Extend Cloud to Edge with KubeEdge

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In this paper, we introduce an infrastructure in edge computing environment, KubeEdge, to extend cloud capabilities to the edge. In the new form of cloud architecture, Cloud consists of computing resources both at centralized data centers and at distributed edges. KubeEdge infrastructure connects and coordinates two computing environments for applications leveraging both computing resources to achieve better performance and user experience. Technically, KubeEdge provides the network protocol infrastructure and the same runtime environment on the edge as in the cloud, which allows the seamless communication of applications with components running on edge nodes as well as cloud servers. It also allows the existing cloud services and cloud development model to be adopted at edge. Based on Kubernetes [1], KubeEdge architecture includes a network protocol stack called KubeBus, a distributed metadata store and synchronization service, and a lightweight agent (EdgeCore) for the edge. KubeBus is designed to have its own implementation of OSI network protocol layers, which connects servers at edge and VMs in the cloud as one virtual network. KubeBus provides a unified multitenant communication infrastructure with fault tolerance and high availability. The distributed metadata store and sync service is designed to support the offline scenario when edge nodes are not connected to the cloud. EdgeController component in KubeEdge architecture is a controller plugin for Kubernetes [1] to manage remote edge nodes and cloud VMs as one logical cluster, which enables KubeEdge to schedule, deploy and manage container applications across edge and cloud with the same API.

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I. Introduction and Related Work

With the rapidly growing requirements for edge based applications such as IoT, AI and stream data analytics, Edge Computing, which enables computation to be "performed at the edge of the network, on downstream data on behalf of cloud services and upstream data on behalf of IoT services"[2], becomes more and more important for cloud computing.