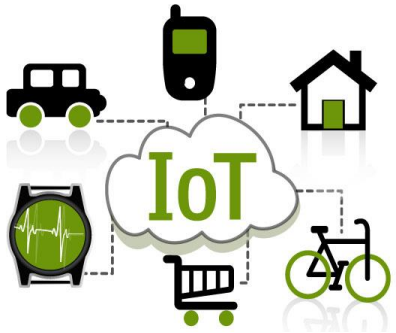

INTERNET OF THINGS
DEVELOPERS CONFERENCE

www.iot-devcon.com

The Necessity and Challenges of IoT Gateway Performance Analysis

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Senior Systems Engineer
Dell | Performance Engineering

IoT Gateway Performance Questions

- What is it?
- Why is it important?
- What can we do today?
- What are the challenges?
- How do we solve the challenges?

Which Performs Better…

Lamborghini

Pickup Truck

… Towing a Big Boat?

Performance Depends on Work

- What's the **workload** to be measured?
  - A strictly defined **set of operations**
  - The workload must match the **usage model**
  - Critical because work can vary greatly

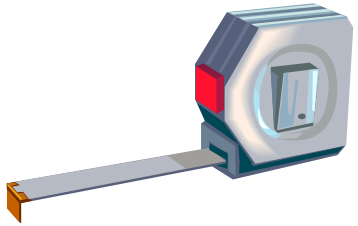
- What's the **metric** to be compared?
  - A quantifiable result indicating performance

What is a Benchmark?

Benchmarks provide a point of reference to compare measurements across common workloads.

Performance is measured by benchmarking

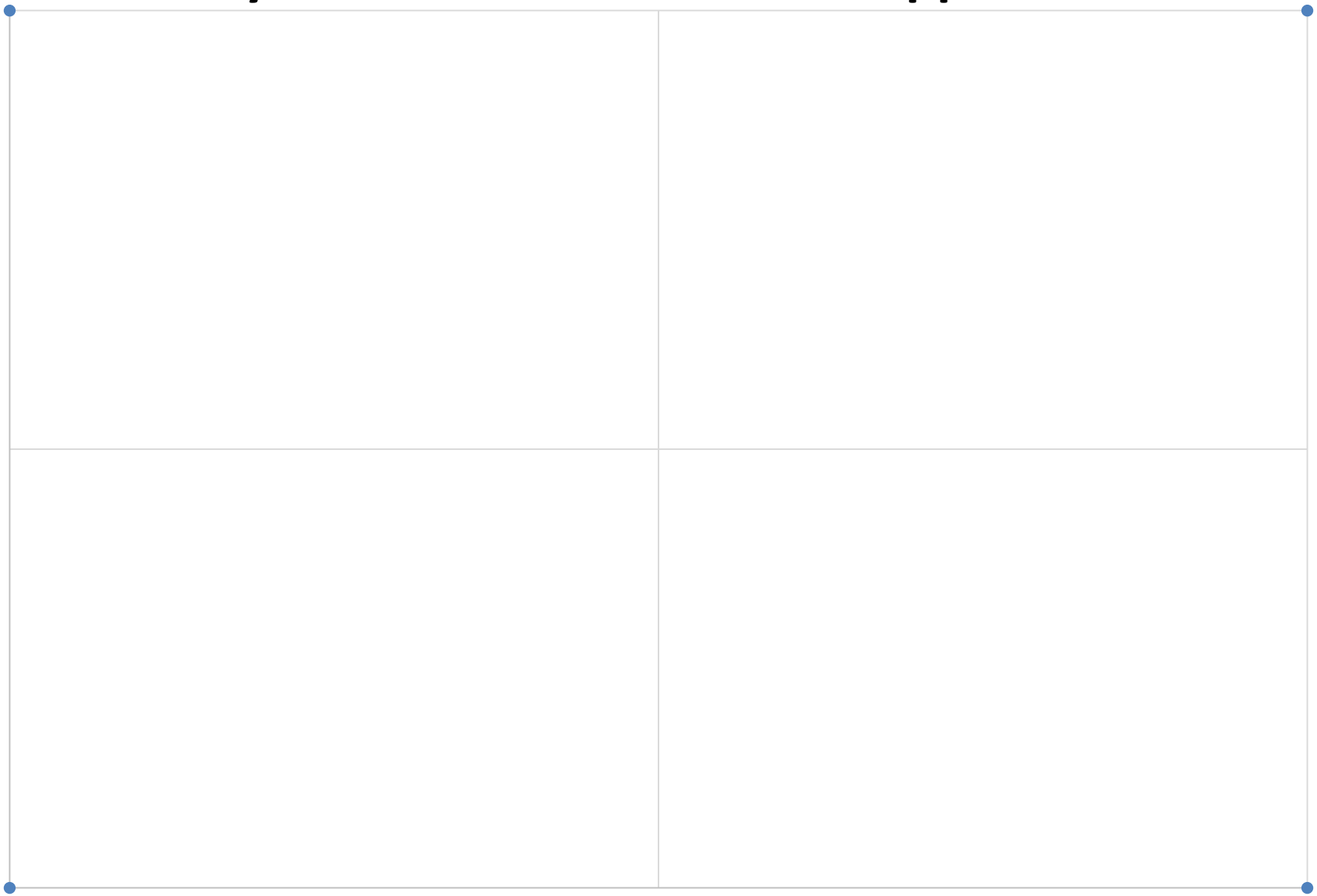
- Speed
  - How **fast** can I perform a certain amount of **work**?
- Throughput
  - How **much work** can I do within a given **time limit**?
- Responsiveness
  - What is the **latency** for an operation?



Measure

Compare

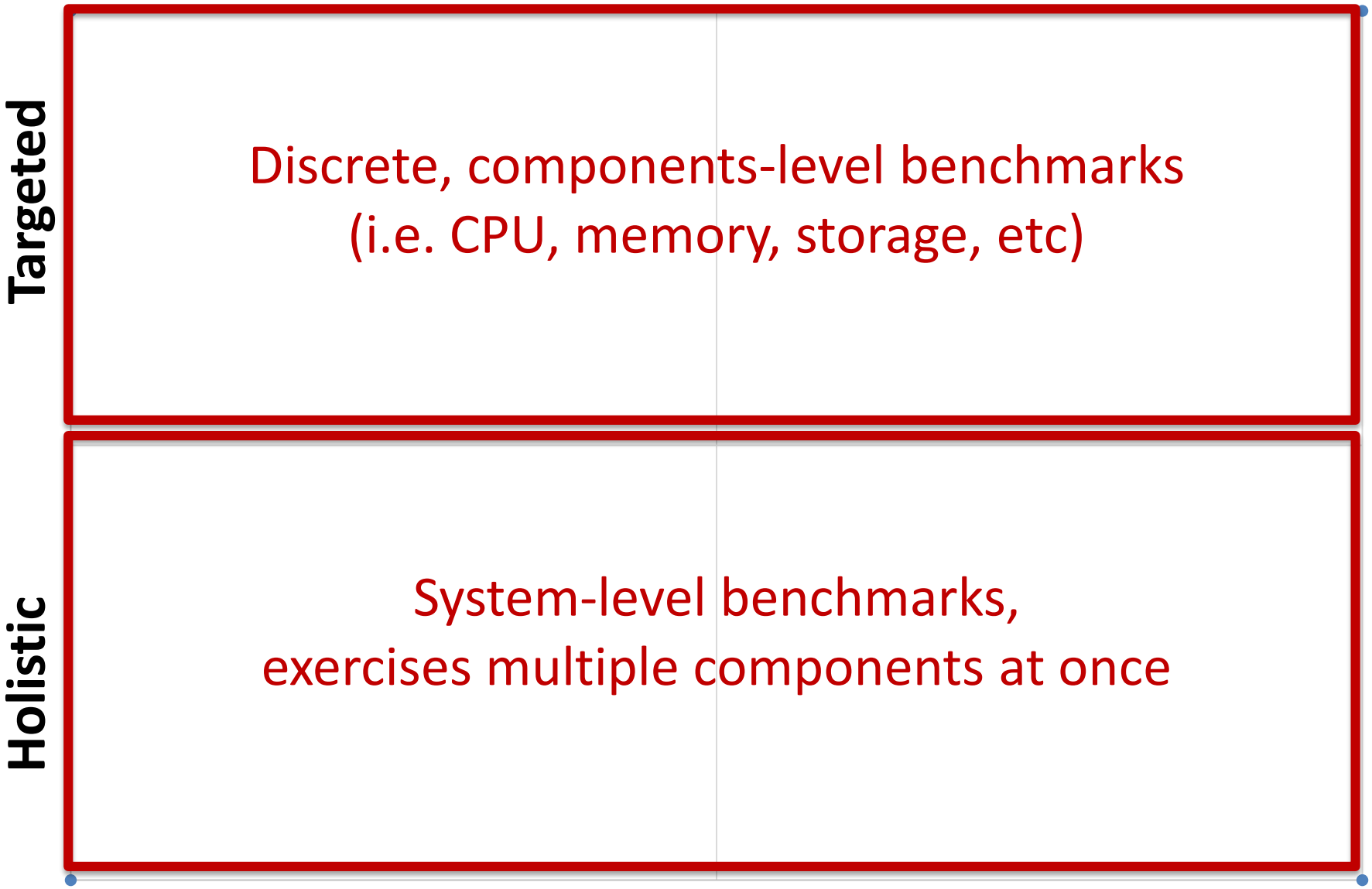
PC Benchmarks



PC Benchmarks

Synthetic	Application
Designed to mimic a particular type of workload	Runs real-world programs

PC Benchmarks



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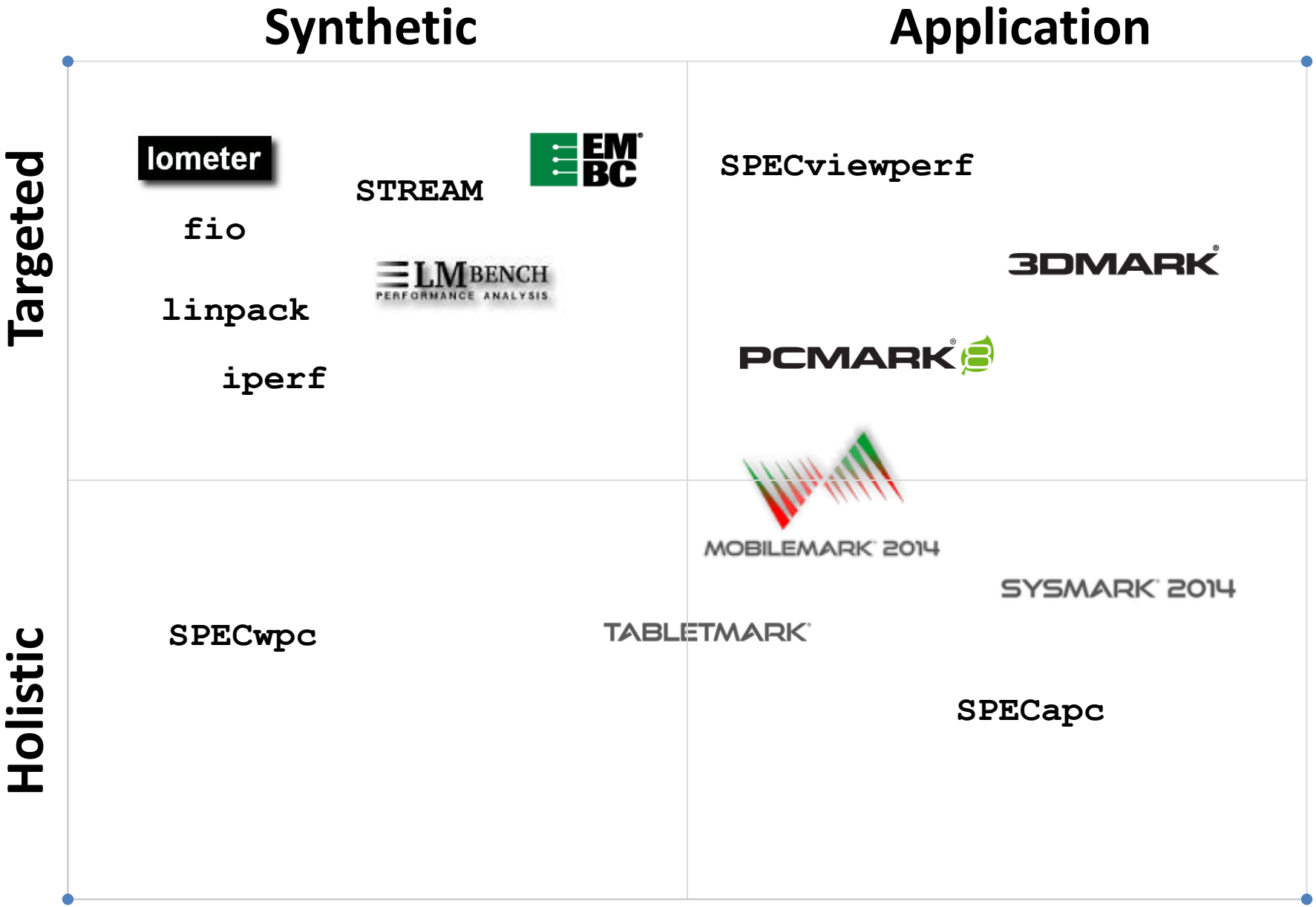

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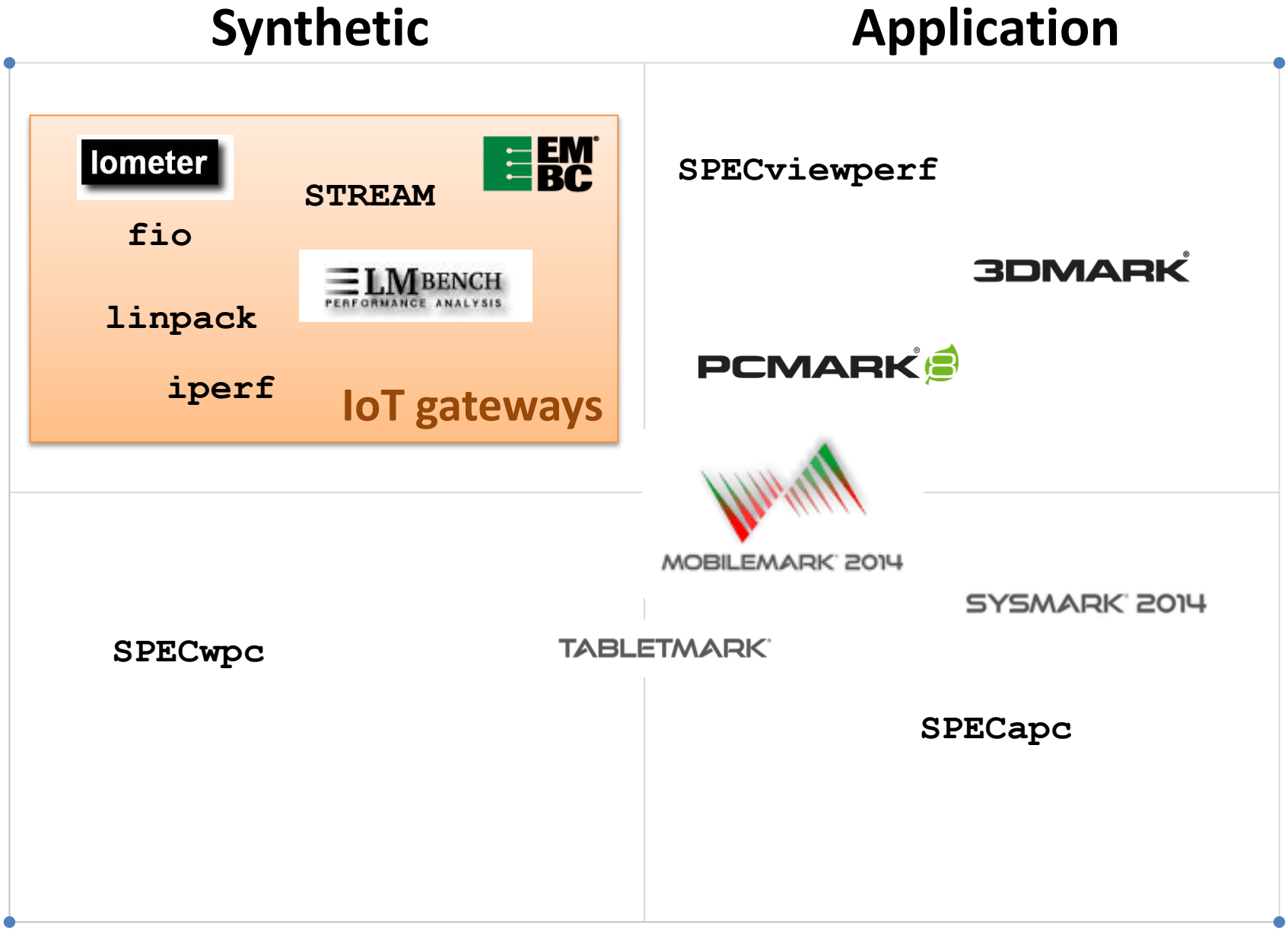

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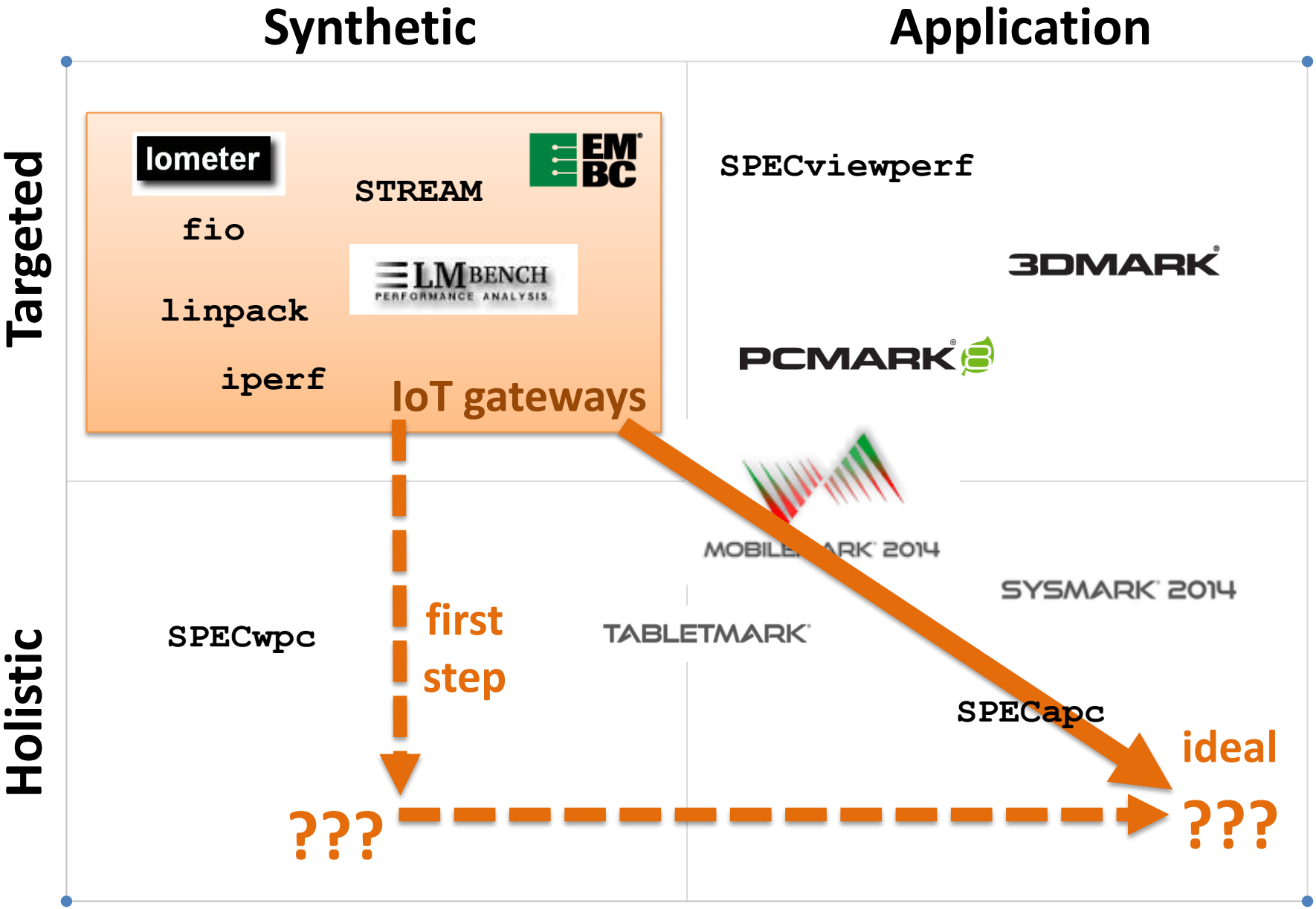


IoT Gateway Performance Today

How many sensors can be connected?

What are the bottlenecks?

What kind of processing is the gateway doing?

How many communication protocols need to be supported?

What physical interfaces are needed?

What kinds and how much traffic is there?

Will this gateway perform better than another?

Can this gateway meet the needs of my application?

http://www.commbits.com/other-business-services/on-site-support-toronto/

We Need an IoT Gateway Benchmark

- **Lack of standards** to determine how well gateways might perform in verticals
  - Marketing and R&D want to build the best product to serve their targeted customer
- Lack of metrics for **apples-to-apples** gateway comparisons
  - Purchasing managers and solution developers want the best gateway for their application needs

GOAL

To provide standardized metrics for evaluating IoT gateway performance in **various verticals**

IoT Gateway Verticals

Automation

Media

Transportation

… Smart Factories, Healthcare, Energy, Education, Finance, and many more…

[1] http://www.infineon.com/iot-security-ebrochure/en/industrial_automation.html
[2] http://www.crosswindtechnology.com/digital_signage.html
[3] https://www.pubnub.com/blog/2014-01-29-connected-cars-build-transportation-management-and-dispatch-apps/

Example Use Cases

Feature	Automation	Media	Transportation
Lots of devices	yes		
Lots of protocols	yes		
Wi-Fi	yes	likely	likely
GPS			yes
CANbus			yes
Cellular			yes
Low Power	likely		yes
Graphics Processing		yes	
CPU Intensive	likely	yes	
Drives displays		yes	likely

IoT Gateway Benchmark Concept

- A variety of workloads
  - Target IoT verticals
- No single overall score
  - Rather a score for each vertical
- Client-server approach
  - Remote/distributed operation
  - Workloads generated across multiple physical ports
- Scalable framework
  - Common interface with plugins

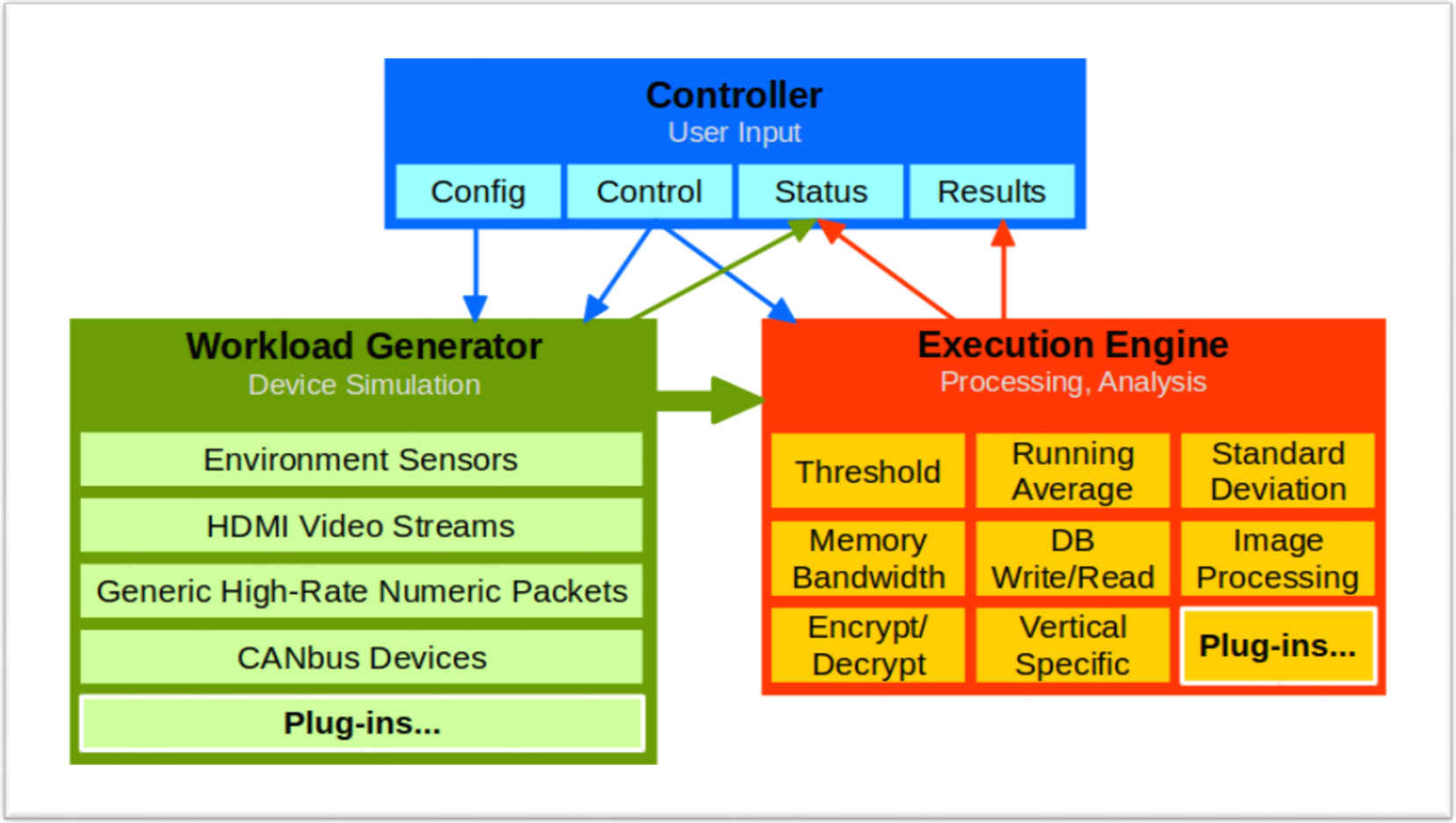
Development Phases

Phase 1 – Local	Phase 2 – Distributed

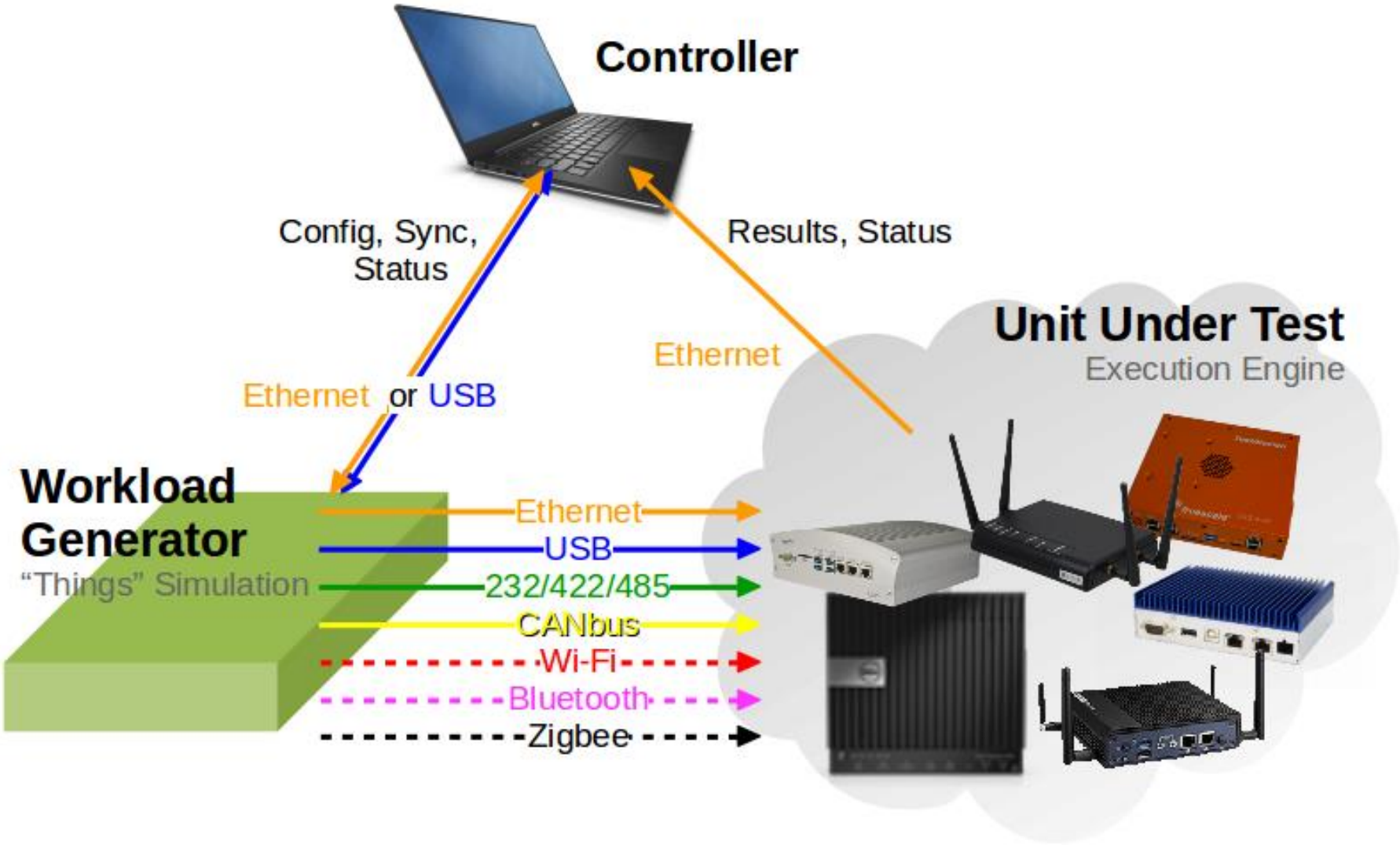
• Software only
  – No physical I/O
• Based on *typical* workloads
• Benchmark controller, workload generator, and execution engine *all run locally* on gateway
	• Physical hardware is needed
	  – Exercises physical I/O
	• Hardware runs *real-world* workloads of profiled devices
	• Controller runs on host PC
	• Workload generator runs on *special benchmarking device*
	• Execution engine runs on gateway

Phase 1 – Local

Gateway (Unit Under Test)



Phase 2 – Distributed



Challenges

- Defining valid workloads
- IoT is new
- IoT is fragmented
- Lack of industry standards
- Community involvement & adoption

Image source: http://blog.imgtec.com/emerging-tech/flowcloud-iot-and-cloud-technology-emerges-in-a-world-of-challenges

Solving These Challenges

- Focus on *key verticals* first
- Involvement from key industry players
- Design scalable benchmark framework
- Well-documented requirements, next steps, owners, timelines

Image source: http://blog.imgtec.com/emerging-tech/flowcloud-iot-and-cloud-technology-emerges-in-a-world-of-challenges

How Can You Help?

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