SOFTWARE PROJECTS BENCHMARKING & ESTIMATION: CONTRIBUTIONS OF COSMIC FUNCTION POINTS

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with contributions from Charles Symons & Sylvie Trudel

Presenter background - Alain Abran

20 years

- Development
- Maintenance
- Process Improvement

25 years

+ 40 PhD

ISO: 19761, 9126, 25000, 15939, 14143, 19759
Agenda

- Software Sizing options for Benchmarking & Estimation
- Versatility of COSMIC Function Points
- Contributions of COSMIC to Benchmarking & Estimation
Software Sizing Options for Benchmarking & Estimation

- Lines of code:  
  - Can’t estimate until software designed
  - Technology-dependent, no standards

- Use case points, object points, ..:  
  - Technology dependent, no standards
  - Mathematical validity?

- Story Points:  
  - Entirely subjective

- Functional size
  - (Function Points):
    - International standard methods
    - Technology-independent
1st Generation of Function Points

Tables of weights

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<thead>
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<th>FTR’s</th>
<th>DATA ELEMENTS</th>
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<tr>
<td>0-1</td>
<td>Low</td>
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<tr>
<td>2</td>
<td>Low</td>
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<tr>
<td>3 or more</td>
<td>Ave</td>
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<th>FTR’s</th>
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<tr>
<td>0-1</td>
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<td>&gt; 3</td>
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<table>
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Key limitations:
- Only 3 values
- Limited ranges (min, max)
- No single measurement unit of 1 FP!
1st Generation of Function Points

Function Points (FP)

3 FP

4 FP

6 FP

= ?
2\textsuperscript{nd} Generation of Function Points: COSMIC measurement scale

A single CFP exists and is well defined

No arbitrary max
2nd Generation of Function Points
All software does this:

Functional Users types:
1. Humans
2. Hardware devices
3. Other software

The ‘Data Movement of 1 data group’ is the unit of measurement: 1 CFP
(1 CFP = 1 COSMIC Function Point)
Functional process: example with a sequence diagram

Boundary

FP of App X being measured

Triggering E
Another E

Human Functional User

Item detail X
Total X
Error msg. X

Boundary

R (for validation)

X Message to the other software E
E Reply from the other software X
W

FP of Software Functional User of App Y

Size = 9 CFP
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Versatility - at any level of software requirements

Application Layer

Middleware Layer (Utilities, etc)

Database Management System Layer

Operating System Layer

Hardware

Keyboard
Screen
Print
Disk
Drive
Driver
Driver
Driver

App 1
App 2
App ‘n’

DBMS 1
DBMS 2
COSMIC supporting documentation

Guidelines per application type & development approach

- Business applications
- Real-time/embedded
- Data Warehouse
- SOA
- Mobile apps
- Web
- Agile Development

Available in 11 languages, including Chinese

Certification

VERSION 1.3a
February 2016

The COSMIC Functional Size Measurement Method
Version 4.0.1

Guideline for Sizing Business Application Software

at www.cosmic-sizing.org

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COSMIC Case Studies at www.cosmic-sizing.org

- **Real-time:**
  - Rice cooker
  - Automatic line switching
  - Valve control

- **Business:**
  - Course registration (distributed)
  - Restaurant management (web & mobile phone)
  - Banking web advice module
  - Car hire (existing legacy app.)
Agile: sizes can be measured at all levels & aggregated up to the system size

COSMIC size measurement is usable for:
- Early Total software sizing & effort estimation
- US, Sprint, .... sizing & estimation
- Progress control at any level

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When requirements are not yet written in details:

A Guideline describing a range of Approximate Sizing methods

• 8 Approaches defined
You do estimation upfront with a lot of uncertainty
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COSMIC data from Industry

COSMIC method in Automotive embedded software

By: Sophie Stern

*Renault*
Data from Renault - 2012
Data from Renault – 2012

BCM: New developments, automatic coding

\[ n=8 \]

\[ R^2 = 0.8624 \]

© Copyright Renault 2012
Renault - Remarkable cost estimation accuracy from its ECU software specifications

Cost vs size (CFP)

Memory size vs software size (CFP)

- Supplier used Scrum - 3 weeks iterations
- Customer requests for new or changed functions
- ‘Poker planning’ to estimate backlog items in Story Points (& converted directly in work-hours)
- 24 tasks from 9 iterations with estimated & actual effort
- Re-measured in COSMIC Function Points
Effort = 0.47 x Story Points + 17.6 hours and $R^2 = 0.33$
Security & Surveillance software with COSMIC Function Points

Effort = 0.47 x Story Points + 17.6 hours and R² = 0.33)

Y = 2.35 x CFP - 0.08hrs and R² = 0.977

COSMIC Function Points

Story Points
Other sources of COSMIC examples with industry data

- COSMIC web site at: www.cosmic-sizing.org
Conclusion

- COSMIC Function Points correlate very well with effort & code size
- Used in a number of countries:
  - Business, real-time & infrastructure software
  - ‘Measurement Manual’ available for FREE in 11 languages
  - 50% of known users are software houses
  - > 30,000 downloads of research & conference papers
- ISO 19761 standard endorsed by:
  - Governments (China, Japan, Mexico, Poland)
  - GAO – USA Government Accountability Office
  - NIST – USA National Institute of Standard and Technology
Thank you for your attention

(www.cosmic-sizing.org)

Alain Abran, Ph.D.