FOG AND EDGE COMPUTING

CA PART-C

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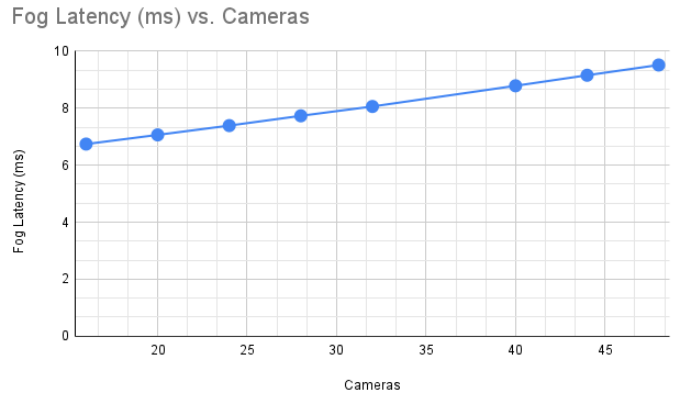
The fog-based implementation of the smart home security system offers significantly lower latency and network usage compared to the cloud-based implementation. In the fog-based scenario, smart cameras placed strategically throughout the house capture visuals, which are then processed and analyzed by nearby fog nodes. This localized processing minimizes the transmission delays, resulting in reduced latency and network usage. On the other hand, in the cloud-based scenario, all video feeds from the cameras are sent to a remote cloud server for processing and analysis, leading to higher latency and network overhead due to longer data transmission distances. As a result, the fog-based approach ensures real-time monitoring and quicker threat detection, making it a more efficient and responsive solution for enhancing security in smart homes.

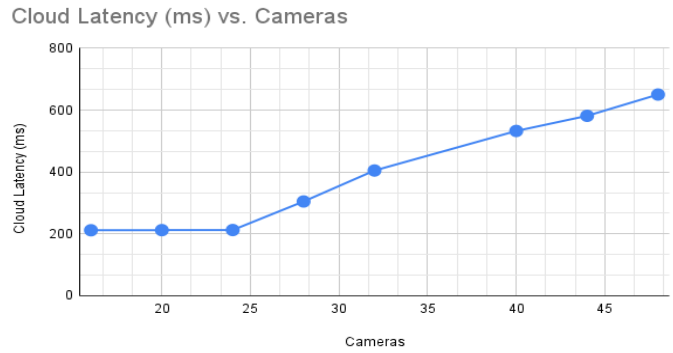
Based on the requirements mentioned in the assessment; For both fog and cloud-based scenarios, I've increased the number of cameras gradually to examine the value of latency and network usage and analysed the results of the proposed fog-based architecture in terms of latency and network usage and compared them with the cloud-based implementation. The experimental results are summarized in the table below.

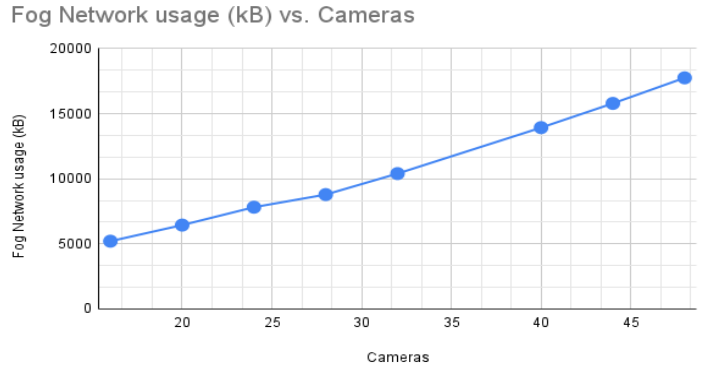
Cameras	Fog Latency (ms)	Cloud Latency (ms)	Fog Network Usage (kB)	Cloud Network Usage (kB)
16	6.74150	211.76451	5206.6	647410.9
20	7.06378	212.15734	6443.0	808918.9
24	7.38988	212.49051	7817.4	970831.6
28	7.73294	304.81474	8786.6	1013606.4
32	8.06067	404.84580	10397.8	1016838.8
40	8.78664	532.67949	13928.0	1023470.6
44	9.15665	581.60512	15789.0	1026782.6
48	9.51632	650.36408	17752.2	1030109.1

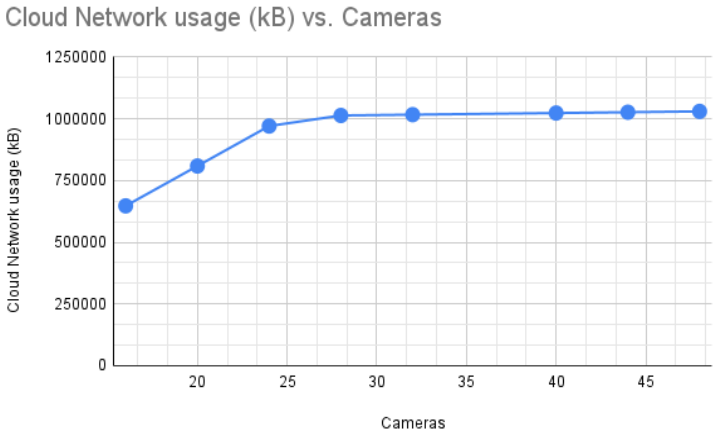
I've defined three application modules: 'video-capture' and 'threat-detector', and 'generate-alert' interconnected by application edges in addition to the sensors (camera lens) and actuators (screen and mobile for text message). As mentioned, camera has computing power, I've made to run the 'video capture' module in the camera along with the sensor. The 'threat-detector' and 'generate-alert' will run in the fog nodes or cloud depending on the selected CLOUD Boolean flag. The above tabulated data presents a compelling demonstration of the superiority of the fog-based implementation over the cloud-based counterpart in terms of latency and network usage.

The following are the 4-line graphs drawn for each of the metric in the table:


Fog Latency (ms) vs. Cameras
Fog Latency (ms)
0
2
4
6
8
10
20
25
30
35
40
45
Cameras


Cloud Latency (ms) vs. Cameras
Cloud Latency (ms)
0
200
400
600
800
20
25
30
35
40
45
Cameras


Fog Network usage (kB) vs. Cameras
Fog Network usage (kB)
0
5000
10000
15000
20000
20
25
30
35
40
45
Cameras


Cloud Network usage (kB) vs. Cameras
Cloud Network usage (kB)
0
250000
500000
750000
1000000
1250000
20
25
30
35
40
45
Cameras