

## Research Spotlight

### 2017 Kick Off Message

Qualcomm Research is excited to start the new year by demonstrating a wide variety of technologies at this month's Mobile World Congress (MWC) 2017 in Spain. This event follows our success at CES last month where we showcased our significant advancements in 5G, Robotics, Automotive, Deep Learning, Computer Vision, and much more. For MWC, we look forward to sharing how we are continually pushing the innovation envelope, putting the spotlight on our revolutionary work in 5G, MulteFire, Wi-Fi, Industrial IoT, and Cellular V2X (C-V2X).

### Qualcomm Research at MWC:

This year, we are thrilled to show our numerous trailblazing projects at MWC 2017 in Barcelona. Come visit us at booth #3E10, Hall 3 at the Fira Gran Via!

### Catch our biggest breakthroughs in 5G.

We continue to pioneer advances in [5G research](#) and look forward to showcasing two cutting-edge demonstrations at MWC. The first will focus on our new 5G sub-6 GHz prototype system, where we'll incorporate a number of key 5G NR techniques, including massive MIMO, self-contained integrated subframe, advanced LDPC coding, and scalable OFDM air interface design. These techniques will enable us to significantly improve data rates and coverage while reducing latency for supporting resource-intensive applications, such as UHD video streaming and virtual reality, in typical urban and suburban environments.

Our second demonstration will prove that mmWave with fast beam tracking can support seamless vehicular and indoor pedestrian mobility of handheld and in-vehicle UEs operating in a real-world environment. During the demonstration, an in-vehicle UE will travel up to 30 mph and **successfully maintain robust connectivity** using dynamic point (base station) selection in a typical suburban environment while encountering and overcoming various types of obstacles, such as foliage and other vehicles. Don't miss it!

[Learn more about our 5G research](#)

### **Check out our latest Wi-Fi innovations.**

Be sure to attend our Wi-Fi Advanced Receiver over-the-air prototype demonstration. During this exciting event, we'll show a dense residential scenario where a user device will upload data to an Access Point (AP) in the same apartment, while it faces interference from multiple hidden neighboring devices, leading to a significant drop in user throughput. To counter this, we'll then activate our Wi-Fi Advanced Receiver at the AP to suppress the interference. Watch as the receiver delivers an incredible 2x - 3x throughput improvement, restoring a significant bulk of the original throughput before the interference was introduced.

[Learn more about our Advanced Receivers](#)

### **See how we're revolutionizing private LTE networks for Industrial IoT.**

Qualcomm Research is advancing the state-of-the-art in private LTE networks for Industrial IoT applications. Be sure to catch this demo set within our manufacturing building on Qualcomm's campus. Industrial environments have challenging connectivity requirements that can be addressed effectively by LTE technology. Our demo focuses on some of the benefits of private LTE for industrial IoT such as high bandwidth and guaranteed QoS for real-time robot control, certificate-based authentication for ease of deployment, reliable coverage and mobility for seamless operation, and scalability allowing the deployment of diverse end-points and integration with industrial internet platform.

[Learn more about our private LTE networks for Industrial IoT](#)

### **Watch as MulteFire makes 4G LTE history.**

Operating solely in the unlicensed band, MulteFire™ combines LTE-grade performance with Wi-Fi type deployment simplicity. During this leading-edge demonstration, our engineers will prove that MulteFire can coexist fairly with Wi-Fi, while providing improved user experience in terms of throughput, coverage, and seamless mobility. This live over-the-air (OTA) demo will kick off from within Qualcomm Research HQ, with four pairs of Wi-Fi access points and devices sharing the same channel in 5 GHz unlicensed spectrum in a mixed deployment. For example, some nodes will detect each other above the Energy Detect (ED) threshold (-62dBm) while others will detect below ED. Next, watch the overall network throughput increase and the OTA packet collisions decrease as we subsequently convert two Wi-Fi pairs into MulteFire. Finally, we'll convert the remaining two pairs to MulteFire, resulting in significant gains in overall network throughput compared to the Wi-Fi baseline.

MulteFire will then perform its first live, outdoor OTA demo, where we'll run a head-to-head comparison between Wi-Fi and MulteFire's coverage. Watch as a base station positioned at our HQ transmits both Wi-Fi and MulteFire to our nearby roving

vehicle equipped with Wi-Fi and MulteFire devices. As the vehicle moves away from the base station/AP, you'll see MulteFire's range go much further beyond where the Wi-Fi call drops, showing a significant gain in coverage. In our second outdoor OTA demo, we'll show seamless handovers in a multi-node MulteFire deployment while sharing the channel with other Wi-Fi nodes.

[Learn more about MulteFire research](#)

### **Get an inside look at how we're transforming driving with C-V2X.**

Qualcomm Research is excited to showcase our C-V2X technology, an "active sensor" that supports today's drivers as well as autonomous driving of tomorrow, providing extended range and increased reliability over DSRC/802.11p. During MWC, we'll discuss three scenarios, each discussing practical use cases that illustrate the C-V2X advantage. In the first scenario, we'll prove C-V2X's merit in a Non-Line-of-Sight (NLOS) environment as it provides early lane-detection warning about a disabled vehicle blocking the road and "hidden" within a blind curve of the road. In our second scenario, watch as C-V2X performs long-range detection, allowing the vehicle with forward visibility blocked by a truck to perform an overtake maneuver safely at high speeds. In the final scenario, C-V2X will enable road hazard avoidance with infrastructure assistance by detecting road hazards and reporting them to the network for dissemination to other drivers in the area.

[Learn more about C-V2X research](#)

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## Technology Highlights

### **Racing drones raise eyebrows**

At CES last month, we showcased our Snapdragon Flight 820 powered by the Snapdragon 820 processor, integrated in a trio of drones which autonomously raced through our arduous obstacle course, flying highly accurate trajectories to dodge obstacles. Perched above them was our hovering camera drone, equipped with two fish eye cameras that streamed real-time 360-degree video of the racing in 4K. Our camera drone also stitched images from both cameras together and streamed the footage in real-time over Wi-Fi which enthralled audiences as well as users equipped with VR Head-mounted Displays (HMD) who received an up close and personal view of the race.

[Learn more about this capability](#)

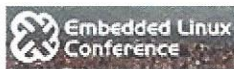
## [Drive Data Platform \(DDP\) hits the road at CES.](#)

Last month, Qualcomm Research successfully demonstrated machine learning and highly accurate autonomous vehicular positioning, two critical capabilities which enable autonomous driving and serve as the bedrock of our DDP system.

[Learn more about DDP and our demo](#)

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## Upcoming Events



### [Embedded Linux Conference](#)

February 21-23, 2017

Portland, OR



### [Mobile World Congress](#)

February 27 - March 2, 2017

Barcelona, Spain



### [San Diego Festival of Science & Engineering](#)

March 4, 2017

San Diego, CA



### [IEEE Wireless Communications & Networking Conference](#)

March 19-22, 2017

San Francisco, CA



### [National Society of Black Engineers Annual Convention](#)

March 27, 2017

Kansas City, MO



### [ISC West / International Security Conference & Exposition](#)

April 5-7, 2017

Las Vegas, NV