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Fun with Analytics

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Agenda

Fun with Analytics

- Intro – About Us
- What is this “fun” all about?
- Hardware
- The Solution
- Results

Who Are We?

Marcello Lino

- Senior Security Engineer
  - 25+ years of IT experience
  - Background in database, development, *NIX
  - Using Splunk for 3 years
  - Splunk Certified Architect
- Hobbies
  - Play guitar (mostly metal \m/)

James Sullivan

- Senior Security Engineer
  - 15+ years of IT experience
  - Background in*NIX, Python, Security
  - Using Splunk for 3 years
  - Splunk Certified Architect
- Hobbies
  - Hiking

What Is This Fun All About?

Science Project

The idea came from a 6th grade science project.

- Objective was to grow plants on different soil types and analyze the results
  - Soil matter→ Clay, Sand, Dirty and Silt.
  - And more and more questions started to come up …
    - How do we measure the amount of water required?
    - Do we need a green house to ensure a constant, stable environment?
    - How do we know if the environment is healthy or not?
      - Sun light?
      - Temperature?
      - Moisture?
      - Humidity?

Let’s Make It Fun

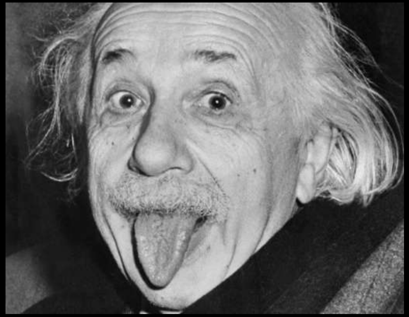
Science Project

So we thought … Let’s collect all the required data automatically!

- Having this data collected allows near real-time analysis on:
  - Illumination (lux)
  - Soil moisture
  - Current green house temperature and humidity
- Data is streamed to Splunk for:
  - Analytics
  - Visualizations

“A **Theory** Can Be Proved By **Experiment**; But No Path Leads From Experiment To The Birth Of A Theory.”

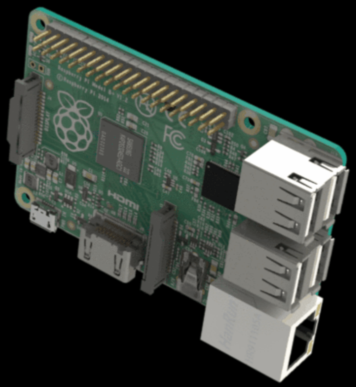
Albert Einstein

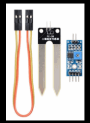
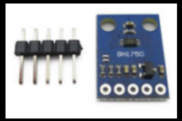


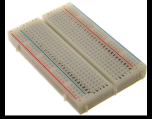
Equipment Used

Science Project

- Raspberry Pi 3
- Sensors, chips, etc:
  - Light intensity sensor BH1750
  - MCP3008 Microchip 8 Channel 10 bit
  - Breadboard MB102 & jumper cables
  - Temperature and Humidity sensor AM2302
  - Soil Moisture Sensor And Automatic Watering System (AWS was not implemented)
  - Traffic light LEDs



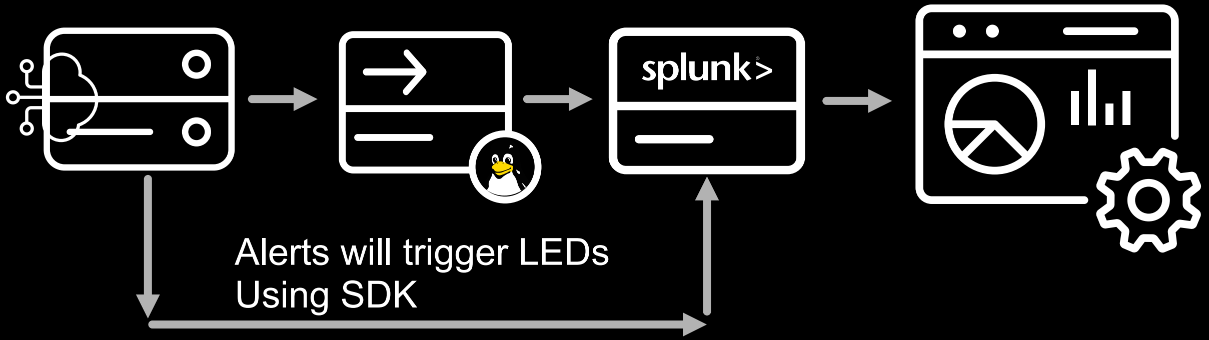


Software Used

Science Project

- Python scripts created for data collection and alerts
- Splunk Universal Forwarder
- Splunk Enterprise (free version!)

Process Flow

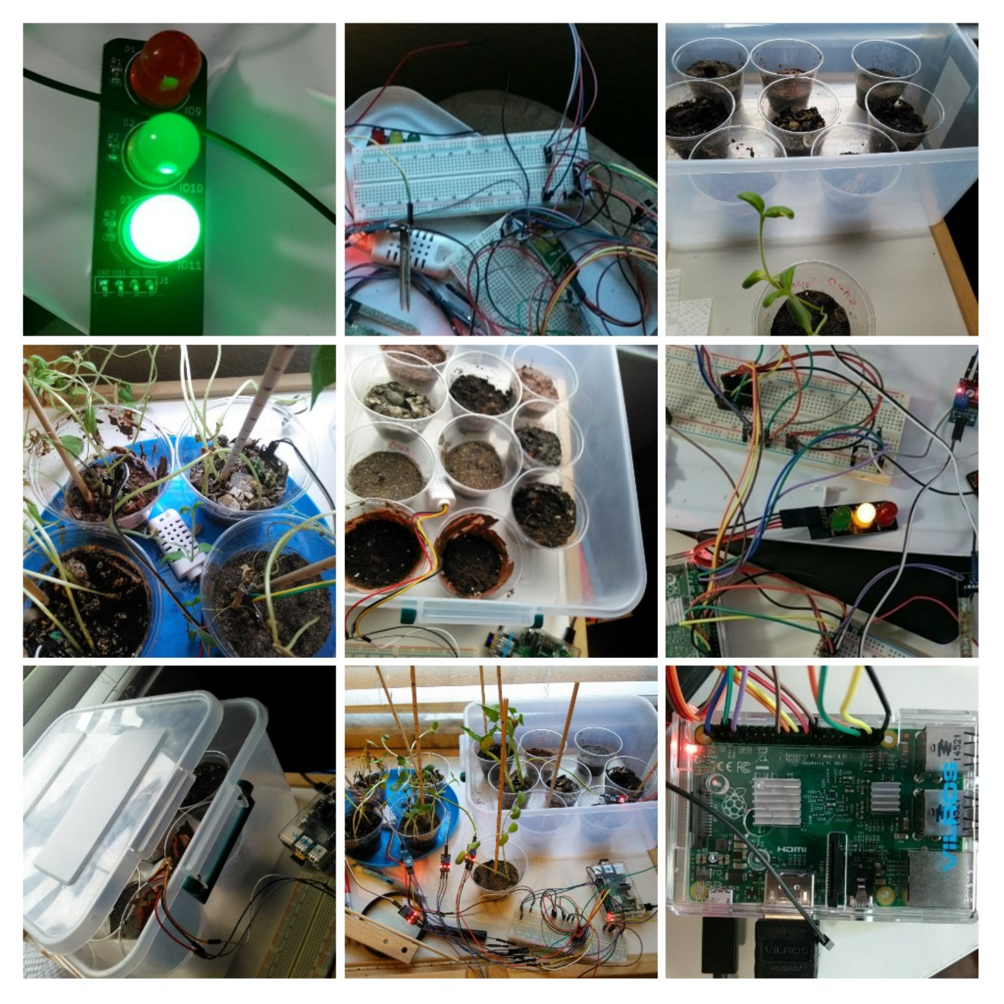


Alerts will trigger LEDs
Using SDK

And When We Put Everything Together

Science Project

- First… Isabella received A+ as final grade (applause…)
- LEDs light up whether the plants are in optimal (Green) or bad conditions (Red).
  - Need water
  - Has too much water
  - Temperature
  - Too humid could indicate plants cannot breath
- Splunk visualizations allows real time analytics



The Sourcetypes

Science Project

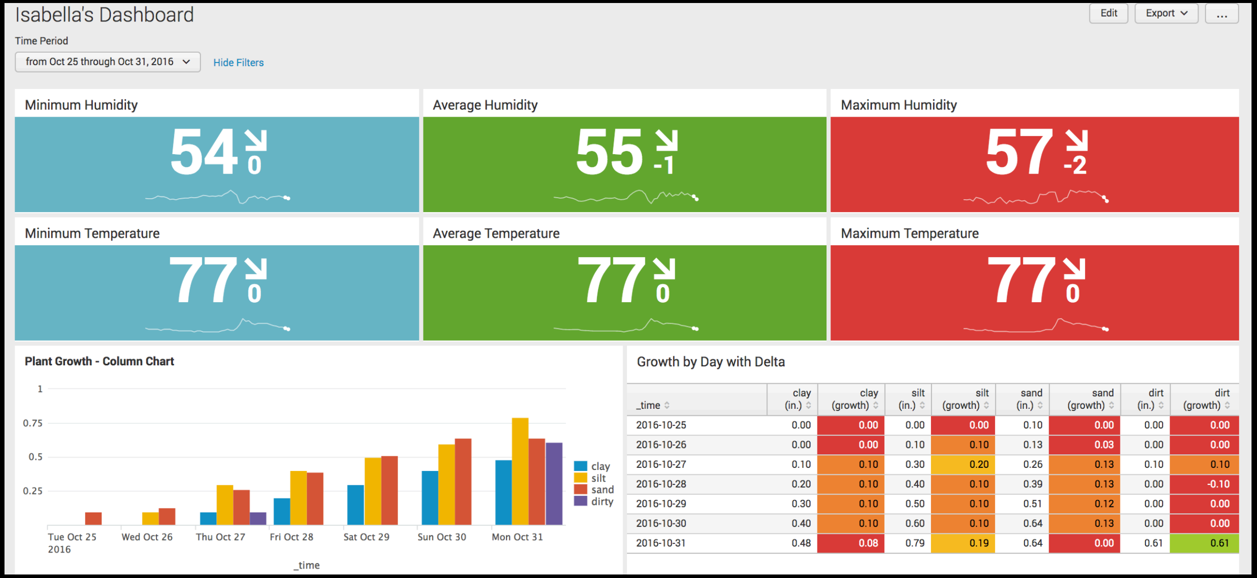
- Greenhouse – Temperature and Humidity
  - Near real-time collection using sensors and Splunk UF
- Growth – Daily plant measurements (in inches)
  - Isabella measured daily and fed results into Splunk via dashboard form input
- Soil – Moisture for each of the soil types
  - Near real-time collection using sensors and Splunk UF

- Data (output) was written w/ normalized timestamps, line breaks and key=value (or JSON) pairs to make indexing and field extraction automatic.

Isabella’s Dashboard

Science Project

- A series of dashboards and reports were built based on Isabella’s requirements
  - Temperature and Humidity: Show me the min, avg and max by day
  - How much did the plant grow for each soil type by day
  - Moisture levels by soil matter. Let’s make sure they are at the right level.



Isabella's Dashboard

Time Period

from Oct 25 through Oct 31, 2016

Minimum Humidity 54 ↘ 0

Average Humidity 55 ↘ -1

Maximum Humidity 57 ↘ -2

Minimum Temperature 77 ↘ 0

Average Temperature 77 ↘ 0

Maximum Temperature 77 ↘ 0

Plant Growth - Column Chart

Growth by Day with Delta

_time	clay (in.)	clay (growth)	silt (in.)	silt (growth)	sand (in.)	sand (growth)	dirt (in.)	dirt (growth)
2016-10-25	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
2016-10-26	0.00	0.00	0.10	0.10	0.13	0.03	0.00	0.00
2016-10-27	0.10	0.10	0.30	0.20	0.26	0.13	0.10	0.10
2016-10-28	0.20	0.10	0.40	0.10	0.39	0.13	0.00	-0.10
2016-10-29	0.30	0.10	0.50	0.10	0.51	0.12	0.00	0.00
2016-10-30	0.40	0.10	0.60	0.10	0.64	0.13	0.00	0.00
2016-10-31	0.48	0.08	0.79	0.19	0.64	0.00	0.61	0.61

Alerting w/ the Python SDK

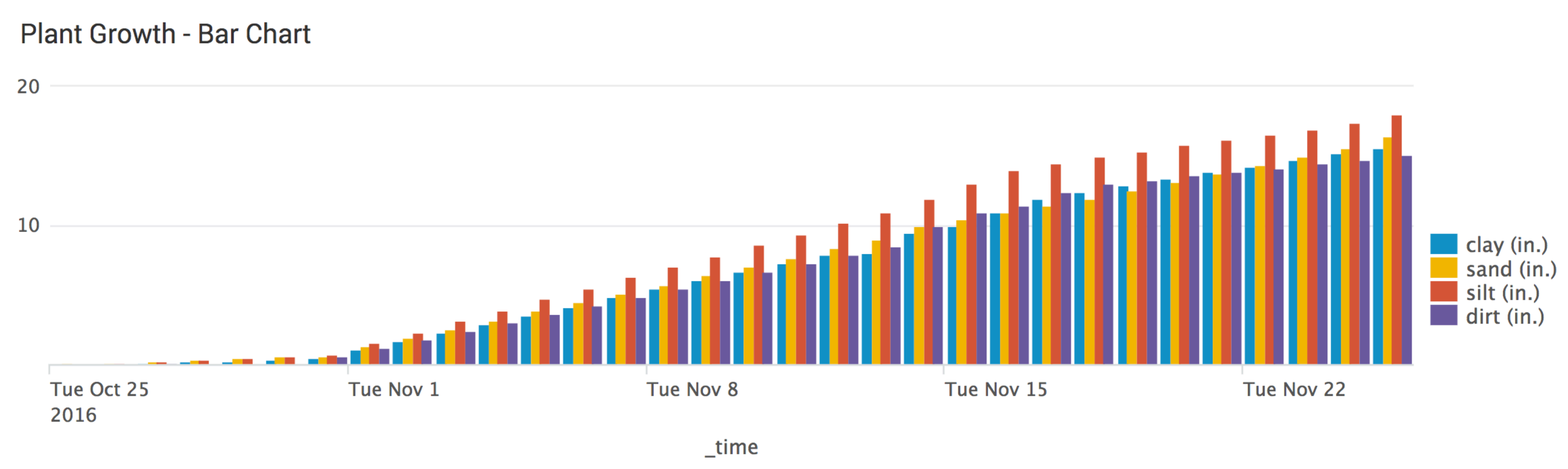
Science Project

- The Splunk SDK for Python was installed on the Raspberry Pi device.
- Every 30 seconds, a script would:
  - Search moisture levels and trigger LED lights.
    - >1000 (Red) = Too Dry!
    - Between 800 and 1000 (Yellow)
    - Between 600 and 800 (Green)
    - Between 100 and 500 (Yellow)
    - <100 (Red) = Too Wet!
- The Python SDK package includes sample scripts (eg. search.py) that helped us get up and running quickly.

Measure Growth by Day

Science Project

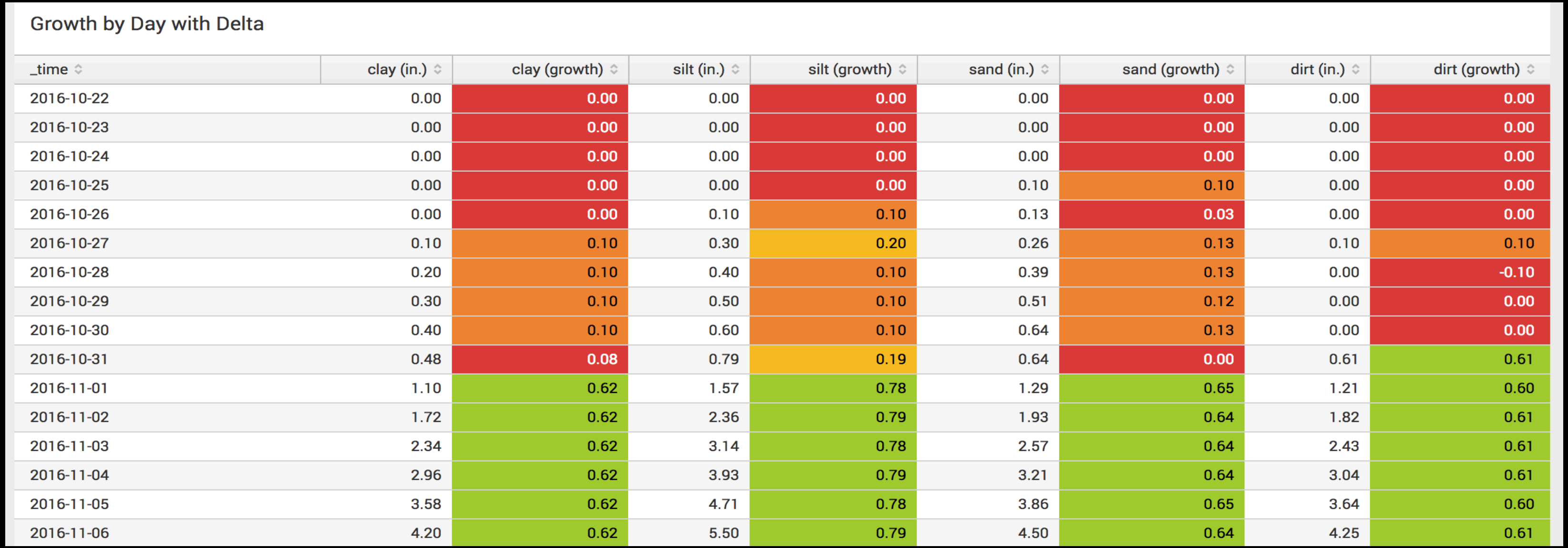
- Use the **timechart** command to visually measure growth by day.
  - **Sample search**: … | timechart max(clay) as “clay (in.)”



Measure Growth by Day

Science Project

- Use the **delta** command to compute the difference in growth by day.
  - Powerful splunk command that computes the difference, **in search order**, between the field value for the event and the field value for the previous event.
  - **Sample search**: … | delta sand as “sand (growth)”



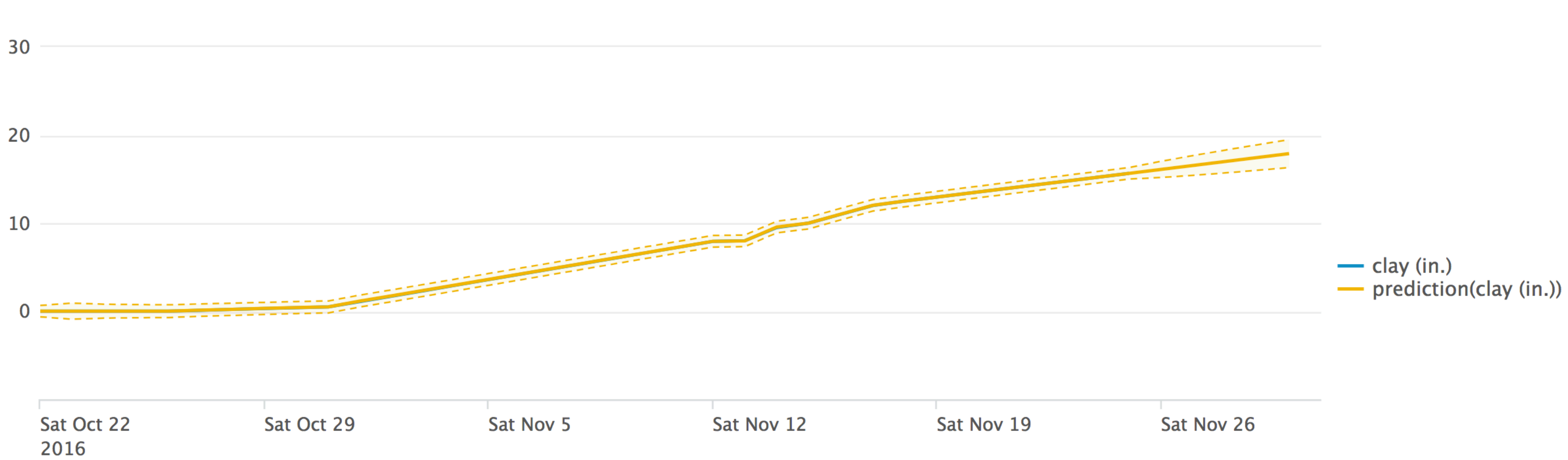
Growth by Day with Delta

_time	clay (in.)	clay (growth)	silt (in.)	silt (growth)	sand (in.)	sand (growth)	dirt (in.)	dirt (growth)
2016-10-22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016-10-23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016-10-24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016-10-25	0.00	0.00	0.00	0.00	0.10	0.10	0.00	0.00
2016-10-26	0.00	0.00	0.10	0.10	0.13	0.03	0.00	0.00
2016-10-27	0.10	0.10	0.30	0.20	0.26	0.13	0.10	0.10
2016-10-28	0.20	0.10	0.40	0.10	0.39	0.13	0.00	-0.10
2016-10-29	0.30	0.10	0.50	0.10	0.51	0.12	0.00	0.00
2016-10-30	0.40	0.10	0.60	0.10	0.64	0.13	0.00	0.00
2016-10-31	0.48	0.08	0.79	0.19	0.64	0.00	0.61	0.61
2016-11-01	1.10	0.62	1.57	0.78	1.29	0.65	1.21	0.60
2016-11-02	1.72	0.62	2.36	0.79	1.93	0.64	1.82	0.61
2016-11-03	2.34	0.62	3.14	0.78	2.57	0.64	2.43	0.61
2016-11-04	2.96	0.62	3.93	0.79	3.21	0.64	3.04	0.61
2016-11-05	3.58	0.62	4.71	0.78	3.86	0.65	3.64	0.60
2016-11-06	4.20	0.62	5.50	0.79	4.50	0.64	4.25	0.61

Predict Future Growth by Day

Science Project

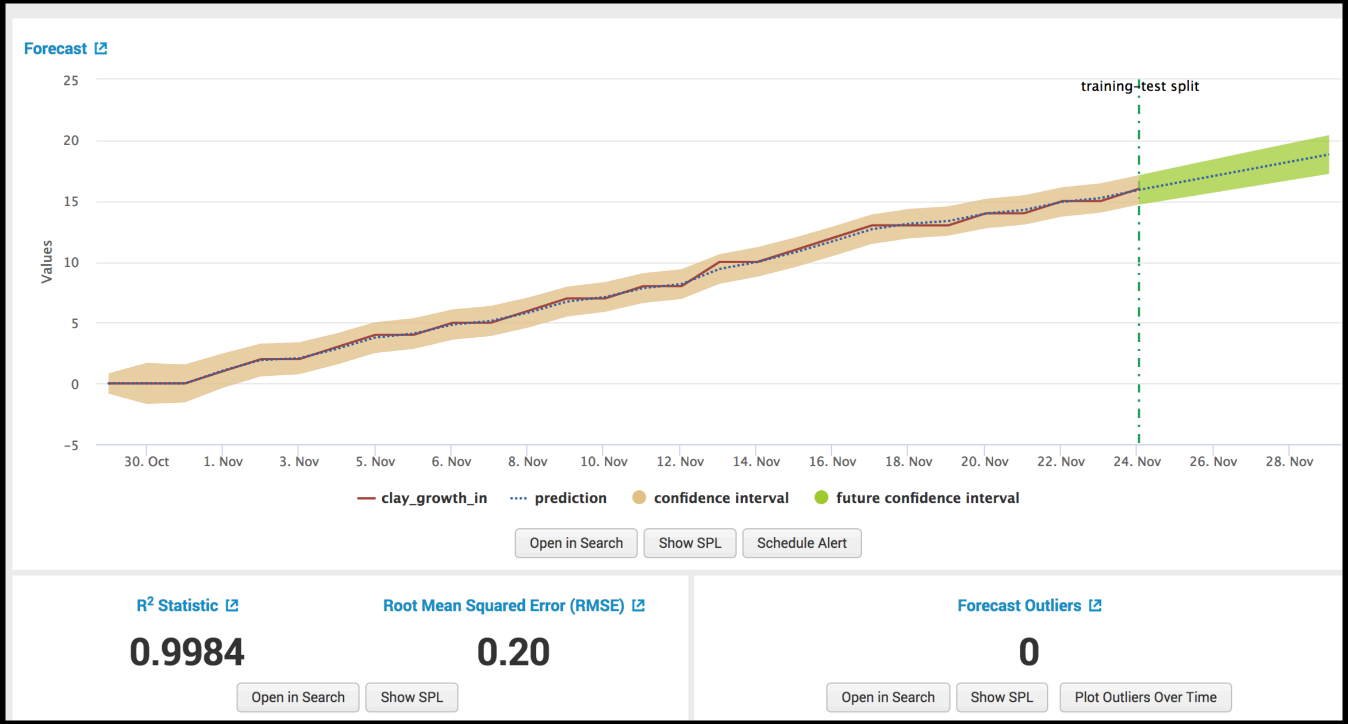
- Use the **predict** search command to predict future growth.
  - **Sample search**: … | timechart max(clay) as “clay (in.)” **| predict “clay (in.)”**



Predict Using The Splunk MLT

Science Project

- Use the Forecast assistant in the Splunk Machine Learning Toolkit
  - Prettier visualization!



R^2 Statistic: 0.9984

Root Mean Squared Error (RMSE): 0.20

Forecast Outliers: 0

Thank You

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