

**Making Middleboxes Someone Else's Problem: Network Processing as a**  
**Cloud Service**  
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Most modern firms still in-house their middlebox processing capabilities. However, this is a highly expensive and resource intensive component for the firms, costing in millions of dollars over a range of five years. Considering the successful rise of cloud computing, the authors argue even middlebox processing can be outsourced to the cloud. However, this topological change would have its own novel challenges like the kind of redirection to be used in order to not substantially increase the latency, resonating with the idea of stateful middleboxes - to name a few. The authors thus, propose APLOMB - a cloud service developed to overcome these challenges. The paper also publishes a study of about 57 enterprise networks' middlebox deployment - the first of its kind.

Owing to the successful movement of IT infrastructure in firms to cloud rather than keeping in-house, the authors argue - in order to reduce the complexity and costs - even the middleboxes can be outsourced to cloud. This would enable the firms to bring down their infrastructure costs, owing to the economies of scale - by scaling up or down, depending upon their needs. They can also avoid failures through standby services. Thus, the authors have decided to show a data driven study of one such provider - APLOMB.

The first challenge APLOMB would face is the obvious challenge of redirection. While we have the option of bouncing the incoming traffic from APLOMB to cloud - the authors argue this would unnecessarily increase the latency and rather we should use redirection using multiple cloud PoPs by relying on DNS based redirection just like its use in the CDN. The other challenge is of the increase in bandwidth demand. The authors have tried to solve this by introducing a redundancy elimination and compression schemes - that would reduce the demand by approximately 1/3rd. In fact the authors APLOMB implementation still keeps in check the minimal latency for most network traffic. This latency is ensured to be lesser than 5 ms.

When performance evaluated for HTTP page load times for about ALEXA top 1,000 sites - for pages at 50th percentile the page load time turned out to be 0.72 seconds without APLOMB while 0.85 with APLOMB. For 95th percentile it took 3.85 second without vs 4.53 second with APLOMB - denoting the latency introduced is not a lot. When evaluated for VoIP applications the APLOMB architecture again performed well. Whereas the acceptable jitter cited by industry experts for one-way is 30 ms, with APLOMB architecture it produces a median inbound/outbound jitter of 2.49/2.46 ms on a call to the residential network. Over Wi-Fi as well the jitter turned out to be 13.21/14.49 ms for inbound/outbound.

Thus, with this study it can be argued, if done on scale, outsourcing the middlebox infrastructure to cloud services can be a cost effective way while maintaining the standards of performance over the spectrums of latency, bandwidth, etc.

I liked the fact that the paper went out to perform a detailed study of real-world middlebox deployments for 57 enterprises ranging from small ( 10 middleboxes) to very large ( 1946 middleboxes). It then went on to build upon their study by providing an actual implementation of the service while successfully performing well on standard performance benchmarks. Also, I learnt from the paper how taxing is keeping up the middleboxes infrastructure for a firm, in terms of labour or cost. I got to know that the cost might go north of \$50,000 and even a small network might require a management team of upto 25 personnel.

Although the paper did have its limitations as well. The fact that there was still about 1.7x increase in bandwidth demand even after all the compression techniques employed by the authors might be a cause of concern. Hopefully, the authors would come up with more ingenious ways to mitigate the increase in bandwidth.

I also believe that the idea of moving the middleboxes infrastructure to cloud for firms can be extended to Indian banking and insurance services which have traditionally been hesitant of using the cloud owing to the security concerns. With the rise in usage of cloud for such infrastructure as well, the security would also enhance as the cloud services would compete to present themselves as the most secured providers.