


# *The Edge of Tomorrow*

 Dark Forests, Relativistic Computing & How to Power a New Internet 

<https://fission.codes>



# The Edge of Tomorrow

The background of the slide is an abstract composition of soft, wavy, organic shapes. The top half is dominated by various shades of light blue and lavender, which blend into a pale green and yellowish-green in the bottom half. The overall effect is a sense of fluid motion and depth, reminiscent of a stylized landscape or a digital environment.



## The Edge of Tomorrow

Where is the line between smart contract virtual machines and other decentralized computation and data storage systems?

What can and should run and be stored on-chain in the future?

How do we choose?

## The Edge of Tomorrow

***Where is the line*** between smart contract virtual machines and other decentralized computation and data storage systems?

What can and should run and be stored on-chain in the future?

***How do we choose?***



**Brooklyn Zelenka**

@expede





# Brooklyn Zelenka

@expede

- Cofounder & CTO at Fission
  - <https://fission.codes>, @FISSIONCodes
  - Infra & SDK for edge apps
  - Local-first, E2EE/EAR, distributed, passwordless
- PLT, VMs, DSys
- Standards: EIPs, UCAN, FVM, WNFS, DIF, others



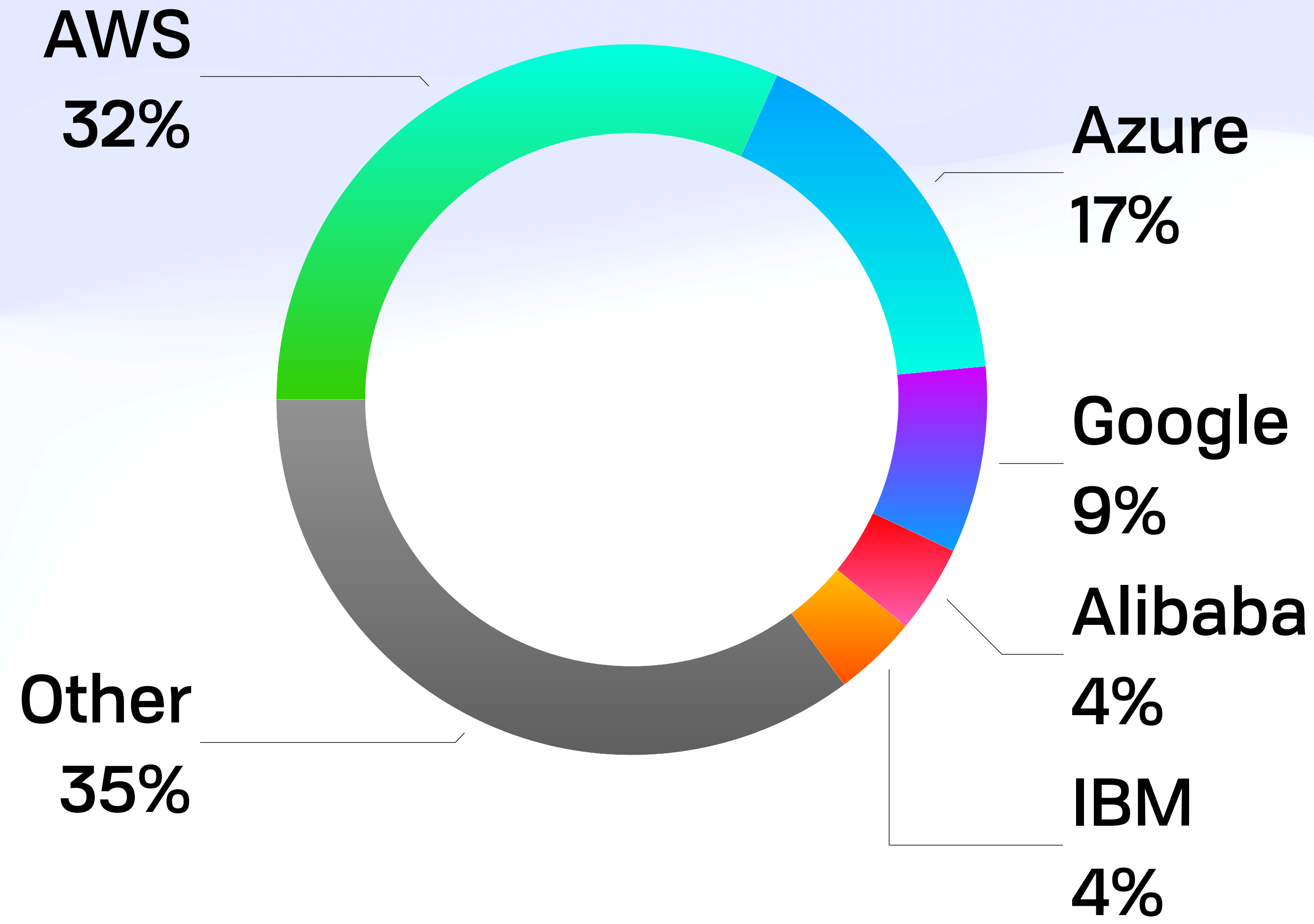


The Edge of Tomorrow

***Baseline Trajectory***

# The Edge of Tomorrow

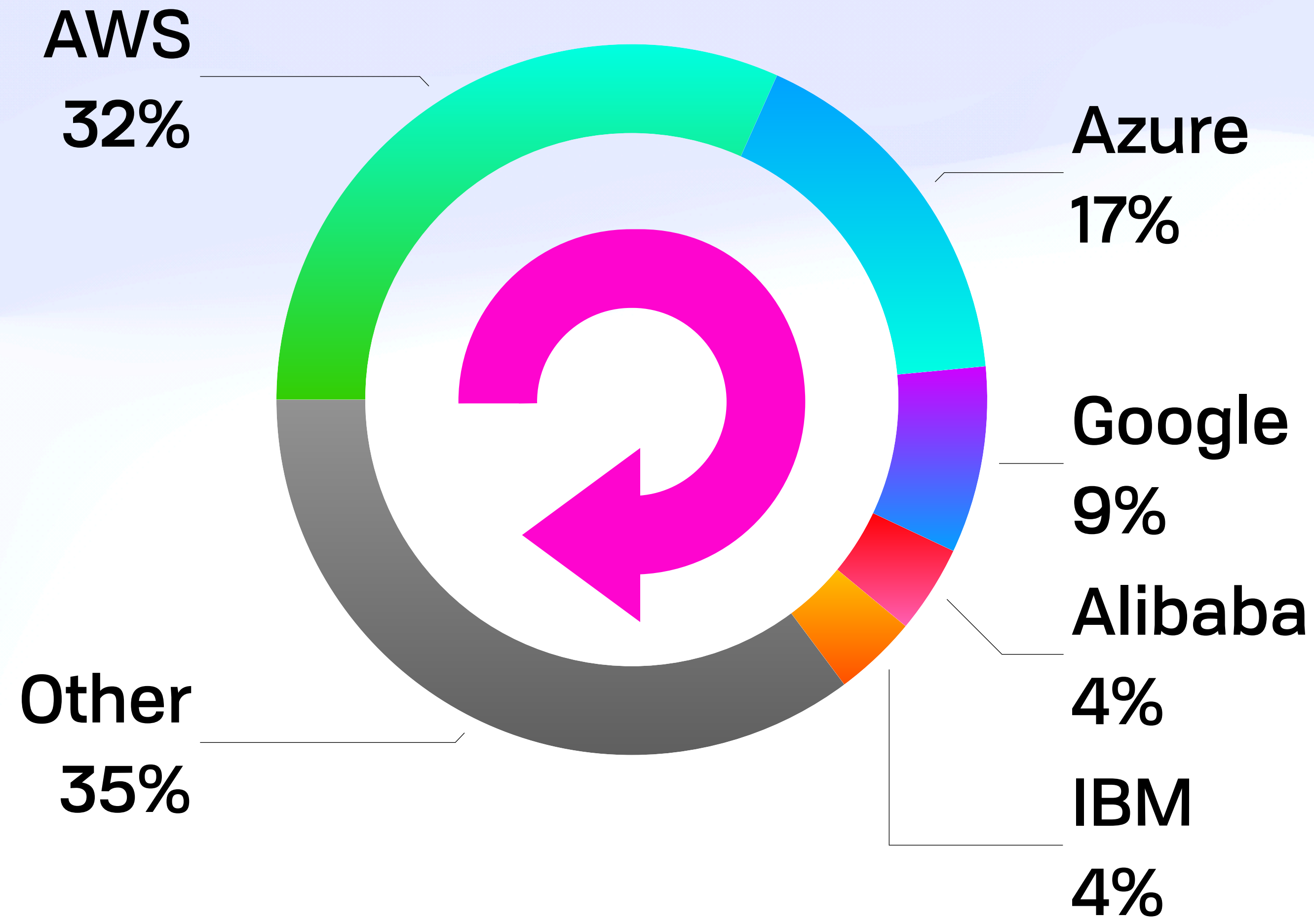
## *Baseline Trajectory*






# The Edge of Tomorrow

## *Baseline Trajectory*



# The Edge of Tomorrow

The background of the slide features a series of overlapping, wavy, organic shapes. The top portion is a light, pale blue, which transitions into a vibrant, lime-green color in the middle. The bottom portion is a bright, clean white. The overall effect is a soft, ethereal, and futuristic aesthetic.



## The Edge of Tomorrow

Nothing less than connecting  
***all of the world's*** users & services.

The "HTTP" storage and compute equivalent:  
***open, interoperable, & everywhere.***

Must be ***substantially*** better than Web 2.0

# ***Consistency & Consensus***

**"On a Need To Know Basis"**



## Consistency & Consensus

# ***Consistency Tradeoffs***

- ◆ Global distributed consensus is expensive
  - ◆ Time (latency) is a hard physical limit
- ◆ Extremely useful for many things!
  - ◆ Mutable pointers, public commitments, public data, broadcast/distribution
  - ◆ ...but not *everything*

Consistency & Consensus

***Very Blurry Pipes***



Consistency & Consensus

# *Very Blurry Pipes*

Far Edge

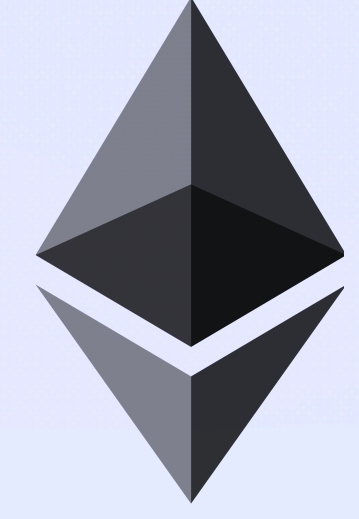
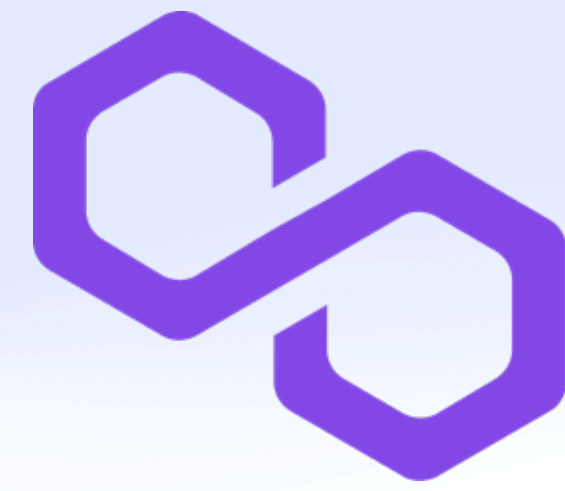
Commons

Cloud & Edge

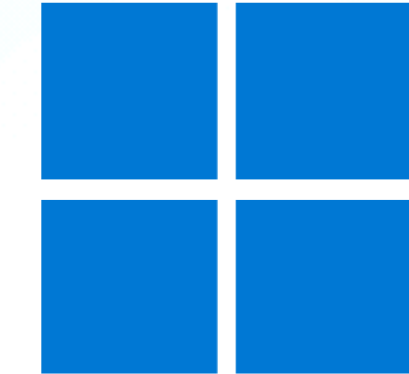
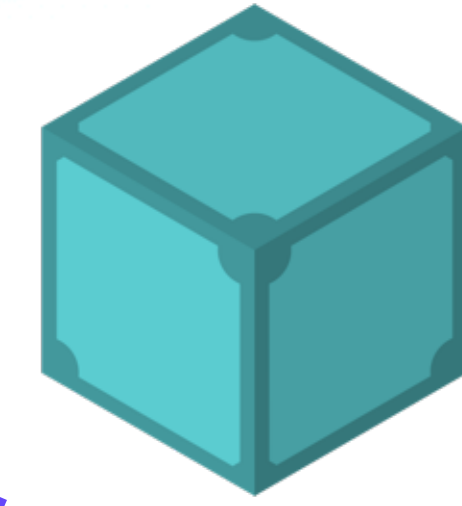
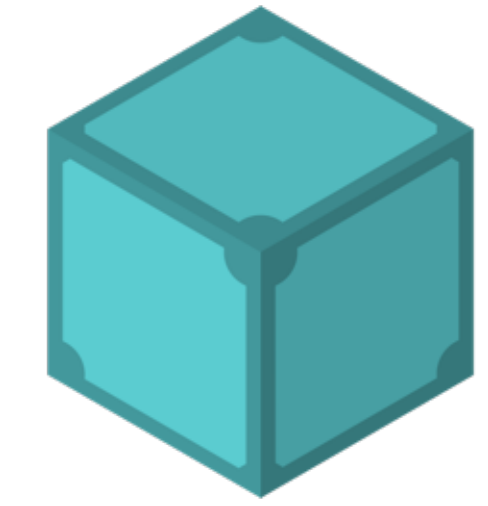
# Consistency & Consensus

# *Very Blurry Pipes*

Commons



Cloud & Edge



Far Edge





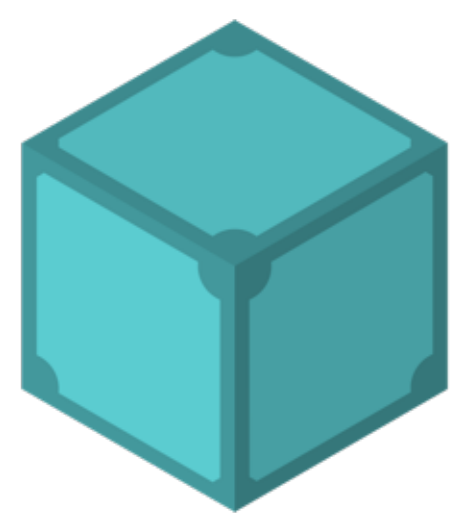
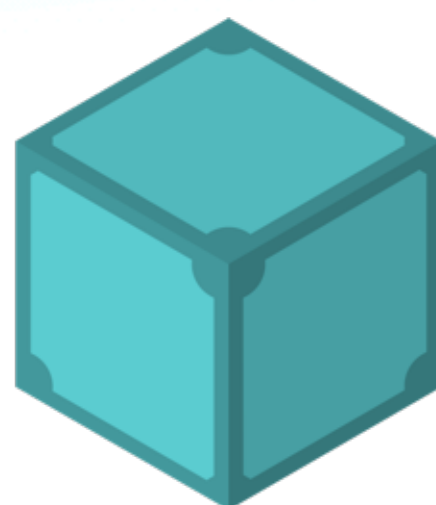
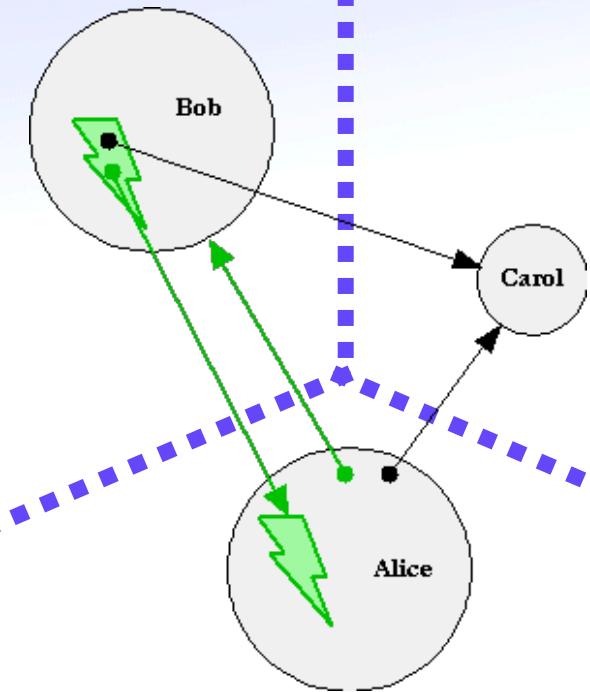
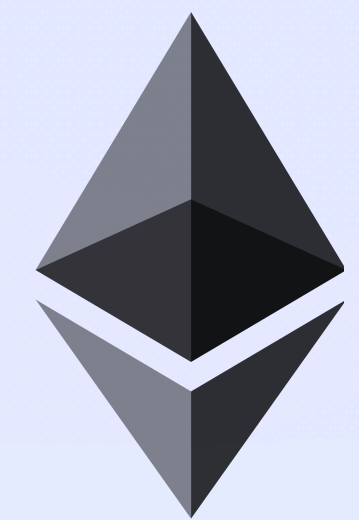
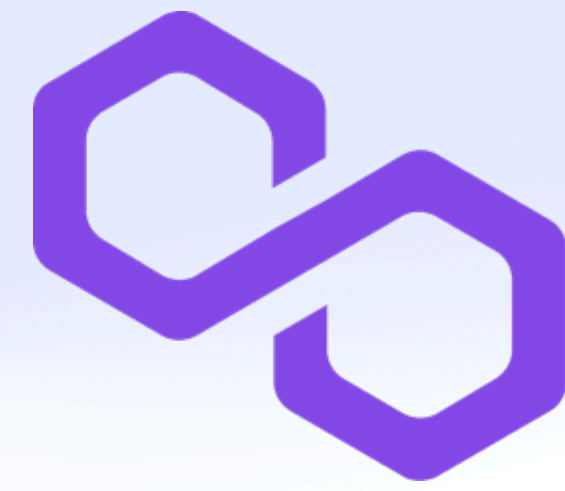
# Consistency & Consensus

# *Very Blurry Pipes*

Commons

Far Edge

Cloud & Edge



Consistency & Consensus

***Growing Toolbox***



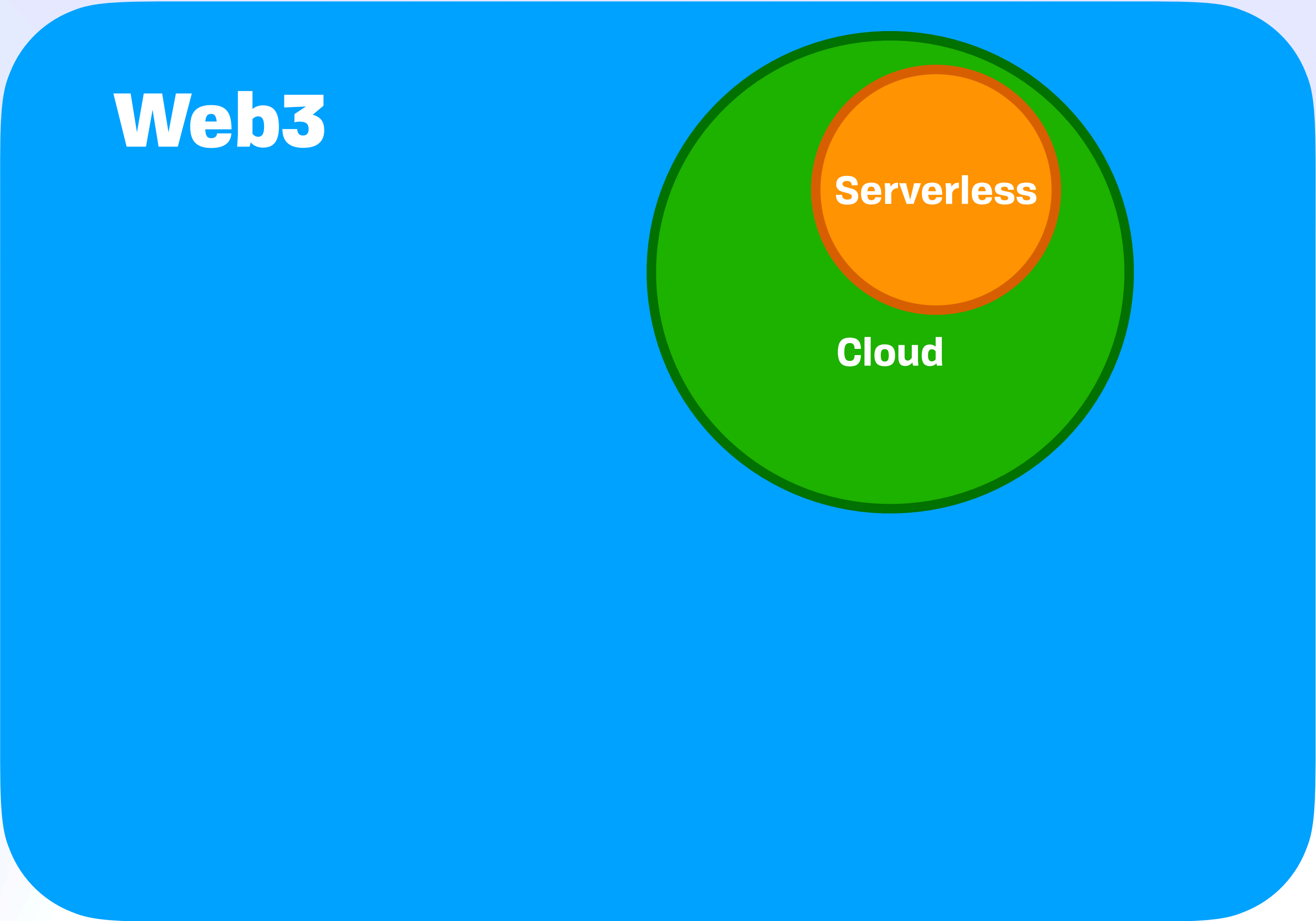
Consistency & Consensus

# *Growing Toolbox*

**Web3**

Consistency & Consensus

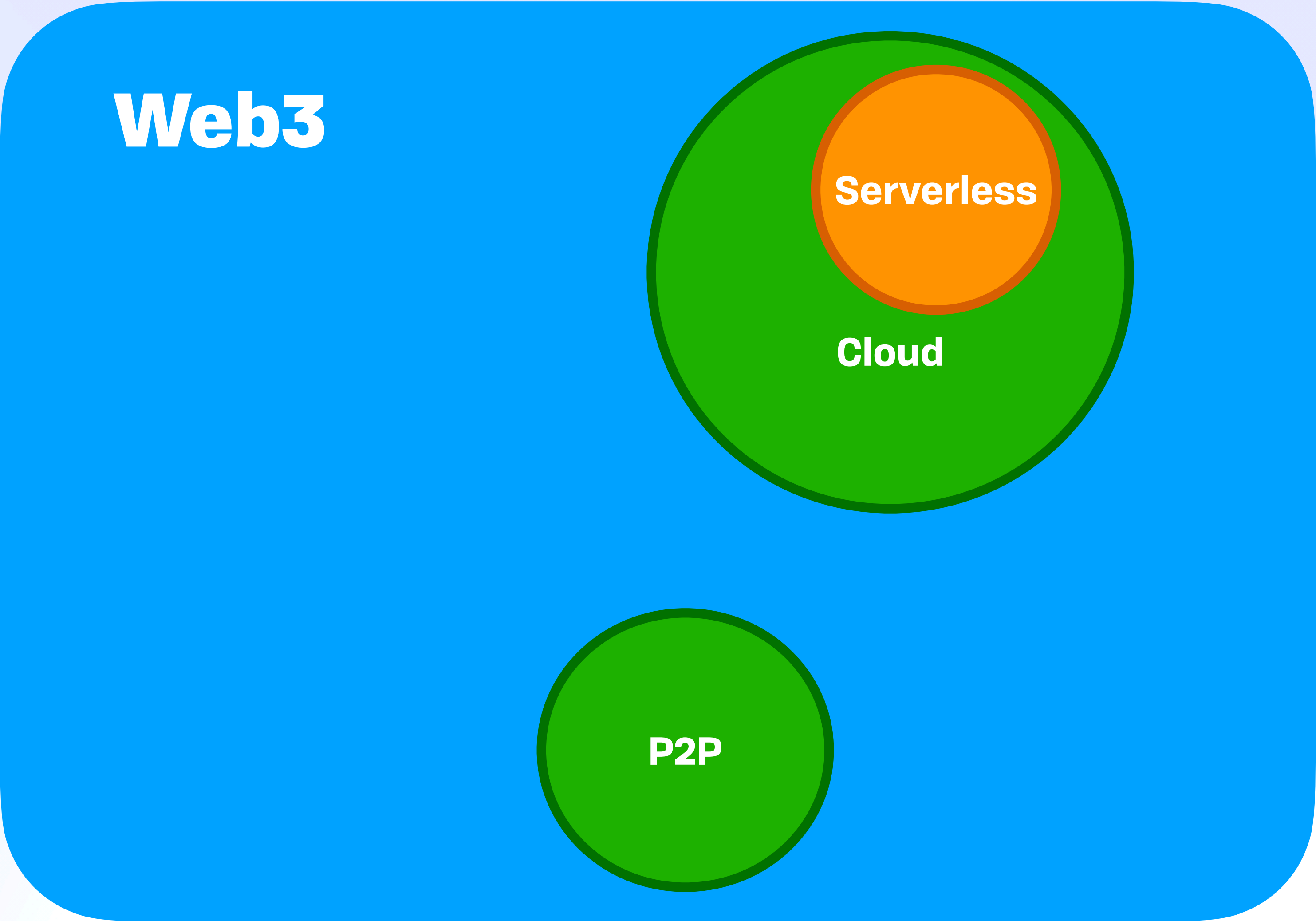
# *Growing Toolbox*





Consistency & Consensus

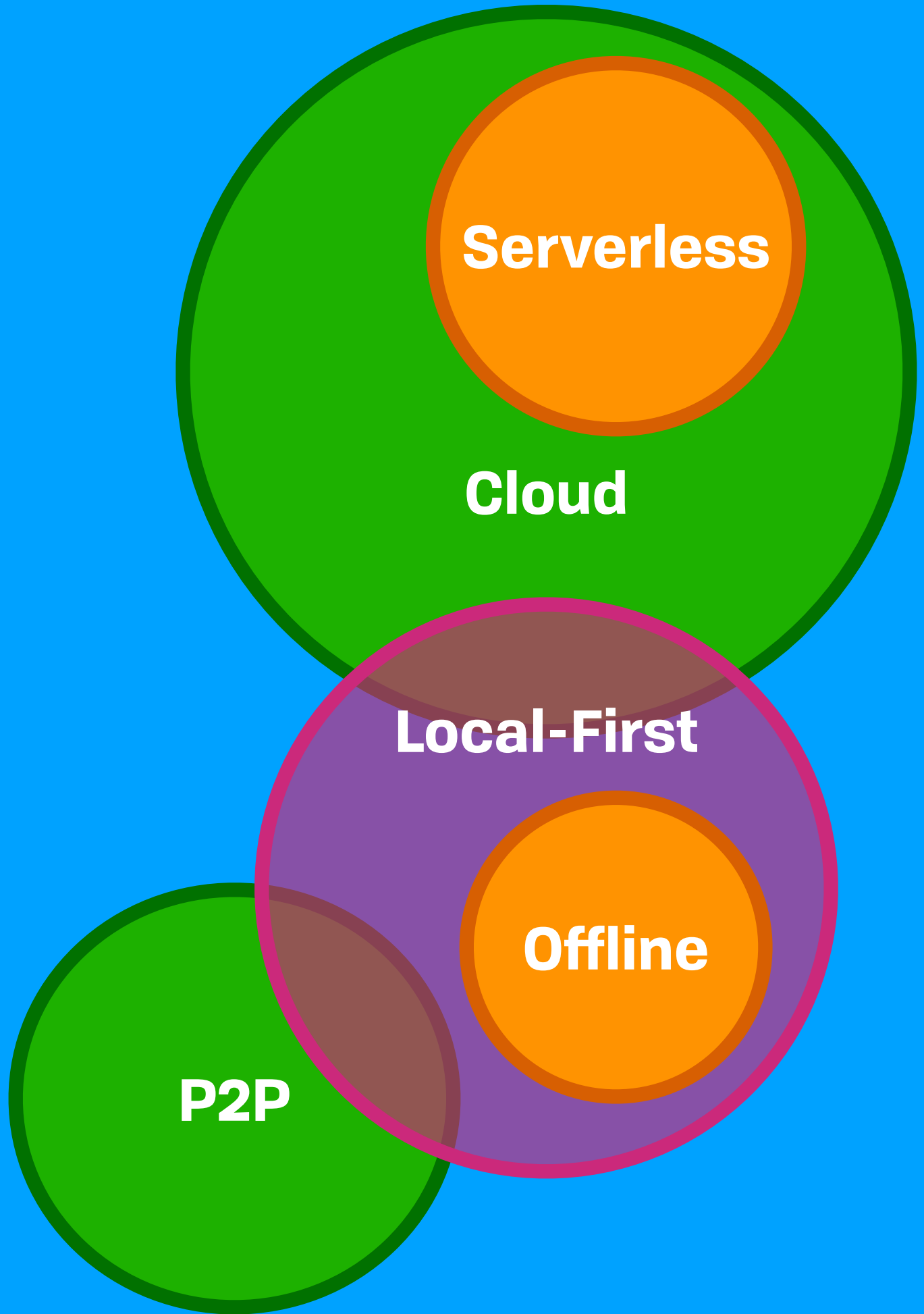
# *Growing Toolbox*



Consistency & Consensus

# *Growing Toolbox*

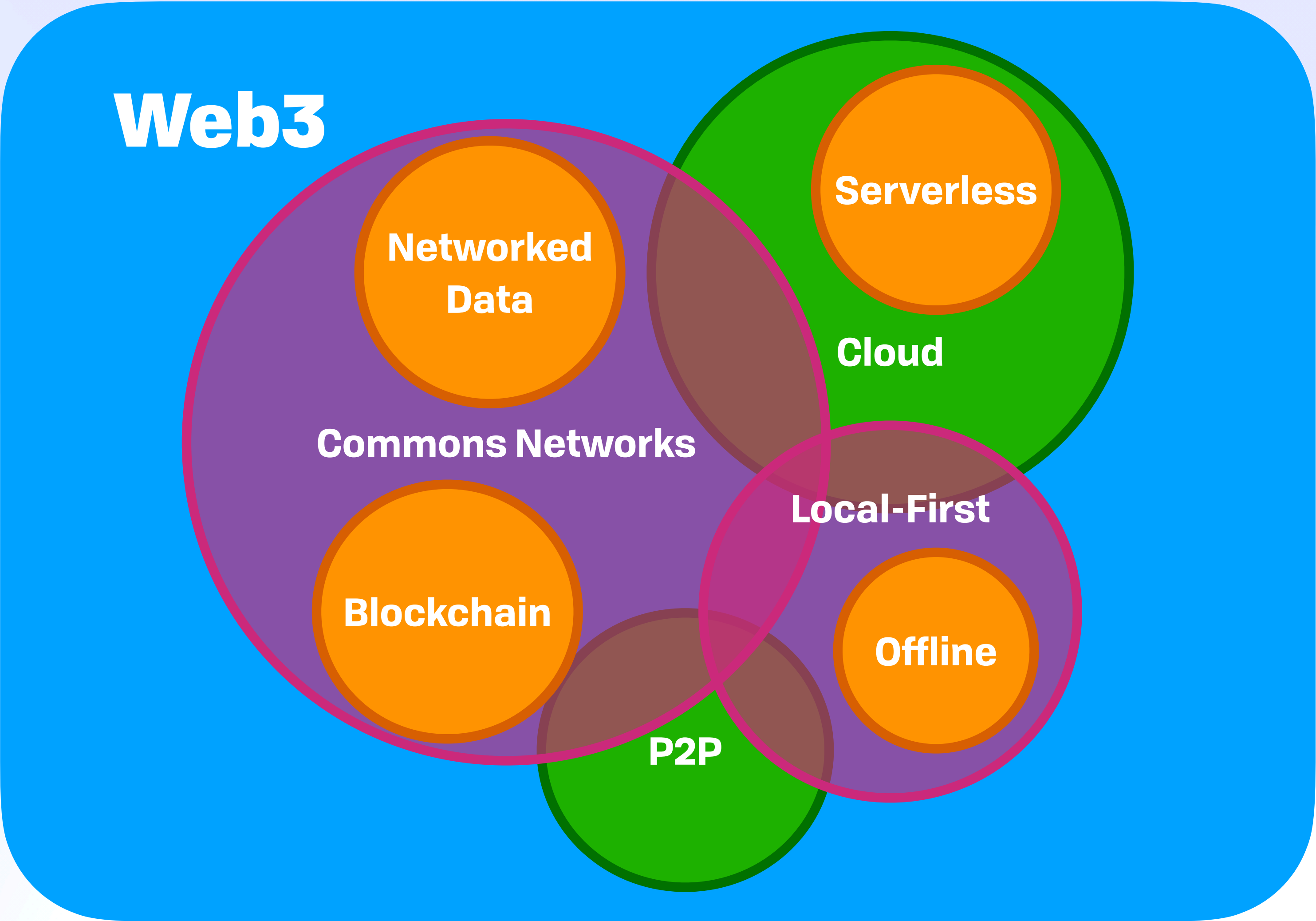
**Web3**





# Consistency & Consensus

# *Growing Toolbox*



# ***Beyond Light Speed***

**Contending with Raw Physics**

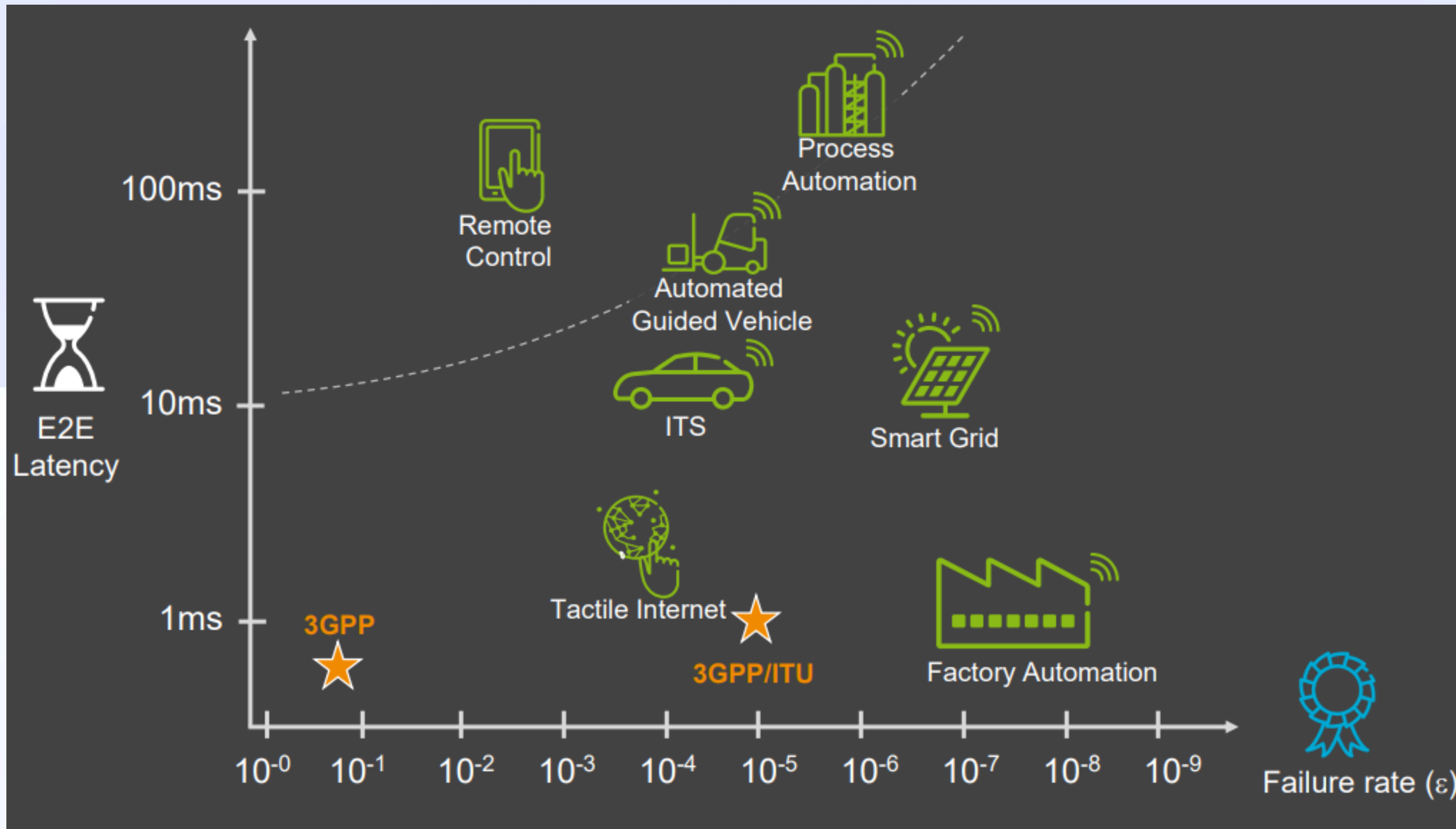


Beyond Light Speed

# ***Edge Constraints***

# Beyond Light Speed

## Edge Constraints



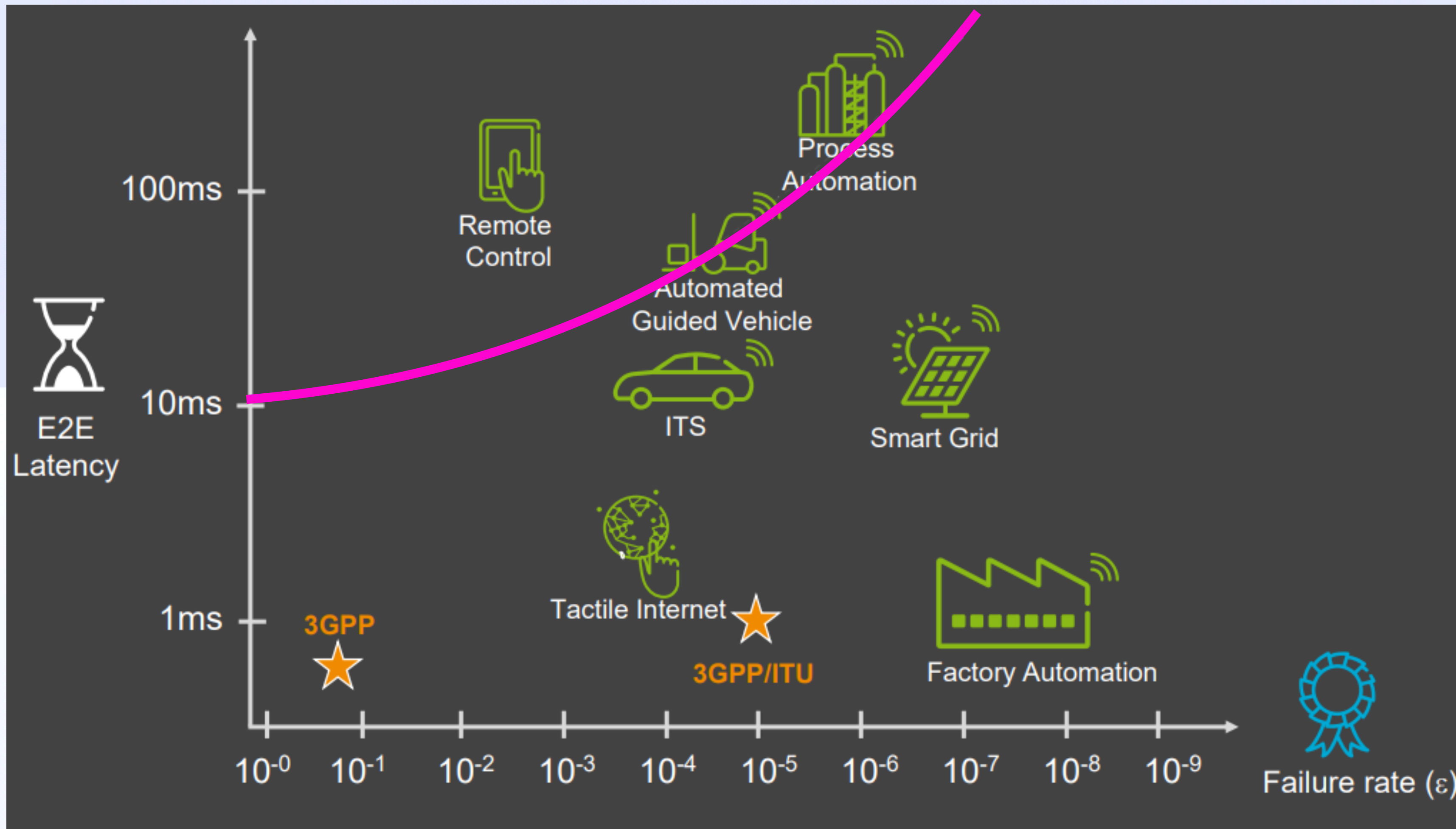
Source: Ericsson

[http://cscn2017.ieee-cscn.org/files/2017/08/Janne\\_Peisa\\_Ericsson\\_CSCN2017.pdf](http://cscn2017.ieee-cscn.org/files/2017/08/Janne_Peisa_Ericsson_CSCN2017.pdf)



# Beyond Light Speed

## Edge Constraints



Source: Ericsson

[http://cscn2017.ieee-cscn.org/files/2017/08/Janne\\_Peisa\\_Ericsson\\_CSCN2017.pdf](http://cscn2017.ieee-cscn.org/files/2017/08/Janne_Peisa_Ericsson_CSCN2017.pdf)

Beyond Light Speed

***What 8ms Looks Like***



# Beyond Light Speed

# *What 8ms Looks Like*

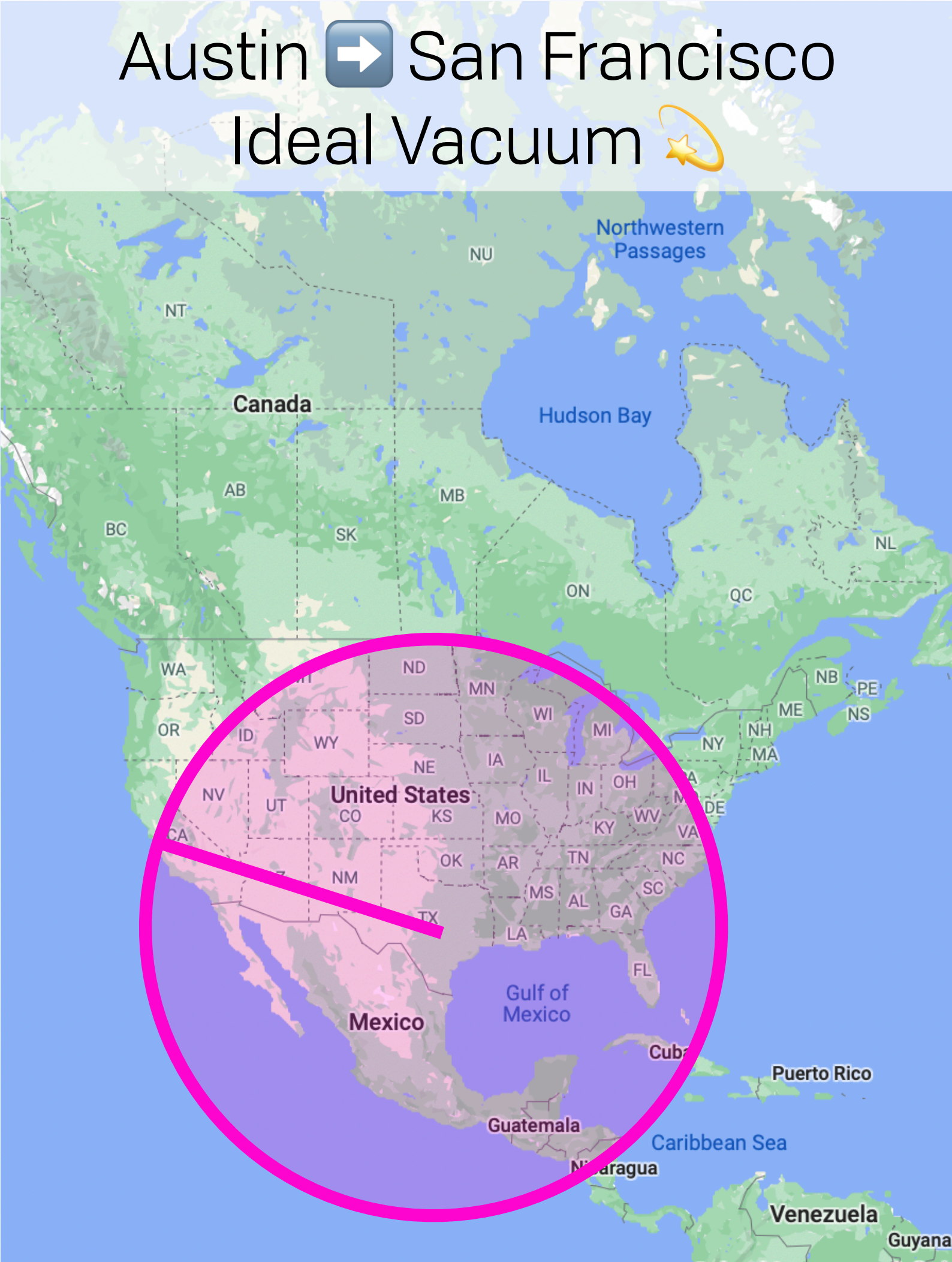




# Beyond Light Speed

# *What 8ms Looks Like*

Austin → San Francisco  
Ideal Vacuum 🌟



Austin ↻ (almost) Atlanta  
Ideal Vacuum 🌟

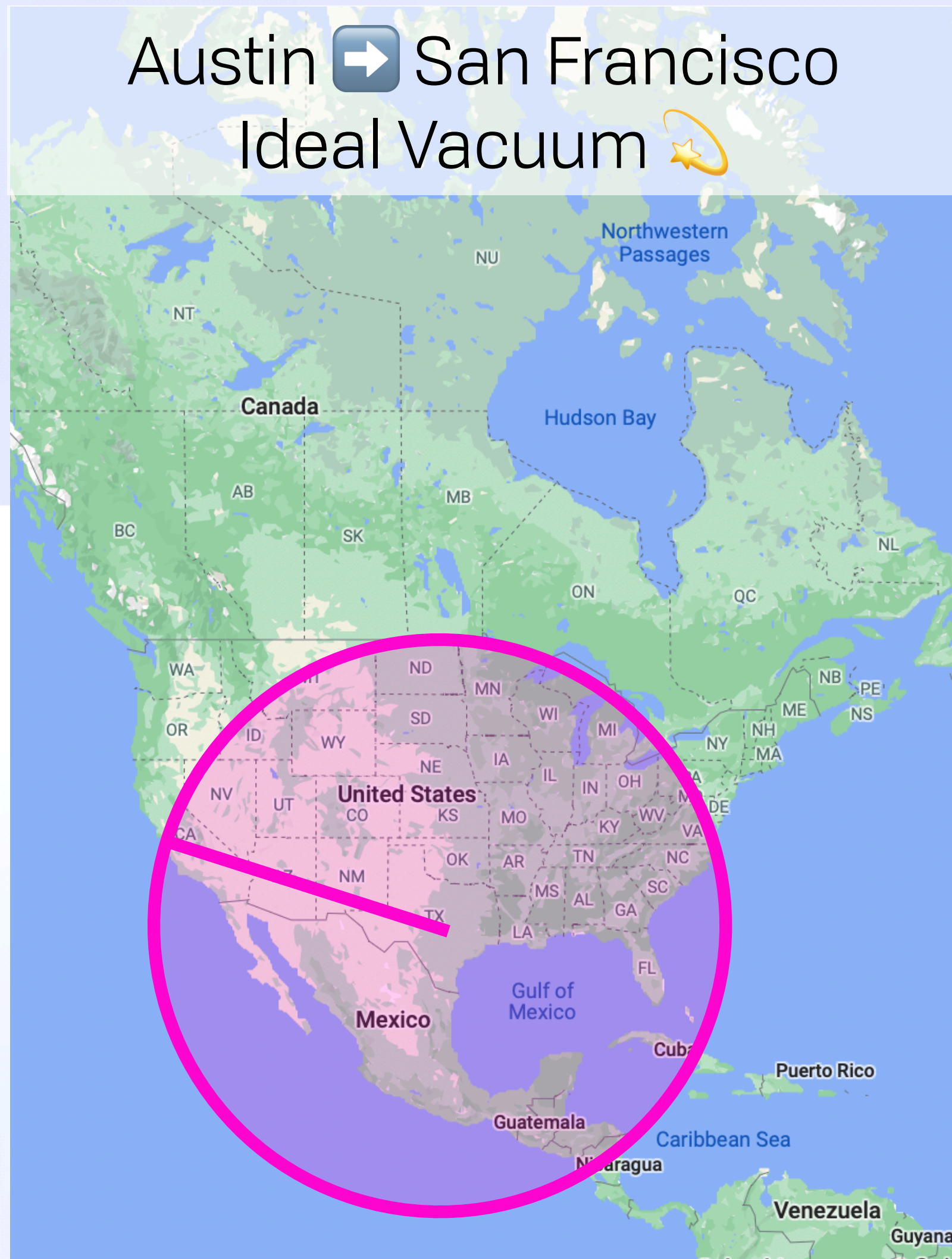




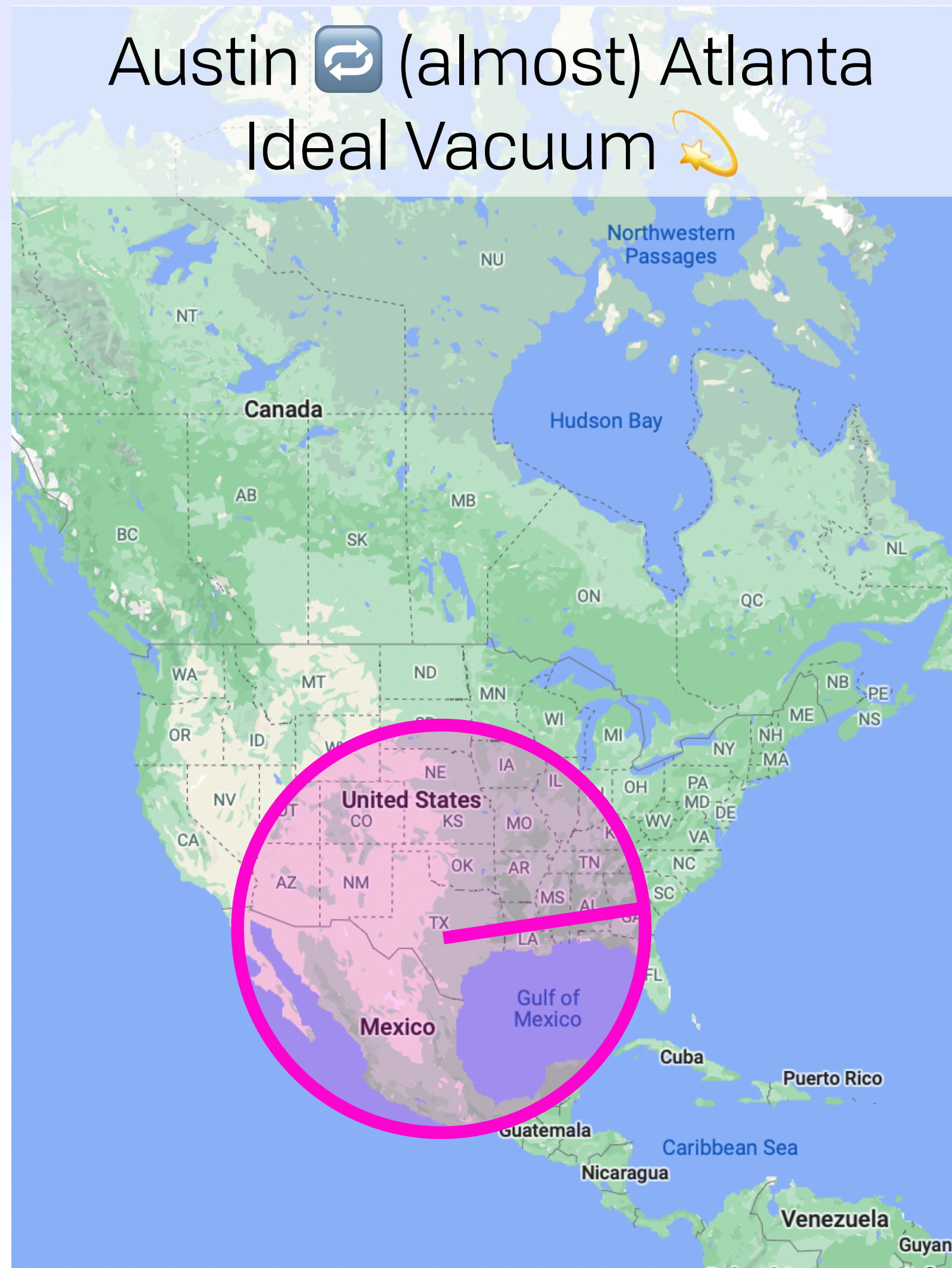
# Beyond Light Speed

## *What 8ms Looks Like*

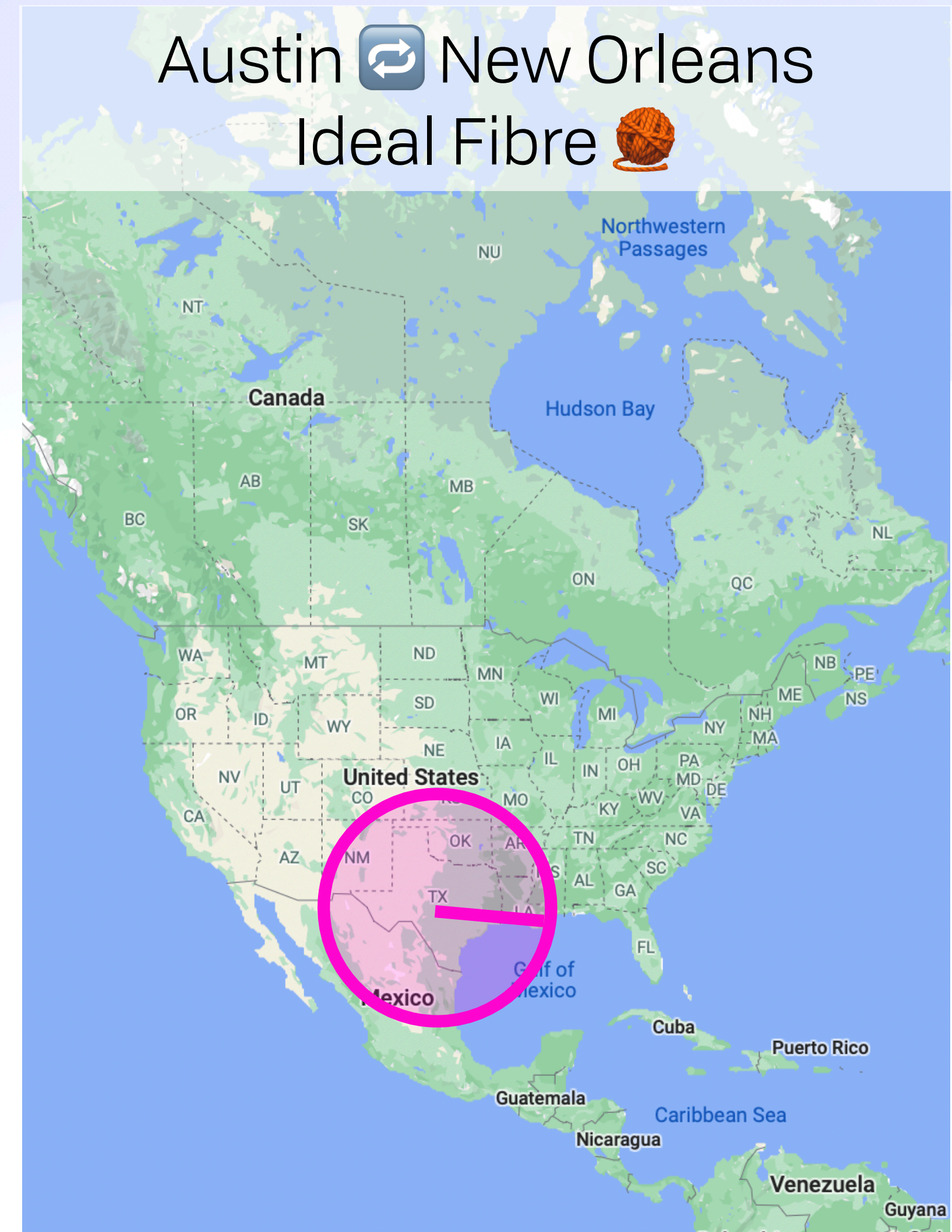
Austin → San Francisco  
Ideal Vacuum 🌟



Austin ↻ (almost) Atlanta  
Ideal Vacuum 🌟



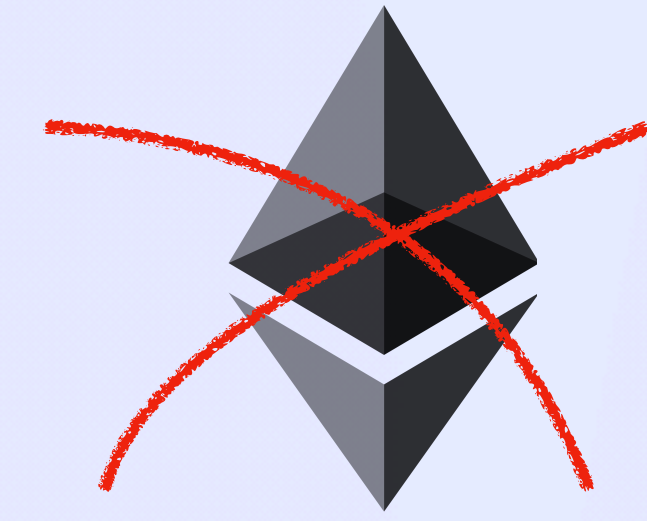
Austin ↻ New Orleans  
Ideal Fibre 🧶



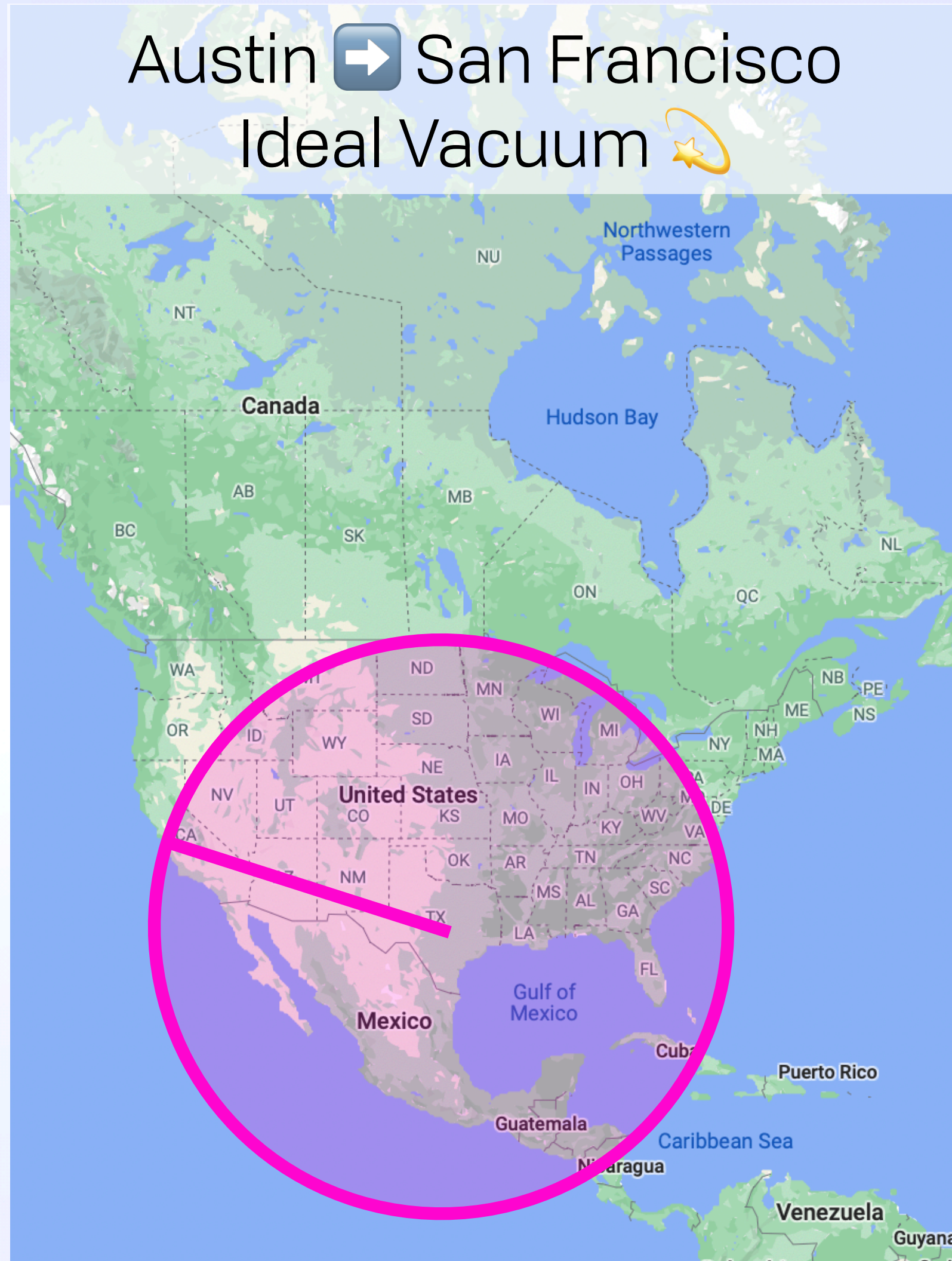


# Beyond Light Speed

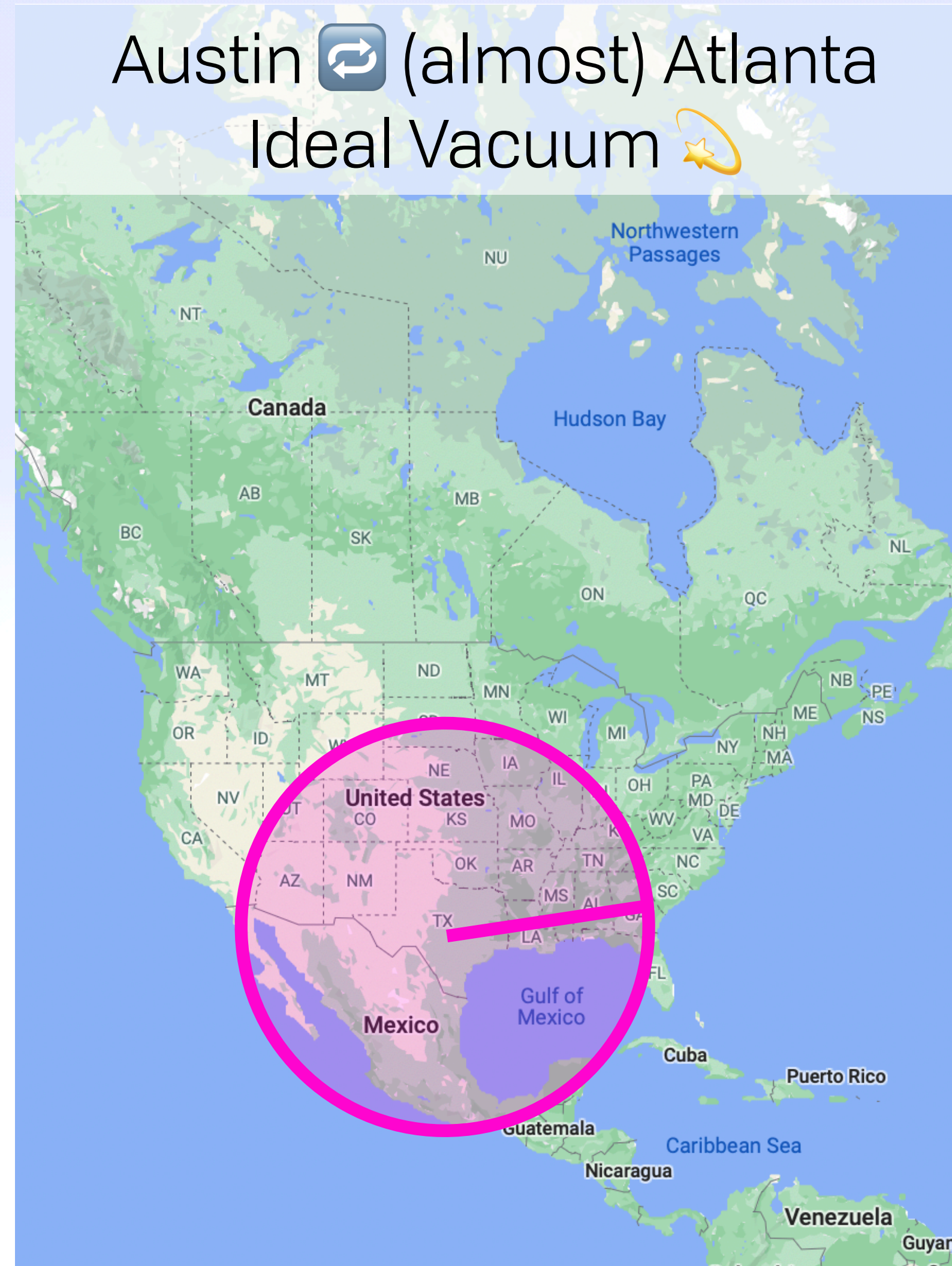
## *What 8ms Looks Like*



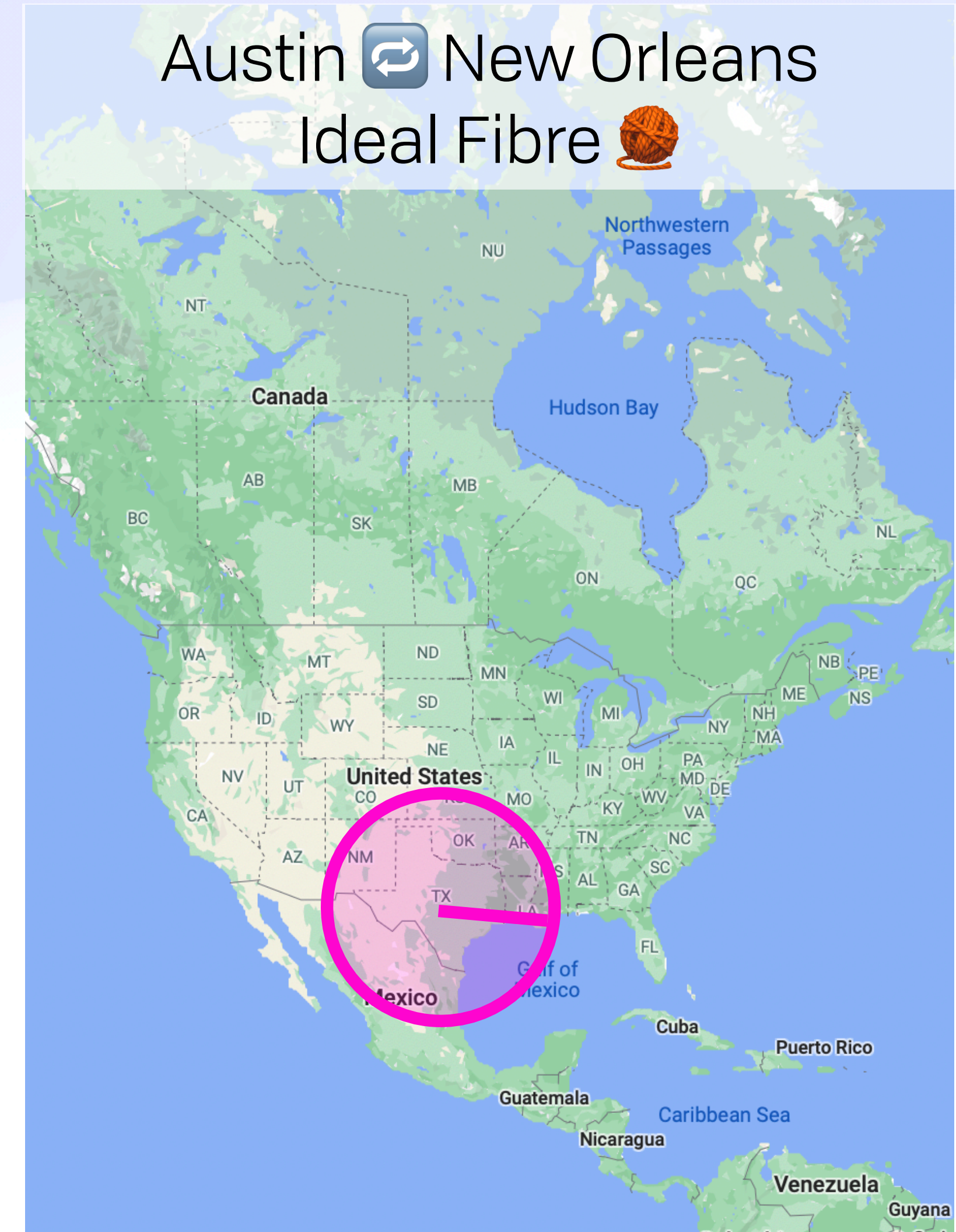
Austin → San Francisco  
Ideal Vacuum 🌟



Austin ↻ (almost) Atlanta  
Ideal Vacuum 🌟



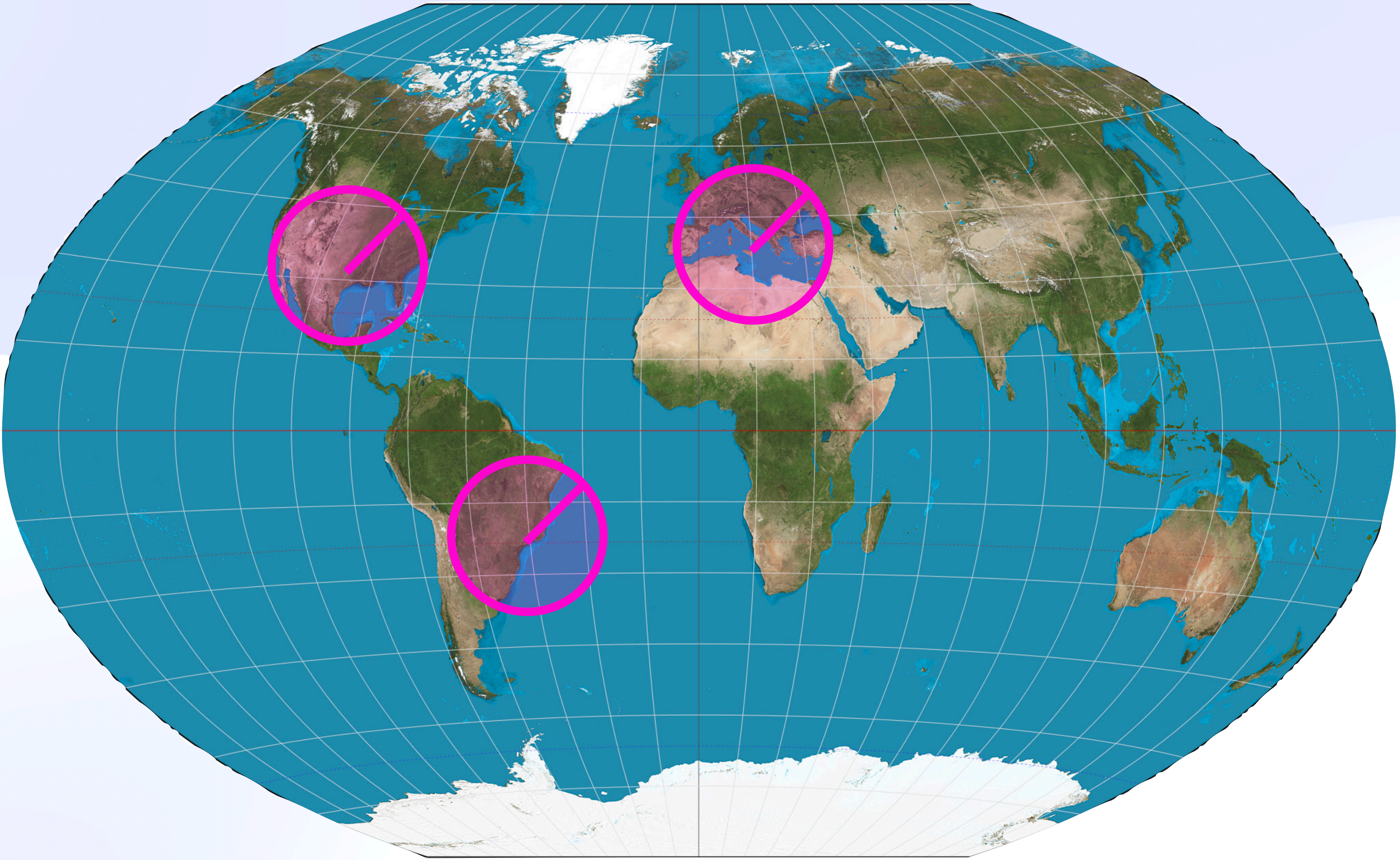
Austin ↻ New Orleans  
Ideal Fibre 🧶





Beyond Light Speed

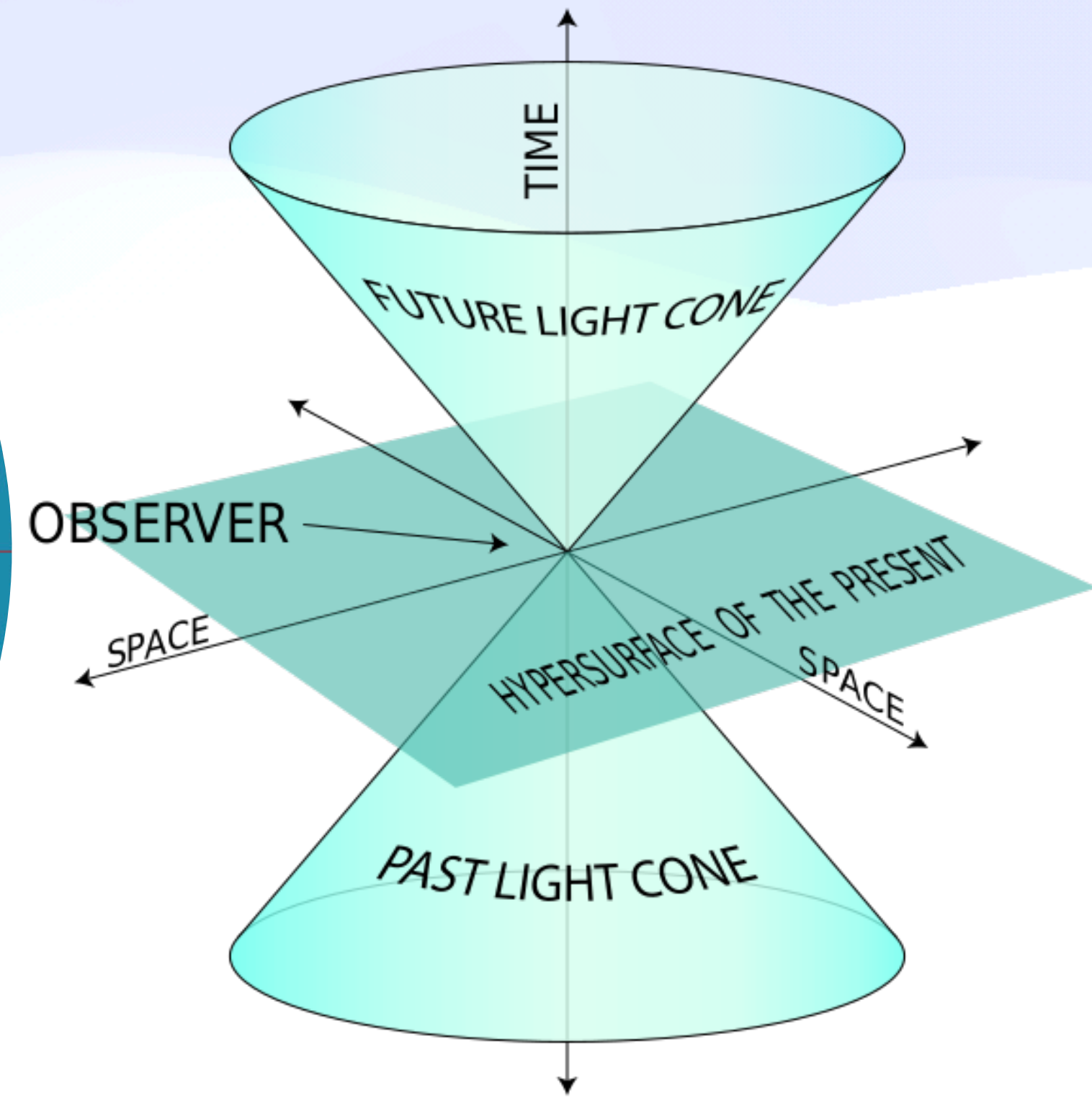
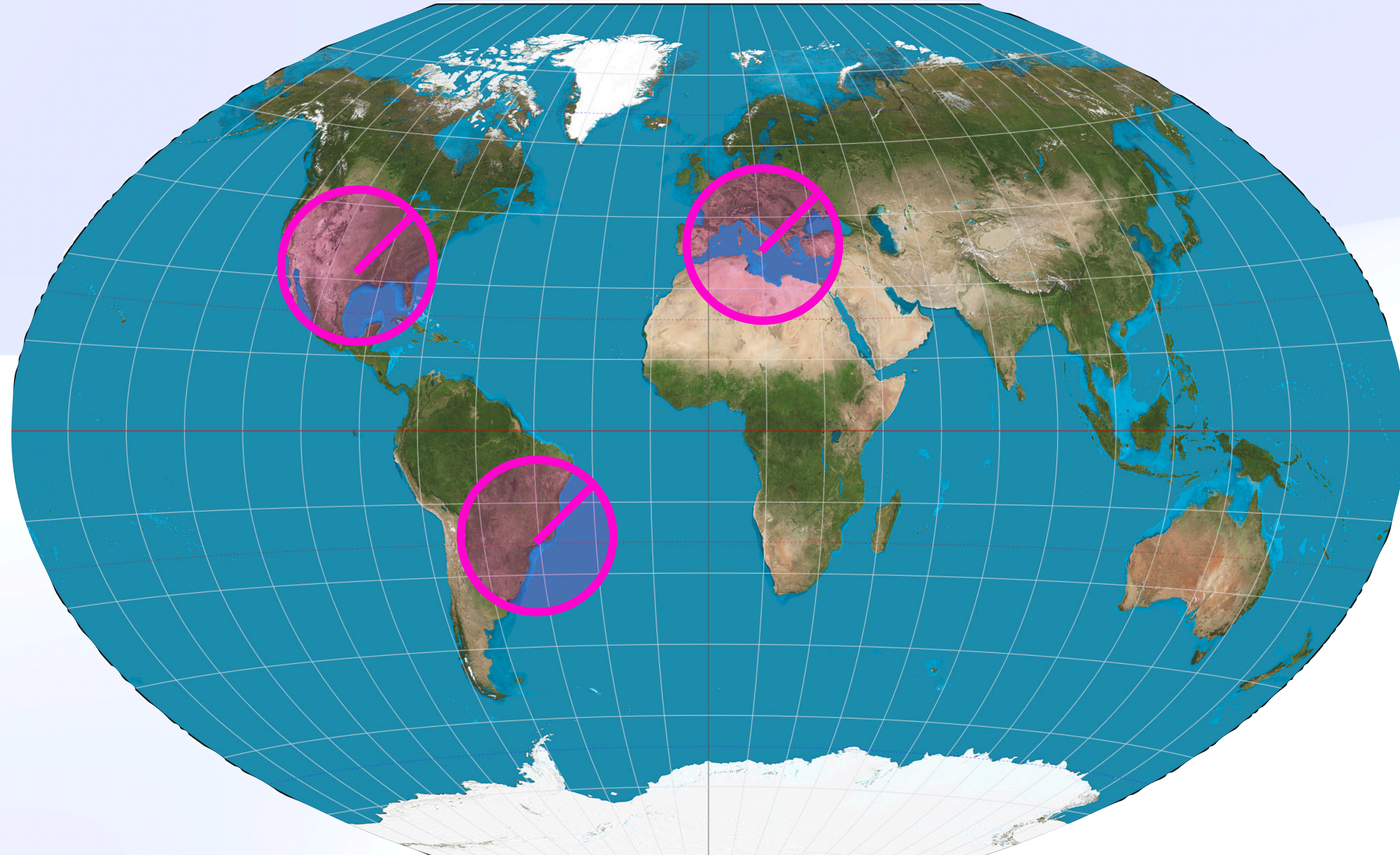
# *Causal Islands* 🏖️ 🌴





# Beyond Light Speed

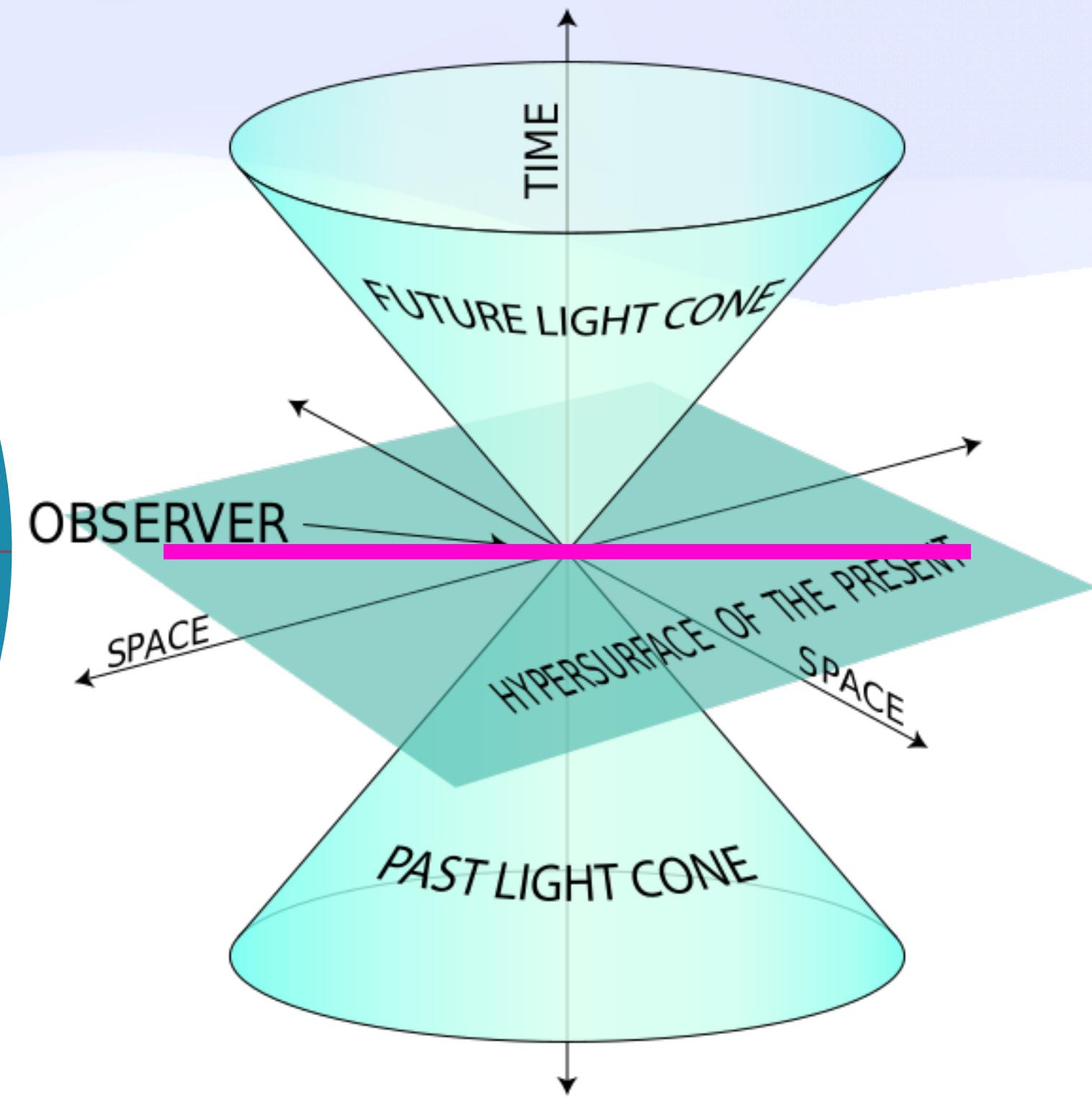
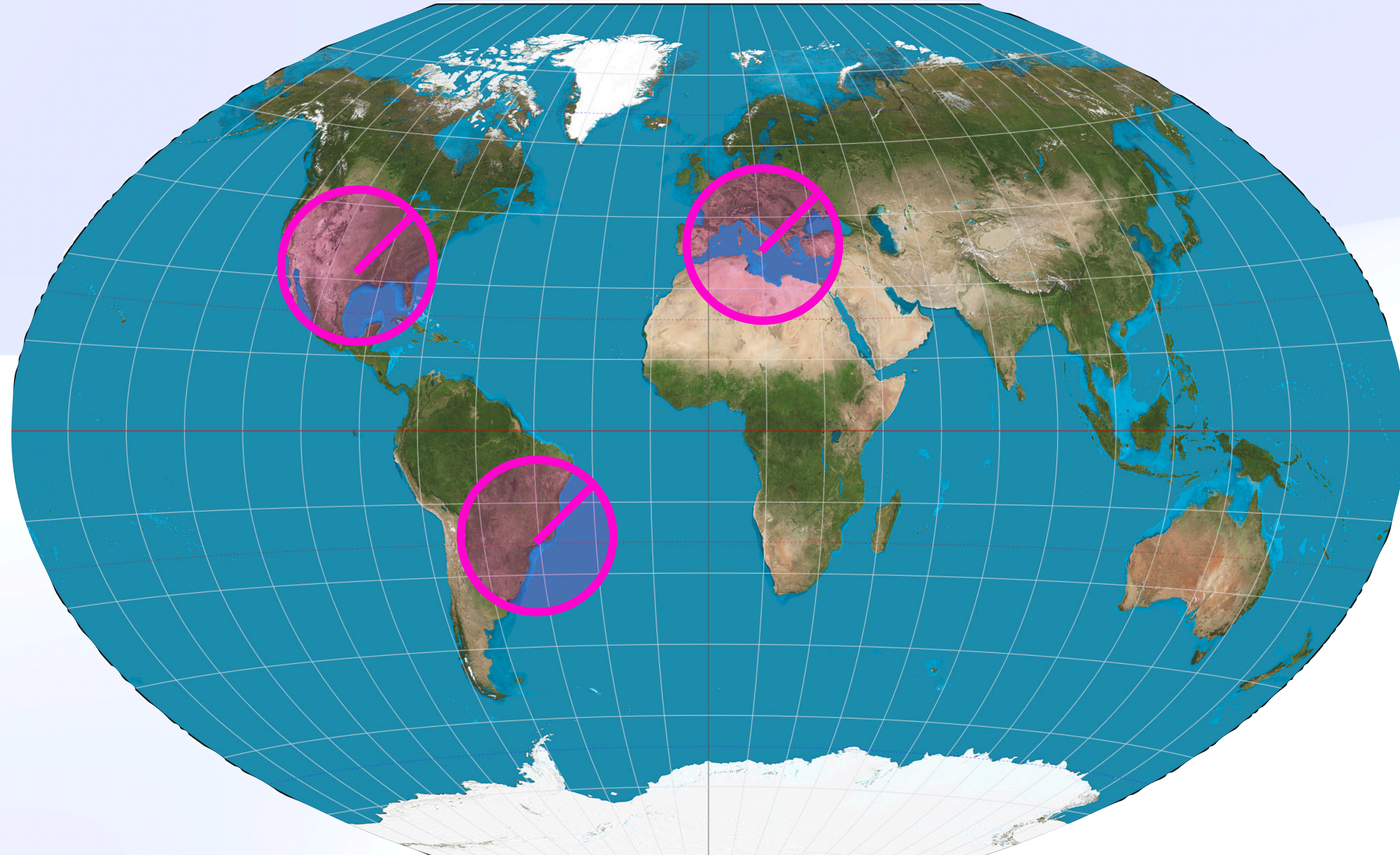
# *Causal Islands* 🏖️ 🌴





# Beyond Light Speed

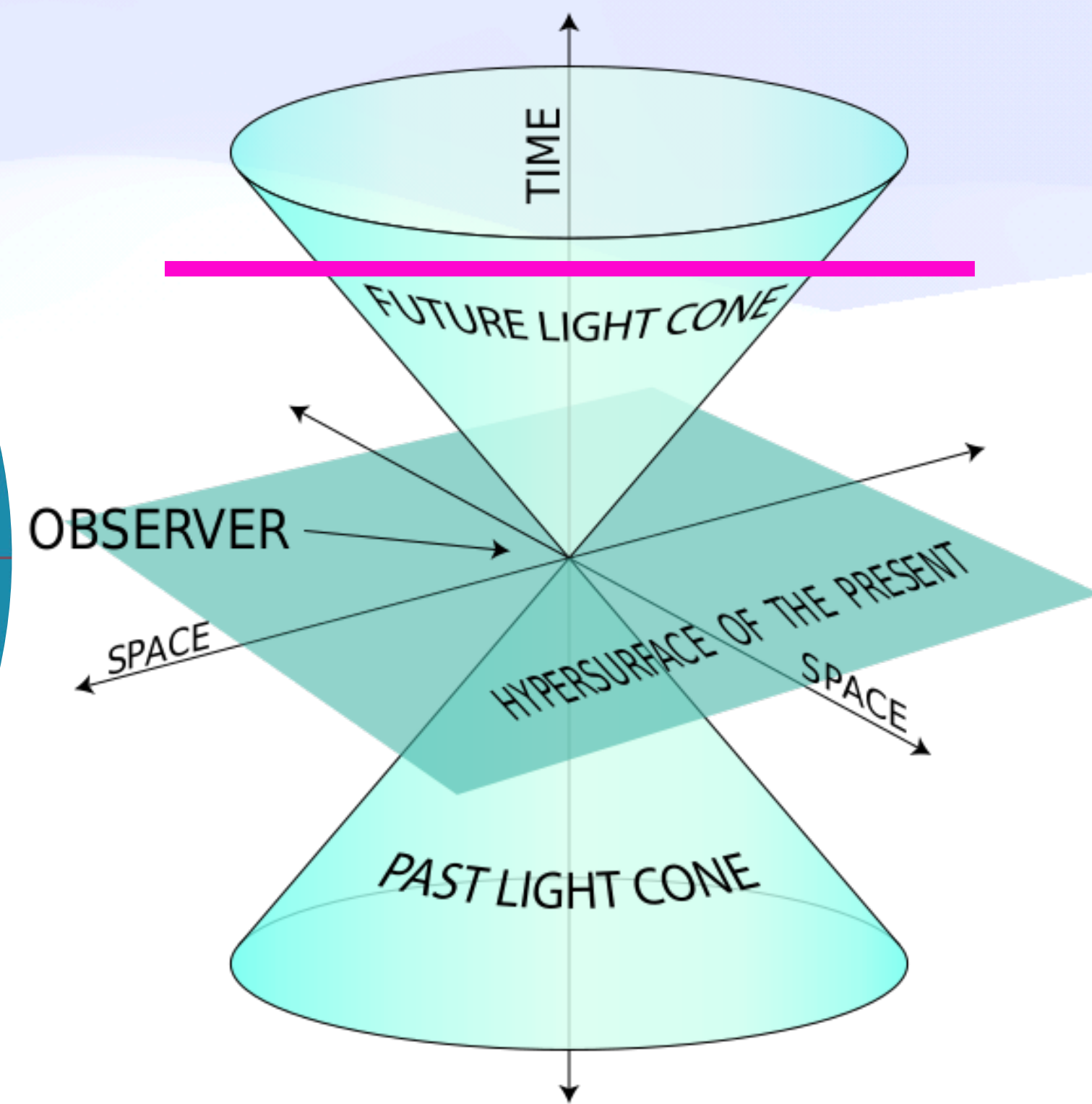
# *Causal Islands* 🏖️ 🌴





# Beyond Light Speed

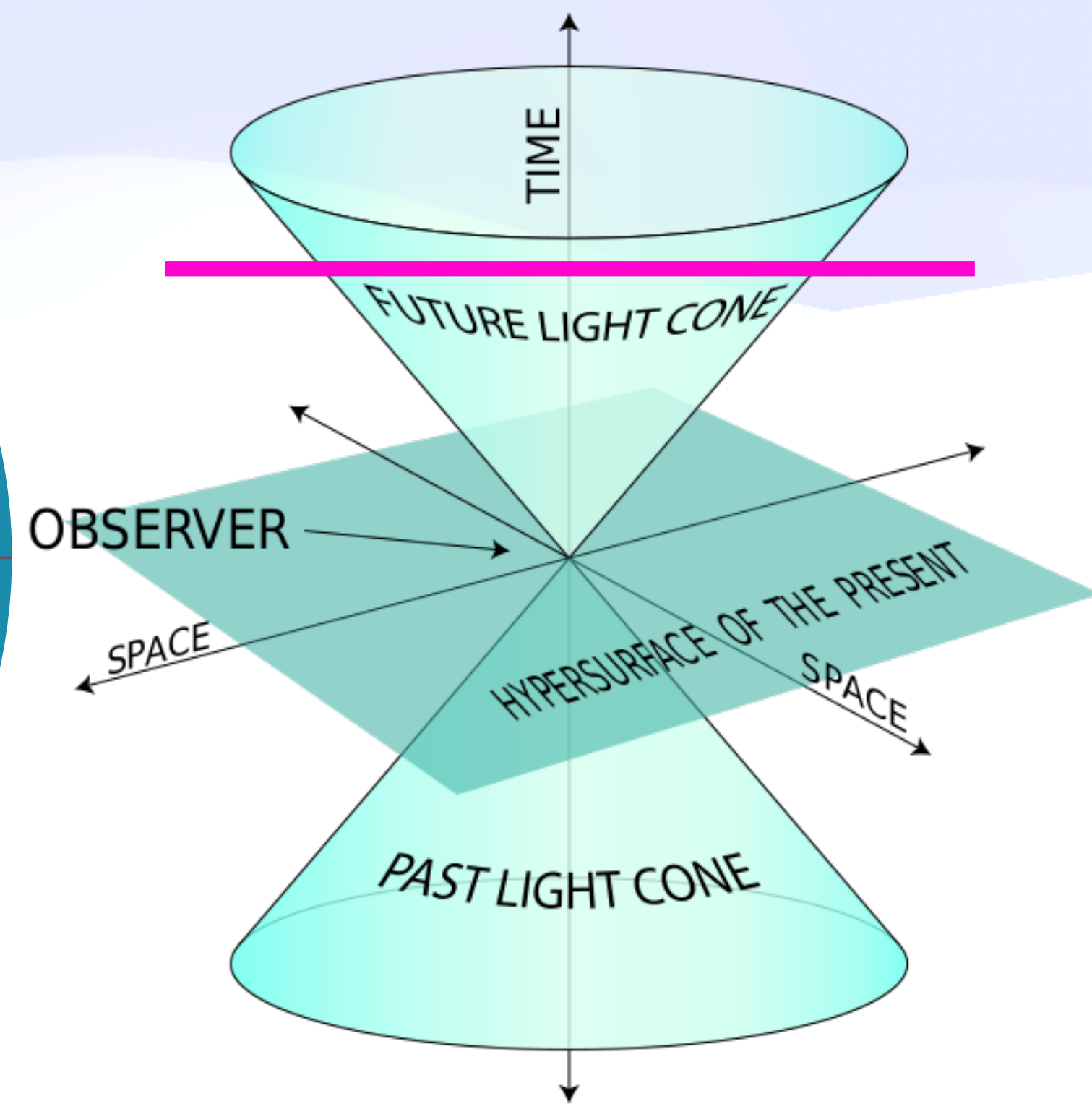
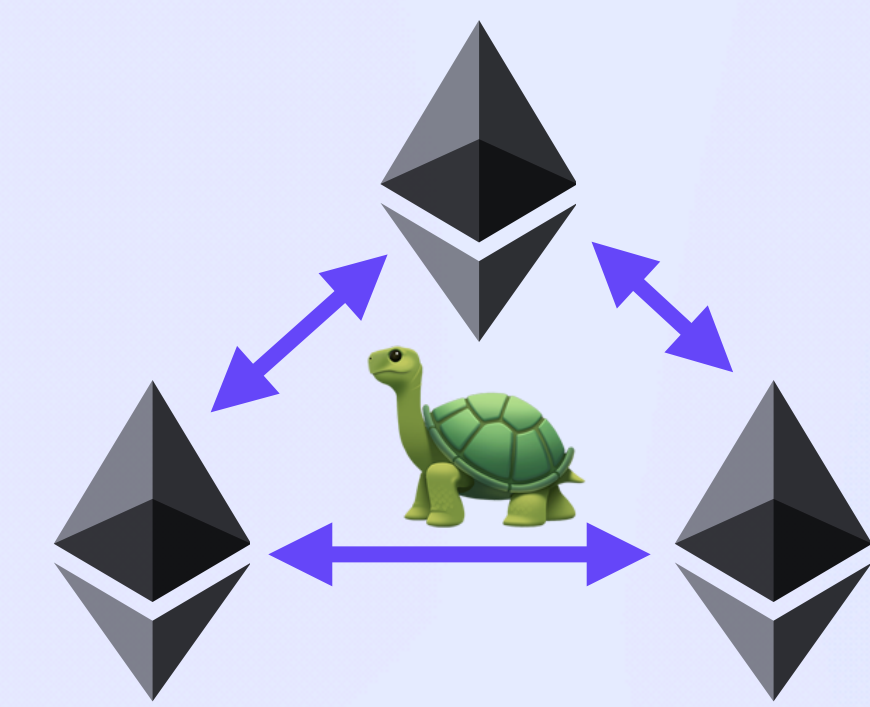
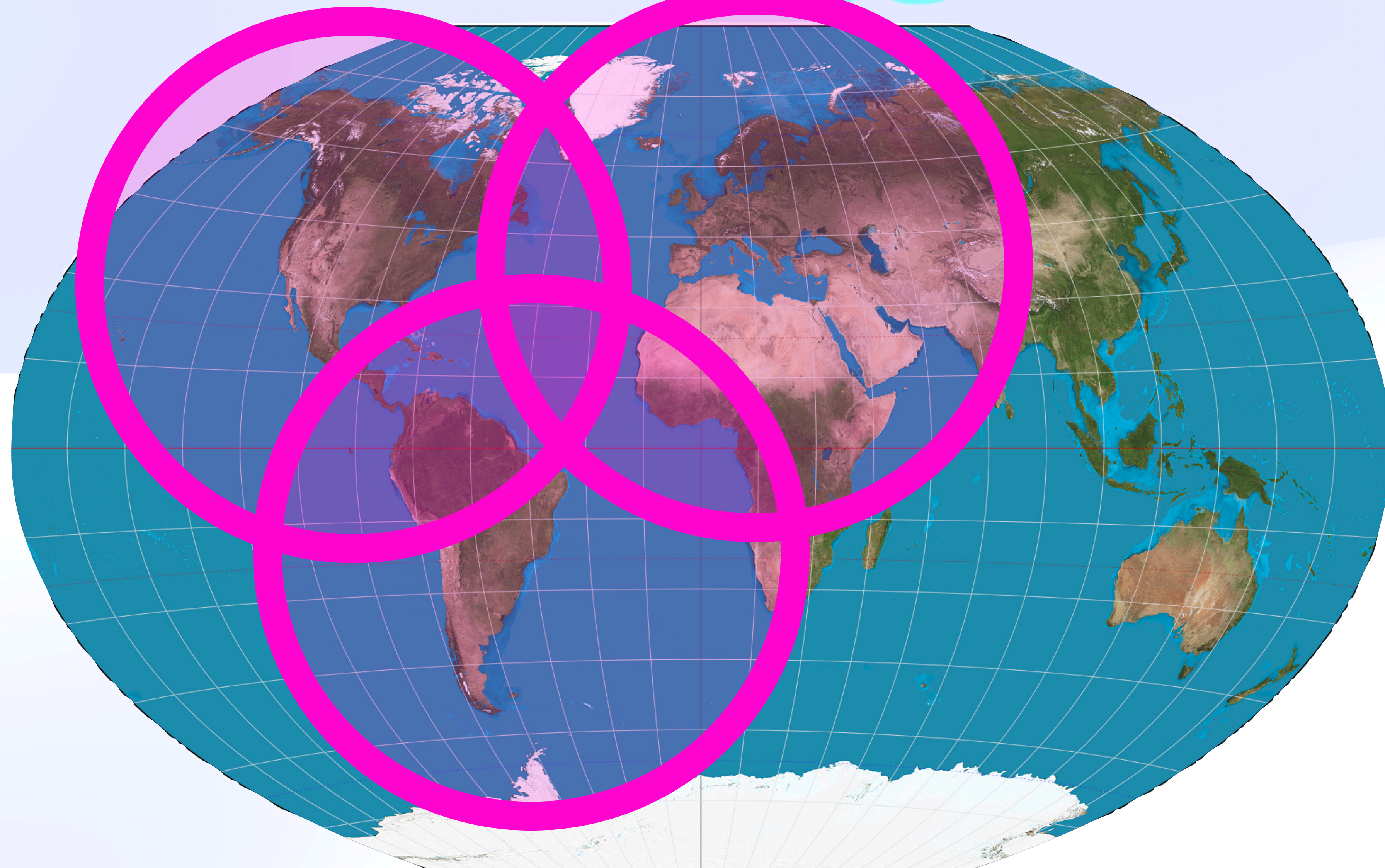
# *Causal Islands* 🏖️ 🌴





Beyond Light Speed

# *Causal Islands*





Beyond Light Speed

**Spectrum** 



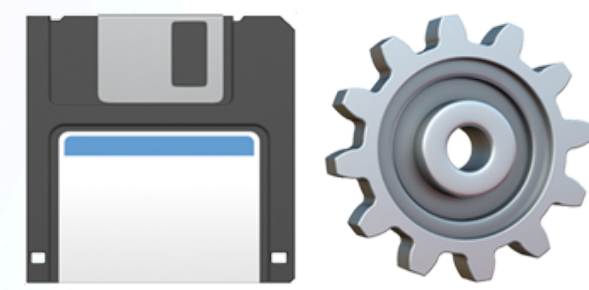
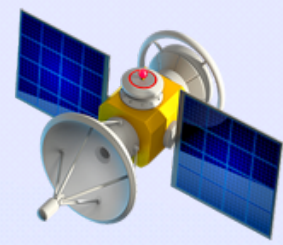
Beyond Light Speed

**Spectrum** 



Beyond Light Speed

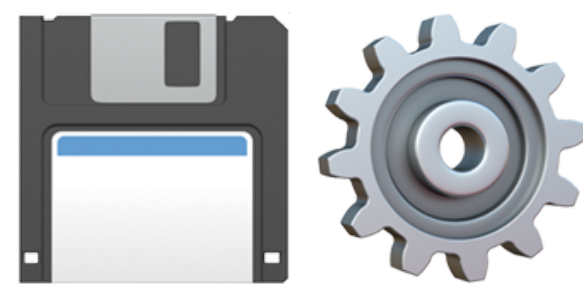
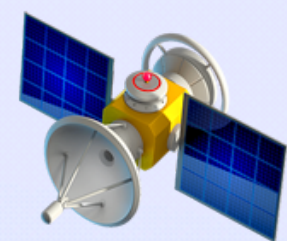
# *Spectrum*





Beyond Light Speed

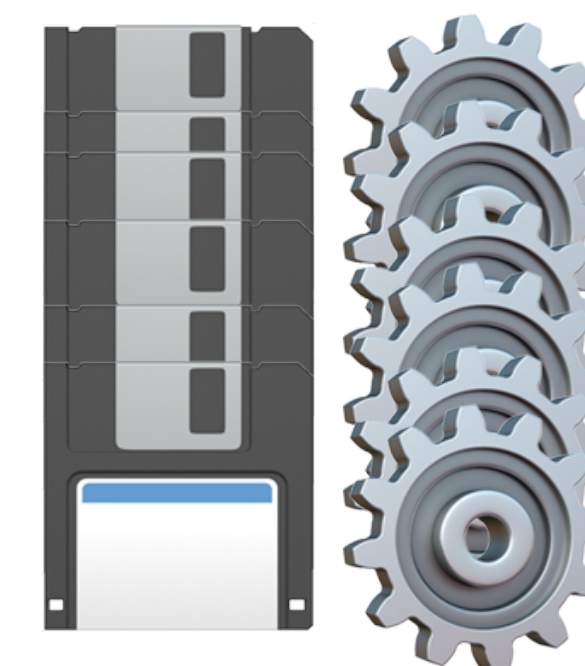
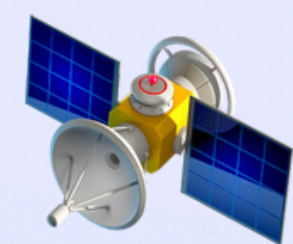
# *Spectrum*





Beyond Light Speed

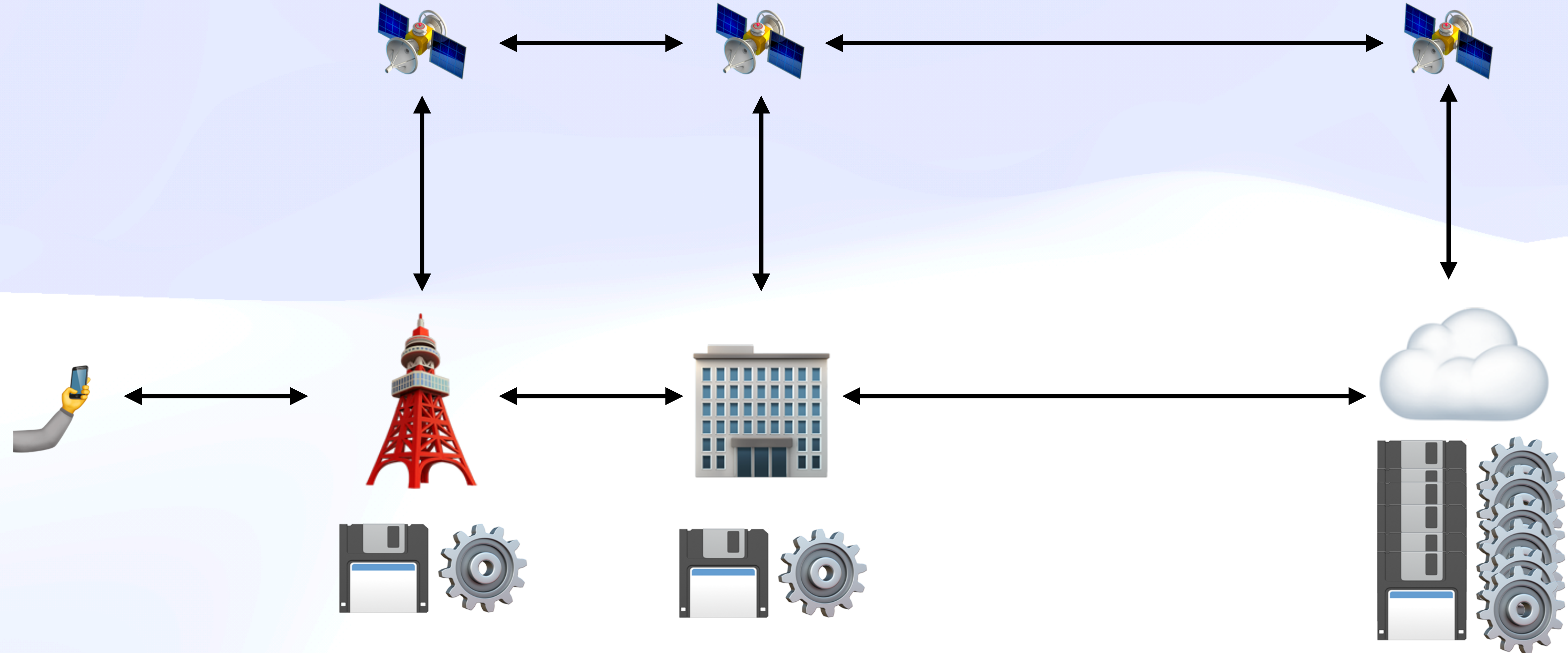
# *Spectrum* 🌈





# Beyond Light Speed

# *Spectrum*

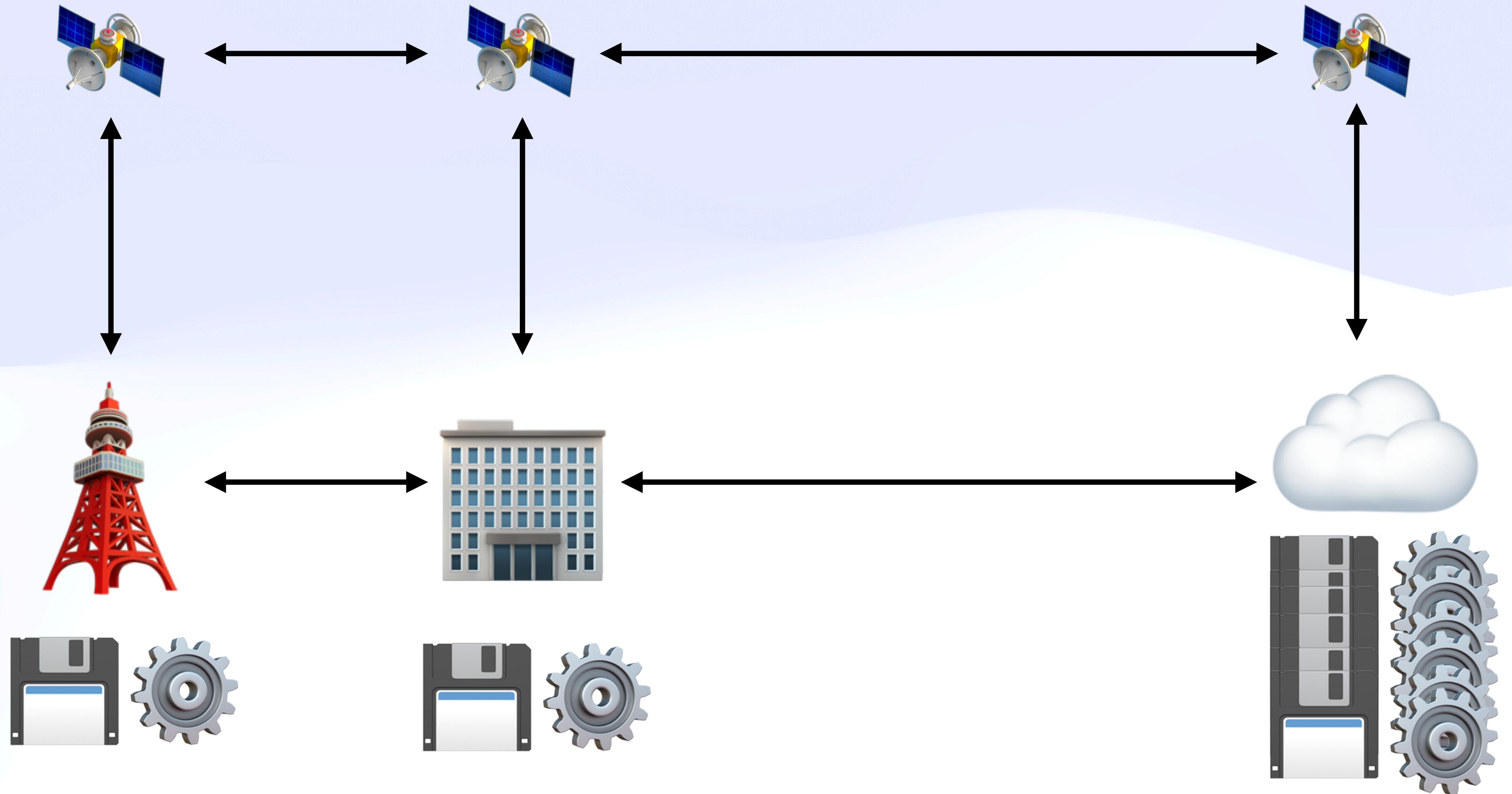




Beyond Light Speed

# *Spectrum*

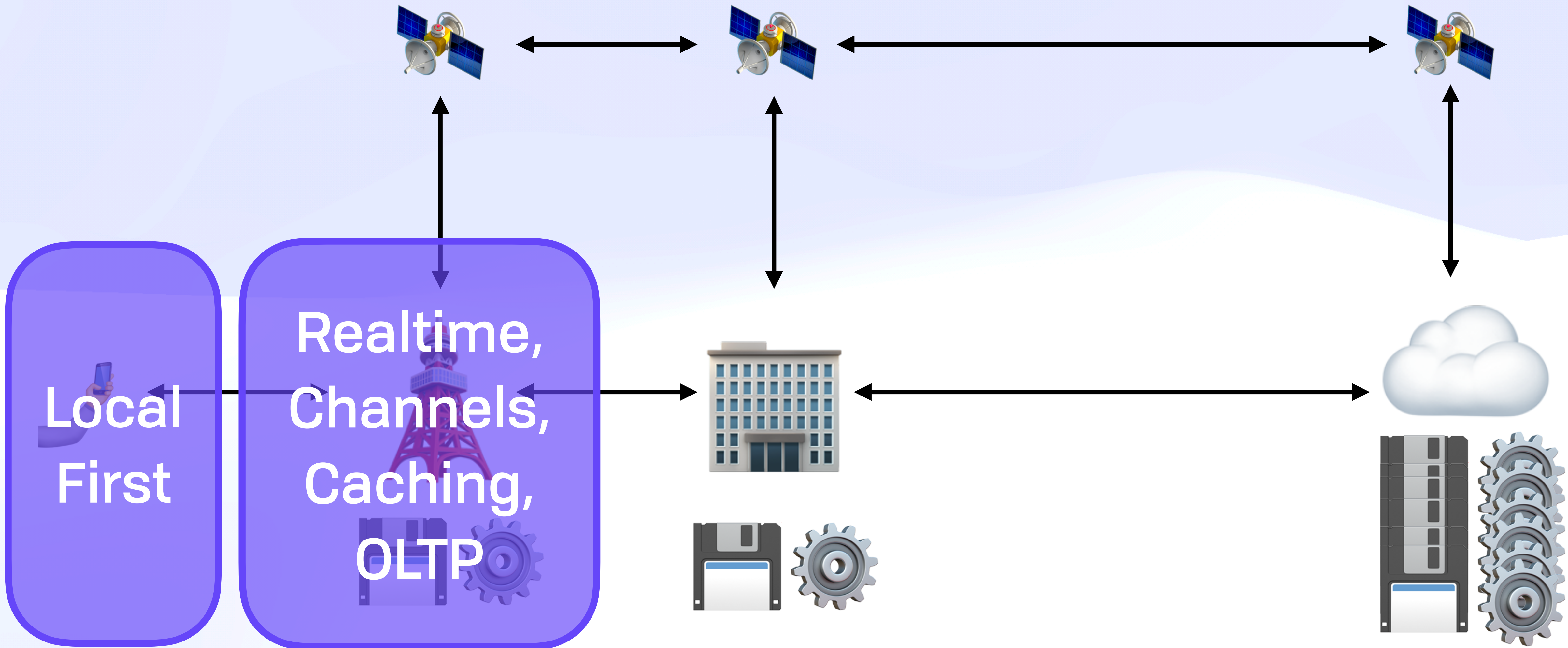
Local  
First





Beyond Light Speed

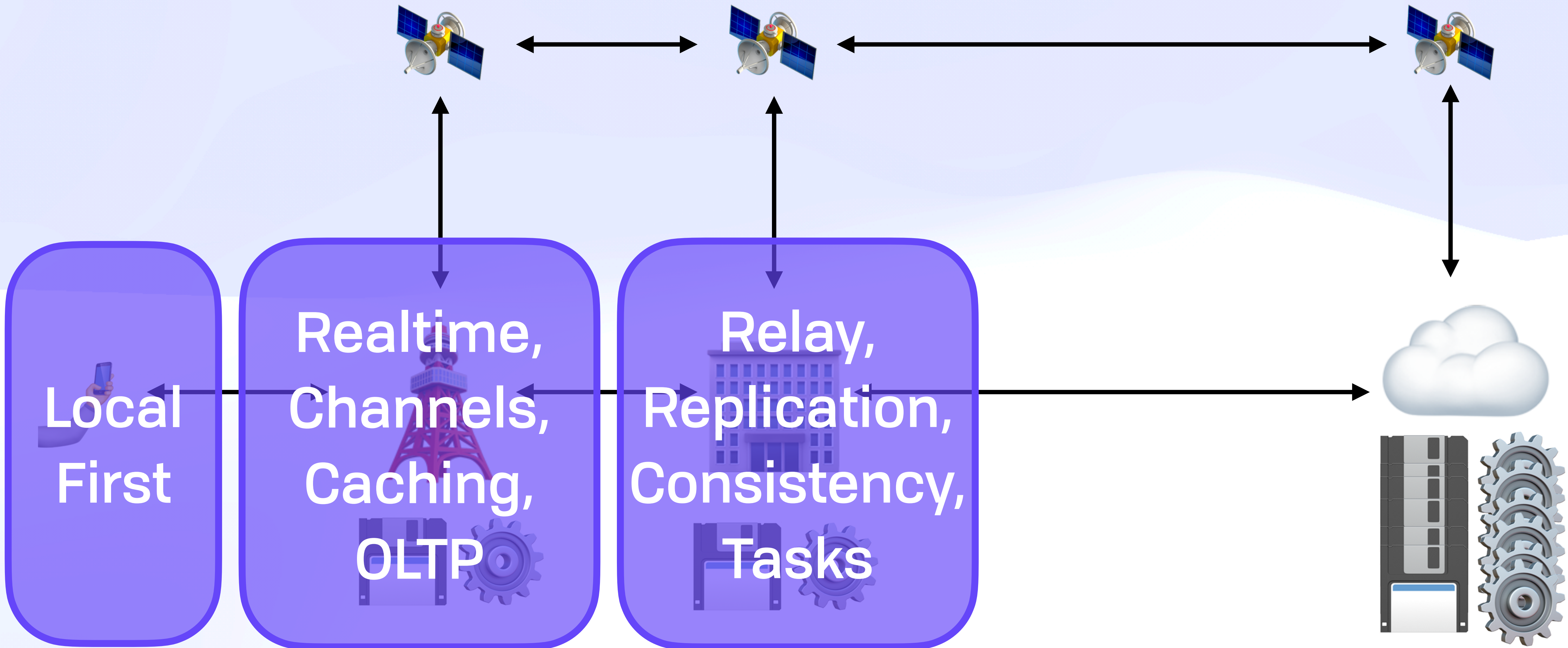
# *Spectrum*





Beyond Light Speed

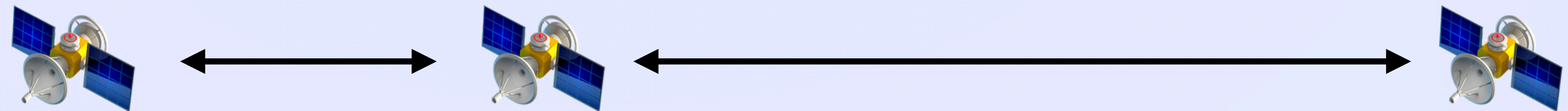
# *Spectrum*






Beyond Light Speed

**Spectrum** 




**Local First**



A blue rounded rectangular box containing the text "Local First" and an icon of a hand holding a smartphone.

**Realtime,  
Channels,  
Caching,  
OLTP**



A blue rounded rectangular box containing the text "Realtime, Channels, Caching, OLTP" and an icon of a radio tower and gears.

**Relay,  
Replication,  
Consistency,  
Tasks**



A blue rounded rectangular box containing the text "Relay, Replication, Consistency, Tasks" and an icon of a server rack and gears.

**Global  
Consensus  
Aggregation,  
Training,  
OLAP**



A blue rounded rectangular box containing the text "Global Consensus Aggregation, Training, OLAP" and an icon of a cloud, server rack, and gears.






Beyond Light Speed


# *Spectrum*



**Local First**



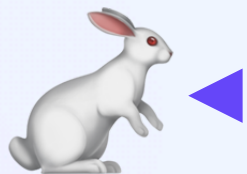
Realtime,  
Channels,  
Caching,  
OLTP



Relay,  
Replication,  
Consistency,  
Tasks



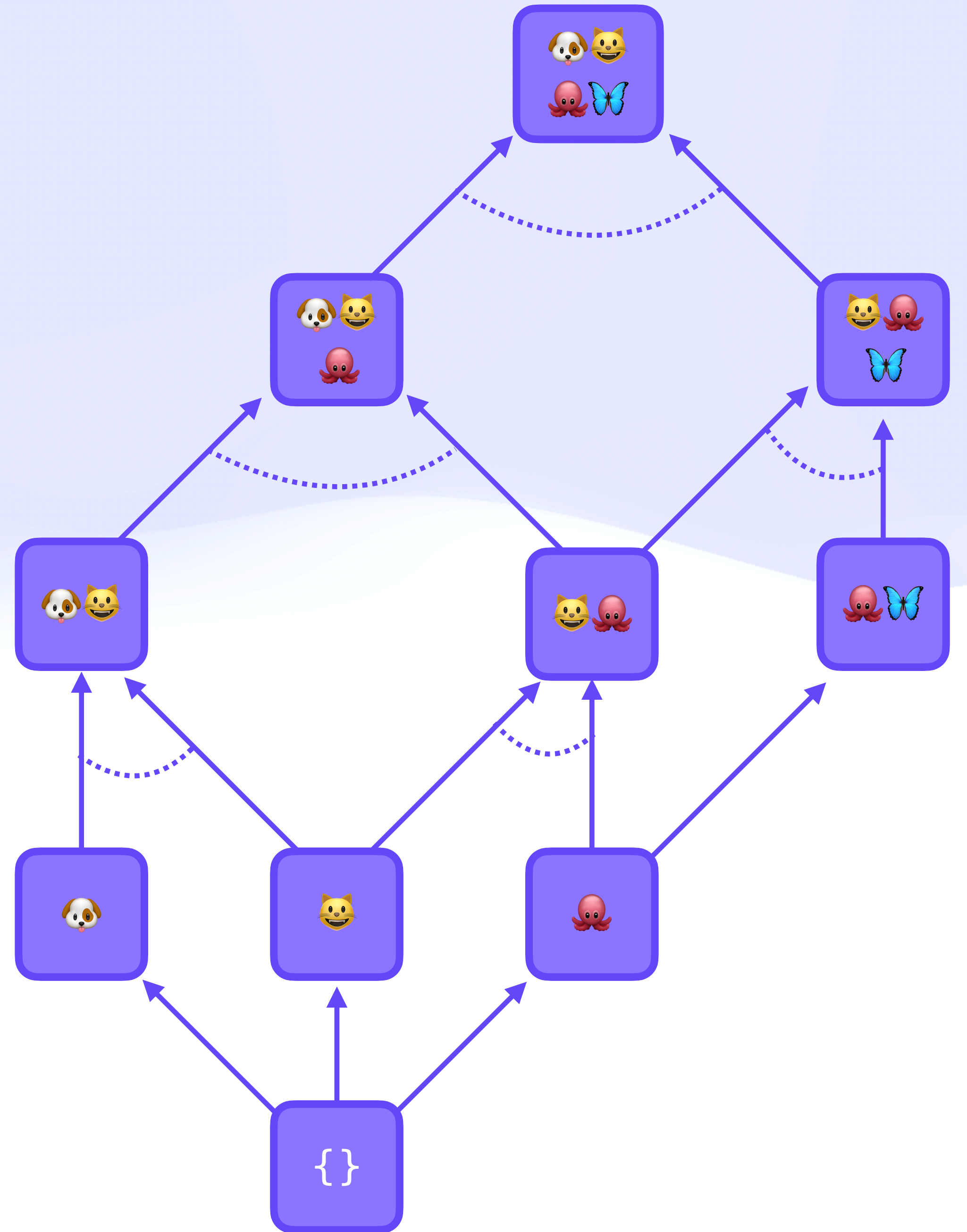
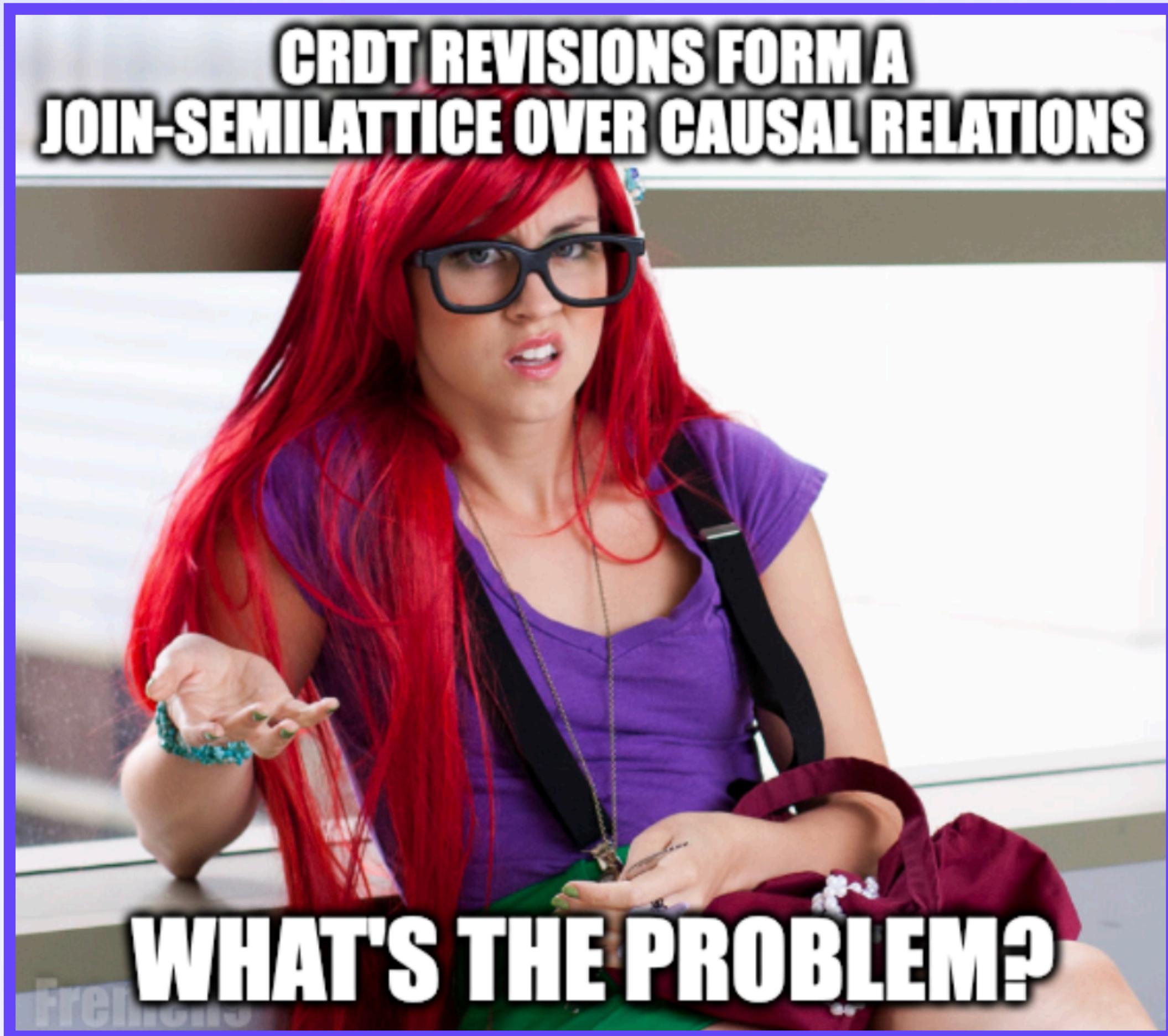
Global  
Consensus  
Aggregation,  
Training,  
OLAP





Beyond Light Speed

# *Weakening Locality*





# ***The Dark Forest***

**Permissionless Auth for Users, Apps, and Machines**



# The Dark Forest



# The Dark Forest

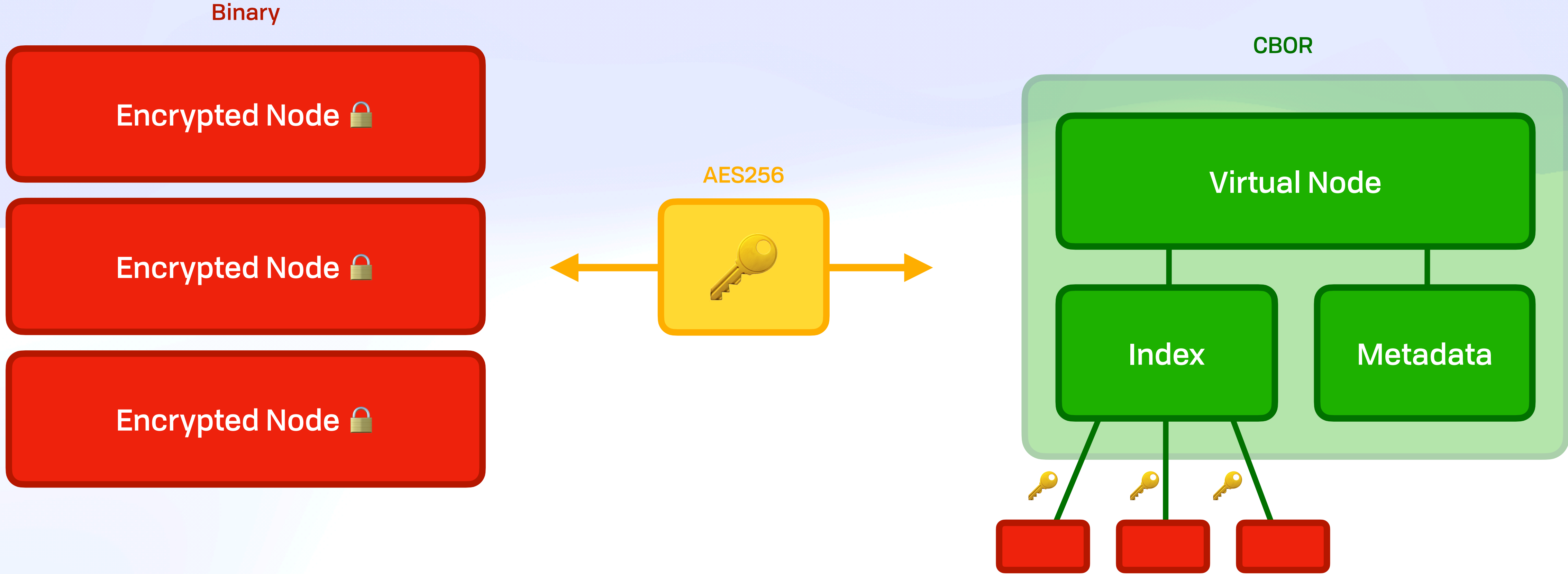
***Cryptography*** is a tool for turning  
lots of different problems into  
***key management problems***

Dr. Lea Kissner, Google's Global Lead of Privacy Technologies



# The Dark Forest

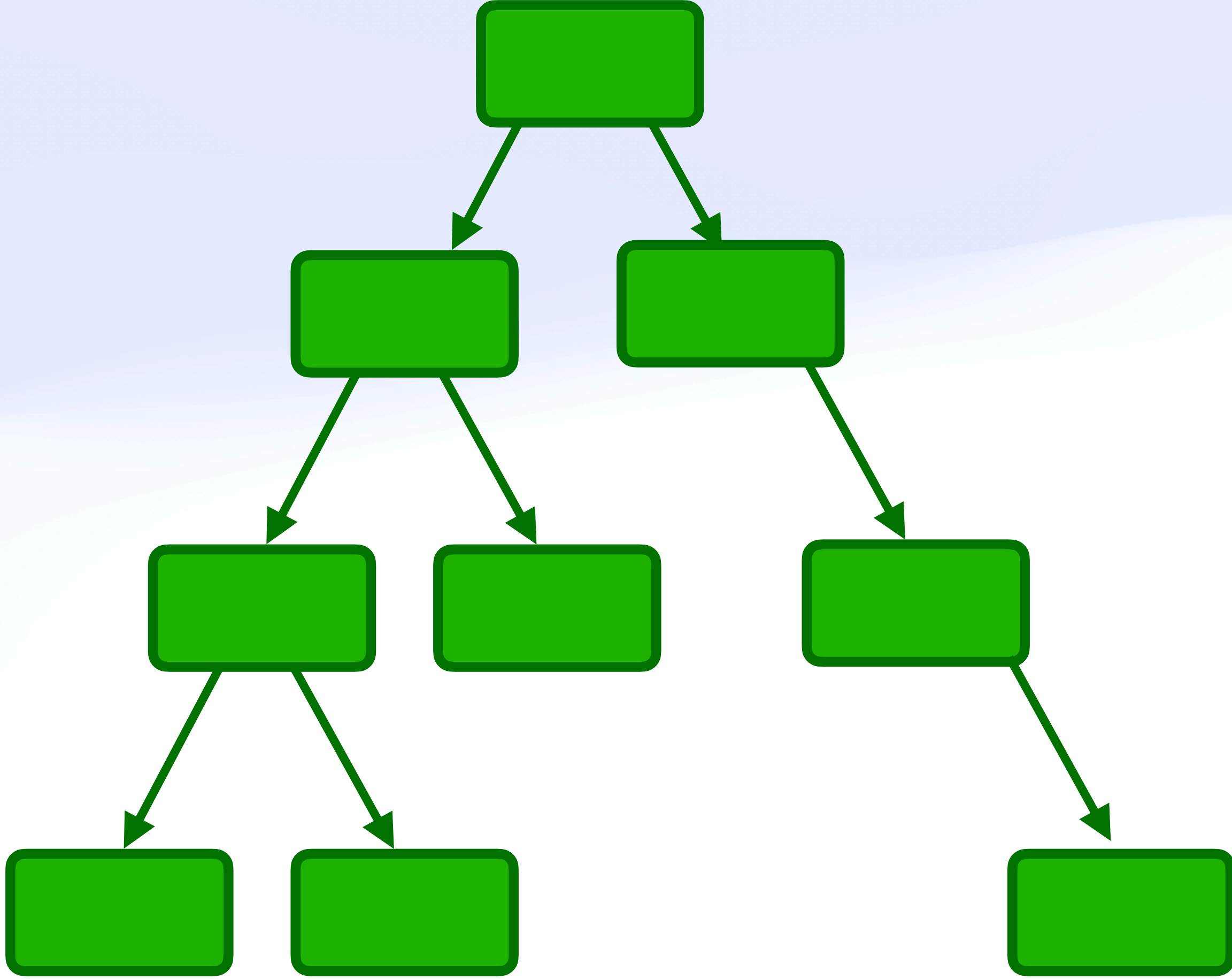
# *Making Private... Public!*





The Dark Forest

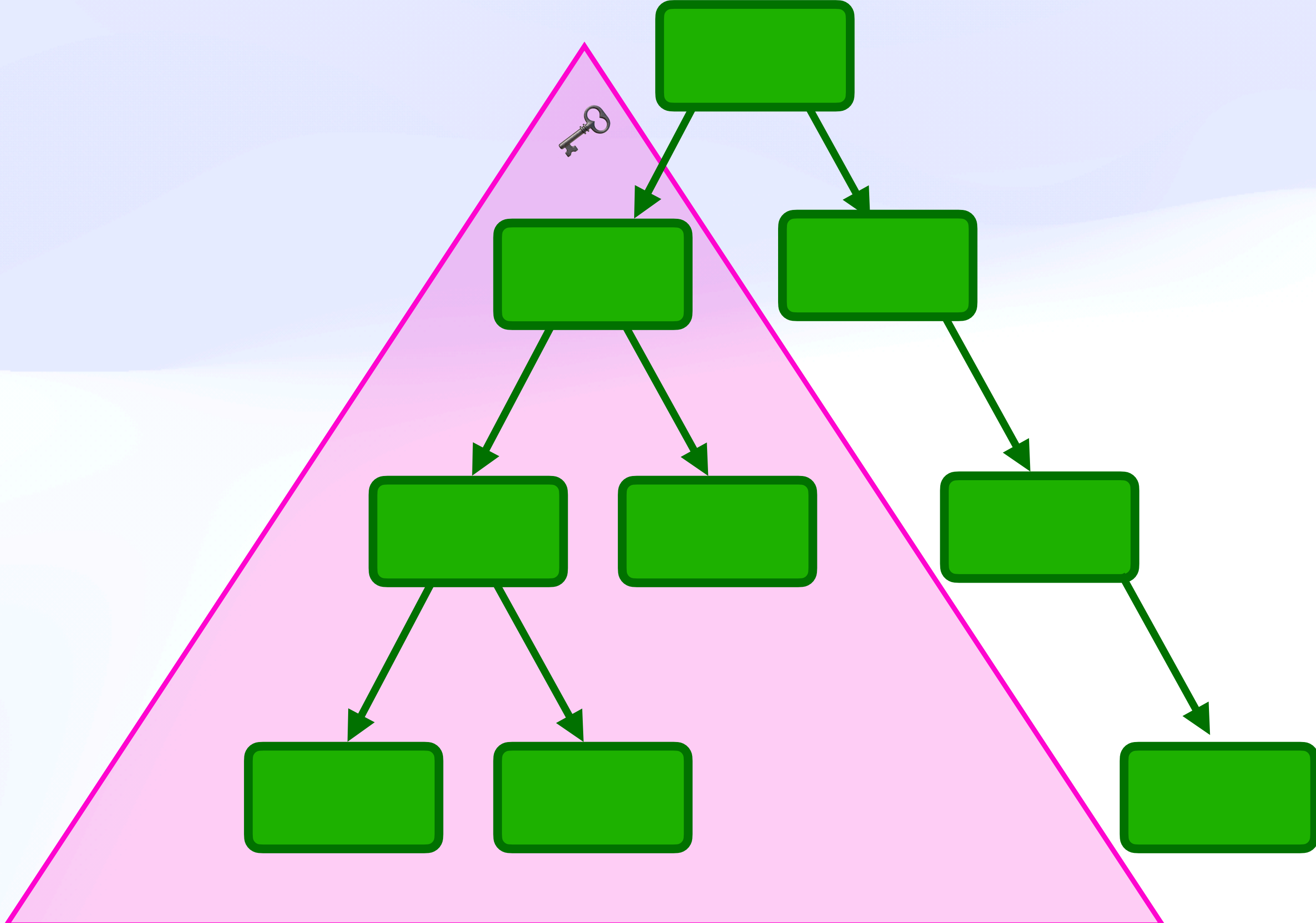
**Subgraph Access**





# The Dark Forest

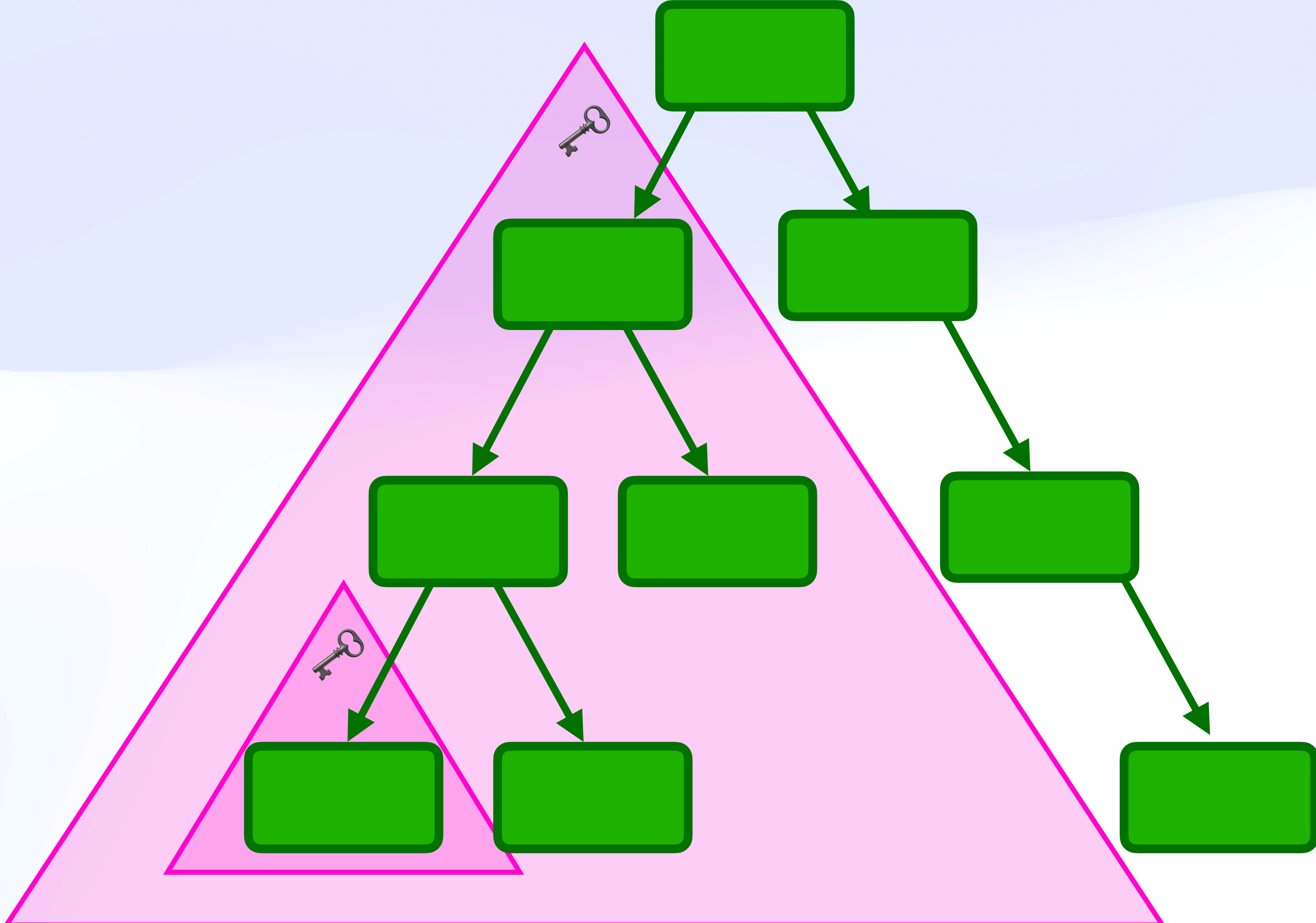
# *Subgraph Access*





# The Dark Forest

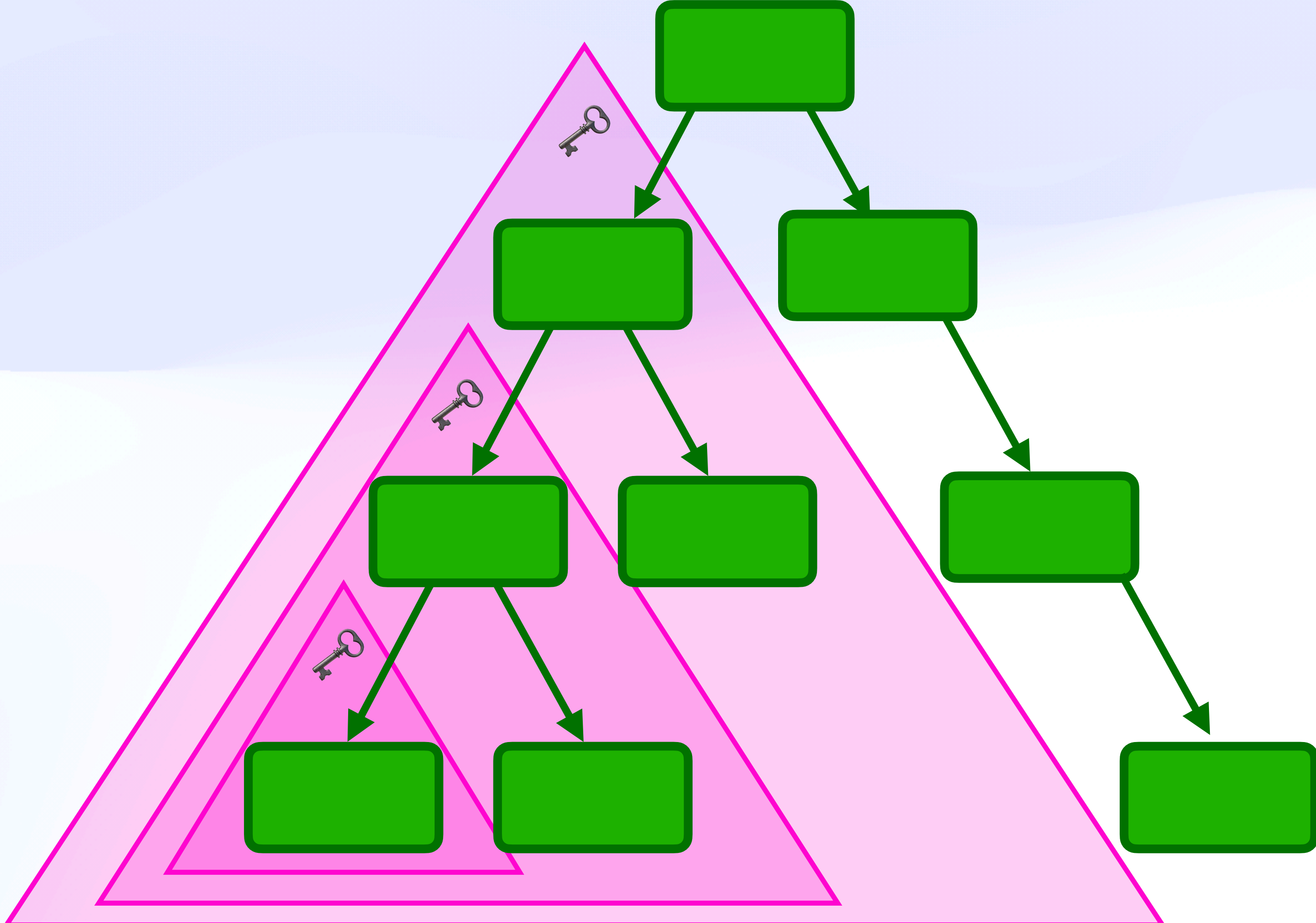
# *Subgraph Access*





# The Dark Forest

# *Subgraph Access*





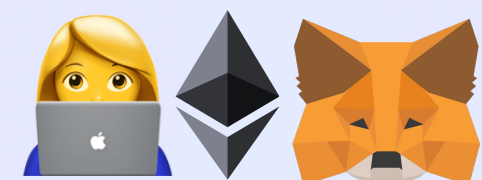
The Dark Forest

***Permissionless***



The Dark Forest

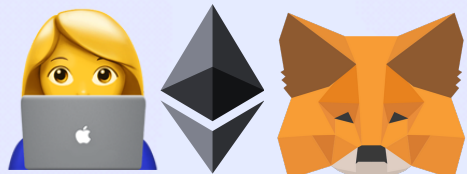
# *Permissionless*





The Dark Forest

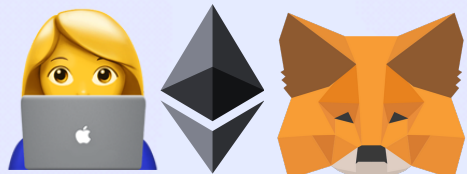
# Permissionless





The Dark Forest

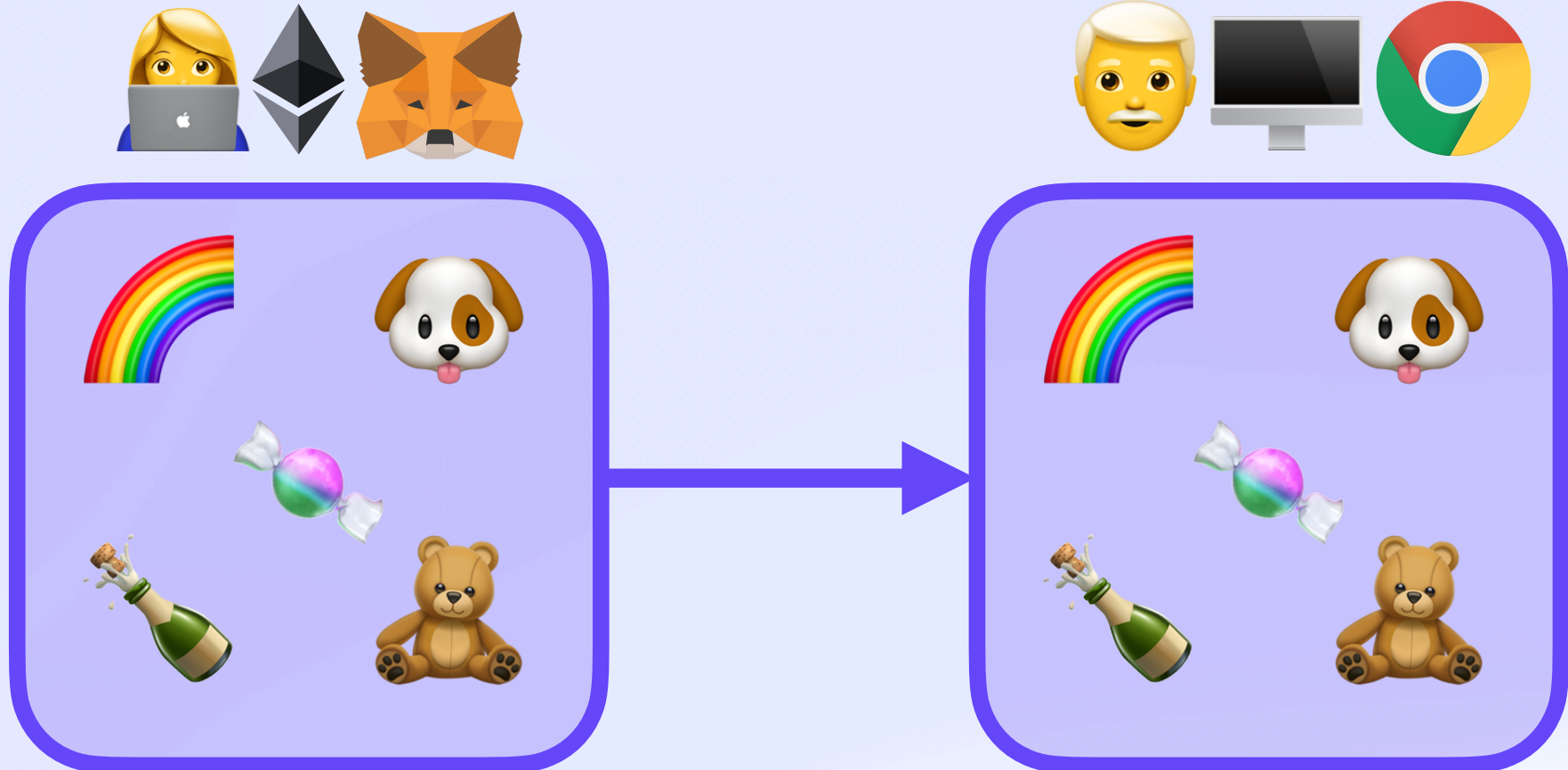
# Permissionless





# The Dark Forest

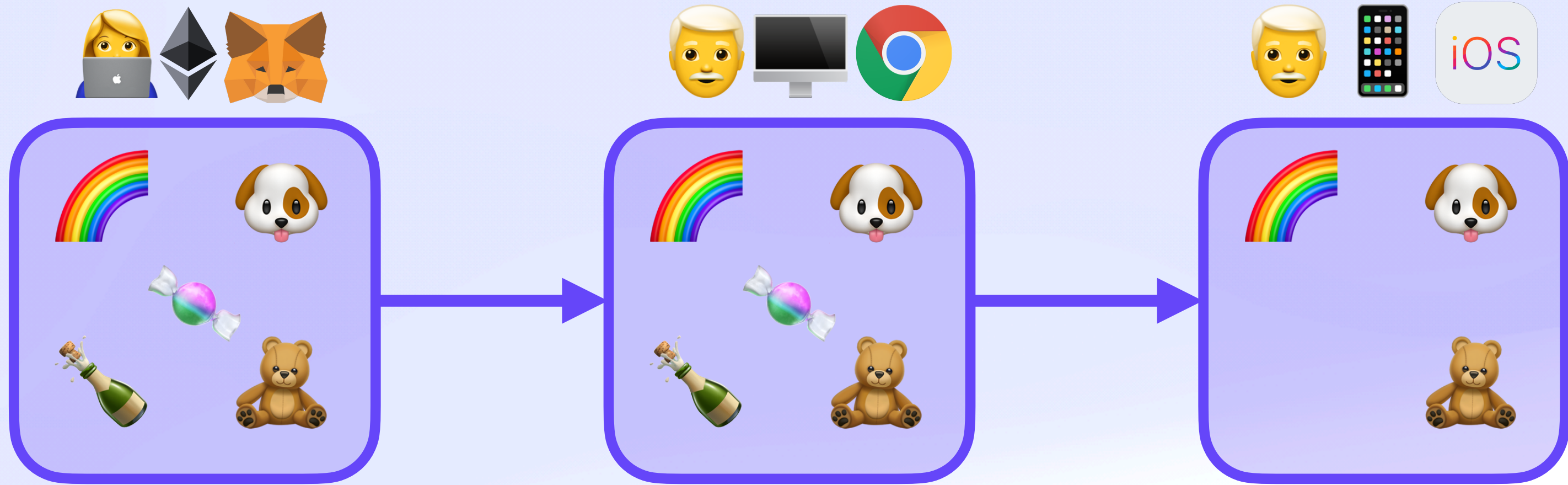
# Permissionless





# The Dark Forest

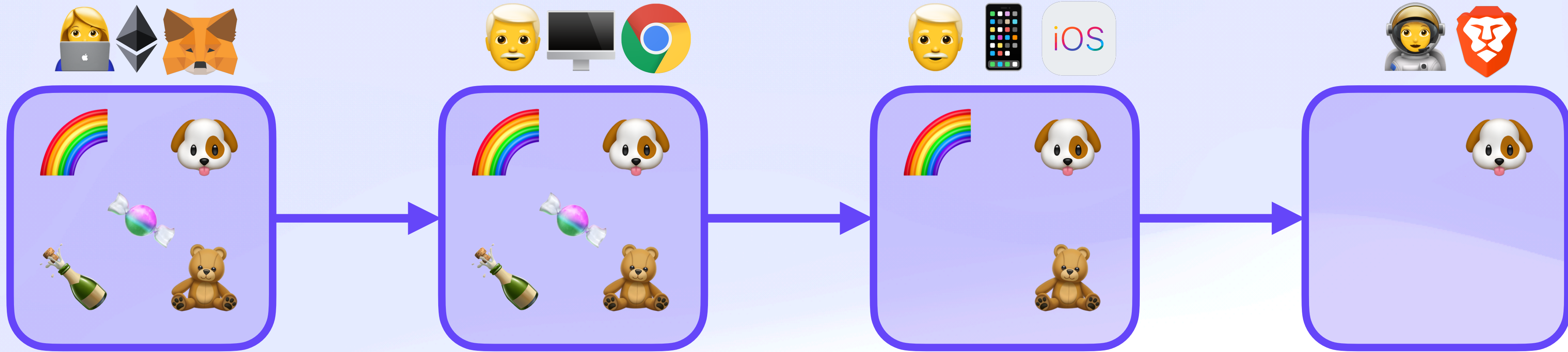
# Permissionless





# The Dark Forest

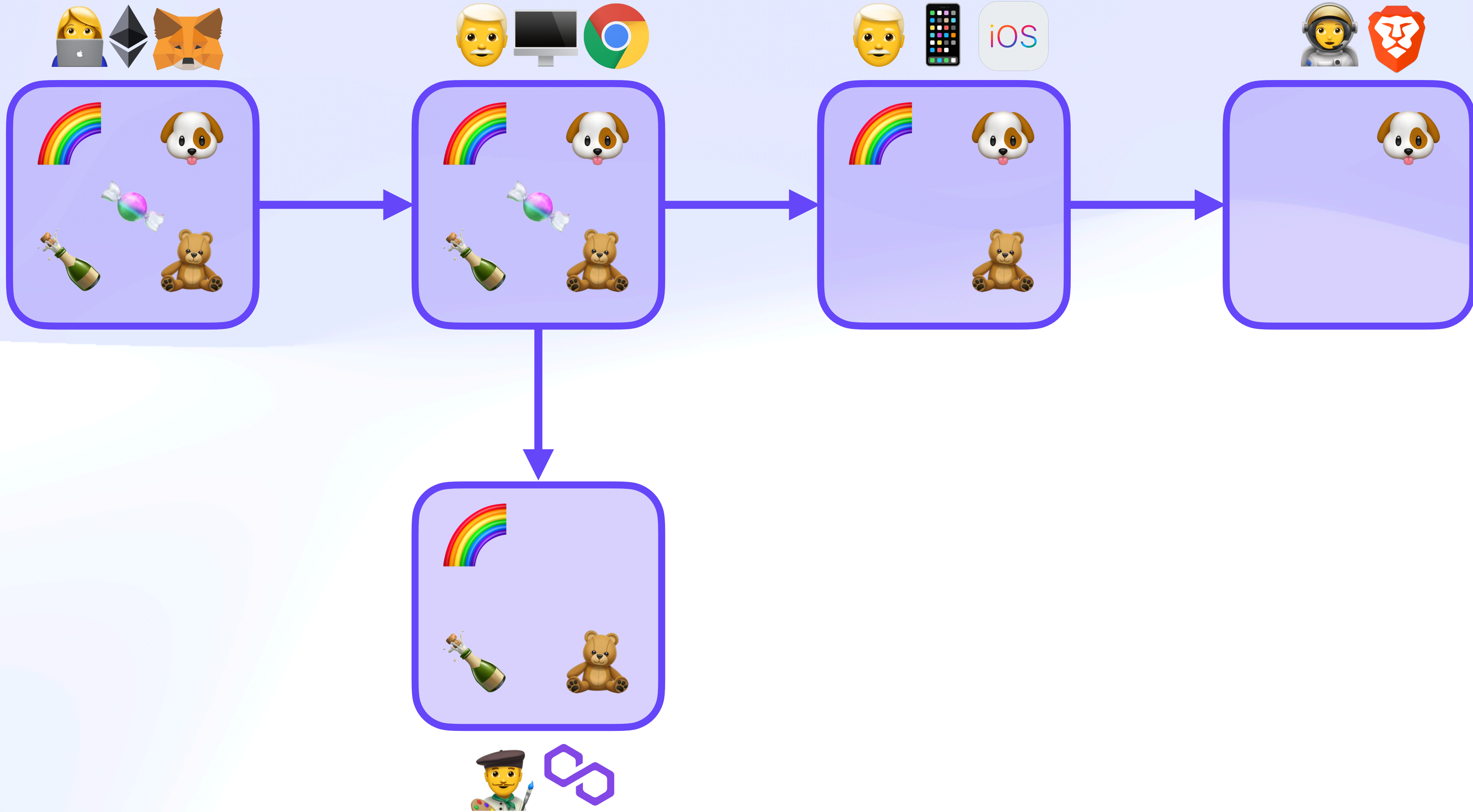
# Permissionless





# The Dark Forest

# Permissionless



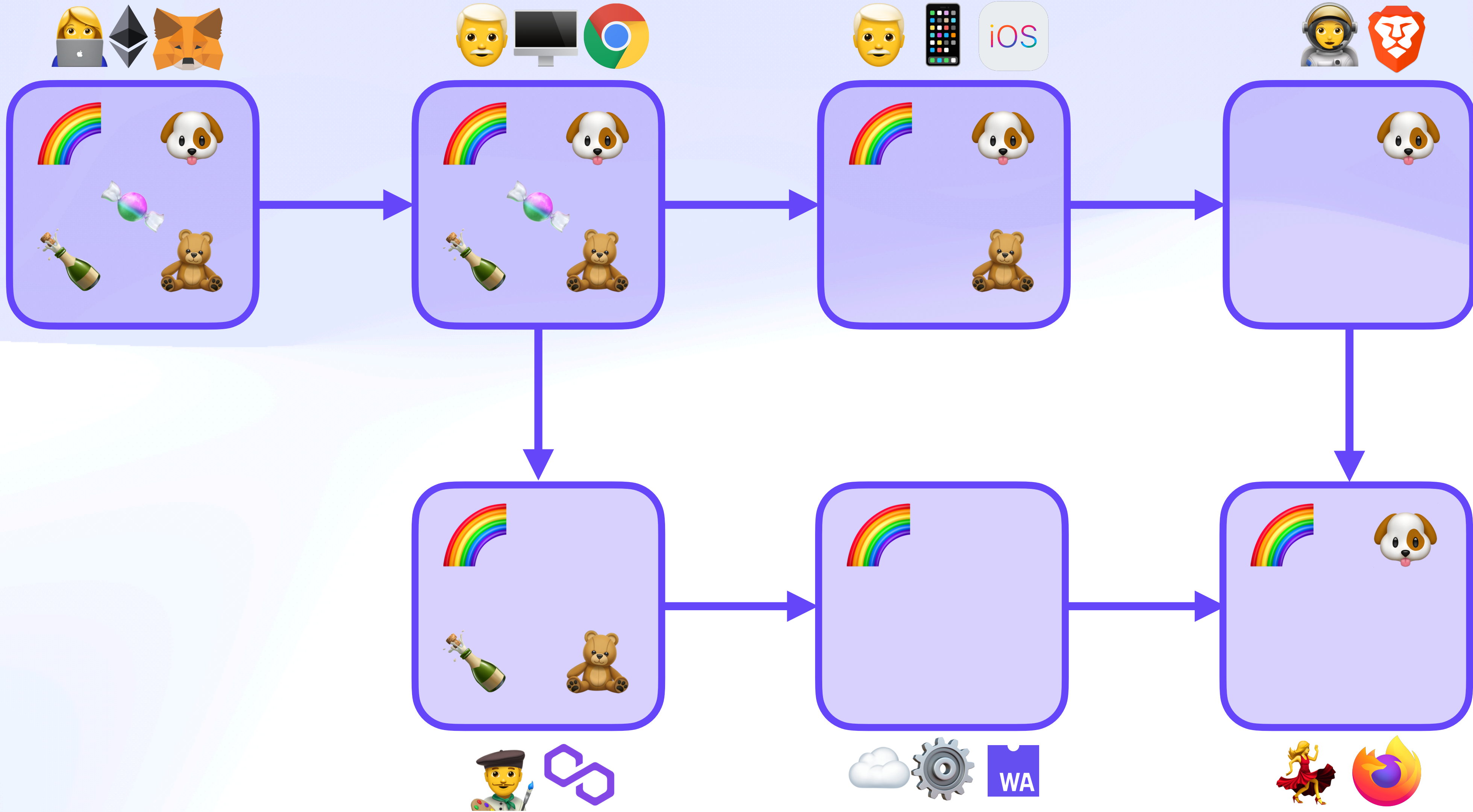






# The Dark Forest

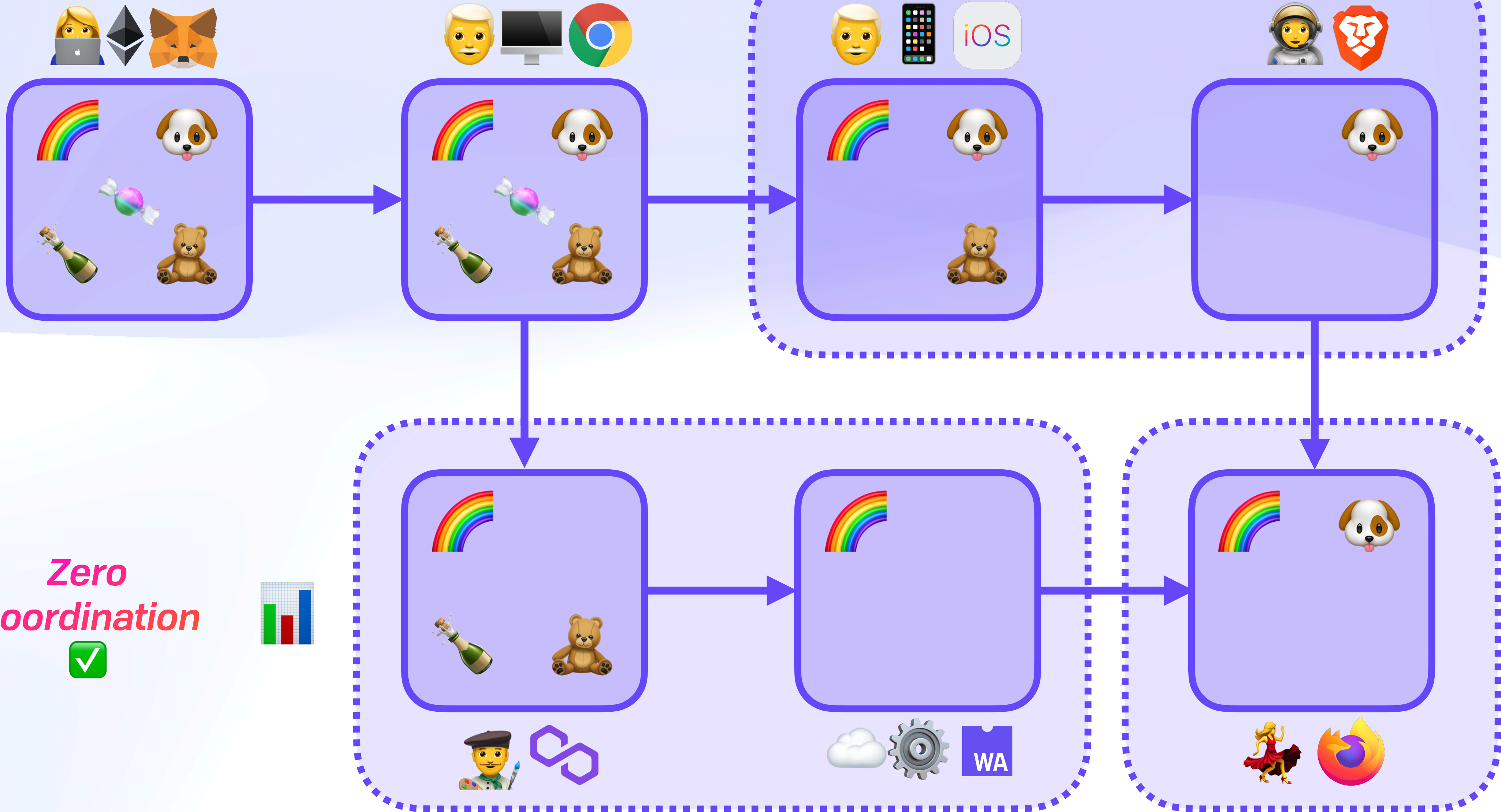
# Permissionless





# The Dark Forest

# Permissionless



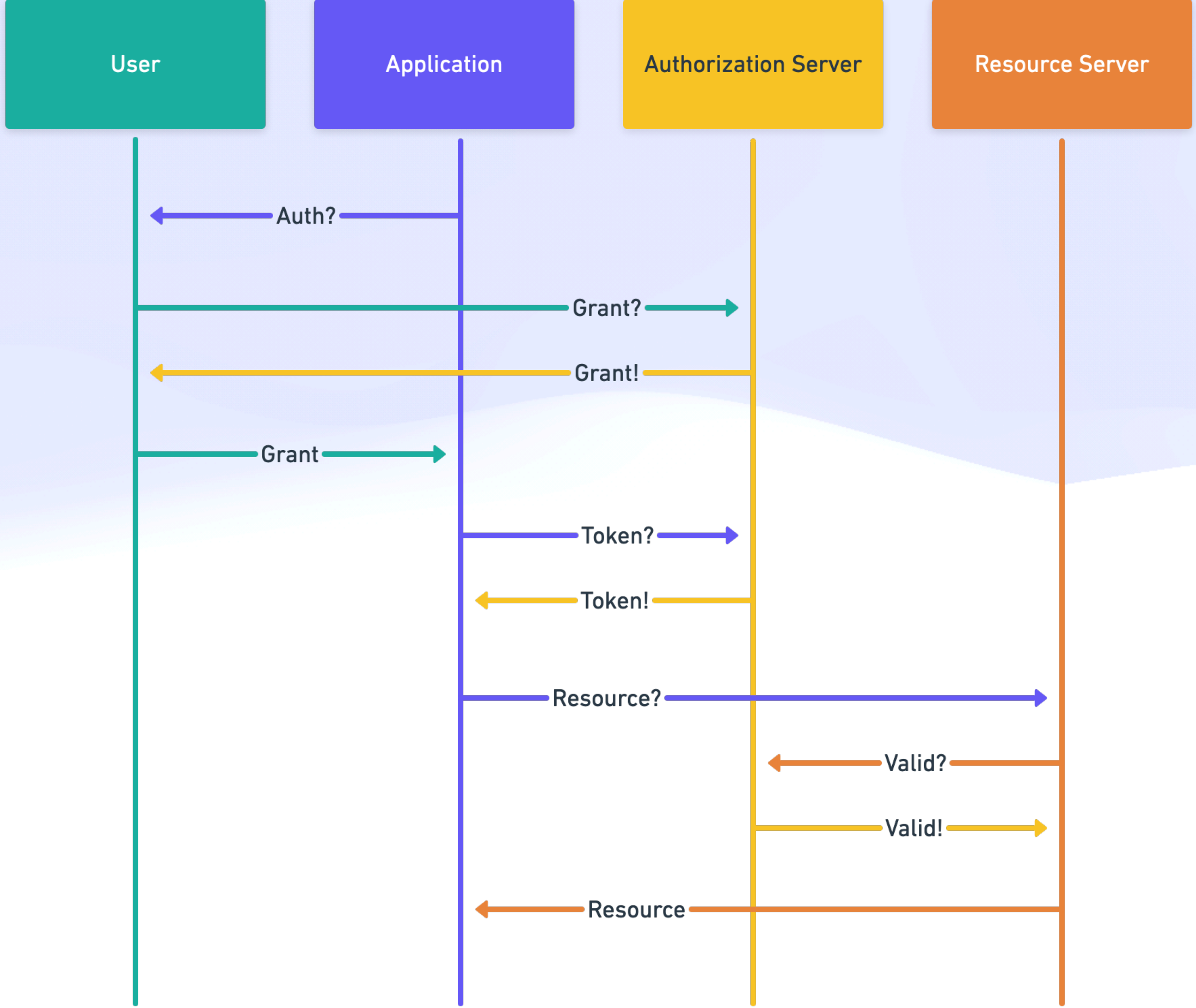
Zero  
Coordination  
✓





# The Dark Forest

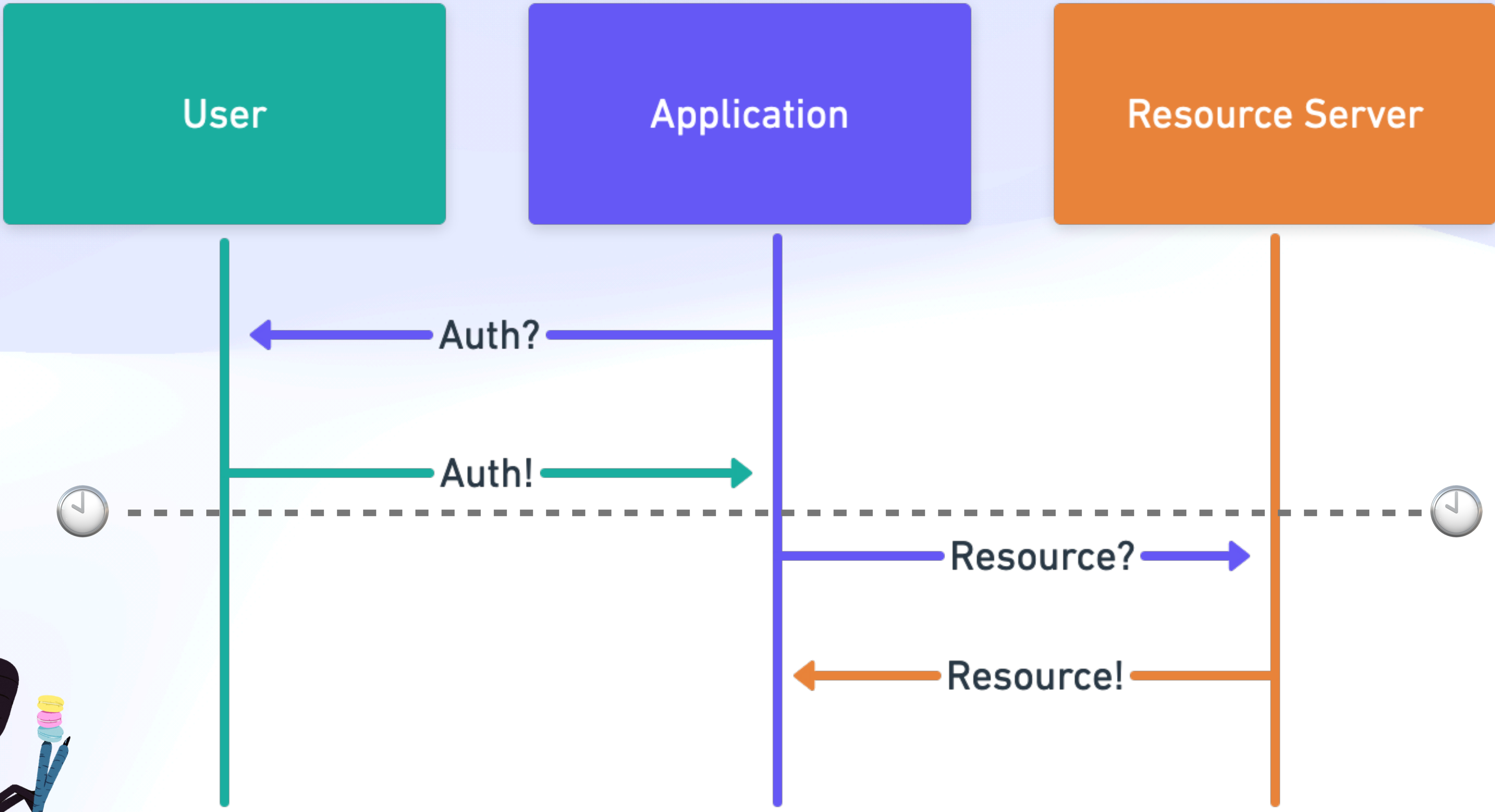
# *OAuth Sequence*





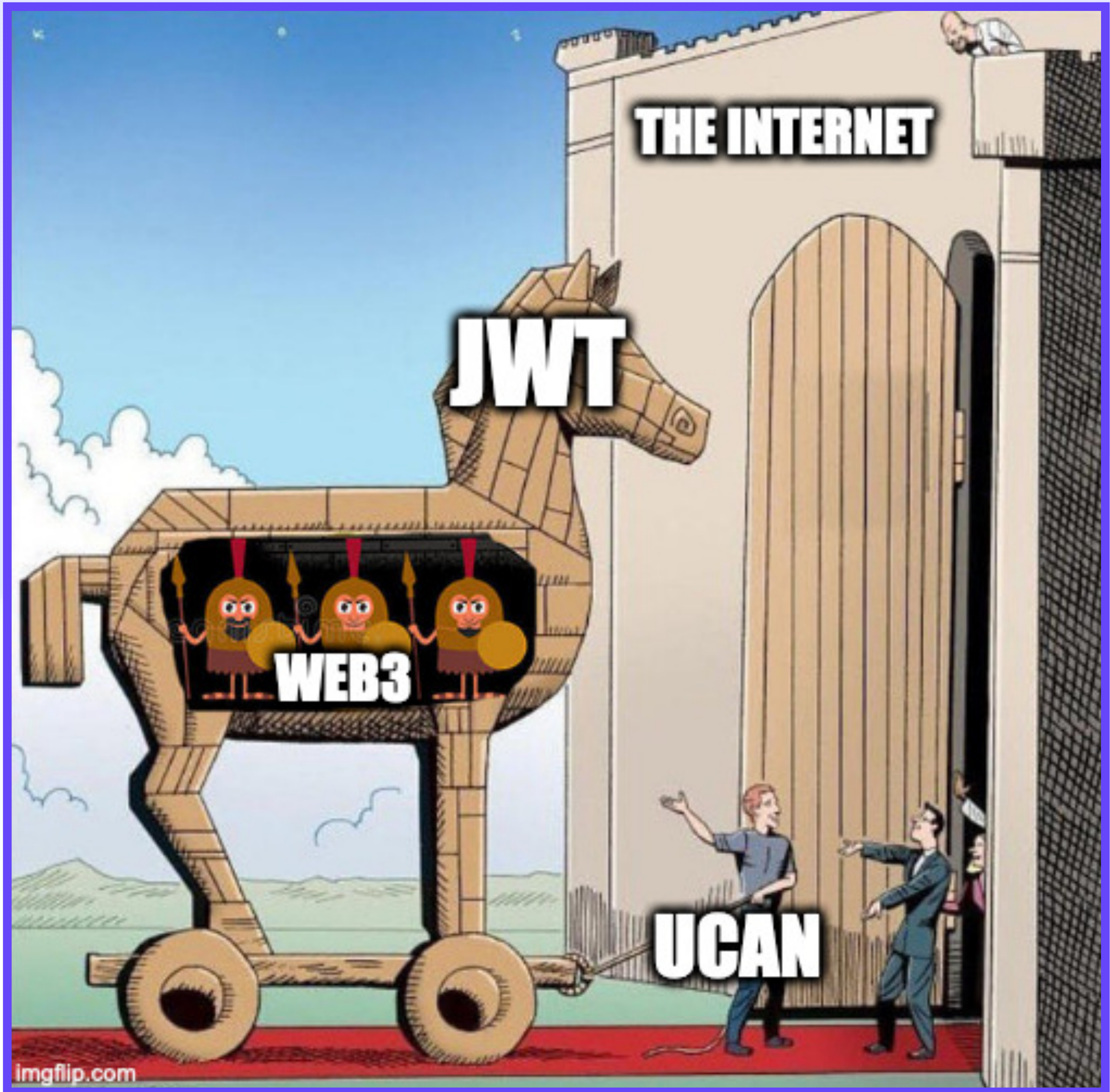
# The Dark Forest

# UCAN Sequence





The Dark Forest  
*Strategy*





# ***Decentralized Compute***

**Scheduling, Execution, Verification**



Decentralized Compute

***Declarative Invokation***



# Decentralized Compute

## ***Declarative Invokation***

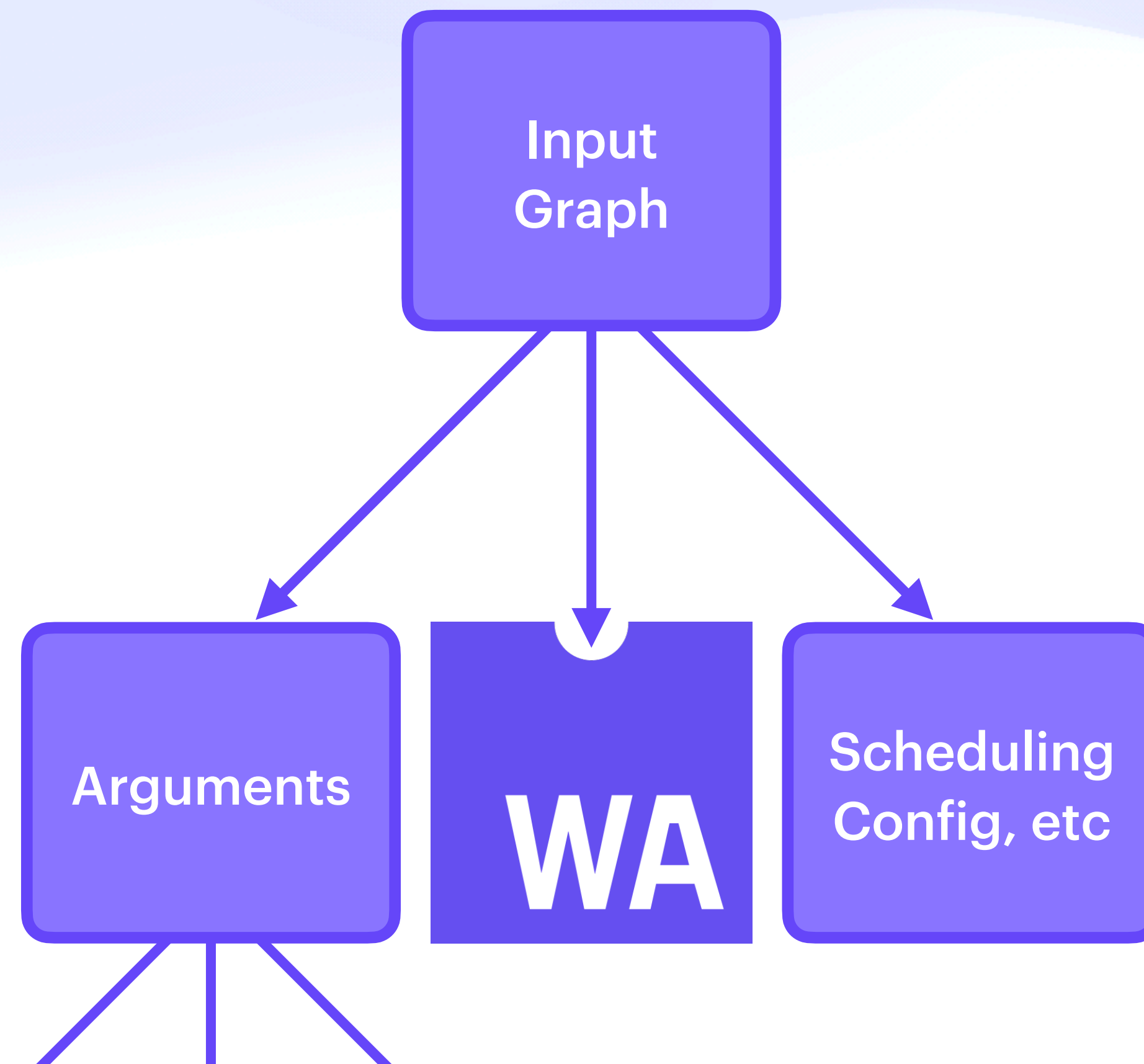
- ◆ Description of jobs & results
- ◆ Index and/or names for later lookup
- ◆ Streams of results per machine
- ◆ (IPVM & IPLI)



# Decentralized Compute

## *Declarative Invokation*

- ◆ Description of jobs & results
- ◆ Index and/or names for later lookup
- ◆ Streams of results per machine
- ◆ (IPVM & IPLI)

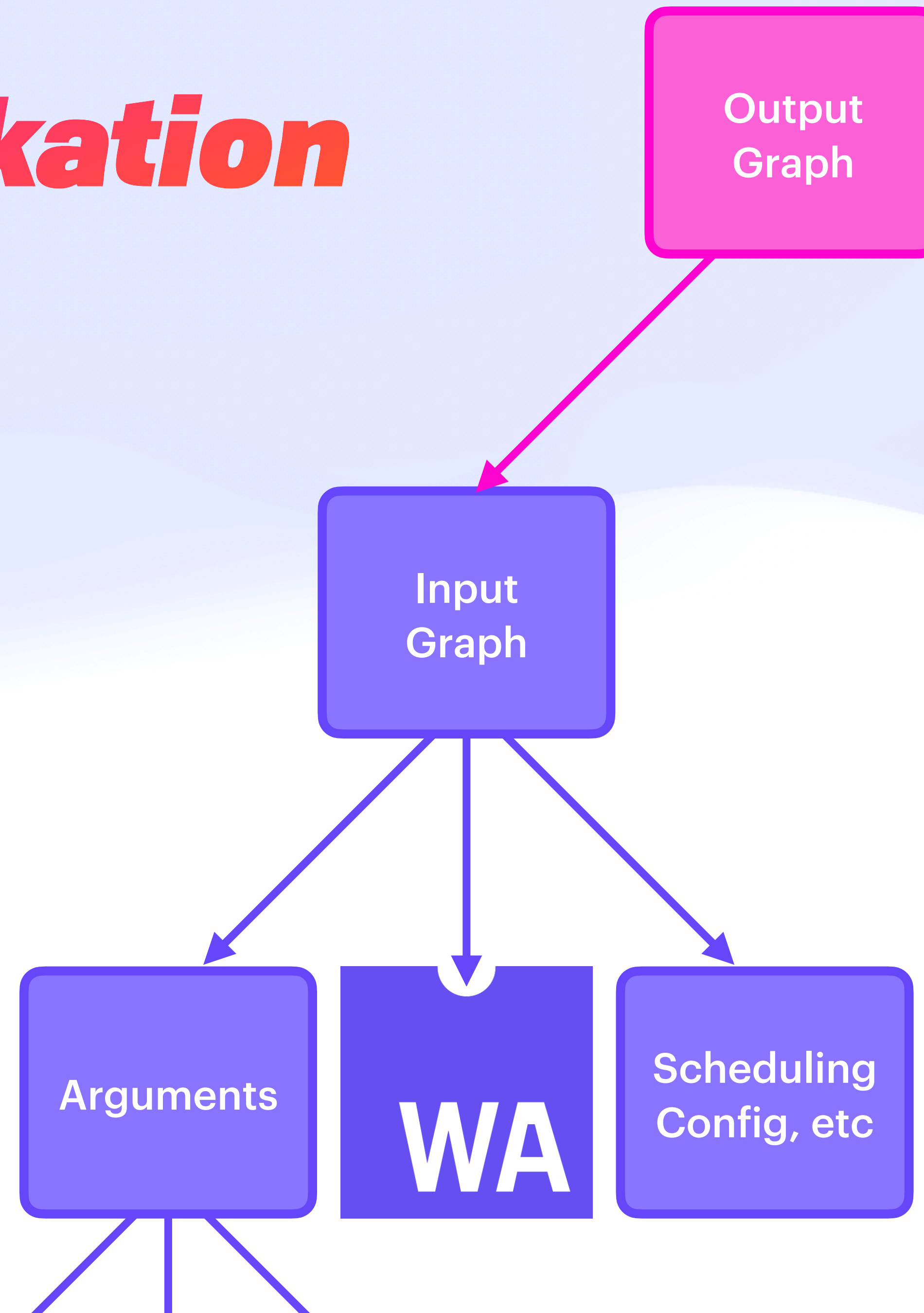




# Decentralized Compute

## *Declarative Invokation*

- ◆ Description of jobs & results
- ◆ Index and/or names for later lookup
- ◆ Streams of results per machine
- ◆ (IPVM & IPLI)

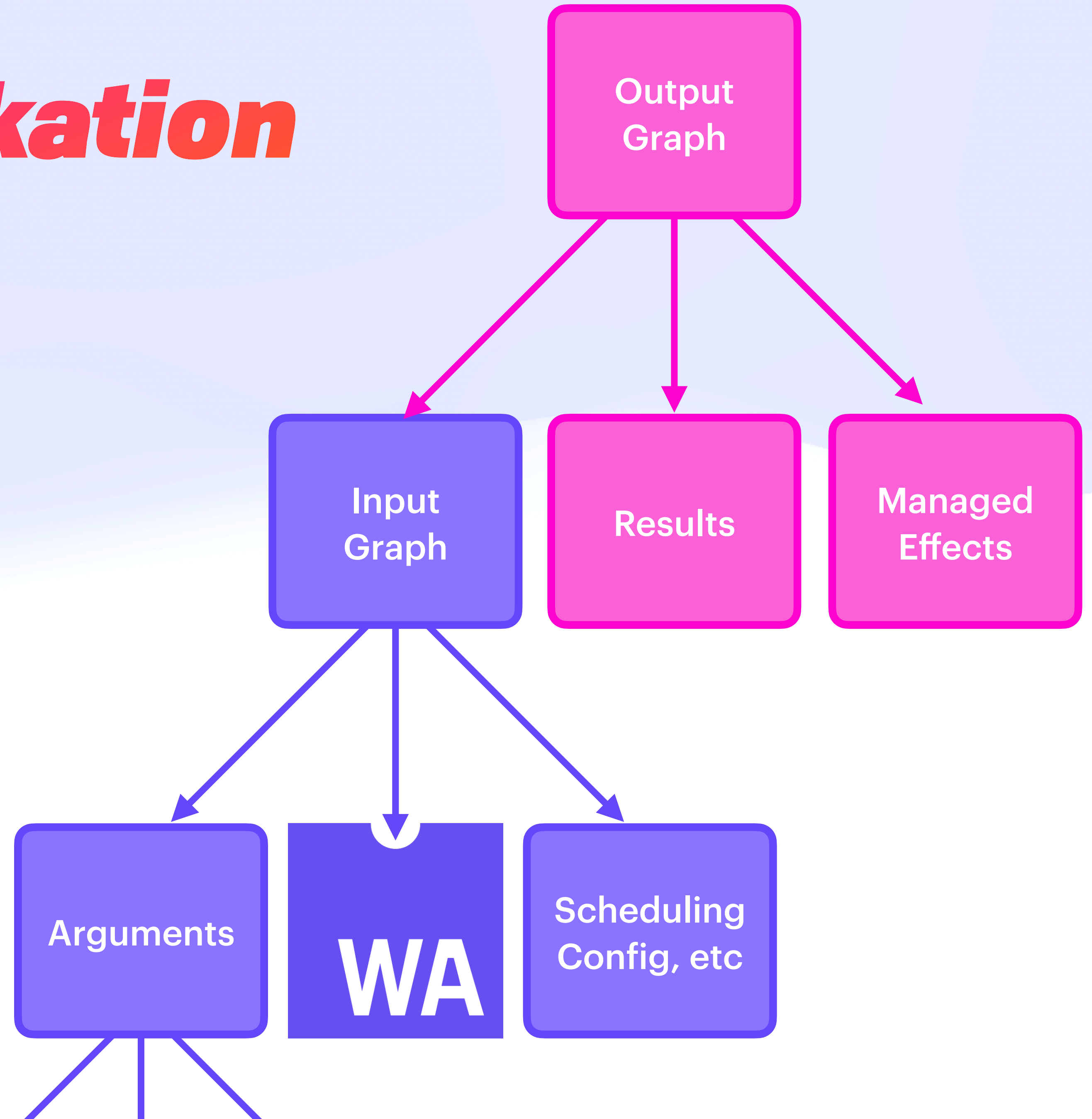




# Decentralized Compute

## *Declarative Invokation*

- ◆ Description of jobs & results
- ◆ Index and/or names for later lookup
- ◆ Streams of results per machine
- ◆ (IPVM & IPLI)





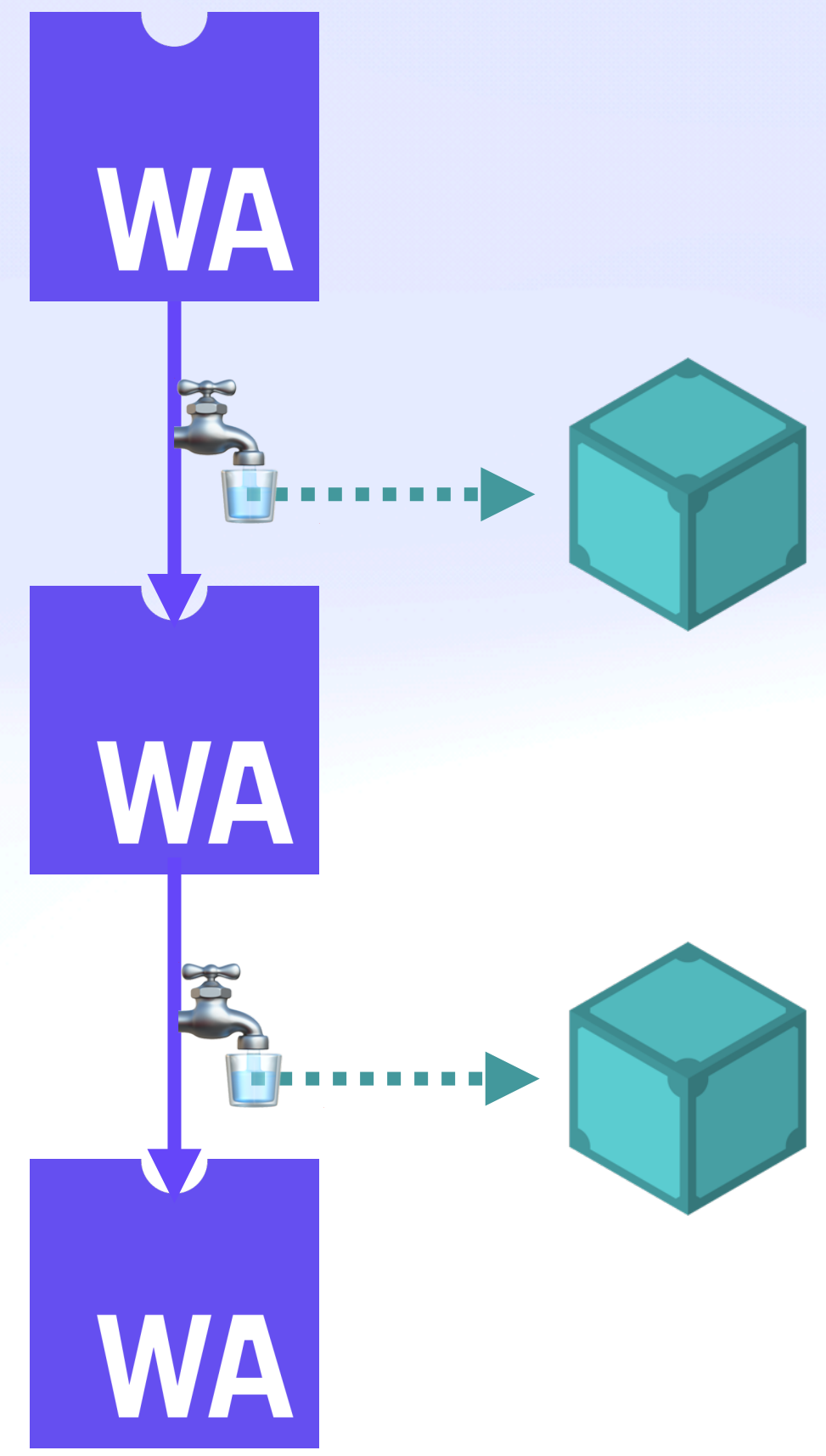
Decentralized Compute

***Cache, Suspend, Verify***



# Decentralized Compute

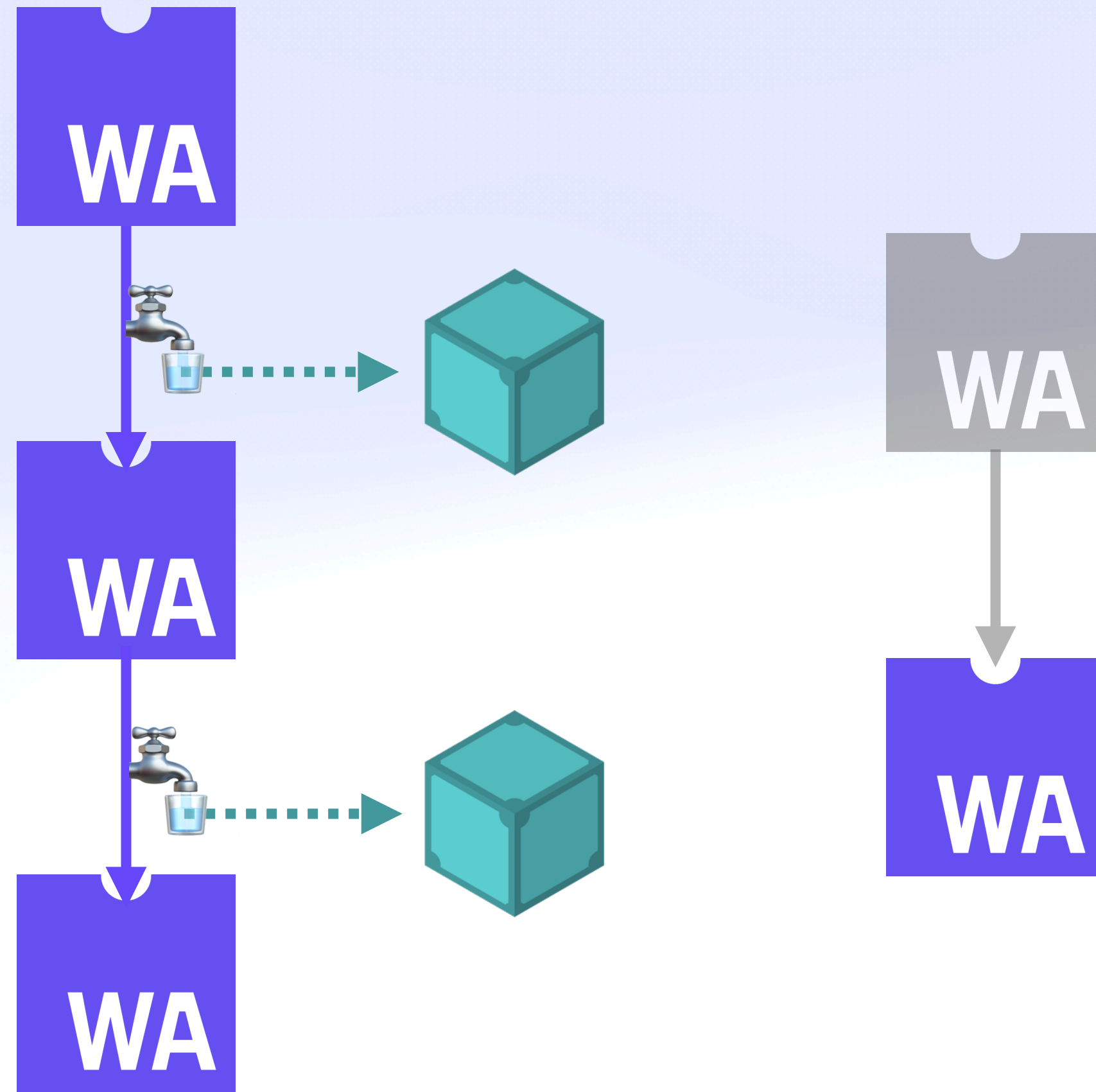
# Cache, Suspend, Verify





# Decentralized Compute

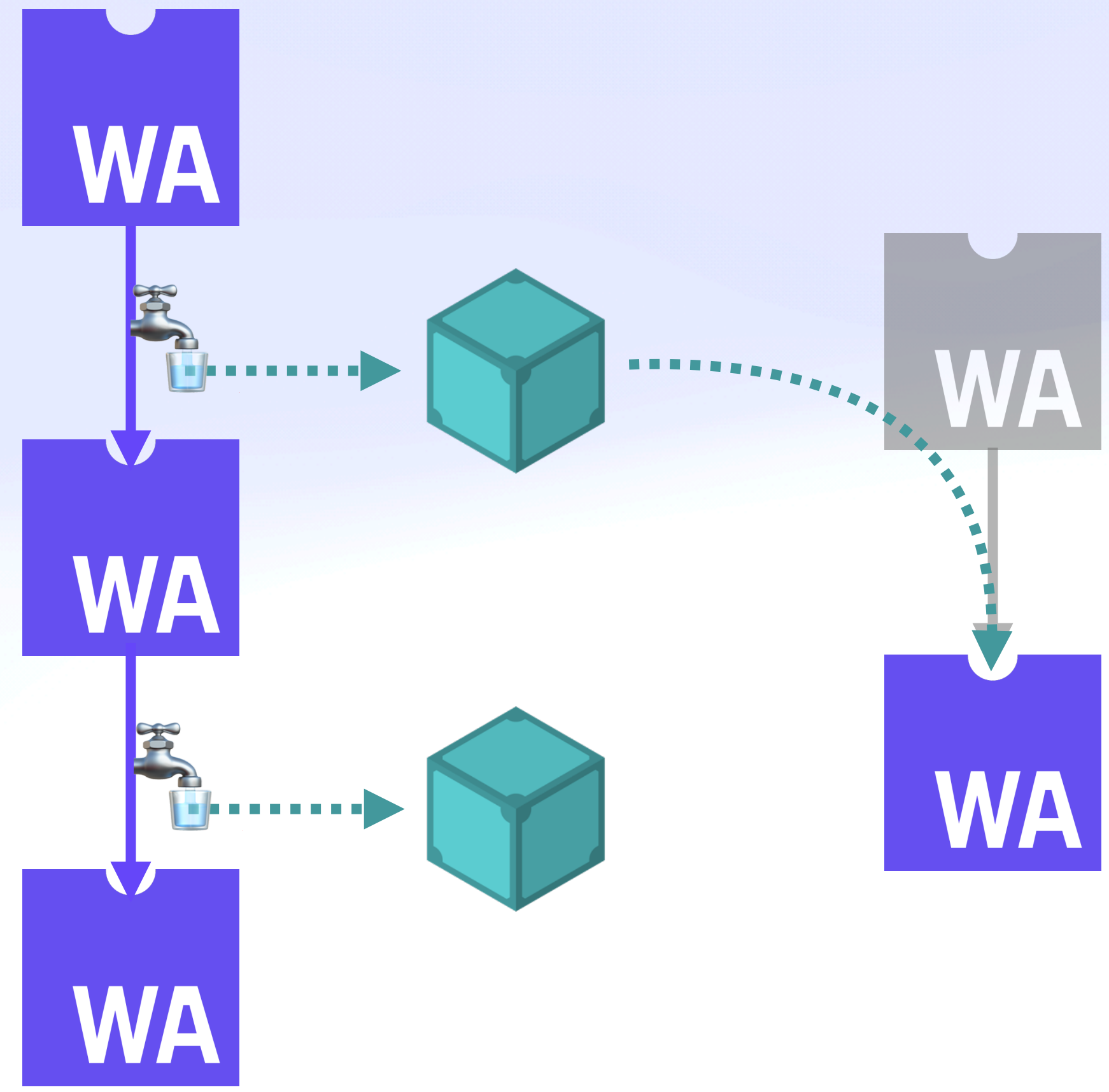
## *Cache, Suspend, Verify*





# Decentralized Compute

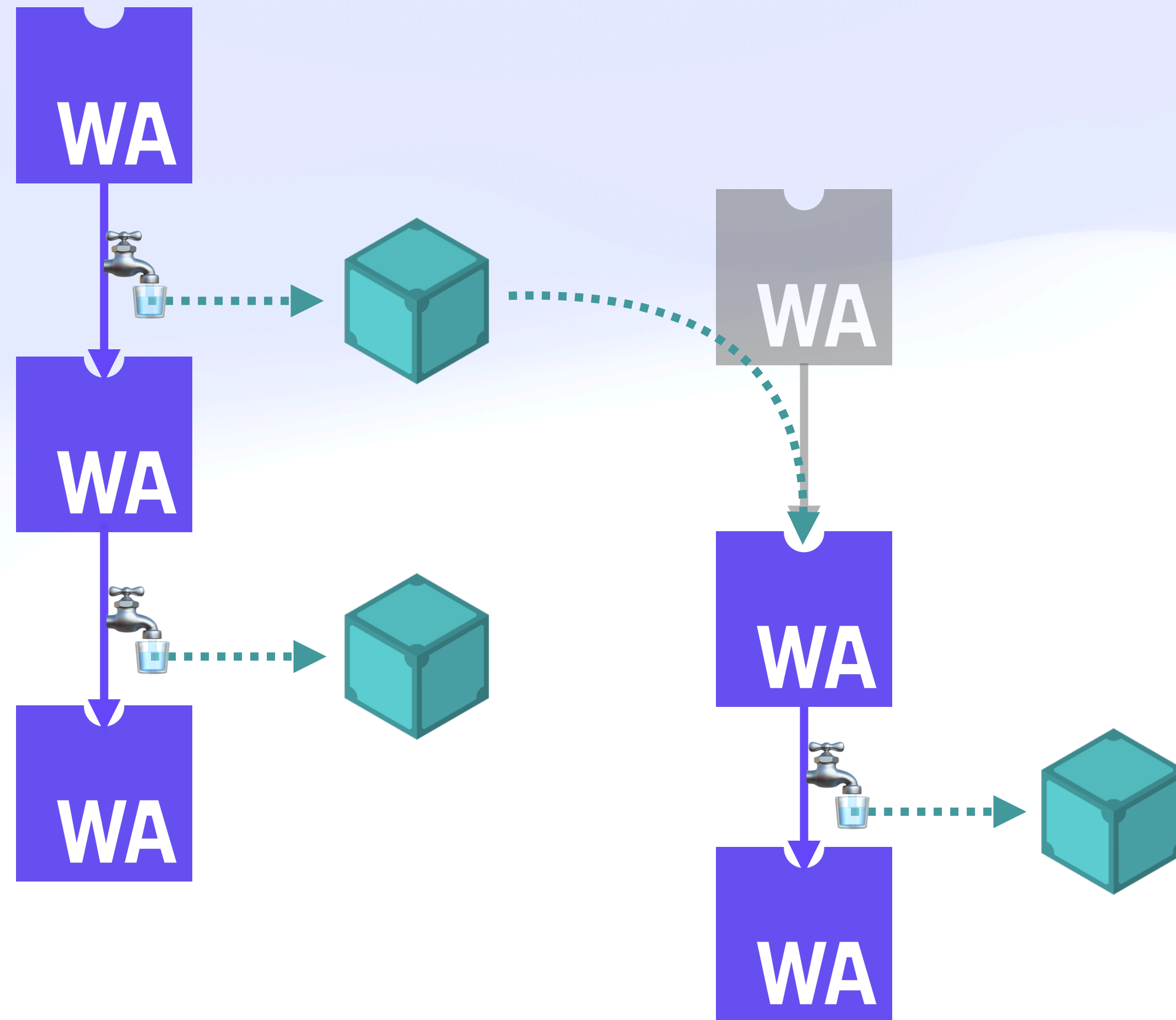
# Cache, Suspend, Verify





# Decentralized Compute

## *Cache, Suspend, Verify*



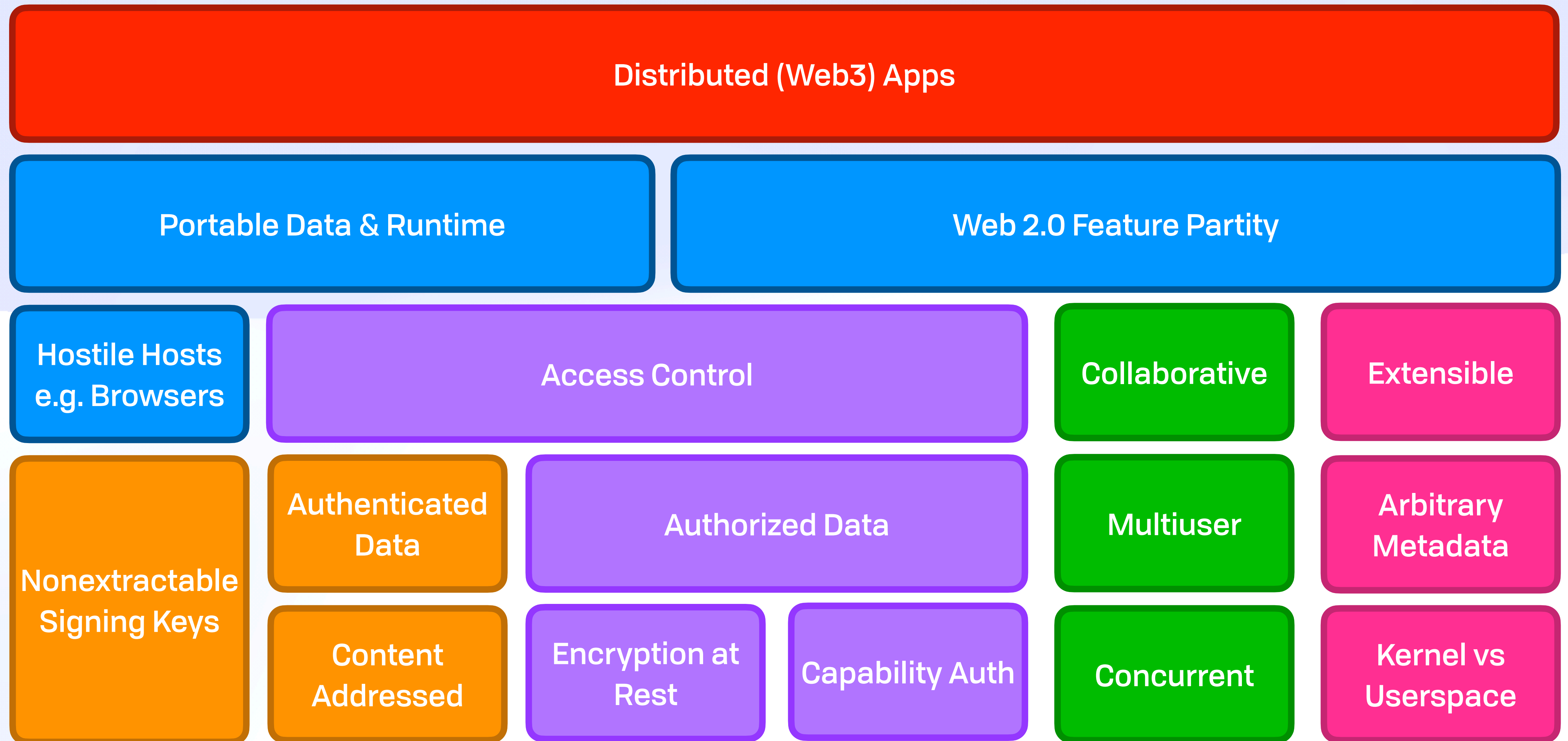


# *Wrap Up*





# Requirements Diagram





 ***Thank You, Paris*** 

**Come build with us!**  
**<https://fission.codes>**  
**brooklyn@fission.codes**  
**@expede**