Maintaining a State of Good Repair w/ Predictive Analytics

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COLORADO

NATIVE COLORADO

REGIS UNIVERSITY

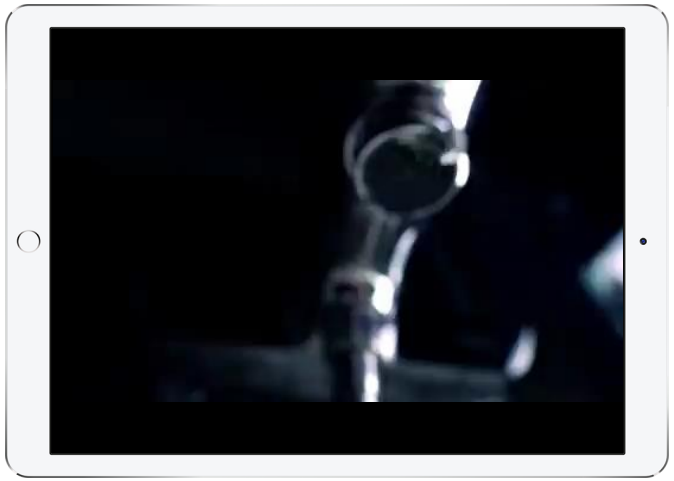
DENVER WATER

Agenda

3 use cases

Corrosion Analytics

Mobile Work Fleet



Water Leak Detection w/ Machine Learning

Agenda

1 App

1 App! (Depends on MLTK & Maps+)

- Take demo home (README.md)
- Take action at work (README.md)
- Up your Splunk game (README.md)

Agenda

Solution Deep Dive(s)/Demo

- SPL takeaways
- Implementation examples
- Tip / Tricks (README.md)
- Q & A

Corrosion Analysis

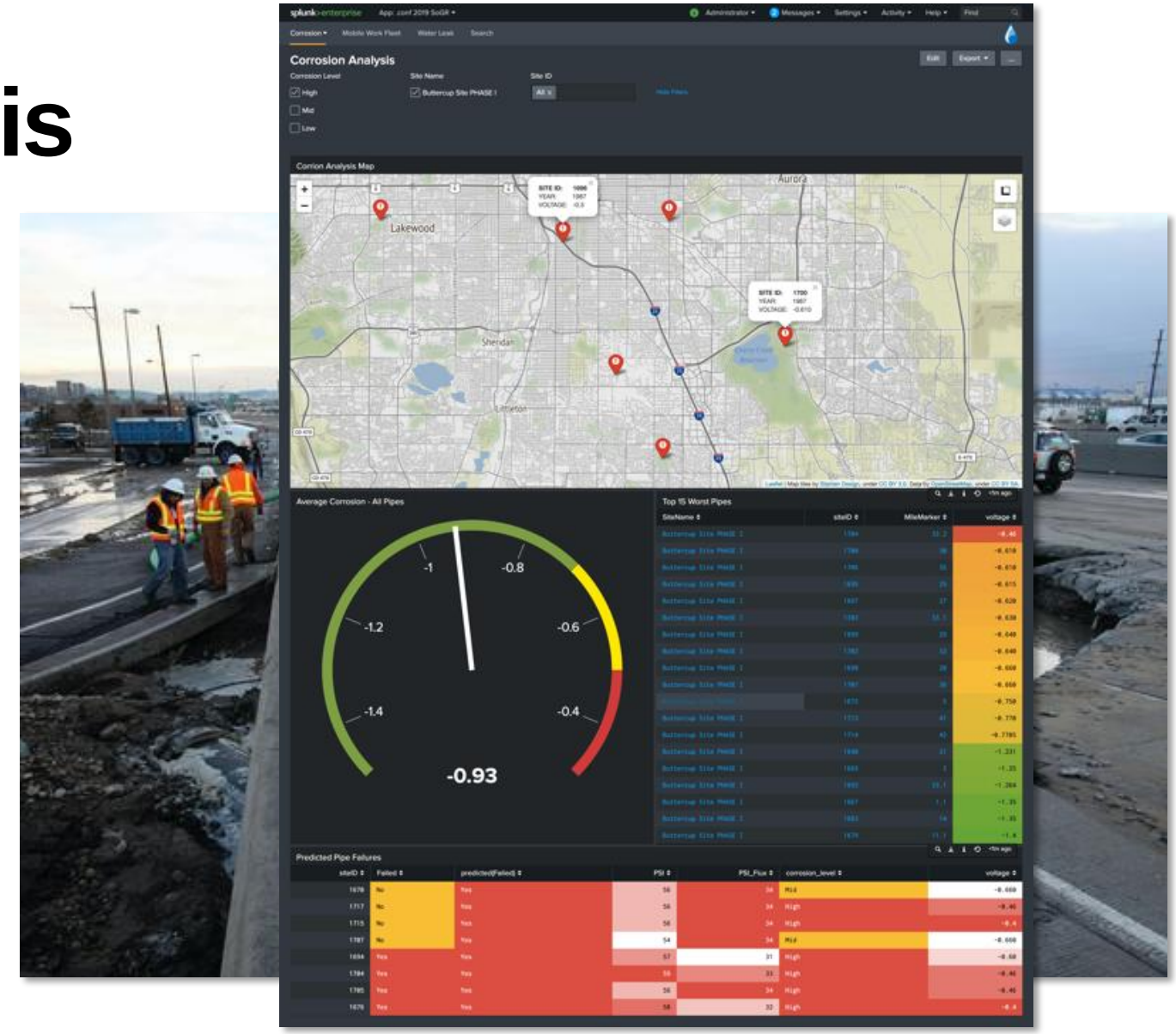
Background

Sinkholes

Disparate Data

- ArcGIS
- Maximo
- IoT devices (voltage, PSI etc.)

Pipe Replacement Priorities



Corrosion Analysis

Map - Deep Dive

Defining Corrosion Level w/ Eval

- Voltage
- Outliers
- Categorize w /Eval! (my favorite!)

```
| inputlookup dbo_vwAnnual_Data.csv
| eval voltage = (MinValue + MaxValue) / 2
| where voltage <="-1.9" AND voltage >="-0.2"
| eval corrosion_level = case(voltage <="-0.65", "High", voltage >"-0.65" AND voltage <="-0.7", "Mid",
    voltage >"-0.7", "Low")
| sort voltage
| dedup siteID
| join siteID [| inputlookup GIS.csv | rename SITE_ID as siteID, LAT as latitude, LON as longitude]
| eval markerColor = case(like(corrosion_level, "%High%"), "red", like(corrosion_level, "%Mid%"),
    "orange", like(corrosion_level, "%Low%"), "green")
| eval icon = case(like(corrosion_level, "%High%"), "exclamation-circle", like(corrosion_level, "%Mid%"
    ), "flash", like(corrosion_level, "%Low%"), "check-circle")
| eval description = "<b>"."SITE ID:      ".siteID."</b><br>"."YEAR:      
    ;   ".YEAR."<br>"."VOLTAGE:   ".voltage
| search siteID=* SiteName="Buttercup Site PHASE I"
| where corrosion_level="High" OR corrosion_level="Mid" OR corrosion_level="Low"
| table description latitude longitude icon voltage markerColor siteID
```

```
| eval voltage = (MinValue + MaxValue) / 2
```
// First, we get average voltage

```
| where voltage <="-1.9" AND voltage >="-0.2"
```
// Next, we eliminate outliers by focusing on just known range

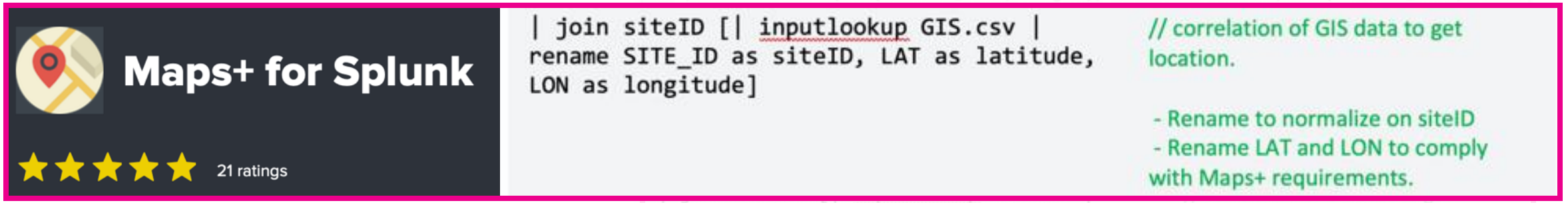
```
| eval corrosion_level = case(voltage <="-0.65", "High", voltage >"-0.65" AND voltage <="-0.7", "Mid", voltage >"-0.7", "Low")
```
// Finally, instantiate "High", "Mid" and "Low" ranges for "corrosion_level" field.

Corrosion Analysis

Map - Deep Dive

Correlation & Normalization

- Join (would normally use a search)
- Rename for normalization



Corrosion Analysis

Map - Deep Dive

Eval ROCKS!

- Coloring mile markers
- Map+ Icons
- HTML Magic!

Coloring Mi

Map+ Icons

HTML Magic!

```
1  | inputlookup dbo_vwAnnual_Data.csv
2  | eval voltage = (MinValue + MaxValue) / 2
3  | where voltage <="-1.9" AND voltage >="-0.2"
4  | eval corrosion_level = case(voltage <="-0.65", "High", voltage >"-0.65" AND voltage <="-0.7", "Mid",
     voltage >"-0.7", "Low")
5  | sort voltage
6  | dedup siteID
7  | join siteID [| inputlookup GIS.csv | rename SITE_ID as siteID, LAT as latitude, LON as longitude]
8  | eval markerColor = case(like(corrosion_level, "%High%"), "red", like(corrosion_level, "%Mid%"),
     "orange", like(corrosion_level, "%Low%"), "green")
9  | eval icon = case(like(corrosion_level, "%High%"), "exclamation-circle", like(corrosion_level, "%Mid%"
     ), "flash", like(corrosion_level, "%Low%"), "check-circle")
10 | eval description = "<b>"."SITE ID:      ".siteID."</b><br>"."YEAR:      
     ;   ".YEAR."<br>"."VOLTAGE:   ".voltage
11 | search siteID=* SiteName="Buttercup Site PHASE I"
12 | where corrosion_level="High" OR corrosion_level="Mid" OR corrosion_level="Low"
13 | table description latitude longitude icon voltage markerColor siteID
```

```
| eval markerColor =
case(like(corrosion_level, "%High%"),
"red", like(corrosion_level, "%Mid%"),
"orange", like(corrosion_level, "%Low%"),
"green")
```

// instantiate default color markers for corresponding Maps+ Icons and associated corrosion levels

```
| eval icon = case(like(corrosion_level,
"%High%"), "exclamation-circle",
like(corrosion_level, "%Mid%"), "flash",
like(corrosion_level, "%Low%"), "check-
circle")
```

// Next, instantiate Maps+ Icons and associated corrosion levels

```
| eval description = "<b>"."SITE ID:
   
 ".siteID."</b><br>"."YEAR:  
     
".YEAR."<br>"."VOLTAGE:   ".voltage
```

// Make interactive pop-ups POP with a little HTML Magic!

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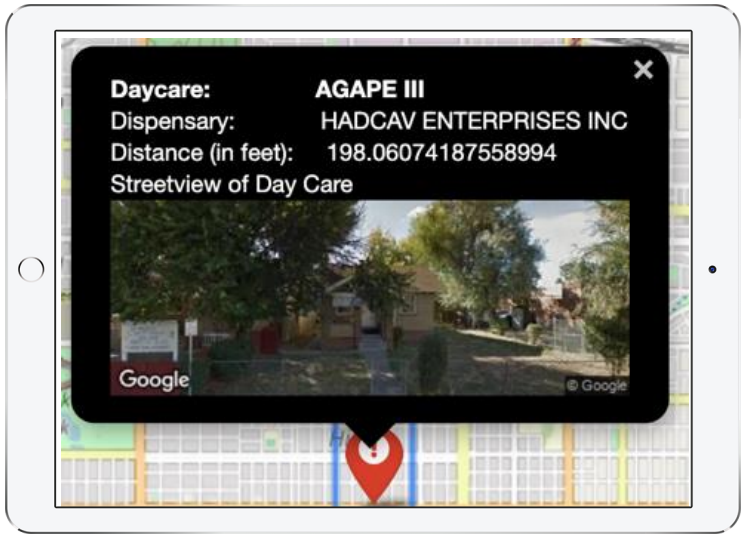
Corrosion Analysis

Map - Deep Dive



Eval ROCKS!

- Coloring mile markers
- Map+ Icons
- HTML Magic!

Calling APIs!

```
7  | eval description = "<b>"."Daycare:                ".Daycare."</b>
8        <br>"."Dispensary:             ".Dispensary."
10       <br>Streetview of Day Care
11       <br><img src=https://maps.googleapis.com/maps/api/streetview?size=400x150&location=".latitude.",".longitude."&key
           =                                                                    >"
```

https://developers.google.com/maps/documentation/javascript/get-api-key

Corrosion Analysis

Prediction - Deep Dive

Machine L

- Apply
- Search
- Report / Ale

Predicted Pipe Failures

siteID	Failed	predicted(Failed)	PSI	PSI_Flux	corrosion_level	voltage
1670	No	Yes	56	34	Mid	-0.660
1717	No	Yes	56	34	High	-0.46
1715	No	Yes	56	34	High	-0.4
1707	No	Yes	54	34	Mid	-0.660
1694	Yes	Yes	57	31	High	-0.60
1704	Yes	Yes	59	33	High	-0.46
1705	Yes	Yes	56	34	High	-0.46
1676	Yes	Yes	58	32	High	-0.4

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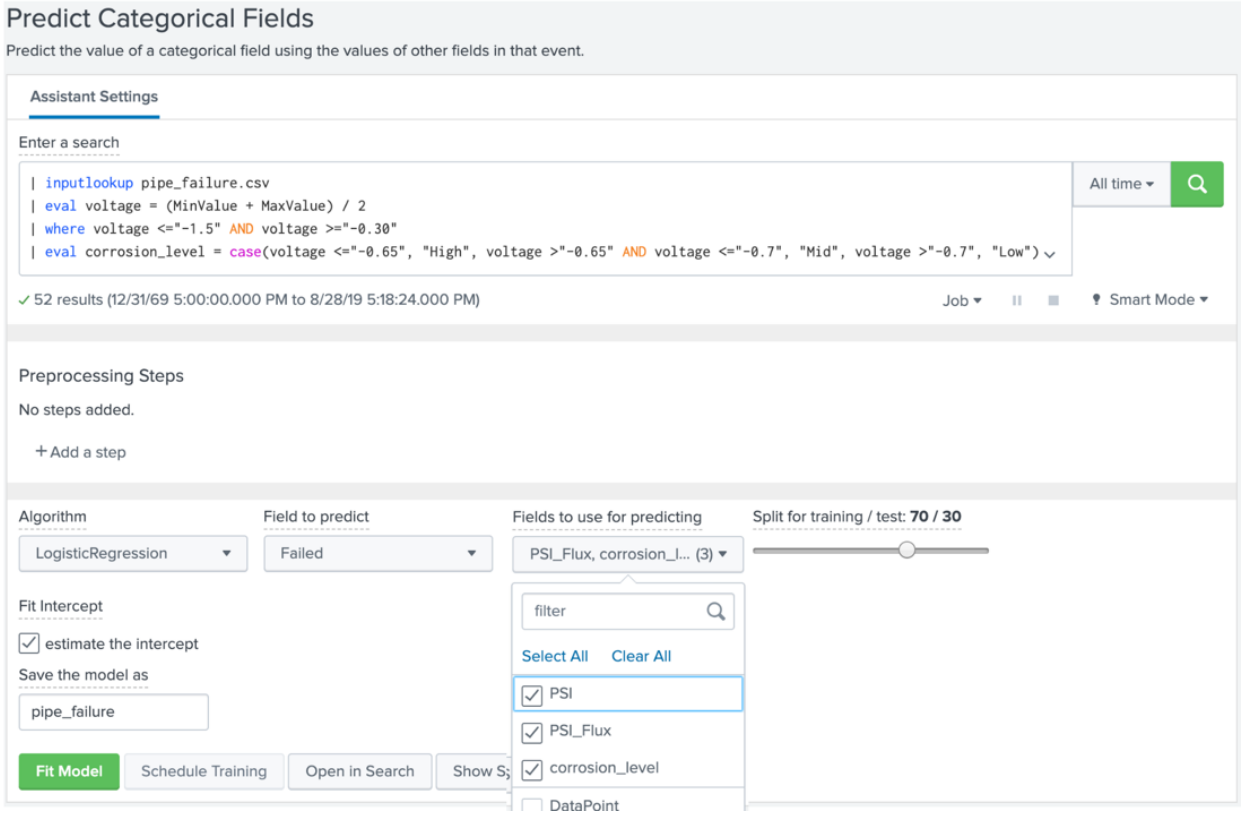
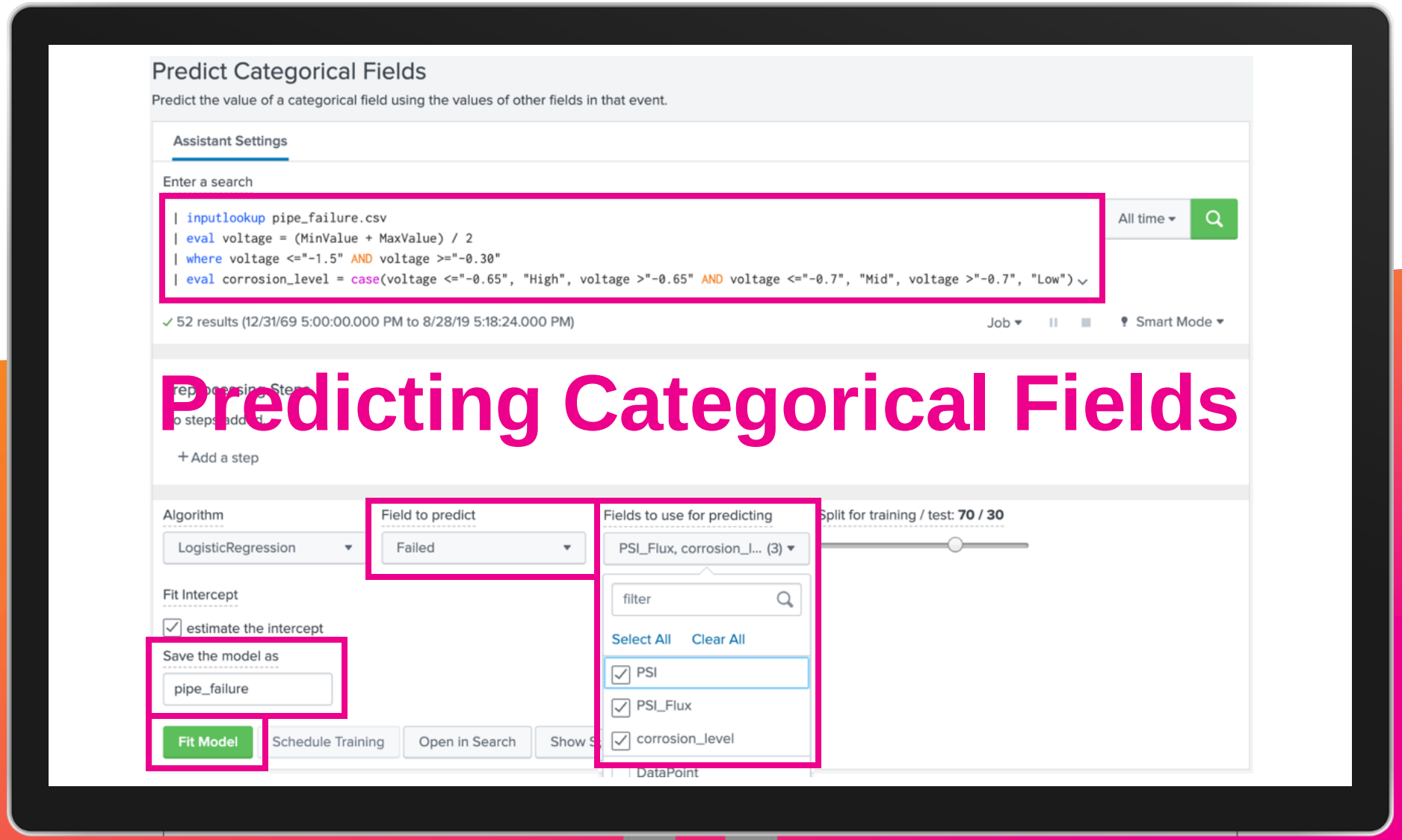
Corrosion Analysis

Prediction – Implementation & requisites

MLTK

- **Predict Categorical Fields assistant**
- Knowledge Objects
- __mlspl_ model lookups



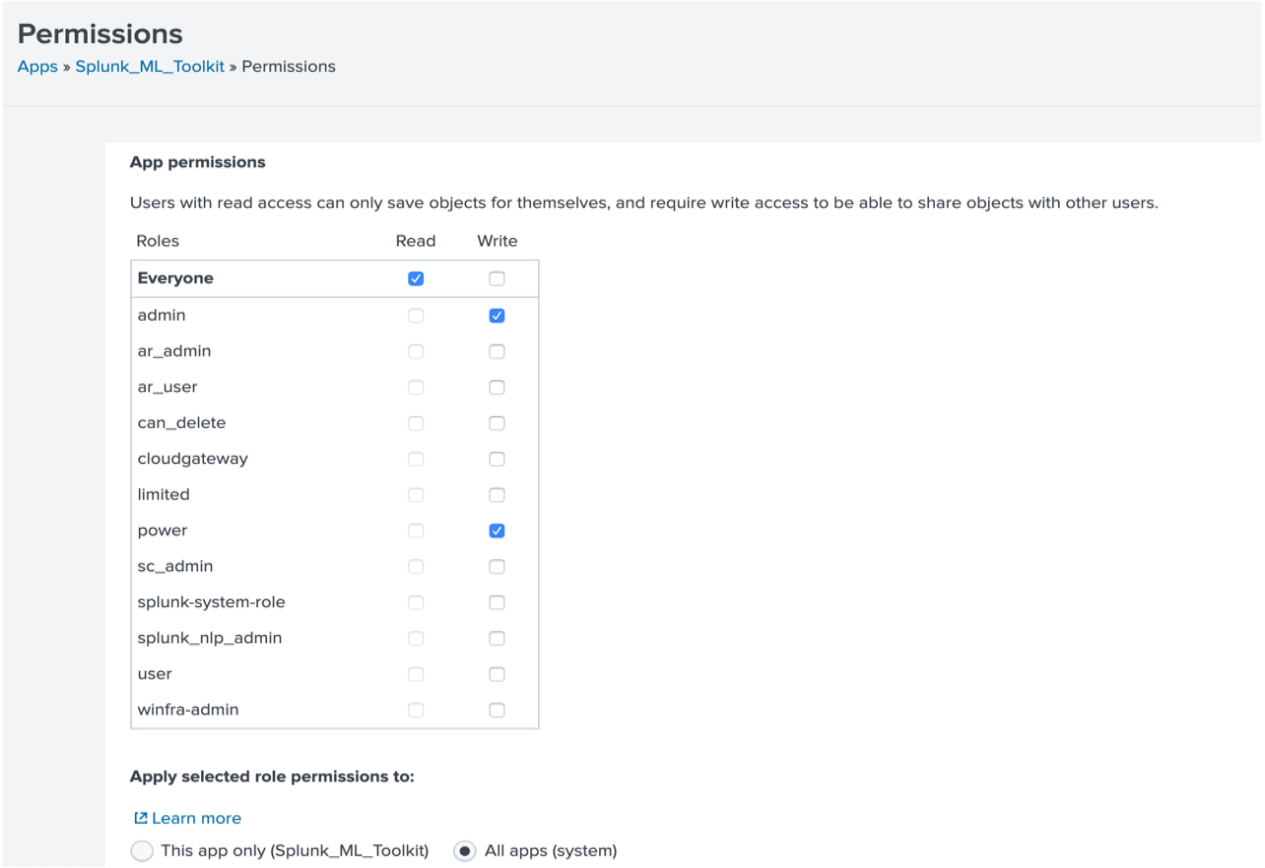


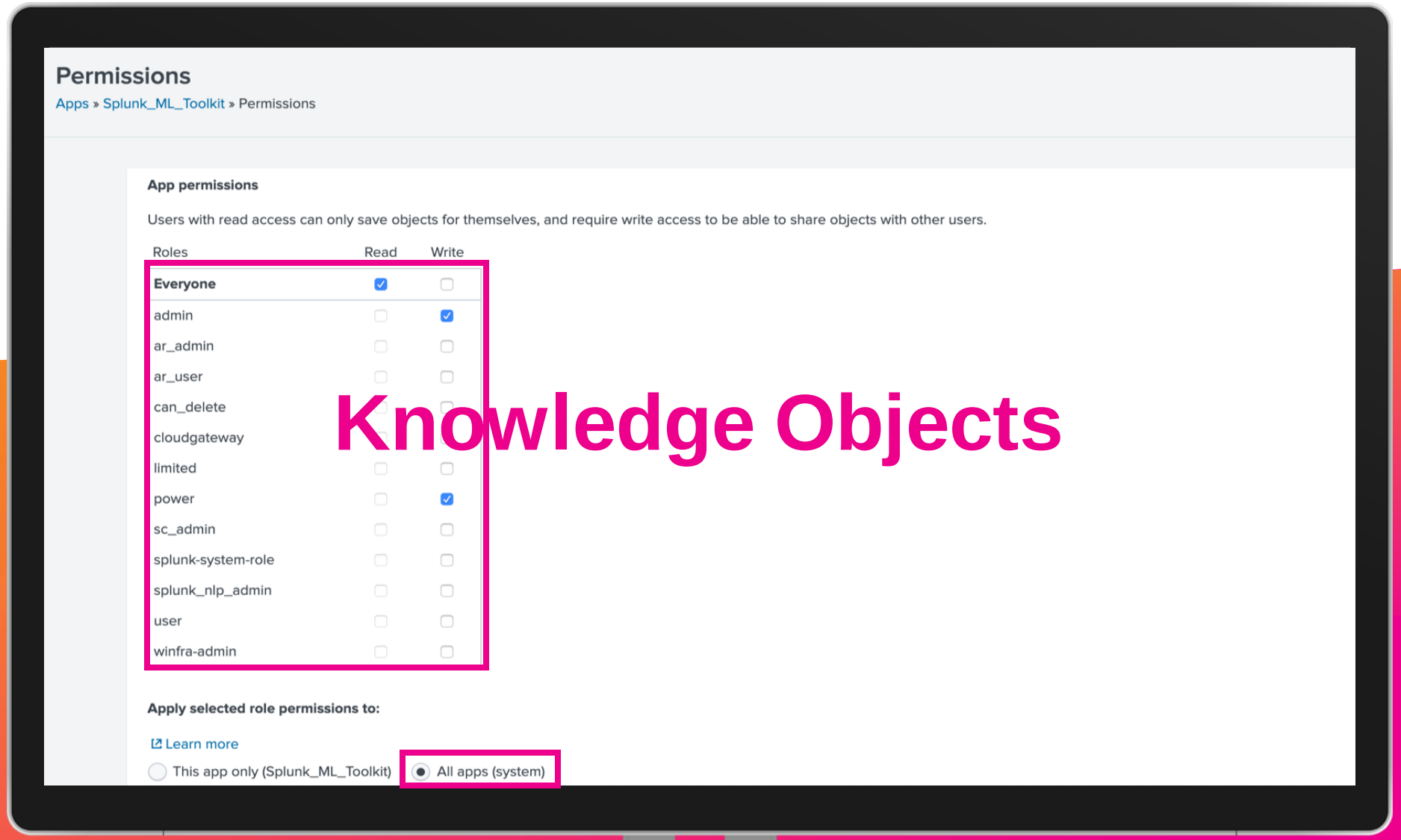
Corrosion Analysis

Prediction – Implementation & requisites

MLTK

- Predict Categorical Fields assistant
- **Knowledge Objects**
- __mlspl_ model lookups





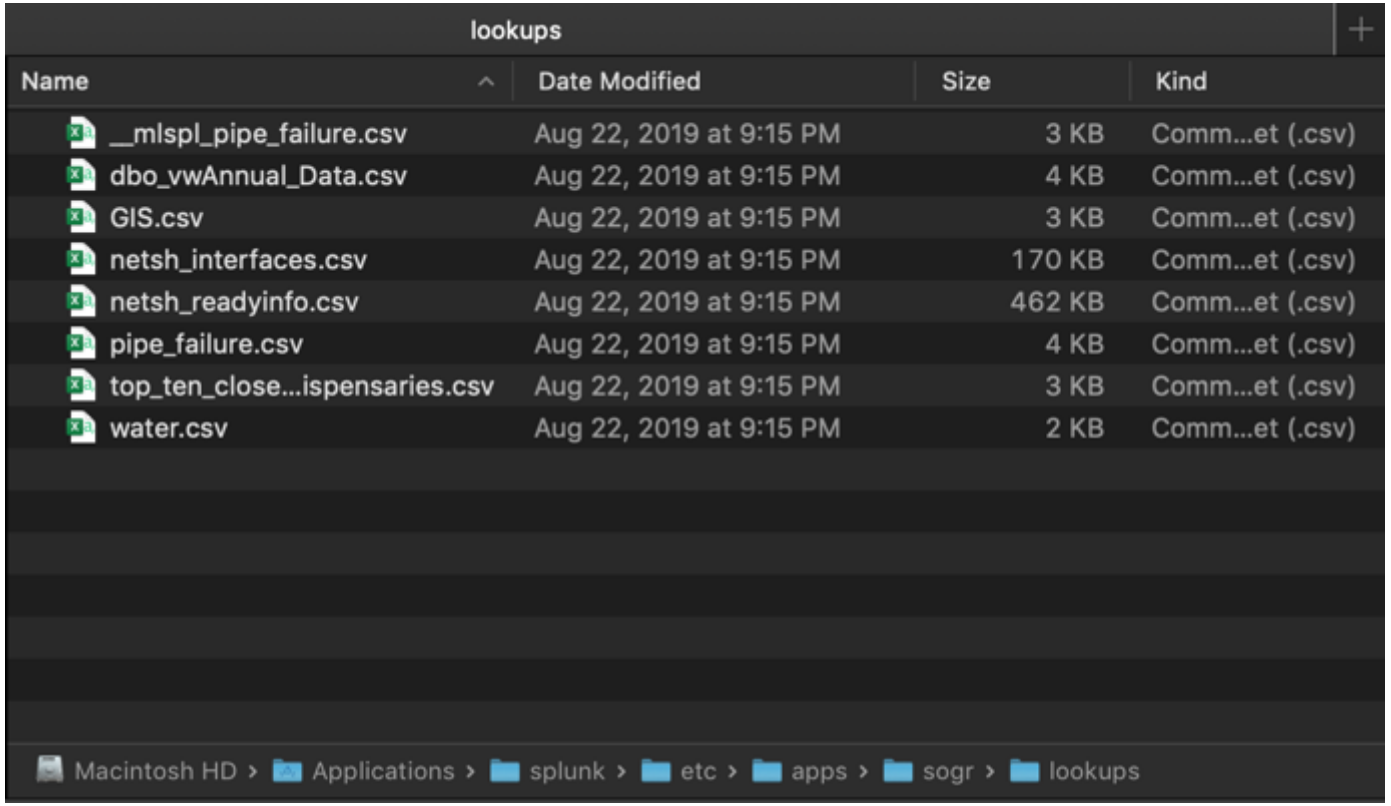
Knowledge Objects

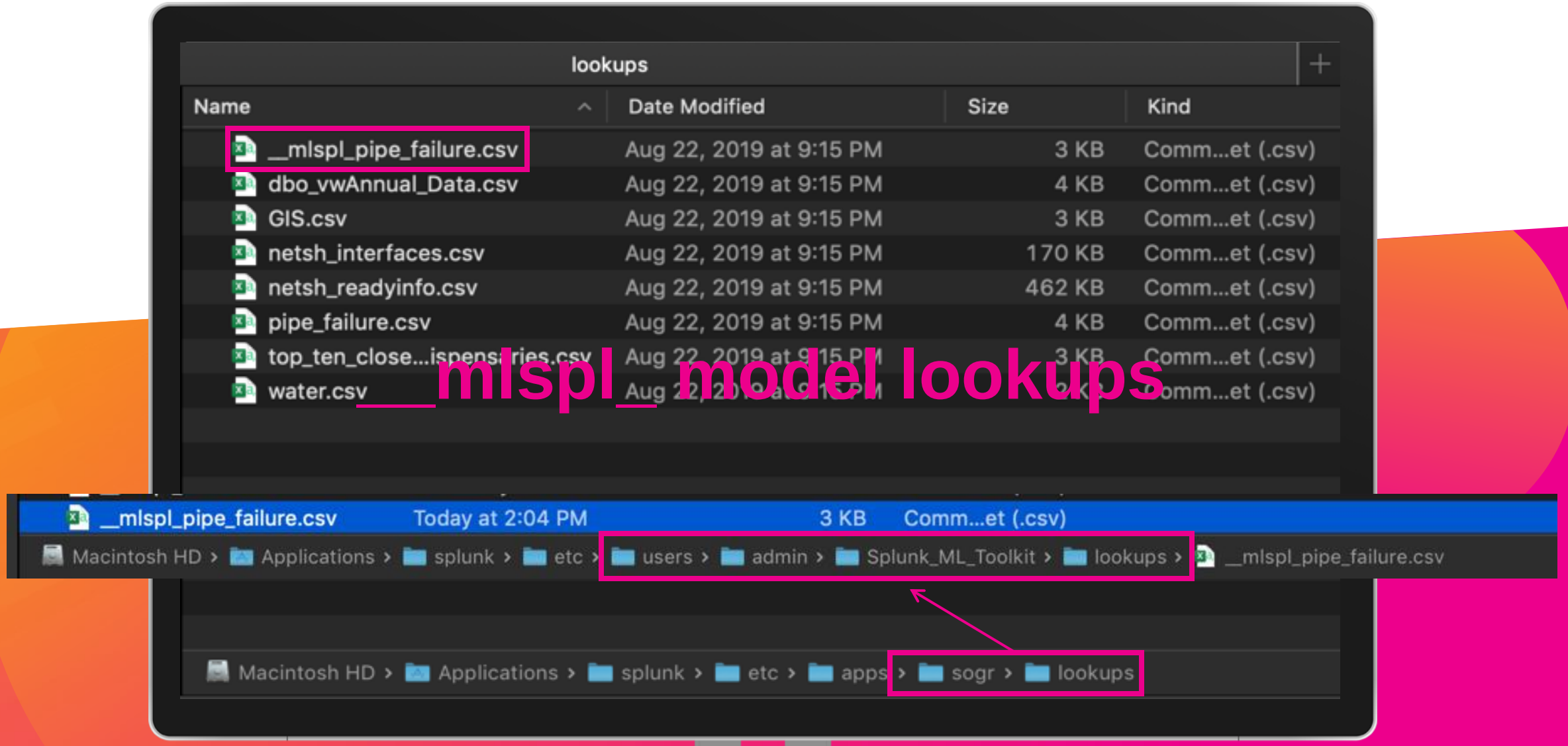
Corrosion Analysis

Prediction – Implementation & requisites

MLTK

- Predict Categorical Fields assistant
- Knowledge Objects
- **__mlspl_ model lookups**





Demo

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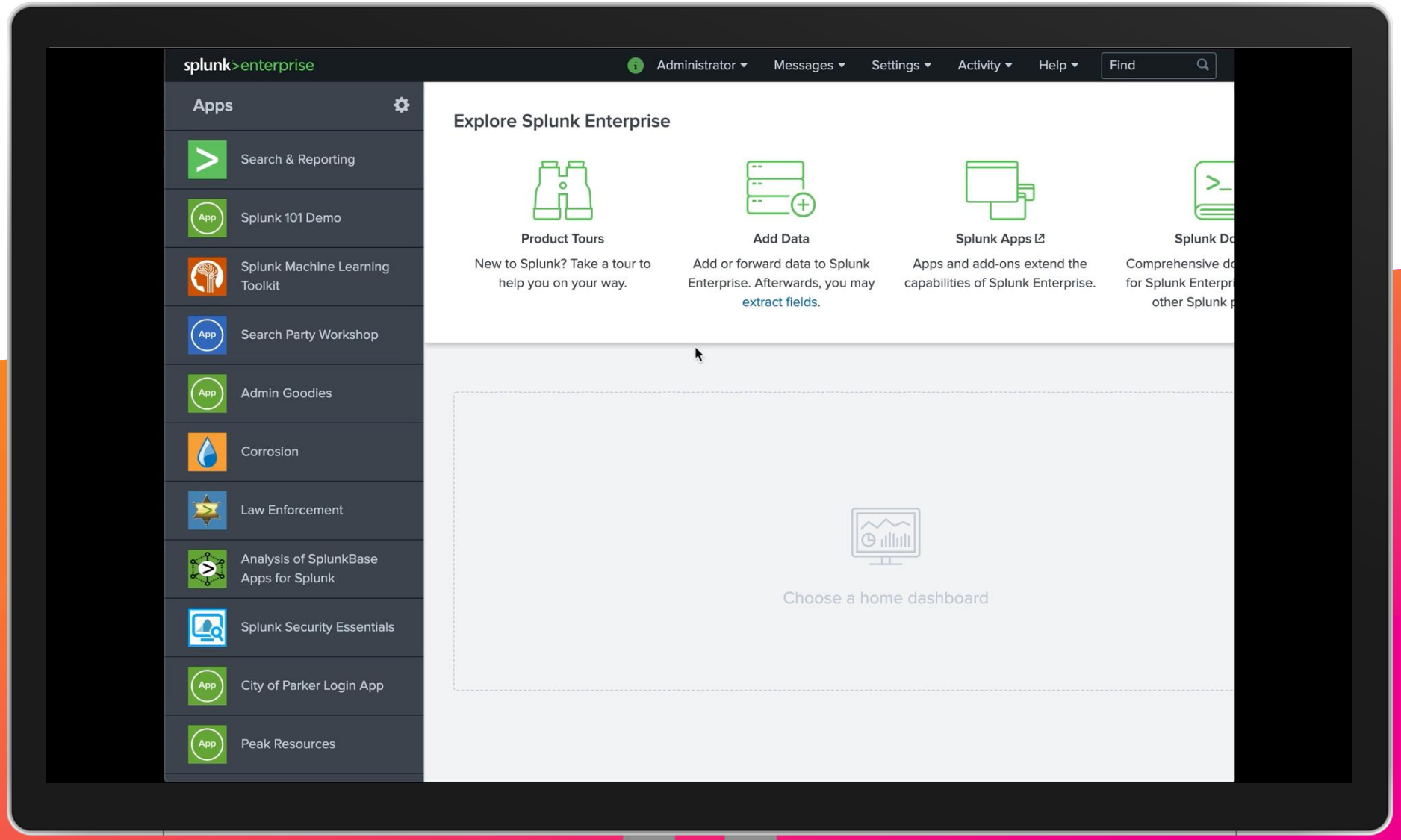

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Mobile Work Fleet

Background

Inventory to AH HA!

No native data

- Scripted inputs

Rate payers want:

- Fiscal responsibility
- Data Driven Decisions
- Maximum Efficiencies

Link to blog

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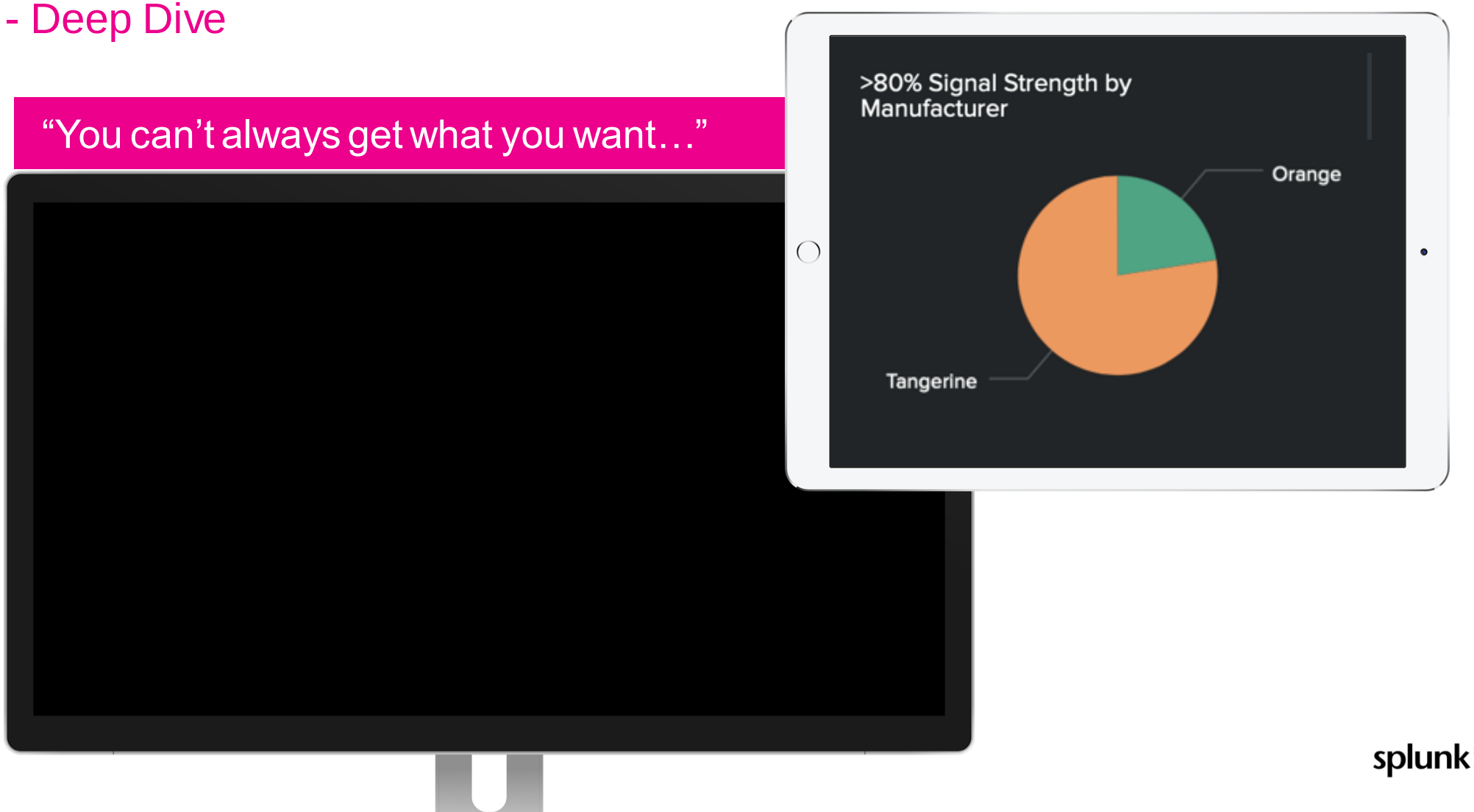
Mobile Work Fleet

Mobile - Deep Dive

"You can't always get what you want…"



Mobile Work Fleet

Mobile – deep dive

- But if you try sometimes, you might just might find, Splunk's got what you need
- No time for % signs cause we are the champions!
- **Is there anybody out there!?**

```
1  | inputlookup netsh_interfaces.csv
2  | search Device=* Signal=*
3  | rex field=Signal "(?<signal>\d+)%"
4  | where signal>80
5  | stats count(signal) by Manufacturer
```

```
| search Device=* Signal=*                    // show only records with necessary fields
| rex field=Signal "(?<signal>\d+)%"          // strip the percent from signal for filtration
| where signal>80                             // show only desired signal or better
```

Is there anybody out there!?

Leak Detection:

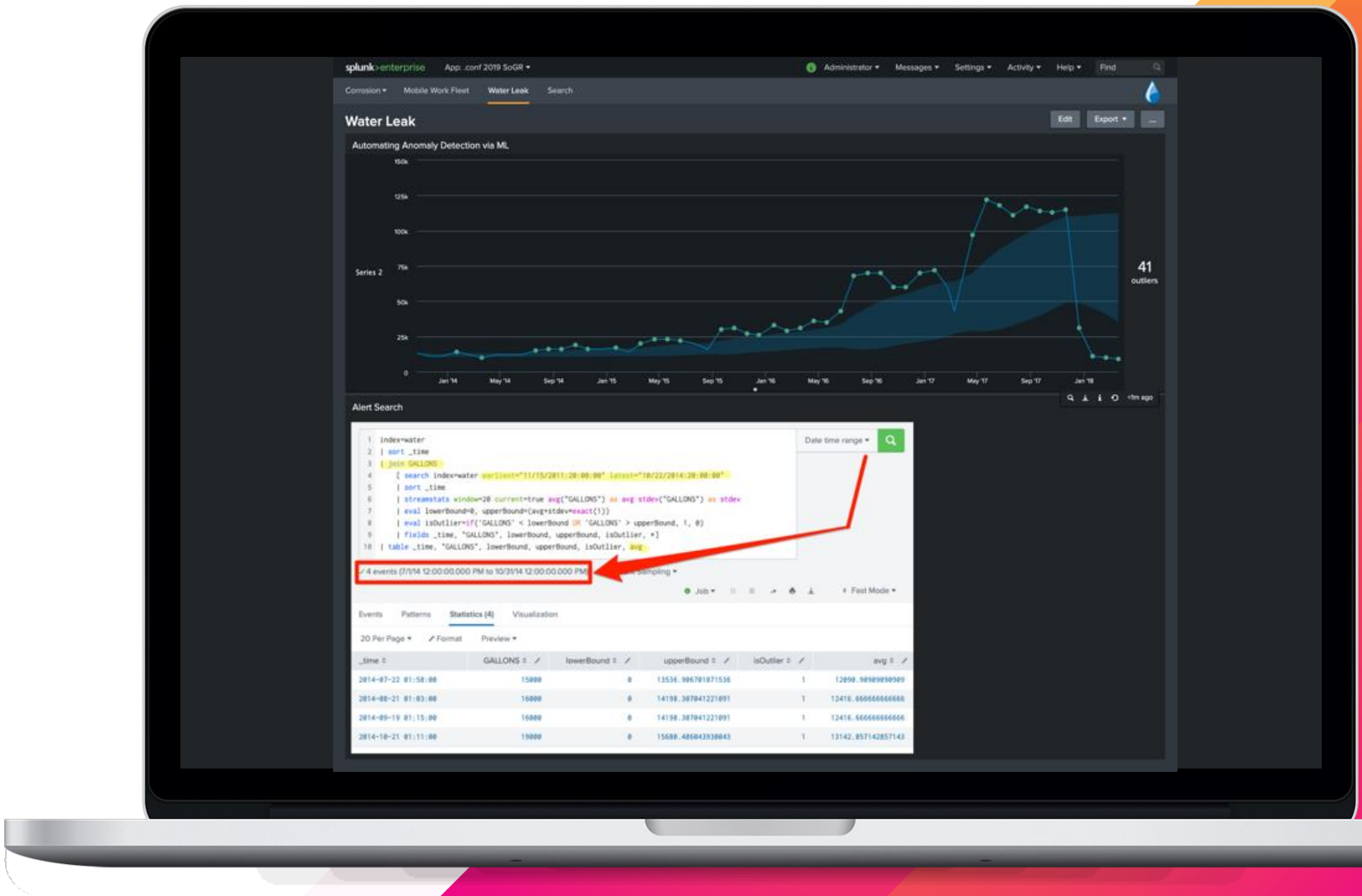
Background

Lazy HOAs

Hot Tube Disasters

Machine Learning for.

- Proactive Monitoring / Alerting
- Predictive Detection
- Prevent YEARS of water waste



Demo

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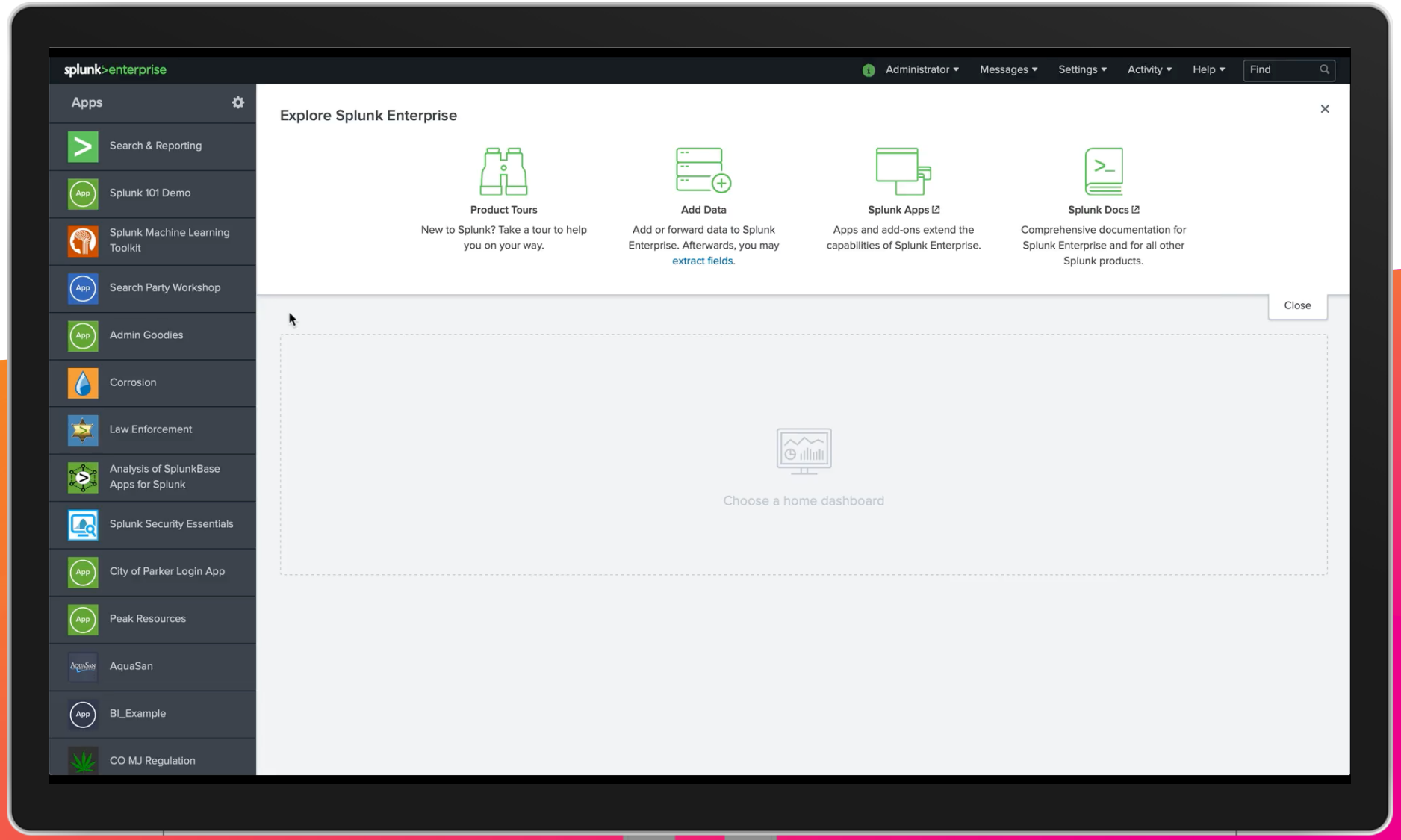

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Key Takeaways

1) Corrosion – ML for predicting failures

2) Mobile – Scripted inputs

3) Water Leaks – Fit your own model w/ subsearch

Dig in!

1 App! (Depends on MLTK & Maps+)

- Take demo home (README.md)
- Take action at work (README.md)
- Up your Splunk game (README.md)

Download the App

.conf19

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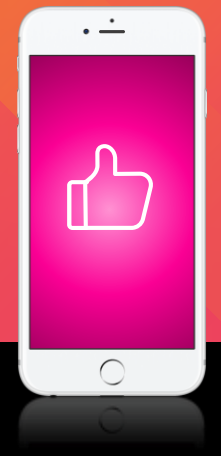
Thank You!

Go to the .conf19 mobile app to

RATE THIS SESSION



Q&A

Tony Nesavich | Staff Sales Engineer

https://github.com/splunk/state-of-good-repair

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