IEC 61850 Tissue Issue

The German VDE/FNN project group (PG Steuerbox) is a committee aiming at the specification of a switching device, called Steuerbox, to be used in the automation of local distribution networks. Thus it heavily relies on the definition of schedules and their properties as described in TR 90-10, now integrated into the new 7-4:2020 edition.

Applying the standard's schedule definitions to practical use cases caused some discussion on how to interpret IEC 61850-7-4:2020.

Part 7-4 states (Annex K.2.4)

> *In case, for whatever reason, the schedule cannot start at the time given by the occurrence of a start time setting, but afterwards, then the schedule will run sharply as if it has started at the time given by the start time setting. Said in other words, the schedule won't shift the scheduled values based on the real-time start.*

This general rule should rigorously be applied to all schedule start times.

Background

German VDE FNN Project Group Steuerbox concluded that an enabled periodic schedule would run as if enabled with its last (periodic) start time, if it were still running from this start.

An example:
Consider a schedule, name it FSCH001, that contains a start time StrTm001.
StrTm001 contains data attributes
- setTm, shall be undefined (1970-01-01 T 00:00:00)
- setCal, shall define a cyclic time setting, starting the schedule every day at noon UTC (12:00:00).

SchdIntv be 3600 s, so the schedule ends at 13:00:00.
We enable the schedule at different times 11:30 and 12:30.

A) FNN interpretation of cyclic starting points

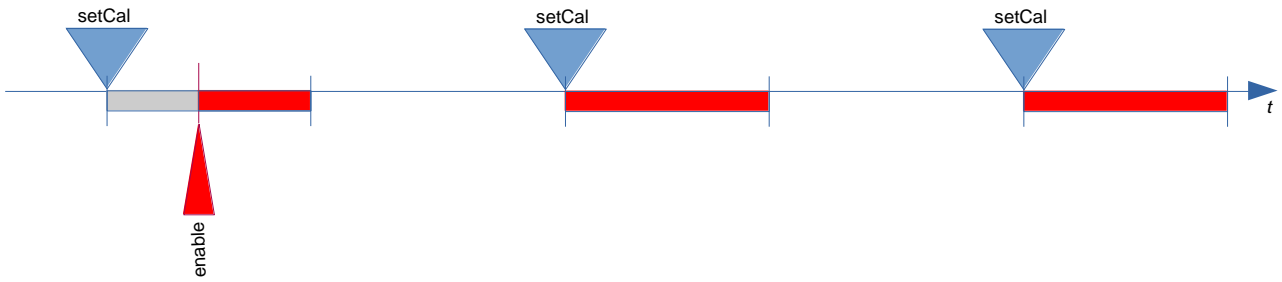| enable at	schedule becomes ,running' at time
11:30	this day, 12:00
12:30	this day, 12:30, runs as if started at 12:00

Fig. 1: Late enable runs schedule as if started before/with last cycle start time

Note: A red line shows the schedule as running.

B) Competing interpretation

A different Interpretation of the cyclic start times would state that the schedule would rather start with the next starting point, like so

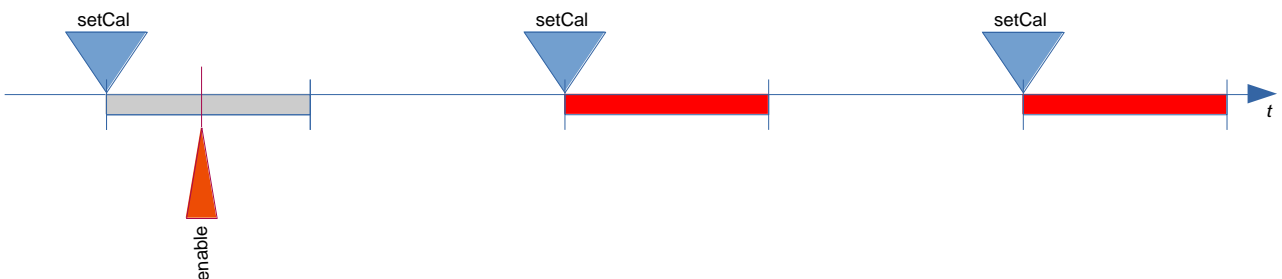| enable at	schedule becomes ‚running' at time
11:30	this day, 12:00
12:30	next day, 12:00

Fig. 2: A different interpretation: Late enable leads to skipping the rest of the schedule

Situation with an Additional UTC Start Time

A similar situation arises if the cyclical start time is augmented with a single UTC time (see figures below). As long as the enable occurs before the first cyclic start time, the schedule may run over its full length. This seems to be widely agreed upon.
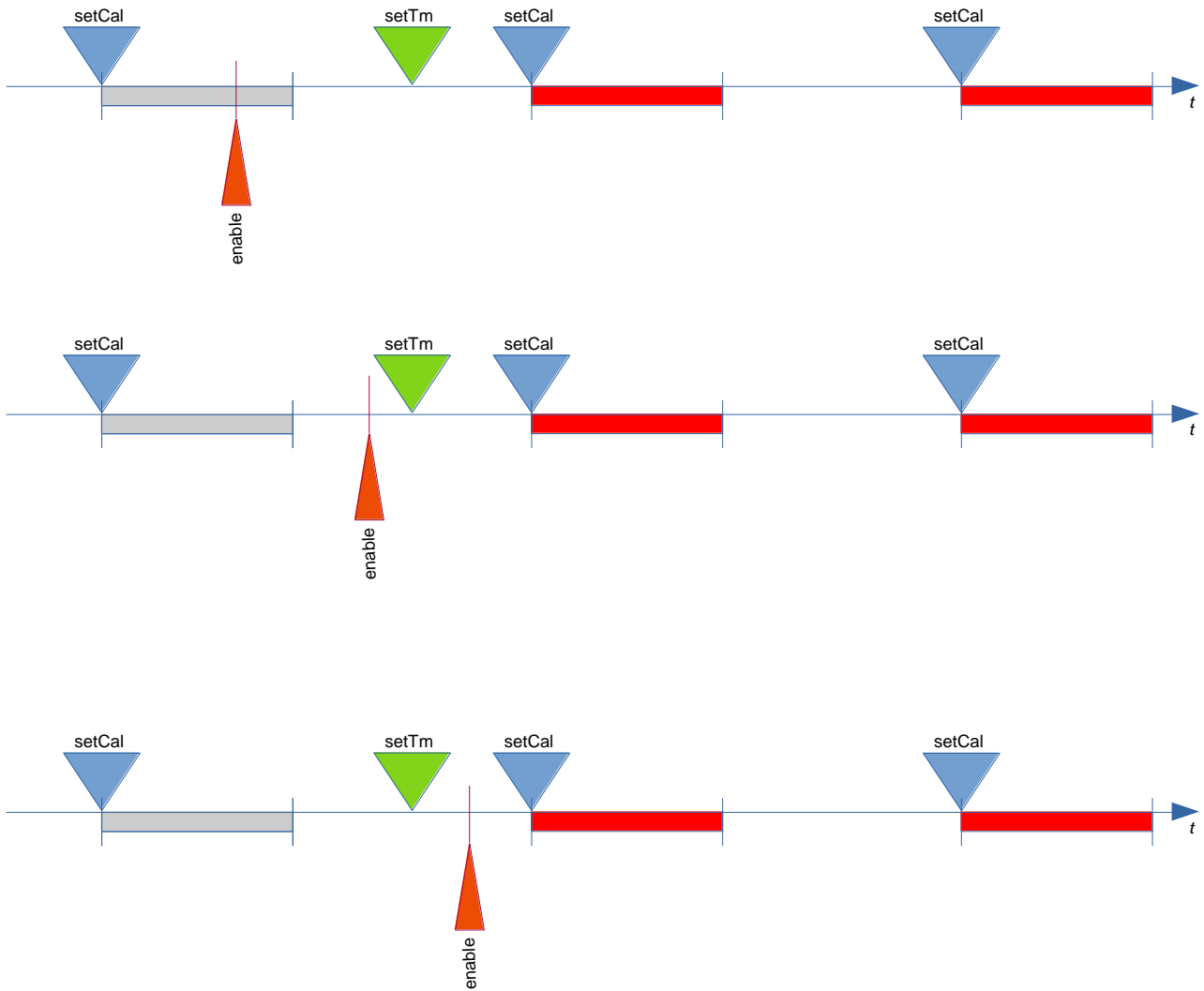
Fig. 3: Schedule enabled before UTC start time: The schedule will completely run from its first cyclic start time after the UTC time.

If the enable operation occurs after a cyclic start time, the schedule should run as if started at that cyclic start time, i.e. become running immediately after the enable.
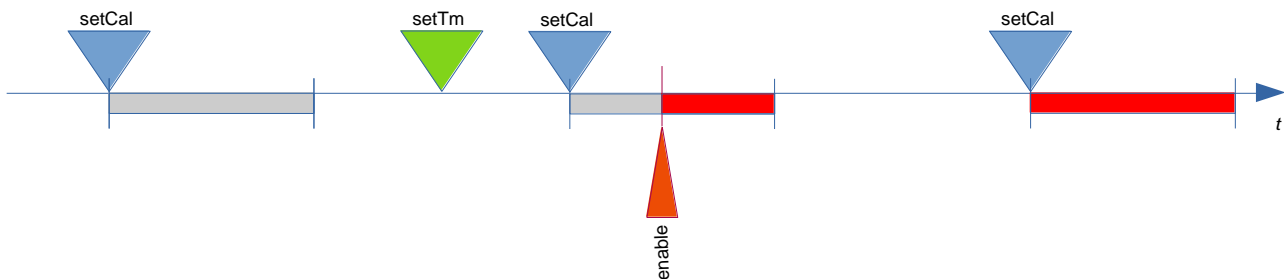

Fig. 4: Schedule starts immediately if enabled after cyclic start time.

Part 7-4 could be also interpreted in a way that such a situation would result in the schedule waiting for the next cyclic start time to become running, which is considered not appropriate.

If, for example, an enable operation was delayed, for reasons like loss of communication or supply outage, the schedule will only run with the next cycle, which is undesirable in most cases.

Practical consequences

VDE/FNN PG Steuerbox wants to implement different use cases using IEC61850 schedules.

One of them ("direct command") is an immediate load switching, requiring immediate action from the IED. It is required that on an enable operation the schedule would immediately become running an output a designated value.

An implementation based on A) would require a schedule running a single interval, say an hour long, and a cyclic start time that starts it at least every hour, so that, if once enabled and running, the schedule would output a single value, until it was disabled again.

Values, e.g.

- NumEntr=1,
- SchdIntv=3600s,
- StrTm01.setTm=0,
- StrTm01.setCal.occType=Time,
- StrTm01.setCal.occPer=Hour,
- StrTm01.setCal.mn=0,
- ValASG001=<output value>.

Following behavior A), the schedule would run immediately after being enabled, which is exactly what is needed. Output ends with disabling the schedule.

Holding to interpretation B) the schedule would not start immediately after the enable op, but with the next cyclic start time.

Note that, in general, a behaviour like B) could simply be achieved under interpretation A) by setting setTm to the intended start time. The other way round, behaviour A) could not be accomplished as easily under an interpretation B).

Short Subject	Clarification of Schedule Start Time Interpretation
Which part	Part 7-4:2020
Page	481
Clause	
Paragraph	K2.4
Detailed description	From the text it is not obviously clear how cyclic schedule start times are to be interpreted.
Solution	Unambiguously specify a distinct interpretation of the start times.

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