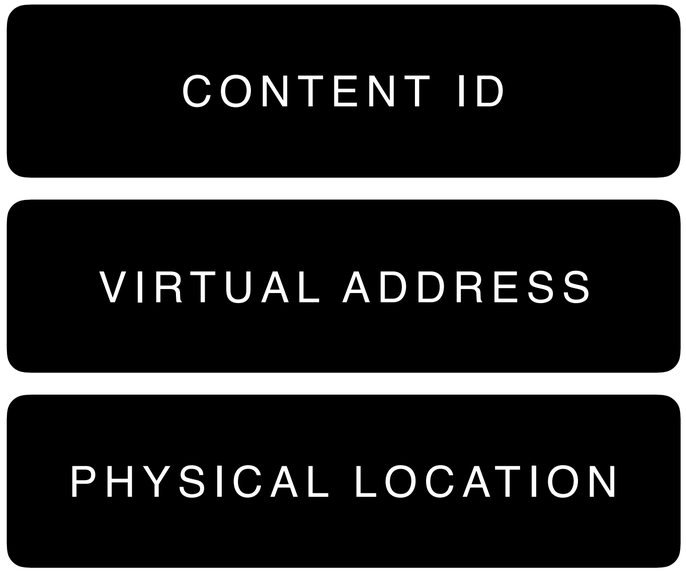
VIRTUAL ADDRESS

PHYSICAL LOCATION

IPFS PRIMER

CONTENT ADDRESSING

- A layer of abstraction above location



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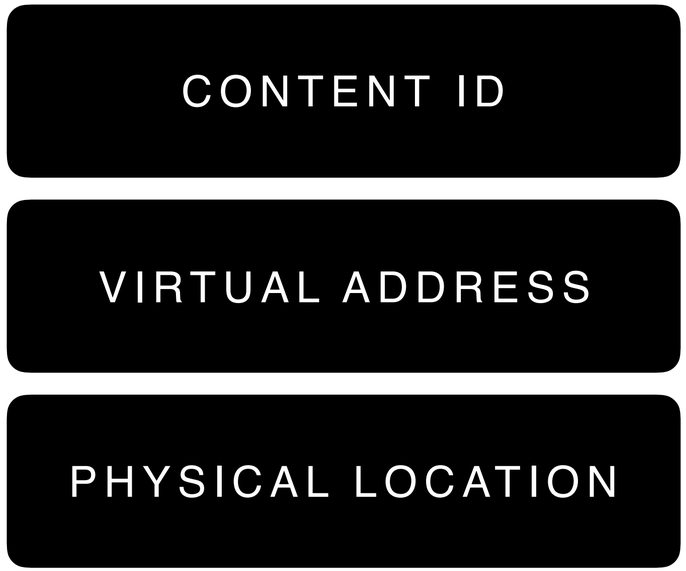
- Like a key/value store **`{hash(content) => content}`**
  - Content hash AKA “content identifier” or CID
  - Special “universal” relationship to content



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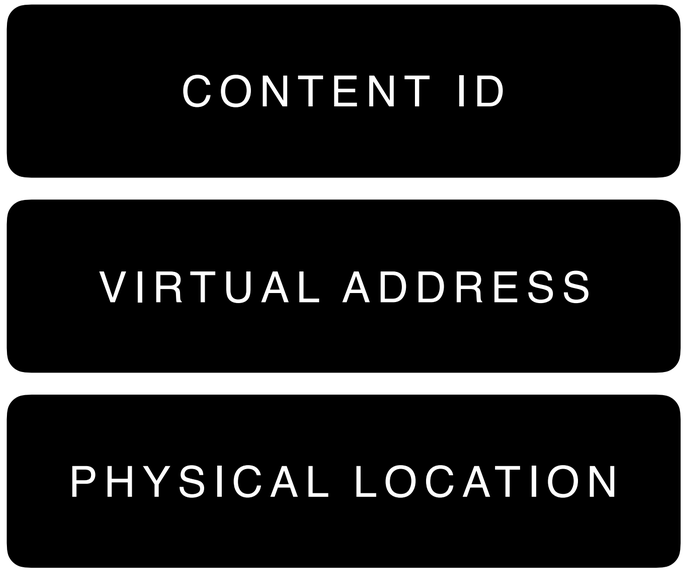

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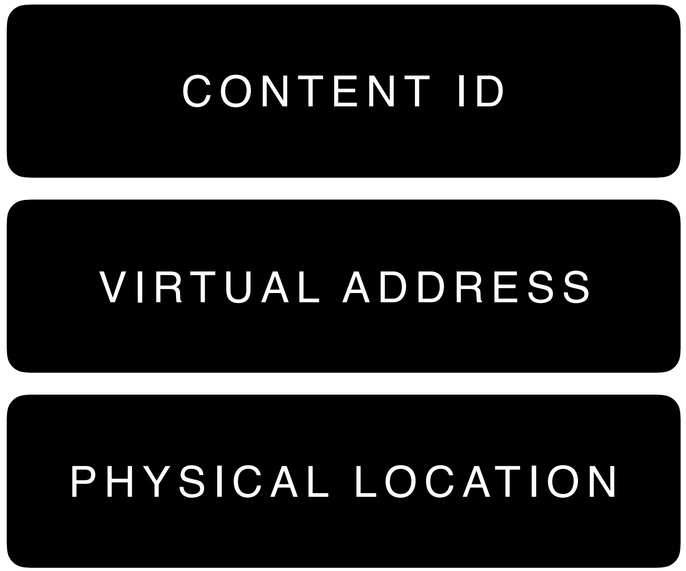
- Does not care where it lives



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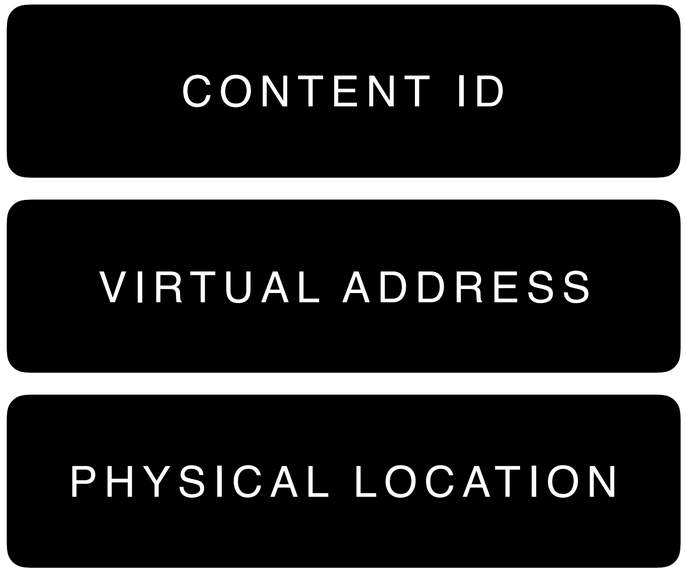
  - Special “universal” relationship to content
- Focused on the data
- Does not care where it lives
- Still have paths
  - Immutable DAG
  - Why no loops?



IPFS PRIMER

LINKED DATA

IPFS PRIMER

LINKED DATA

```
{
  Qm123456…: {
    data: “Hello world”,
    links: [
      {name: “company”, hash: Qmabcdef…}
      {name: “license”, hash: Qmzyxwvu…}
    ]
  }
}
```

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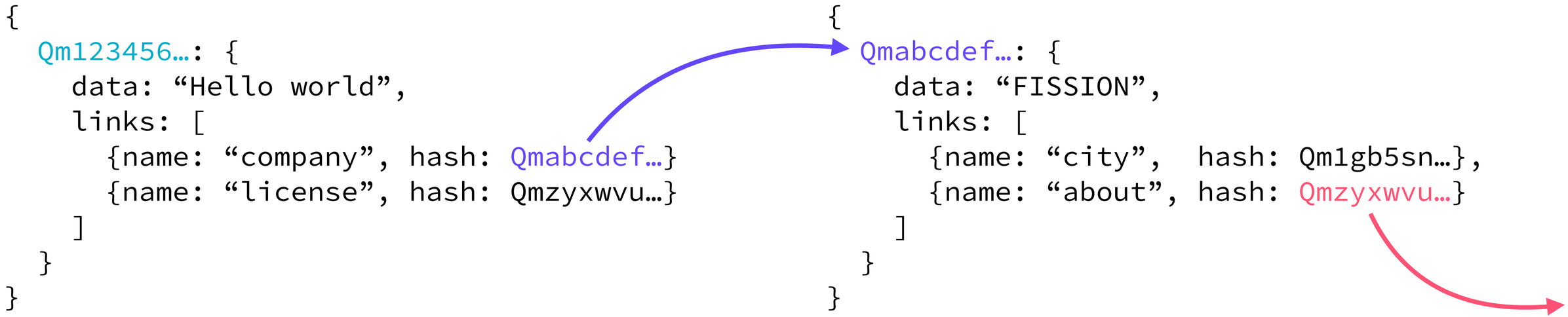

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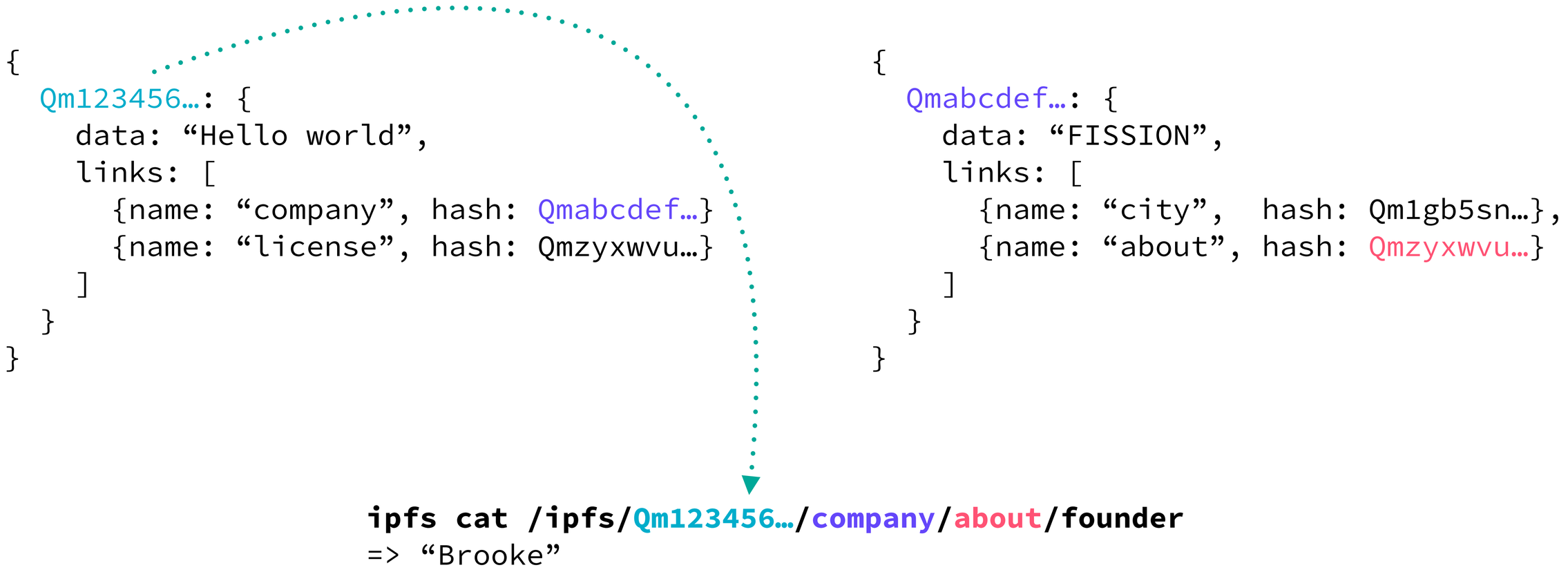

IPFS PRIMER

ROUTING & LOOKUP 🔍🌊

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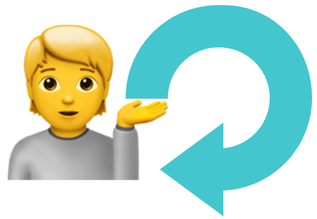

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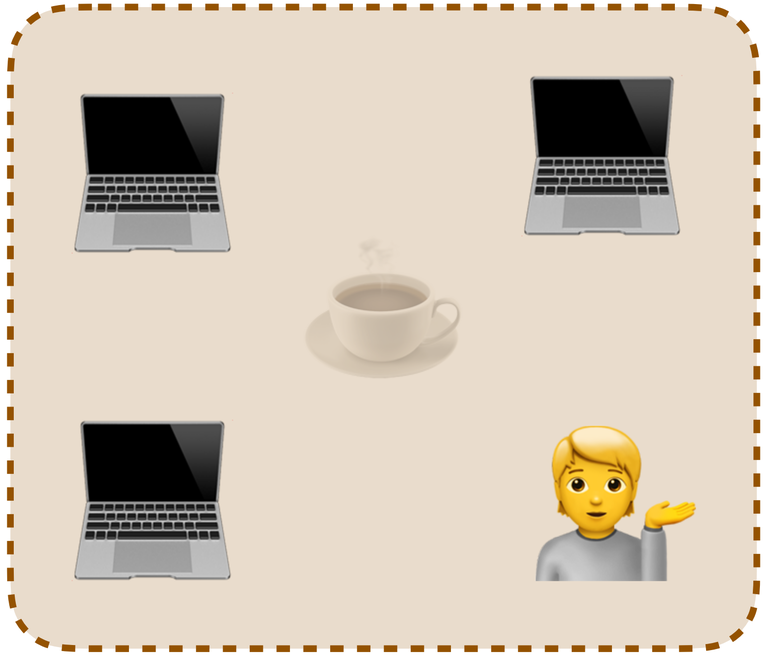

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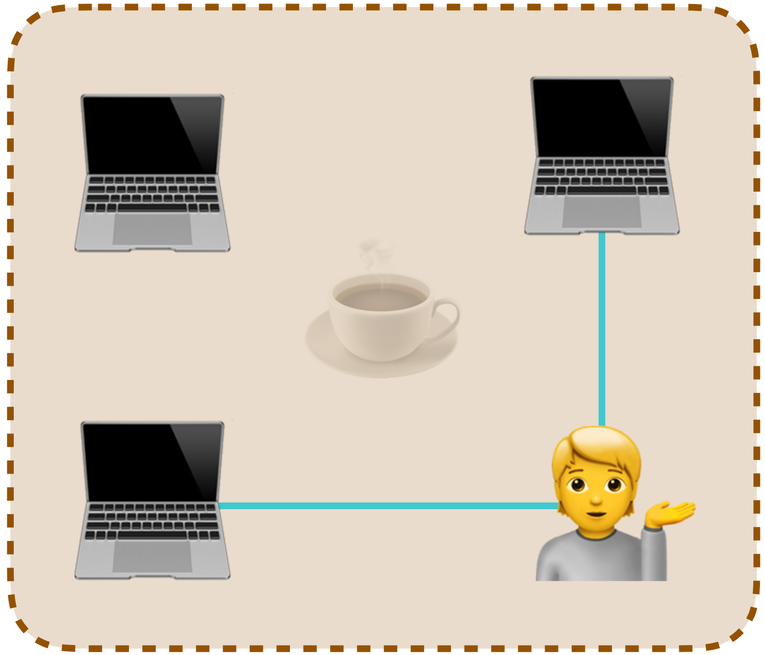

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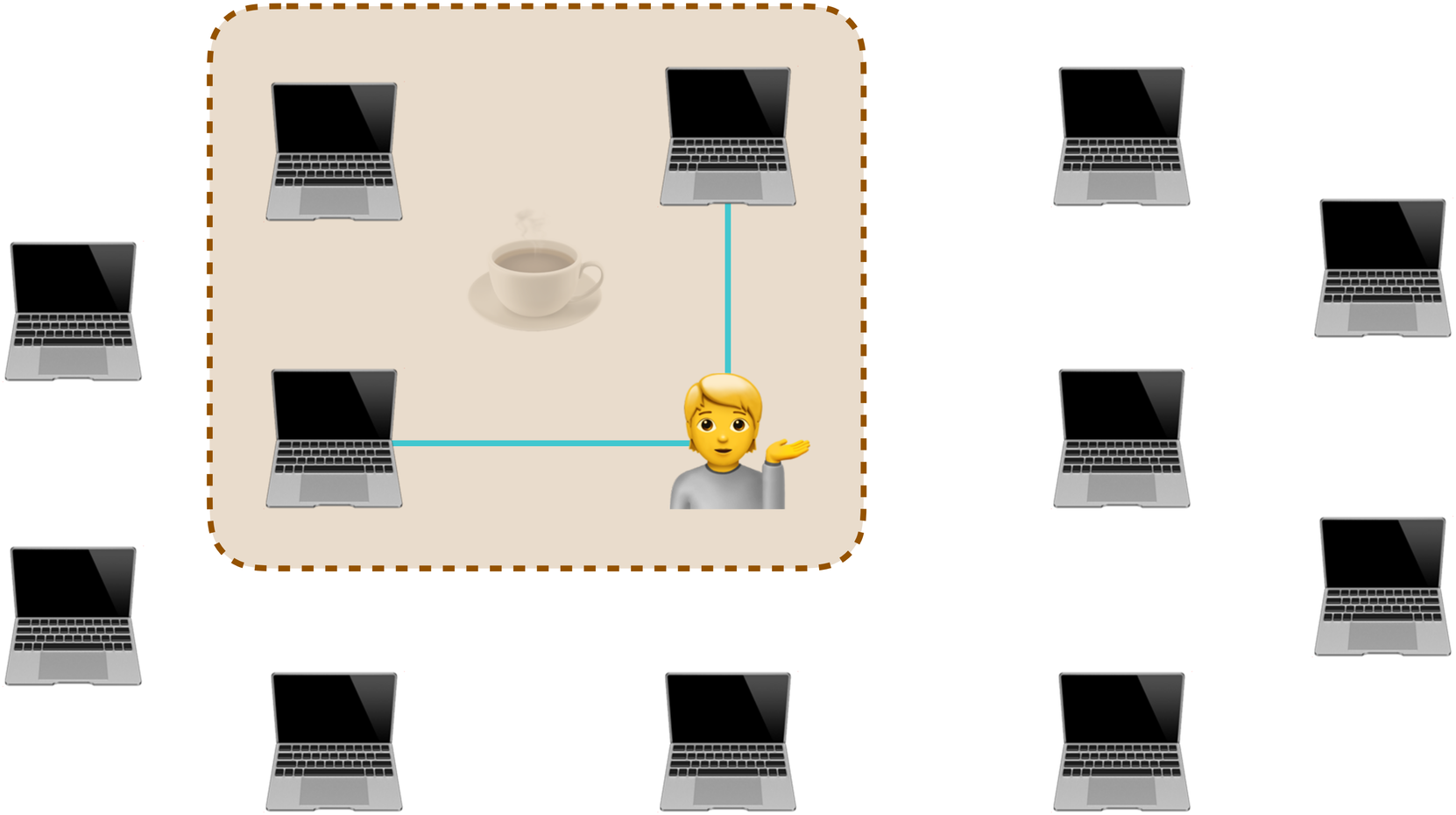

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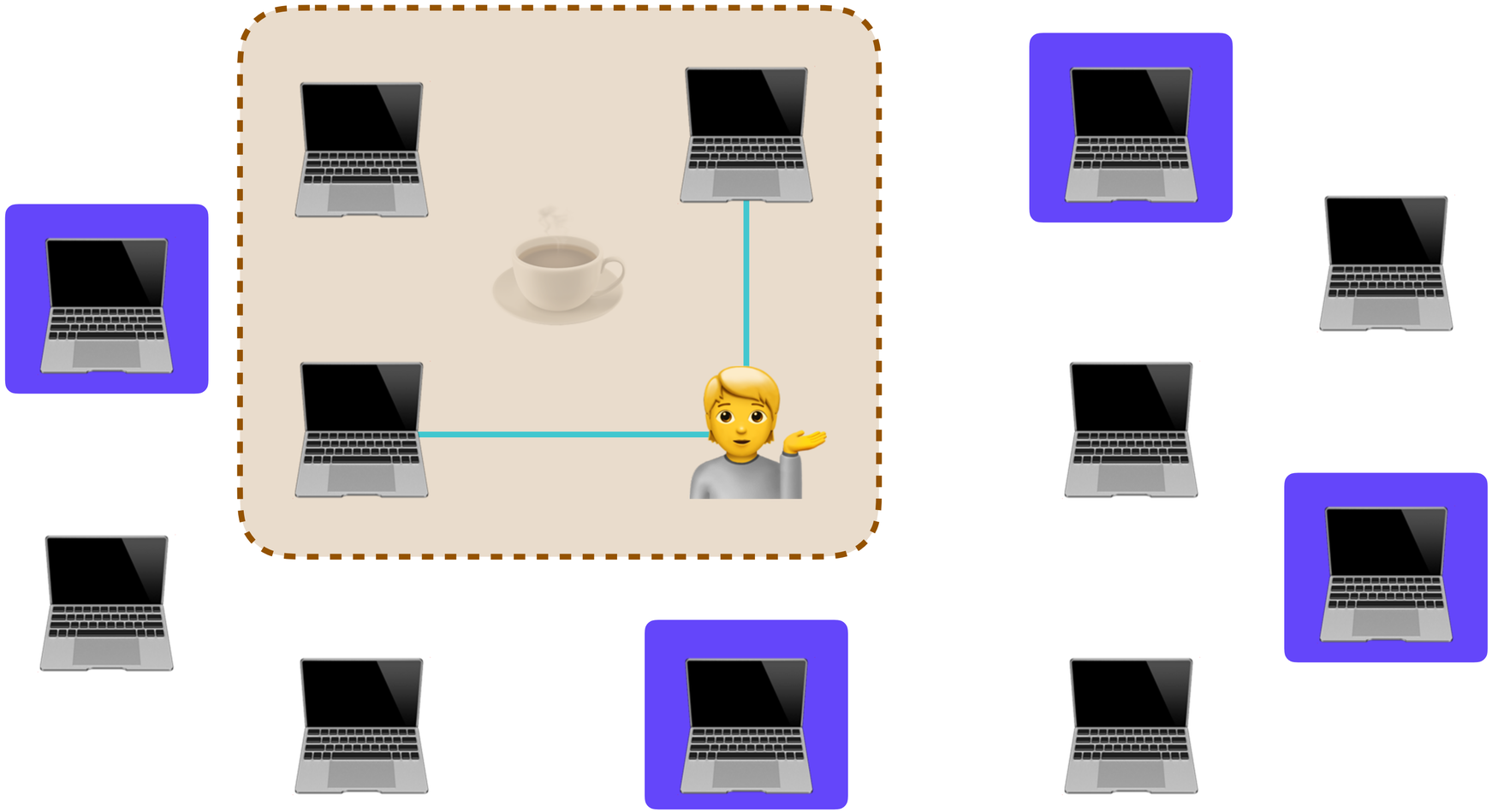

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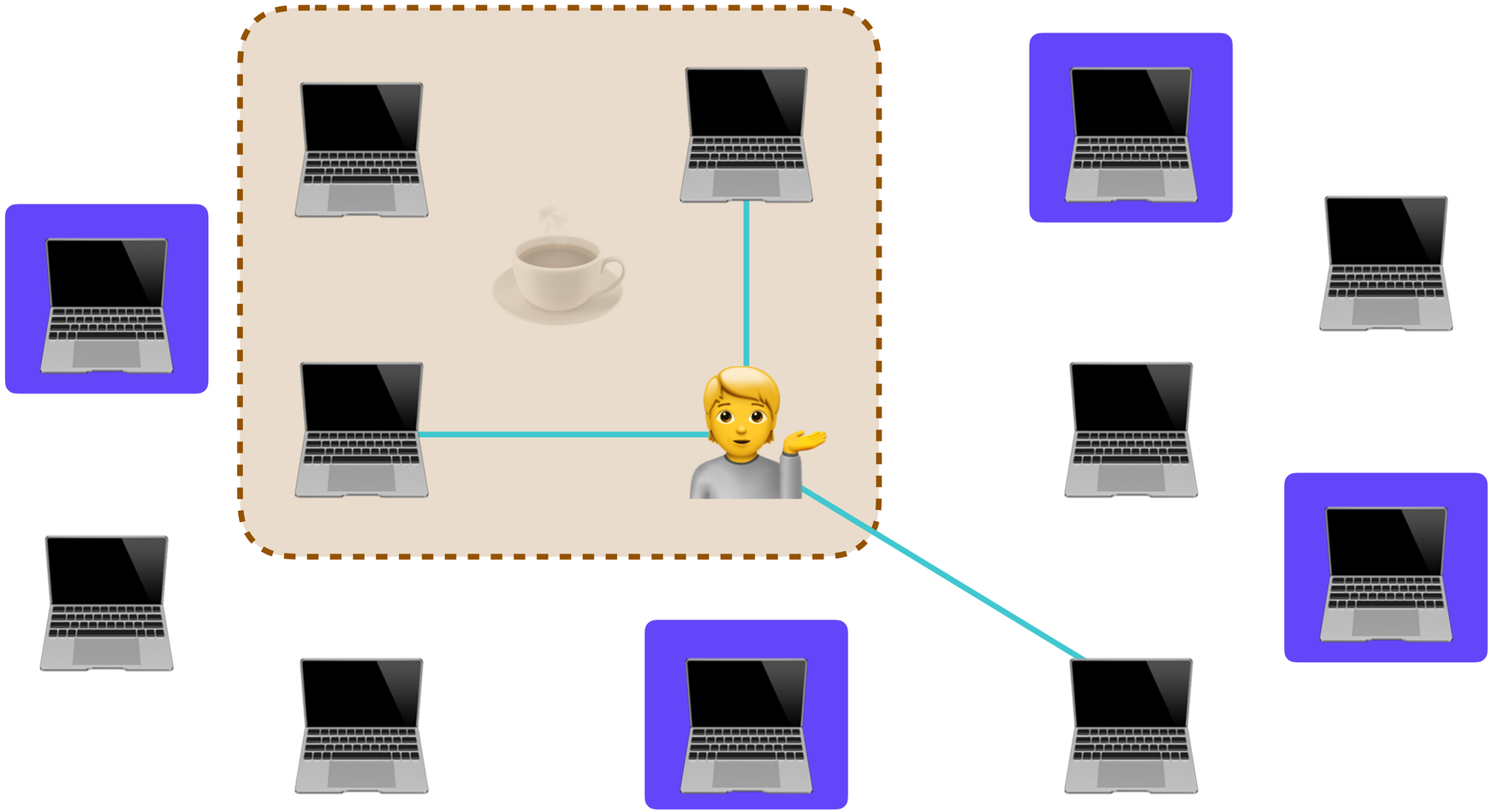

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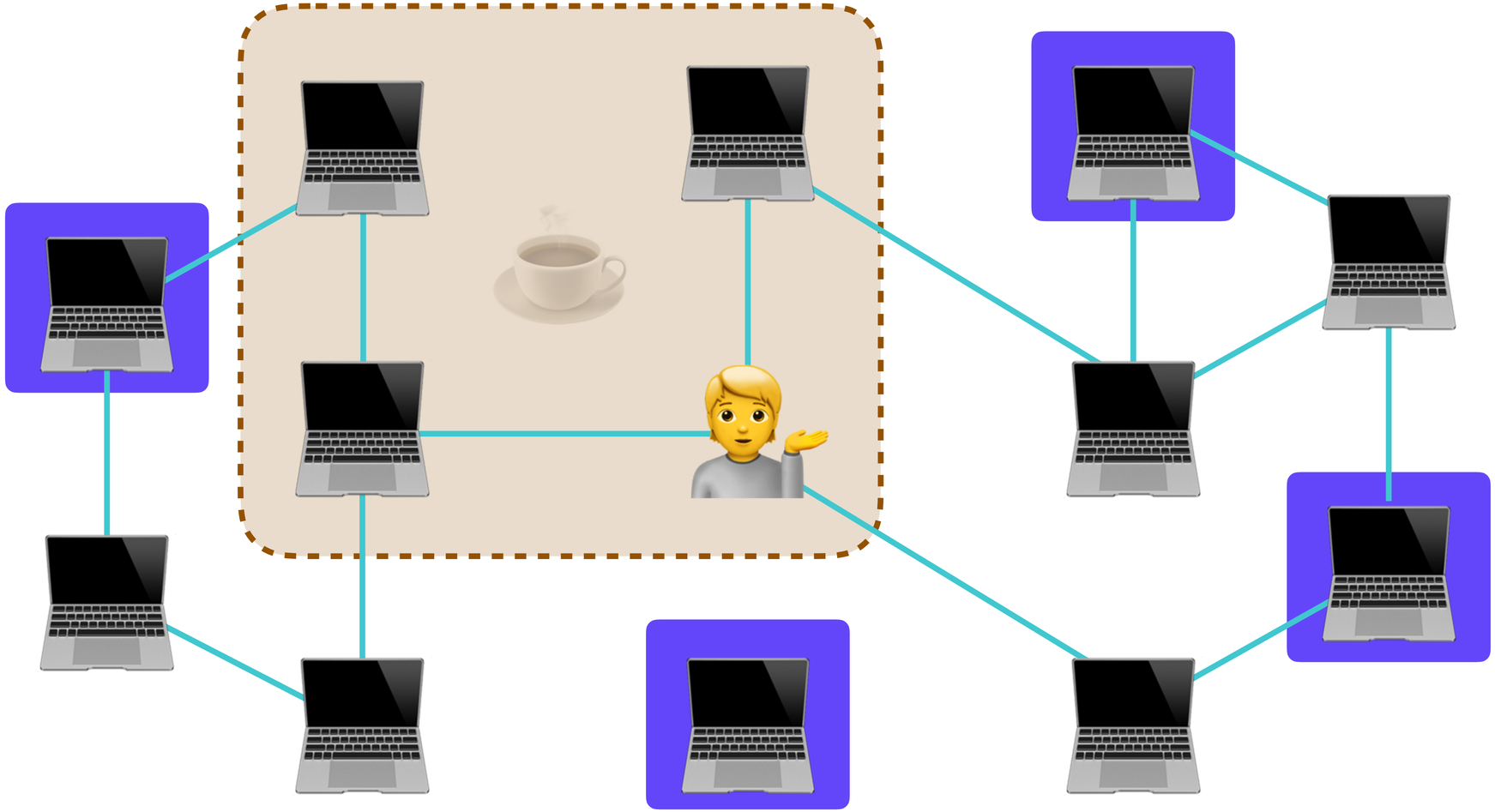

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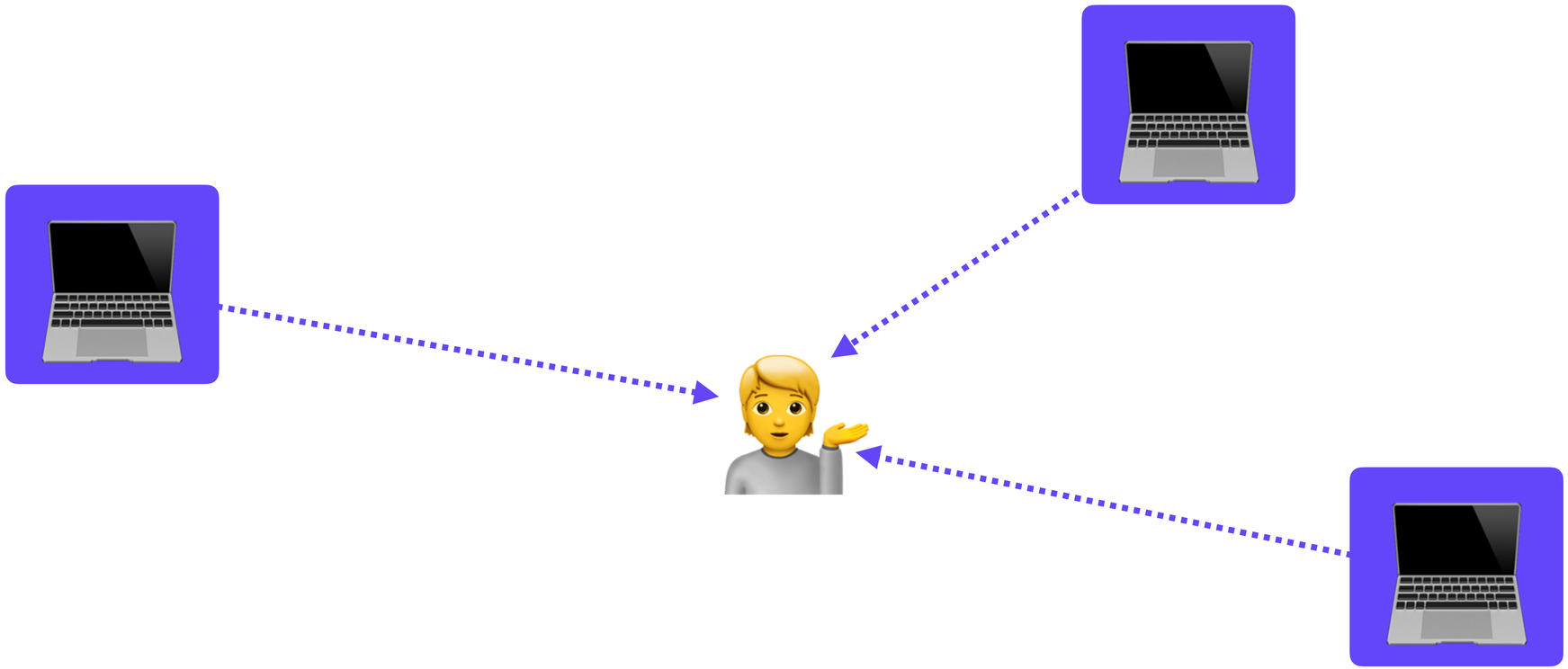

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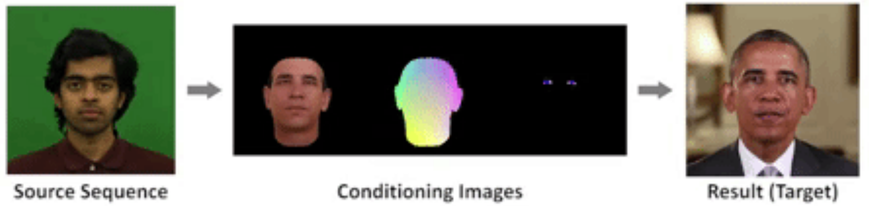

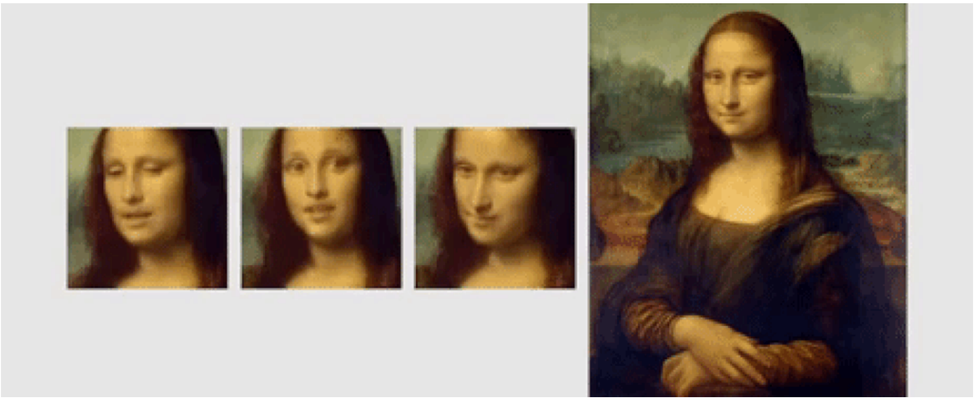

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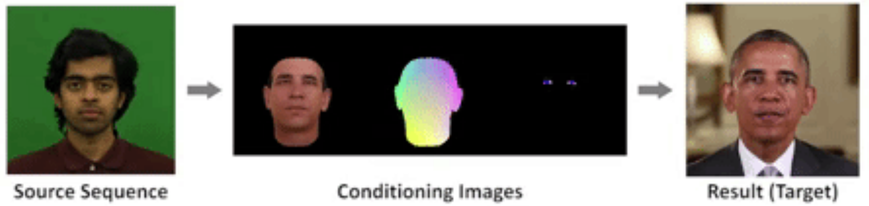

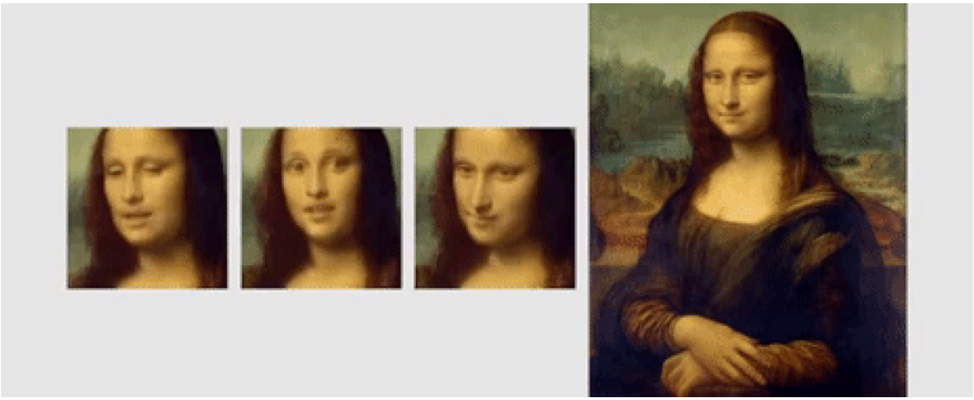

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ONE HUGE NAMESPACE TO RULE THEM ALL 💍🌋

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  - No matter when 🕓
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- Same file = same hash
  - No matter when 🕓
  - No matter where 🌍🌌
  - No matter who 👩🤖👩‍🚀🦸🦊
- Zero file duplication per node
- Replication = CDN-ish features
- Immutable data structures
- Files & data living together!
- 

DIDS

DIDS

🔑 HIGHLY AUTHENTIC 🤦‍♀️

DIDS

STANDARDIZATION

DIDS

STANDARDIZATION

- W3C
- Microsoft
- Government of British Columbia
- Based on public-key cryptography
- Truly “universal” UUIDs
- Agnostic about backing
- For users, devices, and more

FEBRUARY 12, 2018

Decentralized digital identities and blockchain: The future as we see it

By Alex Simons, Vice President of Program Management, Microsoft Identity Division

EXAMPLE 2: Minimal self-managed DID Document

```
{
  "@context": "https://w3id.org/did/v1",
  "id": "did:example:123456789abcdefghi",
  "publicKey": [{
    "id": "did:example:123456789abcdefghi#keys-1",
    "type": "RsaVerificationKey2018",
    "owner": "did:example:123456789abcdefghi",
    "publicKeyPem": "-----BEGIN PUBLIC KEY...END PUBLIC KEY-----\r\n"
  }],
  "authentication": [{
    // this key can be used to authenticate as DID ...9938
    "type": "RsaSignatureAuthentication2018",
    "publicKey": "did:example:123456789abcdefghi#keys-1"
  }],
  "service": [{
    "type": "ExampleService",
    "serviceEndpoint": "https://example.com/endpoint/8377464"
  }]
}
```

DIDS

CLAIMS

DIDS

CLAIMS

- Principle of least information
- “Can attest that this user is over 18”
- All claims signed with private key
- Age, credentials, country residency, job history, event attendance, …

DIDS

WHAT ABOUT TRACKING, PRIVACY, RECOVERY

DIDS

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- Hierarchical deterministic wallets

DIDS

WHAT ABOUT TRACKING, PRIVACY, RECOVERY

- Hierarchical deterministic wallets
- Keychains
  - Generally on a blockchain
  - Some cases on DNS

DIDS

SELF-SOVEREIGN IDENTITY (SSI)

DIDS

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- Generate your own ID!

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- As many as you like 🤷‍♀️

DIDS

SELF-SOVEREIGN IDENTITY (SSI)

- Generate your own ID!
- As many as you like 🤷‍♀️
- Generally use commons infrastructure like a blockchain or DNS

PORTABLE COMPUTE

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⚡ JUST ADD MORE POWER TO JS & WASM AND STIR 🤖

PORTABLE COMPUTE

DYNAMIC FAAS

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- Run everything locally by default
  - Good for devs with powerful machines
  - Slow for students with Chromebooks

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PORTABLE COMPUTE

DYNAMIC FAAS

- Run everything locally by default
  - Good for devs with powerful machines
  - Slow for students with Chromebooks
- Farm out longer running computation to service providers
  - …dynamically at runtime
- Heavy compute, parallel workloads, &c

PORTABLE COMPUTE

APPROACH & TRADE-OFFS

PORTABLE COMPUTE

APPROACH & TRADE-OFFS

- Code-as-data
- Memoization
- Compiler techniques at web scale (“world computer”)
- Network latency (normally zero, now x)
- Restricted subset (e.g. total)
- Event-based w/ two-phase commit
- Trusted (incl. AWS Lambda 🤷)

PORTABLE COMPUTE

TOTALITY

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Side Effects

Pure Functions

PORTABLE COMPUTE

TOTALITY

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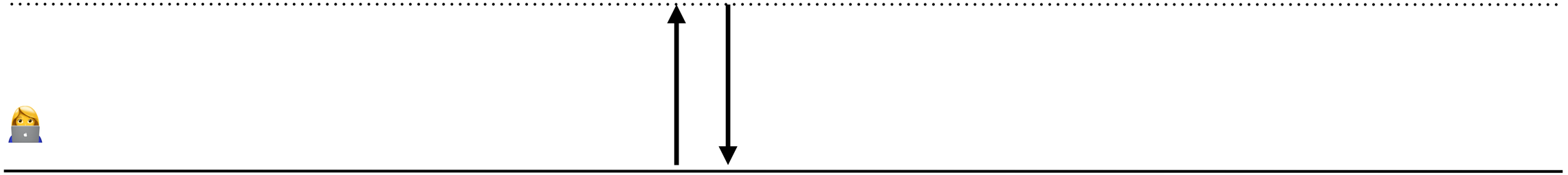

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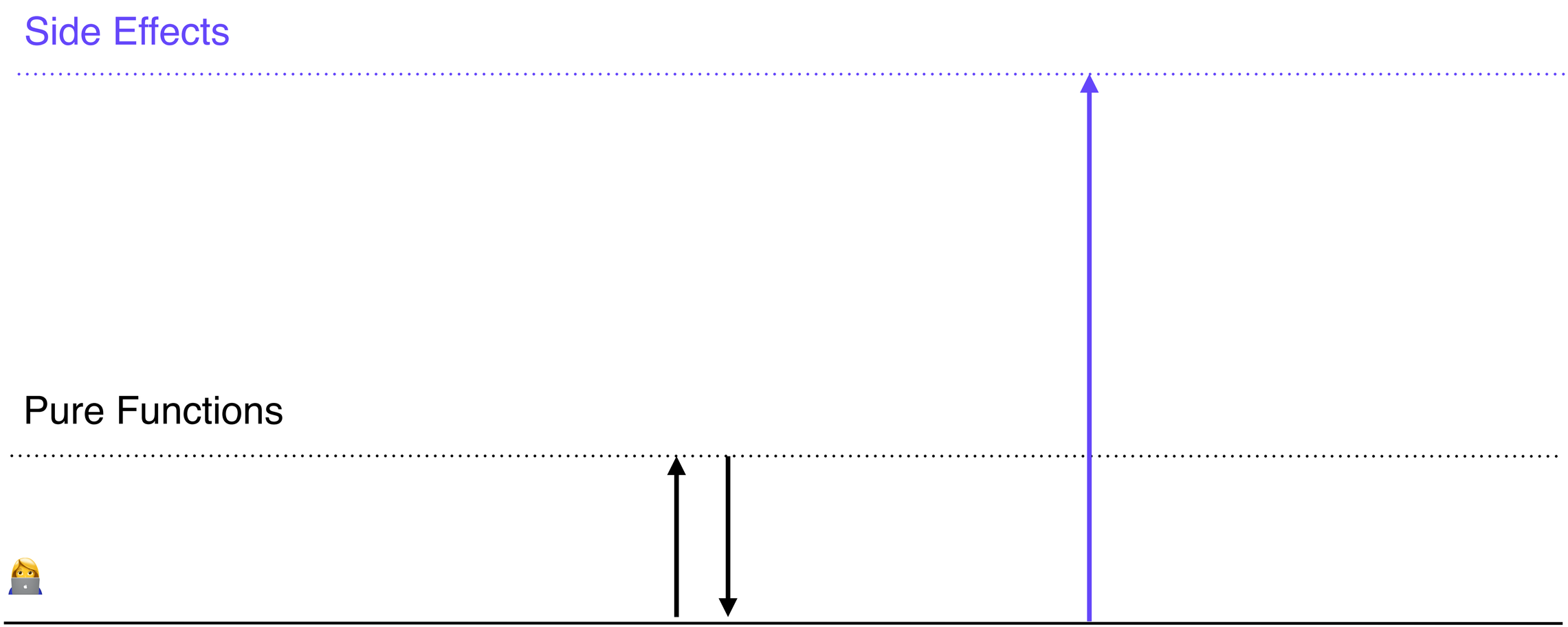


PORTABLE COMPUTE

EVENT BASED (ABSTRACT USER STREAM, CRDTS)

PORTABLE COMPUTE

EVENT BASED (ABSTRACT USER STREAM, CRDTS)

Off-Platform Side Effect Stream

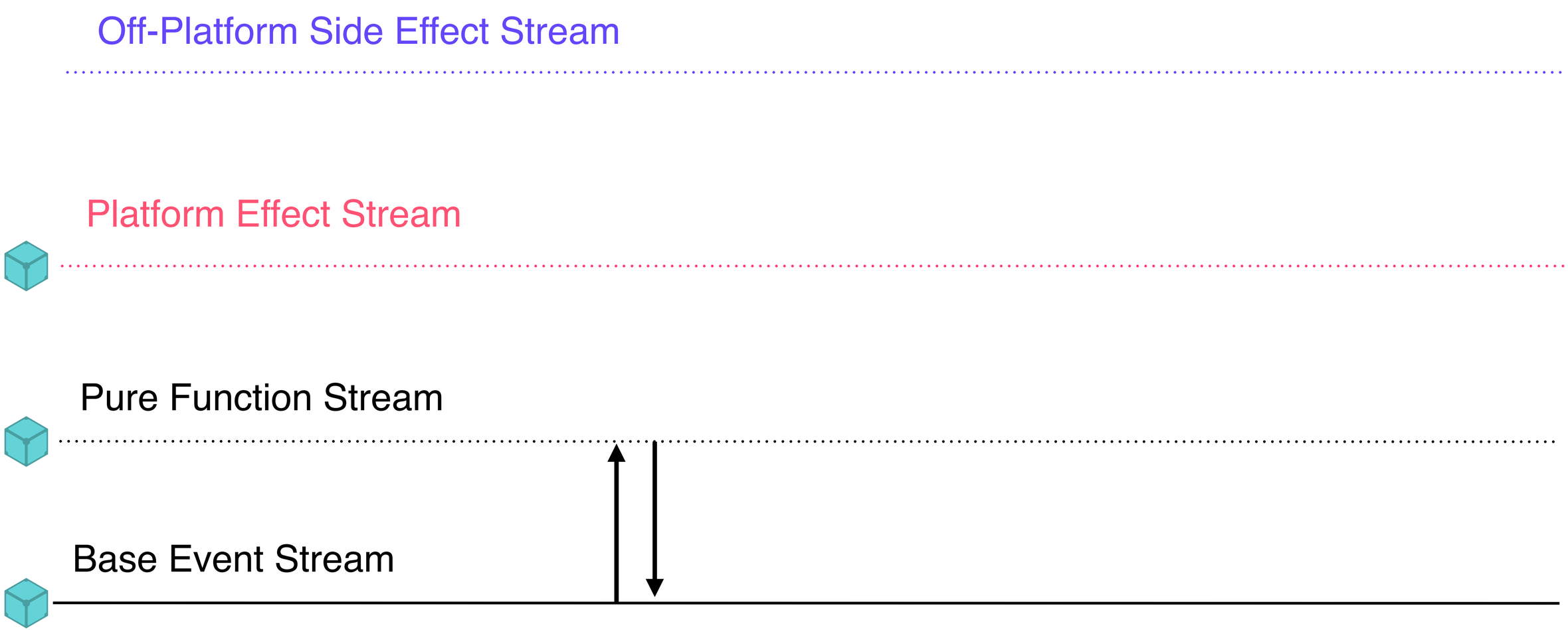
Platform Effect Stream

Pure Function Stream

Base Event Stream

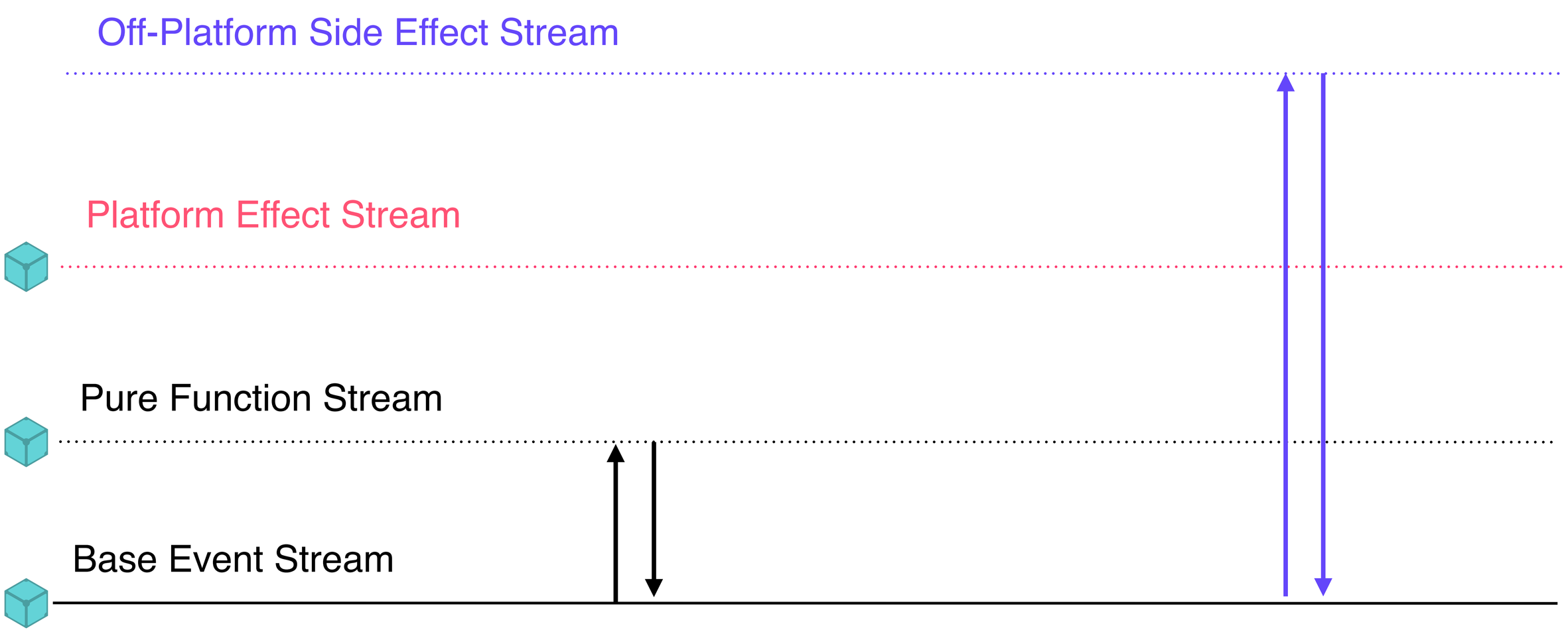
PORTABLE COMPUTE

EVENT BASED (ABSTRACT USER STREAM, CRDTS)



PORTABLE COMPUTE

EVENT BASED (ABSTRACT USER STREAM, CRDTS)



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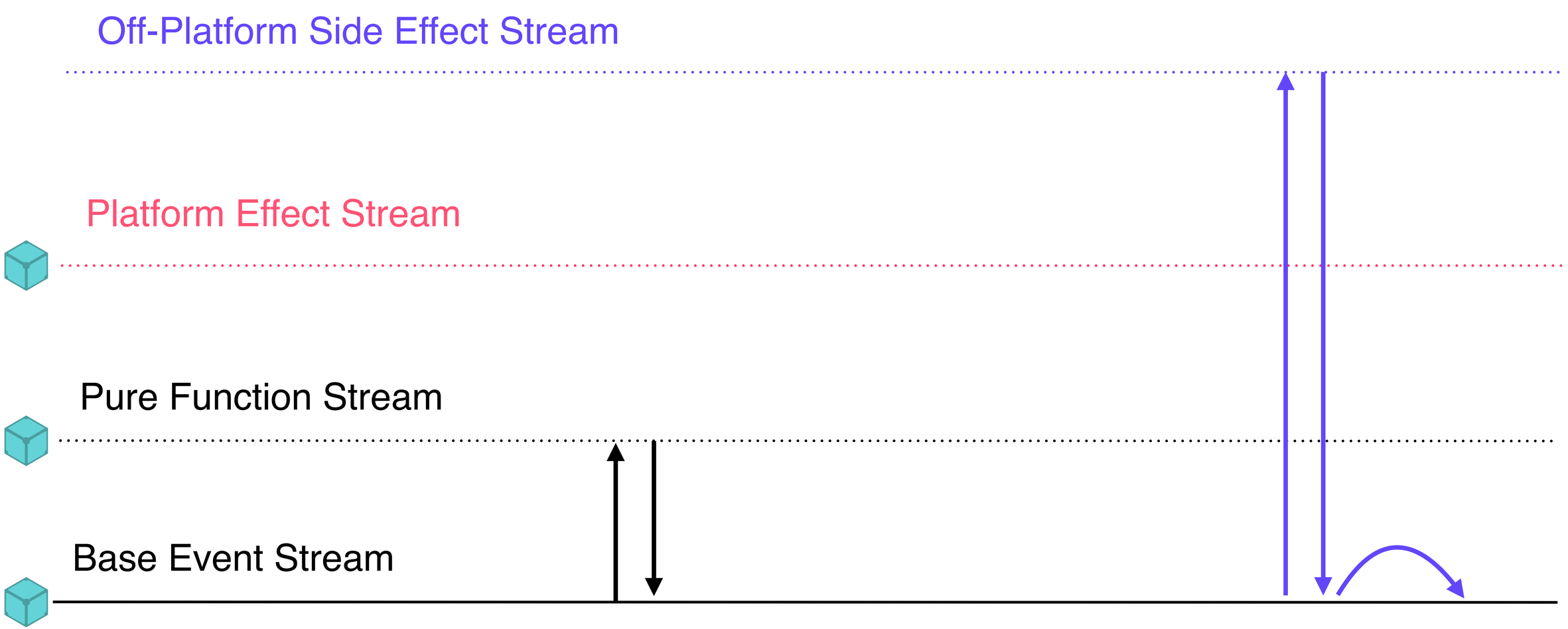
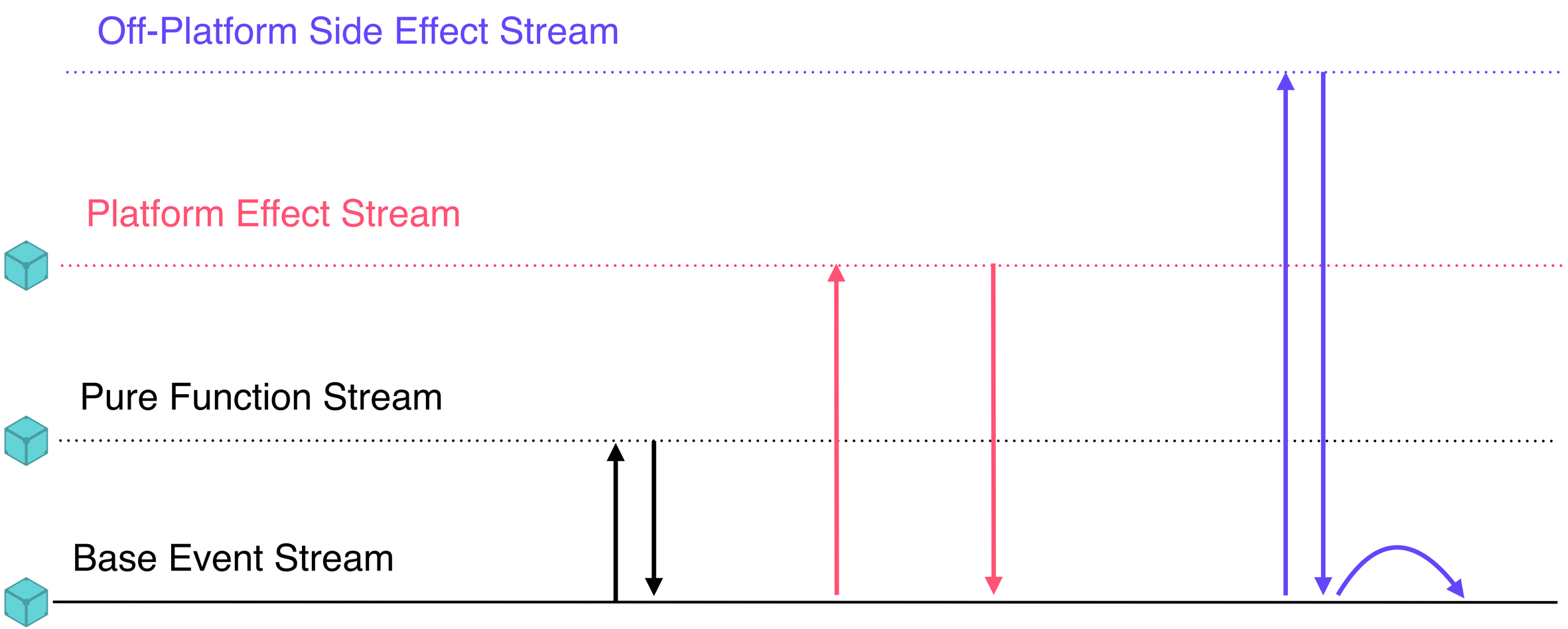


PORTABLE COMPUTE

EVENT BASED (ABSTRACT USER STREAM, CRDTS)



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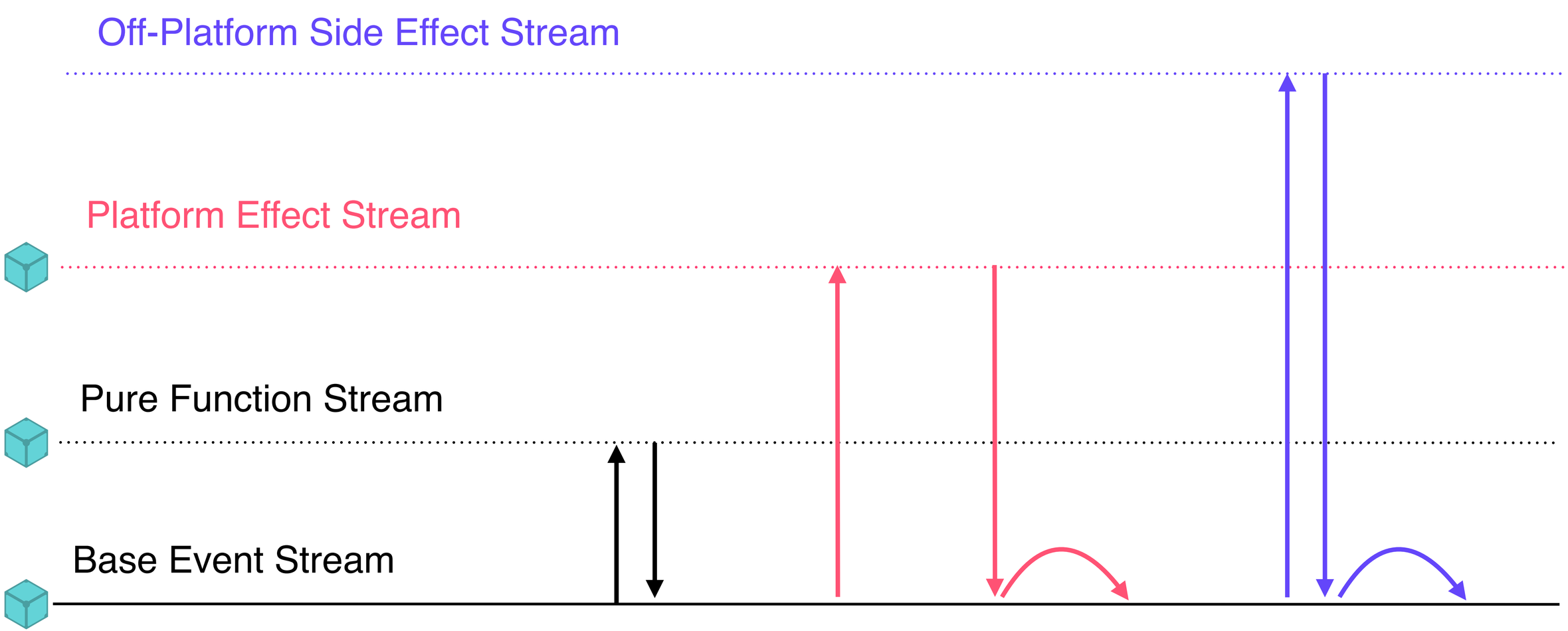

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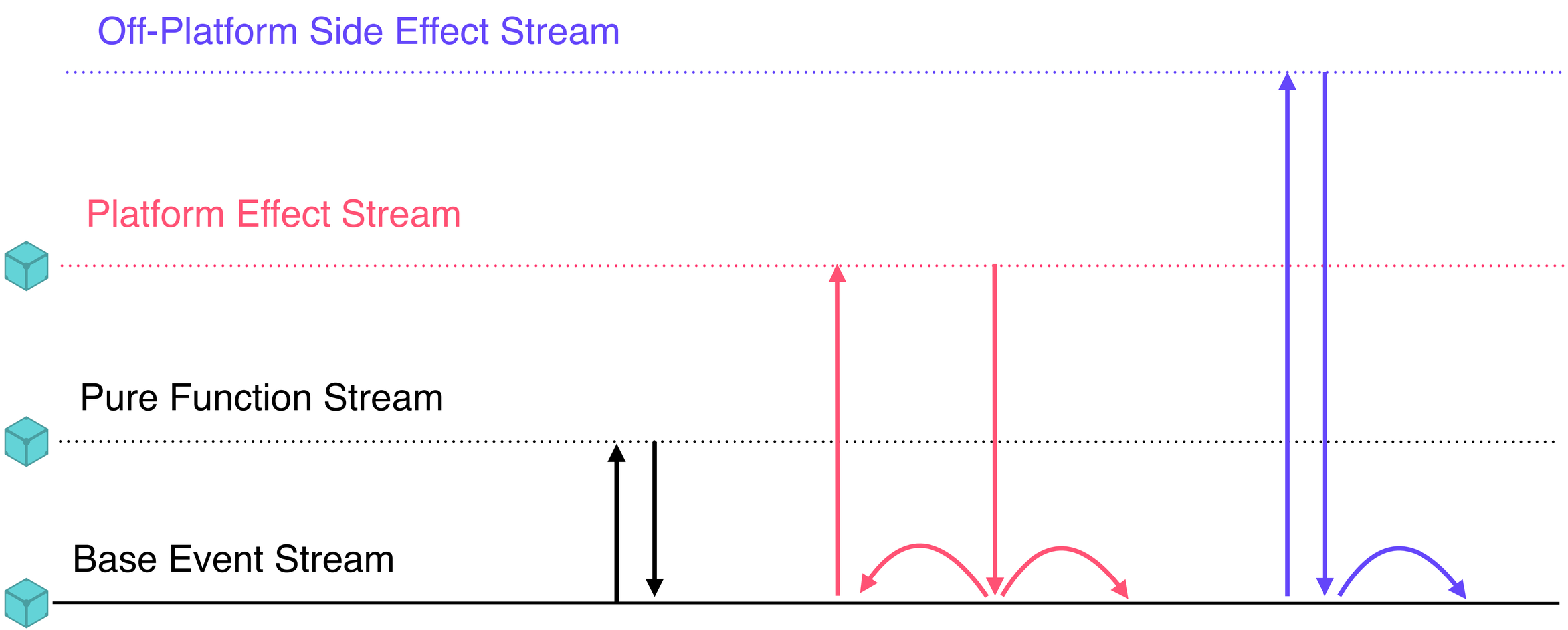


ENCRYPTED COMPUTE

ENCRYPTED COMPUTE

🙈 TRUSTLESSDLY SEND, RUN, & VERIFY 💌

ENCRYPTED COMPUTE

ZERO-KNOWLEDGE PROOFS

ENCRYPTED COMPUTE

ZERO-KNOWLEDGE PROOFS

			2	6		7		1
6	8			7			9	
1	9				4	5		
8	2		1				4	
		4	6		2	9		
	5				3		2	8
		9	3				7	4
	4			5			3	6
7		3		1	8			

ENCRYPTED COMPUTE

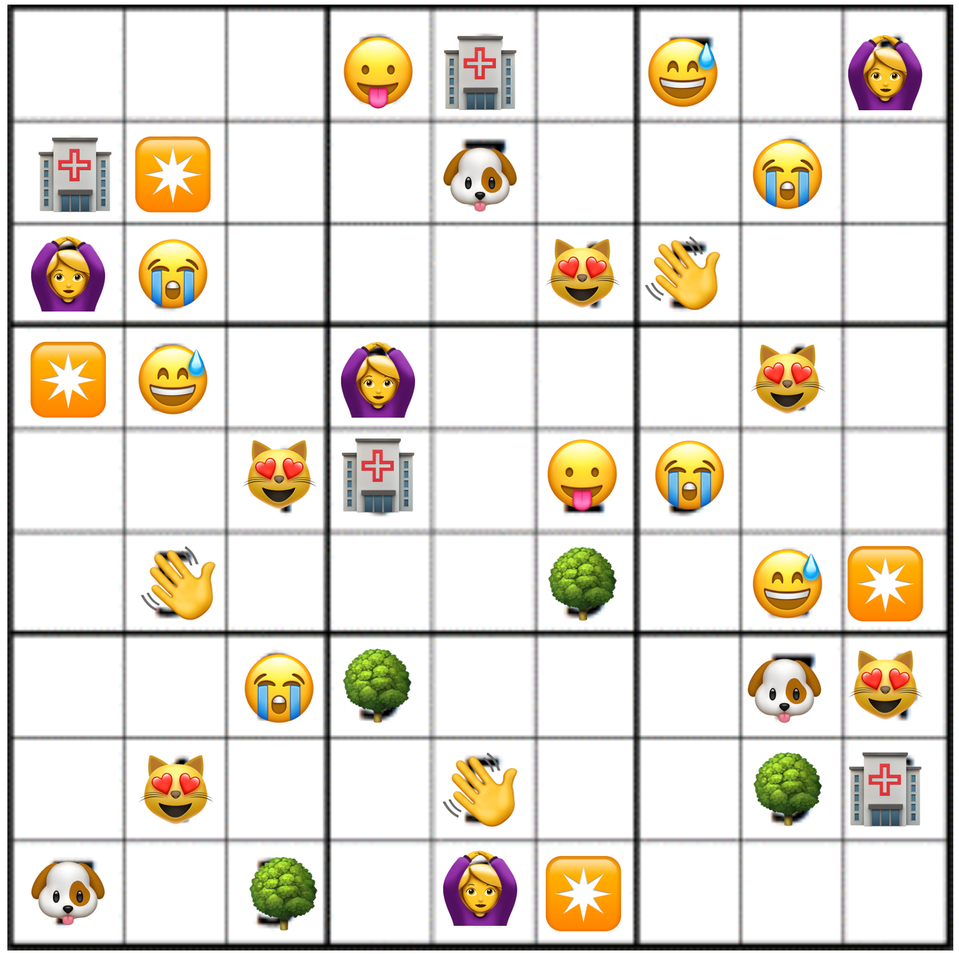
ZERO-KNOWLEDGE PROOFS

			2	6		7		1
6	8			7			9	
1	9				4	5		
8	2		1				4	
		4	6		2	9		
	5				3		2	8
		9	3				7	4
	4			5			3	6
7		3		1	8			

4	3	5	2	6	9	7	8	1
6	8	2	5	7	1	4	9	3
1	9	7	8	3	4	5	6	2
8	2	6	1	9	5	3	4	7
3	7	4	6	8	2	9	1	5
9	5	1	7	4	3	6	2	8
5	1	9	3	2	6	8	7	4
2	4	8	9	5	7	1	3	6
7	6	3	4	1	8	2	5	9

ENCRYPTED COMPUTE

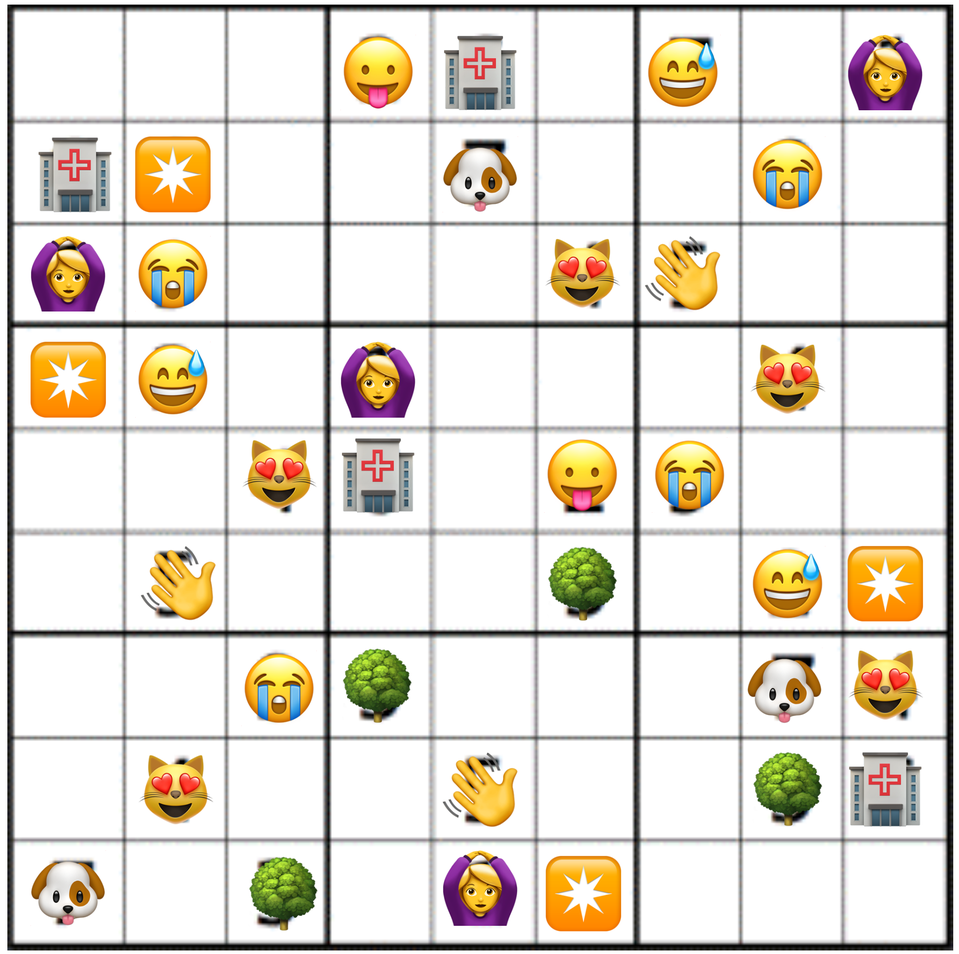
ZERO-KNOWLEDGE PROOFS



4	3	5	2	6	9	7	8	1
6	8	2	5	7	1	4	9	3
1	9	7	8	3	4	5	6	2
8	2	6	1	9	5	3	4	7
3	7	4	6	8	2	9	1	5
9	5	1	7	4	3	6	2	8
5	1	9	3	2	6	8	7	4
2	4	8	9	5	7	1	3	6
7	6	3	4	1	8	2	5	9

ENCRYPTED COMPUTE

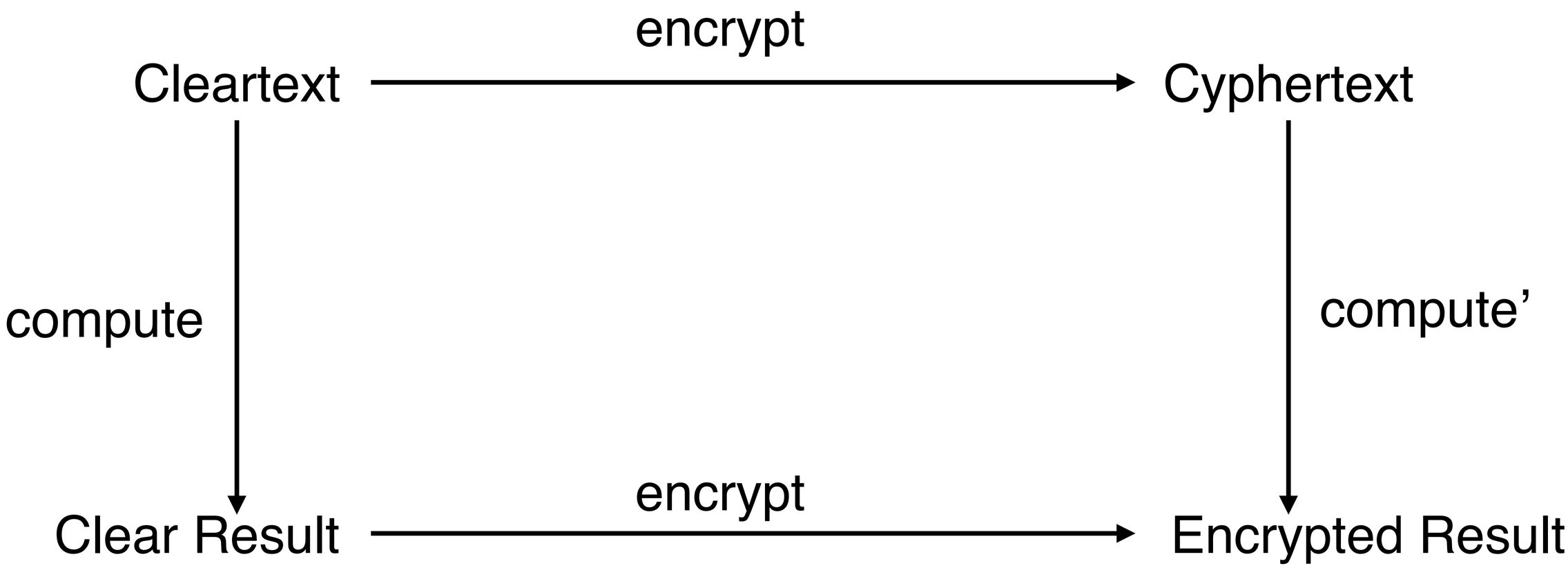
ZERO-KNOWLEDGE PROOFS



- Verify compute result
- Reveal no information
- Interesting for trustless compute providers

ENCRYPTED COMPUTE

COMPUTING OVER ENCRYPTED DATA



LICENSING INNOVATION

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⚖️ FOR THE FIRST TIME IN 15 YEARS!

LICENSE INNOVATION

WHY NOW?

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- Cloud providers making record profits on top of FLOSS projects

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LICENSE INNOVATION AS A SHIELD

LICENSE INNOVATION
AS A SHIELD 

- Do you think current licenses are the best we'll ever have?

LICENSE INNOVATION AS A SHIELD 

- Do you think current licenses are the best we'll ever have?
- Anti 996-License-1.0
  - Derived from MIT License
  - Chinese expression "996.ICU"

LICENSE INNOVATION

DATA ETHICS / DATA LICENSES

LICENSE INNOVATION

DATA ETHICS / DATA LICENSES

- In 2001, people stored credit card details directly in their DB
- Why do people think it’s okay to store PII?
- These techniques & platforms make it so you can’t touch user data!

MAKING LIFE EASIER

MAKING LIFE EASIER

 PUTTING IT ALL TOGETHER 

MAKING LIFE EASIER

THE NEXT WAVE OF PLATFORMS

MAKING LIFE EASIER

THE NEXT WAVE OF PLATFORMS

Global Storage

FILES

DATABASE

MAKING LIFE EASIER

THE NEXT WAVE OF PLATFORMS

Global Storage

FILES 📄

DATABASE 🛢️

Digital Scarcity

IDENTITY 💁

CHECKPOINTS 🕐

MAKING LIFE EASIER

THE NEXT WAVE OF PLATFORMS

Global Storage

FILES 📄

DATABASE 🛢️

Digital Scarcity

IDENTITY 💁

CHECKPOINTS 🕐

Portable Compute

DISTRIBUTED COMPUTE 🖥️

SMART CONTRACTS 📝

A UNIVERSAL HOSTLESS SUBSTRATE

RECAP

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RECAP

- Build and use fully locally
- No such thing as "deployment"
- Zero config
- Default: only serve the app, not data
- Efficient bandwidth

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RECAP

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- Default: only serve the app, not data
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- One login for all accounts
- Device-based authentication
- Military-grade security
- User owned data
- Share nothing with site/app by default
- Flexible FaaS without pre-deployment
- Offline-first and local-network aware

A UNIVERSAL HOSTLESS SUBSTRATE

THE END OF HISTORY

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THE END OF HISTORY

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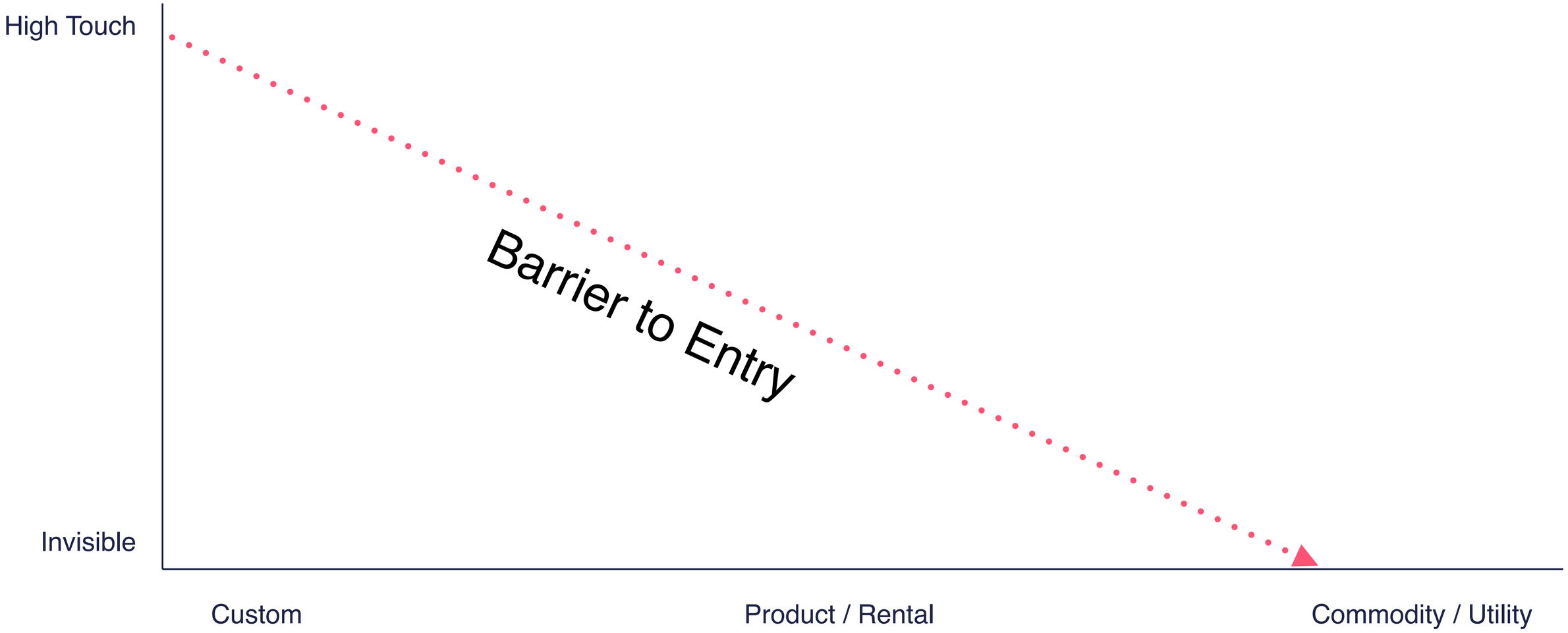
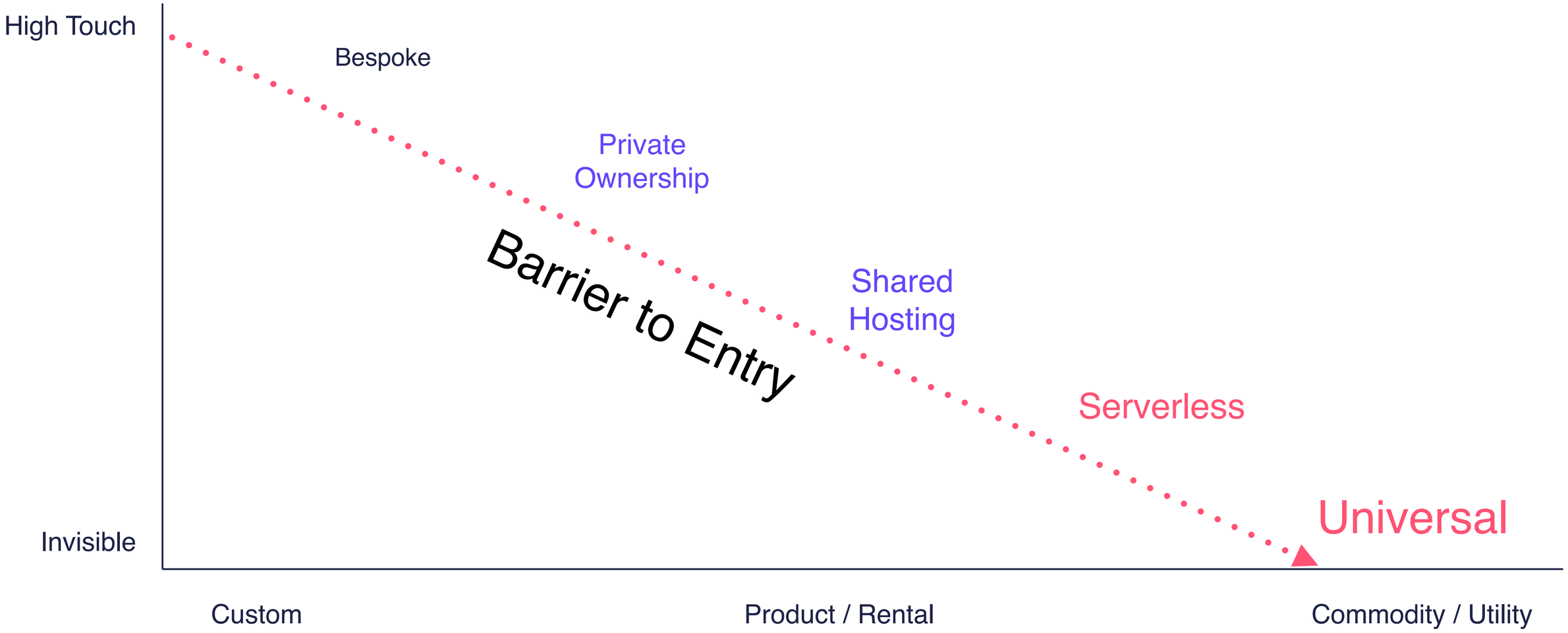


A UNIVERSAL HOSTLESS SUBSTRATE

THE END OF HISTORY



https://fission.codes
https://talk.fission.codes
https://tools.fission.codes

🇨🇦 THANK YOU, FERNIE 🎉

brooklyn@fission.codes
github.com/expede
@expede