



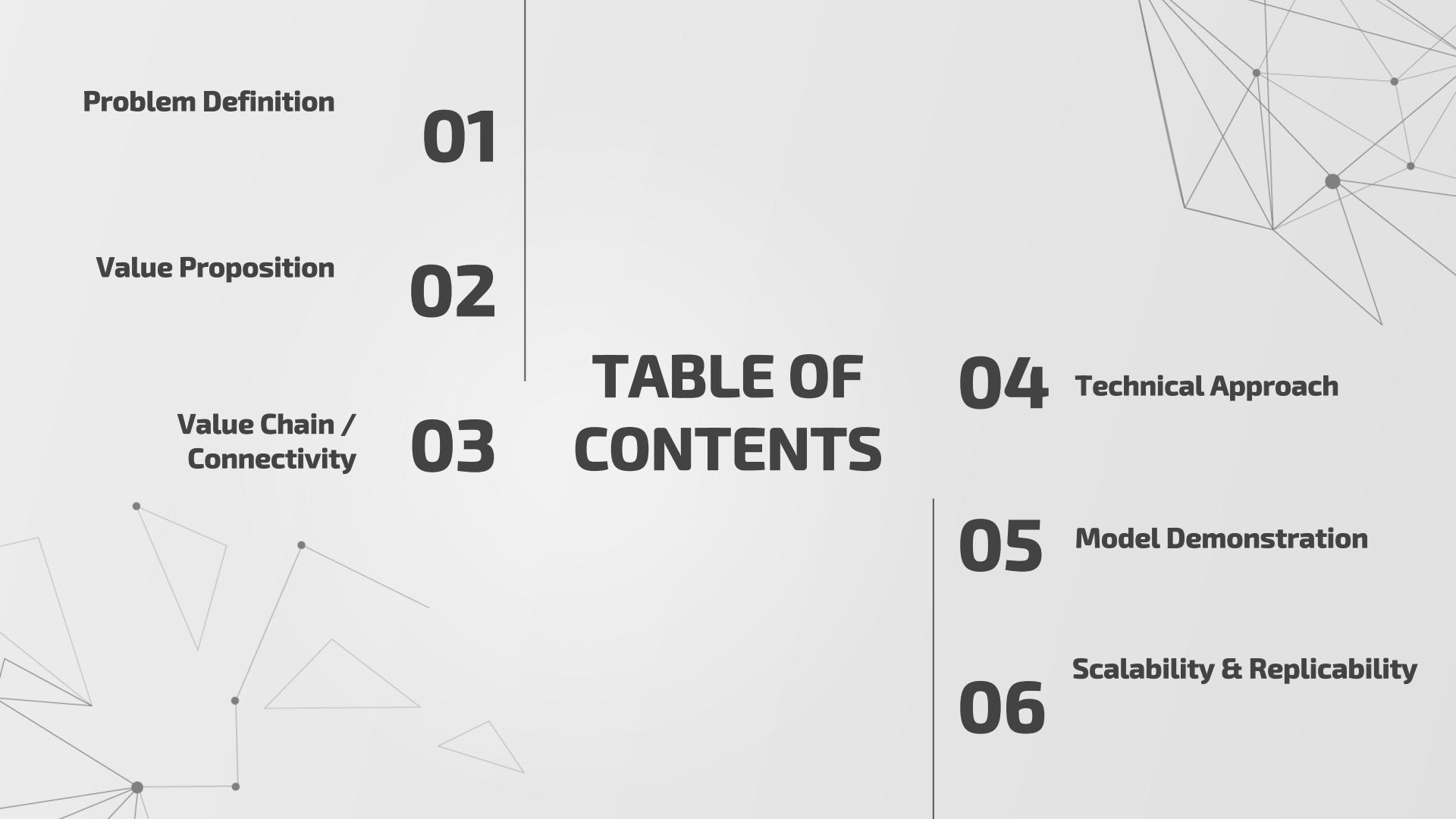
Phase II Presentation

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Problem Definition

01

Value Proposition

02

Value Chain /
Connectivity

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Introduction



- Create laziness
- Unnecessary operation cost increase



- Generate anxiety and unsatisfactory
- Bad Customers' experience
- High TSA failure rate

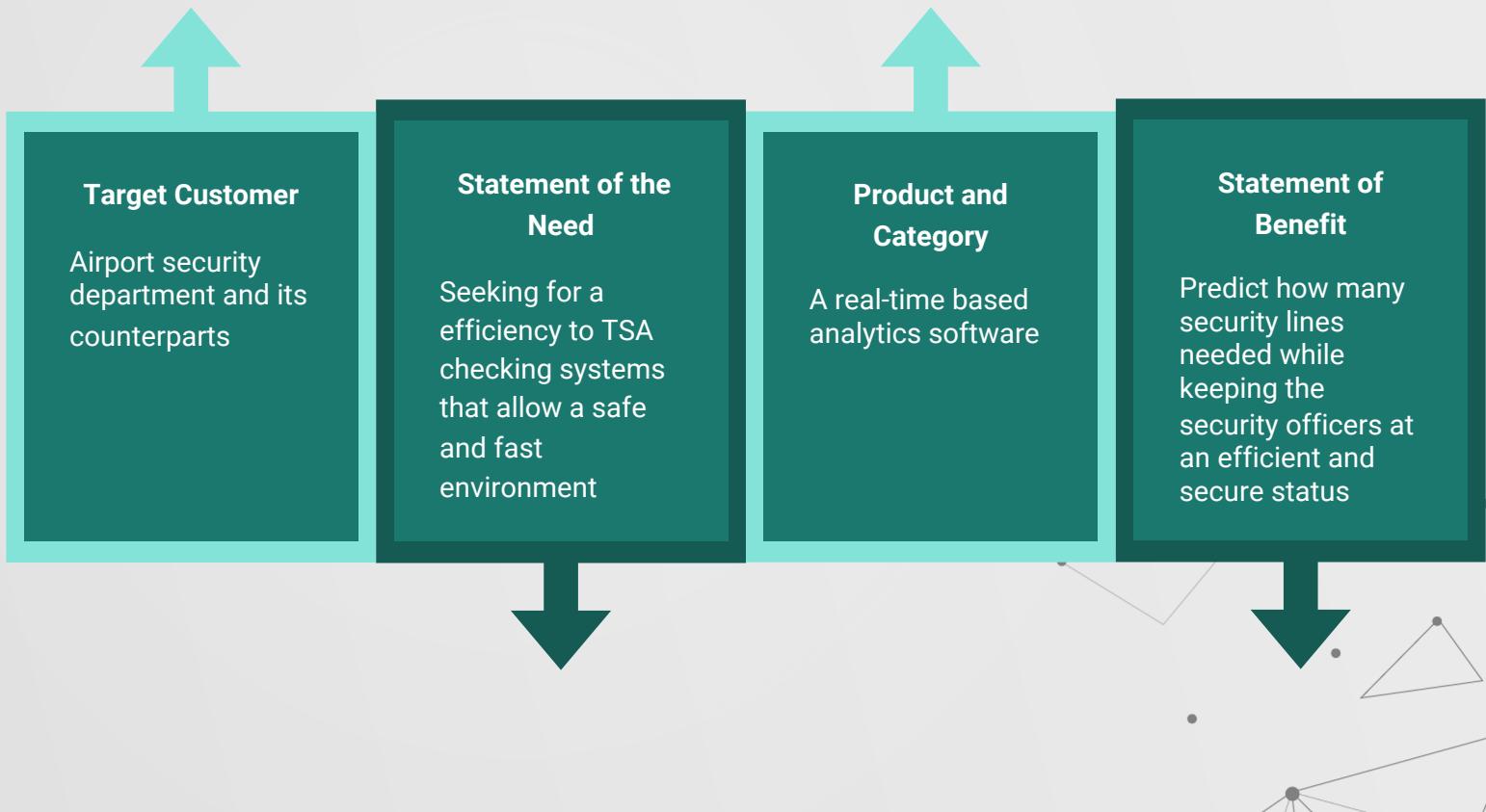


Problem Definition

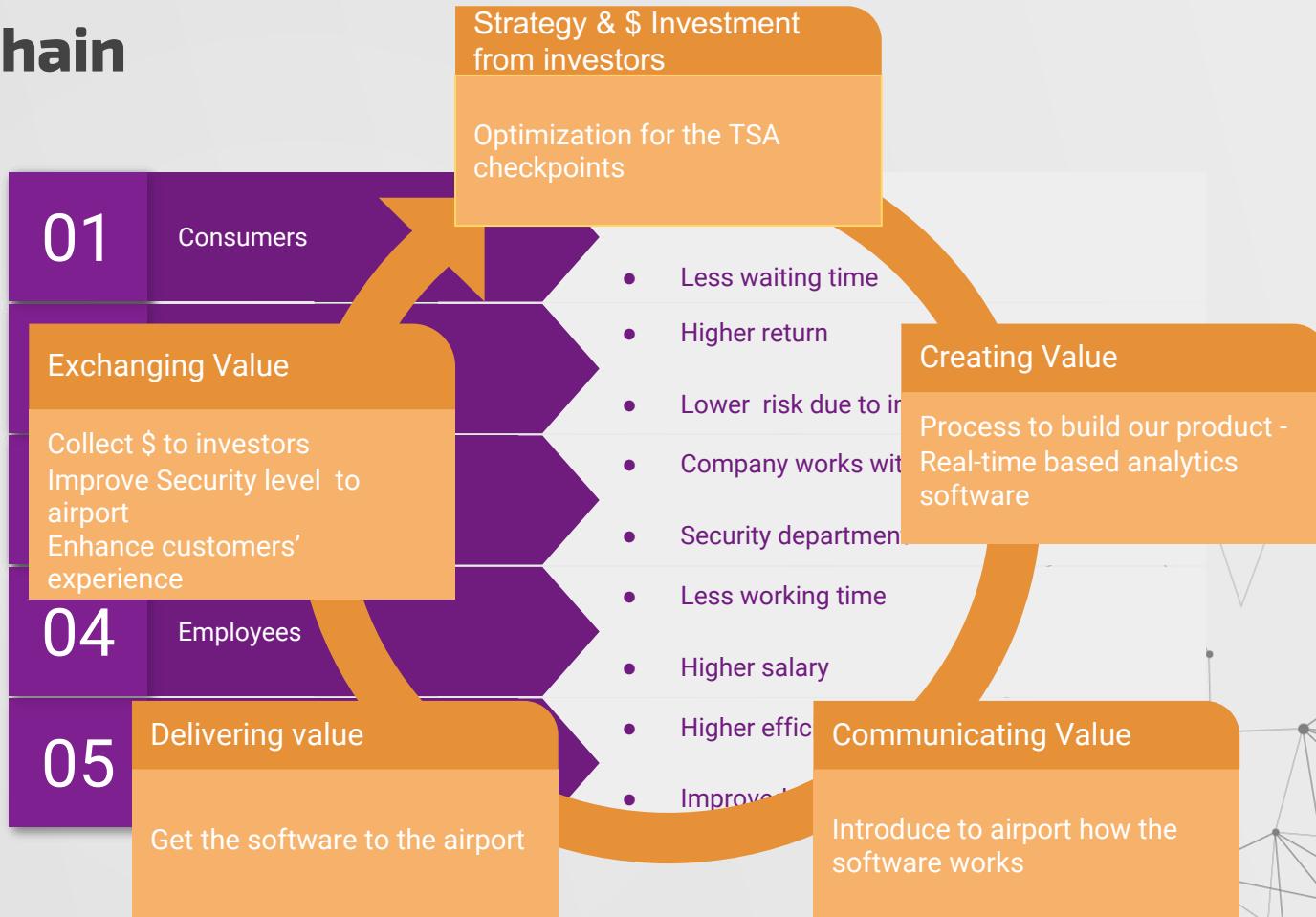
- Optimize the TSA (Transportation Security Administration) checkpoints security screening line according to the size of the flow.
- The airport can arrange the number of screening lines more efficiently and improve the security level.



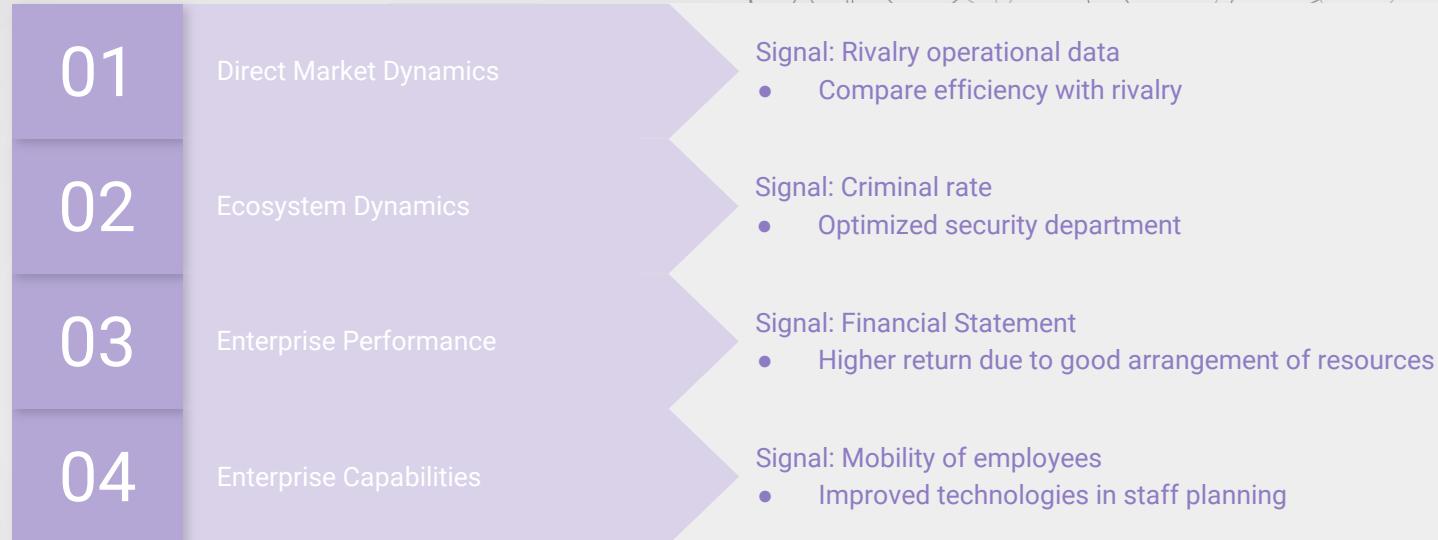
Value Proposition



Value Chain



Connectivity(Usage of Signals)



Technical Approach

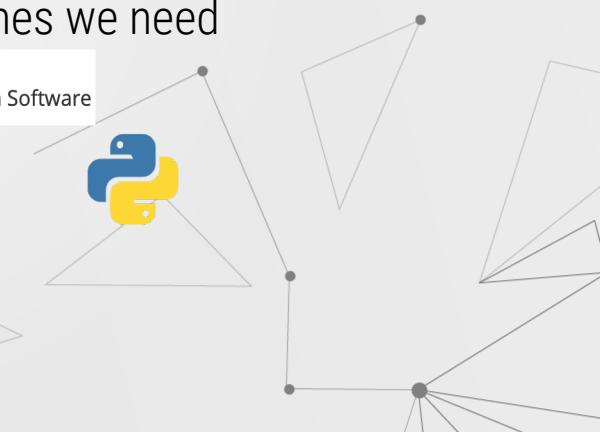
Data processing

- filter the passengers' data
- find out where is the security checkpoints location
- find out how many passengers arrive per 30 mins

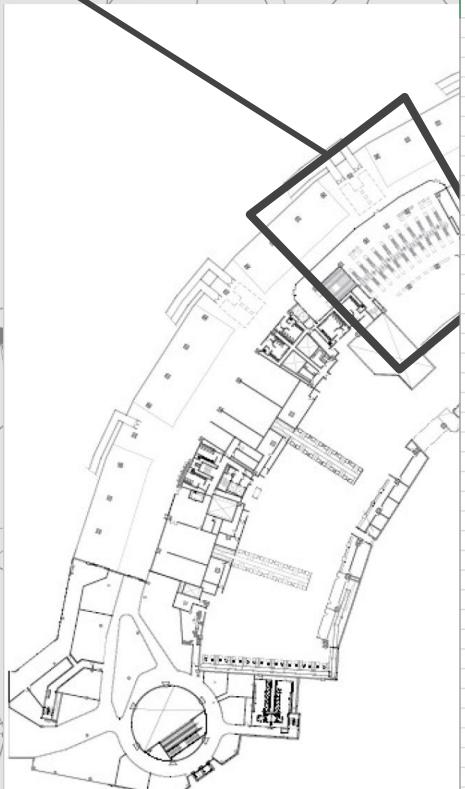


Modeling

- Arena model is built to analyze how many screening lines we need based on passengers' inter-arrival time
- real-time modeling with machine learning technique
- interactive user interface



Dataset Before Arena Model:



International Security Checkpoint

tion

Domestic Security Checkpoint

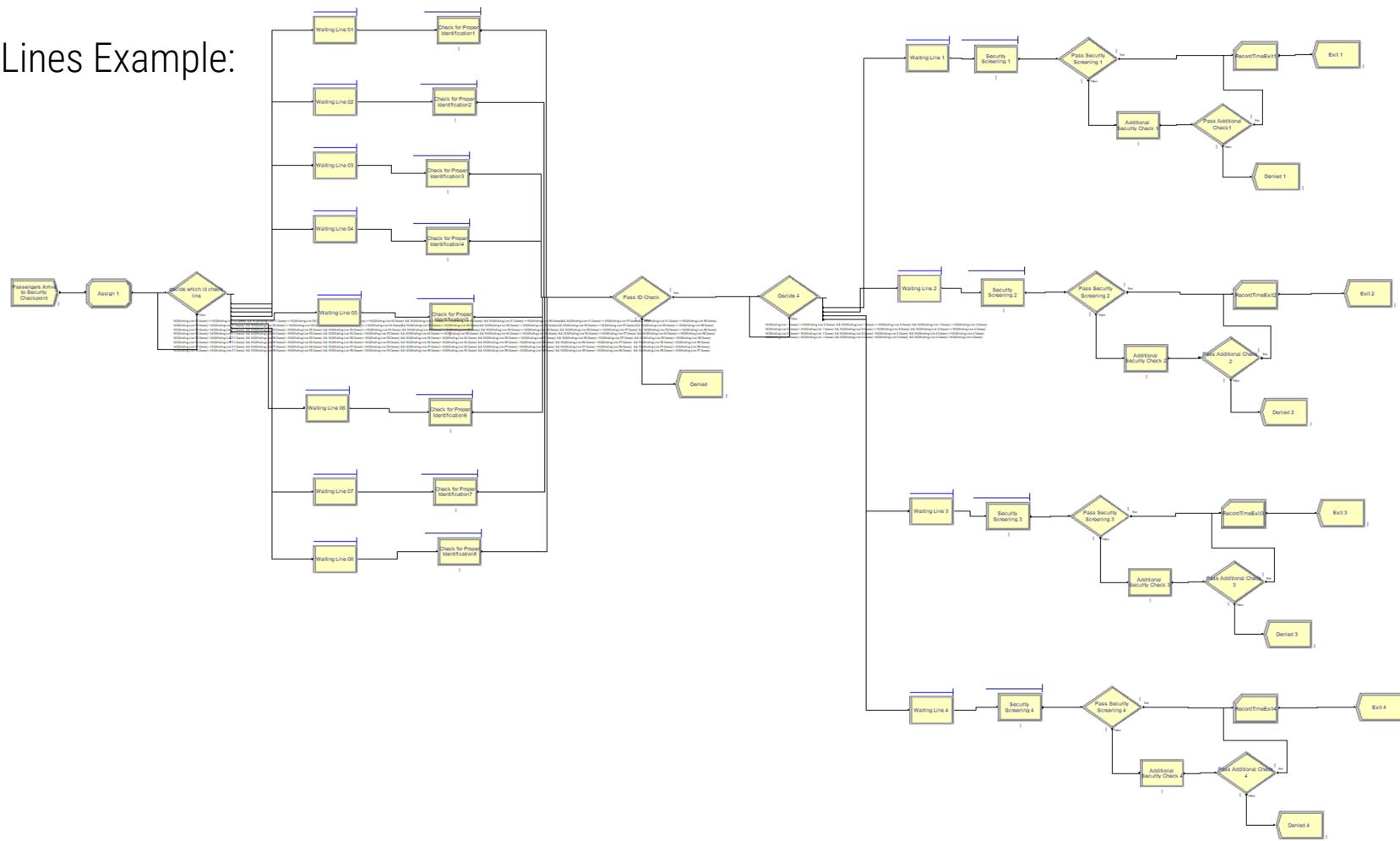
9 Security Lines

For example:
number of people arrive per 30 mins
from 8/11/2019 1:30 - 8/12/2019 6:00

ield:
2.814147
3.247118

8/11/2019 1:30	12
8/11/2019 2:00	16
8/11/2019 2:30	17
8/11/2019 3:00	11
8/11/2019 3:30	17
8/11/2019 4:00	39
8/11/2019 4:30	48
8/11/2019 5:00	73
8/11/2019 5:30	64
8/11/2019 6:00	29
8/11/2019 6:30	64
8/11/2019 7:00	38
8/11/2019 7:30	59
8/11/2019 8:00	42
8/11/2019 8:30	38
8/11/2019 9:00	41
8/11/2019 9:30	53
8/11/2019 10:00	58
8/11/2019 10:30	67
8/11/2019 11:00	5
8/11/2019 12:00	61
8/11/2019 12:30	18
8/11/2019 13:00	122
8/11/2019 13:30	98
8/11/2019 14:00	66
8/11/2019 14:30	71
8/11/2019 15:00	53
8/11/2019 15:30	59
8/11/2019 16:00	86
8/11/2019 16:30	84
8/11/2019 17:00	93
8/11/2019 17:30	96
8/11/2019 18:00	137
8/11/2019 18:30	98
8/11/2019 19:00	59
8/11/2019 19:30	31
8/11/2019 20:00	13
8/11/2019 20:30	13
8/11/2019 21:00	7
8/11/2019 21:30	5
8/11/2019 22:00	1
8/11/2019 22:30	2
8/11/2019 23:00	1
8/11/2019 23:30	6
8/12/2019 0:00	6
8/12/2019 0:30	8
8/12/2019 1:00	11
8/12/2019 1:30	29
8/12/2019 2:00	69
8/12/2019 2:30	84
8/12/2019 3:00	67
8/12/2019 3:30	65
8/12/2019 4:00	58

4 Lines Example:



Dataset After Arena Model:

Area Output

Identifier	Average	localtime	Distinct_Macid	line_needed
Passenger.WIP	15.939	10/1/2019 0:00	9	1
Machine8.NumberBusy	.71683	10/1/2019 0:30	10	1
Machine8.NumberScheduled	1.0000	10/1/2019 1:00	22	3
Machine8.Utilization	.71683	10/1/2019 1:30	38	4
Machine4.NumberBusy	.91277	10/1/2019 10:00	71	8
Machine4.NumberScheduled	1.0000	10/1/2019 10:30	54	6
Machine4.Utilization	.91277	10/1/2019 11:00	53	6
Machine5.NumberBusy	.87039	10/1/2019 11:30	62	8
Machine5.NumberScheduled	1.0000	10/1/2019 12:00	50	6
Machine5.Utilization	.87039	10/1/2019 12:30	67	8
Machine6.NumberBusy	.82904	10/1/2019 13:00	34	4
Machine6.NumberScheduled	1.0000	10/1/2019 13:30	47	6
Machine6.Utilization	.82904	10/1/2019 14:00	44	5
Machine7.NumberBusy	.77610	10/1/2019 14:30	68	8
Machine7.NumberScheduled	1.0000	10/1/2019 15:00	60	7
Machine7.Utilization	.77610	10/1/2019 15:30	42	5
Machine1.NumberBusy	.99677	10/1/2019 16:00	43	5
Machine1.NumberScheduled	1.0000	10/1/2019 16:30	42	5
Machine1.Utilization	.99677	10/1/2019 17:00	38	4
Machine2.NumberBusy	.96956	10/1/2019 17:30	49	6
Machine2.NumberScheduled	1.0000	10/1/2019 18:00	41	5
Machine2.Utilization	.96956	10/1/2019 18:30	48	6
Machine3.NumberBusy	.94173	10/1/2019 19:00	55	6
Machine3.NumberScheduled	1.0000	10/1/2019 19:30	62	8
Machine3.Utilization	.94173	10/1/2019 2:00	20	3
Machine1.NumberBusy	.99677	10/1/2019 2:30	29	3
Machine1.NumberScheduled	1.0000	10/1/2019 20:00	44	5
Machine1.Utilization	.99677	10/1/2019 20:30	33	4
Machine2.NumberBusy	.96956	10/1/2019 21:00	29	3
Machine2.NumberScheduled	1.0000	10/1/2019 21:30	42	5
Machine2.Utilization	.96956	10/1/2019 22:00	23	3
Machine3.NumberBusy	.94173	10/1/2019 22:30	12	1
Machine3.NumberScheduled	1.0000	10/1/2019 23:00	9	1
Machine3.Utilization	.94173	10/1/2019 23:30	9	1
Machine1.NumberBusy	.28041	10/1/2019 3:00	25	3
Machine1.NumberScheduled	8.0000			
Machine1.Utilization	.03505			

Utilization for each line

- Set Generic Human Utilization: 75-90%
- For Example:

72 passengers arrive in 30 mins, so the arrival rate is
0.4167 mins/passenger

- Average Utilization of all lines: 87.7%
- We need to select 8 security lines!
For example:
number of people arrive per 30 mins from 10/01/2019 0:00 - 10/01/2019 5:30, and the lines needed for different number of travelers.



Python - Decision Tree Classifier

We use Decision Tree Classifier as our final model to predict the number of security screening lines needed:

- Target Variable: line_needed
 - Feature Variable: the number of traveler arrive per 30 mins
 - Model Accuracy: 0.9637
- 



Model Demonstration

M&L

PLANNING YOUR SECURITY STAFF!

The number of people every 30 min:

When you're ready, click this button:

Predict

M&L

HERE ARE YOUR RESULTS:

The number of people every 30 min: 100

Arrival rate (arrivals per minute) : 0.3

The lines needed: 9

**Check it out!
CLick: App**



Scalability & Replicability



Museum



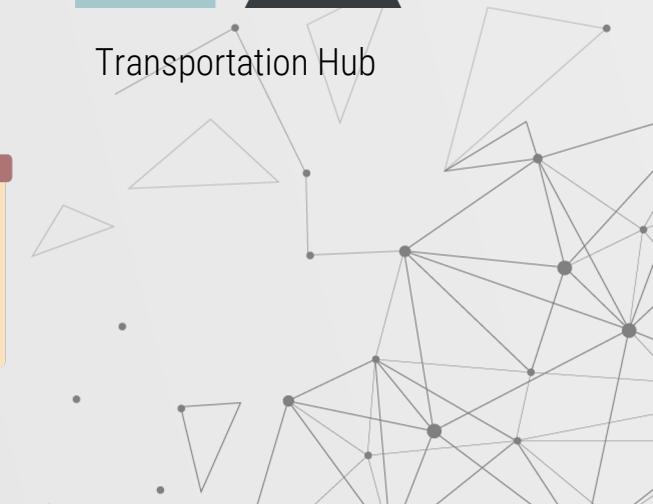
Amusement Park



Exhibition Center



Transportation Hub



M & L



THANKS

Does anyone have any questions?

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