SOLUTION BRIEF

Programmable Solutions
5G

Meet IoT and 5G Challenges with Flexible, Open Small Cells

An end-to-end picocell solution from Comba Telecom using Intel® technologies can be used to create a flexible 5G infrastructure, which provides excellent coverage, capacity and performance

Executive Summary

As a growing number of 5G use cases emerge, the telecommunications industry needs to increase network coverage, capacity and performance. One way to accomplish these goals is with small cell deployments, often called picocells. These enable affordable network densification and can provide reliable signal performance in urban environments and inside buildings such as factories or warehouses.

Comba Telecom has developed an end-to-end picocell solution called 5G iCell that includes everything needed: the base band unit (BBU), the radio hub (rHUB) and remote radio units (RRUs). Based on Intel® technologies such as high-performance and reliable Intel® processors, Intel® FPGAs and Intel® eASIC™ devices with a cloud-native open radio access network (ORAN) architecture, the solution is reconfigurable to serve different network slice and service configurations.

Service providers can take advantage of this affordable, low-power solution to pursue new customers and revenue streams.

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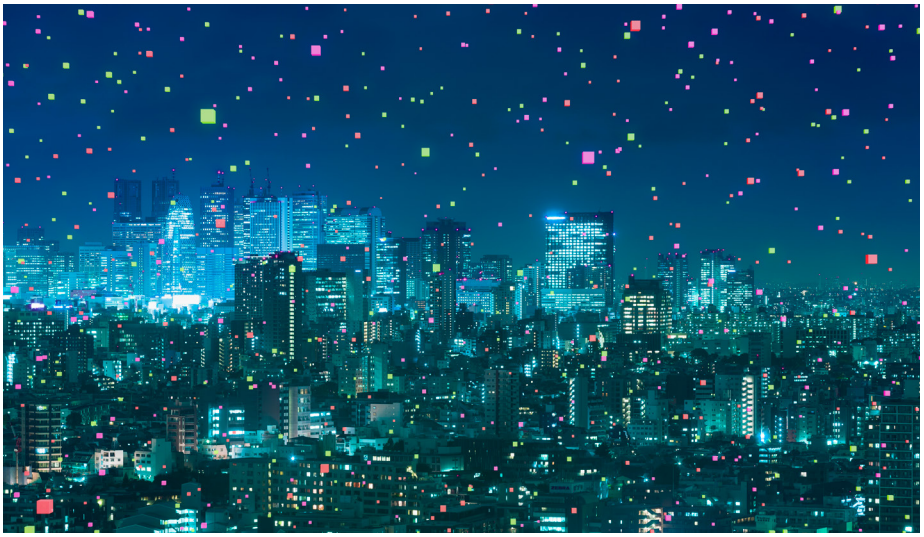


Figure 1. 5G picocells enable network densification, providing the enhanced coverage and low latency required by modern applications.

Solution Benefits

- **Open.** Uses the open radio access network (ORAN) topology to enable interoperable interfaces and RAN virtualization.
- **Flexible.** Intel® FPGA acceleration cards can be reconfigured to serve different network slice and service configurations.
- **End-to-end.** The 5G solution includes everything needed for small cell deployment—baseband unit (BBU), radio hubs (rHUBs) and remote radio units (RRUs).

Business Challenge: Achieving High Capacity & Low Latency in a Dense Network

Workloads such as the Internet of Things (IoT), social media, cloud gaming, video and live streaming are increasing every day. Existing wireless networks struggle to keep up even today—and will be incapable of sustainably providing the high capacity and low latency demanded by emerging 5G use cases, such as enhanced mobile broadband, ultra-reliable and low-latency communications and massive machine-type communications. A 5G-capable network must be:

- **High-performance** to handle the expected 10x increase in throughput[1]
- **High-capacity** to support network densification
- **Flexible** enough to meet the needs of heterogeneous networks (HetNets)
- **Low-power** to simplify power dissipation and lower operational costs
- **Reliable** to meet stringent requirements such as in industrial automation
- **Scalable** to accommodate the ORAN topology
- **Cloud-native** to support containerized slice services

Especially in the urban indoor/outdoor environment, 5G small cell deployments called picocells can contribute to network densification and increase network capacity.

A Picocell Here, a Picocell There...

The tall cell tower is what most people think of when they think of the wireless network. But picocells are essentially wireless radio transmitters and receivers, taking up about as much space as an ice chest or the miniature refrigerator found in many hotel rooms. Because of their small size, picocells can be installed just about anywhere. Some examples include sports facilities, shopping malls, airports, parking lots, streetlights, power poles, university campuses, office buildings, hotels and healthcare facilities. With such broad coverage, network capacity, latency and reliability are all improved—and new use cases are suddenly possible:

- An ambulance racing toward a hospital could take advantage of the picocells it passes to radio the patient's vital signs and ready the staff.
- Robots in a smart factory can communicate with each other without worrying about interference from the standard WiFi network.
- A car in a parking garage several stories underground can connect with an app to help find an empty parking spot.

5G picocells are designed to provide coverage over an area of about 10,000 to 50,000 square feet, enabling the use of higher-frequency radio waves that cannot travel as far as lower-frequency radio waves. Additional useable frequencies mean more capacity and the ability to increase network density.

Meet the Small Cell Forum

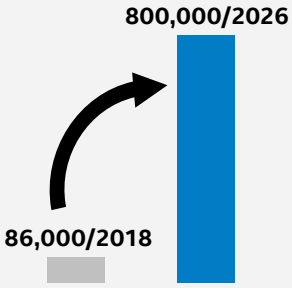
Intel is a member of the Small Cell Forum (SCF), supporting its mission of making mobile infrastructure an accessible resource for industry, enterprise and communities. The SCF members are committed to driving network densification worldwide by accelerating small cell deployments, removing technology and market barriers, working closely with regulators and municipalities, collaborating with enterprises and promoting new use cases. The SCF believes that affordable, flexible and low-power small cell deployments are critical to supporting the growing Internet of Things (IoT) and other 5G use cases.

Solution Value: One-Stop Solution

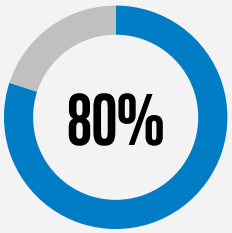
The 5G iCell solution from Comba is just what the industry needs to meet the challenges of IoT and 5G. Because it is a one-stop solution, a small cell can be quickly and affordably deployed. Faster time to market, in turn, leads to higher market share. The 5G solution provides the following specific benefits:

- **High-performance** Intel processors and FPGAs accelerate network performance.
- **Flexible, scalable,** and **cloud-native** ORAN architecture can be reconfigured quickly to meet the needs of different use cases.
- **Reliable** hardware and software can meet stringent service-level agreements and provide an excellent customer experience.
- **Affordable, low-power** solution enables new revenue streams.

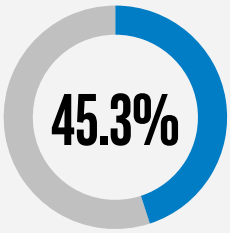
Small Cells by the Numbers



- The trade group Cellular Telecommunications Industry Association (CTIA) expects the number of small cells in the United States to grow from about 86,000 in 2018 to over 800,000 by 2026.[2]



- The U.S. Federal Communications Commission (FCC) predicts that up to 80 percent of new cell site deployments will be small cells.[3]



- In 2018, the value of the small cell 5G network market was USD 344 million. Experts project that this value will increase to USD 6,876 million by 2026 (a compound annual growth rate of 45.3 percent).[4]

Solution Architecture: Open, Flexible, End-to-End Picocell Infrastructure

As shown in Figure 2, the end-to-end 5G solution consists of three primary components:

- The **BBU** device (sometimes referred to as a 5G access unit, or AU) processes baseband 5G PHY and L2/3 layer protocols, operation and maintenance (O&M) functions and core network connections. The BBU is based on an Intel processor and an Intel FPGA acceleration card which can accelerate L1 and L2 functions.
- The **rHUB** expansion units (sometimes referred to as switches, or SWs) are used for cell merging in some exchanges, and for optional based band processing and interface conversions. This device includes an Intel FPGA which can be easily migrated to an Intel rHUB eASIC device for further optimization after volume deployment. Intel eASIC devices are structured ASICs, an intermediary technology between FPGAs and standard-cell ASICs that provide lower unit-cost and lower power compared to FPGAs and faster time-to-market and lower non-recurring engineering cost compared to standard-cell ASICs.[5]
- The **RRUs** (sometimes referred to as 5G Distributed Points, or DPs) are used for radio frequency (RF) reception, digital down- and digital up-conversion, filtering, Common Public Radio Interface (CPRI) interfacing and other functions.

This solution is flexible and easy to program, and it can serve different network slice and service configurations.

5G Picocell Architecture

Baseband Unit (BBU)	Radio Hub (rHUB)	Remote Radio Unit (RRU)
• Supports 8 radio hubs (rHUBs) to connect to 64 remote radio units (RRUs) • Supports 4 cells, each cell can support 400 active users and 1,200 Radio Resource Control (RRC) users • Downlink peak throughput: 850 Mbps/2T2R, 1,700 Mbps/4T4R • Uplink peak throughput: 190 Mbps • Supports cell combination and split • Supports both standalone (SA) and non-standalone (NSA) and CU-DU separation and combination	• Supports 2 levels of concatenation • Supports 8 RRU connections • Supports uplink IQ data merge and downlink traffic distribution • Supports Power over Ethernet (PoE) to supply power to the RRU's photoelectric composite cable	• Supports N41 Frequency Band (it is not recommended to limit N41) • Supports 100 MHz and bandwidths defined by other protocols • 2T2R / 4T4R • Transmission power: 250 mW and 500 mW channels

Figure 2. The end-to-end 5G picocell solution from Comba helps to enable fast time to market, optimized power usage and cost, and excellent flexibility.

A Closer Look at Comba

Comba Telecom Holdings was established in 1997 and is a leading supplier of infrastructure and wireless enhancement solutions to mobile operators and enterprises. Comba's corporate headquarters are located in Hong Kong and the firm has more than 40 offices throughout the Asia Pacific, North and South America, Europe and the Middle East.

Comba' s product portfolio includes wireless enhancement, antennas and subsystems, wireless transmission, wireless broadband and wireless access equipment. This broad range of products combined with its extensive array of services enables Comba to supply its global customer base with end-to-end wireless solutions. Comba won the Small-Cell Innovation of the Year Award at the 10th Telecom Asia Readers' Choice & Innovation Awards 2017 co-organized by Telecom Asia and Questex Media.[6]

Learn More

You may also find the following resources useful:

- Comba solution home page
- Intel® FPGA products
- Intel® eASIC™ devices
- Intel® Xeon® D processors
- 2nd generation Intel® Xeon® Scalable processors

Find the solution that is right for your organization. Contact your Intel representative or visit **https://www.intel.com/content/www/us/en/products/programmable.html**.

Conclusion

Through its collaboration with the telecommunications ecosystem, Intel is enabling a new software-defined and cloud-ready solution that can accelerate and simplify small cell deployment. The 5G iCell solution from Comba is designed for urban environments and in-building dense networks. The solution uses Intel processors and Intel FPGAs to power flexible, high-performance small cell deployments that can support a wide variety of use cases. Using this solution, service providers can pursue exciting new opportunities in the burgeoning IoT and 5G market.

[1] https://www.forbes.com/sites/danielnewman/2018/03/27/4-reasons-5g-is-critical-for-mass-adoption-of-ar-and-vr/#76cf9d321878

[2] https://www.lightreading.com/mobile/small-cells/inside-the-5g-small-cell-opportunity-big-and-messy/d/d-id/751403

[3] See endnote 2.

[4] https://www.alliedmarketresearch.com/small-cell-5g-network-market

[5] https://www.intel.com/content/www/us/en/products/programmable/asic/easic-devices.html

[6] https://www.comba-telecom.com/images/solution/Small_cell_solution_brochure_final.pdf

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