



Presents

# Analyzing Multicore Processor Implementations for Telecomm Applications

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# Who Cares?

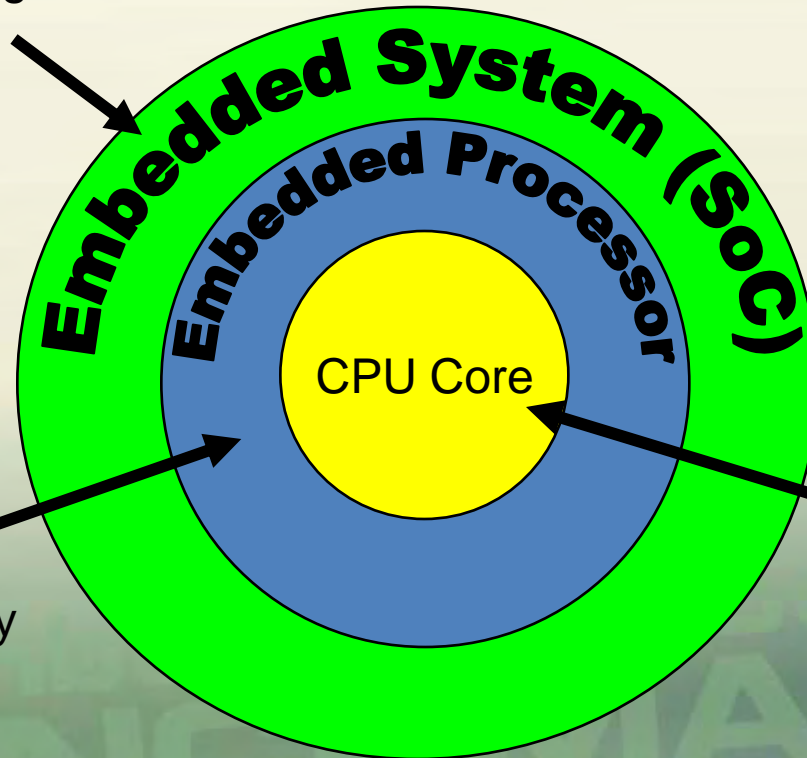
- **Processor vendors are obvious beneficiaries**
  - Framework to guide architectural choices for development stage of processors, compilers, etc.
  - Researchers for experimenting and creating advanced technologies
  - Processor marketing people
- **Platform OEMs have stringent requirements**
  - Compare devices prior to selecting processor for a device
    - Is a specific processor the right one for your application?
  - What types of processing or applications will scale well on a particular device?
    - Determine performance bottlenecks
  - Understand how to improve end user performance

# The Key Segments of Embedded Processor Benchmarking

- Tests interaction of system elements
- I/O and peripheral testing
- Scenario-driven tests

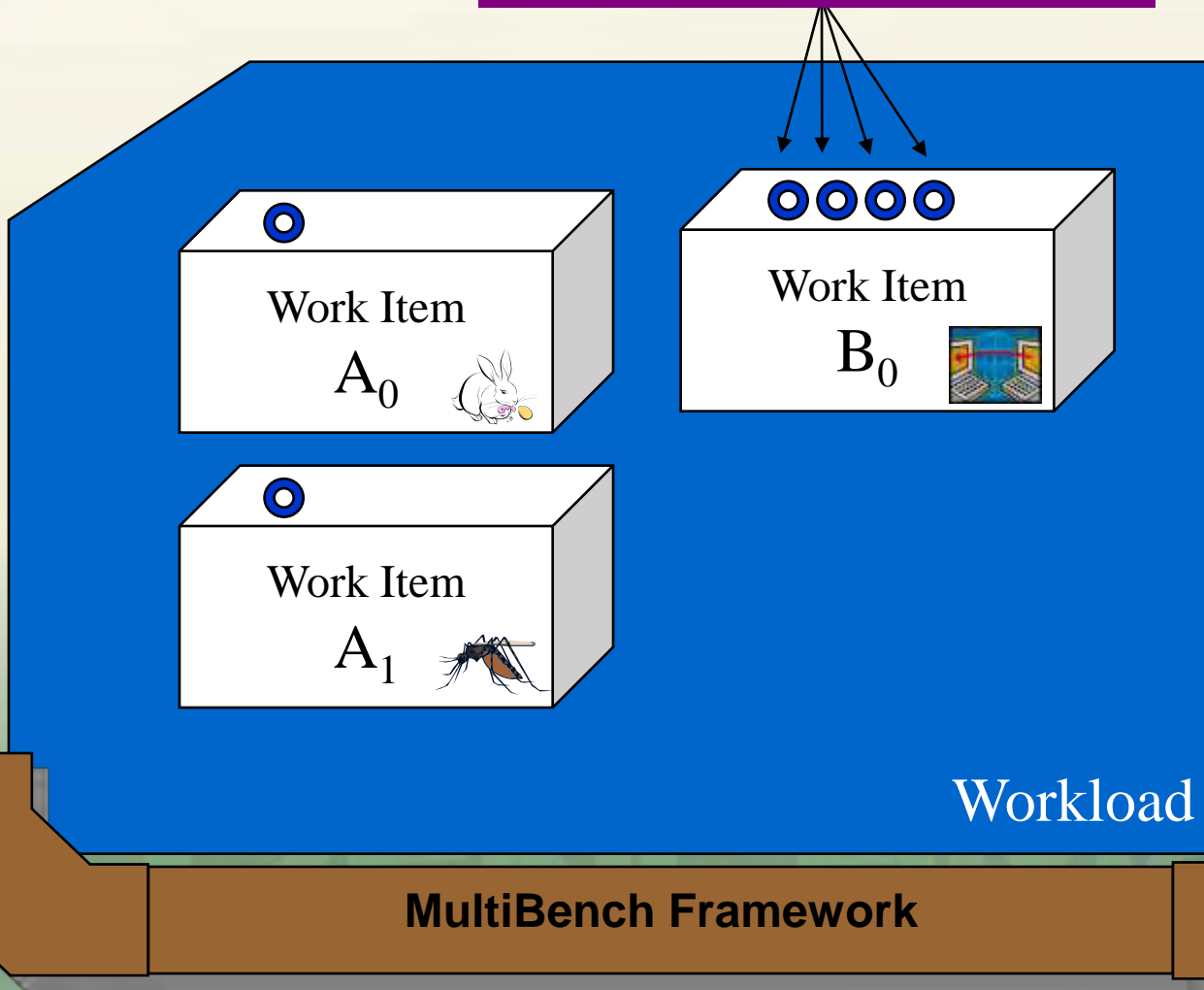
- The domain for traditional EEMBC benchmarks (i.e. AutoBench, DENBench)
- Tests for CPU and memory subsystem
- Includes MultiBench

CoreMark domain



# MultiBench

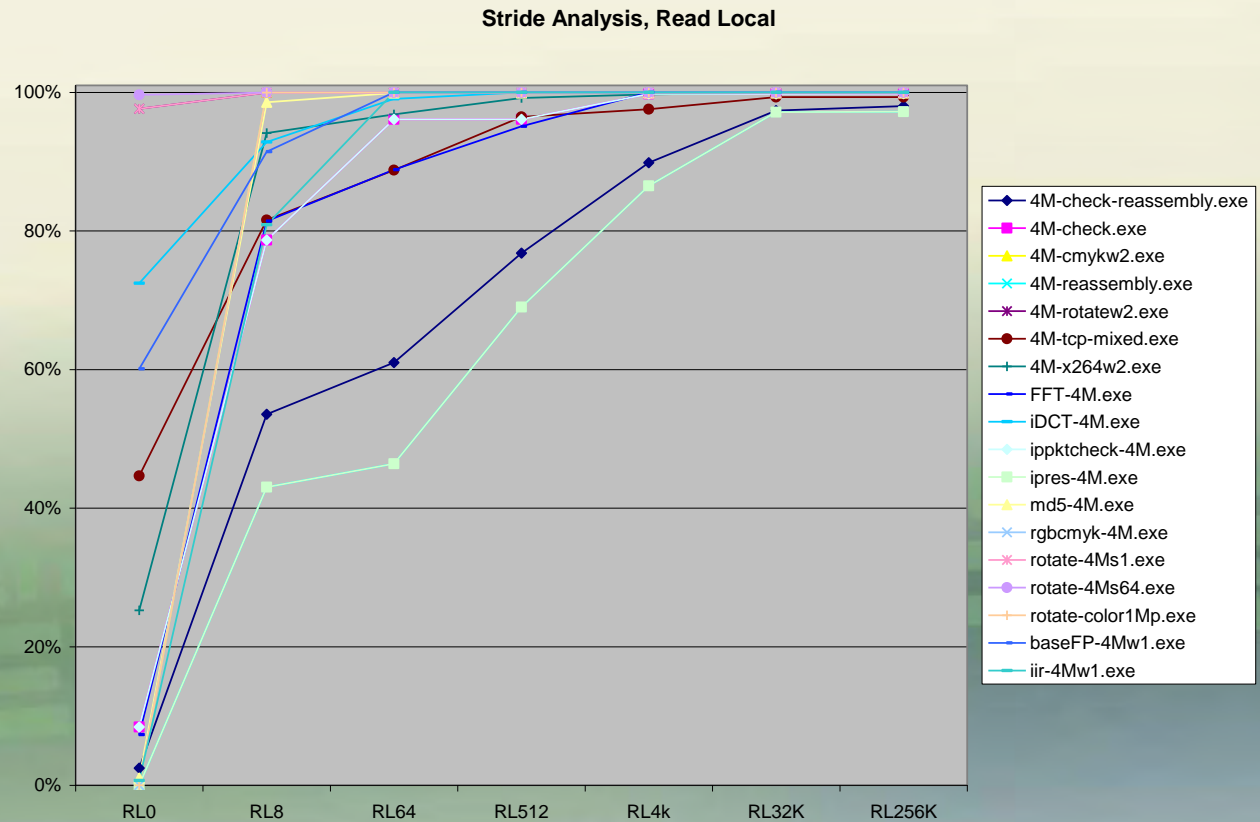
Multiple contexts within an item



- Multiple algorithms
- Multiple datasets
- Robust framework

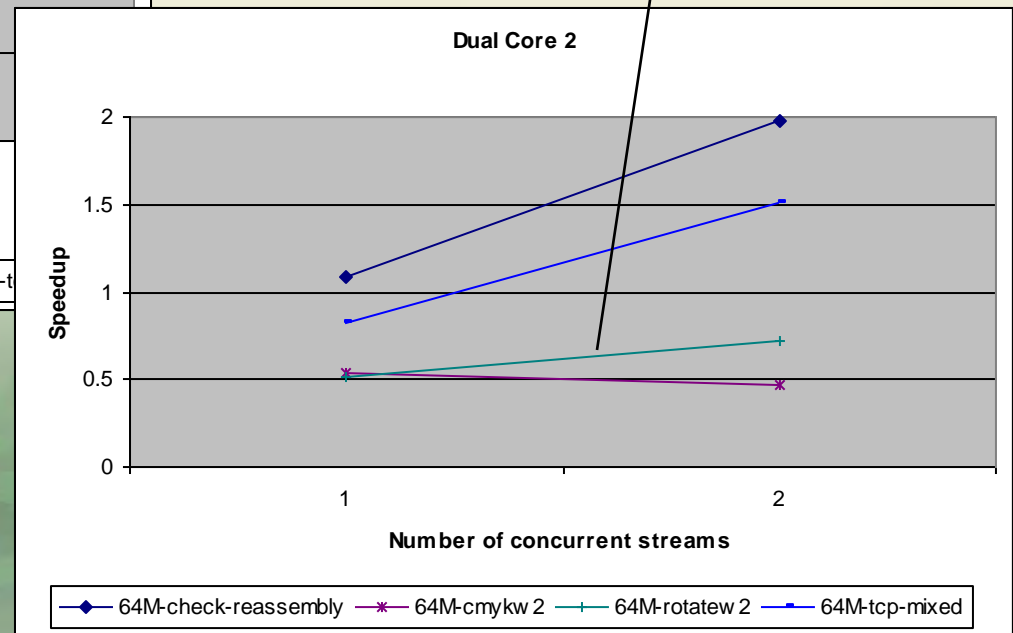
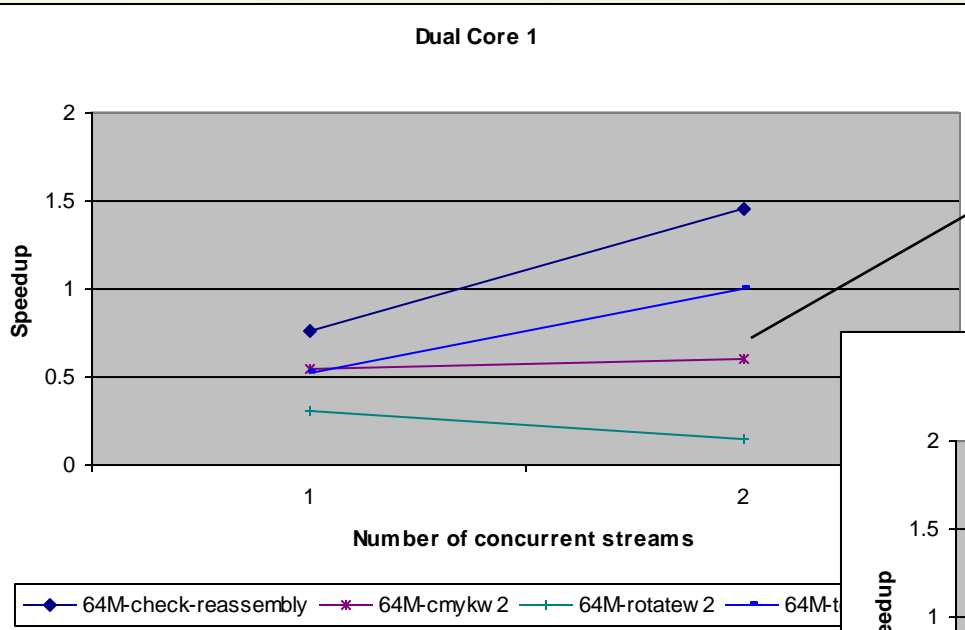
# MultiBench Innards

- Detailed analysis or workload characteristics such as instruction distribution, cache potential, memory access patterns and more...



# Compare Multicore Devices

Various workloads expose different trends in systems



# Application Focus

- Over 200 predefined workloads
- MultiBench Architect to construct your own workloads!

The screenshot displays the MultiBench Architect Workload Creator interface. It features a menu bar (File, Help), a Filter Items input field with 'ip' entered, and a Visualize button. The Workload Name is 'new\_workload', Iterations is '10', and Min Contexts is '1'. Below these are fields for Workload Description and a Connect button. The interface is divided into two main sections: Available Items and Workload Definition.

Item	Index	Data
cpeg-data1	0	data1
cpeg-data2	1	data2
cpeg-data3	2	data3
cpeg-data4	3	data4
cpeg-data5	4	data5
cpeg-data6	5	data6
cpeg-data7	6	data7
djpeg-data1	0	data1
djpeg-data2	1	data2
djpeg-data3	2	data3
djpeg-data4	3	data4
djpeg-data5	4	data5
djpeg-data6	5	data6
djpeg-data7	6	data7

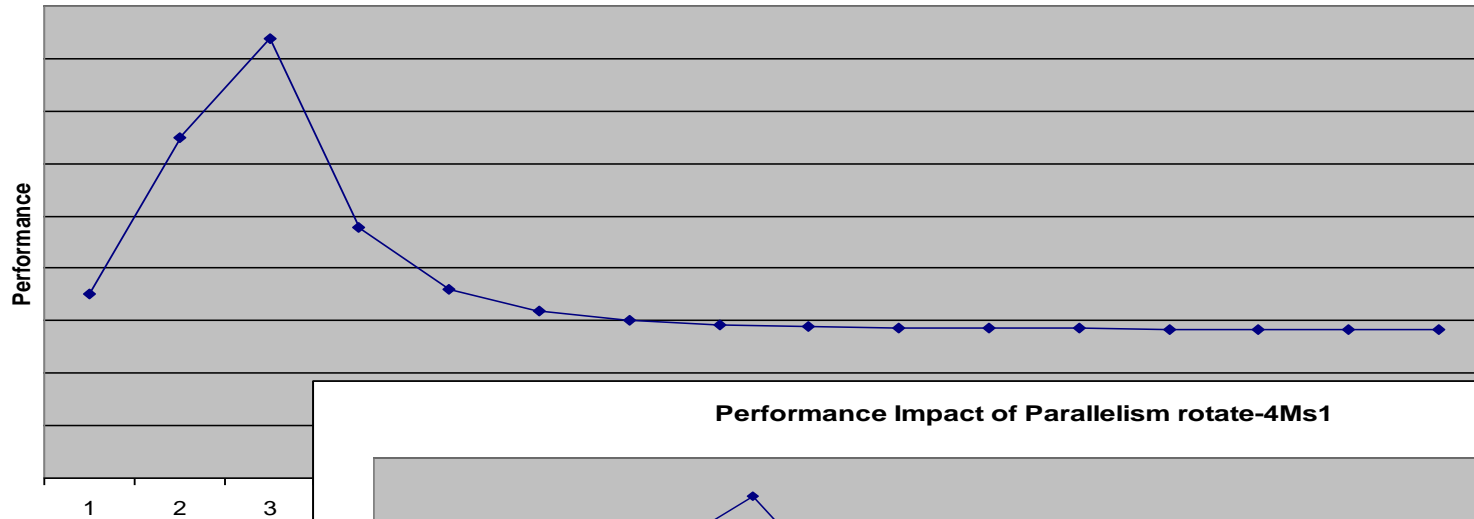
Work Item	Index	Data	Connections
aiffr	3	32M1worker	1: data,
bitmap	3	data32M	
cpeg-data1	0	data1	3: data, 3: ctrl,
djpeg-data1	0	data1	

A 'Show' window displays a dependency graph with four nodes: 0:aiffr, 1:bitmap, 2:cjpeg-data1, and 3:djpeg-data1. Edges are labeled 'data' and 'data ctrl'.

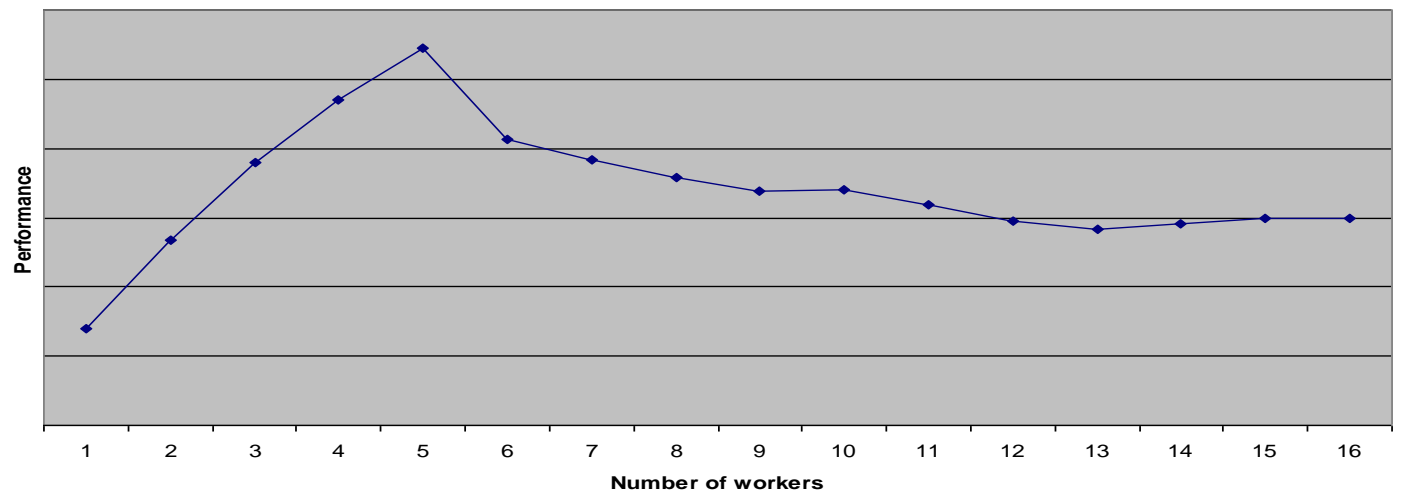
Connected: File: new\_workload.xml

# Scalability Aspect

Performance Impact of Parallelism rotate-4Ms1w1



Performance Impact of Parallelism rotate-4Ms1



# Transitioning to System-Level Benchmarks

- MultiBench works perfectly for most processors with SMP architectures
- What about heterogeneous SoCs?
  - Hardware accelerators
  - Application specific I/O
  - With a hierarchy of on-chip and off-chip memory arrays

BENCHMARKS

# Ideally, this is What the Customer Buys



- Define the workload, the inputs, and expected outputs

BENCHMARKS

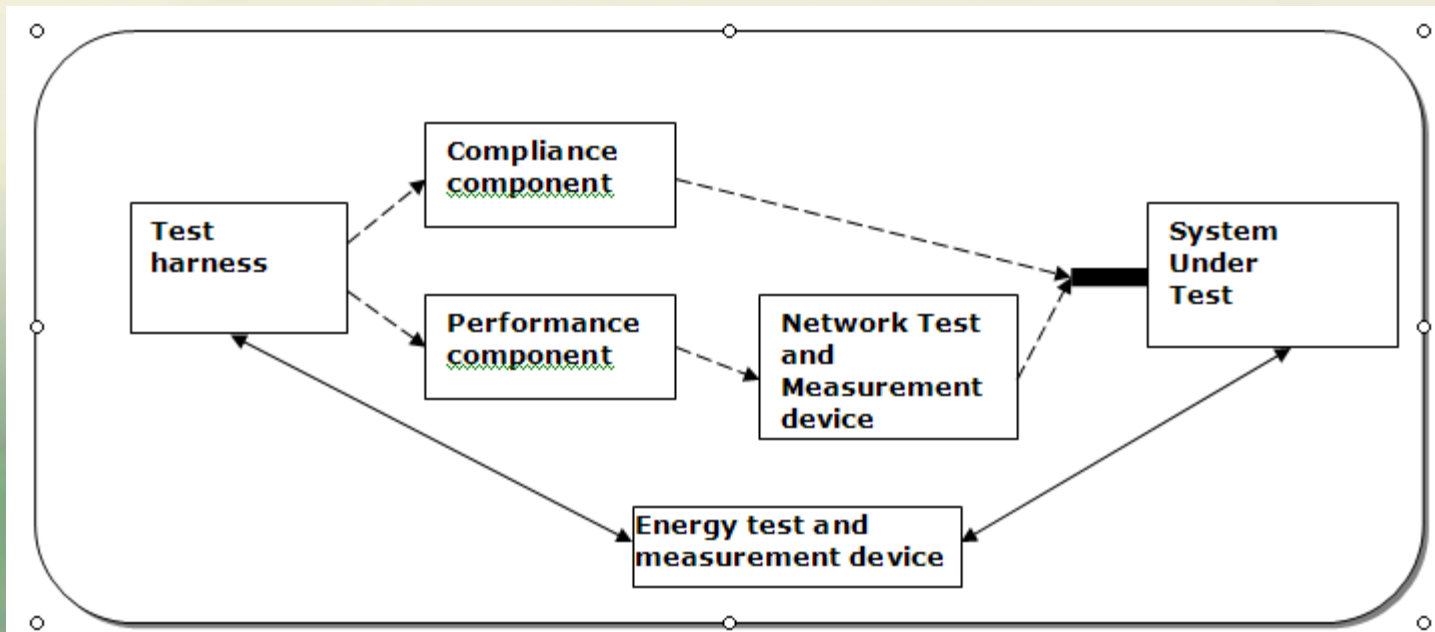
# Adopting a “Blackbox” Approach

- When looking at the system as a whole, benchmark scenarios imply use of any hardware resources, including multiple cores.
- Departure from standard EEMBC model, but becoming more relevant as companies sell complete solutions.

BENCHMARKING MULTICORE PROCESSORS  
BENCHMARKS

# EEMBC TCP Scenarios

- First scenario benchmarks defined by EEMBC, currently in review
- Basic transport layer benchmark to evaluate a system's ability to act as a TCP/IP server



# Compliance

- Due to focus on embedded systems, defined minimum compliance requirements.
  - RFCs 793, 1122, 1323, 2018, 2581, 2582
- Actual compliance is part of the benchmark report – performance results alone are not comparable or sufficient!

BENCHMARKING MULTICORE PROCESSORS  
BENCHMARKS

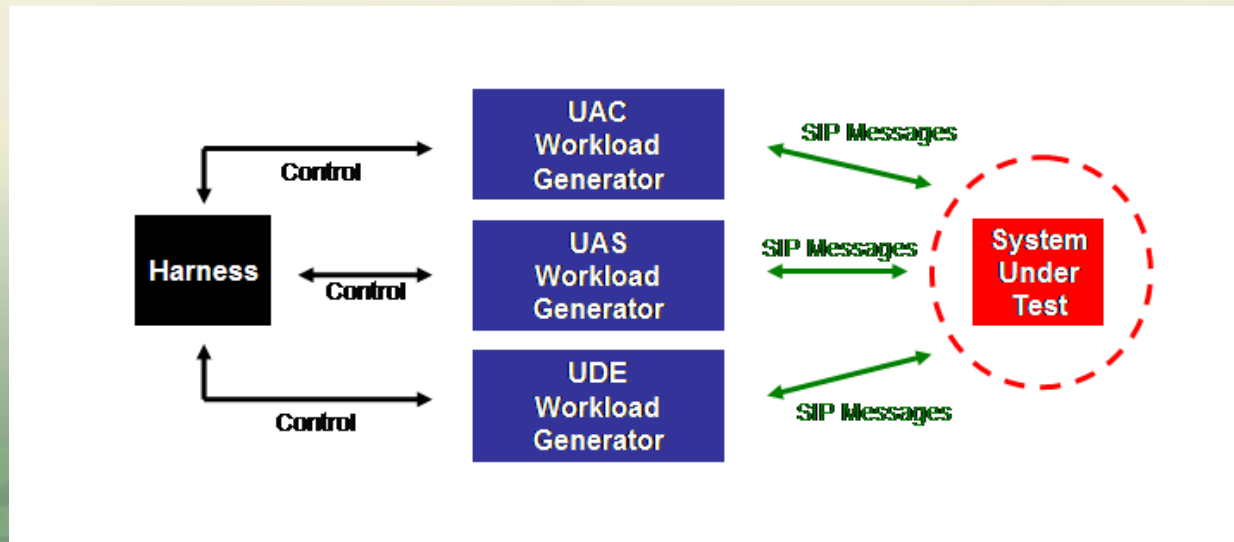
# Performance

- Performance scenarios for connections/sec and throughput.
- Everything defined and standardized
  - IP address and Netmask
  - Client MAC addresses
  - TCP handshake protocol options
  - Actual content of packets expected
  - Etc...

Processor  
BENCHMARKS

# SIP Scenarios

- Application layer scenario
- Collaboration with SPEC
- Using the target as a proxy



# SIP Performance

- Web based interface (FABAN)
- SIPP based clients
- Standardized users
- Authentication required

Benchmark Processor  
BENCHMARKS

# SIP Compliance

- EEMBC specific package aimed at embedded systems.
- Like TCP, minimal functionality has been defined and is tested for.
- Performance numbers always accompanied by compliance information.

BENCHMARKS

# Summary

- EEMBC has multiple solutions to benchmark Multicore systems
- MultiBench is a valuable tool to compare and classify processors
- Scenario based benchmarks can be used as an accurate guide of embedded system performance
- EEMBC benchmarks are available for members and licensees

[www.eembc.org](http://www.eembc.org)