Testing Techniques – Are they of any practical use?

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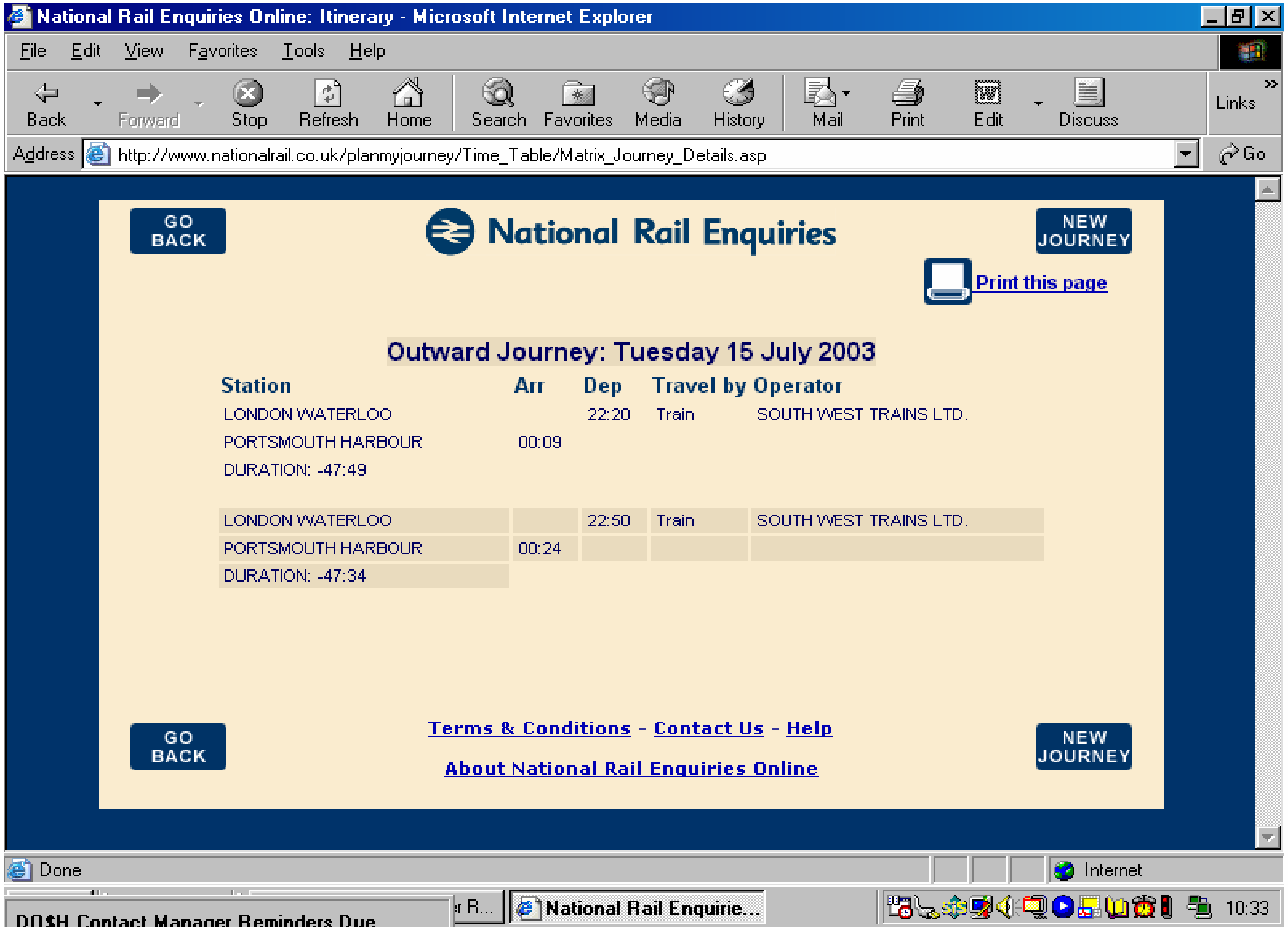
ElectroMind

CREATIVE TRAINING FOR A CHANGING WORLD

Part 1

Testing Theory

Why test software?


National Rail Enquiries Online: Itinerary - Microsoft Internet Explorer
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Address: http://www.nationalrail.co.uk/planmyjourney/Time_Table/Matrix_Journey_Details.asp

Outward Journey: Tuesday 15 July 2003

Station	Arr	Dep	Travel by	Operator
LONDON WATERLOO		22:20	Train	SOUTH WEST TRAINS LTD.
PORTSMOUTH HARBOUR	00:09			
DURATION: -47:49				
LONDON WATERLOO		22:50	Train	SOUTH WEST TRAINS LTD.
PORTSMOUTH HARBOUR	00:24			
DURATION: -47:34				

Read all about it!

US site – down for 3 days, forced to return $30 fee to nearly 260,000 online “fantasy baseball” players.

Shopping Site: 6-hour downtime: $400,000 in direct costs plus additional in discounts to inconvenienced customers.

UK - Concerns over bugs and delays in new air traffic control software

US site down for 2 days, $280,000 in lost sales.

UK – Payment clearing system failure at month end delayed wages to many customers

UK - Televisions, Cameras sold at very low prices

Ineffective Testing

- Creates too many of the wrong tests
- Duplicates effort unnecessarily
- Costs too much and takes too long
- Has an adverse impact on the business as a whole

Effective Testing

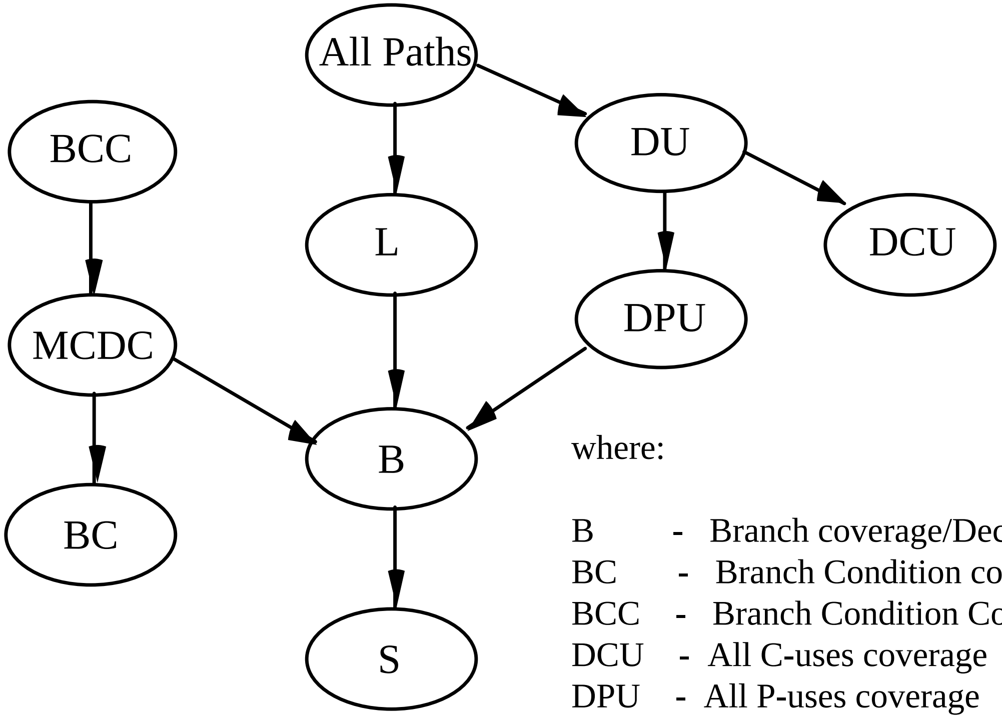
- Begins early (requirements reviews, static analysis, unit testing)
- Uses a risk-based approach aligned to business need and formal techniques to create fewer tests with increased coverage
- Facilitates communication with the business and give pre-production confidence
- Saves time and money

Black Box Techniques

- BS7925 techniques
  - ❑ Equivalence class partitioning
  - ❑ Boundary value analysis
  - ❑ Decision tables
  - ❑ State transition testing
  - ❑ Syntax testing
  - ❑ Random testing

- Other techniques
  - ❑ Pairwise
  - ❑ Domain analysis
  - ❑ Use case testing
- “Techniques”
  - ❑ Risk-based strategy
  - ❑ Process improvement
  - ❑ Test automation

White Box Techniques

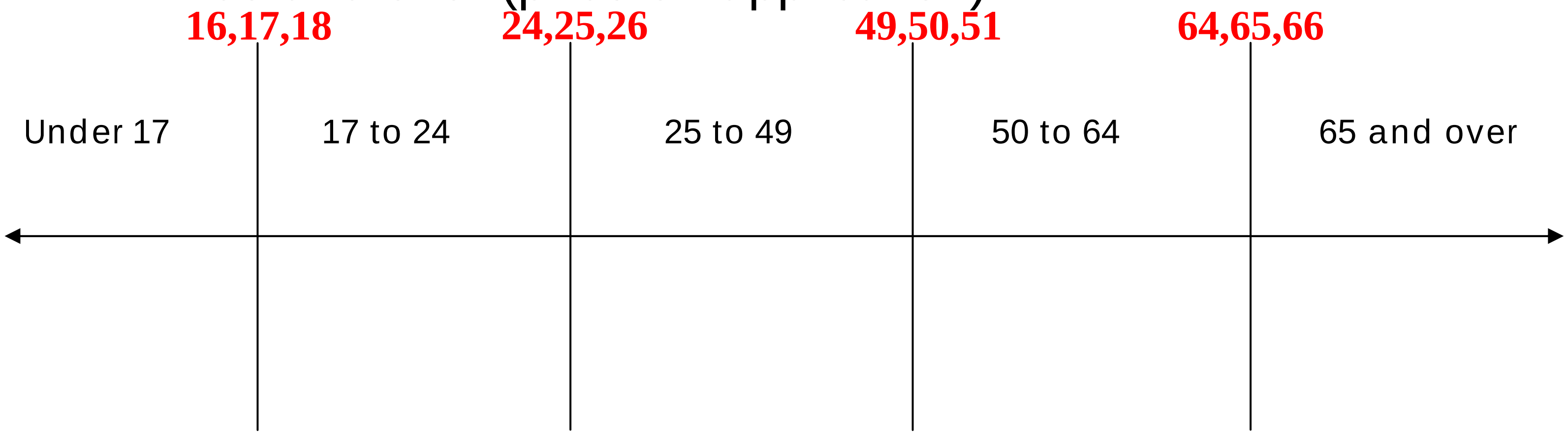


where:

B	-	Branch coverage/Decision coverage
BC	-	Branch Condition coverage
BCC	-	Branch Condition Combination coverage
DCU	-	All C-uses coverage
DPU	-	All P-uses coverage
DU	-	All du-paths coverage
L	-	LCSAJ coverage
MCDC	-	Modified Condition Decision coverage
S	-	Statement coverage

EP / Boundary Value Analysis

- An online car insurance quotation system
  - ❑ Under 17 – unable to quote
  - ❑ 17 to 24 (premium price)
  - ❑ 25 to 49 (30% discount)
  - ❑ 50 to 64 (20% discount)
  - ❑ 65 and over (price on application)



Decision table – ATM example

Conditions	**Rule 1**	**Rule 2**	**Rule 3**	**Rule 4**
Enter valid card	Y	Y	N	N
Enter valid PIN	Y	N	Y	N
Actions	Auth	Reject	Reject	Reject

Example – ATM “don’t care”

Conditions	**Rule 1**	**Rule 2**	**Rule 3**
Enter valid card	Y	Y	N
Enter valid PIN	Y	N	---
Actions	Auth	Reject	Reject

Pairwise Testing

- Test all pairs rather than all combinations
    - ❑ With 4 variables and 3 choices for each you would require 81 test cases whereas you can cover all pairwise input combinations with only 9 tests
    - ❑ For 13 variables and 3 choices for each you would require1,594,323 test cases whereas you can cover all pairwise input combinations with only 15 tests
- Pairwise guides us to help find
    - ❑ Single mode defects
    - ❑ Double mode defects
- You should always add any known risky combinations

Bookings page

- Four fields each with three choices
- Airline type (Scheduled, charter, low-cost)
- Cabin (First, Business, Economy)
- Hotel (Basic, 4 star, luxury)
- When will you travel? (Now, within a month, next month)

Orthogonal Array L_9 (3^4)

	A	B	C	D
Row 1	1	1	1	1
Row 2	1	2	2	2
Row 3	1	3	3	3
Row 4	2	1	2	3
Row 5	2	2	3	1
Row 6	2	3	1	2
Row 7	3	1	3	2
Row 8	3	2	1	3
Row 9	3	3	2	1

This orthogonal array has 9 rows, 4 columns and three ‘levels’ per column

Flight booking example

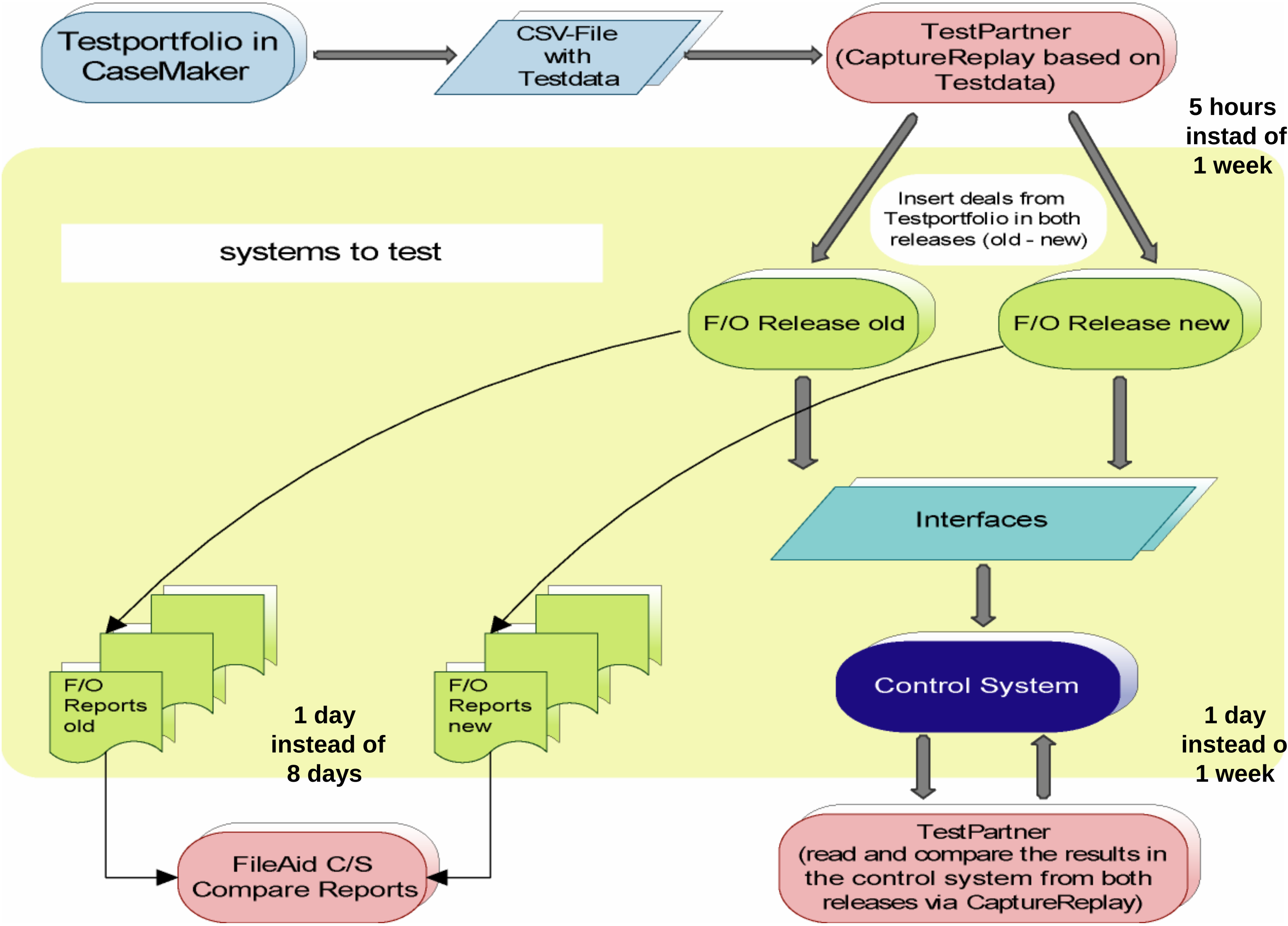
	Airline	Cabin	Hotel	When
Test 1	Scheduled	First	Basic	Now
Test 2	Scheduled	Business	4 star	Soon
Test 3	Scheduled	Coach	Luxury	Later
Test 4	Charter	First	4 star	Later
Test 5	Charter	Business	Luxury	Now
Test 6	Charter	Coach	Basic	Soon
Test 7	Low cost	First	Luxury	Soon
Test 8	Low cost	Business	Basic	Later
Test 9	Low cost	Coach	4 star	Now

Each row becomes a test case – you can add more if you wish

Part 2

Real world problems

Case study 1: Trading application – Improvement of test activities by automation of the chain of testing



Testportfolio in CaseMaker

CSV-File with Testdata

TestPartner (CaptureReplay based on Testdata)

5 hours instad of 1 week

Insert deals from Testportfolio in both releases (old - new)

systems to test

F/O Release old

F/O Release new

Interfaces

Control System

F/O Reports old

F/O Reports new

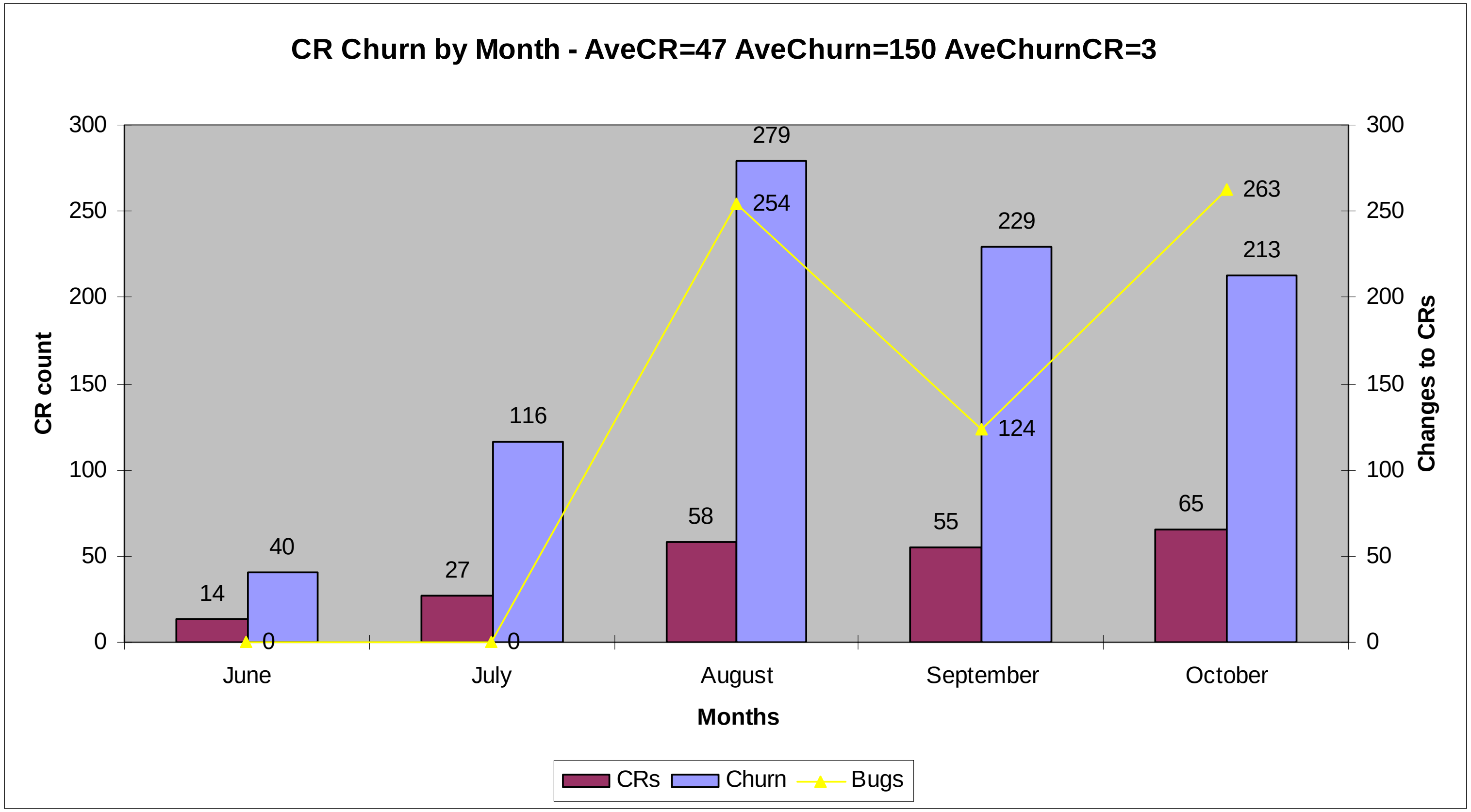
1 day instead of 8 days

1 day instead of 1 week

FileAid C/S Compare Reports

TestPartner (read and compare the results in the control system from both releases via CaptureReplay)

Case study 2 – MIS



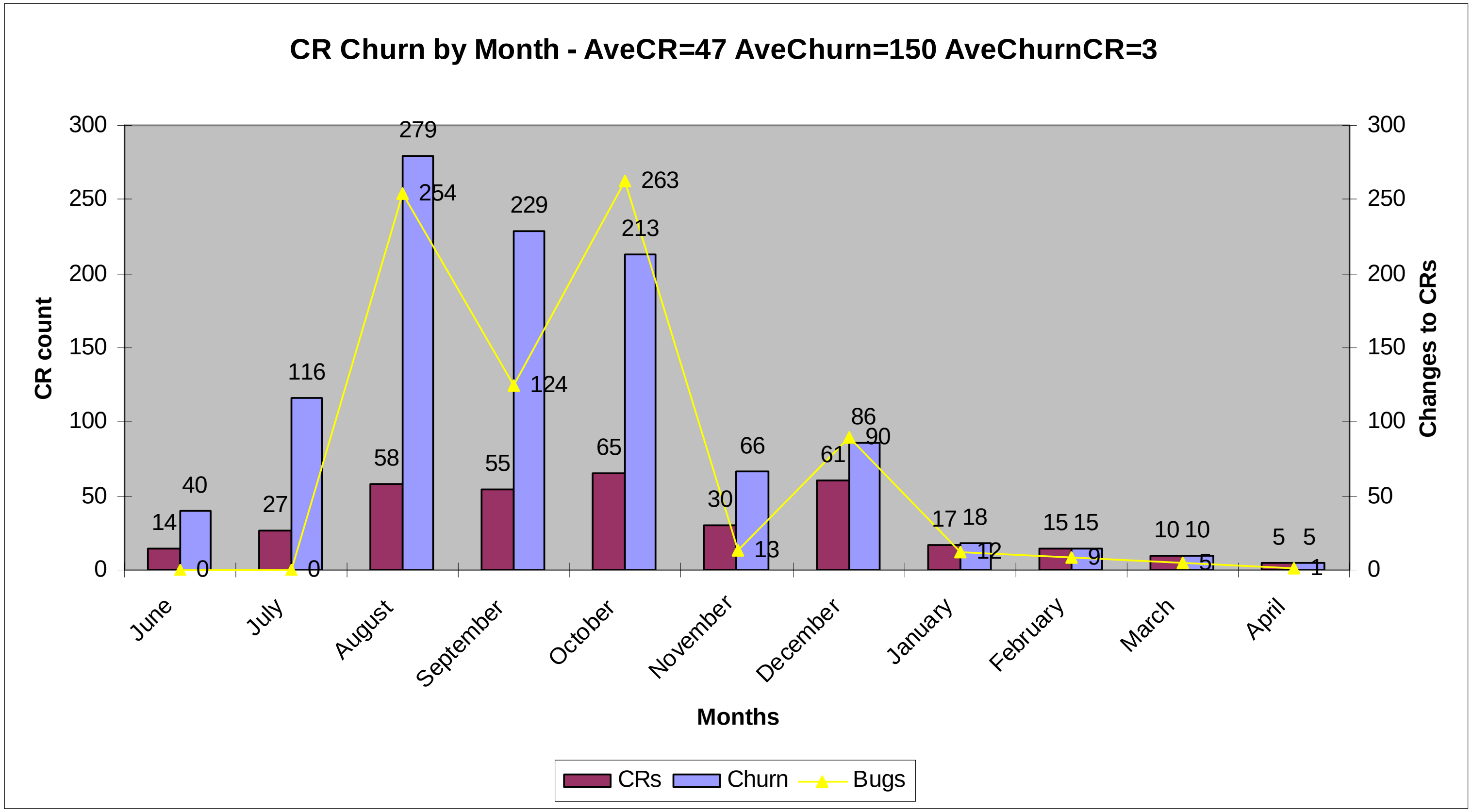
Bug snapshot by priority

	Sev 1	Sev 2	Sev 3	Sev 4	Total
Pri 1	57	81	14		152
Pri 2	19	52	12	1	84
Pri 3		6	14	10	30
Pri 4	2	1			3
None	68	288	114	10	480
Total	146	428	154	21	749

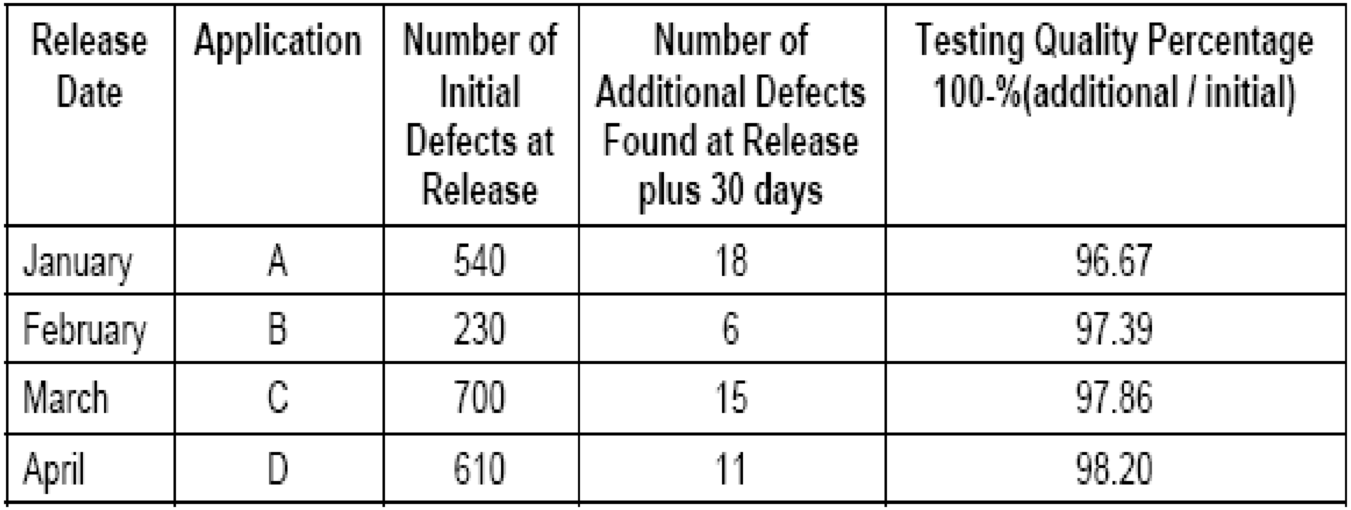
Bug snapshot by resolution

	Sev 1	Sev 2	Sev 3	Sev 4	Total
By design	10	37	29	4	80
Duplicate	6	33	7	1	47
External	2	16	4	0	22
Fixed	86	254	95	12	447
Not repro	29	56	4	0	89
Postponed	12	17	6	4	39
Will not fix	1	15	9	0	25
Total	146	428	154	21	749

Impact of the improvements



Testing quality



Release Date	Application	Number of Initial Defects at Release	Number of Additional Defects Found at Release plus 30 days	Testing Quality Percentage 100-%(additional / initial)
January	A	540	18	96.67
February	B	230	6	97.39
March	C	700	15	97.86
April	D	610	11	98.20

Case study 3 – Banking middleware

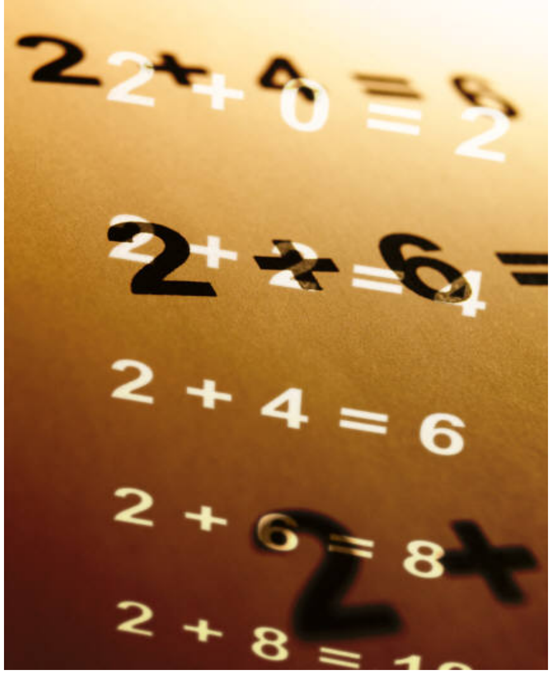
- Commercial tools were not appropriate
- Manual testing took too long
- Business case was difficult to put together
- Just do it!

4. Test Maturity Matrix (extract)

Key Area	1	2	3	4	5	6	7	8	9	10	11	12	13
Test strategy	A					B				C		D	
Life-cycle model	A			B									
Moment of involvement		A				B				C		D	
Estimating and planning			A							B			
Test spec. techniques	A		B										
Static test techniques				A		B							
Metrics					A			B			C		D
Test tools				A			B			C			

Test data and environment

- Theory:
  - ❑ Copy of live data
  - ❑ Realistic data volumes
  - ❑ Range of values and inputs
- Practice:
  - ❑ Live is 100s of GB !
  - ❑ Many servers
  - ❑ Lots of projects
  - ❑ I want it now!



Risk based testing

- Ok for prioritisation at the planning stage but what about the number of tests to run per feature?
- How do we ensure buy in to the process from all stakeholders?
  - ❑ Attending the workshop
  - ❑ Agreeing the risks
  - ❑ Performing the tests
  - ❑ Not blaming afterwards
  - ❑ Learning lessons

Conclusions

- People seem to understand the basic techniques
- Manual documentation (Word, Excel) is variable and poorly written tests are hard to review
- Some test management tools and test automation tools support test case design activities
- Time pressure to write scripts and get testing rather than create good test design documentation
- There are other ways to improve as well as using the recognised models (metrics, people, get basics right)
- Recent success in web development group

How can academia help?

- Introduce more realistic examples and case studies of test design to help bridge the gap from theory to practice
- Help gather more evidence as to the benefits of using techniques, especially allpairs
- Identify the analytical process of test design
- Develop more sophisticated design techniques
- How can we use formal techniques in an agile project
- Consider the problems of scale and speed

“ There are known knowns.
There are things we know we know.
We also know
There are known unknowns.
That is to say
We know there are some things
We do not know.
But there are also unknown unknowns,
The ones we don't know
We don't know.”

Donald Rumsfeld: Feb. 12, 2002

The DR Quality Model

We apply	DANGEROUS	SUCCESSFULL
We don’t apply	CONFUSED	WASTEFULL
	We don’t know	We know

Discussion / Questions?

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