Serverless Computing in Ephemeral Clouds

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Problem
It is difficult to share compute resources.

Motivation
- Why rewrite applications?
- Do we need to own multiple devices?
- What happens without internet access?

Proposal: Ephemeral Clouds
- Serverless function architecture (λ)
- Combine compute power of nearby devices
- Share resources over internet or ad hoc

1. Cloud Condensation

Global Registry
- Federated, fault-tolerant database of nodes
- User requests nearby nodes from registry

Local Area Registry
- Nodes broadcast identity, cache nearby nodes
- User detects one broadcasting node and receives its cache of nearby providers

2. λ Placement

- Communication round-trip time
- Node utilization and capabilities
- Colocate functions with their consumers

3. Migration & Faults

- In response to requester or overutilization
- Live migration: continuous availability
- Transparently reconstruct connections
- Maintain critical computation state on requester

4. Distrust, Compensation

- Neither users nor nodes are trusted
- Secure execution environments (eg. SCONE [2])
- How to agree on price?
- How to verify work was done correctly?

Examples
- Compiling code [3]
- Video analysis, encoding [4]
- Machine learning, rendering [5]

Emerging Use Cases
- Mobile offload
- Vehicular ad hoc networks
- UAV ad hoc networks
- Collaborative compute sharing
- Dynamic data center scaling at peak load

References