



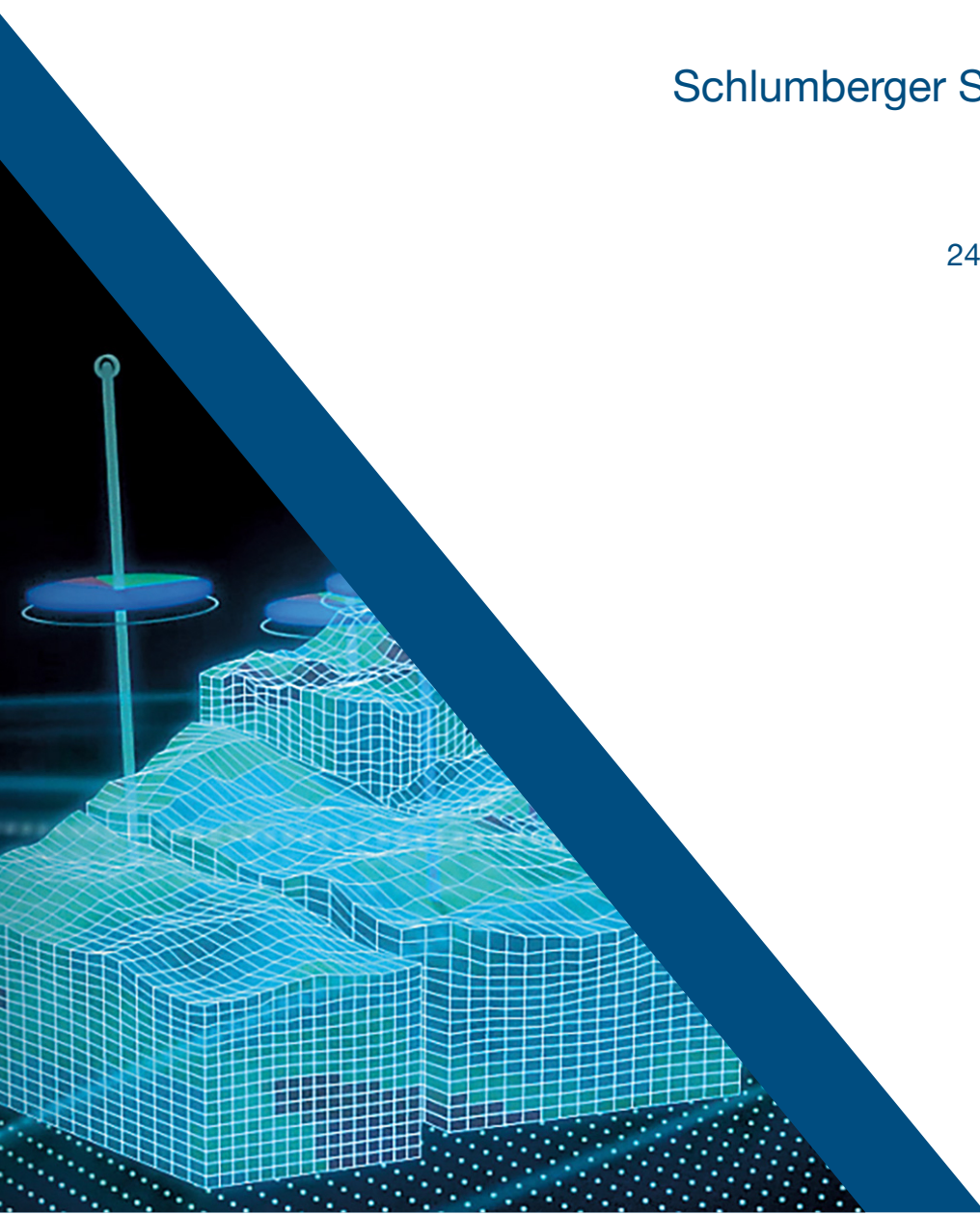
Progressive Web Apps

A new extension of oil & gas digitalization

Schlumberger Software Engineering
Internship Report

24th Jun 2019 - 30th Aug 2019

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CONTENTS

TABLE OF CONTENTS

Confidentiality Disclaimer	3
Acknowledgement.....	4
Executive Summary.....	4
1.0 Introduction	5
1.1 About Myself	5
1.2 Internship Context.....	5
2.0 Solution Process	5
2.1 Defining the Goal.....	5
2.2 Planning a Solution	6
2.3 Implementing the Solution	7
3.0 Final Deliverable	7
4.0 Conclusion & Personal Reflection	8

LIST OF FIGURES

Figure 1: Solution User-Development diagram	6
Figure 2: The PWA Eight Features	7

LIST OF PICTURES

Picture 1: Whiteboard brainstorming	7
Picture 2: Final product screenshots.....	8

Confidentiality Disclaimer

Some information concerning products, code, observations, workflow, practices, or deliverables, were omitted to keep these details confidential. This report was reviewed by the Schlumberger legal department and does not contain any confidential information from Schlumberger, therefore can be made publicly available

Acknowledgement

First of all, I would like to thank my educational institute, Imperial College London, for offering me a wide range of opportunities, skills, and networking environment, that were all helpful in my recruitment process.

I address as well special gratitude to my robotics team members, who helped me shape over five years both my technical and soft skills to reach a unique work ethic, which was very appreciated by the recruiters and later during the internship by the Schlumberger team.

I am obliged to all my internship team members at Schlumberger, for their belief in my capabilities and continuous support and encouragement. I specially address Pavel Khitrov, my manager (a great lead during my internship, who made objectives clear, supported my work, and changed my management views through his unique workflow), Thomas Murray, the product owner (with whom constructive feedback regularly took place, allowing me to understand how to review my work from users perspective and meeting their requirements), and Artemy Orekhov, my internship mentor (an inspiring software architect, who helped me adhere to the team development practices and supported me on both the technical and management side).

Finally, many thanks to Per Goffeng-Nielsen and Pia Granheim from HR for continuously following up my recruitment, relocation, and logistics processes, as well as Richard Davies (Ocean Program Manager) for helping me expand my network and create a strong Schlumberger link for the future.

Executive Summary

The internship takes place in Asker, Norway, at Schlumberger Limited, the world's largest oilfield services company, on the team developing *DrillPlan*, one of the company's recently released digital well construction planning solution.

The task was to prototype a Drilling Program quick-look Progressive Web App (PWA), that will enable drilling engineers to review their reports faster and securely, in any network conditions (slow or offline), on any device (desktop or mobile). This PWA prototype would be an extension of *Reporting*, one of *DrillPlan*'s fundamental tools, as well as a research into building simple, yet effective cross-platform applications, with the domain still under exploration at the department.

The journey of building this prototype starts with three primary phases:

- Brainstorming the core features and UI-UX of the deliverable with the Product Owner
- Setting a clear development workflow timeline with the Manager
- Discussing the product architecture with the Software Architect (the mentor)

These are followed by a closed DevOps loop workflow (Development & Operations), interrupted by weekly meetings to update the team on the progress made. The product was built using Angular 7, NodeJS, existing REST APIs, Service Workers, and GIT source control

The internship successfully concluded with a fully working prototype delivered, which included:

- An effective, simple, and fast navigation through a user's projects and reports on a single page.
- An embedded PDF viewer to quickly read a chosen report.
- A share functionality to send report links between different authorized users.
- A cross-platform, installable product, behaving as any other desktop or mobile application.
- A performant low-network & offline functionality.
- Storage capability of desired reports & version-sync effective control

With regard to the final result, the team was very satisfied with the delivered product, as it is the first fully functional mobile application (PWA) to be built. It was therefore deployed on production servers and is currently accessible by Schlumberger *DrillPlan* clients. Further investigation is required to support new customizations and features, as well as define diverse limitations.

1.0 Introduction

This section will introduce the intern as well as setup the internship context at Schlumberger.

1.1 About Myself

Being interested in both Robotics and Software Development, I wanted to finalize my perception of the Software Engineering field and decide whether or not it is the right field for me to work in. Schlumberger offered an interesting perspective, since it combines Software Engineering with a hands-on-tools field: oil & gas. It was therefore a unique opportunity for me to professionally discover how Software Engineering can be used to apply on real-world tasks. Moreover, being a very large company, it would allow me to experience working on software development within large, interlinked teams, which requires different coordination, work practices, and management, compared to small-scale corporates. Finally, Schlumberger is not purely about software, as it works in other fields, including hardware (e.g. sensors and chips) and robotics (e.g. automated drilling tools). Taking part into the internship would therefore allow me to build a network inside the company and explore the other fields for a potential future internship in one of them.

1.2 Internship Context

Schlumberger is the world's largest oilfield services company, and has many softwares that serve diverse purposes in the domain. These range between geo-simulations, well design, seismic studies, etc... combined with the newest technologies of machine learning or cloud management.

One of these large-scale products is *DrillPlan*¹. Released in 2017, it includes, as of the date writing this report, four fundamental services:

- *Well Planning Orchestration*: guides the collaboration and responsibilities across teams and drives planning procedural adherence
- *Automation & Design Validation*: access to all of the engineering tools and data in a common system. Results in improved drilling program coherency and operational reliability.
- *Make the most of your Data*: leverages integrated learning from your offset well analysis to capture and implement improvement. Results in time and cost management
- *Coherent Drilling Program*: the latest drilling program is always available in the cloud, kept coherent with everyone aligned anywhere at all times. Also named *Reporting* service

The internship targets the fourth fundamental service, *Reporting*, where a Progressive Web App extension could potentially improve the user experience and add new features to the service. The task, as mentioned in the executive summary, will target PWA technologies.

2.0 Solution Process

The following section will take us through the solution process, from narrowing down the features to setting up a clear road to building a fully functional prototype

2.1 Defining the Goal

The first step was to define the different elements where the UX of Reporting could be improved. In other words, the prototype needed to target an existing problem or area where bringing in a new extension could be useful to clients. This step was achieved through three sub-steps:

1. Create a user scenario: *a drilling engineer travels to a drilling area and needs to review reports on the aircraft*

¹ For a detailed description please refer to <https://www.software.slb.com/delfi/delfi-experience/drillplan>

2. Apply the scenario: *user accesses desired projects, followed by desired reports, and downloads each report individually in PDF format*
3. UX observations:
 - No possibility of using the service offline (on the aircraft)
 - Downloaded PDF files need to be organized / sorted manually
 - A newer version of the report needs manual download and sorting
 - Multiple clicks and considerable wait time before reaching and downloading a desired report
 - Sending PDF reports (e.g. through emails) carries the version and sorting observations

At this stage, the goal becomes clear:

Access quickly and securely a drilling program report while offline

Several key questions can then arise, such as:

- Is there a cache size limit?
- Will drilling engineers use a new dashboard?
- Is it secure to store Schlumberger data on mobile devices?

These questions are considered since the first step of implementation, and will provide with the goal a continuous guideline of what the DevOps loop should focus on.

2.2 Planning a Solution

Now that the goal is defined, a solution diagram including both the user and the developer is possible as seen below:

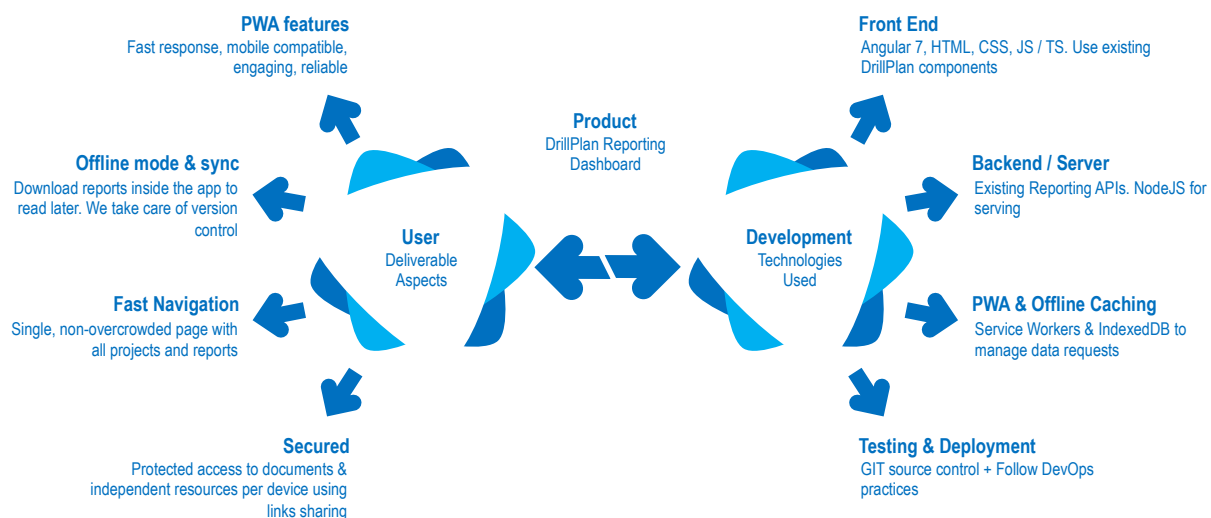


Figure 1: Solution User-Development diagram

The solution focuses on the defined goal and tackles four main user aspects (decided with the product owner) that will need to be treated, and how they will be treated from a technical (or development) perspective. It is possible now to agree on a timeline with the manager and product owner, define the key UI / UX features of the solution and set priorities to the different implementations.

Before going further, let's dive a little deeper into what are exactly PWAs. A Progressive Web App can be defined by eight main features, as the diagram on the next page shows. Once correctly understood, these can be implemented in the development process using the different technologies to achieve a successful product meeting the desired requirements.

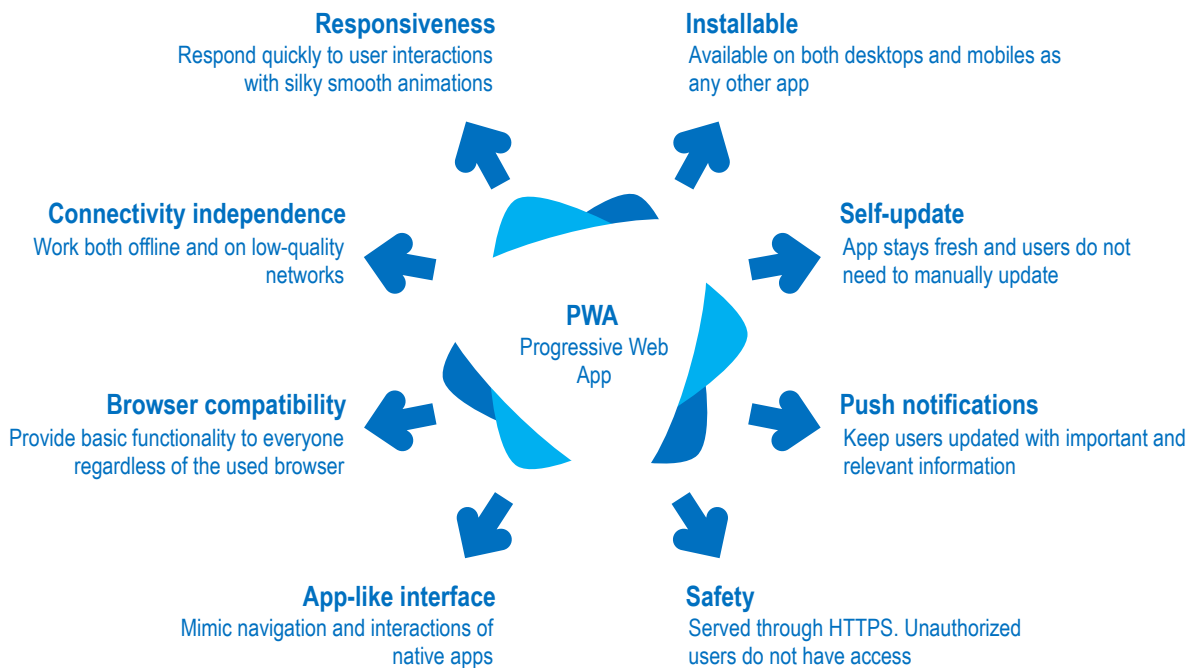
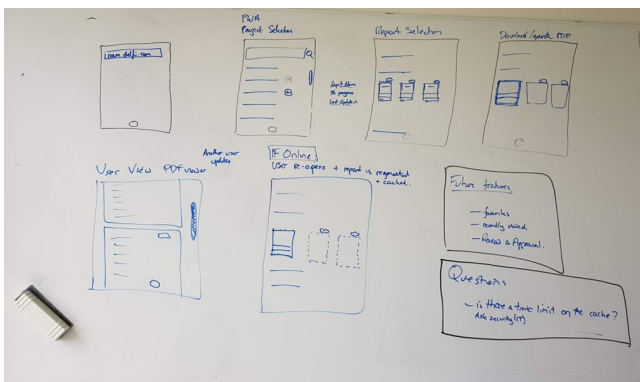


Figure 2: The PWA Eight Features

The next step before implementing the solution is to brainstorm a UI (with the best tool: a storyboard on a whiteboard) with the whole team to maximize the diversity of ideas and opinions.



The final decision was to use a single page view (to minimize navigation) with expandable cells for the projects. Reports sit inside the body of the expanded cell, and follow the same report card design used in DrillPlan. Additional markers (icons, numbers, etc...) are used to highlight relevant information for the users

Picture 1: Whiteboard brainstorming

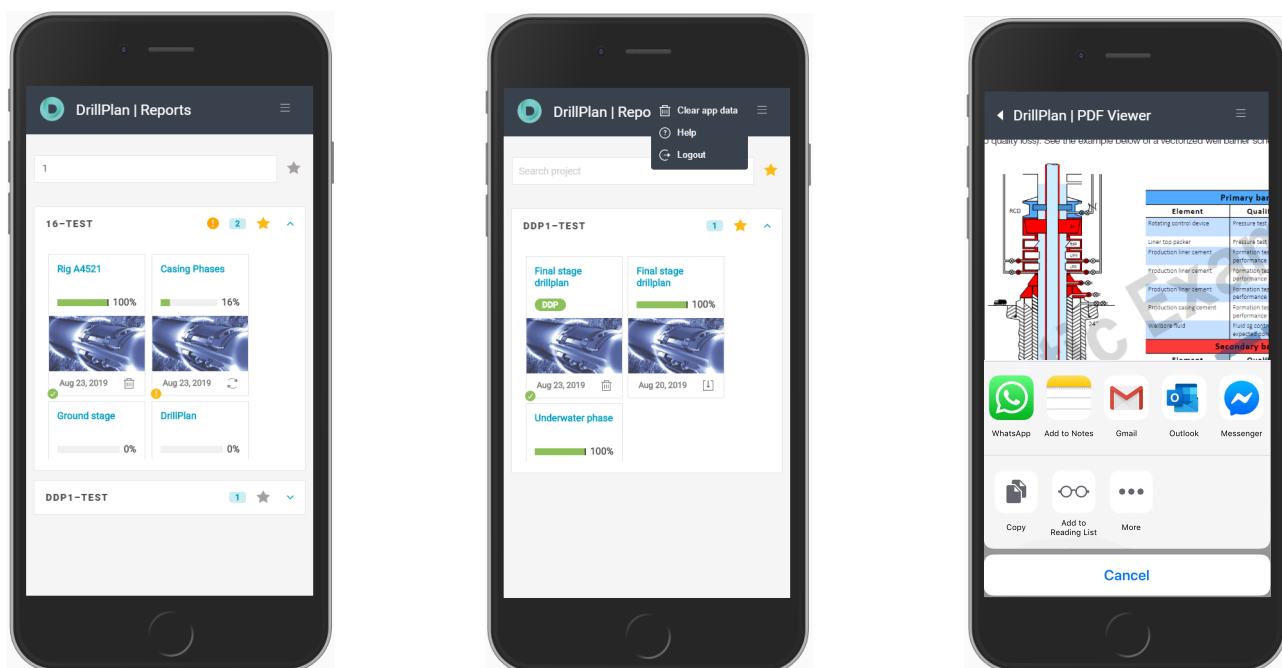
2.3 Implementing the Solution

The four development elements in the solution diagram were followed to implement to planned solution. The workflow went smoothly, and DevOps practices imposed regular testing and customer review (from the product owner and UI / UX consultations), which constantly created improvements to the initial storyboard to avoid any assumptions at the end of the day.

3.0 Final Deliverable

The final prototype was a functional PWA that answers the initial goal set at the beginning of the internship. It included:

- An effective, simple, and fast navigation through a user's projects and reports on a single page.
- An embedded PDF viewer to quickly read a chosen report.
- A share functionality to send report links between different authorized users.
- A cross-platform, installable product, behaving as any other desktop or mobile application.
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Above are three screenshots of a mobile device usage example, showcasing the navigation tools (search bar and book mark), the different report actions (download, sync, delete), the embedded PDF viewer, and the sharing functionality.

4.0 Conclusion & Personal Reflection