

EECS 223:
Real-Time Computer Systems
Config.ini File and GUI

Apr-05 1



config.ini

- Before running their TMO programs, application users have to specify several parameters related to the system configuration, middleware configuration, and network topology via "[config.ini](#)" file.
- The config.ini file must exist in the same directory where executable files reside, e.g., MyProject\Debug.
- TMOToolkit provides a GUI, "TMO Configuration Assistant", for specifying those parameters and for generating the corresponding config.ini file based on the values of those parameters given by application users.
- This TMO Configuration Assistant also provides explanation of each parameter and a default value for it, whenever applicable.



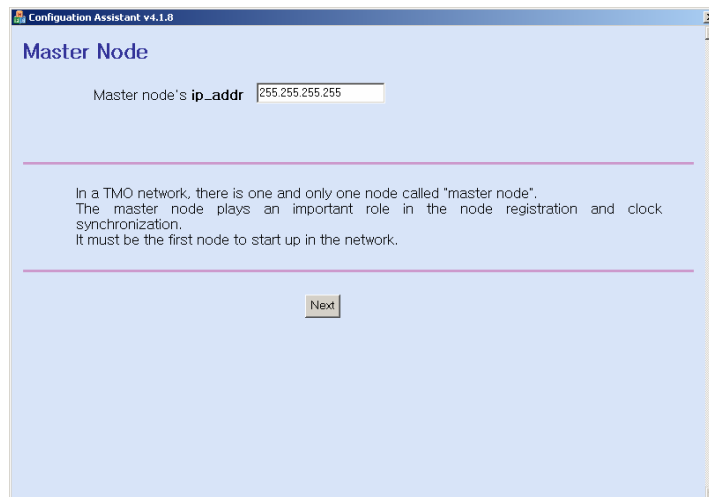
config.ini (cont.)

- Snapshot of TMO Configuration Assistant: Start page



config.ini: Master Node

- Snapshot of TMO Configuration Assistant: Master Node configuration



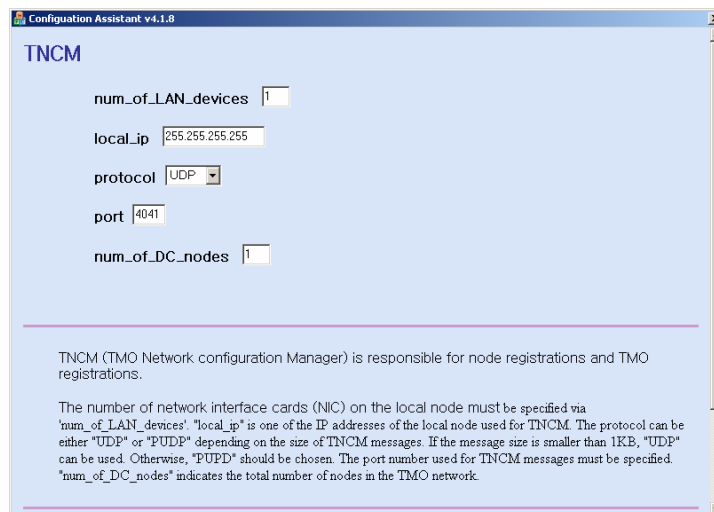
config.ini: Master Node

```
# This is a configuration file for TMOSM.  
#  
# In a TMO network, there is one and only one node called "master node".  
# The master node plays an important role in the node registration and clock  
# synchronization. It must be the first node to start up in the network.  
[master_node]  
ip_addr = 128.195.164.50
```



config.ini: TNCM

- Snapshot of TMO Configuration Assistant: TNCM configuration



Configuration Assistant v4.1.0

TNCM

num_of_LAN_devices

local_ip

protocol

port

num_of_DC_nodes

TNCM (TMO Network configuration Manager) is responsible for node registrations and TMO registrations.

The number of network interface cards (NIC) on the local node must be specified via 'num_of_LAN_devices'. 'local_ip' is one of the IP addresses of the local node used for TNCM. The protocol can be either "UDP" or "PUDP" depending on the size of TNCM messages. If the message size is smaller than 1KB, "UDP" can be used. Otherwise, "PUDP" should be chosen. The port number used for TNCM messages must be specified. 'num_of_DC_nodes' indicates the total number of nodes in the TMO network.



config.ini: TNCM

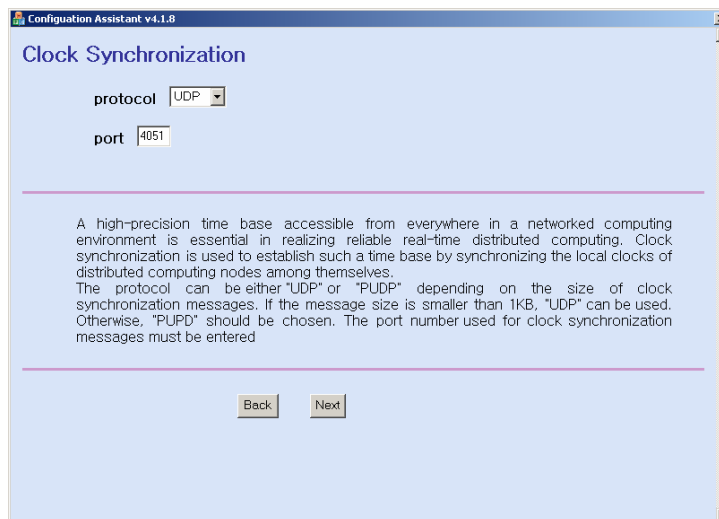
TNCM (TMO Network Configuration Manager) is responsible for node
 # registration and TMO registrations. The number of network interface cards
 # (NIC) in the local node must be specified via "num_of_LAN_devices"
 # parameter. "local_ip" is one of the IP addresses of the local node used for
 # TNCM. The protocol can be either "UDP" or "PUDP" depending on the size
 # of TNCM messages. If the message size is smaller than 1KB, "UDP" can
 # be used. Otherwise, "PUPD" should be chosen. The port number used for
 # TNCM messages must be specified. "num_of_DC_nodes" indicates the total
 # number of nodes in the TMO network.

```
[tncm]
num_of_LAN_devices = 1
local_ip = 128.195.164.50
protocol = UDP
port = 4041
num_of_DC_nodes = 1
```



config.ini: Clock Synchronization

- Snapshot of TMO Configuration Assistant: Clock Sync configuration



config.ini: Clock Synchronization

```
# A high-precision time base accessible from everywhere in a networked
# computing environment is essential in realizing reliable real-time
# distributed computing. Clock synchronization is used to establish such a
# time base by synchronizing the local clocks of distributed computing nodes
# among themselves. The protocol can be either "UDP" or "PUDP" depending
# on the size of clock synchronization messages. If the message size is
# smaller than 1KB, "UDP" can be used. Otherwise, "PUPD" should be chosen.
# The port number used for clock synchronization messages must be entered.
[clock_sync]
protocol = UDP
port = 4051
```



config.ini: Virtual Machine Timeslice

- Snapshot of TMO Configuration Assistant: VM TS configuration

Configuration Assistant v4.1.0

VM execution order

execution order

time_slot_length [microsecond]

Time slices are leased to Virtual Machines (VMs) by the WTST scheduler in a round-robin fashion.

"execution order" defines the order of VMs in a round. Each VM is represented by a unique identifier, and integers from 1 to 10 are reserved by the TMOSM (e.g. VMAT = 1, VCT = 2, VAT = 3, VNATIVE = 4). Customized VMs should use integers other than 1 to 10.

"time_slot_length" defines the length of the time slice leased to VMs and it is specified in microseconds. For example, time_slot_length = 3000 indicates the length of the time slice is 3 millisecond.



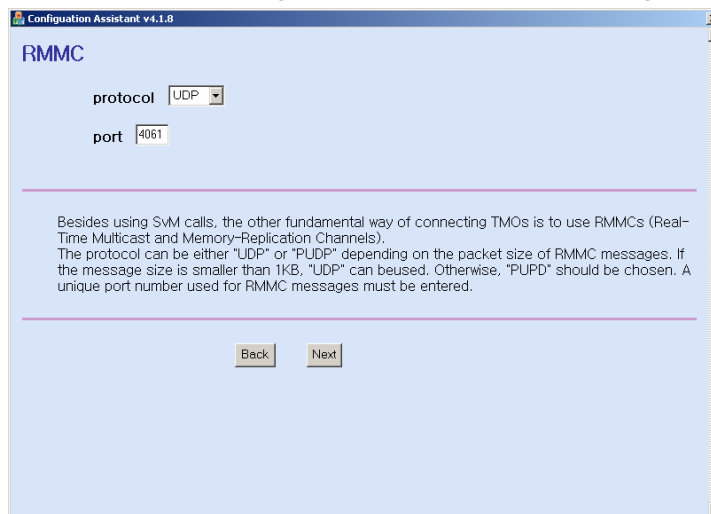
config.ini: VM Timeslice

```
# Time slices are leased to VMs by the WTST in a round-robin fashion.  
# "order" defines the order of VMs in a round. Each VM is represented by a  
# unique identifier, and integers from 1 to 10 are reserved by the TMOSM  
# (e.g. VMAT = 1, VCT = 2, VAT = 3, VNATIVE = 4).  
# Customized VMs should use integers other than 1 to 10.  
# "time_slot_length" defines the length of the time slice leased to VMs and it  
# is specified in microseconds. For example, time_slot_length = 3000  
# indicates the length of the time slice is 3 millisecond.  
[VM_exec_order]  
order = 1, 2, 3  
time_slot_length = 3000
```



config.ini: RMMC

- Snapshot of TMO Configuration Assistant: RMMC configuration



config.ini: RMMC

Besides using SvM calls, the other fundamental way of connecting TMOs is
 # to use RMMCs (Real-Time Multicast and Memory-Replication Channels).
 # The protocol can be either "UDP" or "PUDP" depending on the size of
 # RMMC messages. If the message size is smaller than 1KB, "UDP" can be
 # used. Otherwise, "PUDP" should be chosen. A unique port number used for
 # RMMC messages must be entered.

```
[rmmc]
protocol = PUDP
port = 4061
```



config.ini: Service Requests

- Snapshot of TMO Configuration Assistant: SR configuration

Configuration Assistant v4.1.0

VMAT

protocol

default_tmo_comm_port_num

scheduling_policy

VMAT / Service Request

The port number indicates a special port used for VMAT service messages, including One-way SR, two-way SR and result-return messages. The protocol can be either "UDP" or "PUDP" depending on the size of service request and result return messages. If the message size is smaller than 1KB, "UDP" can be used. Otherwise, "PUDP" should be chosen. "scheduling_policy" defines the scheduling policy of the METs. The value "0" means that the default policy Earliest Deadline First (EDF) scheduler will be used. "1" means that the 2-priority-level EDF scheduler will be used. The principle of the 2-priority-level EDF scheduler is that SpM threads should have priority over SvM threads for grabbing application time-slices. So, if the current policy is an EDF policy, the group of SpM threads should compete first under the EDF policy and only if there are no ready SpM threads, then the group of SvM threads can compete, again under the EDF policy.

Back Next



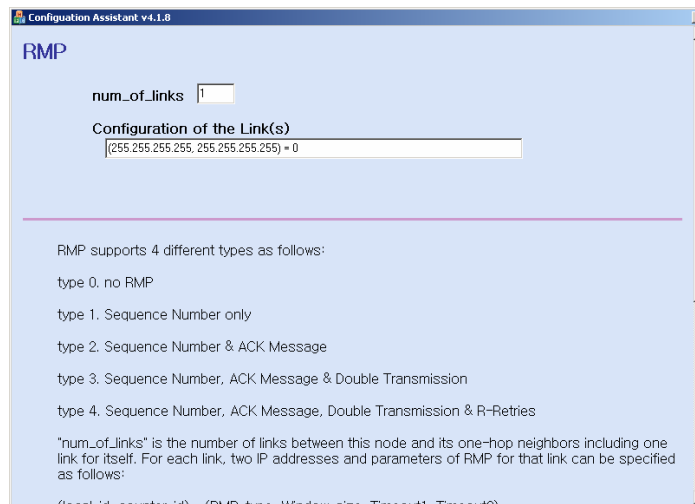
config.ini: Service Requests

```
# The port number indicates a special port used for VMAT service messages,  
# including One-way SR, two-way SR and result-return messages.  
# The protocol can be either "UDP" or "PUDP" depending on the size of  
# service request and result return messages. If the message size is smaller  
# than 1KB, "UDP" can be used. Otherwise, "PUDP" should be chosen.  
[vmst]  
default_tmo_comm_port_num = 3322  
protocol = PUDP
```



config.ini: Reliable Messaging Protocol

- Snapshot of TMO Configuration Assistant: RMP configuration



config.ini: RMP

```
# Reliable Messaging Protocol (RMP) provides a reliable message
# transmission over UDP/IP by utilizing double transmission and
# acknowledgement. Between any pair of nodes, a logical link can be
# established and its RMP parameters must be configured.

# RMP supports 4 different types as follows:
# type 0. no RMP
# type 1. Sequence Number only
# type 2. Sequence Number & ACK Message
# type 3. Sequence Number, ACK Message & Double Transmission
# type 4. Sequence Number, ACK Message, Double Transmission
#           & R-Retries

[rmp]
num_of_links = 2
(128.195.164.50, 128.195.164.50) = 0
(128.195.164.50, 128.195.164.55) = (1, 10, 1000)
```



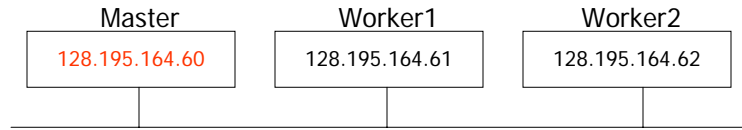
config.ini: RMP (cont.)

```
# "num_of_links" is the number of links between this node and its one-hop
# neighbors including one link for itself. For each link, two IP addresses and
# parameters of RMP for that link can be specified as follows:
#
# (local_id, neighbor_id) = (RMP_type, Window_size, Timeout1, Timeout2)
#
# local_id is one of the IP addresses of the node;
# neighbor_id is the IP address of the other party;
# RMP_type can be '0' for no RMP, '1' for RMP type 1 or '2' RMP type 2;
# Window_size is the number of messages that can be buffered by the
# receiver;
# For RMP type 1, Timeout1 corresponds to the amount of time for the
# receiver to wait until the receiver decides that some messages are lost in
# case of out-of-order delivery, and Timeout 2 is not used;
# For RMP type 2, Timeout1 corresponds to the amount of time for the
# sender to wait until ack messages are received, and Timeout 2 for the
# receivers to wait until the accumulated ACK messages are sent.
```



Connections among Nodes: Physical

Physical Connection



Master, Worker1, and Worker2

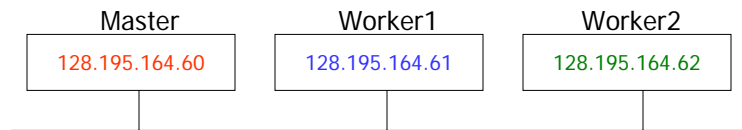
```

#config.ini
#
[master_node]
ip_addr = 128.195.164.60
#
#
.....
  
```



Connections among Nodes: TNCM

TNCM



Master

```

.....
[tncm]
num_of_LAN_devices = 1
local_ip = 128.195.164.60
protocol = UDP
port = 4041
num_of_DC_nodes = 3
#
.....
  
```

Worker1

```

.....
[tncm]
num_of_LAN_devices = 1
local_ip = 128.195.164.61
protocol = UDP
port = 4041
num_of_DC_nodes = 3
#
.....
  
```

Worker2

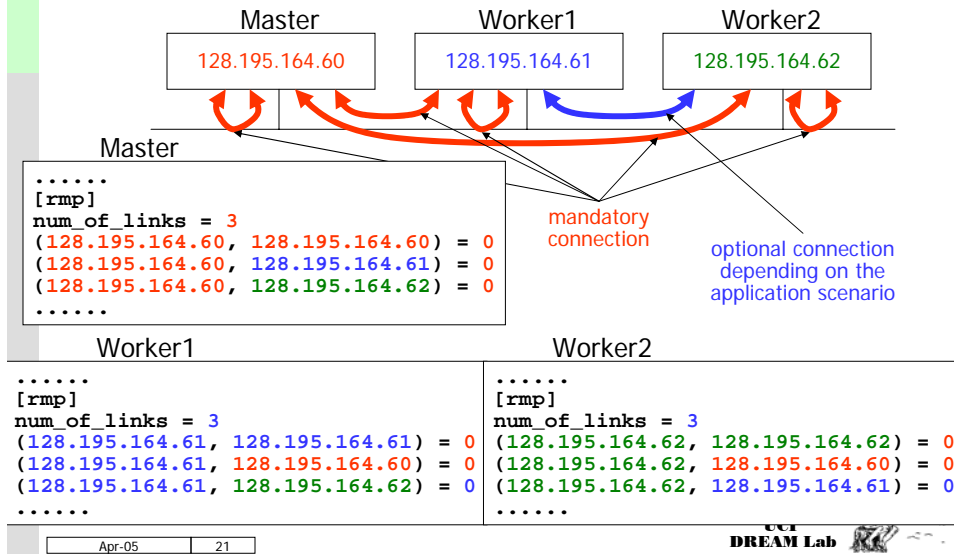
```

.....
[tncm]
num_of_LAN_devices = 1
local_ip = 128.195.164.62
protocol = UDP
port = 4041
num_of_DC_nodes = 3
#
.....
  
```



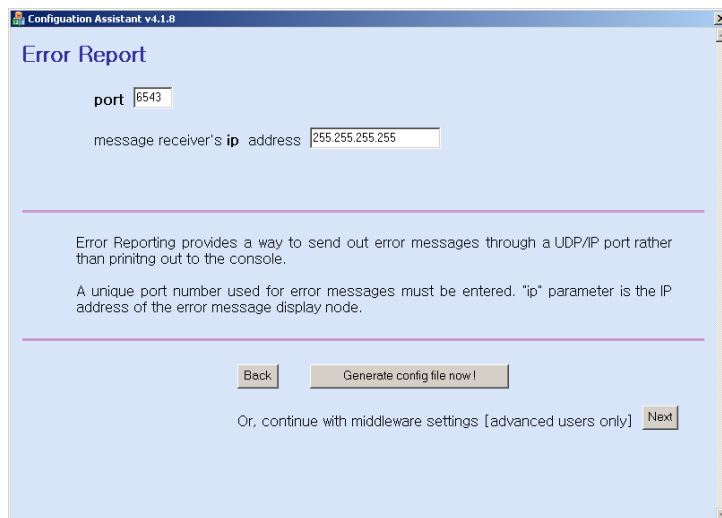
Connections among Nodes: Logical

RMP and Logical Connections



config.ini: Error Reporter

- Snapshot of TMO Configuration Assistant: Error Reporter configuration



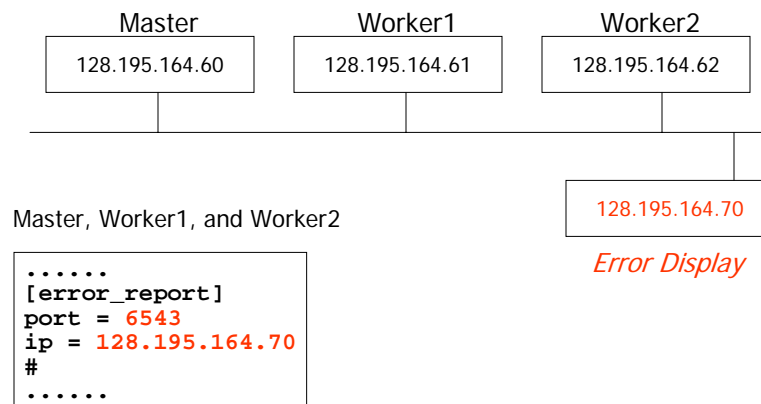
config.ini: Error Reporter

```
# Error Reporting provides a way to send out error messages through a  
# UDP/IP port rather than printing out to console.  
# "ip" parameter is the IP address of the error message display node.  
[error_report]  
port = 6543  
ip = 128.195.164.70
```



Connections among Nodes

Error Report



config.ini: Middleware Internals

```
# These parameters are for configuration of middleware internals.
[mw_config_param]
# Internal TMO middleware configuration parameters for advanced users
#
##### Thread Pool #####
id = S_VMST_THREAD_POOL_SIZE
type = integer
value = 5
#
id = S_VMMCT_THREAD_POOL_SIZE
type = integer
value = 2
#
id = S_VIST_THREAD_POOL_SIZE
type = integer
value = 2
#
# much much more ...
```



config.ini: Middleware Internals

- Snapshot of TMO Configuration Assistant: Middleware Internals

Section	Parameter	Value
Thread Pool	S_VMST_THREAD_POOL_SIZE (integer)	5
	S_VMMCT_THREAD_POOL_SIZE (integer)	2
	S_VIST_THREAD_POOL_SIZE (integer)	2
RMMC	S_MAX_TMO_PER_NODE (integer)	5
	S_MAX_STATE_MSG_PER_QUEUE (integer)	10
	S_MAX_TMO_PER_RMCMC (integer)	5
Gate	S_MAX_GATE_IN_SYSTEM (integer)	2
	S_MAX_CONNECTION_PER_DEVICE (integer)	10
VMMCT	S_MAX_COMMON_DEVICE_PER_NODE (integer)	2
	S_MAX_CONNECTION_PER_DEVICE (integer)	10
S_MAX_OUTGOING_PACKET_PER_CONN (integer)	S_MAX_OUTGOING_PACKET_PER_CONN (integer)	20
	S_MAX_CALLBACK_PER_CONNECTION (integer)	5
	S_MAX_ITEM_IN_RECV_WINDOW (integer)	50
VIST	S_MAX_AAC_PER_IIT (integer)	2
	S_MAX_SIBLING_PER_NODE (integer)	5
Topology	S_MAX_CHILD_PER_NODE (integer)	5
	S_MAX_SIBLING_PER_NODE (integer)	5

