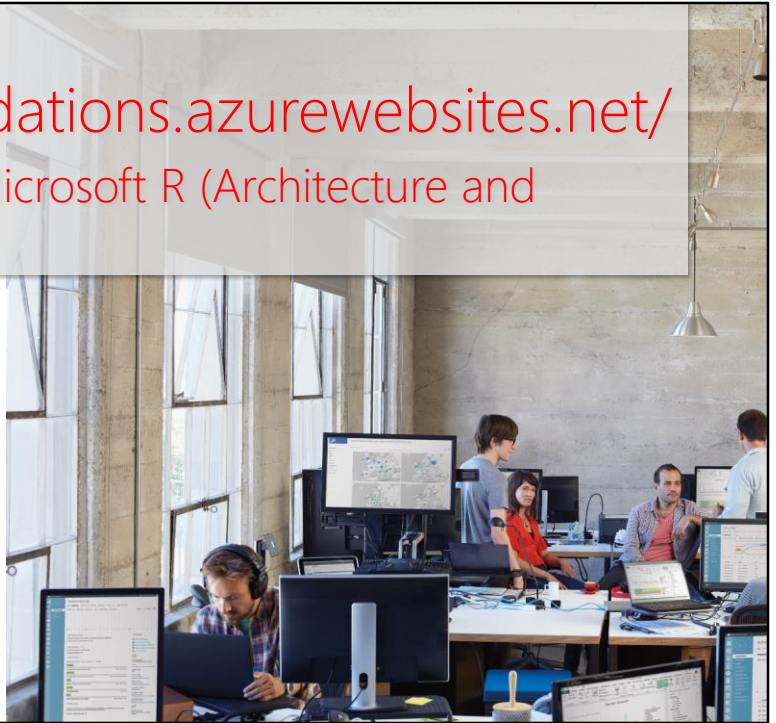
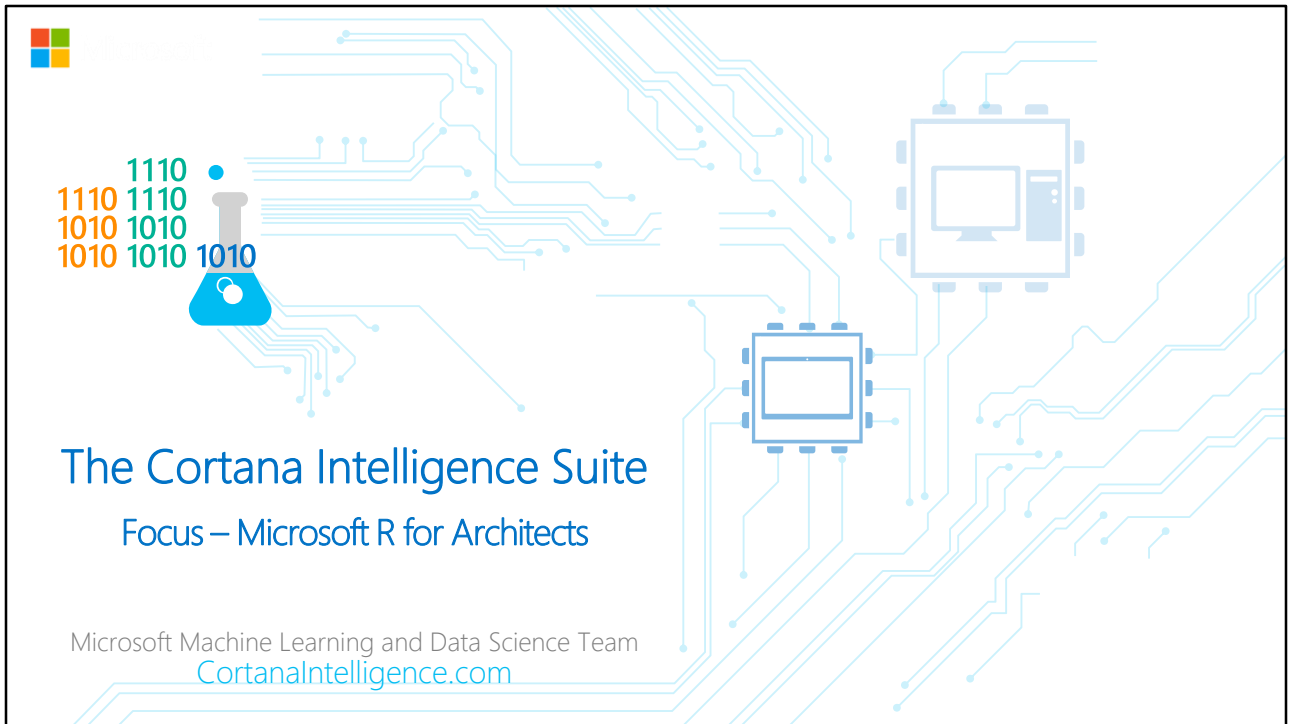


- Log in to the site:
<http://cisw-foundations.azurewebsites.net/>
- Select the "CISR302 - Microsoft R (Architecture and Administration)" Link

Welcome!





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.

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

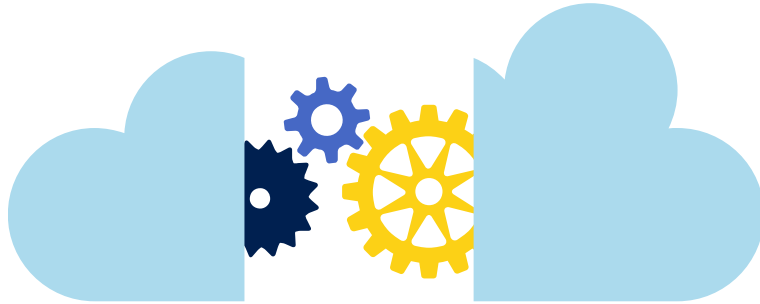


Class

Self-Study

Projects

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

Business Understanding

- Define Objectives
- Identify Data Sources

Data Acquisition and Understanding

- Ingest Data
- Explore Data
- Update Data

Modeling

- Feature Selection
- Create and Train Model

Deployment












- Operationalize

Customer Acceptance

- Testing and Validation
- Handoff
- Re-train and re-score

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

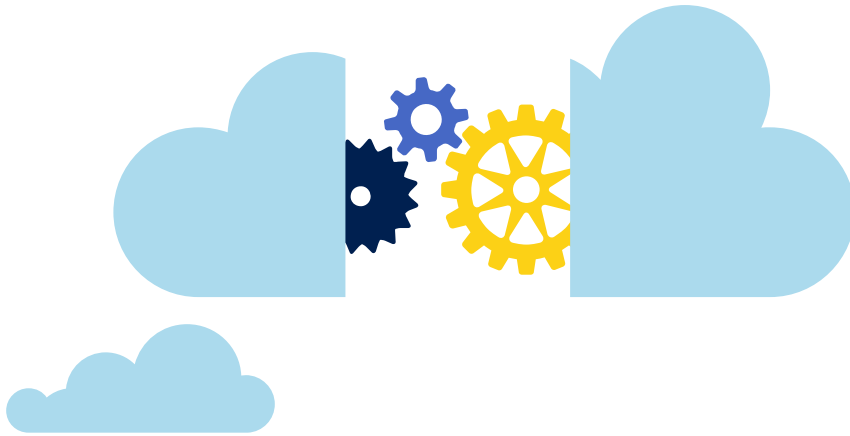
The Cortana Intelligence Platform

	Cortana, Cognitive Services, Bot Framework
	Power BI
	Stream Analytics
	HDInsight
	Azure Machine Learning (MRS)
	SQL Data Warehouse (SQL DB, Document DB)
	Data Lake
	Event Hubs
	Data Factory
	Data Catalog
	Microsoft Azure

1. Platform and Storage: Microsoft Azure – <http://microsoftazure.com> Storage: <https://azure.microsoft.com/en-us/documentation/services/storage/> (Host It)
2. Azure Data Catalog: <http://azure.microsoft.com/en-us/services/data-catalog> (Doc It)
3. Azure Data Factory: <http://azure.microsoft.com/en-us/services/data-factory/> (Move It)
4. Azure Event Hubs: <http://azure.microsoft.com/en-us/services/event-hubs/> (Bring It)
5. Azure Data Lake: <http://azure.microsoft.com/en-us/campaigns/data-lake/> (Store It)
6. Azure DocumentDB: <https://azure.microsoft.com/en-us/services/documentdb/> , Azure SQL Data Warehouse: <http://azure.microsoft.com/en-us/services/sql-data-warehouse/> (Relate It)
7. Azure Machine Learning: <http://azure.microsoft.com/en-us/services/machine-learning/> (Learn It)
8. Azure HDInsight: <http://azure.microsoft.com/en-us/services/hdinsight/> (Scale It)
9. Azure Stream Analytics: <http://azure.microsoft.com/en-us/services/stream-analytics/> (Stream It)
10. Power BI: <https://powerbi.microsoft.com/> (See It)
11. 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)
12. Cognitive Services: <https://www.microsoft.com/cognitive-services>
13. Bot Framework: <https://dev.botframework.com/>
14. All of the components within the suite: <https://www.microsoft.com/en-us/server-cloud/cortana-intelligence-suite/what-is-cortana-intelligence.aspx>
15. What can I do with it? <https://gallery.cortanaintelligence.com/>

16. Getting Started Quickly: <https://caqs.azure.net/#gallery>

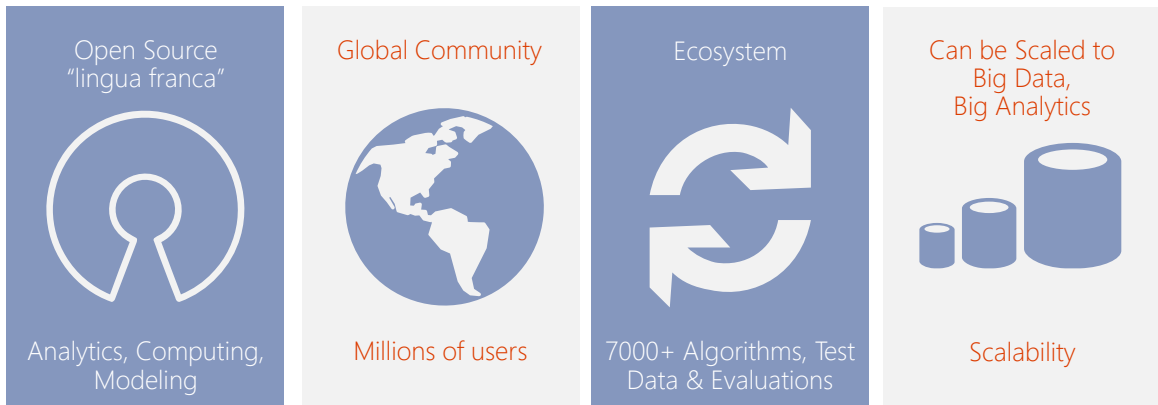
The R Programming Environment



8

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

R Programing 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
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>

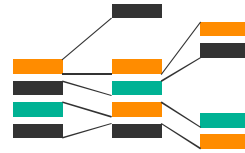
R Data Types

- 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



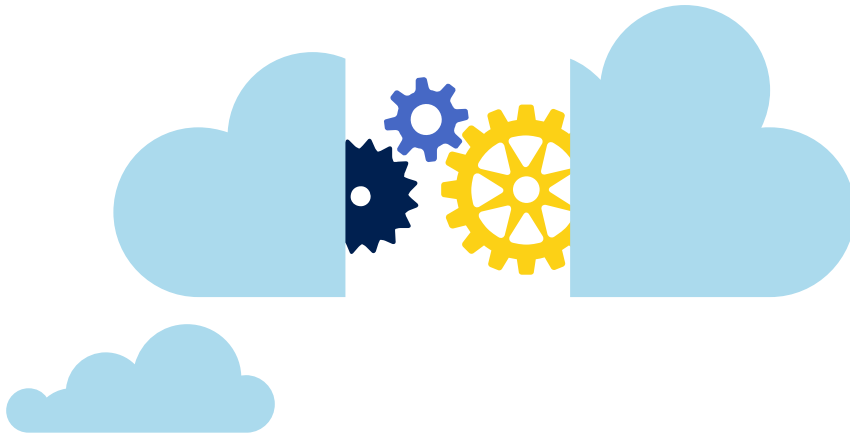
- **Vector**
 - A single-line sequence of one datatype
- **List**
 - An ordered collection of objects, allowing a variety of (possibly unrelated) objects under one name
- **Matrix**
 - A multi-line sequence of the same length and datatype
- **Array**
 - Like a Matrix, but with more dimensions

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



1. If you do not have a Microsoft Azure account, go here: <https://azure.microsoft.com/en-us/free/> (You will need a credit card, but you will not be charged)
 1. Log in to the Azure Portal: <https://ms.portal.azure.com>
 2. Create a new Windows Data Science Virtual Machine (2 Processors, 7GB RAM, HDD): <https://azure.microsoft.com/en-us/documentation/articles/machine-learning-data-science-vm-do-ten-things/>
2. *Optional, if using your local machine:*
 1. Install SQL Server 2016 and ensure you select R Services – see this link: <https://www.microsoft.com/en-us/cloud-platform/sql-server-editions-developers>
 2. Install Visual Studio Community Edition 2015: <https://www.microsoft.com/en-us/download/details.aspx?id=48146>
 3. Install SQL Server Data Tools: <https://docs.microsoft.com/en-us/sql/ssdt/download-sql-server-data-tools-ssdt>
 4. Install R Tools for Visual Studio: <https://microsoft.github.io/RTVS-docs/>
3. For R, Open this site, complete the lessons the instructor assigns: <http://tryr.codeschool.com/>
4. For SQL, Open this site, complete the lessons the instructor assigns: <http://www.w3schools.com/SQL/default.asp>
5. For Advanced R, complete this series: <https://www.datacamp.com/community/open-courses/big-data-revolution-r-enterprise-tutorial#gs.rVTAa4>

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

SQL Server R Services

- Built in Advanced Analytics and Stand Alone Server Capability
- Leverages the Benefits of SQL 2016 Enterprise Edition

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

- Channel 9 videos on Microsoft R:
<https://channel9.msdn.com/Search?term=Microsoft%20R#lang-en=en&ch9Search>

Microsoft R Open

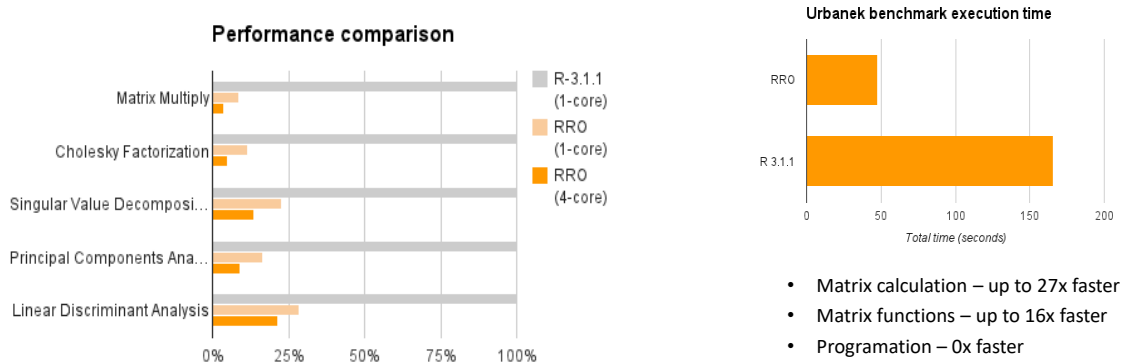
- Enhanced Open Source R distribution
 - Based on the latest Open Source R
 - Built, tested and distributed by Microsoft
 - Enhanced by Intel MKL Library to speed up linear algebra functions
- Compatible with all R-related software
 - CRAN packages, RStudio, third-party R integrations, ...
- Revolutions Open-Source R packages
 - Reproducible R Toolkit – checkpoint
- MRAN website mran.revolutionanalytics.com
 - 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>

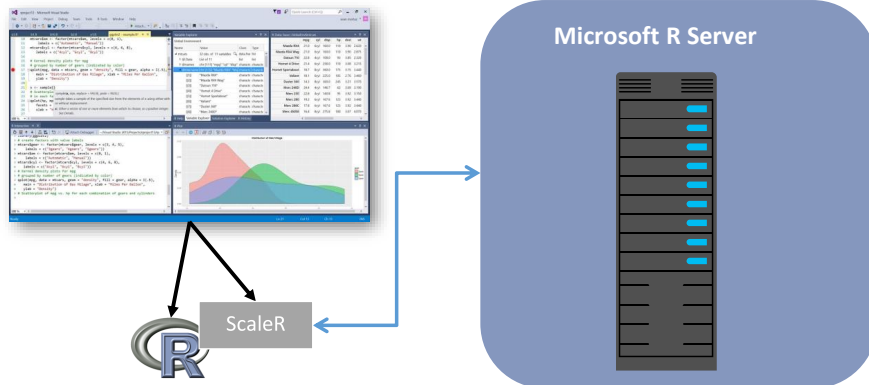
CRAN R compared to Microsoft R Open



- More efficient and multi-threaded math computation.
- Benefits math intensive processing.
- No benefit to program logic and data transform

- Overview: <https://channel9.msdn.com/Series/Microsoft-R-Server-Series/Introduction-to-Microsoft-R-Server-Session-1--Overview>

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 R Services
-
- R in Azure Machine Learning

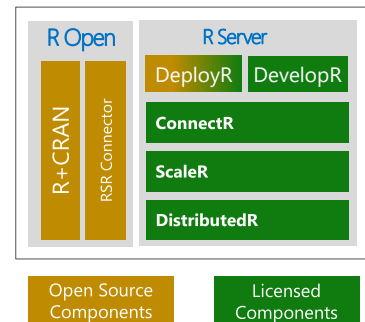
1. Supported Platforms for Microsoft R Server: <https://msdn.microsoft.com/en-us/microsoft-r/rserver-install-supported-platforms>
2. Book and Series: <http://dacrook.com/introduction-to-microsoft-r-open/>
3. Microsoft R Client: <https://msdn.microsoft.com/en-us/microsoft-r/index#mrc>
4. Microsoft R Server: <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 R Server: <https://msdn.microsoft.com/en-us/microsoft-r/index#mrs>

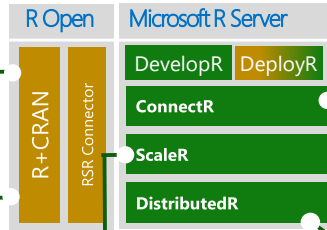
The Microsoft R Server Platform

R+CRAN

- Open source R interpreter
 - R 3.2.2
- Freely-available huge range of R algorithms
- Algorithms callable by MSR
- Embeddable in R scripts
- 100% Compatible with existing R scripts, functions and packages

MRO

- Performance enhanced R interpreter
- Based on open source R
- Adds high-performance math library to speed up linear algebra functions



ScaleR

- Ready-to-Use high-performance big data big analytics
- Fully-parallelized analytics
- Data prep & data distillation
- Descriptive statistics & statistical tests
- Range of predictive functions
- User tools for distributing customized R algorithms across nodes
- Wide data sets supported – thousands of variables

ConnectR

- High-speed & direct connectors

Available for:

- High-performance XDF
- SAS, SPSS, delimited & fixed format text data files
- Hadoop HDFS (text & XDF)
- Teradata Database & Aster
- EDWs and ADWs
- ODBC

DistributedR

- Distributed computing framework
- Delivers cross-platform portability

- Installing on Linux:
<https://channel9.msdn.com/Series/Microsoft-R-Server/Microsoft-R-Server-Installation-Linux>

CRAN, MRO, MRS Comparison

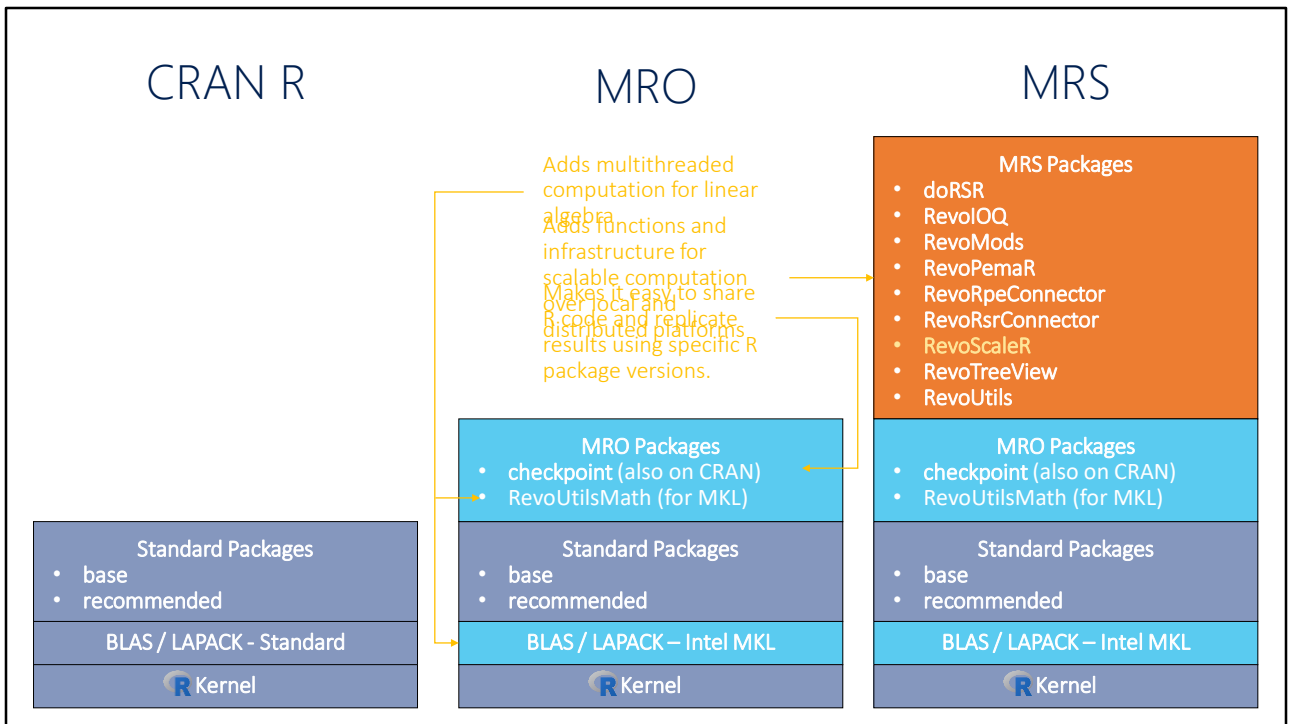


Microsoft
R Open

Microsoft
R Server

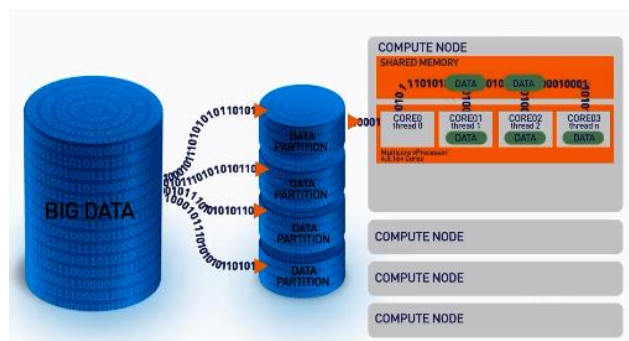
Datasize	In-memory	In-memory	In-Memory or Disk Based
Speed of Analysis	Single threaded	Multi-threaded	Multi-threaded, parallel processing 1:N servers
Support	Community	Community	Community + Commercial
Analytic Breadth & Depth	7500+ innovative analytic packages	7500+ innovative analytic packages	7500+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

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



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

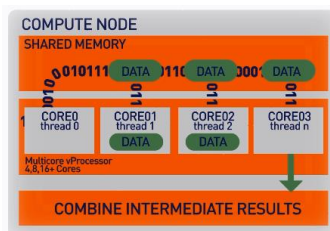
ScaleR – Parallel + “Big Data”



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
- Naïve Bayes



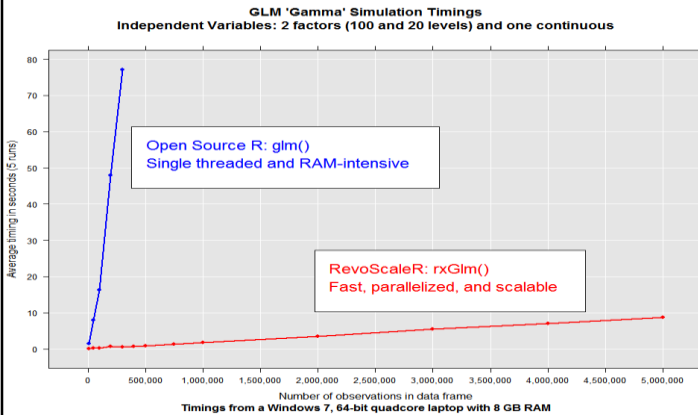
Combination

- rxDataStep
- rxExec
- PEMA-R API Custom Algorithms

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

ScaleR - Performance comparison

Microsoft R Server has no data size limits in relation to size of available RAM. When open source R operates on data sets that exceed RAM it will fail. In contrast Microsoft R Server scales linearly well beyond RAM limits and parallel algorithms are much faster.

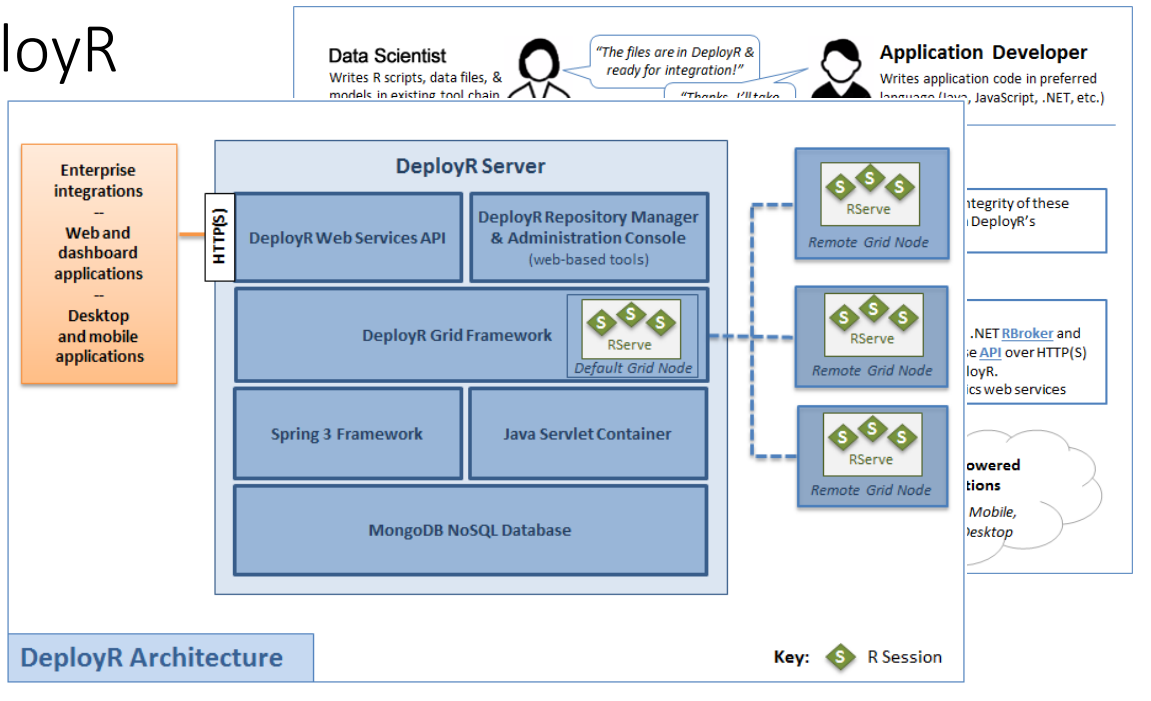


File Name	Compressed File Size (MB)	No. Rows	Open Source R (secs)	Revolution R (secs)
Tiny	0.3	1,235	0.00	0.05
V. Small	0.4	12,353	0.21	0.05
Small	1.3	123,534	0.03	0.03
Medium	10.7	1,235,349	1.94	0.08
Large	104.5	12,353,496	60.69	0.42
Big (full)	12,960.0	123,534,969	Memory!	4.89
V.Big	25,919.7	247,069,938	Memory!	9.49
Huge	51,840.2	494,139,876	Memory!	18.92

- US flight data for 20 years
- Linear Regression on Arrival Delay
- Run on 4 core laptop, 16GB RAM and 500GB SSD

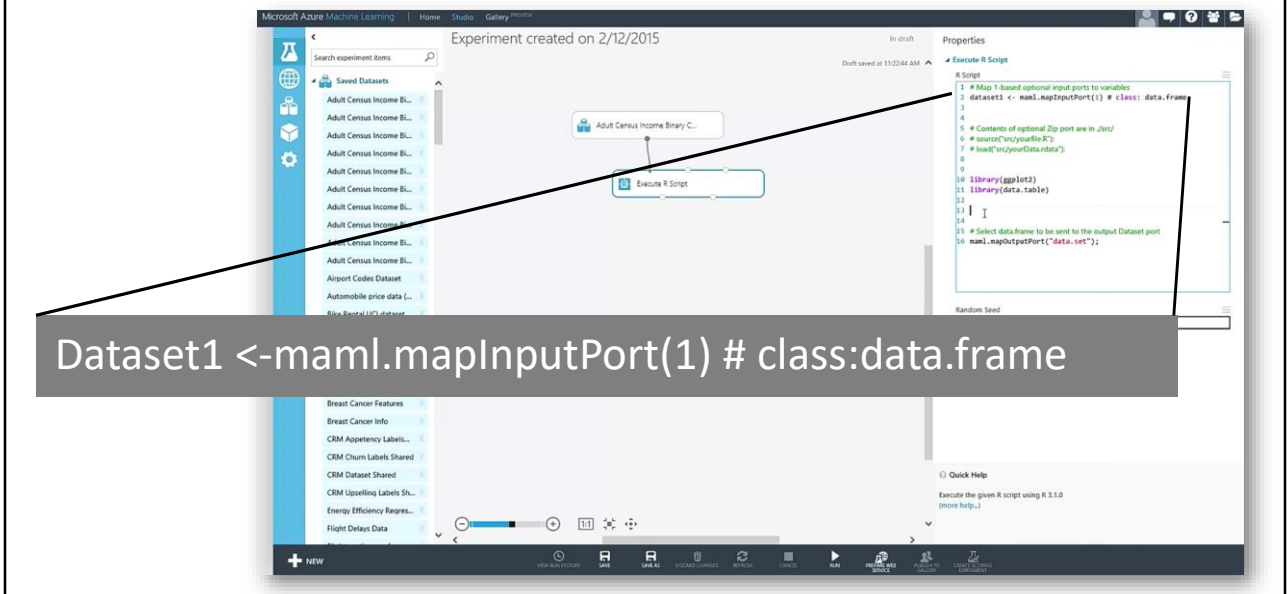
- ScaleR Functions for Working with SQL Server Data:
<https://msdn.microsoft.com/en-us/library/mt732681.aspx>

DeployR



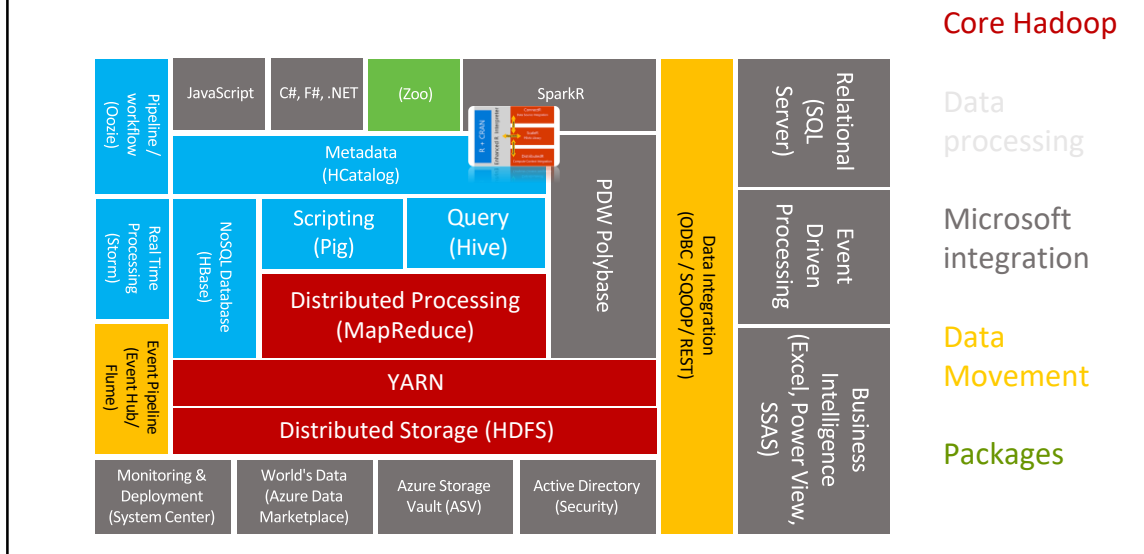
1. Microsoft DeployR Documentation:
<https://msdn.microsoft.com/en-us/microsoft-r/deployr-about>
2. Previous Documentation:
<https://deployr.revolutionanalytics.com/documents/getting-started/about/>

R in Azure Machine Learning



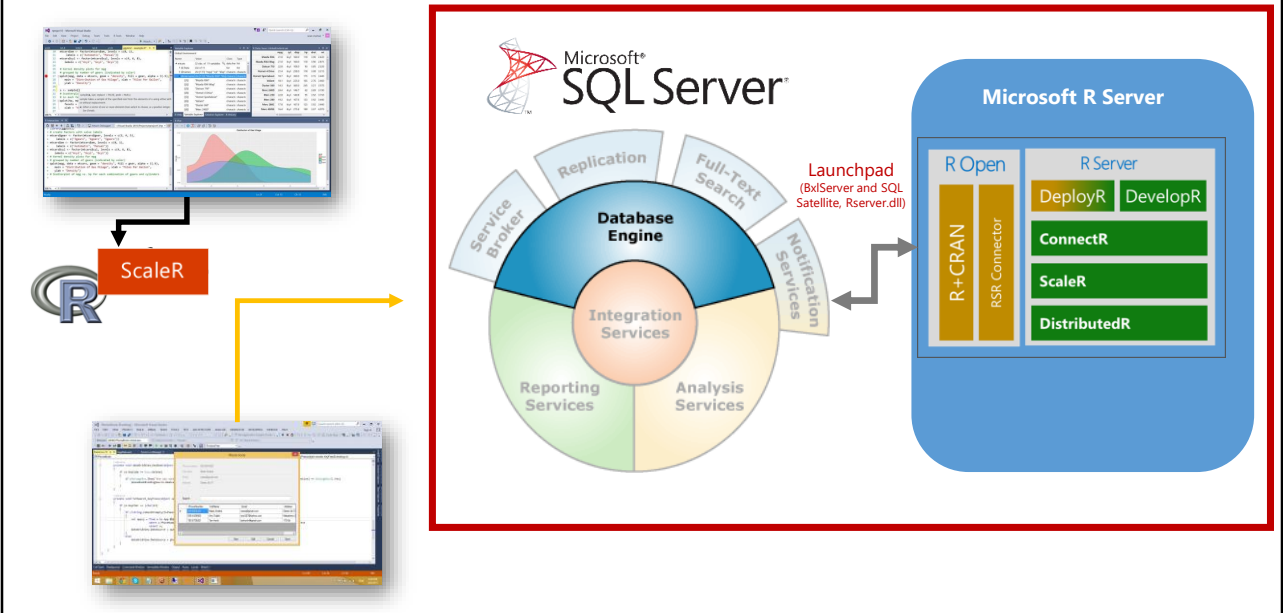
1. Primary reference: <https://msdn.microsoft.com/en-us/library/dn905952.aspx>
2. Using R in Azure Machine Learning: <https://azure.microsoft.com/en-us/documentation/articles/machine-learning-r-quickstart/>
3. Overview Video: <https://channel9.msdn.com/Blogs/Windows-Azure/R-in-Azure-ML-Studio>
4. R Packages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

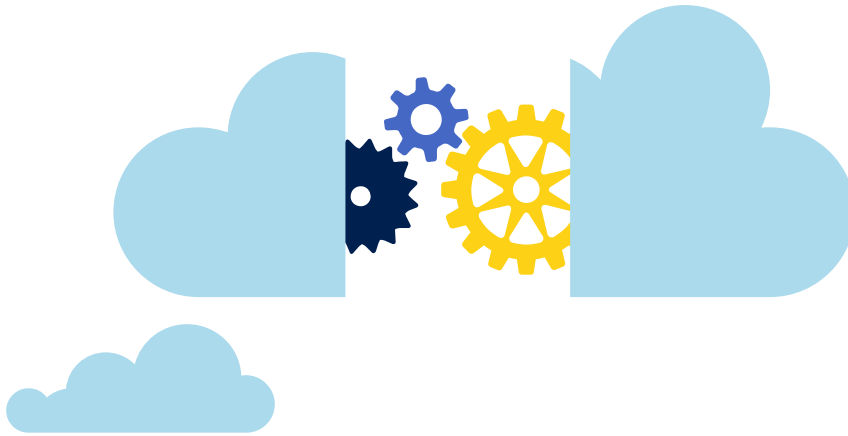


1. Primary Documentation and training: <https://msdn.microsoft.com/en-us/library/mt604845.aspx>
2. Great set of resources: <https://www.r-bloggers.com/r-and-sql-server-articles/amp/>



1. Read the installation page for MRS – <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 MRS 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 2016 and ensure you select R Services – see this link: <https://www.microsoft.com/en-us/cloud-platform/sql-server-editions-developers>
6. Find out if MRS is loaded: - Open an R Client Session (SQL, MRS, AML, etc) and run `sessionInfo()`

R Client Options

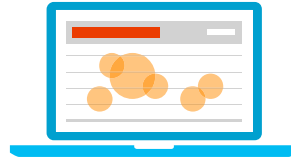


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1. The Microsoft R Client: <https://msdn.microsoft.com/en-us/microsoft-r/install-r-client-windows>

Microsoft R Development Tools

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

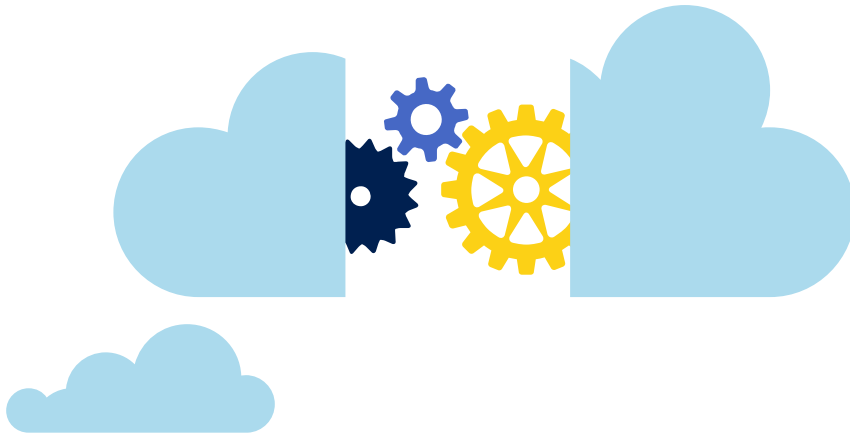


1. Installing Microsoft R Client on Windows:
<https://msdn.microsoft.com/en-us/microsoft-r/install-r-client-windows>
2. Files located at: C:\Program Files\Microsoft\R Client\R_SERVER\bin



1. *Optional:* Install Visual Studio 2015 Community Edition (<https://www.microsoft.com/en-us/download/details.aspx?id=48146>) (Select **Optional**, and include **SQL Server Data Tools**)
2. *Optional:* Install RTVS (<http://microsoft.github.io/RTVS-docs/installer.html>)
3. *Optional:* Install Rstudio (<https://www.rstudio.com/products/rstudio/download2/>)
4. 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
5. 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 Microsoft R

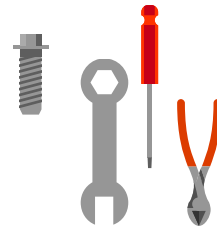


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1. Complete introduction: <https://msdn.microsoft.com/en-us/microsoft-r/microsoft-r-getting-started>
2. Data Exploration and Modeling with R: <https://msdn.microsoft.com/en-us/library/mt590947.aspx>

Configuration and Operation

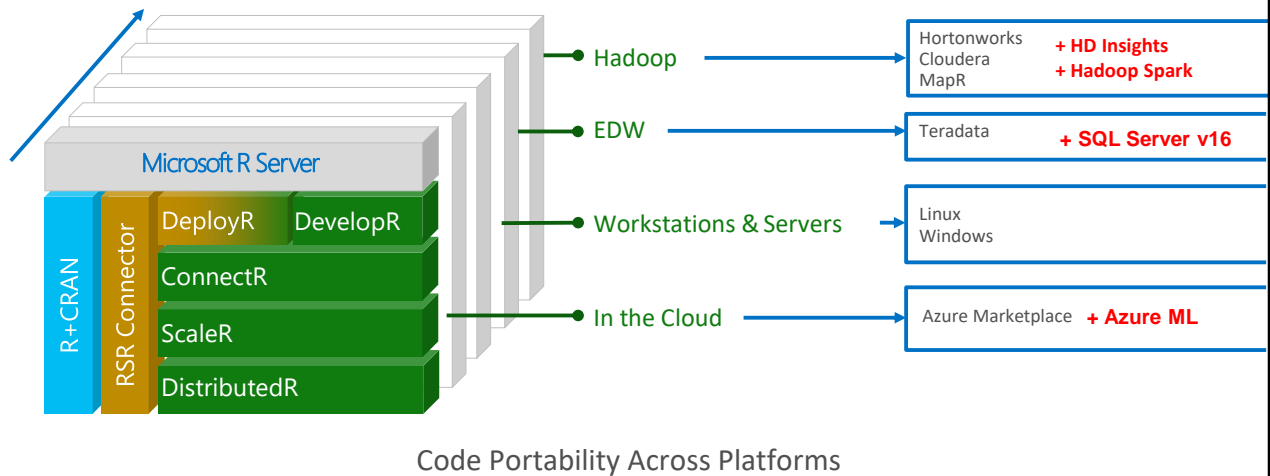
- Planning
 - Specific Environments
- File Locations
- Services and Background Processes
- Package Management
- DeployR Planning



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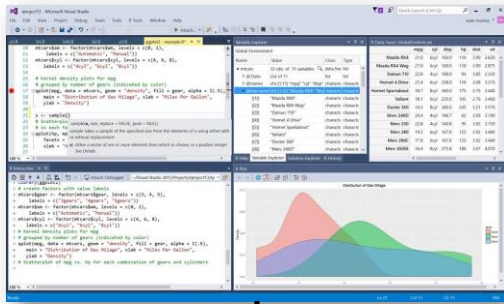
1. Features and Tasks: <https://msdn.microsoft.com/en-us/library/mt590811.aspx>
2. Differences in Features: <https://msdn.microsoft.com/en-us/library/mt721284.aspx>
3. Installing on VM's: <https://msdn.microsoft.com/en-us/library/mt748179.aspx>
4. Setting up R Services: <https://msdn.microsoft.com/en-us/library/mt696069.aspx>

Distributed R - Write once, deploy multiple

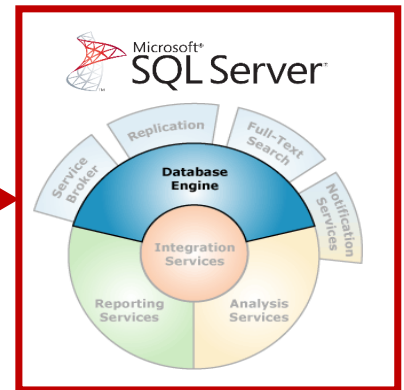


- DeployR Workflow: <https://msdn.microsoft.com/en-us/microsoft-r/deployr-about>

CRAN/Microsoft R Open And Databases

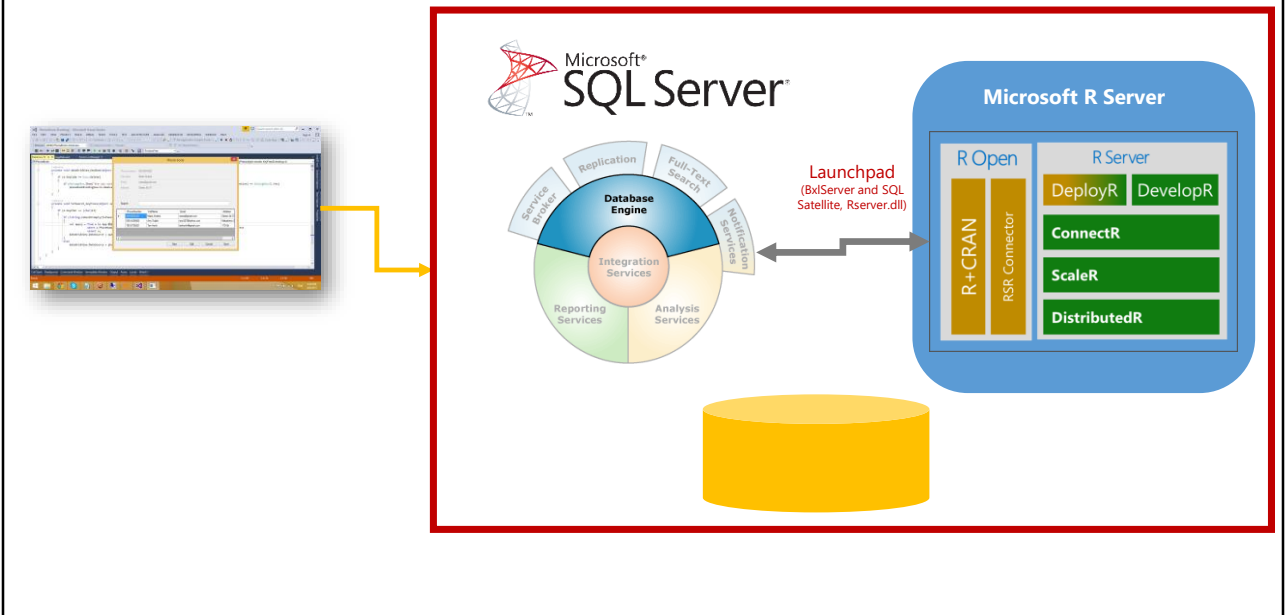


RODBC



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 in SQL Server



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

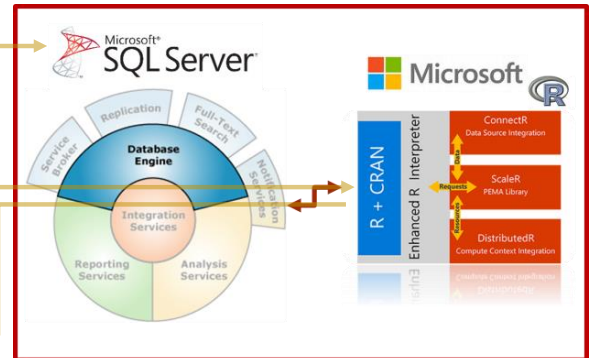
T-SQL and R Interaction

```
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)

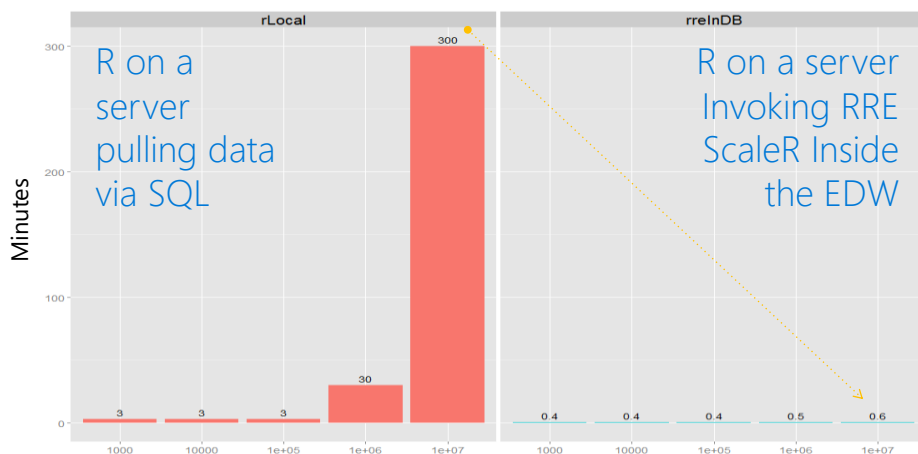


1. From the **Resources** folder open the file **R Services for SQL Server Lab.sql** and run the section marked:

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

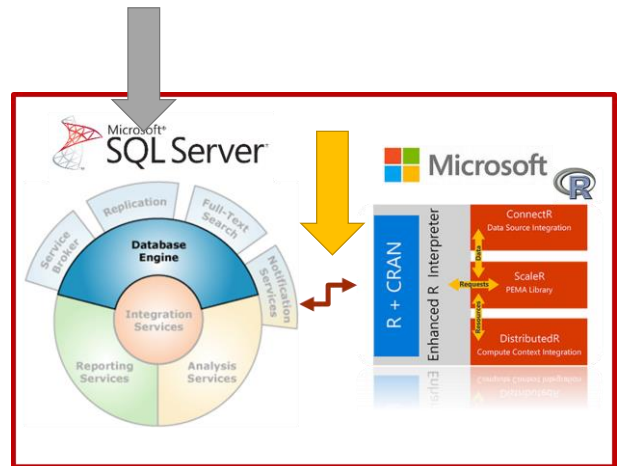
Example of In-Database Acceleration

5+ hours to 40 seconds:



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

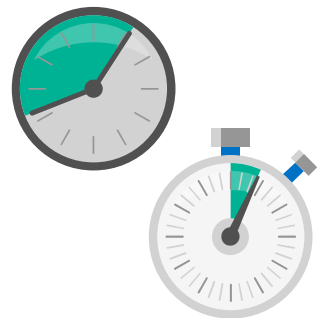


1. From the **Resources** folder open the file **R Services for SQL Server Lab.sql** and run the section marked:

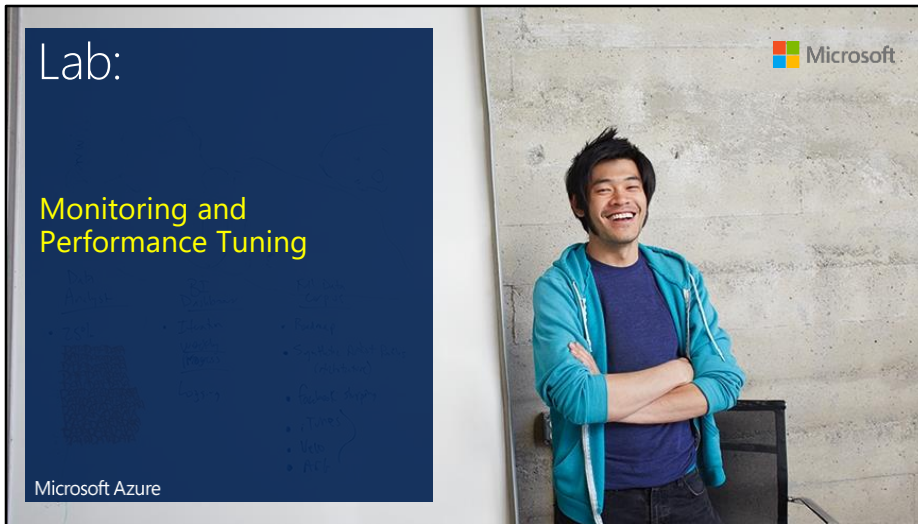
`/* Simple Example using internal R Data */`

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

```
/* Performance Tuning */
```

Security and Governance

- Principals



- Securables



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



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

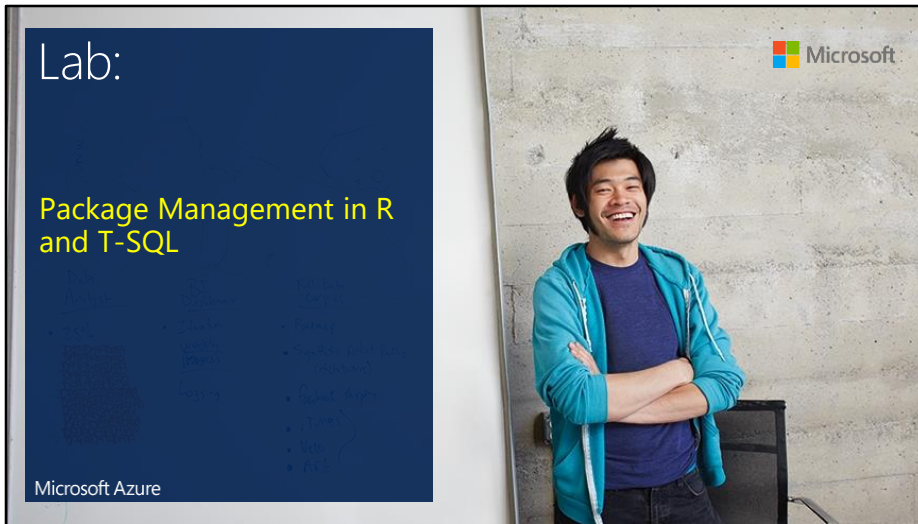
```
/* Security */
```

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
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. From the **Resources** folder open the file **R Services for SQL Server Lab.sql** and follow along with the instructor for the section marked:

```
/* Packages */
```

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. Option 1: <https://www.microsoft.com/en-us/sql-server/developer-get-started/r>
2. Option 2: Open the materials are at: <https://github.com/Microsoft/sql-server-samples/tree/master/samples/features/r-services/Telco%20Customer%20Churn>
3. Option 3: Refer to this link: <https://gallery.cortanaintelligence.com/Tutorial/Predictive-Maintenance-Template-with-SQL-Server-R-Services-1> and work through that example.
4. Demand Forecasting Template: <https://channel9.msdn.com/Blogs/Seth-Juarez/Energy-Demand-Forecasting-Template-with-SQL-Server-R-Services>
5. 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](#)