

## Evaluation System with 1 Gbit/s for TTEthernet



### **TTEvaluation System – Compatible with Standard Ethernet Networks**

TTEthernet is compatible with IEEE 802.3 Ethernet and integrates transparently with Ethernet networks. It takes advantage of design experiences with time-triggered systems in the transportation industry to create a unique approach to hard real-time Ethernet networking. The TTEvaluation System with 1 Gbit/s and 2 channels enables hard real-time communication and event-driven Ethernet traffic on the same network. The standard Ethernet traffic runs in the background and cannot influence determinism and synchronization of hard-real-time Ethernet transfers.

### **Guaranteed Real-Time Performance and Determinism in Ethernet Networks**

TTEthernet is inherently deterministic and has been designed for safe and highly available real-time applications. The TTEvaluation System with 1 Gbit/s and 2 channels allows the exploration of TTEthernet features and the development of distributed real-time applications in a ready-to-run out-of-the-box system. Besides, the TTEvaluation System offers the following benefits:

- High bandwidth, deterministic message transport, parallel routing and fault tolerance in dual channel configuration can be demonstrated
- Pre-configured demonstration, but adaptable by the user
- Basic toolset for configuration and scheduling; current hardware will be supported by later upgrades
- Includes incremental upgrades of this set-up (mainly software and/or IP-based)

### **Build Scalable and Safe Ethernet Networks for Demanding Real-Time Applications**

TTEthernet consolidates experiences and proven mechanisms used in aerospace design, automotive electronics as well as industrial automation. TTEthernet is a unique technological breakthrough that simplifies the design of fault-tolerant and highly available solutions. It excels in large congestion-free transfers of parallel data streams and scales easily to critical and fault-tolerant applications.

### **Open Environment for Hard Real-Time Ethernet Applications**

The TTEvaluation System with 1 Gbit/s and 2 channels enables the quick design of complex real-time applications and offers the freedom to take advantage of innovative Ethernet-based architectures for on-board systems, high-availability and fault-tolerant networks, and infotainment applications.

### **TTEthernet Design Tool Suite**

TTEthernet design tools are used to capture system-level communication requirements and network topology. In a multi-step process configuration files for TTEthernet switches and end systems are generated. Finally, the TTEthernet design tools will be incrementally clustered around an open XML database, supporting the customer's unique work flow by a flexible combination of design steps.

### E/S Controller Features

- Dual-channel 1 Gbit/s Ethernet controller based on fibre optics
- Time-triggered DMA transfers of packets from/to host
- PCIe x1 host interface
- Hardware-implemented synchronization of host/controller access to packet buffers

### TTEthernet Switch Features

- 4x 1 Gbit/s Ethernet ports, GMII interface
- 8 Gbit/s cross-sectional bandwidth
  - Full-duplex operation in parallel on all ports
  - Store-and-forward architecture with pseudo-cut-through support (1 microsecond relay delay)
  - 192 kb frame memory
- Quality of service on layer 2
  - Support of critical traffic (time-triggered / rate-limited) and non-critical traffic (standard Ethernet) with strict priorities
  - Traffic class assigned on Ethernet multicast address basis for max. 4k critical traffic frames
  - Strict priorities
  - Resource reservation for low-latency time-triggered frame relay
- Clock synchronization
  - Configurable up to dual fault tolerance
  - Support for up to 4 clock masters at 4 different priorities
  - Multi-hop support
  - Jitter below 1 microsecond
- Schedule capabilities
  - Up to 4k scheduled events
  - Up to 4 periods from 100 microseconds to 1 second executed in parallel
- Management
  - Manageable via network (configuration data download, diagnosis data queries) through standard Ethernet frames
  - End-of-line programming support through multi-hop capable bootstrap mode
  - Diagnosis through request-response protocol or automatic periodic transmission of programmable diagnostics data to programmable destination

- Traffic rule surveillance
  - Frame drop on violation of traffic rule
  - Actual arrival time vs. scheduled arrival time and source port surveillance for time-triggered traffic
  - Minimum inter-arrival time and source port surveillance for rate-limited traffic
  - Broadcast storm control and source port surveillance for standard Ethernet traffic

### Software Features

- Audio/video streaming
- Additional video streaming from digital video camera
- Platform: Linux (Linux distribution: Ubuntu 6.06 LTS; Linux kernel version: 2.6.22)
- Background traffic over the switch (e.g. ping application with adjustable load)

### Demo Items

- 2 switches (one for each channel)
- 4 E/S controllers
- Comes with fixed time-triggered schedule (can be modified with later TTETools upgrades)
- Driver (Linux-based for standard PC) and API for PCIe-based E/S controller
- Simple demo application

### PC System

- Shuttle SN68SG2/ AM2
- AMD Athlon X2 BE-2350 Socket-AM2 boxed, 2x 2.10GHz
- 2\*/ 512 MB DDR2-800
- 2 GB Flash over IDE-CF Adapter
- 1 set of speaker
- 1 digital video camera (high resolution)

Subject to changes and corrections.

For further information, including price and availability, contact [products@tttech.com](mailto:products@tttech.com).

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