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Using Spark and MLlib for Large Scale Machine Learning With Splunk Machine Learning Toolkit

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What is Machine Learning

- A process for generalizing from examples
- Examples

A, B, … → #	(regression)
A, B, ... → a	(classification)
$X_{past} \rightarrow X_{future}$	(forecasting)
like with like	(clustering)
$\lvert X_{predicted} - X_{actual} \rvert >> 0$	(anomaly detection)

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Overview of ML at Splunk

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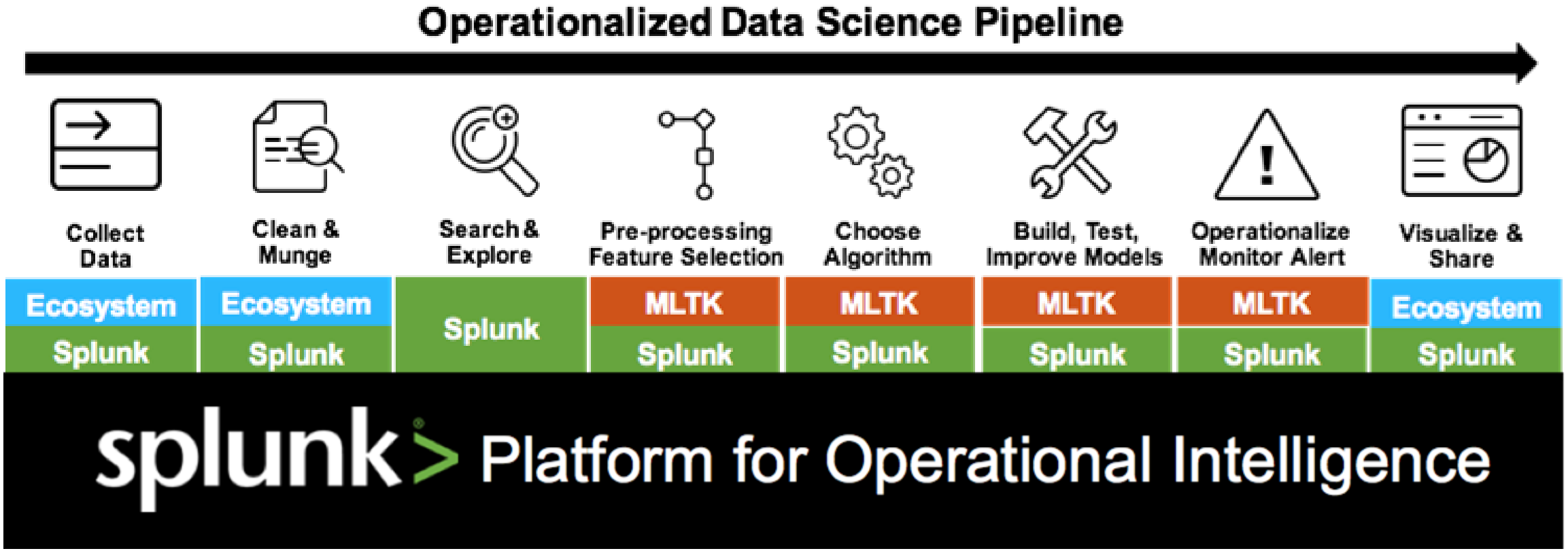
Splunk Machine Learning Toolkit (MLTK)



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Splunk Machine Learning Toolkit (MLTK)

- **Assistants:** Guided model building, testing and deployment for common objectives
- **Showcases:** Interactive examples for typical IT, security, business and IoT use cases
- **Algorithms:** 30 standard algorithms (supervised & unsupervised)
- **ML Commands:** New SPL commands to fit, test and operationalize models
- **ML-SPL API:** Extensibility to easily import any algorithm (proprietary / open source)
- **Python for Scientific Computing Library:** Access to 300+ open source algorithms
- **Connector for Spark**: Support large scale model training

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MLTK is a Bridge to Python for Scientific Computing and Custom ML Algorithms

scikit learn

SM StatsModels
Statistics in Python

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What is Spark

- General-purpose data processing engine
- Optimized to run in memory
- Spark streaming and processing
- Interactive streaming analytics
- Data integration
- Machine learning

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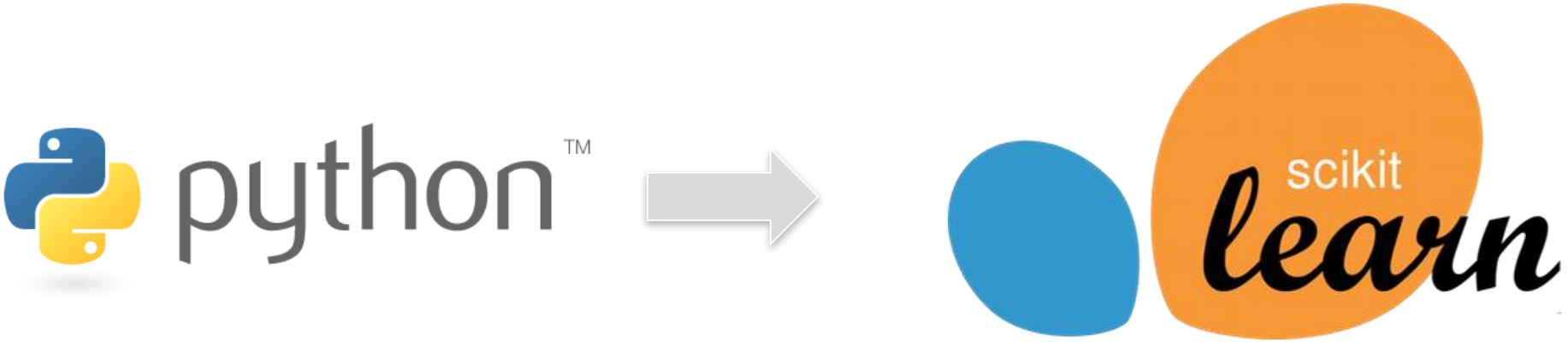
What is Spark MLlib



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Splunk MLTK Connector for Apache Spark™

A bridge from MLTK to Spark MLlib

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Feature Highlights

- Large-scale ML training
  - Large data set from Splunk
  - Distributed/parallelized model training
  - Offload compute from Splunk search head

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Feature Highlights

- BYOSC (Bring Your Own Spark Cluster)
  - Utilize your existing compute resources
  - Use compute resources on demand
  - Minimal provisioning effort

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Feature Highlights

- Resource fine tuning
  - CPU cores
  - Memory limit
  - Return data volume tuning

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Feature Highlights

- Optimization to minimize data round-trip
  - New Syntax ***sparkml [sfit … | sfit …]***
  - Construct ML pipeline

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What Problems are we NOT Solving (YET)

- NOT shipping Spark with splunk
- Only works with a predefined set of algorithms available in MLLib
- NOT designed to run arbitrary Scala code
- NOT designed to ingest data from outside of Splunk

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Supported Algorithm

- Regression
  - LinearRegression
  - DecisionTreeRegressor
  - RandomForestRegressor
  - GBTRegressor
- Preprocessing
  - PCA
- Classification
  - LogisticRegression
  - DecisionTreeClassifier
  - RandomForestClassifier
  - GBTClassifier
  - NaiveBayes
- Clustering
  - K-means

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Resource Managers

- Supported
  - Standalone
- Experimental
  - YARN
    - supports secure mode via kerberos
  - Mesos
- Coming Soon
  - Kubernetes

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When to use Connector for Apache Spark™

- The size of the training data is larger than the physical memory available on the search head
- Have a Spark cluster readily available
- Use the connector to take advantage of parallelizable algorithms in Spark MLLib

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Guidelines used for the Architecture

- Use existing technology and infrastructure
- Minimal configuration
- Easy resource management
- Efficiency

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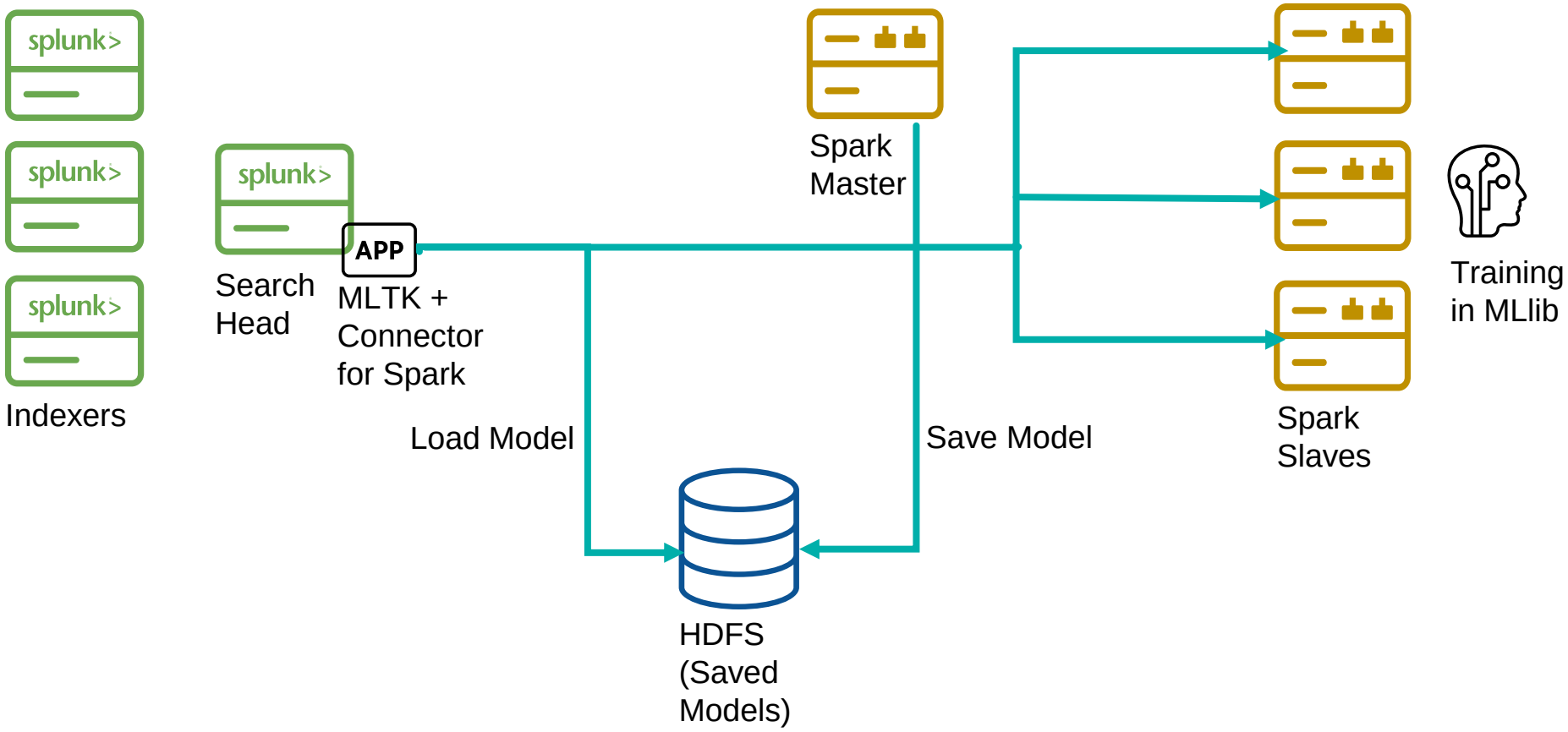
Deployment Architecture



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Requirements

- Splunk Enterprise 7.0+
- Splunk MLTK 2.3+
- Spark cluster 2.1+

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Connection Settings

sparkml.conf

Spark Standalone

Hadoop YARN

Mesos

```
[connection:example]
cluster_manager=standalone
spark.master=local[*]
search.search_head_address=<search head hostname>
```

```
[connection:example]
cluster_manager = yarn
spark.yarn.stagingDir = <location of staging dir on hdfs>
spark.hadoop.yarn.resourcemanager.hostname = <yarn resource
manager hostname>
```

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sparkml.conf

common configuration

Common Configurations

```
spark.executor.memory = 4g
spark.driver.memory = 4g
spark.driver.cores = 4
spark.cores.max = 24
spark.model_dir = ../spark-model/
```

For a complete list of configurable options, refer to our documentations on : https://www.splunk.com/page/preview/mltkconnector

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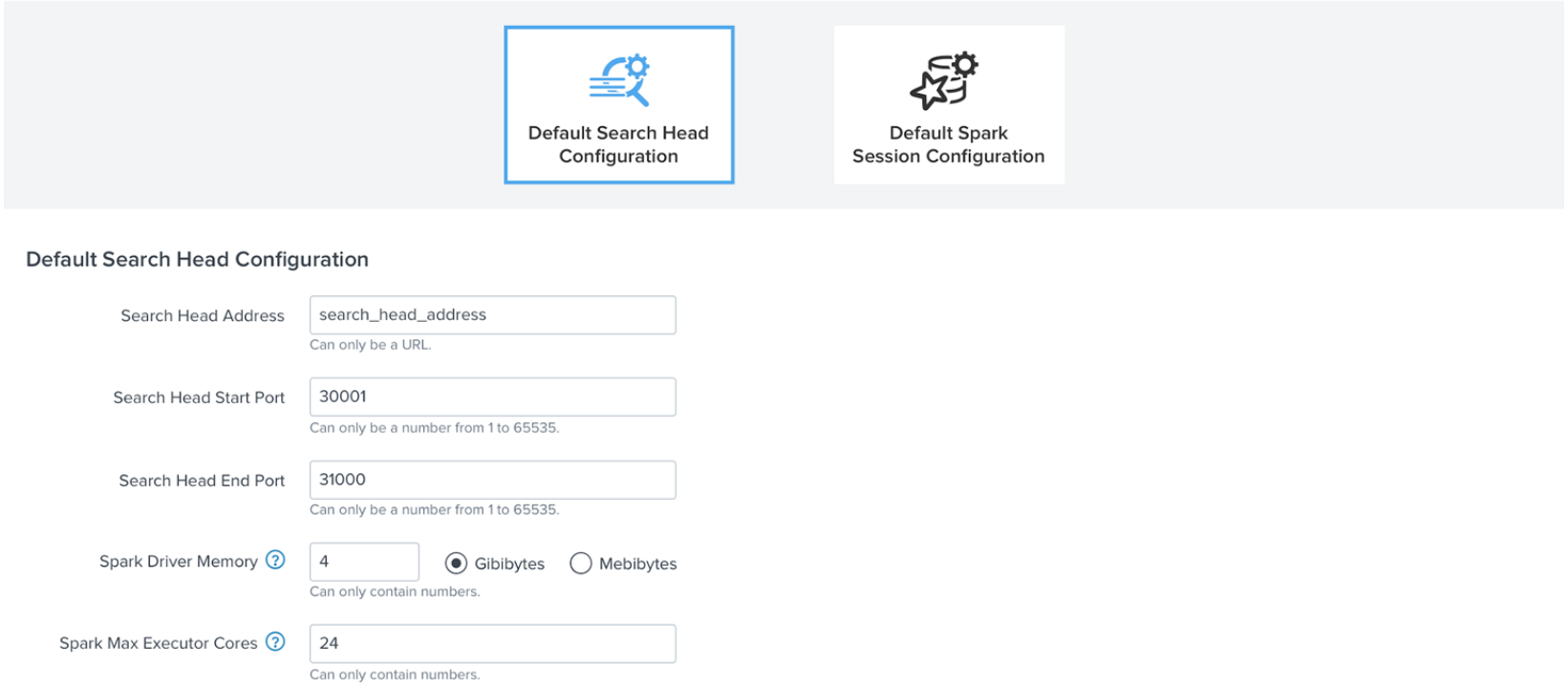
UI Configuration

Hadoop YARN

experimental



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SPL Syntax

sfit

Syntax

```
sfit <algorithm>
        (<option_name>=<option_value>)*
        (<algorithm-arg>)+
        (into <model_name>)?
        (as <output_field>)?
```

Example

```
sparkml [
        sfit LinearRegression errors from _time into errors_over_time
        ]
```

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SPL Syntax

sapply

Syntax

```
sapply <model_name>
    (as <output_field>)?
```

Example

```
sparkml [
    sapply errors_over_time as predicted_errors
    ]
```

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SPL Syntax

sparkml

Syntax

```
sparkml
        (<option_name>=<option_value>)*
        [ <sfit ...> | <sapply ...>*?]
```

Example

```
sparkml [
        sfit PCA k=3 from field1 field2 field3 as pca_output |
        sfit LinearRegression errors from _time pca_output_1
                pca_output_2 pca_output_3
        ]
```

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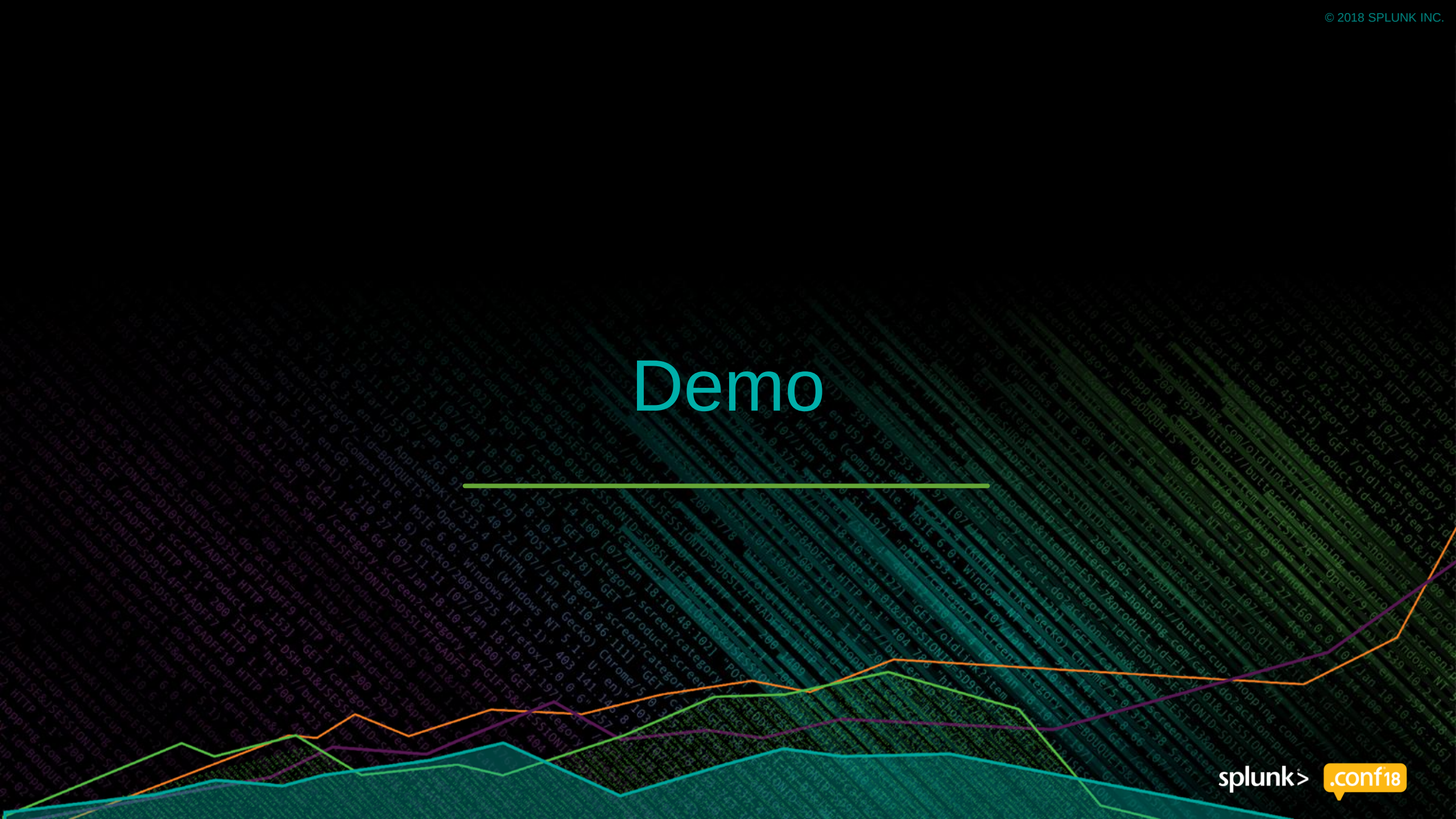
Demo



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Splunk MLTK Connector for Apache Spark™

Version 0.9.0

splunk> listen to your data

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Contact Us

- Beta program feedbacks: sparkml@splunk.com
- We want to hear from you if the add-on provides value ☺
- We also want to hear about things we need to improve
  - Any bugs you run into
  - Failed use cases
    - Why did it fail
    - Why is it important to your business
    - What we can do to make it successful
  - Additional features you want
    - functional: such as new algorithm
    - non-functional: such as more throughput
- Feedback is critical for us to deliver products that bring success to our customers

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Thank you

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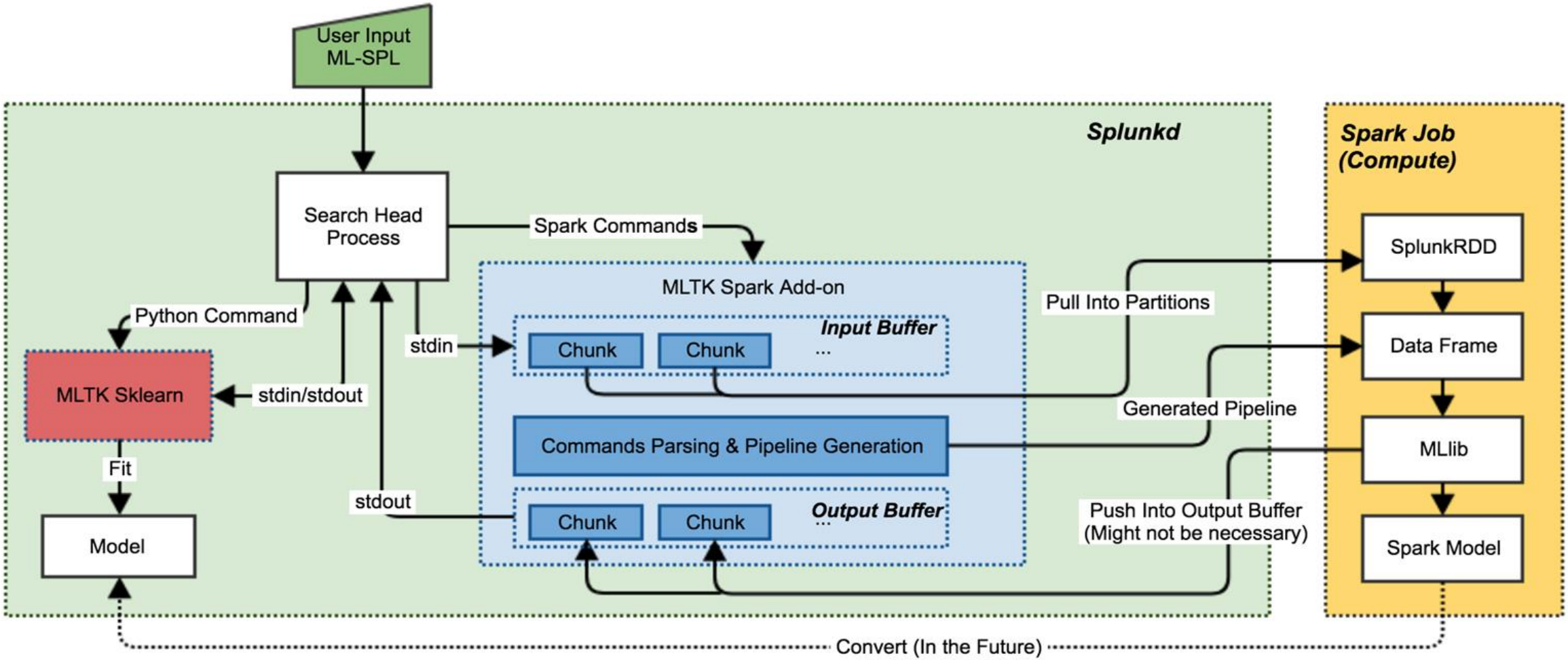
Appendix

Detailed Architecture



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