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Proposing and empirically validating change impact analysis metrics

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Appendix A

Appendix to Chapter 2

A.1 Publication Venues

Table A.1 presents all publication venues that have been searched. The first column denotes the name of the venue, whereas the next four columns represent the criteria that have been taken into account while selecting the publication venues. The last column presents the publication venues that have been selected. In particular, we can observe that seven journals and 5 conferences have been selected.

Table A.1 Publication Venues

Name	cr.1	cr.2	cr.3	cr.4	Included
IEEE Transactions on Software Engineering	A	yes	yes	183	yes
International Conference on Software Engineering	A	yes	yes	118	yes
IEEE Software	B	yes	yes	108	yes
Software: Practice and Experience	A	yes	yes	80	yes
ACM Transactions on Software Engineering and Methodology	A	yes	yes	69	yes
Journal of Systems and Software	A	yes	yes	61	yes
Information and Software Technology	B	yes	yes	46	yes
European Software <i>Engineering</i> Conference and the ACM SIGSOFT International Symposium on the Foundations of Software Engineering	A	yes	yes	44	yes
Automated Software Engineering Conference	A	yes	yes	44	yes
Empirical Software Engineering	A	yes	yes	36	yes
International Conference on Software Process	A	yes	yes	23	yes
International Symposium on Empirical Software Engineering and Measurement	A	yes	yes	21	yes
ACM Computing Surveys	A	no			no
ACM Transactions on Architecture and Code Optimization	A	yes	no		no
ACM Transactions on Computer Systems	A	no			no
ACM Transactions on Design Automation of Electronic Systems	A	no			no
ACM Transactions on Embedded Computing Systems	A	no			no
ACM Transactions on Information and System Security	A	yes	no		no
ACM Transactions on Multimedia Computing Communications and Applications	B	yes	no		no
ACM Transactions on Programming Languages and Systems	A	yes	no		no

Name	cr.1	cr.2	cr.3	cr.4	Included
Acta Informatica	A	yes	yes	N/A	no
Computer Standards and Interfaces	B	no			no
Computers and Electrical Engineering	B	no			no
Computers and Security	B	yes	no		no
Computers in Industry	B	no			no
IBM Journal of Research and Development	A	no			no
IBM Systems Journal	A	no			no
IEEE Transactions on Computers	A	no			no
IEEE Transactions on Dependable and Secure Computing	A	no			no
IEEE Transactions on Multimedia	A	yes	no		no
IEEE Transactions on Reliability	A	yes	no		no
IET Computers and Digital Techniques	B	no			no
Industrial Management + Data Systems	B	no			no
Innovations in Teaching and Learning in Information and Computer Sciences	B	no			no
International Journal of Agent Oriented Software Engineering	B	yes	no		no
International Journal on Software Tools for Technology Transfer	B	yes	no		no
Journal of Computer Security	B	no			no
Journal of Functional and Logic Programming	B	yes	no		no
Journal of Object Technology	B	yes	no		no
Journal of Software	B	yes	yes	N/A	no
Journal of Software Maintenance and Evolution: research and practice	B	yes	no		no
Journal of Systems Architecture	B	yes	no		no
Journal of Visual Languages and Computing	A	yes	no		no
Multimedia Systems	B	yes	no		no
Multimedia Tools and Applications	B	yes	no		no
Requirements Engineering	B	yes	no		no
Science of Computer Programming	A	yes	no		no
Software and System Modelling	B	yes	no		no
Software Testing, Verification and Reliability	B	yes	no		no
Text Technology: the journal of computer text processing	B	no			no
Theory and Practice of Logic Programming	A	yes	no		no
ACM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communication	A	no			no
ACM Conference on Computer and Communications Security	A	no			no

Name	cr.1	cr.2	cr.3	cr.4	Included
ACM Conference on Object Oriented Programming Systems Languages and Applications	A	yes	no		no
ACM International Symposium on Computer Architecture	A	yes	no		no
ACM Multimedia	A	no			no
ACM SIGOPS Symposium on Operating Systems Principles	A	no	no		no
ACM/IFIP/USENIX International Middleware Conference	A	no			no
ACM-SIGACT Symposium on Principles of Programming Languages	A	yes	no		no
ACM-SIGPLAN Conference on Programming Language Design and Implementation	A	yes	no		no
Annual Computer Security Applications Conference	A	yes	no		no
Architectural Support for Programming Languages and Operating Systems	A	yes	no		no
Aspect-Oriented Software Development	A	yes	no		no
Conference on the Quality of Software Architectures	A	yes	no		no
European Conference on Object-Oriented Programming	A	yes	no		no
European Symposium on Programming	A	yes	no		no
European Symposium On Research In Computer Security	A	yes	no		no
Eurosys Conference	A	yes	no		no
IEEE Computational Systems Bioinformatics Conference	A	no			no
IEEE Computer Security Foundations Symposium	A	yes	no		no
IEEE International Conference on Software Maintenance	A	yes	no		no
IEEE International Requirements Engineering Conference	A	yes	no		no
IEEE/IFIP International Conference on Dependable Systems	A	yes	no		no
IEEE/IFIP International Symposium on Trusted Computing and Communications	A	no			no
IEEE/IFIP Working Conference on Software Architecture	A	yes	no		no
IFIP Joint International Conference on Formal Description Techniques and Protocol Specification, Testing, And Verification	A	yes	no		no
Intelligent Systems in Molecular Biology	A	no			no
International Conference on Compiler Construction	A	yes	no		no
International Conference on Coordination Models and Languages	A	yes	no		no
International Conference on Evaluation and Assessment in Software Engineering	A	yes	yes	N/A	no
International Conference on Functional Programming	A	yes	no		no
International Conference on Principles and Practice of Constraint Programming	A	yes	no		no
International Conference on Reliable Software Technologies	A	yes	no		no
International Conference on Security and Privacy for Communication Net-	A	no			no

Name	cr.1	cr.2	cr.3	cr.4	Included
works					
International Conference on Software Reuse	A	yes	no		no
International Conference on Virtual Execution Environments	A	no			no
International Symposium Component-Based Software Engineering	A	yes	no		no
International Symposium on Automated Technology for Verification and Analysis	A	yes	no		no
International Symposium on Code Generation and Optimization	A	yes	no		no
International Symposium on High Performance Computer Architecture	A	yes	no		no
International Symposium on Memory Management	A	yes	no		no
International Symposium on Software Reliability Engineering	A	yes	no		no
International Symposium on Software Testing and Analysis	A	yes	no		no
Tools and Algorithms for Construction and Analysis of Systems	A	yes	no		no
Usenix Network and Distributed System Security Symposium	A	yes	no		no
Usenix Security Symposium	A	yes	no		no
Usenix Symposium on Operating Systems Design and Implementation	A	no			no
USENIX Workshop on Hot Topics in Operating Systems	A	no			no

A.2 Primary Studies

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B.1 Requirements per Project

Table B.1 presents the list of selected requirements per project. The first column denotes the name of requirement, whereas the second column the name of the project, in which it belongs to.

Table B.1 List of Selected Requirements

Requirements	Project
Hydrometer Read (YDATA-HR)	YDATA
Alert Create (YDATA-LC)	YDATA
Global (YDATA-G)	YDATA
Statement Create (YDATA-SC)	YDATA
User Update (YDATA-UU)	YDATA
User Read (YDATA-UR)	YDATA
Payment Create (YDATA-PC)	YDATA
Account Create (YDATA-AC)	YDATA
Hydrometer Create (YDATA-HC)	YDATA
User Create (YDATA-UC)	YDATA
Account Update (YDATA-AU)	YDATA
Statement Read (YDATA-SR)	YDATA
Statement Update (YDATA-SU)	YDATA
Hydrometer Update(YDATA-HU)	YDATA
Statement Delete (YDATA-SD)	YDATA
Payment Read (YDATA-PR)	YDATA
Hydrometer Delete (YDATA-HD)	YDATA
Payment Update (YDATA-PU)	YDATA
Alert Read (YDATA-LR)	YDATA
Connection Create (YDATA-CC)	YDATA
Account Read (YDATA-AR)	YDATA
Citizen Read (CR-CR)	GREGAPI

Requirements	Project
Citizen Update (CR-CU)	GREGAPI
System (CR-S)	GREGAPI
Marriage Create (CR-MC)	GREGAPI
Birth Create (CR-BC)	GREGAPI
Death Create (CR-DC)	GREGAPI
Marriage Update (CR-MU)	GREGAPI
Political Create (CR-PC)	GREGAPI
Marriage Read (CR-MR)	GREGAPI
Political Update (CR-PU)	GREGAPI
Naming Giving Create(CR-NC)	GREGAPI
Birth Read (CR-BR)	GREGAPI
Birth Update (CR-BU)	GREGAPI
Political Delete (CR-PD)	GREGAPI
Citizen Delete (CR-CD)	GREGAPI
Death Update (CR-DU)	GREGAPI
Death Read (CR-DR)	GREGAPI
Marriage Death (CR-MD)	GREGAPI
Name Giving Read (CR-NR)	GREGAPI
Name Giving Update (CR-NU)	GREGAPI
Political Read (CR-PR)	GREGAPI
Birth Delete (CR-BD)	GREGAPI
Citizen Create (CR-CC)	GREGAPI

B.2 Case Study Time Plan

Table B.2 presents the case study time plan of the workshop. The first column denotes the task that has been performed, whereas the second column its duration.

Table B.2 Case Study Time Plan

Task	Duration
Introduction to the content and the goals of the study	15'
<i>Part I:</i> Questionnaire—Ranking of requirements testing prioritization	35'

Task	Duration
Break	10'
Part 2: Summary of questionnaire results	15'
Break	5'
Part 3: Focus group—Discussion on relations between requirements	30'

B.3 Questionnaire

The questionnaire will be structured as follows. In particular, we have developed 4 questionnaires for each project. Each questionnaire corresponds to one requirement. Each row of the questionnaire mentions all other requirements of the project, asking the participants to evaluate possibility of changes in one requirement to propagate into another. The evaluation has been performed based on a Likert scale, ranking from 1 to 5: 1 corresponds to very low probability of co-change, whereas 5 corresponds to very high probability to co-change.

Table B.3.a Questionnaire for Account Read Requirement

<i>Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the Account Read requirement in the YDATA project?</i>						
Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
YDATA-HR						
YDATA-LC						
YDATA-G						
YDATA-SC						
YDATA-UU						
YDATA-UR						
YDATA-PC						
YDATA-AC						
YDATA-HC						
YDATA-UC						
YDATA-AU						
YDATA-SR						
YDATA-SU						
YDATA-HU						
YDATA-SD						
YDATA-PR						
YDATA-HD						
YDATA-PU						
YDATA-LR						
YDATA-CC						

Table B.3.b Questionnaire for Account Update Requirement

<i>Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the Account Update requirement in the YDATA project?</i>						
Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
YDATA-HR						
YDATA-LC						
YDATA-G						
YDATA-SC						
YDATA-UU						
YDATA-UR						
YDATA-PC						
YDATA-AC						
YDATA-HC						
YDATA-UC						
YDATA-AR						
YDATA-SR						
YDATA-SU						
YDATA-HU						
YDATA-SD						
YDATA-PR						
YDATA-HD						
YDATA-PU						
YDATA-LR						
YDATA-CC						

Table B.3.c Questionnaire for Alert Create Requirement

<i>Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the Alert Create requirement in the YDATA project?</i>						
Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
YDATA-HR						
YDATA-AR						
YDATA-G						
YDATA-SC						
YDATA-UU						
YDATA-UR						
YDATA-PC						
YDATA-AC						
YDATA-HC						
YDATA-UC						
YDATA-AR						
YDATA-SR						
YDATA-SU						
YDATA-HU						
YDATA-SD						

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **Alert Create** requirement in the YDATA project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
YDATA-PR						
YDATA-HD						
YDATA-PU						
YDATA-LR						
YDATA-CC						

Table B.3.d Questionnaire for Statement Create Requirement

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **Statement Create** requirement in the YDATA project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
YDATA-HR						
YDATA-LC						
YDATA-G						
YDATA-AU						
YDATA-UU						
YDATA-UR						
YDATA-PC						
YDATA-AC						
YDATA-HC						
YDATA-UC						
YDATA-AR						
YDATA-SR						
YDATA-SU						
YDATA-HU						
YDATA-SD						
YDATA-PR						
YDATA-HD						
YDATA-PU						
YDATA-LR						
YDATA-CC						

Table B.3.e Questionnaire for Citizen Create Requirement

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **Citizen Create** requirement in the GREGAPI project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
CR-CR						
CR-CU						
CR-S						
CR-MC						
CR-BC						
CR-DC						

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **Citizen Create** requirement in the GREGAPI project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
CR-MU						
CR-PC						
CR-MR						
CR-PU						
CR-NC						
CR-BR						
CR-BU						
CR-PD						
CR-CD						
CR-DU						
CR-DR						
CR-MD						
CR-NR						
CR-NU						
CR-PR						
CR-BD						

Table B.3.f Questionnaire for Marriage Read Requirement

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **Marriage Read** requirement in the GREGAPI project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
CR-CR						
CR-CU						
CR-S						
CR-MC						
CR-BC						
CR-DC						
CR-MU						
CR-PC						
CR-CC						
CR-PU						
CR-NC						
CR-BR						
CR-BU						
CR-PD						
CR-CD						
CR-DU						
CR-DR						
CR-MD						
CR-NR						
CR-NU						
CR-PR						

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **Marriage Read** requirement in the GREGAPI project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
CR-BD						

Table B.3.j Questionnaire for Marriage Update Requirement

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **Marriage Update** requirement in the GREGAPI project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
CR-CR						
CR-CU						
CR-S						
CR-MC						
CR-BC						
CR-DC						
CR-MR						
CR-PC						
CR-CC						
CR-PU						
CR-NC						
CR-BR						
CR-BU						
CR-PD						
CR-CD						
CR-DU						
CR-DR						
CR-MD						
CR-NR						
CR-NU						
CR-PR						
CR-BD						

Table B.3.i Questionnaire for System Requirement

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **System** requirement in the GREGAPI project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
CR-CR						
CR-CU						
CR-MR						
CR-MC						
CR-BC						
CR-DC						
CR-MU						
CR-PC						

Please denote how important you believe it is to re-test the below-mentioned requirements, if you perform a change to the **System** requirement in the GREGAPI project?

Affected Req.	1 (VL)	2 (L)	3 (N)	4 (H)	5 (VH)	Justification
CR-CC						
CR-PU						
CR-NC						
CR-BR						
CR-BU						
CR-PD						
CR-CD						
CR-DU						
CR-DR						
CR-MD						
CR-NR						
CR-NU						
CR-PR						
CR-BD						

B.4 Focus Group Questions

The focus group questions are structured as follows:

1. Do you think that requirements, which deal with the same entity need to be re-tested?

CR-CU with CR-CC (high)

CR-MU with CR-MR (medium)

CR-PD with CR-PR (low)

2. Do you think that requirements, which perform the same action on different entities need to be re-tested?

CR-MC with CR-CC (high)

CR-CU with CR-NU (medium)

CR-BD with CR-MD (low)

3. Do you think that system-wide requirements, need to be re-tested when changes to other requirements occur, or vice-verse?

CR-CC with CR-S (From - high)

CR-PR with CR-S (From - medium)

CR-S with CR-CR (To - high)

- CR-S with CR-NR (To - medium)
4. Do you think that requirements, which deal with the same entity need to be re-tested?
YDATA-AU with YDATA-AR(high)
YDATA-SR with YDATA-SD (medium)
YDATA-HU with YDATA-HD (low)
 5. Do you think that requirements, which perform the same action on different entities need to be re-tested?
YDATA-HR with YDATA-AR (high)
YDATA-UC with YDATA-PC (medium)
YDATA-LR with YDATA-PR (low)
 6. Do you think that system-wide requirements, need to be re-tested when changes to other requirements occur, or vice-verse?
YDATA-HR with YDATA-G (From - high)
YDATA-UC with YDATA-G (From - medium)
YDATA-G with YDATA-HR (To - high)
YDATA-G with YDATA-SD (To - medium)
 7. Which of the aforementioned classes are the most important?