Advanced build and test in a large software project

Carlo van Asma, Software Architect
Philips Healthcare Interventional X-Ray
June 3, 2015
Philips Healthcare

interventional X-ray
Deliver quality software on time within budget
Software Development
often not fast and efficient
Software Development

often non optimal for delivering quality
Software Development

aspects

$S_1 = 0.3$

$S_2 = 0.2$
Software Development

performance indicator

\[ M = \sum_{i} m_i \]

with \( m_i = \frac{\alpha_i}{S_i} \)

\[ x = \frac{M}{K} \]

excellent (1)
average (1/5)
poor (1/20)
Software Development

performance indicator (P)

old platform

new platform

• code size reduction
  1.5M -> 300K
  (three subsystems)
• ....
Fast build and test to improve the efficiency of the team
Fast Build and Test

fast feedback

20 min

small change set

1 day
Fast Build and Test

fast feedback

20 min

small change set

1 day

large change set

1 day

conventional
Build and Test

test runs per day (intermittent issues)
Build and Test

test runs per day (intermittent issues)
Test categories

<table>
<thead>
<tr>
<th></th>
<th>test system</th>
<th>performance tests</th>
<th>distributable</th>
</tr>
</thead>
<tbody>
<tr>
<td>system test</td>
<td>complete</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>subsystem tests</td>
<td>partially stubbed</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>component tests</td>
<td>none (single PC)</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>
Distributed Build

IncrediBuild

- build time reduction
  45min -> 7 min
Distributed Test

custom tool

• one test at the time per test PC
• test time reduction 2.5 hours -> 20 minutes

build PC

Server rack (with 20 dedicated test PCs)

LAN
Adequate automated testing to assure quality
Test
coverage
(Sub)system Test
test interfaces

- full UI control
- read state
- completion events
  (policy no sleeps)
- fault injection
- retrieve images (CRC checks)
- retrieve performance profiles
(Sub)system Test
performance testing (non-functional requirements)
(Sub)system Test
performance profile
UI testing

Test automation

Test

TestPeer

KB/Mouse events

UI Control

read state
Convenient build and test tooling
Performance Testing

trend charts
# Build & Test

automated build status report

<table>
<thead>
<tr>
<th>date</th>
<th>Alpha_iEngine_trunk_Distributed</th>
<th>Alpha_iEngine_trunk_iEngineSdk</th>
<th>Lambda_trunk_DeployAndTest</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total builds</td>
<td>failing builds</td>
<td>%</td>
<td>total builds</td>
</tr>
<tr>
<td>2014-10-28</td>
<td>26</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2014-10-27</td>
<td>22</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2014-10-26</td>
<td>50</td>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>2014-10-25</td>
<td>47</td>
<td>1</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>2014-10-24</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2014-10-23</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2014-10-22</td>
<td>18</td>
<td>2</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>
Test

Generated test spec

- test describes scenario
- executable spec

advantages:
- always up-to-date
- never ambiguous
Test

Test Traceability Matrix (TTM)

/*!
Tests image navigation in single viewport mode <BR>
[UID.Allura.Viewing.OverlayText] Show correct image overlay (80%)<BR> */
void testImageNavigation();

/*!
Tests image navigation in run(=series) overview <BR>
[SRS.Allura.Func.Mosaic Overview] <BR>
[UID.Allura.Viewing.OverviewMode.Mosaic.Run] image navigation works correctly in series overview (100%)<BR> */
void testSeriesOverviewImageNavigation();
Test Traceability Matrix (TTM)

<table>
<thead>
<tr>
<th>UnitTag</th>
<th>Test</th>
<th>Test Case</th>
<th>Aspect</th>
<th>Implementation Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRS Ala Function A</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function B</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function C</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function D</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function E</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function F</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function G</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function H</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function I</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function J</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function K</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function L</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function M</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function N</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function O</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function P</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function Q</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function R</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function S</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function T</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function U</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function V</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function W</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function X</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function Y</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
<tr>
<td>SRS Ala Function Z</td>
<td>XrayViewTest</td>
<td>XrayViewTest</td>
<td>test resume exposure settings</td>
<td>80</td>
</tr>
</tbody>
</table>

Philips Healthcare, Carlo van Asma, June 3, 2015
Deployment
fast X-copy deployment
Software Development

performance indicator (P)

old platform

- code size 1.5M (3 subsystems)
- 1 build & test per day
- build & test time 4 hours
- manual UI testing
- deployment cycle 10 min
- manual written test spec

new platform

- 300K (3 subsystems)
- 200 build & test executions per day
- build & test 25 min
- automated UI testing
- automated performance testing
- automated (sub)system level test
- trend charts
- deployment cycle 20 sec
- generated test spec
- ...... and more