INTERNATIONAL ELECTROTECHNICAL COMMISSION

TC65: Industrial-process measurement, control and automation

SC65C: Industrial communication networks

Meeting: 65C / MT9 / PT 61784-6 (TSN); Project Team for:

- IEC 61784-6 Industrial communication networks – Profiles – Part 6: Time sensitive networking profile for industrial use based on IEEE 802.1 and IEEE 802.3

Minutes: Meeting based on, see documents listed in Annex A and the meeting invitation in collaboration tool,
Date: 2017-11-20 — 2017-11-22;

Location: Arlington, VA (USA)

Convenor: Ludwig Winkel

Daily Minutes by: Ludwig Winkel

Compiled Minutes by: Ludwig Winkel

Published: Collaboration tool, see <www. http://collaboration.iec.ch/>

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1 General topics

1.1 Welcome

Ludwig Winkel (LW) thanks TIA for hosting the meeting. Mrs. Stephanie Montgomery (TIA Vice president) welcomed the MT9.PT and provided information about the logistics. Lunch is on our own, so that we have to reserve enough time for lunch to be back in time.

1.2 Membership and attendees

LW called the MT9.PT meeting to order at 2017-11-20, 09:30am and the following days at 09:00am. The list below shows the attendance per day. VD reminded that current guests should consider getting a status as a nominated expert through the NC or a Liaison partner in accordance to the IEC directives.

Sal.	Last Name	First Name	middle	NC/Org	Acron.	11-20	11-21	11-22
Mr	Eisl	David		AT				
Mr	ENZINGER	Thomas		AT		1	1	1
Mr	Kirchmayer	Stephan		AT	SK			
Mr	Jamison	Jim		CA				
Mr	Marko	Paul	Eric	CA				
Mr	Felser	Max		CH				
Mr	Kirrmann	Hubert		CH				
Ms	Ding	Lu		CN				
Mr	Feng	Dongqin		CN	DF	1	1	1
Ms	Liu	Dan		CN				
Mr	Mei	Ke		CN				
Mr	song	yan		CN				
Mr	Xu	Aidong		CN	AX	1	1	1
Mr	Winkel	Ludwig		Convenor MT9	LW	1	1	1
Mr	Dorr	Josef		DE	JD	1	1	1
Mr	Kehrer	Stephan		DE	SKe	1	1	1
Mr	Klemm	Eckehardt		DE	EK			
Mr	Rostan	Martin		DE				
Mr	Thiessmeier	Peter		DE				
Mr	Wamßer	Reiner		DE		1	1	1
Mr	Wohnhaas	Klaus		DE		1	1	1
Mr	STEINDL	Günter		DE, Liaison PI	GS	1	1	1
Mr	SEEWALD	Maik		DE, Liaison TC57		1	1	1
Mr	Johansen	John		DK	JJ			
Mr	Schultz	Regnar		DK				
Mr	BELLIARDI	Rudy		FR	RB	1	1	1
Mrs	Lin	Lan		FR				
Ms	DEMASSIEUX	Valérie		FR, 65C secretary	VD	1	1	1
Mr	Kato	Hiromitsu		GB				
Mr	Shimura	Akitoshi		GB				
Mr	Still	Peter	R.	GB				
Mr	Wood	Graeme	G.	GB	GW	1	1	1
Mr	FUJISHIMA	Mitsushiro		Guest, JP		1	1	1
Mr	Kondo	Kenji		Guest, JP		1	1	1
Mr	Monaco	Antonio		Host				
Mr	ROLLE	Ingo		Host				
Mr	Ferrari	Paolo		IT				
Mrs	Lo Bello	Lucia		IT				
Mr	Russo	Francesco		IT	FR			
Mr	Tomatis	Andrea		IT				
Mr	Adachi	Yoshiaki		JP	YA	1	1	1
Mr	Akabane	Kuniharu		JP				
Mr	Baba	Takenori		JP		1	1	1
Mr	ENOMOTO	Hiroya		JP				
Mr	FUKUDA	Mamoru		JP	MF			
Mr	Harima	Taro		JP	TH	1	1	1

Ludwig.Winkel@Siemens.com

Sal.	Last Name	First Name	middle	NC/Org	Acron.	11-20	11-21	11-22
Mr	HOTTA	Yoshifumi		JP		1	1	1
Mr	NOMIZU	Takuma		JP		1	1	1
Mr	Ogura	Nobuyuki		JP				
Mr	Sato	Alex (Astushi)		JP		1	1	1
Mr	SATO	Kazuo		JP				
Mr	Shiobara	Yasuhisa		JP	YS			
Mr	TAKAHASHI	Ichiro		JP				
Mr	Takayanagi	Yoichi		JP				
Mr	Hong	Seok	Boong	KR				
Mr	Hong	Seung-ho		KR	SHH			
Mr	Kwon	Daehyun		KR	DK			
Mr	BECKMANN	Guido		Liaison EtherCAT	GB			
Mr	MITSCHKE	Stephen		Liaison FIELDCOM Group	SM			
Mr	LUTZ	Peter		Liaison Sercos	PL	1	1	1
Mr	Prytz	Gunnar		NO				
Ms	Gaykovich	Galina	F.	RU				
Mr	Gutierrez	José		US				
Mr	Hantel	Mark		US		1	1	1
Mr	Lee	Derek		US	DL	1	1	1
Mr	Lounsbury	Bob		US	BL			
Mr	Moldovansky	Anatoly		US	AM			
Mr	Neitzel	Lee	A.	US				
Mr	Phinney	Tom		US				

1.3 Copyrights and IPR

LW reminded all MT9.PT experts that patents required for use of the TSN-IA profile must be announced to IEC and made available using the IEC licensing form. Presentations shall not have copyright marks or confidentiality information.

1.4 Abbreviated terms and acronyms

AVNU	Consortium to establish and certify the interoperability of open Audio Video Bridging (AVB)[1] and Time-Sensitive Networking (TSN) standards.
CD	Committee Draft
CDV	Committee Draft for Vote
CollTool	IEC Collaboration Tool, see <http://collaboration.iec.ch>
CP	Communication Profile according to IEC 61784-1 and IEC 61784-2
FDIS	Final draft International Standard
IA	Industrial automation
IEC	International electrotechnical commission
IEC-CO	Central office of International Electrotechnical Committee
IEEE	Institute of Electrical and Electronics Engineers
IEV	International electrotechnical vocabulary
IO	Input output

IPR	Intellectual Property Rights
ISO	International Organization for Standardization
ITU	International Telegraph Union
JTC1	Joint Technical Committee 1 of ISO and IEC
JWG	Joint WG
MAC	Medium access Control
MAU	Medium access unit
MM	Meeting minutes
MT	Maintenance Team
MT9	Maintenance Team 9 of IEC SC65C
NC	National Committee
NP	New work item proposal
OPC	Open platform communications
OPC UA	Open platform communications unified architecture
PAR	Project authorization request
Phy	Physical Layer
PLC	Programmable logic controller
PoE	Power over Ethernet
preCDV	Draft CDV
preFDIS	Final Draft International Standard in preparation; “approved for Committee Draft with Vote”-status plus changes according to RVC and MT9 decision
PT	Project team
Q	Questionnaire
Rev	Revision
RQ	Report on questionnaire
RR	Review report
RVN	Report on voting of an NP
SC	Sub-Committee of a TC
SR	Stream Reservation
TC	Technical Committee
TIA	Telecommunications industry association
TSN-IA	Time sensitive networking – industrial automation
TSN	Time sensitive networking
UNI	User Network Interface
WG	Working Group

2 Purpose of the meeting and agenda

2.1 Purpose of the meeting

MT9.PT is producing a profile for Time Sensitive Networking (TSN) based on IEEE 802.1 and IEEE 802.3 applicable for the industrial automation (IA) use. IEEE 802.1 TSN defines sub-standards – not a single protocol. Therefore a profile is needed to define the suitable sub-standard for IA.

The number of options provided by the TSN-IA profile should be limited to what is essential.

Resource indicators ("performance parameters"), see Frankfurt meeting minutes.

2.2 Review draft agenda and timetable

The draft agenda was reviewed and accepted with modifications. MT9.PT reviewed the agenda again at the beginning of all days and agreed with the proposed changes. The minutes were reviewed at the end of the meeting.

The final agreed and followed agenda was put to the CollTool after the meeting (rev1).

2.3 Organizational issues

A list of the relevant documents of MT9.PT are given in Annex B.

There is a Liaison established with the AVNU consortium, see IEC 65C desktop.

Action: VD will ask the AVNU for a name as a contact person.

MT9/PT61784-6 will closely collaborate with IEC TC57 to try to have as much commonality as possible with their TSN-profile for power distribution.

VD checked the status of the Liaison to TC57 and reported that it exists.

Action: VD to get the name of the TC57 liaison officer listed in the expert data base.

IEEE 802.1 uploaded the Liaison request from VD but did not created an official response.

IEEE 802.3 presented only a letter from Francesco Russo and this was not accepted as an official Liaison; only an informal Liaison.

IEEE 802.1 asked for a joint meeting with the IEC 65C/MT9/PT61784-6. There were negotiations on the way between both organizations and it is to expect that IEEE 802.1 will launch a PAR during their March 2018 plenary. IEC 65C will launch a Questionnaire (Q), followed by a report on questionnaire (RQ) to inform the IEC 65C/NCs. IEEE 802.1 was also asking for a different project number similar to 802, so that LW asked the 65C management for IEC 60802 (or 61784-802).

3 Technical goals and RVN of IEC 61784-6

3.1 Technical goals

The objectives of the MT9.PT were reconsidered and reconfirmed:

a) Pure profile without additional Phy, MAC protocol or services defined in IEC 61784-6 versus IEEE 802.1 and IEEE 802.3.

b) A TSN profile will provide a set of minimum, but compatible TSN bridge capabilities with as few options as possible.

c) Define a profile with minimum requirements to support the industrial automation applications in a high compatible way (Compatibility levels (specified in IEC 61804-2: 2017) are specified in IEC 61784-2:2017) up to exchangeability.

d) Focus this profile on TSN network components. Other device types could be considered, e.g bridged end stations, end stations. Try to limit the number of profiles and options to a minimum!

e) IEEE 802.1ASrev is the selected clock synchronization reference (also called profile of IEEE 1588). A time gateway function will be optionally provided for end stations using time profiles referenced by IEC 61784-2, CPs.

f) Initial network set-up should be achieved; but in the moment postponed.

g) A common understanding how end stations access TSN features on the bridges should be achieved; in the moment postponed but is essential.

The following use cases/features are expected from an IEC 61784-6 TSN network:

1. Streams can be established and removed at any time in ad-hoc manner – within the limits of the associated Stream Reservation (SR) class – without effect on other established streams in the network, i.e. particularly without reboot of the network.
2. Network effectivity and efficiency is independent from the order in which streams were established and/or removed (i.e. history-free).
3. Applications in end nodes need not depend on how the network is organized (trees, etc.).
4. In case of stream failure, sufficient diagnostics information is provided, so that the error cause and potential recovery measures can be identified.
5. The network can be expanded dynamically at any time by attaching an additional TSN bridge – without effect on established streams in the network.
6. Removal of a bridge which is in use will only affect streams which are using that bridge.
7. TSN domain boundaries are detected by TSN bridges and can optionally be controlled by network management to not interfere with TSN traffic and to support non-TSN traffic in a deterministic manner.
8. The requirements of the various industrial traffic types are met (see Clause 8).
9. Applications get access to the TSN network via the User Network Interface (UNI).
10. Several independent applications (e.g. multiple CPx systems, OPC UA@TSN...) are supported at the same time.
11. Interoperability of TSN bridges and the TSN function of end nodes between different vendors need to be ensured.
12. Network can be partitioned according to the user's wishes in individual TSN domains.
13. A default set of parameters shall be provided to enable plug and play. [not yet decided]
14. All industrial topologies (IEC 61918: linear, ring, star) – including topologies with redundant links as defined in IEC 62439-1 – shall be supported.
15. The addition of TSN functionality to an Ethernet network shall not impact proper operation of upper functional safety layers used on top of Ethernet based fieldbuses or networks (see IEC 61784-3).
16. The TSN network should optionally support redundancy for streams. TSN Network management should support reporting of independent physical paths and control of stream setup to allow management of redundancy. The TSN network should also allow redundancy recovery time to be calculated.

3.2 RVN of IEC 61784-6

Comment resolution was done during the Frankfurt meeting for all comments see the RVN document on the IEC server 65C/896/RVN. Not all comment dispositions were implemented in the draft rev03 circulated before this meeting due to lack of time.

3.3 Draft IEC/CD 61784-6 rev3

The group reviewed the draft and some provided comments that were discussed.

Action: JD to incorporate the remaining comments from the RVN and the new comments discussed in this meeting until mid of January 2018 (> one week before Geneva meeting).

Action: JD and SKe will check the definitions especially end-station, end-node, bridged end station, etc.

4 Drafting of IEC 61784-6

4.1 Combined device

The combined device using an end station and bridge in one housing is called “bridged end station”. The bridged end station will be treated in the TSN-IA profile as logical two elements:

- End station
- Bridge with at least two externally accessible ports and a logical third port connected to the end station.

When the draft provides the details of the approach, then the experts are asked to review the draft with the viewpoint of the bridged end station whether there is a need for another profile.

4.2 Link speeds

Each port of a bridge shall support a link speed of 100 Mbit/s and may also support other link speeds. IEC 61158-2 fieldbus-specific MAU Types may be supported.

End-stations may use 10 Mbit/s, 100 Mbit/s, 1 Gbit/s or more; IEC 61158-2 fieldbus-specific MAU Types may be supported. Table 1 provides an overview of media dependent link speeds for bridges. Table 2 provides an overview of optional link speeds for end-stations.

Table 1 – Link speeds for Bridges

Link speed	Media	Comments
10 Mbit/s	Copper	optional
100 MBit/s	Copper	mandatory
1 GBit/s	Copper or optical	optional – should be supported
> 1 GBit/s	Copper or optical	optional

Table 2 – Optional link speeds for end-stations

Link speed	Media	Comments
10 Mbit/s	Copper or fiber	May be used for end station “only” devices connected as leafs to the domain. Dedicated to low performance and lowest energy devices for e.g. process automation. These devices may use PoE as power supply.
100 MBit/s	Copper or fiber	Historical mainly used for Remote IO and PLCs. Expected to be replaced by 1 GBit/s as common link speed.
1 GBit/s	Copper or fiber	Mainly used link speed for all kind of devices
2,5 GBit/s	Copper or fiber	High performance devices or backbone usage

IEEE 802.11, IEEE 802.15.1 (Bluetooth) and IEEE 802.15.4 are out of scope for this version of the profile definition.

A mixture of different link speeds in the same network was discussed. That led to a discussion of the need to specify in the TSN-IA profile numbers of e.g. buffers, resources to guarantee TSN behavior. The behavior shall be calculable off-line and the online behavior shall match this calculation.

Ludwig.Winkel@Siemens.com

5 Work plan and next meetings

5.1 Work plan

VD will launch the Q by 1Dec2017 with a closing date of 12 Jan 2018

1st priority is to implement the remaining comment resolution of 65C/896/RVN.

2nd priority is to work on comments presented in Arlington.

VD will send the rev4.0 to IEEE 802.1 with filtered comment resolution (no technology specifics in it, removed ahead) associated with a Liaison letter to ask them for review and comments.

JD will put the resulting revised document rev5.0 to the CollTool by 17.Jan2018

The resulting work plan see Table A.1 will be put to the CollTool.

The estimated time on discussions for decisions on crucial topics:

1. Shaper selection; Preemption; usage model; link speed; traffic types; stream classes and priorities, etc.: 3 days
2. Centralized/Decentralized configuration: 3d
3. Virtual bridged networks (active topology, ..): 1d
4. OPC-UA: 2h
5. Redundancy selection: 1d
6. Quantities, scalability, etc. 1d
7. CDD with key performance indicators (low priority)
8. Additional requirements in IEEE 802 specs.

5.2 Next meetings

24. .. 25. Jan 2018 Geneva (ITU) joint neeting with IEEE 802.1 (responsible LW)

12 .. 16.March 2018 Frankfurt, inviting IEEE 802.1 (responsible LW)

Option 1: 14 .. 16.Mai 2018, Cleveland IEC, inviting IEEE 802.1 (responsible MH)
17 .. 18Mai 2018, Cleveland, Joint meeting (responsible MH)

Option 2: 16…18Mai 2018 , Cleveland IEC, inviting IEEE 802.1 (responsible MH)
21 .. 22 Mai 2018, Pittsburgh, Joint meeting

12 .. 13 July 2018, San Diego, Joint meeting, (Tentative, could be cancelled during the May meeting.) (responsible LW)

6 Adjournment

Minutes were reviewed and agreed.

MT9.PT expressed thanks to TIA for the hospitality and thanks to Bob Lounsbury and Rockwell Automation for organizing and supporting the meeting.

Adjourned 16:00.

Annex A

SC65C/MT9.PT schedule

The updated work plan is in Table A.1.

Table A.1 – Work plan for TSN-IA profile document

Calender	Date	End	Actions TSN-IA profile IEC	Date	End	Actions TSN-IA profile IEEE 802.1
Dec-16						
Jan-17						
Feb-17						
Mar-17	24.03.2017		IEC/NP 62657-4			
Apr-17						
May-17		16.06.2017				
Jun-17	06.07.2017	07.07.2017	1st meeting Frankfurt			
Jul-17						Asking for a JWG TSN-IA profile
Aug-17						
Sep-17		30.09.2017	Next rev of preCD by Editor			
Oct-17	01.10.2017	30.10.2017	MT9.PT Review			
Nov-17	20.11.2017	22.11.2017	meeting Arlington, VA	09.11.2017		Drafting PAR
Dec-17	01.12.2017		Questionnaire			
Jan-18		12.01.2018				
Jan-18	24.01.2018	25.01.2018	Meeting Geneva, CH, JWG		26.01.2018	PAR
Feb-18						
Mar-18	12.03.2018	16.03.2018	Meeting Frankfurt, DE		09.03.2018	
Apr-18						
May-18	16.05.2018	18.05.2018	Meeting Cleveland			
May-18	17.05.2018	18.05.2018	Meeting Cleveland JWG			
May-18				21.05.2018	25.05.2018	Meeting Pittsburg

Calender	Date	End	Actions TSN-IA profile IEC	Date	End	Actions TSN-IA profile IEEE 802.1
Jun-18						
Jul-18	12.07.2018	13.07.2018	Meeting San Diego, JWG	09.07.2018	13.07.2018	Meeting San Diego
Aug-18	15.08.2018		IEC/CD 61784-6			1st TF draft
Sep-18				10.09.2018	14.09.2018	Meeting Oslo
Oct-18		30.10.2018				
Nov-18	16.11.2018	17.11.2018	Meeting Bangkok, JWG	12.11.2018	16.11.2018	Meeting Bangkok, JWG
Dec-18						1st recirc.
Jan-19						

Ludwig.Winkel@Siemens.com

Annex B

SC65C/MT9.PT documents

The following SC65C MT9.PT documents are downloadable from the IEC server www.iec.ch and reflect the basis and results of MT9.PT.

65C/875/NP	Industrial communication networks – Profiles – Part 6: Time sensitive networking profile for industrial use based on IEEE 802.1 and IEEE 802.3
65C/896/RVN	Result of voting on 65C/875/NP - PNW 65C-875: Industrial communication networks – Profiles – Part 6: Time sensitive networking profile for industrial use based on IEEE 802.1 and IEEE 802.3