

# R at (almost) 21

# A look back on R's history and impact

David Smith  
@revodavid



Photo credit: [twitter.com/HannahOish](https://twitter.com/HannahOish)

# About me

Cloud Advocate, Microsoft  
Director, R Consortium  
Co-author, *Introduction to R*  
Editor, [blog.revolutionanalytics.com](http://blog.revolutionanalytics.com)

[davidsmi@microsoft.com](mailto:davidsmi@microsoft.com)  
[@revodavid](https://twitter.com/revodavid)



"Bit" art by @ashleymcnamara

# 1976: First, there was S

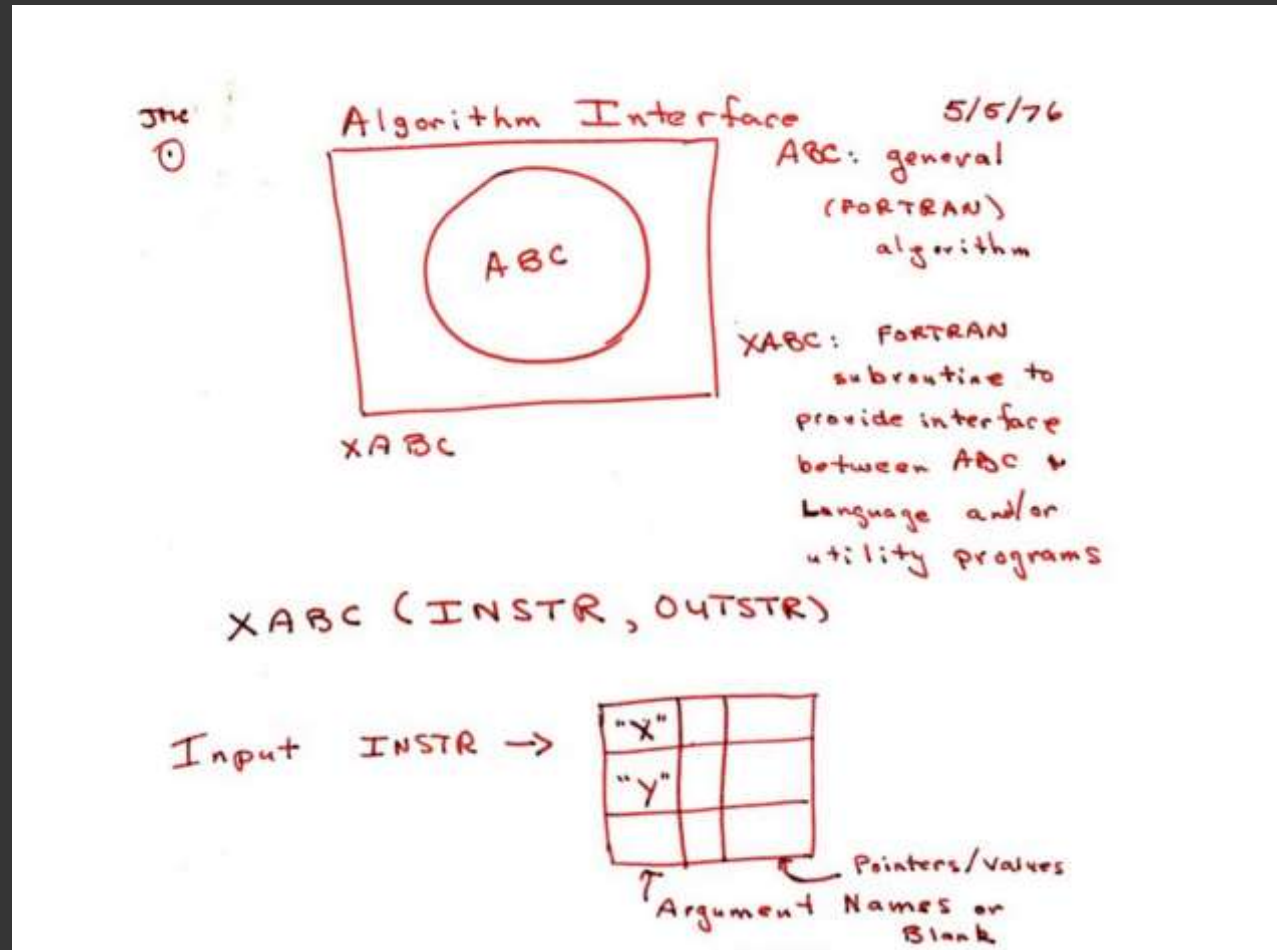


Photo credit: John Chambers

# 1992: R is born



Photo credit: Robert Gentleman

# 1993-08-04: The First Announcement

Date: Wed, 4 Aug 93 14:01:31 NZS  
From: Ross Ihaka  
To: S-news@utstat.toronto.edu  
Subject: Re: Is S available for a Macintosh personal computer?

Joseph B Kruskal writes:

If anyone knows of an S available for a Macintosh computer, I would be pleased to hear about it.

About a year ago Robert Gentleman and I considered the problem of obtaining decent statistical software for our undergraduate Macintosh lab. After considering the options, we decided that the most satisfactory alternative was to write our own. We started by writing a small lisp interpreter. Next we expanded its data structures with atomic vector types and altered its evaluation semantics to include lazy evaluation of closure arguments and argument binding by tag as well as order. Finally we added some syntactic sugar to make it look somewhat like S. We call the result "R".

## R Installation on the Macintosh (Pre-alpha Version)

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Warning: This is VERY preliminary.

Pre-requisites:

A Macintosh computer (floating point is preferable)  
At least 2.5 megabytes of memory free (after the OS loads)



# 1995-06: R released under GPL




## **R : Past and Future History**

*A Draft of a Paper for Interface '98*

Ross Ihaka  
Statistics Department  
The University of Auckland  
Auckland, New Zealand

# 1997: CRAN founded



**These webpages are currently under reconstruction!**

CRAN  
[Mirrors](#)  
[Search](#)

About R  
[R Homepage](#)

Software  
[R Sources](#)  
[R Binaries](#)  
[Package Sources](#)  
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Documentation  
[Manuals](#)  
[Contributed](#)  
[FAQ](#)

## The Comprehensive R Archive Network

Frequently used pages

Unix & Linux	Windows
<ul style="list-style-type: none"><li>• Download the source code of the latest release: <a href="#">R-1.1.1.tgz</a></li><li>• Sources of <a href="#">contributed packages</a></li><li>• Precompiled binaries for <a href="#">Linux</a> and <a href="#">OSF</a></li></ul>	<ul style="list-style-type: none"><li>• Download <a href="#">R for Windows</a> 95, 98, NT4.0 and 2000 on Intel/clone chips</li><li>• Precompiled ZIP files of <a href="#">contributed packages</a></li></ul>

What are R and CRAN?

R is 'GNU S', a freely available language and environment for statistical computing and graphics which provides a wide variety of statistical and graphical techniques: linear and nonlinear modelling, statistical tests, time series analysis, classification, clustering, etc. Please consult the [R project homepage](#) for further information.

CRAN is a network of ftp and web servers around the world that store identical, up-to-date, versions of code and documentation for the R statistical package. Please use the CRAN [mirror](#) nearest to you to minimize network load.

**Recent changes**

[CRAN](#) (<http://cran.R-project.org>) and the [R homepage](#) (<http://www.R-project.org>) have been split into two separate web sites. CRAN now only serves the purpose of providing R related software, documentation etc., it is the "download area" of the R project and mirrored on a number of sites worldwide. The R homepage provides more detailed info and material that need not (or for technical reasons cannot) be mirrored on every CRAN node. This split also means the the HTML pages of CRAN only serve as a frontend for the download area. Many pages (e.g., on mailing lists, books, ...) have moved from CRAN to the R homepage.

**Submitting to CRAN**


To "submit" to CRAN, simply upload to <ftp://cran.r-project.org/incoming> and send email to [wwwadmin@cran.r-project.org](mailto:wwwadmin@cran.r-project.org). Please indicate the copyright situation (GPL, ...) in your submission.

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Last modified: November 9, 2000 by Friedrich Leisch

CRAN on Nov 9, 2000

# 1997: CRAN founded



**The Comprehensive R Archive Network**

**Download and Install R**

Precompiled binary distributions of the base system and contributed packages, **Windows and Mac** users most likely want one of these versions of R:

- [Download R for Linux](#)
- [Download R for \(Mac\) OS X](#)
- [Download R for Windows](#)

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

**Source Code for all Platforms**

Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (2020-02-29, Holding the Windsock) [R-3.6.3.tar.gz](#), read [what's new](#) in the latest version.
- Sources of [R alpha and beta releases](#) (daily snapshots, created only in time periods before a planned release).
- Daily snapshots of current patched and development versions are [available here](#). Please read about [new features and bug fixes](#) before filing corresponding feature requests or bug reports.
- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

**CRAN**  
[Mirrors](#)  
[What's new?](#)  
[Task Views](#)  
[Search](#)

**About R**  
[R Homepage](#)  
[The R Journal](#)

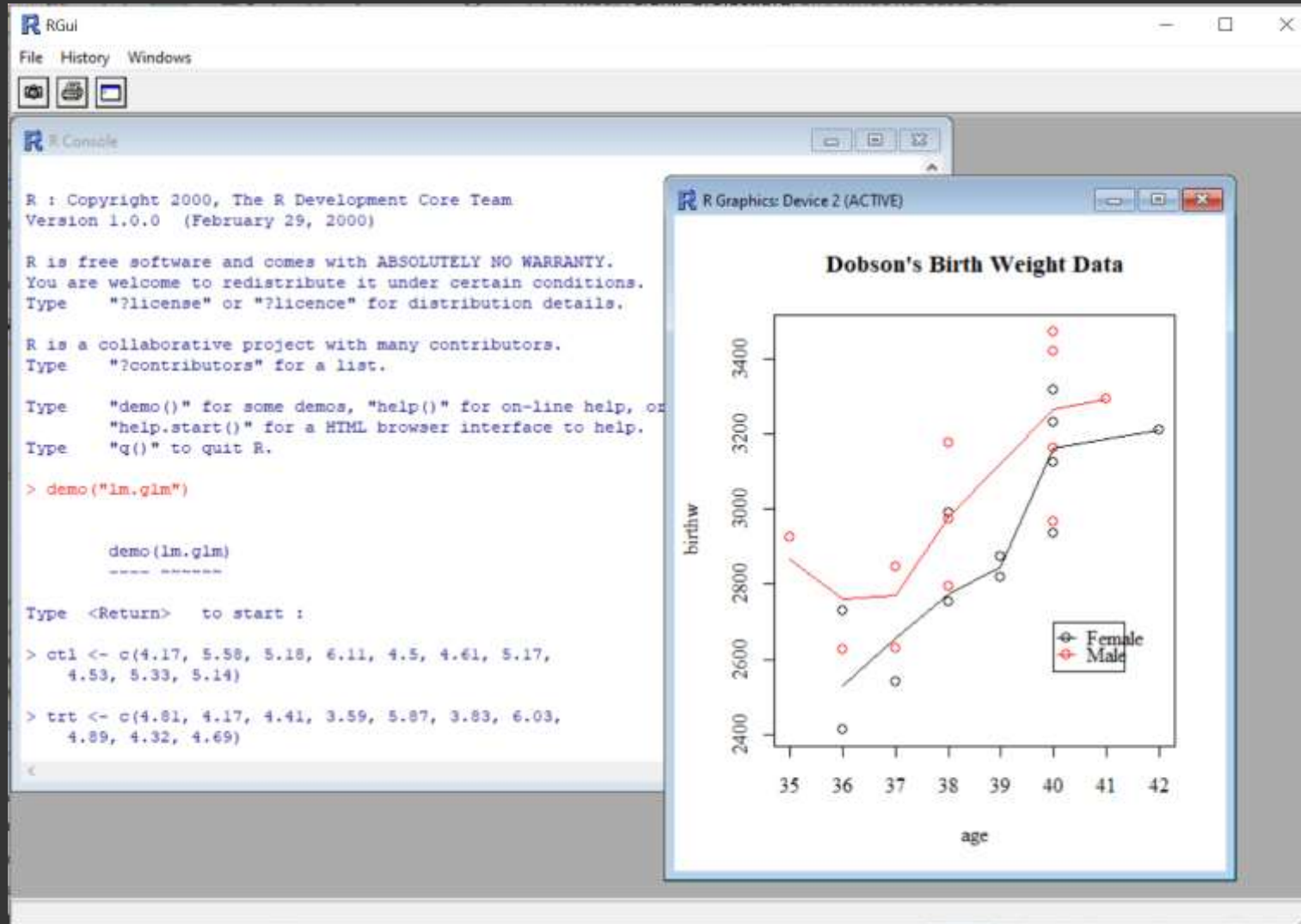
**Software**  
[R Sources](#)  
[R Binaries](#)  
[Packages](#)  
[Other](#)

**Documentation**  
[Manuals](#)  
[FAQs](#)  
[Contributed](#)

CRAN on Mar 26, 2020



# 2000-02-29: R 1.0.0 released



2.8Mb source code


- cf 32Mb today

8.6Mb Windows installer

- cf 84Mb today
- Still runs on Windows 10!

Features a Y2K compliance statement

# 2000-04-03: Incorporation of the R Foundation



The R Foundation for Statistical Computing

[About](#) --- [Board & Seat](#) --- [Membership](#)

About R  
[What is R?](#)  
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[Bioconductor](#)  
[Omega](#)  
[gRaphical models](#)  
[R GUIs](#)

Misc  
[Links](#)

The R Foundation is a not for profit organization working in the public interest. It has been founded by the members of the R Development Core Team in order to

- Provide support for the R project and other innovations in statistical computing. We believe that R has become a mature and valuable tool and we would like to ensure its continued development and the development of future innovations in software for statistical and computational research.
- Provide a reference point for individuals, institutions or commercial enterprises that want to support or interact with the R development community.
- Hold and administer the copyright of R software and documentation.

R is an official part of the [Free Software Foundation's](#) GNU project, and the R Foundation has similar goals to other open source software foundations like the [Apache Foundation](#) or the [GNOME Foundation](#).

Among the goals of the R Foundation are the support of continued development of R, the exploration of new methodology, teaching and training of statistical computing and the organization of meetings and conferences with a statistical computing orientation. We hope to attract sufficient funding to make these goals realities.

The **R Foundation Statutes** can be downloaded as PDF file in [English](#) or [German](#).

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[cran@R-project.org](mailto:cran@R-project.org)  
Last modified: March 6, 2003 by Friedrich Leisch

Founded in Vienna, Austria

Presidents (2002): Robert Gentleman, Ross Ihaka

Holds R copyright

Funds servers, R Journal, and useR! conference

Now accepts [online donations](#)

2007: Revolution Computing founded



# 2009-01-06: R hits the Front Page\*

**The New York Times**

## Business Computing

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION

### Data Analysts Captivated by R's Power



Left, Stuart Isett for The New York Times; right, Kieran Scott for The New York Times

R first appeared in 1996, when the statistics professors Robert Gentleman, left, and Ross Ihaka released the code as a free software package.

By **ASHLEE VANCE**  
Published: January 6, 2009

\*of the technology section of the NYT

# 2011-02-28: RStudio initial public release

## [R] A new IDE for R: RStudio

johannes rara [johannesrara@gmail.com](mailto:johannesrara@gmail.com)

Mon Feb 28 19:29:57 CET 2011

- Previous message: [\[R\].plot data frame](#)
- Next message: [\[R\].power of the comparison of two ROC curves](#)
- Messages sorted by: [\[date\]](#) [\[thread\]](#) [\[subject\]](#) [\[author\]](#)

Hi,


This is not an official announcement, I just discovered that a new IDE for R named RStudio was released today. Looks very very promising to me!

<http://www.rstudio.org>

-J


- Previous message: [\[R\].plot data frame](#)
- Next message: [\[R\].power of the comparison of two ROC curves](#)
- Messages sorted by: [\[date\]](#) [\[thread\]](#) [\[subject\]](#) [\[author\]](#)

[More information about the R-help mailing list](#)

[Home](#) [Screenshots](#) [Download](#) [Docs](#) [Support](#) [Development](#) [Blog](#)

## Introducing RStudio

RStudio™ is a new integrated development environment (IDE) for R. RStudio combines an intuitive user interface with powerful coding tools to help you get the most out of R.



### Productive


RStudio brings together everything you need to be productive with R in a single, customizable environment. Its intuitive interface and powerful coding tools help you get work done faster.

### Runs Everywhere

RStudio is available for [all major platforms](#) including Windows, Mac OS X, and Linux. It can even run alongside R on a server, enabling multiple users to access the RStudio IDE using a web browser.

### Free & Open

Like R, RStudio is available under an open source [license](#) that guarantees the freedom to share and change the software, and to make sure it remains free software for all its users.



### News

#### RStudio Beta Available (2/28/2011)

We are pleased to announce availability of the beta version of RStudio! RStudio is a new open-source IDE for R that runs either on your desktop or on a server (where it is accessed using a browser). We invite everyone to check out the [screenshots](#) for more details; [download](#) the product to try it out, and follow its ongoing [development](#) on github.



# 2015-04-06: Microsoft acquires Revolution Analytics



Official Microsoft Blog

## Microsoft to acquire Revolution Analytics to help customers find big data value with advanced statistical analysis

Jan 23, 2015 | [Joseph Sirosh - Corporate Vice President, Data Group, Microsoft](#)

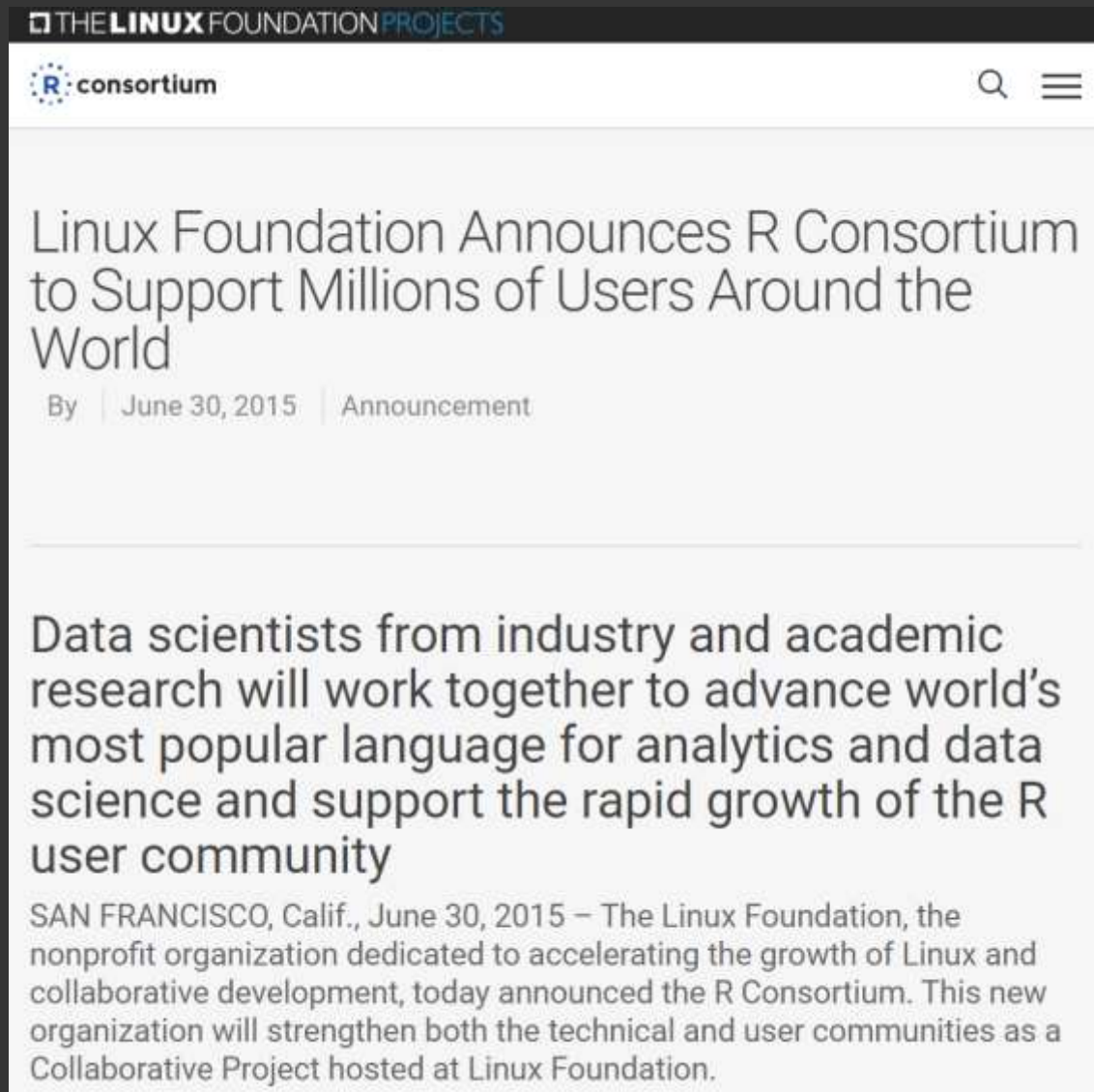


**Update: April 6, 2015:** Microsoft has closed the acquisition of Revolution Analytics. For more details, please read the blog post by Joseph Sirosh [here](#).

I'm very pleased to announce that Microsoft has reached an agreement to acquire [Revolution Analytics](#). Revolution Analytics is the leading commercial provider of software and services for R, the world's most widely used programming language for statistical computing and predictive analytics. We are making this acquisition to help more companies use the power of R and data science to unlock big data insights with advanced analytics.

As their volumes of data continually grow, organizations of all kinds around the world – financial, manufacturing, health care, retail, research – need powerful analytical models to make data-driven decisions. This requires high performance computation that is “close” to the data, and scales with the business’ needs over time. At the same time, companies need to reduce the data science and analytics skills gap inside their organizations, so more employees can use and benefit from R. This acquisition is part of our effort to address these customer needs.

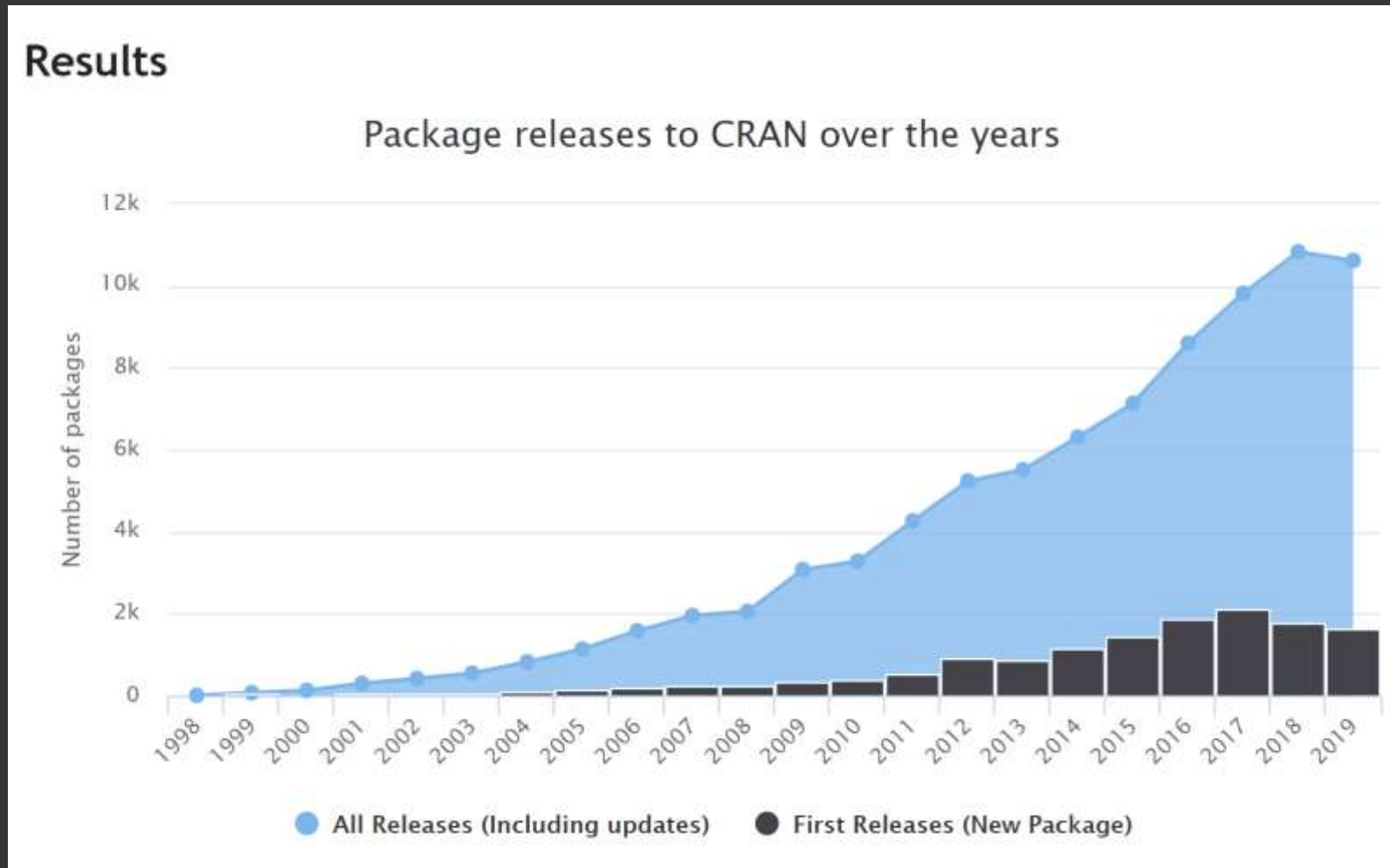
# 2015-06-30: R Consortium founded



Provides funding for:

- R user groups
- R-Ladies
- R-hub
- useR! video streaming
- Community projects, events, and working groups


# 2019-12-31: CRAN Package Growth





CRAN packages in 2019:  
15368 available  
10620 released / updated  
1656 new


Chart: Jozef Hajnala

# 2020-02-29 (R's 20<sup>th</sup> birthday): R 3.6.3 released



## Peter Dalgaard: A Brief History of R and some Thoughts about Its Future @ CeleBration 2020

Watch later Share



if a package's C/C++ calls to BLAS/LAPACK allow for the "hidden" arguments used by most Fortran compilers to pass the lengths of Fortran character arguments, define USE\_FC\_LEN\_T and include Rconfig.h (possibly via \_R\_h\_) before including e\_ext/BLAS.h or R\_ext/Lapack.h.

\* A package with Fortran source code and perhaps C (but not C++) likewise can request for its shared object/DLL Fortran compiler by including a line USE\_FC\_len\_T in its Makevars.in and using \$(SHLIB\_OPENMP\_PAS\_LIBS).

The known reason for doing so is a package (only) OpenMP on a platform where the Fortran is incompatible with the C one (e.g. gfortran 9).

UTILITIES:

```
Peters-UMac1~ release pds logout
Connection to sbs closed.
Peters-MacBook-Air~ pds ssh cbs
Last login: Sat Feb 29 00:05:02 2020 from 172.20.1.10

rscript ~/scripts/ReleaseRforR.R
Peters-UMac1~ pds
Peters-UMac1~ pds rscript ~/scripts/ReleaseRforR.R
Version 3.6.3 ["Holding the Windsock"] was released

The wrap-up release of the R-3.6.x series was 3.6.3.


>
The date for the next release is not yet set.
>
- [==R version 3.6.3 (Holding the Windsock)==] (in
  use/R-3)
  has been released on 2020-02-29.
Peters-UMac1~ pds []
```

```
ssh cbs
rscript ~/scripts/ReleaseRforR.R

od R-release
pds * R-3/R-3.6.3.tar.gz
cbsum -a 156 * R-3/R-3.6.3.tar.gz
head -50 NEWS
logout
```

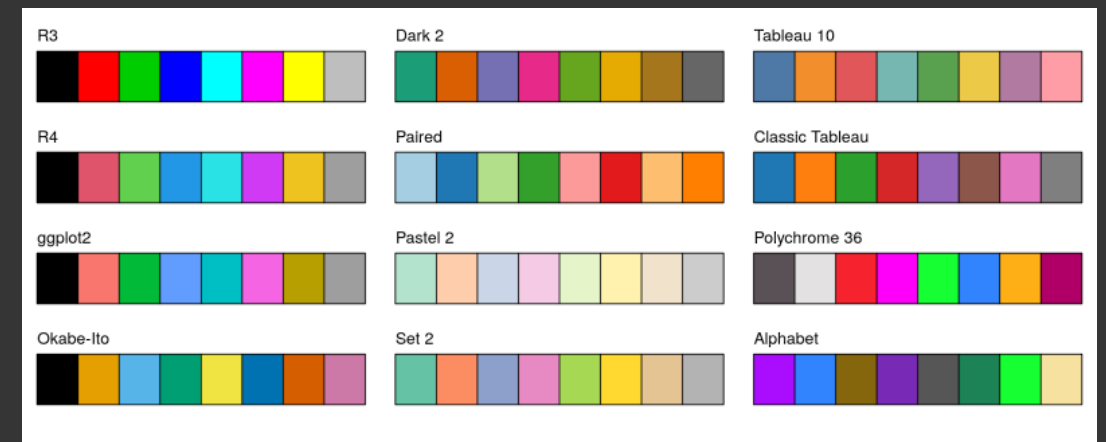
```
[[{"x": "R-3.6.3", "y": "R-3.6.3", "z": "R-3.6.3", "w": "R-3.6.3", "v": "R-3.6.3", "u": "R-3.6.3", "t": "R-3.6.3", "s": "R-3.6.3", "r": "R-3.6.3", "q": "R-3.6.3", "p": "R-3.6.3", "o": "R-3.6.3", "n": "R-3.6.3", "m": "R-3.6.3", "l": "R-3.6.3", "k": "R-3.6.3", "j": "R-3.6.3", "i": "R-3.6.3", "h": "R-3.6.3", "g": "R-3.6.3", "f": "R-3.6.3", "e": "R-3.6.3", "d": "R-3.6.3", "c": "R-3.6.3", "b": "R-3.6.3", "a": "R-3.6.3"}]]
```

File Saved: Finished at Fri Feb 29 20:12:52



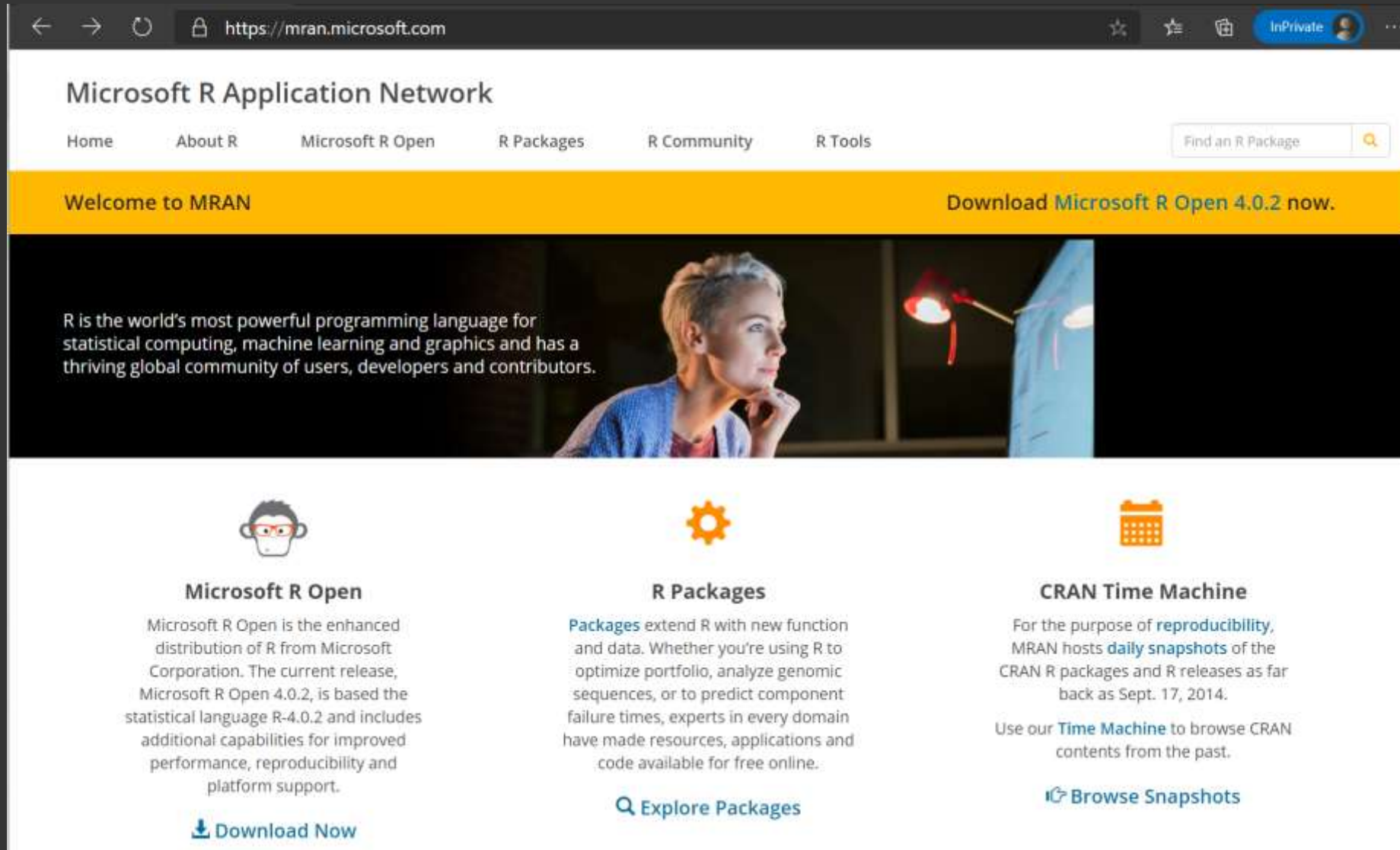
# 2020-04-17 R 4.0.0

- Reference counting (better memory usage)
- Changes to defaults (**stringsAsFactors**)
- New syntax `r("raw strings")`
- Unification of **matrix** and **array** objects
- Performance improvements
- New color palletes





# 2020: Microsoft supports R



The screenshot shows the Microsoft R Application Network (MRAN) website. The browser address bar displays <https://mrان.microsoft.com>. The page features a navigation bar with links: Home, About R, Microsoft R Open, R Packages, R Community, and R Tools. A search bar labeled "Find an R Package" is also present. A yellow banner at the top reads "Welcome to MRAN" and "Download Microsoft R Open 4.0.2 now." Below this is a large image of a woman looking at a computer screen with the text: "R is the world's most powerful programming language for statistical computing, machine learning and graphics and has a thriving global community of users, developers and contributors." The main content area is divided into three columns. The first column, titled "Microsoft R Open" with a monkey icon, describes the enhanced distribution of R from Microsoft Corporation, mentioning the current release, Microsoft R Open 4.0.2, and its features. It includes a "Download Now" button. The second column, titled "R Packages" with a gear icon, explains that packages extend R with new functions and data, and lists various applications. It includes an "Explore Packages" button. The third column, titled "CRAN Time Machine" with a calendar icon, states that MRAN hosts daily snapshots of CRAN R packages and R releases as far back as September 17, 2014. It includes a "Browse Snapshots" button.


Microsoft R Application Network

Home About R Microsoft R Open R Packages R Community R Tools

Find an R Package


Welcome to MRAN Download Microsoft R Open 4.0.2 now.

R is the world's most powerful programming language for statistical computing, machine learning and graphics and has a thriving global community of users, developers and contributors.

 **Microsoft R Open**


Microsoft R Open is the enhanced distribution of R from Microsoft Corporation. The current release, Microsoft R Open 4.0.2, is based the statistical language R-4.0.2 and includes additional capabilities for improved performance, reproducibility and platform support.

[Download Now](#)

 **R Packages**

**Packages** extend R with new function and data. Whether you're using R to optimize portfolio, analyze genomic sequences, or to predict component failure times, experts in every domain have made resources, applications and code available for free online.

[Explore Packages](#)

 **CRAN Time Machine**

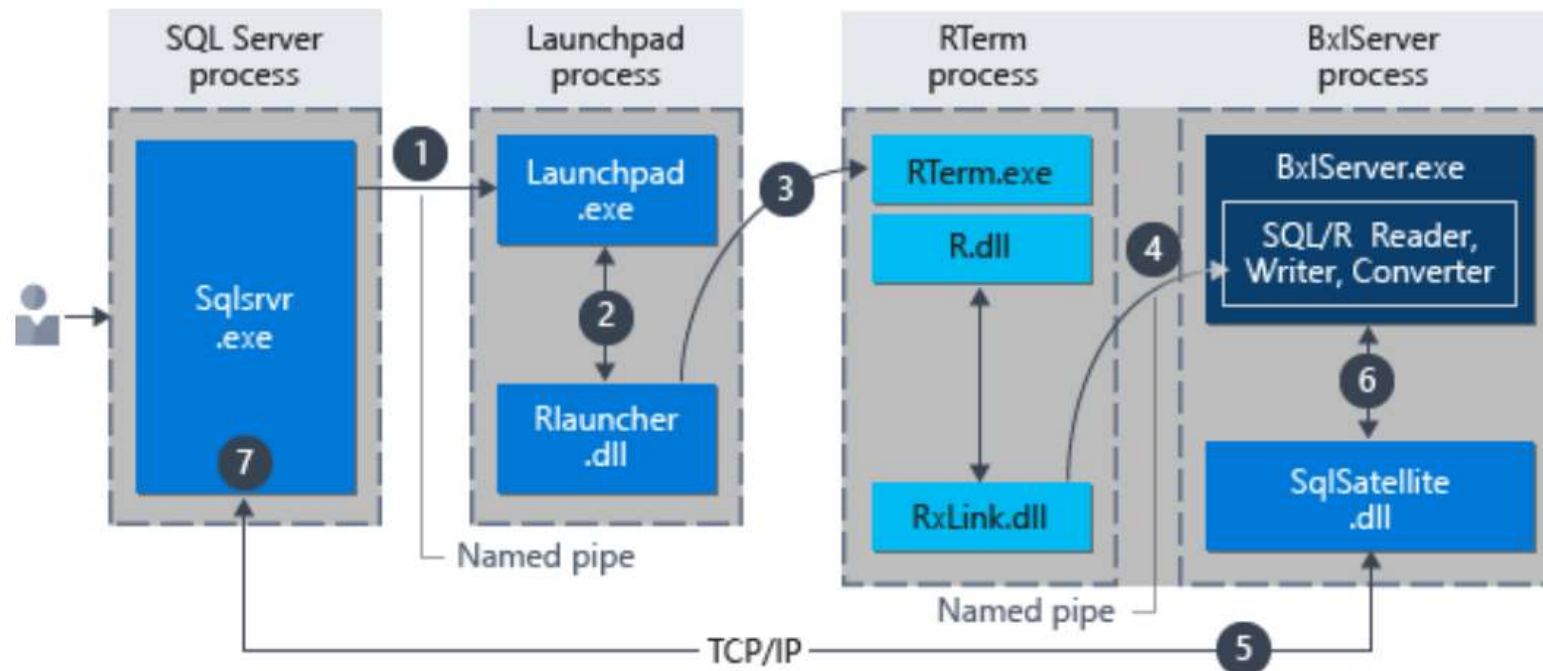
For the purpose of **reproducibility**, MRAN hosts **daily snapshots** of the CRAN R packages and R releases as far back as Sept. 17, 2014.

Use our **Time Machine** to browse CRAN contents from the past.

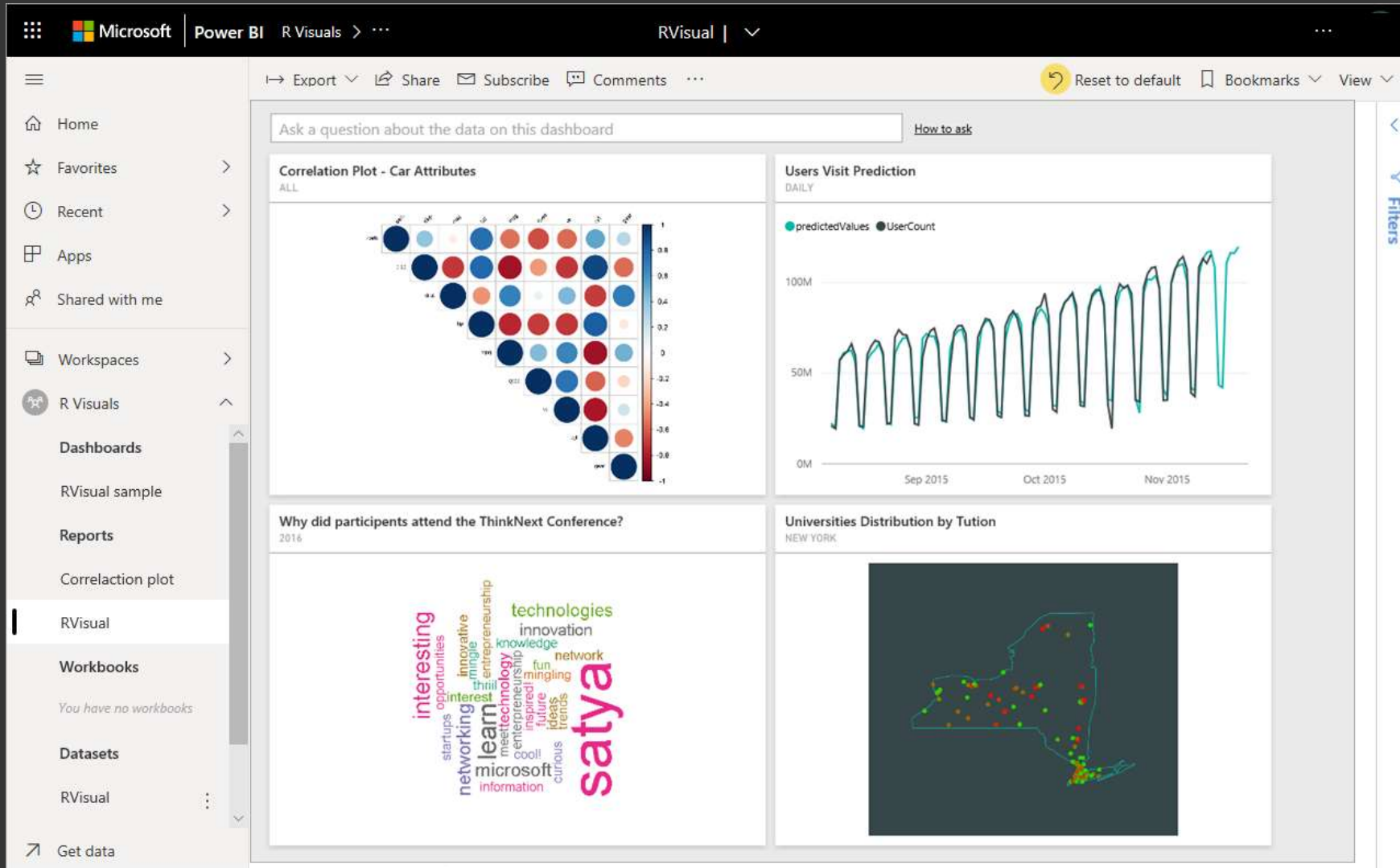
[Browse Snapshots](#)

# R in SQL Server

R code that is run from "inside" SQL Server is executed by calling a stored procedure. Thus, any application that can make a stored procedure call can initiate execution of R code. Thereafter SQL Server manages the execution of R code as summarized in the following diagram.



# R in Power BI



# R in Azure


[aka.ms/R-in-Azure](https://aka.ms/R-in-Azure)

[Azure DataBricks](#)

[Azure HDInsight](#)

[Azure Data Science VM](#)


[Azure ML Service](#)

 Microsoft | Docs Documentation Learn Q&A Code Samples


Azure Product documentation ▾ Architecture ▾ Learn Azure ▾ Develop ▾ Resources ▾

Azure / Architecture / Data Architecture Guide

## R developer's guide to Azure

04/02/2020 • 8 minutes to read •  +8

Many data scientists dealing with ever-increasing volumes of data are looking for ways to harness the power of cloud computing for their analyses. This article provides an overview of the various ways that data scientists can use their existing skills with the [R programming language](#) in Azure.



Microsoft has fully embraced the R programming language as a first-class tool for data scientists. By providing many different options for R developers to run their code in Azure, the company is enabling data scientists to extend their data science workloads into the cloud when tackling large-scale projects.

Let's examine the various options and the most compelling scenarios for each one.

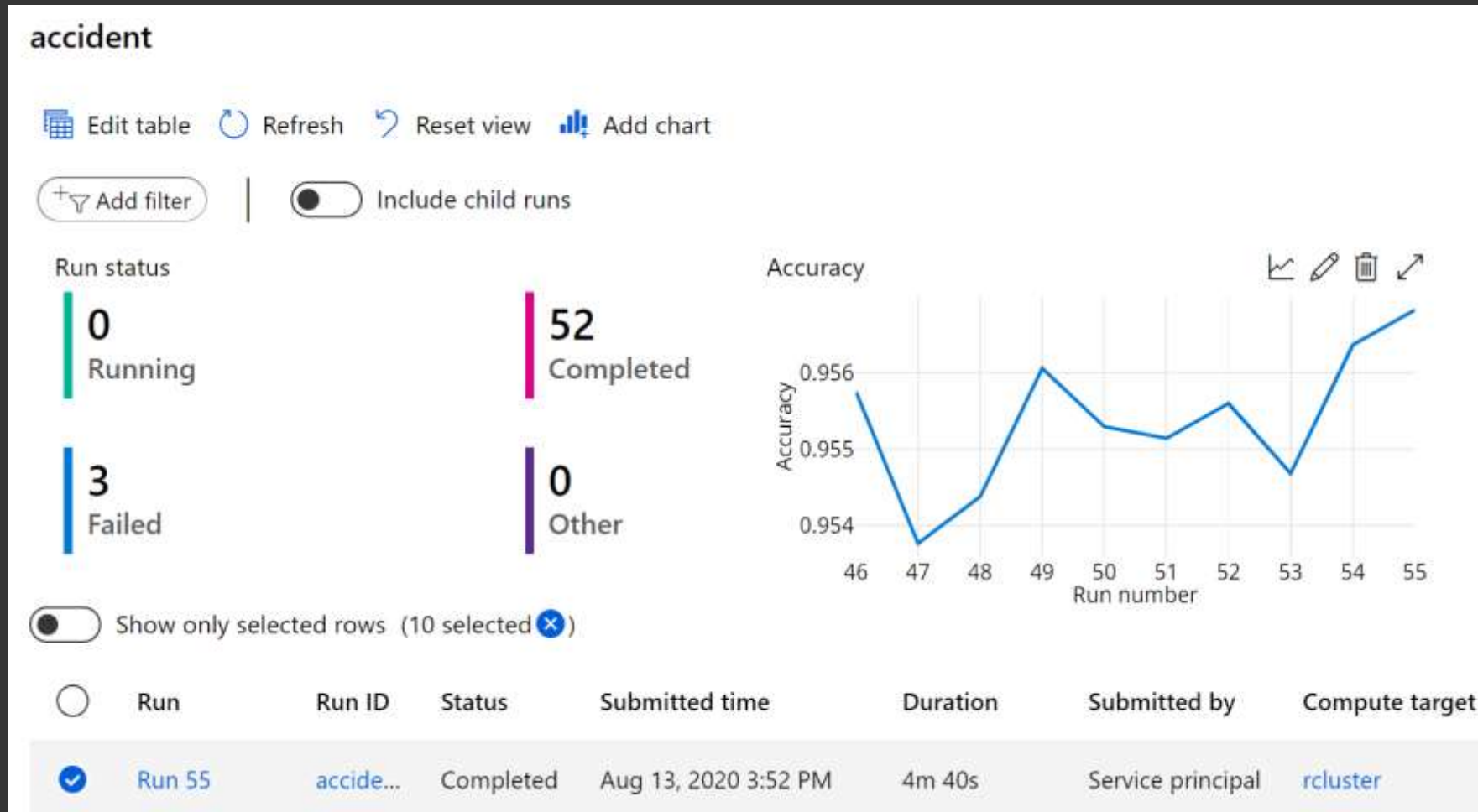
### Azure services with R language support

This article covers the following Azure services that support the R language:

Service	Description
<a href="#">Azure Machine Learning Server</a>	enterprise software for data science, providing R and Python interpreters
<a href="#">Data Science Virtual Machine</a>	a customized VM to use as a data science workstation or as a custom compute target
<a href="#">ML Services on HDInsight</a>	cluster-based system for running R analyses on large datasets across many



# Azure ML Service: MLOPS and GitHub Actions



revodavid / mlops-r-gha

Code Issues Pull requests Actions

All workflows New

Filter workflows

86 results

Event	Status	Branch	Actor
✓ purple bar	Quick Deploy to Shiny #22: Commit a02ba71 pushed by revodavid	3 months ago	32s main
✓ blue bar	Quick Deploy to Shiny #21: Commit 850df0b pushed by revodavid	3 months ago	35s main
✓ purple bar	Quick Deploy to Shiny #20: Commit b083225 pushed by revodavid	3 months ago	30s main



# AzureR: Manage Azure services from R

## AzureRMR



- Lightweight, extensible R6-based interface to *Azure Resource Manager*
- Manage subscriptions and resource groups
- Create, update and delete *resources and templates*
- Work with *role-based access control (RBAC)*

## AzureKeyVault



- Resource Manager and client interface to *Azure Key Vault*
- Secure facility for *passwords, cryptographic keys, certificates, storage account logins*
  - Encrypt and decrypt with keys
  - Sign and verify certificates
  - Rotate storage account access keys

## AzureStor



- Resource manager and client interface to *Azure blob storage, file storage and Data Lake storage gen2*
- List, upload and download files
- Authenticate with access key, SAS or AAD token
- Fast *parallel transfers* for multiple files

## AzureContainers



- Interface to *Azure Container Registry, Azure Container Instances and Azure Kubernetes Service*
- Push and pull images to and from ACR
- Spin up containers with ACI
- Create AKS clusters and *deploy and manage services*

[github.com/Azure/AzureR](https://github.com/Azure/AzureR)

## AzureGraph



- R6-based interface to *Microsoft Graph*
- Emphasis on registered apps and service principals, to support other packages in family
- Can be extended to work with other services in Graph: *SharePoint, OneDrive, Outlook, device management, etc*

## AzureVM



- Flexible, configurable interface to *virtual machines and virtual machine scale sets*
- *Customise your deployment* by virtual network, security rules, IP address, load balancer, and more
- *Prebuilt configurations* for popular Windows and Linux images

## AzureKusto



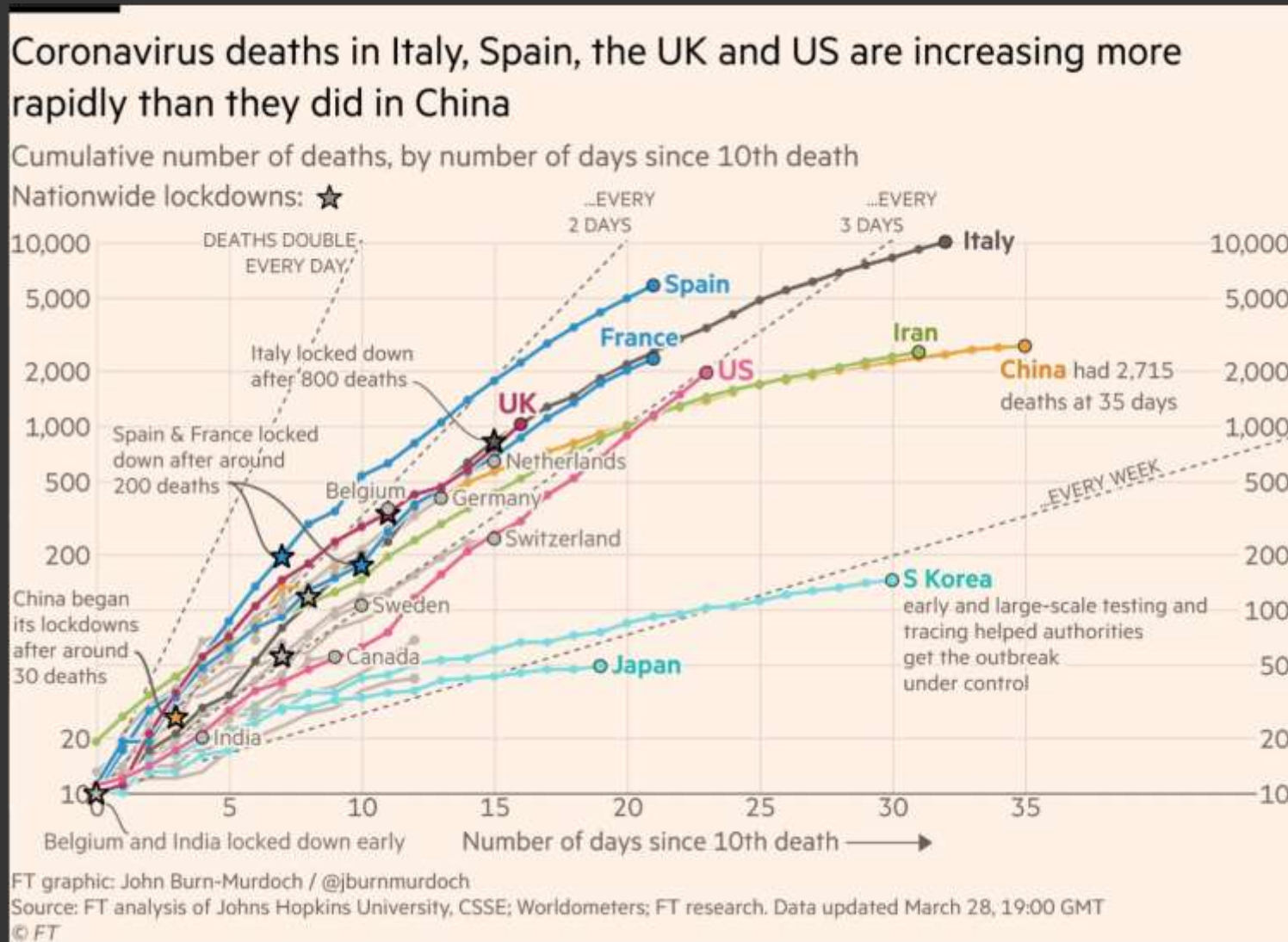
- Resource Manager and client interface to *Azure Data Explorer, aka Kusto*
- Query data using *dplyr and DBI interfaces*
  - Built in the manner of *dbplyr* (delayed execution)
- On control plane side, create and manage database principals

## AzureAuth



- *OAuth* authentication for *Azure Active Directory*
- Supports *multiple authentication flows*: *authorization\_code, device\_code, resource\_owner, client\_credentials*
- Supports AAD v1.0 and v2.0
- Authenticate with password or *private key (certificate)*

# 2020: R in Industry



... and the next 20?



# Thanks to R Core Team members, past and present

Douglas Bates

John Chambers

Peter Dalgaard

Seth Falcon

Robert Gentleman

Kurt Hornik

Stefano Iacus

Ross Ihaka

Tomas Kalibera

Michael Lawrence

Friedrich Leisch

Uwe Ligges

Thomas Lumley

Martin Maechler

Guido Masarotto

Martin Morgan

Duncan Murdoch

Paul Murrell

Martyn Plummer

Brian Ripley

Deepayan Sarkar

Heiner Schwarte

Duncan Temple Lang

Luke Tierney

Simon Urbanek

# Thank you!

Slides, links and credits:  
[github.com/revodavid/20-years-of-R](https://github.com/revodavid/20-years-of-R)



David Smith  
davidsmi@microsoft.com  
@revodavid