Computing-Aware Traffic Steering (CATS) Problem Statement, Use Cases, and Requirements

draft-ietf-cats-usecases-requirements-03
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Update summary from revision 02 to 03

- Terminology on “Computing Service”
- Appendix A on complementary use cases
- Authors change, @Med volunteered to be removed from the authors list, due to number limitation. Many thanks to his consistent contributions.

https://author-tools.ietf.org/iddiff?url2=draft-ietf-cats-ucases-requirements-03
• Terminology on “Computing Service”
  • Address the comments on the difference between “Computing Service” and “Service” (Please see relevant discussion in list archives)

Computing Service: An offering that is made available by a provider by orchestrating a set of computing resources (without networking resources).

Some differences and similarities exist between service and computing service:

* Service is packet-based, while computing service is transaction-based. Application content is exposed within a computing service.

* Both service and computing service can be “on-path” or on “endpoint”, depending on the service logic or computing service logic that are defined by the provider.
Appendix A use cases summary

- **CATS for CDN (4K videos)**, deployed in Henan and Jiangsu, China (China Mobile)
- **CATS for cloud rendering**, in Zhejiang, China (China Mobile)
- **CATS for Internet of Vehicles**, in Hebei, China (China Unicom)
CATS Trials for CDN and Cloud Rendering

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Overview of CATS deployment in 5 Provinces, in China

- **Henan, China**: CDN 4K videos, Distributed approach
- **Jiangsu, China**: CDN 4K videos, Centralized approach
- **Zhejiang, China**: Cloud Rendering, Hybrid approach
- **Guangdong, China**: Intelligent detection, Centralized approach
- **Hebei, China**: Intelligent detection, Distributed approach
CATS for CDN(4K videos)

• **Service mode:**
  • Clients fetch data chunk every 10 seconds, store locally and repeat.
• **Service-level requirements:**
  • smooth experience, no lag, no mosaic, no waiting when jumping or dragging the scroll bar.
• **Mapping to network-level and computing-level requirements:**
  • fast connection of first packet
  • congestion avoidance, and not exceed the upper limit of network link BW and server I/O BW.
  • fast recovery from congestion
  • instance affinity may not be needed
• **Experiment benchmarking:**
  • Average size of data chunk of 4K videos is about 25 to 30 Mbps, and 300 clients pull videos requests simultaneously. Peak value is around 7.5Gbps to 9Gbps.
  • BGP update time duration: every 15 seconds.
• **Primary metrics:**
  • **Computing side:**
    • the average server load(CPU utilization in percentage)
    • the average utilization of I/O bandwidth of each site(in percentage)
  • **Network side:**
    • Link utilization(in percentage)
    • packet loss rate(in percentage)
CATS for CDN (4K videos), deployment in Henan, China

CATS Egress

CATS Ingress

N

10GE

CDN Switch

1

10GE

2

10GE

Jiaozuo

Luoyang

Xuchang

1

10GE

Katang

Zhoukou

2

10GE

Zhengzhou

PA17/18

Nanyang

Xinyang

NAT

APP Server

CATS Egress

CATS Ingress

N*10GE

CDN Switch
CATS for CDN (4K videos), deployment in Jiangsu, China
# CATS for CDN(4K videos), test cases and preliminary results

<table>
<thead>
<tr>
<th>Test cases</th>
<th>Procedures</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATS based on server load</td>
<td>• 200 clients fetch data chunks and get connected</td>
<td>difference of the CPU utilization rate between sites is under 5%, the service of each client is well guaranteed.</td>
</tr>
<tr>
<td></td>
<td>• choose one site to improve the CPU utilization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• newly add 20 clients</td>
<td></td>
</tr>
<tr>
<td>CATS based on server I/O BW utilization</td>
<td>• 200 clients fetch data chunks and get connected</td>
<td>difference of the number of session connections between sites is under 5%, the service of each client is well guaranteed</td>
</tr>
<tr>
<td></td>
<td>• newly add 20 clients</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• repeat the second procedure for 5 times</td>
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</tbody>
</table>
CATS for MIGU cloud rendering

- Service mode:
  - MIGU is a digital content subsidiary of China Mobile
  - Applications rendering jobs distributedly in real-time

- Service-level requirements:
  - Fast rendering (typically within 100ms), batch processing.

- Mapping to network-level and computing-level requirements:
  - GPU required.
  - Considering both transmission delay, instance processing delay and client side delay.
  - I/O BW also need to be considered when packing high resolution videos.
  - Instance affinity required.

- Primary Metrics:
  - Computing side:
    - Processing delay, including encoding, encapsulation, inter-frame delay. (in ms)
    - GPU rendering capabilities (in frame per second (FPS))
    - The average utilization of I/O bandwidth of each site (in percentage)
  - Network side:
    - Packet loss rate (in percentage)
    - Transmission delay (in ms)
  - Service side:
    - The amount of service calls
CATS for cloud rendering, in Zhejiang, China

- Deployed in 4 cities in Zhejiang, China.
- Each city with one edge site
- Each site with several rendering instances and management instances
- Management instances grab metrics and upload to MIGU cloud platform
- MIGU cloud platform passes metrics to network controller through restful API.
Summary and Considerations for next steps

- CATS for CDN and CATS for cloud rendering have different maturity and different requirements on metrics.
- Polish existing use cases, maybe classify them into “immediate use cases” and “future/upcoming use cases”?
- Maybe we need a better derivation from the problems to requirements, other than basic performance driven factors, but also factors like cost?
- Then should we consider more factors which may not be directly measured?(comments from Luis)