The TSN-EP is suitable for the implementation of sources of traffic and bridges for TSN Ethernet networks requiring robust, low-latency, and deterministic communication. Such networks are used in automotive, industrial control, and aerospace applications.

Applications

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### Block Diagram

![Block Diagram](image)

**Applications**

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### Features

**TSN Ethernet Endpoint**
- One Ethernet port & one host processor port
- Suitable for star-topology networks
- 10/100/1000 Mbps Ethernet

**Time Synchronization**
- Implements IEEE 802.1AS-2020
- Grandmaster or Slave functionality
- Highly accurate synchronization. Accuracy is typically in the order of a few tens ns.
- Provides the system with timestamps, periodic event triggers, and alarms

**Traffic Shaping**
- Implements Traffic Scheduling as per IEEE 802.1Qav and IEEE 802.1Qbv
- Implemented Frame Preemption as per IEEE 802.1Qbu and IEEE 802.3br
- Supports up to 8 traffic classes, as per VLAN (IEEE 802.1Q)
- Enables bandwidth reservation and allocation per traffic class, and deterministic, low-latency, low-jitter communication for all traffic classes

**Optional TSN Protocols**
- Frame Replication and Elimination (IEEE 802.1CB) and Per-Stream Filtering and Policing (IEEE 802.1Qci) optionally implemented in hardware
- Path Control and Reservation per IEEE 802.1Qca, and Enhancements to Stream Reservation Protocol per EEE 802.1Qcc are optionally implemented in software

**Easy System Integration**
- AMBA/AXI4 Interfaces
  - 32-bit APB for control/status registers
  - 32-bit AXI4-Stream for packet data
- MII, GMII and RGMIII Ethernet PHY interface
- Complete reference designs available, including sample application software
- Requires minimal host assistance for its initialization

**Verification IP**
- The TSN-VIP Ethernet Verification IP package is available for this core
Support
The core as delivered is warranted against defects for ninety days from purchase. Thirty days of phone and email technical support are included, starting with the first interaction. Additional maintenance and support options are available.

Verification
The TSN-EP has been rigorously verified, hardware-validated, and tested in real-life environments.
It has also been tested and verified at TSN interoperability plugfests organized by the Labs Network Industry 4.0 (LNI 4.0) association and the Industrial Internet Consortium (IIC).
The TSN-VIP TSN Ethernet Verification IP package is also available, to help test the TSN-EP or an SoC containing it.

Deliverables
The core includes everything required for successful implementation:
- Verilog RTL source code or targeted FPGA netlist
- Testbenches
- Sample Simulation and Synthesis scripts
- Comprehensive Documentation
- Lightweight PTP stack and device driver for FreeRTOS, easily portable to any other RTOS.

Customers may optionally choose to license the TSN-EP core pre-integrated with a deeply embedded processor running the PTP stack.

Related Products
The core is a member of CAST’s family of automotive interface products that includes:
- TSN-SE TSN Ethernet Switched Endpoint IP core
- TSN-SW: TSN Ethernet Switch IP Core
- TSN-VIP TSN Ethernet Verification IP
- LEMAC-1G Low-Latency 10/100/1000 Ethernet MAC IP core
- CAN 2.0/CAN FD/CAN XL Controller IP core
- CAN 2.0/CAN-FD Verification IP
- LIN 2.2/2.1/2.0 Master/Slave Controller IP core
- SENT / SAE J2716 Transmitter/Receiver Controller IP core