COSMIC-FFP
Some results from the field trials

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Agenda...

- Context
- COSMIC-FFP - brief review of key points
- Field trials results - first analysis
- Field trials results - second analysis
- Conclusion
A new functional size measurement method, COSMIC-FFP, was put in the public domain a year ago.

Field trials were conducted essentially until the end of summer 2000.

The first experimental results of the field trials are presented here.

COSMIC-FFP – Key points...

**Software model**

![Diagram showing the software model and F.U.R. (Functional Unique Requirement) with sub-processes and data types.]

Functionality = Data movements and Data manipulations.
COSMIC-FFP – Key points...

Measurement process

- Functional User Requirements of the Software to be measured
- COSMIC-FFP software P/I/A. model
- COSMIC-FFP Measurement Manual
- Measurement Phase
- COSMIC-FFP Function size
- Key points...

Measurement system

- Unit of measure: COSMIC Functional Size Unit (Cfsu).
- Yardstick (by convention): 1 Cfsu = 1 elementary data movement.
- Base Functional Components (BFC): entry (E), exit (X), read (R) and write (W)
- Therefore each BFC receives 1 Cfsu.
- FFP results can be aggregated at the desired level of detail by arithmetically adding the size units assigned to sub-processes.
Field trials results

1st analysis: Study the range of functional process size.

2nd analysis: Study the role of the number of data attributes per data movement.

Field trials results – data sample

- One organization, a world class manufacturer of real-time systems,
- Sample of 93 functional process taken from 6 software delivered in 1999 or 2000,
- Sample of 456 individual data movements from the same 6 software.
### Field trials results – data sample

<table>
<thead>
<tr>
<th>Software ID</th>
<th>No. of functional processes</th>
<th>Software size (Gbp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9</td>
<td>32</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>76</td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>56</td>
</tr>
<tr>
<td>D</td>
<td>46</td>
<td>142</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>F</td>
<td>18</td>
<td>142</td>
</tr>
<tr>
<td>Overall</td>
<td>93</td>
<td></td>
</tr>
</tbody>
</table>

### Field trials results – 1st analysis

<table>
<thead>
<tr>
<th>Software ID</th>
<th>No. of func processes</th>
<th>Software size (Gbp)</th>
<th>Average size (Gbp)</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9</td>
<td>32</td>
<td>3,6</td>
<td>0,5</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>76</td>
<td>9,5</td>
<td>1,9</td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>56</td>
<td>7,0</td>
<td>2,1</td>
</tr>
<tr>
<td>D</td>
<td>46</td>
<td>142</td>
<td>3,1</td>
<td>0,7</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>8</td>
<td>2,0</td>
<td>0,0</td>
</tr>
<tr>
<td>F</td>
<td>18</td>
<td>142</td>
<td>7,9</td>
<td>7,1</td>
</tr>
<tr>
<td>Overall</td>
<td>93</td>
<td>456</td>
<td>4,5</td>
<td>4,1</td>
</tr>
</tbody>
</table>
### Field trials results - 1st analysis

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
- Average value
- 1 Standard deviation

**Inferences:**
Establish an equivalence between COSMIC-FFP functional process and IFPUG elementary process...

### Field trials results - 1st analysis

- Range of possible values according to the IFPUG method
- Overall: 25% of the 93 functional processes would have been mis-scored by the IFPUG method
Field trials results – 1st analysis

- COSMIC-FFP was designed to better capture the amount of functionality within functional process
- We have corroborative evidence that the design of the method meets its goal
- The granularity of COSMIC-FFP allow to better capture the variations in functional size, as it is often observed in real-time software.

Field trials results – 2nd analysis

- Number of data attributes counted for 344 of the 456 individual data movements,
- Is there a significant difference in the number of data attributes moved by each type of data movement?
- Would it justify different "weights" for each type of data movement?
### Field trials results – 2nd analysis

<table>
<thead>
<tr>
<th>Data movement types</th>
<th>Average no. of data attribute</th>
<th>Standard deviation</th>
<th>Number of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTRY</td>
<td>3.1</td>
<td>2.9</td>
<td>96</td>
</tr>
<tr>
<td>EXIT</td>
<td>2.9</td>
<td>2.7</td>
<td>121</td>
</tr>
<tr>
<td>READ</td>
<td>3.5</td>
<td>4.1</td>
<td>63</td>
</tr>
<tr>
<td>WRITE</td>
<td>4.7</td>
<td>3.3</td>
<td>64</td>
</tr>
</tbody>
</table>
Field trials results - 2nd analysis

H₀: both type (E) move on average the same number of data attributes.
P(H₀) below:

<table>
<thead>
<tr>
<th></th>
<th>ENTRY</th>
<th>EXIT</th>
<th>READ</th>
<th>WRITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTRY</td>
<td>0.6094</td>
<td>0.5188</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXIT</td>
<td>0.2620</td>
<td></td>
<td>0.0007</td>
<td></td>
</tr>
<tr>
<td>READ</td>
<td></td>
<td>0.0271</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H₀ rejected at the 0.05 level.

Field trials results - 2nd analysis

○ Analysis indicate a difference between WRITE and the other three data movement type (as a group),
○ Magnitude of the difference is small though,
○ Unless there would be experimental data supporting a difference of a larger magnitude, each type of data movement will be considered of equal "weight".
Conclusion...

- From the 1st analysis:
  - The granularity of COSMIC-FFP allows to better capture the variations in functional size, as it is often observed in real-time software for instance.

- From the 2nd analysis:
  - Unless there would be experimental data supporting a difference of a larger magnitude, each type of data movement will be considered of equal "weight".

These two analysis are the first field trial results to be published,
- There is much more to come in the following months,
- Disclosure of field trial results can be monitored at:
  
  http://www.lrgl.uqam.ca/ffp.html
Acknowledgments

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