ABSTRACT

Internet of Things (IoT) network is estimated to be deployed to serve billions of devices constructing super-dense networks. This thesis analyzes the decoding behaviour of Narrowband Internet of Things (NB-IoT) network and Single Carrier Internet of Things (SC-IoT) network using extrinsic information transfer (EXIT) charts to observe the characteristics and efficiency. With the analysis, the characteristic of IoT networks is evaluated as well as the maximum number of devices to be supported in the networks.

NB-IoT uses slotted ALOHA, where the collided packets are discarded, while SC-IoT uses coded random access (CRA) scheme, where the collided packets are to be resolved later using successive interference cancellation technique. This thesis also analyzes network performances in terms of packet-loss-rate (PLR), throughput and computational complexity using a series of computer simulations.

The results of this thesis show that EXIT chart of SC-IoT has smaller gap between curves of slot nodes and user nodes than the gap of NB-IoT indicating that SC-IoT has better efficiency providing higher throughput. It is because SC-IoT can use the best or optimal degree distribution, while NB-IoT can not design degree distribution because it uses slotted ALOHA. Throughput of SC-IoT is higher than NB-IoT because it can support more users. PLR of SC-IoT is smaller than NB-IoT. Computational complexity of SC-IoT is slightly similar with NB-IoT at $G < 1$, but increasing up to 7 times at $G > 1$. The results of this thesis confirm that SC-IoT is suitable for the implementation of future IoT with multi user detection (MUD) or without the MUD.

Keywords: Narrowband Internet of Things, Single Carrier Internet of Things, Slotted ALOHA, Coded Random Access, EXIT chart.