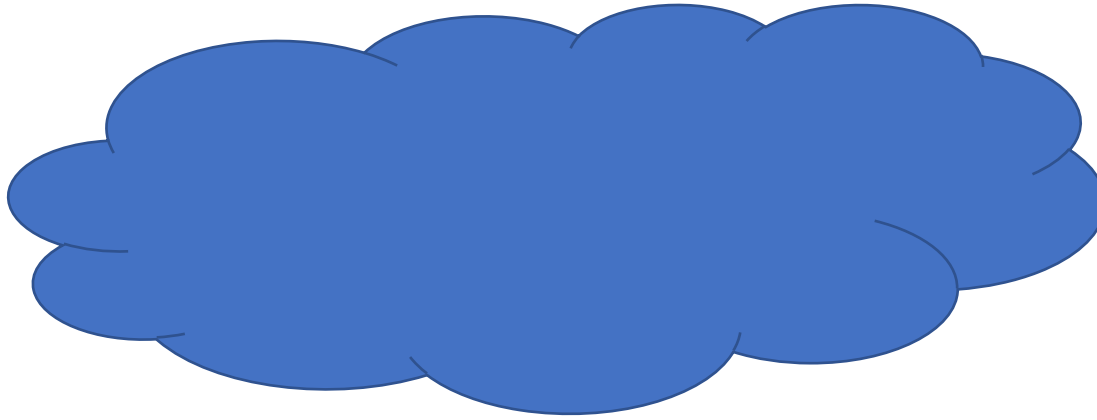
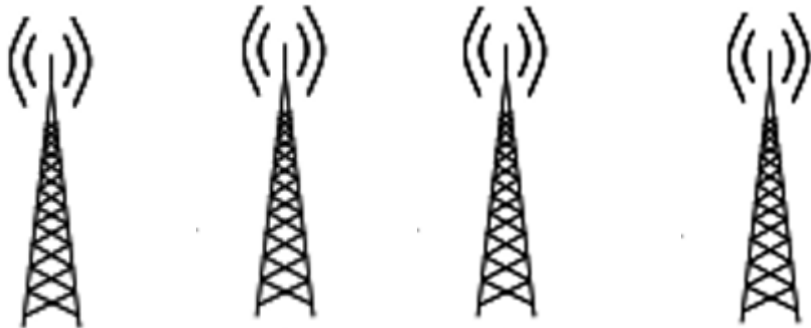


Practical Implementations of Monitoring Phase in 5G eNodeB

Telecom



5G NR

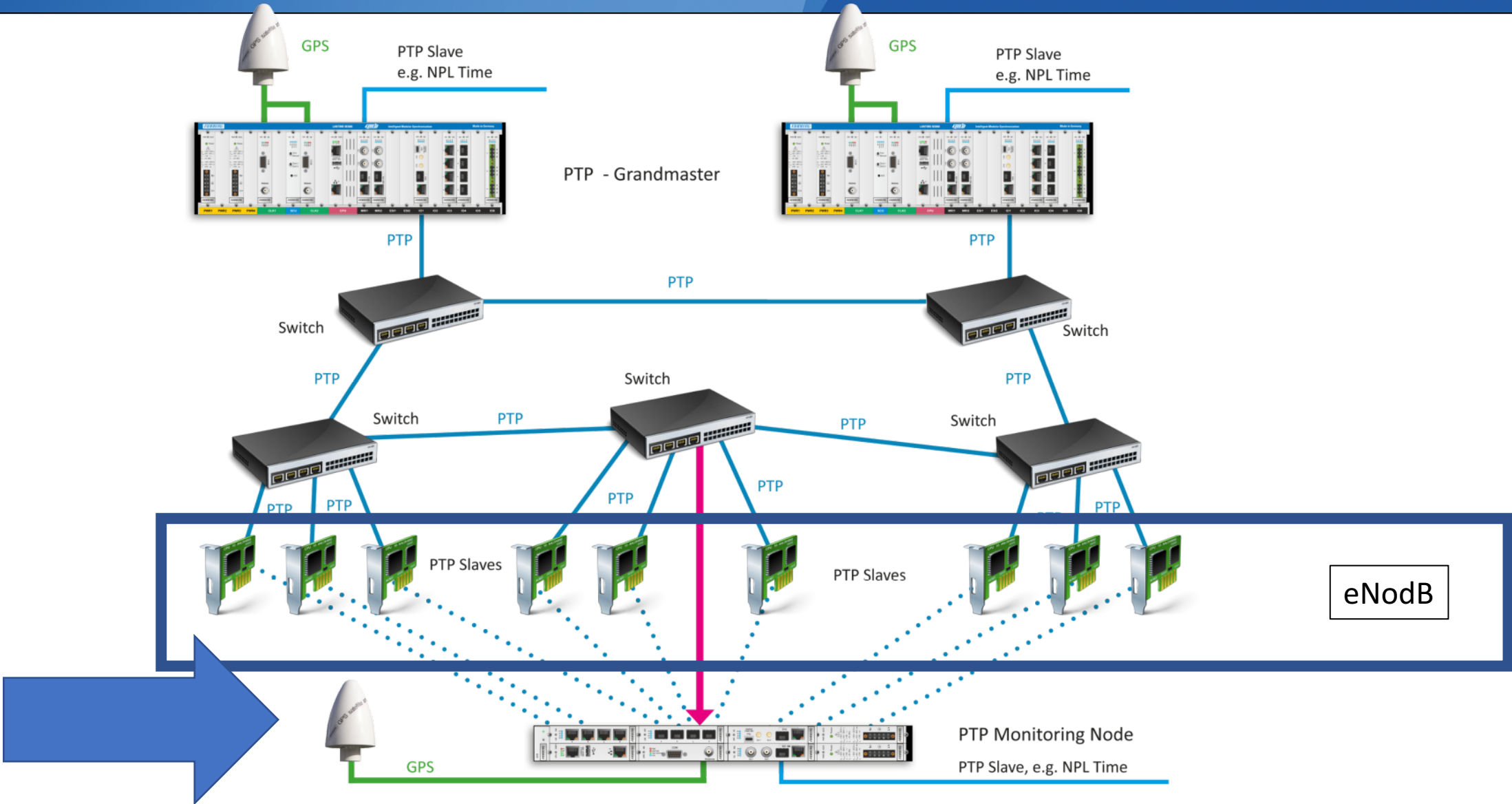


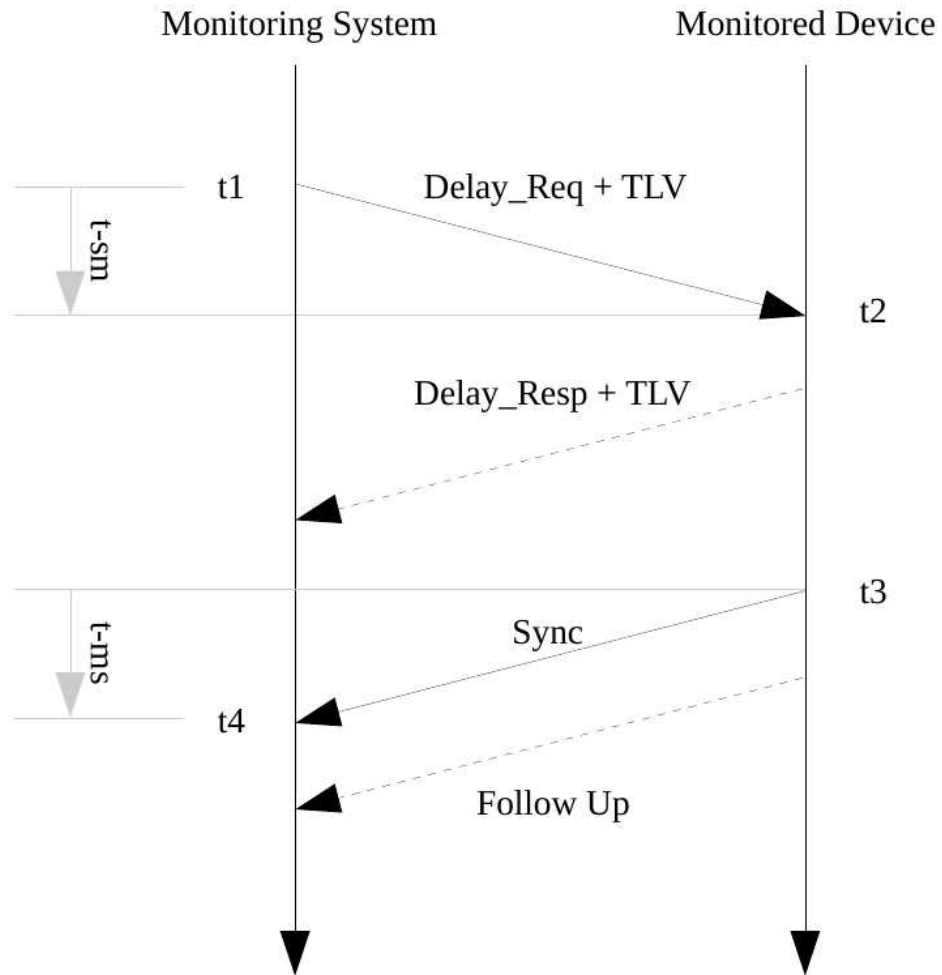
eNodeB

Ericsson asked us:

- **The operator wants a system in which they can see what is happening and get alarm before it happens.**
- **No extra cost for some more units in the network.**
- **No need for people in the field.**

Meinberg's NetSync Monitor





Timestamps
known by MS

t1

t1, t2

t1, t2, t4

t1, t2, t3, t4

Communication is done in unicast

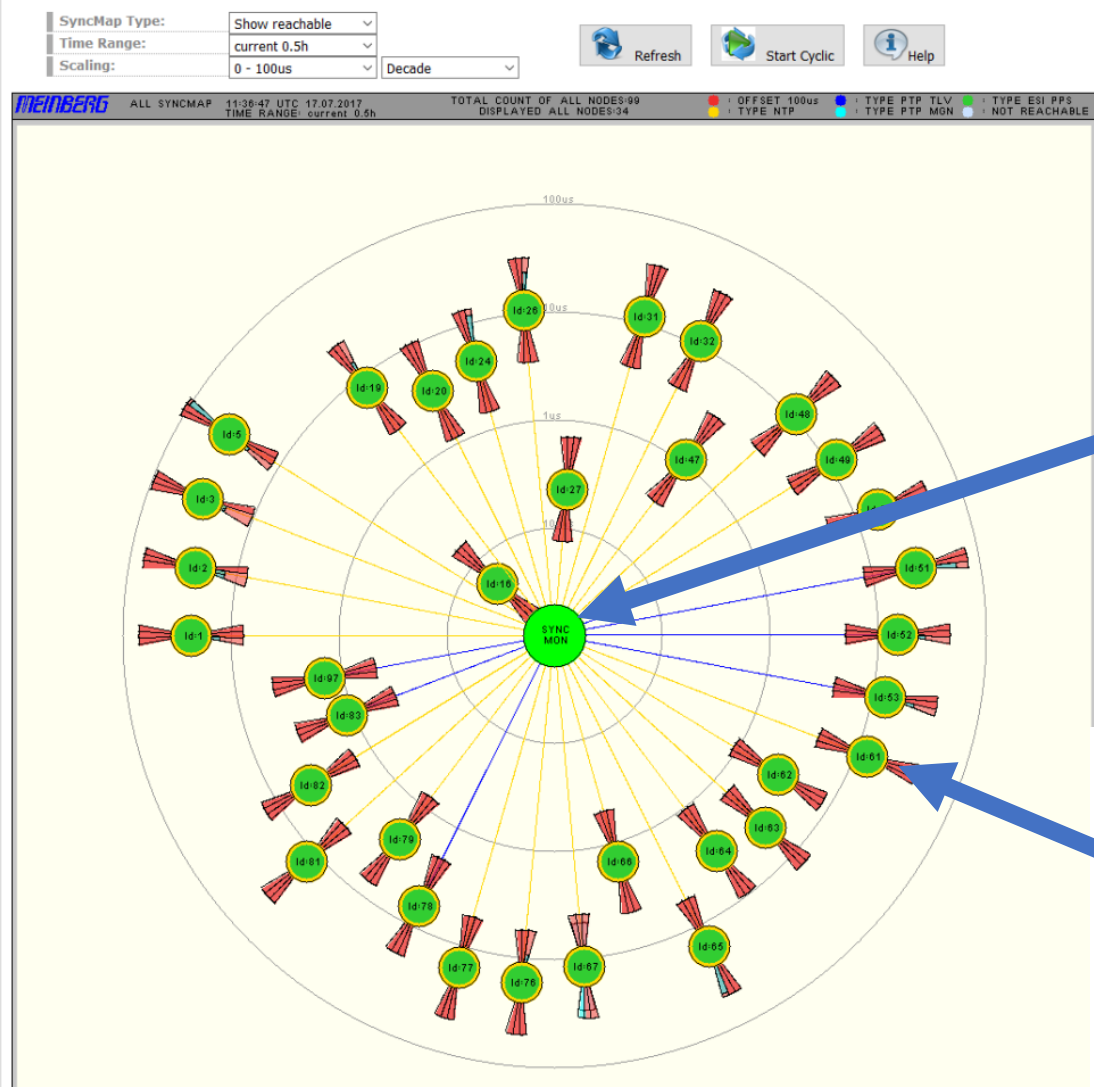
Uses standard PTP message formats

Default Interval is 1 monitoring request every 60 seconds

10 min to get the TLV commands into Ericsson eNodeB.

The testing took weeks



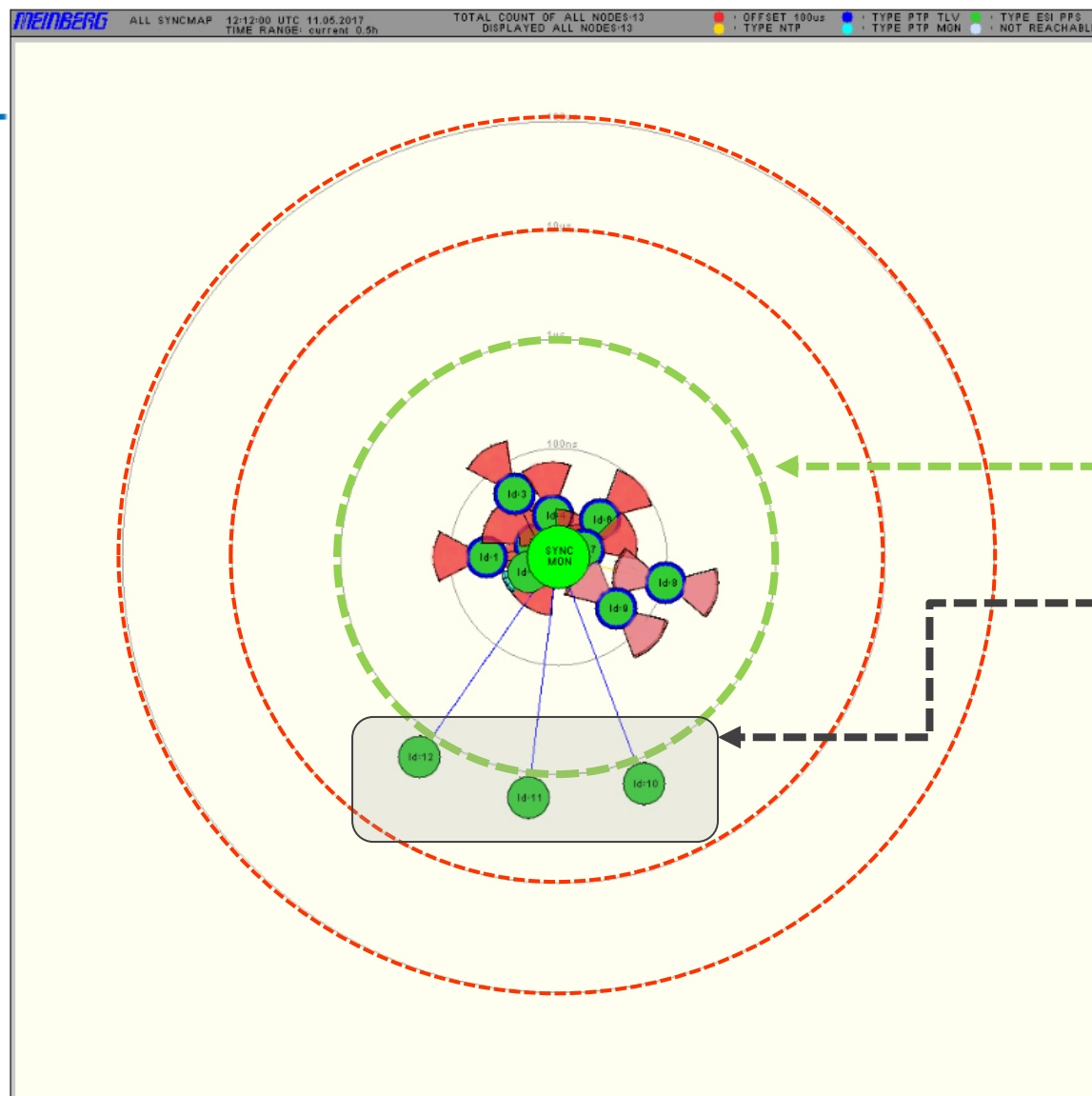


Phase PTP monitoring

ID	GrpID	Alias	Location	Address	Offset	StdDev
1	0	Rack_01_28_1_1	Testraum	172.28.1.1	-74.0ns	+24.76us
2	0	Rack_01_28_1_2	Testraum	172.28.1.2	-74.0ns	+24.76us
3	0	Rack_01_28_1_3	Testraum	172.28.1.3	-74.0ns	+24.76us
4	0	Rack_01_28_1_4	Testraum	172.28.1.4	-74.0ns	+24.76us
5	0	Rack_01_28_1_5	Testraum	172.28.1.5	-74.0ns	+24.76us
6	0	Rack_01_28_1_6	Testraum	172.28.1.6	-74.0ns	+24.76us
7	0	Rack_01_28_1_7	Testraum	172.28.1.7	-74.0ns	+24.76us
8	0	Rack_01_28_1_8	Testraum	172.28.1.8	-74.0ns	+24.76us
9	0	Rack_01_28_1_9	Testraum	172.28.1.9	-74.0ns	+24.76us
10	0	Rack_01_28_1_10	Testraum	172.28.1.10	-74.0ns	+24.76us
11	0	Rack_01_28_1_11	Testraum	172.28.1.11	-74.0ns	+24.76us
12	0	Rack_01_28_1_12	Testraum	172.28.1.12	-74.0ns	+24.76us
13	0	Rack_01_28_1_13	Testraum	172.28.1.13	-74.0ns	+24.76us
14	0	Rack_01_28_1_14	Testraum	172.28.1.14	-74.0ns	+24.76us
15	0	Rack_01_28_1_15	Testraum	172.28.1.15	-74.0ns	+24.76us
16	1	Rack_02_28_2_1	Testraum	172.28.2.1	-74.0ns	+24.76us
17	1	Rack_02_28_2_2	Testraum	172.28.2.2	-74.0ns	+24.76us
18	1	Rack_02_28_2_3	Testraum	172.28.2.3	-74.0ns	+24.76us
19	1	Rack_02_28_2_4	Testraum	172.28.2.4	-74.0ns	+24.76us
20	1	Rack_02_28_2_5	Testraum	172.28.2.5	-74.0ns	+24.76us
21	1	Rack_02_28_2_6	Testraum	172.28.2.6	-74.0ns	+24.76us
22	1	Rack_02_28_2_7	Testraum	172.28.2.7	-74.0ns	+24.76us
23	1	Rack_02_28_2_8	Testraum	172.28.2.8	-74.0ns	+24.76us
24	1	Rack_02_28_2_9	Testraum	172.28.2.9	-74.0ns	+24.76us
25	1	Rack_02_28_2_10	Testraum	172.28.2.10	-74.0ns	+24.76us
26	1	Rack_02_28_2_11	Testraum	172.28.2.11	-74.0ns	+24.76us
27	1	Rack_02_28_2_12	Testraum	172.28.2.12	-74.0ns	+24.76us
28	1	Rack_02_28_2_13	Testraum	172.28.2.13	-74.0ns	+24.76us
29	1	Rack_02_28_2_14	Testraum	172.28.2.14	-74.0ns	+24.76us
30	1	Rack_02_28_2_15	Testraum	172.28.2.15	-74.0ns	+24.76us
31	1	Rack_02_28_2_16	Testraum	172.28.2.16	-74.0ns	+24.76us
32	1	Rack_02_28_2_17	Testraum	172.28.2.17	-74.0ns	+24.76us
33	1	Rack_02_28_2_18	Testraum	172.28.2.18	-74.0ns	+24.76us
34	1	Rack_02_28_2_19	Testraum	172.28.2.19	-74.0ns	+24.76us
35	1	Rack_02_28_2_20	Testraum	172.28.2.20	-74.0ns	+24.76us
36	1	Rack_02_28_2_21	Testraum	172.28.2.21	-74.0ns	+24.76us
37	1	Rack_02_28_2_22	Testraum	172.28.2.22	-74.0ns	+24.76us
38	1	Rack_02_28_2_23	Testraum	172.28.2.23	-74.0ns	+24.76us
39	1	Rack_02_28_2_24	Testraum	172.28.2.24	-74.0ns	+24.76us
40	1	Rack_02_28_2_25	Testraum	172.28.2.25	-74.0ns	+24.76us
41	1	Rack_02_28_2_26	Testraum	172.28.2.26	-74.0ns	+24.76us
42	1	Rack_02_28_2_27	Testraum	172.28.2.27	-74.0ns	+24.76us
43	1	Rack_02_28_2_28	Testraum	172.28.2.28	-74.0ns	+24.76us
44	1	Rack_02_28_2_29	Testraum	172.28.2.29	-74.0ns	+24.76us
45	1	Rack_02_28_2_30	Testraum	172.28.2.30	-74.0ns	+24.76us
46	1	Rack_02_28_2_31	Testraum	172.28.2.31	-74.0ns	+24.76us
47	1	Rack_02_28_2_32	Testraum	172.28.2.32	-74.0ns	+24.76us
48	1	Rack_02_28_2_33	Testraum	172.28.2.33	-74.0ns	+24.76us
49	1	Rack_02_28_2_34	Testraum	172.28.2.34	-74.0ns	+24.76us
50	1	Rack_02_28_2_35	Testraum	172.28.2.35	-74.0ns	+24.76us
51	1	Rack_02_28_2_36	Testraum	172.28.2.36	-74.0ns	+24.76us
52	1	Rack_02_28_2_37	Testraum	172.28.2.37	-74.0ns	+24.76us
53	1	Rack_02_28_2_38	Testraum	172.28.2.38	-74.0ns	+24.76us
54	1	Rack_02_28_2_39	Testraum	172.28.2.39	-74.0ns	+24.76us
55	1	Rack_02_28_2_40	Testraum	172.28.2.40	-74.0ns	+24.76us
56	1	Rack_02_28_2_41	Testraum	172.28.2.41	-74.0ns	+24.76us
57	1	Rack_02_28_2_42	Testraum	172.28.2.42	-74.0ns	+24.76us
58	1	Rack_02_28_2_43	Testraum	172.28.2.43	-74.0ns	+24.76us
59	1	Rack_02_28_2_44	Testraum	172.28.2.44	-74.0ns	+24.76us
60	1	Rack_02_28_2_45	Testraum	172.28.2.45	-74.0ns	+24.76us
61	1	Rack_02_28_2_46	Testraum	172.28.2.46	-74.0ns	+24.76us
62	1	Rack_02_28_2_47	Testraum	172.28.2.47	-74.0ns	+24.76us
63	1	Rack_02_28_2_48	Testraum	172.28.2.48	-74.0ns	+24.76us
64	1	Rack_02_28_2_49	Testraum	172.28.2.49	-74.0ns	+24.76us
65	1	Rack_02_28_2_50	Testraum	172.28.2.50	-74.0ns	+24.76us
66	1	Rack_02_28_2_51	Testraum	172.28.2.51	-74.0ns	+24.76us
67	1	Rack_02_28_2_52	Testraum	172.28.2.52	-74.0ns	+24.76us
68	1	Rack_02_28_2_53	Testraum	172.28.2.53	-74.0ns	+24.76us
69	1	Rack_02_28_2_54	Testraum	172.28.2.54	-74.0ns	+24.76us
70	1	Rack_02_28_2_55	Testraum	172.28.2.55	-74.0ns	+24.76us
71	1	Rack_02_28_2_56	Testraum	172.28.2.56	-74.0ns	+24.76us
72	1	Rack_02_28_2_57	Testraum	172.28.2.57	-74.0ns	+24.76us
73	1	Rack_02_28_2_58	Testraum	172.28.2.58	-74.0ns	+24.76us
74	1	Rack_02_28_2_59	Testraum	172.28.2.59	-74.0ns	+24.76us
75	1	Rack_02_28_2_60	Testraum	172.28.2.60	-74.0ns	+24.76us
76	1	Rack_02_28_2_61	Testraum	172.28.2.61	-74.0ns	+24.76us
77	1	Rack_02_28_2_62	Testraum	172.28.2.62	-74.0ns	+24.76us
78	1	Rack_02_28_2_63	Testraum	172.28.2.63	-74.0ns	+24.76us
79	1	Rack_02_28_2_64	Testraum	172.28.2.64	-74.0ns	+24.76us
80	1	Rack_02_28_2_65	Testraum	172.28.2.65	-74.0ns	+24.76us
81	1	Rack_02_28_2_66	Testraum	172.28.2.66	-74.0ns	+24.76us
82	1	Rack_02_28_2_67	Testraum	172.28.2.67	-74.0ns	+24.76us
83	1	Rack_02_28_2_68	Testraum	172.28.2.68	-74.0ns	+24.76us
84	1	Rack_02_28_2_69	Testraum	172.28.2.69	-74.0ns	+24.76us
85	1	Rack_02_28_2_70	Testraum	172.28.2.70	-74.0ns	+24.76us
86	1	Rack_02_28_2_71	Testraum	172.28.2.71	-74.0ns	+24.76us
87	1	Rack_02_28_2_72	Testraum	172.28.2.72	-74.0ns	+24.76us
88	1	Rack_02_28_2_73	Testraum	172.28.2.73	-74.0ns	+24.76us
89	1	Rack_02_28_2_74	Testraum	172.28.2.74	-74.0ns	+24.76us
90	1	Rack_02_28_2_75	Testraum	172.28.2.75	-74.0ns	+24.76us
91	1	Rack_02_28_2_76	Testraum	172.28.2.76	-74.0ns	+24.76us
92	1	Rack_02_28_2_77	Testraum	172.28.2.77	-74.0ns	+24.76us
93	1	Rack_02_28_2_78	Testraum	172.28.2.78	-74.0ns	+24.76us
94	1	Rack_02_28_2_79	Testraum	172.28.2.79	-74.0ns	+24.76us
95	1	Rack_02_28_2_80	Testraum	172.28.2.80	-74.0ns	+24.76us
96	1	Rack_02_28_2_81	Testraum	172.28.2.81	-74.0ns	+24.76us
97	1	Rack_02_28_2_82	Testraum	172.28.2.82	-74.0ns	+24.76us
98	1	Rack_02_28_2_83	Testraum	172.28.2.83	-74.0ns	+24.76us
99	1	Rack_02_28_2_84	Testraum	172.28.2.84	-74.0ns	+24.76us



SyncMap



- currently reachable nodes are shown in the Sync Map

configured limit

violating nodes



Alarm Signal Messages

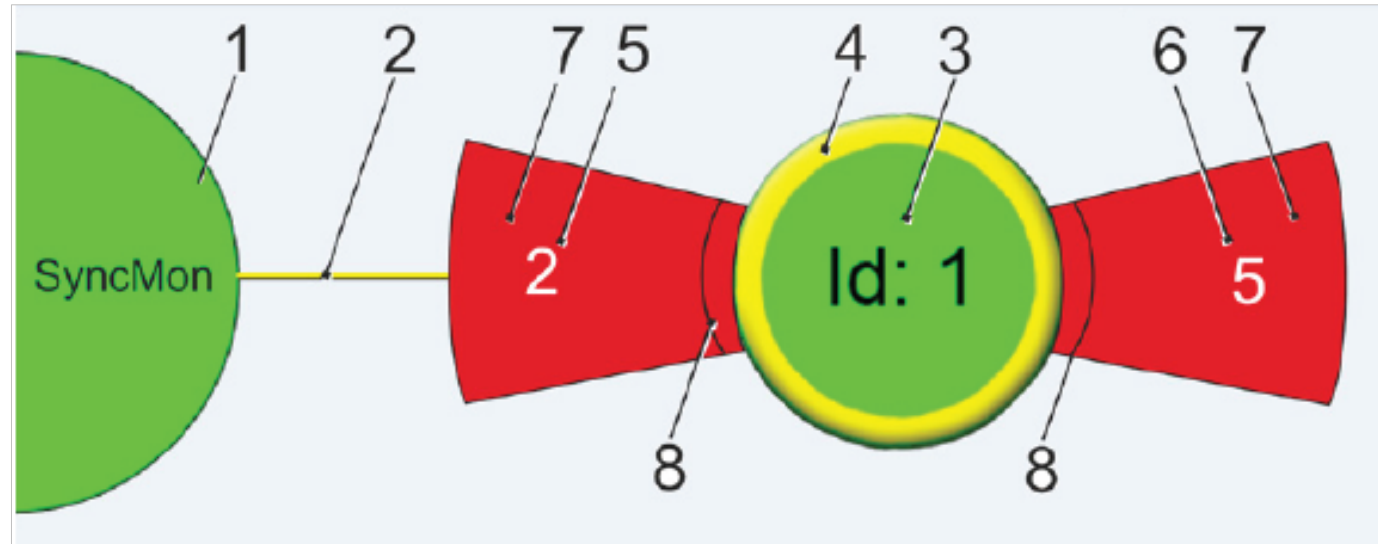
- via SNMP
- via E-Mail

Visual overview with a SyncMap – all nodes or selected group depicted in a polar diagram

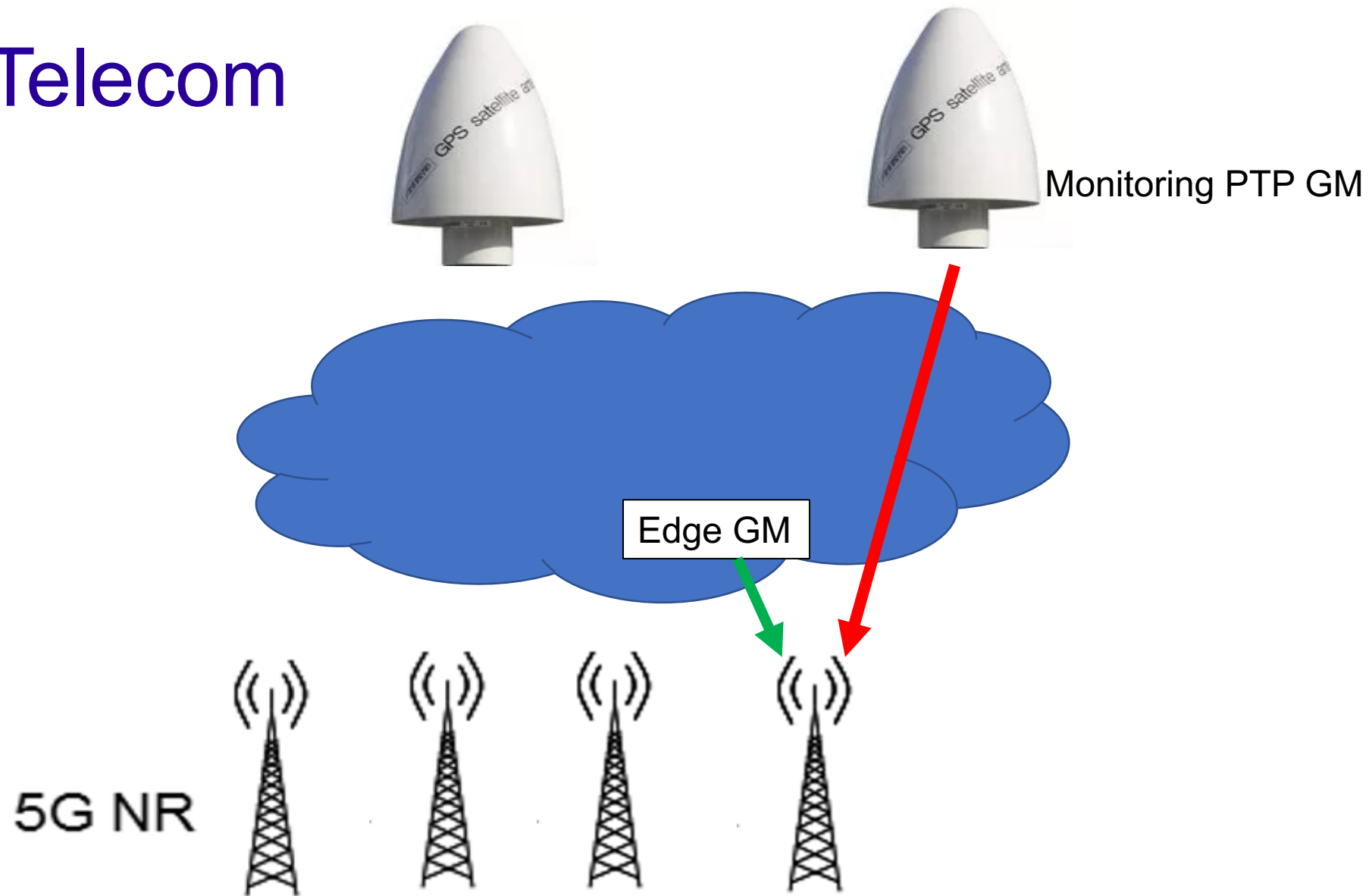
Symbols representing additional statistical information (min / max offset, standard dev.)

Color Legend:

- Status: green = Offset < Limit
red = Offset \geq Limit or outside the maximum scaling
- Type: yellow = NTP
dark blue = PTP with TLV
light blue = PTP with MGMT
green = ESI PPS
grey = not available



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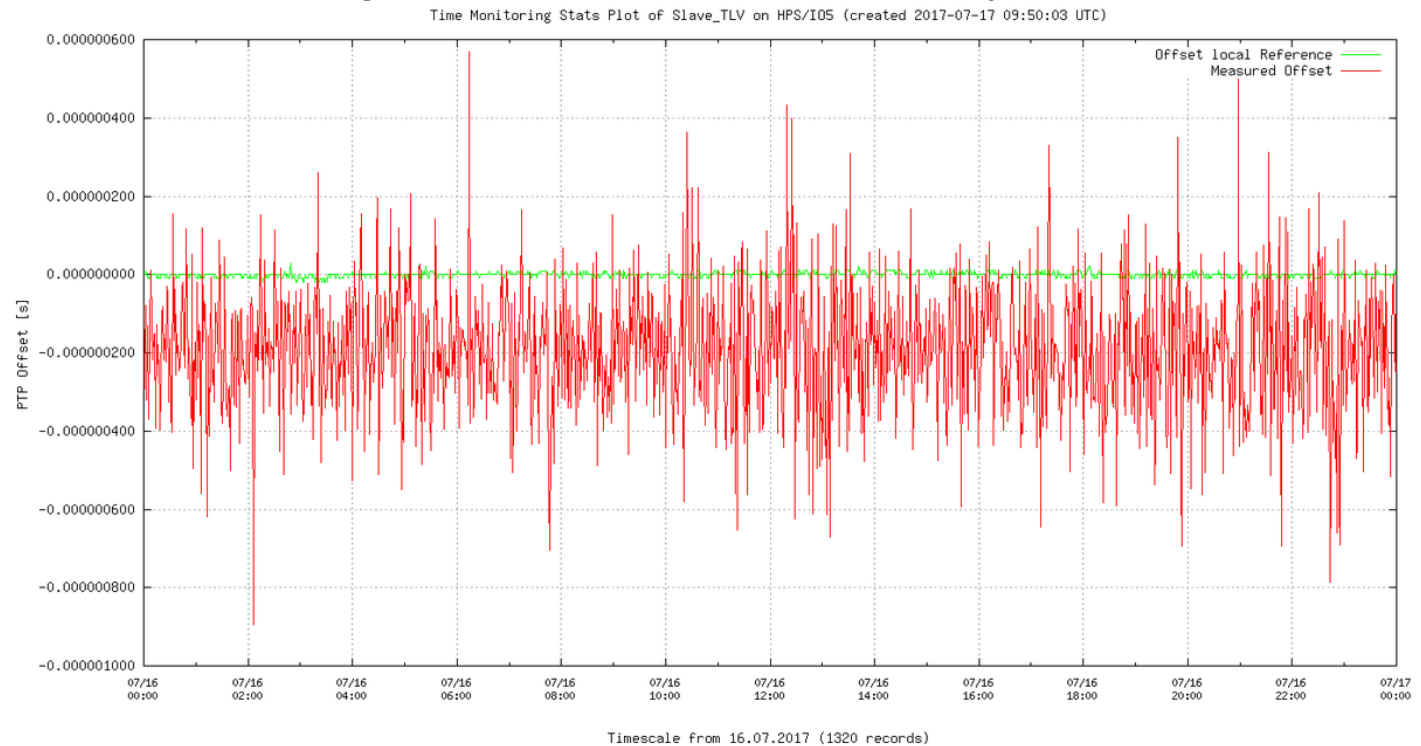


Graphical representation for each NTP / PTP / PPS monitored node

Selectable time intervals (day, week, month or manual selection)

The red line represents the measured offset, the green line represents the sync node reference

Logged data are saved to the internal flash card, or via *rsync* mirrored to an external storage



**Ericsson MicroWave will
implement TLV in their
PTP products**



Why customer and supplier should use this software for PTP units

- Free software**
- Reduce the need of edge grandmasters**
- No need for sync probe**
- Can easily see how the network behave**

Following companies has implement TLV comands:

<https://blog.meinbergglobal.com/2018/05/13/ptp-monitor-how-it-works/>

<https://blog.meinbergglobal.com/2018/05/10/the-virtues-of-clock-watching-why-its-important-to-monitor-your-timing-network/>

<https://www.youtube.com/watch?v=IHHrkJrOsT8>



If you want TLV comand document send a mail to

THANKS to Ericsson

- Mikael
- Seth
- Richard
- Anders
- Per-Erik
- Jonas
- Mats