DYPOP: Datacenter beside your telco-POP

Katsushi Kobayashi
Advanced Institute for Computational Science (AICS),
RIKEN
ikob@riken.jp
Motivation

• Is it sustainable that cloud service requires $$$?
  • Big Data Center:
    • Google: 1M servers, Apple: 1B USD for Cloud, Amazon: Tokyo DC for Japanese customer.
  • CDN:
    • Akamai (sells RTT): 90k edges REDUCE/CONCEAL RTT between services and ends, e.g. 4 sec. rule for Web site.

• P2P is NOT an alternative,
  • Even if it can be made without $$$, BitTorrent, NanoDataCenters (NaDa).

• Worse QoE by difficulty of predict component behavior:
  • Unreliable home nodes make system to unstable.
  • Too much diverse CPU, OS, Disks, Access BW.
DYPOP: Datacenter beside Your telco-POP

- **Goal:** Predictable distributed computing infrastructure.
- **To eliminate uncertain components from system, i.e. home nodes and access.**
  - Server rack on aggregation-POP hosts application.
  - > 99.9% reliability and small latency are expected.
  - Ends on POP can know access circuit BW/Latency.
  - 3K aggregation-POP in Japan, 20M FTTH access in Japan, but in under-utilization.
  - similar to US Ignite: To deploy GENI racks onto several cities. And to develop applications on it.
  
  Note: RS-DVR service is not available in Japan.
Vertical Traffic view

DYPOP + P2P

Datacenter + Federation

Global Distribution

Datacenter

P2P

Scale UP

CDN

DYPOP

Local

# of Server or Resource

Latency / Bandwidth⁻¹ between user and server
Horizontal traffic view

- Datacenter
- Datacenter + Federation
- Global Distribution
- DYPOP
- DYPOP + P2P
- P2P
- CDN
- Local
- Scale UP

Latency or Bandwidth\(^{-1}\) among servers
On-path discovery, deployment, and global directory.

- Scenario and Key components
  - On-Path computing resource discovery
  - i-Path: E2E Cross-layer
  - Application provisioning
  - FreeBSD jail: OS virtualization
  - Global content and service discovery
  - Overlay, scalable P2P
i-Path: Network Transparency

- end-to-end in-band cross-layer approach for “application” not only for transport
- Network “application” can do better itself, if underlying path information is provided.
  - Bottleneck, link/queue utilization, cause of loss, distance of circuit,....
  - P2P peer selection, FEC redundancy, multi-path potential,....
- Network “application” can discover computing resources on communication path. Application will deploy own “agent” on it.
- One packet is enough to discover “nearest” computing resource.
Why i-Path?

• Flexible
  • Distributed approach, no central manager.
  • Computing resource discovery, e.g., CPU, memory, storage
    • not only to visualize underlying network.
• Compatible with Security framework
  • i-Path protocol layer is in between IP and Transport.
    DYPOP edge can be aware on-path discovery packet, even if original connection is made with TLS.
How to share edge cost?

- Service Provider, video, game, private storage, SNS etc.:
  - To provision own service to edge as Akamai Edge Computing.
- Power saving:
  - Low power idle or power cut can save access circuit. Sleep proxy on edge also saves power on home node.
  - DYPOP edge cost is depreciated by 2yr. (in Japan).
    - Edge cost is 4,000 Yen/core (50$)
    - 20W home devices can be in stand-by 16hr./day. Edge working 24hr. consumes 2W.
    - 20W x 16hr. - 2W x 24hr. = 99kWh/yr. = 2,000 Yen.
Thank you!

http://dypop.riken.jp

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