

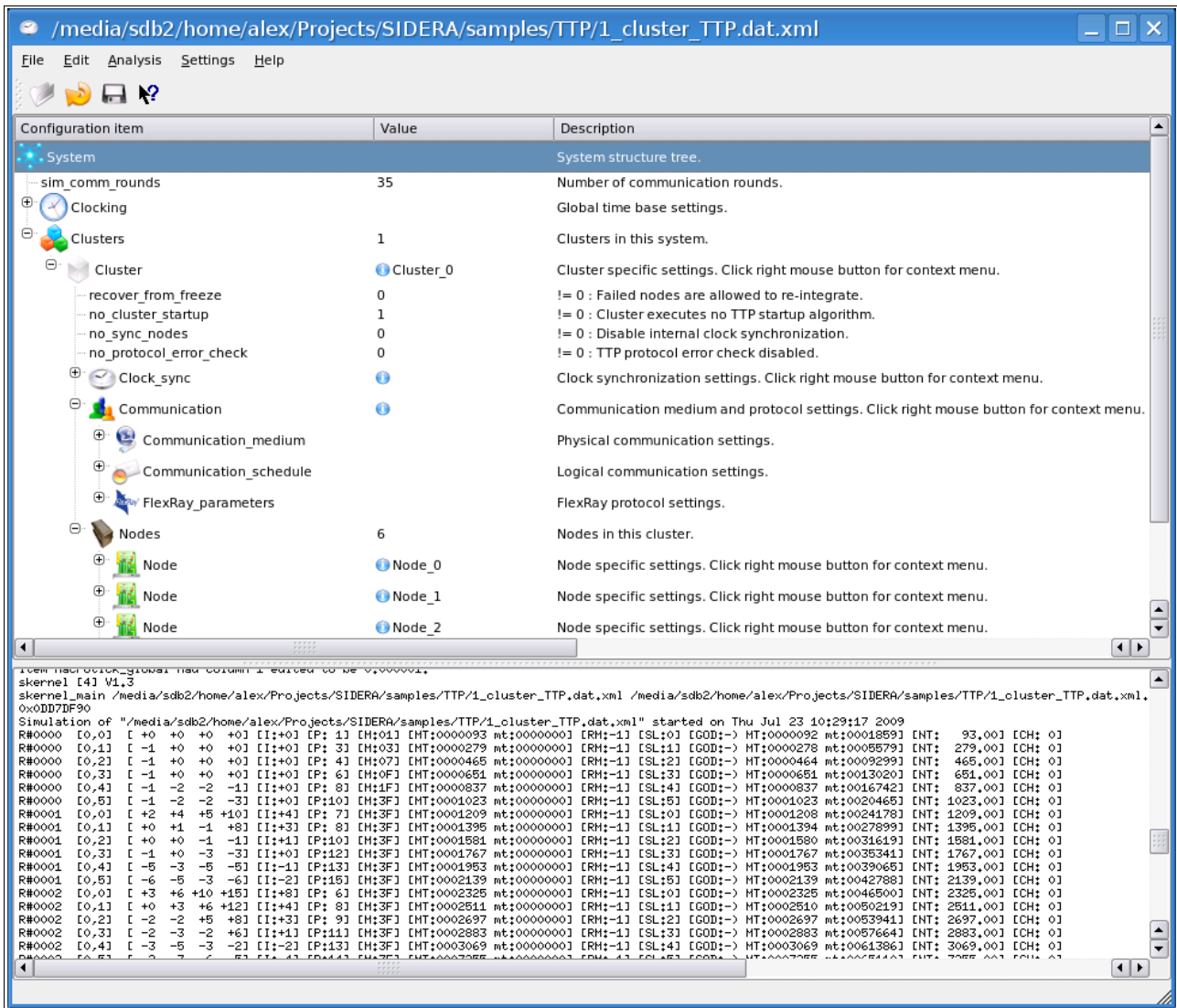
## SIDERA – Frequently Asked Questions

1 What is SIDERA?.....	1
2 How is the GUI structured?.....	2
3 How can I get help for the different application menu items?.....	3
4 How can I change the value of a configuration item?.....	3
5 How can I figure out the meaning of the different configuration items?.....	3
6 What is the meaning of the blue "Info" icon shown for some configuration items in the column "Value"?.....	4
7 What is the meaning of the non-editable numeric value shown for some configuration items in the column "Value"?.....	4
8 How can I add or remove configuration items?.....	4
9 How many failures per failure class and node can be defined?.....	5
10 How can a FlexRay cluster be configured?.....	5
11 What is the "Cluster/no_cluster_startup" configuration item?.....	6
12 What is the "Clock_sync/delta_0" configuration item ?.....	7
13 How can a multi-cluster system be configured?.....	7
14 What is displayed in the log window while simulation is running?.....	9
15 Can SIDERA be started in a batch mode to allow execution of a sequence of different tests?.....	9
16 Which output files are generated during simulation?.....	10
17 Can I run some experiments and analyze the results at a later time?.....	10
18 How are the local clocks initialized?.....	11
19 What is the meaning of the „Clock_sync/Clock_calibration“ configuration item?.....	12
20 What are the caveats for the configuration of the „Communication_schedule“?.....	13

### 1 What is SIDERA?

SIDERA (**S**imulation environment for **DE**pendable **R**eal-time **A**rchitectures) is a simulation model for time-triggered distributed real-time systems. It is based on the Time-Triggered Architecture TTA and allows the simulation of large-scale real-time systems, so-called *multi-cluster systems*. SIDERA provides simulation of various real-time protocol services like system startup, communication, clock synchronization, membership service and protocol error detection and handling. A failure simulation module allows testing the stability of the systems under investigation in the presence of node failures. Furthermore, SIDERA supports simulation of the *FlexRay* protocol, a standardized fault-tolerant communication system for advanced automotive applications.

## 2 How is the GUI structured?



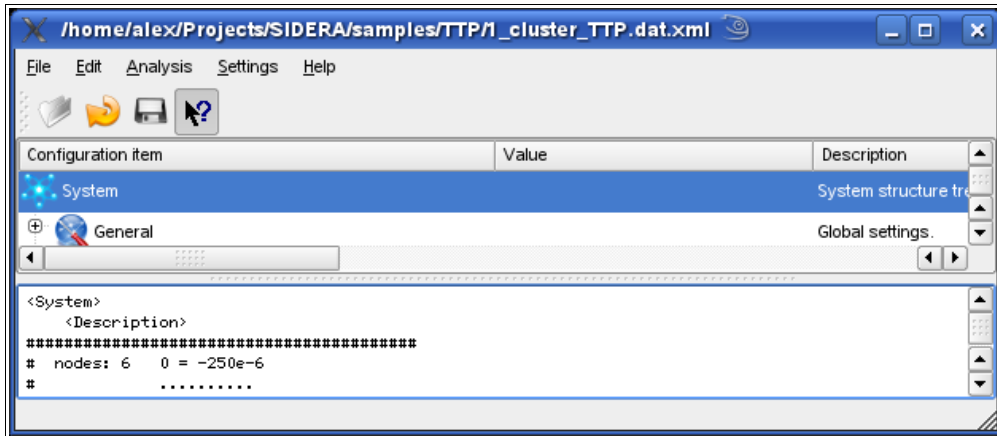
The GUI is splitted into two main windows: the upper window shows a tree view of the current system configuration. During a simulation run, the lower window shows online status information as well as the results of the simulation experiment.

A system configuration consists of a hierarchically structured set of so-called „Configuration items“. Each configuration item has a value, which defines the behaviour of this configuration item, and a description, which shows the meaning of the configuration item.

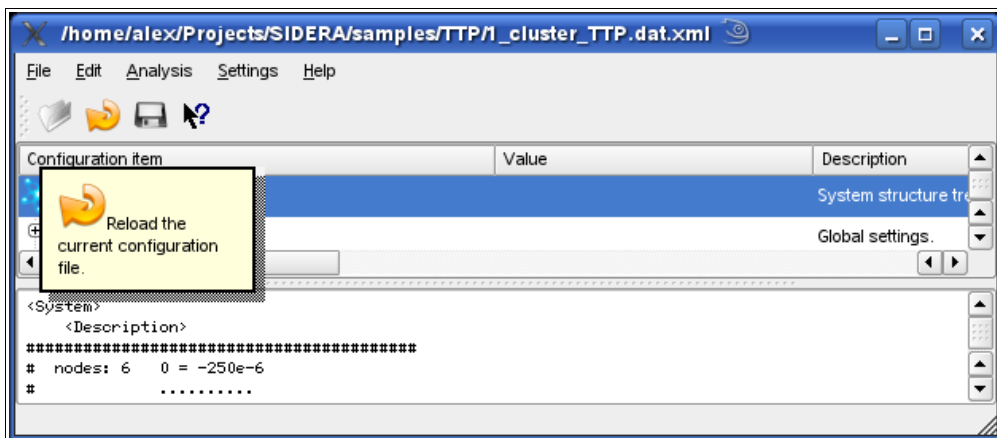
In the tree view there is one line for each configuration item, which is divided into three columns for the configuration item, its value and its description, respectively.

### 3 How can I get help for the different application menu items?

To access the help texts associated with the different application menu items, press the „Whats this?“ button (the rightmost button on the application window tool bar).

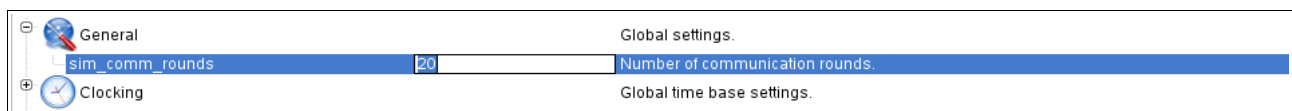


The mouse cursor changes its shape into some kind of questionmark. Now, select a menu item of interest and click the left mouse button. A window containing a description of the selected menu item is displayed.



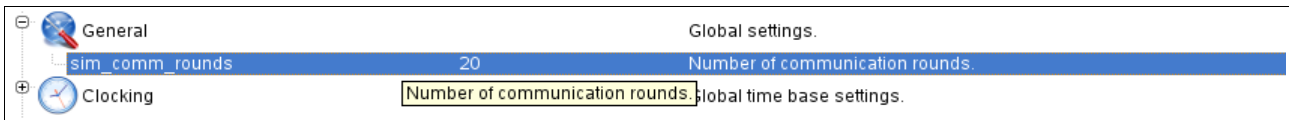
### 4 How can I change the value of a configuration item?

Move the mouse into the "Value" column for the configuration item of interest and click the left mouse button. The "Value" column turns into an edit field. Change the value to the desired one and press ENTER.



### 5 How can I figure out the meaning of the different configuration items?

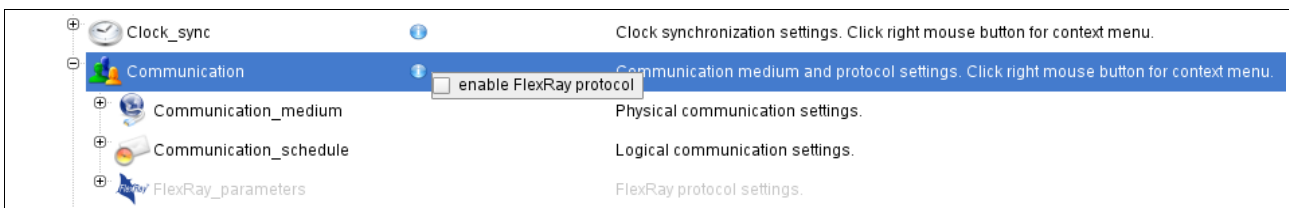
The column „Description“ shows a short descripton of the configuration items. You can also move the mouse over a configuration item of interest and wait a while. A tool-tip containing a short description of the configuration item appears.



## 6 What is the meaning of the blue "Info" icon shown for some configuration items in the column "Value"?

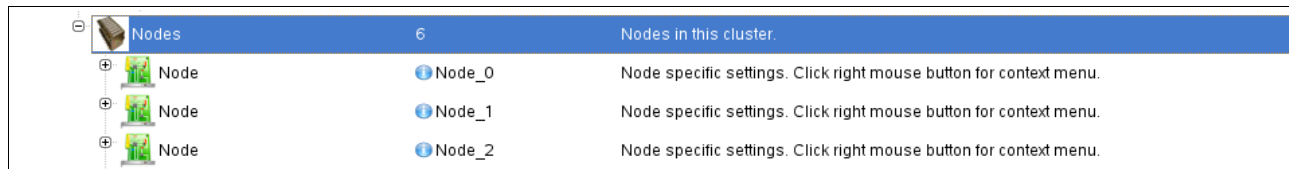
The blue "Info" icon beside some configuration items indicates that there is some more functionality related to this item. Move to a configuration item with a blue "Info" icon and press the right mouse button. A popup menu will appear that allows to trigger some actions related to this configuration item.

For example, moving to configuration item "Cluster/Communcation" and clicking the right mouse button opens a popup menu containing the checkbox item "enable FlexRay protocol".



## 7 What is the meaning of the non-editable numeric value shown for some configuration items in the column "Value"?

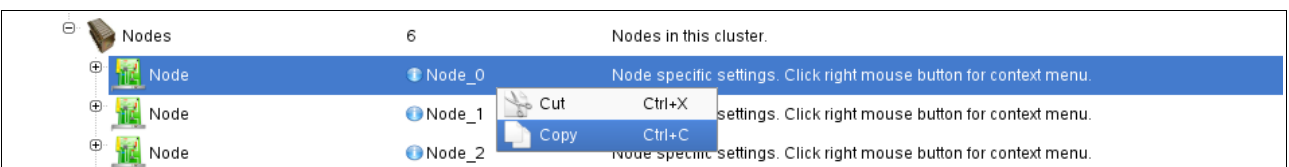
Some configuration items are containers for child items of equal structure.



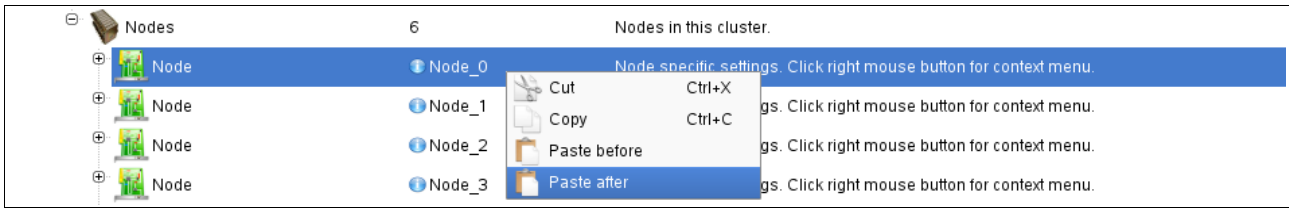
For example, the "Cluster/Nodes" configuration item has several "Node" child items. The numeric value besides the "Cluster/Nodes" configuration item simply shows the number of nodes (i.e. the number of subsequent "Nodes/Node" configuration items).

## 8 How can I add or remove configuration items?

Some configuration items can be cut, copied and pasted. For these configuration items, the context menu contains „Cut/Copy/Paste“ menu items. For instance, right-clicking into a „Node“ configuration item opens a „Cut/Copy“ popup menu.

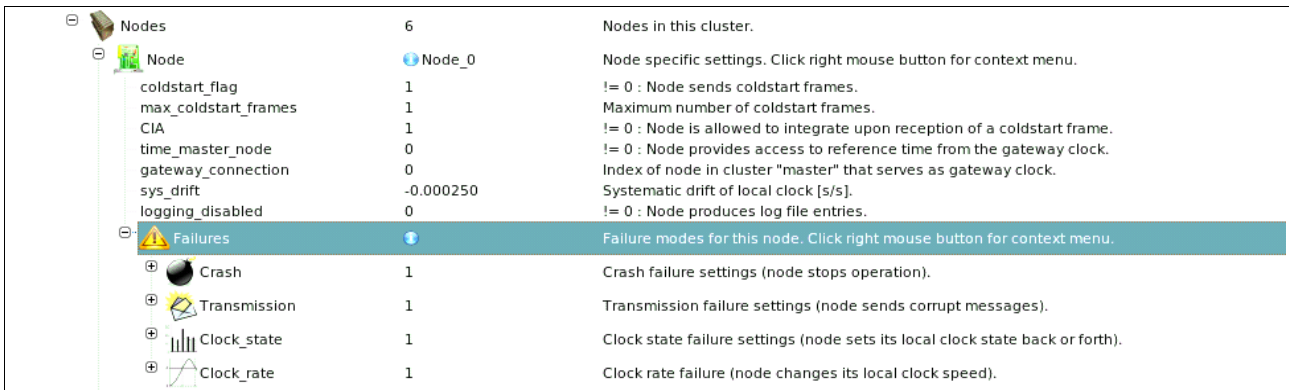


Once a „Node“ configuration item has been copied (or cut, unless it is the last one), it can be pasted into the node list at a desired position.



To create a new „Node“ configuration item, simply copy an existing one , paste it at the desired location into the node list and edit the pasted „Node“ configuration as needed.

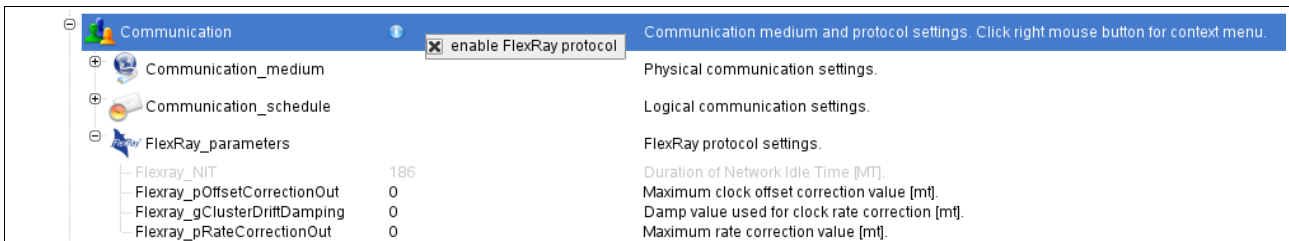
### 9 How many failures per failure class and node can be defined?



At the moment, up to 10 failure entries can be defined for all failure classes.

### 10 How can a FlexRay cluster be configured?

A FlexRay cluster configuration can be derived from a TTP cluster configuration.



Locate the "Cluster/Communication" configuration item and press the right mouse button. Activate the "enable FlexRay protocol" checkbox in the appearing popup window. Now, the "Communication/FlexRay\_parameters" configuration item can be opened. Uncheck the "enable FlexRay protocol" checkbox to disable the FlexRay cluster configuration and to return to TTP protocol operation for this cluster.

To match a TTP cluster configuration to a FlexRay cluster configuration, the following has to be done:

- Activate the „enable FlexRay protocol“ checkbox (see above).
- Choose the slot length „slot\_len“ and the number of slots „num\_slots“ such that  $slot\_len * number\_slots = cluster\_cycle\_len$ , where  $cluster\_cycle\_len$  is the duration of the FlexRay cluster cycle in Macroticks.

Communication		Communication medium and protocol settings. Click right mouse button for context menu.
Communication_medium		Physical communication settings.
slot_len	186	Duration of slot in static segment [MT].
bandwidth	10000000	Communication medium bandwidth [bps].
message_size	36	Message size [bytes].
transmission_delay_min	0	Minimum transmission delay [5ns].
transmission_delay_max	0	Maximum transmission delay [5ns]. transmission_delay_min == transmission_delay_max: cons
Communication_schedule		Logical communication settings.
static_action_point_offset	93	Message send time offset relative to slot start [MT].
Slots	6	Assignment of communication bandwidth to nodes.

- Set the „SYF“ flag for all slots in which sync frames are sent.

Slots	6	Assignment of communication bandwidth to nodes.
slot		Communication slot settings. Click right mouse button for context menu.
LogicalSenderId	0	Index of node that is sender in current slot.
CS	0	!= 0 : Internal clock synchronization is done in current slot.
SYF	1	!= 0 : Message received is used for remote clock reading.
RA	0	
ECS	0	

- Set the „CS“ flag in the last slot of the communication schedule (clock correction in FlexRay is done in the network idle time NIT which usually is at the end of the cluster cycle).

Slots	6	Assignment of communication bandwidth to nodes.
slot		Communication slot settings. Click right mouse button for context menu.
LogicalSenderId	0	Index of node that is sender in current slot.
CS	0	!= 0 : Internal clock synchronization is done in current slot.
SYF	1	!= 0 : Message received is used for remote clock reading.
RA	0	
ECS	0	

FlexRay cluster configurations can be found in the folder "samples/FlexRay".

## 11 What is the "Cluster/no\_cluster\_startup" configuration item?

Cluster	Cluster_0	Cluster specific settings. Click right mouse button for context menu.
recover_from_freeze	0	!= 0 : Failed nodes are allowed to re-integrate.
no_cluster_startup	1	!= 0 : Cluster executes no TTP startup algorithm.
no_sync_nodes	0	!= 0 : Disable internal clock synchronization.
no_protocol_error_check	0	!= 0 : TTP protocol error check disabled.

Setting "no\_cluster\_startup" to 0 causes the cluster to execute the TTP/C C1 startup algorithm: one node sends coldstart frames that the other nodes integrate on. For this purpose, a coldstart node has to be defined in the "Node" part of the configuration tree.

Nodes	6	Nodes in this cluster.
Node	Node_0	Node specific settings. Click right mouse button for context menu.
coldstart_flag	1	!= 0 : Node sends coldstart frames.
max_coldstart_frames	1	Maximum number of coldstart frames.
CIA	1	!= 0 : Node is allowed to integrate upon reception of a coldstart frame.
time_master_node	0	!= 0 : Node provides access to reference time from the gateway clock.
gateway_connection	0	Index of node in cluster "master" that serves as gateway clock.
sys_drift	-0.000250	Systematic drift of local clock [s/s].
logging_disabled	0	!= 0 : Node produces log file entries.

For the coldstart node, set the "coldstart\_flag" configuration item to 1 and define the number of coldstart frames to be sent by setting "max\_coldstart\_frames" to the desired value. For the other nodes, the coldstart integration allowed item "CIA" has to be set to „1“ (which is the default value, however).

## 12 What is the "Clock\_sync/delta\_0" configuration item ?

⊖	Clock_sync	?	Clock synchronization settings. Click right mouse button for context menu.
	capturing_buffer_size	4	Remote clock reading buffer size used for clock synchronization.
	num_faulty_nodes_max	1	Maximum number of faulty nodes (k-Parameter used for FTA/FTM clock synchronization algorithm).
	no_pi_2_check	0	!= 0 : Clock synchronization error check disabled.
	delta_0	0.000500	Interval out of which all nodes are assigned a systematic drift value.
	time_flooding	0	!= 0 : Prevent slave cluster from startup until master cluster is synchronized.
	div_ext_corr_term	0	!= 0 : Halve external clock correction term.
⊕	Clock_calibration		Clock rate correction settings.

The "delta\_0" configuration item is the base for the calculation of the systematic drift rates of the nodes. The individual node drift rates can be set manually (if "delta\_0" is 0) by adjustment of configuration item "Node/sys\_drift".

⊖	Nodes	6	Nodes in this cluster.
⊖	Node	?	Node specific settings. Click right mouse button for context menu.
	coldstart_flag	1	!= 0 : Node sends coldstart frames.
	max_coldstart_frames	1	Maximum number of coldstart frames.
	CIA	1	!= 0 : Node is allowed to integrate upon reception of a coldstart frame.
	time_master_node	0	!= 0 : Node provides access to reference time from the gateway clock.
	gateway_connection	0	Index of node in cluster "master" that serves as gateway clock.
	sys_drift	-0.000250	Systematic drift of local clock [s/s].
	logging_disabled	0	!= 0 : Node produces log file entries.
⊕	Failures	?	Failure modes for this node. Click right mouse button for context menu.

If "delta\_0" is different from „0“, the systematic drift  $drift_i$  of node  $i$  equals

$$drift_i = \frac{-delta_0}{2} + \frac{delta_0}{n-1}$$

where  $n$  is the number of nodes in the cluster.

## 13 How can a multi-cluster system be configured?

To configure a multi-cluster system, the following has to be done:

- At least 2 clusters have to exist in the system.
- In the „ClusterMap“, define for each „ClusterMapEntry“, which cluster is the „master“ and which cluster is the „slave“ (the „slave“ cluster is externally synchronized by the „master“ cluster).

⊖	ClusterMap	1	Defines flow of timing information for inter-cluster clock synchronization.
⊖	ClusterMapEntry	?	Click right mouse button for context menu.
	— master	0	Index of cluster that is a reference time server for subsequent cluster "slave".
	— slave	1	Index of cluster that uses preceding cluster "master" as external reference time server.

- In the „slave“ cluster, choose a „Node“ and set the „time\_master\_node“ configuration item to „1“.
- In the „Node“ selected in the previous step, set the „gateway\_connection“ entry to the index of the „Node“ in the „master“ cluster that shall provide access to reference time (the „time\_master\_node“ in the „slave“ cluster reads the local clock of the „gateway\_connection“ node in the „master“ cluster and distributes an external clock correction term to the other nodes in the „slave“ cluster).

Cluster	Cluster_1	Cluster specific settings. Click right mouse button for context menu.
recover_from_freeze	0	!= 0 : Failed nodes are allowed to re-integrate.
no_cluster_startup	1	!= 0 : Cluster executes no TTP startup algorithm.
no_sync_nodes	0	!= 0 : Disable internal clock synchronization.
no_protocol_error_check	0	!= 0 : TTP protocol error check disabled.
Clock_sync		Clock synchronization settings. Click right mouse button for context menu.
Communication		Communication medium and protocol settings. Click right mouse button for context menu.
Nodes	6	Nodes in this cluster.
Node	Node_0	Node specific settings. Click right mouse button for context menu.
Node	Node_1	Node specific settings. Click right mouse button for context menu.
Node	Node_2	Node specific settings. Click right mouse button for context menu.
coldstart_flag	0	!= 0 : Node sends coldstart frames.
max_coldstart_frames	1	Maximum number of coldstart frames.
CIA	1	!= 0 : Node is allowed to integrate upon reception of a coldstart frame.
time_master_node	1	!= 0 : Node provides access to reference time from the gateway clock.
gateway_connection	0	Index of node in cluster "master" that serves as gateway clock.
sys_drift	-0.000003	Systematic drift of local clock [s/s].
logging_disabled	0	!= 0 : Node produces log file entries.

- In the „Communication/Communication\_schedule/Slots“ configuration item select a „slot“ in which the previously chosen „time\_master\_node“ is sending (a „slot“ entry for which the „LogicalSenderName“ equals the index of the „time\_master\_node“) and set the „ECS“ configuration item to „1“.

Cluster	Cluster_1	Cluster specific settings. Click right mouse button for context menu.
recover_from_freeze	0	!= 0 : Failed nodes are allowed to re-integrate.
no_cluster_startup	1	!= 0 : Cluster executes no TTP startup algorithm.
no_sync_nodes	0	!= 0 : Disable internal clock synchronization.
no_protocol_error_check	0	!= 0 : TTP protocol error check disabled.
Clock_sync		Clock synchronization settings. Click right mouse button for context menu.
Communication		Communication medium and protocol settings. Click right mouse button for context menu.
Nodes	6	Nodes in this cluster.
Node	Node_0	Node specific settings. Click right mouse button for context menu.
Node	Node_1	Node specific settings. Click right mouse button for context menu.
Node	Node_2	Node specific settings. Click right mouse button for context menu.
coldstart_flag	0	!= 0 : Node sends coldstart frames.
max_coldstart_frames	1	Maximum number of coldstart frames.
CIA	1	!= 0 : Node is allowed to integrate upon reception of a coldstart frame.
time_master_node	1	!= 0 : Node provides access to reference time from the gateway clock.
gateway_connection	0	Index of node in cluster "master" that serves as gateway clock.
sys_drift	-0.000003	Systematic drift of local clock [s/s].
logging_disabled	0	!= 0 : Node produces log file entries.

- If the „slave“ cluster executes a startup algorithm („Cluster/no\_cluster\_startup“ is „0“): in this case the „time\_master\_node“ in the „slave“ cluster shall also be the coldstart node (the configuration item „coldstart\_flag“ has to be „1“.

Cluster	Cluster_1	Cluster specific settings. Click right mouse button for context menu.
recover_from_freeze	0	!= 0 : Failed nodes are allowed to re-integrate.
no_cluster_startup	0	!= 0 : Cluster executes no TTP startup algorithm.
no_sync_nodes	0	!= 0 : Disable internal clock synchronization.
no_protocol_error_check	0	!= 0 : TTP protocol error check disabled.
Clock_sync		Clock synchronization settings. Click right mouse button for context menu.
Communication		Communication medium and protocol settings. Click right mouse button for context menu.
Nodes	6	Nodes in this cluster.
Node	Node_0	Node specific settings. Click right mouse button for context menu.
coldstart_flag	1	!= 0 : Node sends coldstart frames.
max_coldstart_frames	1	Maximum number of coldstart frames.
CIA	1	!= 0 : Node is allowed to integrate upon reception of a coldstart frame.

- Now, if the „Clock\_sync/time\_flooding“ configuration item in the „slave“ cluster is „1“, then the „time\_master\_node“ in the „slave“ cluster (which is also the coldstart node, see last step) waits until the „master“ cluster is synchronized. That means that the „slave“ cluster startup is delayed until the „master“ cluster startup has completed.





## 16 Which output files are generated during simulation?

For example, be „1\_cluster\_TTP.dat.xml“ the name of a SIDERA configuration file. The following output files are generated:

1_cluster_TTP.dat.xml	24,4 KB	XML-Dokument
1_cluster_TTP.dat.xml.sout	360,0 KB	Unbekannt
1_cluster_TTP.dat.xml.txt	0 B	Einfacher Text

- 1\_cluster\_TTP.dat.xml.sout  
A binary output file that contains all information necessary for subsequent analysis using the „Analysis“ menu of the SIDERA GUI.
- 1\_cluster\_TTP.dat.xml.txt  
A text file that contains the contents of the online log window for later analysis.

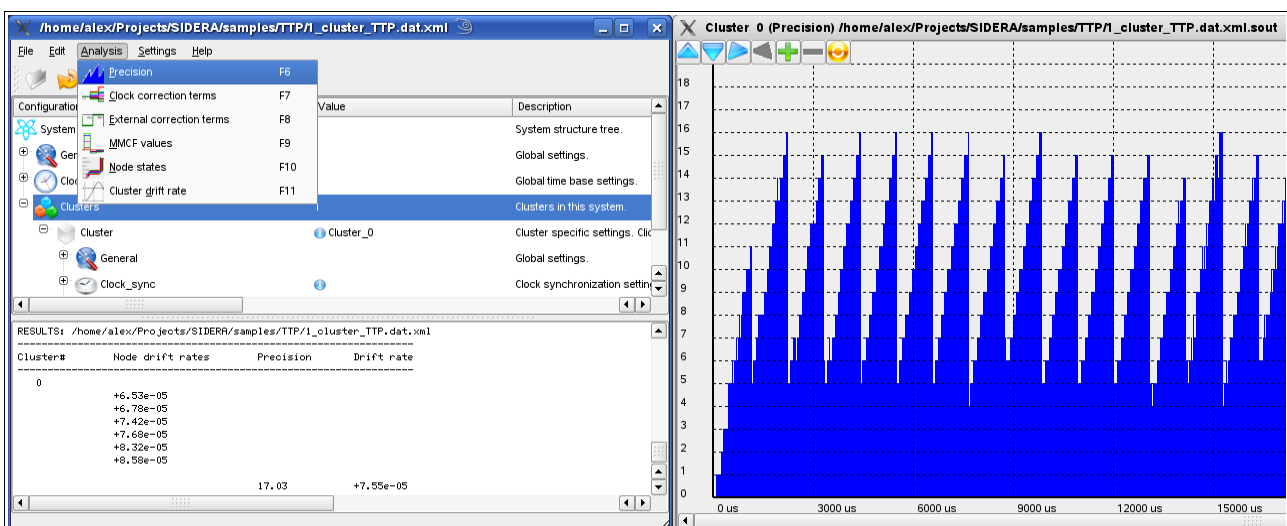
Additionally, a session log file is generated in the „temp“ folder. The name of the session log file is „timestamp.log.txt“, whereas „timestamp“ is the date and time of the last invocation of the SIDERA GUI.

2009-06-23 13:02:54.log.txt	9,6 KB	Einfacher Text
2009-06-23 13:03:39.log.txt	64,6 KB	Einfacher Text

If SIDERA is started from the console (or from a batch file), only the output file „1\_cluster\_TTP.dat.xml.sout“ is generated. The online log information is displayed in the console window. If this online log information shall be stored, the user has to redirect the console output to a file (see above).

## 17 Can I run some experiments and analyze the results at a later time?

Yes. The online log files „\*.dat.txt“ are stored and can be viewed at a later time. The usage of the „Analysis“ feature of the SIDERA GUI can also be postponed. Simply load the configuration file (e.g. „1\_cluster\_TTP.dat.xml“). If the corresponding binary output file „1\_cluster\_TTP.dat.xml.sout“ file exists, the „Analysis“ feature can be used.



## 18 How are the local clocks initialized?

In the "Cluster" part of the tree, locate item "no\_cluster\_startup". If "no\_cluster\_startup" is „1“, all nodes start running at the same time with an initial clock value of 0.

Cluster		Cluster_0	Cluster specific settings. Click right mouse button for context menu.
recover_from_freeze	0	!= 0 : Failed nodes are allowed to re-integrate.	
no_cluster_startup	1	!= 0 : Cluster executes no TTP startup algorithm.	
no_sync_nodes	0	!= 0 : Disable internal clock synchronization.	
no_protocol_error_check	0	!= 0 : TTP protocol error check disabled.	

The clocks are running free with their individual clock rates assigned (item "Node/sys\_drift") until the first clock synchronization instant.

Node		Node_0	Node specific settings. Click right mouse button for context menu.
coldstart_flag	1	!= 0 : Node sends coldstart frames.	
max_coldstart_frames	1	Maximum number of coldstart frames.	
CIA	1	!= 0 : Node is allowed to integrate upon reception of a coldstart frame.	
time_master_node	0	!= 0 : Node provides access to reference time from the gateway clock.	
gateway_connection	0	Index of node in cluster "master" that serves as gateway clock.	
sys_drift	-0.000250	Systematic drift of local clock [s/s].	
logging_disabled	0	!= 0 : Node produces log file entries.	

From this point in time, all synchronized local clocks follow the drift rate of the cluster time (i.e. the internally synchronized global time base established by execution of the fault-tolerant average algorithm).

If "no\_cluster\_startup" is set to „0“, all nodes listen for a coldstart frame from a dedicated coldstart node. Upon reception of a coldstart frame, all nodes initialize their local clocks with the time information contained in the coldstart frame and start execution of the clock synchronization algorithm. A typical cluster startup sequence for a cluster with 6 nodes looks like

```
[0,0] FREEZE -> LISTEN [T:1]
[0,1] FREEZE -> LISTEN [T:1]
[0,2] FREEZE -> LISTEN [T:1]
[0,3] FREEZE -> LISTEN [T:1]
[0,4] FREEZE -> LISTEN [T:1]
[0,5] FREEZE -> LISTEN [T:1]
[0,0] INFO: start COLDSTART timeout (iframe_count = 1) [T:93]
[0,0] LISTEN -> COLDSTART [T:93]
R#0000 [0,0] [ +0 +0 +0 +0] [I:+0] [P: 0] [M:01] [MT:0000093 mt:0000000] [RM:-1] [SL:0] [GDD:-) MT:0002232 mt:0044649] [NT: 2233.00] [CH: 0]
[0,1] LISTEN -> ACTIVE [T:93]
[0,2] LISTEN -> ACTIVE [T:93]
[0,3] LISTEN -> ACTIVE [T:93]
[0,4] LISTEN -> ACTIVE [T:93]
[0,5] LISTEN -> ACTIVE [T:93]
R#0000 [0,1] [ +8 +0 +0 +0] [I:+0] [P: 0] [M:03] [MT:0000279 mt:0000000] [RM:-1] [SL:1] [GDD:-) MT:0002418 mt:0048367] [NT: 279.00] [CH: 0]
[0,0] COLDSTART -> ACTIVE [T:278]
```

After complete execution of the startup algorithm, all nodes are initially synchronized and start execution of the communication protocol.

## 19 What is the meaning of the „Clock\_sync/Clock\_calibration“ configuration item?

If the „Clock\_calibration“ configuration item is enabled (right-click into the „Clock\_sync“ configuration item and activate the „enable clock calibration“ checkbox), the cluster executes a central clock synchronization algorithm that combines clock state correction and clock rate correction.

A cluster for which the „Clock\_calibration“ configuration item is enabled is referred to as a *calibrated cluster*. A calibrated cluster usually shows a much better precision due to the clock rate synchronization part which brings the drifts of the local clocks closer together, resulting in smaller clock state deviations between two clock synchronization instants.

Clock_sync		enable clock calibration	Clock synchronization settings. Click right mouse button for context menu.
capturing_buffer_size	4	<input checked="" type="checkbox"/>	Remote clock reading buffer size used for clock synchronization.
num_faulty_nodes_max	1		Maximum number of faulty nodes (k-Parameter used for FTA/FTM clock synchronization alg
no_pi_2_check	0		!= 0 : Clock synchronization error check disabled.
delta_0	0.000500		Interval out of which all nodes are assigned a systematic drift value for their local clocks.
time_flooding	0		!= 0 : Prevent slave cluster from startup until master cluster is synchronized.
div_ext_corr_term	0		!= 0 : Halve external clock correction term.
Clock_calibration			Clock rate correction settings.

For configuration of this this central algorithm, a derivative of which is used in the Time-

Triggered Ethernet TTE, the following has to be considered:

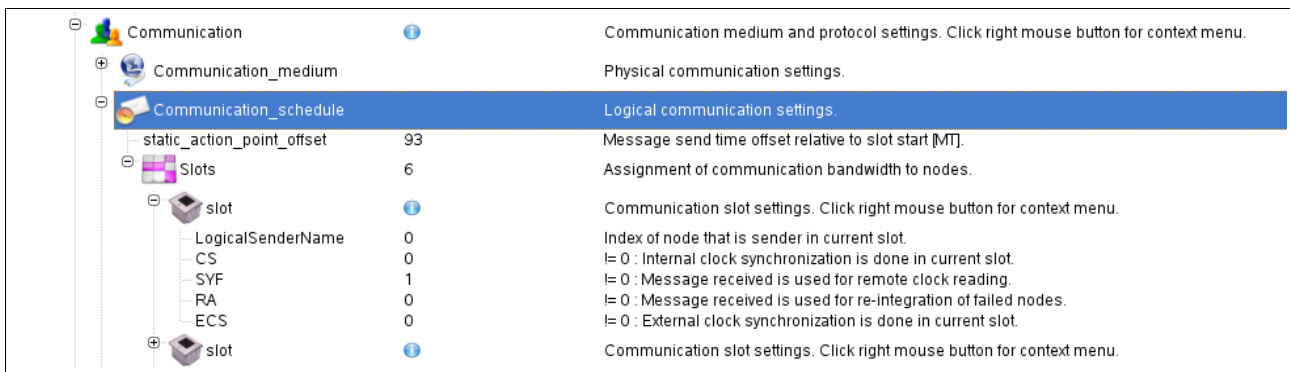
Clock_calibration		Clock rate correction settings.	
-master_clock_node	0	Index of node used as rate master.	
-rm_state_corr_int	0	!= 0 : Rate master node participates in internal clock synchronization.	
-rm_state_corr_ext	1	!= 0 : Rate master node calibrates its clock using clock readings from the gateway clock.	
-tk_state_corr_int	0	!= 0 : Time keeping nodes perform internal clock synchronization.	
-tk_state_corr_rm	1	!= 0 : Time keeping nodes use clock readings from rate master node for clock state correction.	

- The cluster contains a dedicated „master\_clock\_node“, all other nodes are so-called time-keeping nodes.
- All time-keeping nodes adjust their clock state and clock rate according to the periodically measured clock state deviation from the „master\_clock\_node“.
- In the „Communication\_schedule/Slots“ configuration item select a „slot“ in which the previously chosen „master\_clock\_node“ is sending (a „slot“ entry for which the „LogicalSenderName“ is equal to the „master\_clock\_node“ entry) and set the „SYF“ configuration item to „1“.

Communication_schedule		Logical communication settings.	
-static_action_point_offset	93	Message send time offset relative to slot start [MT].	
Slots	6	Assignment of communication bandwidth to nodes.	
slot		Communication slot settings. Click right mouse button for context menu.	
LogicalSenderName	0	Index of node that is sender in current slot.	
CS	0	!= 0 : Internal clock synchronization is done in current slot.	
SYF	1	!= 0 : Message received is used for remote clock reading.	
RA	0	!= 0 : Message received is used for re-integration of failed nodes.	
ECS	0	!= 0 : External clock synchronization is done in current slot.	

- If the „rm\_state\_corr\_int“ configuration item is „1“, then the „master\_clock\_node“ takes part in the internal clock synchronization of the cluster (**this configuration item should be „0“**, because if the „master\_clock\_node“ takes part in the distributed clock synchronization of the cluster, the drift of the cluster time is not only affected by the drift of the „master\_clock\_node“'s local clock).
- If the „tk\_state\_corr\_int“ configuration item is „1“, then the time-keeping nodes take part in the internal clock synchronization of the cluster (**this configuration item should be „0“**, because the states and rates of the time-keeping node's local clocks shall only be affected by the „master\_clock\_node“).
- In a multi-cluster system, if the „rm\_state\_corr\_ext“ configuration item is „1“, then the „master\_clock\_node“ corrects its clock state and clock rate according to the periodically measured deviation from the gateway clock. **In single-cluster systems, this configuration item is obsolete.**
- If the „tk\_state\_corr\_rm“ is „1“, then the time-keeping nodes correct their clock state according to the periodically measured state deviation from the „master\_clock\_node“ (**this configuration item should be „1“**).

20 What are the caveats for the configuration of the „Communication\_schedule“?



To ensure proper protocol operation, a set of counters is maintained by each node, namely ACK, INV and FAIL. After having sent a message, each node sets ACK=1, INV=0, FAIL=0. Each node updates the counters such that

- ACK++: a valid message was received in the current slot
- INV++: an invalid message was received in the current slot
- FAIL++: no message was received in the current slot

Before sending a message, each node checks ACK and INV.

- ACK+INV>1: at least one other node has sent a message between two message send slots of this node
- ACK+INV==1: no traffic was observed between two message send slots of this node ==> COMMUNICATION SYSTEM BLACKOUT
- ACK<=INV: there is no majority of valid messages compared to the number of invalid messages received ==> ACKNOWLEDGEMENT ERROR

Therefore, a node is not allowed to send in two subsequent communication slots. Note that the first and the last slot in the communication schedule are also subsequent slots (the communication schedule is traversed in a cyclic manner).

Examples:

Slot	0	1	2	3	4	
Sender	0	1	2	3	3	not OK
Sender	0	1	2	3	0	not OK
Sender	0	1	2	3	1	OK
Sender	0	1	2	3	2	OK