**Code Guide**

**The code is for the paper:** An Analytical Model for the Directional Hybrid MAC Protocol in the IEEE 802.15.3c (**Under submission**)

If you have used the code, you must cite the above paper.

Code Language: OPNET 14.5

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**How to run the code?**

Our IEEE 802.15.3c library is in the folder “library”.

Extract the near the library folder. Open the project.

**Summary of modeling**

Fig.1 shows the simulation of the IEEE 802.15.3c standard in OPNET. Fig.1 (a) shows the node model of the ordinary node. The node model for the PNC is different. In the node model, a separate queue has been considered for each RCAP and CTA area. One , one , and processor are used. Most of the physical parameters, like the data rate, frequency, type of antenna, channel status have been set in radio and antenna block.

In Fig. 1 (b) a parent process has been defined for the data generator of the ordinary node. The parent process includes three child processes: beacon, RCAP, and CTA. In this process, as each time area of the superframe expires, the node goes to the next state. At the beginning of the superframe, the node is in the beacon state, and during this time, the beacon child process is run. During this process, the beacon frame is received from PNC. When beacon duration is over, the node waits for its RSCAP turn. Then it goes to the RCAP state. In this state, the RCAP child process is run. During this state, arrival CTA packets are buffered by the use of the function. When the RCAP duration is over, the node goes to the CTA state, and the CTA child process is run. During this state, arrival RCAP packets are buffered by using the function. After the CTA state, the nod returns to the beacon state, and this process continues.

Fig. 1 (c) shows the RCAP process, which is based on the random backoff process. The CTA process is similar to the RCAP process with the difference that, in the CTA process, there is no competition. In each part, many programs have been written according to the OPNET functions, which is included in GitHub.

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| 1. Node Model | (b) Parent process |
| (c) RCAP process (child process) | |

Fig. 1 simulation of the IEEE 802.15.3c standard in OPNET