



**Enter the Matrix**  
**Install your own Matrix server on Arch Linux**

# Who am I?

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Core committer on Synapse, the reference Matrix homeserver implementation

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What is Matrix?

# Matrix is an open network for secure, decentralised real-time communication.



Interoperable chat



Interoperable VoIP



Open comms for VR/AR



Real-time IoT data fabric

**Mission: to create a global decentralised encrypted comms network that provides an open platform for real-time communication.**

# What do you get in the spec?

- Decentralised conversation history
- Group Messaging (and 1:1)
- End-to-end Encryption
- VoIP signalling for WebRTC
- Server-side push notification rules
- Server-side search
- Read receipts, Typing Notifs, Presence
- Synchronised read state and unread counts
- Decentralised content repository
- “Account data” for users per room

**No single party owns your  
conversations.**

**Conversations are shared  
over all participants.**

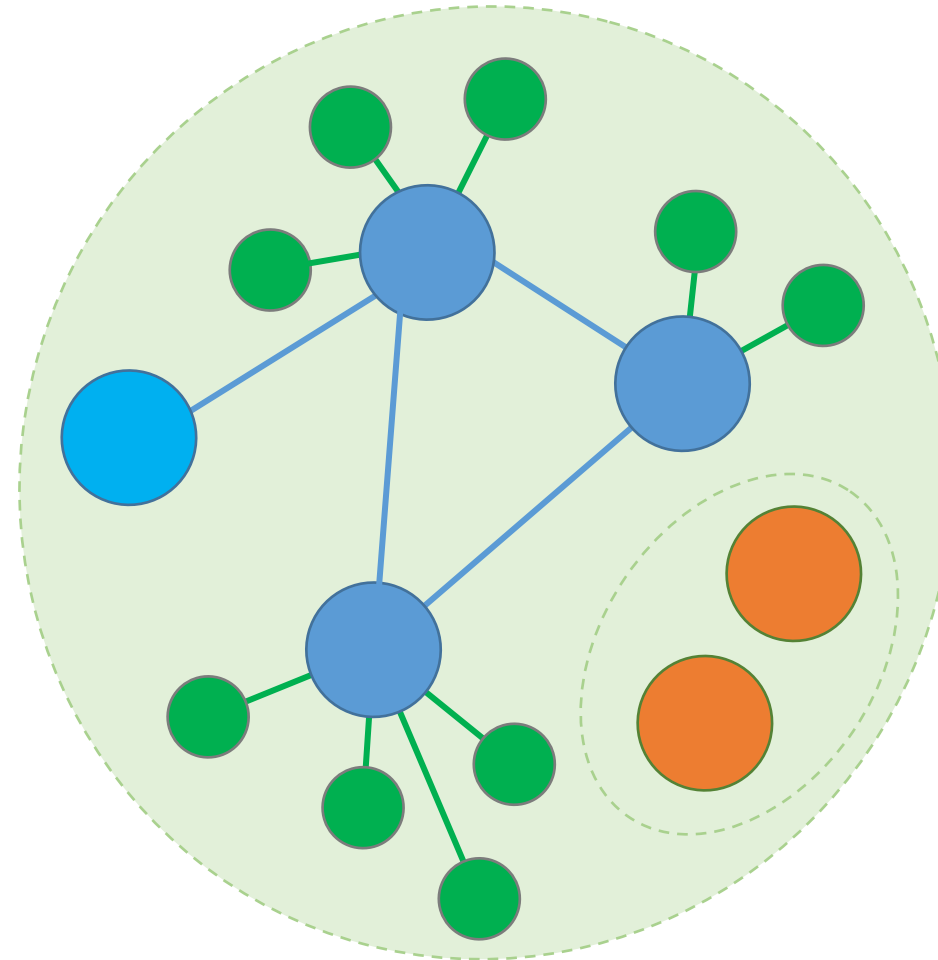
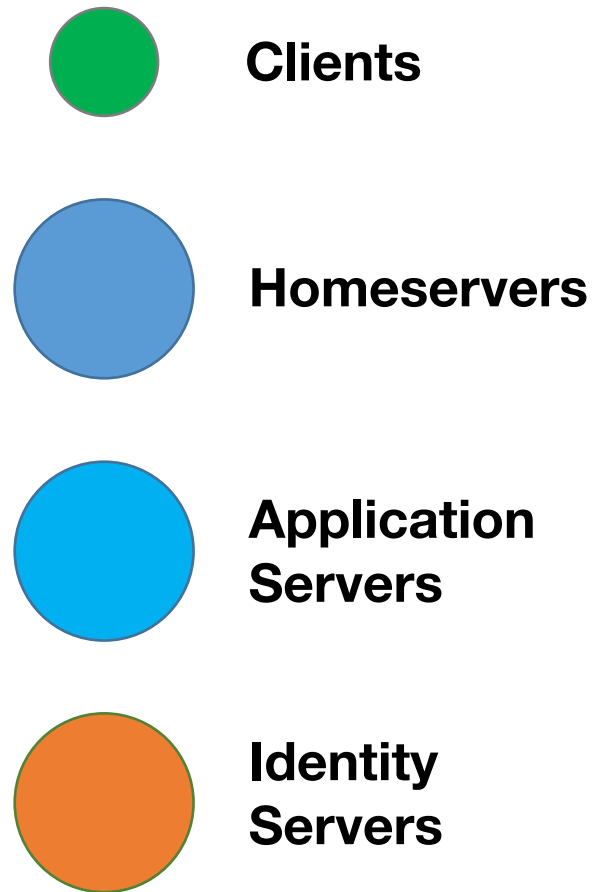
# The Matrix APIs

- **Client-Server API**
- **Server-Server API** (a.k.a. the federation API)
- **Application Service API**
- **Identity Server API**



# Matrix: Distributed Architecture

[matrix]



# The Client-Server API

To send a message:

```
curl -XPOST -H 'Authorization: Bearer ACCESS_TOKEN'  
-d '{"msgtype": "m.text", "body": "hello"}'  
"https://alice.com:8448/_matrix/client/api/v1/rooms/ROOM_ID/send/m.room.message"
```

```
{  
  "event_id": "$YUwRidLecu"  
}
```

# The Client-Server API

To control a Hue light:

```
curl -XPOST -d '{\n  "room": "1",\n  "light": 2,\n  "brightness": 0.5,\n}'\n"https://alice.com:8448/_matrix/client/api/v1/rooms/ROOM_ID/send/org.matrix.midi?access_token=ACCESS_TOKEN"
```

```
{ "event_id": "$ORzcZn2" }
```

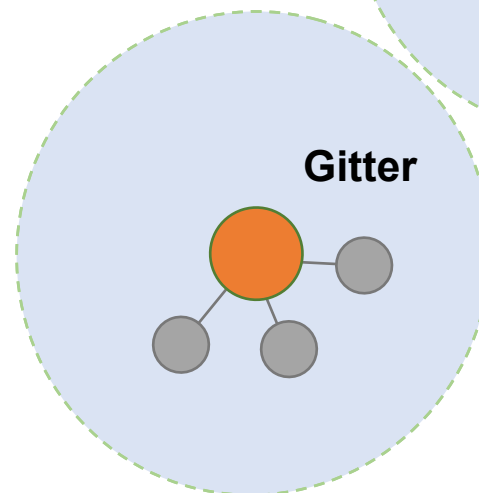
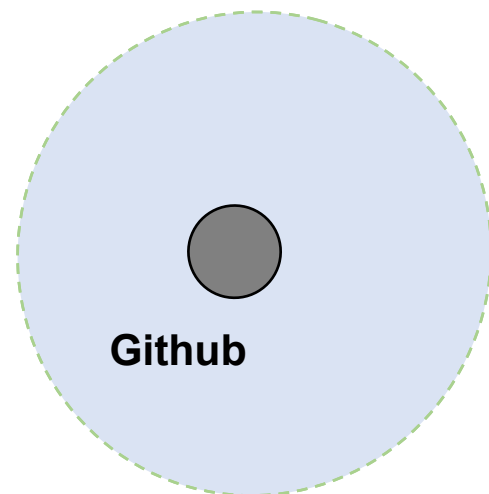
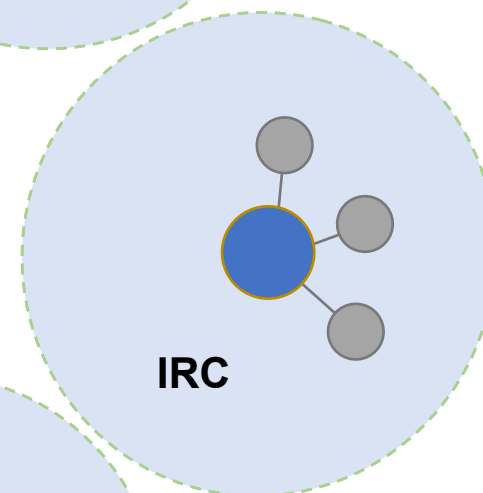
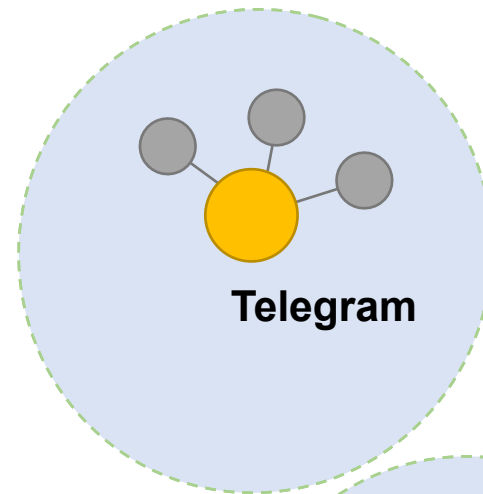
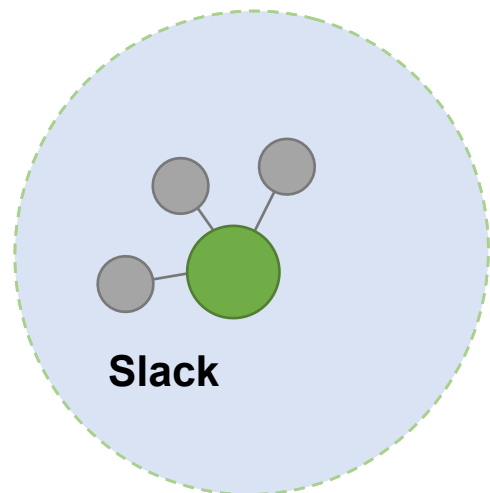
## Server-Server API

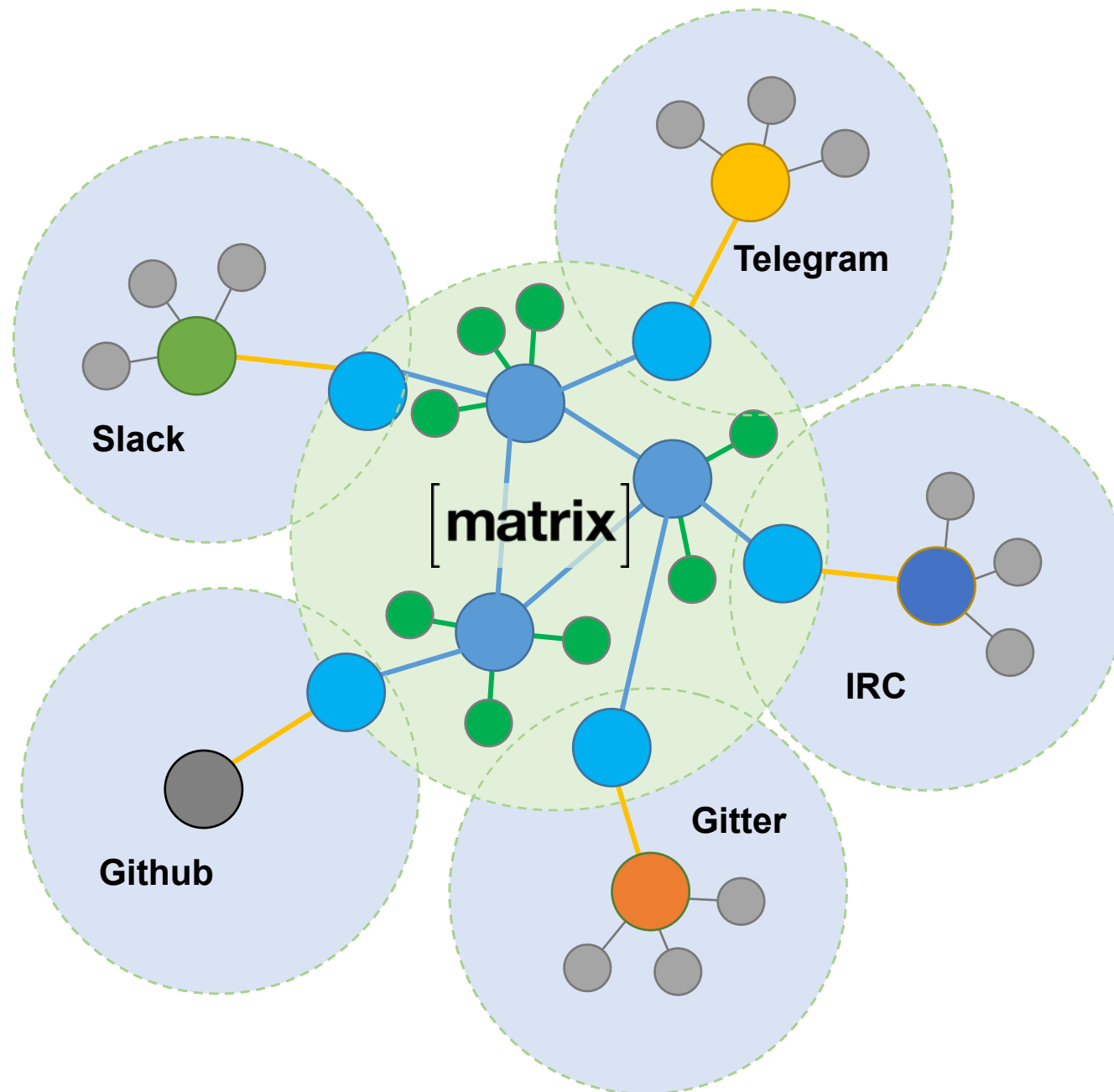
- Synchronises messages and room state between servers, in real-time
- Can retrieve historic messages from each other
- Query profile and presence information about users on each other's servers

## Application Services API

- Have privileged access to the server
- Can subscribe to server traffic to provide custom application logic
- They can masquerade as 'virtual users'.

# Bridges





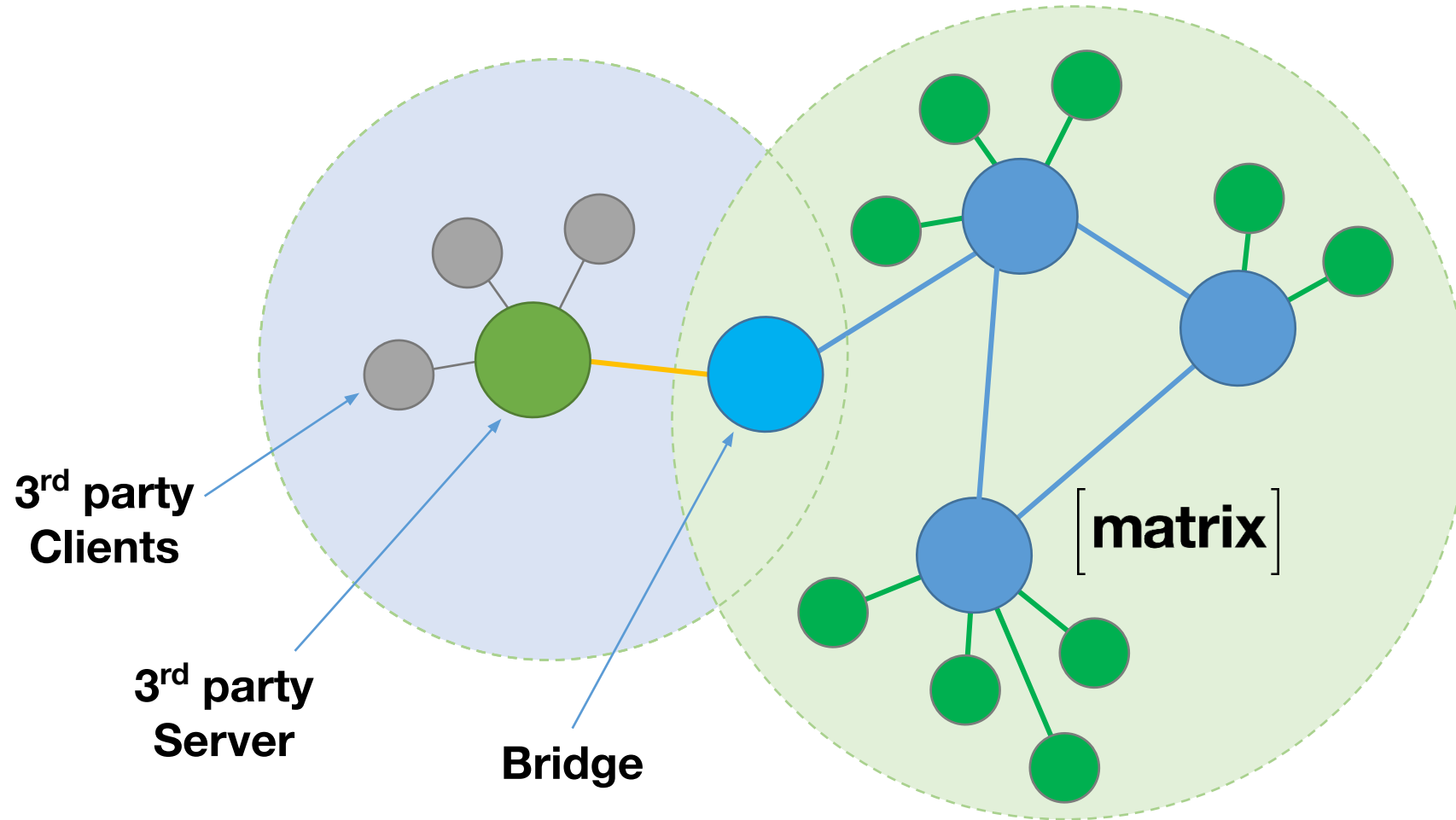
# Bridges

- IRC
- Discord
- Telegram
- Slack
- SMS
- Gitter
- RocketChat
- Email
- Mastodon
- ...more

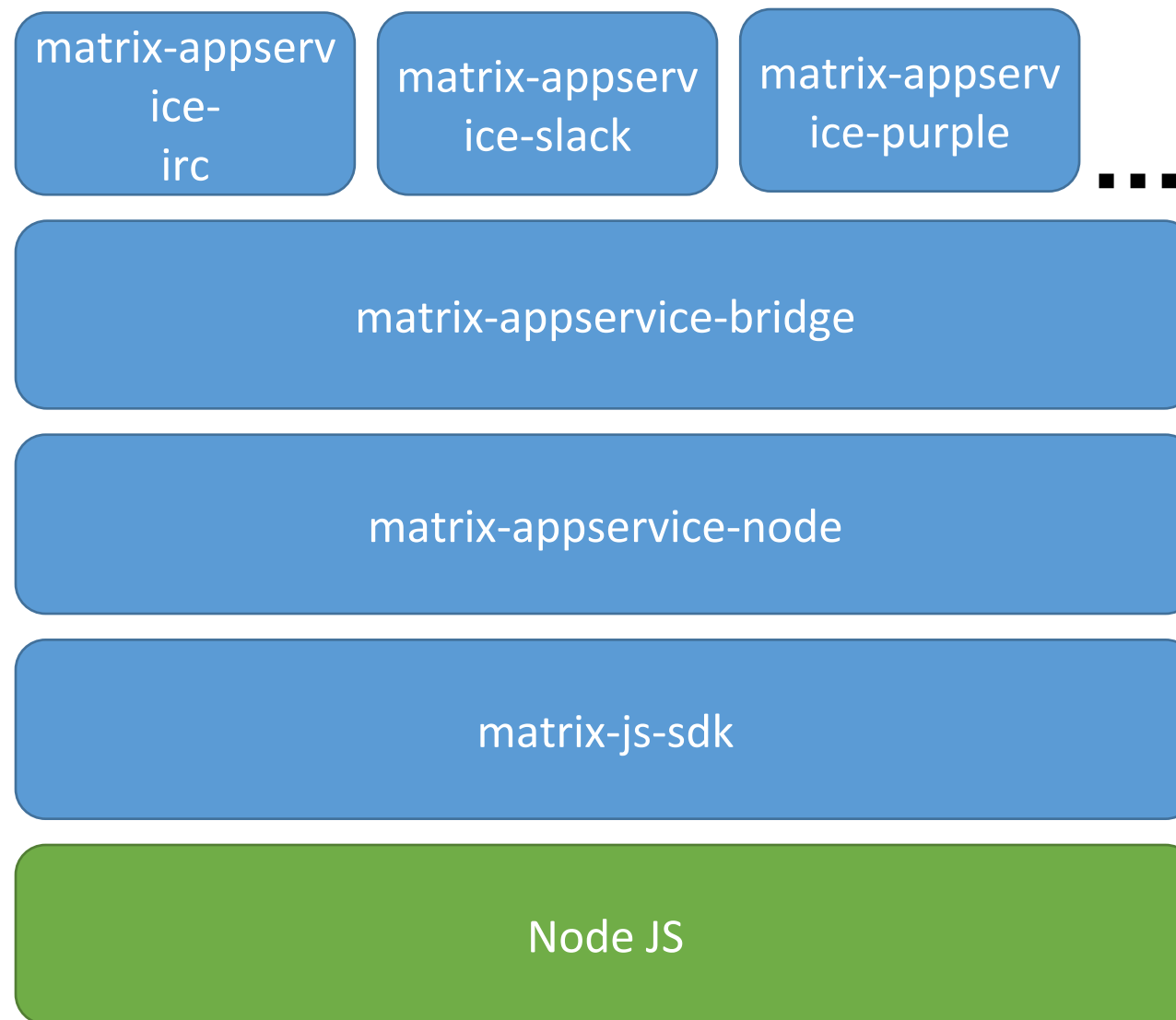
→ <https://matrix.org/bridges/>



# Building Bridges

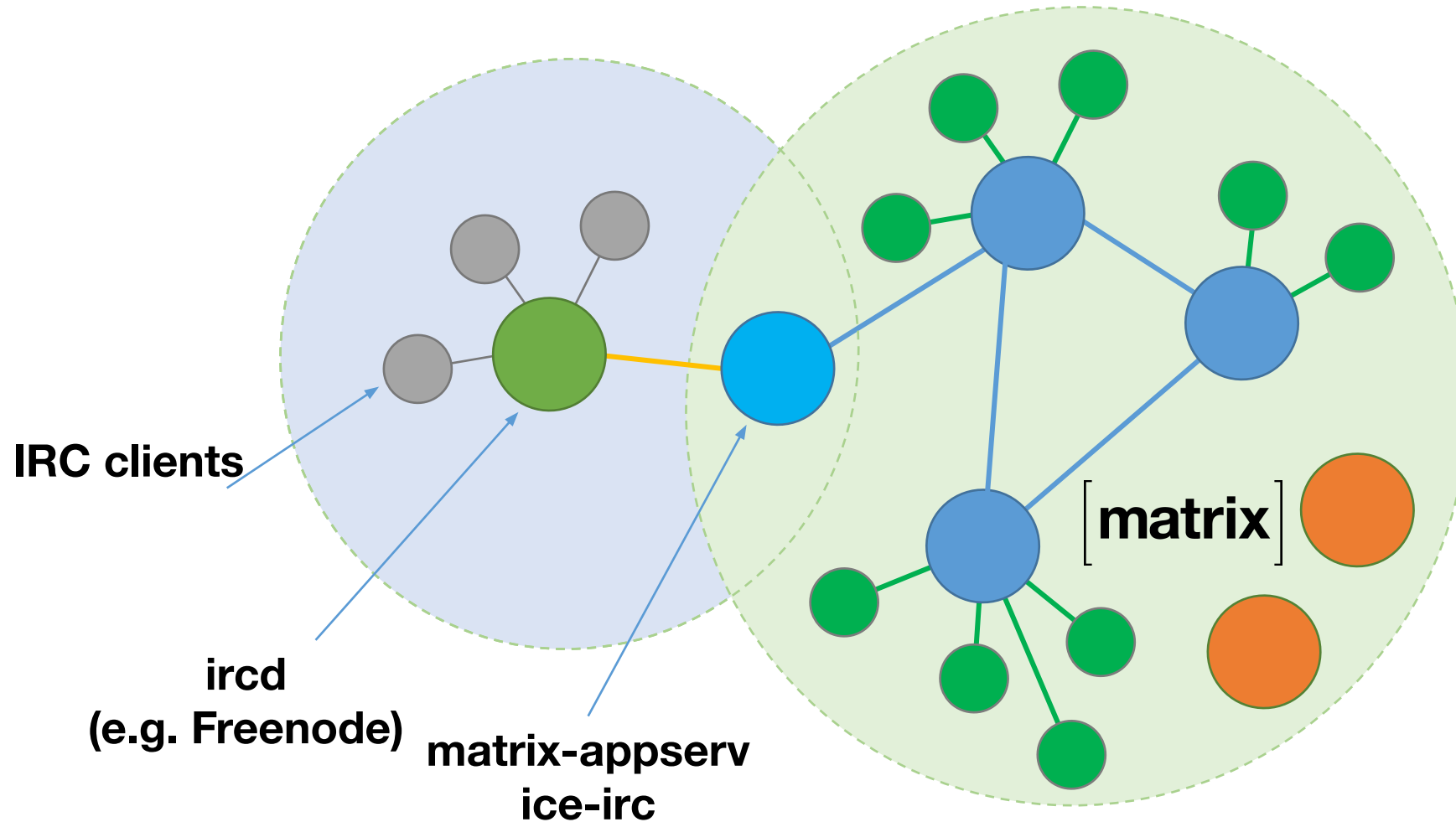


# Typical Bridging Stack



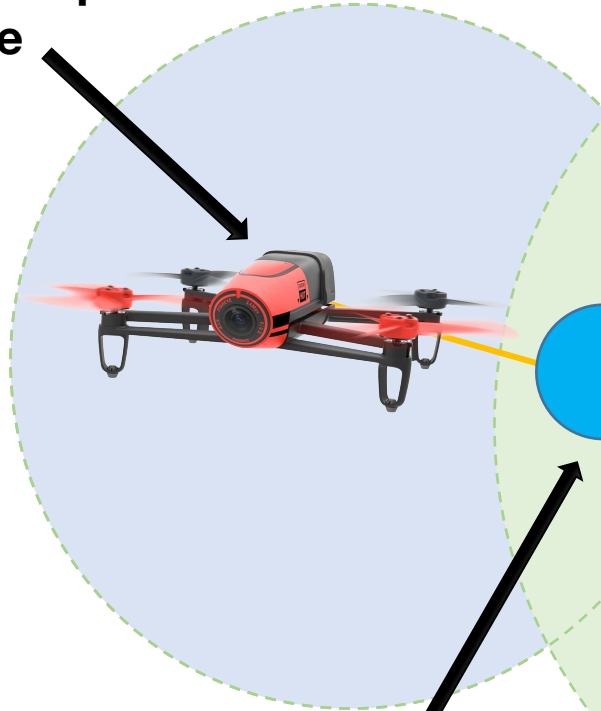
# Matrix to IRC

[matrix]

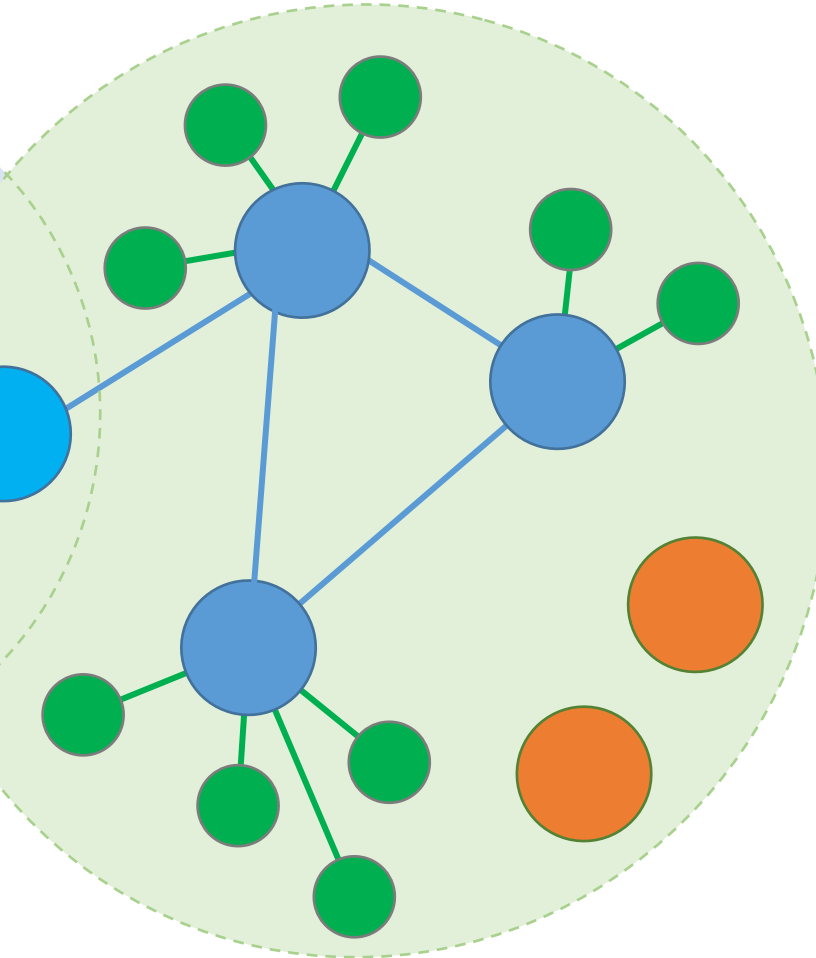


# Matrix to IoT...

Parrot Bebop Drone

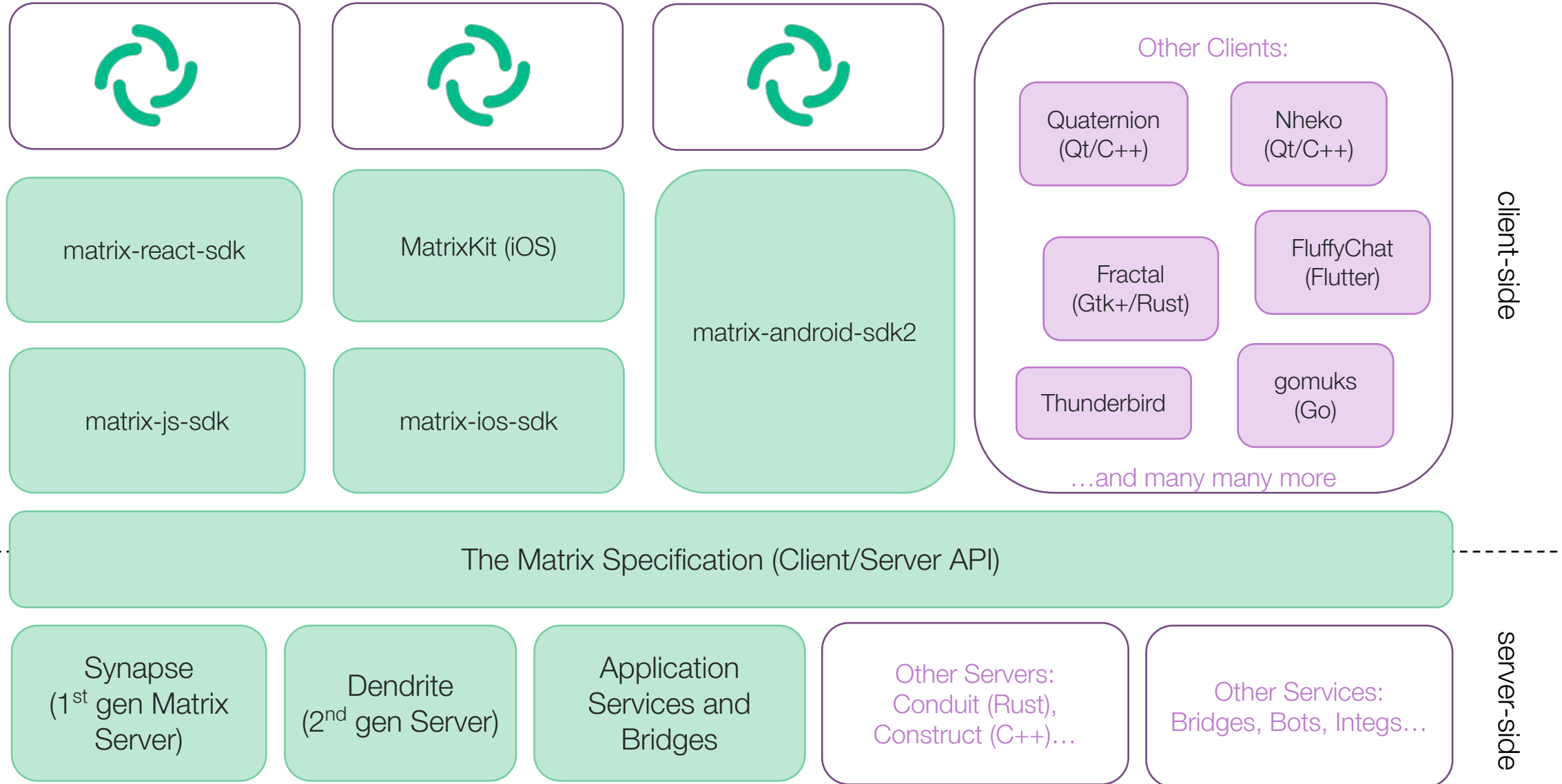


Janus WebRTC Gateway  
(from MeetEcho)



# Ecosystem

# Matrix Open Source Ecosystem



# Clients

- Clients available for every platform
  - <https://matrix.org/clients/>
- Many client-side SDKs:
  - Official: JS, React, iOS, Android
  - Community: Go, Python, Erlang, Java, Scala, Ruby, Perl6, Lisp, Elixir, Haskell, Rust, Nintendo 3DS...
- <https://matrix.org/sdks/>

# Homeservers

- Synapse: reference homeserver implementation from the core team
- Dendrite: next generation, work in progress homeserver from the core team
- Community implementations
  - Conduit (Rust)
  - Construct (C++)
  - ...



## Community Status

- ~18.5M global visible accounts
- ~5.5M messages per day
- ~4.3M chatrooms
- ~45,000 federated servers
- ~3500 msgs/s out, ~35 msgs/s in on Matrix.org
- ~500 projects building on Matrix
- ~100 companies building on Matrix
- ~5 governments deploying Matrix

# Governance

# The Matrix.org Foundation

- Non-profit Common Interest Company registered in the UK
- Neutral guardian of Matrix and its reference implementations on behalf of the entire Matrix community

→ <https://matrix.org/foundation/>

# Element

- For-profit company registered in the UK, in France and in the US
- Founded by the creators of Matrix
- Employs most of the Matrix core team to enable them to work on Matrix as their day job
  - All of the work done by Element employees on the spec and reference implementations are donated to the foundation
  - Doesn't hold a majority in the foundation's leadership
- Builds commercial services on top of Matrix

Let's install a  
homesever!

Wait, what's a  
homesever?

# Three types of Matrix servers

- Identity server
- Application service
- Homeserver

# What's a homeserver?

- It's the “home” of a Matrix account
- Implements the Client-Server API
- Implements the federation API
- Clients connect to it to send and receive messages
- Other homeservers connect to it to send and receive messages



# Synapse: the reference implementation

The screenshot shows the GitHub repository page for `matrix-org/synapse`. At the top, there are navigation links for `Code`, `Issues` (1k), `Pull requests` (28), `Actions`, `Wiki`, `Security`, and `Insights`. The repository is currently on the `develop` branch, with 682 branches and 422 tags. A recent commit by `anoadragon453` is highlighted, titled "Add support for running Complement against ...", committed 2 hours ago with 17,605 commits. Below this, a list of folders and their corresponding commit messages and times are shown:

<code>.buildkite</code>	Mark the shadow_banned column as boolean in synapse_port...	5 days ago
<code>.circleci</code>	Stop uploading -py3 docker images (#8056)	2 months ago
<code>.github</code>	bug report template: move comments into comment (#8030)	2 months ago
<code>changelog.d</code>	Add support for running Complement against the local checko...	2 hours ago
<code>contrib</code>	Remove obsolete __future__ imports (#8337)	12 days ago
<code>debian</code>	1.20.1	5 days ago
<code>demo</code>	Fix demo script on ipv6-supported boxes (#6229)	11 months ago
<code>docker</code>	Add required Debian dependencies to allow docker builds on t...	last month
<code>docs</code>	Add checks for postgres sequence consistency (#8402)	21 hours ago
<code>scripts-dev</code>	Add support for running Complement against the local checko...	2 hours ago
<code>scripts</code>	Add `ui_auth_sessions_ips` table to `synapse_port_db` ignore...	yesterday
<code>snap</code>	Added explicit Python build tools to snap requirements (#7213)	6 months ago
<code>stubs</code>	Add type hints for state. (#8140)	last month
<code>synapse</code>	Filter out appservices from mau count (#8404)	2 hours ago
<code>synmark</code>	Rename database classes to make some sense (#8033)	2 months ago
<code>tests</code>	Filter out appservices from mau count (#8404)	2 hours ago

On the right side, the **About** section describes Synapse as the Matrix reference homeserver, with links to `matrix.org`, `python`, and `matrix-org`. It also includes a `Readme` link and the `Apache-2.0 License`. The **Releases** section shows 422 releases, with the latest being `v1.20.1` (5 days ago). The **Sponsor this project** section lists sponsorship options: `patreon.com/matrixdotorg`, `liberapay.com/matrixdotorg`, and `https://paypal.me/matrixdotorg`. A link to `Learn more about GitHub Sponsors` is also present.

# The plan

- Install Synapse using the official Arch Linux repo  
`sudo pacman -S matrix-synapse`
- Configure Synapse
- Install and configure a reverse proxy (Caddy)

Let's do this!

# Database

- By default, Synapse uses SQLite
- PostgreSQL is recommended for production

→ <https://github.com/matrix-org/synapse/blob/master/docs/postgres.md>

# Federation and TLS

- Before Matrix 1.0 (June 2019), Matrix was using “perspectives” to validate TLS on federation
- From Matrix 1.0, a valid TLS certificate is required
- Easiest done through a reverse proxy

# ACME support

- Uses Twisted's txacme library
- Currently only supports ACME v1, which is being turned off by Let's Encrypt
- Work in progress on Twisted's side to support ACME v2, but progress is slow

# Reverse proxy

- Reverse proxy the localhost listener on port 8008
- This demo was using Caddy because of automatic TLS, but other options work

→ [https://github.com/matrix-org/synapse/blob/master/docs/reverse\\_proxy.md](https://github.com/matrix-org/synapse/blob/master/docs/reverse_proxy.md)

Let's do this!



Going further

# Workers

- Synapse is written in Python → 1 process = 1 CPU core
  - Main process + workers that handle part of the main process's workload
  - Communication between processes through Redis
  - Example: Syncing with synchrotrons
- <https://github.com/matrix-org/synapse/blob/master/docs/workers.md>

# Delegation

- Allows the homeserver for example.com to be hosted at, e.g. matrix.example.com
- Also allows the federation port to be something else than the default (8448)
- Usually done with a JSON file at a .well-known URL on the delegating domain (example.com in our example)

# Delegation

```
https://example.com/.well-known/matrix/server
```

```
{  
  "m.server": "matrix.example.com:443"  
}
```

## TURN (VoIP)

→ <https://github.com/matrix-org/synapse/blob/master/docs/turn-howto.md>

## Metrics (Prometheus + Grafana)

→ <https://github.com/matrix-org/synapse/blob/master/docs/metrics-howto.md>

**[matrix]**

**Thank You!**

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