## **Kind of a brief history:**

This started out with dynamic route optimization in an intelligent transportation system (ITS).

From there:

* Blockchain infrastructure
* Data collection/infrastructure
* Incentive mechanisms
* Integration with AI and ML

Thoughts on SUMO and other simulators

* Initial idea was to use SUMO to test placement strategies for edge computing placement in an urban environment ITS. That is, where are best/optimal counts and placements of edge computing?
* It is open source and models realistic traffic simulation. It supports integration with Python for ML model testing
* OMNet++ is a network simulator that can be used to model communication between vehicles and edge nodes.

Latest approach includes Dynamic Identity Management

* Uses cryptographic mechanism to generate time-limited pseudonym
* Uses ZKP to verify that the pseudonym is derived from a valid vehicle identity without revealing the original
* Temporary identity mappings are stored in a private blockchain ledger for auditing

## **What it’s migrated to:**

Overall approach: authentication that uses ZKPs and One-Time Passwords to ensure privacy is preserved in V2I communication. It also has extensions for dynamic identity management and possibly sustainability metrics

SUMO is used for traffic simulation

Mininet is used for network simulation: https://mininet.org/

Blockchain is used for secure logging

Ganache used for local blockchain development with Ethereum

Truffle is used to compile and deploy a smart contract, which is used to log vehicle identity transitions on the blockchain

Python library web3 is used for interacting with Ethereum

## What we have to do:

1. Install SUMO and required python libraries (e.g. TraCI, Traffic Control Interface)
   1. https://eclipse.dev/sumo/
2. Create a basic road network with SUMO
   1. https://www.openstreetmap.org/#map=5/38.01/-95.84
3. Add dynamic identity management during the simulation
4. Run the simulation
5. Analyze: measure time taken to generate and log identities. Also validate identity transitions, test for scalability by adding higher numbers of vehicles, measure performance in terms of latency and usage of resources.

**Things for the students to learn:**

* SUMO simulator
* Mininet simulator
* Python
* ZKP authentication
* One-time passwords
* Blockchain
* Ganache
* Truffle
* Web3
* TraCI

Our week 1 pre-wednesday tasks:

* Send the students copy of the paper
* Send them links to various youtube tutorials
* Send them links to SUMO, Mininet, etc.

Week 1 tasks:

* Watch youtube tutorials to learn about SUMO
* Watch youtube tutorials to learn about Mininet
* Explore how Mininet and SUMO can be configured to work together
* Try to build a SUMO simulation - interaction with roadside units (RSUs)
* Try to build a Mininet simulation - similar interaction
* Try to make them talk in whatever fashion

Week 2 tasks:

Week 3 tasks: