MQTT Support in TINE

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Background

What is MQTT?

- Efficient publish/subscribe messaging protocol.
- Designed for resource-limited devices and low-bandwidth networks
- Decouples the sender and receiver via asynchronous communication

History and Purpose:

- Origin: Developed in 1999 by IBM and Arcom.
- Purpose: Data collection from multiple remotely distributed nodes.

- Growth: Became OASIS standard in 2013, in 2019 version 5.0 was released, became defacto main IoT protocol.

Rationale for incorporating it into TINE:

- New devices and software often support MQTT out-of-the-box.
- In many scenarios simpler, more efficient alternative to OPC UA
- Scalability from embedded devices to complex systems, future-proof

Example with QoS 0



* Source: Wikipedia.org

New MQTT Bus Plug for CDI

- Support for multiple brokers
- Familiar configuration process
- Easy mapping of MQTT topics to TINE properties
- Native archiving can be easily enabled with the "|HIST" access flag

5 ILI ICIU	Template	Entry	Fieldbus	Manifest	Schedule	Server										
NAM	IE	TARGET		BU	s	LINE	ADDRES A	ADDRES FORMAT	MASK	ACCESS	INPUT	ADDRESS_MAP	L P.	T R	R D	IN
_304_pos	s_X		MQTT:Pe	BoSeg01.d	lesy.de	1		Double		RD [HIST		BSM_NOL_09/p3/tunnel/segmentgap/R_304/pos_X[mm]				
_304_pos	s_Y		MQTT:Pe	BoSeg01.d	esy.de	1		Double		RD HIST		BSM_NOL_09/p3/tunnel/segmentgap/R_304/pos_Y[mm]				
_304_pos	s_Z		MQTT:Pe	BoSeg01.d	esy.de	1		Double		RD [HIST		BSM_NOL_09/p3/tunnel/segmentgap/R_304/pos_Z[mm]				
emp1			MQTT:Pe	BoSeg01.d	lesy.de	1		Double		RD HIST		BSM_32_11/p3/tunnel/segmentgap/RS_XX/Temp[□□C]				
S_XX_pos	s_X		MQTT:Pe	BoSeg01.d	esy.de	1		Double		RD [HIST		BSM_32_11/p3/tunnel/segmentgap/RS_XX/pos_X[mm]				
S_XX_pos	s_Y		MQTT:Pe	BoSeg01.d	esy.de	1		Double		RD (HIST		BSM_32_11/p3/tunnel/segmentgap/RS_XX/pos_Y[mm]				
S_XX_pos	s_Z		MQTT:Pe	BoSeg01.d	lesy.de	1		Double		RD [HIST		BSM_32_11/p3/tunnel/segmentgap/RS_XX/pos_Z[mm]				
YT271_TE	EST3_TE		MQTT:do	ocsbroker.	desy.de	2		Double		RD (HIST		XFEL.HYT271_TEST1/TEMPERATURE				
YT271_TE	EST3_TE		MQTT:do	ocsbroker.	desy.de	2		Double		RD [HIST		XFEL.HYT271_TEST2/TEMPERATURE				
YT271_TE	EST3_TE		MQTT:do	ocsbroker.	desy.de	2		Double		RD (HIST		XFEL.HYT271_TEST3/TEMPERATURE				
YT271_TE	EST4_TE		MOTT:do	a seb to kee												
CTOTA TO				ocaoroker.	desy.de	2		Double		RD HIST		XFEL.HYT271_TEST4/TEMPERATURE				
11271_10	ESTS_TE.		MQTT:do	ocsbroker.	desy.de desy.de	2		Double Double		RD (HIST RD (HIST		XIFLUHT221_TESTS/TEMPERATURE				
112/1_10	ESTS_TE-		MQTT:do	ocsbroker.	desy.de desy.de	2		Doubk Doubk		RD (HIST RD (HIST		XIELHYT222_TESTS/TEMPERATURE				
Row: 1	туре:		MQTT:do	ocsbroker.	desy.de desy.de	2		Double Double		RD HIST RD HIST		VIELWYT27_TESTS/TEWERATURE		wn	Re	emo
Row: Value Typ	Туре:	v Vak	MQTT:do	ocsbroker	desy.de	2		Deuble		RD HIST RD HIST		VIELWY222_TESTS/TEMERATURE		With	R	emo
Row: Yalue Typ	Type: pe:	z Vak	MQTT:do	ocsbroker.	desy.de	2		Double Double	y Car	RD HIST RD HIST		VIEL-HYT272_TESTS/TEMERATURE		wn	R	emo
Row: Yalue Typ	Type: pe:	valu	MQTT:do	ocsbroker.	desy.de	2		Double Double	/Cat	RD (HIST RD (HIST		VIELWYT27_TESTS/TEMERATURE		Wh	Re	emo

Operational highlights

 Data is collected in real-time and buffered(retained) within the CDI server

 Historical trend archiving can be performed using standard TINE services, either locally or centrally



Databa	se Entries									
Index	Active	Device Server	Device Name	Davice Pronarty	Index: 602	Tweak		Cione	New	Add MCA
					Data Collection Co	onfiguration				
501	ENABLED	PETRA/GIODABCOlector	Keyword	Energy	Context			Server		
562	ENABLED	PETKA/GIODBELONCTOF	Keyword	Beamcurrent				MOTT.CDI		
363	ENABLED	PETRA/GIODABCONCCOP	Keyword	NumberOfBunches	and the					
505	ENABLED	TestServer3M	*0	NAME101	Device			Property		
200	ENABLED	T est serv er JM	10	NAME16						
567	ENABLED	TestServer3M	40	NAME16LNAM	Format	Array Size		Input Format	D	ata Input
573	ENABLED	PubeServer	40	Ampikude		-		No. of A		
574	ENABLED	ARCHIVER	Magnets	AlarmsCount						
575	ENABLED	BunchScope.RPT	Bunch-1	LBunch.1Turn	Filtering of Data	Storage				
576	ENABLED	BunchScope.RPT	Bunch-1	LBunch.NAM	During (
577	ENABLED	BunchScope.RPT	Bunch-1	LBunch.Scaled	I NEVER		ALWAYS		- 4	rress Rate -
578	ENABLED	BunchScope.RPT	Bunch-1	LSum.1Turn		-				
580	ENABLED	SheServer	SineGen0	Ampikude.NAM	SLOW	FIXTIME 🕑				
582	ENABLED	LINAC2/ComBobL2Pa	£0	IonPump.Description					A	rchive Heart
583	ENABLED	LA8/VAC.JON_PUMP	40	DEVICES	VOLATILE	NOPOI			90	10
584	ENABLED	LAB/VAC.30N_PUMP	e0	P						
585	ENABLED	LAB/VAC.JON_PUMP	£0	HV	Property Viewing	Configuration —				
586	ENABLED	PEX/TTTP04.ML	SMU_RotZ	MotorPosition	MQTT.CD1Temp1,D	OUBLE,1,,0.0,0.0,0.	1,0.1,LIN,	1.0,0.0,hardware	unit 1 (hard	ware unit 1),,
587	ENABLED	SineServer	SineGen1	Phase						
588	ENABLED	SineServer	SineGen0	Echo						
589	ENABLED	PETRA/GLOBALS	keyword	BeamLifetime	4					
590	ENABLED	SITE/VbrADCs.Guraþ.Ste.	Dev-1	VC.State.82.Mca						
591	ENABLED	SITE/VibrAD Cs.Guralp.Site.	Dev-1	Channel.D escription	Maxim	ium size (bytes):	8	Remaining elem	ients:	0
592	ENABLED	SITE/VbrADCs.Gurab.Ste.	e0	VC_Criteria.NAM						
593	ENABLED	PETRA/ARCHIVER	keyword	SynthStatusReg.PETRA	Keyword	Data Format	286	Units	Max	ME
594	ENABLED	PETRA/ARCHIVER	keyword	SynthSE VC. Criteria NAM	MQTT.CD1Temp1	DOUBLE				
595	ENABLED	SITE/VbrAD Cs.Gurab.Ste.	Dev-1	Channel Archweu evices	Abs Tolerance	Rel Tolerance		Pint Style	Offset	Scale
596	ENABLED	LINAC2/TestModDeFVI	AB	Deby	0.1			1.74		
597	ENABLED	LINAC2/TestModDel-VI	#0	Delay JLAM				1.94		1.0
500	ENABLED	LINAC2/ComBobL2Pa	#0	TestMod.DG645.Deby.NAM	Description		Subsys	tem		
	ENABLED	PETRA/FOFB_DC_REMOV.	OrbitController	getCorrectionData	hardware unit 1 (ha	rdware unit 1)	Diagno	istics 💌	Associate:	
599	ENABLED	PETRA/REFORBIT	#0	PROPERTY.STATS						
599								Min	M	K U
599 600 601	ENABLED	MQTT.CD1	PETRA_WEST	PosX						

Future directions:

- Releases for other platforms: Linux, embedded hardware platforms and OSs(Ubuntu Core, Raspberry Pi, Intel NUC)
- Enhanced JSON schemas support for better data structuring
- New models to consider:
 - Brokerless MQTT, can TINE do broker's job?
 - MQTT over QUIC?