

Y9.HIL.4: Secure Communication Network in Support of RSC/DGI and HIL Testbed

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1. Project Goals

Progress hitherto includes two tasks on the project proposal regarding the secure mechanisms and enhancements for the FREEDM network communications, including:

- 1) Task 1: expanding the network simulator's capabilities by adding another simulator machine that is also running OPNET;
- 2) Task 2: securing the firmware update mechanism for DGIs, which can be further extended to the firmware updating procedures of other power system devices in FREEDM system when necessary.

2. Role in Support of Strategic Plan

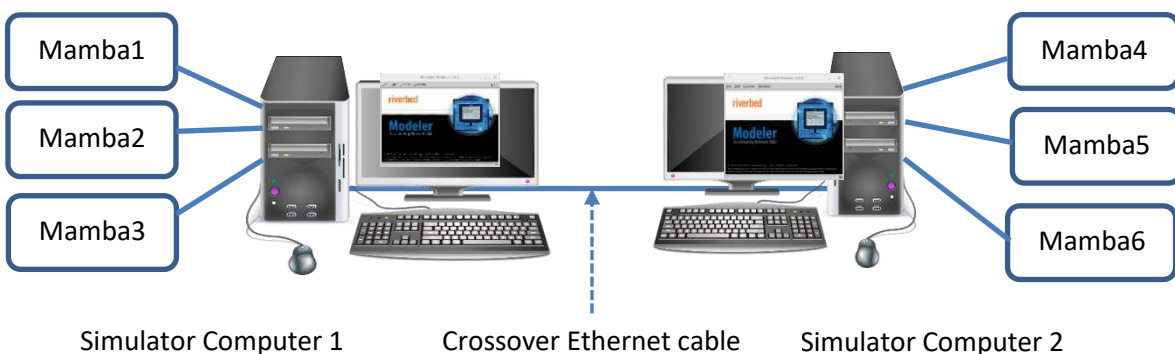
- 1) Choosing appropriate implementation plan and techniques;
- 2) Detailed technical implementation and integration tests.

3. Fundamental Research, Technological Barriers and Methodologies

- 1) Task 1: Complex communication networks require more computation power to simulate in order to reduce dropped packets due to tight delay requirements when passing packets between the real world and the simulated network environment.
- 2) Task 2
 - a) Use sftp protocol to ensure the sender/receiver pair authentication:
Goal: ensure the receiver is receiving the data from the trusted sender
 - b) Firmware forgery prevention:
Use digital signature to guarantee the data integrity of the firmware
Sender sends: original firmware + digital signature, with the signature attached at the end of the data block
Receiver verifies the data integrity with the signature after extracting it from the complete data received

4. Achievements

- 1) Progress on Task 1
 - a) An additional simulation computer will be connected to the existing one with the following topology:

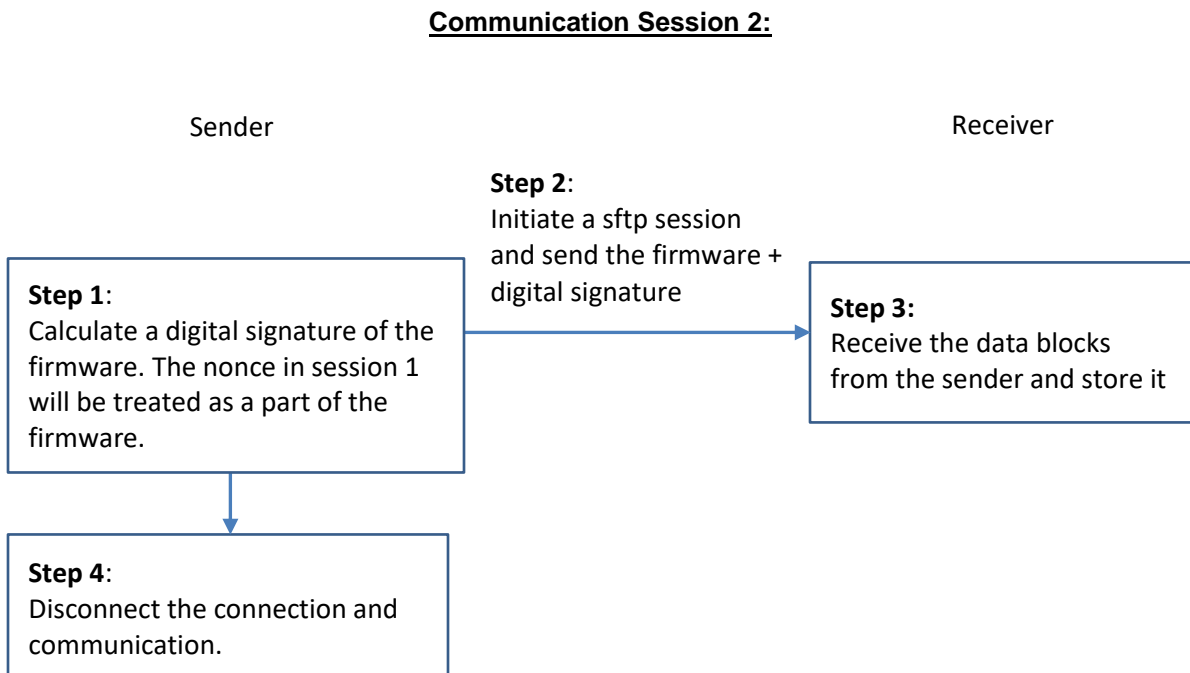
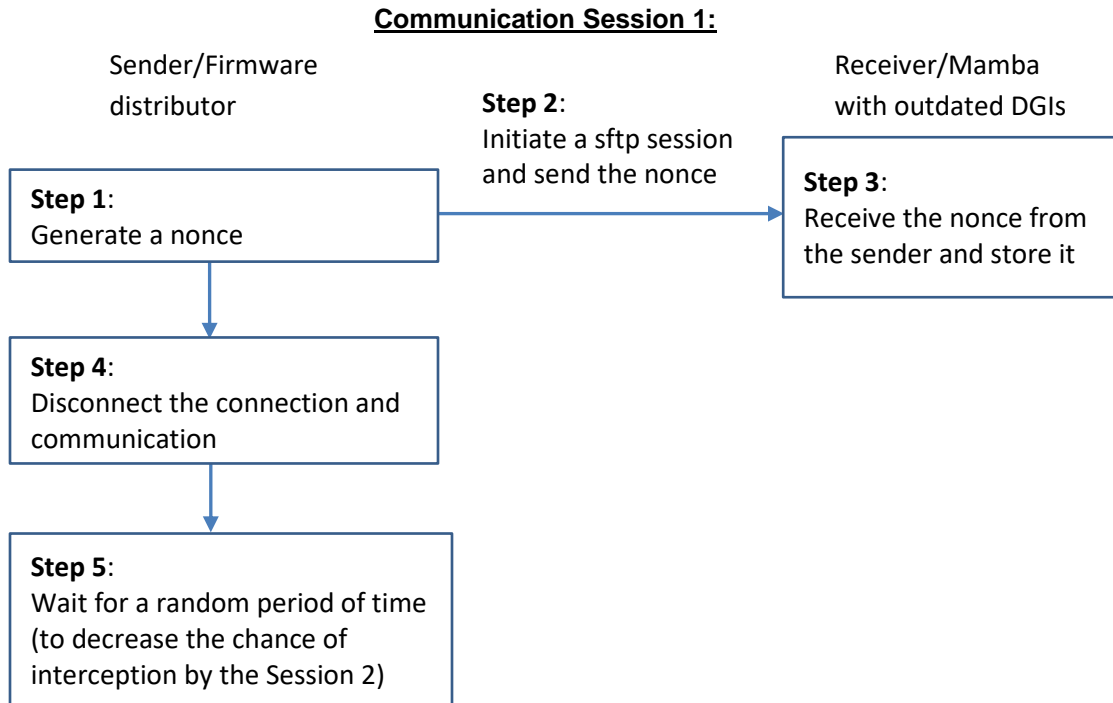


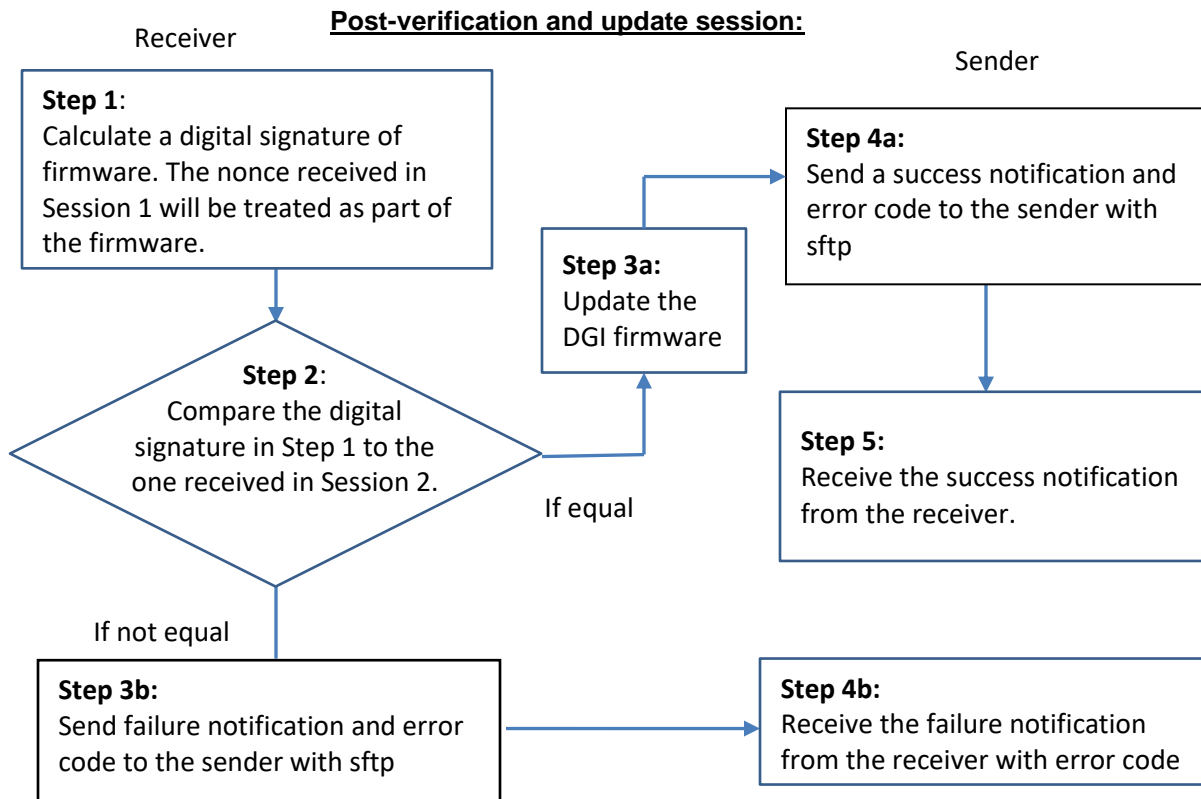
b) Software configuration

Routing tables on the simulator computers need to be configured so that simulation network packets inside OPNET will be forwarded to the other NIC on the other network simulator in the other computer.

2) Progress on Task 2

The framework with function diagram for the secure firmware update is described as follows.





5. Other Relevant Work Being Conducted Within and Outside of the ERC

We are not aware of similar work outside the ERC.

6. Milestones and Deliverables

Currently achieved:

- 1) Task 1
 - a) Hardware upgrade configuration has been proposed
 - b) Software configuration is ready as a draft
 - c) Hardware purchase is in progress
- 2) Task 2
 - a) Software framework is proposed and discussed
 - b) Partial coding is ongoing

The methodologies are regarded as feasible and are expected to bring about improvements to the OPNET network simulation environment when they are fully implemented.

Next milestone: in May for working hardware connection and program code.

7. Plans for Next Five Years

The expanded OPNET simulation capability is expected to play a significant role in future projects under the HIL-TB umbrella.

8. Member Company Benefits

The work on the secure firmware update mechanism is expected to be of interest to FREEDM industry members.

9. References

N/A