Validating R in Biotech-Pharma Industry

BBSW - R User Meetup, Feb 20, 2020

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Agenda

- R Ecosystem
- Definition of Validation in Biotech-Pharma
- Key Components for Validating R

Advantages of Adopting R

Comprehensive Statistics Capabilities

Power of Data Visualization

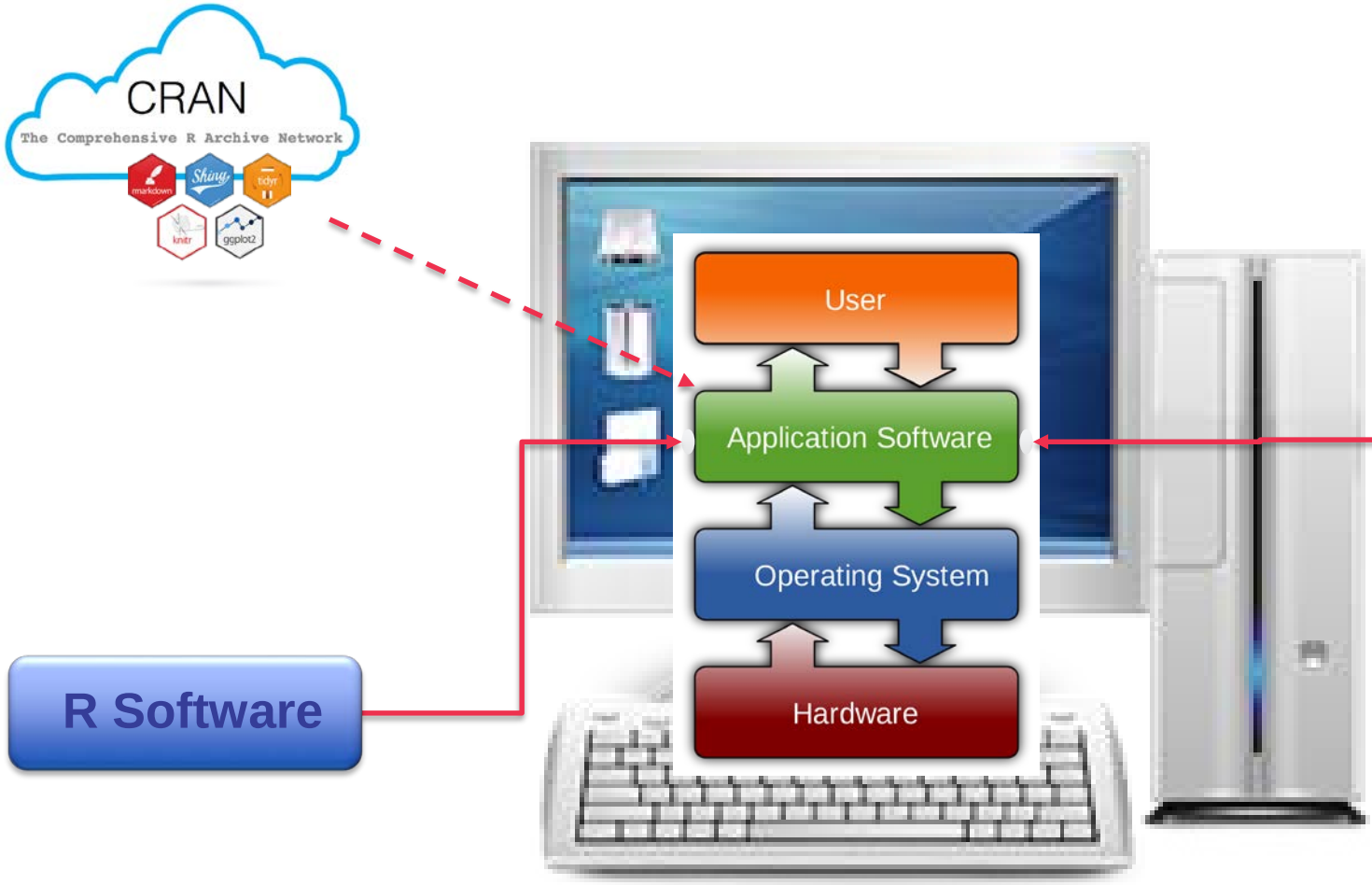
Web Based Applications

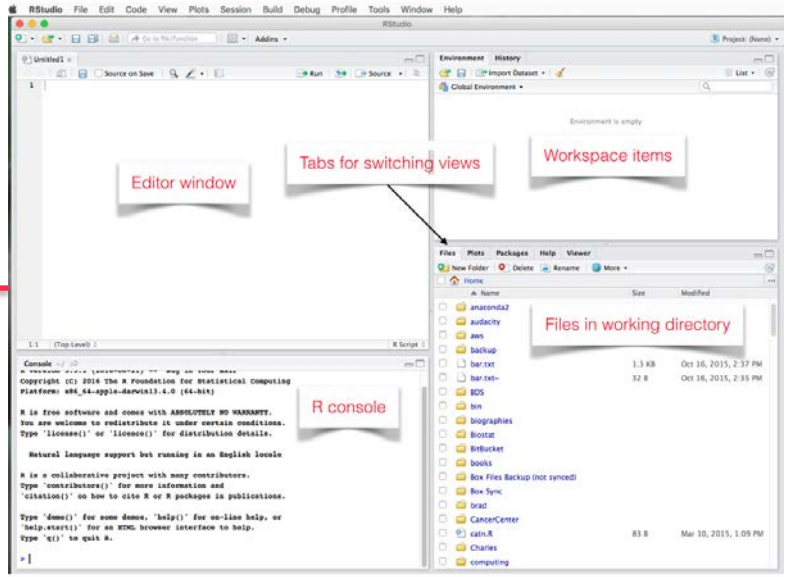
Adoption of New Technologies

Lower Cost

R Ecosystem

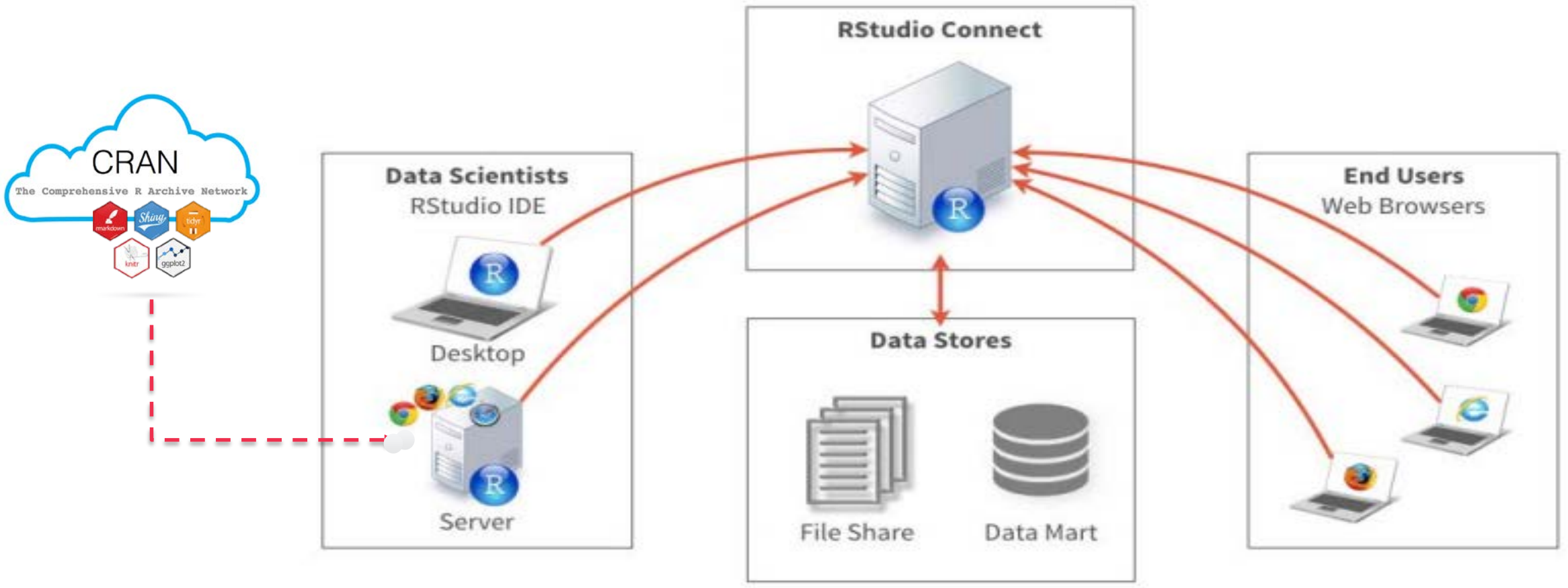
R Software – PC Based Setting





IDE (e.g. RStudio)

R Platform – Sever Based Setting



R Ecosystem

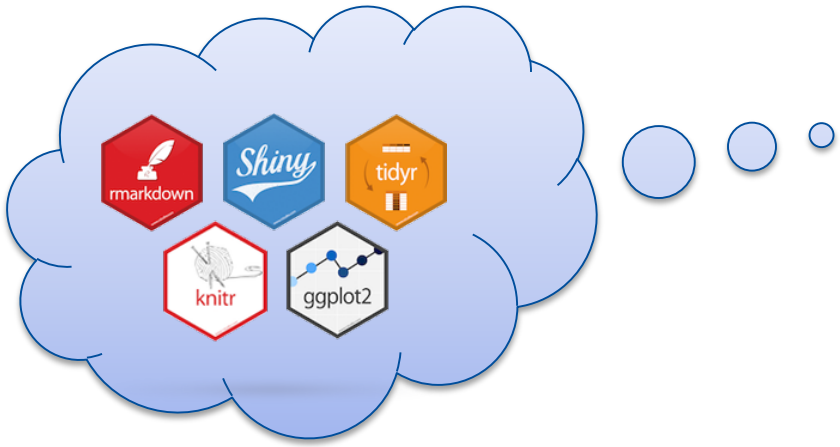
CRAN

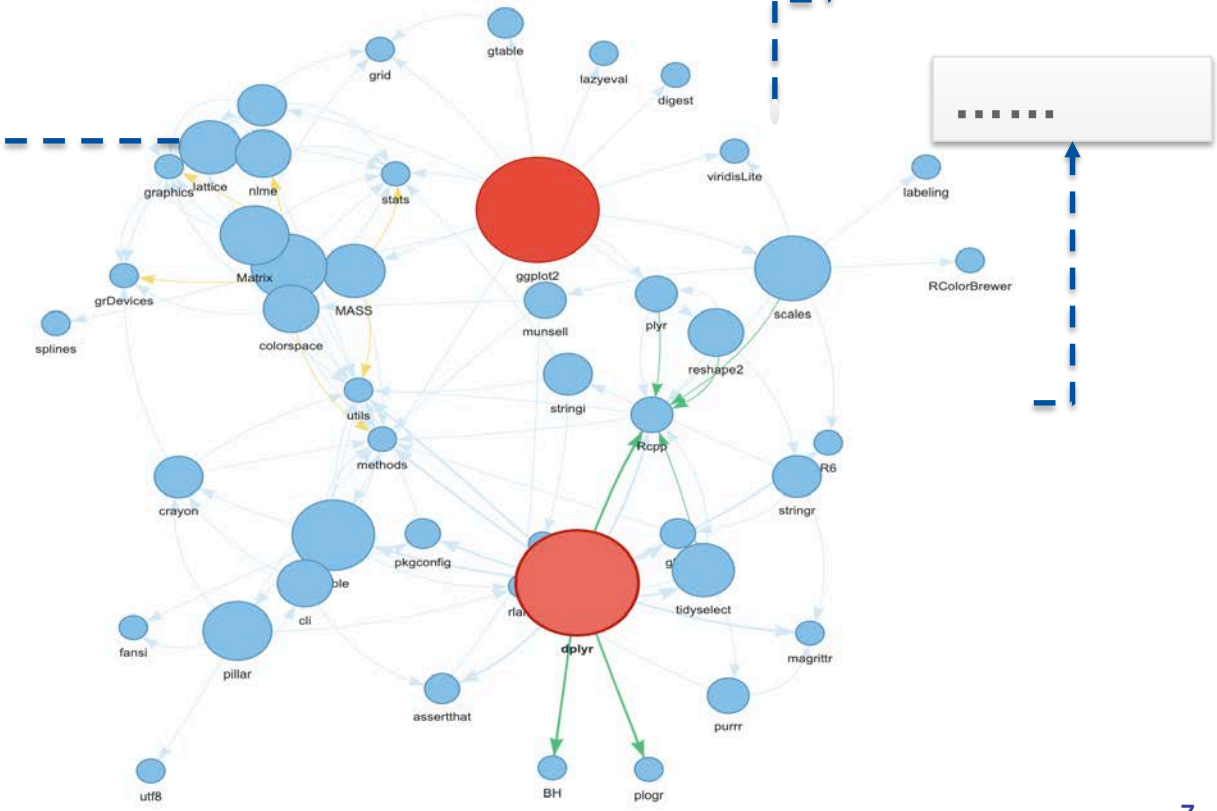
The Comprehensive R Archive Network

GitHub

Bioconductor

OPEN SOURCE SOFTWARE FOR BIOINFORMATICS





Validating R can be a daunting task!

VALIDATION IN BIOTECH-PHARMA

Computerized System Validation (CSV)

- **21 CFR Part 11 Requirement** [1,2]
  - Part 11 (Electronic Records, Electronic Signatures), is widely applicable to general software development in the pharmaceutical industry
- **System Risk Assessment: ISPE GAMP5** [3]
  - Determine GAMP category
  - System risks on product, patient safety, regulatory and data impact
- **System Qualifications** [3,4,5]
  - IQ (Installation Qualification)
  - OQ (Operational Qualification)
  - PQ (Process/Product Performance Qualification)

Validation – FDA Definition [5]

Establishing **documented evidence** which provides a high degree of **assurance** that specific process will **consistently** produce a product meeting its **predetermined specifications** and quality attributes.

- Accurate: **meeting its predetermined specifications**
- Reproducible: **consistently produce a product**
- Traceable: **documented evidence**

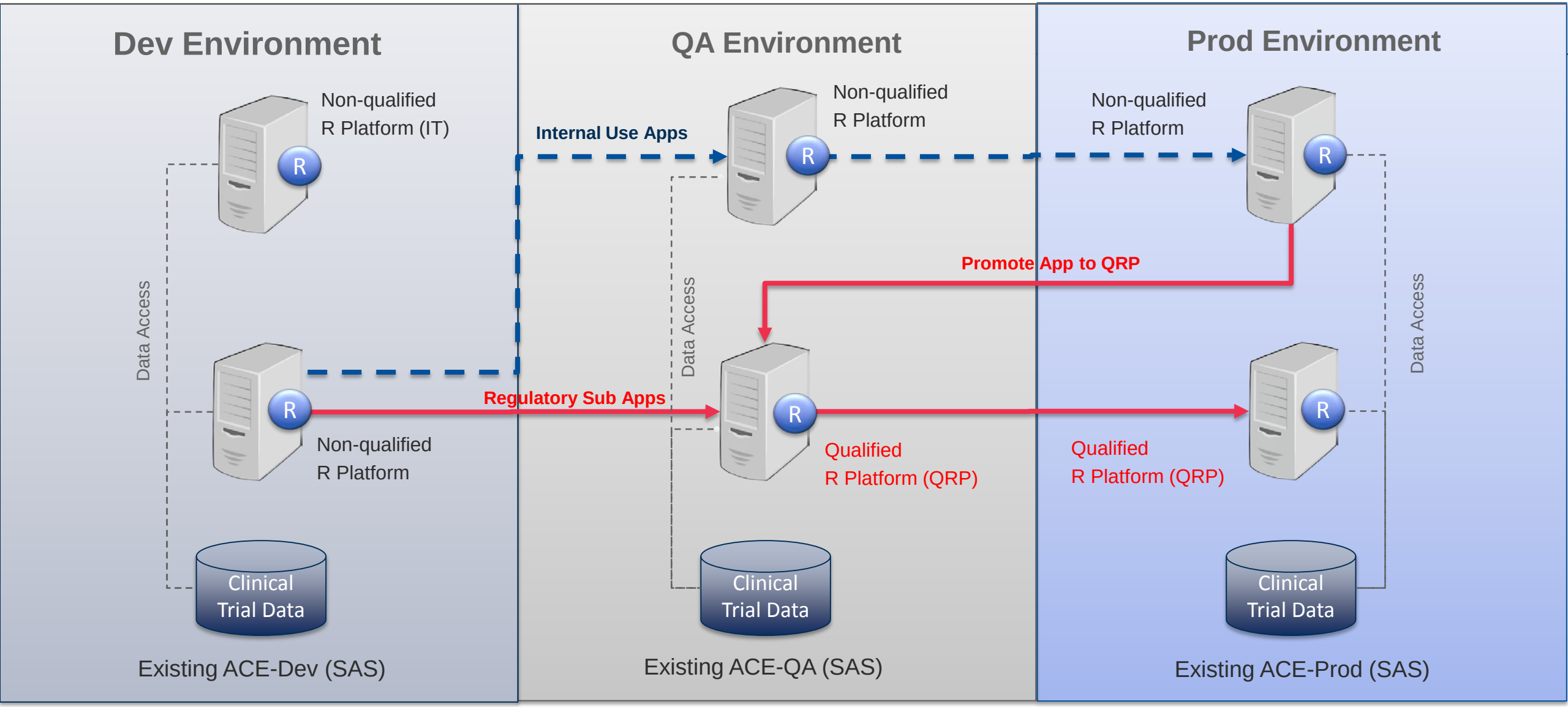
↳ **a high degree of assurance**: confidence on your product

KEY COMPONENTS FOR VALIDATING R

R System Setup (Major Points)

- Qualified vs. non-qualified system
- Analysis computing environment: DEV, QA, PROD
- Security and data access (user management)
- Source code control system (version control)
- Software installation (patch, version upgrade, etc.)
- Backup and disaster recovery (hardware or OS update)
- Process and documentations (SOPs, WIs, etc.)

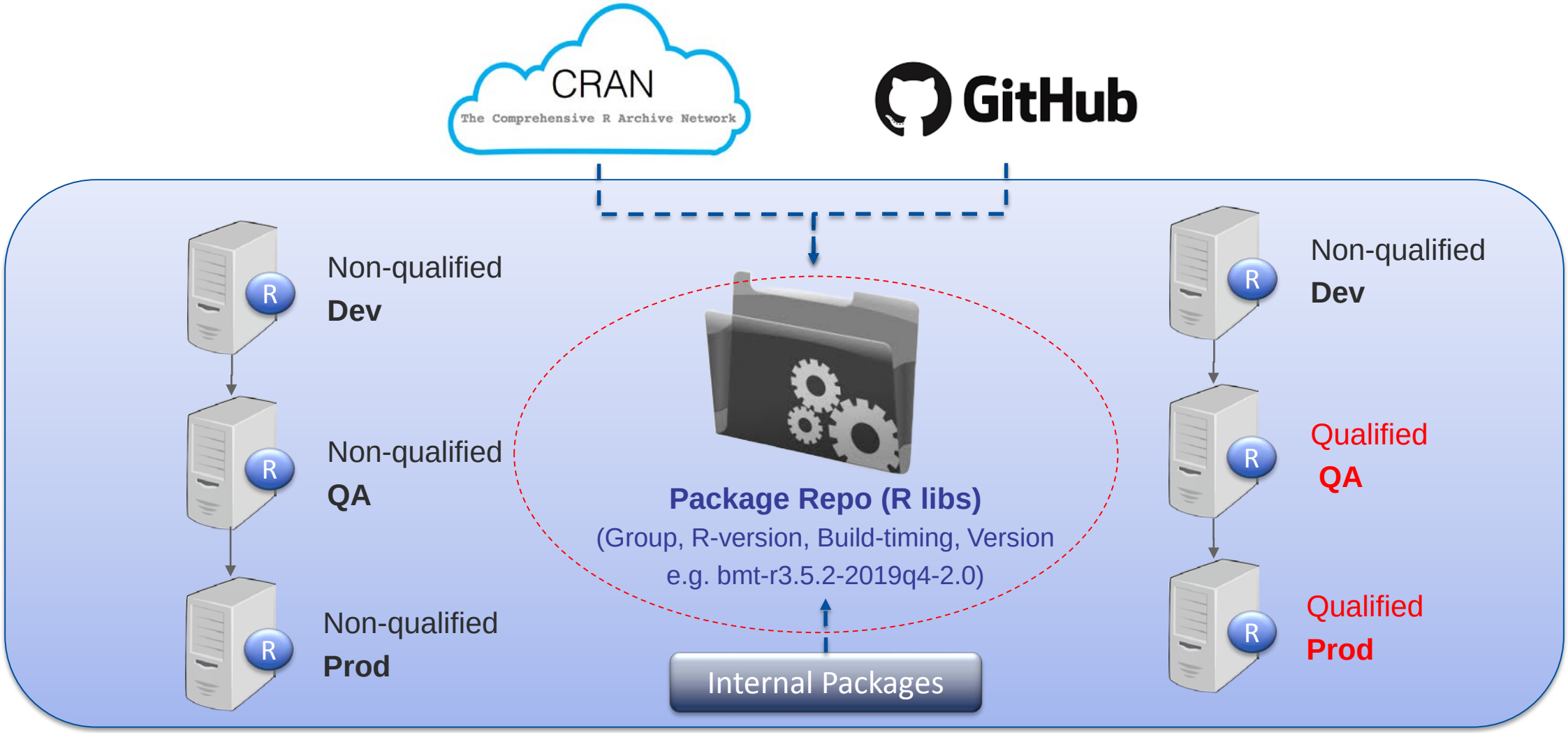
R Platform Setup at BioMarin



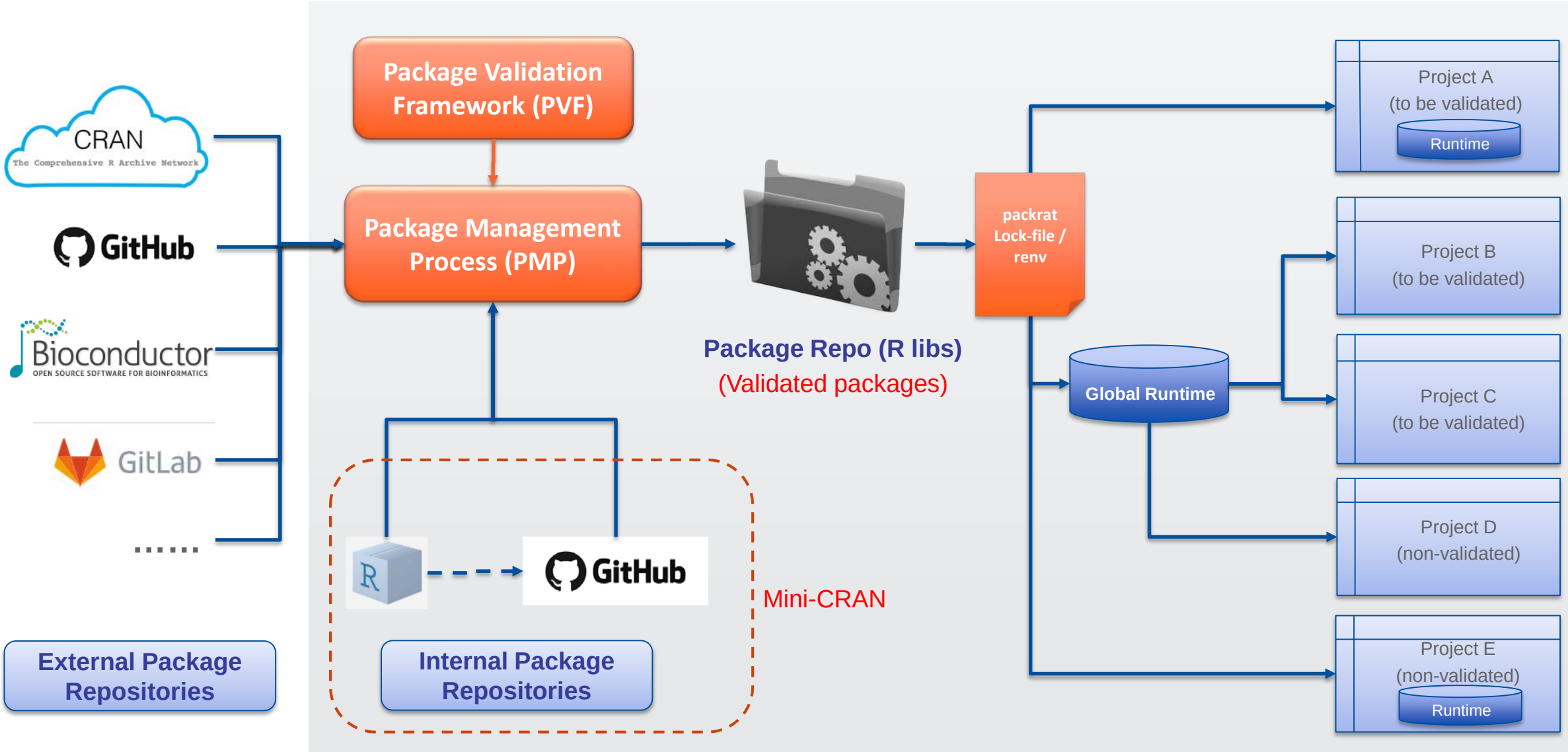
Key Components for Package Validation: PMP and PVF

- **Package Management Process (PMP)**
  - Project based package management
- **Package Validation Framework (PVF)**
  - Spec-driven, risk-based, expandable, automated approach

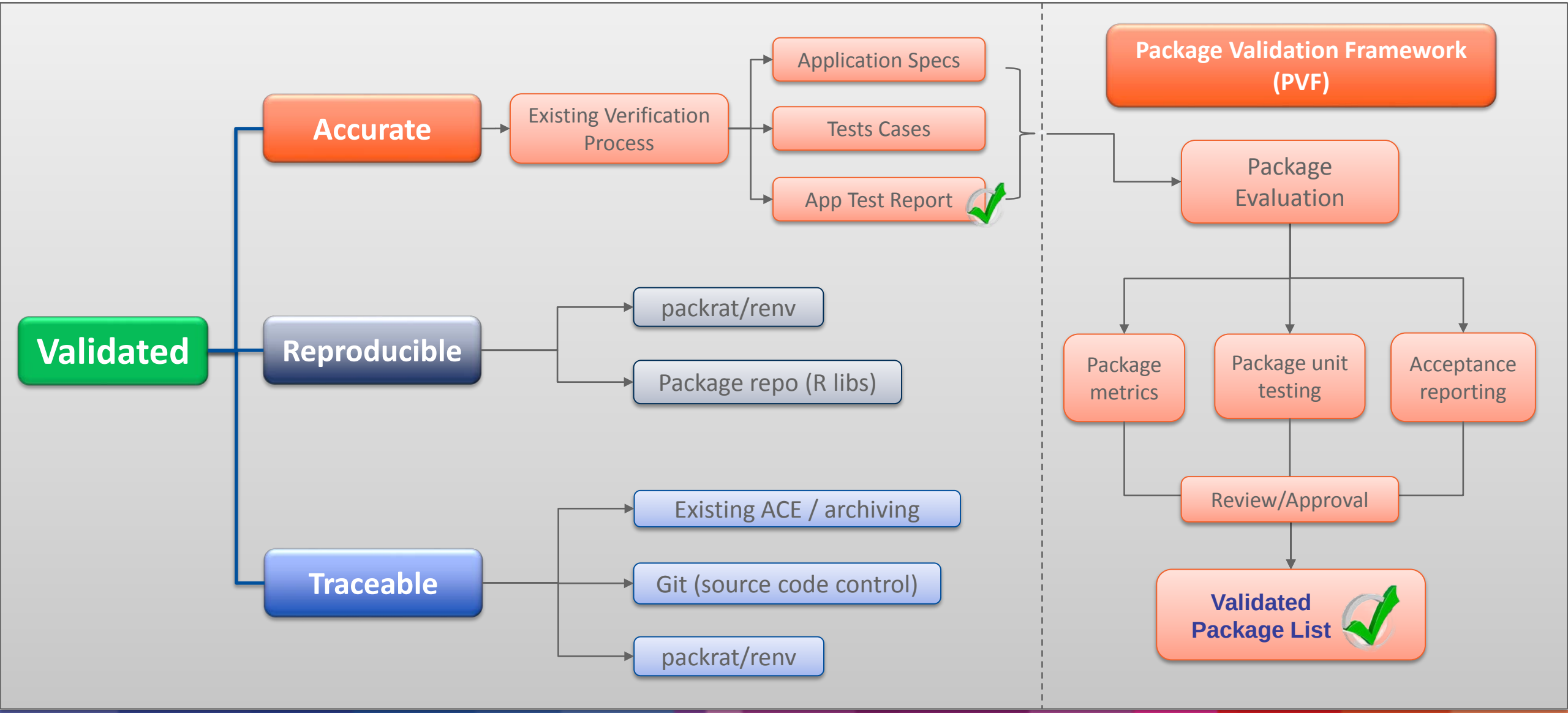
Package Repository (R Libraries)



Package Management Process (PMP)



Package Validation Framework (PVF)



Where Are We on Adopting R at BioMarin?

- Data visualization application homepage
- R-Shiny apps (Study Data Viewer, SQM Reporter, Generic Tools, etc.)
- Comprehensive Patient Profiler (outputs submitted in a BLA)

Takeaways

- Biotech-Pharma can take many advantages of R for clinical trial data analysis and reporting, such as data visualization
- Validating R is extremely challenging in regulated setting, but it's feasible with appropriate system infrastructure and process setup
- Through collaboration, R validation can be achieved and benefited by the R user community in Biotech-Pharma industry

References

1. FDA: 21 CFR Part 11 (1997)
2. FDA: Guidance for Industry: Part 11, Electronic Records; Electronic Signatures – Scope and Application (2003)
3. ISPE, GAMP 5: A Risk-Based Approach to Compliant GxP Computerized Systems (2008)
4. FDA: General Principles of Software Validation: Final Guidance for Industry and FDA Staff (2002)
5. FDA: Glossary Of Computerized System and Software Development Terminology (1995)

THANK YOU

BIOMARIN