Interoperable HTTP Signalling with Matrix

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Quick Intro/Recap:

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WebRTC has no standard signalling.

→ Users lose control of UX
→ Fragmentation
→ Vendor lock-in
→ The Dark Side

So, how about some standard WebRTC-friendly signalling?

Client–Server Signalling

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Do you do HTTP/1? HTTP/2? WebSockets? non-HTTP?
What protocol? SIP? XMPP? Custom? Something else?
Is it an open standard, proprietary open API, or closed?
What are your identifiers?
How stateful is your connection?
What payload encoding? JSON? Protobuf? CBOR?
What session descriptors? SDP? ORTC?
How extensible do you make it?
Do you do end-to-end crypto? How do keys work?
Do you support group conversations?
Do you handle conversation history?
Do you specify how Push fits in?
Do you support federation?
How mature is the technology?

SIP-over-WebSockets

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Do you do HTTP/1? HTTP/2? WebSockets? non-HTTP?
What protocol? SIP? XMPP? Custom? Something else?
Is it an open standard, proprietary open API, or closed?
What are your identifiers? SIP URIs
How stateful is your connection? Very
What payload encoding? SIP Headers + MIME body
What session descriptors? SDP? ORTC?
How extensible do you make it? Fairly
Do you do end-to-end crypto? No
Do you support group conversations? Via focuses
Do you handle conversation history? Not really
Do you specify how Push fits in? No
Do you support federation? Yes
How mature is the technology? Very

XMPP–FTW

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Do you do HTTP/1? HTTP/2? WebSockets? non-HTTP?
What protocol? SIP? XMPP? Custom? Something else?
Is it an open standard, proprietary open API, or closed?
What are your identifiers? XMPP JIDs
How stateful is your connection? Very
What payload encoding? JSON
What session descriptors? Jingle
How extensible do you make it? Very
Do you do end-to-end crypto? Competing XEPs
Do you support group conversations? Via MUCs
Do you handle conversation history? Competing XEPs
Do you specify how Push fits in? Yes, as of Mar 2015
Do you support federation? Yes
How mature is the technology? Very

Matrix

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Do you do HTTP/1? HTTP/2? WebSockets? non-HTTP?
What protocol? SIP? XMPP? Custom? Something else?
Is it an open standard, proprietary open API, or closed?
What are your identifiers? 3rd party IDs & Matrix IDs
How stateful is your connection? No state.
What payload encoding? JSON
What session descriptors? SDP (ORTC in future?)
How extensible do you make it? Extensible data
Do you do end-to-end crypto? Per-room
Do you support group conversations? Yes
Do you handle conversation history? Yes
Do you specify how Push fits in? Yes
Do you support federation? Yes
How mature is the technology? Beta

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Server–Server Signalling

Is it similar complexity to client–server or heavier?
Is compulsorily encrypted?
Does it have cryptographically strong IDs?
Does it track reputation or trust?
Does group traffic fan out (multicast)?
Is history decentralised?
Is history tamper-resistent?

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SIP-over-WebSockets (S2S)

Is it similar complexity to client-server or heavier?
Is compulsorily encrypted? No
Does it have cryptographically strong IDs? No
Does it track reputation or trust? No
Does group traffic fan out (multicast)? No
Is history decentralised? No
Is history tamper-resistent? No

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XMPP-FTW (S2S)

Is it similar complexity to client-server or heavier?
Is compulsorily encrypted? Since May 2014
Does it have cryptographically strong IDs? With XEPs
Does it track reputation or trust? No
Does group traffic fan out (multicast)? No
Is history decentralised? Only on FMUC XEP
Is history tamper-resistent? Only on FMUC XEP

Matrix Federation

Is it similar complexity to client-server or heavier?
Is compulsorily encrypted? Yes
Does it have cryptographically strong IDs? Yes
Does it track reputation or trust? Perhaps
Does group traffic fan out (multicast)? Real soon now
Is history decentralised? Yes
Is history tamper-resistent? Yes

Architecture

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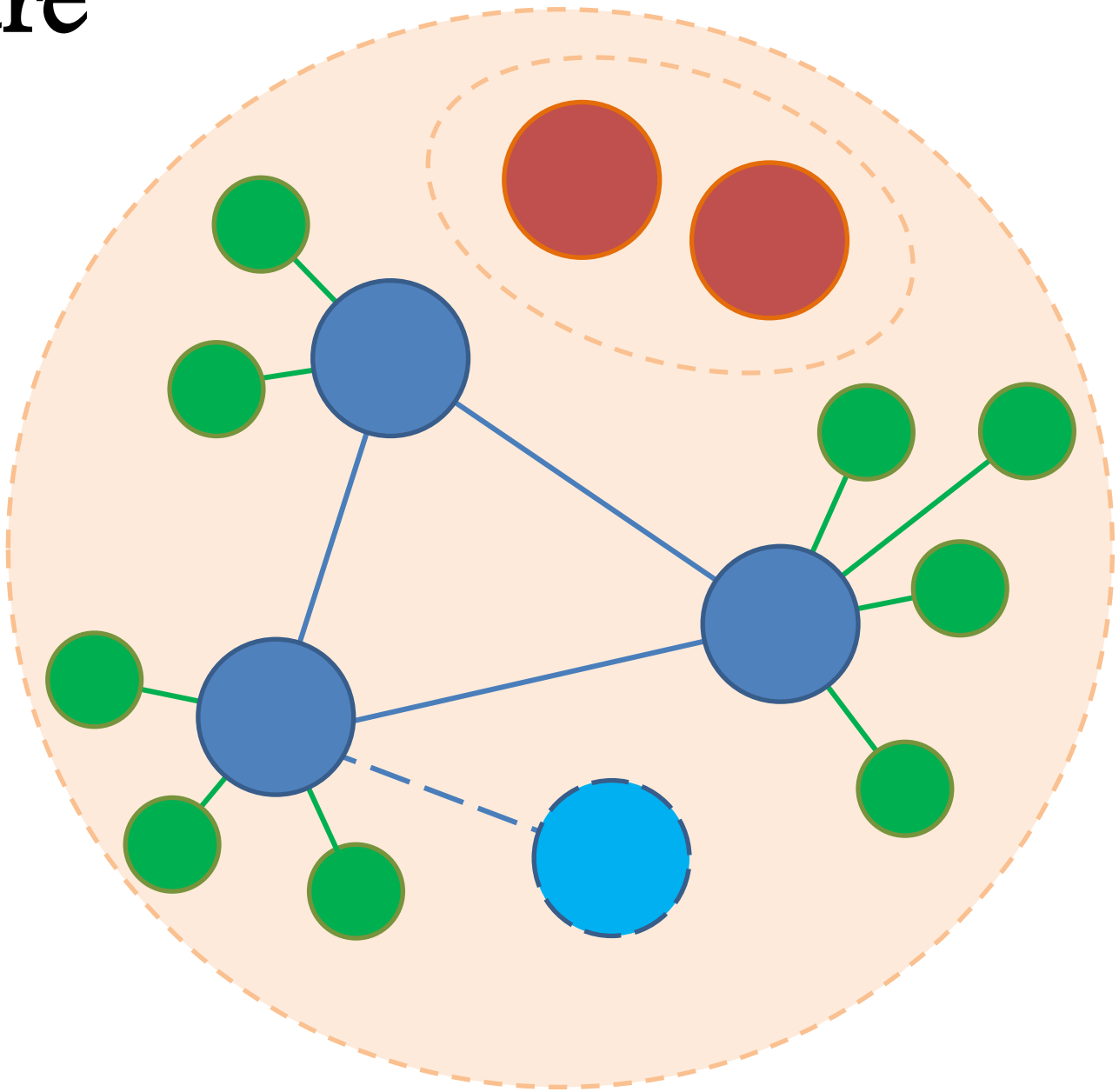
Clients

Home Servers

Identity Servers

Application Services



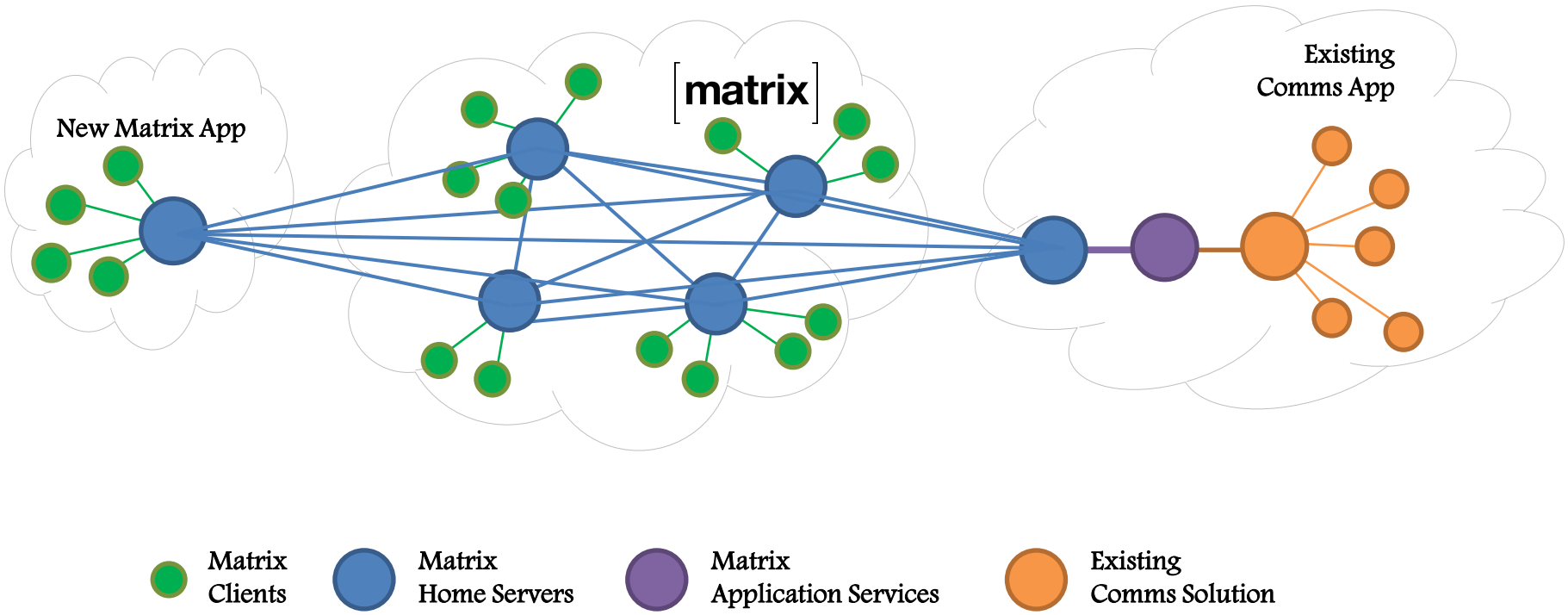
[matrix]

Open
Decentralised
Persistent
Eventually Consistent
Cryptographically Secure
Messaging Database
with JSON-over-HTTP API.

Federation Demo

https://matrix.org

Architecture (Bridging)



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OpenWebRTC

Dangerous Demo!!!

The client–server API

To send a message:

```
curl -XPOST -d '{"msgtype":"m.text", "body":"hello"}'
"https://alice.com:8448/_matrix/client/api/v1/rooms/ROOM_
ID/send/m.room.message?access_token=ACCESS_TOKEN"
```

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

The client–server API

To set up a WebRTC call:

```
curl -XPOST -d '{\
  "version": 0, \
  "call_id": "12345”, \
  "offer": {
    "type" : "offer”,
    "sdp" : "v=0\r\no=- 658458 2 IN IP4 127.0.0.1…"
  }
}'
"https://alice.com:8448/_matrix/client/api/v1/rooms/ROOM_ID/send/m.call.invite?access_token=ACCESS_TOKEN"

{ "event_id": "ZruiCZBu” }
```

The client–server API

To persist some MIDI:

```
curl -XPOST -d '{\
    "note": "71",\
    "velocity": 68,\
    "state": "on",\
    "channel": 1,\
    "midi_ts": 374023441\
}'
"https://alice.com:8448/_matrix/client/api/v1/rooms/ROOM_
ID/send/org.matrix.midi?access_token=ACCESS_TOKEN"

{ "event_id": “ORzcZn2” }
```

The client–server API

…or to persist some tap gestures for animating an Avatar…

```
curl -XPOST -d '{
    "thumbnail":
"http://matrix.org:8080/_matrix/content/QGtlZ2FuOm1hdHJpeC5vcmcvNupjfhmFhjxDPquSZGaGlYj.aW1hZ2U
vcG5n.png",
    "actions": [
        {"x": "0.5521607", "y": "6.224353", "t": "0.9479785"},
        {"x": "0.5511537", "y": "6.220354", "t": "0.9701037"},
        {"x": "0.5510949", "y": "6.214756", "t": "0.9804187"},
        {"x": "0.5499267", "y": "6.213634", "t": "0.9972034"},
        {"x": "0.5492241", "y": "6.210211", "t": "1.013744"},
        {"x": "0.5486694", "y": "6.206304", "t": "1.030284"},
        {"x": "0.5482137", "y": "6.201648", "t": "1.046764"},
...
        {"x": "0.9997056", "y": "4.022976", "t": "8.970592"},
        {"x": "0.9995697", "y": "4.043199", "t": "8.987072"}
    ]
}'
"https://alice.com:8448/_matrix/client/api/v1/rooms/ROOM_ID/send/org.matrix.demos.unity.stickme
n?access_token=ACCESS_TOKEN"

{ "event_id": “ORzcZn2” }
```

The server–server API

```
curl -XPOST -H 'Authorization: X-Matrix origin=matrix.org,key="898be4…",sig="j7JXfIcPFDWl1pdJz…"' -d '{
    "ts": 1413414391521,
    "origin": "matrix.org",
    "destination": "alice.com",
    "prev_ids": ["e1da392e61898be4d2009b9fecce5325"],
    "pdus": [{
        "age": 314,
        "content": {
            "body": "hello world",
            "msgtype": "m.text"
        },
        "context": "!fkILCTRBTHhftNYgkP:matrix.org",
        "depth": 26,
        "hashes": {
            "sha256": "MqVORjmjauxBDBzSyN2+Yu+KJxw0oxrrJyuPW8NpELs"
        },
        "is_state": false,
        "origin": "matrix.org",
        "pdu_id": "rKQFuZQawa",
        "pdu_type": "m.room.message",
        "prev_pdus": [
            ["PaBNREEuZj", "matrix.org"]
        ],
        "signatures": {
            "matrix.org": {
                "ed25519:auto": "jZXTwAH/7EZbjHFhIFg8Xj6HGoSI+j7JXfIcPFDWl1pdJz+JJPMHTDIZRha75oJ7lg7UM+CnhNAayHWZsUY3Ag"
            }
        },
        "origin_server_ts": 1413414391521,
        "user_id": "@matthew:matrix.org"
    }]
}' https://alice.com:8448/_matrix/federation/v1/send/916d630ea616342b42e98a3be0b74113
```

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Application Services (AS)

- Extensible custom application logic
- They have privileged access to the server (granted by the admin).
- They can subscribe to wide ranges of server traffic (e.g. events which match a range of rooms, or a range of users)
- They can masquerade as 'virtual users'.
- They can lazy-create 'virtual rooms'
- They can receive traffic by push.

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Uses for AS API

- Gateways to other comms platforms
- Data manipulation
  - Filtering
  - Translation
  - Indexing
  - Mining
  - Visualisation
  - Orchestration
- Application Logic (e.g. bots, IVR services)
- …

The application service API

Register the AS with the homeserver (this actually is turning into HS config):

```
curl -XPOST -d \
'{
   "as_token":"TOKEN",
   "url":"http://localhost:5000",
   "namespaces":{
     "aliases":[{"regex": "#logged_.*", "exclusive": false}]
   }
 }' \
 "https://alice.com:8448/_matrix/appservice/v1/register"
```

The application service API

Receive events from the homeserver:

```
import json, requests  # we will use this later
from flask import Flask, jsonify, request
app = Flask(__name__)

@app.route("/transactions/<transaction>", methods=["PUT"])
def on_receive_events(transaction):
    events = request.get_json()["events"]
    for event in events:
        print "User: %s Room: %s" % (event["user_id"], event["room_id"])
        print "Event Type: %s" % event["type"]
        print "Content: %s" % event["content"]
    return jsonify({})

if __name__ == "__main__":
    app.run()
```

Current Progress

- Funded May 2014
- Launched alpha Sept 2014
- Entered beta Dec 2014
- May 2014: v1.0 release?!
- Remaining:
  - Performance improvements in reference impls
  - Build more gateways
  - Finalise spec
  - End-to-End Encryption
  - v2 Client-Server API

Won **Audience Choice** & Best Social Integration awards at WebRTC Expo 2014 and **Best Innovation** at WebRTC Paris 2014

We need help!!

- We need partners to participate in Matrix.
- We need people to run their own servers and join Matrix.
- We need feedback on the APIs.
- We need more people to actually use it!

http://matrix.org

THANK YOU!

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