Increase Robustness with Time Travel
Is It Possible and Reasonable?

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Giesecke+Devrient is a German company with headquarters in Munich. It provides banknote, securities printing, smart cards and cash handling systems.
What we test at G+D Currency Technology

- Multiple products based on common product platform that are deployed worldwide in banknote printing, central banks, cash-in-transit centers, casinos, etc.

- Each processes millions of banknotes/day, 24/7 & is configurable for any currency
How we work – Scrum & CI-CD

Sprint 14 days

Product Releases

Product Release

Sprint Review

Release candidate

Daily

TEAM1..n

MST manual smoke test

ART automatic regression test (nightly tests)

MT manual feature test

Product backlog

Sprint backlog

SPRINTPLANNING

TEAM MASTER

Daily

Product Test Team

MT

ART

MST

MT

ART

ART

ART
Our Scrum process setup

1 PO
1 SW architect
1 manual machine tester
1 SM
1 automation tester
n SW developers

1 SW architect
1 PO
1 manual machine tester
1 SM
1 automation tester
n SW developers
Test environment

Test (C# + TTCN3)

Test result
Motivation for testing time boundaries

We have to improve our nightlies!
Our problem: Very short time cycles

- No time for testing with real time
- Need to manipulate day and time in tests
- Better analysis possible because of repeatability
The hard part: Test cases

<table>
<thead>
<tr>
<th>Test criteria</th>
<th>Test cases</th>
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<tbody>
<tr>
<td>Reporting / logging system</td>
<td>Day/ Month change – with/without closing of different deposits</td>
</tr>
<tr>
<td>Long time periods without closing deposits</td>
<td>Week change</td>
</tr>
<tr>
<td>Year change issues</td>
<td>New year change</td>
</tr>
<tr>
<td>IT software maintenance / updates</td>
<td>Specific time (02:00)</td>
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<tr>
<td>Power outage/ Hardware maintenance</td>
<td>Hour jumps</td>
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<tr>
<td>Robustness of the system / database / reporting / software cleanup</td>
<td>Deposits for more than 1 month with time jumps</td>
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Easy part: the implementation

Test automation is done by C# / TTCN3

We use powershell commands to manipulate date and time
Even more test case ideas

- Update of local hour (E.g.: after BIOS reset)
- Change of time zone
- Daylight saving time changes
- 2038-01-19 03:14:02 UTC (Unix systems)
- Travel back in time (Motherboard battery failure)
- ...

Testing of Trustworthy Systems #UCAAT
Initially our nightlies did not catch our problem with time boundaries
Hard part turned to be the design of test cases
Implementation turned out to be relatively simple
We believe it is both reasonable and possible to automate such checks
Today our nightly tests (& weekly test) check these time boundaries and lead to better robustness!
Any further questions?

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