finding a data race bug

measure coverage

finding a timing bug
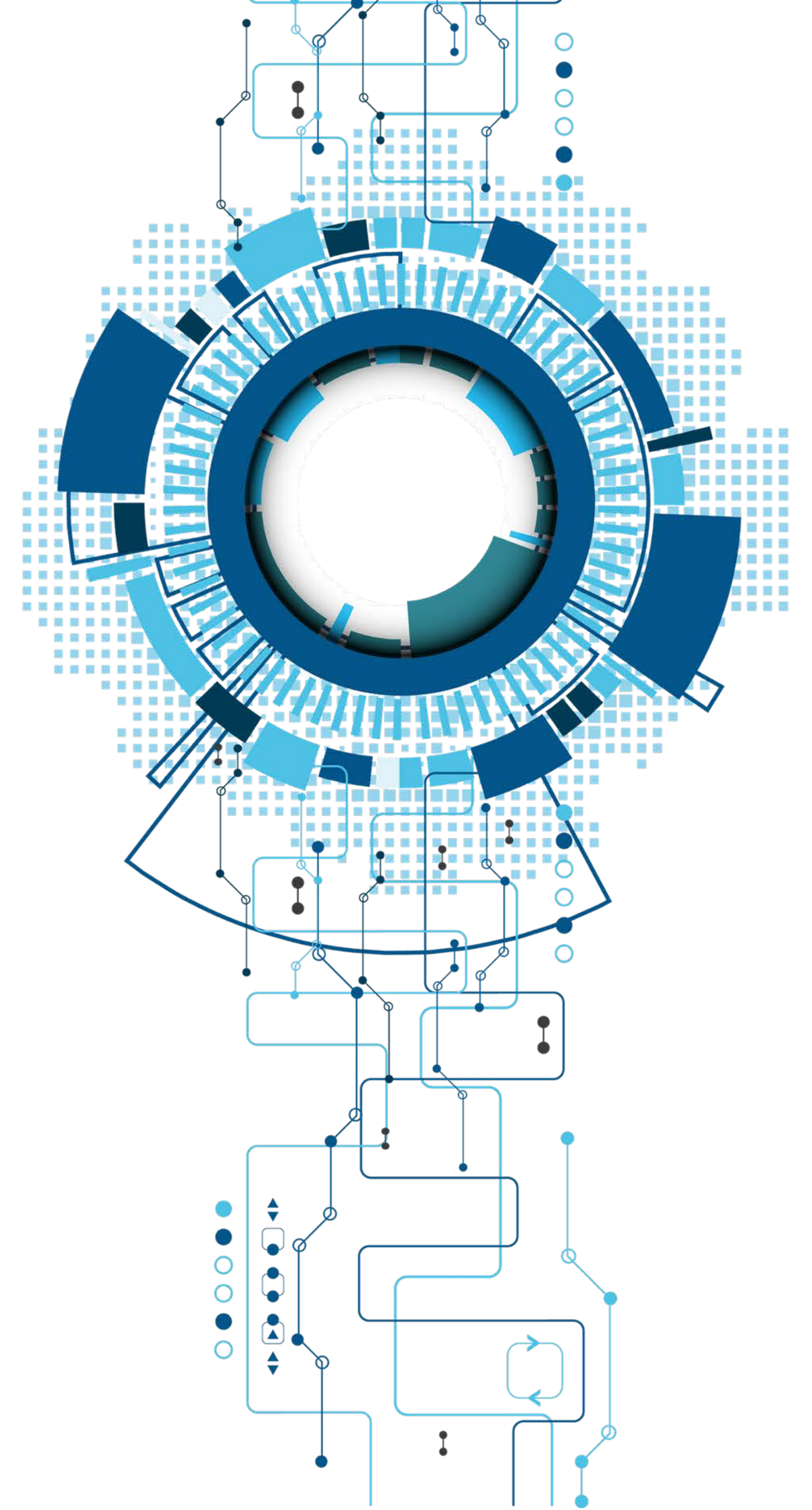
finding a functional bug

worst case execution time (wcet)
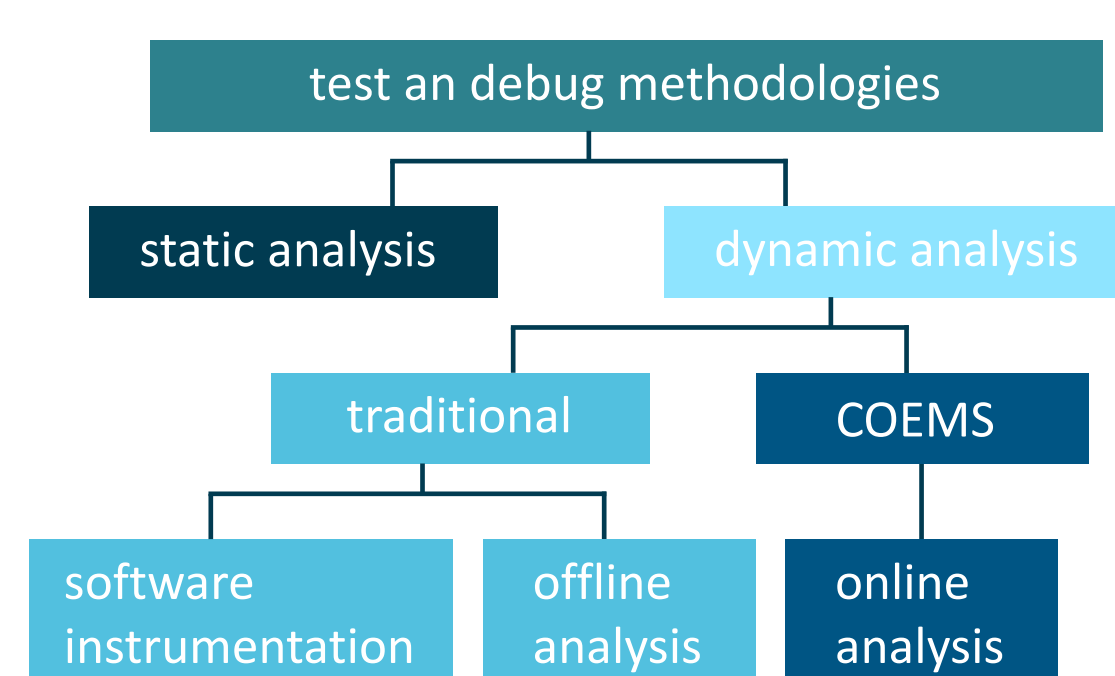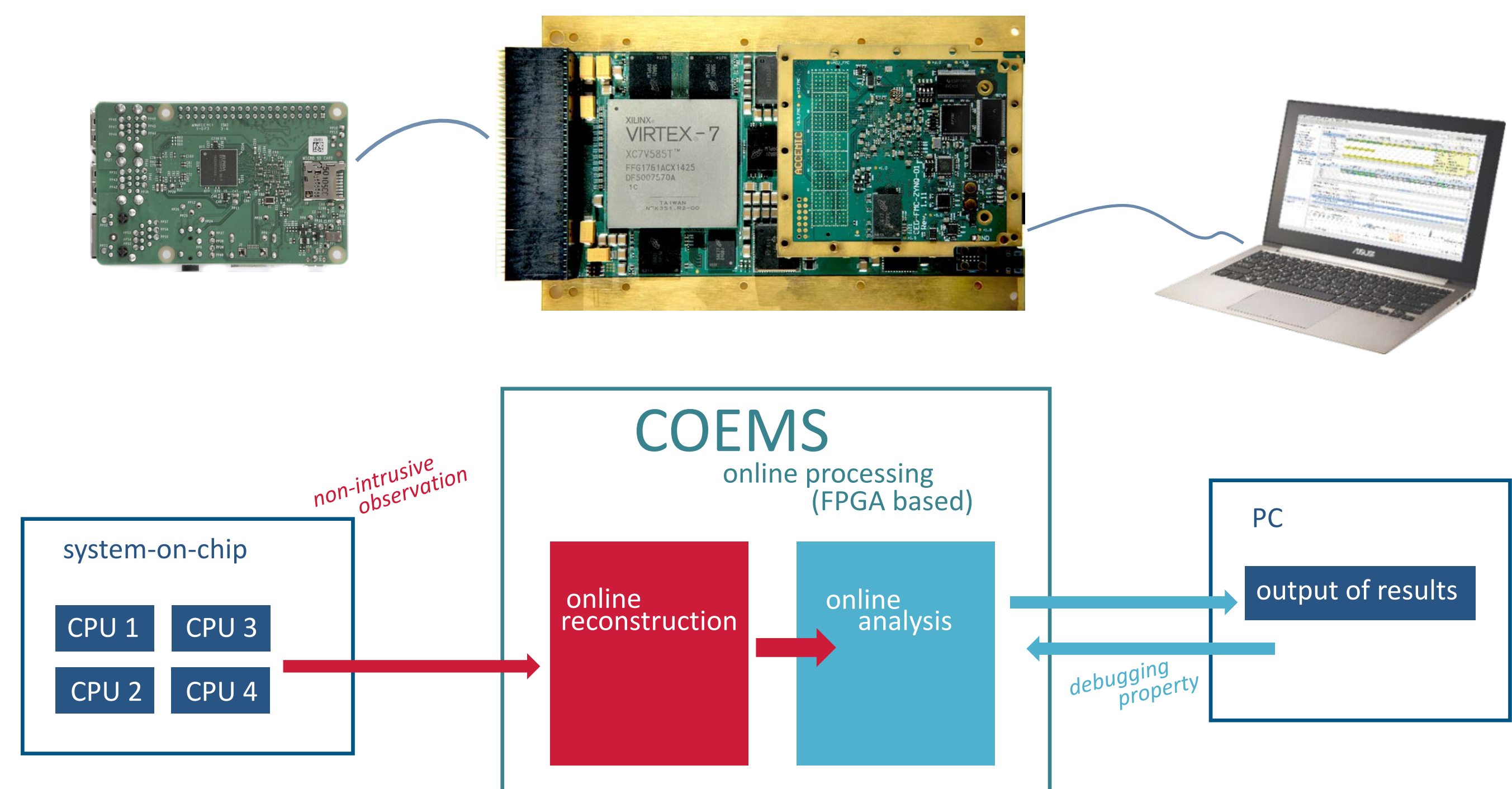
The New Way of Testing

ICT-10-2016
COEMS
Continuous Observation of
Embedded Multicore Systems

COEMS Continuous Observation of Embedded Multicore Systems

Within COEMS a novel platform for online monitoring of multicore systems is developed.
It gives insight to the system's behaviour without affecting it. This insight is crucial to detect non-deterministic failures
as for example caused by race conditions and access to inconsistent data.

A system-on-chip is observed using the tracing capabilites available on many modern multi-core processors.
They provide highly compressed tracing information over a separate tracing port.
From this information the COEMS system reconstructs the sequence of instructions executed by the processor. This sequence can then be analysed online by a reconfigurable monitoring unit. Analyse are described in a highlevel temporal stream-based specification language (TESSLA) that are compiled to configurations of the monitoring unit.
To cope with the amount of tracing data generated by modern processors the COEMS system is implemented in hardware using an FPGA.

COEMS
online processing
(FPGA based)

non-intrusive observation

system-on-chip
CPU 1   CPU 3
CPU 2   CPU 4

online reconstruction

online analysis

PC
output of results

debugging property

test an debug methodologies
static analysis — dynamic analysis
traditional — COEMS
software instrumentation — offline analysis — online analysis

	traditional: software instrumentation	traditional: offline analysis	COEMS: online analysis
long observation	✓	✗	✓
non-intrusiveness	✗	✓	✓
multicore	✗	▲	✓
multible focuses	✓	▲	✓
autonomous operation	▲	▲	✓
time and cost efficiency	▲	▲	✓
results immediately	✓	✗	✓

✓ well suited solution
▲ significant limitations
✗ unsuitable in most cases

A special hardware unit observes the processor internal states, compresses and outputs this information via a dedicated trace port. An external trace device records the trace data stream and forwards the data after the observation period to a PC for offline decompression and processing. A special hardware unit observes the processor internal states, compresses and outputs this information via a dedicated trace port. An external trace device records the trace data stream and forwards the data after the observation period to a PC for offline decompression and processing.

www.coems.eu