



AS6802 Deterministic Time-Triggered Ethernet Product Overview

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Avionics Interface Technologies AS6802 Deterministic Time-Triggered Ethernet Product Overview

GENERAL FEATURES

The new SAE Standard AS 6802, or Deterministic Time-Triggered Ethernet, is a natural extension of ARINC 664 and standard IEEE 802.3 for hard, real-time applications. Deterministic TTEthernet is scalable, open, real-time Ethernet. It constantly synchronizes the clocks in all devices to offer "zero jitter" precision timing in the sub-microsecond range.

Deterministic TTEthernet supports mixed-criticality systems with three traffic classes:

- ♦ Time-Triggered traffic (TT), AS6802-compliant
- ♦ Shaped traffic, ARINC 664p7-compliant
- ♦ Best Effort (BE) standard Ethernet traffic, IEEE 802.3 and IEEE 1588-compliant

Our Deterministic TTEthernet airborne products are designed around DO-178B and DO-254 certified chipsets. They meet environmental specifications and are ideally suited for avionics applications. The ground development, test, and simulation products are available in lab and rugged versions, for a variety of backplanes. Carriers for PXI, VME and VXI will be released soon. All our Deterministic TTEthernet products support standard Ethernet, ARINC 664, and Deterministic Ethernet simultaneously.

STANDARDS COMPLIANCE

- ♦ SAE AS6802
- ♦ ARINC 664 Part 7
- ♦ ARINC 653 (IMA applications)
- ♦ IEEE 802.3
- ♦ IEEE 1588
- ♦ RTCA DO-254 DAL A NIC Controller
- ♦ RTCA DO-178B DAL A Embedded Software
- ♦ RTCA DO-160F Environmental Ratings

Gigabit Rugged Network End Systems

^{TTE}PMC End System

^{TTE}XMC End System

^{TTE}PCI End System

^{TTE}PCIe End System

- ♦ Supports 100/1000 Mbit/s full duplex Ethernet links
- ♦ Superior performance: 1 Gbit/s data rate is ten times faster than the industry standard
- ♦ Up to three channels using SFP connectors
- ♦ The NIC controller implements the ARINC 664 end system chip IP with two ports
- ♦ 128 send Virtual Links (VL), 512 receive VLs
- ♦ 1024 send COM ports, 4096 receive ports
- ♦ Flexible configurable periods (is granularity)
- ♦ ARINC 653 type sampling and queuing ports handled onboard
- ♦ IP/UDP handled on hardware
- ♦ ICMP handling
- ♦ Diagnosis and status registers
- ♦ PCI bridge (PLX) and DMA support
- ♦ Software Driver for Linux



^{TTE}PCI-C ES

^{TT}E Development Switch, 100 Mbit/s, 8 Ports

- ◆ Configurable time-triggered schedule for deterministic real-time communication
- ◆ Guaranteed real-time delivery and microsecond synchronization
- ◆ Legacy Ethernet devices can synchronize to network time base without knowing about Ethernet network
- ◆ Support for legacy Ethernet and BE delivery
- ◆ Standard TCP/IP-based protocols and applications can be used
- ◆ Routing of ARINC 664p7 transmissions to non-ARINC 664p7 devices possible



^{TT}E Development System 100 Mbit/s

- ◆ 100 MBit/s TTEthernet Switch with eight ports
- ◆ Two Intel ATOM-based end system PCs
- ◆ Software-based TTEthernet as Linux driver
- ◆ Mapping the software-based TTEthernet buffers to Linux network device drivers
- ◆ Configuration and development tools
- ◆ TTEthernet API
- ◆ Real-Time demo application in source code

^{TT}E Development System 1 Gbit/s for Linux

- ◆ High-bandwidth, deterministic message transport, fault tolerance in dual channel configuration can be demonstrated
- ◆ Support for time-triggered, rate constraint, and best effort ethernet traffic
- ◆ Audio- and video streaming application
- ◆ Out-of-the-box pre-configured demo application -- adaptable by the user



^{TT}E Development Switch, 1 Gbit/s, 4 Ports

- ◆ Four 1 Gbit/s ports - copper or fibre optic
- ◆ Configuration data programmable via the network
- ◆ Store-and-forward message relay mechanism
- ◆ Standard IEEE 802.3 flow control mechanism
- ◆ Predefined schedule with transparent delay jitter
- ◆ Multi-hop capability: switches can be linked together and synchronized to each other



^{TT}E Monitoring Switch

- ◆ Four port 1000-BASE-X switch including four additional monitoring ports
- ◆ Simultaneous port mirroring
- ◆ Configurable Rx/Tx direction per port

^{TT}E Monitoring System

- ◆ Records Gigabit Ethernet traffic without package drops
- ◆ 30 minutes of full-speed 1 Gbit/s traffic recording
- ◆ Offline viewing and analysis of the recorded data using WireShark™ protocol dissector with TTEthernet plug-in
- ◆ Additional network port for transferring recorded data onto file servers -- only during offline times



^{TT}E Development Switch, 1 Gbit/s, 12 Ports

- ◆ High-speed ARINC for development applications
- ◆ 12 full-duplex 1 Gbit/s ports
- ◆ 24 Gbit/s cross-sectional bandwidth
- ◆ Full power of the ARINC 664p7 switch IP
 - ◆ Eight subschedules
 - ◆ 16 clock sync masters
 - ◆ 4096 VL IDs
 - ◆ 256 shared BAGs
- ◆ Clock synchronization at sub-μs level
- ◆ Front panel JTAG connector



TTETools Suite



TTETool Build

The Tool for Producing Configuration Files for End Systems and Development Switches

TTETool Build is a software tool that supports the generation of hardware-dependent device configuration data for TTETool Development Switches and End Systems. It takes a device configuration XML file as input and generates the binary configuration image as output ready for download. The XML schemas used to describe these specifications are fully documented and allow a high level of flexibility when TTETool Build is integrated with third-party tools or customer-specific tool chains. The XML schema was designed to make manual editing of the configuration file easy. TTETool Build is a batch tool that is integrated in the Eclipse IDE and packaged as a plug-in. It is also usable as a stand-alone command line tool.



TTETool Load

The Tool for Downloading Configuration Files into Network Components

TTETool Load is capable of configuring the TTETool Development Switch by downloading the binary configuration image to the switch. TTETool Load connects to the management interface of the switch and performs a safe unlocking procedure before reprogramming the static configuration memory of the TTETool Development Switch. It also supports bootstrap configurations of TTETool Development Switches and can be used as a batch tool.



TTETool Verify

The Tool for Automating Reviews of Configuration Implementations

TTETool Verify is a verification tool for automating reviews of configuration implementations against their requirements. This software tool ensures that the binary configuration file has been assembled exactly according to the bit-level specification defined in the device configuration XML file. A traceability report that is sufficient to satisfy automation of DO-178B "code review" requirements for the configuration files is generated. The tool is applicable to both switch and end system configurations.



TTETool View

Protocol Dissector for Wireshark

TTETool View is capable of monitoring, recording, and dissecting Ethernet traffic, including ARINC 664p7 and Ethernet data. It is a plug-in to Wireshark™, an open-source Ethernet protocol analyzer that has been enhanced to dissect and display TTETool Ethernet-specific frames. It supports recording and analysis of more than 300 Ethernet and Internet protocols. With the TTETool Frame Dissector plug-in for Wireshark™, users can monitor Ethernet traffic in a proven and high-performing low-cost environment. It is best used in conjunction with the TTETool Monitoring Switch and the TTETool Monitoring System for high-performance traffic monitoring and displaying without frame loss.

TTTech

Time-Triggered Ethernet products offered
in partnership with TTTech North America

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