OTP SCHEDULE OPTIMIZER

NETWORK PLANNING

CDAO Canada

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Presented by: **CECILIA (SI) CHEN**

Manager, AI Transformation

AIR CANADA

Background

PLANNED SCHEDULE
Network Planner

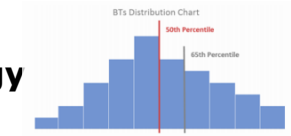
An optimal schedule that is designed to maximize network profitability based on forecasted revenues and asset costs, may not consider operational variability that could result in potential delays, associated delay costs and customer impact

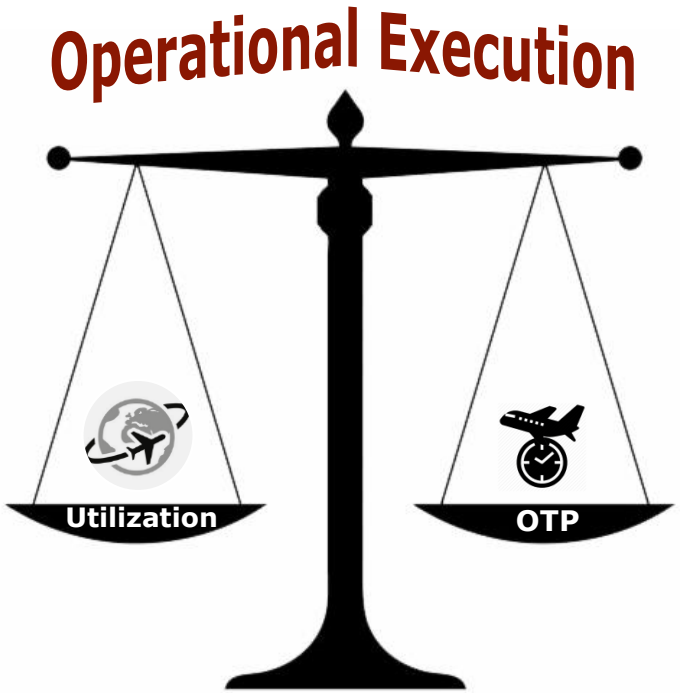
OPERATING SCHEDULE
Operations

Schedule Design Parameters

Schedule Design Inputs

- Block Strategy
- Turn Strategy
- Minimum Connection Times
- Other ...





Operational Results

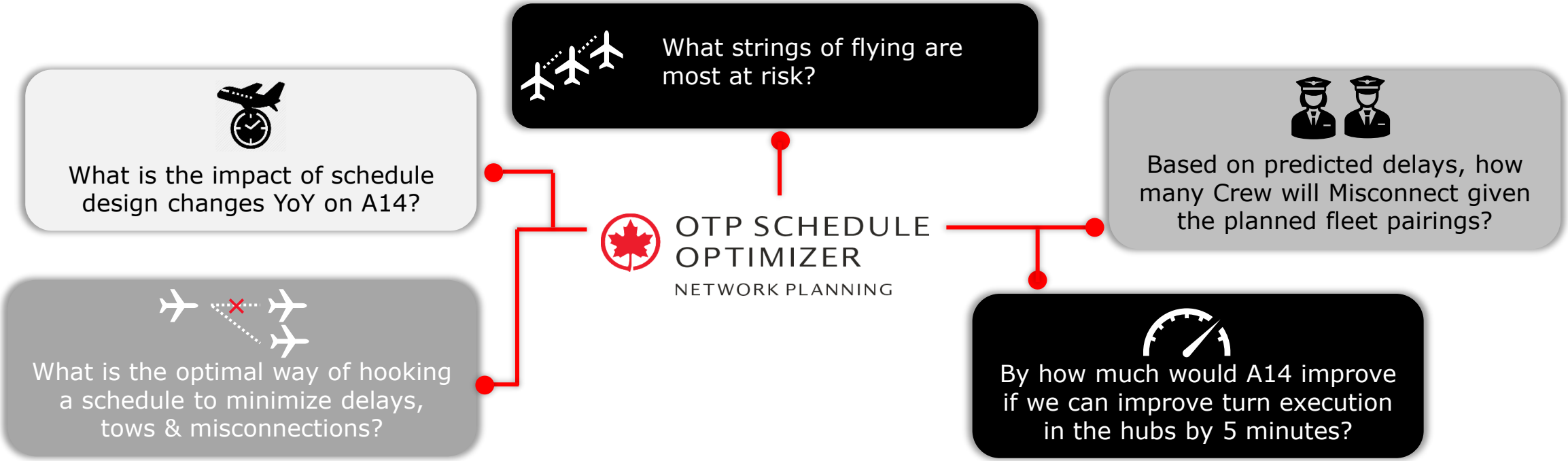
- Arrival Delays
- Departure Delays
- Passenger Misconnections
- Other ...

What is the impact of a parameter or execution on the resulting performance and where is buffer most needed?

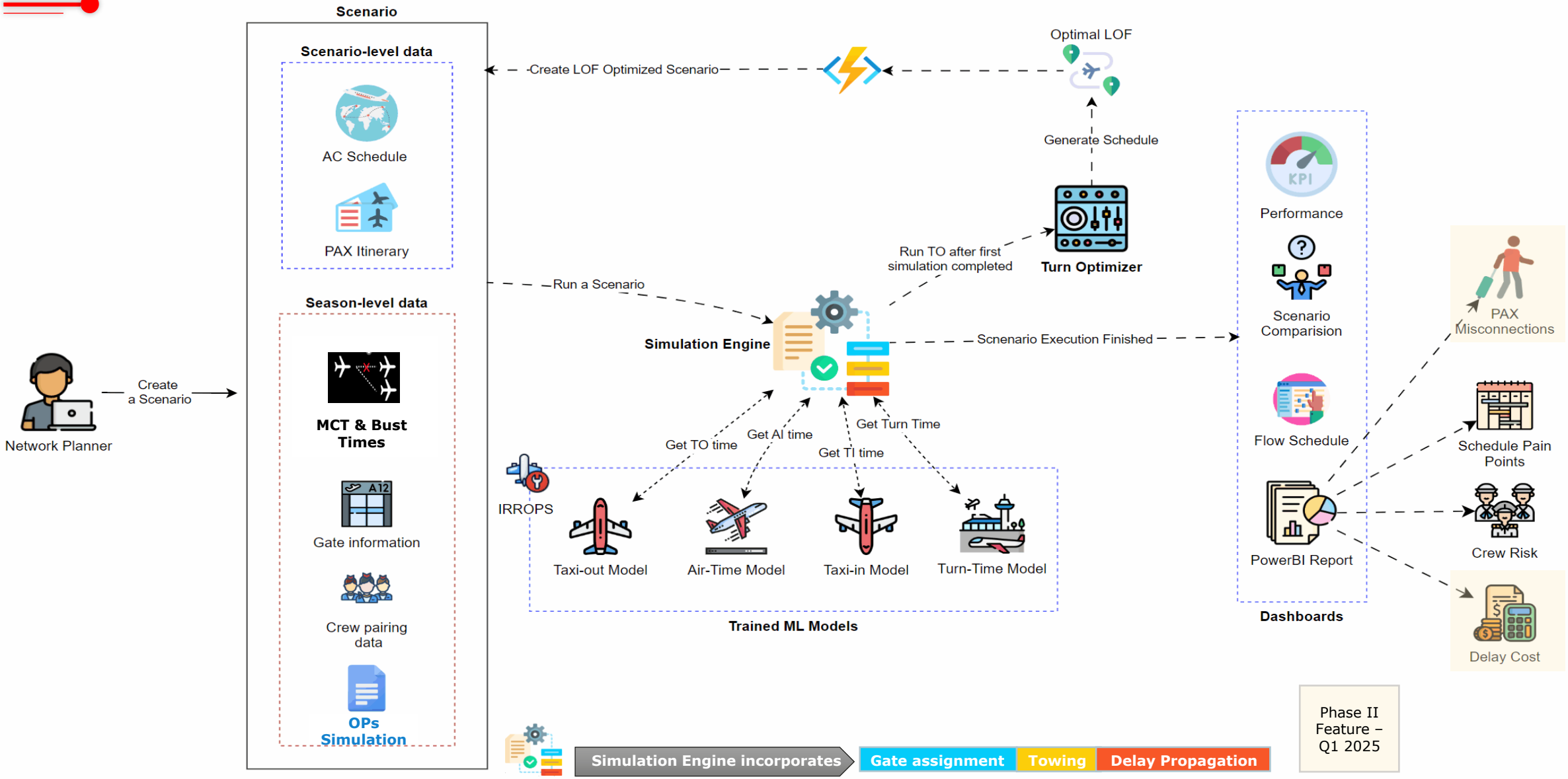
Project Objective & Use Cases

PROJECT Objective

Create a tool capable of evaluating a schedule scenario and **model expected delays** and their impact on our **aircraft performance, passenger flow and crew flow**, providing all associated performance KPIs, passenger misconnections, and highlighting crew violations, both at high level and flight/string level. In addition, the tool will also be capable of optimizing string of flights to minimize delays and misconnections, and to simulate the impact of varying execution parameters on our overall performance



AI Model Strategy



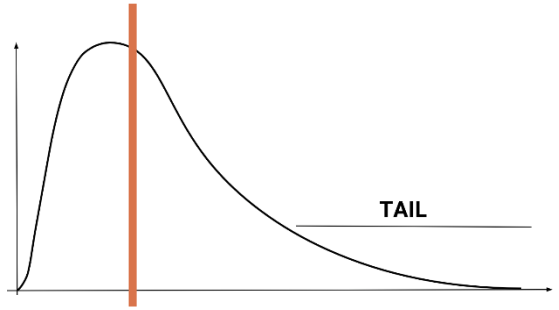
Replicas/Accuracy in each Release

Blue Sky *= Explained and predicted via features of turn and block*

Regular *= Outliers are removed, and 30 replicas are generated to integrate unexplained variances*

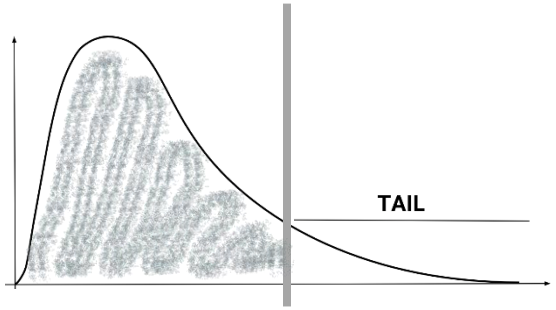
IRROPS *= This includes datapoints which were previously considered as Outliers. Only the extreme Outliers (0.5%) are removed.*

Blue Sky Replica
ex: A14 90%



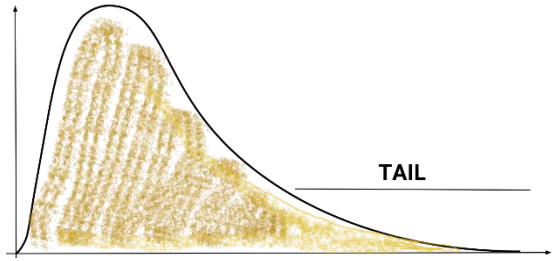
Median solution

Baseline Replica
ex: A14 80%



Multi Replica excluding major IRROPS

IRROPs Replica
ex: A14 75%



Multi Replica including ALL IRROPS

Low Level View

High Level View

Features in Machine Learning Models

Taxi-out ML Model

- Origin Station
- Aircraft type
- Flight Sector
- Month of the year
- Hour of the day

Taxi-in ML Model

- Destination Station
- Outbound Sector
- Hour of the day
- Aircraft Type
- Destination Geo Info

Airtime ML Model

- Great Circle Mileage
- City Pair Direction
- Aircraft Type
- Month of the year
- City Pair

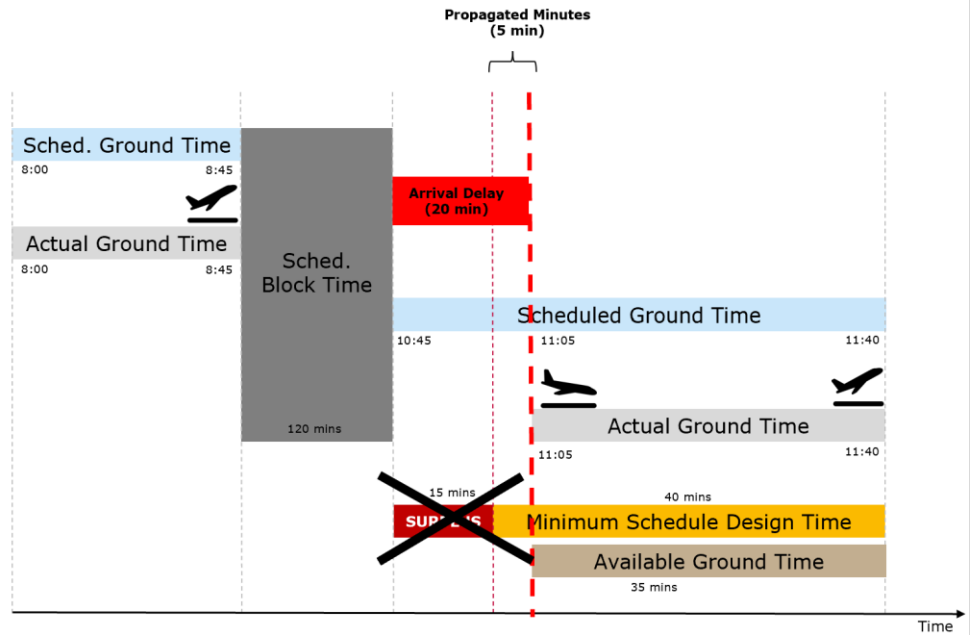
Turn ML Model*

- Number of Seats
- Origin Geo Info
- Destination Geo Info
- Previous Flight Station
- Departure Local Time
- Month of the year

* Future enhancements on Passenger loads

Features in Simulation Models

Simulation of Delay Propagation

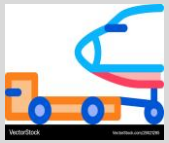


- Iterative approach to estimating stressed turns
- Logic for "surplus" in turns and cutting strings
- Delay Propagation beyond Overnight Maintenance

Simulation of Gate Assignment

- Gate Rules by Hub/Aircraft Type
- Gate Wait for Availability
- Gate Capacity for AC*
- Swing Gate Capability
- Assignment by Pred. Arr. Time

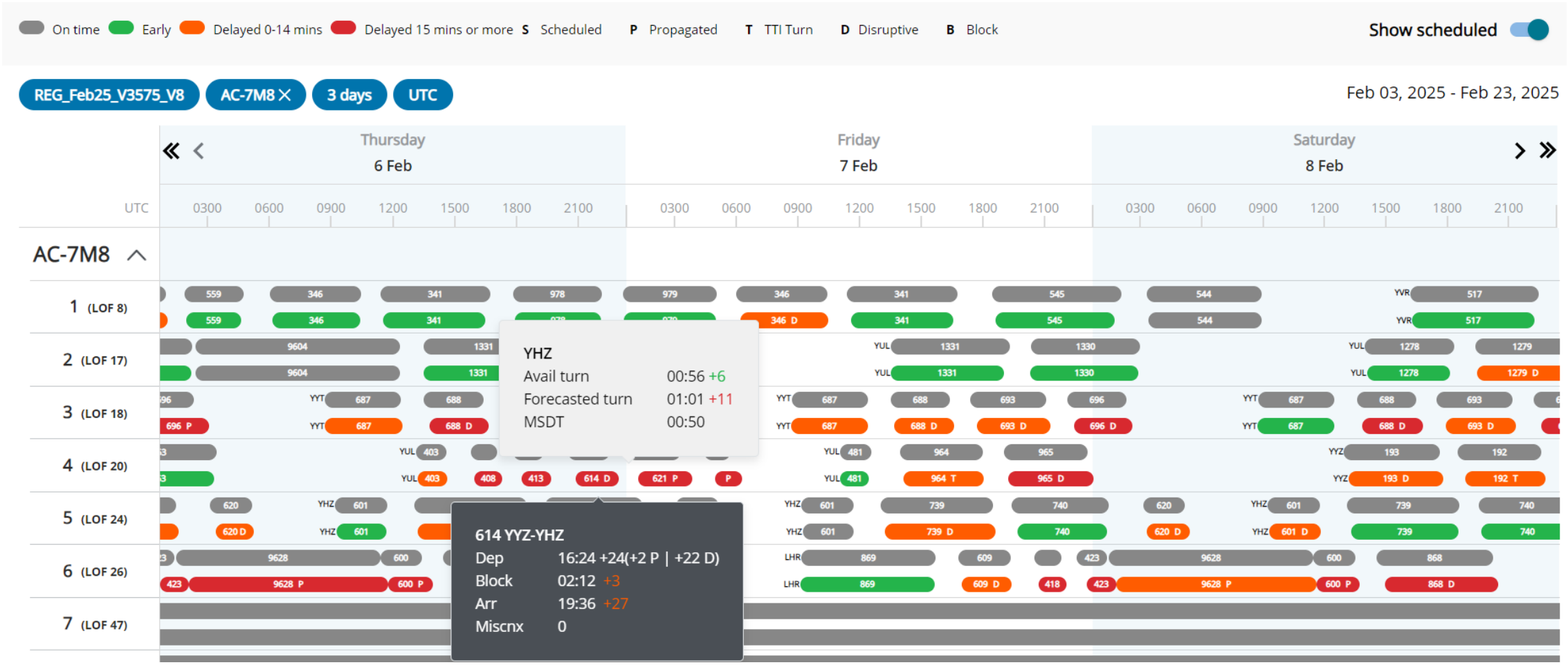
Simulation of Towing



- When Must Tow
- When Swing is Not Available
- When Ample Turn Time
- Turn Prediction based on Tow or not

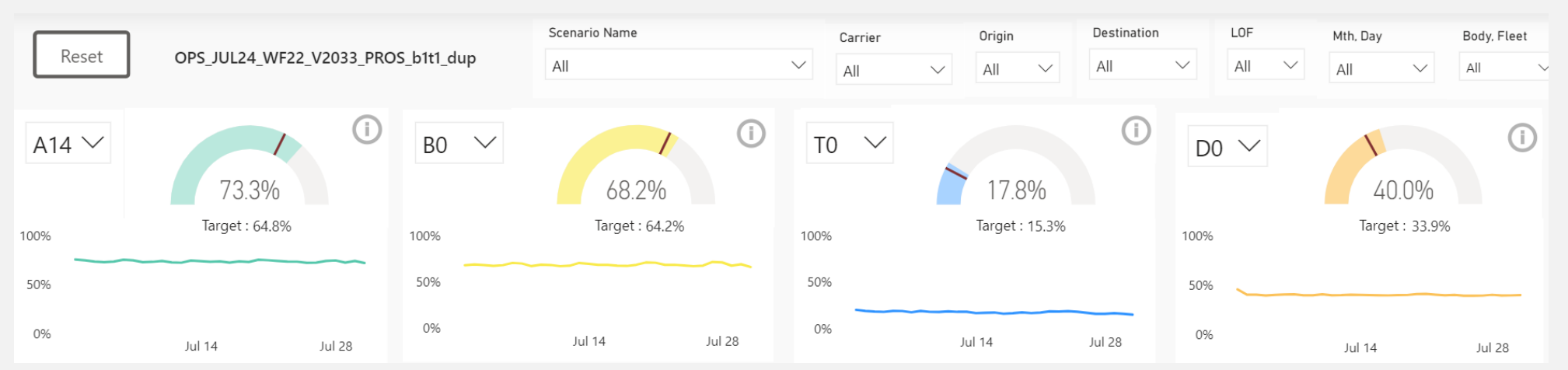
* Future enhancements to include simulating OAL schedule

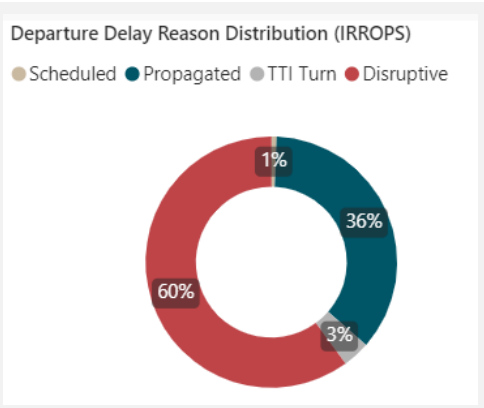
Low Level KPIs – Flow Schedule

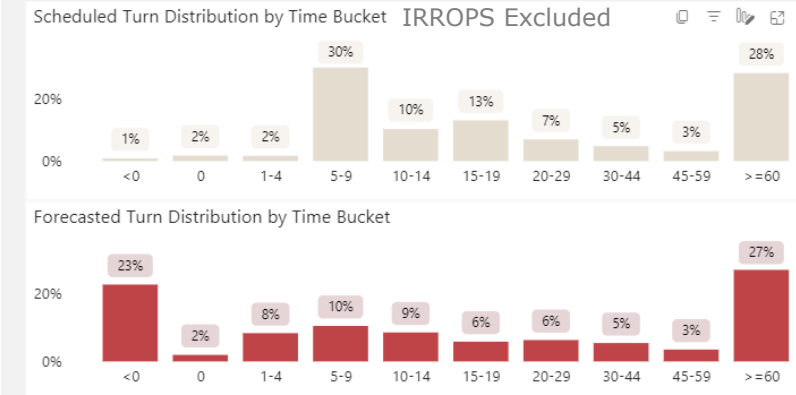


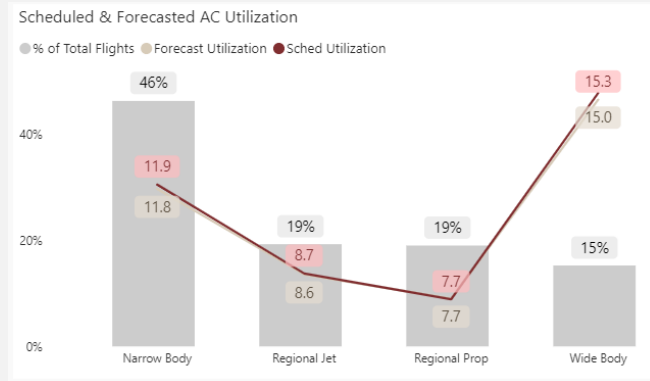
High Level KPIs

To provide centralized access to schedule metrics for review and comparison









Year	Month	Replica _Def	A14(%)	B0(%)	T0(%)	D0(%)	MSDT %	MSDT #	Sum Scheduling Delay	Sum Propagated Delay	Sum TTI Turn Delay	Sum Disruptive Delay	Sum Departure Delay	Sum Block Delay	Sum Arr Delay
2025	Feb	4	69.4%	64.5%	21.9%	47.5%	35.9%	8,165	2,640	146,623	13,416	231,745	391,482	-52,860	338,622

Chronos | AI

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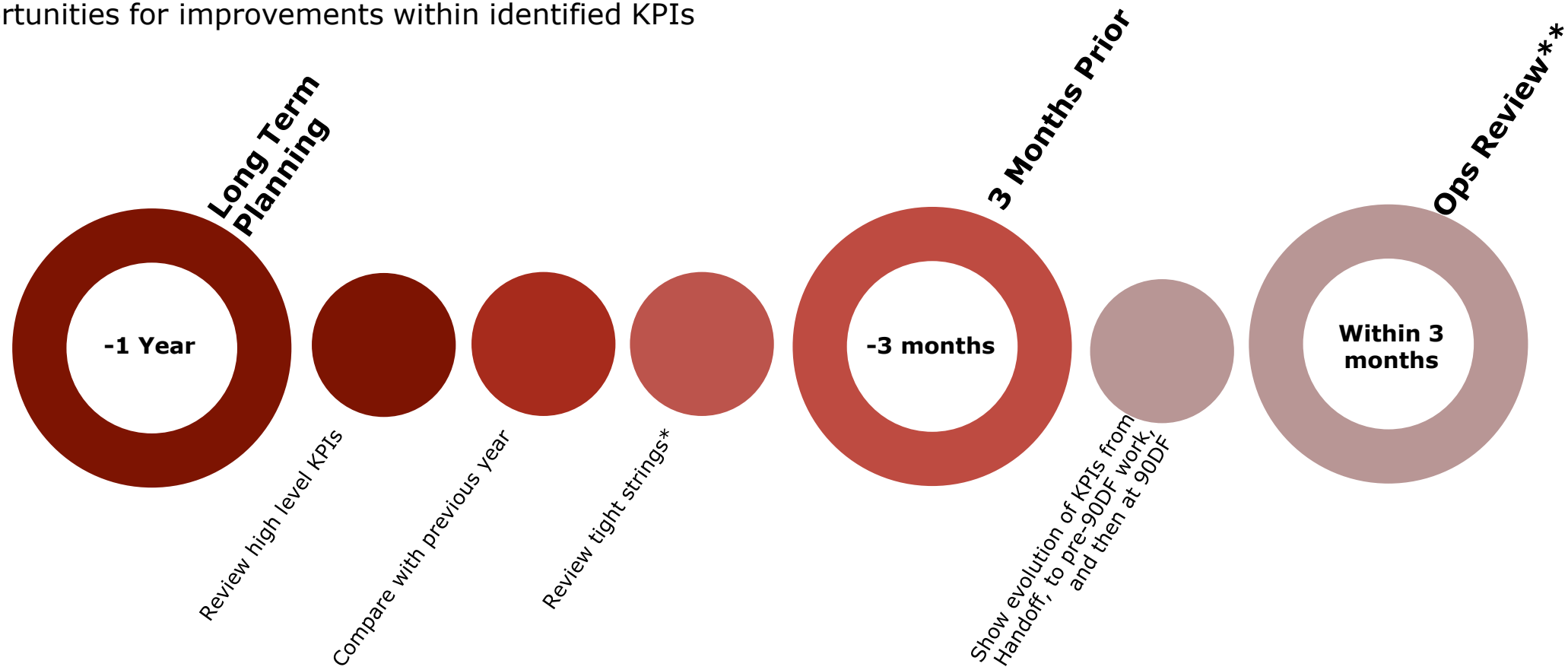
Chronos Review Process

Chronos will be used throughout the schedule design process to review the next year schedule performance and inform opportunities for improvements within identified KPIs



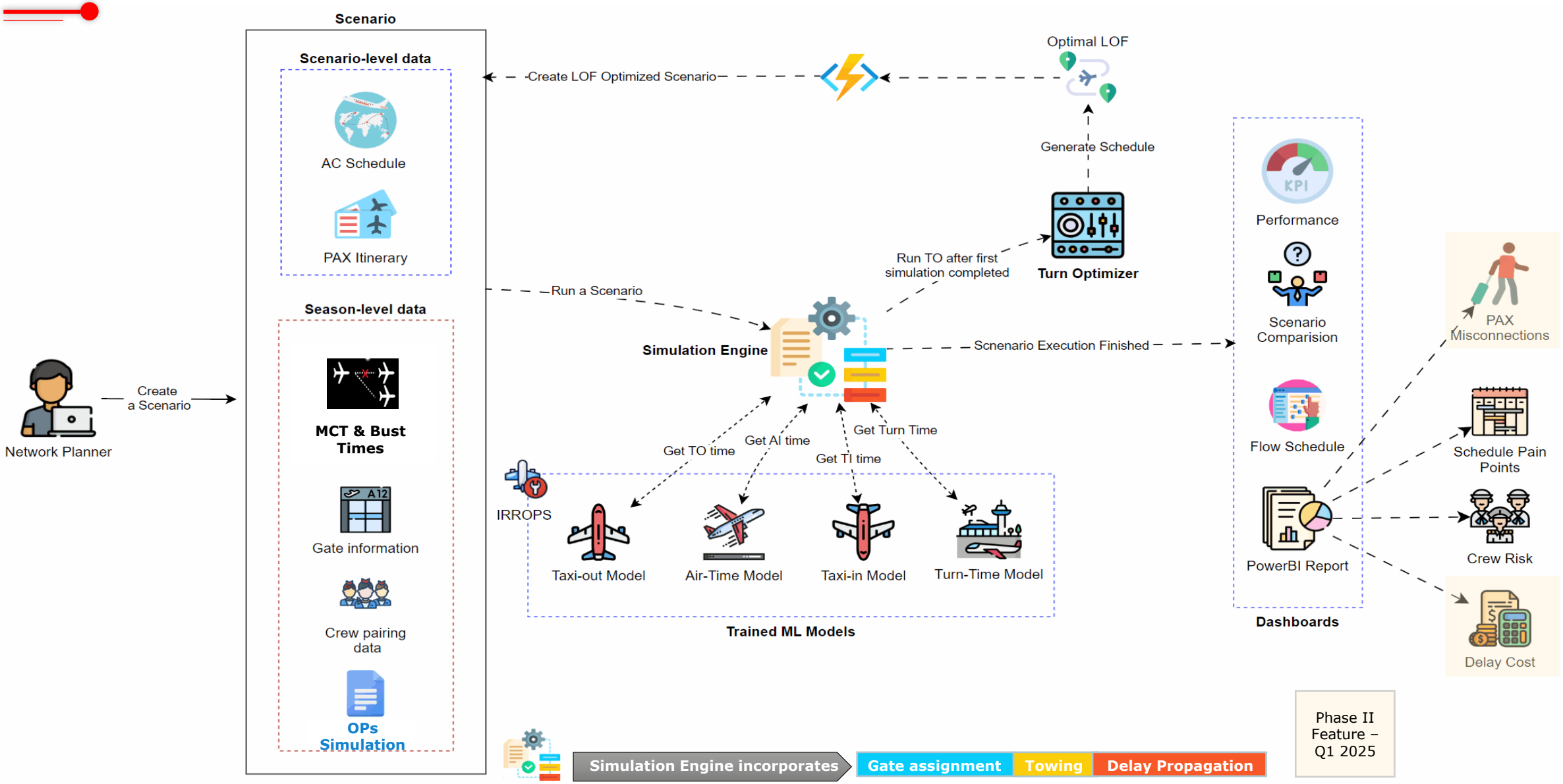
***Review Tight Strings**

- ❑ Reroute/retime if possible, to loosen strings
- ❑ Take note of changes by identifying "Chronos changes" in Sched Manager
- ❑ Rerun revised schedule scenario to understand OTP improvements

**** Ops Review**

- ❑ Ops feedback is throughout the Planning & Intermediate process
- ❑ Need to establish post-freeze process for execution focus when schedule changes are not possible or more restricted

What is next?


Scenario
Scenario-level data
AC Schedule
PAX Itinerary
Season-level data
MCT & Bust Times
Gate information
Crew pairing data
OPs Simulation
Network Planner
Create a Scenario
Create LOF Optimized Scenario
Optimal LOF
Generate Schedule
Run TO after first simulation completed
Turn Optimizer
Run a Scenario
Simulation Engine
Scnenario Execution Finished
Get TO time
Get AI time
Get TI time
Get Turn Time
IRROPS
Taxi-out Model
Air-Time Model
Taxi-in Model
Turn-Time Model
Trained ML Models
KPI
Performance
Scenario Comparision
Flow Schedule
PowerBI Report
Dashboards
PAX Misconnections
Schedule Pain Points
Crew Risk
Delay Cost
Simulation Engine incorporates
Gate assignment
Towing
Delay Propagation
Phase II Feature – Q1 2025

OTP SCHEDULE OPTIMIZER

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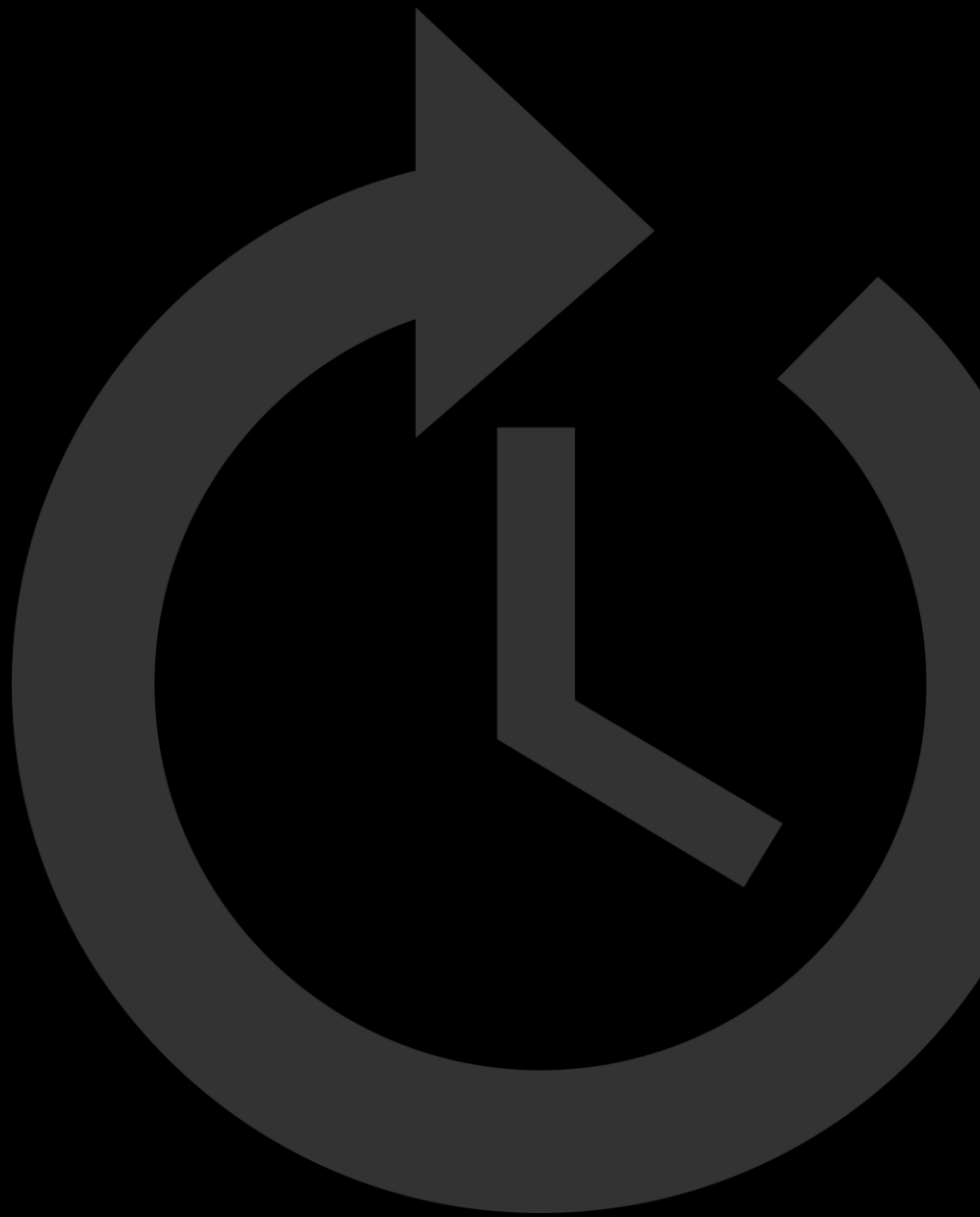
Questions?



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