Adaptive Scheduling of High Bandwidth Periodic Packet Switch Sources for Congestion Handling

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Abstract

Industrial Internet of Things (IIoT) networks are quite prevalent in many types of sectors today. Also, in the near future, many sensors are estimated to be connected and used. With the development of sensor technologies, they transmit extra data to the core network. Optimization methods are crucial to cater to this high bandwidth traffic without expanding the aggregation servers and links.

This work has proposed a two-tier IIoT network architecture with several scheduling algorithms at tier one (Data Loggers). The network has been simulated using Omnet++. The traffic distribution at the aggregation layer has been compared for several scheduling algorithms to get the best possible method to optimize the network without using a centralized scheduler or controller. The results show that out of the proposed algorithms, the best methods in terms of distributing traffic are Initial Uniform Slot Selection (IUSS) and Initial Bernoulli Slot Selection (IBSS) methods.

Declaration

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List of Abbreviations

CAPEX Capital Expenditure

DL Data-Logger

FIFO First-in/first-out

GA Global-Aggregator

IBSS Initial Bernoulli Slot Selection

IIoT Industrial Internet of Things

IoT Internet of Things

IUSS Initial Uniform Slot Selection

LAN Local Area Network

QoS Quality of Service

RBSS Random Bernoulli Slot Selection

RCSP Rate Controlled Static Priority

RR Round Robin

RUSS Random Uniform Slot Selection

RUSSPI Random Uniform Slot Selection with Path Initialization

SF Switching Fabric

SP Static Priority

Nomenclature

τ	Message generation time
a	Lower bound on data
b	Shape parameter
i	A message generating node
k	Sampling period number
m	Number of Bernoulli trials
M_s	Number of sensors connected with one data logger
M_{dl}	Number of data loggers connected with aggregator
N	Number of time slots in a sampling period
n	Selected time slot by a data logger
p	Probability of success
T	Sampling time period
t	First message sending time
x	Random variable
Y_c	Packet size of a SYN and ACK messages
Y_d	Packet size of a data chunk