NGI EXPLORERS

CHALLENGE #32
SCU-EDGE-02

Resource Allocation in Edge and Fog Computing Systems

Meet the expectations of this US Node through the technology challenge described below

GOALS

Resource-constrained IoT devices need to rely on edge, fog, or cloud computing resources to fulfill their application requirements. Resource allocation requires slicing both networking and computing resources in a timely and predictable manner. To this end, parameters such as the available resources of edge/fog nodes, the available bandwidth of links, and the delay of communication and processing resources must be taken into account. We will design and develop algorithms to control the reservation of both computing and communication resources in an efficient manner. Here, efficiency refers to reducing decision making time regarding resource allocation, as well as reducing the amount of traffic required to enforce the reservations. Since edge/fog computing is a relatively new field, there is no standard platform for research and development in a realistic environment. Existing works rely on simulation or emulation tools. On the other hand, existing edge and fog computing architectures only deal with the challenges of bringing cloud computing paradigms and NFV towards the network edge. In response to these challenges, we have developed a platform called the fog development kit (FDK) for on-demand reservation (and release) of communication and computing resources. By providing high-level interfaces for allocating resources, the fog system abstracts the complexities of fog computing from developers. We will extend the edge/fog system by adding the following features: (1) We will enhance the architecture to allow for resource negotiation when enough resources are not available to be reserved for a non-mission-critical application. For example, a video surveillance application may switch to the next lower video resolution and request for resources again. (2) We will add interfaces to control the allocation of resources on each fog node to switching and processing tasks. We will rely on the existing virtualization technologies (e.g., processor pinning) to slice these resources. (3) We will enable fog nodes to perform duty cycling, similar to our previous work in. This enhancement will improve the energy efficiency and scalability of the fog system. Duty cycling of the fog nodes will be centrally managed.

DETAILS

((1) Profiling and reducing the traffic required to enforce resource allocation in edge/fog networks, (2) centralized and distributed resource allocation algorithms compatible with existing SDN and virtualization technologies, (3) enabling in-network processing and software switching to reduce the deployment cost and maintenance of edge/fog computing systems.

SKILLS REQUIRED

Software-defined networking, virtualization technologies, software switching, OVS, DPDK, Docker, algorithms, machine learning, optimization

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