NXP GenAVB/TSN Stack FreeRTOS™ Release Notes

Contents

1. Release Description

The GenAVB/TSN Stack FreeRTOS™ 3_3_5 release is a set of components allowing **Development** of AVB/TSN functionality on NXP i.MX RT1170 and i.MX RT1050 crossover processors families.

The GenAVB/TSN FreeRTOS™ **Evaluation** package includes all the necessary binaries and documents to assist users in setting up and running AVB/TSN demonstrators on NXP i.MX RT1170/i.MX RT1050 boards and platforms. This includes AVB and TSN example applications making usage of the GenAVB/TSN API. The related API documentation is also provided.

The GenAVB/TSN FreeRTOS™ **Development** package includes elements allowing integration of the GenAVB/TSN stack in a customized i.MX RT1170/i.MX RT1050 platform. This includes a MCUXpresso SDK patch for integration with the MCUXpresso SDK build environment, and related sources/binaries for regeneration of application image binaries.

2. Release Content

In the following release content description, the supported target platforms and package types are as follow:

- TARGET_PLATFORM:
    - MIMXRT1050-EVK: i.MX RT1050 Evaluation board
    - MIMXRT1170-EVK: i.MX RT1170 Evaluation board
- PKG_TYPE:
    - TSN endpoint : TSN endpoint role
    - AVB endpoint : AVB endpoint role
- MCUXpressso SDK version:
    - REL_2.9.0_REL13_RFP_RC3_2 for i.MXRT1050
    - REL_2.9.0_RT1170_RFP_DOC for i.MXRT1170

The GenAVB/TSN FreeRTOS™ **Evaluation** package includes the following components:

- GenAVB/TSN FreeRTOS™ Release Notes (GAVBFRRN) Major changes since the last release

- GenAVB/TSN FreeRTOS™ Evaluation User's Guide (GAVBFREVALUG) User information for running evaluation setups

- **genavb-tsn_app-evaluation-freertos_rt1176-3_3_5.tar.gz** TSN example application binary image that can be used for i.MX RT1170 flash boot

- **genavb-avb_audio_app-evaluation-freertos_rt1176-3_3_5.tar.gz** AVB example application binary image that can be used for i.MX RT1170 flash boot

- **genavb-avb_audio_app-evaluation-freertos_1052-3_3_5.tar.gz** AVB example application binary image that can be used for i.MX RT1050 flash boot

The GenAVB/TSN FreeRTOS™ **AVB Development** package includes the following components:

- GenAVB/TSN FreeRTOS™ Release Notes (GAVBFRRN) Major changes since the last release

- GenAVB/TSN FreeRTOS™ Evaluation User's Guide (GAVBFREVALUG) User information for running evaluation setups

- GenAVB/TSN MCUXpresso User's Guide (GAVBMCUXUG) User information for using MCUXpresso to build GenAVB/TSN applications

- GenAVB/TSN FreeRTOS™ Programmer's Reference Guide (html format)

- GenAVB/TSN Stack API information for programmers

- **mcuxpresso-sdk-SDK_2.9.0_MIMXRT1170-EVK_rfp-3_3_5.patch** GenAVB/TSN patch to basis i.MX RT1170 MCUXpresso SDK

- **mcuxpresso-sdk-SDK_2.9.0_EVKB-IMXRT1050_rfp-3_3_5.patch** GenAVB/TSN patch to basis i.MX RT1050 MCUXpresso SDK

- **genavb-sdk-endpoint_avb-freertos_rt1176-3_3_5.tar.gz** GenAVB/TSN SDK for i.MX RT 1170 AVB endpoints

- **genavb-sdk-endpoint_avb-freertos_rt1052-3_3_5.tar.gz** GenAVB/TSN SDK for i.MXRT1050 AVB endpoints

- **genavb-apps-freertos-3_3_5.tar.gz** GenAVB/TSN example applications source code

The GenAVB/TSN FreeRTOS™ **TSN Development** package includes the following components:

- GenAVB/TSN FreeRTOS™ Release Notes (GAVBFRRN) Major changes since the last release

- GenAVB/TSN FreeRTOS™ Evaluation User's Guide (GAVBFREVALUG) User information for running evaluation setups

- GenAVB/TSN MCUXpresso User's Guide (GAVBMCUXUG) User information for using MCUXpresso to build GenAVB/TSN applications

- GenAVB/TSN FreeRTOS™ Programmer's Reference Guide (html format)

- GenAVB/TSN Stack API information for programmers

- **mcuxpresso-sdk-SDK_2.9.0_MIMXRT1170-EVK_rfp-3_3_5.patch** GenAVB/TSN patch to basis i.MX RT1170 MCUXpresso SDK

- **genavb-sdk-endpoint_tsn-freertos1176-3_3_5.tar.gz** GenAVB/TSN SDK for i.MX RT1170 TSN endpoints

- **genavb-apps-freertos-3_3_5.tar.gz** GenAVB/TSN example applications source code

The GenAVB/TSN SDK package includes AVB/TSN library, sources and makefiles for integration with the MCUXpresso SDK build environment.

The GenAVB/TSN application packages includes full source code for example AVB and TSN applications. See GenAVB/TSN MCUXpresso User's Guide (GAVBMCUXUG) for more details.

3. Release Notes

- **3_3_5**
  - o Support MCUXpresso SDK 2.9.x version

- Feature highlights
  - o Support FreeRTOS™
  - o Support MCUXpresso Linux Host and ARM Embedded GNU toolchain build environment
  - o Support i.MX RT1050 (only AVB)
  - o Support i.MX RT1170
  - o Support TSN Controller/Slave endpoints
  - o Support AVB Talker/Listener endpoints
  - o AVB/TSN protocols:
    - ▪ gPTP (IEEE 802.1AS-2011)
    - ▪ AVTP (IEEE 1722-2016)
    - ▪ FQTSS (IEEE 802.1Q-2018, section 34)
    - ▪ SRP (IEEE 802.1Q-2018, section 35)
    - ▪ AVDECC (IEEE 1722.1-2013)
    - ▪ EST (IEEE 802.1Qbv-2015)
    - ▪ FP (IEEE 802.3br-2016/IEEE 802.1Qbu-2016)

  - o SRP control API's
  - o gPTP clock and timer service API's
  - o TSN feature highlights
    - ▪ Enhancements for scheduled traffic control API's
    - ▪ Layer 2 socket API's
    - ▪ Example TSN control application
    - ▪ Example TSN motor control application
  - o AVB feature highlights
    - ▪ AVTP stream formats supported:
      - • IEC 61883-6: AM824/MBLA, 32-bit float, 32-bit integer.
      - • AVTP Audio Format (AAF).
      - • IEC 61883-4: MPEG2-TS container for H.264, MPEG-2, MJPEG, AAC….
      - • Compressed Video Format (CVF): MJPEG, Listener only, for MPC5604EKIT support.
      - • Compressed Video Format (CVF): H264.
      - • Clock Reference Format (CRF).

- AVTP Control Format (ACF).
  - Support up to 32 audio channels per audio stream (IEC61883-6 and AAF)
  - Support up to 8 AVTP streams.
  - Audio sampling rates supported: 32, 44.1, 48, 88.2, 96, 176.4 and 192 kHz.
  - Support for SR classes A, B, C, D and E.
  - Support init-time configuration of enabled SR classes
  - Support for hardware Media Clock Recovery.
  - Support for hardware Media Clock Generation.
  - AVTP and AVDECC control API's
  - Passed AVnu certification ProAudio Endpoint.
  - Example AVB Talker/Listener Audio application

4. Performance

These values illustrate AVB endpoint performance per audio stream. They are measured on the current GenAVB code release, provided as indication and not guaranteed as they depend on overall system configuration. Measures are done for SR class A audio streams, AAF, 48KHz sampling, 2 channels, 24/32bits, 6 samples/packet with 1ms periodic processing.

SoC	ARM Core	CPU load per stream(%)	
		Talker	Listener
i.MX RT1052	Cortex M4@600MHz	4.9	5.8
i.MX RT1176	Cortex M7@1GHz	3.4	4.3

Table 1. CPU load per stream

SoC	Total Internal Memory (KiB)	Memory usage per stream (KiB)	
		Talker	Listener
i.MX RT1052	512	11.6	7.3
i.MX RT1176	2048	11.6	7.3

Table 2. Memory usage per stream

5. Known Issues

Issue description	Remarks
MIMXRT1170-EVK boards revisions prior to revision C (and B0 device) are not supported by this release.	Continue using release 3.0.2 for MIMXRT1170-EVK revision B1 and below support.
Some MIMXRT1170-EVK rev C and C1 boards may exhibit some CRC errors when receiving high load traffic on the Gbps interface.	
Once *User Button* is pressed on TSN Motor IO device and the state is STAY_INDEX, the log 'pos real' shows a value different from 0.0.	Restart the TSN Motor IO device and press the button again. When the TSN Motor IO device is correctly initialized, the value must be 0.0.

MIMXRT1050-EVK ethernet back-to-back doesn't work with long cables	The issue has only been observed in back-to-back and using a < 20 cm cable fixes the problem.
AVB switches may limit the maximum number of SR class C, D and E streams.	AVB switches that don't support SR Classes C, D and E will reserve extra bandwidth when those traffic classes are used by GenAVB stack. For a 100Mbit/s link the bandwidth limit will be reached even for a low number of streams.

Table 2. Known issues