Using Qt for GUI Tasks and Graphics in R

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R and Qt

- **R**: primarily command-line (Read-eval-print loop)
  - Allows GUI front-ends to embed **R**
  - Facilitates bindings to external libraries; e.g.
    - libxml, *tcltk*, *RGtk2*
- **Qt**: powerful C++ Application and UI framework
  - Mature, cross-platform, high-performance
  - Latest release (Qt 4.5) is GPL/LGPL on all platforms
  - Good candidate for binding to R
Focus areas

- Improve access to \( R \) documentation
  - Difficult to search (Java search engine?)
  - Inaccessible when \( R \) is running
  - Multiple matches not handled gracefully
  - \( S4 \) method documentation hard to find

- Enable Qt GUI programming
  - Beneficial for many problems
    - e.g., domain-specific GUI, graphical debugger
  - Should be accessible to \( R \) programmers

- Graphics (both static and dynamic)
  - \( R \) graphics powerful for static graphics, but slow (grid!)
  - Not designed for dynamic manipulation
• **RK Ward**: Qt/KDE based front-end embedding *R*
• **RQt**
  • Proof-of-concept Omegahat project (Duncan Temple Lang)
  • Long-term focus on automatic generation of bindings
• **qtinterfaces**
  • Recently registered R-forge project
  • Initial developers:
    Deepayan Sarkar, Michael Lawrence, Hadley Wickham
• Goal:
  
  *Create a coherent collection of R packages that provide an interface to the Qt application and UI framework, with a focus on enabling GUI development and advanced graphics.*
Some Demos

- Using Qt Assistant to view R documentation
- “Object viewer” with applications
- An \texttt{R} graphics device implemented using Qt’s Graphics/View framework
- Mosaiq: a high-level graphics system not unlike lattice, but completely independent of the R graphics engine.
- RGtk2 driving a dynamic Qt view
Qt Assistant

- Standalone Qt library documentation viewer
- Can also be used as viewer for third-party static HTML files
  - Requires preprocessing (add keywords, register, compile)
  - Once processed, much more powerful help interface than anything R has
- *But*, R documentation is dynamic!
- Incompatible models, but we can get snapshots, almost as useful
Qt GUI programming

- Creation and memory management of widgets and other Qt objects (as external pointers)
- Manipulate these objects using R functions
- Connect Qt signals to arbitrary R functions
- Examples:
  - “Object viewer” with applications
  - Data import wizard
Based on the Scene Graph model; supports layers and layouts

Fast implementation of low-level drawing
- Custom OpenGL layer
- Default Qt abstraction (output to PDF, SVG, pixmap, etc.)

Callbacks for painting and events (everything happens in R)

Examples:
- R graphics device based on a scene graph
- Mosaiq: a high-level graphics system similar to lattice
An animated tour

• Contributed by Hadley and Bei Bei
• An RGtk2 GUI control driving a Qt canvas