Performance Evaluation of WiMAX-Wi-Fi Video Surveillance System

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Introduction

- Traditional surveillance system are mainly wired.
- Wired systems suffer vandalism, affected by rock environment, can not be installed easily in old buildings.
- However, wireless solution should be seen to be complementing the wired systems[1].

WiMAX-WiFi IP Video Surveillance Design

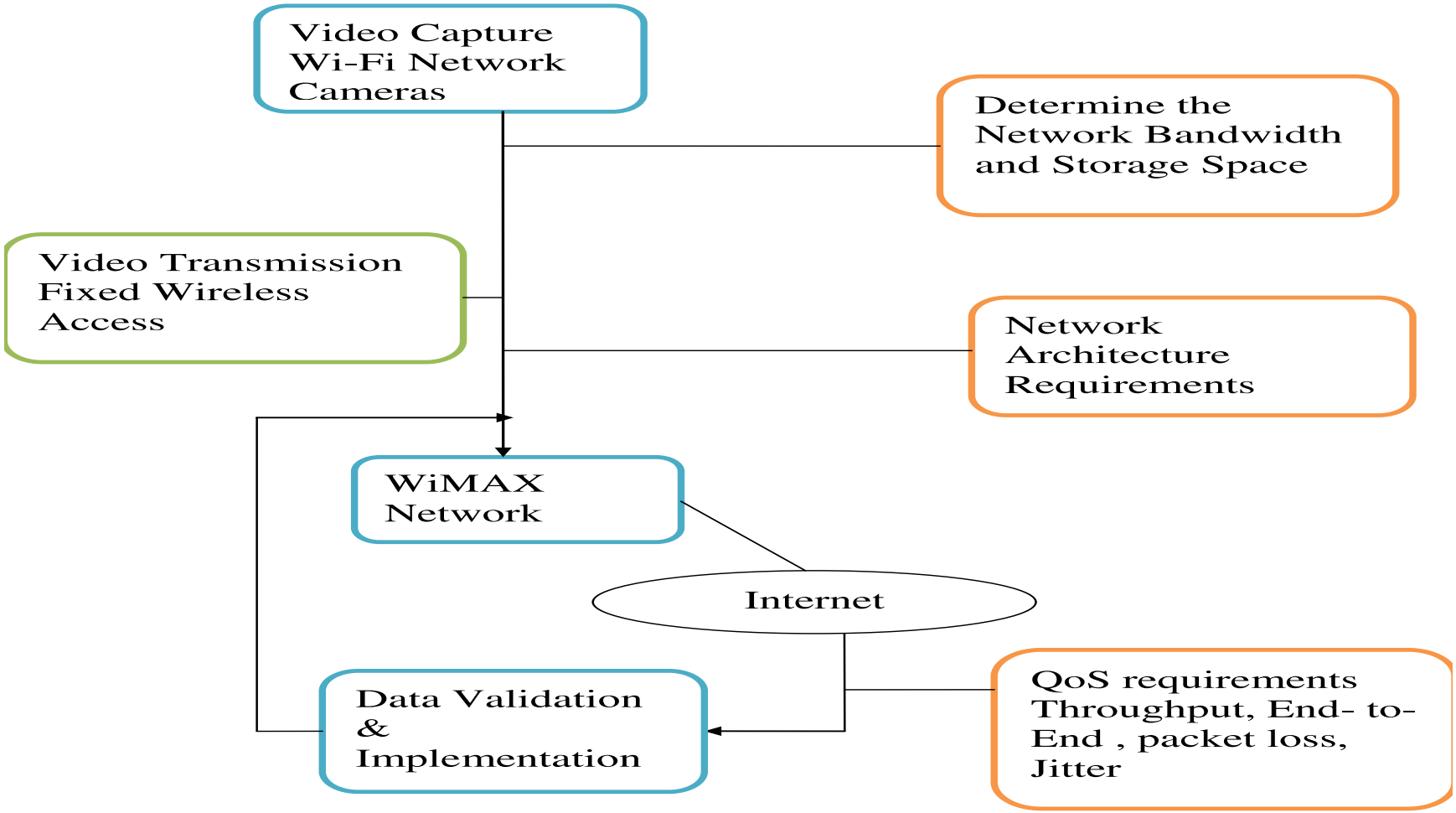

Fig.1: WiMAX- Wi-Fi IP Video Surveillance Design

Network bandwidth and storage space

- In general the network bandwidth (B) is given by :

$$B = \frac{MSDU \times FR \times N \times 8}{1024}$$

- Where: MSDU size in Kilobytes is, FR is the frame rate and N is the number of IP cameras.
- The constant 8 is included since there are eight bits per byte.

Network bandwidth and Storage Space Cont'

- The server storage space (B_S) can be calculated :

$$B_S = \frac{MSDU \times FR \times N \times 8 \times 24 \times 60 \times 60}{1024 \times 1024}$$

- B_S is in Gb

Table 1: Qos Requirements for IP Video Surveillance

Qos parameter	Definition	Acceptable Range
Throughput	amount of video data that can be transferred to the preferred destination (video server) per unit time (usually bits/second.	Depends on load in bits per second
load	total bits per second offered to the wireless network [2]	Depends on number of cameras
Packet loss	number of video packets not reaching the preferred destination [2].	Less than 1% [3]
End to end delay	time difference between video data departure and arrival [4]	150-200 ms [3,5]
jitter	absolute value of delay difference between selected packets [6]	Less than 60ms [3]

Network Architecture: WiMAX -Wi-Fi IP Video Surveillance Model

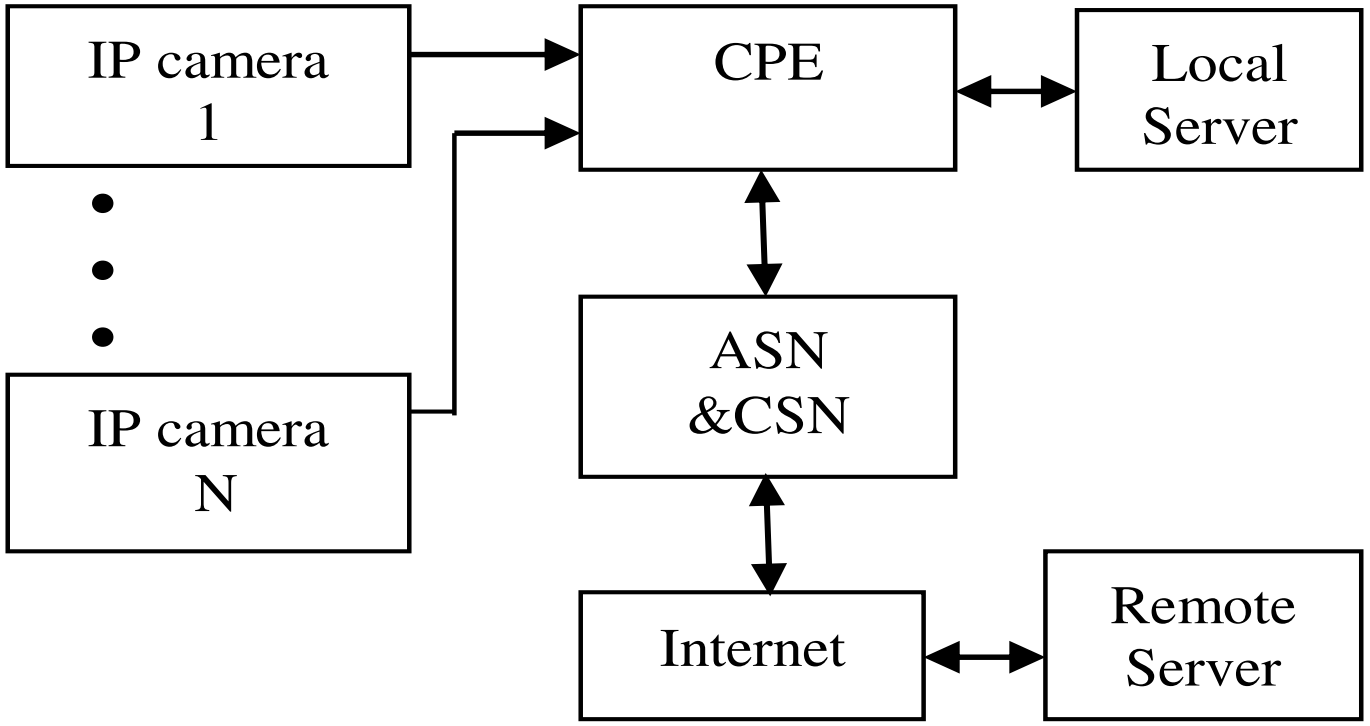

Fig.2: WiMAX –Wi-Fi IP video surveillance model

Table 2: Related work

Authors	Surveillance Env.	MAC Protocol	Max Throughput	Network Topology	Video Delivery
Hourdakis *et al [7]*	highway	802.16	3-30Mbps	star	simulcast
S.Leader [8]	highways	802.11a/ 802.16	20-60Mbps/ 100Mbps	Star/ring	unicast
Neves *et a*l [9]		802.16e		star	unicast
Guinella *et al [10]*	fire prevention,	802.16e		star	unicast
Ahmad *et al [11,12]*		802.16e		star	unicast
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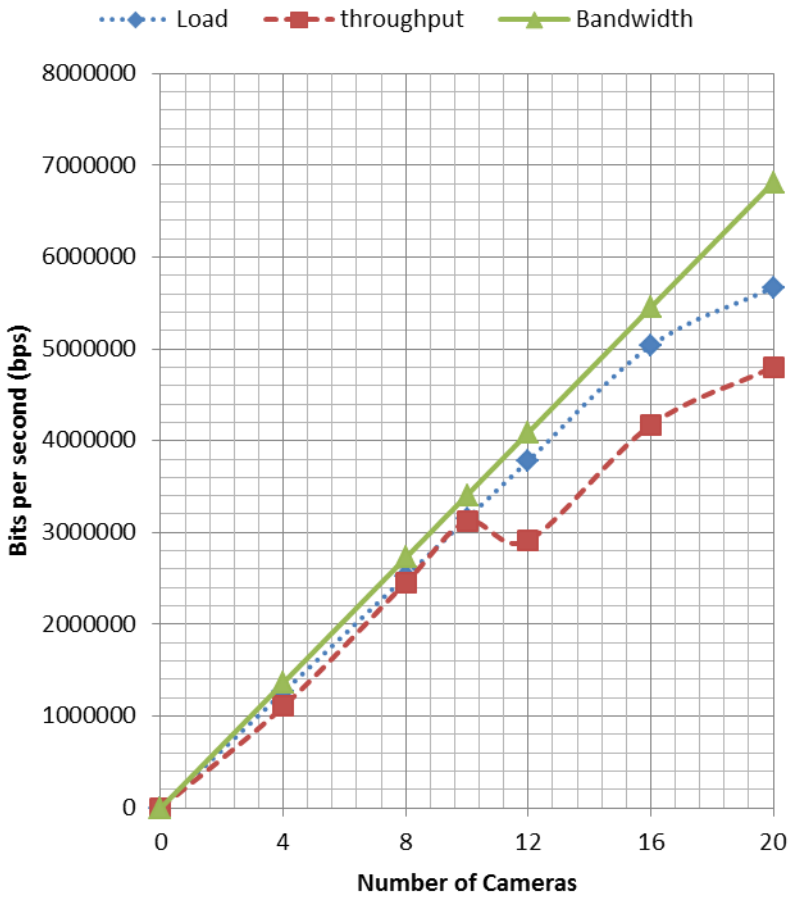
Lubobya et al	Bus station, old buildings, shanty compound	802.16d/ 802.11g	3-30Mbps	Star/mesh	unicast

Performance Evaluation Methodology

- OPNET Modeler 17.5 simulation package
- A 1420 Byte, 30 fps compressed Video was used. Varying number of Wi-Fi cameras.
- Simulated the WiMAX -Wi-Fi video surveillance models.
- Throughput Results compared with calculated values while jitter, end to end and packet loss was compared with acceptable QoS range

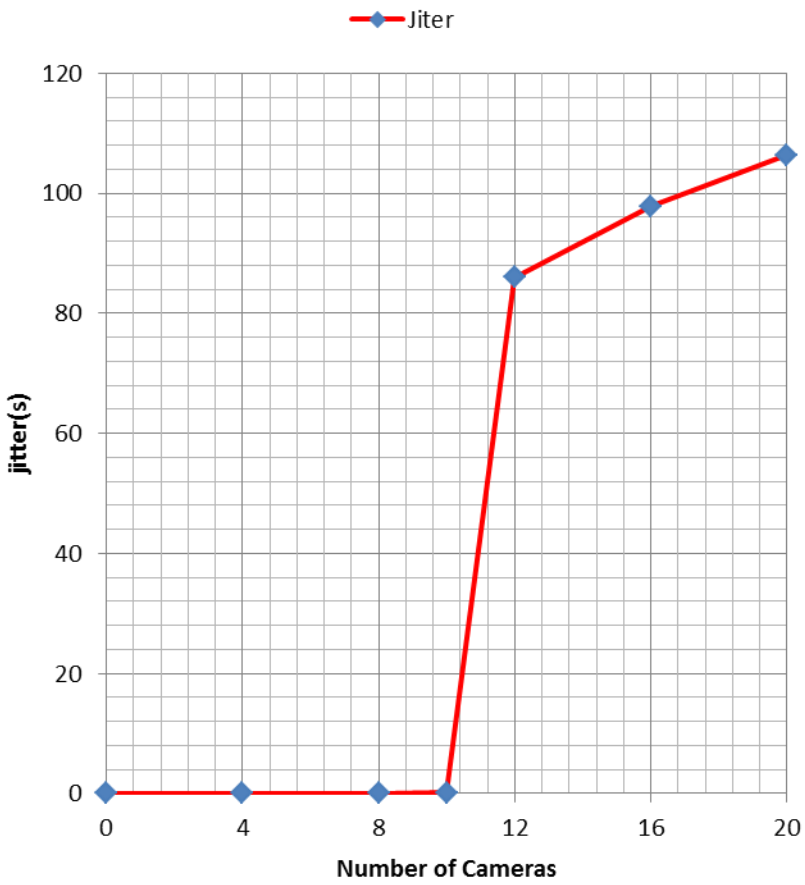
Results and Discussion



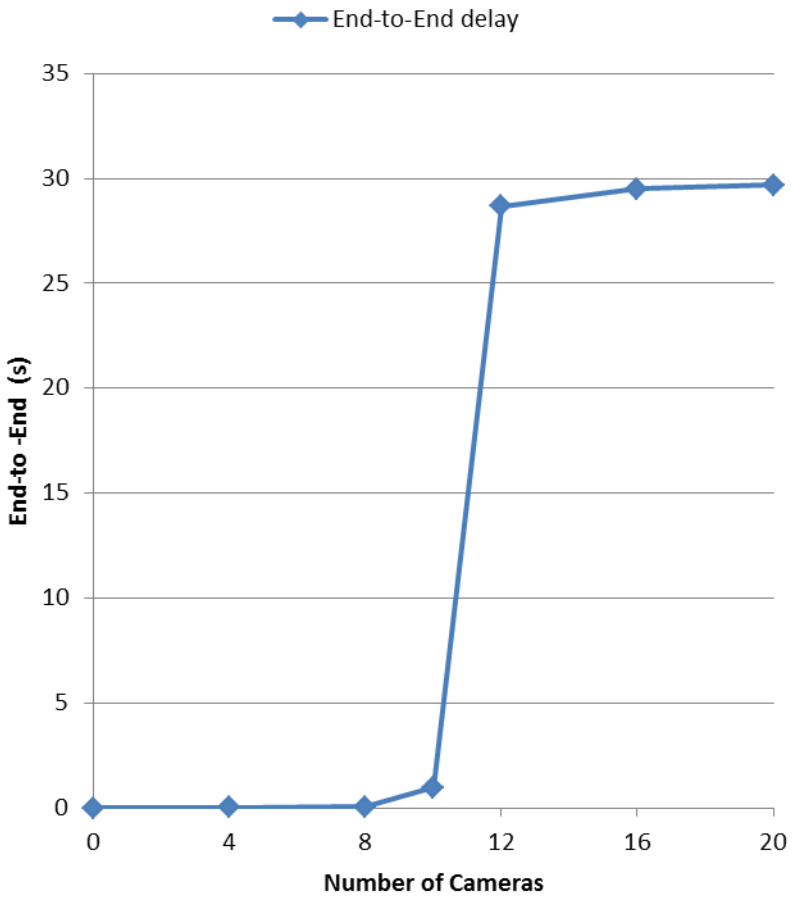
- Throughput is compared to the calculated network bandwidth and load.
- Beyond 10 cameras the packet loss increases above 1%.

Results and Discussion

- Jitter ranges within the acceptable values of below 60ms up to 11 cameras.
- Beyond that extremely high and unacceptable jitter values have been measured



Results and Discussion



- End to end delay must not exceed 200ms for video transmission.
- A similar trend of good results was recorded upto 11 cameras.

Conclusion

- This work proposes and evaluates the WiMAX -Wi-Fi video surveillance models.
- The evaluations is performed in terms of throughput, end to end delay, packet loss and jitter.
- For the simulated scenarios a CPE can effectively connect to 11 cameras beyond which throughput, jitter, packet loss and end to end delay becomes bad

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Thanks

Questions, comments, suggestions