# SAS AND OPEN SOURCE

MATT MALCZEWSKI, SAS CANADA

# Your Trial, Your Data

Visual Analytics – Register for Trial

- Smart data exploration with self-services analytics makes this product usable for anyone. Interactive reporting makes it collaborative. Scalability and governance make it fit the needs of your organization, no matter the size.

Visual Statistics – Register for Trial

- Multiple users can explore and visualize data, then interactively create and refine descriptive and predictive models. Distributed, in-memory processing reduces model development time so you can run complex analytic computations – and get precise results – in minutes.

# ACKNOWLEDGEMENTS

TAMARA DULL, SAS BEST PRACTICES
STEVE HOLDER, NATIONAL ANALYTICS LEAD, SAS CANADA

# WHY OPEN SOURCE?

## Why the drive to open source?

- Cost effective –considering total cost of ownership
- Flexible – customers can “build anything”
- Immediate access & easy to get started
- Latest technology and latest algorithms
- Strong community and online support
- Many new data scientists learn in open source

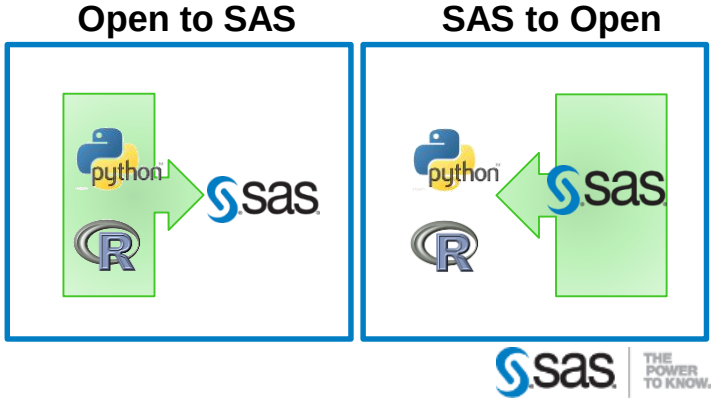

## So why use SAS to extend open source?

# SAS AS AN ENHANCEMENT

AND

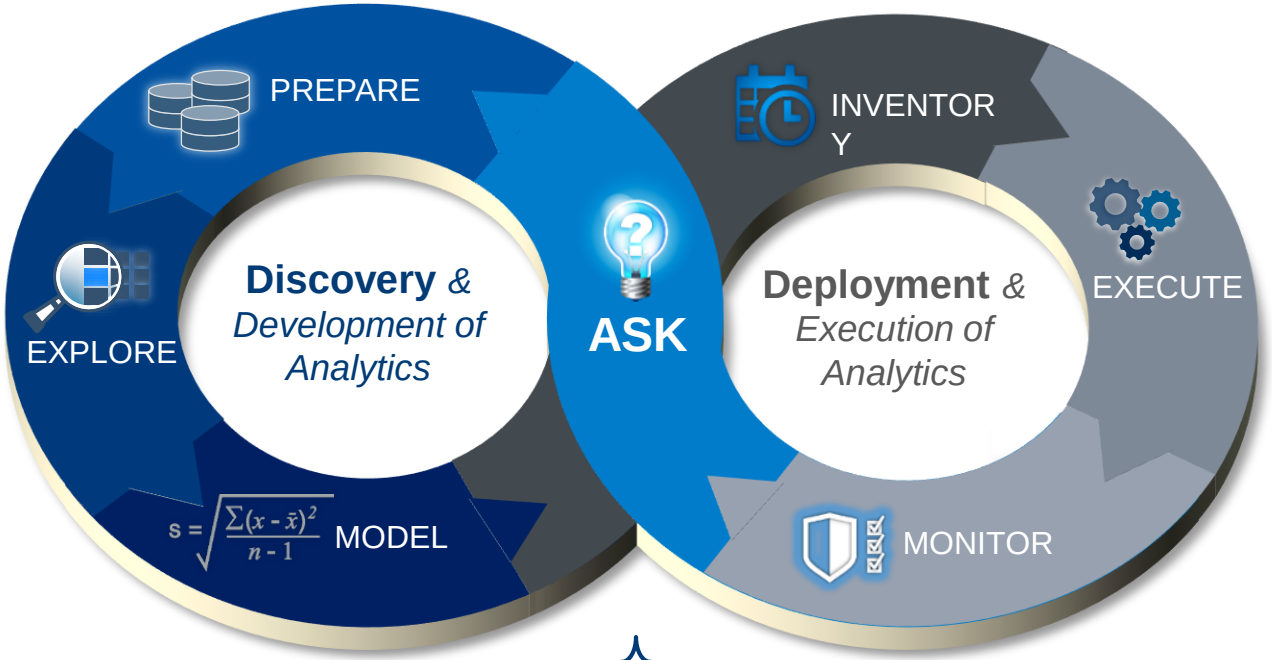
**SAS can augment open source**

- Increase productivity
- Leverage your assets, people and platforms
- Bring the power of SAS to open source
- Create deployable analytics
- Goal is to ‘embrace’ and ‘extend’



# THE ANALYTIC LIFECYCLE


Lots of Data
New Data
Experimentation
Fail Fast
Test & Learn
Interactive
Iterative
Innovation
Flexibility
Data Science





Regulated
Automated
Governed
Embed
Reliable
Decisions
Consistent
Documented
Actions
IT

# THE ANALYTIC LIFECYCLE: SAS AND OPEN SOURCE

**Discovery** *& Development of Analytics* **Deployment** *& Execution of Analytics*


- SAS embraces open source for Data Prep
- Open source and SAS work well for Discovery and Development
- SAS can extend open source
  - inventory, register and manage models
  - deploy and execute models in Hadoop and in database
  - enhance models and provide monitoring and reporting

***EMBRACE*** + ***EXTEND***

# THE ANALYTIC LIFECYCLE

***EMBRACE***

**Discovery** *& Development of Analytics* **Deployment** *& Execution of Analytics*


## Enterprise Wish List

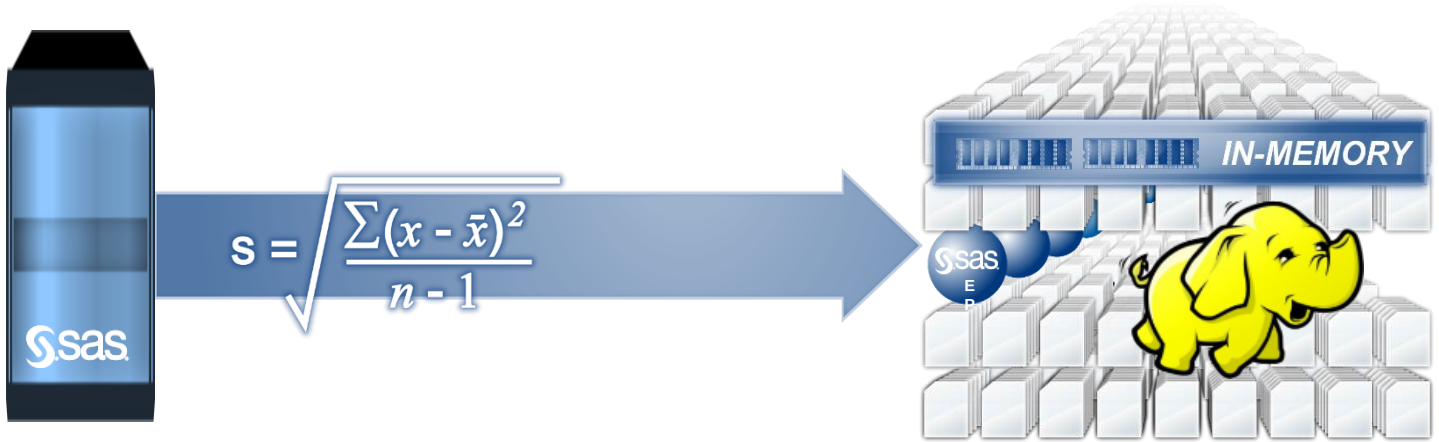
- Ability to connect to Hadoop
- Run natively in Hadoop
- Minimize data movement

## How SAS Embraces…

- Optimized engine to access Hadoop
- Embedded engine so Hadoop can run SAS

# HADOOP AS PROCESSING ENGINE

EMBRACE




- Use Hadoop as the horsepower for analytics
- Run SAS in Hadoop - no data movement
- Expose Hadoop data to more people through a range of interfaces
- Predictive analytics and machine learning
- SAS for Model Deployment / Scoring

# THE ANALYTIC LIFECYCLE

***EMBRACE***

**Discovery** *& Development of Analytics*

**Deployment** *& Execution of Analytics*


## Enterprise Wish List

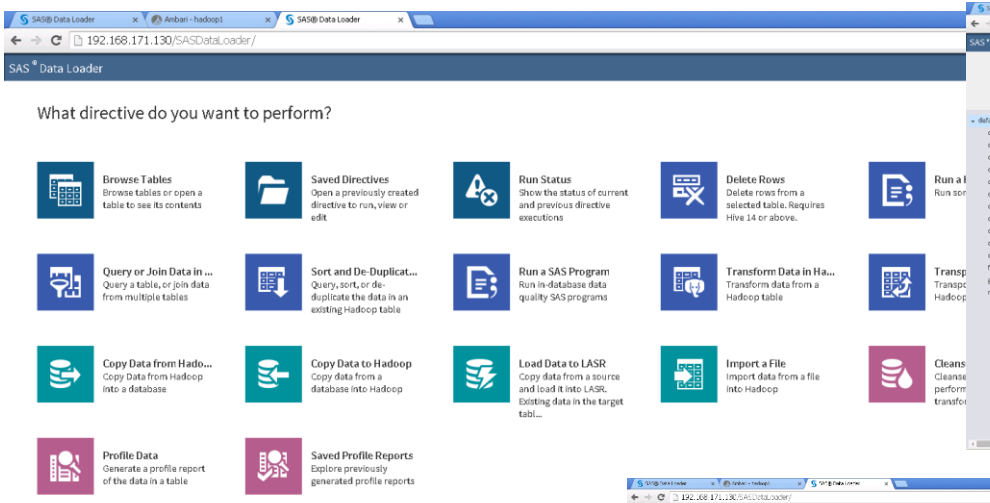
- A way for users to interact with Hadoop
- Ability to create analytic views and tables
- Ability to assess data quality


## How SAS embraces…

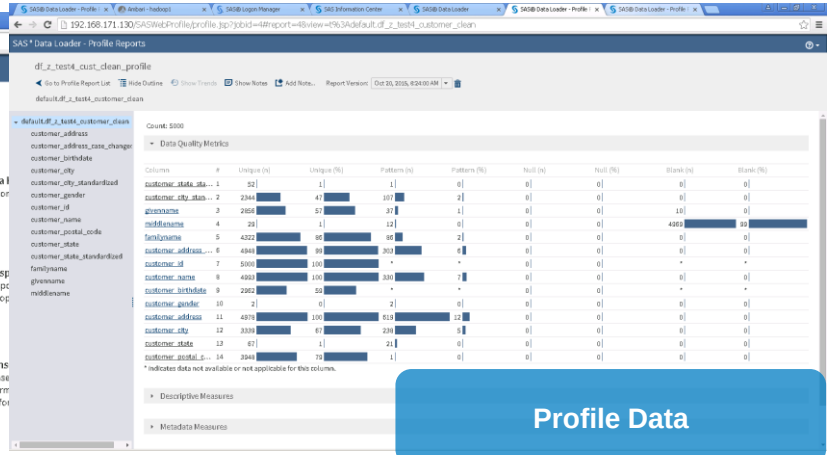
- A business user interface to facilitate:
  - Querying Hadoop
  - Adding data
  - Profiling data
  - Cleansing data
  - Transforming data
- With no data movement

# SELF SERVE ACCESS TO HADOOP

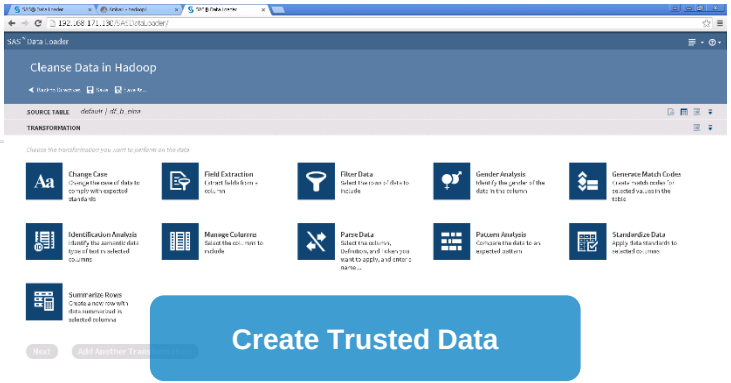
**EMBRACE**




**Business user UI**




**Profile Data**




**Create Trusted Data**

# THE ANALYTIC LIFECYCLE

**EXTEND**

**Discovery** *& Development of Analytics* **Deployment** *& Execution of Analytics*


## Enterprise Wish List

- Best possible analytics
- Flexibility of tools
- Productivity
- Greater insights = models
- Trusted models

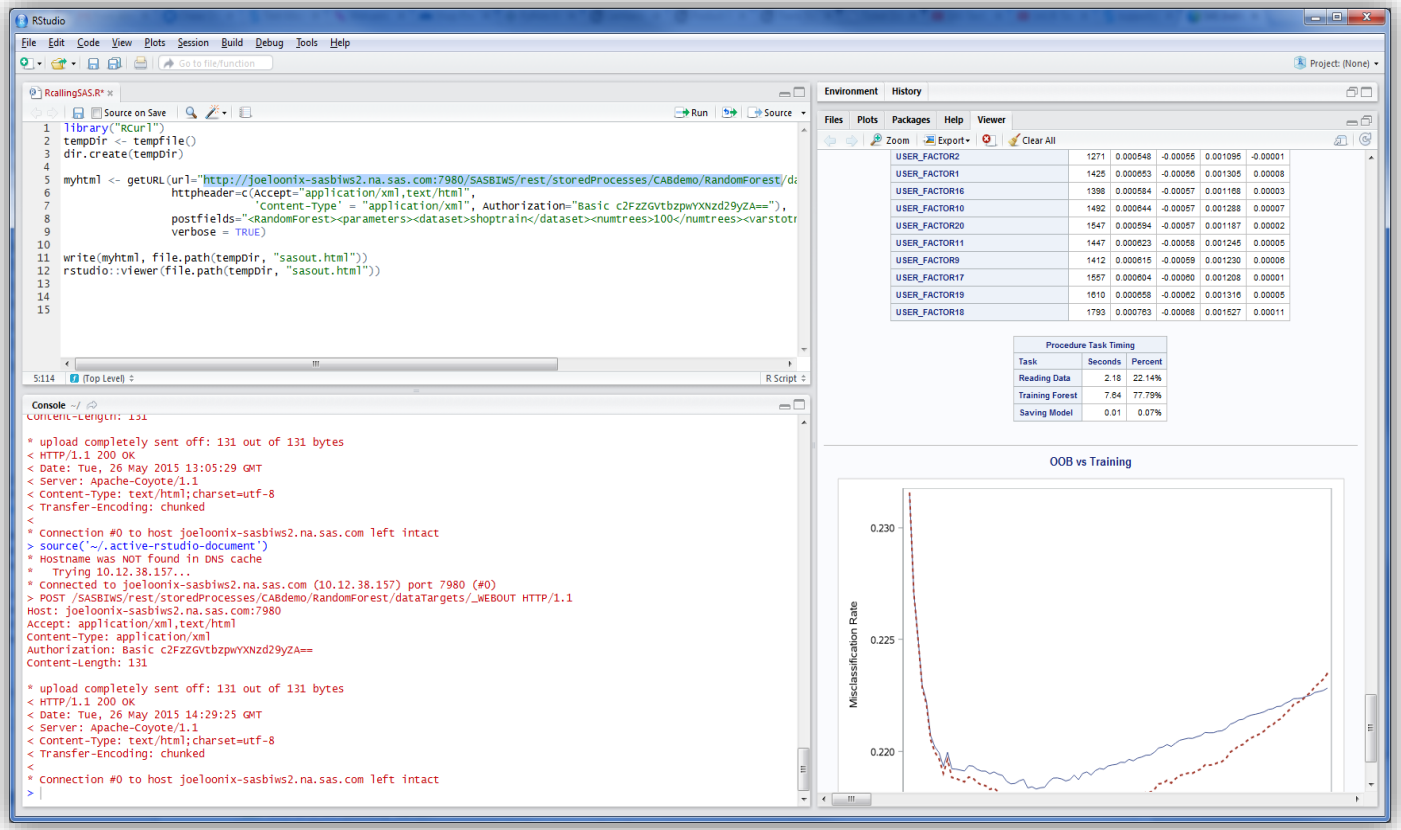
## How SAS Extends…

- A variety of options to develop models
- Allows data scientist to code in language of choice
- Ability to scale to any data volume
- Handle complex graphics

# SAS FROM R

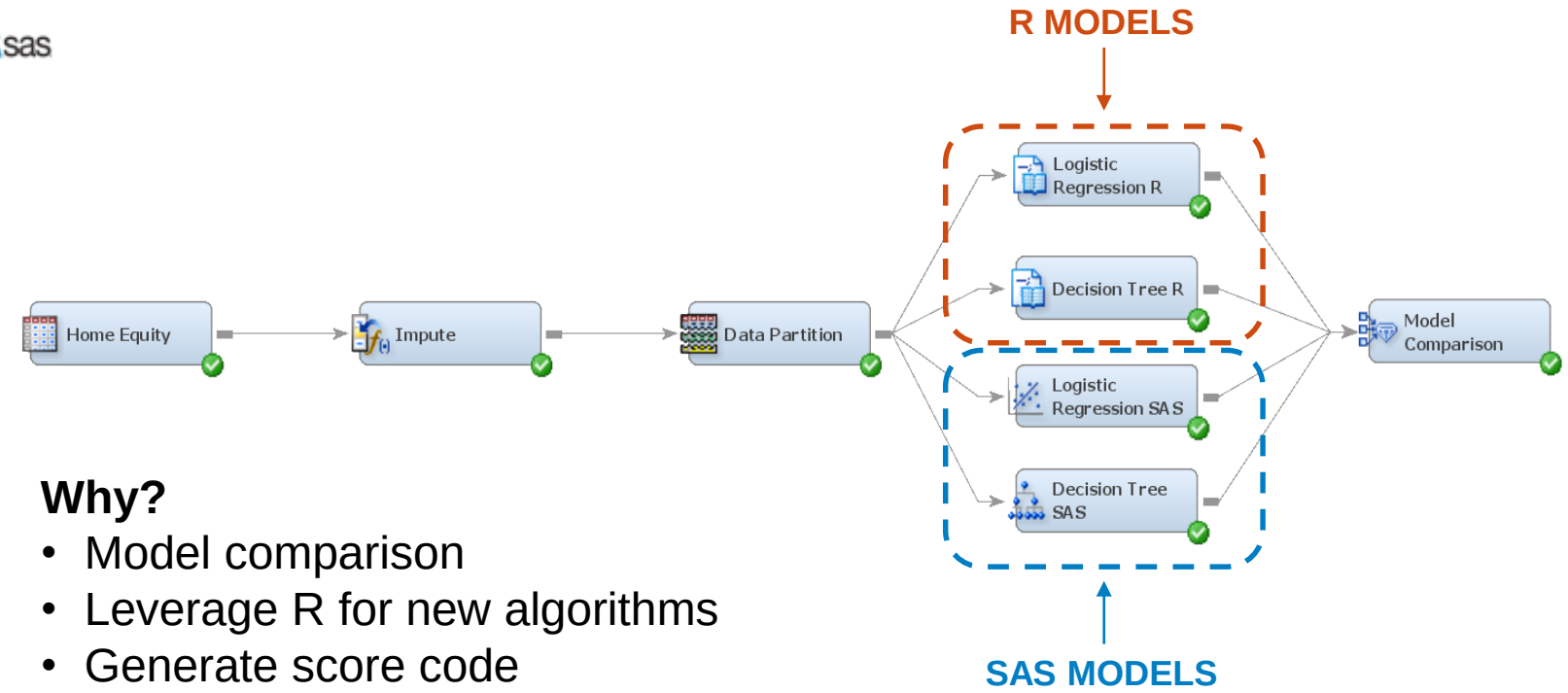
EXTEND






# USE SAS TO INTEGRATE R

EXTEND

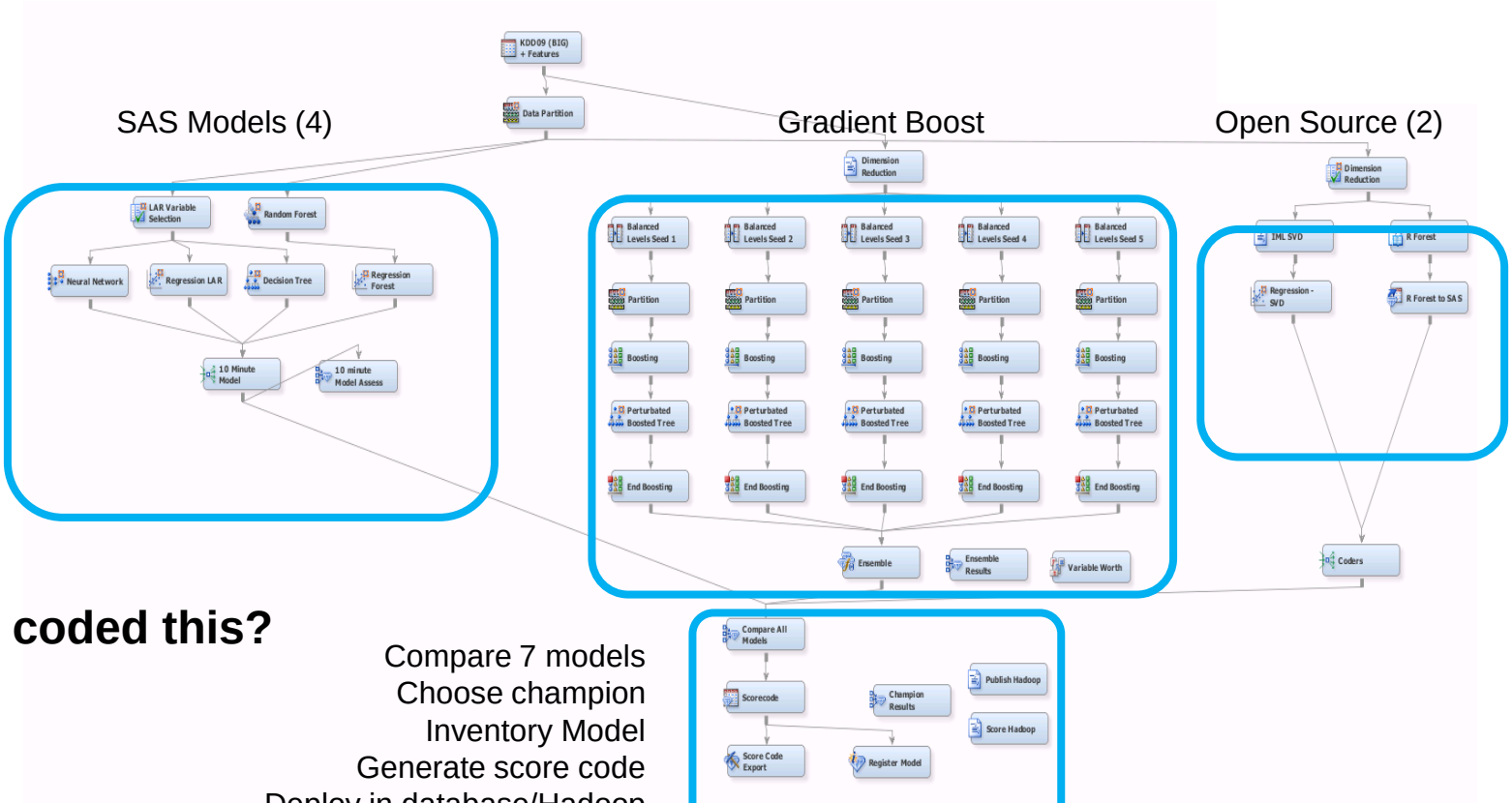




**Why?**

- Model comparison
- Leverage R for new algorithms
- Generate score code
- Deploy R models

# PRODUCTIVITY

EXTEND

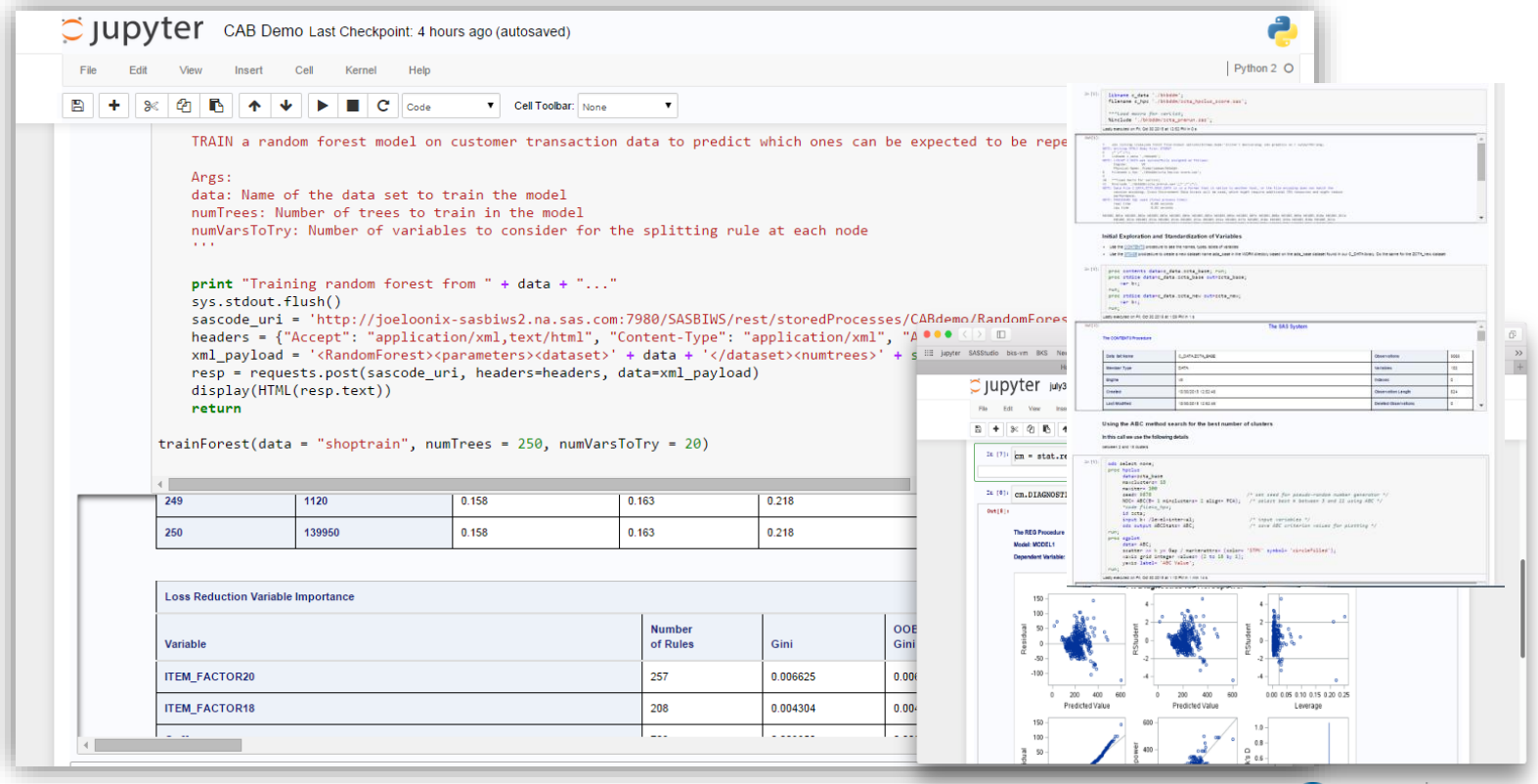

## What if you coded this?

Compare 7 models
Choose champion
Inventory Model
Generate score code
Deploy in database/Hadoop

# SAS FROM JUPYTER

EXTEND






# THE ANALYTIC LIFECYCLE

**EXTEND**

**Discovery** *& Development of Analytics*

**Deployment** *& Execution of Analytics*


## Enterprise Wish List

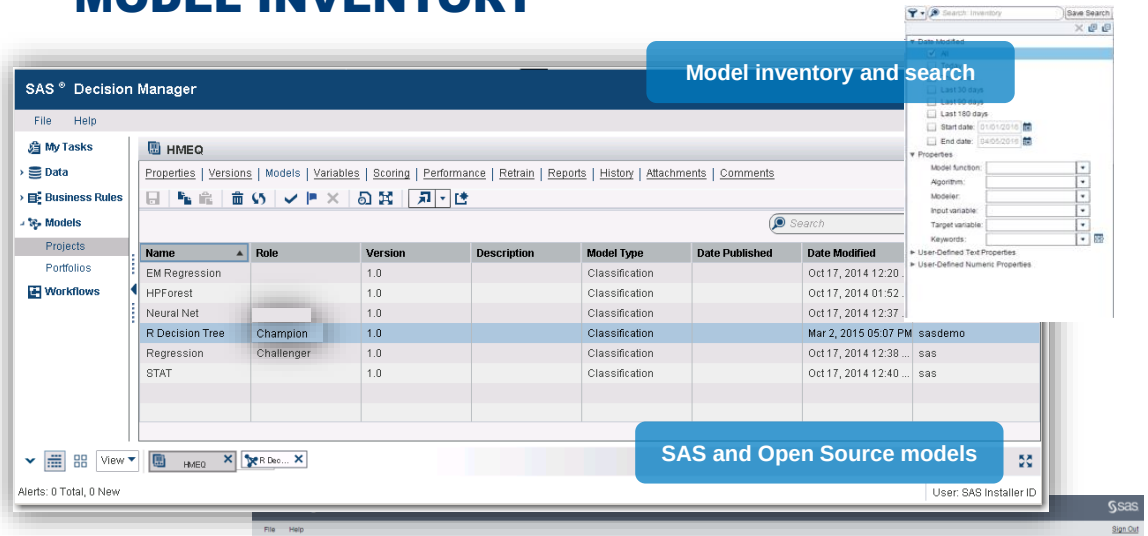
- Model management platform
- Inventory ALL models
- Know who's working on what
- Ability to deploy models
- Auditable models

## How SAS Extends…

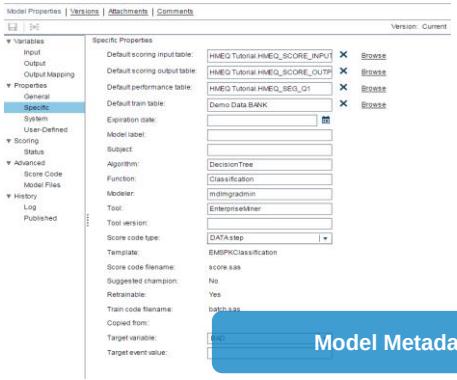
- Central model management platform
- Repository for SAS models and open source (R, Python, PMML)
- Model history
- Version control
- Model and data lineage
- Model governance

# MODEL INVENTORY

**EXTEND**

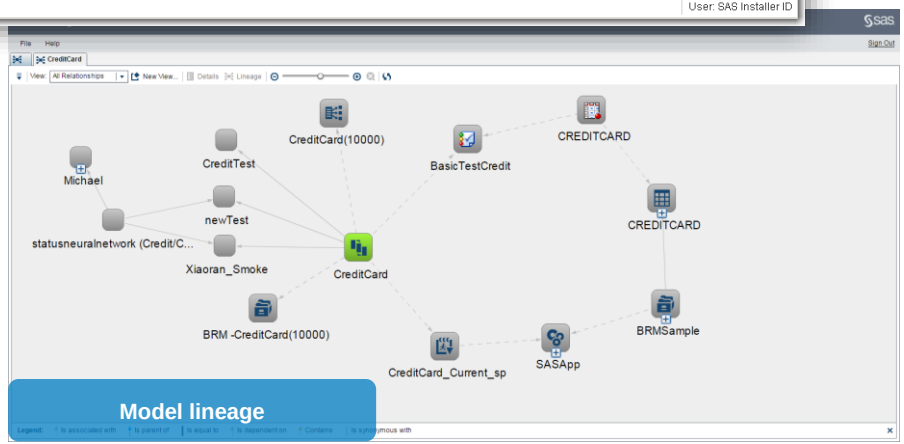



Model inventory and search




Model Metadata

SAS and Open Source models




Model lineage

# THE ANALYTIC LIFECYCLE

**EXTEND**

**Discovery** *& Development of Analytics*

**Deployment** *& Execution of Analytics*


## Enterprise Wish List

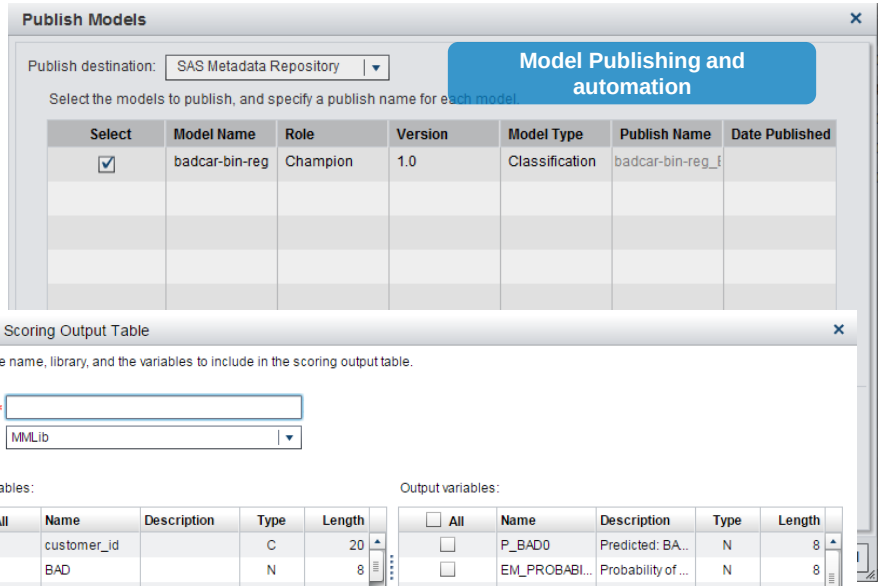
- Deployable analytics
- Automation
- Faster time to model execution
- In Hadoop/database model execution

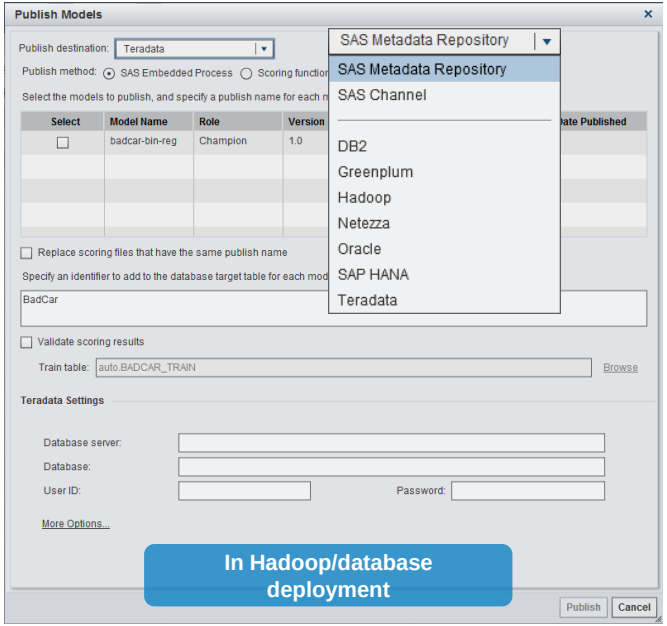
## How SAS Extends…

- Model execution platform
- Execute models as database functions
- No language conversion
- Purpose built model execution engines

# MODEL EXECUTION

EXTEND




# THE ANALYTIC LIFECYCLE

**EXTEND**

**Discovery** *& Development of Analytics*

**Deployment** *& Execution of Analytics*


## Enterprise Wish List

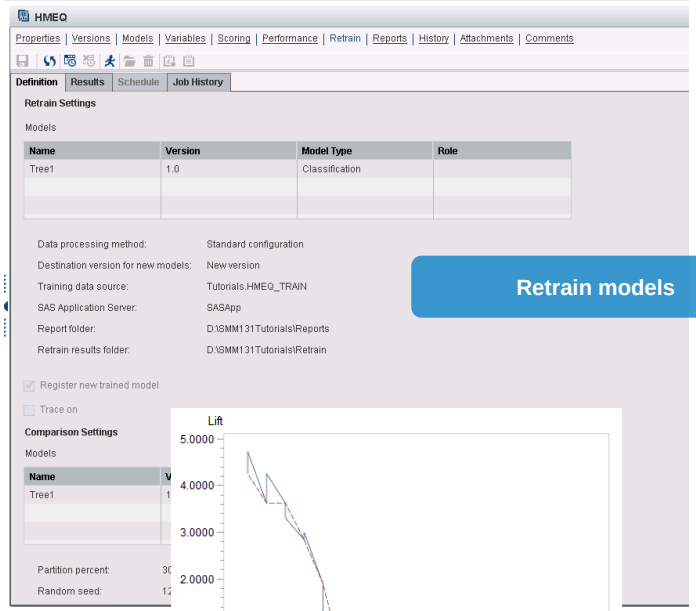
- Best possible models
- Model tournaments
- Visibility into performance
- Easy retraining
- Champion/challenger modelling

## How SAS Extends…

- Model performance platform to keep models “fresh”
- Compare multiple models at once
- Assess model accuracy (Lift, ROC, K-S)
- Champion/challenger modeling
- Model retraining including open source

# MODEL PERFORMANCE

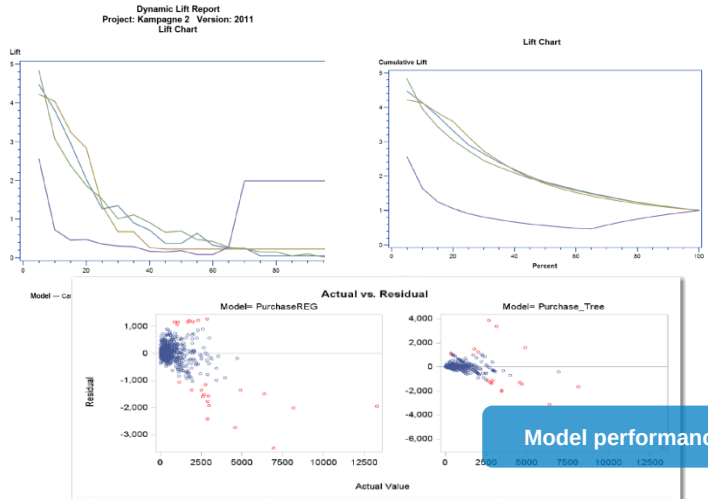
EXTEND



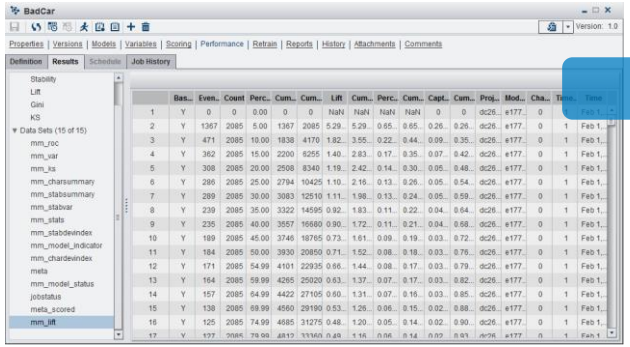

Retrain models




Model comparisons



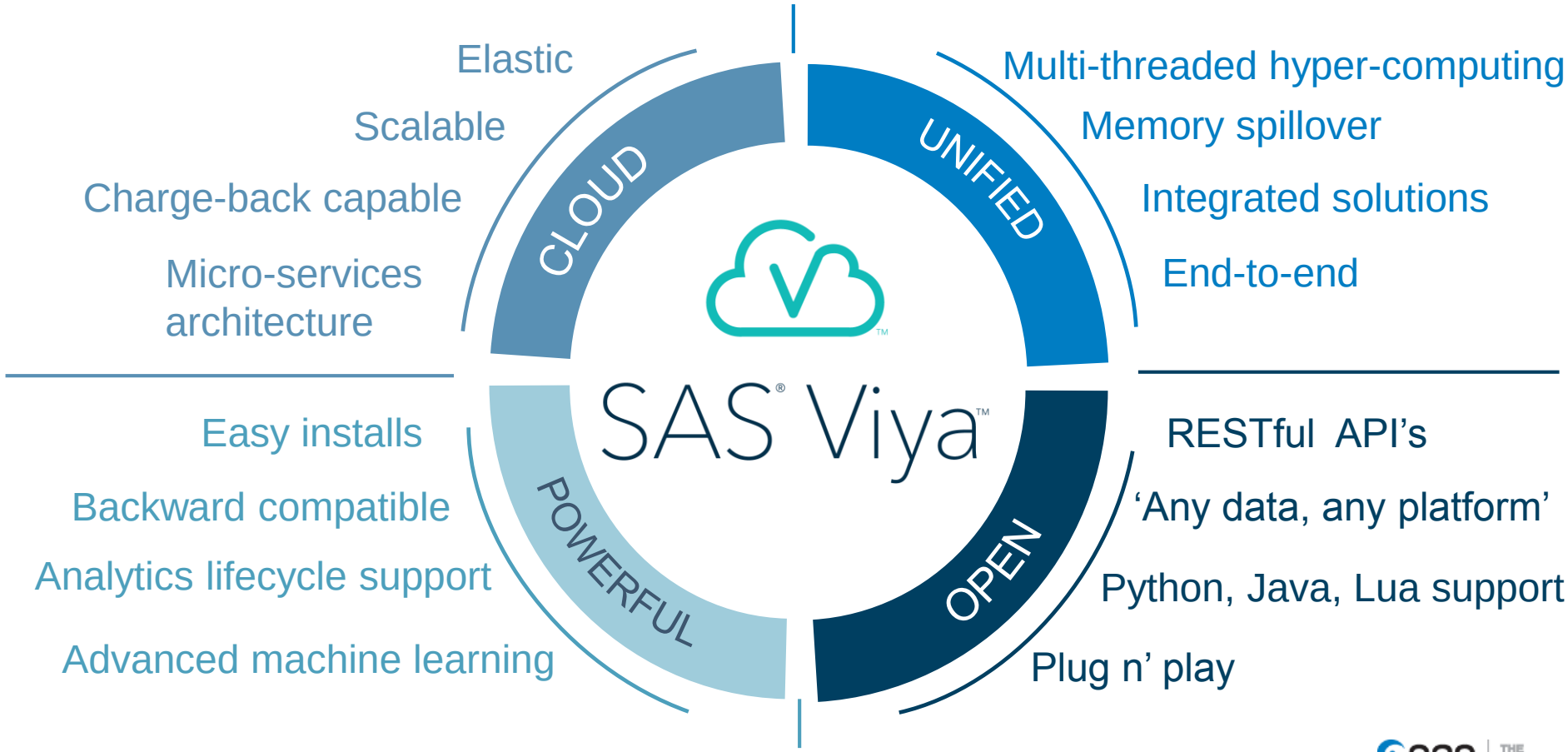

Model performance reports




Monitor data drift

# THE FUTURE IS NOW...

# SUPPORTING CURRENT INDUSTRY TRENDS



# SAS AND OPEN SOURCE

SAS 9.4


## EMBRACE

open source by including it and leveraging it where we can

+

## EXTEND

open source by improving its interoperability and utility for the enterprise

# THANK YOU

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# FOR MORE INFORMATION

**Empowering the SAS/IML user with the functionality of R**

**Documentation:** *IML User's Guide - Calling Functions in the R Language*
http://support.sas.com/documentation/cdl/en/imlug/66845/HTML/default/viewer.htm#imlug_r_toc.htm

**Video:** *Calling R Procedures from SAS/IML® Software*
https://www.youtube.com/watch?v=rUaTTre24kI

**Video:** *SAS/IML and R: Using Them Together*
https://www.youtube.com/watch?v=nmRQ3MtkG6A

**Blogs:** *The DO Loop – R tags*
http://blogs.sas.com/content/iml/tag/r/

**Paper (p 14-17):** *Rediscovering SAS/IML® Software: Modern Data Analysis for the Practicing Statistician*
http://support.sas.com/resources/papers/proceedings10/329-2010.pdf

**Article:** *Versions of R that are supported by SAS/IML*
http://blogs.sas.com/content/iml/2013/09/16/what-versions-of-r-are-supported-by-sas.html

# FOR MORE INFORMATION - EXTENDING R

**Video:** *Using R in SAS Enterprise Miner*
*https://www.youtube.com/watch?v=TbXo0xQCqDw*

**Blogs:** *Spectral Clustering in SAS® Enterprise Miner™ Using Open Source Integration Node*
*https://communities.sas.com/docs/DOC-8011*

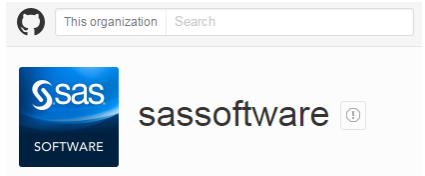
**Blogs:** *How to execute a Python script in SAS® Enterprise Miner™*
https://communities.sas.com/docs/DOC-10832

**Blogs:** *Open Source Integration Using the Base SAS Java Object*
*https://communities.sas.com/docs/DOC-10746*

**Article:** *The Open Source Integration node installation cheat sheet*
*https://communities.sas.com/docs/DOC-9988*

**Usage Notes:**
*http://support.sas.com/dsearch?Find=Search&ct=&qt=open+source&col=suppprd&nh=25&qp=&qc=suppsas&ws=1&qm=1&st=1&lk=1&rf=0&oq=&rq=0*

# FOR MORE INFORMATION MATERIALS ON GITHUB




Sas integration and sample code

Integration with R, Python

https://github.com/sassoftware/enlighten-integration

Integration with Jupyter Notebook and Python

https://github.com/sassoftware/sas_kernel

https://github.com/sassoftware/saspy

Sample codes of SAS Machine Learning methods

https://github.com/sassoftware/enlighten-apply

SAS Enterprise Miner process flow diagrams

https://github.com/sassoftware/dm-flow