

Requirements Engineering in Industry: Modular Foundational Online Training to Build Basic Practices

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Abstract

Requirements Engineering is a practice critical to successful product development, but often underdeveloped or underappreciated by practicing engineers. Modular, quickstart training that touches on several key RE activities and practices can demonstrate quick benefit to engineers and product development teams, and even build interest in further RE training to secure additional value from the practice.

Keywords

Requirements Engineering, Requirements, Industrial Practice, Training, Remote Training

1. Introduction

Industrial Requirements Engineering (RE) practice can be a paradox. When done well, RE activities should be transparent to the work at hand. Requirements *specification* – writing natural language requirements statements that define the product to be developed – is most noticeable when it is poorly executed. Requirements *verification* – assessing requirements for defects that could lead to different interpretations of requirements, resulting in incorrect design – is recognized most when requirements escapes result in product defects later. Inadequate requirements practice can have catastrophic results for a project, product, or even a company, while excellent practice may go unrecognized. Rewards are rarely given for what many may consider to be preventative maintenance.

Given the criticality of RE in product development practice, it is perhaps surprising that many engineers have had no formal exposure to the practice, and often aren't aware that "requirements engineering" is itself an engineering discipline. Without exposure to good requirements practice during formal study, "writing requirements" is often a task undertaken as a necessary step during product planning, but one assumed to need no additional skills or training to accomplish. Indeed, it is not uncommon for engineers with deep technical expertise in their original discipline to react with surprise when they learn that additional training may be required for them to adequately specify their work.

A North Star principle that industrial RE practitioners do well to keep in mind is the following: *The company is not paid to deliver documentation*. Every minute spent in work outside of the core product ideation, planning, development, test, and delivery cycle is either an investment in improving that cycle, or a liability that detracts from it. While continuous learning is valued, few engineers will commit a significant amount of time to attending courses outside the scope of their work, especially if they believe they are already competently writing requirements. The task for our Requirements Engineering instructors and curriculum is to provide RE training that is both immediately applicable, and that demonstrates the value to the engineer of continuing to invest in honing their RE skills as well.

Many RE researchers are used to spending between a few days and a few weeks on RE across the software engineering or computer science curricula. Within industry, we may be afforded from a few minutes to a handful of hours to make the case for investment in improving one's RE practice.

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2. The Intel RE Curriculum

Intel Corporation has developed a series of short courses and tutorials that address specific topics in Requirements Engineering, Systems Engineering, and Systems Thinking. Early versions of core courses were initially developed in 2000, and evolved over time as RE as a discipline, our senior practitioners' time and interests, and the company's investment in the work changed as well. The core course around which much of the RE curriculum itself revolves, Requirements Specification, is in its ninth major revision, with incremental releases as participant questions or instructor insights suggest minor additions. As of March 2021, Requirements Specification has been taught to over 18,500 participants. In addition, an externally-approved version of this course has regularly been offered as a tutorial at the IEEE International Requirements Engineering Conference, under the name "Writing Good Requirements."

2.1. Delivering the RE Curriculum

Despite significant shifts both within Intel and across industry to more just-in-time, web-based training, the majority of Intel's Requirements Engineering courses remain instructor-led. We contend that Requirements Engineering proficiency is a dialectical process, furthered both through discussions among participants and instructors in a live classroom setting, and through the work itself of eliciting, analyzing and validating, specifying, verifying, and managing requirements work products. Limited volunteer instructor availability, geographically-dispersed teams, and – as of 2020 – the COVID-19 pandemic – have led to the development of modular versions of several of the Intel RE courses, but at present they remain instructor-led and continue to be highly participatory. Consistent Net Promoter scores and other feedback from participants suggests that we must maintain live sessions, whether remote or once again colocated after the pandemic.

Although course materials are available for many activities of Requirements Engineering, the primacy of the Requirements Specification/Writing Good Requirements course reflects the "just in time" constraints that we work under with our practitioners. Development, maintenance, and even delivery of this content is not formally resourced, but continues thanks to the support of organizations that respect its value and permit "extracurricular" work among a core few of their employees.

3. 2020 Requirements Quickstart

The Intel RE Training course materials in this OpenRE submission were delivered to approximately 100 employees in November, 2020. Travel limitations due to COVID-19 abruptly ended sessions delivered in our preferred, face-to-face instructor-led format. Participants attended the session from their homes in multiple countries across three continents. Additional participants opted to watch recordings of the live sessions. In order to combat the ills of online meeting fatigue and in recognition of the breadth of time zones represented, eight hours of training were delivered over four two-hour sessions, two each in two consecutive weeks.

The training delivered during this Quickstart was comprised of excerpts from three courses from Intel's Requirements Engineering curriculum.

The first two sessions were derived from our core Requirements Specification course. Topics covered include Problems with Natural Language, Detail Level and Timing Issues, Specification Basics, Specifying Functional Requirements and Constraints, and Specifying Quality Requirements. The third session was a brief overview of Requirements Verification, including the introduction of a checklist to assess objective requirements quality, and a specific review practice targeted toward

Researchers will also gain insight into a not-uncommon starting point for engineers, which could inform subsequent research into other rapidly-applicable RE techniques suitable for tech transfer.

5. License

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6. Acknowledgements

The initial version of the Intel Corporation Requirements Engineering content was developed by Erik Simmons. Other current and former colleagues in instances of the Intel RE program, at times officially-chartered but more often volunteer-driven, and several thousand Intel employees who have taken the training and provided feedback have been instrumental in its ongoing development.

We also acknowledge the support of the Intel Internet of Things Group (IOTG) Business Acceleration Systems Engineering and Requirements team. Continued evolution of the materials and delivery across the corporation, not just in the IOTG business unit, is enabled through their recognition of its overall importance.

Of course, our curriculum is also immeasurably improved through our two decades of involvement in the global RE research and practitioner community. We are grateful to have the community as a wealth of opportunities for our ongoing education. Our RE practice is all the better for it.

7. References

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