Towards Real-World Deployment of Cloudlets
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Motivation
- Conventional Cloud is not enough for rich/interactive applications due to high latency and low bandwidth.
- Cloudlets provide Cloud-like capabilities near the mobile users

Cloudlets bring the Cloud closer to the user

Cloudlet-specific Features

Cloudlet workflow
1. Cloudlet Discovery:
   Cloudlets by definition are dispersed at the edge of the Internet. Need a mechanism to find a nearby cloudlet.
2. Rapid Just-in-Time Provisioning:
   Not practical & scalable to pre-provision every cloudlet with every software. Need to provision on demand.
3. VM Handoff across WAN:
   What if a mobile user wanders away from the cloudlet?

Discover! Provision! Handoff!

Increasing Cloudlet Mindshare
- Academic Research
  - Citation count is rapidly increasing
  - Papers at MobiSys, IEEE Pervasive Computing, HotMobile, etc.
  - Not just our own papers!
  - New Symposium on Edge Computing
- Industry influence
  - Mobile Edge Computing
    - Industry initiative to standardization edge computing (hardware) for cellular networks
  - MEC congress: http://meccongress.com
  - Intel, Huawei, Vodafone, Nokia, IBM, NTT DoCoMo, ...
  - Open Edge Computing (OEC): New Industry + Academy initiative for open-source Cloudlet software

Bootstrapping Deployment
- Classic bootstrapping problem
- Need practical applications to incentivize cloudlet deployment
- Developers cannot rely on a cloudlet infrastructure
- OpenStack++: Cloudlet-extended OpenStack
  - Leveraging an open ecosystem for cloud computing
  - Anyone who uses OpenStack for cloud can easily use cloudlets
  - Systematic way to expedite cloudlet deployment

Leverage OpenStack to expedite Cloudlet deployment

OpenStack++: Cloudlet Extension

- New features: 1) Rapid Provisioning 2) Adaptive handoff
- Design Principles
  - Modular Approach using Extension mechanism
  - Minimize maintenance despite the rapid OpenStack release cycle
  - Support both OpenStack++ and standalone version

Increasing Cloudlet Mindshare

SUCCESSFULLY INTEGRATED CLOUDLET CAPABILITY INTO OPENSTACK KILO

Future Plans
- Distribute to early adopters. Code is available at: https://github.com/cmusatyalab/elijah-openstack
- Intel-supplied Wi-Fi cloudlets for CMU class projects (Fall 2015)
- Merge into OpenStack upstream

Cloudlet concept gaining acceptance from academia and industry