🪐 The Dark Forest 🚀

A Distributed File System for Secure P2P Applications

github.com/wnfs-wg
github.com/fission-codes

Brooklyn Zelenka

@expede

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@expede

- Cofounder & CTO at Fission
  - @FissionCodes
  - https://fission.codes
  - Infra & SDK for edge apps
- Standards: UCAN, EIPs, FVM, Multiformats, CAR Pool, WNFS,&c

Meta

WNFS

Meta

WNFS

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WNFS

- First principles, flipped tradeoffs
- "Can't be done" → super hard but ***works & scales!***
- Sharp corners
- Under explored design space
  - Databases, blind busses, nym servers, etc
- Novel ways to recombine a few ideas

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Video Killed the Radio Star

A New Environment

A New Environment 🏝️

New Environment, Who Dis?

A New Environment 🏝️

New Environment, Who Dis?

	Then 📠	Now 🚀

A New Environment 🏝️

New Environment, Who Dis?

	Then 🖷	Now 🚀
Need	Convenient 🤷‍♀️	Critical 🚨

A New Environment 🏝️

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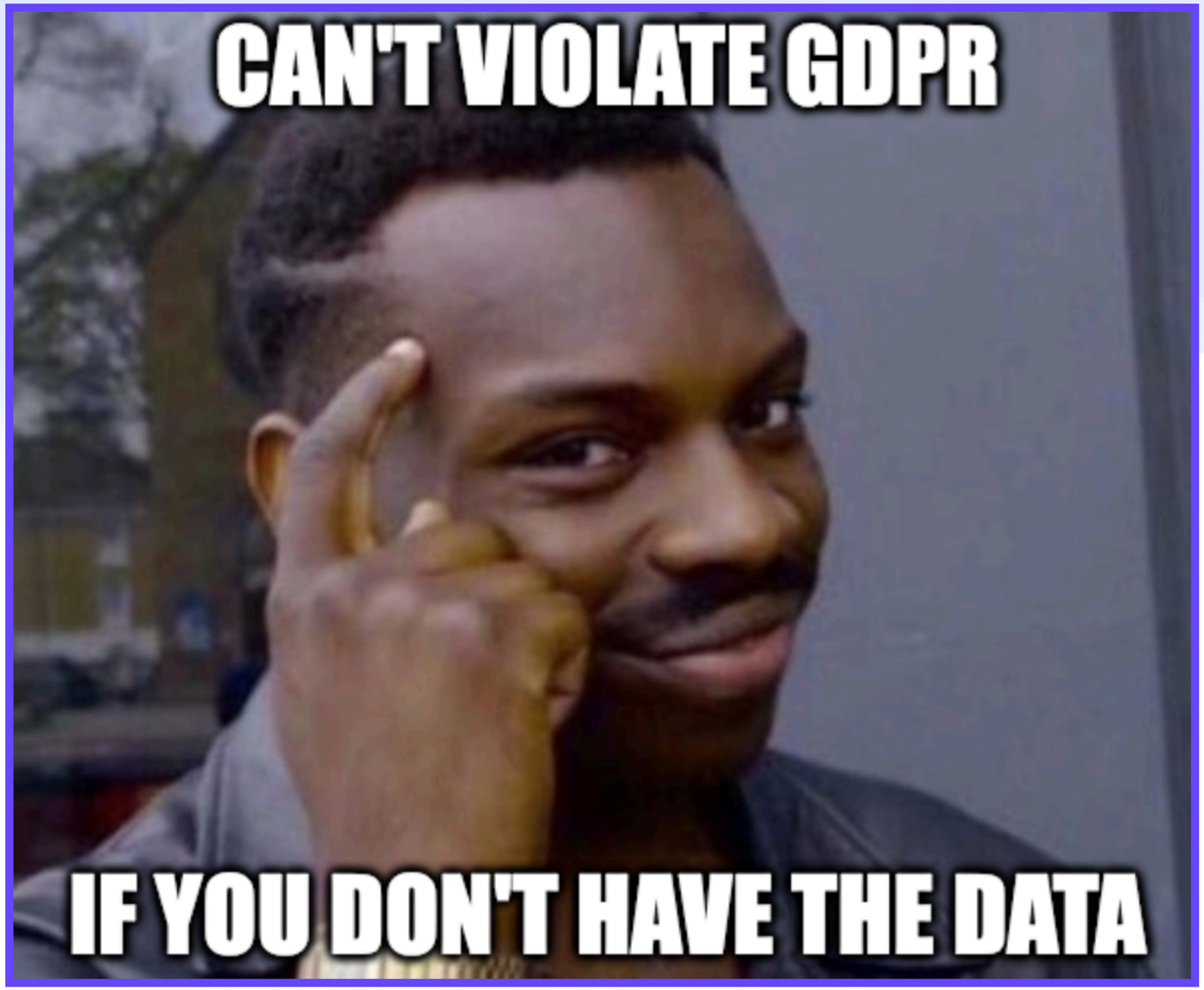
Market	🇺🇸🇪🇺	🌎🌍🌏 … 🌕

A New Environment 🏝️

Toxic Data

- **2005:** Credit card data in DB
- **2015:** Personal info in DB
- **2025:** Nothing in DB



A New Environment 🏝️

What LAMP Has Wrought

A New Environment 🏝️

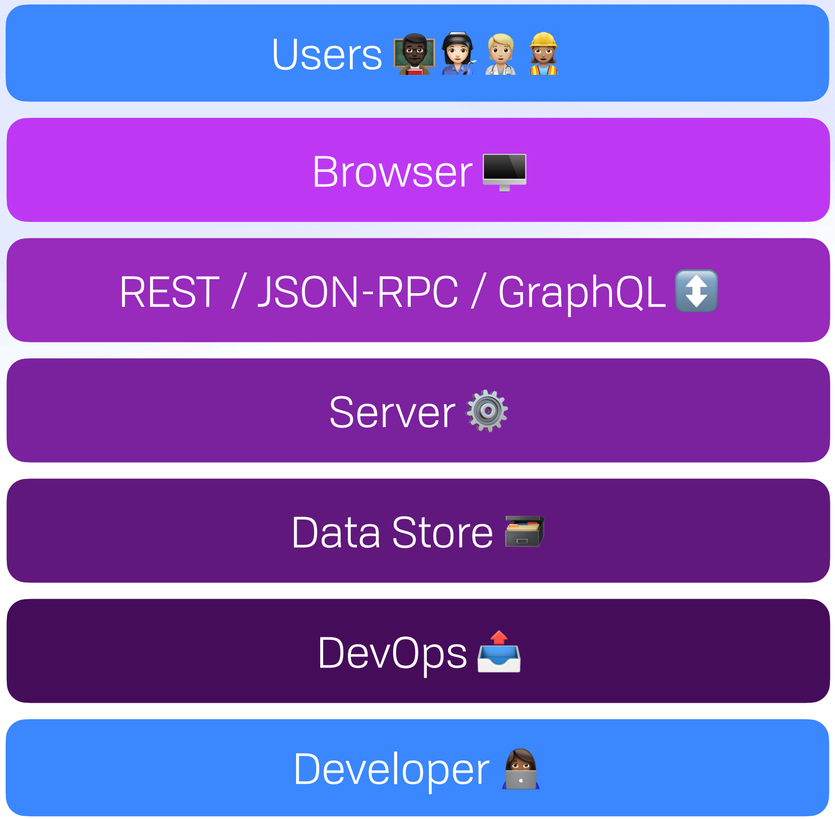
What LAMP Has Wrought

Users 👩🏿‍💻👩🏻‍🔧👨🏼‍💼👷

Developer 👩🏾‍💻

A New Environment 🏝️

What LAMP Has Wrought



A New Environment 🏝️

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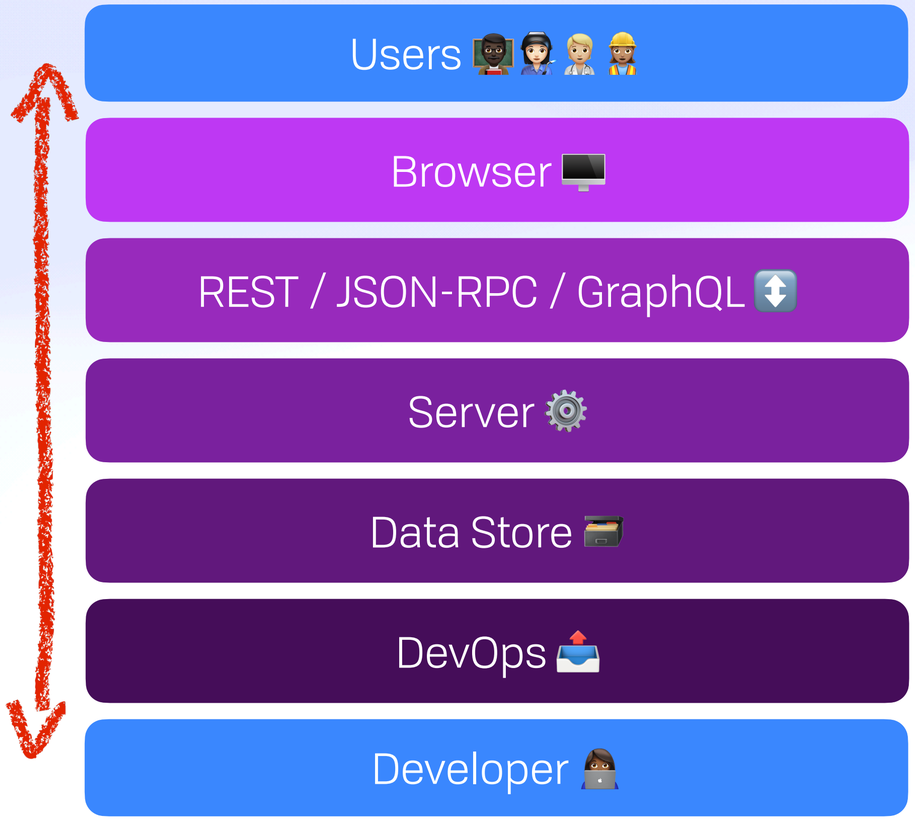

A New Environment 🏝️

Federate Data, Not Apps

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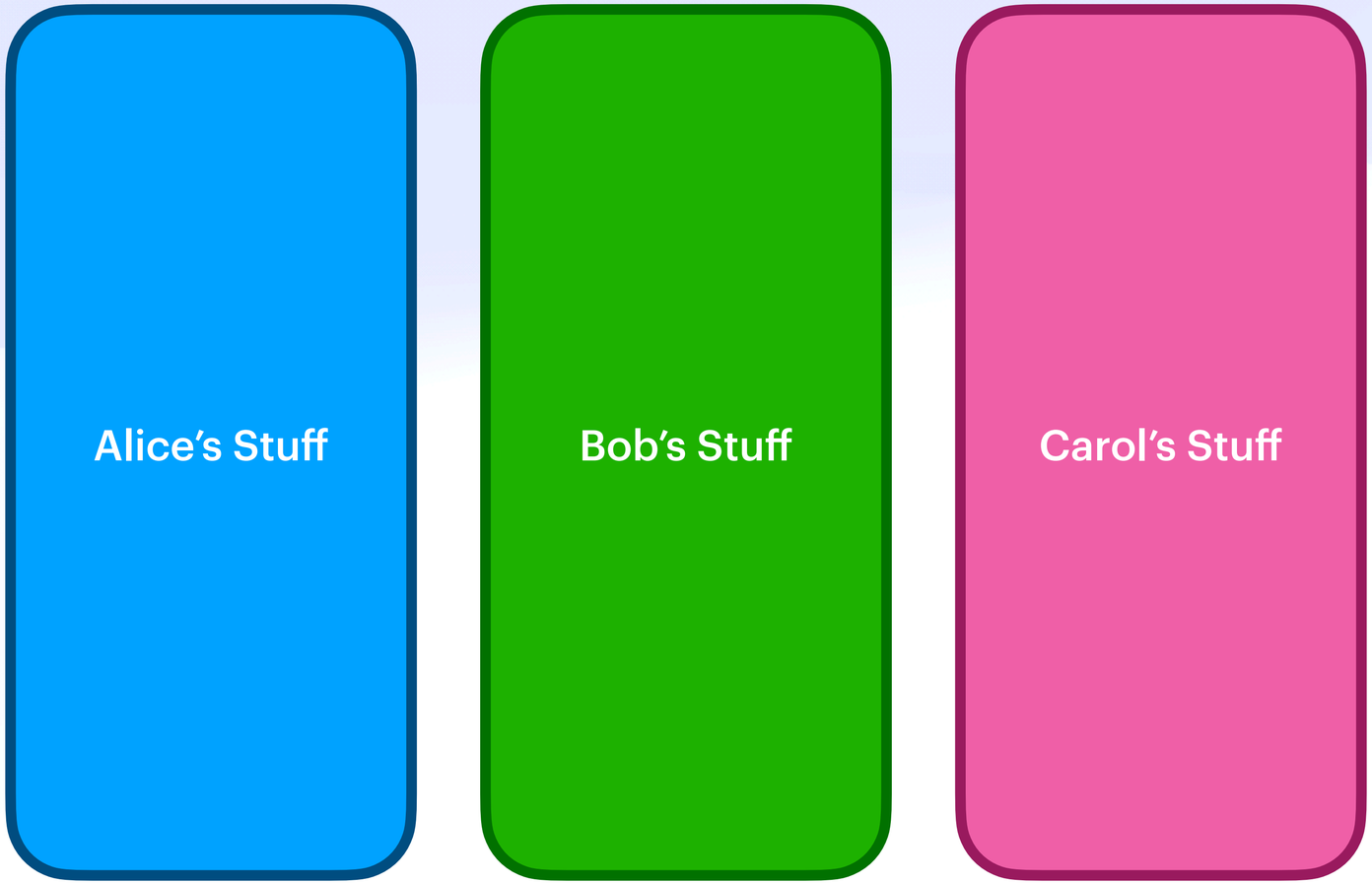

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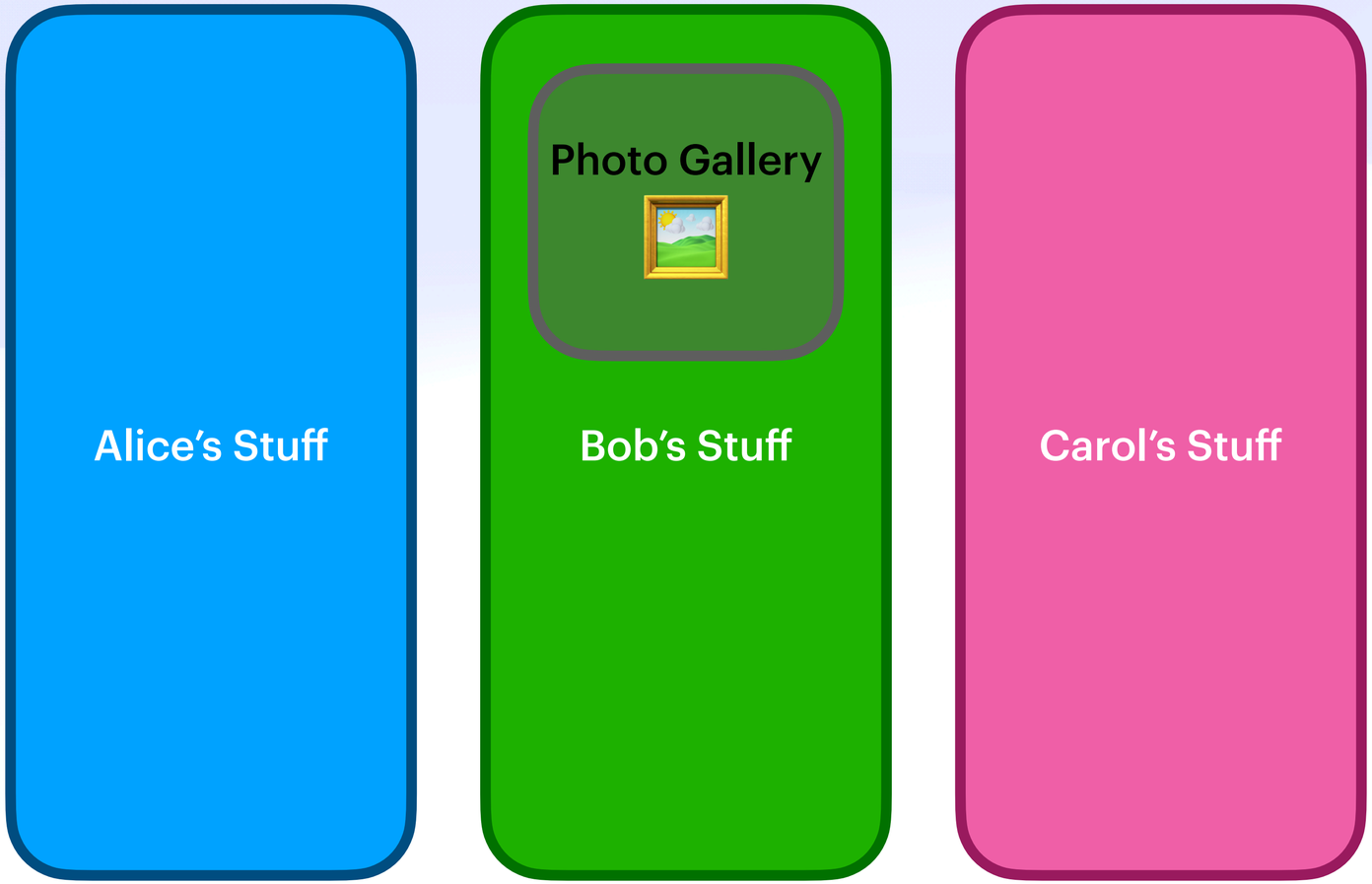

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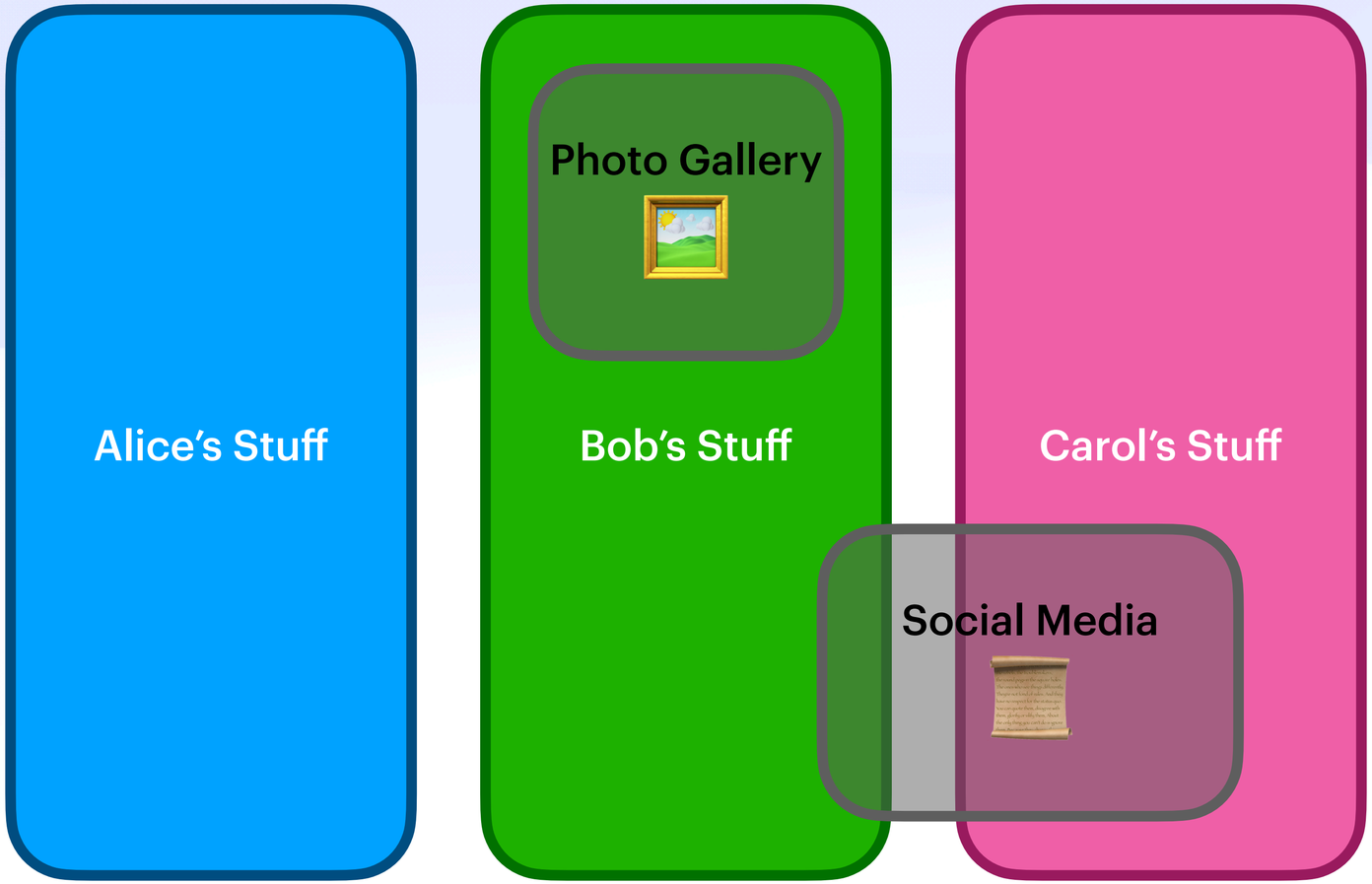

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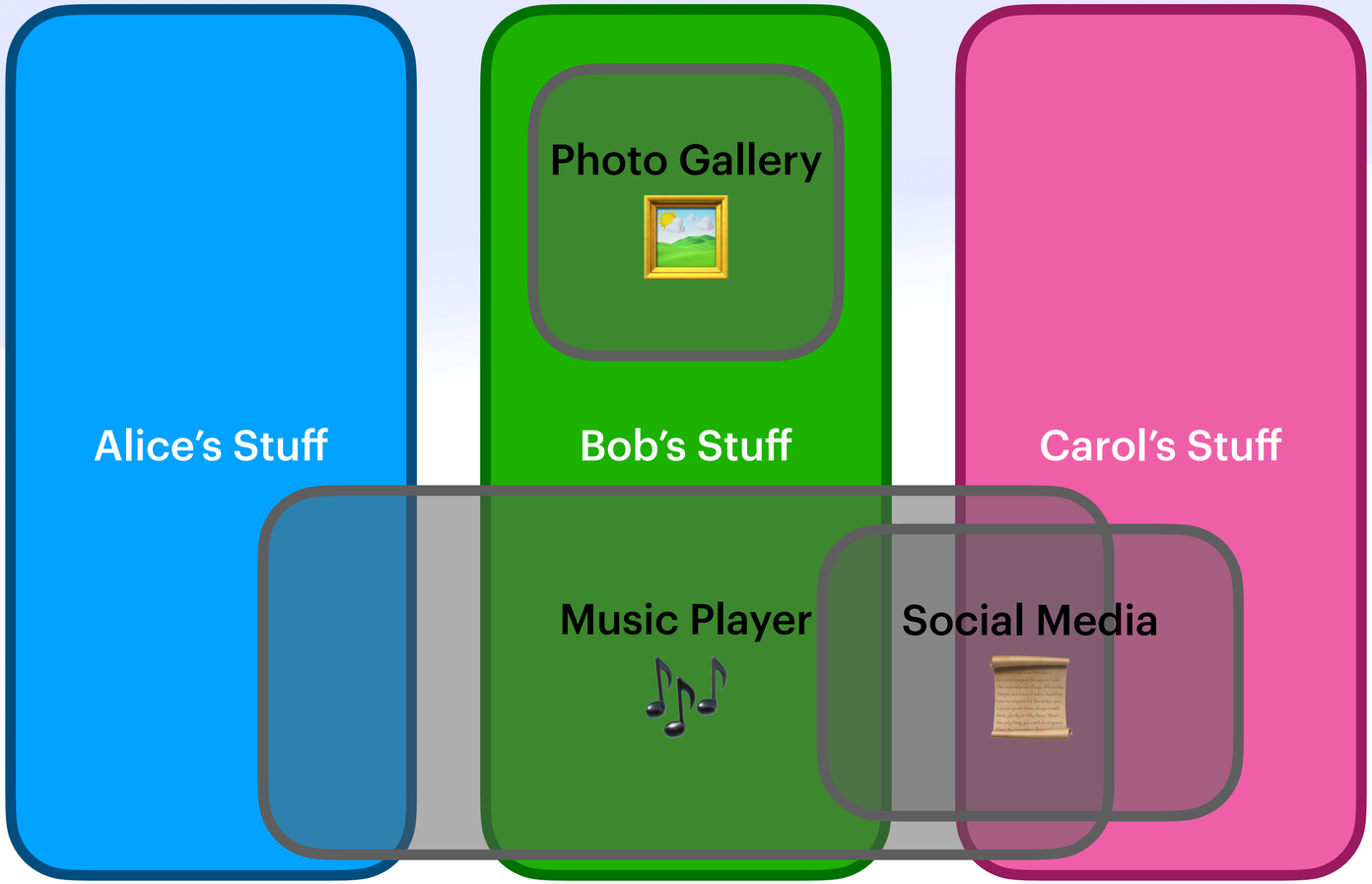

A New Environment 🏝️

Common Needs

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1. 🎟️ Local-first access control
2.  Arbitrary metadata
3. 🪄 Mutability
4. 🐣 Versioning (→ concurrency)

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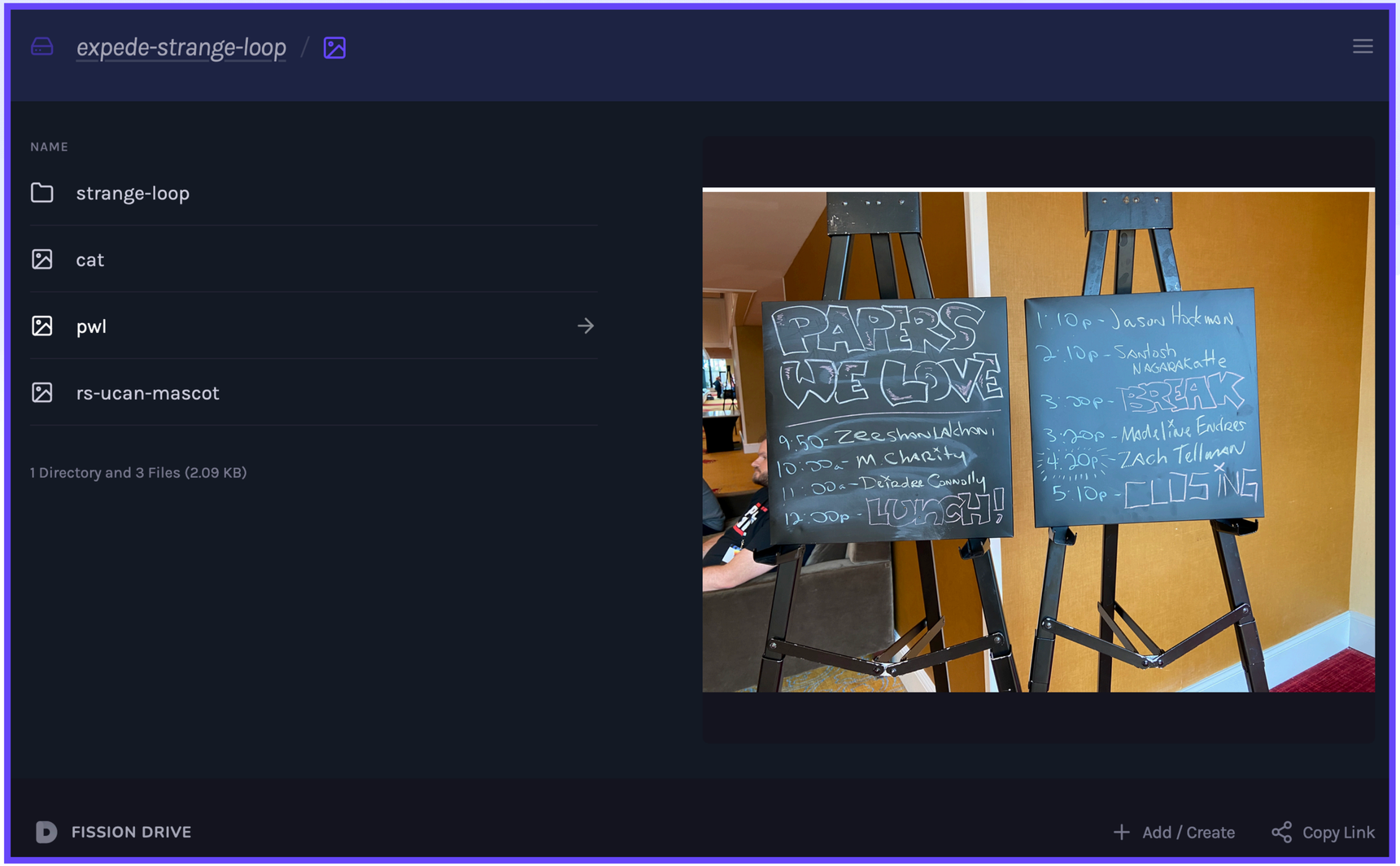

A New Environment 🏝️

Ideally Invisible & General

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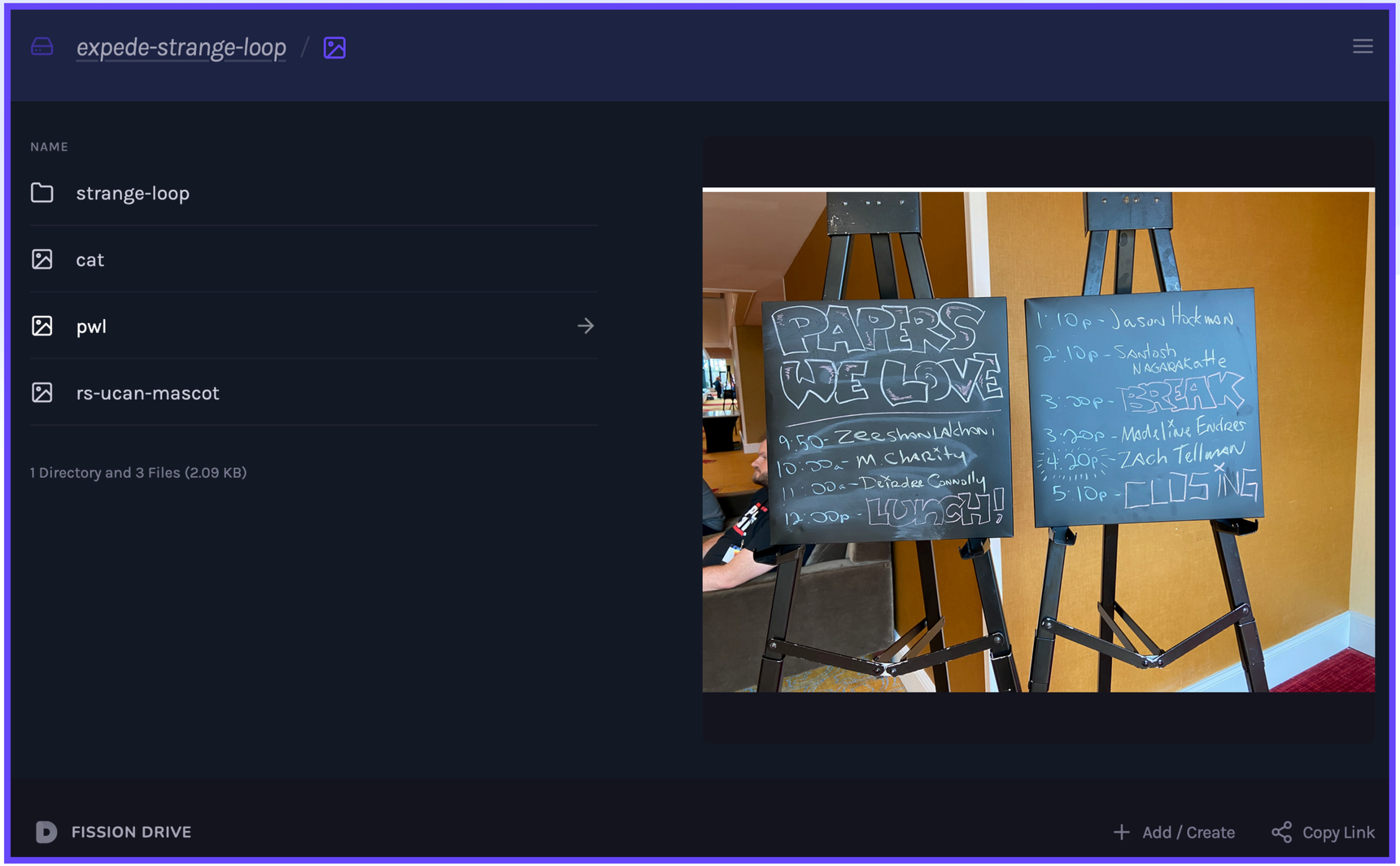
Tools for Thought
e.g. TiddlyWiki



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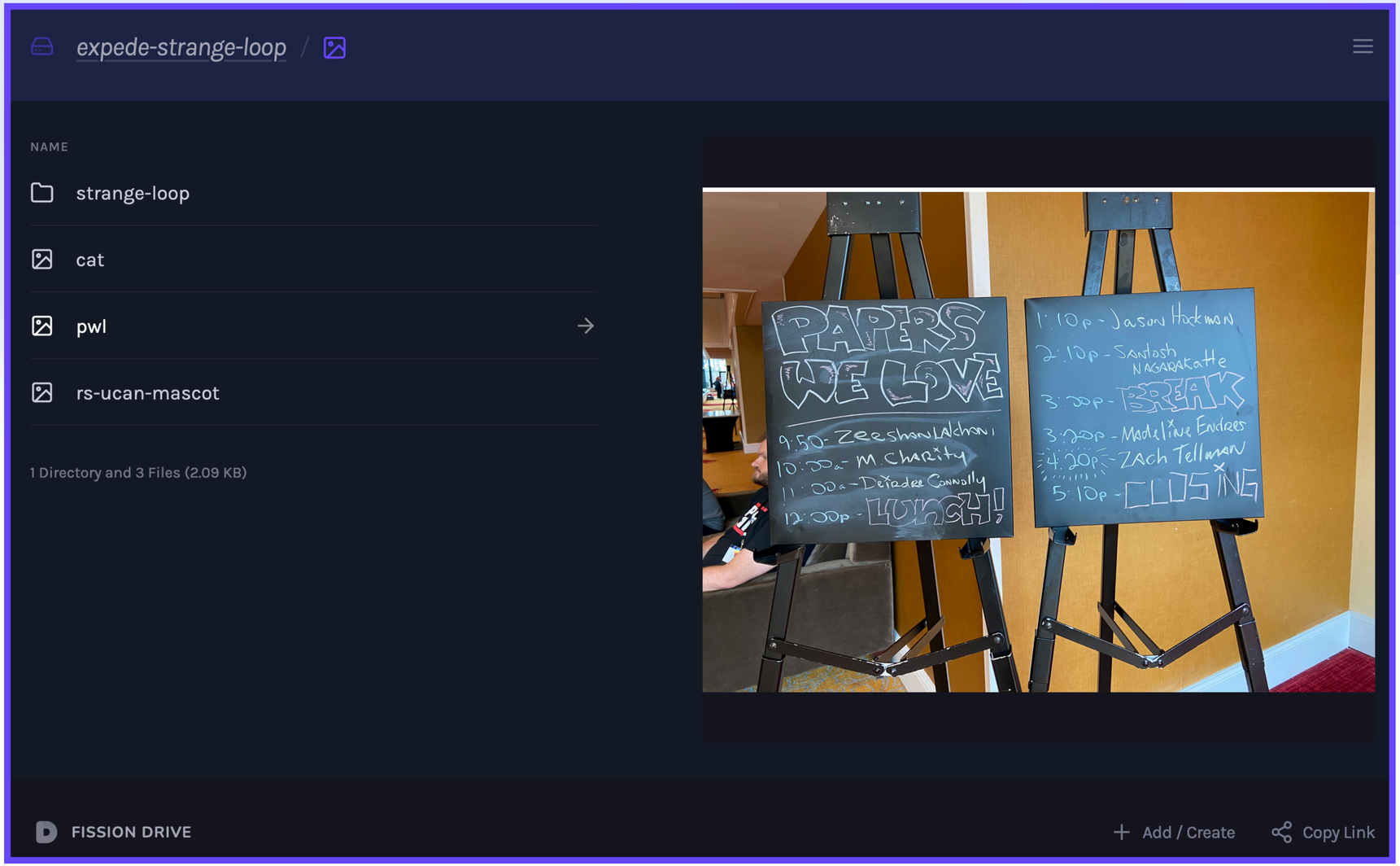

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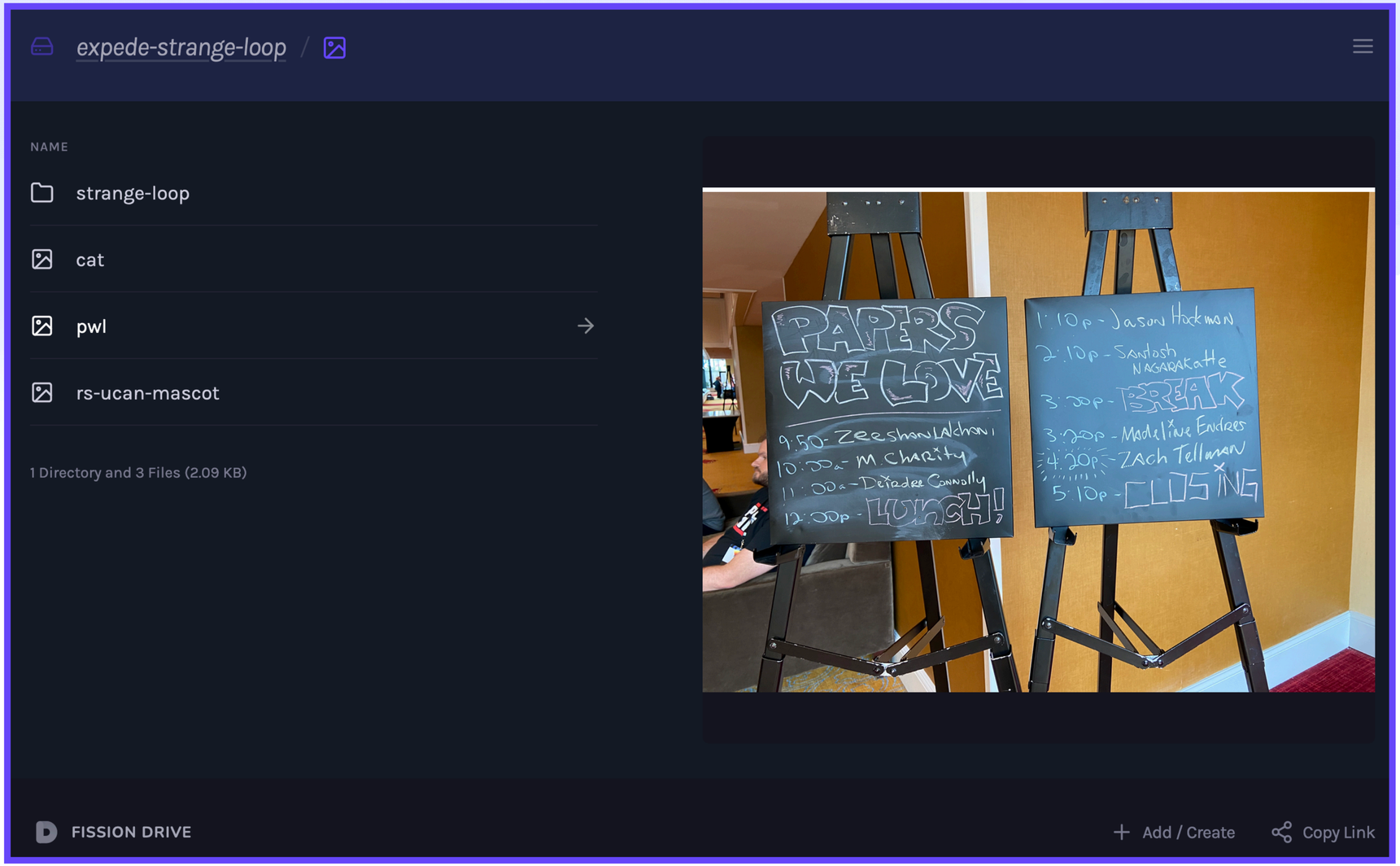
Storage Networks
WIP



A New Environment 🏝️

WNFS API

A New Environment 🏝️

WNFS API

- `add`
- `cat`
- `ls`
- `mkdir`
- `rm`
- `mv`
- `write`

A New Environment 🏝

WNFS API

- add
- cat
- ls
- mkdir
- rm
- mv
- write

```
// After initialising …
const fs = state.fs

// List the user's private files that belong to this app
await fs.ls(fs.appPath())

// Create a sub directory and add some content
await fs.write(
  fs.appPath(wn.path.file("Sub Directory", "hello.txt")),
  "👋"
)

// Announce the changes
await fs.publish()
```

https://guide.fission.codes/developers/webnative/file-system-wnfs

A New Environment 🏝

WNFS API

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```
file.history.list()
// { delta: -1, timestamp: 1606236743 }
// { delta: -2, timestamp: 1606236532 }


// Get the previous version
file.history.back()
```

https://guide.fission.codes/developers/webnative/file-system-wnfs

Content Addressing Primer

From a File System Perspective

Content Addressing 🗺️

Content Addressing 🗺️

The limitation of ***local knowledge***
is the ***fundamental fact***
about the setting in which we work,
and it is ***a very powerful limitation***

– Nancy Lynch, A Hundred Impossibility Proofs for Distributed Computing

Content Addressing 🗺️

Addressing Stack

Content Addressing 🗺️

Addressing Stack

Virtual (Machine) Location 🗺️

```
(42.123.45.6/path)@t0 = content1
(42.123.45.6/path)@t1 = content2
```

Content Addressing 🗺️

Addressing Stack

Named Location 📪

Virtual (Machine) Location 🗺️

`{DNS → IP}`

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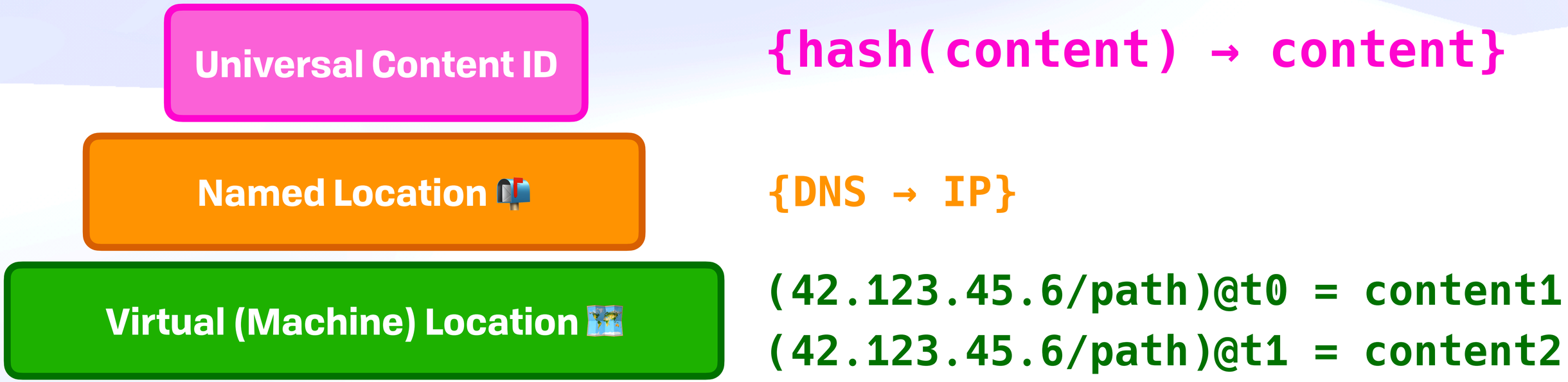
Content Addressing 🗺️

Addressing Stack



{hash(content) → content}

{DNS → IP}

(42.123.45.6/path)@t0 = content1
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Content Addressing 🗺️

IPLD Node

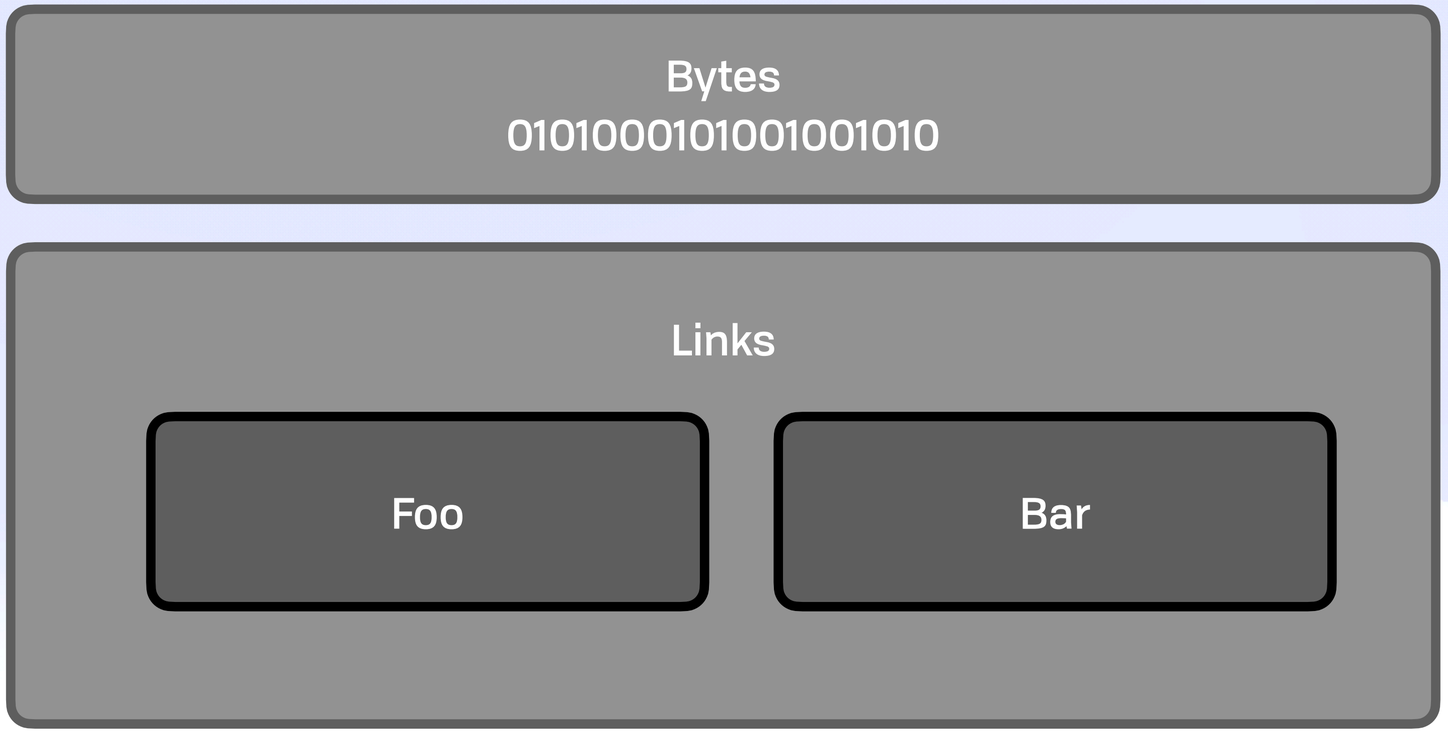
Content Addressing 🗺️

IPLD Node

Bytes
0101000101001001010

Content Addressing 🗺️

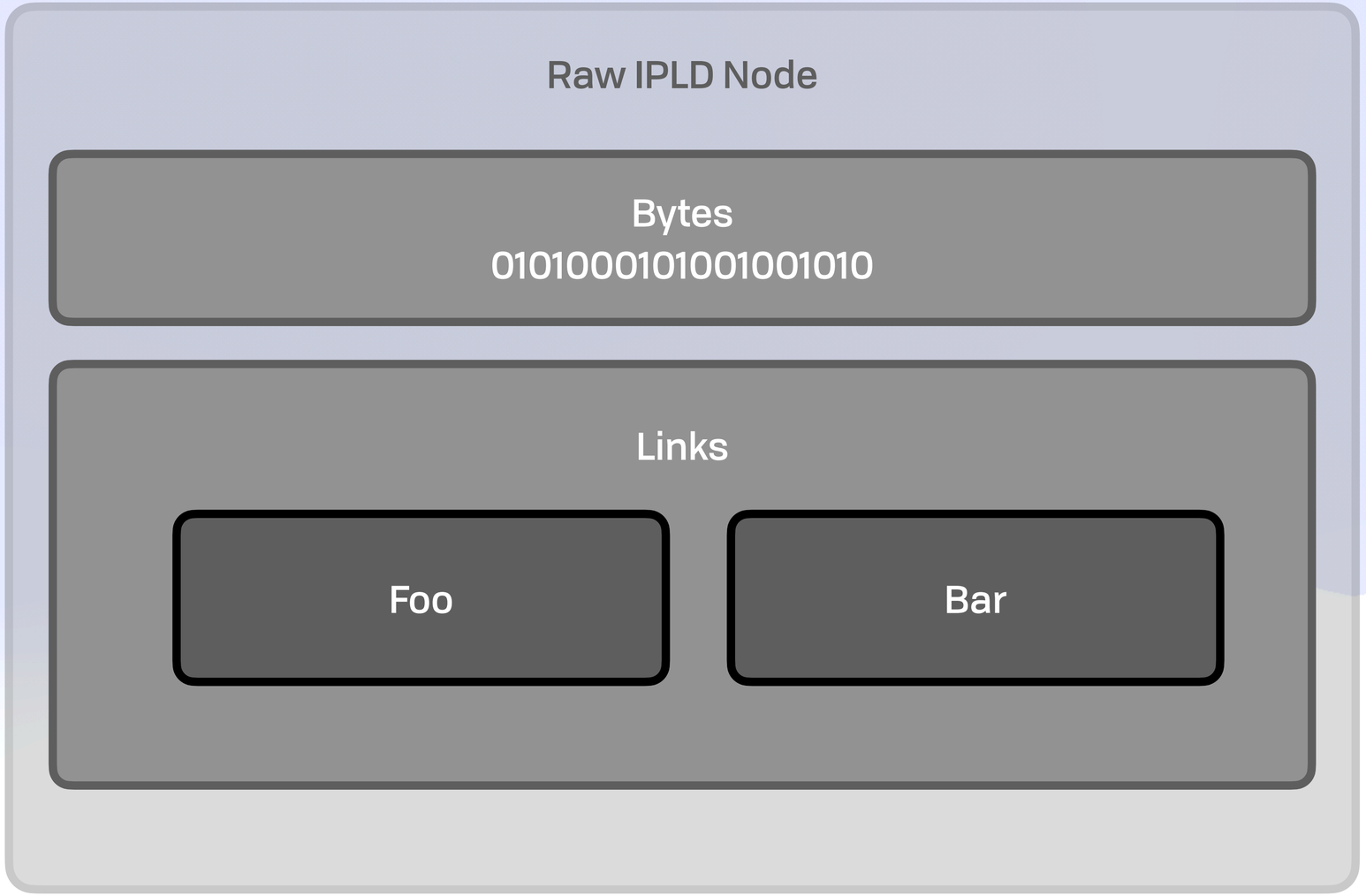
IPLD Node



Content Addressing 🗺️

IPLD Node

bafy12345



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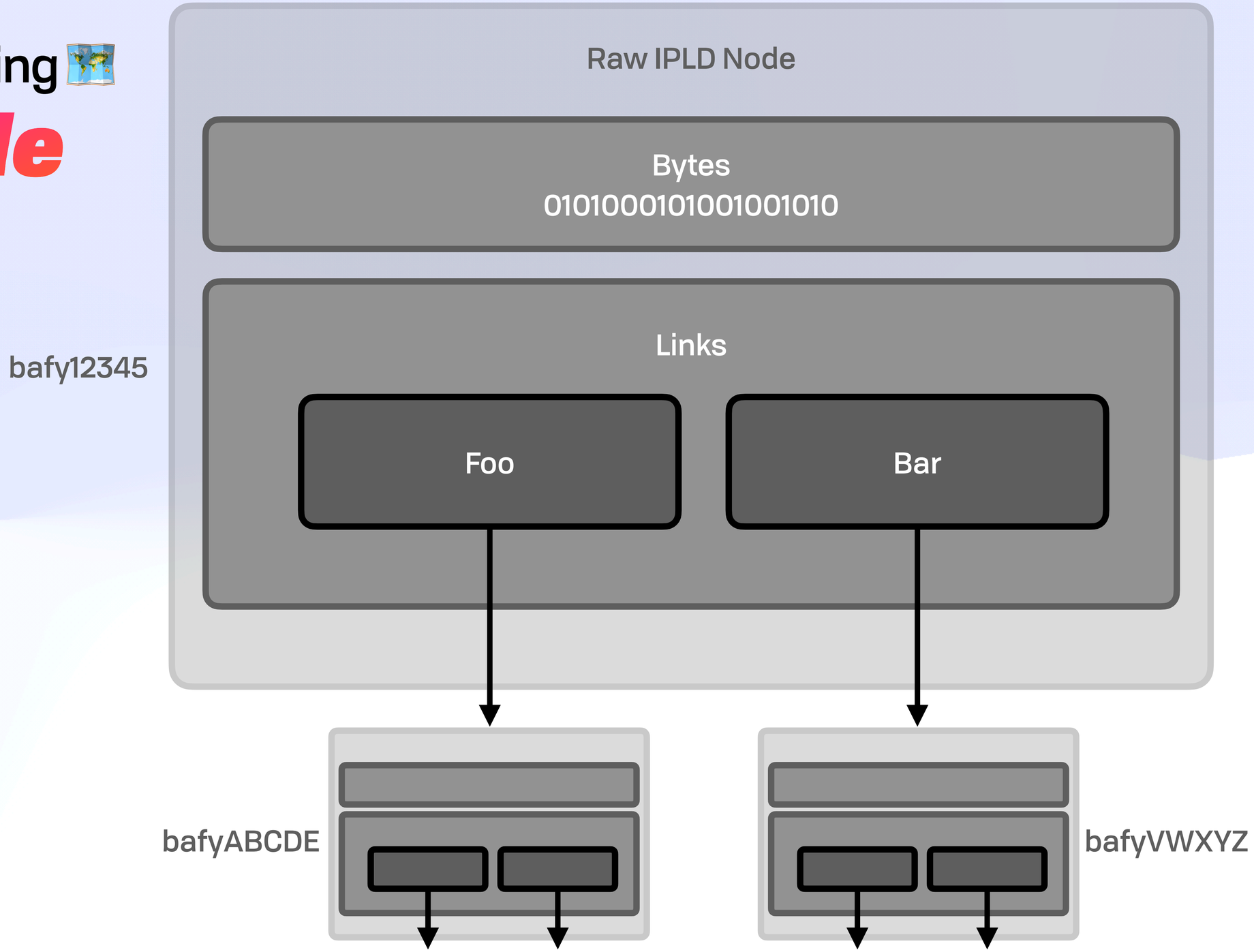

Content Addressing 🗺️

Mutability

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TXT _dnslink.akiko.example.com
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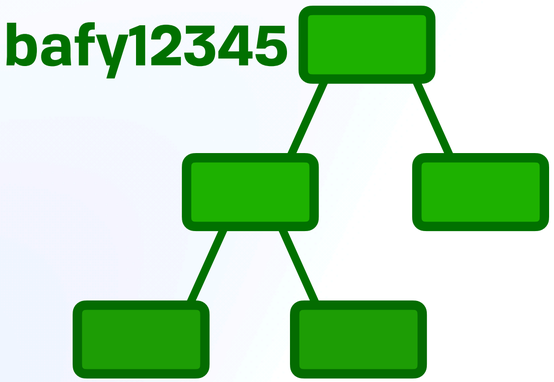

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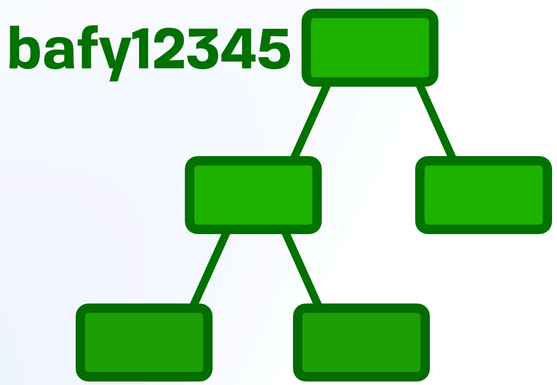

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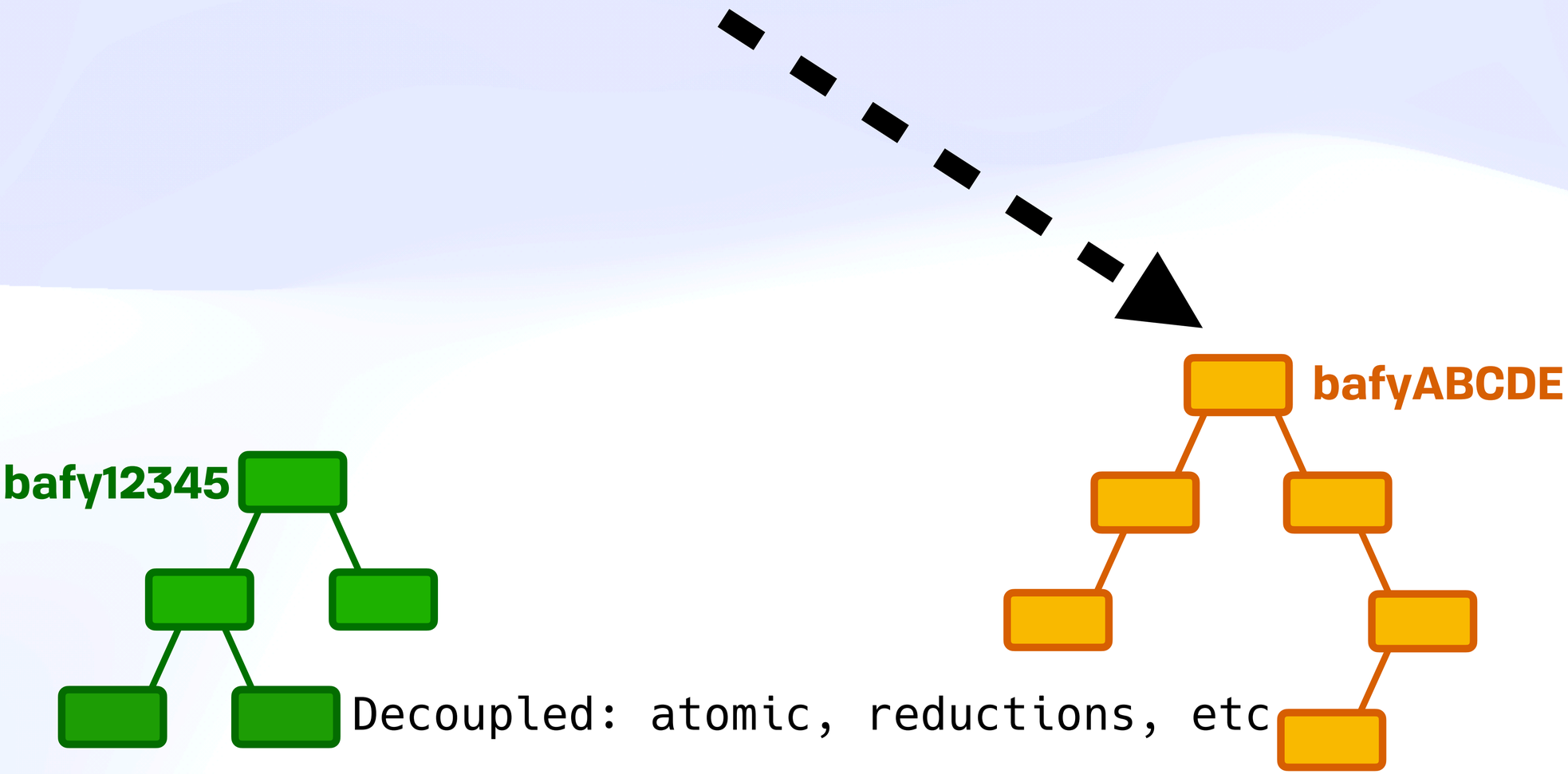

Decoupled: atomic, reductions, etc

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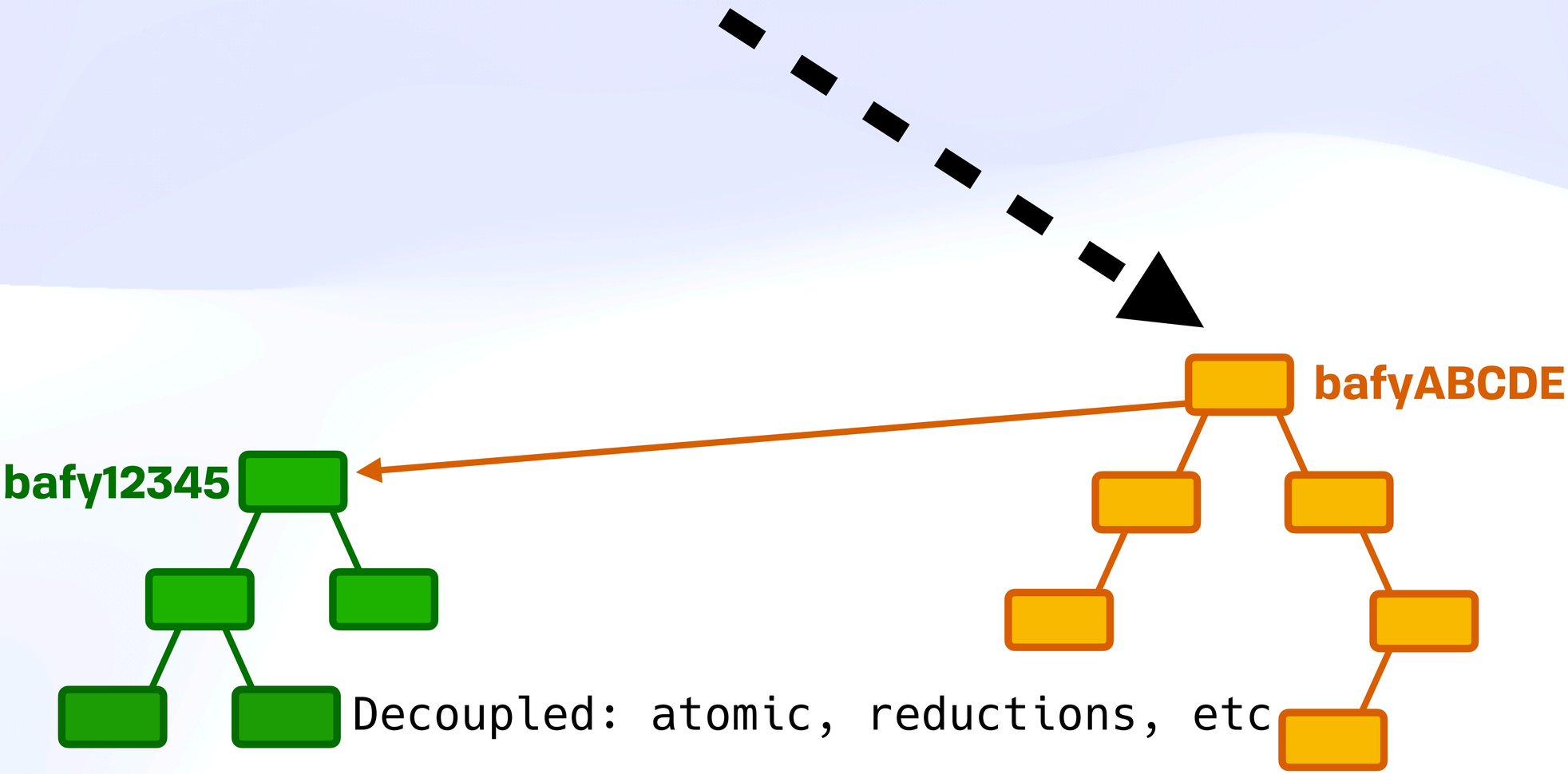

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Content Addressing 🗺️

Hard & Soft Links

Content Addressing 🗺️

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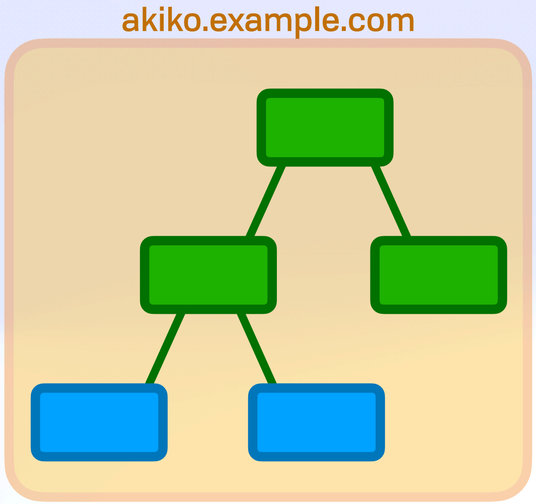

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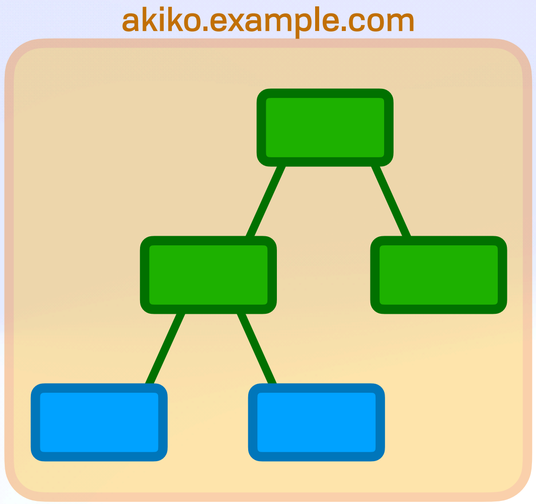
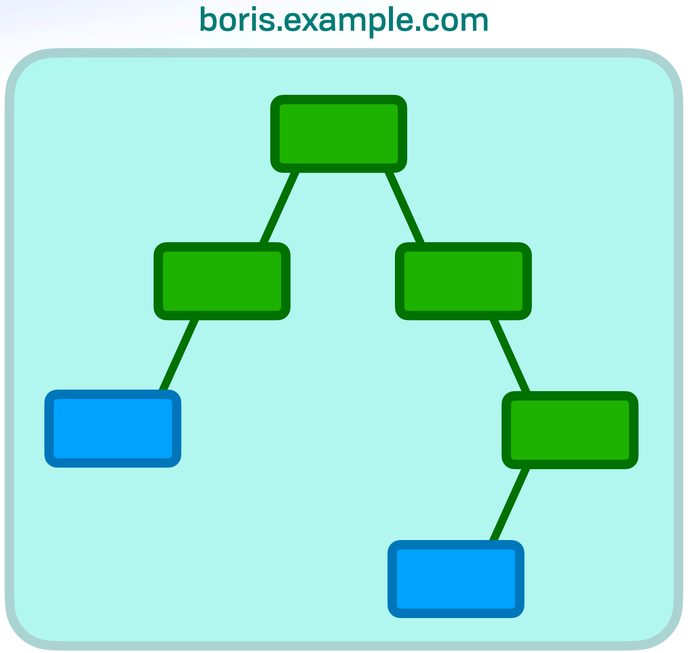


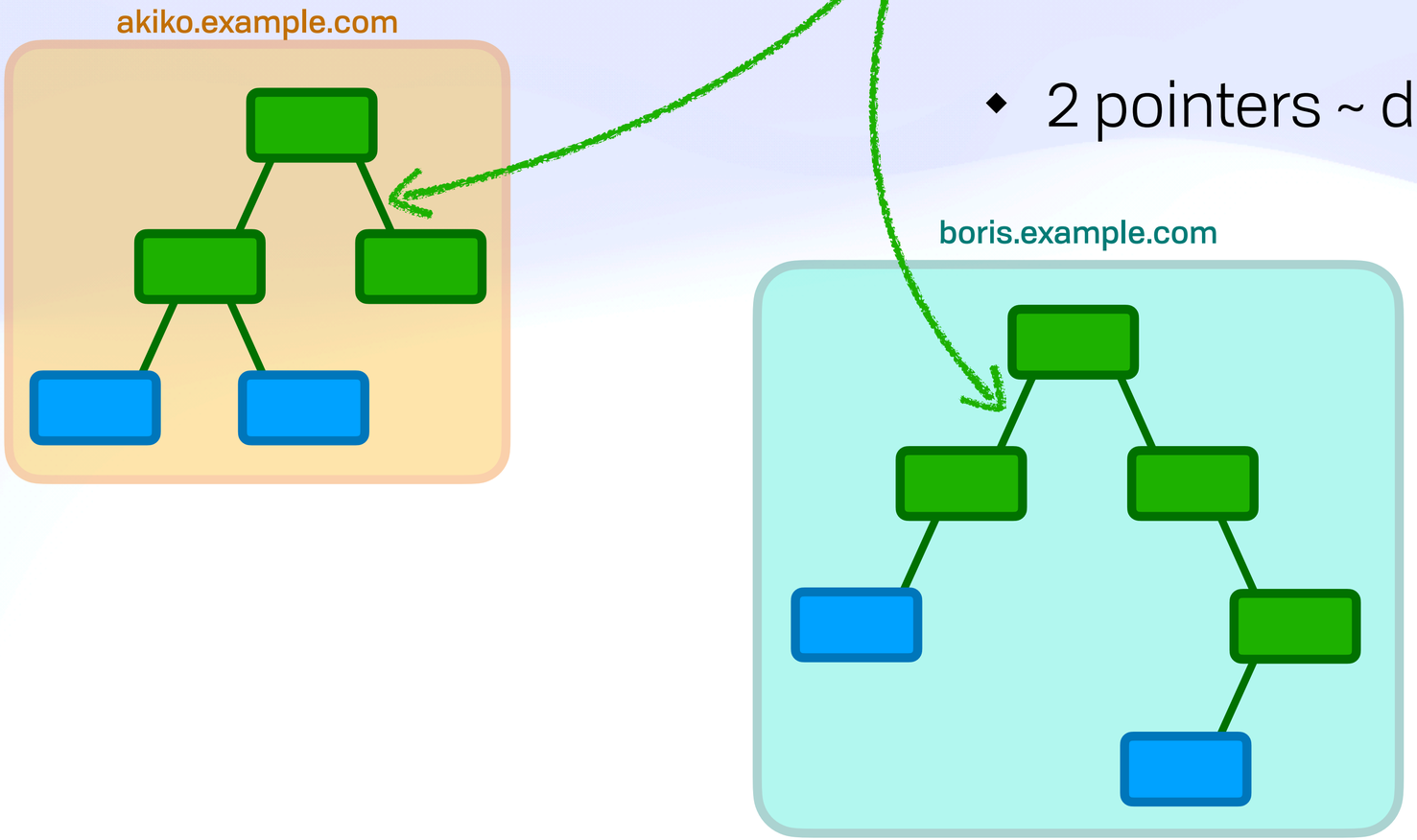


Content Addressing 🗺️

Hard & Soft Links

Hard Links

- New for the web!
- Direct reference
- 2 pointers ~ deduplicate



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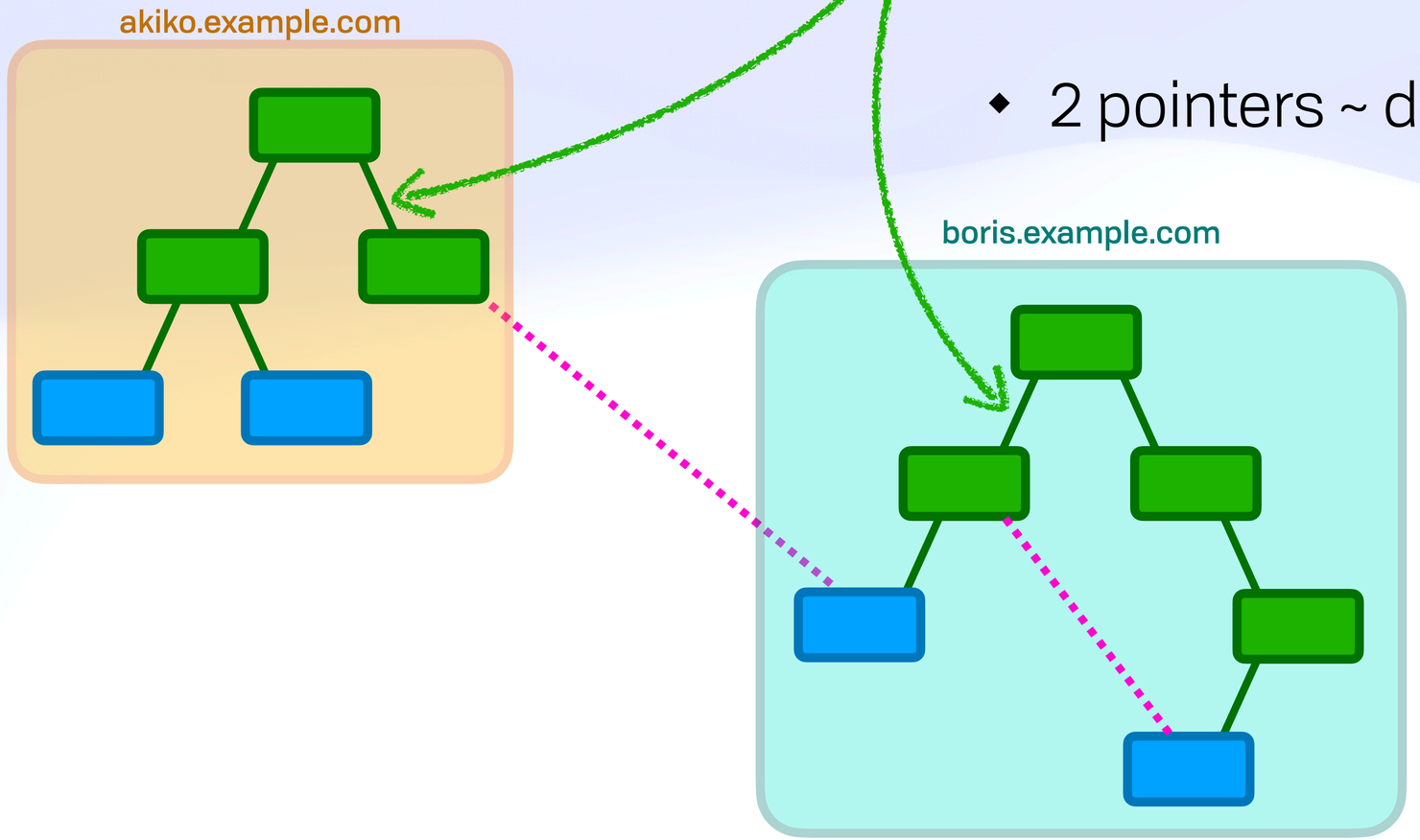

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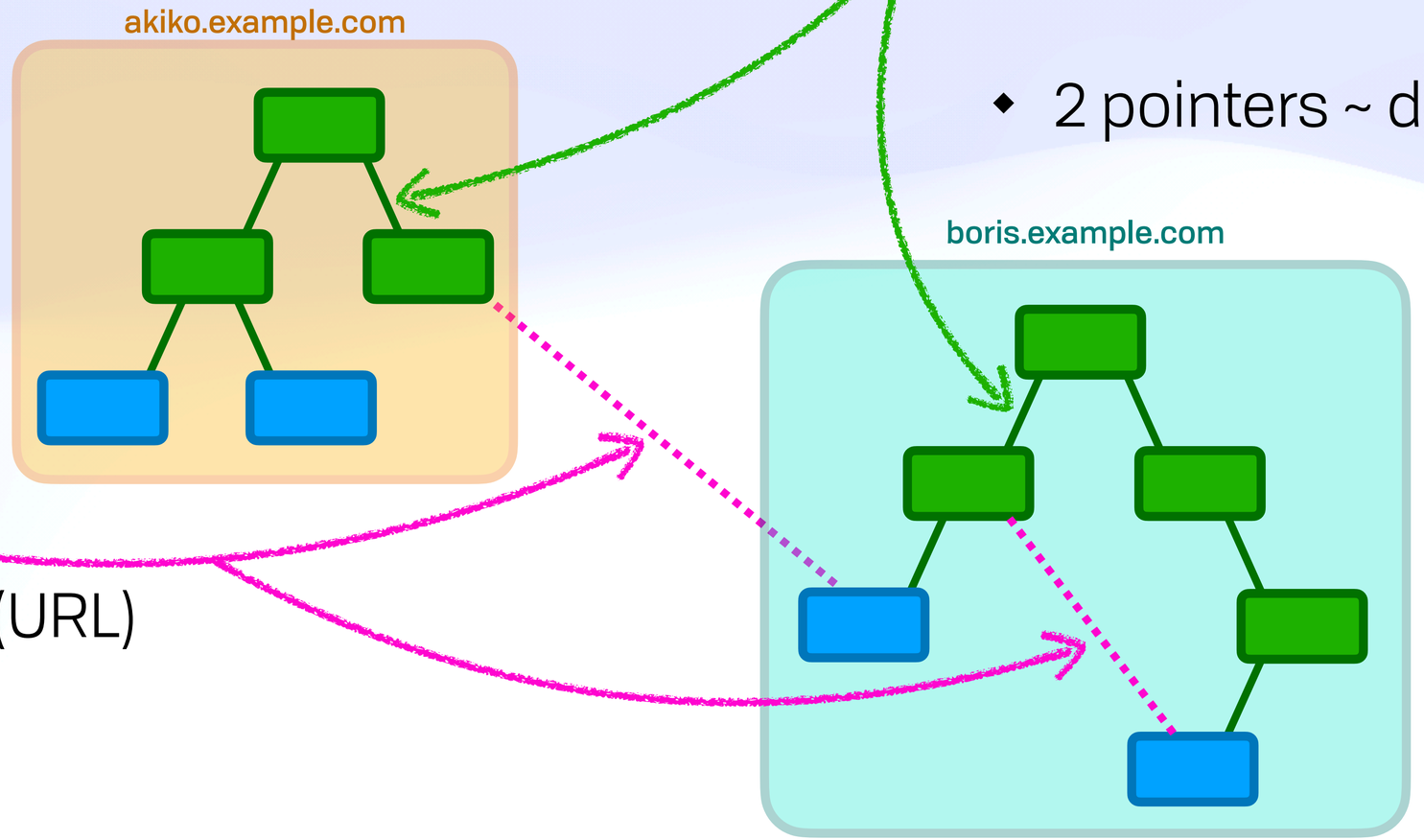
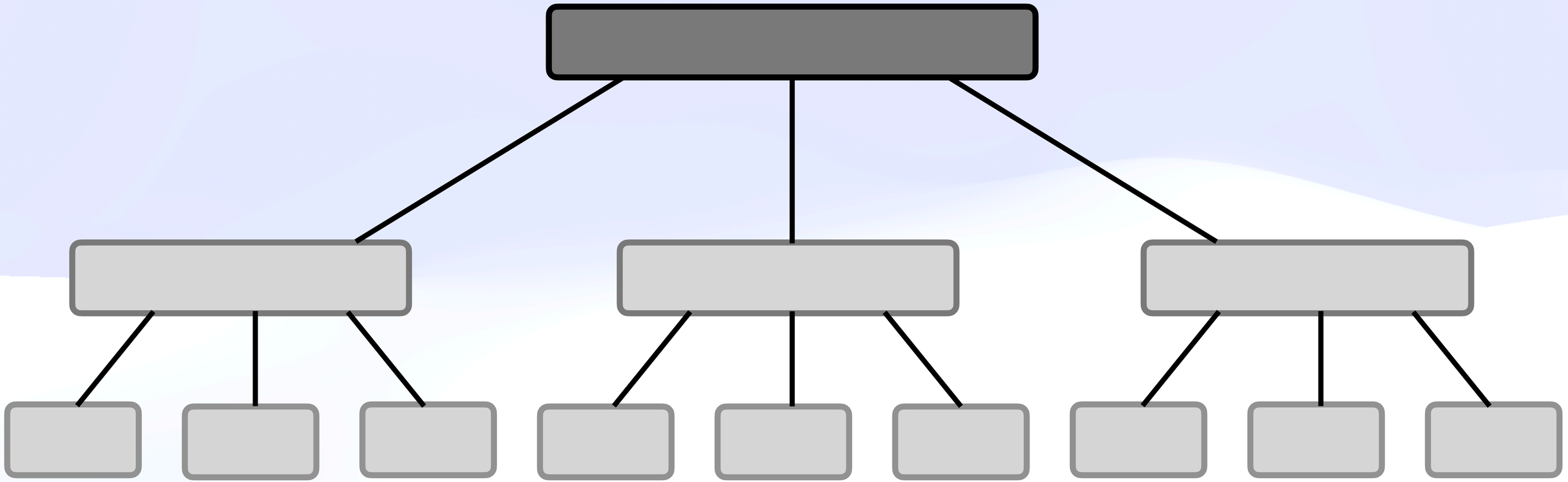


Soft Links

- Symlink or web link (URL)
- Pointer ~ latest
- Latest may break

Content Addressing 🗺️

Data Partitioning & Selective Replication



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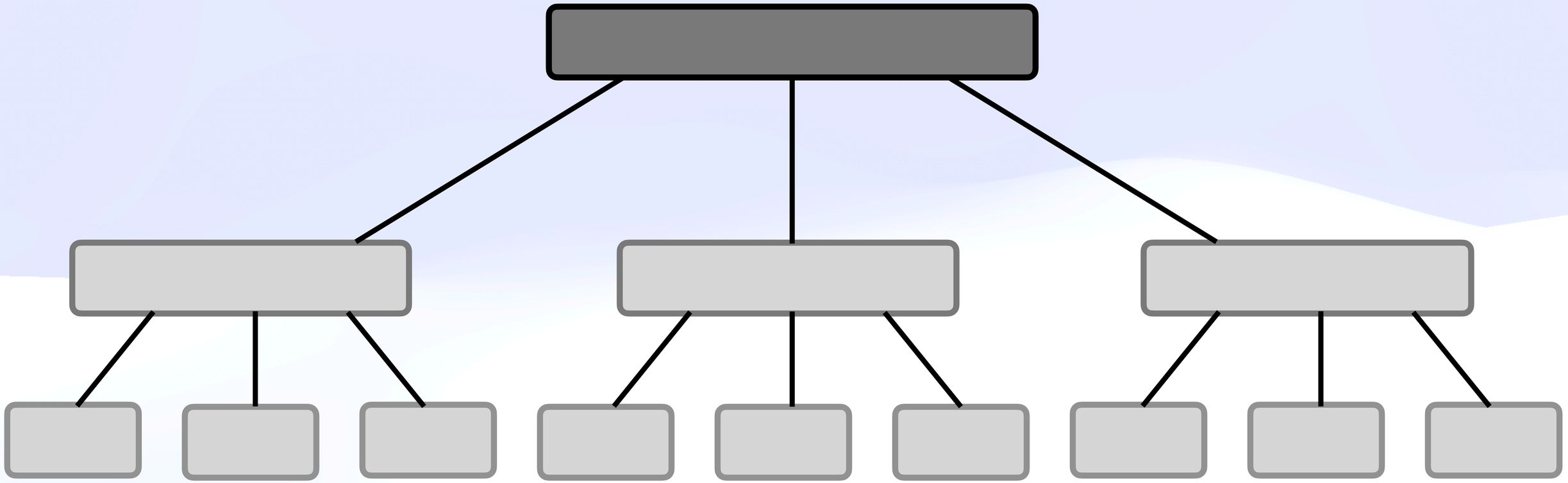

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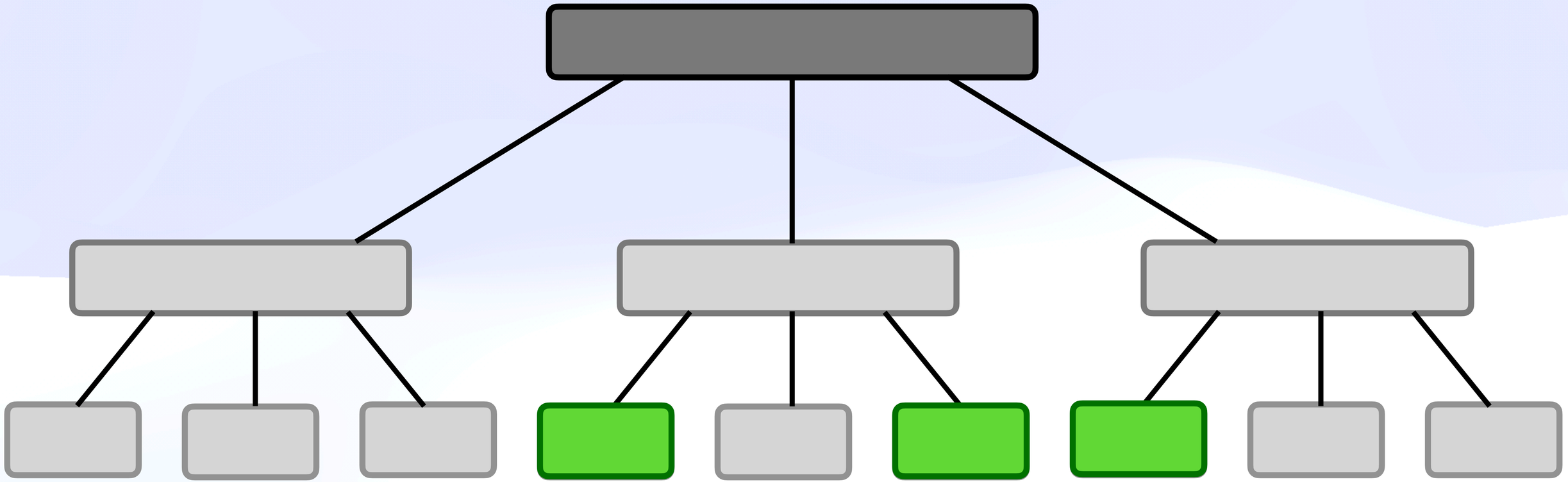

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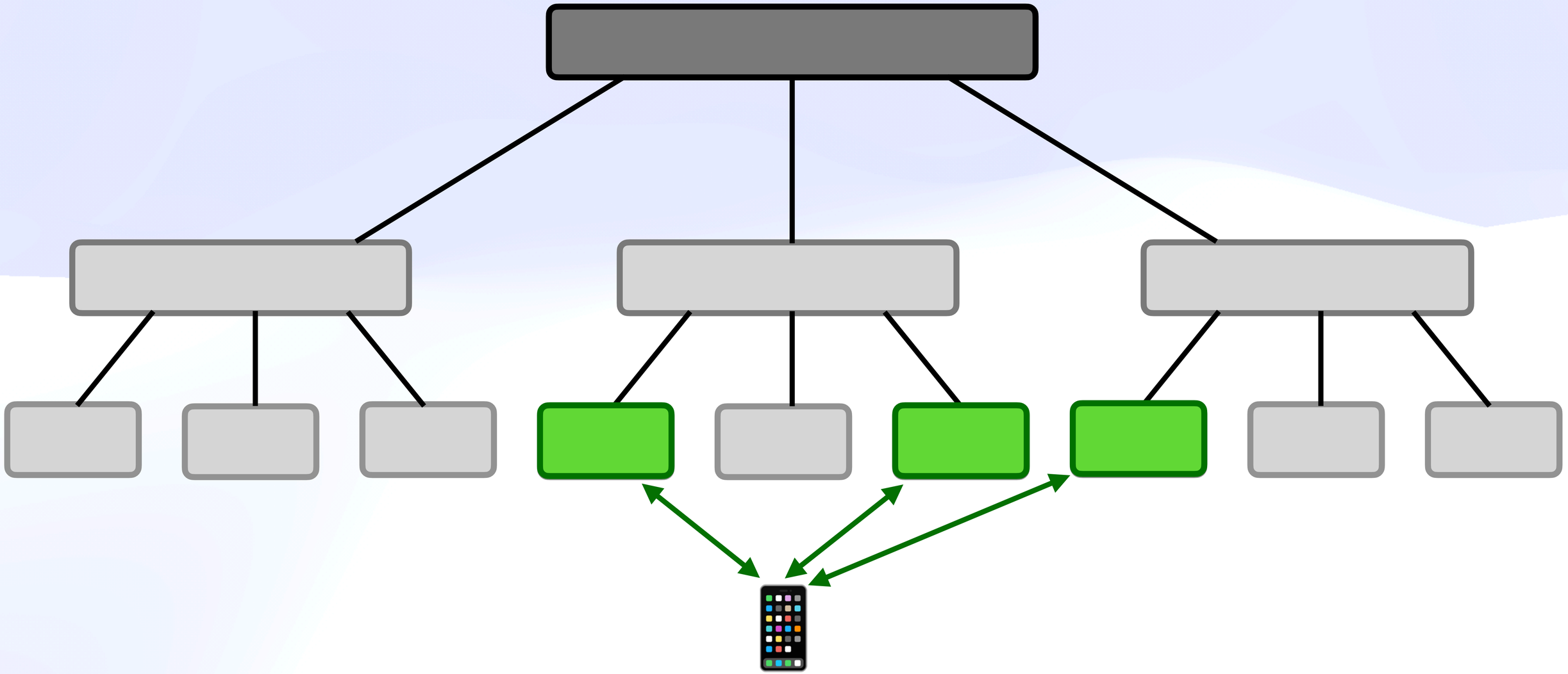

Content Addressing 🗺️

Layout

Content Addressing 🗺

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Content Addressing 🗺️

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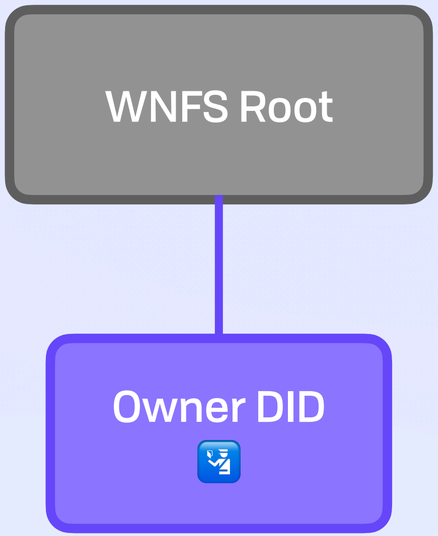

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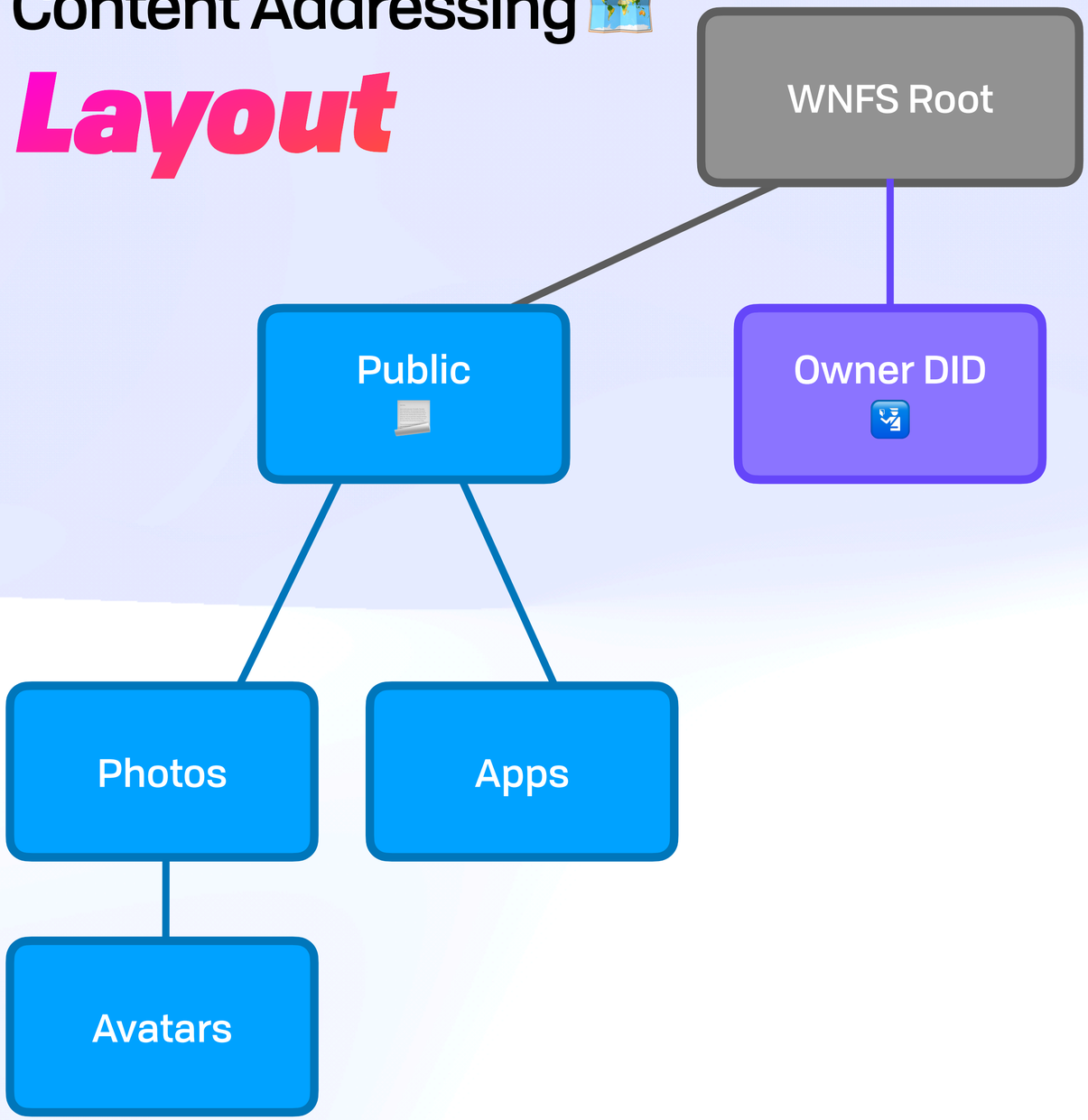

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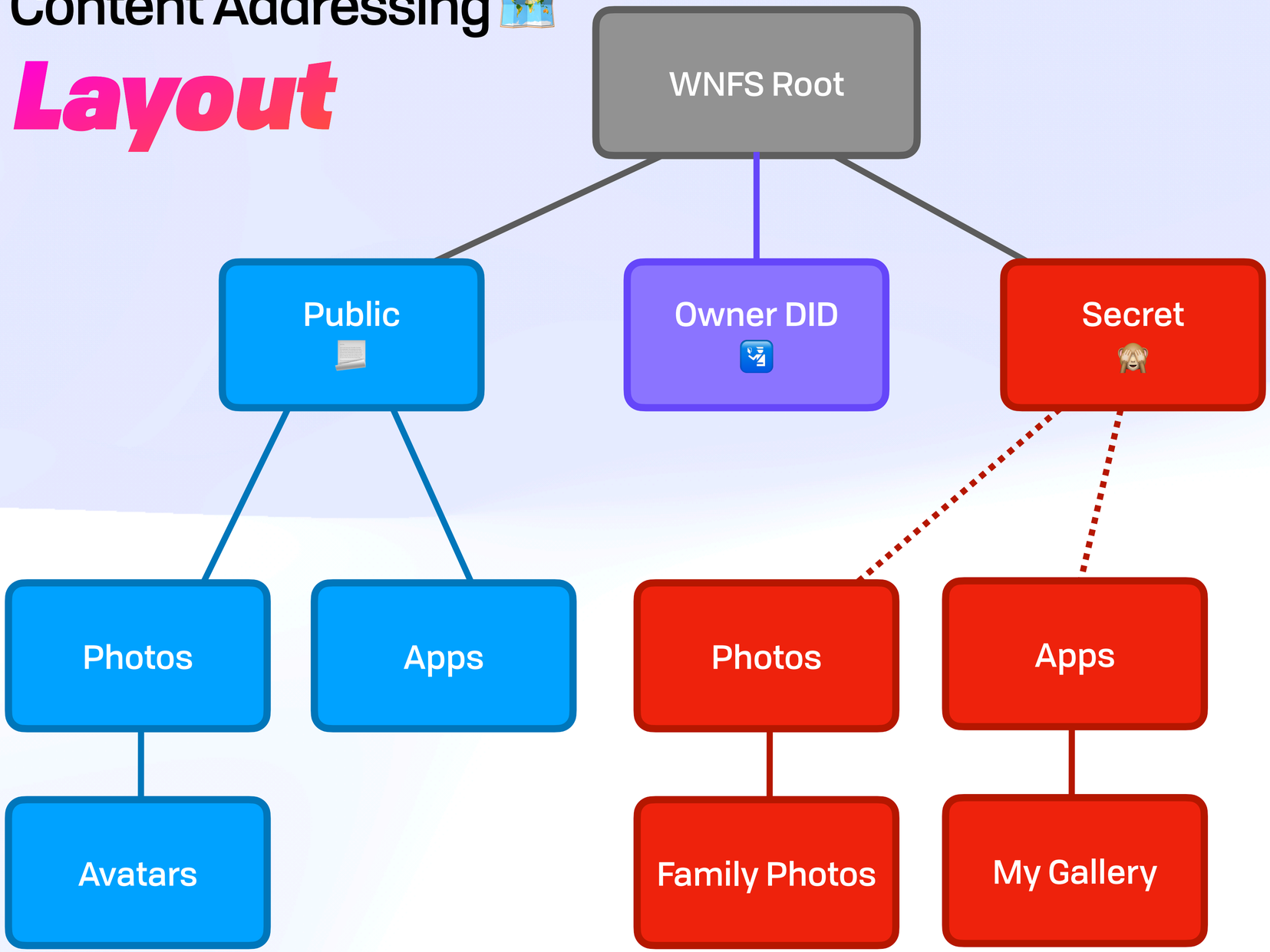

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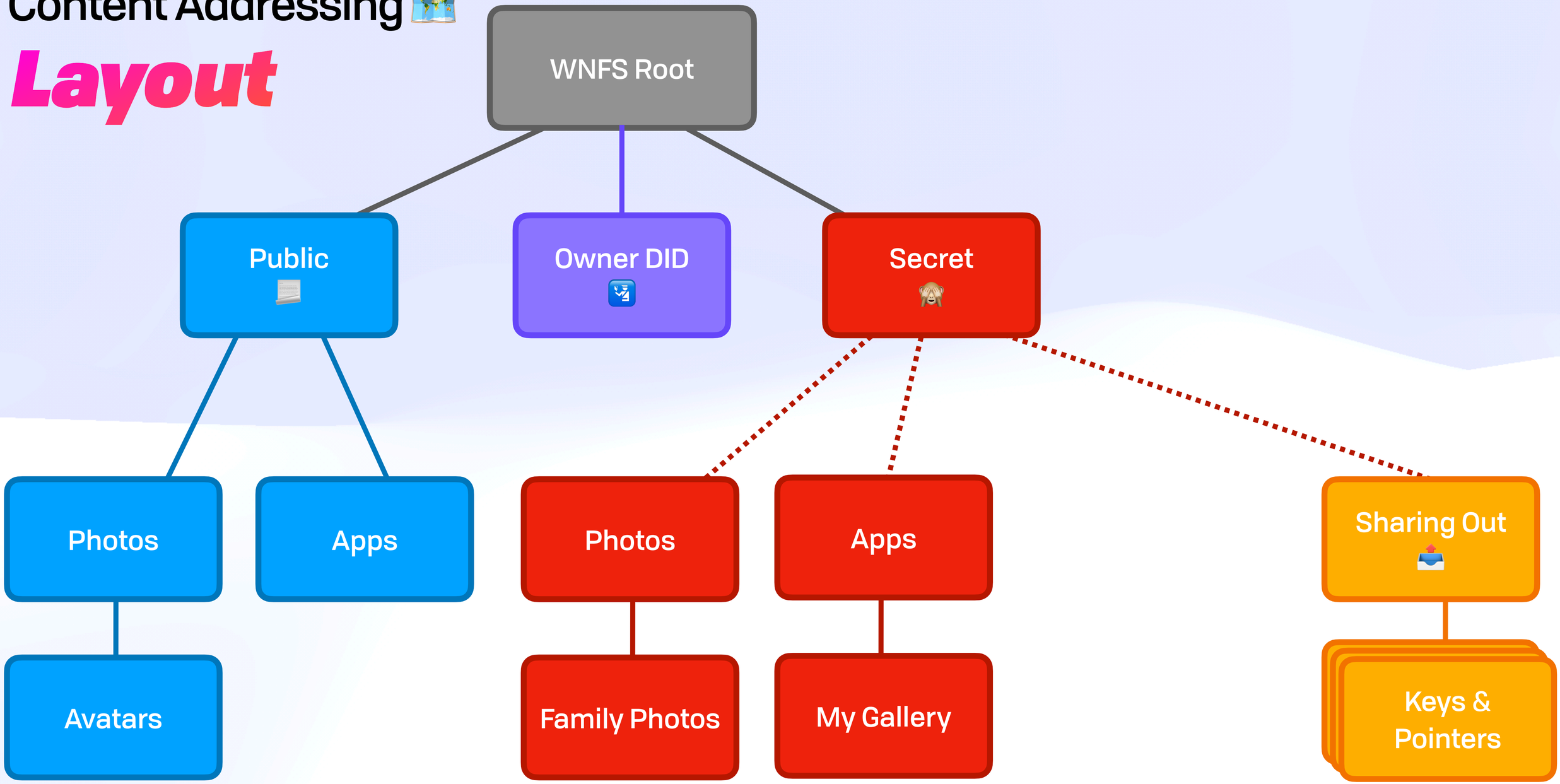

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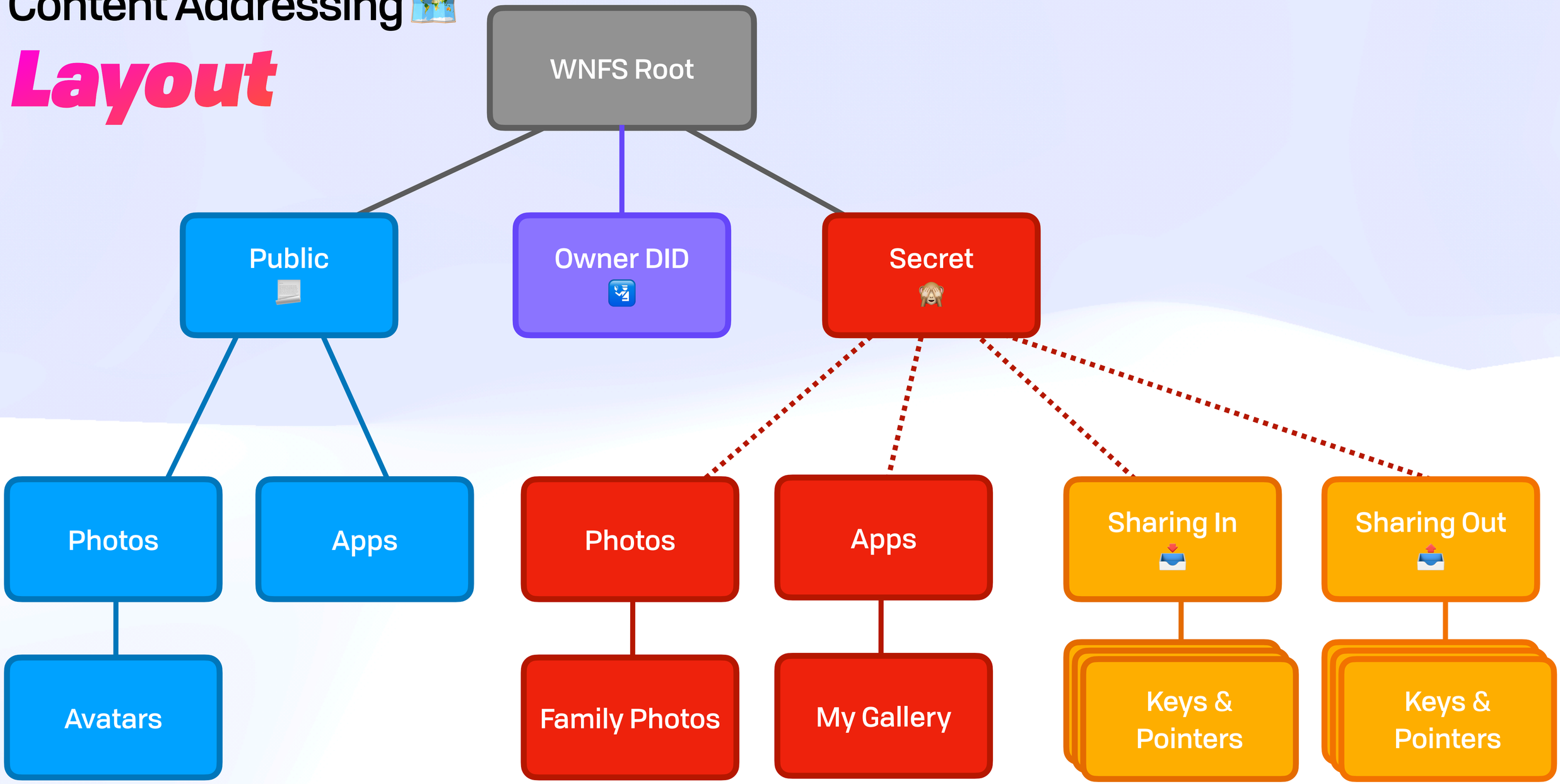

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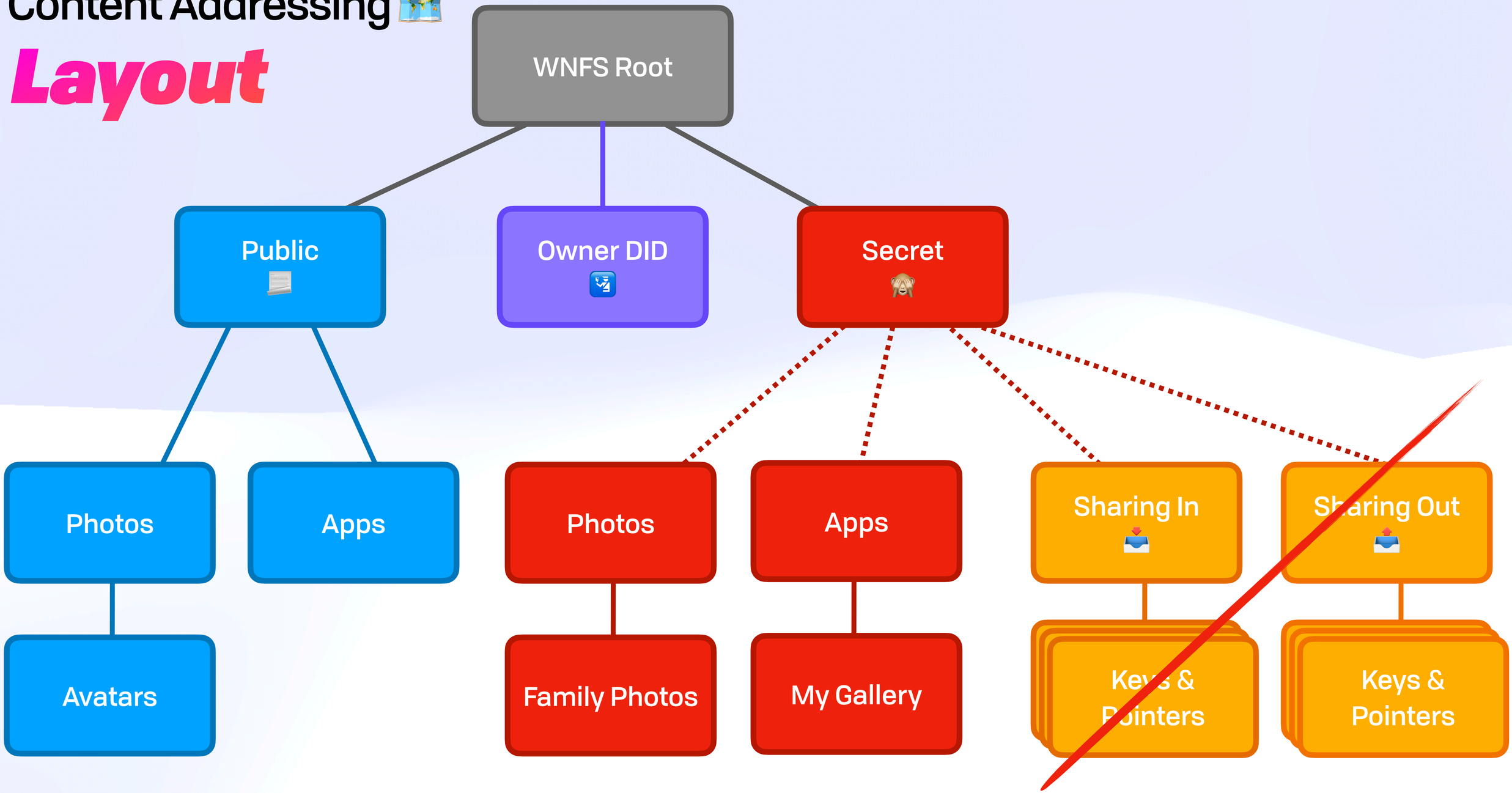

Content Addressing Primer 🗺️

Semantic Layers

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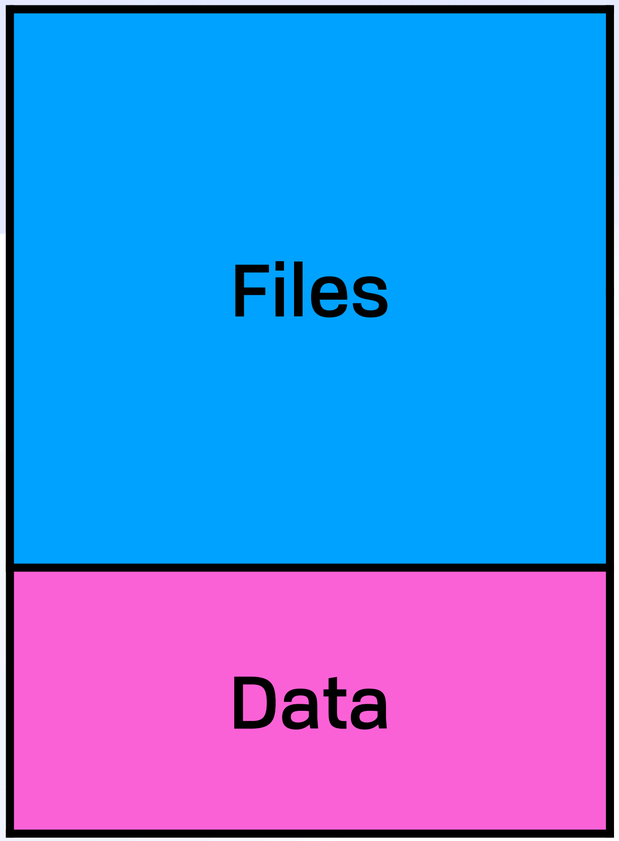
Semantic Layers

Noun



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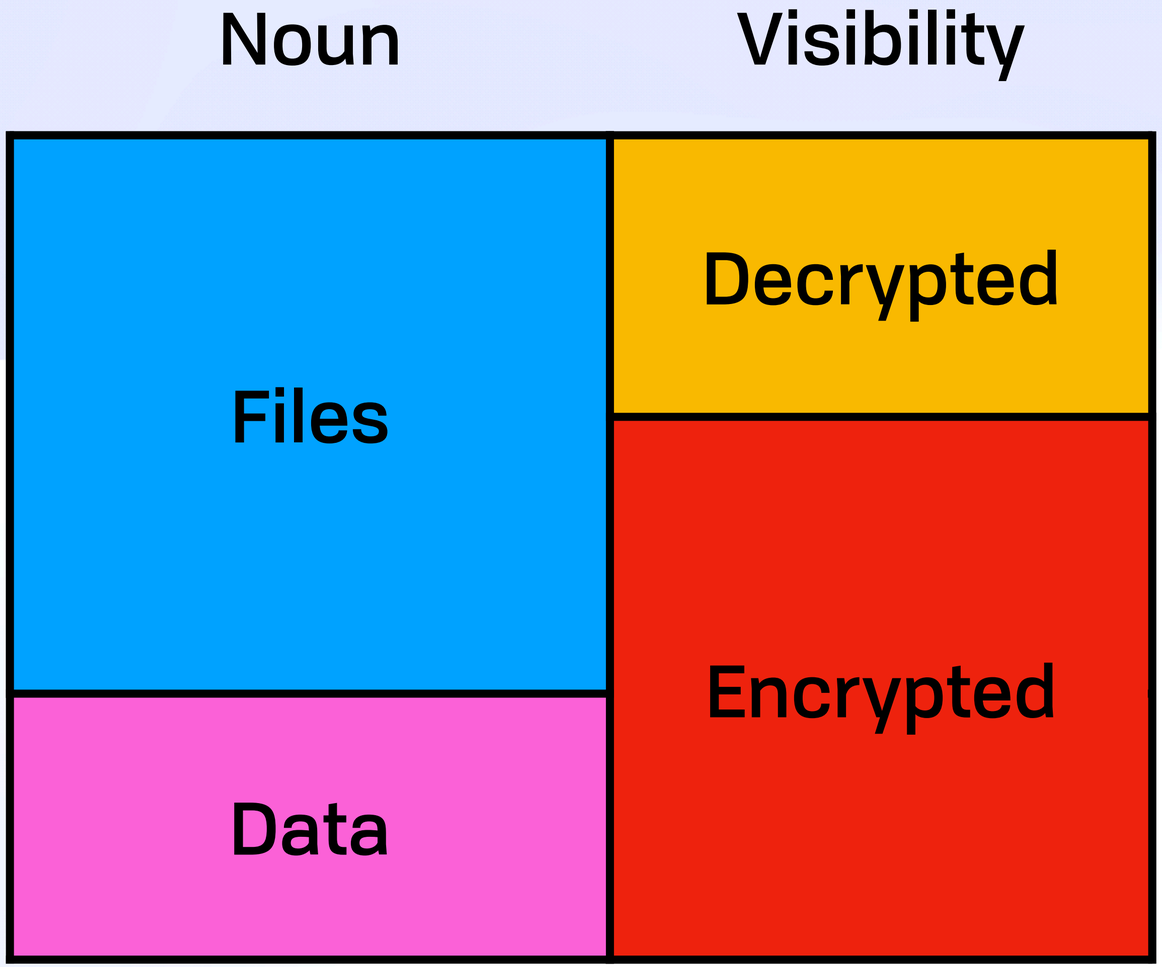
Semantic Layers



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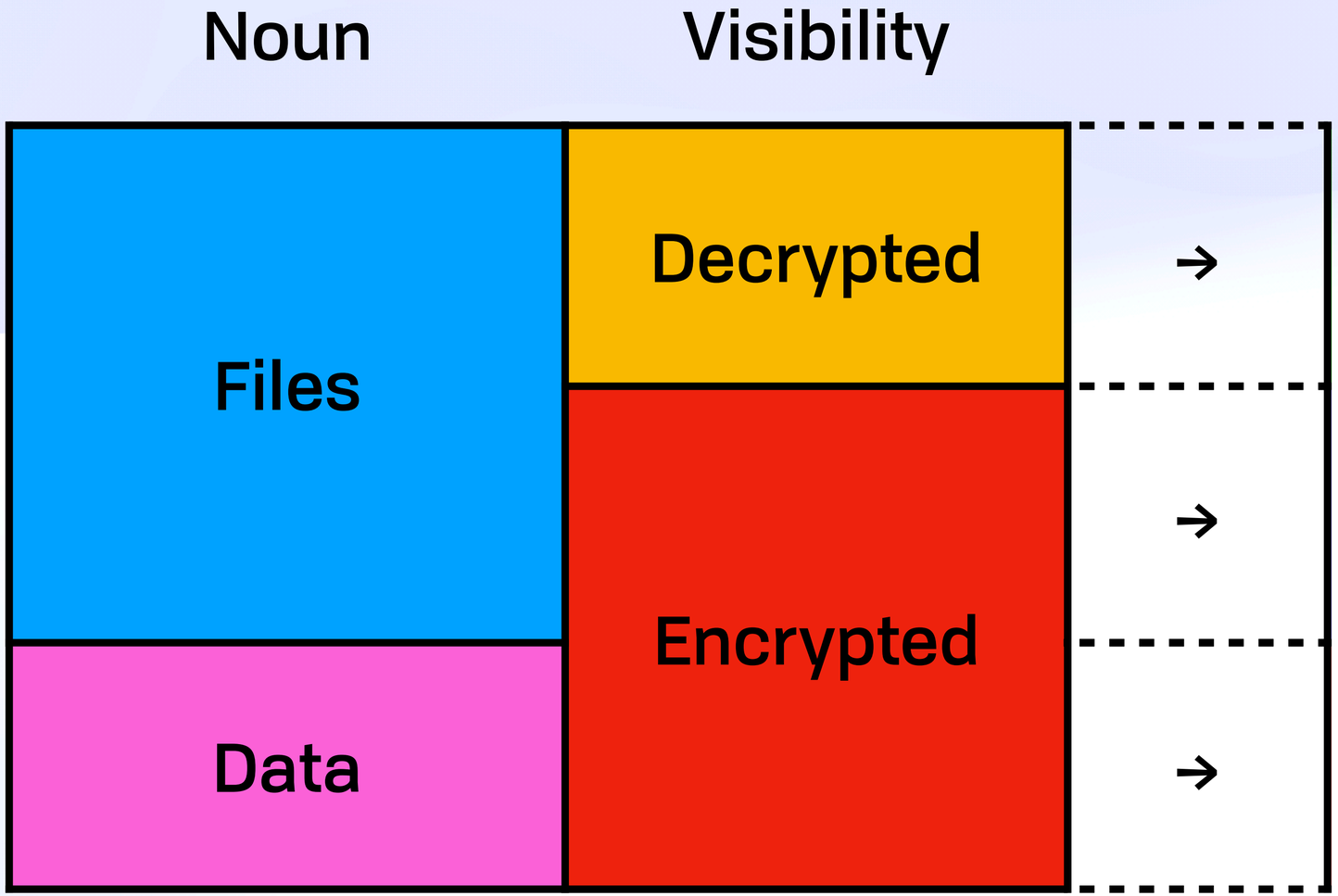
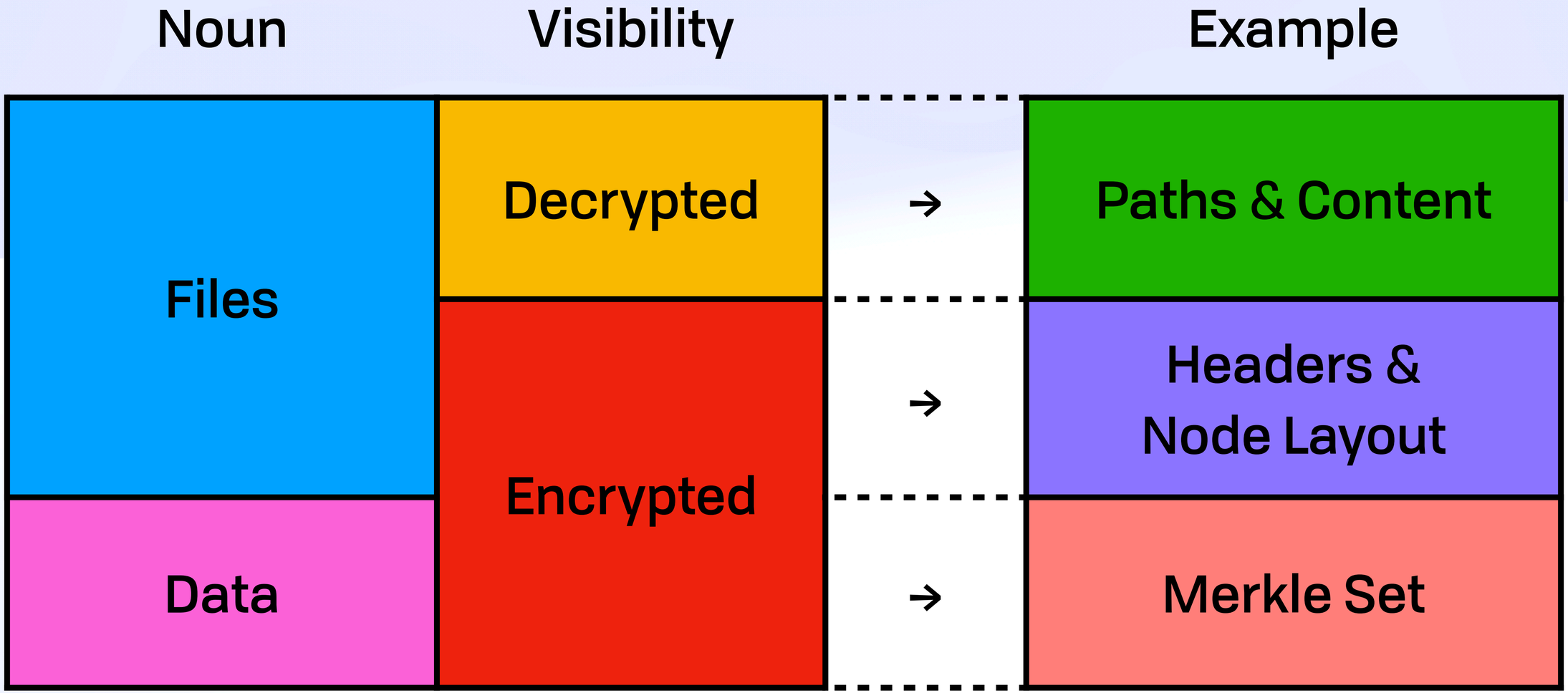
Semantic Layers



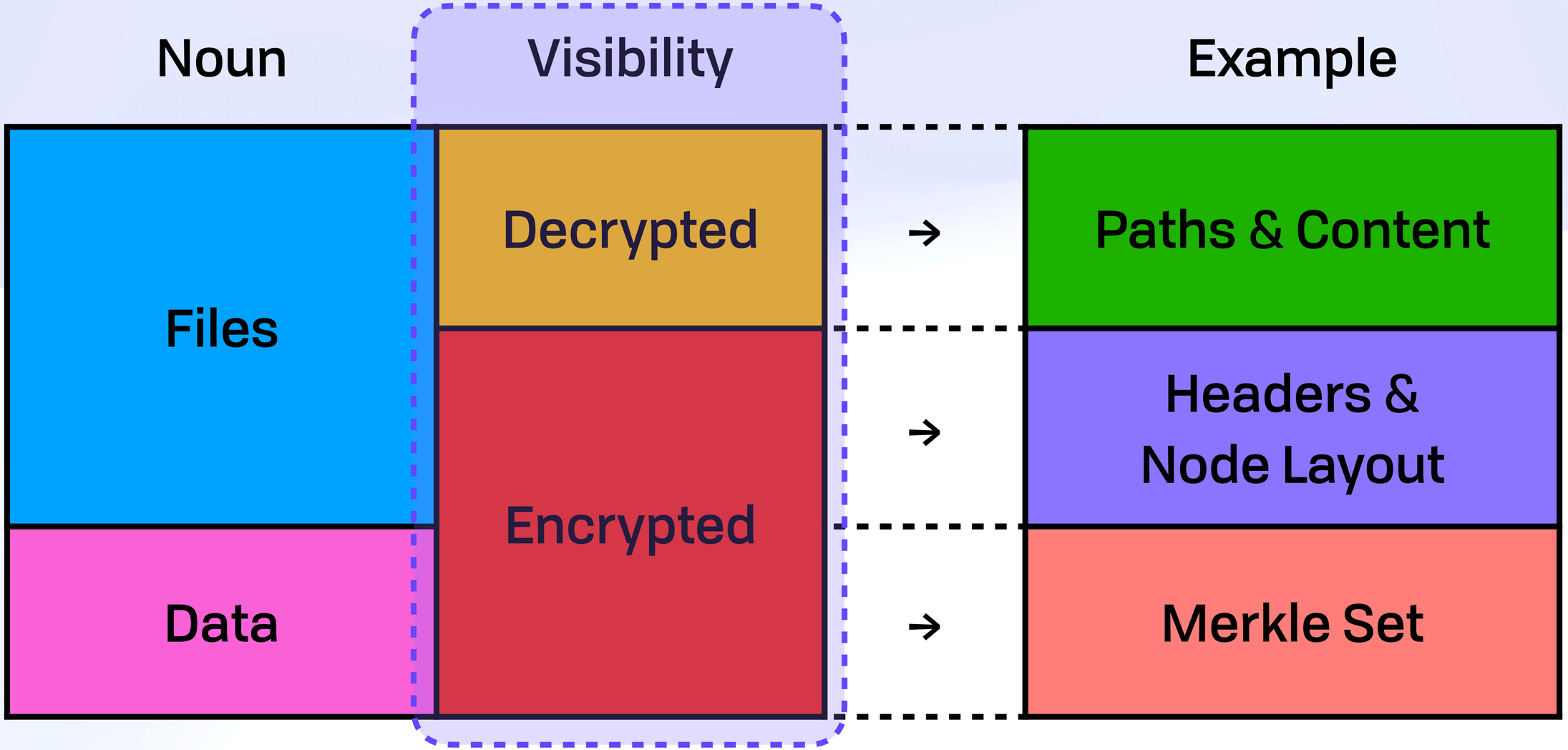
Content Addressing Primer 🗺️

Semantic Layers



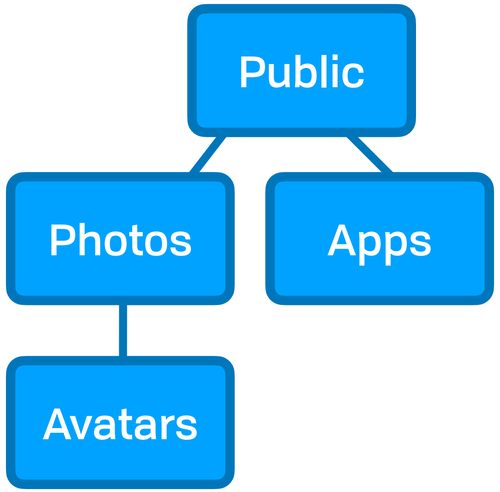
Content Addressing Primer 🗺️

Semantic Layers



Public Files 📂

WNFS Data Model



Public Files 📂

Virtual Nodes

Public Files 📂

Virtual Nodes

Raw Content
(Hash Linked Binary Data)

Public Files 📂

Virtual Nodes

Raw Content
(Hash Linked Binary Data)

File Node

Public Files 📂

Virtual Nodes

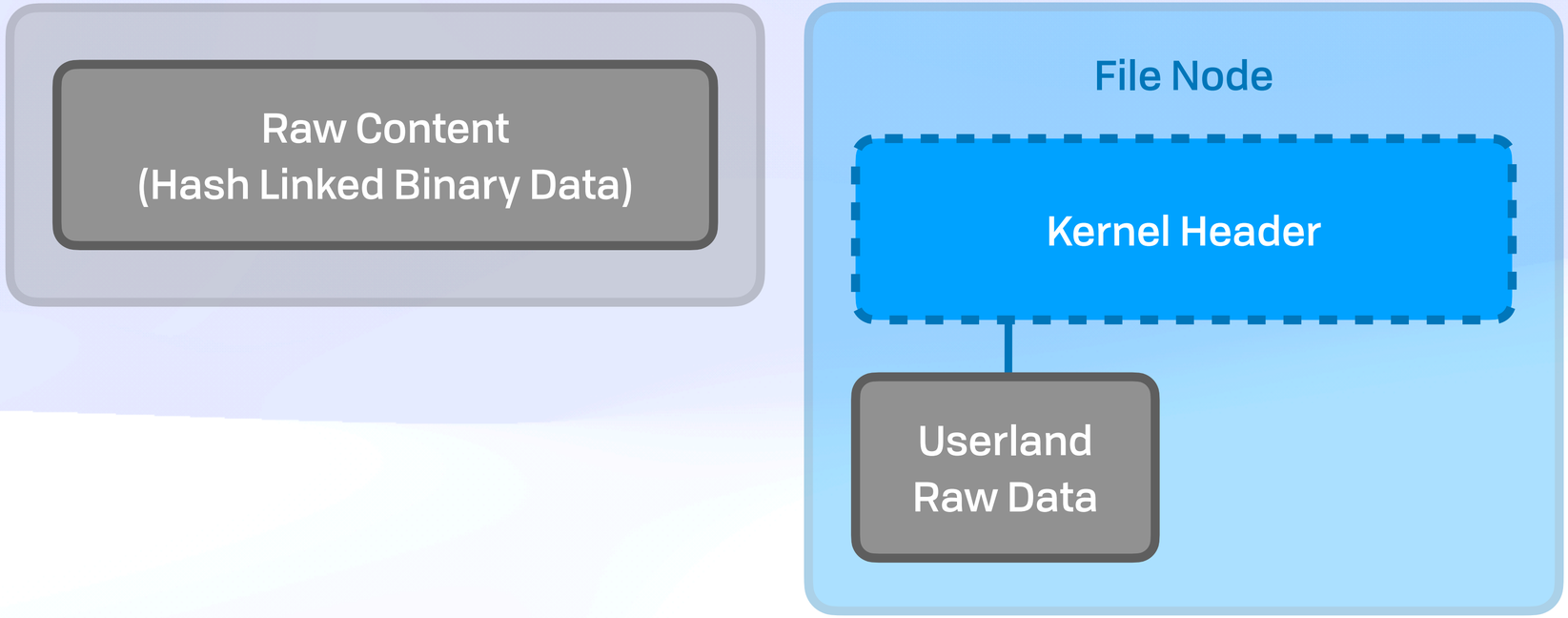
Raw Content
(Hash Linked Binary Data)

File Node

Kernel Header

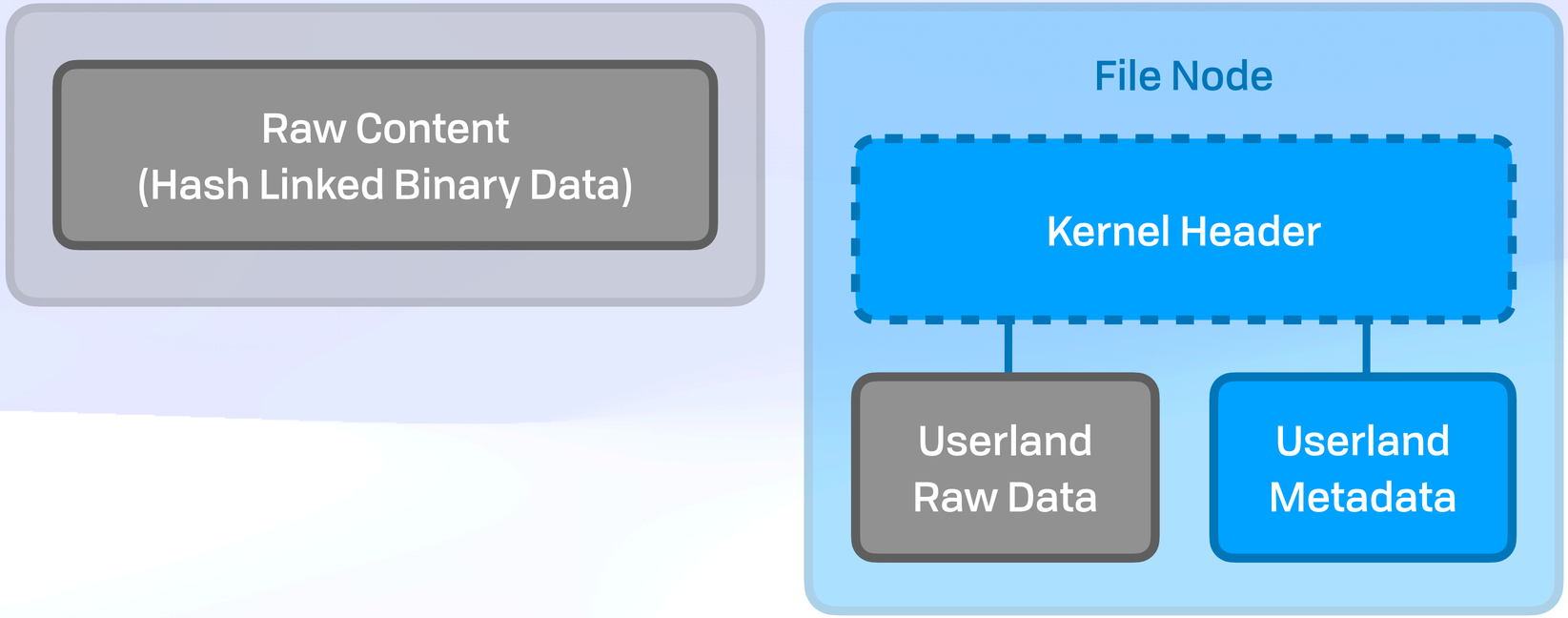
Public Files 📂

Virtual Nodes



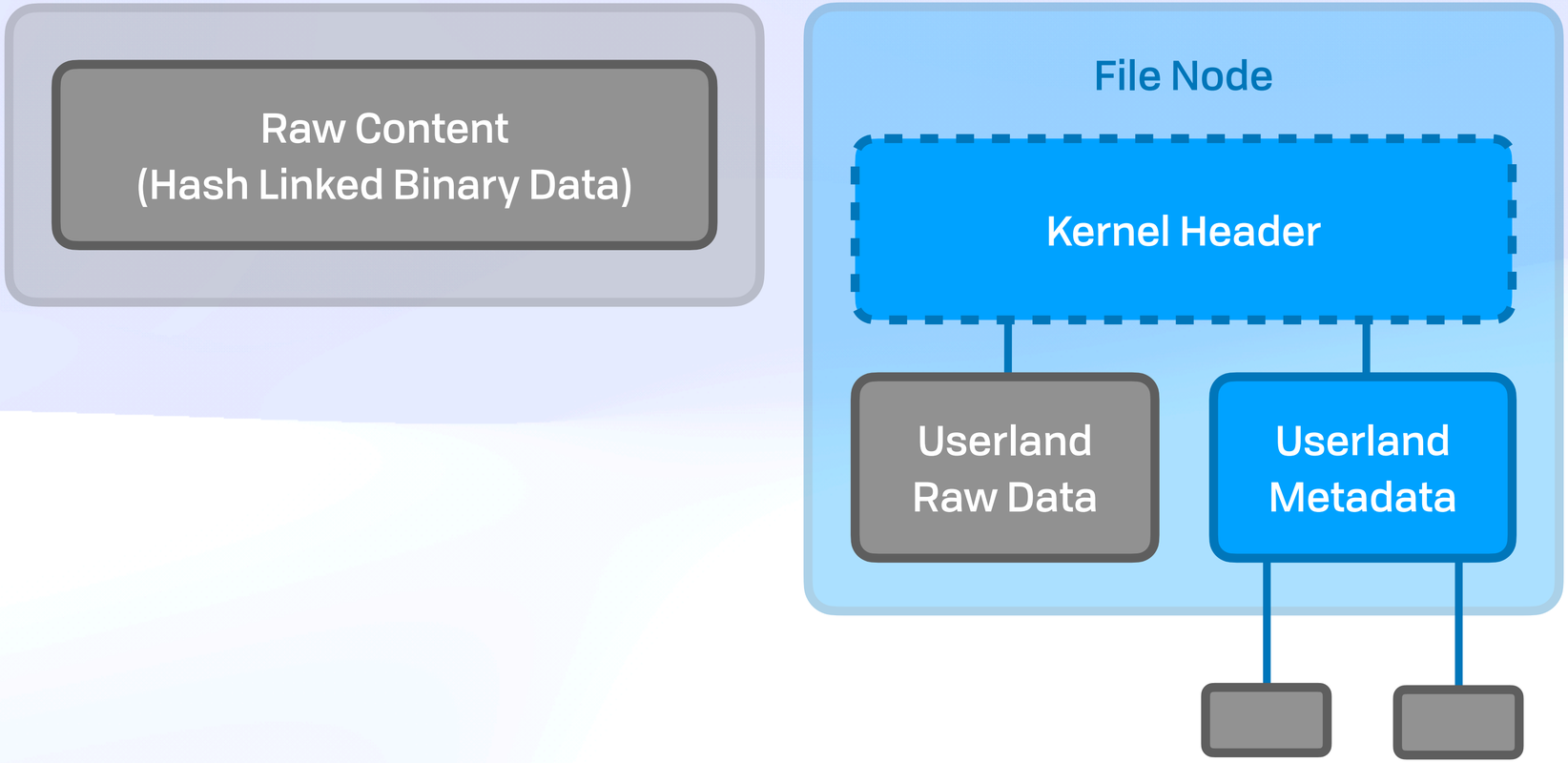
Public Files 📂

Virtual Nodes



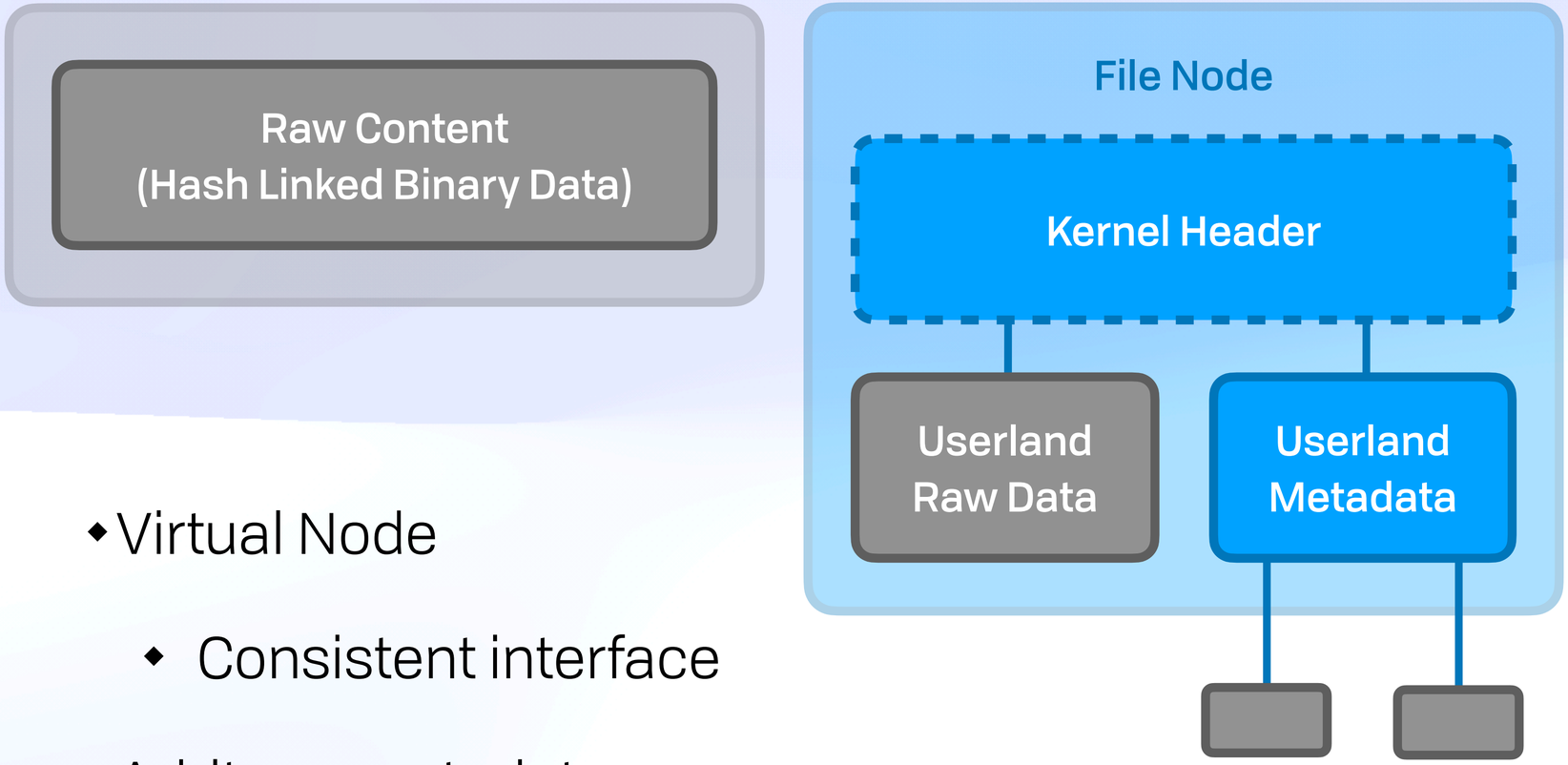
Public Files 📂

Virtual Nodes



Public Files 📂

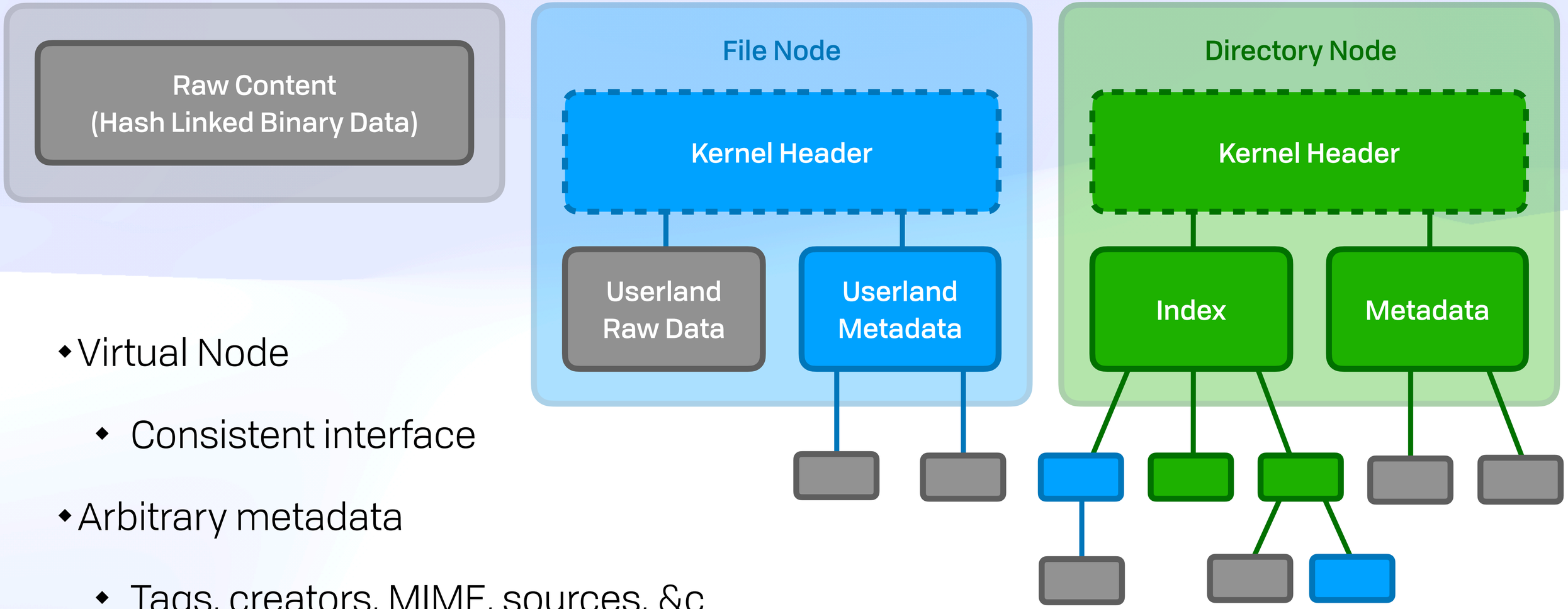
Virtual Nodes



- Virtual Node
  - Consistent interface
- Arbitrary metadata
  - Tags, creators, MIME, sources, &c

Public Files 📂

Virtual Nodes



- Virtual Node
  - Consistent interface
- Arbitrary metadata
  - Tags, creators, MIME, sources, &c

Public Files 📂

Hash-Linked Layout

Public Files 📂

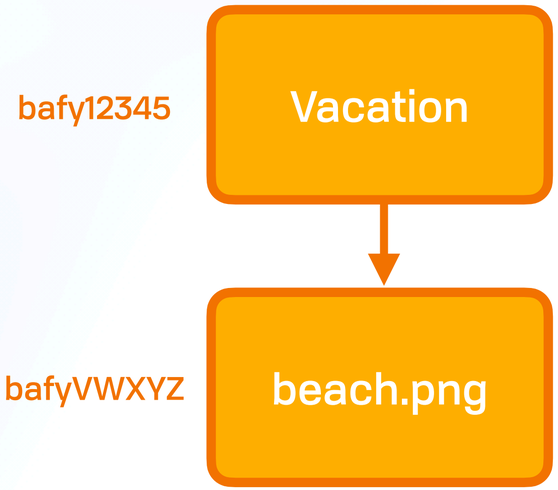
Hash-Linked Layout

bafyVWXYZ

beach.png

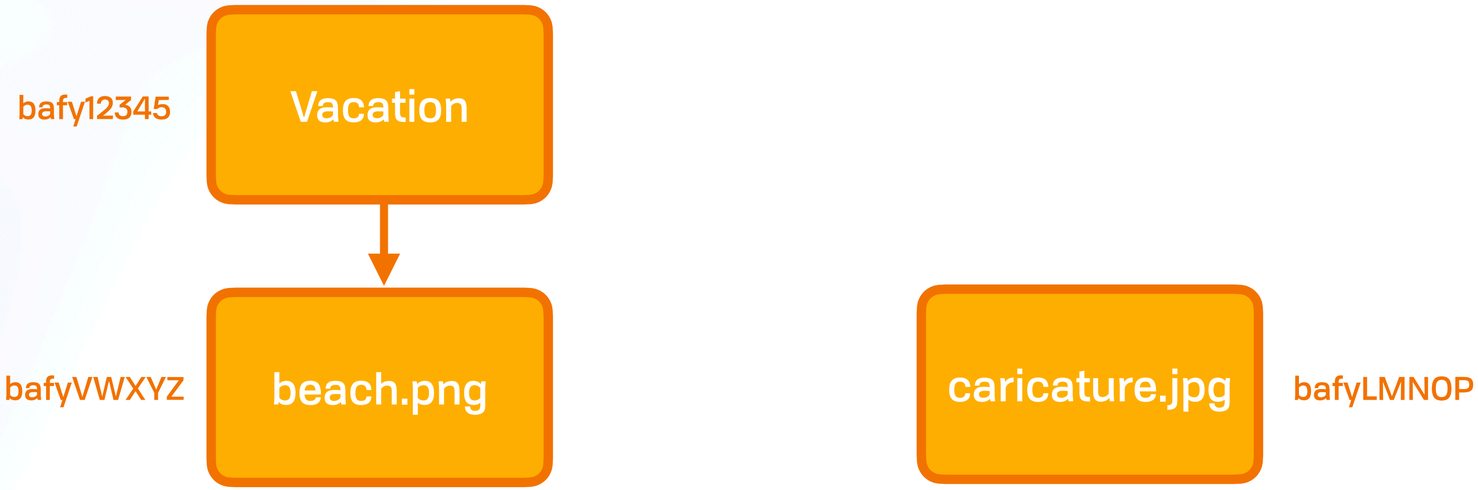
Public Files 📂

Hash-Linked Layout



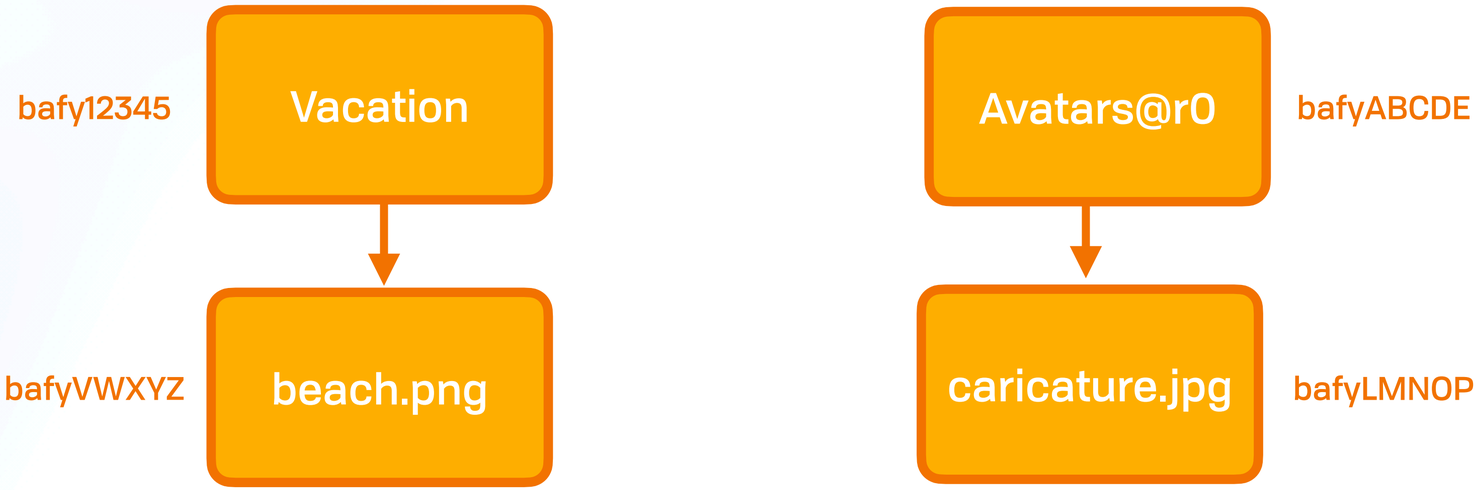
Public Files 📂

Hash-Linked Layout



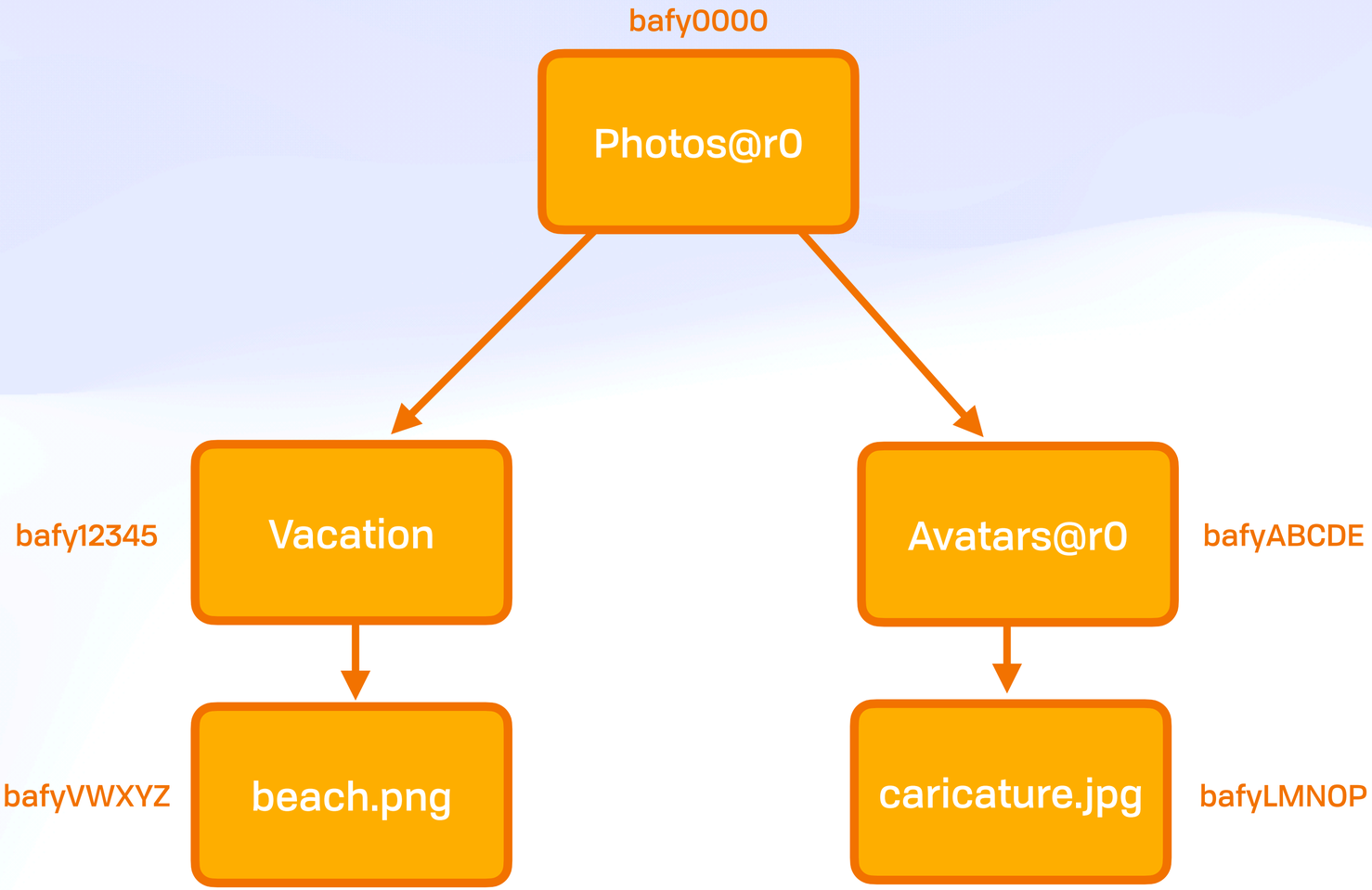
Public Files 📂

Hash-Linked Layout



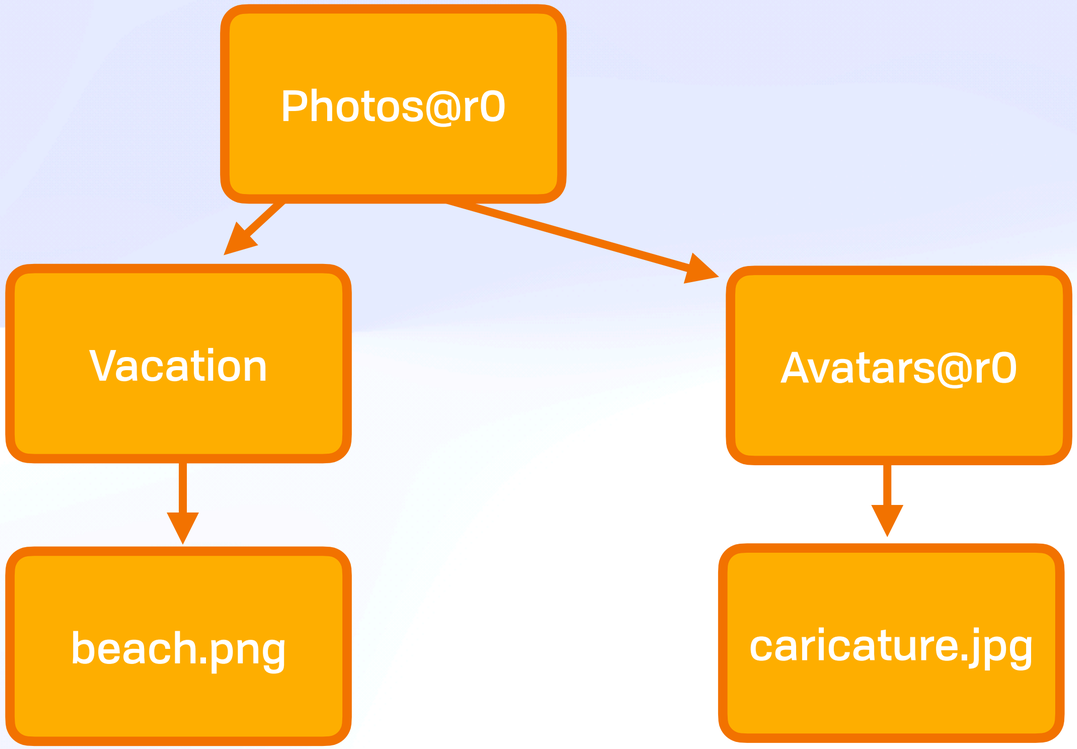
Public Files 📂

Hash-Linked Layout



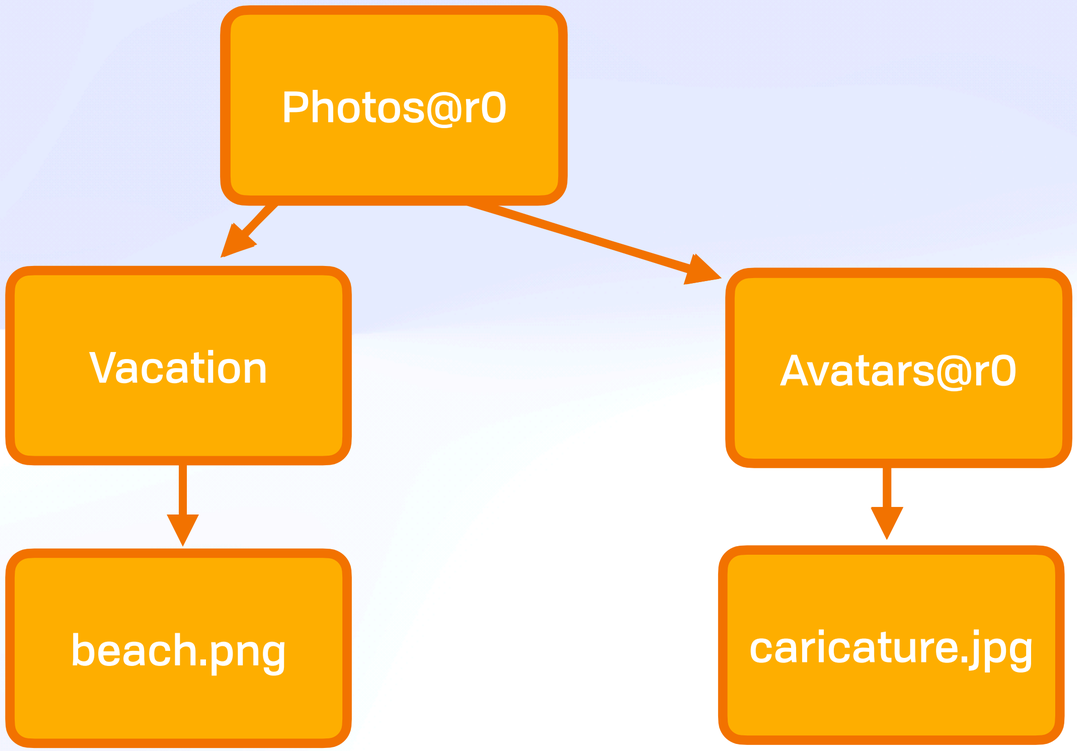
Public Files 📂

Hash-Linked Layout



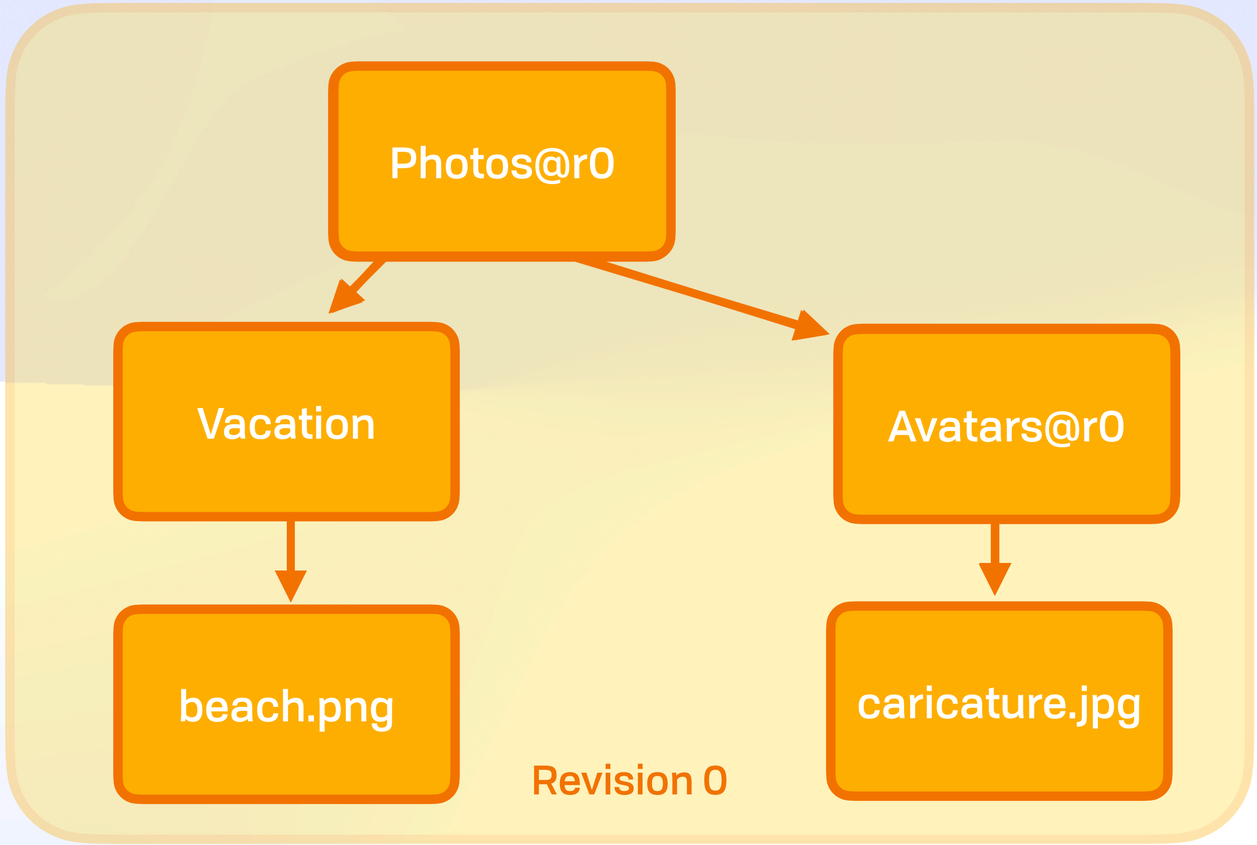
Public Files 📂

Persistent Versioning



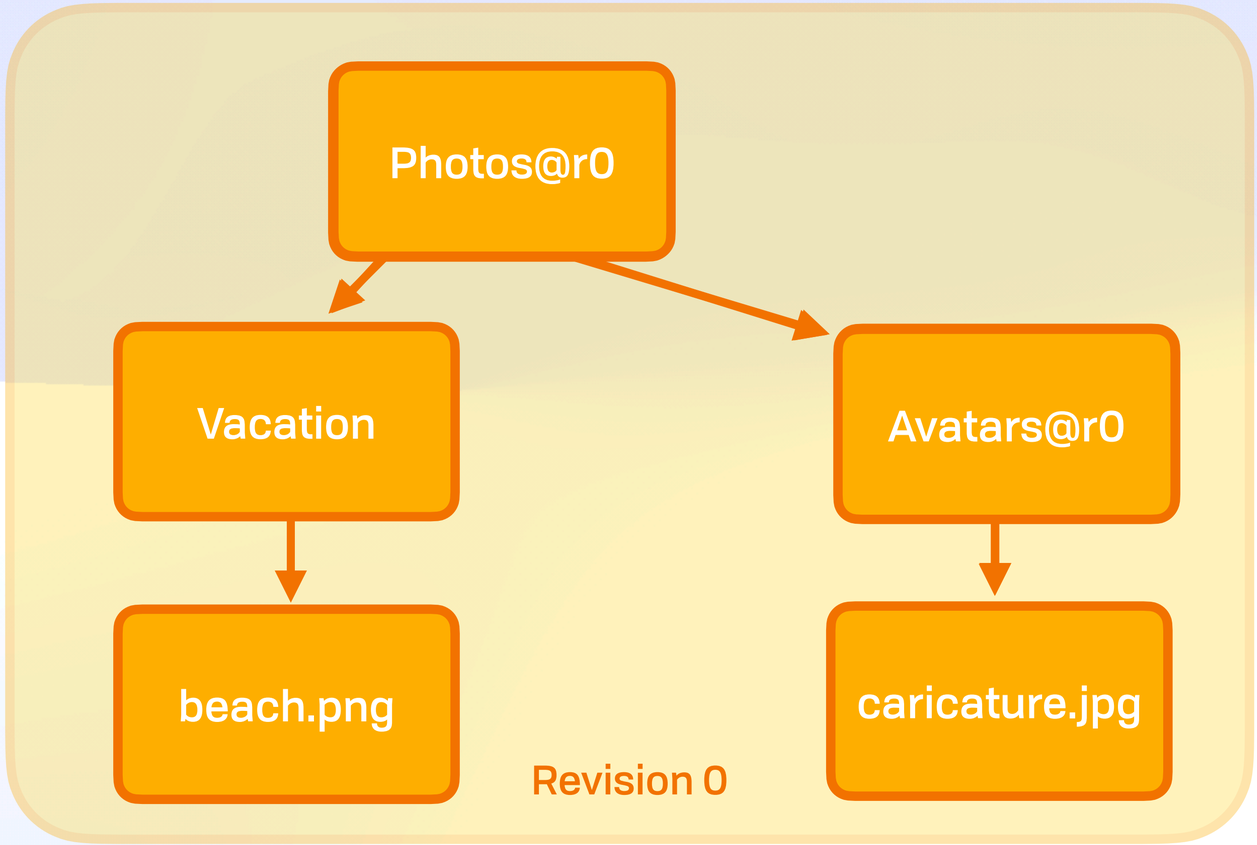
Public Files 📂

Persistent Versioning



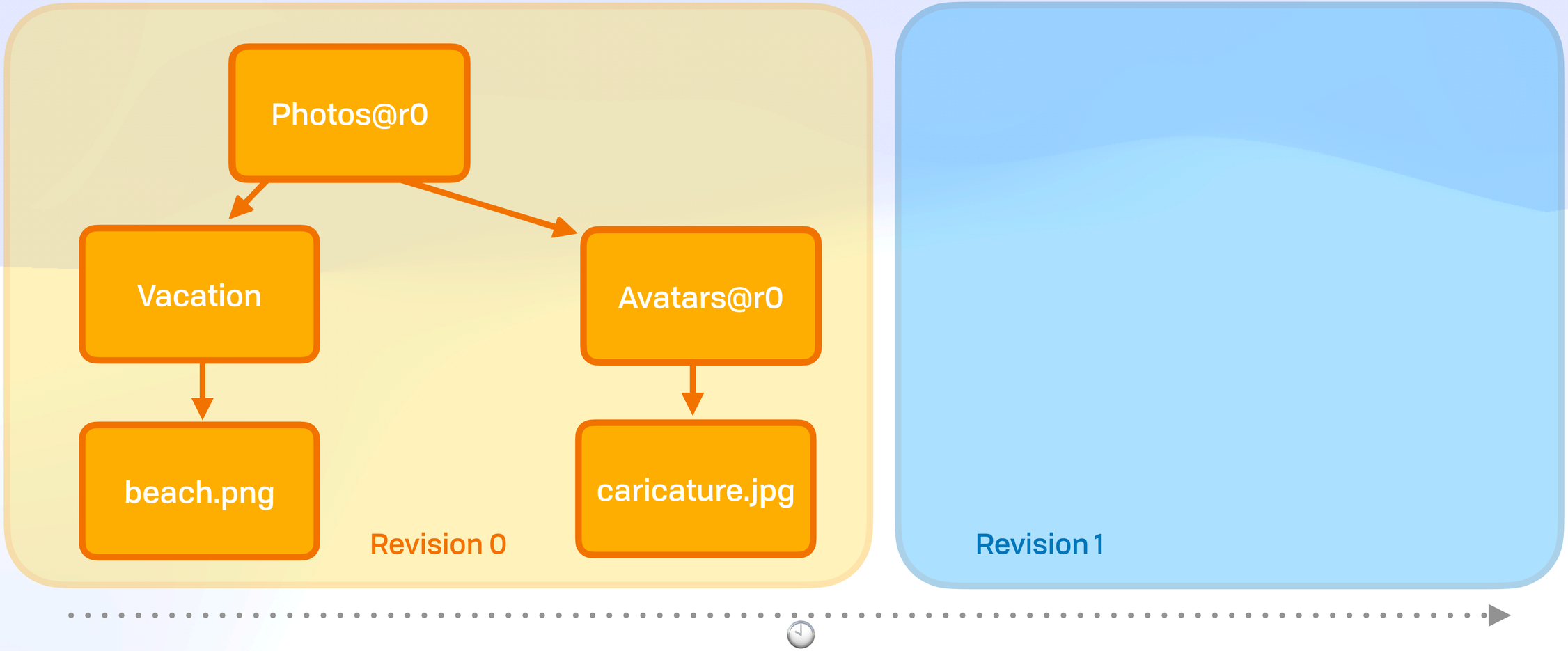
Public Files 📂

Persistent Versioning



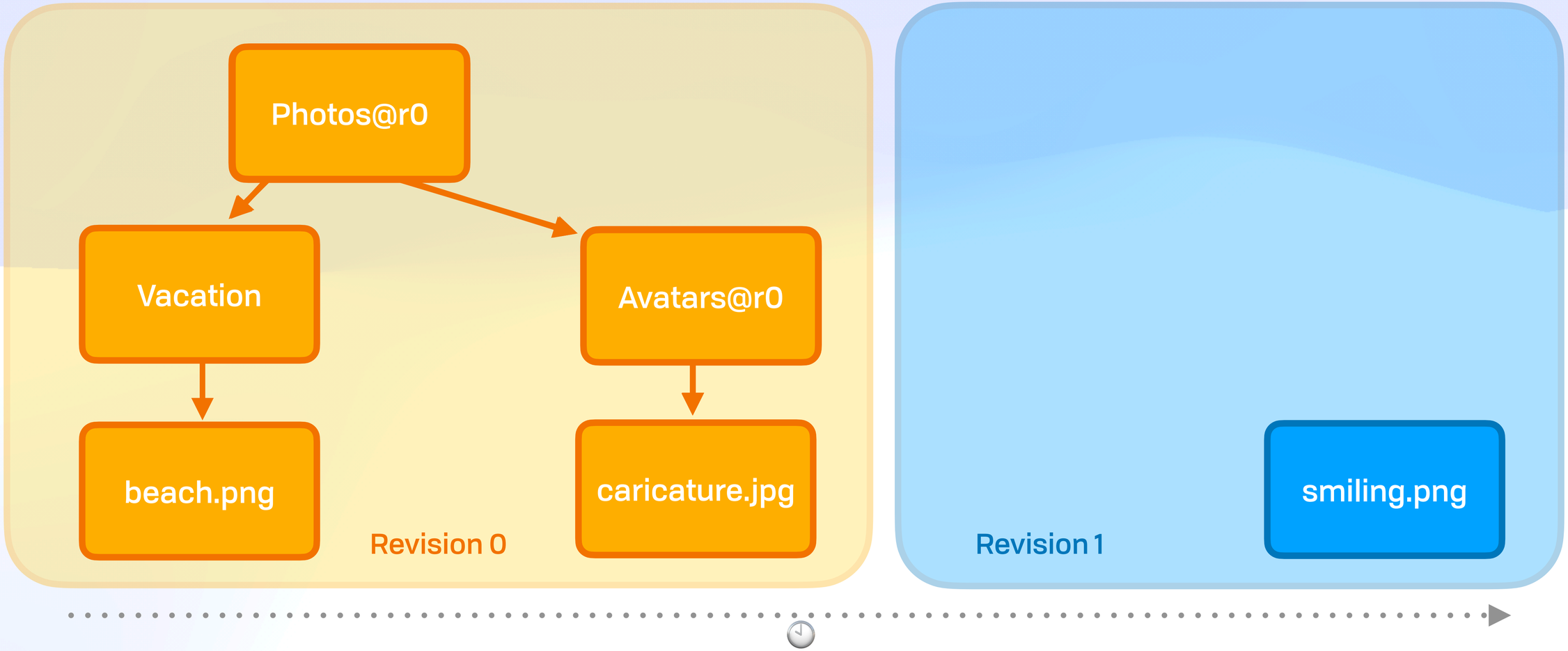
Public Files 📂

Persistent Versioning



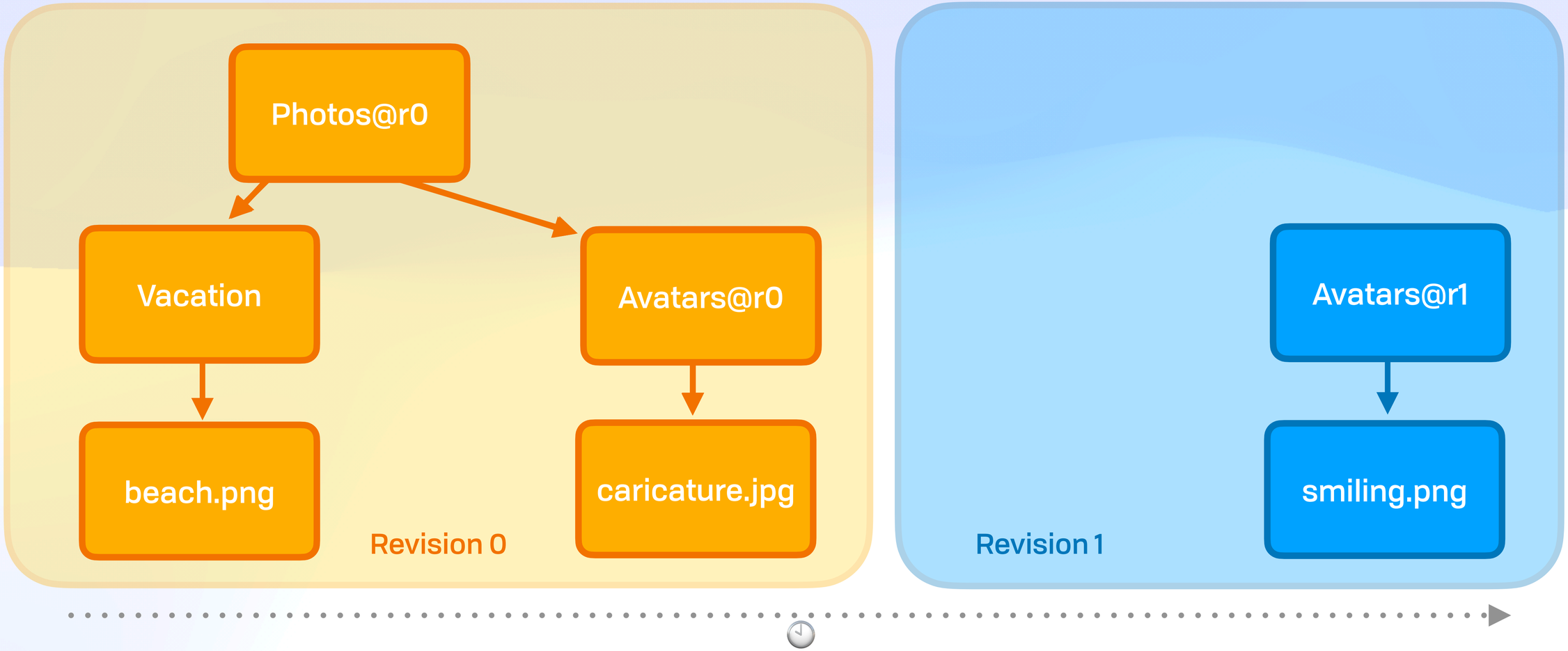
Public Files 📂

Persistent Versioning



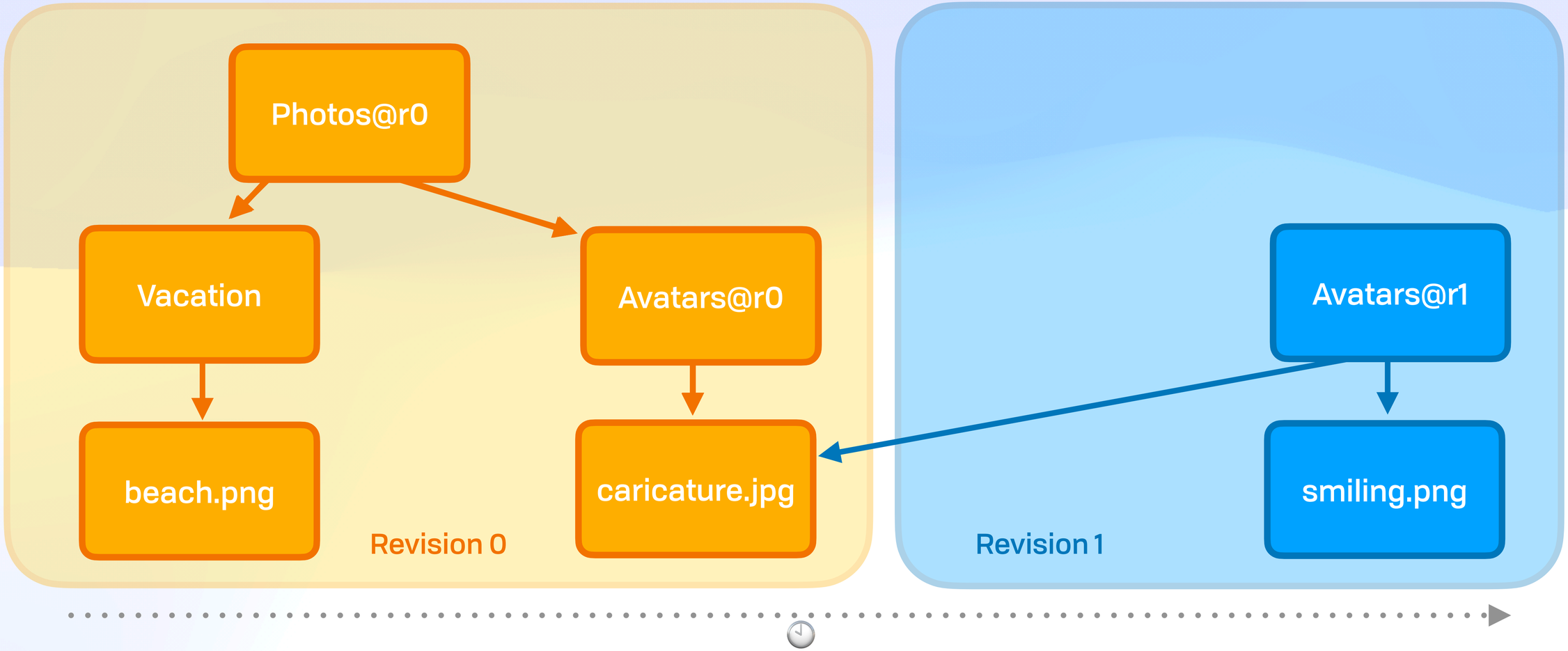
Public Files 📂

Persistent Versioning



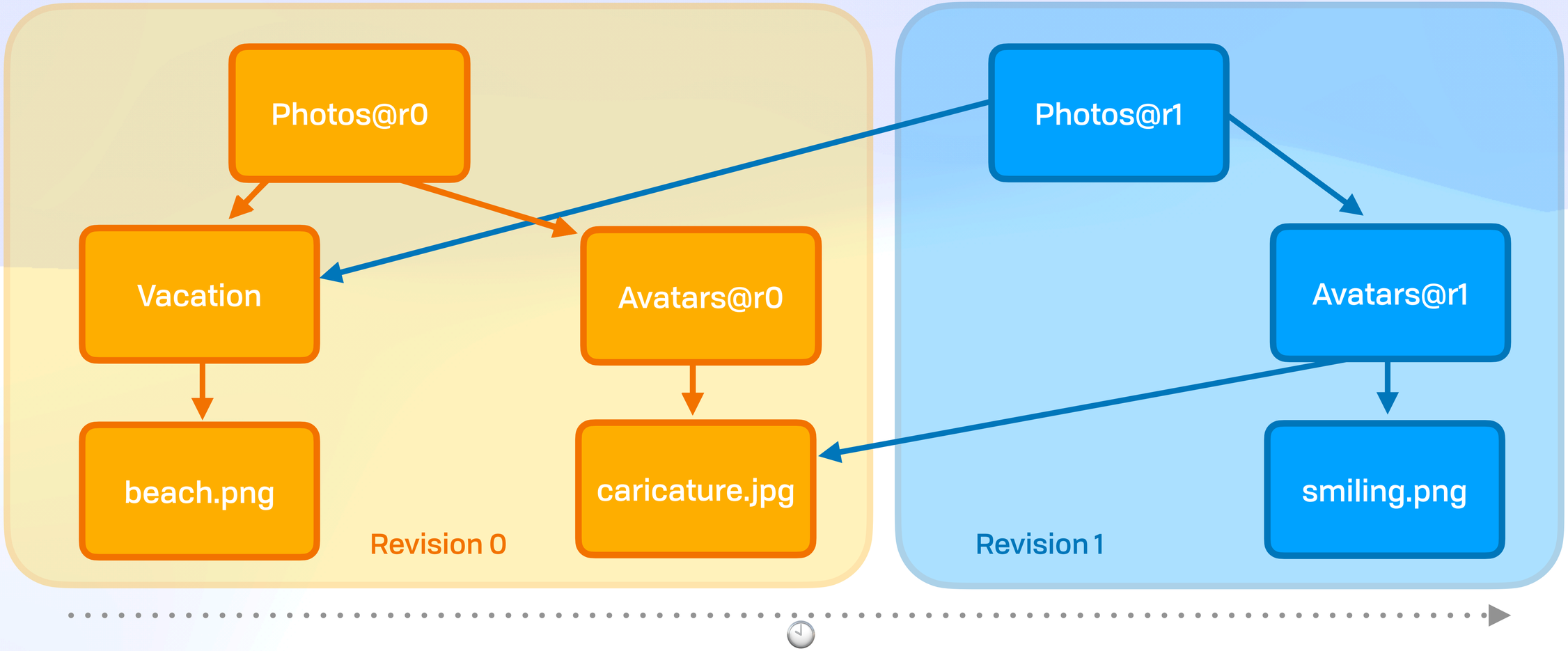
Public Files 📂

Persistent Versioning



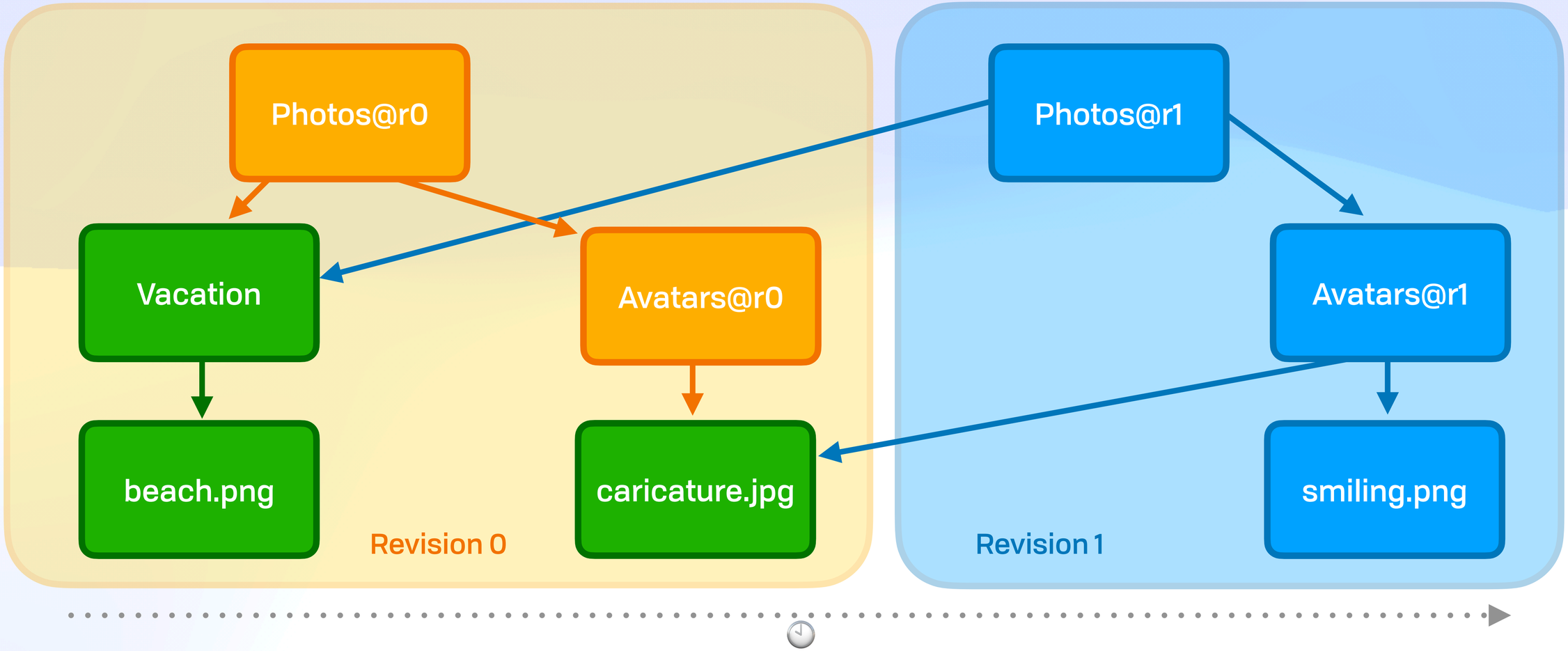
Public Files 📂

Persistent Versioning



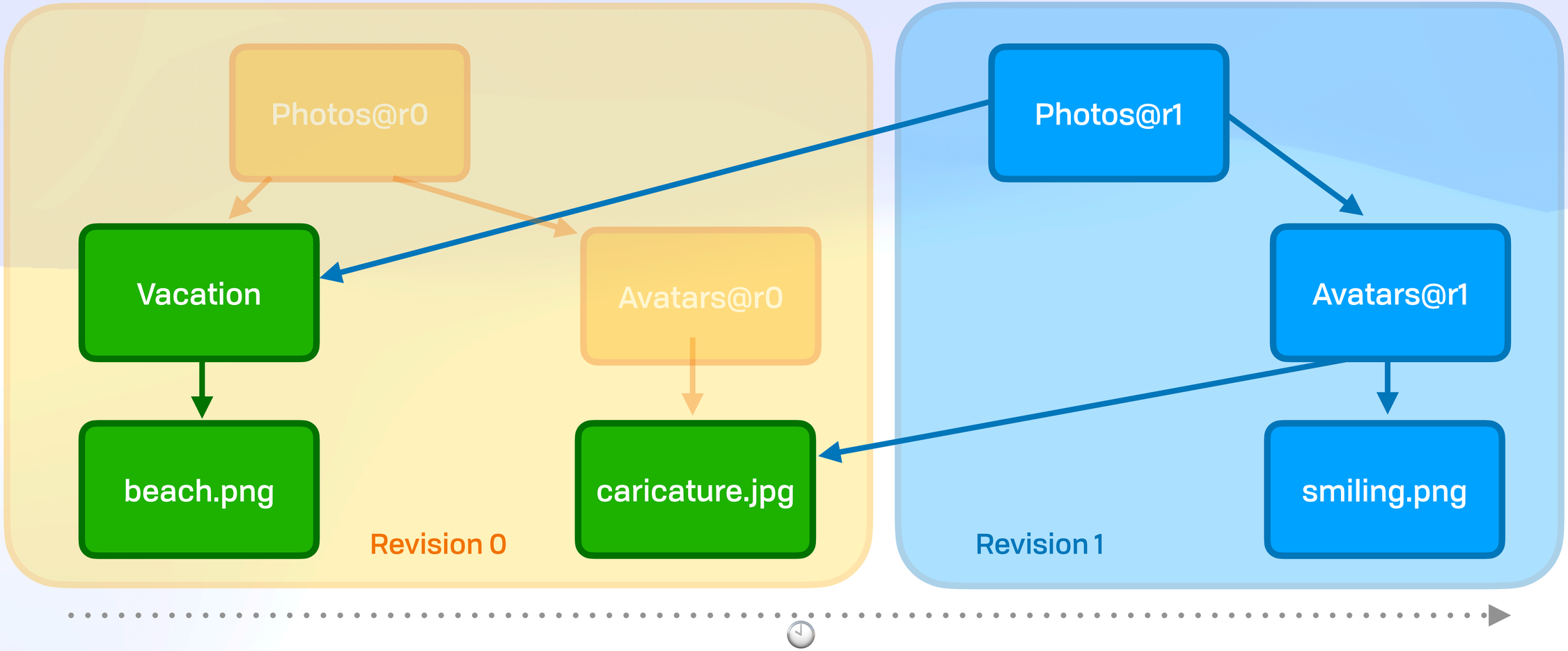
Public Files 📂

Persistent Versioning



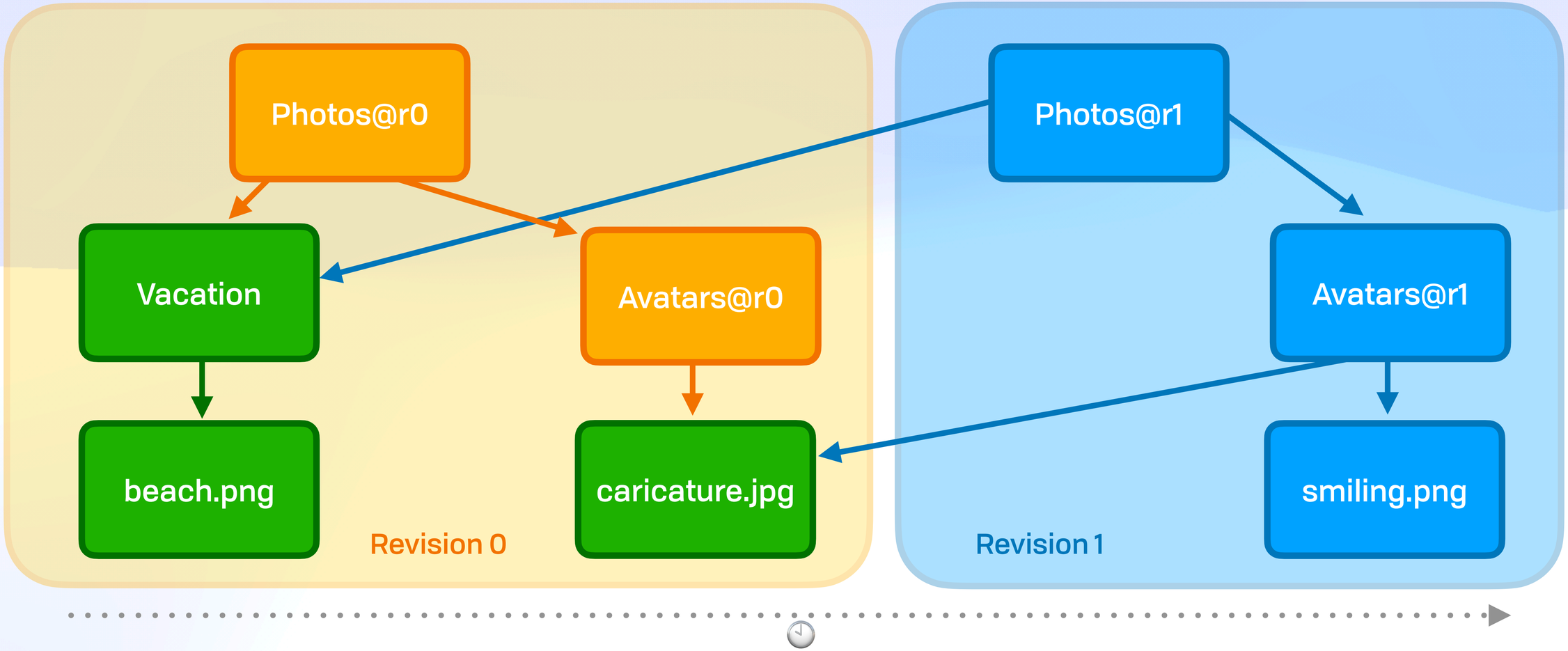
Public Files 📂

Persistent Versioning



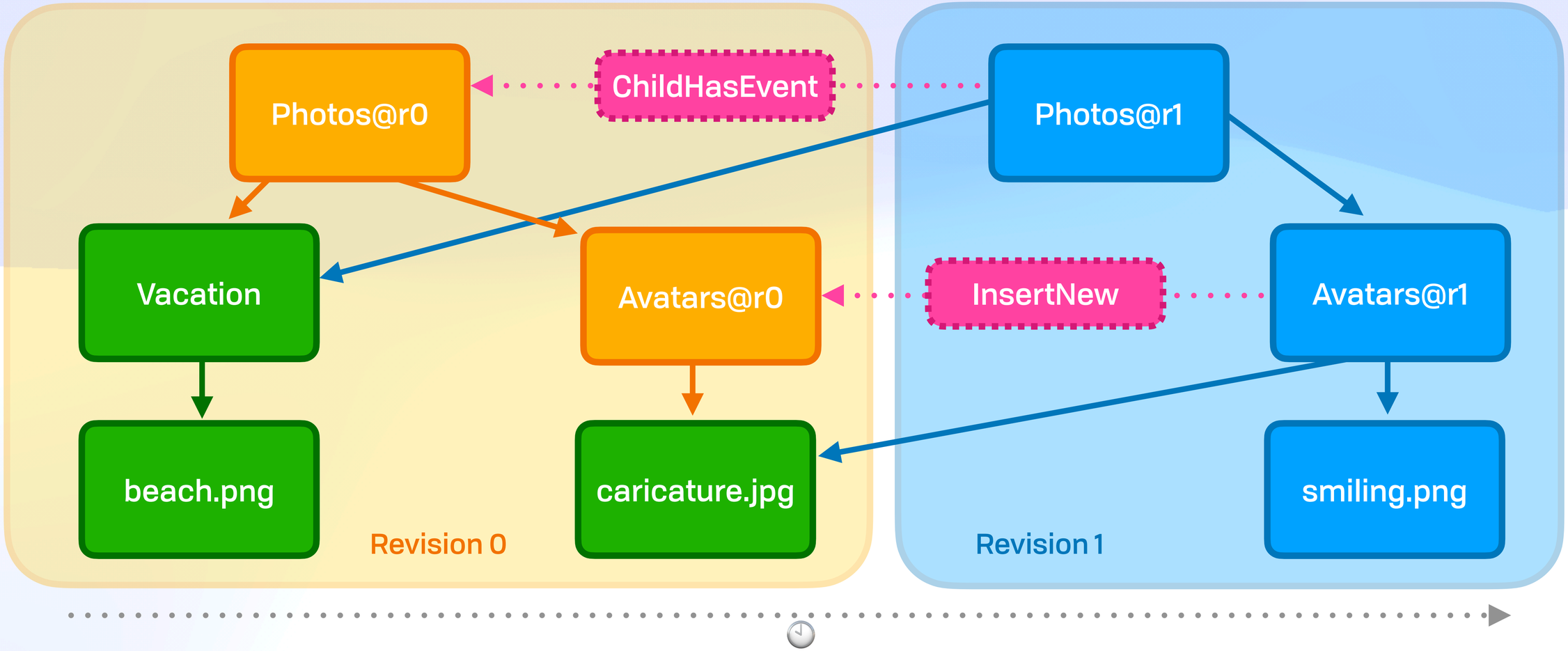
Public Files 📂

Persistent Versioning



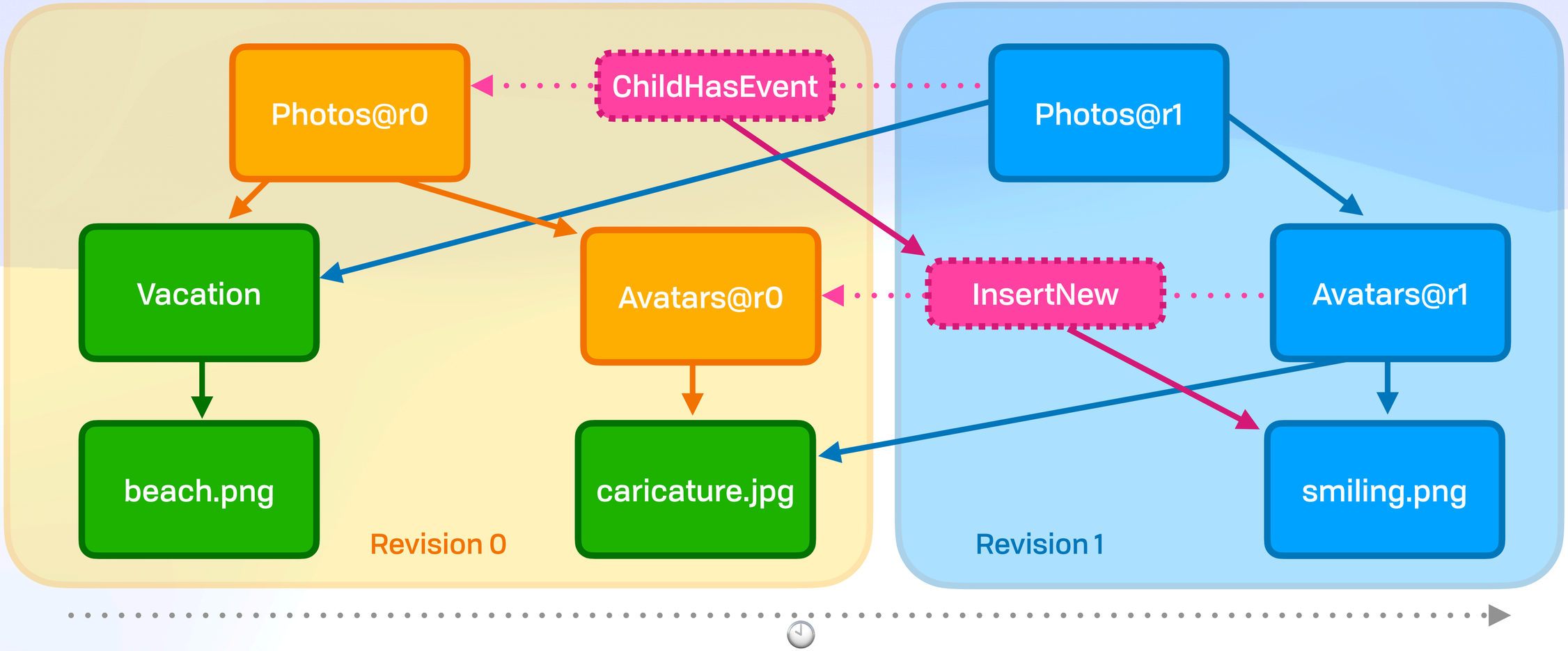
Public Files 📂

Persistent Versioning



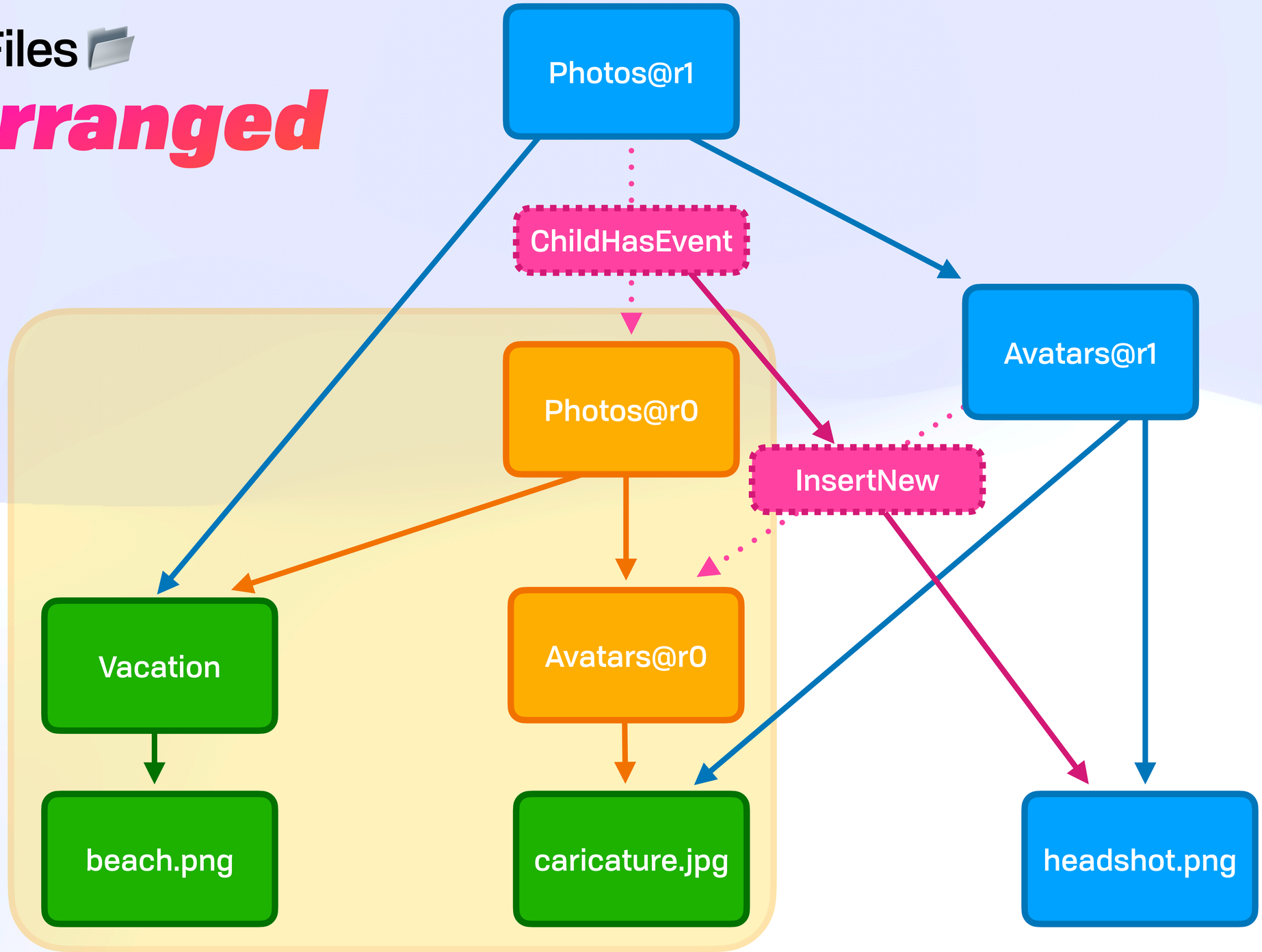
Public Files 📂

Persistent Versioning



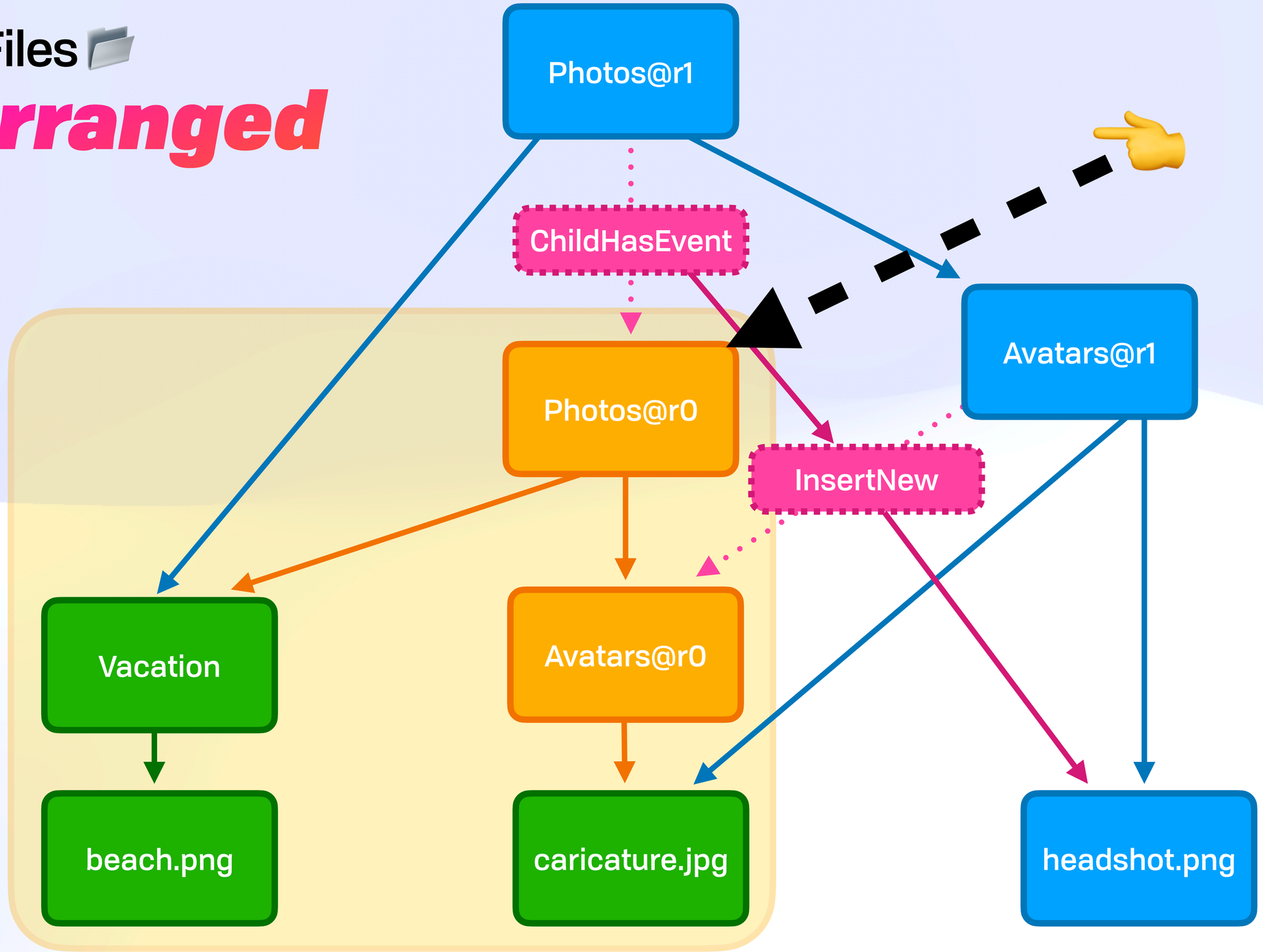
Public Files 📂

Rearranged



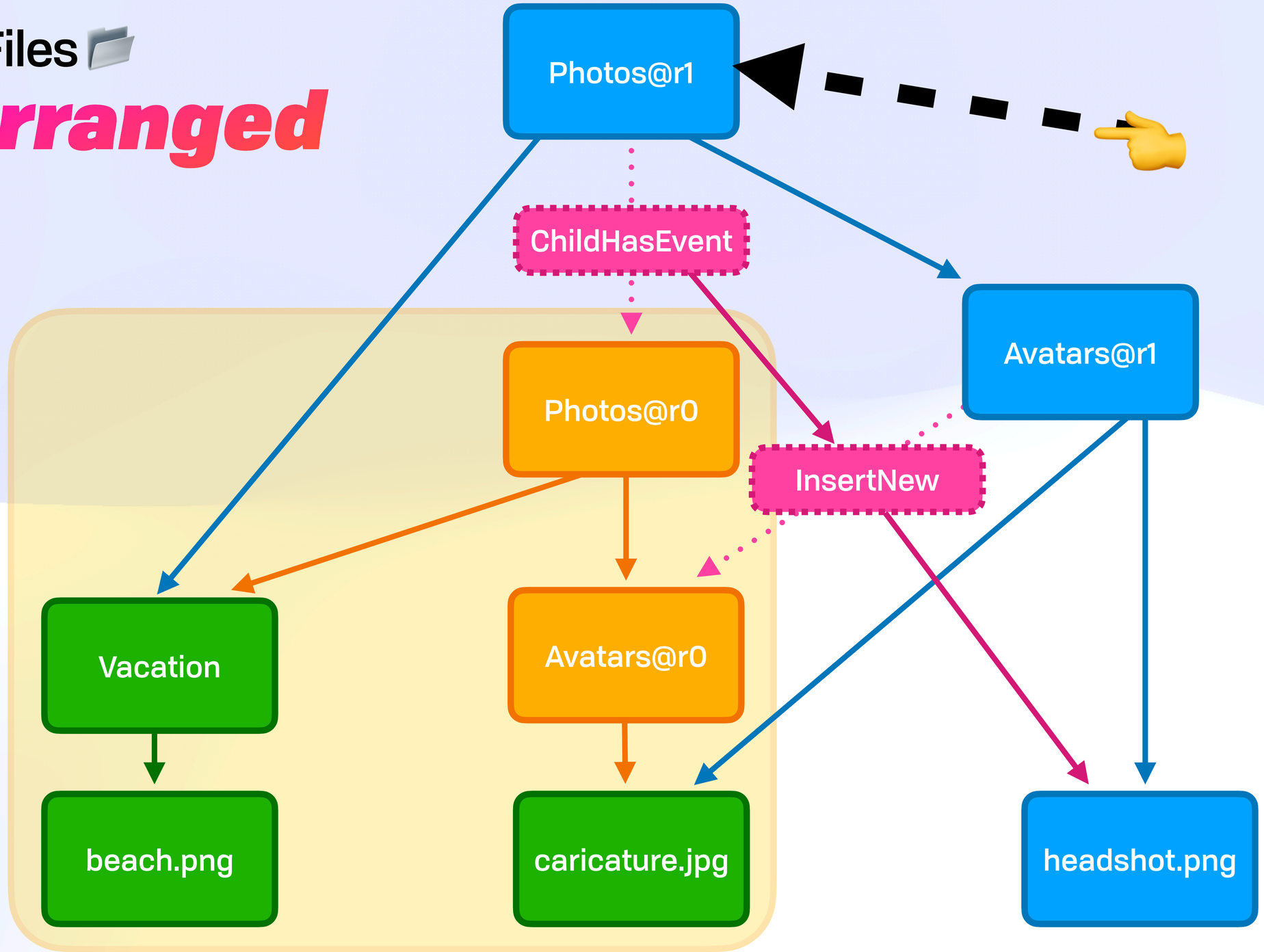
Public Files 📂

Rearranged



Public Files 📂

Rearranged



Public Files 📂

It's All Just Maps

```
{
  kernel: {
    ty: FILE,
    history: [
      {cid: "bafkreidrgwjljxy6s7o5uvrifxnweffgi7chmye3pn6wyisv2n4b3uordi", event: UPDATE},
      {cid: "bafkreicushgsax35ihrwo6smk4qmjuwzbf7qzqg6olqxyaisuxtgpyxrim", event: REPLACE}
    ]
  },
  metadata: {
    utime: 1661837091,
    author: "did:key:StEZpzSMtTt9k2vszgvCwF4fLQQSyA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4"
  },
  content: "HwRZys6pMUjvyS4pYKSS4Et33jDB+kwvCuMJu4GeNCan1eAmhPykHFR+gc2D+Qa/..."
}
```

Public Files 📂

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  kernel: {
    ty: FILE,
    history: [
      {cid: "bafkreidrgwjljxy6s7o5uvrifxnweffgi7chmye3pn6wyisv2n4b3uordi", event: UPDATE},
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    ]
  },
  metadata: {
    utime: 1661837091,
    author: "did:key:StEZpzSMtTt9k2vszgvCwF4fLQQSyA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4"
  },
  content: "HwRZys6pMUjvyS4pYKSS4Et33jDB+kwvCuMJu4GeNCan1eAmhPykHFR+gc2D+Qa/..."
}
```

Public Files 📂

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  kernel: {
    ty: FILE,
    history: [
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}
```

Public Files 📂

It's All Just Maps

```
{
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    ]
  },
  metadata: {
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    author: "did:key:StEZpzSMtTt9k2vszgvCwF4fLQQSyA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4"
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}
```

Multiple?! (More on this later)

Public Files 📂

It's All Just Maps

```
{
  kernel: {
    ty: FILE,
    history: [
      {cid: "bafkreidrgwjljxy6s7o5uvrifxnweffgi7chmye3pn6wyisv2n4b3uordi", event: UPDATE},
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    ]
  },
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    utime: 1661837091,
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  },
  content: "HwRZys6pMUjvyS4pYKSS4Et33jDB+kwvCuMJu4GeNCan1eAmhPykHFR+gc2D+Qa/..."
}
```

Public Files 📂

It's All Just Maps

```
{
  kernel: {
    ty: FILE,
    history: [
      {cid: "bafkreidrgwjljxy6s7o5uvrifxnweffgi7chmye3pn6wyisv2n4b3uordi", event: UPDATE},
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    ]
  },
  metadata: {
    utime: 1661837091,
    author: "did:key:StEZpzSMtTt9k2vszgvCwF4fLQQSyA15W5AQ4z3AR6Bx4eFJ5crJFbuGxKmbma4"
  },
  content: "HwRZys6pMUjvyS4pYKSS4Et33jDB+kwvCuMJu4GeNCan1eAmhPykHFR+gc2D+Qa/..."
}
```

Public Files 📂

Single Public File History

Public Files 📂

Single Public File History

Single File History / "Causal Shadow"

Public Files 📂

Single Public File History

A

Single File History / "Causal Shadow"

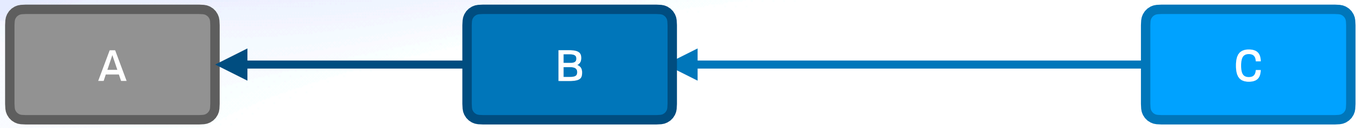
Public Files 📂

Single Public File History

Single File History / "Causal Shadow"

Public Files 📂

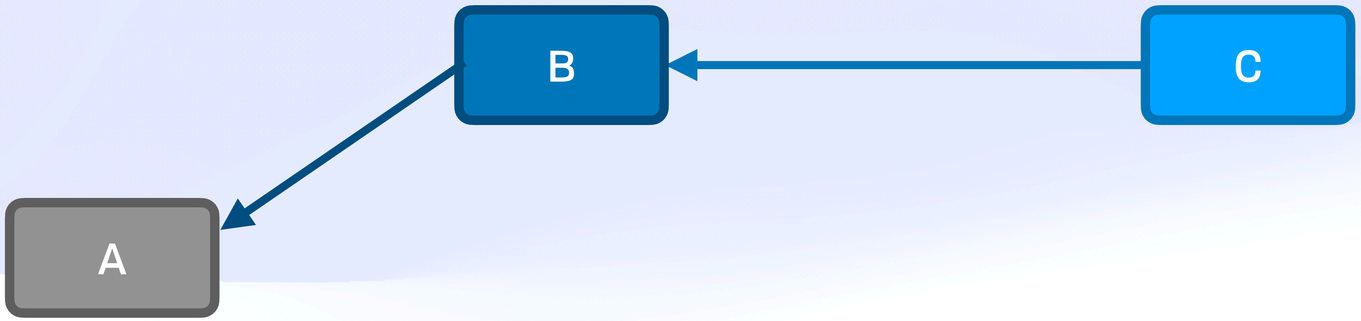
Single Public File History



Single File History / "Causal Shadow"

Public Files 📂

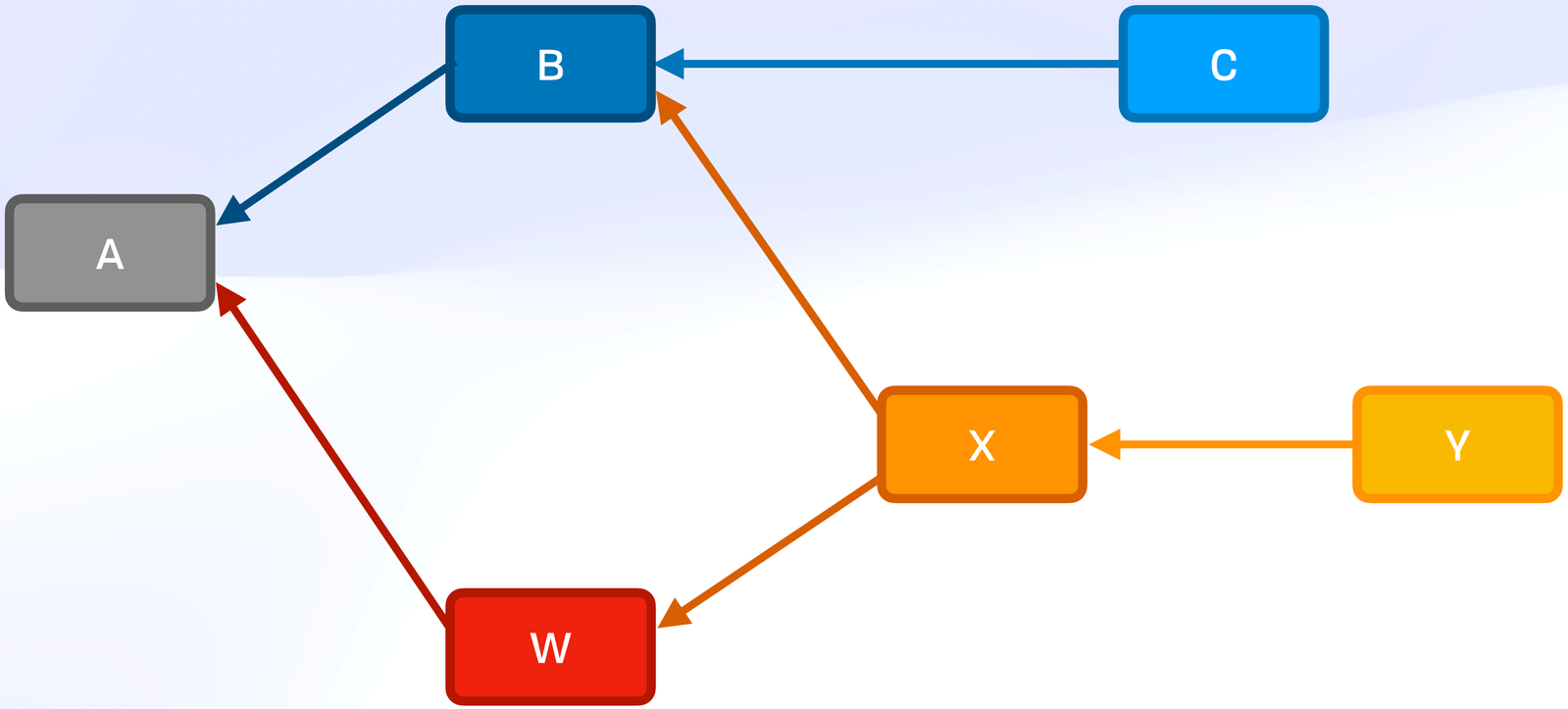
Single Public File Confluence



Single File History / "Causal Shadow"

Public Files 📂

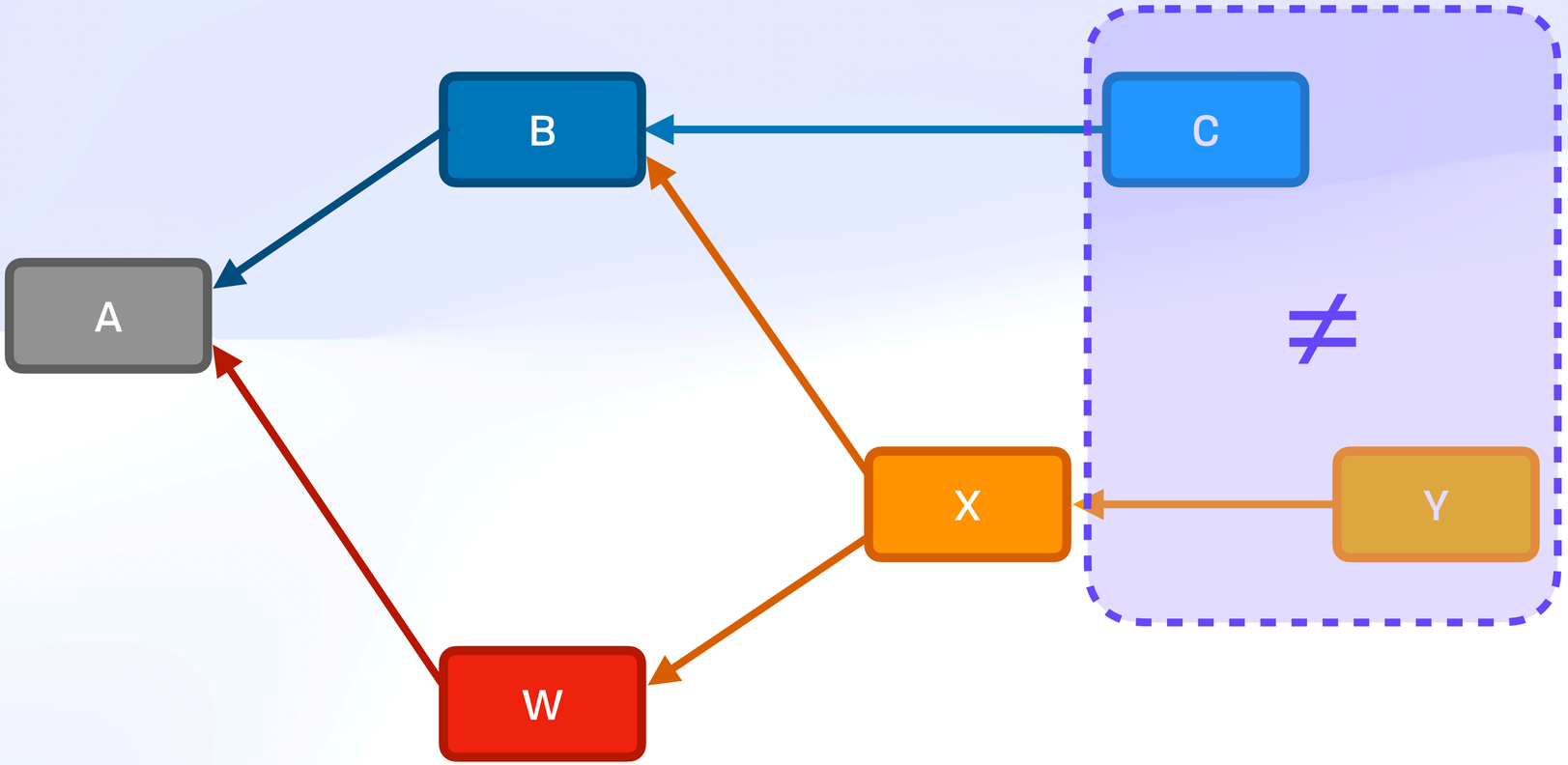
Single Public File Confluence



Single File History / "Causal Shadow"

Public Files 📂

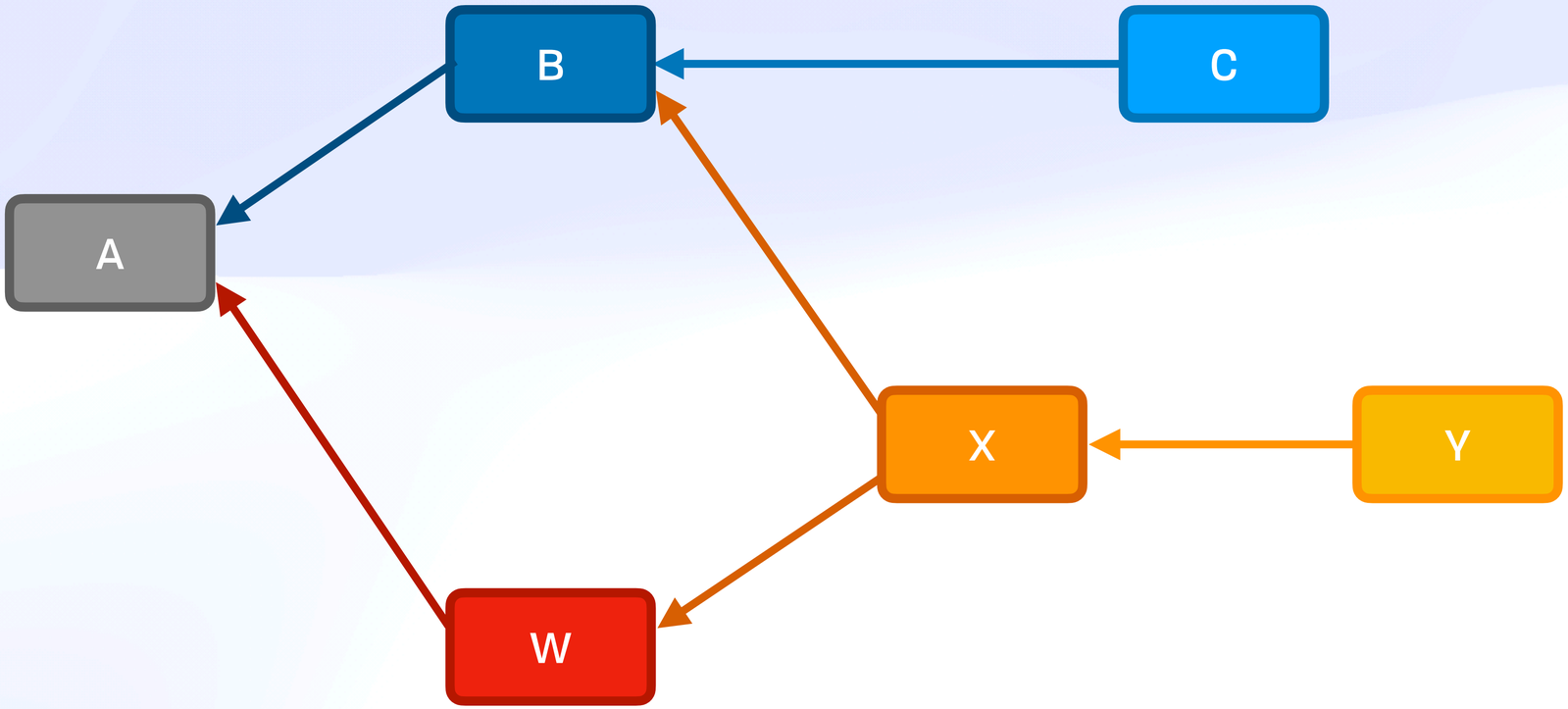
Single Public File Confluence



Single File History / "Causal Shadow"

Public Files 📂

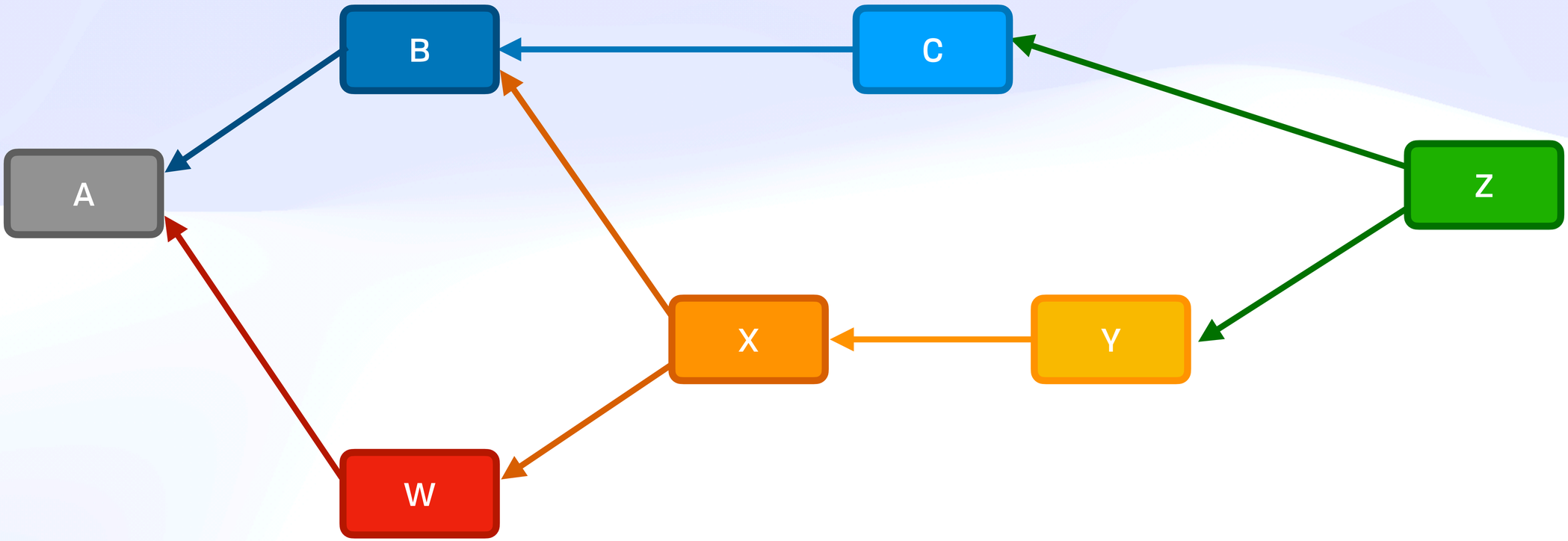
Single Public File Confluence



Single File History / "Causal Shadow"

Public Files 📂

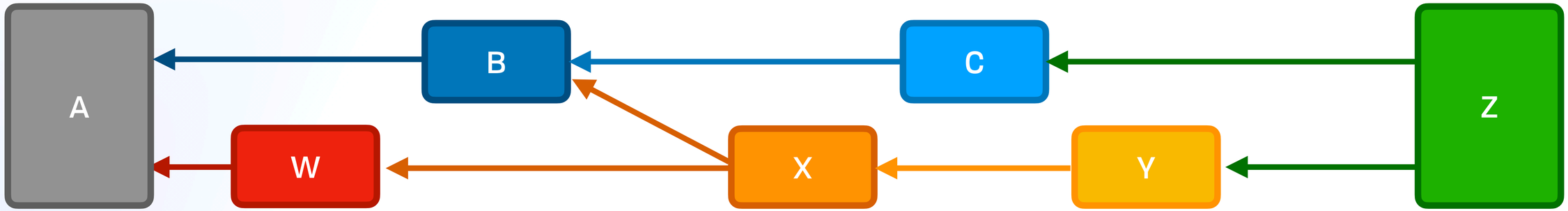
Single Public File Confluence



Single File History / "Causal Shadow"

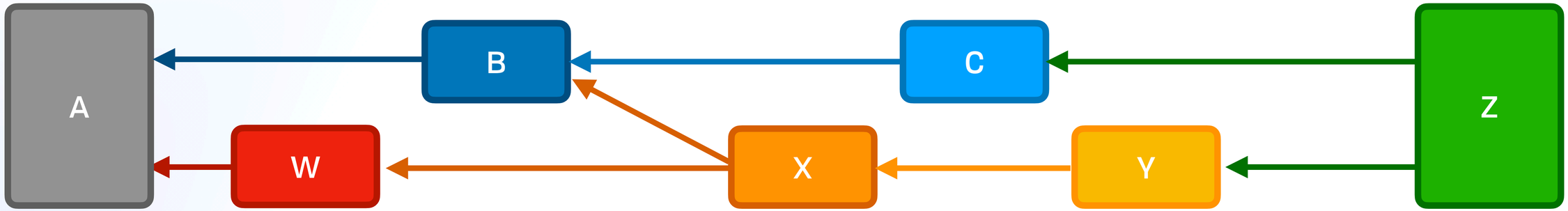
Public Files 📂

Single Public File Confluence



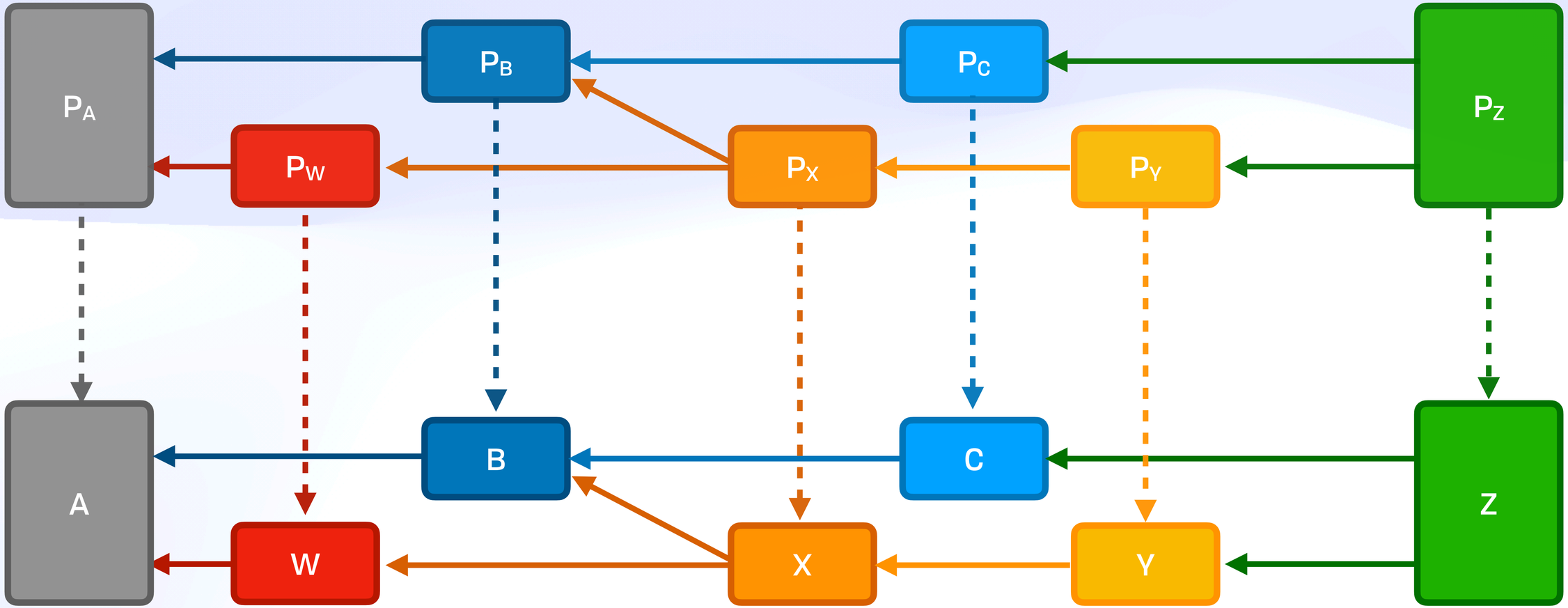
Public Files 📂

Directory History



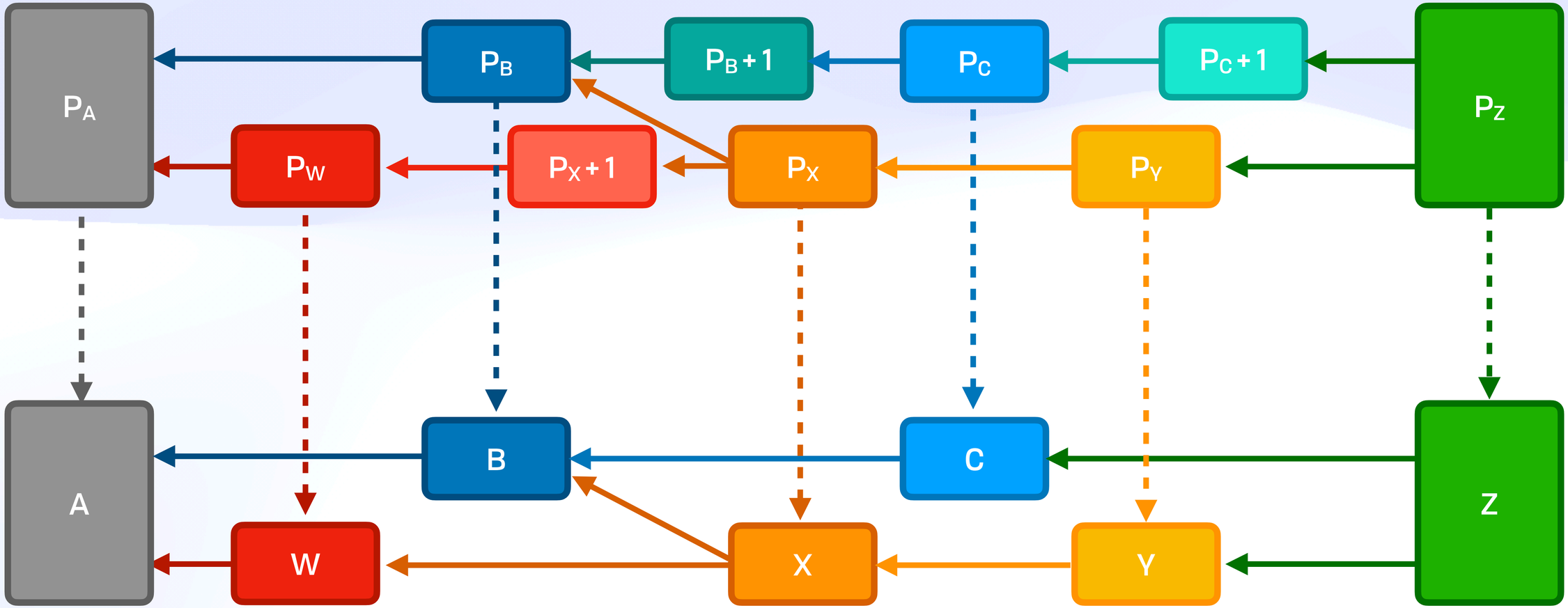
Public Files 📂

Directory History



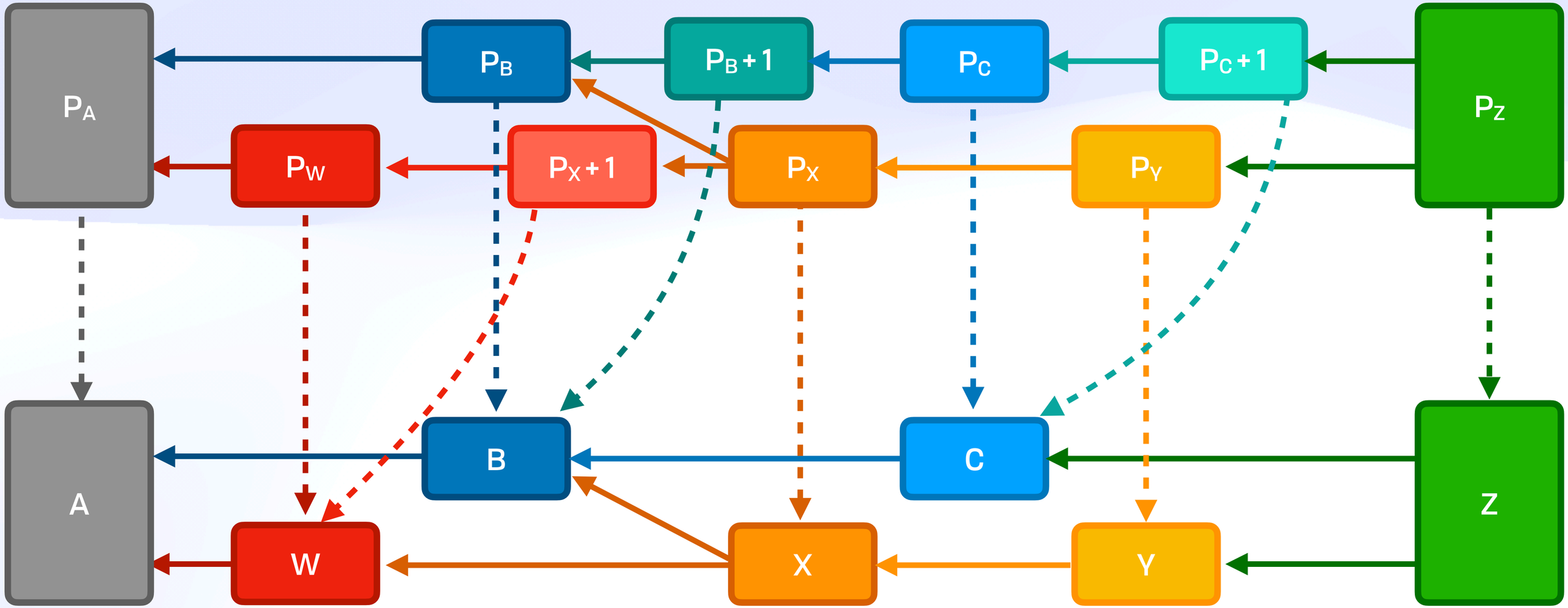
Public Files 📂

Directory History + Extra Updates



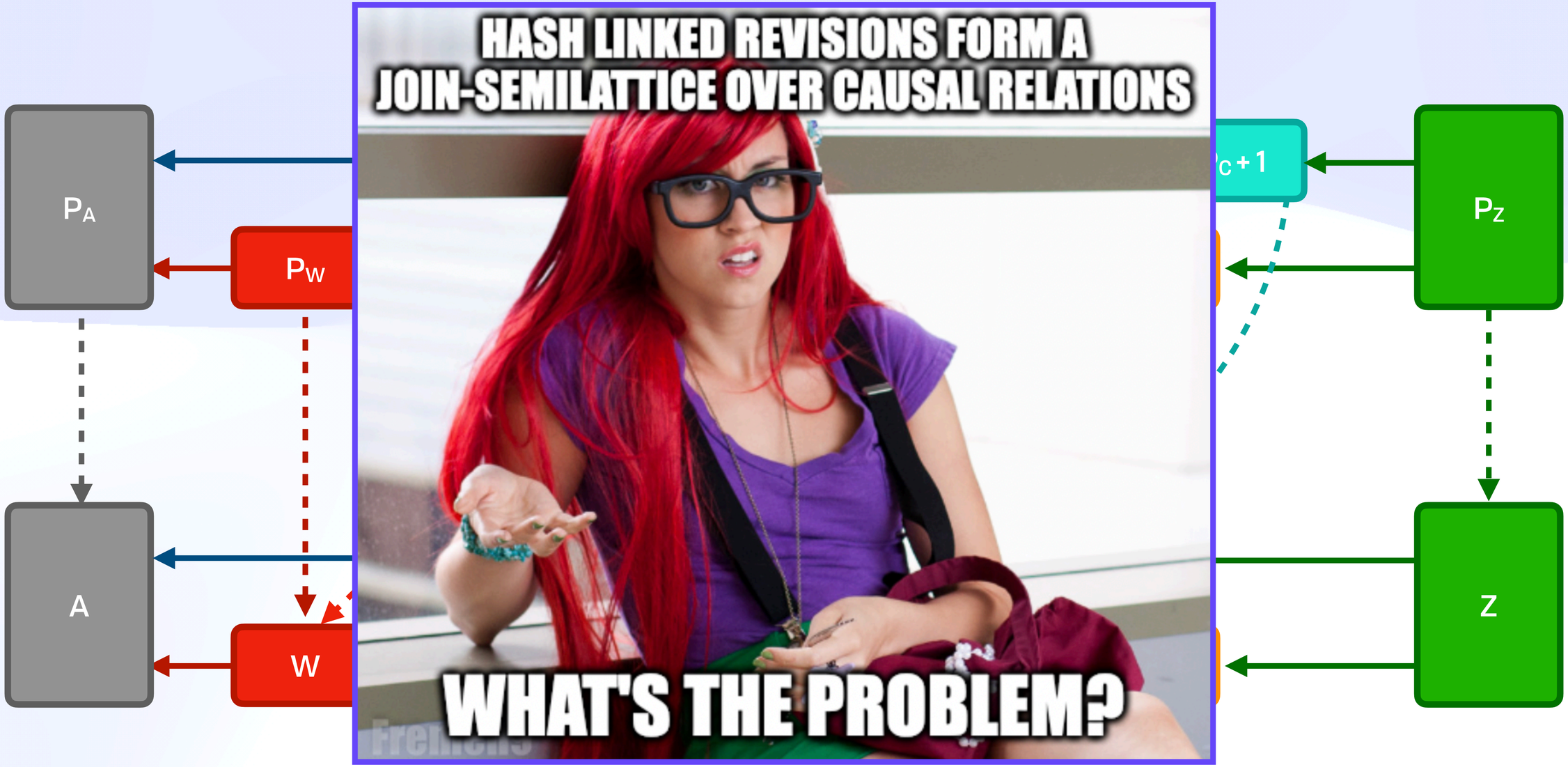
Public Files 📂

Directory History + Extra Updates



Public Files 📂

Directory History + Extra Updates

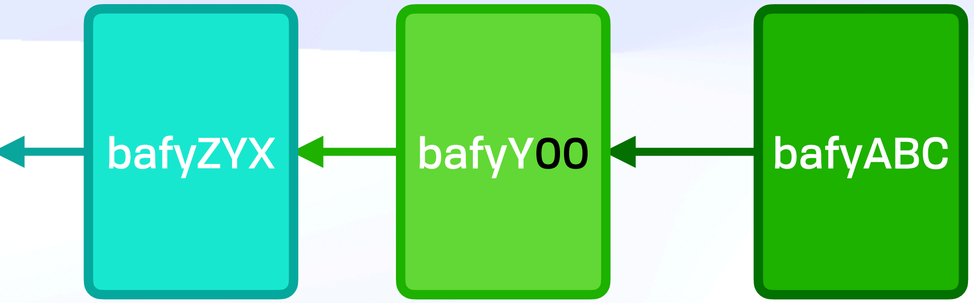


Public Files 📂

Diff Checkpointing

Public Files 📂

Diff Checkpointing

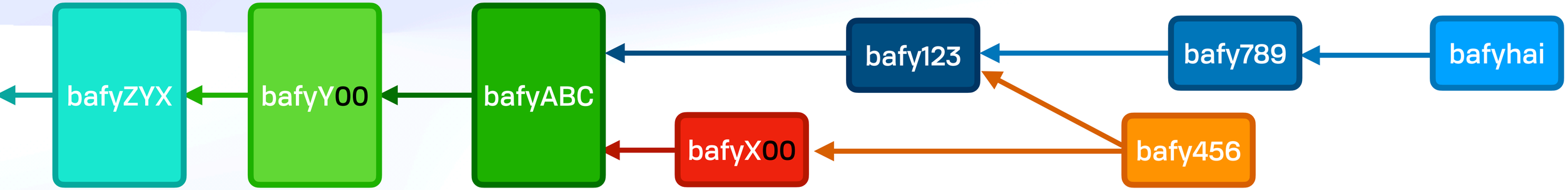


Public Files 📂

Diff Checkpointing

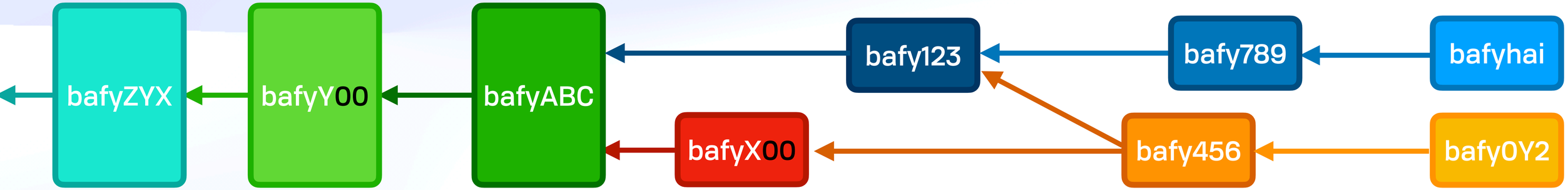
Public Files 📂

Diff Checkpointing



Public Files 📂

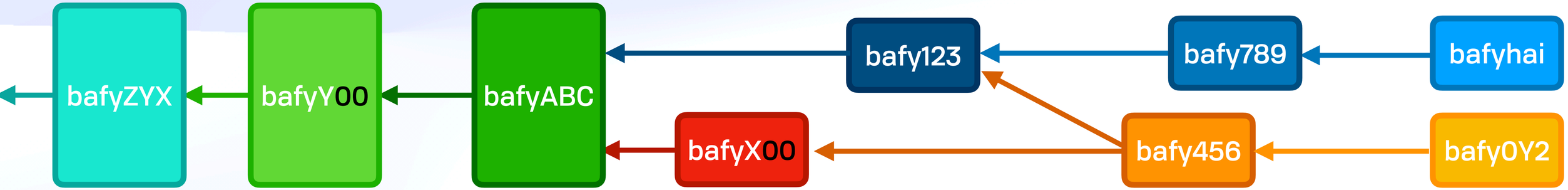
Diff Checkpointing



Public Files 📂

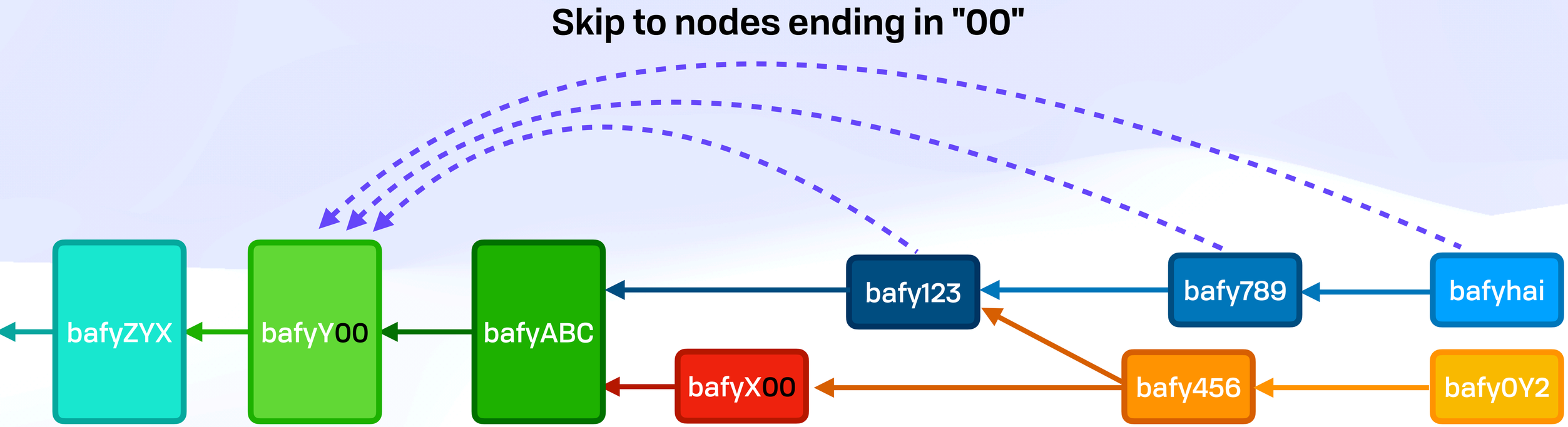
Diff Checkpointing

Skip to nodes ending in "00"



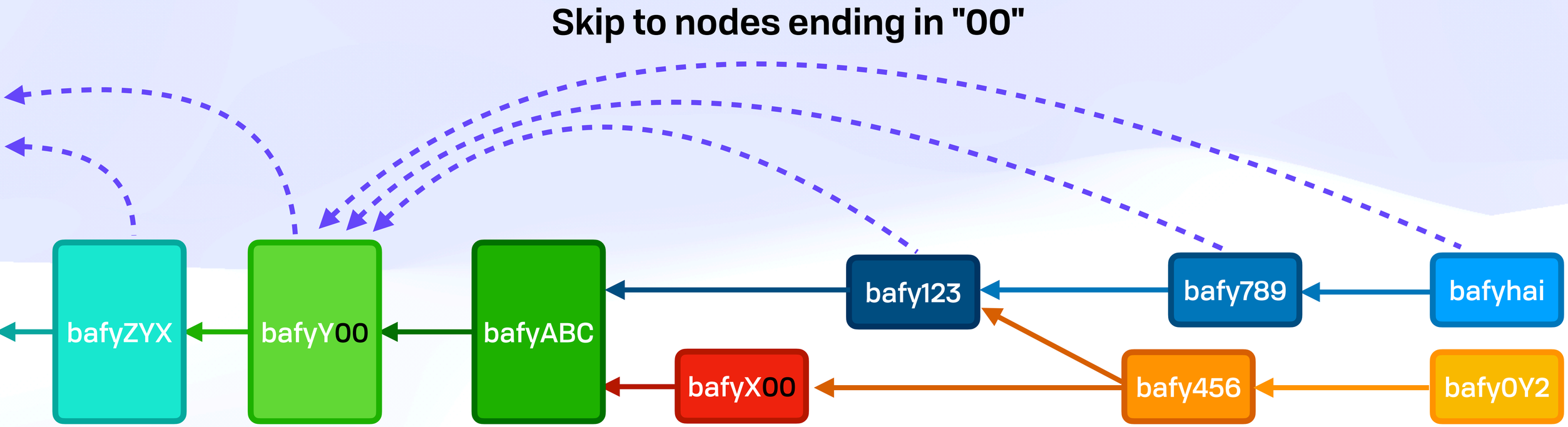
Public Files 📂

Diff Checkpointing



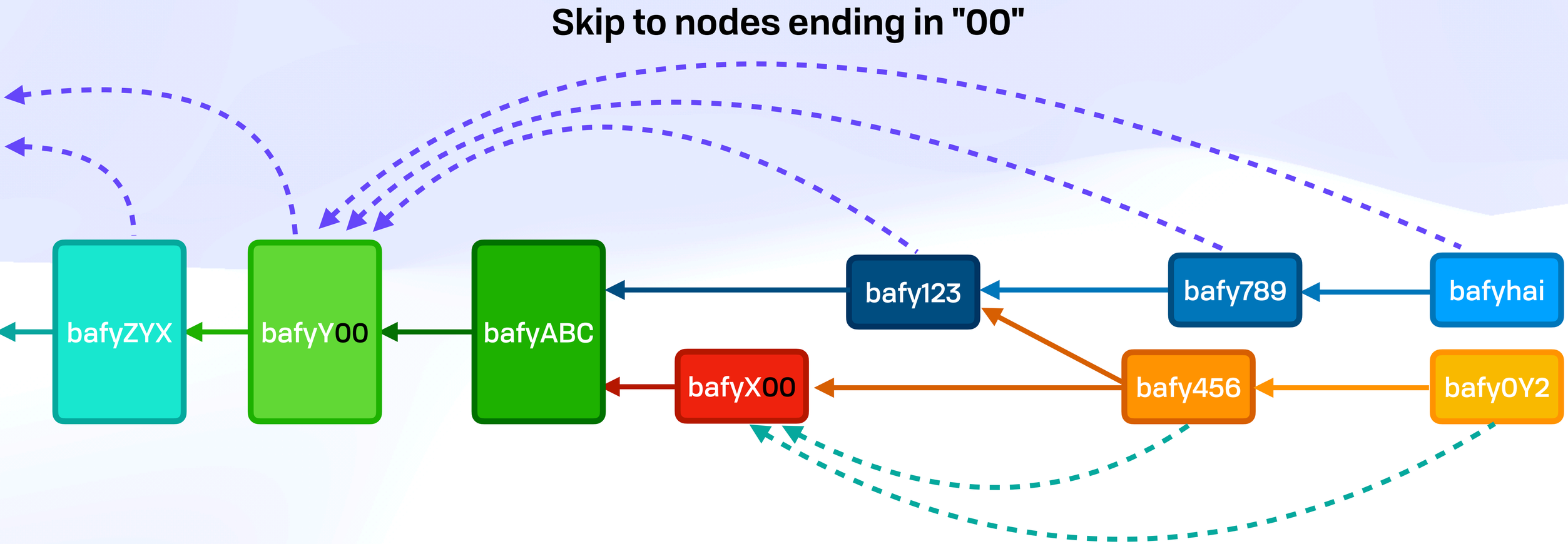
Public Files 📂

Diff Checkpointing



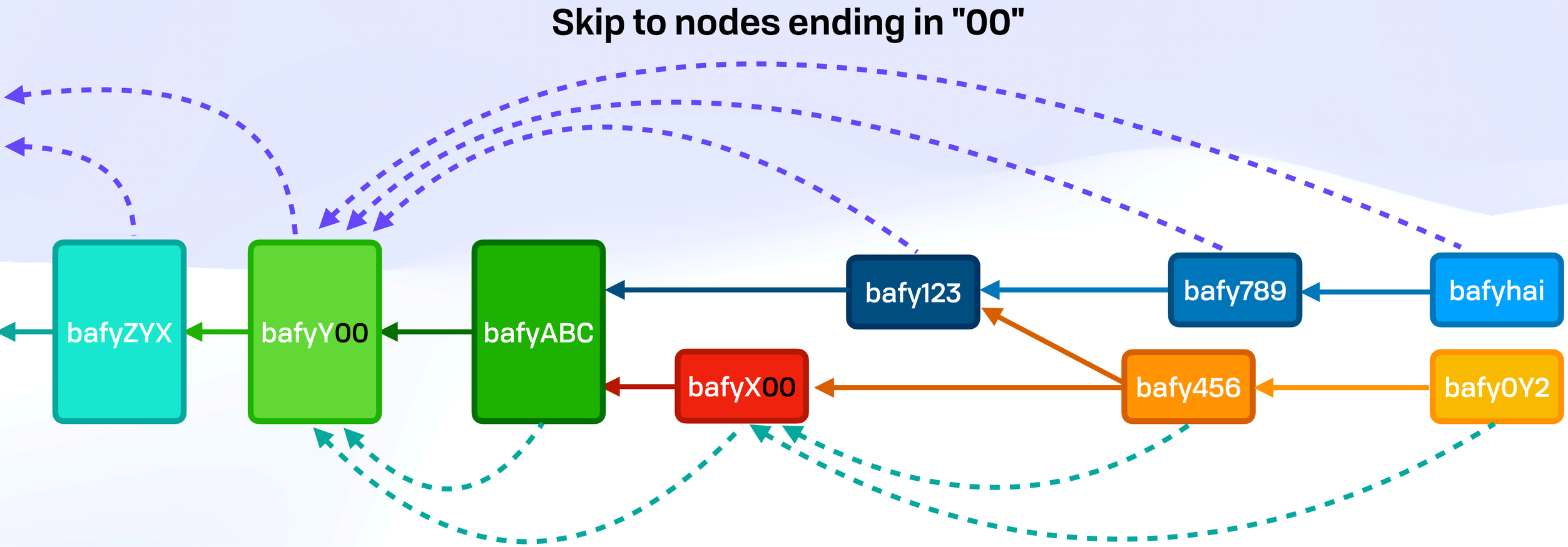
Public Files 📂

Diff Checkpointing



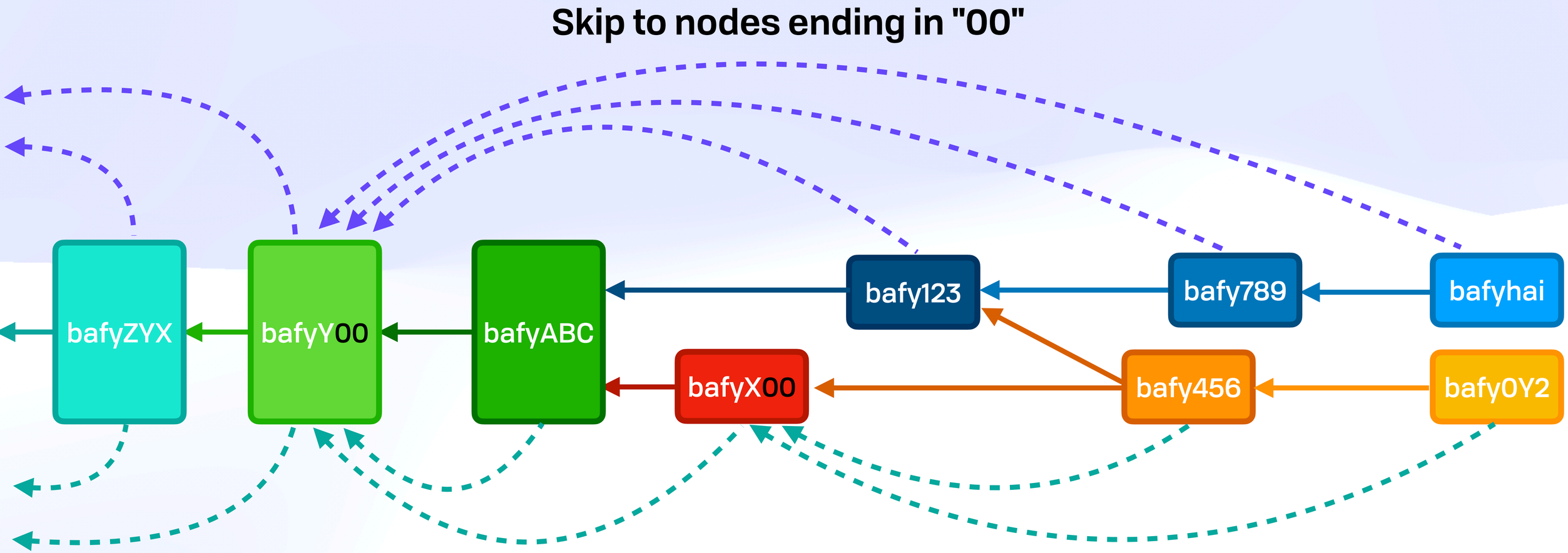
Public Files 📂

Diff Checkpointing



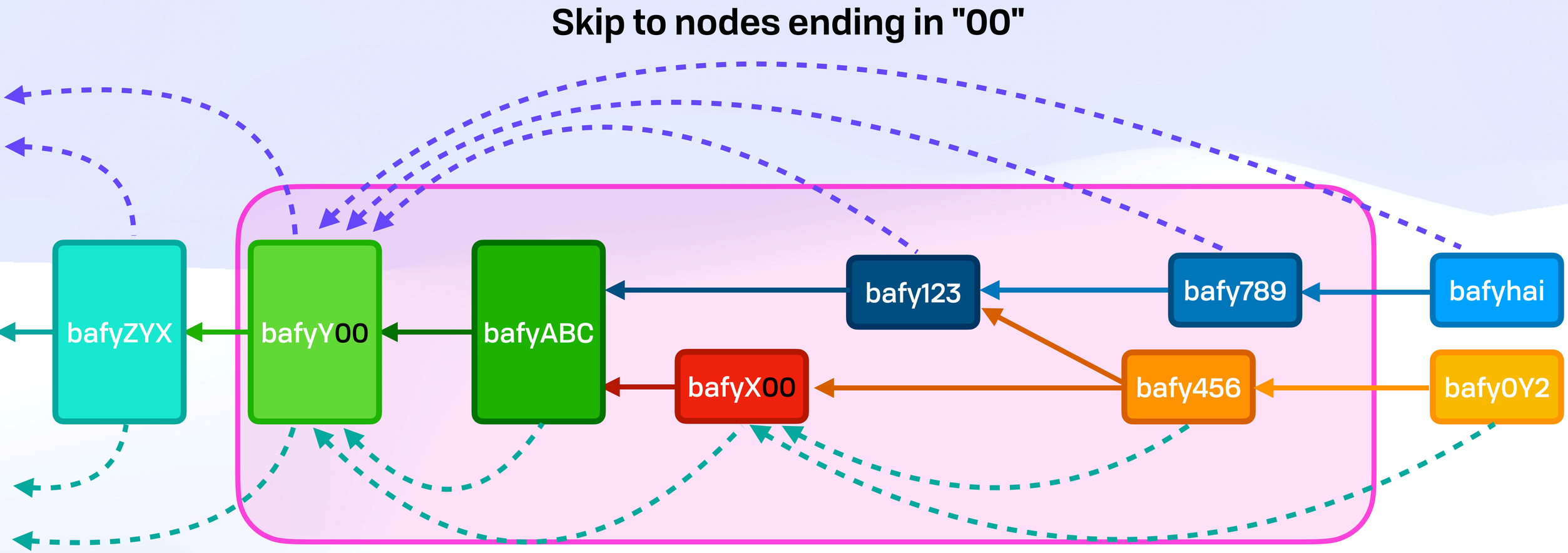
Public Files 📂

Diff Checkpointing



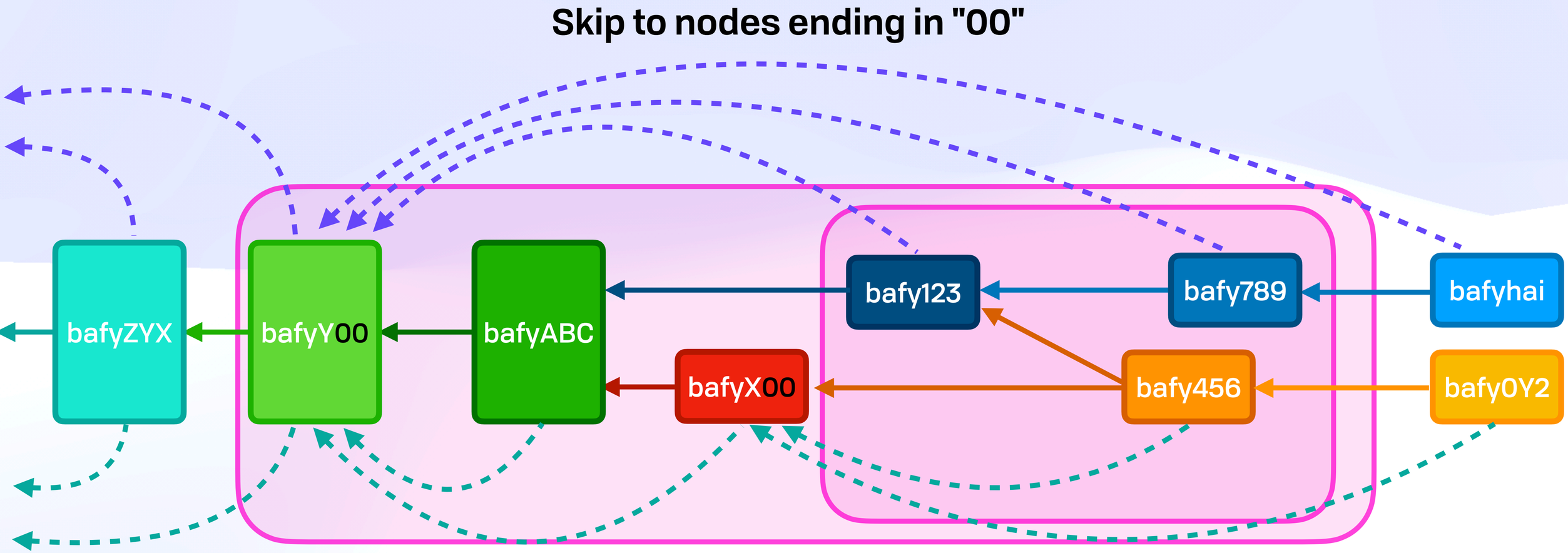
Public Files 📂

Diff Checkpointing



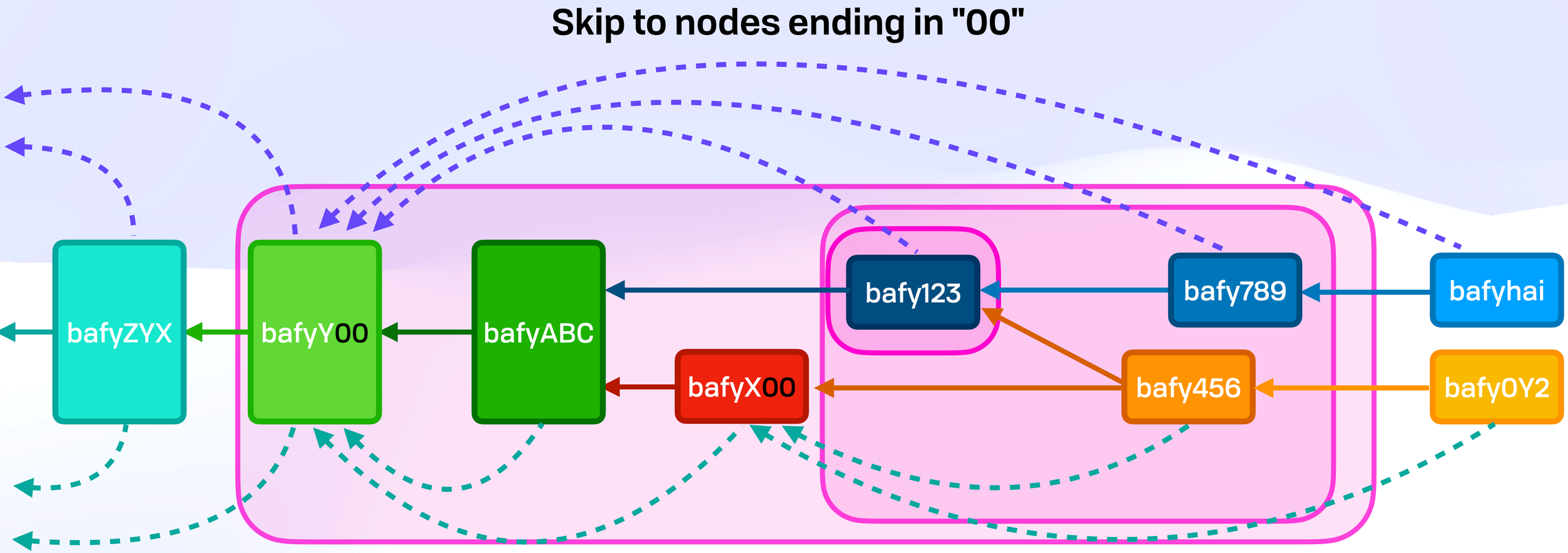
Public Files 📂

Diff Checkpointing



Public Files 📂

Diff Checkpointing

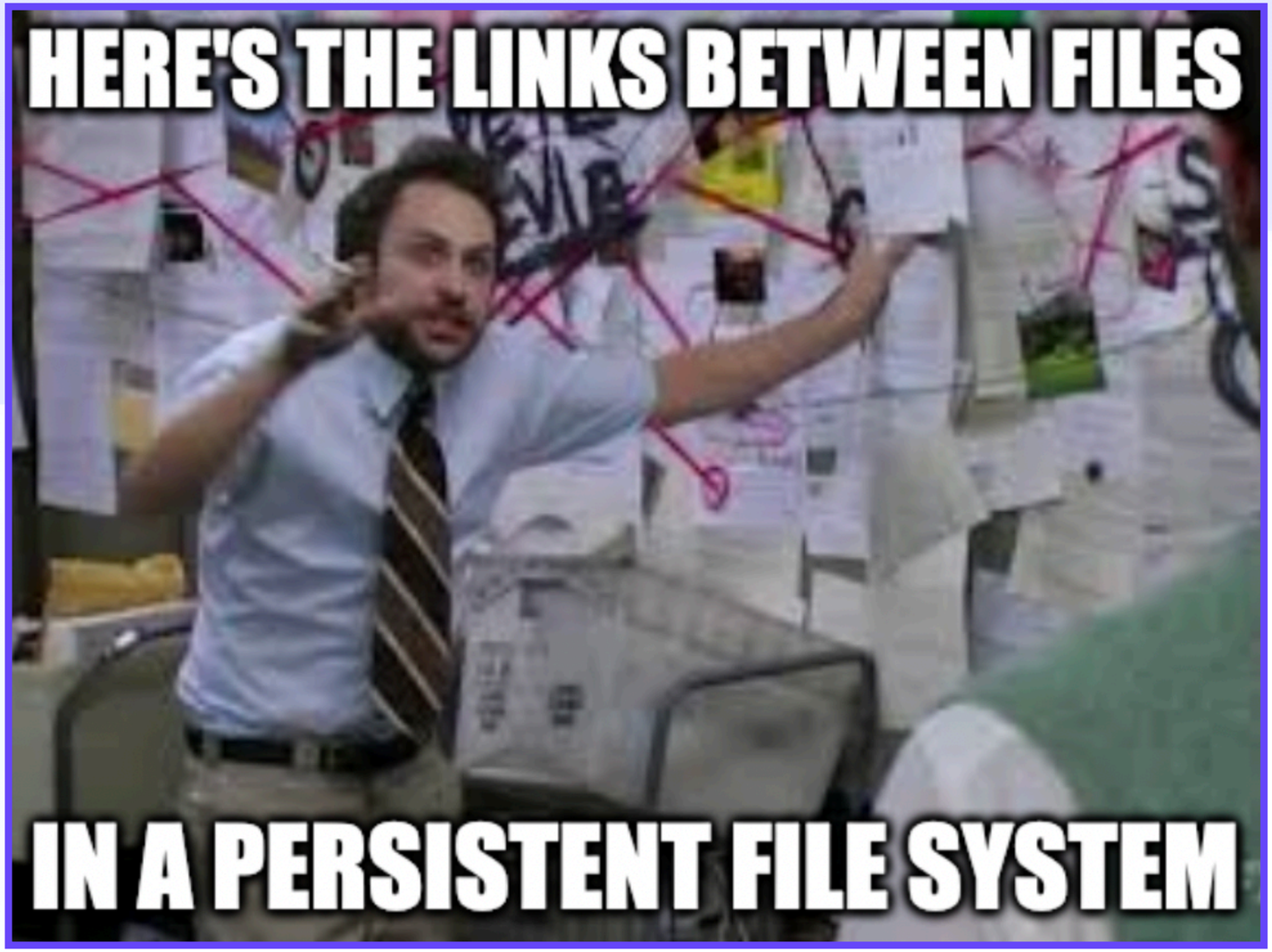


Public Files 📂

...Moving On...

Public Files 📂

...Moving On...



🈯 Secret Files 🥷

Distributed Storage When The Pipes Are Broken

💾

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

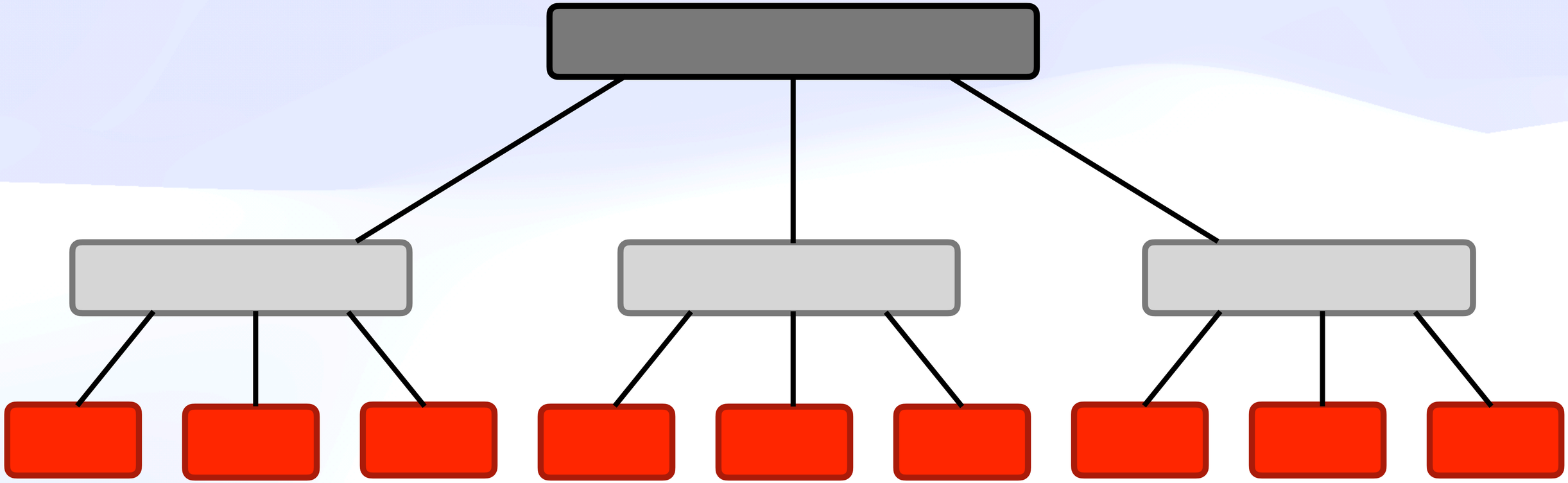
Dr. Lea Kissner, Google's Global Lead of Privacy Technologies

Secret Files 🥷

Dark Forest

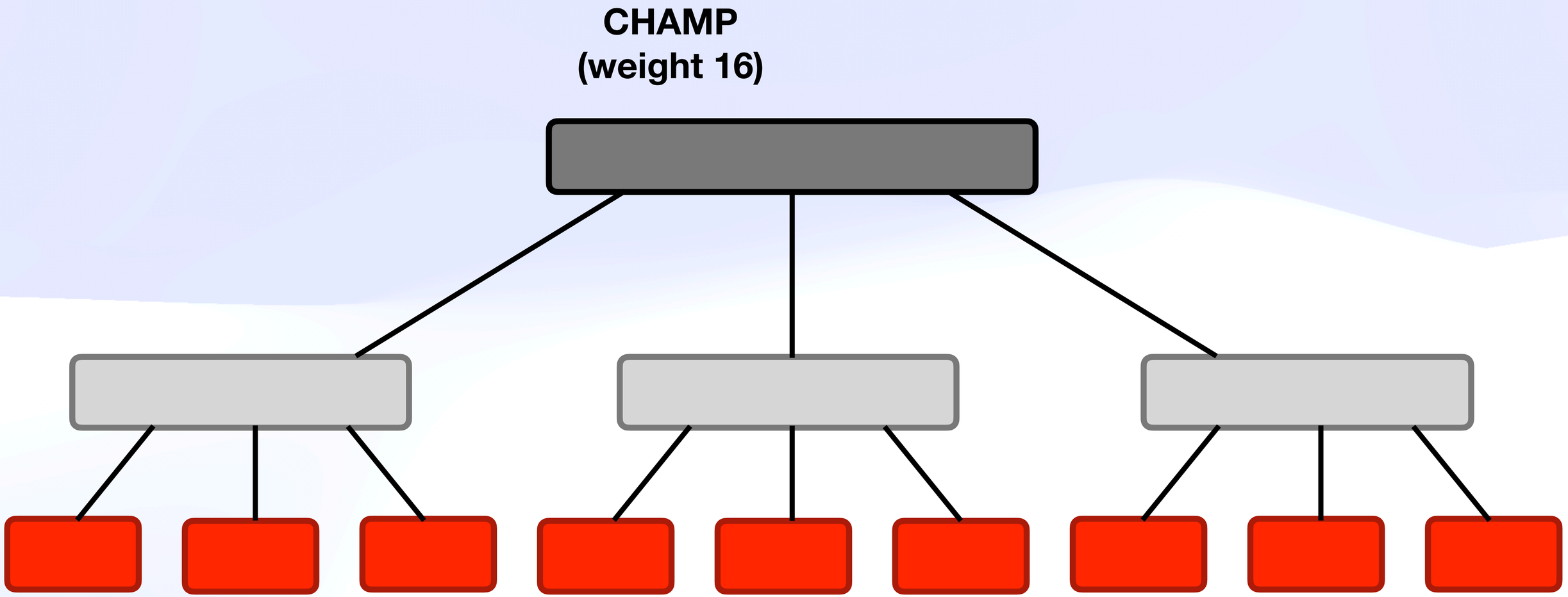
Secret Files 🥷

Dark Forest



Secret Files 🥷

Dark Forest

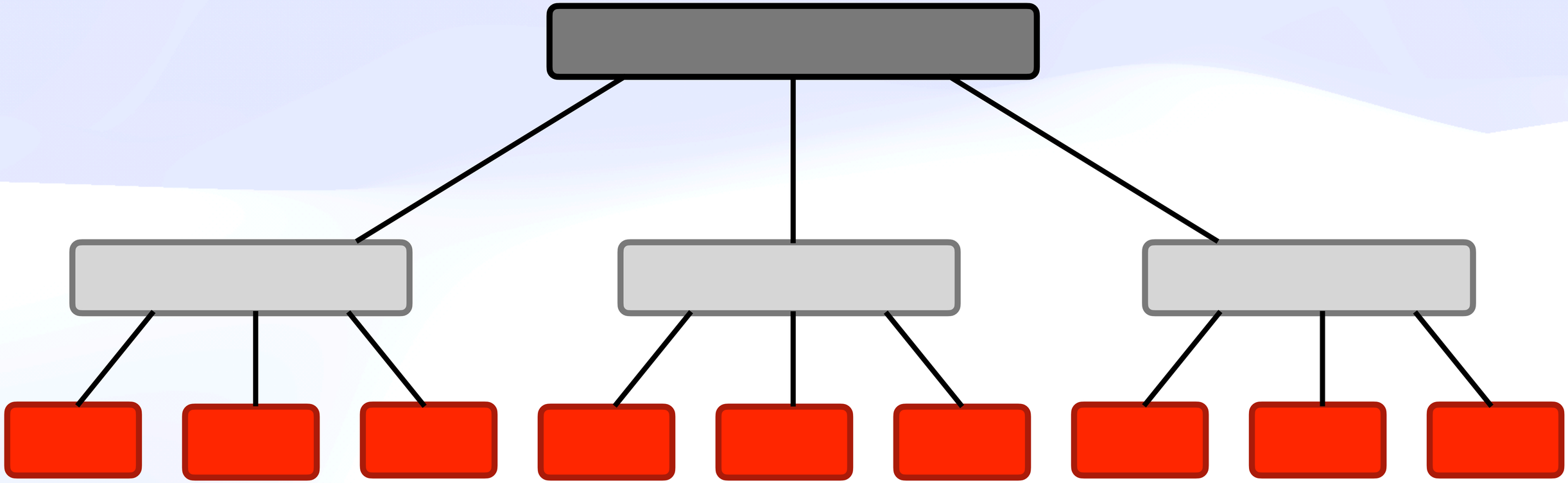


Secret Files 🥷

Dark Forest

CHAMP
(weight 16)

16^3 > 4k buckets
16^4 > 65k buckets
16^5 > 1M buckets



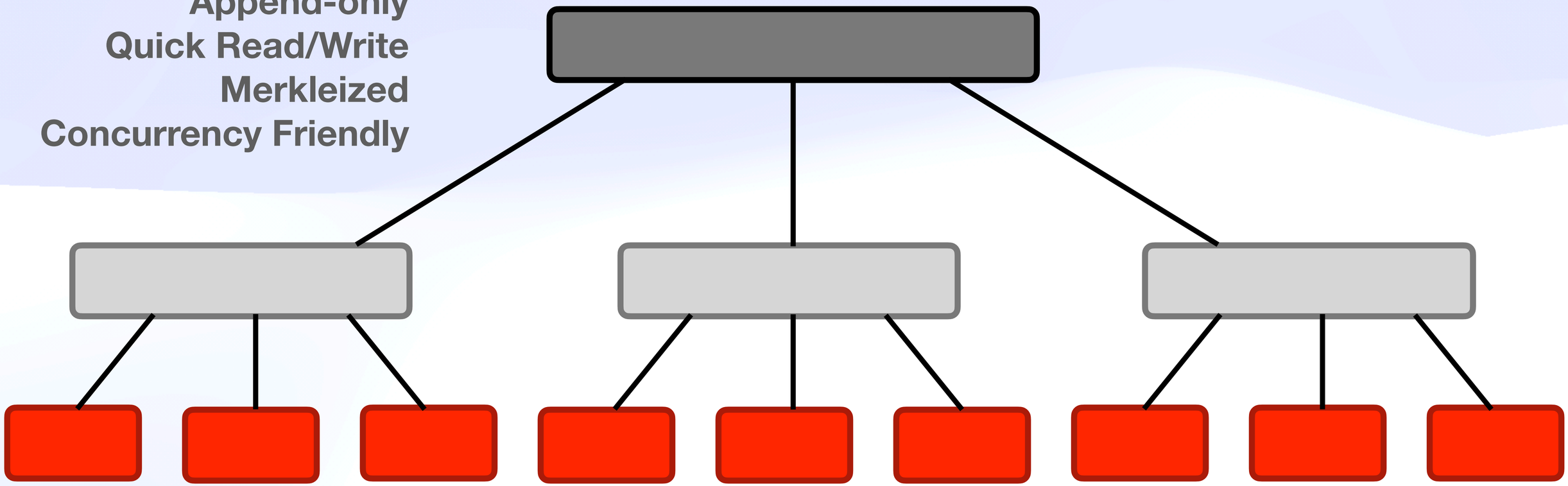
Secret Files 🥷

Dark Forest

CHAMP
(weight 16)

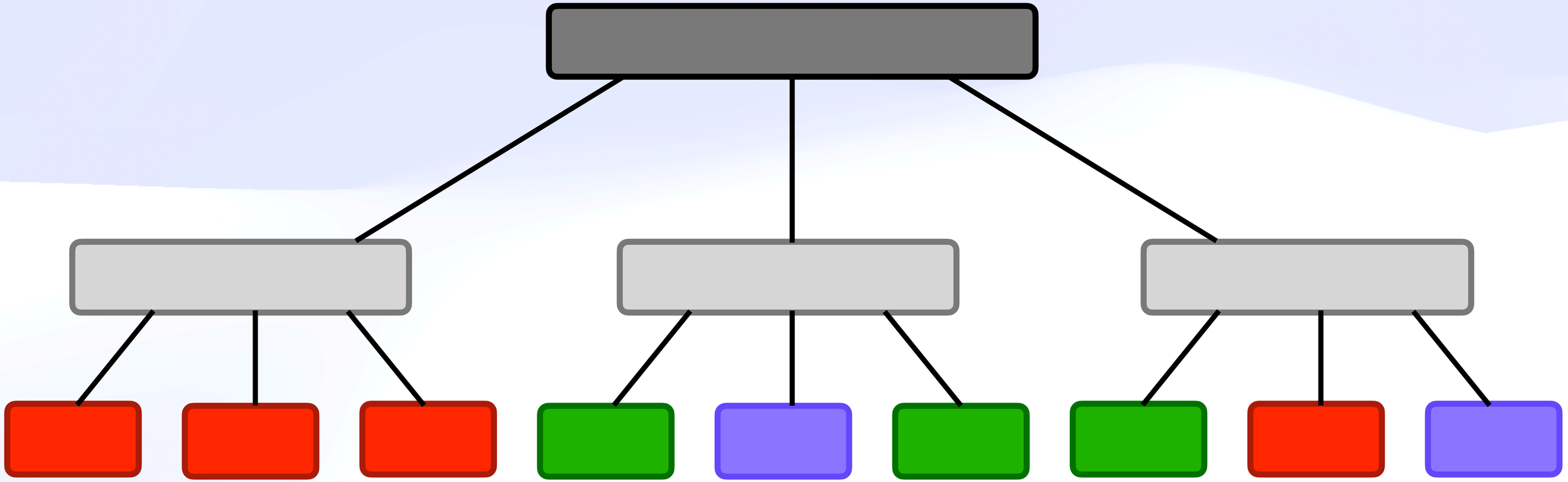
16^3 > 4k buckets
16^4 > 65k buckets
16^5 > 1M buckets

Append-only
Quick Read/Write
Merkleized
Concurrency Friendly



Secret Files 🥷

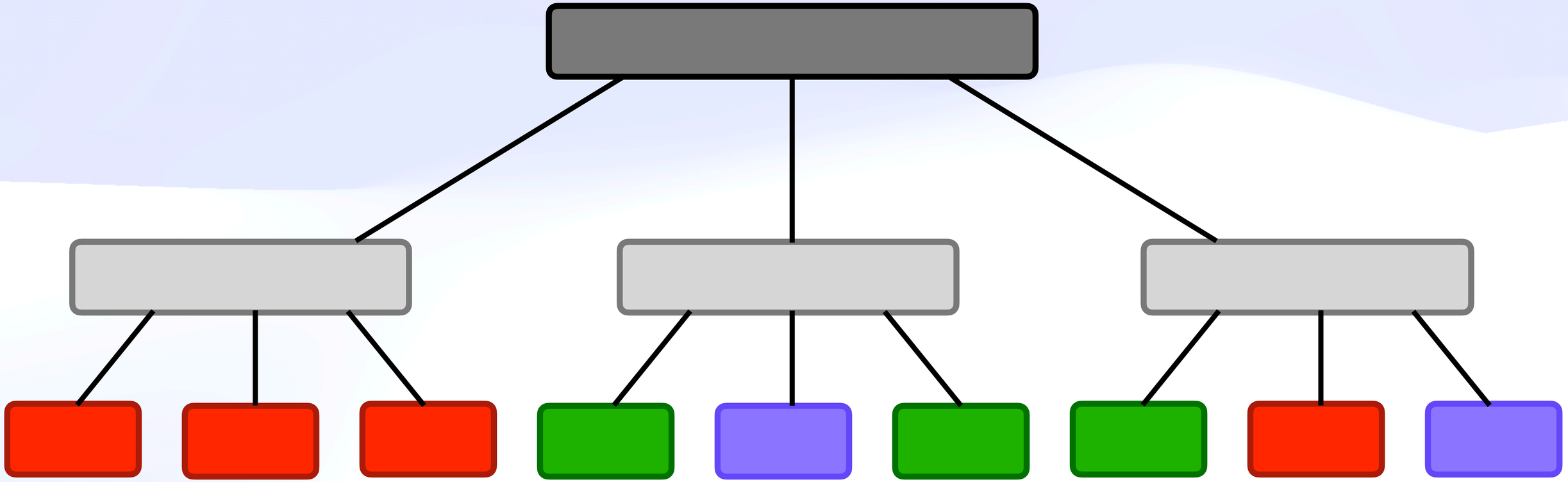
Dark Forest



Secret Files 🥷

Dark Forest

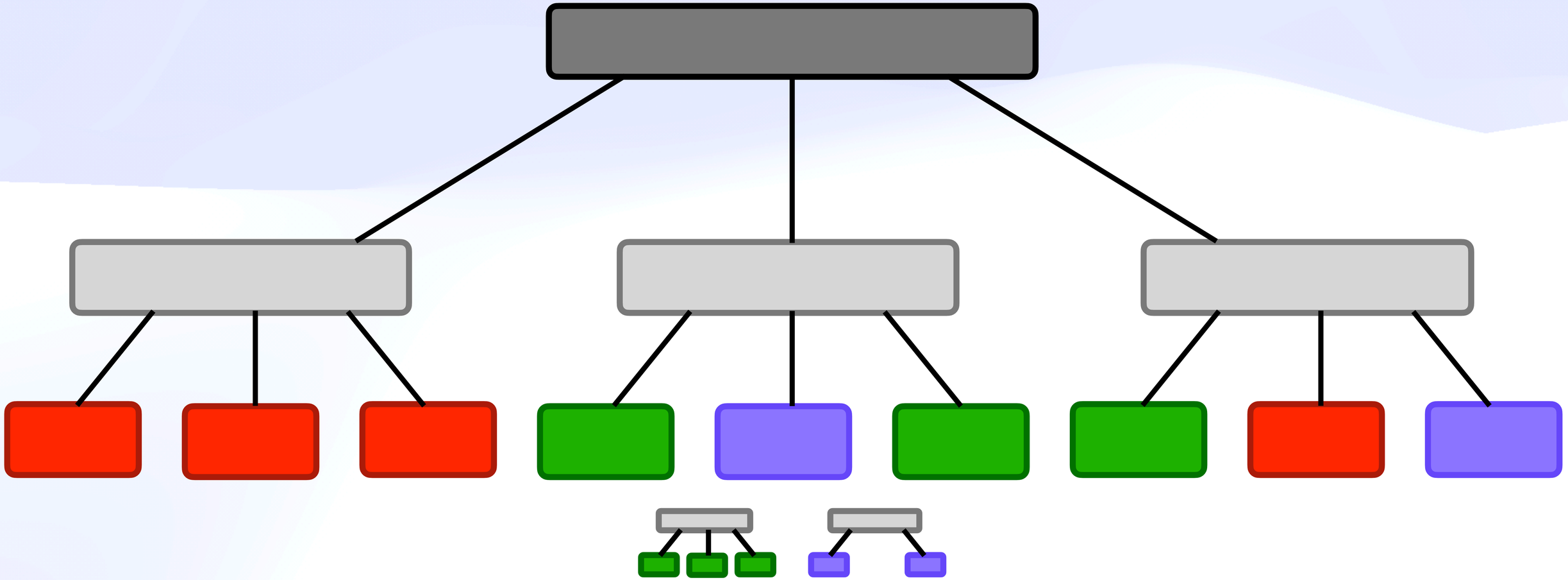
One Pointer Machine
Many (Secret) Roots



Secret Files 🥷

Dark Forest

One Pointer Machine
Many (Secret) Roots

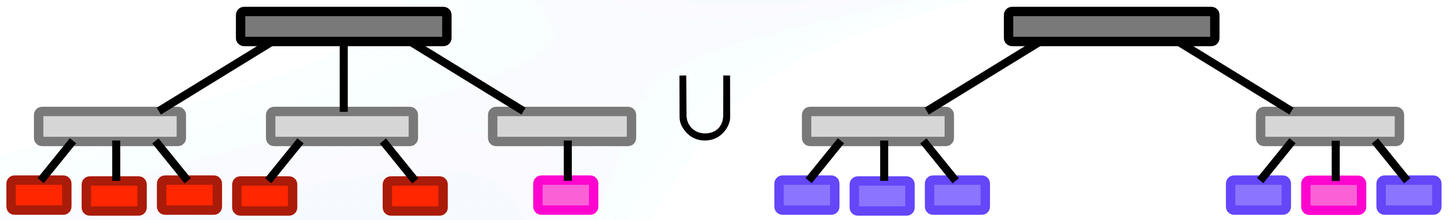


Secret Files 🥷

Useful: Arbitrary Merge

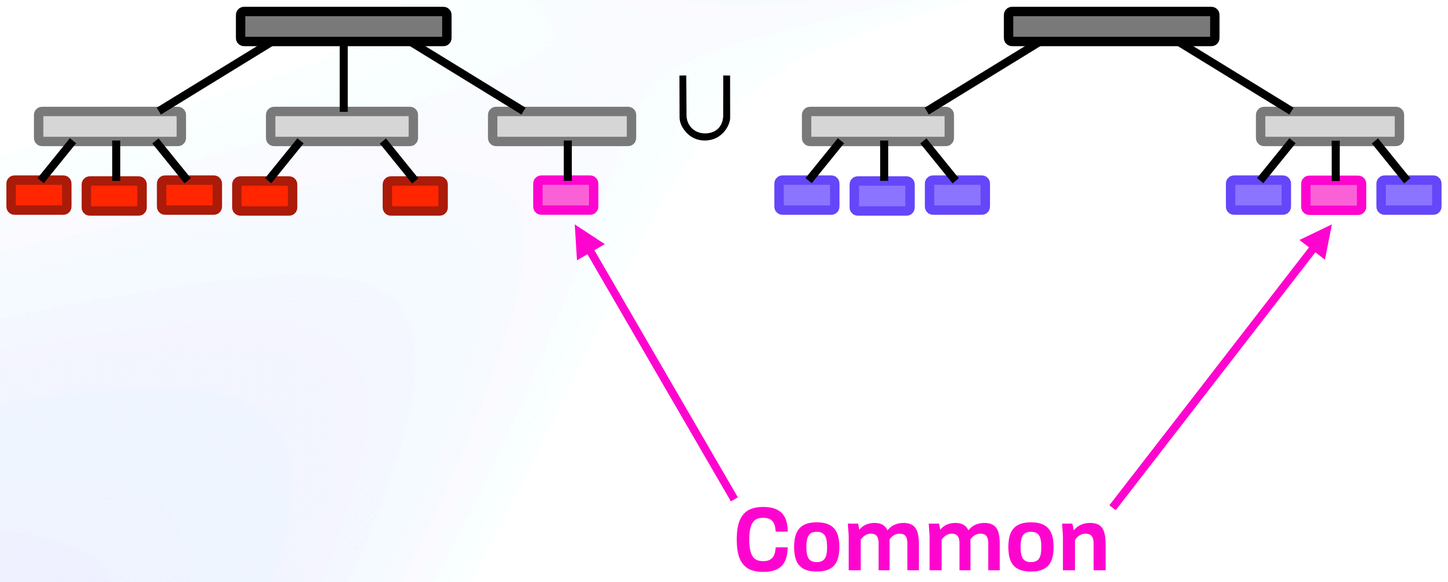
Secret Files 🥷

Useful: Arbitrary Merge



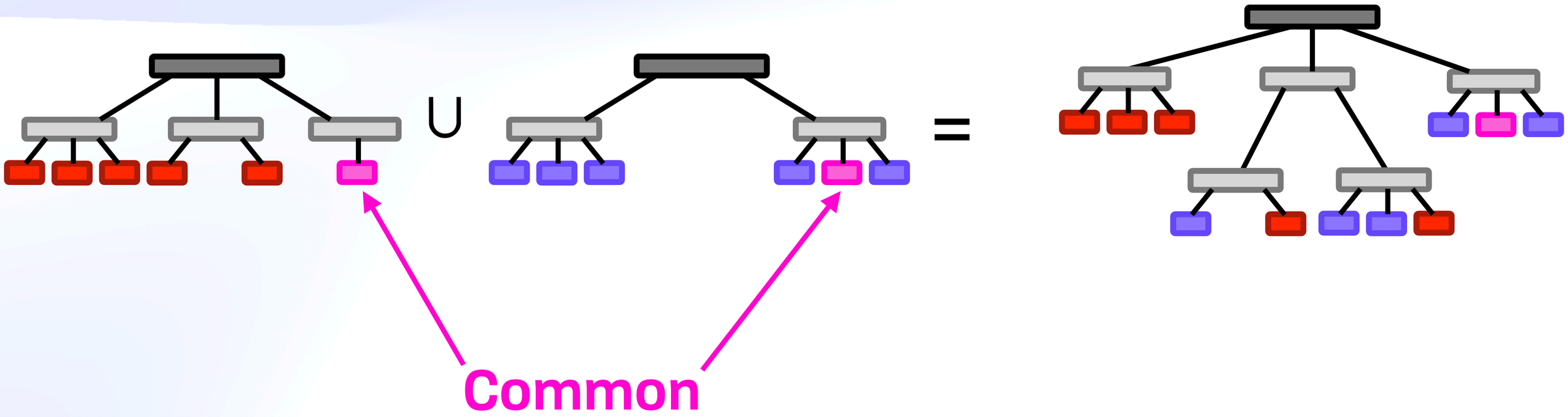
Secret Files 🥷

Useful: Arbitrary Merge



Secret Files 🥷

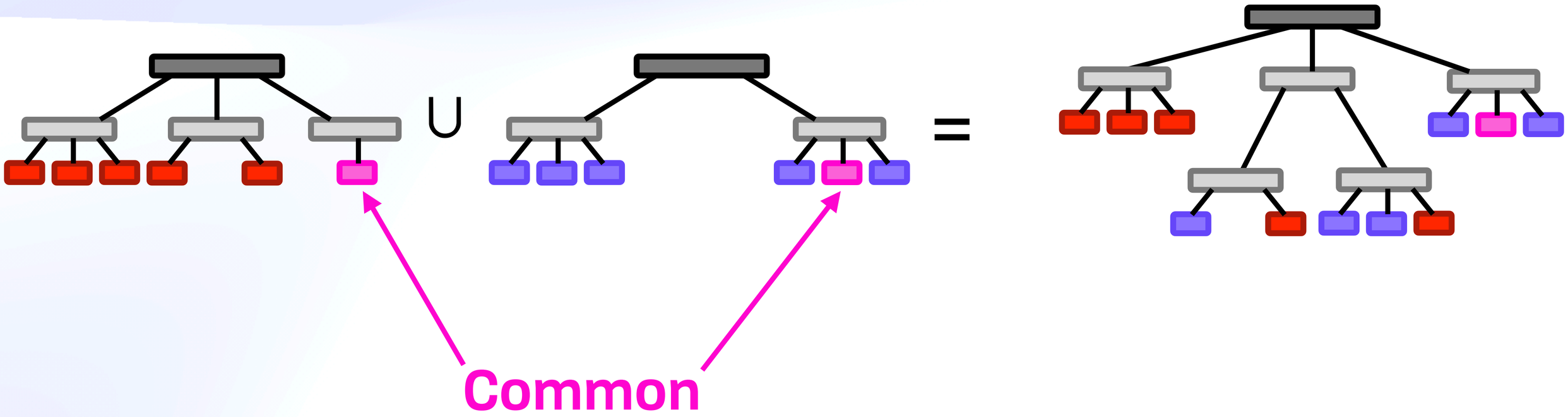
Useful: Arbitrary Merge



Secret Files 🥷

Useful: Arbitrary Merge

Visibility	Noun		Example
Decrypted	Files	→	Paths & Content
Encrypted		→	Headers & Node Layout
	Data	→	Merkle Set

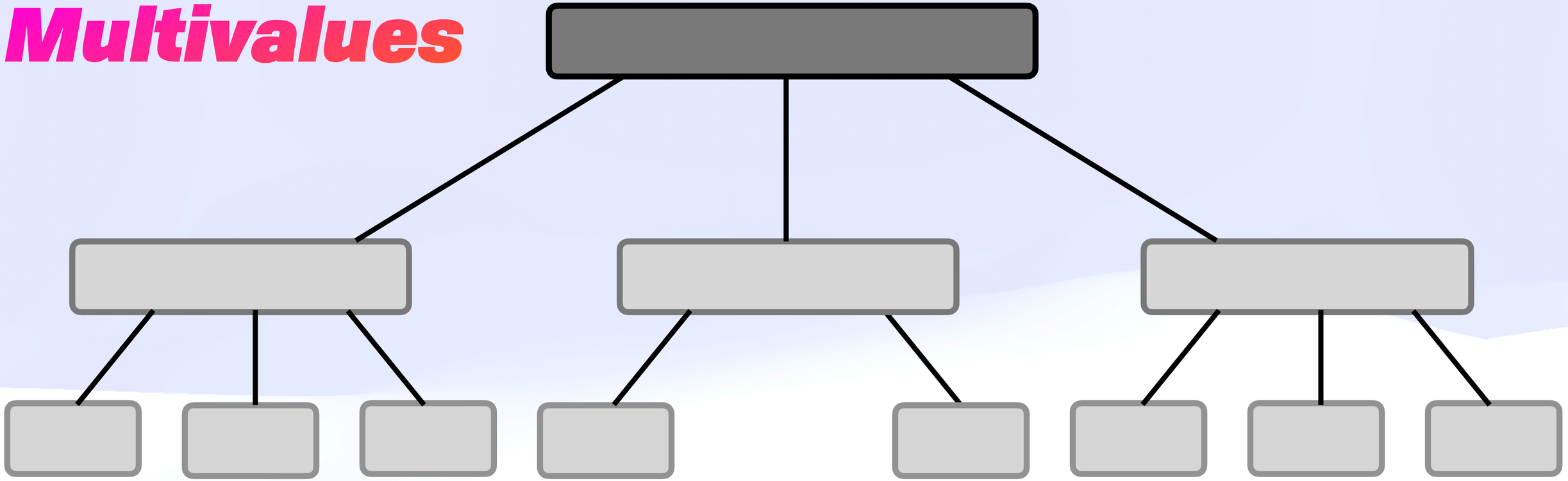


Secret Files 🥷

Multivalues

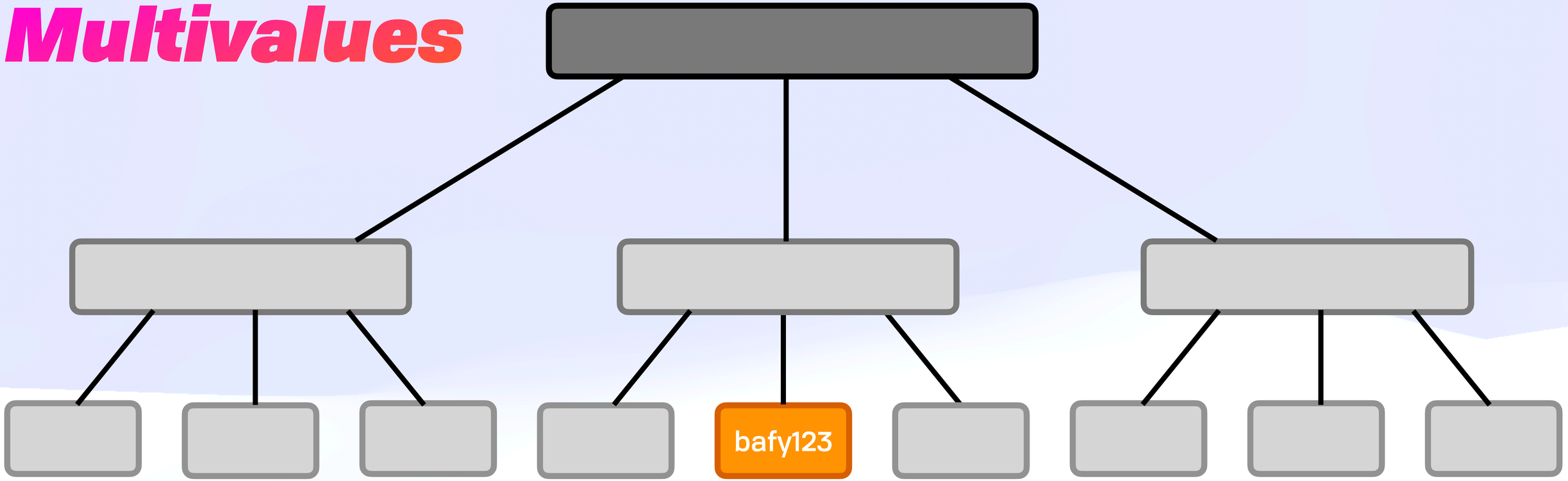
Secret Files 🥷

Multivalues



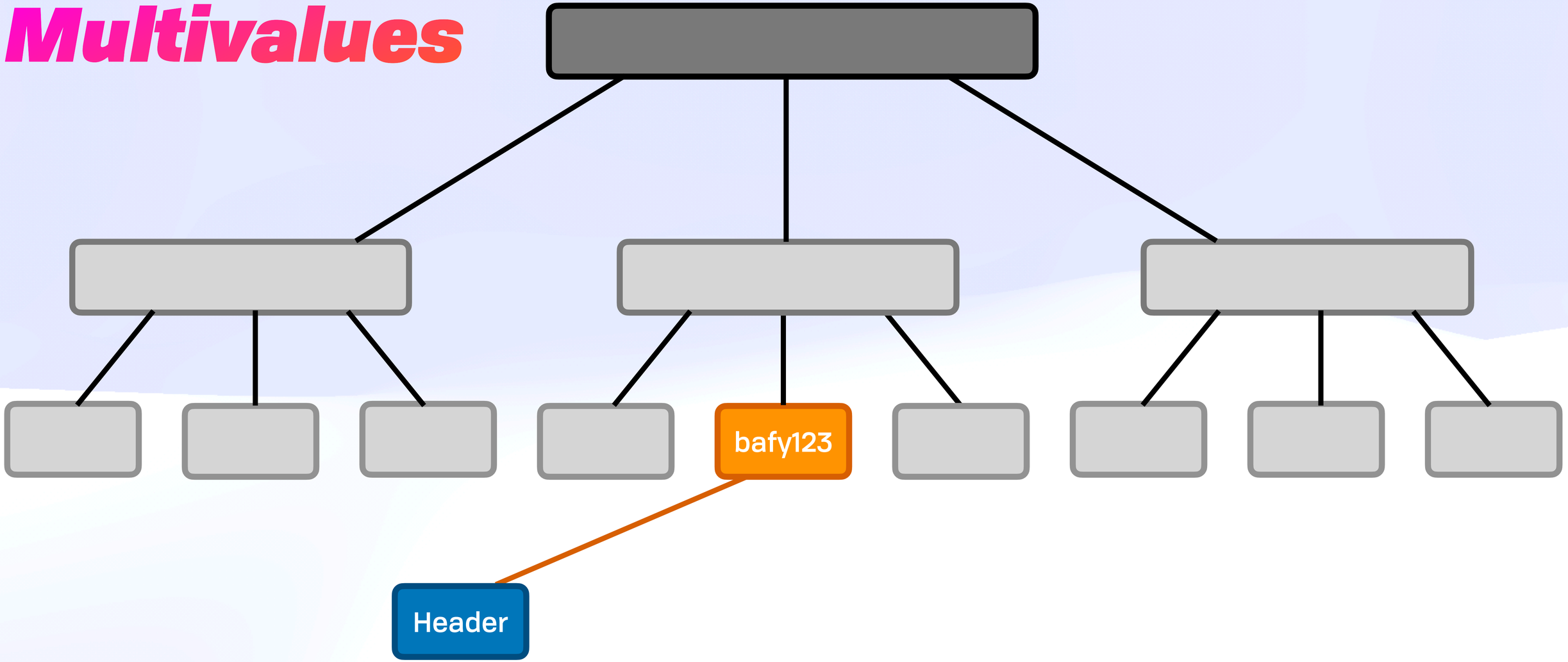
Secret Files 🥷

Multivalues



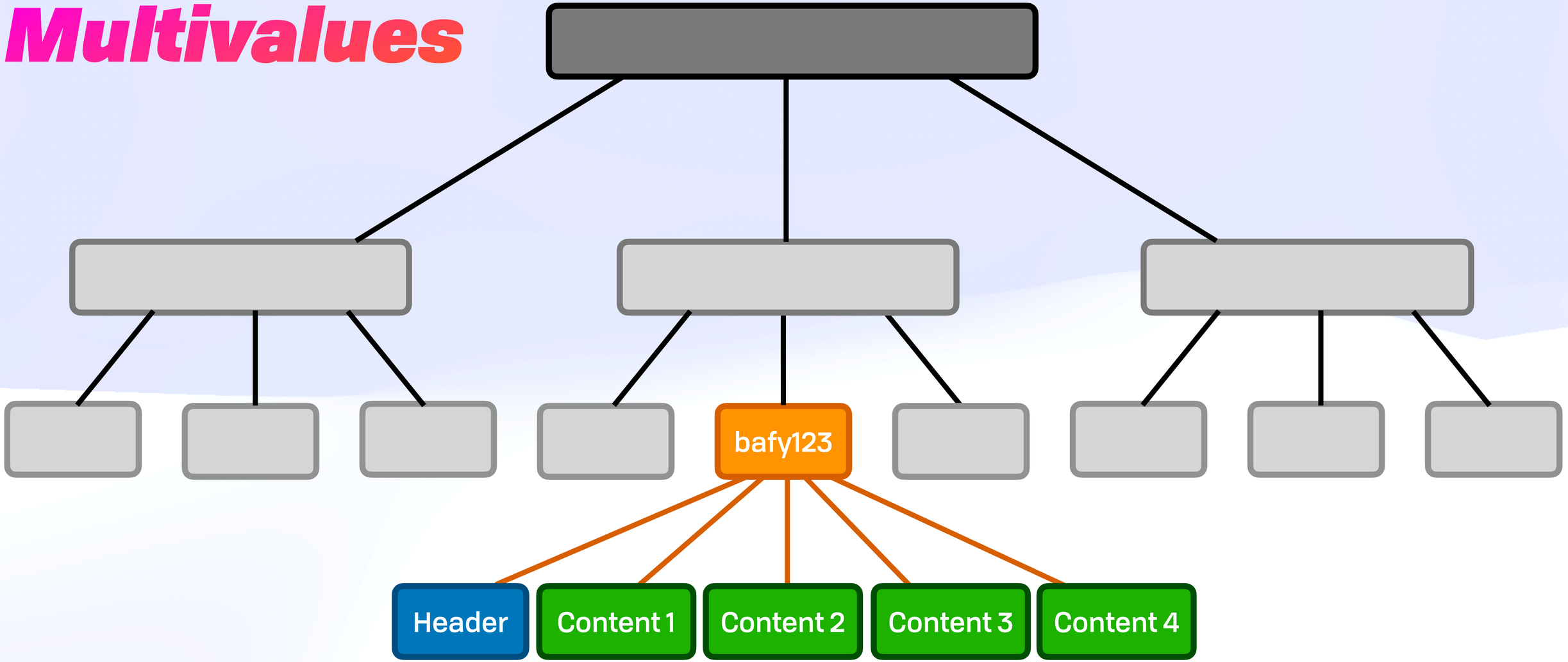
Secret Files 🥷

Multivalues



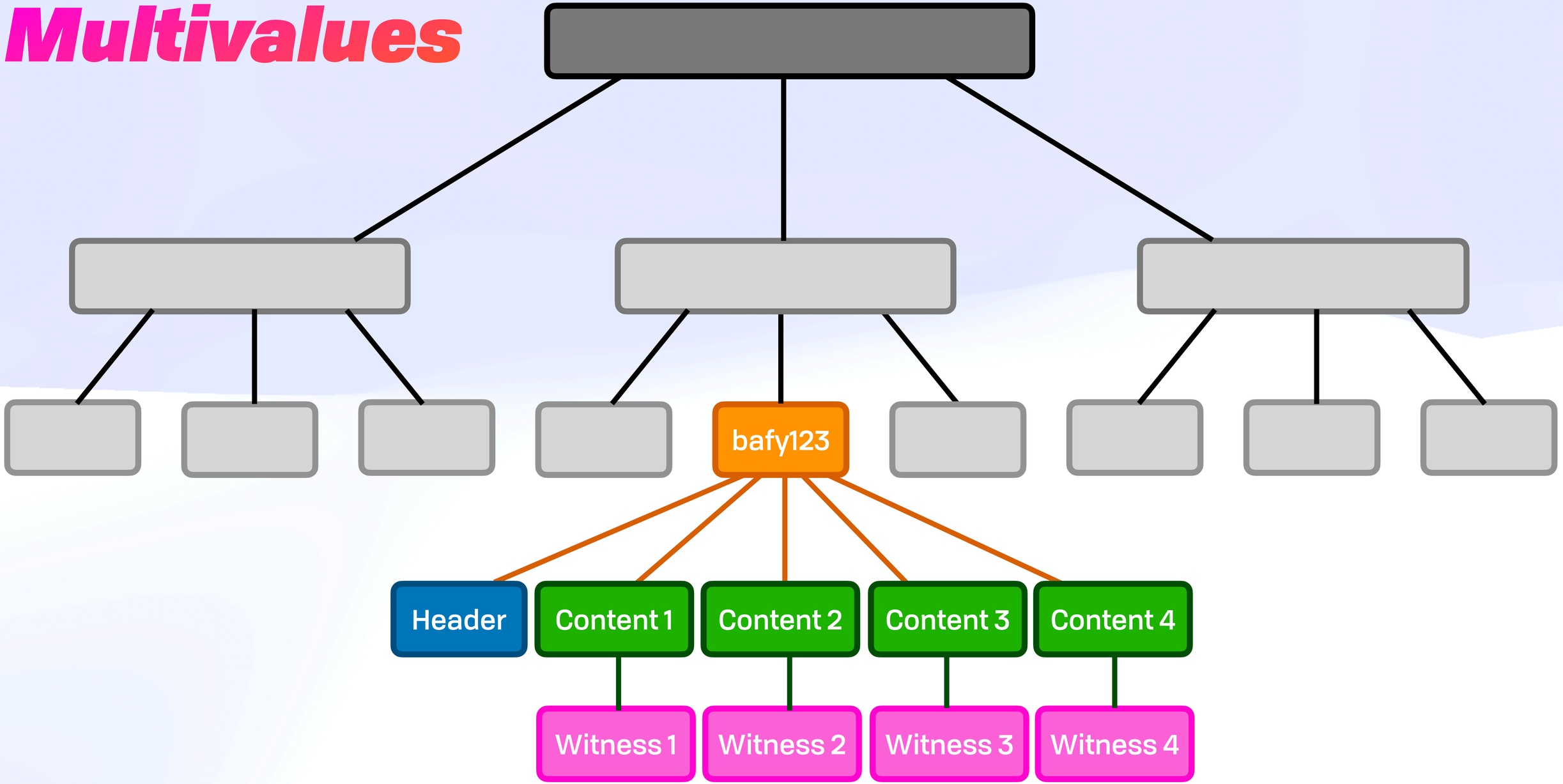
Secret Files 🥷

Multivalues



Secret Files 🥷

Multivalues



Secret Files 🥷

Single Private Node

Secret Files 🥷

Single Private Node

Binary

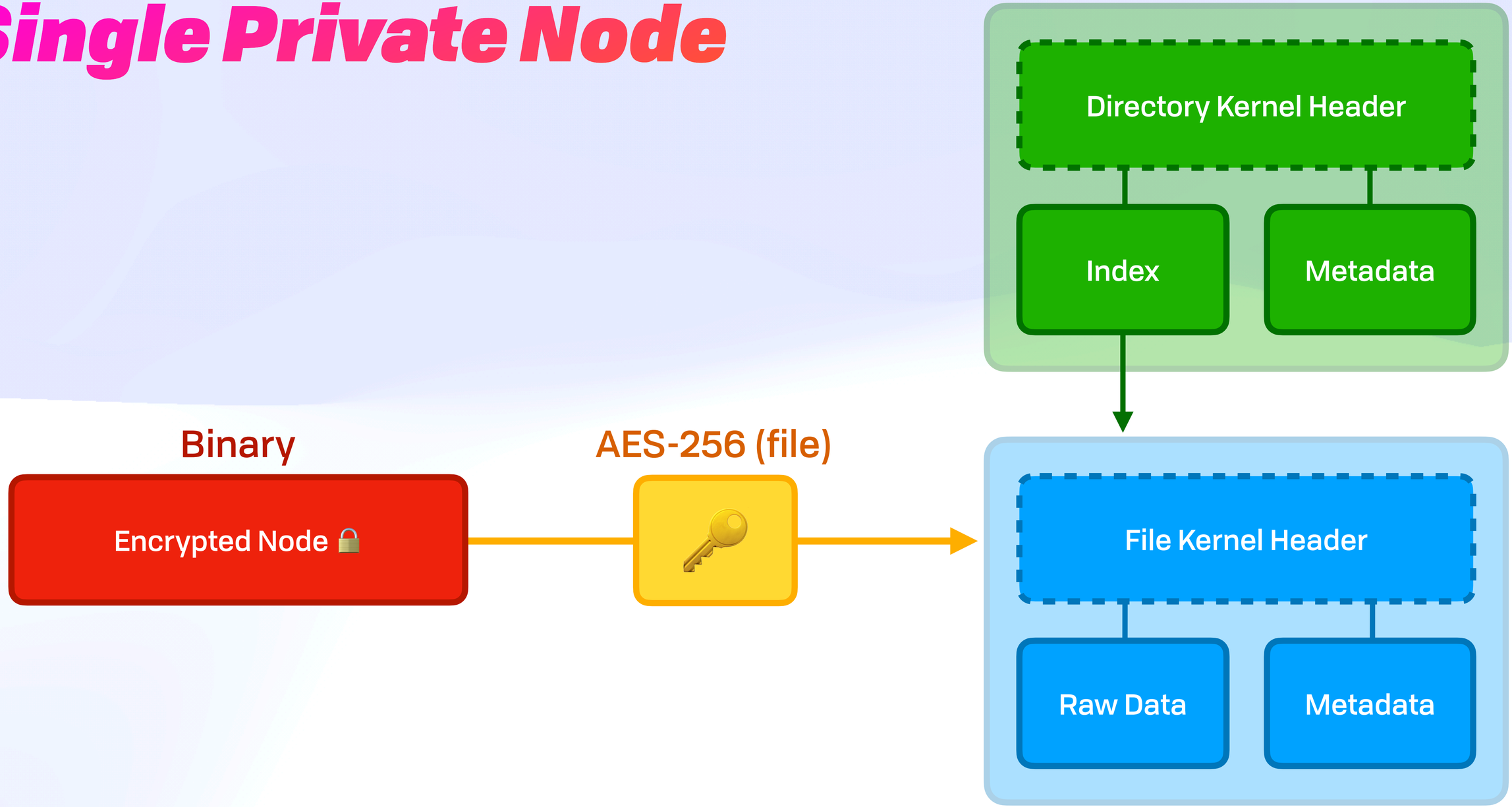
Encrypted Node 🔒

Secret Files 🥷

Single Private Node

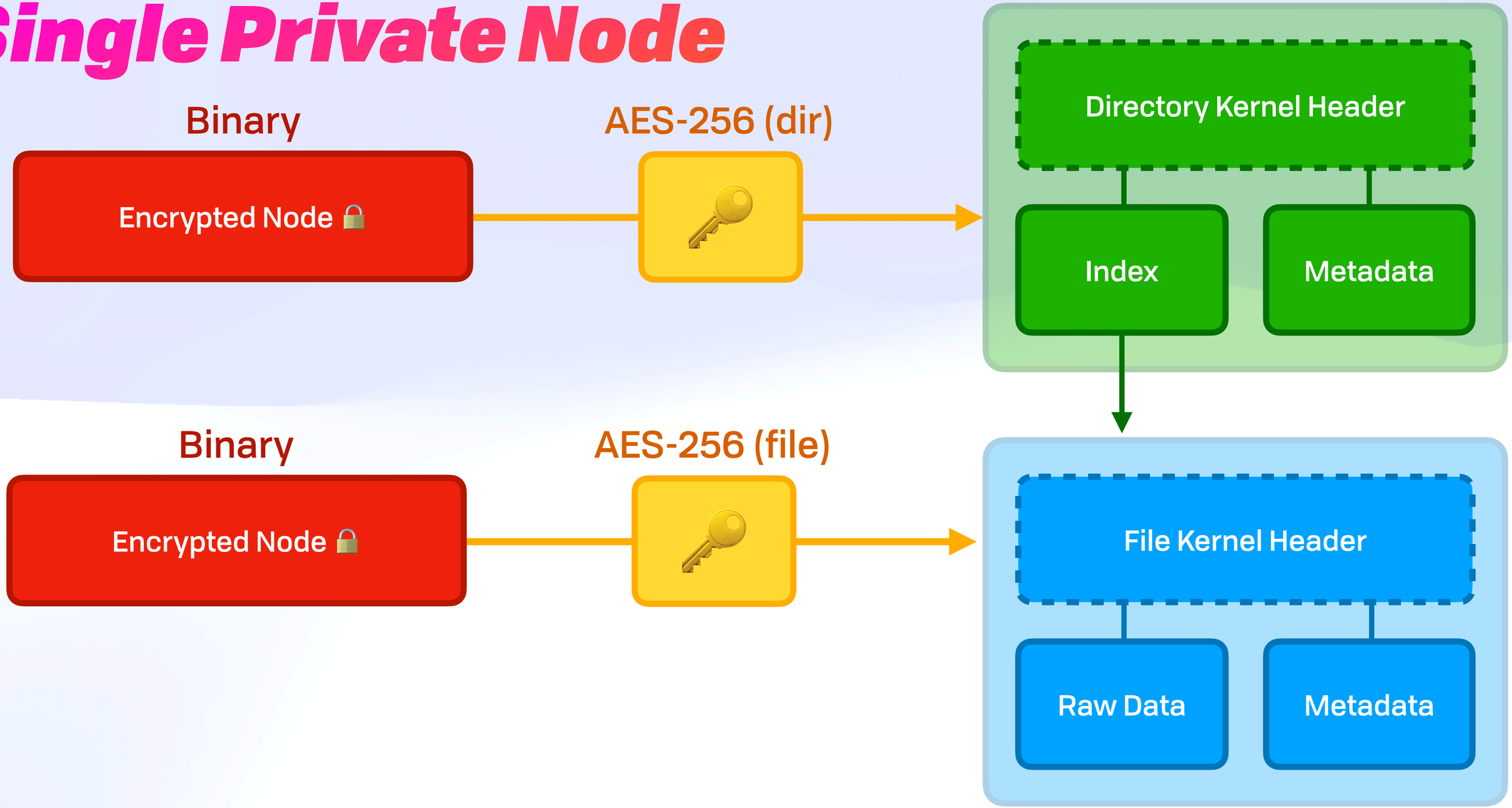
Secret Files 🥷

Single Private Node



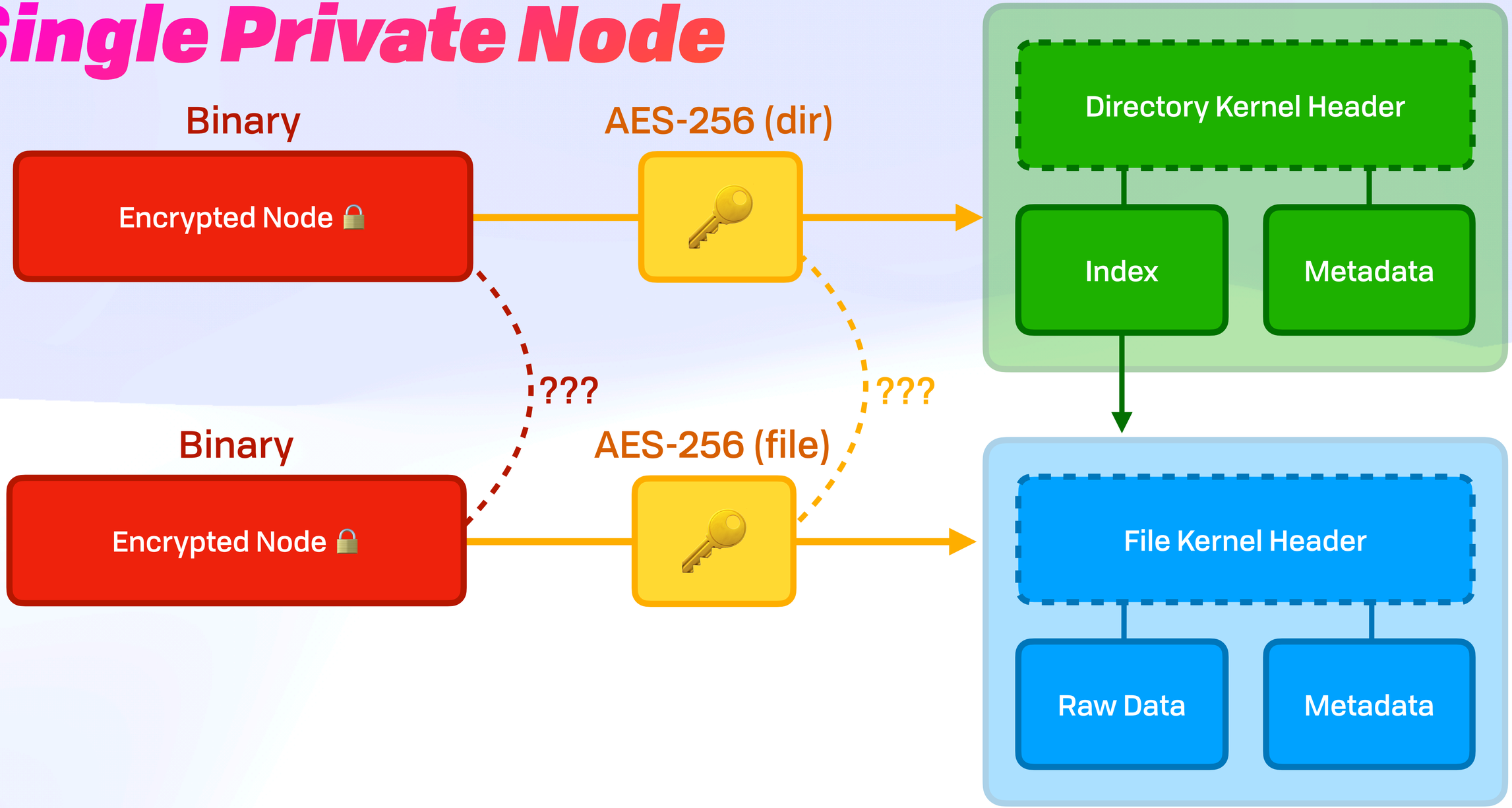
Secret Files 🥷

Single Private Node



Secret Files 🥷

Single Private Node



Secret Files 🥷

Keys... Lots of Keys

Encrypted Node 🔒

Encrypted Node 🔒

Encrypted Node 🔒

Encrypted Node 🔒

Secret Files 🥷

Keys... Lots of Keys

Encrypted Node 🔒

Encrypted Node 🔒

Encrypted Node 🔒

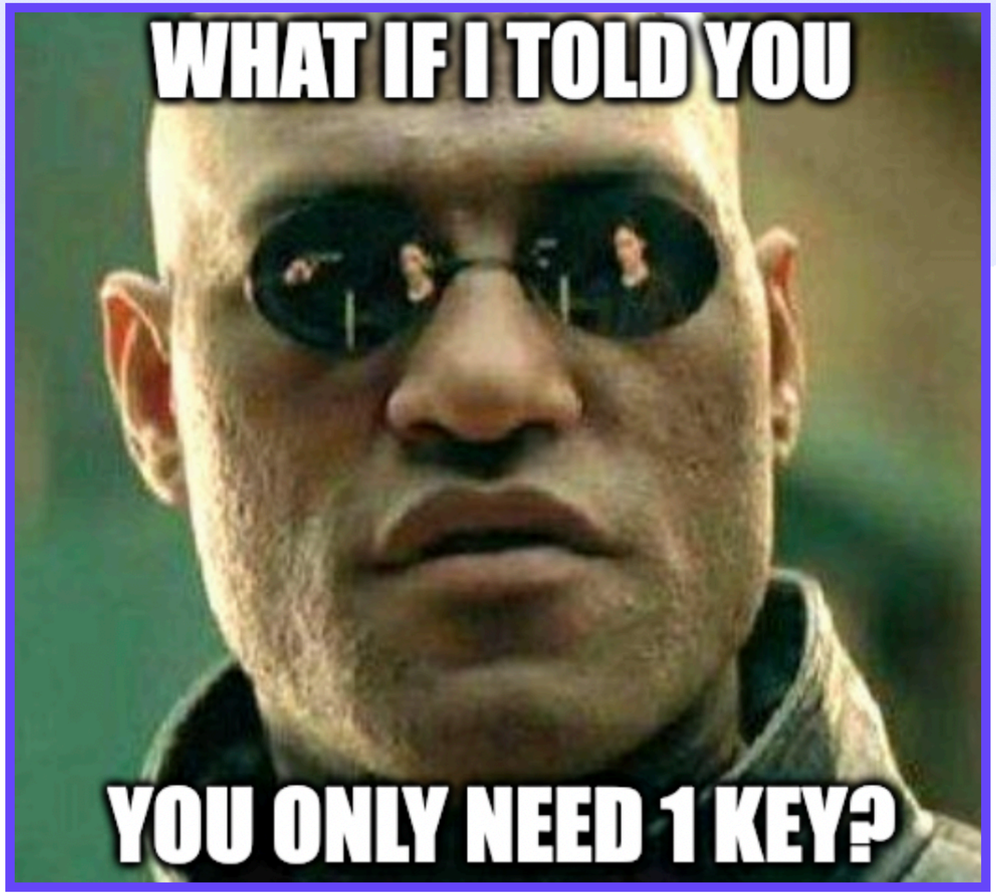
Encrypted Node 🔒

🔑

🔑

🔑

🔑



Secret Files 🥷

Keys... Lots of Keys

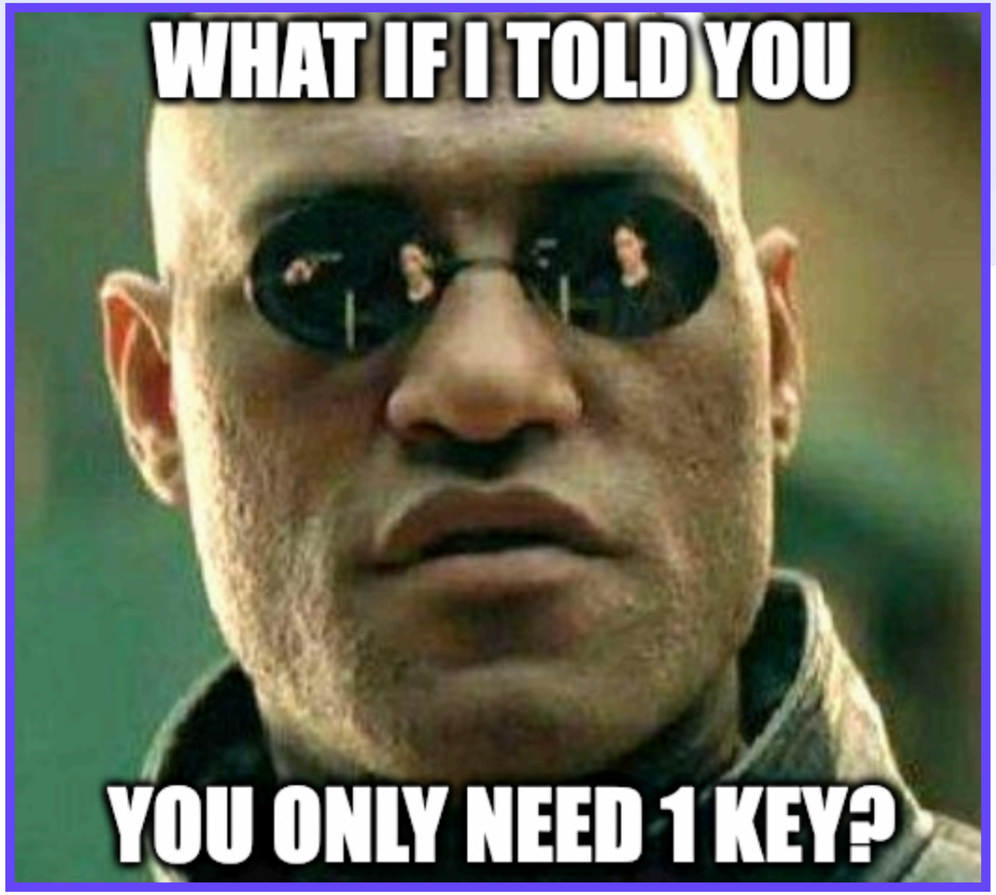
Encrypted Node 🔒

Encrypted Node 🔒

Encrypted Node 🔒

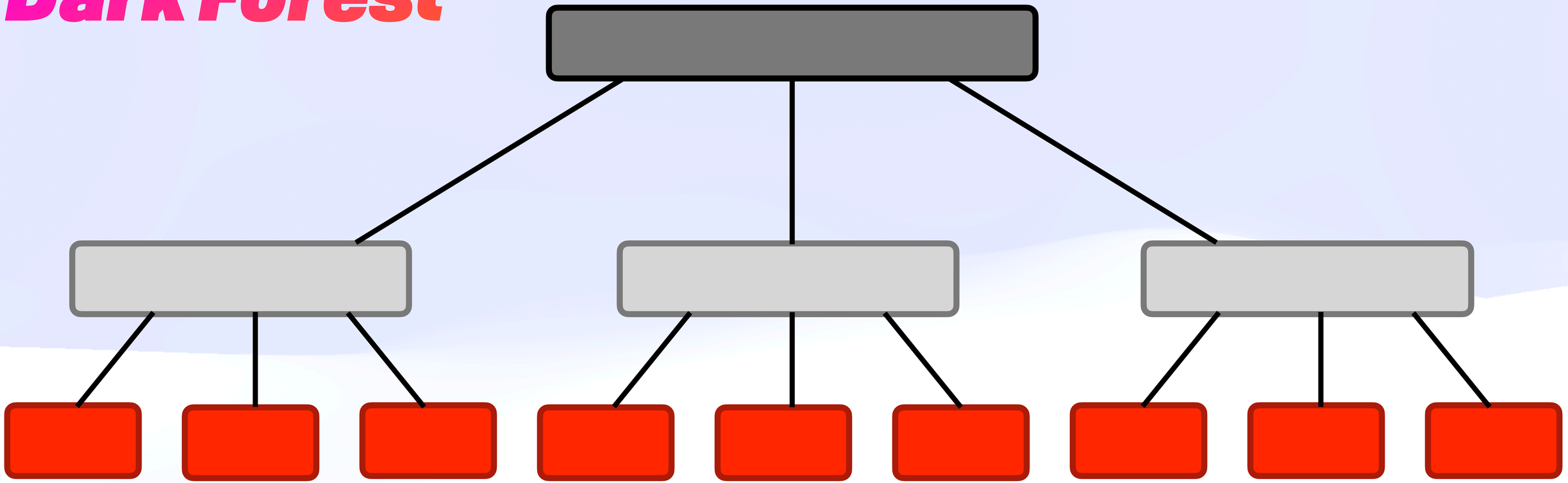
Encrypted Node 🔒

🔑



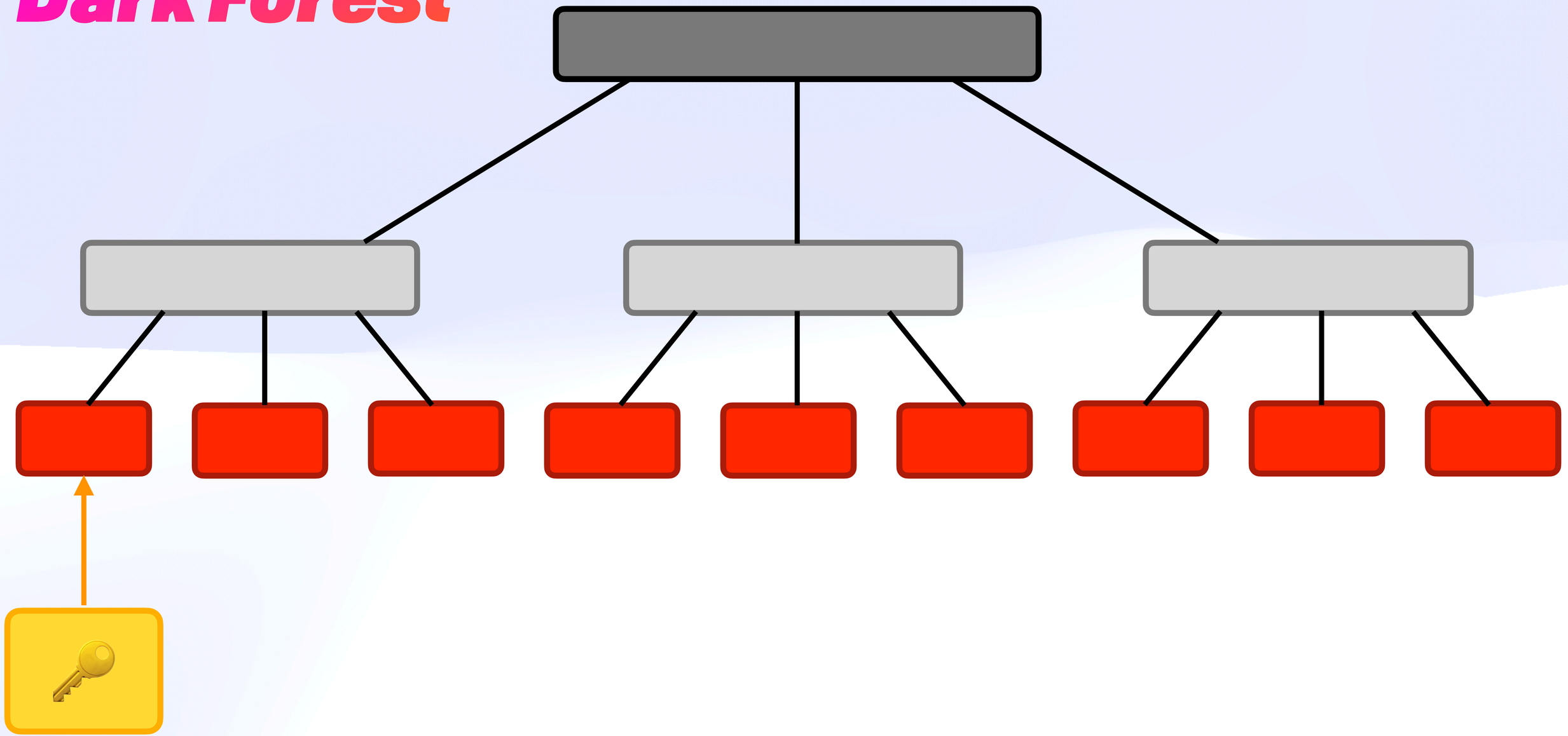
Secret Files 🥷

Dark Forest



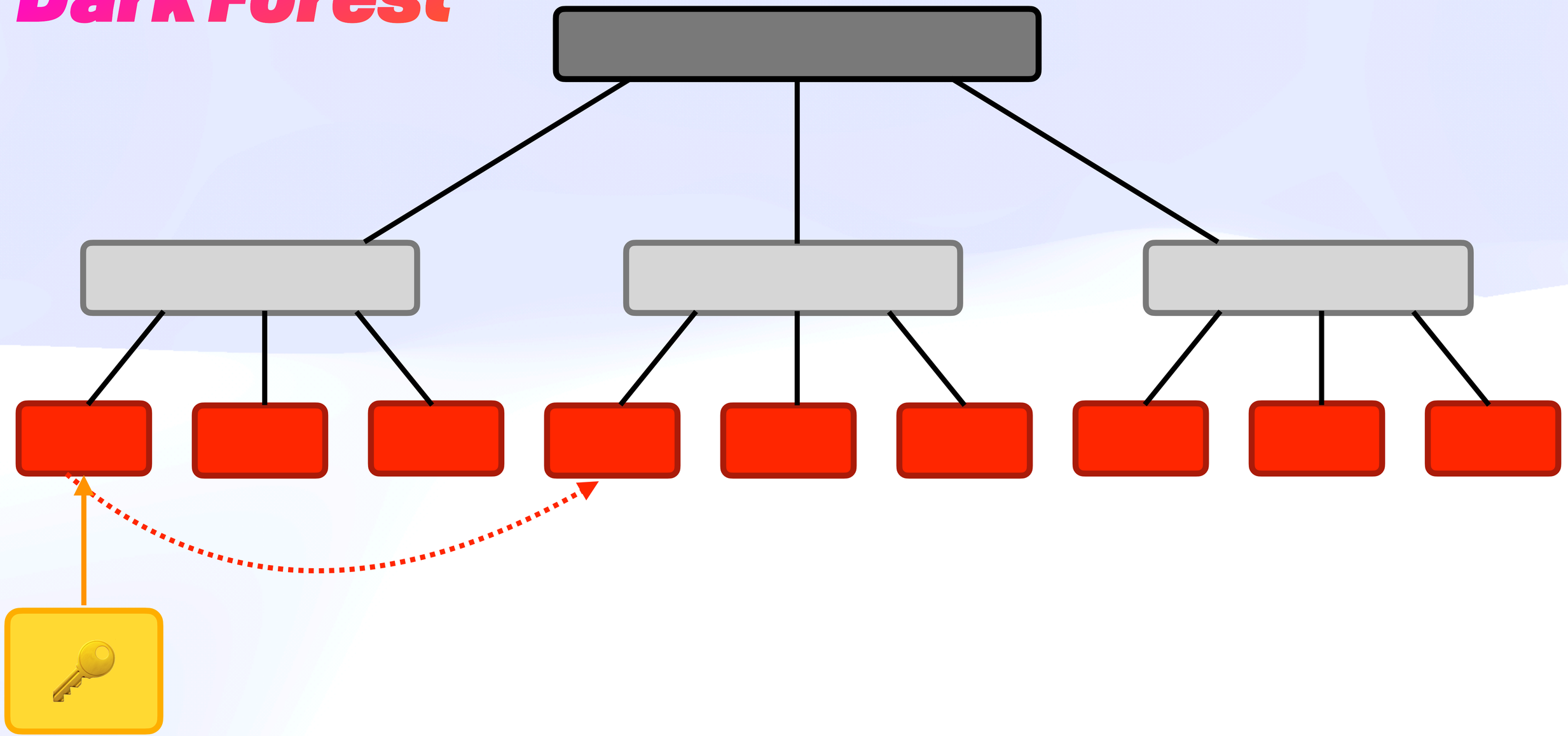
Secret Files 🥷

Dark Forest



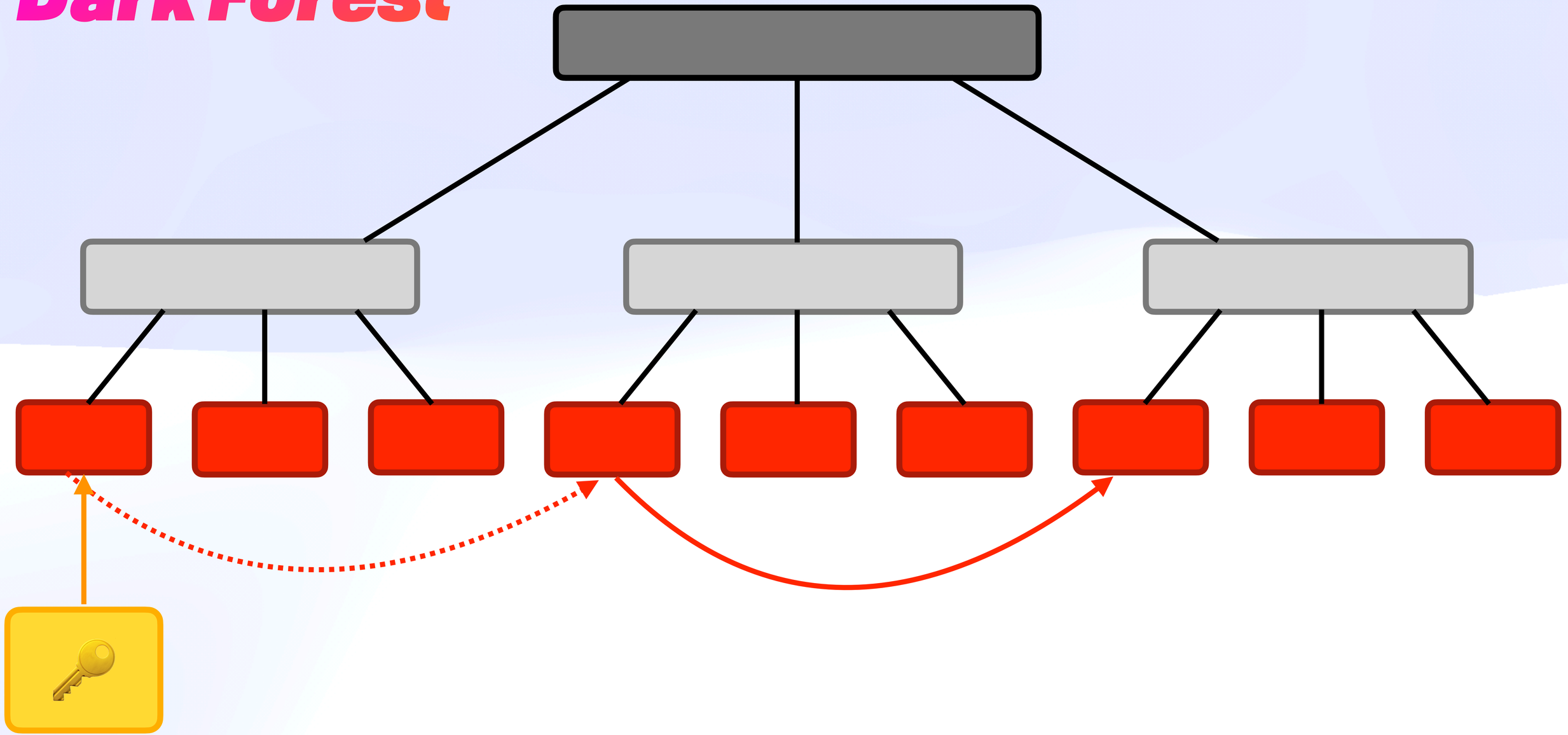
Secret Files 🥷

Dark Forest



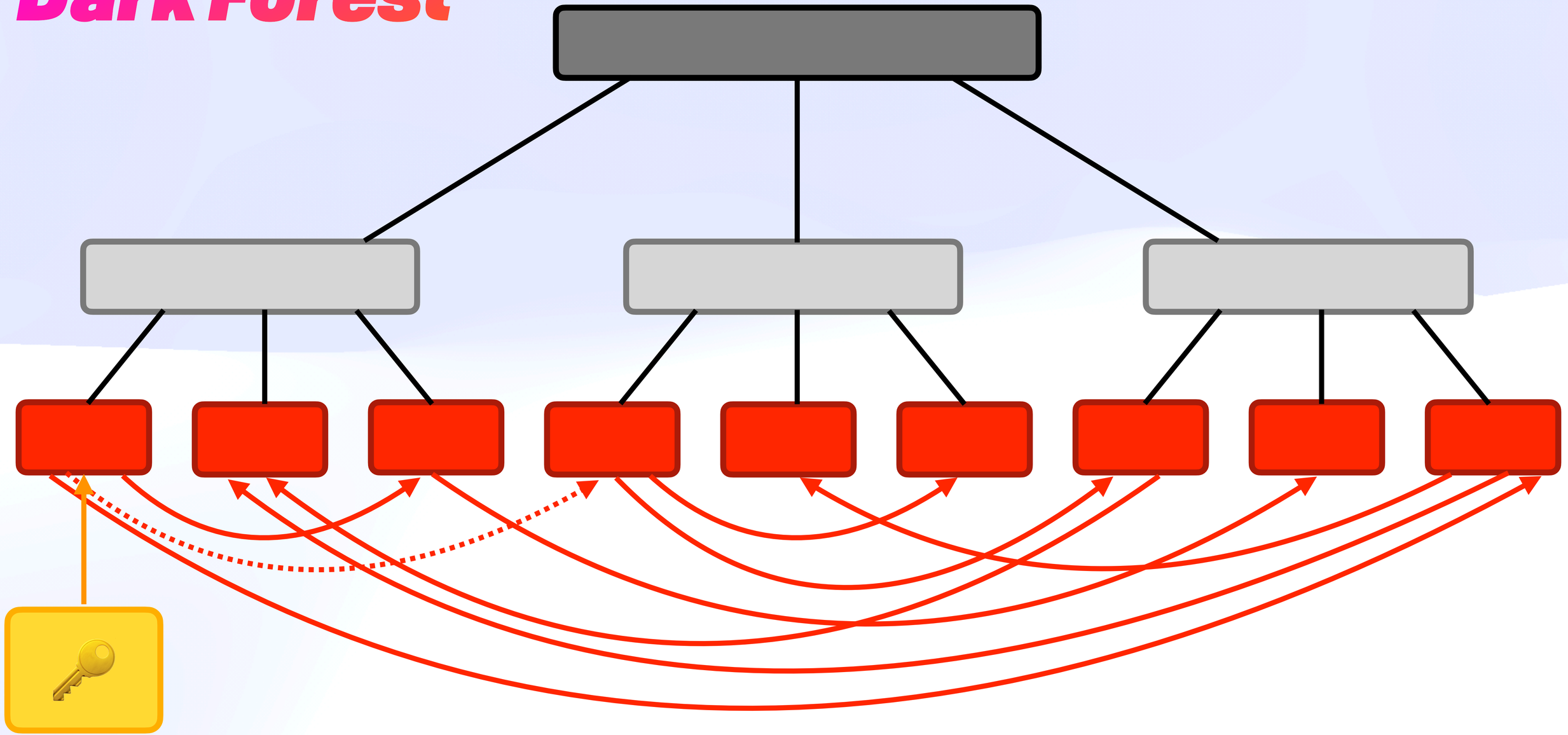
Secret Files 🥷

Dark Forest



Secret Files 🥷

Dark Forest



Secret Files 🥷

Cryptree

Secret Files 🥷

Cryptree

Binary

Encrypted Node 🔒

Encrypted Node 🔒

Encrypted Node 🔒

Secret Files 🥷

Cryptree

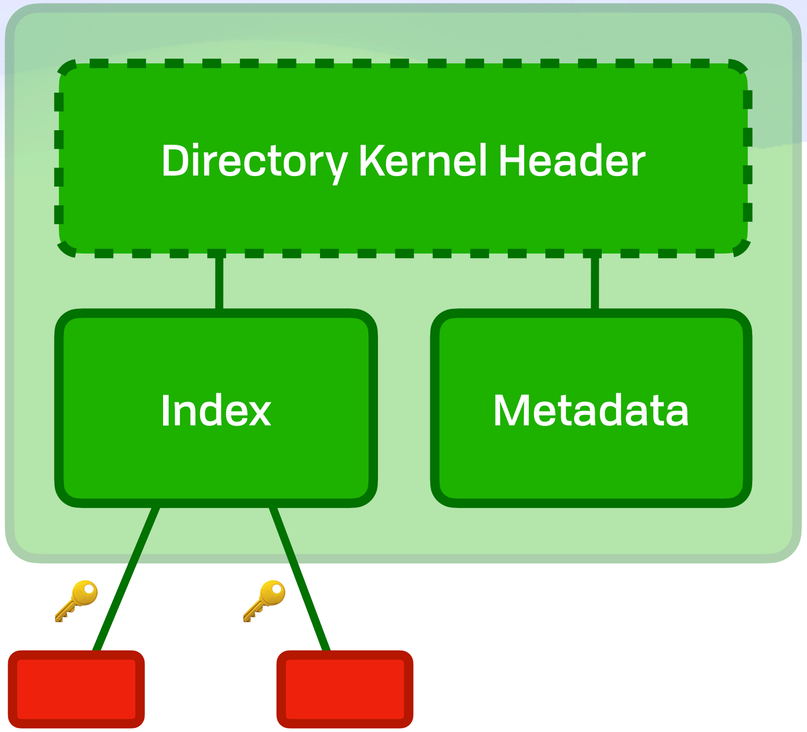
Binary

Encrypted Node 🔒

Encrypted Node 🔒

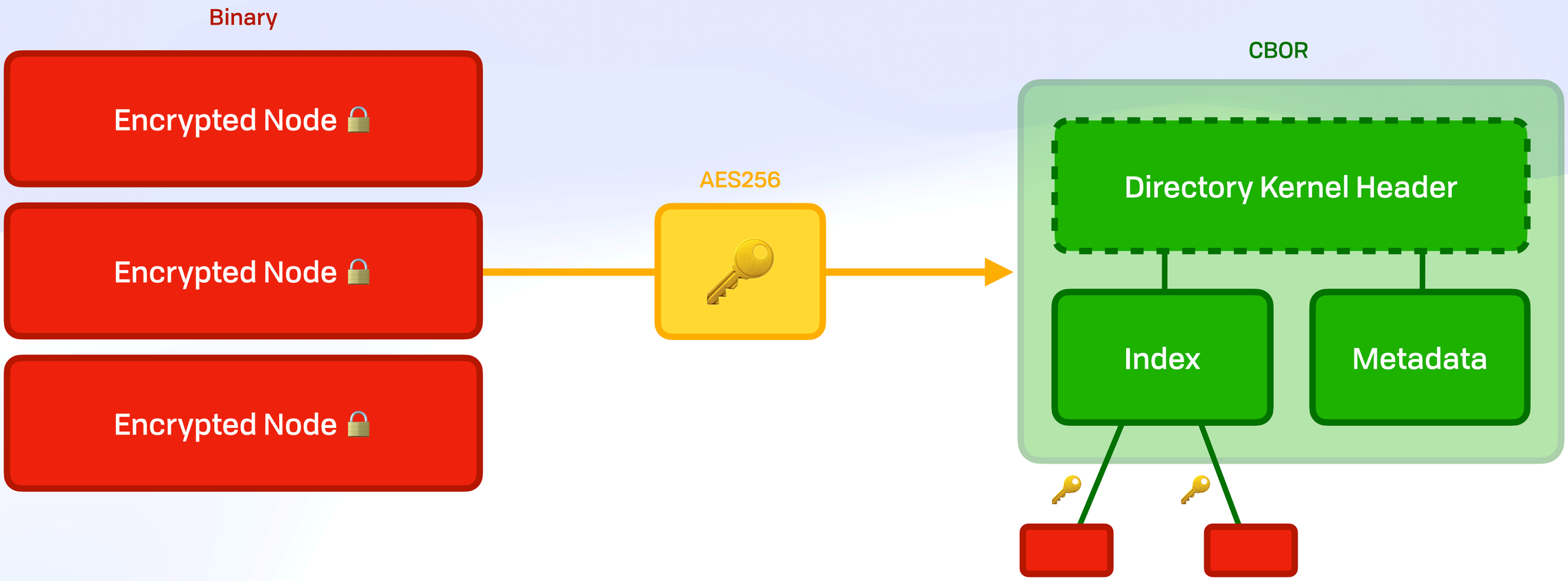
Encrypted Node 🔒

CBOR



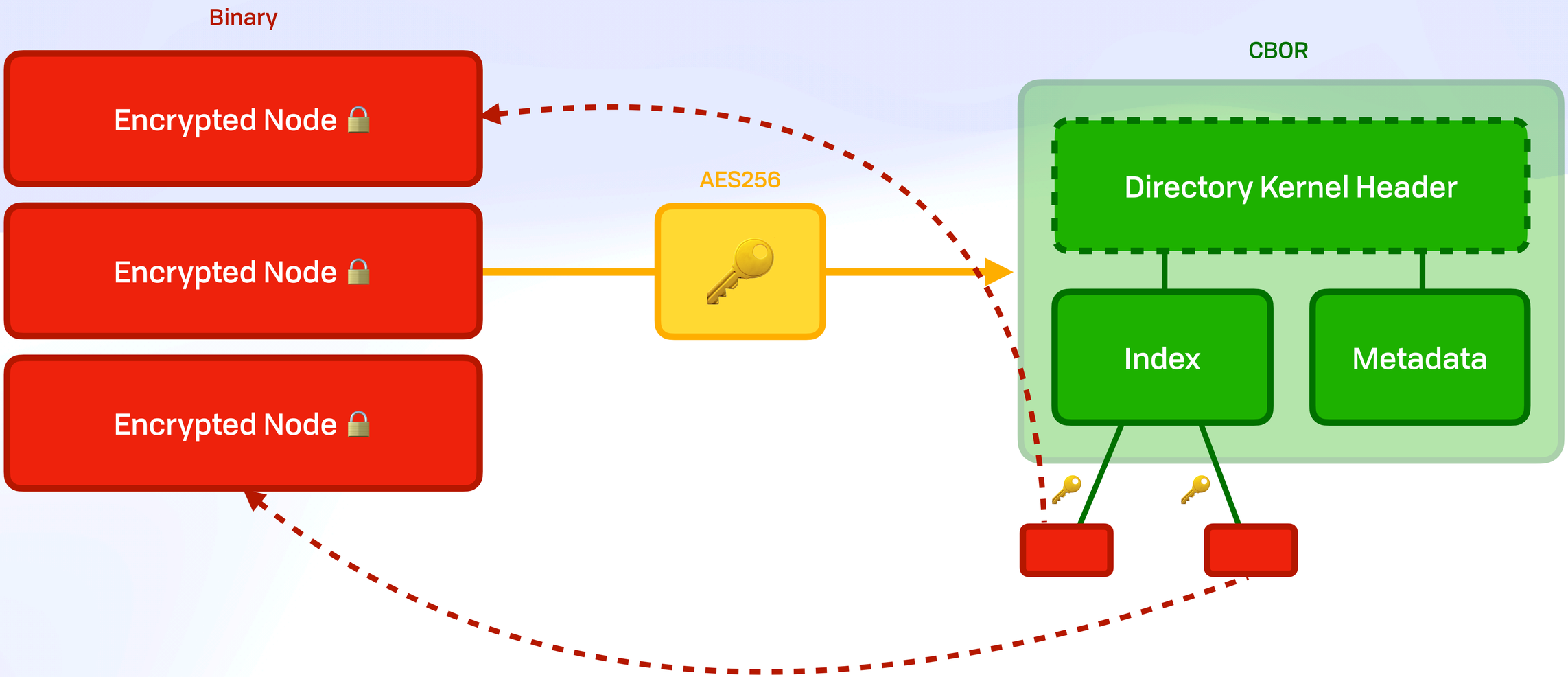
Secret Files 🥷

Cryptree



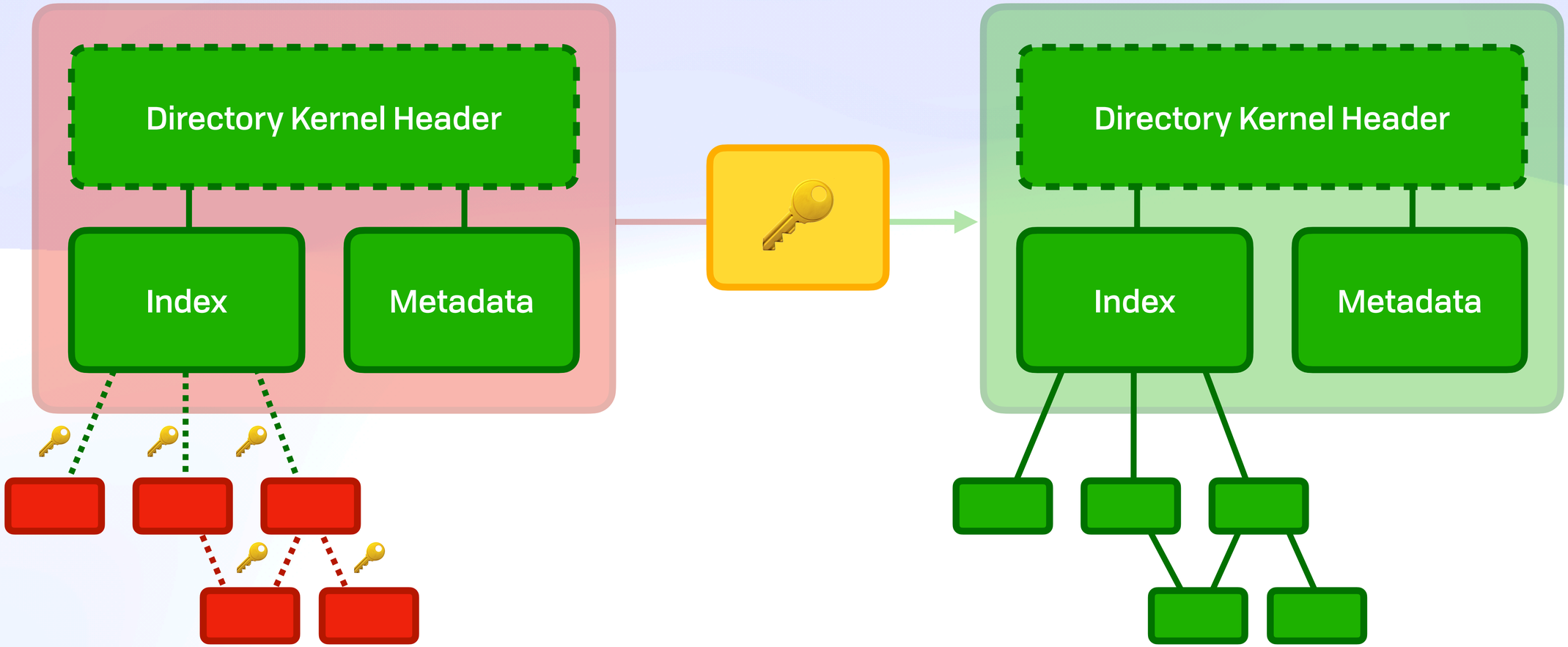
Secret Files 🥷

Cryptree



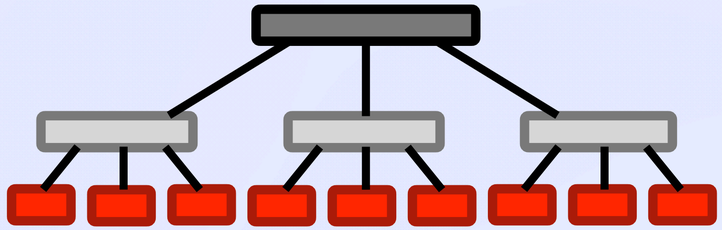
Secret Files 🥷

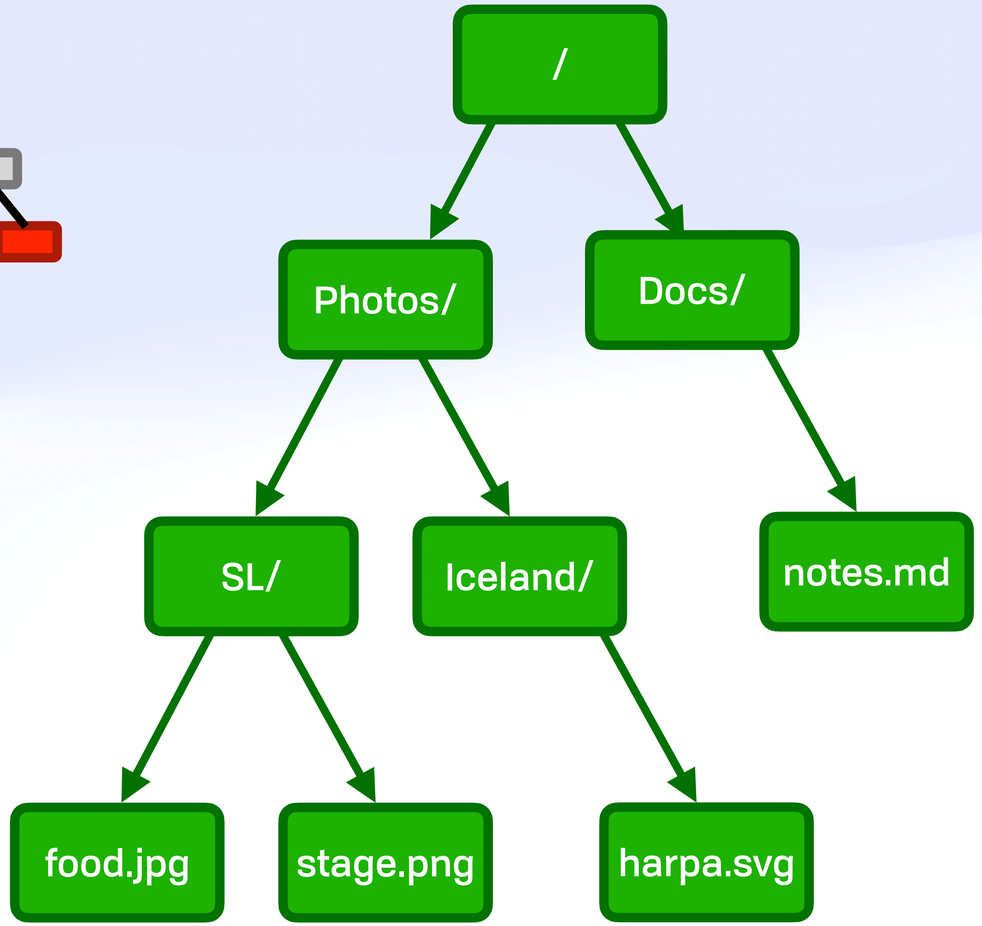
Read Window



Secret Files 🥷

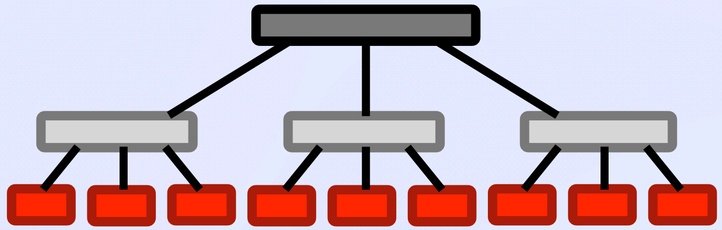
Offline Access Control

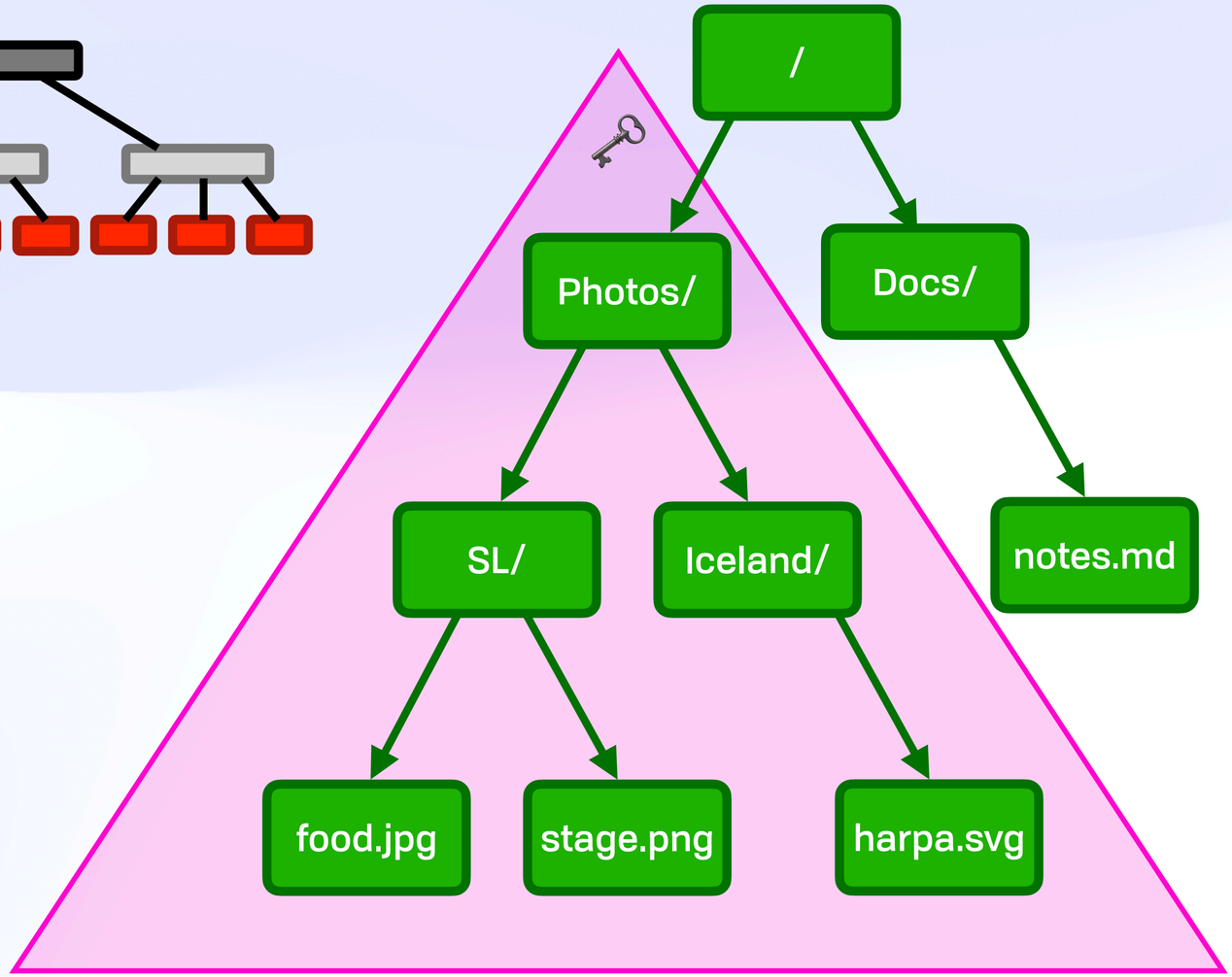




Secret Files 🥷

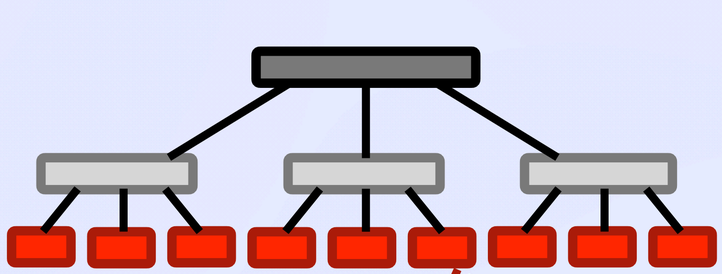
Offline Access Control

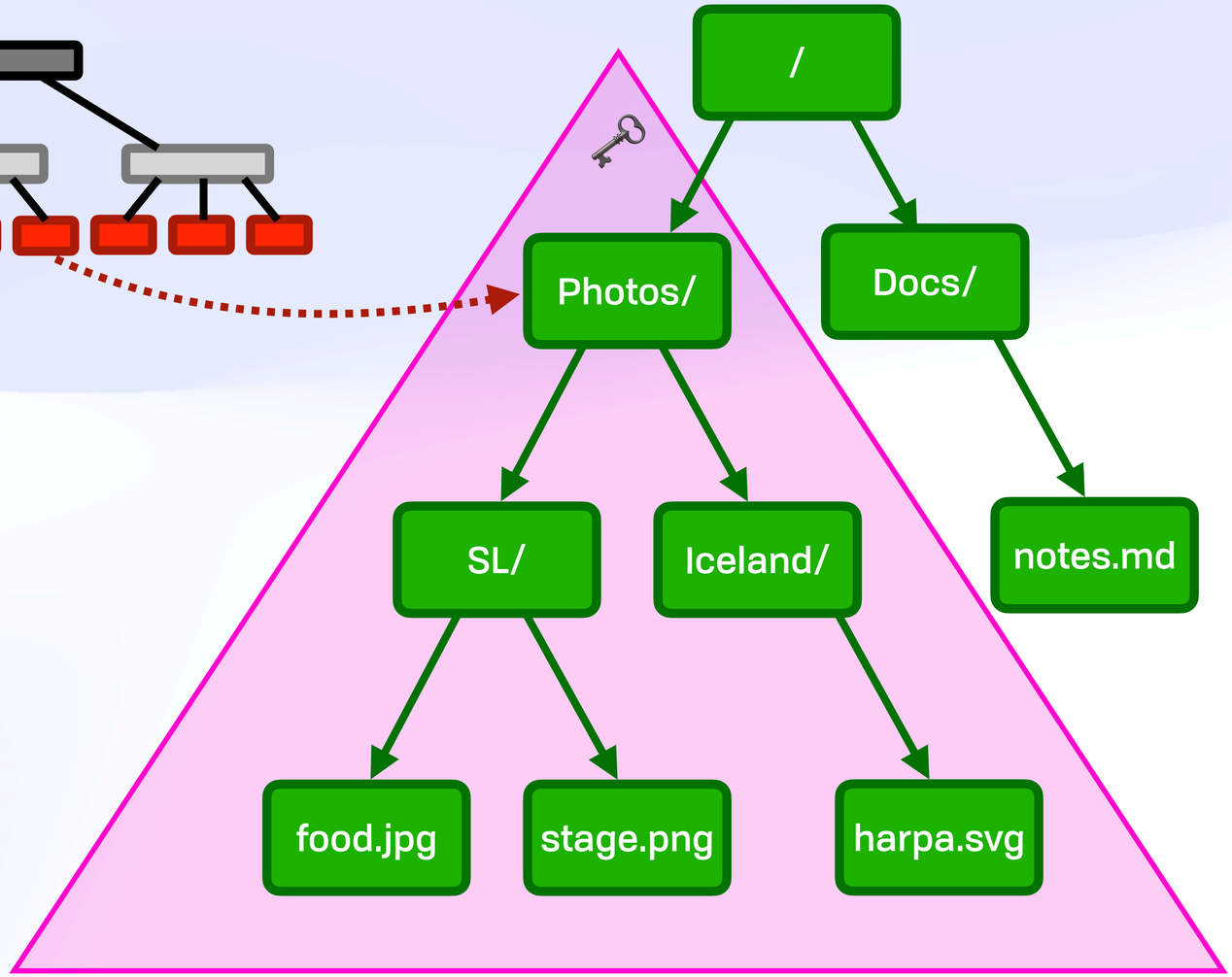




Secret Files 🥷

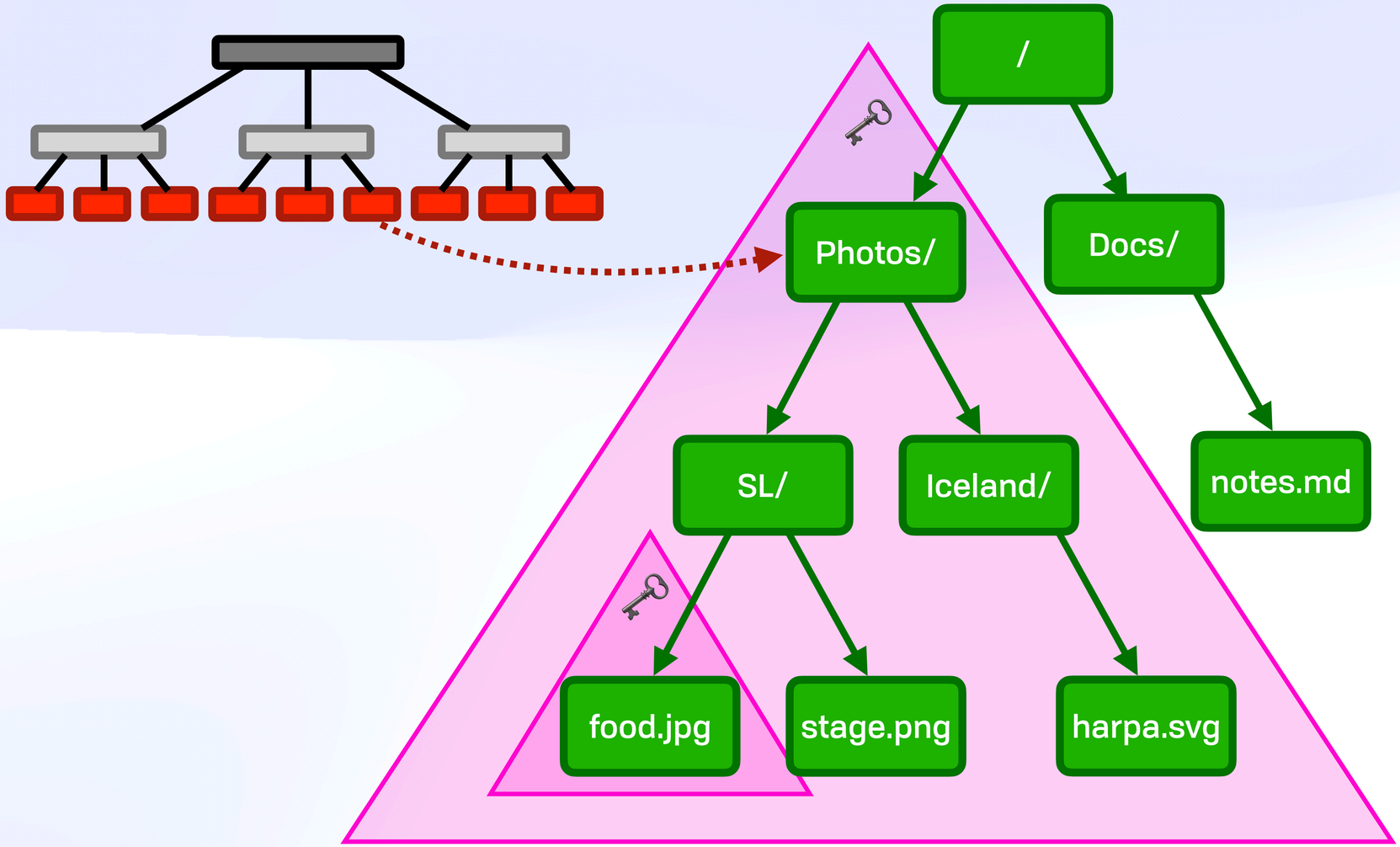
Offline Access Control





Secret Files 🥷

Offline Access Control



Secret Files 🥷

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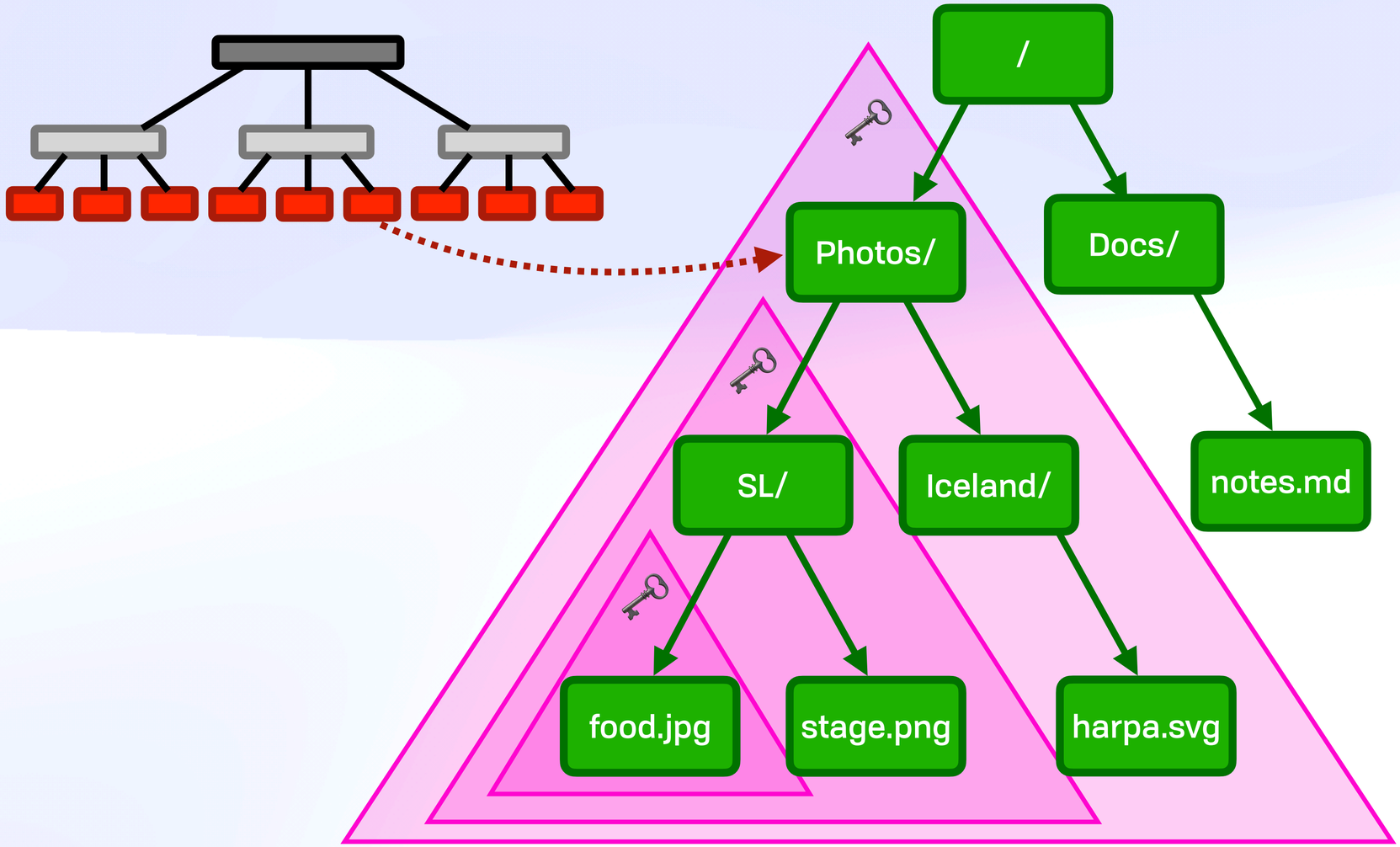
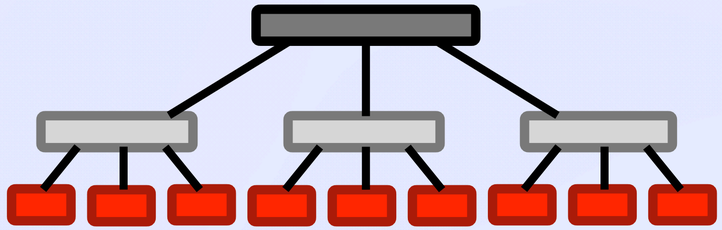
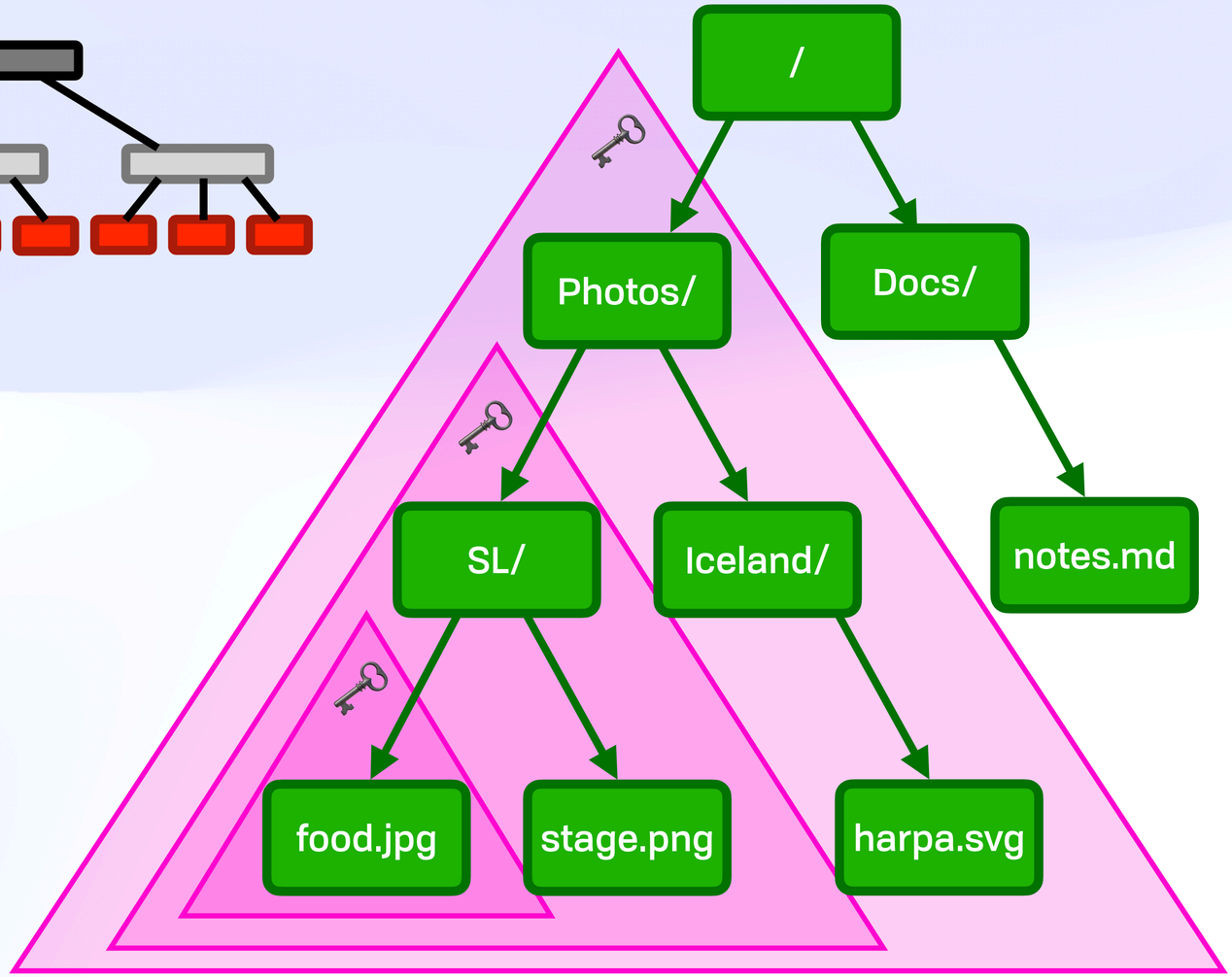


Secret Files 🥷

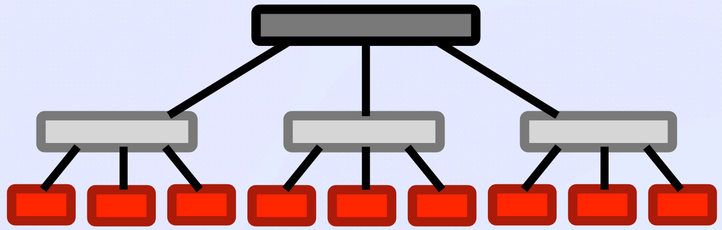
Offline Access Control

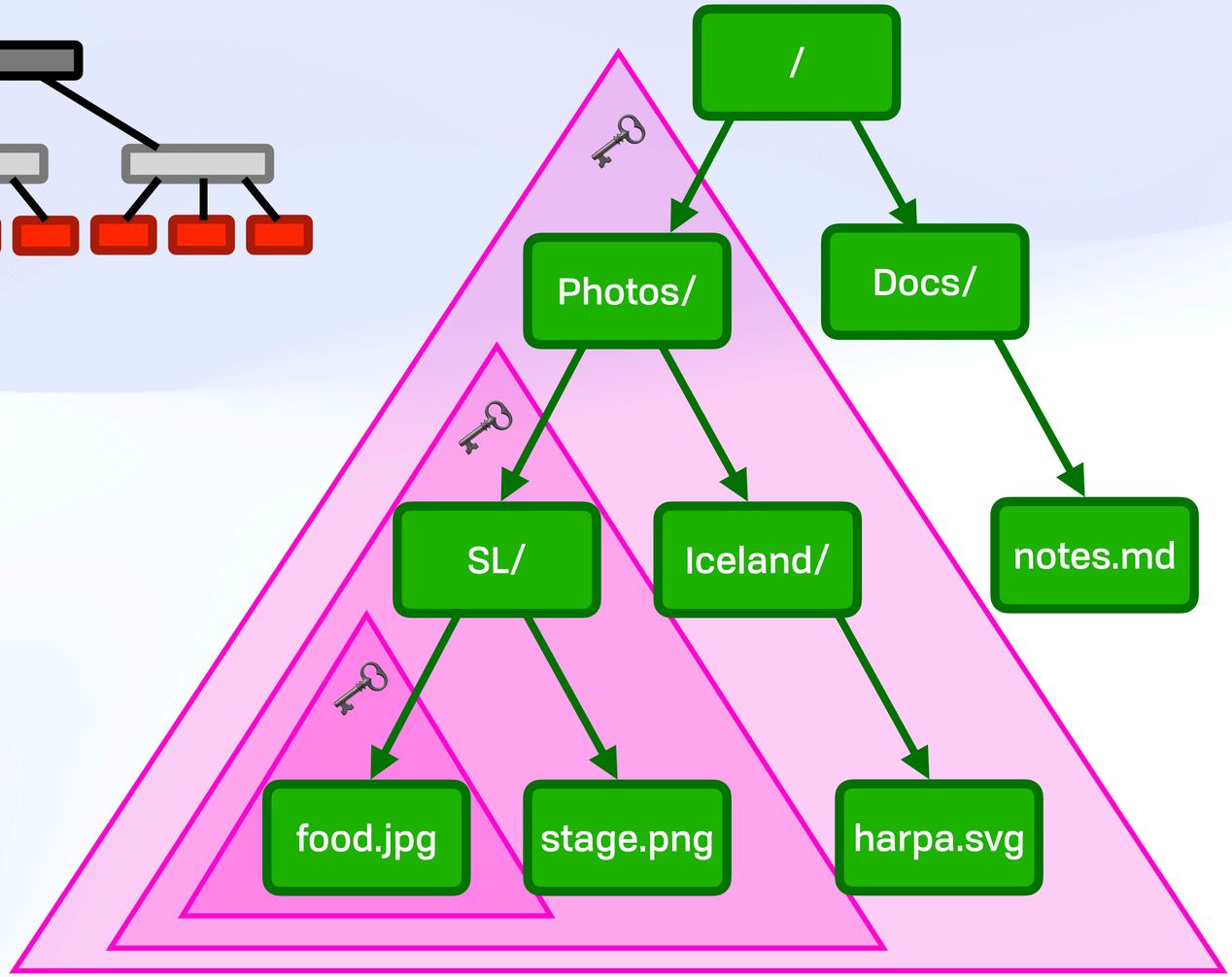




Secret Files 🥷

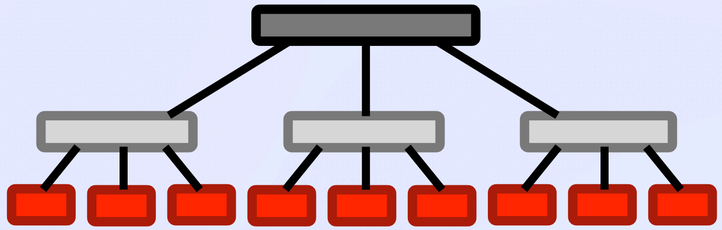
Offline Access Control

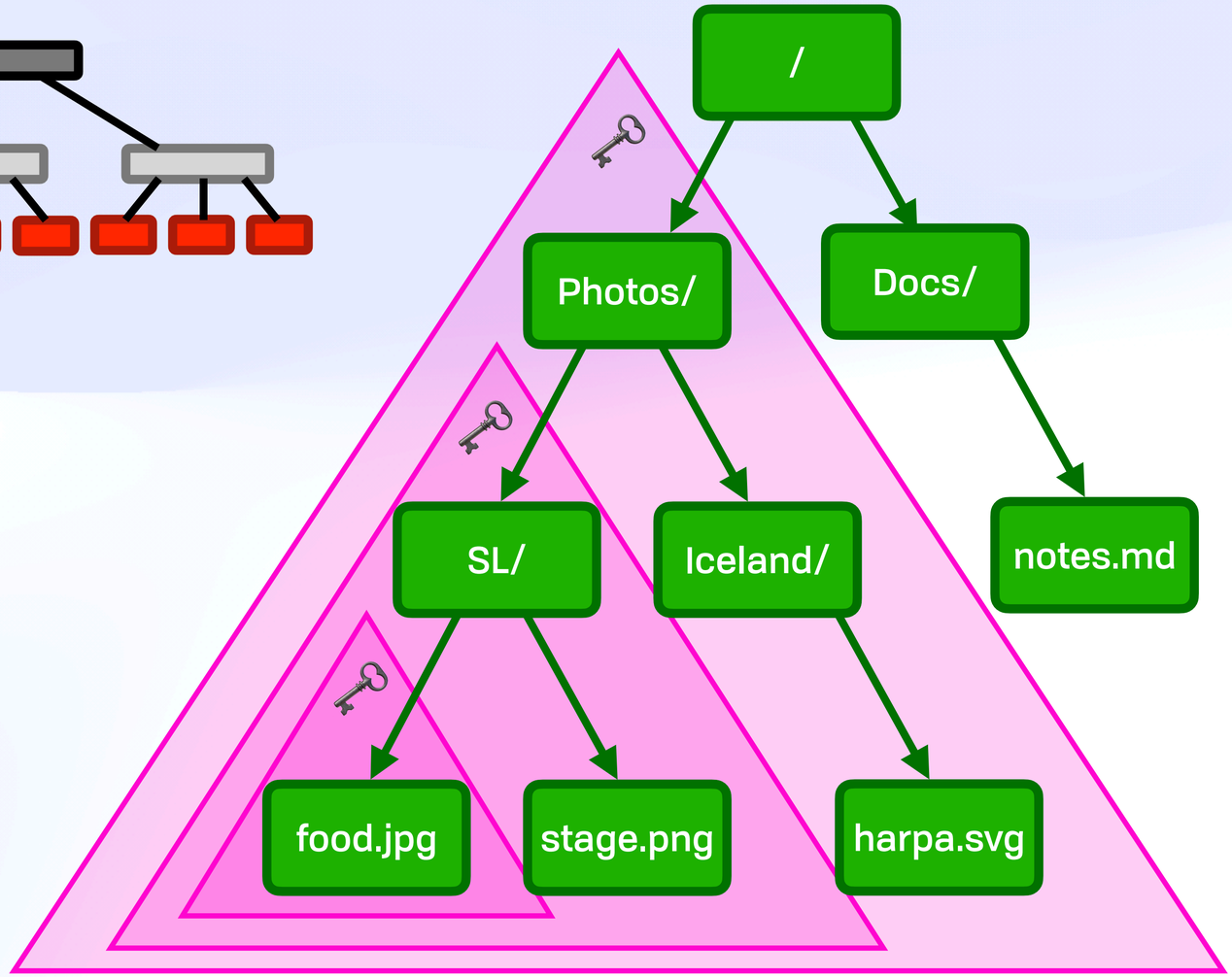




Secret Files 🥷

Offline Access Control





Secret Files 🥷

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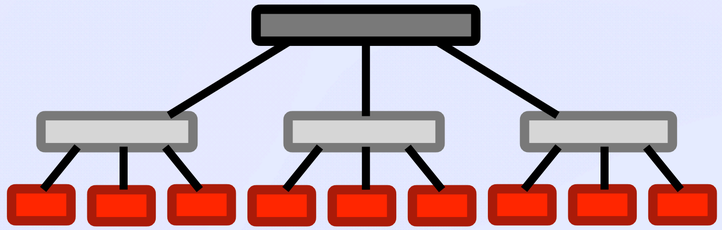

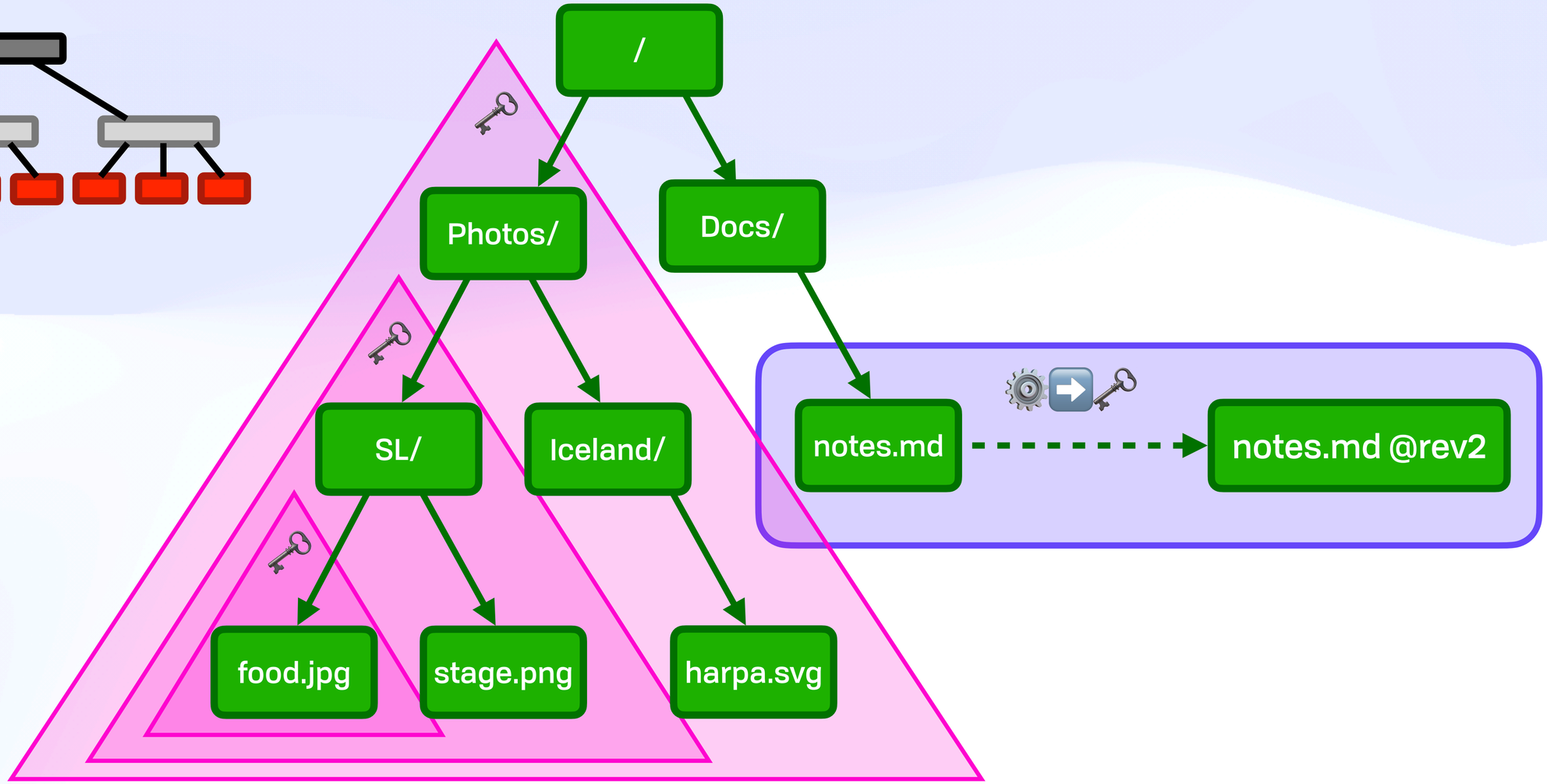

Secret Files 🥷

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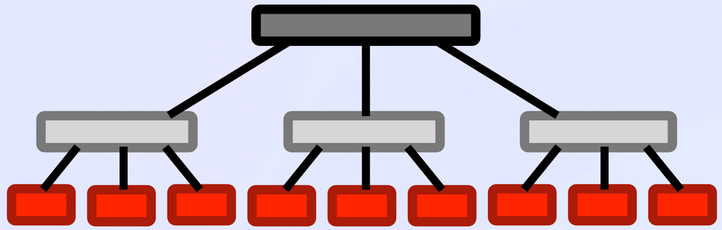

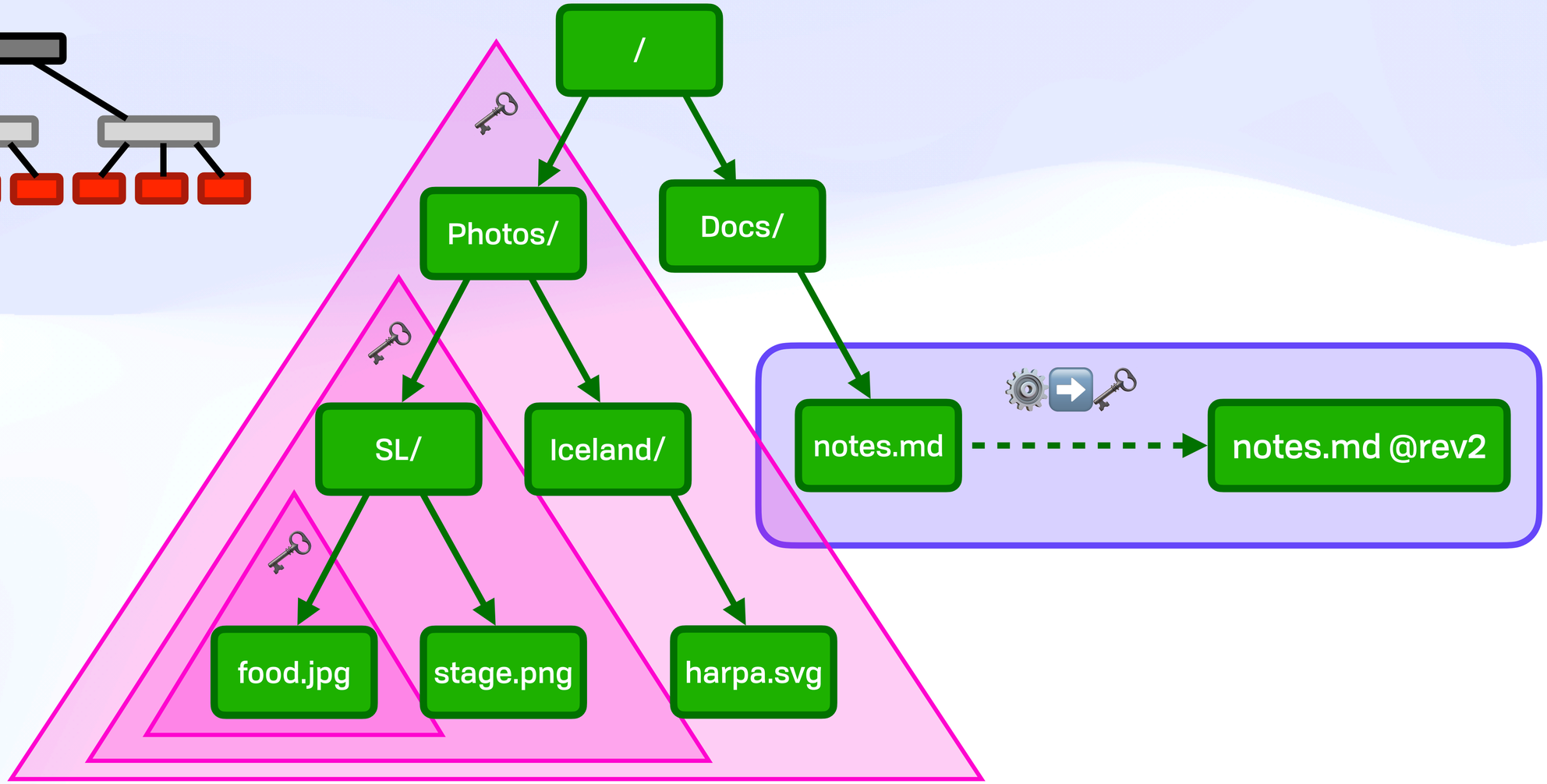

Secret Files 🥷

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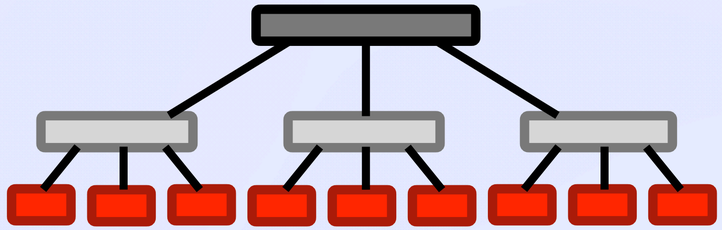

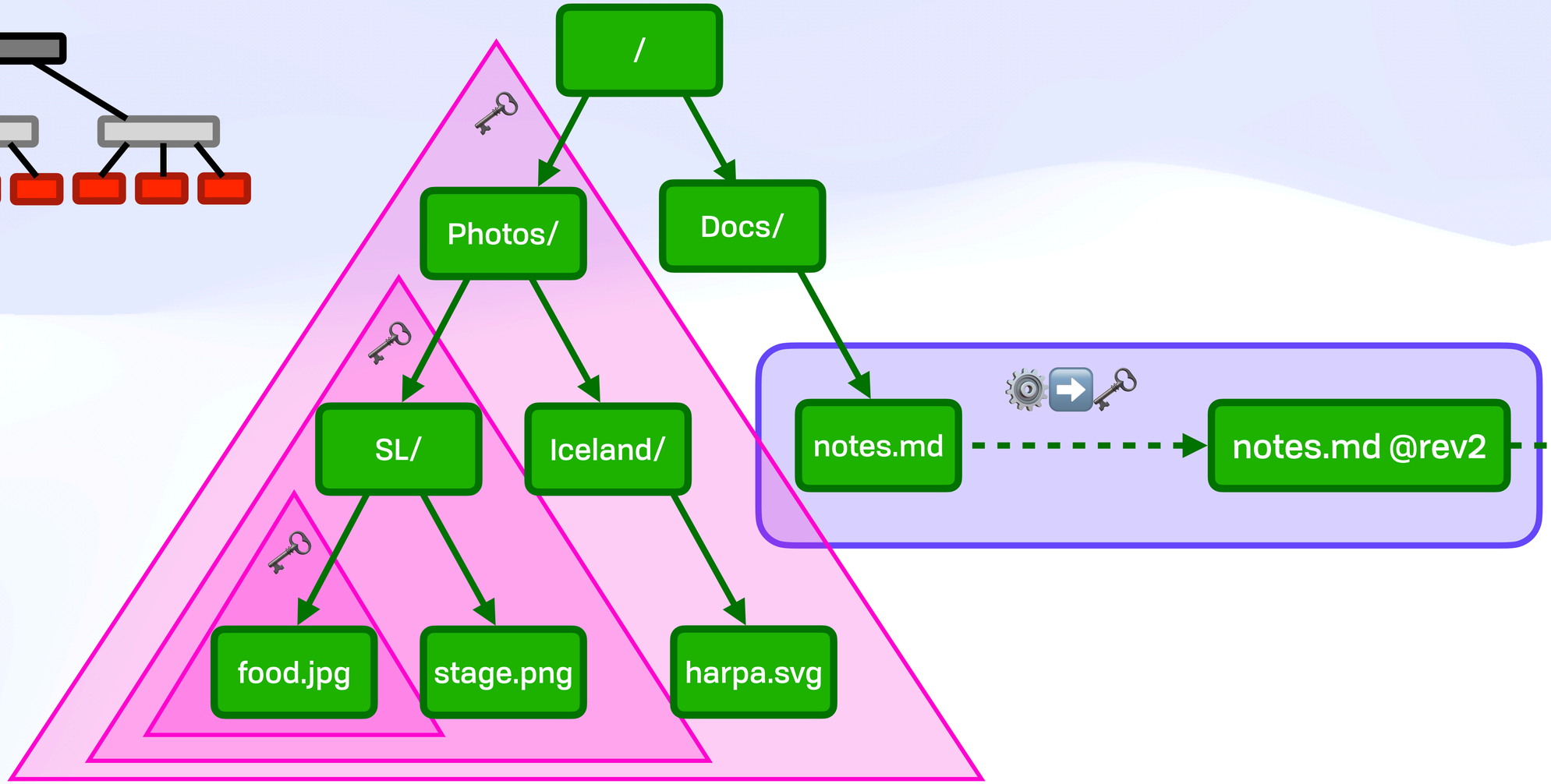

Temporal Cryptree

⏱️ Secrets in Space & Time 🚀

Temporal Cryptree ⏱️

Access Control in Space & Time 🛸

Temporal Cryptree ⏱️

Access Control in Space & Time 🛸

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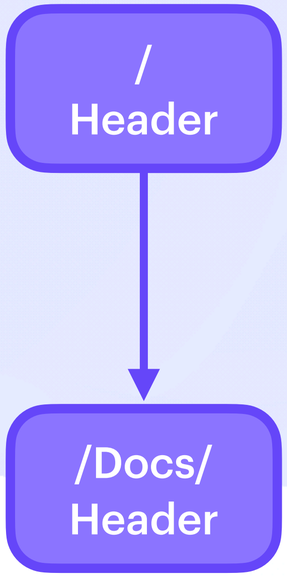
Header

Temporal Cryptree ⏱️

Access Control in Space & Time 🛸

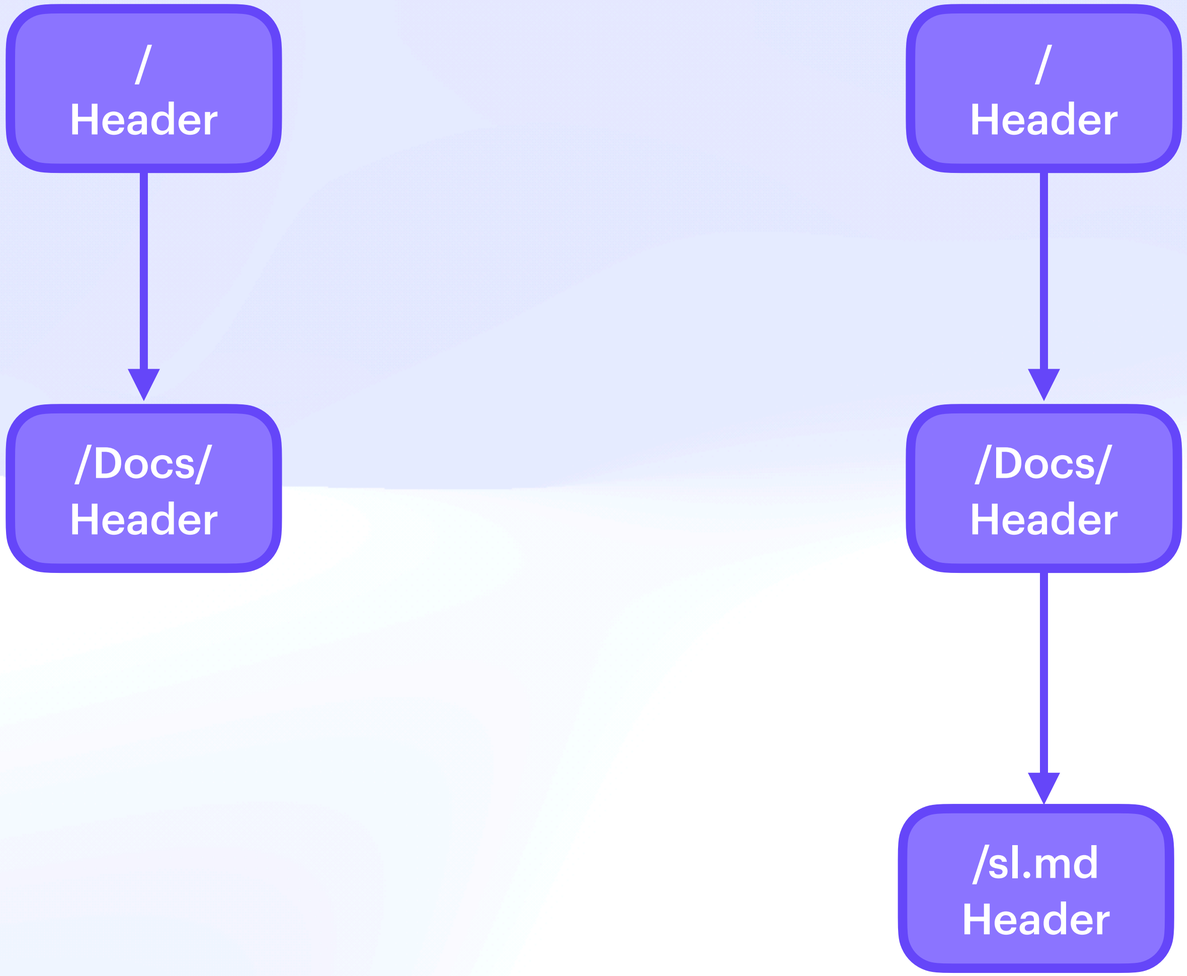


Temporal Cryptree ⏱️

Access Control in Space & Time 🛸

Temporal Cryptree ⏱️

Access Control in Space & Time 🛸



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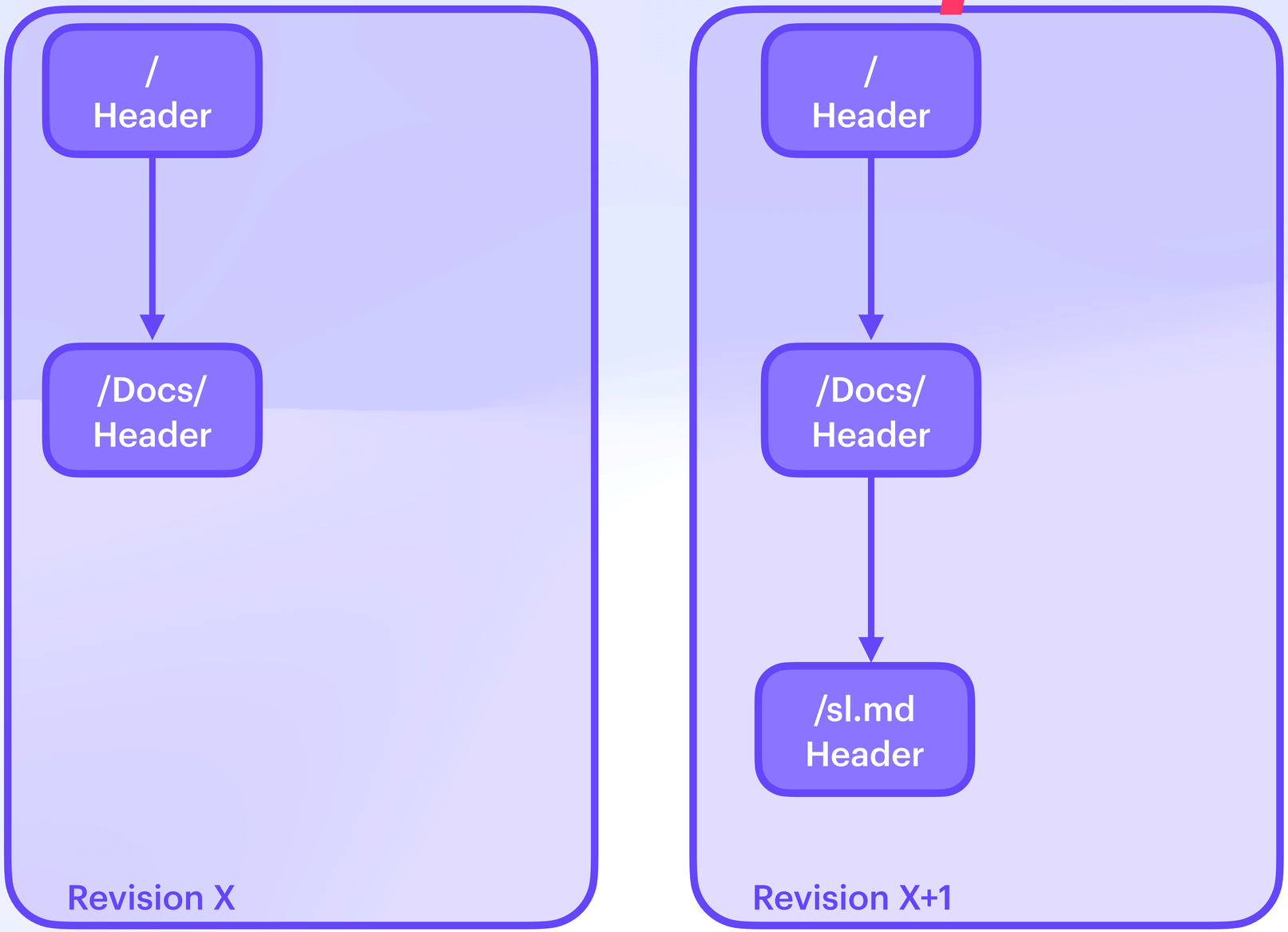
Access Control in Space & Time 🛸



Temporal Cryptree ⏱️

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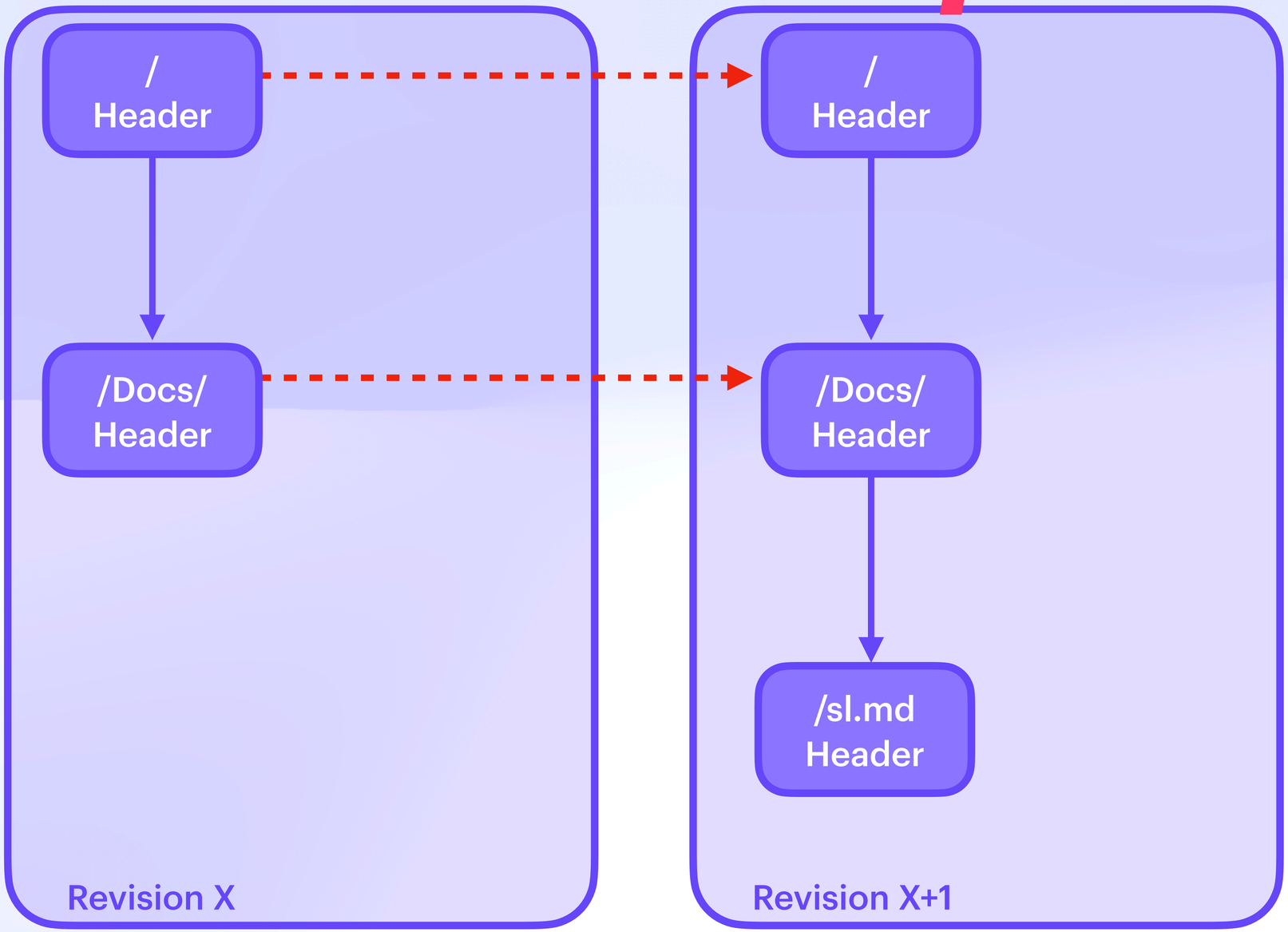
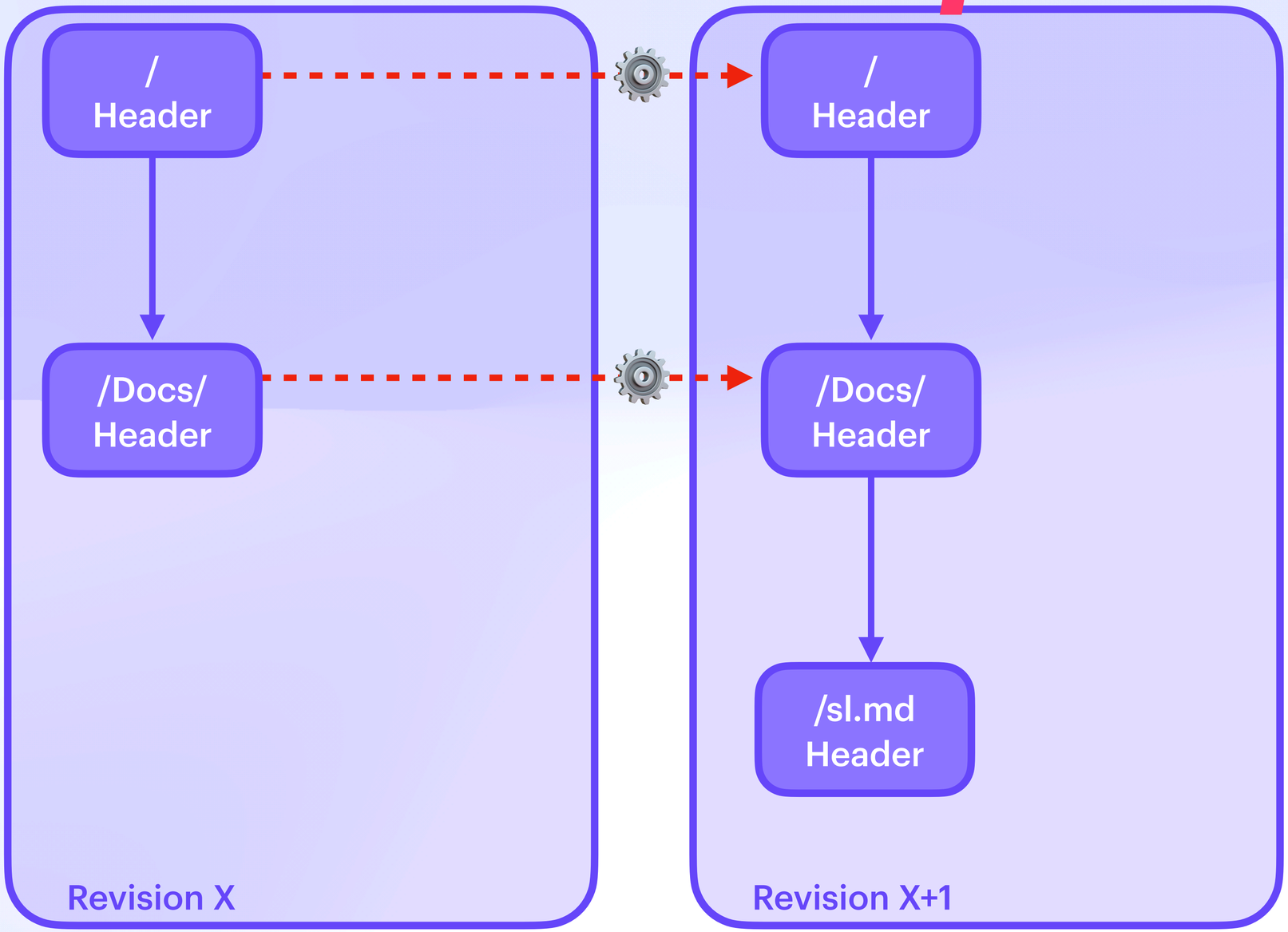


Temporal Cryptree ⏱️

Access Control in Space & Time 🛸



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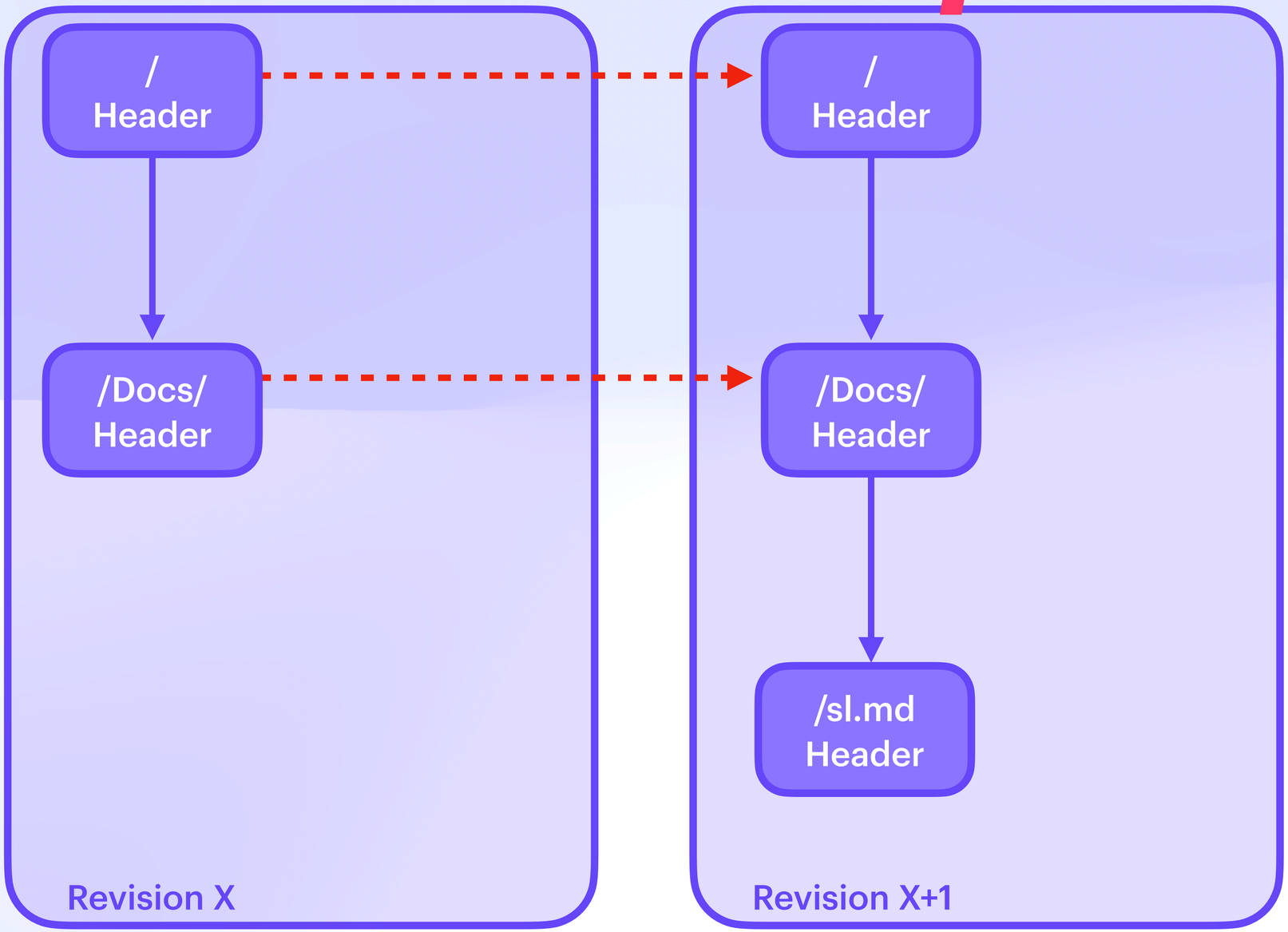

Temporal Cryptree ⏱️

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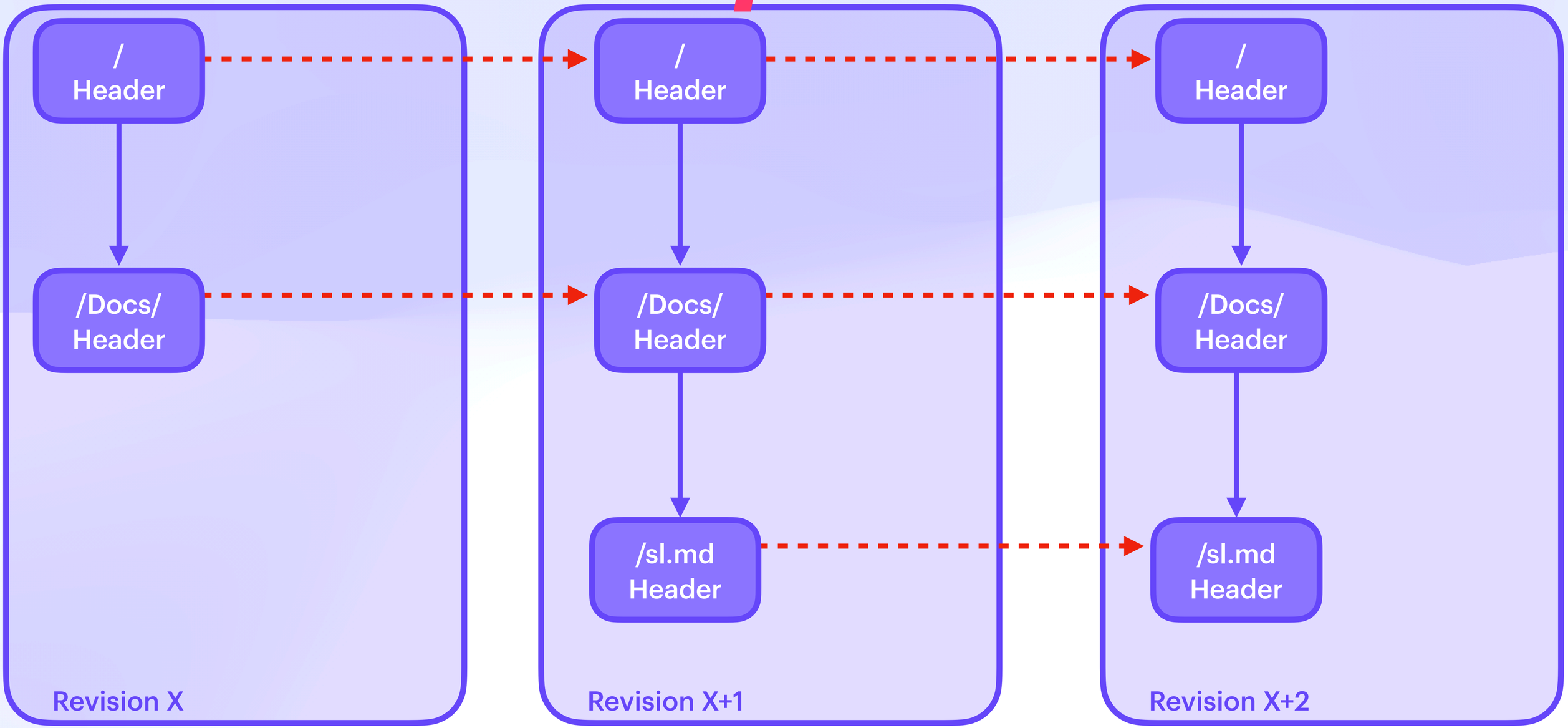

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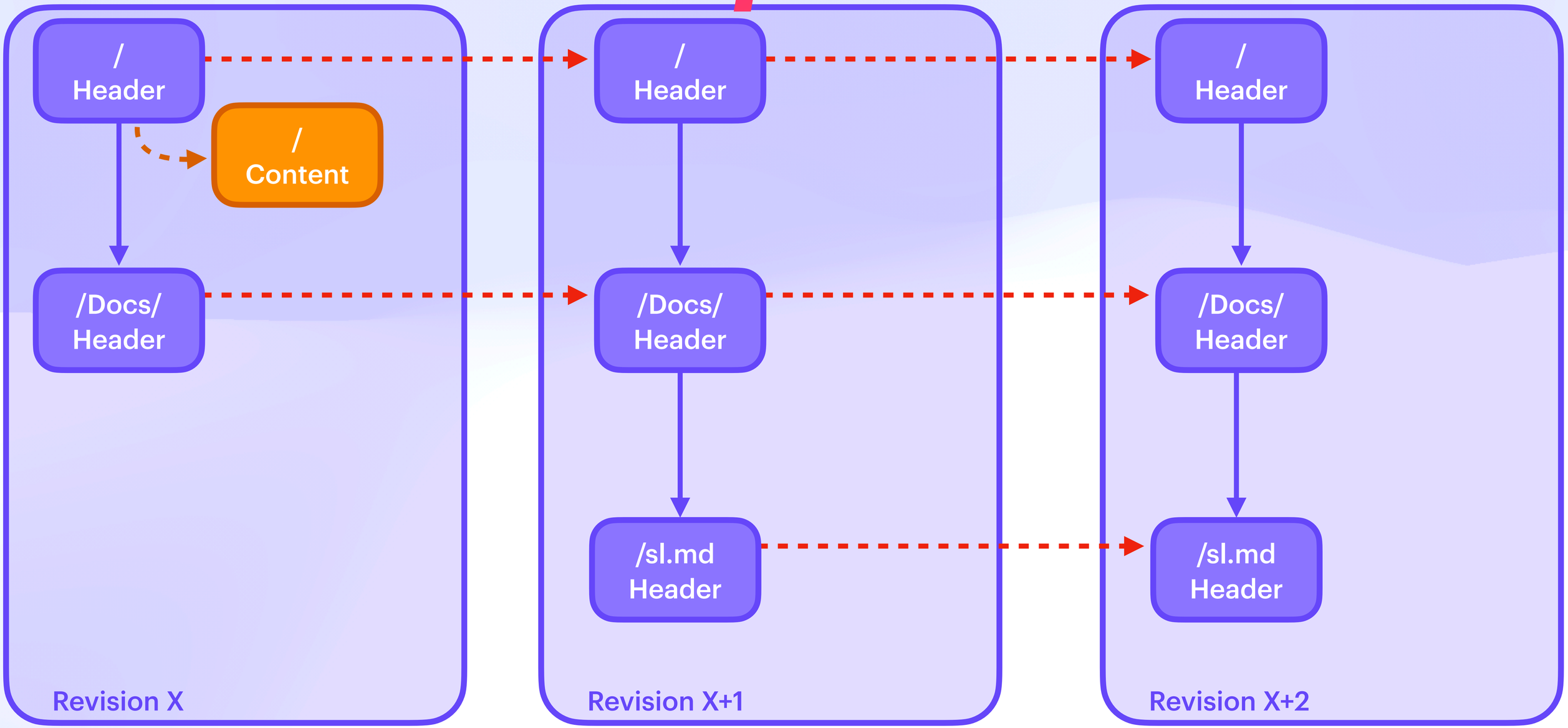

Temporal Cryptree ⏱️

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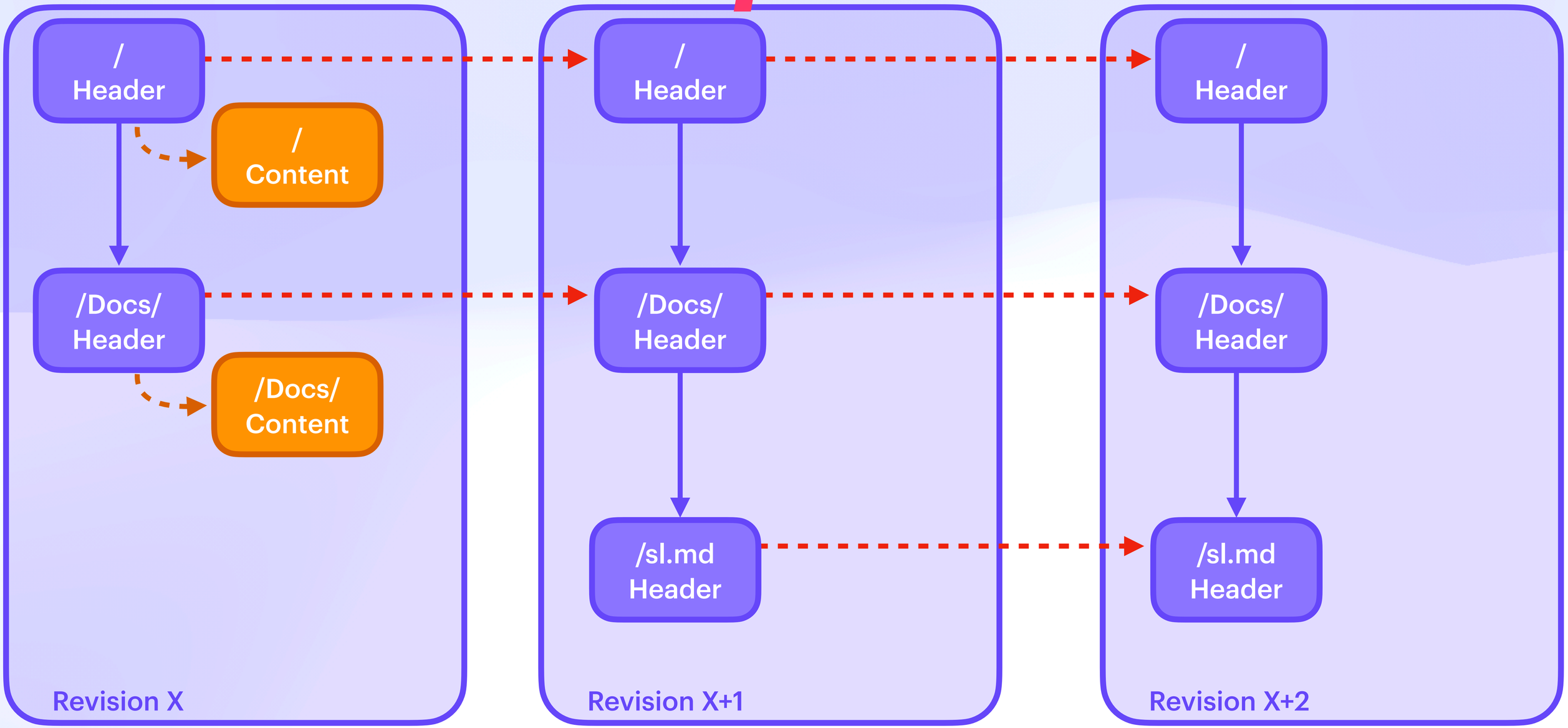

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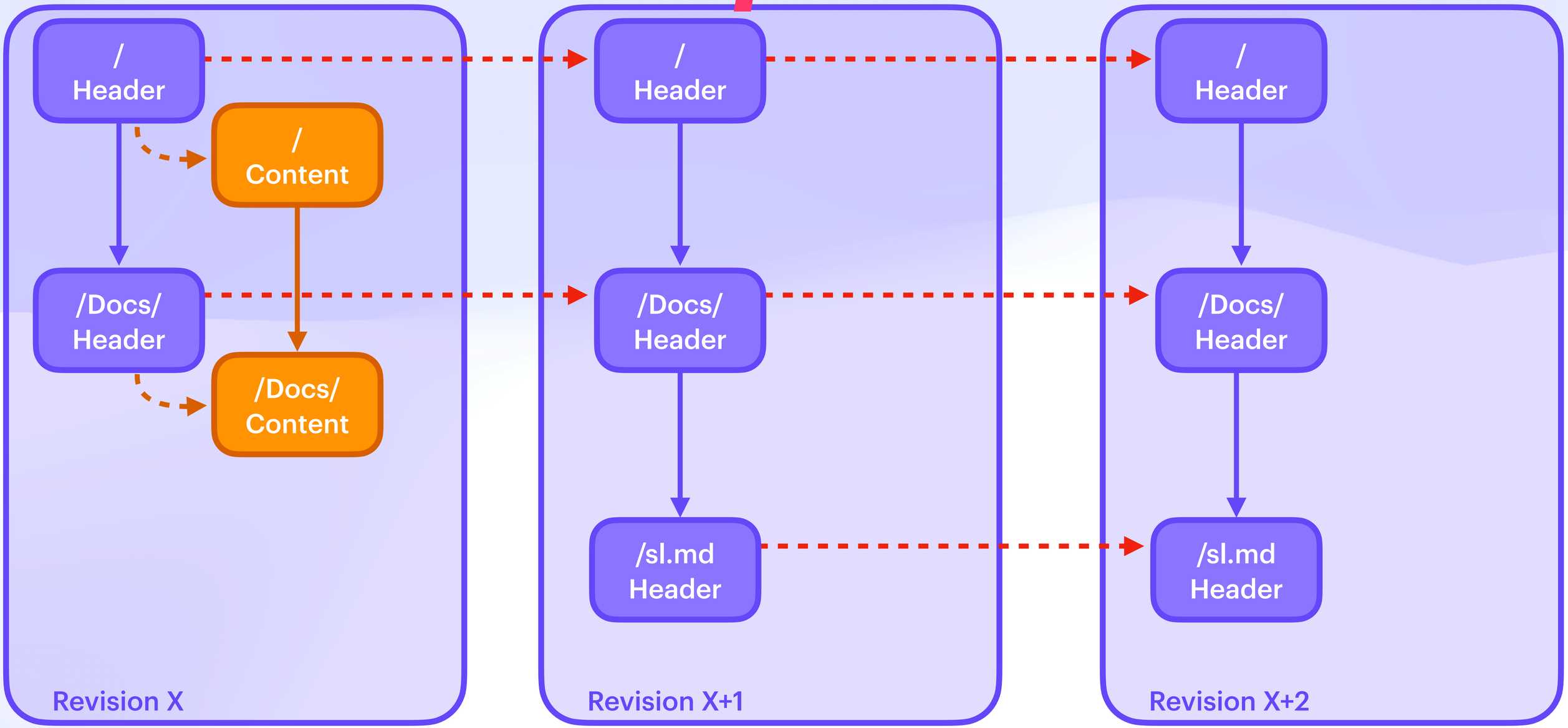

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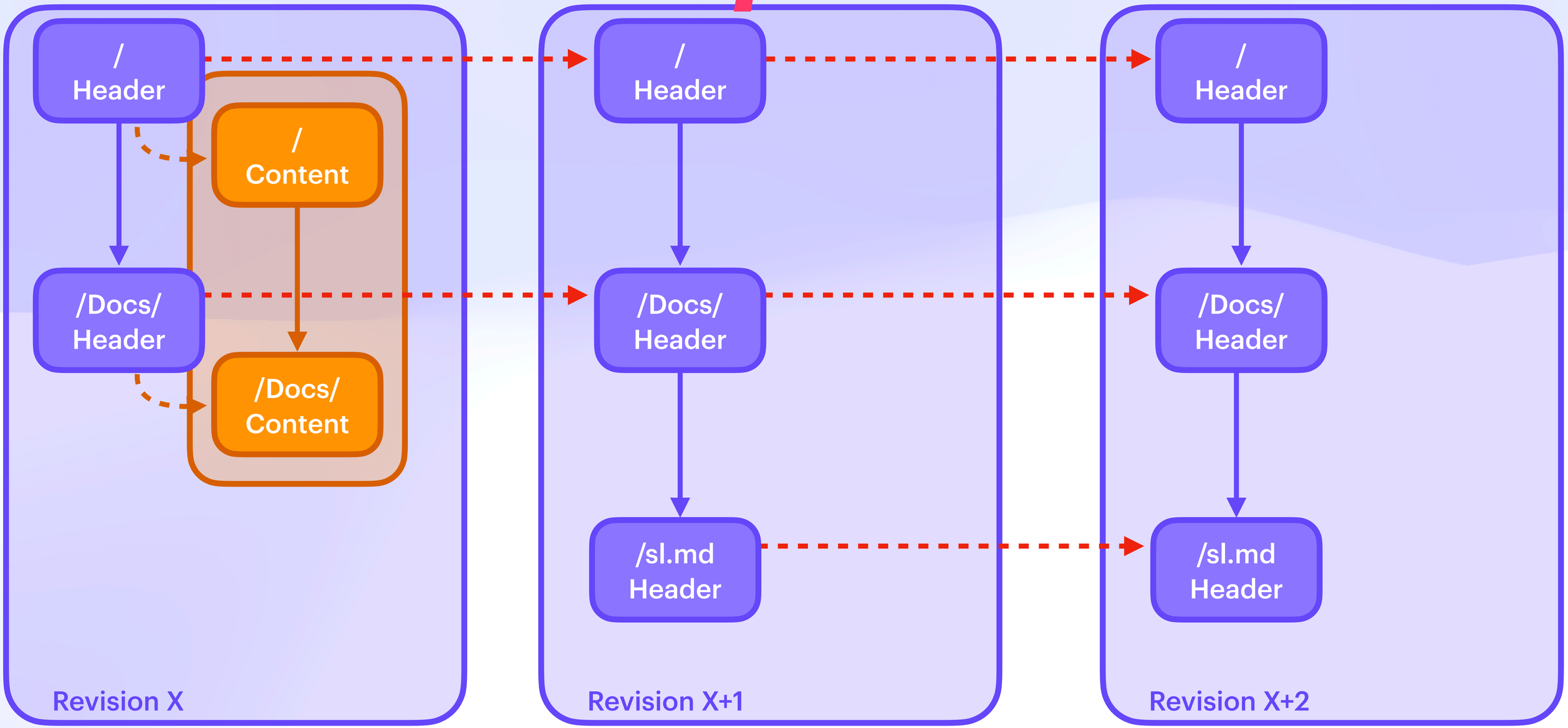

Temporal Cryptree ⏱️

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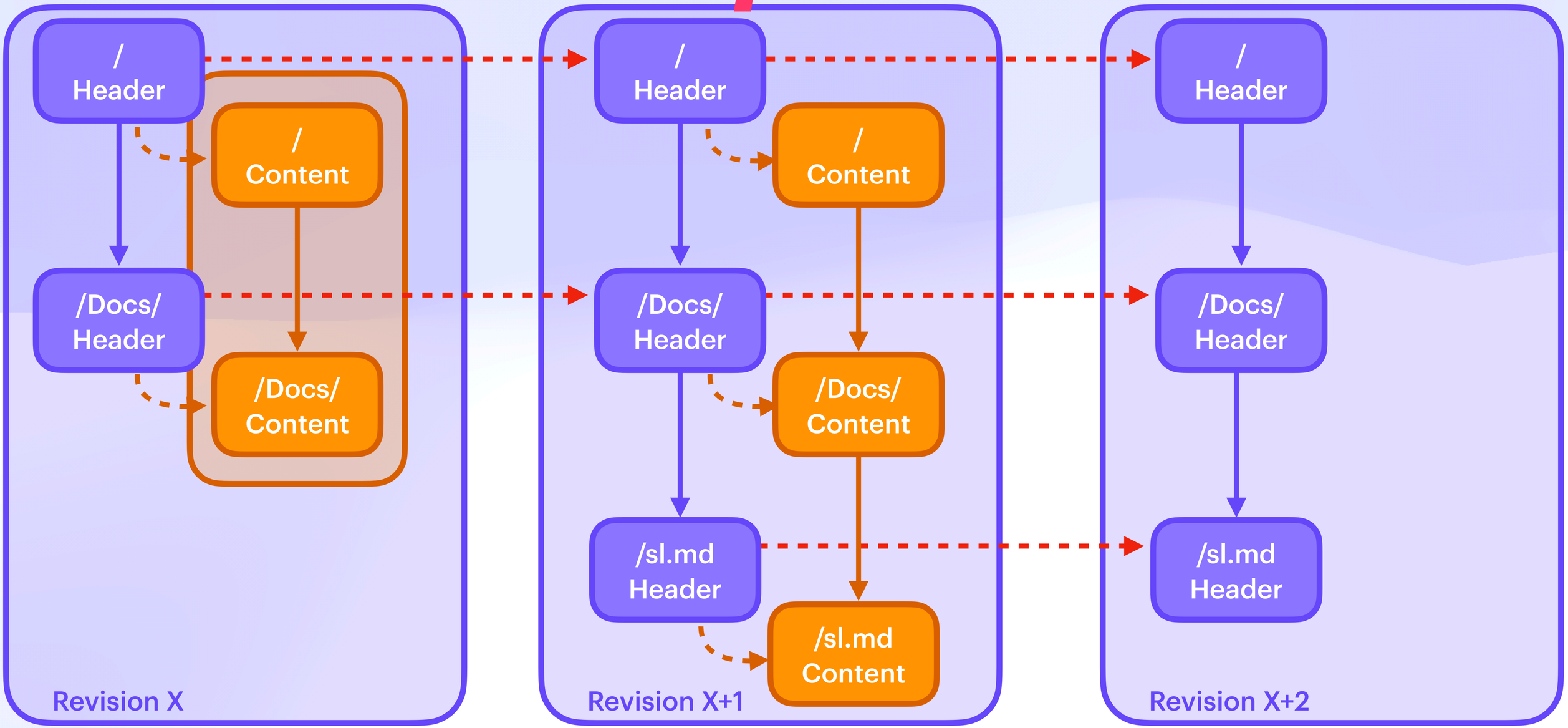

Temporal Cryptree ⏱️

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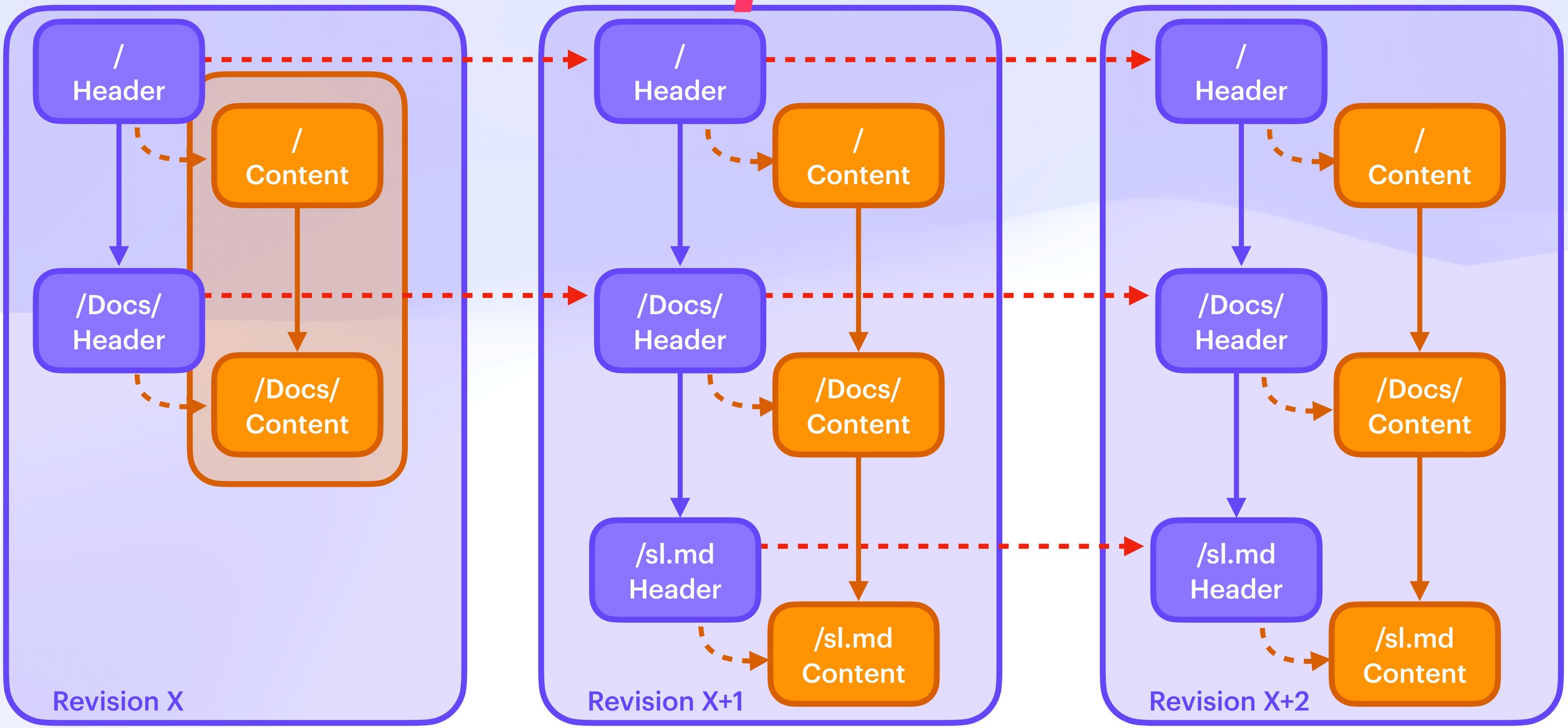

Temporal Cryptree ⏱️

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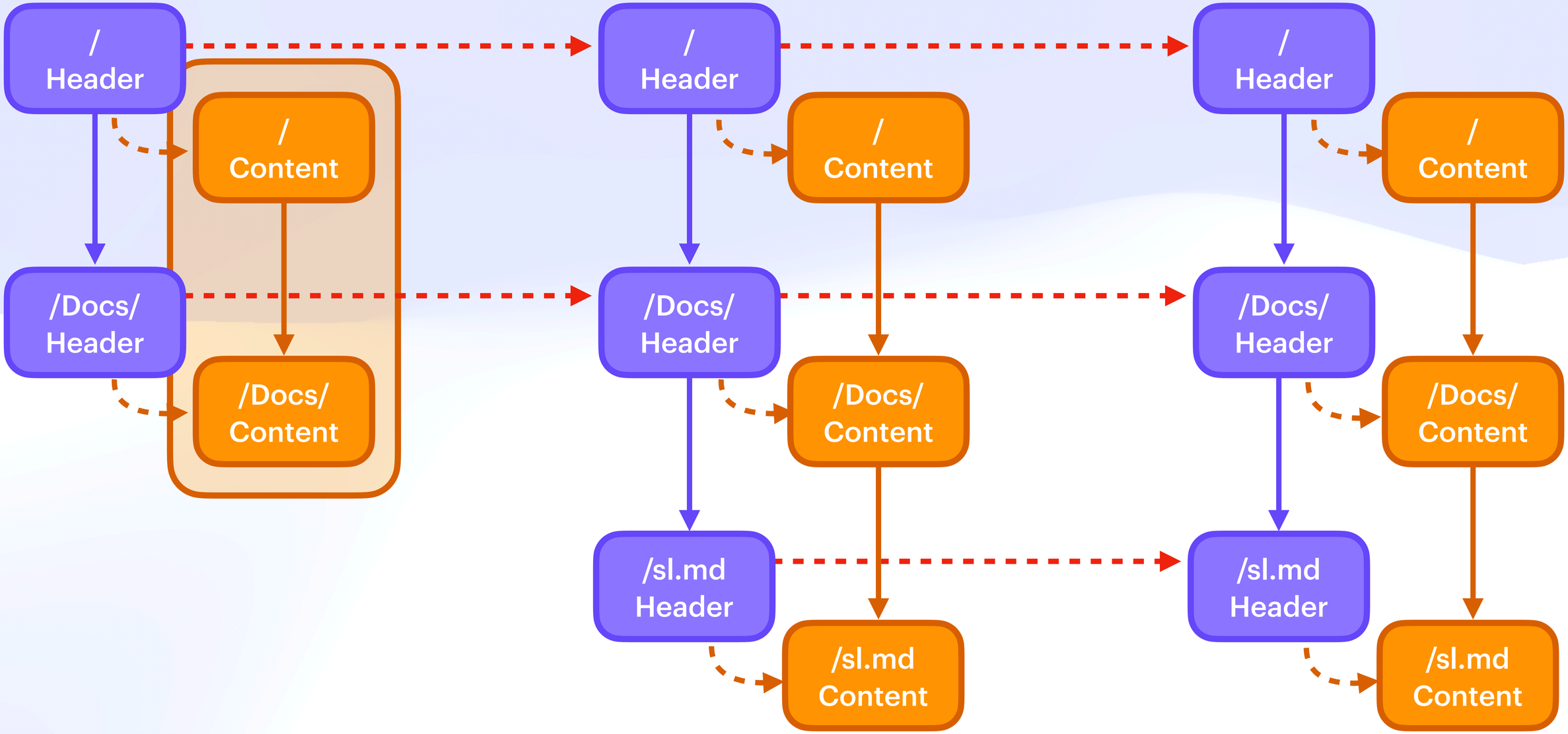

Temporal Cryptree ⏱️

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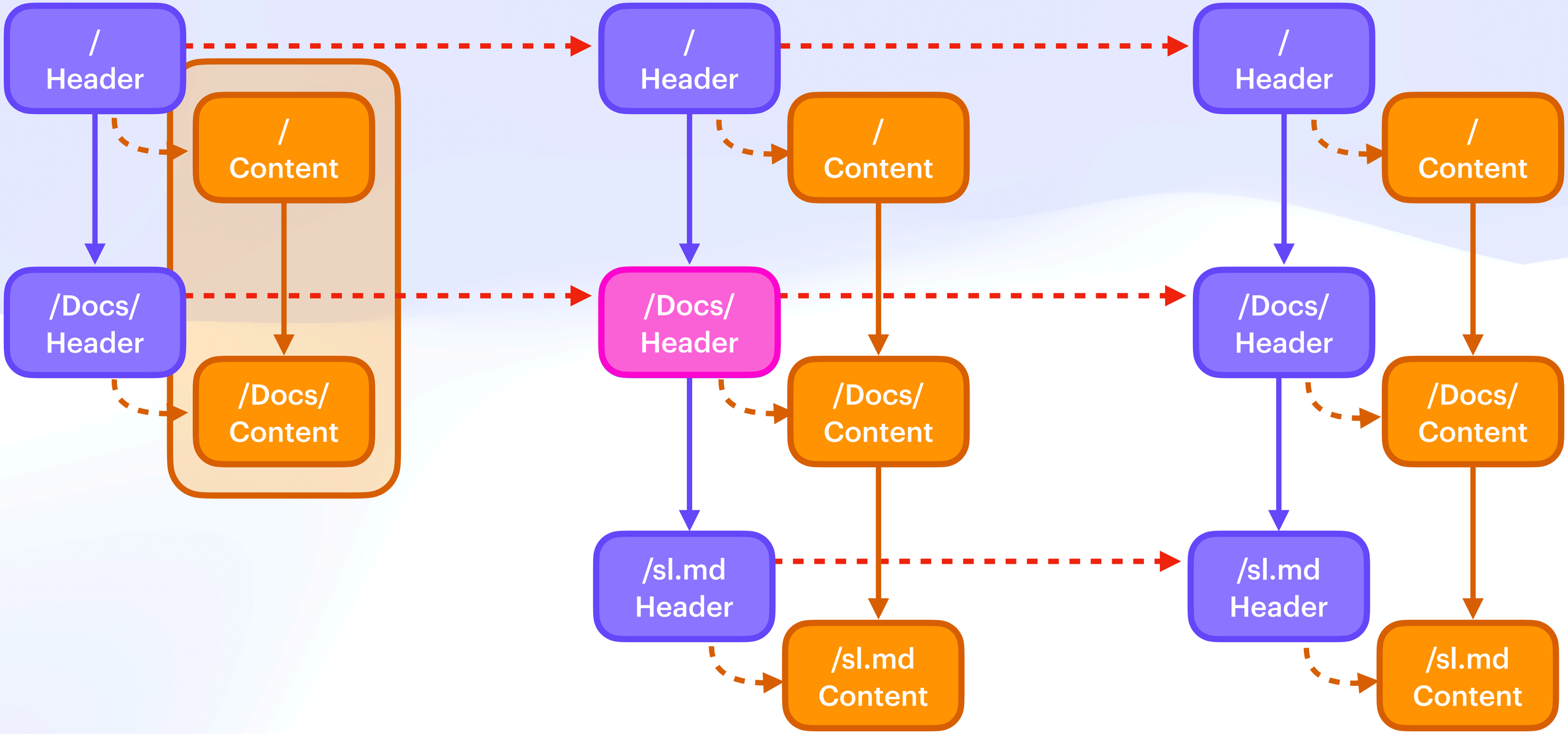

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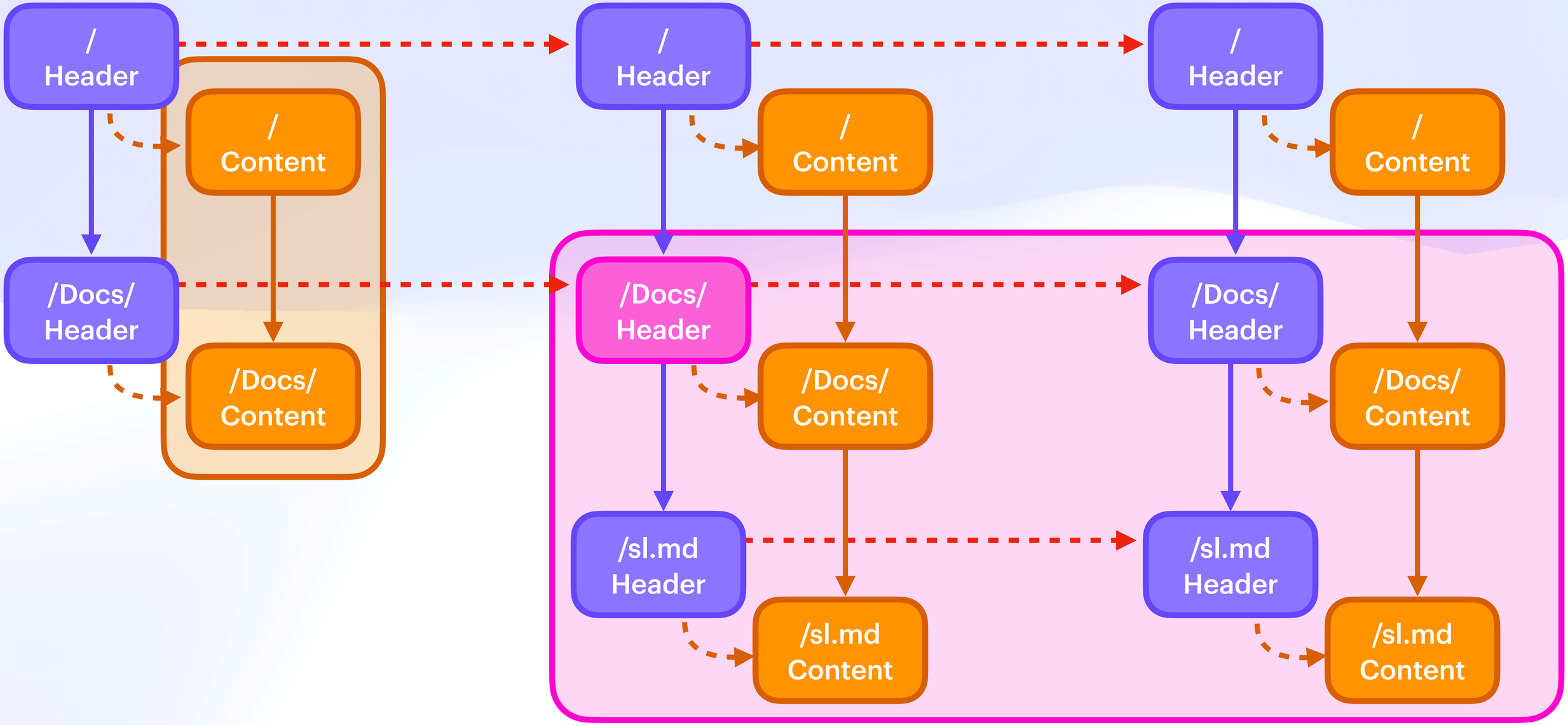

Temporal Cryptree ⏱️

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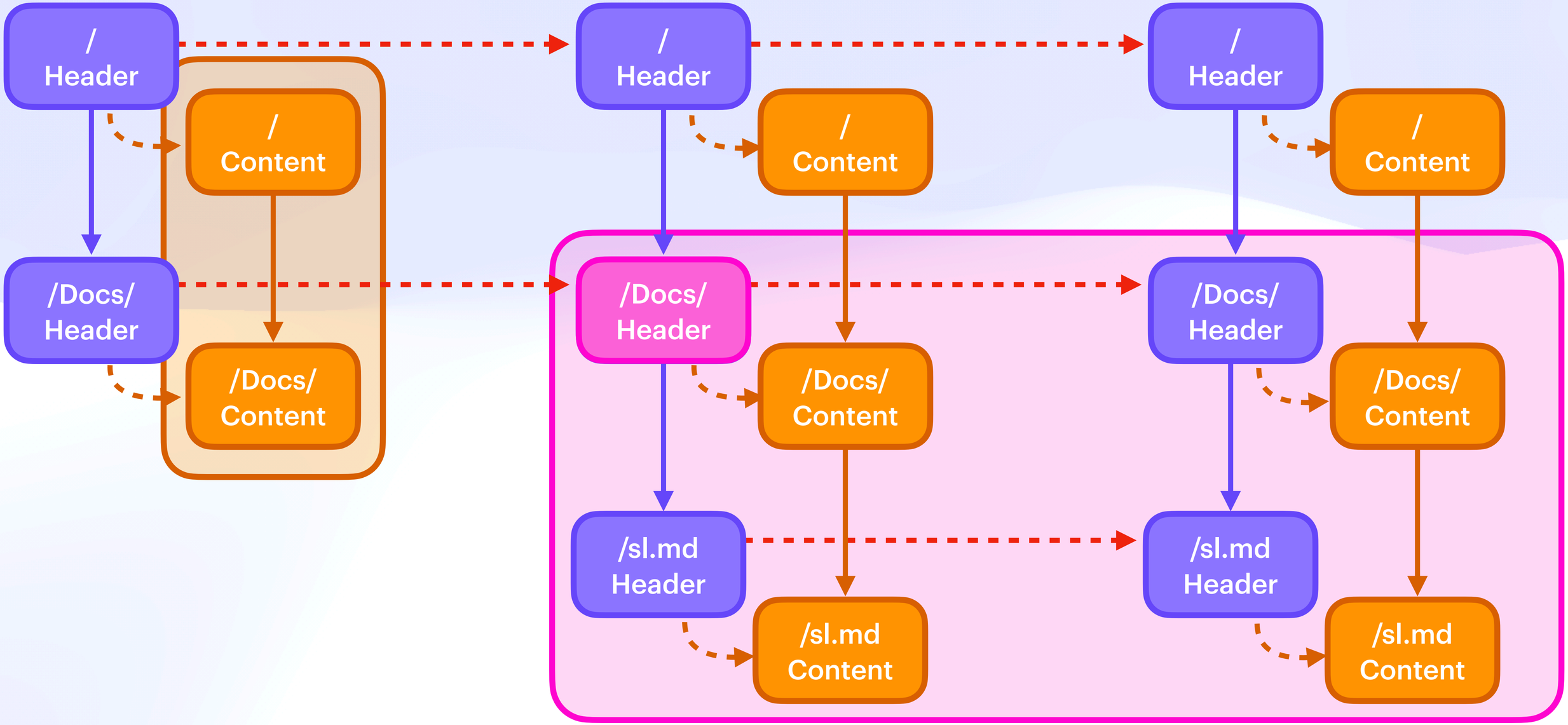

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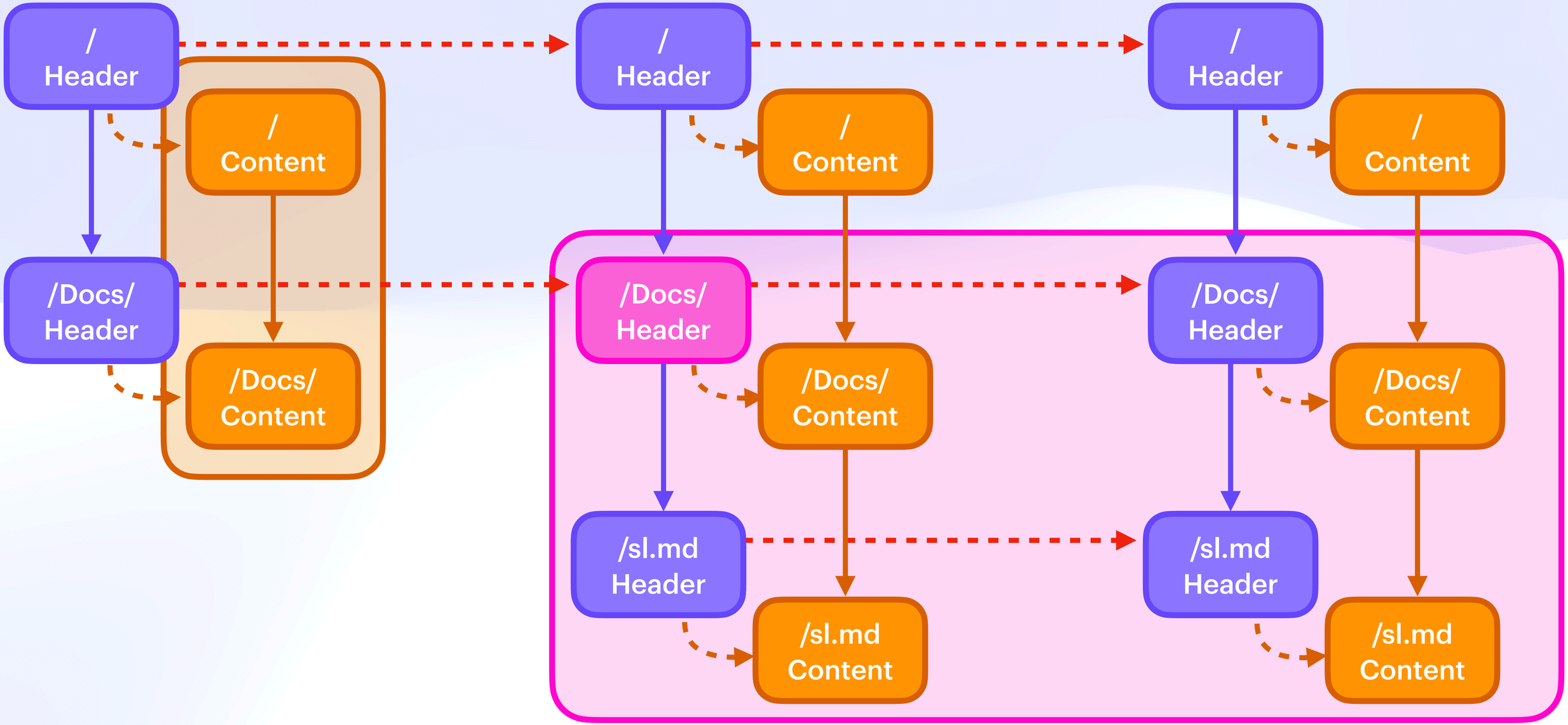

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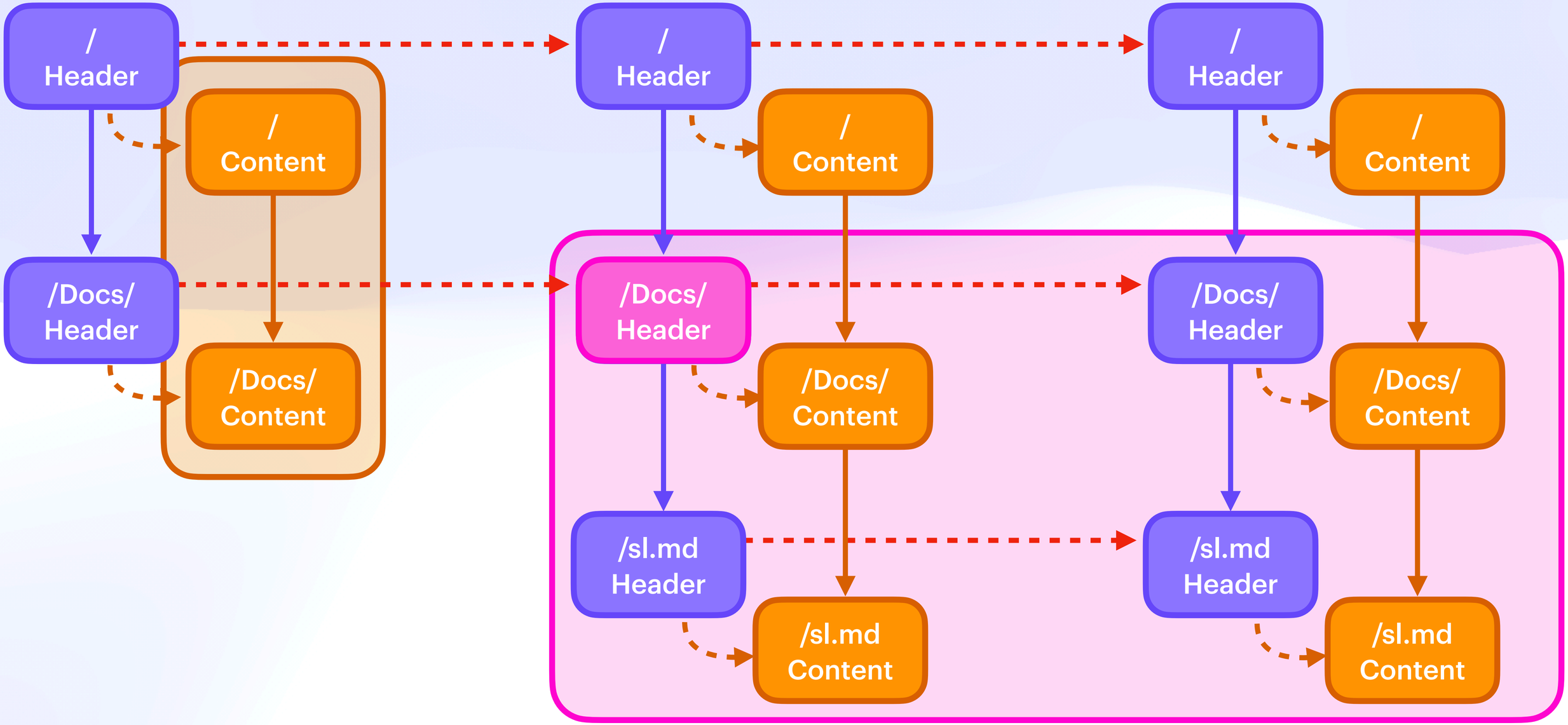
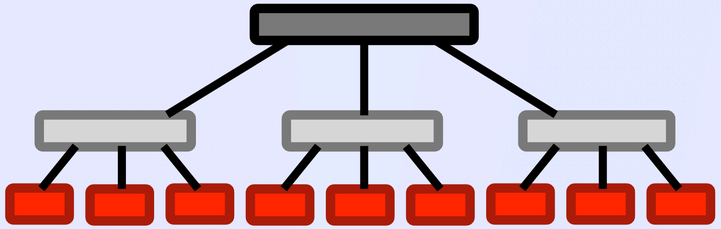


Temporal Cryptree ⏱️

Lazy Rooting

Temporal Cryptree ⏱️

Lazy Rooting



Temporal Cryptree ⏱️

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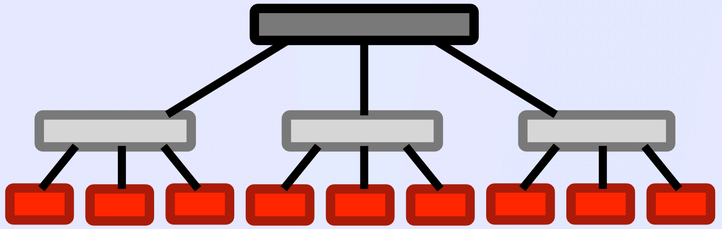

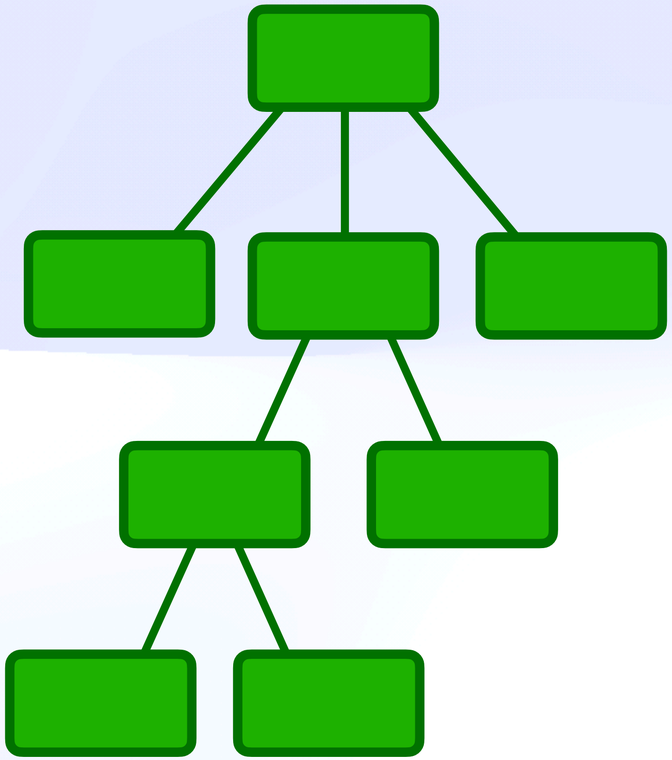

Temporal Cryptree ⏱️

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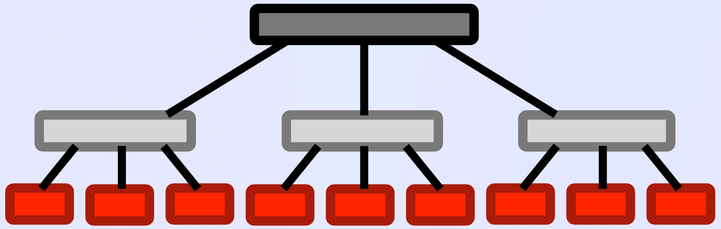

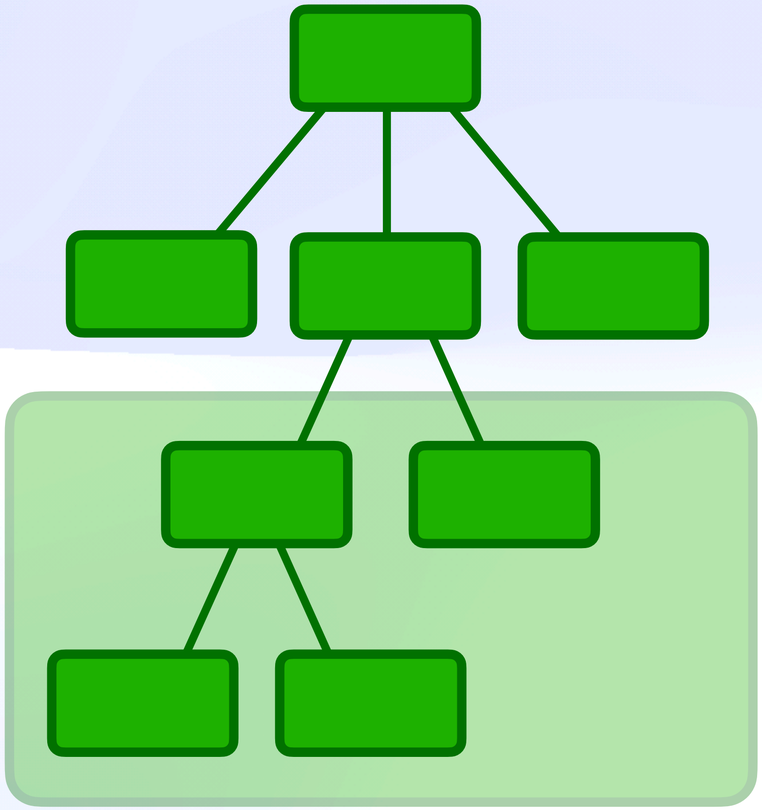

Temporal Cryptree ⏱️

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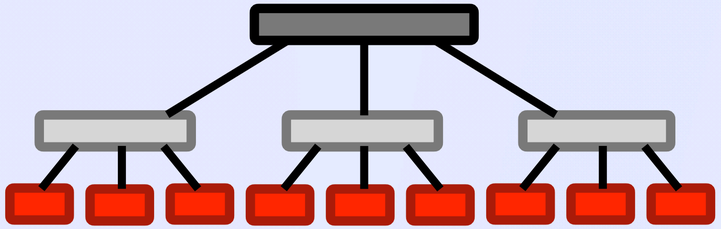
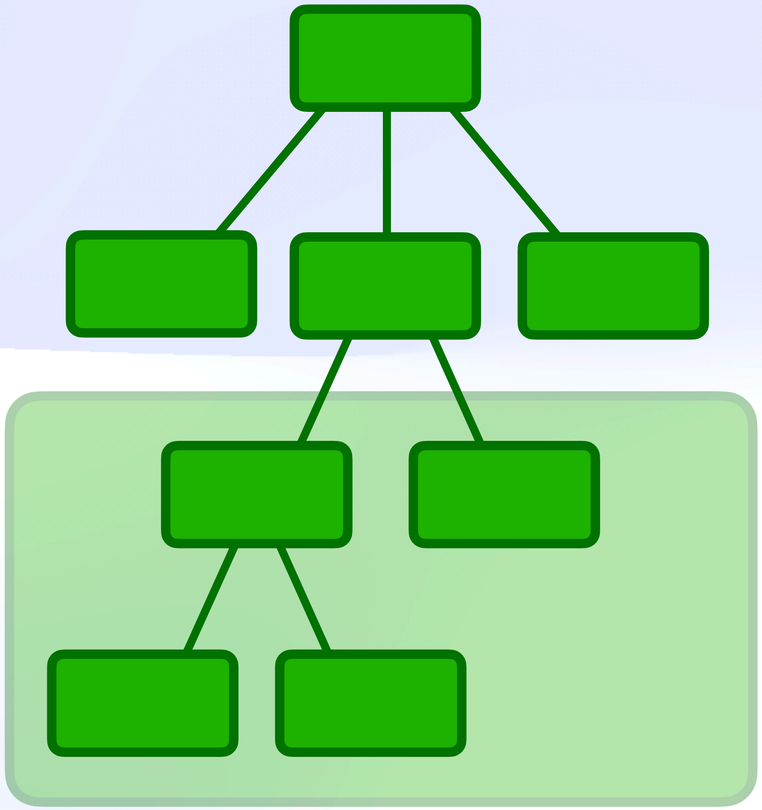
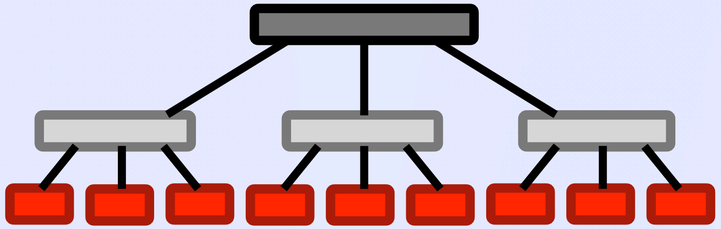


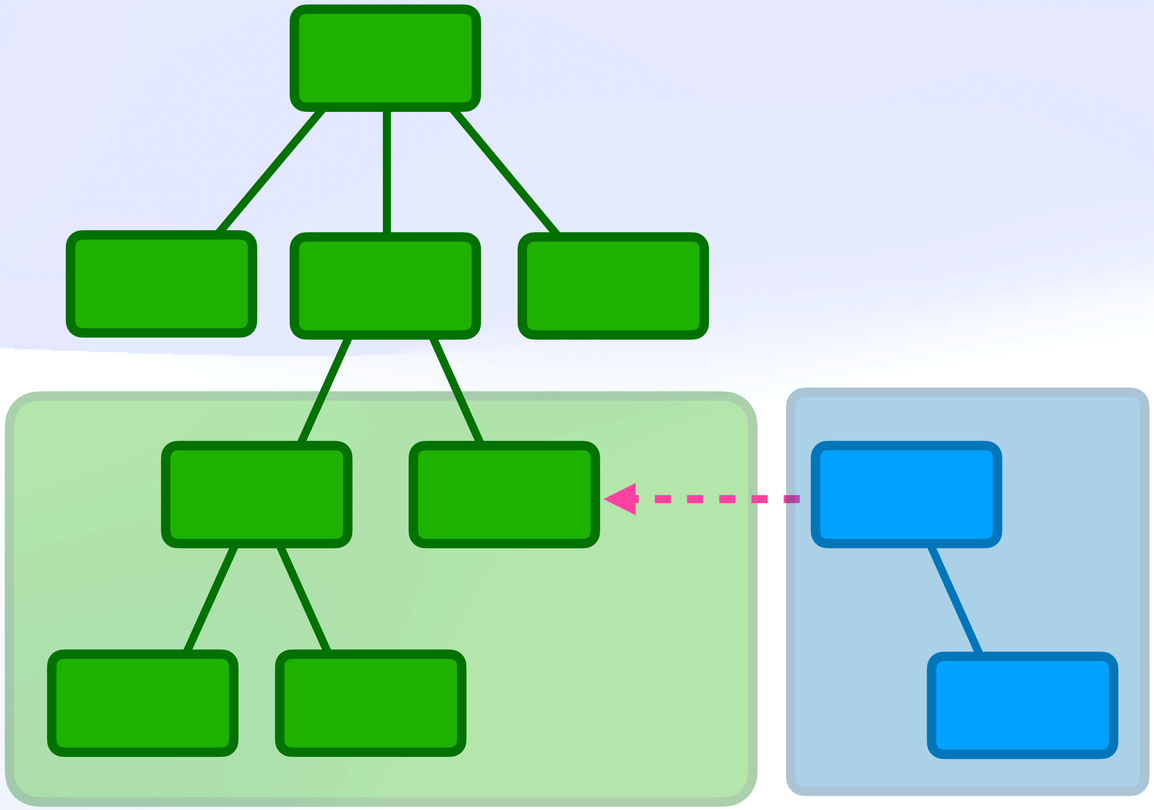


Rev 0

Temporal Cryptree ⏱️

Lazy Rooting



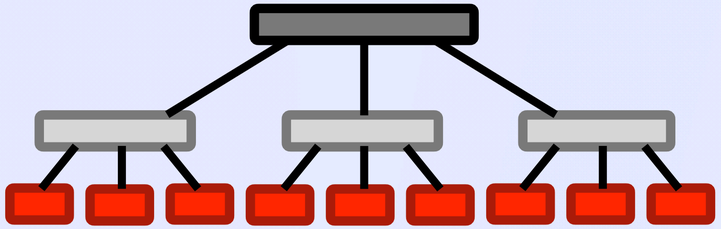


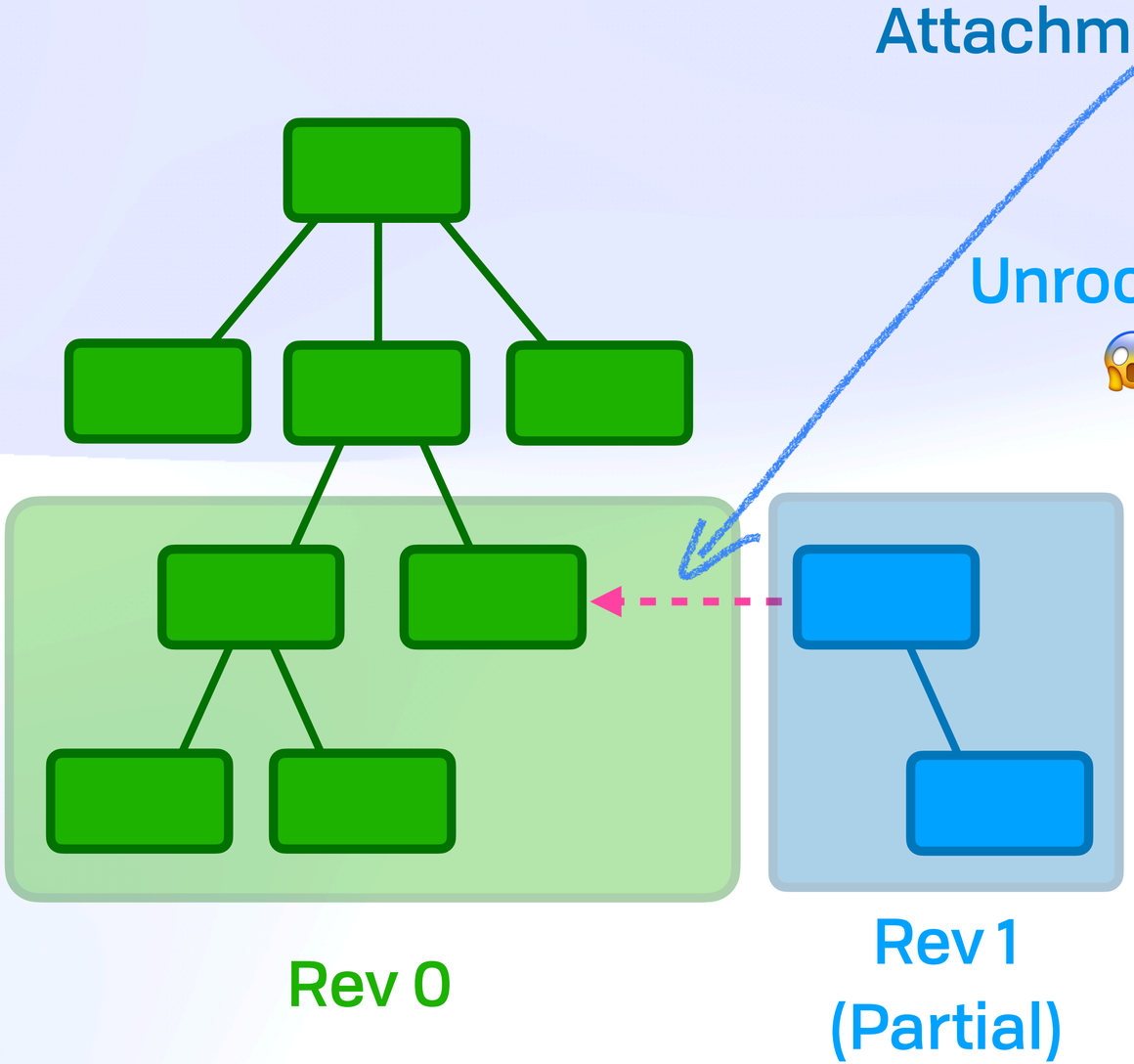
Rev 0

Rev 1
(Partial)

Temporal Cryptree ⏱️

Lazy Rooting





Temporal Cryptree ⏱️

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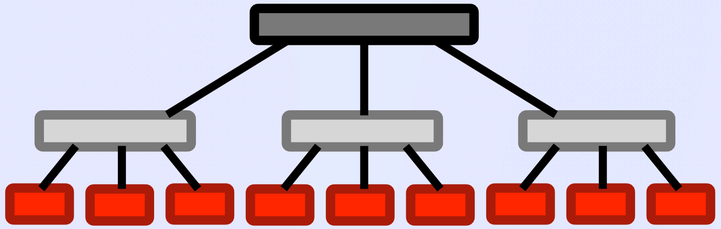
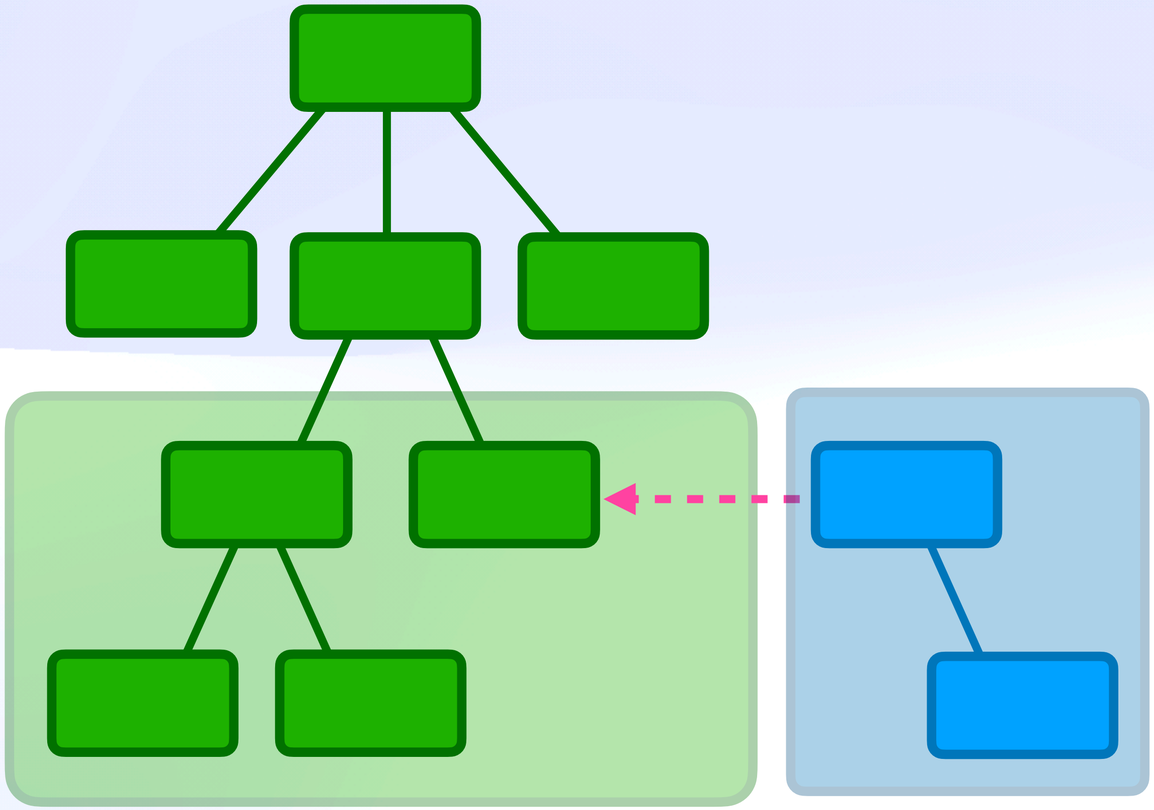


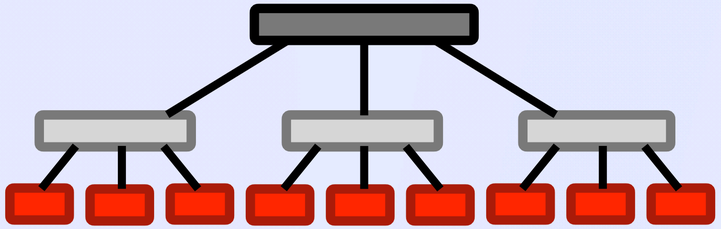


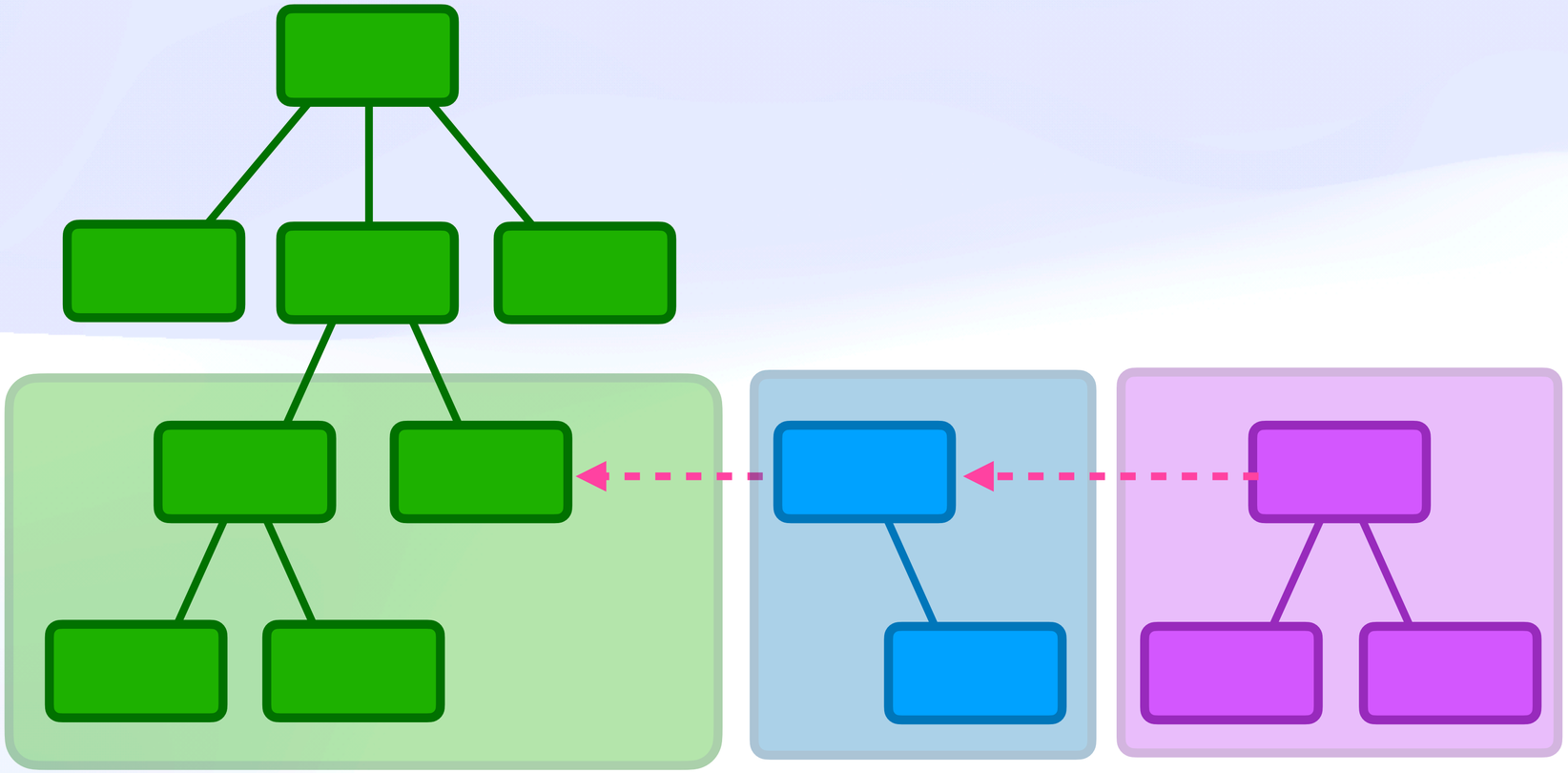
Rev 0

Rev 1
(Partial)

Temporal Cryptree ⏱️

Lazy Rooting





Rev 0

Rev 1
(Partial)

Rev 2
(Partial)

Temporal Cryptree ⏱️

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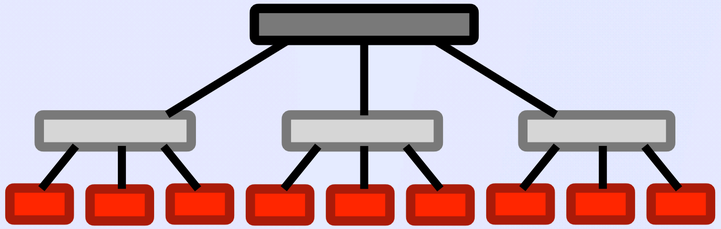

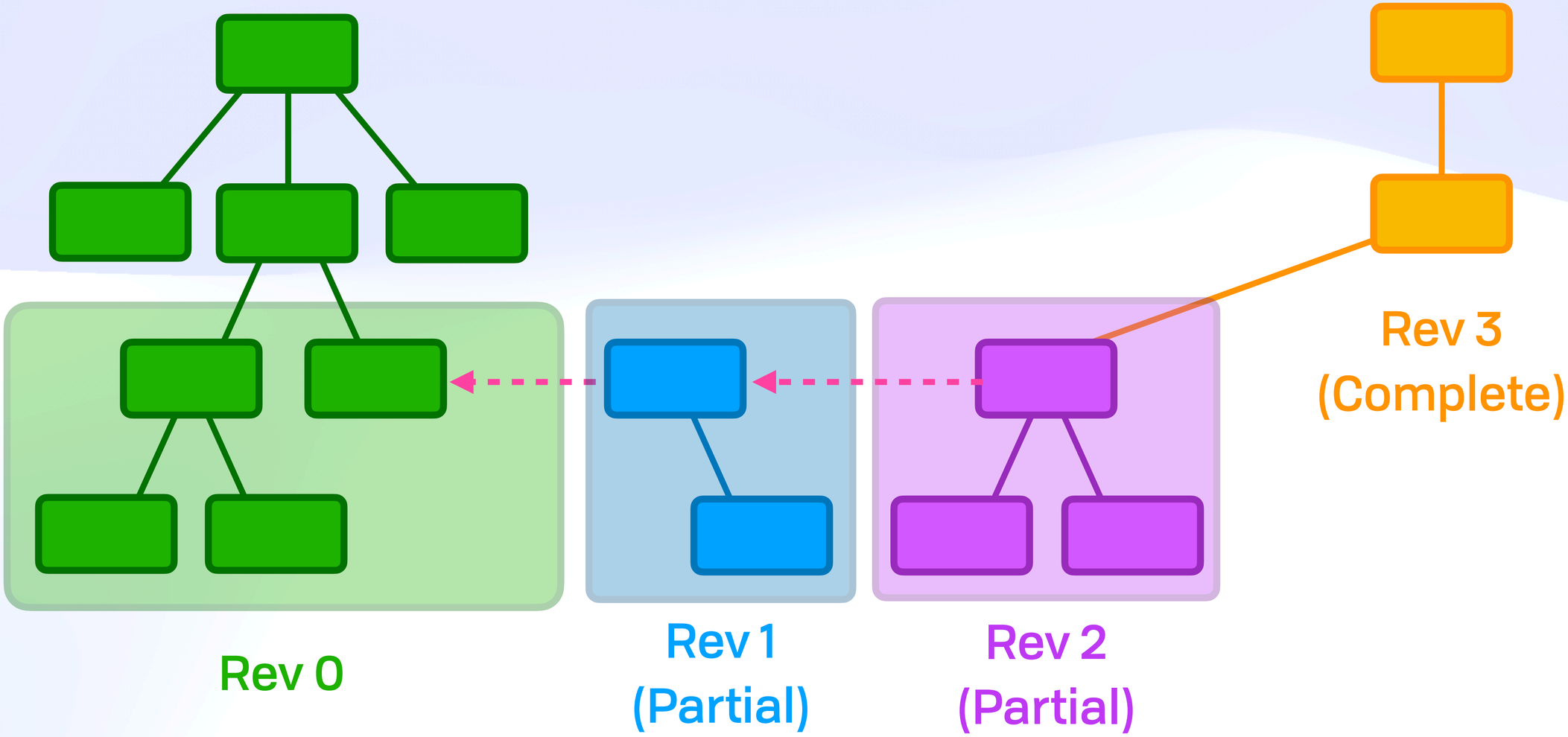

Temporal Cryptree ⏱️

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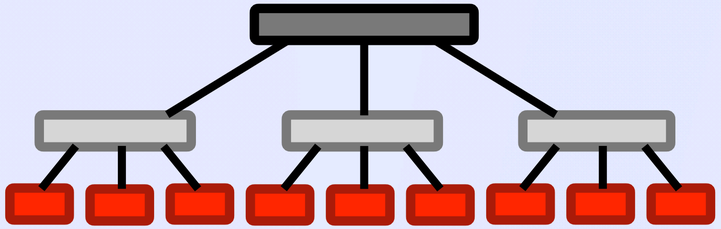

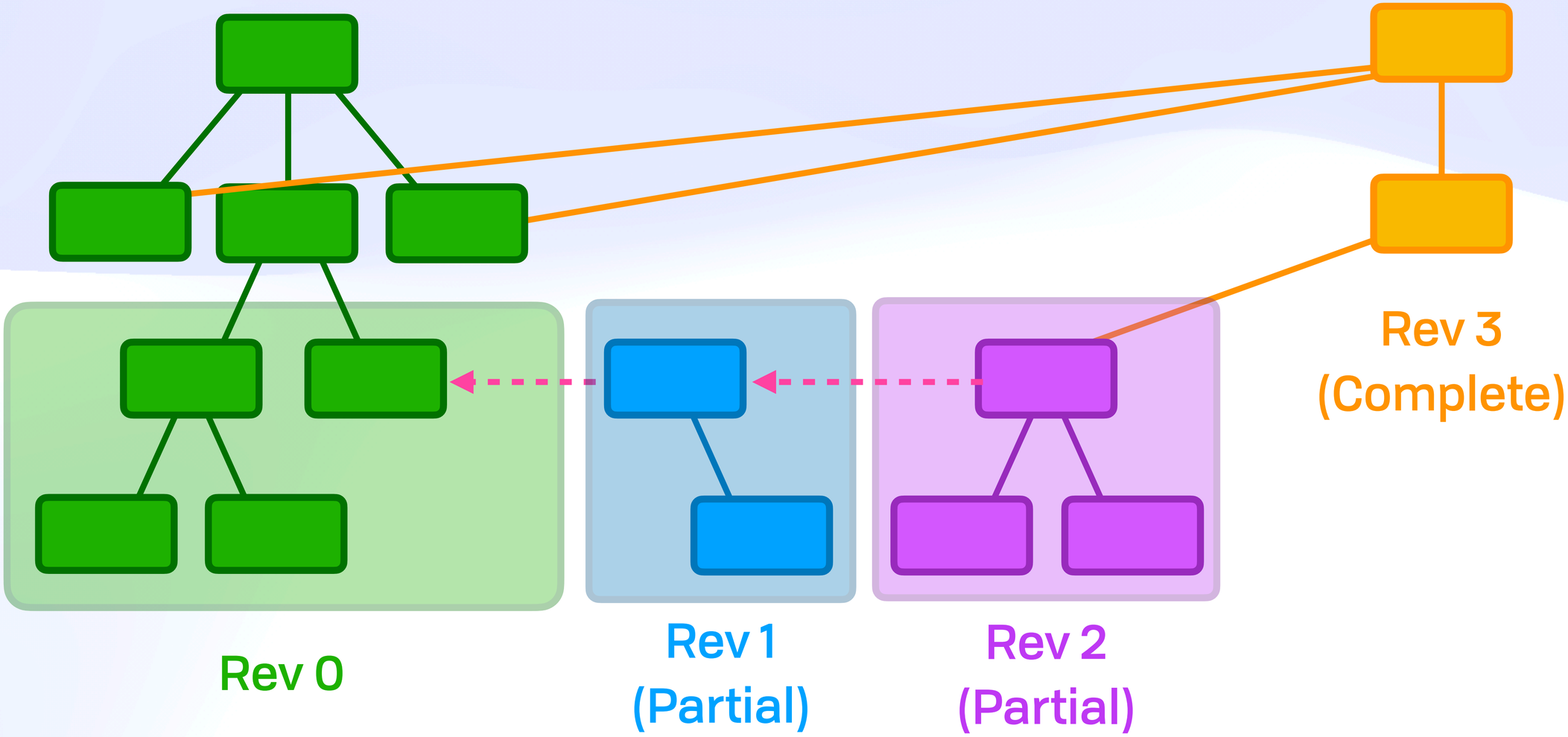

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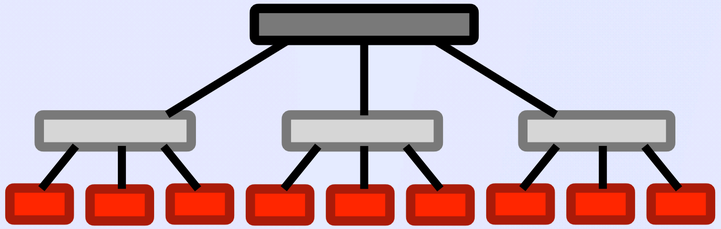
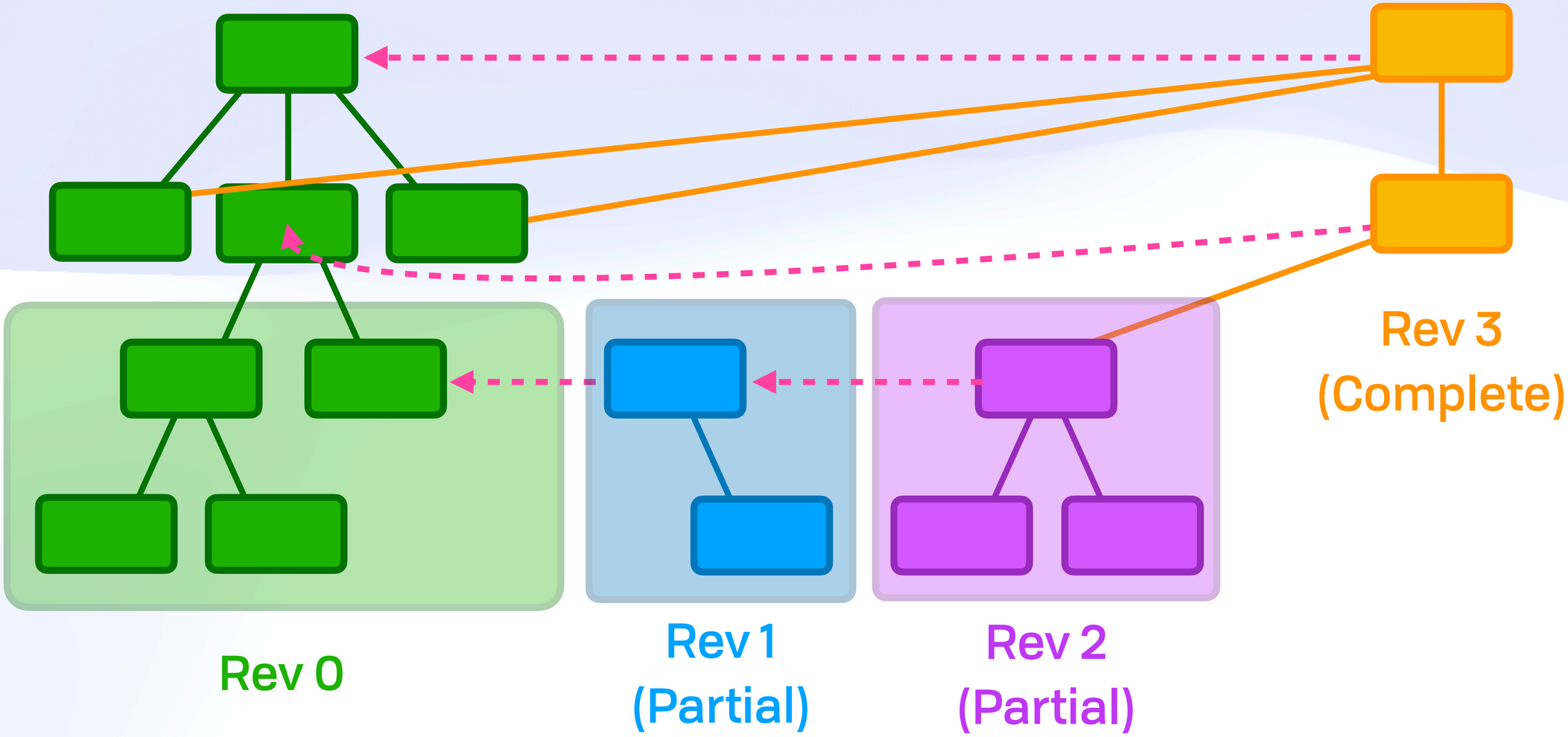




What's In a Name?

🙈 Hiding Paths In Plain Sight 🤩

What's In a Name? 🙈

Why Hidden Paths?

- TL;DR correlation is bad
- File hierarchy (space)
- File history (time)

What's In a Name? 🙈

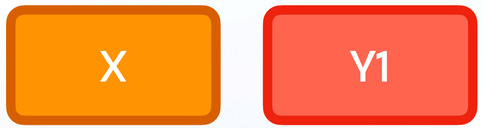
Quasi-Commutative Hash

What's In a Name? 🙈

Quasi-Commutative Hash

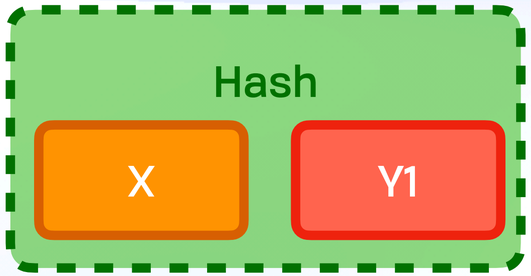
What's In a Name? 🙈

Quasi-Commutative Hash



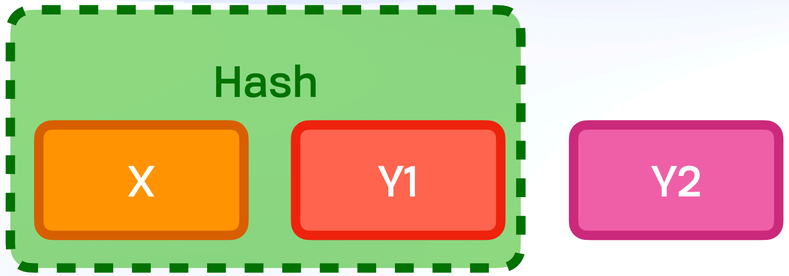
What's In a Name? 🙈

Quasi-Commutative Hash



What's In a Name? 🙈

Quasi-Commutative Hash



What's In a Name? 🙈

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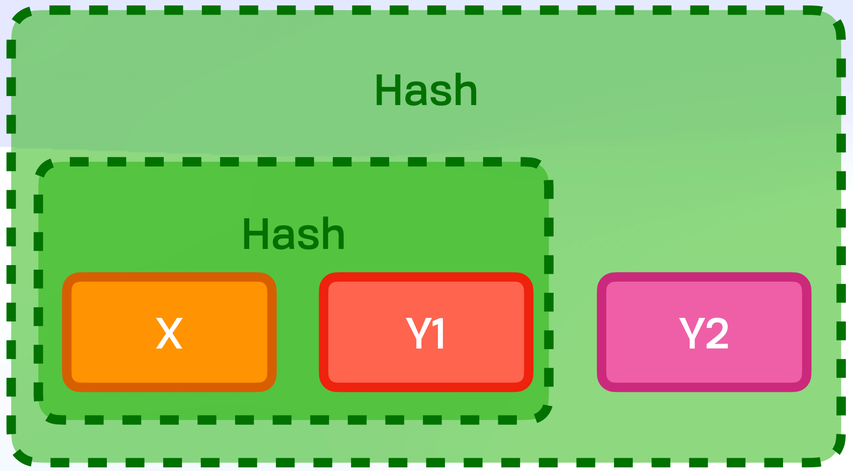

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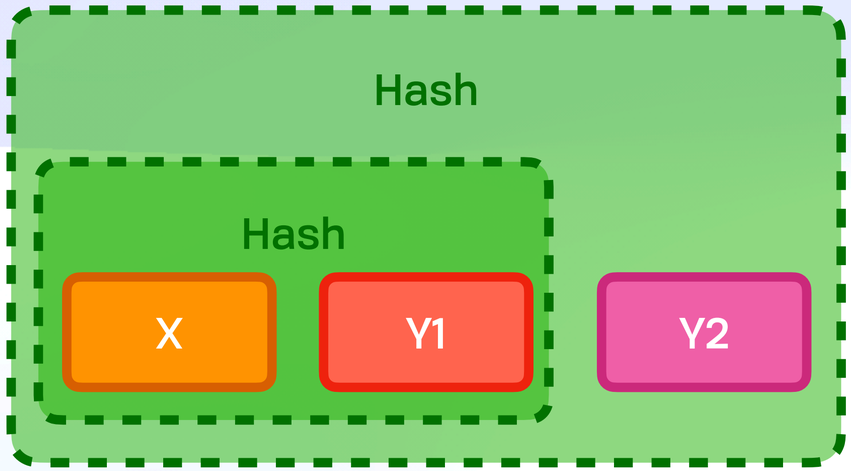
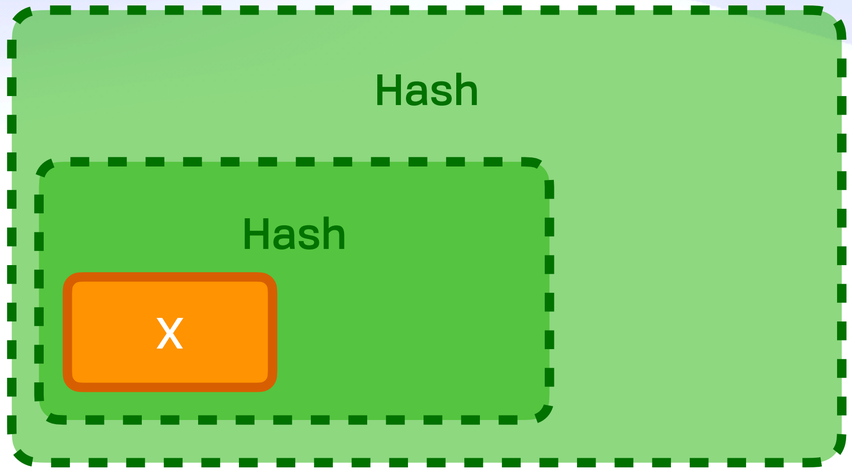
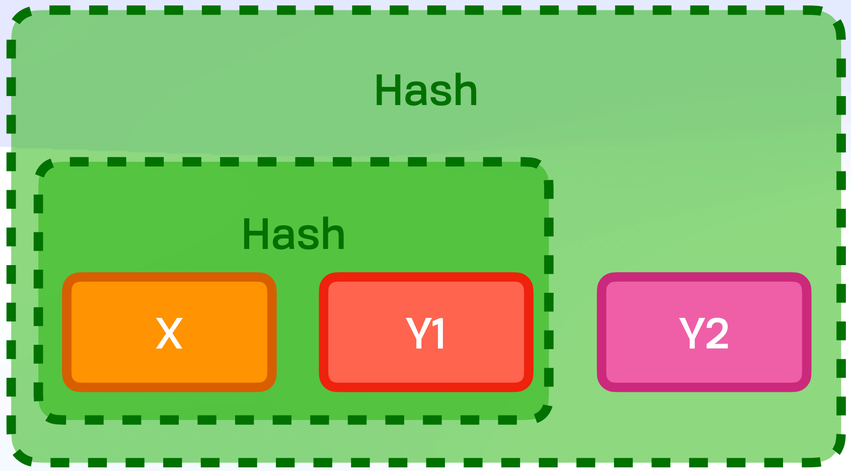
Quasi-Commutative Hash

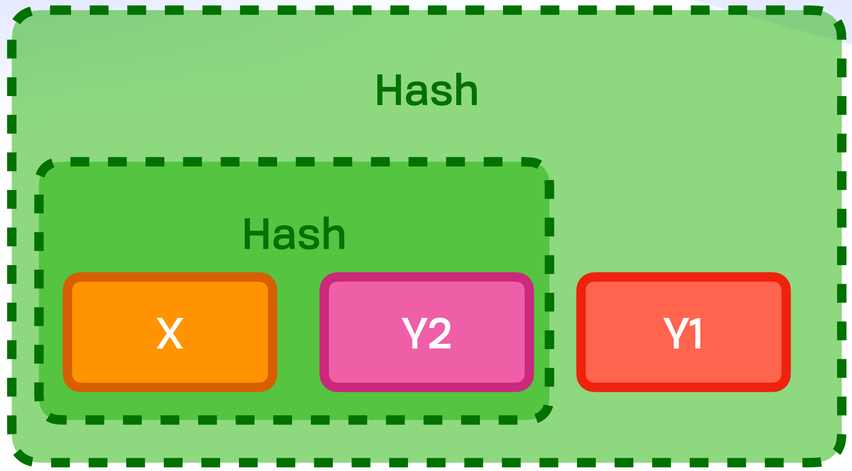




What's In a Name? 🙈

Quasi-Commutative Hash





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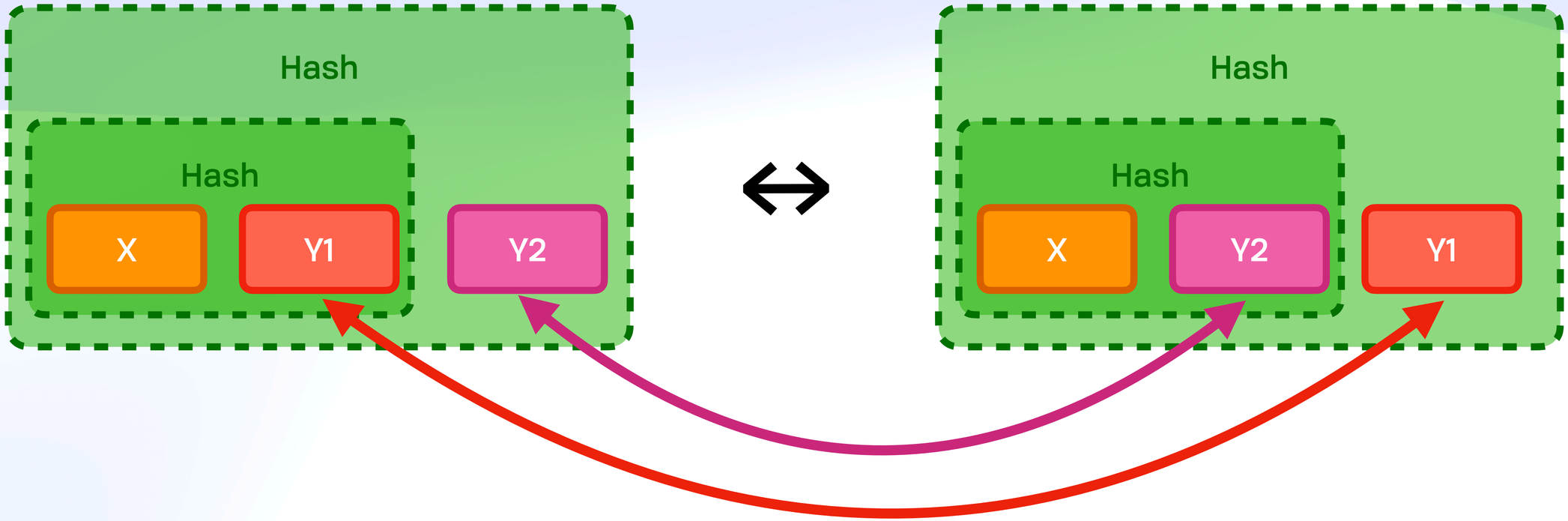
Quasi-Commutative Hash



What's In a Name? 🙈

Cryptographic Accumulator

What's In a Name? 🙈

Cryptographic Accumulator

/
root i-number

/Strange Loop/
SL i-number

/Photos/
Photos i-number

/stage.png
stage.png i-number

stage.png@42
hash(AES Key)

What's In a Name? 🙈

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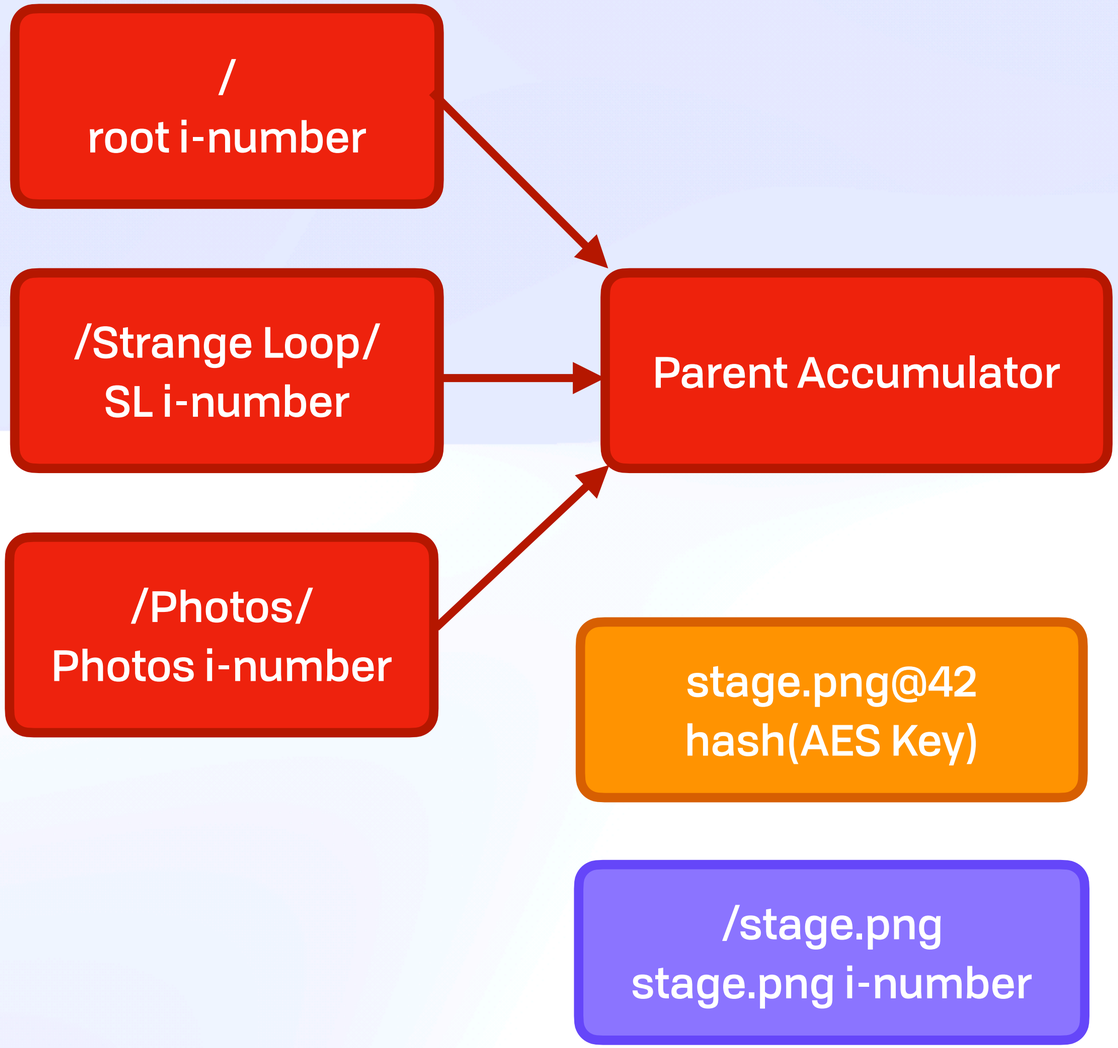
Cryptographic Accumulator



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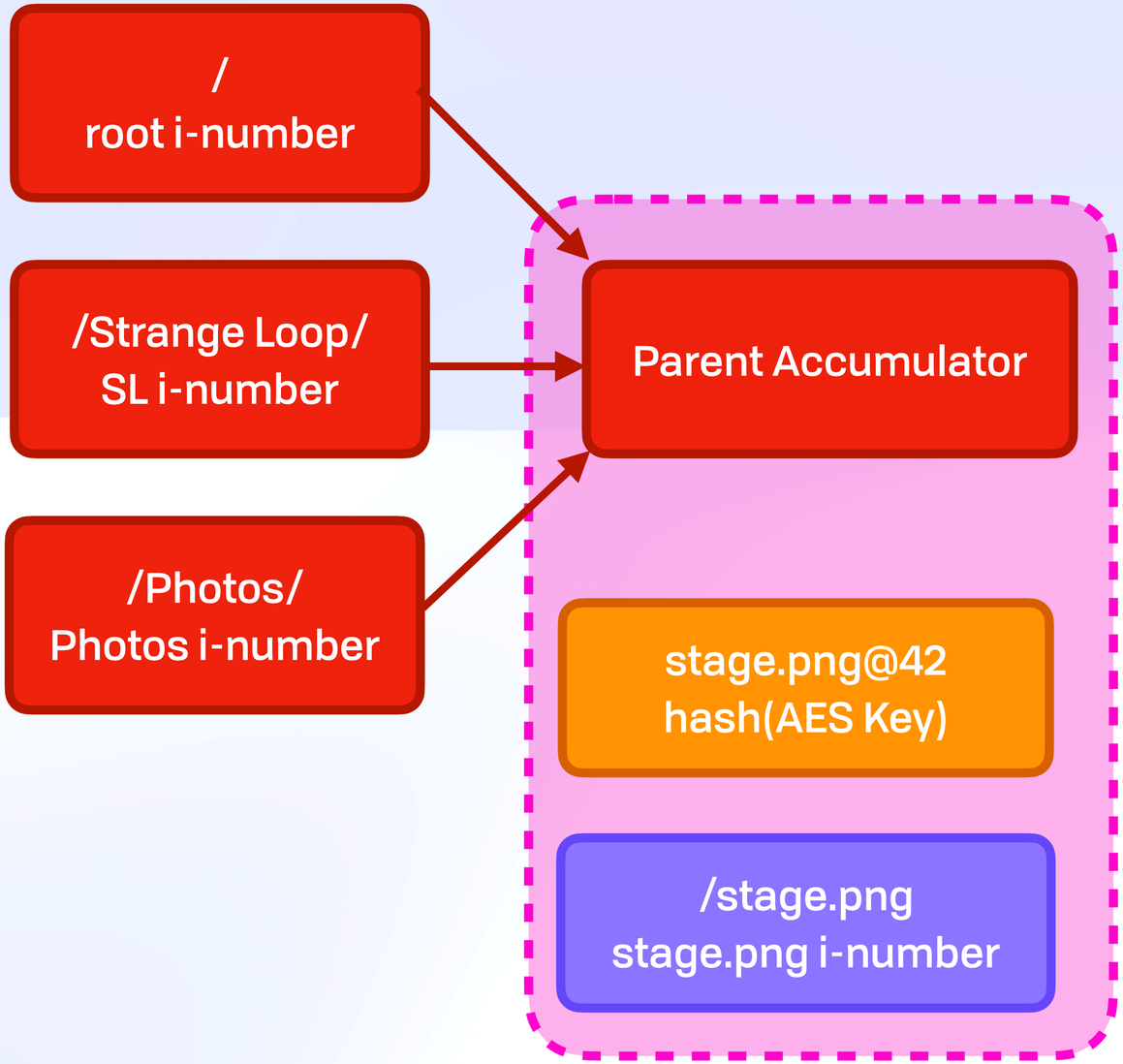

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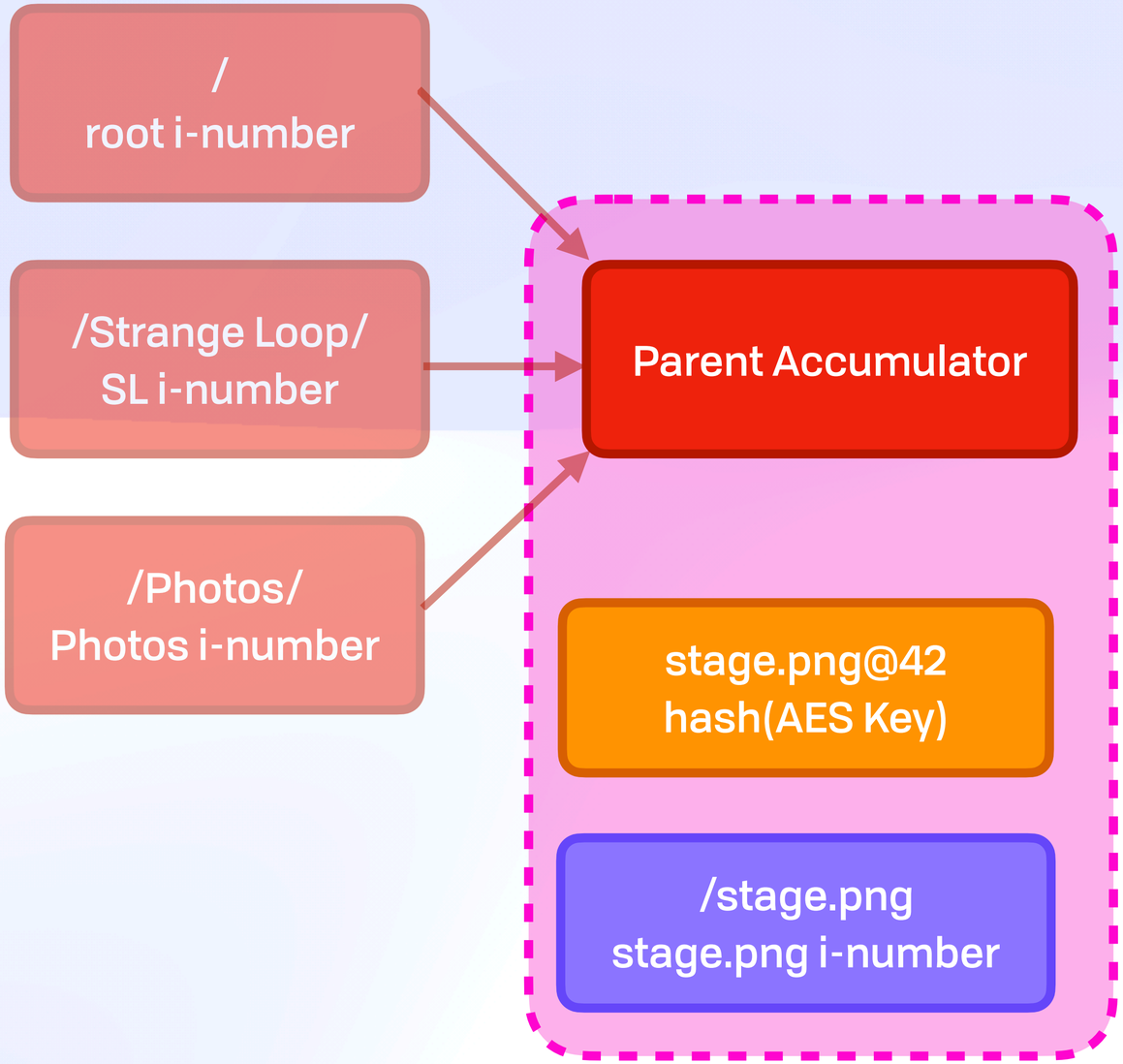

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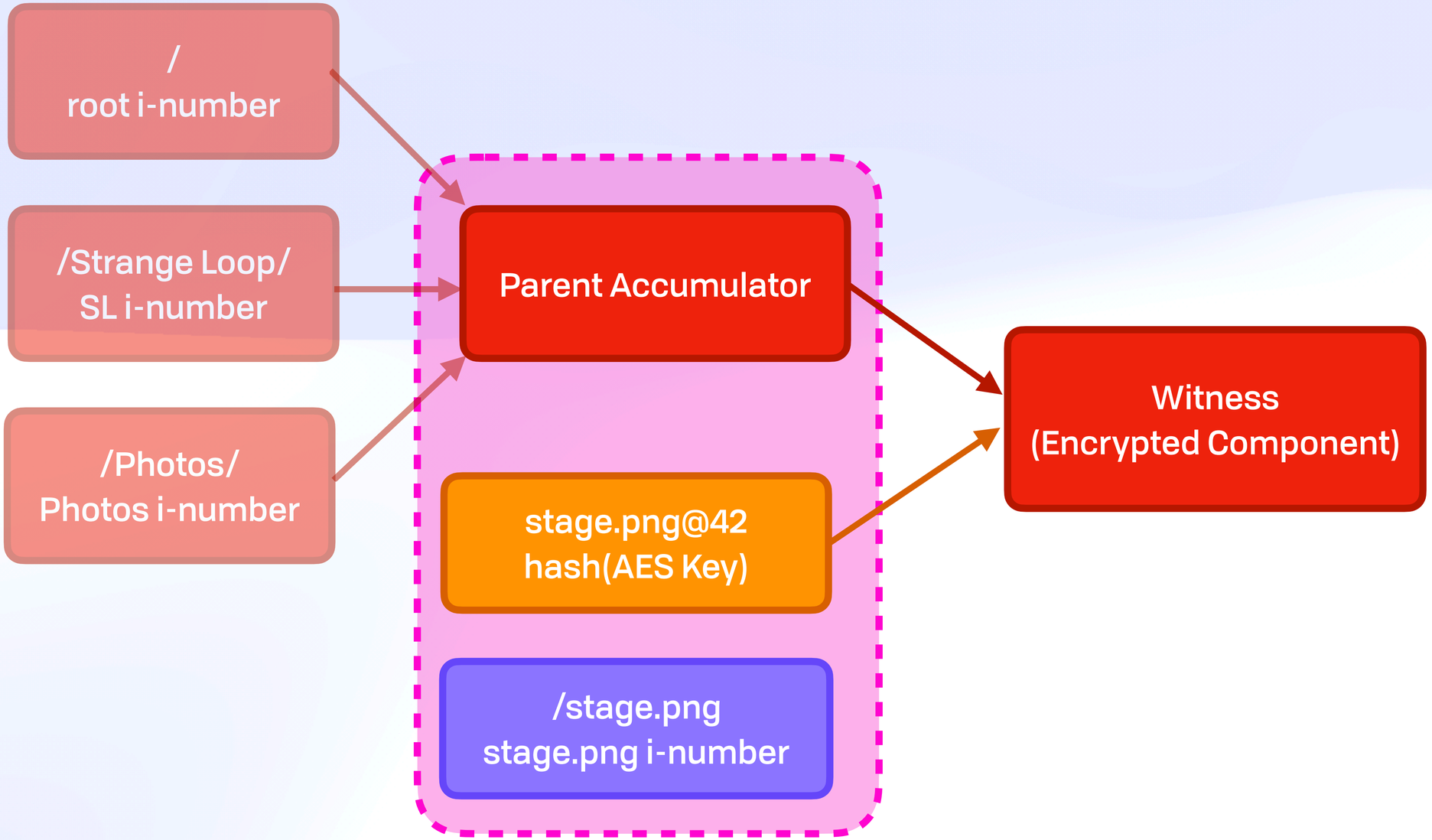
Cryptographic Accumulator



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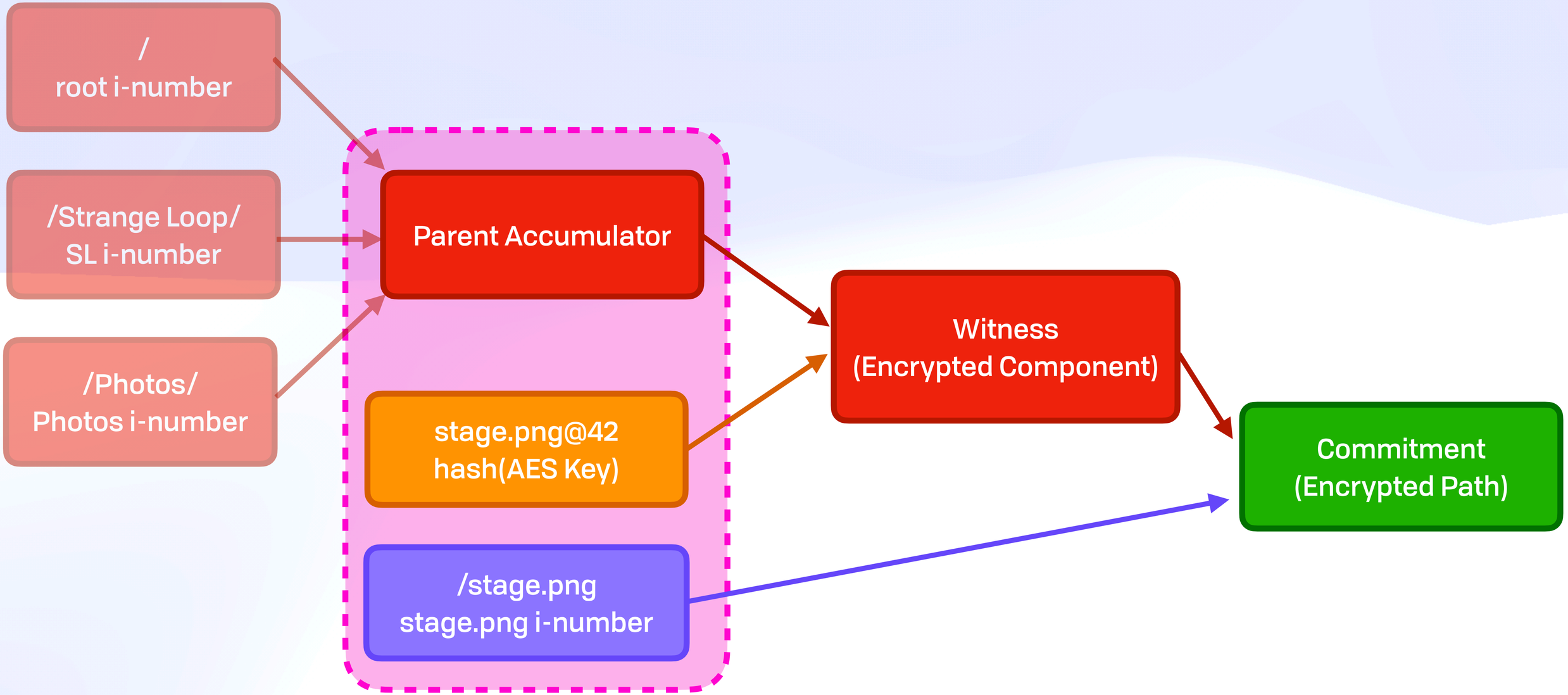

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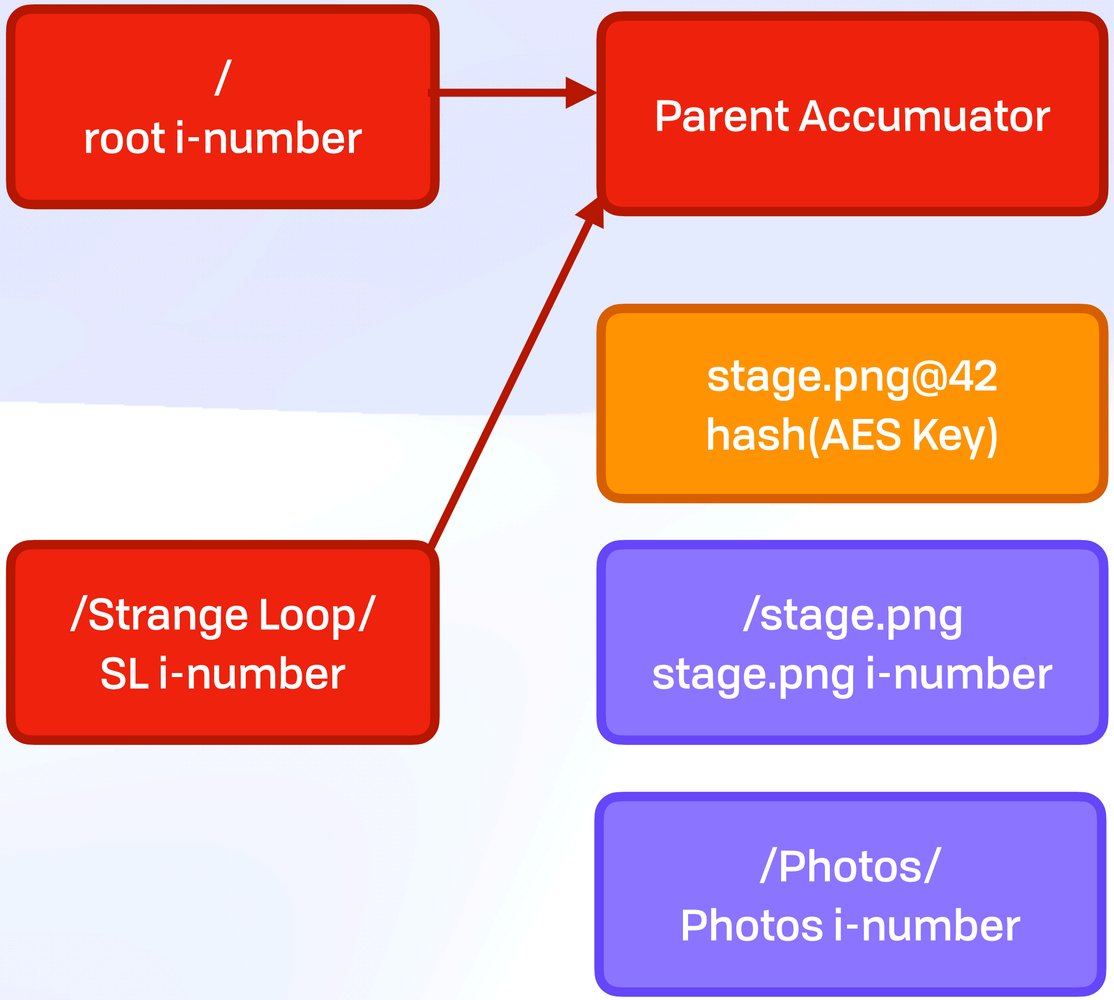

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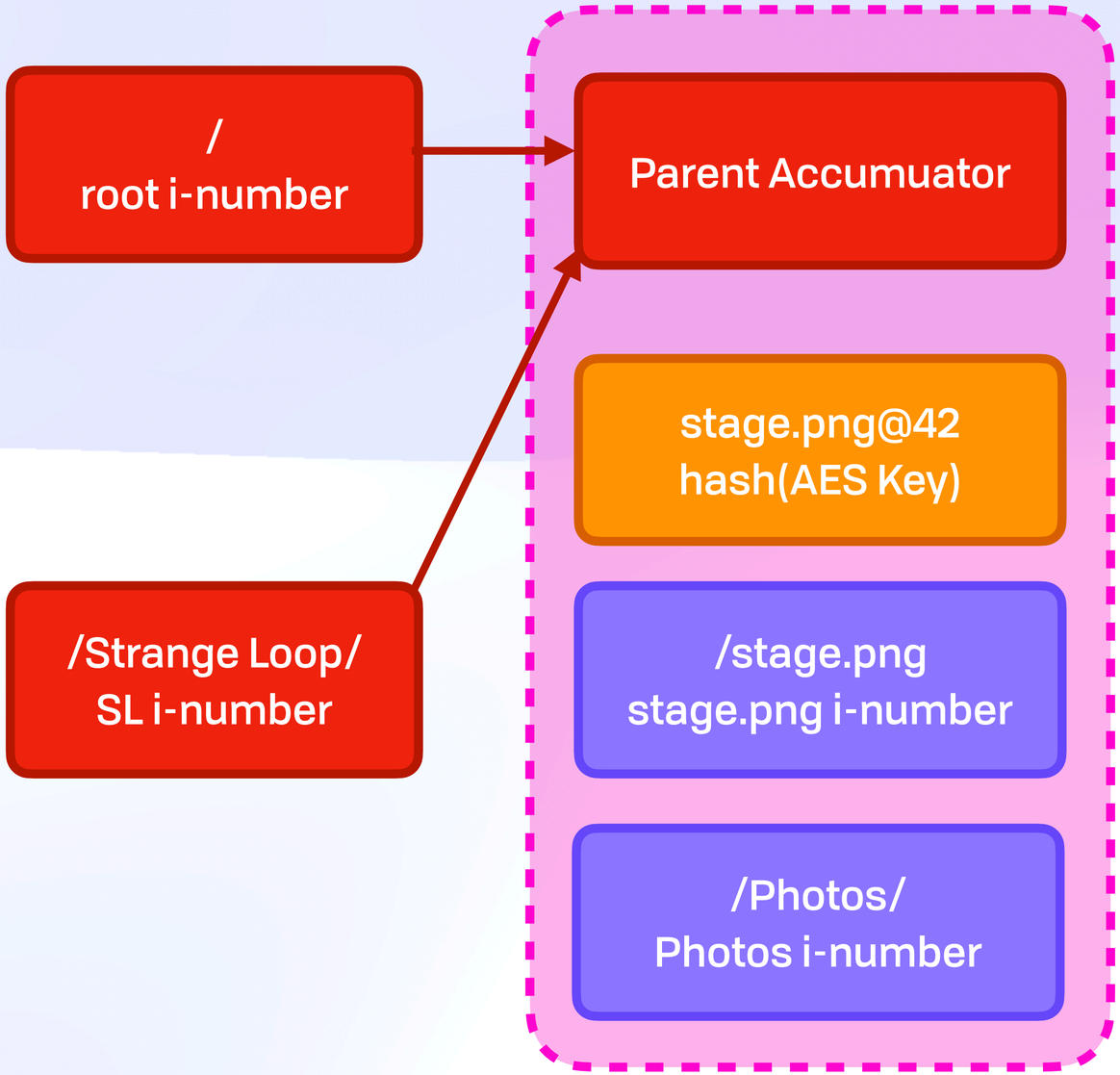

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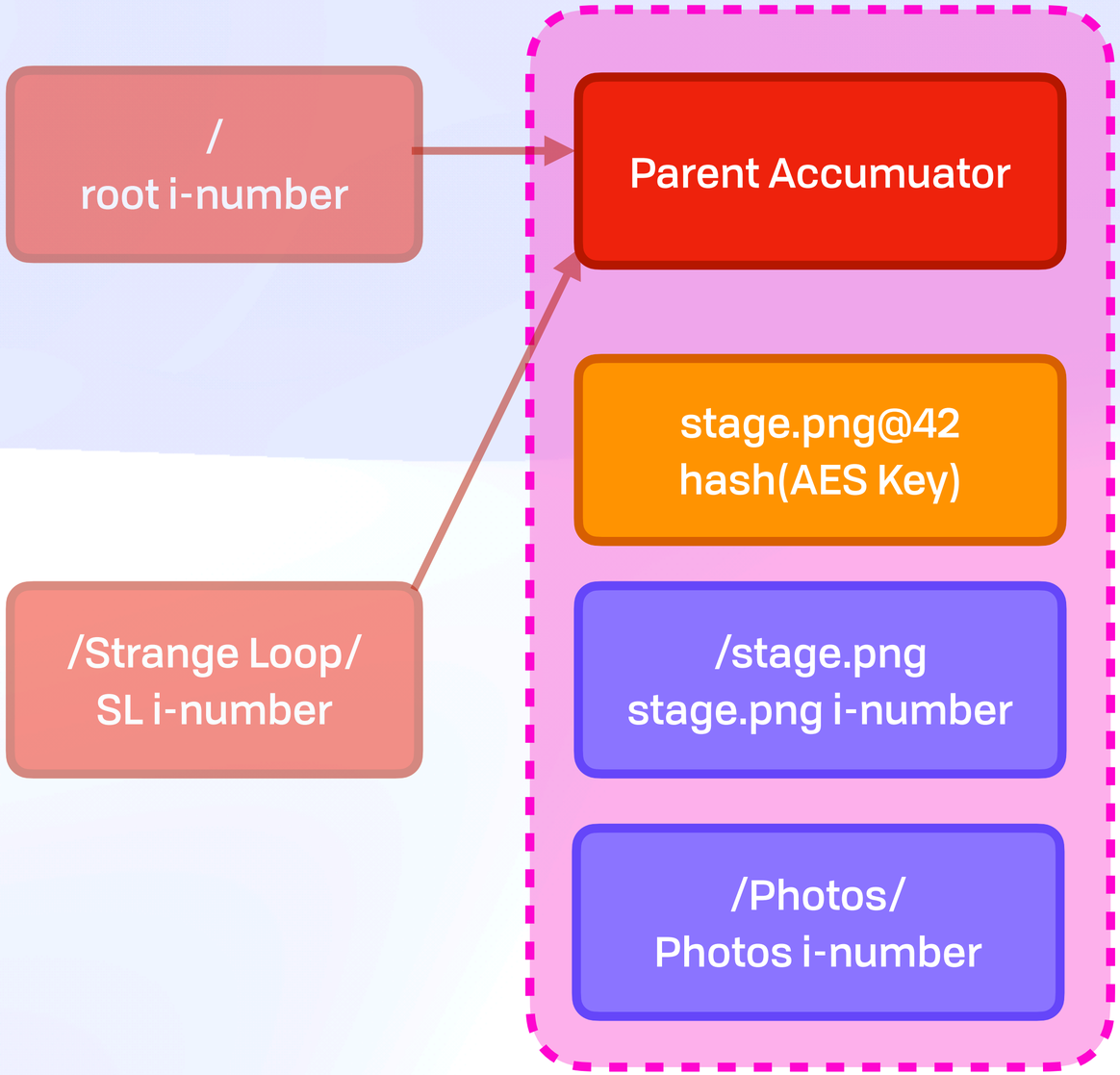

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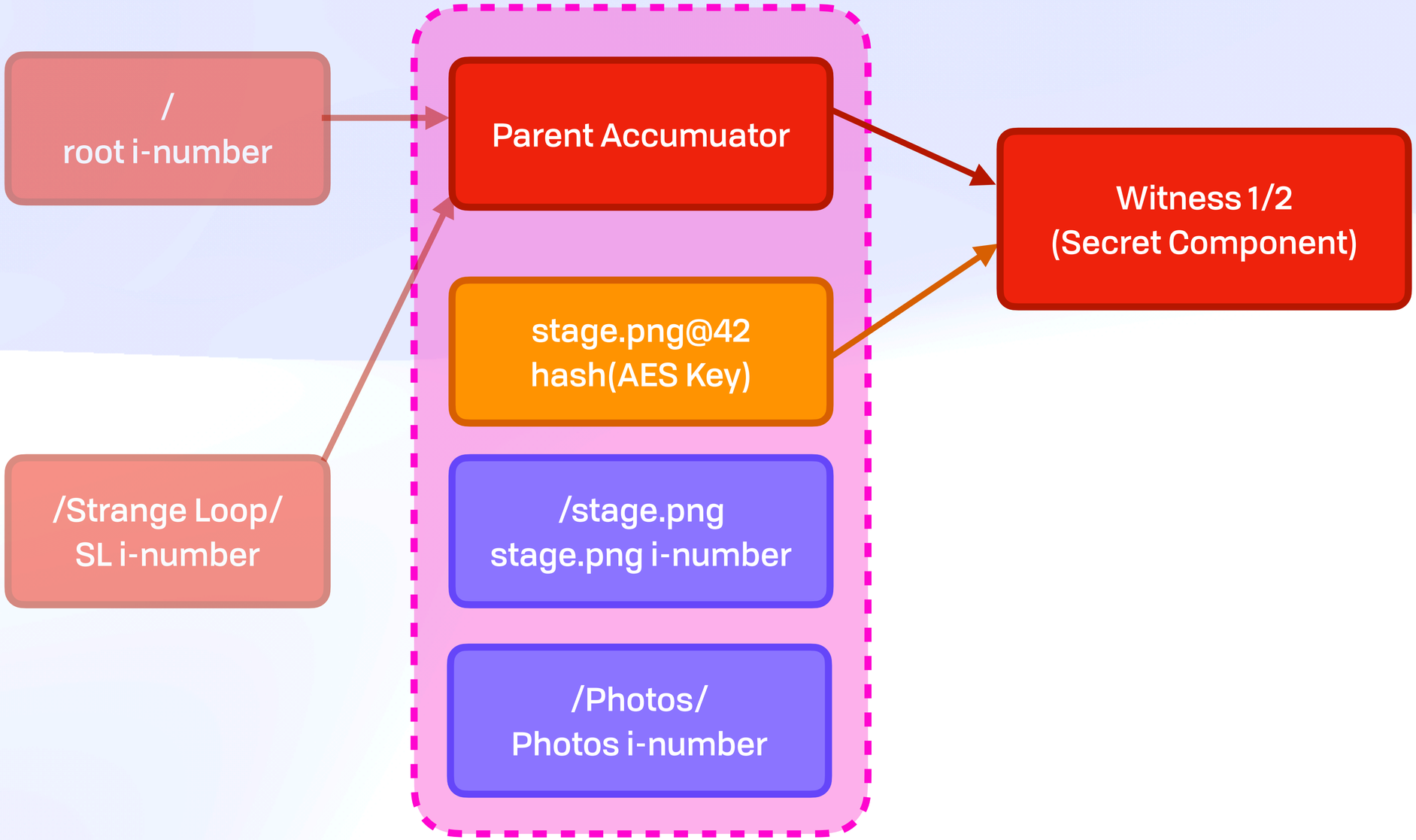

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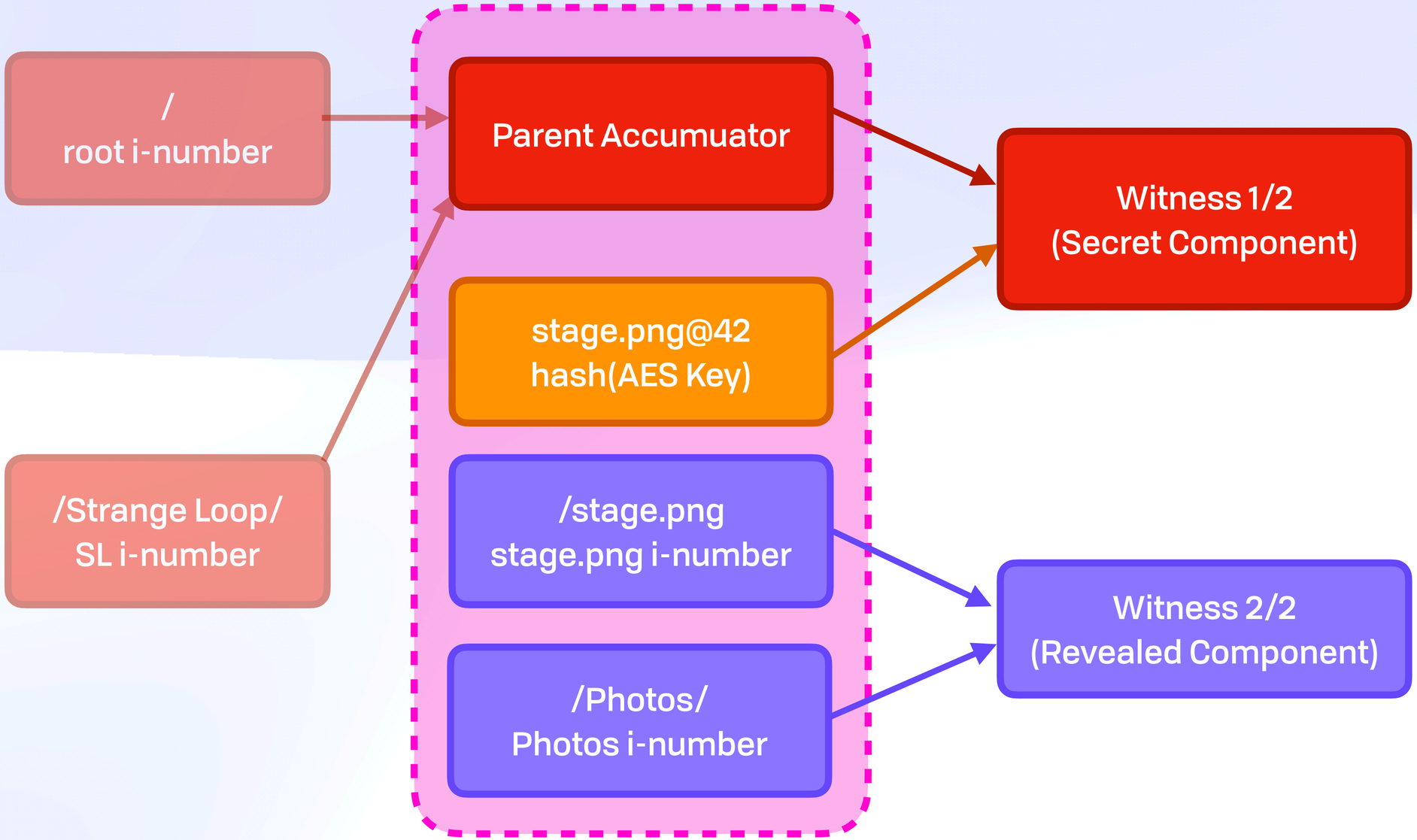

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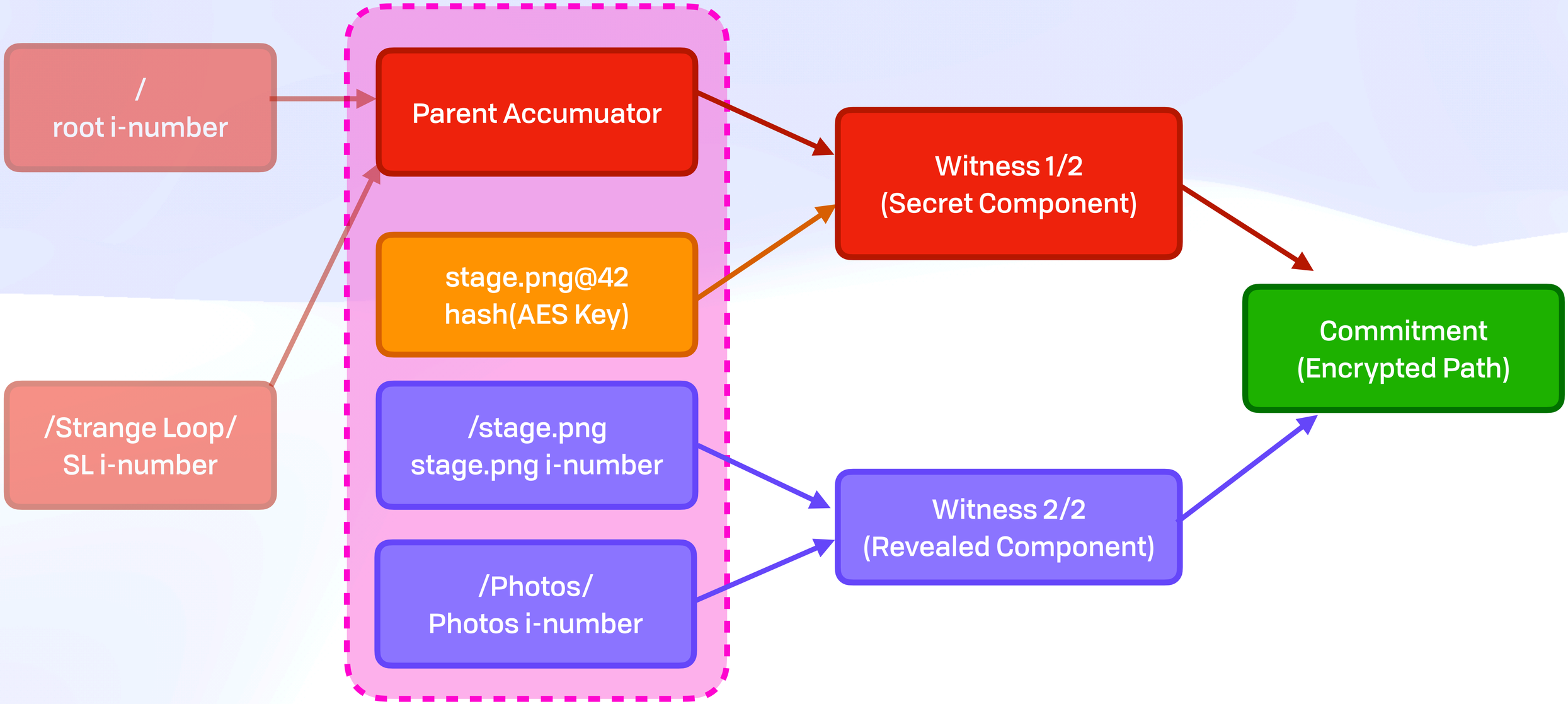

Wrap Up

Wrap Up 🎁

Is That All?

- Hash linked files
- Privacy-preserving paths
- Cryptrees: one key per entrypoint
- Temporal access control
- History & fork/merge on public and private data

Wrap Up 🎁

Future Work

- Wasm & native SDKs based on rs-wnfs — soon!
- Local-first, encrypted-at-rest, collaborative datalog
- Faster, more reliable networking
- ZK-ify private tree certificates
- FUSE support

Wrap Up 🎁

Where To Get Started

guide.fission.codes

github.com/wnfs-wg/spec

github.com/wnfs-wg/rs-wnfs

The Difficult is that which can be done immediately;
the Impossible that which takes a little longer.

— George Santayana

🎉 Thank You, Strange Loop ♾️

@expede
brooklyn@fission.codes

https://fission.codes

discord.gg/fissioncodes

✨ github.com/wnfs-wg(/spec) ✨