Preliminary Analysis for the provision of a Wireless Backhaul Network for Border Control

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1. Objective

The objective of this document is to provide a budgetary quotation for the provision of a wireless backhaul network.

Goal is to interconnect 50 stations located along a 110km long border to a central command center; average distance between each site is around 50km.

Data to be transported is video + radar + IP flows, therefore requiring typically 99.99% radio link availability.

Throughput per station is 15Mbps.

2. Network Topology

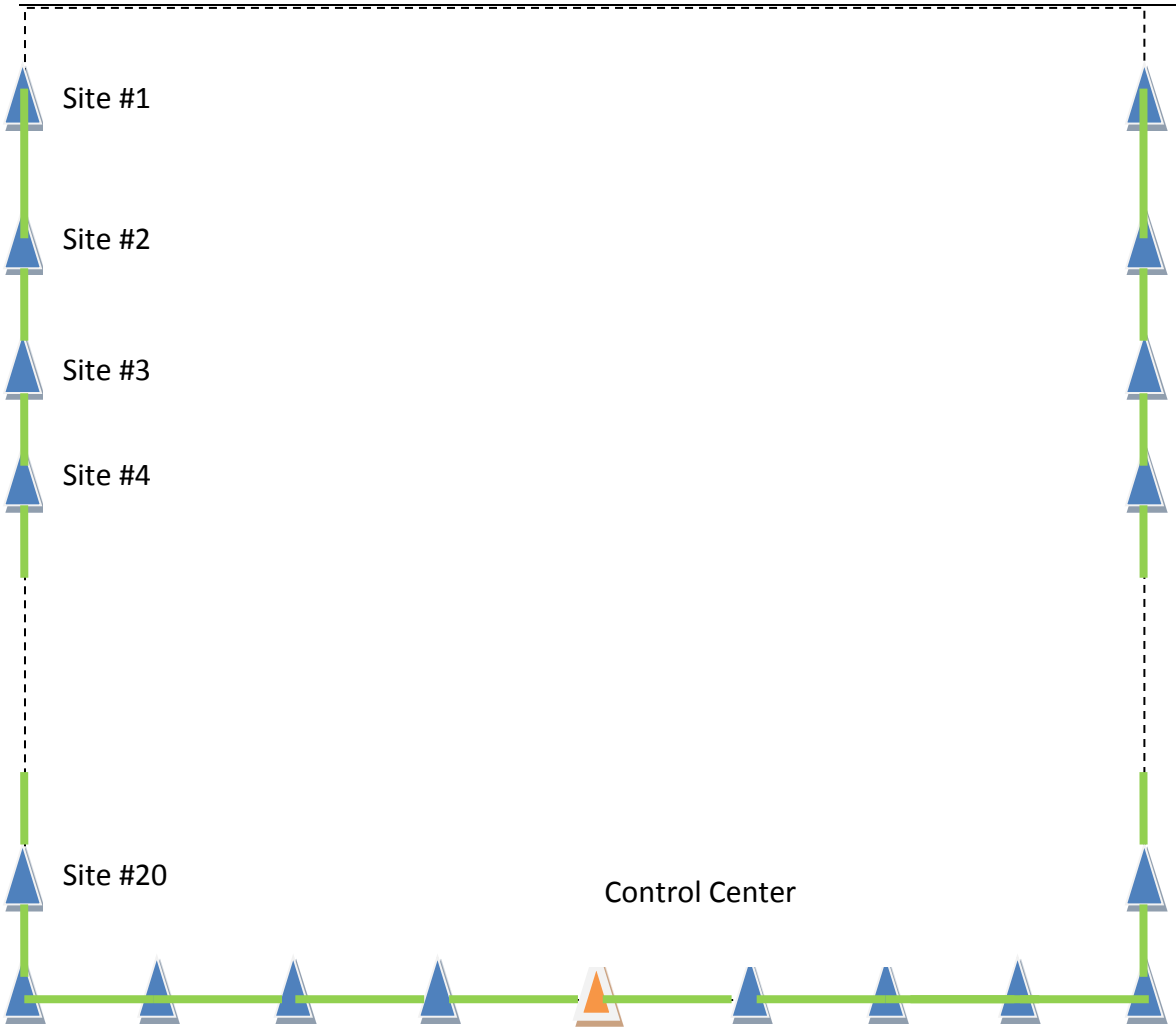
Different topologies are considered in order to provide several scenarios and the associated quotation estimates. A budgetary quotation will be estimated by comparing the different resulting estimates.

The challenge in designing this network is due to the fact that all sites are located along a border, which requires a linear topology, where capacity is increasing at each new hop as data is transported from the farthest location to the main command location.

A single wireless link allows for the backhaul of up to 380Mbps. In this case, it is possible to backhaul on a single link the aggregated traffic collected through 25 locations.

3.1. Daisy-chain topology

All links are daisy-chained, in a totally unprotected topology.



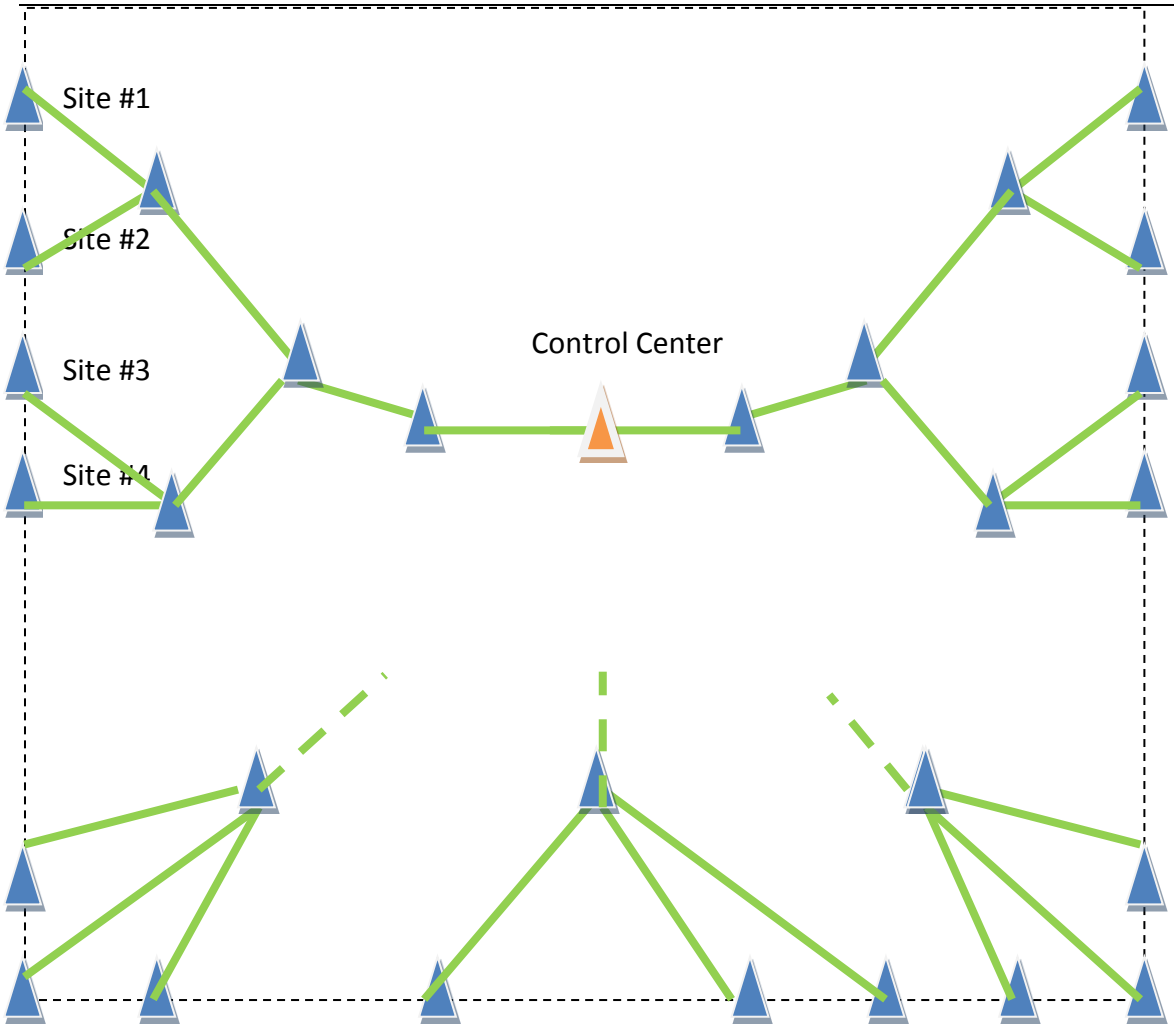
The closer to the main control center, the higher the link throughput requirement. Below table summarizes the changing link characteristics as the link throughput increases. All calculations are based on 3Roam's experience for the provision of high- and low-capacity links across a large variety of territories. Climatic factor for these simulations are based on a scenario where the country is located in the middle-east region.

For a 50 km link, the proposed frequency is 7GHz, as it minimizes path loss. The higher the throughput, the bigger the antenna to ensure the required 99.99% availability while modulation scheme increases and link robustness decreases.

Link Throughput	Number of sites backhauled	Antenna's Size	Frequency	Estimated Link Cost	Number of links
15 Mbps to 50 Mbps	Up to 3	60 cm	7 GHz	xxx USD	6
50 to 100 Mbps	Up to 6	80 cm	7 GHz	xxx USD	6
100 to 200 Mbps	Up to 13	120 cm	7 GHz	xxx USD	14
200 to 300 Mbps	Up to 20	150 cm	7 GHz	xxx USD	14
300 to 380 Mbps	Up to 25	180 cm	7 GHz	Xxx USD	10
TOTAL					xxx USD

3.2. Hierarchical topology

Traffic is collected through a tree topology network from remote ends up to a center control center. Protection level increases, while there is an increasing need for sites dedicated transmission sites to interconnect remote location to the command center.



Considering each border is 400km long, approximately 4 hops are required to collect traffic from the edge sites to the command control, considering all hops are 50km long. It is estimated that all sites at level N collect traffic from 3 sites at level N-1.

All links are still running at 7GHz. A rough cost estimates is provided in below table.

Link Throughput	Number of sites backhauled	Antenna's Size	Frequency	Estimated Link Cost	Number of links
15 Mbps to 50 Mbps	Up to 3	60 cm	7 GHz	xxx	50
50 to 100 Mbps	Up to 6	80 cm	7 GHz	xxx	17
100 to 200 Mbps	Up to 13	120 cm	7 GHz	xxx	6
200 to 300 Mbps	Up to 20	150 cm	7 GHz	xxx	2
TOTAL					xxx USD

3.1. Conclusion

Cost estimates based on any of the above two network simulations are very similar. A real network would be designed using a combination of either daisy-chain or tree topologies. It is fair to think that the overall cost of the network should be close to the cost estimates resulting from any of these simulations.

Of course, the actual border layout of the country would very much impact the final cost of such network. However the estimate provided herein should be realistically close to the cost of a real network.