



NTNU – Trondheim
Norwegian University of
Science and Technology

Understanding Data Analysis in an End-to-End IoT System

Sindre Schei

Submission date: March 2016
Responsible professor: Frank Alexander Kraemer, ITEM
Supervisor: David Palma, ITEM

Norwegian University of Science and Technology
Department of Telematics

Abstract

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

This is the second paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

And after the second paragraph follows the third paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

After this fourth paragraph, we start a new paragraph sequence. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of

the original language. There is no need for special content, but the length of words should match the language.

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Sammendrag

Sikkerheten til nesten all offentlig nøkkel-kryptografi er basert på et vanskelig beregnbarhetsproblem. Mest velkjent er problemene med å faktorisere heltall i sine printallsfaktorer, og å beregne diskrete logaritmer i endelige sykliske grupper. I de to siste tiårene, har det imidlertid dukket opp en rekke andre offentlig nøkkel-systemer, som baserer sin sikkerhet på helt andre type problemer. Et lovende forslag, er å basere sikkerheten på vanskeligheten av å løse store likningsett av flervariable polynomlikninger. En stor utfordring ved å designe slike offentlig nøkkel-systemer, er å integrere en effektiv “falluke” (trapdoor) inn i likningssettet. En ny tilnærming til dette problemet ble nylig foreslått av Gligoroski m.f., hvor de benytter konseptet om kvasigruppe-strengtransformasjoner (quasigroup string transformations). I denne masteroppgaven beskriver vi en metodikk for å identifisere sterke og svake nøkler i det nylig foreslåtte multivariable offentlig nøkkel-signatursystemet MQQ-SIG, som er basert på denne idéen.

Vi har gjennomført et stort antall eksperimenter, basert på Gröbner basis angrep, for å klassifisere de ulike parametrene som bestemmer nøkkelene i MQQ-SIG. Våre funn viser at det er store forskjeller i viktigheten av disse parametrene. Metodikken består i en klassifisering av de forskjellige parametrene i systemet, i tillegg til en innføring av konkrete kriterier for hvilke nøkler som bør velges. Videre, har vi identifisert et unødvendig krav i den originale spesifikasjonen, som krevde at kvasigruppene måtte oppfylle et bestemt kriterie. Ved å fjerne denne betingelsen, kan nøkkel-genererings-algoritmen potensielt øke ytelsen med en stor faktor. Basert på alt dette, foreslår vi en ny og forbedret nøkkel-genereringsalgoritme for MQQ-SIG, som vil generere sterkere nøkler og være mer effektiv enn den originale nøkkel-genereringsalgoritmen.

Preface

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

Contents

List of Figures	xi
List of Tables	xiii
List of Algorithms	xv
1 Example	1
1.1 First section	2
1.1.1 First subsection with some <i>Math</i> symbol	2
1.1.2 Mathematics	2
1.1.3 Source code example	3
2 Background	5

List of Figures

1.1	A figure	2
-----	--------------------	---

List of Tables

1.1	A table	3
-----	-------------------	---

List of Algorithms

1.1	The Hello World! program in Java.	3
-----	-------------------------------------------	---

Chapter 1

Example

Here is an example of how to use acronyms such as Norwegian University of Science and Technology (NTNU). The second time only NTNU is shown and if there were several you would write NTNUs. And here is an example¹ of citation [?].

This is the second paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

And after the second paragraph follows the third paragraph. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

After this fourth paragraph, we start a new paragraph sequence. Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look.

¹A footnote



Figure 1.1: A figure

This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

1.1 First section

1.1.1 First subsection with some *Math* symbol

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

- item1
- item2
- ...

1.1.2 Mathematics

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. $\sin^2(\alpha) + \cos^2(\beta) = 1$. If you read this text, you will get no information $E = mc^2$. Really? Is there no information? Is there a

Table 1.1: A table

a	b	c	d	e
f	g	h	i	j
k	l	m	n	o
p	q	r	s	t
u	v	w	x	y
z	æ	ø	å	

difference between this text and some nonsense like “Huardest gefburn”? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$. This text should contain all letters of the alphabet and it should be written in of the original language. $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$. There is no need for special content, but the length of words should match the language. $a \sqrt[n]{b} = \sqrt[n]{a^n b}$.

Proposition 1.1. *A proposition... (similar environments include: theorem, corollary, conjecture, lemma)*

Proof. And its proof. □

1.1.3 Source code example

Algorithm 1.1 The Hello World! program in Java.

```
class HelloWorldApp {
    public static void main(String[] args) {
        //Display the string
        System.out.println("Hello World!");
    }
}
```

You can refer to figures using the predefined command like Figure 1.1, to pages like page 2, to tables like Table 1.1, to chapters like Chapter 1 and to sections like Section 1.1 and you may define similar commands to refer to proposition, algorithms etc.

Chapter 2

Background

- Background IoT
- Background 6LoWPAN
- Background BLE
- Background Nordic Semiconductor nRF52
- Background Raspberry Pi
- Background setting up Ubuntu Mate
- Background ADXL345
- Background setting up ADXL345