



#### **CONTEXT**



#### Context

 Mango are speaking with an increasing number of customers who would like to convert their existing S+ application into an R equivalent



## Why Convert an S+ Application to R?

We have seen three primary drivers for change:

- Long term cost reduction (S+ licenses)
- Incompatibility of S+ version with new OS
- Withdrawal of Support
- Wider uptake of R in industry

Clearly R is a natural choice as a replacement for S+



#### Aim

 To provide a high level overview of the considerations for converting an S+ application to R



## Agenda

- Context
- Considerations
- Menu System
- Code Conversion
- Validation and Testing



#### **CONSIDERATIONS**



## This is Easy, Right?

Some (true?) statements:

- R can be considered as a different implementation of S
- There are some important differences, but much code written for S runs unaltered under R

Discuss...

Source: www.r-project.org



#### Considerations

S+ applications can generally be split into two pieces:

- An underlying library of code
- A set of functions defining the menu system and help pages



## Case Study

Multinational confectionary, food and drinks company

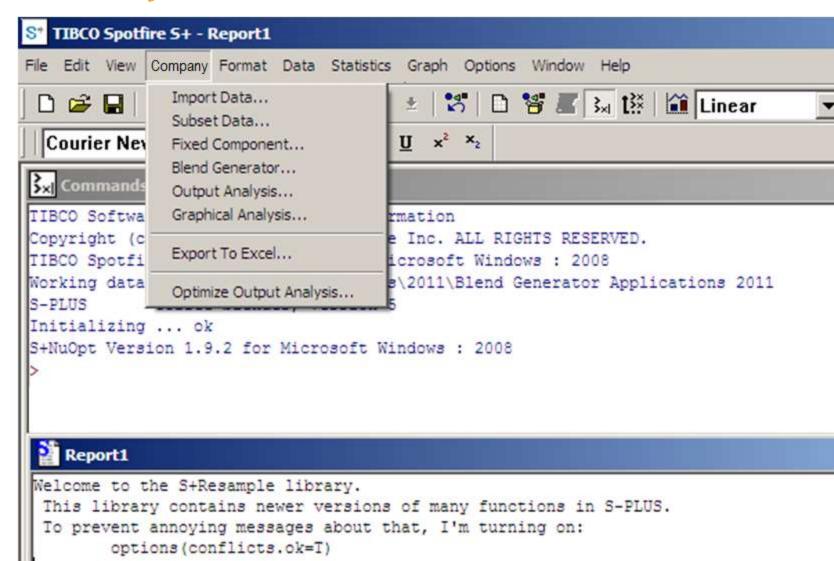
- Existing S+ application consisting of an integrated menu and some analysis code
- S+ libraries consisting of 7,000+ lines of S code spread over 80 functions
- After removing those functions relating to the menu and help files, only around 3,000 lines of code remained



#### MENU SYSTEM



### S+ Menu System



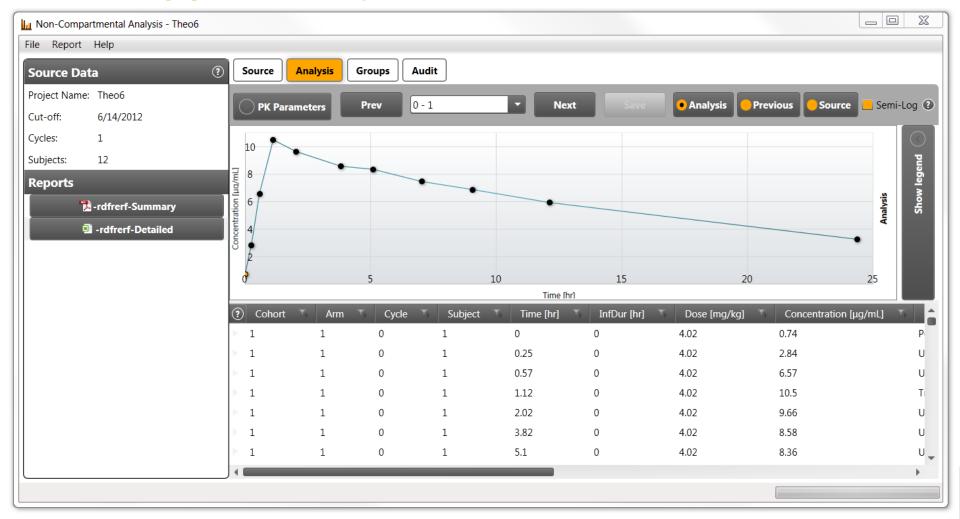


## Menu System Opportunities

- S+ Applications tend to be integrated into the S+ GUI
- R systems can be also be integrated but require new code
- The move to R represents an opportunity to hide the R GUI



## An Opportunity to Hide R





## An Opportunity to Hide R

- Hiding R can improve user acceptance amongst nontechnical colleagues
- It can also improve the visual appeal of the system



#### Menu Choices

#### Some R/R-based technologies:

- tcltk is R's 'recommended' menu builder
- Glade, RGtk2
- gWidgets
- rpanel
- Deducer
- manipulate (Rstudio)

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#### Menu Choices

#### Other options:

- Choice is almost limitless
- Often they require a knowledge of other languages such as Java or C
- Possibly warrants a standalone talk...



#### **CODE CONVERSION**



### Approach

There are essentially two approaches to code conversion:

- Direct Conversion
- Test-based Conversion



#### **Direct Conversion**

- Requires knowledge of both languages (stdev vs sd)
- Relatively quick to achieve
- Difficult to prove the new code does what the old code did



#### **Test-based Conversion**

- Generating unit tests in S+ requires some S+ knowledge
- Takes some time to generate and document tests but better in the long-run
- Unit tests give a definitive PASS/FAIL result
- Can often be automated



## Code Conversion Challenges

- The application upgrade usually coincides with an operating system upgrade
- Windows (or other) version and R version need to be determined in advance
- It is almost guaranteed that the new system will produce different results for the same test data!



#### What is "different"?

- Often this is simply rounding
  - Still require agreement on precision: 0.049782 vs 0.050436
- If simulation is involved this can be VERY difficult to define!!!
- Appearance of graphics may also differ
  - Usually less of an issue



## Other Challenges

As the business owner I want to use the opportunity to improve the application:

- New menu items
- New functionality
- Modifications to existing functionality

All of these require careful planning



### **VALIDATION AND TESTING**



# Validation and Testing

- This is not exciting!
- When we use an application, we assume it has been "tested" and hope/require that it has been "validated"
- But what does this really mean?



#### **Validation**

#### What is validation?

- Design Qualification
- Installation Qualification
- Operational Qualification
- Performance Qualification
- A lengthy documentation exercise



# System Testing

- Unit tests check individual pieces of code
- A system is made up of many pieces
- We need to ensure it has been pieced together correctly!



## System Testing

#### Requires:

- Patience
- An independent tester/test team
- Planning
- More documentation!!!



# System Testing

#### Recommended:

- An automated build system
  - Hudson, Jenkins
- Bug reporting system



## Summary

- Converting an S+ application requires careful planning
- It presents an opportunity to make improvements
- Validation and independent testing are key to a successful migration



#### Questions