CSC 591 Homework 3 Report

Team members & percentage Contribution

- Dinesh - 33%
- Pratik - 33%
- Siddhant - 34%

Contribution Table

Task	Dinesh	Pratik	Siddhant
Setting up MQTT, CoAP, and HTTP environments (broker/server/client configurations)	34%	33%	33%
Coding MQTT Publisher and Subscriber (QoS1 and QoS2)	0%	100%	0%
Running MQTT Experiments (QoS1, QoS2) and Logging Results	33%	33%	34%
Implementing CoAP Server and Client	100%	0%	0%
Running CoAP Experiments and Collecting Results	33%	33%	34%
Implementing HTTP Server and Client for File Transfer	0%	0%	100%
Running HTTP Experiments and Recording Results	33%	34%	33%
Data aggregation and computation of Throughput and Overhead	33%	34%	33%
Preparing “Results File.xlsx” and validating data consistency	33%	33%	34%
Writing documentation and submission	33%	33%	34%

Results.xlsx file:

	Throughput (in kilo bits per second)								transferred from sender to receiver (including header content) pe			
	100B file		10kB file		1MB file		10MB file		100B file	10kB file	1MB file	10MB file
	Average	*Std. Dev.*	*Average*	*Std. Dev.*	*Average*	*Std. Dev.*	*Average*	*Std. Dev.*	*Average*	*Average*	*Average*	*Average*
MQTT QoS1	2.96	1.46	1293.6	57.21	54679.09	7284.99	72890.03	3374.51	2.46	2.004688	2.0000046	2.000005
MQTT QoS2	1.25	0.19	644.85	61.09	27121.89	2034.97	42310.36	10514.32	2.46	2.004688	2.0000046	2.000005
CoAP	132.28	22.33	1223.07	136.68	1210.89	60.46	942.24	106.34	1.11	1.009863	1.010499	1.010718
HTTP	909.94	119.56	97970.67	16215.07	7702024.71	965880.66	4681397.52	1288943.16	9	1.08	1.00008	1.00076

Experimental Observations and Analysis

- MQTT
  - **QoS2** is less than **QoS1** at all sizes due to additional acknowledgment steps required for reliable message delivery.
  - For small files (100 B), both QoS levels show extremely low throughput, as fixed MQTT headers and topic names create significant overhead.
  - The overhead ratio remains around **2 X** for all file sizes, which aligns with the protocol's structure.
- CoAP
  - CoAP achieves moderate throughput for smaller files (100 B and 10 kB) but drops slightly for larger ones (1 MB and 10 MB).
  - This behavior matches expectations, as CoAP uses confirmable messages and blockwise transfers that add latency between blocks.
  - The overhead is very low (about **1.01 X** for large files), showing CoAP's compact header design and efficient binary encoding.
- HTTP
  - HTTP has the highest throughput for medium and large file sizes, reaching several megabits per second due to persistent TCP connections and continuous streaming.
  - For small payloads (100 B), the relative overhead is extremely high (about 9 X) because the HTTP headers and response metadata are large compared to the payload.
  - As file size increases, this overhead becomes negligible (about **1.00 X**), since the fixed header cost is amortized over large data transfers.

Conclusion

- The measured data confirms theoretical expectations that **HTTP** performs best for large file transfers, **CoAP** offers balanced efficiency, and **MQTT** trades speed for reliability.