Testing the Big Bang of Smart Devices

Imagine today's typical test manager, awash in an alphabet soup of wireless protocols and sensors upon sensors.

Thanks to the proliferation of smart devices in the Internet of Things (IoT), it's a circumstance not unlike the overwhelming sense of wonder and bewilderment that ancient Greek astronomer Ptolemy must have felt when gazing up at a sky full of stars on a clear winter's night, trying to rationalize the vast tableau before him.

But just as we wouldn't critique early astronomers and philosophers for thinking stars revolved around Earth, we shouldn't fault test managers for seeing the IoT from a device-under-test (DUT)-centric view. From this vantage point, the IoT can easily seem like an insurmountable 50-billion-device challenge for any test organization. But when we apply what we now know about astronomy, we begin to see the expected universe of smart devices as systems of systems based on a few core elements that orbit a core architecture. By developing a test strategy with this architecture-centric perspective, your organization will be prepared to meet the challenges and opportunities of the IoT and will be well positioned to capitalize on the expected $19 trillion business opportunities it represents.

Survival of the Smartest

The three core elements at the nucleus of most smart devices are battery power, wireless connectivity, and sensors. Be it a smart thermostat, fitness tracker, or smartphone, the "smart" devices of tomorrow will always have sensors for interacting with the world around them, a rechargeable battery for untethered operation, and various modes of wireless connectivity to send and receive information from the Internet and other devices around them.

Instead of designing a unique test system for each unique DUT, test leaders must design a smart test system that can adapt to and test all smart devices. Mino Taoyama, vice president of manufacturing, operations, and quality at Intel Corporation, and his team are tackling this problem head on. "With wearables, choice is a necessity because not everyone has the same taste in style," he said. "However, when testing wearables, choice results in a high degree of product mix. At Intel, a single manufacturing line might produce thousands of different models of a fashion product in a year. The high mix requires that test systems be flexible enough to test a wide range of products and transition between them quickly. Our test systems are designed to handle a superset of the test needs of any one product—from supporting multiple wireless standards to mixed-signal testing."

Testing a sensor requires the ability to reproduce physical stimuli often with other types of sensors or transducers. Testing a battery requires the ability to source, sink, and measure power. Testing wireless communication requires the ability to both generate and analyze RF signals. Add up this laundry list of functionality and it's not hard to imagine a fully stacked, incredibly expensive rack of instrumentation. But thanks to Moore's law, test instrumentation can now benefit from the same embedded technology that's flooding the market with smart devices of all shapes and sizes.

It stands to reason, however, that testing an accelerometer is not the same as testing a force sensor, or that testing a Bluetooth transceiver is not the same as testing a cellular antenna. Given this, how can test systems truly adapt? Again, the secret comes from looking at a smart device. A tablet and a fitness tracker both have an accelerometer within, but the accelerometer plays a very different role for each device. In a tablet, it's used to sense how the user is holding the device and then orient the screen accordingly. But in the fitness tracker, the accelerometer is used to count the steps that the user takes throughout the day. The secret ingredient that spans across each? Software.

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> —**Mino Taoyama**, Vice President of Manufacturing, Operations, and Quality, Intel Corporation

A Sense of Scale

Just as a smartphone's functionality can be extended by apps and firmware updates, the functionality of a smart, software-defined test system can be extended and modified by software to keep pace with rapidly evolving device functionality. With a forward-looking investment in a hardware platform that can be easily upgraded to test the latest protocols, it's easy to see how a test system can economically evolve at the speed of software and reverse the trend of rising test costs.

Astronomy has evolved since Ptolemy took his first look at the sky and proposed the geocentric model. Nicolaus Copernicus made a bold move by proposing that Earth and other planets revolved around a larger and much brighter mass: the sun in a heliocentric model. By recognizing the core elements of the universe of smart devices, we can gain the proper perspective necessary to scale system development and move beyond a collection of tools to a scalable strategy that brings unity to our understanding of the test industry.

ONE TEST STRATEGY PER DUT VERSUS ONE TEST ARCHITECTURE FOR ALL DUTS