

# Innovate2011

The Rational Software Conference

11th and 12th of October

Let's **build** a smarter planet.



## Use of IBM Rhapsody for design of an automotive wheel motor

**Richard Burke**

**Development Manager (Software & Electronics)**

**Protean Electric Limited**



# Protean Electric

- **Founded about 2 ½ years ago**
- **100% owned by venture capitalists (Oak Investment Partners)**
- **Developing in-wheel motors for automotive applications**
- **Low volume prototypes running on several different types of vehicle**
- **Now developing production intent design**



# The Product and Applications

- 1000Nm torque
- 2000 RPM top speed (~145 mph)
- 0-60 mph in 5 seconds (Volvo)
- Regenerative braking



# Software Tool-chain

## Includes:

- Reqtify (related to Rhapsody Gateway – requirements management)
- IBM Rhapsody Architect for Software (SysML and UML)
- Simulink (modelling)
- Embedded Coder (auto-generation of code from Simulink)
- Subversion (open source configuration management)
- PushOK plugin (to provide Subversion interface in Rhapsody)



# The Challenges – Functional Safety

- **ISO 26262 (New Automotive Functional Safety Standard)**
  - Based on IEC 61508
- **Wheel motor is ASIL D (highest level of safety criticality in the standard)**
- **Traceability of requirements to design & implementation**
- **Testing & Review**
- **The standard highly recommends semi-formal design notations**
- **Must be able to detect and act on fault conditions**



# The Challenges – Software Design

- Integration of tools
- Fast control loop (runs every 62.5  $\mu$ s)
- Applying OO principles to C code
- No RTOS
- MISRA guidelines
- Traceability of requirements to source code
- Consideration of possible failure scenarios



# Use of IBM Rhapsody

- **Import requirements from Reqtify**
- **Limited subset of diagrams**
  - Use case diagrams (to aid understanding, not for requirements)
  - Sequence diagrams
  - State diagrams
  - Class diagrams
  - Object diagrams
- **Configuration of stereotypes to limit complexity of design and keep developers focussed on design rather than the tool**



# How Rhapsody helps us

- **SysML for system design activities**
- **UML helps team to speak the same language and visualise scenarios that would be difficult to describe in words**
- **Good traceability from requirements to code**
- **Earlier identification of the difficult parts of the design**
- **Strong reverse-engineering and round-tripping capabilities**
  - Working prototype can be analysed to see where reuse is possible
- **Good support network (training, forums, help desk)**

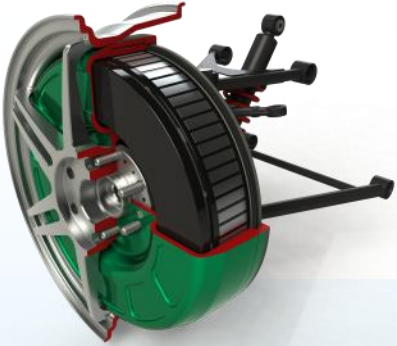




# Open Issues

- **Tool Configuration**
  - Setting up of stereotypes
  - Configuration of code centric scheme
  - Level of configuration control of model
  - Integration with Simulink
- **Requirements change control**
  - Impact on a developed model





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## MBSE in Telecommunications

**Chris Noble**

Alcatel-Lucent – Multi Generation Radio – Systems Engineering



Alcatel-Lucent



# Introduction

- **Alcatel-Lucent – Multi Generation Radio – Systems Engineering**
- **MGR SE includes: GSM, CDMA, W-CDMA, & LTE**
- **Introduced Model Based System Engineering (MBSE)**
- **Toolset:**
  - Rational Rhapsody to capture System Model
  - Rational Team Concert for Collaboration and Configuration Management

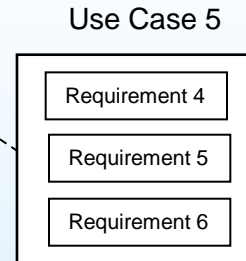
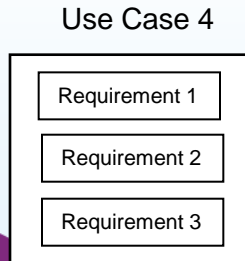
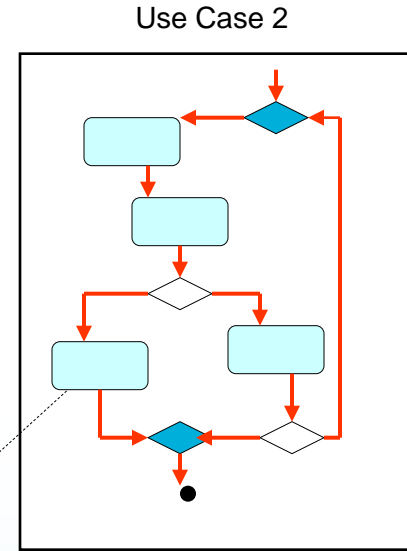
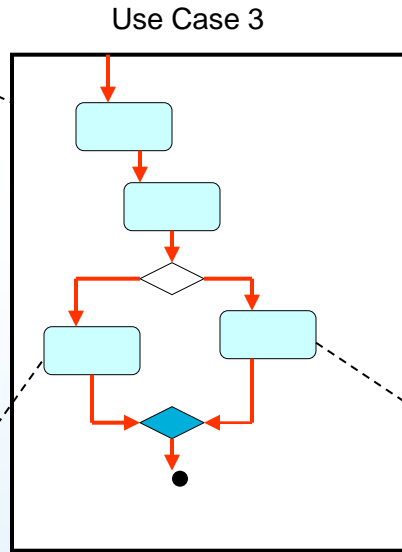
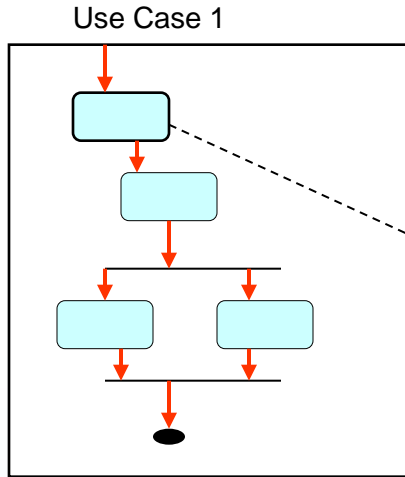


# Model Structure

- **Organised by Use Case**
- **Many levels of Use Case hierarchy**
- **Limited UML diagram usage**
- **Use cases specified mainly by Activities or Requirements supplemented with Sequence diagrams**
- **Using Activities promotes full elaboration, abstraction, reuse and provides strong traceability**



# Activities Hierarchy

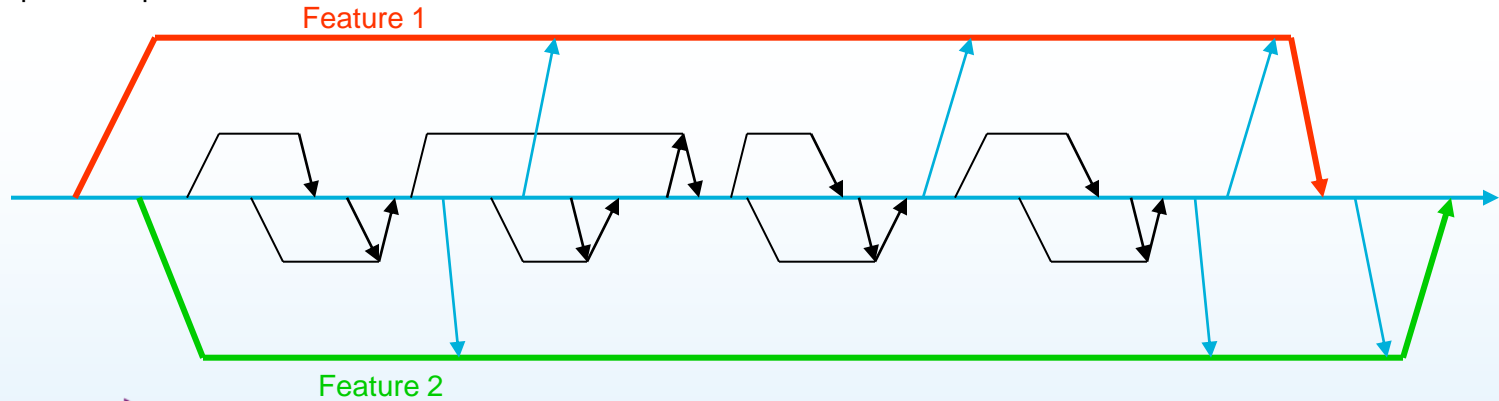


# Collaboration



- **Integration of Rhapsody within Team Concert provides excellent collaboration for parallel retrospective system model creation and feature working.**

Retrospective Updates



# Configuration Management



- **Several toolset capabilities support the configuration management within this complex stream structure**
- Using RTC Work Items and the history capabilities of RTC allows full feature traceability without explicit tagging
- Auto resolve feature of RTC reduces the need for manual merge
- Graphical merge within Rhapsody DiffMerge allows manual merging of Activity diagrams when necessary
- RTC 'Change Flow Target' capability allows easy merging between streams
- RTC ability to compare streams allows feature interaction analysis





# Toolset Addition – Design Manager

- **Significant issue with current toolset is limited access to the model for wider stakeholders (without RTC and Rhapsody access)**
- **Review and wider distribution has to be via model output to Documents or HTML which loses one of the major tool benefits – navigation.**
- **Looking to trial Rational Design Manager to allow wider access via web browsing to the system model.**
- **This should reduce the need for documents and make the process more model centric**





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## Smarter Development in medical devices

**Sean Morley**  
**Senior Manager- Advanced Engineering and**  
**Software Engineering Manager**

Elekta



# Introduction



Elekta is a global human care company pioneering significant innovations and clinical solutions for treating cancer and brain disorders.



## *We care for life*

Elekta's mission is to enhance patient and customer value by providing solutions that improve, prolong and save lives.

Sean Morley  
Senior Manager – Advance Engineering

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 Software. Everyware.

# What we wanted to achieve

Transform Software Engineering such that we:

- Can hold to a committed release date
- Produce safe and effective products
- Increase team productivity
- Reduce risk early
- Are flexible to changing business needs
- Clearly monitor and report progress
- Break the mythical man month
- Change the culture

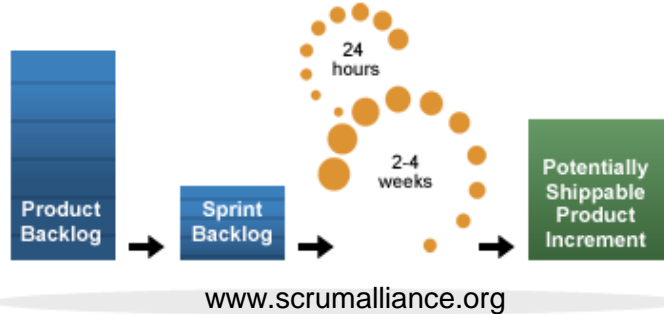
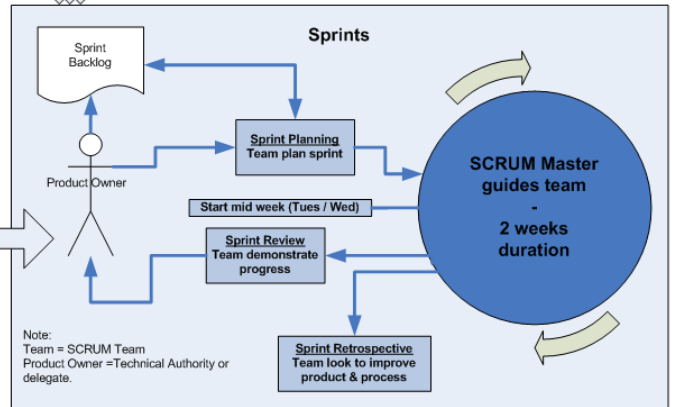
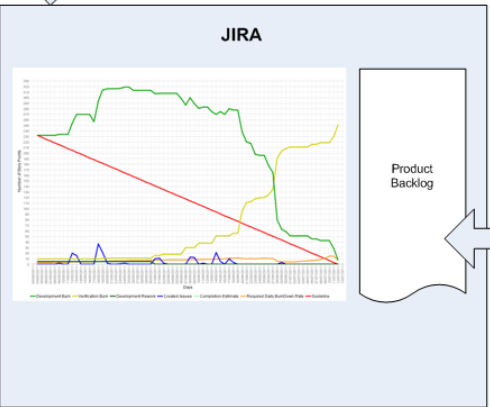
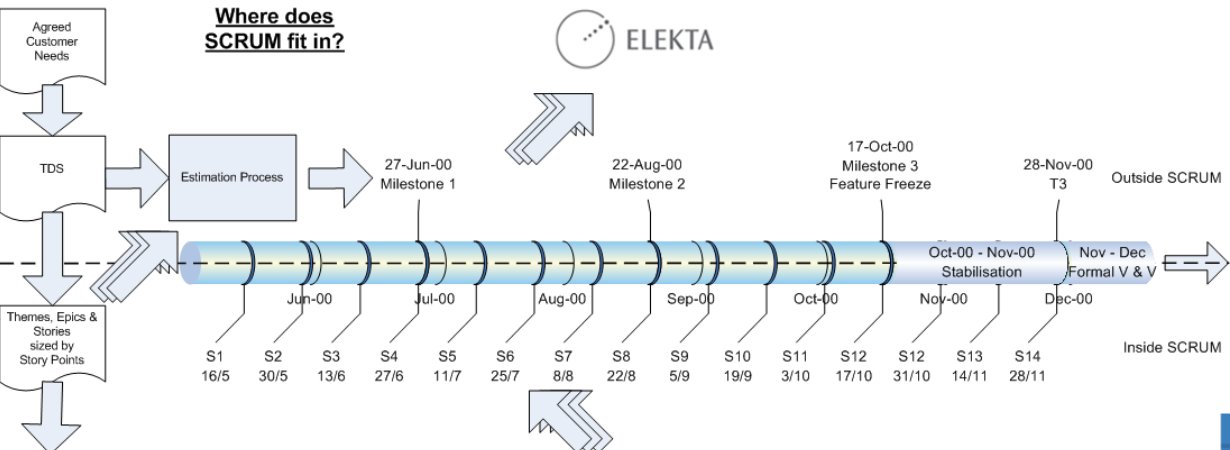
Chose to introduce Agile Software Development using the Scrum methodology



# What is Scrum



## Where does SCRUM fit in?

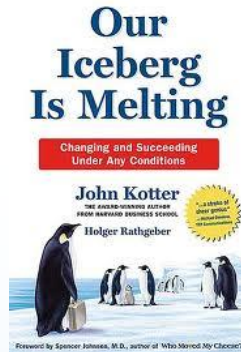


# What people said about Scrum

**It will not work in our regulated environment!**

**Senior management will never get it!**

**We can not break our work down enough!**



**Our tools and processes do not support it!**

**Testing does not fit!**

**We have always done it this way, why change!**



# How did we do – initial results



What we wanted	Where we are
Hold to a committed release date	Were slipping a month every two, but have now held steady for 6 months
Produce safe and effective products	Have yet to release but are performing the analysis and testing much earlier than usual
Increase team productivity	Output has doubled and is getting better all the time
Reduce risk early	Dynamic performance testing done early exposing areas of concern
Are flexible to changing business needs	Are able to add, remove and move features as external pressures require
Clearly monitor and report progress	Have regular checkpoints that produce charts and metrics, improving confidence
Change the culture	People have forgotten the initial concerns – see next slide
Break the mythical man month	People have been successfully added from a number of sources, through a Scrum of Scrums



# What people are saying & doing now

**Moving commitments  
and meetings away  
from sprint changeover**

**Regulatory and  
compliance work  
getting equal priority to  
development tasks**

**Refusing to do work not  
allocated to the sprint**

**Feeling pressure to  
complete something  
every 2 weeks**

**Testing changes as  
early as possible**

**VP heard a Software  
Engineer talking about  
delivery schedules at lunch**

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# Retrospective



## What went well 😊

- Employed consultants in the new tools and processes
- Produced a one day Scrum awareness training and placed all people who needed to know on it
- Made a tester a Scrum Master

## What did not go so well 😞

- Do not roll out agile on the largest most business critical project for many years, practise on a small project
- Select a toolset that integrates nicely
- Find a workflow tool that has good built in time and people management facilities

A journey of a thousand miles  
begins with a single step.

Lao Tzu, 604 BC





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