

CIS-490H Edge Computing

With Dr. Zheng Song

Paper Review: Week 11

**“BumbleBee: Application-aware adaptation for edge-cloud
orchestration”**

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1. Summary.

(1) Motivation

The primary motivation for the BumbleBee application-aware adaptation for edge-cloud orchestration is to manage performance changes closer to the source of where that performance change occurs rather than relying on traditional end-to-end network protocol data analysis to adjust network performance. So, instead of averaged, network-based adaptations, BumbleBee can manage applications in a way that requires minimal codebase infrastructure in order to manage resources internally within the same set of containers; it works alongside the Envoy between container groups (called pods), which is essentially a virtual router that allows inter-pod communication. So instead of network traffic from a real router and from internetwork communication, BumbleBee uses internal network traffic to manage applications and adapt to their performance needs.

(2) Contribution

The researchers provide three primary contributions: First, they do an analysis which lead to identifying four common patterns applications use to adapt to network variability. Then, they design and implement a setup which allows them to test the identified common patterns based on the needs of specific applications. Finally, they develop their BumbleBee prototype to manage application performance adaptation which proved that edge workloads can benefit from it compared to the traditional four patterns that most applications use to adapt to network variability.

(3) Methodology and/or argument

For their implementation, they used a traditional Kubernetes container orchestrator to manage pods and the Envoy between them. They make use of this Envoy/router-like program to create queues based on inter-pod communications by employing an additional script alongside the Envoy, while also using a script that allows an application to decide its adaptive behavior based on a container's performance.

(4) Conclusion

Overall, their model proved to improve on video processing and machine learning models ran between edge and cloud resources. Performance increase was based off reduced round trip times and seamless adaptations when network events occur.

2. Critique.

One of the most important lines I read in the paper comes from the introduction:

"BumbleBee's approach also allows placement of adaptive mechanisms closer to the point at which change occurs in the network, improving agility over more end-to-end approaches."

That statement should have been made in the abstract and also brought up and expanded upon much more early on. Even though they mention it toward the end of the introduction, they make it the last point and then give a summary of all of the sections in the paper as well as their contributions. From the very first sentence in the introduction, they should have brought up that specific point and made that the starting point for their project and idea as I notice that this is the pivotal reason for their work and why it is needed, and how it may be helpful to edge computing and network and software technologies in general.

3. Synthesis.

Overall, I see that with machine learning and edge computing and networking in general, the internet is becoming increasingly connected and is taking up a sort of *oneness*. Soon, every device on the network will be acting as a microservice, a micro controller to the much larger distributed system, where not only is storage complexly and efficiently distributed, but also computation. So, the whole world of technology as it turns out is becoming one giant, distributed computer, even though in some sense it always has been.