Group Term Project

Course: CS578 Internet of Things

Project Requirements:

A key component of TSCH (Time Slotted Channel Hopping) is the scheduling function that builds the communication schedule. This schedule tells which nodes in the network can communicate with which other node in which channel at what time.

YSF is a link scheduling algorithm aimed to minimize the end-to-end latency, specifically designed for data gathering applications in IIoT (Industrial Internet of Things). You can download the paper from the following link: https://ieeexplore.ieee.org/document/9560144 . Reference of the paper is as follows:

Y. Tanaka, P. Minet, M. Vučinić, X. Vilajosana and T. Watteyne, "YSF: A 6TiSCH Scheduling Function Minimizing Latency of Data Gathering in IIoT," in *IEEE Internet of Things Journal*, vol. 9, no. 11, pp. 8607-8615, 1 June1, 2022, doi: 10.1109/JIOT.2021.3118017.

Requirement in this terms project is to **implement the research paper** YSF: a 6TiSCH Scheduling Function Minimizing Latency of Data Gathering in IIoT and **do the simulation using the 6TiSCH simulator** to evaluate its performance.

You can download and install 6TiSCH simulator from this URL: https://bitbucket.org/6tisch/simulator/src/master/ . The reference of the research paper corresponding to 6TiSCH Simulator is as follows:

E. Municio, G. Daneels, M. Vucinic, S. Latre, J. Famaey, Y. Tanaka, K. Brun, K. Muraoka, X. Vilajosana, and T. Watteyne, "Simulating 6TiSCH Networks", Wiley Transactions on Emerging Telecommunications (ETT), 2019; 30:e3494. https://doi.org/10.1002/ett.3494

In simulation, consider the following parameter settings. For other parameters, you can use the default values.

- ✓ Topology: FullyMeshed, Linear and Random
- ✓ Traffic pattern (CBR: Constant Bit Rate): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF. (here P/SF means Packets/Slotframe)
- ✓ Number of nodes: vary from 10 to 80 as follows 10, 20, 30, …., 80
- ✓ Transmission queue sizes: You can consider 3 or 4 different values. Default is 10.
- ✓ Slotframe length: 29, 47, 101 slots

The number of slotframes per run must be 3600. You may change the other default configurations, if required. If you change, specify the modified configuration in your project report.

See the attached Table/Excel in which the exact value for the above parameters are mentioned which is assigned for your group. You have to use the assigned values in your simulation and producing results corresponding to few evaluation metrics which is described in the following paragraph.

Results of your simulation will be shown in the form of 3 graph plots on Packet Delivery Ratio (PDR), end-to-end latency and energy consumption w.r.t. number of nodes as mentioned in the configuration. In other words, for all the 3 graphs, the X-axis will be the number of nodes and the Y-axis will have those three metrics (PDR, end-to-end delay, energy consumption) for 3 graph plots, respectively. You should mention the assigned configuration for which you plotted the results. The unit of delay is second and for energy is Joule (J) or mill Joule (mJ).

Finally, **you have to submit a project report along with the modified/newly written code files.** In the submitted project report, you must write the following sections:

1) Summary of YSF in one paragraph
2) You should mention explicitly (i) which code script you have modified or added newly, (ii) what is the purpose of this modification, and (iii) exactly what you have modified.
3) Results of your simulation in the form of 3 graph plots on PDR, end-to-end delay, energy consumption.
4) Shortcomings of the YSF from your observation.

Project Evaluation Strategy: Total Marks = 20

1) Every student of the group will get equal marks in general case. Exceptions will be treated separately.
2) For correct implementation of all the modules of YSF: 6 marks
3) For correctly generating 3 plots: 3 marks each
4) Viva: 5 marks

Report Submission Strategy:

Maximum two A4 pages are allowed to write for submission.

Naming convention: GrpNo_<Group number>_IoT_Term_Project.pdf

Group number and corresponding simulation configuration.

Group No	Simulation Configuration
1	All the three mentioned topologies, Traffic rate: 4P/SF
2	Topology: Linear and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF
3	Topology: FullyMeshed and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF
4	Topology: Random and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF
5	vary TX queue sizes, Topology: Linear, Traffic rate: 4P/SF
6	vary TX queue sizes, Topology: FullyMeshed, Traffic rate: 2P/3SF
7	vary TX queue sizes, Topology: Random, Traffic rate: 2P/3SF
8	Slotframe length: 29, All the three mentioned topologies, Traffic rate: 4P/SF
9	Slotframe length: 47, All the three mentioned topologies, Traffic rate: 4P/SF
10	Topology: Linear and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF, slotframe length 29
11	Topology: Linear and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF, slotframe length 47
12	Topology: FullyMeshed and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF, slotframe length 29
13	Topology: Random and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF, slotframe length 29
14	Vary slotframe length to 29,47,101, and keep Topology linear with traffic 2P/SF
15	Vary slotframe length to 29,47,101, and FullyMeshed with traffic 2P/SF
16	Vary slotframe length to 29,47,101, and Random with traffic 2P/SF
17	Topology: Random and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF
18	Topology: Random and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF, Slotframe length:29
19	Topology: Random and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF, Slotframe length:47
20	Topology: Linear and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF, Slotframe length:29
21	vary TX queue sizes, Topology: Random, Traffic rate: 2P/3SF
22	Topology: FullyMeshed and Traffic pattern (CBR): 1P/4SF, 2P/3SF, 2P/SF, 4P/SF