Exploring the Convertibility between IFPUG and COSMIC FP: Preliminary Findings

Çiğdem GENCEL & Carl BIDEAU

IWSM MENSURA 2012

October 17-19 2012, Assisi, Italy

Freie Universität Bozen
Libera Università di Bolzano
Free University of Bozen · Bolzano

Capgemini
CONSULTING.TECHNOLOGY.OUTSOURCING

Çiğdem GENCEL

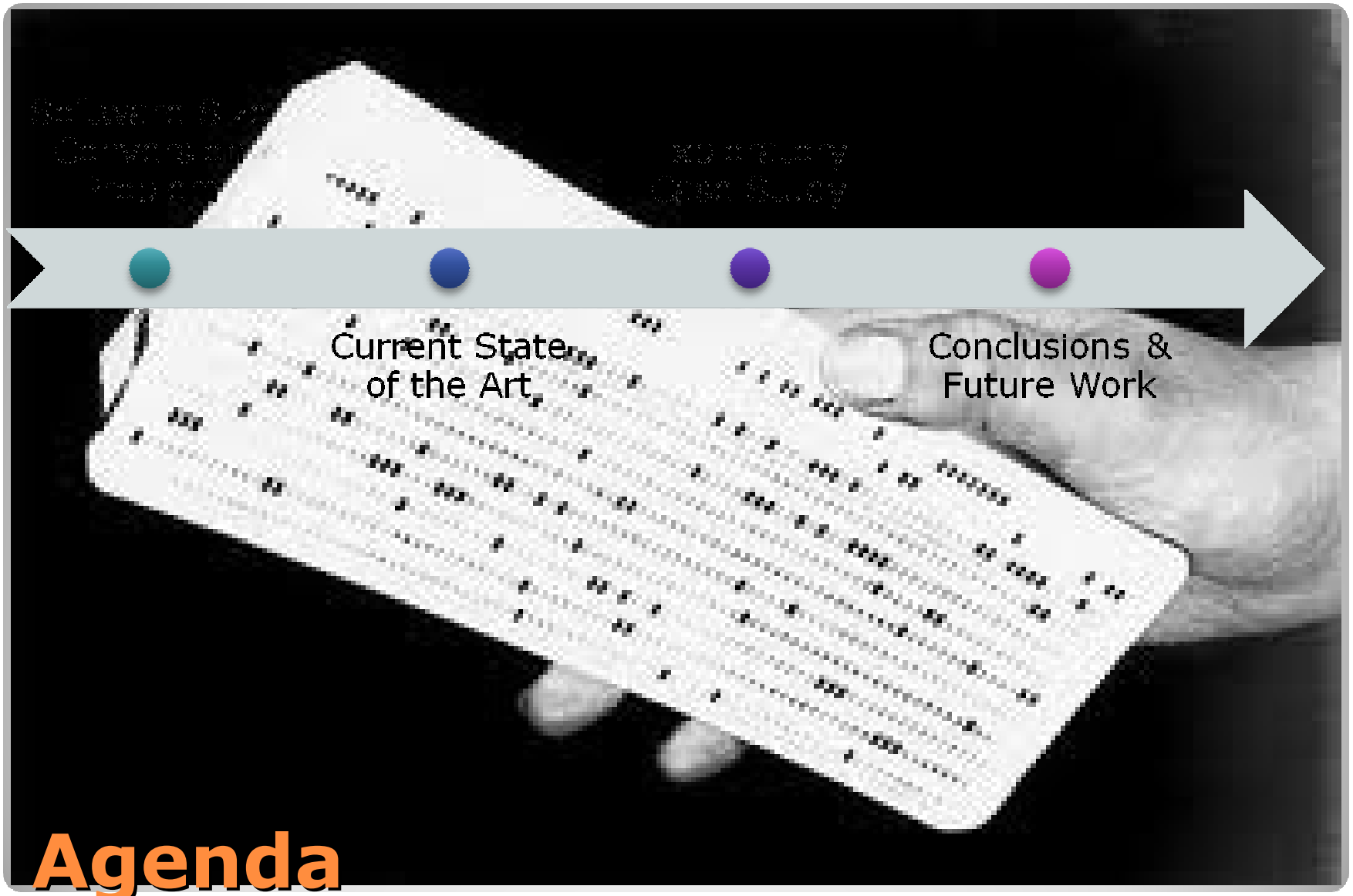
Assist.Prof., Free University of Bolzano, ITALY

Email: cigdem.gencel@unibz.it

Carl BIDEAU

Senior Analyst, CAPGEMINI UK, Estimating & Measurement Centre

Email: carl.bideau@capgemini.com



Agenda

- Each FSM method measure functional size by its own measurement process, model, rules and metrics

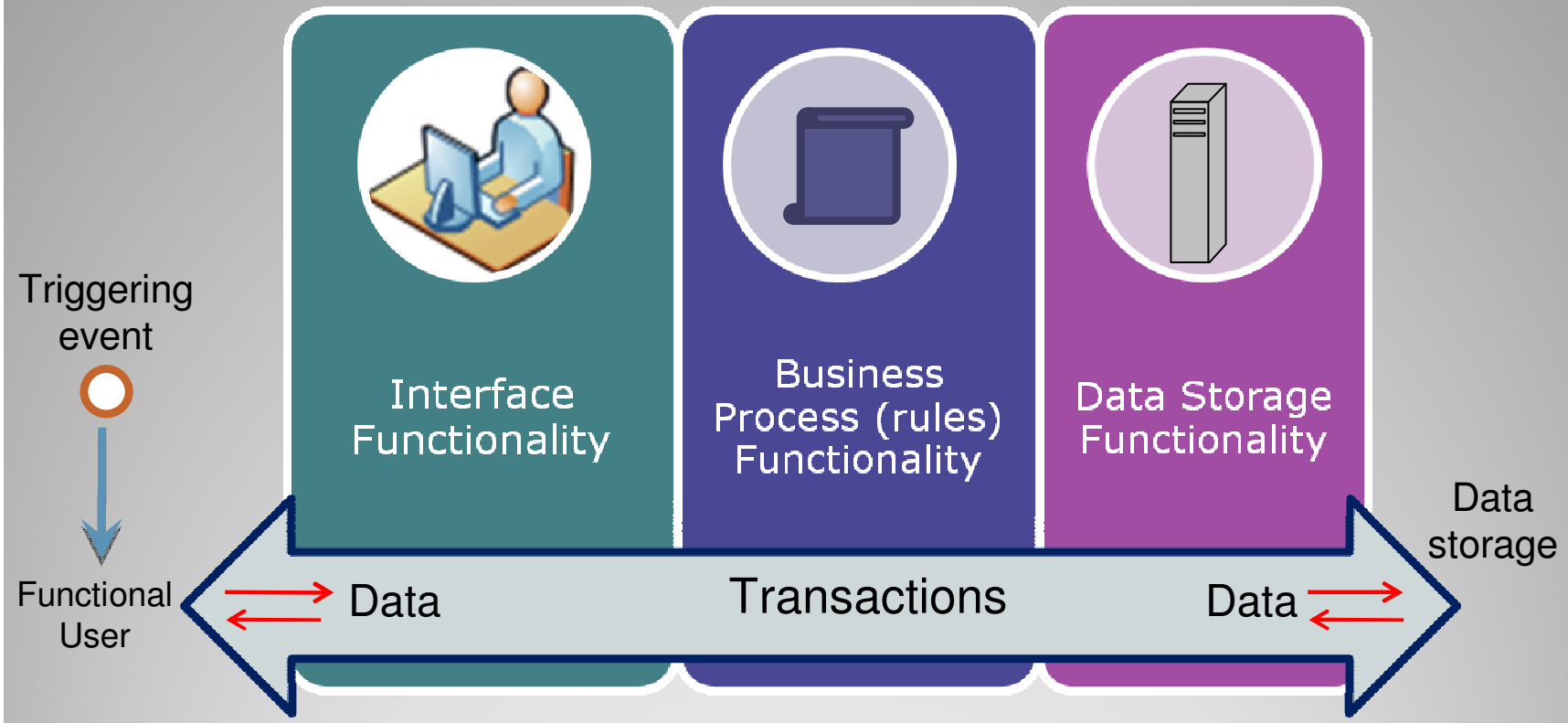
A piece of software has several functional sizes

IFPUG FP ≠ CFP

Different Functional Sizes

- Albrecht, A.: "the amount of function to be provided by the application" (1979)
- ISO 14143-1: "A size of the software derived by quantifying the Functional User Requirements" (1998)
- Rule, G.: "A measure of the quantity of information processing functionality the customer requires of the software independent of the technology used" (1999)

Software Functional Size



Functional Size: “the amount of information processing functionality as defined by FUR”

What do we measure by FP?

Measurement Models of FSM

BFC Types

COSMIC: Transactions Size
(Entries, eXits, Reads, Writes)

Relative Sizes of E = X = R = W

IFPUG: Transactions Size
(Input/Output DETs, FTRs) + Data Size (Logical Files, RETs)

Different pre-defined relative size weights for each component

Functionality Types & Measures

"We consider migrating from sizing method A to B, but can we still use our accumulated historical data afterwards?"

"This method seems more suitable for our needs, but there is not enough external benchmarking data which we can use"

"We are using sizing method A, but clients would like to benchmark against a different sizing measure. How can we convert size figures to correctly compare our productivity?"

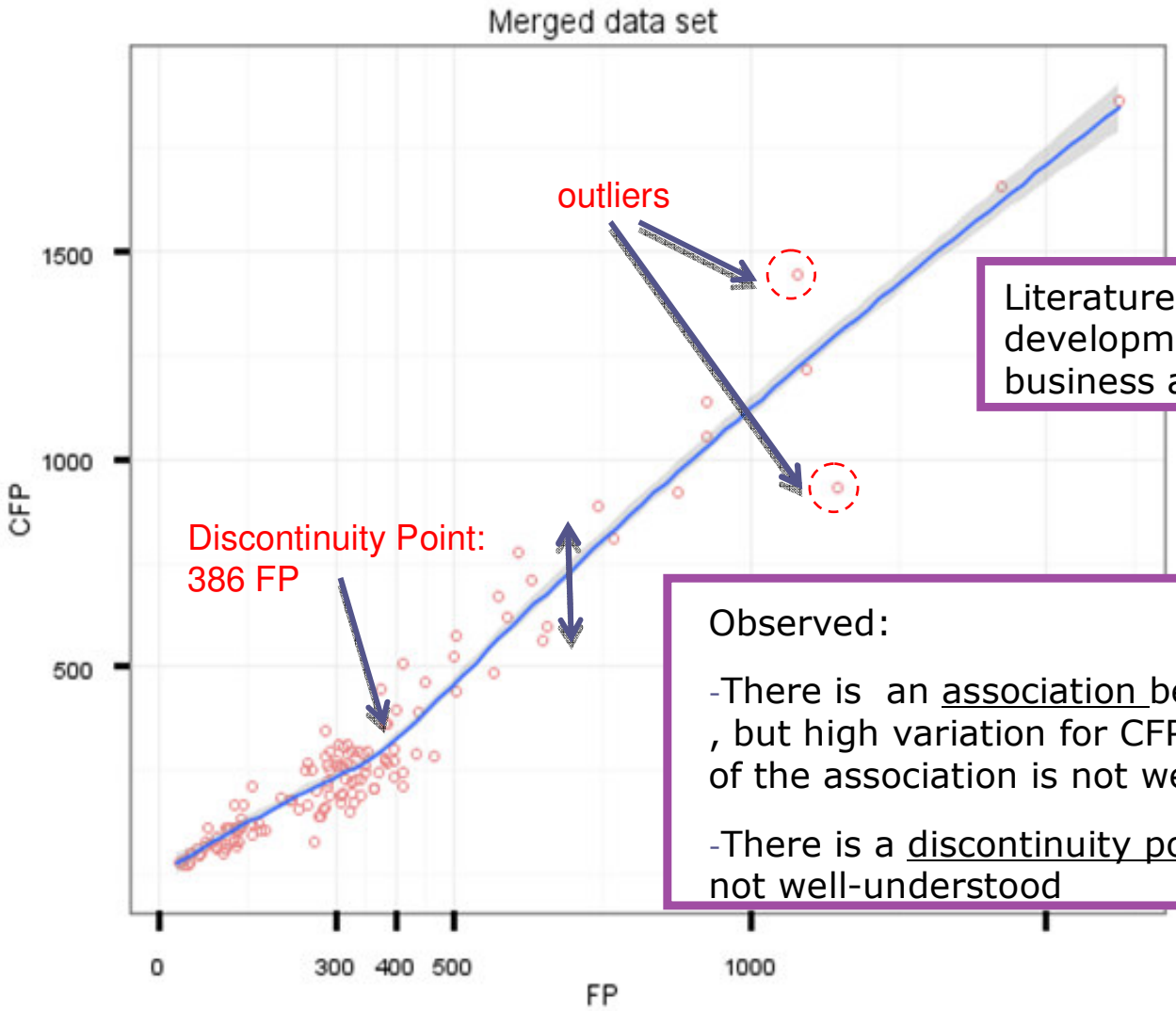
Practical Challenges

Studies	Conversion Model	R^2
Fetcke	$CFP = 1.1 \times UFP - 7.6$ (5 data warehouse applications)	0.99
Vogelezang & Lesterhuis	$CFP = 1.2 \times UFP - 87$ (11 bank applications)	0.99
Abran et al.	$CFP = 0.84 \times UFP + 18$ (6 applications from a governmental organization)	0.91
Desharnais et al.	$CFP = 1.0 \times UFP - 3$ (14 MIS applications)	0.93
Van Heeringen	$CFP = 1.22 \times UFP - 64$ (26 business appl. from banking, insurance, gov. organizations)	0.97
Cuadrado-Gallego et al.	$CFP = 0.83 \times UFP - 36.6$ (21 applications developed by a university in collaboration with an external company & measured by students)	0.7
	$CFP = 0.85 \times UFP + 0.2$ (14 applications developed by a university in collaboration with an external company & measured by students)	0.86
	$CFP = 0.73 \times UFP - 4.5$ (35 applications by merging the previous two datasets)	0.9

Empirically-driven Models

Empirically-driven Models (II)

- Abran et al, then Lavazza and Morasca observed discontinuity points in the relationship between IFPUG FP & CFP
- They suggested splitting the datasets into two and define formula for each part (e.g. for projects <200 FP and >200 FP)
- Cuadrado-Gallego et al. performed a non-linear analysis on the previously published datasets and concluded that 1 IFPUG FP = 1 CFP.



Literature: 8 datasets, 134 new development projects (mostly business applications)

Observed:

-There is an <u>association</u> between CFP and IFPUG , but high variation for CFP/FP ratio & the nature of the association is not well-known

-There is a <u>discontinuity point</u>, but the reasons not well-understood

Systematic Literature Review: CFP-IFPUG FP

A Comprehensive Evaluation of Conversion Approaches for Different FP by Amiri, J.M., Padmanabhuni, V.V.K., Gencel, C., 2011 (to be submitted)

Studies	Conversion Model (only Transactions Size)	R^2
Abran et al.	$CFP = 1.35 \times UFP\_TX + 5.5$	0.98
Desharnais et al.	$CFP = 1.36 \times UFP\_TX$	0.98

- Cuadrado-Gallego et al.: an interval for COSMIC size based on IFPUG FTRs and their association to COSMIC data group movements.

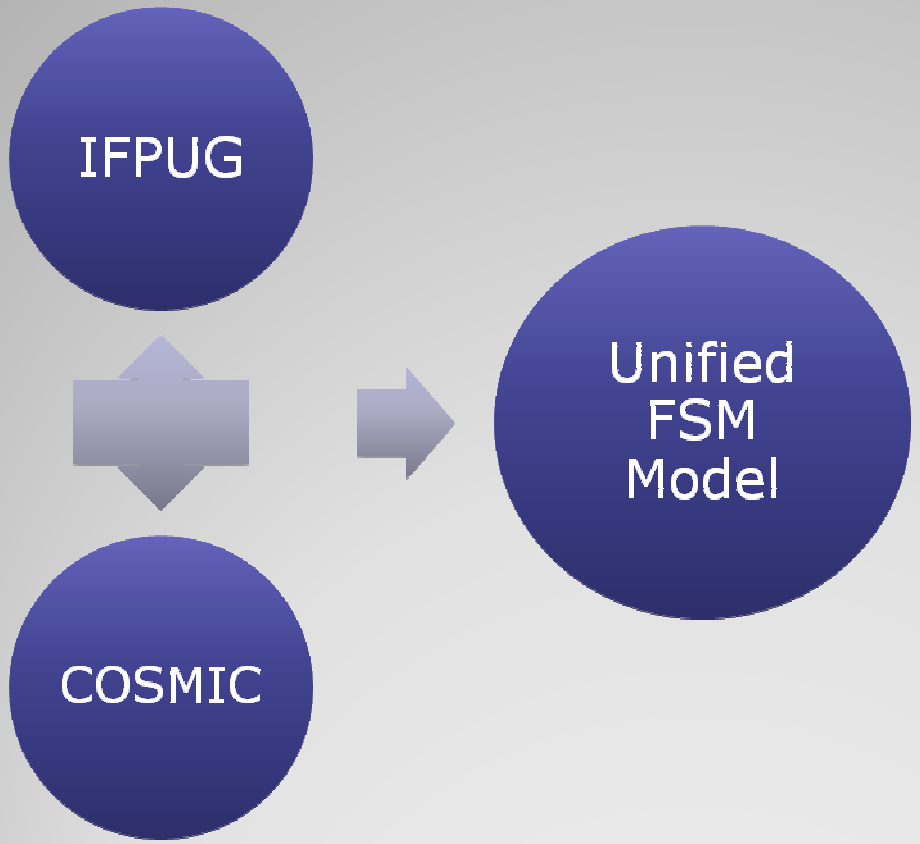
$$\sum_{i=0}^{EI} \max(2, FTR_i + 1) + \sum_{i=0}^{EO} \max(2, FTR_i + 1) + \sum_{i=0}^{EQ} \max(2, FTR_i + 1)$$

$$\leq \boldsymbol{CFP} \leq$$

$$\sum_{i=0}^{EI} \max(2, 2\times FTR_i + 1) + \sum_{i=0}^{EO} \max(2\times FTR_i + 1) + \sum_{i=0}^{EQ} \max(2, 2\times FTR_i + 1)$$

Theoretically-driven Models (I)

Demirörs, O., Gencel, C., "Conceptual Association of Functional Size Measurement Methods", IEEE Software, vol. 26, no. 3, May/June 2009.



The basic concepts & rules mapped and a unified model and toolset developed

- Simultaneous sizing & conversion
- Difficult to use retrospectively (requires details of measurement)
- New rules and refinements, the model has to be refined

Theoretically-driven Models (II)

Most of the studies conducted at the project level, considering total size figures

What is happening at the transactional level?

RQ: "What factors influence the convertibility between functional sizes of the transactions measured by IFPUG FP and COSMIC FP?"

- How do the proposed conversion approaches in the literature compare in a real-life setting?
- Do different functionality types affect conversion between IFPUG FP and CFP?

An Exploratory Case Study

Capgemini UK Plc.

- part of a large international company developing applications from various functional domains
- has wide variety of clients who can have different requirements for application sizing
- uses IFPUG, MkII, NESMA and COSMIC FSM + In-house sizing methods

Case Organization

- A large new development project for a unified reporting system to replace a number of legacy systems
- Capgemini experts selected 15 of the 67 UC for a preliminary exploratory study at the transactional level
- The UCs belong to four different modules of the system: data management, maintenance, schedule management and administration

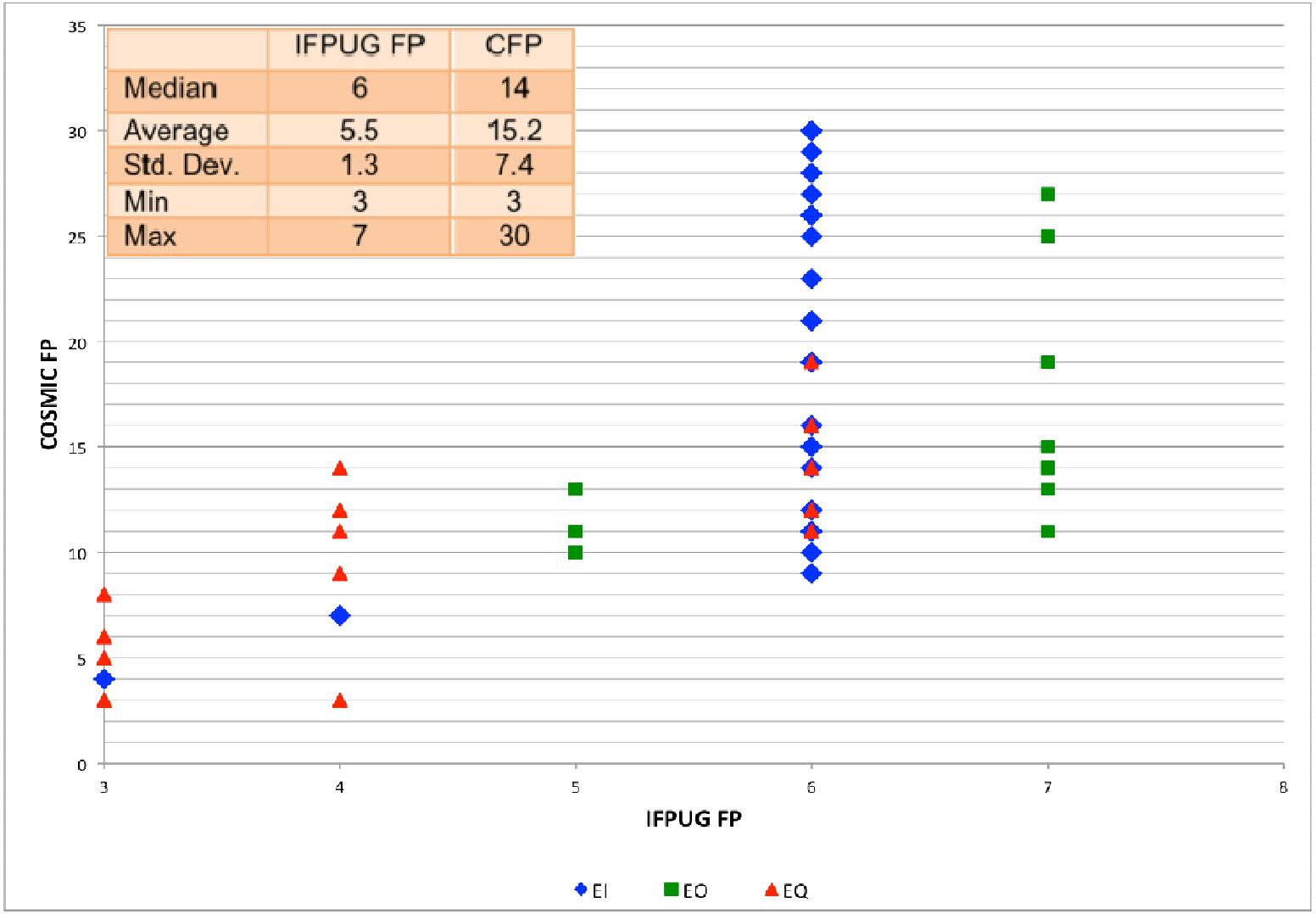
Case Project

- *Multiple sources for data collection:* UCs with Storyboards, the Domain Model & continuous communication with the domain experts
- *Independent sizing:* Two parties: One external and two internal measurement analysts from Capgemini
- *Sizing template:*
  - Detailed sizing information recorded for each Use Case
  - Traceability of size measurements
  - Cross-checking each other's assumptions to minimize measurement errors
- *Communication:* Teleconferencing and email

Data Collection

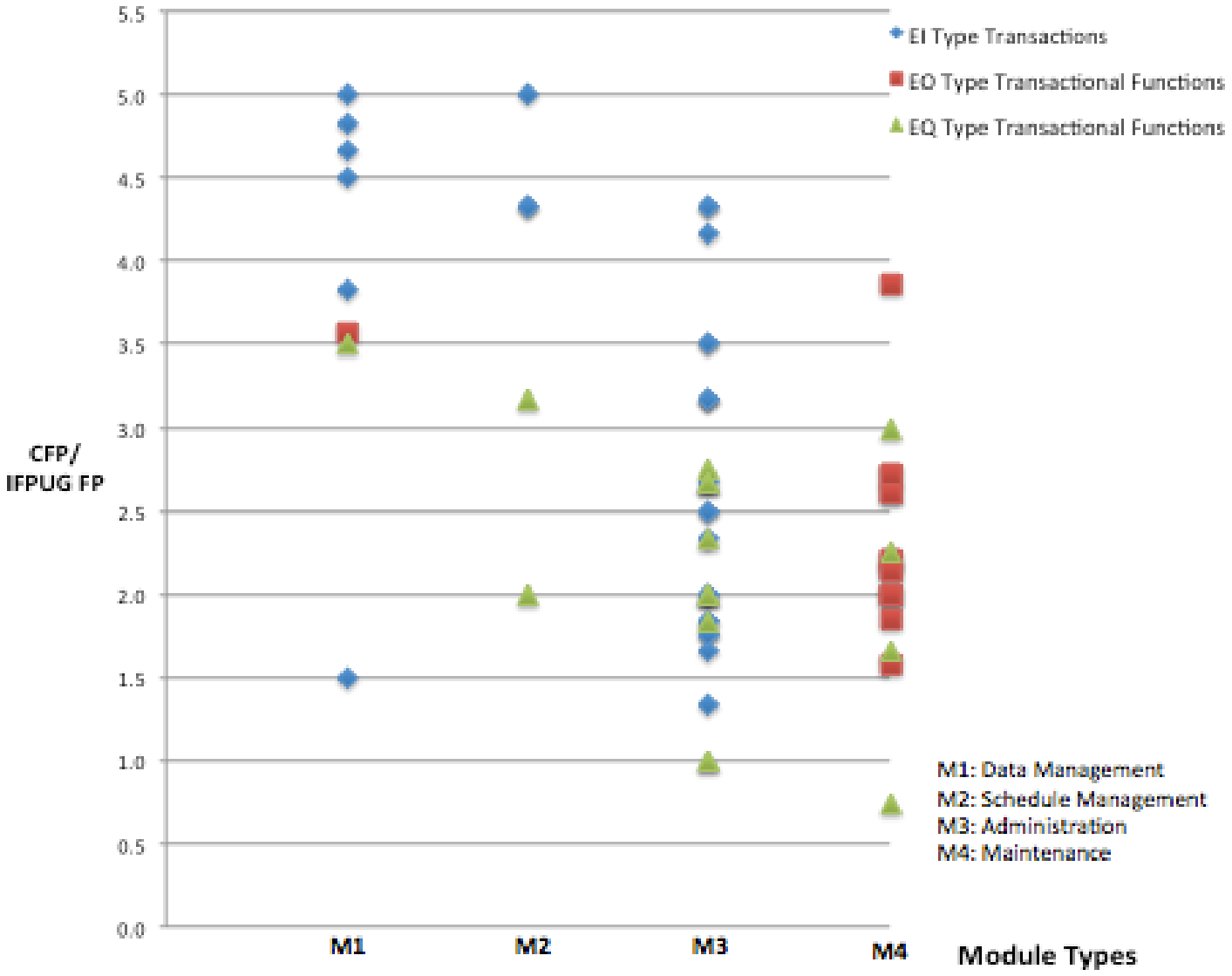
UC No	# of Transactions	FP (Trans. Size)	CFP	CFP / FP
Data Management (DM)				
UC213	1	6	27	4.5
UC222	1	7	25	3.6
UC223	1	6	29	4.8
UC224	3	16	46	2.9
UC225	1	6	30	5.0
UC230	1	6	28	4.7
Maintenance (M)				
UC414	9	44	112	2.5
UC415	9	59	122	2.1
Schedule Management (SM)				
UC101	2	12	52	4.3
UC102	2	9	25	2.8
UC106	1	6	30	5.0
Administration (A)				
UC103	15	88	267	3.0
UC405	10	51	113	2.2
UC606	5	17	24	1.4
UC703	1	6	10	1.7
TOTAL	62	339	940	2.8

Results –Size per UC



	IFPUG FP	CFP
Median	6	14
Average	5.5	15.2
Std. Dev.	1.3	7.4
Min	3	3
Max	7	30

CFP vs IFPUG FP – Transactions Size



CFP/FP Ratio wrt. Functionality Types

Conclusions (I)

- The conversion approaches published in the literature did not work well for our case (significant underestimation of the transactions size in CFP).
- Significant factors for conversion:
  - Max size limits on IFPUG transactions, which do not exist in COSMIC
  - For specific situations, differences between the rules for when mapping candidate entities to BFC Types (Logical Files ≠ Persistent DG)
- Module type does not appear to be a significant determinant of the observed variability in the COSMIC/IFPUG FP ratio.
- The types of transactions (EI, EO, EQ) seem to affect the CFP/IFPUG FP.
- EQ type did not hit the complexity limit as often as EI and EO.

- Errors made in conversion would propagate throughout performance measurement, benchmarking, estimating etc.

- Software organizations should be very careful in using published conversion models and check how they perform in their contexts until a more general model is developed.

Conclusions (II)

Thank you for your attention!