

Is Automated Function Point Counting Useful Yet?

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Agenda

- Review IFPUG Tool Certification Requirements
- Introduce the counting capabilities and approaches of some Level 2+ tools on the market
- Report Zurich's experiences in using one of these tools
- Suggest ways that these tools can be used for automated function point counting



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Background

- IFPUG recognizes and certifies tools to assist function point counting at three levels.
- A number of tools that assist human counters have been certified at the first two levels but no tools have been certified at level 3 which essentially requires the replacement of a human counter with a computer.
- Based on experience at Zurich and industry research, this presentation reviews the evolution, over the past few years, of “automated function point counting” capabilities inside static code analysis tools used for code quality analysis.
- These tools seem to be something more than IFPUG level 2 but not yet IFPUG level 3.



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IFPUG Software Tool Certification Types

- **Type 1 Software** provides Function Point data collection and calculation functionality, where the user performs the Function Point count manually and the software acts as a repository of the data and performs the appropriate Function Point calculations.
- **Type 2 Software** provides Function Point data collection and calculation functionality, where the user and the system/software determine the Function Point count interactively. The user answers the questions presented by the system/software and the system/software makes decisions about the count, records it and performs the appropriate calculations.
- **Type 3 Software** carries out an automatic Function Point count of an application using multiple sources of information such as the application software, database management system and stored descriptions from software design and development tools. The Software records the count and performs appropriate calculations. The user may enter some data interactively, but his or her involvement during the count is minimal. Software Type 3 instructions and criteria are currently under review by the IFPUG Board of Directors.
- The software and its associated documentation must conform to the Counting Practices Manual.



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The current situation

- The requirements for Type 3 are valid but represent a huge jump from Type 2 – essentially requiring a machine to count the way a human would using the same materials.
- Requirements for Type 3 may be beyond current technology



BUT ...

- There may be current technology that has worthwhile capabilities beyond Type 2 but nowhere near Type 3
- There are current software products that are “carefully” claiming the ability to automate FP counting.

Strengths and Weaknesses of the different approaches

- The IFPUG approach requires the ability to deal with many different forms of input and significant pattern recognition.
- These are processes which humans are very good at.
- The subjectivity in this approach and consequent variability of human outputs is constrained (as best as it can be) by a significant body of rules – the Counting Practices Manual or CPM. This makes it time-consuming and, for some very large tasks, punitively expensive.
- A computer generally does not do subjectivity.
- Hence, if input variation can be reasonably constrained and if a reasonable set of rules can be combined into an algorithm, a computer will always produce the same result – consistently and inexpensively.
- Consequently, automation will always work better on some types of problems than others until the problem can be reformatted to suit the computer.



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Strengths and Weaknesses of the different approaches

	New Dev Project Estimate	New Dev Project @ completion	Enh. Project Estimate	Enh. Project @ completion	Application Count	Application re-count	Portfolio Baseline	Portfolio re-baseline
FPA by CFPS	Good	Good	Good	Good	Good	Good but expensive	Good but prohibitively expensive	Good but prohibitively expensive
Projection based on sample FPA by CFPS	N/A	N/A	N/A	N/A	N/A	N/A	OK but sample-sensitive	OK but sample-sensitive
Tool-supported FPA by CFPS	N/A	N/A	N/A	May be feasible	OK? – probably not less expensive	OK? – less expensive	OK? – may be less expensive	OK? – less expensive
Tool-only FPA	Not enough AI capability today to judge	Not enough AI capability today to judge	Not enough AI capability today to judge	Not enough AI capability today to judge	OK? – probably not less expensive	OK? – less expensive	OK? – may be less expensive	OK? – less expensive



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Level 2+ tools on the market - CAST Application Intelligence Platform



- The CAST solution can read, analyze and semantically understand most kinds of source code, including scripting and interface languages, 3GLs, 4GLs, Web and mainframe technologies, across all layers of an application (UI, logic and data). By analyzing all tiers of a complex application, CAST measures quality and adherence to architectural and coding standards, while providing real-time system blueprints.
- This application quality analysis is a powerful tool for knowledge transfer (especially for poorly documented code) and for the quality of maintenance of an application
- As a byproduct of its application quality analysis, it develops a view of the architecture and data structure of the code which allows it to use an IFPUG-like algorithm to generate an IFPUG-like size metric.



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Level 2+ tools on the market - Relativity Technologies – A Micro Focus Company

- The Micro Focus Application Portfolio Management Solution can help the efficient everyday implementation and running of applications throughout the enterprise by supporting:
 - Definitive input into project planning
 - Full documentation of applications with drill-down capability to source code
 - Complete impact analysis of all proposed changes
 - Automatic creation of comprehensive audit trails
 - Automatic metrics for complexity, size/volume, maintainability and trend analysis
 - Technical function points and other decision metrics
- The automated function point counting capability (mainly focused on COBOL) makes use of a higher level of manual CFPS intervention to “tune” the automatic size calculation to produce results more consistent with IFPUG manual counts



Level 2+ tools on the market - Function Point Modeler Inc

- **Function Point Modeler Advanced Enterprise™** sizes software with *Function Point Analysis*, estimates software with *COCOMO* and also manages the whole IT-Metrics (Project, Product and Process Metrics) of your company in a *Software Life Cycle Experience Database (SLED)*.
- Function Point Modeler™ includes formulas to calculate the *three* types of function point counts—*development project, enhancement project, and application* according to *CPM 4.2.1*.
- Function Point Modeler can also import any UML Model (UseCase or Class Model) to its Function Point Model.
- It is not clear to what degree the full function point analysis is automated versus the simple automation of the calculations following normal human CFPS analysis.



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Level 2+ tools on the market - Others ...

- This problem seems to have been attempted on a number of occasions in various different organizations to improve their in-house productivity. These include actual attempts to mimic the IFPUG algorithm and project comparison tools that include some parametrization.
- Some of the more sophisticated software estimation tools (e.g. SEER for Software from Galorath) have FP approximation tools built into the front ends of their estimation software.



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CAST at Zurich

- Vendor input
 - Counts for mainframe and 4 GL applications
 - Application counting
 - Not comparable to hand counting
 - Function Point Backend can only count what it knows
 - Backfire and LOC by technology
 - CAST can only count what is loaded to it
 - Can not count interfaces into 3rd party software
 - 5 jurisdiction reviewed
 - 30 applications from North America (Sample A)
 - 4 applications from Europe (Sample A)
 - 12 applications from Europe (Sample B)
 - 57 applications from Europe (Sample C)
 - 38 applications from North America (Sample B)



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CAST – Topics Recorded

- Supportability
 - . SEI rating for maintainability

 - Health Factors
 - . Transferability
 - . Changeability
 - . Robustness
 - . Performance
 - . Security

 - Snapshot
 - . Application Code (pie chart)
- Quantity Summary
 - LOC
 - Number of files
 - Number of programs
 - Number of SQL artifacts
 - Backfired IFPUG FPs
 - Automated IFPUG FP's

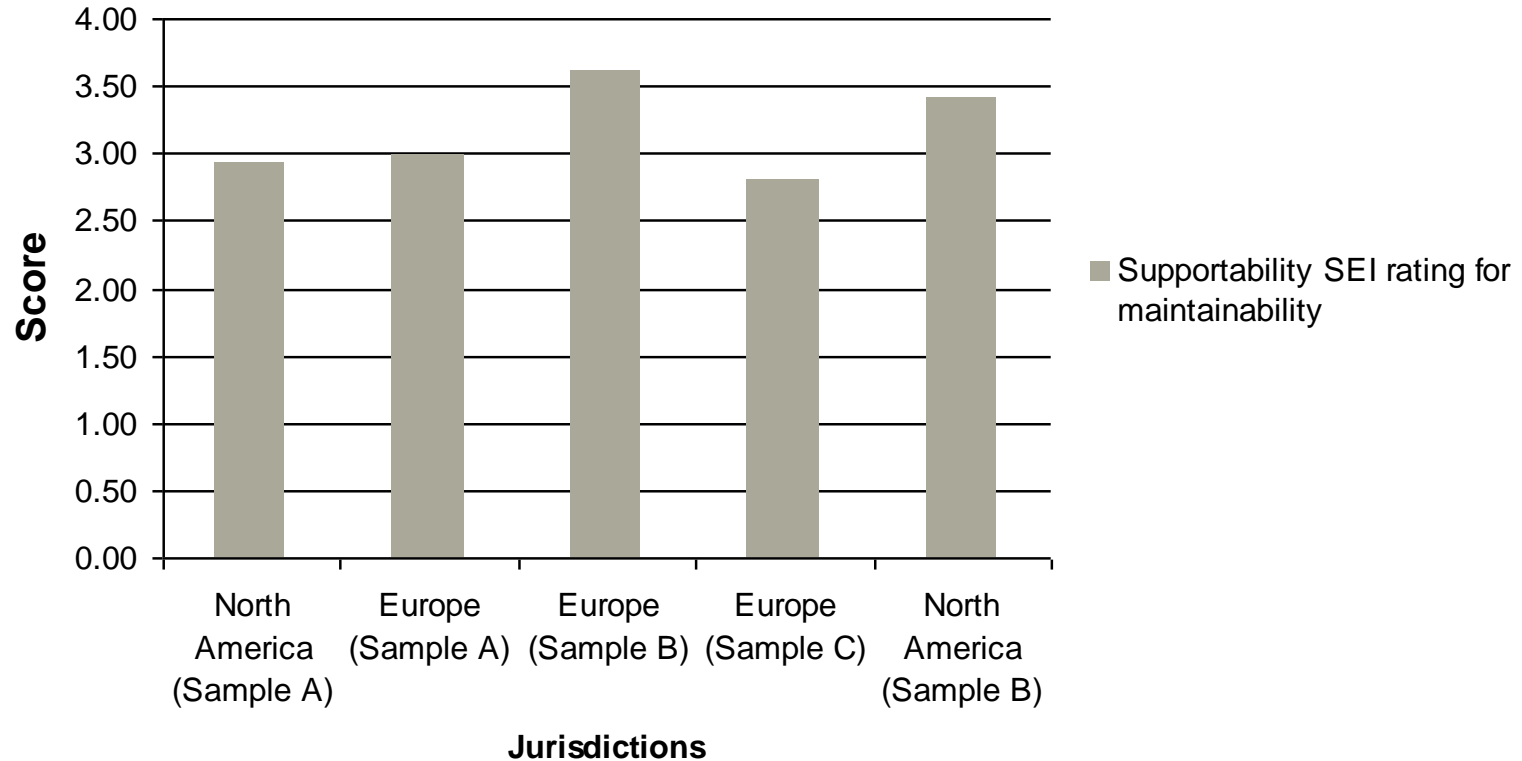
 - Architecture
 - Overall Grade
 - Reuse
 - Object level dependencies

CAST – one off review

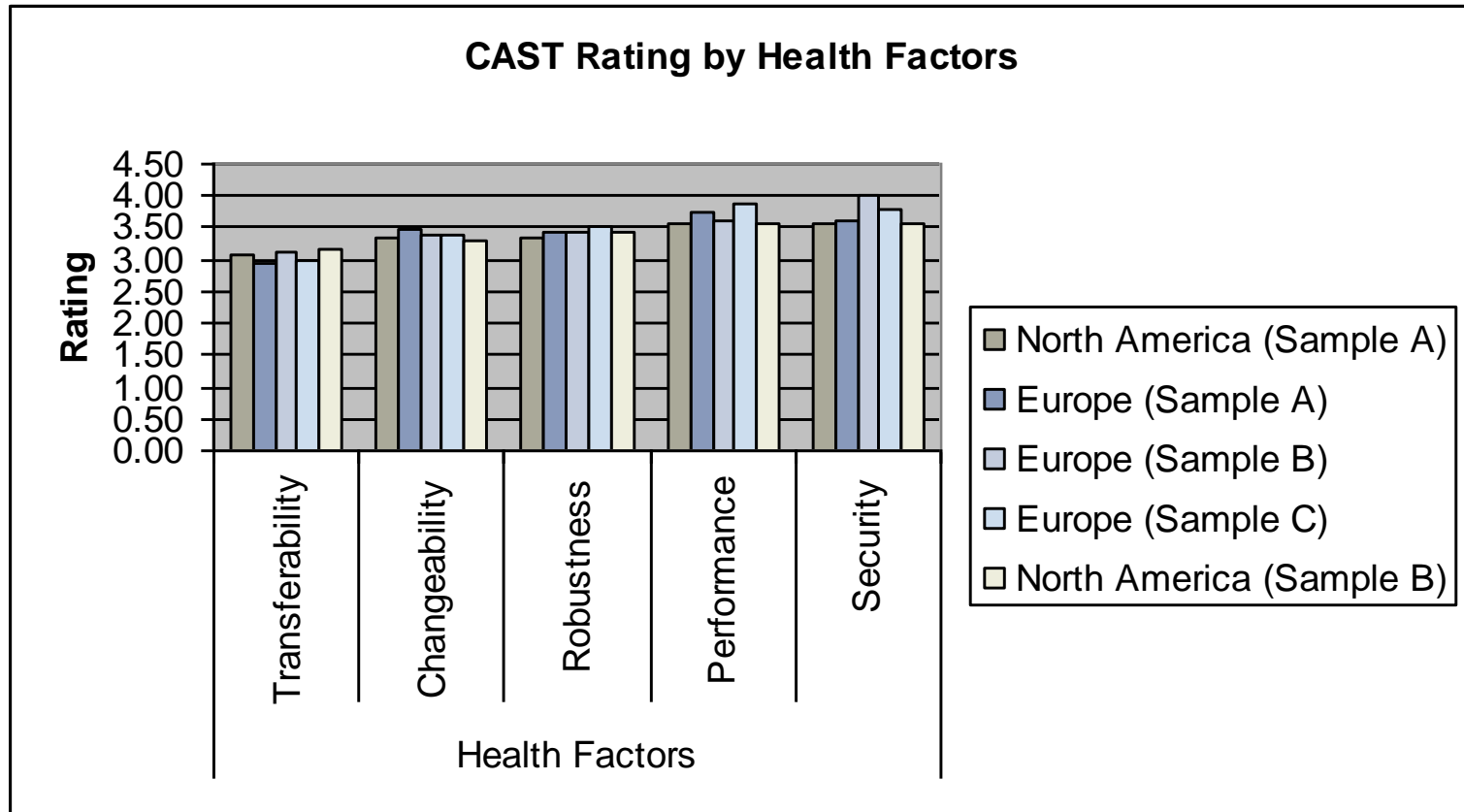
		North America (Sample A)	Europe (Sample A)	Europe (Sample B)	Europe (Sample C)	North America (Sample B)
Supportability	SEI rating for maintainability	2.94	2.98	3.61	2.79	3.40
		North America (Sample A)	Europe (Sample A)	Europe (Sample B)	Europe (Sample C)	North America (Sample B)
Health Factors	Transferability	3.07	2.96	3.13	2.97	3.18
	Changeability	3.35	3.46	3.37	3.39	3.32
	Robustness	3.32	3.44	3.43	3.52	3.43
	Performance	3.58	3.74	3.63	3.87	3.58
	Security	3.57	3.63	4.00	3.80	3.54
		North America (Sample A)	Europe (Sample A)	Europe (Sample B)	Europe (Sample C)	North America (Sample B)
Quantity Summary	LOC	27,327,603	2,290,433	1,158,987	11,845	13,925,895
	Number of files	94,274	5,210	5,693	3,648	50,702
	Number of programs	20,527	2,257	571	0	8,039
	Number of SQL artifacts	153	115	1,062	153,182	2,522
	Backfired IFPUG FPs	172,770	12,996	9,256	27,454	115,992
	Automated IFPUG FP's	133,924	15,269	11,619	0	73,081
		North America (Sample A)	Europe (Sample A)	Europe (Sample B)	Europe (Sample C)	North America (Sample B)
Architecture	Overall Grade	3.10	2.98	3.08	3.13	9.73
	Reuse	2.67	2.68	2.84	2.77	2.93
	Object level dependancies	3.36	3.37	3.07	3.29	3.06

CAST – Supportability

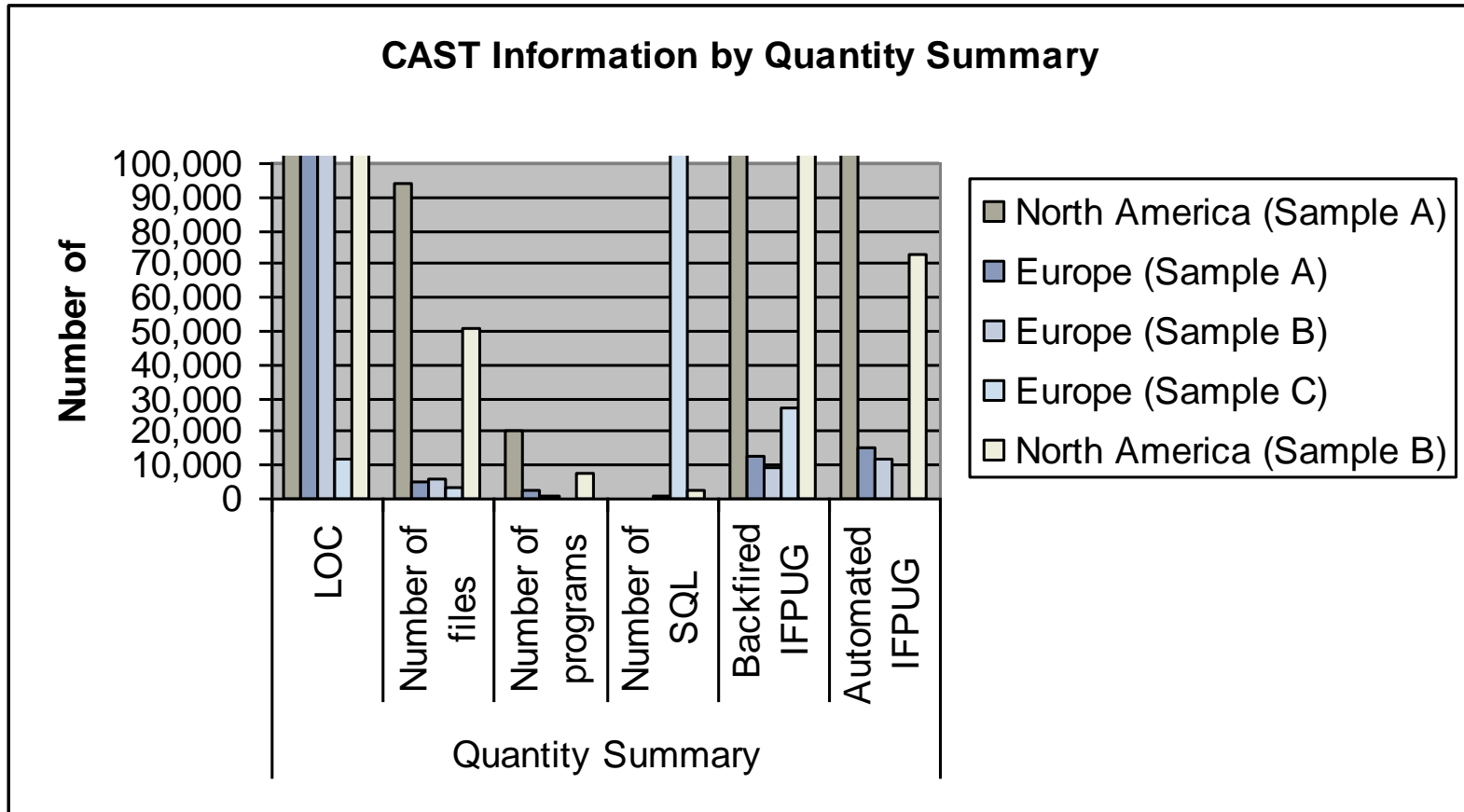
Supportability SEI rating for maintainability



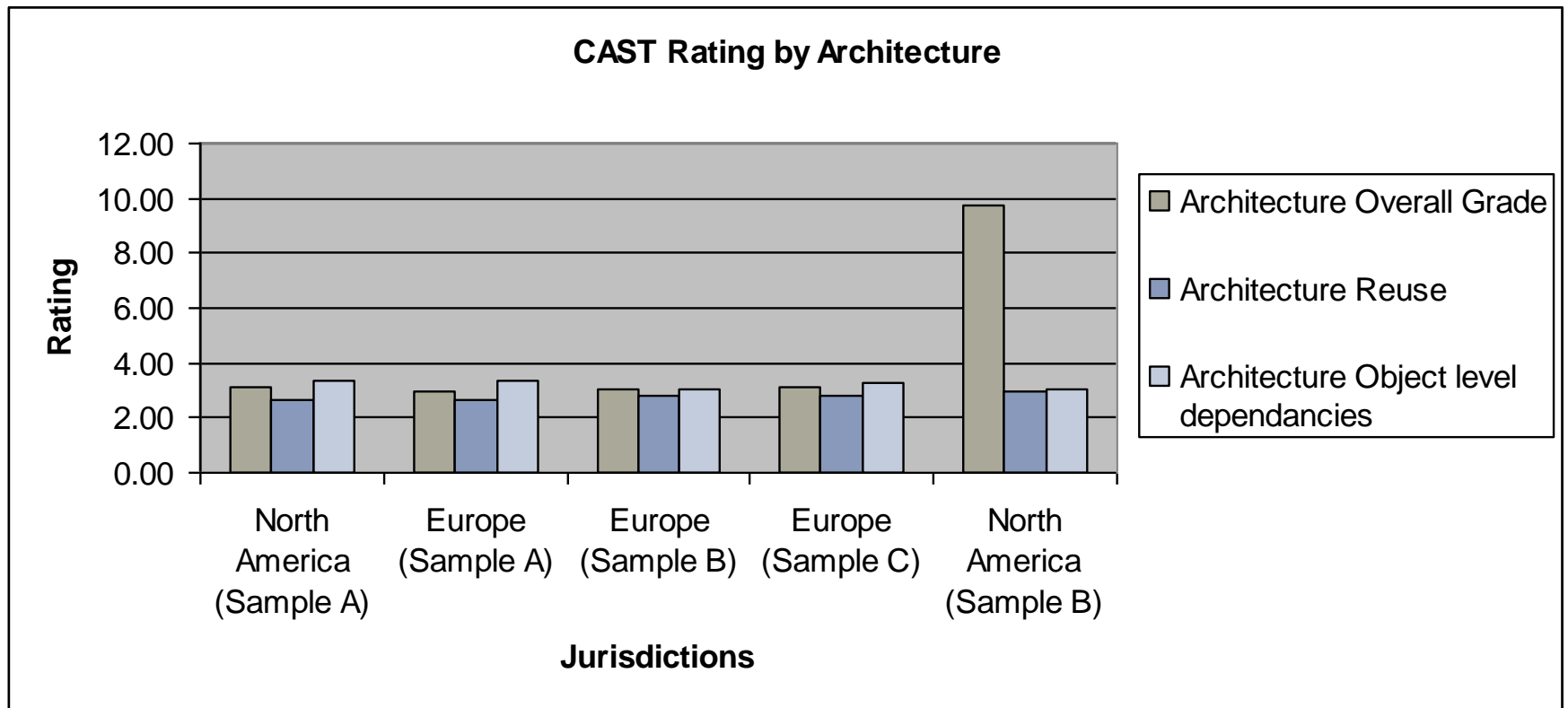
CAST – Health Factors



CAST – Quantity Summary



CAST – Rating by Architecture



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The Challenges presented by the current situation (1)



- FP's are used in different ways to meet different needs.
 - For some, human (CFPS) intervention will be required for the foreseeable future.
 - For others, technology available today (above level 2 but below level 3 capabilities) may be a more viable way for companies to use FP's than only human intervention.
- Consistency vs "Accuracy"
 - Current Type 3 certification requires that tools apply the CPM
 - However, the CPM rules are designed to ensure Consistency (between one CFPS and the next). For tools at the Type 2+ level, once certification is granted, there is no need for concern over consistency, the software will run the same way every time.
 - There should **not** be concern over accuracy if there is consistency.

The Challenges presented by the current situation (2)

- This raises challenges of certification granularity ...By technology?
By language?
- ... and process
 - does IFPUG keep a “gold standard” set of source code and documentation to be analyzed or
 - do we ask the vendors to bring their own?
 - How many examples do we need for statistical soundness?



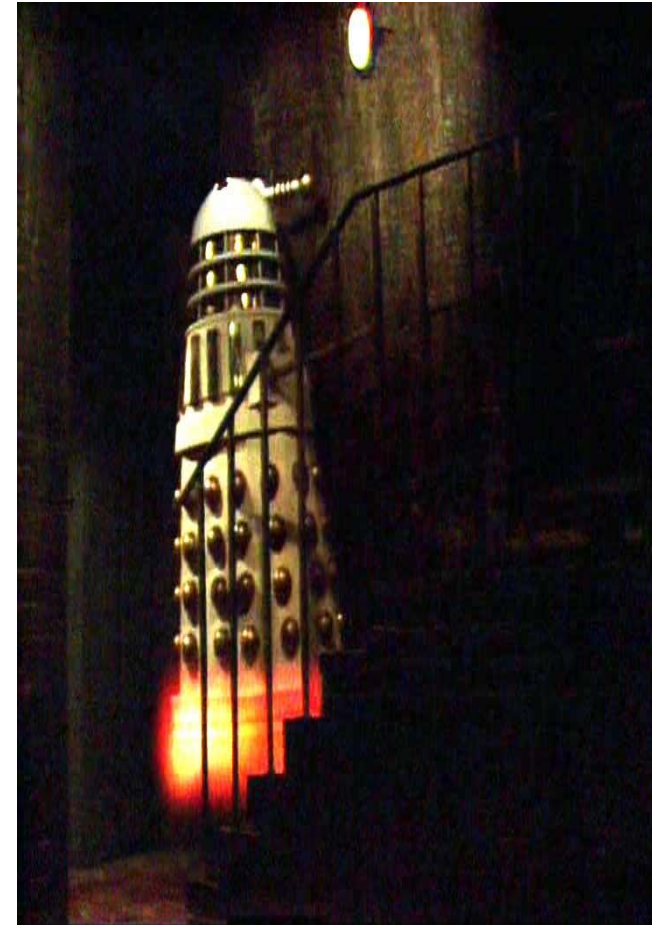
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A basis for moving Forward?

Supports ...	Type 1	Type 2	Type 3 (if ever produced)	Type 2a (New?)	Type 2b (New?)	Type 2c (New?)	Type 2d (New?)
Pre-project	Y	Y	Y	N	N	N	?
Post-project	Y	Y	Y	Y	N	N	?
Application	Y	Y	Y	Y	N	N	?
Results components stored in IFPUG format	Y	Y	Y	Y	Y	Y	?
Uses CPM algorithm to calculate FP's	N	N	Y	N	N	N	?
Input: Reqmts Spec.	N	N	Y	N	N	N	?
Input: Design Spec.	N	N	Y	N	N	N	?
Input: Source code	N	N	N?	Y	Y	Y	?
Input: Human CFPS	Y	Y	N	N	Y	N	?
Output: FP	Y	Y	Y	N?	Y?	N?	?
Output: AFP	Y?	Y?	Y?	Y?	Y?	Y?	?
Use for ...	All	All	All	Productivity counts & Portfolio counts	Productivity enhancement for CFPS	Portfolio counts	?

A Way around the Challenges?

- An alternative metric?
 - Is there value in defining an alternative metric – perhaps Automated Function Points (AFPs) – that IFPUG (or someone else) could define using a modified version of the CPM tailored to address issues of automated tool use.
 - For example, AFP's might be defined as:
 - Being traceable to standard IFPUG component elements
 - Generated from source code
 - Not including “user visibility”
 - Using simplified assumptions for data element updates by transactions



Next “Steps”?

- Can “Automated FPs” be standardized?
- What is needed?
 - More discussion – lets work out how we can manage the current situation with minimum effort and maximum kudos.
 - Participation with the vendors
 - A practical approach to certification
 - A working group or sub-committee to take this and run with it.
 - Any other thoughts?
- How can you help?



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Questions/Discussion?

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Useful Yet?



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SEI Maintainability Index

$$M = 171 - 5.2 * \log_2(\text{aveV}) - 0.23 * \text{aveV}(g') - 16.2 * \log_2(\text{aveLOC}) + 50 * \sin(\sqrt{2.4 * \text{perCM}})$$

M < 65 **poor maintainability**

65 < MI < 85 **fair maintainability**

85 < MI **excellent maintainability**

The coefficients are derived from actual usage.

The terms are defined as follows:

aveV = average Halstead Volume V per module

aveV(G) = average cyclomatic complexity per module

aveLOC = the average count of lines of code (LOC) per module; and, optionally

perCM = average percent of lines of comments per module



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