

# DESIGN, IMPLEMENTATION, AND VERIFICATION OF A SECURITY SYSTEM FOR DATA-CENTRIC OPERATING SYSTEMS

**BSc Thesis**

written by

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## Abstract

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# Contents

<b>1 Introduction</b>	<b>2</b>
1.1 Data Centric Operating Systems	2
1.2 Capability Based Security Systems	2
1.3 Our Contributions	2
<b>2 Implementation</b>	<b>3</b>
2.1 Capabilities	3
2.1.1 Gates	3
2.1.2 Flags	3
2.1.3 Signature	3
2.2 Security Contexts	3
2.3 Key Pairs	3
<b>3 Results</b>	<b>4</b>
<b>4 Conclusion</b>	<b>5</b>
<b>Bibliography</b>	<b>6</b>

# Chapter 1

## Introduction

In mainstream operating systems, security policy is enforced at runtime by a omniscient and all powerful kernel. It acts as the bodyguard, holding all i/o and data protected unless the requesting party has the authorization to access some resource. This tight coupling of security policy and access mechanisms works great since the kernel is always **there** and the only way to access anything through it. However the enforcement of security policy starts getting complicated when we try to seperate the access mechanisms from the kernel.

### 1.1 Data Centric Operating Systems

Data centric operating systems are defined by two principles [Bit+20]:

1. Provide direct, kernel-free, access to data.
2. A notion of pointers that are tied to the data they represent.

Mainstream operating systems fail to classify as data-centric operating systems, as they rely on the kernel for all data access, and use virtualized pointers per process to represent underlying data. The benefit of this “class” of operating systems comes from the low overhead for data manipulation, due to the lack of kernel involvement. However our previous security model fails to operate here as, by defenition, the kernel cannot be infront of accesses to data.

### 1.2 Capability Based Security Systems

Capability based security systems utilize capabilities, a finegrained

### 1.3 Our Contributions

# Chapter 2

## Implementation

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### 2.1 Capabilities

Capabilities are

#### 2.1.1 Gates

#### 2.1.2 Flags

#### 2.1.3 Signature

### 2.2 Security Contexts

### 2.3 Key Pairs

## Chapter 3

# Results

## Chapter 4

## Conclusion

## Bibliography

- [Bit+20] Bittman D, Alvaro P, Mehra P, Long DDE, Miller EL. Twizzler: a Data-Centric OS for Non-Volatile Memory. In: 2020 USENIX Annual Technical Conference (USENIX ATC 20), USENIX Association; 2020, pp. 65–80.