Predictive Maintenance with MATLAB

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Why perform predictive maintenance?

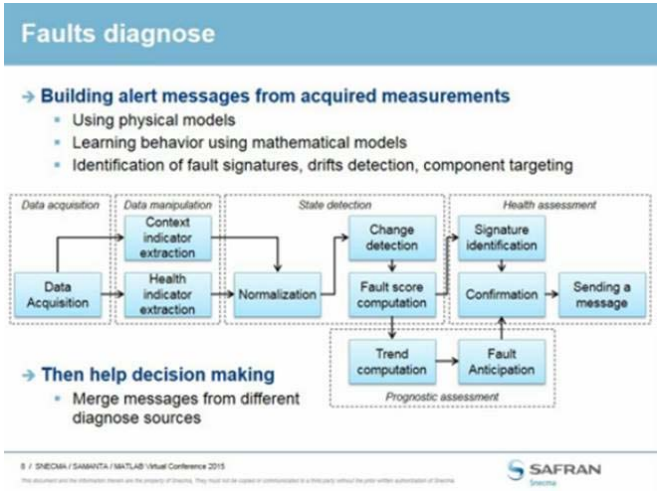
- Increase “up time”
- Minimize maintenance cost
- Optimize supply chain

→

- Reliability
- Reputation
- Cost of Ownership

What is predictive maintenance?

- Predict and fix failures before they arise
  - Import and analyze historical sensor data
  - Train model to predict when failures will occur
  - Deploy model to run on live sensor data
  - Identify failures in real time
- Snecma: [Presentation of a Platform for the Development of Aircraft Engine Monitoring Algorithms: SAMANTA]

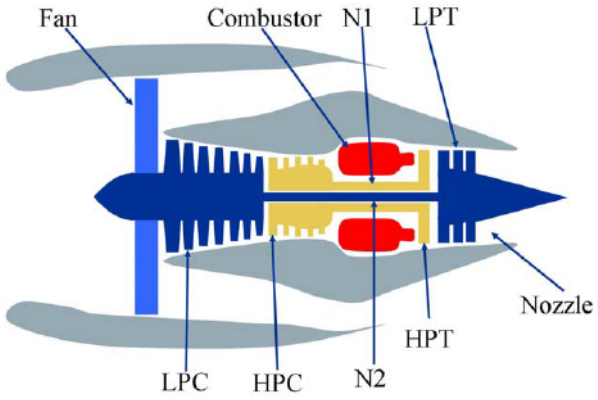


CFM56-5B
Nearly 105 millions of cumulative flight hours
More than 5 895 engines in service at 198 operators
Thrust range: 21 600 to 32 000 lb
Applications : Airbus Family A318, A319, A320, A321

CFM56-7B
More than 195 millions of cumulative flight hours
9 801 engines in service at 265 operators
Thrust range : 19 500 to 27 300 lb
Applications : Boeing Family 737-600, 737-700, 737-800, 737-900

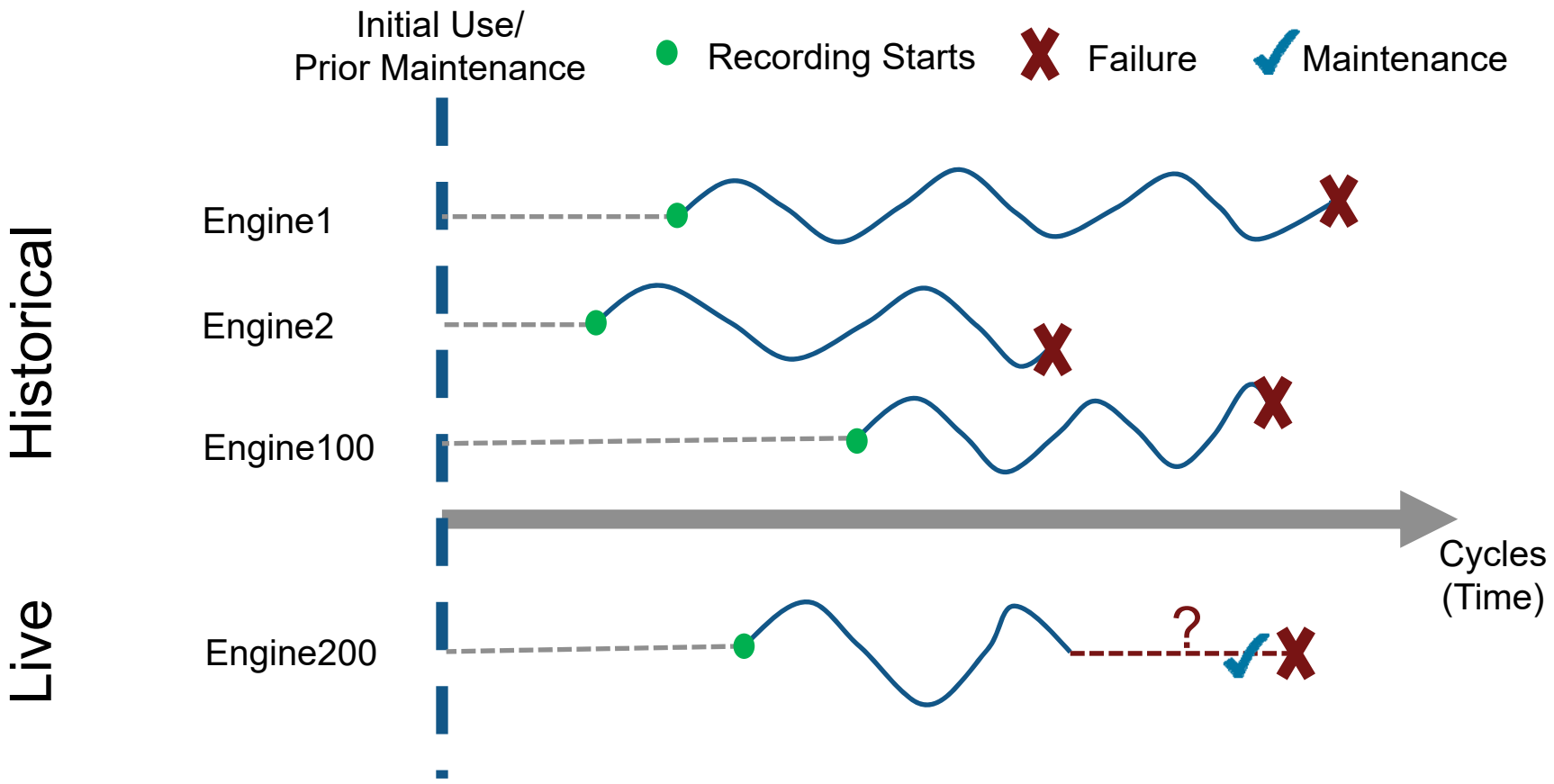
Predictive maintenance of turbofan engine

- Sensor data from 100 different engines of the same model
- Goal: predict when failures will occur on engines based on their live sensor data

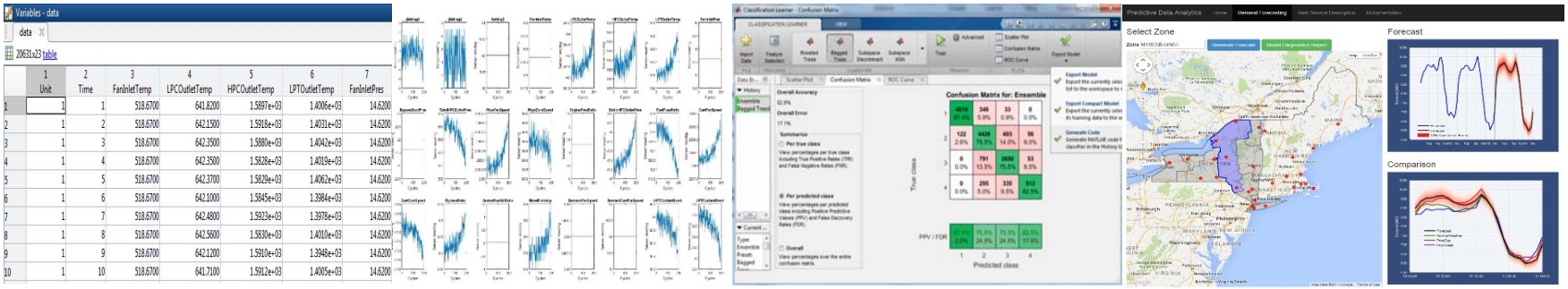


Data provided by NASA PCoE
http://ti.arc.nasa.gov/tech/dash/pcoe/prognostic-data-repository/

Use historical data to predict when failures will occur



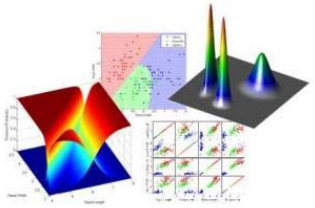
Data analytics workflow



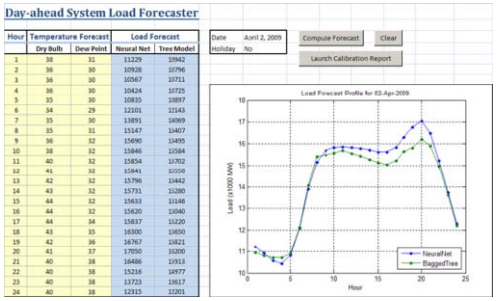
Access and Explore Data → Preprocess Data → Develop Predictive Models → Integrate Analytics with Systems

Machine Learning

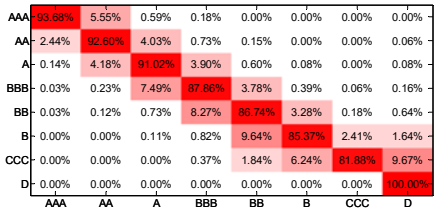
Characteristics and Examples



- Characteristics
  - Too many variables
  - System too complex to know the governing equation
    (e.g., black-box modeling)



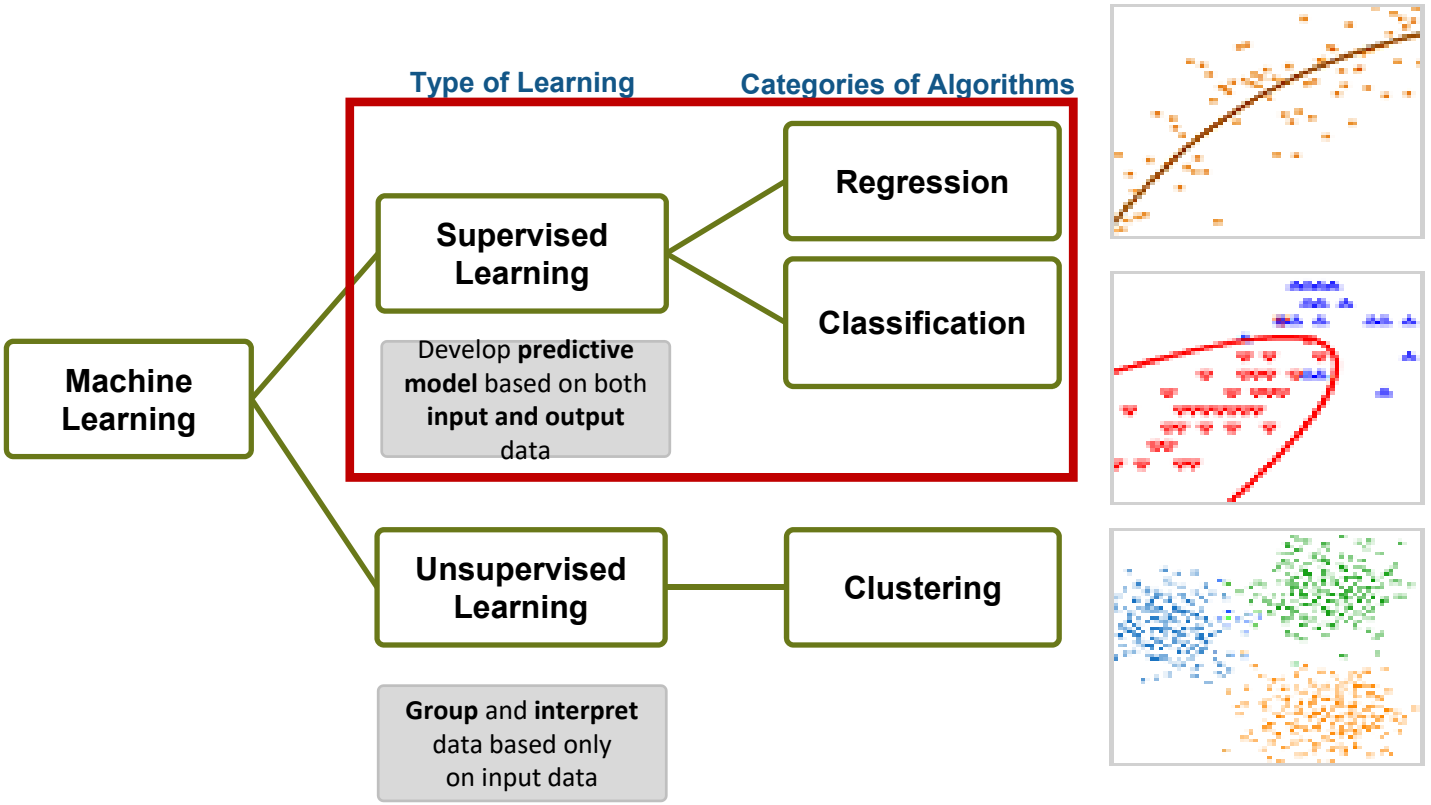
- Examples
  - Pattern recognition *(speech, images)*
  - Financial algorithms *(credit scoring, algo trading)*
  - Energy forecasting *(load, price)*
  - Biology *(tumor detection, drug discovery)*



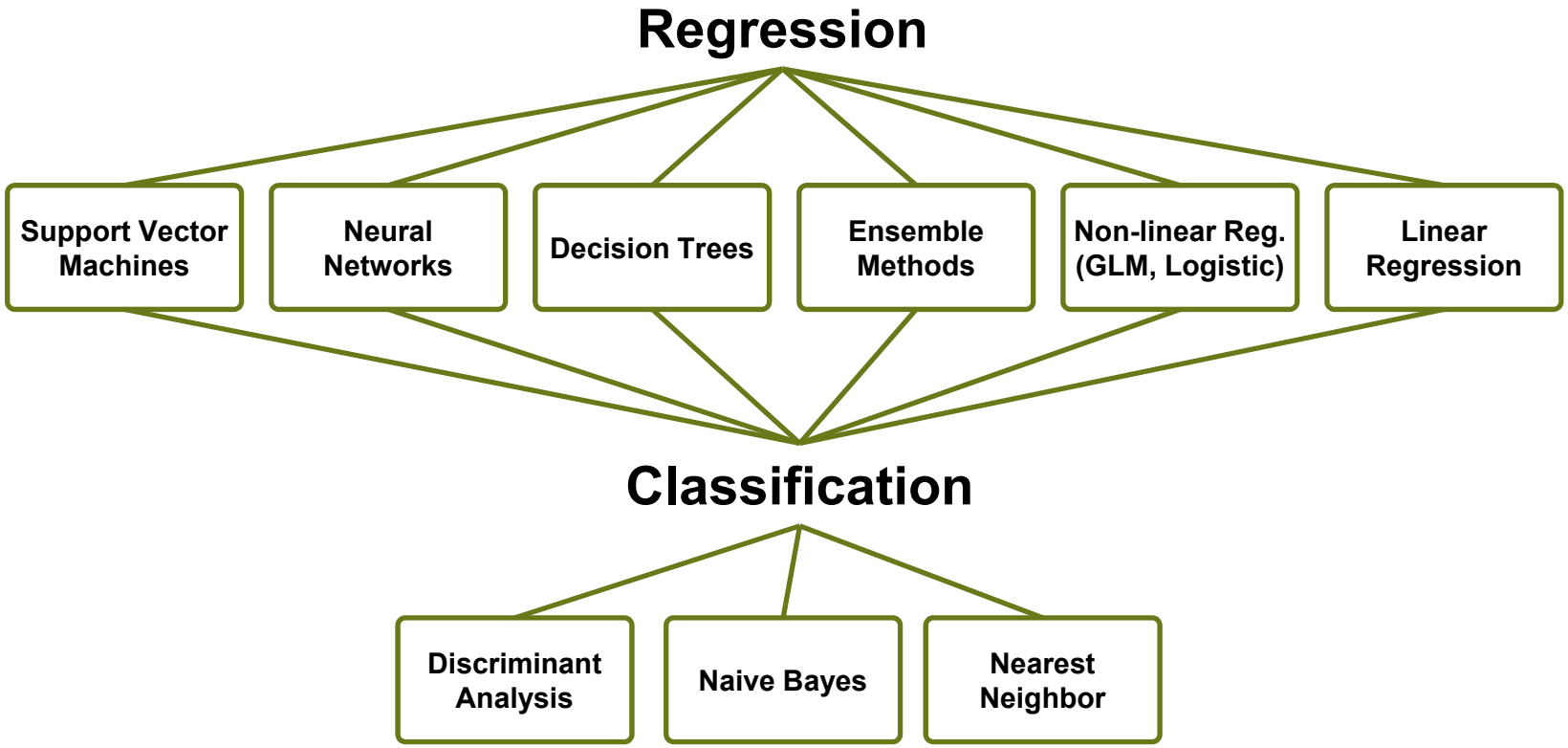
Challenges – Machine Learning

- Significant technical expertise required
- No “one size fits all” solution
- Locked into Black Box solutions
- Time required to conduct the analysis

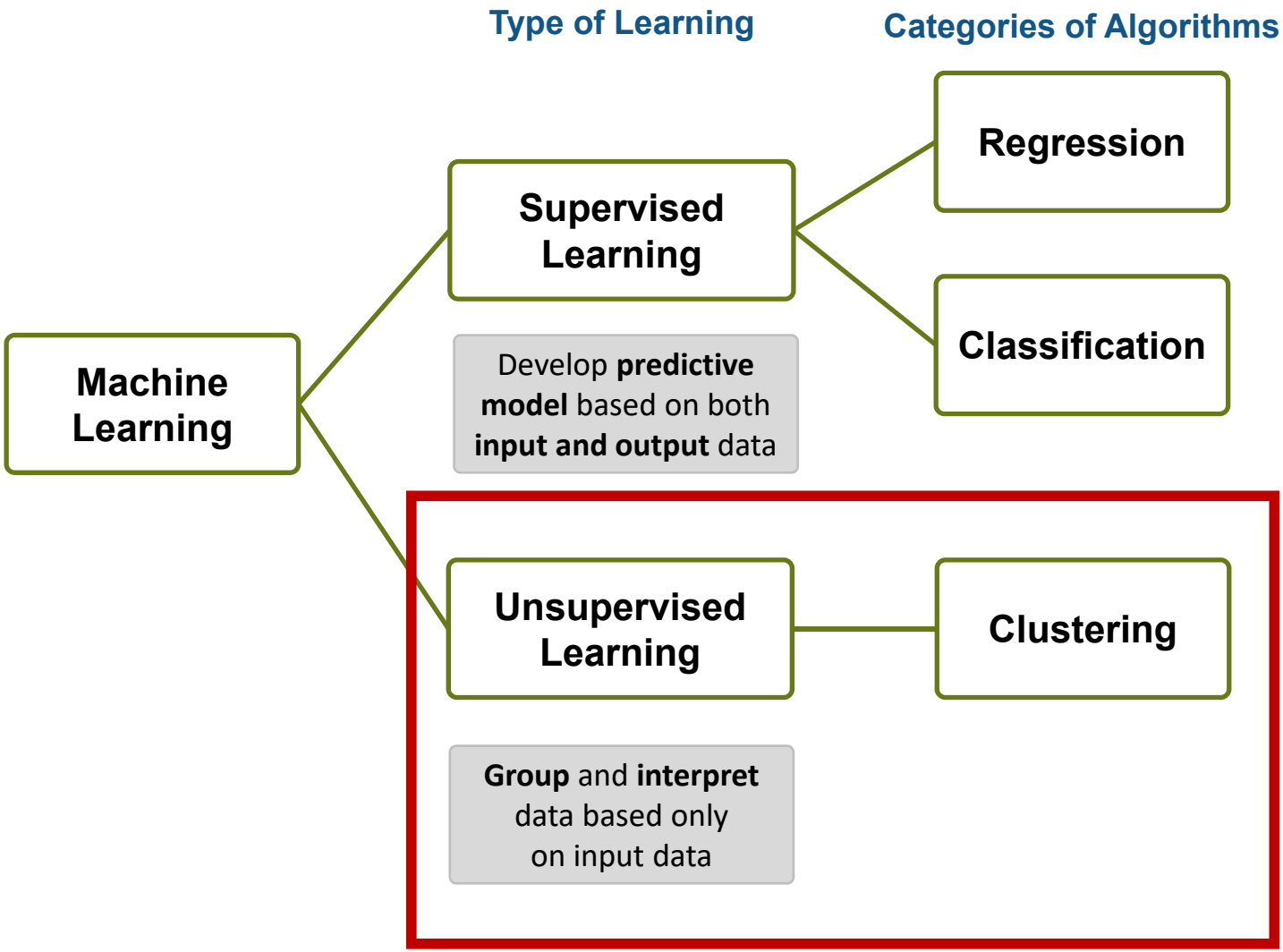
Overview – Machine Learning



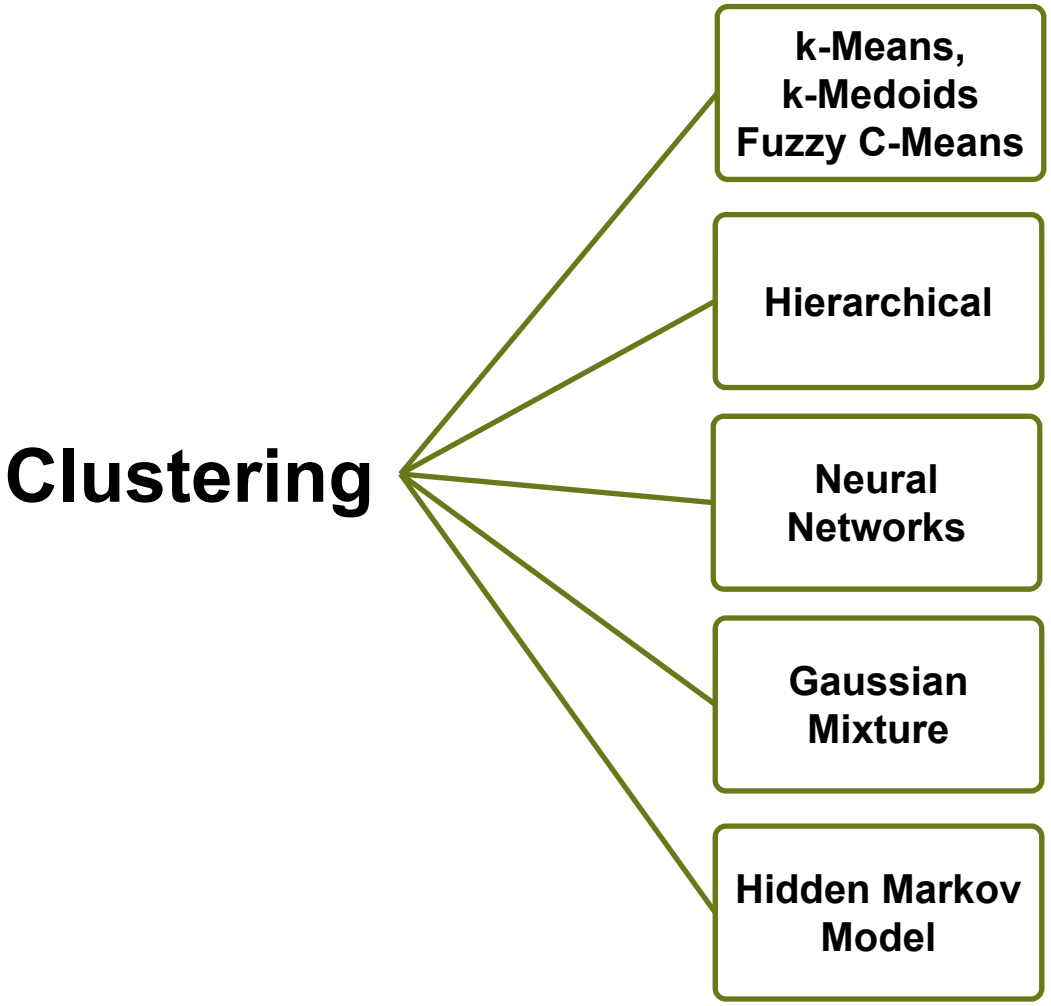
Supervised Learning



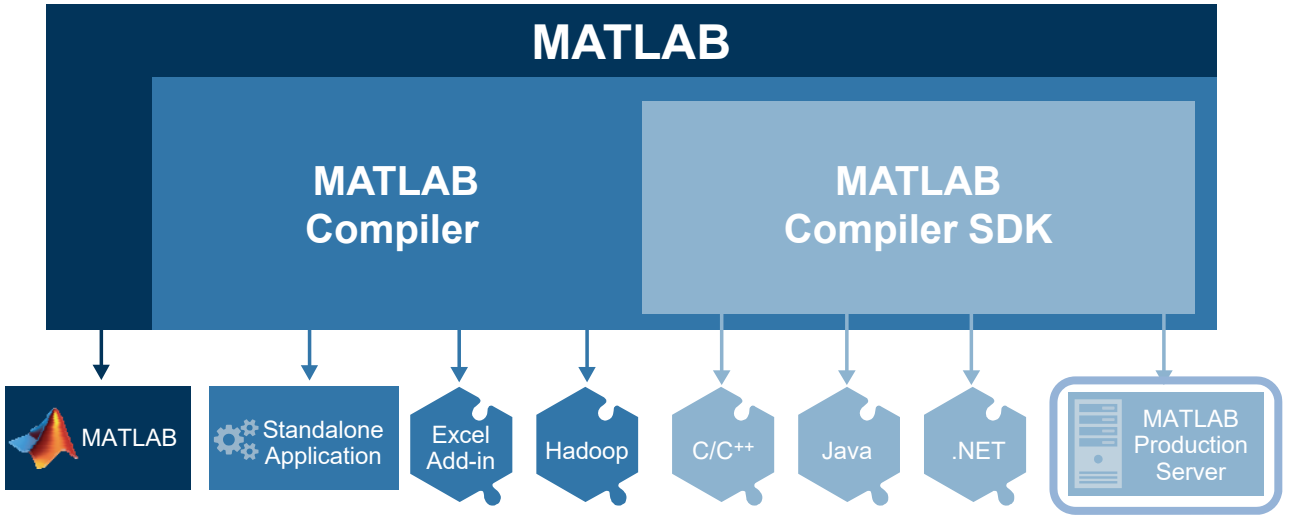
Overview – Machine Learning



Unsupervised Learning

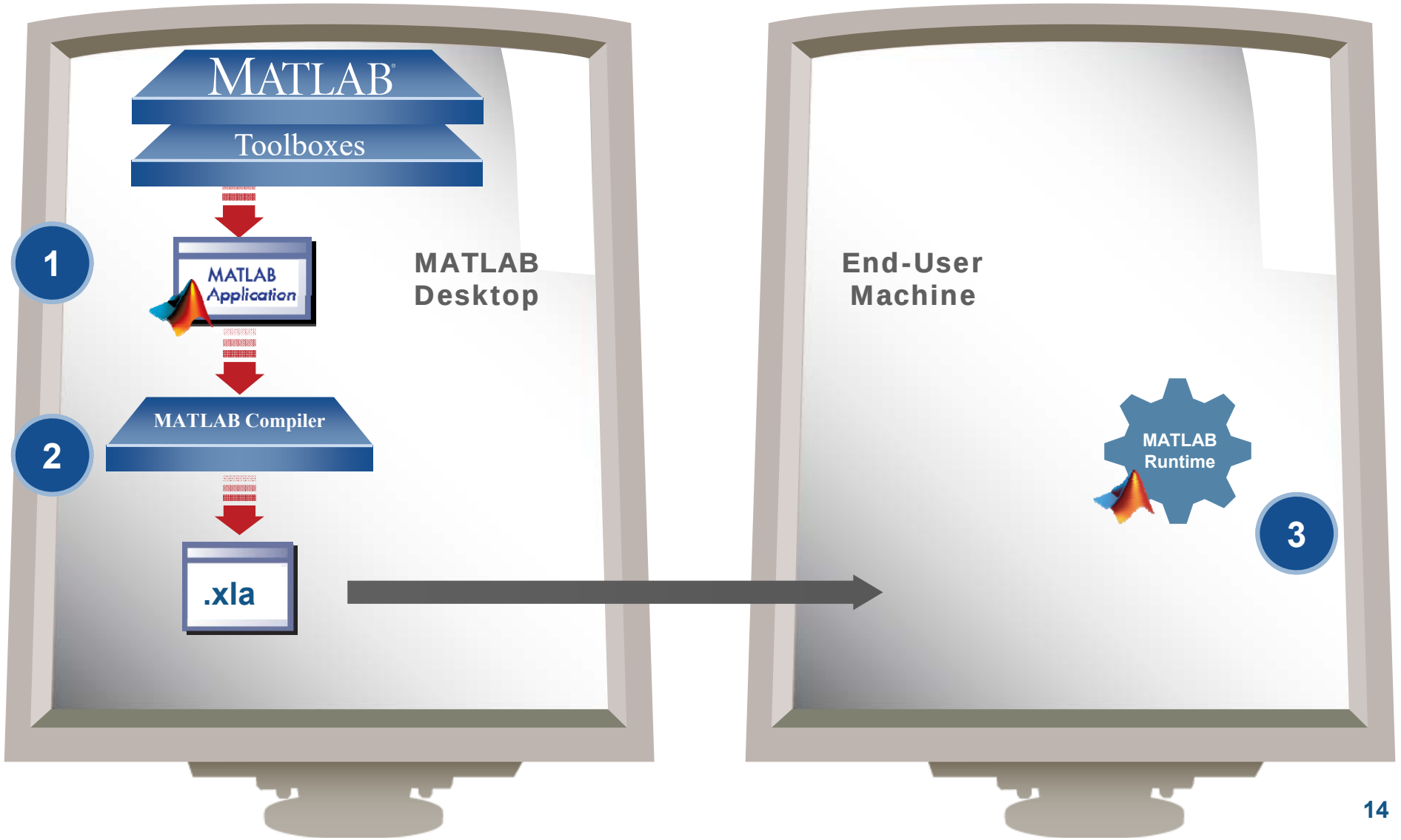


Sharing MATLAB Applications

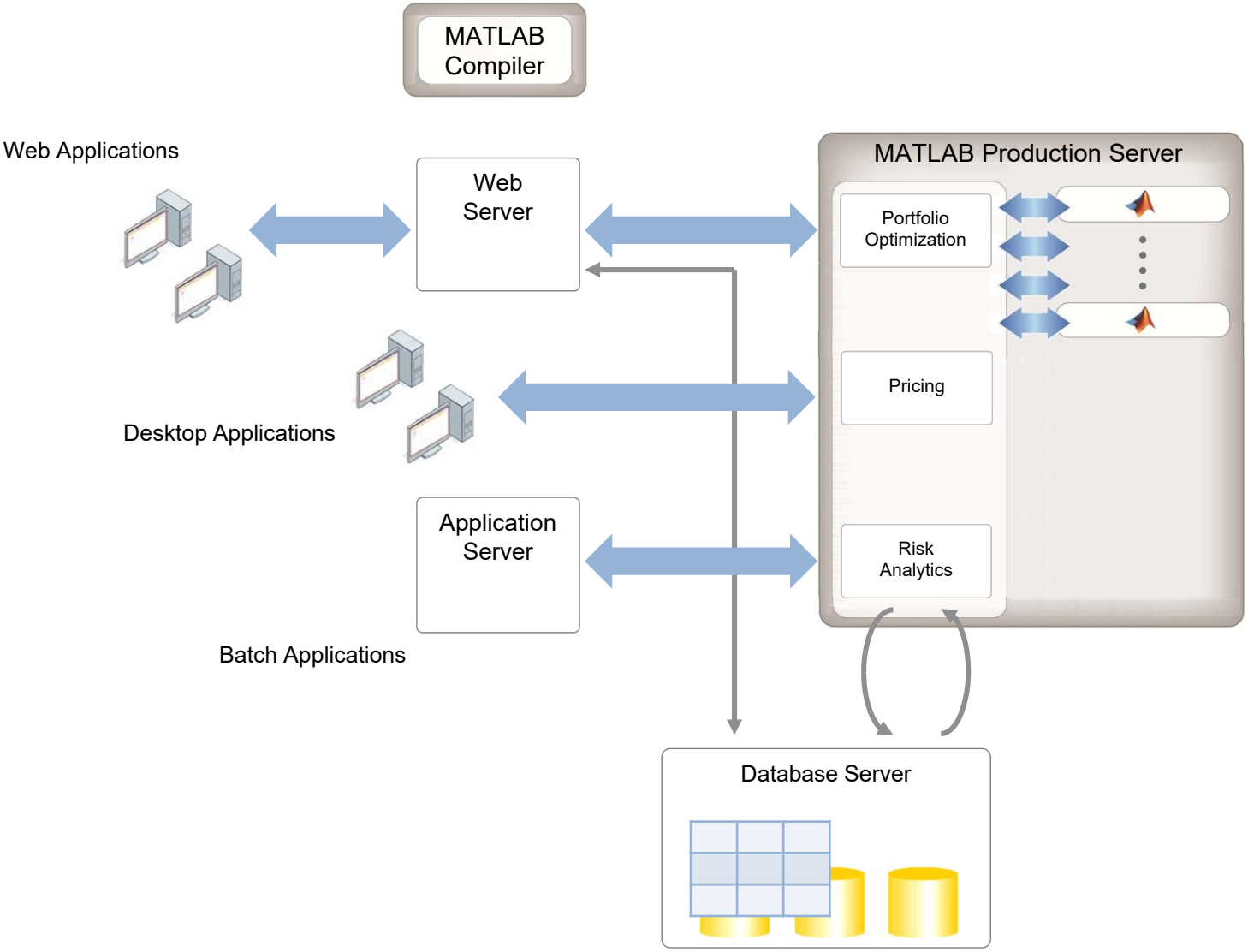


- Share applications with those who do not need MATLAB
- Royalty free
- ***MATLAB Production Server*** provides most efficient path for secure and scalable enterprise applications

Deploying Applications with MATLAB



Integration with IT systems



Questions?