WebNative SDK

A Portable Edge App Stack

github.com/fission-suite

Just...

Just...

An Encrypted-At-Rest File System, Location Independence, User Controlled Data, Self-Modifying Apps, & a Serverless Auth Protocol

...in a tench coat

Brooklyn Zelenka

@expede

CTO @ Fission

Intro

Condensing The Stack

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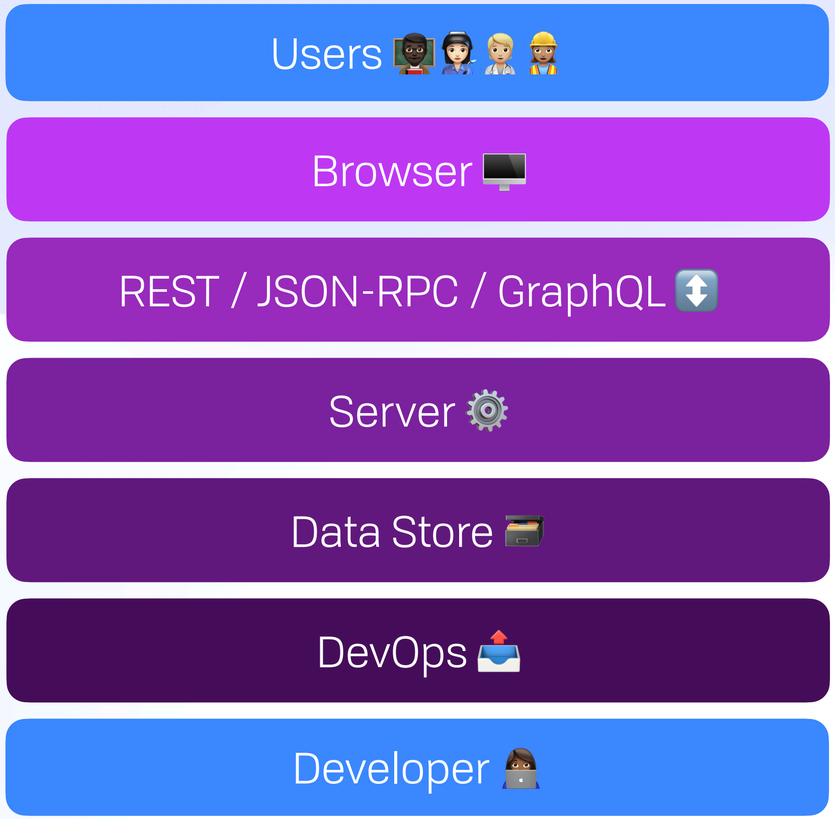
Condensing The Stack

Users 👩🏿‍💻👩🏻‍💻👨🏼‍💼👷

Developer 👩🏾‍💻

Intro

Condensing The Stack



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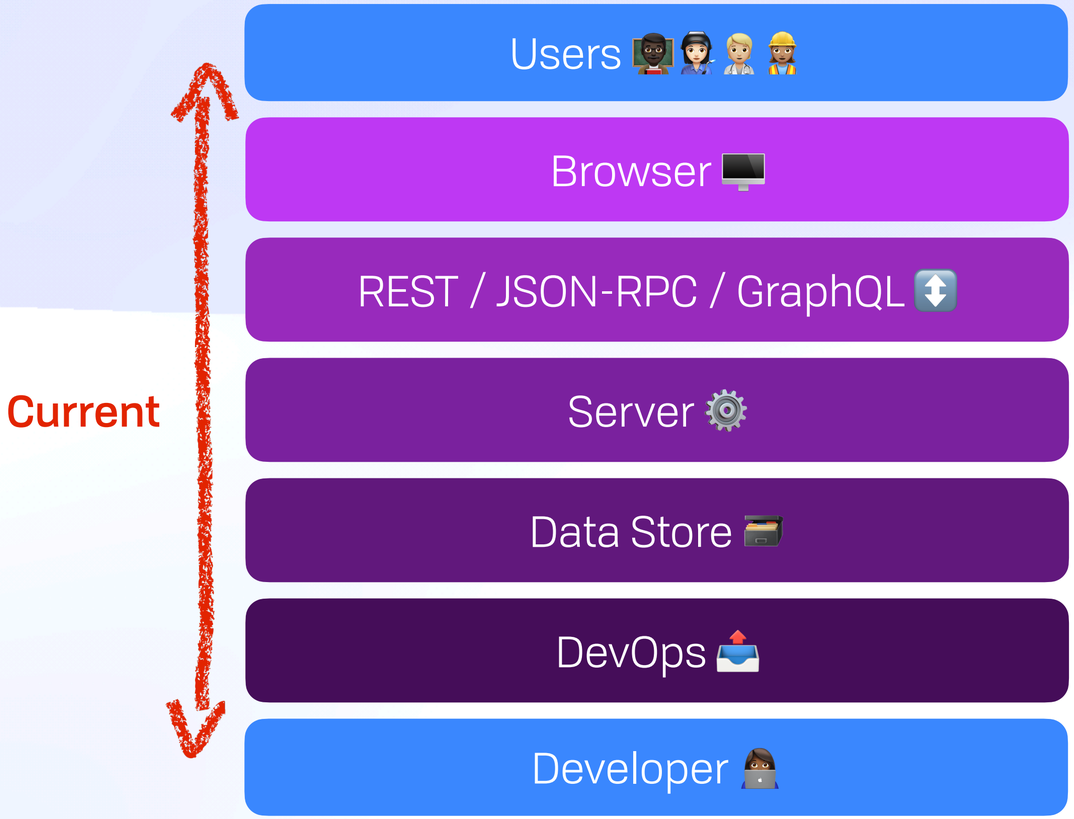

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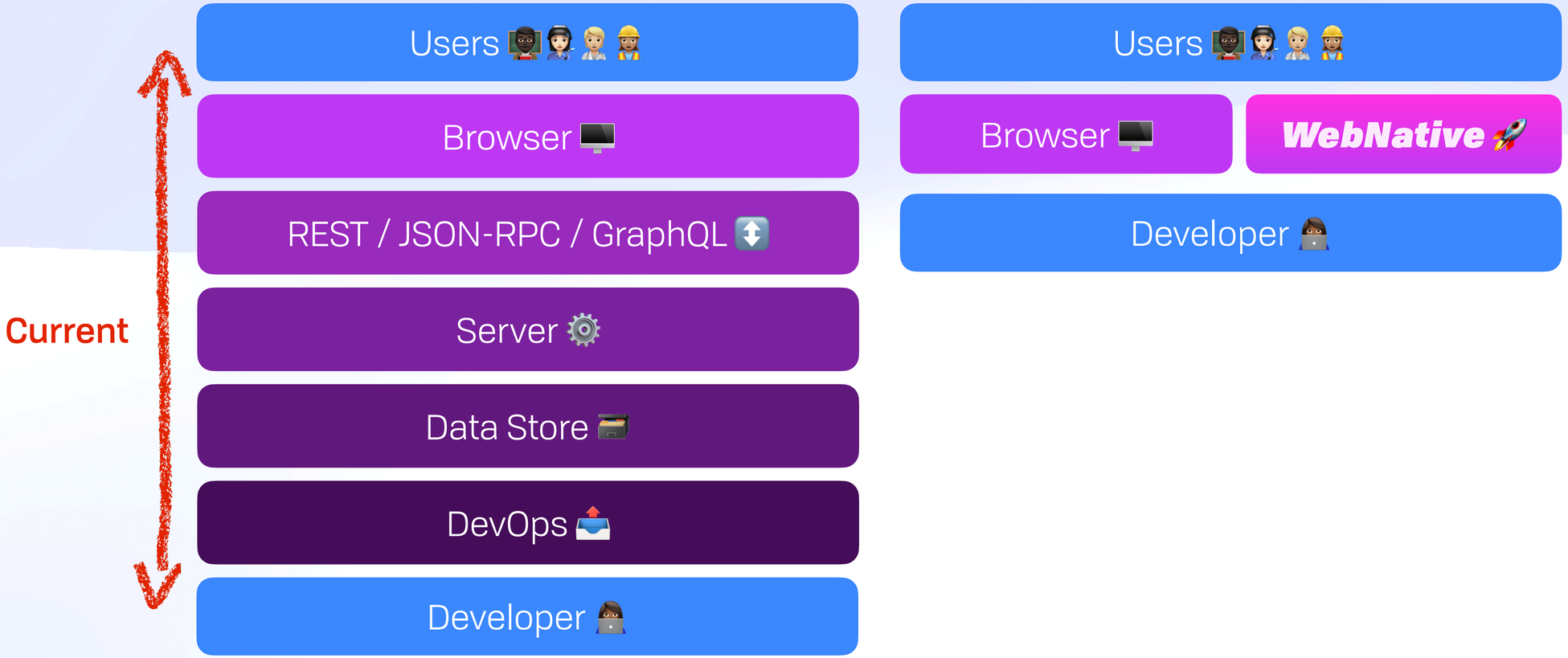

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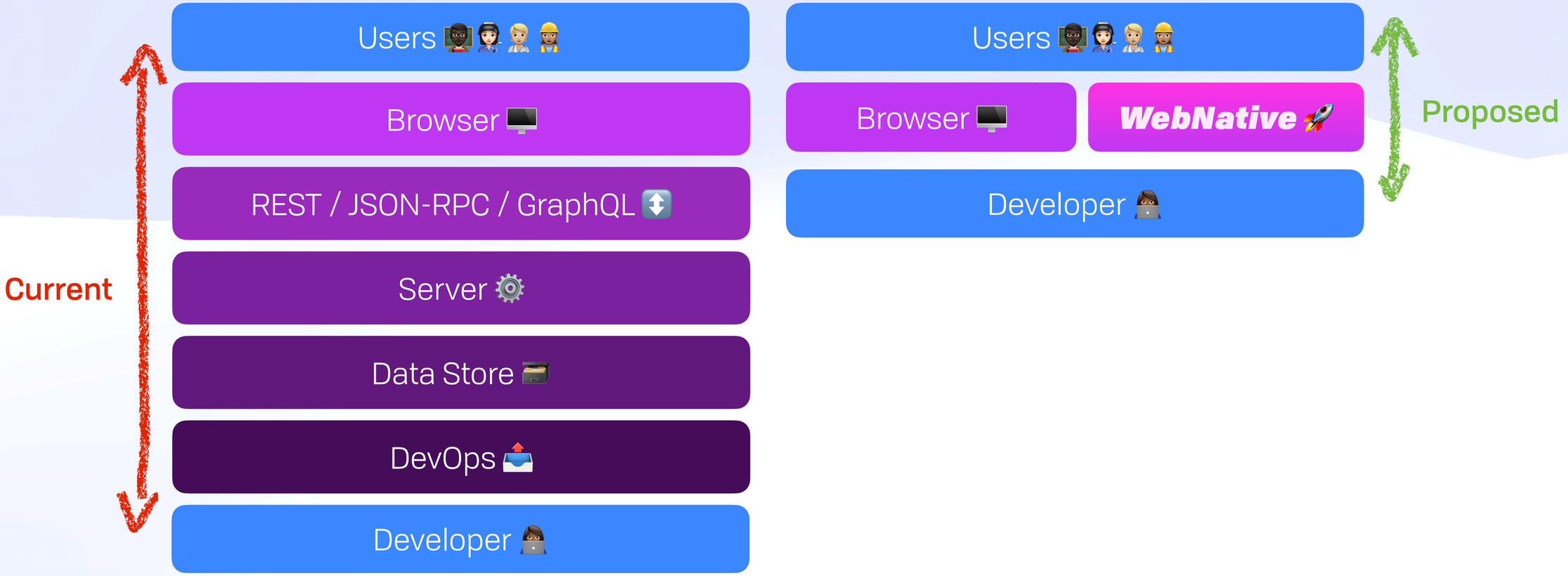

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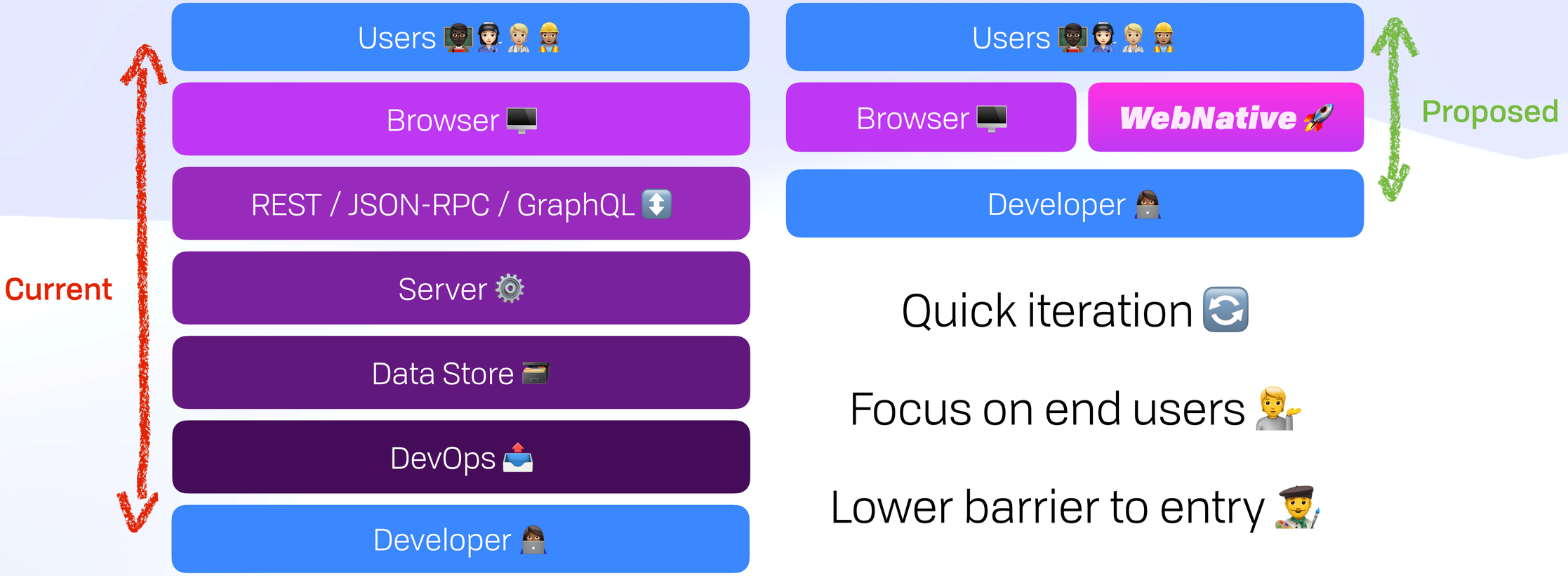

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High Level Dependencies

Intro

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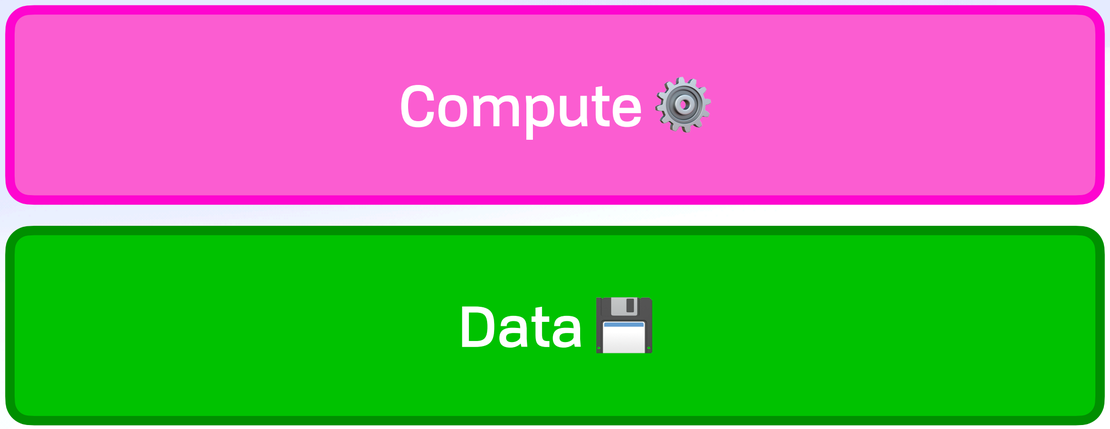
Compute ⚙️

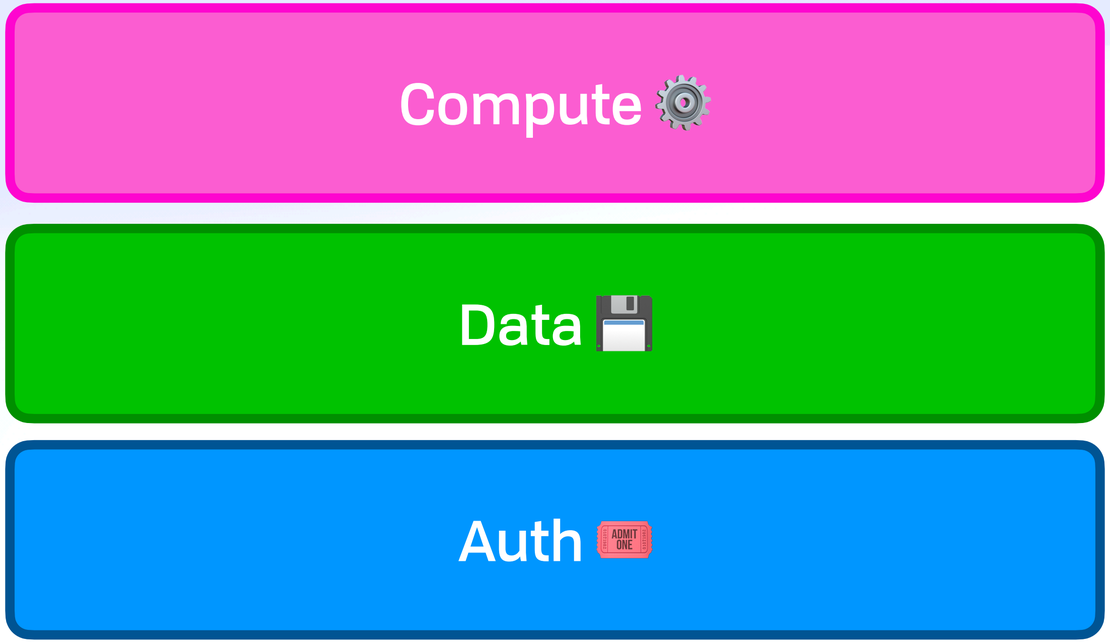
Intro

High Level Dependencies



Intro

High Level Dependencies



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Stack

⬆️ Apps

⬇️ Core Technology

1st & 3rd Party

Dev's App
Business Logic & View

API

Platform Abstractions
WebNative SDK

Distributed Compute

Portable Computate
WebNative Distributed Tasks

Broadcast

Collaboration, Chat, Instant Sync
Soft Realtime Store

Global: Aggregation, Forms, Feeds
Gossip Broadcast

Offline & Async Sharing
Exchange Store

Durable Structured Store
WebNative Database

Durable Data

Durable File Store
WebNative File System

Auth & ID

Command/Mutation
UCAN

Networking
DNS, IPFS, PubSub, Matrix

Read/Query
Cryptree

Identity
did:key

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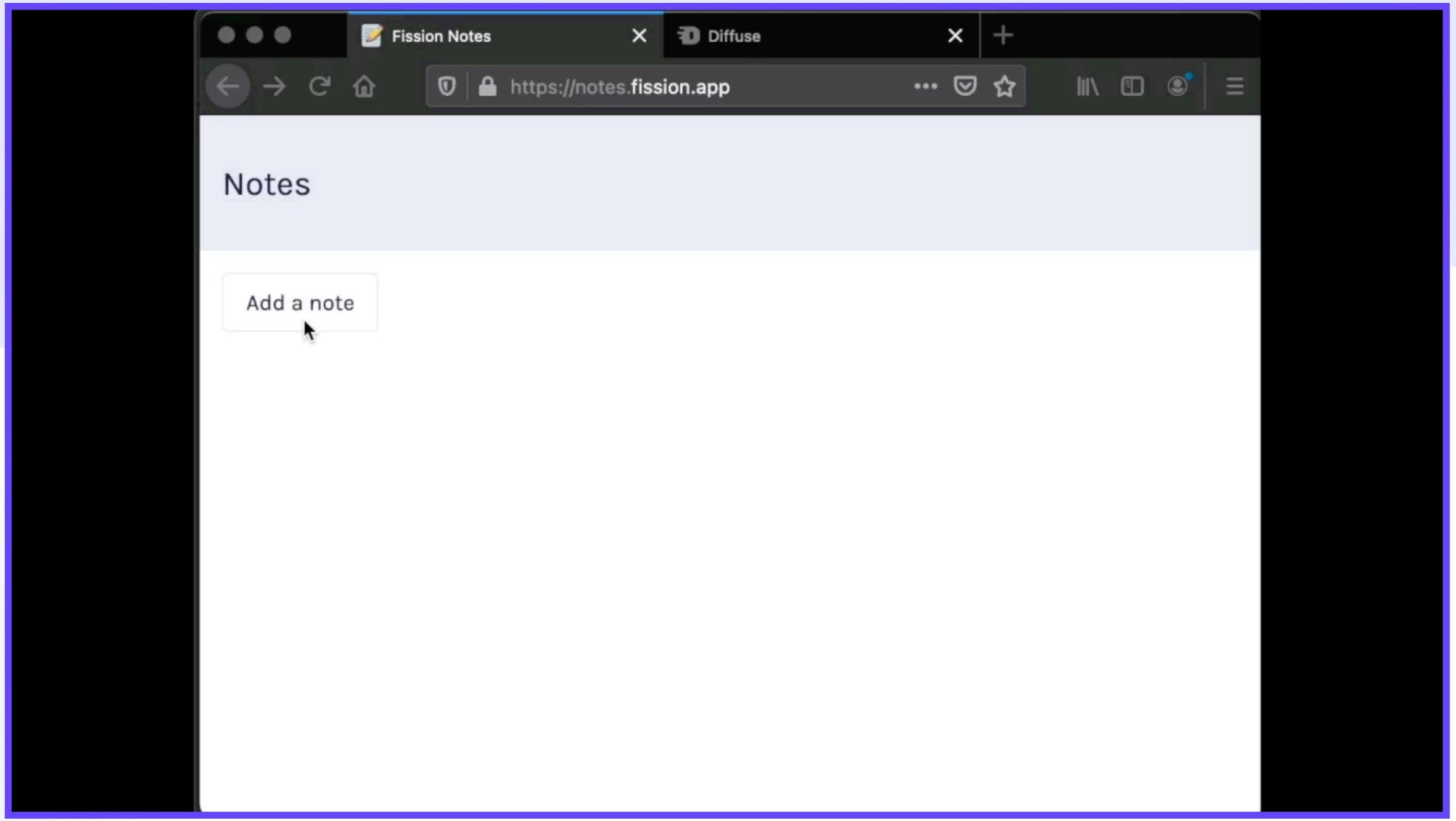
Mini-Demo



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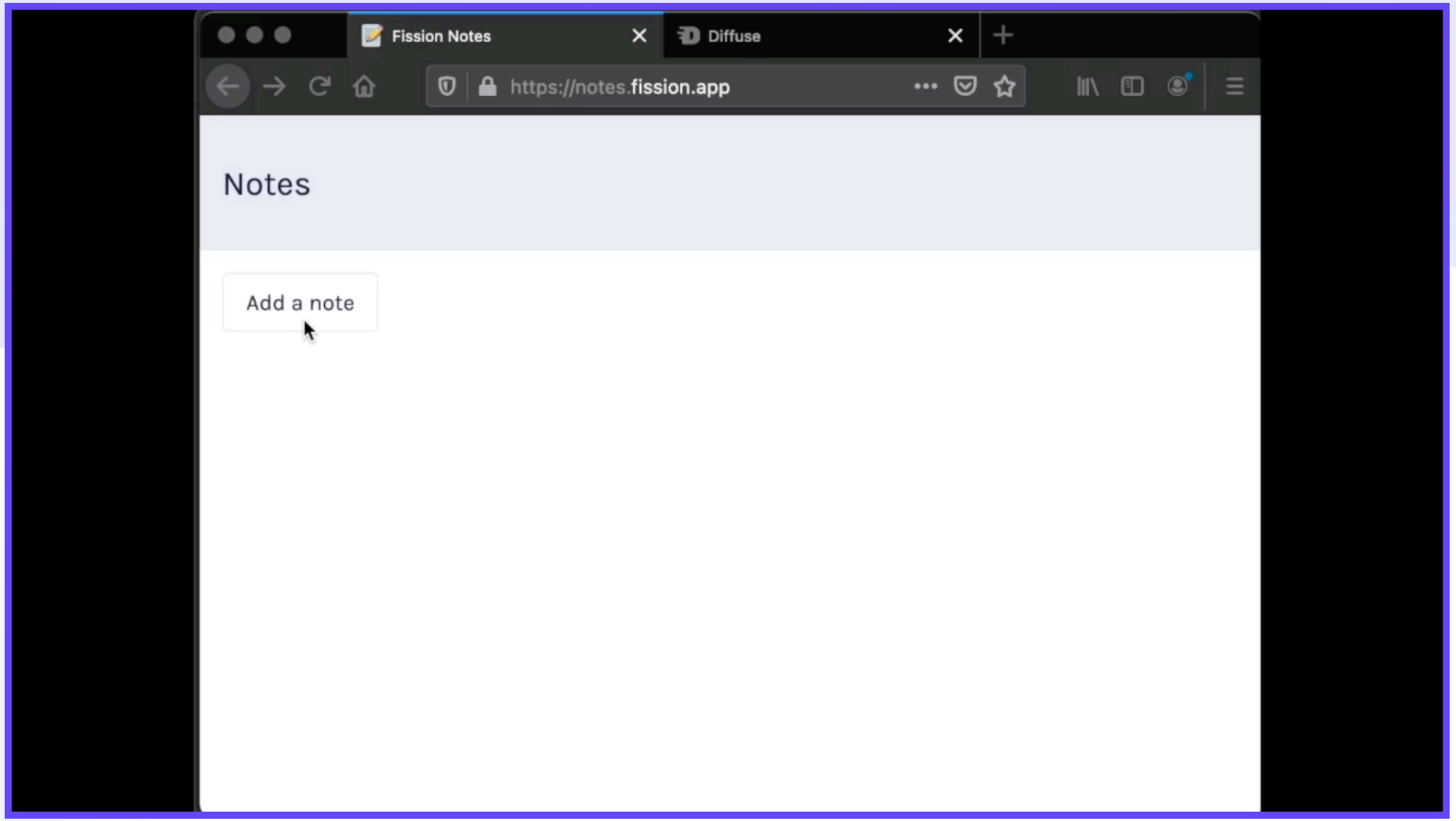
Mini-Demo



AuthN & AuthZ

DIDs, Self-Authenticated History, UCAN, and More

AuthN & AuthZ

Non-Extractable Keys

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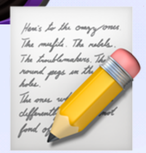


AuthN & AuthZ

DIDs

EXAMPLE 2: Minimal self-managed DID Document

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

AuthN & AuthZ

DIDs

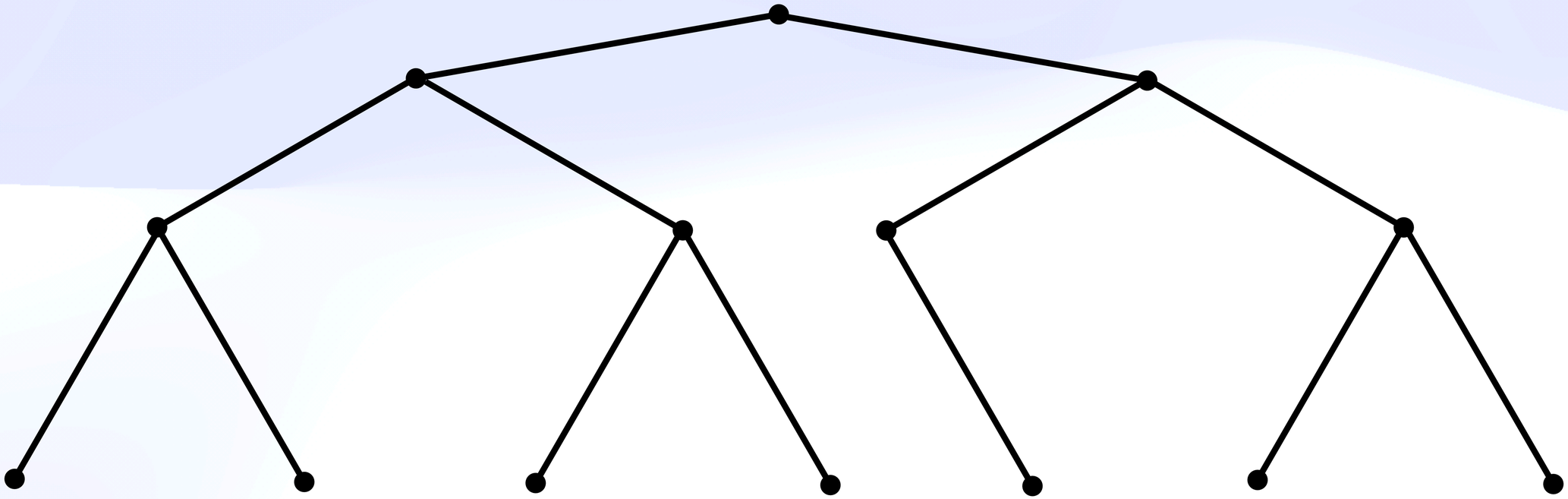
- W3C
- Microsoft
- Government of British Columbia
- Based on public-key cryptography
- Truly “universal” user IDs
- Agnostic about backing
- For users, devices, and more

EXAMPLE 2: Minimal self-managed DID Document

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

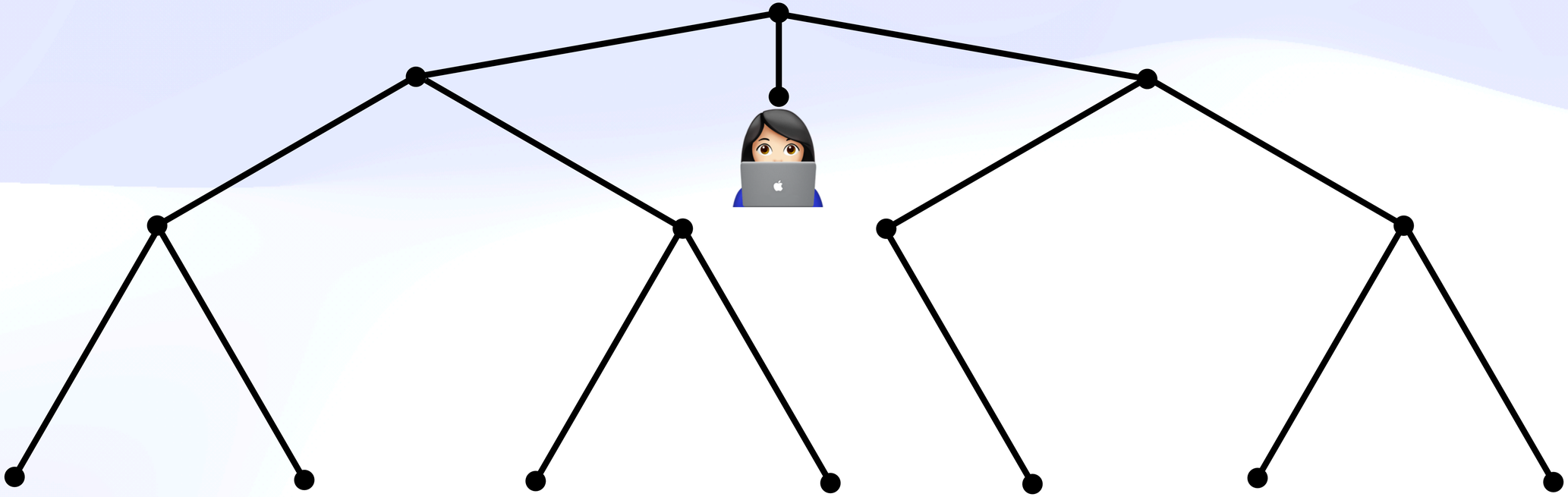
AuthN & AuthZ

.well-known



AuthN & AuthZ

.well-known



AuthN & AuthZ

Wherefore Art Thou UCAN?

AuthN & AuthZ

Wherefore Art Thou UCAN?

DIDs say who ***you are***

AuthN & AuthZ

Wherefore Art Thou UCAN?

DIDs say who ***you are***

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

AuthN & AuthZ

Wherefore Art Thou UCAN?

AuthN

DIDs say who **you are**

UCANs show what **you can do**

AuthZ

AuthN & AuthZ

Anatomy of a Capability

AuthN & AuthZ

Anatomy of a Capability

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

AuthN & AuthZ

Anatomy of a Capability

Resource / "noun"

(URI)

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

AuthN & AuthZ

Anatomy of a Capability


```
[
  {
    "with": "http://example.com/alice/photos/",
    "can": "crud/read"
  },
  {
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    "nb": {
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  }
]
```
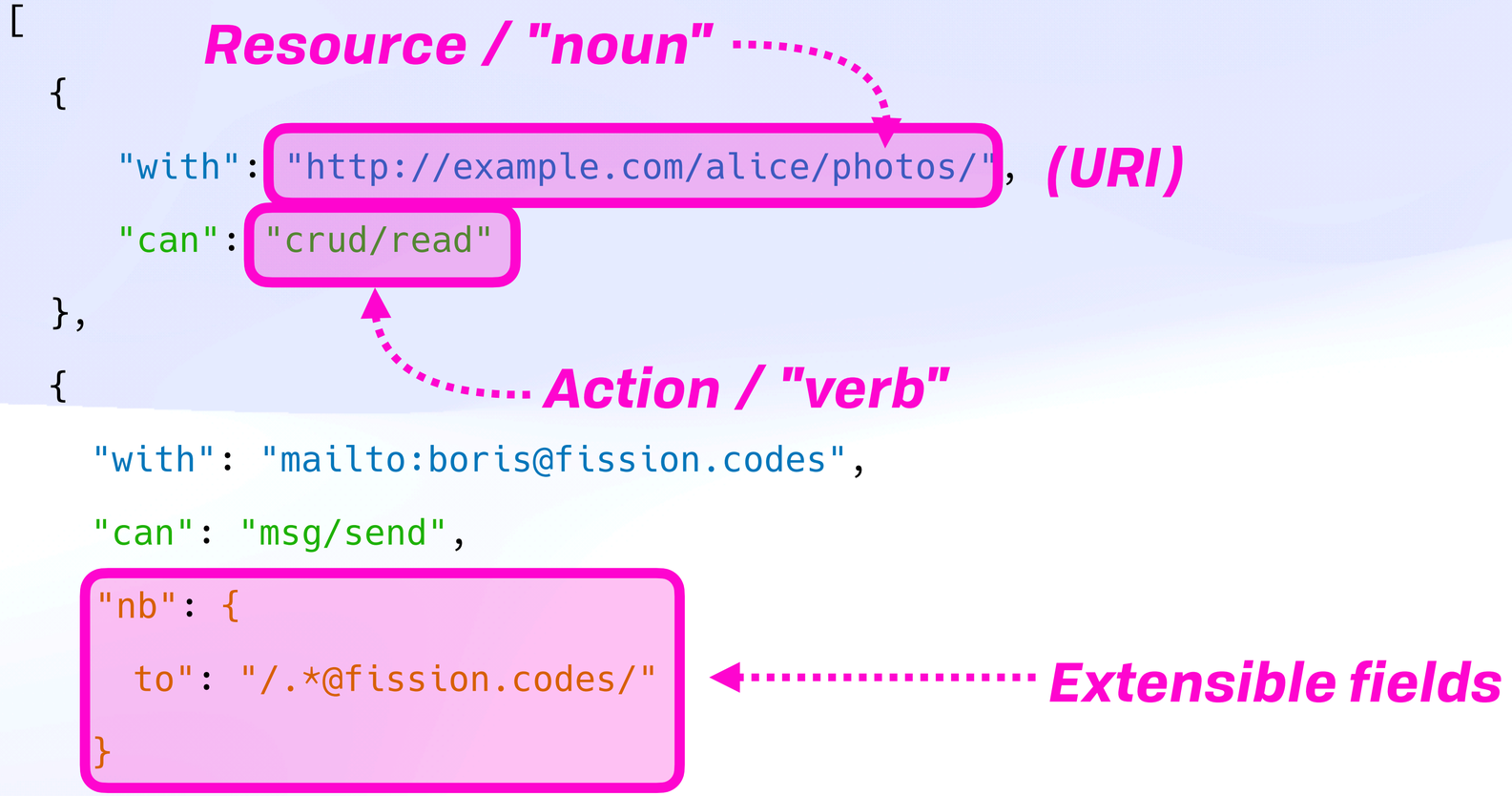

AuthN & AuthZ

Anatomy of a Capability



AuthN & AuthZ

Chain Witnesses

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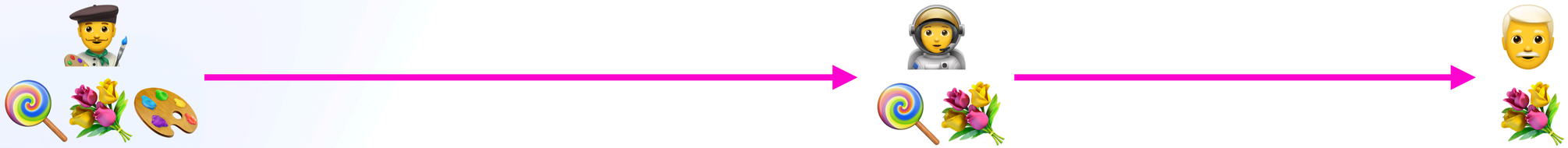
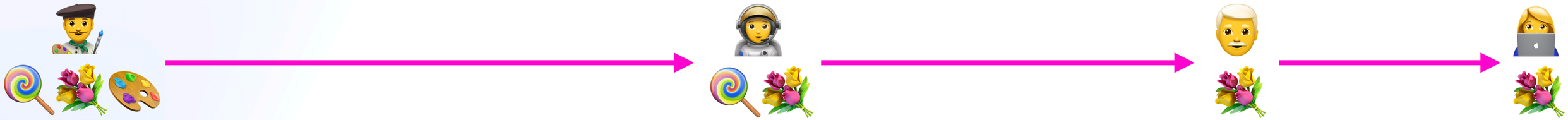


AuthN & AuthZ

Chain Witnesses



AuthN & AuthZ

Chain Witnesses

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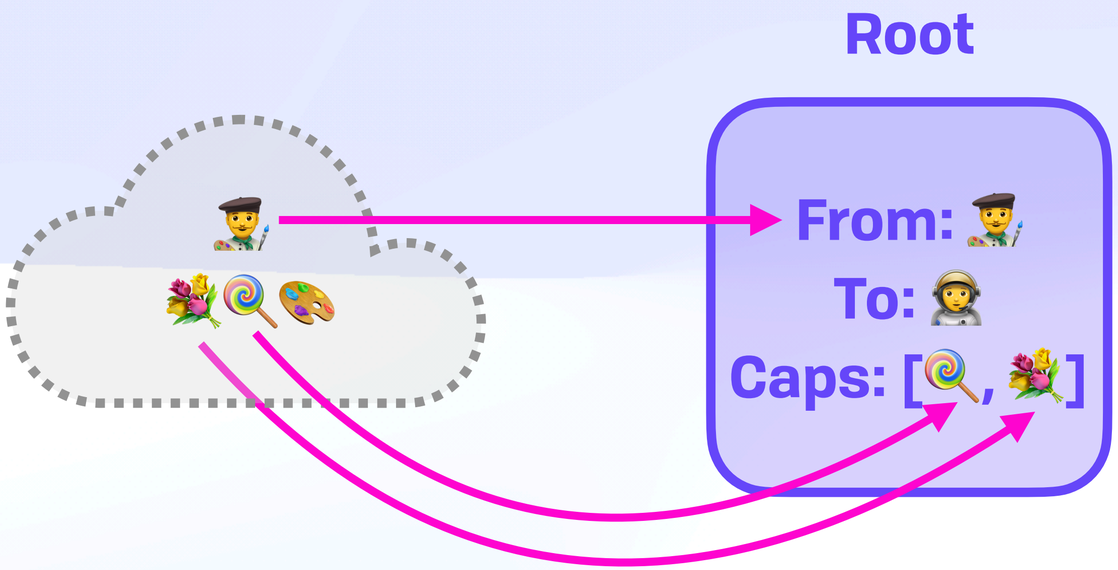
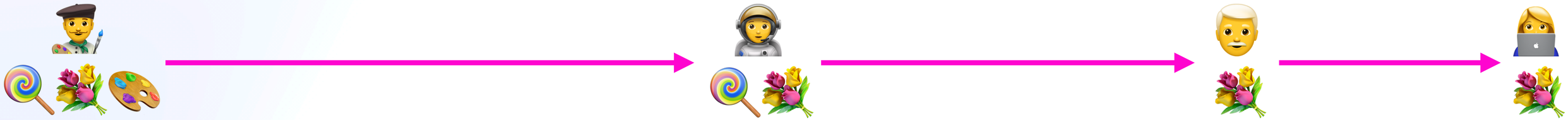
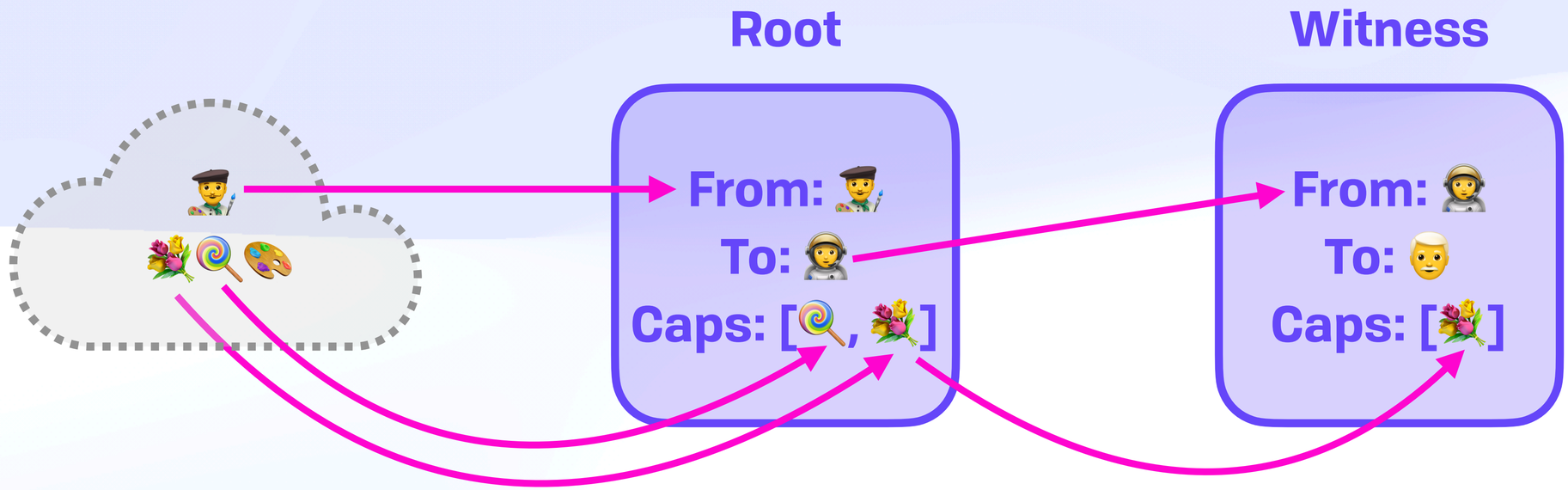
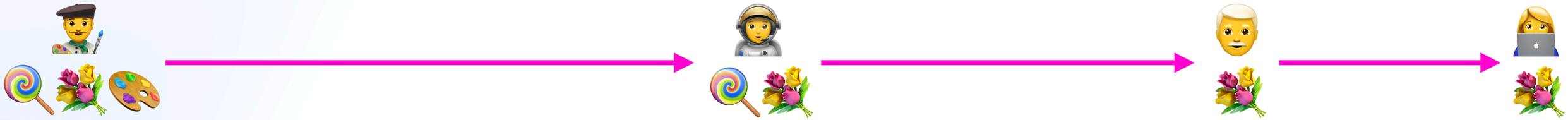




AuthN & AuthZ

Chain Witnesses





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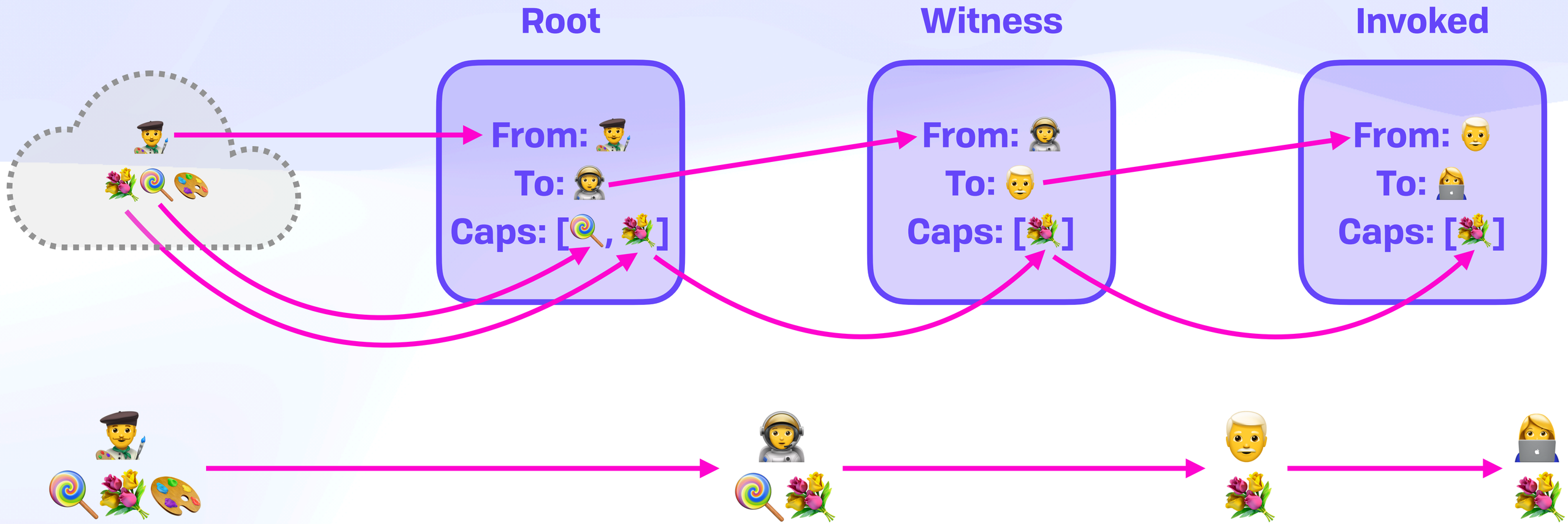
Chain Witnesses



AuthN & AuthZ

JWT → UCAN

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
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zejlzMk1Ic3FZdkxvY2N5SHdYNVNleVpLcHE3OUd0NDVmRkdFWlI5OSIsIm5iZiI6MTYzOTYwO
DI5MywicHJmIjpbXX0.4TNhuHRrPG9aHo869HXlsNK8_FmlShQ5GzG4itN2NKk-
yKTbAMoFwTuptG0XFgNIvHulPplVzZYDVDexo76kAw",

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

Signature

```
kwRdqPN74pkcpXGgdk7Z7FW3M1mRR
YaDE5ZgkG6srAuu6V6mvMVRdBLnD5
CWid-X4tDIKpliVjlCSLTntB4pCw
```

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{
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  "typ": "JWT",
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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
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  "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
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    yKTbAMoFwTuptG0XFgNIvHulPplVzZYDVDexo76kAw",
    "eyJhbGciOiJFZERTQSIsInR5cCI6IkpXVCIsInVjdiI6IjAuNy4wIn0.eyJhdWQiOiJkaWQ6a
    2V5Ono2TWtzWFFCZkw4b3d6dFRDSlRtN2hOUmY2YjE4WXhYUHAzaTY2b0pIbThMM1lHSiIsImF
    0dCI6W3sid25mcyI6ImRlbW91c2VyLmZpc3Npb24ubmFtZS9wdWJsaWMvbm90ZXMvIiwiY2FwI
    joiT1ZFUldSSVRFIn1dLCJleHAiOjkyNTY5Mzk1MDUsImlzcyI6ImRpZDprZXk6ejZNa3A1RXN
    6OXMyTUhzcVl2TG9jY3lId1g1U2V5WktwcTc5R3Q0NWZGR0VaUjk5IiwibmJmIjoxNjM5NjA4M
    jkzLCJwcmYiOltdfQ.MgYarLqy7RmQ1AIrqYL6cFy9z7a5WIAU--
    TYARPSgirOSszvar3_DNr25rbPretHbnT0mMVKyoaQXruR7KbrBg"
  ]
}
```

✅

Signature

```
kwRdqPN74pkcpXGgdk7Z7FW3M1mRR
YaDE5ZgkG6srAuu6V6mvMVRdBLnD5
CWid-X4tDIKpliVjlCSLTntB4pCw
```

AuthN & AuthZ

Proof

Header


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


Payload

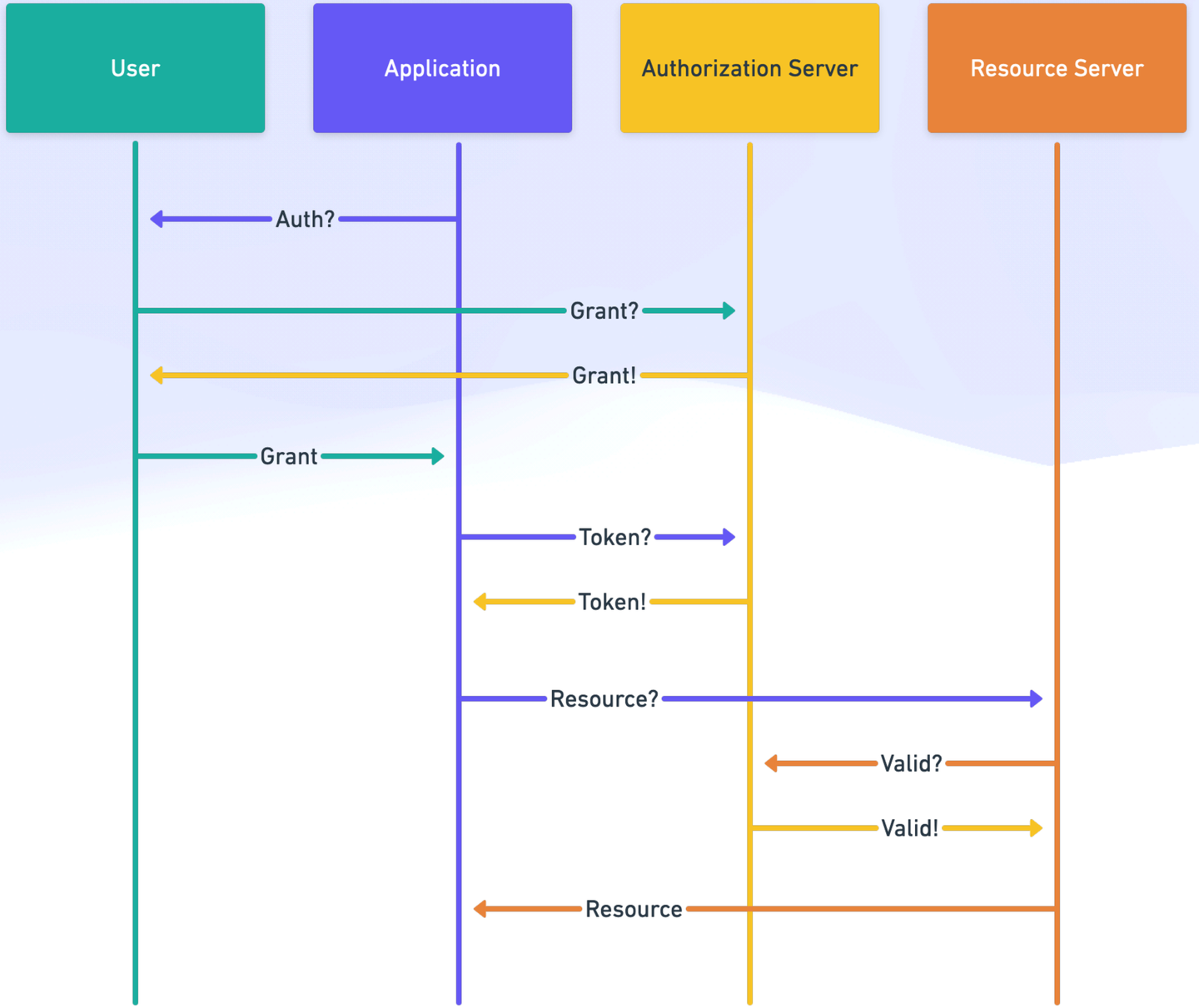

```
{
  "iss": "did:key:z6Mkp5Esz9s2MHsqYvLoccyHwX5SeyZKpq79Gt45fFGEZR99",
  "aud": "did:key:z6MksXQBfL8owztTCJTm7hNRf6b18YxXPp3i66oJHm8L3YGJ",
  "nbf": 1639608293,
  "exp": 9256939505,
  "att": [
    {
      "with": "wnfs://demouser.fission.name/public/photos/",
      "can": "OVERWRITE"
    }
  ],
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


Signature


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

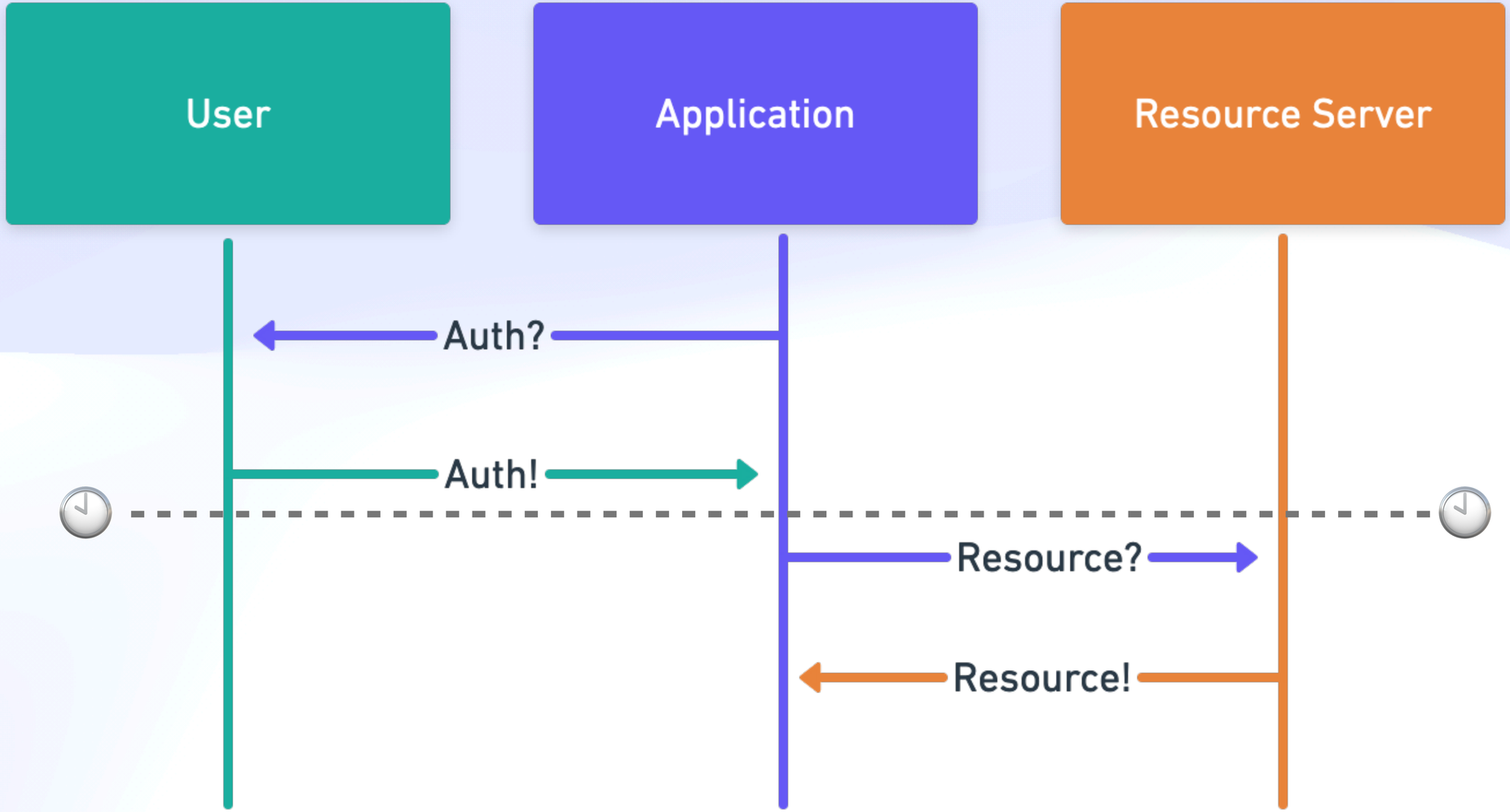
AuthN & AuthZ

OAuth Sequence



AuthN & AuthZ

UCAN Sequence



WebNative File System

File System

Grouped by User, Not by App

File System

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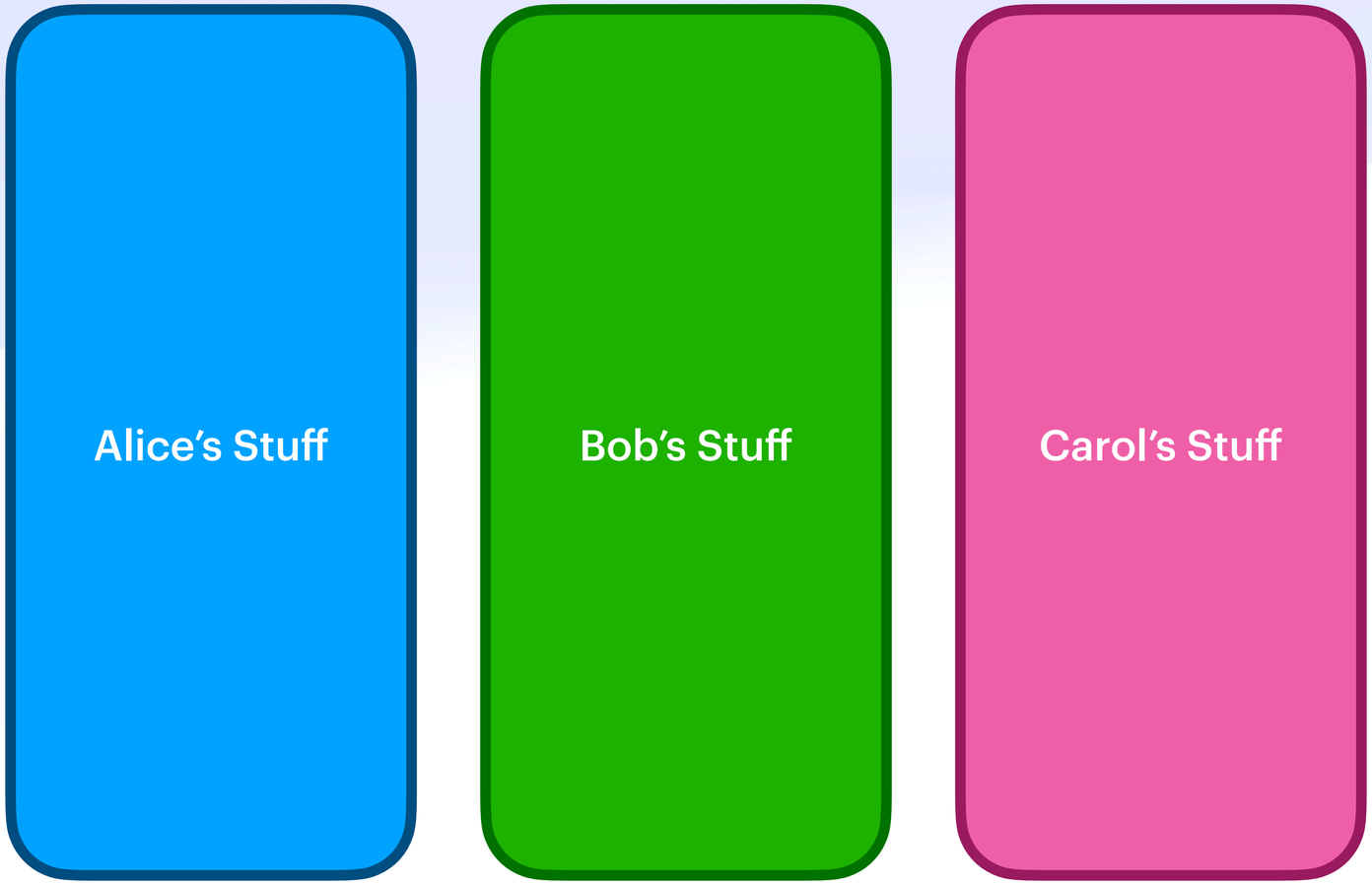

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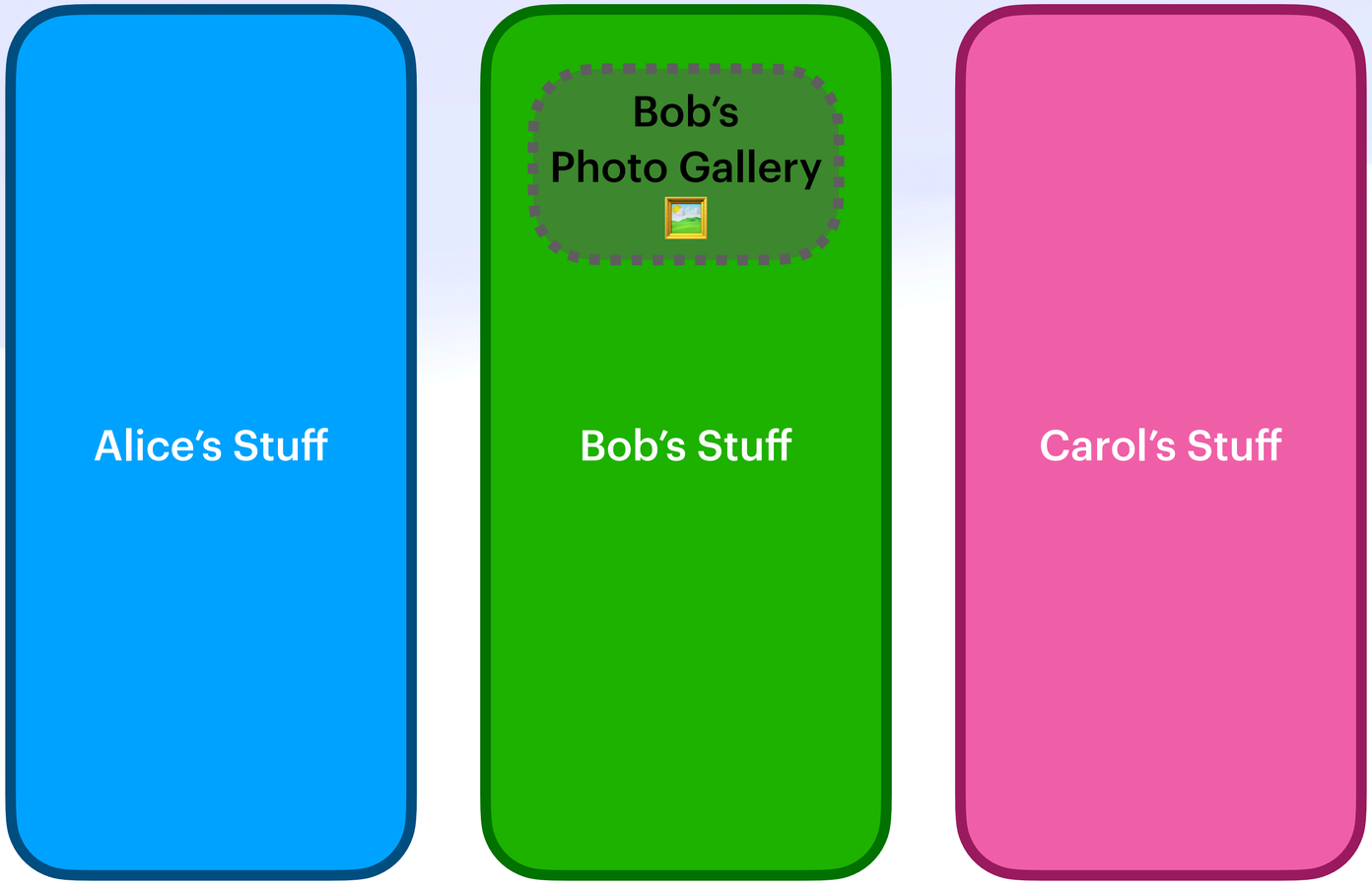

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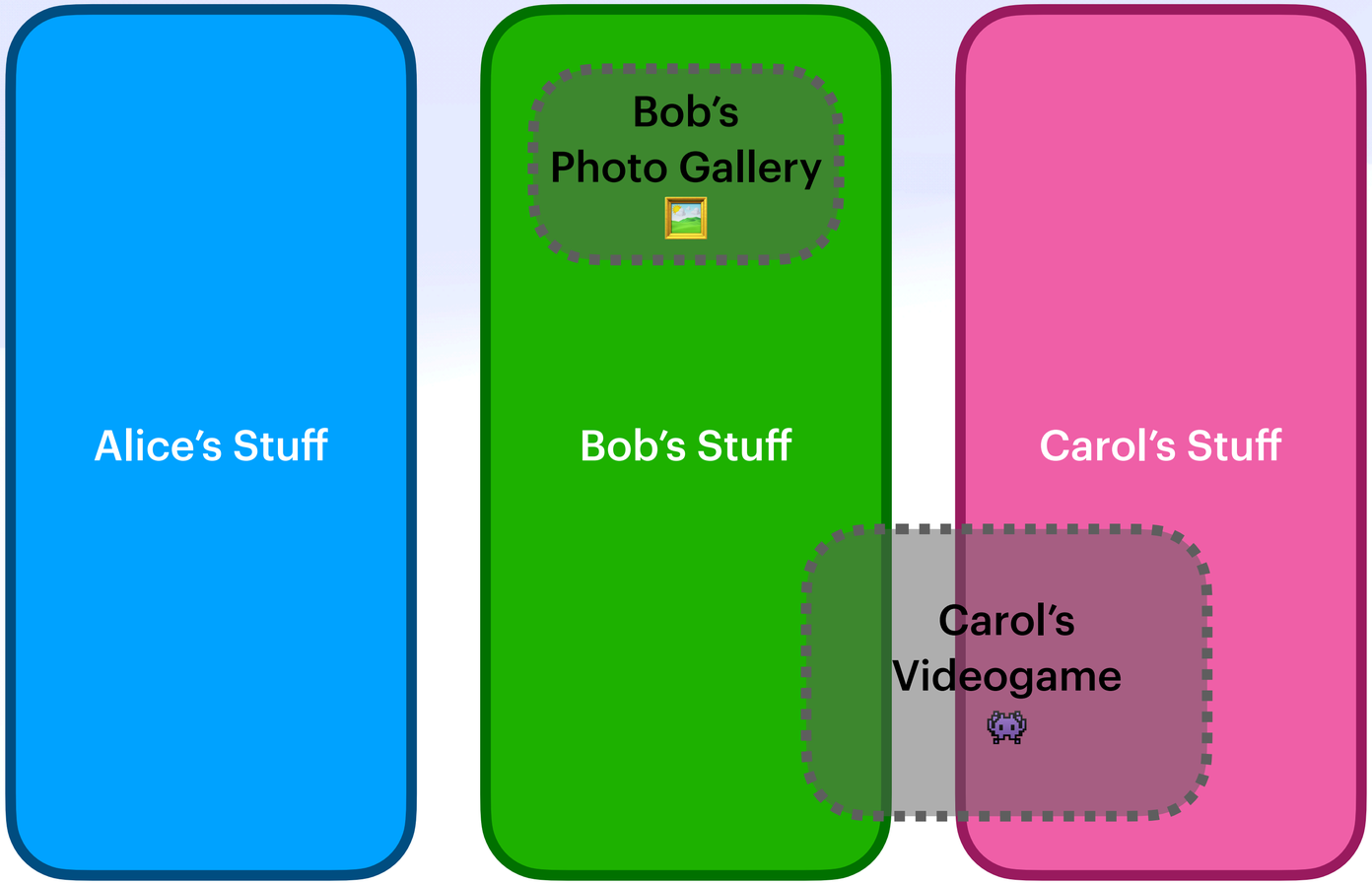

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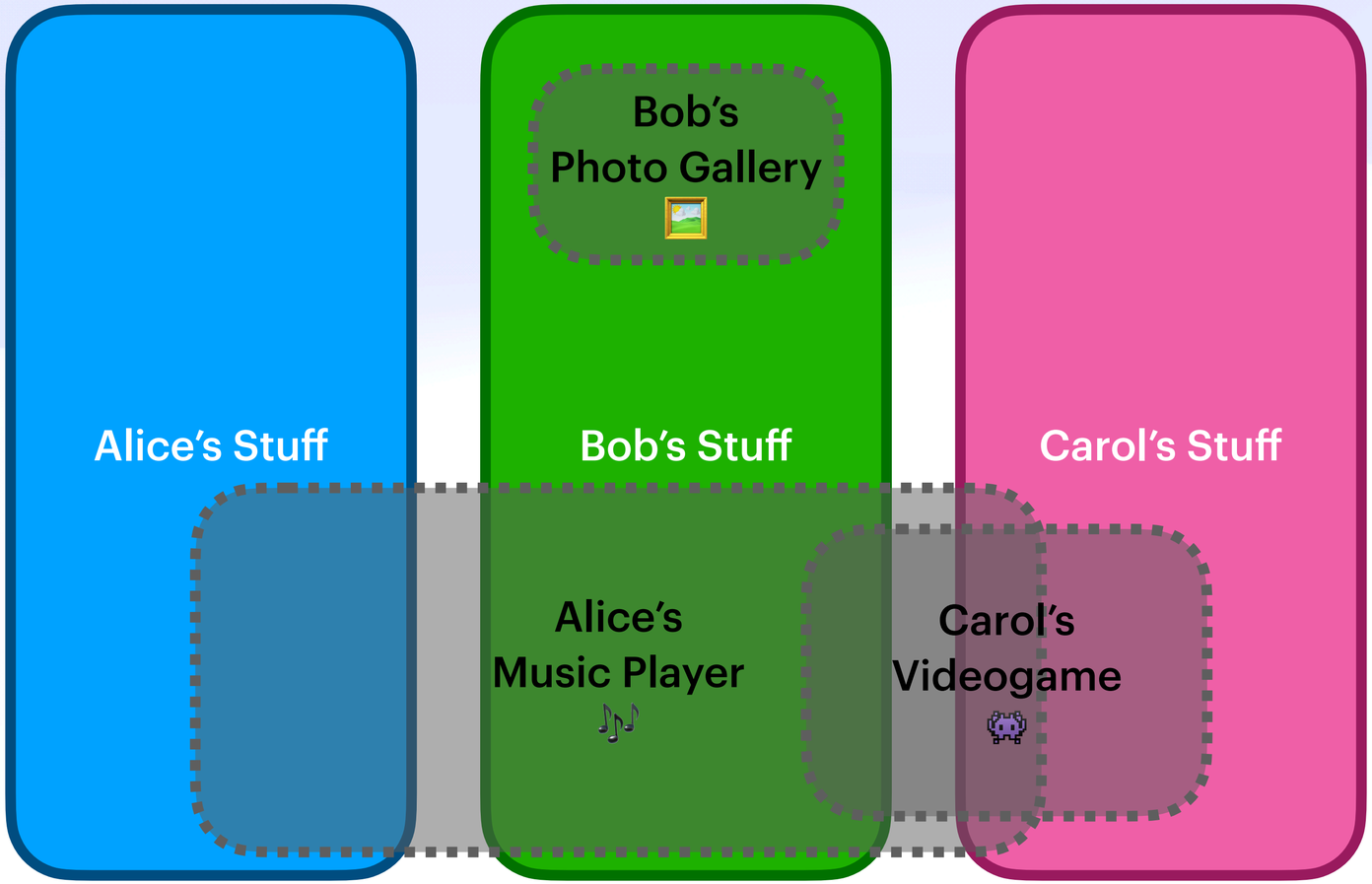

File System

Persistent Versioning

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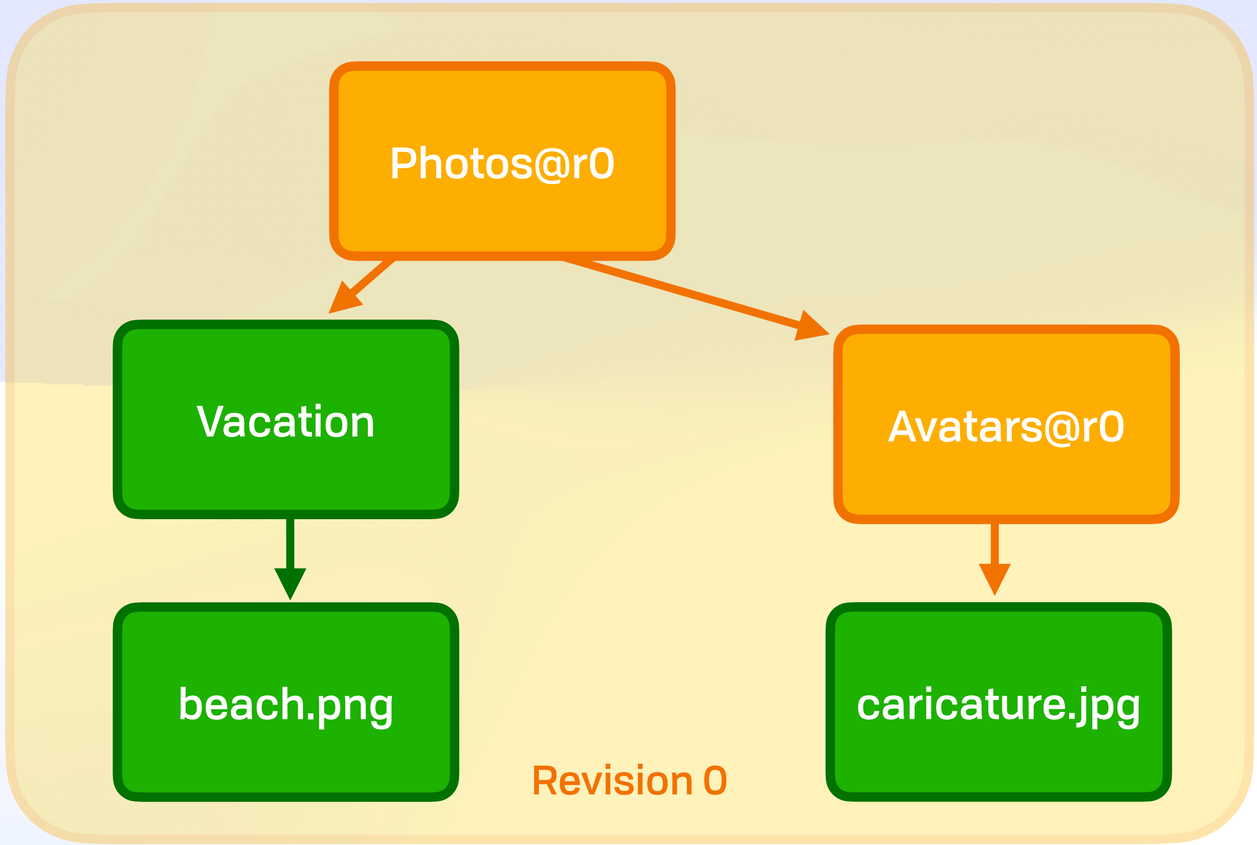
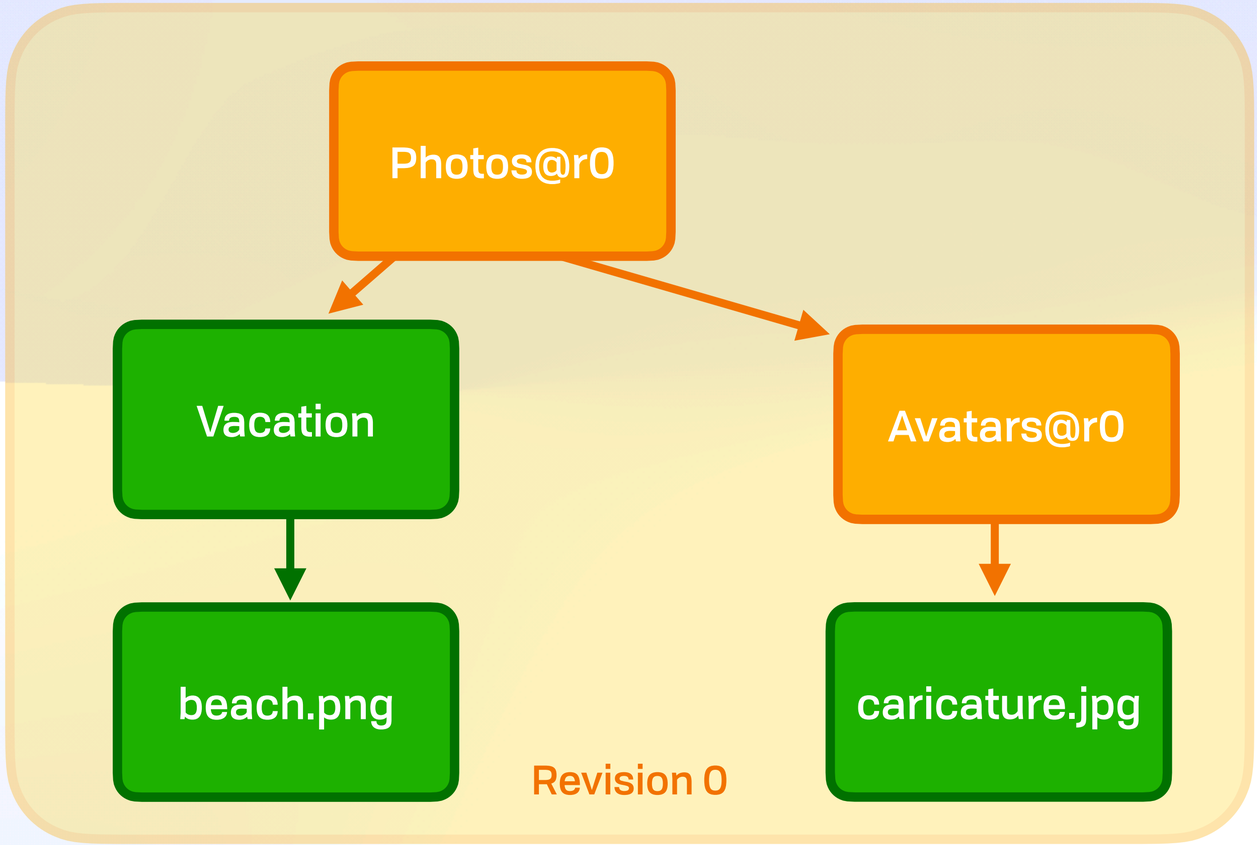


File System

Persistent Versioning



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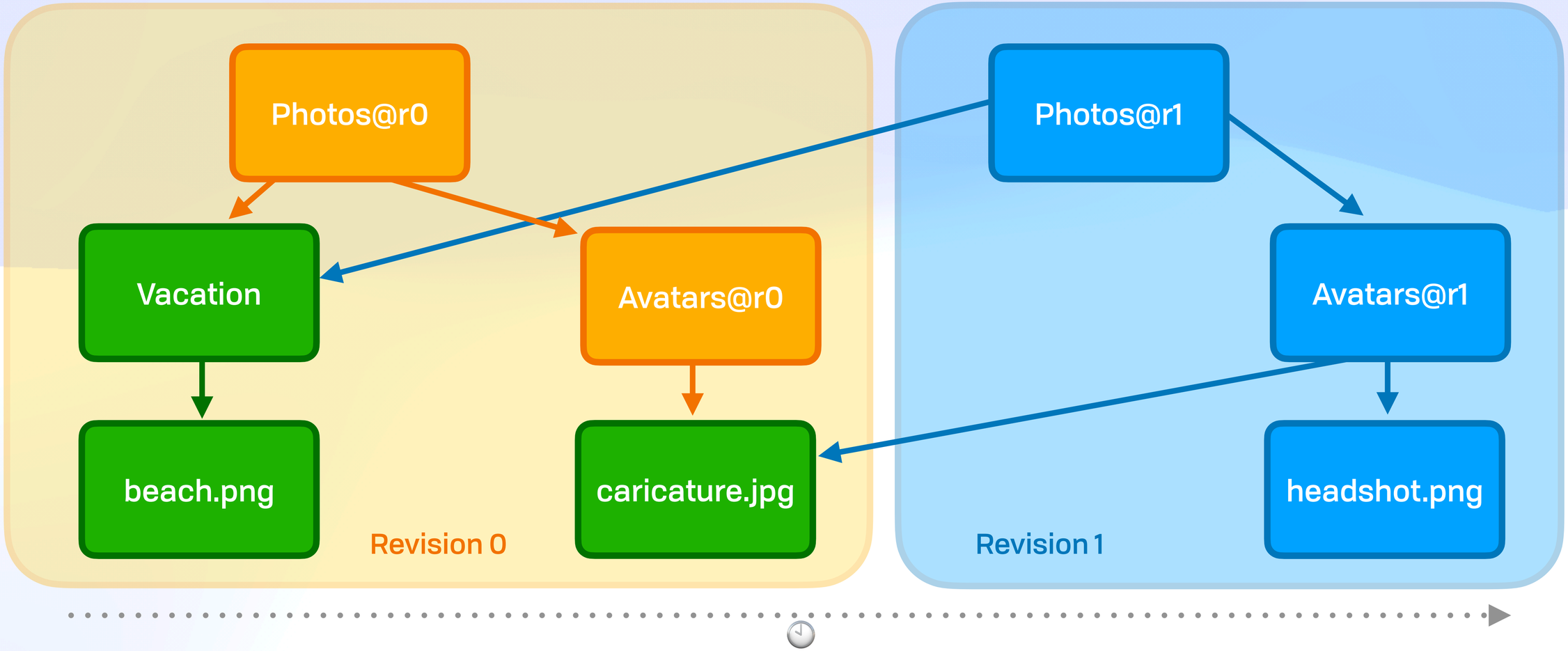
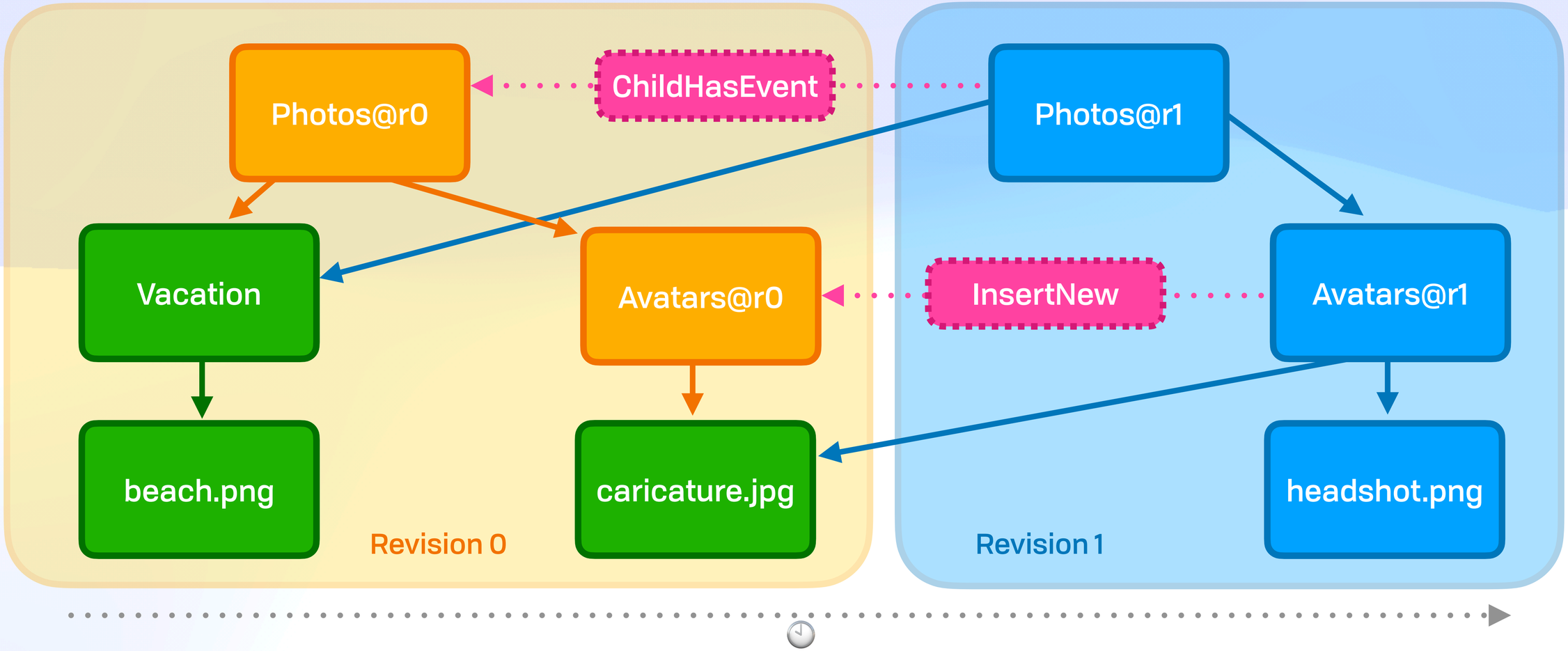
Persistent Versioning



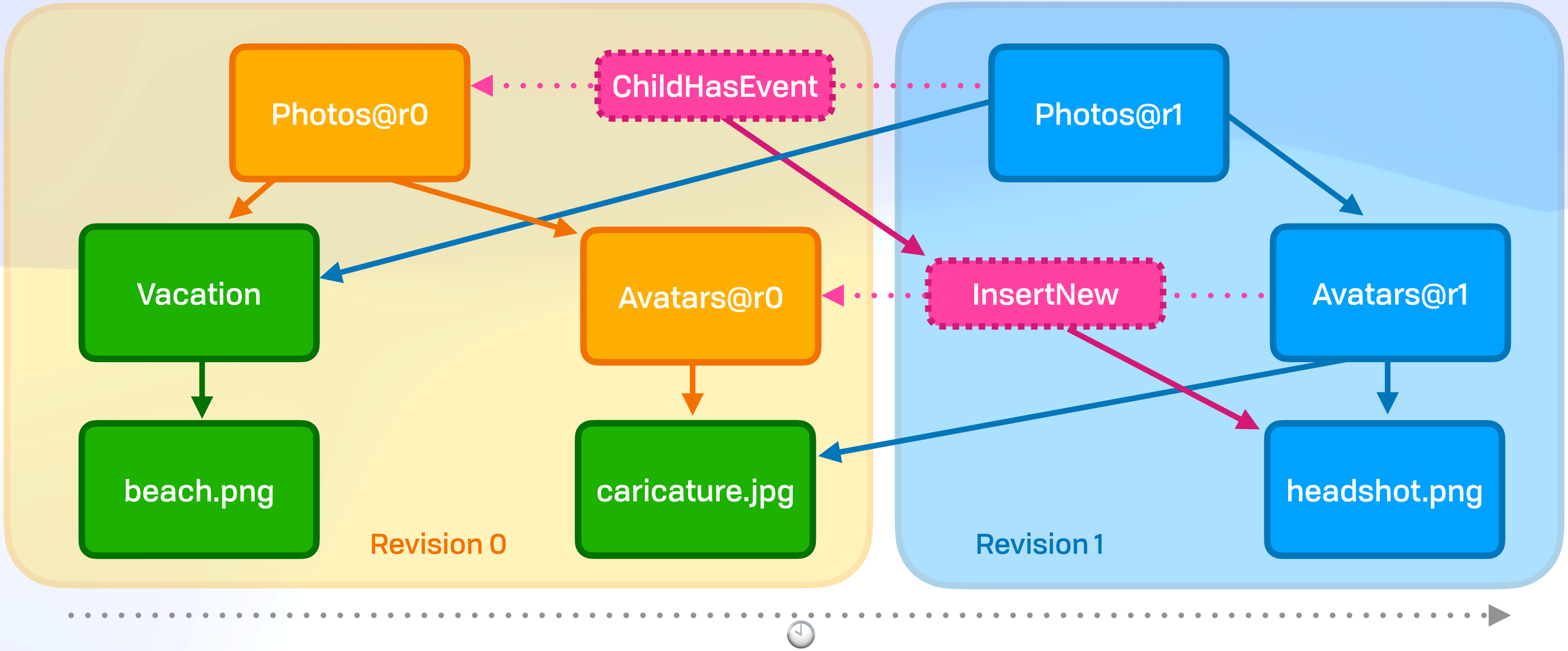
File System

Persistent Versioning



File System

Persistent Versioning



File System

Confluence

File System

Confluence

- One of the first Merkle CRDT papers was from PL 🙌
- Persistent data structure
- Automatic file-level reconciliation
- Pluggable sub-file reconciliation (forthcoming)
- Basis of upcoming BFT Datalog "at scale" work 😉

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Single File History / "Causal Shadow"

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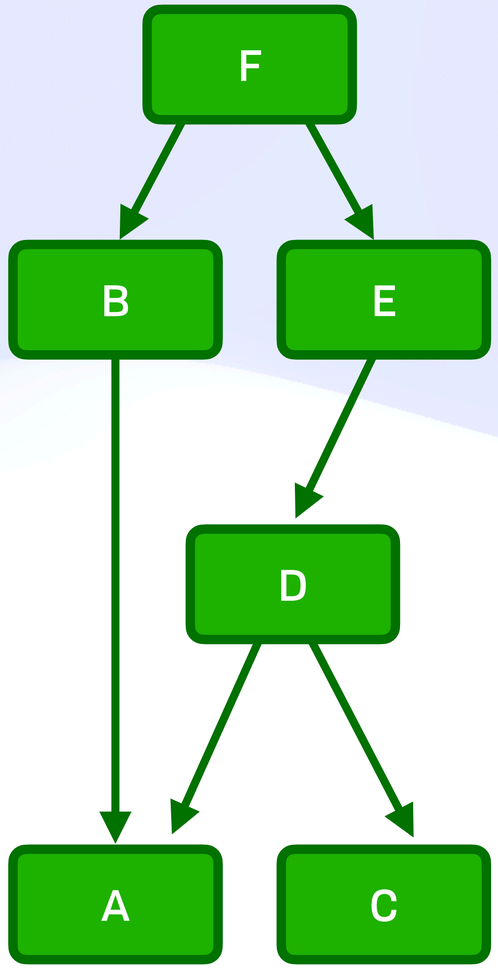
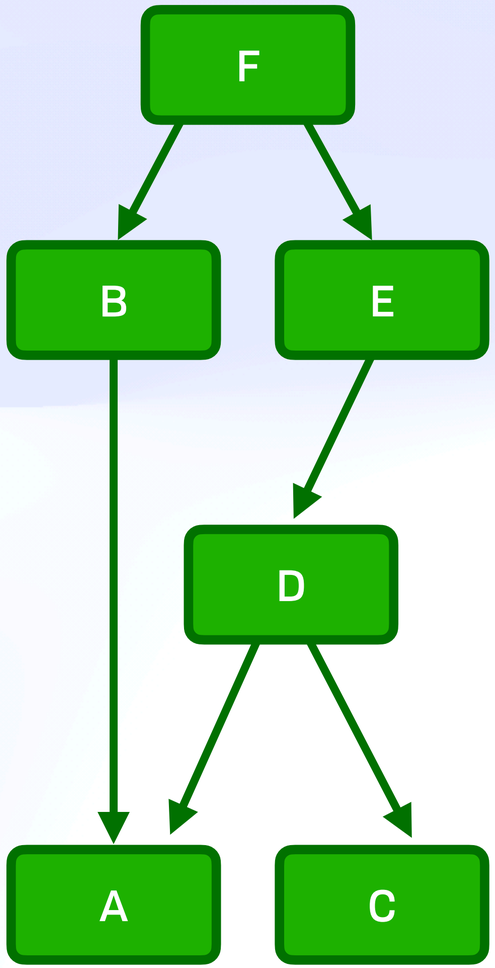


Single File History / "Causal Shadow"

File System

Mergable, Trivially



File System

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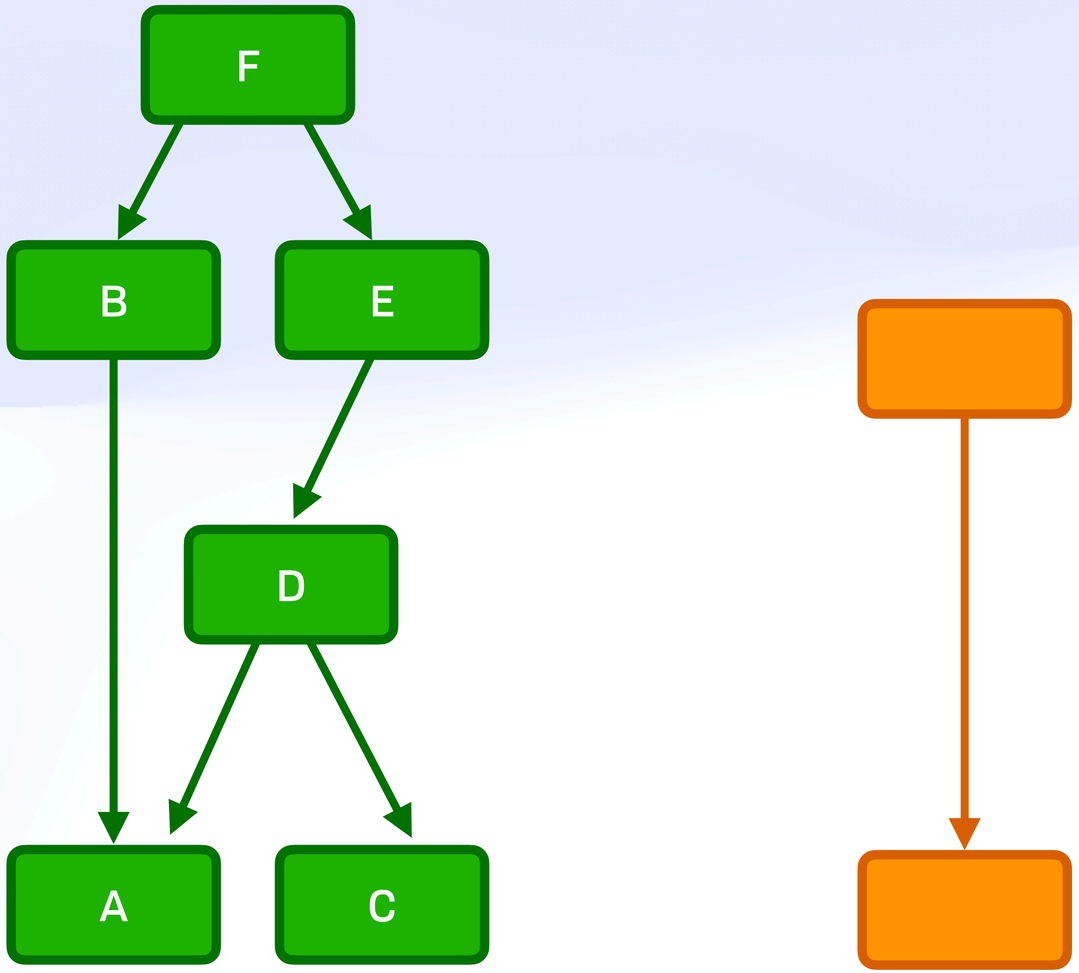
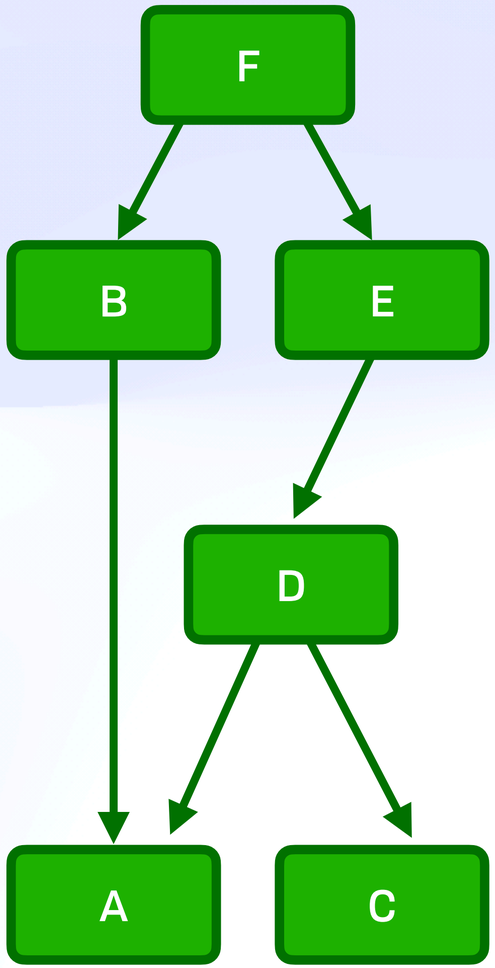
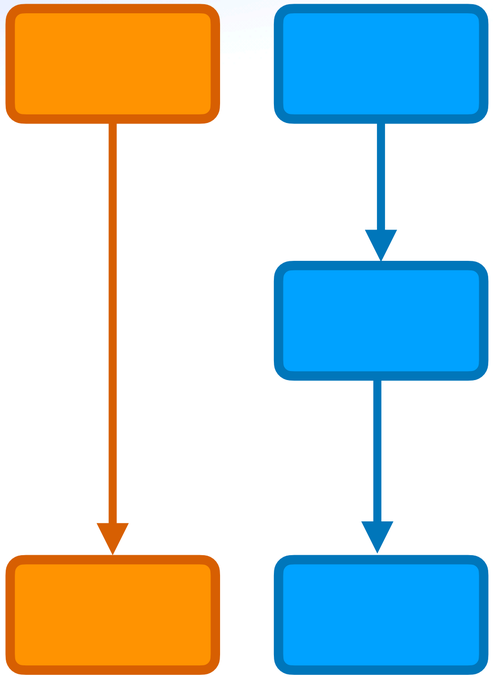


File System

Mergable, Trivially





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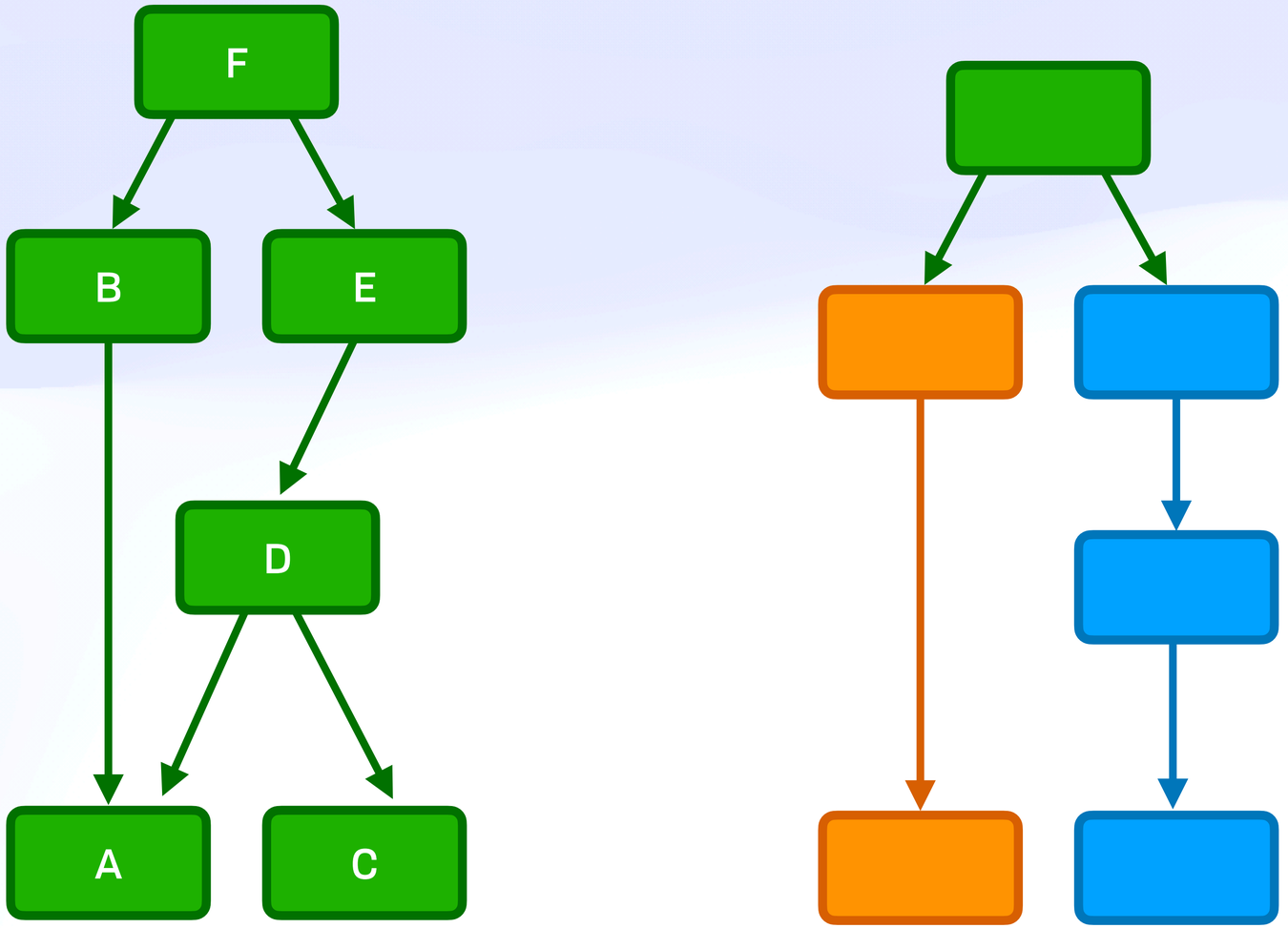
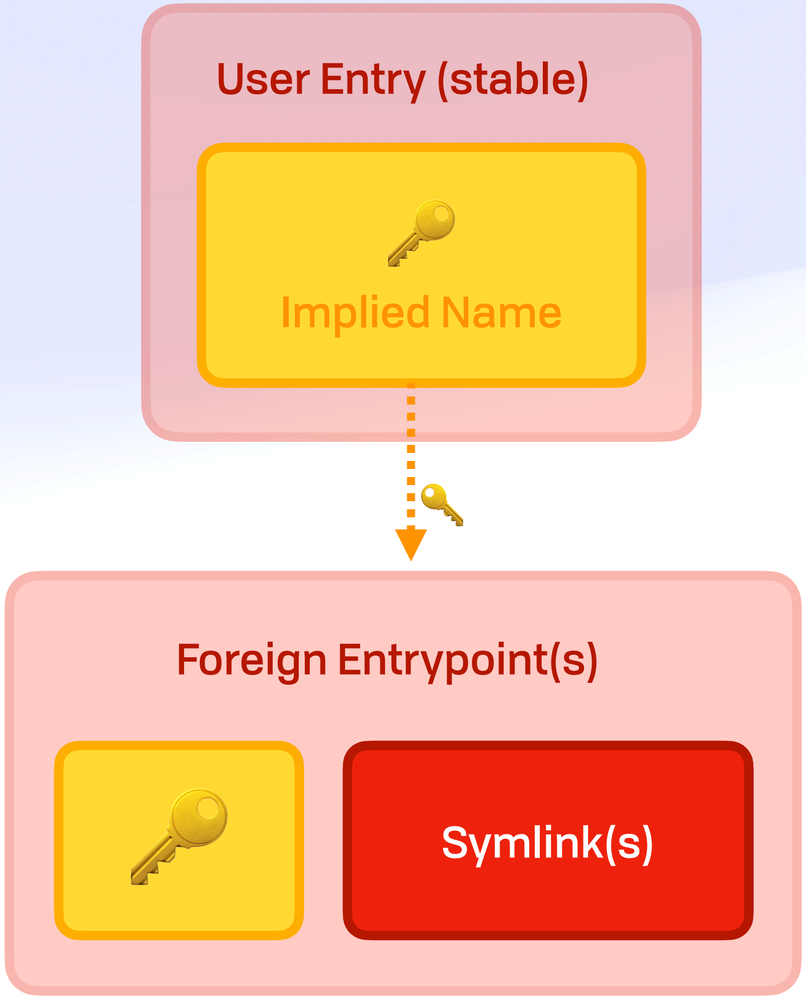


File System

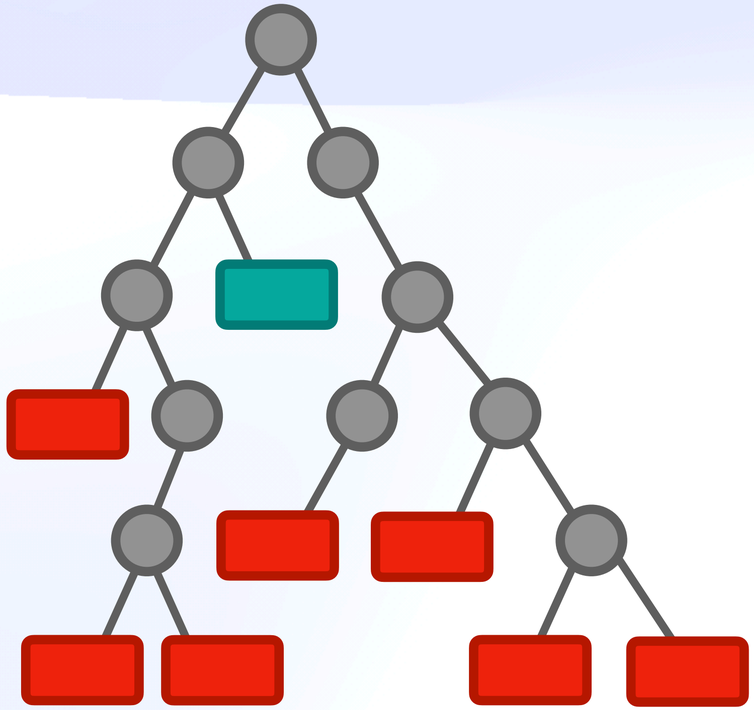
Sharing is Caring

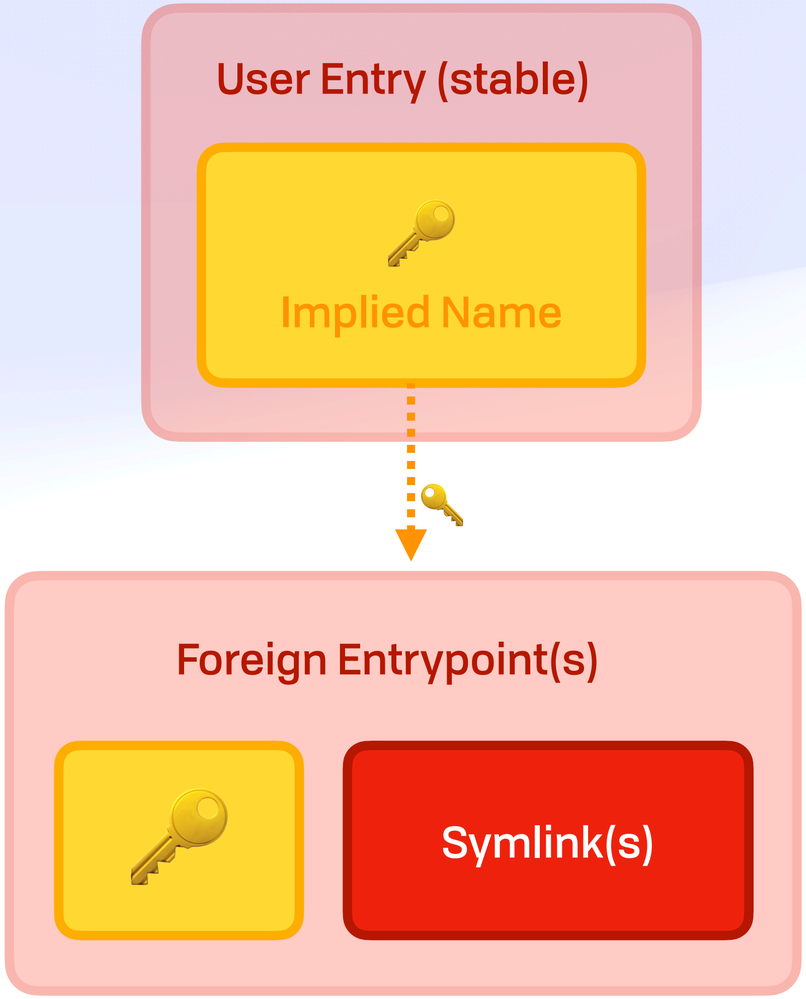


File System

Sharing is Caring

Sender
Secret WNFS





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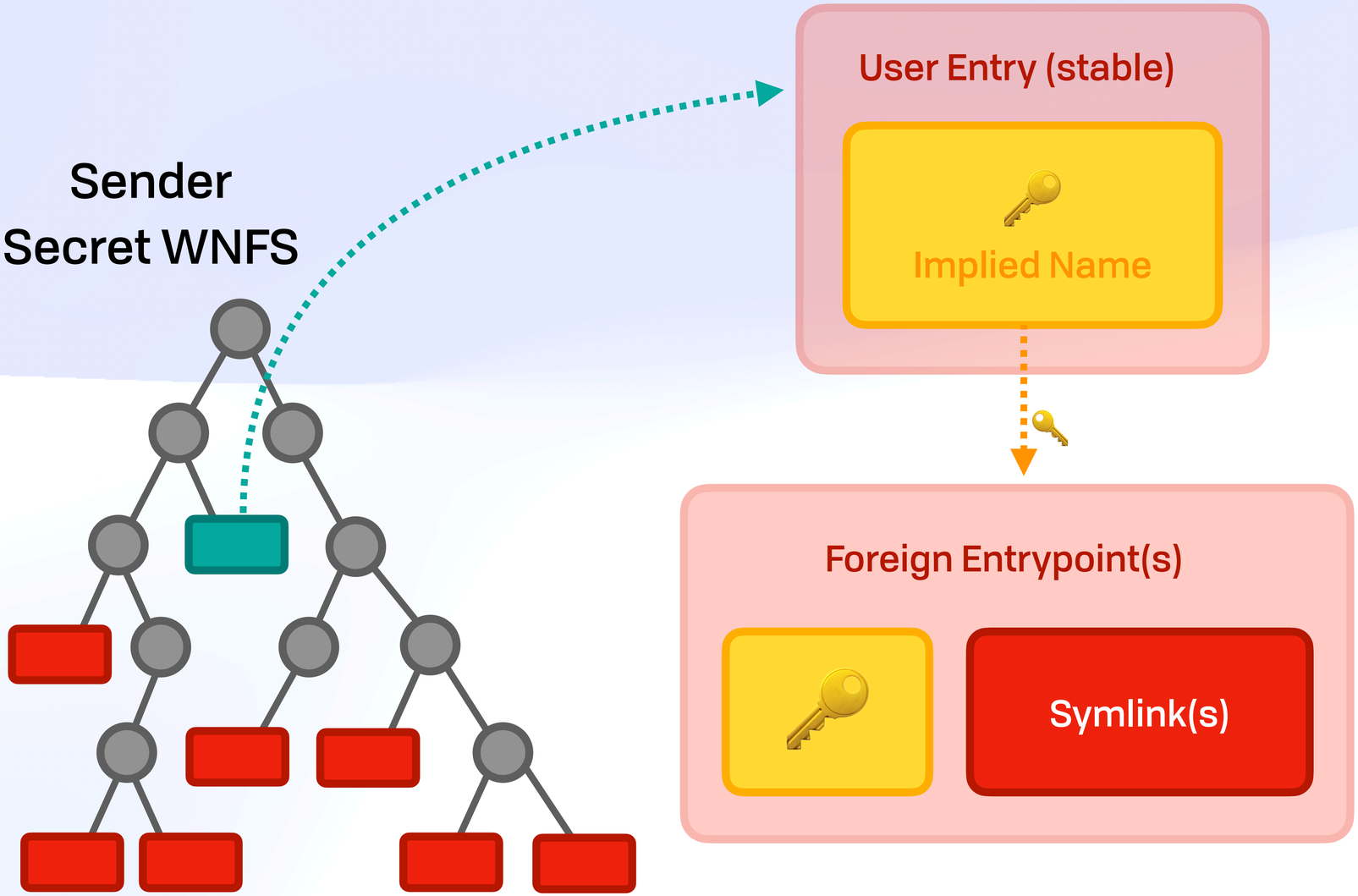

File System

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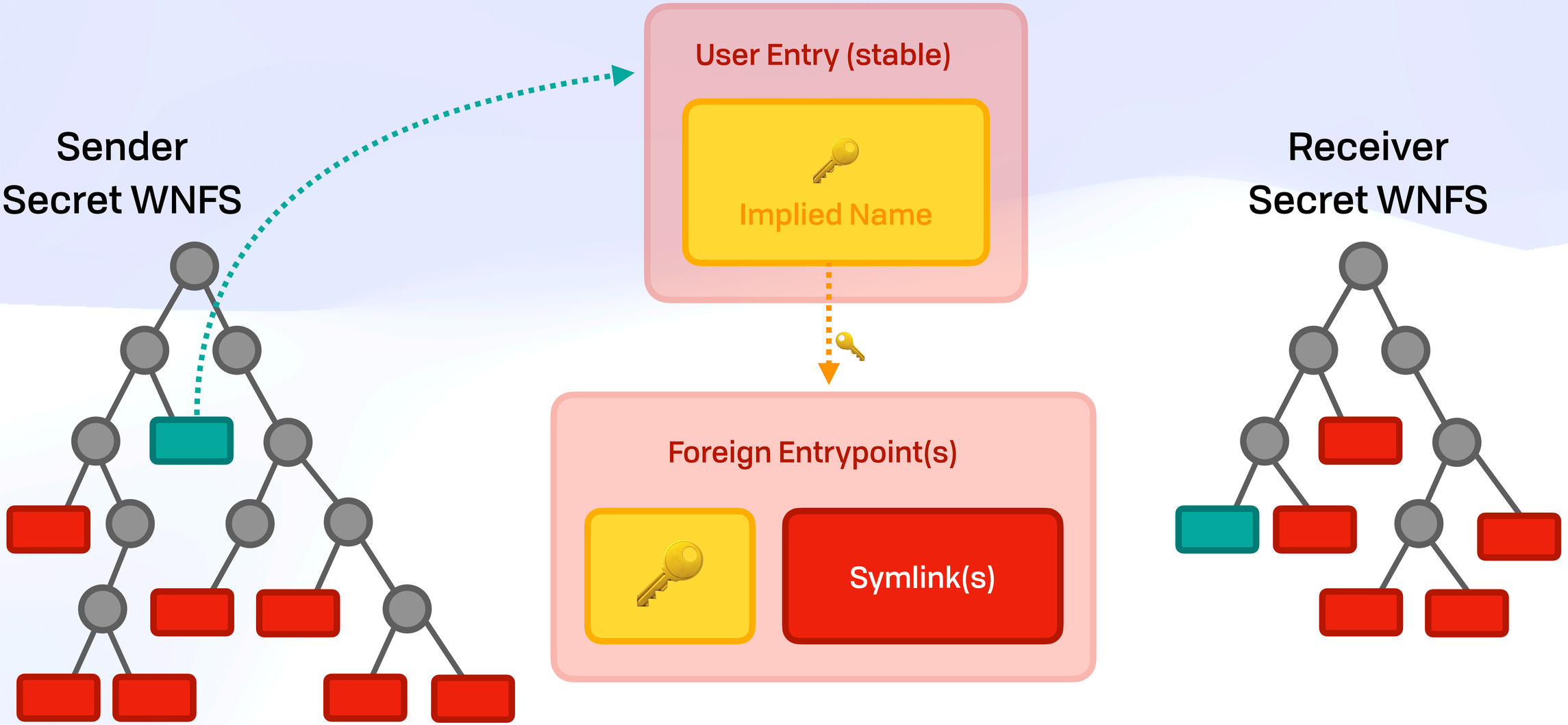

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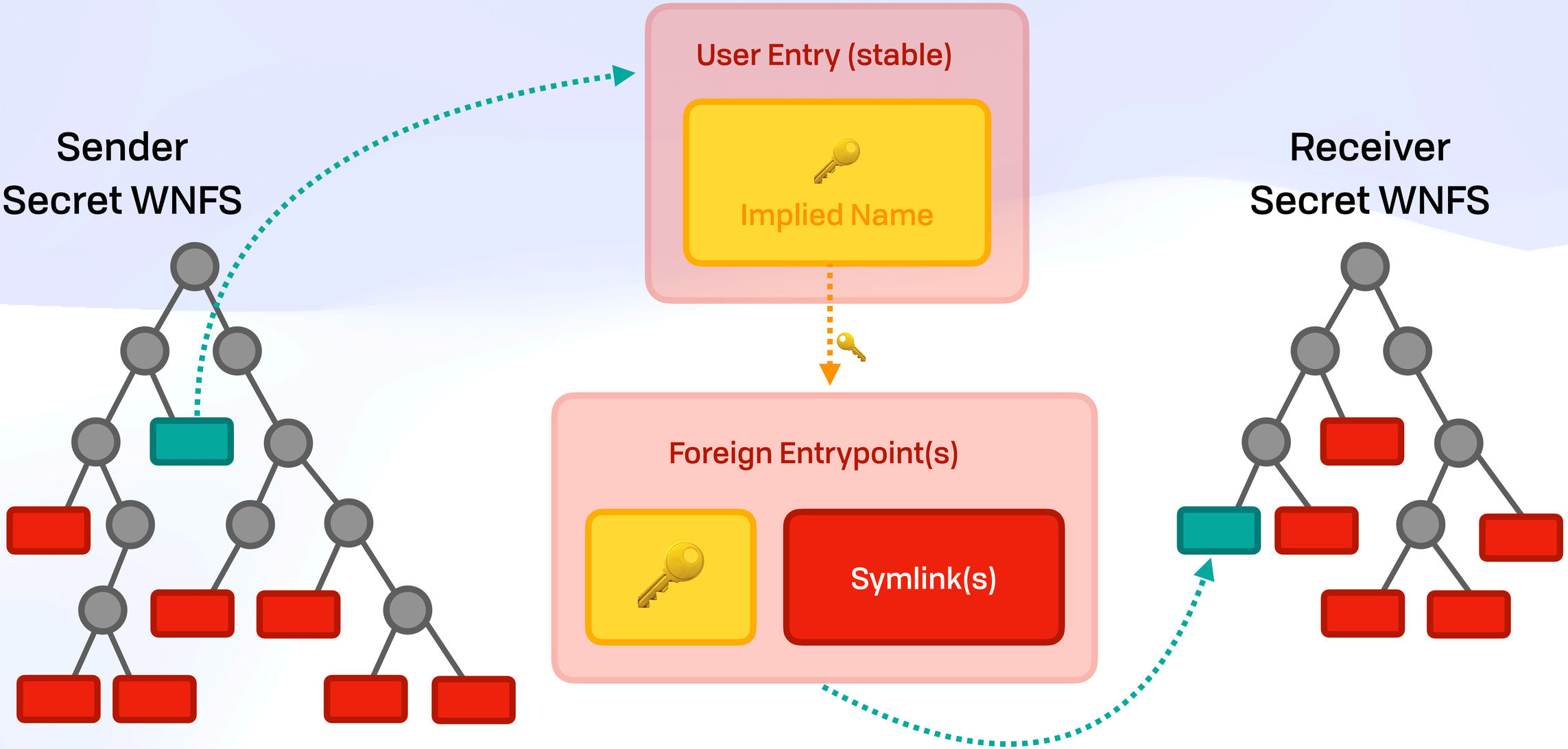
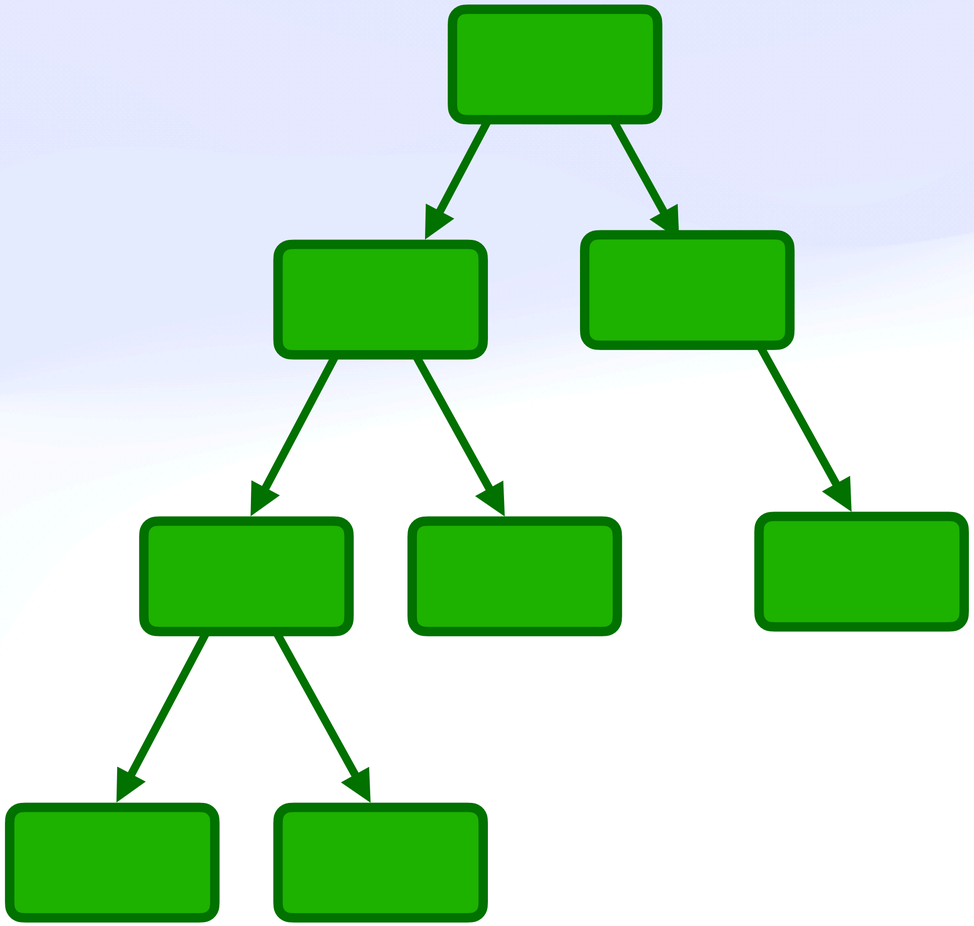


File System

Subgraph Access



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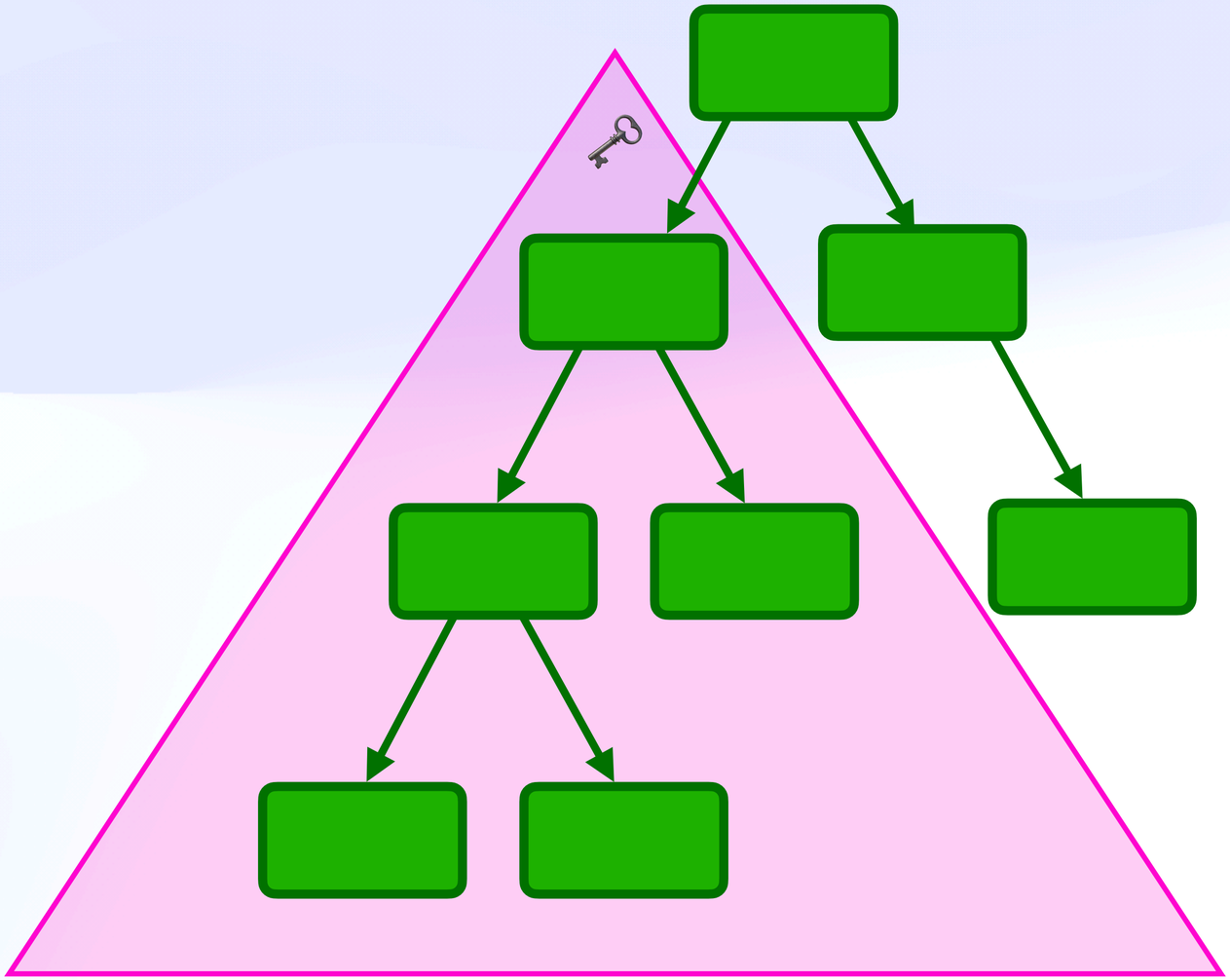
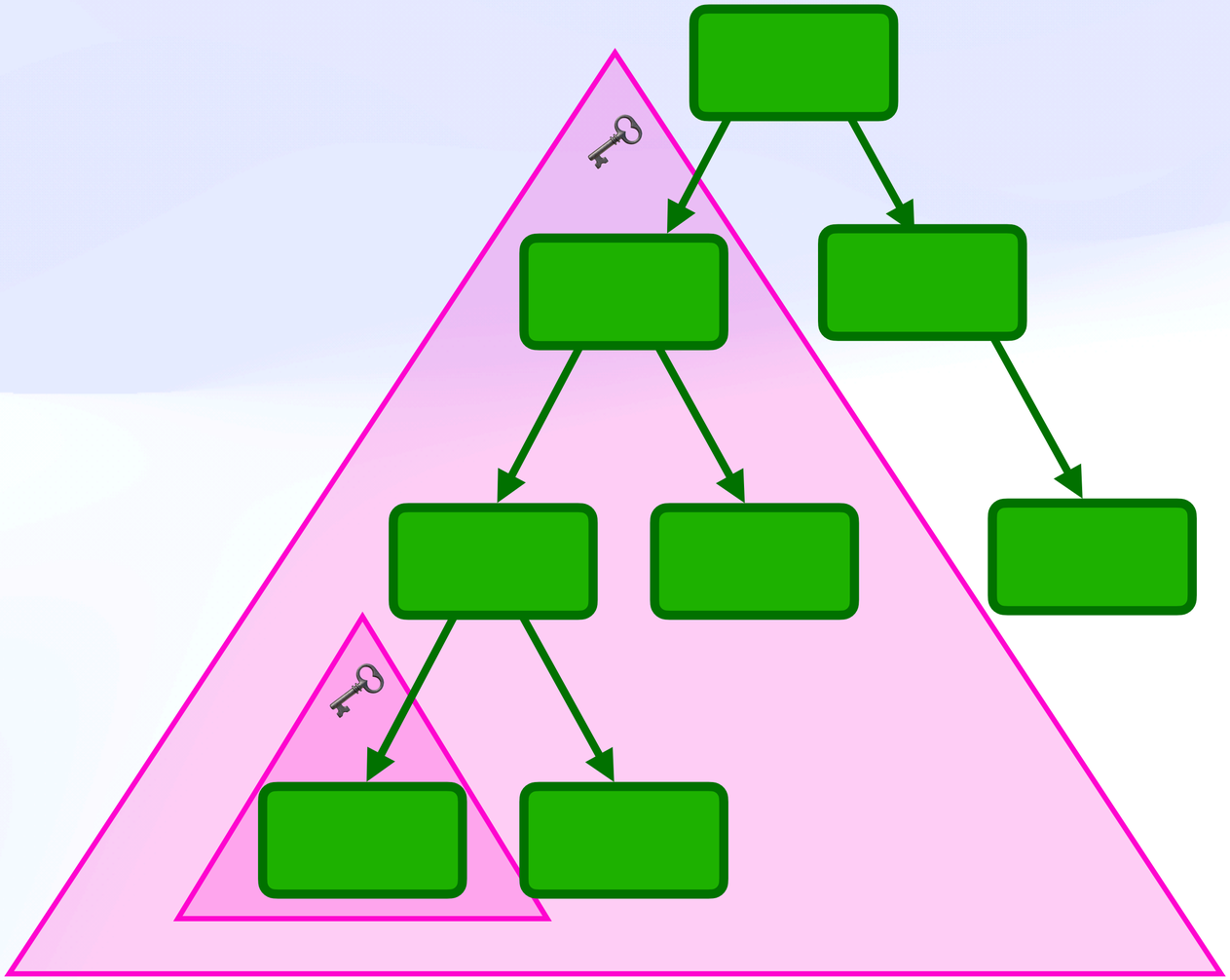


File System

Subgraph Access



File System

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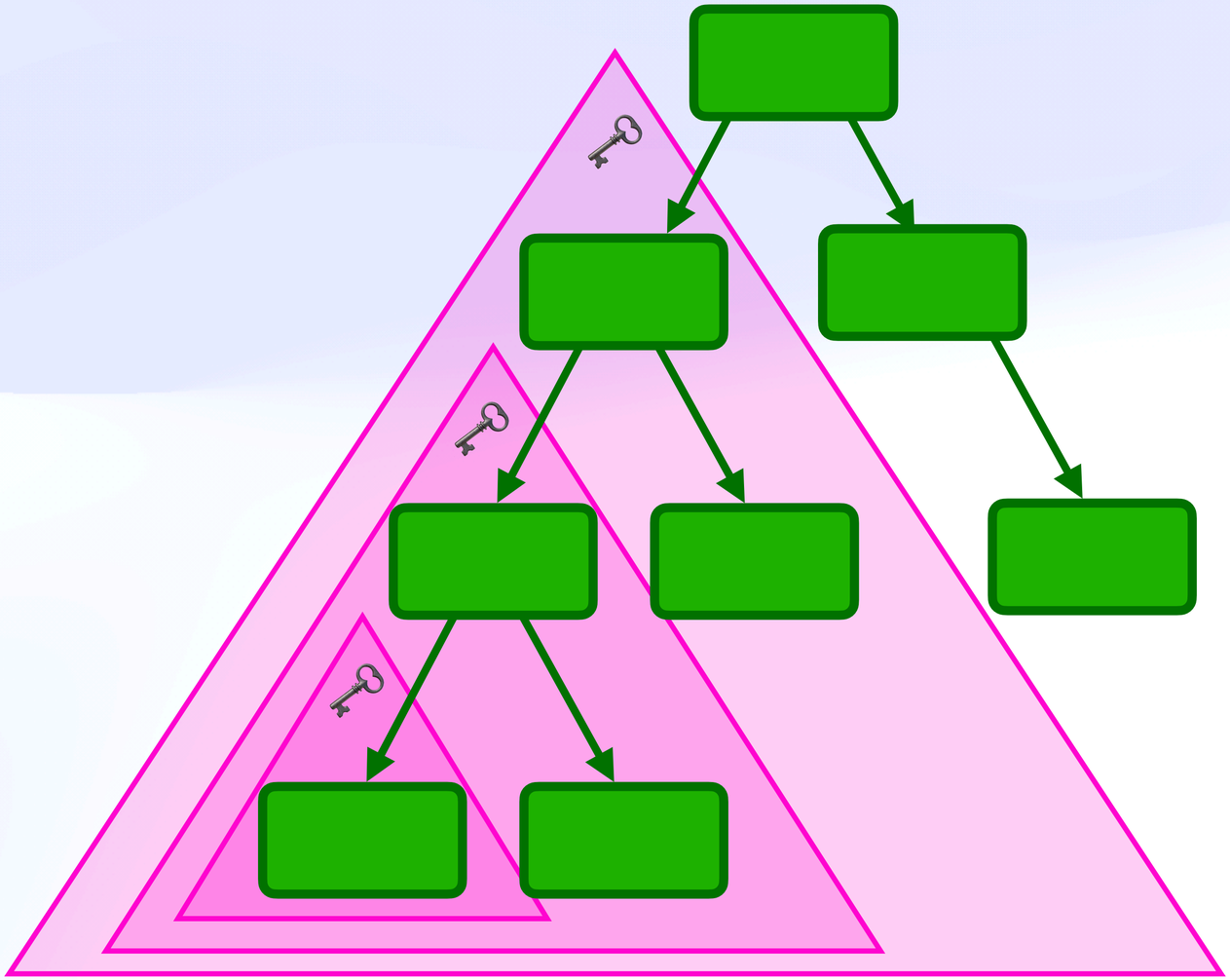

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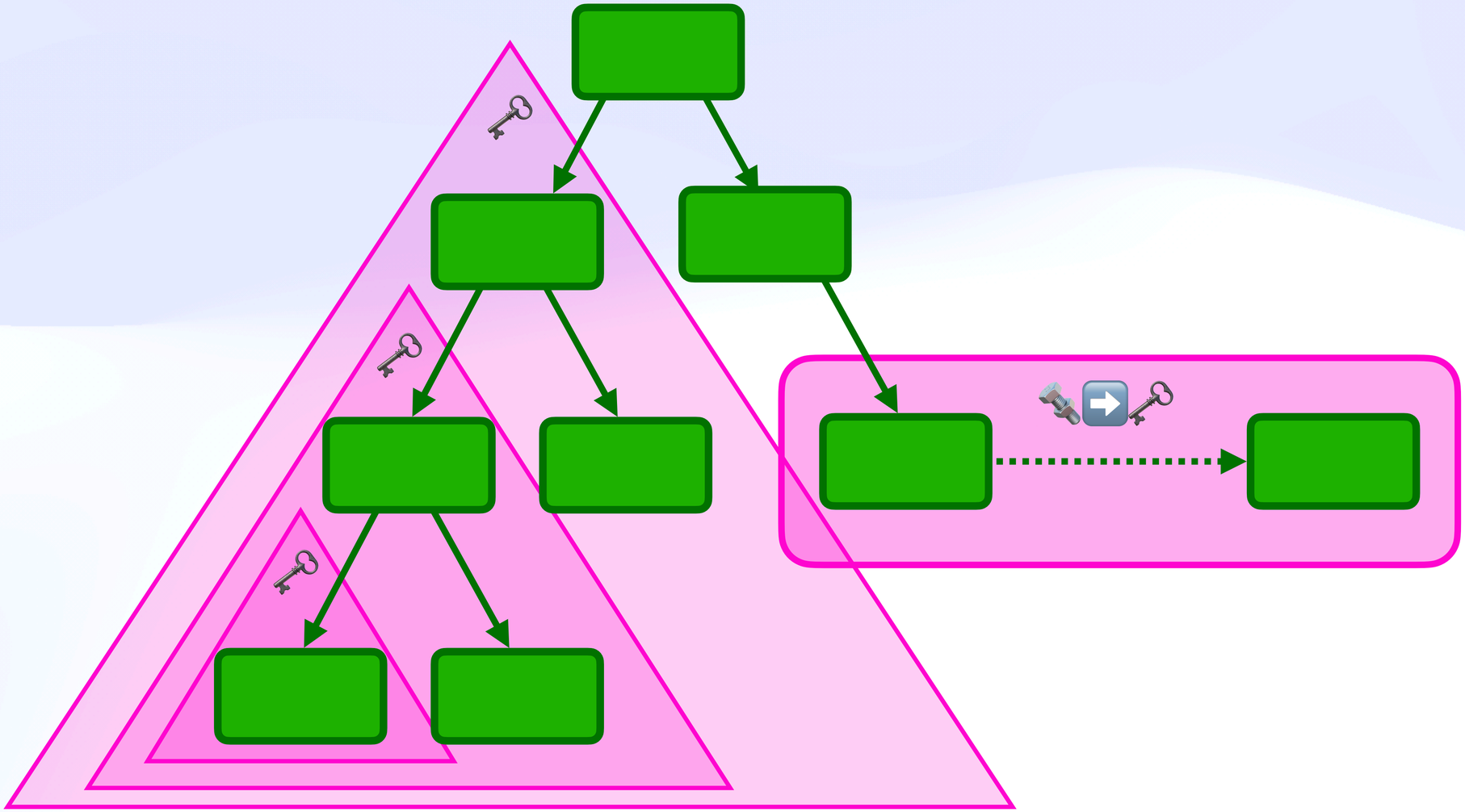

File System

Skip Ratchet

File System

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- Ratchet keys for future (backwards) secrecy
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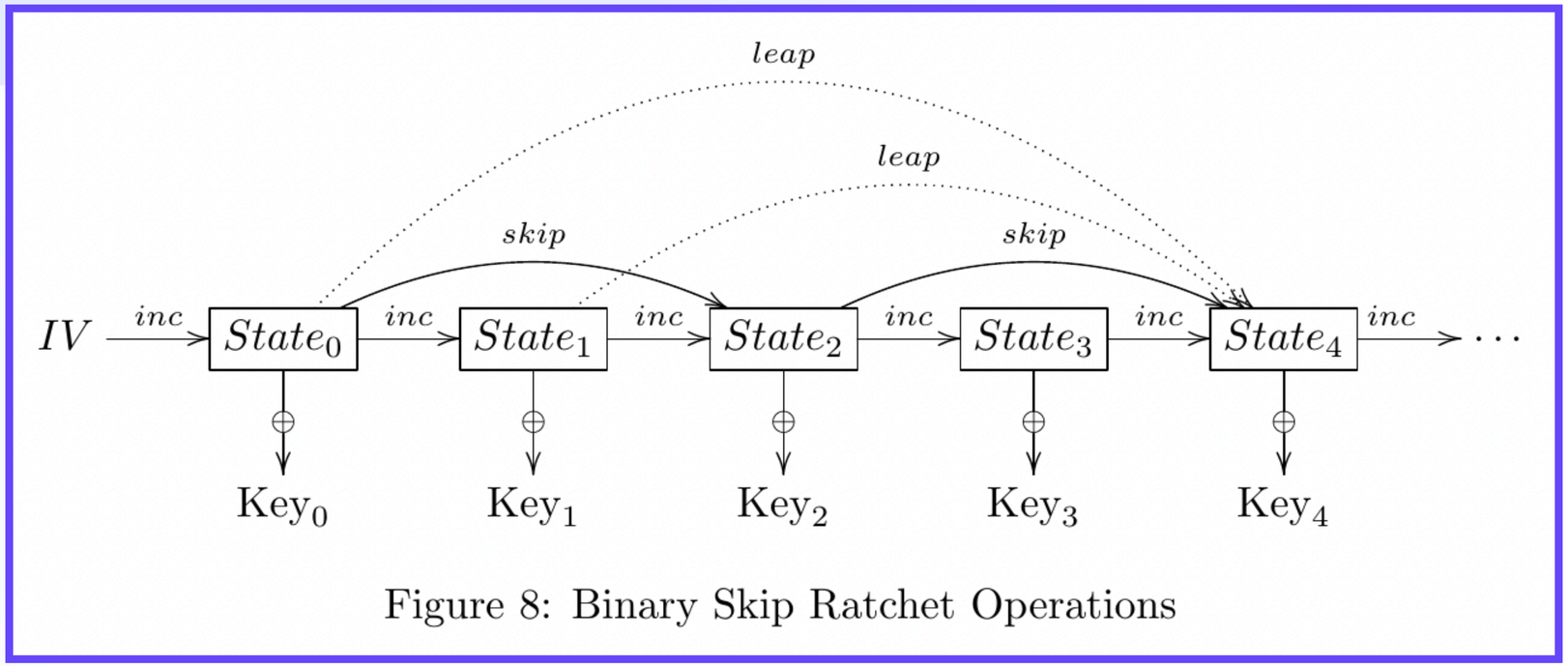

Figure 8: Binary Skip Ratchet Operations

File System

Skip Ratchet

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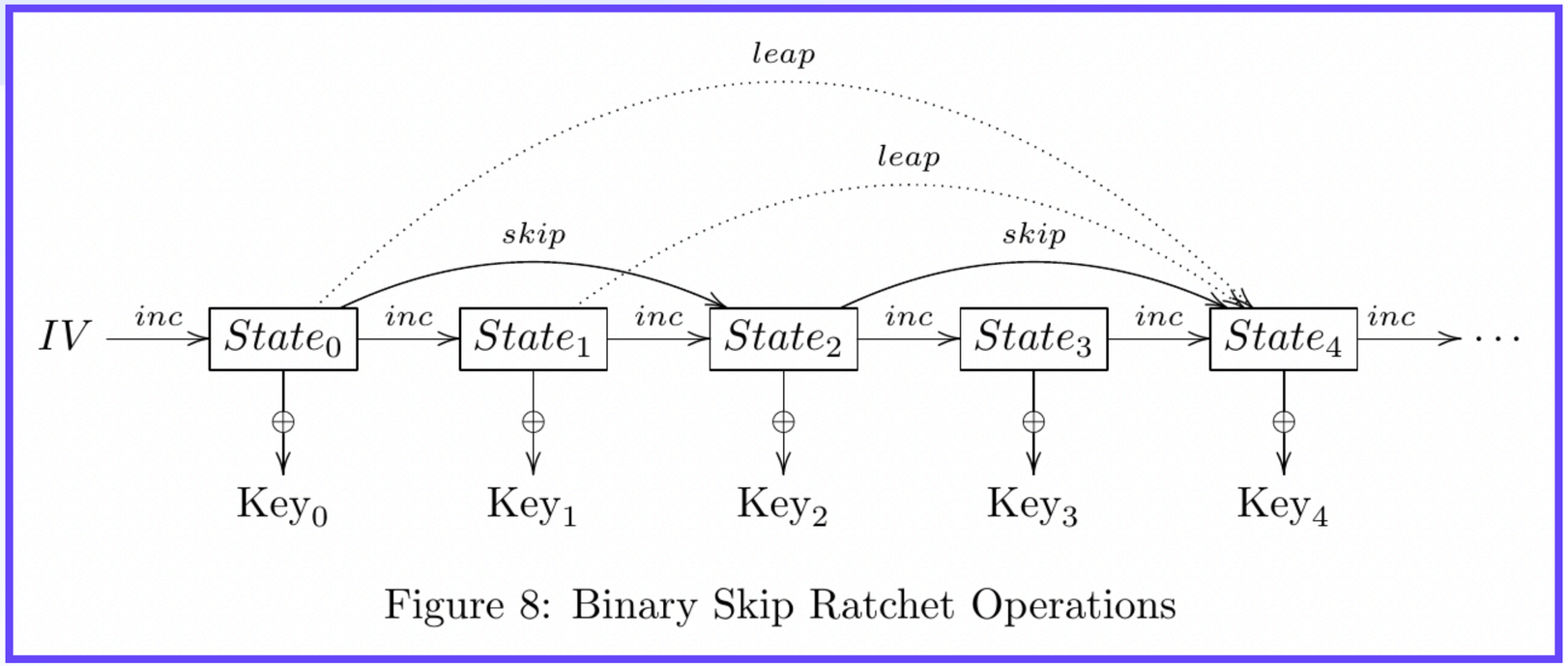

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File System

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current rev + 2^n

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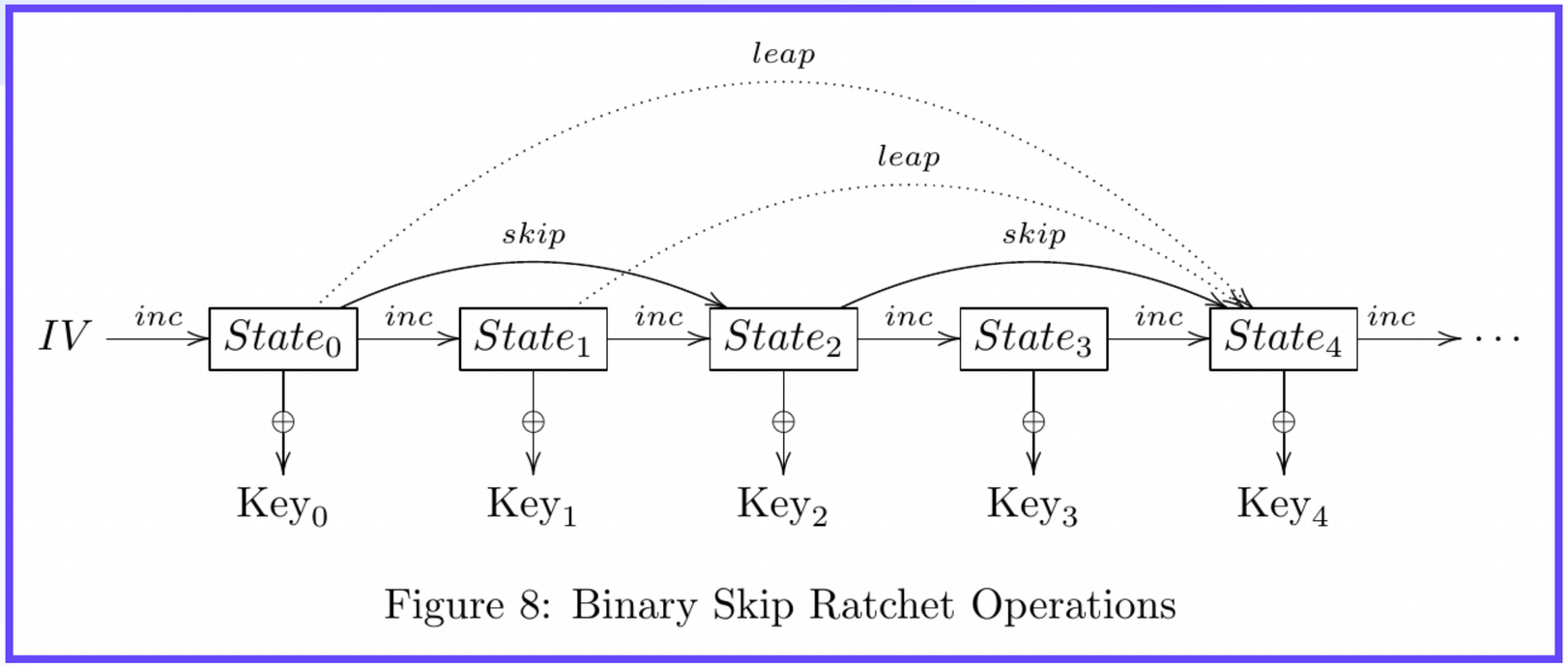

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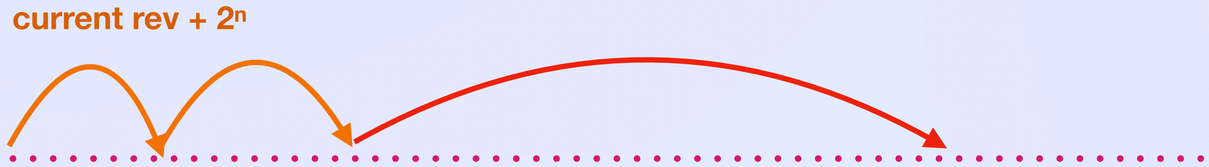

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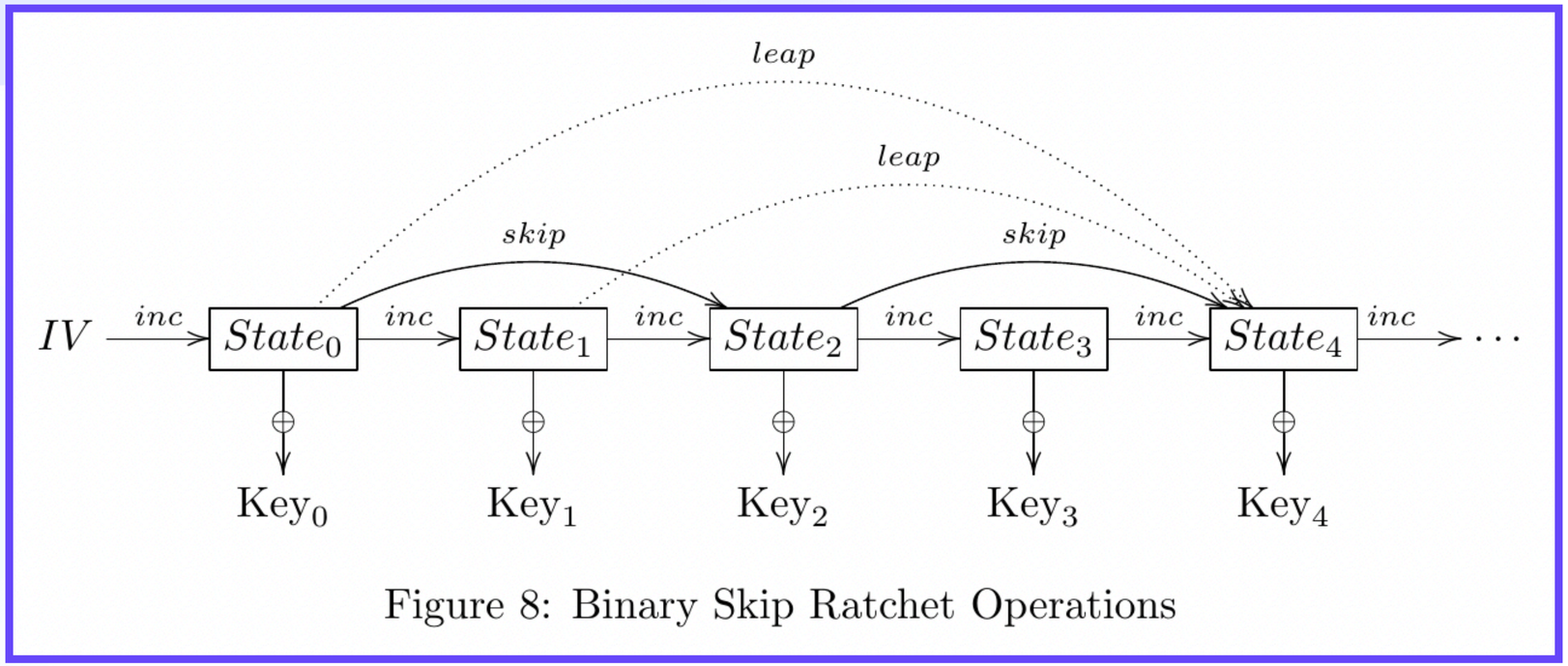

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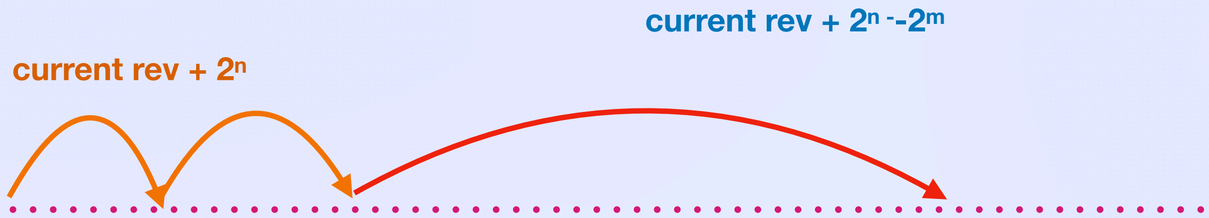

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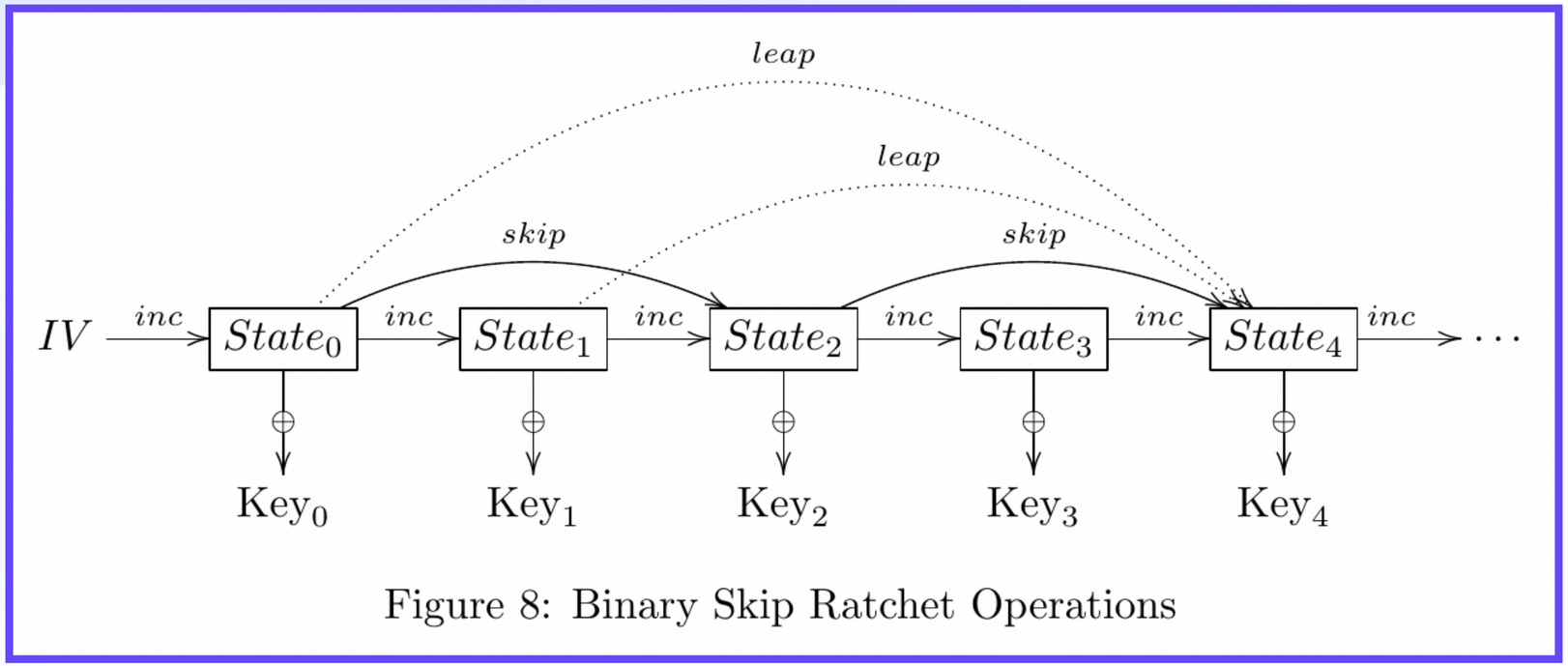

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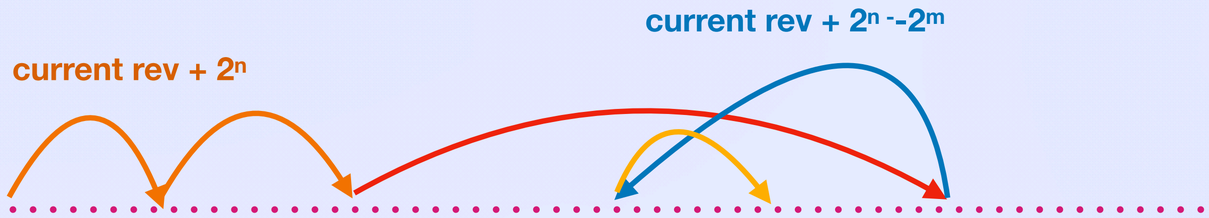

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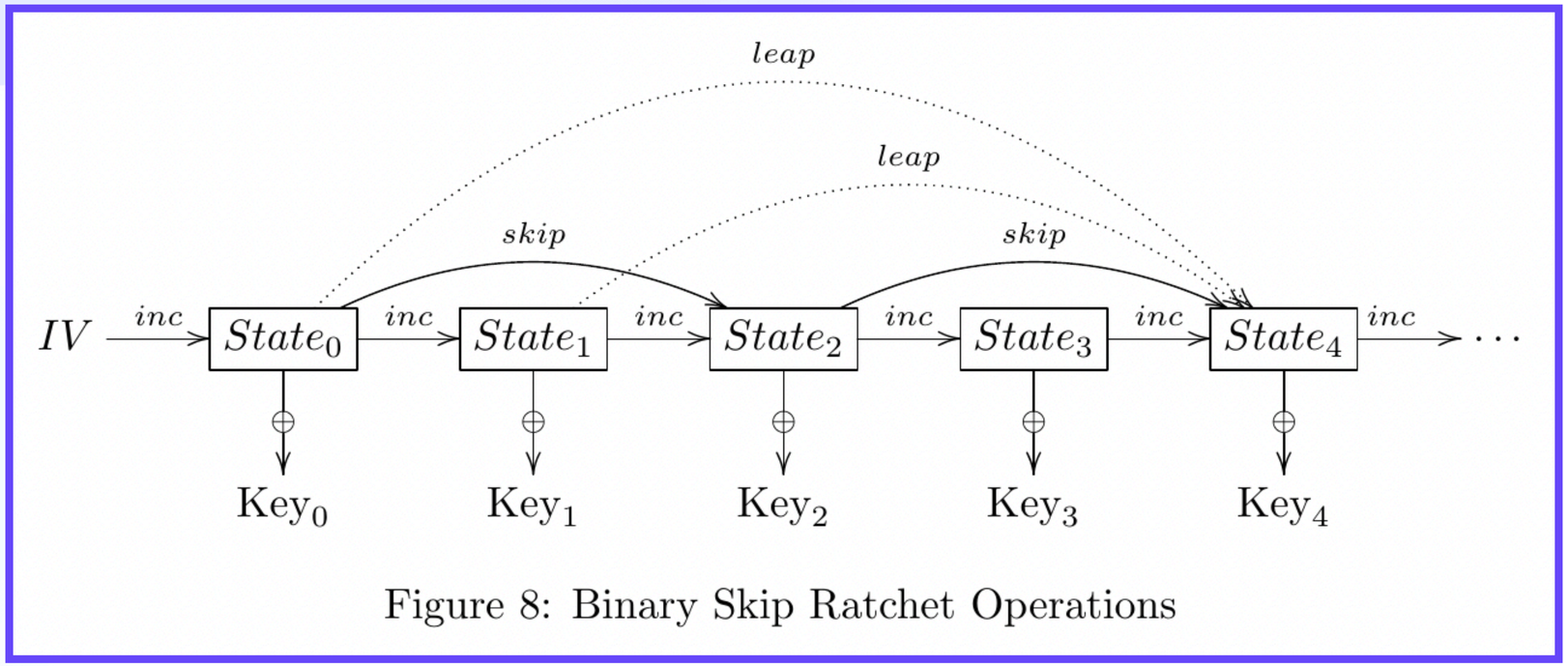

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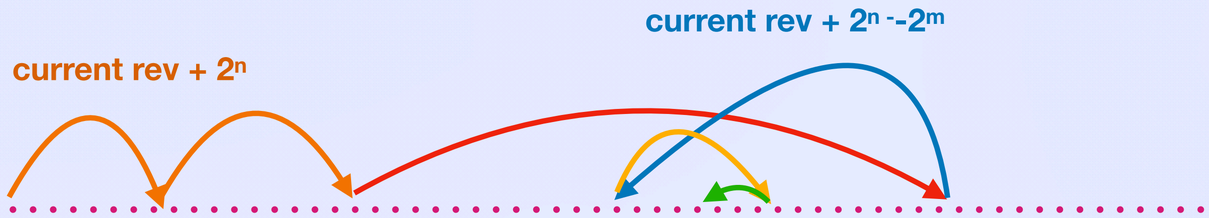

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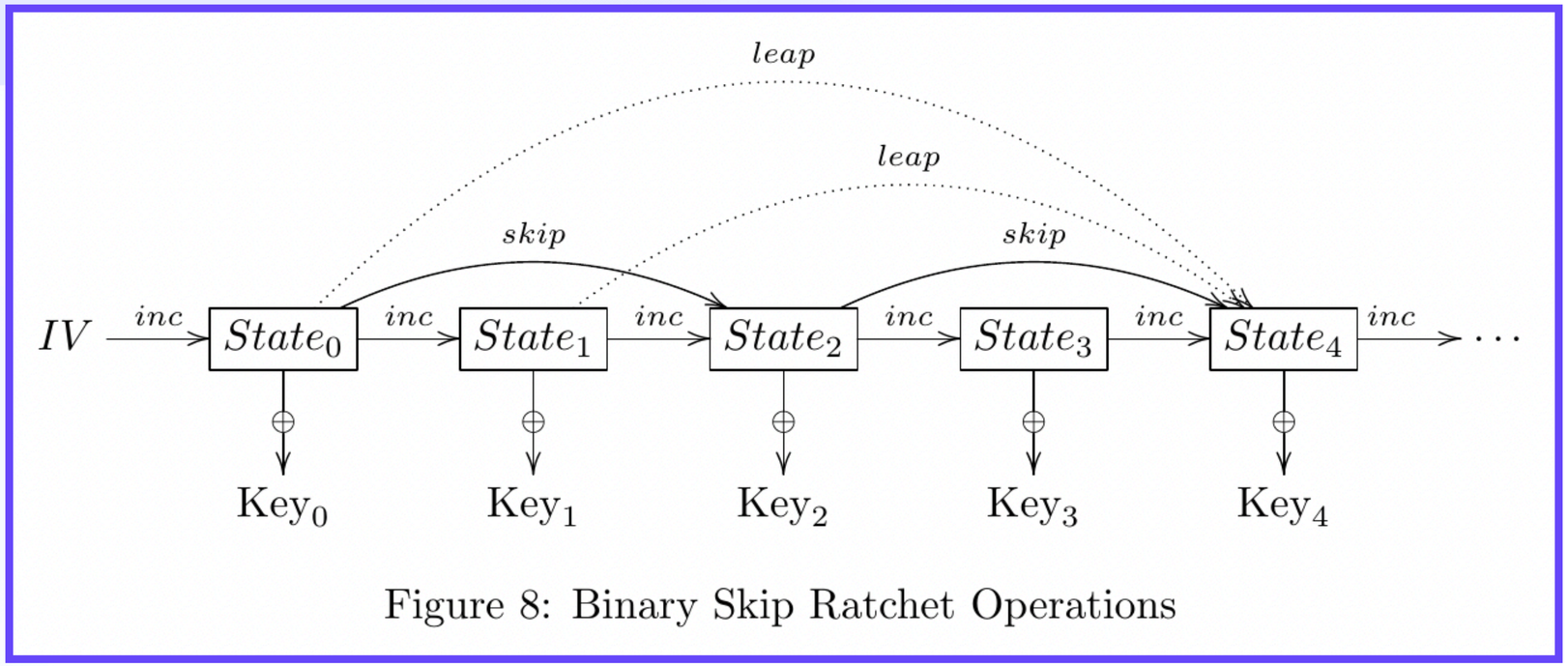

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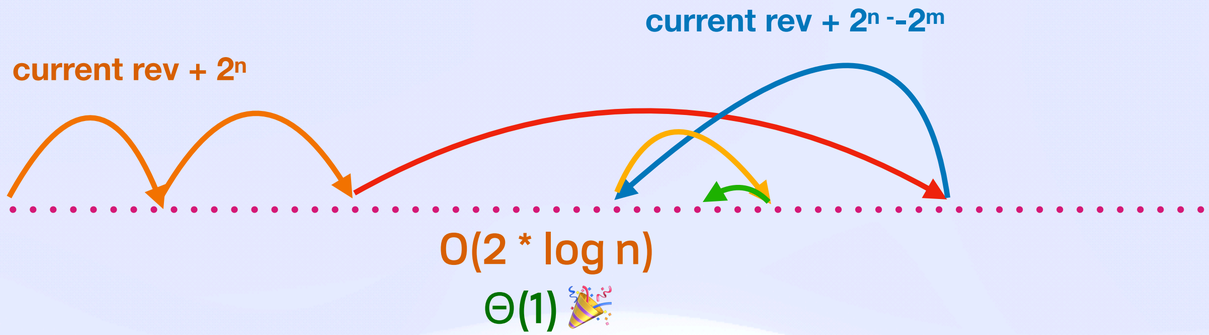

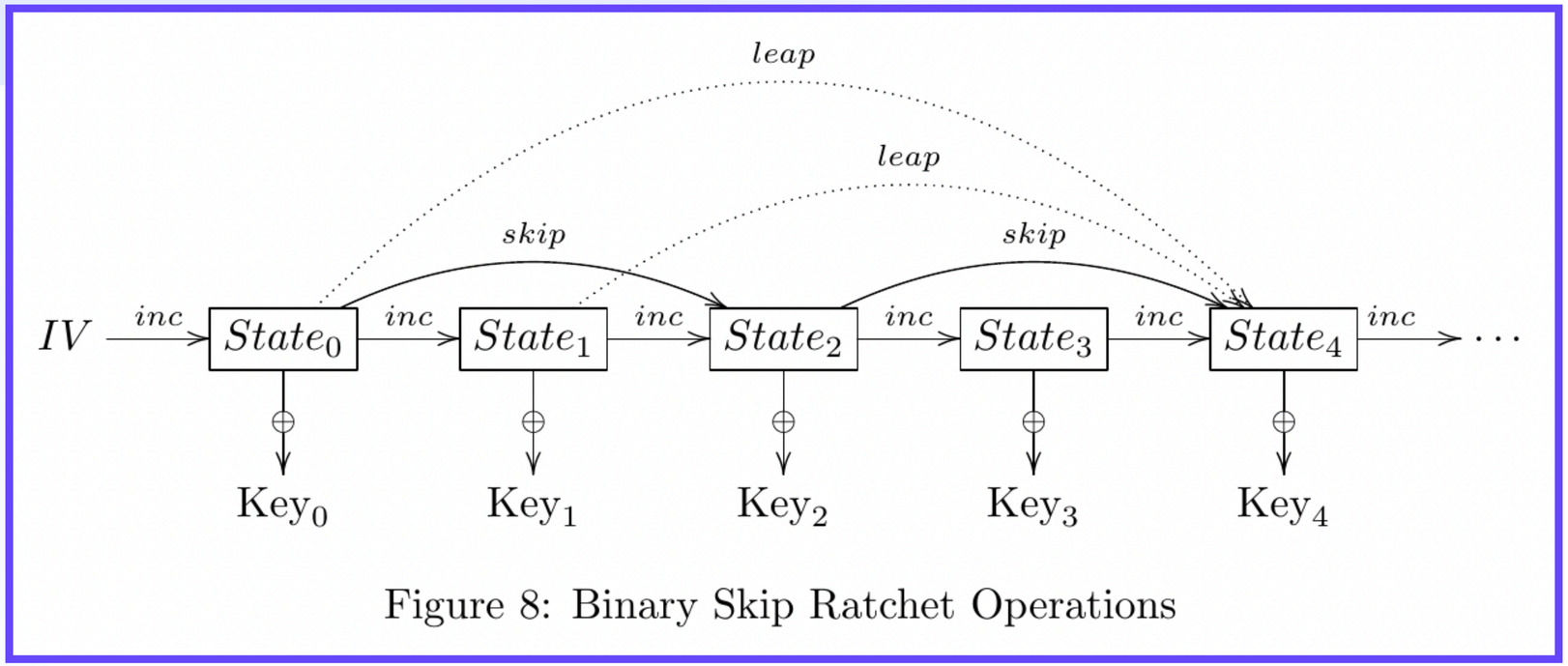

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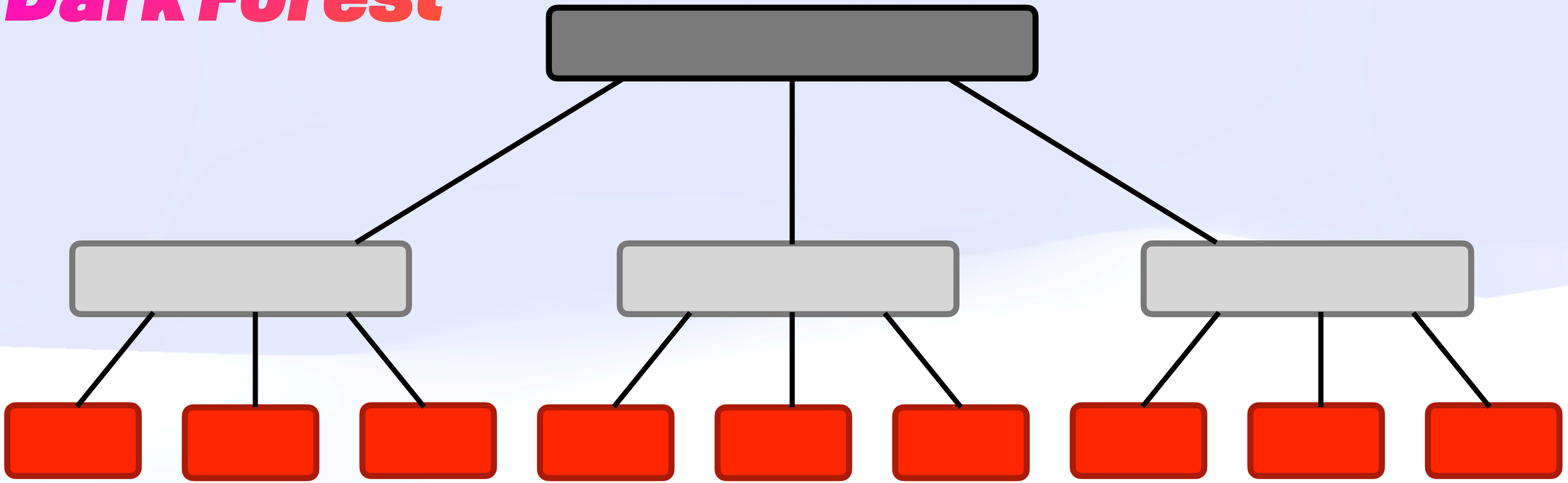
File System

Dark Forest



File System

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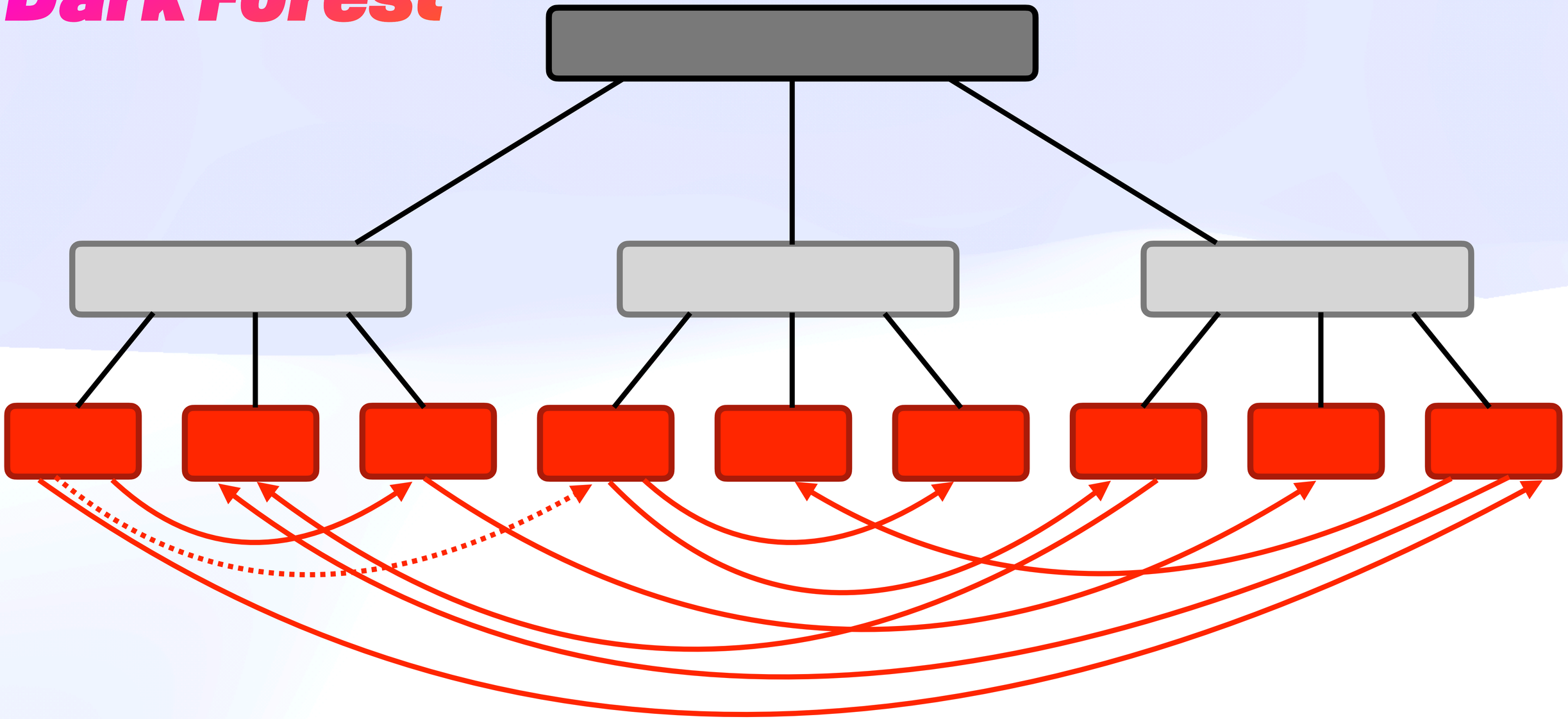


File System

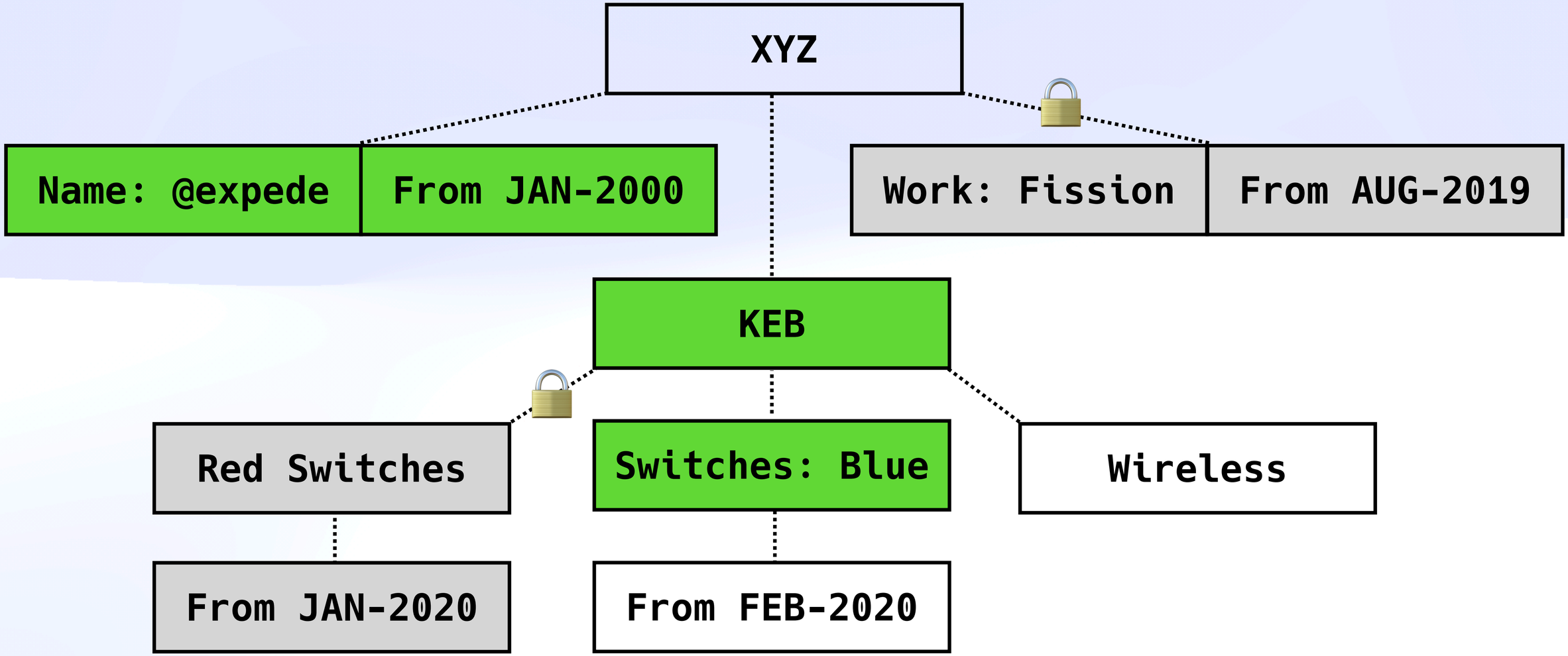
WebNative is Carcinising

Preview: Codename "Dialog"

Embarrassingly Parallel Multiverse Database

Preview: Codename "Dialog"

Property Graph



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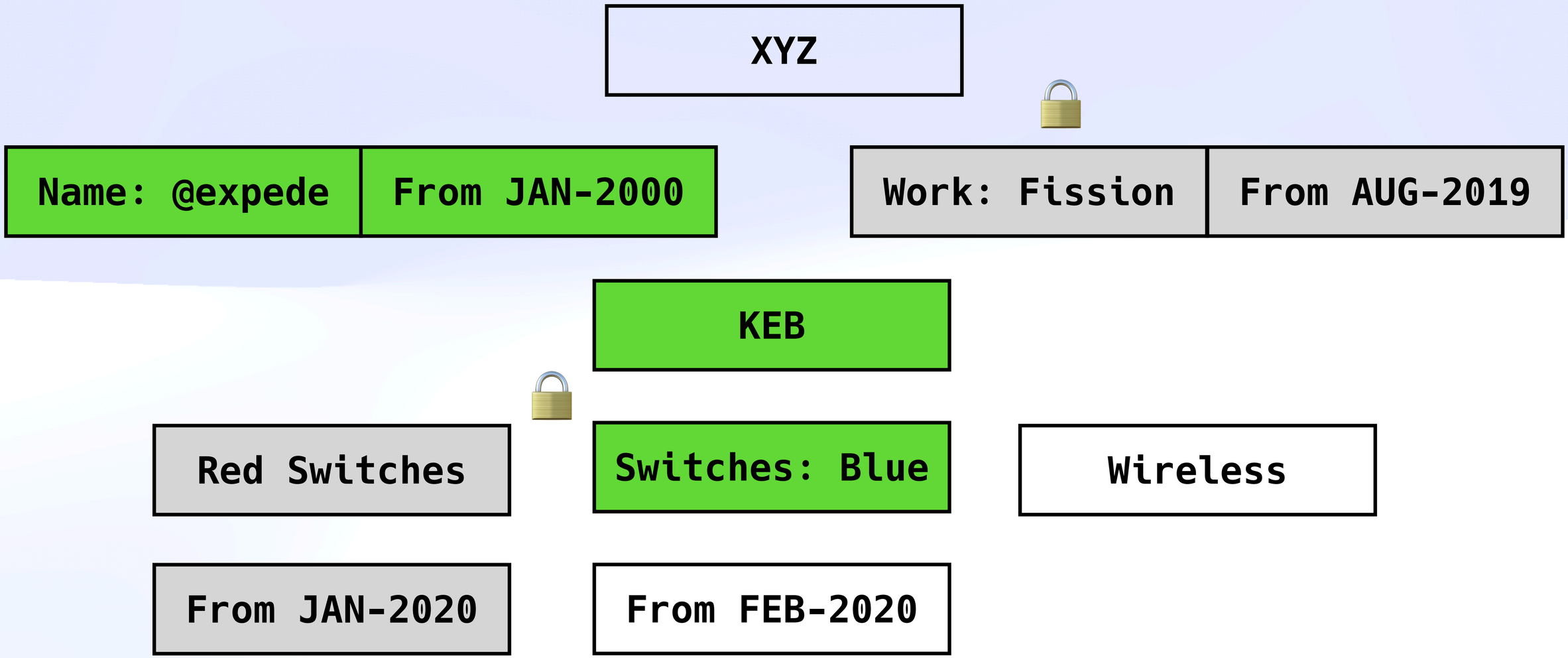


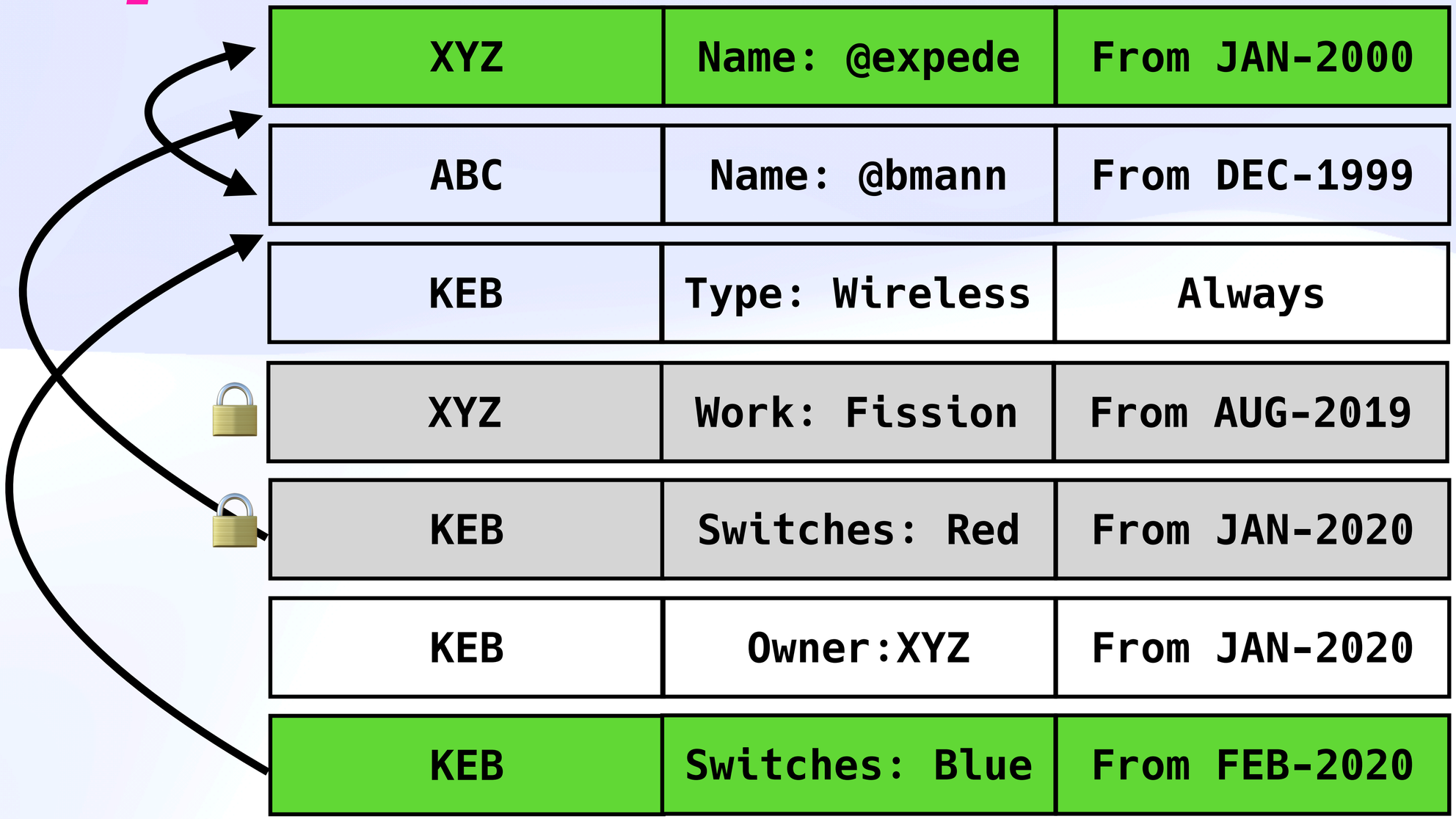
Preview: Codename "Dialog"

A Sequel to SQL: Nonlinear DBs

XYZ	Name: @expede	From JAN-2000
ABC	Name: @bmann	From DEC-1999
KEB	Type: Wireless	Always
XYZ	Work: Fission	From AUG-2019
KEB	Switches: Red	From JAN-2020
KEB	Owner:XYZ	From JAN-2020
KEB	Switches: Blue	From FEB-2020

Preview: Codename "Dialog"

A Sequel to SQL: Nonlinear DBs



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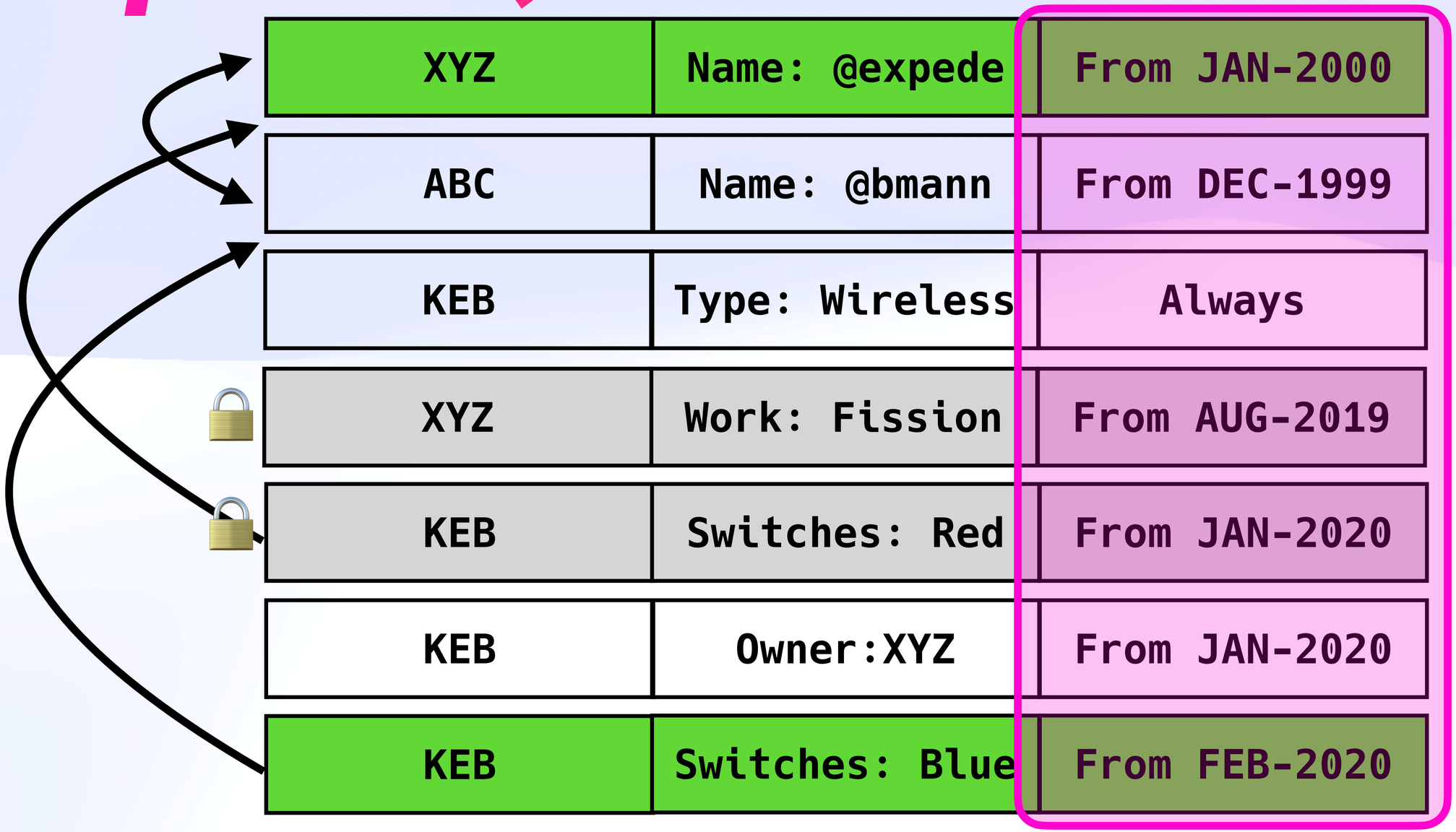

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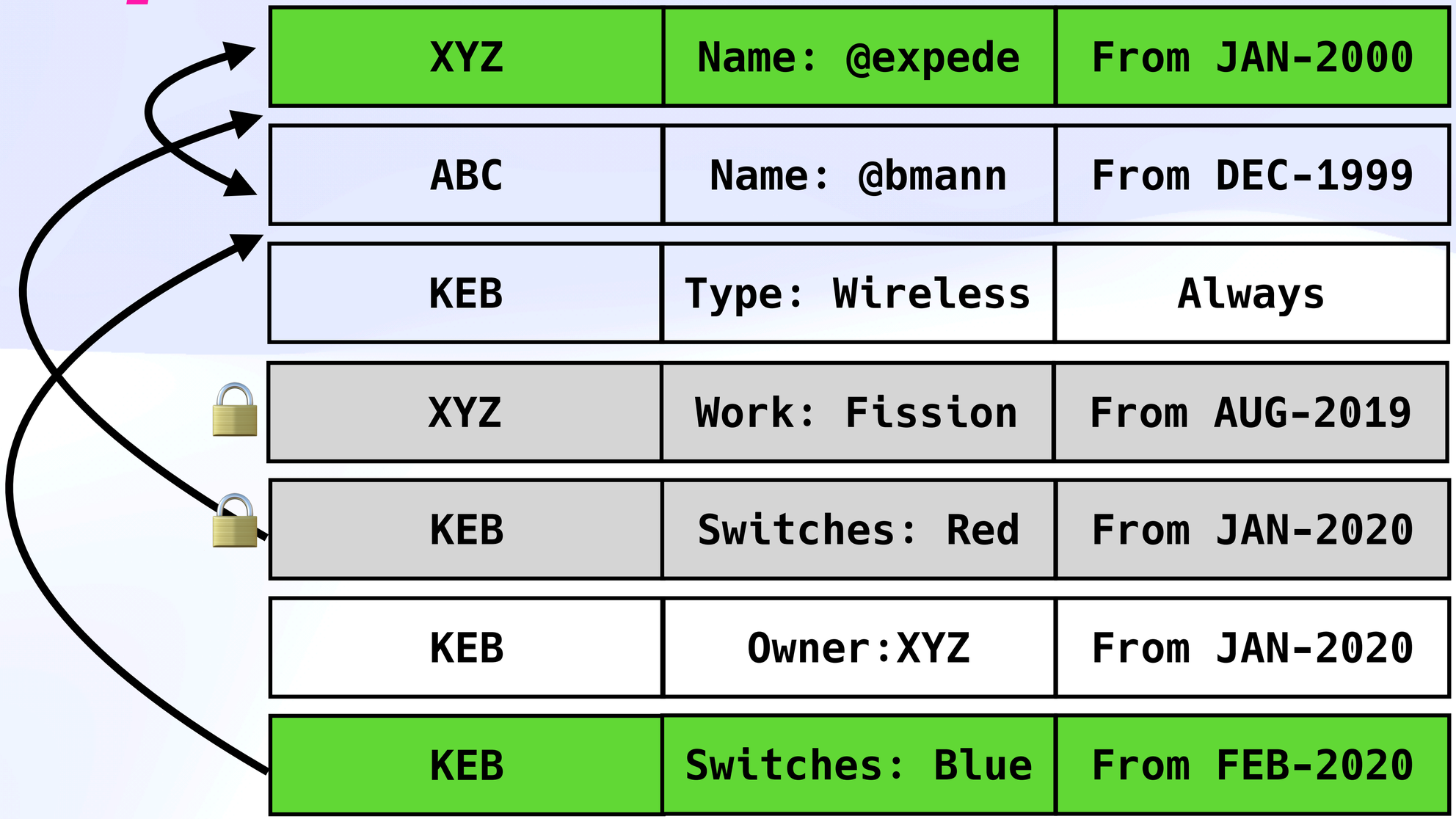

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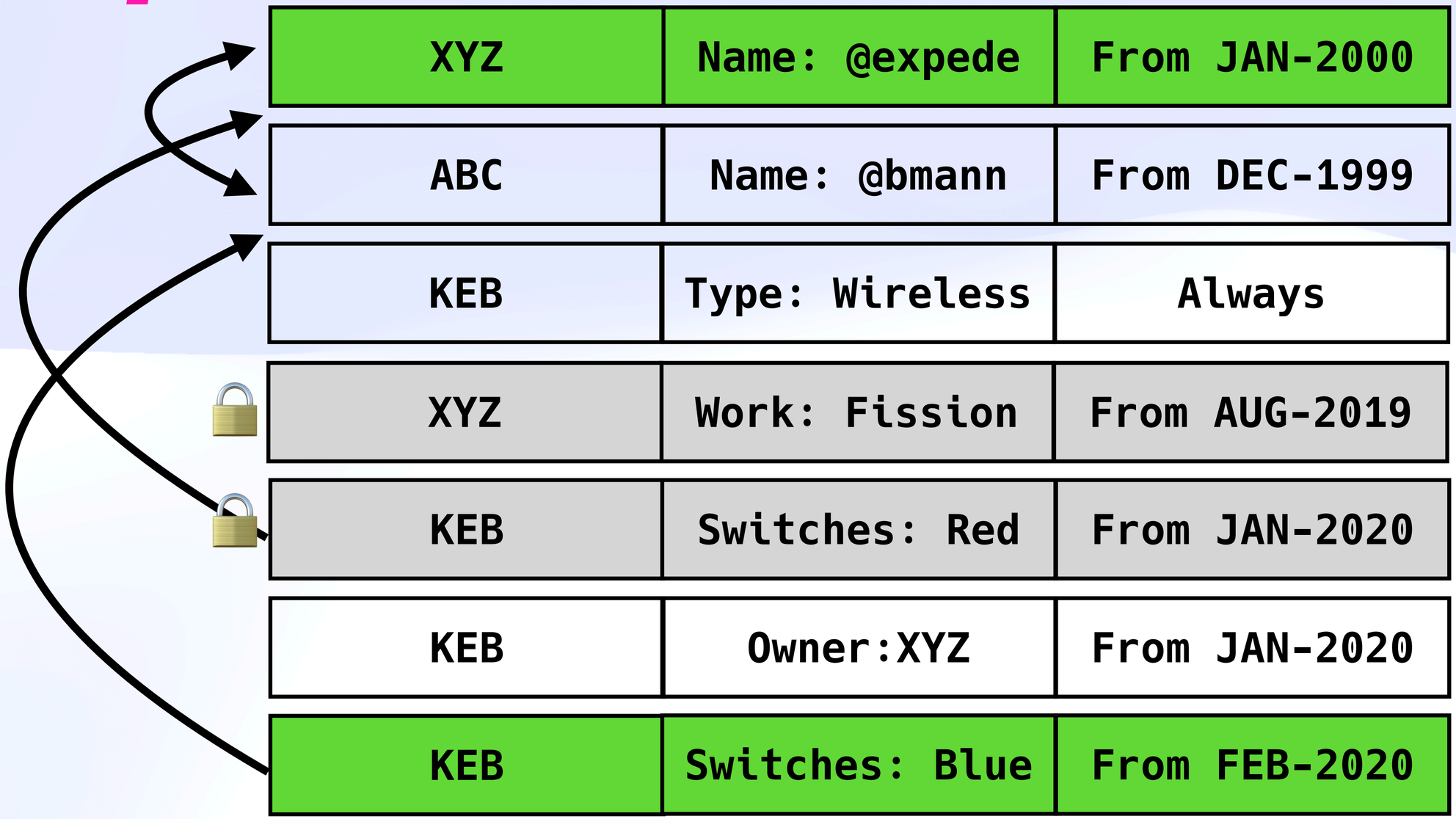
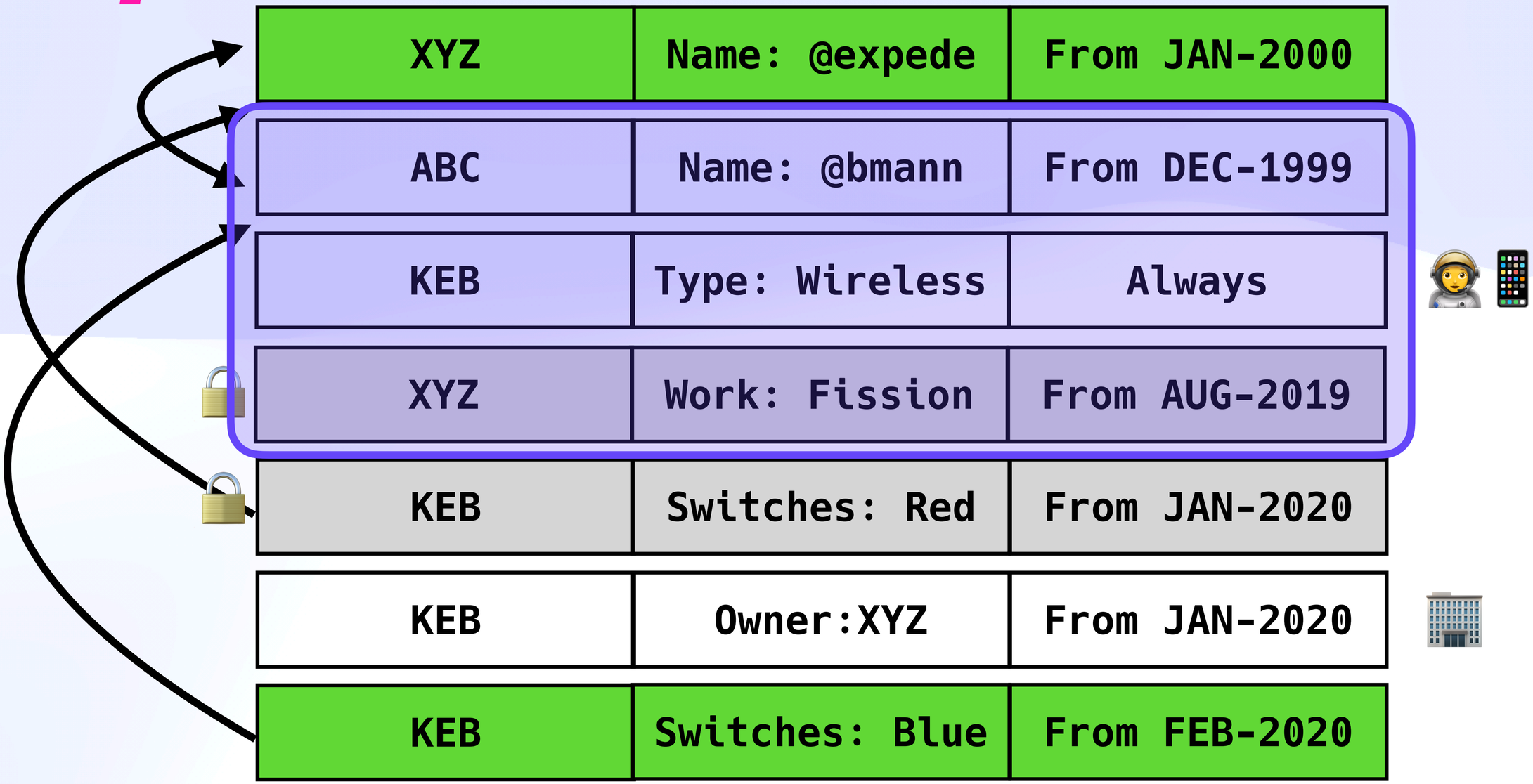


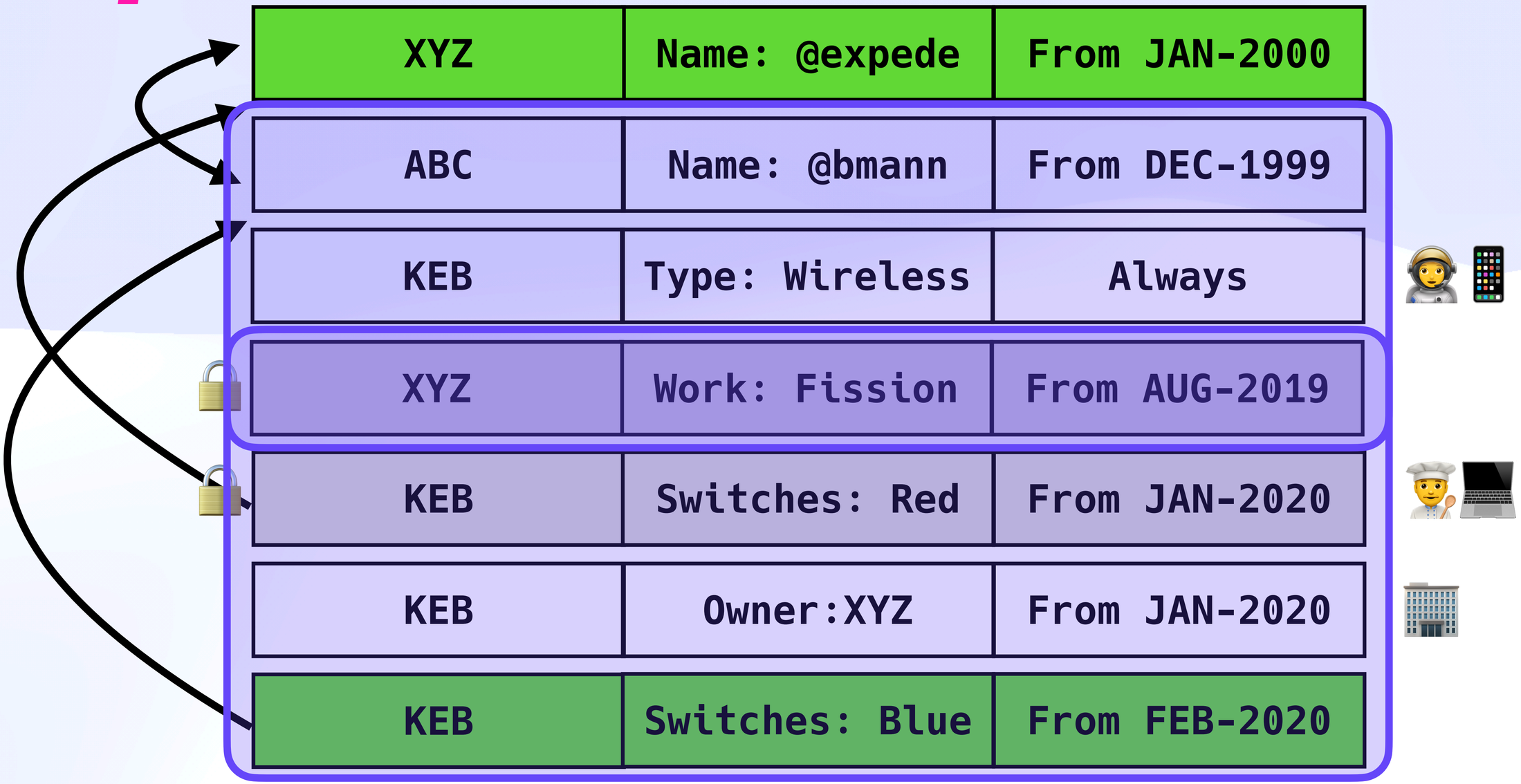
Preview: Codename "Dialog"

A Sequel to SQL: Nonlinear DBs



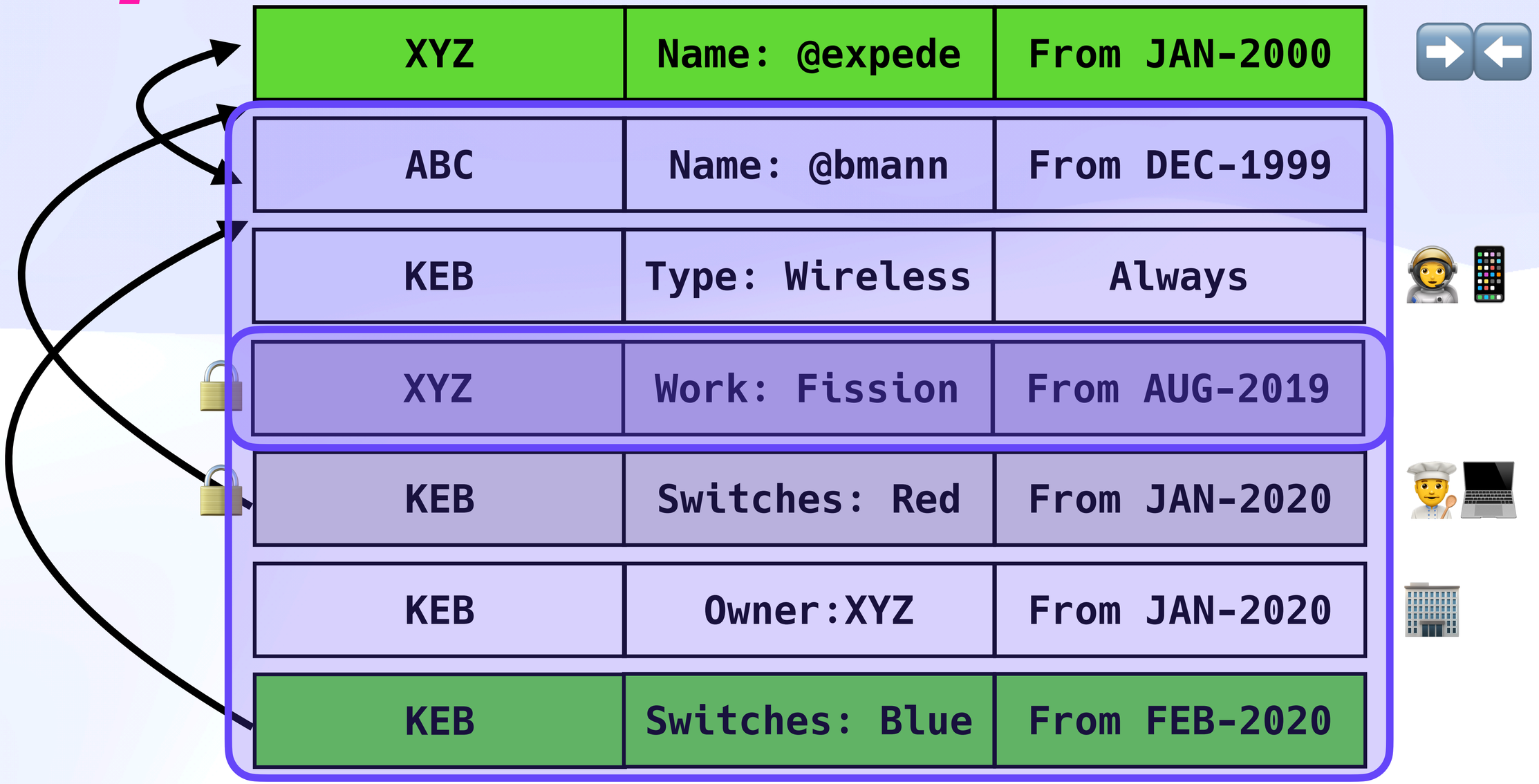
Preview: Codename "Dialog"

A Sequel to SQL: Nonlinear DBs



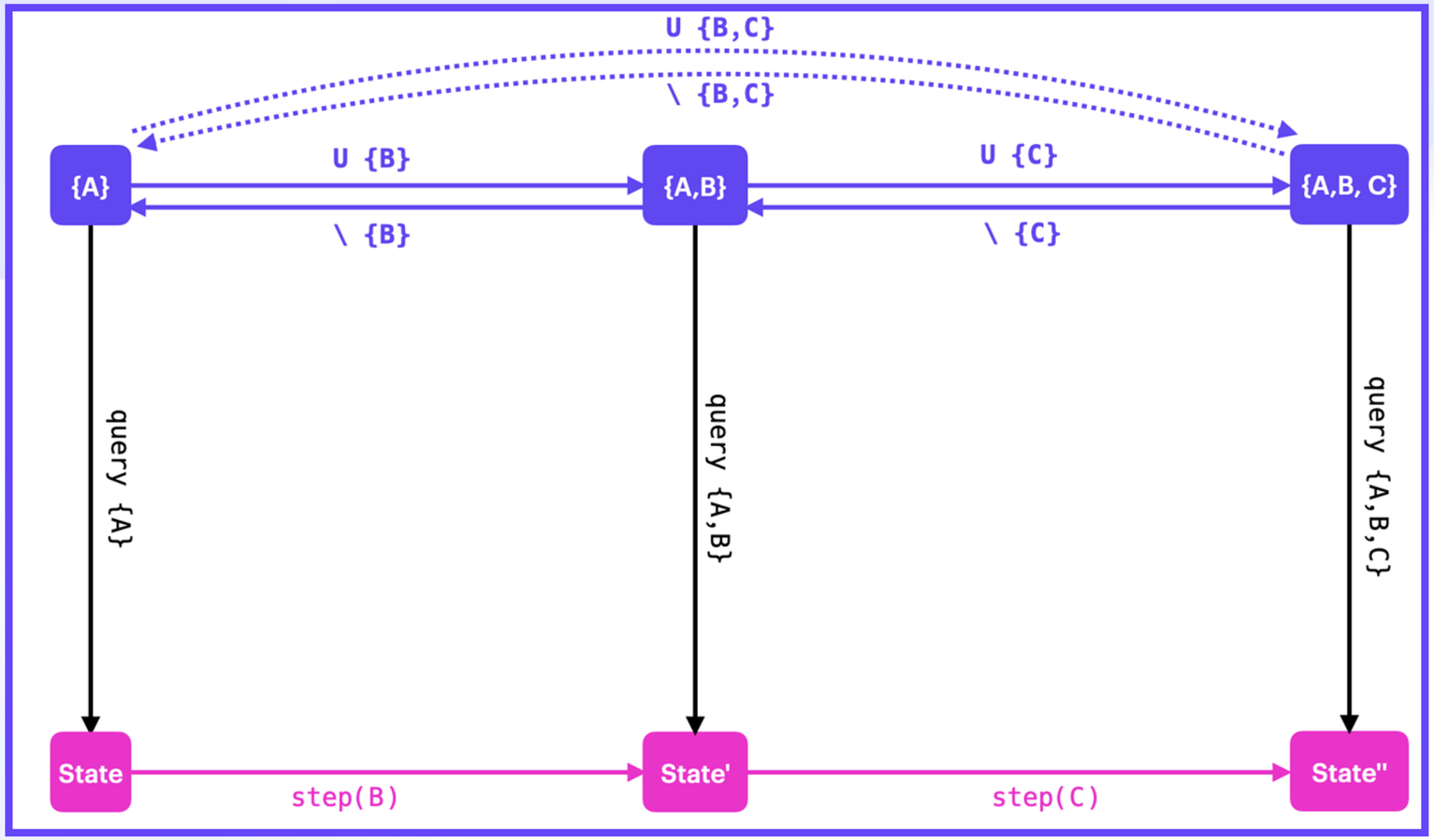
Preview: Codename "Dialog"

A Sequel to SQL: Nonlinear DBs



Preview: Codename "Dialog"

Scale, Aggregation, & Real Time

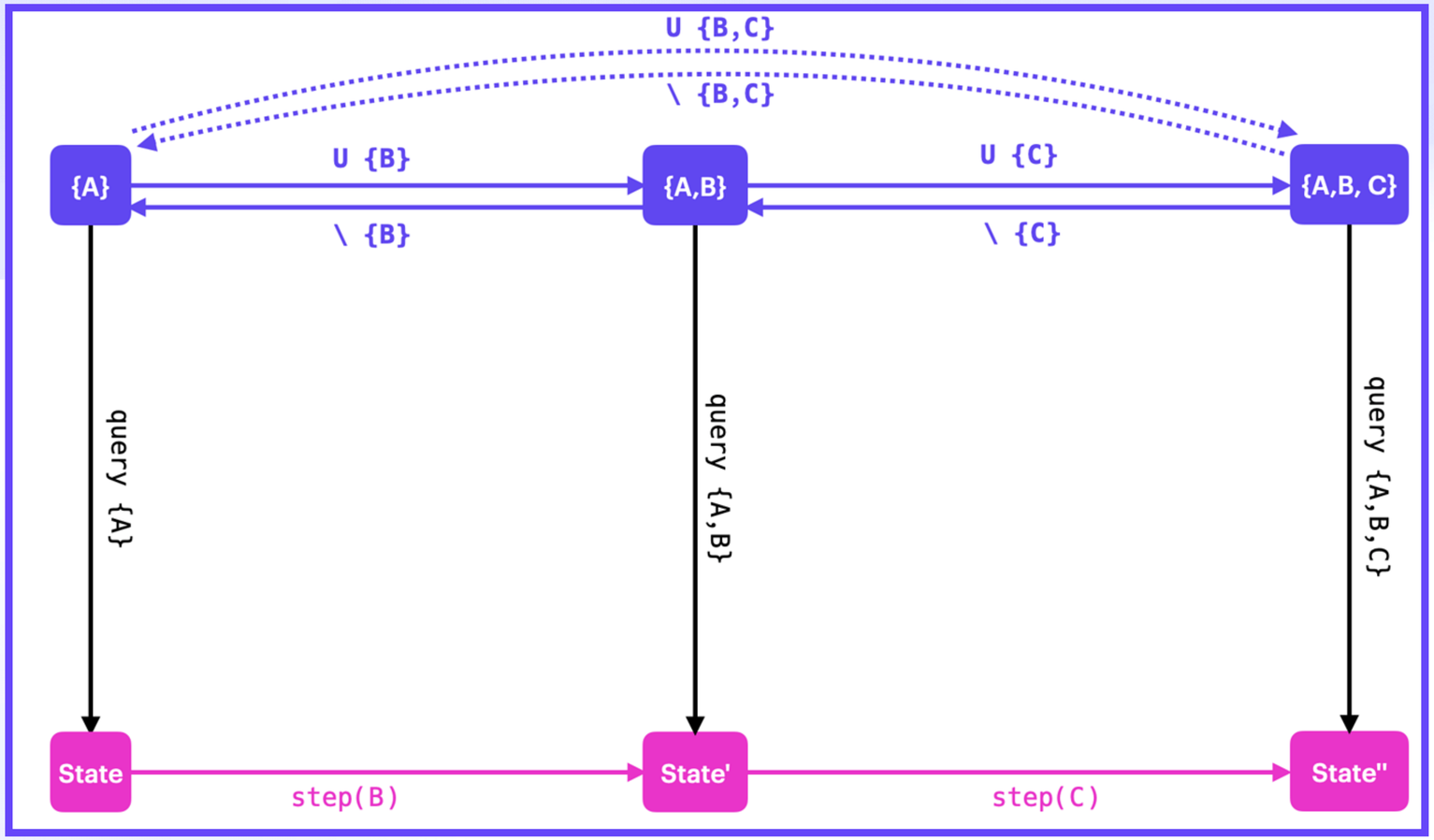


Global: Aggregation, Forms, Feeds
Gossip Broadcast

Collaboration, Chat, Instant Sync
Soft Realtime Store

Preview: Codename "Dialog"

Scale, Aggregation, & Real Time



Global: Aggregation, Forms, Feeds

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🎉 Thank You, IPFS þing 🇮🇸

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✨ white paper.fission.codes ✨

✨ github.com/ucan-wg ✨

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