



Creating Infinite
Possibilities.

Planned Maintenance Tool (PMT): A Data-Driven Approach to Recommending the Best Time for Planned-Maintenance

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PMT - Introduction

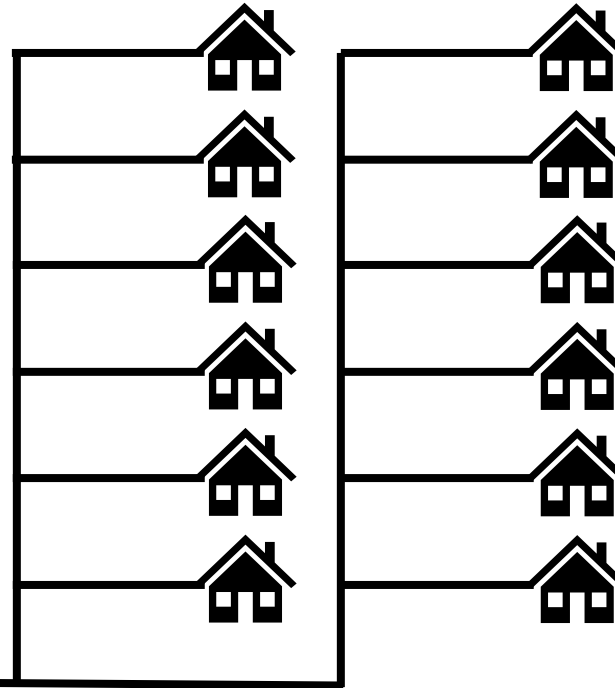
SIE
'Service Interrupting Event'

I just need 5 to 10 minutes!

New Part



Repair



**Diverse Users =
Diverse Schedules**



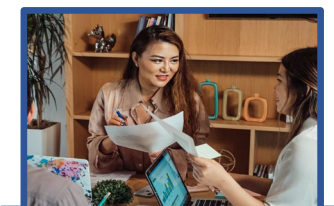
Senior Living



University Life

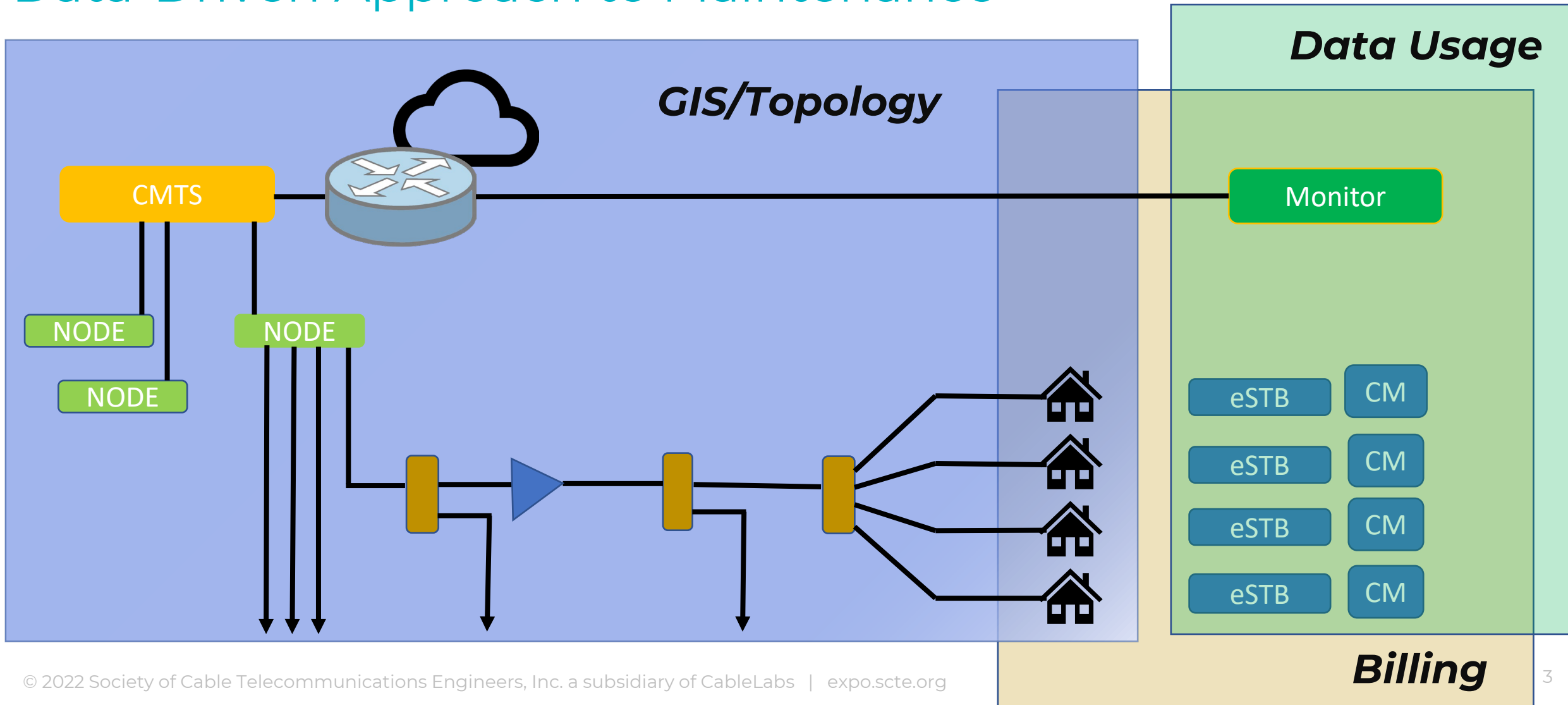


Remote Learning

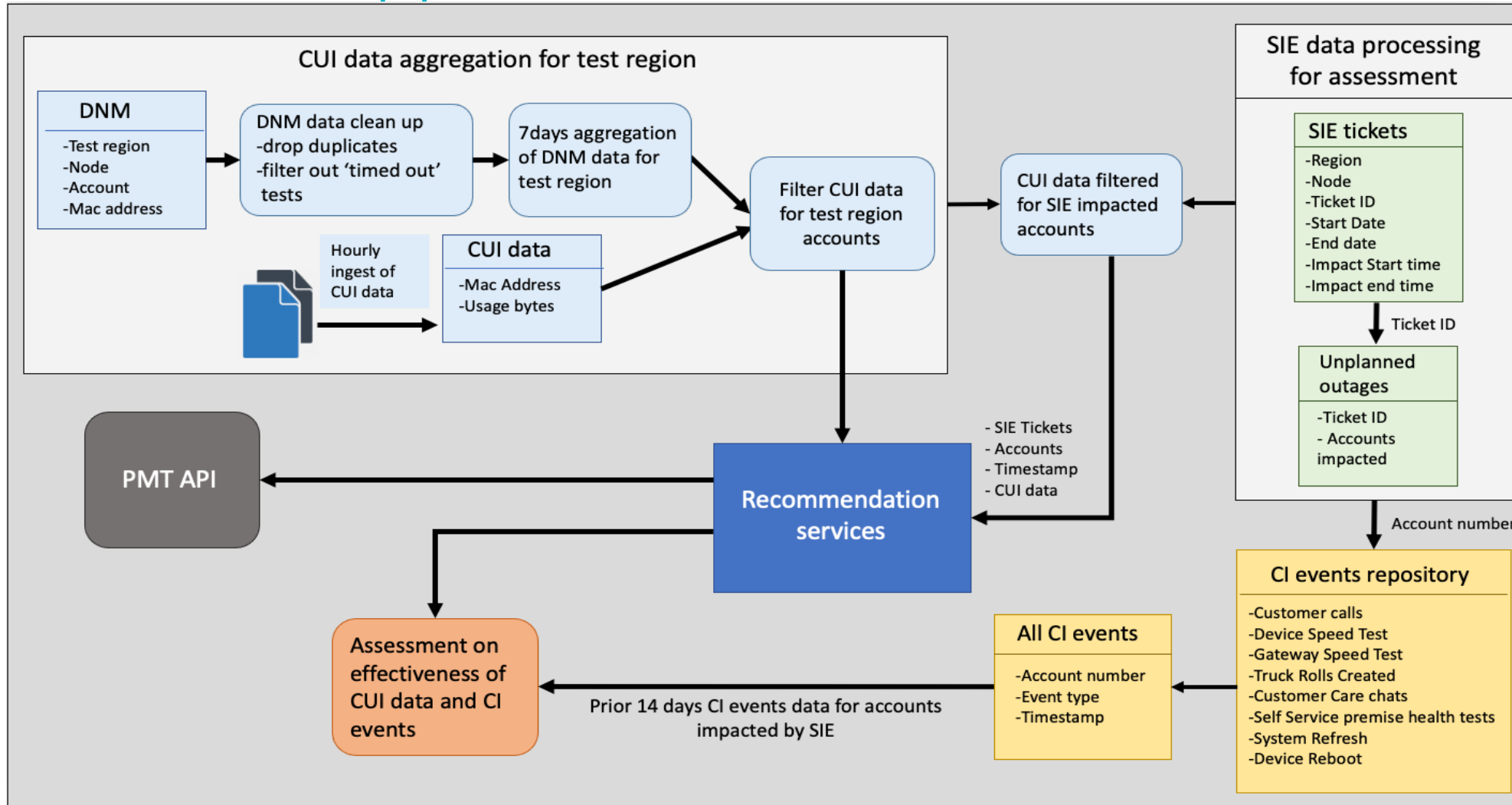


Remote Office

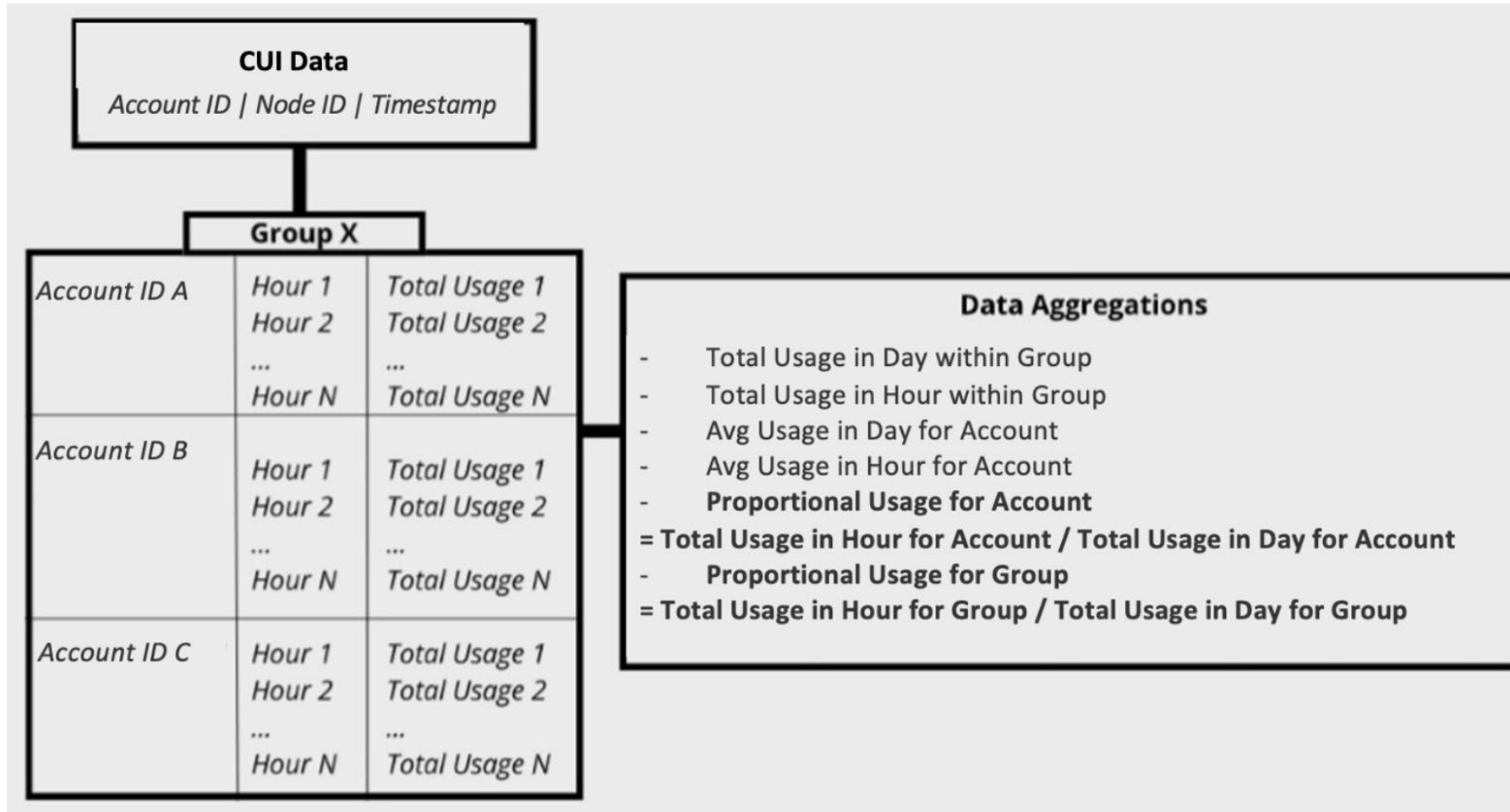
Data-Driven Approach to Maintenance



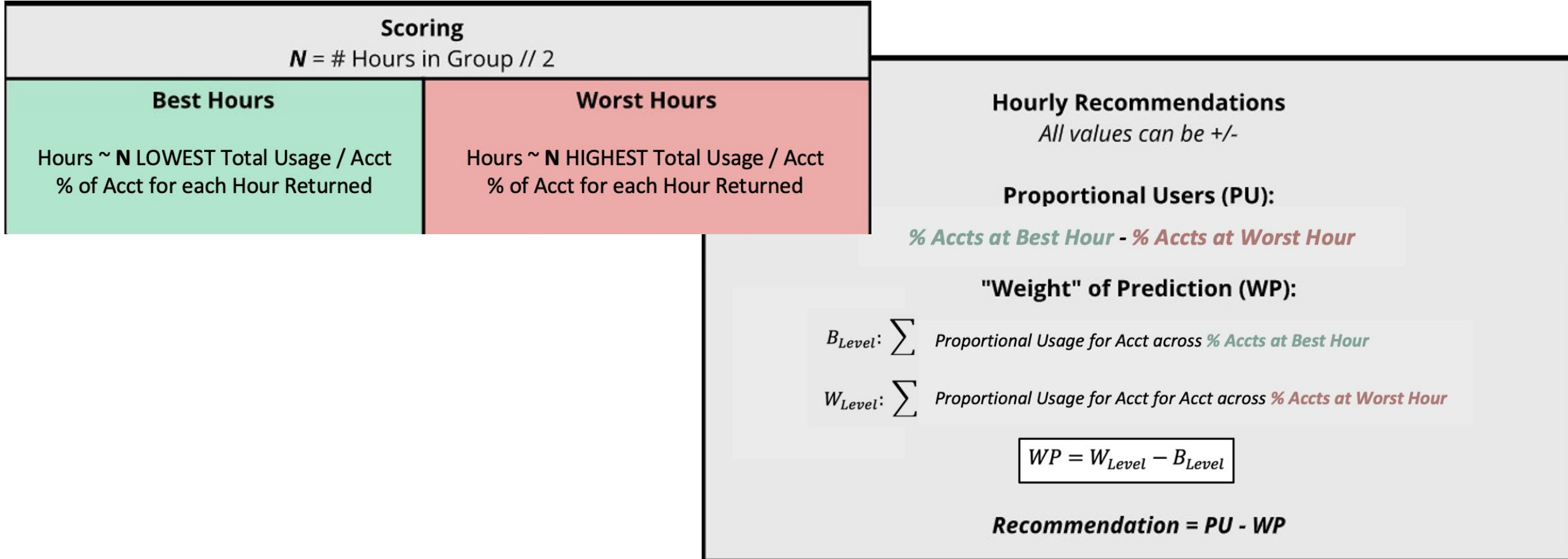
Data-Driven Approach to Maintenance



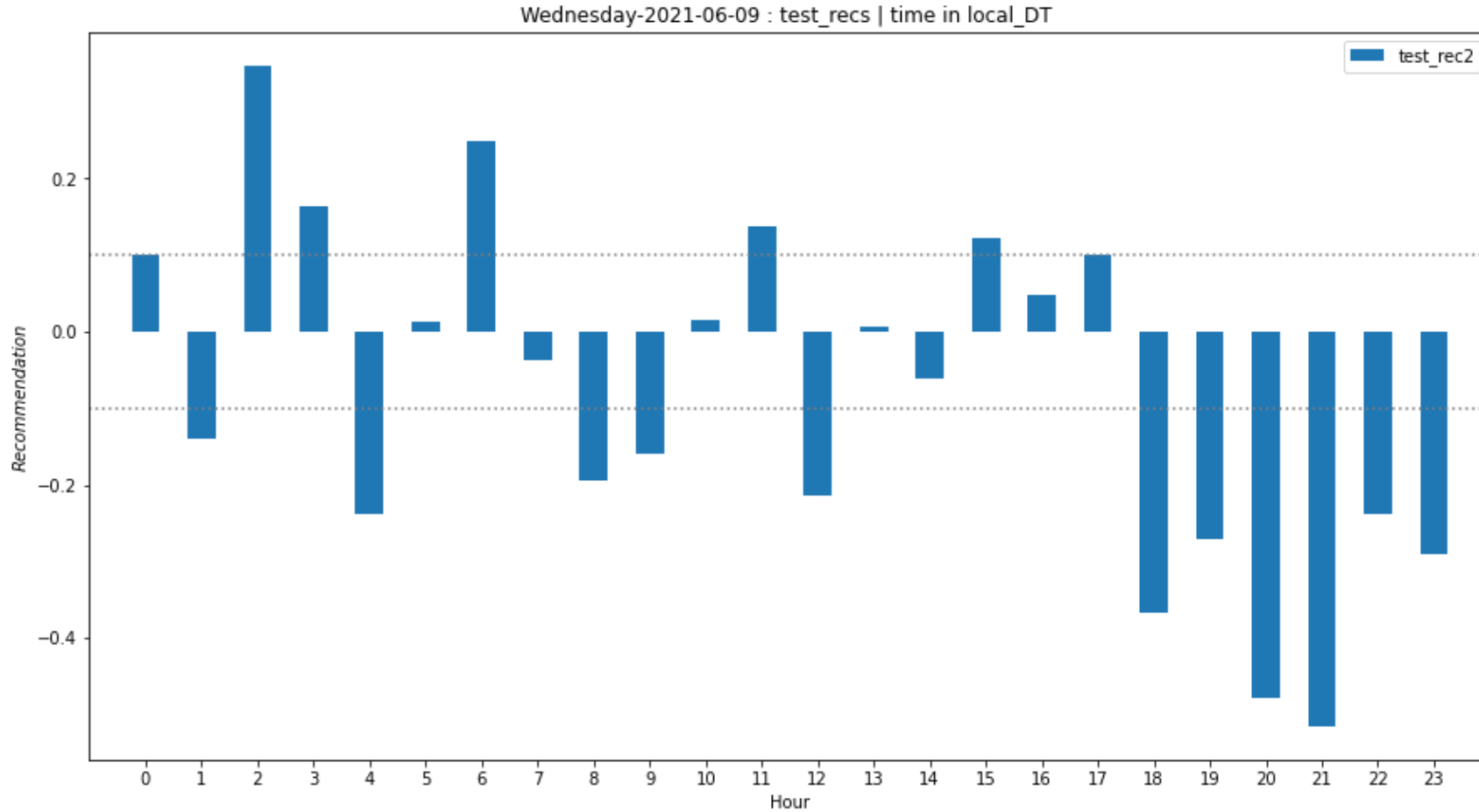
PMT Algorithm – Data Aggregation



PMT Algorithm – Calculating Recommendations



PMT Algorithm – Recommendations by Hour



Assessment – Results Summary

The assessment, focused on one geographic test region during selected weeks in the winter and spring of 2022, was performed using data from approximately 3000 Service Impacting Events (SEIs)

The assessment was...

...performed against three baselines of measured customer impact

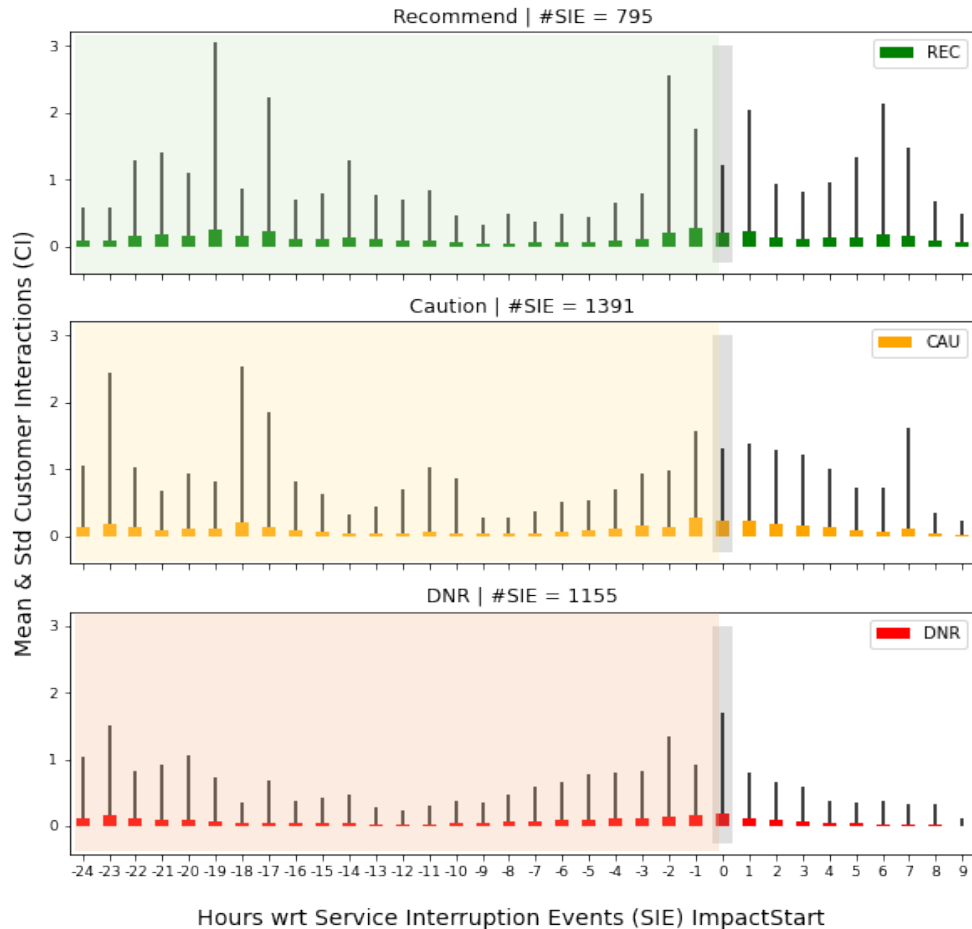
24hrs prior / 7days prior @TSI_Hr / 14days prior @TSI_Hr

...performed against all Customer Impacting (CI) events as well as with some removed:

- App Troubleshooting
- Device Speed Test
- Gateway Speed Test
- Self Service PHT
- System Refresh
- Device Reboot

In all cases, Service Impacting Events (SIEs) that were performed during PMT “Recommended” hours showed lower customer impact versus those performed during PMT “Do-Not-Recommend” hours

Assessment – Results Example



Example Results – 24 Hr Baseline

All Customer Interaction Event Types

'Repair Voice', 'XA Troubleshooting', 'Device Speed Test', 'Gateway Speed Test', 'Trouble Call Created', 'Repair Chat', 'Self Service PHT', 'System Refresh', 'Device Reboot'

CI	SIE category	prior24Hrs	@SIE_Hr	delta_ratio
All Types	REC	0.119	0.199	1.673
	CAU	0.105	0.238	2.273
	DNR	0.083	0.182	2.200

Avg # Customer Interactions events / hour / SIE over 24 hours prior to SIE

Avg # Customer Interactions events / SIE during the hour after the start of SIE impact

¹Each TSI ticket's set of SIE-affected accounts associated timeline events are considered.

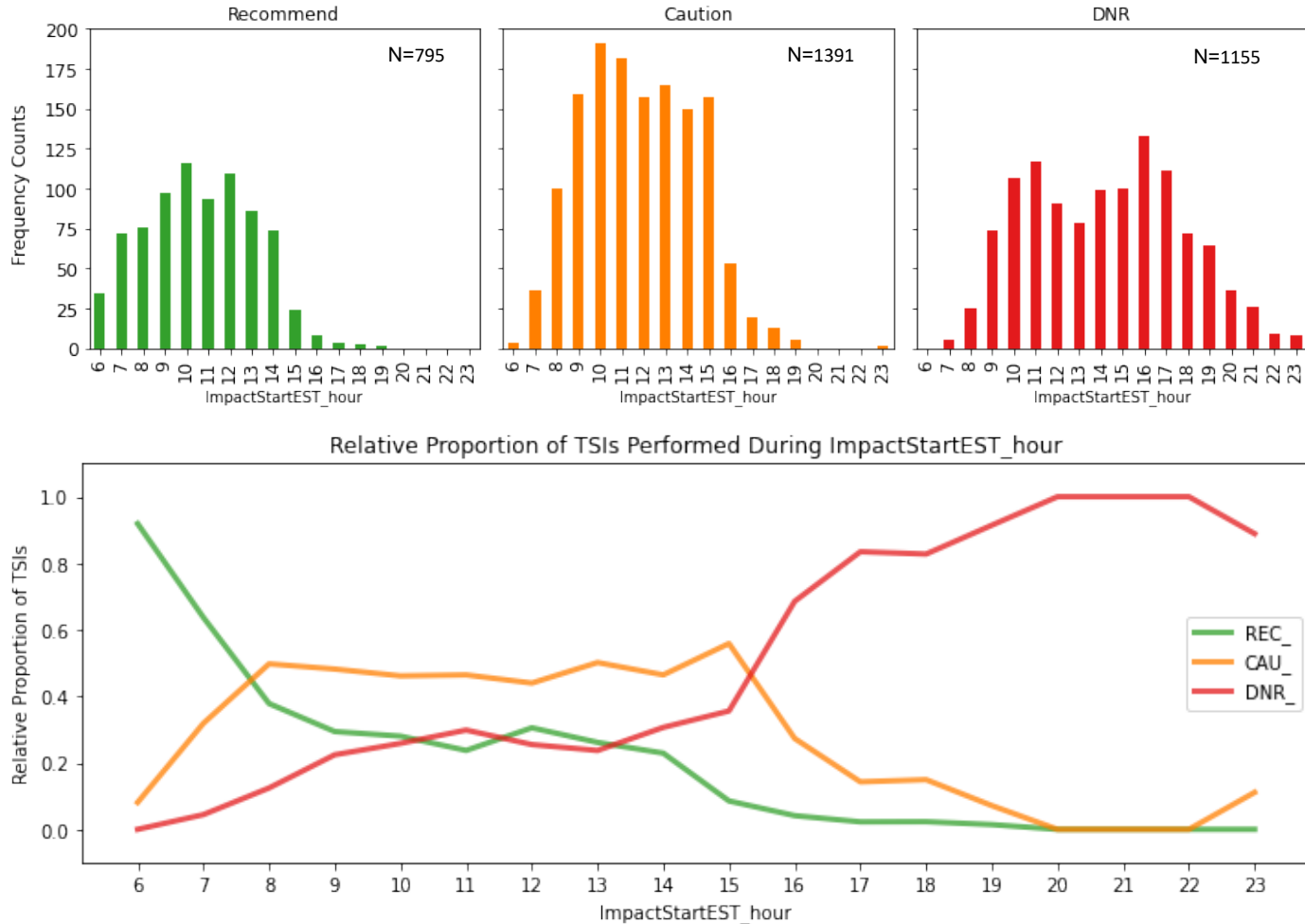
*Potential time-of-day effects in the 24hr prior baseline prompted us to consider prior 7|14 days' SIE_startHr baselines

Assessment – A Different View of the Results

The upside of trying different analyses is that sometimes you learn something new about your data

- It was observed that recommended hours rolled off around 3pm
- ...and that not-recommended hours overlapped with recommended starting at 9am and didn't improve until very late

Could such observations be helpful in planning maintenance?



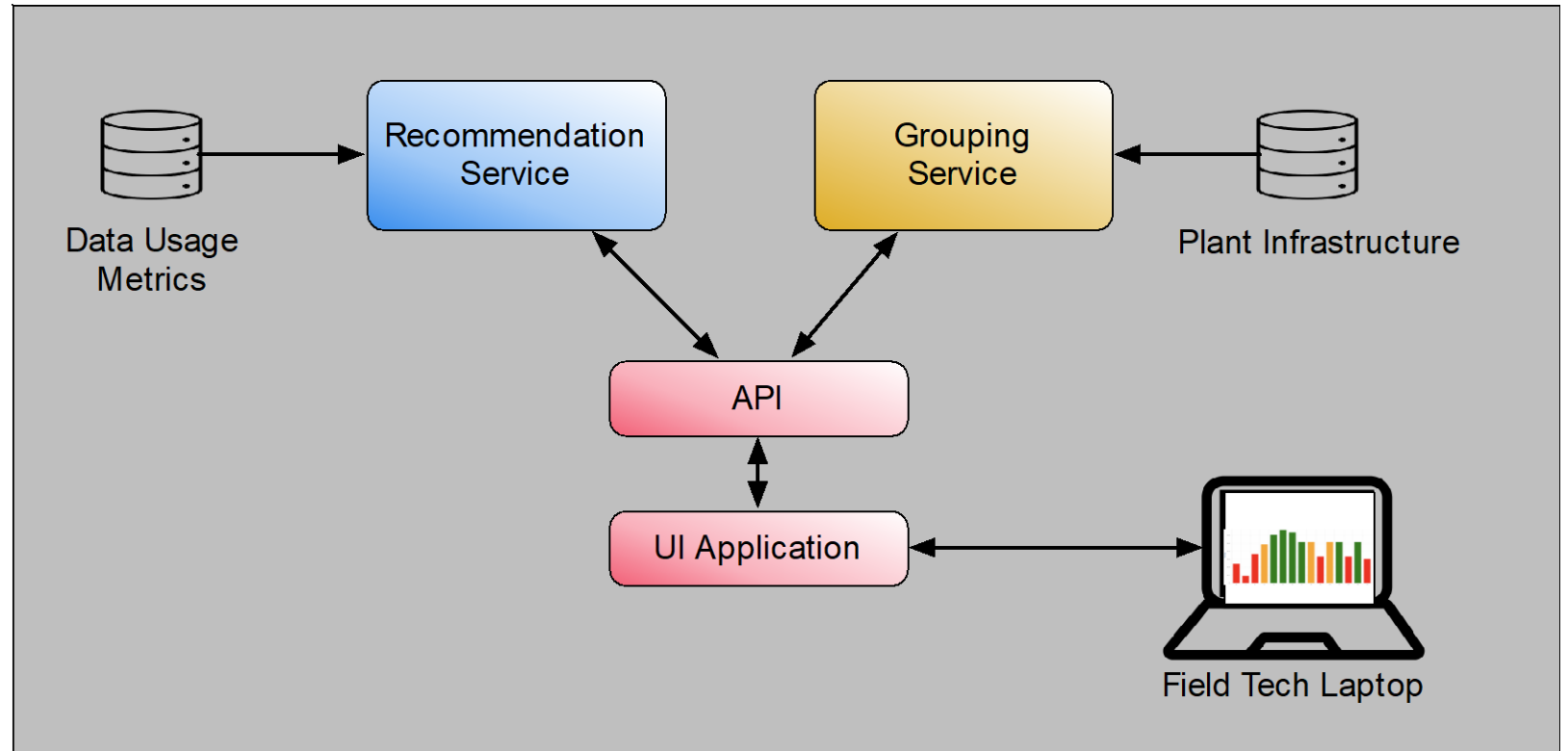
PMT – User Application Architecture

Deceptively simple in appearance

Recommendation Service uses an algorithm that takes into consideration the majority of accounts without squashing the minority

Grouping Service uses a multi-pass approach to merging plant data with billing data to tie MAC addresses to the plant topology

PMT API coordinates data flows, stores recommendations and identifies recommendations for specific requests



Results and Recommendations

Assessment

- An idealized test showed that there may be adequate “signal” in hourly user data consumption for the PMT Recommendation Service to accurately find the best and worst times to perform plant maintenance
- Helps to identify daily trends which, in aggregate, may be useful in recommending how operations managers should schedule service interruptions
- More data is required to be able to state that a ‘statistically significant’ evidence
- Additional testing is recommended to provide higher confidence in the findings...
 - ...in the same test region over more calendar days
 - ...in other regions

PMT Application

- A trial-ready application was successfully built and made operational
- However, a trial nearing a full-scale deployment would be needed to prove its effectiveness
- The effort required to create the application was worthwhile because it led to a deeper understanding of our data and has sparked innovations that will drive new projects

“We collect, store, and use all data in accordance with our privacy disclosures to users and applicable laws”.



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Thank You!

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