HPCC Systems – The Kit and Kaboodle

for Big Data and Data Science

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LexisNexis®

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HPCC SYSTEMS®

LexisNexis® RISK SOLUTIONS

RELX Group

HPCC Systems:
End to End Data Lake Management

Completely free

open source data lake solution

Out of the box capabilities for consistency and

ease of use

Less coding

and more using (even though we love to code)

We are your one stop shop for all your data integration, querying and analytical needs

10 YEARS
HPCC SYSTEMS®
OPEN SOURCE

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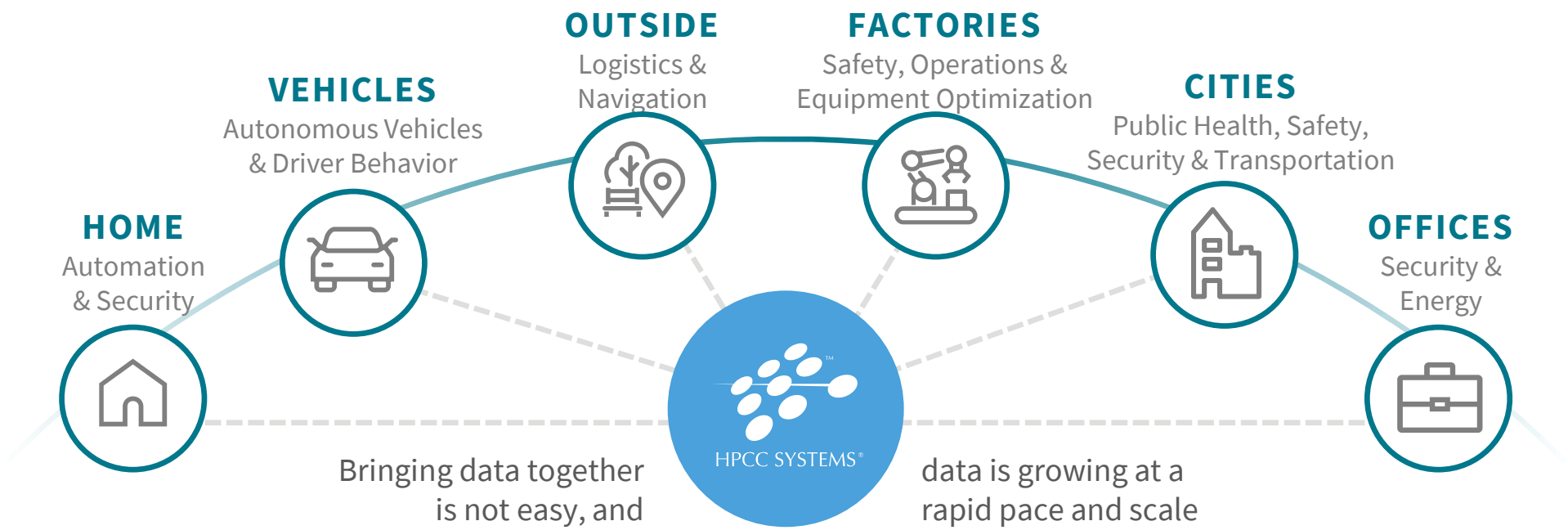
A Brief History of HPCC!

Why does HPCC Systems exist?

- ✓ It was NOT developed with the idea of selling the technology to anybody else!
- ✓ It was all created only to solve some of the data-handling problems that we encountered as we were developing our products.
- ✓ HPCC defined is a *distributed data parallel processing* platform.

A platform purpose-built for high-speed data engineering



Bringing data together is not easy, and data is growing at a rapid pace and scale

A processing platform is vital for bringing all your data together across all verticals

HPCC Systems Evolution

2001

Original version of HPCC Systems released

2011

Open source Apache license and code release to GitHub

Exceeded market-leading performance benchmark achieved

2012 – 16

Continuous **QUALITY-FOCUSED** improvements

Better support and training with improved integration — faster and easier to use

2017-2022

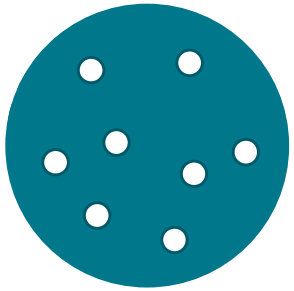
Improved processing architecture

IoT enabled

More Bundles and ML Expansion!

The Data Centric Approach

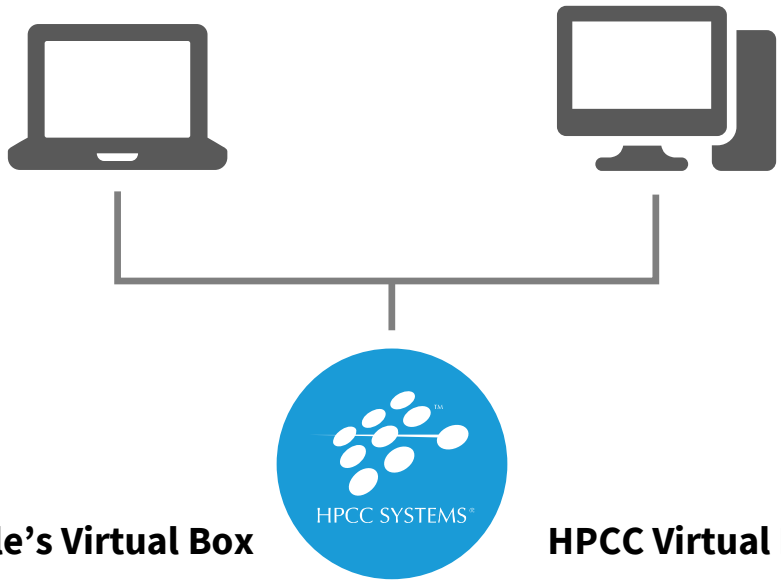
A single source of data is insufficient to overcome inaccuracies



Our platform is built on the premise of absorbing data from **many data sources** and transforming them to **actionable smart data**

Scale from Small to Big

The stack can run on a single laptop or desktop.



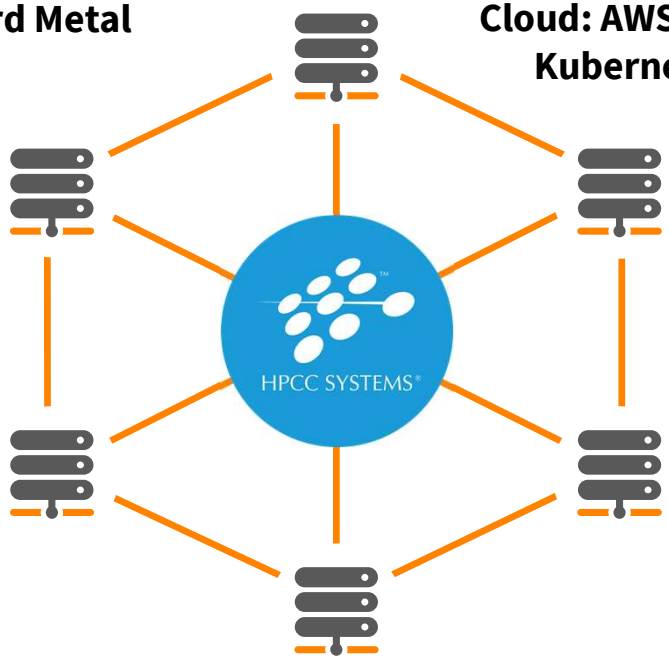
Oracle's Virtual Box

HPCC Virtual Machine

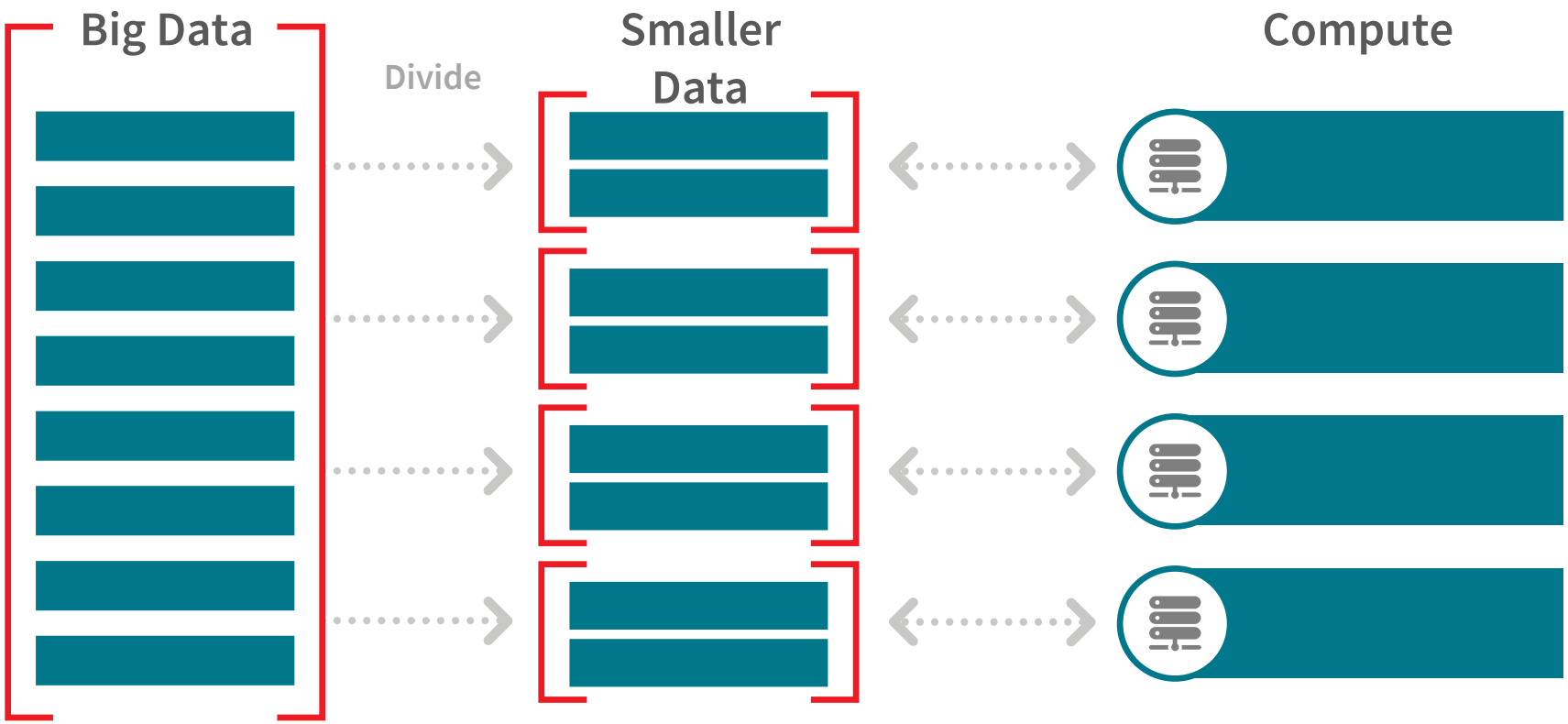
In more sophisticated cases, HPCC Systems run *clusters*, hundreds of servers working as a single processing entity, to transform and deliver big data.

Hard Metal

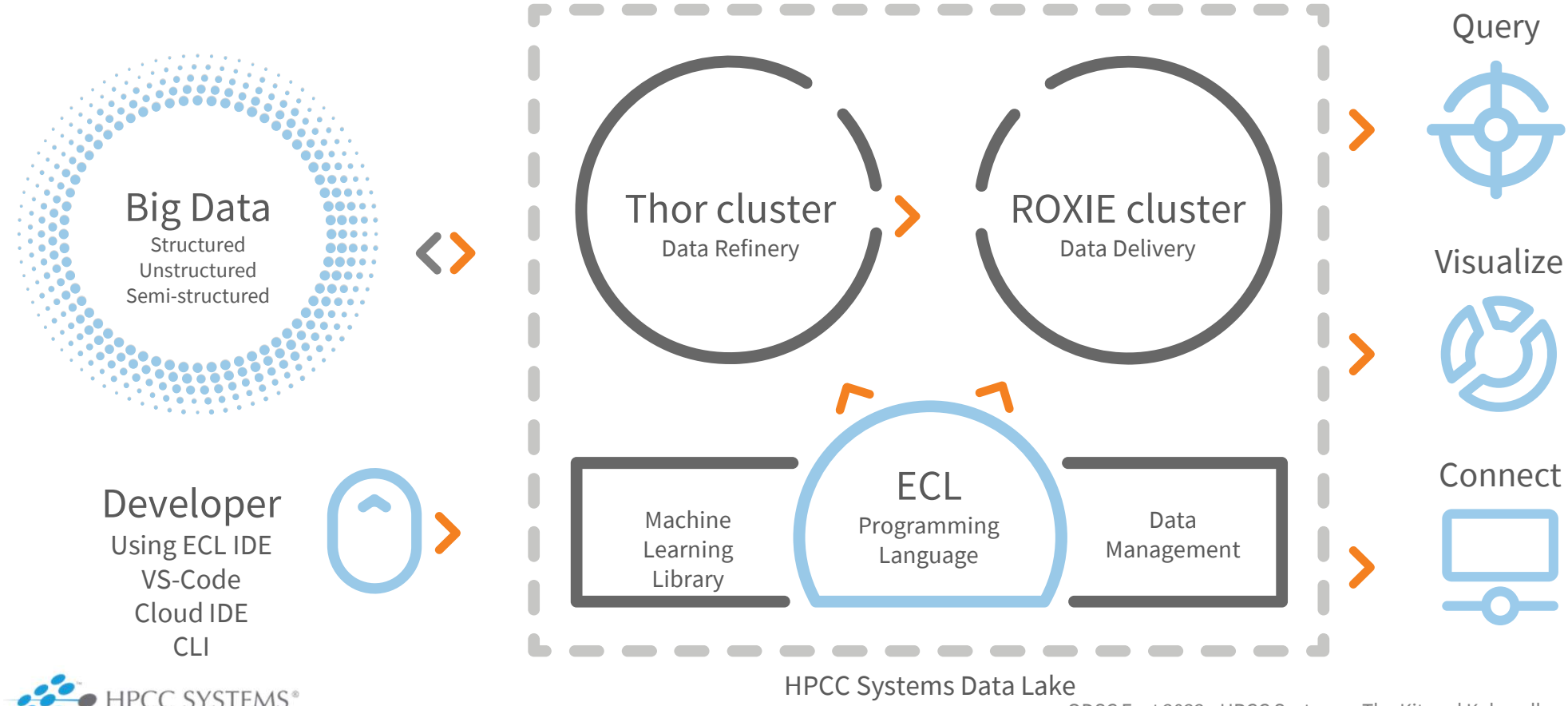
Cloud: AWS/Azure Kubernetes



Anatomy of a Big Data Processing System



The HPCC Systems Components



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Technology — The Open Source Stack

Thor: Data Refinery Cluster
Extraction, loading, cleansing, transforming, linking and indexing

ROXIE: Data Delivery Engine
Rapid data delivery cluster with high-performance online query delivery for big data

Data Management Tools
Data profiling, cleansing, snapshot data updates, consolidation, job scheduling and automation

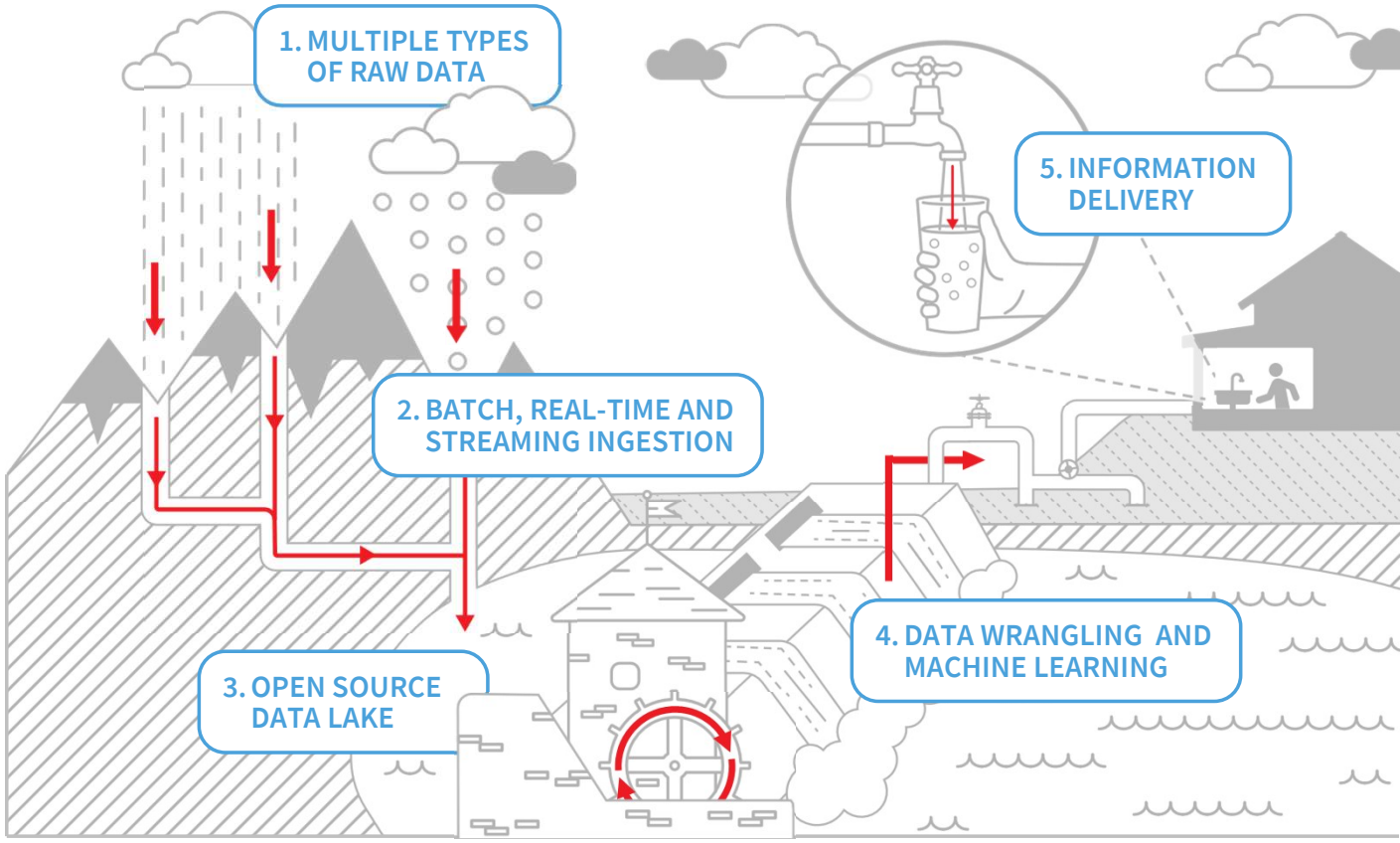
Machine Learning Library
Linear regression, logistic regression, decision trees and random forests

Connectivity & Third-Party Tools
New plugins to help integrate third party tools with the HPCC Systems platform

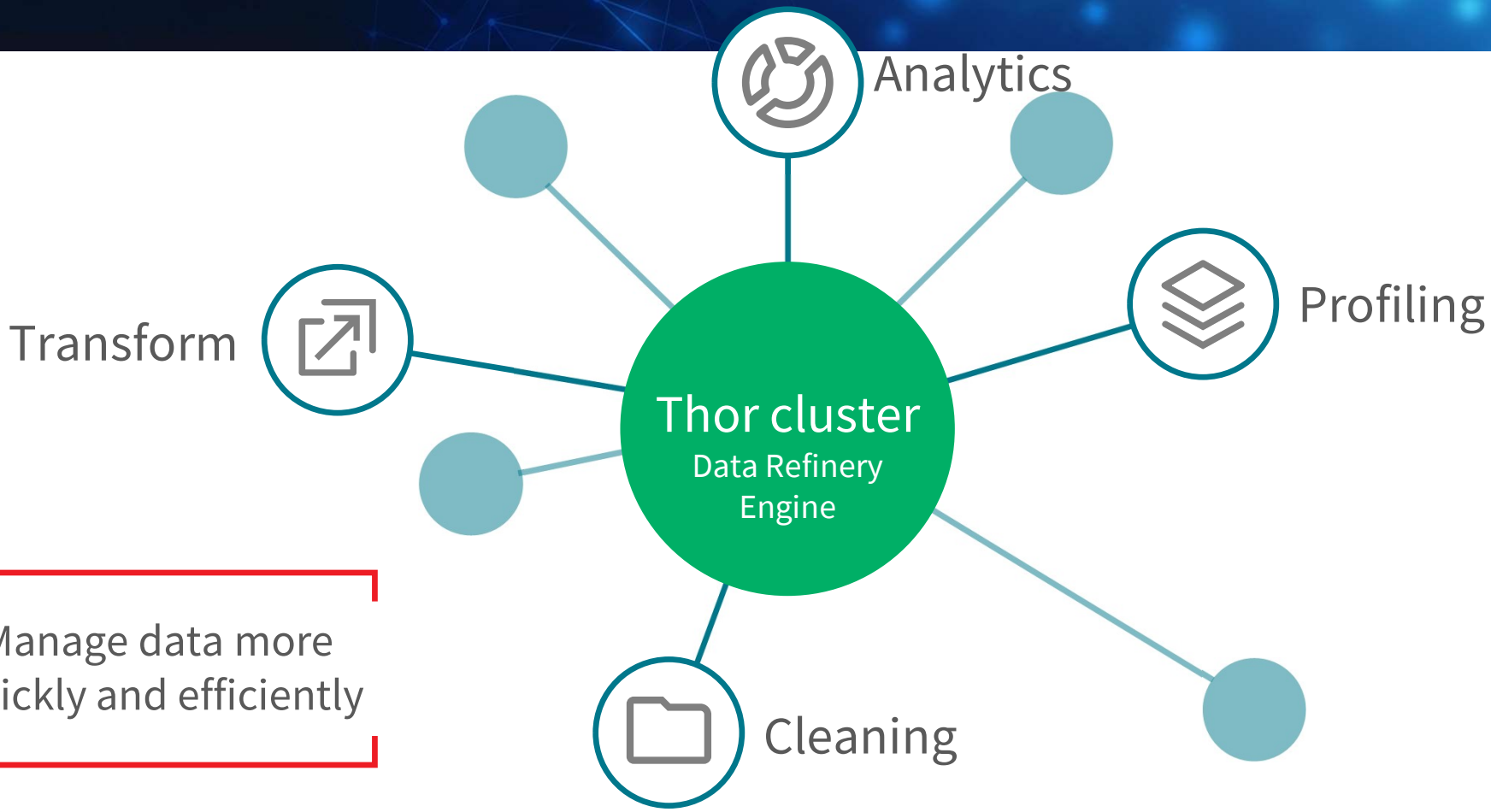
Key aspects of our data lake solution

The HPCC Systems advantage

- Open source data lake platform
- Batch, real-time and streaming data ingestion
- Built-in data enhancement and Machine Learning APIs
- Scalable to many petabytes of data
- Runs on commodity hardware and in the cloud
- Increased responsiveness to customers and stakeholders



THOR at a glance:



Manage data more quickly and efficiently

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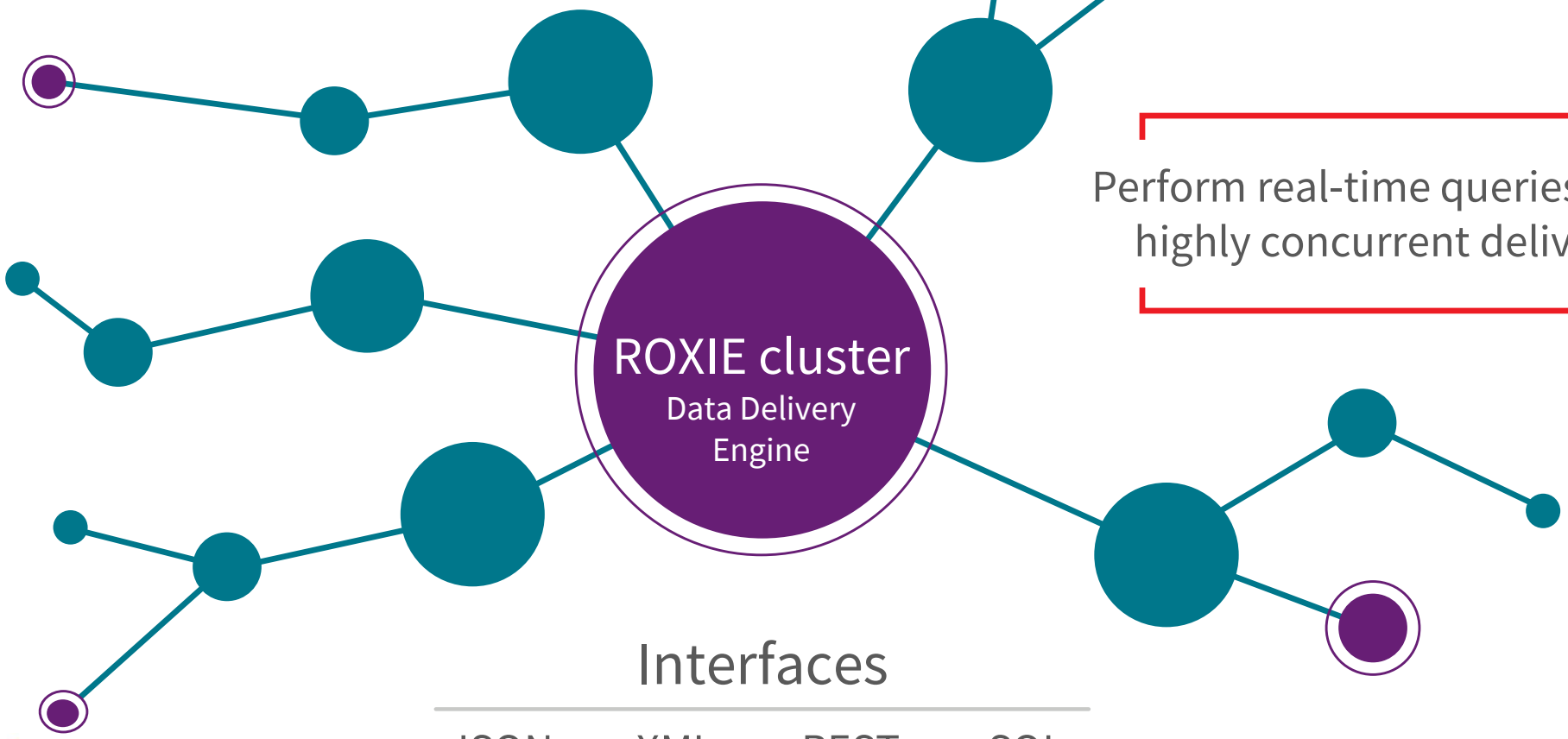
ROXIE at a glance:



Perform real-time queries with highly concurrent delivery

Interfaces

JSON XML REST SQL

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An Introduction to ECL

ECL
Enterprise Control Language

```
IMPORT $, STD, ML;
EXPORT Func(UNSIGNED C, UNSIGNED2 Dist, UNSIGNED size, STRING Fld, REAL Parm1=0, REAL Parm2=0, REAL Parm3=0) := MODULE
  SHARED Node := STD.system.Thorlib.Node()+1;
  SHARED PersistPrefix := $.Parms.PersistPrefix;
  SHARED TotalRecs := $.Parms.RecCnt*CLUSTERSIZE;
  SHARED UIDval := IF(C=1, node, node + ((C-1)*CLUSTERSIZE));
  SHARED BOOLEAN IsRandFile := $.Parms.Randomness = $.ut.RandomSrc.file;
  SHARED Normal := FUNCTION
    Thisdist := IF(Parm3=0,
                   ML.Distribution.Normal(Parm1, Parm2),
                   ML.Distribution.Normal(Parm1, Parm2, Parm3));
    RetVals := ML.Distribution.GenData(TotalRecs, Thisdist, 1) : PERSIST(PersistPrefix + 'NormalDistInt' + Fld,EXPIRE(1));
    RETURN RetVals;
    END;
  SHARED Normal2 := FUNCTION
    Thisdist := IF(Parm3=0,
                   ML.Distribution.Normal2(Parm1, Parm2),
                   ML.Distribution.Normal2(Parm1, Parm2, Parm3));
    RetVals := ML.Distribution.GenData(TotalRecs, Thisdist, 1) : PERSIST(PersistPrefix + 'Normal2DistInt' + Fld,EXPIRE(1));
    RETURN RetVals;
    END;
  SHARED Uniform := FUNCTION
    Thisdist := IF(Parm3=0,
                   ML.Distribution.Uniform(Parm1, Parm2),
                   ML.Distribution.Uniform(Parm1, Parm2, Parm3));
    RetVals := ML.Distribution.GenData(TotalRecs, Thisdist, 1) : PERSIST(PersistPrefix + 'UniformDistInt' + Fld,EXPIRE(1));
    RETURN RetVals;
    END;
  SHARED StudentT := FUNCTION
    Thisdist := ML.Distribution.StudentT(Parm1, Parm2);
    RetVals := ML.Distribution.GenData(TotalRecs, Thisdist, 1) : PERSIST(PersistPrefix + 'StudentTDistInt' + Fld,EXPIRE(1))
    RETURN RetVals;
```

- Transparent and implicitly parallel programming language
- Both powerful and flexible

- Optimized for data-intensive operations, declarative, non-procedural and dataflow oriented
- Uses intuitive syntax which is modular, reusable, extensible and highly productive

How to do it ✗ vs. ✓ What to do

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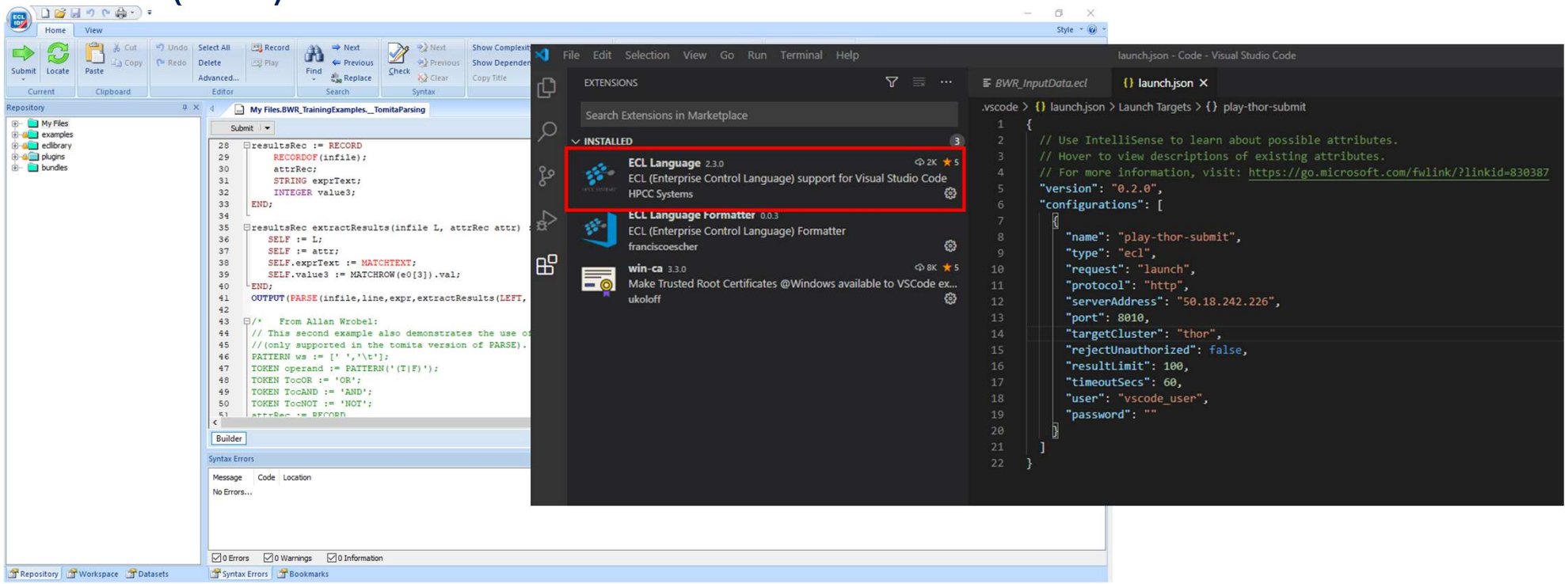
Integrated Development Environments

ECL IDE (Win)

Visual Studio Code (Ux/MacOS)



And CLI too! ECL.EXE

ECL IDE Features:

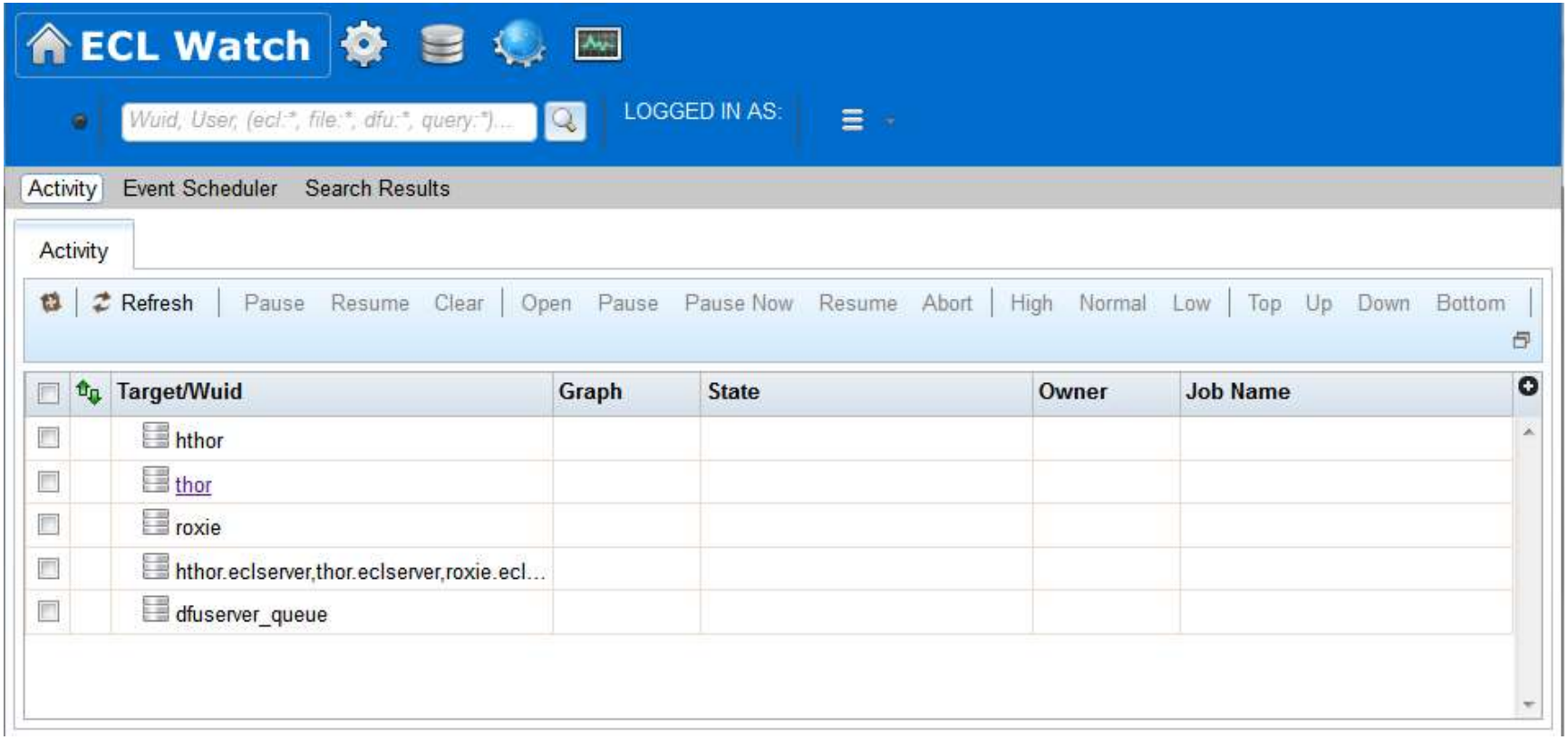
A full-featured GUI for ECL development providing access to the ECL repository and many of the ECL Watch capabilities.

Uses various ESP services via SOAP.

Provides the easiest way to create:

1. Queries into your data.
2. ECL Definitions to build your queries which:
   - Are created by coding an expression that defines how some calculation or record set derivation is to be done.
   - Once defined, can be used in succeeding ECL definitions.

The ECL Watch



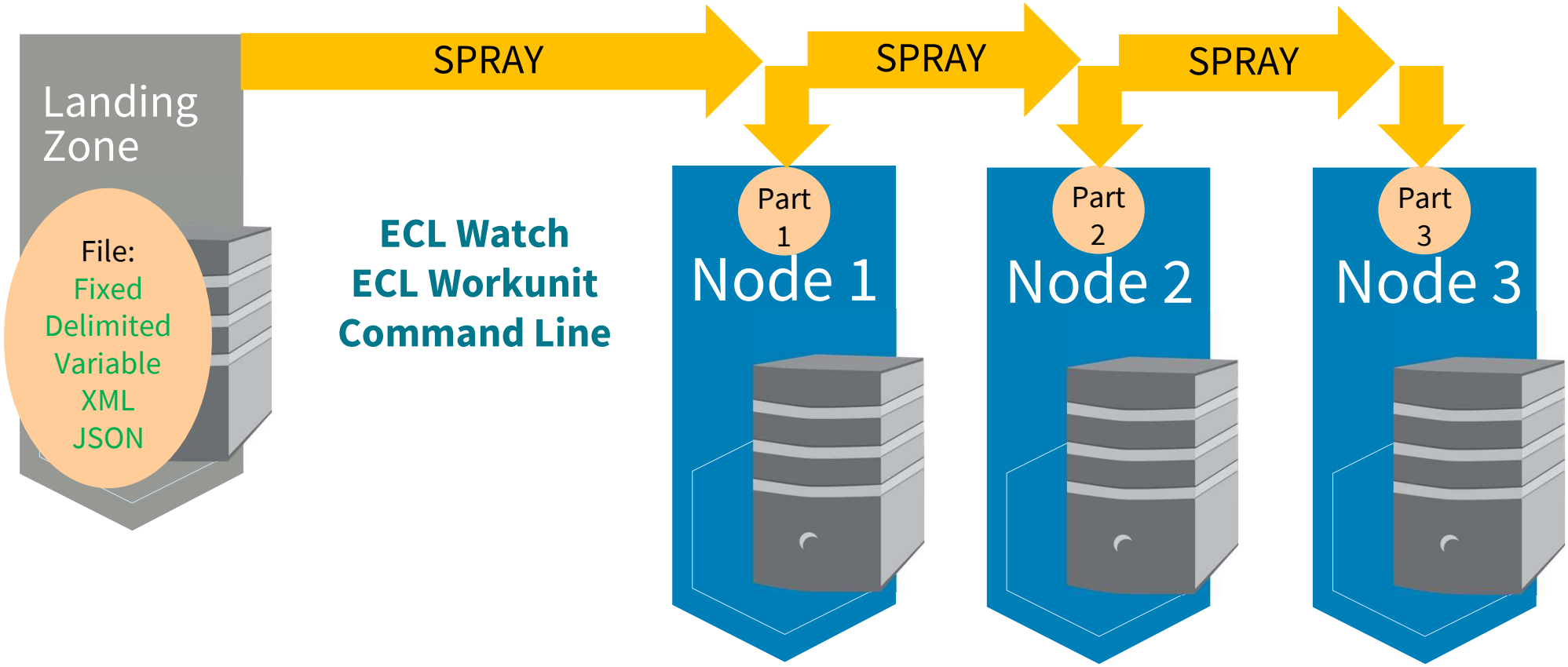
ECL Watch Features:

A web-based query execution, monitoring and file management interface. It can be accessed via ECL IDE or a web browser.

ECL Watch allows you to:

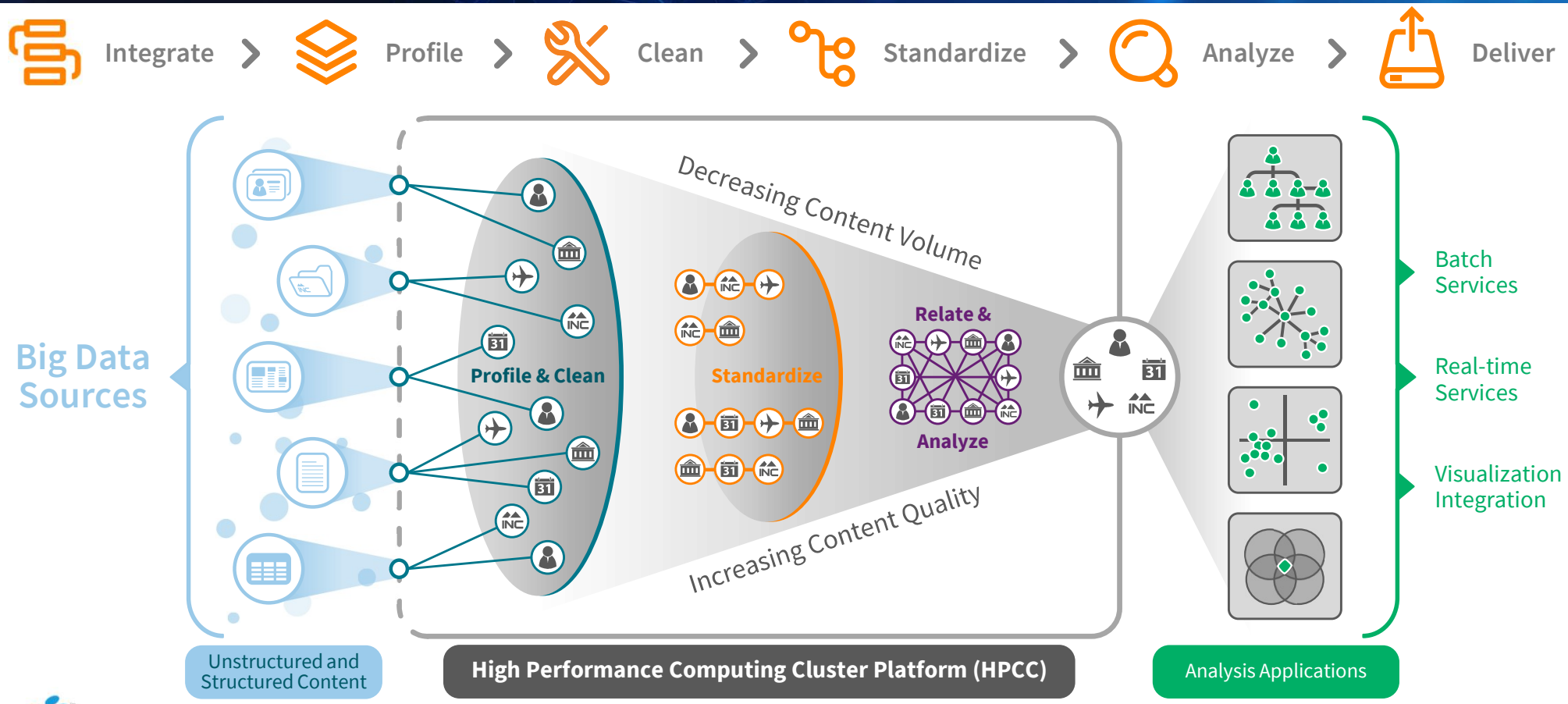
1. See information about active workunits.
2. Monitor cluster activity.
3. Browse through previously submitted WUs:
   See a visual representation of the data flow within the WU.
   Complete with statistics which are updated as the job progresses.
4. Search through files and see information including:
   Record counts and layouts.
   Sample records.
   The status of all system servers whether they are in clusters or not.
5. View log files.
6. Start and stop processes.

SPRAY Operation



Treated as a single logical file…

HPCC Systems (Small to Big Data) ETL



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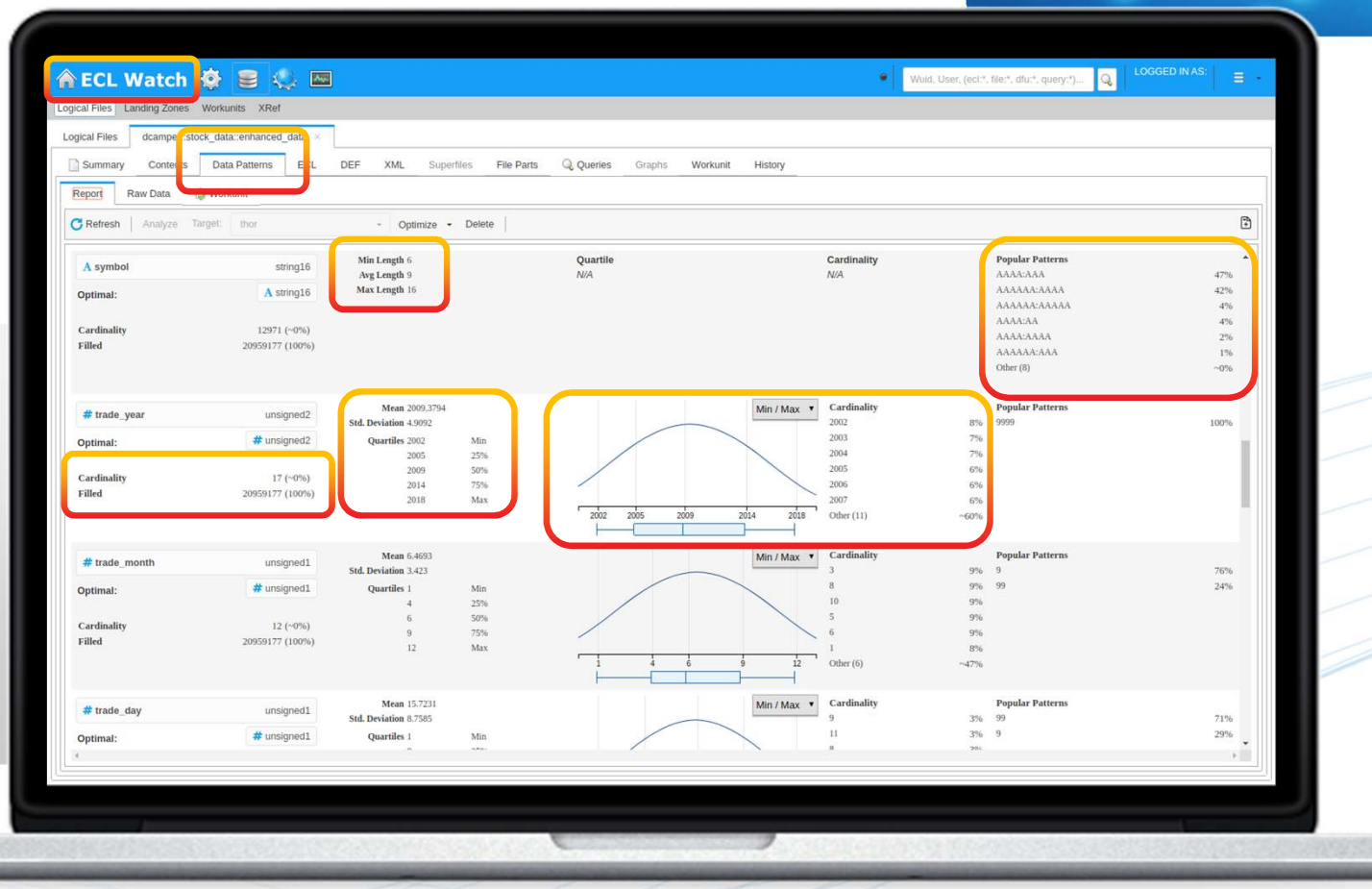
Libraries and Plugins

Integrated Data Profiling

Built-in data profiling exposes field-level details

- Fill rates and cardinality details
- Numeric range detail, including quartiles
- Textual patterns highlight common and rate formats



It's a Machine Learning World

Classical Machine Learning

Unsupervised

Clustering
DBSCAN
K-Means

Pattern Search
Text Vectors
Levenshtein Deletion Neighborhood

Dimension Reduction
PCA

Supervised

Classification
SVM
Decision Trees
Logistic Regression
Classification Forest
Latent Dirichlet Allocation (Topic Modeling)

Regression
Linear Regression
Regression Forest

Neural Nets & Deep Learning

Autoencoders
Convolutional Neural Networks
Recurrent Neural Networks
Perceptrons

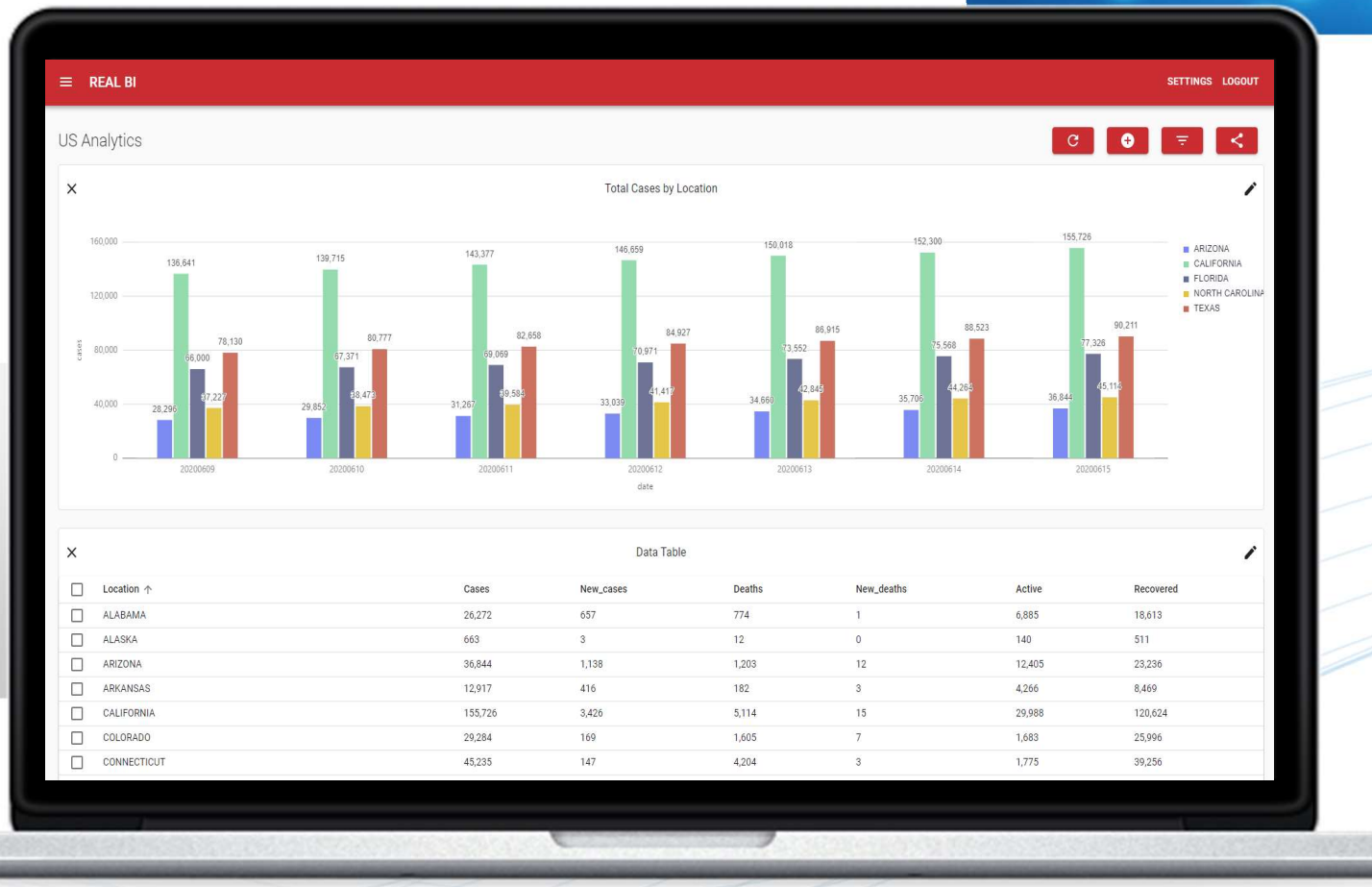
Ensemble Methods

Random Forest
Gradient Boosted Forest
Gradient Boosted Trees

Visualization Bundle

Create custom data visualizations from HPCC clusters

- Chart live data from HPCC logical files and ROXIE queries
- Share dashboards and visualizations with others



HPCC Systems: Plugins

WsSQL

SPARK

JDBC/ODBC Driver

KAFKA

PENTAHO

HPCC

Couchbase

Tableau

SQS

Java API

MEMCACHED

REDIS

Embedded Language

- C++
- R
- Python
- Java
- Cassandra
- SQL/SqLite

CODE: SELECT ALL

```
IMPORT python;
r := RECORD
  STRING word;
  UTF8 tags;
END;
DATASET(R) tag(STRING text) := IMPORT(python, './ex2.tag');
tag('Once upon a time there was a boy called Richard');
```

CODE: SELECT ALL

```
IMPORT java;
STRING jcat(STRING a, STRING b) :=
   IMPORT(java,
          'JavaCat.cat:(Ljava/lang/String;Ljava/lang/String;)Ljava/lang/String;' :
classpath('/opt/HPCCSystems/classes'));

jcat('Hello ', 'world!');
```

CODE: SELECT ALL

```
IMPORT MySQL;
stringrec := RECORD
   string name
END;
sqlrec := RECORD
   string ssn;
   string address;
END;
DATASET(sqlrec) MySQLJoin(dataset(stringrec) inrecs) := EMBED(mysql)
  SELECT * from tbl1 where name = ?;
ENDEMBED;
MySQLJoin(indata);
```

CODE: SELECT ALL

```
IMPORT python;
SET OF STRING split(STRING text) := EMBED(python)
  return text.split()
ENDEMBED;
split('Once upon a time');
```

Summary

Discover HPCC Systems, an end-to-end data lake management solution:

- A mature platform that has been heavily used in commercial applications for almost two decades
- Created by LexisNexis Risk Solutions and open source for nearly a decade now
- It is a powerful and versatile platform to work with and manipulate data as needed
- Makes it easier for your clients to query and find the data they need

Indeed, it is the Kit and Kaboodle for your Big Data Solutions!

Thank you!

Want to know more?

Portal:

https://hpccsystems.com

Free online training (138 classes and counting!):

https://learn.lexisnexis.com/hpcc

Free access to an HPCC (try it out!):

https://play.hpccsystems.com:18010

Please email our training team:

training@hpccsystems.com

Join our Community

Help us make HPCC Systems better. Register on our community portal.