Week 4: Mobility Bibliography

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# Mobility Bibliography

## Evolution of Mobile Apps

Zhang et al. (2013) compare the evolution of mobile development against traditional desktop engineering. The basis of their assessment comes from Lehman’s law, which claims software is always (1) continuing to change, (2) increasing in complexity, and (3) declining in quality. Next, they measured four open-source application’s code churn, total commits, feature enhancements, and bug fixes. The authors quantified each data point by examining GIT commit messages and applying heuristics. Afterward, plotting these metrics shows that the projects are continuing to evolve with more features and defects. Ultimately, the central goal of proving Lehman’s law remains inconclusive.

Their study is deeply flawed for multiple reasons. First, the four chosen applications are two programs built upon two platforms. Any results are not generalizable without increasing the sample set. Second, a direct correlation between complexity and commits does not exist. This limitation comes from the unique-style that individual developers follow. For instance, some users commit changes every block versus others who wait until the end of the day. Another set of inherent challenges arise from merging and squashing branches. These standard behaviors skew the total lines within each change.

There are also several limitations to using defects resolved as a measurement of quality and complexity. Most software engineering processes refrain from resolving defects that are not severe enough to warrant the regression risk. This “bug bar” naturally fluctuates in response to the business cycle (e.g., before versus after a major release) and can generate misleading signals. Assuming a static bug bar, an increase in defects likely represents new investments into app features.

## Mobile Development Processes

Corral et al. (2013) examine the growing interest in agile processes within mobile development. They perform a light survey of competing strategies such as Mobile-D, Scrum, and Lean Six Sigma. Under Mobile-D, businesses began following an iterative waterfall-like process for building mobile software. This approach was wildly successful in the early 2000s, with variations like MASAM (Mobile Application Software Agile Methodology) reducing life cycle overhead. After examining the evolution of agile methodologies, the authors attempt to map the different requirements of mobile development to agile characteristics.

Most of these agile permutations lack real-world sponsorship residing within academic journals at the time of writing. Since then, Scrum and Lean methodologies became everyday staples while Mobile-D fell to the wayside. The primary driver of those processes’ success is the ability to remove waste and improve time-to-market. Businesses that can release features more quickly and economically have the opportunity to be more competitive. However, those same organizations need to align their delivery cycles with customer’s ability to consume those changes.

Consider Philip Hue’s Smart Light App that runs on Android devices and controls Smart LEDs’ coloration. Regardless of Philip’s Continuous Integration and Delivery (CI/CD) pipeline, customers will not update this app frequently. Unless that behavior changes, the engineering team’s incentive is to release higher quality versions at a slower pace. In contrast, Facebook’s Android app renders XHTML responses from a remote server. Since Facebook users instantly consume any change, F.B. can risk quality and promote innovation quicker. When a feature regression occurs, the operations team centrally deploys an update, restoring the previous experience.

## Challenges with Mobile Development

Joorabchi et al. (2013) conducted semi-structured interviews with twelve mobile development professions. Responses from participants qualitatively explore challenges across different aspects of mobile engineering. For instance, a subset of questions examines the impact of Android versus iOS platforms. There is also a particular interest in how developers spend their time (e.g., designing versus testing). After collecting and analyzing the ground truths, the researchers conclude that heterogeneous platforms create the most overhead. Developers are also overwhelmed needing to test their code across various hardware configurations.

Ratification of the HTML 5 standard took place two years after this paper. Developers adopting this framework can abstract many platform-specific details, freeing teams to focus on value-differentiating aspects of the programs. There are still niche areas, such as 3-D gaming, that cannot embrace those features. When engineering groups must use native platforms, they can often rely on open-source libraries that implement boilerplate code. Since the mobile world is far more eight-years more mature, it would be interesting to revisit this portion of the interviews.

The last decade also brought significant innovation into mobile testing. Previously developers would purchase dozens of dedicated devices to confirm hardware dependencies or rely on generic simulators for finding defects. Modern simulators can verify more scenarios than ever before. Additionally, cloud services enable renting devices for short periods on-demand. Outside of raw technical improvements, the software industry embraces combined engineering patterns (e.g., DevOps) because it improves efficiencies. When an engineering team owns their code from end-to-end, it eliminates any assumptions that someone else will find the issues. Businesses need to promote that accountability as it results in higher quality software.

## Suitability of Agile for Mobile

Khalid et al. (2014) explore whether agile methodologies are complementary to mobile development processes. Their research is very similar to Corral et al. (2013), even including the same tables. This piece confidently presents agile as the best choice for mobile development. Affirming this claim comes from agile’s (1) boost toward delivery, (2) responsiveness toward changing markets, and (3) identify risk at early stages. Developers leverage those characteristics to meet business requirements faster and more economically.

While agile methodologies are appropriate for many mobile applications, they are not universally the right choice. The authors invest significant portions of the paper, describing the challenges of planning the deliverable upfront. It would be beneficial to see examples where agile improves well-defined projects. For example, Starbuck’s Android app enables customers to purchase coffee without interacting with a barista. Delivering that experience requires an engineering feat, compromising countless micro-services and Point-of-Sale (POS) integrations. However, the client’s experience is relatively stationary.

The authors discuss the euphoric state of agile development but ignore challenges and risks. For instance, agile processes are most effective across small teams. Businesses also must fully commit to adopting the models. Securing that agreement can encounter political resistance as it rocks the status quo. Additionally, accelerating the delivery cadence necessitates removing process-overhead. Removing those checks-and-balances might decrease the software’s quality and increase regression risk.

Lastly, the study investigates several legacy development strategies. There would be value in expanding the content to include modern paradigms. For example, cloud-based services and high-speed WiFi are ubiquitous and game-changing in every aspect of mobile.

## Improving Mobile Capabilities

Nguyen (2015) states that Android devices spend between 18 to 50% of their time waiting for I/O responses. He conducted several experiments to discover that these issues arise from mixing sequential reads and concurrent writes. The presenter demonstrated a replacement I/O scheduler that makes this scenario up to 25% more performant. Afterward, a comparison of several alternative schedulers assesses this is the best solution available. Facebook incorporates this functionality within its application, which allows faster loading and more responsive customer experiences.

Traditional desktop operating systems are extensive performance tuned. While there is room for improvement, researchers already picked the lowest hanging fruit. Meanwhile, systems like mobile, embedded, and System On Chip (SoC) contains numerous innovation opportunities. Since these platforms often operate with limited resources, any change to squeeze out more performance or improve battery life produces measurable value.

Delivering that value requires first creating mechanisms for measuring inefficiencies across the system’s lifecycle. For instance, WiFi radios are notorious battery hogs due to staying active during asynchronous communication. Instead, modern scheduling protocols could more aggressively turn off the receiver between packets. Alternatively, a buffering system might enable receiving larger packet batches.

These enhancements could span the external systems of the mobile application. For instance, a Cyber-Physical Systems (CPS) might start within a cloud service before reaching into our car’s navigational controls. Mobile is more extensive than mere smartphones, continuing to appear within ever-growing use-cases. Each use-case comes with unique constraints and requirements that are ripe for discovery.

# References

Carral, L., Sillitti, A., & Succi, G. (2013). Software development processes for mobile systems. *International Workshop on the Engineering of Mobile-Enabled Systems* (pp. 19-24). Mobile-Enabled Systems. doi:10.1109/MOBS.2013.6614218

Joorabchi, M., Mesbah, A., & Kruchten, P. (2013). The real challenges in mobile app development. *International Symposium on Empirical Software Engineering and Measurement* (pp. 15-24). ACM-IEEE International Symposium. doi:10.1109/ESEM.2013.9

Khalid, A., Zahra, S., & Khan, M. (2014). Suitability and Contribution of Agile Methods in Mobile Software Development. *I.J. Modern Education and Computer Science, 2*, 56-65. doi:10.5815/ijmecs.2014.02.08

Nguyen, D. (2015). Reducing smartphone application delay through reading and writing isolation. *ACM MobiSys.* Florence, Italy: Association for Computing Machinery. Retrieved from YouTube: https://youtu.be/pYhssJACORg

Zhang, J., Sagar, S., & Shihab, E. (2013). The evolution of mobile apps. *International Workshop on Software Development Lifecycle for Mobile* (pp. 1-8). New York, NY, USA: Association for Computing Machinery. doi:10.1145/2501553.2501554