Scalable Computing – Assignment 3

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1. **Mobile Edge Computing: A Survey** by Nasir Abbas, Yan Zhang, Amir Taherkordi & Tor Skeie

Key contributions/findings/conclusions of the paper

- *Mobile cloud computing* (MCC) has improved computation, storage & energy of mobile devices by utilizing centralised cloud
- Even though Mobile edge computing (MEC) is in its development stage, it has exhibited potential application in augmented reality, mobile data & video analytics, vehicles connectivity, smart building, sensor-actuator networks & ocean monitoring
- A significant concern for the MEC technologist today is security and privacy. Deployment of MEC which involves its integration with mobile services poses a severe security risk, hijacking and data breach could cripple the complete network
- MEC has shown great potential for edge technologies of the future (5G mobile network). It provides elastic resources at the edge of the network for applications which require low-latency & high computation capabilities

Key technological insights provided by the paper

- In Radio Access Network (RAN), MEC improves efficiency & reduces failures & bottlenecks by connecting user with a cloud-edge network nearest to him/her instead of directing linking user with core network
- Cloudlet consists of multi-core computers connected to remote cloud servers which are deployed at public places like offices, hospitals etc. The aim is to bring cloud tech. closer to users through Wi-Fi to provide support & reduce latency
- In Fog Computing (term coined by CISCO), computation & decision making is done in local area network generally by a single processors which gathers data from multiple sensors wirelessly. It has lower latency than a cloud servers
- The Cloud RAN integrates all base station computational resources in centralised cloud improving collaboration & efficiency

Key insights of relevance cloud/fog/edge scalability

- The distributed MEC servers provide reliability & scalability since they migrate computational tasks to external resources instead of central servers. This migration decreases power consumption & reduce latency & delays
- Application service providers can utilize MEC to scale services by deploying infrastructure-as-a-service at their network edge
- Grid control & data acquisition systems & smart meters integrated with MEC are used to balance and scale the load
- Software defined networks reduce network cost & allow for easier scalability of the network resources

2. **Survey of Fog Computing: Fundamental, Network Applications, and Research Challenges** by Mithun Mukherjee, Lei Shu & Di Wang

Key contributions/findings/conclusions of the paper

- Cloud computing faces issues like network congestion, delays, high cost & data processing challenges. These issues arise because of the huge distances between data centres & users. Also, data centres have high energy requirements & massive carbon footprint
- Many major tech companies & academic bodies like Cisco, Dell, AT&T, Princeton University etc.) have collaborated to create *OpenFog Consortium*. The consortium aims to develop scalable, reliable & secure open source fog computing architecture
- *Nano Data Centres* servers host & distribute content via peer-to-peer model. Energy is saved as content is pushed closer to users
- Fog computing is an extension & not a replacement for cloud computing. It extends the cloud by bringing network communication, storage & computation to the edge

Key technological insights provided by the paper

- A *'mini-cloud'* at the edge of the network consists of numerous geographically distributed devices (user devices, routers etc.) These devices are managed in a distributed fashion; they maintain device-to-device links & share resources with their neighbours
- *Data centres Visualization*(DCV) creates many independently implemented virtual networks(VN). The hardware like servers, links etc. are virtualized making VNs logically separated. The performance isolation makes application deployment easier in DCVs
- The *AR/VR* tech can utilise fog computing for the seamless merger of physical & virtual information. This tech requires high speeds (~200MBps) & low latency which can be achieved by moving resources to the edge of the network
- In remote *Gaming-as-a service*, users don't need to install games locally but it is executed & processed over cloud; audio-video is streamed to user's local devices & user game controls are relayed back to the cloud.

Key insights of relevance cloud/fog/edge scalability

- The cloud computing finds its usefulness in emergency applications. Cloud architecture provides scalable & flexible virtual servers for storage & processing of large data amounts. Fog architecture is suitable for low latency health & emergency scenarios
- As fog computing doesn't have massive computing/storage capacities, its scalability becomes an issue. Poor scalability leads to difficulties in dynamic load balancing & task management/assignment
- The *TelcoFog* architecture, introduced for telecom providers, provides a scalable framework which is both distributed & programmable. *TelcoFog* also supports dynamic deployment of network services & virtualisation
- Resource management & scalability of fog network can be enhanced through implementation of Software-defined Networking (SDNs) architecture