Software Integration and Test Techniques in a Large Distributed Project: Evolution, Process Improvement, Results

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Antenna Prototypes at ALMA
Test Facility: 2005
ALMA Geographical distribution
Trilateral Computing IPT Organisation

Total Bilateral staff now: 40 FTEs
Total trilateral staff now: 65 FTEs
SLOC per Subsystem over Releases

Subsystems:
- ACS
- ARCHIVE
- CONTROL
- CORR
- EXEC
- OBSPREP
- OFFLINE
- PIPELINE
- SCHEDULING
- TELCAL
- ICD
- OBSOPS
- ACACORR
- TICS

Source lines of Code:
- 357,109
- 251,176
- 64,207
- 39,548
- 87,871
- 13,602
- 41,135
- 34,674
- 67,136
- 24,856
- 21,493
- 113,427

Legend:
- Apr 2004
- Oct 2004
- Apr 2005
- Oct 2005
- Apr 2006
- Oct 2006
- Apr 2007
ALMA System Dataflow
EXEC: Operator Master Client
CASA Viewer

- Visibility displays (raw, corrected data)
- Image, data cube displays
  - Statistics, profiles, raster, contour, vector support
Standards and Tools

- Alma Common Software
- Environment
- CVS organization
- Makefile
- Standard Test Environment (STE)
- Tool for automated testing
- Bug tracking tool (JIRA)
ALMA Release Cycle

Monthly integration = last day of the month

ICD Freeze = 15th of the month

Minor Release: Mar 31

Major Release: Sep 30

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec
Lessons learned

- Releases twice per year
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but...

- Subsystem developers working in isolation
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- Results thrown over the wall to ITS at release time
Lessons learned

- Releases twice per year

but...

- Subsystem developers working in isolation
- Results thrown over the wall to ITS at release time
  - Each integration took ~2 months
  - At completion of integration code was already obsolete
Function-based Teams

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACS 7.0</td>
<td>01 Nov '07</td>
<td>01 Nov '07</td>
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<tr>
<td>2</td>
<td>Stability Initiative #2</td>
<td>02 Nov '07</td>
<td>10 Jan '08</td>
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<tr>
<td>3</td>
<td>R5.0 (SFI with dynamic fringes)</td>
<td>03 Sep '07</td>
<td>30 Nov '07</td>
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<td>4</td>
<td>ACS 7.0 Porting</td>
<td>03 Dec '07</td>
<td>14 Dec '07</td>
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<td>5</td>
<td>ACA Correlator #2</td>
<td>01 Nov '07</td>
<td>04 Jan '08</td>
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<tr>
<td>6</td>
<td>ITS validation</td>
<td>07 Jan '08</td>
<td>18 Jan '08</td>
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<td>7</td>
<td>Schema Versioning</td>
<td>15 Oct '07</td>
<td>14 Dec '07</td>
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<td>8</td>
<td>ITS validation</td>
<td>17 Dec '07</td>
<td>04 Jan '08</td>
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<td>9</td>
<td>ASDM Finalization</td>
<td>07 Jan '08</td>
<td>29 Feb '08</td>
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<td>10</td>
<td>ITS validation</td>
<td>03 Mar '08</td>
<td>14 Mar '08</td>
</tr>
<tr>
<td>11</td>
<td>Flagging and Blanking</td>
<td>07 Jan '08</td>
<td>14 Mar '08</td>
</tr>
<tr>
<td>12</td>
<td>ITS validation</td>
<td>17 Mar '08</td>
<td>28 Mar '08</td>
</tr>
<tr>
<td>13</td>
<td>R5.1 Validation at ATF</td>
<td>31 Mar '08</td>
<td>18 Apr '08</td>
</tr>
</tbody>
</table>

FBTs organization

Z  SharedSimulator-2006-02-B (branch)
SharedSimulator-2006-02-RootOfBranch (tag of the HEAD)

A  SharedSimulator-2006-02-BeforeMerge

B  TRUNK-SharedSimulator-2006-02-BeforeMerge

C  TRUNK-SharedSimulator-2006-02-AfterMerge (tag of the HEAD)
SharedSimulator-2006-02-AfterMerge-B (branch)

F  SharedSimulator-2006-02-FINAL
Summing it up

• FBTs advantages:
  – Improve communication
  – More effective involvement of testers

• Testing end-to-end since the beginning
  – Good for object-oriented software
  – A lot of maintenance on the test cases
  – It is not enough -> user tests
Future developments

• ... the list can be very long ...

For the near future we want to focus on:
• Stability tests
• More automation