

PHILIPS

sense and simplicity

Model Testing at Philips Healthcare

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GTC-FXD

Nov 18th, 2011

Testing in a medical environment

What is so special about testing in a medical environment?

Nothing!!

Just use common sense

But

Regulations

Not written, Not done!

You are working on equipment that may harm or cure someone

What if!!

The system breaks down in the middle of a critical procedure.

Contents:

- Philips Healthcare:
 - Introduction.
 - Interventional X Ray and its systems.
- Model Based Testing:
 - Problem statement.
 - Model based Testing
 - Next steps.

Depth and reach of Philips Healthcare

What we do. Where we are.

Philips Healthcare

Businesses

Imaging Systems



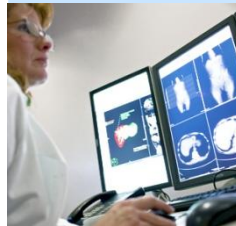
40%

Home Healthcare Solutions



15%

Patient Care and Clinical Informatics



20%

Services



25%

Sales & services geographies

North America



48%

International



34%

Emerging Markets



18%

€8.6

Billion in sales in 2010

35,000+

People employed worldwide in 100 countries

8%

of system sales invested in R&D In 2010

450+

Products and services offered in over 100 countries

Key products and services of Philips Healthcare

Providing comprehensive support

Philips Healthcare

Businesses

Imaging Systems



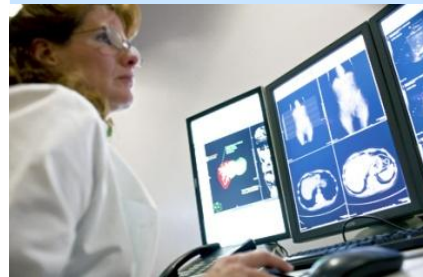
Interventional X-Ray
Diagnostic X-Ray
CT
MR
SPECT/CT
PET/CT
Ultrasound
Women's health

Home Healthcare Solutions



Sleep disordered breathing
Home Respiratory care
Home monitoring

Patient Care and Clinical Informatics



Patient monitoring
Clinical informatics
Cardiac resuscitation
ECG solutions
Ventilation

Services



Site planning and project management
Ambient experience
Education
Performance services
Maintenance

Philips interventional X Ray: Minimal Invasive Interventions

- Benefits:
 - Improved productivity.
 - More effective treatments.
 - Better success rate.
 - Increased quality of life patient.
- Lowering Healthcare Cost:
 - Shorter hospital stay.
 - Higher throughput.
- People will contribute longer to society.

surgery:
invasive, open

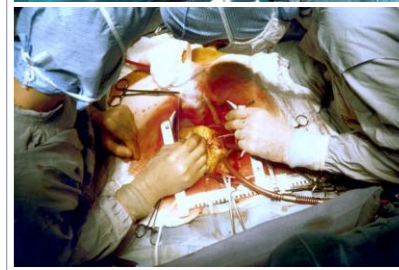
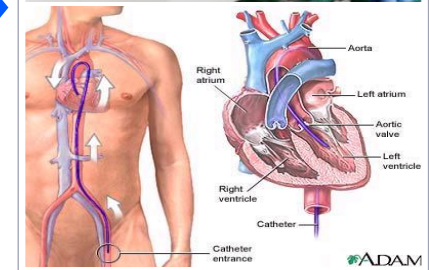
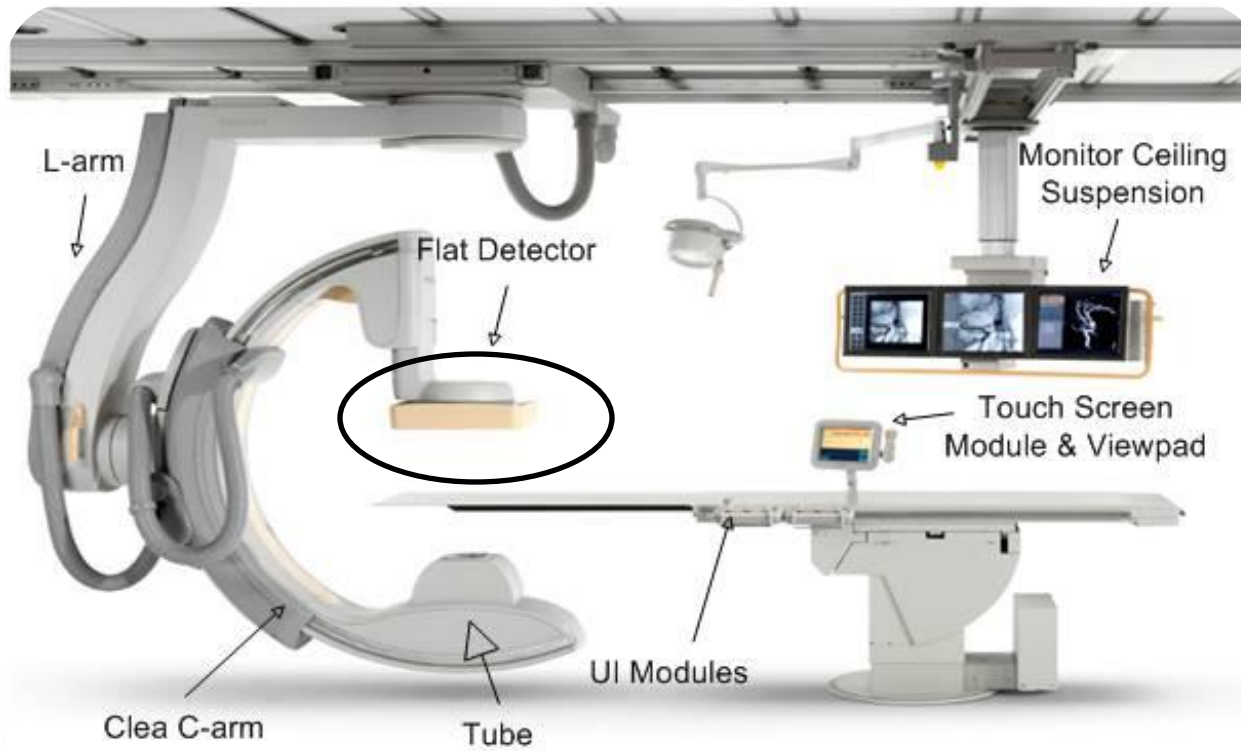


image guided intervention:
minimal invasive, closed



Philips iXR: Introduction



Control Room

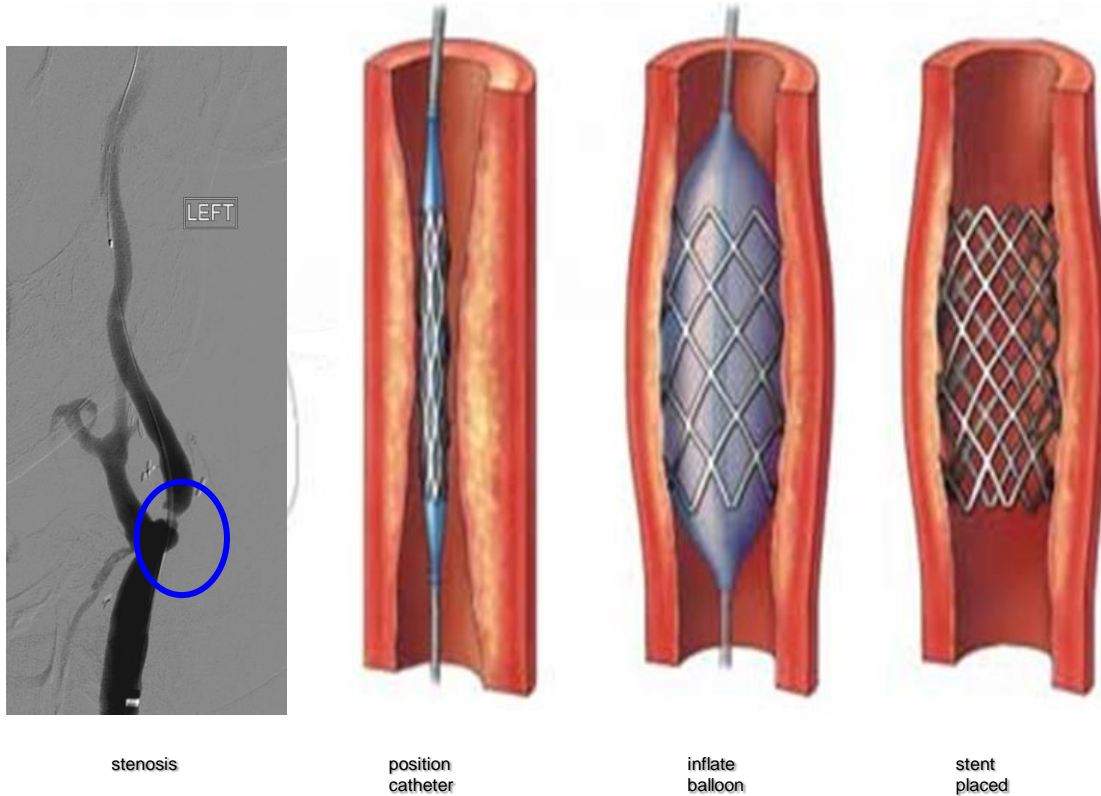
Intervention Room



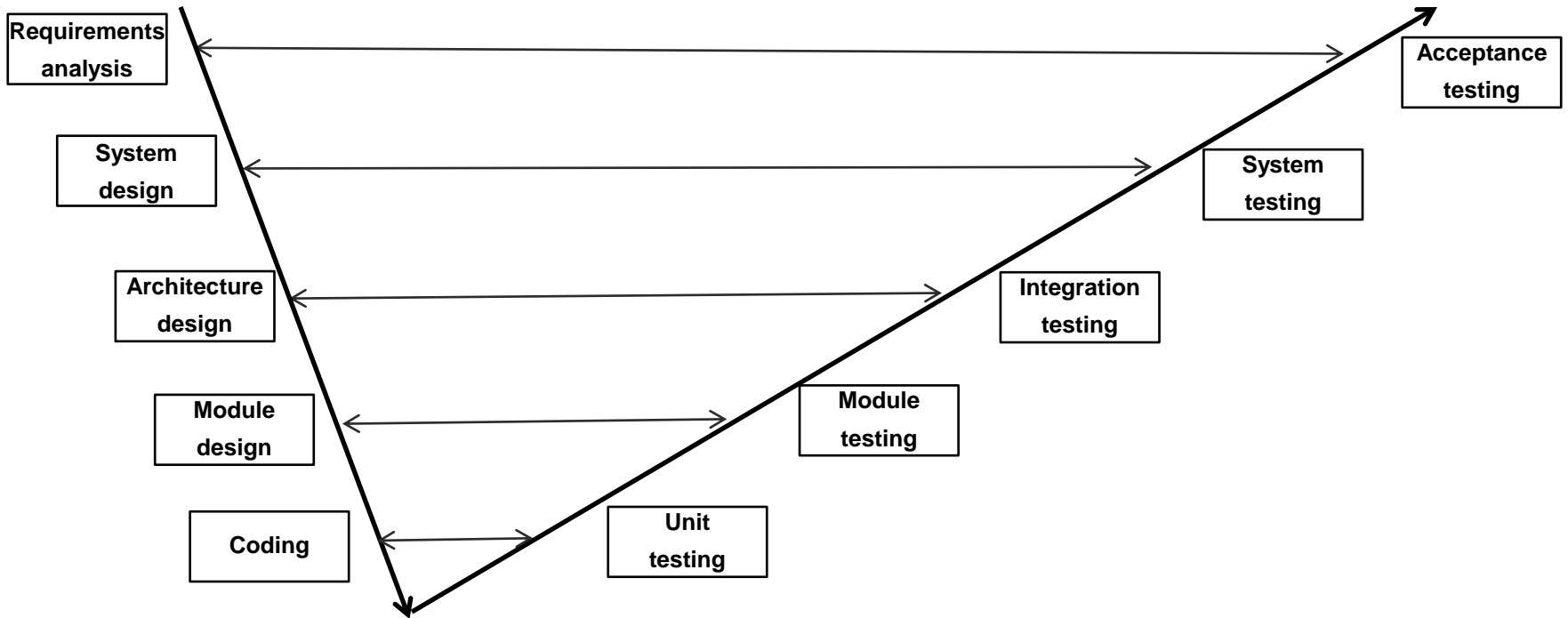
Cardio Vascular - visualization of blood vessels



Stenosis: Principle of Catheterization

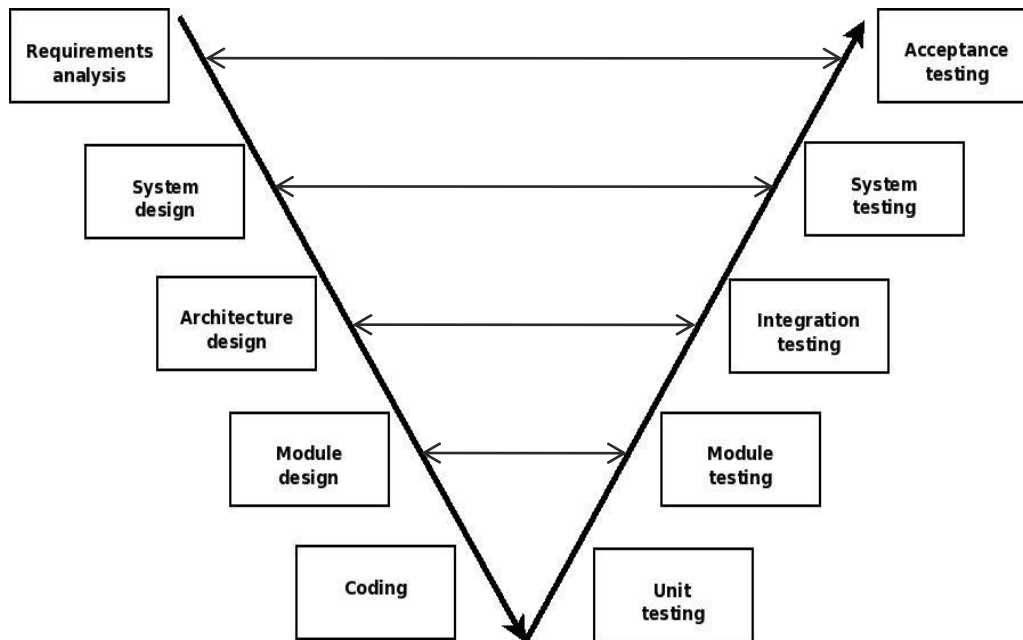


Problem Statement



Most effort on right side of V-model

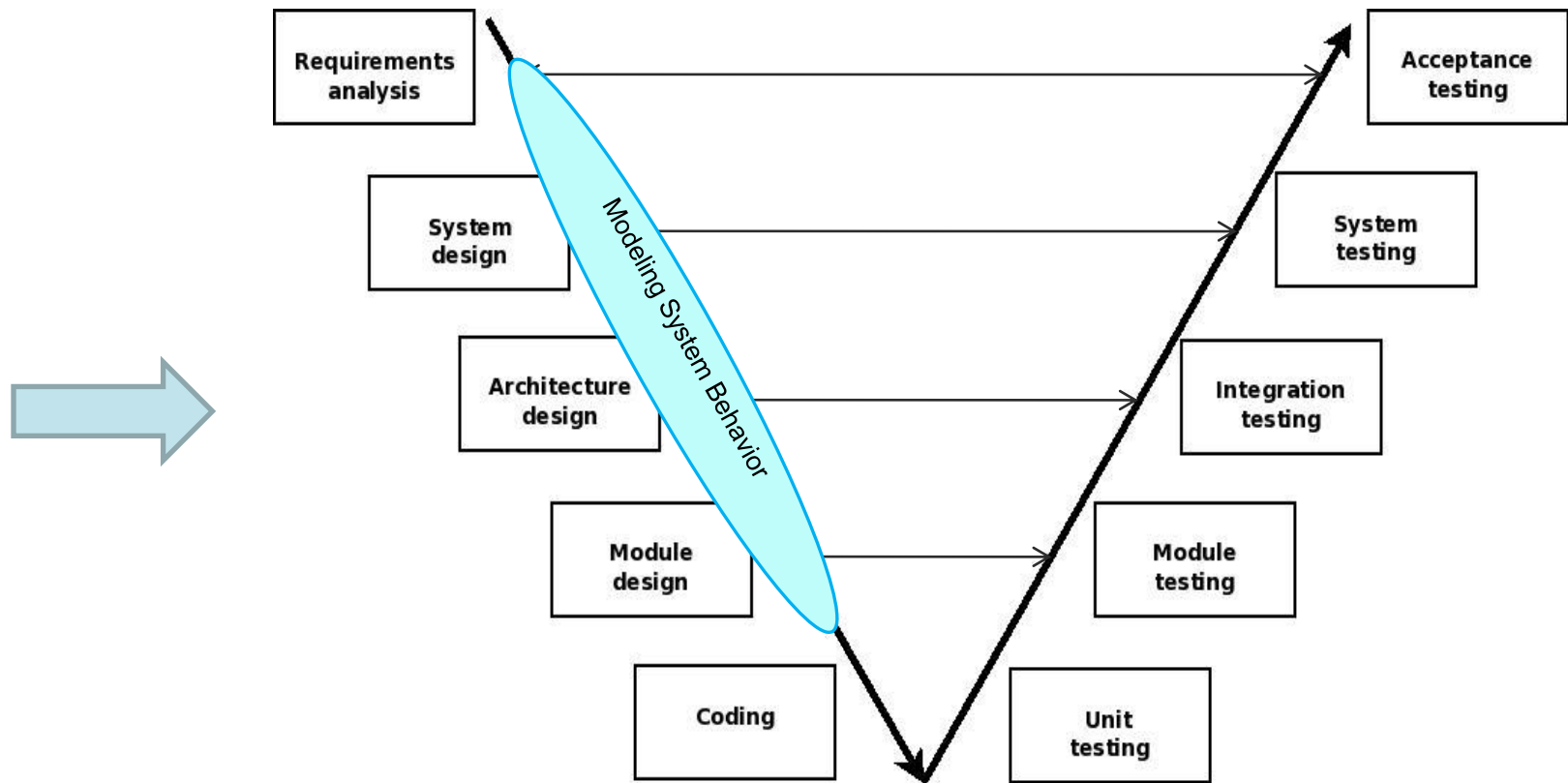
Improving Speed of Innovation



Fault prevention instead of fault removal

More verification and validation on the left
Less effort and more predictability on the right

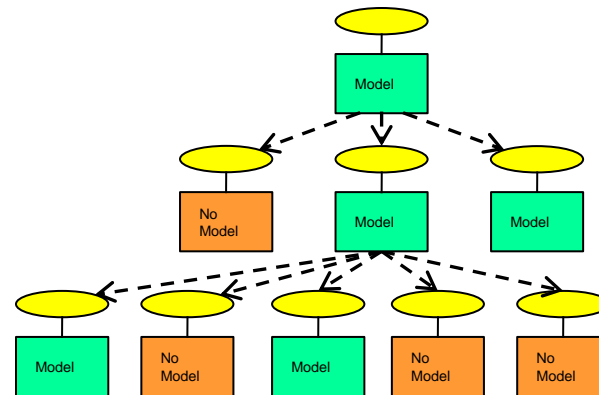
The addressed Area in the Development Process



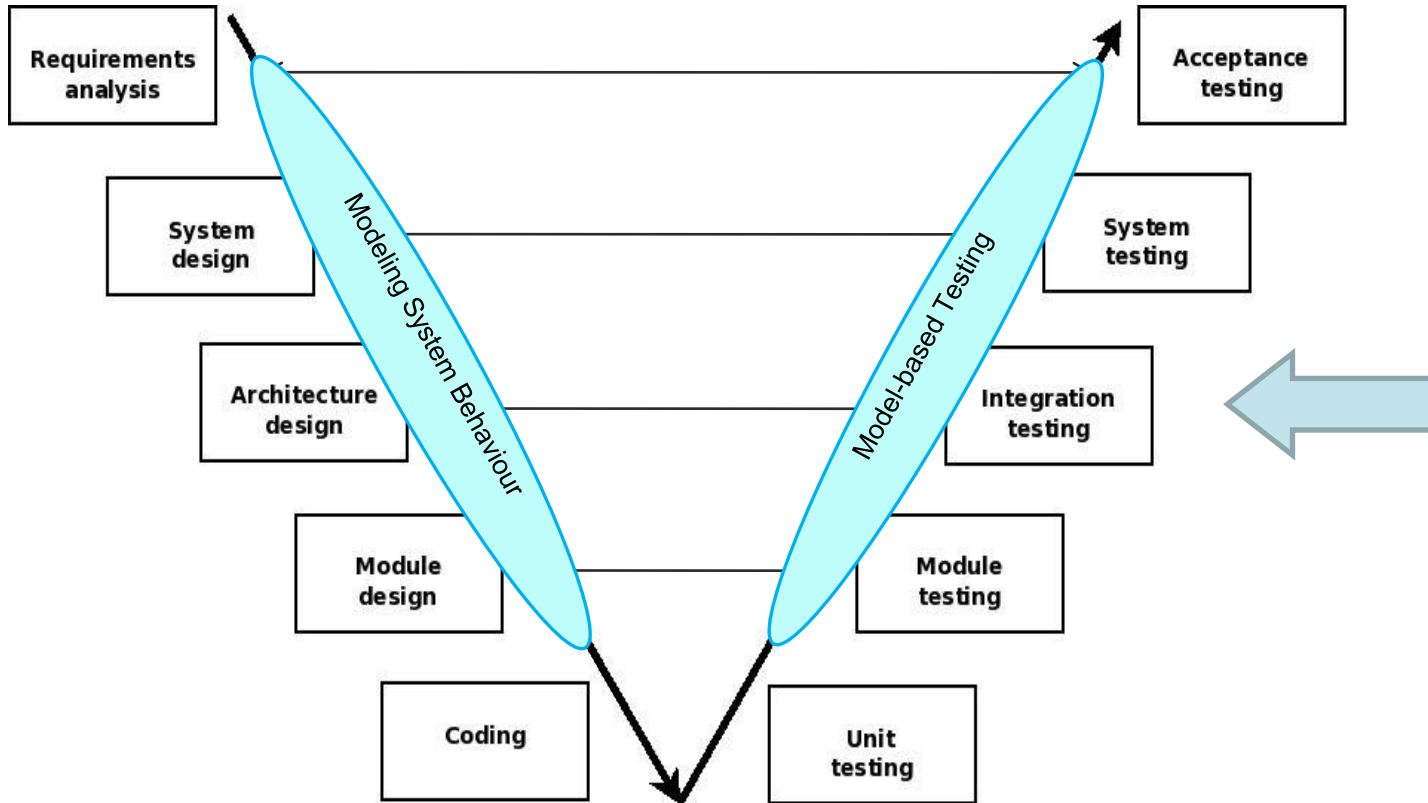
Vision on Solution

A system design methodology which

- Delivers component-based architectures with formally specified interfaces
- Eases communication with non technical stakeholders
- Allows design space exploration and “what if” analysis
- Uses models to test with less effort and more predictability
- Validates architectures by
 - Ensuring control correctness
 - Ensuring data correctness
 - Predicting performance
 - Evaluating evolvability



The addressed Area in the Development Process

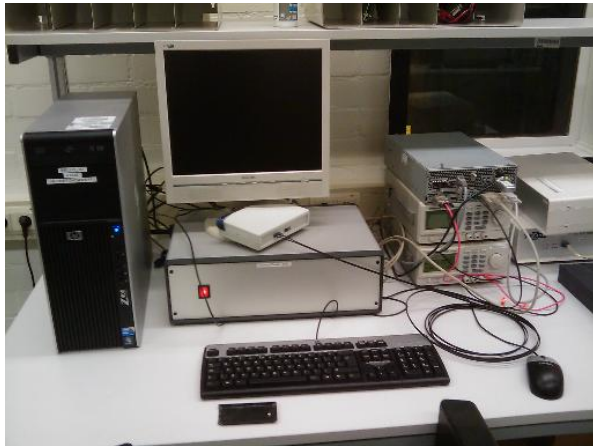


Model Based Testing in Flat detector departement

- FXD did a pilot with the tooling and methodology supplied by Axini
- In a controller we called internally FDC (Flat X Ray detector Controller)
- In the next slides a summary of our findings

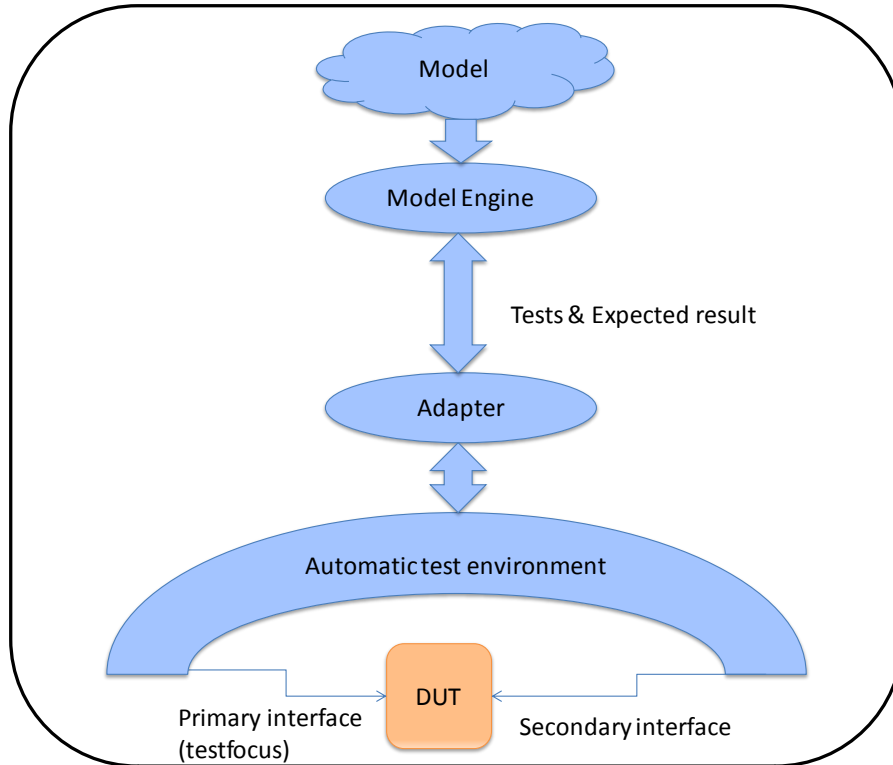
Starting point

- FXD already has a fully automated test environment.
 - Connecting the model to the DUT was easy. Test harness was almost complete at the start of the pilot.
 - We could almost immediately go to the modeling stage





The Configuration



- Primary interface
 - Interface with test focus.
 - fully described in model.
- Secondary Interface(s)
 - Interfaces needed to force DUT into a condition.
 - Interface(s) needed to get the DUT working
 - Secondary interfaces are not mentioned when designing an interface, but are essential for behavior of DUT. Therefore they may be an essential part of Model based testing.
 - Secondary interfaces can be a requirement for the test environment of the DUT

Two Models

- Main state machine of DUT
 - Comparison with automated test

- Calibration procedure
 - No alternative test available



Compare MBT and FXDT (State machine)

- Design: almost same effort
- Scripting: see following table
- Test generation: within neglectable time

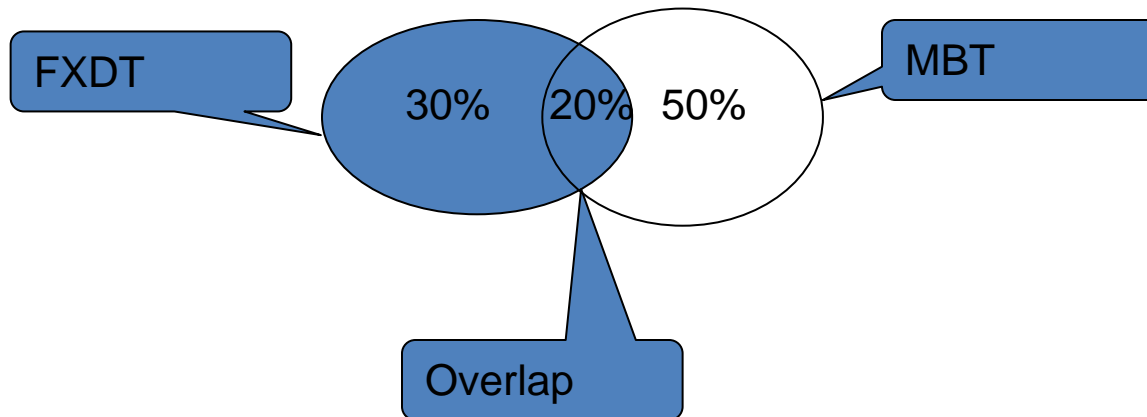
<i>FXDT</i>	<i>MBT</i>
100 hrs for creation of scripts + 20 hrs for maintenance 0-switch state transition test	10 hrs max for Model. 2 hrs maintenance 1- switch state transition test Including learning

Adapter one time effort + small maintenance (max 20 hrs)



Compare MBT and FXDT (Calibration)

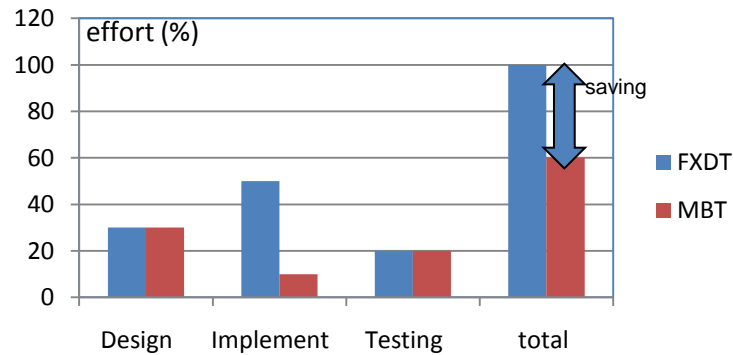
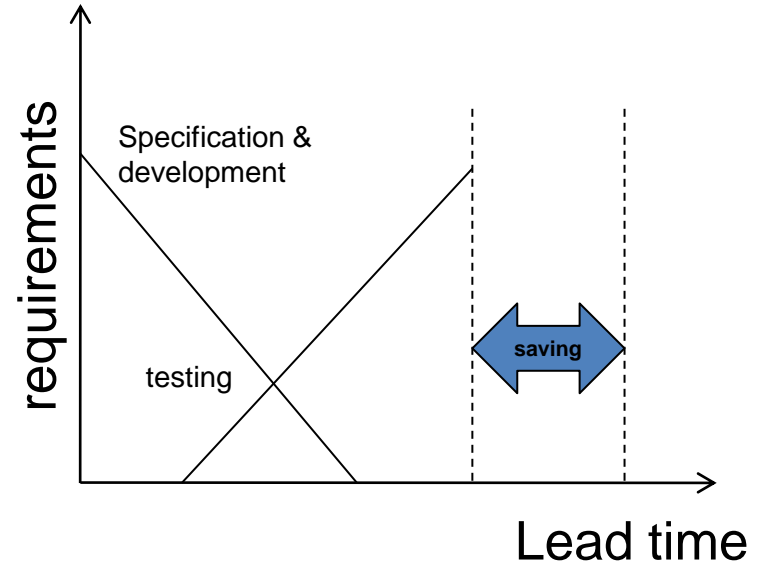
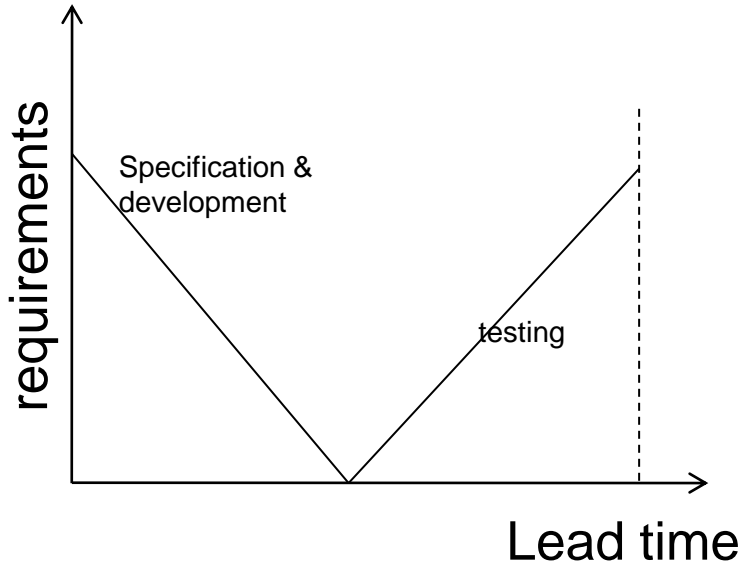
- # Total test cases (test case action, check)
- Metric: % of test cases same as FXD, % of new test



During project, in depth comparison of traditional DFA test and MBT DFA test results in the following conclusion: both test techniques are complementary. Different types of errors were found with the two different approaches.



Resourcing over Time





Other aspects:

- Motivating:
 - New exiting challenge and fun for testers!!
- Reusability:
 - A model is very maintenance friendly
- Efficiency:
 - Investigation of a defect is easy. Just follow the scenario
 - MBT reduces test suite maintenance costs:
manage the test model instead of the test cases wish is important when requirements changes.
- Learnability:
 - Easy to learn, if one is used to think in different abstraction levels
 - If familiar with formal test techniques, combined with some SW experience it is very intuitive

Next Steps

- Expand on “Model-Based” Testing by looking also to:
 - Data modeling.
 - Performance.
 - Evolvability
- And, continuously evaluate new design approaches that are supported by **commercially** available tools.





ANY QUESTIONS?

