PI System for Big Data in the Classroom

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OSIsoft.

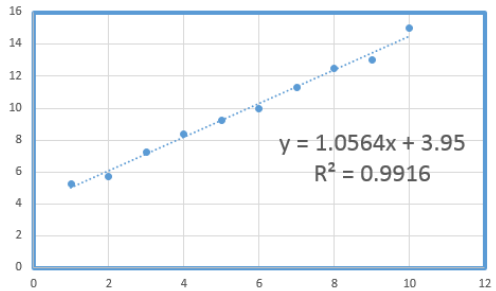
Need for Data Science in Curricula

- The data deluge
  - Companies own terabytes of data
  - Sensor-based data generated rapidly
- Value lies in making data actionable
  - Need for highly skilled employees

Evolving STEM Curricula: Data Education

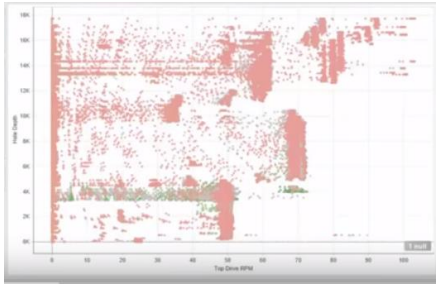
Traditional Approach

- Problem solving based on models
- Analysis of small datasets using basic statistics
- Simple data visualization

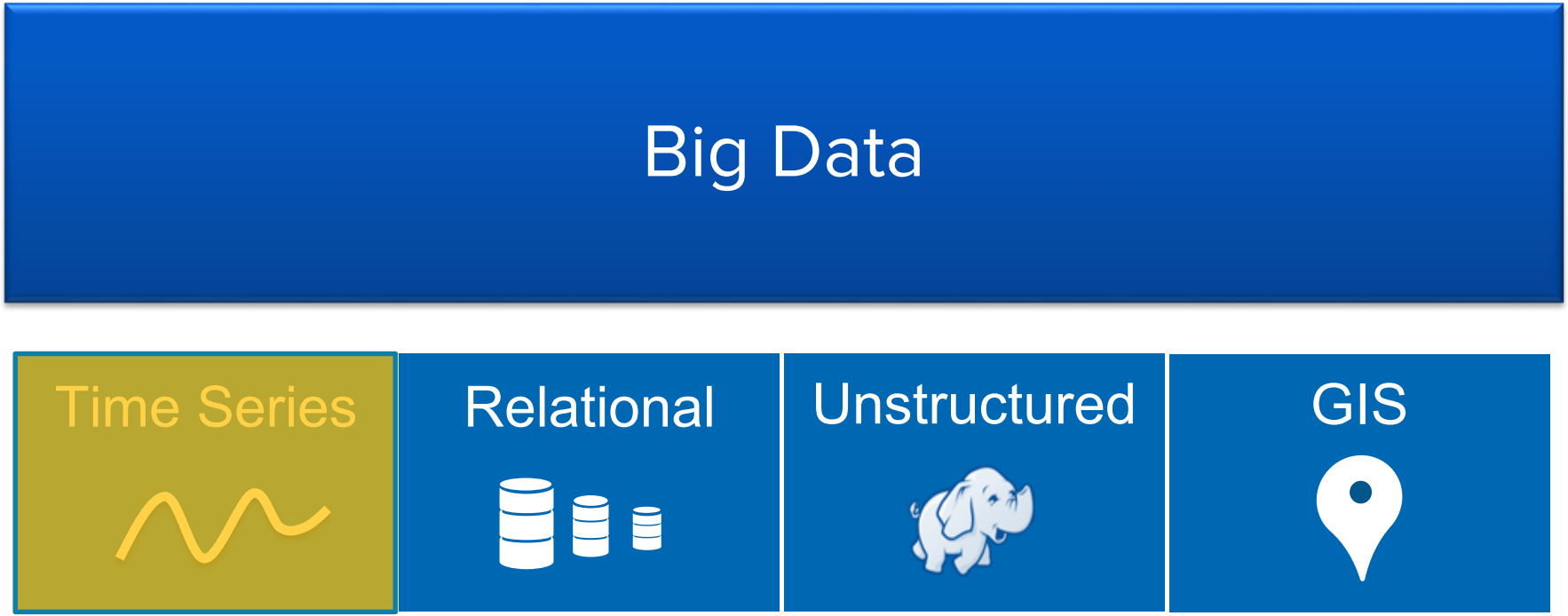


Data Science Approach

- Complex, real-world data
- Advanced analytical tools
- Interactive visualizations that aid in analysis



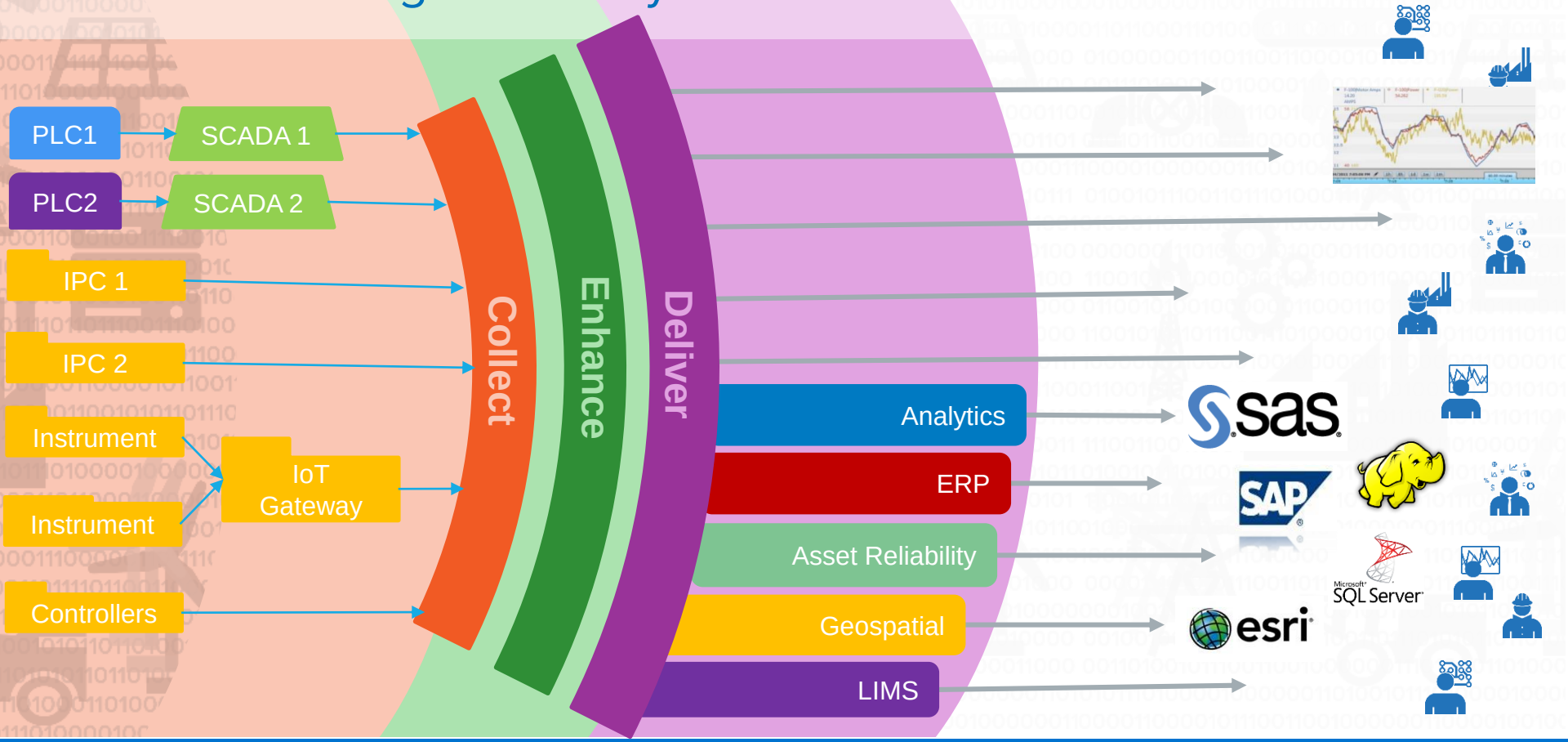
PI and Data Science



PI to Deliver Time-Series Data

- Live, time-series data seamlessly delivered to students
  - Many data sources on campus
    - Shared services and utilities
    - Buildings
    - IoT and lab-based sensors
  - Collaborations with industry
  - Hosted data and data sharing with other universities

Data Flow through the PI System



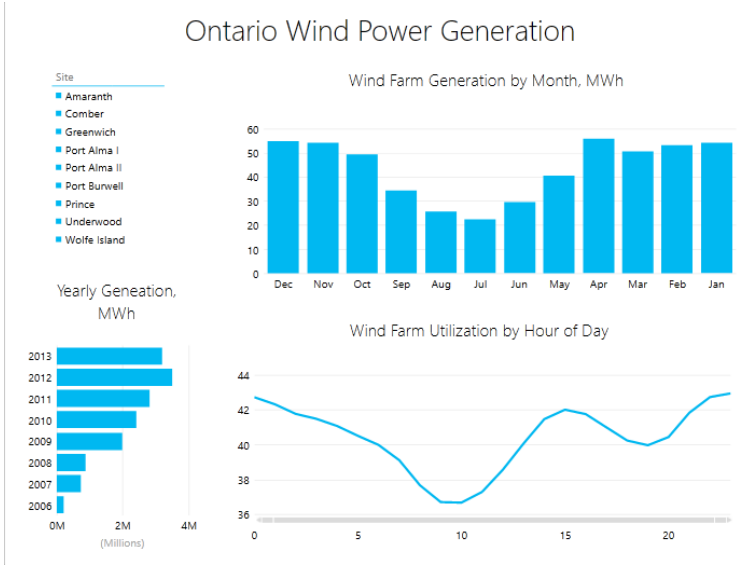
Toolbox for Data Science

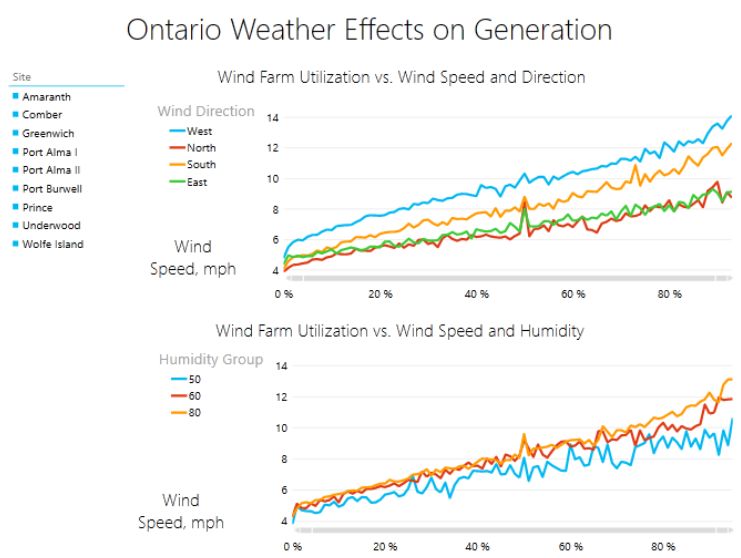
PI Integrator for Business Analytics

- PI System data integrated with sophisticated BI tools

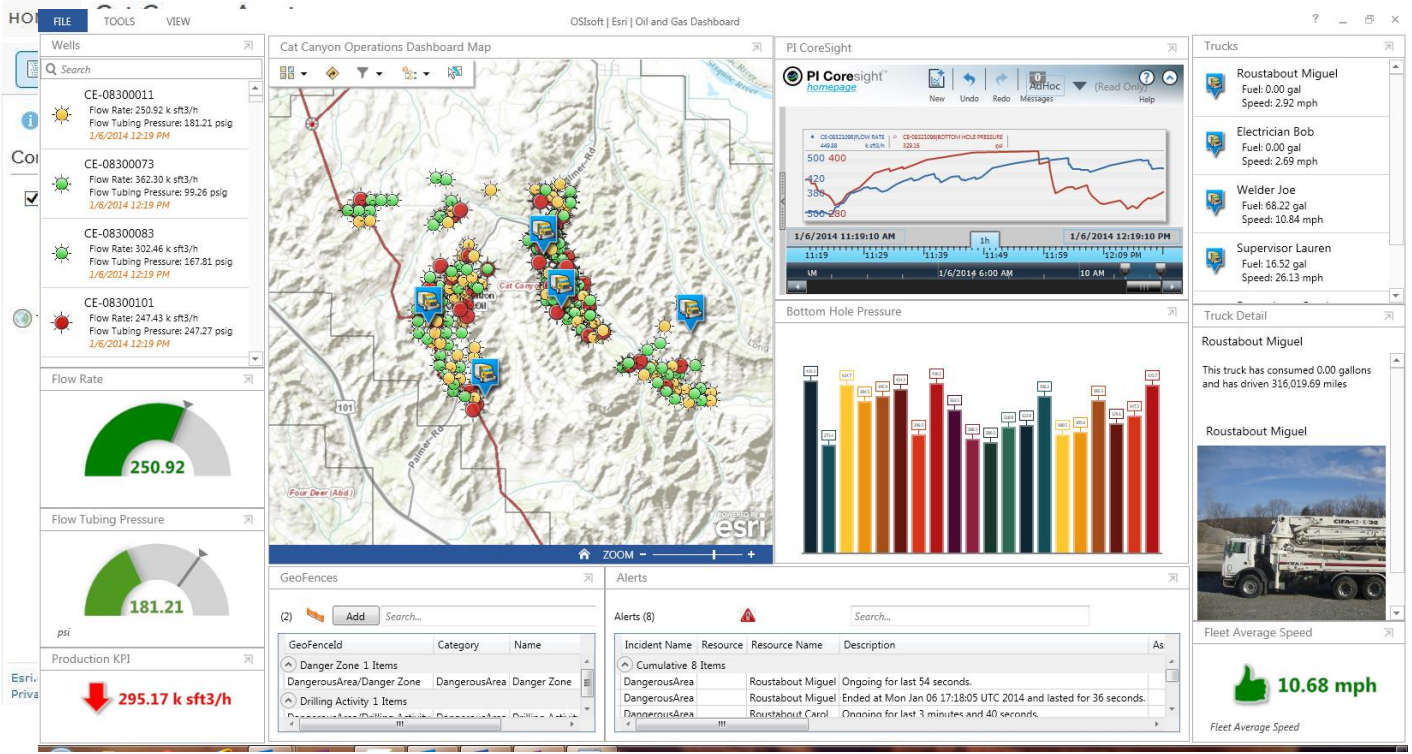
PI Integrator for Business Analytics

- Power BI & wind farm power generation data





PI Integrator for Esri ArcGIS



PI Integration with R

- R platform central to Data Science curriculum
  - Free and platform-independent tool
  - Complex statistical analyses and data visualizations accomplished easily
- PI Integrator for BA to bring in historical data
- PI Web API
  - Advantages include complex calculations, real-time deployment, ability to write back to PI

PI Integration with R

- Program developed to quickly pull large amounts of data into R

  - We’re sharing this as a learning resource
    - Look for it on GitHub with an announcement on PI Square

Data Science Lab

What we'll cover

- OSIsoft Learning Labs
- IIoT sensor data – historical and live
- Remote access
- End-to-end machine learning examples
  - Predictive maintenance – equipment failure
  - Predict hourly energy usage – facility/building

Predict engine failure/remaining useful life

Lab Exercise

In a deployment with about 100 engines which are similar, sensor data such as rpm, burner fuel/air ratio, pressure at fan inlet, and twenty other measurements plus settings for each engine – for a total of about 2000 tags – are available. On average, an engine fails after 206 cycles, but it varies widely - from about 130 to 360 cycles.

Using an open source tool such as R for machine learning, you will create a multivariate model to predict engine failures within approximately a 10 cycle window ***before they fail***. The lab will walk through the end-to-end data science process – preparing the dataset, visually exploring it, partitioning the data for training and testing, validating the models using previously unseen data, and finally deploying the model with AF asset analytics for predictive maintenance.

Level: 300 (familiarity with R will be useful but is not a requirement)

For hands-on experience, please enroll in the TechCon lab – Day3 or Day 4

http://www.osisoft.com/uc2016/sf/day3.html - Use Data Science for Machine Learning and Predictions based on PI System data

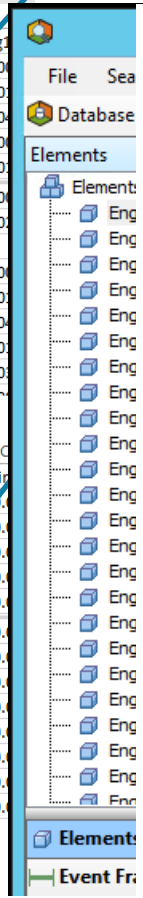
Engine data

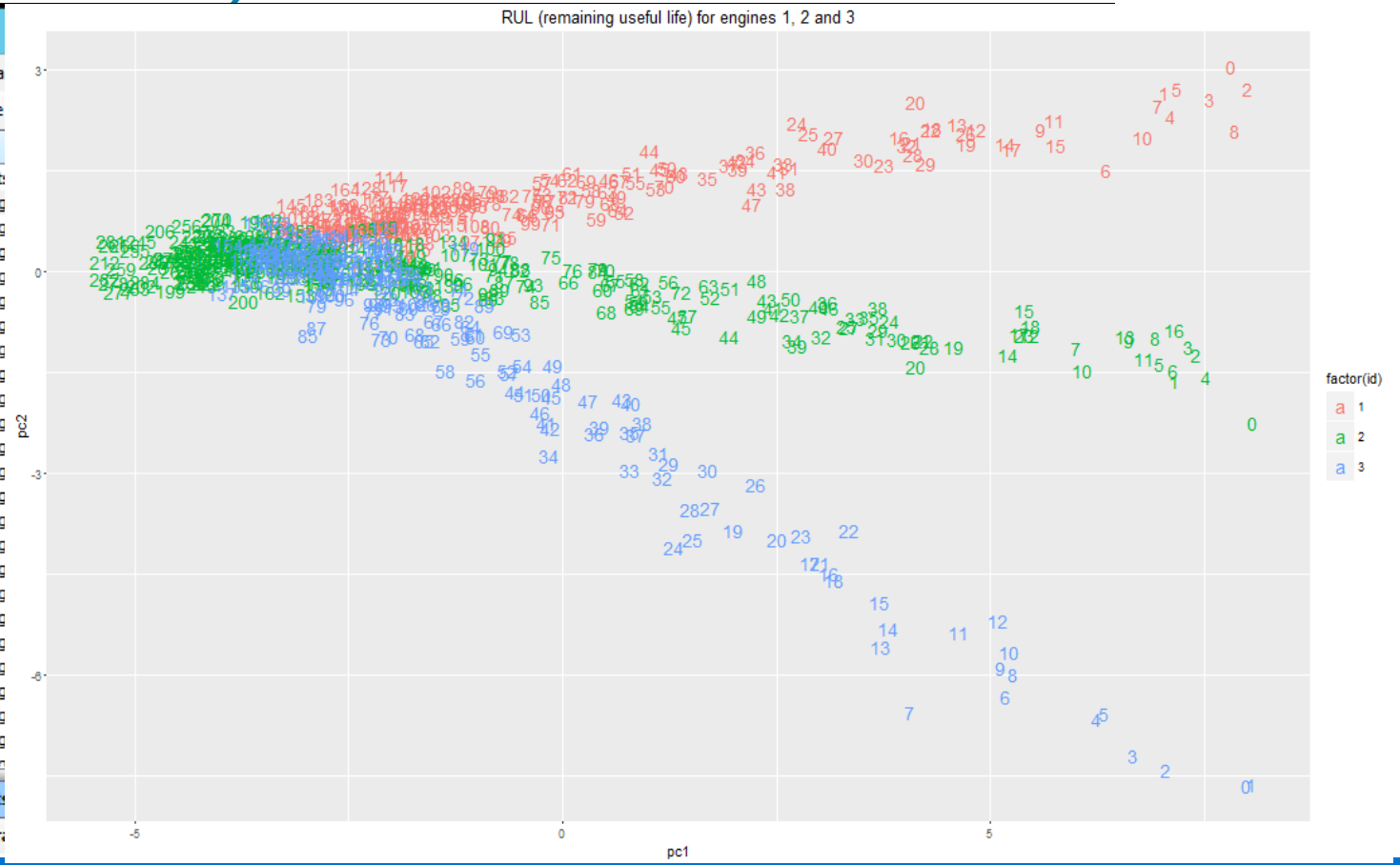
Engine 1

Engine 100

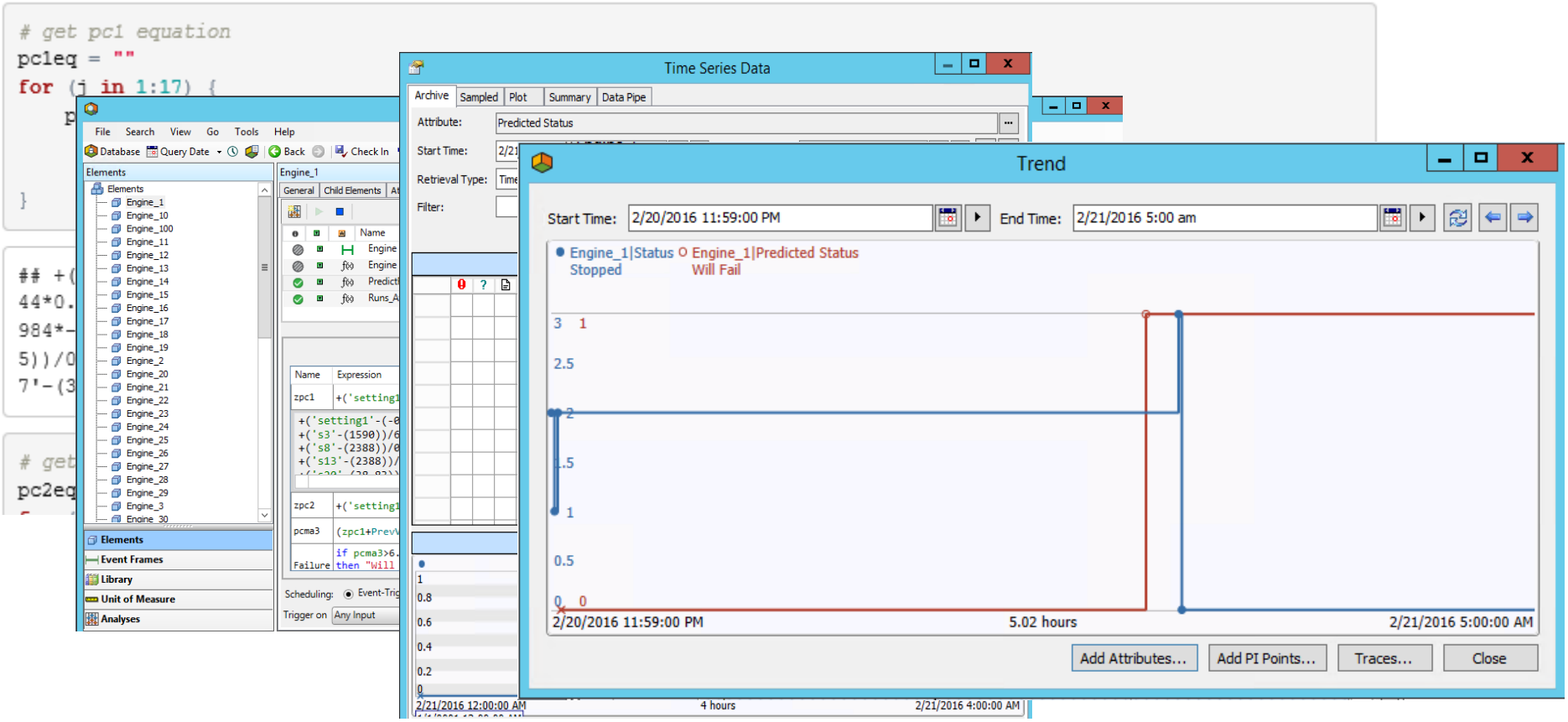
	A	B	C
1	id	cycle	setting1
2	1	1	-0.00
3	1	2	0.00
4	1	3	-0.00
5	1	4	0.00
6	1	5	-0.00
190	1	189	-0.00
191	1	190	-0.00
192	1	191	
193	1	192	0.00
194	2	1	-0.00
195	2	2	0.00
196	2	3	0.00
197	2	4	0.00

	A	B	C
1	id	cycle	setti
2	1	1	-0.
3	1	2	0.
4	1	3	-0.
5	1	4	0.
6	1	5	-0.
20625	100	193	-0.
20626	100	194	-0.
20627	100	195	-0.
20628	100	196	-0.
20629	100	197	-0.
20630	100	198	0.
20631	100	199	-0.
20632	100	200	-0.

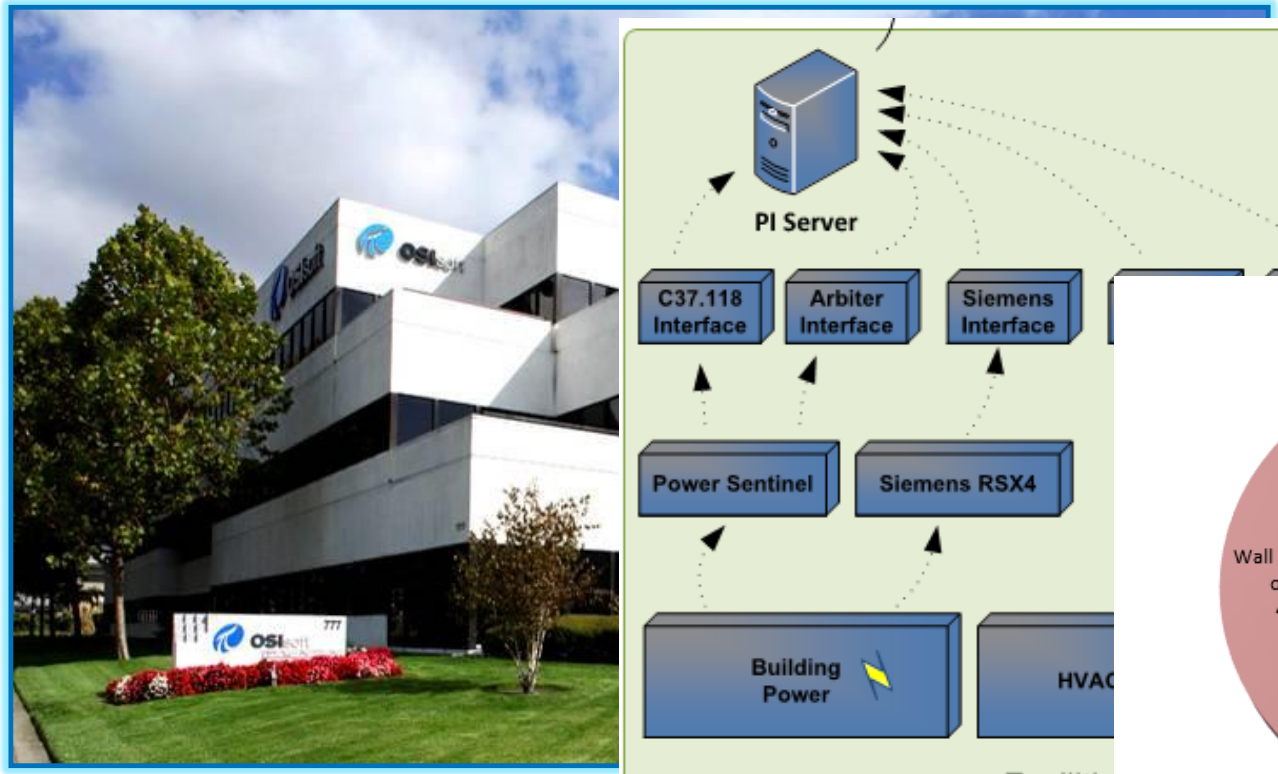




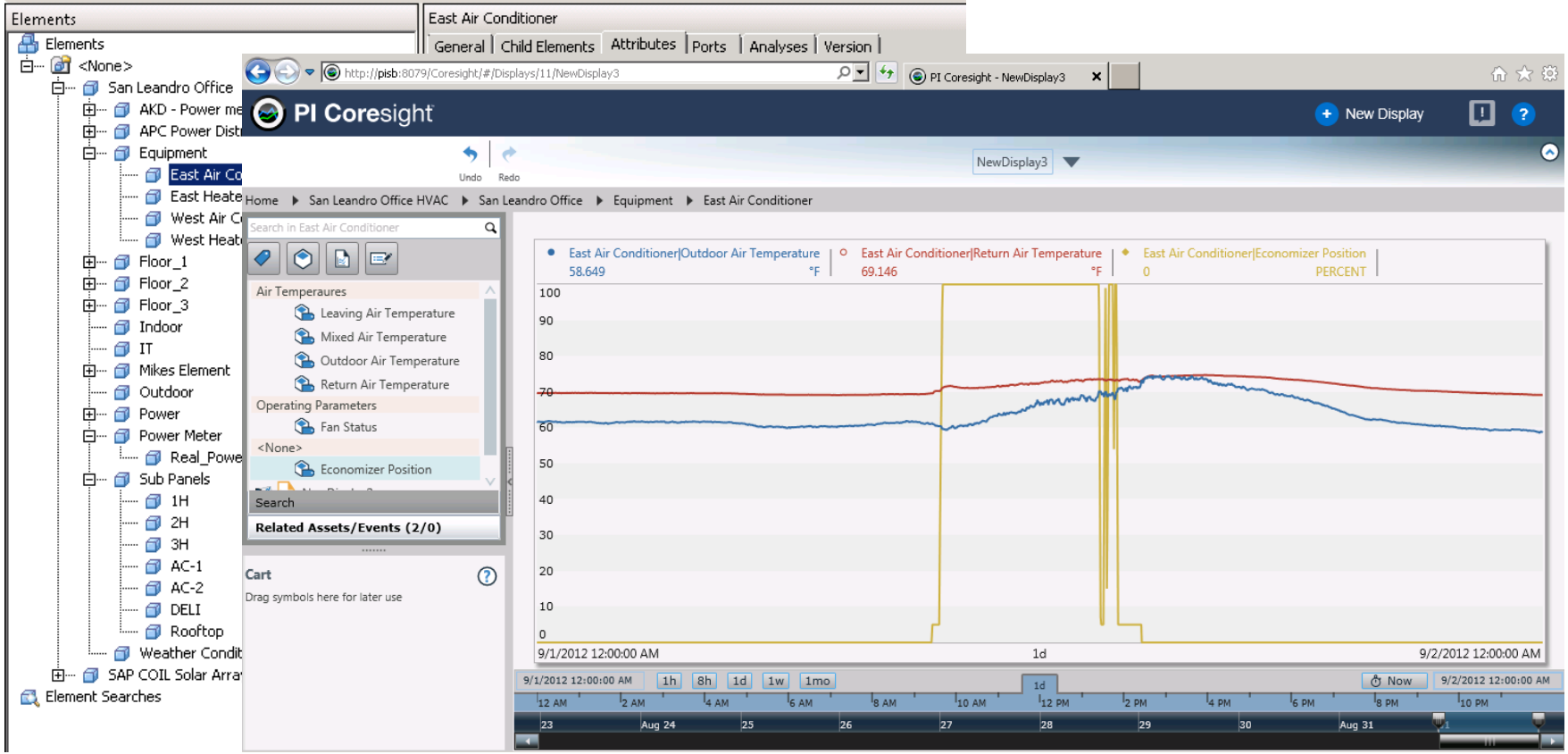
Engine failure prediction



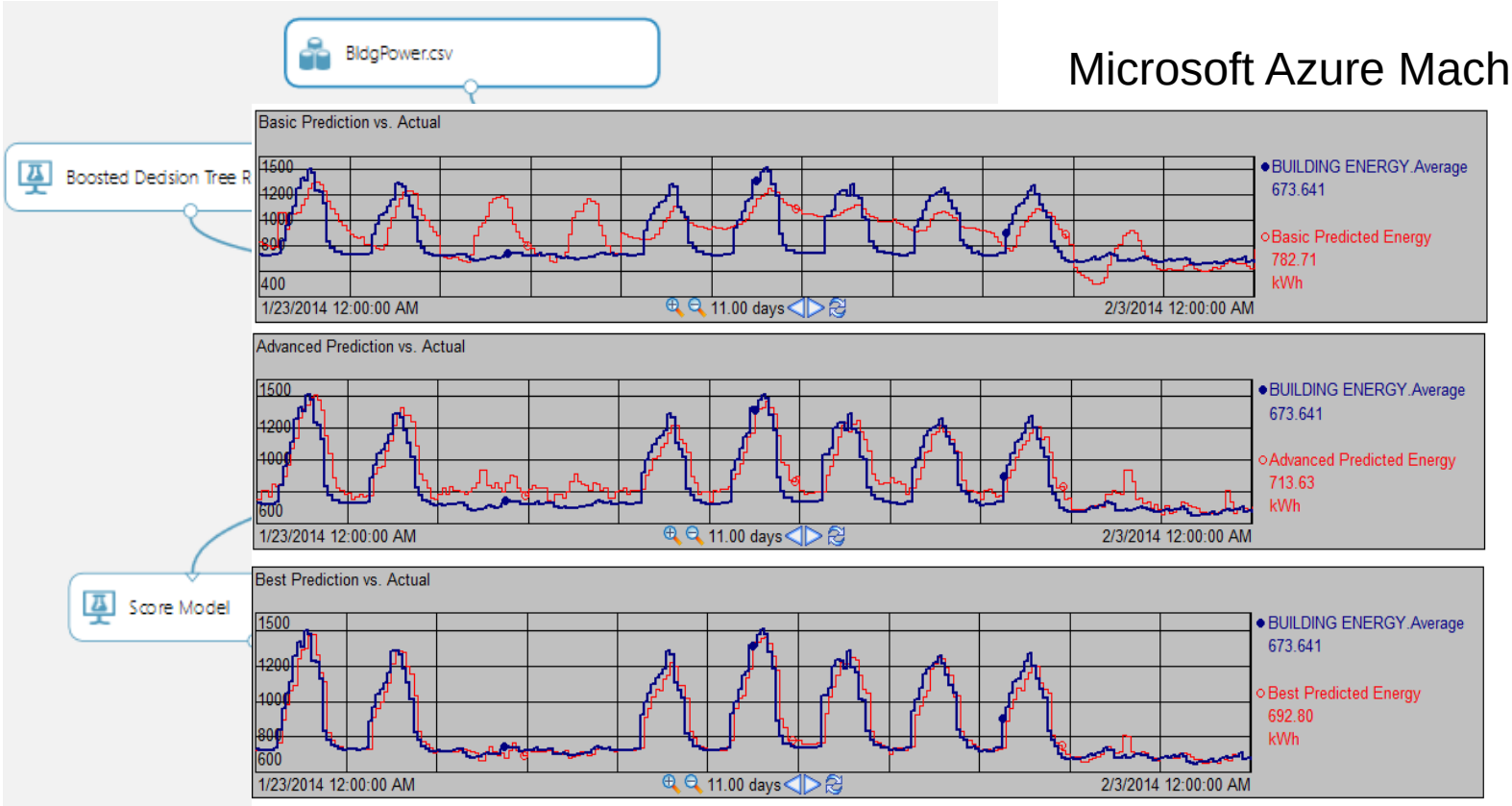
Building/facility – HVAC and Power



Building/facility – HVAC - Economizer



Building/facility - Predict hourly energy use



Microsoft Azure Machine Learning

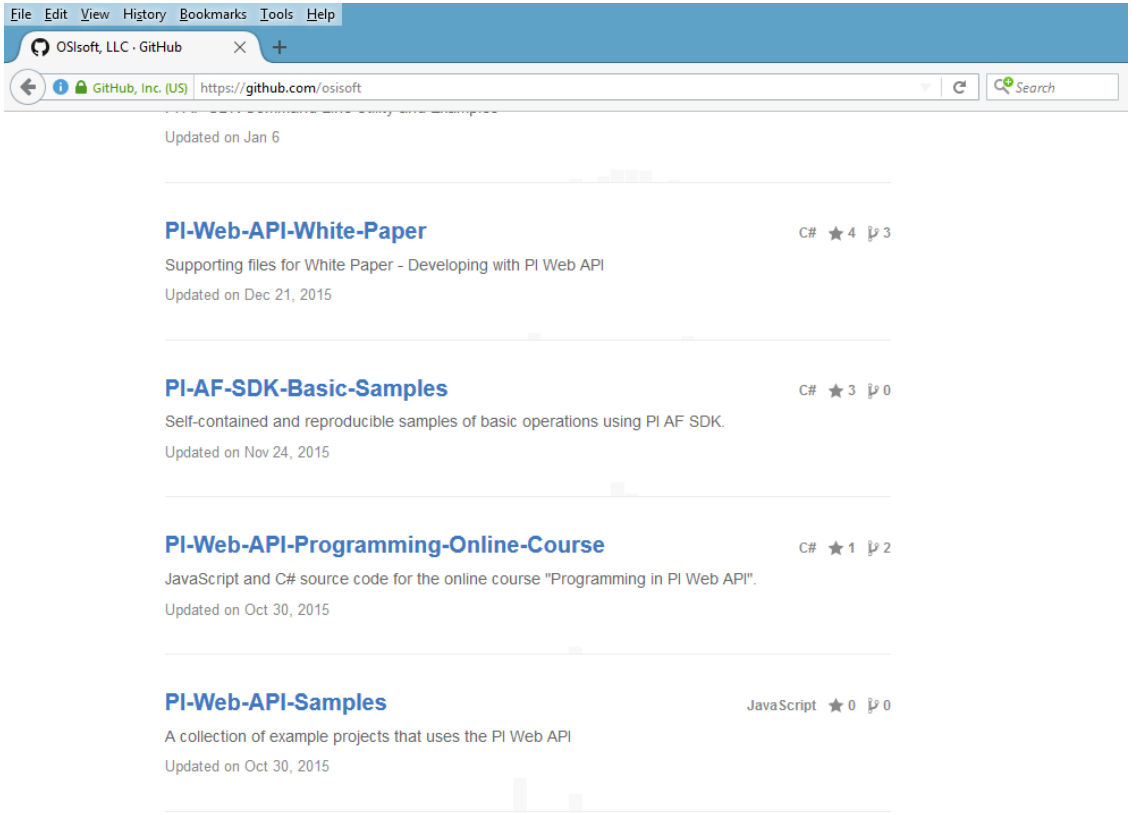
Lab Exercise

-Basic

-Advanced

-Best

https://github.com/osisoft



Call to Action + Q&A

- Think about how these tools fit into your curriculum
- To discuss your course syllabus, contact Erica Trump

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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado