In Search of a Metric for Managing ~~Architectural~~ Technical Debt

A 10 Year Retrospective

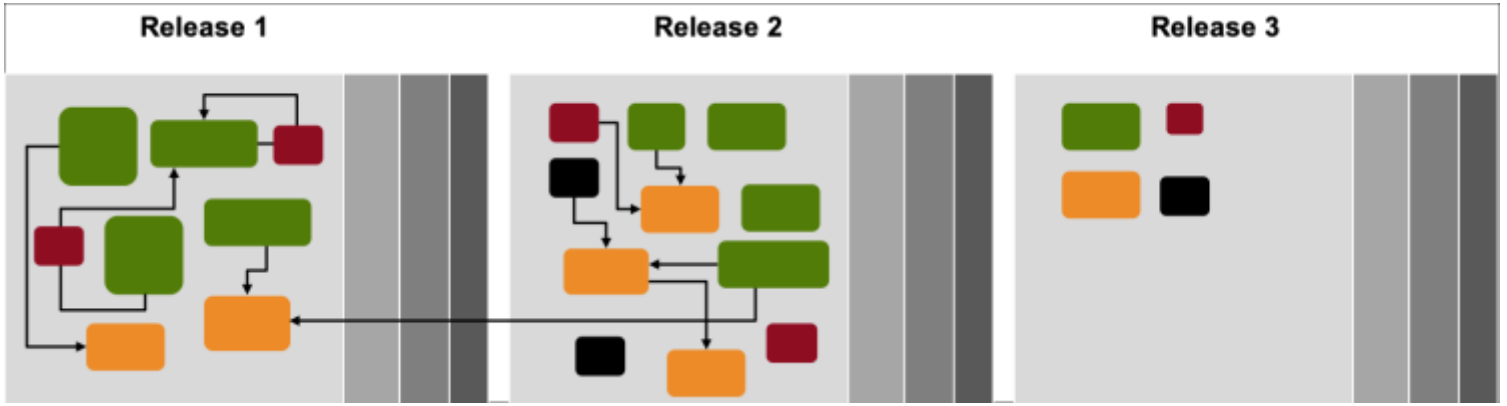
Robert Nord (rn@sei.cmu.edu)
Ipek Ozkaya (ozkaya@sei.cmu.edu)
Philippe Kruchten (pbk@ece.ubc.ca)
Marco Gonzalez-Rojas (emarkux@protonmail.com)

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Our vision in 2012

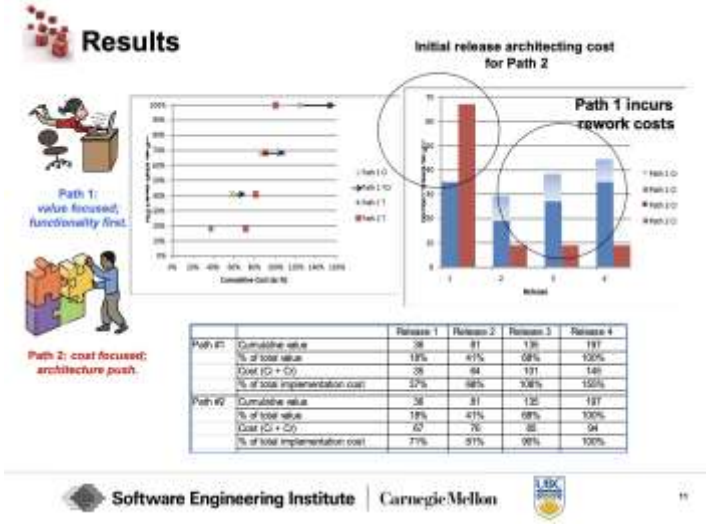
Provide a way for the software engineering community to recognize that technical debt has its roots in architecture rework.

The 2012 ICSA paper presented a dependency analysis framework for measuring architecture rework as a proxy for technical debt.



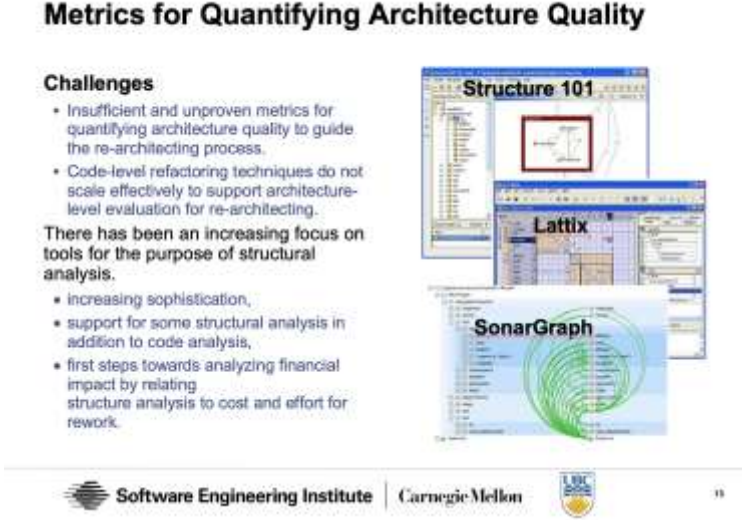
legend

Let's Recall the Paper and the Presentation



We demonstrated the potential rework created as a consequence of the tension between architecture decisions and delivering priority functional requirements.

We exemplified use of one metric, propagation cost, but emphasized that quantifying rework is not trivial.



The Work that Built on the Paper

Research recognizing the **connection of architecture and design roots of technical debt**

- e.g. Martini and Bosch 2014-2015, Lin, Liang, Avgeriou 2015

Research investigating propagation cost (Pc) and other **architecture related metrics and architecture smell detection**

- e.g. Abad 2015, Ampatzoglou 2015, MacCormack 2016, Azadi 2019, Verdecchia 2020

Self-admitted technical debt research which identified conversations in code comments providing further examples of technical debt and architecture.

- e.g. Maldonado and Shihab 2017

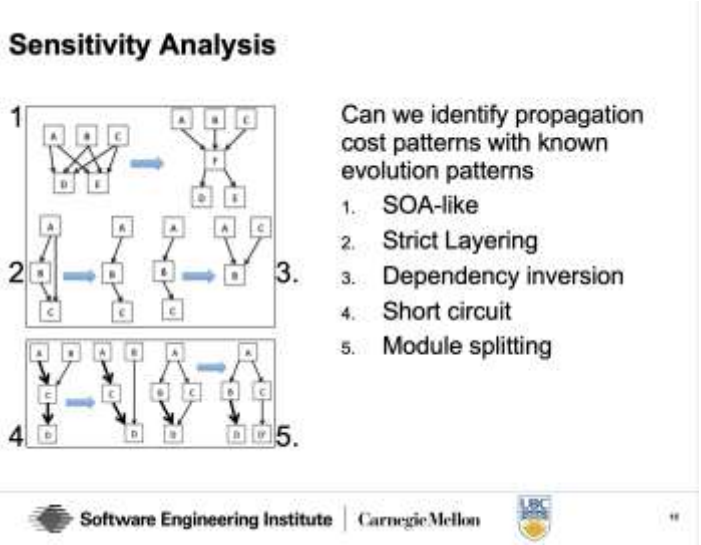
Work that focused on understanding **how to manage technical debt** and **architecture evolution,** including systematic literature studies

- e.g. Fontana 2016, Guo 2016, Letouzey 2012, Rios 2018, Besker 2018

The good, the bad, and the opportunity

The paper made the architecture roots of technical debt very visible.

“Architectural technical debt” in our title unintentionally implied a technical debt taxonomy.



Not enough people attended the presentation to pick up on our tease to investigate the relationship between design patterns and metrics.

R. L. Nord, I. Ozkaya, R. S. Sangwan, J. Delange, M. A. Gonzalez, P. Kruchten: *Variations on Using Propagation Cost to Measure Architecture Modifiability Properties*. ICSM 2013: 400-403

Going forward

Both commercial software industry (e.g. agile at scale/DevOps practices) and regulated software environments (e.g. Adaptive Acquisition Framework) today recognize technical debt management as a core software engineering practice.

TechDebt conference (www.techdebtconf.org) is a way to connect to ongoing research.

Open questions include:

- How to quantify rework with a variety of metrics to guide how and when to refactor systems to resolve technical debt?
- How can rework quantification be related to operational practices, e.g. how should technical debt be recorded and prioritized?
- How can empirical data and analysis be used to improve iterative and incremental architecture practices to manage technical debt?

THANK YOU!

This material is based upon work funded and supported by the Department of Defense under Contract No. FA8702-15-D-0002 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and development center.

DM22-0211