Fog Computing

Introduction:

Fog Computing is a paradigm that extends Cloud computing and services to the edge of the network. Similar to Cloud, Fog provides data, compute, storage, and application services to end-users. The distinguishing Fog characteristics are its proximity to end-users, its dense geographical distribution, and its support for mobility. Services are hosted at the network edge or even end devices such as set-top-boxes or access points. By doing so, Fog reduces service latency, and improves QoS, resulting in superior user-experience. Fog Computing supports emerging Internet of Everything (IoE) applications that demand real-time/predictable latency (industrial automation, transportation, networks of sensors and actuators). Thanks to its wide geographical distribution the Fog paradigm is well positioned for real time big data and real time analytics. Fog supports densely distributed data collection points, hence adding a fourth axis to the often mentioned Big Data dimensions (volume, variety, and velocity).

Unlike traditional data centers, Fog devices are geographically distributed over heterogeneous platforms, spanning multiple management domains. Facilitating service mobility across platforms, and technologies that preserve end-user and content security and privacy across domains is an open item that will need to be addressed.

Fog provides unique advantages for services across several verticals such as IT, entertainment, advertising, personal computing etc. Developing Fog Computing scenarios related to Internet of Everything (IoE), Sensor Networks, Data Analytics and other data intensive services to demonstrate the advantages of such a new paradigm, to evaluate the trade-offs in both experimental and production deployments and to address potential research problems for those deployments is a logical requirement.

Full Description:

While Fog conceptually extends Cloud computing and leverages Cloud's underlying technologies, Fog, by definition, spans wider geographic locations than Cloud, and in a denser way. Also, Fog devices are much more heterogeneous in nature, ranging from end-user devices, access points, to edge routers and switches. To accommodate this heterogeneity, Fog services are abstracted inside a container for ease of orchestration. Example container technologies are Java Virtual Machine (JVM), and Linux containers. Investigation of service mobility across Fog platforms is required. Specifically,

- Technologies that support workload mobility between Cloud and Fog platforms based on policies and the capability of the underlying infrastructure.
- Technologies that optimize different aspects of service mobility.

Fog services will be orchestrated across management domains; services will be provisioned, monitored and tracked across these domains. Investigating security and privacy in the context of Fog Computing is required. Specifically,

- Privacy, security threat analysis for various Fog players (ex: service provider, end-user, content provider) in the context of different Fog service verticals (ex: IoE, Sensor Networks, Data Analytics, IT, entertainment, personal computing).
- Technologies that preserve security and privacy of user/content across domains.
- Technologies that seamlessly integrate and extend existing Cloud security/privacy solutions in the context of Fog.

While Fog provides unique advantages for services across several verticals such as IT, entertainment, advertising, personal computing etc., investigating Fog advantages for Big Data services in several verticals including IoE is required. Specifically, innovations in compute, storage offerings for data intensive services such as the following:

- Interplay between the Fog and the Cloud. Typically, the Fog platform supports real-time, actionable analytics, processes, and filters the data, and pushes to the Cloud data that is global in geographical scope and time.
- Data collection and analytics (pulled from access devices, pushed to Cloud)
- Data storage for redistribution (pushed from Cloud, pulled by downstream devices)
- Technologies that facilitate data fusion in the above contexts.
- Analytics relevant for local communities across various verticals (ex: advertisements, video analytics, health care, performance monitoring, sensing etc.)
- Methodologies, Models and Algorithms to optimize the cost and performance through workload mobility between Fog and Cloud.

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