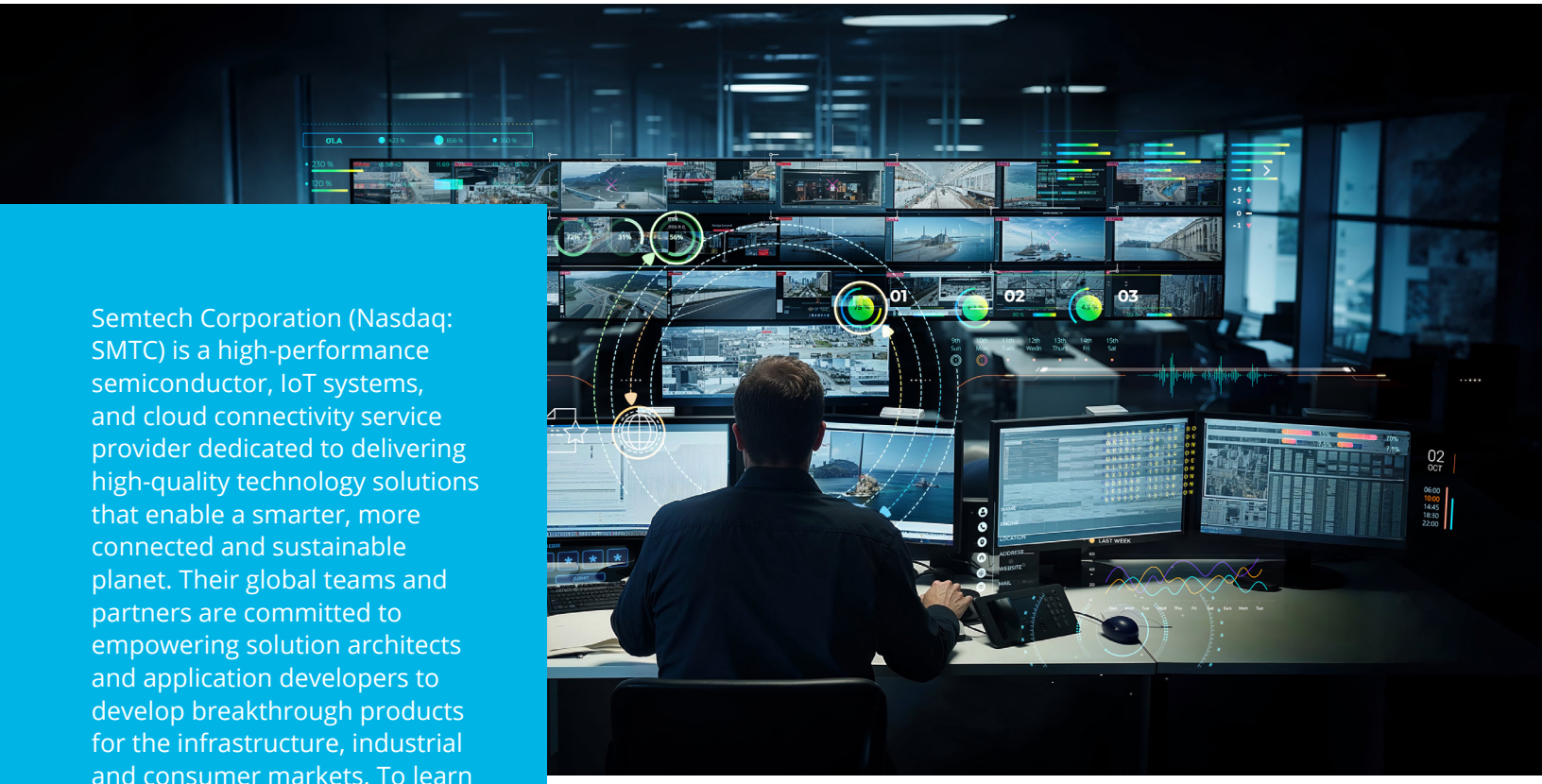
Case Study



Semtech Corporation (Nasdaq: SMTC) is a high-performance semiconductor, IoT systems, and cloud connectivity service provider dedicated to delivering high-quality technology solutions that enable a smarter, more connected and sustainable planet. Their global teams and partners are committed to empowering solution architects and application developers to develop breakthrough products for the infrastructure, industrial and consumer markets. To learn more visit Semtech.com.

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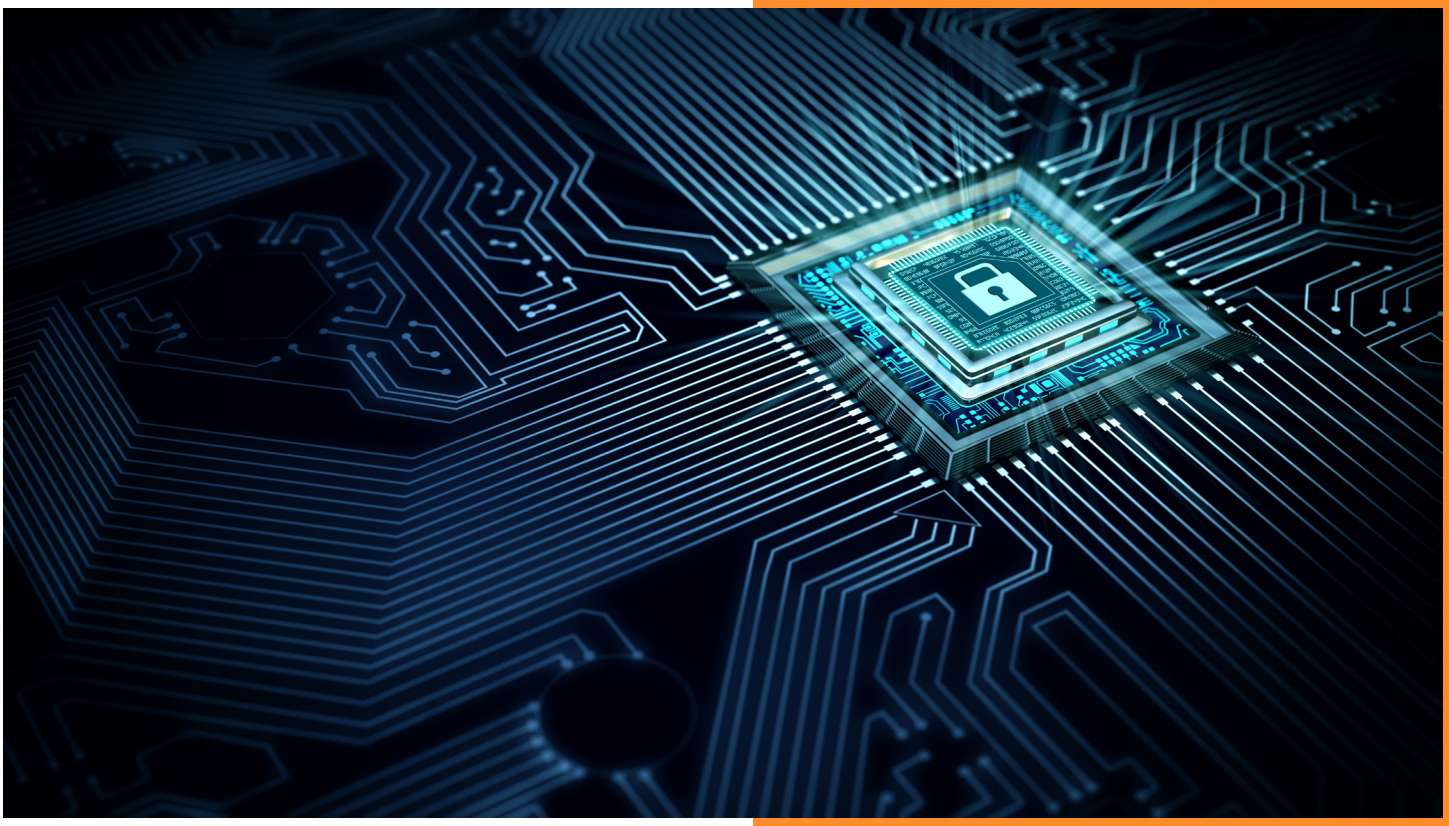
Semtech® Enables Long-Distance, Deterministic USB® 2.0 Connectivity Using SmartFusion® 2 SoC FPGAs

As Professional Audio-Visual (Pro AV), industrial automation and medical imaging systems become increasingly distributed, system architects face growing challenges extending USB® 2.0 connectivity beyond traditional cable limits—without compromising reliability, latency or protocol compliance.



Semtech Approach

To address these challenges, Semtech® developed the UEX2000 USB 2.0 Extender Platform, a protocol-aware, Ethernet-based solution capable of extending USB protocol-level connections up to kilometers while maintaining deterministic, real-time behavior. At the heart of the UEX2000 platform is our SmartFusion® 2 SoC FPGA, enabling precise USB traffic control, system monitoring, and secure, always-on operation without host-side drivers.

This collaboration highlights how our SoC FPGA architecture enables customers to solve system-level problems—not simply adding programmable logic—by combining FPGA fabric, embedded processing and long-term product stability.

Challenge

USB 2.0 was not designed for long-distance operation. Existing solutions either rely on USB emulation, introducing latency, or other approaches not designed to operated over networks and resulting in:

- Unreliable enumeration and device dropouts
- Non-deterministic latency that breaks isochronous USB traffic
- Limited visibility into device state and health
- Complex software dependencies and driver installation

Semtech needed a solution that could re-architect USB at the protocol level, enabling long-distance extension over Ethernet while preserving full USB class support, plug-and-play behavior, and real-time performance.

Requirements

- Protocol-compliant USB 2.0 extension up to 100 meters over CAT-5e cable or kilometers using fiber
- Deterministic, low-latency USB traffic handling
- Support for all USB device classes with no host-side drivers
- Continuous, always-on operation for Pro AV and enterprise deployments
- Compact, power-efficient design suitable for embedded platforms
- Long product availability to support extended customer lifecycles

Solution

Central to this innovative solution is Microchip's SmartFusion® 2 SoC FPGA, which combines FPGA fabric and an Arm® Cortex®-M3 processor to deliver deterministic USB protocol control, robust system management, and seamless integration, all without the need for host-side software.

Key architectural advantages include:

FPGA fabric for deterministic USB control

- The programmable fabric implements precise USB timing, real-time re-enumeration, class filtering and protocol monitoring, all capabilities difficult to achieve with software alone

Arm® Cortex®-M3 processor for system management

- The embedded processor handles configuration, diagnostics, firmware updates and Ethernet management, reducing external components and system complexity

Always-on, low-power operation

- SmartFusion 2's nonvolatile FPGA technology enables instant-on behavior and power efficiency, for 24/7 Pro AV and enterprise installations

Comprehensive Solution

- The UEX2000 reference design integrates USB and Ethernet PHYs alongside the SoC FPGA, accelerating time-to-market and simplifying customer adoption

Results and Benefits

Reliable USB extension up to 100m over or CAT-5e kilometers over fiber

Protocol-aware architecture eliminates common failure modes associated with traditional extenders

Driver-free deployment

Plug-and-play operation reduces installation complexity and support costs

Deterministic, low-latency performance

Supports real-time USB devices such as cameras, touchscreens, Keyboard-Video-Mouse (KVM) devices and medical imaging equipment

Scalable Network Architectures

Supports point-to-point and switched Ethernet configurations, including one-to-many USB distribution

Long-Term Design Stability

SmartFusion 2 offers longevity, which helps Semtech customers avoid forced migrations

Applications

- ProAV and Bring-Your-Own-Meeting (BYOM) conferencing systems
- Industrial control and manufacturing automation
- Medical imaging and integrated operating rooms
- Enterprise KVM and remote peripheral access

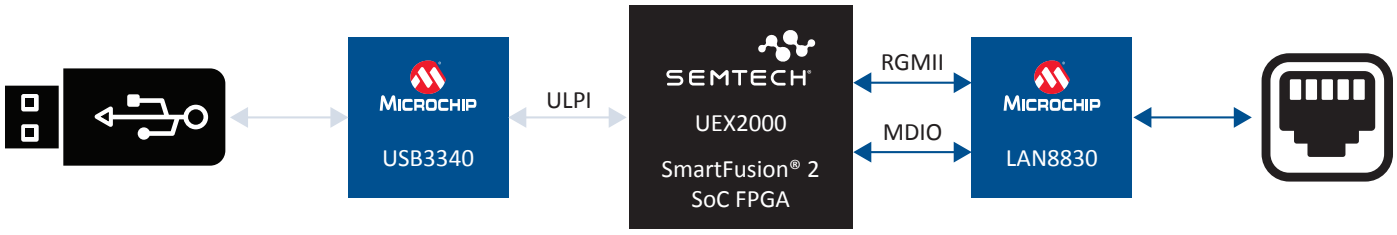


Figure 1—Semtech Reference Design

Why SmartFusion 2: From Architecture to Production Advantage

Semtech's decision to build the UEX2000 platform on SmartFusion 2 SoC FPGAs delivered advantages well beyond functional USB extension. The integrated architecture combining FPGA fabric and an embedded Arm Cortex-M3 processor enabled Semtech to move quickly from system concept to a production-ready design while minimizing integration risk. USB protocol handling was implemented directly in hardware for deterministic, real-time behavior, while system management, monitoring and configuration were handled on-chip without the need for external processors or complex software stacks.

The nonvolatile nature of SmartFusion 2 was important in accelerating time-to-market. Instant-on operation eliminated external configuration memory and simplified board design, allowing Semtech to shorten bring-up cycles and reduce overall system complexity. This always-on behavior also aligned well with Pro AV and enterprise environments where devices are expected to operate continuously and recover predictably from power interruptions.

Low power consumption was a critical enabler for the UEX2000 platform rather than a secondary benefit. SmartFusion 2's inherently power-efficient architecture allowed Semtech to deliver a compact, thermally stable design capable of 24/7 operation without active cooling. This predictable power and thermal profile is essential for deployments in space-constrained AV racks, conference rooms and medical environments where reliability and uptime are mandatory.

Security was addressed at both the architectural and production levels. SmartFusion 2 SoC FPGAs provide built-in hardware security features including secure boot, authenticated configuration and strong protection of design IP against cloning and reverse engineering. Semtech further leveraged code marking to uniquely identify and authenticate devices in the field, supporting traceability and controlled deployment across customer installations.

To support secure, high-volume manufacturing, Semtech utilized our Secure Production Programming Solution (SPPS). SPPS enabled secure key injection and device personalization during production without exposing sensitive material to contract manufacturers. By combining SmartFusion 2's inherent security with SPPS, Semtech enabled every UEX2000 device shipped with consistent security, authenticity and production readiness while maintaining a fast and predictable manufacturing ramp.

“With SmartFusion 2 and Microchip’s USB & Phy portfolio, we developed a future-ready USB extension platform that delivers unmatched control and integration in the ProAV space.”

Mr. Stephane Tremblay, CTO of AptoVision Products at Semtech

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