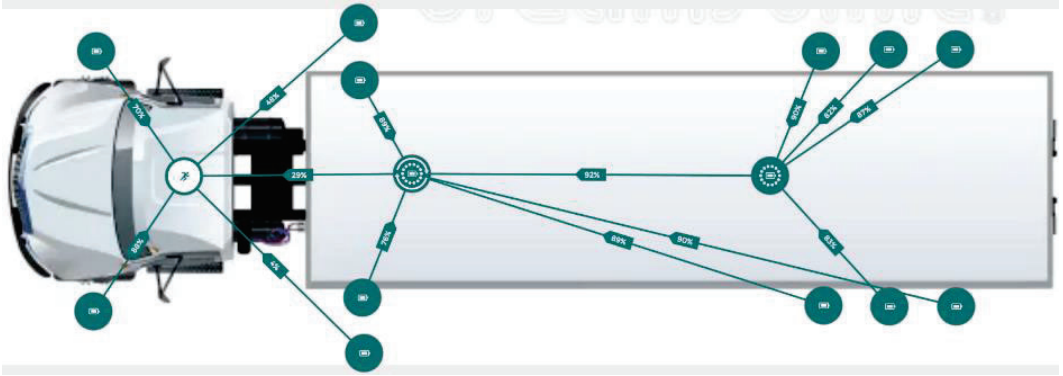
fyrqom

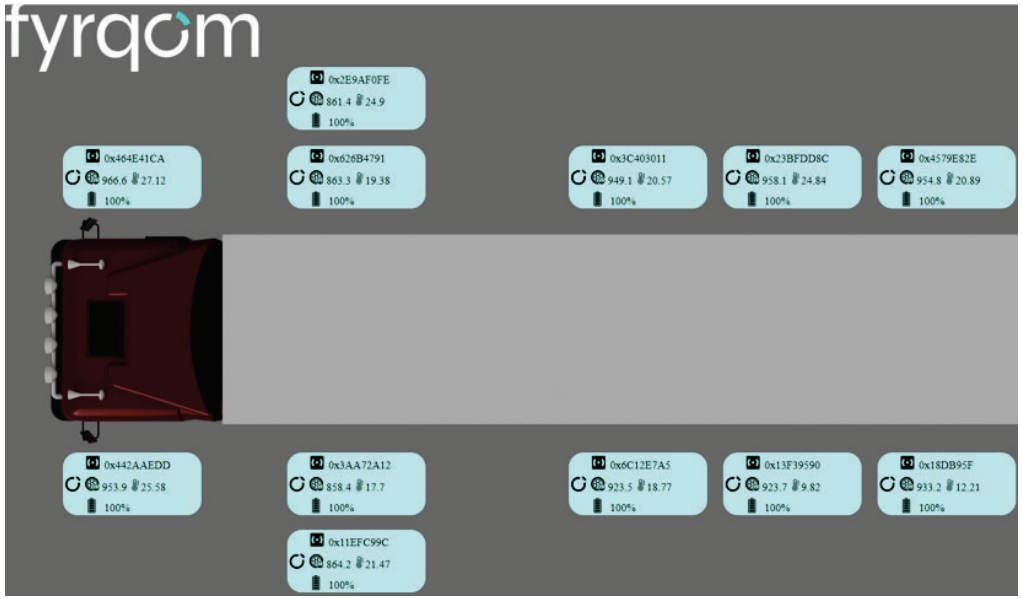
Truck Trailer VSN (Vehicle Sensor Network) using TGW3 by Volvo

FFI Accelerate Startup Partnership

250516

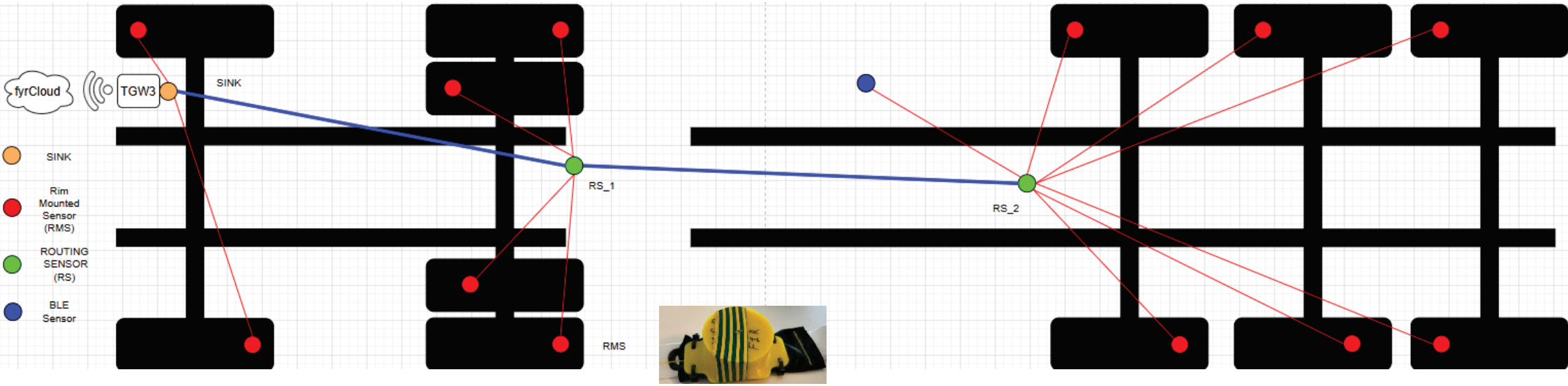
Test Vehicle: 4x2 truck + single mount 3 axled trailer (12 wheels)





fyrqom

Vehicle Sensor Network Setup



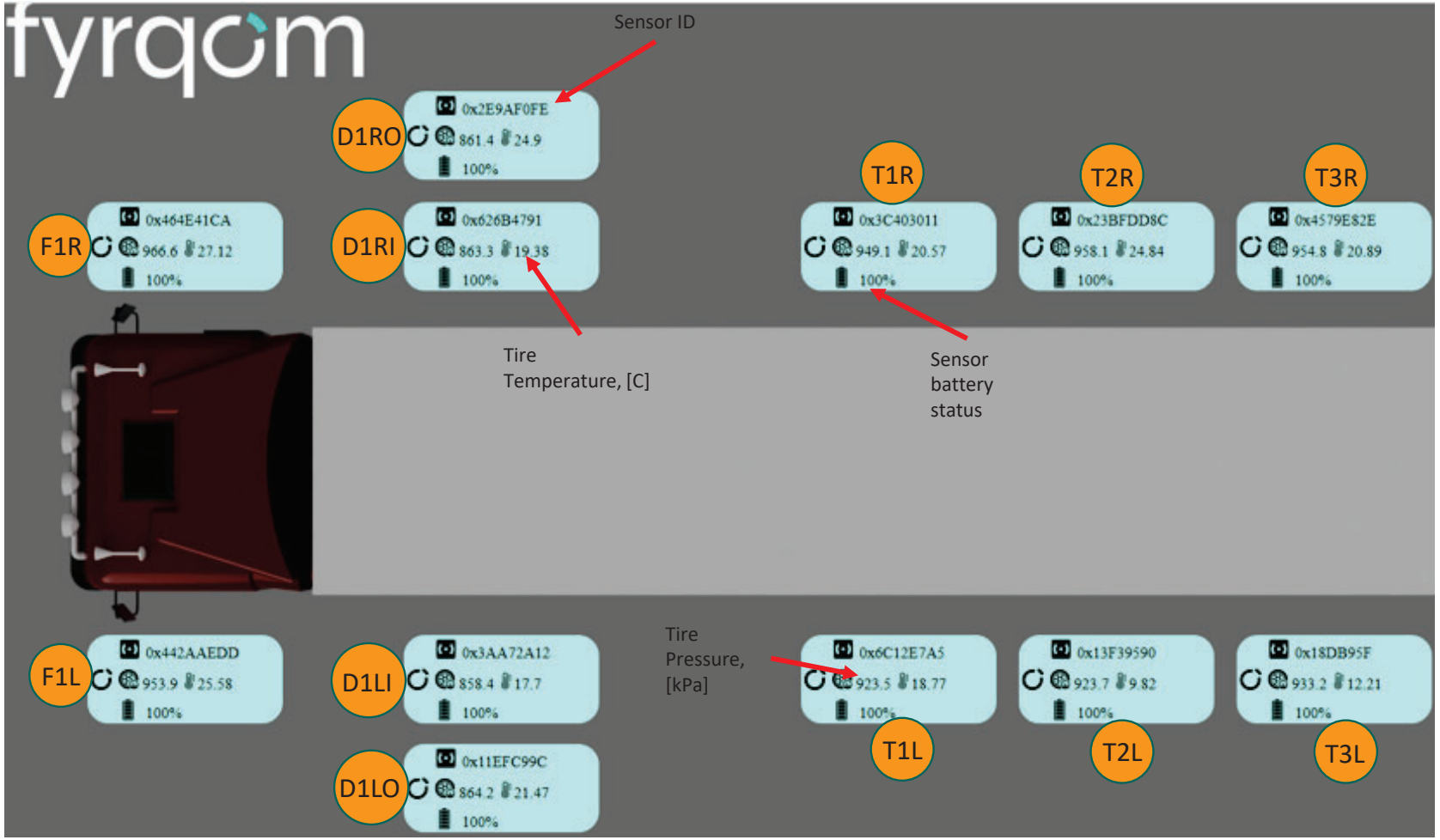
TGW3 and SINK

Battery powered
RS_1 on truck

Battery powered
RS_2 on trailer

fyrqom

Offboard TPMS data



fyrqom

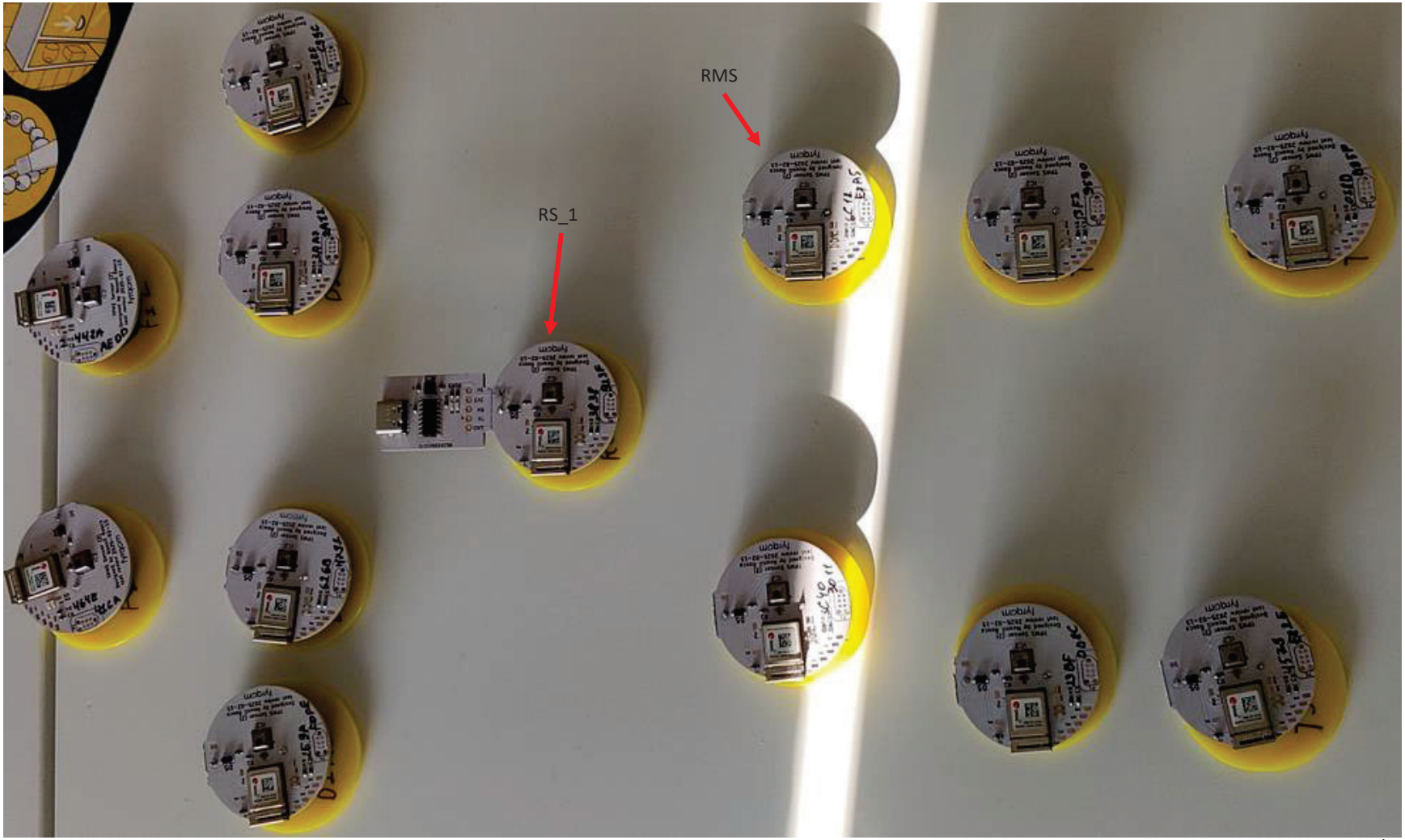
Routing sensors

RS_1

RS_2

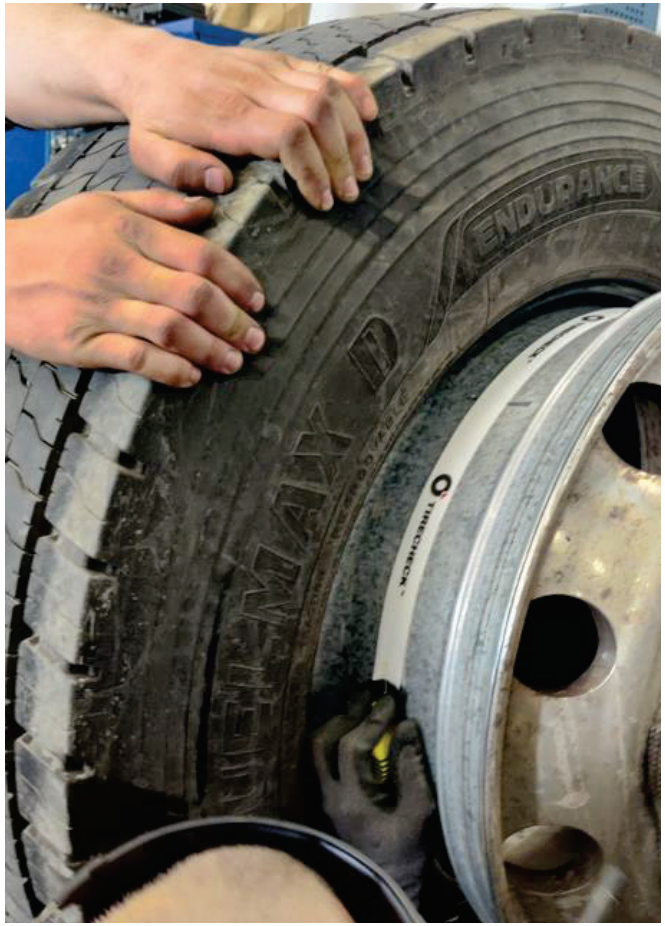
fyrqom

RIM MOUNTED SENSOR (RMS)



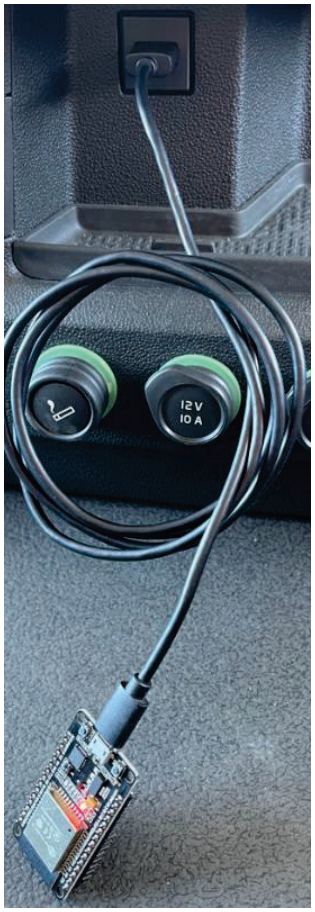
fyrqom

RMS strapping to the rim



fyrqom

3PP BLE temperature sensor

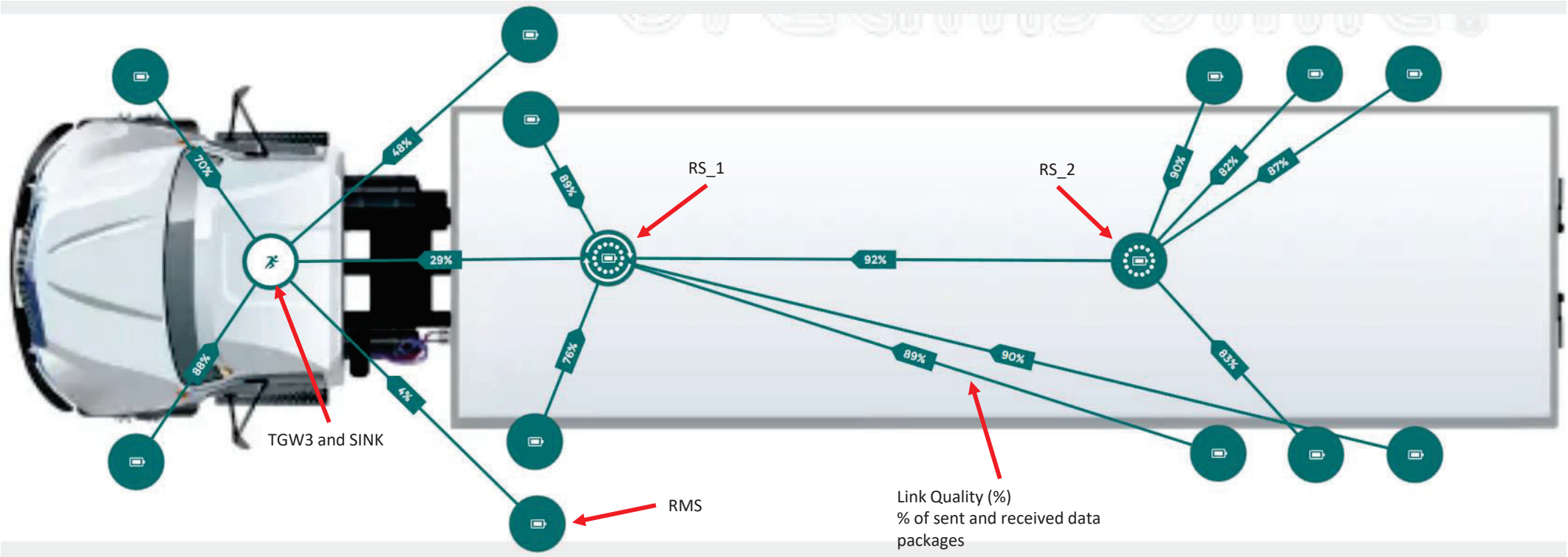


3PP (3rd party BLE sensor) powered from USB port of the vehicle

Temperature value from 3PP BLE sensor routed by VSN to the back-end

fyrqom

Snapshot of VSN



VSN (Vehicle Sensor Network) is formed by the self-routing battery driven wheel integrated (RMS) and chassis mounted (RS) sensors

The wheel integrated sensors besides routing data of nearby sensors measure pressure, temperature, acceleration of the wheels providing an onboard TPMS functionality.

VSN serves as a wireless infrastructure around the vehicle (truck + trailer) capable of reading other 3rd party (3PP) BLE sensors

VSN is continuously monitoring connections between sensors and dynamically adapts for best connection and data transfer to preserve the battery lifetime

fyrqom

VSN Metrics 1 of 2

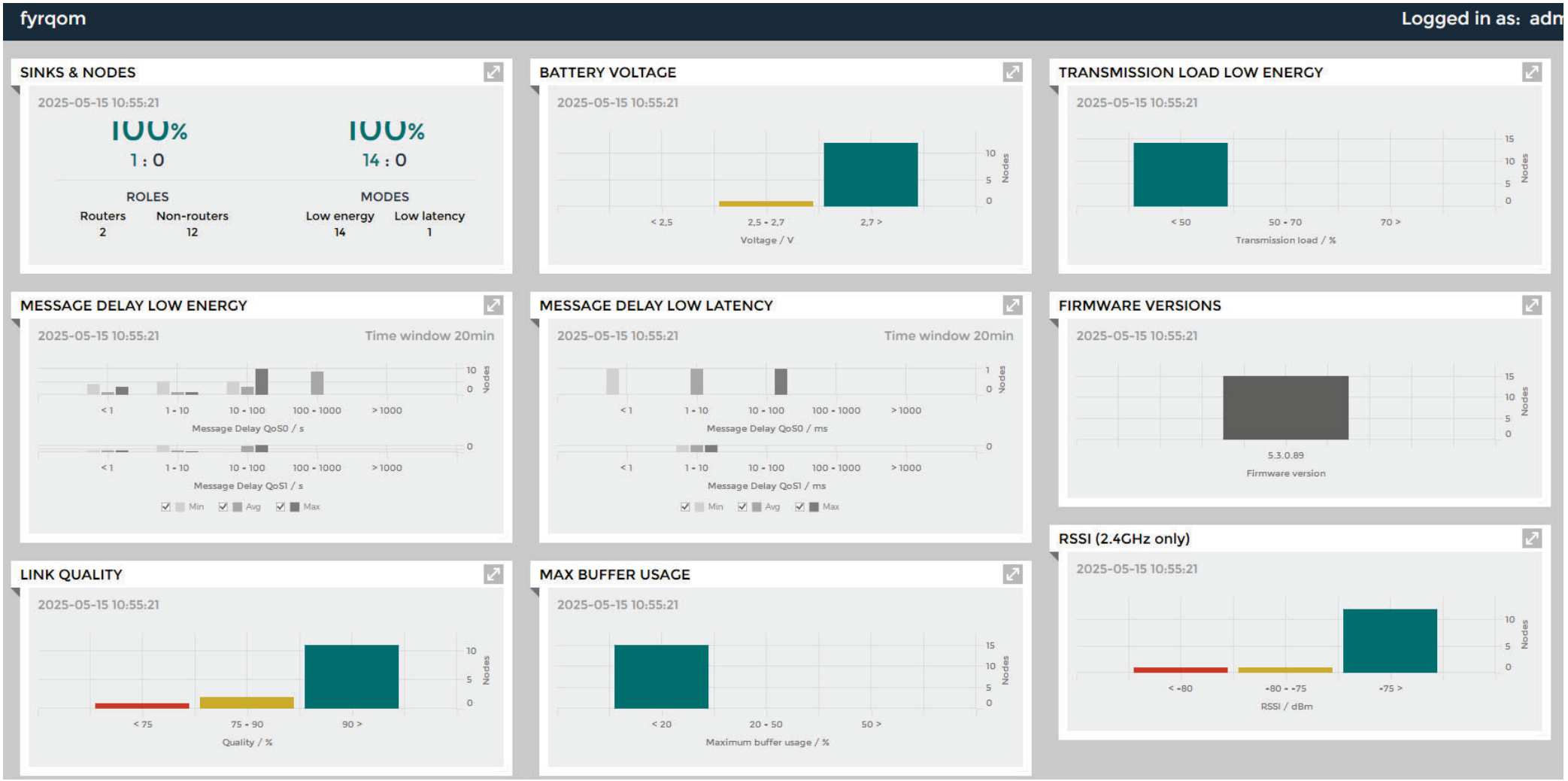
fyrqom

NODES

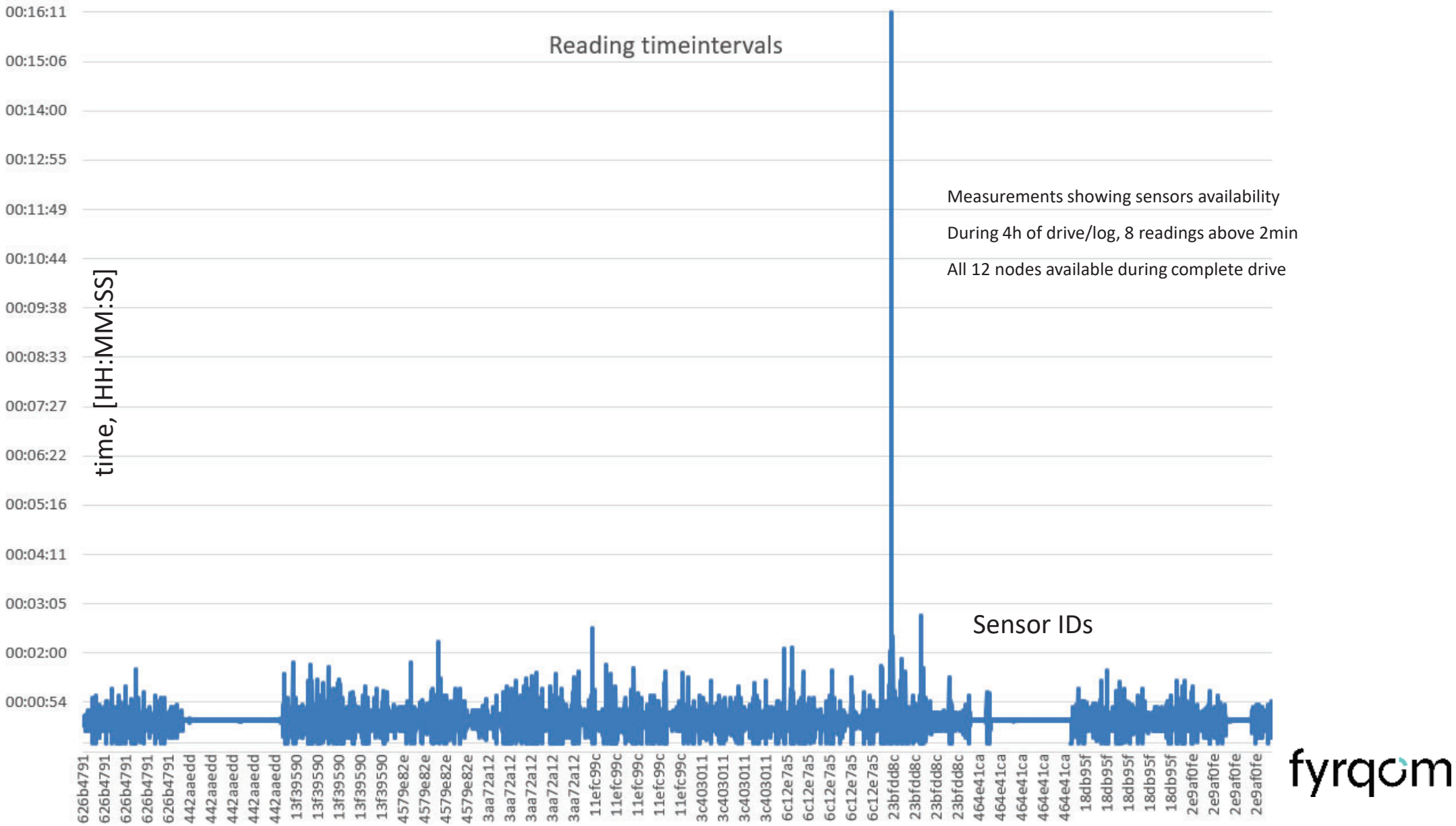
NETWORK	ADDRESS	NODE NAME	ROLE	POSITION ROLE	MODE	AUTO ROLE	BATTERY VOLTAGE	MEMORY ALLOCATION FAILURES	NORMAL PRIORITY DROPPED PACKETS	DROPPED NORMAL AND HIGH PRIORITY PACKETS TOTAL AMOUNT	MAX BUFFER USAGE	
fyrqom	98765	SINK	Sink	Unknown	Low latency	Off					0,00 %	Truck
fyrqom	1143647965	F1L	Non-router	Unknown	Low energy	Off	2,80 V			2	16,08 %	Truck
fyrqom	1651197841	D1RI	Non-router	Unknown	Low energy	Off	2,80 V			2	0,39 %	Truck
fyrqom	943231551	RS1	Router	Unknown	Low energy	On	2,73 V			2	0,00 %	Truck
fyrqom	1010839569	T1R	Non-router	Unknown	Low energy	Off	2,74 V			2	0,78 %	Truck
fyrqom	1813178277	T1L	Non-router	Unknown	Low energy	Off	2,83 V			1	0,78 %	Truck
fyrqom	26065247	T3L	Non-router	Unknown	Low energy	Off	2,84 V			2	0,78 %	Truck
fyrqom	287454020	RS2	Router	Unknown	Low energy	Off				3	1,18 %	Truck
fyrqom	1179533770	F1R	Non-router	Unknown	Low energy	Off	2,79 V			2	0,39 %	Truck
fyrqom	781906174	D1RO	Non-router	Unknown	Low energy	Off	2,77 V			2	0,78 %	Truck
fyrqom	984033810	D1LI	Non-router	Unknown	Low energy	Off	2,82 V			1	0,78 %	Truck
fyrqom	300927388	D1LO	Non-router	Unknown	Low energy	Off	2,59 V			10	0,78 %	Truck
fyrqom	599776652	T2R	Non-router	Unknown	Low energy	Off	2,76 V			73	0,78 %	Truck
fyrqom	334730640	T2L	Non-router	Unknown	Low energy	Off	2,72 V			260	0,78 %	Truck
fyrqom	1165617198	T3R	Non-router	Unknown	Low energy	Off	2,76 V			1	0,39 %	Truck

fyrqom

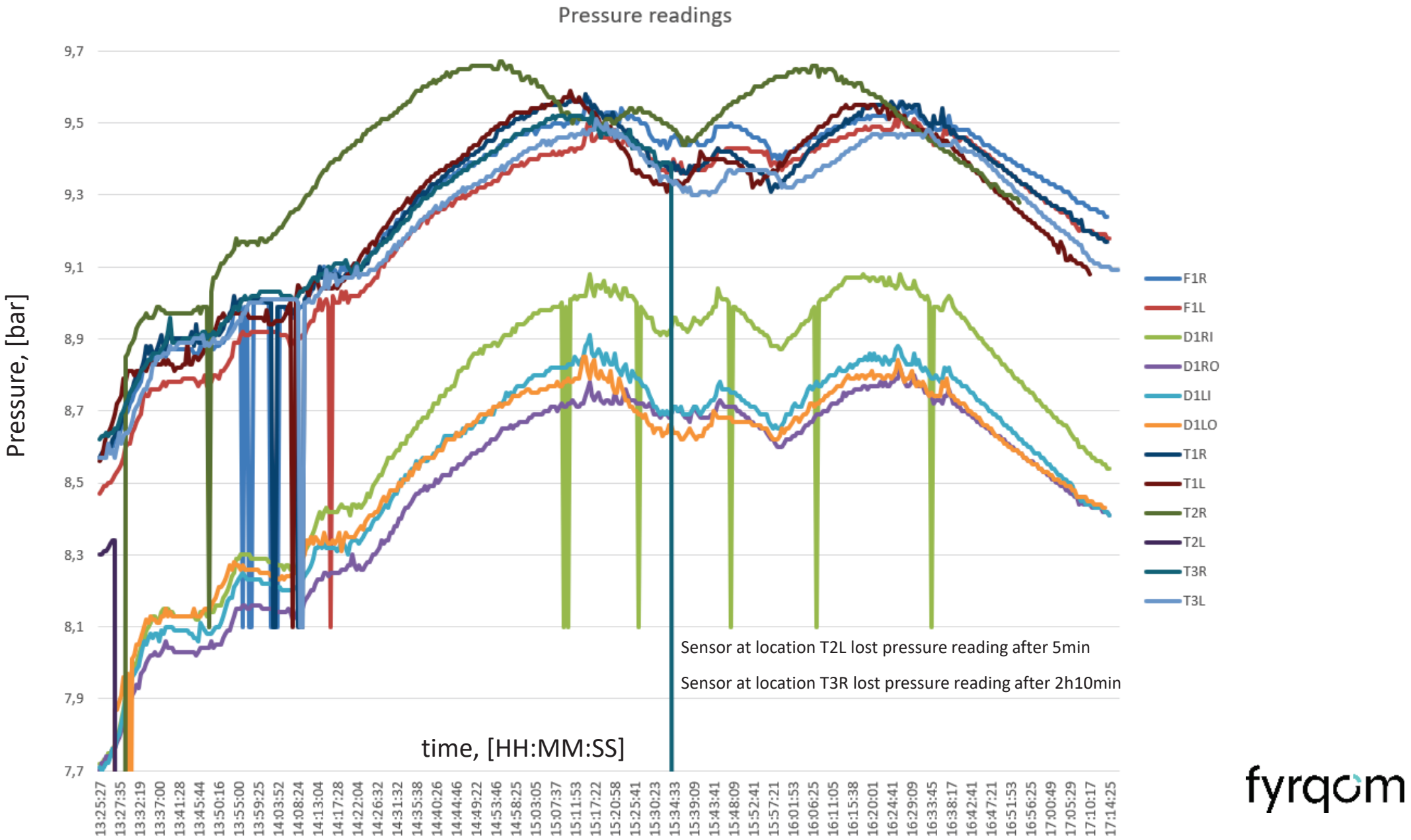
VSN Metrics 2 of 2



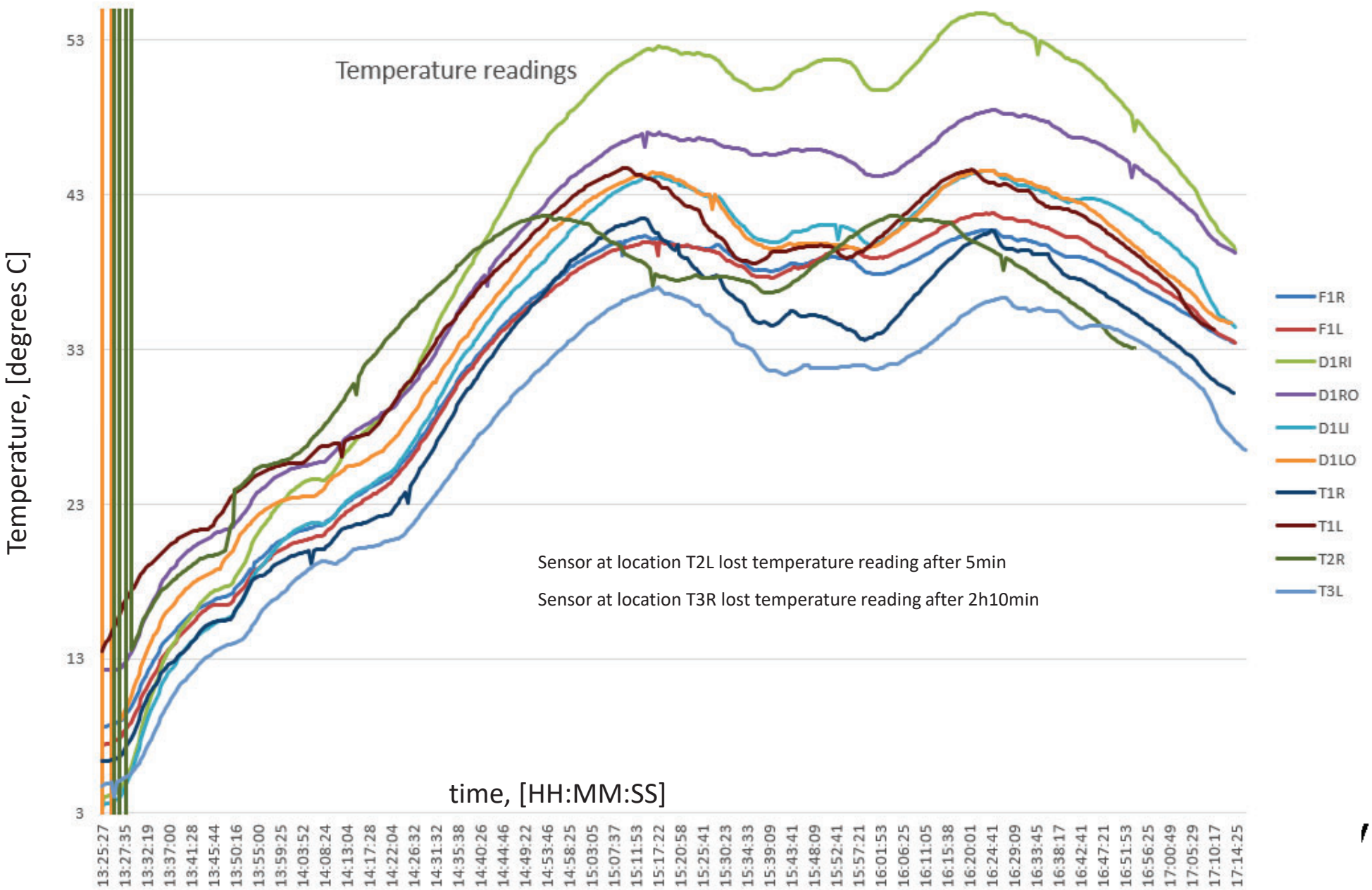
fyrqom


Reading timeintervals
time, [HH:MM:SS]
00:16:11
00:15:06
00:14:00
00:12:55
00:11:49
00:10:44
00:09:38
00:08:33
00:07:27
00:06:22
00:05:16
00:04:11
00:03:05
00:02:00
00:00:54
Measurements showing sensors availability
During 4h of drive/log, 8 readings above 2min
All 12 nodes available during complete drive
Sensor IDs
626b4791
442aaedd
13f39590
4579e82e
3aa72a12
11efc99c
3c403011
6c12e7a5
23bfdd8c
464e41ca
18db95f
2e9af0fe

fyrqom


Pressure readings
Pressure, [bar]
9,7
9,5
9,3
9,1
8,9
8,7
8,5
8,3
8,1
7,9
7,7
F1R
F1L
D1RI
D1RO
D1LI
D1LO
T1R
T1L
T2R
T2L
T3R
T3L
Sensor at location T2L lost pressure reading after 5min
Sensor at location T3R lost pressure reading after 2h10min
time, [HH:MM:SS]
13:25:27
13:27:35
13:32:19
13:37:00
13:41:28
13:45:44
13:50:16
13:55:00
13:59:25
14:03:52
14:08:24
14:13:04
14:17:28
14:22:04
14:26:32
14:31:32
14:35:38
14:40:26
14:44:46
14:49:22
14:53:46
14:58:25
15:03:05
15:07:37
15:11:53
15:17:22
15:20:58
15:25:41
15:30:23
15:34:33
15:39:09
15:43:41
15:48:09
15:52:41
15:57:21
16:01:53
16:06:25
16:11:05
16:15:38
16:20:01
16:24:41
16:29:09
16:33:45
16:38:17
16:42:41
16:47:21
16:51:53
16:56:25
17:00:49
17:05:29
17:10:17
17:14:25

fyrqom


Temperature readings
Temperature, [degrees C]
53
43
33
23
13
3
time, [HH:MM:SS]
13:25:27
13:27:35
13:32:19
13:37:00
13:41:28
13:45:44
13:50:16
13:55:00
13:59:25
14:03:52
14:08:24
14:13:04
14:17:28
14:22:04
14:26:32
14:31:32
14:35:38
14:40:26
14:44:46
14:49:22
14:53:46
14:58:25
15:03:05
15:07:37
15:11:53
15:17:22
15:20:58
15:25:41
15:30:23
15:34:33
15:39:09
15:43:41
15:48:09
15:52:41
15:57:21
16:01:53
16:06:25
16:11:05
16:15:38
16:20:01
16:24:41
16:29:09
16:33:45
16:38:17
16:42:41
16:47:21
16:51:53
16:56:25
17:00:49
17:05:29
17:10:17
17:14:25
F1R
F1L
D1RI
D1RO
D1LI
D1LO
T1R
T1L
T2R
T3L
Sensor at location T2L lost temperature reading after 5min
Sensor at location T3R lost temperature reading after 2h10min

Conclusions and next steps

During the project mesh based IoT-sensor network (VSN) covering both a 2 axled truck and a 3 axled trailer was demonstrated

VSN was created by battery powered mesh capable TPMS sensors integrated in wheels and battery powered sensors assembled on the chassis

VSN was stable during driving in different environments such as parkings, public roads, highways and at different speeds up to 90km/h

Vehicle's telematic unit (TGW3 by Volvo) was updated with a specific designed SW to enable its connection to the VSN

TGW3 was commissioned to fyrCloud (back-end by Fyrqom) by means of multi-APN functionality

TGW3 was able to connect to VSN by means of a BLE dongle attached to TGW3's USB port

Data collected through VSN was displayed in fyrPortal (front-end GUI by Fyrqom, onboard/offboard)

Presented data: sensor ID, tire pressure, tire temperature and sensor battery status

Mesh network was presented in real time showing dynamical connections between VSN sensors

fyrqom

Makes it easy to simplify

fyrqom