

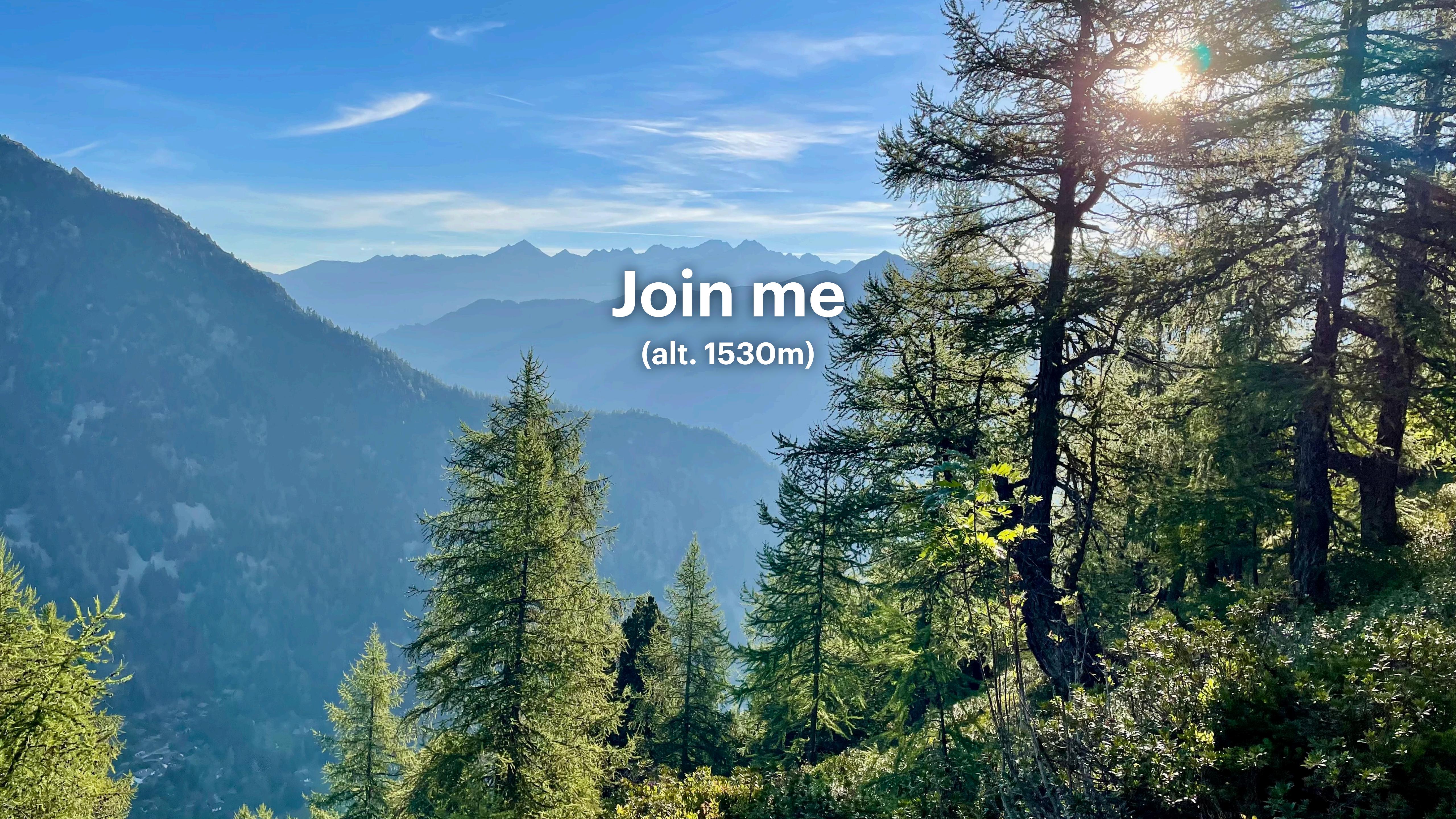
Sliding Sync.next

**Stabilising an experimental
new sync mechanism**

Ivan Enderlin – Matrix Conference 2024

At the beginning...

- Matrix is about communication
- Communication happens inside rooms
- Rooms are listed in a **room list**
- Each room contains a **timeline**, composed of **events**
- We need to **sync** the rooms with their new events, including **e2ee** events
- We want to sync as **fast** as possible

A scenic mountain landscape. In the foreground, there's a dense forest of tall, thin coniferous trees, likely larches, with some yellow autumn leaves visible. The middle ground shows a valley with more forested slopes. In the background, a majestic range of mountains stretches across the horizon under a clear blue sky with a few wispy clouds.

Join me
(alt. 1530m)

Driven by room list features

Filtering and searching →

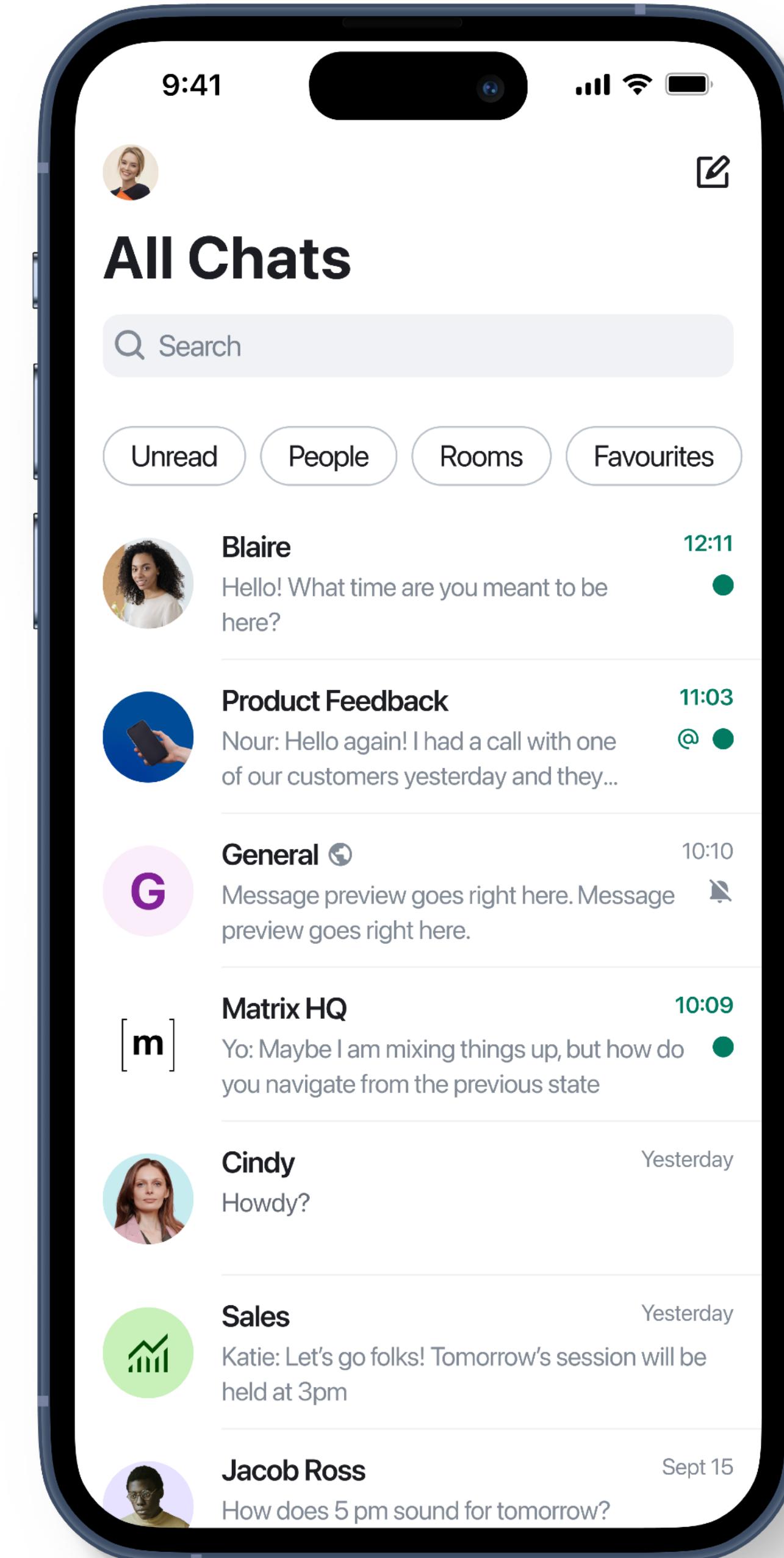
- live, works while syncing

Sorting →

- live, works while syncing
- how to sort encrypted rooms?

Room →

- preview (may be encrypted)
- name with heroes
- room avatar
- what if the event is not a `m.room.message`?



← Markers

Sliding sync in a nutshell

- **Iterative** sync
- Load the room list **page by page**
 - Rooms are sorted
 - How to sort rooms if they are encrypted?
 - Pre-populate a timeline on-demand
 - How many events do we want?
 - Load more events for rooms that are likely to be opened by the user
 - Can we decrypt the latest event for the room preview?
 - Query other data, like e2ee events, account data, read receipts, members...

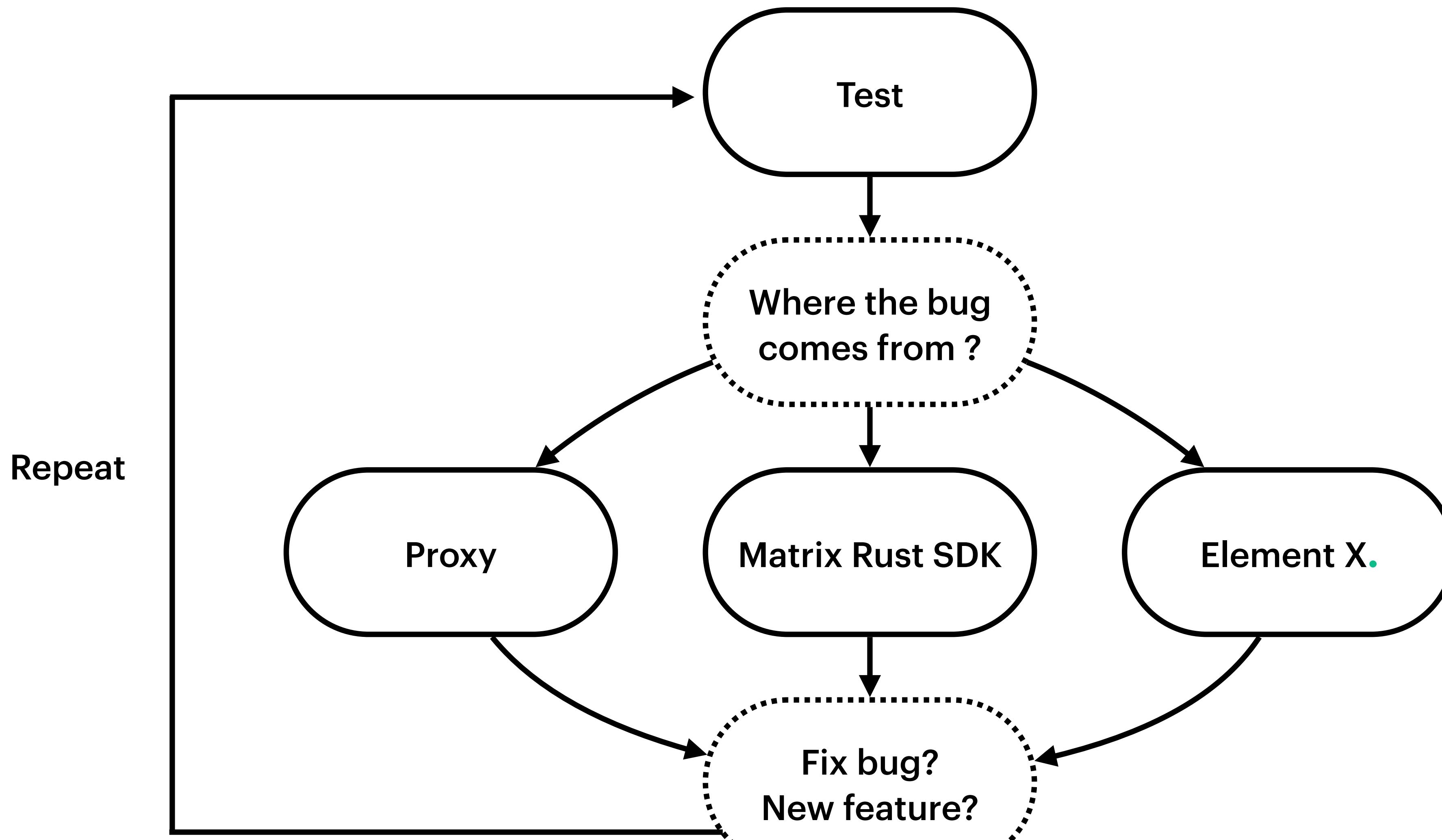
Enter MSC3575

Sliding sync

- December 20th, 2021, first draft of MSC3575
- First server implementation as a proxy, running on top of Synapse
- First client implementation inside the Matrix Rust SDK
- First app to use it is Element X.
- Let the fun begins
 - One new server. One new client. Two new apps. One new sync mechanism.
 - ▶ What can go wrong?

The debugging cycle

(don't do that)



What did we test?

- Accuracy
 - Do we have all the **correct** data we need?
 - Can we select more data when we need to?
- Network performance
 - Bandwidth, request and response sizes
 - How fast is it to recover from an error, or an inactive session?
 - How fast is it to render the room list or a room?
- Does it handle all the e2ee scenarios?

The sliding sync proxy

- 1864 commits
- 204 files, 55'349 lines
- Released to the community

tests-integration	Check for lower	2 months ago
testutils	Ensure txns are closed so we can wipe the db for other te...	3 months ago
.dockerignore	Add dockerfile	3 years ago
.gitignore	unix socket support	9 months ago
ARCHITECTURE.md	add extensions for typing and receipts; bugfixes and addi...	2 years ago
CONTRIBUTING.md	add DCO	last month
Dockerfile	Prioritise retriable errors over unretriable errors	last year
LICENSE	Initial commit	3 years ago
README.md	Update README.md	2 months ago
RELEASING.md	Remind releaser to bump the version string	8 months ago
go.mod	Bump complement@main	9 months ago
go.sum	Bump complement@main	9 months ago
package.json	client: use prettier; add README	2 years ago
v3.go	Use 0222	8 months ago

README Apache-2.0 license Security

Sliding Sync

Run a sliding sync proxy. An implementation of [MSC3575](#).

Proxy version to MSC API specification

This describes which proxy versions implement which version of the API drafted in [MSC3575](#). See <https://github.com/matrix-org/sliding-sync/releases> for the changes in the proxy itself.

As of v0.99.12, the proxy implements [this version of the MSC](#) with the following exceptions:

- the `Limited` flag is not set in responses.
- Delta tokens are unsupported.

Usage

NOTE: The proxy works fine with Dendrite and Synapse, but it doesn't work well with Conduit due to spec violations in the `state` of a room in `/sync`. Running the proxy with Conduit will cause more expired connections (HTTP 400s) when room state changes, and log lines like `WRN Accumulator.filterToNewTimelineEvents: seen the same event ID twice, ignoring`.

Setup

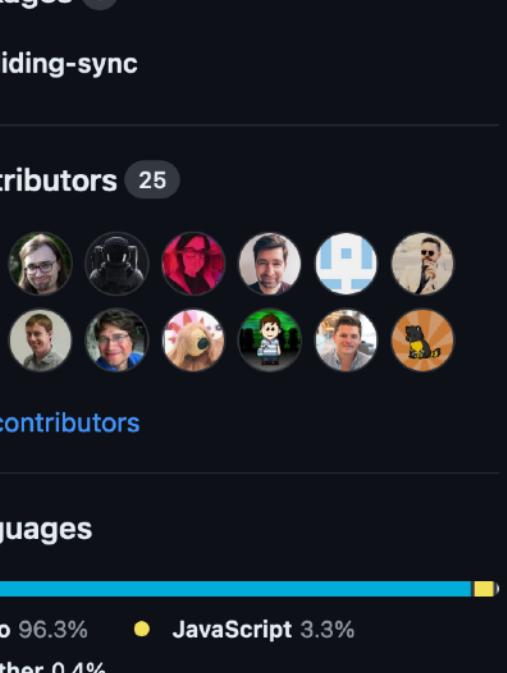
Requires Postgres 13+.

First, you must create a Postgres database and secret:

```
$ createdb syncv3
$ echo -n "$(openssl rand -hex 32)" > .secret # this MUST remain the same throughout the lifet
```

The Sliding Sync proxy requires some environment variables set to function. They are described when the proxy is run with missing variables.

Here is a short description of each, as of writing:



The Matrix Rust SDK

- Introduce a new SlidingSync API
- Introduce new APIs built on top of sliding sync
 - RoomListService
 - EncryptionSync
 - NotificationClient
- API have been carefully designed to avoid any sliding sync aspects, i.e. it feels agnostic of any sync mechanisms

Timeline: add support for local reactions to local events 21 minutes ago

uniffi-bindgen chore: Upgrade uniffi to 0.23.0 last year

xtask sdk-base: hack to avoid over-recursion when evaluating S... 21 minutes ago

.editorconfig build: Adding .editorconfig 2 years ago

.gitignore git: ignore the code coverage report from the output 5 months ago

.rustfmt.toml chore: Add rust.vim edition workaround 2 years ago

.typos.toml Review: Fix false positive typo in b64 string 3 weeks ago

CONTRIBUTING.md Add a tip about using RustRover last week

Cargo.lock chore: Use ruma::time instead of instant 5 days ago

Cargo.toml MatrixRTC: Update ruma revision. last week

LICENSE rust-sdk: Switch the license to Apache 2.0. 4 years ago

README.md docs: updated readme - rust version (#2047) last year

RELEASE.md RELEASE.md: remove spurious backticks 7 months ago

UPGRADING-0.5-to-0.6.md Fix some typos last year

codecov.yaml Remove matrix-sdk-appservice last year

tarpaulin.toml test: Merge the two integration test suites into a single one 10 months ago

[README](#) [Apache-2.0 license](#) [Security](#)

build passing coverage 84% License Apache 2.0 matrix #matrix-rust-sdk docs main docs v0.7.1

matrix-rust-sdk

matrix-rust-sdk is an implementation of a Matrix client-server library in Rust.

Project structure

The rust-sdk consists of multiple crates that can be picked at your convenience:

- matrix-sdk - High level client library, with batteries included, you're most likely interested in this.
- matrix-sdk-base - No (network) IO client state machine that can be used to embed a Matrix client in your project or build a full fledged network enabled client lib on top of it.
- matrix-sdk-crypto - No (network) IO encryption state machine that can be used to add Matrix E2EE support to your client or client library.

Minimum Supported Rust Version (MSRV)

These crates are built with the Rust language version 2021 and require a minimum compiler version of 1.70.

Status

The library is in an alpha state, things that are implemented generally work but the API will change in breaking ways.

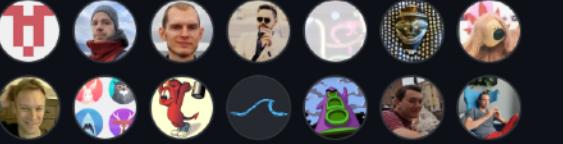
If you are interested in using the matrix-sdk now is the time to try it out and provide feedback.

Bindings

Some crates of the matrix-rust-sdk can be embedded inside other environments, like Swift, Kotlin, JavaScript, Node.js etc. Please, explore the [bindings/](#) directory to learn more.

Packages
No packages published Publish your first package

Used by 503
 + 495

Contributors 121

+ 107 contributors

Deployments 500+
✓ [github-pages](#) last year
+ more deployments

Languages
Rust 99.9% Shell 0.1%
Swift 0.0% Python 0.0%
Ruby 0.0% Perl 0.0%

Element X.

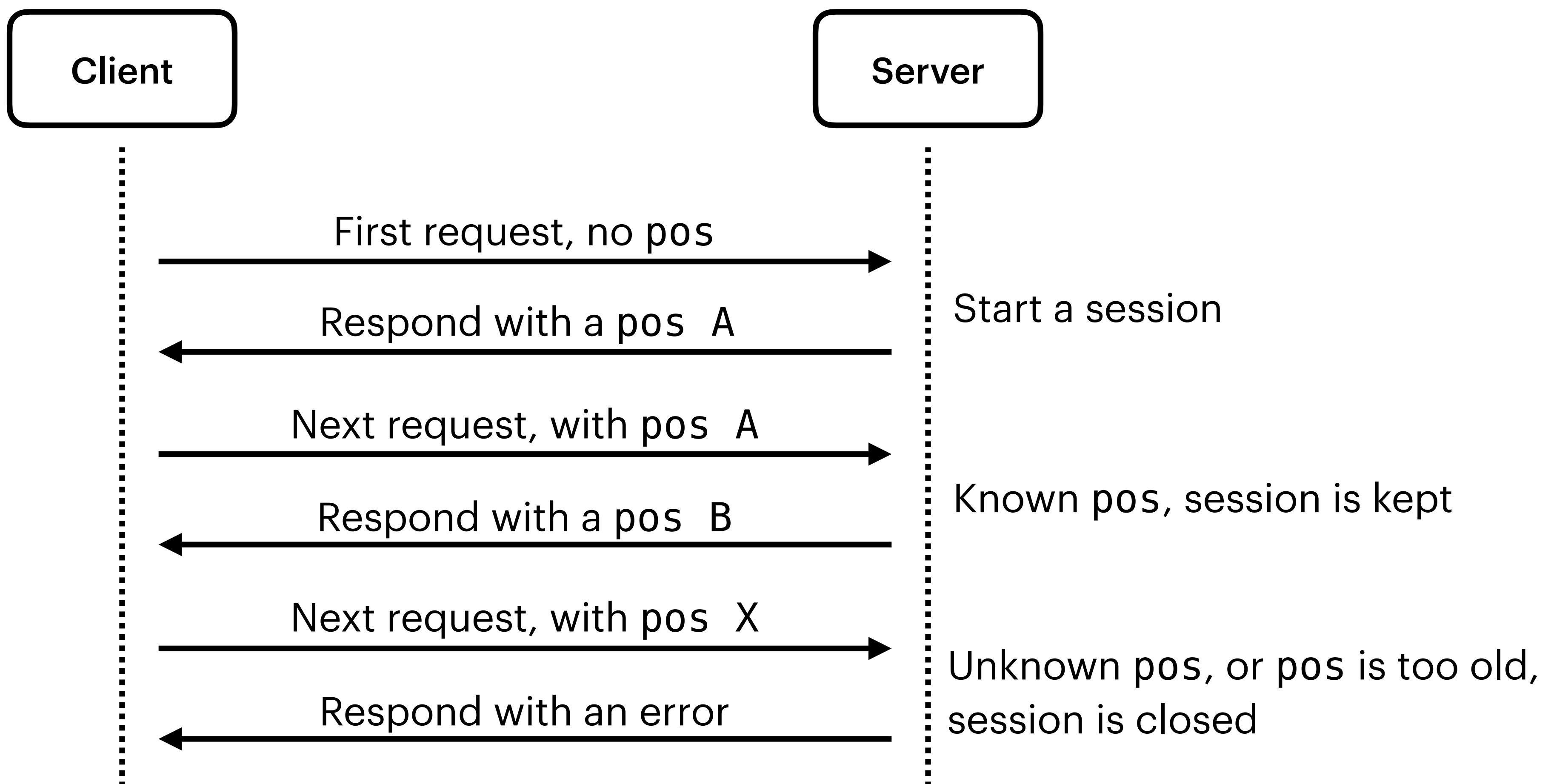
- A new Matrix client
- Built entirely on top the Matrix Rust SDK
- Requiring sliding sync



Sliding sync principles

- The server maintains **one or more lists of rooms**, based on the request
- A list is sorted and filtered
- A list is updated by some events
 - Rooms move in a list if one of their event triggers a “bump” (a new sort)
- Each room of a list has a maximum number of events
 - It pre-populates the **timeline**
- The client requests a slice of each list, based on **a range**

Sliding sync sessions



pos is a totally opaque value for the client

HTTP: the request

POST /_matrix/client/unstable/org.matrix.msc3575-sync?pos=7

```
{  
    "conn_id": "...",  
    "txn_id": "...",  
    "lists": { ... },  
    "room_subscriptions": { ... },  
    "unsubscribe_rooms": { ... },  
    "extensions": { ... }  
}
```

HTTP: the request

"lists"

```
"lists": {  
    "my_list_name": {  
        "ranges": [ [0, 9] ],  
        "sort": [ "by_recency", "by_name" ],  
        "bump_event_types": [ "m.room.message", ... ],  
        "timeline_limit": 1,  
        "include_heroes": true,  
        "filters": [  
            "is_tombstoned": false,  
            "not_room_types": [ "m.space" ]  
        ],  
        "required_state": [ [ "m.room.encryption", "" ], ... ]  
    ...  
}
```

HTTP: the response

```
{  
  "pos": "...",  
  "txn_id": "...",  
  "initial": ...,  
  "lists": { ... },  
  "rooms": { ... },  
  "extensions": { ... }  
}
```

HTTP: the response

"lists"

```
"lists": {  
    "my_list_name": {  
        "count": 42,  
        "ops": [  
            {  
                "op": "SYNC",  
                "range": [0, 3],  
                "room_ids": [  
                    "!foo:bar",  
                    ...  
                ]  
            }  
        ]  
    }  
}
```

HTTP: the response

"rooms"

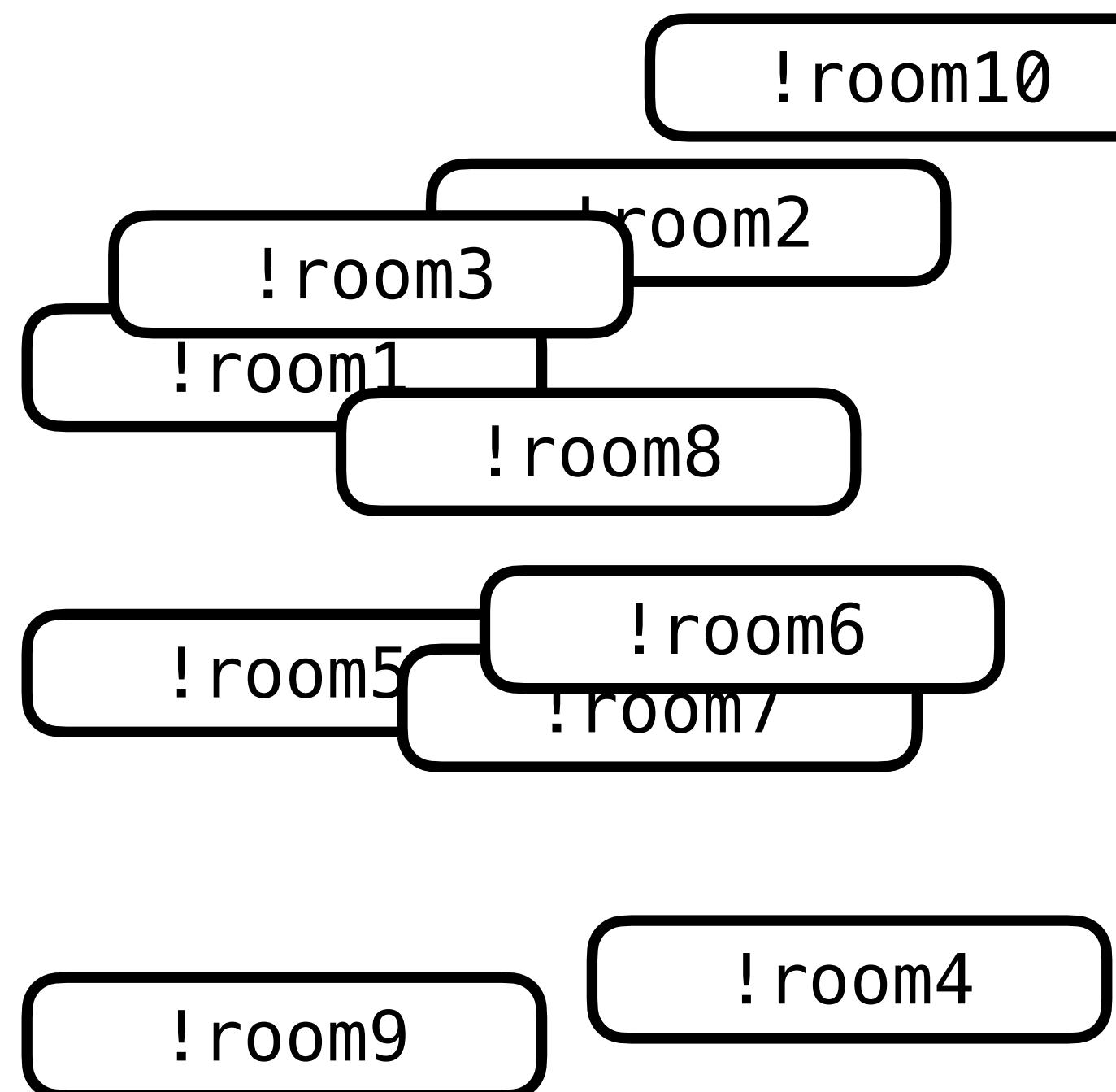
```
"rooms": {
    "!foo:bar": {
        "name": "Alice and Bob",
        "avatar": "mxc://...",
        "initial": true,
        "required_state": [ ... ],
        "timeline": [
            {
                "sender": "@alice:qux",
                "type": "m.room.message",
                "content": { "body": "Hello 🙌" }
            }
        ],
        "prev_batch": "t111_222_333",
        "joined_count": 1,
        "invited_count": 0,
        "notification_count": 1,
        "highlight_count": 0
    },
    ...
}
```

Sliding sync in “action”

Client

Server

Federation



Sliding sync in “action”

Client

request #1:

- pos = None
- range = 0..=4

Server

! room1

! room2

! room3

! room4

! room5

! room6

! room7

! room8

! room9

! room10

Federation

Sliding sync in “action”

Client

request #1:

- pos = None
- range = 0..=4

Server

! room1

! room2

! room3

! room4

! room5

! room6

! room7

! room8

! room9

! room10

response

Federation

Sliding sync in “action”

Client

request #1:

- pos = None
- range = 0..=4

Server

! room1

! room2

! room3

! room4

! room5

! room6

! room7

! room8

! room9

! room10

Federation

Sliding sync in “action”

Client

request #2:

- pos = A
- range = 0..=4

Server

! room1

! room2

! room3

! room4

! room5

! room6

! room7

! room8

! room9

! room10

Federation

Sliding sync in “action”

Client

request #2:

- pos = A
- range = 0..=4

Server

response

Federation

! room6

! room7

! room8

! room9

! room10

Sliding sync in “action”

Client

request #2:

- pos = A
- range = 0..=4

Server

! room1

! room2

! room3

! room4

! room5

! room6

! room7

! room8

! room9

! room10

Federation

Sliding sync in “action”

Client

request #3:

- pos = B
- range = 0..=9

Server

! room1

! room2

! room3

! room4

! room5

! room6

! room7

! room8

! room9

! room10

Federation

Sliding sync in “action”

Client

request #3:

- pos = B
- range = 0..=9

Server

response

! room6

! room7

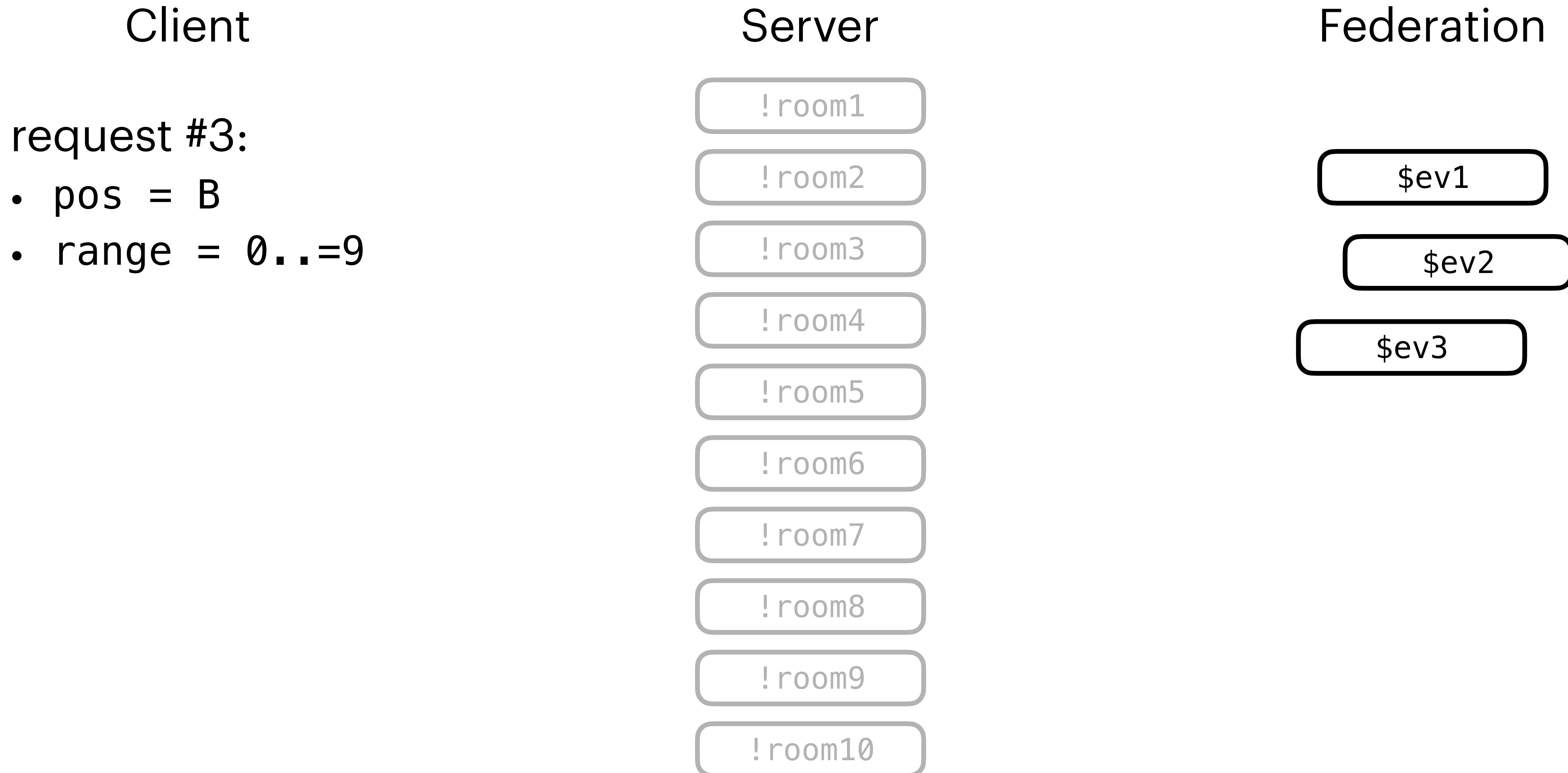
! room8

! room9

! room10

Federation

Sliding sync in “action”



Sliding sync in “action”

Client

Server

Federation

! room3

! room7

! room2

! room1

! room4

! room5

! room6

! room8

! room9

! room10

Sliding sync in “action”

Client

request #4:

- pos = C
- range = 0..=9

Server

! room3

! room7

! room2

! room1

! room4

! room5

! room6

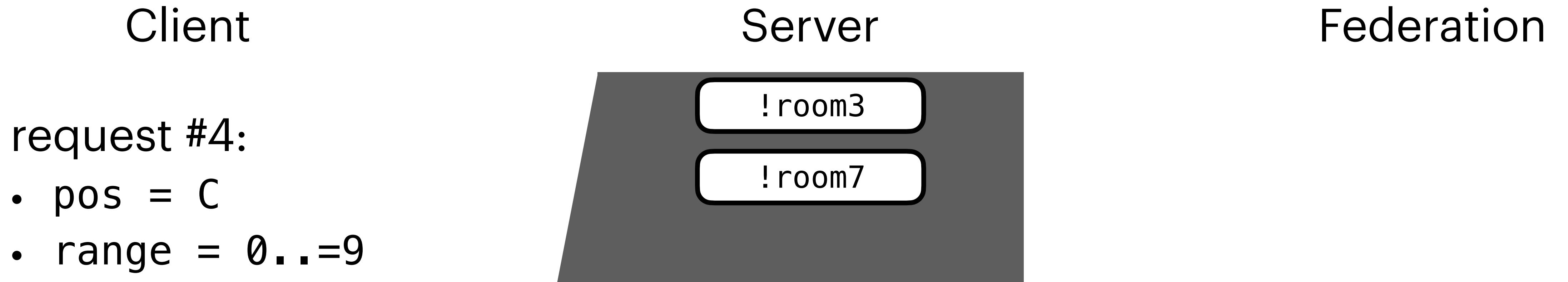
! room8

! room9

! room10

Federation

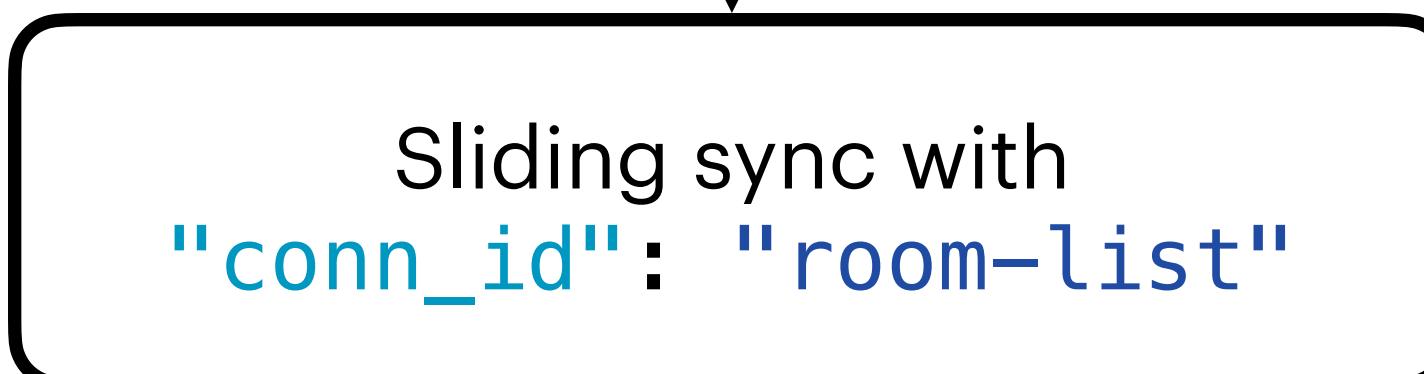
Sliding sync in “action”



Concurrent sliding syncs inside the client

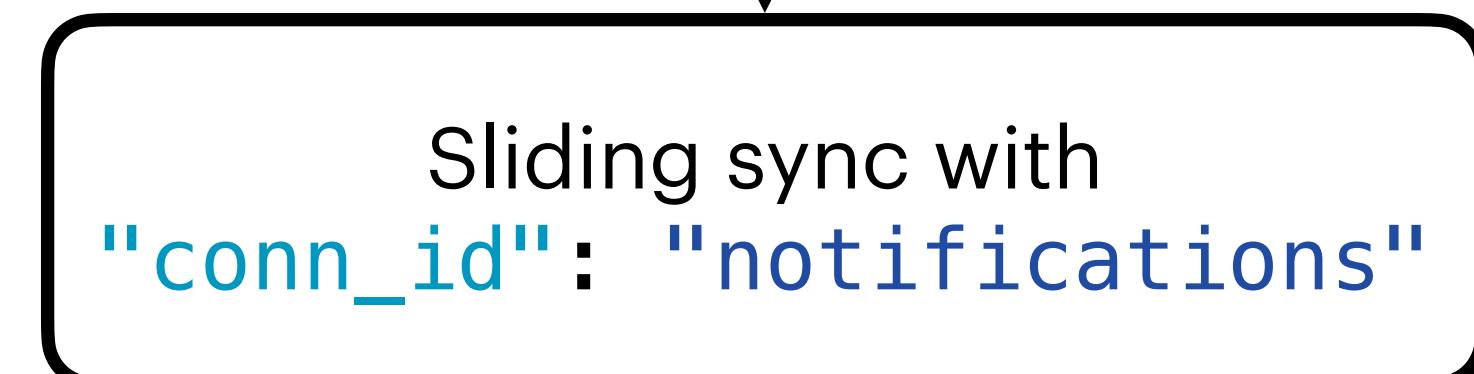
Application

2 sync loops

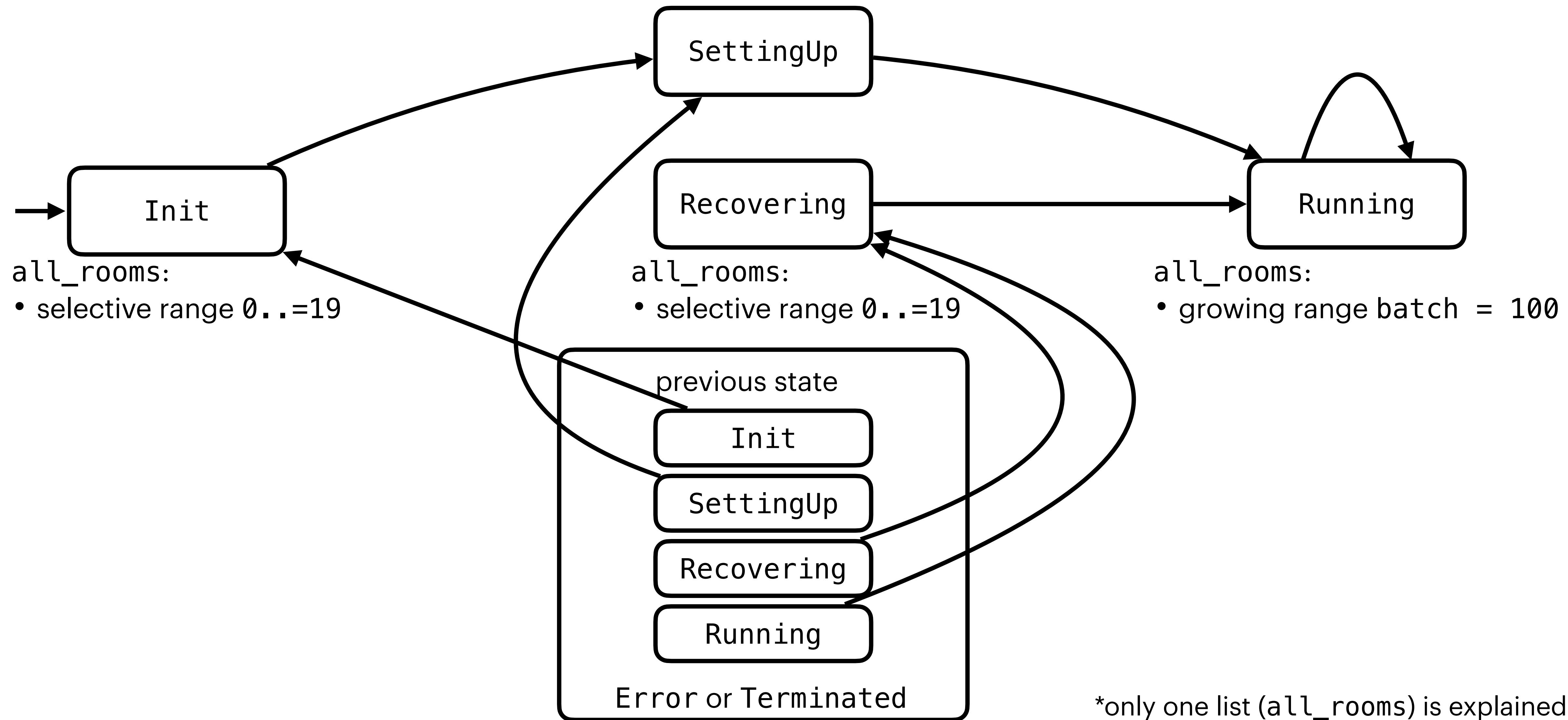


Push notifications

1 sync loop



The syncing room list state machine



Client ranges API

Selective range:

- always the same range

Example with size = 20:

- request #1: `0..=19`
- request #2: `0..=19`
- request #3: `0..=19`

Growing range:

- starts from 0
- adds `batch_size` every time

Example with `batch_size` = 100:

- request #1: `0..=99`
- request #2: `0..=199`
- request #3: `0..=299`



Taking a break
(alt. 2740m)

Is sliding sync working?

- After almost 2 years of iteration, an efficient pattern is emerging
- It's working
- It's fast
- It's really fast (within 3 order of magnitude compared to sync v2)
- But the proxy is too costly to run
- And there is bugs... like... complex bugs
- Bugs hide in features we may not need
- Now we know what to do: might we **simplify sliding sync**?



The objective

Removing filters

- Filtering the room list must be instantaneous
- **Filtering moves on client-side**
- Remove most filters from the request:

~~is_dm~~

~~spaces~~

~~is_encrypted~~

- **is_invite**
- ~~is_tombstoned~~
- ~~room_types~~
- **not_room_types**
- ~~room_name_like~~
- ~~tags~~
- ~~not_tags~~
- ~~others~~

```
let (stream, controller) = room_list.entries_with_dynamic_adapters(...);
controller.set_filter(Box::new(new_filter_all(vec![
    Box::new(new_filter_unread()),
    Box::new(new_filter_favourite()),
    Box::new(new_filter_fuzzy_match_room_name("matco")),
]));
```

Removing sorting operations

- Sorting happened on the server-side, via ops
 - The server was maintaining the lists and was sending the “diff”s
 - SYNC or INVALIDATE: Insert or remove a range of rooms
 - INSERT or DELETE: insert or delete a single room
 - Super complex, incorrect by nature, and costly for the server = error-prone and inefficient
- Remove ops entirely
- **Sorting moves client-side**

```
stream.sort_by(new_sorter_lexicographic(vec![  
    Box::new(new_sorter_recency()),  
    Box::new(new_sorter_name())  
]))
```

Other removals

A detailed list for the implementors

^{DEL} **bump_event_types** is now hard-coded on the server-side

^{DEL} **delta_token** was never implemented

^{DEL} **slow_get_all_rooms** can be replaced by a growing range

^{DEL} **include_old_rooms** is hard-coded on the server-side

^{DEL} **unsubscribe_rooms** is no more possible (can only subscribe)

End of the experiment

- The proxy aimed at iterating and hacking quickly for the experiment
- At this point, we know exactly what we want
 - Sliding sync is more stable
 - Plus, we don't want to keep the proxy on top of Synapse
- **Let's deprecate the proxy**

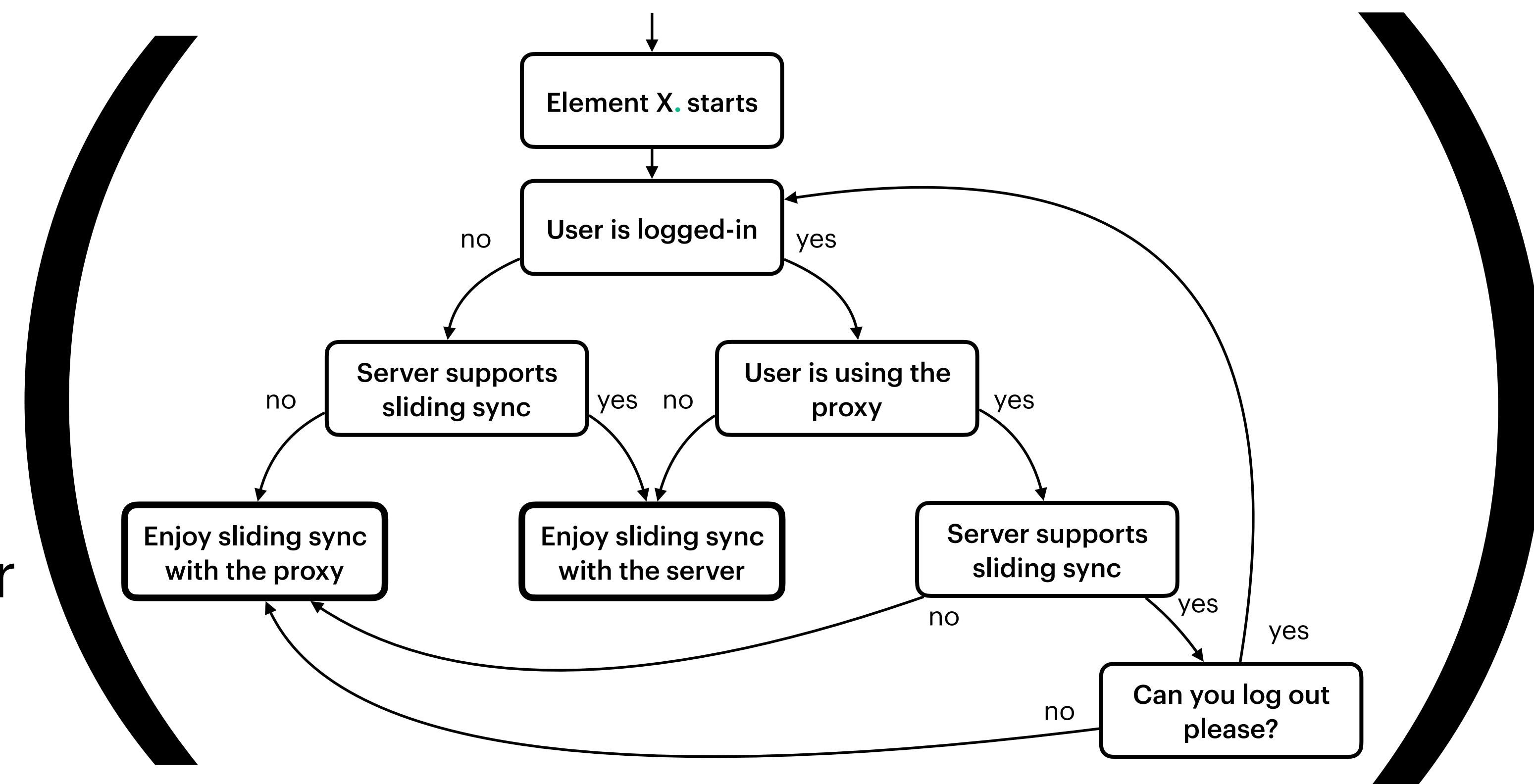
Enter MSC4186

Simplified sliding sync

- August 31st, 2024, first draft of MSC4186
- `POST /_matrix/client/unstable/org.matrix.simplified_msc3575-sync`
- **Simplified sliding sync is implemented inside Synapse!**
- The proxy doesn't and won't implement simplified sliding sync
- We are migrating from the proxy to Synapse
- We want to sunset the proxy as soon as possible
 - Farewell playmate
- The Matrix Rust SDK speaks both MSC3575 and MSC4186

Migration

- Element X. automagically detects sliding sync on the homeserver and switches the user
- Homeserver maintainers have little to do
 1. Update the homeserver
 2. Wait for all users to migrate from the proxy
 3. Uninstall the proxy



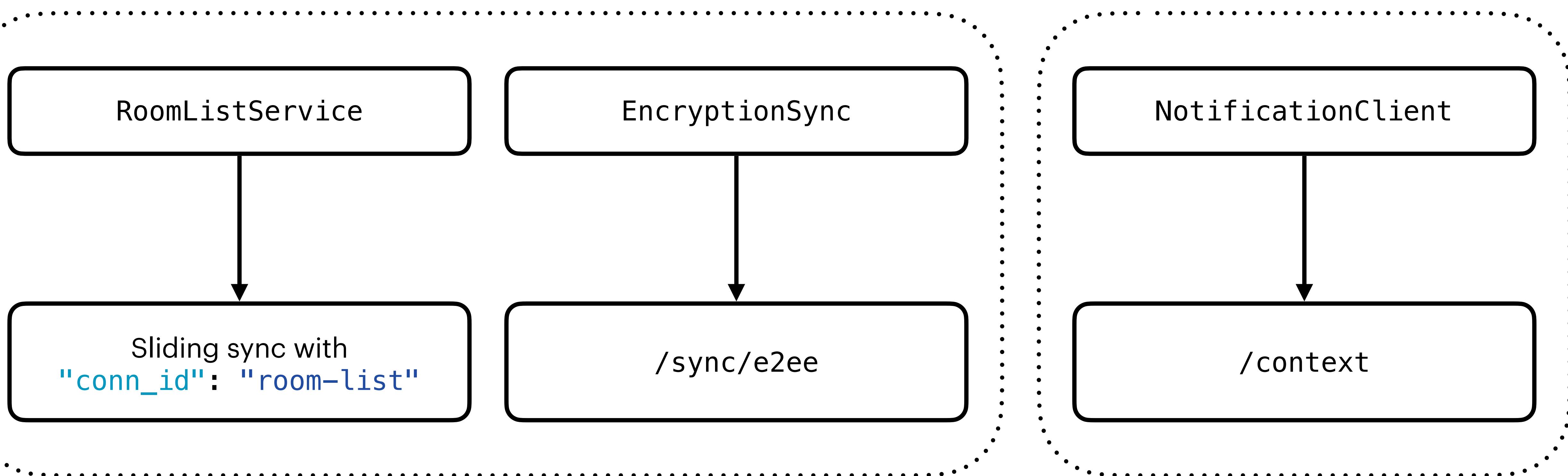
Moooar simplifications

- Sliding sync has a non-negligible cost on the server-side
- Based on our experience, we see patterns that can be isolated
- Extract some usage of sliding sync into their own **endpoint**
 - New /sync/e2ee
 - Enhanced /context
 - Reduce loads and complexity for the server (may remove conn_id)

In a short future

Application

2 different sync loops



Push notifications

0 sync loop

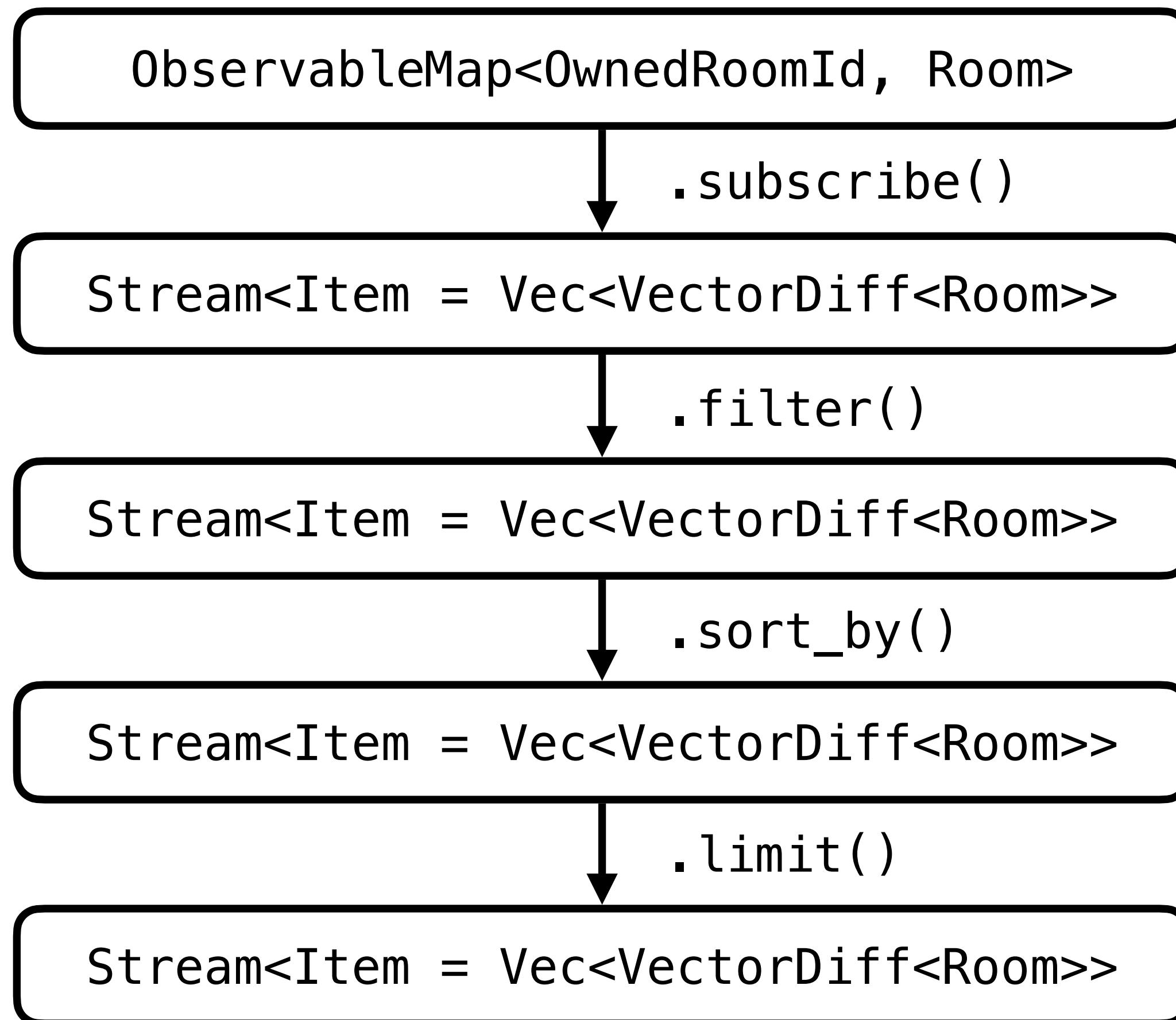


Summit
(alt. 3180m)

Cabane du Trient, CH

Reactive programming

The beauty of higher-order Stream



- Single source of truth
- Ultra flexible, tiny memory footprint (`VectorDiff<Room>` is 72 bytes only), async, lazy, performant
- Traverse bindings to Swift and Kotlin easily and cheaply
- Learn more at: <https://mnt.io/series/reactive-programming-in-rust/>

Thanks!

- MSC3575 was an experimental proposal
 - Implemented inside a proxy
- **MSC4186** is the final proposal
 - Implemented inside Synapse
- Matrix Rust SDK supports both
- All applications based on the SDK support both:
 - Element X., Fractal...

Fun patches

- SDK:
 - (In eyeball) Implement the SortBy stream adapter (#43) +1,029 -23
 - Client-side sorting in RoomList (#3585) +1,516 -1,779
 - Remove RoomListEntry and ops (#3664) +167 -1,506
 - Migrate from Sliding Sync to Simplified Sliding Sync (#3676) +600 -695
 - Total +24,903 -15,262 over 525 pull requests
- Synapse:
 - Add Sliding Sync /sync endpoint (#17187) +2,302 -15