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FoneBRIDGE Specifications

Summary of Terminology

Ethernet frame – a TDMoE or configuration Ethernet frame

Frame – one DS1, including any framing bit or assorted framing structure. This is specifically referring to one 192-bit T1 frame or 256-bit E1 frame

Link – refers specifically to the line-side T1 or E1 interface

Span – refers specifically to the TDMoE frames associated with a particular link

Timeslot – one DS0 (in T1) or one channel (in E1); specifically refers to a particular set of eight bits in the DS1

TDMoE Standard

Time-Division Multiplexing (TDM) is a scheme used to combine numerous signals onto a single transmission line. The TDM over Ethernet (TDMoE) standard was developed to provide an analog method for TDM over Ethernet. TDMoE specifies the following header format:

TDMoE Header

Word0		Word1		Word2		Word3	
Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
Span #	Span #	# Sample	Flags	TX Cnt	TX Cnt	#Channels	#Channels

Field Description and RBS Header

0:1 (2 byte)	Span number	Network Byte Order
2	# of samples per channel	N/A
3	Flags on span	N/A
4:5 (2 byte)	TX counter	Network Byte Order
6:7 (2 byte)	# of channels	Network Byte Order
8:...	RBS Bits	Network Byte Order

NB: Although this is the TDMoE header, we still use a standard Ethernet frame header with destination MAC, source MAC, and packet type. All TDMoE information is part of the Ethernet frame payload.

Description of Header Fields

The span number (bytes 0:1) is a primitive method for sending multiple TDMoE spans to the same destination. This is because the Ethernet frame format only provides a destination MAC, source MAC, and type field. We are relegated to the type 0xD00D for TDMoE, and so must differentiate between spans inside the Ethernet frame payload. For the foneBRIDGE, each T1/E1 link should be mapped to its own TDMoE span such that the first link has span number 0, the second link has span number 1, and so on. Regular TDMoE environments (non-foneBRIDGE) can use any span numbering scheme they wish, but the ordering on the foneBRIDGE is not modifiable by the user.

The number of samples per channel should be the constant decimal value '8'. This is because each TDMoE payload contains 8 buffered samples for each timeslot of the T1 or E1 link. Since 125useconds*8 = 1 millisecond, this means we will need to send a TDMoE packet every millisecond **per span.**

The flags on span are used to denote YELLOW alarm status and the presence of RBS bits. See the ztdynamic sources for the right bits to set. As of this writing, ztdynamic **always** includes the RBS bits, even on a PRI link. This is because the userland tools don't enable the user to easily specify if RBS is needed or not. For this reason, the RBS part of the header (bytes 8+) must always be included and the RBS flag must always be set.

The TX counter is a simple 16-bit counter that must increment each time a TDMoE frame is transmitted. No special action is required should the counter rollover.

The RBS bits are the extracted robbed bit signaling data from the T1 or E1 link. Each timeslot of the T1 or E1 has four signaling bits associated with it. They are called the A, B, C, and D bits and their function is specific to the type of signaling used. In particular, their location may vary depending on the type of framing used. The most popular framing used for T1s is Extended Super Frame (ESF) specifies the locations of the A, B, C and D bits inside the ESF. Other framing modes, such as SF, do not support 4 discrete signaling bits. In cases such as

SF, we allow A → C and B → D. The RBS header always includes all four bits per DS0, even if the framing mode is SF. It is useful to note that the signaling bit is always the least significant bit of each timeslot when a signaling bit is present.

The actual format of the RBS bits in the TDMoE header consists of sets of 16-bit words in network byte order, containing signaling bits for four timeslots with the least significant four bits being the least significant timeslot.

Word0		Word1		...
Byte 0	Byte1	Byte2	Byte3	...
TS3 TS2	TS1 TS0	TS7 TS6	TS5 TS4	...

Also note, this figure has already been converted to Network Byte Order.

TDMoE Payload

The TDMoE payload contains the actual data from the T1 or E1. It is transmitted in timeslot order, all samples per timeslot. Since we buffer eight (8) samples (that is, DS0s) the payload should be as follows:

TS0	TS1	...
SAMPLE0 SAMPLE1 …SAMPLE 8	SAMPLE0 SAMPLE1 …SAMPLE8	...

and so on. No byte-order is specified, since each sample is only 8-bits. It is useful to note that this will convert T1/E1's rate of 8000 samples/sec/link to 1000 TDMoE frames/sec/span.

For T1 spans (24 timeslots) we get a payload length of 192-bytes. Adding the 12-byte RBS header and 8-byte TDMoE header, we get 212 bytes. If we add the 14-byte Ethernet header, the total is 226 bytes.

For E1 spans (31 used timeslots, see below) we get a payload length of 248-bytes. Adding the 16-byte RBS header and 8-byte TDMoE header, we get 272 bytes. If we add the 14-byte Ethernet header, the total is 240 bytes.

Asterisk/TDMoE does not expect timeslot 0 (TS0) in the E1 payload. TS0 contains frame check, CRC, and other information

that is unused by the TDMoE layer. For this reason, we will drop TS0 and use only TS1-31, for a total of 31 timeslots.

References

Henderson, Michael P., DS1/DS3 and E1/E3 Framing, <http://members.cox.net/michael.henderson/Papers/Framing.pdf>