Innobase & S2C

Innobase Improves Verification Efficiency with FPGA Prototyping

Innobase started its business in 2021 to develop SoCs for mobile communications with a focus on technologies for IoT applications. Adapted to 4G/5G networks where low cost, low latency, and massive connectivity are key industry imperatives, Innobase specifically targets the Consumer, Industrial, and Municipal markets, including,

Consumer – wearable devices, bicycle sharing, and smart home
Industrial – UAVs (Unmanned Aerial Vehicles), logistics tracking, and industrial control
Municipal – monitoring systems, intelligent traffic, and the Smart City

Innobase SoCs for IoT terminal devices include Baseband Processors, Application Processors, and RF Chips and Components. Today's 5G Baseband Processors are SoCs constructed with highly complex functional blocks on a single chip that include CPUs, DSPs, Channel Encoders, MODEMs, and Interface Modules. Verification of its Baseband Processor SoCs presented a major design challenge for Innobase, and they made a strategic decision to include FPGA prototyping as part of their SoC design verification methodology. FPGA prototyping allowed Innobase to quickly build an FPGA verification model of their 5G Baseband Processor design during silicon development and run simulated network traffic on the design prior to the availability of silicon.

The 5G Future Is Now

“5G”, the 5th-generation broadband cellular network standard, evolved under the guidance of the 3rd Generation Partnership Project (3GPP). Starting with the first-generation network (1G) in the 1980s for analog voice, then 2G in the 1990s that introduced digital voice, and 3G in the 2000s to support mobile data, and 4G LTE for mobile broadband, and now 5G that will support the next level of global connectivity for the Internet of Things (IoT) buildout. The 5G standard is the planned successor to the 4G standard used for connectivity to most cellphones today, so cellular service companies began deploying 5G networks worldwide in 2019. Cellular network service areas are divided into small geographic areas called cells, and all 5G wireless devices in a cell are connected to the Internet and telephone network using signals through local antennae in the cell. As everything digital moves to the Cloud, the challenge will be to enable cost-effective, and functionally-effective connectivity for any device, for any purpose, anytime. Since 5G technology is expected to deliver multi-Gbps peak data speeds, ultra-low latencies, greater reliability, and better spectrum efficiency – it is also expected to significantly improve the cellular user experience and enable feasible connectivity for a flood of new IoT applications.

FPGA Prototyping – A Required Component of 5G Verification Flows

During the development of complex SoCs, popular verification wisdom is to apply as much *real-world stimulus* to the SoC design as possible during design verification to confirm that a design will operate as expected in the end-product – prior to committing the design to silicon. In the case of 5G chipsets, the real-world stimulus includes testing complex communication protocols, data encoding techniques, modulation methods, and running hardware-dependent software on the design prototype – all with the added verification complexity of a variety of different 5G chipset operating modes. This is a monumental verification challenge and can only be accomplished by running the SoC design at hardware speeds connected to real system hardware.

"We selected S2C's Prodigy Logic Systems based on S2C's 20 years of prototyping experience and their position today as a global leader of FPGA prototyping solutions for innovative SoC designs," said Junbo Han, Senior R&D Director at Innobase. Han added: "Partnering with S2C enables us with the quality prototyping hardware and software we need for

successful verification of our 5G chips. The partnership has laid a solid foundation for pre-silicon system-level verification of our complete 5G chip platform – and enabled us to shorten our overall development times."

Innobase implemented a comprehensive SoC verification flow for its 5G chip platform, including S2C's FPGA prototyping hardware, a powerful segmentation engine to improve performance and efficiency, S2C's prototyping software and deep-trace debug tools, and S2C's Prototype-Ready IP – for pre-silicon verification of its 5G physical-layer designs. While other tools were part of Innobase's verification flow for surgical verification of short periods of chip operation, only prototyping could enable Innobase to achieve sufficient operational testing of their 5G SoCs prior to silicon.

Innobase's FPGA prototype platform was connected directly to bench-top instrumentation during SoC development to apply 5G communications traffic to the FPGA prototype at hardware speeds and confirm the correct operation of the communication system uplink, and board-level system operation of the 5G physical-layer functionality. With the addition of FPGA prototyping, Innobase was able to "shift-left" their chip development process to include early hardware/software co-development.

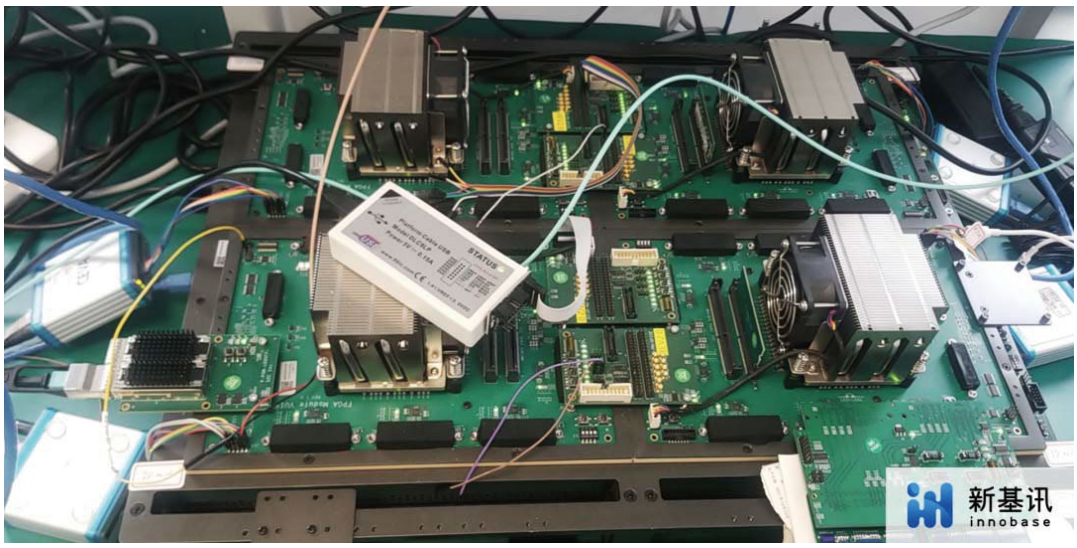

Figure 1: Innobase 5G SoC Verification Platform

Innobase's Prototyping Platform

Innobase chose S2C's Prodigy S7-19PQ Logic System for prototyping its 5G chips. The S7-19PQ Logic System includes four (4) large Xilinx FPGAs (Virtex UltraScale+ VU19P) in a single integrated chassis with board-level connectors designed for reliable FPGA-to-FP

GA interconnect, and to plug-and-play with the real-world through cables and daughter cards (S2C's "Prototype-Ready IP" or customer-designed daughter cards).

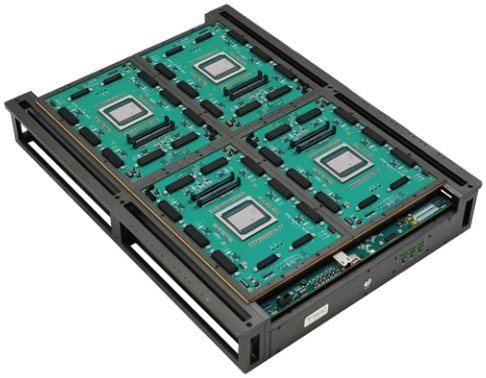

Figure 2: S2C S7-19PQ Logic System

Each Prodigy S7-19PQ Logic System includes the following features:

- Up to an estimated 196M equivalent ASIC gates
- 5,288 high-performance I/Os for verification environment connectivity
- 176 high-speed transceivers at 16Gbps
- 8 on-board DDR4 SODIMMs totaling 128GB at up to 2,400Mbps
- S2C's PlayerPro Software with feature-rich runtime controls

S2C offers a broad selection of prototyping hardware platforms based on popular Xilinx and Intel prototyping FPGAs for different prototyping requirements, and prototyping accessories designed and built to operate seamlessly with S2C's prototyping hardware platforms for complete prototyping solutions.

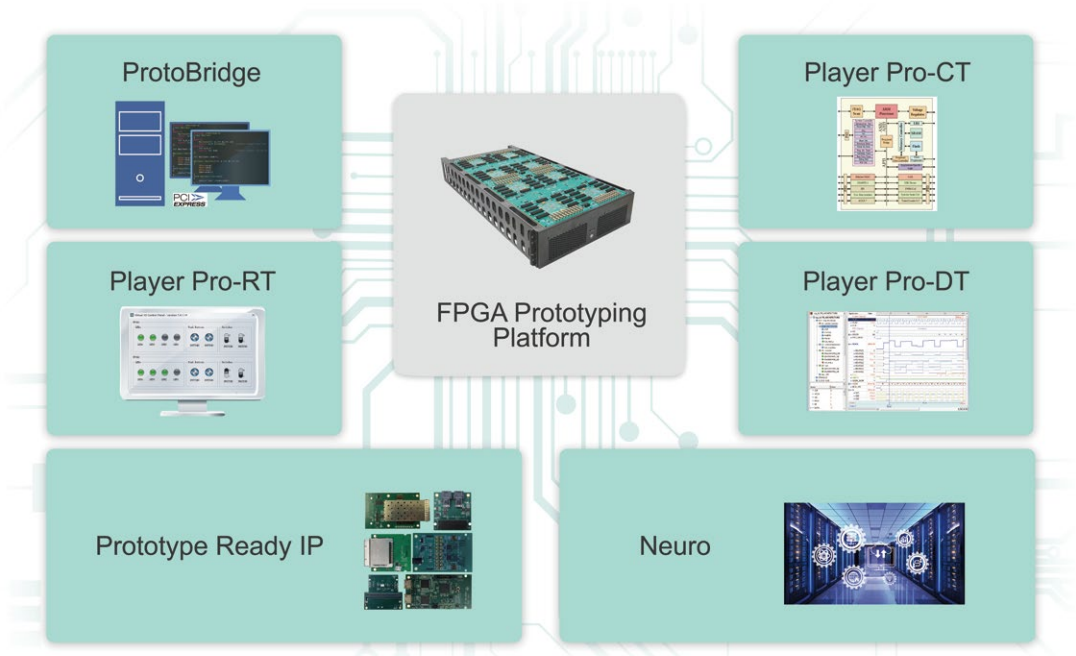

Figure 3: S2C Complete Prototyping Solutions

Prodigy ProtoBridge – provides a high-speed (4 GBps) data channel between the host computer and the prototyping hardware platform for streaming test data to the design modeled with the FPGA prototype.

Prodigy Multi-Debug Module Pro – provides simultaneous viewing of waveforms from multiple FPGAs in a single debug window, with rich trace-data trigger/capture features and 8 GB of external hardware trace-data memory.

Prodigy Player Pro Software – provides system monitor, self-test, remote system management, guided and automatic FPGA partitioning with pin-multiplexing insertion, and debug set-up and control.

Prodigy Prototype-Ready IP – provides off-the-shelf daughter cards for high-speed GT peripherals (PCIe, mini-SAS, SMA, etc.), general peripherals (USB, PHY, JTAG, etc.), memory modules, ARM processor adapters, embedded and multi-media (HDMI and MIPI), expansion and accessories (HPC, LPC, level-shifters, etc.), and interconnect cables and modules.

About Innobase

Innobase is a professional wireless communication chip manufacturer with 5G/4G technology as its core. Innobase focuses on mobile communication technology for IoT and baseband SoC chip products. Our team consists of seasoned chip designers and communication engineers, many of whom worked at leading smartphone chip suppliers. Key team members have 20+ years of experience in modem technology. The Innobase team includes over 100 R&D staff members at four locations in China: Shanghai, Nanjing, Chengdu, and Zhuhai.

About S2C

S2C is a leading global supplier of FPGA prototyping solutions for today’s innovative SoC and ASIC designs, now with the second largest share of the global prototyping market. S2C has been successfully delivering rapid SoC prototyping solutions since 2003. With over 500 customers, including 6 of the world's top 15 semiconductor companies, our world-class engineering team and customer-centric sales team are experts at addressing our custom

er’s SoC and ASIC verification needs. S2C has offices and sales representatives in the US, Europe, mainland China, Hong Kong, Korea, Japan, and Taiwan. For more information about S2C’s FPGA-based prototyping solutions, and how to contact us, please visit our website at s2cinc.com.