

Evolution of testing strategies for verification of new features in 3G Networks

SoftTest AGM

Thursday, 6th November 2008

Michael Monaghan



Overview of LM Ericsson (Ireland)

- Operating in Ireland since 1957
- Around 1600 employees, 3 sites (Athlone, Dun Laoghaire, Clonskeagh)
- 3 Main Activities
 - Sales & Support to local Customers
 - Sales, delivery and customer support for the Irish Market
 - Global Service Delivery Centre
 - Complements Market Unit services
 - Systems Integration, Education, Network & Technology Consulting, Business Consulting, Managed Services and Solutions & Performance Management
 - Research & Development
 - Product Development Unit OSS, Operator Support for 2G, 3G Systems
 - **Radio Access and Control (RAC), 3G (RNC) Development**

Feature Verification in 3G Networks

- The scenario
 - Very complex systems
 - Very complex features
 - Very difficult to recreate real world environment
 - Many levels of test from block test to complex network test
 - Many tools needed

- The aim
 - To verify that features behave as specified
 - To make a quality statement about new features, so a decision can be made about whether to release them
 - To satisfy TTM and cost goals for the feature

© Ericsson AB 2008

SoftTest AGM

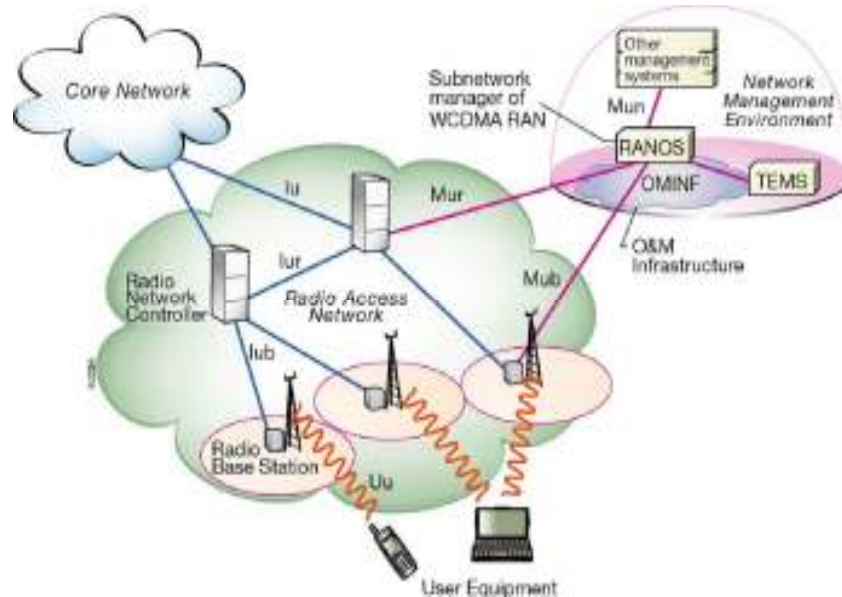
3

Michael Monaghan

2008-11-06



Feature Verification in 3G Networks



© Ericsson AB 2008

SoftTest AGM

4

Michael Monaghan

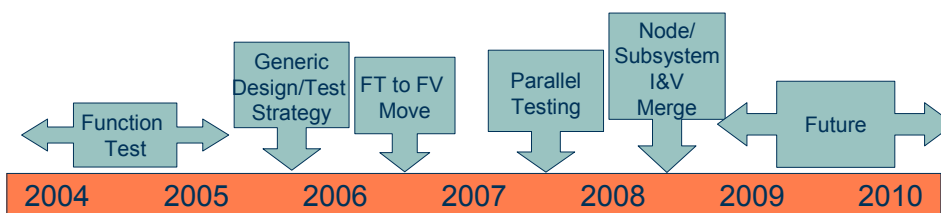
2008-11-06





Major Advances in Verification of RAN Features

- Evolution from Function Based to Feature Based Verification
- More generic development leads to verification savings
- Evolution of Feature Verification
- Looking to the Future
- Summary

Advances in RNC Feature Verification in PDU WCDMA RAN



Function Test

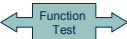




- RNC verification was done from a functional viewpoint

- Several functional teams triggered the same call case and then checked one part of the result

© Ericsson AB 2008 SoftTest AGM 7 Michael Monaghan 2008-11-06 ERICSSON

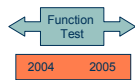
Function Test

	Mobility Team	Control Plane Team	User Plane Team
Feature1	Mobility		User Plane
Feature2	Mobility	Control Plane	
Feature3		Control Plane	User Plane
Feature4	Mobility	Control Plane	
Feature5	Mobility	Control Plane	User Plane

© Ericsson AB 2008 SoftTest AGM 8 Michael Monaghan 2008-11-06 ERICSSON

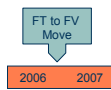
Function Test



- Small area of expertise for each engineer
- Little feature overview knowledge in verification
- Led to rigid test organisations and verification projects

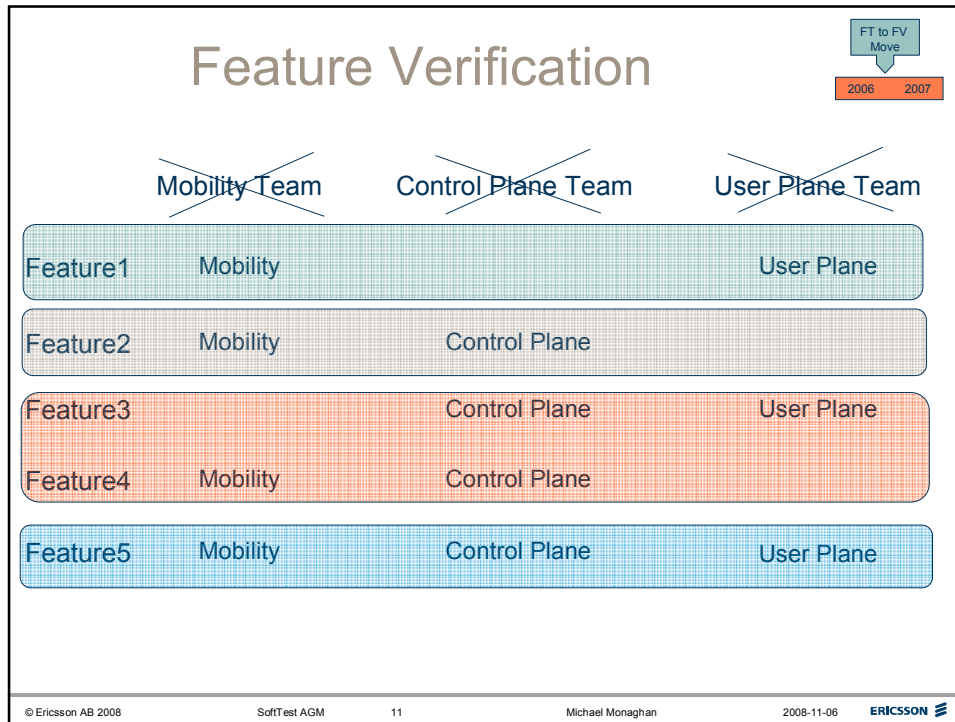
© Ericsson AB 2008 SoftTest AGM 9 Michael Monaghan 2008-11-06 ERICSSON

Feature Based Verification




- Verification based on Use Cases
- Verify features end to end
- Verify each Use Case in the most suitable environment
- Many challenges had to be overcome

© Ericsson AB 2008 SoftTest AGM 10 Michael Monaghan 2008-11-06 ERICSSON




Feature Based Verification



- FV Verification has led to significant cost savings
- Very responsive and flexible test organisation
- An enabler for a feature based release strategy
- Evaluation :

Feature	#TCs with FT WoW	Cost per TC with FT WoW	Cost (FT)	#TCs with FV WoW	Cost per TC with FV WoW	Cost (FV)
Feature1	168	9	1512	34	8-20 (Avg 14)	476
						69% saving

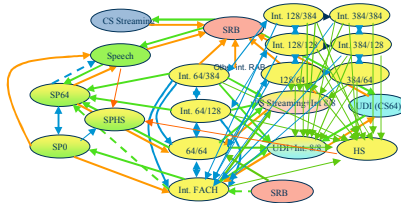
© Ericsson AB 2008
SoftTest AGM
12
Michael Monaghan
2008-11-06


Generic Design/Test Strategy

Generic Design/
Test
Strategy

2005 2006

- Market pressure for many radio connection combinations
 - e.g. different interactive packet RAB rates and combinations
- Development began to be based on generic code units which made it easier to introduce new RAB rates and combinations
- In P6 the number of RAB combinations exploded : (13 in P3, 18 in P4), 39 in P5, > 70 in P6, Not possible to verify all transitions



© Ericsson AB 2008

SoftTest AGM

13

Michael Monaghan

2008-11-06

ERICSSON

Generic Test Strategy

Generic Design/
Test
Strategy

2005 2006

- Test strategy was to verify the generic code once and then run a greatly reduced test scope on new RABs/RAB Combinations going forward
- Reduced scope testing based on RAB type groups
- Cost savings :

Feature	Pre-Generic (including all error and exception TCs)	Generic Test Principle 1 (Removal of error and exception TC)	Generic Test Principle 2 (Rab type groups)	Generic Test Principle 3 (Some functions moved outside FV)	Generic Test Principle 4 (Functional based changes costs removed)
Feature2	~ 196 TC ~ Exe cost 1764 Mhours	96 TC (-100) ~ Exe cost 864 Mhours	88 TC (-8) ~ Exe cost 792 Mhours	58 TC (-30) ~ Exe cost 522 Mhours	43 TC (-15) ~ Exe cost 387 Mhours
					79% saving

© Ericsson AB 2008

SoftTest AGM

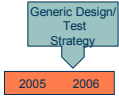
14

Michael Monaghan

2008-11-06

ERICSSON


Generic Test Strategy



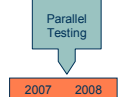
- Effectiveness :

Feature	#TCs run in RNC FV	Faults found by RNC	Faults found by IODT	Faults found by RAN I&V	Slipthrough analysis to RAN I&V
Feature3	102	34	8 <small>Analysis: Same faults would have been found in RNC but testing was done in parallel</small>	2 <small>Actual TRs on feature</small>	2 <small>Analysis: 1 due to tools issues, 1 due to intro of fault after test case had been run.</small>


- Generic test is very effective when applied correctly


© Ericsson AB 2008
SoftTest AGM
15
Michael Monaghan
2008-11-06


More Demanding Environment





- 2 releases per year
- Market demand for many and more complex features (MBB)
- Continuous improvements in Time To Market required
- Need for continuous improvements in operational excellence
- Need to streamline verification further:
 - Introduce more parallel testing
 - Minimize repetition in testing at all levels
 - Maximise test effectiveness




© Ericsson AB 2008
SoftTest AGM
16
Michael Monaghan
2008-11-06


Parallel Testing






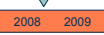
- RNC node test work more closely with IODT and RAN I&V
- Form a RAN Level Joint Test team with participation from RNC, RBS and RAN
- Make Phased Deliveries for key features
- Split scope of feature test RAN/node




© Ericsson AB 2008 SoftTest AGM 17 Michael Monaghan 2008-11-06 ERICSSON

Node/Subsystem I&V Merge







- Subsystem I&V is a very useful, low cost and under-utilised test environment
- Was Best Effort/Happy Test
- Merge means node level TCs are passed in a Subsystem I&V environment
- Improves verification lead times at RNC node level
- Reduces repetition between Subsystem and RNC test documentation and execution
- Need to minimise quality risk to RNC and Subsystem



© Ericsson AB 2008 SoftTest AGM 18 Michael Monaghan 2008-11-06 ERICSSON



Maximise Test Effectiveness



- Eurostar conference
 - Ericsson verification problems are industry-wide
 - We compare favourably with other companies in many respects
 - However there are some methodologies we should study more
- Risk Based Testing
 - Each test case ranked by likelihood and impact
 - Trial ongoing
 - If useful, this will be rolled out in RNC
- Estimate number of remaining faults
 - Tools exist which predict number of latent faults in a feature
 - Too much emphasis now on “slip-through”
 - Trial ongoing
- Preventive Testing

© Ericsson AB 2008 SoftTest AGM 19 Michael Monaghan 2008-11-06 ERICSSON

Summary



- We have come a long way
- Time pressure will continue to mount
- Borders between layers of the development process are being broken down

© Ericsson AB 2008 SoftTest AGM 20 Michael Monaghan 2008-11-06 ERICSSON

