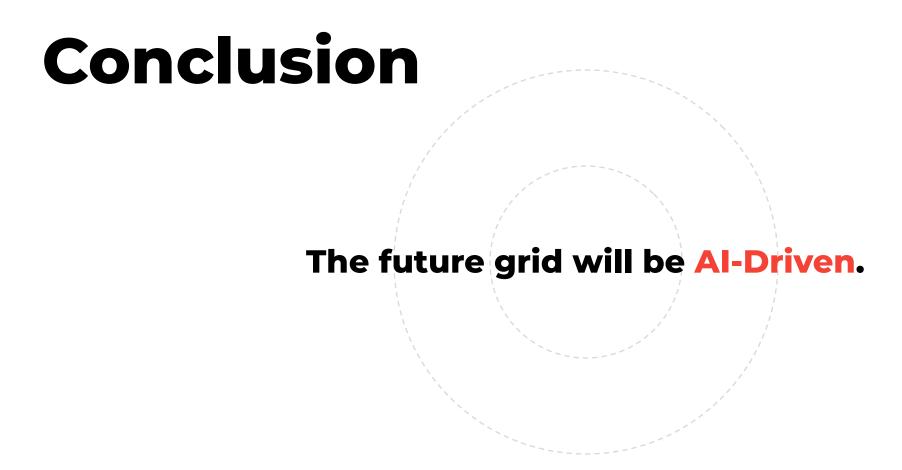
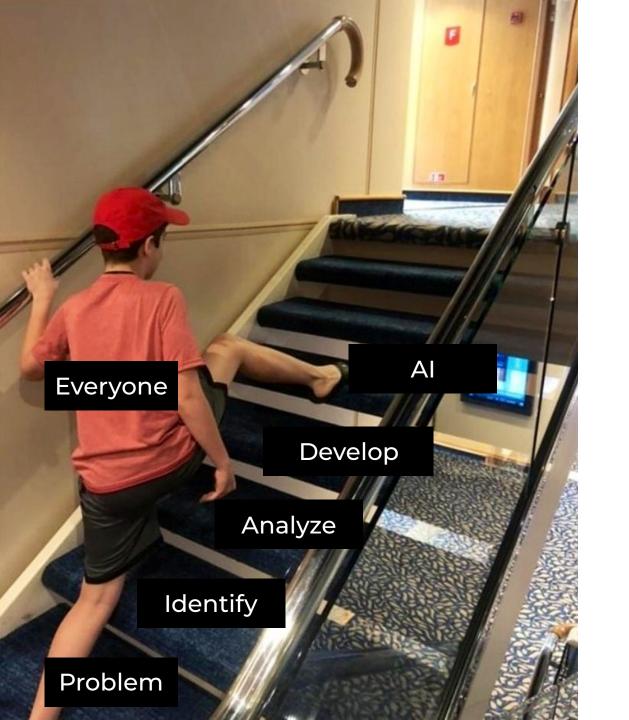
ETX Simulation Framework

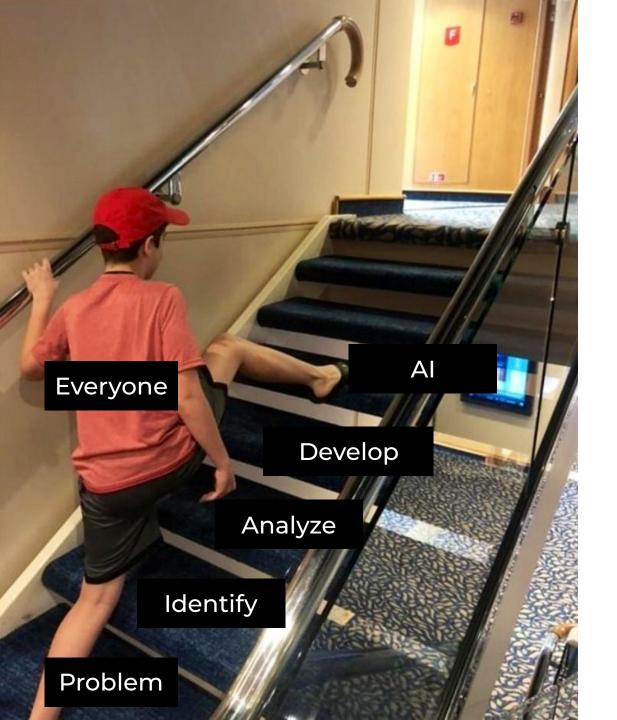
white paper

CCECE 2019

Steven Zhang shidal@ualberta.ca

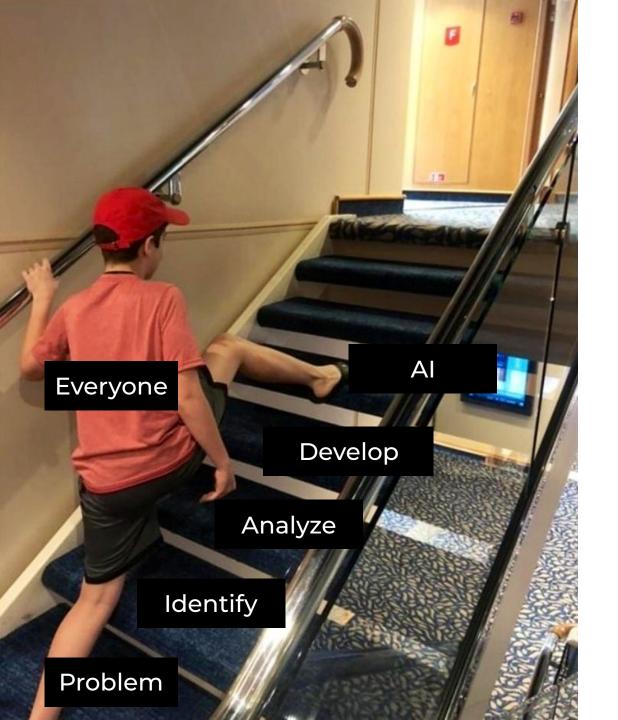






Al is not

An excuse to skip engineering



Al is not

An excuse to skip engineering

Al is

Another option to solve certain types of problems

Requires knowledge, expertise, and LOTS of experimentation

Problem

There will be a huge influx of DERs

Problem



Localization

As DER penetration increases, grid violations become highly localized.



Mobile Electricity

Electric vehicles will make electricity mobile and far less predictable.



Transience

Grid becomes more sensitive to weather, mobility, etc. Day-ahead planning becomes ineffective.



Energy Management

Far too complex for most people. "Expert" designed systems do not scale. Demand response programs not precise and too forceful.

Problem

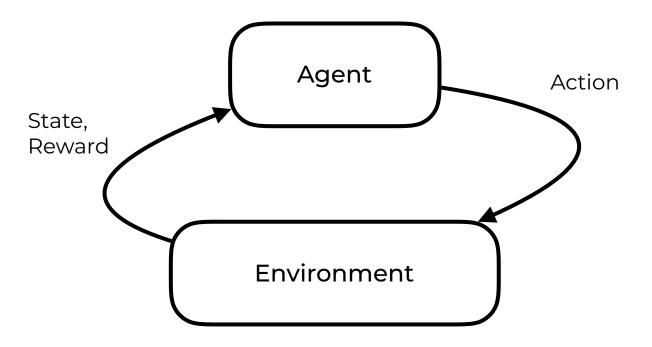
How to effectively utilize DERs?

Agents

Learn the optimal interaction model in the environment



Learn the optimal interaction model in the environment



Agents

Learn the optimal interaction model in the environment

Markets

Access to other DERs.
Localized price signals
for both the value of
energy and the impact
on the grid.

Agents

Learn the optimal interaction model in the environment

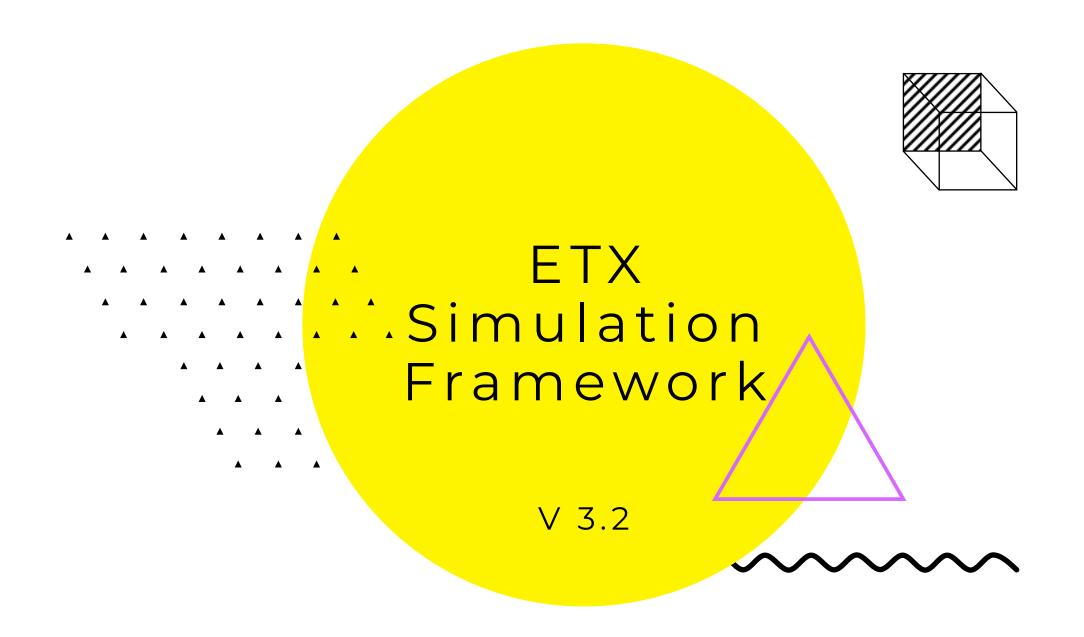
Markets

Access to other DERs.
Localized price signals
for both the value of
energy and the impact
on the grid.

Environment

Enables agents to learn how their actions affect the market and the grid.

Environment



ETX



Originally designed for engineering Transactive Energy markets.



Used a ledger system called Energy Tokens, hence ETX

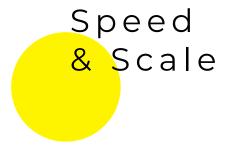


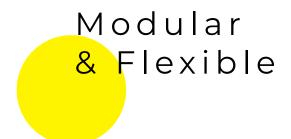
The hyper-interconnected nature between users, market, and power made it unsatisfactory to study from just a market perspective



Scoped expanded to be a fully modular simulation environment with a focus on Al development.

Highlights



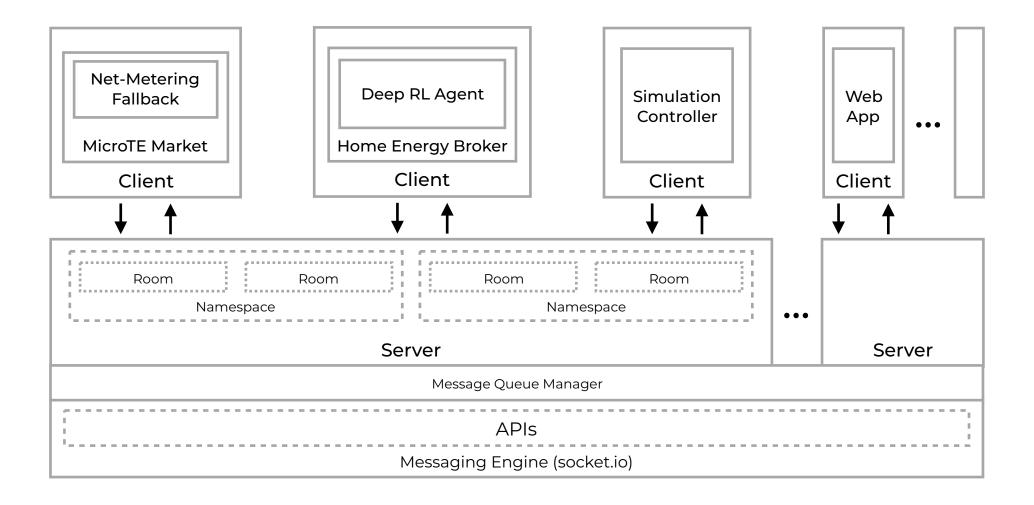




Can handle millions of agents while keeping simulation time complexity constant.

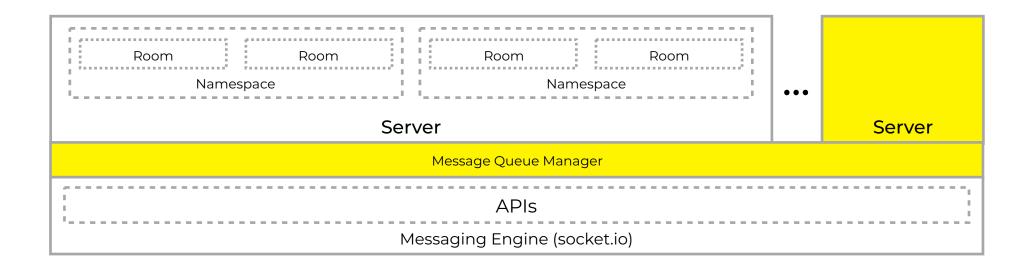
Supports any combination of client modules. New modules should be simple to develop and integrate.

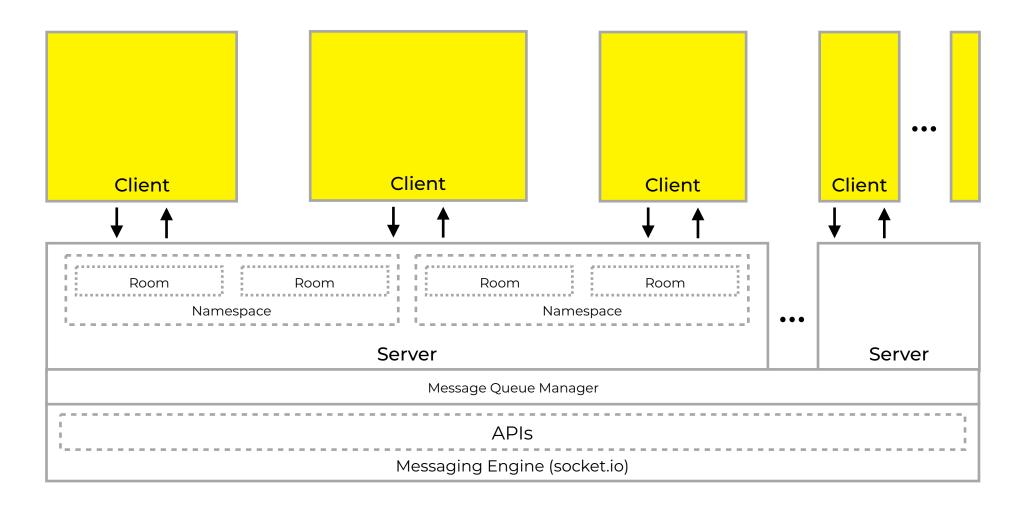
Code written for simulations should be deployable in the real world with minimal changes.

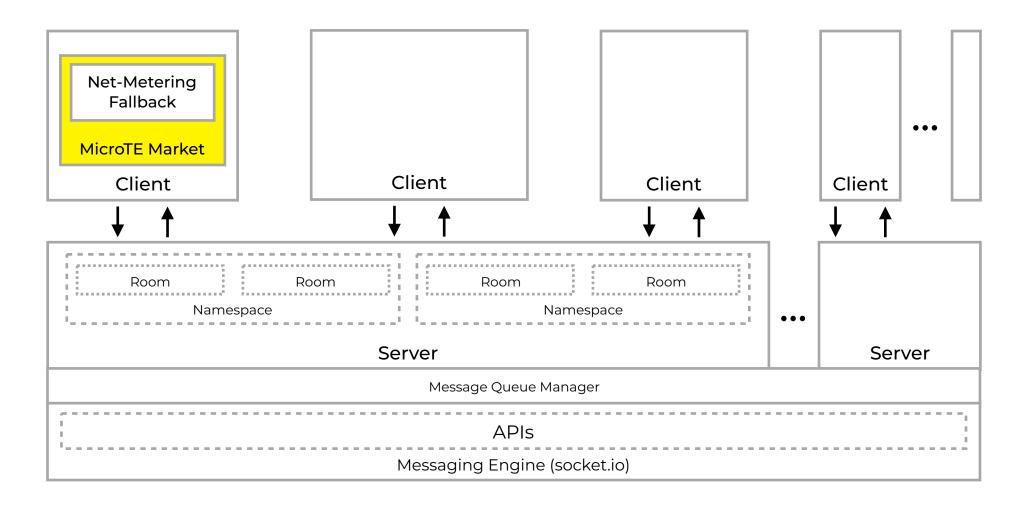


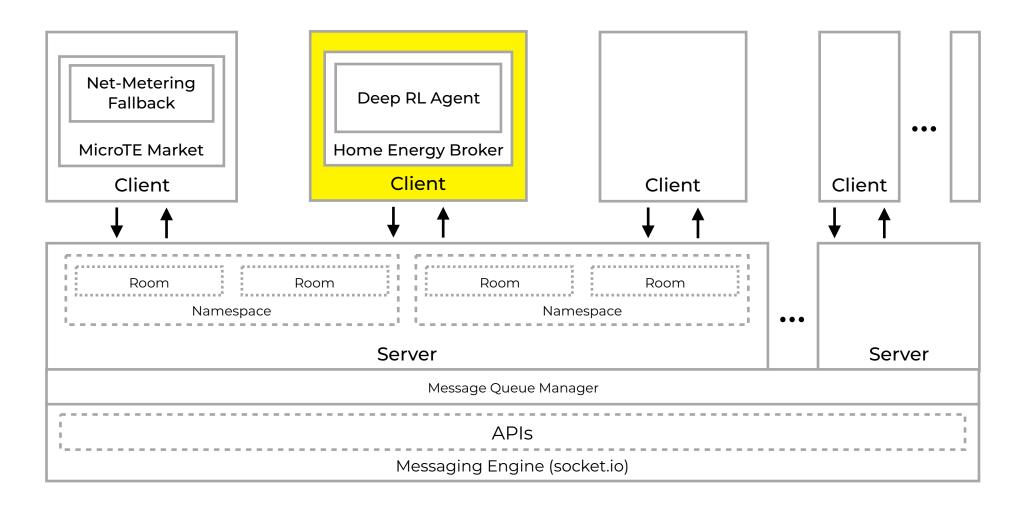
		c				
Room	Room		Room	Room		
Namespace			Namespace			
Server						

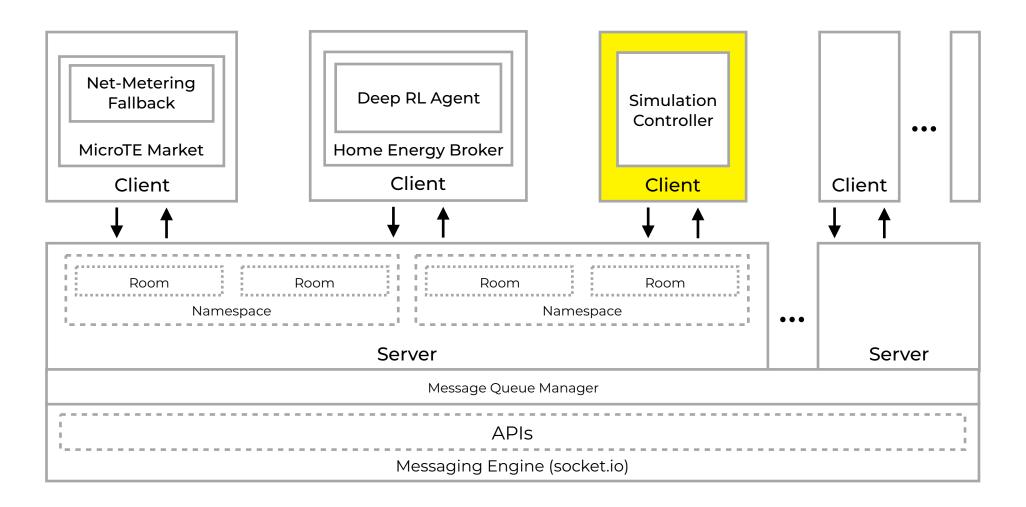
		,				
APIs						
Messaging Engine (socket.io)						

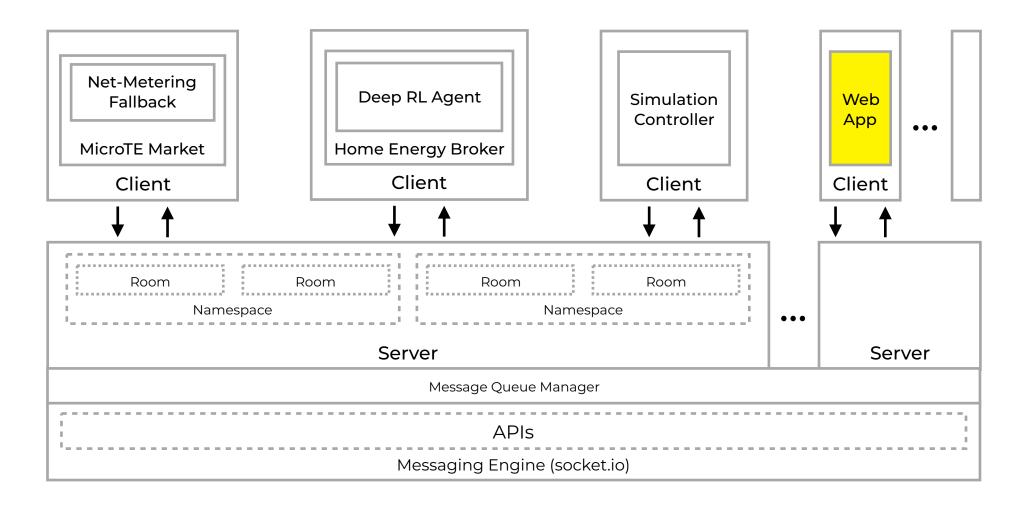


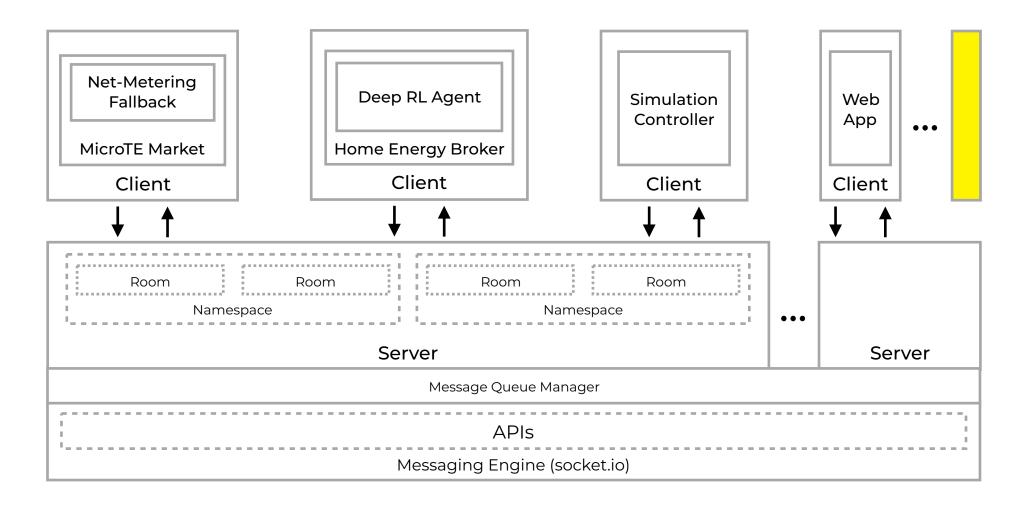






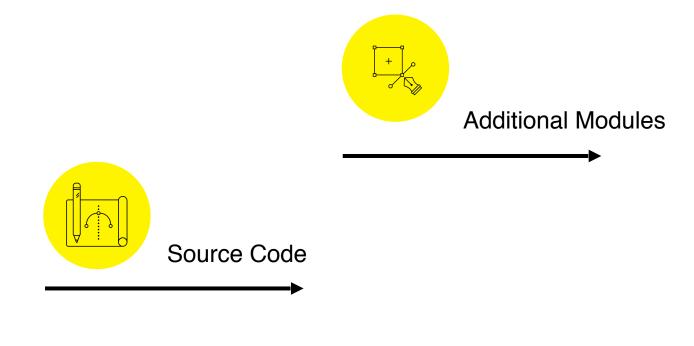


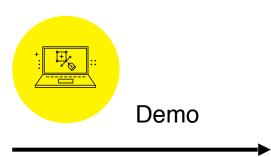


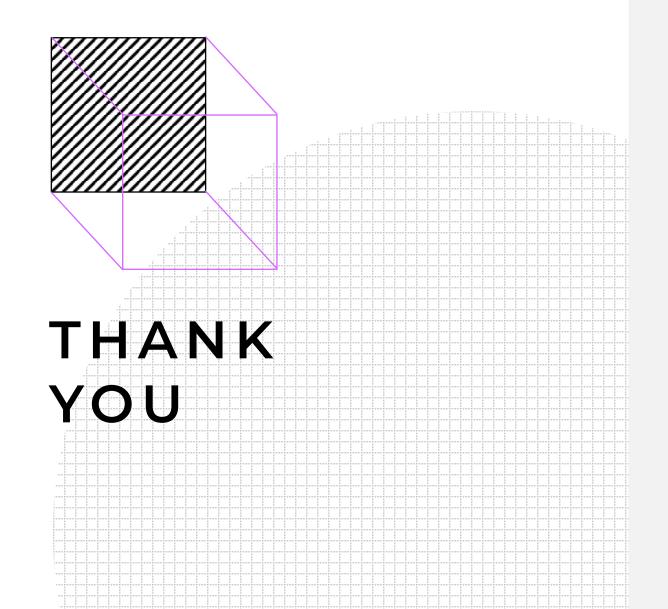


Open Source

Timeline







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