Edge Computing

CSE 315

Peripherals & Interfacing

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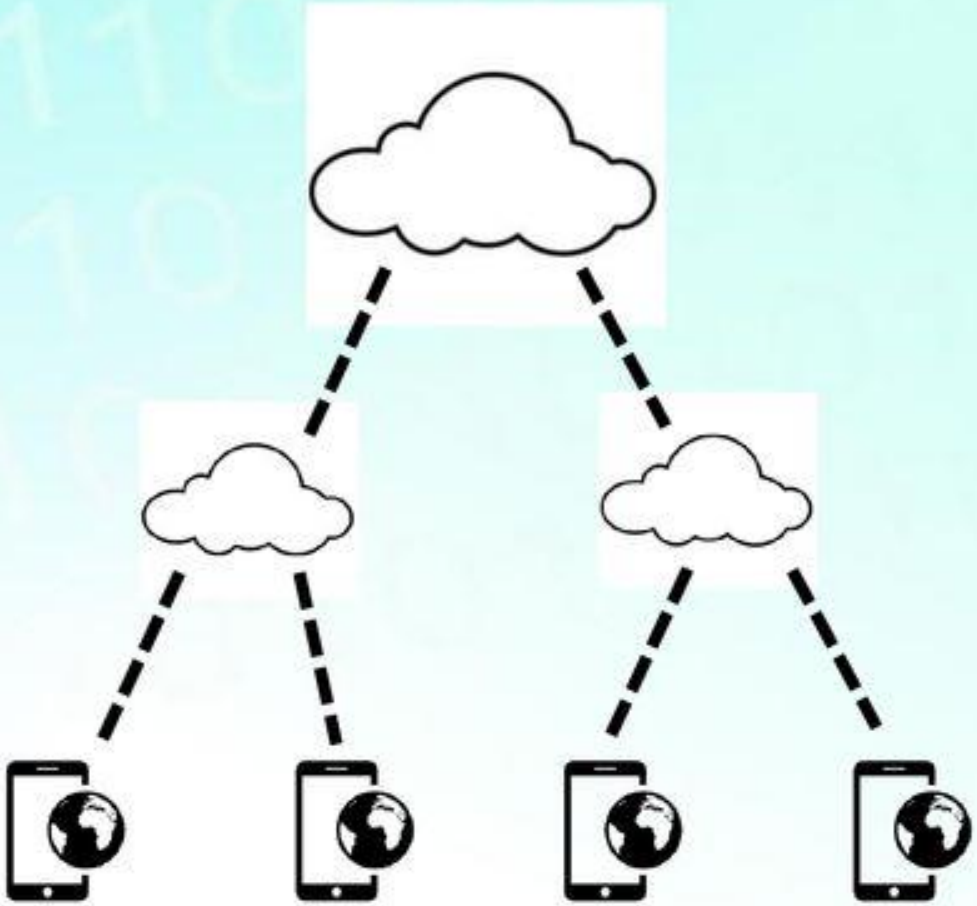
What is Edge Computing

- Edge
  - Any computing and network resources along the path between data sources and cloud data centers

Three-level Architecture

- First level:
  - unmodified cloud infrastructure
- Second level:
  - dispersed elements called cloudlets with state cached from the first level
- Third level:
  - Mobile-device or IoT device



Technology

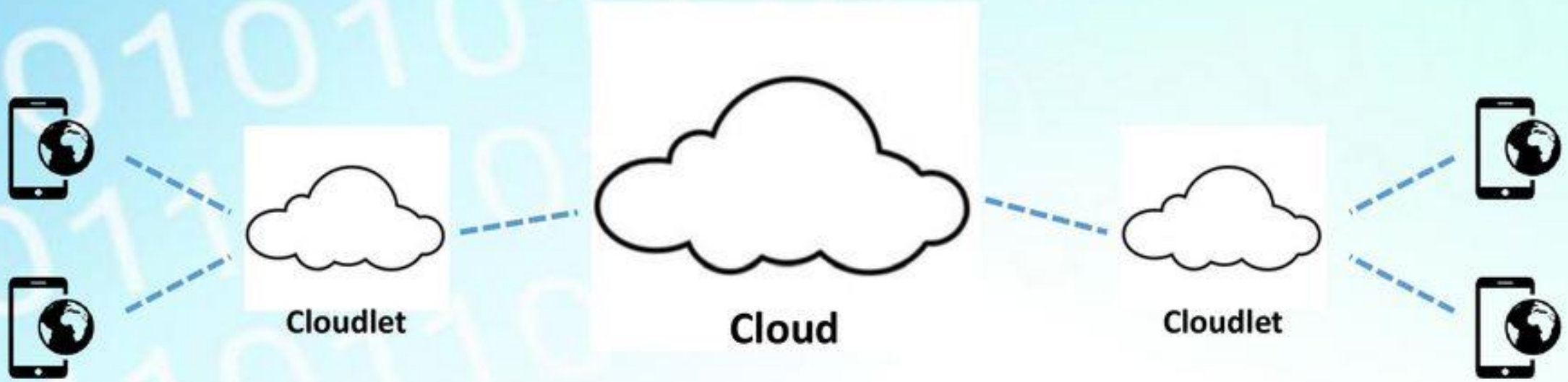
- Content Delivery Network (CDN)
- Fog nodes
  - Cloudlets
  - Micro datacenters

CDN

- **Geographically distributed** network of proxy servers and their data centers
- Benefits
  - Reducing bandwidth costs
  - Improving page load times
  - Increasing global availability of content
  - Location-relevant advertising
- Techniques
  - **web caching**
  - **server-load balancing**
  - **request routing**

Cloudlets (Edge)

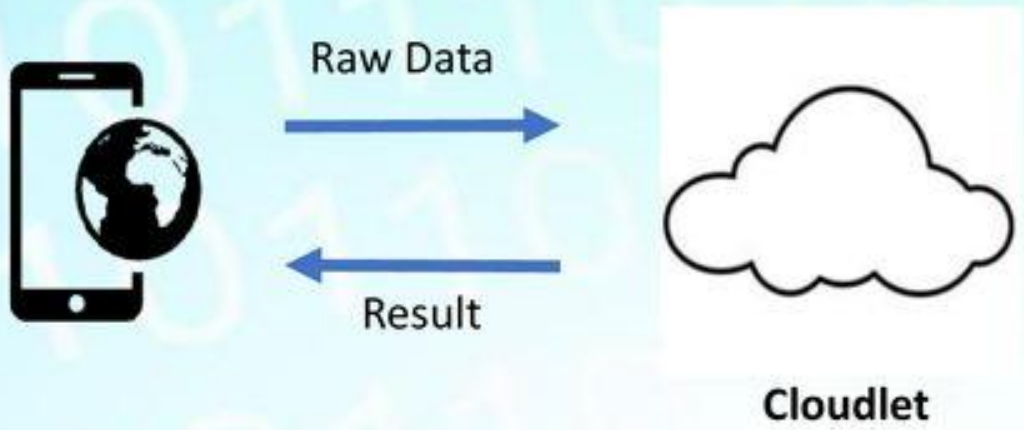
- A mobility-enhanced small-scale cloud datacenter that is located at the edge of the Internet



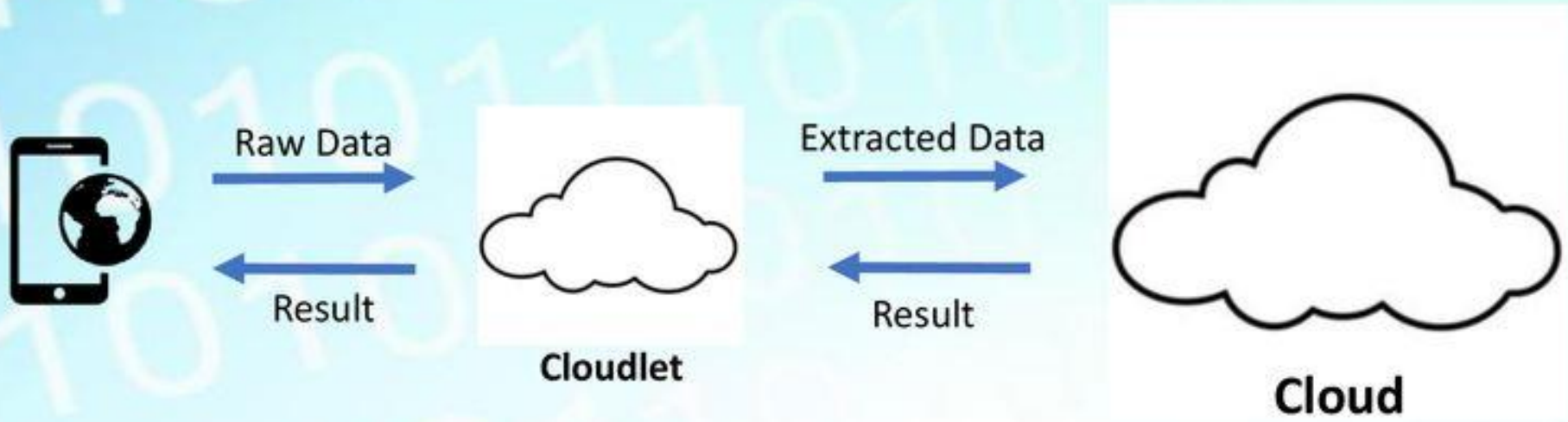
Cloudlets

- Based on standard cloud technology (**virtual machines**) : Openstack
- **Soft state** only (Storage)
  - contain cached states from the cloud
  - buffer data originating from a mobile device and going to the cloud
  - entirely self-managing
- Close at hand
  - "**Logical proximity**" of the mobile devices
- Resources and connectivity (Networking and Processing)
  - sufficient CPU, RAM, etc. to offload resource-intensive computations from several mobile devices
  - good connectivity (bandwidth) to the cloud
  - not limited by electric power supply

Processing



Processing



Benefits of Cloudlets

- Highly responsive cloud services.
  - low end-to-end
  - Low latency, high bandwidth
- Scalability via edge analytics.
  - Raw data is analyzed on cloudlets. Only the extracted information transmitted to the cloud.
- Privacy-policy enforcement.
  - A cloudlet can enforce the privacy policies of its owner prior to release of the data to the cloud
- Masking cloud outages.
  - If a cloud service becomes unavailable , a fallback service on a nearby cloudlet can temporarily mask the failure

Compare to Cloud Computing

Parameters	Cloud Computing	Fog Computing
Server nodes location	Within the Internet	At the edge of the local network
Client and server distance	Multiple hops	Single/multiple hop
Latency	High	Low
Delay Jitter	High	Low
Security	Non-locally controllable	Locally controllable
Location awareness	No	Yes
Vulnerability	Higher probability	Lower probability
Geographical distribution	Centralized	Dense and Distributed
Number of server nodes	Few	Very large
Real time interactions	Not fully supported	Supported
Usual last mile connectivity	Leased line /wireless	Mainly wireless
Mobility	Limited support	Supported

Challenges

- Collective **control and sharing of cloudlets** in distributed computing
- Managing dispersed cloudlet infrastructure
- **Higher management cost** than centralized infrastructure