

ntt.com



Internet traffic expansion submarine cable

May, 2017
NTT Communications Corporation
Kohei Kitade

Transform your business, transcend expectations with our technologically advanced solutions.

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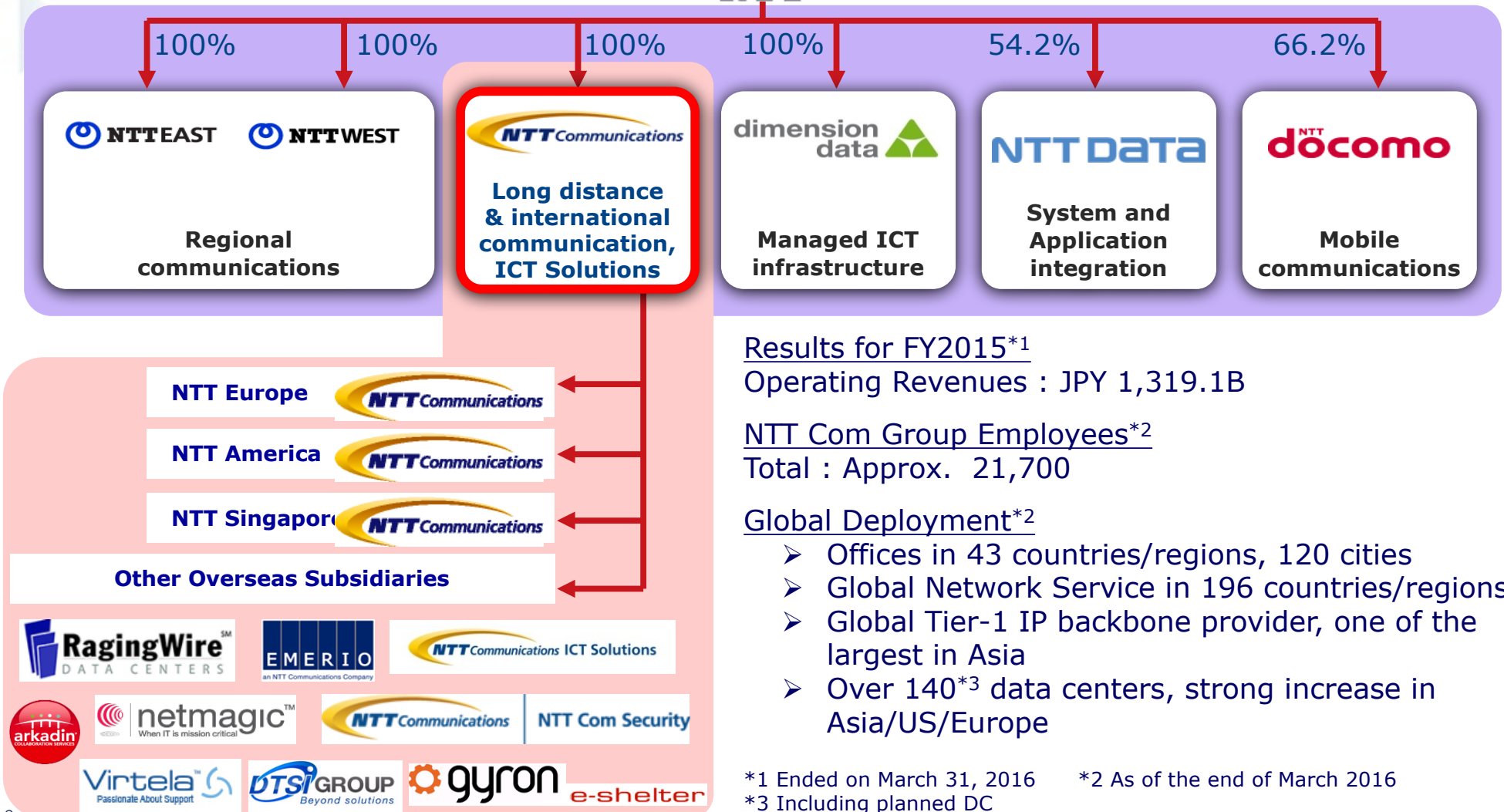


1. About NTT

1-1.Introduction of NTT group



One of the world's largest ICT companies
(Consolidated revenue of approximately
11.5 trillion JPY)



Results for FY2015*1

Operating Revenues : JPY 1,319.1B

NTT Com Group Employees*2

Total : Approx. 21,700

Global Deployment*2

- Offices in 43 countries/regions, 120 cities
- Global Network Service in 196 countries/regions
- Global Tier-1 IP backbone provider, one of the largest in Asia
- Over 140*3 data centers, strong increase in Asia/US/Europe





















*1 Ended on March 31, 2016

*2 As of the end of March 2016

*3 Including planned DC

1-2. Introduction of NTT Communications

Enhance capabilities to fulfill Global Cloud Vision through M&A activities

Service Area	EMEA	US	APAC
Managed ICT			 
Managed Security	 	 	
Cloud-based Applications			
Data Center/ Cloud			 
			    
Network / VoIP			

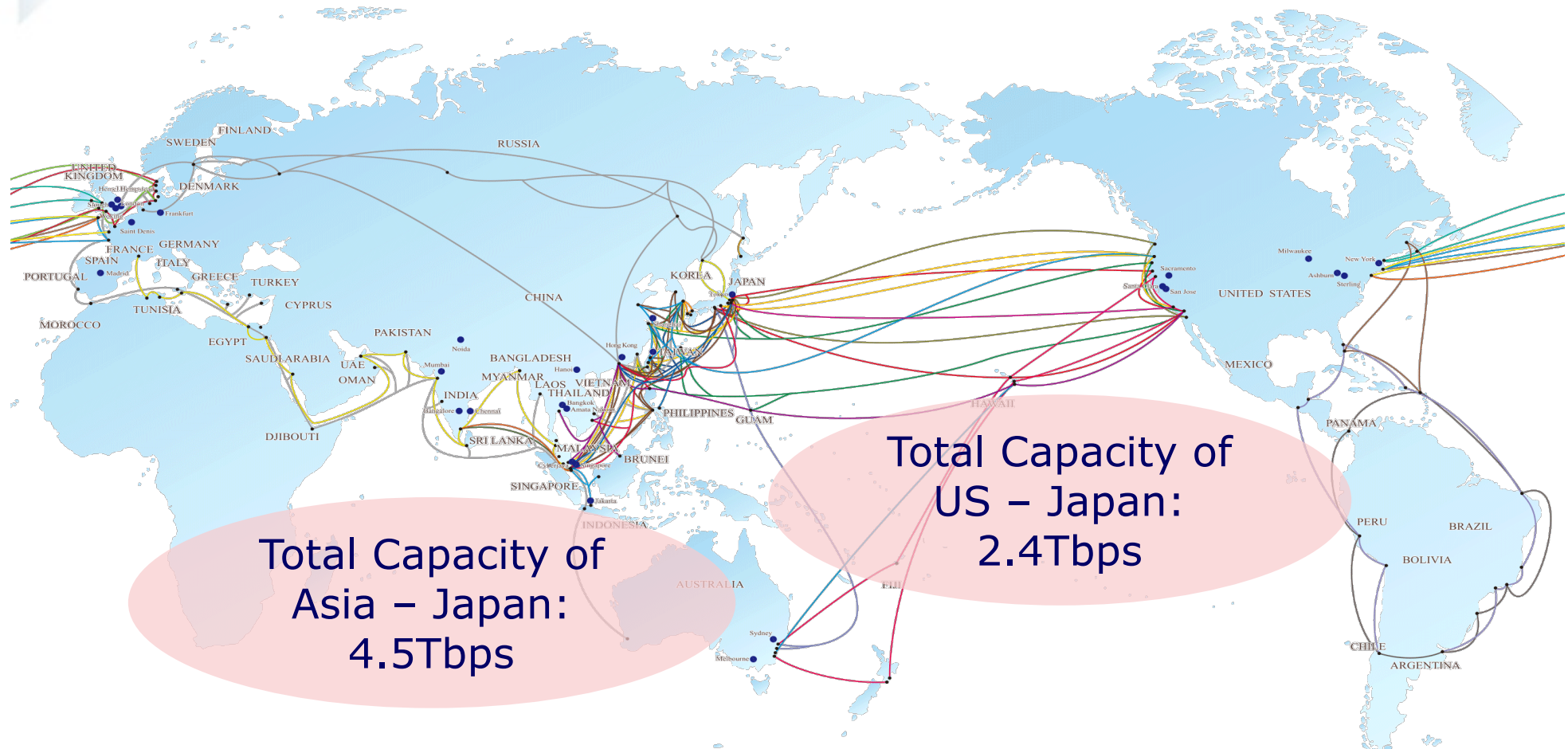


2. Cable expansion over the globe

2-1. Global Cable systems overview

Currently operating 8.7Tbps* of communication cables in total across the globe

* Terabit per sec



* As of June 2016

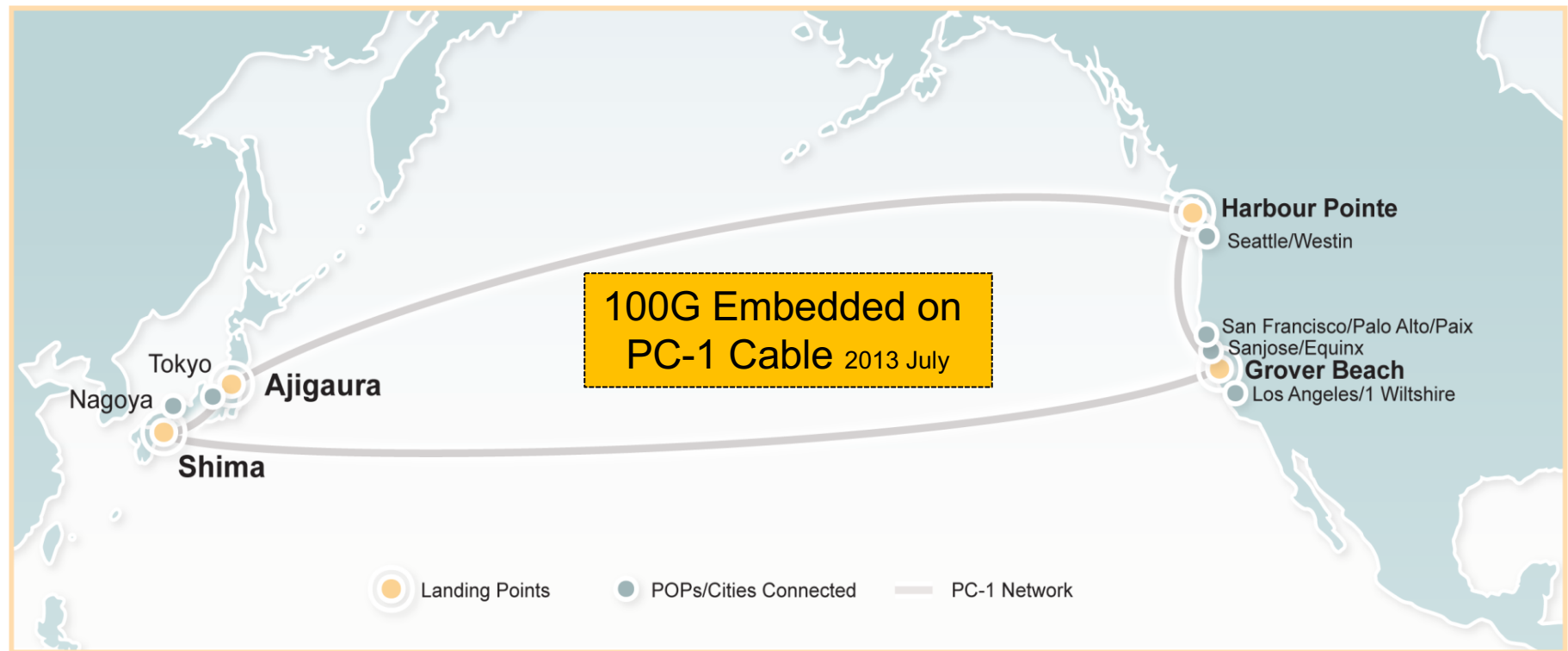
2-2. Sub-Sea Cables Owned by NTTCom

Cable	Designed Capacity	Landing Points
Pacific Crossing-1 (PC-1)	8,400G	Ajigaura/Japan, Grover Beach, California/United States, Harbour Pointe, Washington/United States, Shima/ Japan
Asia Submarine-cable Express (ASE)	43,800G	East Coast/Singapore, Daet/Philippines, Maruyama/Japan, Okinawa/Japan Mersing/Malaysia, Tseung, Kwan O/Hong Kong
Asia Pacific Gateway (APG) (RFS: Q3 2016)	54,800G	Chongming/China, Danang/Vietnam, Kuantan/Malaysia, Maruyama/Japan, Nanhui/China, Pusan/Korea, Rep., Shima/Japan, Songkhla/Thailand, Tanah Merah/Singapore, Toucheng/Taiwan, Tseung Kwan O/Hong Kong
Hokkaido-Sakhalin Cable System (HSCS)	640G	Ishikari/Japan, Nevelsk/Russia
Trans-Pacific Express (TPE) Cable System	8,000G	Chongming/China, Keoje/Korea, Rep., Maruyama/Japan, Nedonna Beach, Oregon/United States, Qingdao/China, Tanshui/Taiwan
Japan-U.S. Cable Network (JUS)	9,800G	Kitaibaraki/Japan, Makaha, Hawaii/United States, Manchester, California/United States, Maruyama/Japan, Morro Bay, California/United States, Shima/Japan
APCN-2	51,200G	Batangas/Philippines, Chikura/Japan, Chongming,/China, Katong/Singapore, Kitaibaraki/Japan, Kuantan/Malaysia, Lantau Island/Hong Kong, Pusan/Korea, Rep., Shantou/China, Tanshui/Taiwan
Australia-Japan Cable (AJC)	5,000G	Maruyama/Japan, Oxford Falls/Australia, Paddington/Australia, Shima/Japan, Tanguisson Point/Guam, Tumon Bay/Guam
Korea-Japan Cable Network (KJCN)	96,000G	Fukuoka/Japan, Kita-kyushu/Japan, Pusan/Korea, Rep.

2-3. Submarine Cable Systems: PC-1

NTT Communications deployed
100Gbps Digital Coherent Technology on Transpacific Submarine Cable PC-1 Cable
System's Capacity Increased More than 2.5 Times to 8.4 Tbps.

(Announced on July 17, 2013)



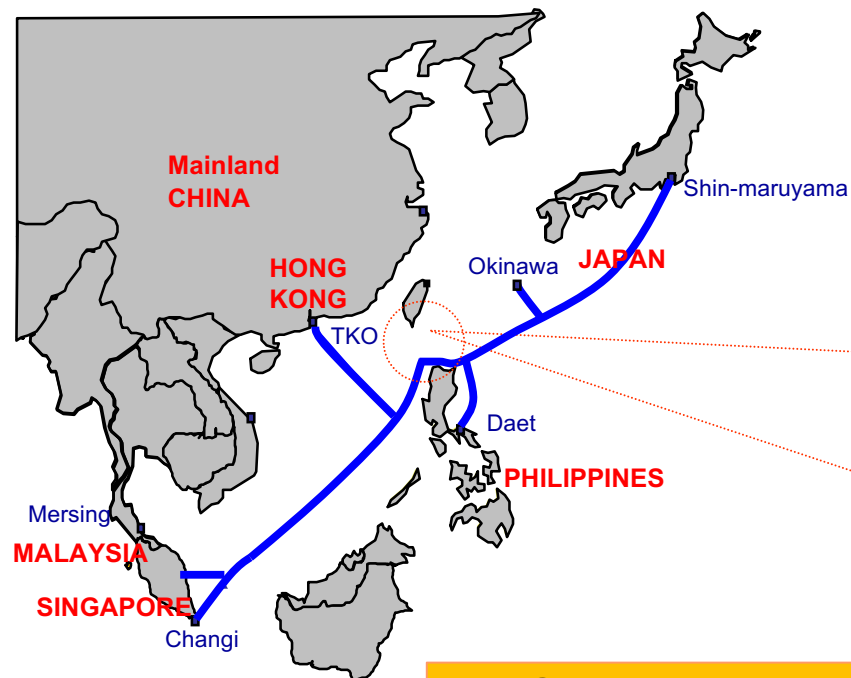
2-4. Submarine Cable Systems: ASE

High Reliability

- Avoidance of affecting area by typhoons and undersea earthquakes in Bashi Channel.
- Further to the above, just in case of cable fault in Bashi Channel, the traffic can be secured through the Philippines branch (Please refer to the next page for the detail).

Low Latency

Routes between Japan and Singapore covers the shortest possible distances to maximize reliability and minimize latency.



Frequent cut-off area
(the Bashi Channel, south of Taiwan)

1. December 2006 (earthquake)



ASE

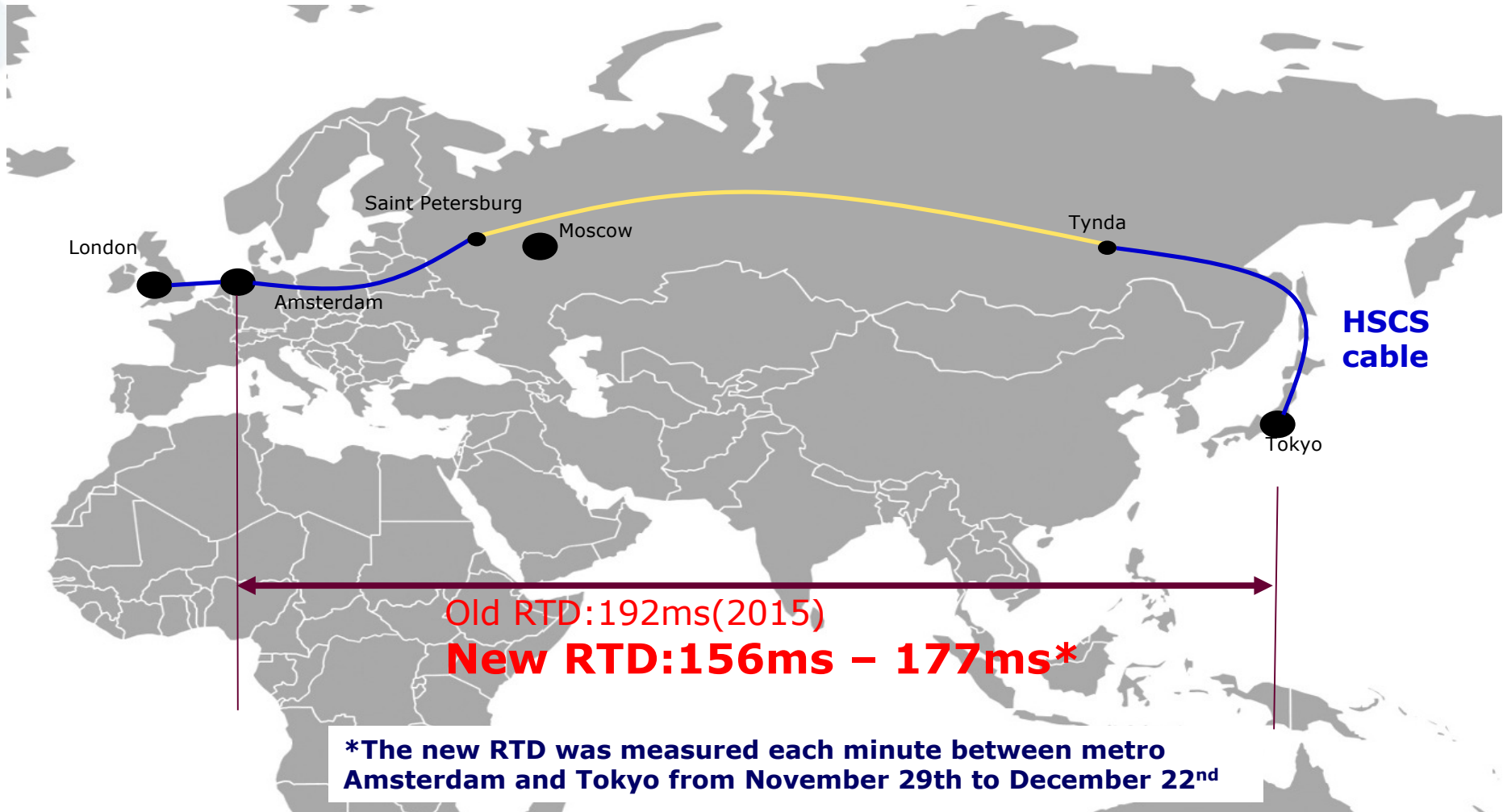
- 1, Ultra low latency
- 2, Avoid Southern Taiwan route
- 3, Stock Exchange nearby (Hong Kong/Singapore)
- 4, Directly connected TKO Hong Kong data center
- 5, Reachable to major data centers in each country
- 6, Ideal for transit to westbound via Singapore
- 7, "ASE+PC1" bundled special promotion available

ASE Cable

100G embedded on ASE (Q4, 2014)

2-5. Improvement of RTD between JP-EU

As the result of infrastructure improvement initiatives from 2014 to Sep 2016(DWDM, fiber, etc...) on the Saint Petersburg-Tynda portion inside Russia, the latency between Japan and Europe has considerably been shorten.



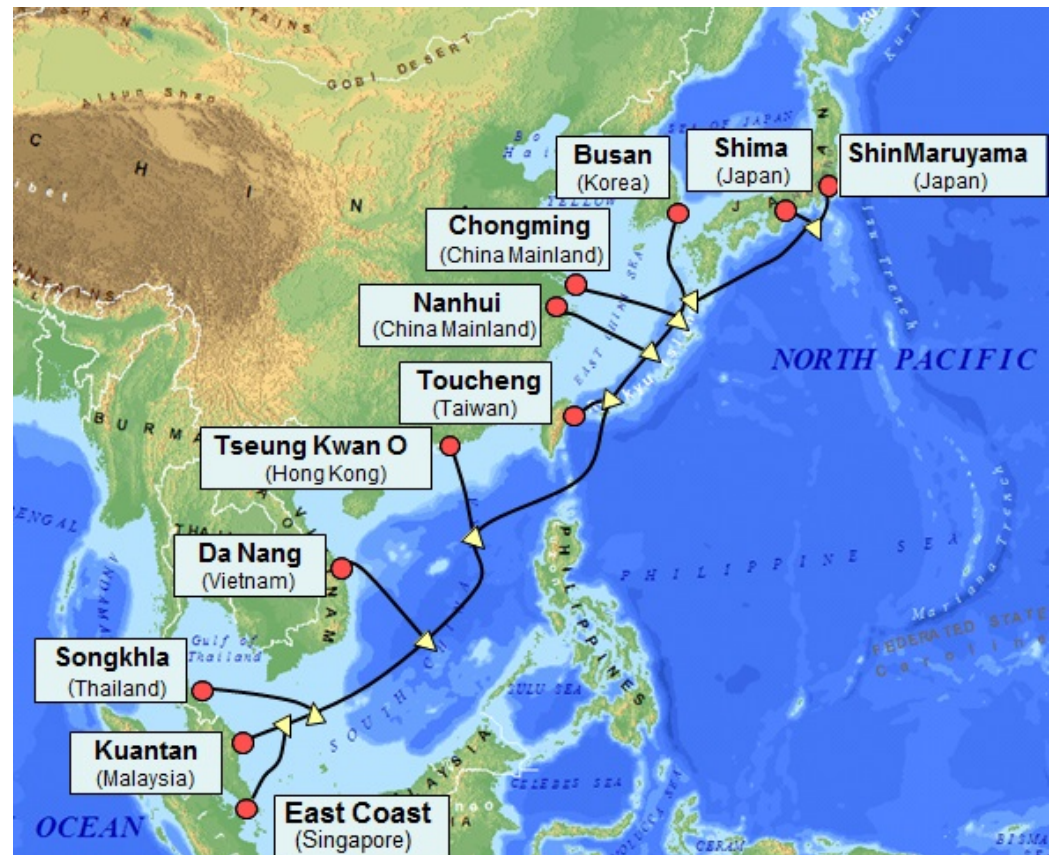
2-6. Submarine Cable Systems: APG

Asia Pacific Gateway (APG) is a submarine communications cable system that is planned to connect the following:

- China Mainland
- Hong Kong
- Japan
- South Korea
- Malaysia
- Taiwan
- Thailand
- Vietnam
- Singapore.

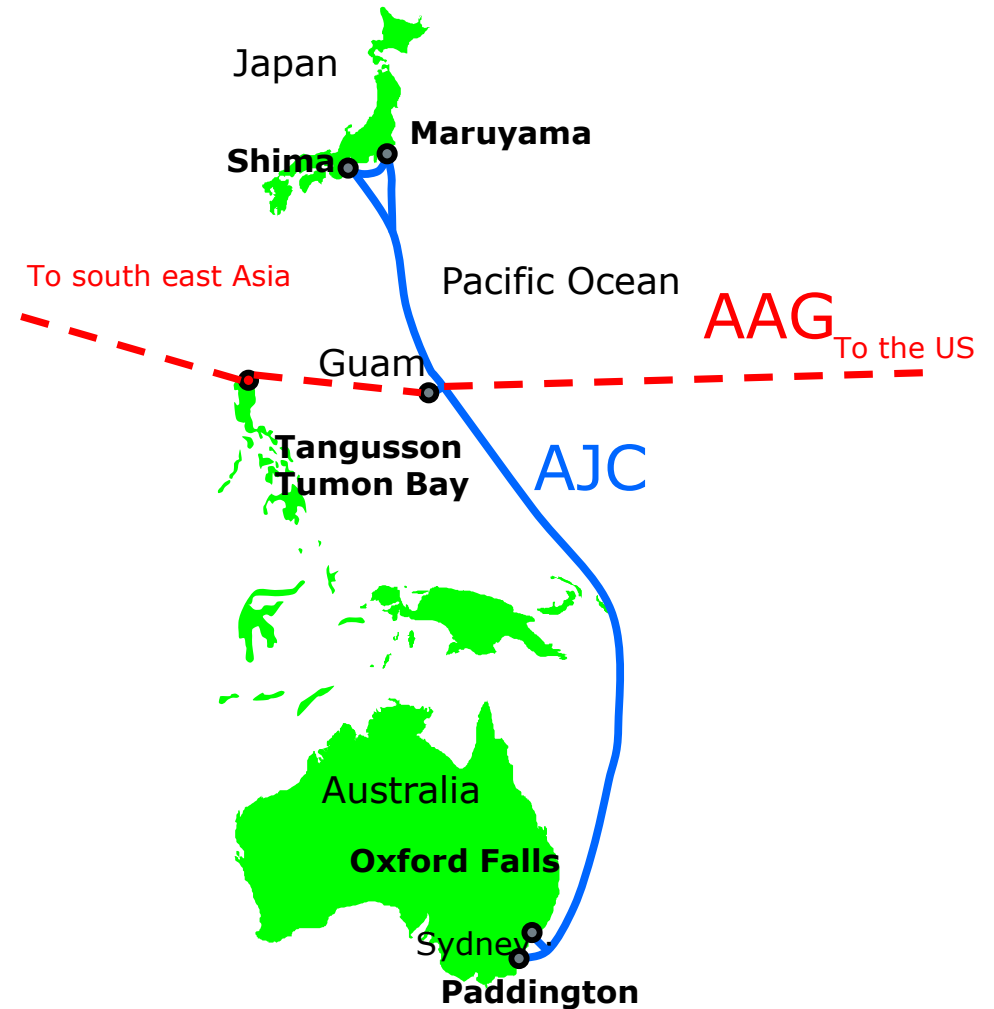
<Features>

- Length : 10,400 kilo meters long.
- Capacity: 54.8 Terabits/second.
- Consortium Members:
11 leading carriers in the region
- RFS : October of 2016.



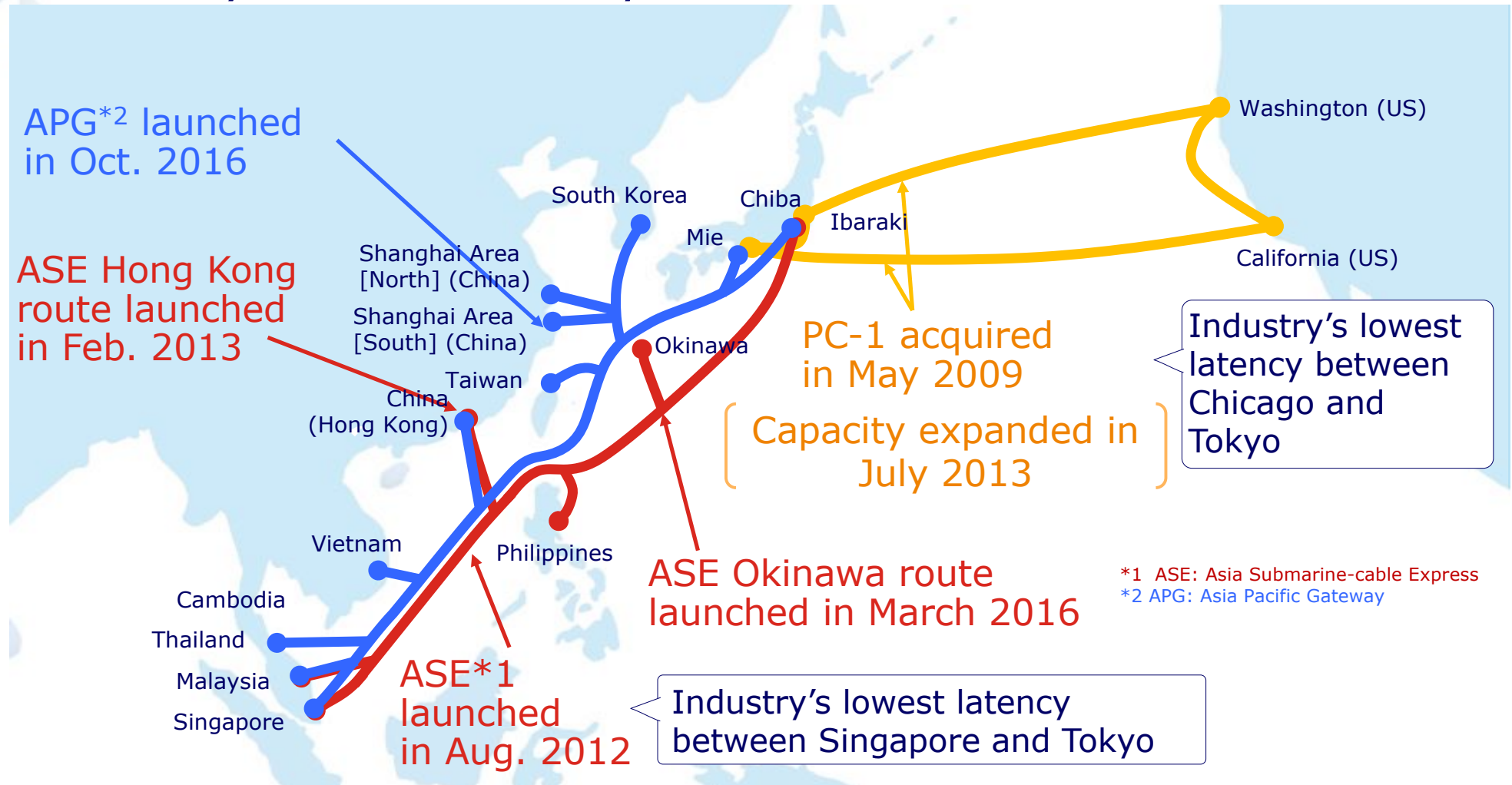
2-7. Submarine Cable Systems: AJC

- The Australia-Japan Cable System (AJC Cable System) is a submarine cable directly connecting Australia and Japan, via Guam.
- The AJC cable system has a design capability up to 5 Tbit/s, enabling further upgrades as required. The AJC cable system was ready for service on 30 December 2001, with a design life to 2026.



2-6. Asia-JP-US cable systems

Connect major cities in Japan, APAC and US with industry's lowest latency



2-7. Global Latency Overview

Low Latency Network (Estimated*)

*RTD is rough estimated numbers with our assumption and not guaranteed numbers.

Singapore Serangoon/Keppel DC

to @Tokyo: approx. 64ms
to Westin: approx. 150ms

HK TKO

to @Tokyo approx. 44ms
to Chicago approx. 125ms

Mumbai

to @Tokyo approx. 124ms
to Chicago approx. 252ms

Jakarta

to @Tokyo approx. 124ms
to Chicago approx. 252ms

BKK

to @Tokyo approx. 92ms
to Chicago approx. 218ms

Seoul

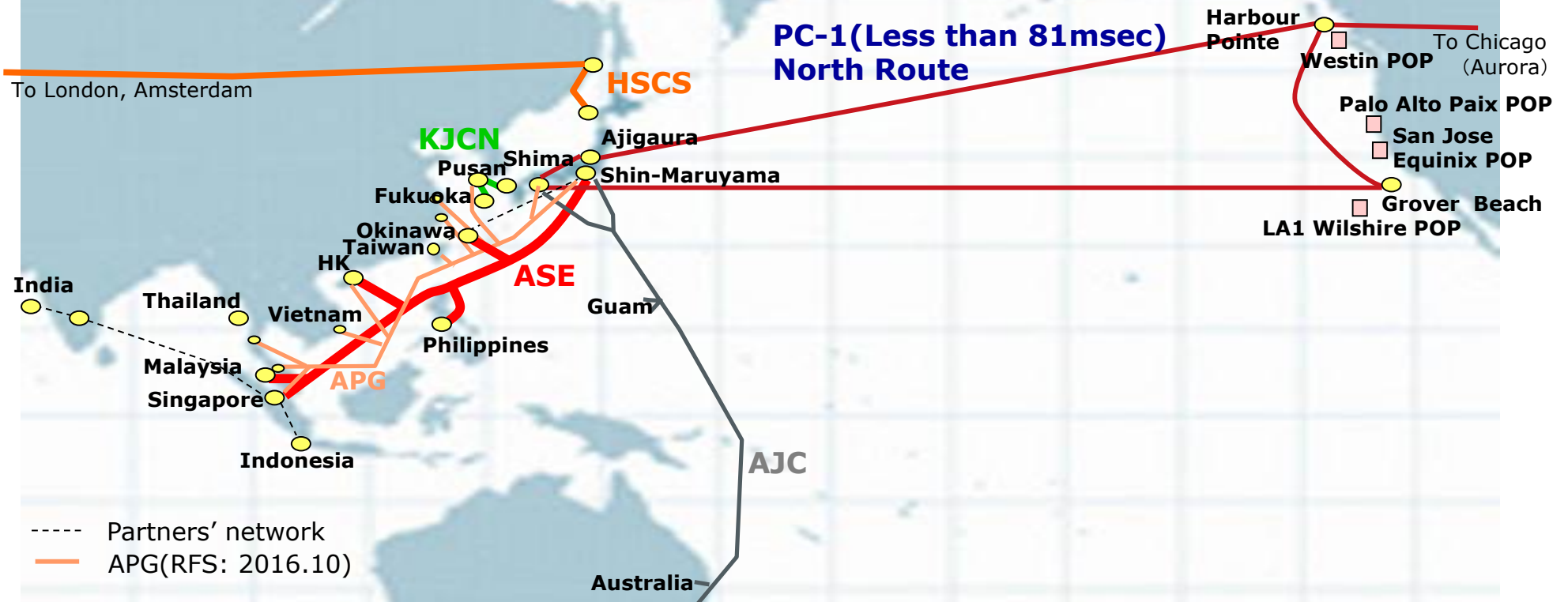
to @Tokyo: approx. 37ms
to Chicago: approx. 160ms

Taipei

to Chicago approx. 157ms

London Equinix LD4

to @Tokyo approx. 192ms
→156ms – 177ms (See P12)





3. Traffic trend analysis

3-1. Global IP Network Service

High-speed and large-capacity IP backbone connecting 26 countries/regions across the globe



3-2. Global IP Network Service

Renesys ranking in wholesale market

Global

IPv4 Customer Base: Wholesale		
1	NTT	2914
2	Telia Carrier	1299
3	Level 3	3356
4	Cogent	174
5	Tata Communications	6453
6	GTT	3257
7	Hurricane Electric	6939
8	Verizon Business	701
9	Telecom Italia Sparkle	6762
10	SprintLink Global Network	1239

Asia

IPv4 Customer Base: Wholesale		
1	NTT	2914
2	Tata Communications	6453
3	Verizon Business	701
4	China Telecom	4134
5	SprintLink Global Network	1239
6	PCCW Global	3491
7	Hurricane Electric	6939
8	Telia Carrier	1299
9	CNCGROUP Backbone	4837
10	Cogent	174

North America

IPv4 Customer Base: Wholesale		
1	Level 3	3356
2	Cogent	174
3	Telia Carrier	1299
4	NTT	2914
5	Hurricane Electric	6939
6	GTT	3257
7	Comcast	7922
8	Tata Communications	6453
9	XO	2828
10	CenturyLink	209

Europe

IPv4 Customer Base: Wholesale		
1	Telia Carrier	1299
2	Level 3	3356
3	Cogent	174
4	Telecom Italia Sparkle	6762
5	GTT	3257
6	NTT	2914
7	Orange	5511
8	Vodafone	1273
9	Deutsche Telekom	3320
10	Tata Communications	6453

Oceania

IPv4 Customer Base: Wholesale		
1	Telstra Global	4637
2	SingTel	7474
3	SingTel	7473
4	Pacnet	10026
5	Vocus	4826
6	NTT	2914
7	GTT	3257
8	Telstra	1221
9	Telia Carrier	1299
10	AAPT	2764

Africa

IPv4 Customer Base: Wholesale		
1	Cogent	174
2	Level 3	3356
3	Telecom Italia Sparkle	6762
4	Telefonica	12956
5	Tata Communications	6453
6	SEACOM Ltd	37100
7	Orange	5511
8	NTT	2914
9	Telia Carrier	1299
10	ORAN LINK S.L.	57023

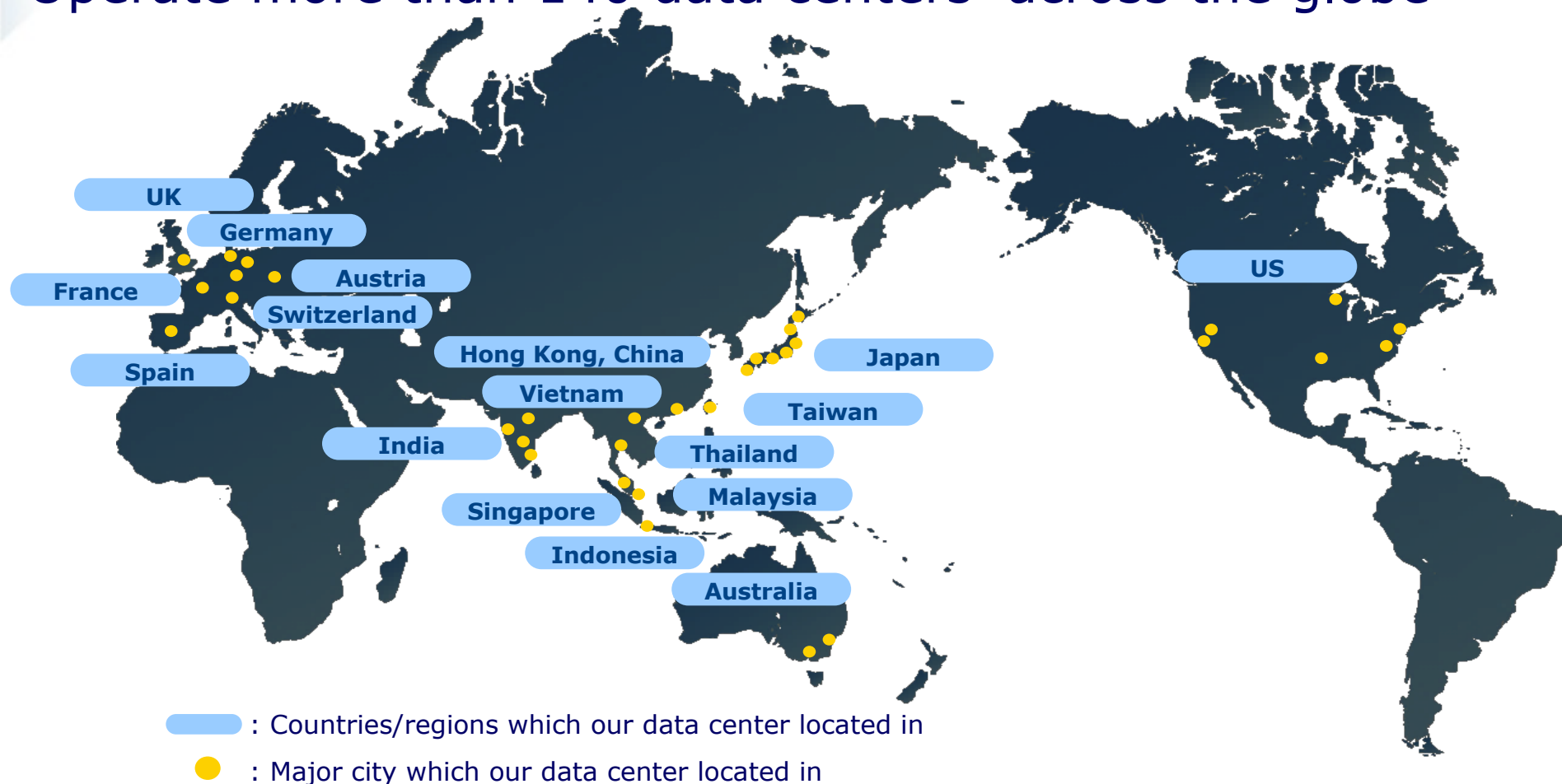
Renesys - As of July 21 2016 <http://research.dyn.com/>

3-3. Global Data Center

Nexcenter

Global Data Center Footprint:

Operate more than 140 data centers* across the globe



*As of April 2016, including plans



3-4. Global Data Center

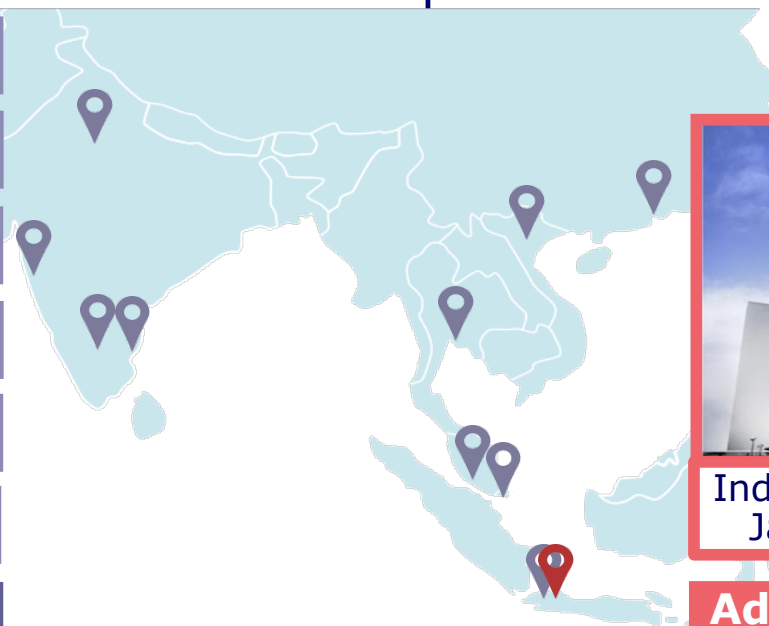
Acquired Cyber CSF, a data center operator in Indonesia
(renamed to PT. NTT Indonesia Nexcenter)

<Server Floor Space >

China [Hong Kong]	26,270m ²
India	19,400m ²
Singapore	7,370m ²
Malaysia	7,170m ²
Thailand	4,550m ²
Others in APAC (excl. Japan)	5,600m ²
Before M&A	
Total: 70,300m²	

[Legend]

-  : PT. NTT Indonesia Nexcenter
-  : Existing data center



Indonesia
Jakarta 7,700m²

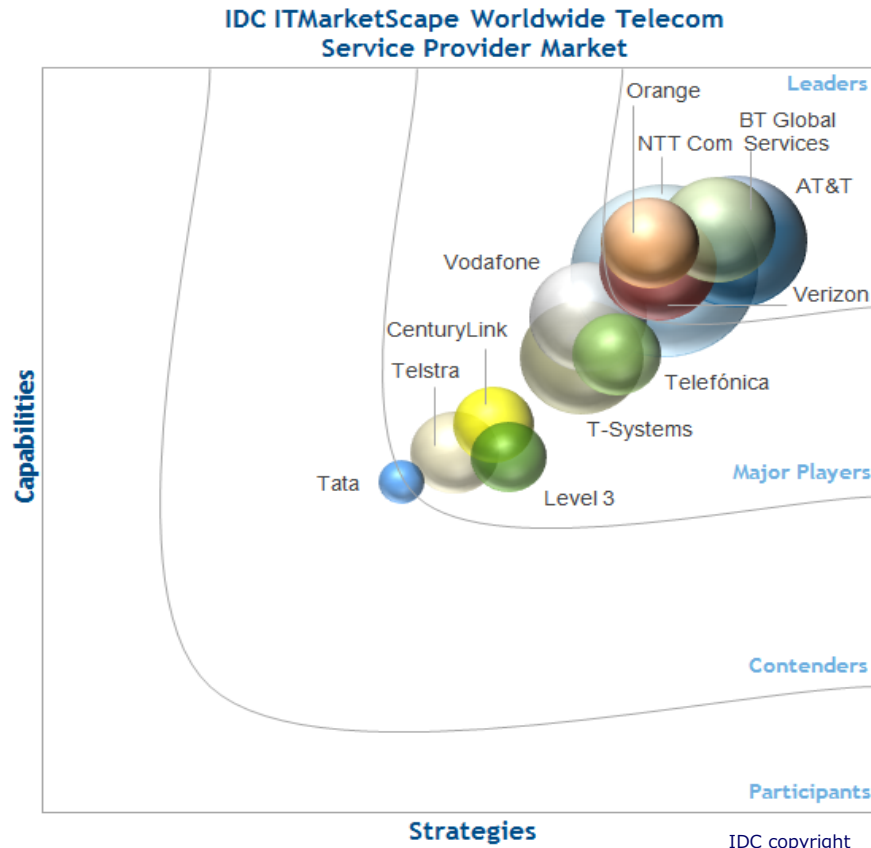
Addition by M&A
Total: 7,700m²

Grand Total:
78,000m²

3-5. Evaluation Reports

IDC ITMarketScape: Worldwide Telecom Service Provider

(July 2015)



← Positioned as a "Leader"

<Evaluated Services>

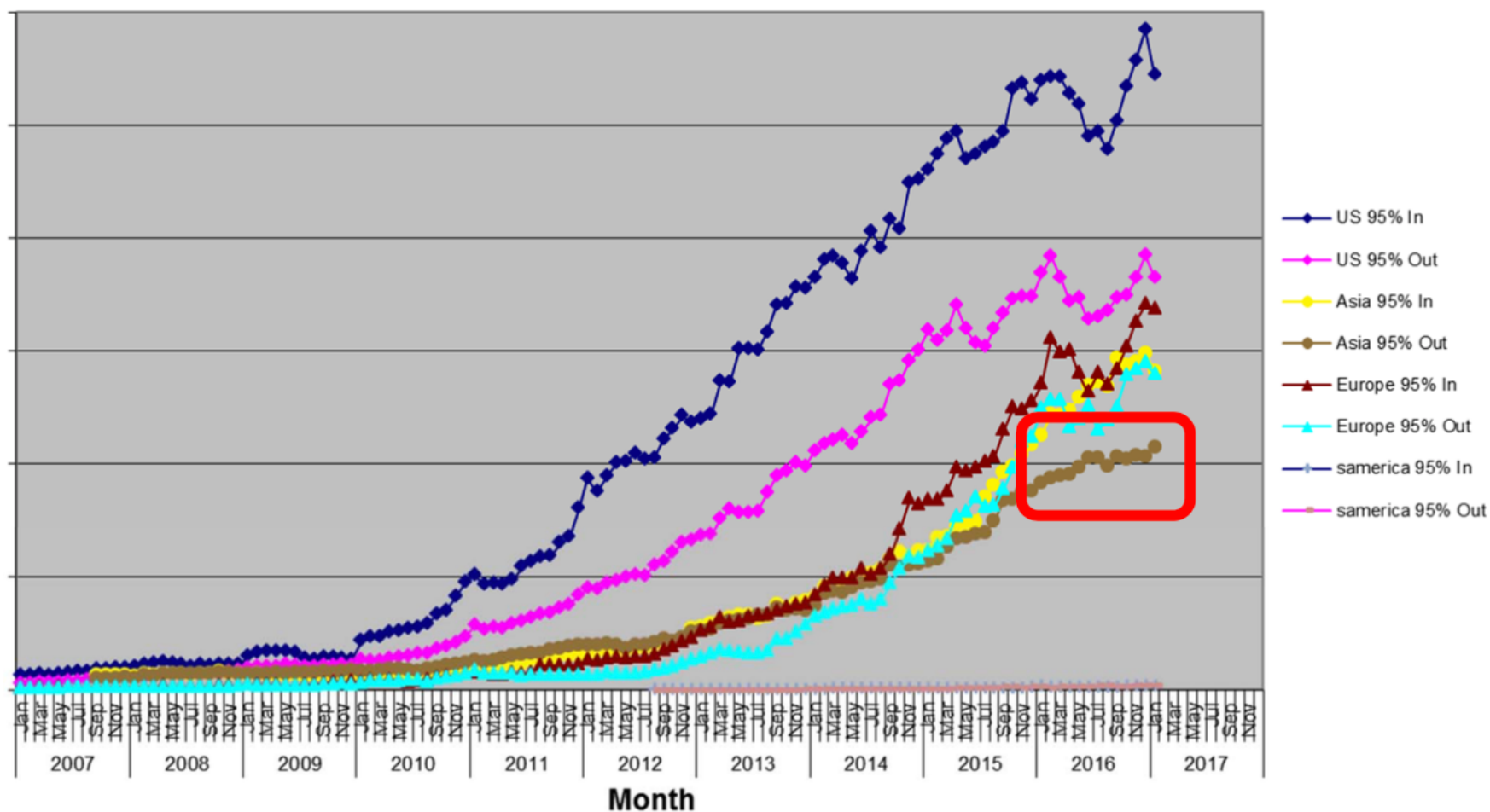
- ✓ Network
- ✓ Cloud
- ✓ Colocation
- ✓ VoIP
- ✓ UCaaS
- ✓ Collaboration
- ✓ Contact Center

Source: IDC, July 2015 "IDC ITMarketScape: Worldwide Telecom Service Provider 2015 Vendor Assessment"(257339)

About IDC ITMarketScape:

IDC ITMarketScape vendor analysis model is designed to provide an overview of the competitive fitness of ICT suppliers in a given market. The research methodology utilizes a rigorous scoring methodology based on both qualitative and quantitative criteria that results in a single graphical illustration of each vendor's position within a given market. The Capabilities score measures vendor product, go-to-market and business execution in the short-term. The Strategy score measures alignment of vendor strategies with customer requirements in a 3-5-year timeframe. Vendor market share is represented by the size of the circles. Vendor year-over-year growth rate relative to the given market is indicated by a plus, neutral or minus next to the vendor name.

3-6. Global Traffic trend



3-7. Traffic model

Model A:

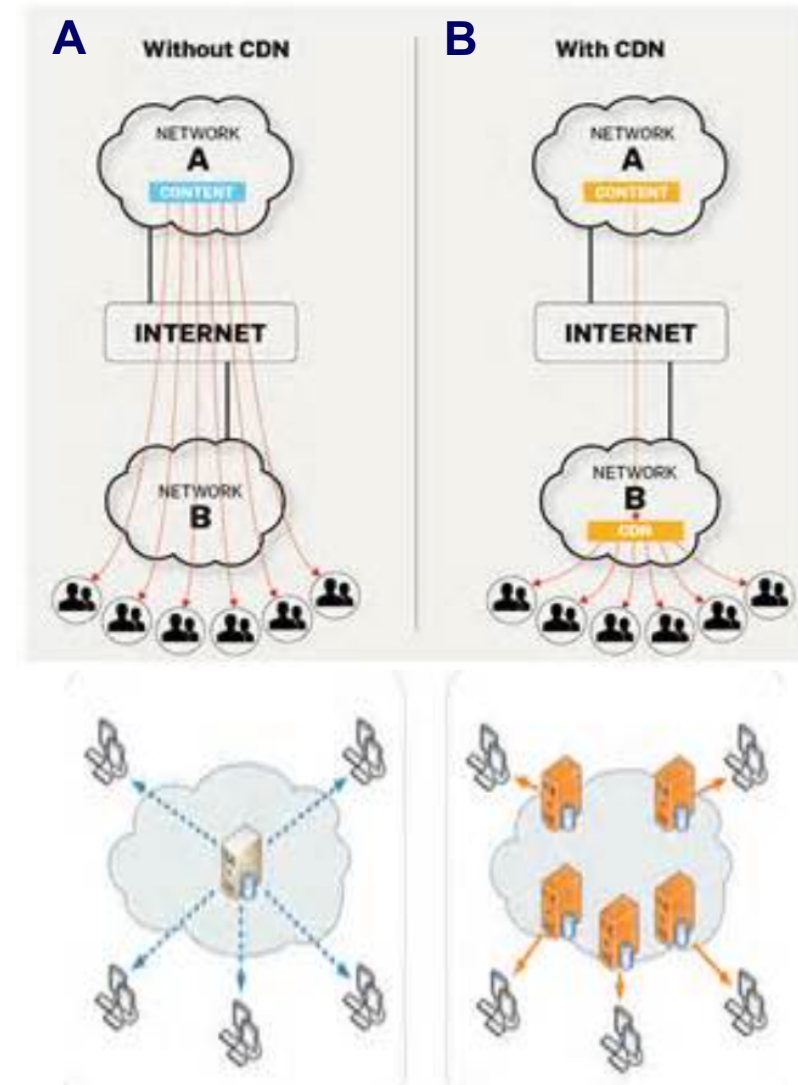
Traffic from other site ↑

- Pull from other site
- No or small CDN or ICP
- will grow!

Model B:

Traffic from other site ↓ or =

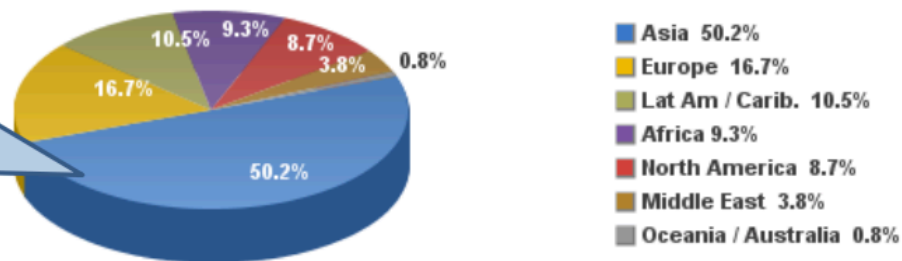
- Server localization + cache
- More utilization of local peering.
- OTT shifts to their own network.



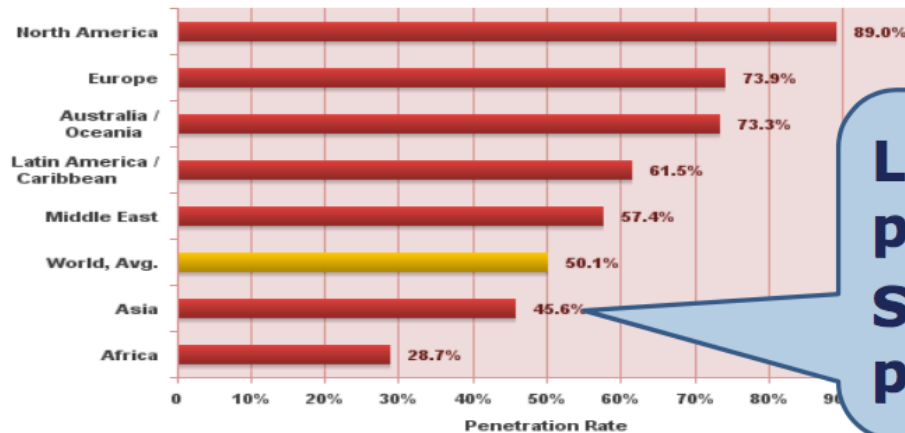
3-8. Asian traffic growth

**Half of the
internet users
are in Asia!**

**Internet Users in the World by Regions
June 2016**



**Internet World Penetration Rates
by Geographic Regions - June 2016**



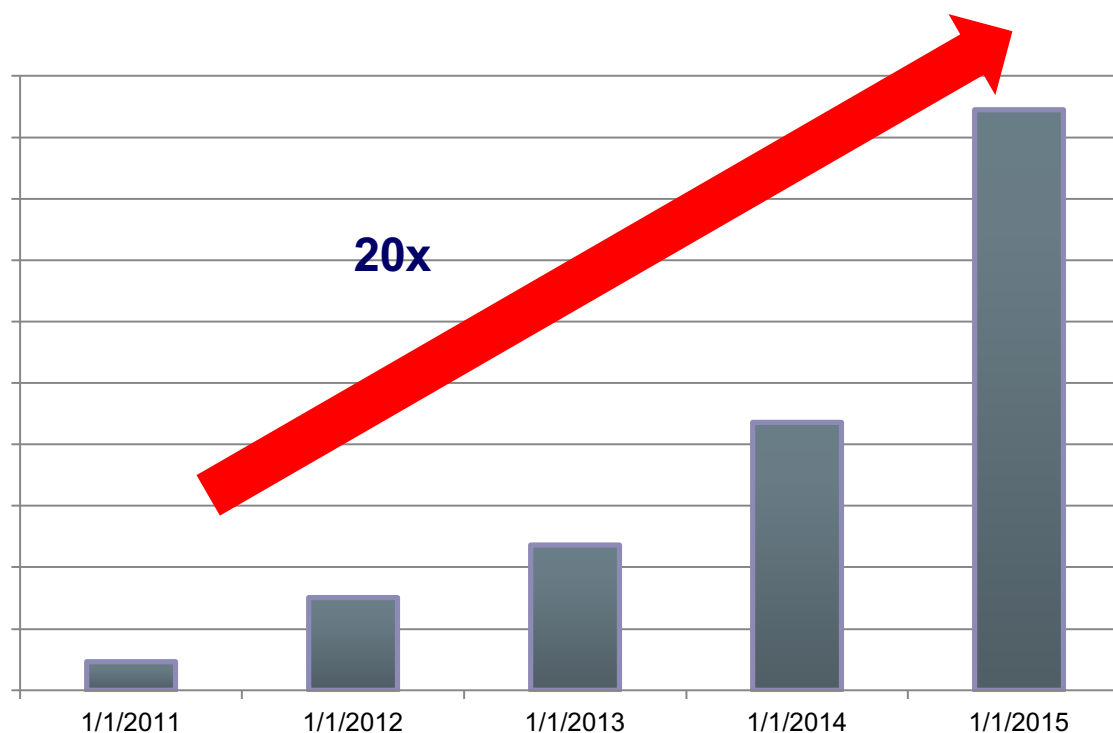
**Less than half
penetration in Asia.
Still lots of growth
potential.**

Source: Internet World Stats - www.internetworldstats.com/stats.htm
Penetration Rates are based on a world population of 7,340,094,096
and 3,675,824,813 estimated Internet users on June 30, 2016.
Copyright © 2016, Miniwatts Marketing Group

www.internetworldstats.com/stats.htm
Internet users on June 30, 2016
Marketing Group

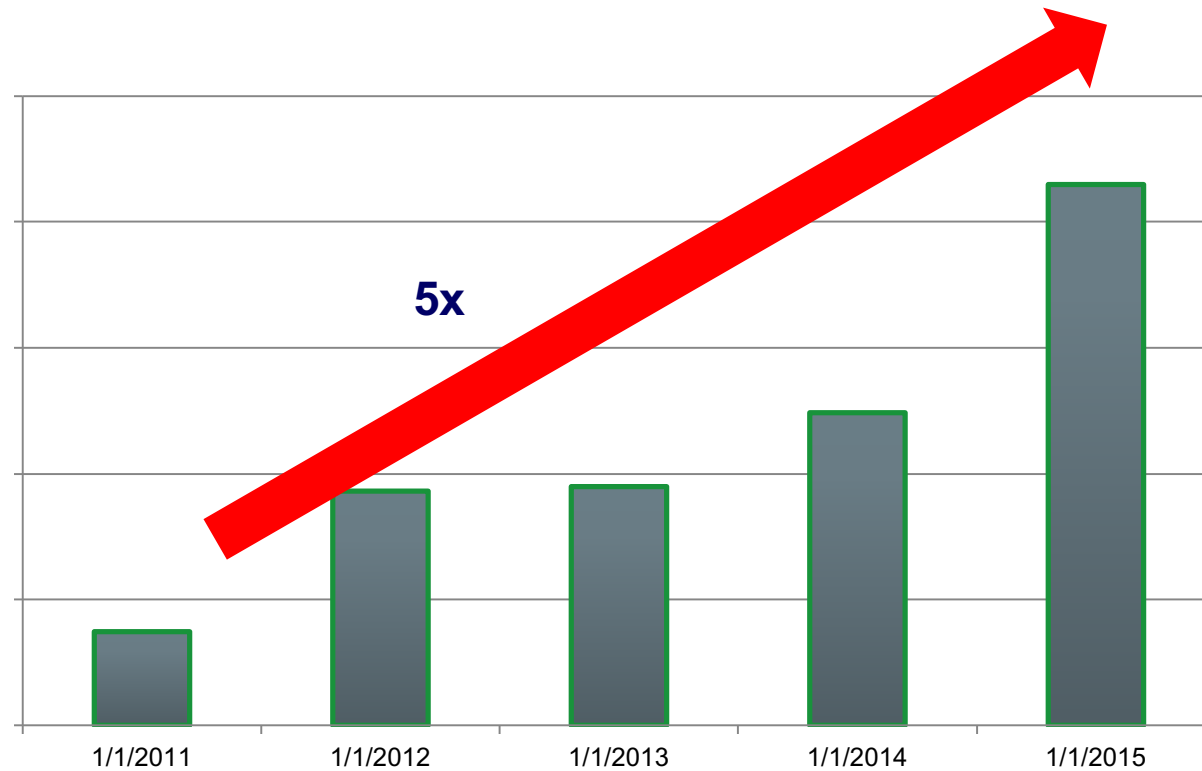
3-9. Our Traffic Growth of OTT/ICP

Same trend as last year.

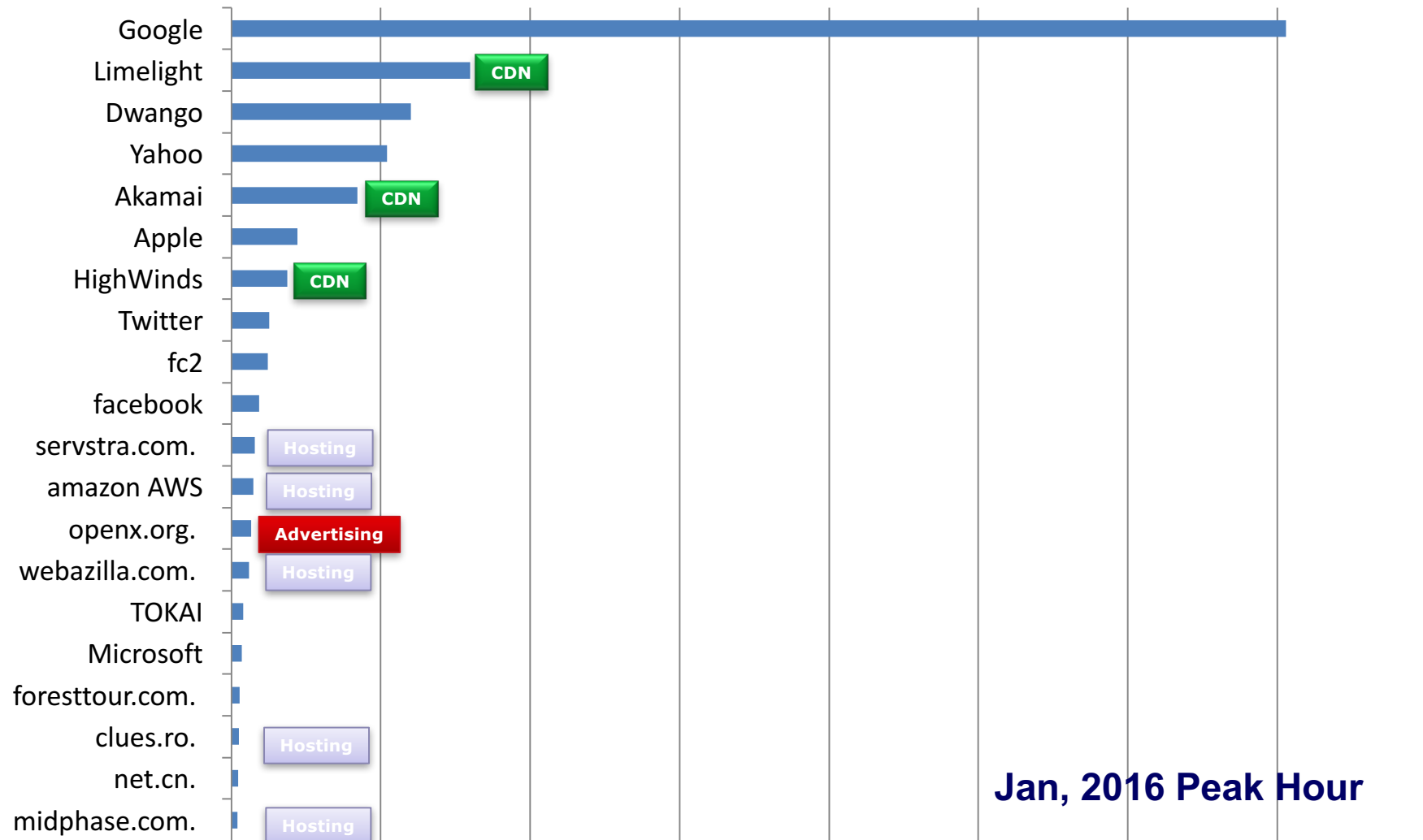


3-10. Our Traffic Growth of CDN Players

Also same trend as last year.



3-11. Our Customer Access Site TOP20





4. One of the Next Step

4-1. from IEEE802

- **400GE**

- IEEE P802.3bs

- 25G/lane
 - LR16 -> NG
 - QSFP56-400G-LR16(4Q2017)

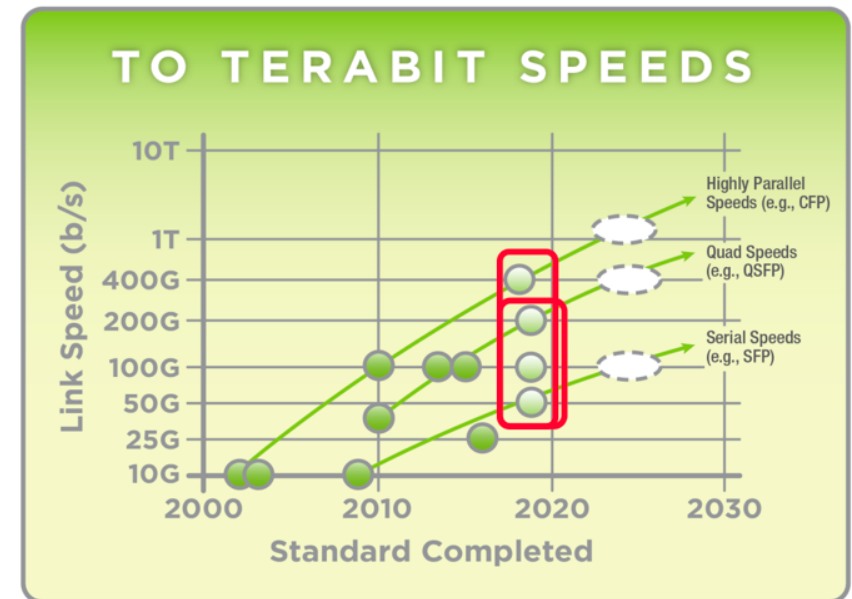
- IEEE P802.3cd

- 50G/lane
 - LR8
 - QSFP-DD-400G-LR8(4Q2018)

- ???

- 100G/lane
 - uQSFP


Form Factor	CR	SR	DR	FR	LR
SFP56	50	50	50	50	50
QSFP56 and uQSFP	4 X 50 2 X 100 1 X 200	4 X 50 2 X 100 1 X 200	4 X 50 2 X 100 1 X 200	2 X 100 1 X 200	2 X 100 1 X 200
QSFP-DD and OBO-8	8 X 50 4 X 100 2 X 200	8 X 50 4 X 100 2 X 200	8 X 50 4 X 100 2 X 200	2 X 200	2 X 200



4-2. Implementation (image)

- **Now testing...**
 - Tester
 - Router,sw



- 
- Forward-looking statements and projected figures concerning the future performance of NTT Com, NTT and their respective subsidiaries and affiliates contained or referred to herein are based on a series of assumptions, projections, estimates, judgments and beliefs of the management of NTT Com in light of information currently available to it regarding NTT Com, the economy and telecommunications industry in Japan and overseas, and other factors. These projections and estimates may be affected by the future business operations of NTT Com, NTT and their respective subsidiaries and affiliates, the state of the economy in Japan and abroad, possible fluctuations in the securities markets, the pricing of services, the effects of competition, the performance of new products, services and new businesses, changes to laws and regulations affecting the telecommunications industry in Japan and elsewhere, other changes in circumstances that could cause actual results to differ materially from the forecasts contained or referred to herein, as well as other risks included in NTT's most recent Annual Report on Form 20-F and other filings and submissions with the United States Securities and Exchange Commission.
 - "FY" in this material indicates the fiscal year ending March 31 of the succeeding year
 - Figures in USD are not official but are provided for reference (exchange rate used is USD 1 : JPY 100).



Thank you!!

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