

# Application of new Software V&V Methods for Complex Cyber Physical Systems



## Test and Verification Solutions

*Delivering Tailored Solutions for  
Hardware Verification and Software Testing*



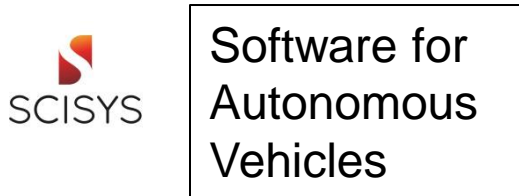
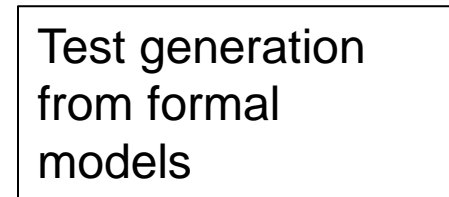
# The Problem

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- **Cyber Physical Systems introduce a complex software testing challenge**
  - A large input space
  - Difficulty predicting expected response
- **Hardware faced a similar problem 20 years ago**
  - Over the past 20 years a number of “Advanced Hardware Verification Techniques” (AHVT) have been introduced
  - To automate test generation and response checking
- **Can this be done within a safety framework?**

# The Project

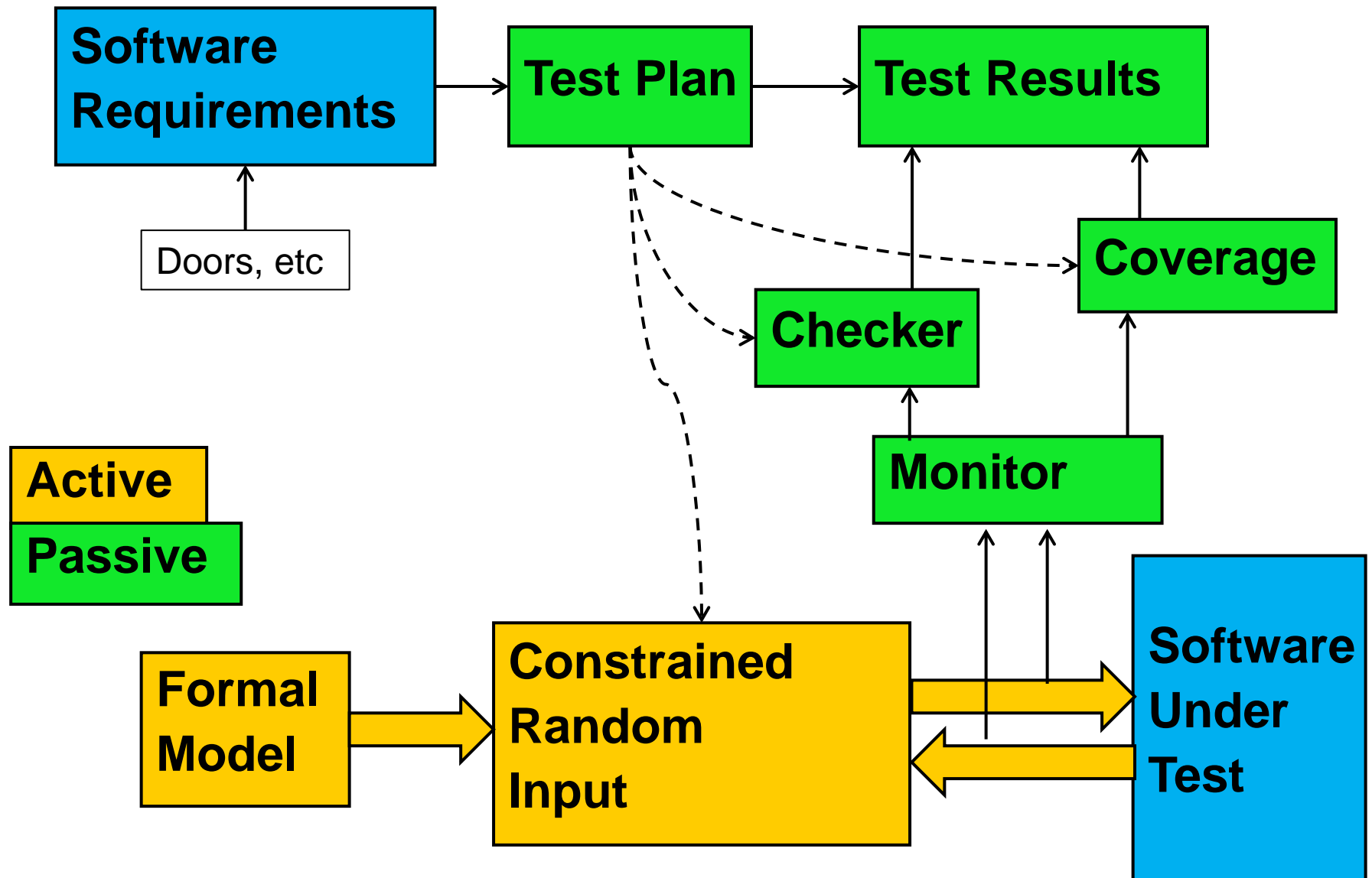
- Investigate the feasibility of applying **Advanced Hardware Verification Techniques to testing of software for Cyber Physical Systems**
  - Technical feasibility
  - Market feasibility
- **TVS**
  - Producing tools for evaluation by end user partners



Dejanira Araiza-Illan, David Western, Anthony Pipe and Kerstin Eder.

- Coverage-Driven Verification — An Approach to Verify Code for Robots that Directly Interact with Humans.
- Systematic and Realistic Testing in Simulation of Control Code for Robots in Collaborative Human-Robot Interactions.

# Advanced Hardware Verification Techniques



# Results of Bubble Sort “Proof of Concept”

Lists of

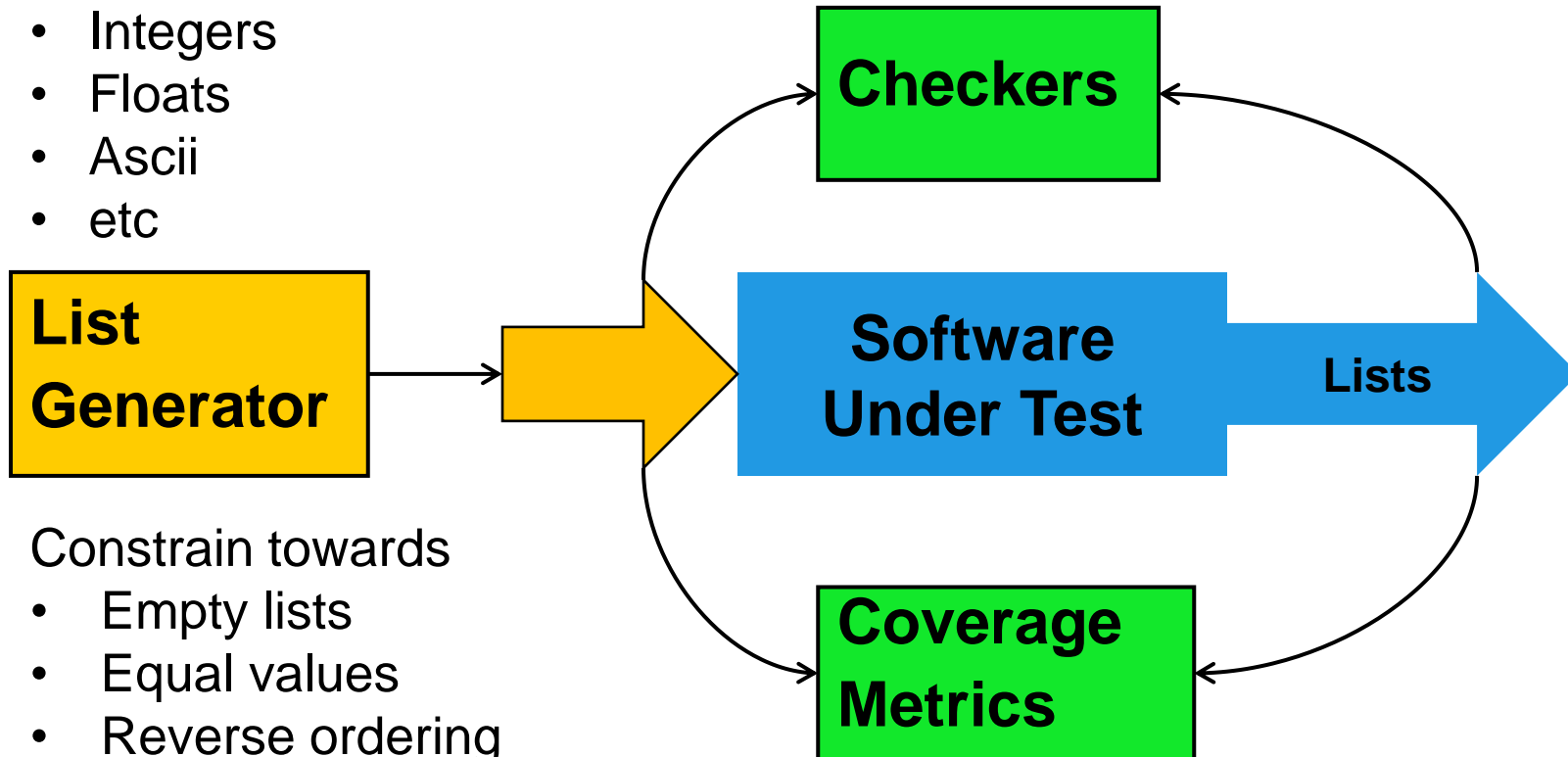
- Integers
- Floats
- Ascii
- etc

**List  
Generator**

Constrain towards

- Empty lists
- Equal values
- Reverse ordering

- Check output list is ordered
- Output list contents == input list contents



- Empty List
- Reverse ordered
- Error cases (mix integers, floats, ascii
- etc

# The Status and the Opportunity

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<http://www.testandverification.com/projects/>

## ■ Requirements Driven Verification

- Tool released to partners

## ■ Partner V&V Requirements Analysis

- Understanding how to adapt AHVT to software
- Tooling being adapted
  - Checkers
  - Coverage
  - Test Generation

## ■ The Opportunity

- Able to deliver the tooling to new partners
- Contact Mike Bartley
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