

The Cortana Intelligence Suite  
Focus – Microsoft R for Architects

Microsoft Machine Learning and Data Science Team  
[CortanaIntelligence.com](http://CortanaIntelligence.com)

1. Main page -<http://cortanaanalytics.com>
2. To begin this module, you should have:
  1. Basic Math and Stats skills
  2. Business and Domain Awareness
  3. General Computing Background

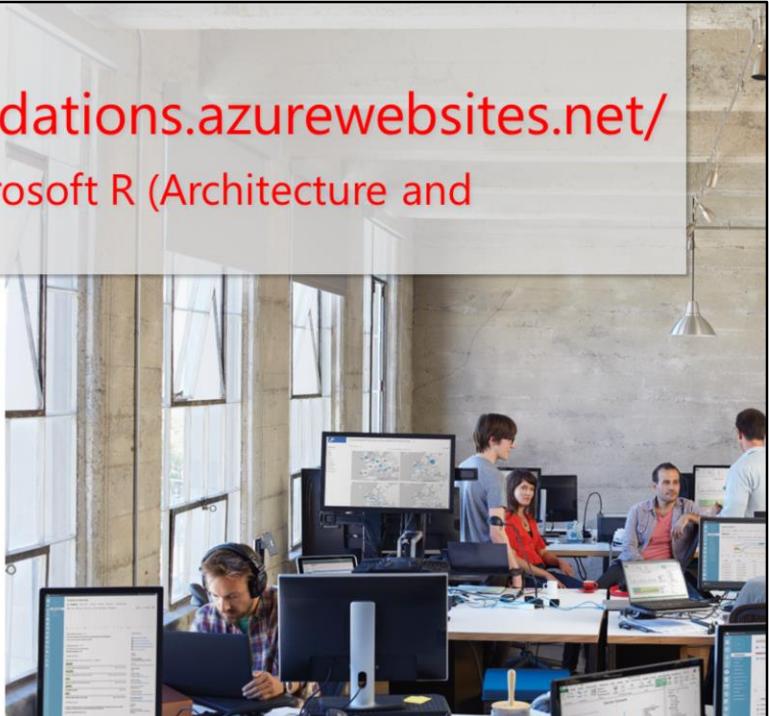
NOTE: These workbooks contain many resources to lead you through the course, and provide a rich set of references that you can use to learn much more about these topics. If the links do not resolve properly, type the link address in manually in your web browser. If the links have changed or been removed, simply enter the title of the link in a web search engine to find the new location or a corollary reference.

Log in to the site:

<http://cisw-foundations.azurewebsites.net/>

Select the “**CISR302 - Microsoft R (Architecture and Administration)**” Link

Welcome!



Note to instructor: the lab that follows is for students that will be running this course locally. Since Visual Studio takes a very long time to run, you should start that lab (if the students are running locally) immediately.

If the students are going to use the Windows Data Science Virtual Machine then this lab is not needed.



1. *Optional, if using your local machine:*
  - a) All binaries are available here -  
<https://learnanalyticsassets.blob.core.windows.net/mrs/rclass.zip>
  - b) Install SQL Server 2016 and ensure you select R Services
  - c) Install Visual Studio Community Edition 2015 (This will take quite some time), ensure you select SQL Server Data Tools
  - d) Install R Tools for Visual Studio
2. Also optional – instead of SQL Server 2016 and Visual Studio 2015, you can use SQL Server 2017 Developer Edition if you select “SQL Server ML Services”, and Visual Studio 2017 Community Edition, if you install the “Data Science” workload.

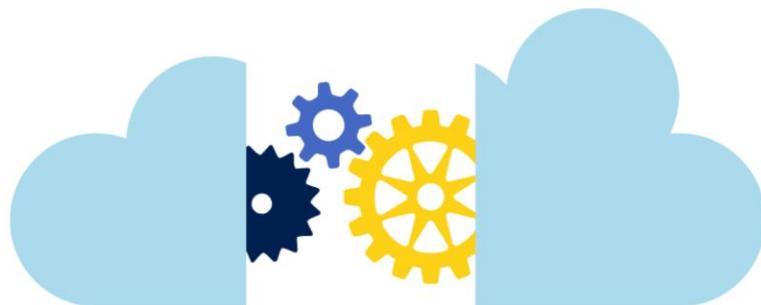
## Learning Objectives

1. Understand the R Language and where it is used
2. Understand the Microsoft R Platform and its capabilities
3. Set up and use the server and various client tools for a R environment
4. Know how to operationalize a SQL Server R Services environment
5. Use the Microsoft R capabilities in a solution



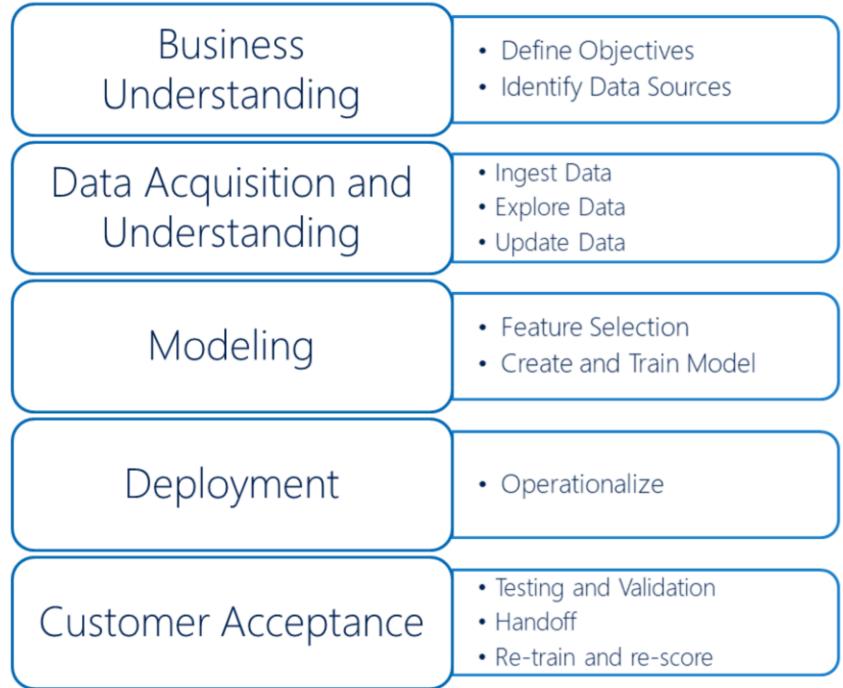
1. At the end of this Course, you will:
  1. Understand the R Language and where it is used
  2. Understand the Microsoft R Platform and its capabilities
  3. Set up and use the server and various client tools for a R environment
  4. Know how to operationalize a SQL Server R Services environment
  5. Use the Microsoft R capabilities in a solution

## The Data Science Process and Platform



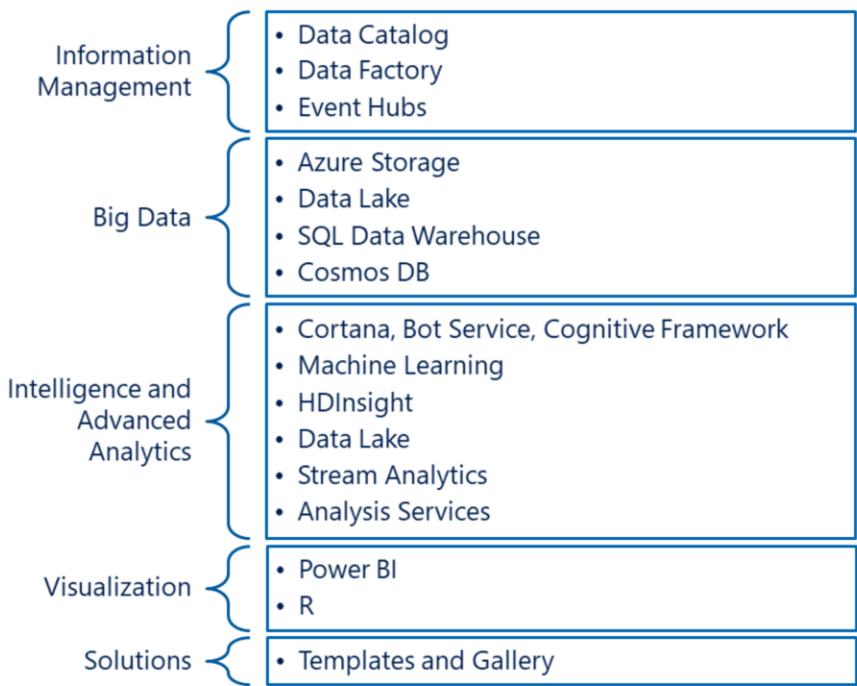
1. This process largely follows the CRISP-DM model -  
<http://www.sv-europe.com/crisp-dm-methodology/>

## The Team Data Science Process



1. It also references the Cortana Intelligence process -  
<https://azure.microsoft.com/en-us/documentation/articles/data-science-process-overview/>
2. A complete process diagram is here -  
<https://azure.microsoft.com/en-us/documentation/learning-paths/cortana-analytics-process/>
3. Some walkthrough's of the various services -  
<https://azure.microsoft.com/en-us/documentation/articles/data-science-process-walkthroughs/>
4. An integrated process and toolset allows for a more close-to-intent deployment
5. Iterations are required to close in on the solution – but are harder to manage and monitor

# The Cortana Intelligence Platform



1. Azure Data Catalog - <http://azure.microsoft.com/en-us/services/data-catalog> (**Doc It**)
2. Azure Data Factory - <http://azure.microsoft.com/en-us/services/data-factory/> (**Move It**)
3. Azure Event Hubs - <http://azure.microsoft.com/en-us/services/event-hubs/> (**Bring It**)
4. Platform and Storage - Microsoft Azure – <http://microsoftazure.com> Storage - <https://azure.microsoft.com/en-us/documentation/services/storage/> (**Host It**)
5. Azure Data Lake - <http://azure.microsoft.com/en-us/campaigns/data-lake/> (**Store It**)
6. Azure SQL Data Warehouse - <http://azure.microsoft.com/en-us/services/sql-data-warehouse/> (**Relate It**)
7. Azure Cosmos DB - <https://docs.microsoft.com/en-us/azure/cosmos-db/introduction>
8. Cortana - <http://blogs.windows.com/buildingapps/2014/09/23/cortana-integration-and-speech-recognition-new-code-samples/> and <https://blogs.windows.com/buildingapps/2015/08/25/using-cortana-to-interact-with-your-customers-10-by-10/> and <https://developer.microsoft.com/en-us/Cortana> (**Say It**)
9. Cognitive Services - <https://www.microsoft.com/cognitive-services>
10. Bot Framework - <https://dev.botframework.com/>
11. Azure Machine Learning - <http://azure.microsoft.com/en-us/services/machine-learning/> (**Learn It**)
12. Azure HDInsight - <http://azure.microsoft.com/en-us/services/hdinsight/> (**Scale It**)
13. Azure Stream Analytics - <http://azure.microsoft.com/en-us/services/stream-analytics/> (**Stream It**)
14. Analysis Services - <https://docs.microsoft.com/en-us/azure/analysis-services/analysis-services-overview>
15. Power BI - <https://powerbi.microsoft.com/> (**See It**)

16. All of the components within the suite - <https://www.microsoft.com/en-us/server-cloud/cortana-intelligence-suite/what-is-cortana-intelligence.aspx>
17. Templates -  
<https://gallery.cortanaintelligence.com/browse?orderby=freshness%20desc&skip=0&categories=%5B%2210%22%5D> and <https://caqs.azure.net/#gallery>

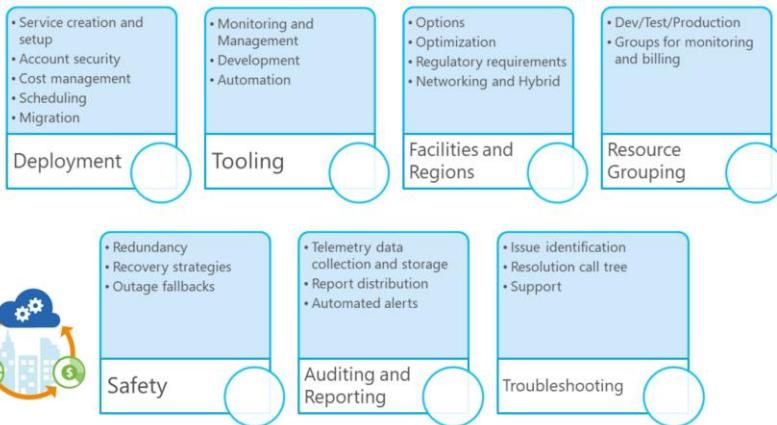
## DevOps for Data Science



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1. Complete DevOps guide -  
<https://docsmsftpdfs.blob.core.windows.net/guides/azure/azure-ops-guide.pdf>

## Azure DevOps for Advanced Analytics



### 1. Deployment

- Service Creation and Setup - <https://azure.microsoft.com/en-us/offers/ms-azr-0003p/>
- Authentication and Access - <https://docs.microsoft.com/en-us/azure/active-directory/connect/active-directory-aadconnect>
  - Security best practices - <https://docs.microsoft.com/en-us/azure/active-directory/role-based-access-control-configure>
- Cost Management (Pricing) - <https://azure.microsoft.com/en-us/pricing/>
- Migrations - <https://msdn.microsoft.com/en-us/library/dn727097.aspx>

### 2. Tools

- The Azure Portal - <https://docs.microsoft.com/en-us/azure/azure-portal-overview>
- PowerShell - <https://docs.microsoft.com/en-us/powershell/azure/overview?view=azurermps-3.8.0>
- CLI - <https://docs.microsoft.com/en-us/cli/azure/install-azure-cli>
- Others - Visual Studio, System Center, Jenkins, chef
- Azure Automation - <https://azure.microsoft.com/en-us/services/automation/>

### 3. Facilities and Regions

- Locations - <https://azure.microsoft.com/en-us/regions/>
- Azure Trust Center - <https://azure.microsoft.com/en-us/support/trust-center/>

### 4. Resource Grouping

- Resource Groups - <https://docs.microsoft.com/en-us/azure/azure-resource-manager/resource-group-overview>
  - Using the ARM model - <https://docs.microsoft.com/en-us/azure/azure-resource-manager/resource-group-template-deploy-portal>
- Safety - <https://docs.microsoft.com/en-us/azure/storage/storage-redundancy>
- Auditing - <https://msdn.microsoft.com/en-us/library/mt662411.aspx?f=255&MSPPError=-2147217396>
- Troubleshooting and Support - <https://azure.microsoft.com/en-us/blog/understanding-azure-troubleshooting-and-support/>

Special considerations for Advanced Analytics:

- Account management
- Storage and redundancy
- Privacy and data protection
- Scheduling and Pipelined workflows
- Networking
- Optimization
- Security
- Advanced Analytics Services awareness – data transfer, storage and processing
- Dependencies and interactions

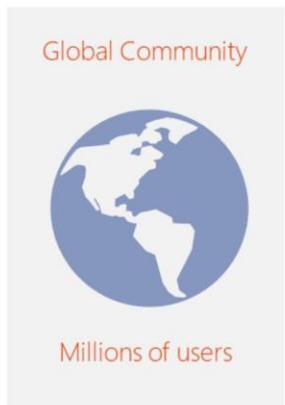
## The R Programming Environment



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1. Video Introduction to R -  
<https://mran.revolutionanalytics.com/documents/what-is-r/>

# R Programming and Environment



## 1. R In Youtube -

<https://www.youtube.com/user/thelearnr>

## 2. R Links -

<http://www.datasciencecentral.com/m/discussion?id=6448529%3ATopic%3A280135>

## 3. R resources - <https://msdn.microsoft.com/en-us/microsoft-r/microsoft-r-more-resources>

## SQL and R Contrasted

 1011  
101

## SQL

- 1. Client/Server
- 2. Database Objects
- 3. DML, DDL
- 4. DCL
- 5. Declarative Code

## R

- 1. Interactive Environment
- 2. Data Structures
- 3. Functions
- 4. Libraries (Packages)
- 5. Functional Code Flow

1. Learn SQL - <http://www.w3schools.com/SQL/default.asp>
2. Try R, with a great interface -  
<http://tryr.codeschool.com/levels/1/challenges/22>
3. R and Statistics Intro -  
<https://www.youtube.com/watch?v=xb5P5xdcr2U&feature=youtu.be&a>
4. R Online -  
[http://www.tutorialspoint.com/r\\_terminal\\_online.php](http://www.tutorialspoint.com/r_terminal_online.php)
5. Using R to explore data -  
<http://www.analyticsvidhya.com/blog/2015/10/cheatsheet-11-steps-data-exploration-with-codes/>
6. Quick R Intro -  
<http://www.datasciencecentral.com/m/blogpost?id=6448529%3ABlogPost%3A112754>
7. Creating a recommender engine in R –  
<http://www.analyticbridge.com/profiles/blogs/build-basic-recommendation-engine-using-r>
8. Visualizations cheat-sheet in R -  
<http://www.datasciencecentral.com/forum/topics/cheat-sheet-data-visualization-with-r?groupUrl=tutorials>

## R Data Types

- Numeric
- Integer
- Complex
- Logical
- Character



1. Video Introduction to R -  
<https://mran.revolutionanalytics.com/documents/what-is-r/>
2. Working with R Data Types -  
<https://msdn.microsoft.com/en-us/library/mt590948.aspx>

## R Data Structures



- **Vector**
  - A single-line sequence of one datatype
- **List**
  - An ordered collection of objects, allowing a variety of (possibly unrelated) objects under one name
- **Matrix**
  - A multi-line sequence of the same length and datatype
- **Array**
  - Like a Matrix, but with more dimensions
- **Dataframe**
  - Table-like structure

1. R Data Structures from Advanced R by Hadley Wickham -  
<http://adv-r.had.co.nz/Data-structures.html>
2. Factors - [https://www.tutorialspoint.com/r/r\\_factors.htm](https://www.tutorialspoint.com/r/r_factors.htm)



1. If you are not using a local installation of SQL Server and R, Use an Azure Account. (go here for a free account - <https://azure.microsoft.com/en-us/free/> You will need a credit card, but you will not be charged)
  - a) Log in to the Azure Portal -<https://ms.portal.azure.com>
  - b) Click the + sign , and type **Data Science Virtual Machine** to create a new Windows Data Science Virtual Machine (use at least 2 Processors, around 6GB of RAM, and use HDD not SSD – larger systems will perform faster but will cost more per hour) -<https://azure.microsoft.com/en-us/documentation/articles/machine-learning-data-science-vm-do-ten-things/>
2. Pick from one of the following options:
  - a) If you are new to R:
    - i. Option 1: Open R, and then type `install.packages("swirl")`. Then type `swirl()`
    - ii. Option 2: If you are new to R, open this site and complete the lessons the instructor assigns - <http://tryr.codeschool.com/>
  - b) If you are new to SQL, open this site and complete the lessons the instructor assigns - <http://www.w3schools.com/SQL/default.asp>
  - c) If you already know R and SQL, using headsets, start this series

- <https://www.datacamp.com/community/open-courses/big-data-revolution-r-enterprise-tutorial>

## The Microsoft R Platform



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1. Primary Microsoft R Site - <https://msdn.microsoft.com/en-us/microsoft-r/index>

# Microsoft R Products

## Microsoft R Open

- Free and open source R distribution
- Enhanced and distributed by Revolution Analytics

## Microsoft R Server

- Microsoft R Server for Redhat Linux
- Microsoft R Server for SUSE Linux
- Microsoft R Server for Teradata DB
- Microsoft R Server for Hadoop on Redhat

## SQL Server ML Services

- Built in Advanced Analytics and Stand Alone Server Capability
- Python and Microsoft R

- Microsoft Machine Learning Services -  
<https://docs.microsoft.com/en-us/sql/advanced-analytics/r/r-services>

## Microsoft R Open

### Enhanced Open Source R distribution

- Based on the latest Open Source R
- Built, tested and distributed by Microsoft
- Enhanced by Intel MKL Library to speed up linear algebra functions



### Compatible with all R-related software

- CRAN packages, RStudio, third-party R integrations, ...

### Revolutions Open-Source R packages

- Reproducible R Toolkit – checkpoint

### MRAN website [mran.revolutionanalytics.com](http://mran.revolutionanalytics.com)

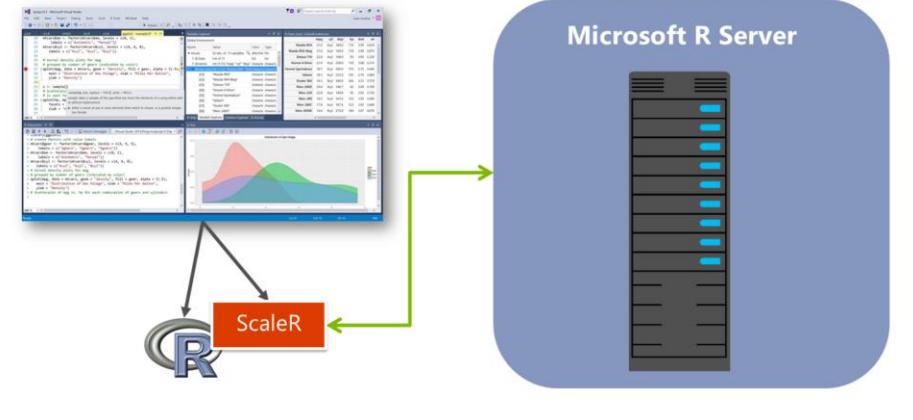
- Enhanced documentation and learning resources
- Discover 7500 free add-on R packages

Open source (GPLv2 license) - 100% free to download, use and share

## 1. Quick Video on R Client -

<https://channel9.msdn.com/blogs/MicrosoftR/Microsoft-Introduces-new-free-Microsoft-R-Client>

## Microsoft R Open and R Client



1. Book and Series - <http://dacrook.com/introduction-to-microsoft-r-open/>
2. Microsoft R Client - <https://msdn.microsoft.com/en-us/microsoft-r/index#mrc>

# Microsoft R Components

- Microsoft R Open
- Microsoft R Client
- Microsoft R Server
- HDInsight SparkR / SQL Server ML Services
- R Module in Azure Machine Learning

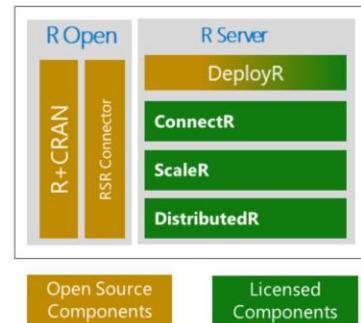
1. Supported Platforms for Microsoft R Server -  
<https://msdn.microsoft.com/en-us/microsoft-r/rserver-install-supported-platforms>
2. Book and Series – <http://dacrook.com/introduction-to-microsoft-r-open/>
3. Microsoft R Client - <https://msdn.microsoft.com/en-us/microsoft-r/index#mrc>
4. Microsoft R Server - <https://msdn.microsoft.com/en-us/microsoft-r/index#mrs>
5. SQL Server R Services -<https://msdn.microsoft.com/en-us/microsoft-r/index#sqlr>
6. HDInsight SparkR -<https://azure.microsoft.com/en-gb/services/hdinsight/apache-spark/>

# Microsoft R Server

Microsoft R Server is a broadly deployable enterprise-class analytics platform based on R that is supported, scalable and secure. Supporting a variety of big data statistics, predictive modeling and machine learning capabilities, R Server supports the full range of analytics – exploration, analysis, visualization and modeling

## High-performance open source R plus:

- Data source connectivity to big-data objects
- Big-data advanced analytics
- Multi-platform environment support
- Inpredictive modeling
- Development and production environment support
  - IDE for data scientist developers
  - Secure, Scalable R Deployment



Microsoft ML Server - <https://msdn.microsoft.com/en-us/microsoft-r/index#mrs>

# CRAN, MRO, R Comparison

		Microsoft R Open	Microsoft R Server
Datasize	In-memory	In-memory	<b>In-Memory or Disk Based</b>
Speed of Analysis	Single threaded	Multi-threaded	<b>Multi-threaded, parallel processing 1:N servers</b>
Support	Community	Community	<b>Community + Commercial</b>
Analytic Breadth & Depth	7500+ innovative analytic packages	7500+ innovative analytic packages	<b>7500+ innovative packages + commercial parallel high-speed functions</b>
License	Open Source	Open Source	<b>Commercial license. Supported release with indemnity</b>

- Technology Overview -  
<https://channel9.msdn.com/Series/Microsoft-R-Server/Technology-Overview-for-Microsoft-R-Server-2016>

## CRAN R



## MRO

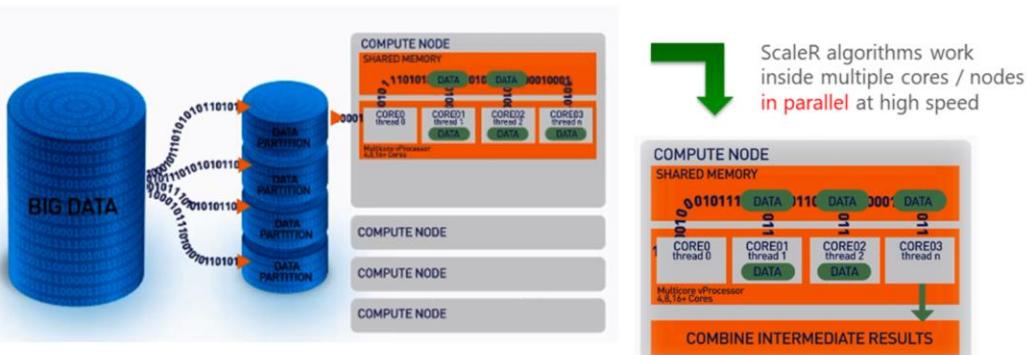


## R Server



- Getting Started - <https://msdn.microsoft.com/en-us/microsoft-r/?f=255&MSPPError=-2147217396>

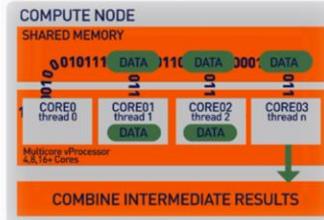
# ScaleR – Parallel + “Big Data”



**Stream data in to RAM in blocks.** “Big Data” can be any data size. Handle Megabytes to Gigabytes to Terabytes...

**XDF file format** is optimised to work with the ScaleR library and significantly speeds up iterative algorithm processing.

ScaleR algorithms work inside multiple cores / nodes in parallel at high speed



Interim results are collected and combined analytically to produce the output on the entire data set

- Function Breakdown - <https://msdn.microsoft.com/en-us/microsoft-r/scaler/scaler>

# Scale R – Parallelized Algorithms & Functions

## Data Preparation

- Data import – Delimited, Fixed, SAS, SPSS, ODBC
- Variable creation & transformation
- Recode variables
- Factor variables
- Missing value handling
- Sort, Merge, Split
- Aggregate by category (means, sums)

## Descriptive Statistics

- Min / Max, Mean, Median (approx.)
- Quantiles (approx.)
- Standard Deviation
- Variance
- Correlation
- Covariance
- Sum of Squares (cross product matrix for set variables)
- Pairwise Cross tabs
- Risk Ratio & Odds Ratio
- Cross-Tabulation of Data (standard tables & long form)
- Marginal Summaries of Cross Tabulations

## Statistical Tests

- Chi Square Test
- Kendall Rank Correlation
- Fisher's Exact Test
- Student's t-Test

## Sampling

- Subsample (observations & variables)
- Random Sampling

## Predictive Models

- Sum of Squares (cross product matrix for set variables)
- Multiple Linear Regression
- Generalized Linear Models (GLM) exponential family distributions: binomial, Gaussian, inverse Gaussian, Poisson, Tweedie. Standard link functions: cauchit, identity, log, logit, probit. User defined distributions & link functions.
- Covariance & Correlation Matrices
- Logistic Regression
- Classification & Regression Trees
- Predictions/scoring for models
- Residuals for all models

## Variable Selection

- Stepwise Regression

## Simulation

- Simulation (e.g. Monte Carlo)
- Parallel Random Number Generation

## Cluster Analysis

- K-Means

## Classification

- Decision Trees
- Decision Forests
- Gradient Boosted Decision Trees
- Naive Bayes

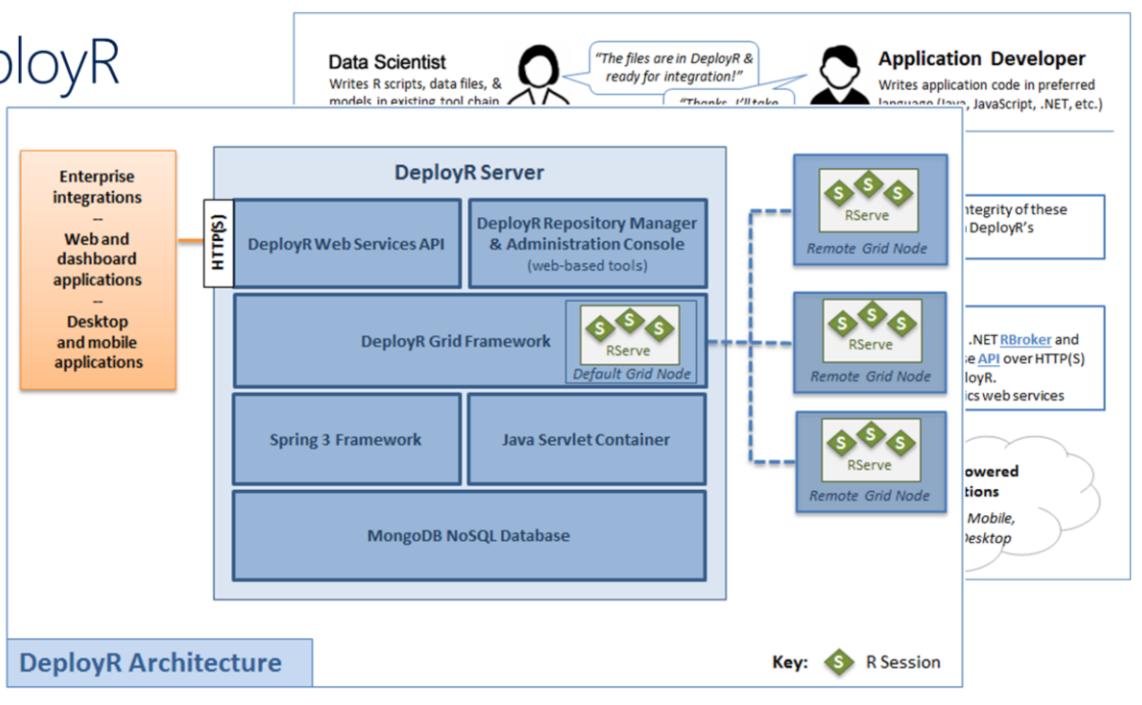


## Combination

- rxDataStep
- rxExec
- PEMA-R API Custom Algorithms

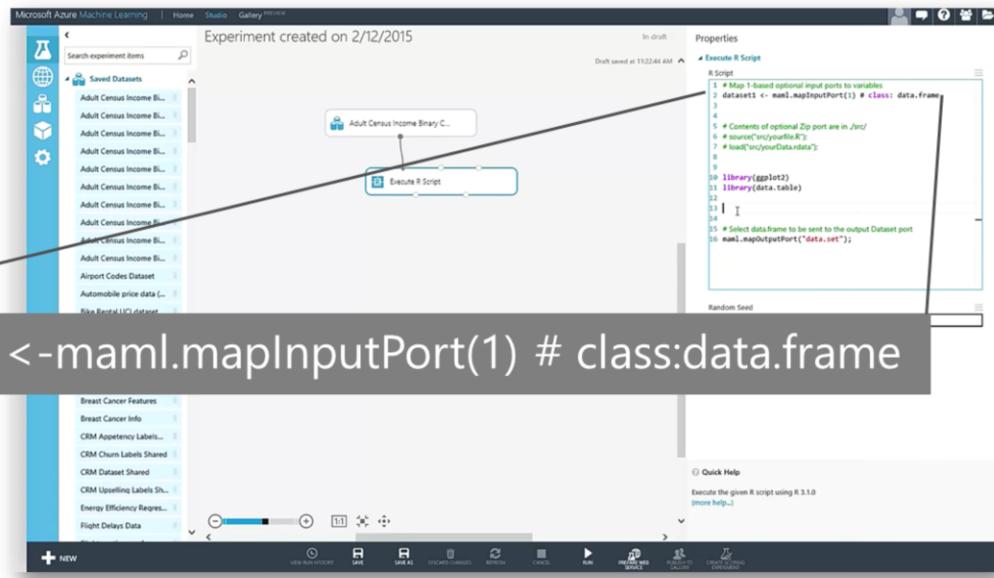
- SQL Server Implementation of ScaleR Functions - <https://msdn.microsoft.com/en-us/library/mt652103.aspx>

# DeployR



1. Microsoft DeployR Documentation -  
<https://msdn.microsoft.com/en-us/microsoft-r/deployr-about>
2. Previous Documentation -  
<https://deployr.revolutionanalytics.com/documents/getting-started/about/>

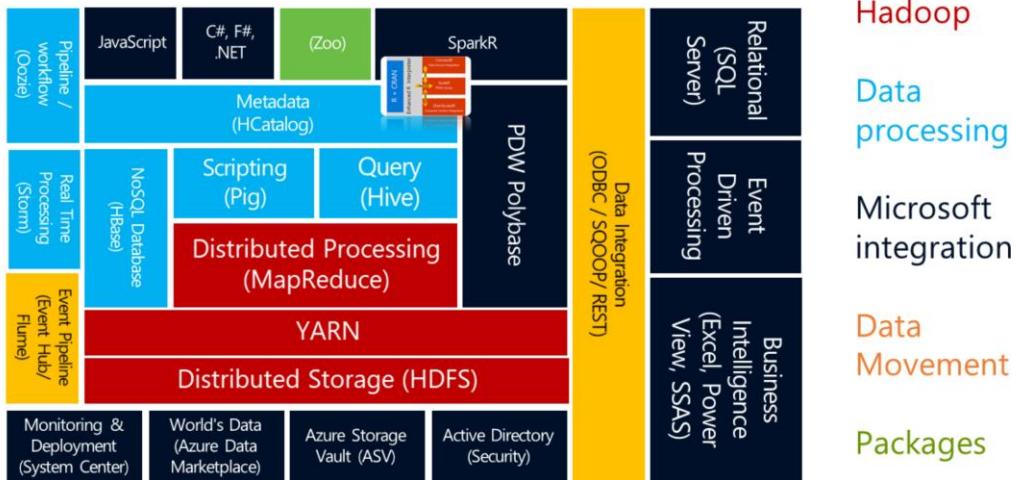
# R Module in Azure Machine Learning



Dataset1 <-maml.mapInputPort(1) # class: data.frame

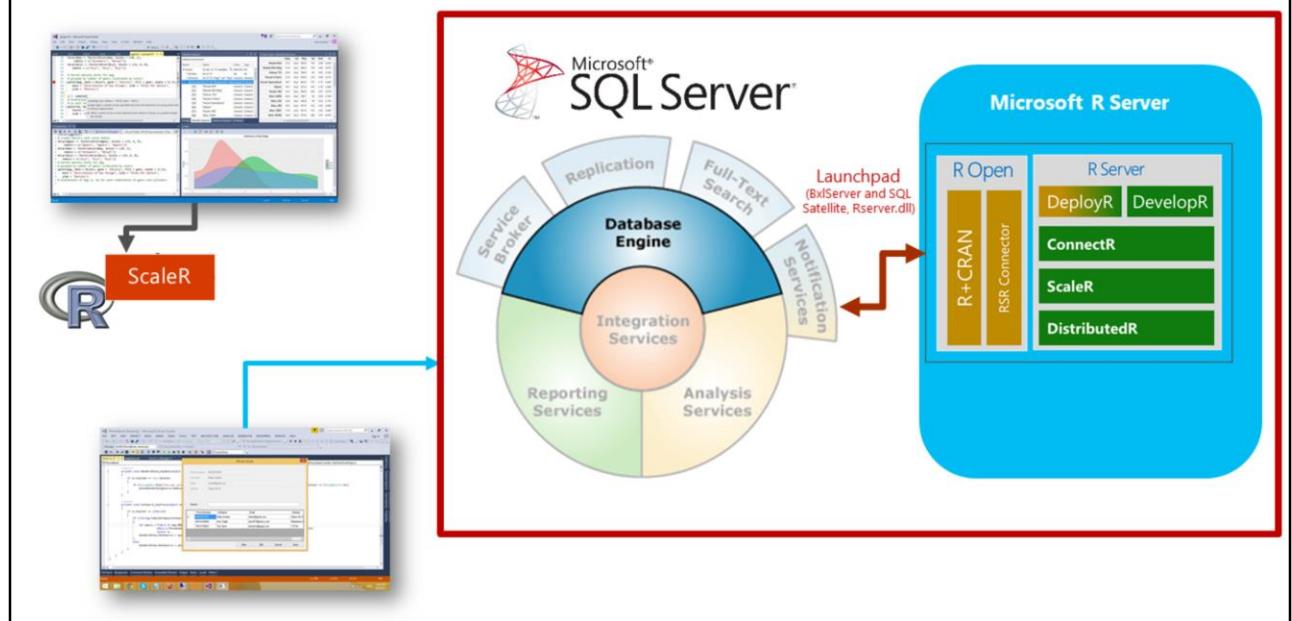
1. Primary reference - <https://msdn.microsoft.com/en-us/library/dn905952.aspx>
2. Using R in Azure Machine Learning - <https://azure.microsoft.com/en-us/documentation/articles/machine-learning-r-quickstart/>
3. Overview Video - <https://channel9.msdn.com/Blogs/Windows-Azure/R-in-Azure-ML-Studio>
4. R Packages supported - <https://msdn.microsoft.com/en-us/library/mt741980.aspx>

# R in Spark HDInsight Cluster



1. Full training example for the local HDP Instance -  
<http://hortonworks.com/hadoop-tutorial/hello-world-an-introduction-to-hadoop-hcatalog-hive-and-pig/>
2. More detail on the Hadoop Components -  
<http://www.datasciencecentral.com/profiles/blogs/hadoop-herd-when-to-use-what>

# Microsoft ML Services in SQL Server



1. Primary Documentation and training -  
<https://msdn.microsoft.com/en-us/library/mt604845.aspx>
2. Great set of resources - [https://www.r-bloggers.com/r-and-sql-server-articles/amp/](https://www.r-bloggers.com/r-and-sql-server-articles/)



1. Read the installation page for ML Server –  
<https://msdn.microsoft.com/en-us/microsoft-r/rserver-install-supported-platforms>
2. As assigned: Install Microsoft R Client –  
<https://msdn.microsoft.com/en-us/microsoft-r/install-r-client-windows>
3. As assigned: Install MRS on Windows –  
<https://msdn.microsoft.com/en-us/microsoft-r/rserver-install-windows?f=255&MSPPError=-2147217396>
4. As assigned: Install ML Server on Linux – note: MSDN account required -<https://msdn.microsoft.com/en-us/microsoft-r/rserver-install-linux-server?f=255&MSPPError=-2147217396>
5. As assigned: Install SQL Server and ensure you select ML Services – see this link -<https://www.microsoft.com/en-us/cloud-platform/sql-server-editions-developers>
6. Find out if R is loaded: - Open an R Client Session (SQL, MRS, AML, etc) and run `sessionInfo()`

## R Client Options



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1. The Microsoft R Client -<https://msdn.microsoft.com/en-us/microsoft-r/install-r-client-windows>

## Microsoft R Development Tools

- Command-Line
- RStudio
- R Tools for Visual Studio (RTVS)
- SQL Server tools



1. Installing Microsoft R Client on Windows -  
<https://msdn.microsoft.com/en-us/microsoft-r/install-r-client-windows>
2. Files located at: C:\Program Files\Microsoft\R Client\R\_SERVER\bin



1. Connect to R in Visual Studio or Rstudio or Command line (C:\Program Files\Microsoft SQL Server\MSSQL13.MSSQLSERVER\R\_SERVICES\bin>R.exe) , and Run **Revo.version** to ascertain MRS running
2. Open Visual Studio, and read through the walkthrough of the RTVS tools for SQL Server and R - <https://microsoft.github.io/RTVS-docs/sqlserver.html>

## Operationalize R



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1. Complete introduction -<https://msdn.microsoft.com/en-us/microsoft-r/microsoft-r-getting-started>
2. Data Exploration and Modeling with R -  
<https://msdn.microsoft.com/en-us/library/mt590947.aspx>

## Configuration and Operation

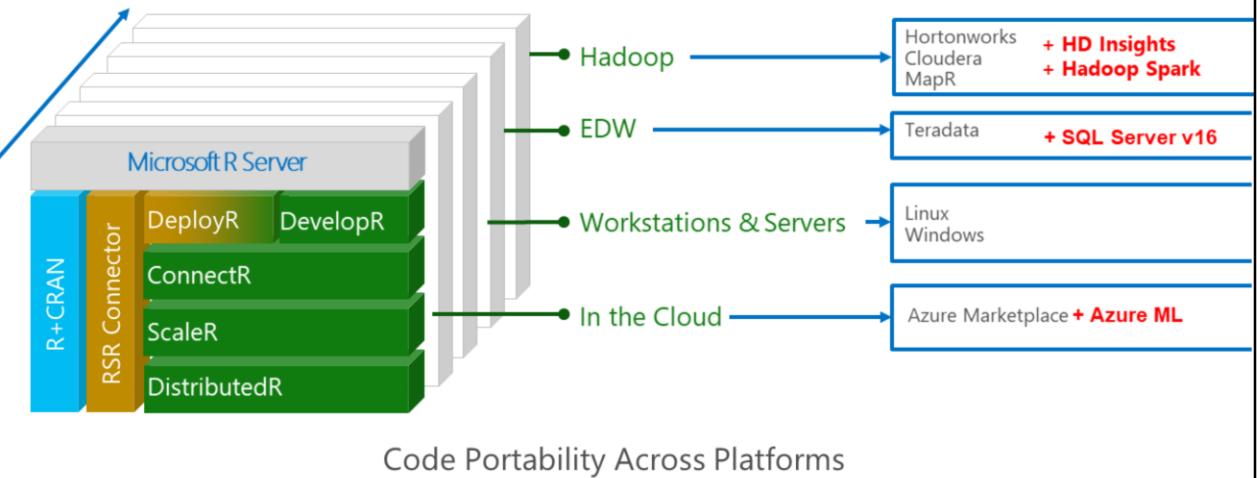
- Planning
  - Specific Environments
- File Locations
- Services and Background Processes
- Package Management
- DeployR Planning



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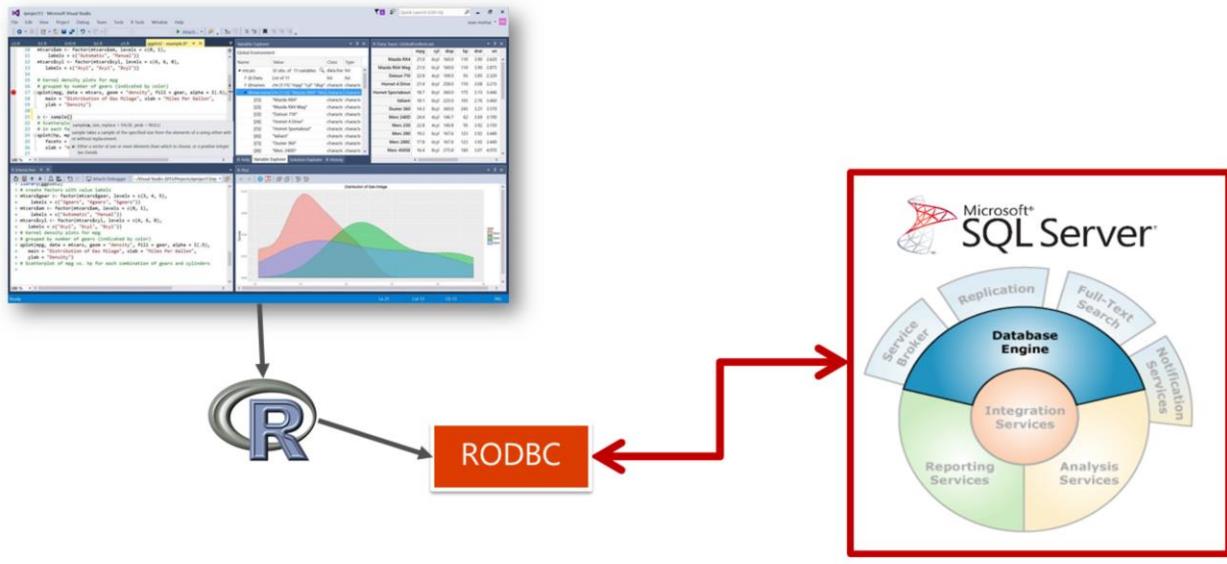
1. Setting up R Services - <https://msdn.microsoft.com/en-us/library/mt696069.aspx>
2. Features and Tasks - <https://msdn.microsoft.com/en-us/library/mt590811.aspx>
3. Differences in Features - <https://msdn.microsoft.com/en-us/library/mt721284.aspx>
4. Installing on VM's - <https://msdn.microsoft.com/en-us/library/mt748179.aspx>

# Distributed R - Write once, deploy multiple



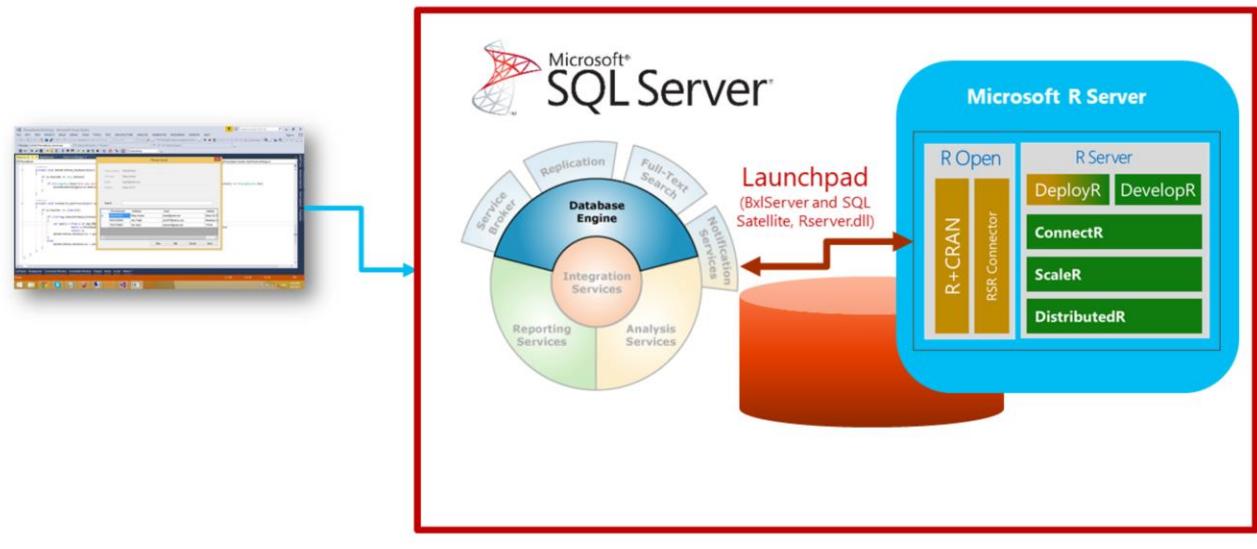
- DeployR Workflow - <https://msdn.microsoft.com/en-us/microsoft-r/deployr-about>

# CRAN/Microsoft R Open And Databases



1. Book and Series - <http://dacrook.com/introduction-to-microsoft-r-open/>
2. Microsoft R Client - <https://msdn.microsoft.com/en-us/microsoft-r/index#mrc>

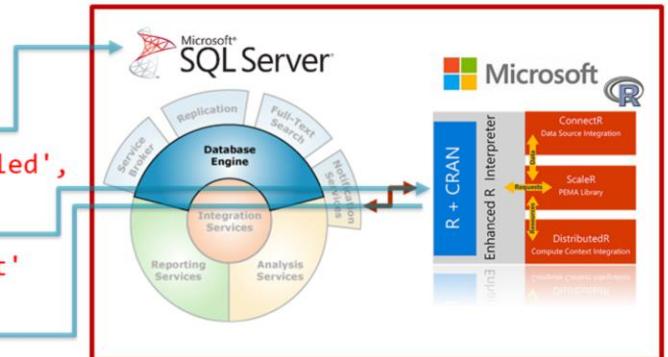
# Microsoft ML Services in SQL Server



1. Primary Documentation and training -  
<https://msdn.microsoft.com/en-us/library/mt604845.aspx>

## T-SQL and R Interaction

```
EXEC sp_execute_external_script  
@language =N'R',  
  
-- SQL Part (sends to @script)  
@input_data_1 =N 'SELECT 1 as Installed',  
  
-- R Part (gets @input_data_1)  
@script=N'OutputDataSet<-InputDataSet'  
  
WITH RESULT SETS  
(([Installed] int not null));  
GO
```



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1. Components and Architecture -  
<https://msdn.microsoft.com/en-us/library/mt709082.aspx>  
(with graphics)

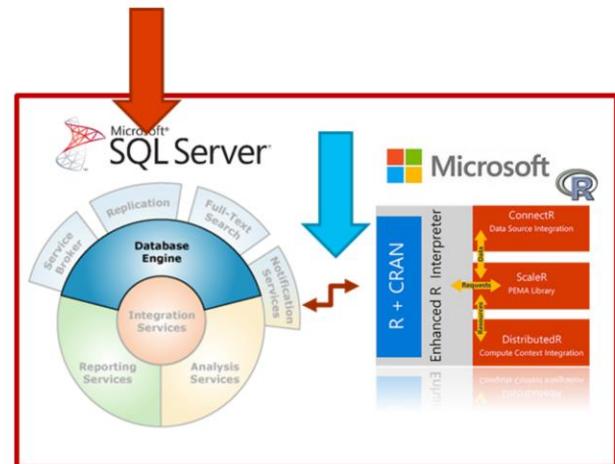


1. From the Resources folder open the file **R Services for SQL Server Lab.sql** and run the section marked:

```
/* Check to see if R is Installed and available */
```

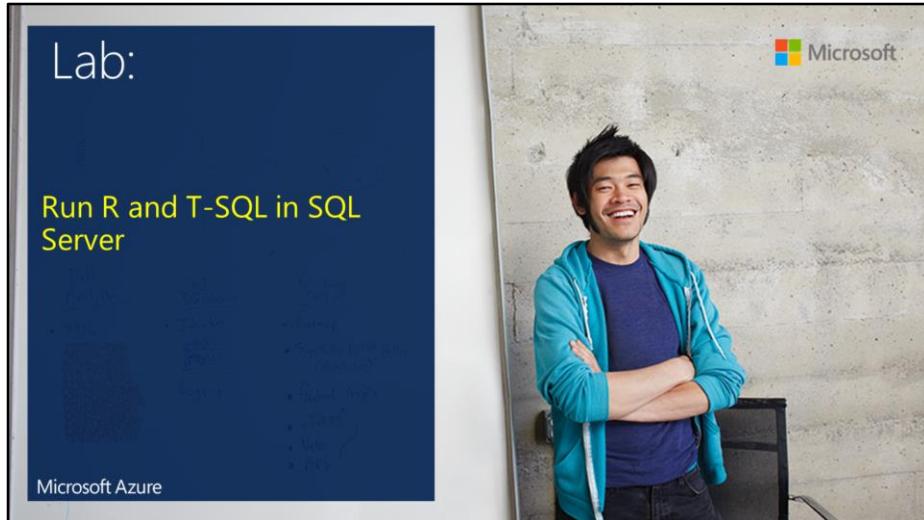
## T-SQL and R Interaction

1. T-SQL Code
  1. SELECT data
2. sp\_execute\_external\_script
  1. Launchpad (*BxlServer and SQL Satellite, Rserver.dll*)
3. R Data or Object Returns



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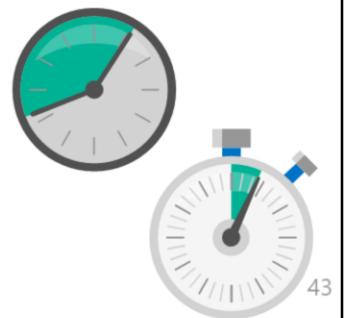
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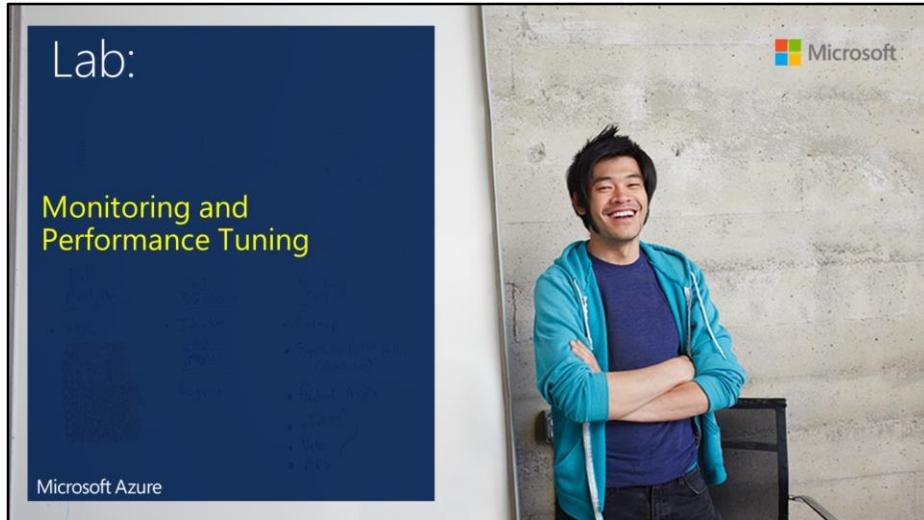
1. Open this link and complete the assignments (1-3) from the instructor - <https://docs.microsoft.com/en-us/sql/advanced-analytics/tutorials/rtsql-using-r-code-in-transact-sql-quickstart>

## Performance and Monitoring

- Performance considerations
- Monitoring
- Tuning



1. Extended Events for SQL Server R Services -  
<https://msdn.microsoft.com/en-us/library/mt628054.aspx>



1. Open this link and create the custom reports for SSMS - <https://docs.microsoft.com/en-us/sql/advanced-analytics/r/monitor-r-services-using-custom-reports-in-management-studio>
2. Open this link and complete the assignments from the instructor - <https://docs.microsoft.com/en-us/sql/advanced-analytics/r/how-to-create-a-resource-pool-for-r>

## Security and Governance

- Principals

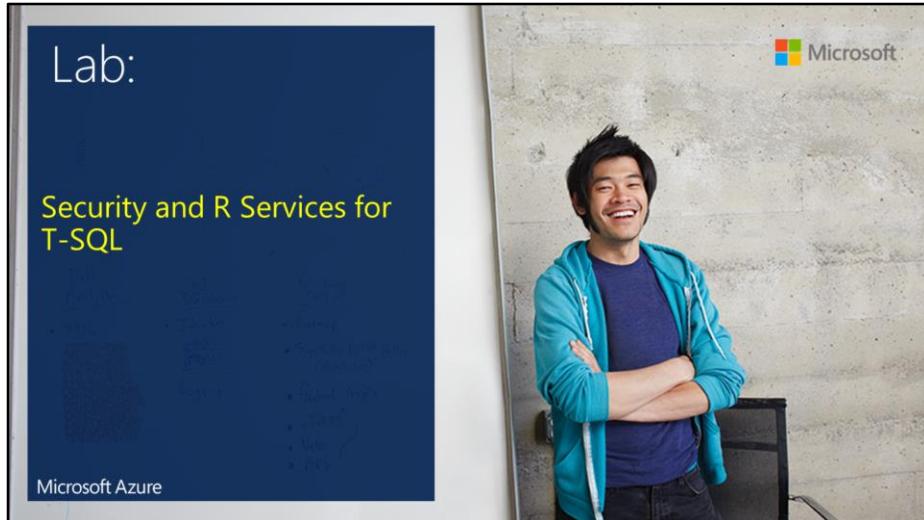


- Securables



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1. Security Overview - <https://msdn.microsoft.com/en-us/library/mt709078.aspx>



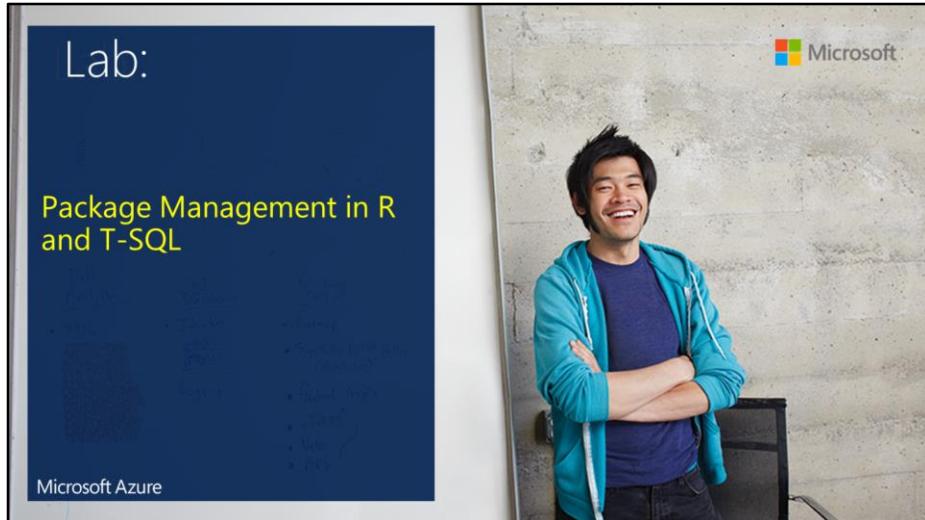
1. Review and bookmark this link -  
<https://docs.microsoft.com/en-us/sql/advanced-analytics/r/security-considerations-for-the-r-runtime-in-sql-server>
2. Open a command-prompt on your server and type NET USERS (Enter). Review the accounts you see there.

## Packages

- Use
- Adding
- Querying
- Considerations



1. Packages - <http://www.dummies.com/programming/r/how-to-install-load-and-unload-packages-in-r/> and [https://cran.r-project.org/doc/manuals/R-admin.html#Add\\_002don-packages](https://cran.r-project.org/doc/manuals/R-admin.html#Add_002don-packages)
2. Book on Creating your own Packages - <http://r-pkgs.had.co.nz/>
3. A useful set of packages - <https://support.rstudio.com/hc/en-us/articles/201057987-Quick-list-of-useful-R-packages>
4. R Packages supported by Azure Machine Learning - <https://msdn.microsoft.com/en-us/library/mt741980.aspx>
5. R Package Management for SQL Server R Services - <https://msdn.microsoft.com/en-us/library/mt790486.aspx>
6. Scaling Packages - <https://msdn.microsoft.com/en-US/library/mt637368.aspx>



1. Open this link and review - <https://docs.microsoft.com/en-us/sql/advanced-analytics/r/r-package-management-for-sql-server-r-services>
2. Install the `ggplot2` package on your server

## Implementation Considerations



- Coordinating with the R professional
- Best Practices



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1. Managing and monitoring R Solutions for SQL Server -  
<https://msdn.microsoft.com/en-us/library/mt590866.aspx>
2. Upgrade and Installation -<https://msdn.microsoft.com/en-us/library/mt653951.aspx>
3. Considerations -<https://msdn.microsoft.com/en-us/library/mt590540.aspx>

## Creating a Microsoft R Solution



<https://mva.microsoft.com/ebooks/>

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1. Complete introduction - <https://msdn.microsoft.com/en-us/microsoft-r/microsoft-r-getting-started>



1. Optional - <https://docs.microsoft.com/en-us/sql/advanced-analytics/tutorials/sqldev-in-database-advanced-analytics-for-sql-developers>
2. Optional - <https://docs.microsoft.com/en-us/sql/advanced-analytics/tutorials/walkthrough-data-science-end-to-end-walkthrough>
3. Optional -  
<https://gallery.cortanaintelligence.com/Tutorial/Predictive-Maintenance-Template-with-SQL-Server-R-Services-1>

Channel 9 Video on examples -

<https://channel9.msdn.com/Shows/Cloud+Cover/Episode-226-Microsoft-R-Server-Solutions>

More labs - <https://github.com/Microsoft/SQL-Server-R-Services-Samples> and

<https://gallery.cortanaintelligence.com/Collection/ML-Templates-with-SQL-Server-R-Services-1>



1. Understand the R Language and where it is used
2. Understand the Microsoft R Platform and its capabilities
3. Set up and use the server and various client tools for a R environment
4. Know how to operationalize a SQL Server R Services environment
5. Use the Microsoft R capabilities in a solution

## Questions?

More resources:

<https://msdn.microsoft.com/en-us/microsoft-r/microsoft-r-more-resources>

[Revolutions Blog](#)

Microsoft R and SQL Server - <https://www.r-bloggers.com/r-and-sql-server-articles/amp/>

[Blog: Joseph Sirosh, "Making R the Enterprise Standard..."](#)

[Getting Started with Microsoft R](#)

[Diving In.. Data Analysis in Microsoft R](#)

[R Server Technology – Video](#)

[R Tools for Visual Studio Sneak Peek](#)

[R Tools for Visual Studio Overview](#)

[SQL R Services Overview – Youtube](#)

[SQL R Services Feature Overview - Youtube](#)

[SQL R Services Overview at Build](#)

[SQL R Services Tutorial](#)