

# Matrix: An open network for secure, decentralized communication

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Sumner Evans

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Beeper

## A bit about me

- I graduated in 2018 with my bachelor's in CS from Mines.
- I graduated in 2019 with my master's in CS, also from Mines.
- I worked at The Trade Desk for two years right after graduating.
- I currently am teaching *CSCI 400 Principles of Programming Languages* and I have previously taught *CSCI 406 Algorithms* and *CSCI 564 Advanced Computer Architecture*.
- I started at Beeper in July.

# A bit about you

I'd like to get to know everyone a bit more and get a feel for everyone's experience levels.

- How many of you have taken Algorithms?
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- How many of you have taken Intro to Computer Science?
- How many of you are in the ACM Matrix club?

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# Overview

1. Why Matrix?
2. What does Matrix provide?
3. How does it work?
4. What does Beeper do?
5. Things that I'm excited about in Matrix
6. How to get involved with Matrix
7. A few general tips for everyone

# Why Matrix?

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# Let's talk about chat platforms...

Which of the following chat networks do you use/have you used?

- SMS/MMS
- iMessage
- LinkedIn
- Snapchat
- WhatsApp
- Instagram
- Discord
- Facebook Messenger
- Hangouts
- Slack
- Microsoft Teams
- Signal
- Telegram
- Wire

What do all of these chat networks have in common?

They are **non-interoperable, and many are closed source and/or unencrypted.**

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The **closed source** platforms are problematic because you can never be sure *how your data is being used*.

The **unencrypted** platforms are problematic because your messages are not private.

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# What does Matrix provide?

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# Matrix solves all your problems

Matrix is an **open** specification for **encrypted, decentralized** communication.

It is also designed in such a way that it makes it easy to break down walled garden communication platforms via **bridging**.

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## A side note

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I first became interested in Matrix when I was the incoming Chair of ACM. Robby (VC) and I tried out most of the open source chat platforms and ended up landing on Matrix because it had all of these characteristics.

# Matrix is an *open specification*

Open specifications and standards are all around you. They just make sense™.

Examples:

- Power plugs
- USB
- Wi-Fi
- Every crypto algorithm that's any good

Open protocols allow for *open development* and *clean-room implementations*, they *encourage competition*, and are *externally auditable*.

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## Matrix is *encrypted* by default\*

Matrix has encryption built-in. It is implemented using Olm, which is a clone of the Signal protocol

## Matrix is *decentralized*

The Matrix architecture is actually a *federated* architecture.

Individual devices communicate to a *homeserver* which anyone can host.

The homeserver communicates with other homeservers in the federation.

Think of it like email. You can email somebody using Outlook from Gmail.\*

Every server in the federation gets a copy of a room, so no one entity controls the network.

This also means that the network is resilient to individual server outages, or even wider internet outages.

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Bridges bring external chat networks into Matrix. More on this later.

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# How does it work?

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The architecture of  
eventual consistency



# Federation (Server-Server) API

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# A bit of graph theory

DAG



# A bit of software engineering

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Git

# The event DAG

## State events

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# What does Beeper do?

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## Things that I'm excited about in Matrix

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\* Obviously excited about bridges \* Excited about possibilities with bots \* Excited about possibilities of building on top of Matrix. For example, matrix notepad and matrix board \* Excited about spaces and the potential for better community management

# How to get involved with Matrix

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**A few general tips for everyone**

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