runtime verification

Company Overview

www.runtimeverification.com

What We Do

runtime verification

Runtime Verification Inc. **applies runtime verification-based techniques to improve the safety, reliability, and correctness of software systems** for aerospace, automotive, and the blockchain.

formal analysis framework

formal design

dynamic analysis

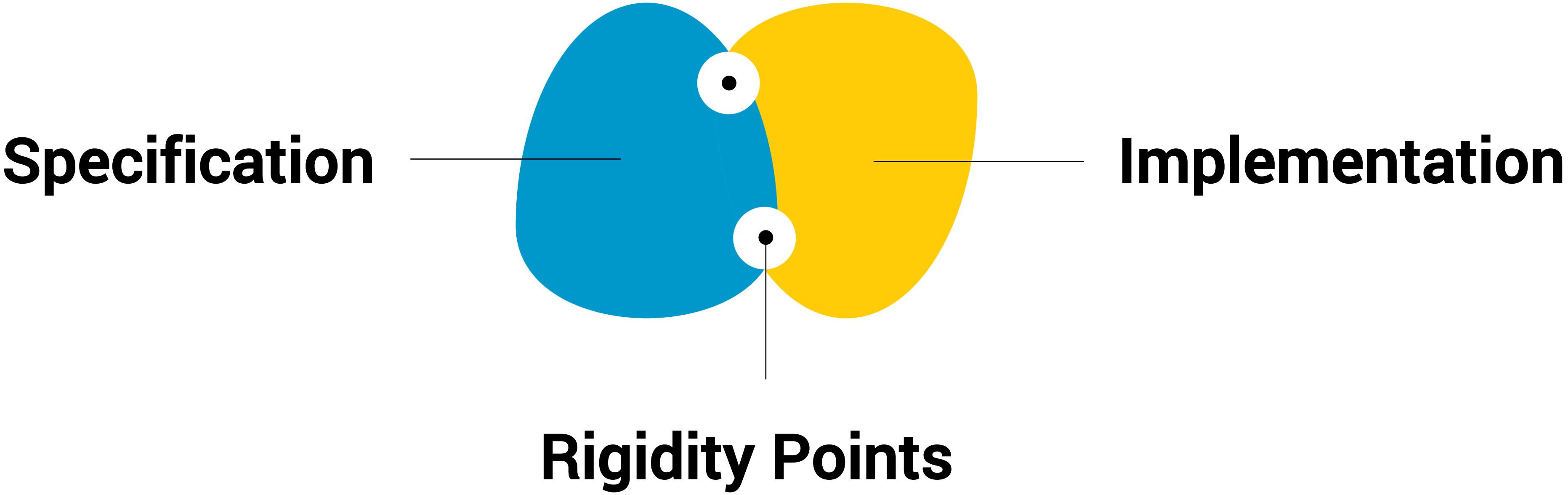
blockchain

Story

The **runtime verification** term was coined by Professor Grigore Rosu (UIUC) and his colleague Dr. Klaus Havelund (NASA) in three papers they published in 2001 and 2002. The papers received the **Most Influential Paper award** at the ACM/IEEE Automated Software Engineering Conference in 2016, the **Test of Time award** at the Runtime Verification Conference in 2018, and respectively the **Best Software Science Paper award** at ETAPS 2002.

The company was founded in 2010.

Symbol



During **runtime verification** we prove that the specification and the implementation are tightly connected, hence two rigidity points.

Executive Team

Our company is fueled by people. We are **pioneers in the runtime verification community**, with hundreds of publications that shaped the field.

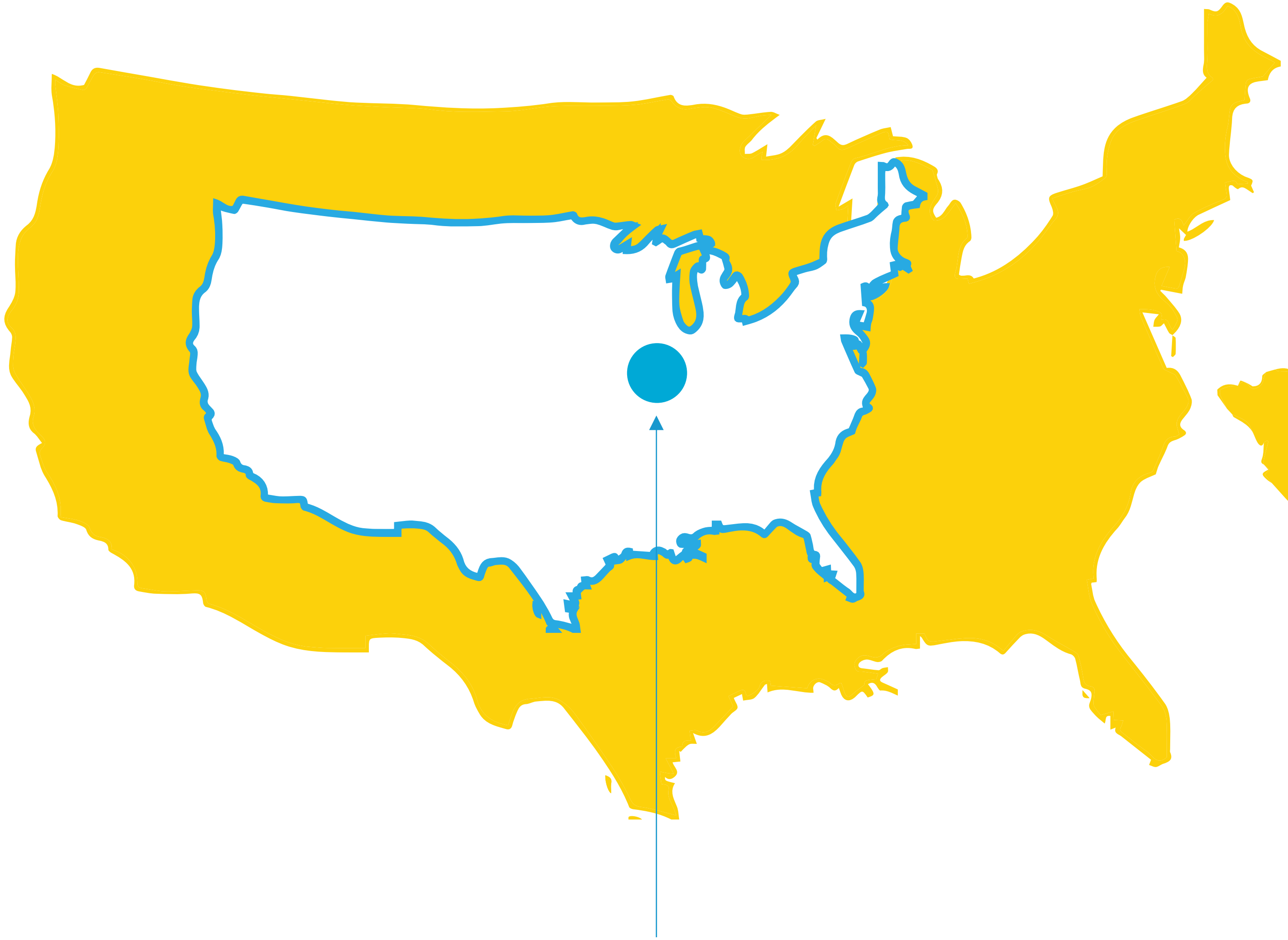
Grigore Rosu
President and CEO

Patrick MacKay
Chief Operating Officer

Ralph Johnson
Program Management Officer

Darko Marinov
Chief Quality Officer

Main Offices



University of Illinois at Urbana-Champaign

Ranked #2 worldwide in Formal Methods

University of Bucharest

Ranked #1 University in Romania

Partners & Customers

runtime verification

NSF

NASA

DARPA

DENSO
Crafting the Core

TOYOTA
InfoTechnology Center Co., Ltd.

BOEING

INPUT | OUTPUT

ethereum

Algorand™

casper

GNOSIS

MAKER

What is runtime verification?

runtime verification

A subfield of program analysis and verification – just like static analysis – aimed at verifying computing systems as they execute: with good scalability, rigor, and **no false alarms**.

Runtime Verification **complements** **Static Analysis**

Runtime verification is **different** from static analysis because: it **executes** programs to analyze, **observes** execution traces, **builds** models from the execution trace, and **analyzes** the model.

RV-Match

RV-Match is a semantics based automatic debugger for common and subtle C errors, and the most advanced and precise semantics-based bug finding tool.

RV-Match gives you:

- an automatic debugger for subtle bugs other tools can't find, with no false positives
- seamless integration with unit tests, build infrastructure, and continuous integration
- a platform for analyzing programs, boosting standards compliance and assurance

Case study – Toyota ITC benchmark

Toyota ITC benchmark

In a Toyota ITC benchmark evaluation, comparing RV-Match with various static analysis solutions, our product received the **best** score by finding more bugs than the static analysis tools and achieving a perfect false positive rate of zero false positives.

Case study – NASA cFE

runtime verification

NASA core Flight Executive

NASA core Flight Executive (cFE) is a development and run-time environment for enabling cross-platform embedded systems.

RV-Match detected:

- 15 undefined behaviors
- 1036 implementation-defined behaviors

runtime verification match

RV-Predict

RV-Predict automatically detect the rarest and most difficult data races in your Java and C/C++ code, saving on development and testing effort with the most precise race finder available.

RV-Predict gives you:

- an automatic debugger for subtle Java and C/C++ data races with no false positives
- seamless integration with unit tests, build infrastructure, and continuous integration
- a maximal detection algorithm that finds more races than any sound dynamic tool

Case study – Dynamic analysis

The Stolz queue

RV-Predict/C and LLVM ThreadSanitizer both detected a race on the Stolz queue. However, in producing a report in 5-10 seconds, RV- Predict/C bested ThreadSanitizer by a factor of 10 as the latter took more than a minute to generate the same report.

Smart Contract Verification

runtime verification

We formalize your smart contract as a mathematical specification. We refine the specification to match the target low-level virtual machine, and then compile the smart contract from its high-level language (e.g., **Solidity**, **Vyper**, **Plutus**) to virtual machine bytecode. We can then prove whether the bytecode satisfies the refined specification.

MAKER GNOSIS ethereum 币乎 好文有好报 Uniswap

Consensus Protocols

runtime verification

We developed formal models of **Casper** and **Algorand,** and specified two classes of properties: **safety** (that the protocol guarantees consensus) and **liveness** (that the protocol will always continue to make progress). The formal models make explicit the assumptions under which these properties are satisfied, which is extremely important for properly setting the expectations from systems built on top of them.

casper

Algorand™

Virtual Machines

In partnership with blockchain research firm, **IOHK**, we designed and developed **IELE**, a new virtual machine that represents an evolution of sorts of the Ethereum virtual machine (EVM). It leverages the **KEVM** project, which successfully demonstrated that a K formal specification of EVM can generate automatically, a "fast enough" virtual machine.

Tokens

ERC20-K

ERC777-K

For the larger Ethereum ecosystem we specified **ERC20-K** and **ERC777-K**, the mathematically rigorous formalization of the first of its kind ERC20 and increasingly popular ERC777 token standards. These two industry first formalizations facilitate formal verification of token implementations.

Partnerships

We always valued the friends and partners who have contributed mightily to our success. Therefore, we are happy to introduce the new commissions for the following services:

Customer Introduction by Partner – A qualified introduction to a Runtime Verification executive, that leads to a new completed engagement. (NET 5%)

Sales Made by Partner – An executed contract to a new Runtime Verification customer. (NET 15%)