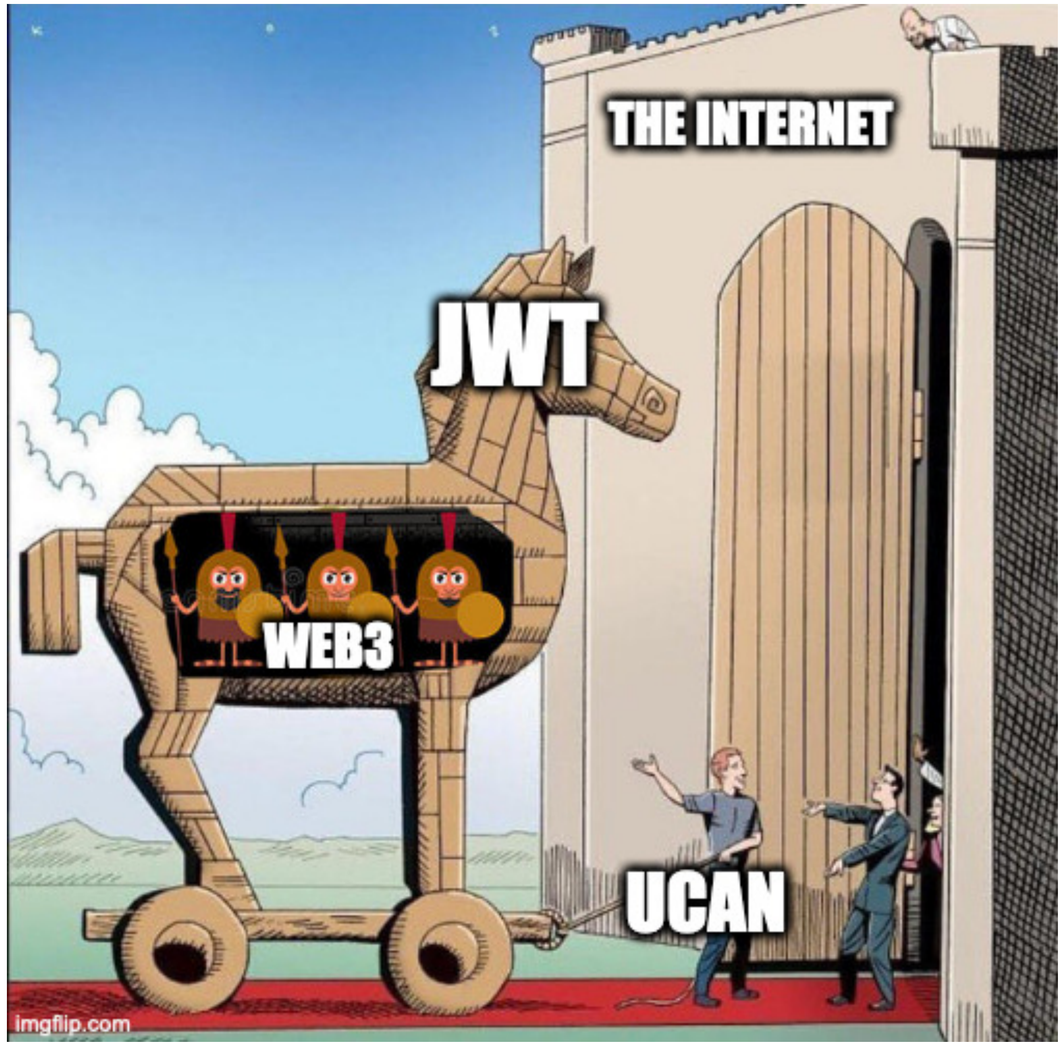
An Intro to UCAN

Or: how to make the internet web3, from the inside out



Every program has (at least) two purposes: the one for which it was written, and another for which it wasn't

Alan Perlis, Epigram #16

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

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

Brooklyn Zelenka

@expede

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- Cofounder & CTO at Fission
  - https://fission.codes / @FISSIONCodes
  - Chain agnostic from the ground up!

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https://lu.ma/distributed-systems

Meta

Wherefore Art Thou UCAN?

Meta

Wherefore Art Thou UCAN?

DIDs say who ***you are***

Meta

Wherefore Art Thou UCAN?

DIDs say who ***you are***

UCANs show what ***you can do***

Meta

Wherefore Art Thou UCAN?

AuthN

DIDs say who ***you are***

UCANs show what ***you can do***

AuthZ

Meta

Teaser Token


```
eyJhbGciOiJFZERTQSIsInR5cCI6IkpXVCIsInVjdiI6IjAuNy4wIn0.eyJhdWQiOiJkaWQ6a2V5Ono2TWtzWFFCZkw4b3d6dFRDSlRt
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ZXMvIiwiY2FwIjoiT1ZFUldSSVRFIn1dLCJleHAiOjkyNTY5Mzk1MDUsImlzcyI6ImRpZDprZXk6ejZNa3A1RXN6OXMyTUhzcVl2TG9j
Y3lId1g1U2V5WktwcTc5R3Q0NWZGR0VaUjk5IiwibmJmIjoxNjM5NjA4MjkzLCJwcmYiOltdfQ.MgYarLqy7RmQ1AIrqYL6cFy9z7a5W
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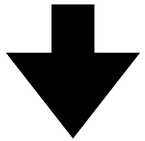
```


```
{
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  "exp": 9256939505,
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    {
      "with": "wnfs://demouser.fission.name/public/notes/",
      "can": "OVERWRITE"
    }
  ]
}
```

How to Power a New Internet

How to Power a New Internet 🔌

How to Power a New Internet 🔌

web3 ⊋ Blockchain

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web3 ⊋ Blockchain

P2P, IPFS, Matrix

How to Power a New Internet 🔌

web3 ⊋ Blockchain

P2P, IPFS, Matrix

Open, accessible, trustless, portable

How to Power a New Internet 🔌

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User sovereignty: mobile browsers, local-first

How to Power a New Internet 🔌

web3 ⊋ Blockchain

P2P, IPFS, Matrix

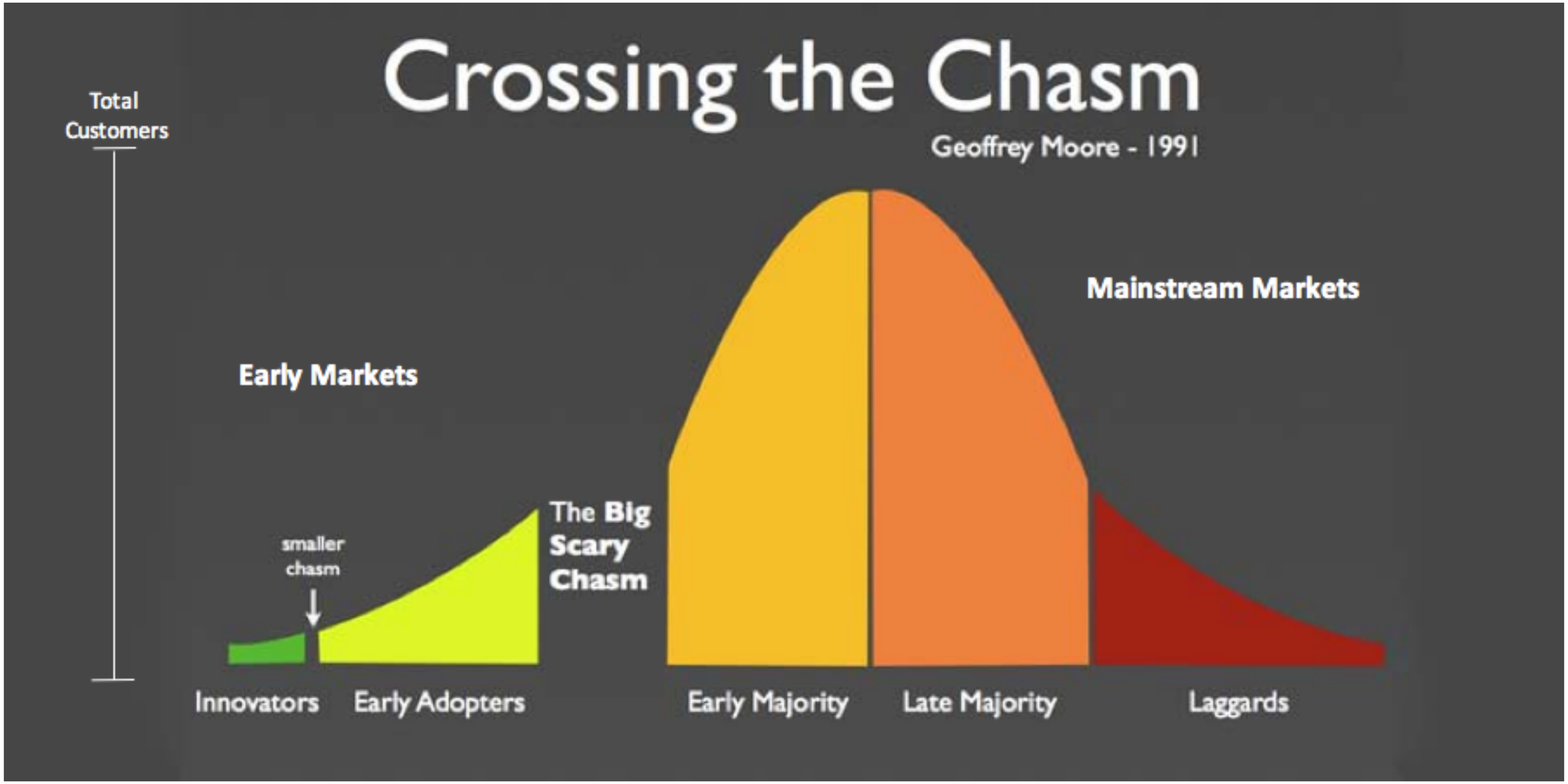
Open, accessible, trustless, portable

User sovereignty: mobile browsers, local-first

...and so on

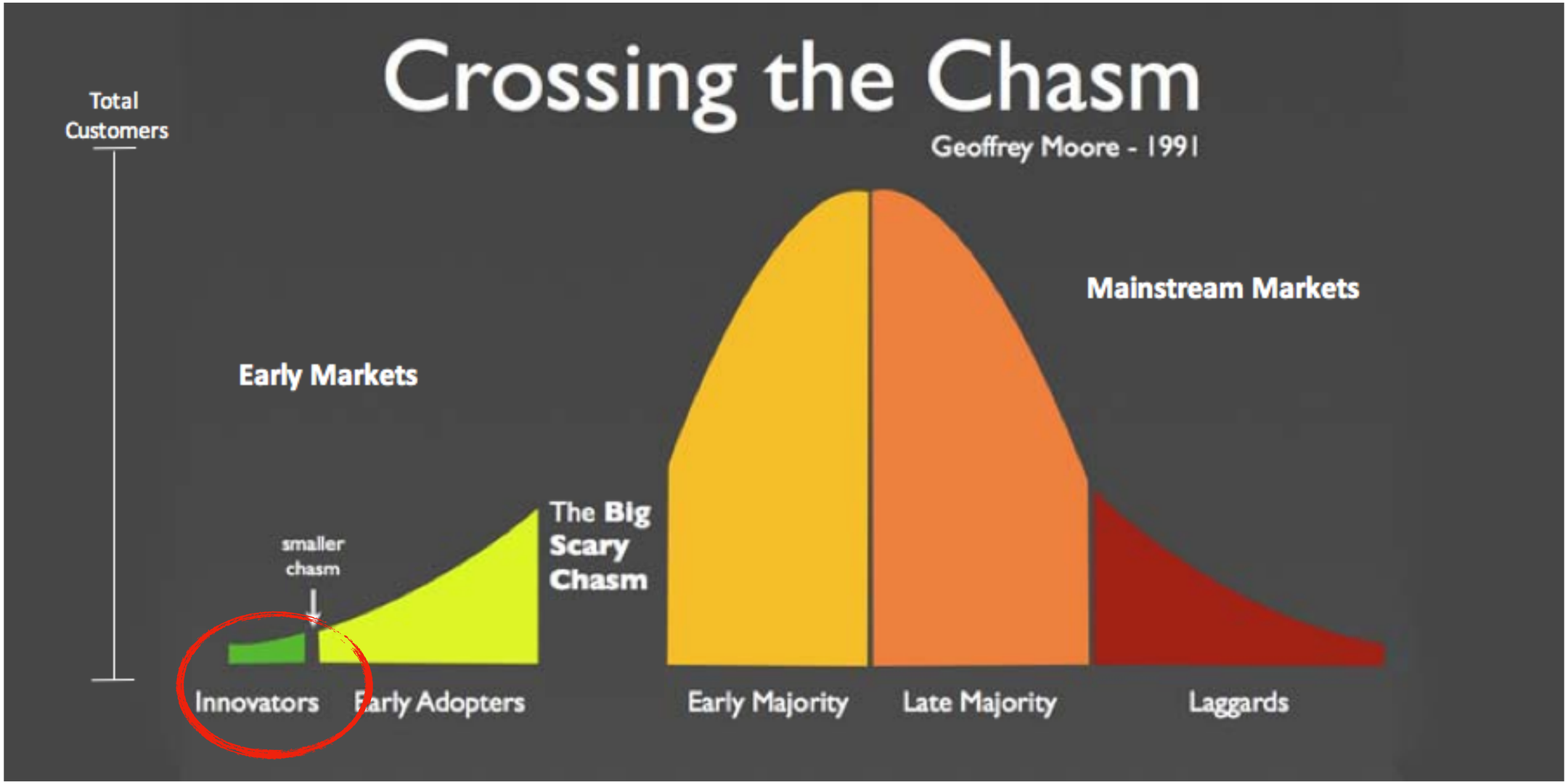
How to Power a New Internet 🔌

It's Still Extremely Early Days!



How to Power a New Internet 🔌

It's Still Extremely Early Days!



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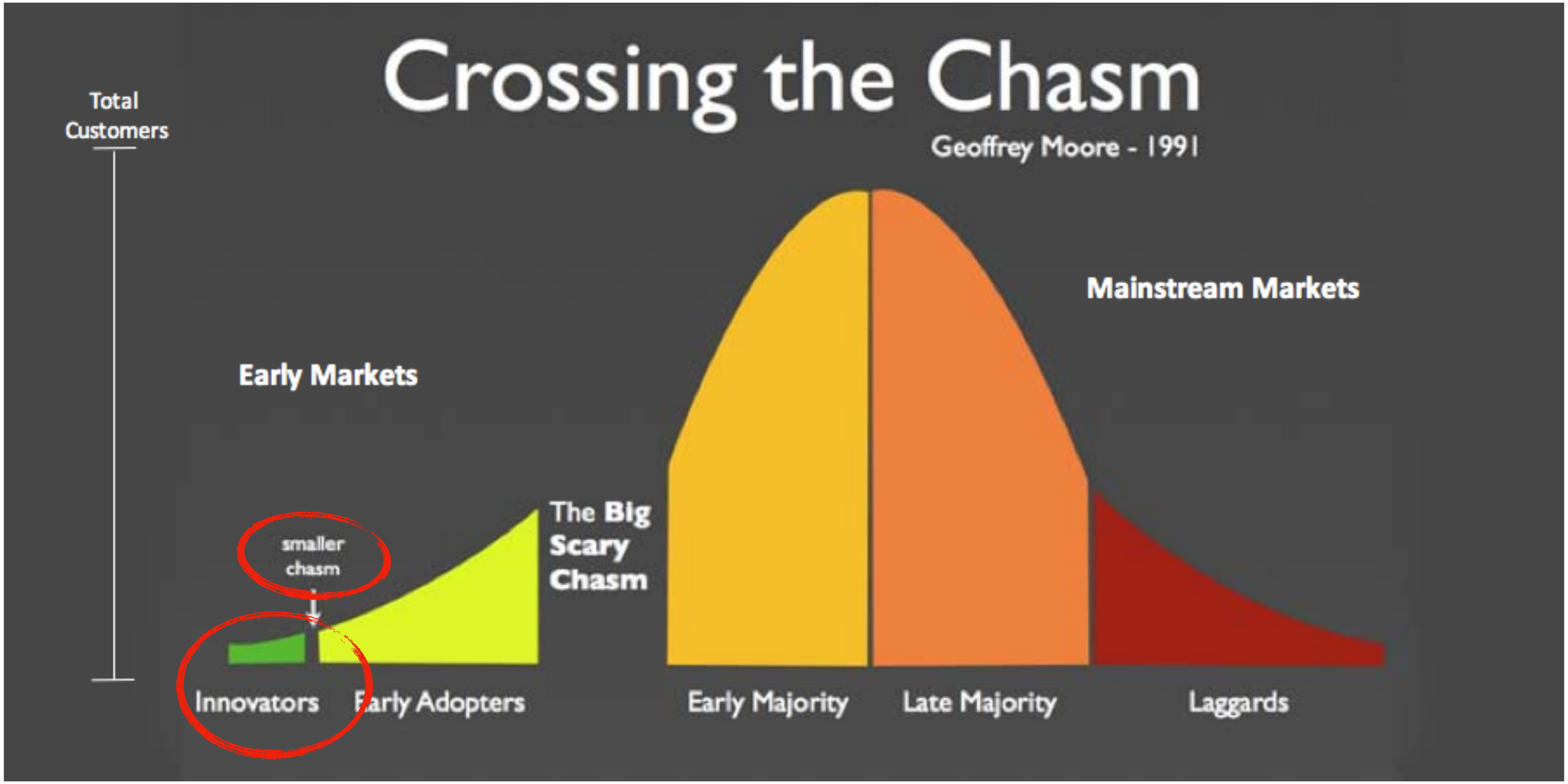

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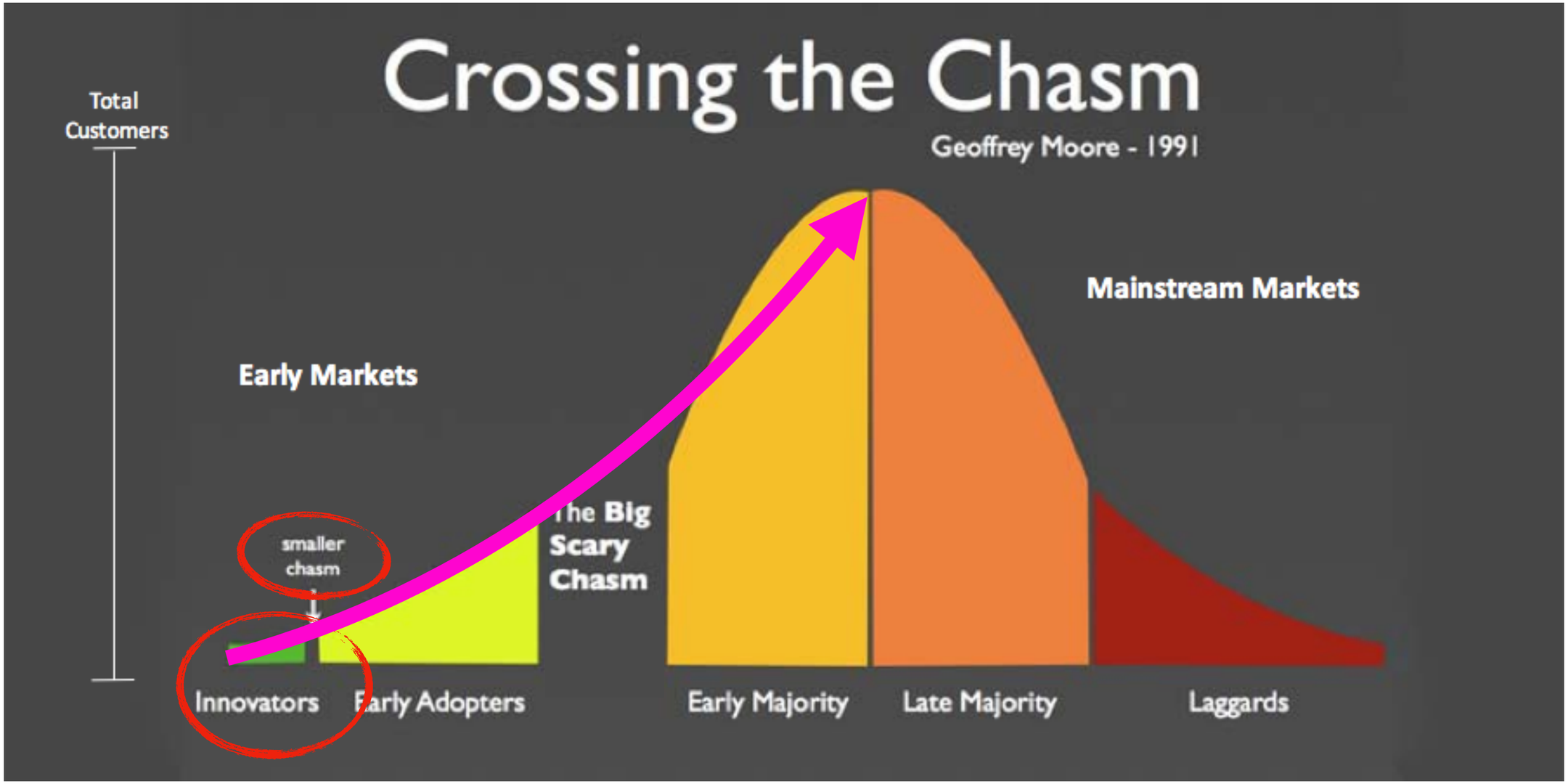
It's Still Extremely Early Days!



How to Power a New Internet 🔌

User Problems

How to Power a New Internet 🔌

User Problems

Dapp UX is ***too hard*** for many users

How to Power a New Internet 🔌

Dev Problems

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Dev Problems

Too many (d)apps are ***centralized(!)***

How to Power a New Internet 🔌

Move the Needle

How to Power a New Internet 🔌

Move the Needle

Realpolitik

Easier, more secure, & more open than:
OAuth, X.509, SAML,
MetaMask, WalletConnect, etc

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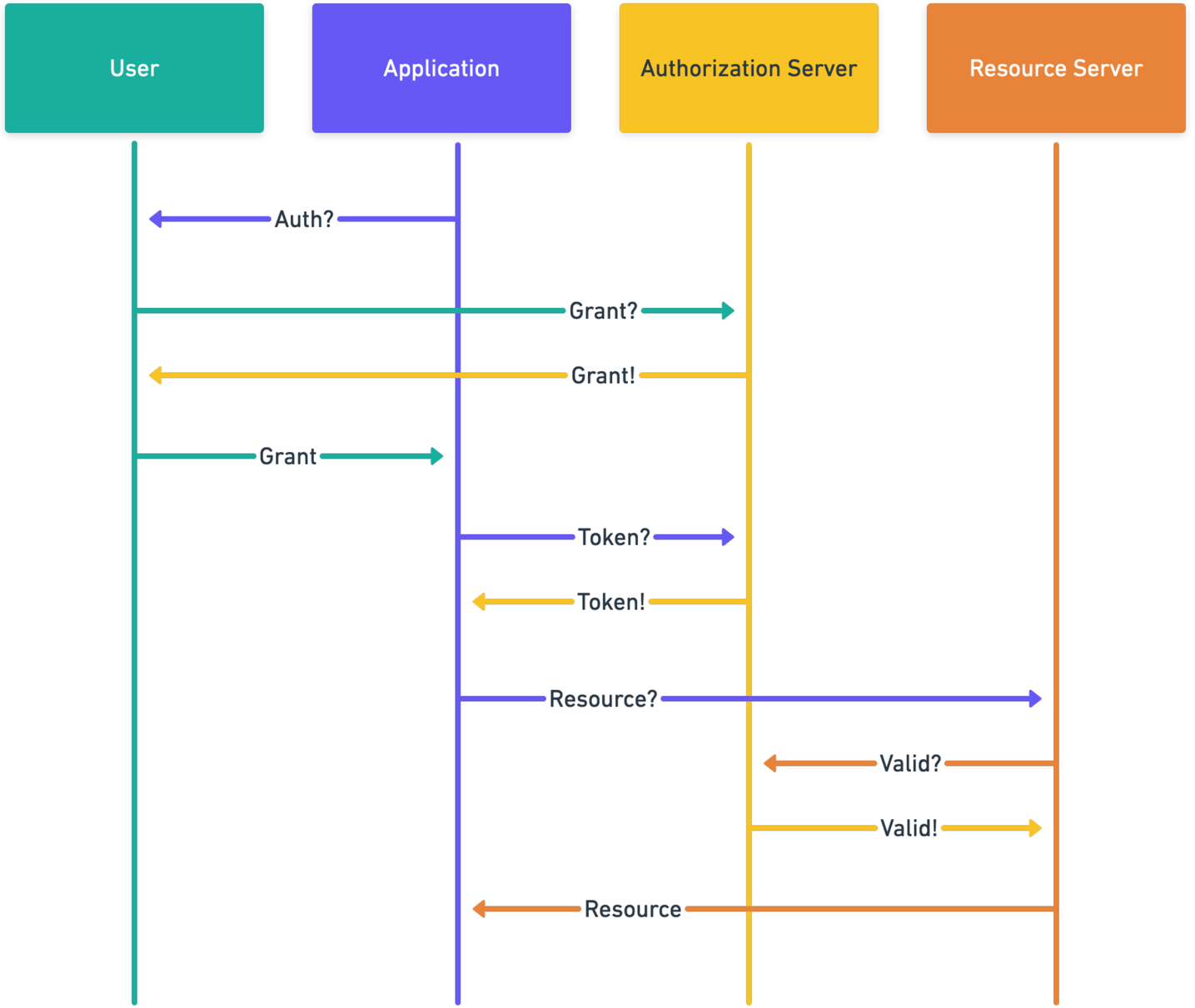
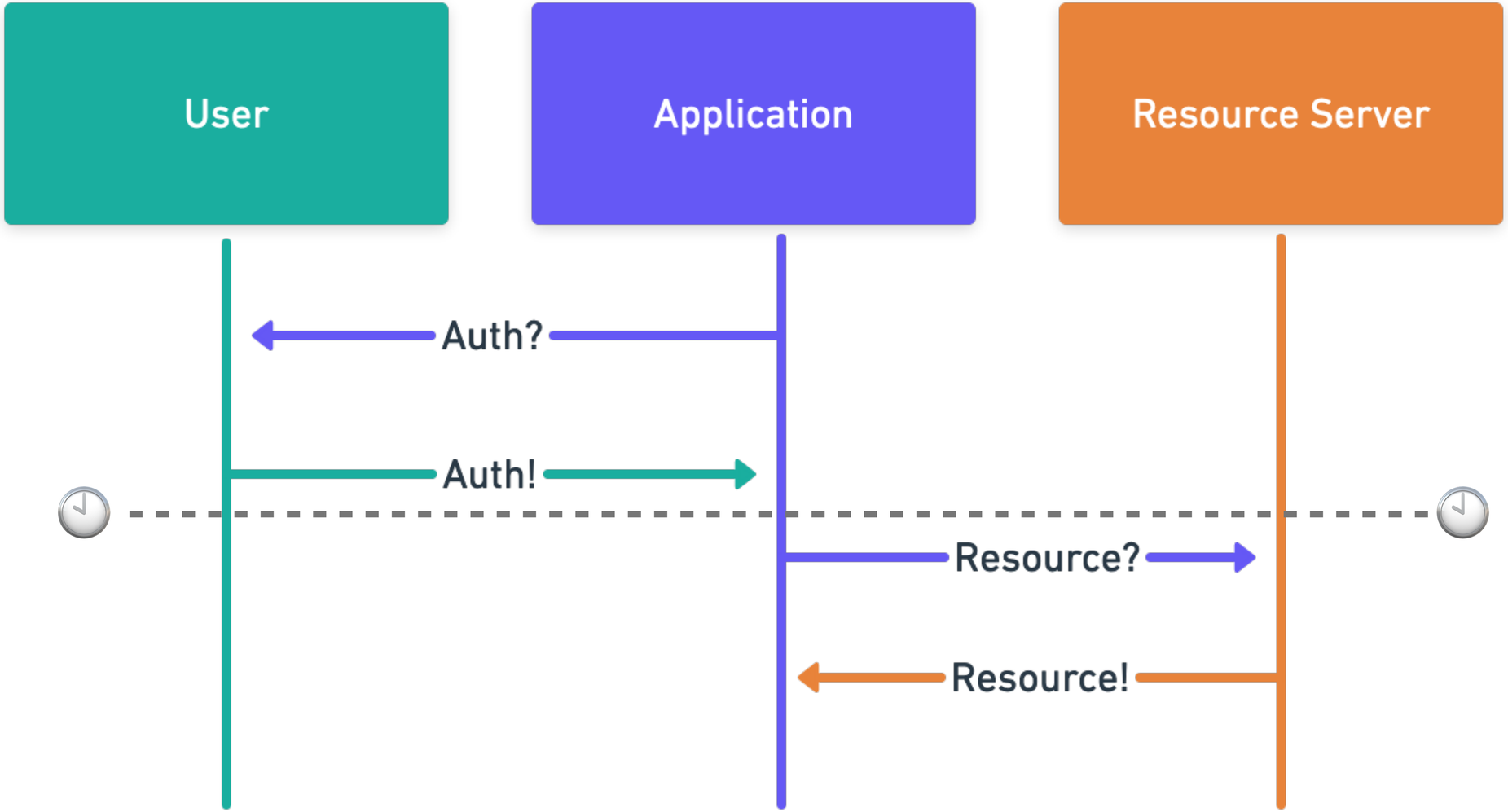
OAuth Sequence



How to Power a New Internet 🔌

UCAN Sequence



Design Principles

Design Principles 📐

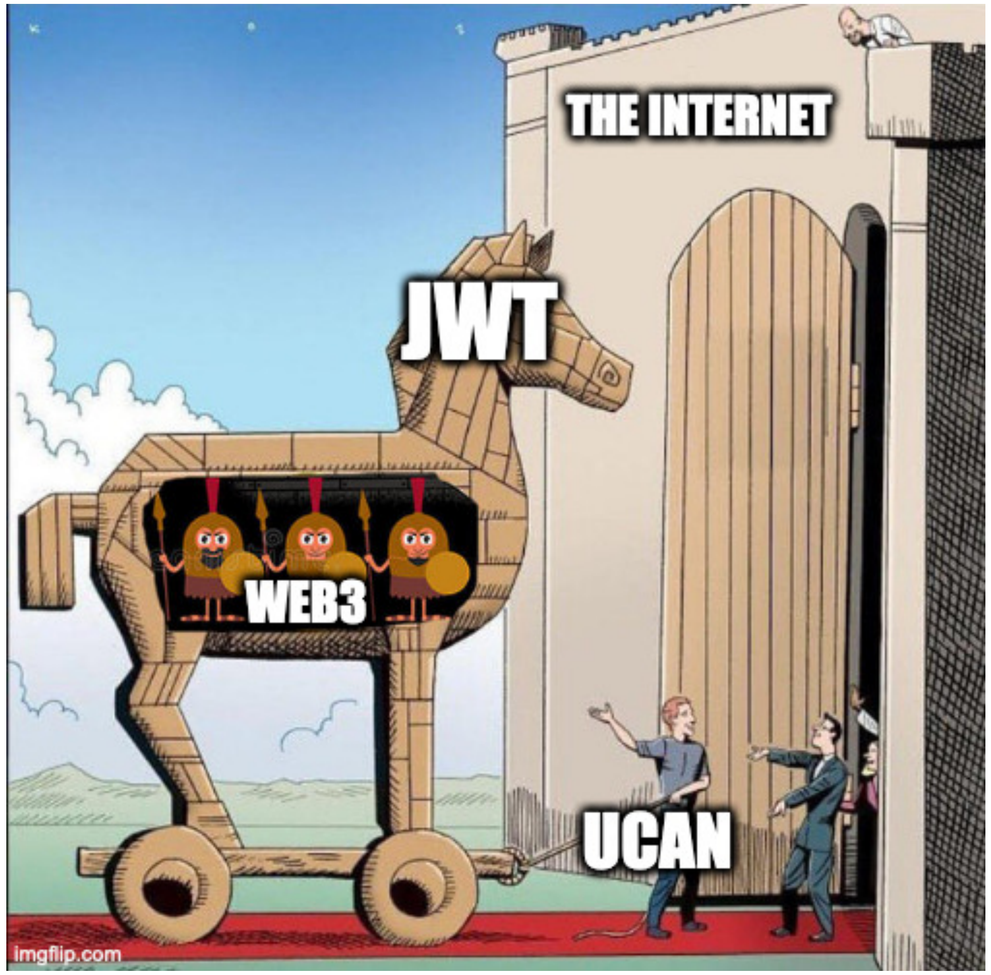
Adoption

Design Principles 📐

Adoption

Be a Trojan Horse

Build on widely supported, familiar, well-understood standards



Design Principles 📐

Adoption

Design Principles 📐

Adoption

Convenience > ideology

Design Principles 📐

Adoption

Design Principles 📐

Adoption

Play Nice with Others

Plug into existing tools

Bridge to other standards

Integrate with other systems

User Controlled, Local-First, Universal Auth

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Non-Extractable Browser Keys

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Non-Extractable Browser Keys

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Non-Extractable Browser Keys

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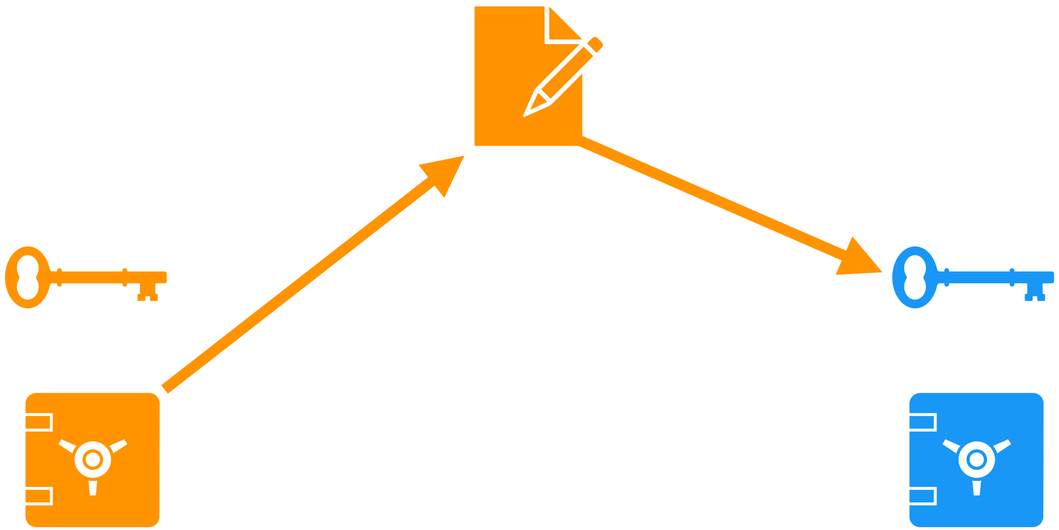
Non-Extractable Browser Keys



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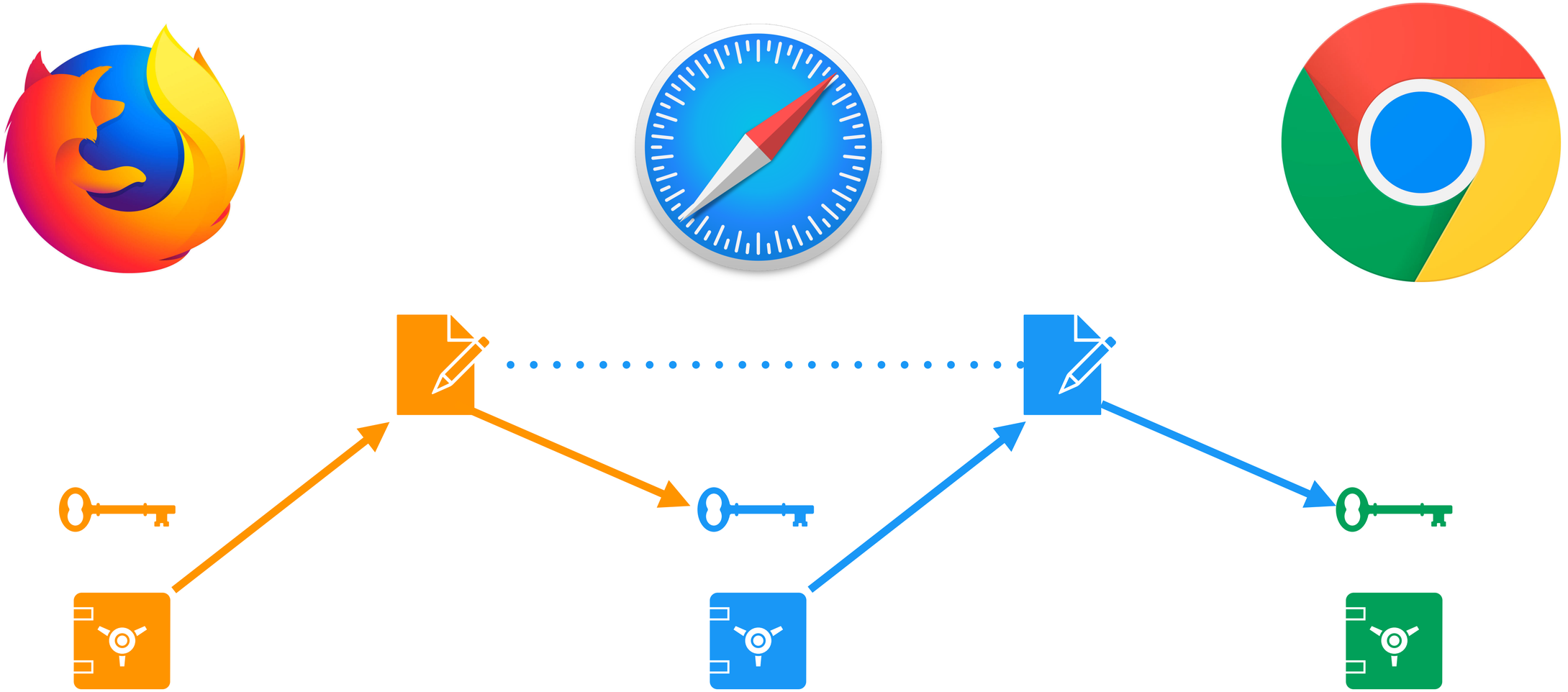
Non-Extractable Browser Keys



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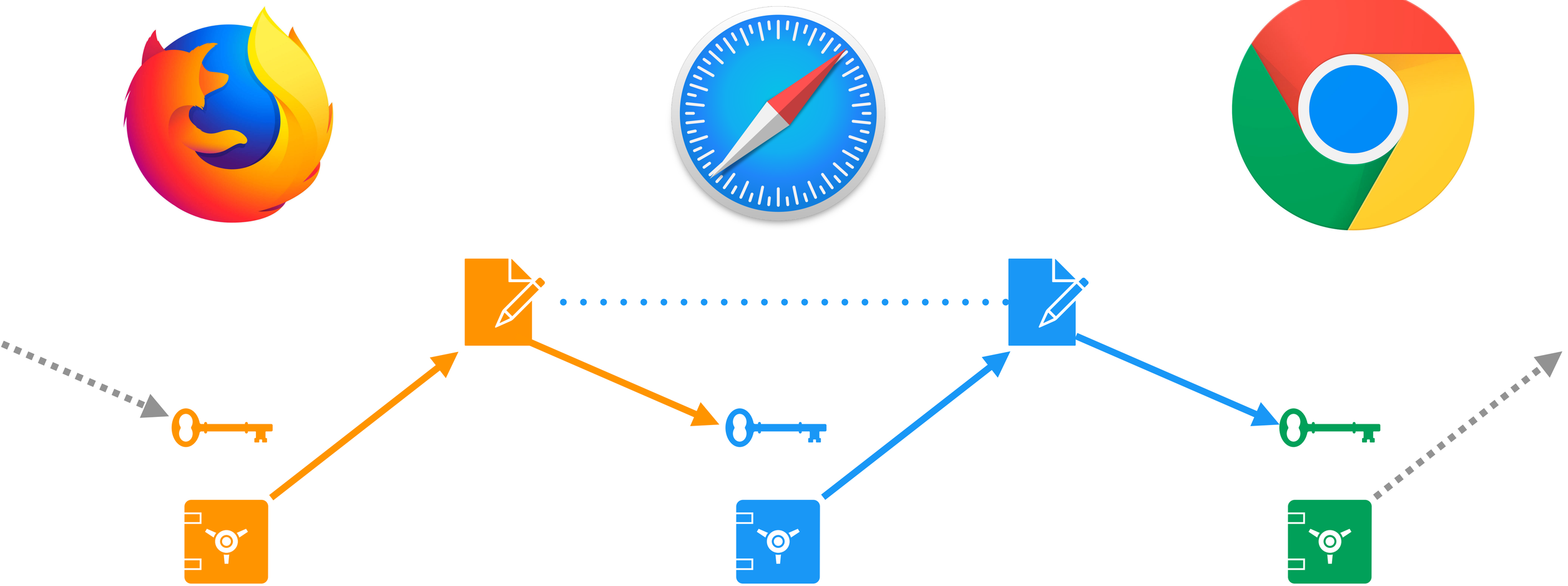
Non-Extractable Browser Keys



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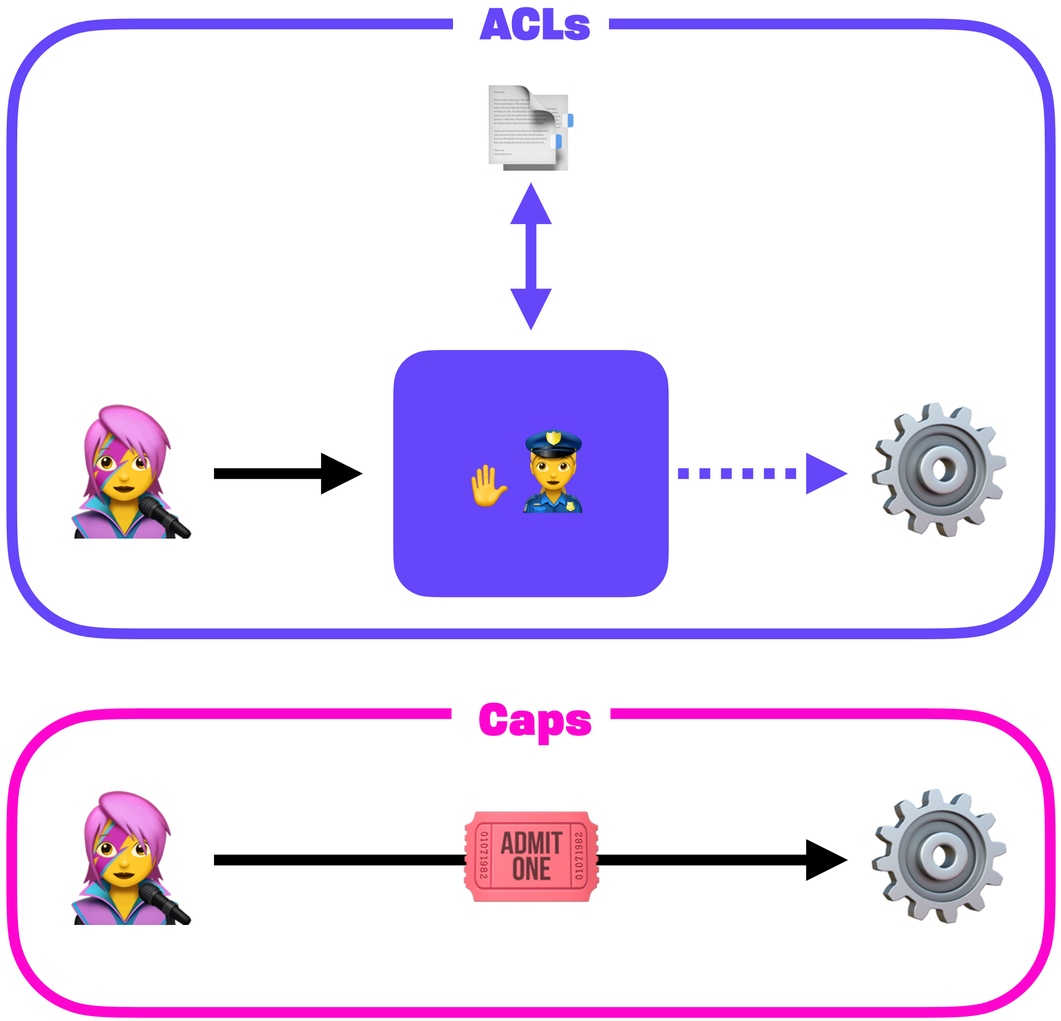
Auth Models

UCAN

Auth Models



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ACL Read & Write

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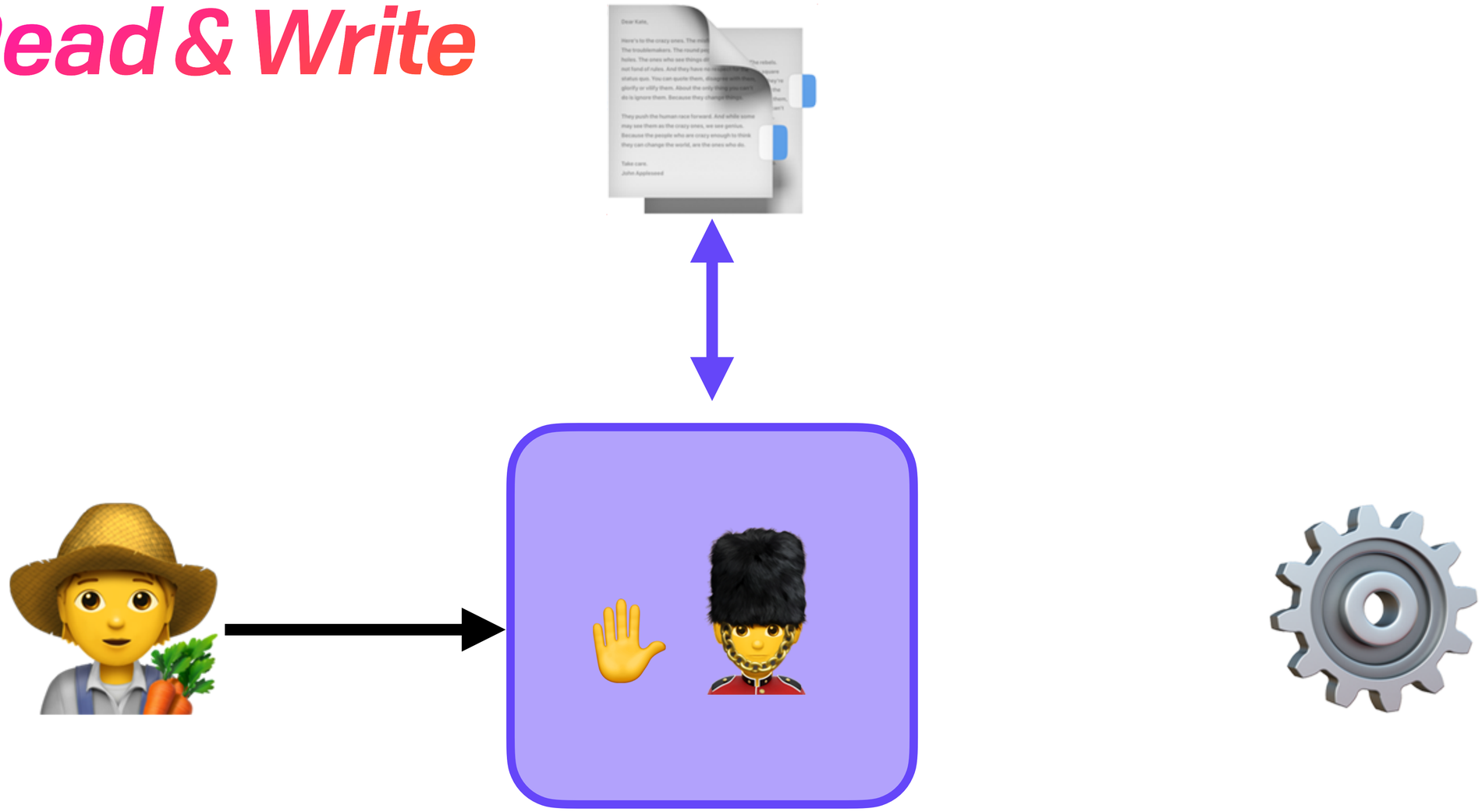

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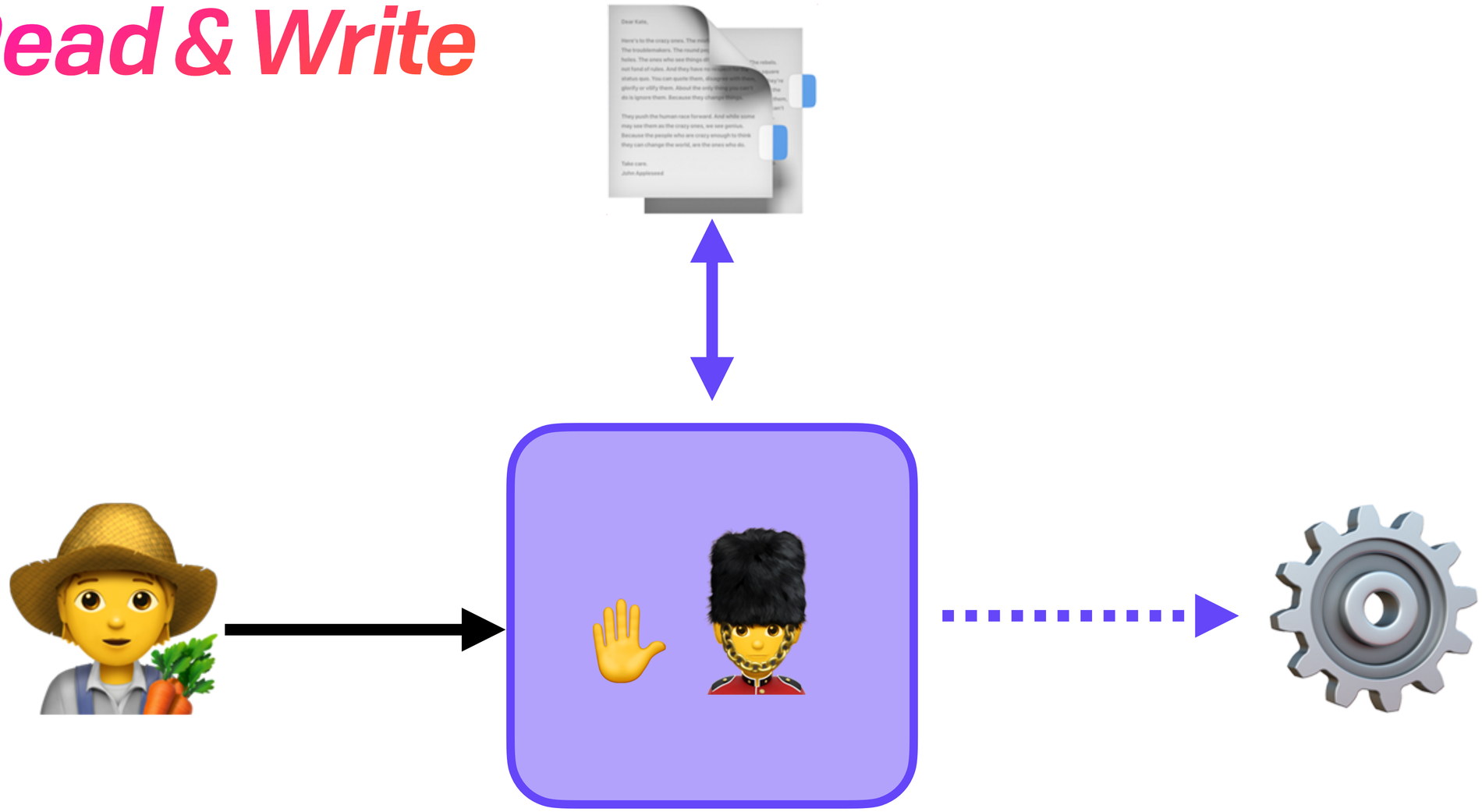

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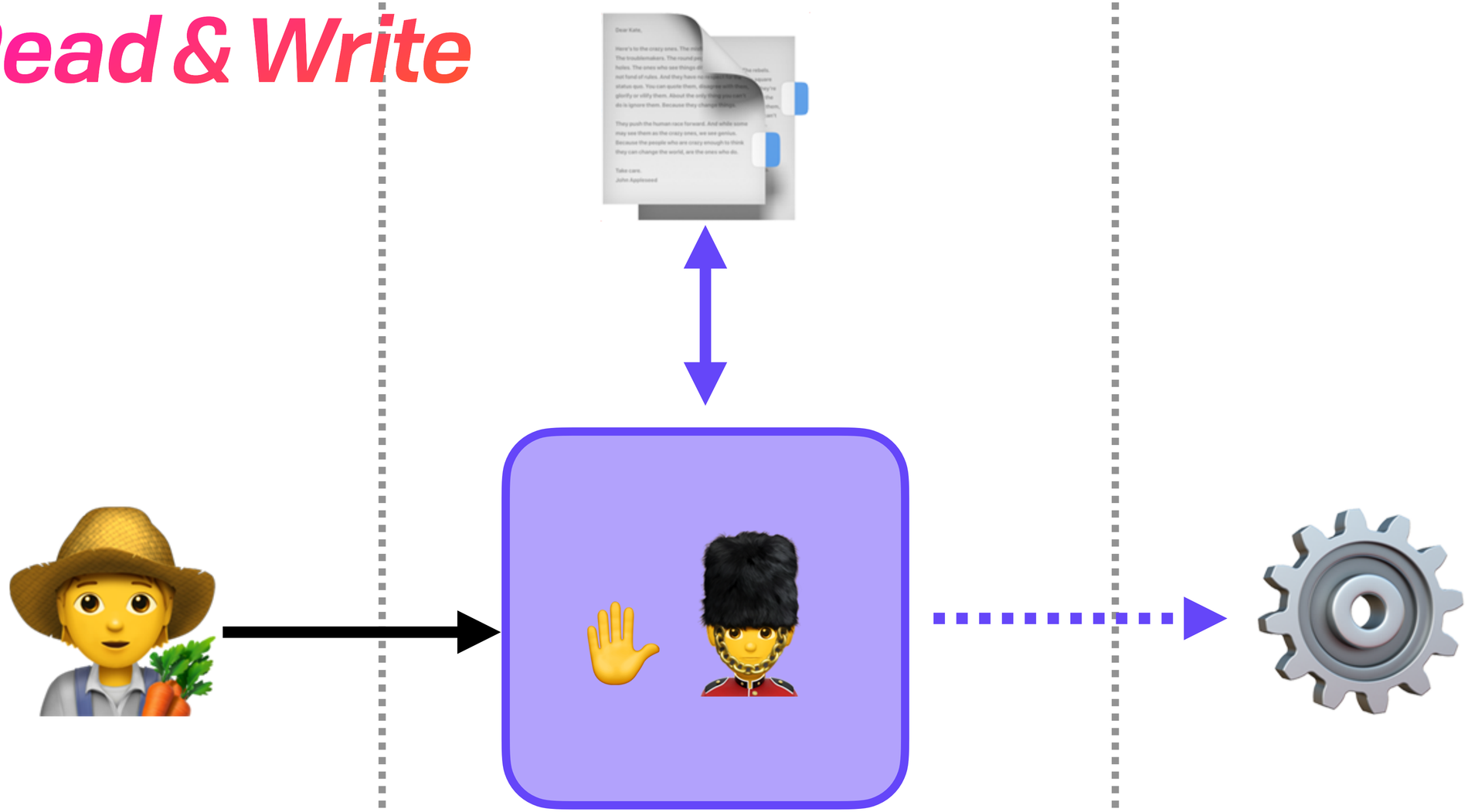

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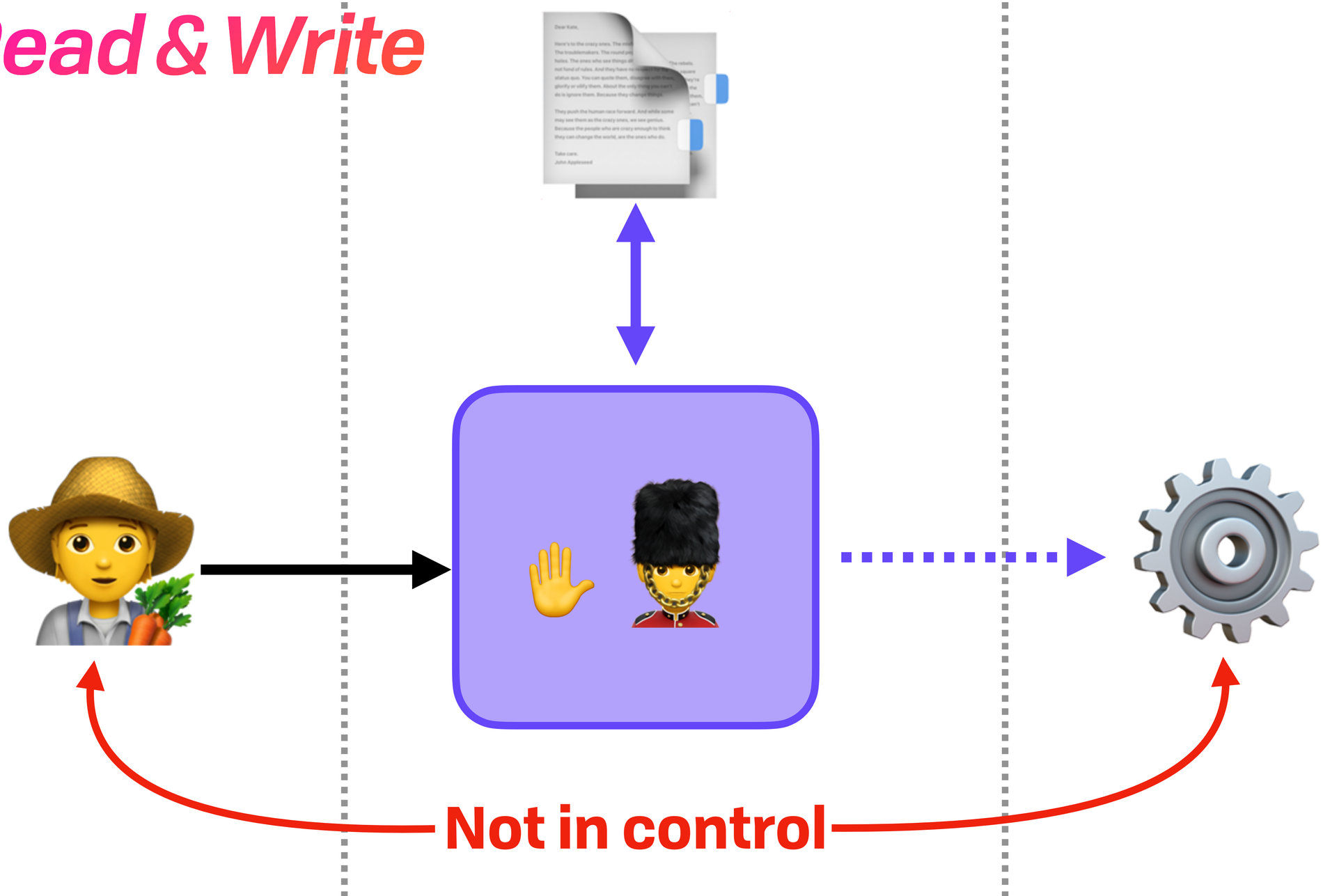

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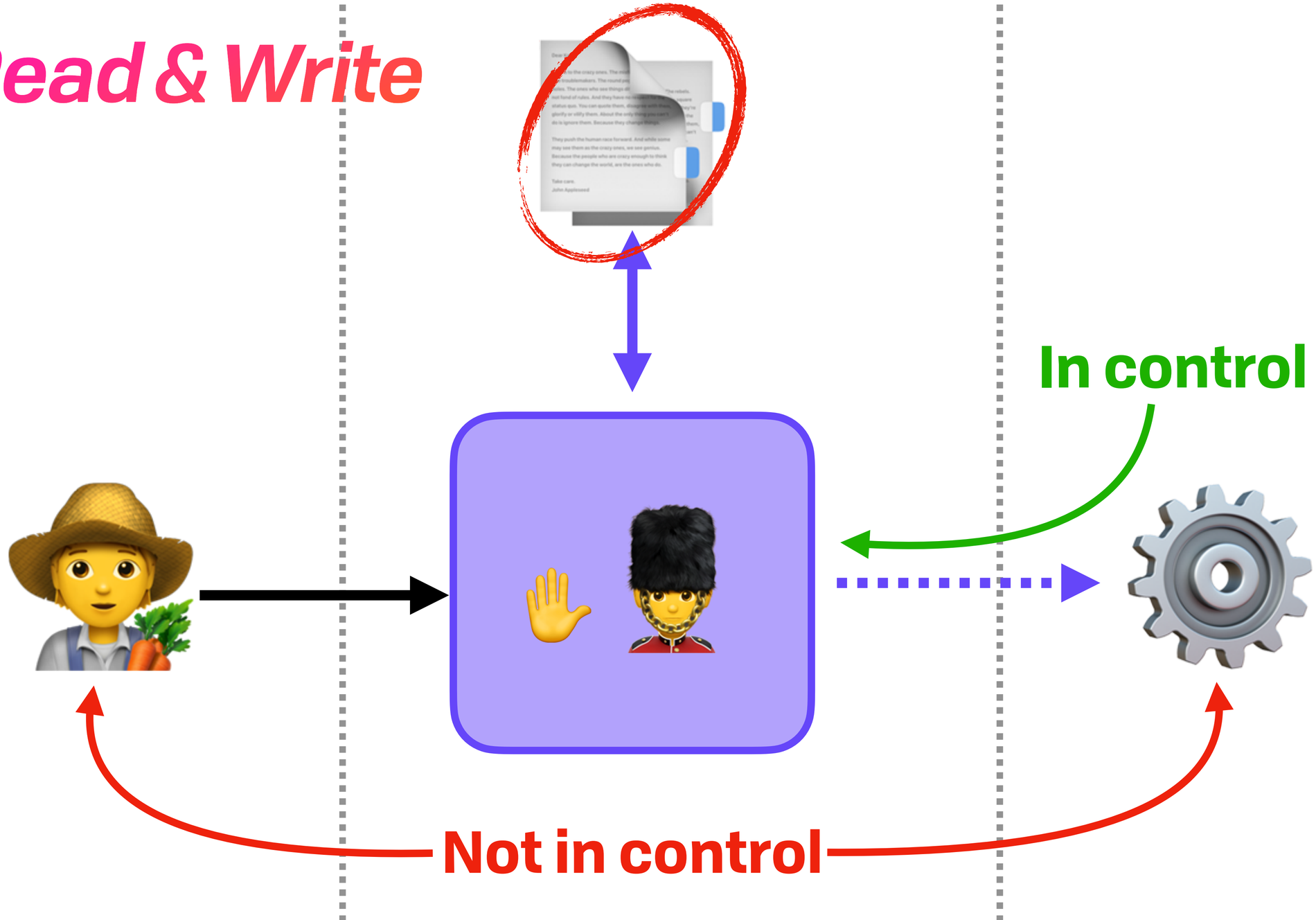
ACL Read & Write

In control

Not in control

UCAN

ACL Read & Write



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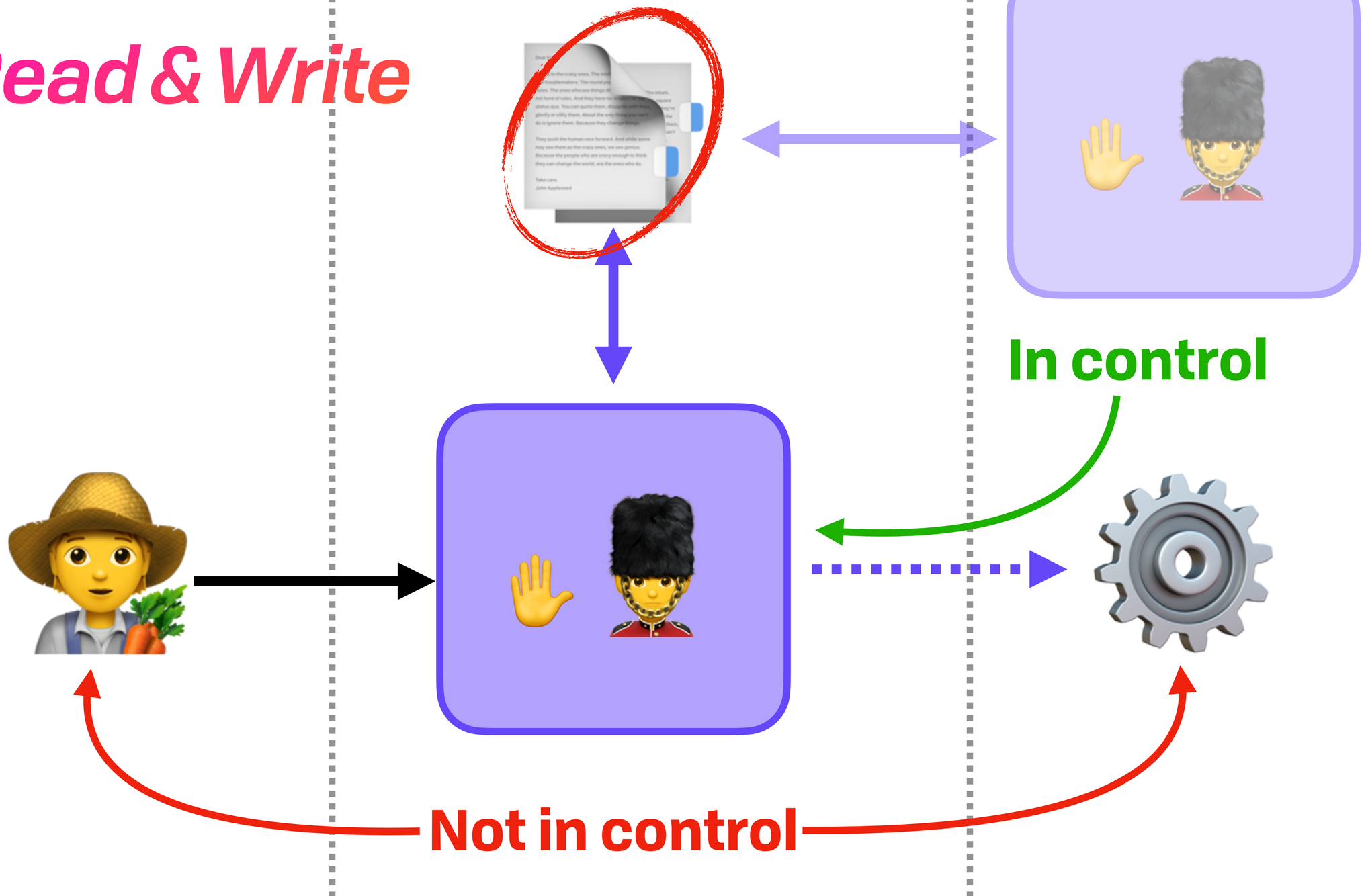

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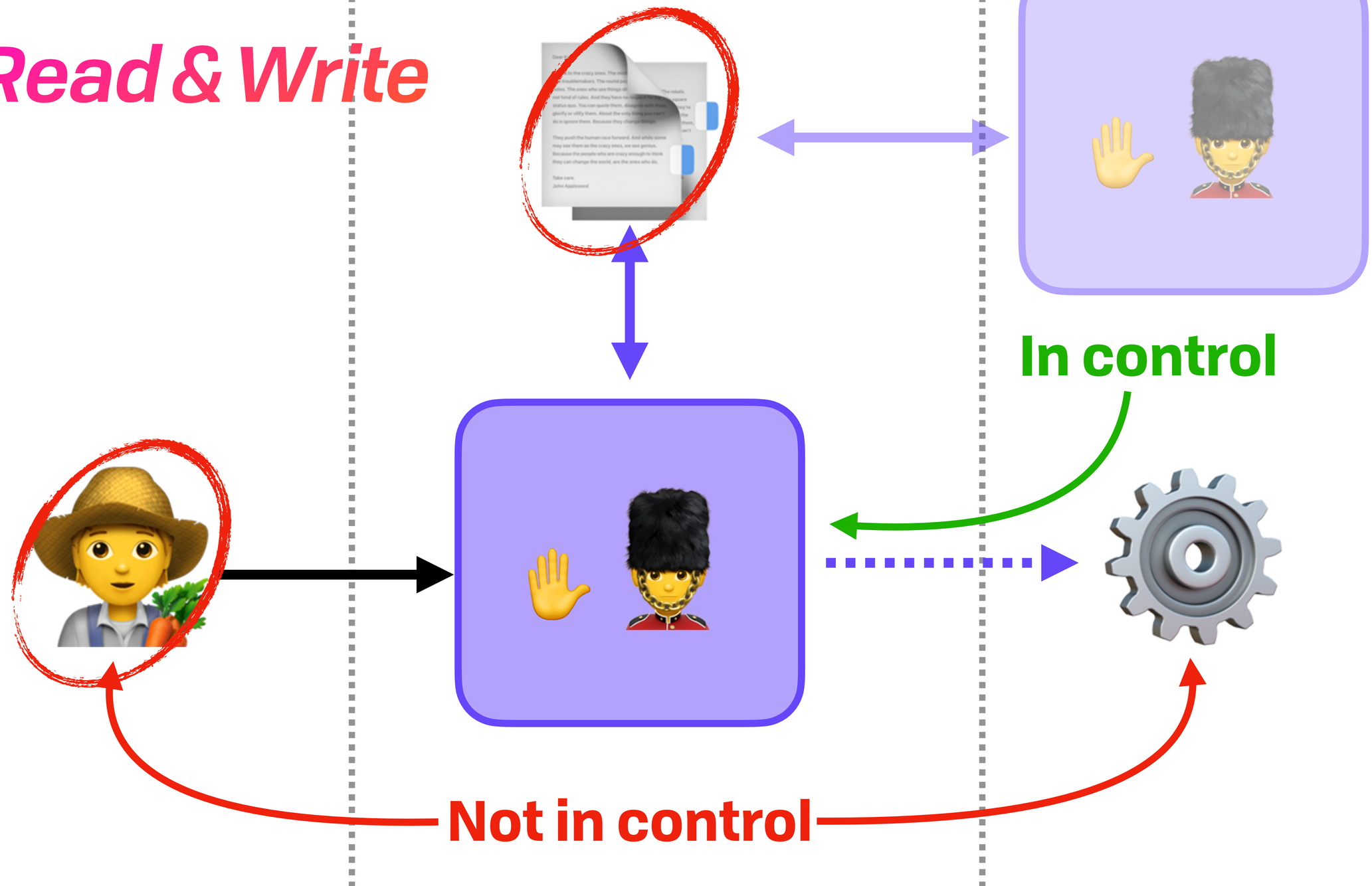

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From Actors to Capabilities

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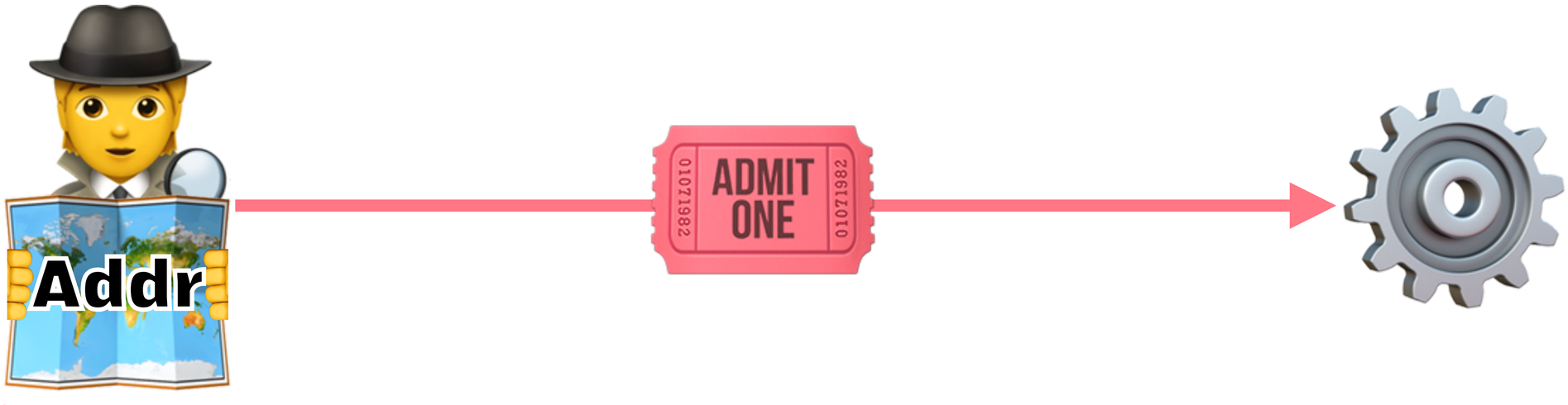

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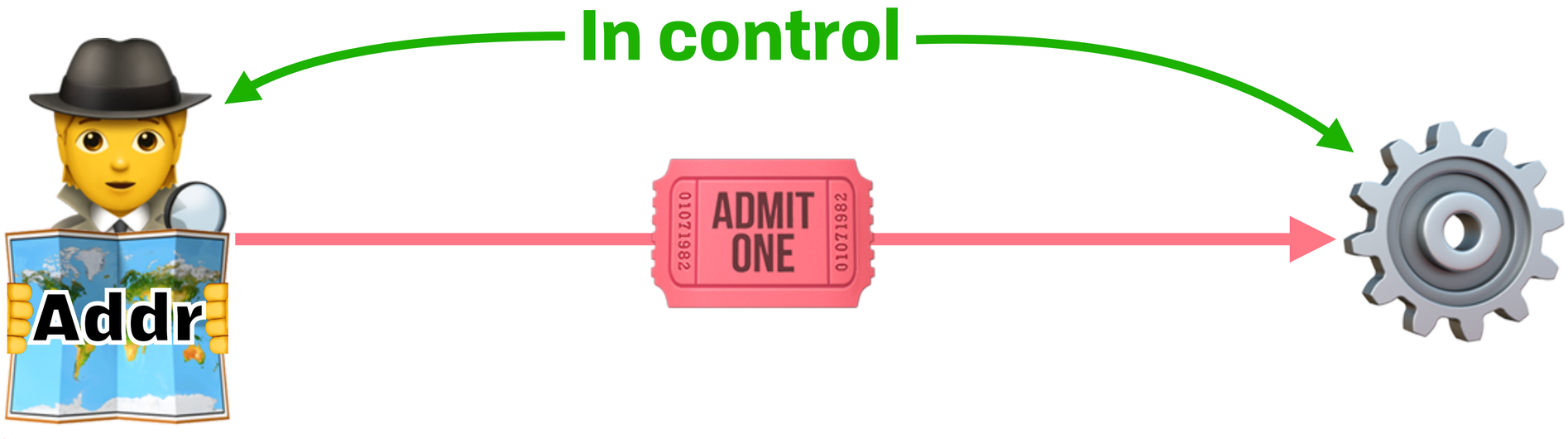

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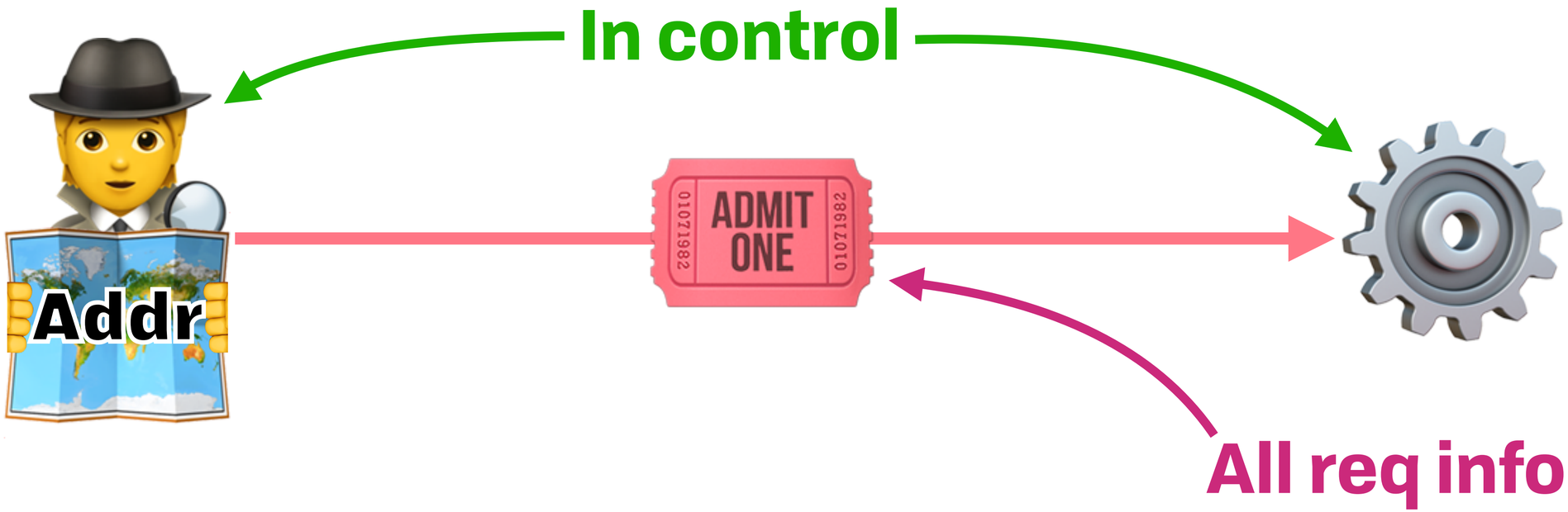

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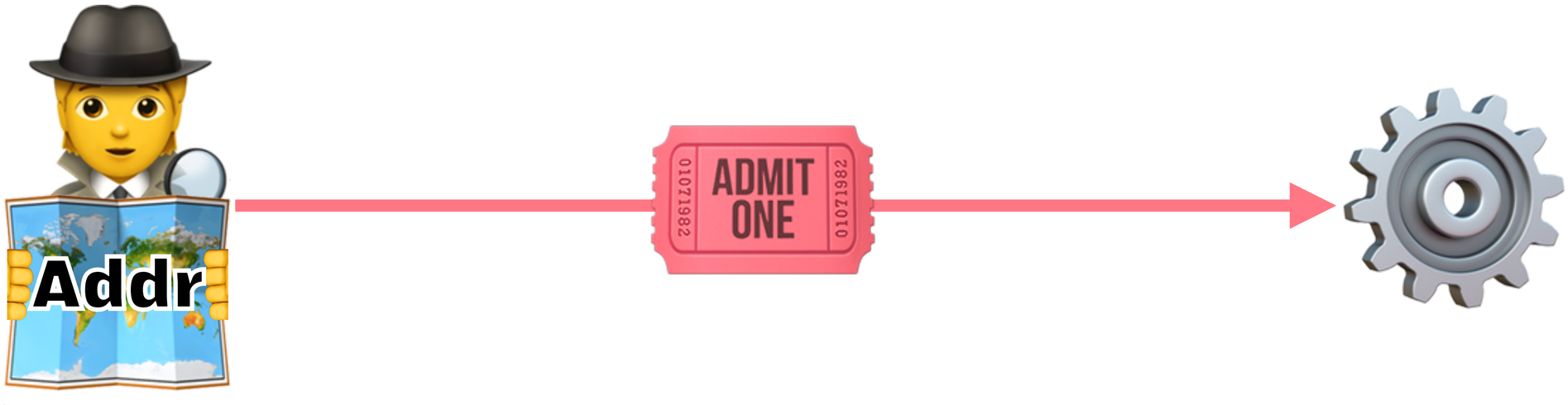

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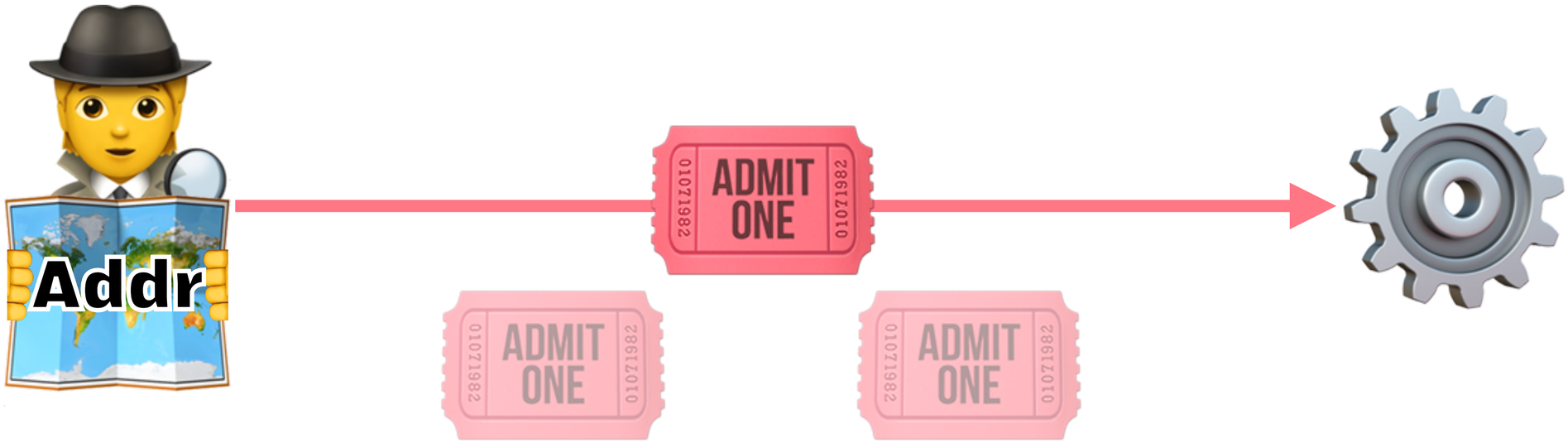

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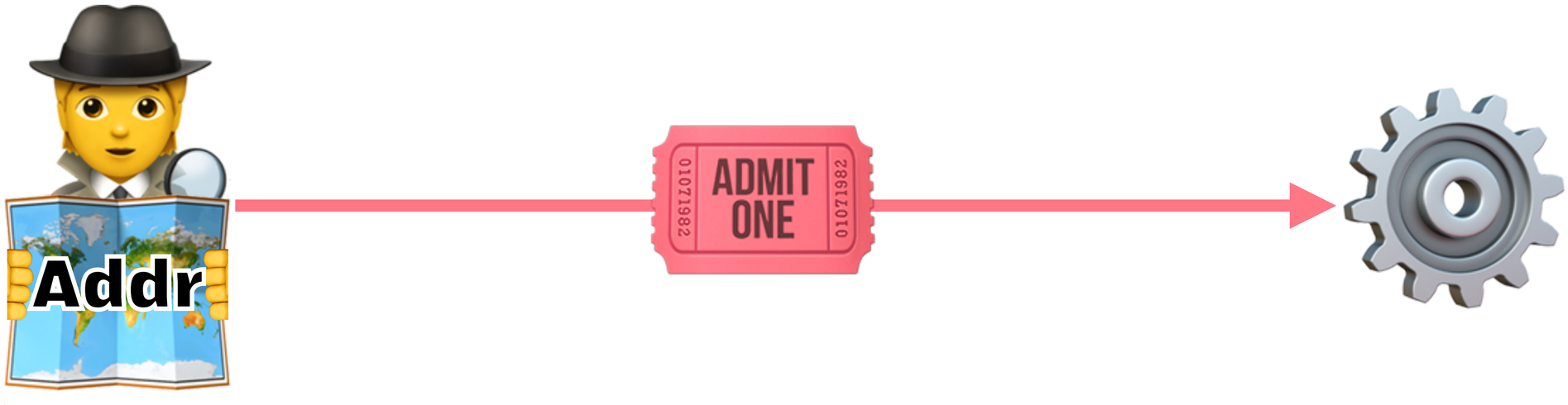

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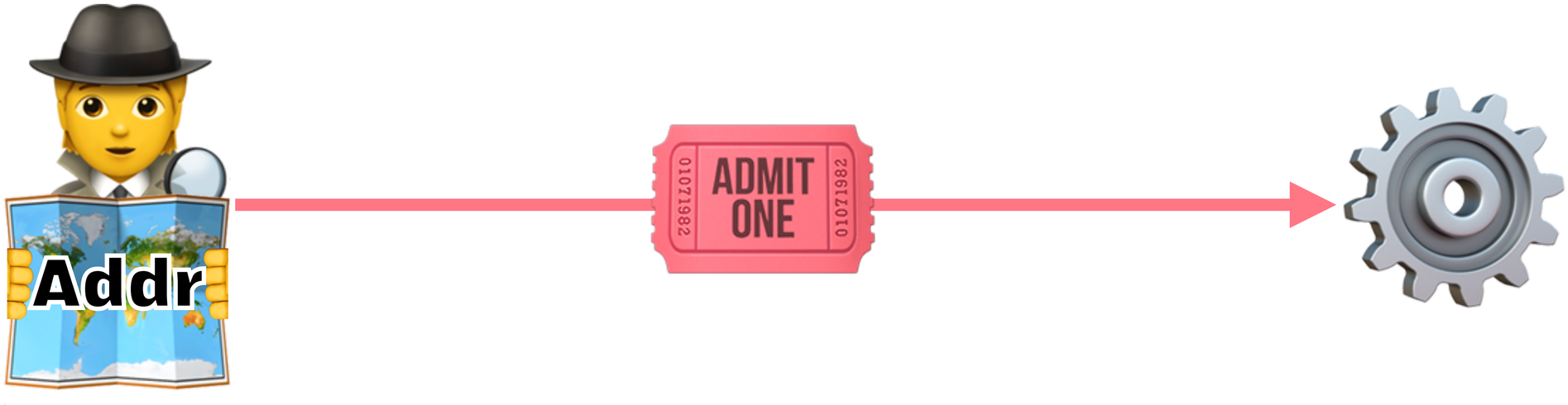

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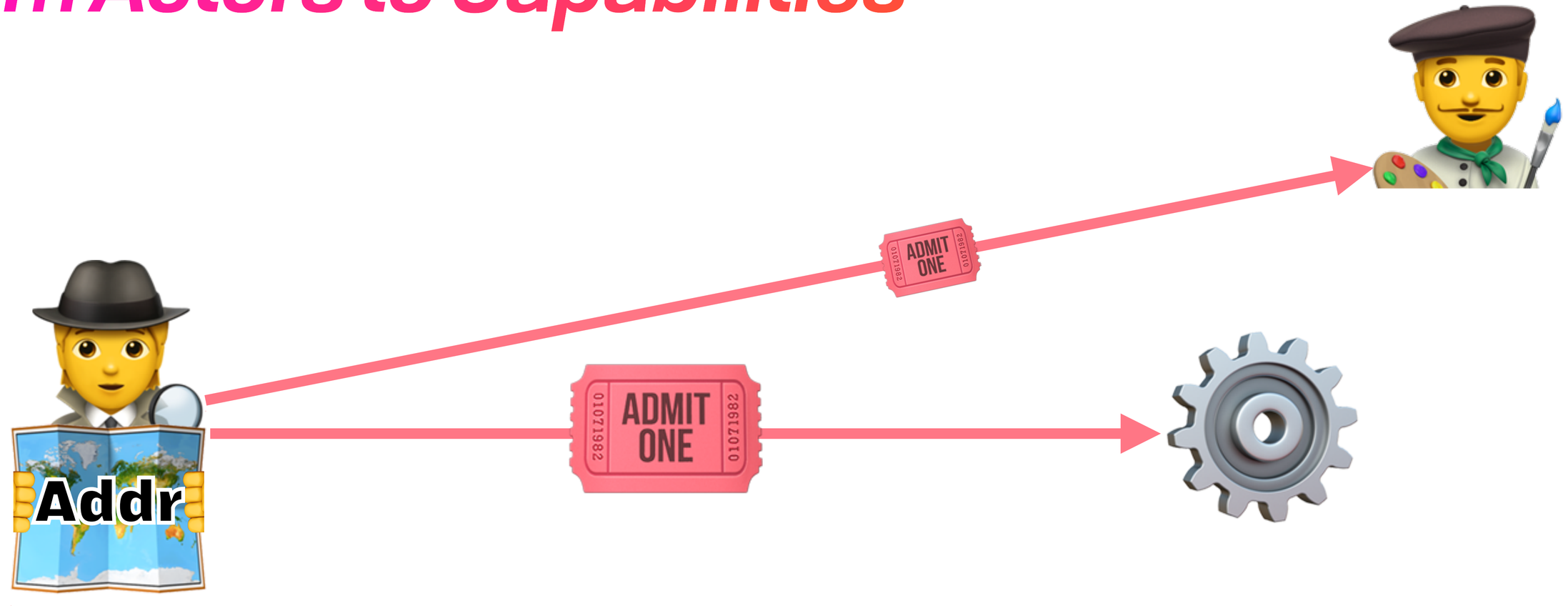

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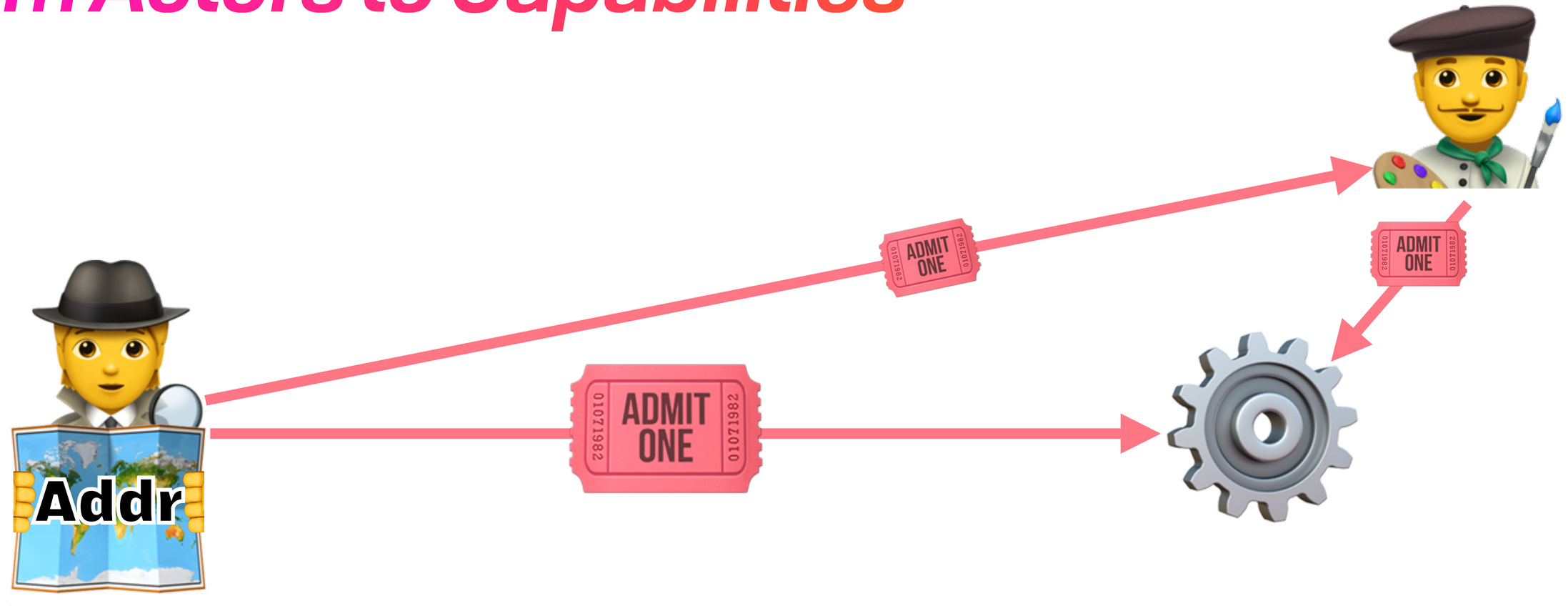

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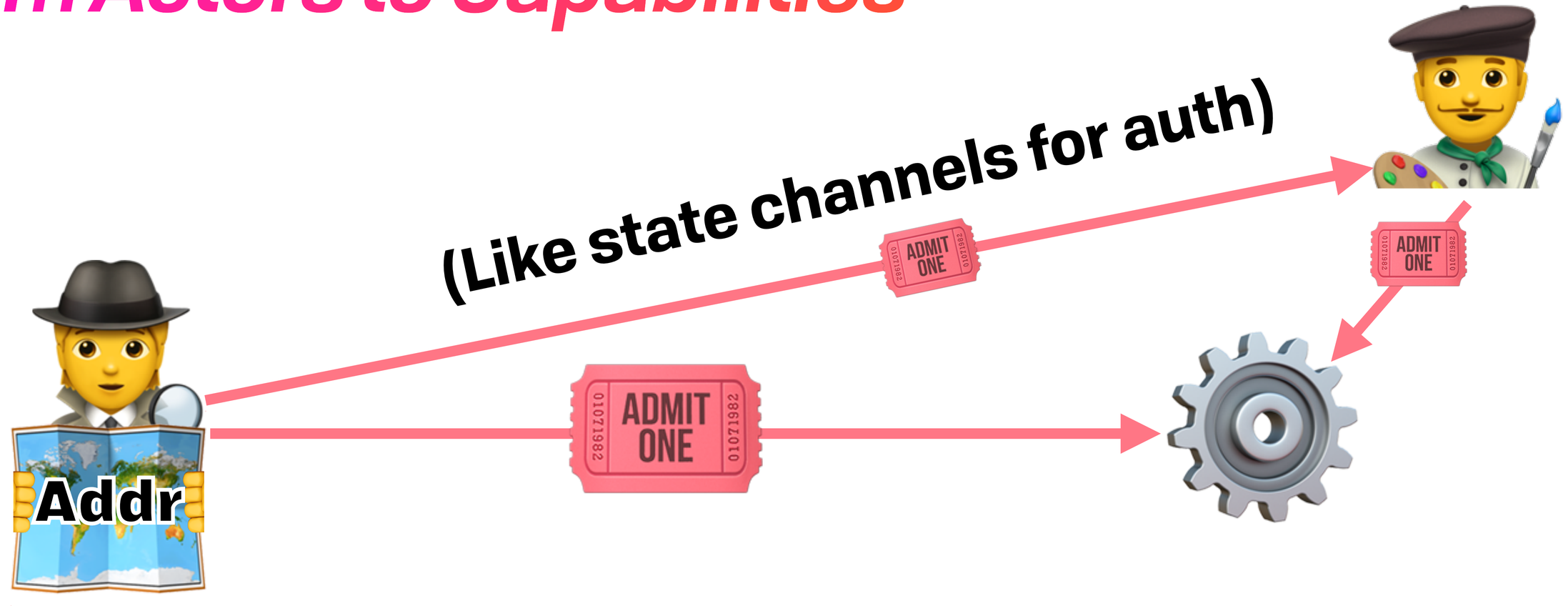

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Rights Amplification

UCAN

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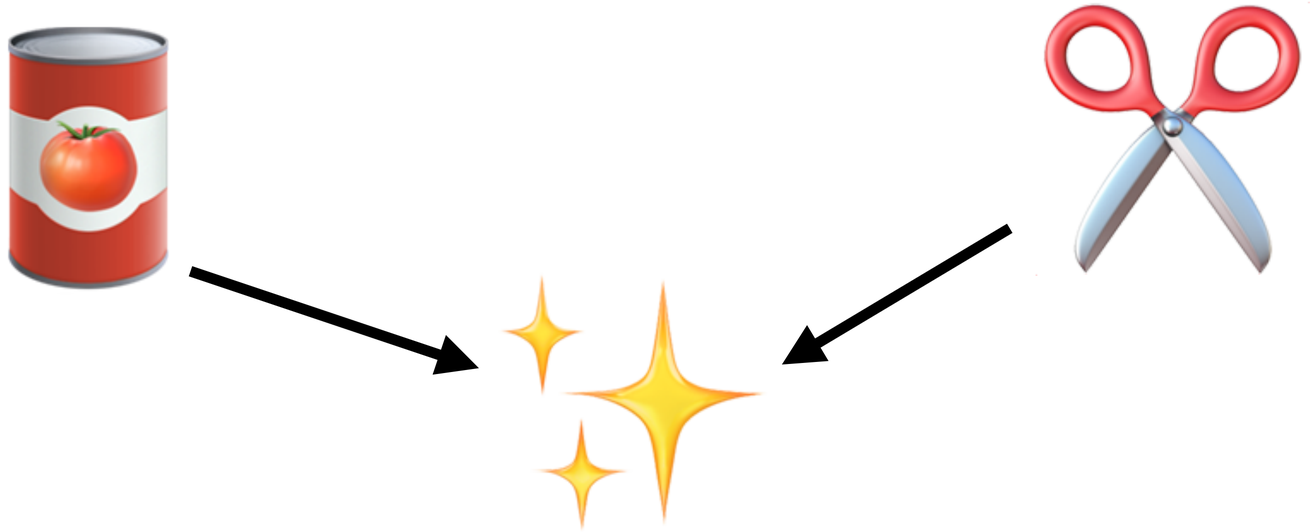
Rights Amplification



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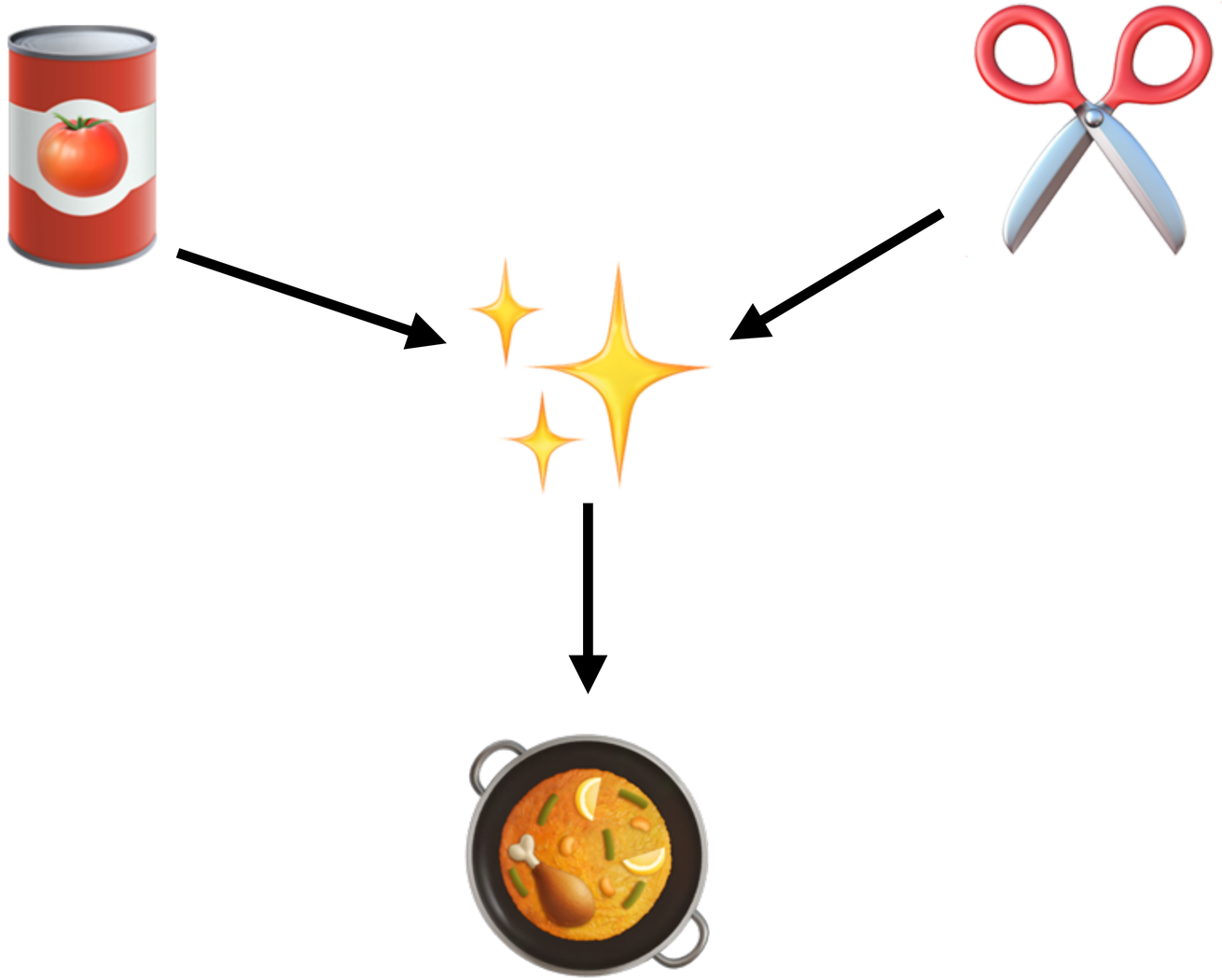
Rights Amplification



UCAN

JWT → UCAN

UCAN

JWT → UCAN

Header

```
{
  "alg": "EdDSA",
  "typ": "JWT",
  "ucv": "0.9.0"
}
```

UCAN

JWT → UCAN

Header

```
{
  "alg": "EdDSA",
  "typ": "JWT",
  "ucv": "0.9.0"
}
```

Payload

```
{
  "iss": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ",
  "aud": "did:key:z6MkvXfPUv8bxtsVQiGo7Ntk4qKJNcgK2it52pc73teUpRLT",
  "nbf": 1639608293,
  "exp": 9256939505,
  "fct" {"hello": "world},
  "att": [
    {
      "with": "wnfs://demouser.fission.name/public/photos/",
      "can": "wnfs/overwrite"
    },
    {
      "with": "wnfs://demouser.fission.name/public/notes/",
      "can": "wnfs/append"
    }
  ]
}
```

UCAN

JWT → UCAN

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  "alg": "EdDSA",
  "typ": "JWT",
  "ucv": "0.9.0"
}
```

Payload

```
{
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  "nbf": 1639608293,
  "exp": 9256939505,
  "fct" {"hello": "world},
  "att": [
    {
      "with": "wnfs://demouser.fission.name/public/photos/",
      "can": "wnfs/overwrite"
    },
    {
      "with": "wnfs://demouser.fission.name/public/notes/",
      "can": "wnfs/append"
    }
  ]
}
```

Signature

```
kwRdqPN74pkcpXGgdk7Z7FW3M1mRR
YaDE5ZgkG6srAuu6V6mvMVRdBLnD5
CWid-X4tDIKpliVjlCSLTntB4pCw
```

UCAN

JWT → UCAN

Header

```
{
  "alg": "EdDSA",
  "typ": "JWT",
  "ucv": "0.9.0"
}
```

Payload

```
{
  "iss": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ"
  "aud": "did:key:z6MkvXTPUv8bxtsVQtGo7Ntk4qKJNcgK2tt52pc73teUpRLT",
  "nbf": 1639608293,
  "exp": 9256939505,
  "fct" {"hello": "world},
  "att": [
    {
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      "can": "wnfs/overwrite"
    },
    {
      "with": "wnfs://demouser.fission.name/public/notes/",
      "can": "wnfs/append"
    }
  ]
}
```

✅

Signature

```
kwRdqPN74pkcpXGgdk7Z7FW3M1mRR
YaDE5ZgkG6srAuu6V6mvMVRdBLnD5
CWid-X4tDIKpliVjlCSLTntB4pCw
```

UCAN

Anatomy of a Capability

UCAN

Anatomy of a Capability

```
[
  {
     "with": "http://example.com/alice/photos/",
     "can": "crud/read"
  },
  {
    "with": "mailto:boris@fission.codes",
    "can": "msg/send",
    "ext": {
      to": "/.*@fission.codes/"
    }
  }
]
```

UCAN

Anatomy of a Capability

Resource / "noun"

(URI)

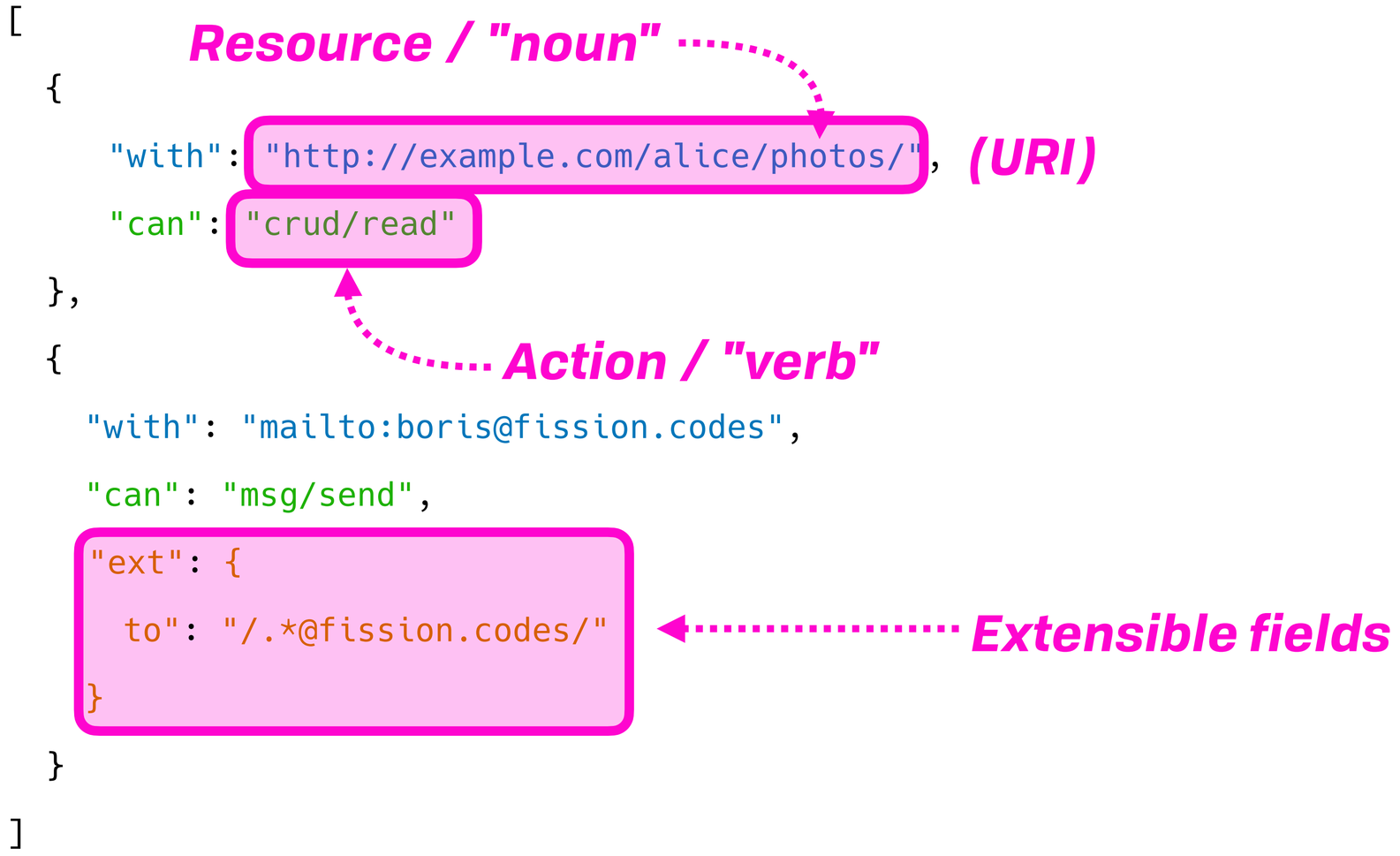
```
[
  {
    "with": "http://example.com/alice/photos/",
    "can": "crud/read"
  },
  {
    "with": "mailto:boris@fission.codes",
    "can": "msg/send",
    "ext": {
      to": "/.*@fission.codes/"
    }
  }
]
```

UCAN

Anatomy of a Capability

UCAN

Anatomy of a Capability



UCAN

Chain Witnesses

UCAN

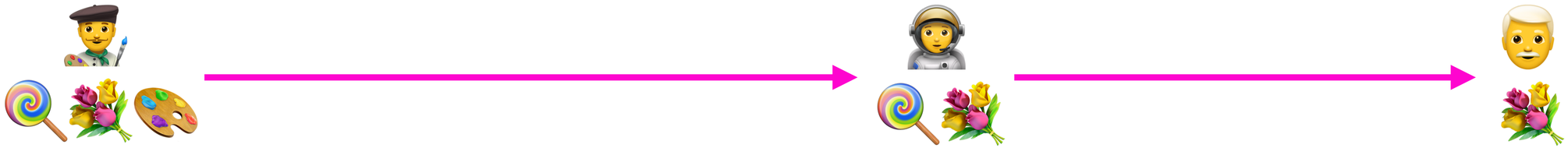
Chain Witnesses

UCAN

Chain Witnesses

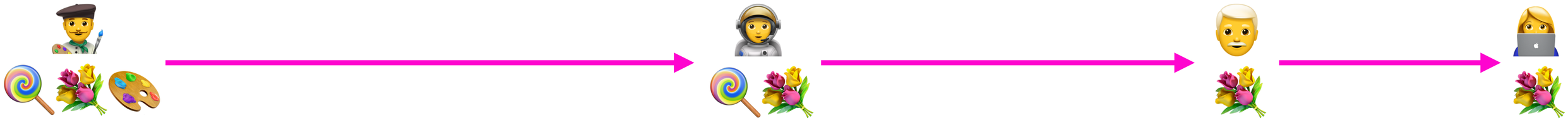
UCAN

Chain Witnesses



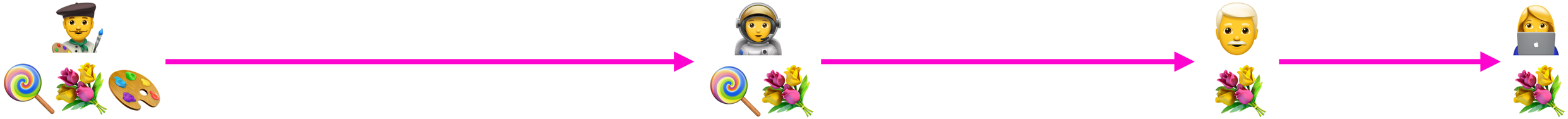
UCAN

Chain Witnesses



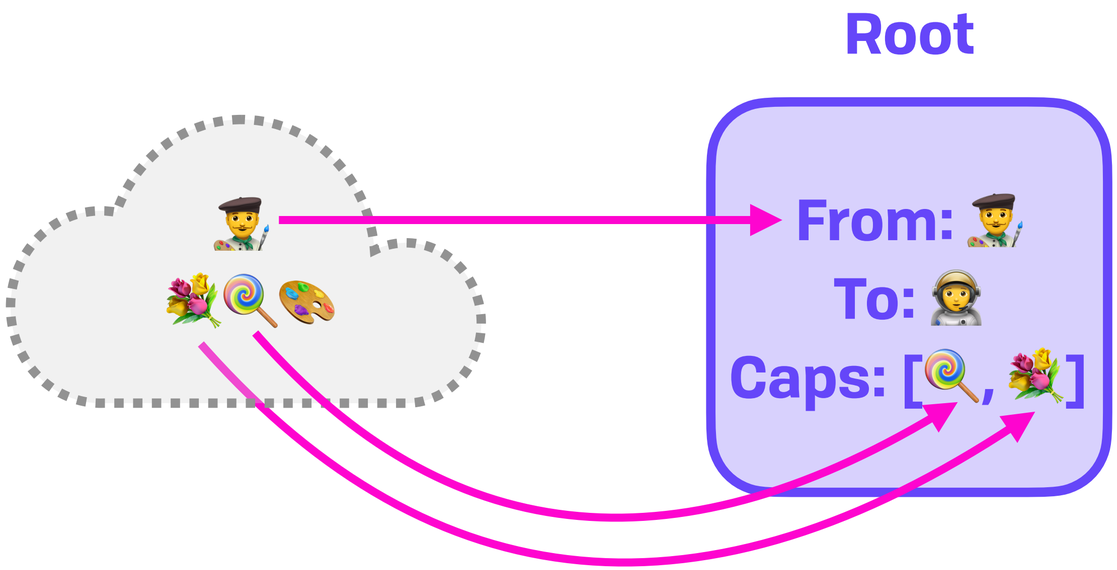
UCAN

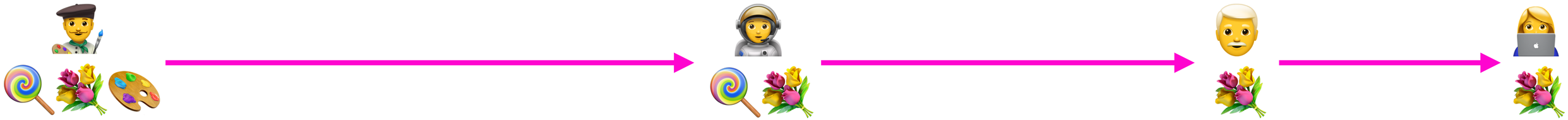
Chain Witnesses



UCAN

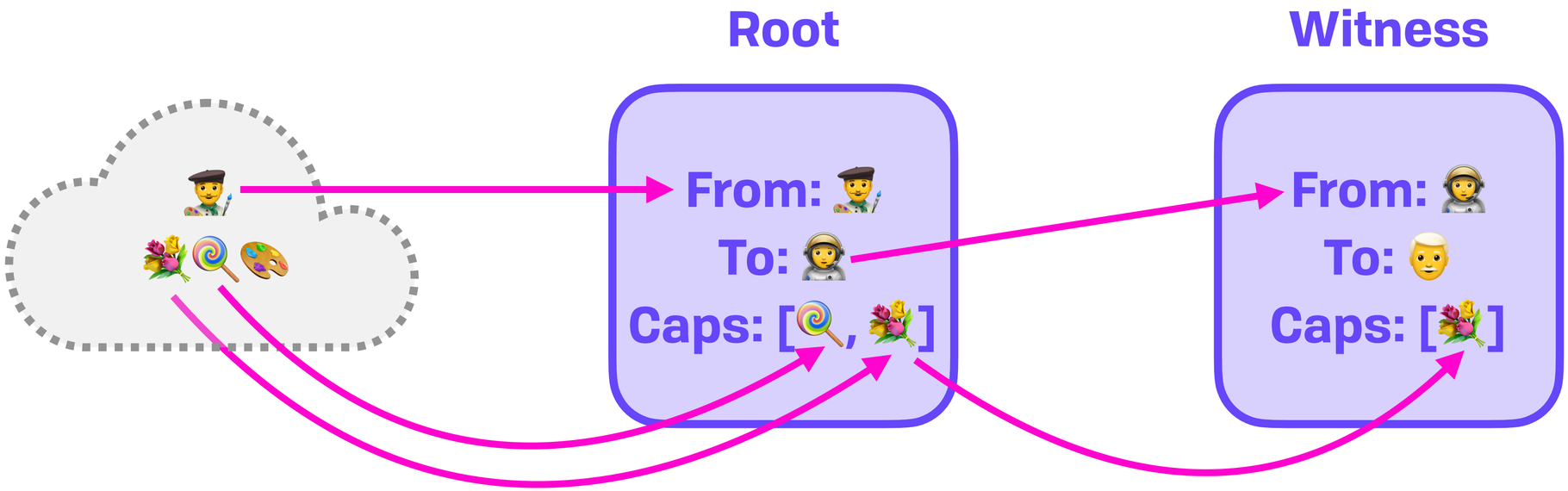
Chain Witnesses

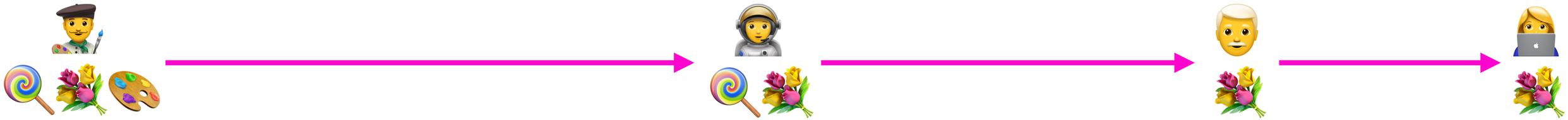




UCAN

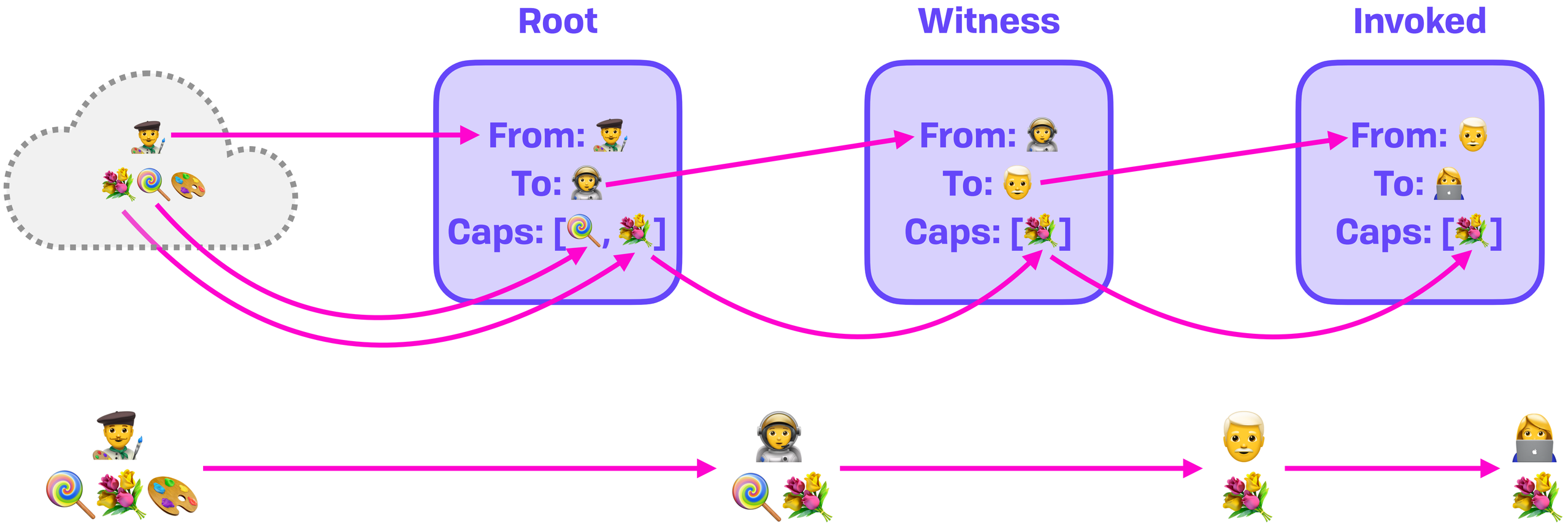
Chain Witnesses





UCAN

Chain Witnesses



UCAN

Zoomed Out

UCAN

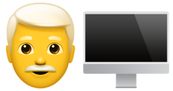
Zoomed Out

UCAN

Zoomed Out

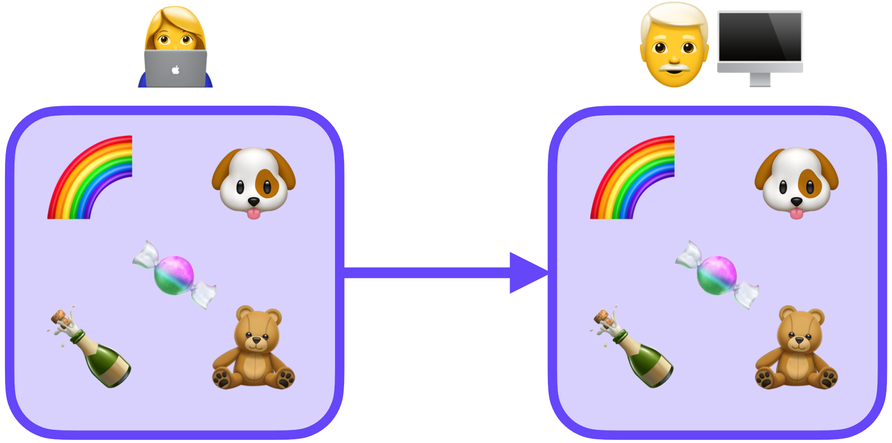
UCAN

Zoomed Out



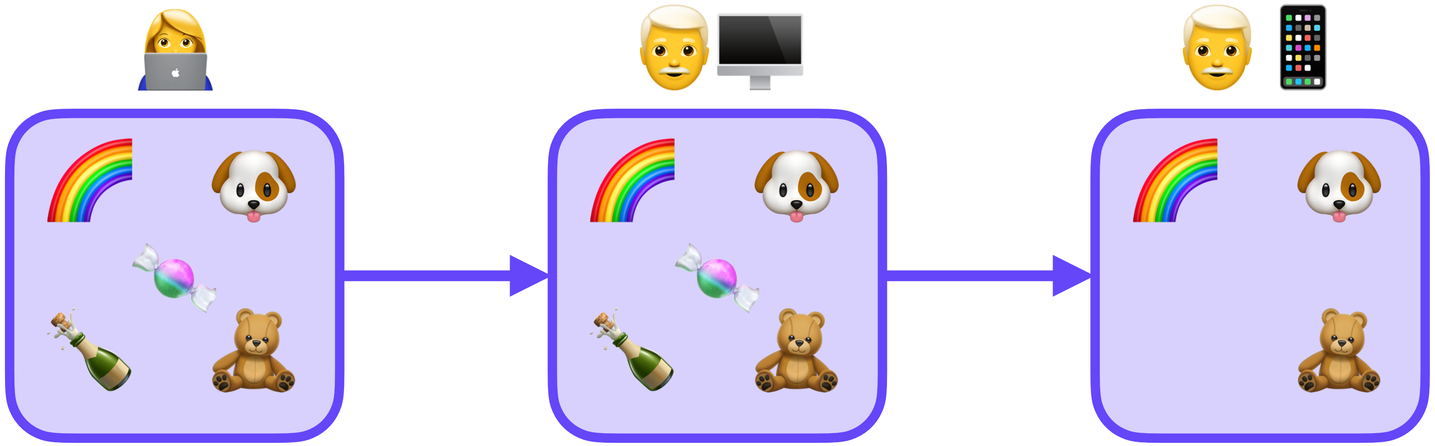
UCAN

Zoomed Out



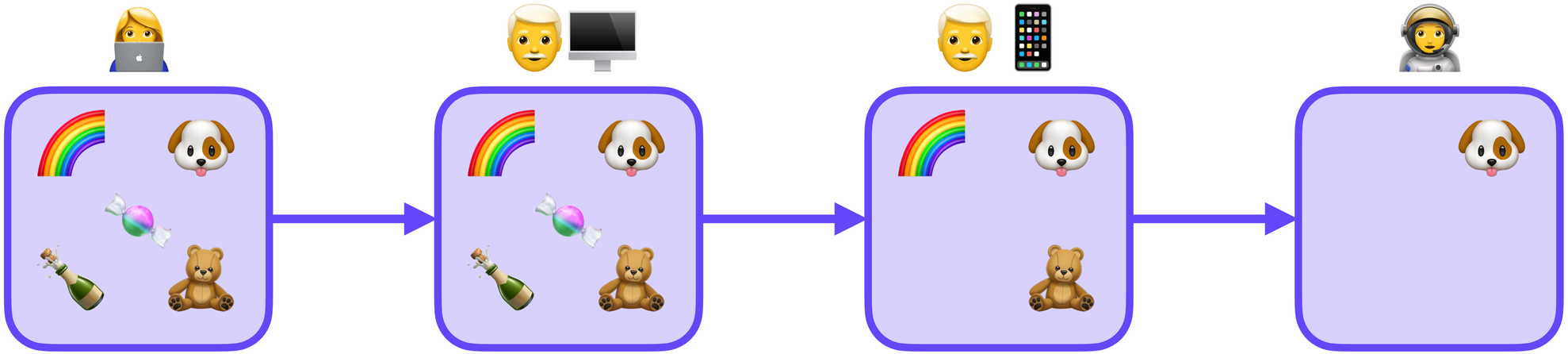
UCAN

Zoomed Out



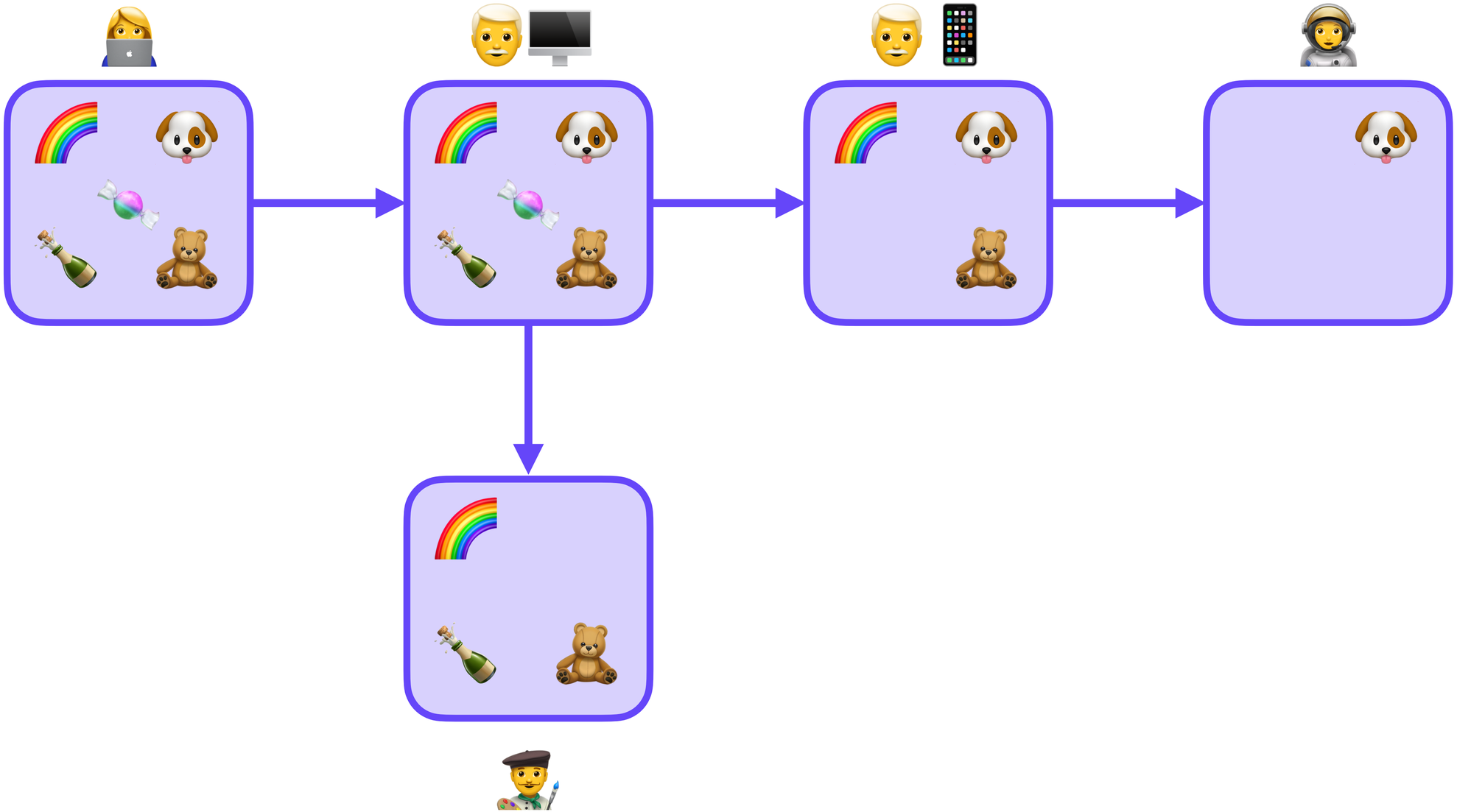
UCAN

Zoomed Out



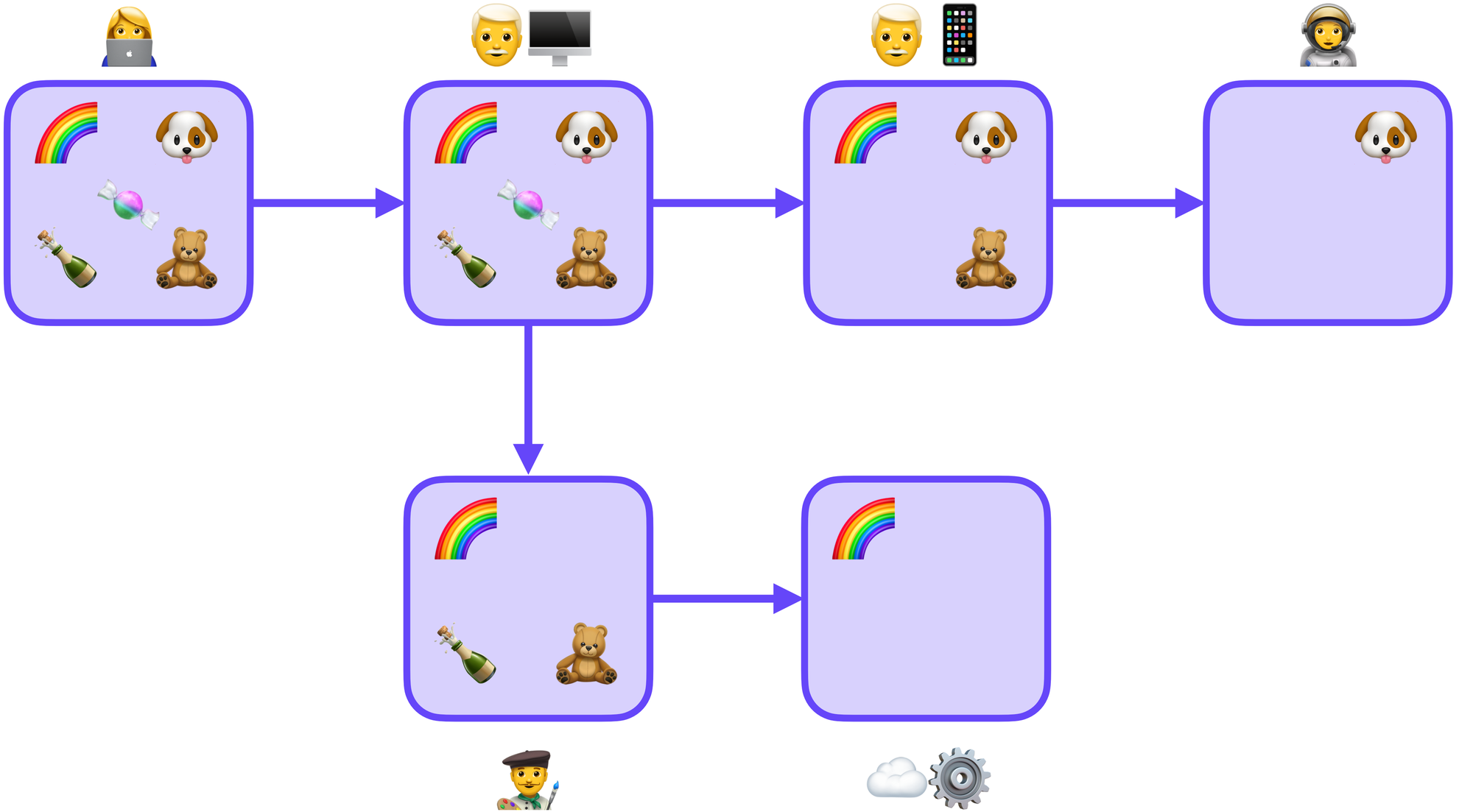
UCAN

Zoomed Out



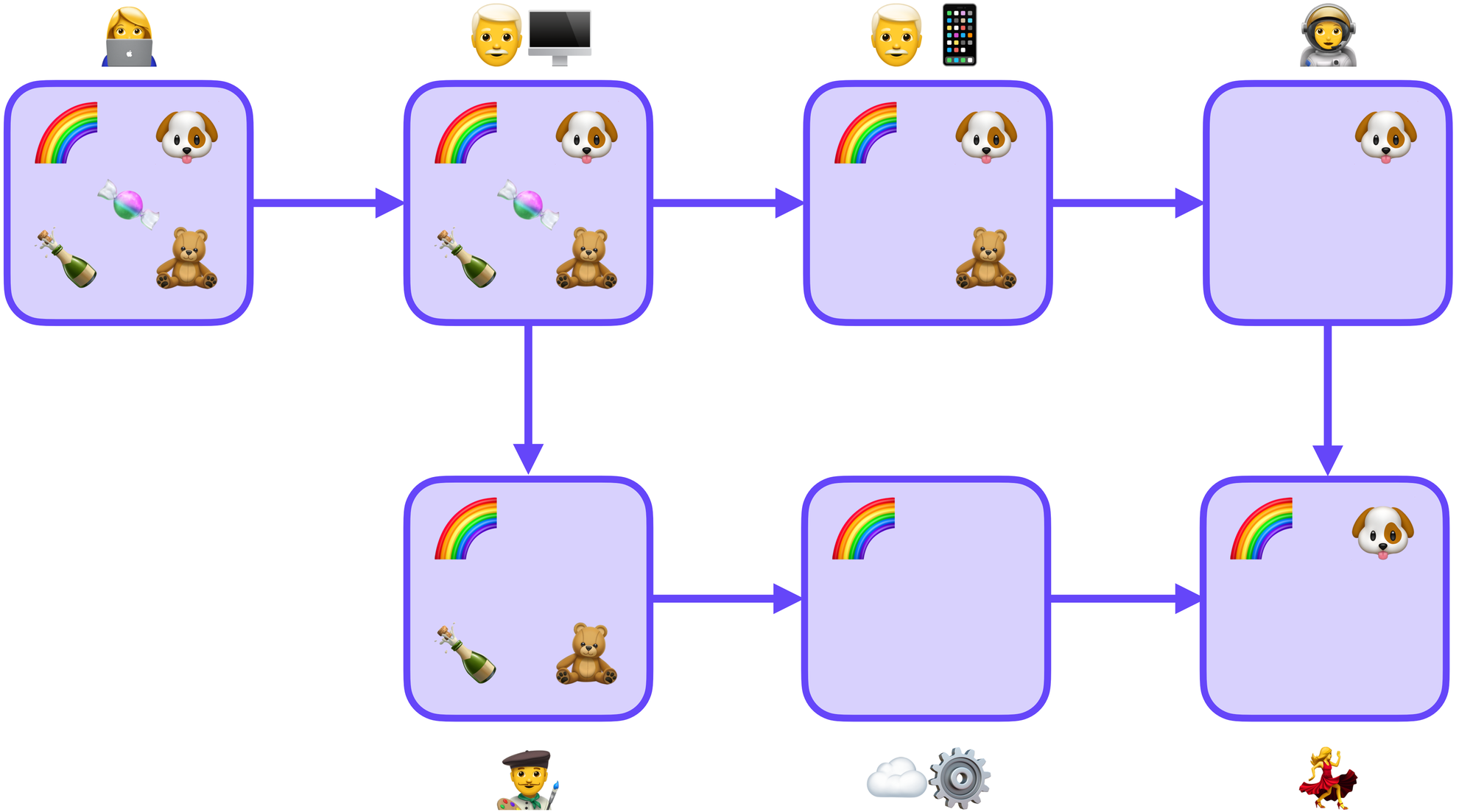
UCAN

Zoomed Out



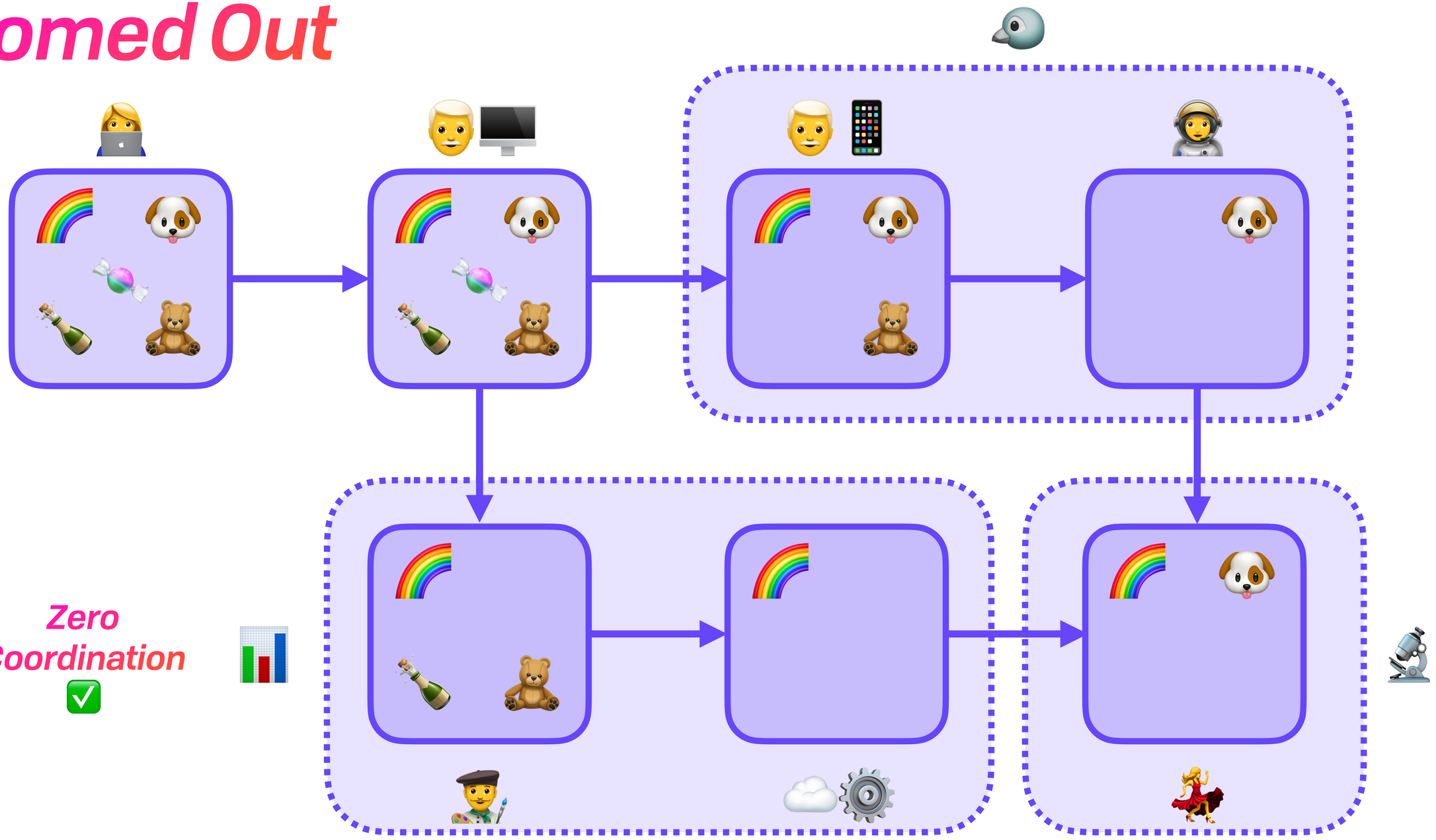
UCAN

Zoomed Out



UCAN

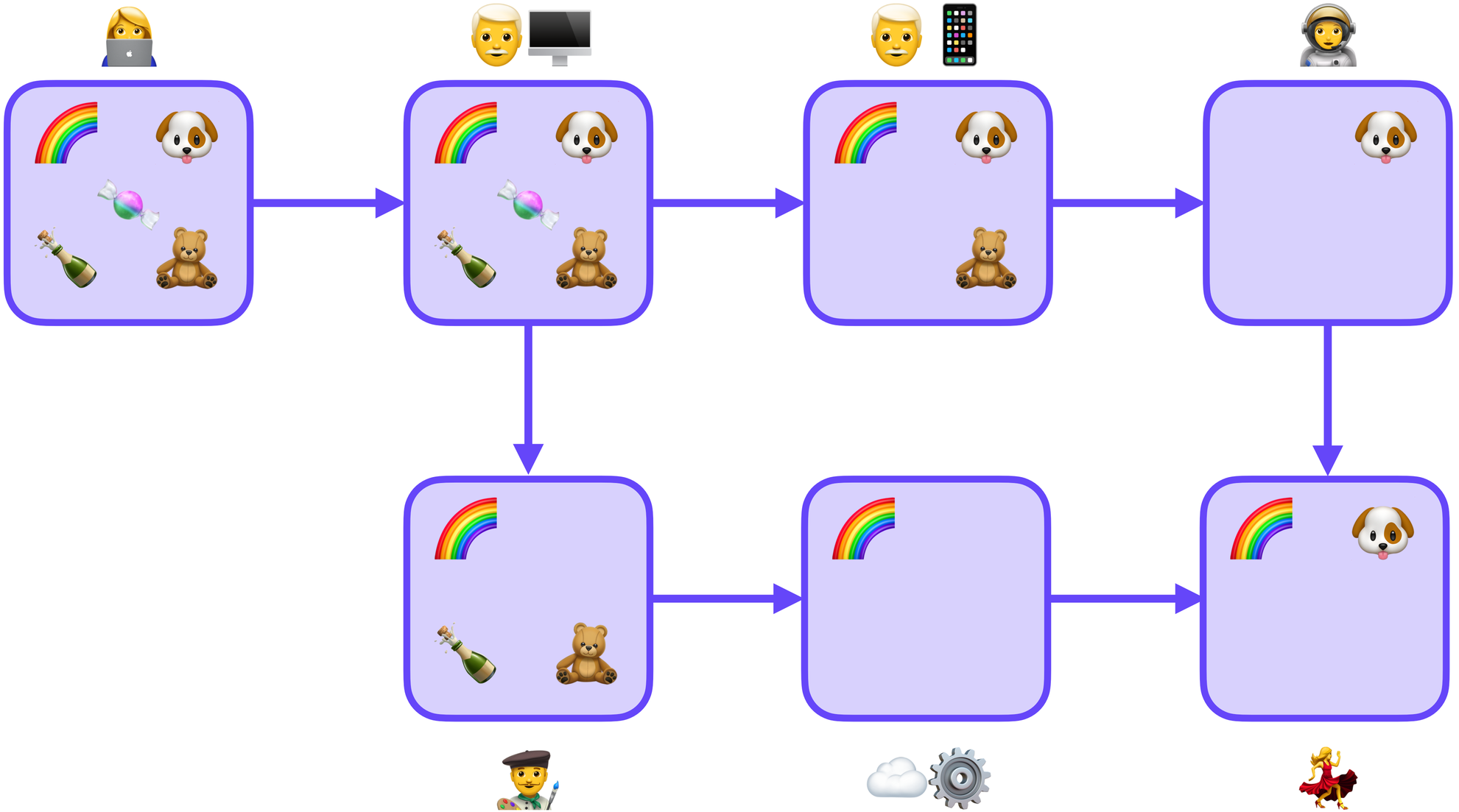
Zoomed Out



Zero Coordination ✅

UCAN

Revocation Cascade



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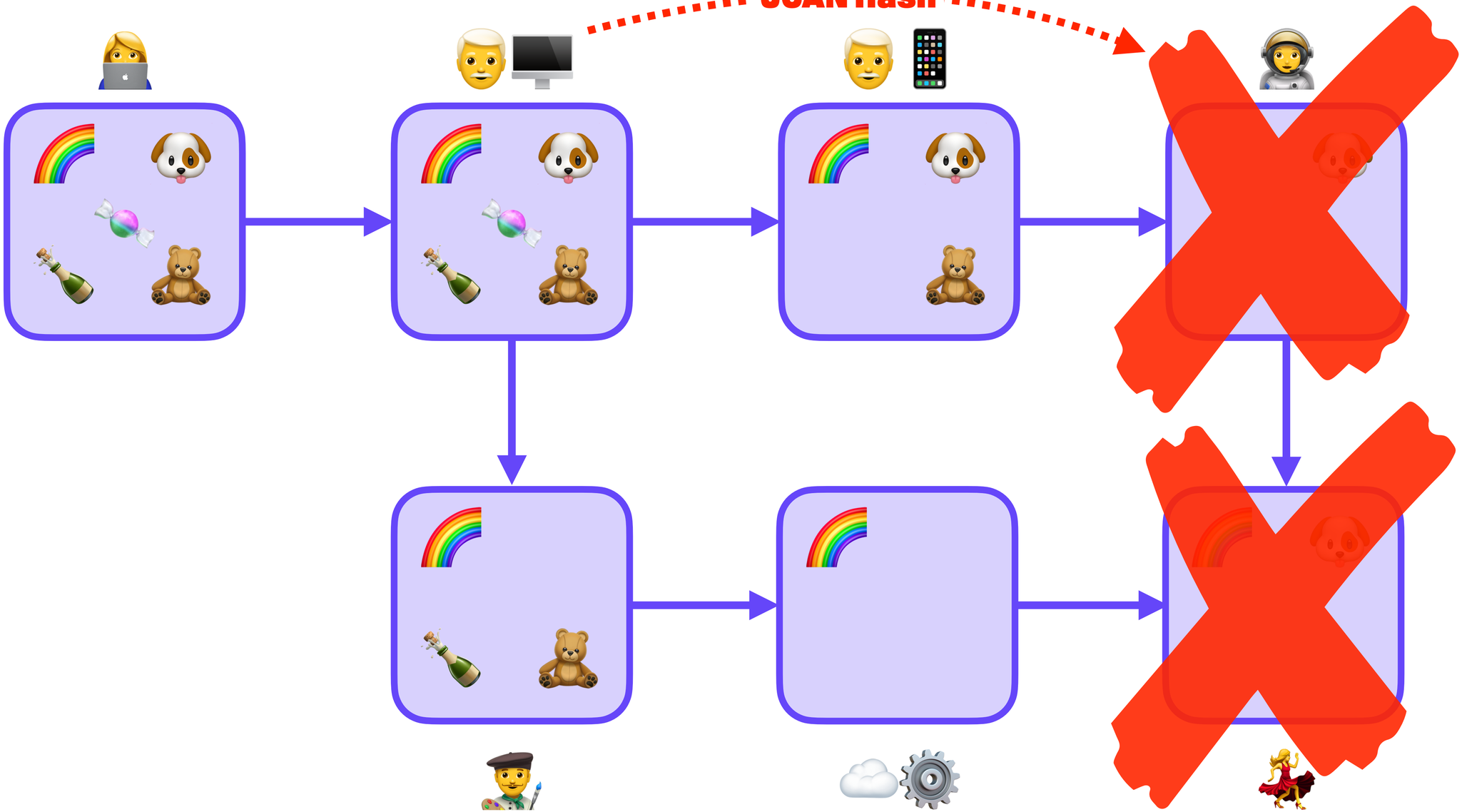
Revocation Cascade



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Composable Standard Library

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Composable Standard Library

Resource (URI)	***Action (Cap)***
`https:`	`crud/create`
`mailto:`	`crud/read`
`file:`	`crud/update`
`wnfs:`	`crud/destroy`
`dns:`	
`news:`	`msg/send`
	`msg/receive`
	`group/ban`
	`group/join`

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Semantic Extension

UCAN

Semantic Extension

```
{
  "with": "http://example.com/alice/photos/",
  "can": "crud/read"
}
{
  "with": "http://example.com/alice/photos/devconnect/",
  "can": "album/publish"
}
```

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Semantic Extension

```
{
  "with": "http://example.com/alice/photos/",
  "can": "crud/read"
}
{
  "with": "http://example.com/alice/photos/devconnect/",
  "can": "album/publish"
}
```

`album/publish ⇒ crud/read`

Nontrivial Example

Nontrivial Example

Encoded

Nontrivial Example

Encoded


```
eyJhbGciOiJFZERTQSIsInR5cCI6IkpXVCIsInVjdiI6IjAuNy4wIn0.eyJhdWQiOiJkaWQ6a2V5Ono2T
Wt2WGZQVXY4Ynh0c1ZRaUdvN050azRxS0pOY2dLMml0NTJwYzczdGVVcFJMVCIsImF0dCI6W3sid25mcy
I6ImRlbW91c2VyLmZpc3Npb24ubmFtZS9wdWJsaWMvcGhvdG9zLyIsImNhcCI6Ik9WRVJXUklURSJ9LHs
id25mcyI6ImRlbW91c2VyLmZpc3Npb24ubmFtZS9wdWJsaWMvbm90ZXMvIiwiY2FwIjoiT1ZFUldSSVRF
In1dLCJleHAiOjkyNTY5Mzk1MDUsImlzcyI6ImRpZDprZXk6ejZNa3NYUUJmTDhvd3p0VENKVG03aE5SZ
jZiMThZeFhQcDNpNjZvSkhtOEwzWUdKIiwibmJmIjoxNjM5NjA4MjkzLCJwcmYiOlsiZXlKaGJHY2lPaU
pGWkVSVFFTSXNJblI1Y0NJNklrcFhWQ0lzSW5WamRpSTZJakF1Tnk0d0luMC5leUpoZFdRaU9pSmthV1E
2YTJWNU9ubzJUV3R6V0ZGQ1prdzRiM2Q2ZEZSRFNsUnROMmhPVW1ZMllqRTRXWGhZVUhBemFUWTJiMHBJ
YlRoTU0xbEhTaUlzSW1GMGRDSTZXM3NpZDI1bWN5STZJbVJsYlc5MWMyVnlMbVpwYzNOcGIyNHVibUZ0W
lM5d2RXSnNhV012Y0dodmRHOXpMeUlzSW1OaGNDSTZJazlXUlZKWFVrbFVSU0o5WFN3aVpYaHdJam81TW
pVMk9UTTVOVEExTENKcGMzTWlPaUprYVdRNmEyVjVPbm8yVFd0d05VVnplamx6TWsxSWMzRlpka3h2WTJ
ONVNIZFlOVk5sZVZwTGNIRTNPVWQwTkRWbVJrZEZXbEk1T1NJc0ltNWlaaUk2TVRZek9UWXdPREk1TXl3
aWNISm1JanBiWFgwLjRUTmh1SFJyUEc5YUhvODY5SFhsc05LOF9GbWxTaFE1R3pHNGl0TjJOS2steUtUY
kFNb0Z3VHVwdEcwWEZnTkl2SHVsUHBsVnpaWURWRGV4bzc2a0F3IiwiZXlKaGJHY2lPaUpGWkVSVFFTSX
NJblI1Y0NJNklrcFhWQ0lzSW5WamRpSTZJakF1Tnk0d0luMC5leUpoZFdRaU9pSmthV1E2YTJWNU9ubzJ
UV3R6V0ZGQ1prdzRiM2Q2ZEZSRFNsUnROMmhPVW1ZMllqRTRXWGhZVUhBemFUWTJiMHBJYlRoTU0xbEhT
aUlzSW1GMGRDSTZXM3NpZDI1bWN5STZJbVJsYlc5MWMyVnlMbVpwYzNOcGIyNHVibUZ0WlM5d2RXSnNhV
012Ym05MFpYTXZJaXdpWTJGd0lqb2lUMVpGVWxkU1NWUkZJbjFkTENKbGVIQWlPamt5TlRZNU16azFNRF
VzSW1semN5STZJbVJwWkRwclpYazZlalpOYTNBMVJYTjZPWE15VFVoemNWbDJURzlqWTNsSWQxZzFVMlY
1V2t0d2NUYzVSM1EwTldaR1IwVmFVams1SWl3aWJtSm1Jam94TmpNNU5qQTRNamt6TENKd2NtWWlPbHRk
ZlEuTWdZYXJMcXk3Um1RMUFJcnFZTDZjRnk5ejdhNVdJQVUtLVRZQVJQU2dpck9Tc3p2YXIzX0ROcjI1c
mJQcmV0SGJuVDBtTVZLeW9hUVhydVI3S2JyQmciXX0.kwRdqPN74pkcpXGgdk7Z7FW3M1mRRYaDE5ZgkG
6srAuu6V6mvMVRdBLnD5CWid-X4tDIKpliVjlCSLTntB4pCw
```

Nontrivial Example

Decoded

Header

```
{
  "alg": "EdDSA",
  "typ": "JWT",
  "ucv": "0.8.0"
}
```

Payload

```
{
  "iss": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ",
  "aud": "did:key:z6MkvXfPUv8bxtsVQiGo7Ntk4qKJNcgK2it52pc73teUpRLT",
  "nbf": 1639608293,
  "exp": 9256939505,
  "att": [
    {
      "with": "wnfs://demouser.fission.name/public/photos/",
      "can": "OVERWRITE"
    },
    {
      "with": "wnfs://demouser.fission.name/public/notes/",
      "can": "APPEND"
    }
  ],
  "prf": [
"eyJhbGciOiJFZERTQSIsInR5cCI6IkpXVCIsInVjdiI6IjAuNy4wIn0.eyJhdWQiOiJkaWQ6a
2V5Ono2TWtzWFFCZkw4b3d6dFRDSlRtN2hOUmY2YjE4WXhYUHAzaTY2b0pIbThMM1lHSiIsImF
0dCI6W3sid25mcyI6ImRlbW91c2VyLmZpc3Npb24ubmFtZS9wdWJsaWMvcGhvdG9zLyIsImNhc
CI6Ik9WRVJXUklURSJ9XSwiZXhwIjo5MjU2OTM5NTA1LCJpc3MiOiJkaWQ6a2V5Ono2TWtwNUV
zejlzMk1Ic3FZdkxvY2N5SHdYNVNleVpLcHE3OUd0NDVmRkdFWlI5OSIsIm5iZiI6MTYzOTYwO
DI5MywicHJmIjpbXX0.4TNhuHRrPG9aHo869HXlsNK8_FmlShQ5GzG4itN2NKk-
yKTbAMoFwTuptG0XFgNIvHulPplVzZYDVDexo76kAw",

"eyJhbGciOiJFZERTQSIsInR5cCI6IkpXVCIsInVjdiI6IjAuNy4wIn0.eyJhdWQiOiJkaWQ6a
2V5Ono2TWtzWFFCZkw4b3d6dFRDSlRtN2hOUmY2YjE4WXhYUHAzaTY2b0pIbThMM1lHSiIsImF
0dCI6W3sid25mcyI6ImRlbW91c2VyLmZpc3Npb24ubmFtZS9wdWJsaWMvbm90ZXMvIiwiY2FwI
joiT1ZFUldSSVRFIn1dLCJleHAiOjkyNTY5Mzk1MDUsImlzcyI6ImRpZDprZXk6ejZNa3A1RXN
6OXMyTUhzcVl2TG9jY3lId1g1U2V5WktwcTc5R3Q0NWZGR0VaUjk5IiwibmJmIjoxNjM5NjA4M
jkzLCJwcmYiOltdfQ.MgYarLqy7RmQ1AIrqYL6cFy9z7a5WIAU--
TYARPSgirOSszvar3_DNr25rbPretHbnT0mMVKyoaQXruR7KbrBg"
  ]
}
```

Signature

```
kwRdqPN74pkcpXGgdk7Z7FW3M1mRR
YaDE5ZgkG6srAuu6V6mvMVRdBLnD5
CWid-X4tDIKpliVjlCSLTntB4pCw
```

Nontrivial Example

Decoded

Header


```
{
  "alg": "EdDSA",
  "typ": "JWT",
  "ucv": "0.8.0"
}
```


Payload


```
{
  "iss": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ",
  "aud": "did:key:z6MkvXfPUv8bxtsVQiGo7Ntk4qKJNcgK2it52pc73teUpRLT",
  "nbf": 1639608293,
  "exp": 9256939505,
  "att": [
    {
      "with": "wnfs://demouser.fission.name/public/photos/",
      "can": "OVERWRITE"
    },
    {
      "with": "wnfs://demouser.fission.name/public/notes/",
      "can": "APPEND"
    }
  ],
  "prf": [
    "eyJhbGciOiJFZERTQSIsInR5cCI6IkpXVCIsInVjdiI6IjAuNy4wIn0.eyJhdWQiOiJkaWQ6a
    2V5Ono2TWtzWFFCZkw4b3d6dFRDSlRtN2hOUmY2YjE4WXhYUHAzaTY2b0pIbThMM1lHSiIsImF
    0dCI6W3sid25mcyI6ImRlbW91c2VyLmZpc3Npb24ubmFtZS9wdWJsaWMvcGhvdG9zLyIsImNhc
    CI6Ik9WRVJXUklURSJ9XSwiZXhwIjo5MjU2OTM5NTA1LCJpc3MiOiJkaWQ6a2V5Ono2TWtwNUV
    zejlzMk1Ic3FZdkxvY2N5SHdYNVNleVpLcHE3OUd0NDVmRkdFWlI5OSIsIm5iZiI6MTYzOTYwO
    DI5MywicHJmIjpbXX0.4TNhuHRrPG9aHo869HXlsNK8_FmlShQ5GzG4itN2NKk-
    yKTbAMoFwTuptG0XFgNIvHulPplVzZYDVDexo76kAw",
    "eyJhbGciOiJFZERTQSIsInR5cCI6IkpXVCIsInVjdiI6IjAuNy4wIn0.eyJhdWQiOiJkaWQ6a
    2V5Ono2TWtzWFFCZkw4b3d6dFRDSlRtN2hOUmY2YjE4WXhYUHAzaTY2b0pIbThMM1lHSiIsImF
    0dCI6W3sid25mcyI6ImRlbW91c2VyLmZpc3Npb24ubmFtZS9wdWJsaWMvbm90ZXMvIiwiY2FwI
    joiT1ZFUldSSVRFIn1dLCJleHAiOjkyNTY5Mzk1MDUsImlzcyI6ImRpZDprZXk6ejZNa3A1RXN
    6OXMyTUhzcVl2TG9jY3lId1g1U2V5WktwcTc5R3Q0NWZGR0VaUjk5IiwibmJmIjoxNjM5NjA4M
    jkzLCJwcmYiOltdfQ.MgYarLqy7RmQ1AIrqYL6cFy9z7a5WIAU--
    TYARPSgirOSszvar3_DNr25rbPretHbnT0mMVKyoaQXruR7KbrBg"
  ]
}
```


Signature


```
kwRdqPN74pkcpXGgdk7Z7FW3M1mRR
YaDE5ZgkG6srAuu6V6mvMVRdBLnD5
CWid-X4tDIKpliVjlCSLTntB4pCw
```

Nontrivial Example

Decoded Witness #1

Header

```
{
  "alg": "EdDSA",
  "typ": "JWT",
  "ucv": "0.8.0"
}
```

Payload

```
{
  "iss": "did:key:z6Mkp5Esz9s2MHsqYvLoccyHwX5SeyZKpq79Gt45fFGEZR99",
  "aud": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ",
  "nbf": 1639608293,
  "exp": 9256939505,
  "att": [
    {
      "with": "wnfs://demouser.fission.name/public/photos/",
      "can": "OVERWRITE"
    }
  ],
  "prf": []
}
```

Signature

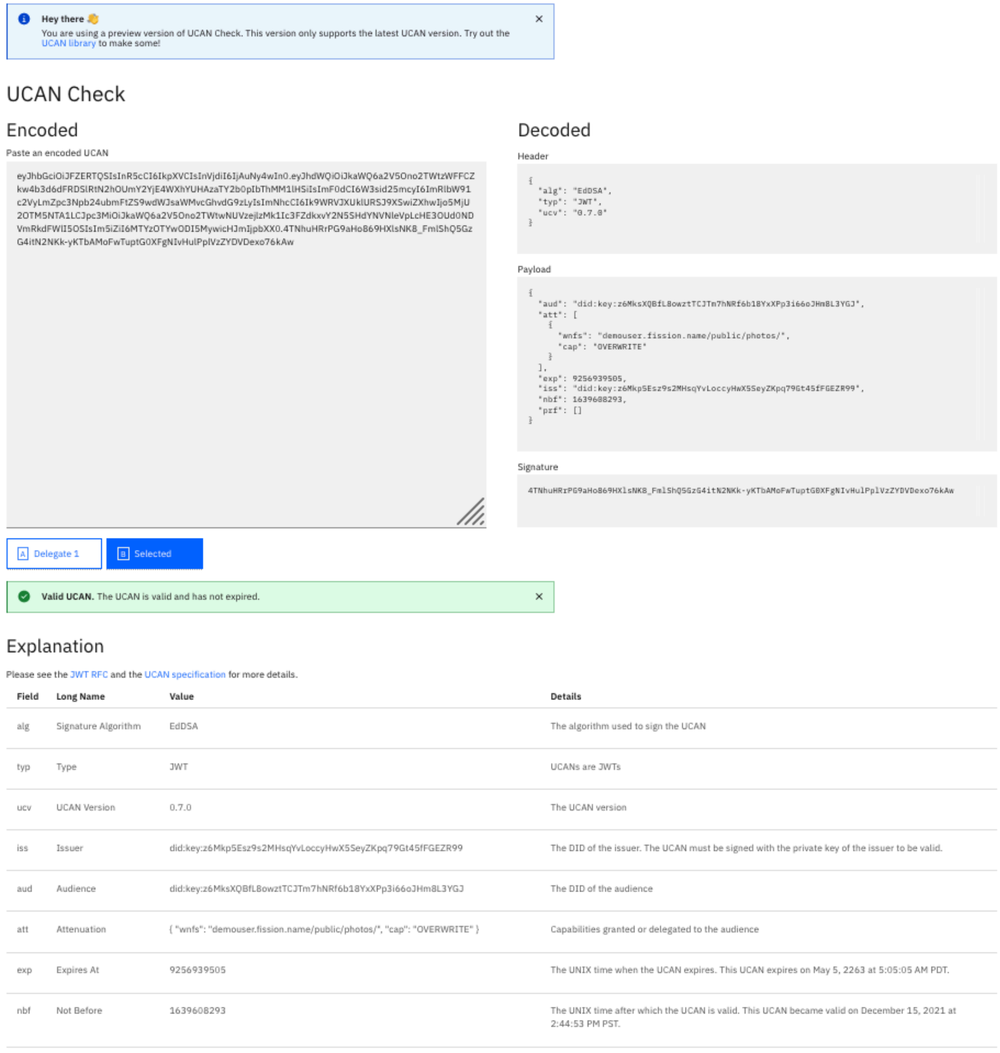
```
4TNhuHRrPG9aHo869HXlsNK8_FmlShQ5GzG
4itN2NKk-
yKTbAMoFwTuptG0XFgNIvHulPplVzZYDVDe
xo76kAw
```

Nontrivial Example

ucan.xyz — Online Explorer / Validator

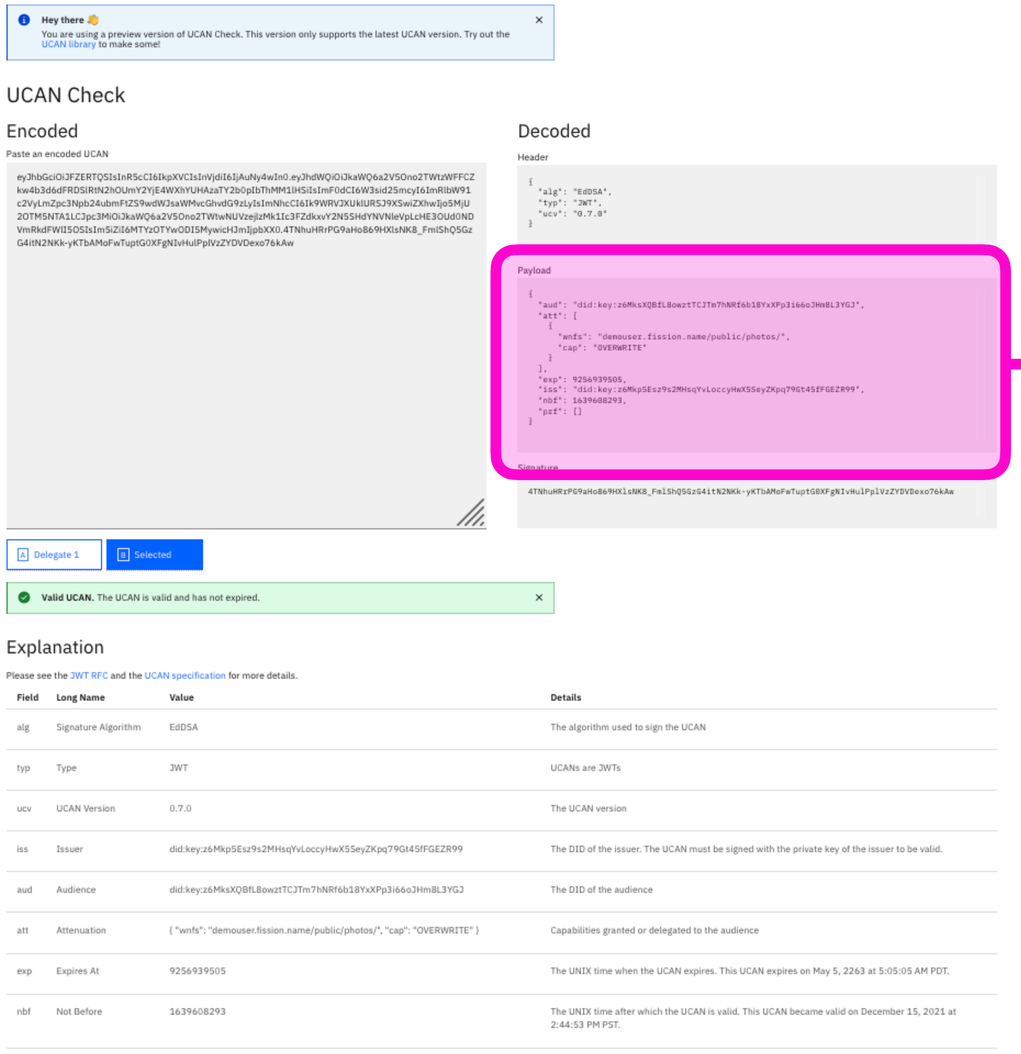
Nontrivial Example

ucan.xyz — Online Explorer / Validator



Nontrivial Example

ucan.xyz — Online Explorer / Validator

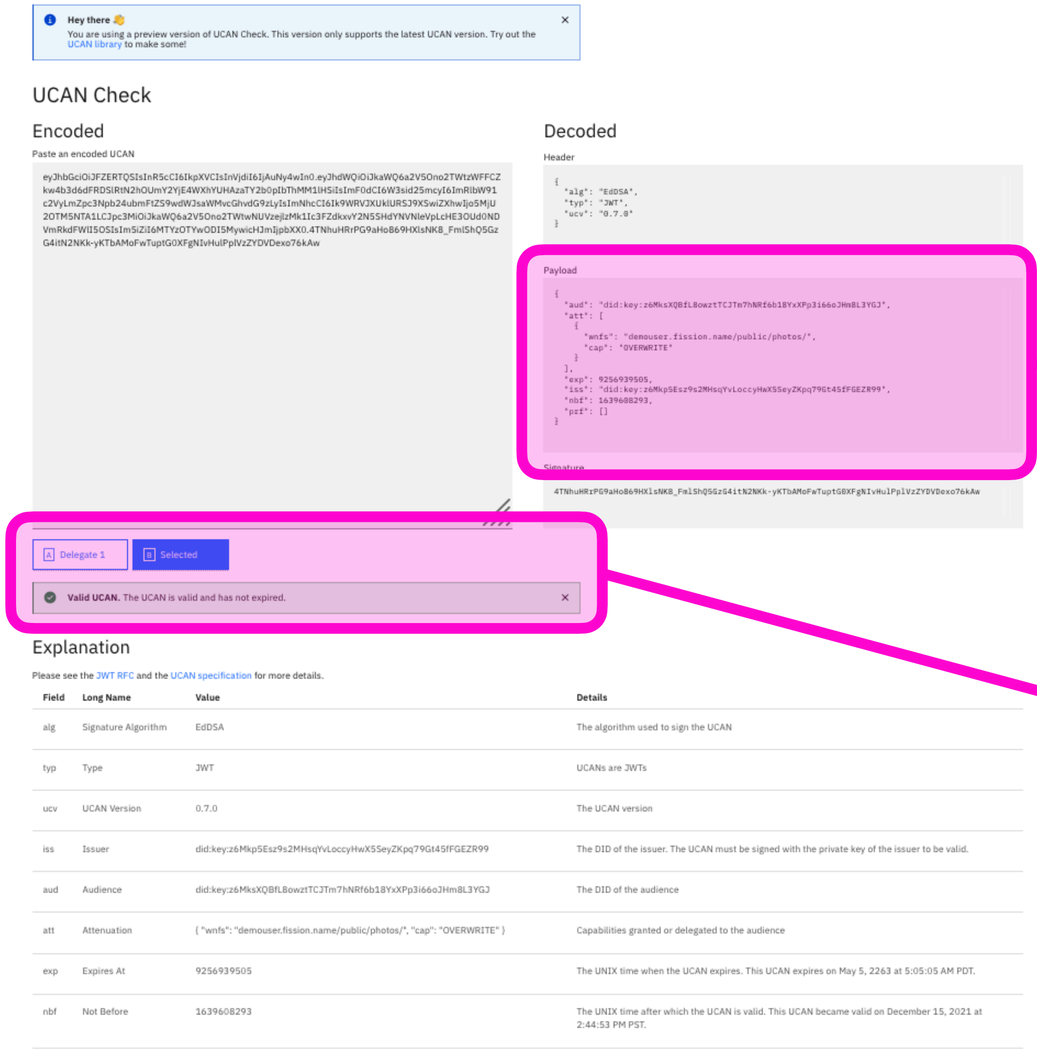


Payload


```
{
  "aud": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ",
  "att": [
    {
      "wnfs": "demouser.fission.name/public/photos/",
      "cap": "OVERWRITE"
    }
  ],
  "exp": 9256939505,
  "iss": "did:key:z6Mkp5Esz9s2MHsqYvLoccyHwX5SeyZKpq79Gt45fFGEZR99",
  "nbf": 1639608293,
  "prf": []
}
```

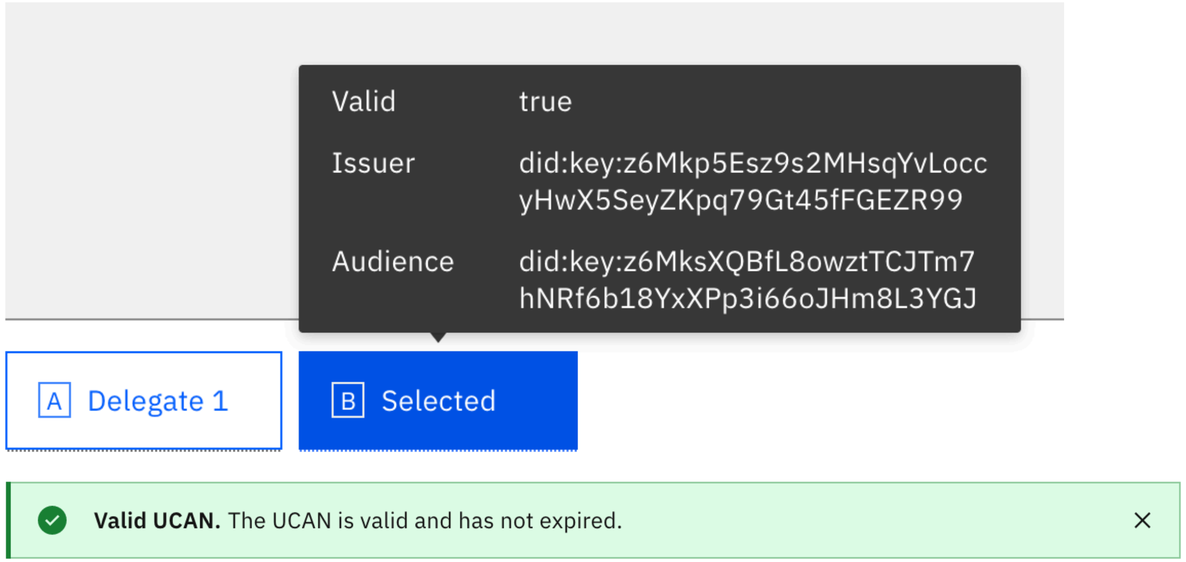
Nontrivial Example

ucan.xyz — Online Explorer / Validator



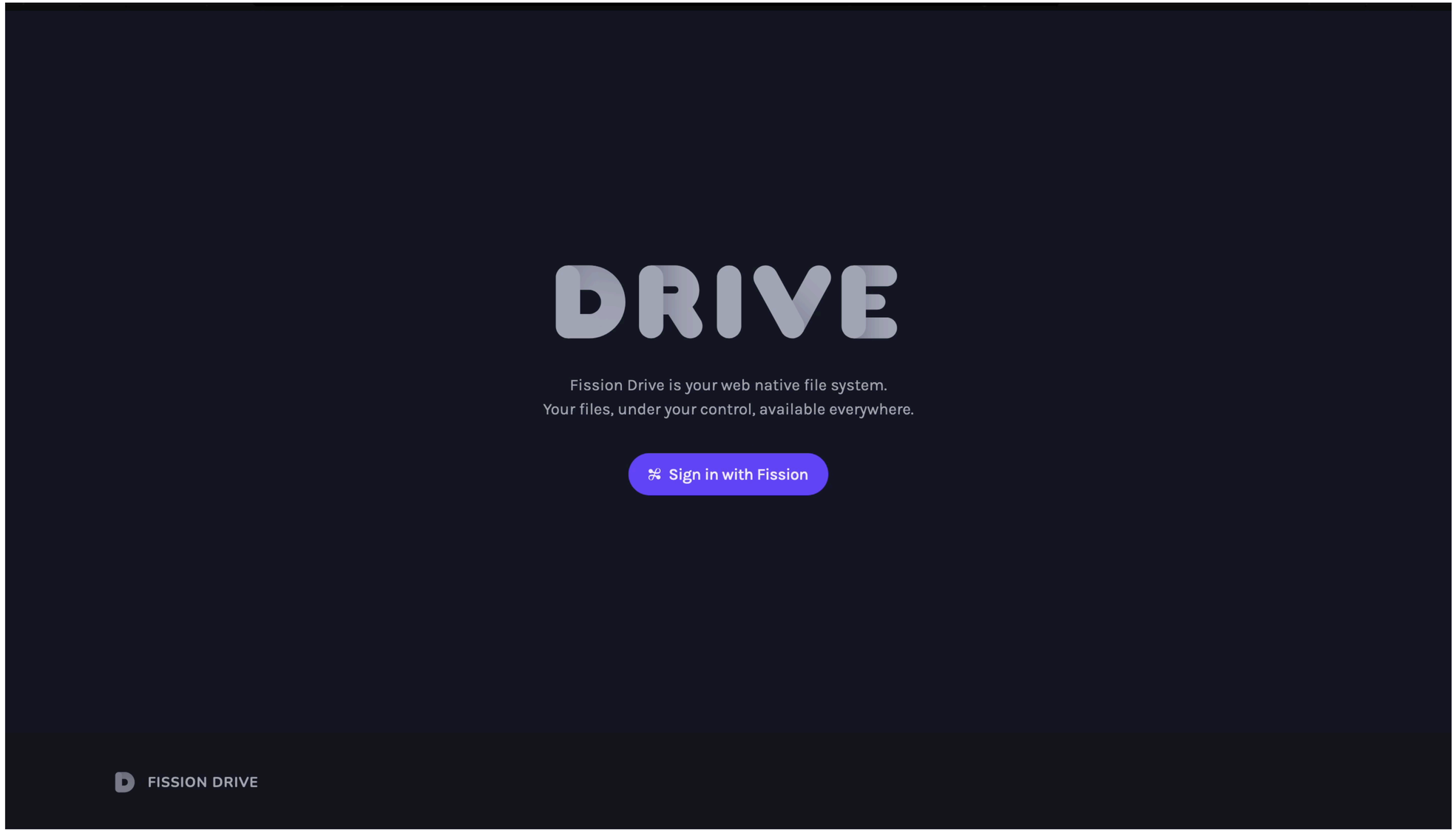
Payload


```
{
  "aud": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ",
  "att": [
    {
      "wnfs": "demouser.fission.name/public/photos/",
      "cap": "OVERWRITE"
    }
  ],
  "exp": 9256939505,
  "iss": "did:key:z6Mkp5Esz9s2MHsqYvLoccyHwX5SeyZKpq79Gt45fFGEZR99",
  "nbf": 1639608293,
  "prf": []
}
```

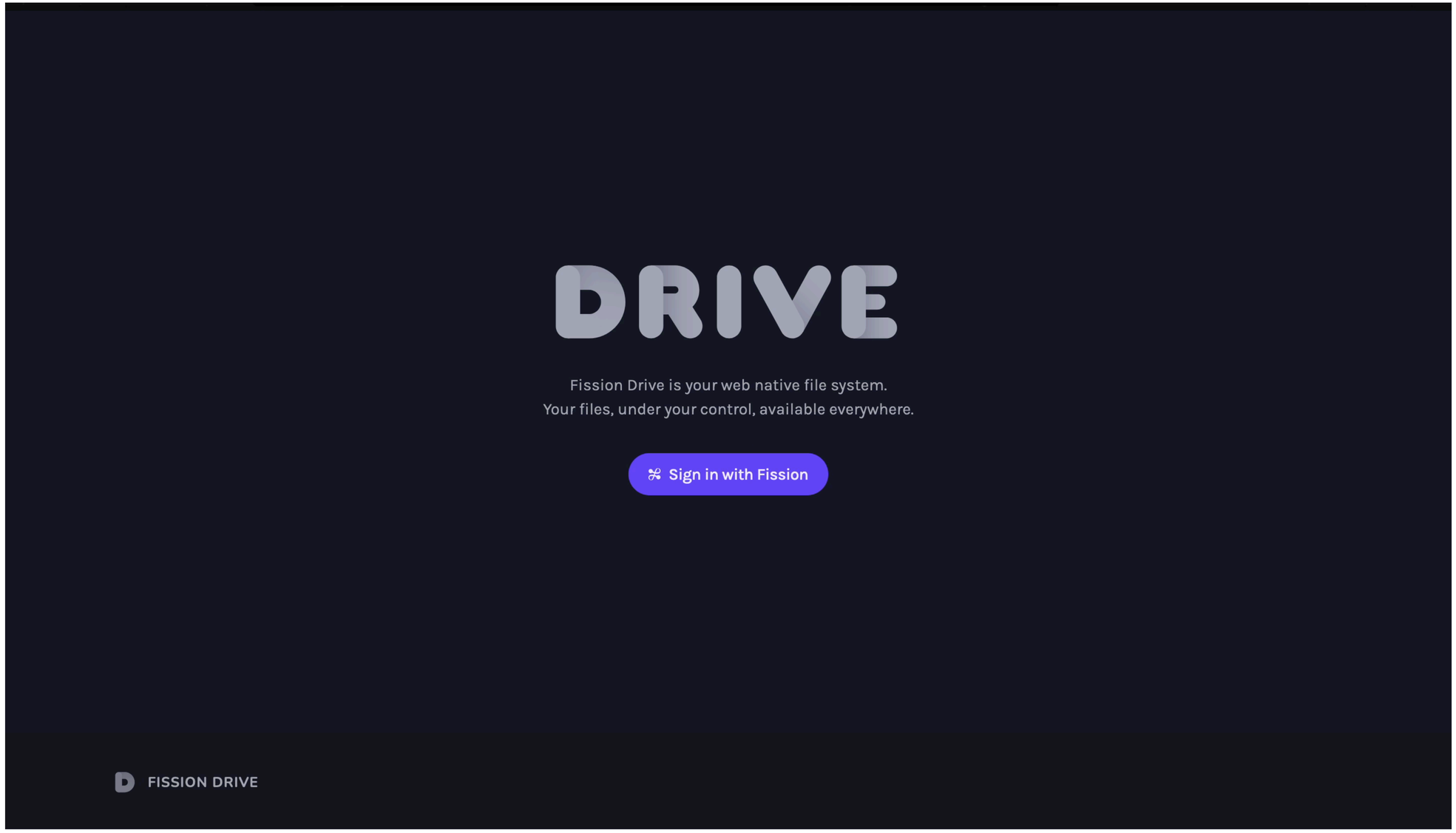
Nontrivial Example

Auth Should be Boring!



Nontrivial Example

Auth Should be Boring!



Resources

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Further Reading

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Further Reading

- https://talk.fission.codes/t/user-controlled-authorization-networks-ucan-resources/1122
- https://github.com/ucan-wg/
  - Spec, Improvement Proposals
  - Libraries in TypeScript, Rust, Golang, Haskell
- Capability Myths Demolished (https://srl.cs.jhu.edu/pubs/SRL2003-02.pdf)
- ACLs Don't (http://waterken.sourceforge.net/aclsdont/current.pdf)
- https://erights.org
- https://theworld.com/~cme/html/spki.html

https://ucan.xyz
https://github.com/ucan-wg

🎉 ***Thank You, CASA Amsterdam*** 🇳🇱

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