SCVM: An Efficient, Automated RAM-Model Secure Computation Framework

Memory Trace Oblivious Program Execution.[CSF'13]

Chang Liu, Michael Hicks, Elaine Shi

Automating Efficient RAM-Model Secure Computation. [S&P'14]

Chang Liu, Yan Huang, Elaine Shi, Jonathan Katz, Michael Hicks

Oblivious Data Structures.[CCS'14]

Xiao Shaun Wang, Kartik Nayak, Chang Liu, T-H. Hubert Chan, Elaine Shi, Emil Stefanov, Yan Huang

SCORAM: Oblivious RAM for Secure Computation.[CCS'14]

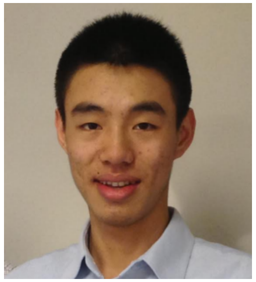
Xiao Shaun Wang, Yan Huang, T-H. Hubert Chan, abhi shelat, and Elaine Shi.

More to come soon!

(A Subset of) Our Team

Chang Liu

Kartik Nayak


Xiao Shaun Wang

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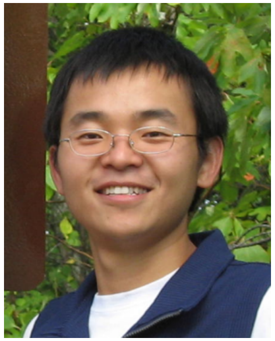
Yan Huang
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Jonathan Katz

Michael Hicks

Elaine Shi

“One year ago, we took **four months** to design efficient oblivious algorithms for matrix factorization, and implement them on a garbled circuit backend.”

— Nina Taft (Distinguished Scientist)
and Udi Weinsberg (Researcher)
Technicolor Research

Our Ultimate Goals

Usability

Non-expert programmers can accomplish secure computation tasks in a few hours.

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Usability

Non-expert programmers can accomplish secure computation tasks in a few hours.

Formal security

Guaranteed through type systems.

Efficiency

Competitive to customized circuits for a large class of algorithms.

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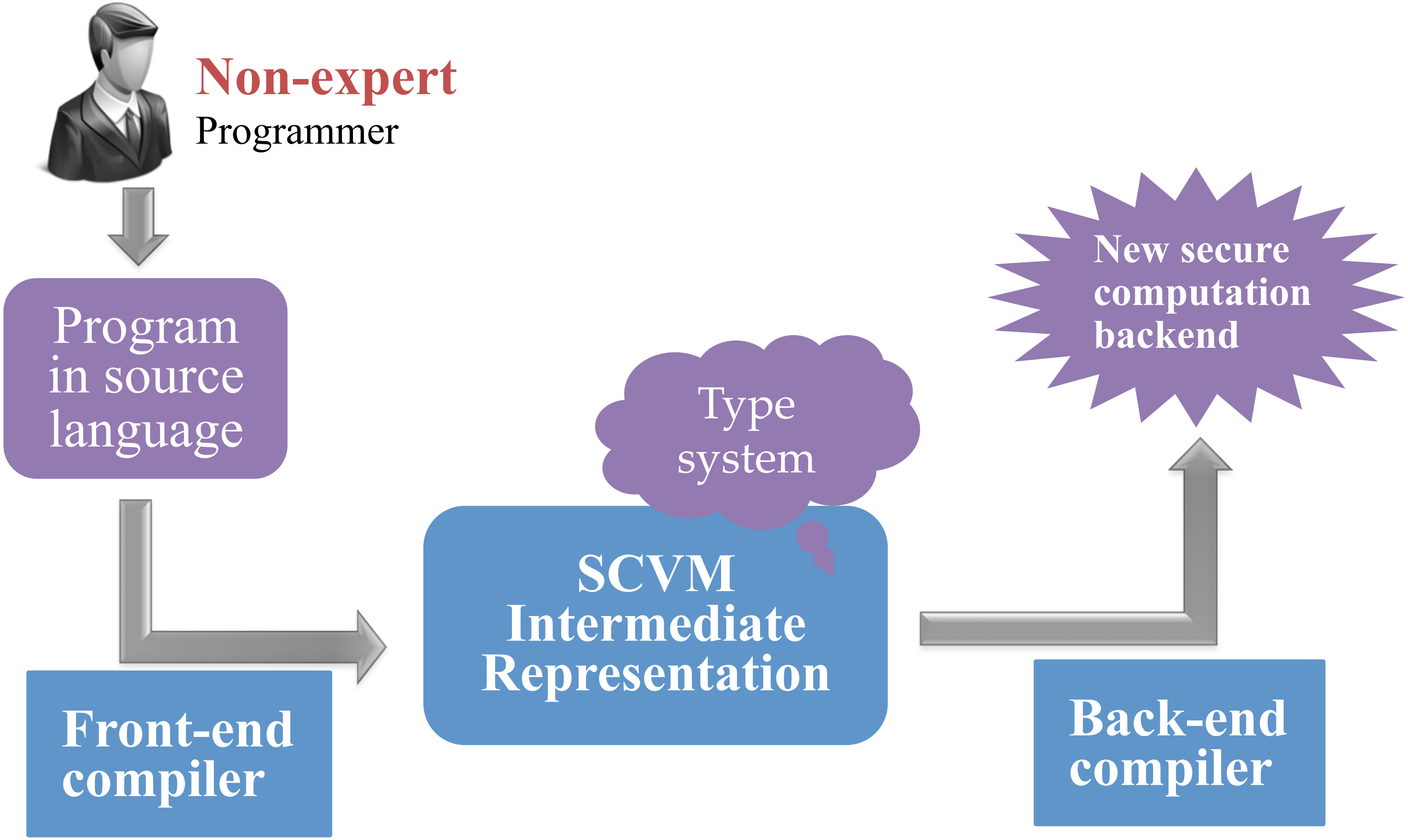

Non-expert Programmer

Program in source language

Front-end compiler

Type system

SCVM Intermediate Representation

Back-end compiler

New secure computation backend

Compile-Time Optimizations

[Liu et al. Oakland 14]

Instruction-trace obliviousness:

Eliminate universal next-instruction circuit

Memory-trace obliviousness:

Minimize use of ORAM

Mixed-mode execution

Local computation for local/public data

Watch out for our open source release!

SCVM Compiler

Efficient ORAM Constructions

Efficient Garbled Circuit Backend

Watch out for our open source release!

SCVM Compiler

Rich Libraries

data structures, floating point, machine learning, matrix operations, graph algorithms

Efficient ORAM Constructions

Efficient Garbled Circuit Backend

Thank You

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