SIOUX
EMBEDDED SYSTEMS

Automated testing of an X-Ray medical device

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About Bryan Bakker

- Test Expert
- Certifications: ISTQB, TMap, Prince2
- Member of ISTQB Expert Level on Test Automation
- Tutor of several test related courses
- Domains: medical systems, professional security systems, semi-industry, electron microscopy
- Specialties: test automation, integration testing, design for testability, reliability testing

About Sioux

SIOUX EMBEDDED SYSTEMS

niko Illuminating ideas.

technicolor

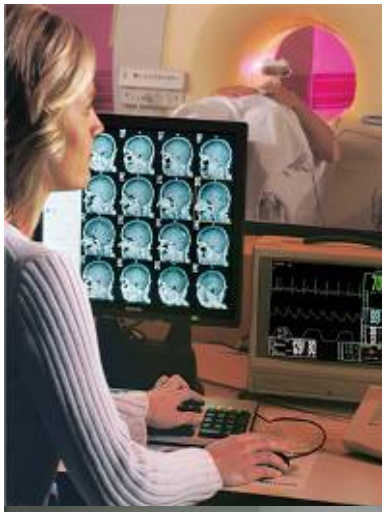
SONY

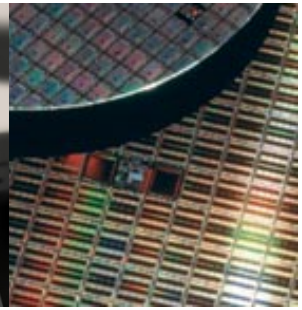
PHILIPS

PUNCH

ICOS

océ





ERICSSON

ASML

TOMTOM

CISCO

BOSCH

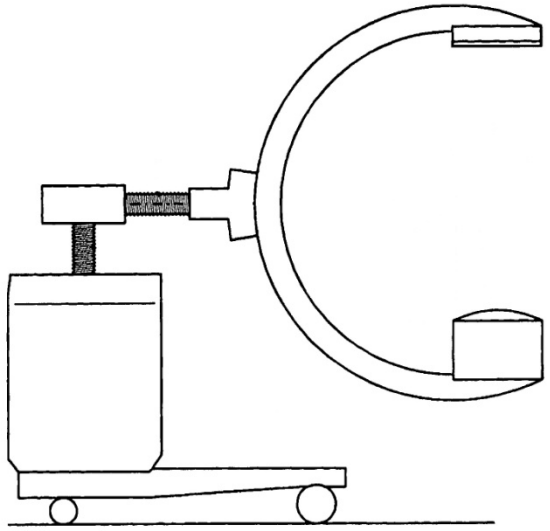
SIEMENS VDO Automotive

FEI

Intro – The need for action

Medical Surgery Device:

- X-ray exposure + acquisition during surgery activities
- Real-time image chain
- Mobile device (frequently off/on)
- Quality and testing considered important in organization

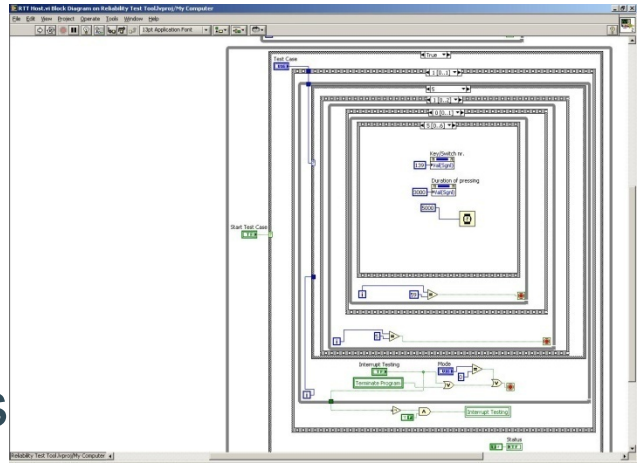


Reliability was an issue:

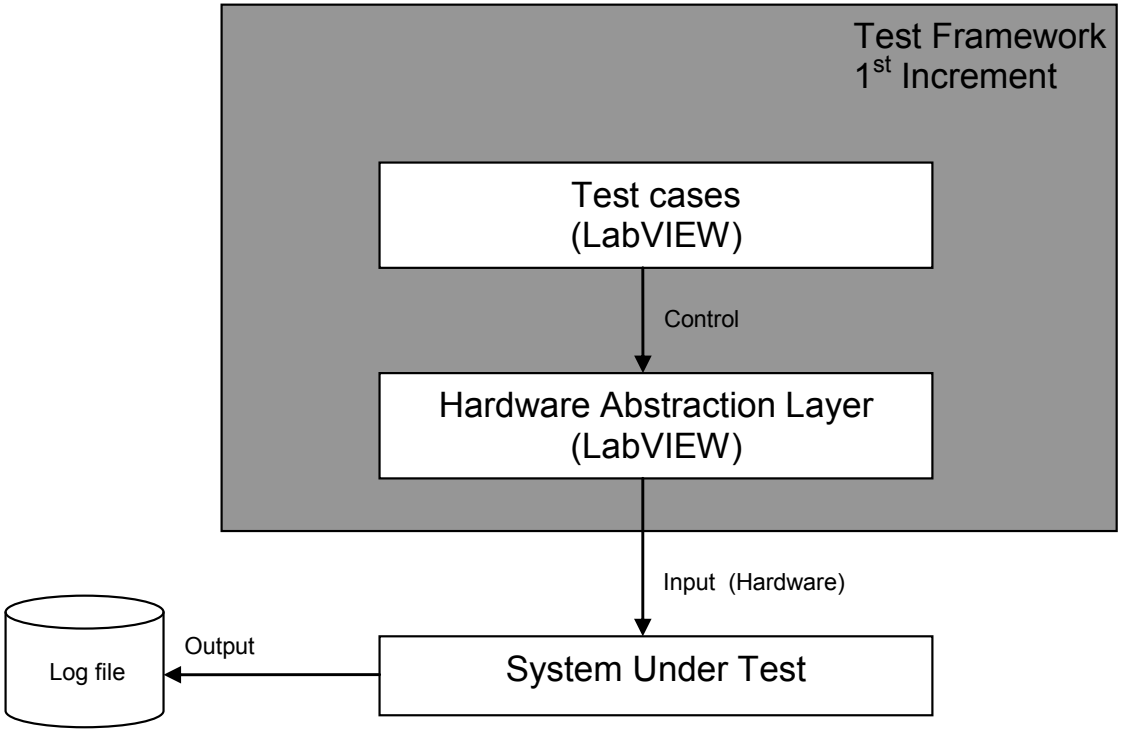
- “Frequent” startup failures
- Aborted acquisitions
- Always safe… but not reliable!

First increment – First success

- Hardware interfaces used to invoke actions on SUT
  - Buttons on different keyboards
  - Handswitches
  - Footswitches
  - Different power-switches
- LabVIEW generates hardware signals
- Test cases defined in LabVIEW
- Only logfiles stored, no other verification performed
- No software changes needed for this approach



First increment – First success



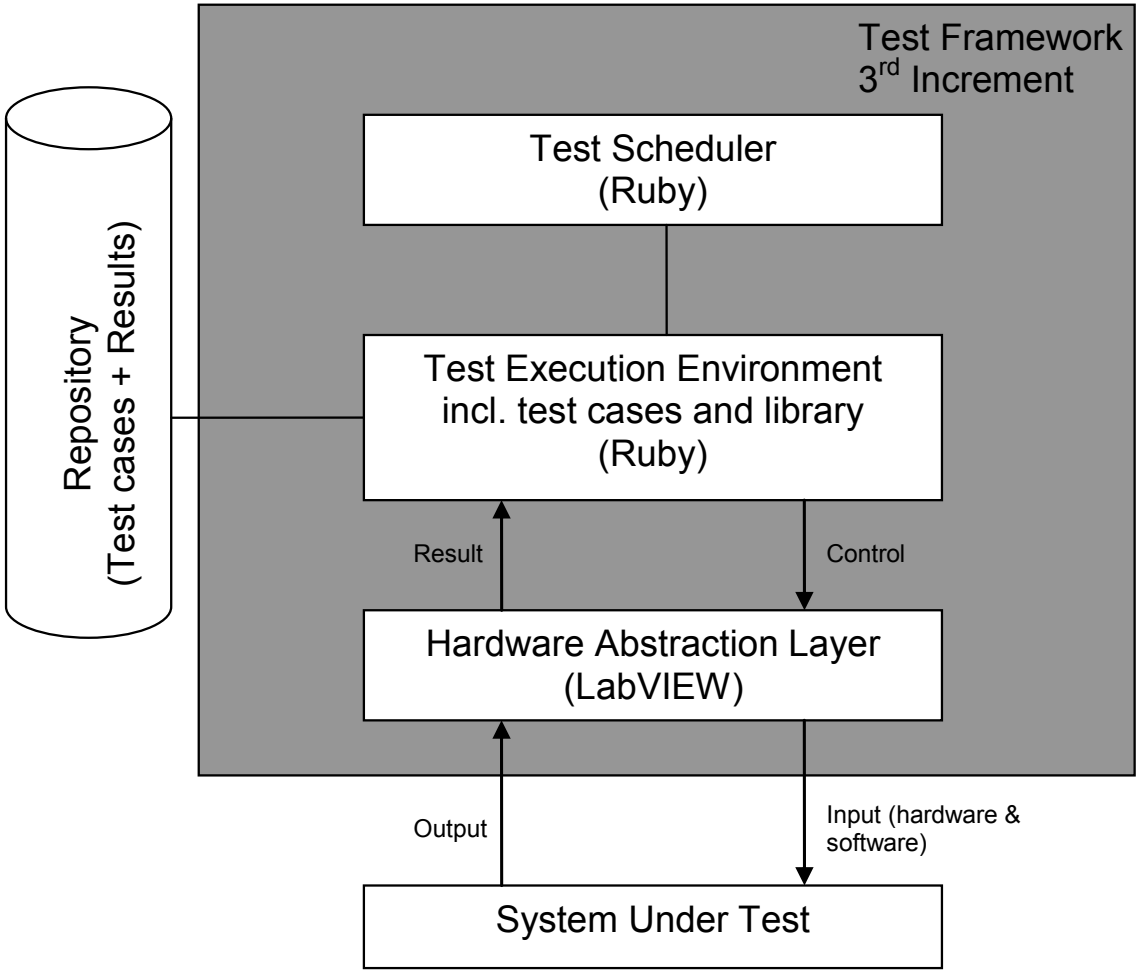
- Simple, but quick first results
- Multiple reliability issues found
- Work to do for the developers

Next increment
Logfile interpretation

- Logfile scanned during test case execution
- Determine pass/fail criteria
- Detect system states and act upon:
  - Hot generator → extensive acquisition not possible
  - Execute other test cases (e.g. power-cycle), until
  - Generator has cooled down

- Log file analysis after test was still performed
- Still no software changes in the SUT, but existing interfaces were available now

Next increment
Logfile interpretation



ROI

- >100 reliability hits identified
  - Which ones would have slipped through other tests?
  - Which ones would the customer complain about?

- “Independent” analysis of hits:
  - 8 would have been in system test, but not earlier
  - 7 would not have been found, but customer would compain (and fix would be necessary)

ROI

- ROI:
  $(8 \times X_1) + (7 \times X_2) - \text{costs} > 0$
- Costs (manhours + material) = 200K Euro
- X_1: costs of defect found in system test: 10K Euro
- X_2: costs of field defect: 200K Euro

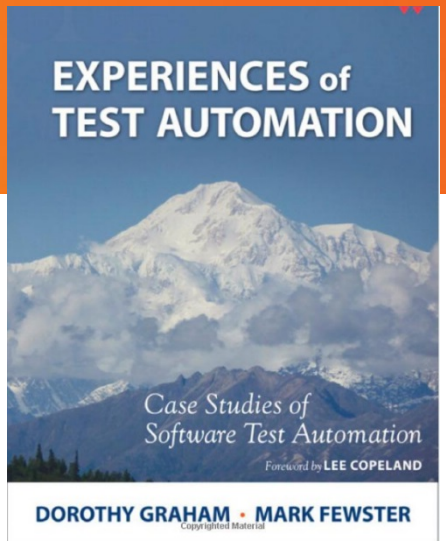
- 80K + 1.4M – 200K → **1.2M Euro saved**

- More money and time became available…
  →Implementing/executing more tests
  →More projects/products

Results

- Numerous reliability hits identified + solved
- MTBF measured and predicted
- More testing hours on systems
- Customer satisfaction
- More projects wanted this approach
- Only 5 system test cycles remaining (was 15)

Questions



- This case study is described in detail:

Dorothy Graham & Mark Fewster
Experiences of Test Automation
Case studies of software test automation
ISBN 0321754069

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