

Containerized Secure Multiparty Computing (MPC) Module for RSA Keypair Generation, Encryption and Decryption

(RSA 키생성 및 암호/복호화를 위한 컨테이너화된 안전한
다자간 계산 모듈)

지도교수 : Bernard Egger

이 보고서를 공학학사 학위 논문
대체 보고서로 제출함.

2022년 5월 27일

서울대학교 자연과학대학
생명과학부
Minghang Li

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Abstract

Secure Multiparty Computing (MPC) is a heated research field in cryptography with the goal of creating methods for multiple parties to jointly contribute to the computation while keeping the input private to each party. Rives-Shamir-Adleman (RSA) encryption algorithm, which requires lots of computations involving multiplication and modulus on large prime numbers, is suitable to be modified to work in an MPC scenario. However, there is no existing implementation for distributed RSA keypair generation.

Here we present a modern containerized MPC module for RSA keypair generation, encryption and decryption. It implements the classic Boneh & Franklin Scheme in a highly parallel manner using gRPC, a high performance Remote Procedure Call (RPC) framework. The implementation achieved the goal of eliminating the need for trusted dealer in secret sharing and successfully demonstrated the effectiveness of shared RSA key generation. With the sieving method and several pruning techniques applied, it also showed sufficiently high performance, which is about 50 times faster than the traditional single-threaded scheme.

The MPC RSA module is freely open source at <https://github.com/matchy233/mpc-rsa>. The Docker images can be found at `matchy233/mpc-project_manager` and `matchy233/mpc-project_worker`.

keywords: Cryptography, Secure Multiparty Computing (MPC), Distributed RSA algorithm, Distributed computing, Containerization

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1 Introduction

1.1 Multi

국문초록

RSA 키생성 및 암호/복호화를 위한 컨테이너화된 안전한 다자간 계산 모듈

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