goto;

DOWNLOAD & USE
THE GOTO GUIDE APP

CREATE YOUR SCHEDULE
NETWORK WITH OTHERS
ASK QUESTIONS
RATE SESSIONS

Download on the App Store

GET IT ON Google Play

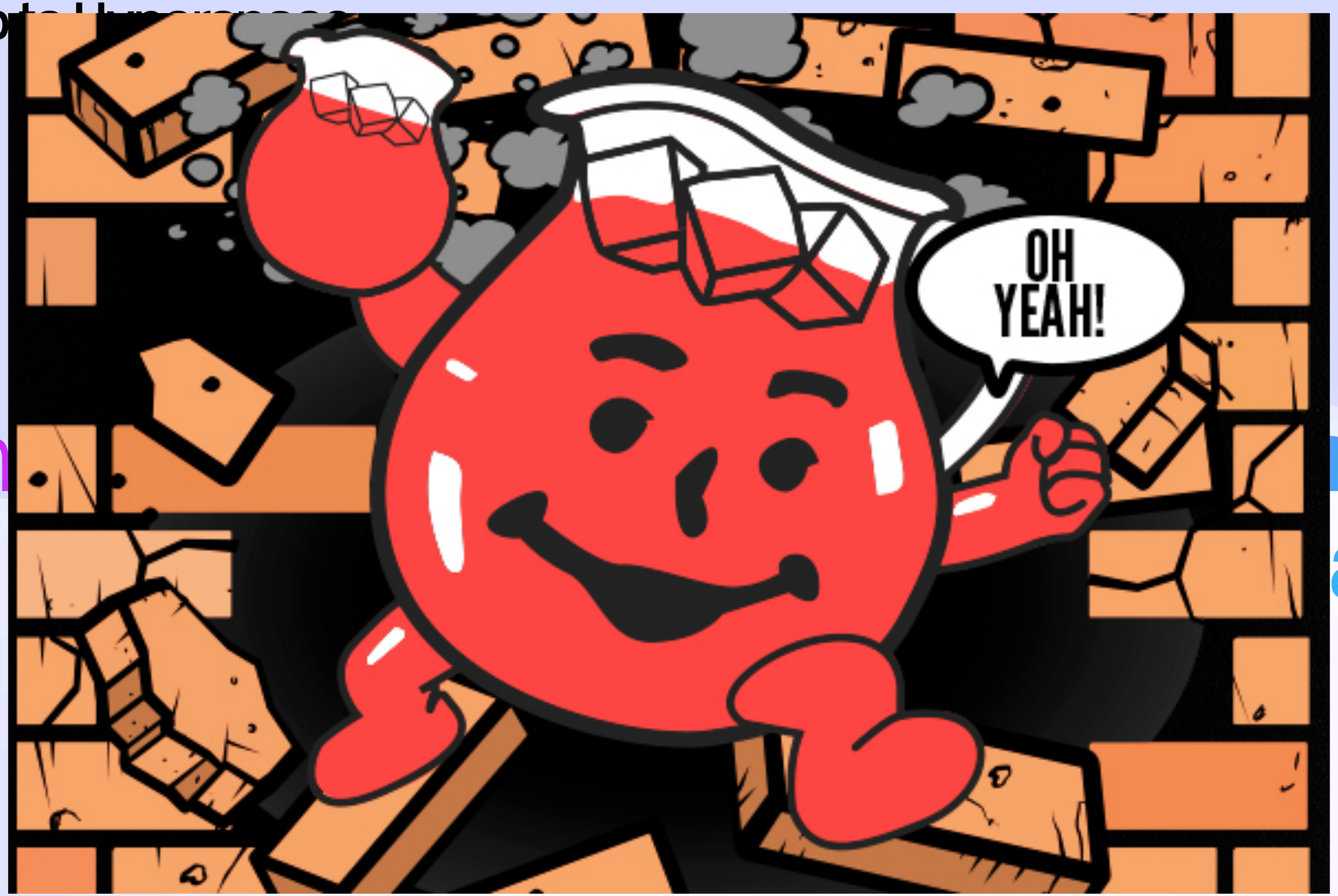

The Jump to Hyperspace
🌈 Light Speed, User Agency, & Moving Past the Cloud 🌤️

The Jump to Hyperspace

I suppose it is tempting,
if the only tool you have is a ***hammer***,
to treat everything as if it were a nail

– **Abraham Maslow**

The Jumpto Uncanniness



if th ***ner***,
to ail

The Jump to Hyperspace

Brooklyn Zelenka @expede

The Jump to Hyperspace

Brooklyn Zelenka @expede



`github.com/expede`
Vancouver 🇨🇦

The Jump to Hyperspace

Brooklyn Zelenka @expede

- Auth team lead at Ink & Switch
  - Beehive: local-first access control 🐝
- Spec editor at UCAN Working Group
- Prev. Ethereum core dev
- PLs and DS are my jam 🤘



`github.com/expede`
Vancouver 🇨🇦

The Jump to Hyperspace

Topics



The Jump to Hyperspace

Topics

- **High Level:** Current state of (networked) software
- **What is LoFi?** Philosophy & high level architecture
    1. Data
    2. Auth
    3. Compute
- **Looking forward**: developments for the next chapter



The Jump to Hyperspace

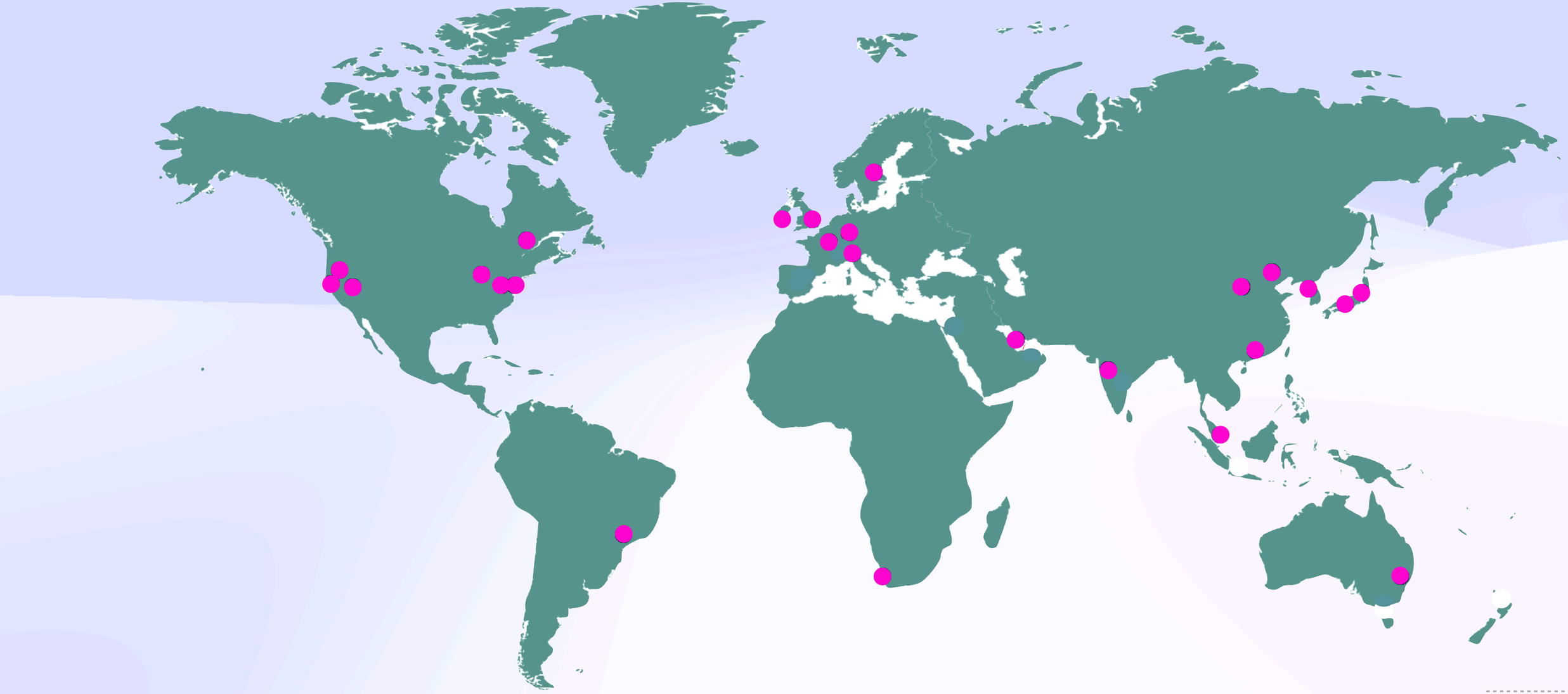
Audience Poll

Economic Weight Class

🐋 One Size Does Not Fit All 🐀

Economic Weight Class

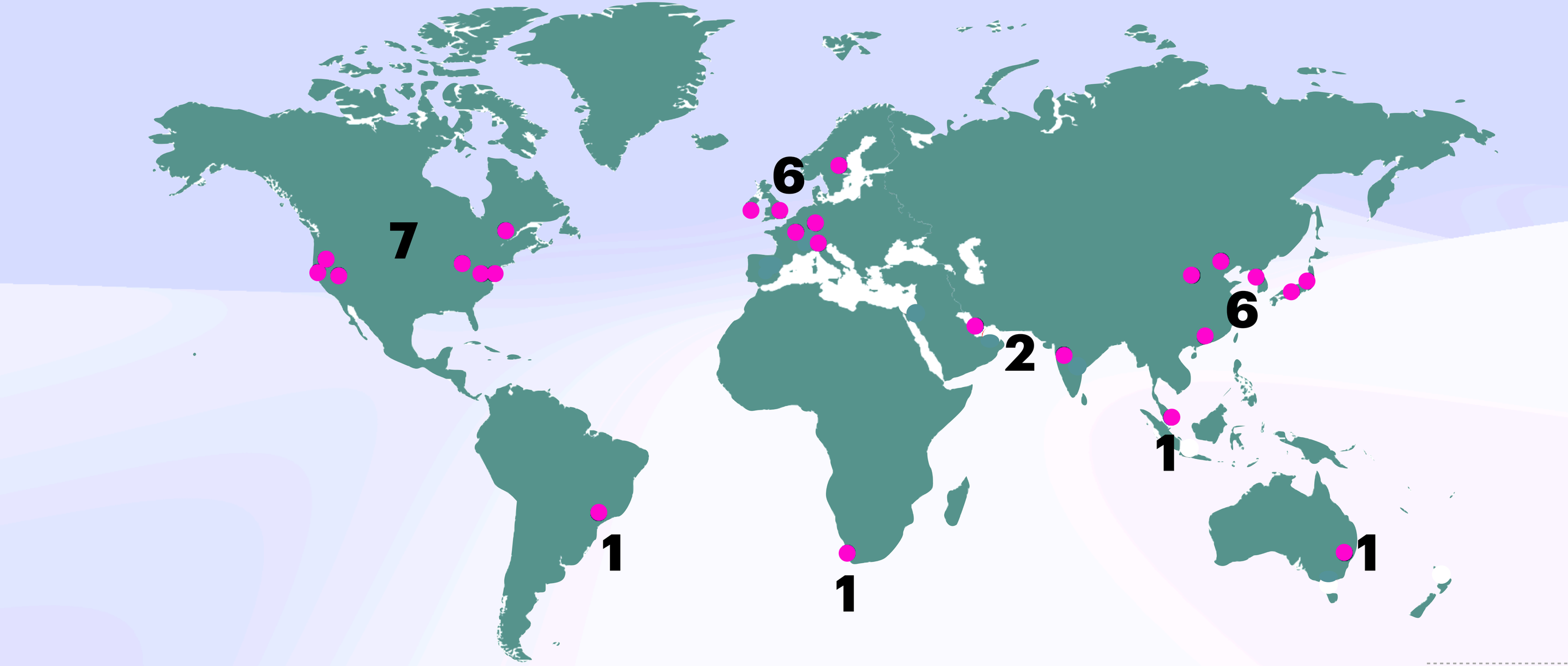
Users vs Cloud Infra



Source: AWS

Economic Weight Class

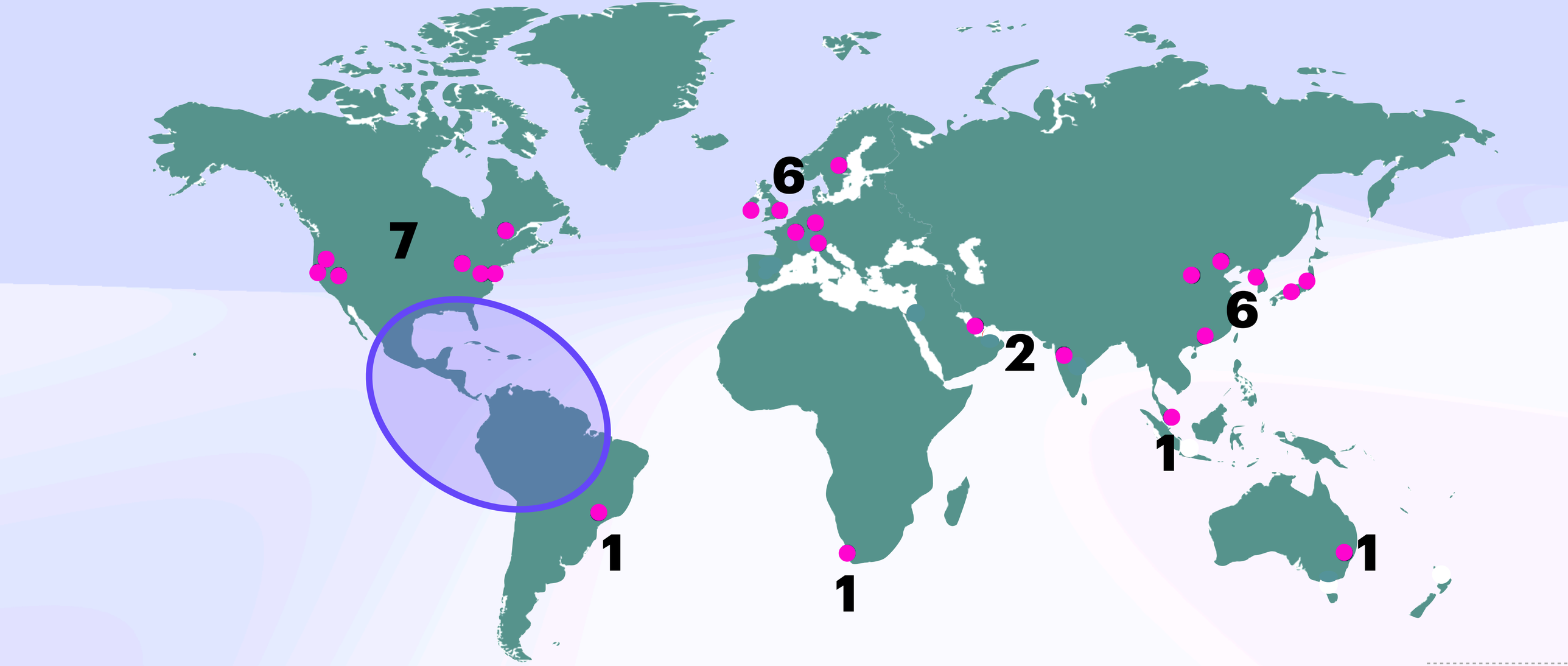
Users vs Cloud Infra



Source: AWS

Economic Weight Class

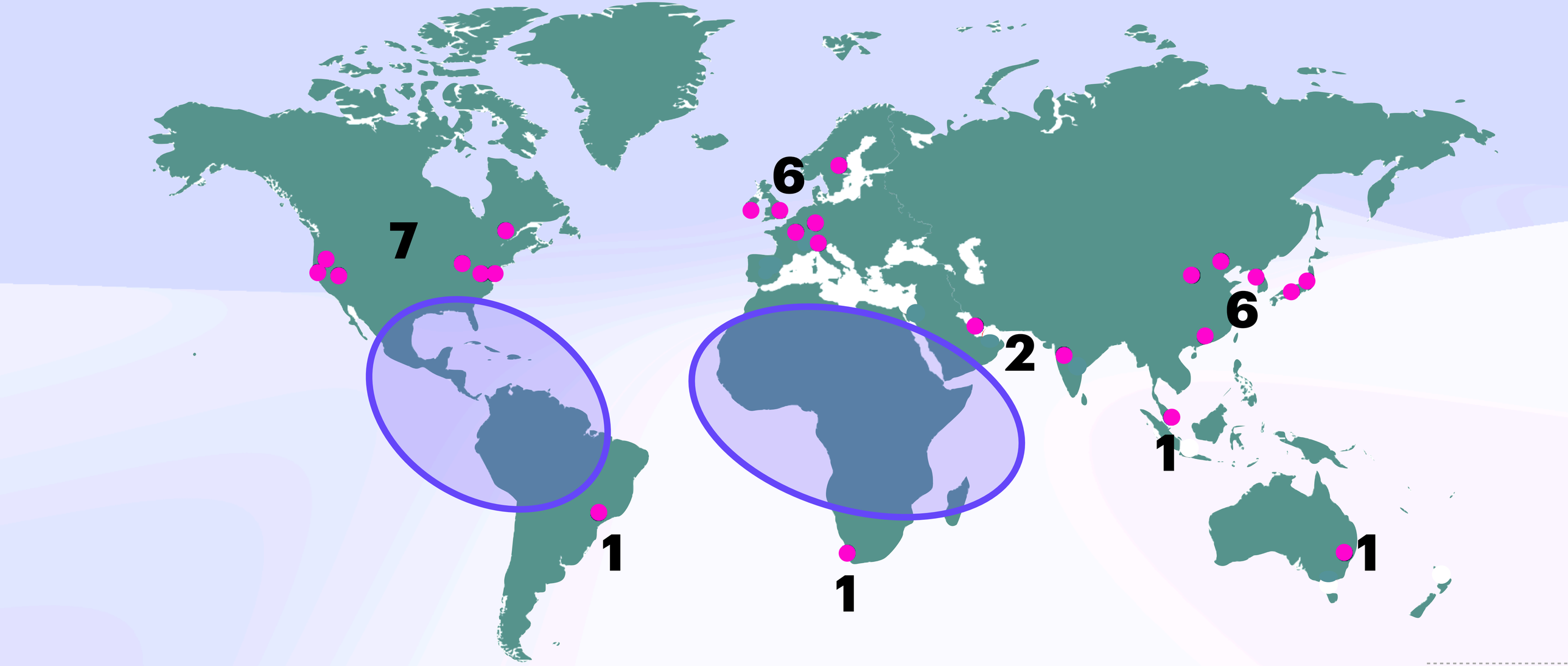
Users vs Cloud Infra



Source: AWS

Economic Weight Class

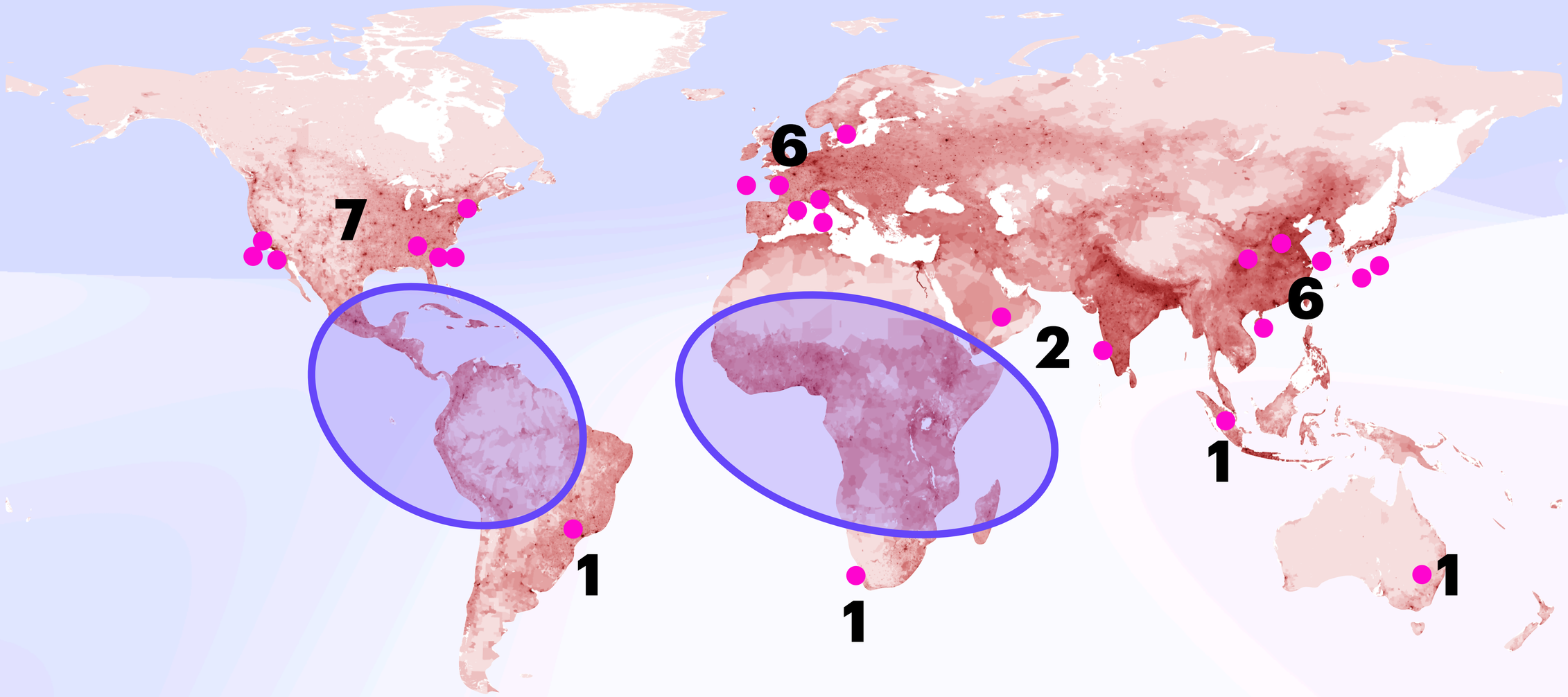
Users vs Cloud Infra



Source: AWS

Economic Weight Class

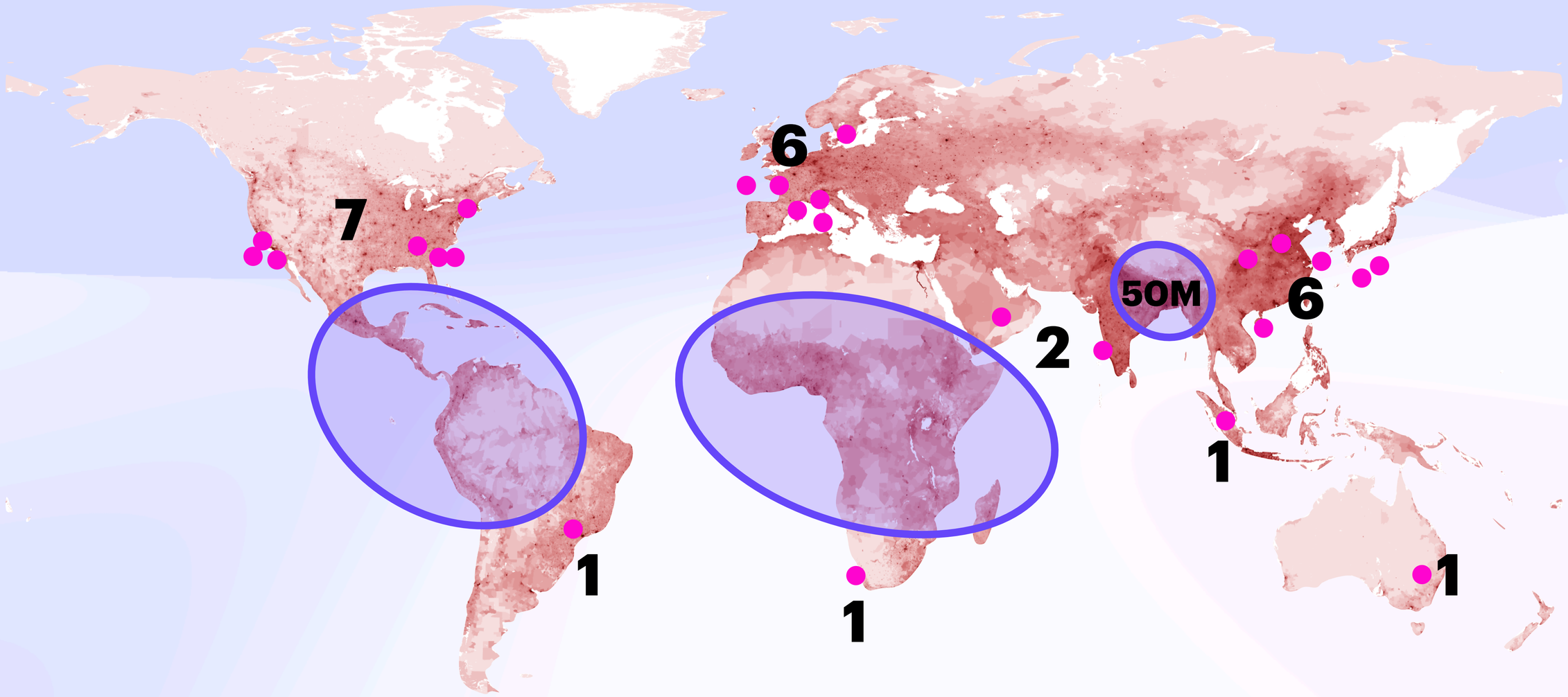
Users vs Cloud Infra



Source: AWS

Economic Weight Class

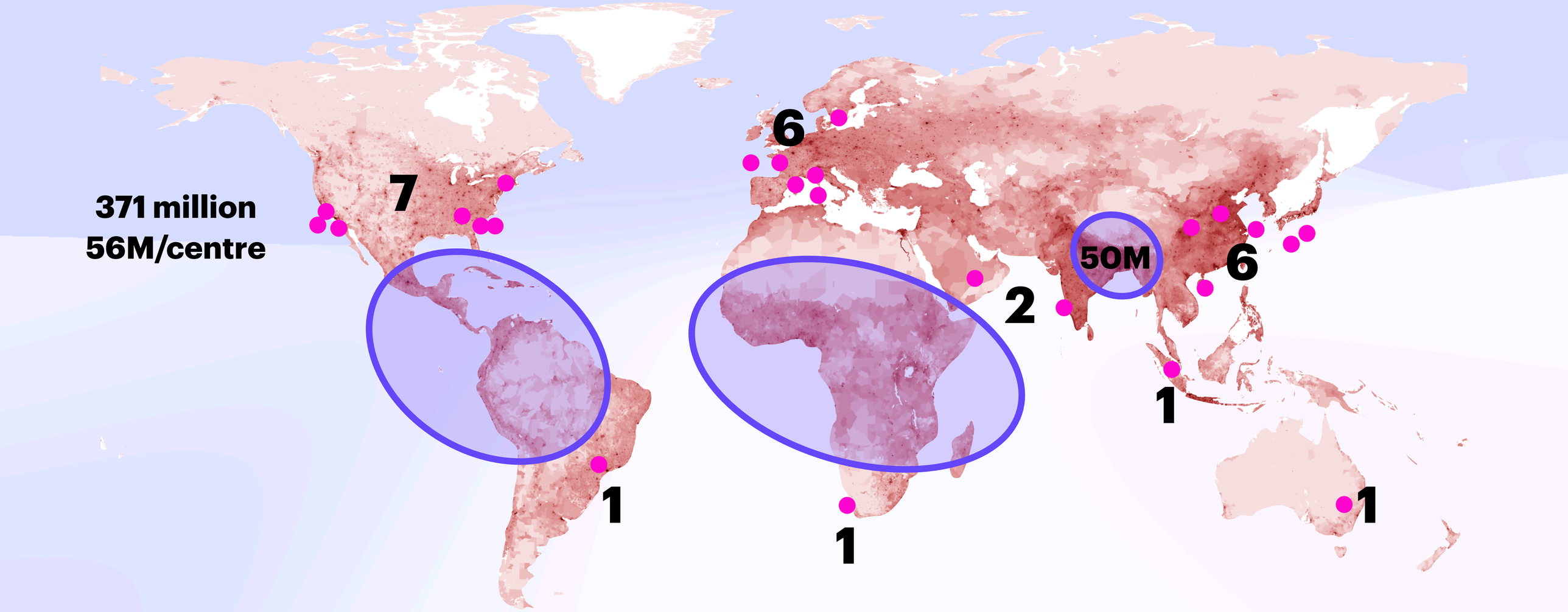
Users vs Cloud Infra



Source: AWS

Economic Weight Class

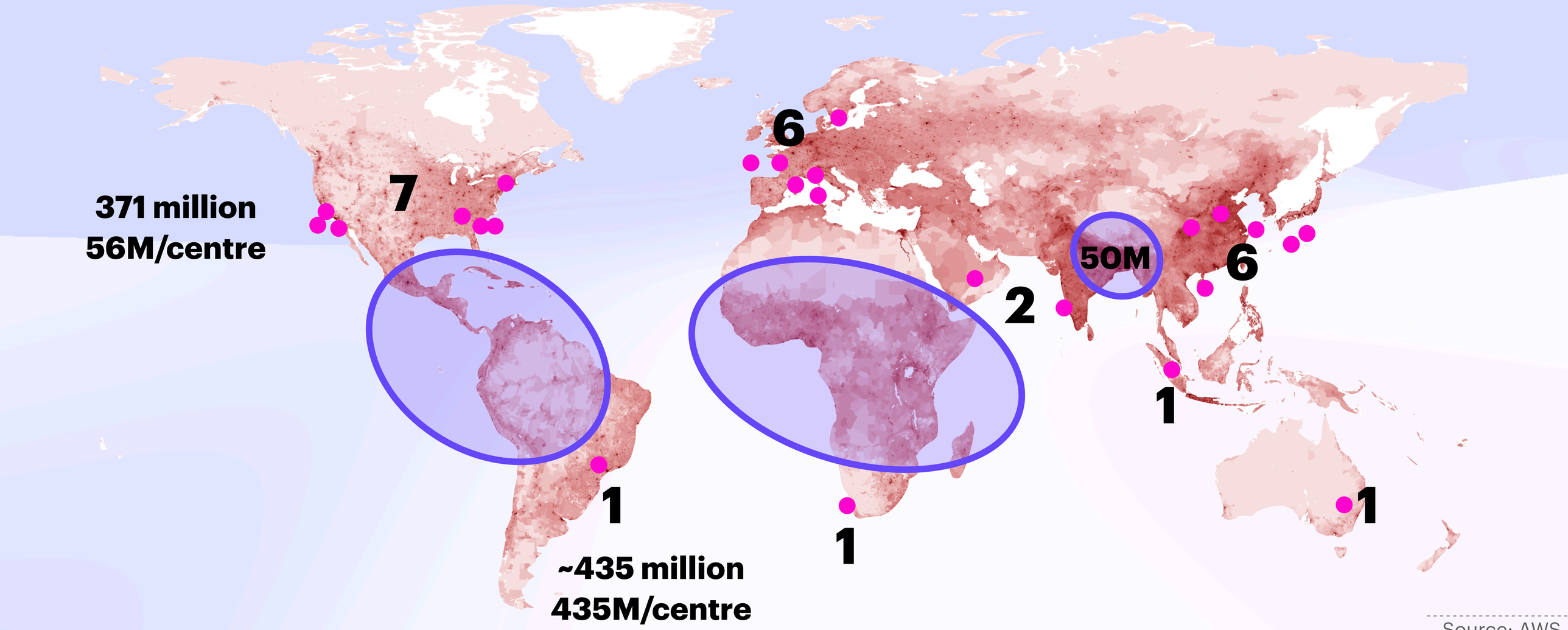
Users vs Cloud Infra



Source: AWS

Economic Weight Class

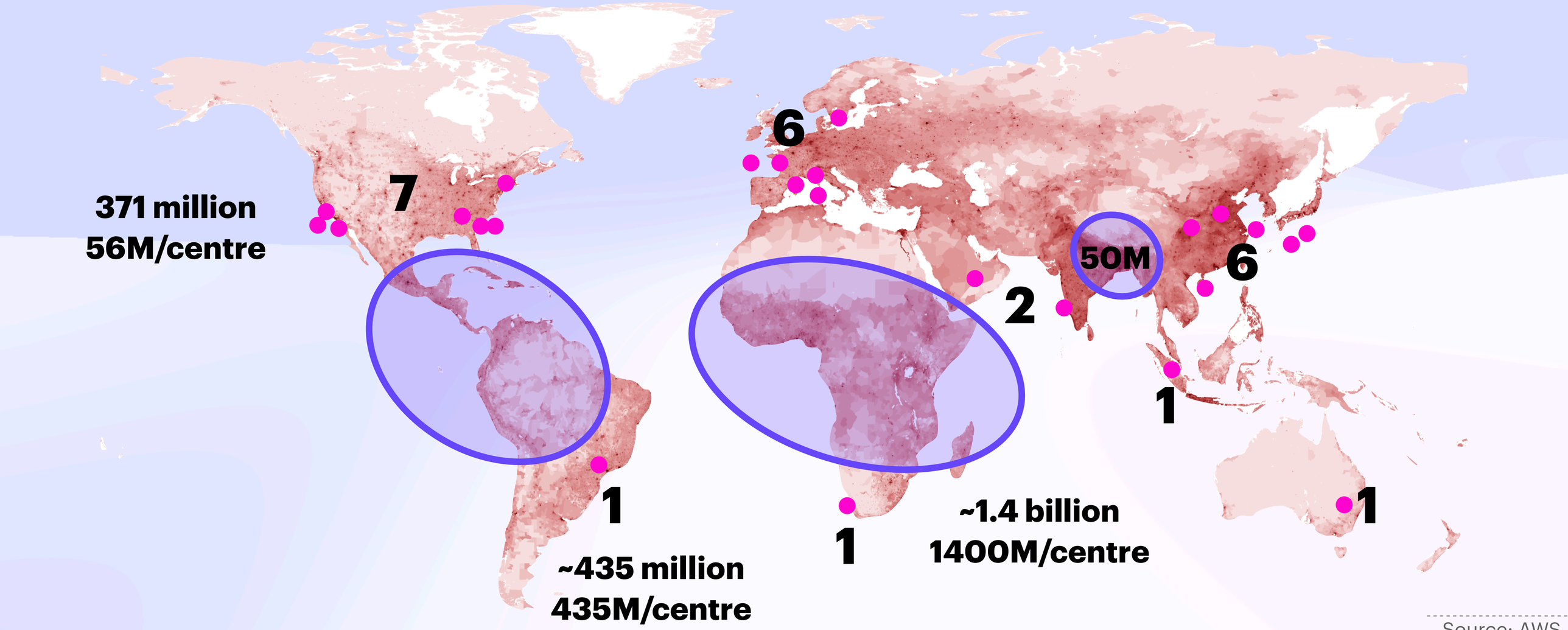
Users vs Cloud Infra



Source: AWS

Economic Weight Class

Users vs Cloud Infra



Source: AWS

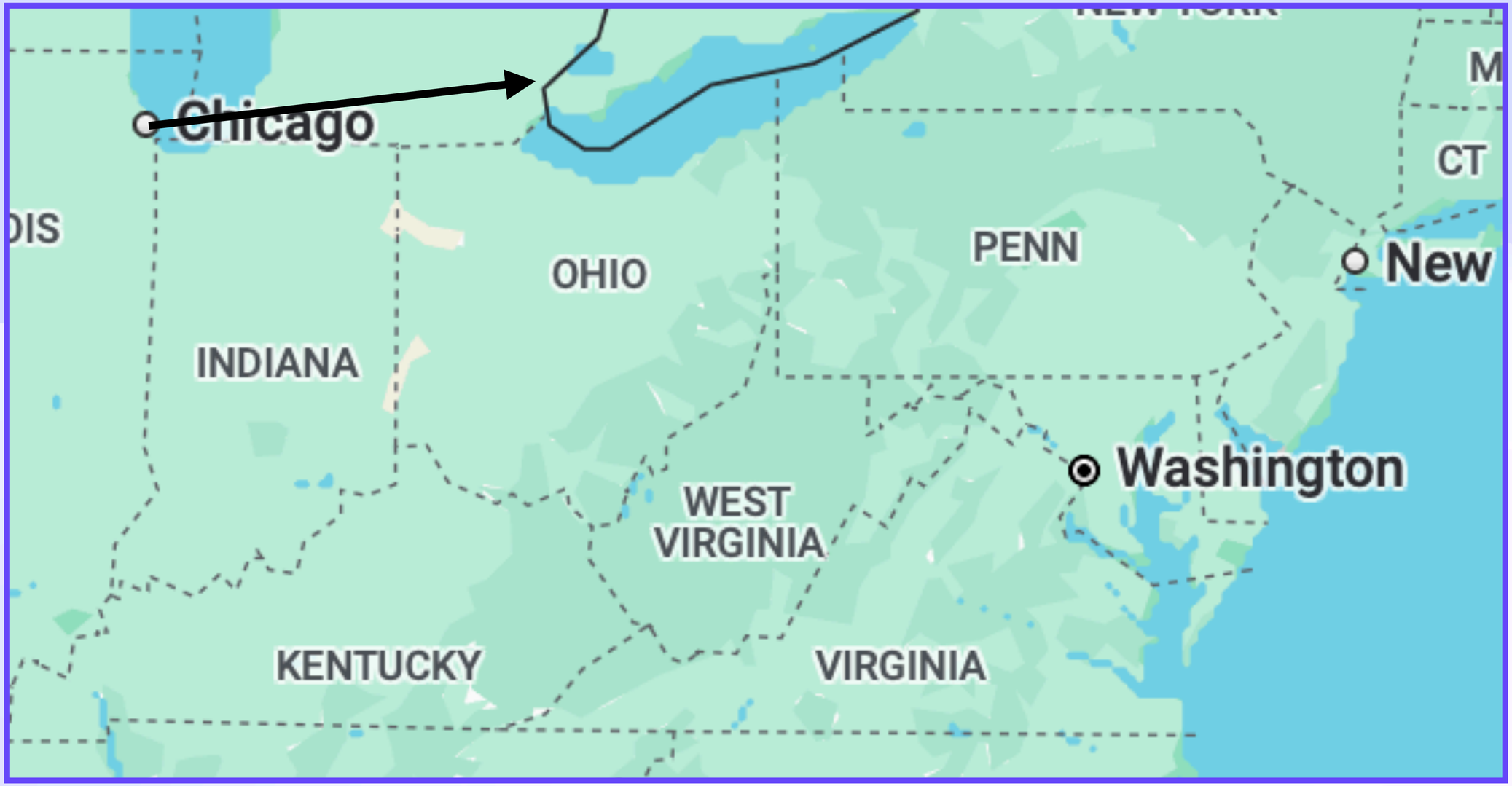
Economic Weight Class

Sending a "Direct" Message in 2024



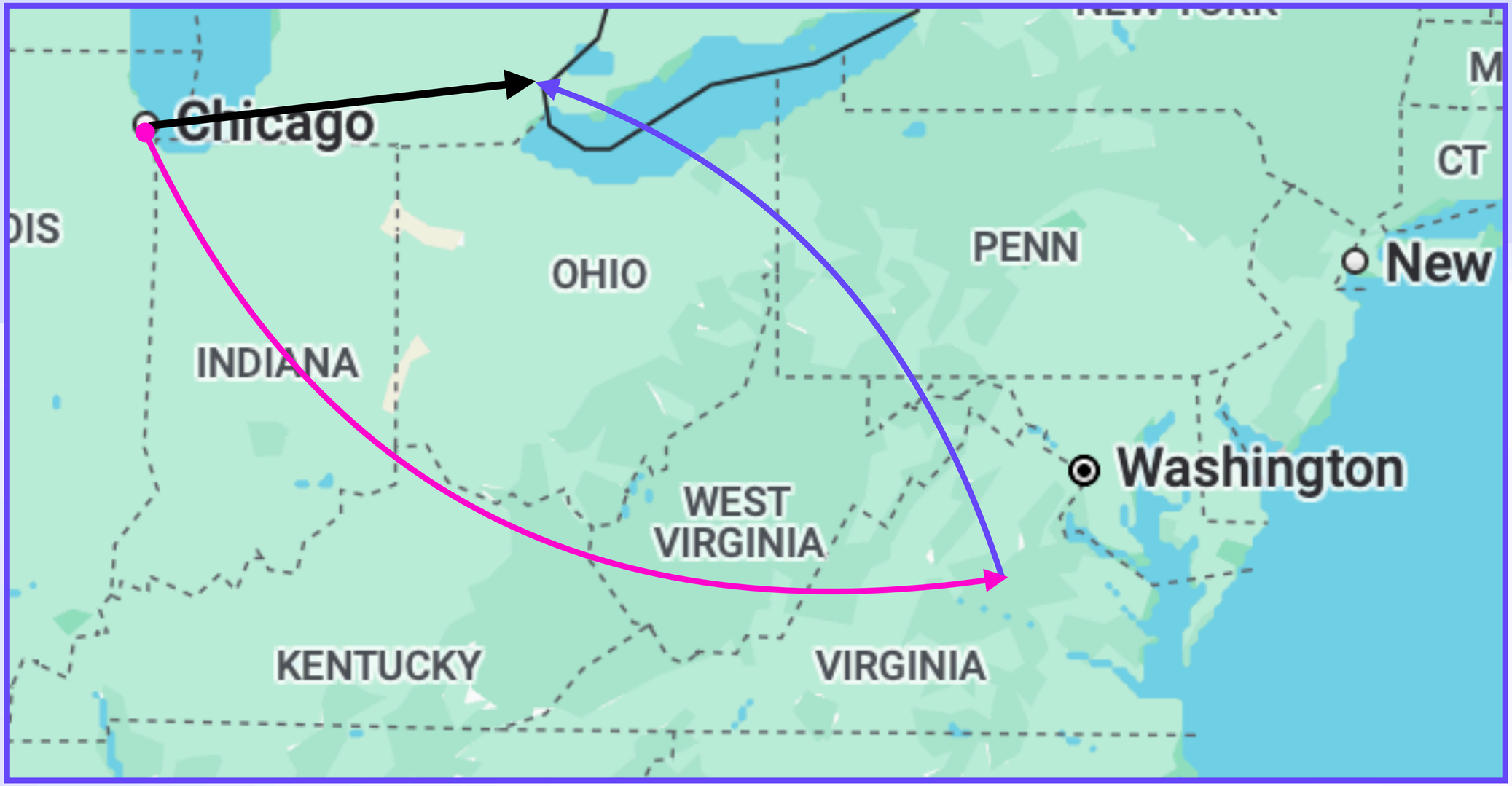
Economic Weight Class

Sending a "Direct" Message in 2024



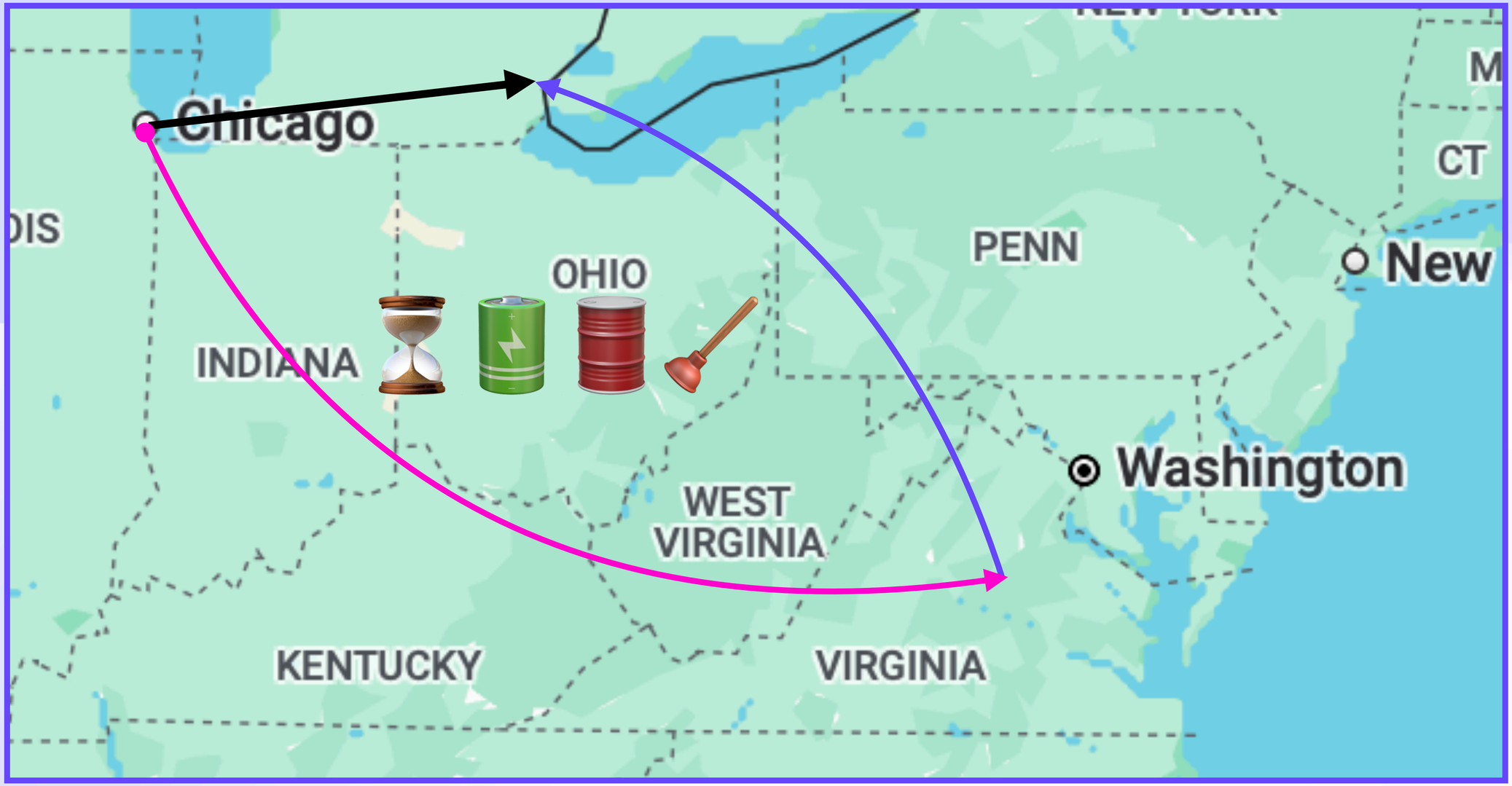
Economic Weight Class

Sending a "Direct" Message in 2024



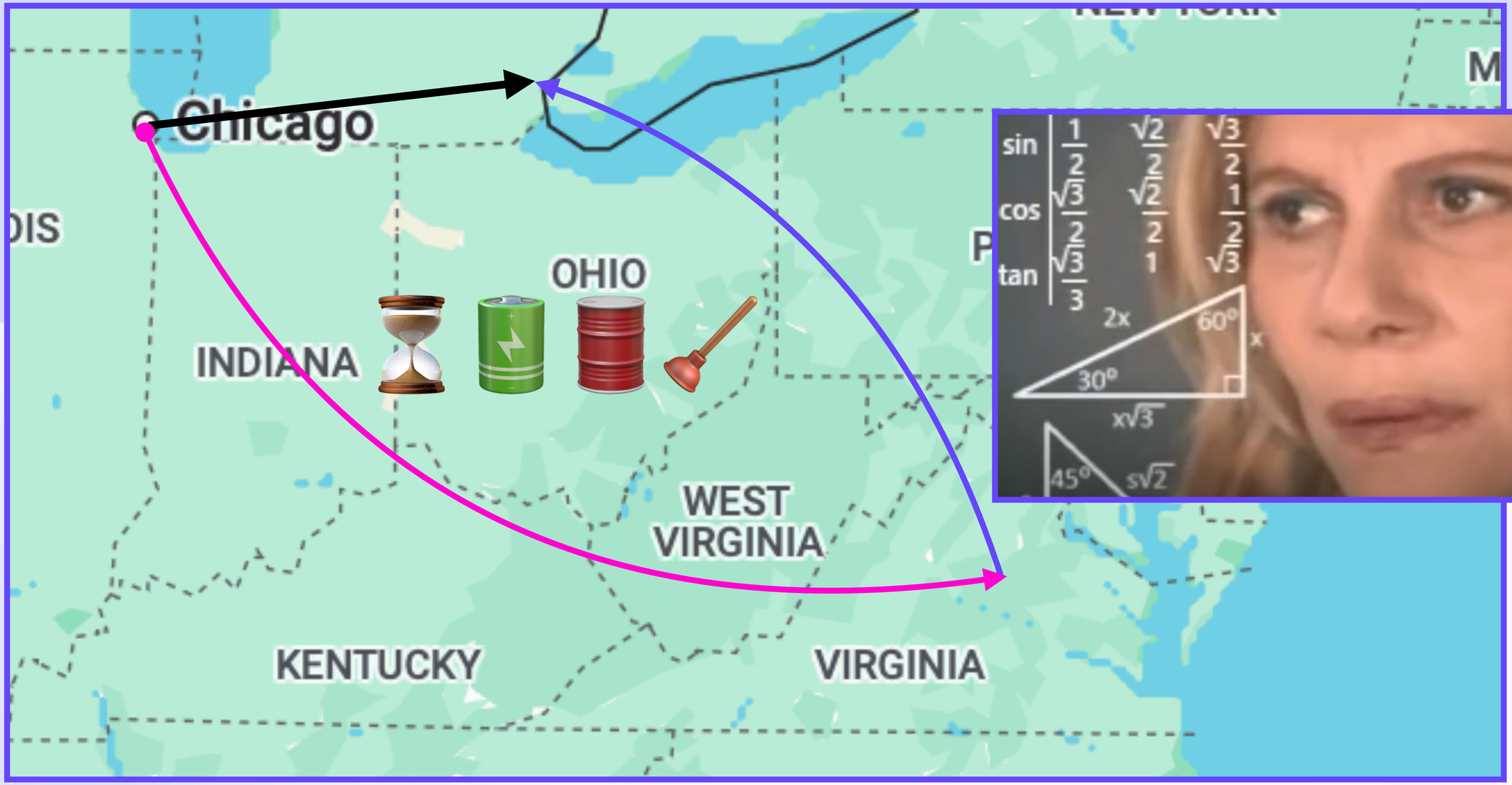
Economic Weight Class

Sending a "Direct" Message in 2024



Economic Weight Class

Sending a "Direct" Message in 2024



Economic Weight Class

Industrial

USS Nimitz
Crew: ~5k
Cost: >$8.5 billion (USD)

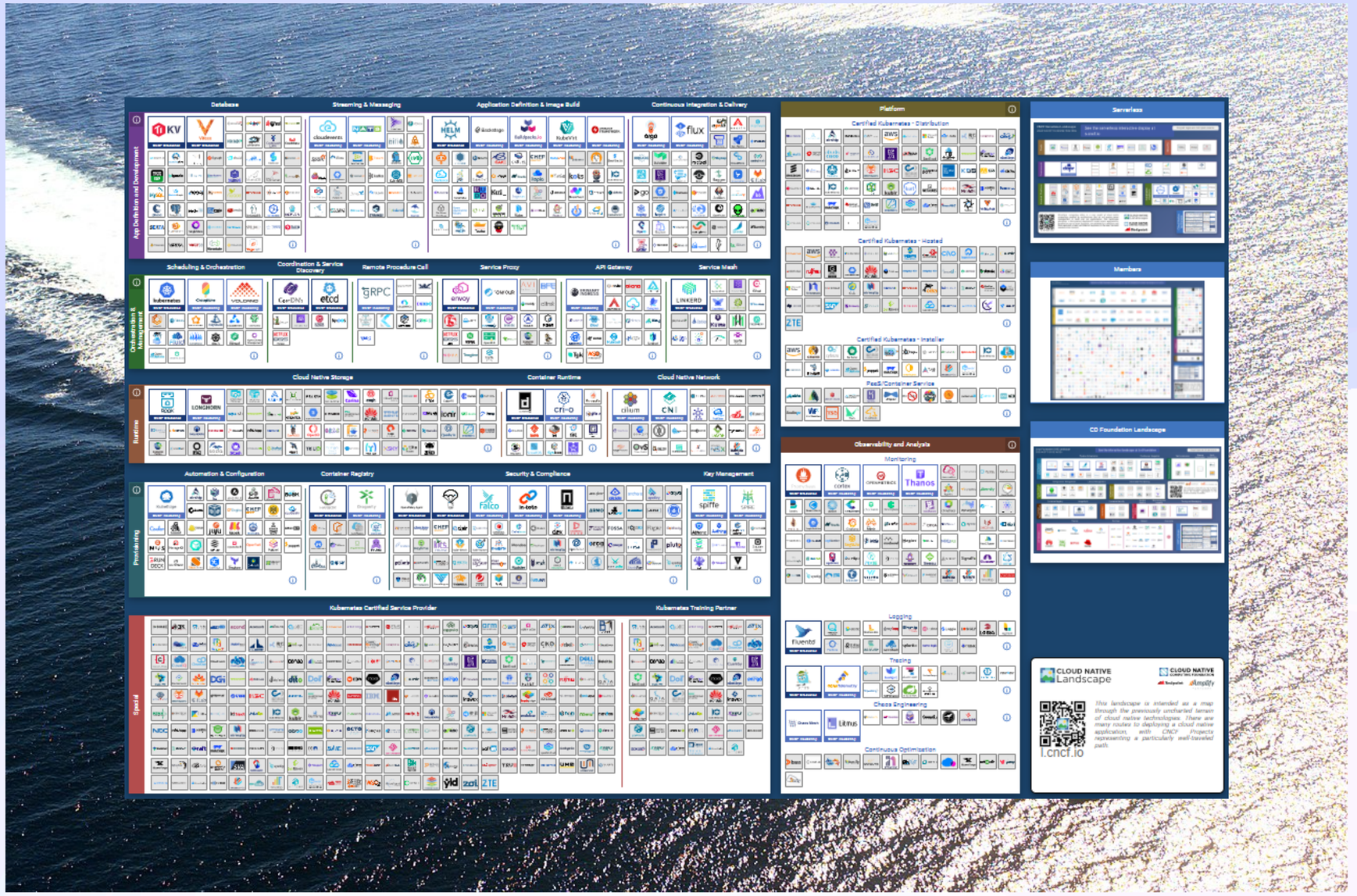


Metaphor credit: @pvh

Economic Weight Class

Industrial

USS Nimitz
Crew: ~5k
Cost: >$8.5 billion (USD)



Economic Weight Class

Consequences 🍂

Economic Weight Class

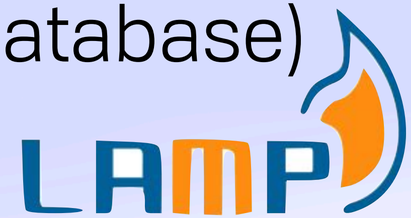
Consequences 🍂

- Single source of truth ("**the**" database)

Economic Weight Class

Consequences

- Single source of truth ("**the**" database)
- Server-centric
  - "Full stack development"
  - DevOps, Docker, k8s
  - How to train enough engineers?



Economic Weight Class

Consequences

- Single source of truth ("**the**" database)
- Server-centric
  - "Full stack development"
  - DevOps, Docker, k8s
  - How to train enough engineers?



Economic Weight Class

Condensing The Stack

Economic Weight Class

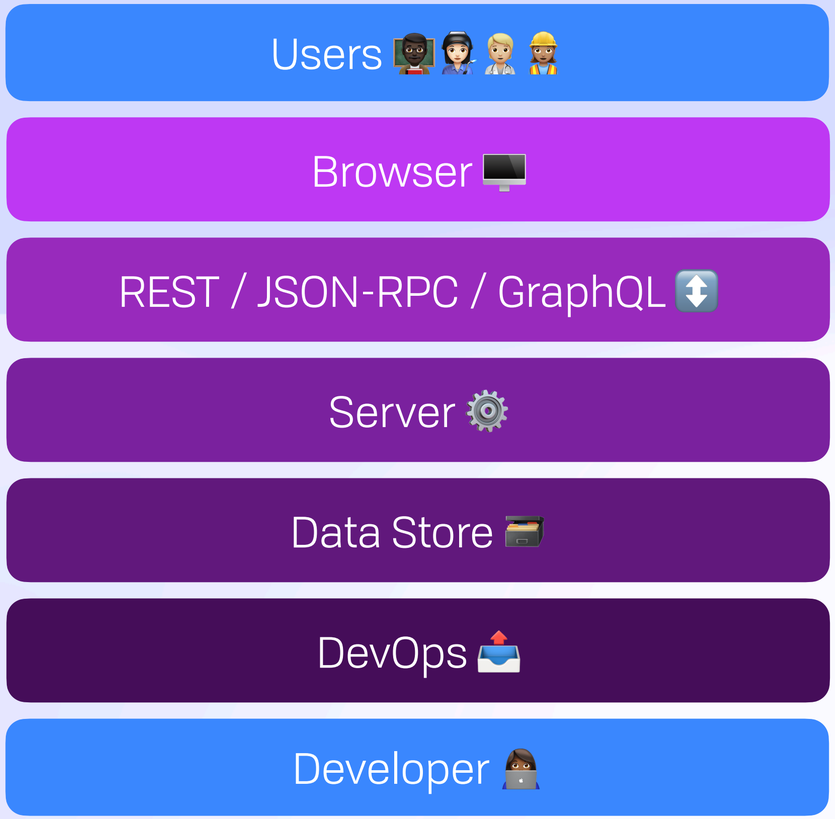
Condensing The Stack

Users 👩🏿‍💻👩🏻‍🚀👨🏼‍🦳👷

Developer 👩🏾‍💻

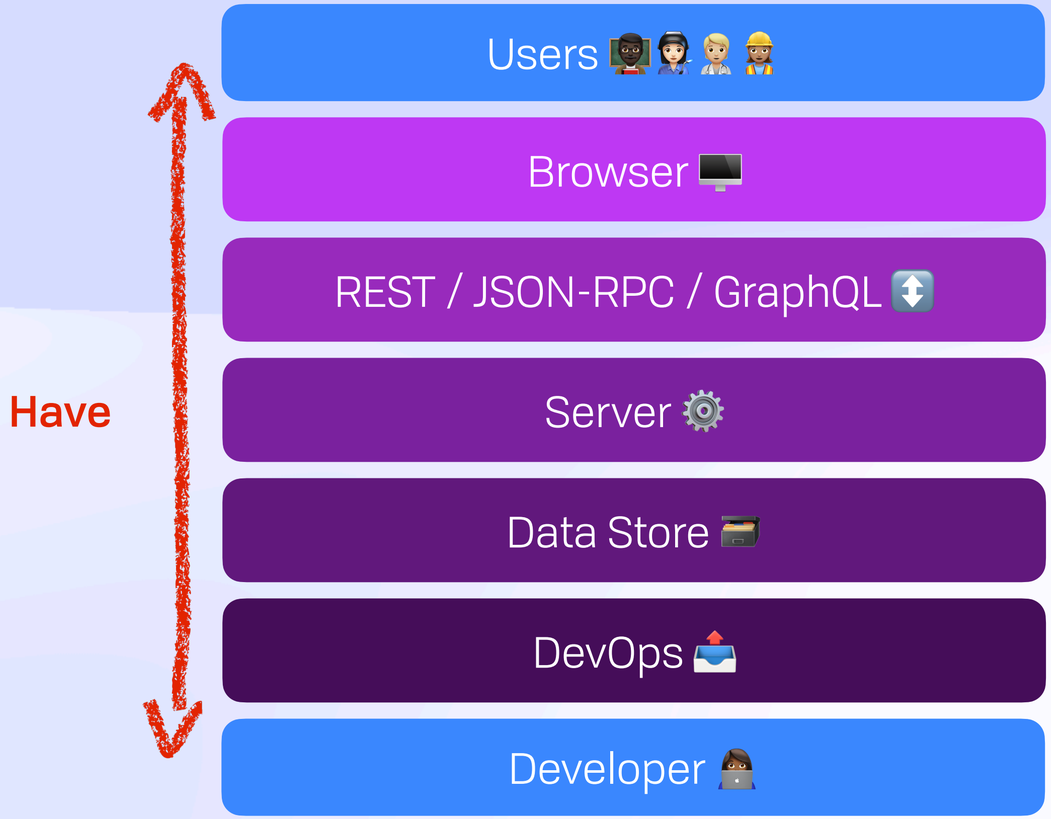
Economic Weight Class

Condensing The Stack



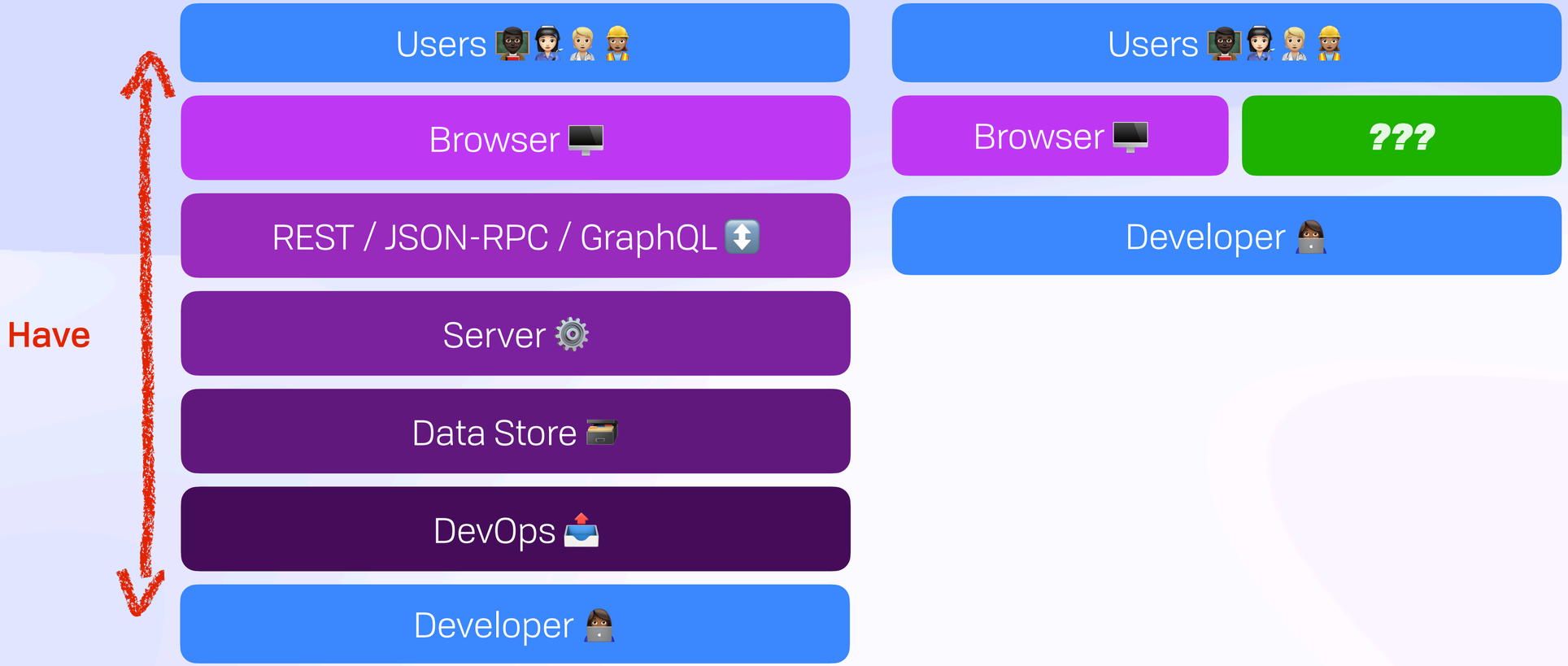
Economic Weight Class

Condensing The Stack



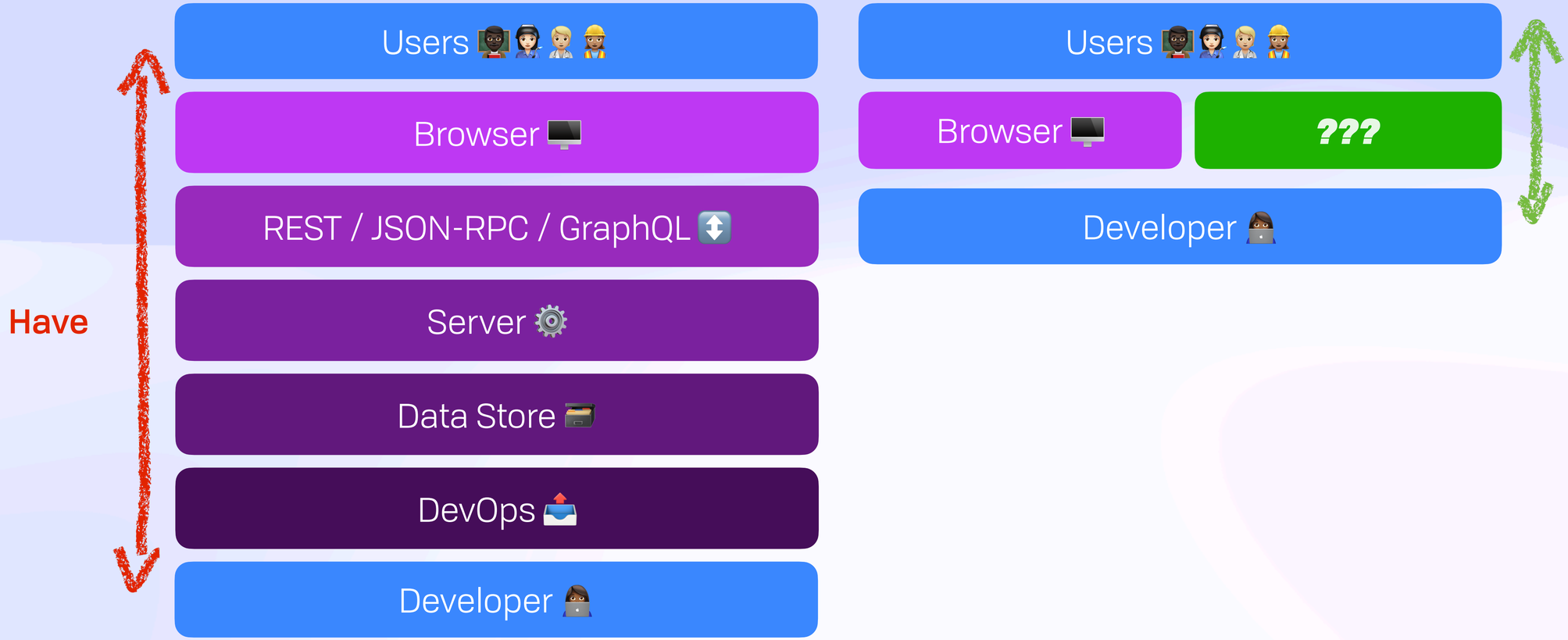
Economic Weight Class

Condensing The Stack



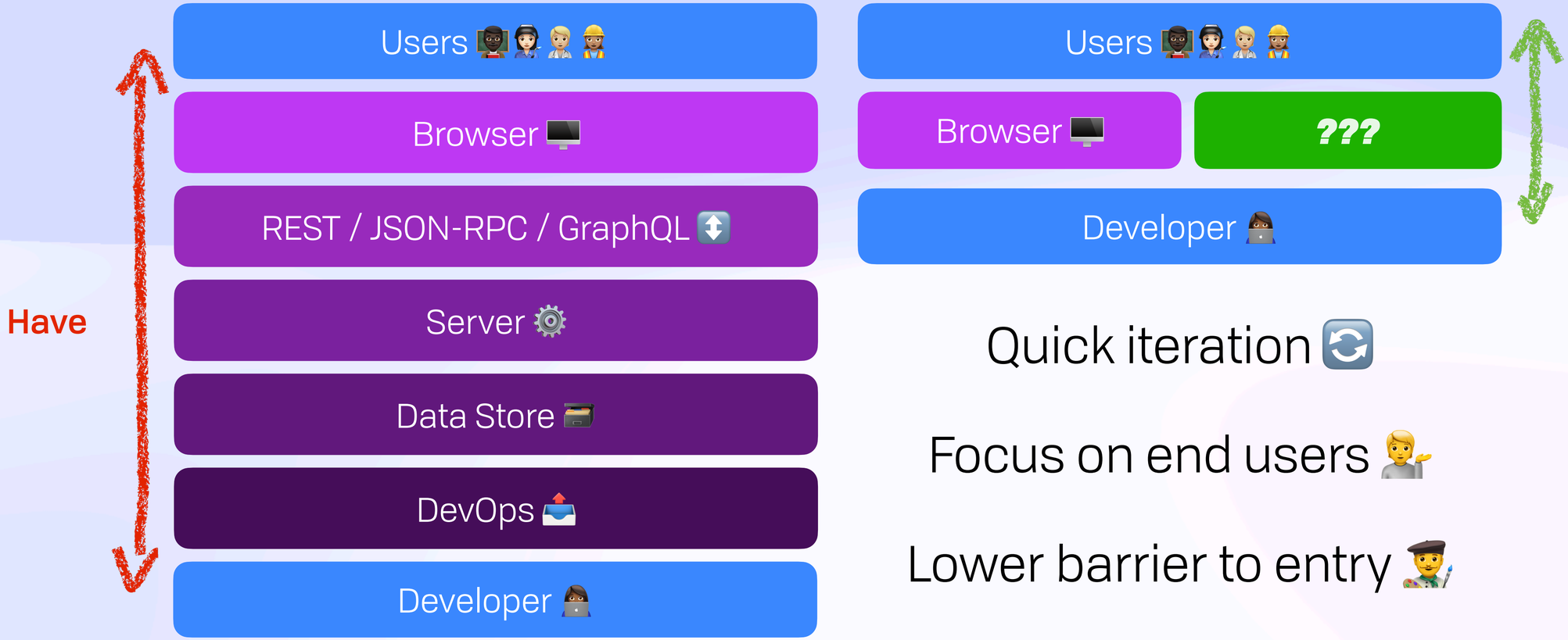
Economic Weight Class

Condensing The Stack



Economic Weight Class

Condensing The Stack



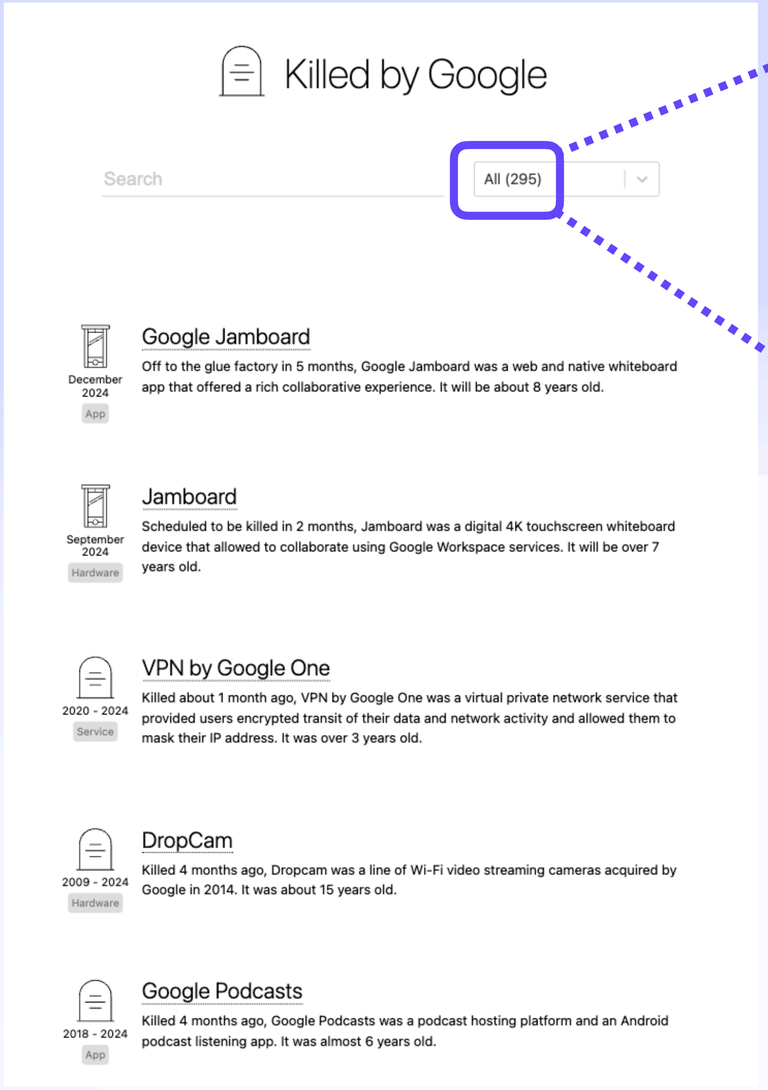
Quick iteration 🔄

Focus on end users 💁‍♂️

Lower barrier to entry 👨‍🎨

Economic Weight Class

An Incredible Journey... Into a Dark Age





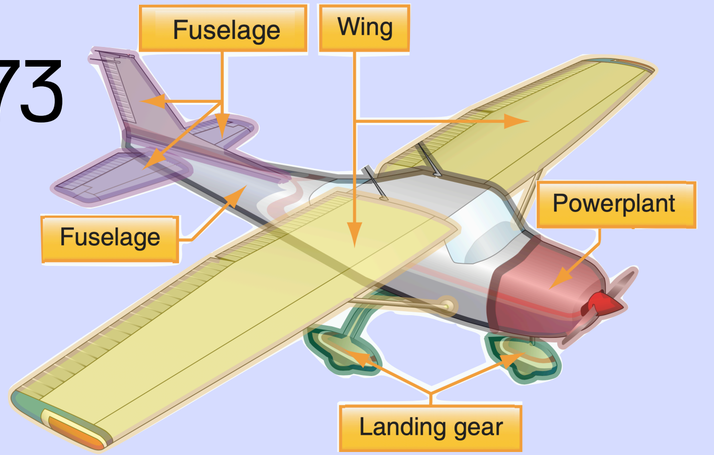
Economic Weight Class

Functional Fixedness

Economic Weight Class

1959 - 1973

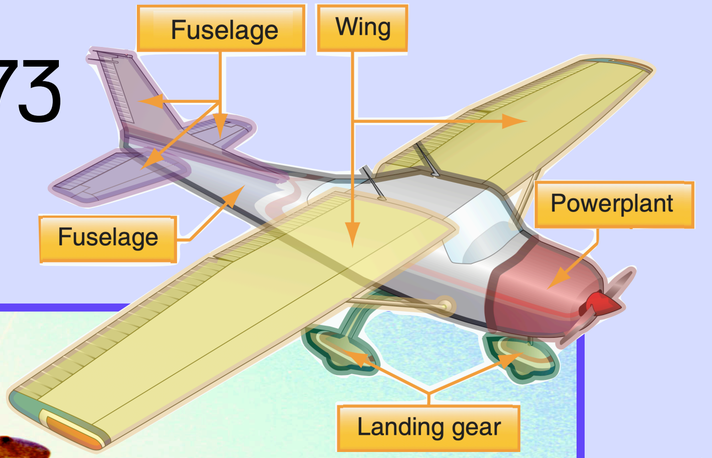
Functional Fixedness



Economic Weight Class

1959 - 1973

Functional Fixedness

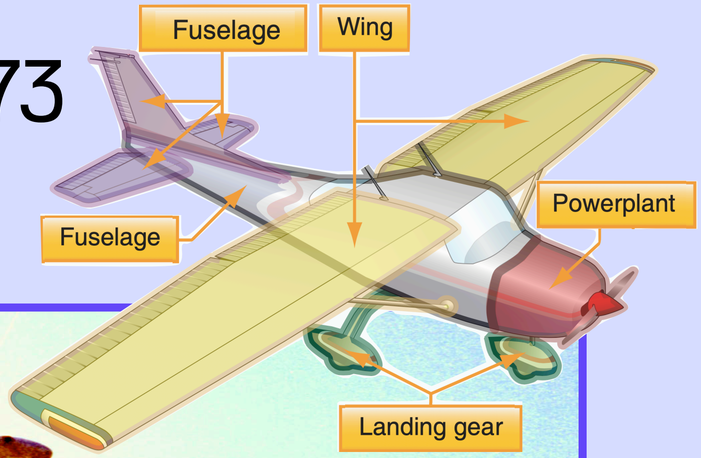




Economic Weight Class

Functional Fixedness

1959 - 1973



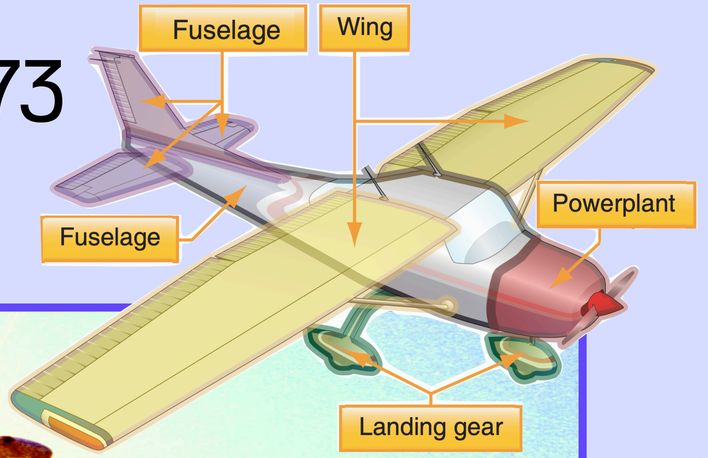
"Everyone else was trying to make an airplane. We were trying to do human powered flight!"



Economic Weight Class

Functional Fixedness

1959 - 1973



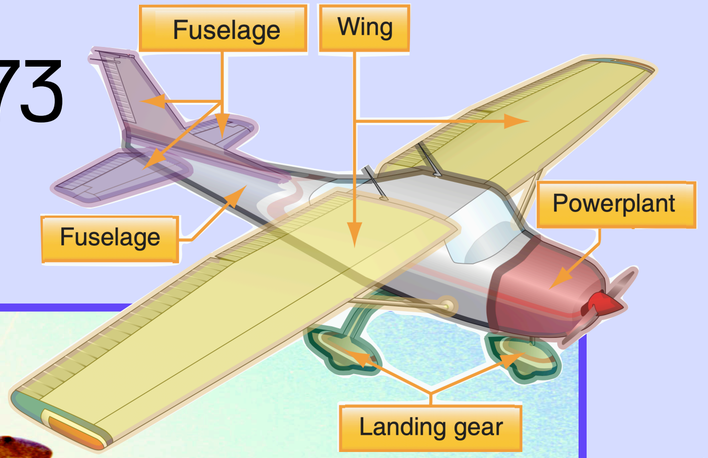
"Everyone else was trying to make Google. We were trying to do human powered flight!"



Economic Weight Class

Functional Fixedness

1959 - 1973



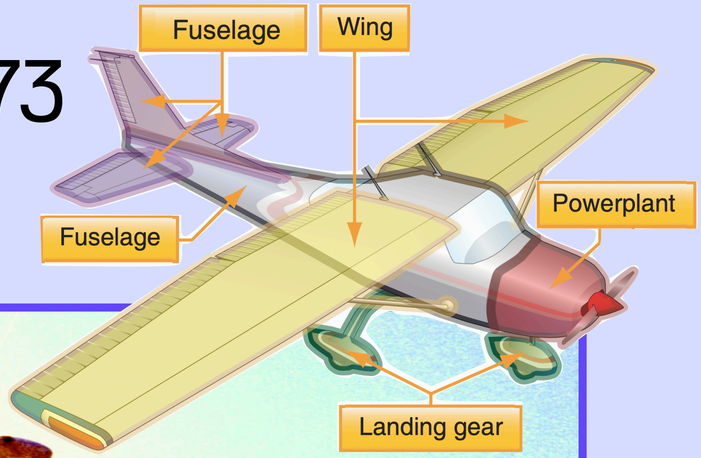
"Everyone else was trying to make **Google**. We were trying to **build apps**!"



Economic Weight Class

Functional Fixedness

1959 - 1973



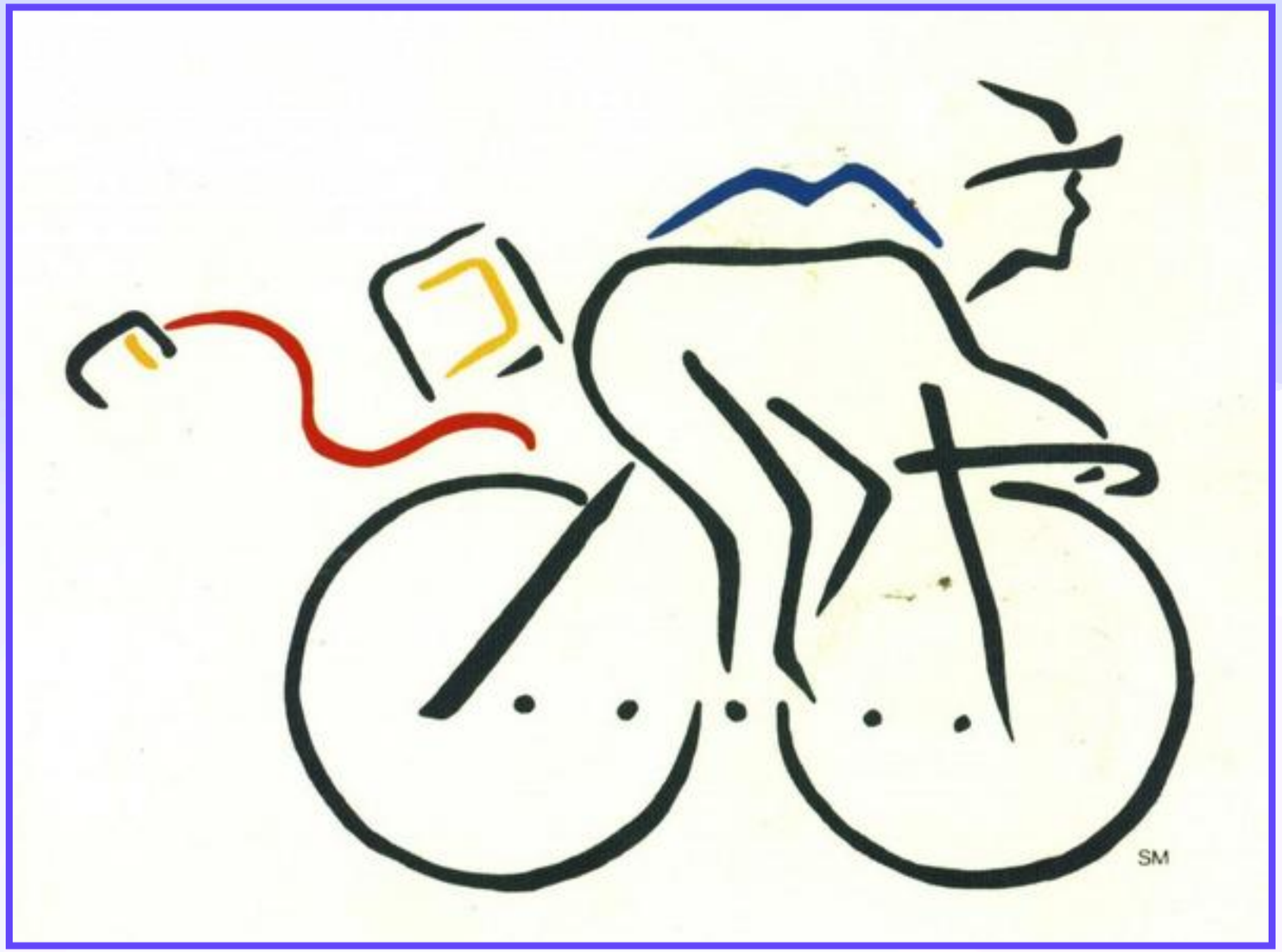
"Everyone else was trying to make **Google**. We were trying to **solve user problems**!"



Economic Weight Class

Human

A bike
Crew: 1
Cost: <$8.5 billion (USD)



Economic Weight Class

Command & Control

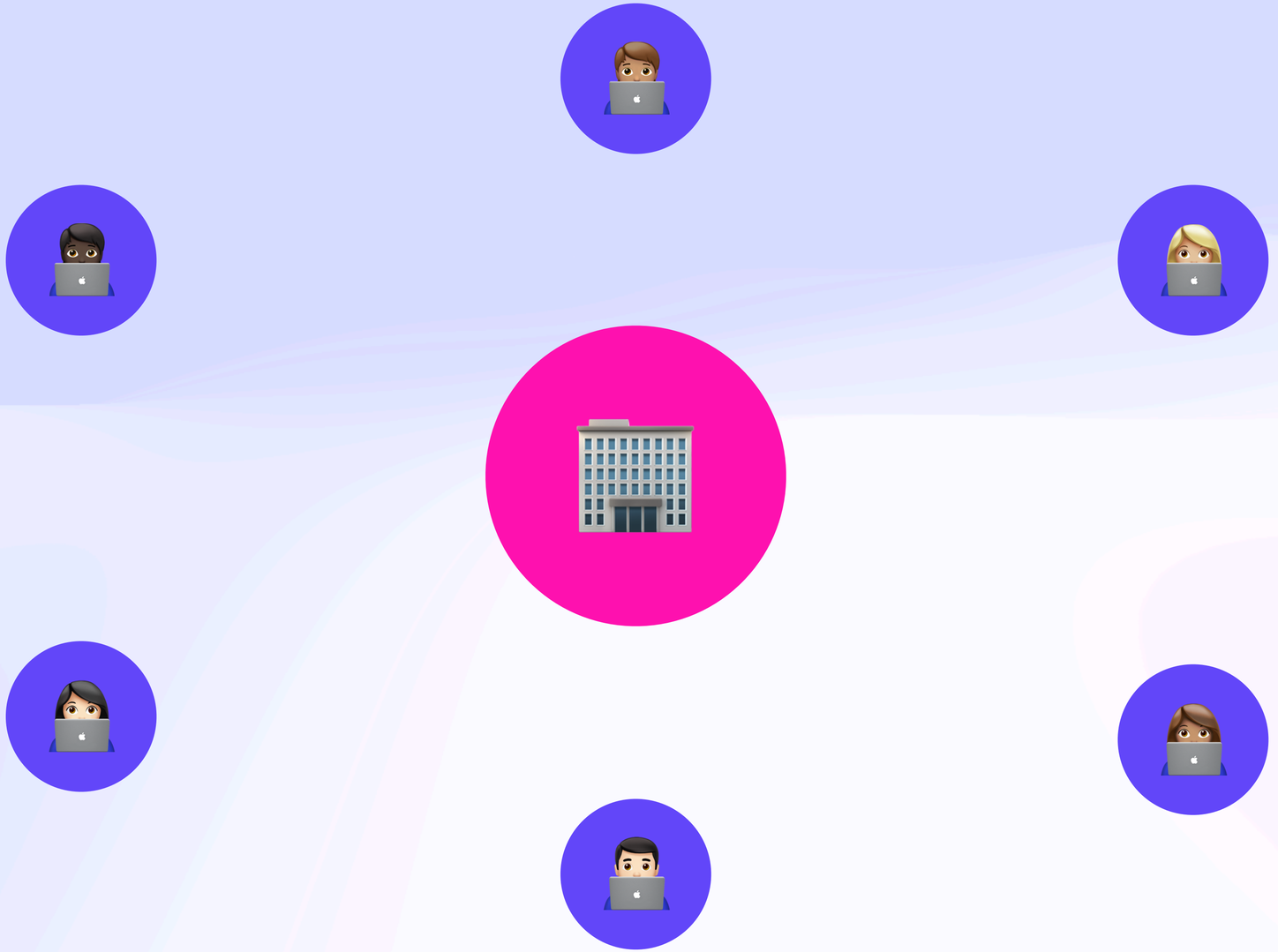
Economic Weight Class

Command & Control



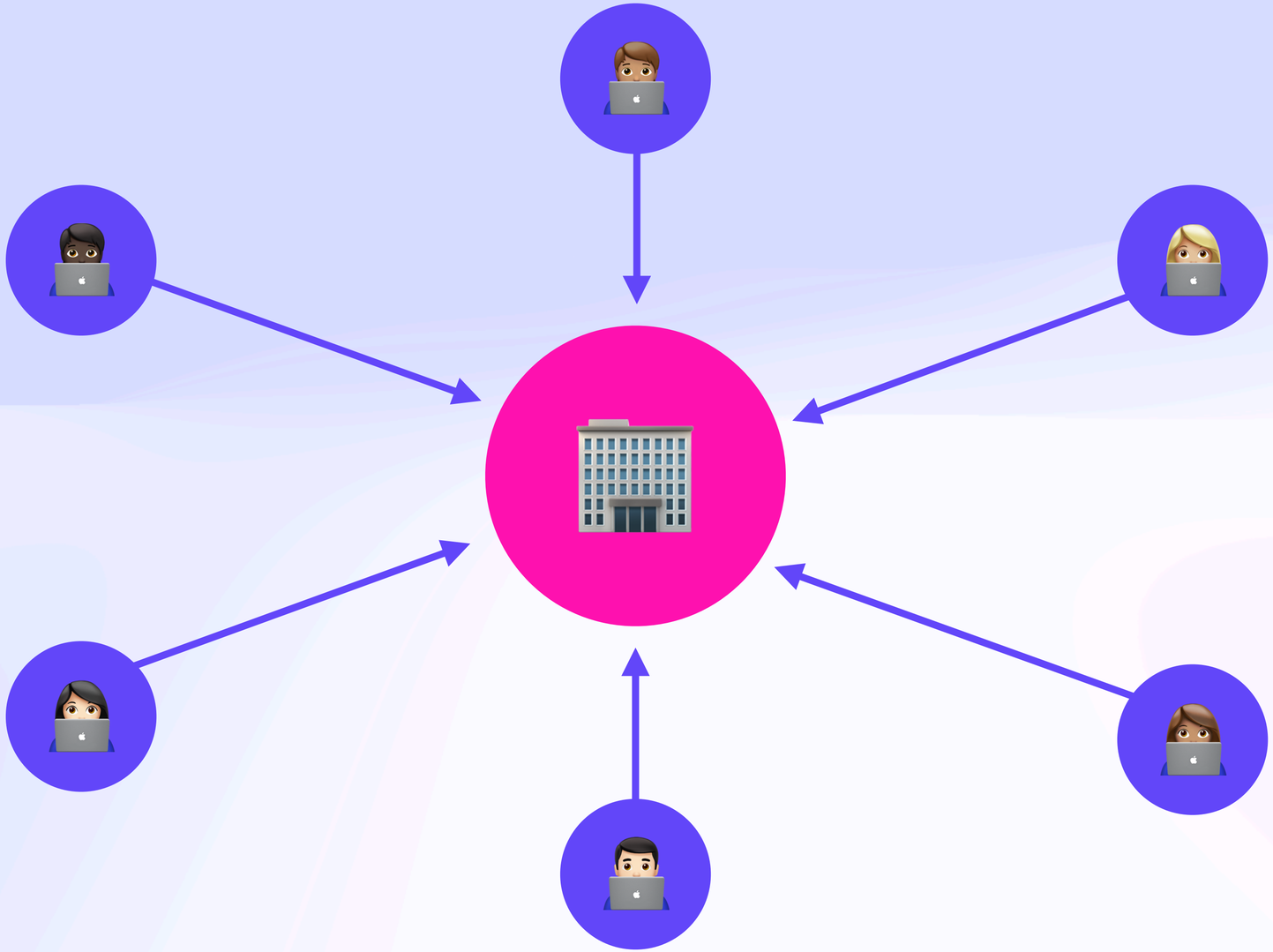
Economic Weight Class

Command & Control



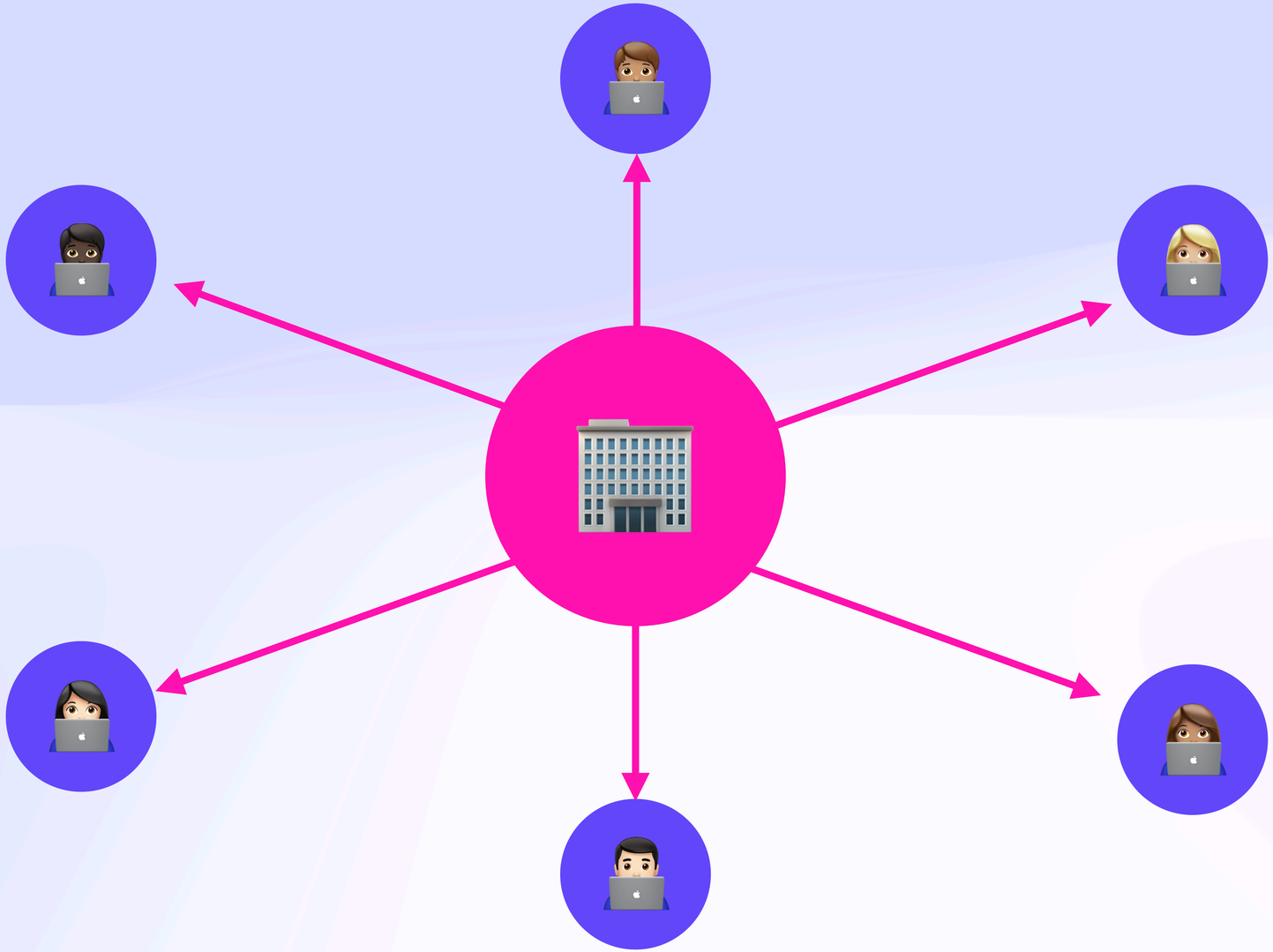
Economic Weight Class

Command & Control



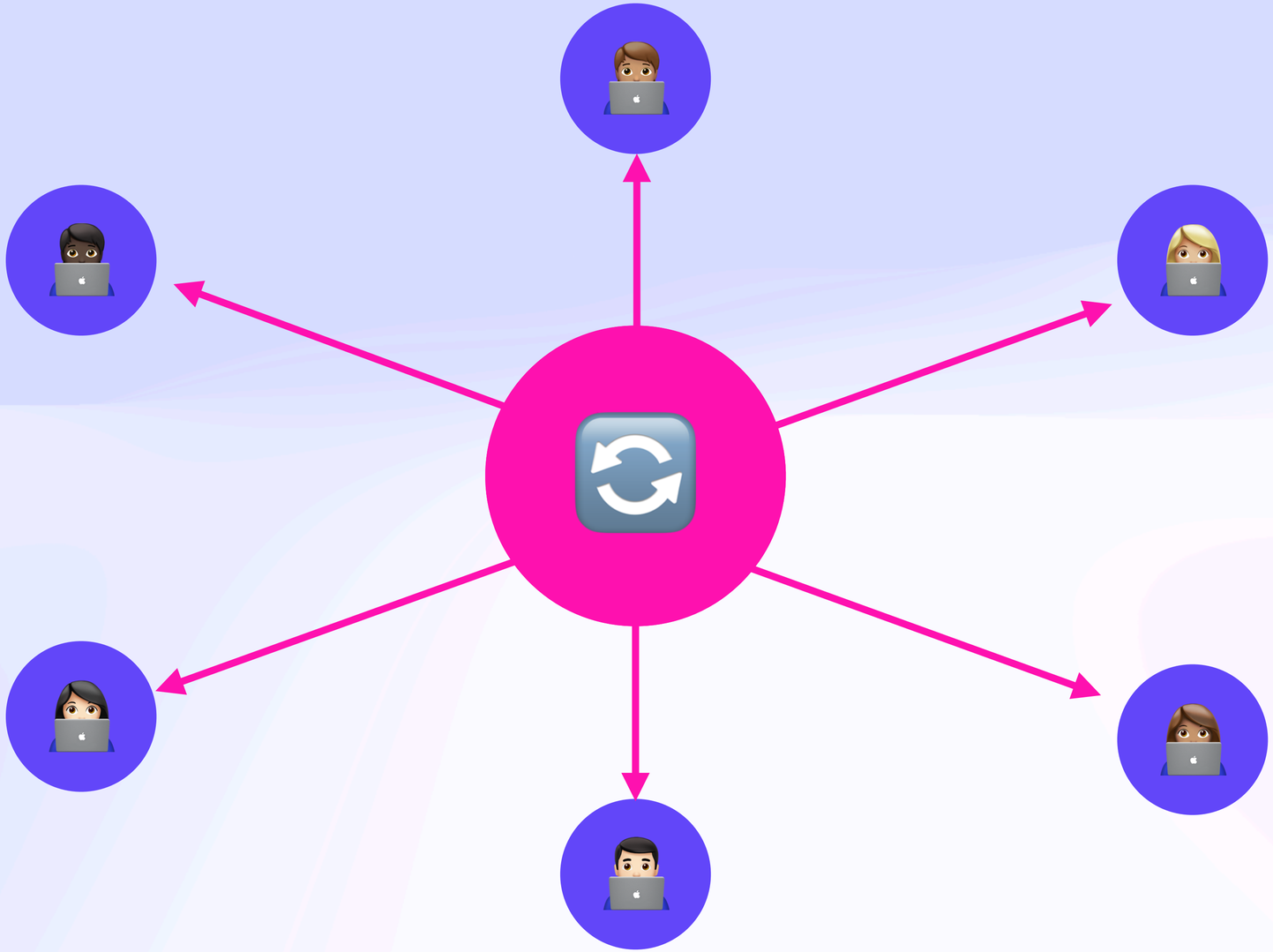
Economic Weight Class

Hive Dynamics



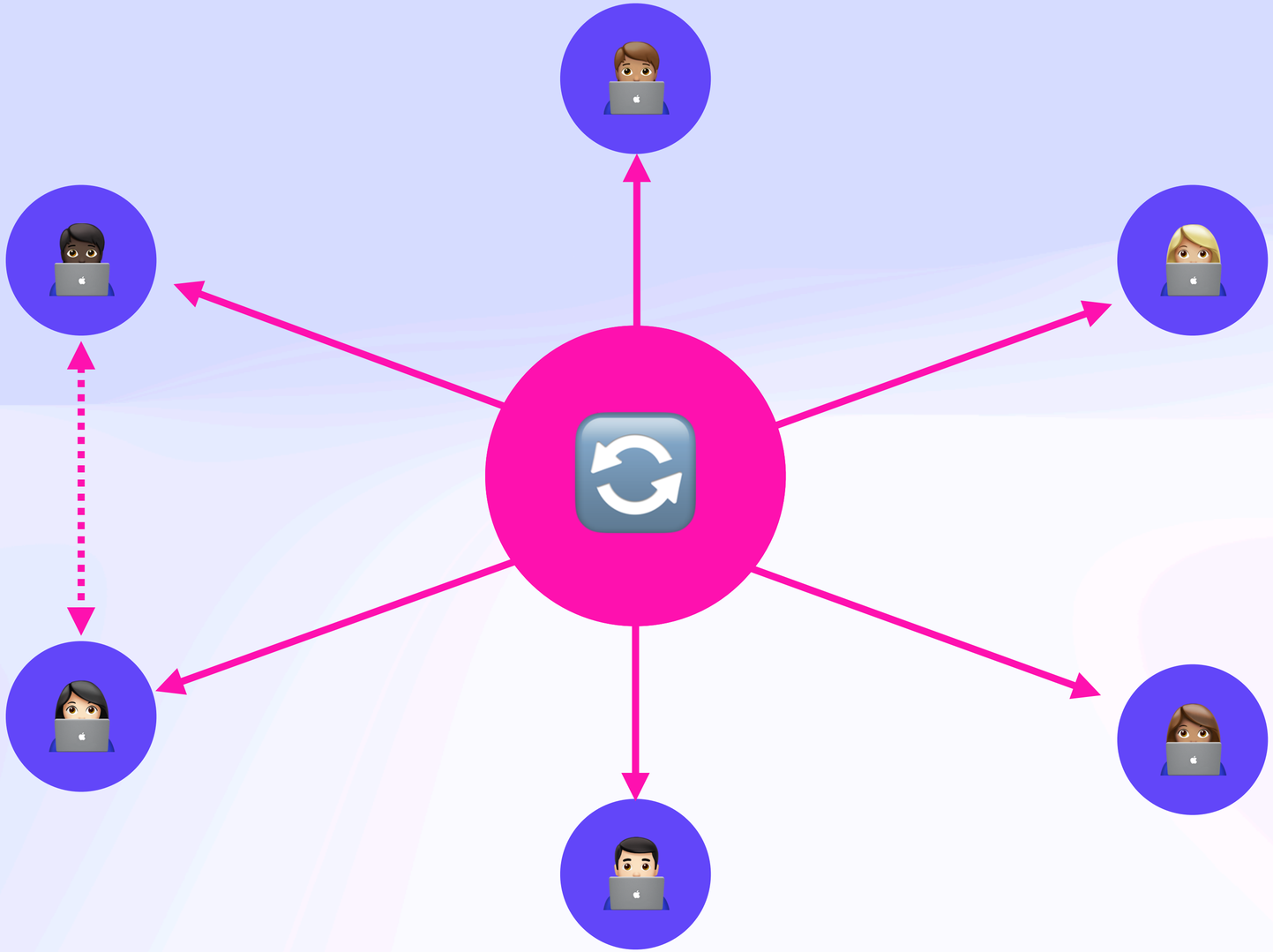
Economic Weight Class

Hive Dynamics



Economic Weight Class

Hive Dynamics



Economic Weight Class

Solving Lamport's Problem

Economic Weight Class

Solving Lamport's Problem

A distributed system is one in which the failure of a computer you didn't even know existed can ***render your own computer unusable***

— Leslie Lamport

Economic Weight Class

Solving Lamport's Problem

A distributed system is one in which the failure of a computer you didn't even know existed can ***render your own computer unusable***

— Leslie Lamport

...by this definition,

LoFi isn't a distributed system 😉

— Martin Kleppmann

Economic Weight Class

A Litmus Test 🧪

...by this definition,

LoFi isn't a distributed system 😉

— Martin Kleppmann

Economic Weight Class

What If Computing Were Interpersonal?

Image credit: https://bestofjs.org/projects/tldraw

Economic Weight Class

What If Computing Were Interpersonal?



Image credit: https://bestofjs.org/projects/tldraw

Economic Weight Class

What If Computing Were Interpersonal?

'80s

'90s

'00s

'10s

'20s

'30s



Desktop: Personal Computing (Classical, Isolated)

Image credit: https://bestofjs.org/projects/tldraw

Economic Weight Class

What If Computing Were Interpersonal?

'80s

'90s

'00s

'10s

'20s

'30s





Desktop: Personal Computing (Classical, Isolated)

Cloud: Impersonal Computing (Modernist, Industrial)

Image credit: https://bestofjs.org/projects/tldraw

Economic Weight Class

What If Computing Were Interpersonal?

'80s

'90s

'00s

'10s

'20s

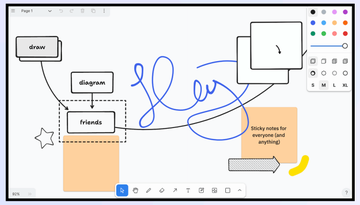
'30s



Desktop: Personal Computing (Classical, Isolated)



Cloud: Impersonal Computing (Modernist, Industrial)



Agentic: Interpersonal Computing (Postmodern, Cosy)

Image credit: https://bestofjs.org/projects/tldraw

Finally...

A New Hope



A New Hope

Early But Exciting



A New Hope

Early But Exciting



VIDEO: ARDHIRA PUTRA

GREGORY BARBER BACKCHANNEL AUG 3, 2023 6:00 AM

The Cloud Is a Prison. Can the Local-First Software Movement Set Us Free?



A New Hope

Early But Exciting



VIDEO: ARDHIRA PUTRA

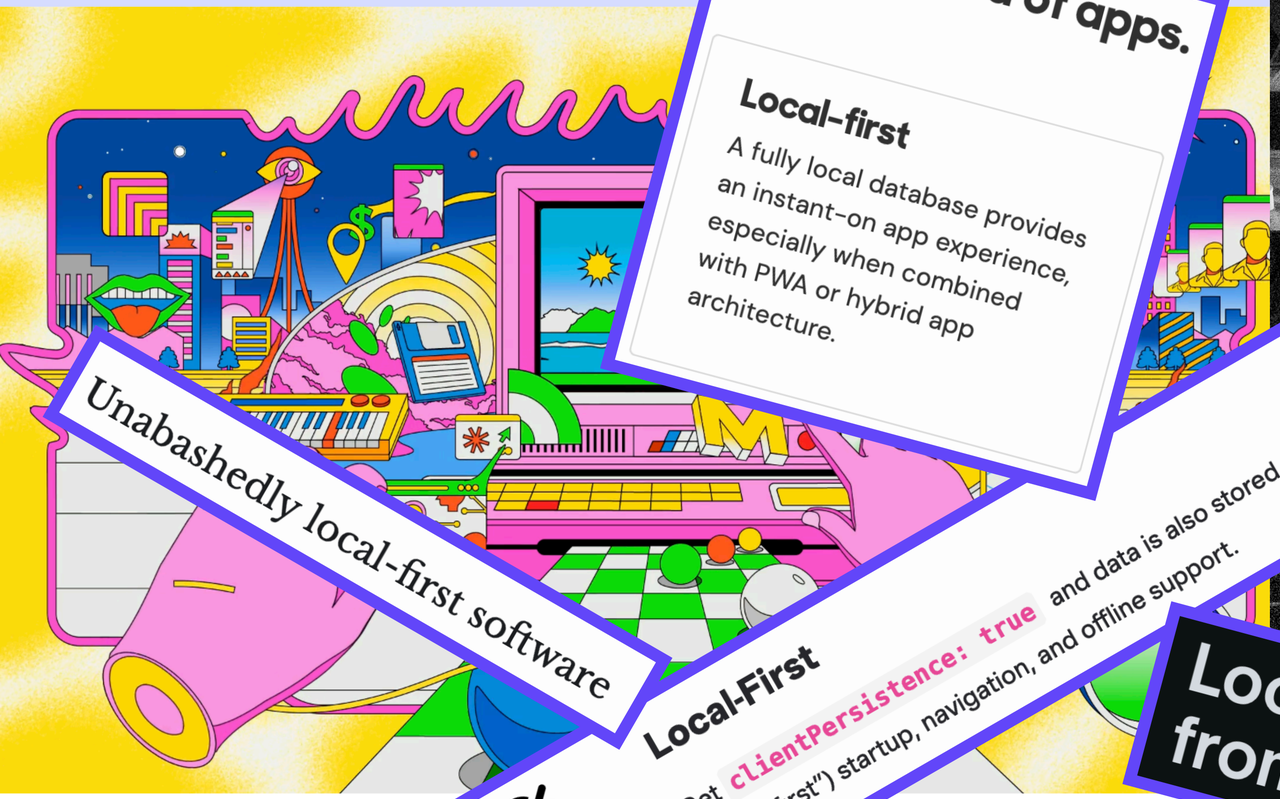
GREGORY BARBER BACKCHANNEL AUG 3, 2023 6:00 AM

The Cloud Is a Prison. Can the Local-First Software Movement Set Us Free?



A New Hope

Early But Exciting



VIDEO: ARDHIRA PUTRA

GREGORY BARBER BACKCHANNEL AUG 3, 2023 6:00 AM

The Cloud Is a Prison. Can t… cal-First Software Movement Set Us Free?

A new breed of apps.

Local-first

A fully local database provides an instant-on app experience, especially when combined with PWA or hybrid app architecture.

Unabashedly local-first software

Local-First

Set `clientPersistence: true` and data is also stored on the client, providing instant ("local-first") startup, navigation, and offline support.

The best way to **local-first**



Local-first sync for Postgres from the inventors of CRDTs

A New Hope

In the Wild 🦁

A New Hope

In the Wild 🦁







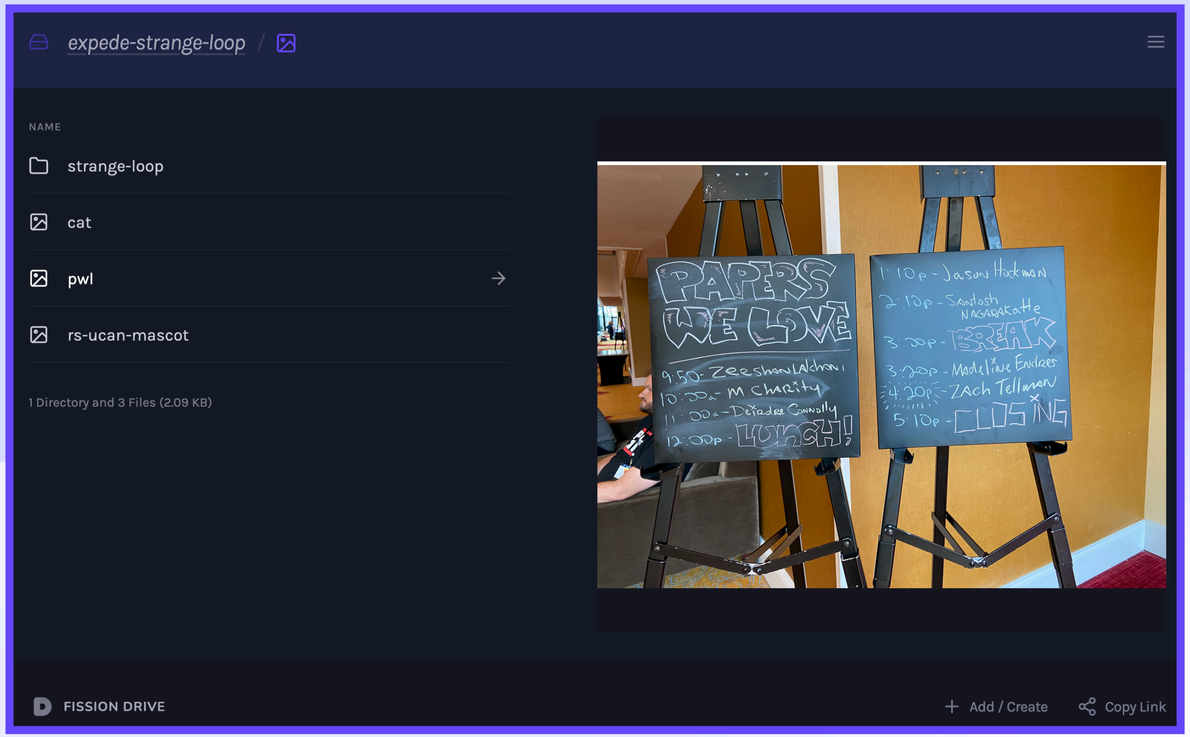


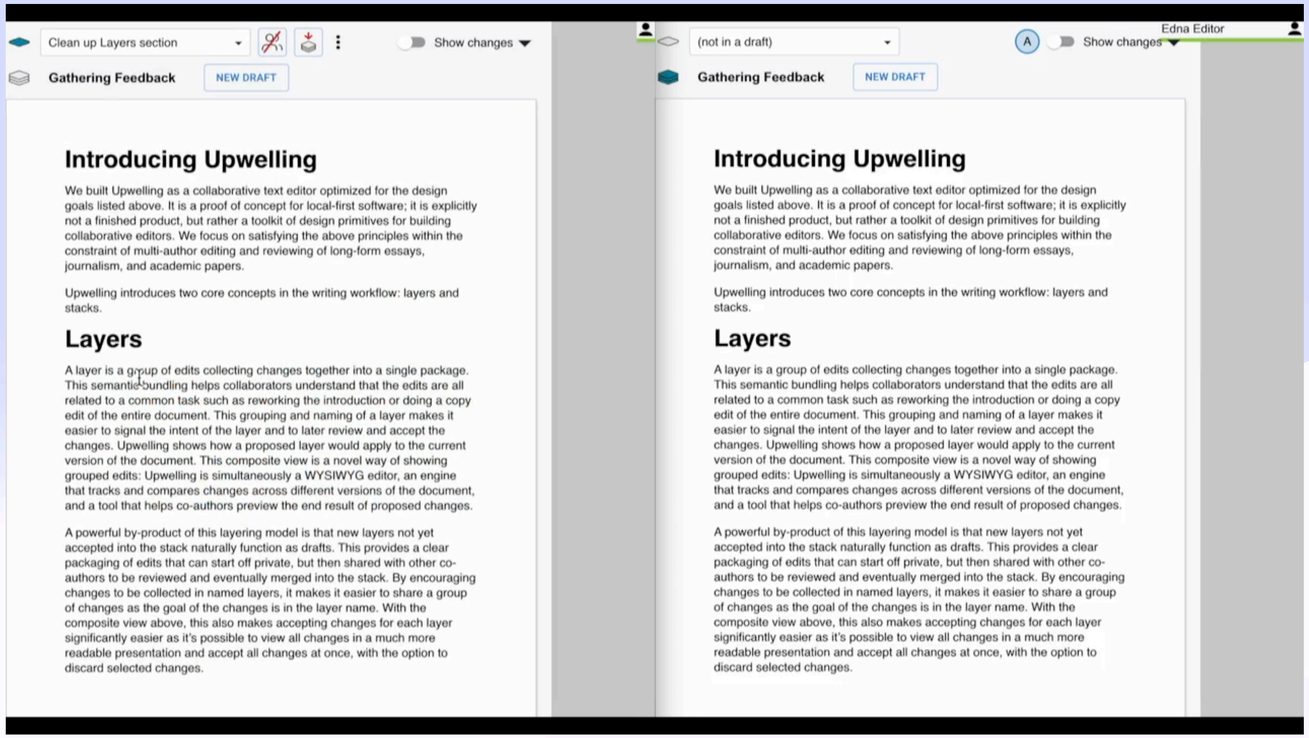
A New Hope

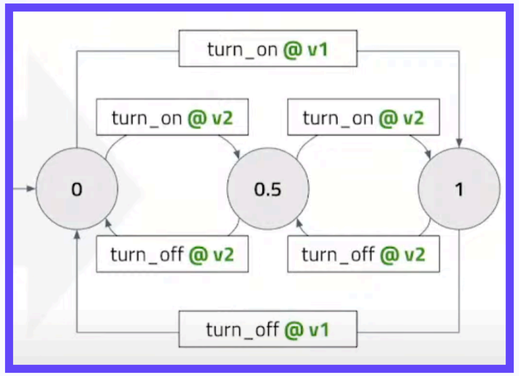
In the Wild 🦁

A New Hope

In the Wild 🦁







https://www.inkandswitch.com/upwelling/

A New Hope

Slicing the Problem

Seven ideals for local-first software

1. No spinners: your work at your fingertips
2. Your work is not trapped on one device
3. The network is optional
4. Seamless collaboration with your colleagues
5. The Long Now
6. Security and privacy by default
7. You retain ultimate ownership and control

A New Hope

Slicing the Problem

Seven ideals for local-first software

1. No spinners: your work at your fingertips
2. Your work is not trapped on one device
3. The network is optional
4. Seamless collaboration with your colleagues
5. The Long Now
6. Security and privacy by default
7. You retain ultimate ownership and control

A New Hope

Slicing the Problem

Seven ideals for local-first software

1. No spinners: your work at your fingertips
2. Your work is not trapped on one device
3. The network is optional
4. Seamless collaboration with your colleagues
5. The Long Now
6. Security and privacy by default
7. You retain ultimate ownership and control



A New Hope

Slicing the Problem

Seven ideals for local-first software

1. No spinners: your work at your fingertips
2. Your work is not trapped on one device
3. The network is optional
4. Seamless collaboration with your colleagues
5. The Long Now
6. Security and privacy by default
7. You retain ultimate ownership and control



A New Hope

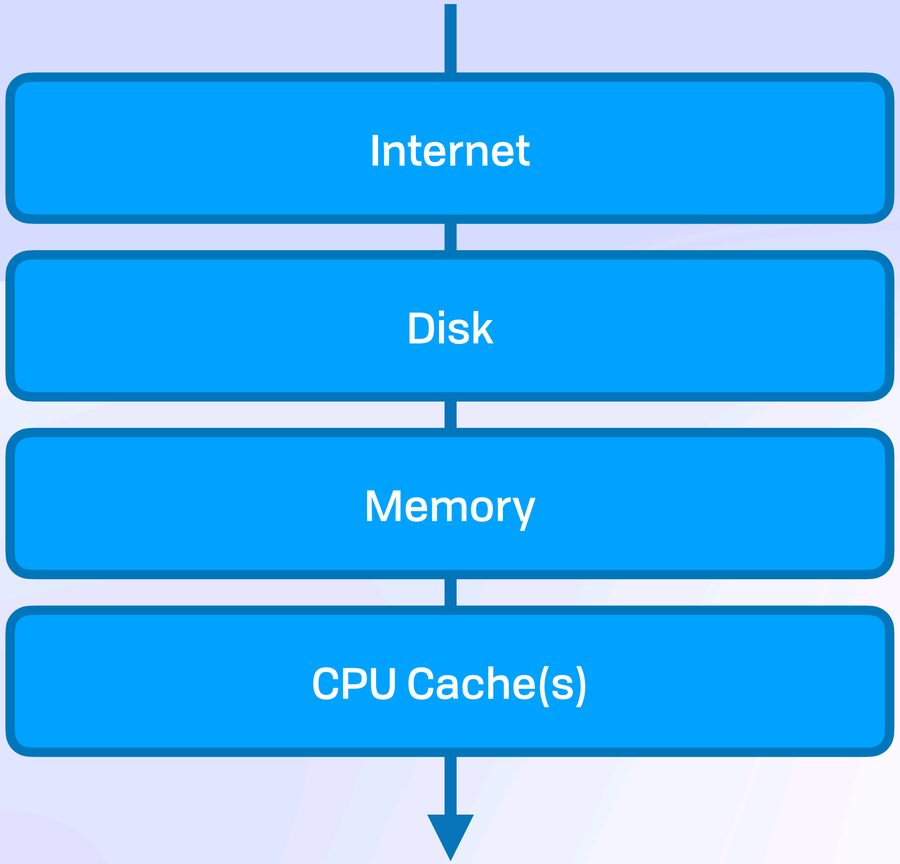
New Metaphors

Layered / "Cache for the Internet"

A New Hope

New Metaphors

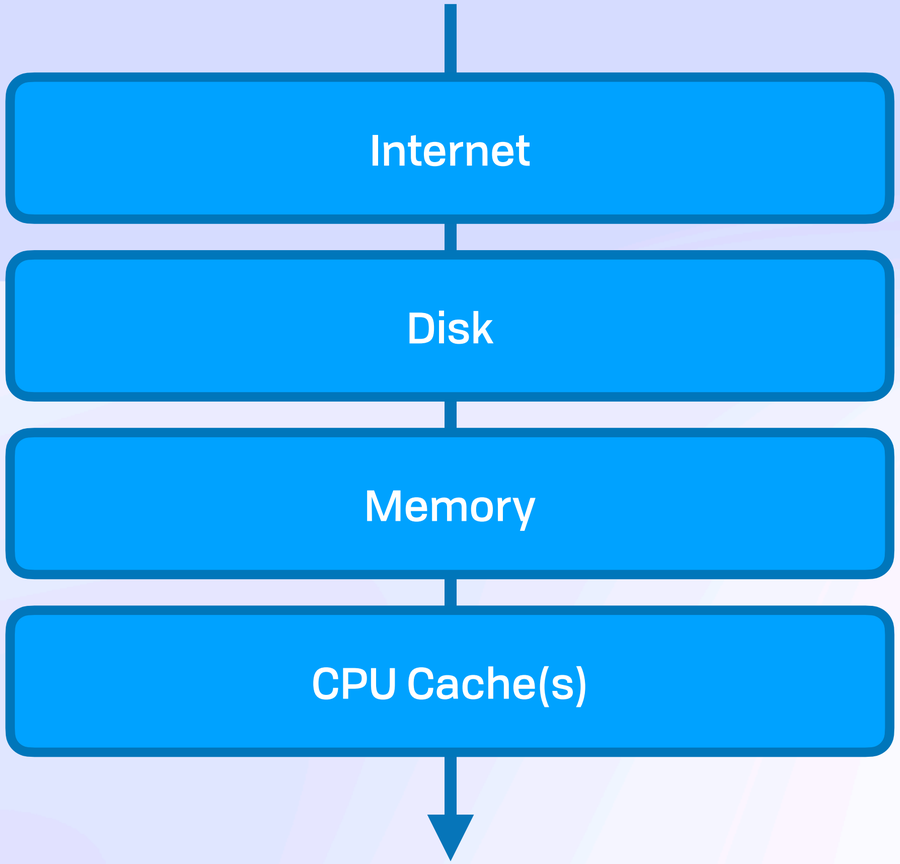
Layered / "Cache for the Internet"



A New Hope

New Metaphors

Layered / "Cache for the Internet"

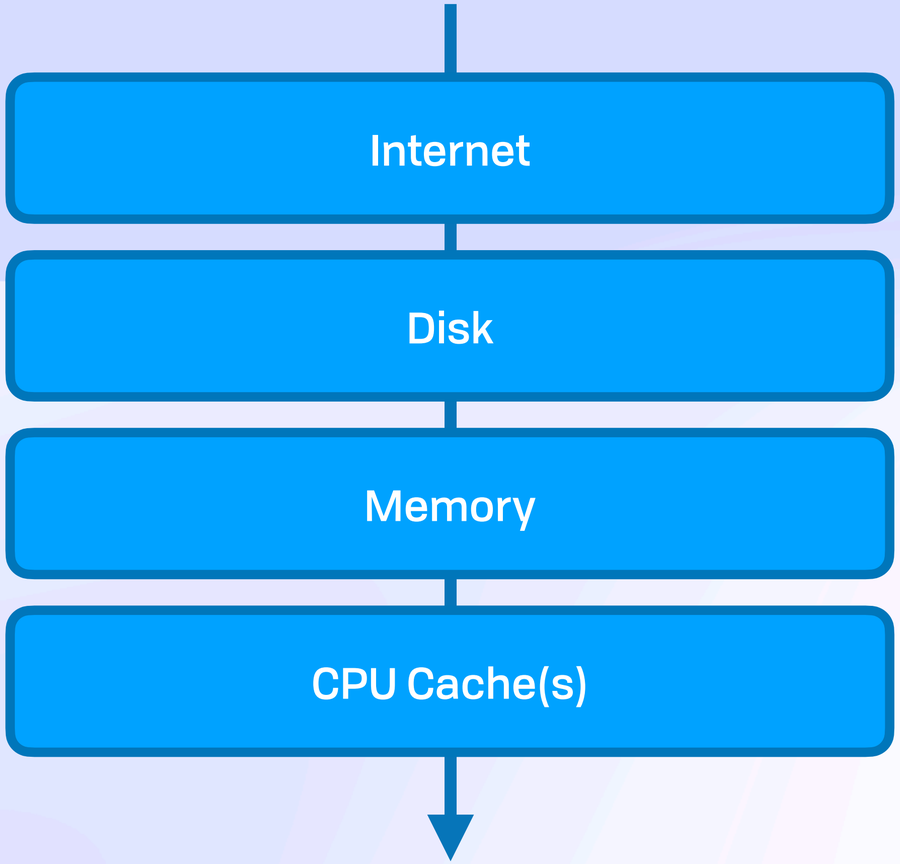


Cellular / P2P

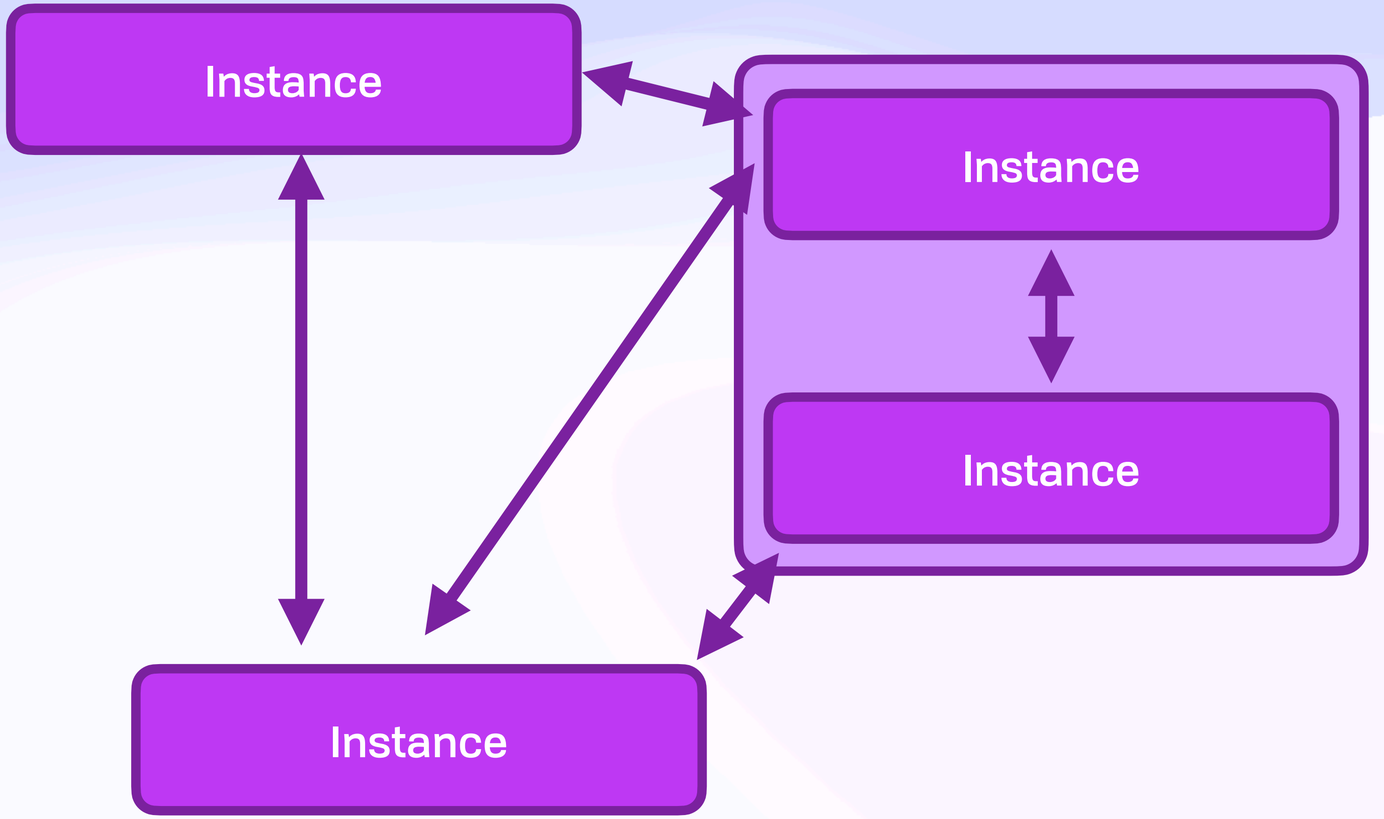
A New Hope

New Metaphors

Layered / "Cache for the Internet"



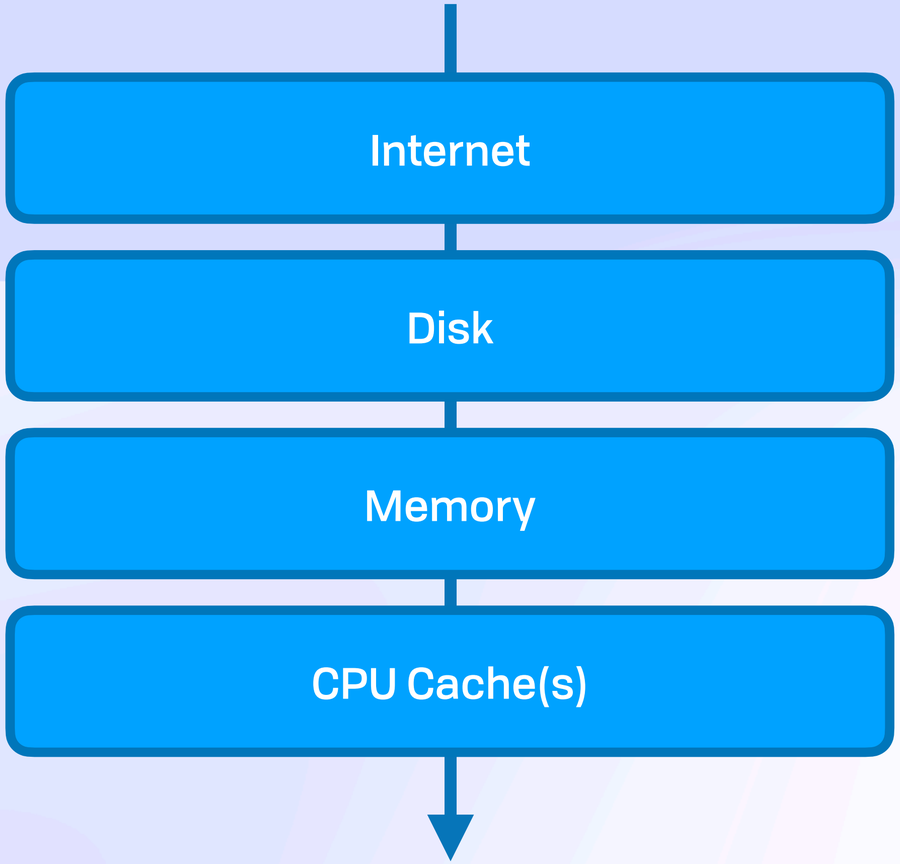
Cellular / P2P



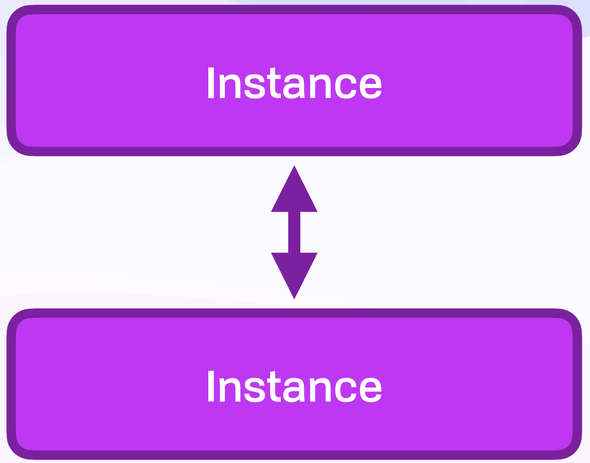
A New Hope

New Metaphors

Layered / "Cache for the Internet"



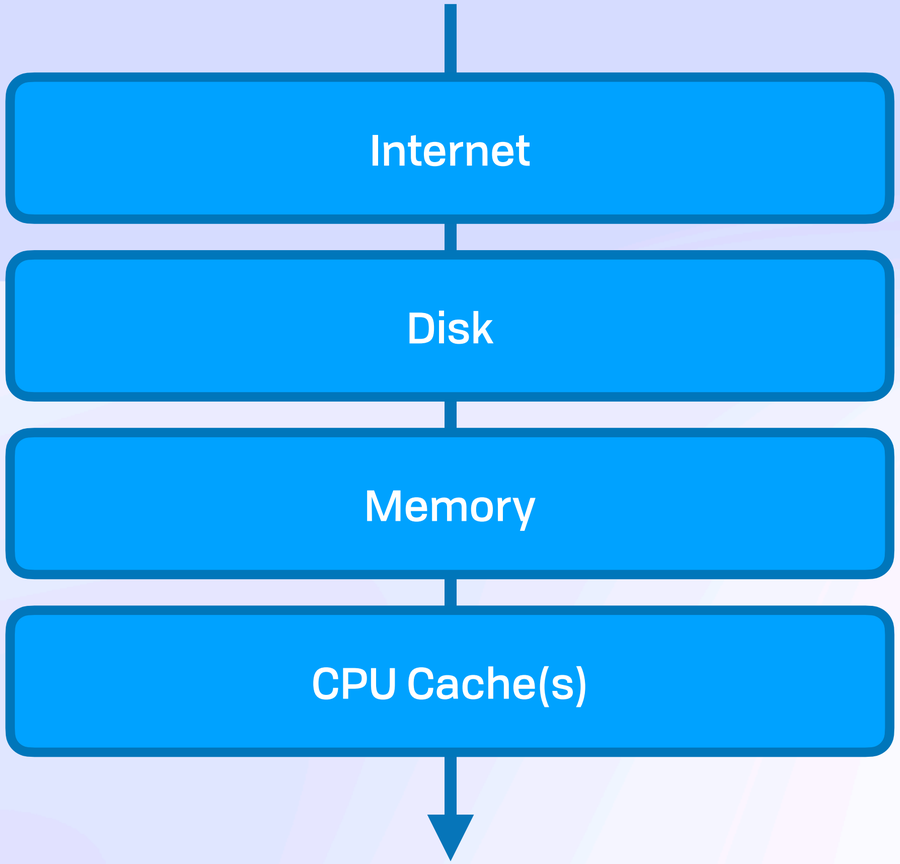
Cellular / P2P



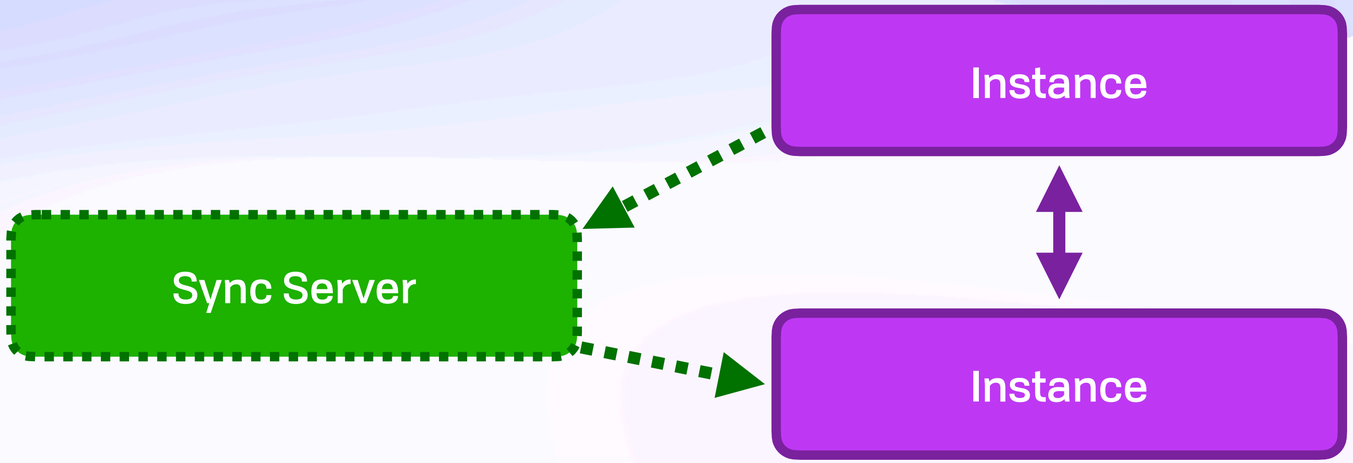
A New Hope

New Metaphors

Layered / "Cache for the Internet"



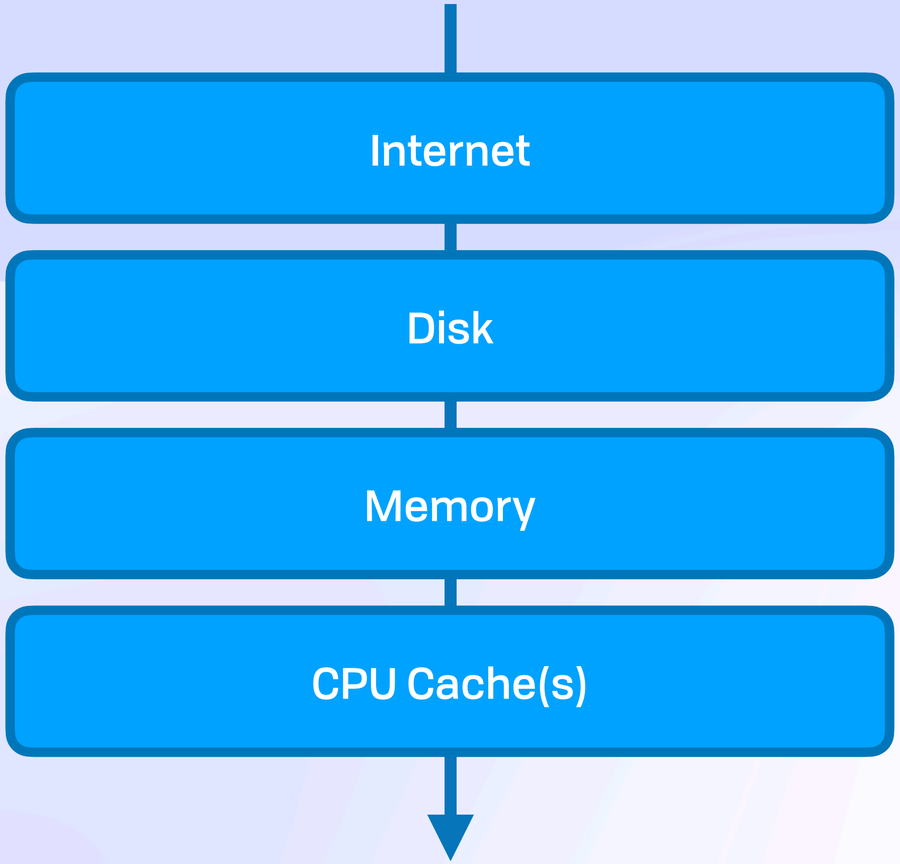
Cellular / P2P



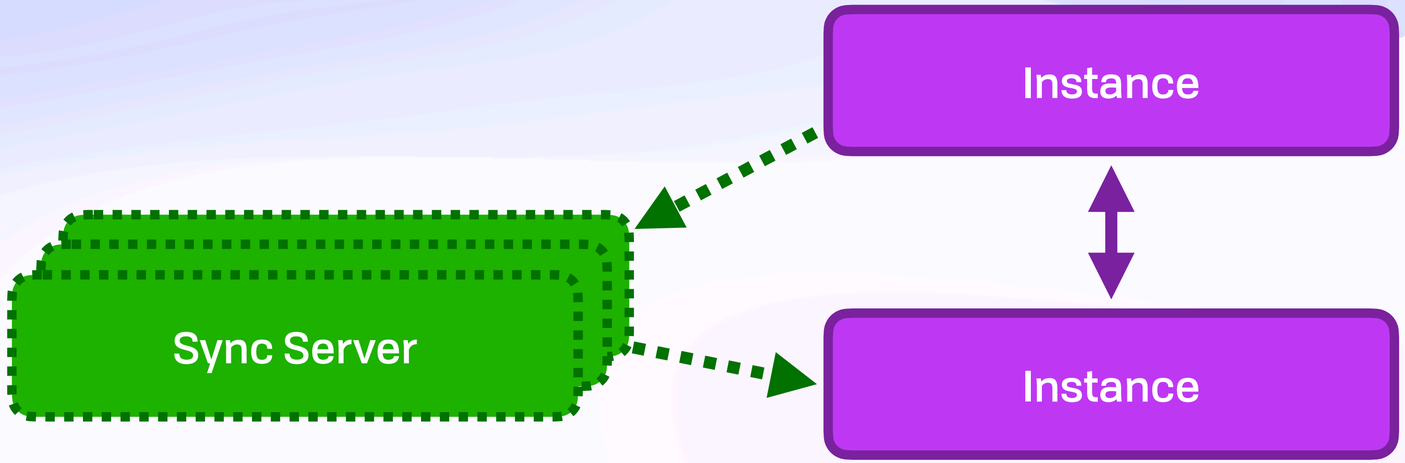
A New Hope

New Metaphors

Layered / "Cache for the Internet"



Cellular / P2P



A New Hope

Back to Our Roots

A New Hope

Back to Our Roots

1. Decentralisation
2. Non-discrimination
3. Bottom-up Design
4. Universality
5. Consensus

– **The Web Foundation**, History of the Web

A New Hope

Back to Our Roots

1. Decentralisation
2. Non-discrimination
3. Bottom-up Design
4. Universality
5. Consensus

Layer			Protocol data unit (PDU)
Host layers	7	Application	Data
	6	Presentation	
	5	Session	
	4	Transport	Segment, Datagram
Media layers	3	Network	Packet
	2	Data link	Frame
	1	Physical	Bit, Symbol

en.wikipedia.org/wiki/OSI_model

– **The Web Foundation**, History of the Web

A New Hope

Back to Our Roots

1. Decentralisation
2. Non-discrimination
3. Bottom-up Design
4. Universality
5. Consensus

Layer			Protocol data unit (PDU)
Host layers	7	Application	Data
	6	Presentation	
	5	Session	
	4	Transport	Segment, Datagram
Media layers	3	Network	Packet
	2	Data link	Frame
	1	Physical	Bit, Symbol

en.wikipedia.org/wiki/OSI_model

– **The Web Foundation**, History of the Web

A New Hope

Back to Our Roots

1. Decentralisation
2. Non-discrimination
3. Bottom-up Design
4. Universality
5. Consensus

Layer			Protocol data unit (PDU)
Host layers	7	Application	Data
	6	Presentation	
	5	Session	
	4	Transport	Segment, Datagram
Media layers	3	Network	Packet
	2	Data link	Frame
	1	Physical	Bit, Symbol

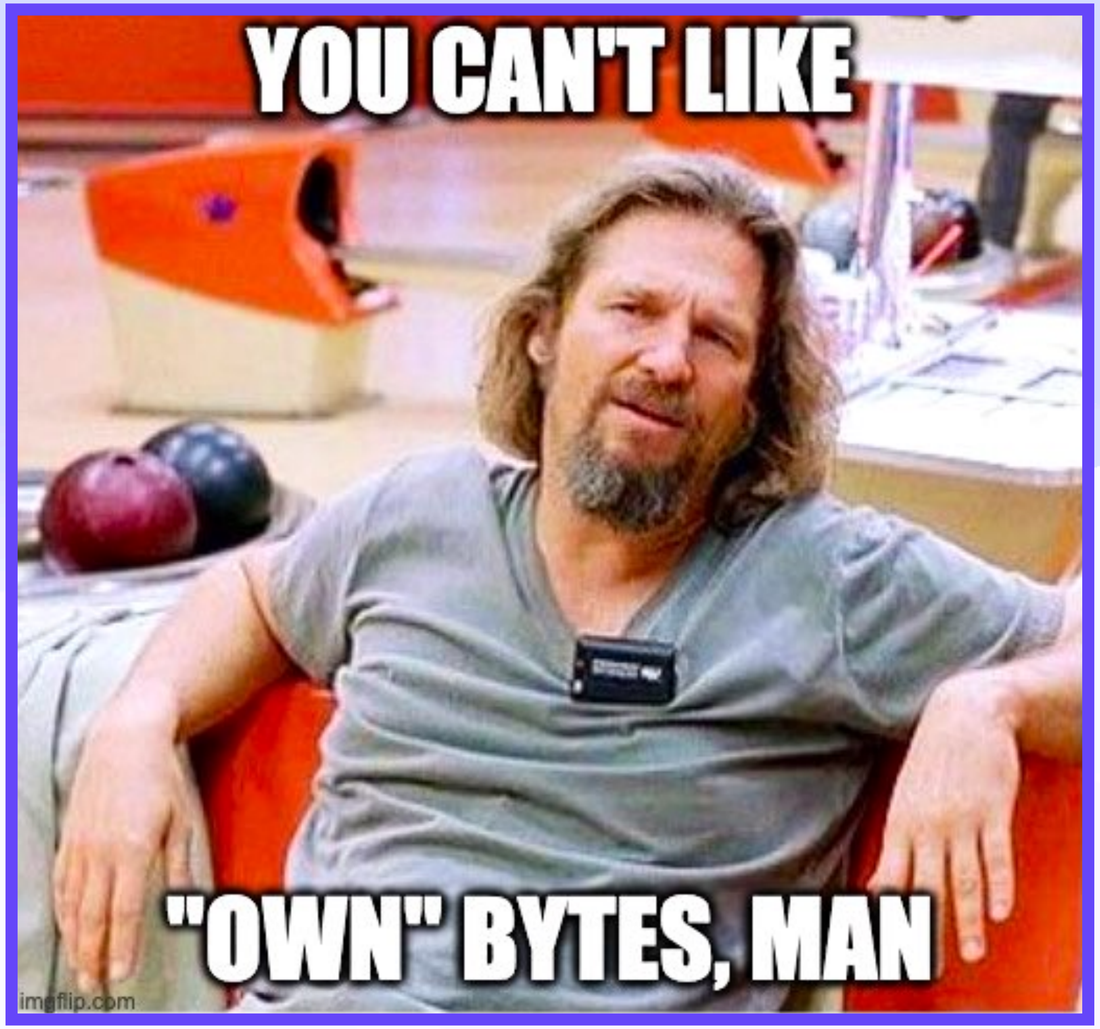
en.wikipedia.org/wiki/OSI_model

– **The Web Foundation**, History of the Web

A New Hope

User Agency

- **Entry:** Empower users to participate
- **Exit:** Option to move or leave
- **Safety:** Control access to *your* data
- **Serve:** Provide capacity to others



Welcome to the Jungle

Distributed Systems



Welcome to the Jungle

Systems



Welcome to the Jungle

Disorderly Systems



Disorderly Systems

Much of the ***pain*** in traditional distributed programming comes from this mismatch: programmers are expected to ***bridge from an ordered programming model into a disordered reality*** that executes their code.

— The Bloom Language Website

Disorderly Systems



Disorderly Systems



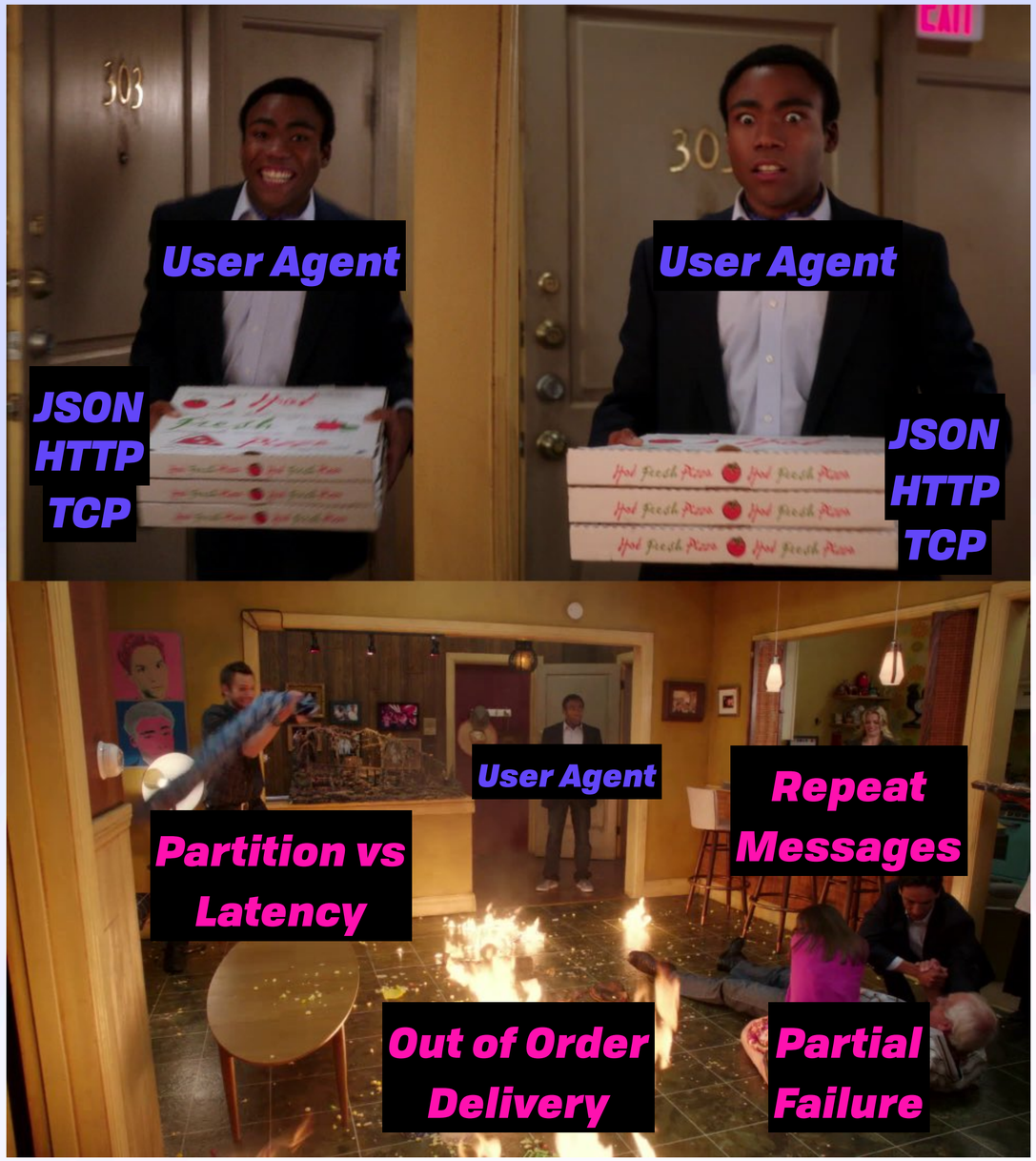
Disorderly Systems



Disorderly Systems

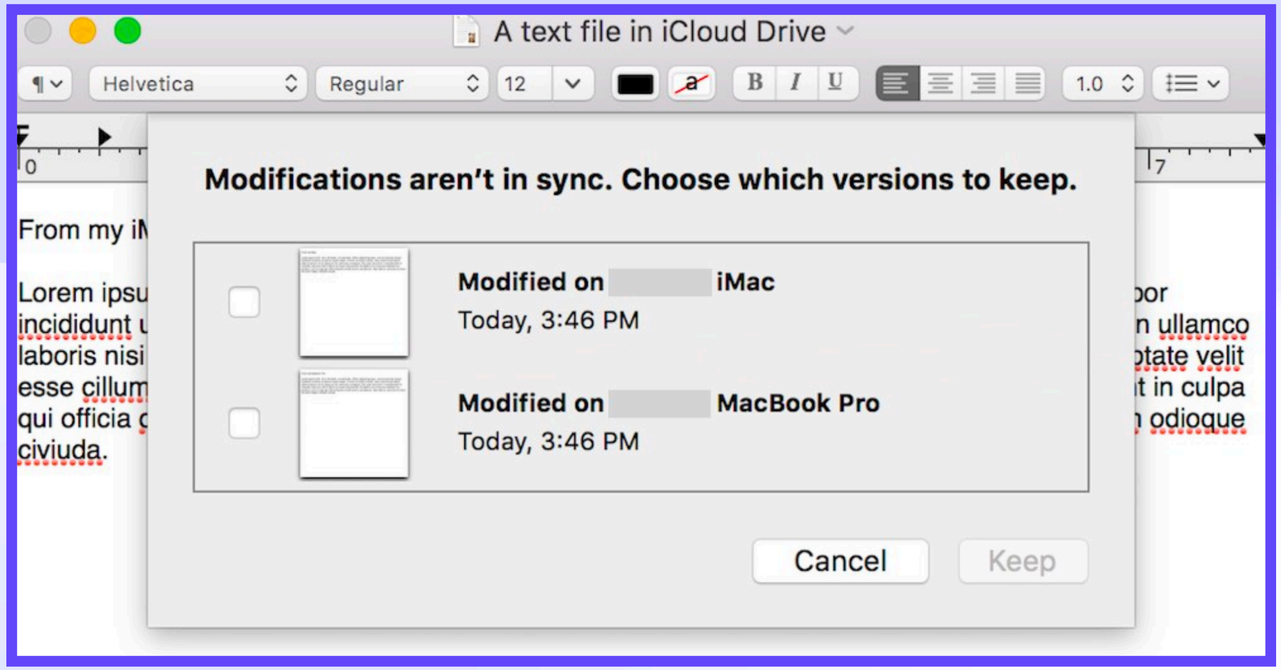


Disorderly Systems



Disorderly Systems

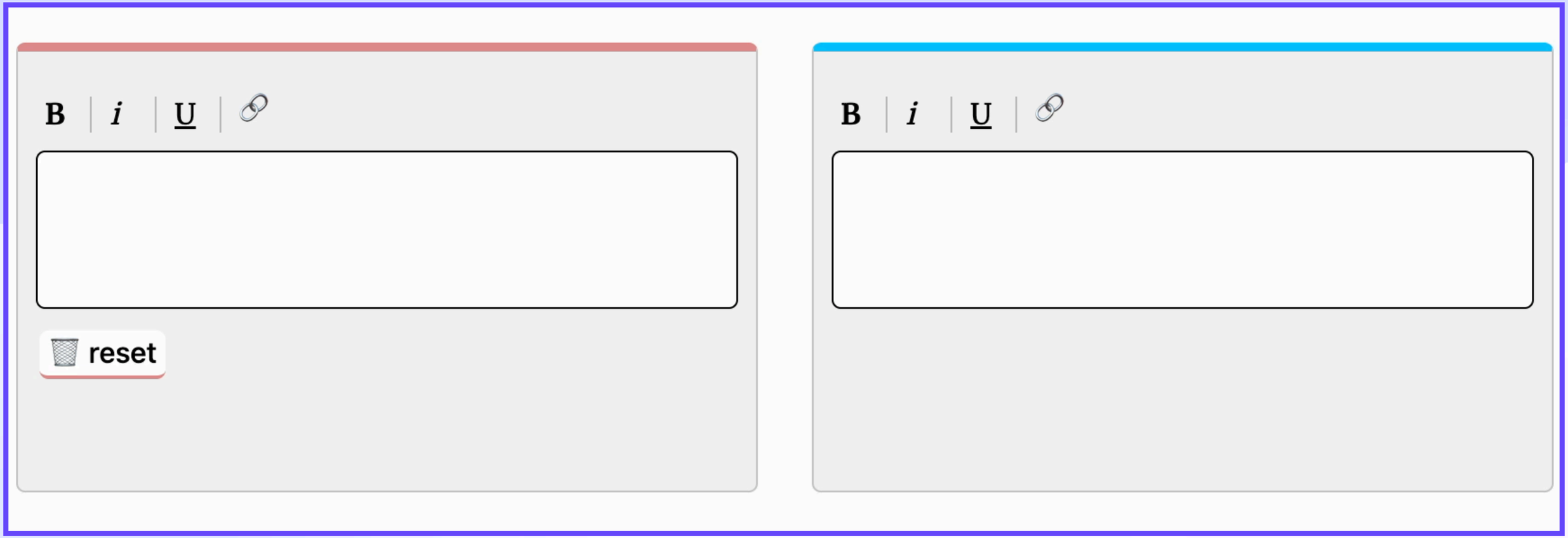
Objectivist Ergonomics




```
<<<<<<< HEAD
Option A
=======
Option B
>>>>>>> some-branch
```

Disorderly Systems

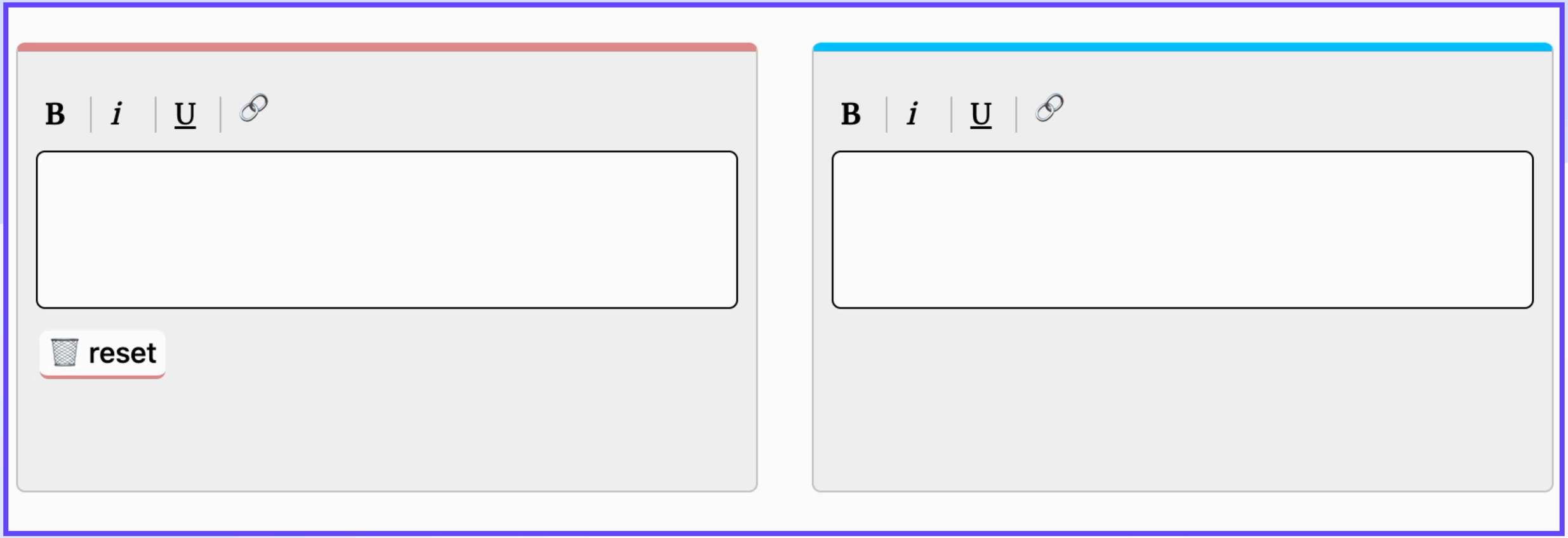
Enabling Tech: CRDTs



Video source: https://www.inkandswitch.com/peritext/

Disorderly Systems

Enabling Tech: CRDTs



Video source: https://www.inkandswitch.com/peritext/

Disorderly Systems

Keeping CALM 🧘

A problem has a ***consistent, coordination-free*** distributed implementation if and only if it is ***monotonic***.

The CALM Theorem

Disorderly Systems

Monotonicity

Disorderly Systems

Monotonicity

```
max(a, b)
```

Disorderly Systems

Monotonicity

```
max(a, b)
```



Disorderly Systems

Monotonicity

```
max(a, b)
max(1, 2)
```

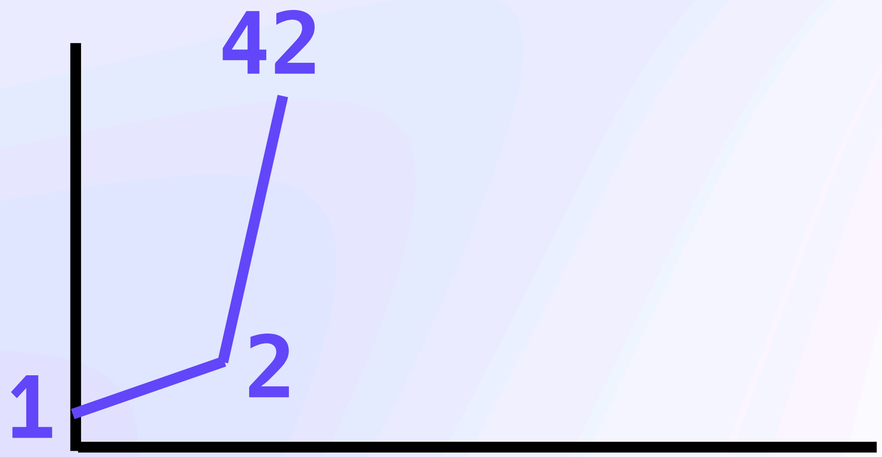


Disorderly Systems

Monotonicity

```
max(a, b)
```

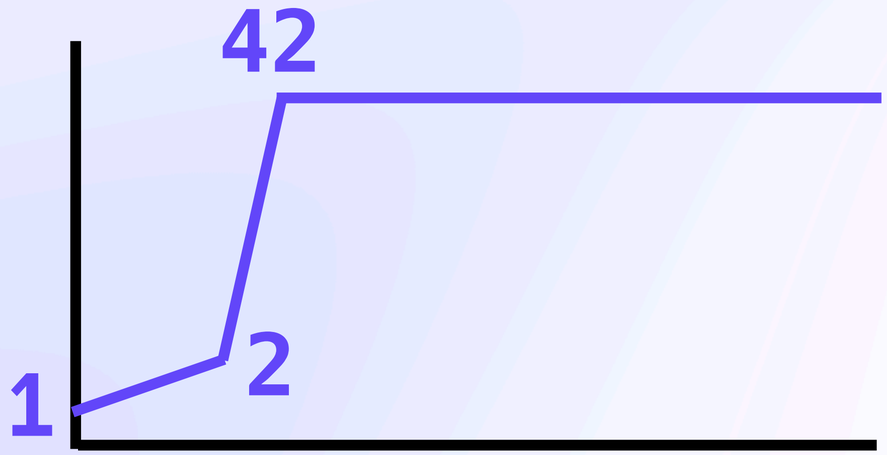
```
max(1, 2)
max(2, 42)
```



Disorderly Systems

Monotonicity

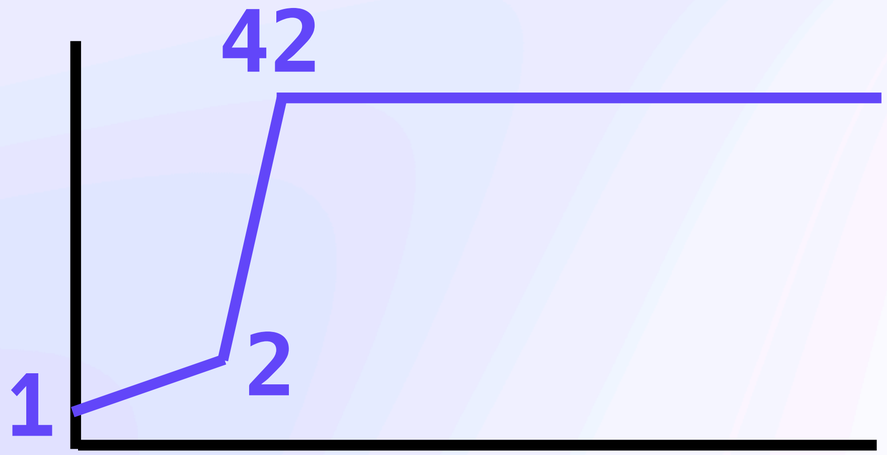
```
max(a, b)
max(1, 2)
max(2, 42)
max(42, 10)
```



Disorderly Systems

Monotonicity

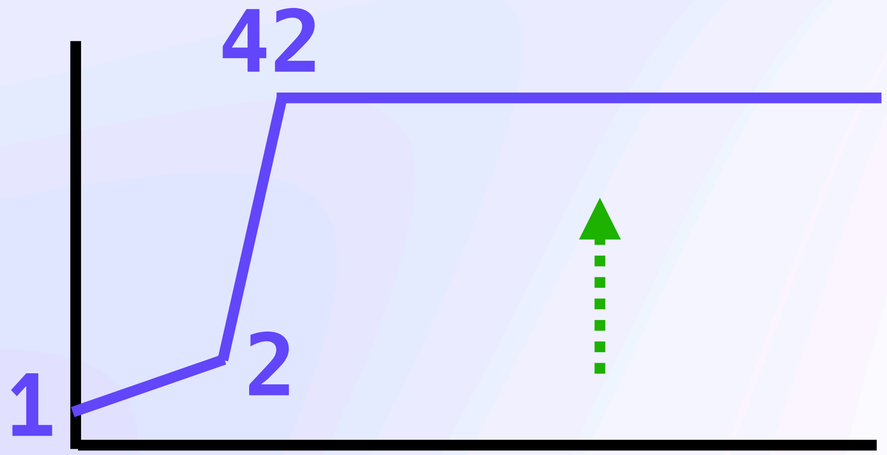
```
max(a, b)
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```



Disorderly Systems

Monotonicity

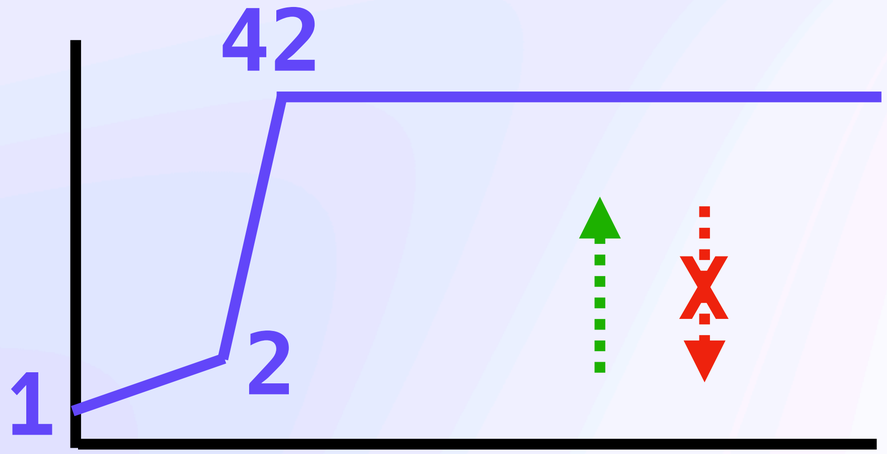
```
max(a, b)
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```



Disorderly Systems

Monotonicity

```
max(a, b)
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```



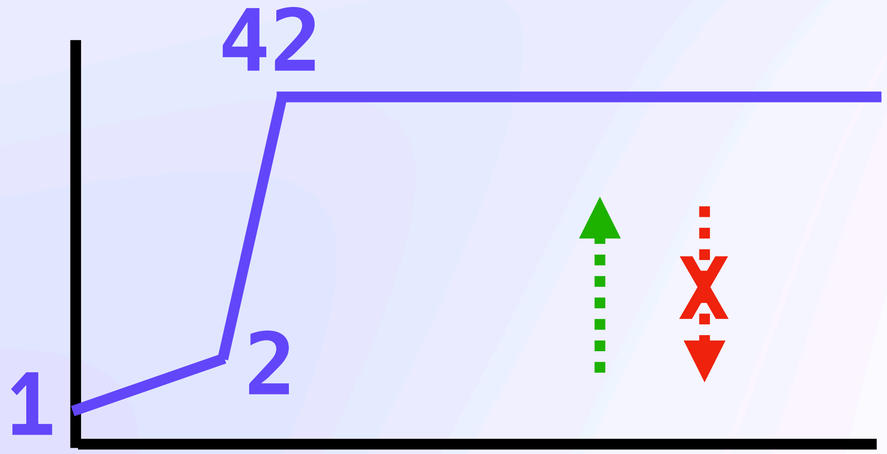
Disorderly Systems

Monotonicity

```
max(a, b)
```

```
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```

```
set.add(item)
```



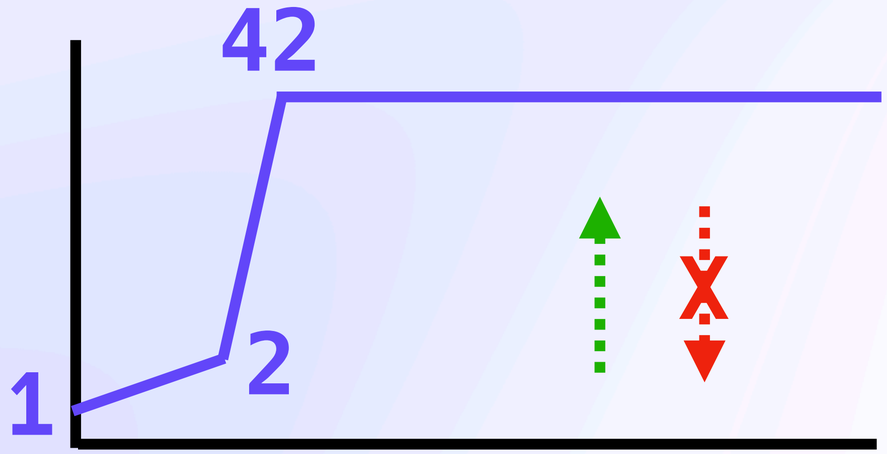
Disorderly Systems

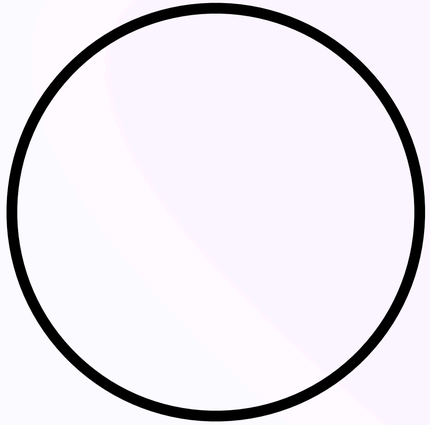
Monotonicity

```
max(a, b)
```

```
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```

```
set.add(item)
```



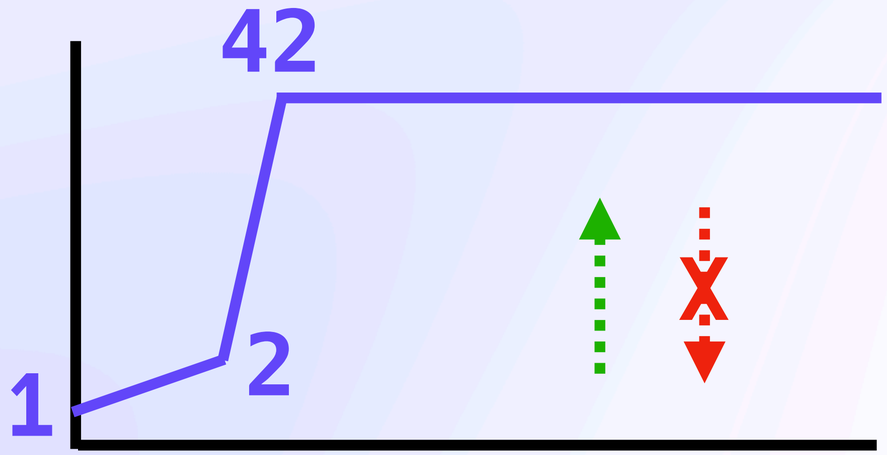


Disorderly Systems

Monotonicity

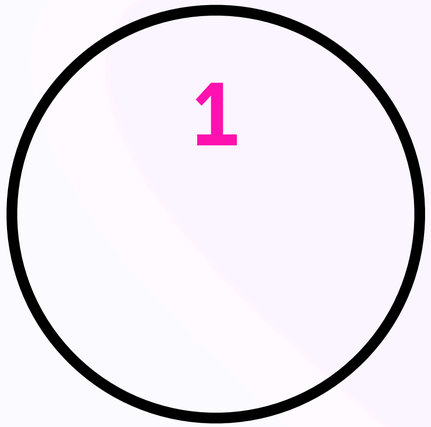
max(a, b)

```
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```



set.add(item)

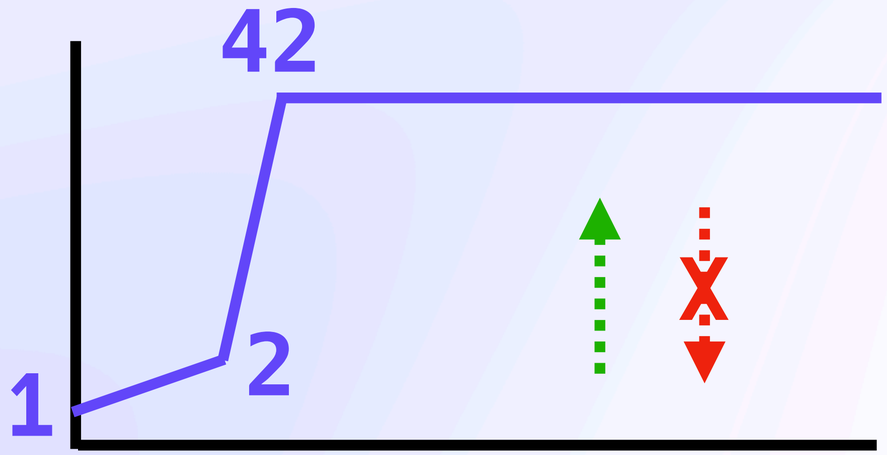
```
{}.add(1)
```



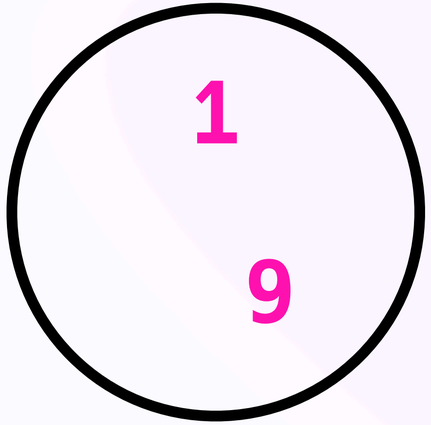
Disorderly Systems

Monotonicity

```
max(a, b)
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```




```
set.add(item)
{}.add(1)
{1}.add(9)
```

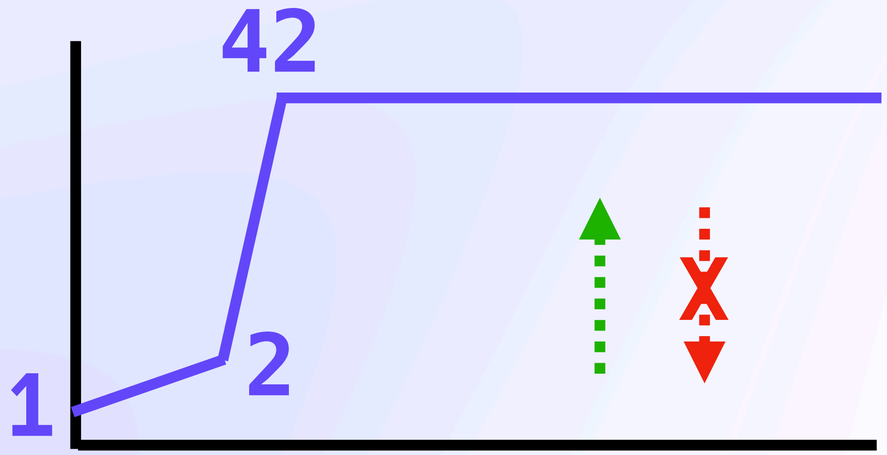


Disorderly Systems

Monotonicity

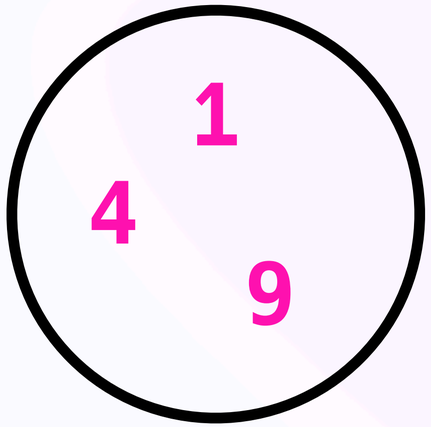
max(a, b)

max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)



set.add(item)

{}.add(1)
{1}.add(9)
{1,9}.add(4)

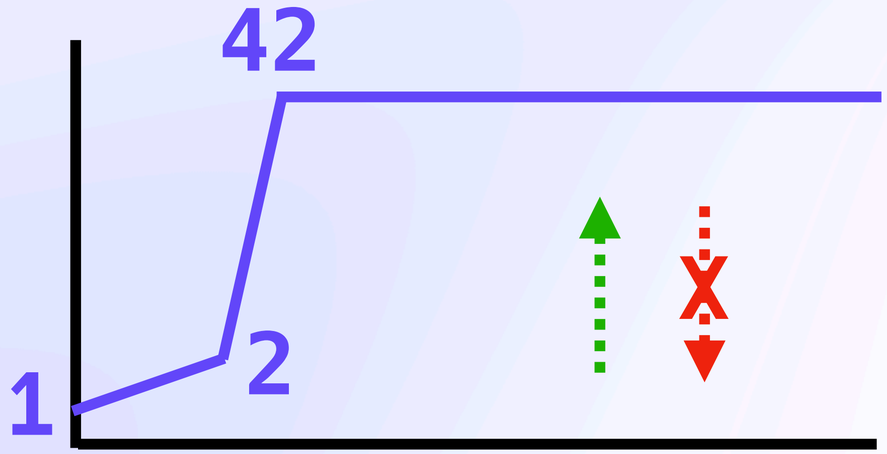


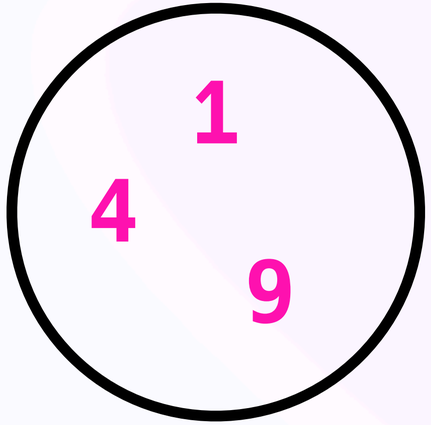
Disorderly Systems

Monotonicity

```
max(a, b)
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```

```
set.add(item)
{}.add(1)
{1}.add(9)
{1,9}.add(4)
{1,4,9}.add(9)
```



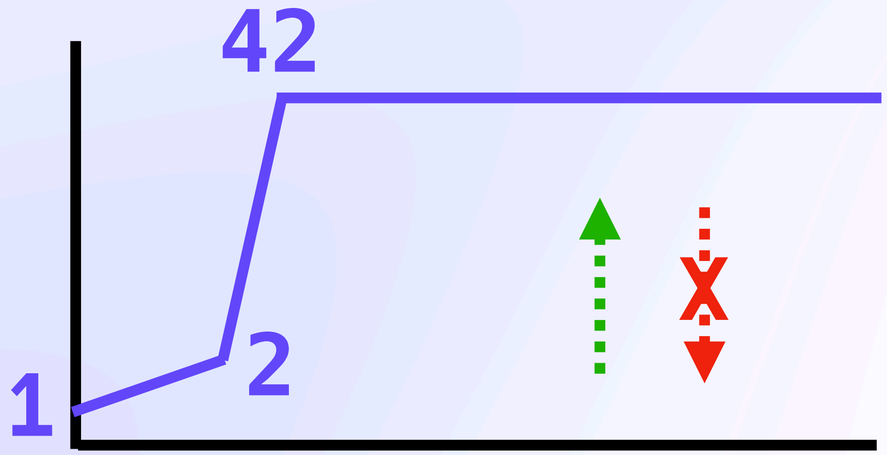


Disorderly Systems

Monotonicity

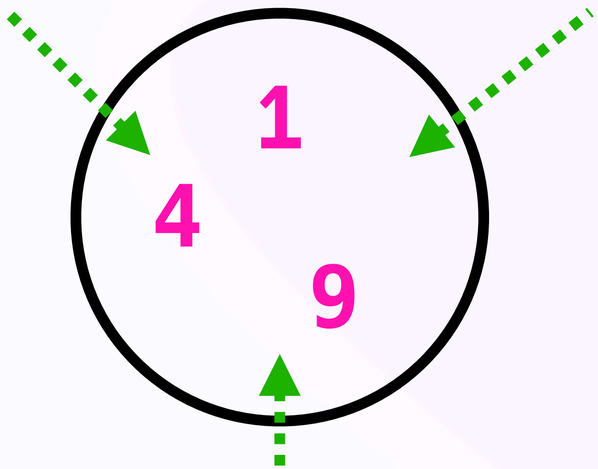
max(a, b)

max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)



set.add(item)

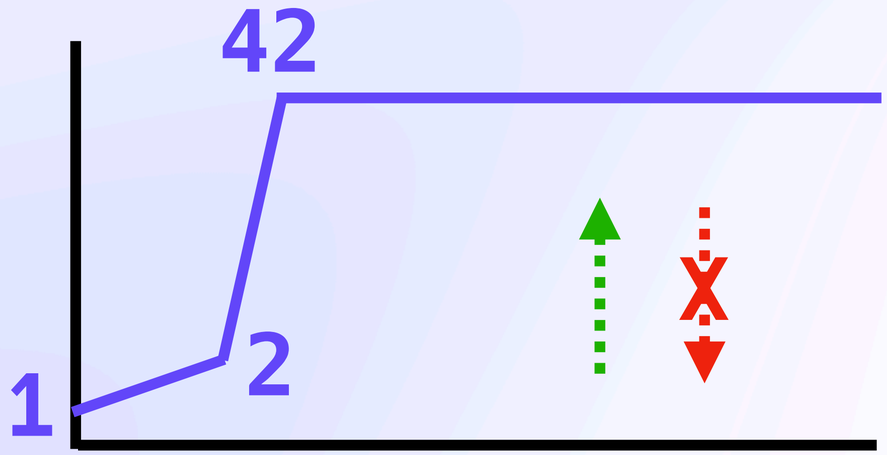
{}.add(1)
{1}.add(9)
{1,9}.add(4)
{1,4,9}.add(9)



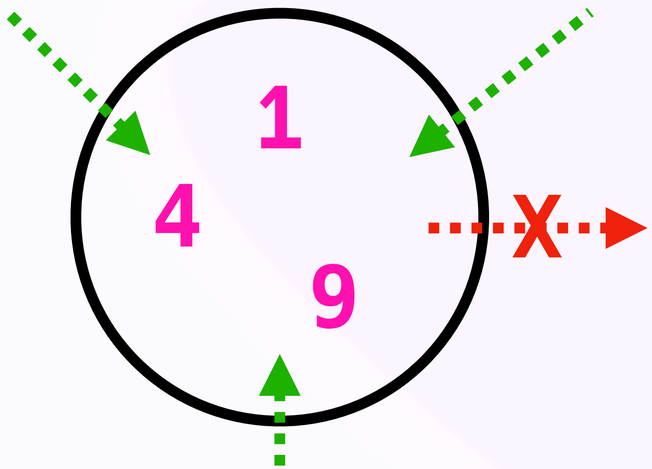
Disorderly Systems

Monotonicity

```
max(a, b)
max(1, 2)
max(2, 42)
max(42, 10)
max(11, 42)
```




```
set.add(item)
{}.add(1)
{1}.add(9)
{1,9}.add(4)
{1,4,9}.add(9)
```

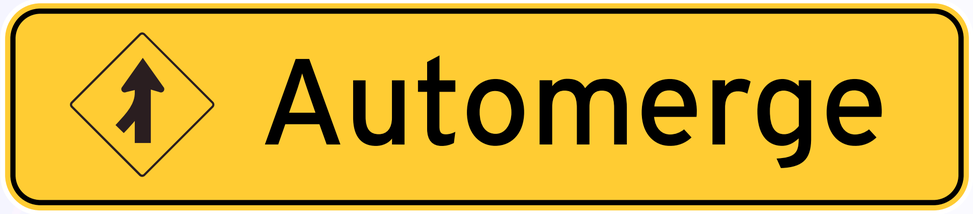


Disorderly Systems

Unafraid of Change 😤

Disorderly Systems

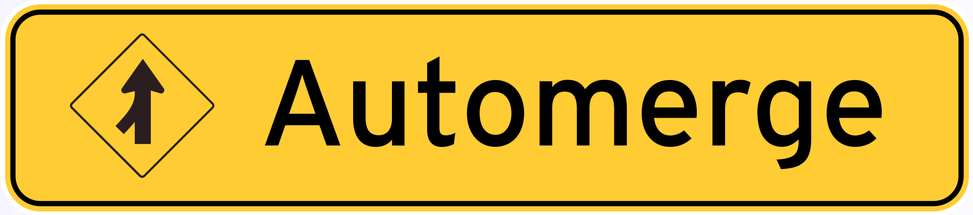
Unafraid of Change 😤



Disorderly Systems

Unafraid of Change 😤

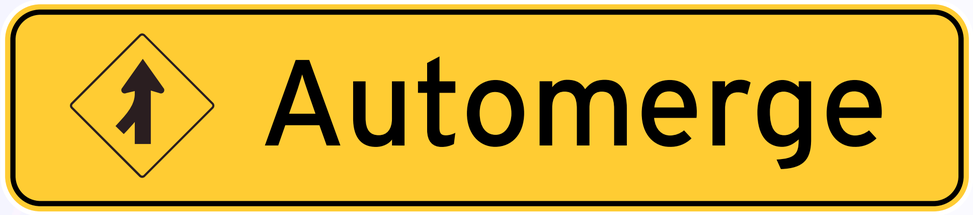
```
automerge.change(doc, tx ⇒ {
```



Disorderly Systems

Unafraid of Change 😤

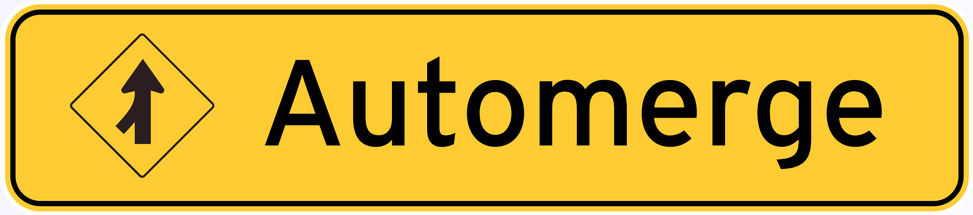
```
automerge.change(doc, tx ⇒ {
    automerge.splice(tx, ["text"], 0, 0, "Hello ")
```



Disorderly Systems

Unafraid of Change 😤

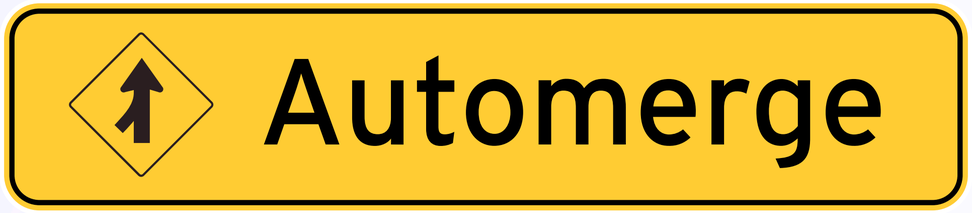
```
automerge.change(doc, tx ⇒ {
    automerge.splice(tx, ["text"], 0, 0, "Hello ")
    tx.counter.increment(20)
```



Disorderly Systems

Unafraid of Change 😤

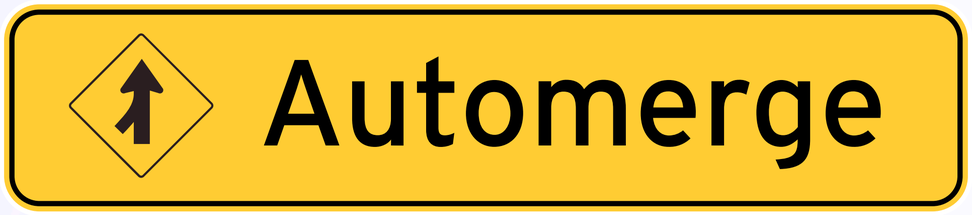
```
automerge.change(doc, tx ⇒ {
    automerge.splice(tx, ["text"], 0, 0, "Hello ")
    tx.counter.increment(20)
    tx.map.key = "new value"
    tx.map.nested_map.key = "new nested value"
```



Disorderly Systems

Unafraid of Change 😤

```
automerge.change(doc, tx ⇒ {
    automerge.splice(tx, ["text"], 0, 0, "Hello ")
    tx.counter.increment(20)
    tx.map.key = "new value"
    tx.map.nested_map.key = "new nested value"
    tx.list[0] = "A"
    tx.list.insertAt(0, "Z")
    tx.list[4].nested = "MAP"
    tx.list[5][0] = "NESTED LIST"
})
```



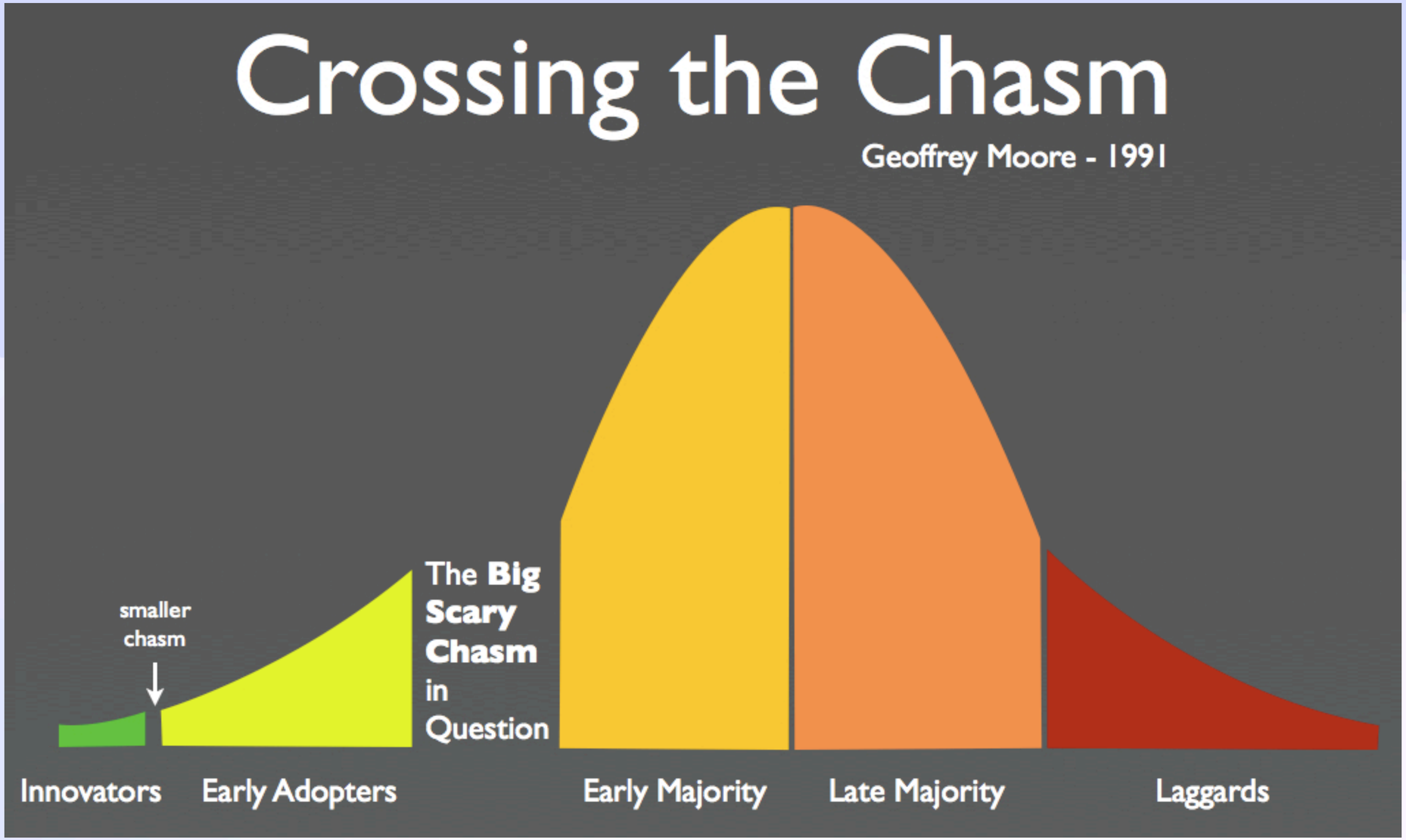
Fixing The Leaky Pipes... Statically

Access Control



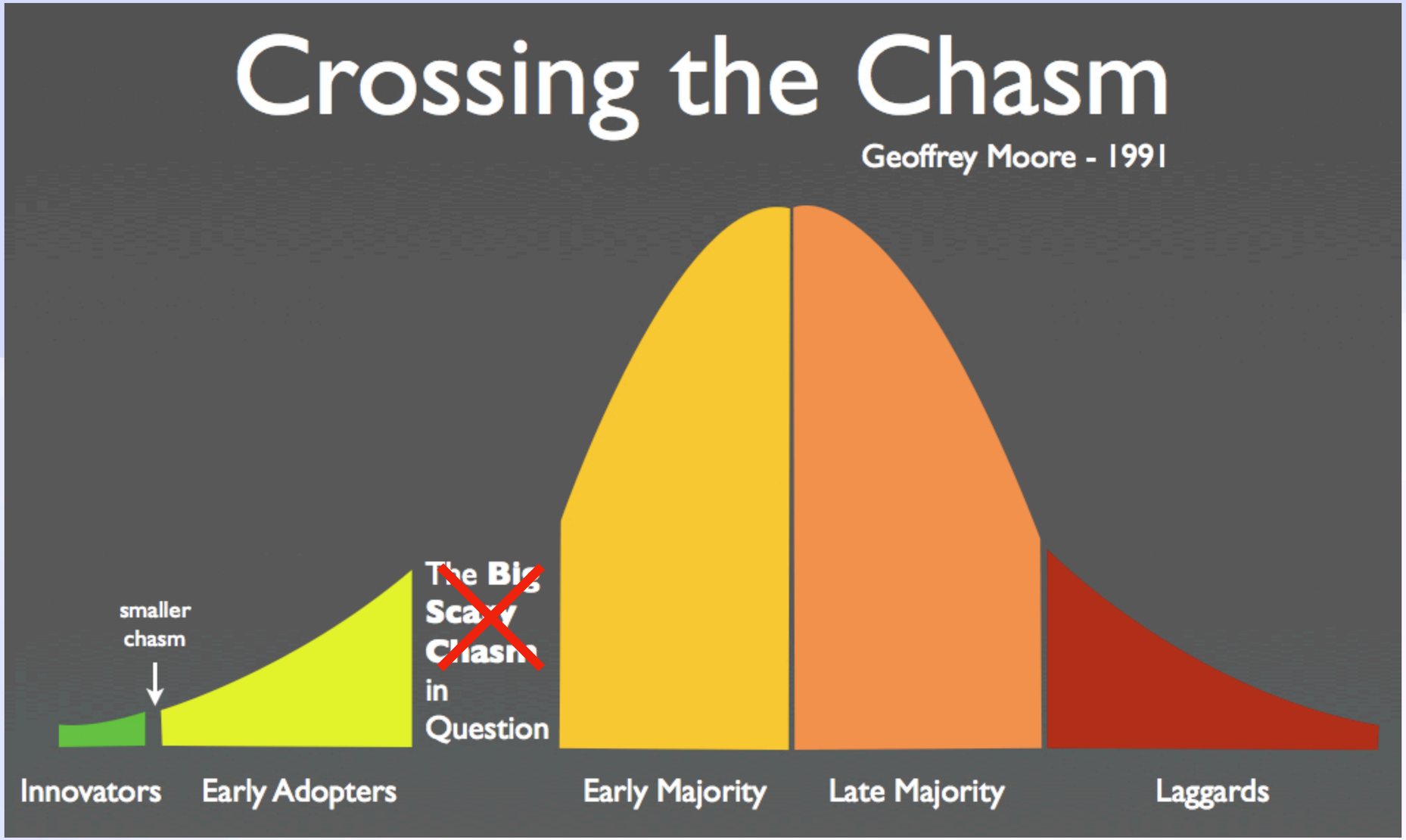
Access Control

Next Stage of Evolution



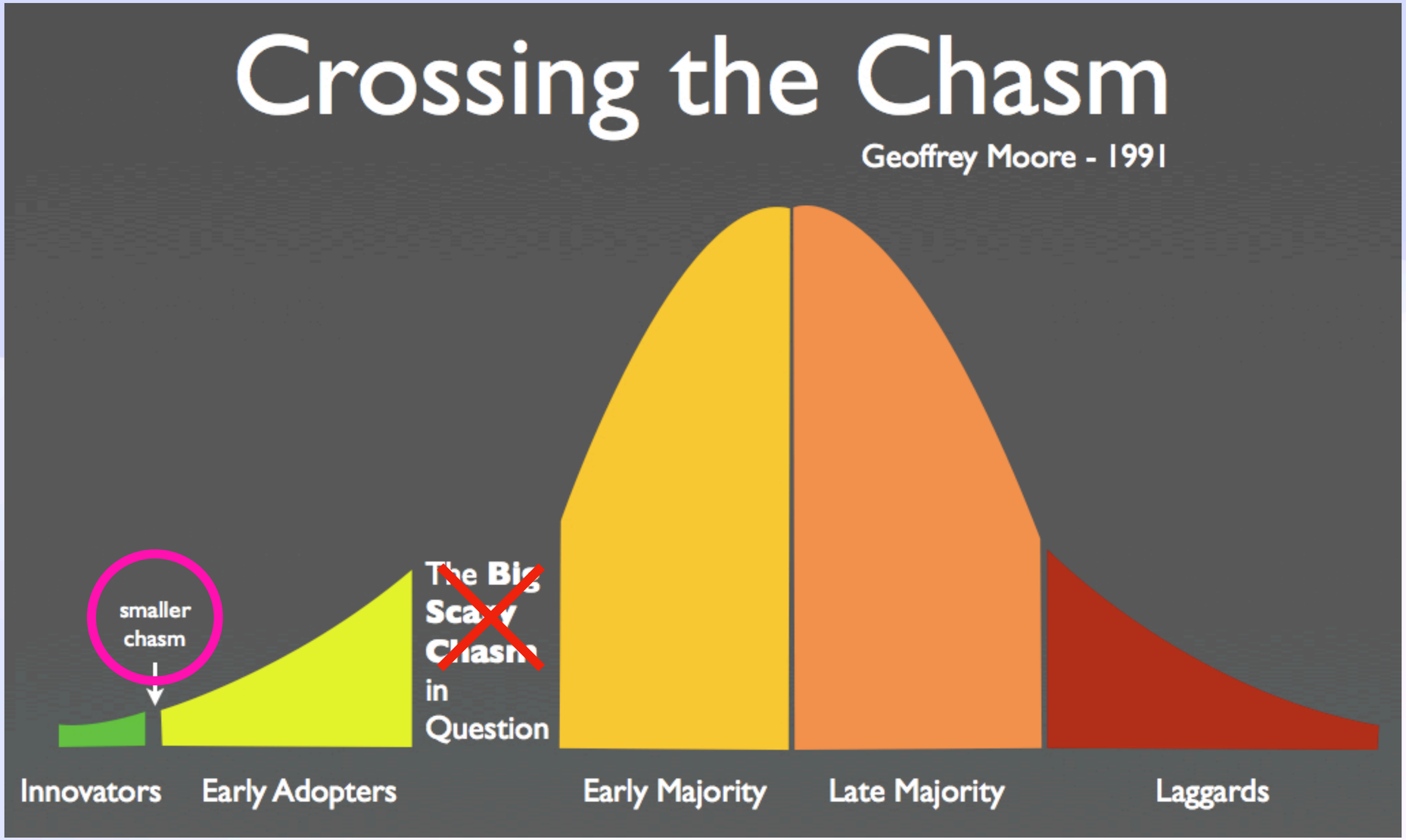
Access Control

Next Stage of Evolution



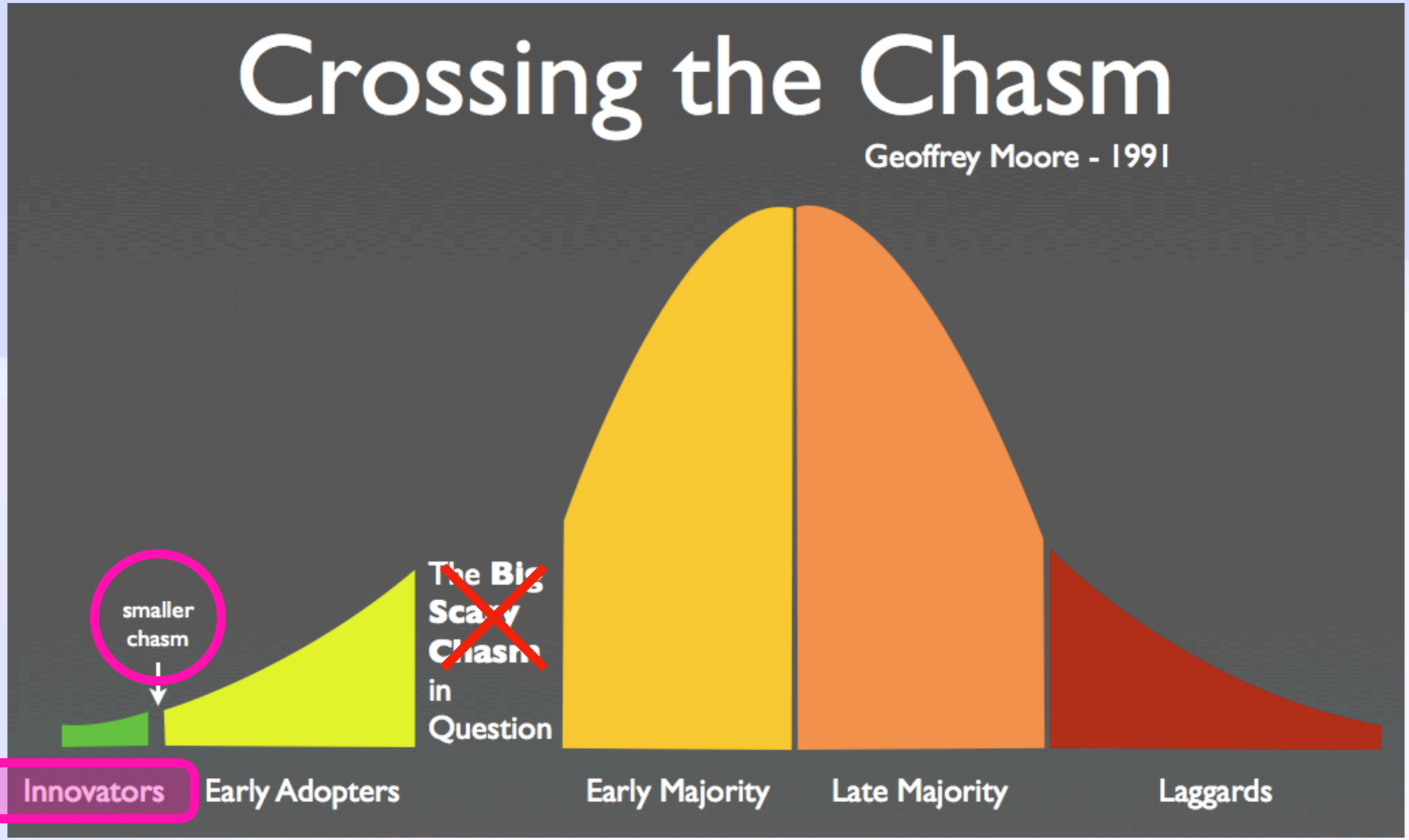
Access Control

Next Stage of Evolution



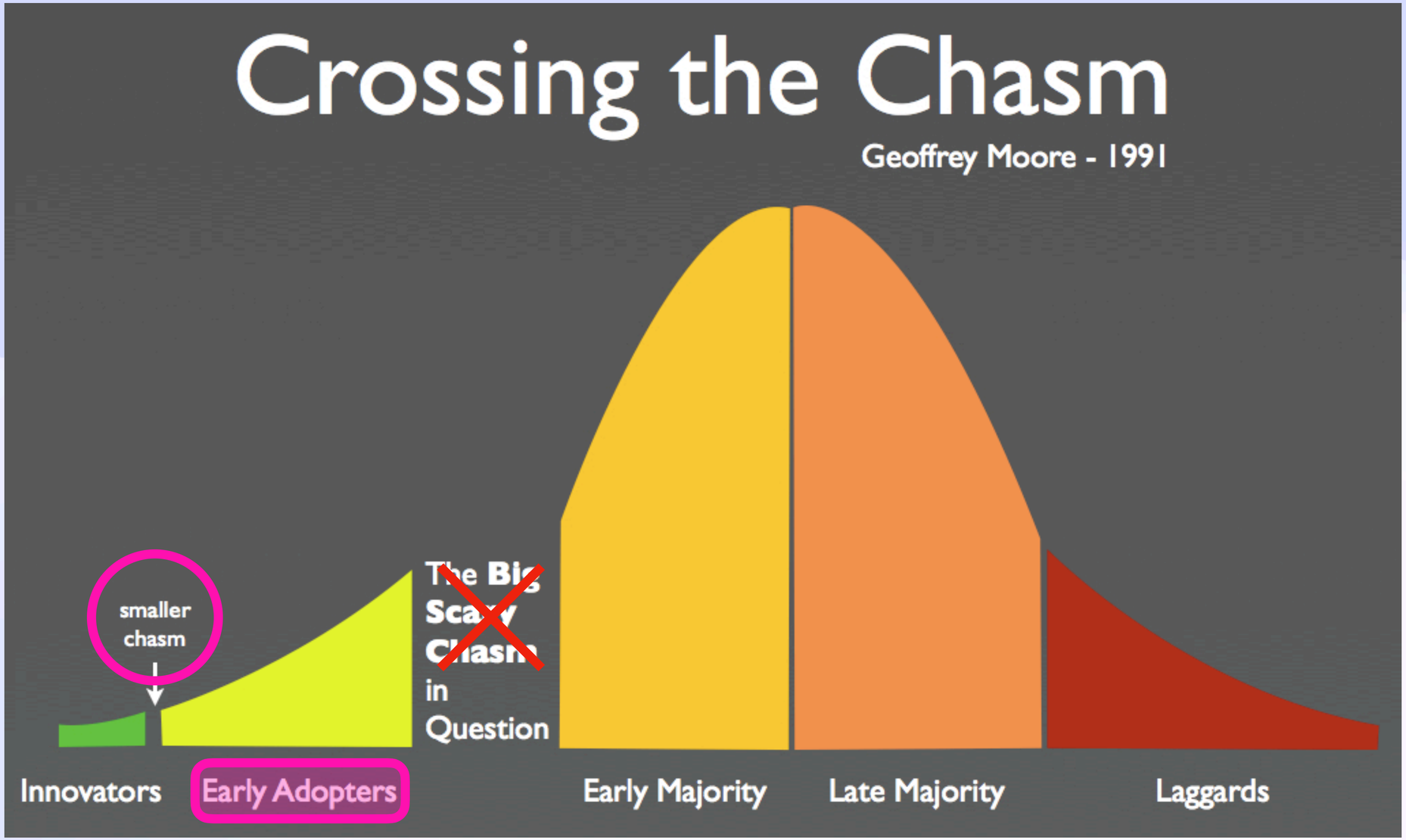
Access Control

Next Stage of Evolution



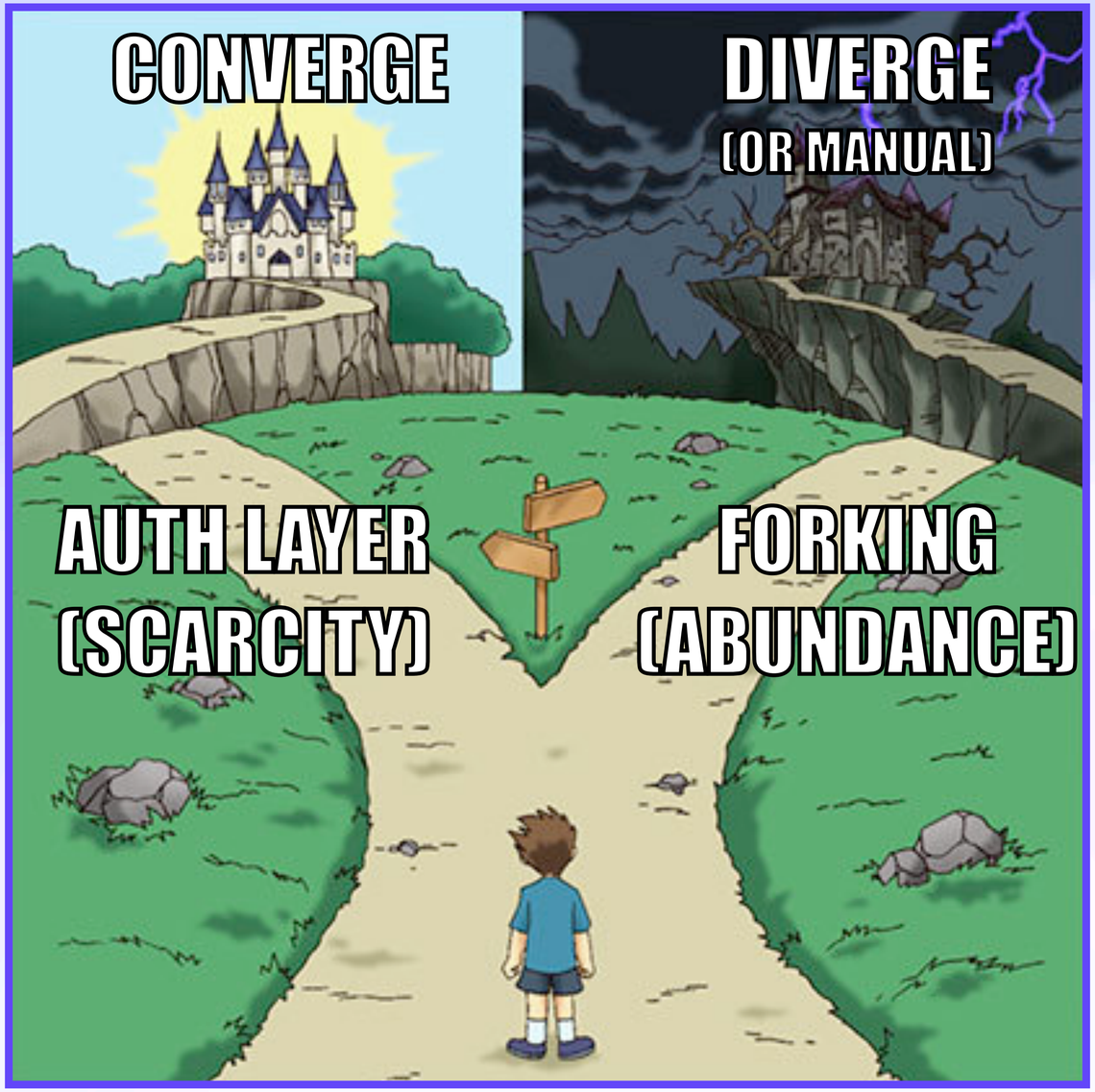
Access Control

Next Stage of Evolution



Access Control

Automatic Merging With Scarcity



Access Control

Cloud Auth Flow





Access Control

Cloud Auth Flow



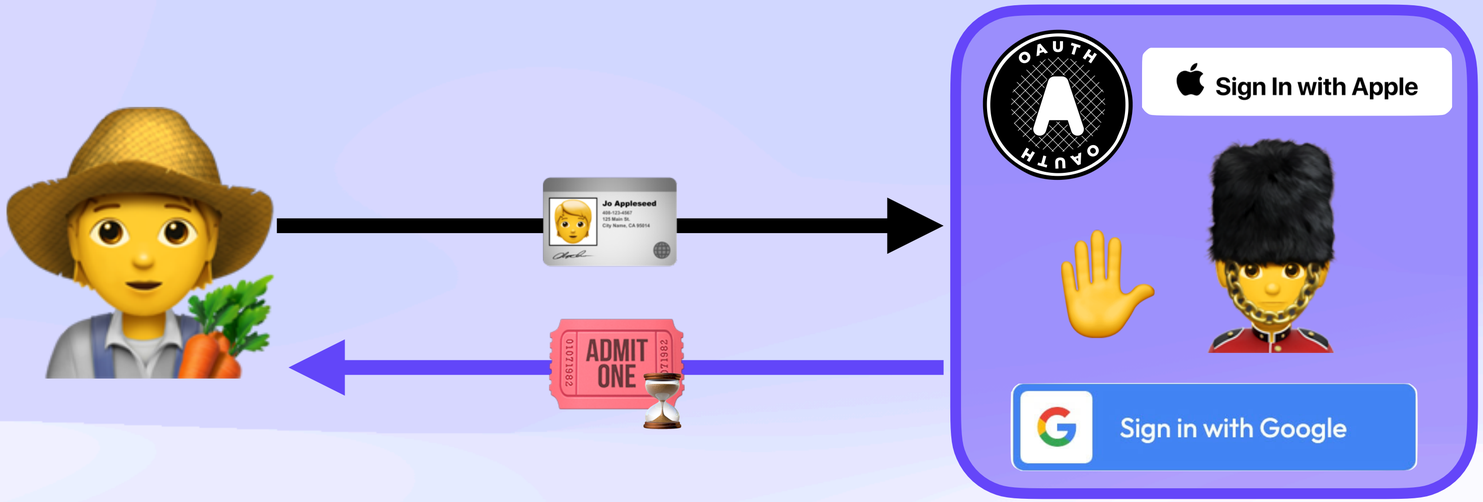
Access Control

Cloud Auth Flow



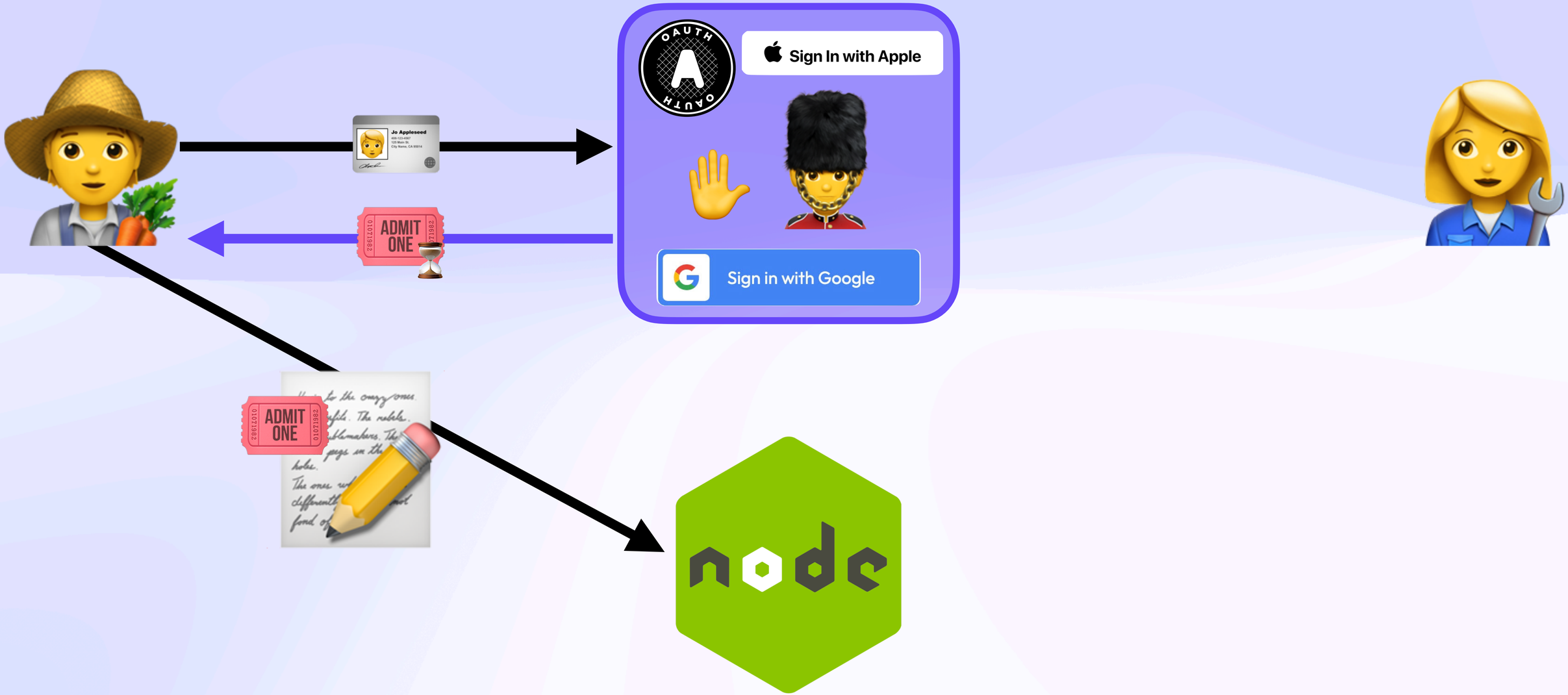
Access Control

Cloud Auth Flow



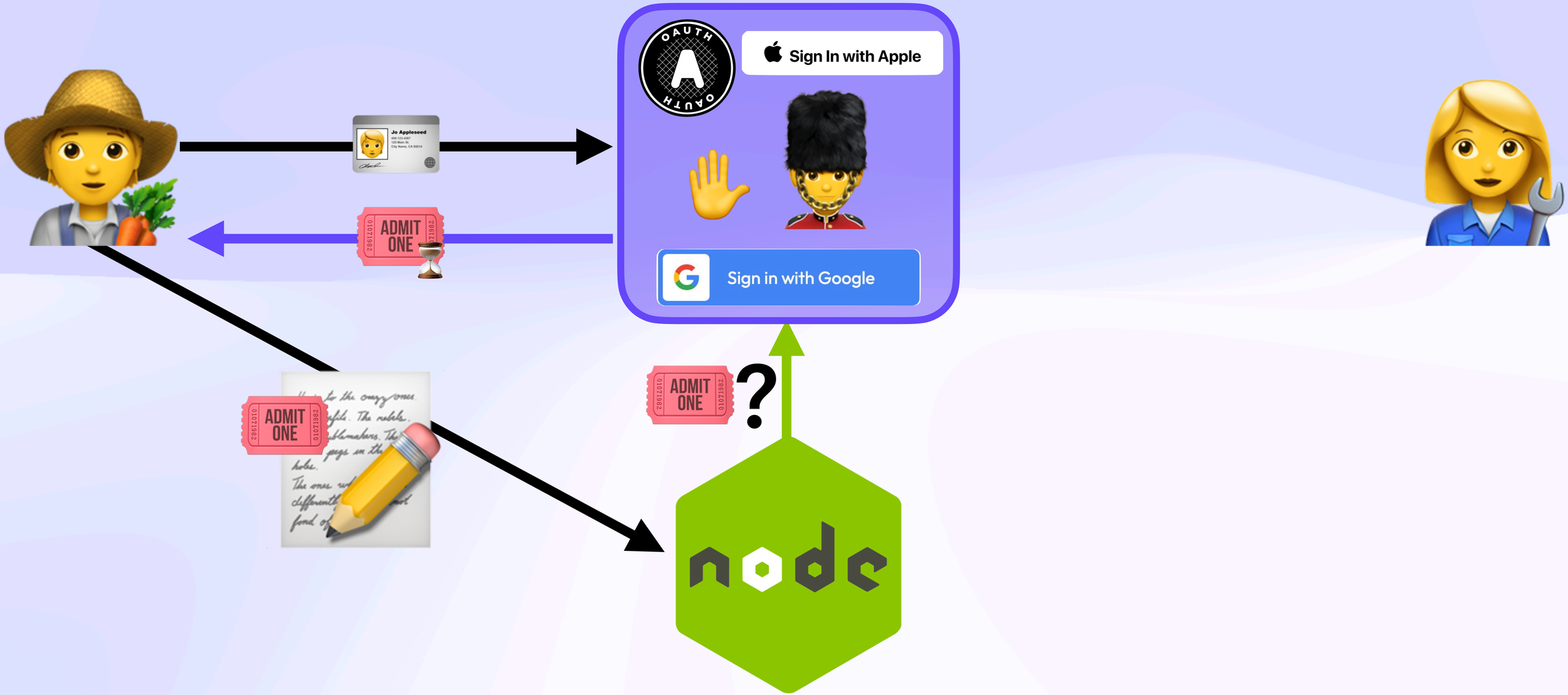
Access Control

Cloud Auth Flow



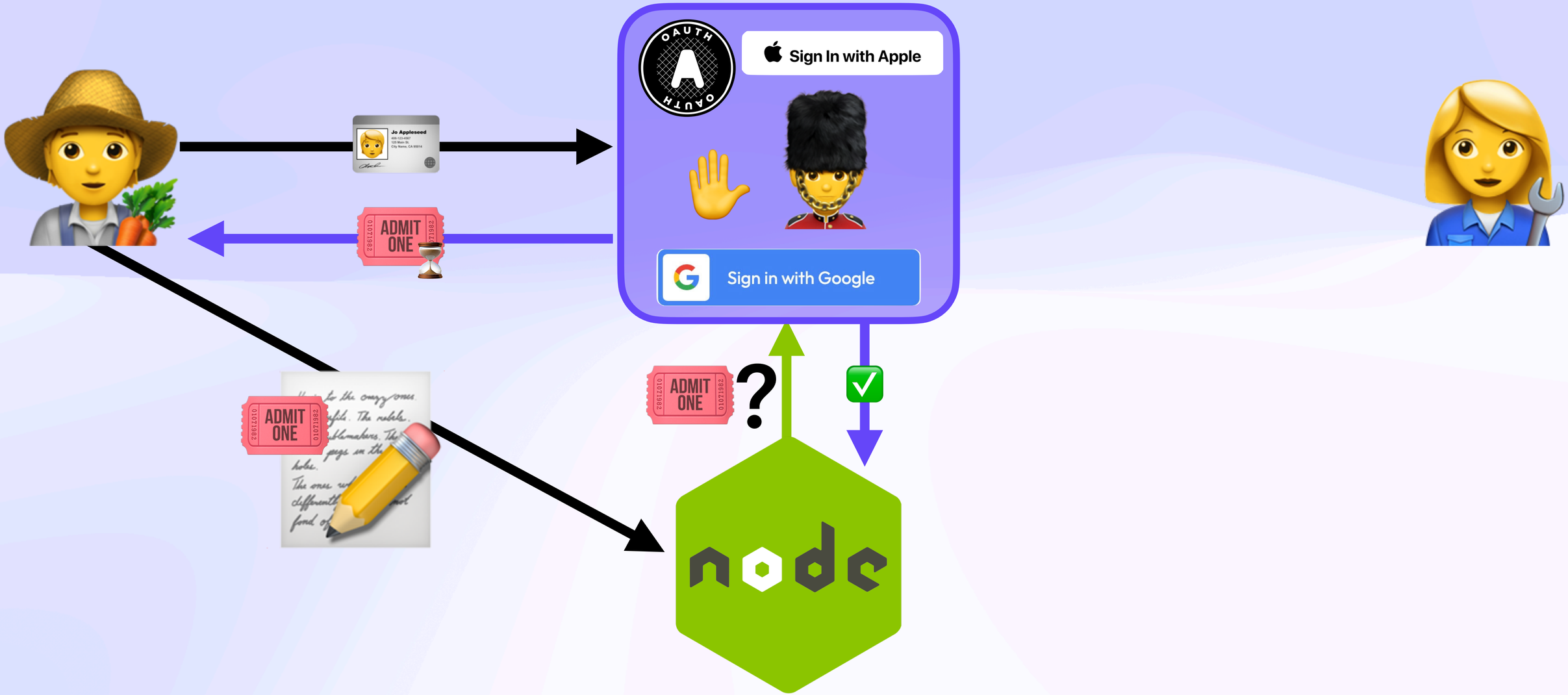
Access Control

Cloud Auth Flow



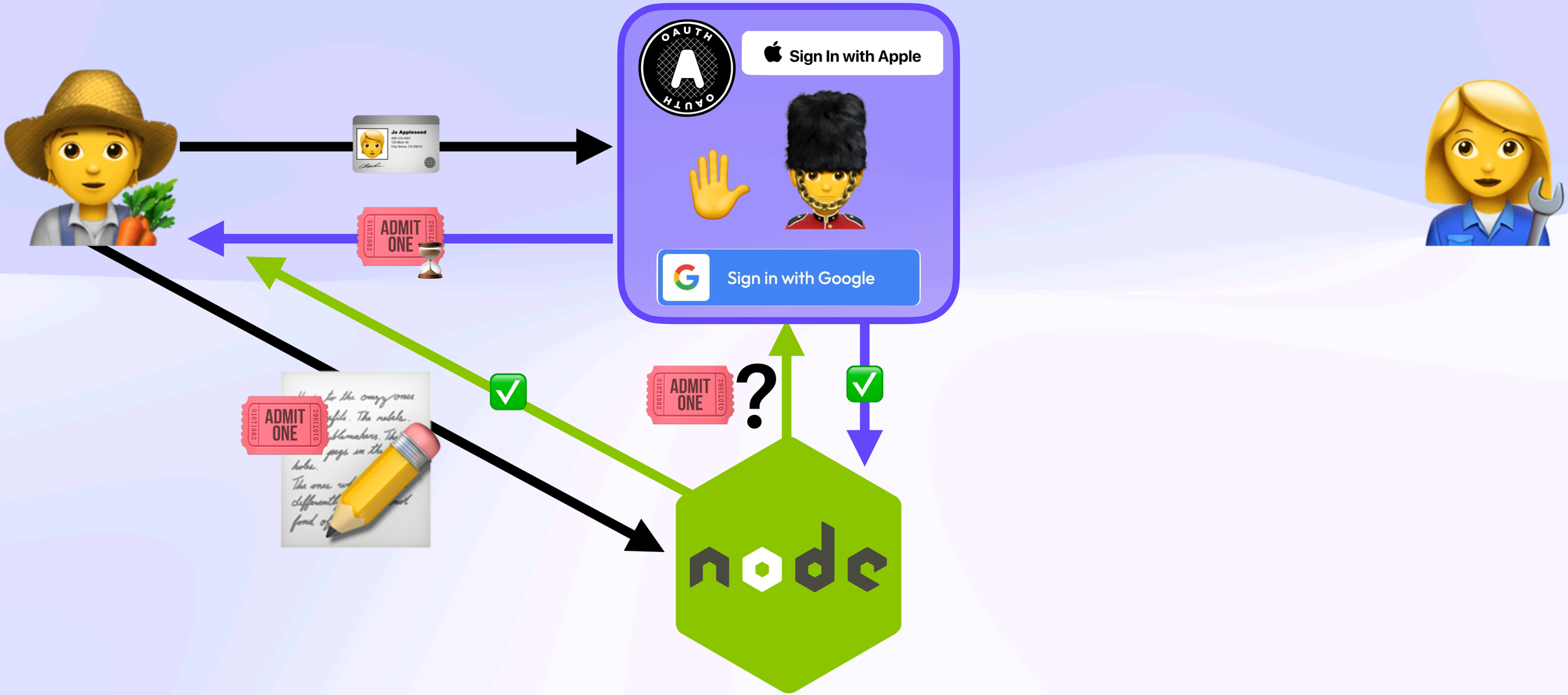
Access Control

Cloud Auth Flow



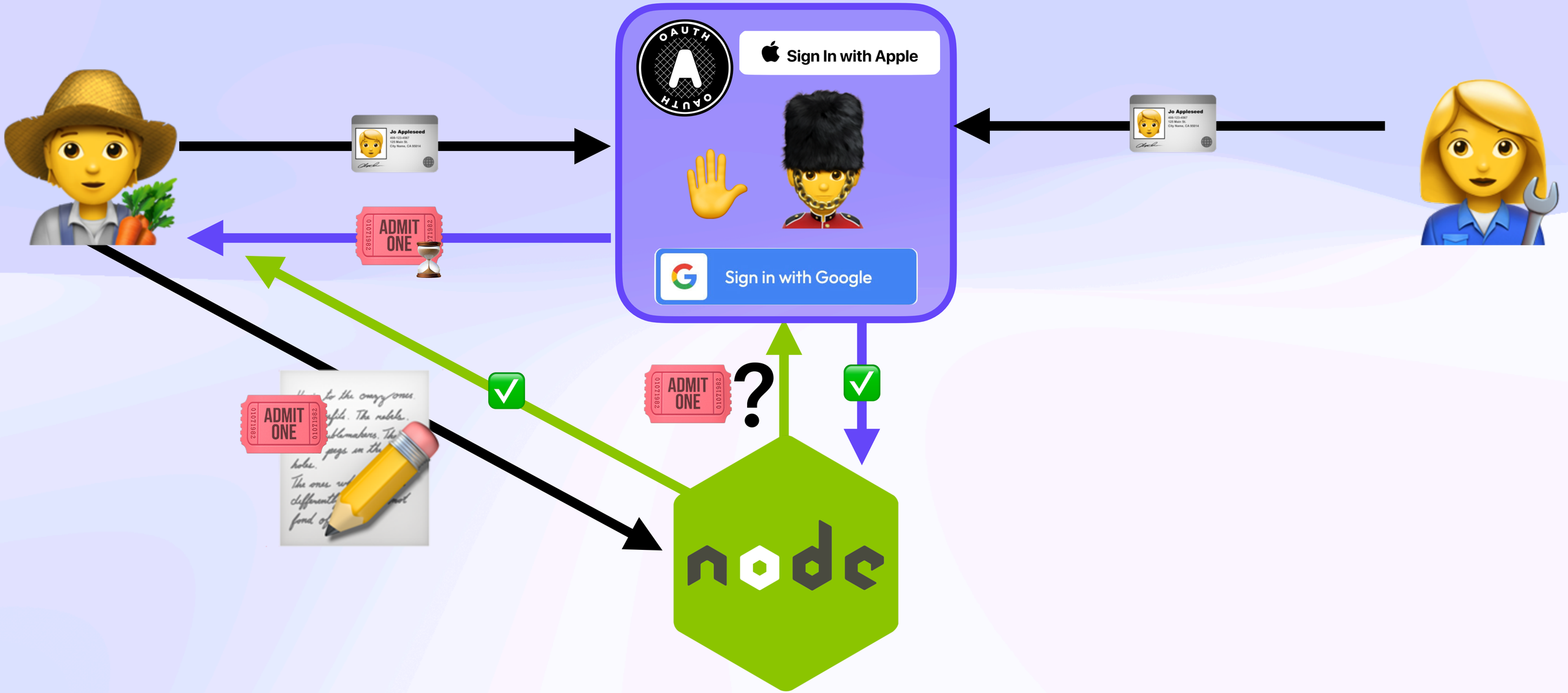
Access Control

Cloud Auth Flow



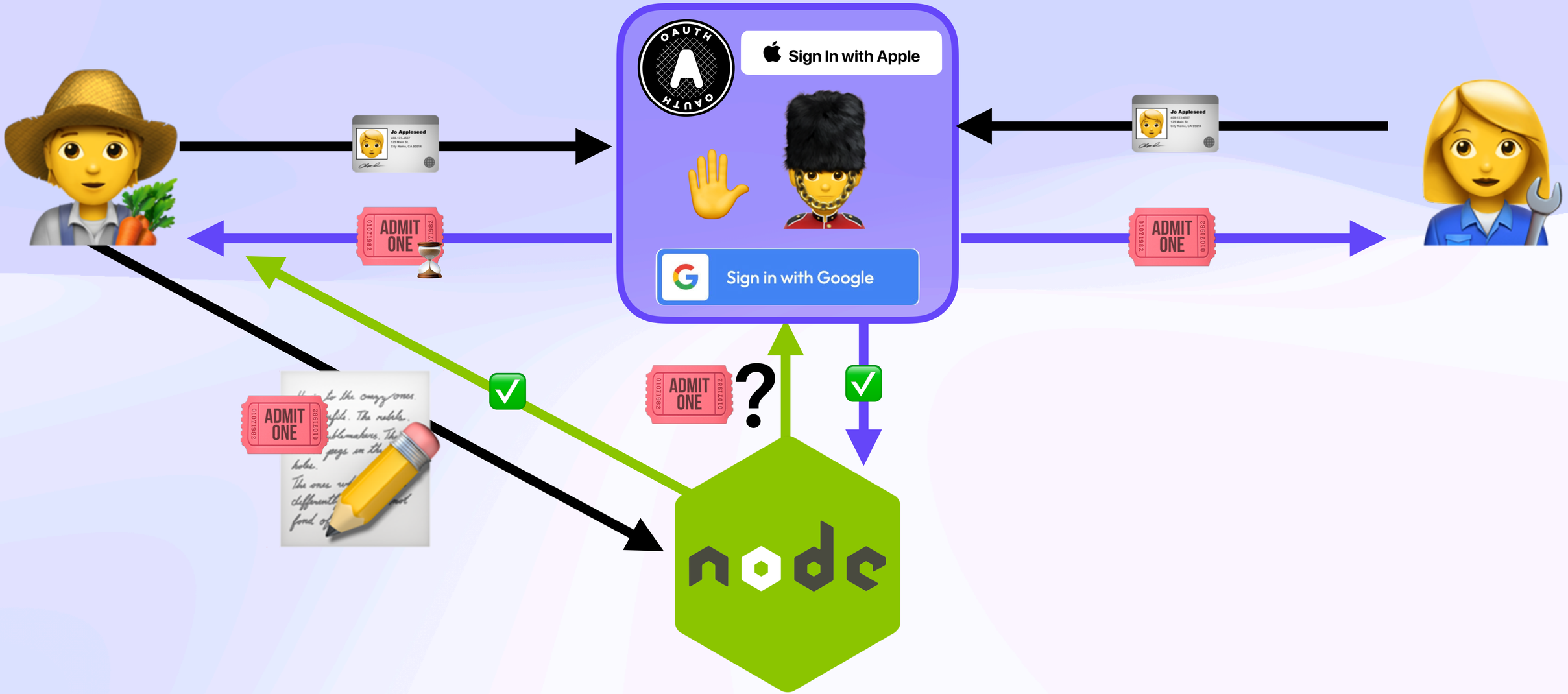
Access Control

Cloud Auth Flow



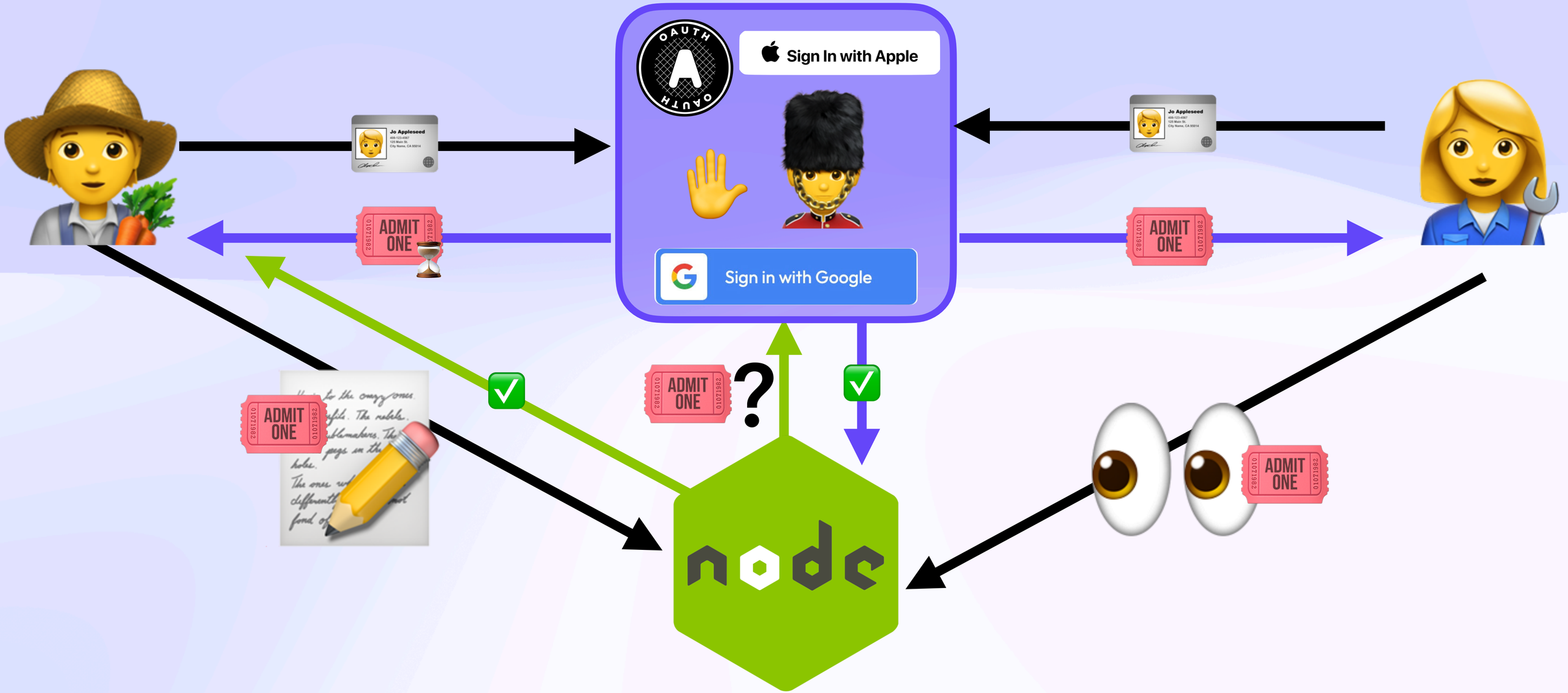
Access Control

Cloud Auth Flow



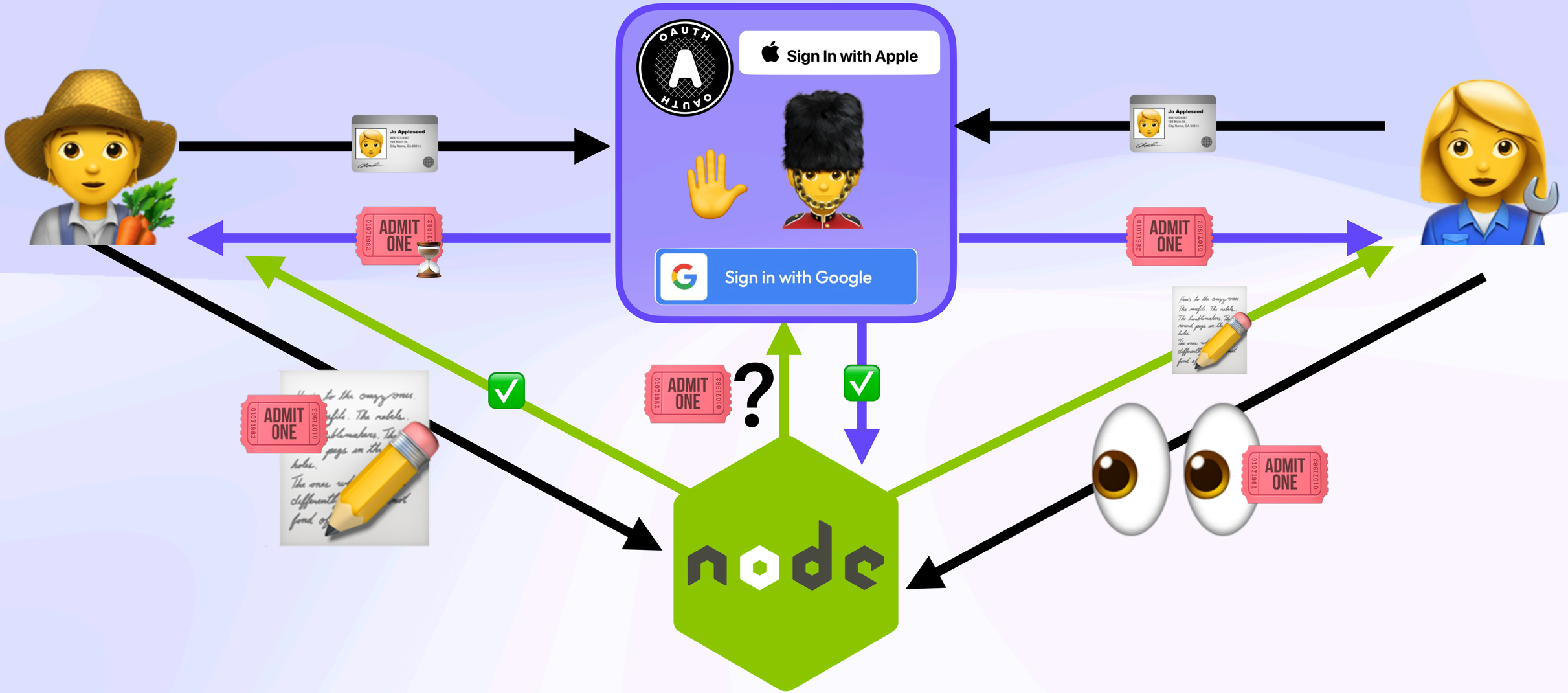
Access Control

Cloud Auth Flow



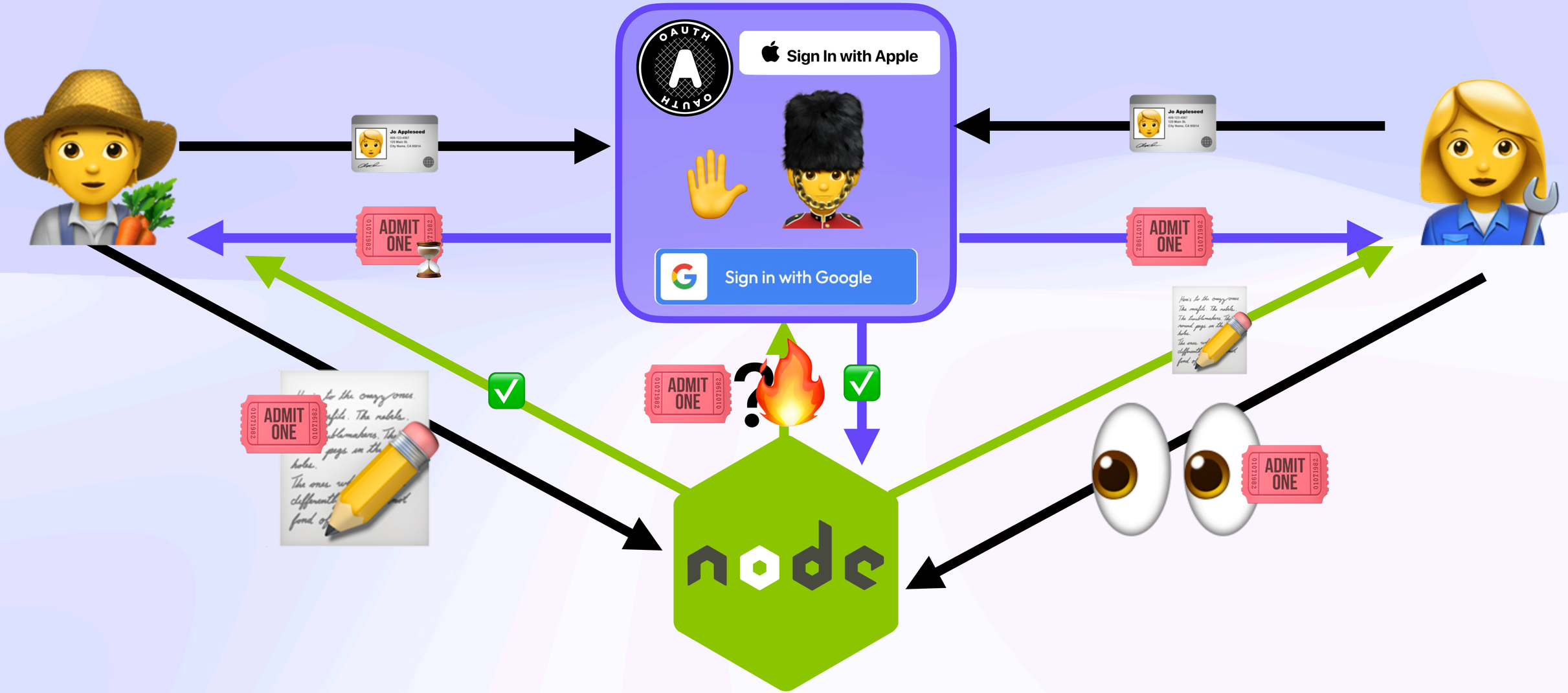
Access Control

Cloud Auth Flow



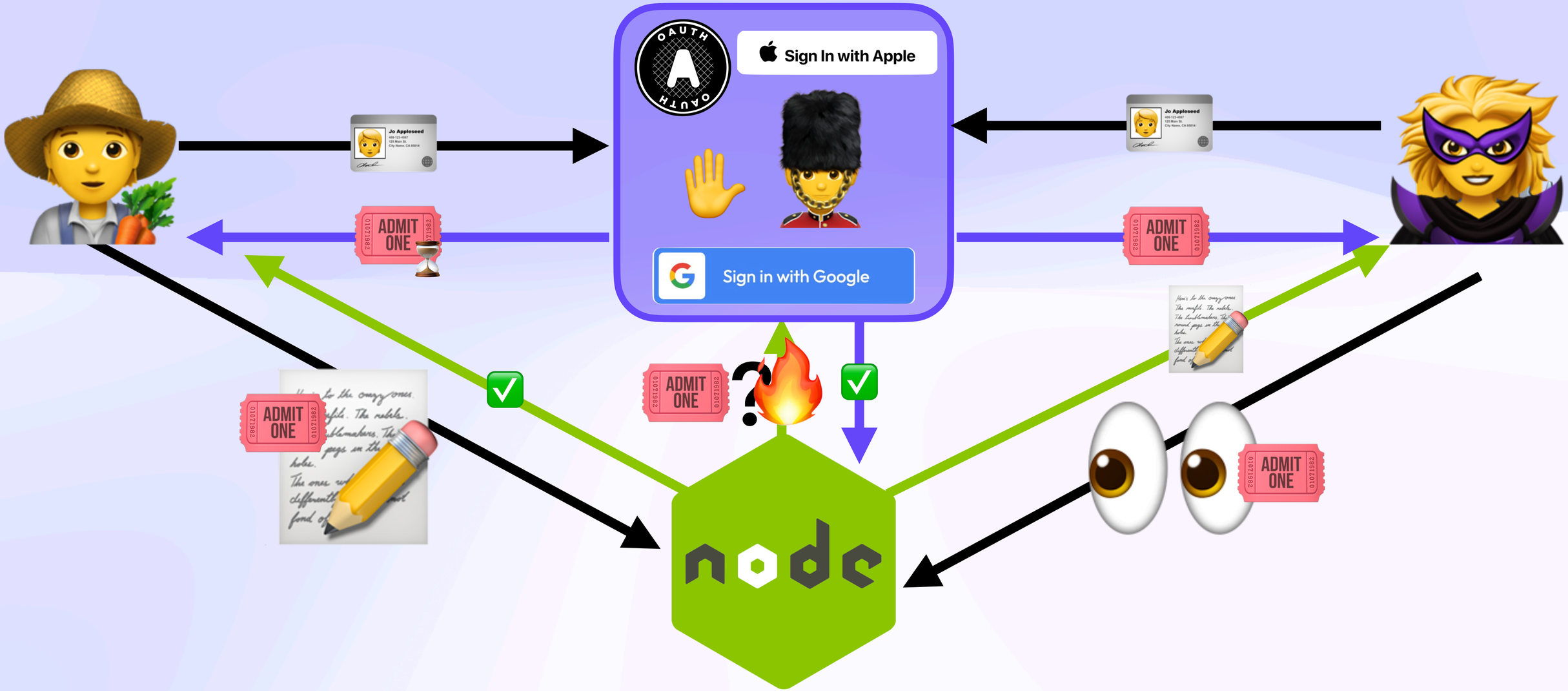
Access Control

Cloud Auth Flow



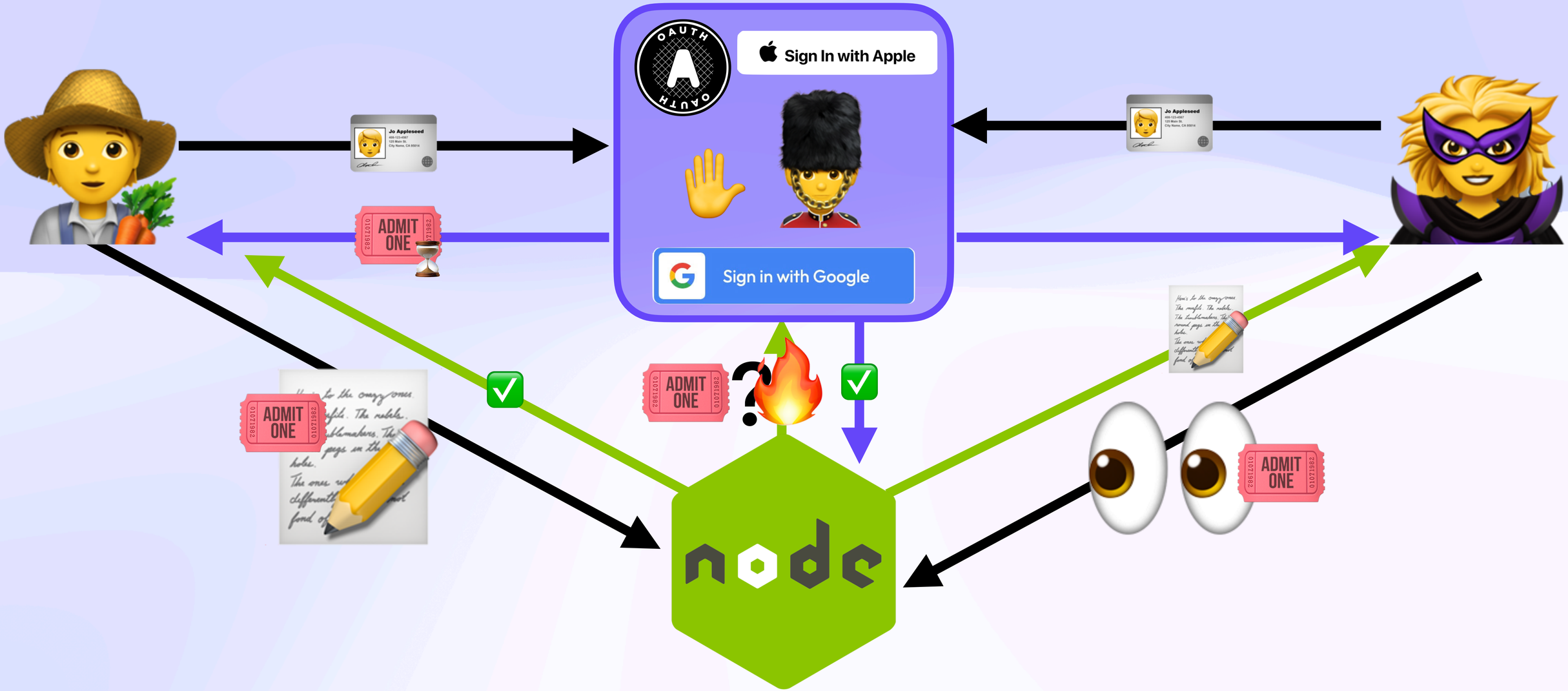
Access Control

Cloud Auth Flow



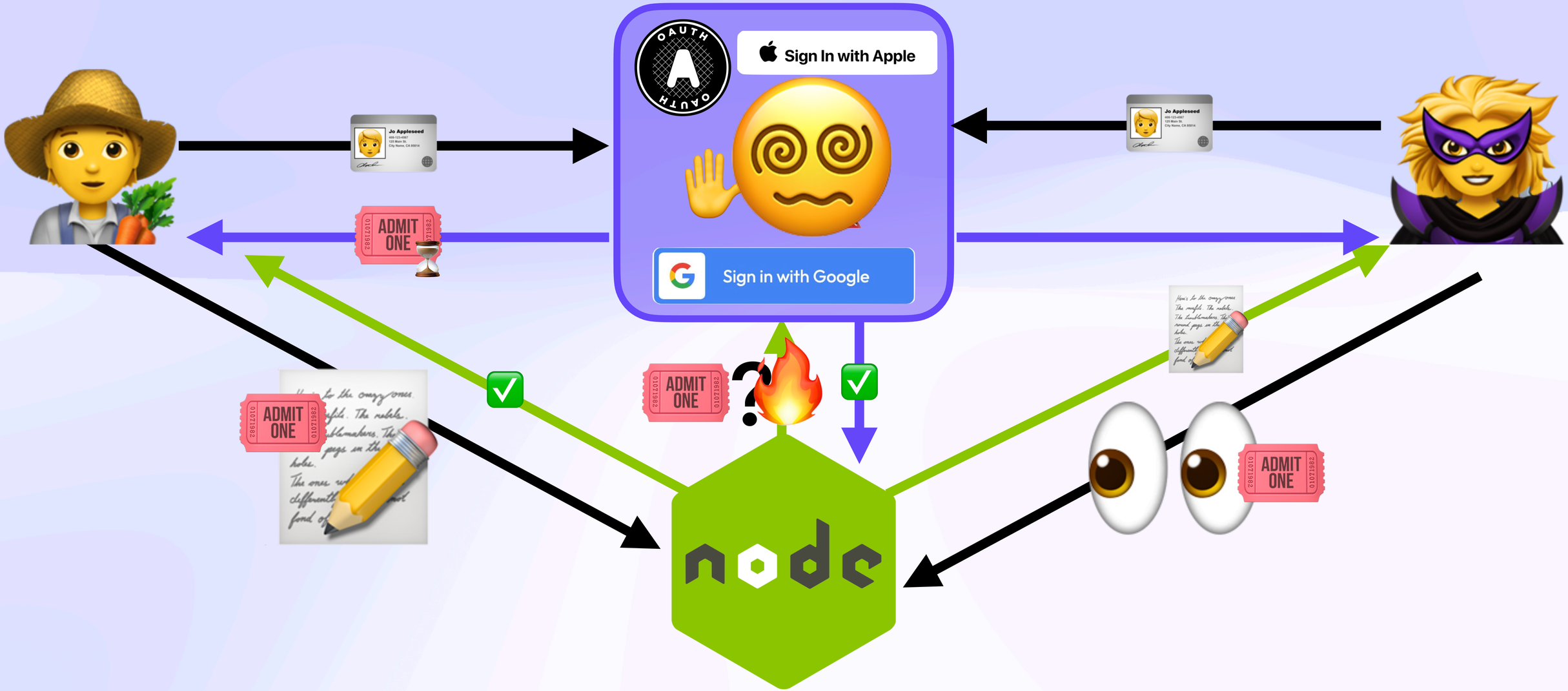
Access Control

Cloud Auth Flow



Access Control

Cloud Auth Flow



Access Control

Cloud: Auth-as-Place

Access Control

Cloud: Auth-as-Place





Access Control

Cloud: Auth-as-Place

"Over Here"



"Over There"



Access Control

Cloud: Auth-as-Place

"Over Here"





"Over There"



Access Control

Local-First: In Pictures

Access Control

Local-First: In Pictures



✅

💔

Access Control

Local-First: In Pictures



✅💔



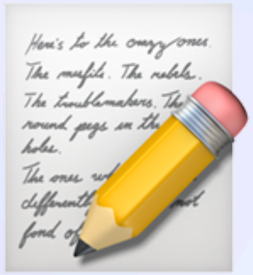
✅❤️‍🩹

Access Control

Auth as Data: "Auth Must Travel with Data"

Access Control

Auth as Data: "Auth Must Travel with Data"





Access Control

Auth as Data: "Auth Must Travel with Data"





Access Control

Auth as Data: "Auth Must Travel with Data"







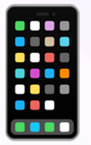
Access Control

Auth as Data: "Auth Must Travel with Data"









Access Control

Auth as Data: "Auth Must Travel with Data"

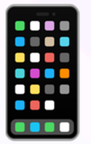
"Auth Here"
"Data Here"





"Auth There"
"Data There"





Access Control

Auth as Data: "Auth Must Travel with Data"

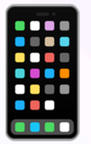
"Auth Here"
"Data Here"





"Auth There"
"Data There"





Access Control

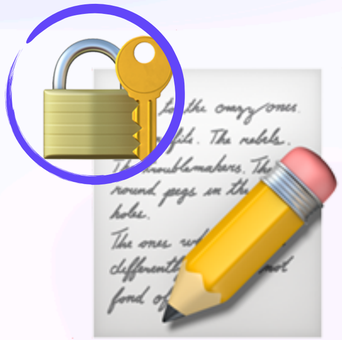
Auth as Data: "Auth Must Travel with Data"

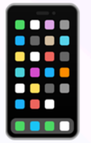
"Auth Here"
"Data Here"





"Auth There"
"Data There"





Access Control

Access Control

Cloud

Local-First

Access Control

Cloud

Auth

Compute

Data





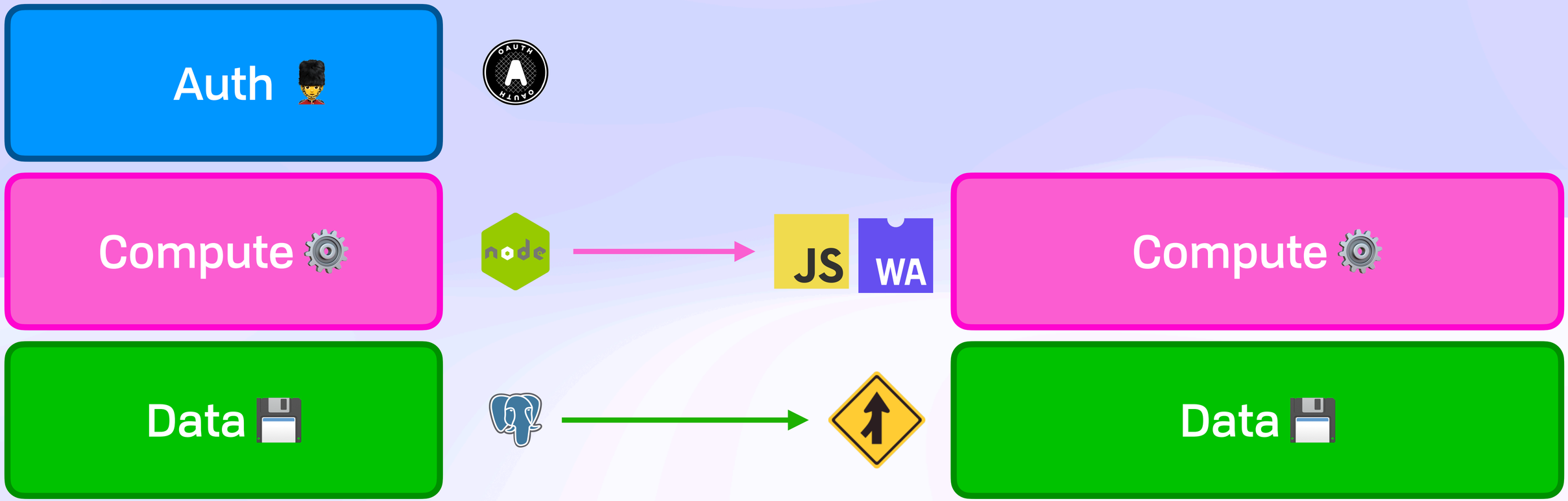


Local-First

Access Control

Cloud

Local-First



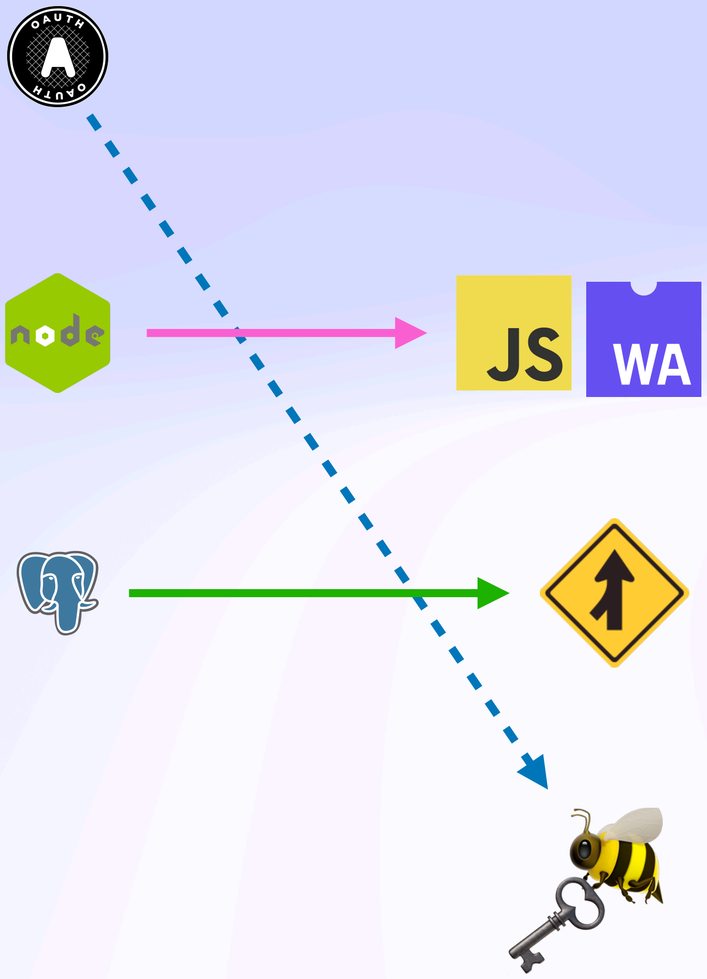
Access Control

Cloud

Auth

Compute

Data



Local-First

Compute

Data

Auth

Access Control

Cryptography is a tool for turning lots of different problems into ***key management problems***

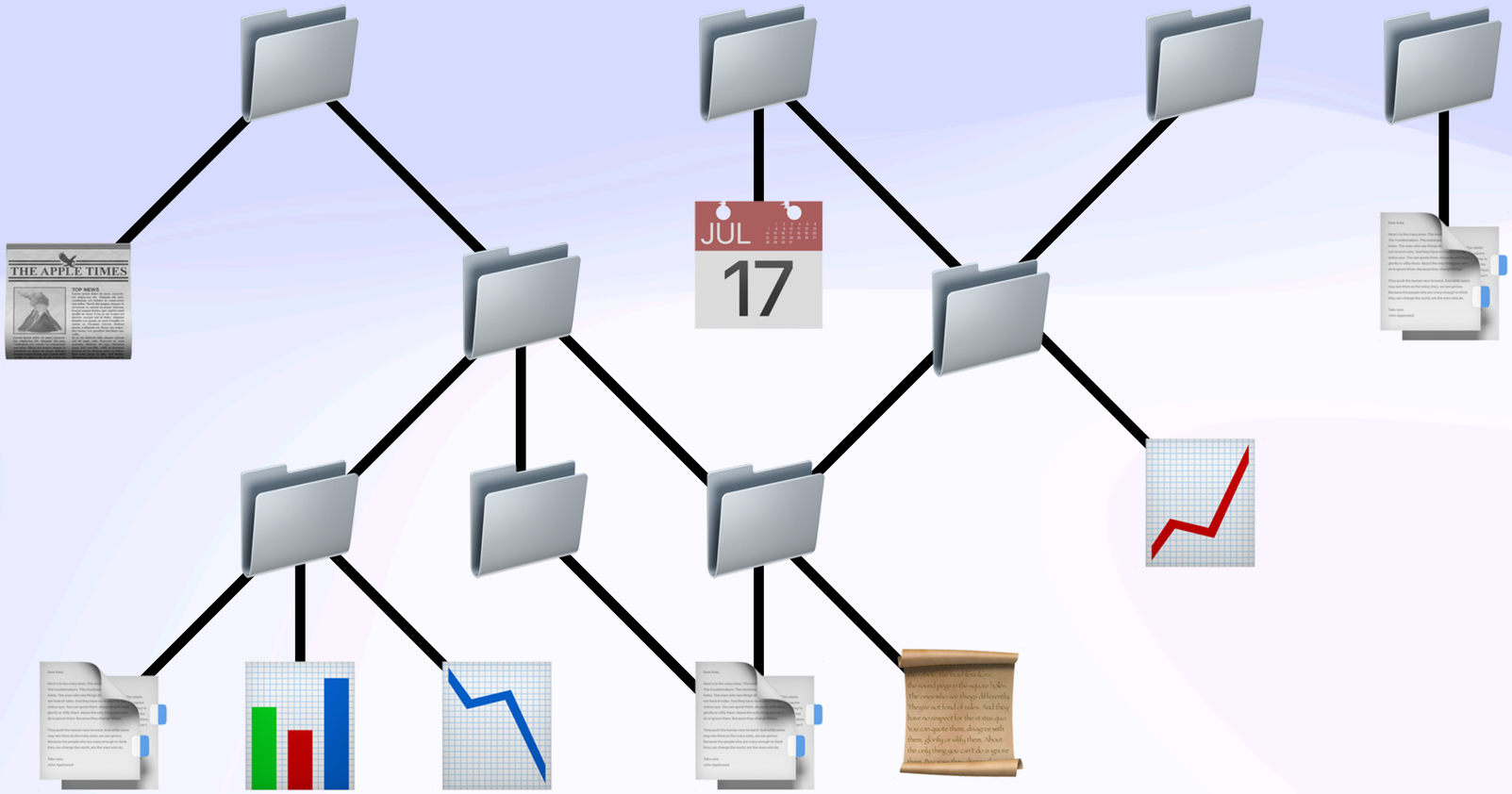
Lea Kissner, Google's Global Lead of Privacy Technologies

Access Control

Universal Read Control

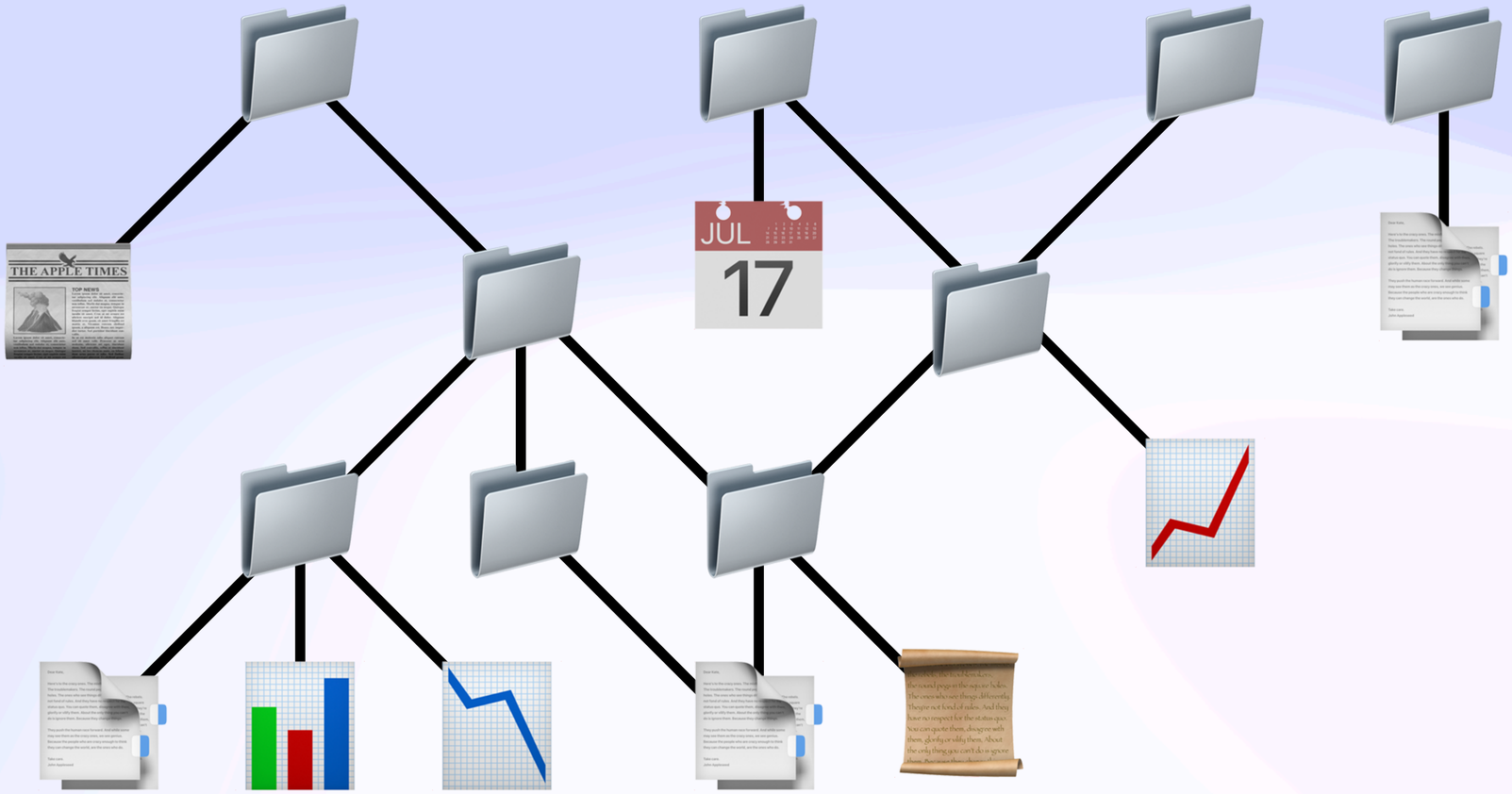
Access Control

Universal Read Control



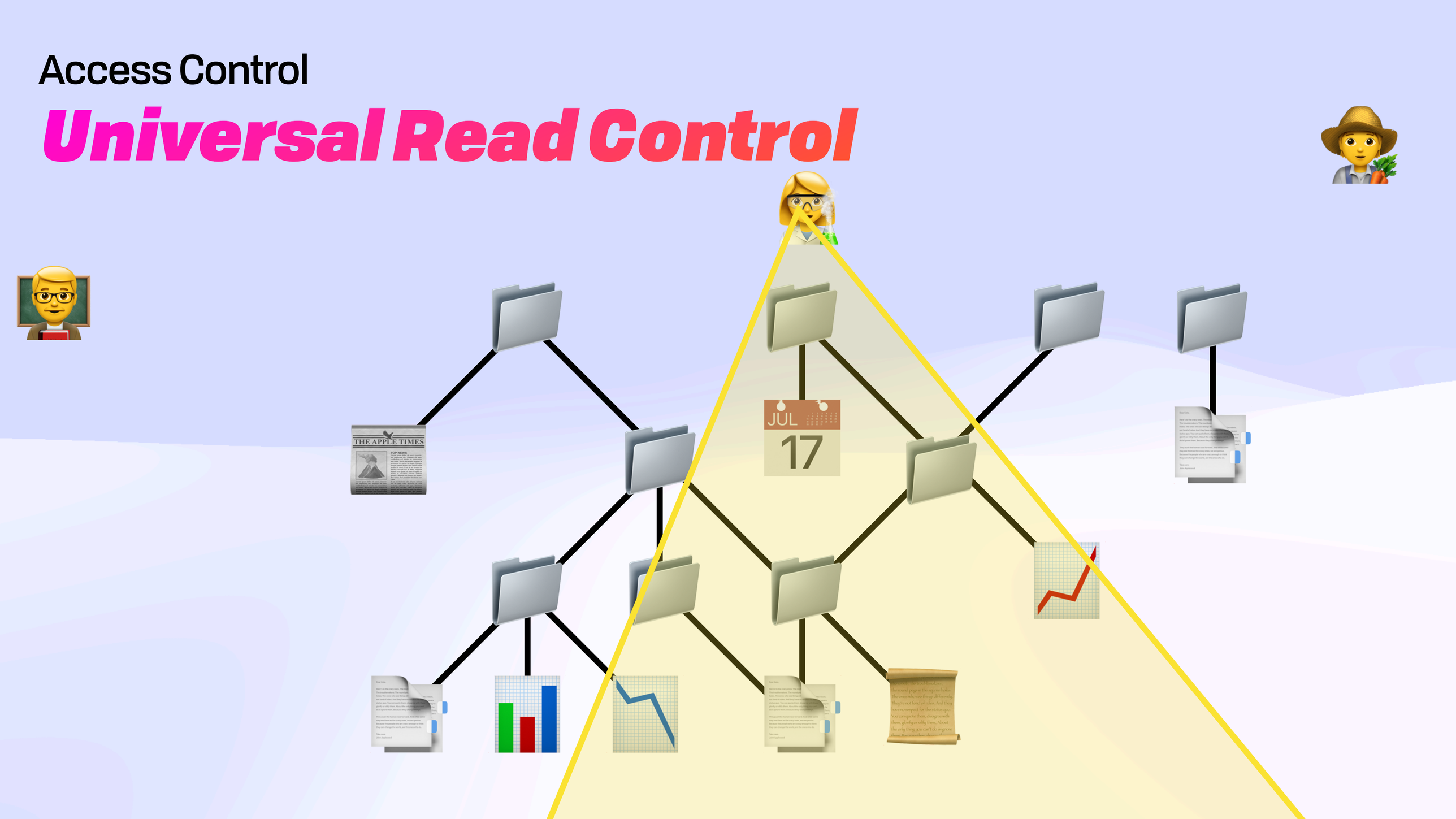
Access Control

Universal Read Control



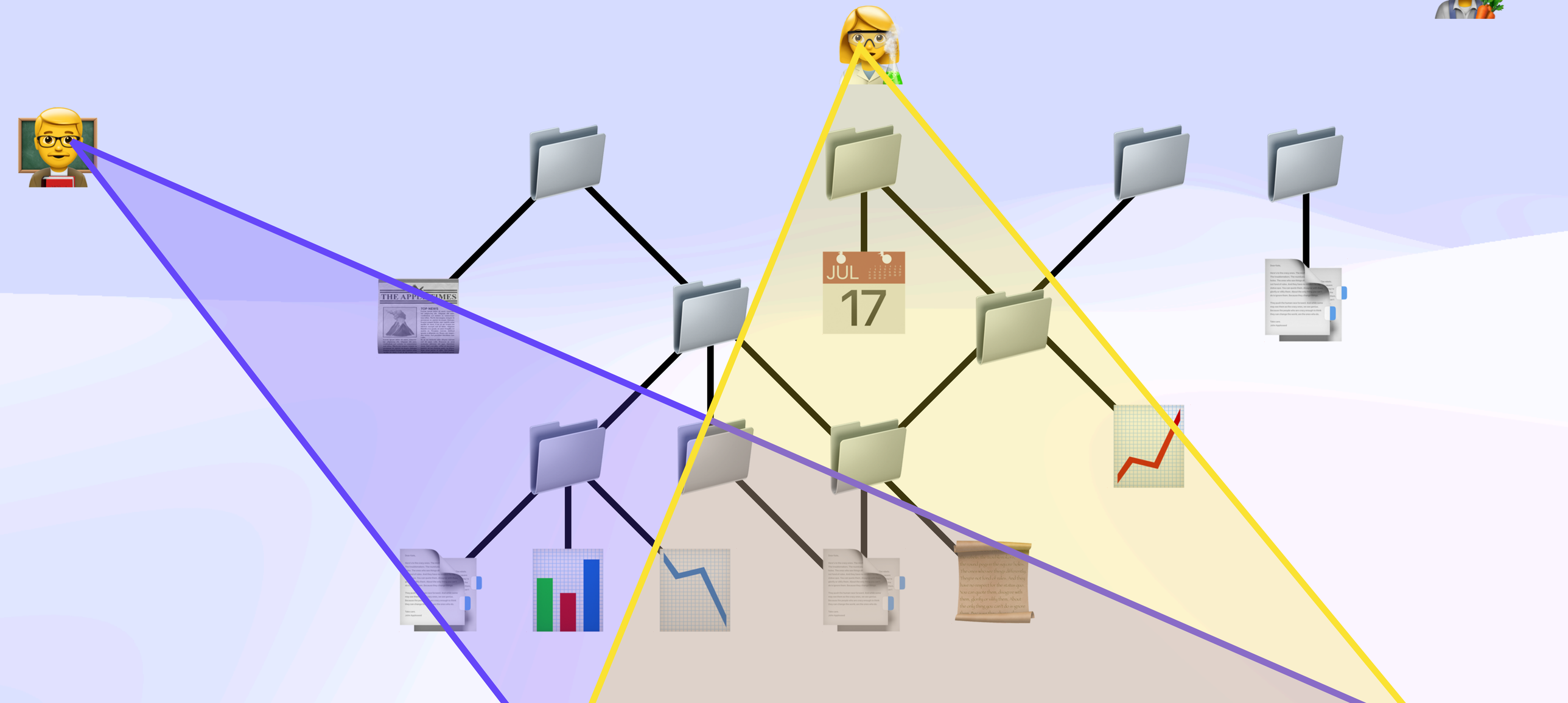
Access Control

Universal Read Control



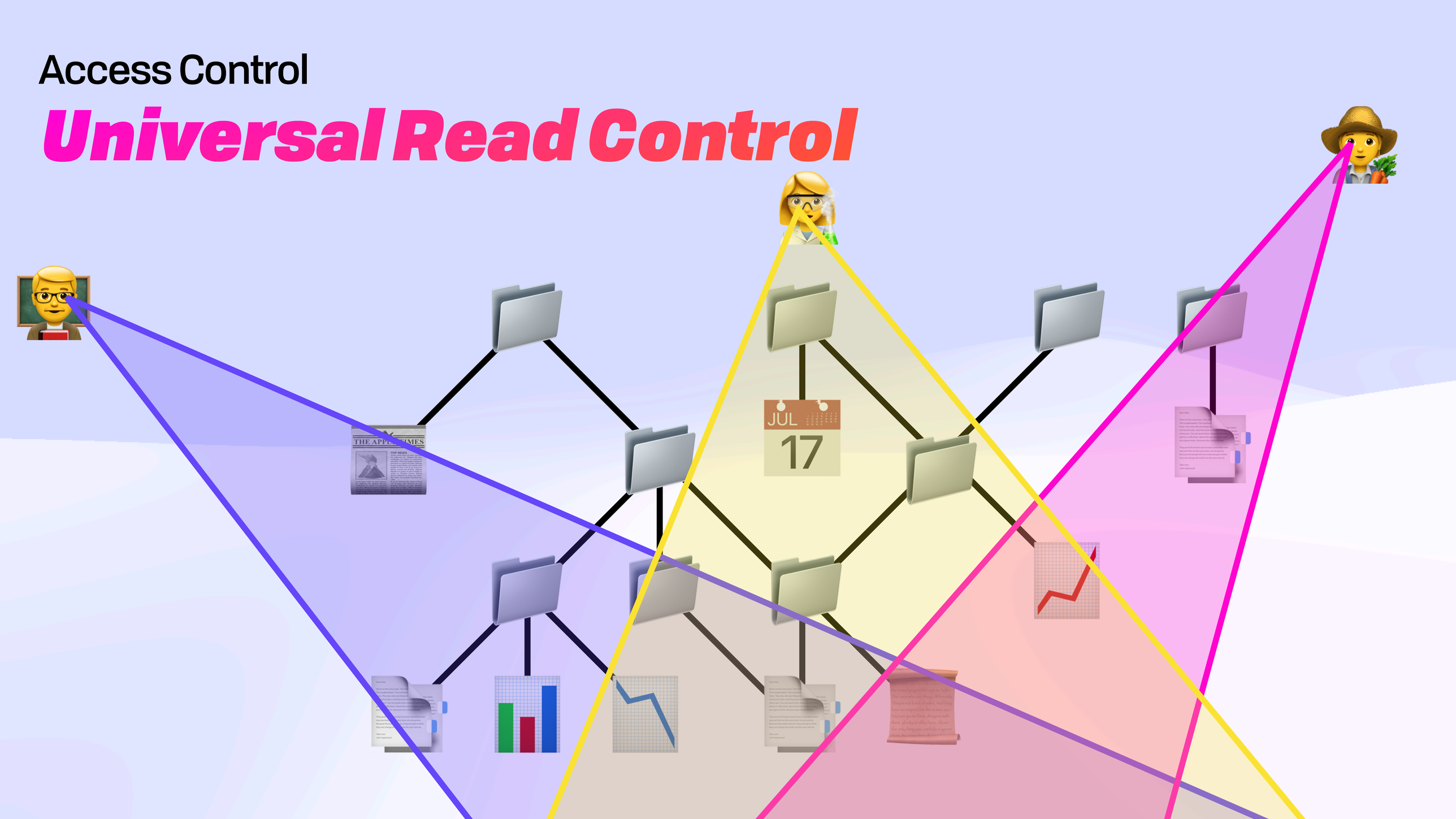
Access Control

Universal Read Control



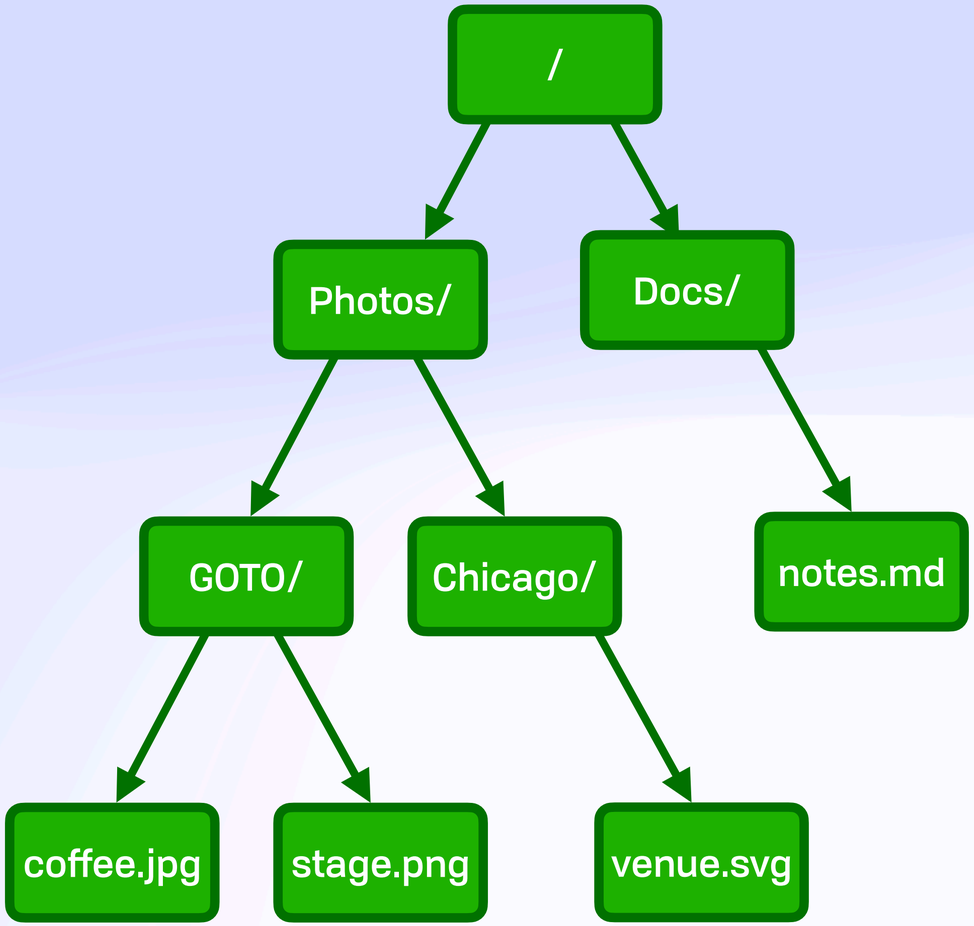
Access Control

Universal Read Control



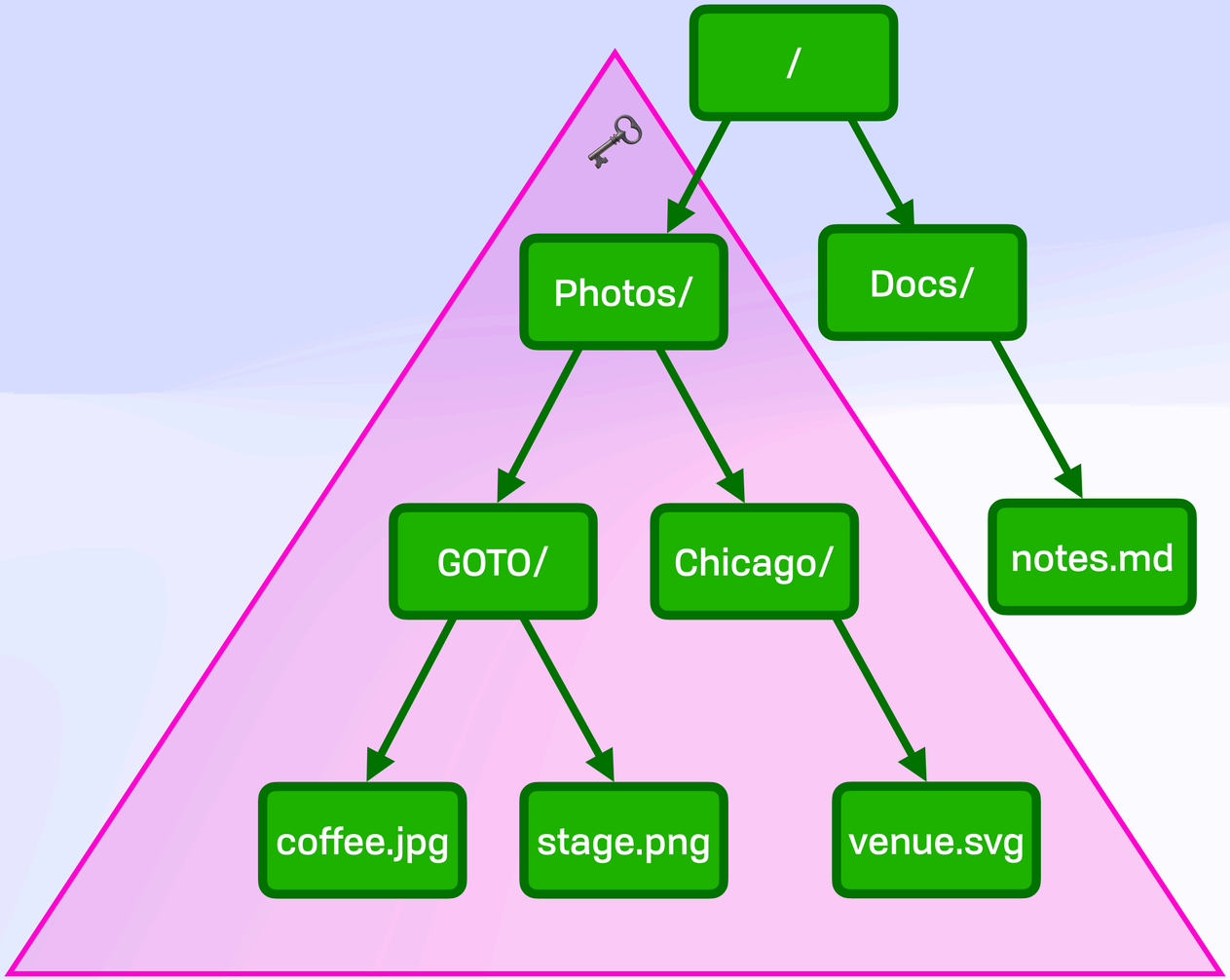
Access Control

Offline Read Control



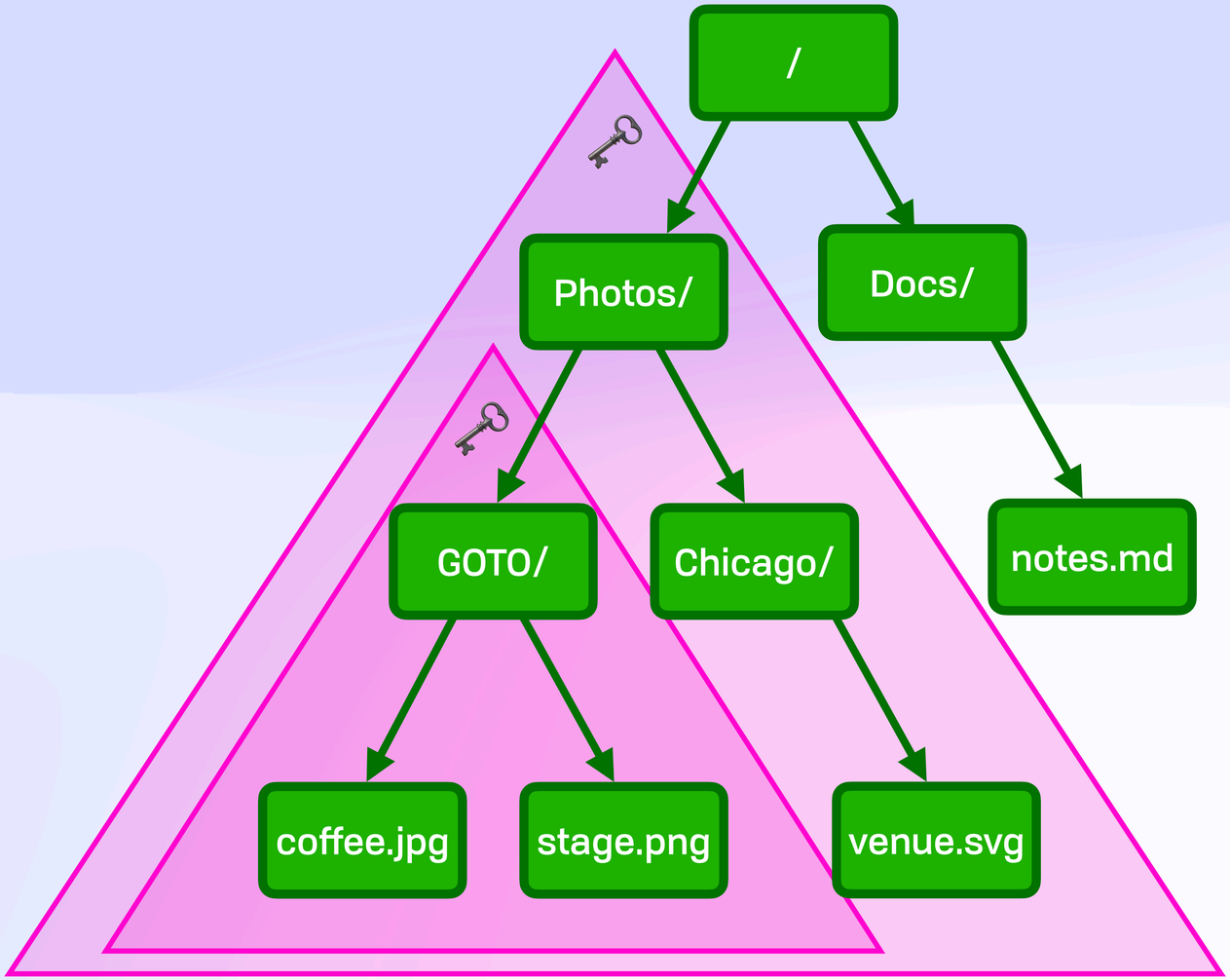
Access Control

Offline Read Control



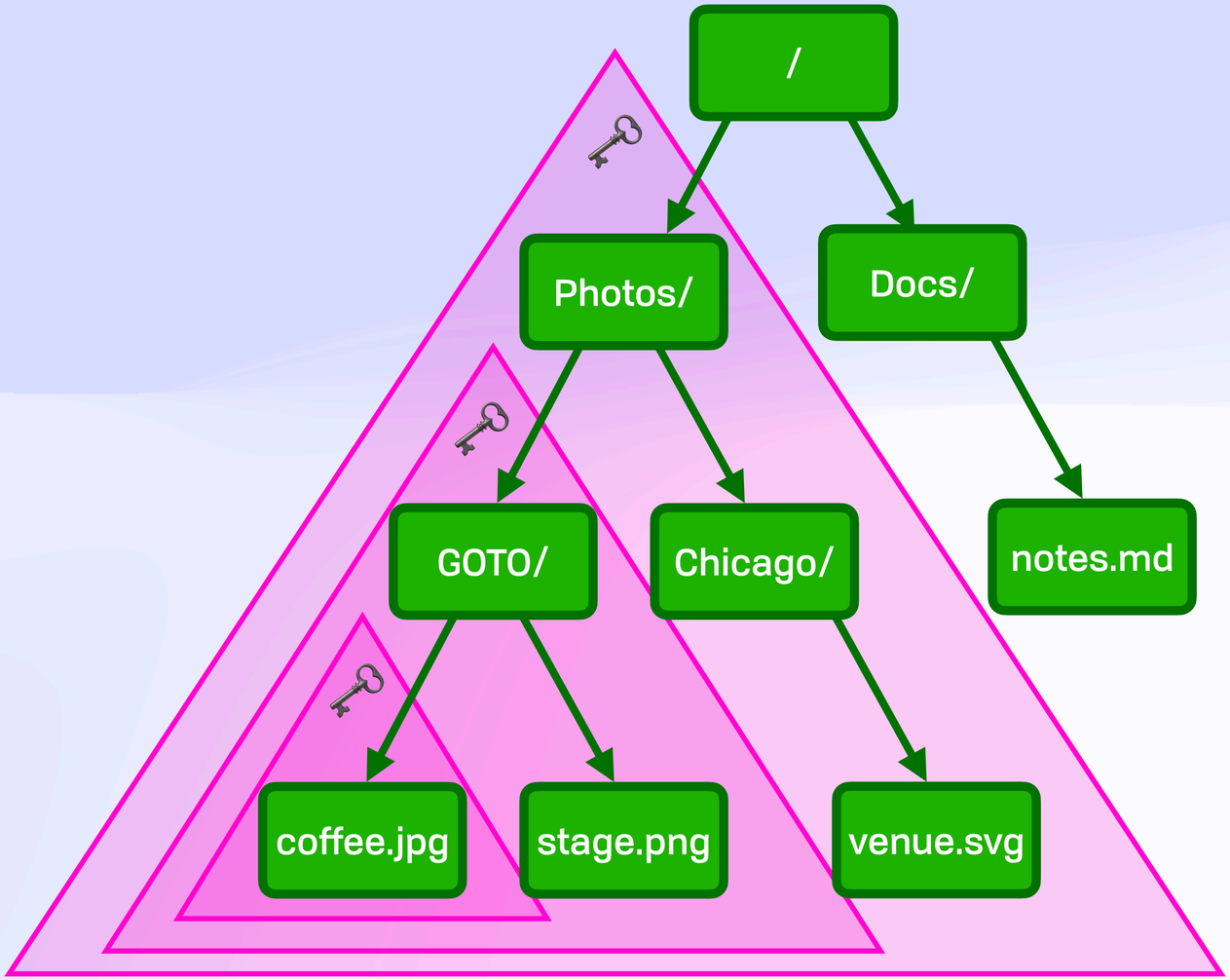
Access Control

Offline Read Control



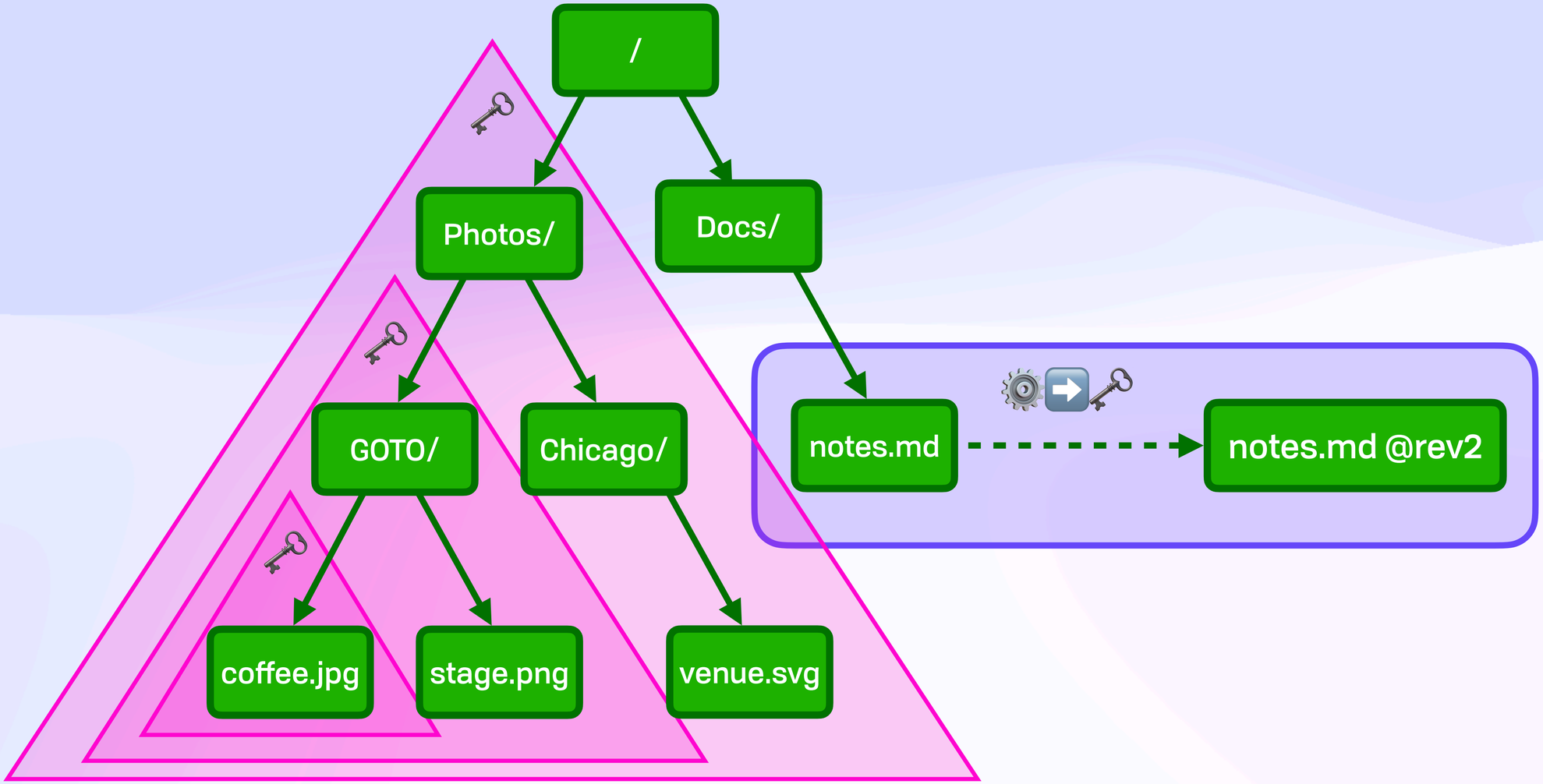
Access Control

Offline Read Control



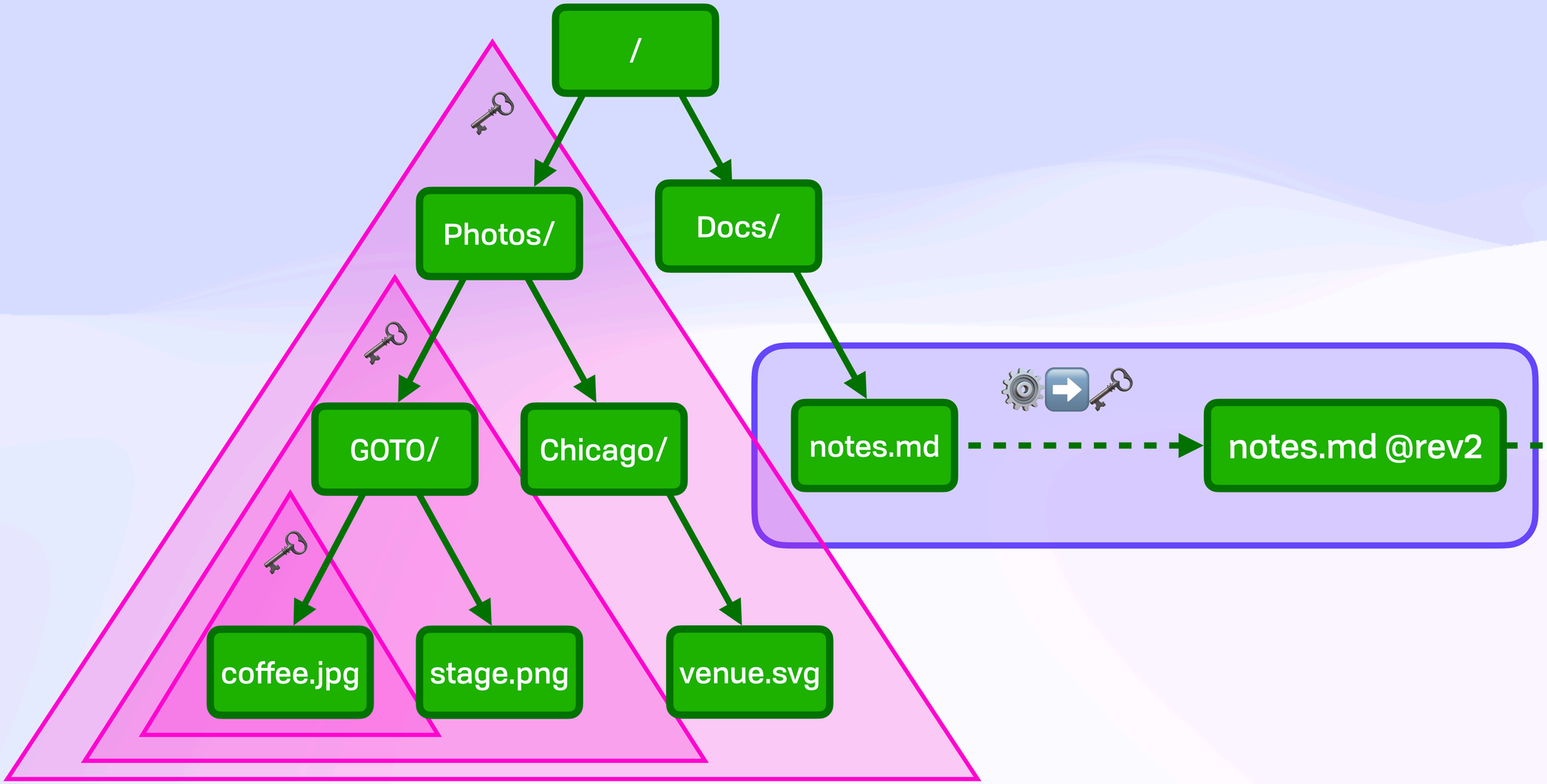
Access Control

Offline Read Control



Access Control

Offline Read Control

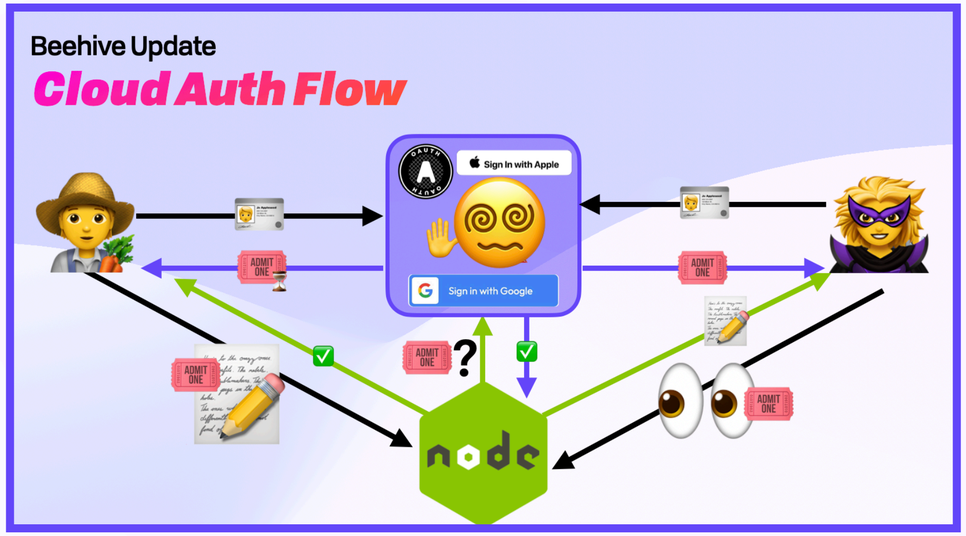


Access Control

Self-Authenticating Changes

Access Control

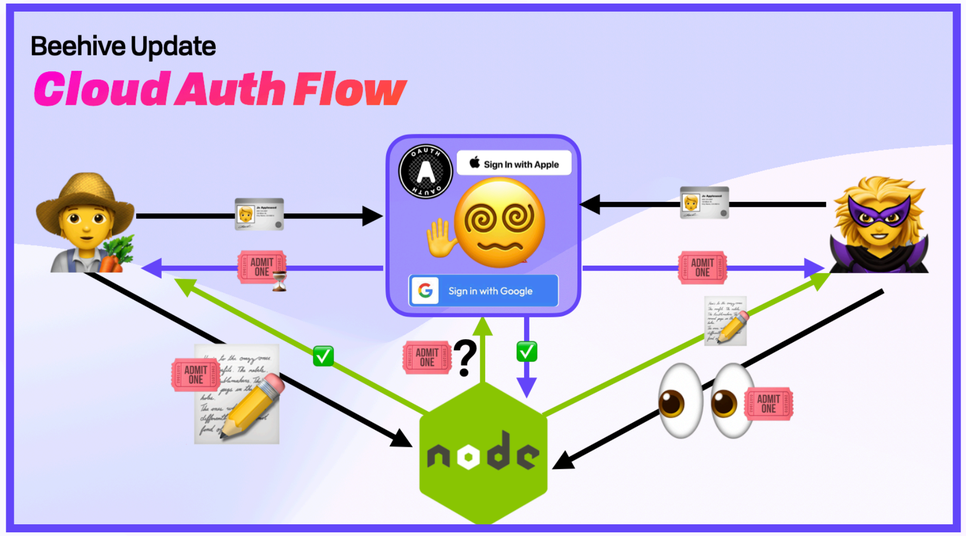
Self-Authenticating Changes



Access Control

Self-Authenticating Changes

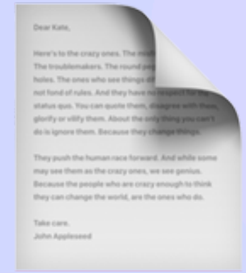


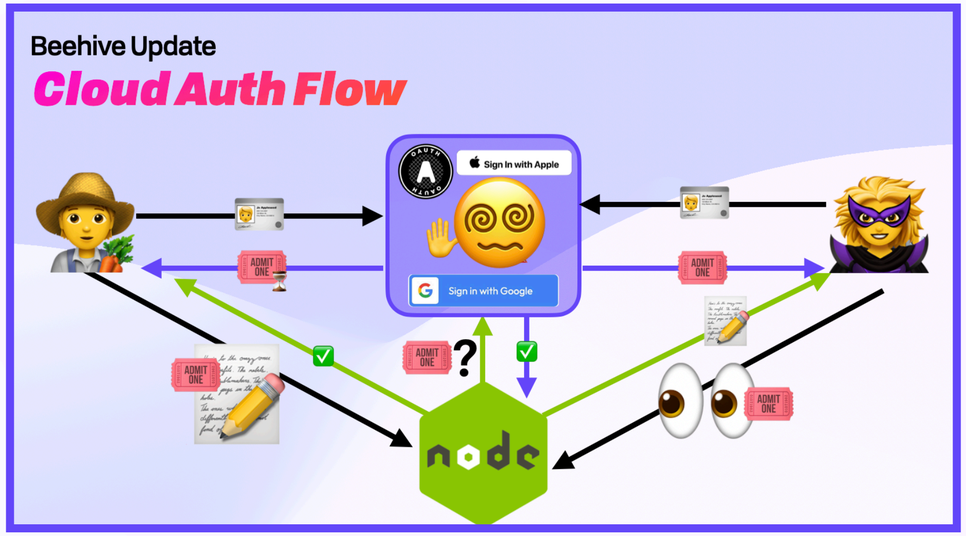


Access Control

Self-Authenticating Changes





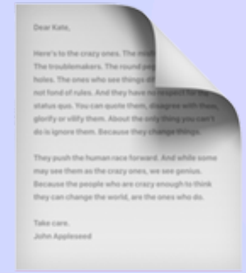


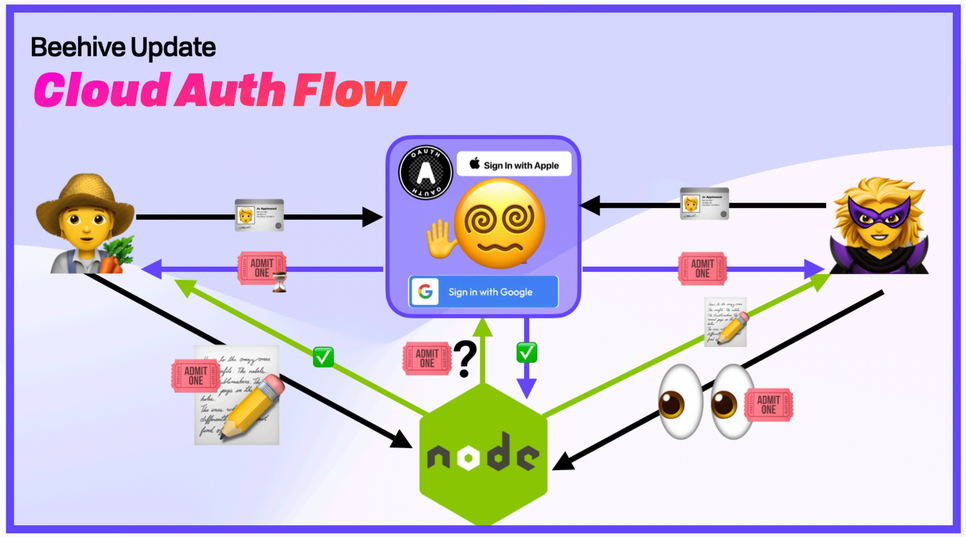
Access Control

Self-Authenticating Changes







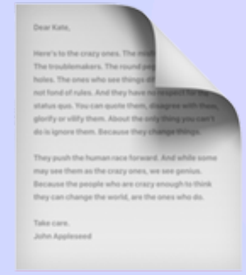


Access Control

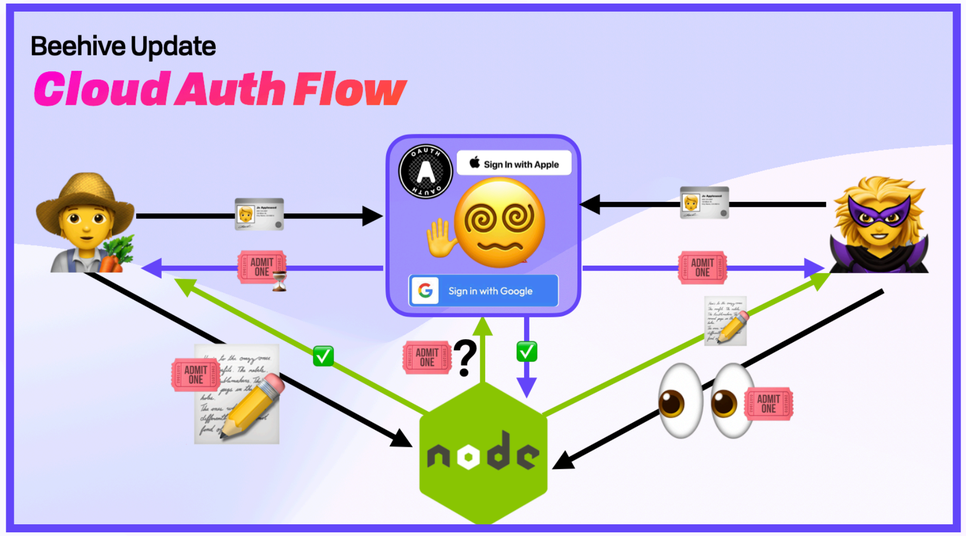
Self-Authenticating Changes









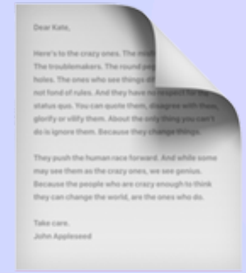


Access Control

Self-Authenticating Changes





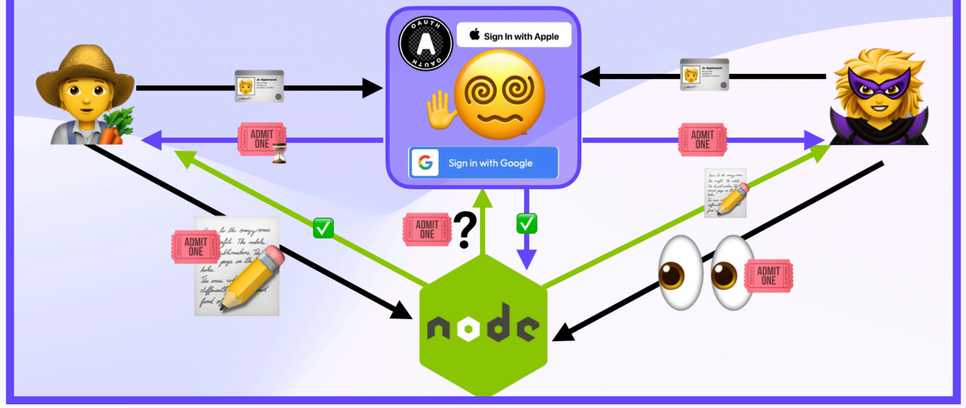






Beehive Update

Cloud Auth Flow



Access Control

Self-Authenticating Changes

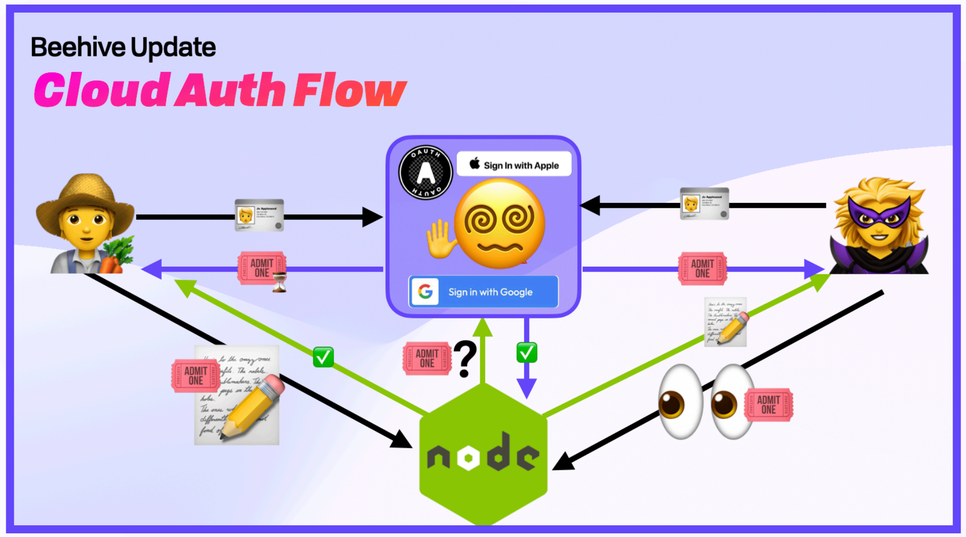












Access Control

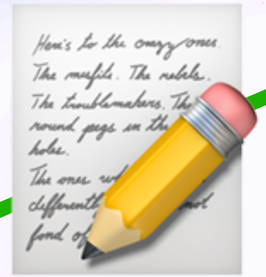
Self-Authenticating Changes



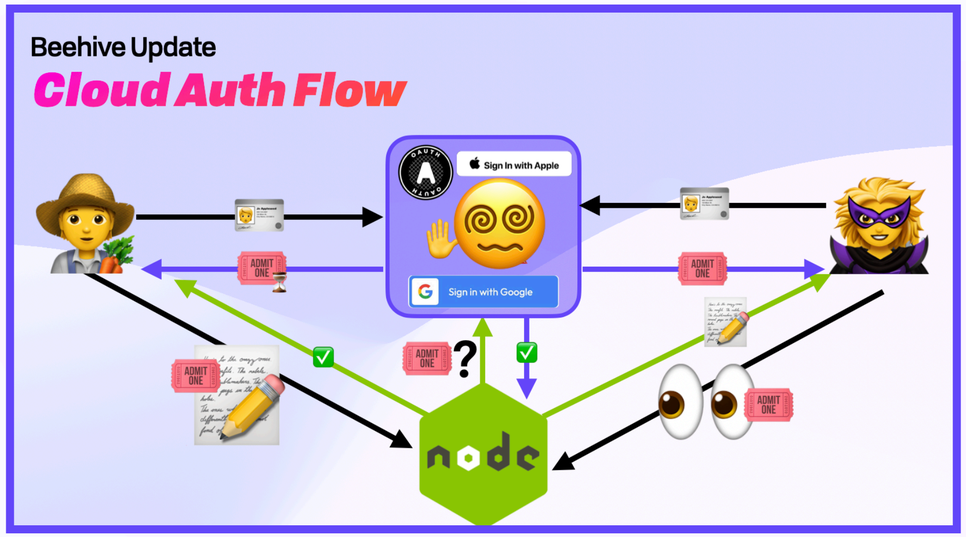












Access Control

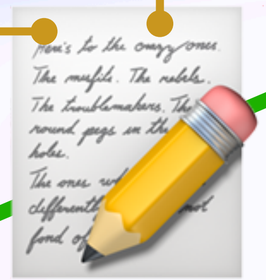
Self-Authenticating Changes



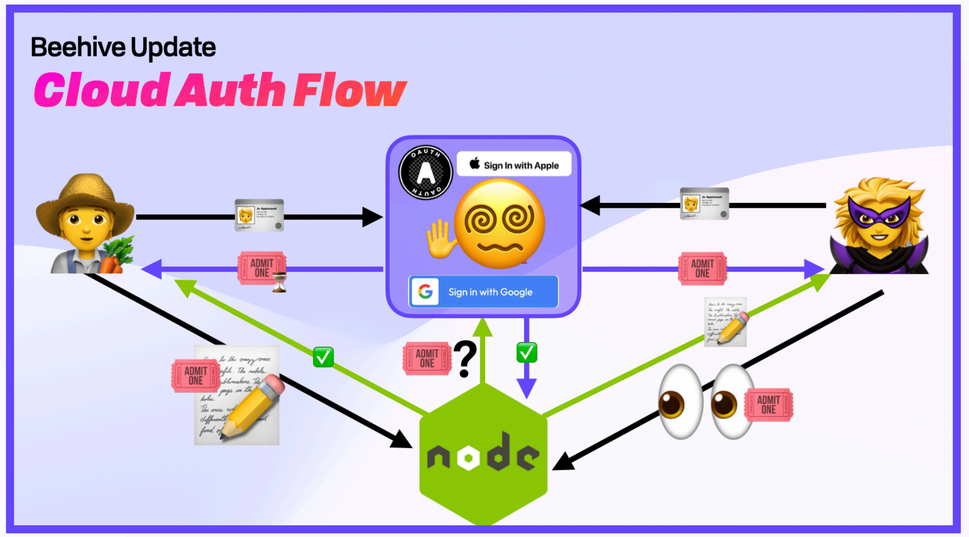






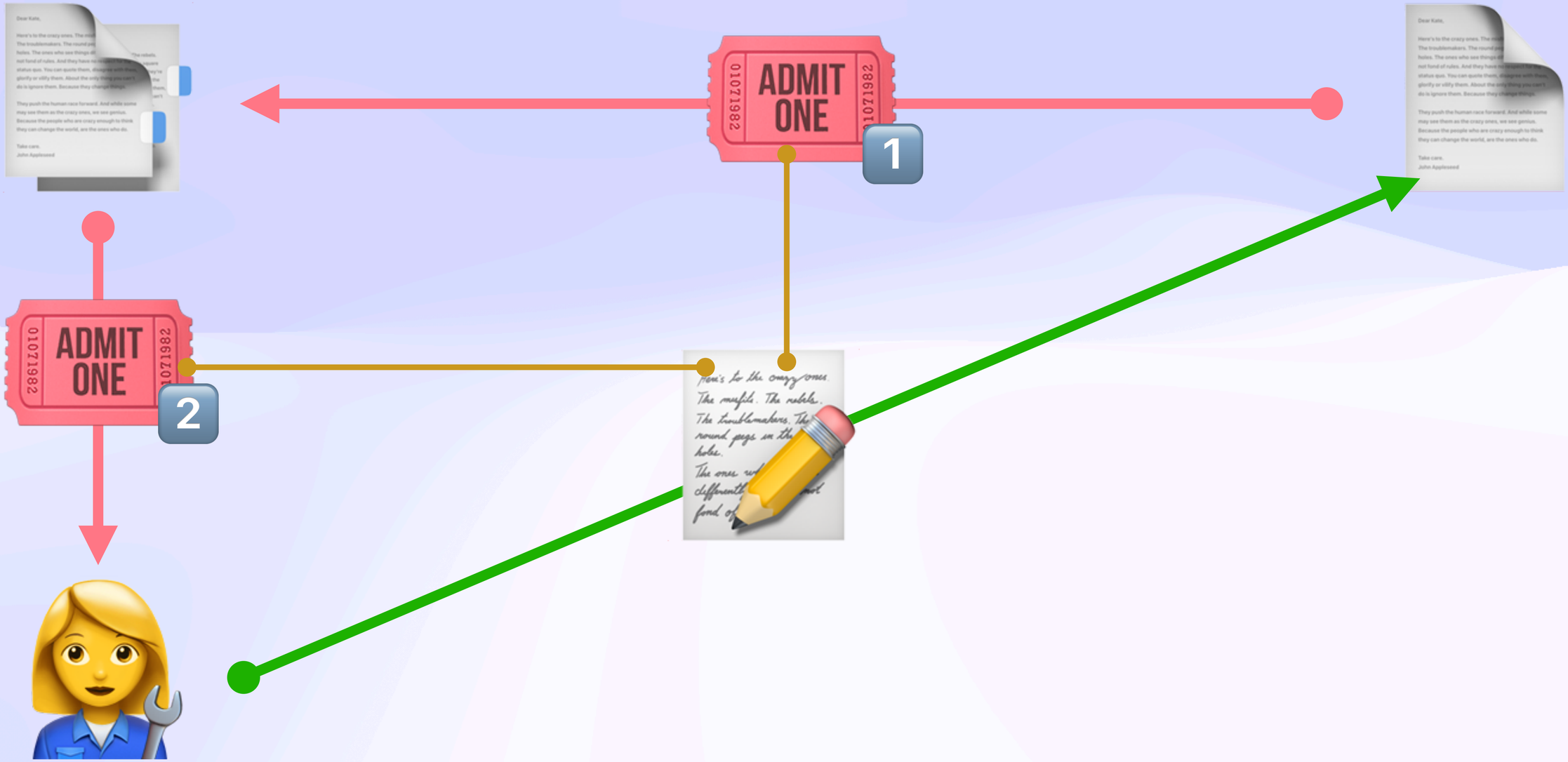






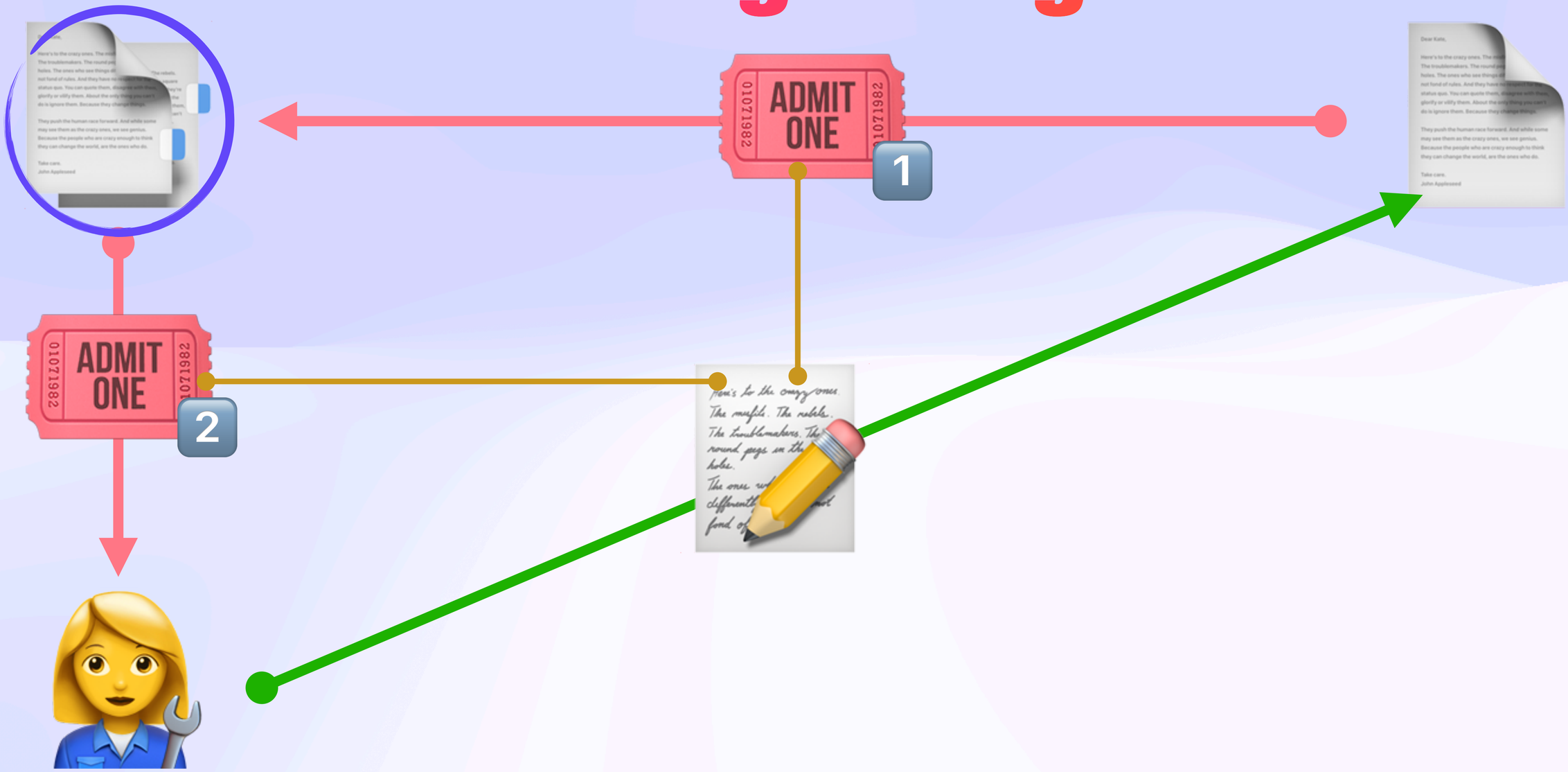
Access Control

Self-Authenticating Changes



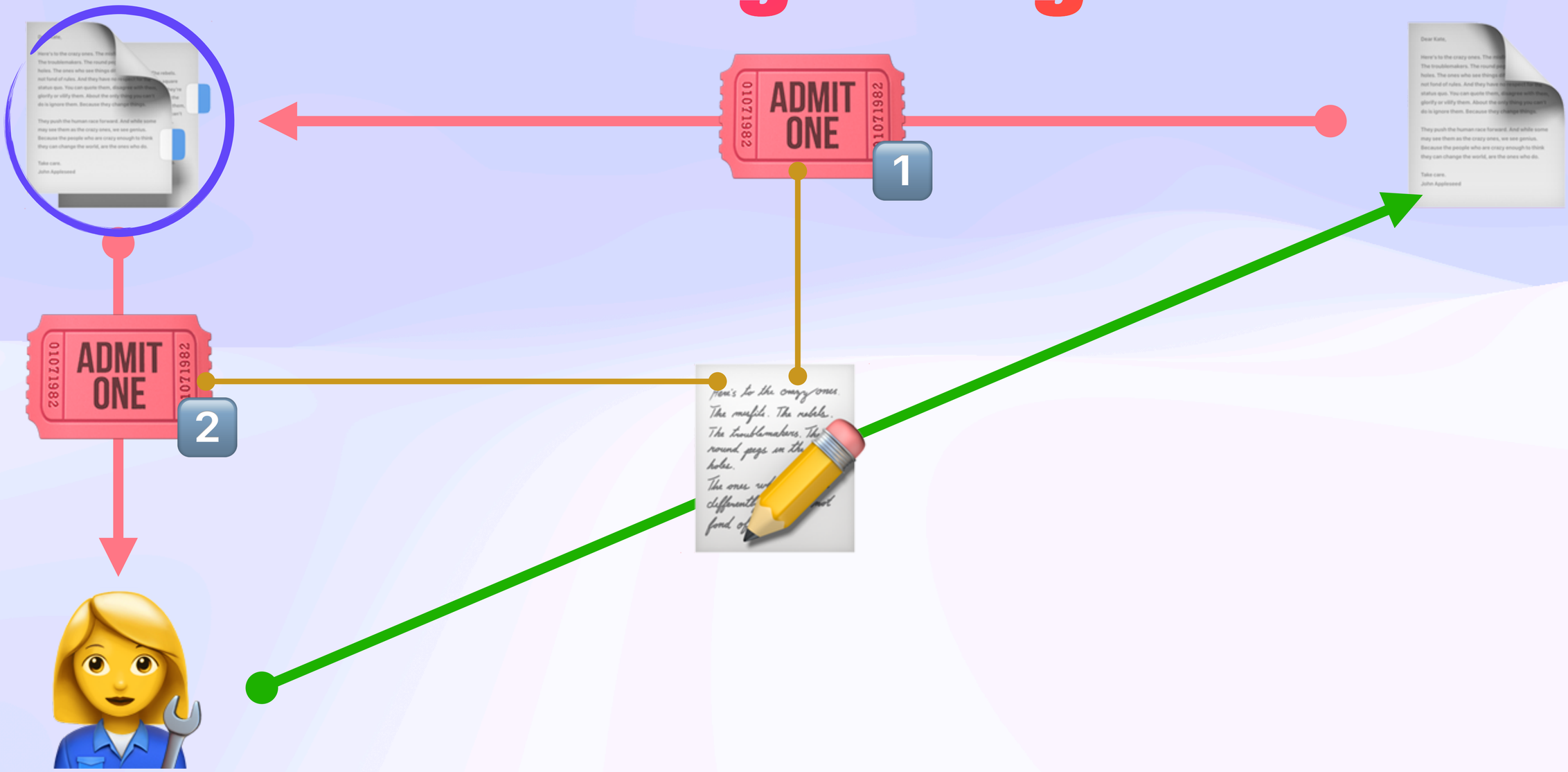
Access Control

Self-Authenticating Changes



Access Control

Self-Authenticating Changes



Access Control

JWT++


```
{
  "aud": "did:key:zStEZpzSMtTt9k2vszgvCwF4fLQQSyA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4",
  "iss": "did:key:z5C4fuP2DDJChhMBCwAkpYUMuJZdNWWH5NeYjUyY8btYfzDh3aHwT5picHr9Ttjq",

  "nbf": 1611204719,
  "exp": 1611300000,

  "fct": [
    {
      "sha256": "B94D27B9934D3E08A52E52D7DA7DABFAC484EFE37A5380EE9088F7ACE2EFCDE9",
      "msg": "hello world"
    }
  ]

  "att": [
    {
      "wnfs": "boris.fission.name/public/photos/",
      "cap": "OVERWRITE"
    },
    {
      "email": "boris@fission.codes",
      "cap": "SEND"
    }
  ],

  "prf": [
    "eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCIsInVhdiI6IjAuMS4wIn0.eyJhdWQiOiJkaWQ6a2V5Onp
  ]
}
```

Access Control

JWT++


```
{
  "aud": "did:key:zStEZpzSMtTt9k2vszgvCwF4fLQQSvA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4",
  "iss": "did:key:z5C4fuP2DDJChhMBCwAkpYUMuJZdNWWH5NeYjUyY8btYfzDh3aHwT5picHr9Ttjq",

  "nbf": 1611204719,
  "exp": 1611300000,

  "fct": [
    {
      "sha256": "B94D27B9934D3E08A52E52D7DA7DABFAC484EFE37A5380EE9088F7ACE2EFCDE9",
      "msg": "hello world"
    }
  ]

  "att": [
    {
      "wnfs": "boris.fission.name/public/photos/",
      "cap": "OVERWRITE"
    },
    {
      "email": "boris@fission.codes",
      "cap": "SEND"
    }
  ],

  "prf": [
    "eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCIsInVhdiI6IjAuMS4wIn0.eyJhdWQiOiJkaWQ6a2V5Onp
  ]
}
```

Access Control

JWT++


```
{
  "aud": "did:key:zStEZpzSMtTt9k2vszgvCwF4fLQQSvA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4",
  "iss": "did:key:z5C4fuP2DDJChhMBCwAkpYUMuJZdNWWH5NeYjUyY8btYfzDh3aHwT5picHr9Ttjq",

  "nbf": 1611204719,
  "exp": 1611300000,

  "fct": [
    {
      "sha256": "B94D27B9934D3E08A52E52D7DA7DABFAC484EFE37A5380EE9088F7ACE2EFCDE9",
      "msg": "hello world"
    }
  ]

  "att": [
    {
      "wnfs": "boris.fission.name/public/photos/",
      "cap": "OVERWRITE"
    },
    {
      "email": "boris@fission.codes",
      "cap": "SEND"
    }
  ],

  "prf": [
    "eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCIsInVhdiI6IjAuMS4wIn0.eyJhdWQiOiJkaWQ6a2V5Onp
  ]
}
```

Access Control

JWT++


```
{
  "aud": "did:key:zStEZpzSMtTt9k2vszgvCwF4fLQQSvA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4",
  "iss": "did:key:z5C4fuP2DDJChhMBCwAkpYUMuJZdNWWH5NeYjUyY8btYfzDh3aHwT5picHr9Ttjq",

  "nbf": 1611204719,
  "exp": 1611300000,

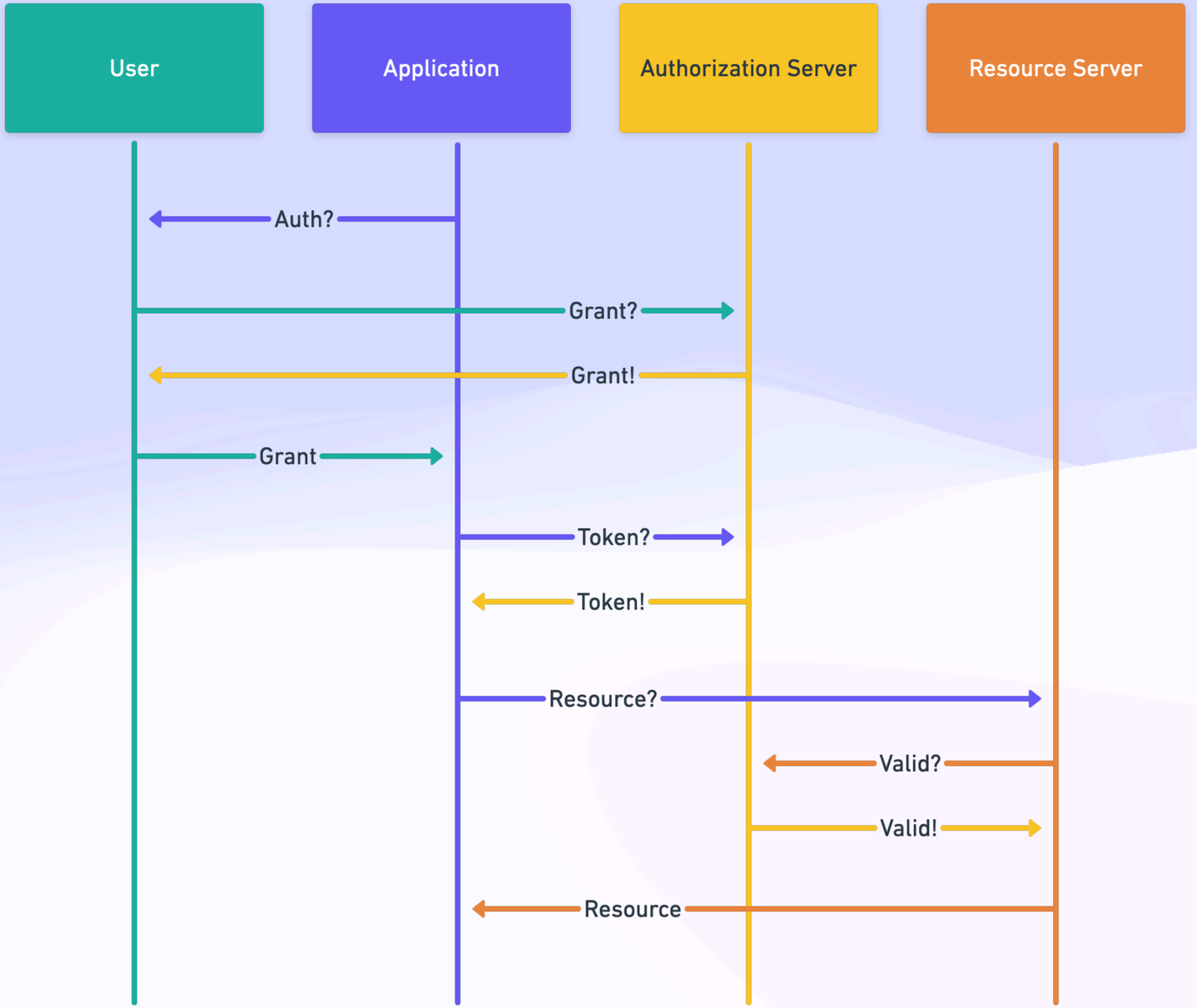
  "fct": [
    {
      "sha256": "B94D27B9934D3E08A52E52D7DA7DABFAC484EFE37A5380EE9088F7ACE2EFCDE9",
      "msg": "hello world"
    }
  ]

  "att": [
    {
      "wnfs": "boris.fission.name/public/photos/",
      "cap": "OVERWRITE"
    },
    {
      "email": "boris@fission.codes",
      "cap": "SEND"
    }
  ],

  "prf": [
    "eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCIsInVhdiI6IjAuMS4wIn0.eyJhdWQiOiJkaWQ6a2V5Onp
  ]
}
```

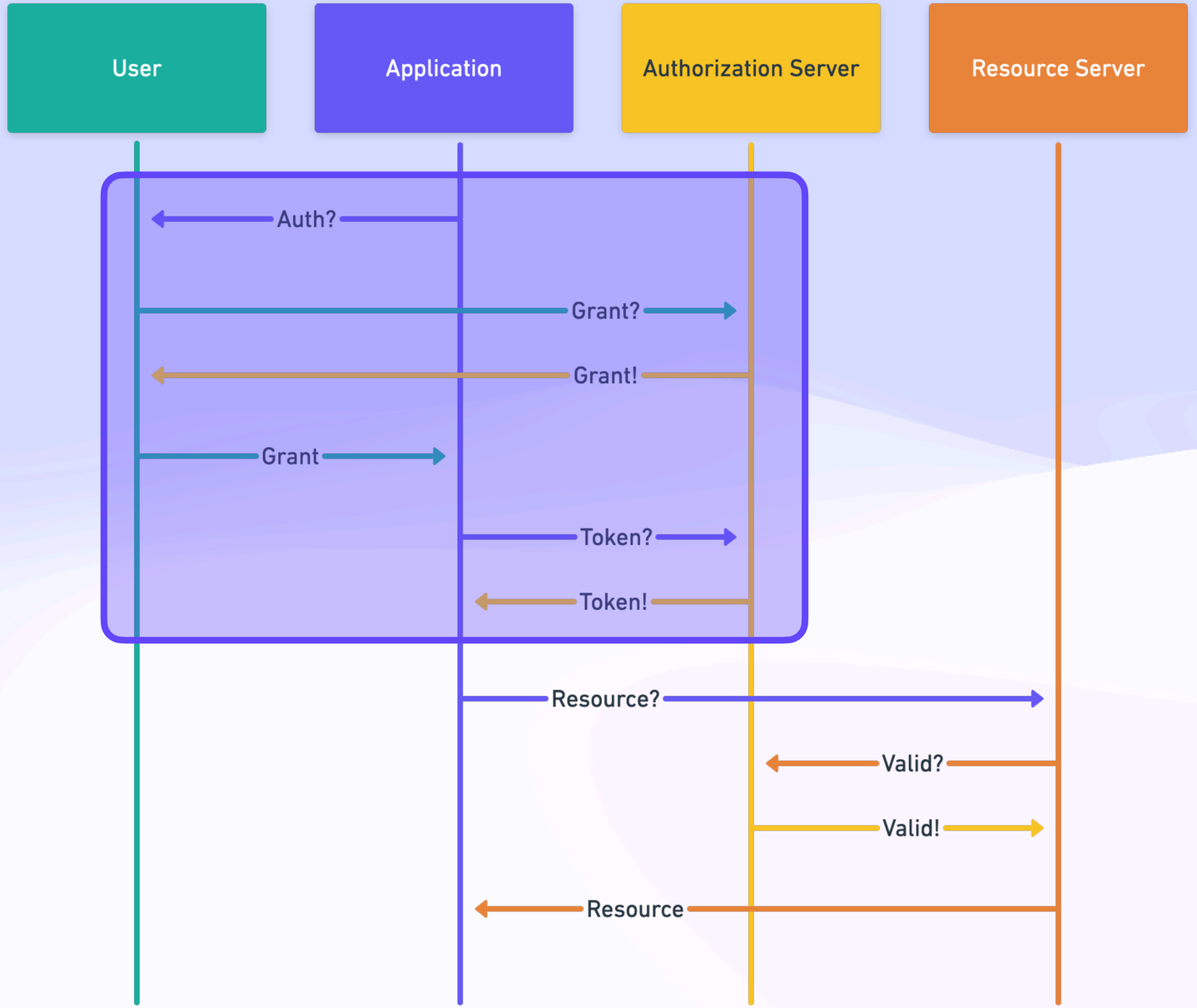
Access Control

OAuth Sequence



Access Control

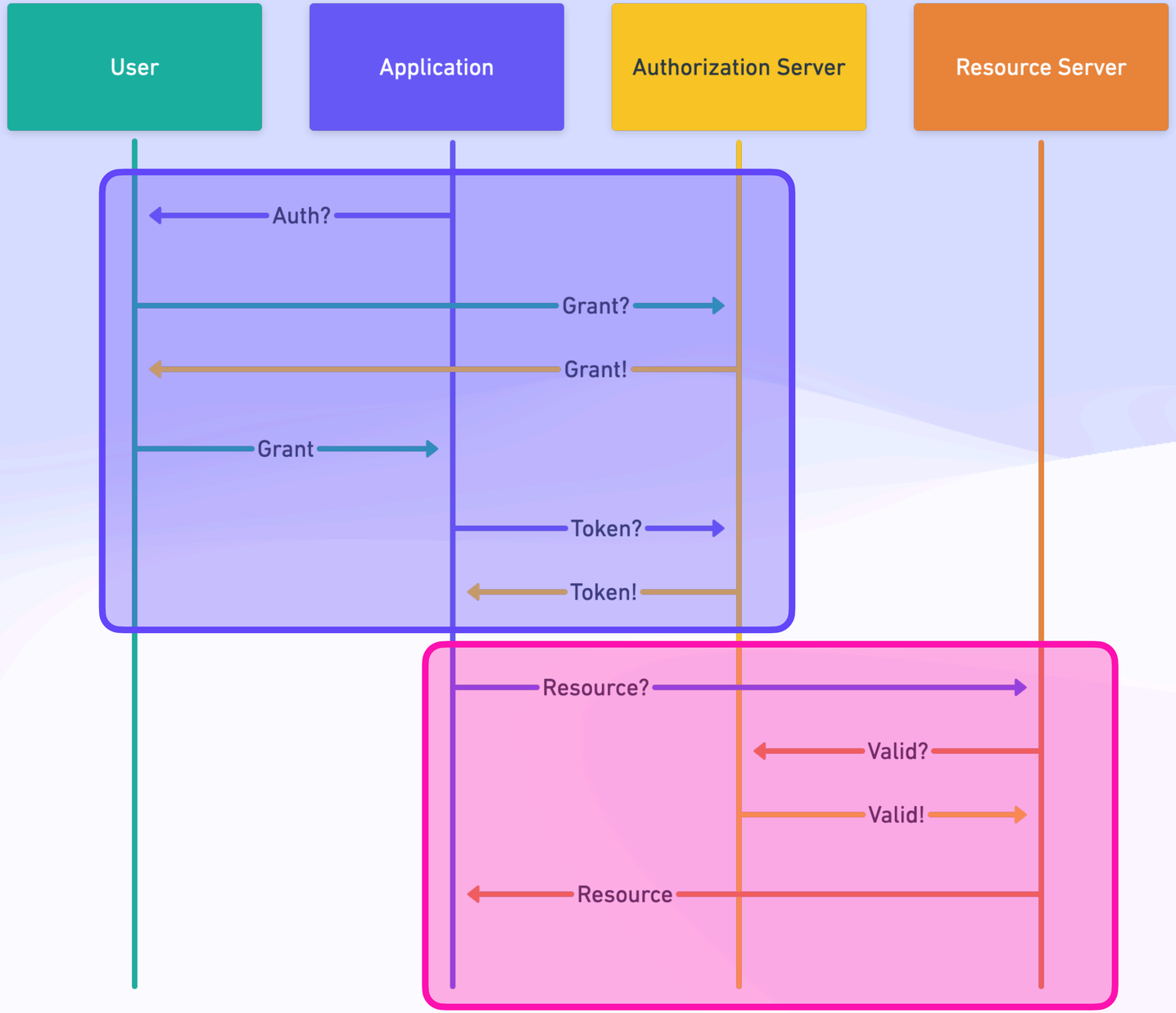
OAuth Sequence



Access Control

OAuth Sequence

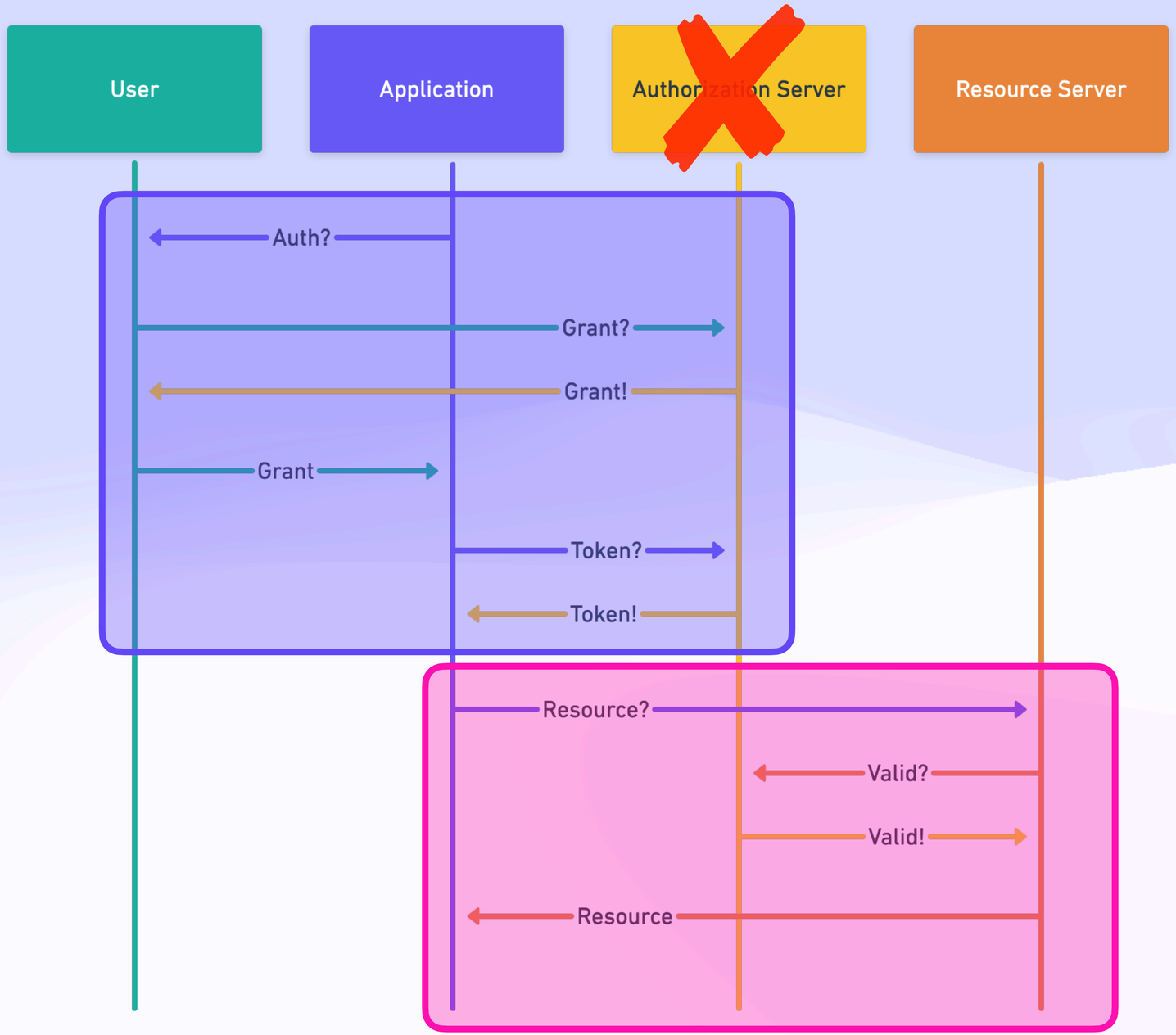




Access Control

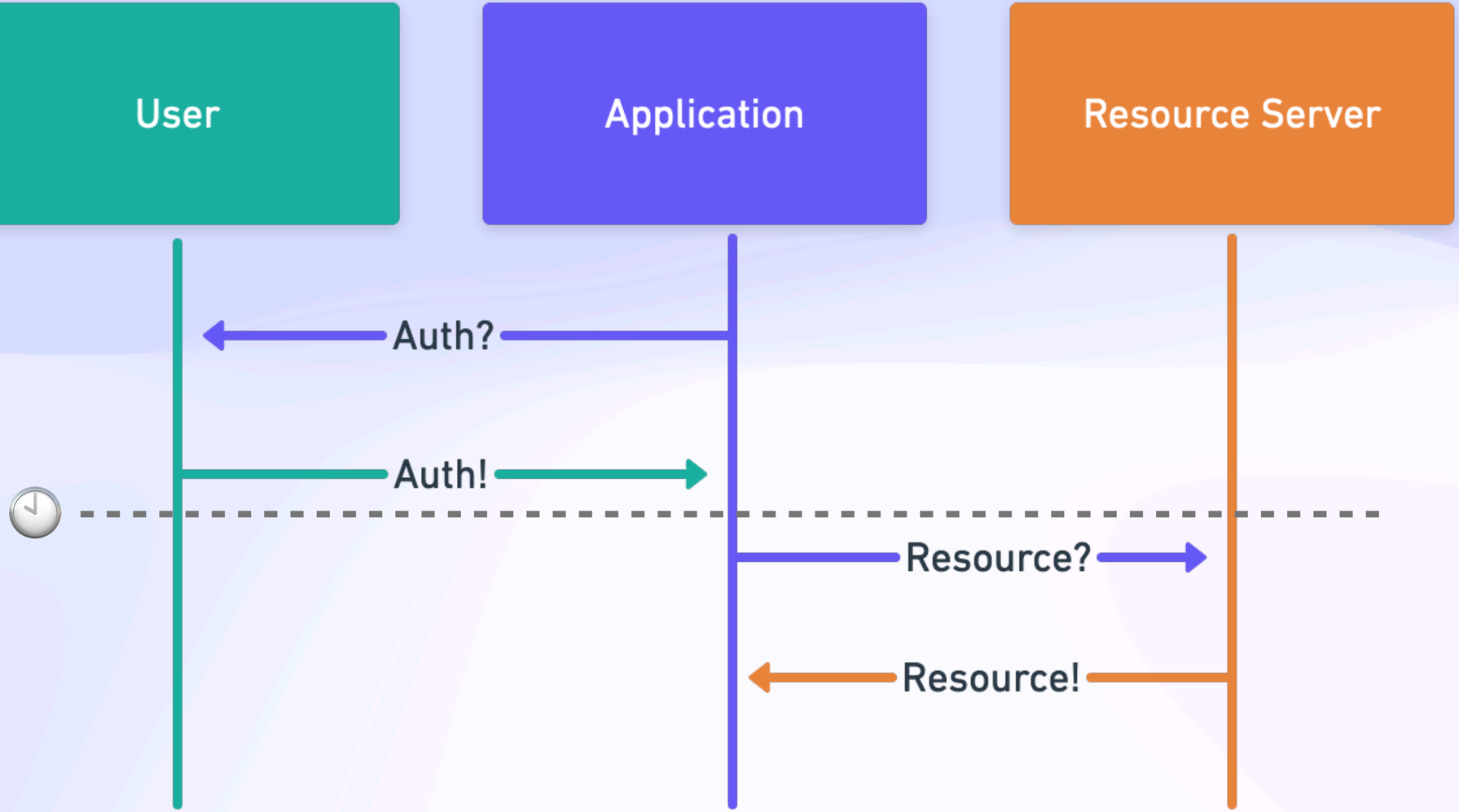
OAuth Sequence





Access Control

UCAN Sequence



Access Control

UCAN Sequence





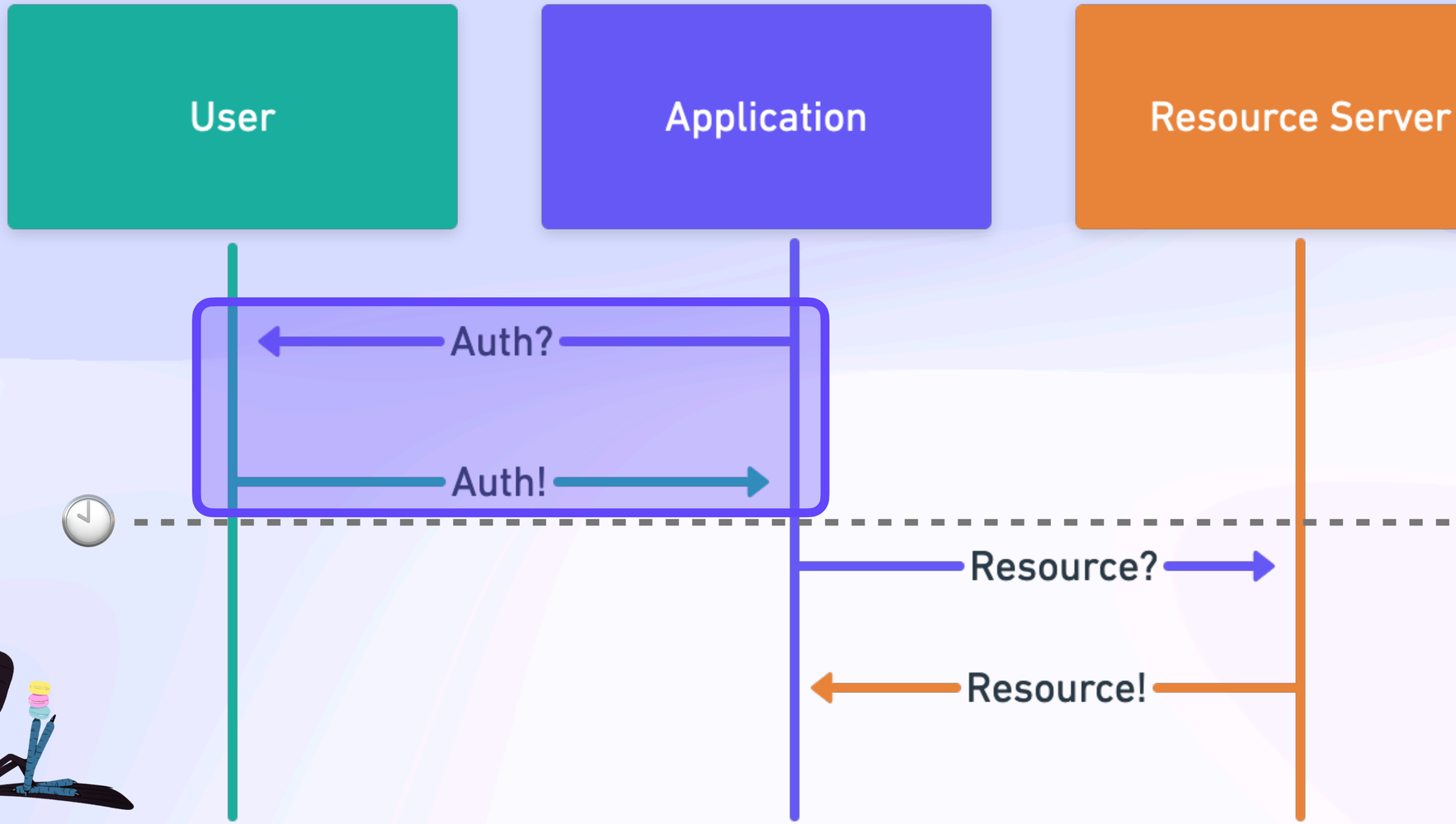


Access Control

UCAN Sequence





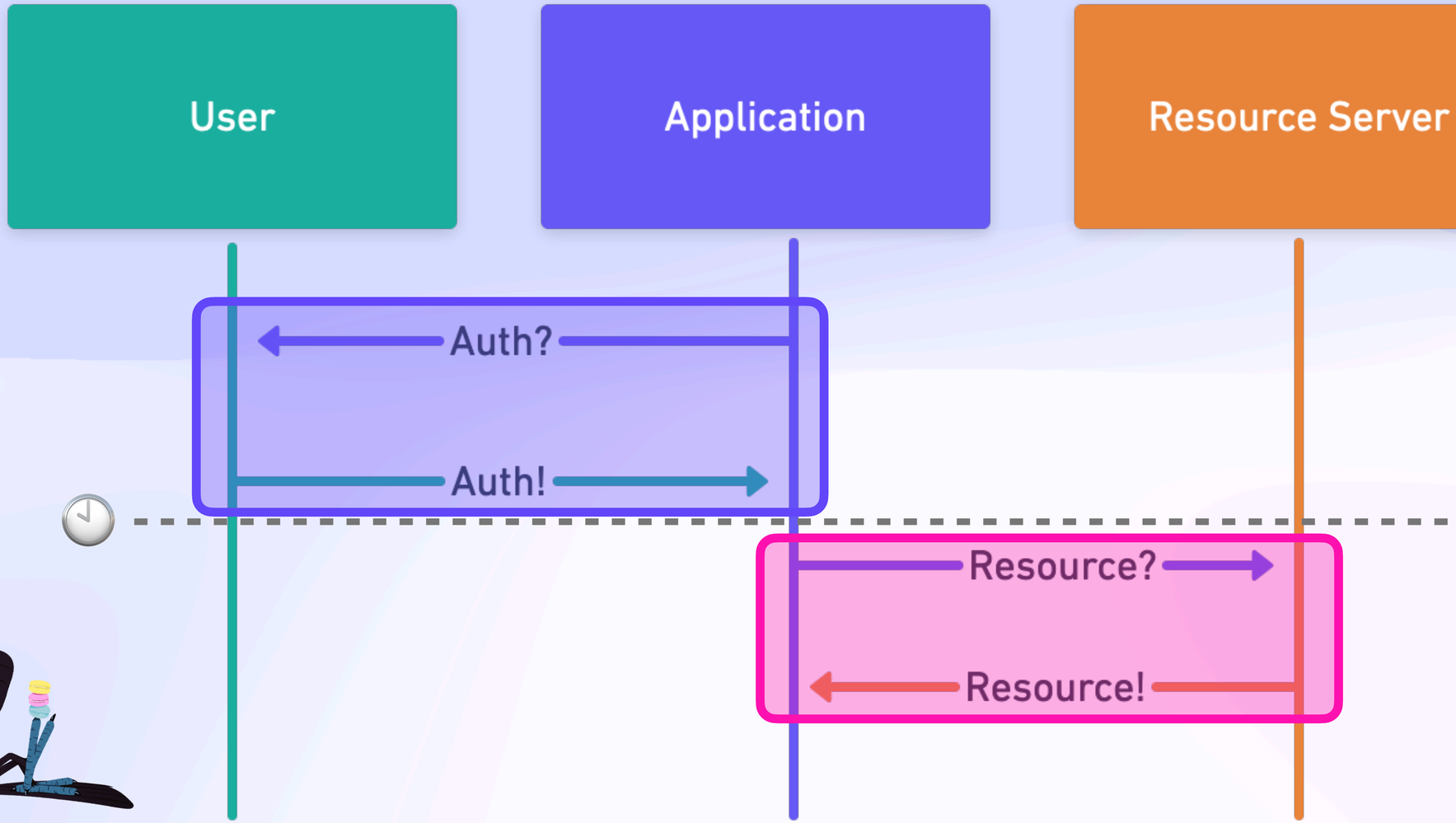


Access Control

UCAN Sequence







Goodbye Cloud, Hello Crowd

Universal Compute



Compute Substrate

Code-as-Data

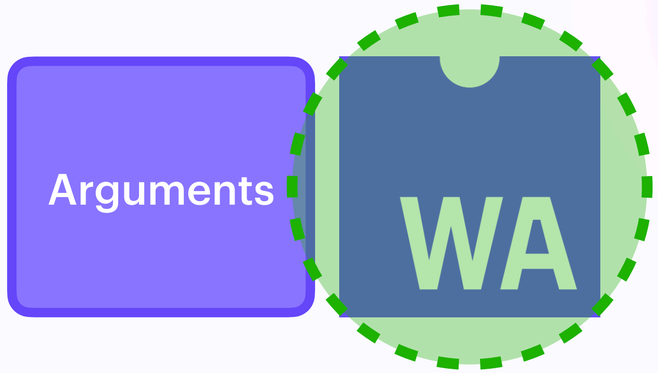
Compute Substrate

Code-as-Data



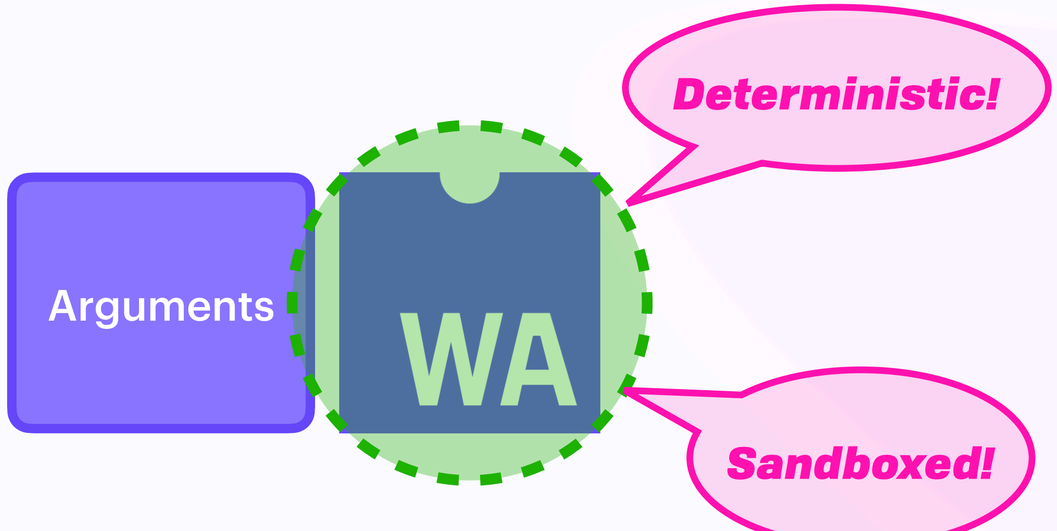
Compute Substrate

Code-as-Data



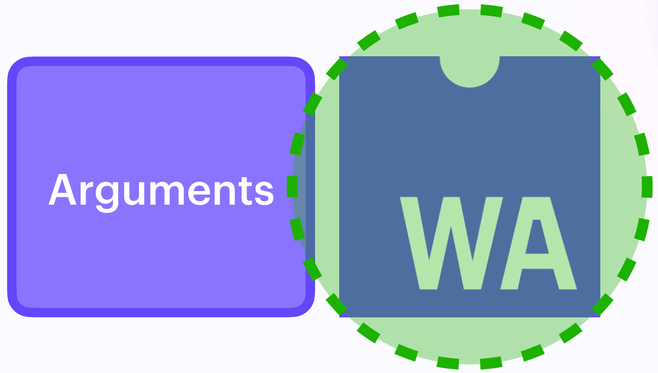
Compute Substrate

Code-as-Data



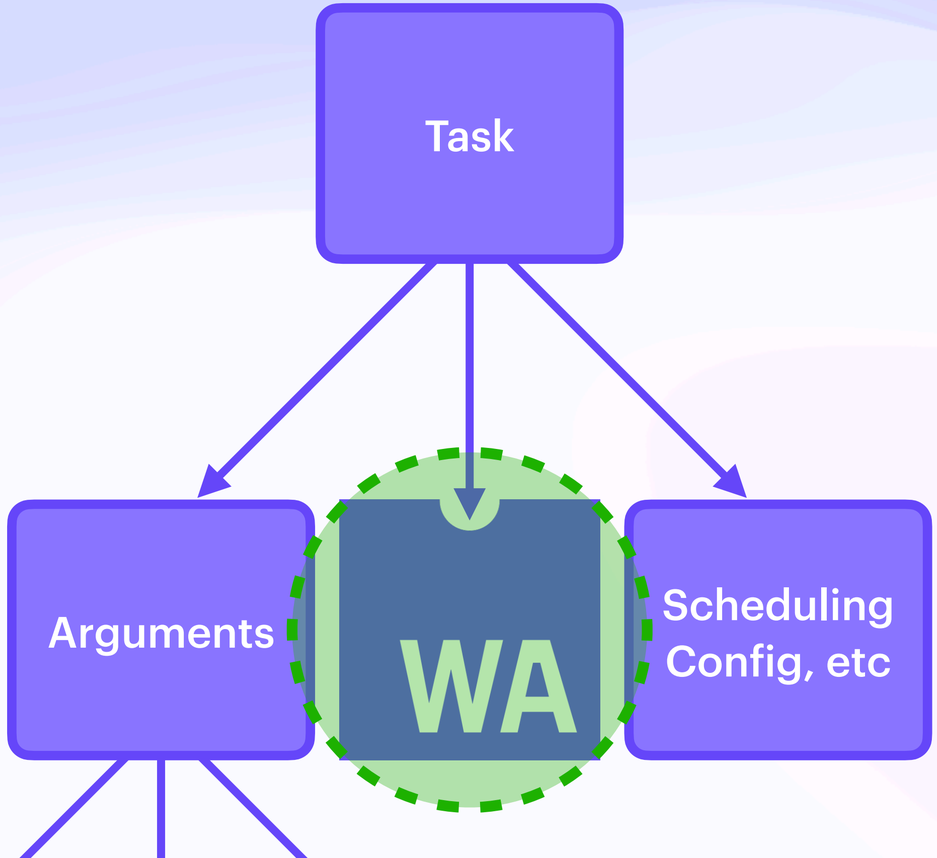
Compute Substrate

Code-as-Data



Compute Substrate

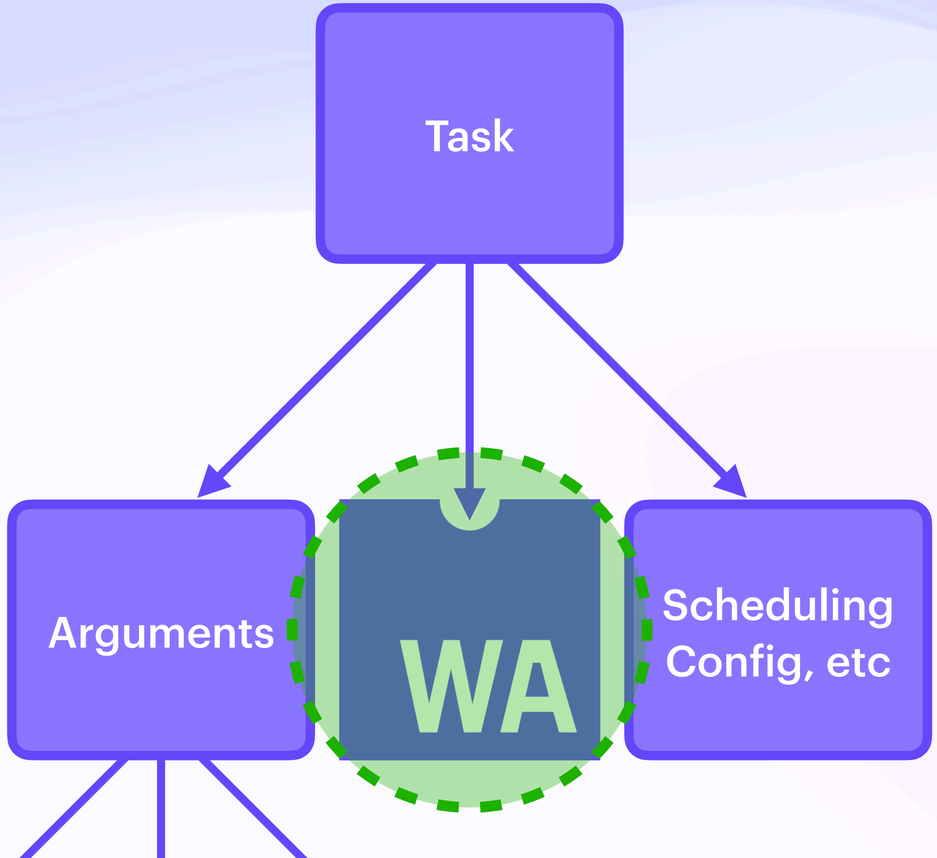
Code-as-Data



Compute Substrate

Code-as-Data

```
const message = () ⇒ alert("hello world")
```

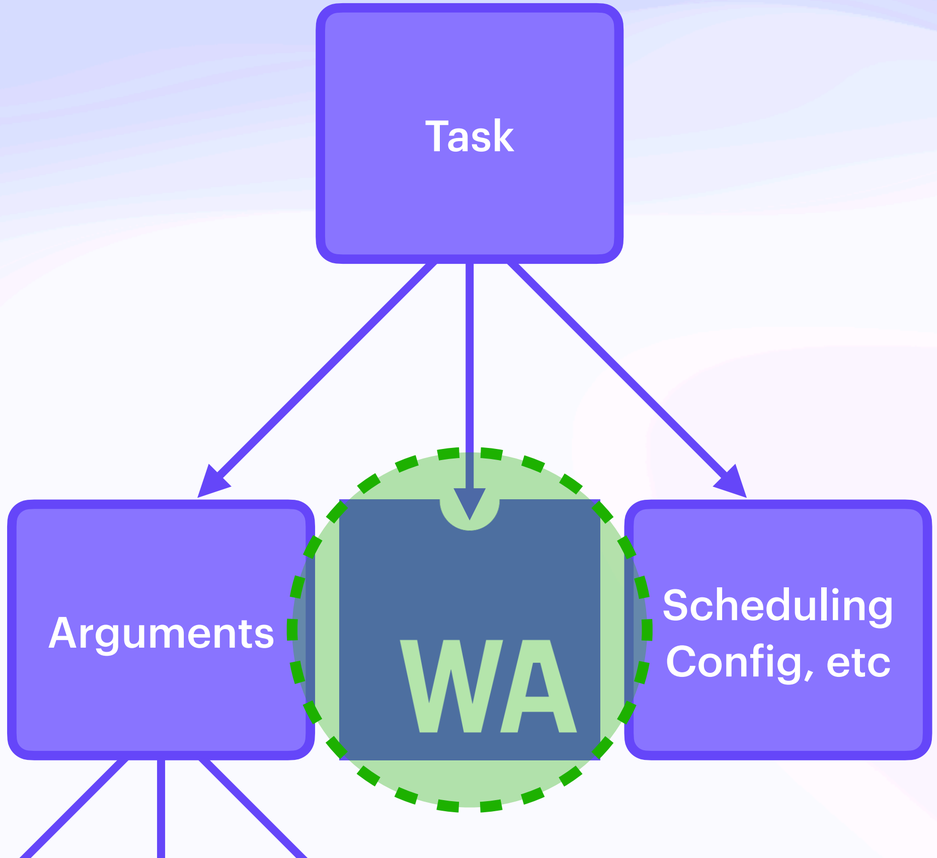


Compute Substrate

Code-as-Data

```
const message = () ⇒ alert("hello world")

message // Nothing happens
```



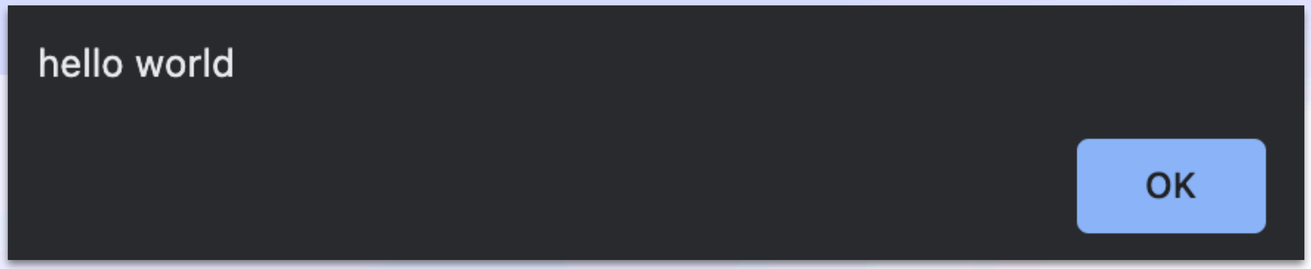
Compute Substrate

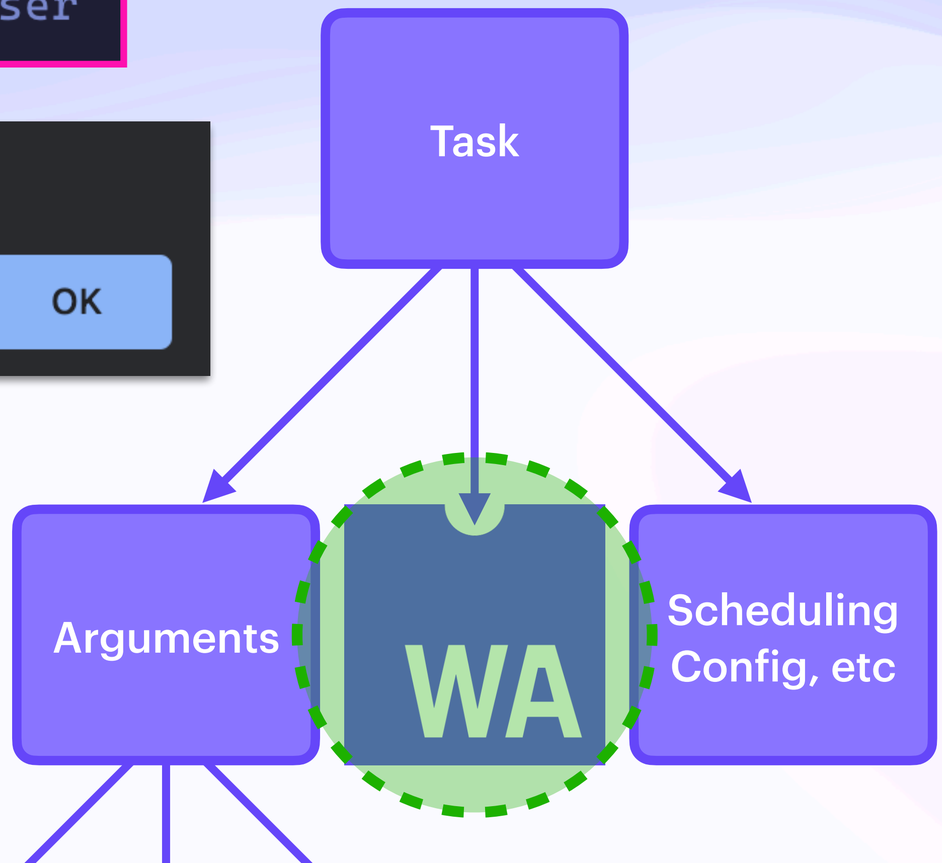
Code-as-Data

```
const message = () ⇒ alert("hello world")

message // Nothing happens

message() // A message interrupts the user
```





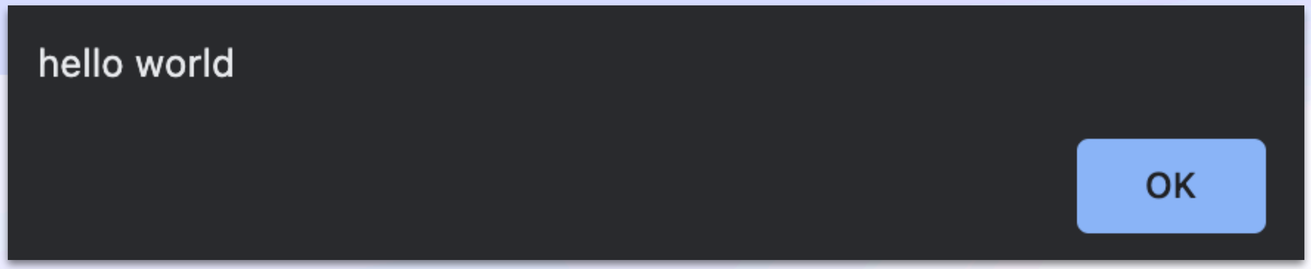
Compute Substrate

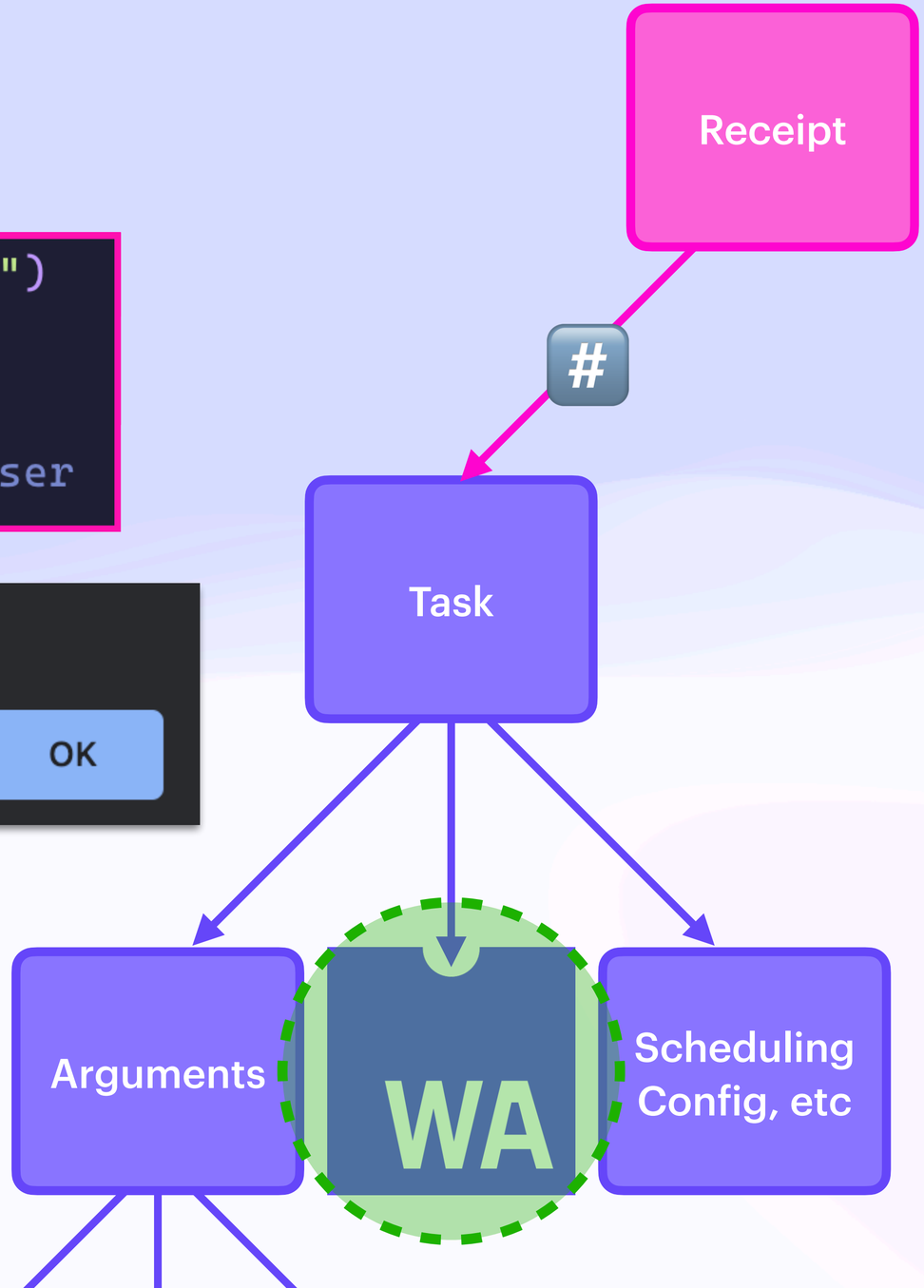
Code-as-Data

```
const message = () ⇒ alert("hello world")

message // Nothing happens

message() // A message interrupts the user
```





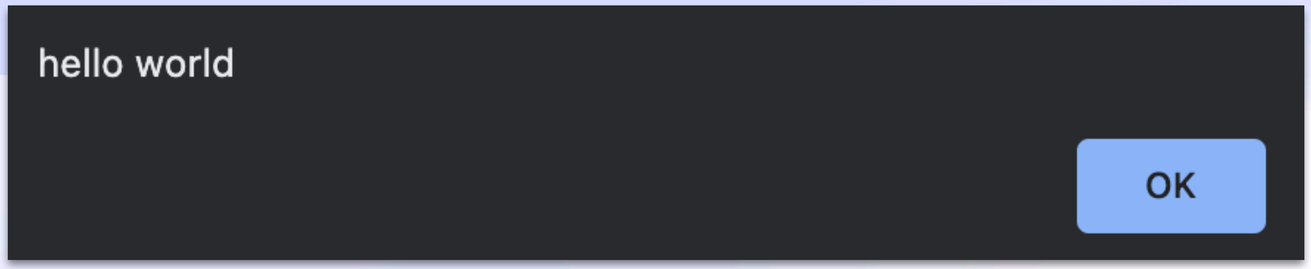
Compute Substrate

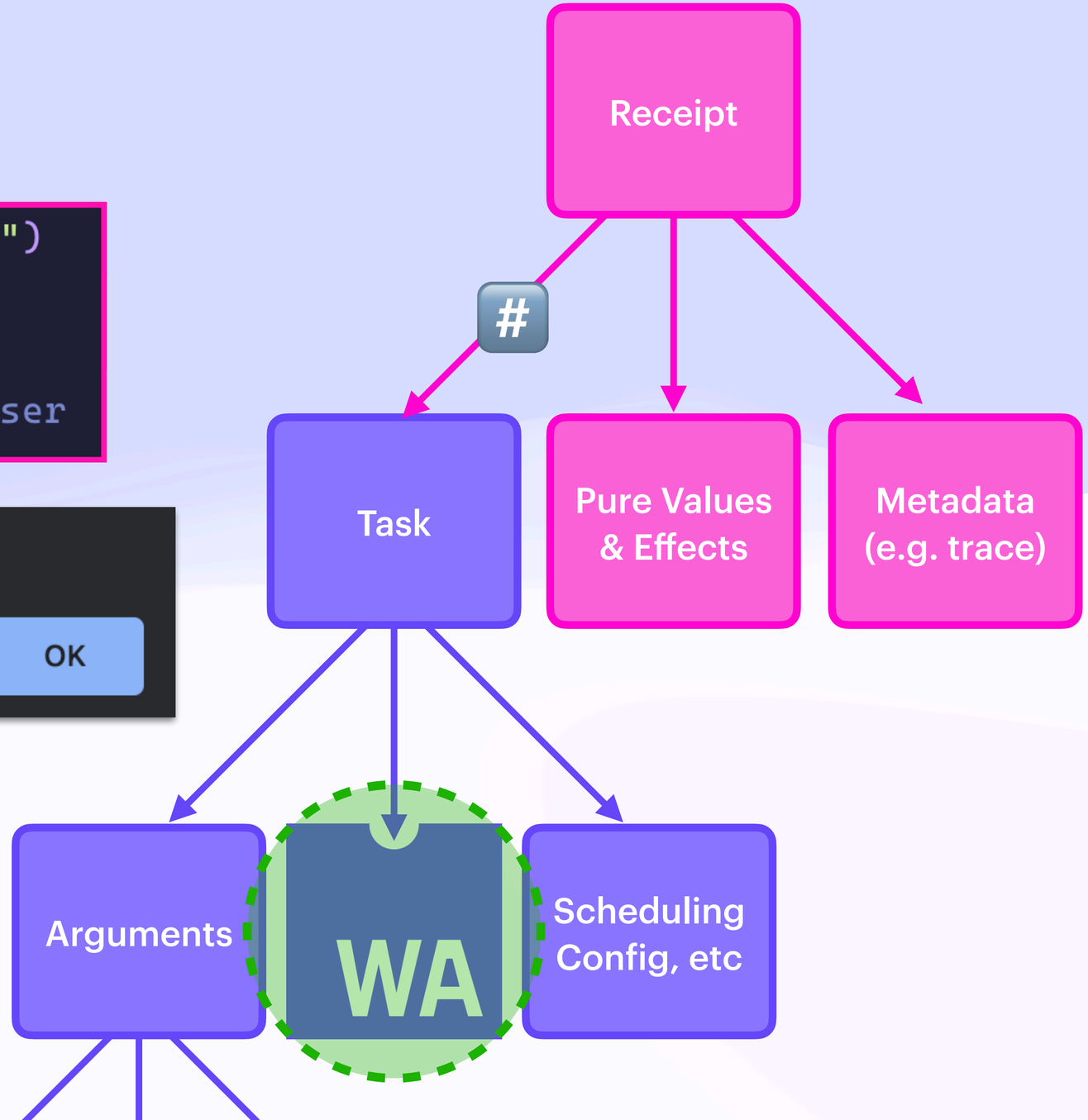
Code-as-Data

```
const message = () ⇒ alert("hello world")

message // Nothing happens

message() // A message interrupts the user
```





Compute Substrate

Distributed Invocation

Compute Substrate

Distributed Invocation

```
{
    "uri": "ipfs://bafkreibmj5zo6x2g7kuzcqpsikr5q34rnzgbjkxk6rjf5ibu5szmx74hxy",
    "call": "wasm/run",
    "input": {
        "func": "add_one",
        "args": [42]
    }
}
```

Compute Substrate

Distributed Invocation

```
{
    "uri": "ipfs://bafkreibmj5zo6x2g7kuzcqpsikr5q34rnzgbjkxk6rjf5ibu5szmx74hxy",
    "call": "wasm/run",
    "input": {
        "func": "add_one",
        "args": [42]
    }
}
```

```
{
    "uri": "ipfs://bafkreibmj5zo6x2g7kuzcqpsikr5q34rnzgbjkxk6rjf5ibu5szmx74hxy",
    "call": "wasm/run",
    "input": {
        "func": "add_one",
        "args": [{"await/ok": {"/": "bafkreiauharffox63dv2iakndymassol3ryznr32tqii6ijw6ter3ksleu"}}]
    }
}
```

Compute Substrate

Distributed Invocation

```
{
    "uri": "ipfs://bafkreibmj5zo6x2g7kuzcqpsikr5q34rnzgbjkxk6rjf5ibu5szmx74hxy",
    "call": "wasm/run",
    "input": {
        "func": "add_one",
        "args": [42]
    }
}
```

```
{
    "uri": "ipfs://bafkreibmj5zo6x2g7kuzcqpsikr5q34rnzgbjkxk6rjf5ibu5szmx74hxy",
    "call": "wasm/run",
    "input": {
        "func": "add_one",
        "args": [{"await/ok" {"/": "bafkreiauharffox63dv2iakndymassol3ryznr32tqii6ijw6ter3ksleu"}}]
    }
}
```

Compute Substrate

Distributed Invocation

```
{
    "uri": "ipfs://bafkreibmj5zo6x2g7kuzcqpsikr5q34rnzgbjkxk6rjf5ibu5szmx74hxy",
    "call": "wasm/run",
    "input": {
        "func": "add_one",
        "args": [42]
    }
}
```

```
{
    "uri": "ipfs://bafkreibmj5zo6x2g7kuzcqpsikr5q34rnzgbjkxk6rjf5ibu5szmx74hxy",
    "call": "wasm/run",
    "input": {
        "func": "add_one",
        "args": [{"await/ok": {"/": "bafkreiauharffox63dv2iakndymassol3ryznr32tqii6ijw6ter3ksleu"}}]
    }
}
```

Compute Substrate

Distributed Invocation

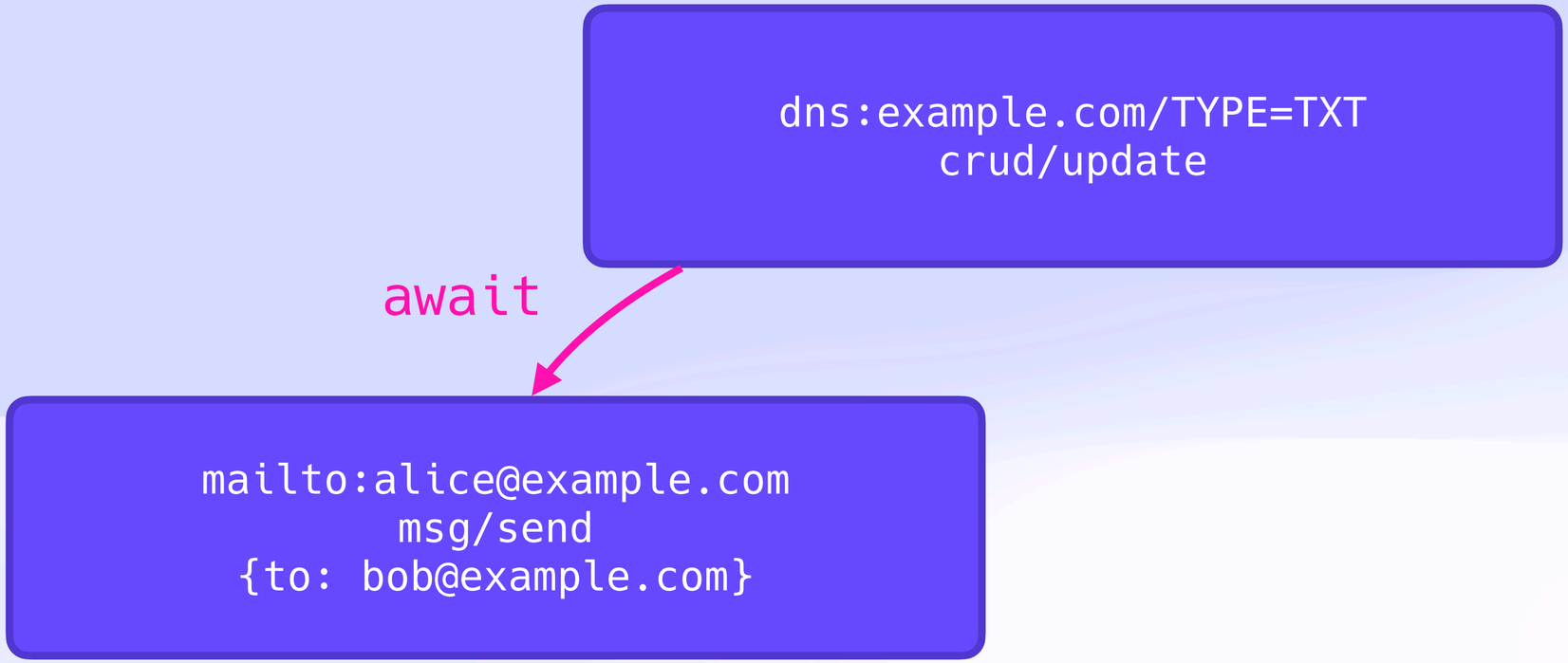
Compute Substrate

Distributed Invocation

```
dns:example.com/TYPE=TXT
crud/update
```

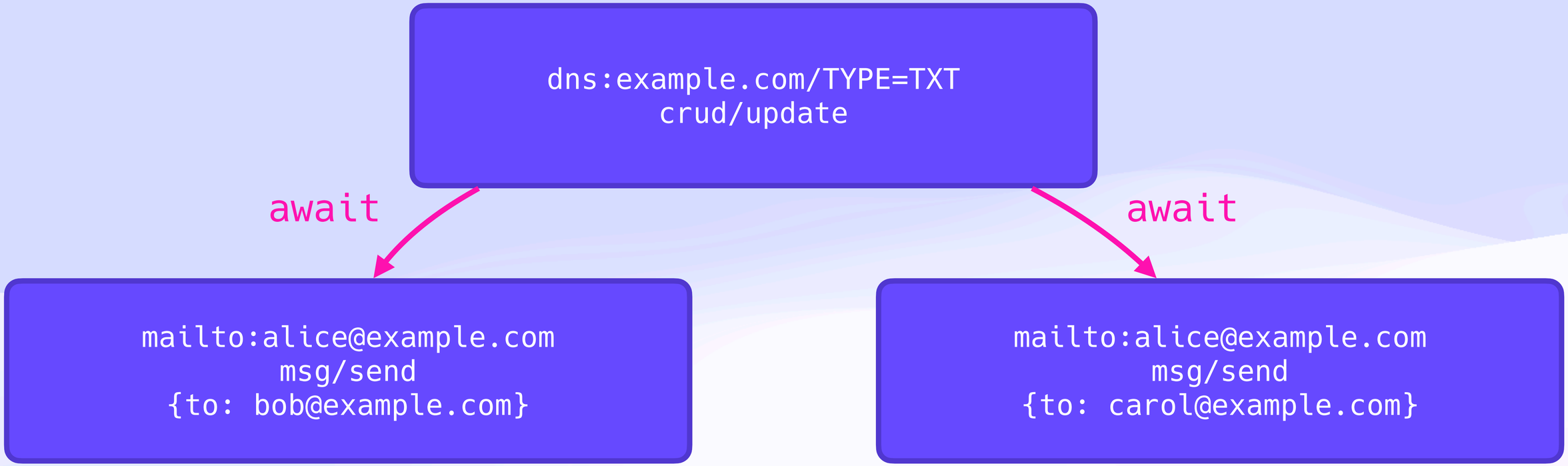
Compute Substrate

Distributed Invocation



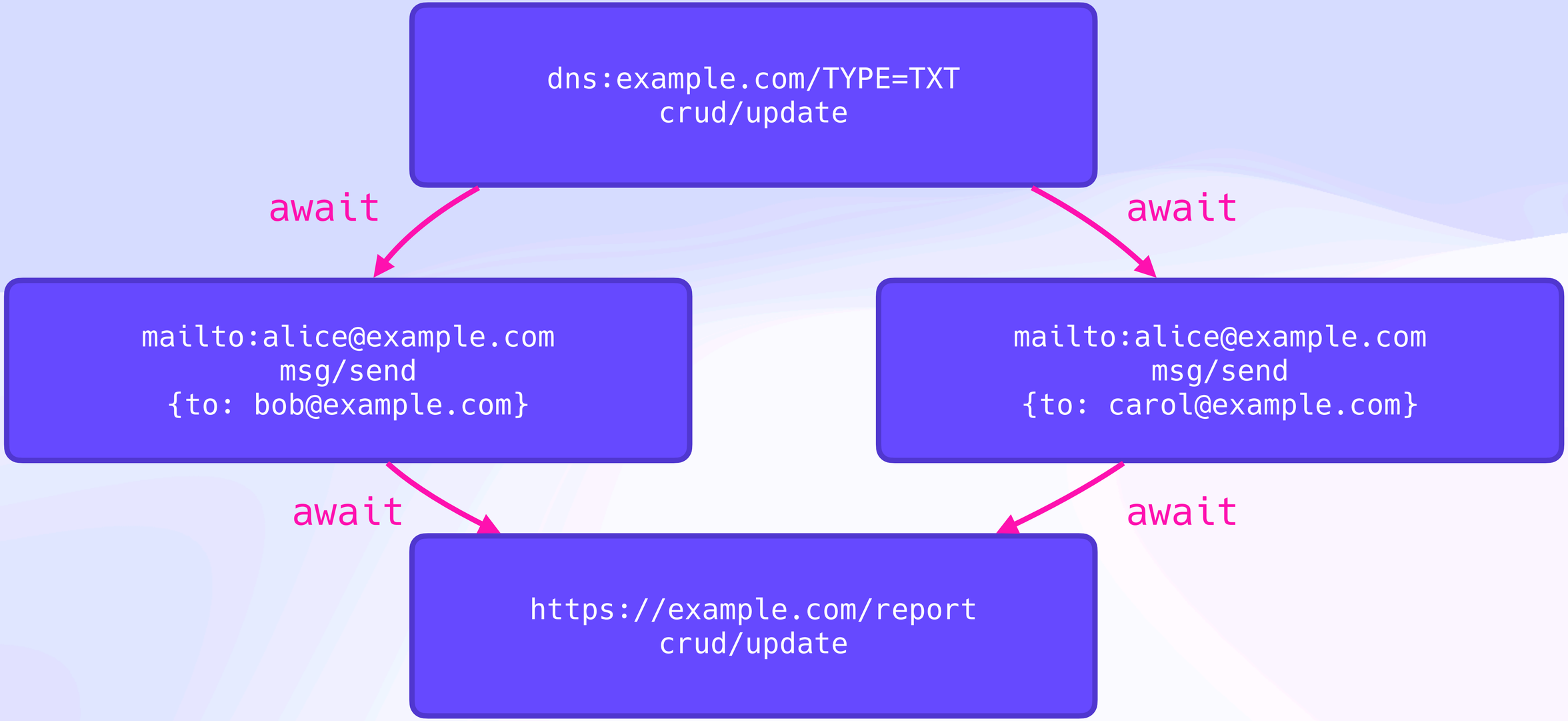
Compute Substrate

Distributed Invocation



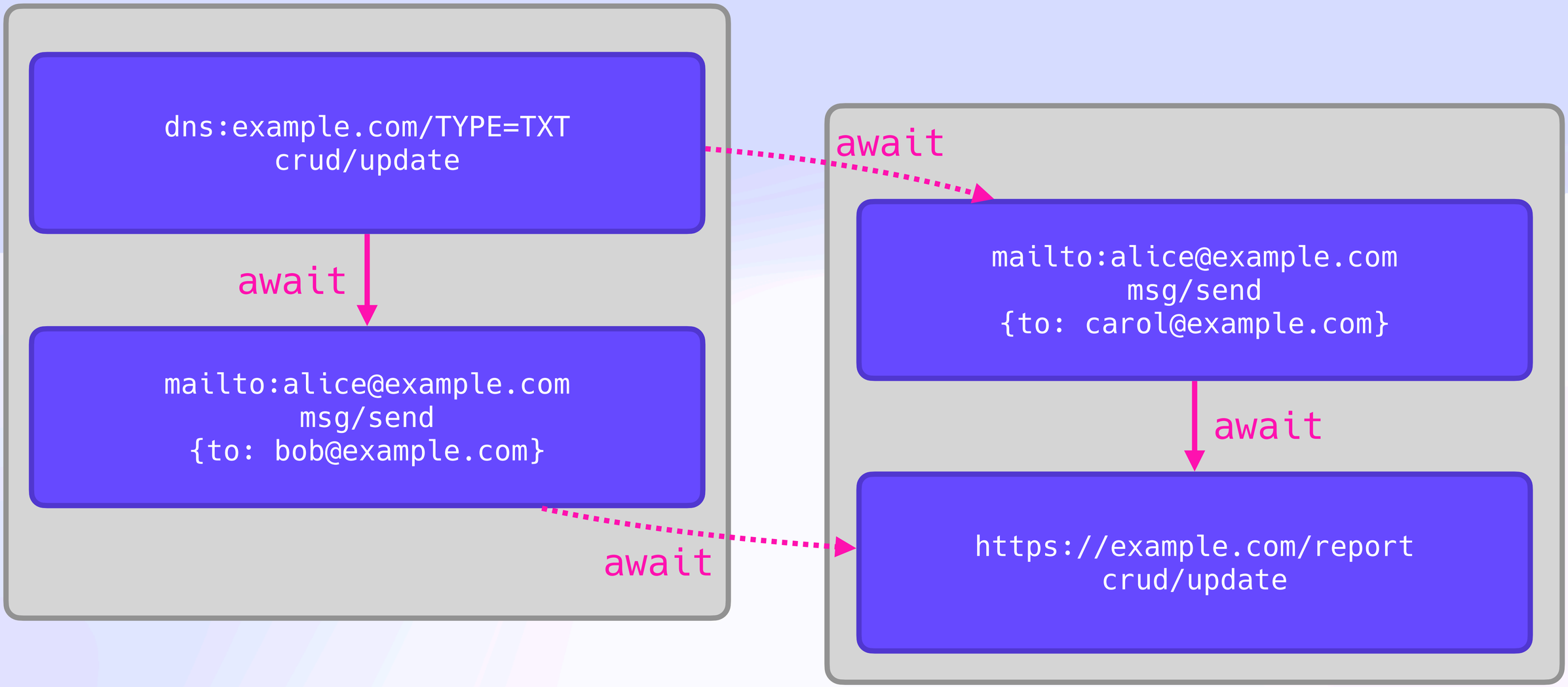
Compute Substrate

Distributed Invocation



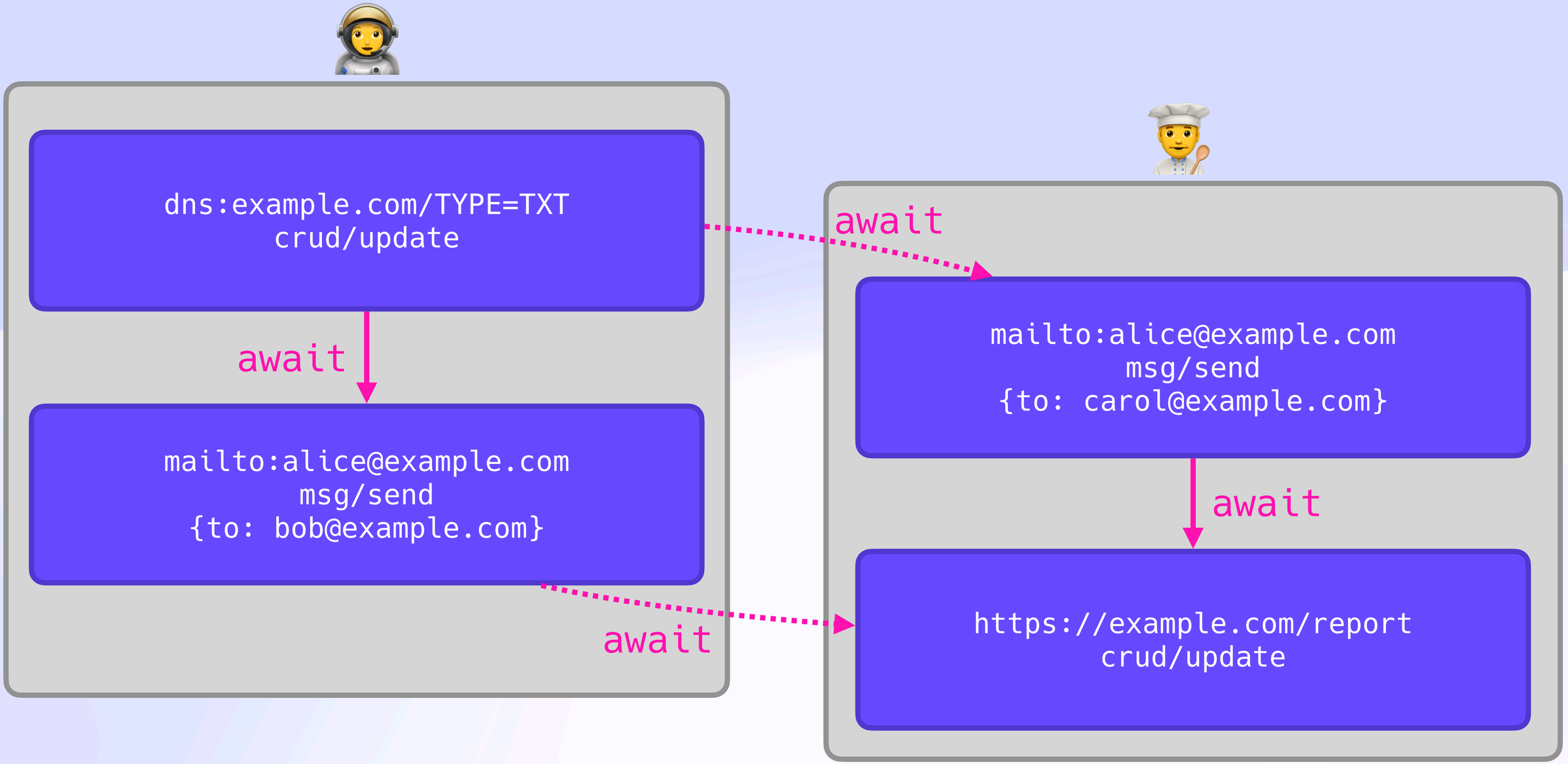
Compute Substrate

Distributed Invocation



Compute Substrate

Distributed Invocation

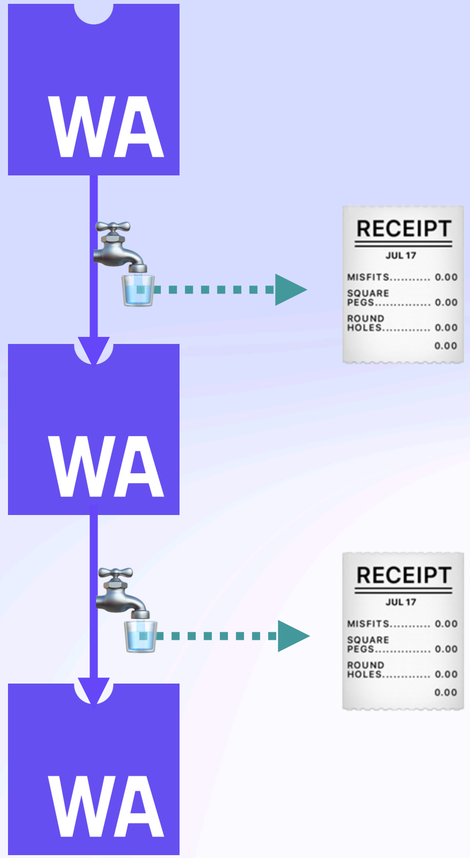


Compute Substrate

Cache, Suspend, Move, Verify

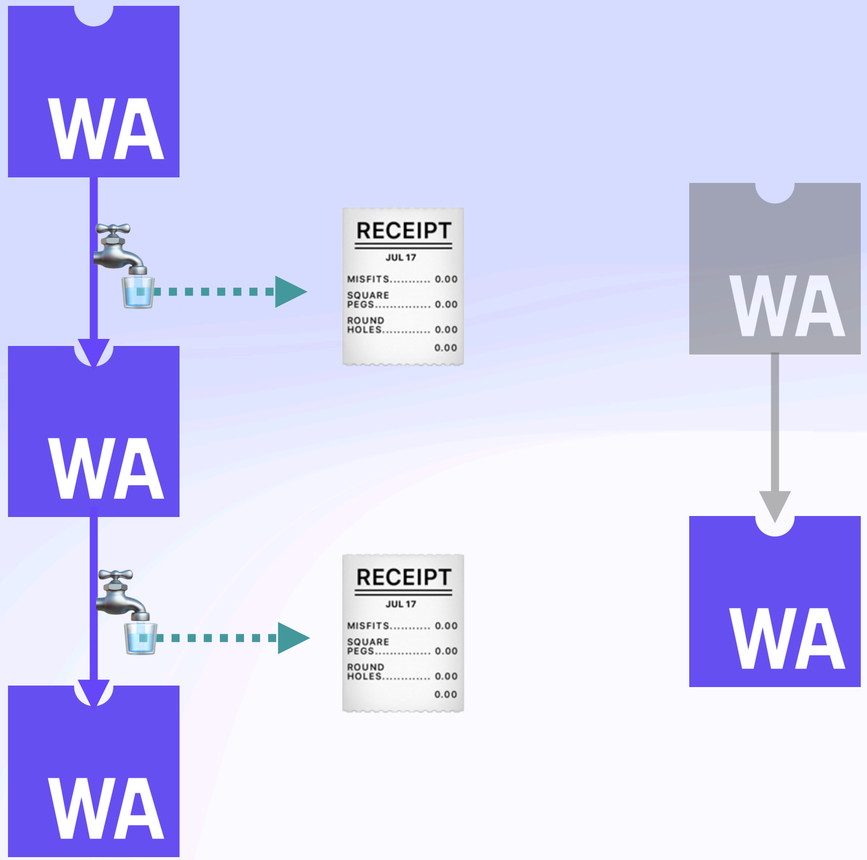
Compute Substrate

Cache, Suspend, Move, Verify



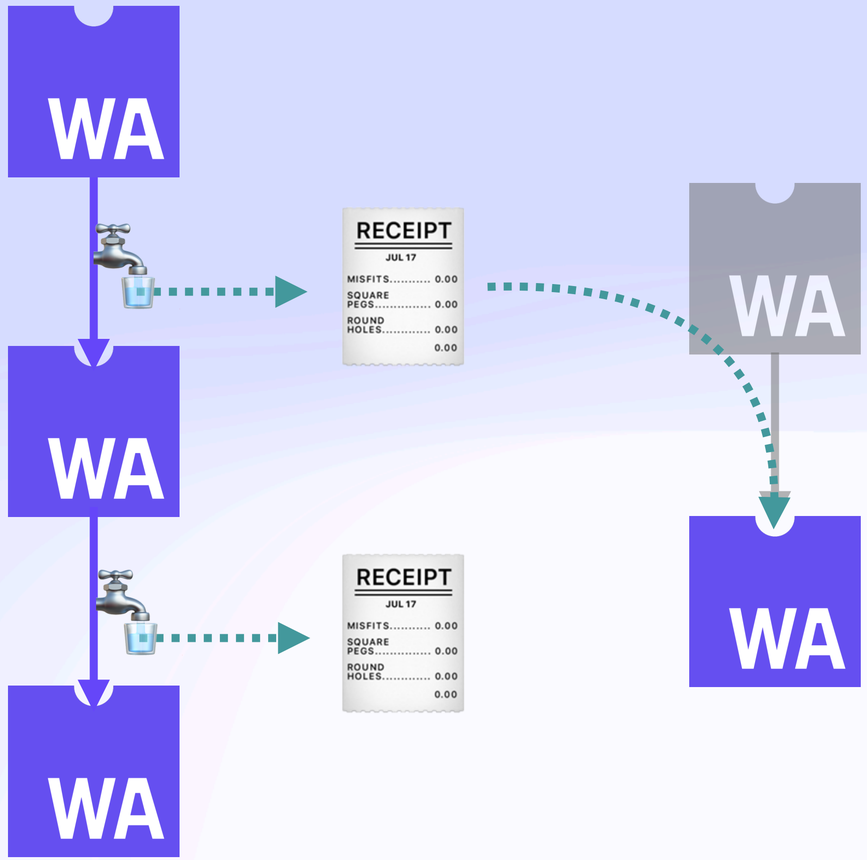
Compute Substrate

Cache, Suspend, Move, Verify



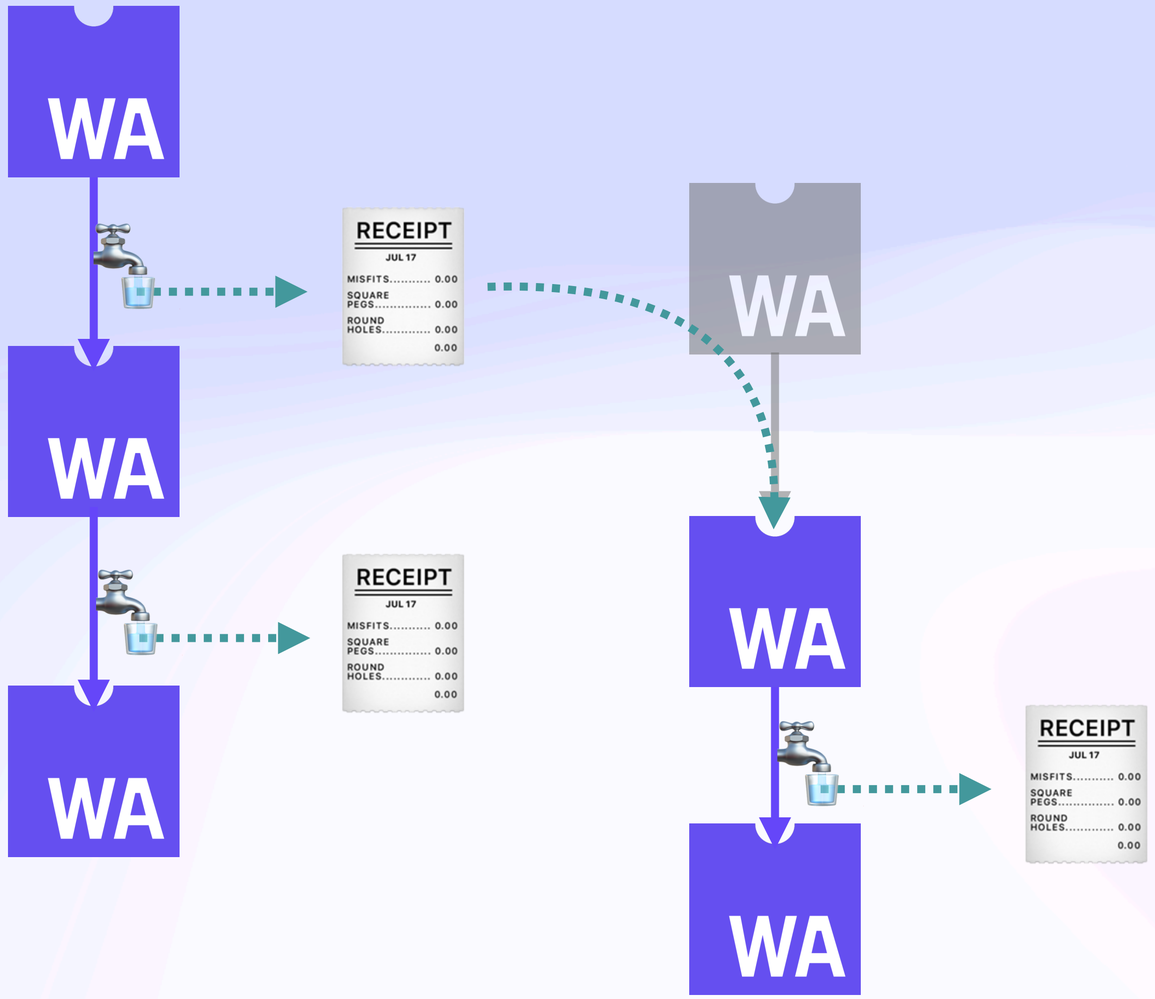
Compute Substrate

Cache, Suspend, Move, Verify



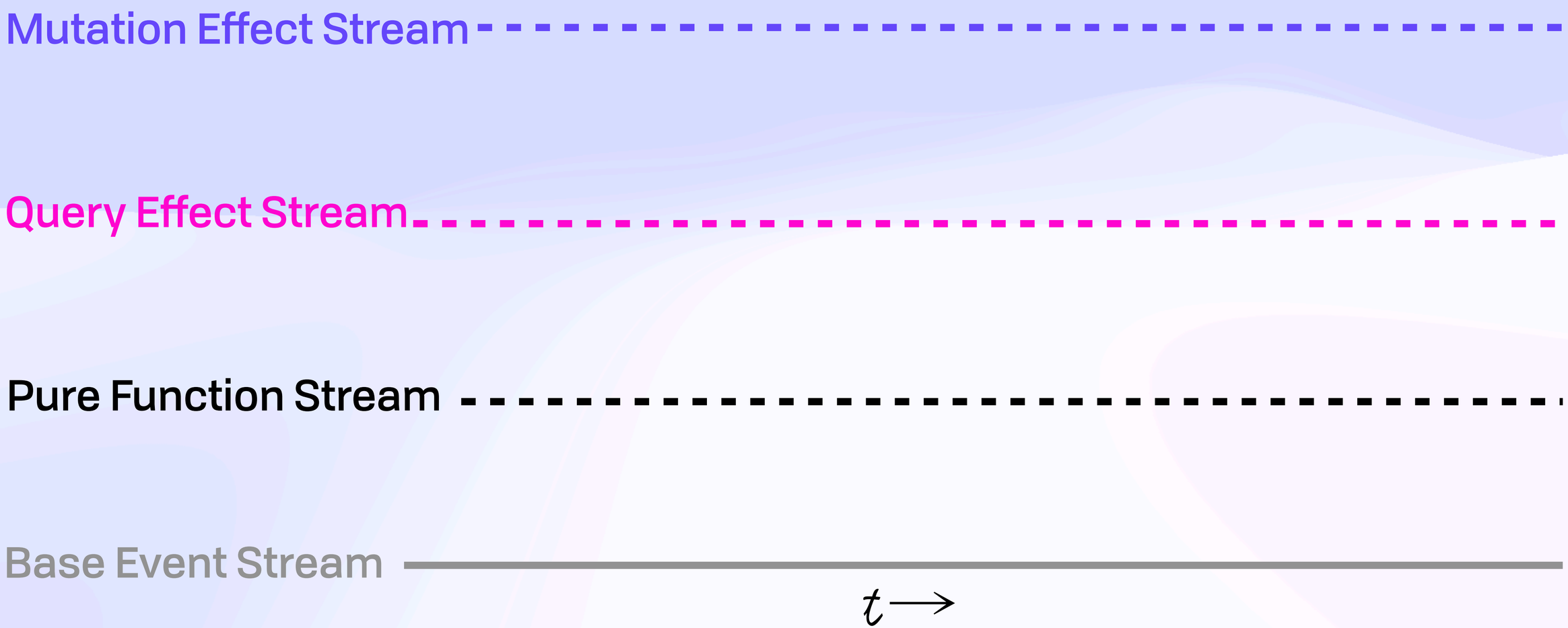
Compute Substrate

Cache, Suspend, Move, Verify



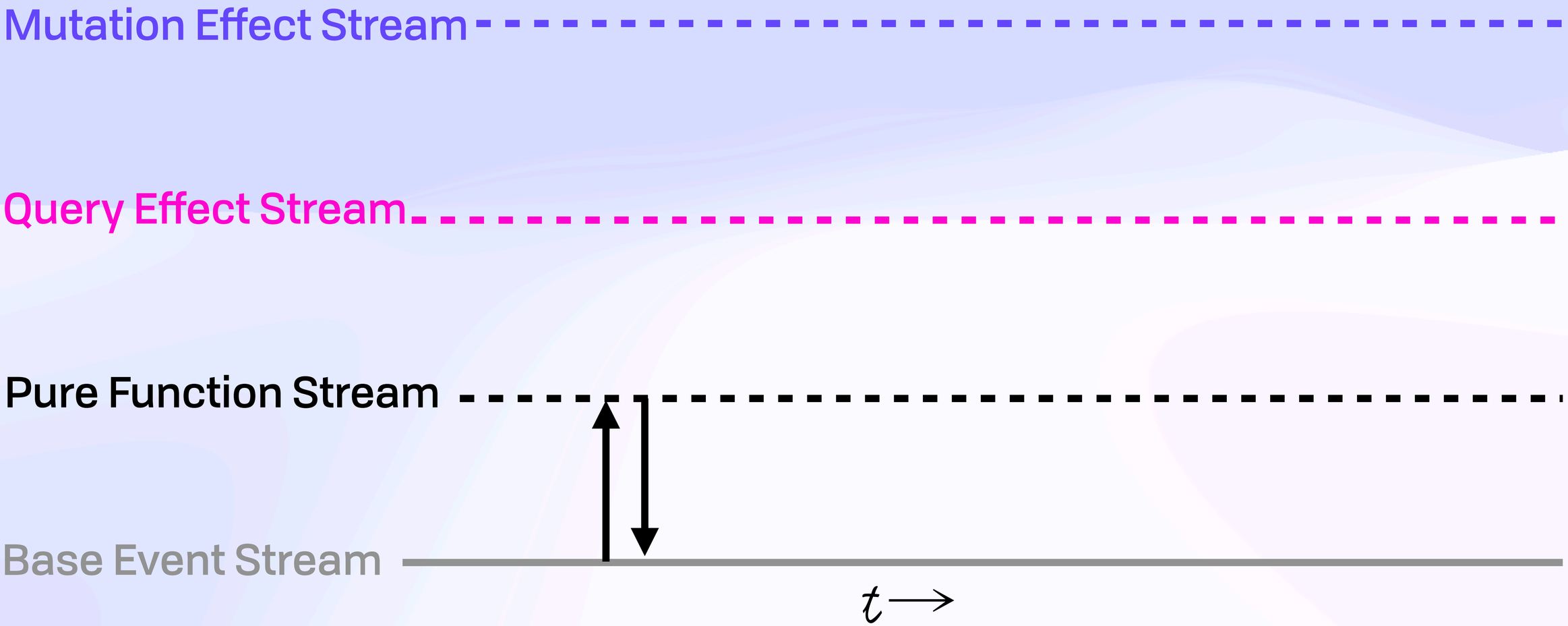
Compute Substrate

Command! Query? Compute.



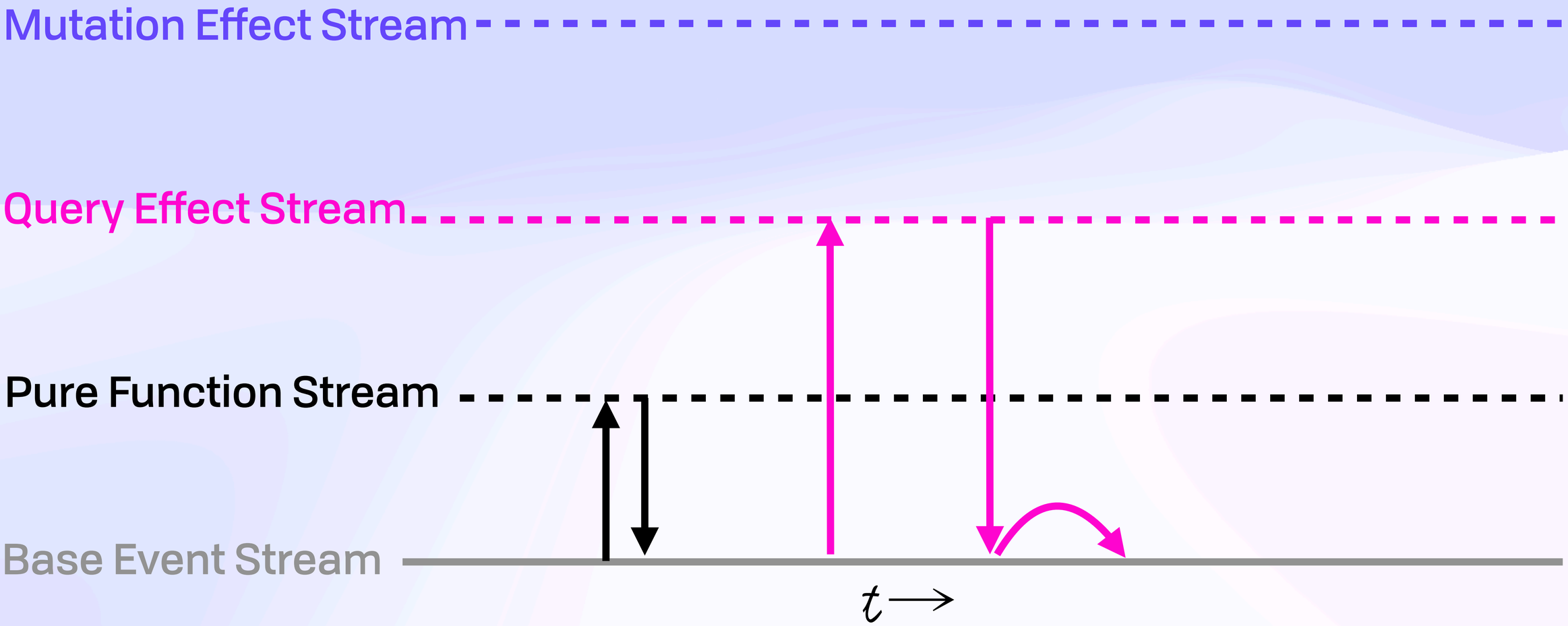
Compute Substrate

Command! Query? Compute.



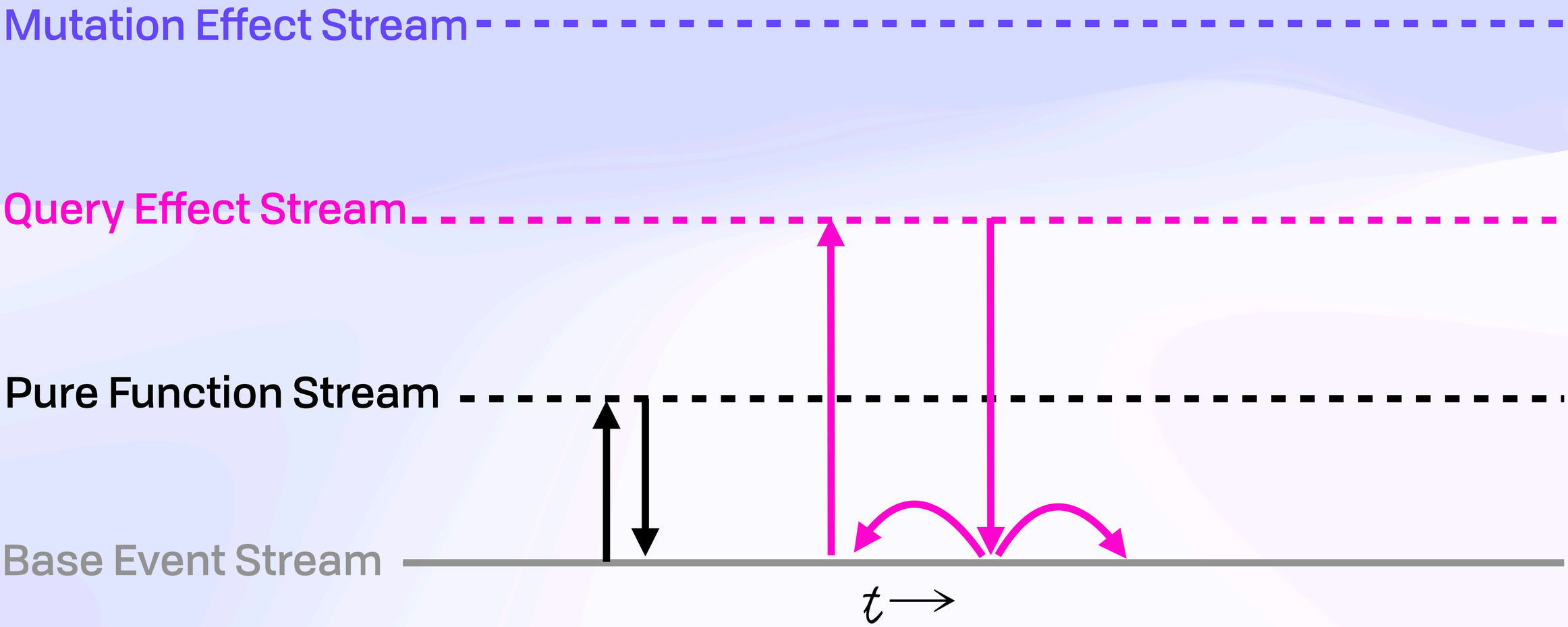
Compute Substrate

Command! Query? Compute.



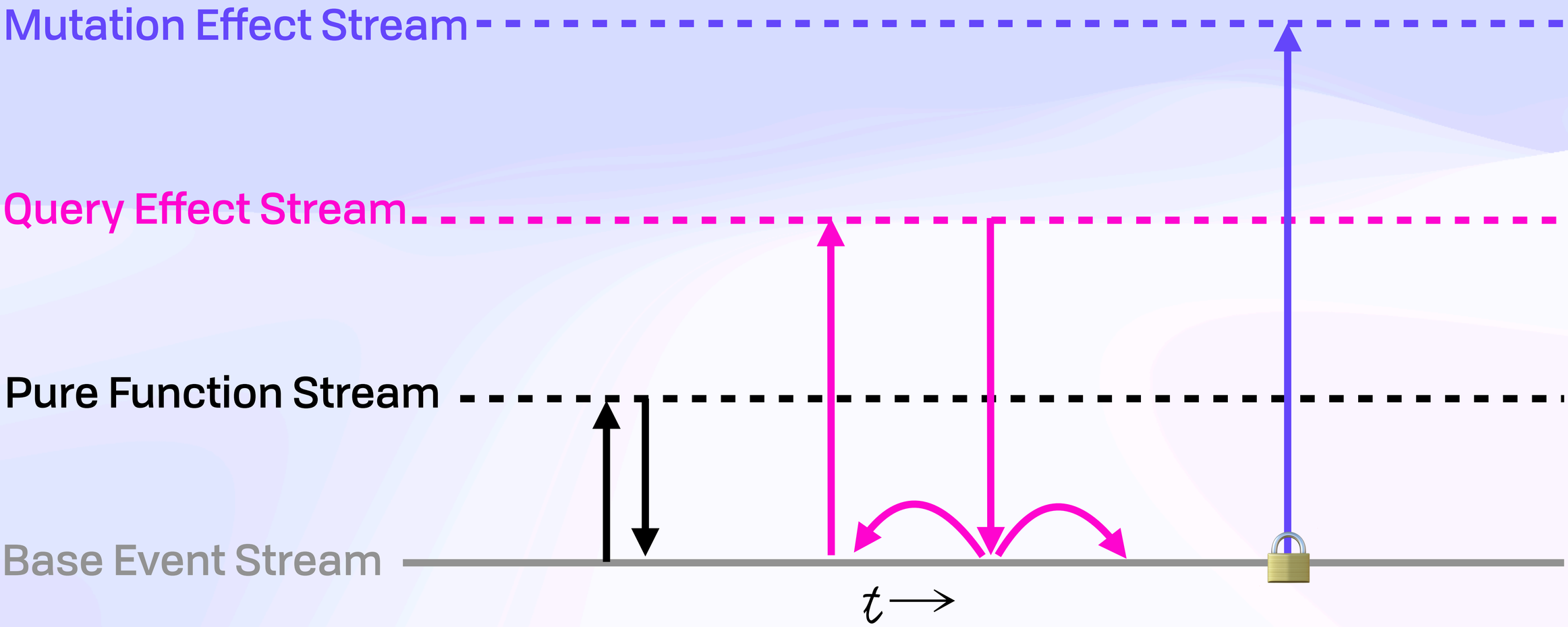
Compute Substrate

Command! Query? Compute.



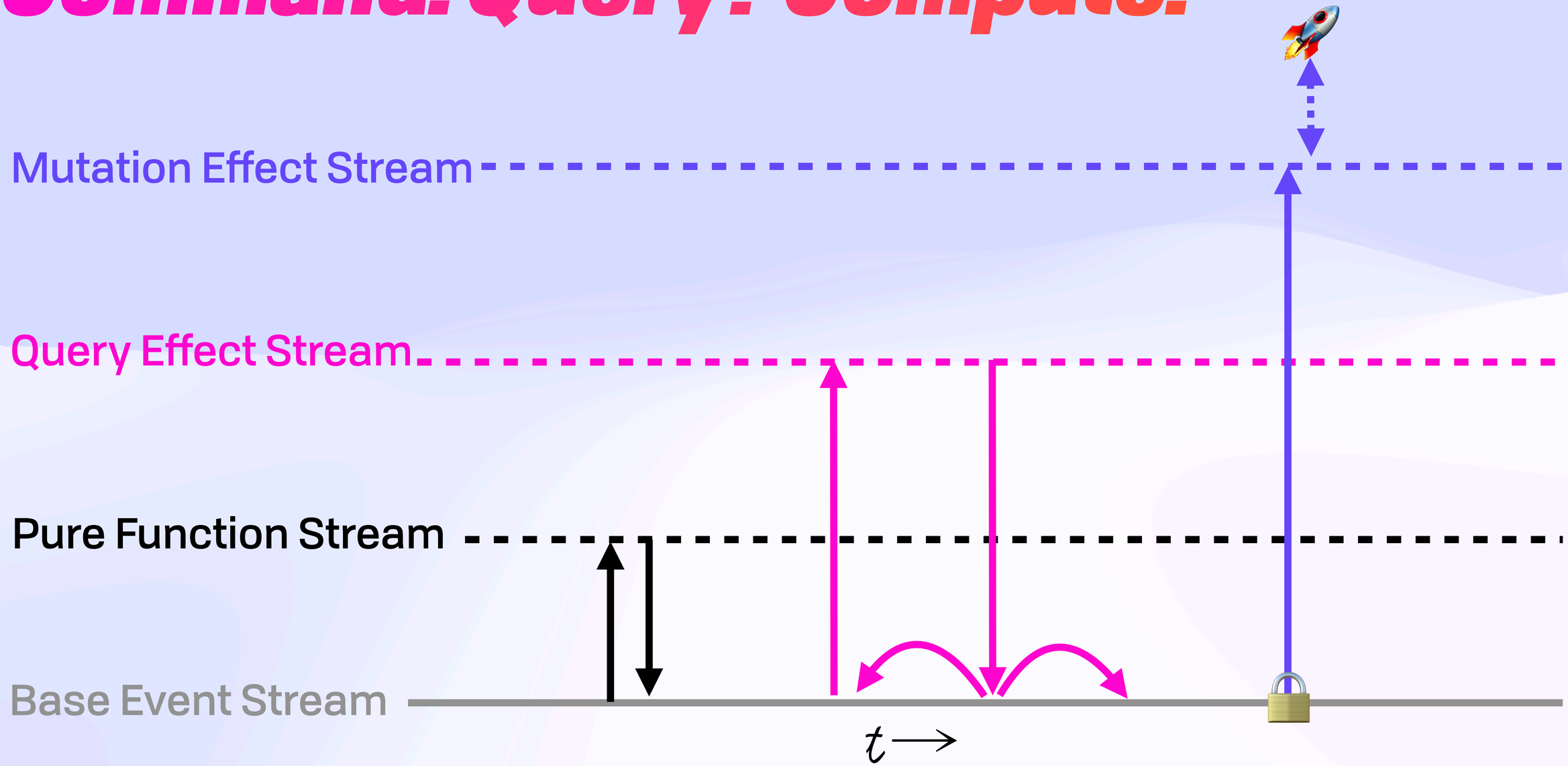
Compute Substrate

Command! Query? Compute.



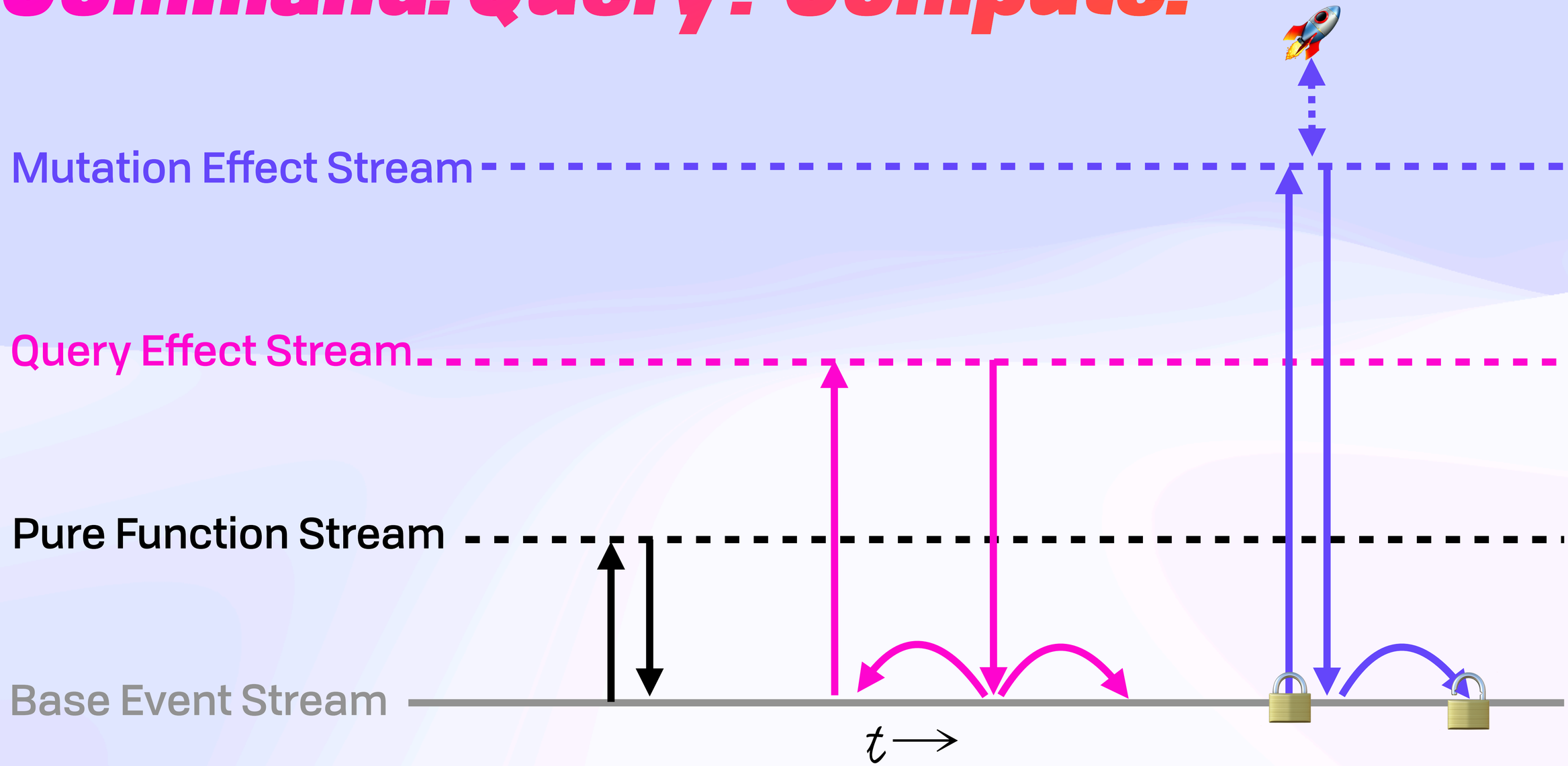
Compute Substrate

Command! Query? Compute.



Compute Substrate

Command! Query? Compute.

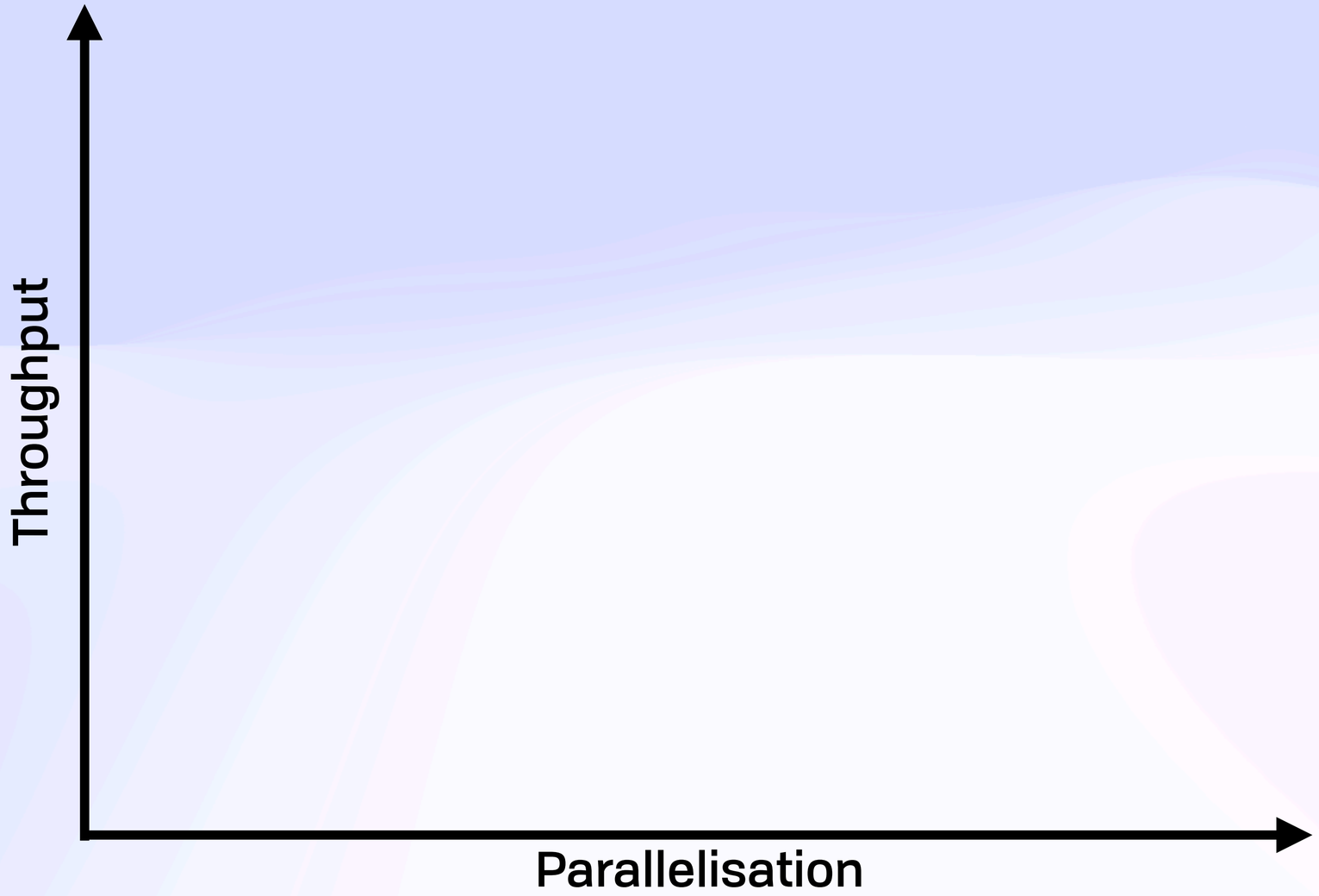


Compute Substrate

With a Little Help From My Friends

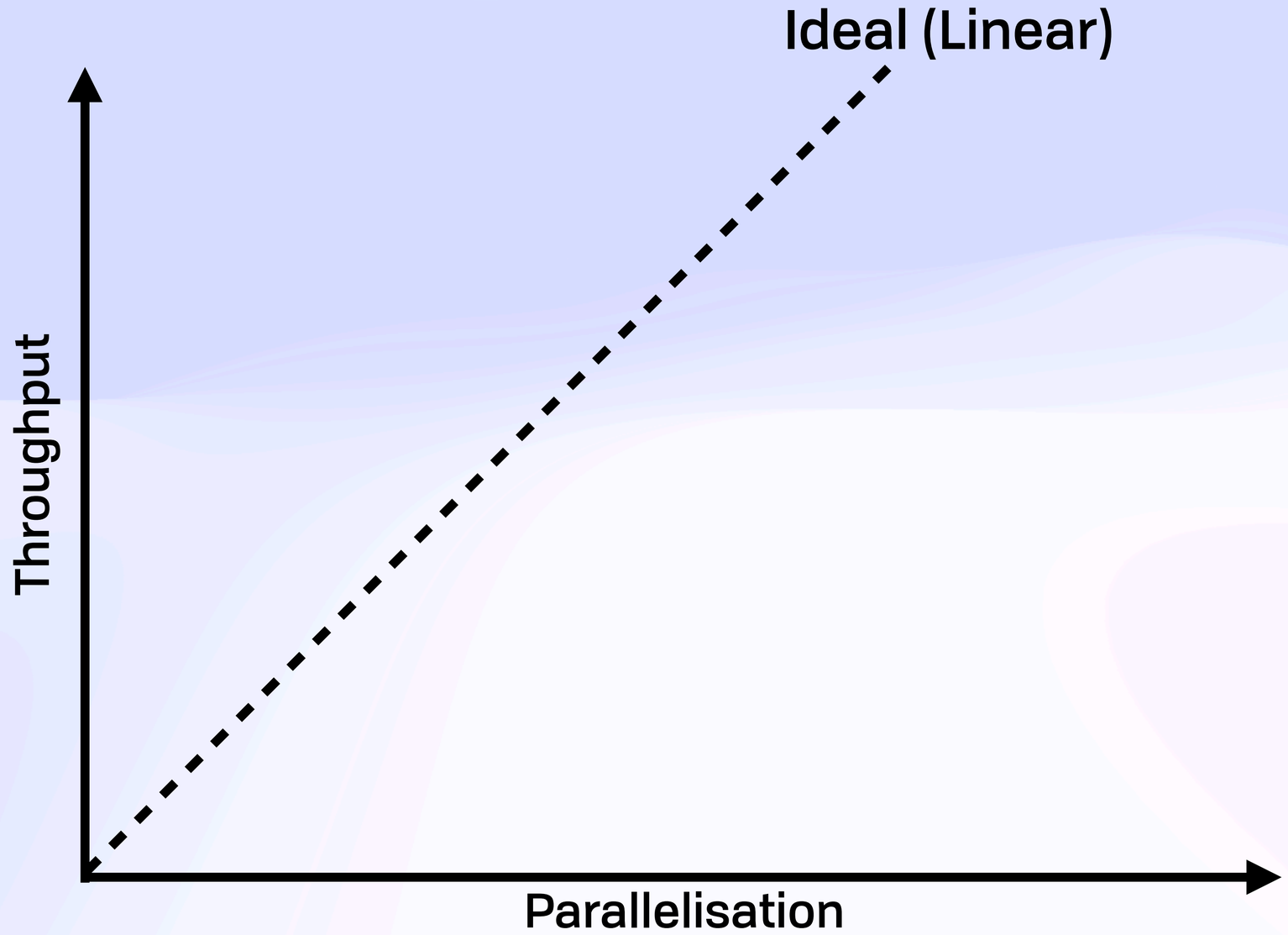
Compute Substrate

With a Little Help From My Friends



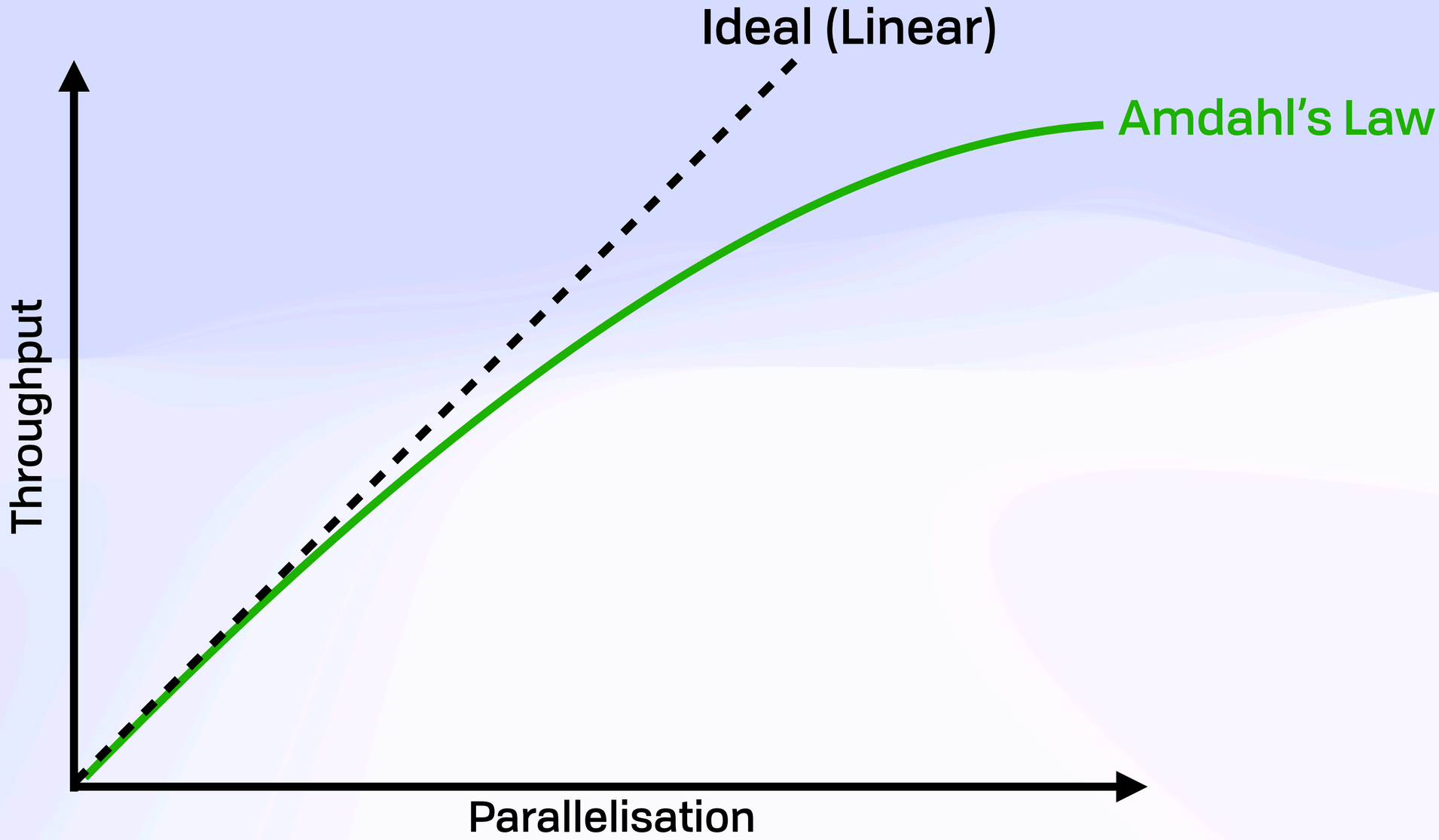
Compute Substrate

With a Little Help From My Friends



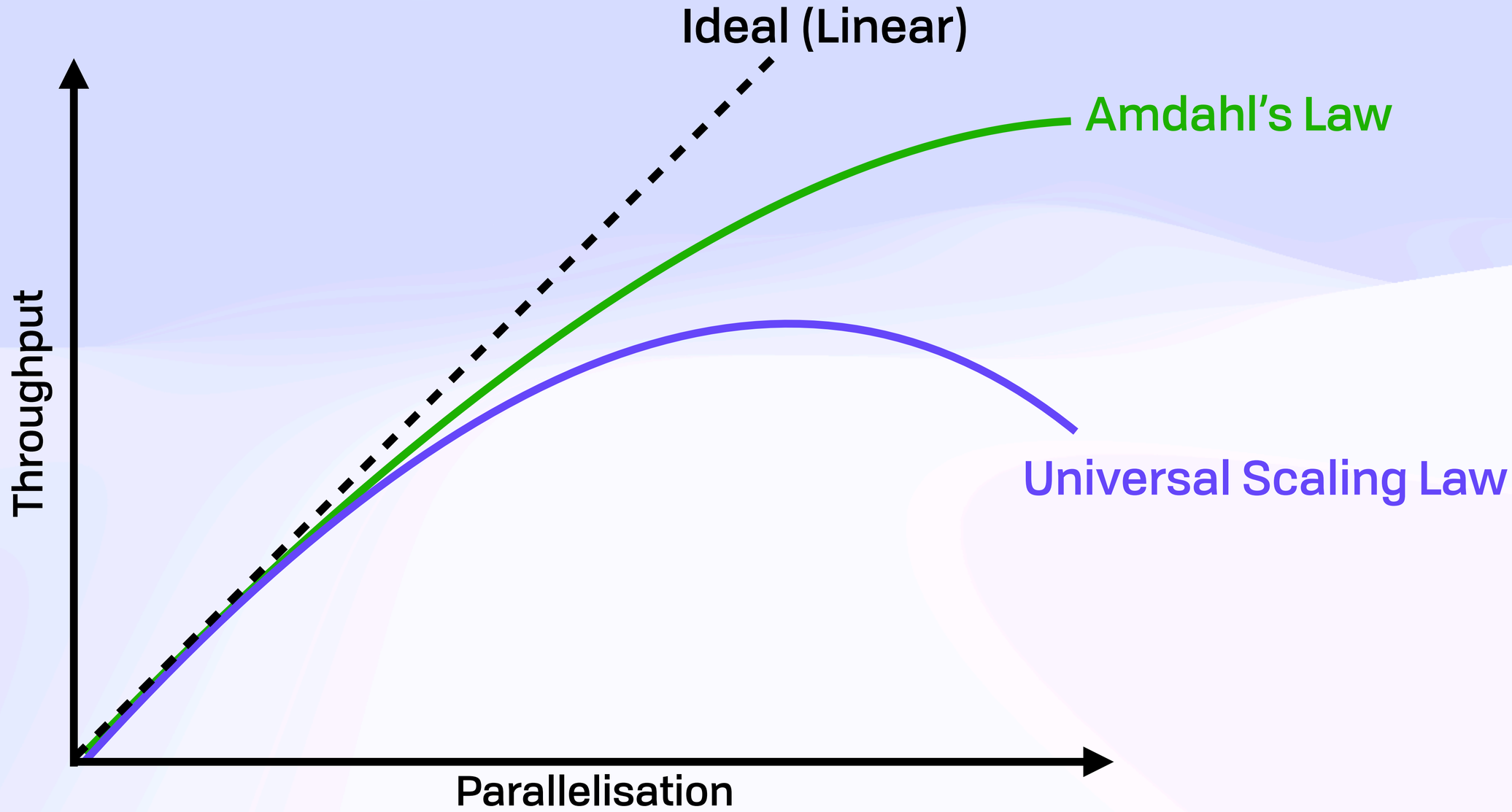
Compute Substrate

With a Little Help From My Friends



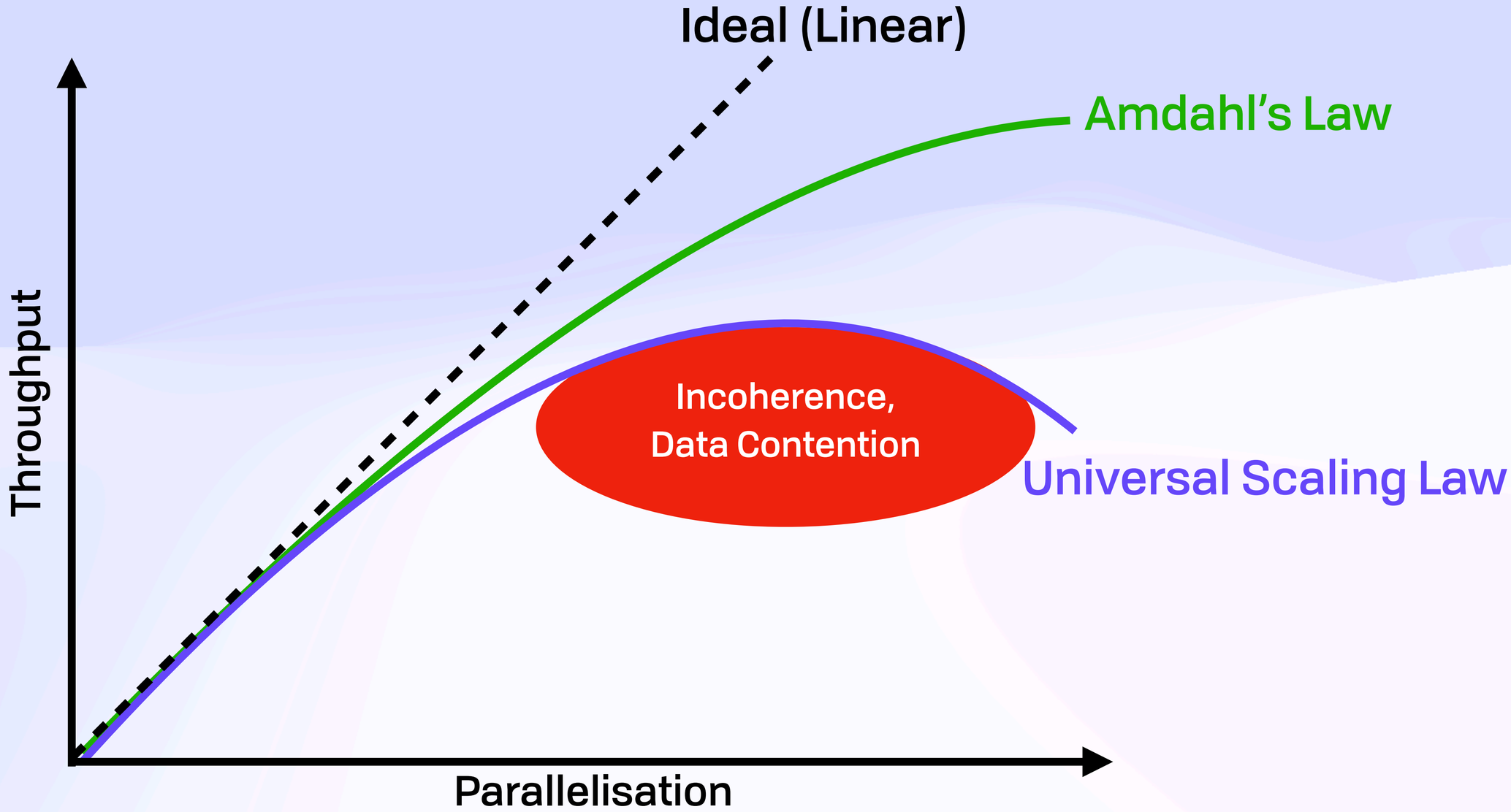
Compute Substrate

With a Little Help From My Friends



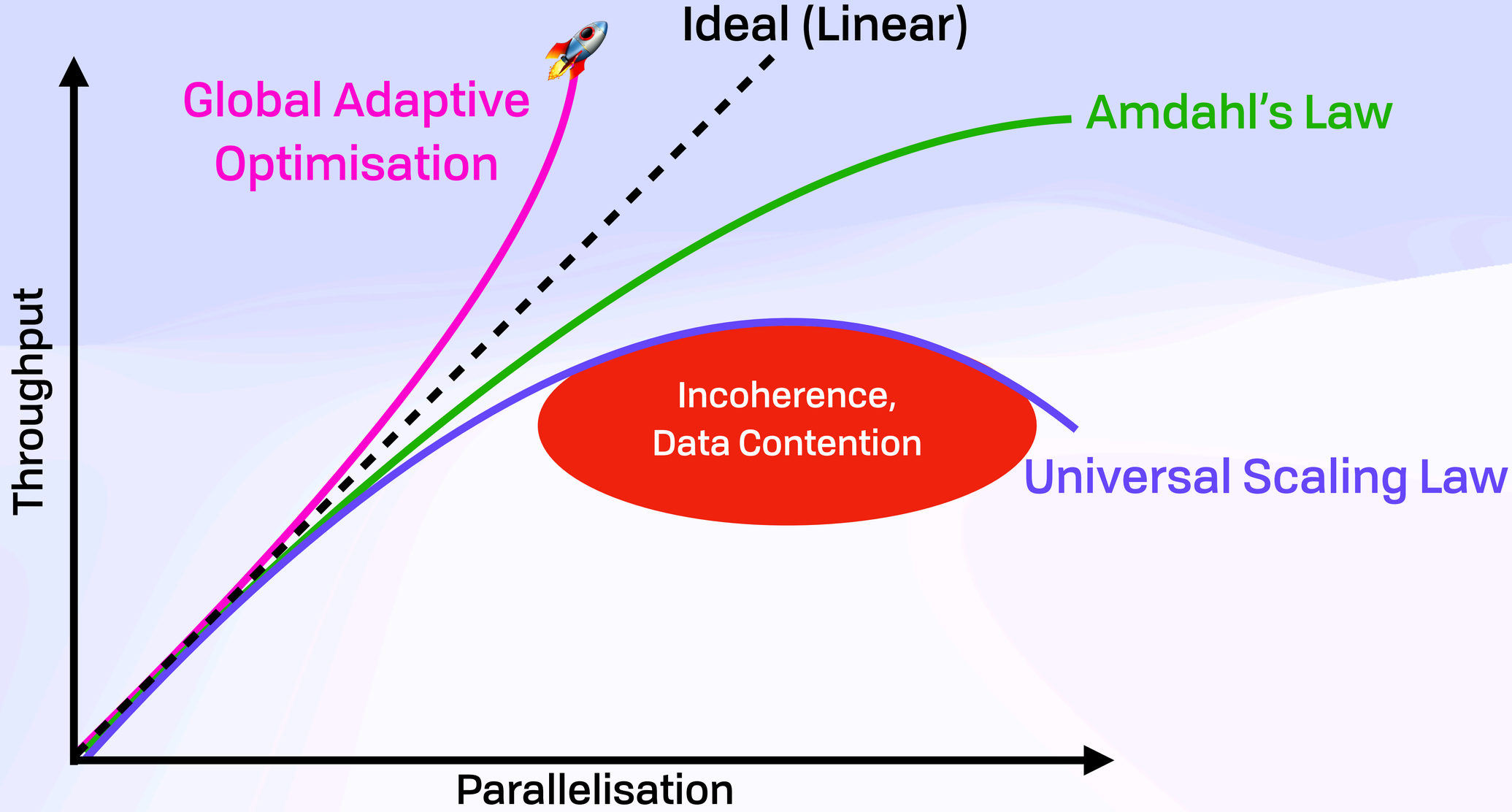
Compute Substrate

With a Little Help From My Friends



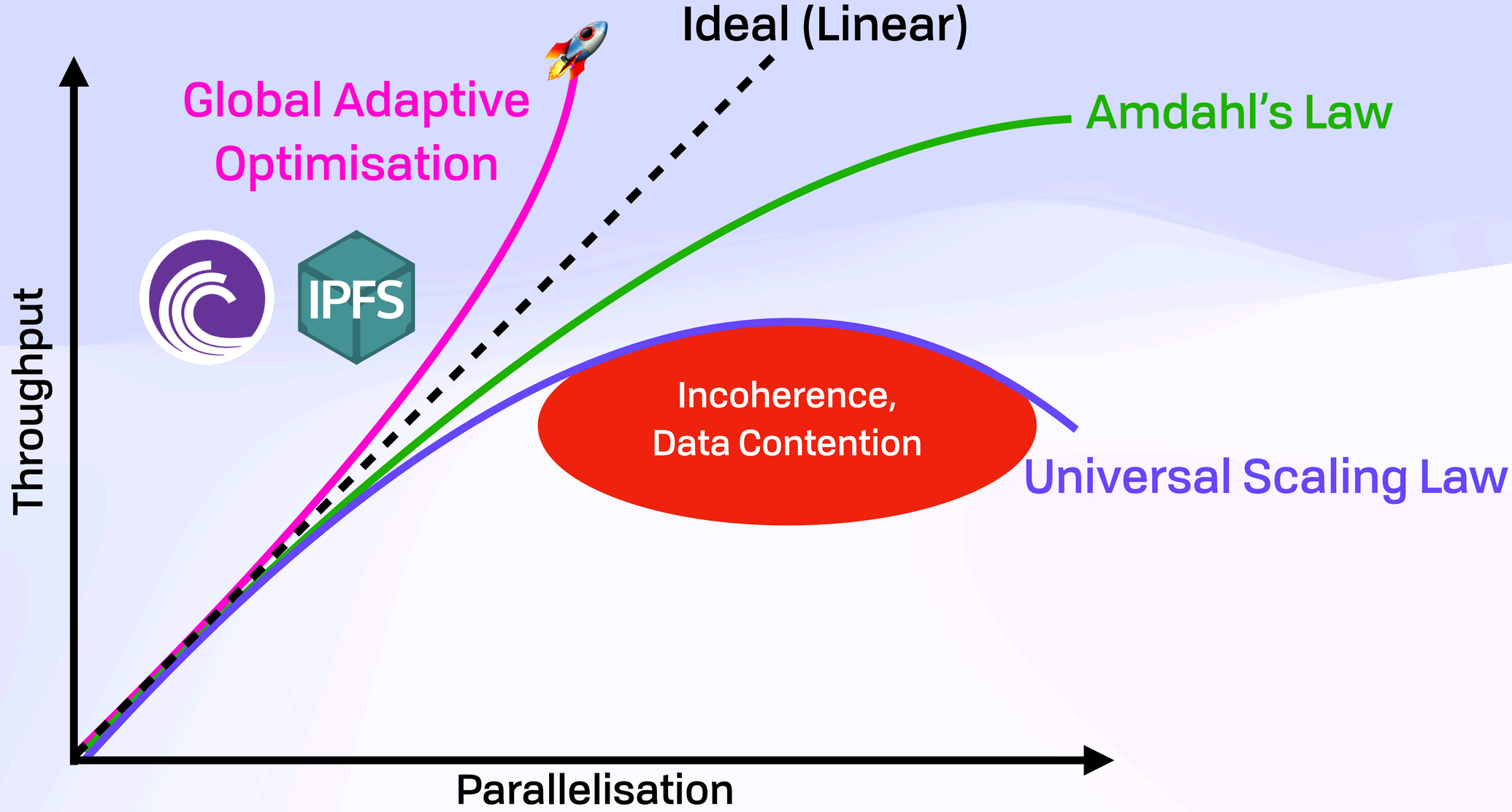
Compute Substrate

With a Little Help From My Friends



Compute Substrate

With a Little Help From My Friends



Compute Substrate

Run Once, And Never Again



Compute Substrate

Run Once, And Never Again



- **Input Hash → Cached Output**

Compute Substrate

Run Once, And Never Again



- **Input Hash → Cached Output**
  - "Instant" AI

Compute Substrate

Run Once, And Never Again



- **Input Hash → Cached Output**
  - "Instant" AI
    - e.g. moderation, tagging

Compute Substrate

Run Once, And Never Again



- **Input Hash → Cached Output**
  - "Instant" AI
    - e.g. moderation, tagging
  - EigenTrust

Compute Substrate

Run Once, And Never Again



- **Input Hash → Cached Output**
  - "Instant" AI
    - e.g. moderation, tagging
  - EigenTrust
  - Resizing, thumbs, cropping

Compute Substrate

Run Once, And Never Again



- **Input Hash → Cached Output**
  - "Instant" AI
    - e.g. moderation, tagging
  - EigenTrust
  - Resizing, thumbs, cropping
  - Durable execution ***everywhere***

Wrapping Up

Where Do We Go From Here?



Where Do We Go From Here?

There Is No ~~Spoon~~ Back End

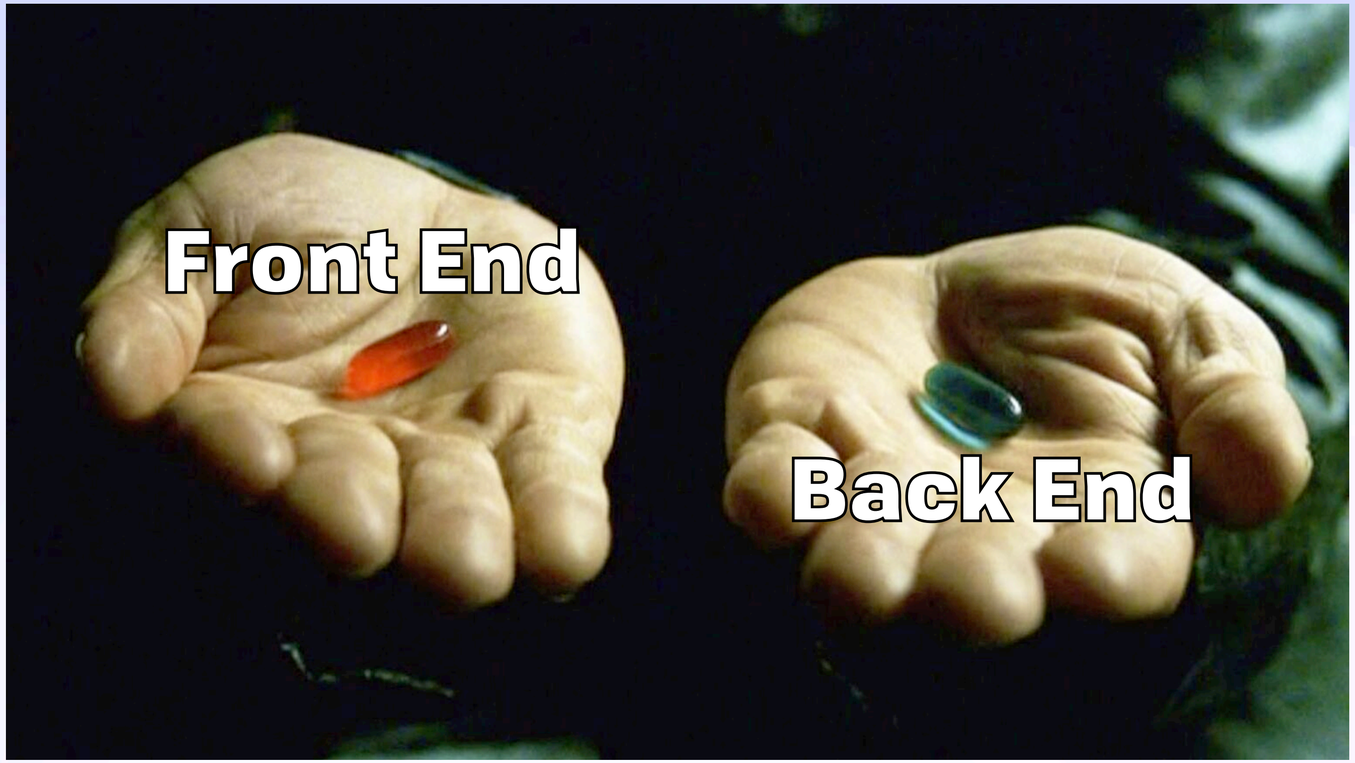
Where Do We Go From Here?

There Is No ~~Spoon~~ Back End



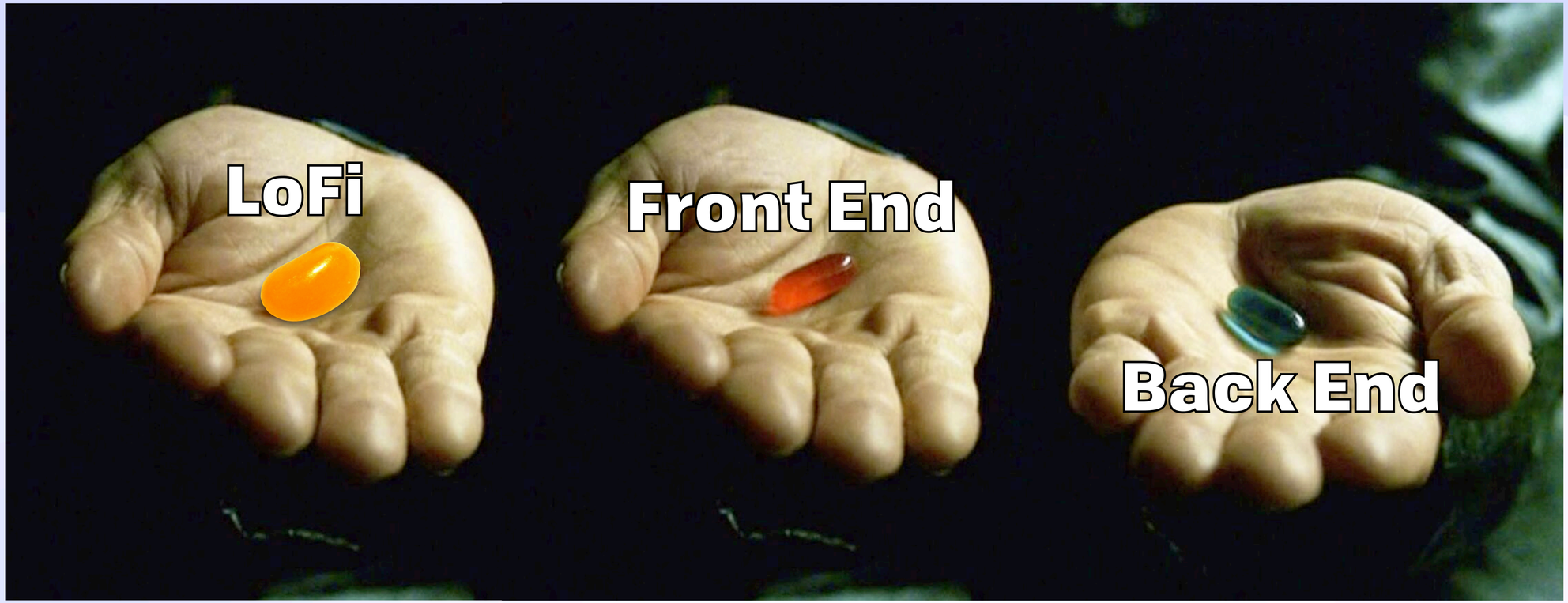
Where Do We Go From Here?

There Is No ~~Spoon~~ Back End



Where Do We Go From Here?

There Is No ~~Spoon~~ Back End



Where Do We Go From Here?

New Constraints = New Design Space

https://commons.wikimedia.org/wiki/File:Flight_dynamics_with_text.png

Where Do We Go From Here?

New Constraints = New Design Space

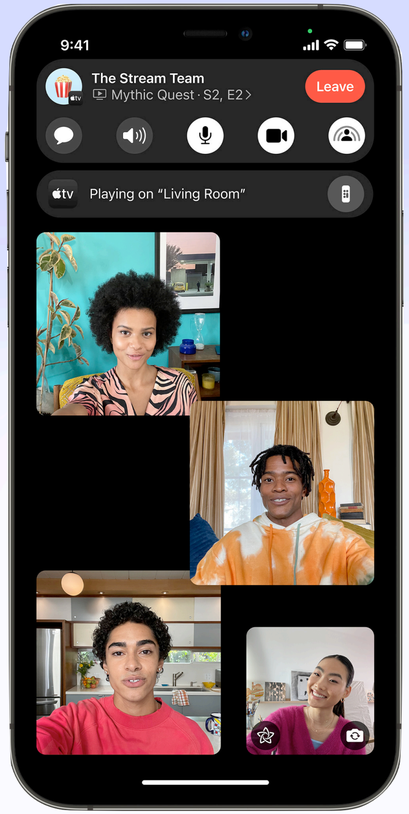


https://commons.wikimedia.org/wiki/File:Flight_dynamics_with_text.png

Where Do We Go From Here?

New Constraints = New Design Space



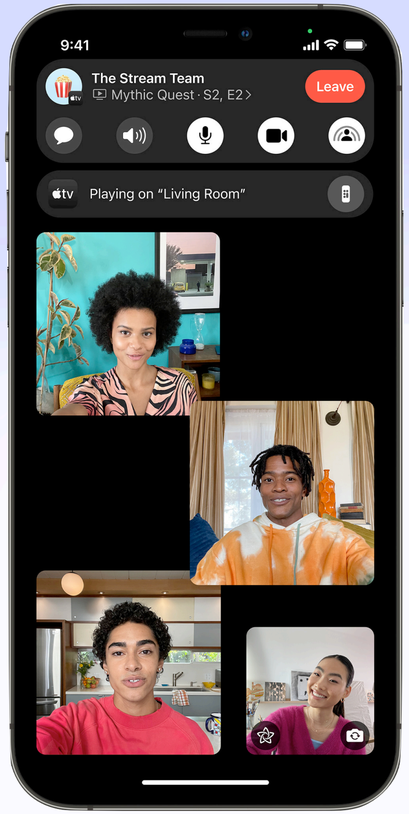


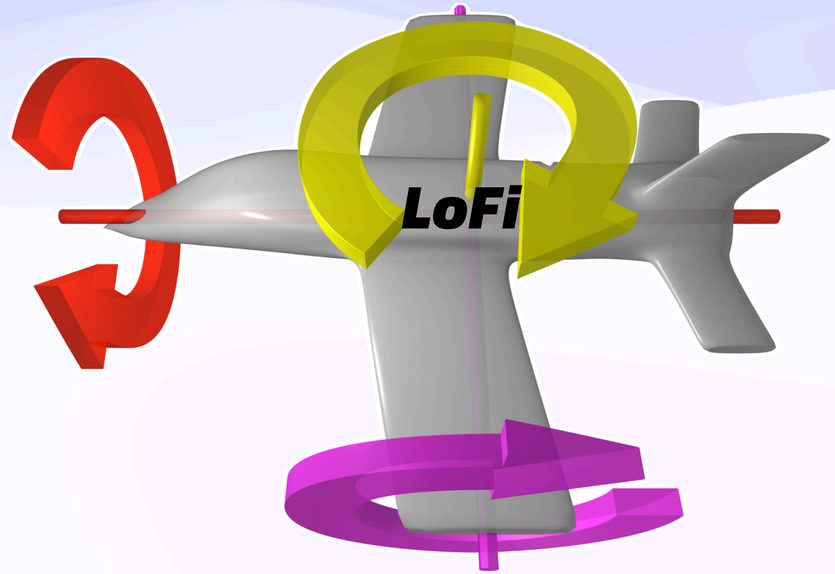
https://commons.wikimedia.org/wiki/File:Flight_dynamics_with_text.png

Where Do We Go From Here?

New Constraints = New Design Space



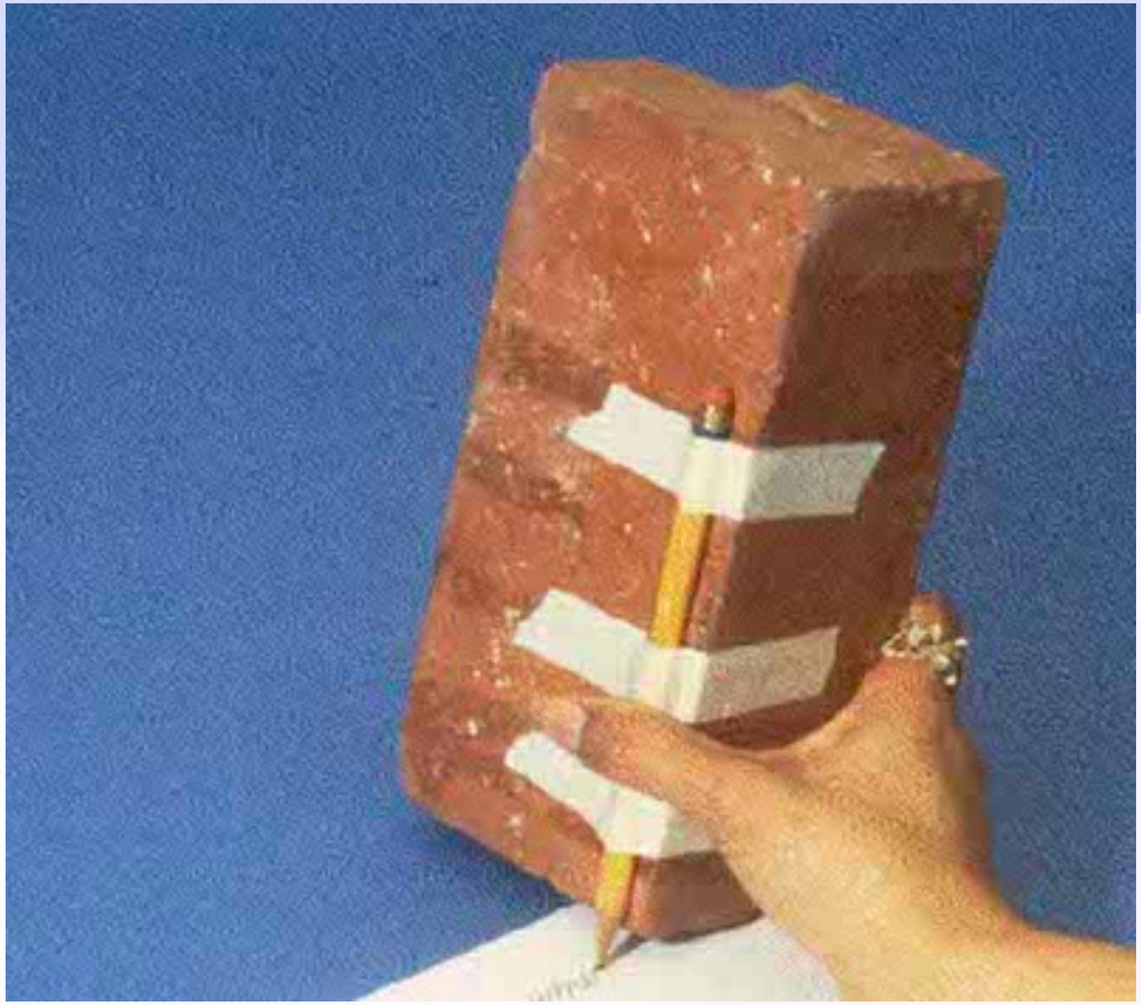




https://commons.wikimedia.org/wiki/File:Flight_dynamics_with_text.png

Where Do We Go From Here?

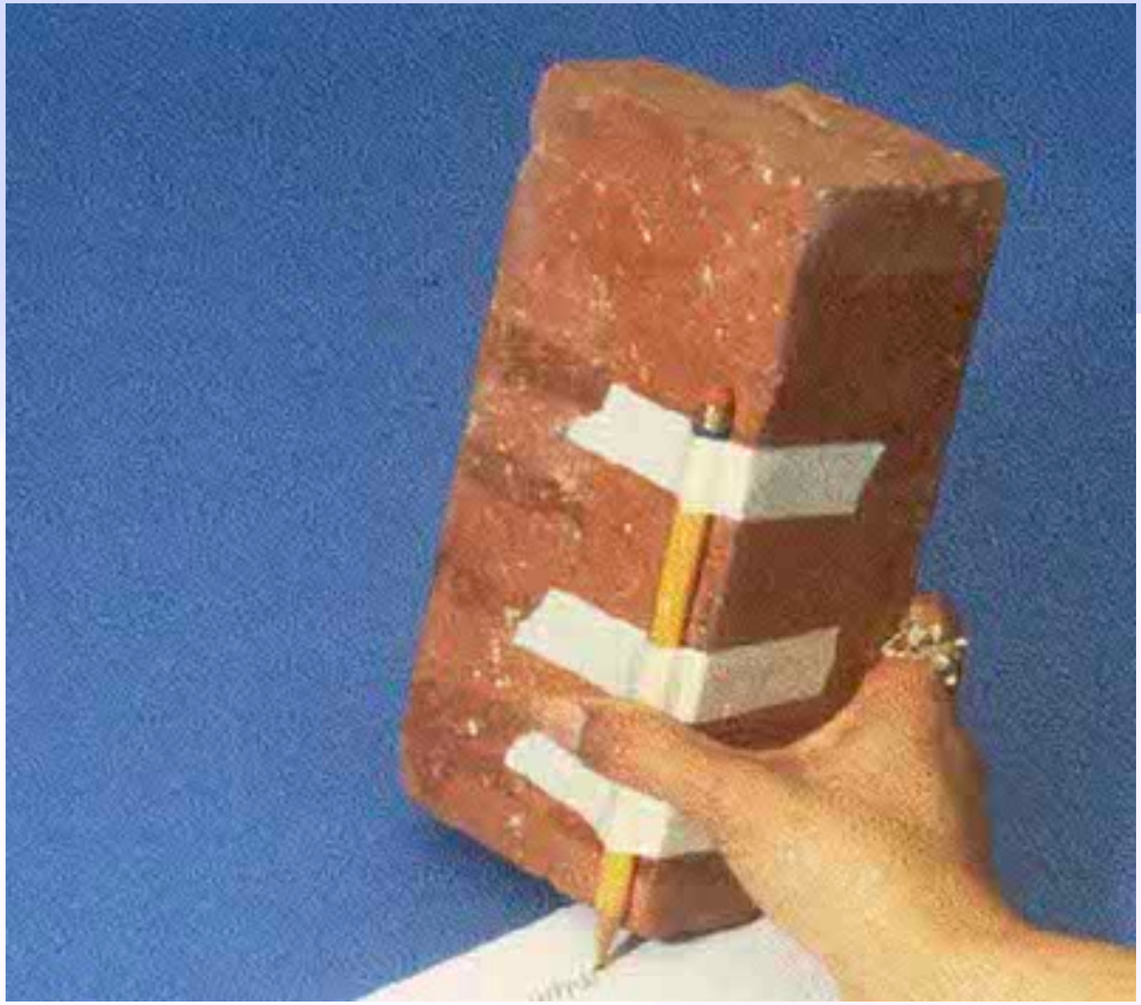
Not All or Nothing



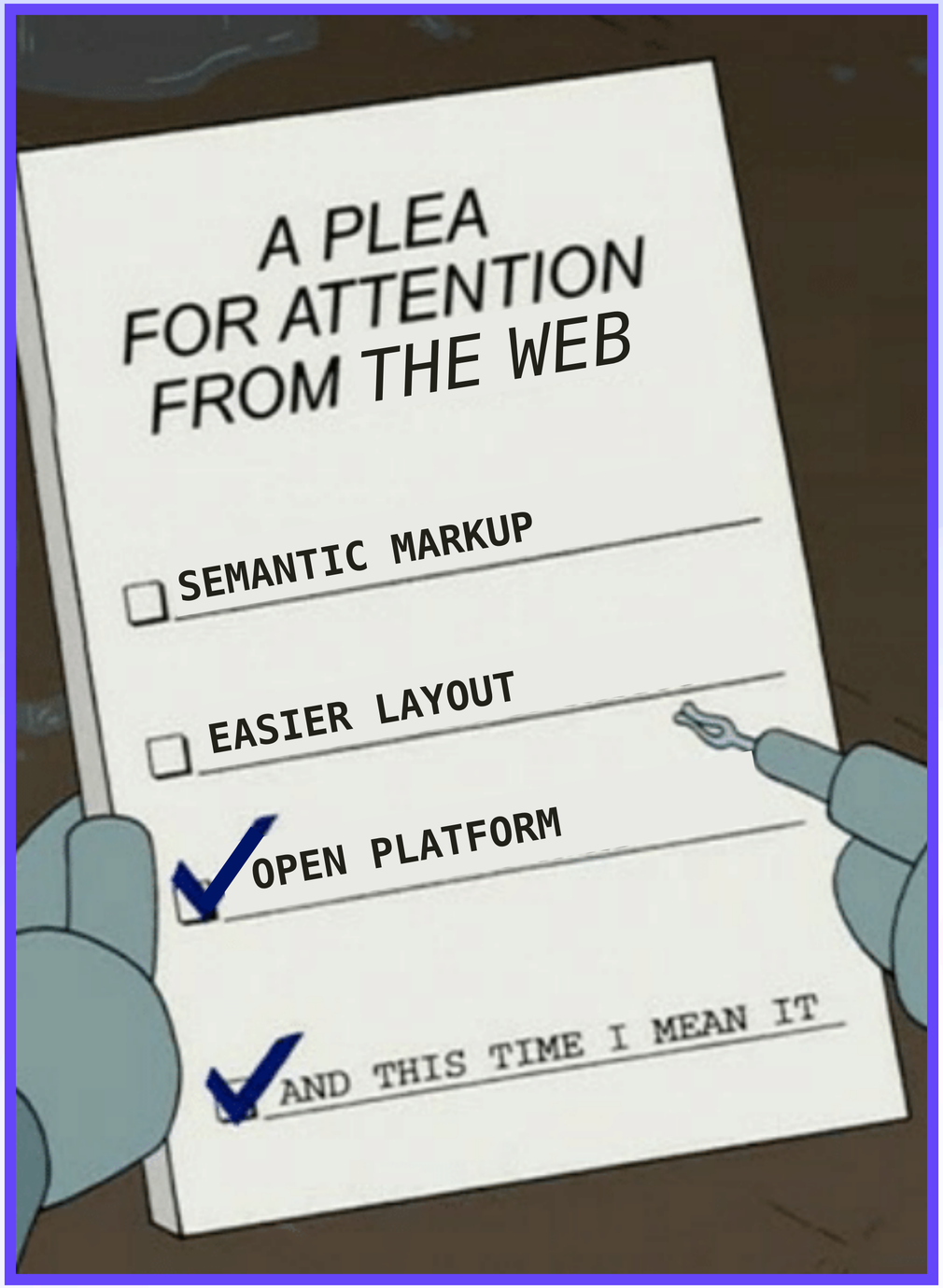
Where Do We Go From Here?

Not All or Nothing

- LoFi is great at human sizes & speeds
- ...but harder to do global things
  - e.g. "Build the Bluesky firehose"



A Roadmap Wrap Up





automerge.org



inkandswitch.com/beehive

github.com/ucan-wg





Thank You, Chicago



@expede@types.pl

bsky.app/profile/expede.wtf

hello@brooklynzelenka.com

goto;

DOWNLOAD & USE
THE GOTO GUIDE APP

CREATE YOUR SCHEDULE
NETWORK WITH OTHERS
ASK QUESTIONS
RATE SESSIONS

Download on the App Store

GET IT ON Google Play

goto;

Rate this session in the GOTO Guide app

Help us make GOTO even better