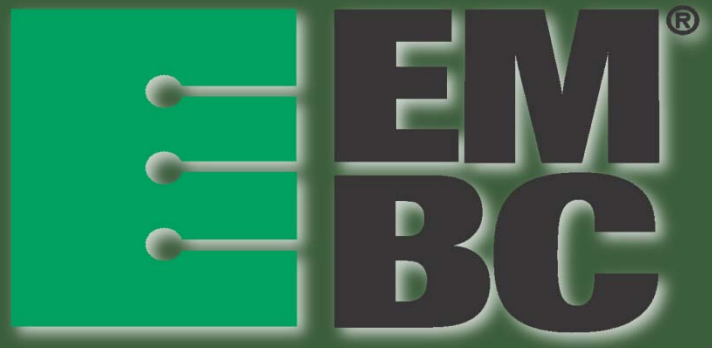

MultiCore Expo

April 2, 2008

Multicore Benchmarks Help Match Programming to Processor Architecture

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What's Up?

- What is EEMBC
- Multicore benchmarking framework
- Multicore sample results

Our Focus

- Industry standard benchmarks since 1997
- New: Evaluating current and future development of MP platforms
  - Uncovering MP bottlenecks
  - Analysis of multicore systems

MultiBench – Overview

- Multicore is everywhere
  - Hence our focus on benchmarking embedded multicore solutions.
- Initial implementation targets SMP
  - Easiest model to work with
  - Current metrics misleading (rate, DMIPS, etc)
- Workloads and work items
  - Develop workloads closer to real life

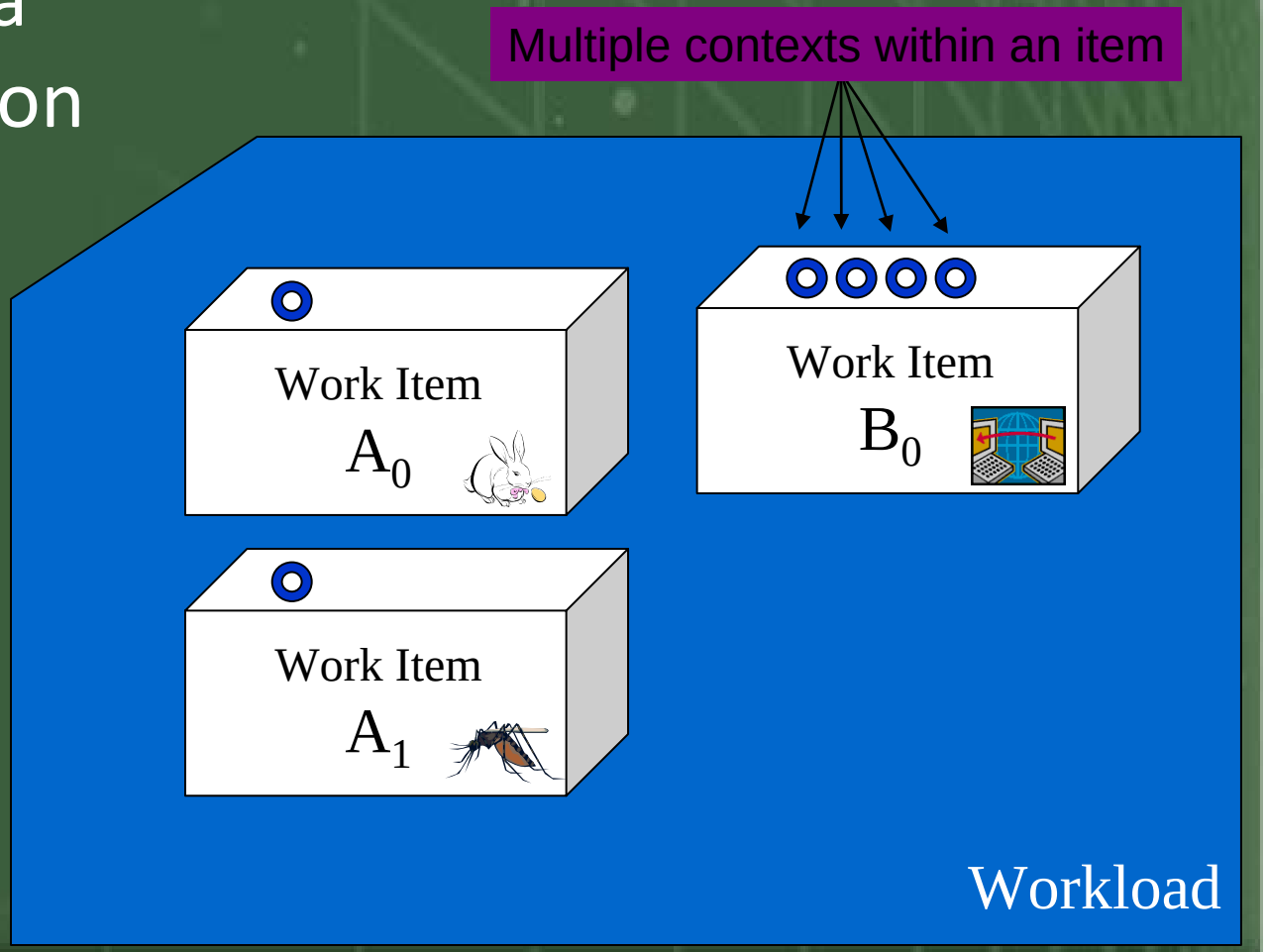
  Individual kernels are work items within a workload

MultiBench – Abstraction

- Easy to run
  - Only 13 calls to implement means quick porting to any platform/OS/toolchain
- Wide range of applications
  - Sufficient functionality with minimum porting effort for most embedded applications.
- Most EEMBC benchmarks ported
  - Thread safety
  - New datasets
  - Common API

Workloads and Work Items

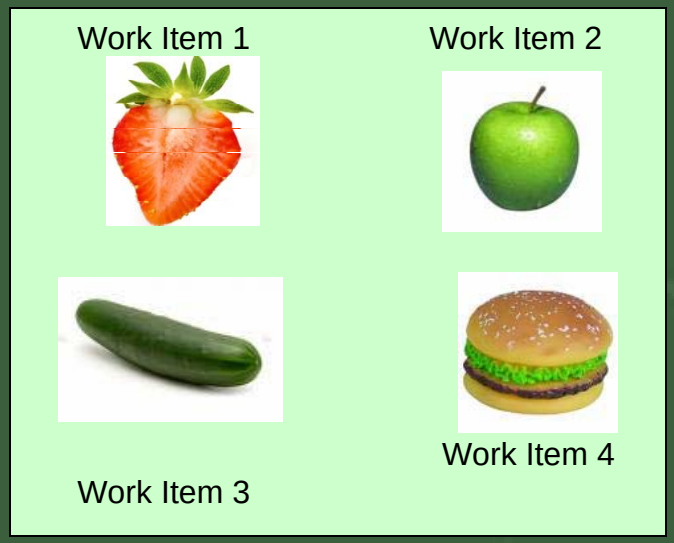
- Multiple algorithms
- Multiple data
- Decomposition



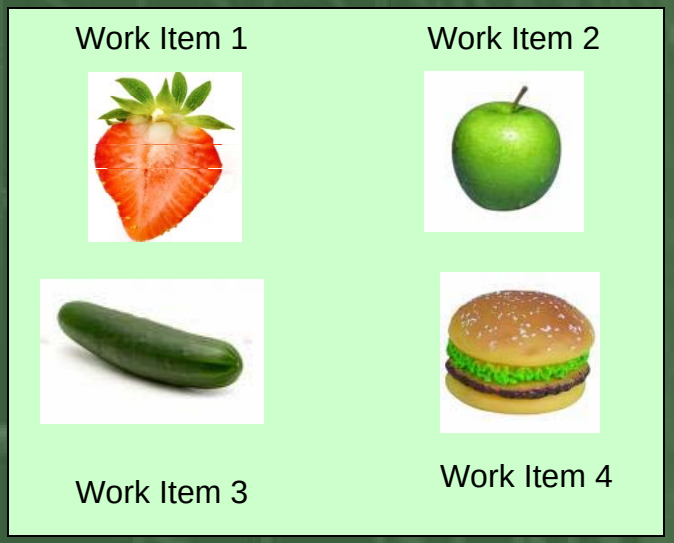
Concurrency

Multiple Work Items
Note: Algorithm same, different datasets

Workload



Workload



Can be run one item at a time ……

Or concurrently, depending on processing resources and scheduling

Multiple Iterations

Example with two contexts doing four repeats

Core 1

Core 2

Idle Time

Start next iteration here

NOTE:
Alternatively, the OS may schedule Core 1 and Core 2 to run only hamburgers and cucumbers, respectively. Other combinations are possible.

Time Sequence

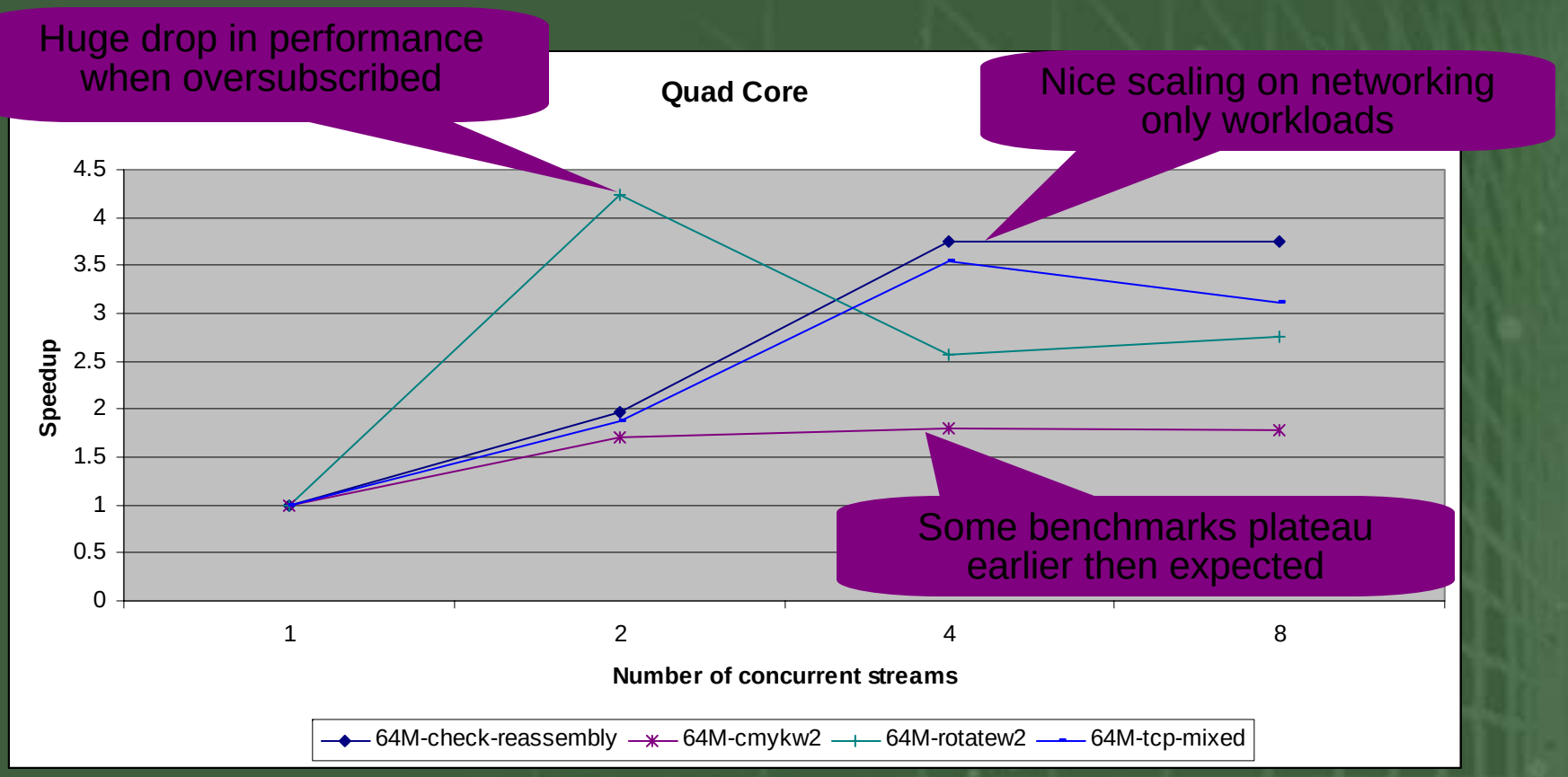
Work Items and Workers

A collection of threads working on the same item are referred to as workers

Workload set #1

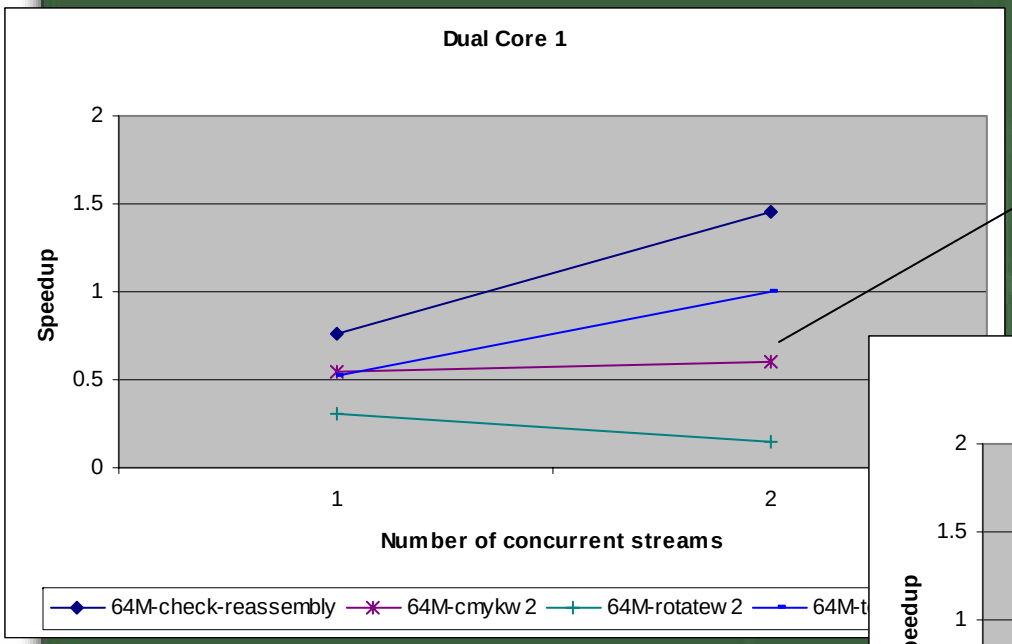
- Carefully selected subset
  - Only 30 workloads over a few kernels
- Benchmark efficiency of various multi-processing system related effects
  - Computation / Synchronization
  - Memory / Cache
- Work items from multiple segments
  - Networking
  - Consumer

Workloads scale in mysterious ways…



Compare Two Systems

Various workloads expose different trends in systems



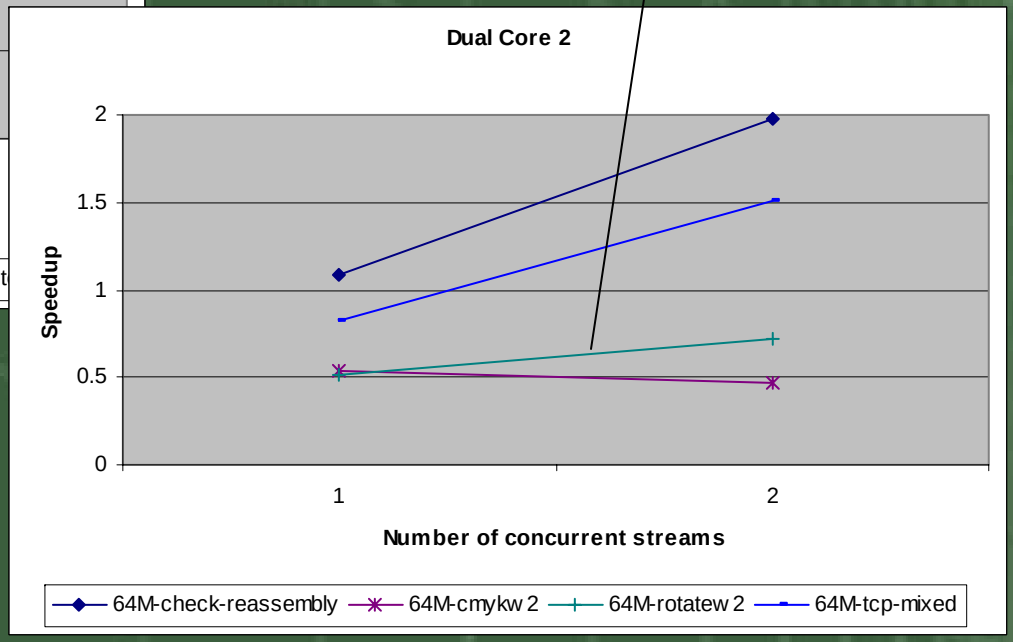
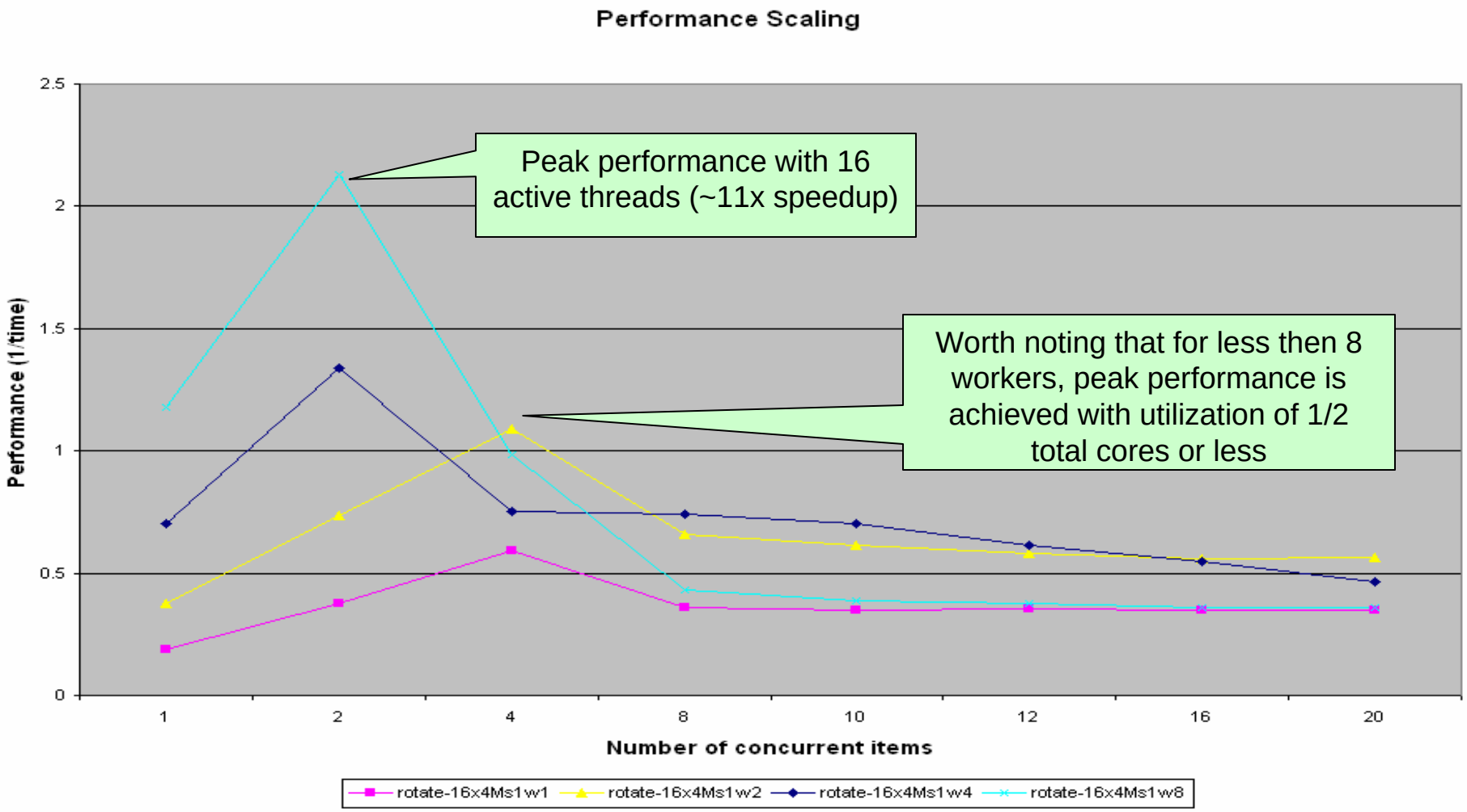


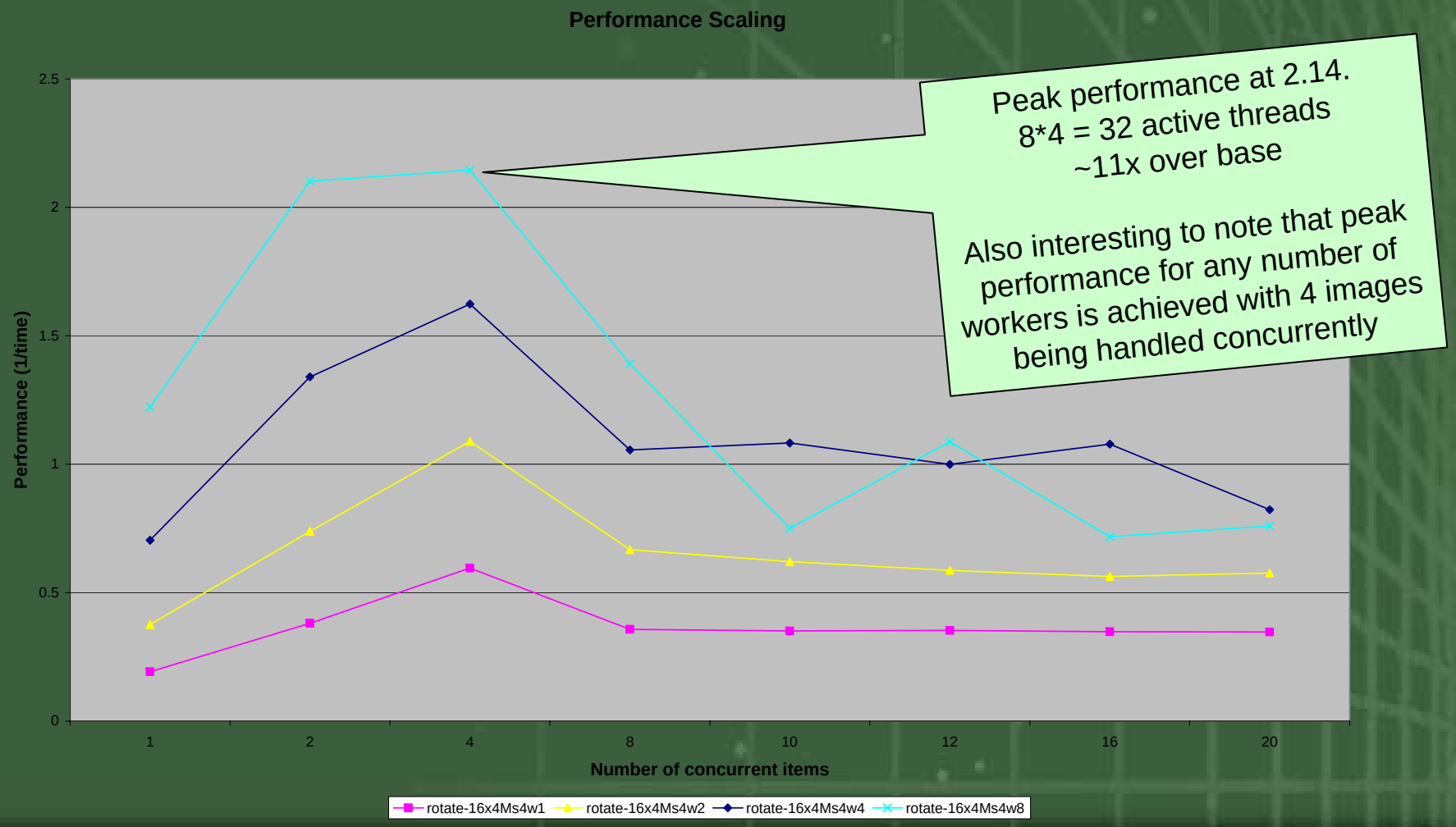
Image Rotation, 90° CW

- Simple algorithm, very little computation
- Easy to slice to workers, since each pixel is independent.
- Depending on slicing and image size, can exercise the system in interesting ways.
- Many other applications use similar data movement patterns.

Rotation Benchmark (Slice = 1)



Rotation Benchmark (Slice = 4)

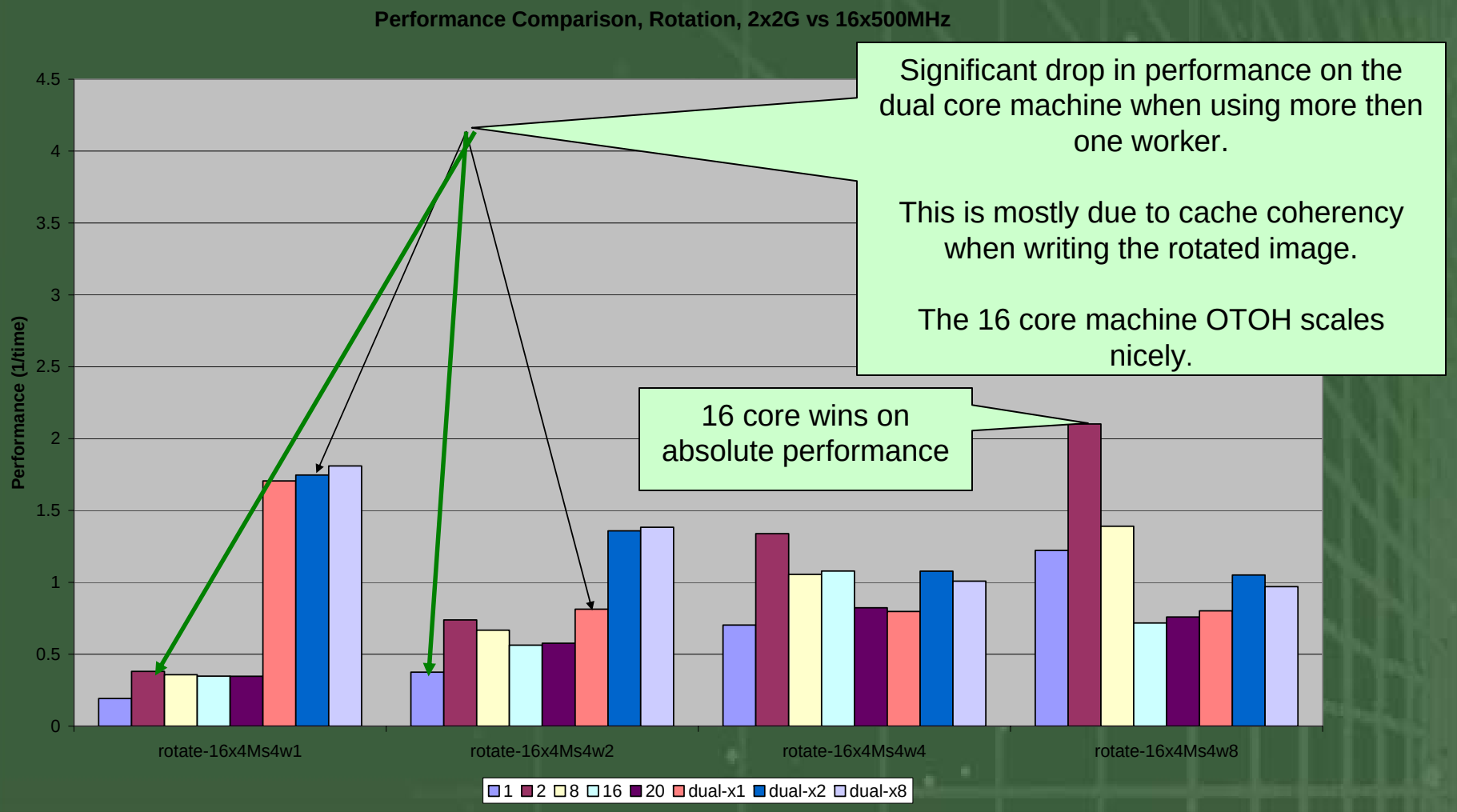


Rotation Benchmark (Slice = 32)

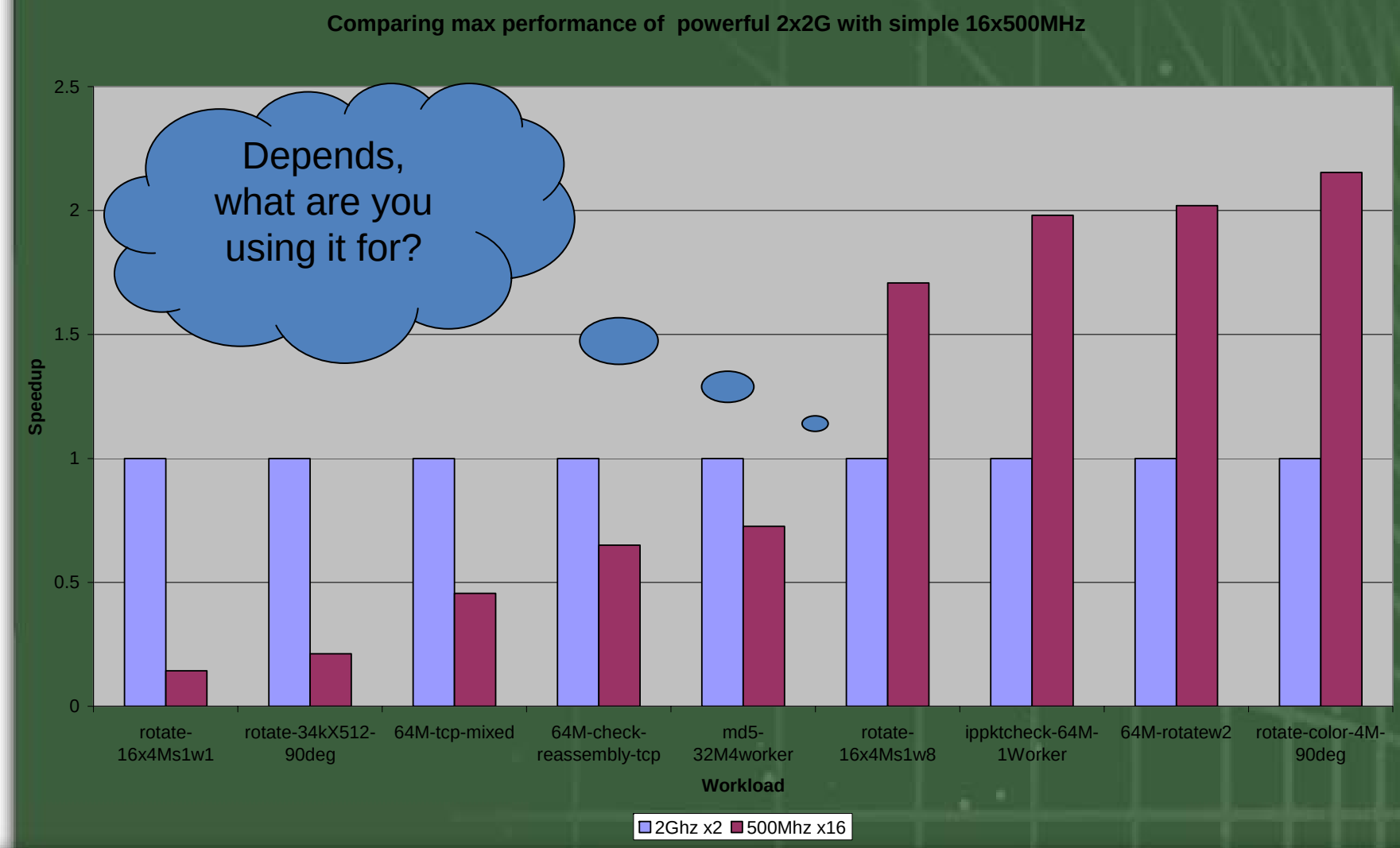
Use results to design software!

- Results show low overhead for sync
  - Take advantage of data decomposition.
  - Use medium to small granularity.
- Results show throughput max with small number of concurrent data streams
  - Pay more attention to the lower level concurrency.
- Results show bottlenecks
  - Make sure system resources are not oversubscribed by testing with lower load.

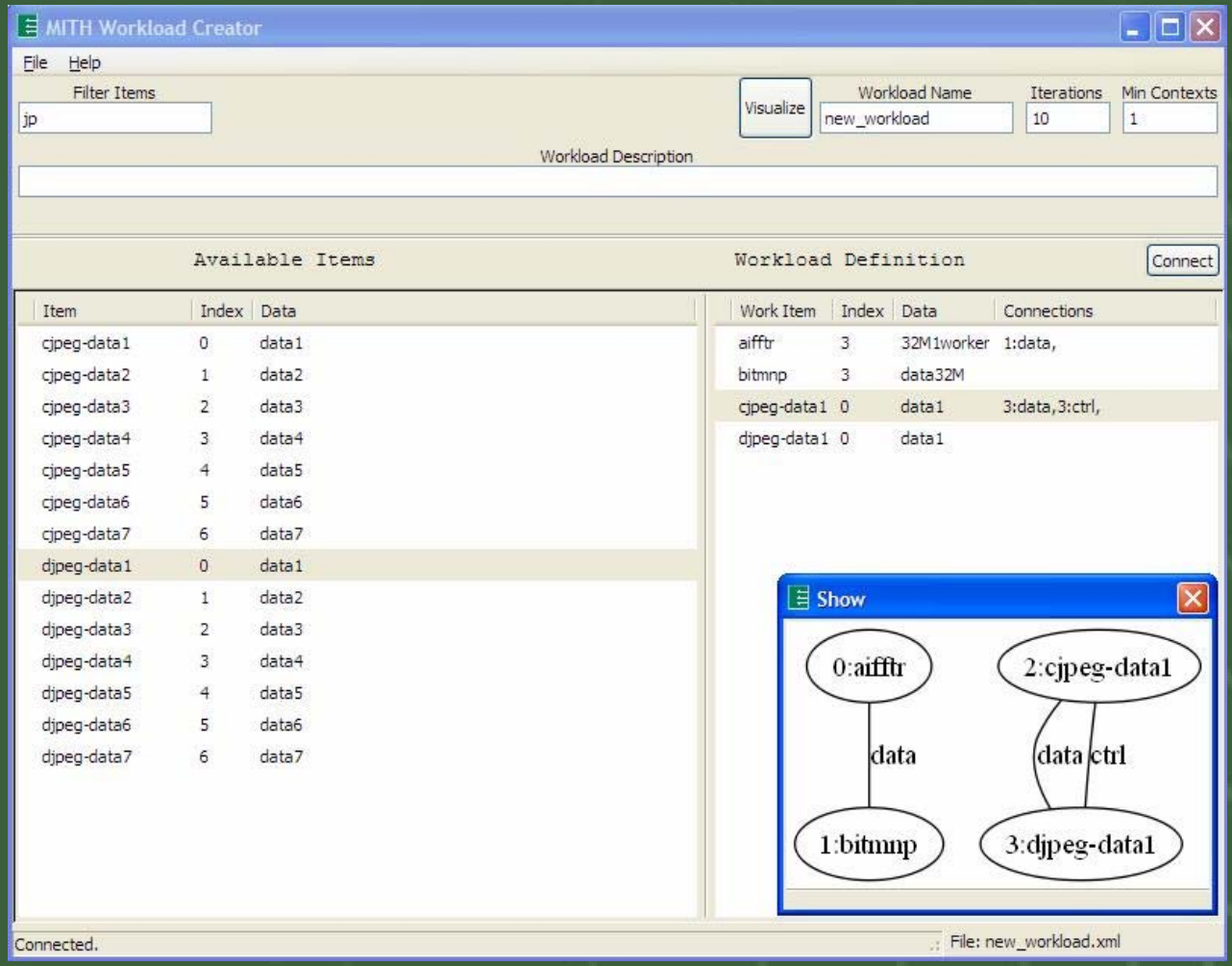
Rotation Benchmark Comparison
Dual 2GHz vs. 16 core at 500MHz



So which system is better?



Composing Workloads

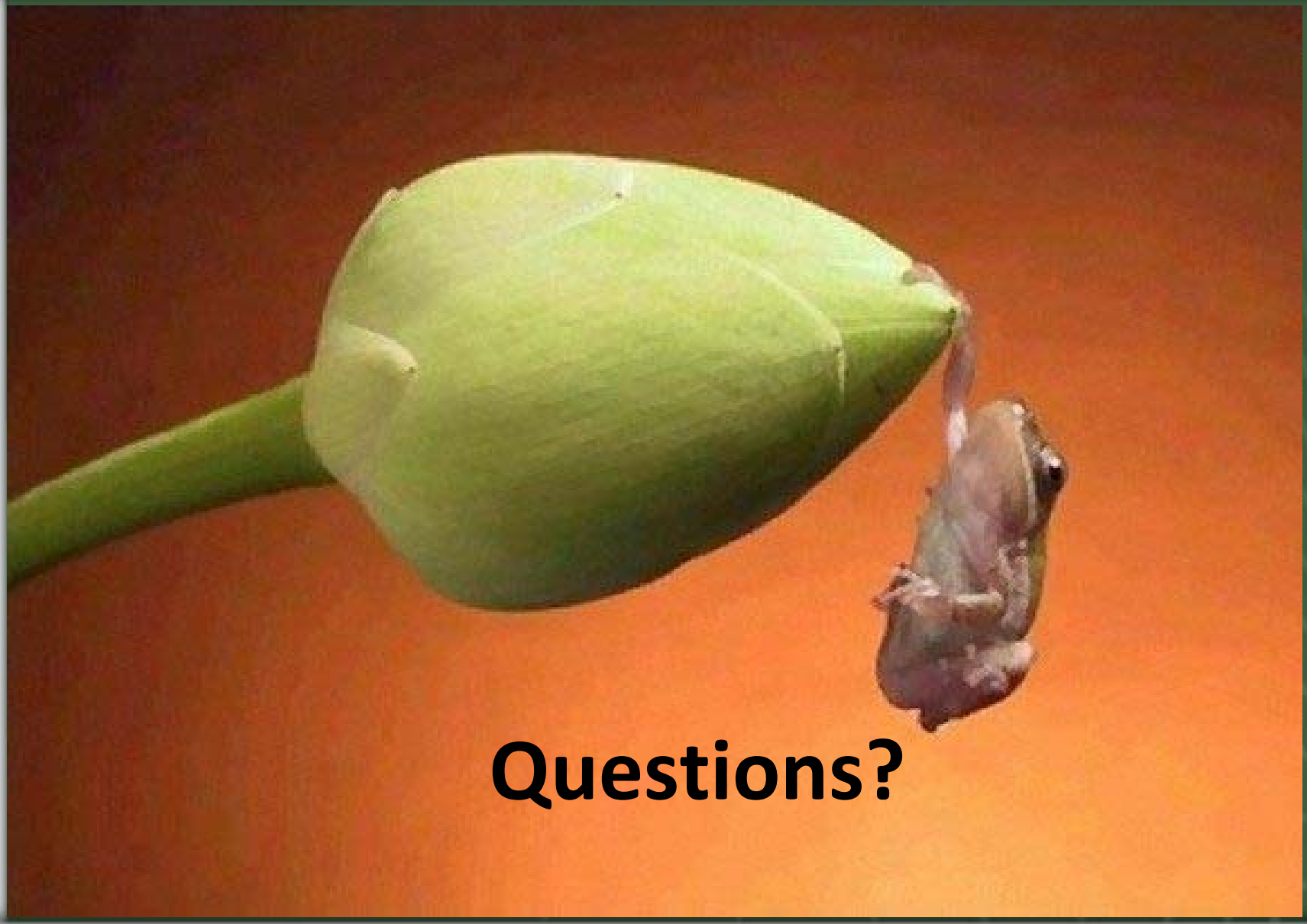


EEMBC Benchmarking Services

- Analysis of complex systems
  - Take advantage of in-house expertise
  - Quickly pick the right processor
- Targeted benchmarking
  - Creation of relevant benchmarks
  - Creation of automated benchmark systems
- Quick benchmark results
  - Utilize expertise with multiple embedded environments
  - Utilize experience with EEMBC suites and other benchmarks
- Guidance for optimizing your applications

Summary

- EEMBC has a new suite for burning multicore issue.
- Use EEMBC benchmarks to guide software development as well as analyze platforms.
- EEMBC launched new service to assist with benchmarking and analysis.


Questions?