APII Workshop 2012

Overlay Content Routing Test over KOREN

Yi, Dong-Hoon | 2012. 10. 29

Contents

1-1 Background

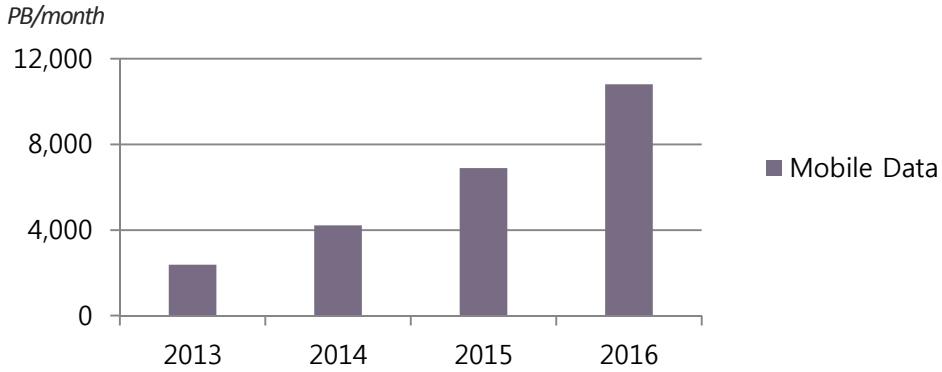
Paradigm Shift form WWW to MMM (Mobile Multi-Media)

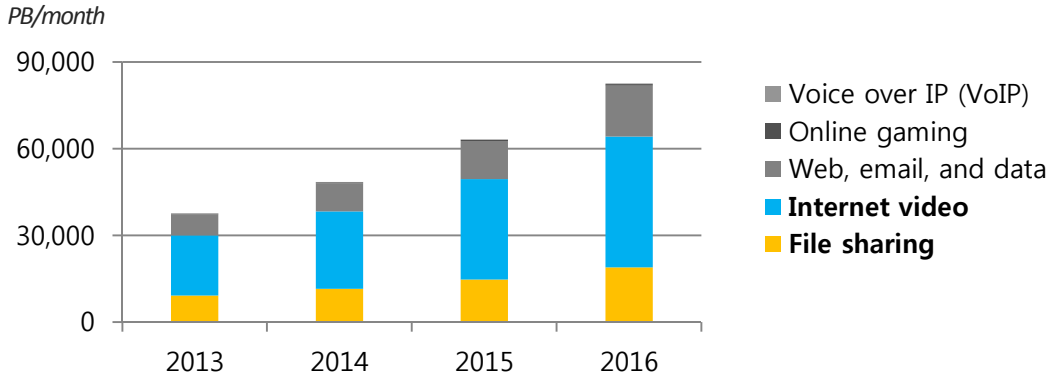
Trend on Internet Consumer Traffic

- **Mobile**
  - Broadband mobile access network
  - High performed Smart Phone, Tablet PC
  - VM, Cloud computing & services

- **Multi-Media Contents**
  - VOD, Real-time Streaming, IPTV
  - SNS, Personal broadcasting

Global Consumer IP Traffic (Cisco VNI`12)



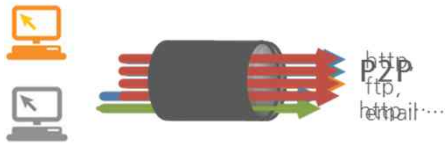


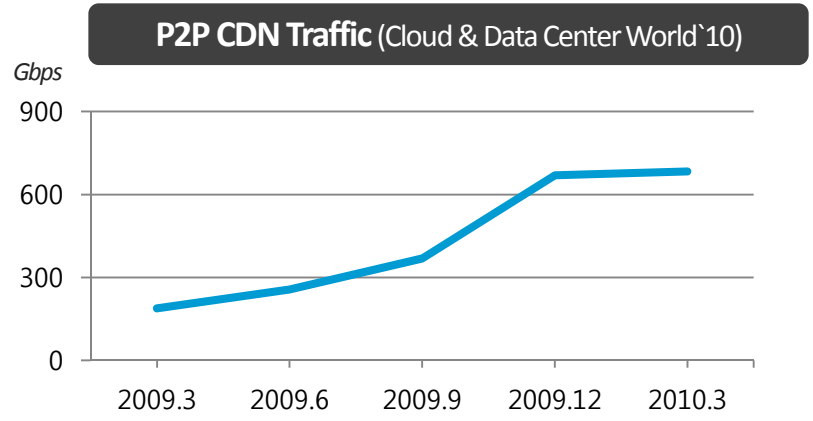
1-2 Background

ISP's Crisis? or Chance?

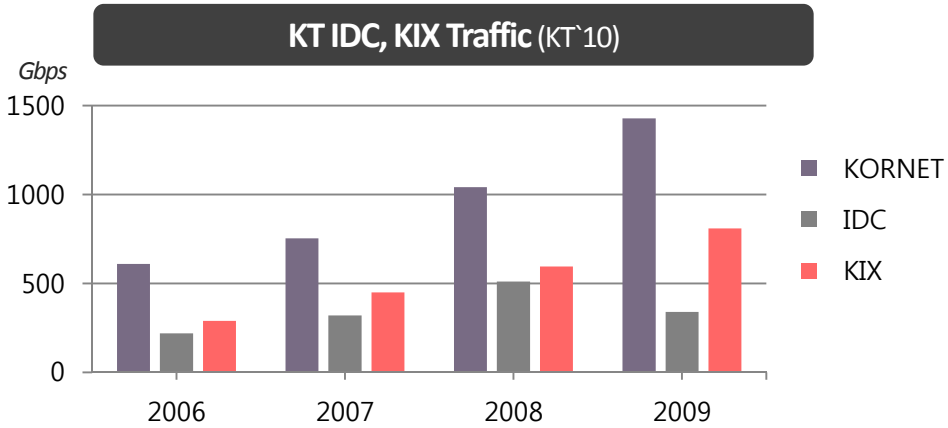
Subscriber Demand = 'Freemium' Service

- **P2P-based CDN solution**
  - Low-cost P2P content delivery
  - Using subscriber's line
  - Multi-flow unfairness issues





- **ISP's Stance**
  - Non-profitable burden
  - Increasing KIX traffic & cost
  - Congestion, Bed effect on QoS
  - Potential profit source

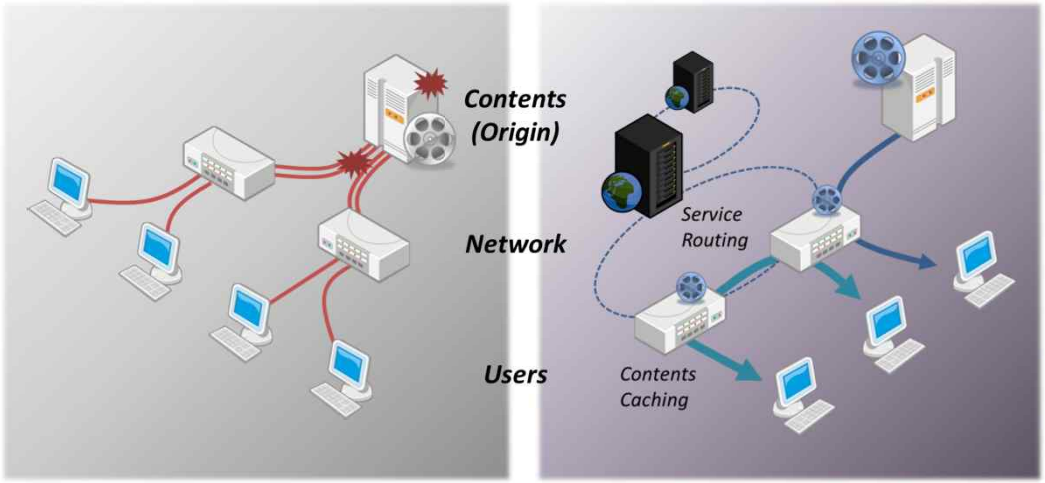


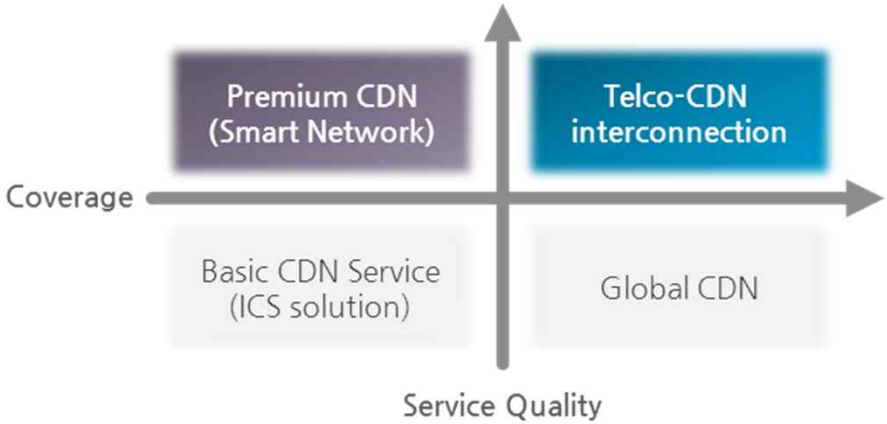
1-3 Background

Content-Centric, Smart Delivery Network

From Dumb to Smart Pipe

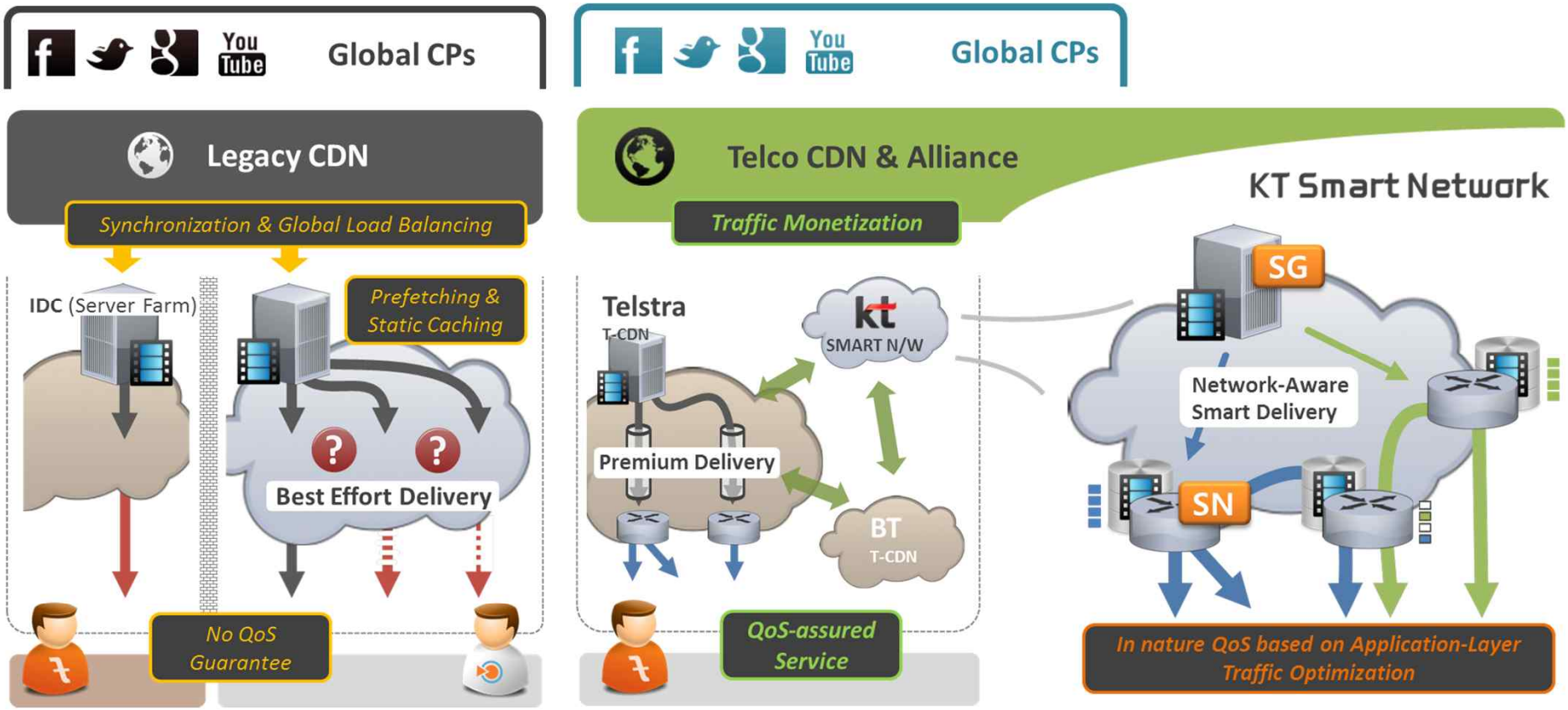
- **Mitigating traffic burden**
  - Traffic localization (ALTO, P4P)
  - Reduce duplicated delivery
- **Guaranteeing user QoE**
  - Content caching & delivery
- **Global-wide premium CDN**
  - Telco CDN alliance & collaboration
  - Service delivery platform





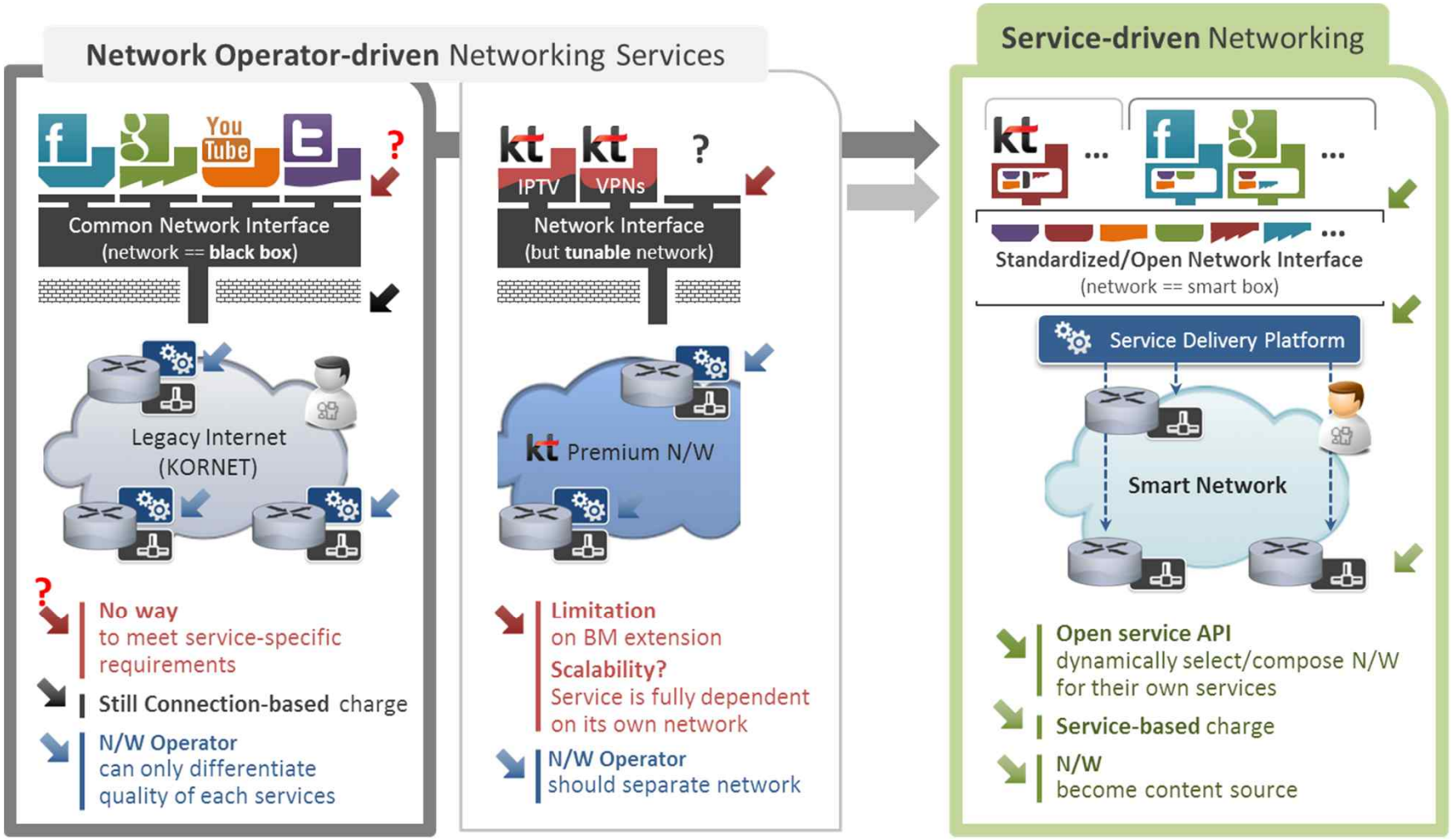
1-4 Background

Legacy CDN vs. Telco CDN + Smart Network



2-1 Smart Network

The First Step towards Open Network Eco-System



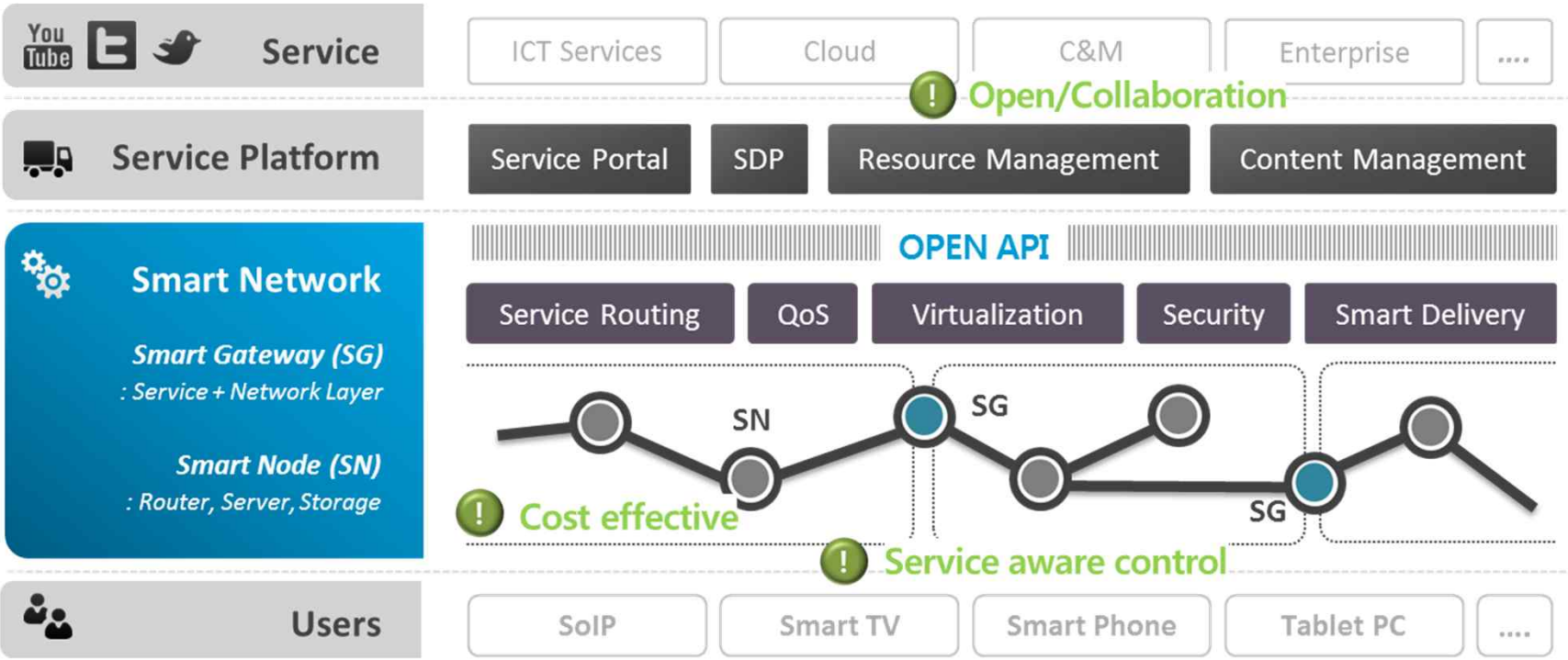
Fall behind the IT players
> Fall to the fat dumb-pipe

Major role in new IT value eco-system
> Evolve to smart-pipe

2-2 Smart Network

Definition

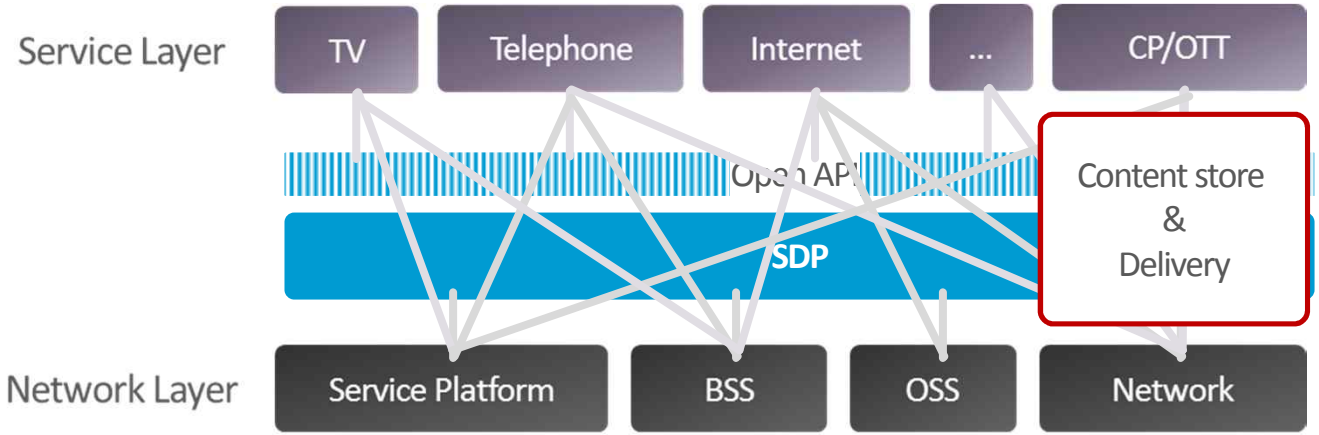
OpenEco network infrastructure based on proximity & open API for next generation business model *which is co-working between KT and other internet key players*



2-3 Smart Network

Service Delivery Platform focusing on Content Delivery

SDN (Service Delivery Platform)	Smart Network
SDP is providing Open API, for the simplification of each service delivery and for the combination between Service layer and Resource layer, Open API: Open Application Program interface, which is provided by SDP to Service developer.	Smart Network is similar to SDP, because they are providing Open API for the common Infra. But, SN provides smart content delivery feature by storing, forwarding of each contents with network information.



2-4 Smart Network

Standardization & Industrial Efforts

Standardization

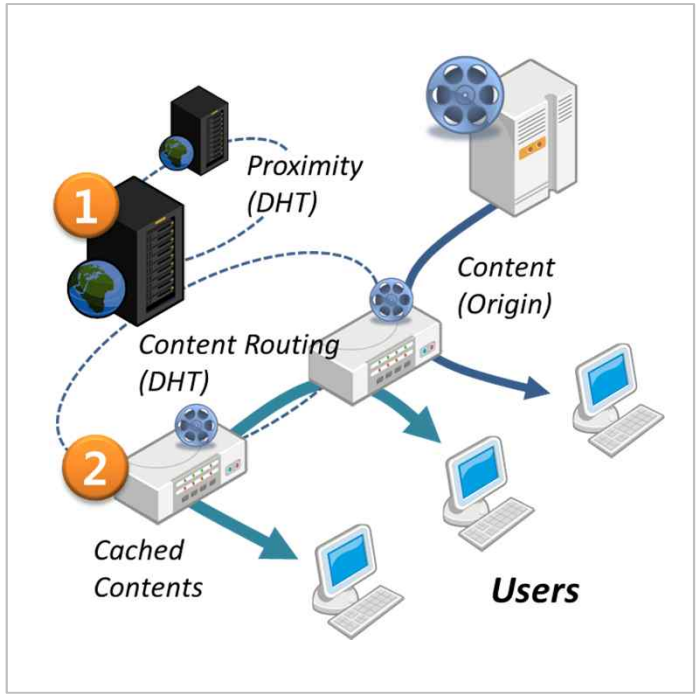
- **IETF ALTO (Application Level Traffic Optimization) WG**
- **IEEE NGSON (Next Generation Service Overlay Network)** – IP-based Overlay Framework
- **ITU-T SG 13** – DSN (Distributed Service Networking)

Vendors

- **Service Routing - Cisco (w/ CANVAS Project), Alcatel-Lucent**
- **ISP manageable P2P - Huawei**
- **Smart Cache - Juniper (+ Media flow controller), Verivue (w/ Google-Verizon Project)**

2-5 Smart Network

Components for Overlay Content Routing

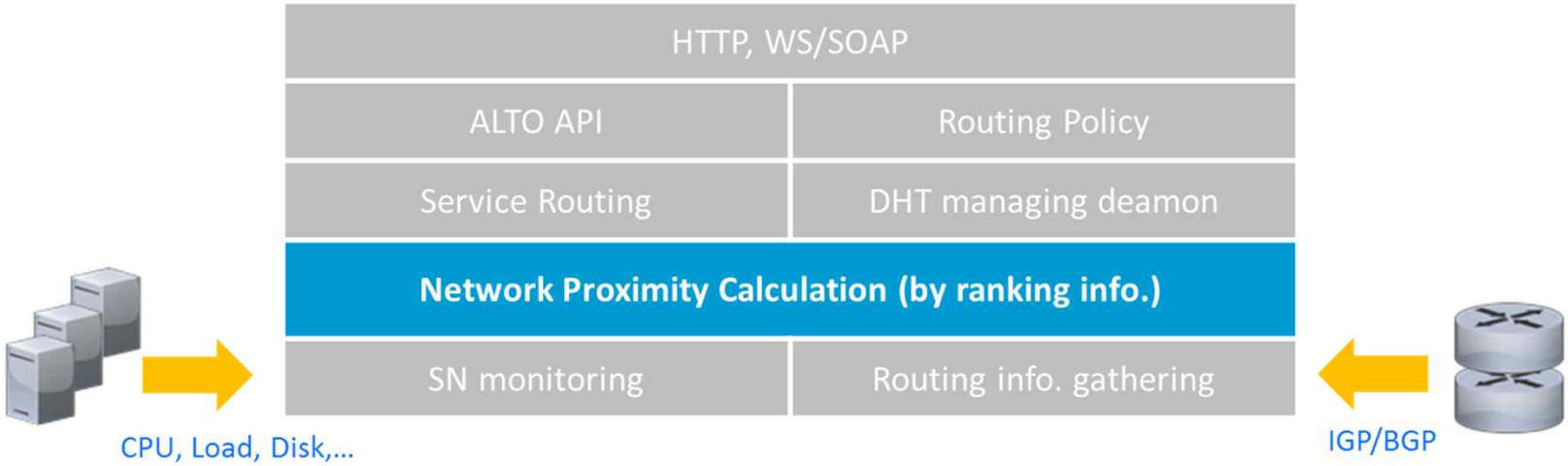


1 Smart Gateway	Delivery optimization (Network proximity, Topology, Traffic)
2 Smart Node	Content Routing - Search, Manage Content Delivery - Streaming Content in network caching
Smart API	Proving open network resources as a service
DHT	Get proximity info Content routing

2-6 Smart Gateway

Definition & Structure

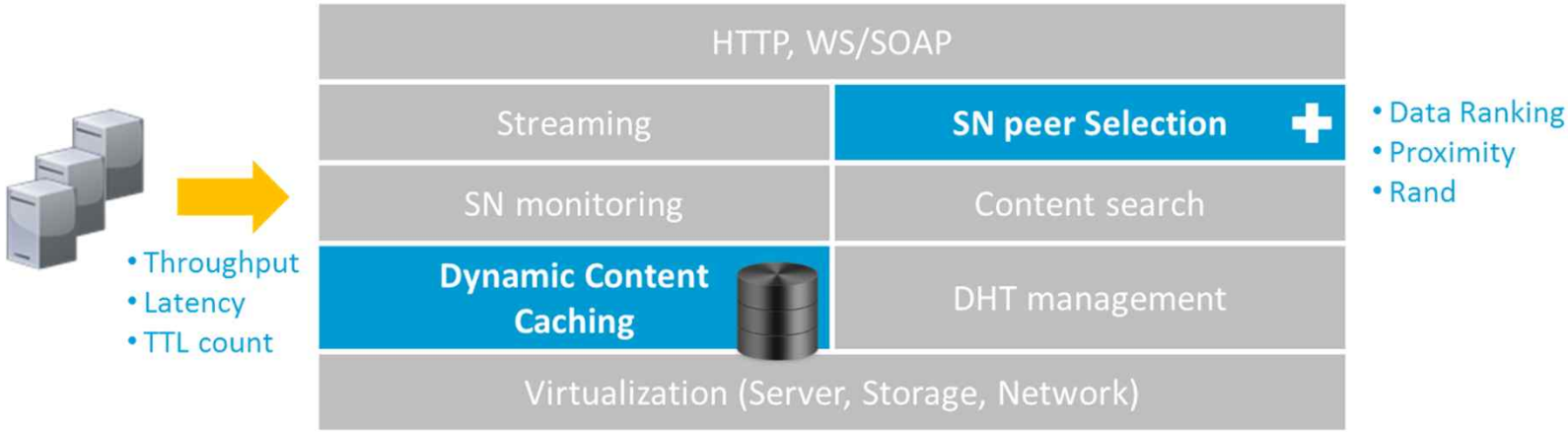
- **Determine optimal delivery route** (use proximity & topology info.)
- **Internetworking via heterogeneous network** (build overlay network)
  - Service routing, ranking computation & policy
  - Routing (IGP/BGP) info. gathering & analyzing (IS-IS CLI, TFTP, Quagga)
  - SN monitoring
  - DHT management daemon, ALTO API (proximity info.)



2-7 Smart Node

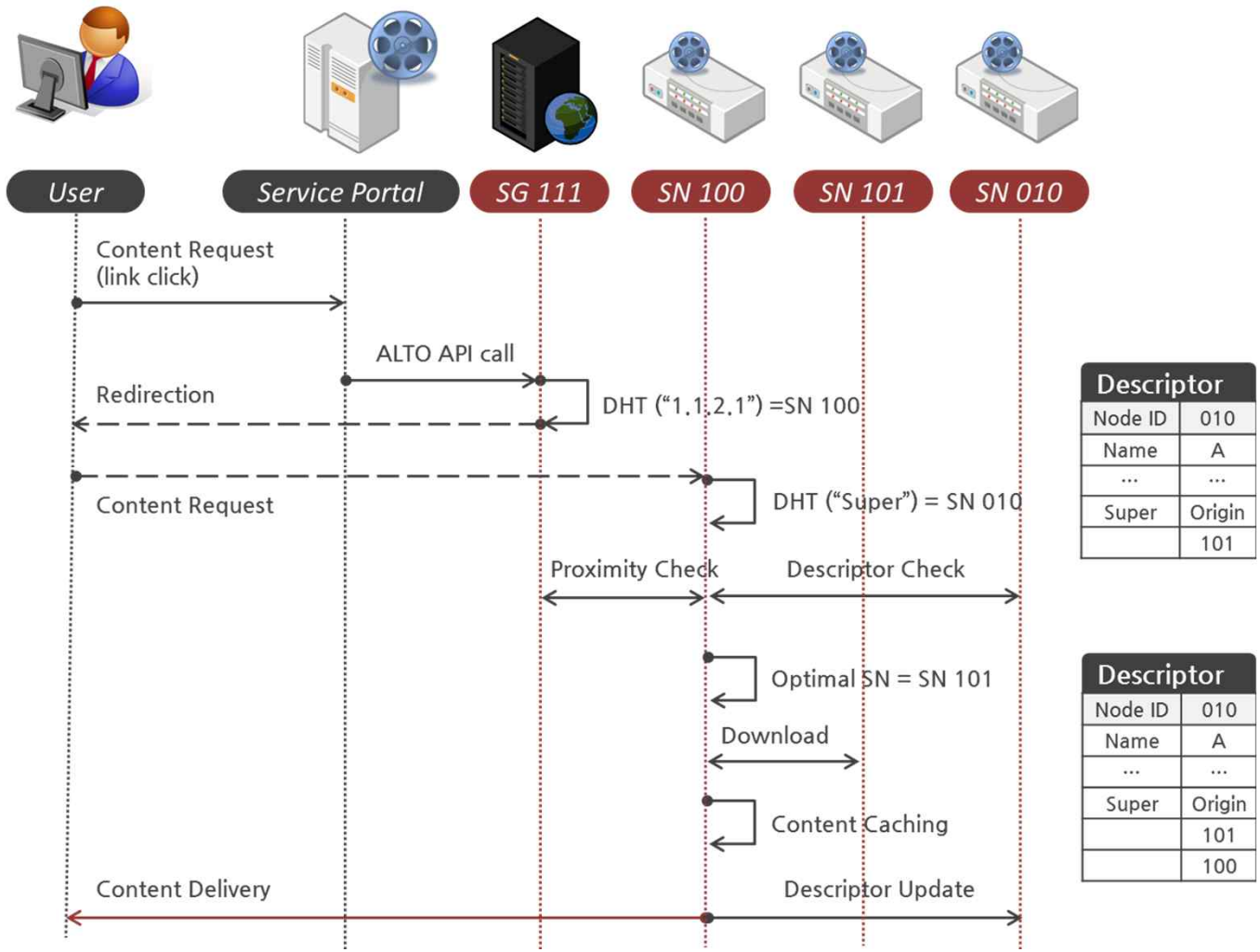
Definition & Structure

- **Network entity for delivery content and distributing, caching, exchanging**
  - Dynamic caching, content search (DHT), streaming (Live/VOD)

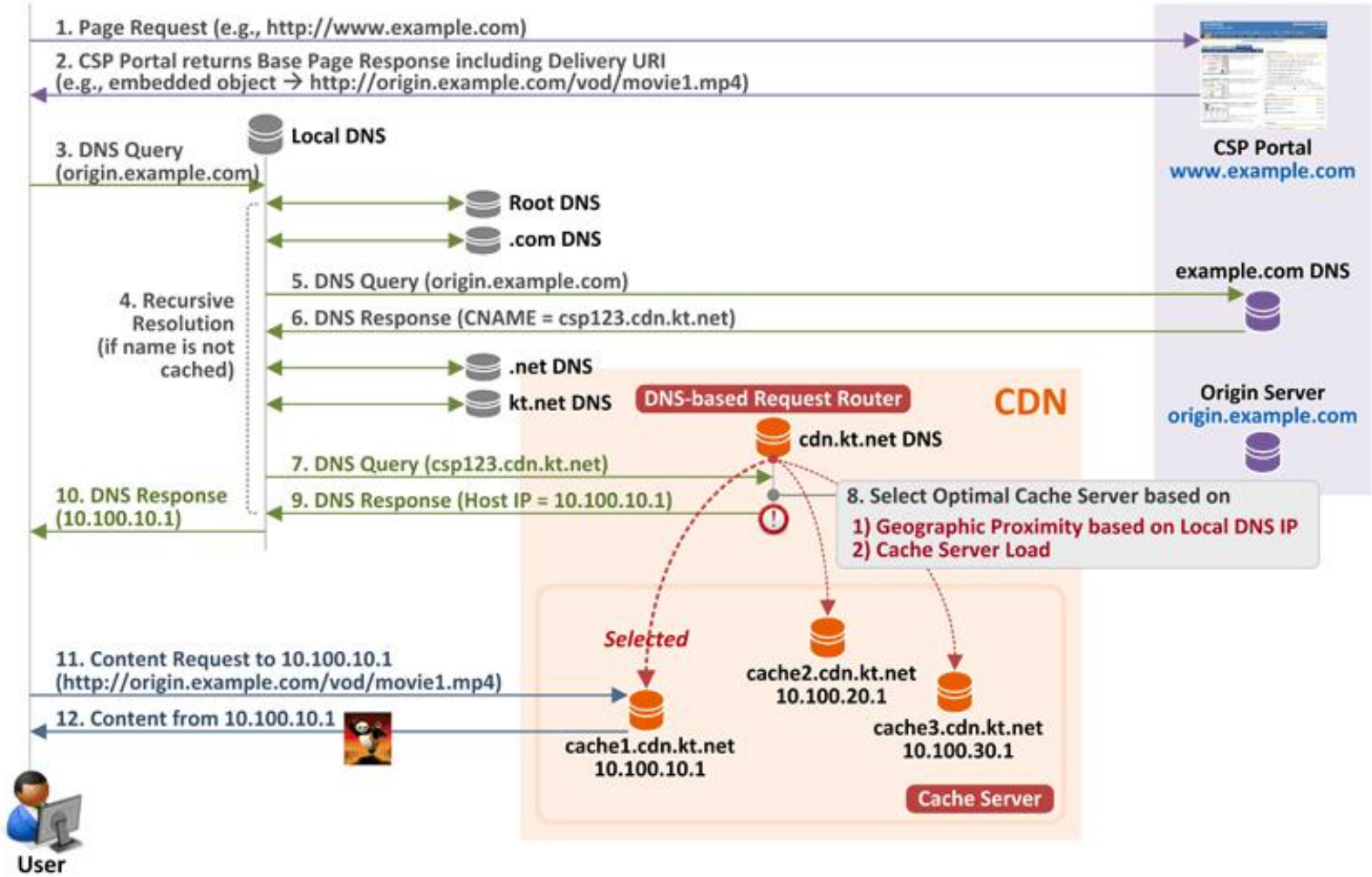


2-8 Overlay Content Routing

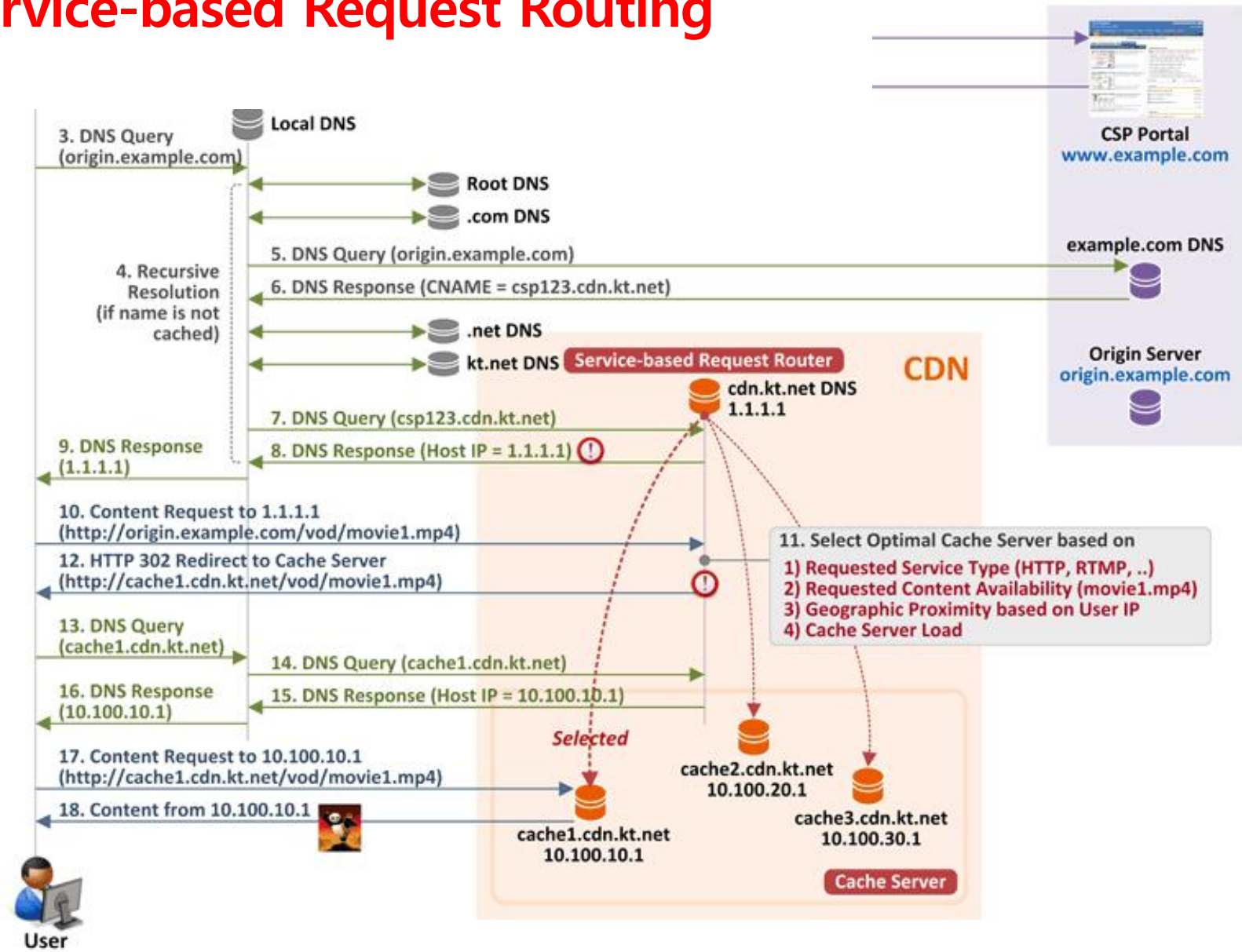
+ Service-based Request Routing



Ref. DNS-based Request Routing

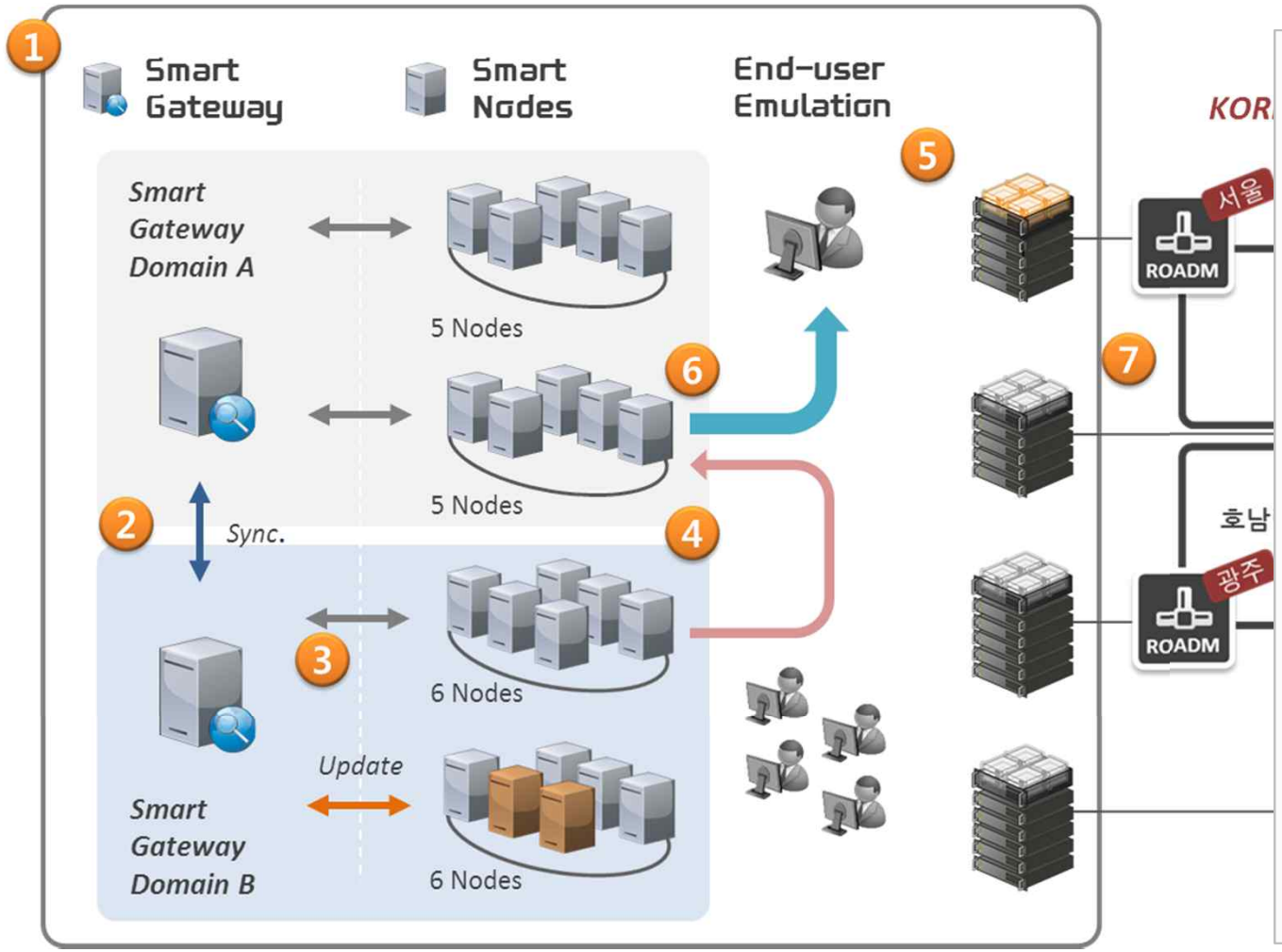


Ref. Service-based Request Routing



3-1 Overlay Content Routing Test

Objectives



1. **KOREN Testbed**
   22 generic servers
2. **SG Functions**
   Domain routing info. ALTO
3. **SG/SN Interworking Func.**
   Join/Leave, Redirection, Search,, Concurrent session
4. **SN Functions**
   DHT content routing, caching
5. **End-user Emulation**
   Vmware (Xen Server)
6. **User QoE**
   Resp. time, DL speed, Buffering
7. **Traffic Localization**
   Traffic reduction between POPs

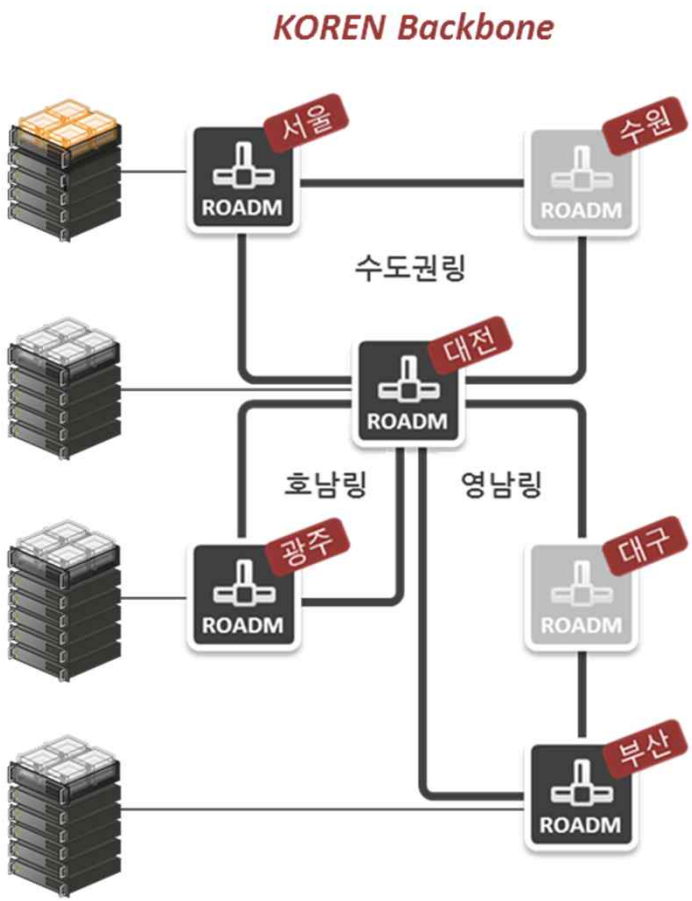
3-2 Overlay Content Routing Test

KOREN TESTBED Setup

KOREN TESTBED

- **Server**
  - Seoul (5): xxx.xxx.xxx.116 ~ 120
  - Daejeon (5): xxx.xxx.xxx.211 ~ 215
  - Gwangju (6): xxx.xxx.xxx.69 ~ 74
  - Pusan (6): xxx.xxx.xxx.117 ~ 122

- **Setup**
  - CentOS 6.3
  - XEN Server

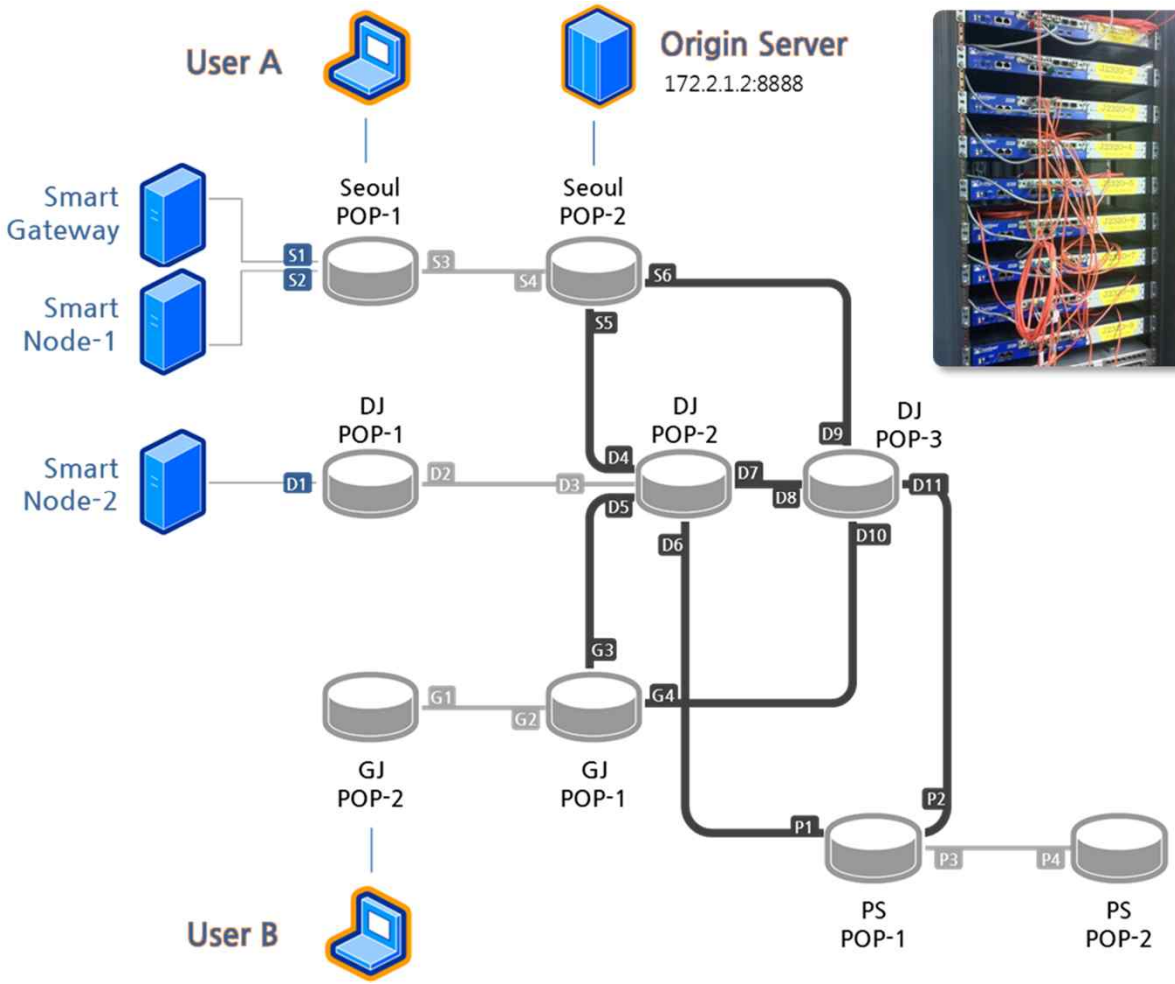


3-3 Overlay Content Routing Test

KOREN TESTBED Setup

Local (Lab.) TESTBED

S1	[서울POP-1] ge-0/0/1	172.1.0.0/24
S2	[서울POP-1] ge-0/0/2	172.1.1.0/24
S3	[서울POP-1] ge-1/0/0	172.2.0.1/30
S4	[서울POP-2] ge-1/0/0	172.2.0.2/30
S5	[서울POP-2] ge-1/0/1	172.3.0.1/30
S6	[서울POP-2] ge-1/0/2	172.6.0.1/30
D1	[대전POP-1] ge-0/0/0	172.5.0.0/24
D2	[대전POP-1] ge-1/0/0	172.4.0.0/24
D3	[대전POP-1] ge-1/0/1	172.4.0.0/24
D4	[대전POP-2] ge-1/0/0	172.3.0.2/30
D5	[대전POP-2] ge-1/0/3	172.8.0.0/24
D6	[대전POP-2] ge-1/0/4	172.11.0.0/24
D7	[대전POP-2] ge-1/0/2	172.7.0.0/24
D8	[대전POP-3] ge-1/0/1	172.7.0.0/24
D9	[대전POP-] ge-1/0/0	172.6.0.2/30
D10	[대전POP-3] ge-1/0/2	172.9.0.0/24
D11	[대전POP-3] ge-1/0/3	172.12.0.0/24
G1	[광주POP-2] ge-1/0/1	172.10.0.0/24
G2	[광주POP-1] ge-1/0/2	172.10.0.0/24
G3	[광주POP-1] ge-1/0/0	172.8.0.0/24
G4	[광주POP-1] ge-1/0/1	172.9.0.0/24
P1	[부산POP-1] ge-1/0/0	172.11.0.0/24
P2	[부산POP-1] ge-1/0/1	172.12.0.0/24
P3	[부산POP-1] ge-1/0/2	172.13.0.0/24
P4	[부산POP-2] ge-1/0/2	172.13.0.0/24

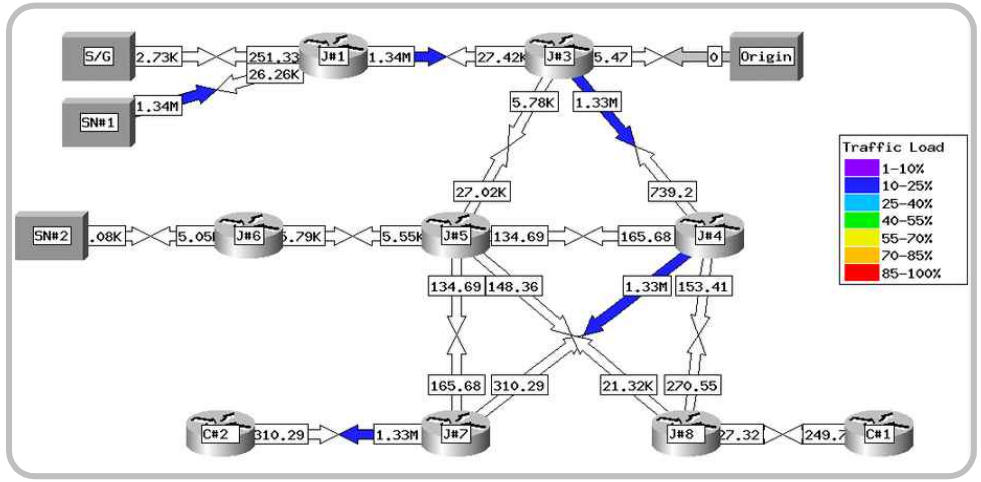


3-4 Overlay Content Routing Test

KOREN TESTBED Setup

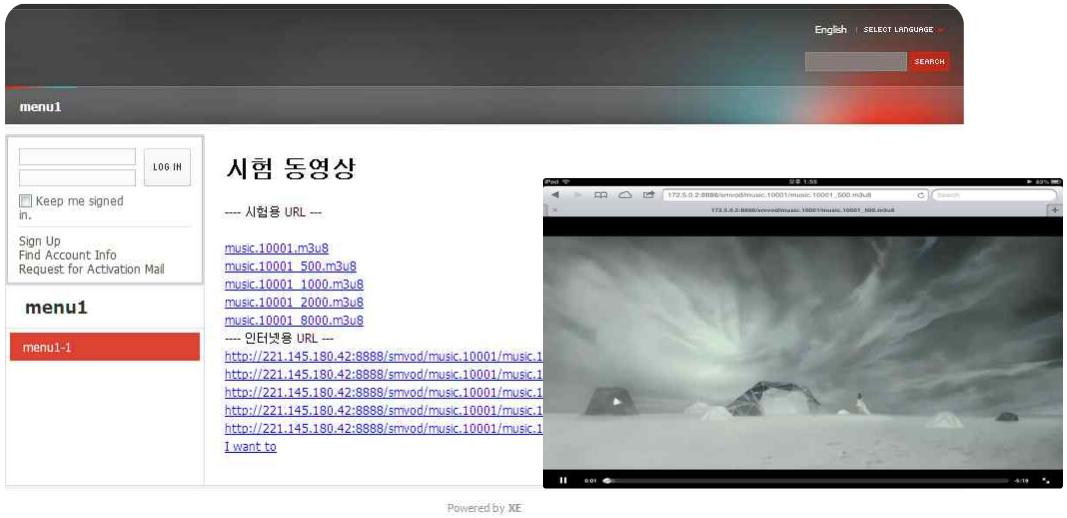
Traffic Monitoring

- **Cacti**
  - RRD-tool based graphing
  - Monitoring traffic each links
  - Flow route



Origin Server

- **Test VOD Contents**
  - HTTP adaptive streaming
  - 500k, 1M, 2M, 8M bitrate



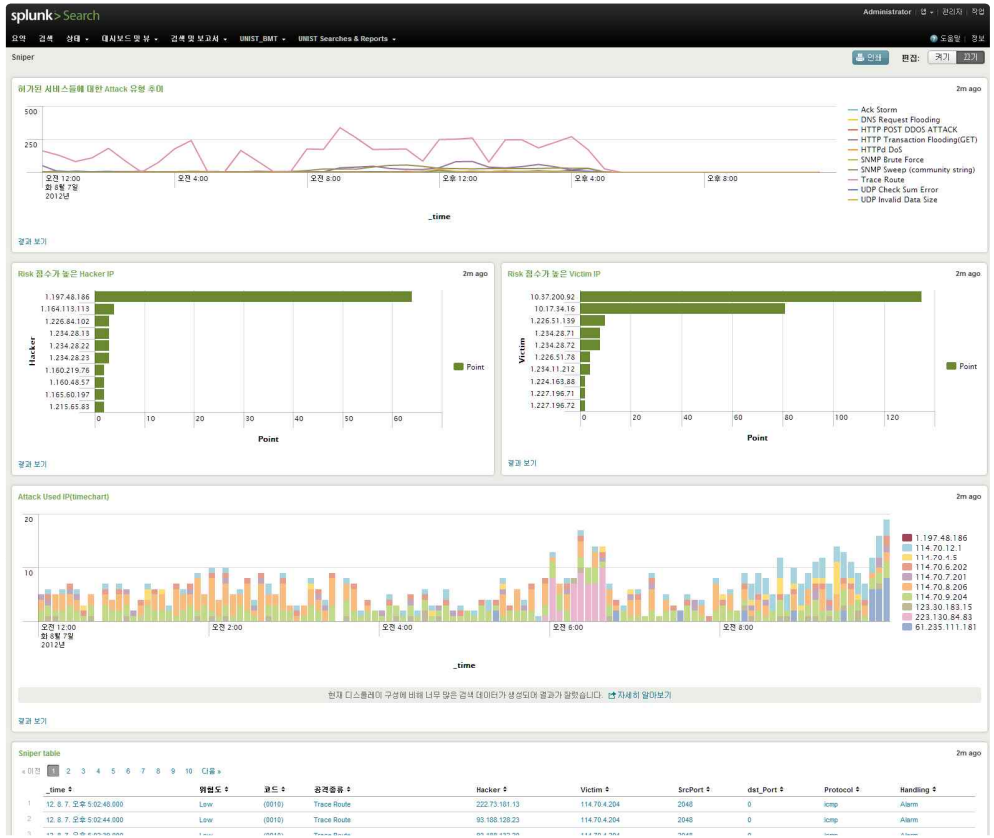
3-5 Overlay Content Routing Test

KOREN TESTBED Setup

SG, SN Log/DB Data Indexing

- **Status Monitoring**
  - Define log data & format
  - Export DB data
  - Integrate & Manipulate data

- **Splunk**
  - Logging data indexing
  - Visualization



3-6 Overlay Content Routing Test

Define Test Items & Scenarios

Smart Gateway (SG)	**Domain monitoring** (ranking info.), **SG/SN monitoring** (leave, Join) **Service routing** (DNS interworking), **ALTO** (routing info. gathering/managing)
Smart Node (SN)	**Contents caching** (caching algo., statistics, prefetching,), **Content routing** (DHT routing node & info. management, ...), **Content delivery** (VOD/Live, format, ...)
Interworking	**Provisioning** (delivery service, channel, server, VOD manifest management, ...) **Performance/fault/usage management** (SNMP MIB Trap..)

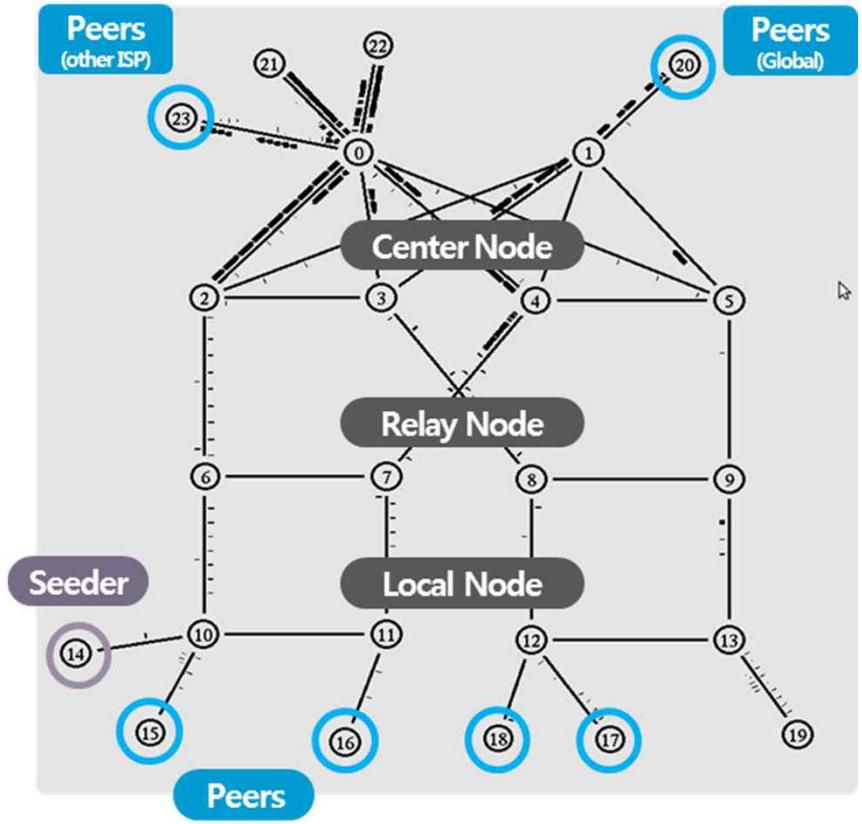
SG/SN Performance	Concurrent session, response time (request, search) , service throughput, cache hit ratio, ...
QoE, Traffic OAM	Response time, download speed, buffering, Traffic ratio between SNs, Recovery time, ...

3-7 Partial Results

NS Simulation

ALTO

File Size	20MB
# of Seeder	1
# of Peer	100/200/300/400
# of tracker peer	50
BW	KT internal (100 Mbps) Global ISP – KT (10Mbps) Other ISP – KT (20Mbps)
Choking interval	0~10 sec

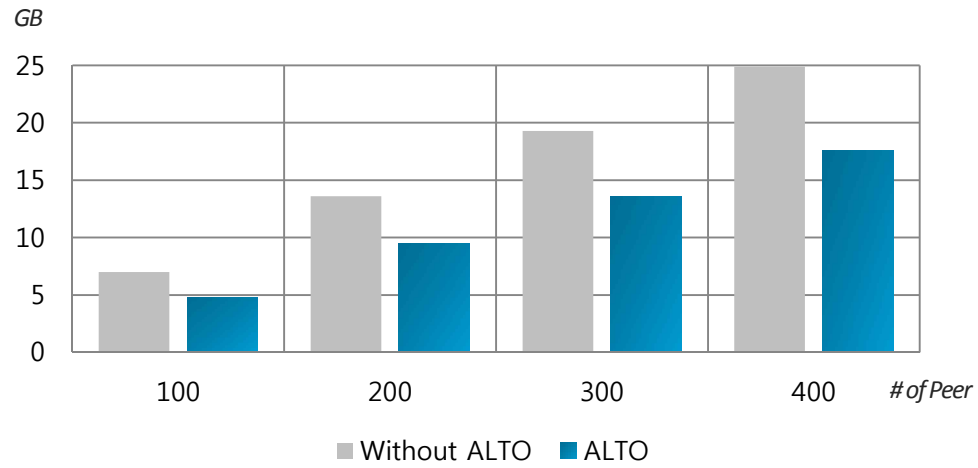


3-8 Partial Results

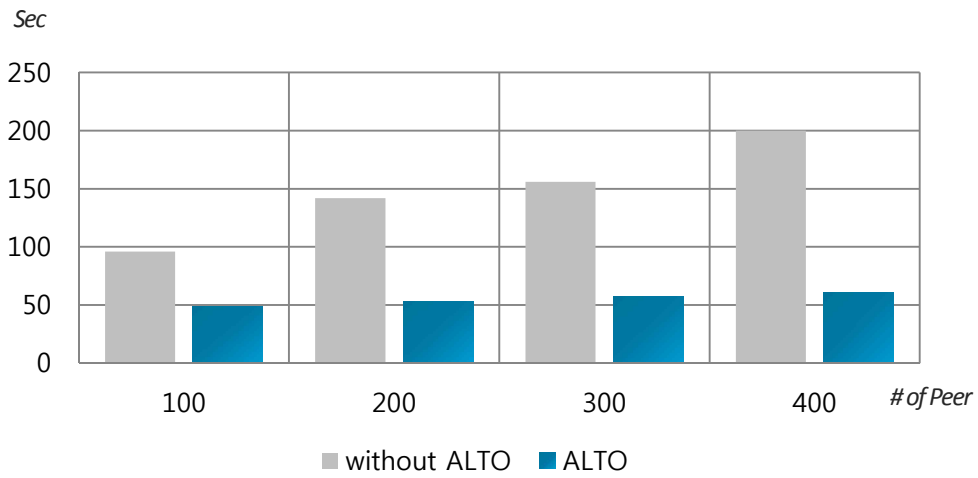
NS Simulation

ALTO

- **Total Traffic volume**
  - ~ 30% reduction per each link



- **Download time**
  - ~ 61% time enhancement

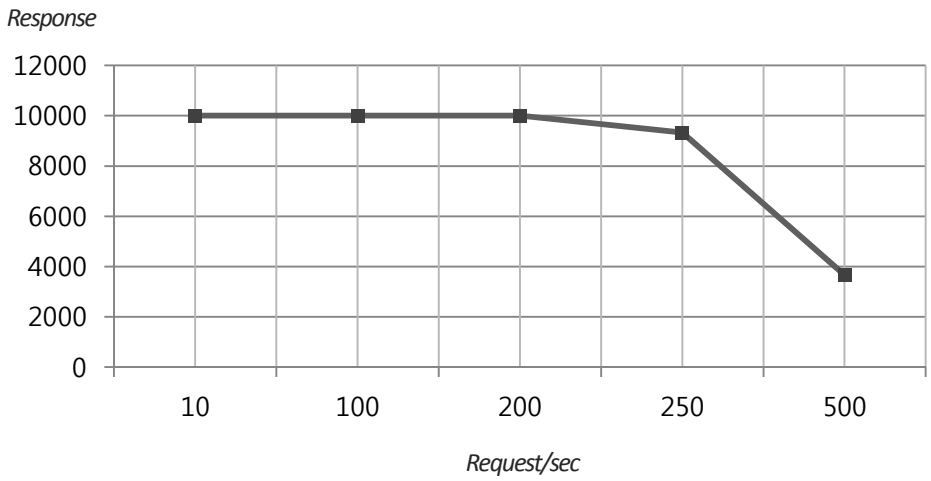


3-9 Partial Results

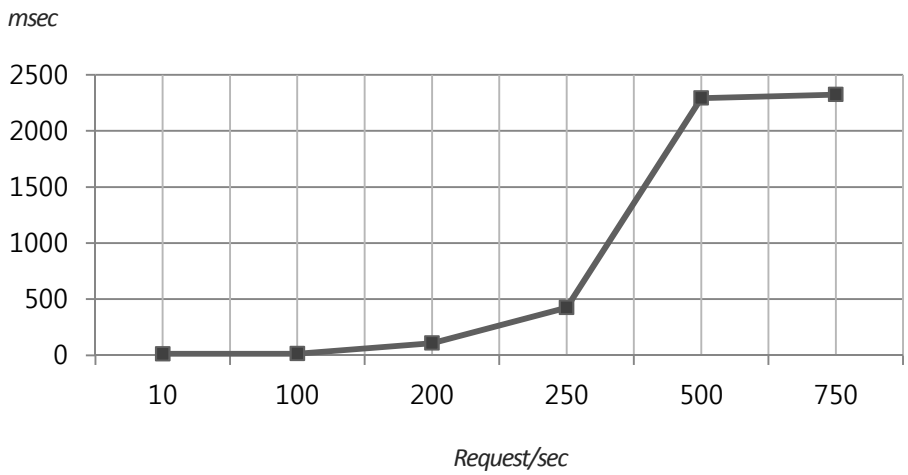
Lab. Testbed

Smart Gateway

- **Concurrent session**
  - 6.7% loss at 250 request/sec



- **Response time**
  - For service redirection
  - 2 sec at 500 request/sec



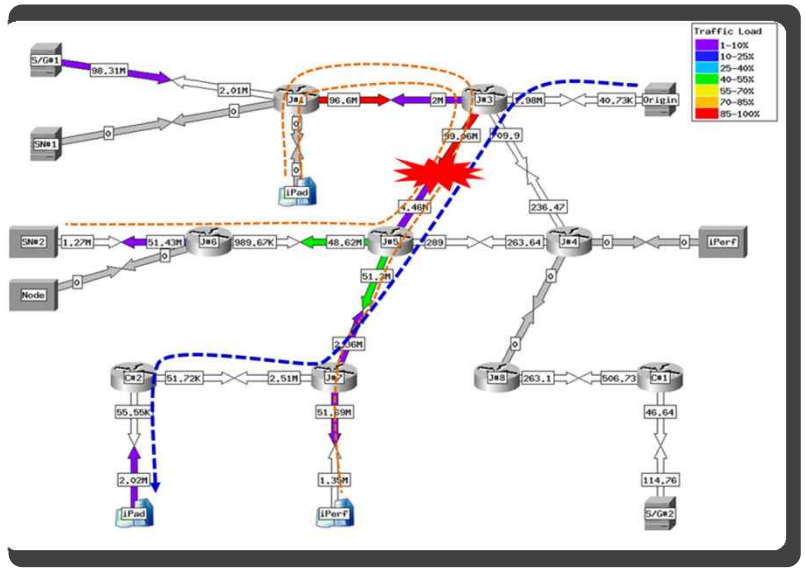
3-10 Partial Results

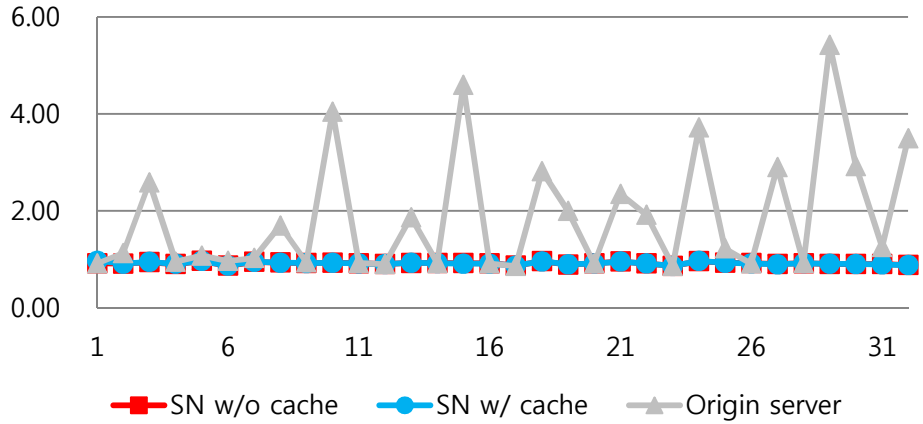
Lab. Testbed

Smart Node

- **Video segment download time**
  - Under backbone congestion
  - 32 TS video segments
  - 1) From origin server
  - 2) form Smart node (w/o cache)
  - 3) form Smart node (w/ cache)

- **SN regulate DL speed**





3-11 Partial Results

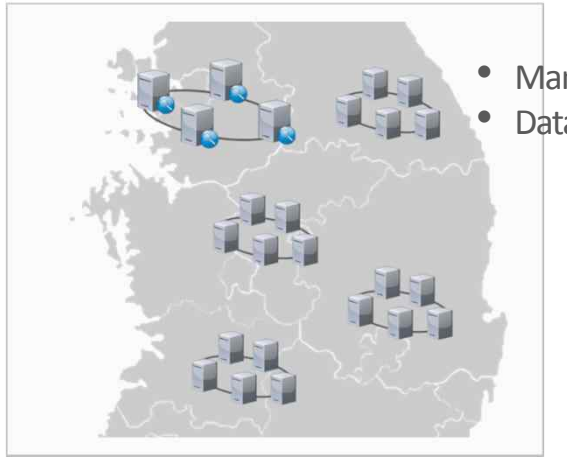
Benchmark Test

- **Service Routing Capacity**
  - Concurrent Session w/ CPU loads
- **Streaming Capacity**
  - HLS (HTTP Live Streaming)
  - 20Gbps (10Gx2) interface: max 15Gbps: 2Mbps (10,000 session), 8Mbps (2,500 session)
- **User side QoS**
  - Average response time of each video file segments, download speed

4 Summary & Discussion

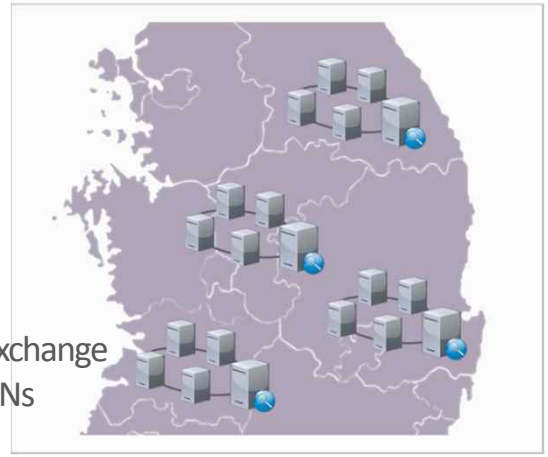
- **Smart Network is…**
  - A service delivery platform focusing on content delivery
  - First step towards Open Network Eco-System where KT and other internet key players can collaborate
- **We will …**
  - Test & verify the functions and performance of Smart N/W on KOREN testbed
  - Deploy Smart N/W for pilot service (5~10% of traffic coverage, collaborate with major CPs)
  - Consider several issues such as placement of SG

Centralized



- Management, Backup
- Data exchange between SGs

Distributed



- Frequent data exchange between SG & SNs

Thank you

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