

# COSSIM: A Novel, Comprehensive, Ultra- Fast, Security-Aware CPS Simulator

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# Presentation Outline

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- A Short Introduction to COSSIM
  - Project Overview, Objectives, Expected Results
- COSSIM Simulation Framework
  - Framework Architecture
  - Current Status and Work-in-Progress
  - New Opportunities
  - Commercial Exploitation Plans

# State of Cyber Physical Systems

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- Cyber Physical Systems' extraordinary growth in all kinds of applications results in systems that
  - Incorporate a *multitude of processing systems*, from microcontrollers to sophisticated servers
  - Require hierarchical networks that have to use a *wide range of communication technologies*
  - Have autonomous components with *strict energy constraints*
  - Need to provide *credible security guarantees*

# Motivation behind COSSIM

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- COSSIM was born out of the observation that currently *an **integrated design, analysis and simulation framework** for CPS development is not available*
- Furthermore, the fragmented CPS tools ecosystem is *slow, imprecise and does not support any form of security testing*

# Project Objectives (1)

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- COSSIM is developing the *first integrated CPS design and simulation framework*
  - Simulates CPS nodes together with the network connecting them in a cycle-accurate way
  - Simulates the OS/drivers/system libraries and application code to enable application functional and performance testing
  - Provides hooks to all (simulated) hardware, software and network components for security and robustness testing

## Project Objectives (2)

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- COSSIM is developing the *first integrated CPS design and simulation framework*
  - Models devices at varying levels of detail
  - Provides power/energy estimations based on low-level descriptions and dynamic (application-specific) usage
  - Enables acceleration through parallelization and use of custom hardwired accelerators
  - Provides an expandable platform that can be connected to external tools to cover additional aspects

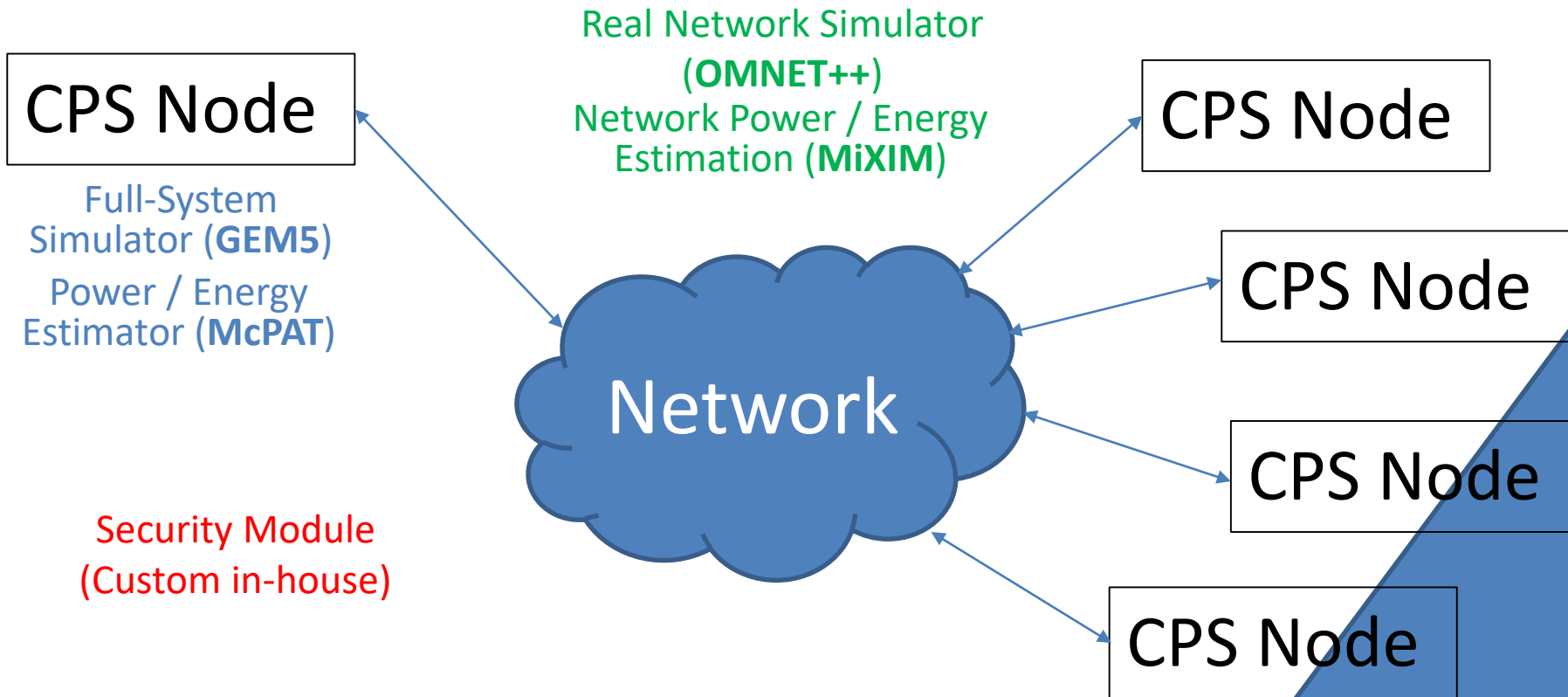
# Project Expected Results

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- Significantly *reduce the time required to design/simulate* a CPS
- Provide *accurate* results
- Significantly *reduce design costs and time-to-market*
- Offer for the first time *security and robustness testing tools* to a CPS simulation environment

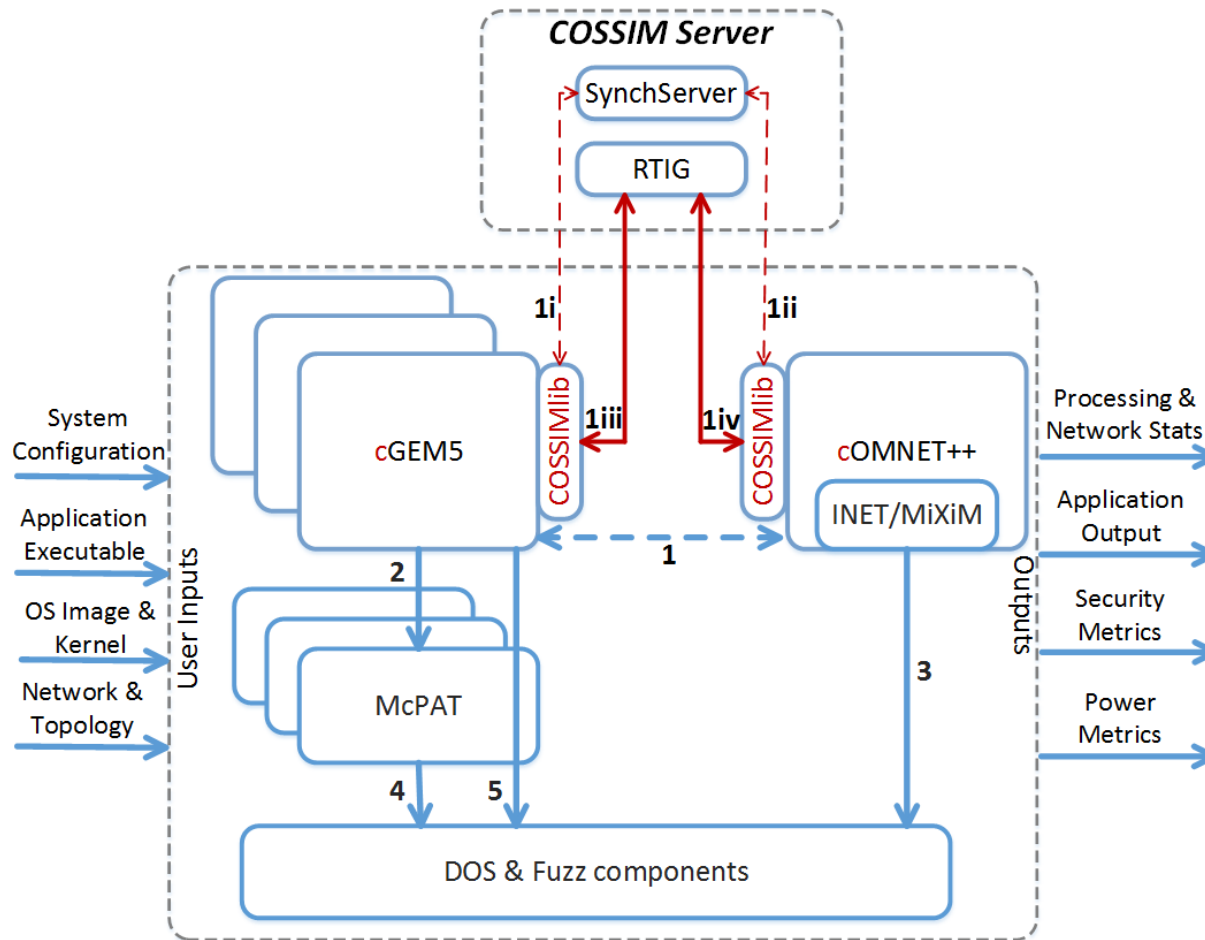
# What is COSSIM?

COSSIM is a simulation framework for CPS





# Top-Level Software Architecture



# Current State of Development

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- The first major version is *complete*
  - All components are integrated under a common GUI, the tool is fully-functional
- The framework is being validated by the project's industrial partners through two real-world applications
  - Building Management System
  - Mobile Visual Search

# Work in Progress

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- The framework currently supports parallel and distributed simulation
  - We are working on adding FPGA hardware acceleration for the power estimation modules
- We currently model and simulate the digital aspects of a CPS
  - We are working on integrating COSSIM with a physical process simulator (Ptolemy) through HLA

# Opportunities Beyond CPS

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- The framework in its current form extends significantly major simulators such as GEM5 and OMNET++
- Beyond CPS, this makes COSSIM especially attractive for *Parallel Systems architectural design and HPC application development and analysis*

# Commercial Exploitation

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- The basic (fully-functional) COSSIM framework will be made available to the community as a *free and open source* package
- COSSIM intends to establish a spin-off to oversee future development
- The spin-off will handle customization and support services



Thank you!