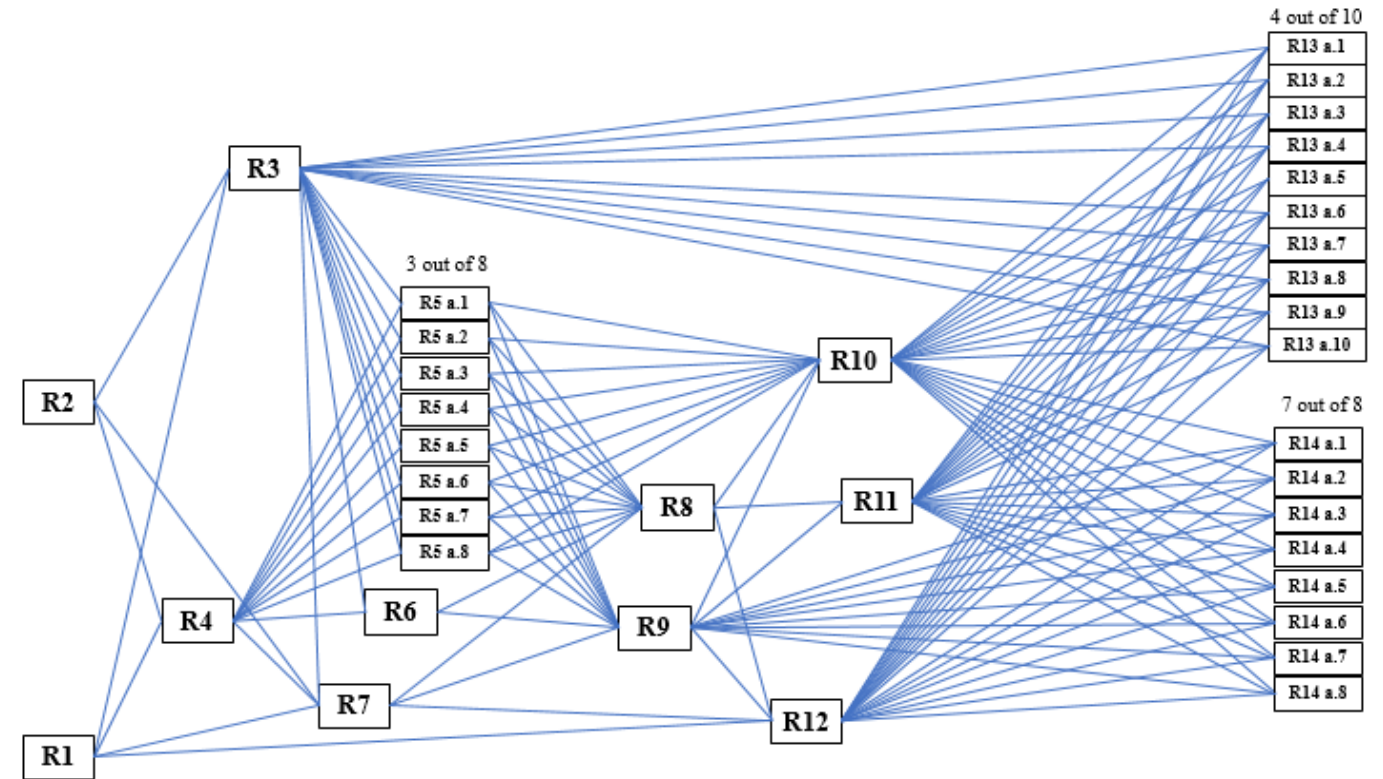


# Reliability Analysis

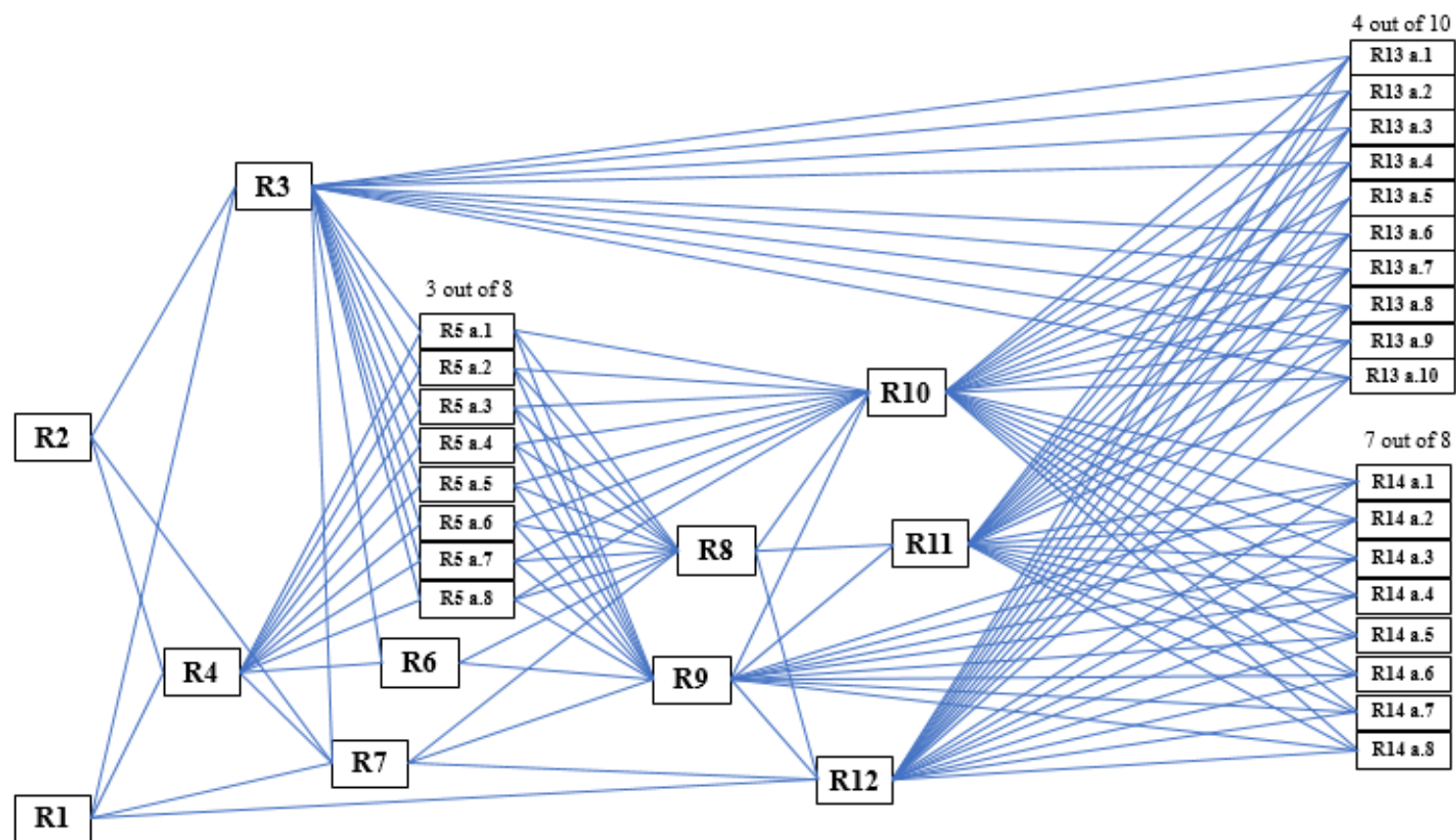
Implementation of a novel combinatorial algorithm in conditional and redundancy systems using advanced computational techniques



Jesus Olivera, Data Analytics & Visualization Student at  
Yeshiva University /Data Engineer at IBM

In collaboration with A.O. Olivera, Mechanical & Electrical Engineering  
Student at University of Puerto Rico – Mayaguez Campus

# Introduction



# Problem Statement

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# National Laboratories

# Adrian Olivera Olivera

## Education:

- **Double BS (*In Progress*):** Mechanical and Electrical Engineering
- **Cybersecurity Certification (2019):**

## Experience:

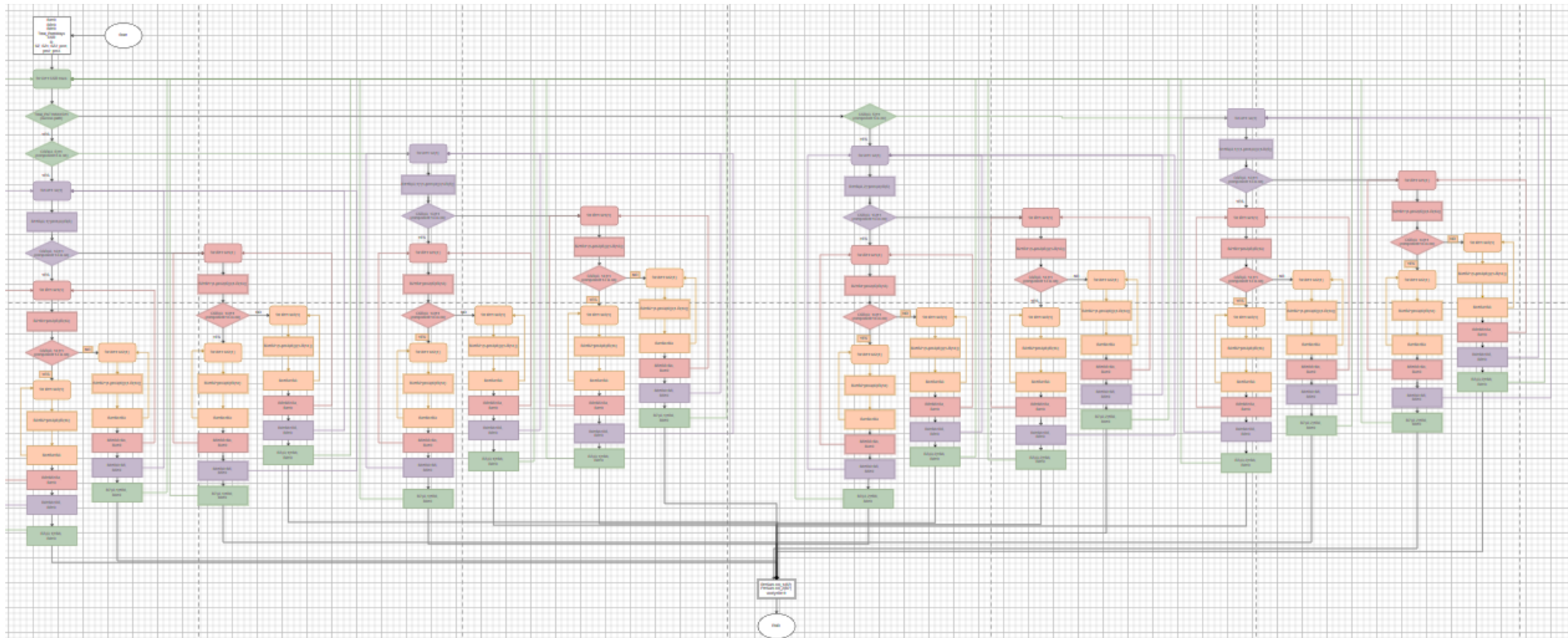
Sandia National Laboratory (2018, 2019, 2021), Army Research Laboratory, NASA, Lilly Del Caribe, Pratt & Whitney

# Novel Closed Form Solutions for Hard Reliability Problems!

- Based on a novel combinatorial math method.
  - ✓ “*the right rotation method*”

[illegible]

# Objective

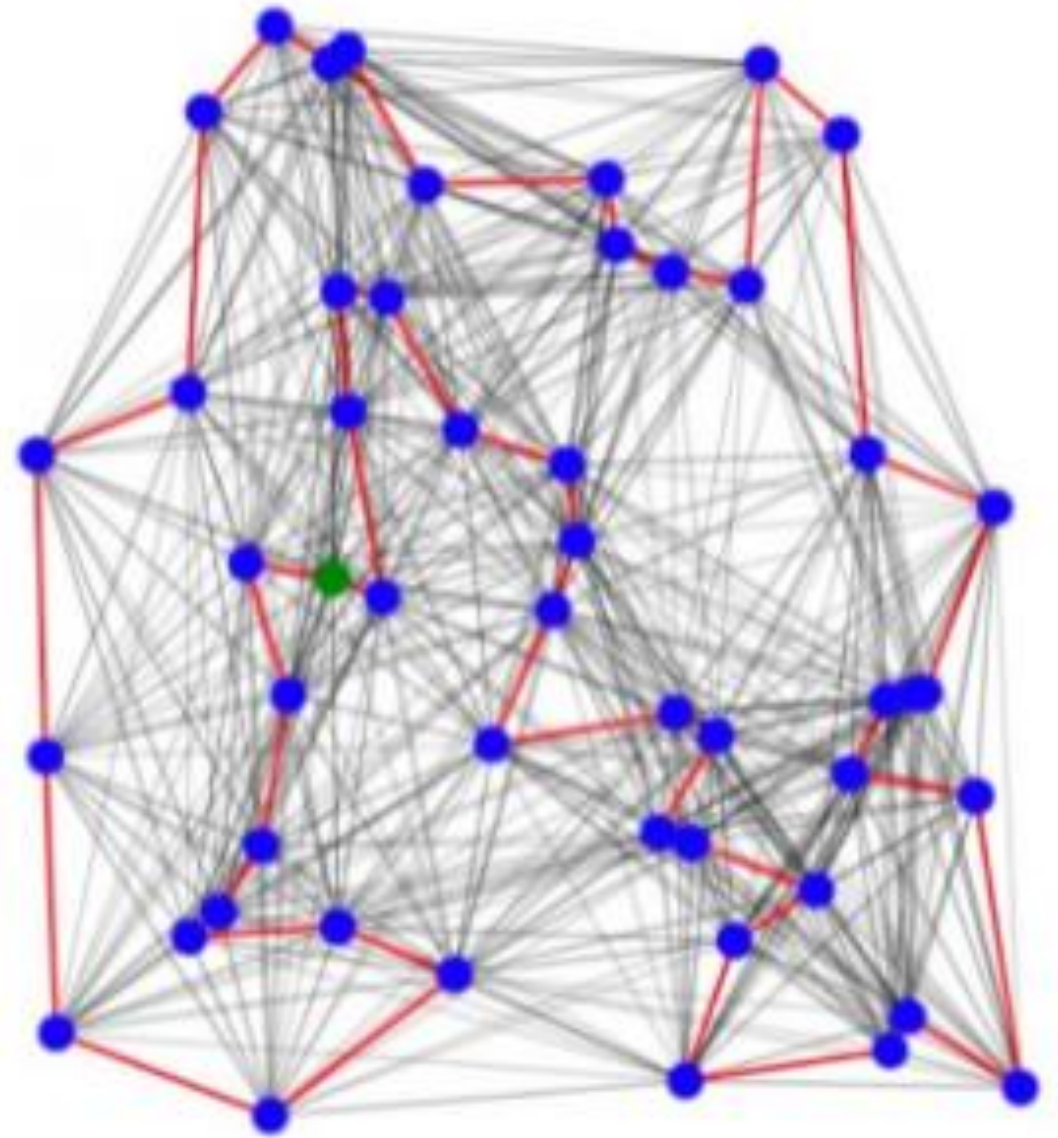




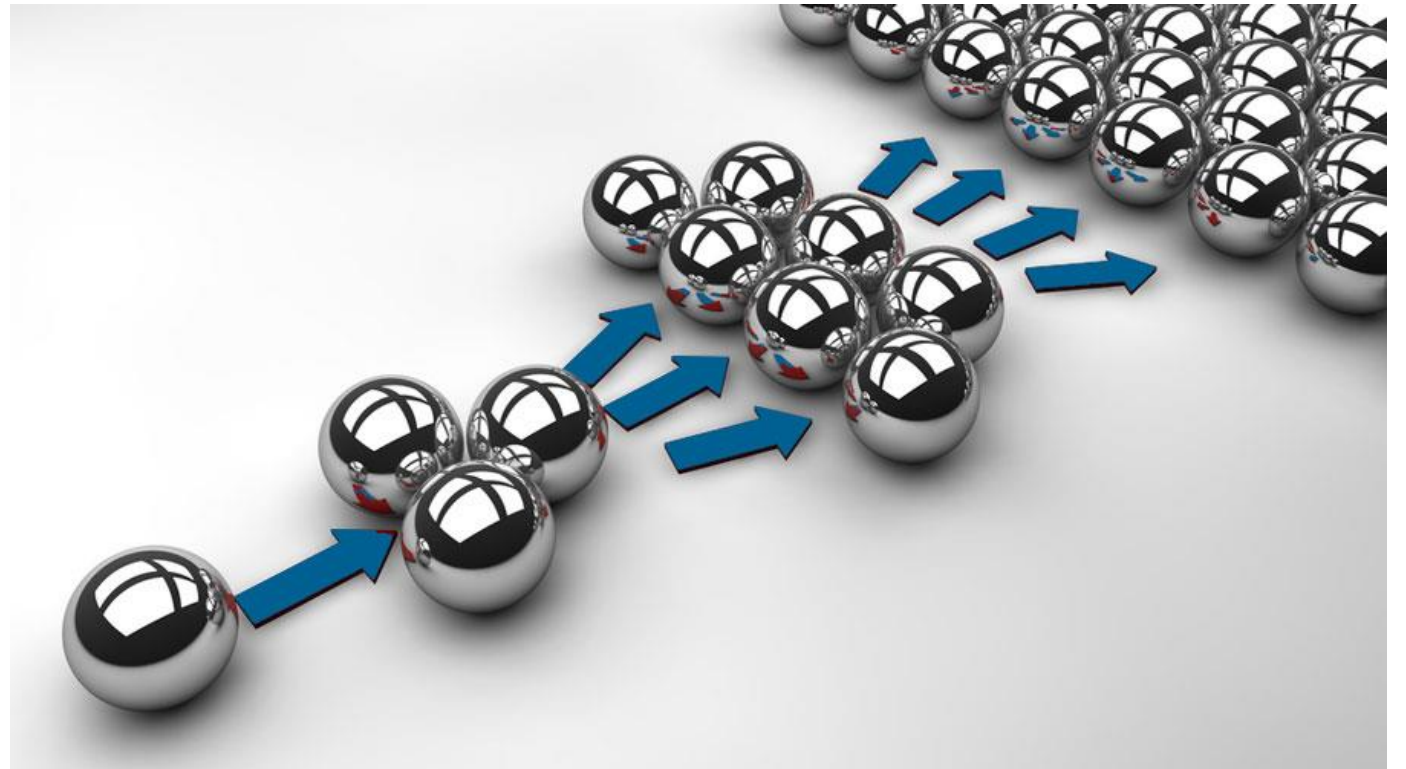
## Previous Research & Current Knowledge

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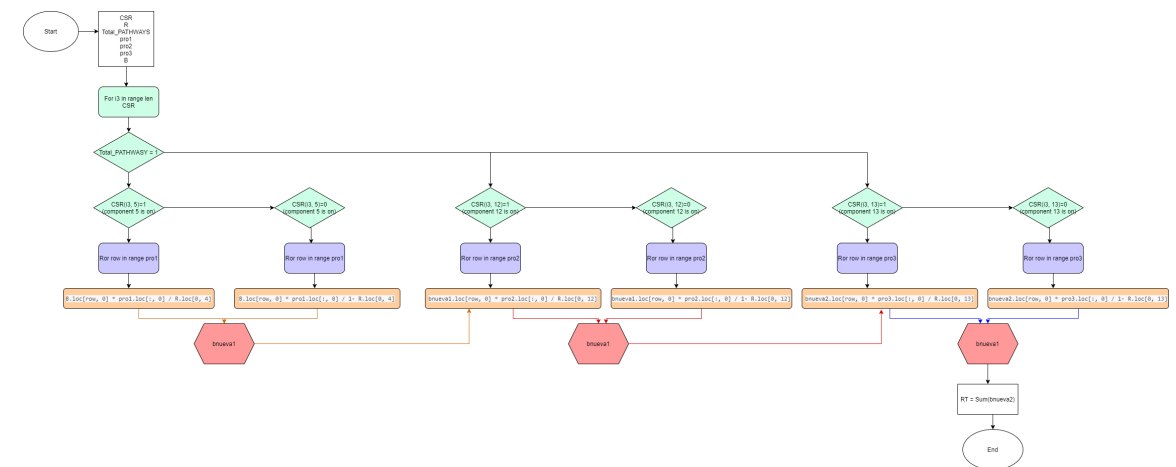
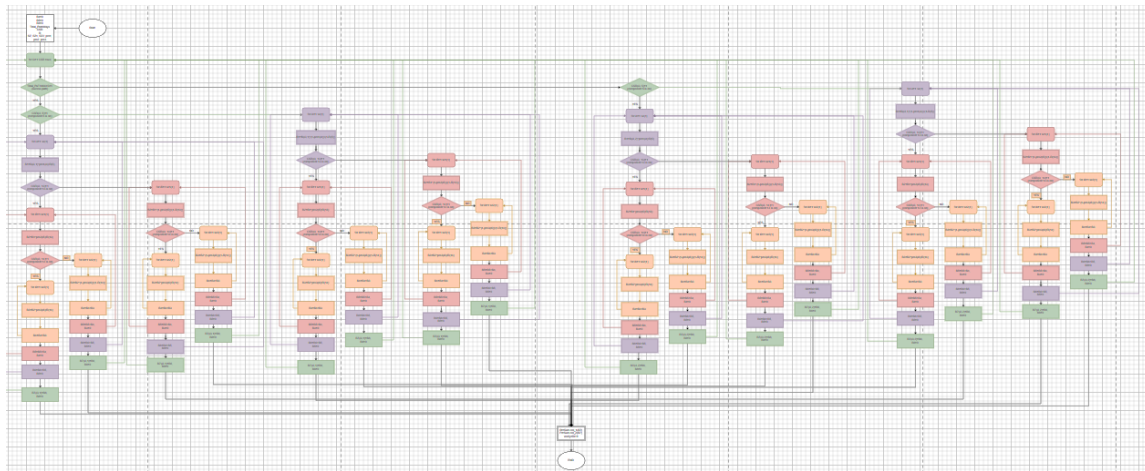
1. Overview of the conditional algorithm developed by A.O. Olivera
2. Algorithm optimization and enhancement of computational resources to solved the use case, by Jesus Olivera.



# Importance & Broader Impact



# Optimization Techniques





# Challenges & Resolutions

## Data Alignment

```
bnueva = bnueva.append(pd.DataFrame(a), ignore_index=True).replace(0, np.nan).dropna(how='all', axis=0)
```

## Profiling and Parallelism

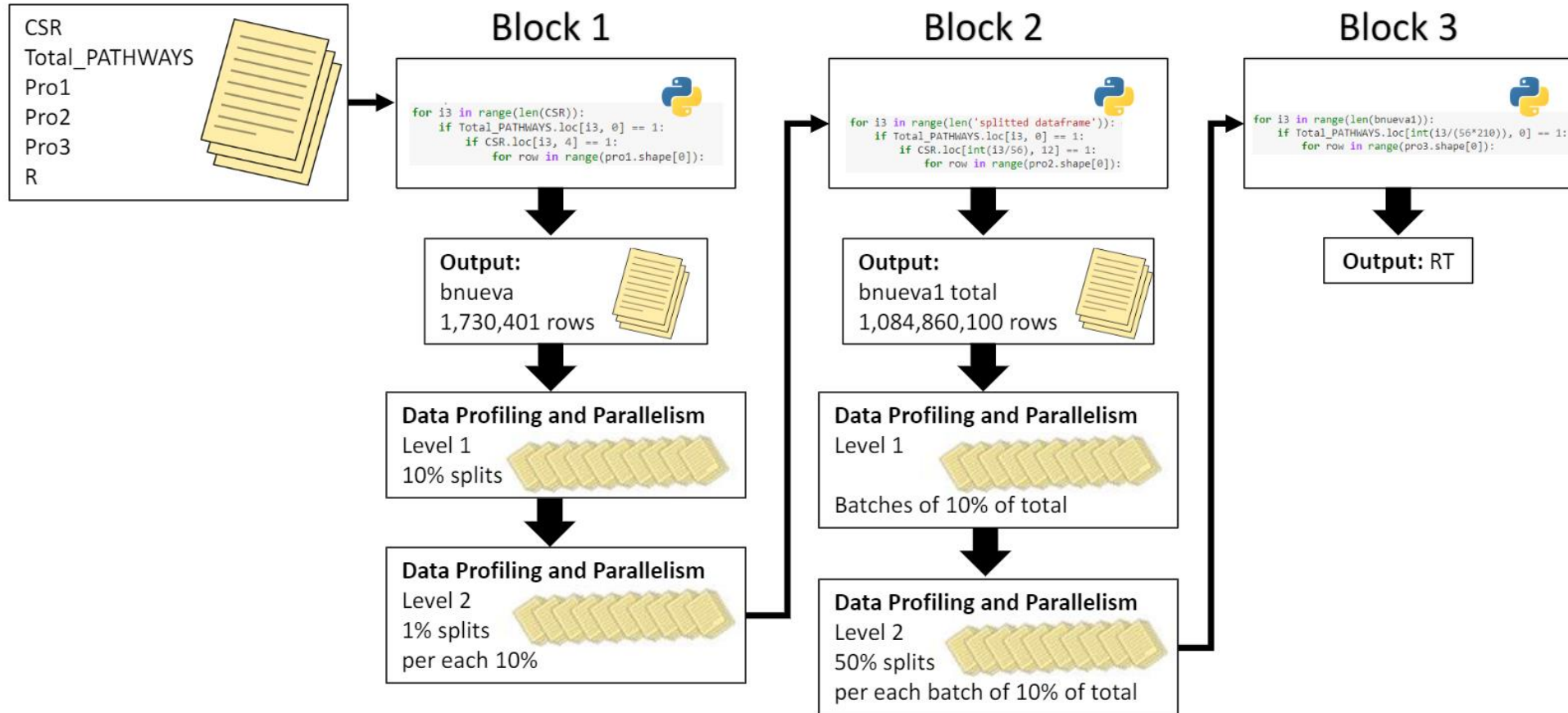
```
bnueva_A = bnueva.iloc[0:173040,:].copy().reset_index(drop=True)
```



```
bnueva_A1 = bnueva.iloc[0:1000,:].copy().reset_index(drop=True)
```

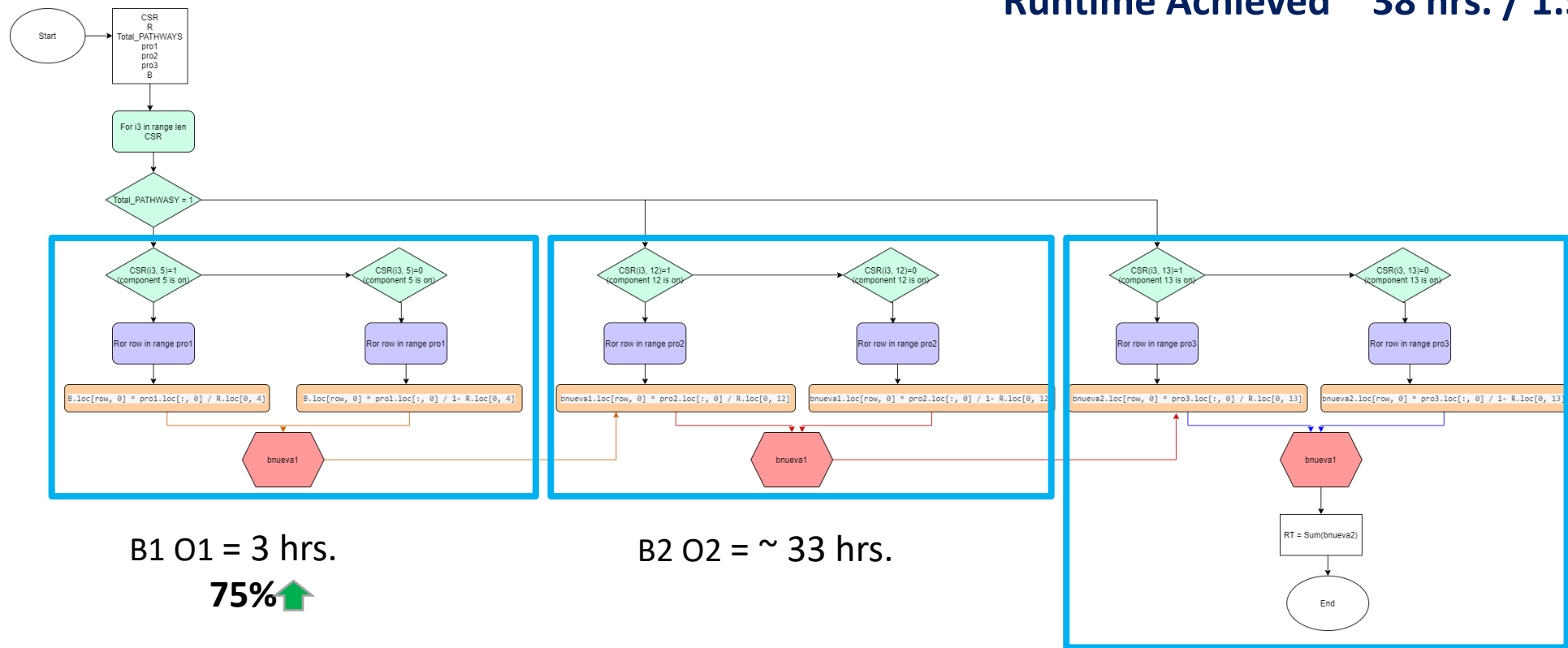
```
bnueva1 = bnueva.iloc[0:5424301,:].copy().reset_index(drop=True)  
bnueva2 = bnueva.iloc[5424301:10848602,:].copy().reset_index(drop=True)
```

# Algorithm Data Flow Diagram

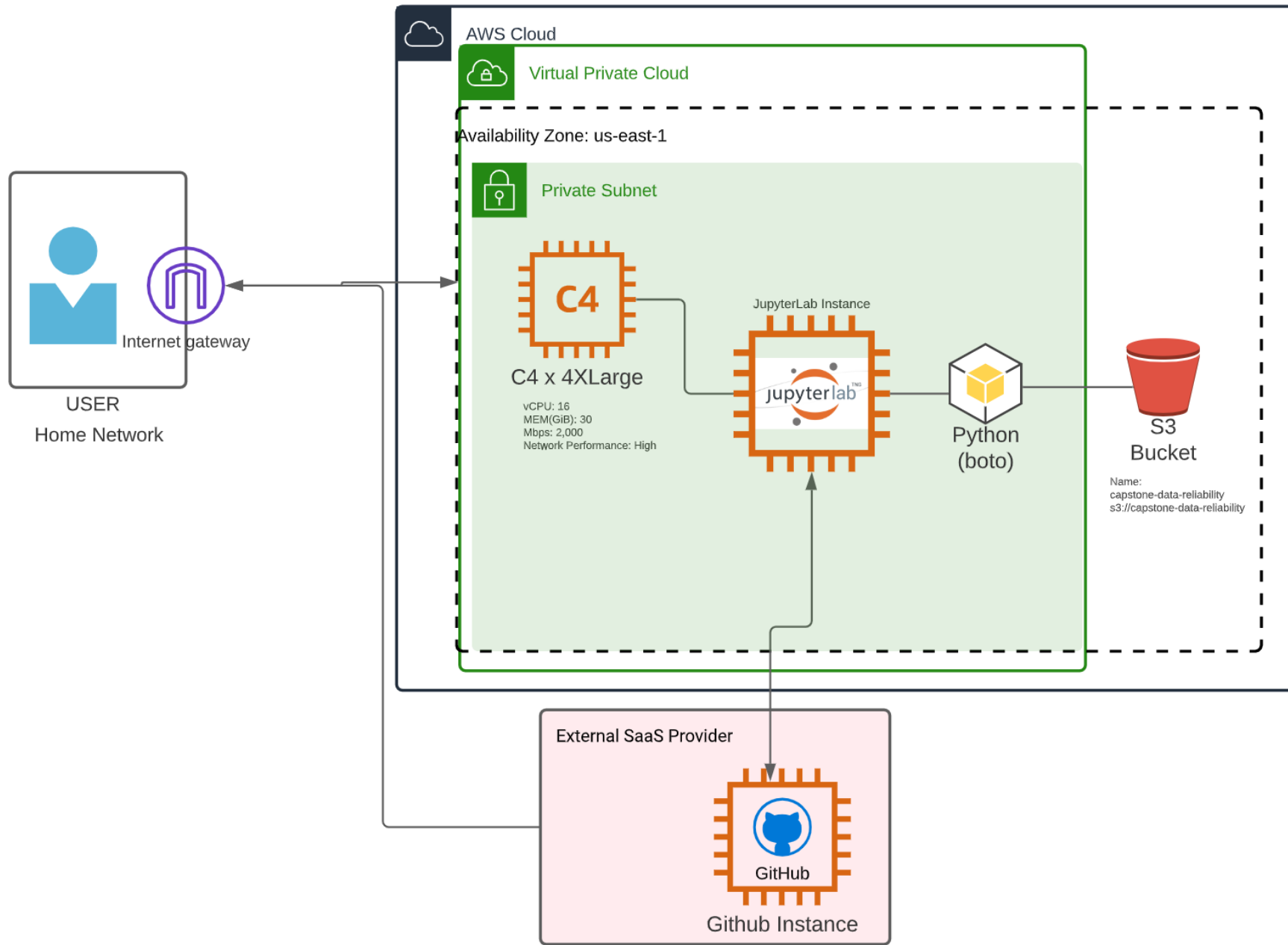


# Optimization Techniques

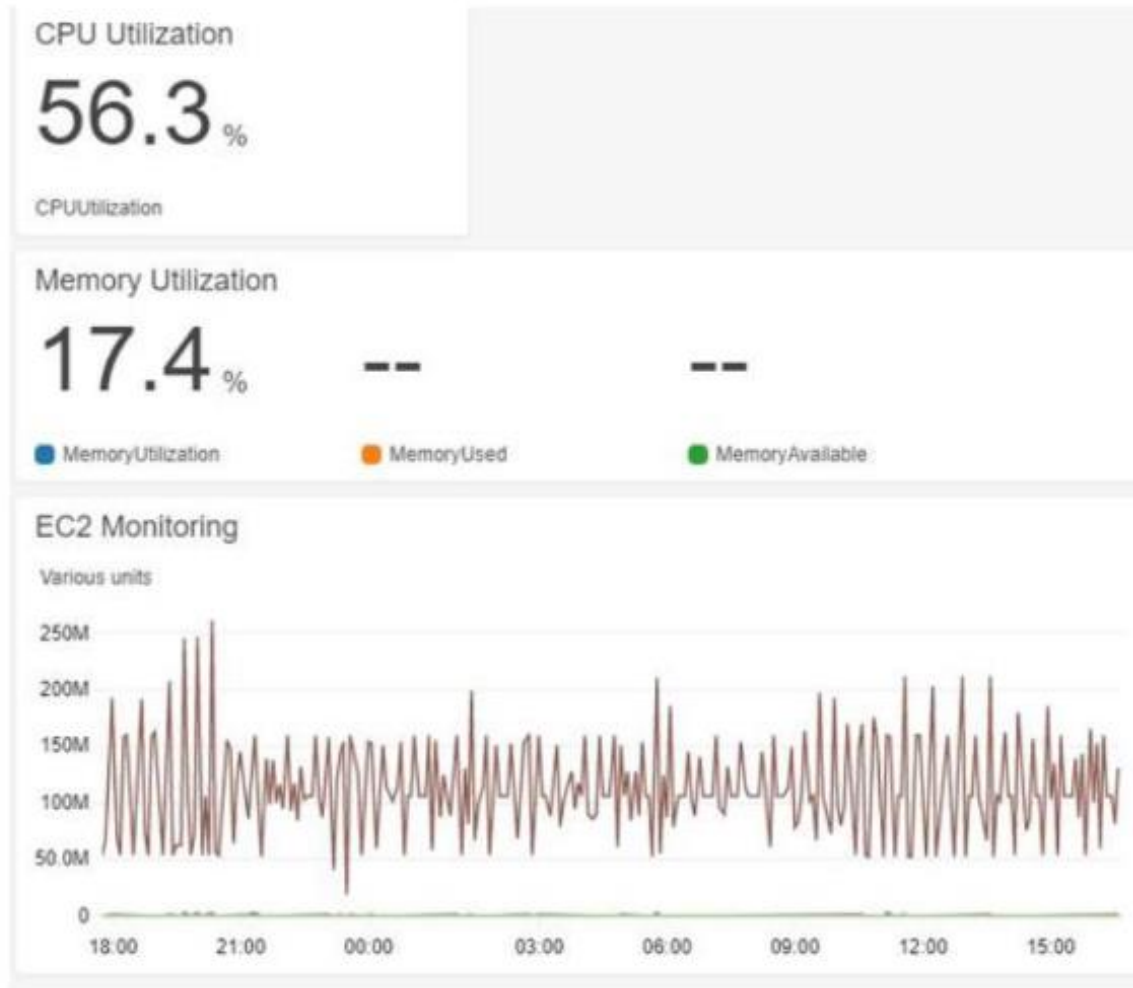
Runtime Achieved ~ 38 hrs. / 1.58 Days



# Computational Virtual Environment



## High Peak Performance



### Minimum Resources Requirements (peak)

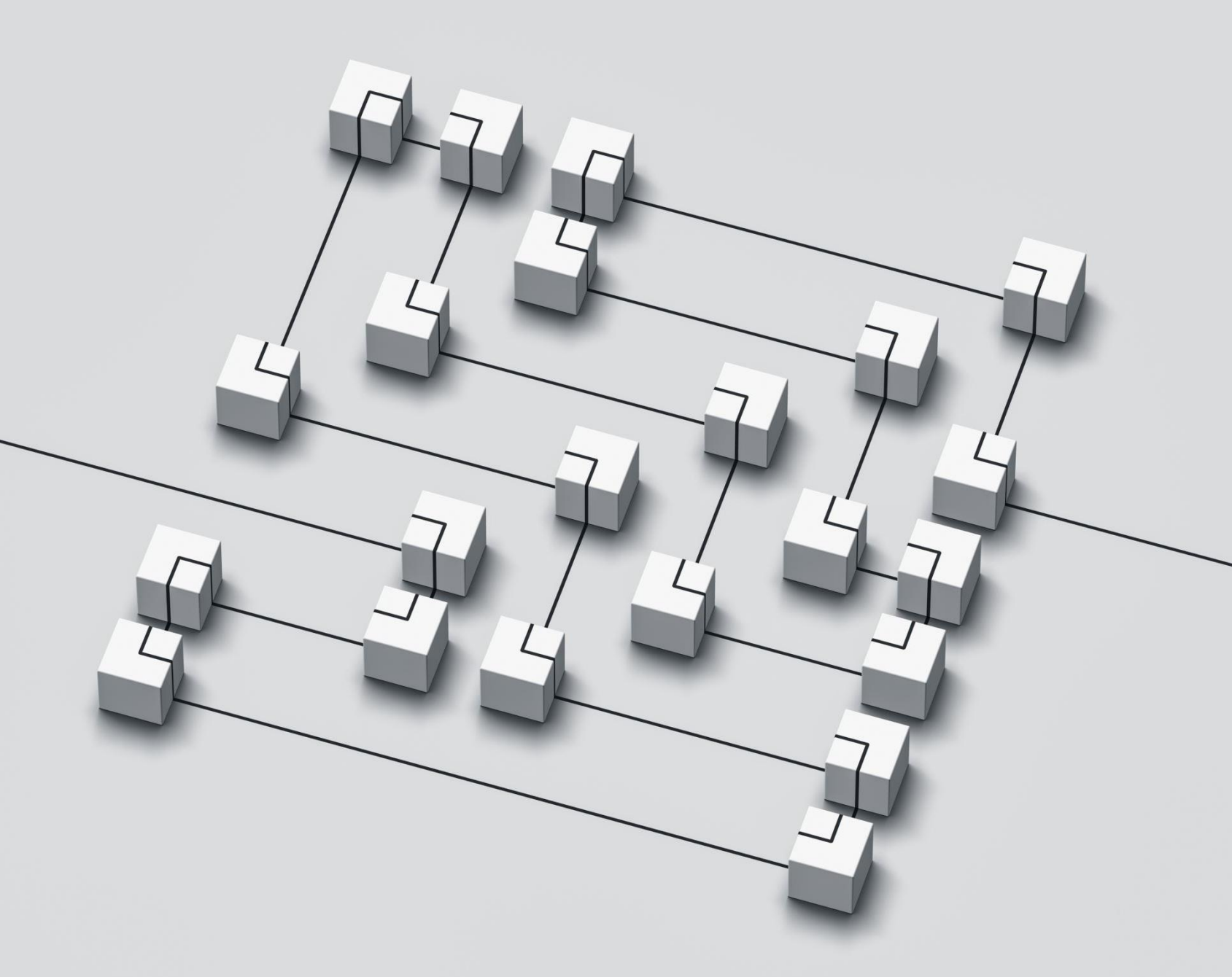
vCPU: 9

MEM(GiB): 5.1

NetworkOut (Bytes): 110,444,655

NetworkIn (Bytes): 5,706,704





# Future Steps

- Leverage functions and input parametrization
- Explore automation by building ETL integration
- Design a deployment space
- Built deployment space
- Expose deployment space
- Explore big data processing libraries like PySpark, Vaex, Dask, Rapids, Koalas, etc.

# Thanks !

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Jesus Olivera  
[olivera@mail.yu.edu](mailto:olivera@mail.yu.edu)  
646-575-6544