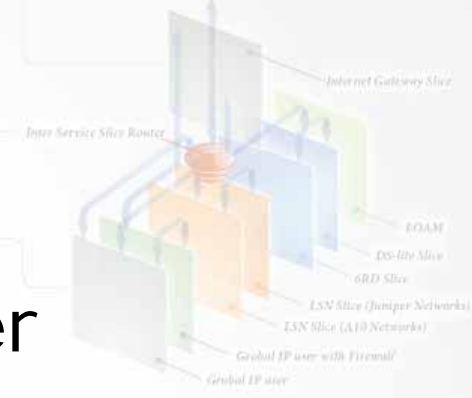
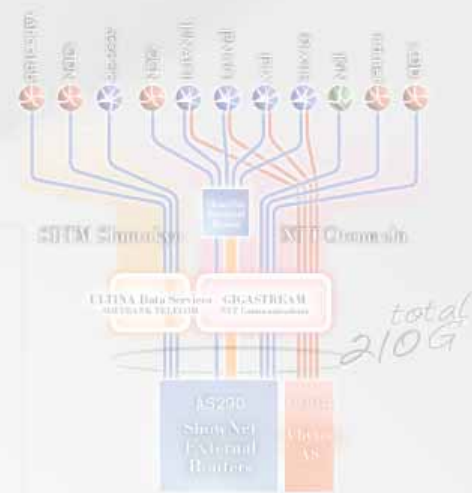


# ShowNet 相互接続実験検証結果レポート

## Interop Tokyo 2010 ShowNet Network Operation Center

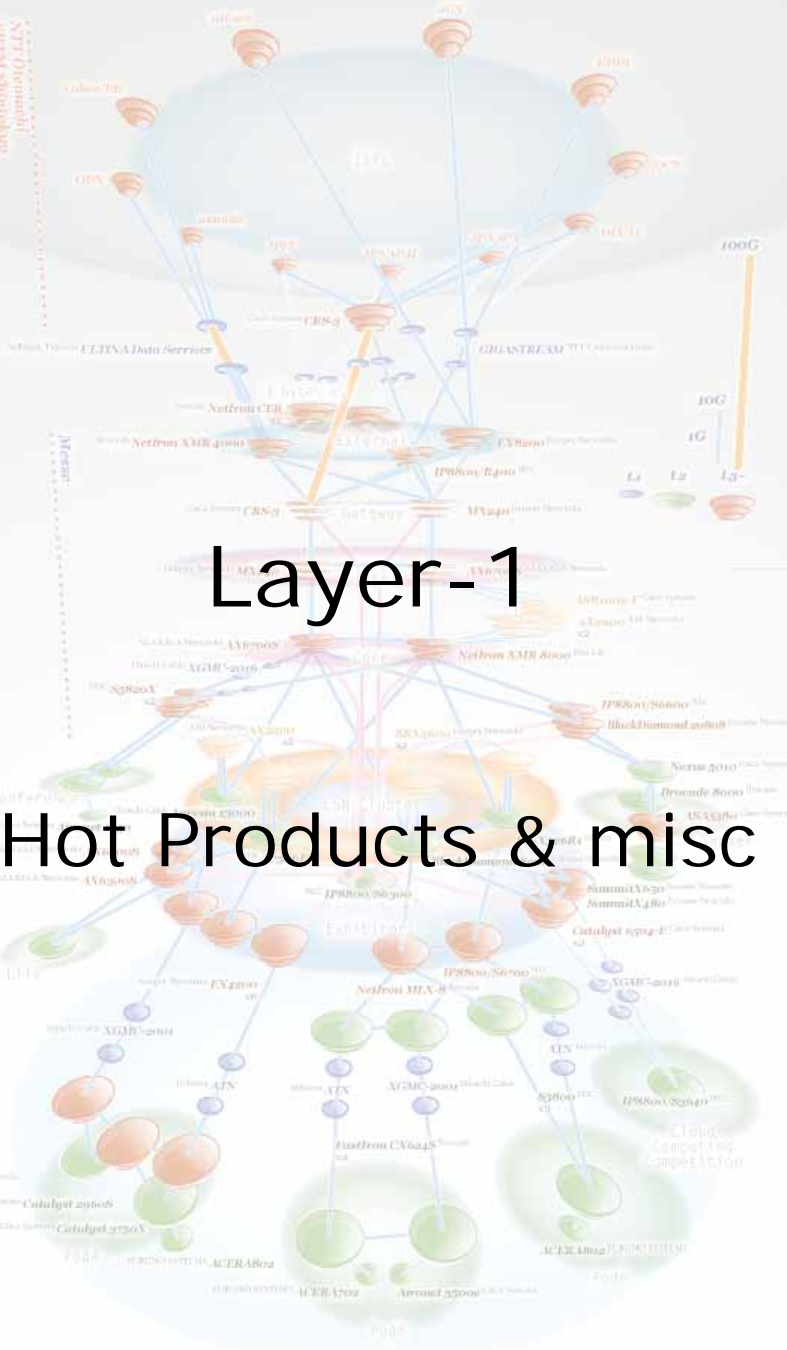


Service  
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- 01. Brocade 3200
- 02. TurboIron 24X
- 03. Nexus 2248P
- 04. PowerConnect 111
- 05. Summit X470
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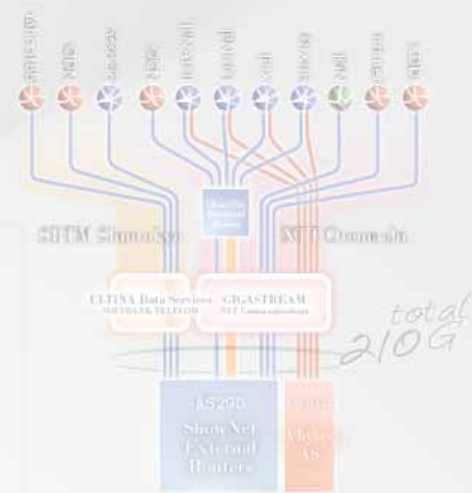
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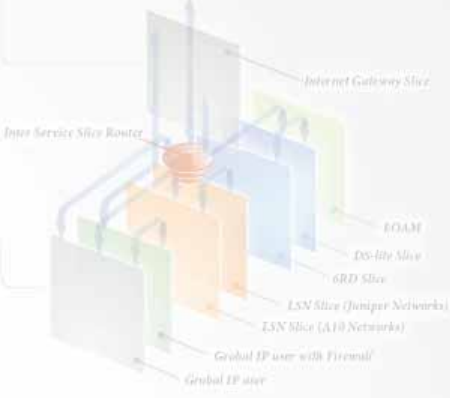


Layer-1

Hot Products & misc



total 210G



#sh.net <->  
> count zero

INTEROP  
TOKYO | 7-11 JUNE, 2010

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# Layer-1 Hot Products (摂津金属製ラック)

- クラウドラック SCRシリーズ
  - 耐震性能1G (搭載質量800kg) !
  - サーバー高密度実装化に最適な、高耐震型19インチサーバーラック



**INTEROP**  
TOKYO | 7-11 JUNE, 2010

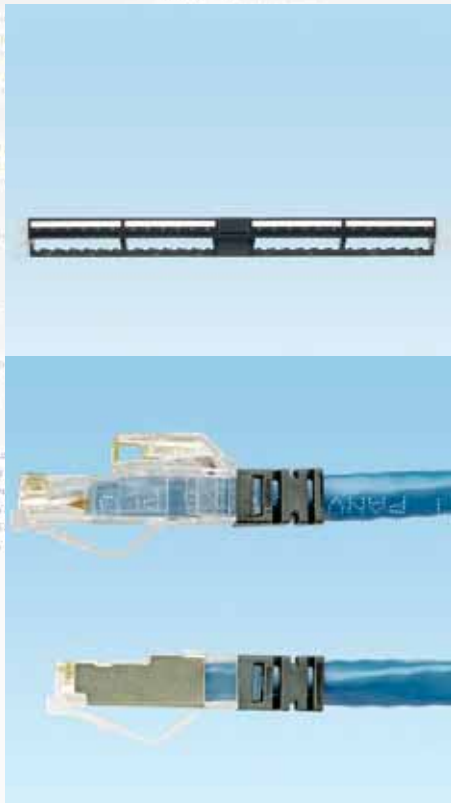
# Layer-1 Hot Products (Panduit製ラック)

- Net-SERV™キャビネットラック
  - 高密度サーバ搭載を実現する一体型フレーム構造
  - 効率的なケーブル管理を実現



# Layer-1 Hot Products (Panduit製パッチパネル&コード)

- PanView iQ™ パッチパネル&コード
  - ラック内での高密度化による識別効率を向上





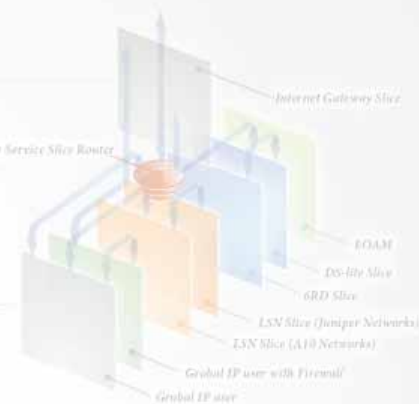
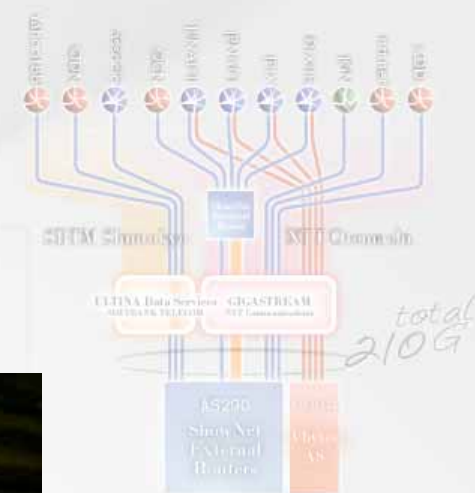
## 高密度化への対応

- プレターミネートMTPカセット&プレターミネートMTPトランクケーブル
  - ファイバ12芯を一括成端
  - カセットで12芯をSC/LCコネクタに変換



# Tester / Tool

- 伝送速度の高速化に伴うケーブル品質向上に貢献  
 - フルーク ネットワークス製品







# 100GbE インタフェース概要

Physical Layer Reach	1 m Backplane	7 m Copper Cable	100 m OM3, 125 m OM4 MMF	10 km SMF	40 km SMF
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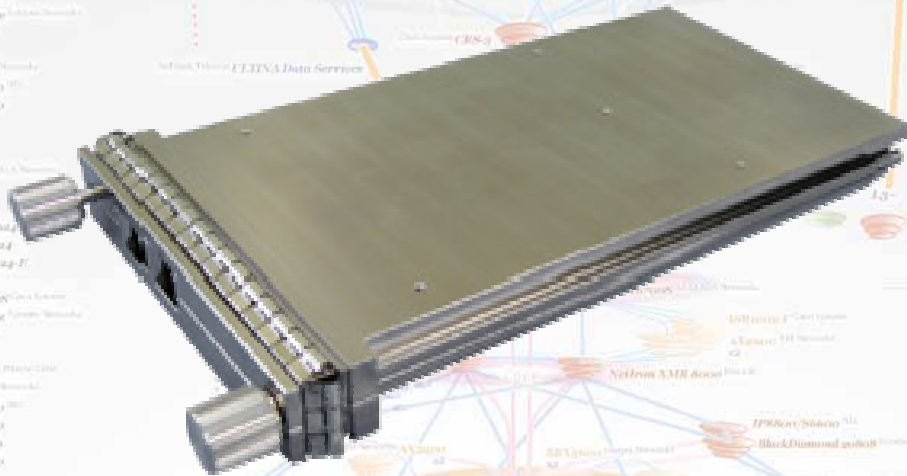
## 40 Gigabit Ethernet: Target Applications – Servers, Data Center, Campus, Metro, Backbone

Name	40GBASE-KR4	40GBASE-CR4	40GBASE-SR4	40GBASE-LR4	
Signaling	4 x 10 Gb/s	4 x 10 Gb/s	4 x 10 Gb/s	4 x 10 Gb/s	
Media	Copper Backplane	Twinax Cable	MPO MMF	Duplex SMF	
Module/Connector		QSFP Module, CX4 Interface	QSFP Module	QSFP Module, CFP Module	
Availability	No Known Development	2010	2010	QSFP 2011-2012 CFP 2010	

## 100 Gigabit Ethernet: Target Applications – Data Center, Campus, Metro, Backbone, WAN

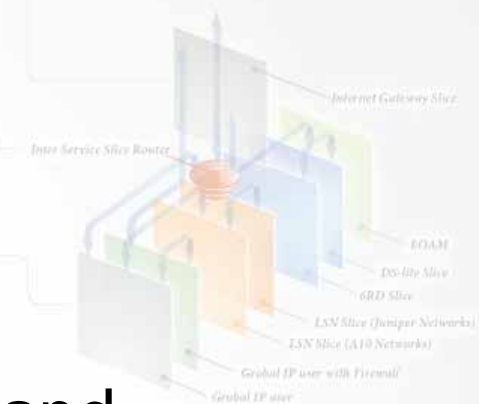
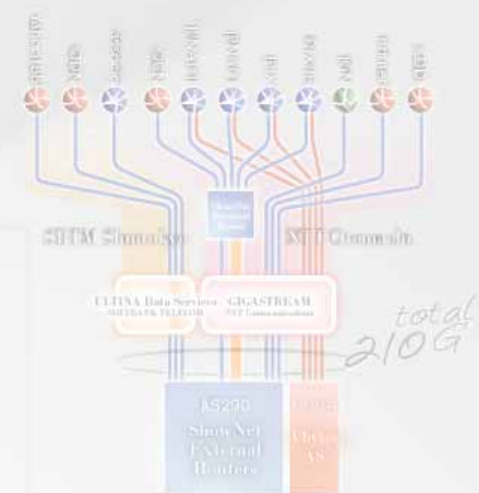
Name		100GBASE-CR10	100GBASE-SR10	100GBASE-LR4	100GBASE-ER4
Signaling		10 x 10 Gb/s	10 x 10 Gb/s	4 x 25 Gb/s	4 x 25 Gb/s
Media		Twinax Cable	MPO MMF	Duplex SMF	Duplex SMF
Module/Connector		CXP Module	CXP Module, CFP Module	CFP Module	CFP Module
Availability		2010	2010	2010	2011-2012

# CFPモジュール

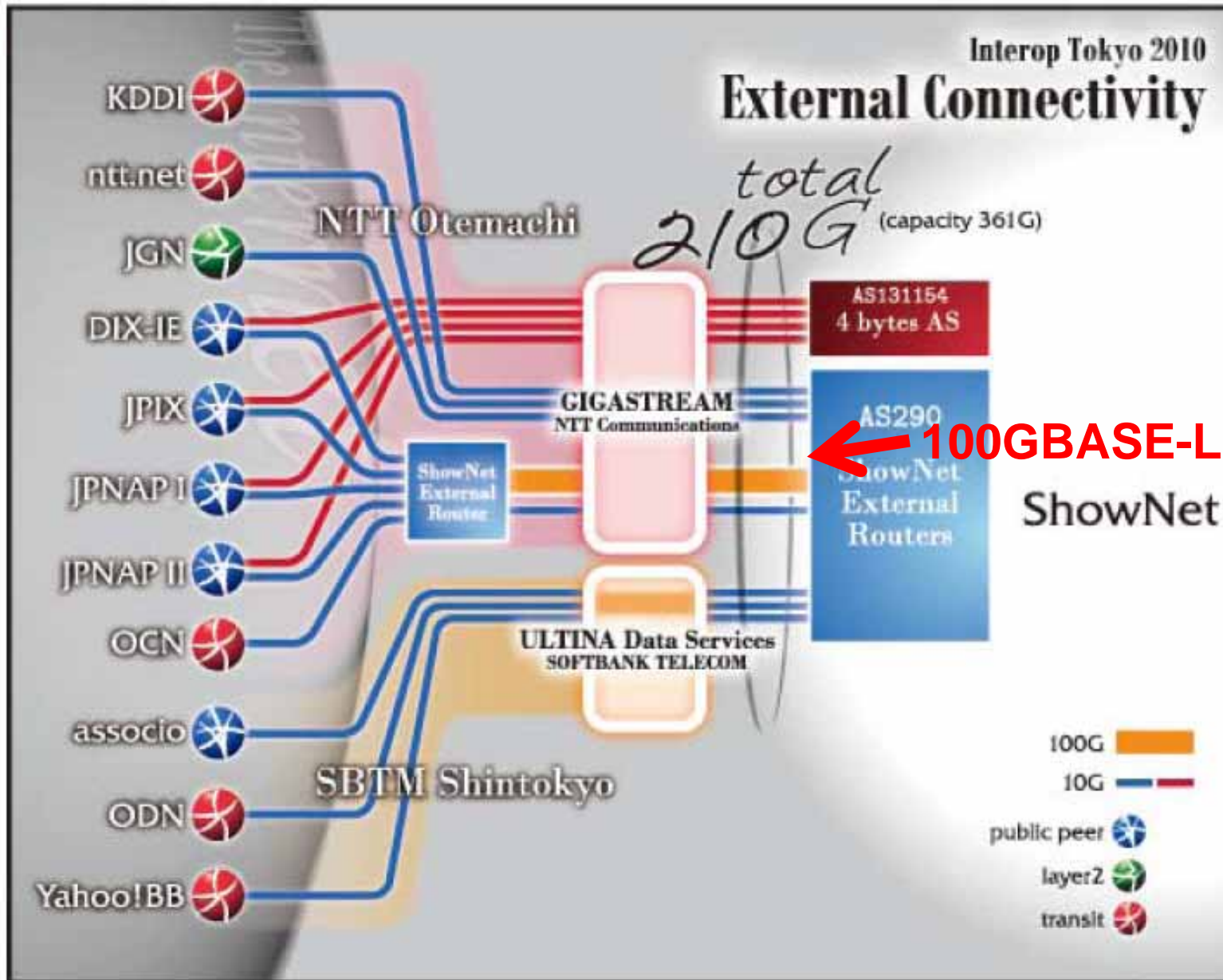


XENPAKの2倍の大きさ

40GBASE-SR4, 40GBASE-LR4,  
100GBASE-SR10, 100GBASE-LR4 and  
100GBASE-ER4に利用予定



# 100GEに実インターネットトラフィックを流すのは世界初!!



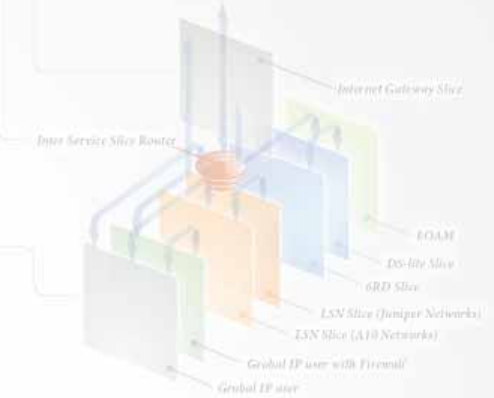
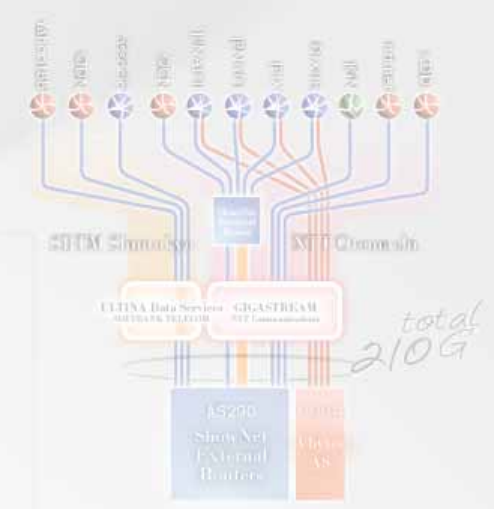
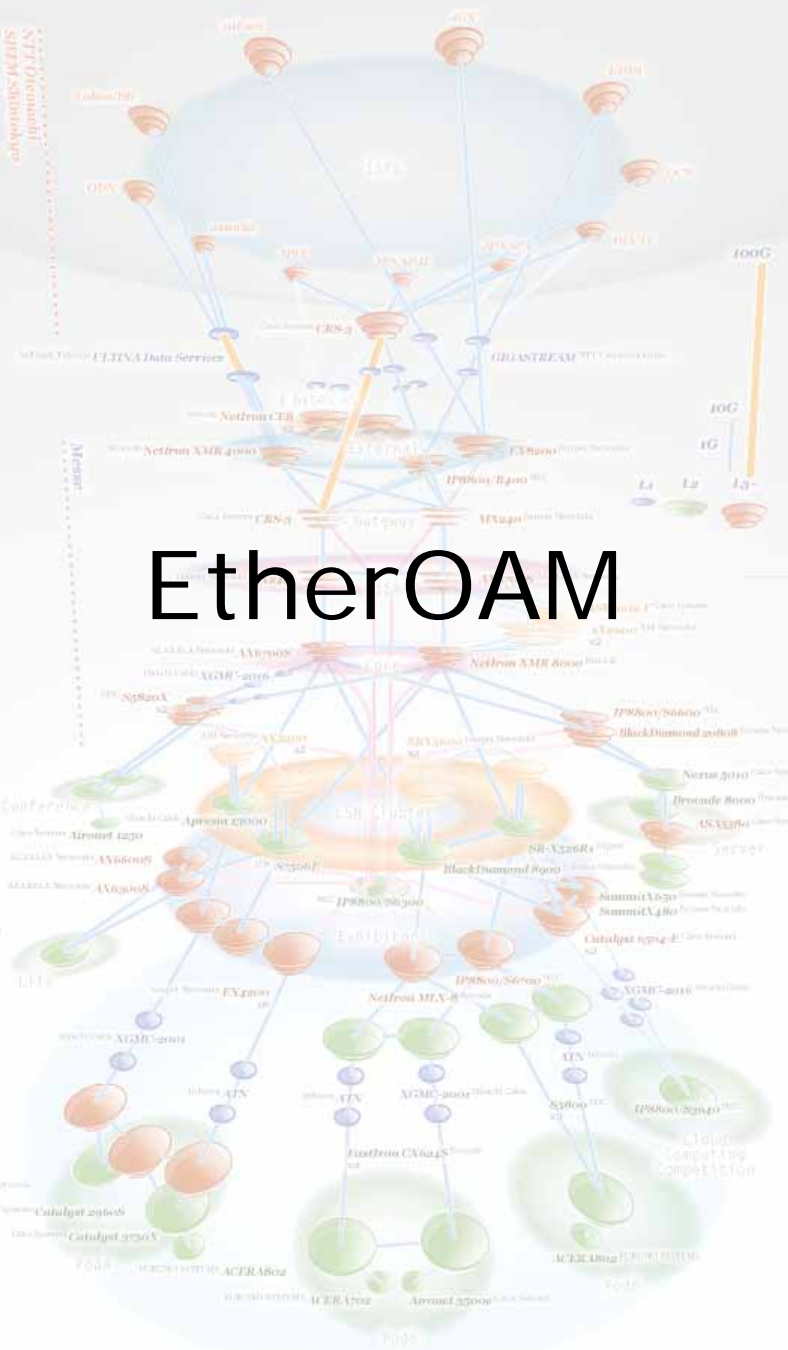
# 今回の相互接続試験には以下のコントリビュータ様に御協力いただきました



## テスターによる100GbE試験を実施



# EtherOAM



**sh<sub>Δ</sub>net** ← ↷  
 > count zero

- SERVER / SAN / STORAGE**
- 01. Brocade 3200
  - 02. TurboIron 24X
  - 03. Nexar 2448T
  - 04. PowerComment 100
  - 05. Summit X490
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# 今回の試験内容

- 相互接続性試験

- IEEE802.1ag:

CC, LB, LT

- Y.1731:

CC, LB, LT, DM

- 冗長プロトコルとの接続性

- トポロジーの一部に冗長プロトコル(STP)を使用して実施

- 実際の運用に使ってみる

- CCによる死活監視

- Network MAP

- 階層的なメンテナンスドメインレベル毎の監視

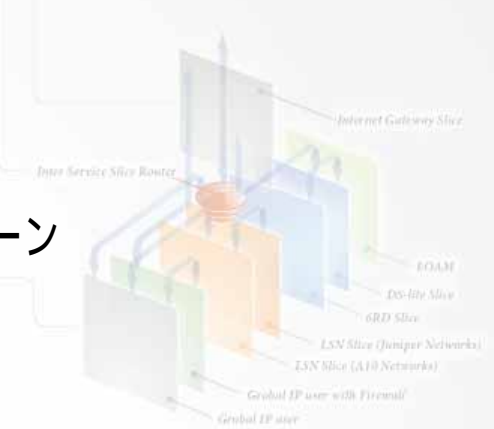
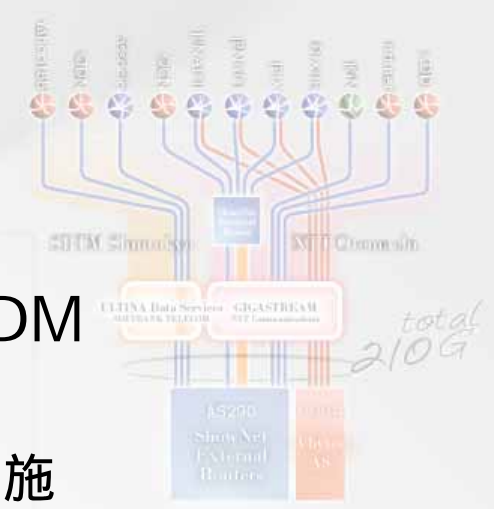
- level 0 (physical MD Level) : リンク部分

- level 4 (service provider MD Level): バックボーン

- level 5 (customer MD Level) : 出展社様間

- パフォーマンス試験

- CCの間隔: 1sec (去年は1min)



# 今回の相互接続試験には以下のコントリビュータ様に御協力いただきました (12社45台)

**Alaxala**

**BROCADE**

**CISCO**

**JUNIPER NETWORKS**

**extreme networks**

**NEC**

**H3C**

**SII**

**東陽テクニカ**

**ALPHANET**

**Hitachi Cable**  
Empowering Energy & Communication

**FUJITSU** 富士通九州ネットワークテクノロジーズ

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**INTEROP**  
TOKYO | 7-11 JUNE, 2010

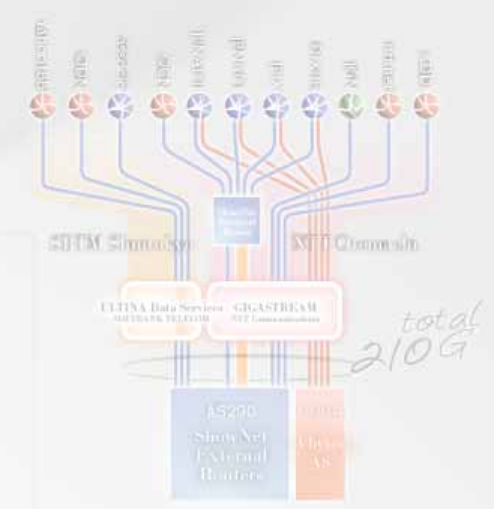
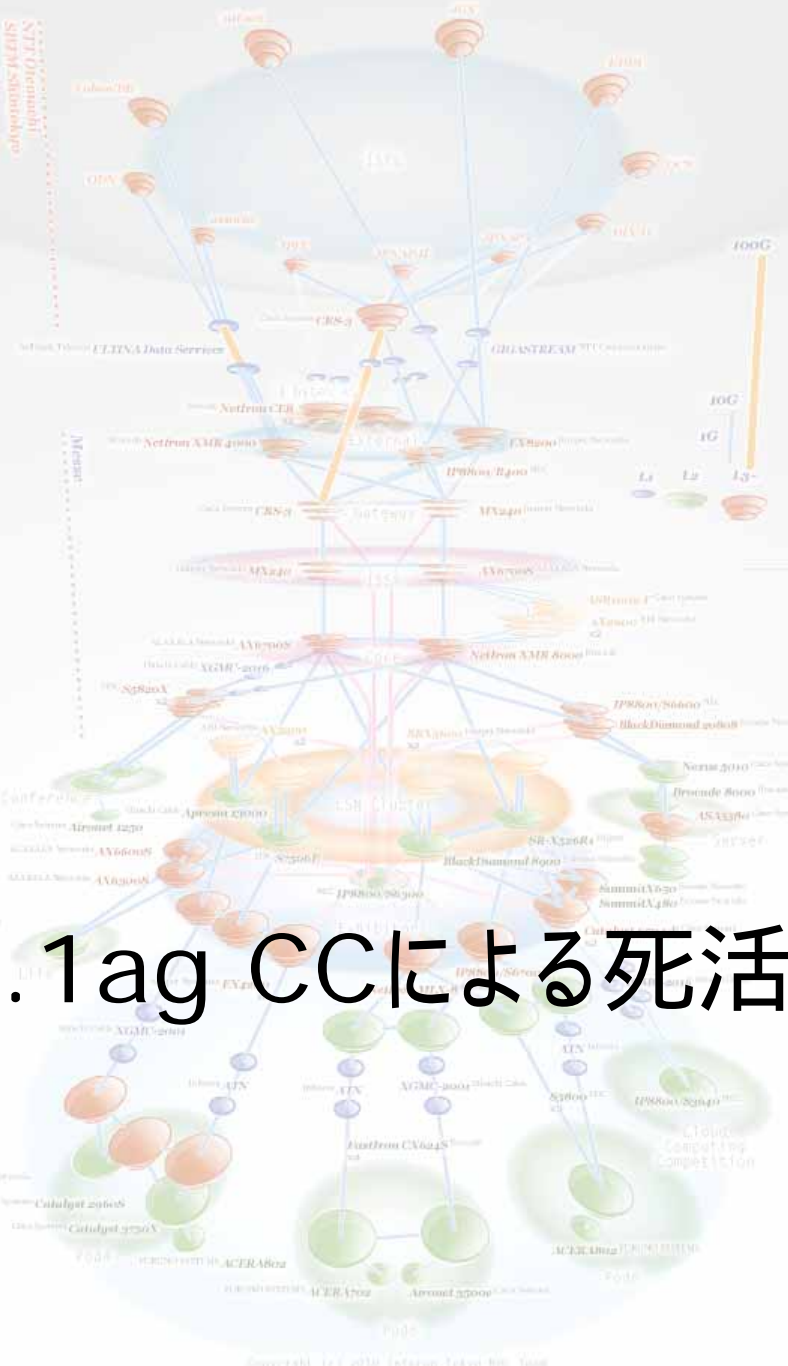


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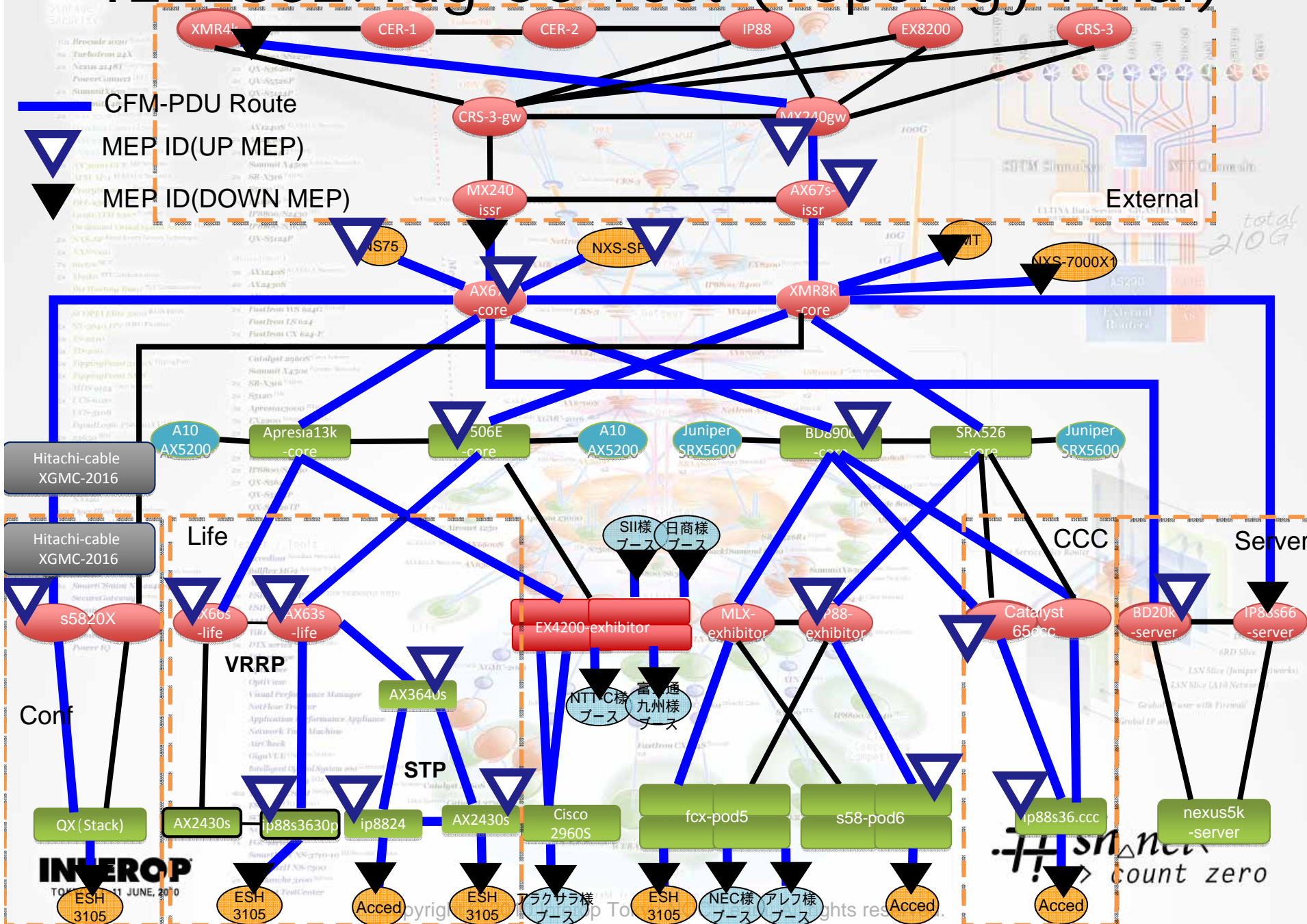


# IEEE 802.1ag CCによる死活監視

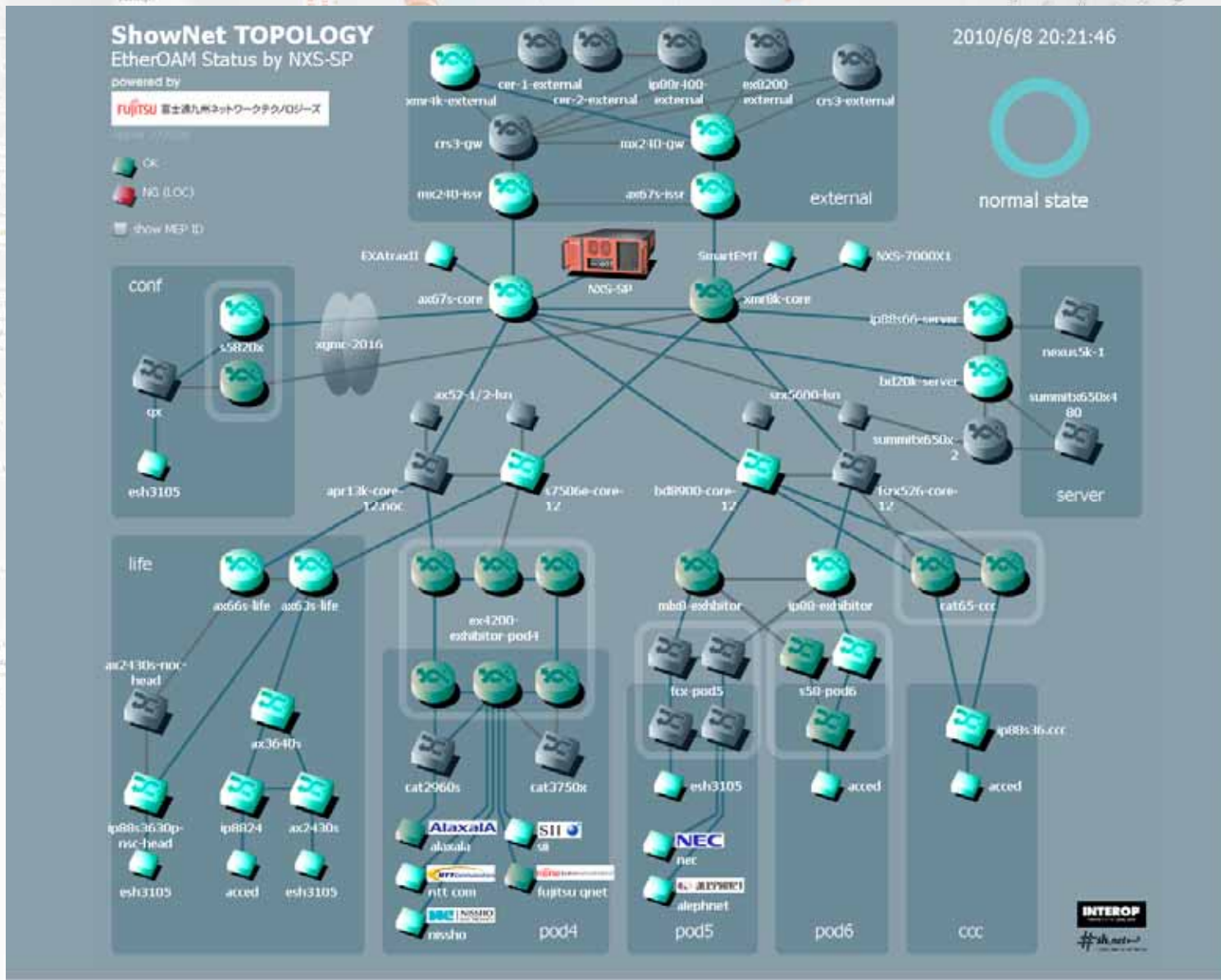
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# IEEE802.1ag CC Test (Topology Final)

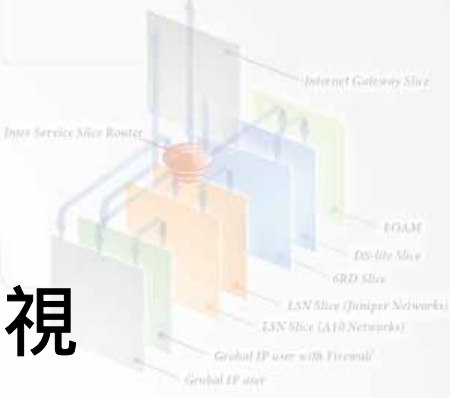
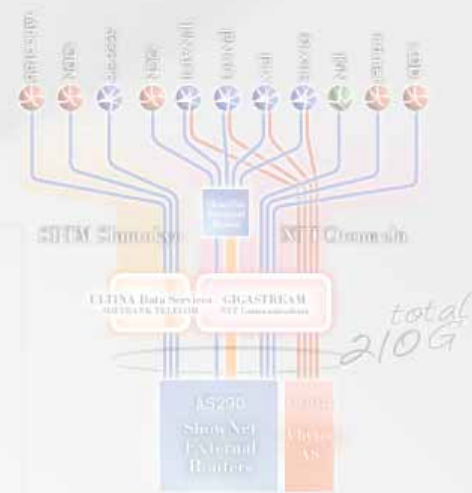
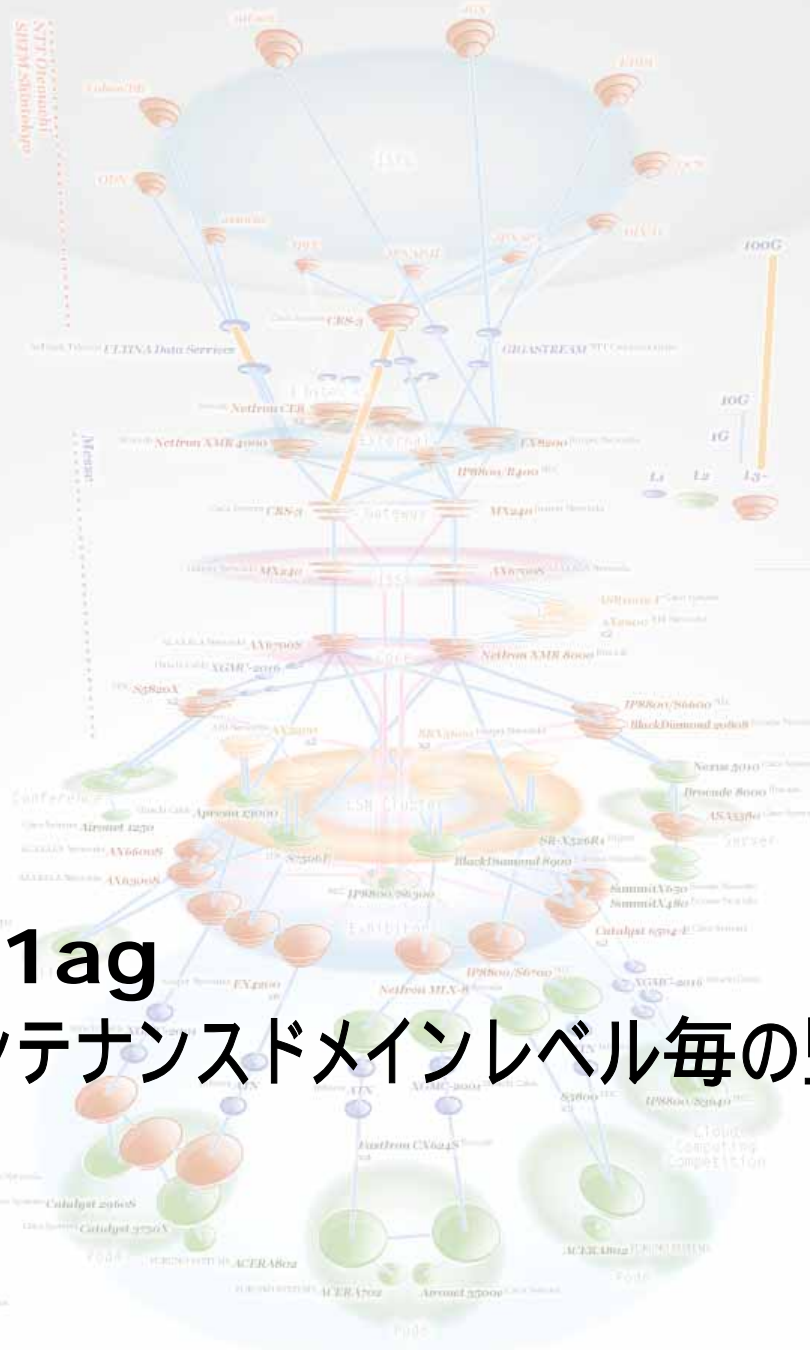


# CC死活監視画面



NOCルームディスプレイ・NOCラック・他、各出展社様デモにてご覧になれます！！

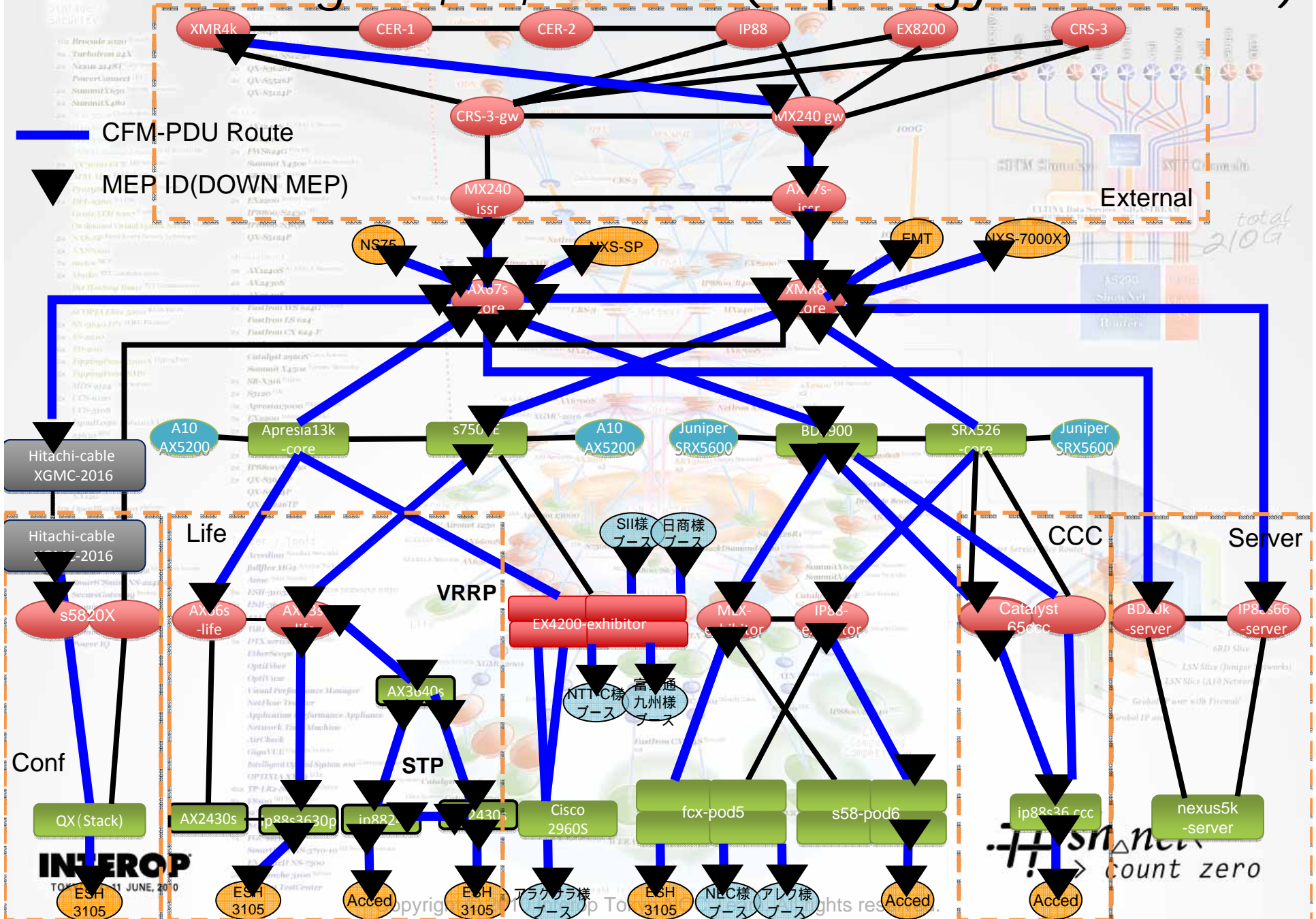
- 016 Broadband 2020
- 017 Turbo from 24X
- 018 Nexus 2448P
- 019 PowerConnect 1312
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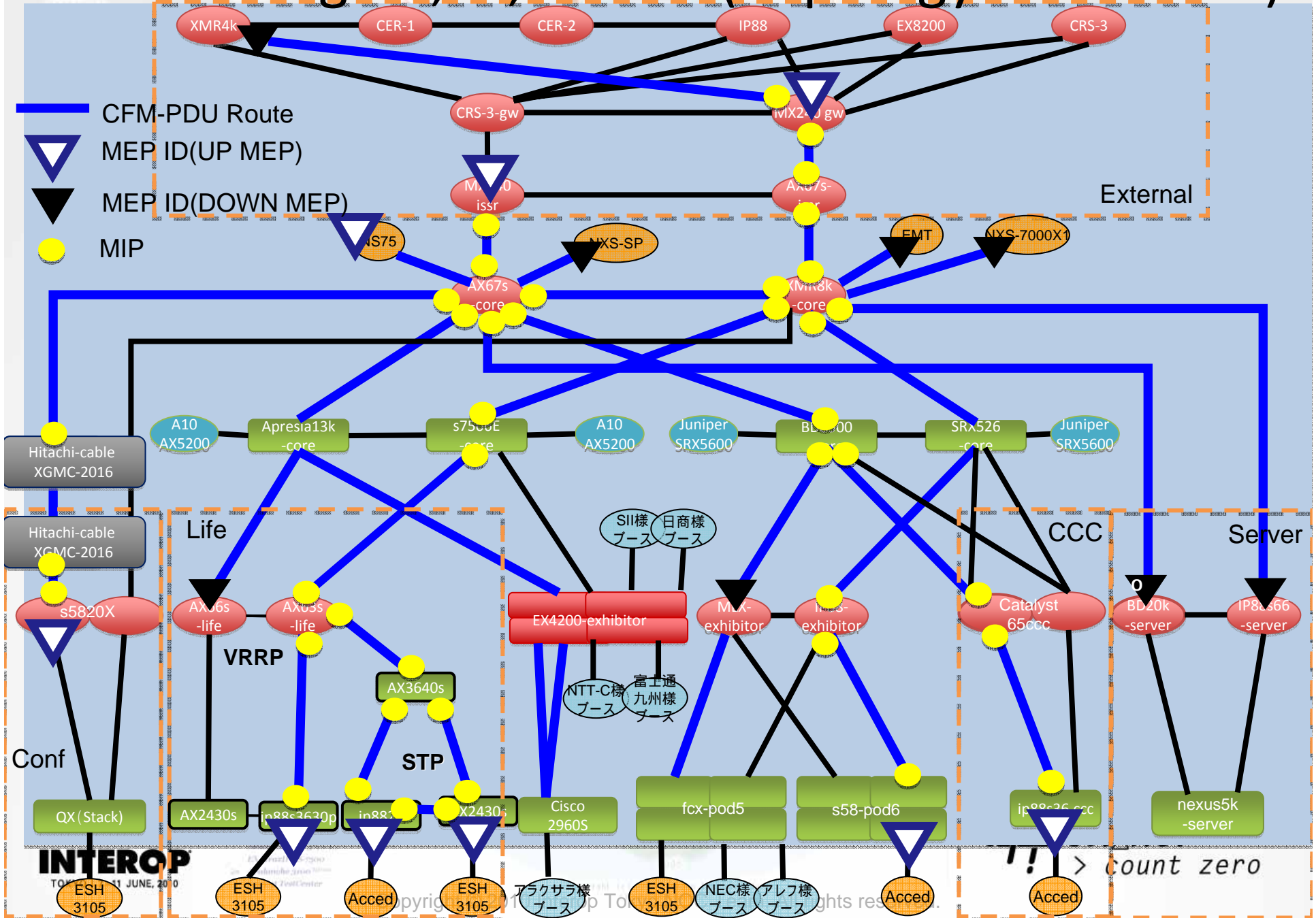
# IEEE802.1ag 階層的なメンテナンスドメインレベル毎の監視

#sh<sub>Δ</sub>net ←  
> count zero

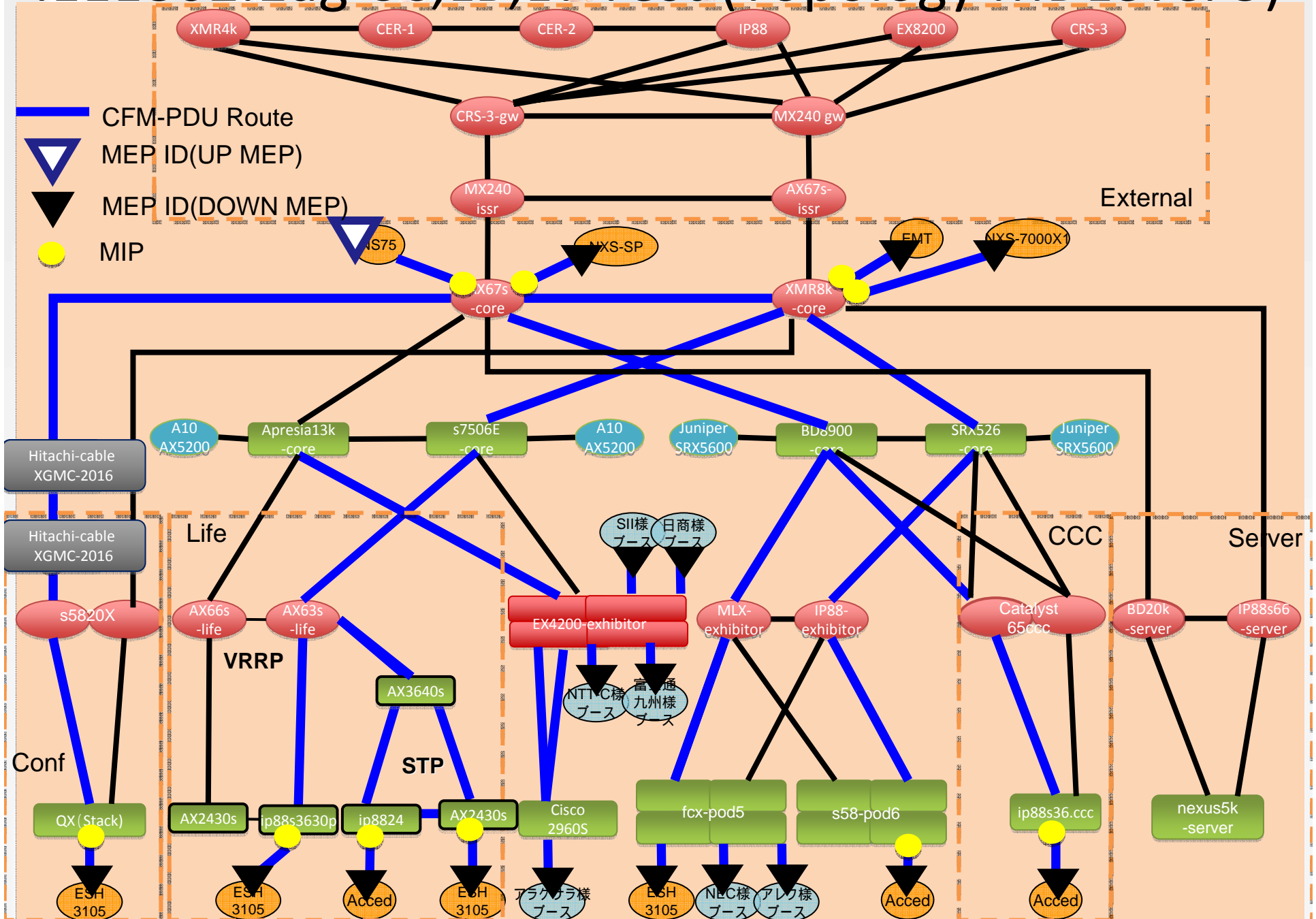
# IEEE802.1ag CC, LB, LT Test (Topology MDLevel 0)



# IEEE802.1ag CC, LB, LT Test (Topology MDLevel 4)



# IEEE802.1ag CC, LB, LT Test (Topology MDLevel 5)



# CC確認画面例

Remote MEP count: 15

Identifier	MAC address	State	Interface
1	08:00:83:*:*:*	ok	xe-0/*/*.*
2	00:e0:00:*:*:*	ok	xe-0/*/*.*
3	08:00:83:*:*:*	ok	xe-0/*/*.*
22	00:04:80:*:*:*	ok	xe-0/*/*.*
30	00:23:89:*:*:*	ok	xe-0/*/*.*
34	00:e0:00:*:*:*	ok	xe-0/*/*.*
47	00:22:83:*:*:*	ok	xe-0/*/*.*
80	00:12:e2:*:*:*	ok	xe-0/*/*.*
85	00:12:e2:*:*:*	ok	xe-0/*/*.*
90	00:12:e2:*:*:*	ok	xe-0/*/*.*
96	00:12:e2:*:*:*	ok	xe-0/*/*.*
110	00:04:96:*:*:*	ok	xe-0/*/*.*
112	00:12:e2:*:*:*	ok	xe-0/*/*.*
121	08:00:83:*:*:*	ok	xe-0/*/*.*
123	00:e0:00:*:*:*	ok	xe-0/*/*.*



# LB、LT確認画面例

## LB確認画面結果

```
PING to 00:12:e2:*:*:*, Interface xe-0/*/*.*
64 bytes from 00:12:e2:*:*:*: lbm_seq=292
64 bytes from 00:12:*:*:*: lbm_seq=293
64 bytes from 00:12:e2:*:*:*: lbm_seq=294
64 bytes from 00:12:e2:*:*:*: lbm_seq=295
--- ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
```

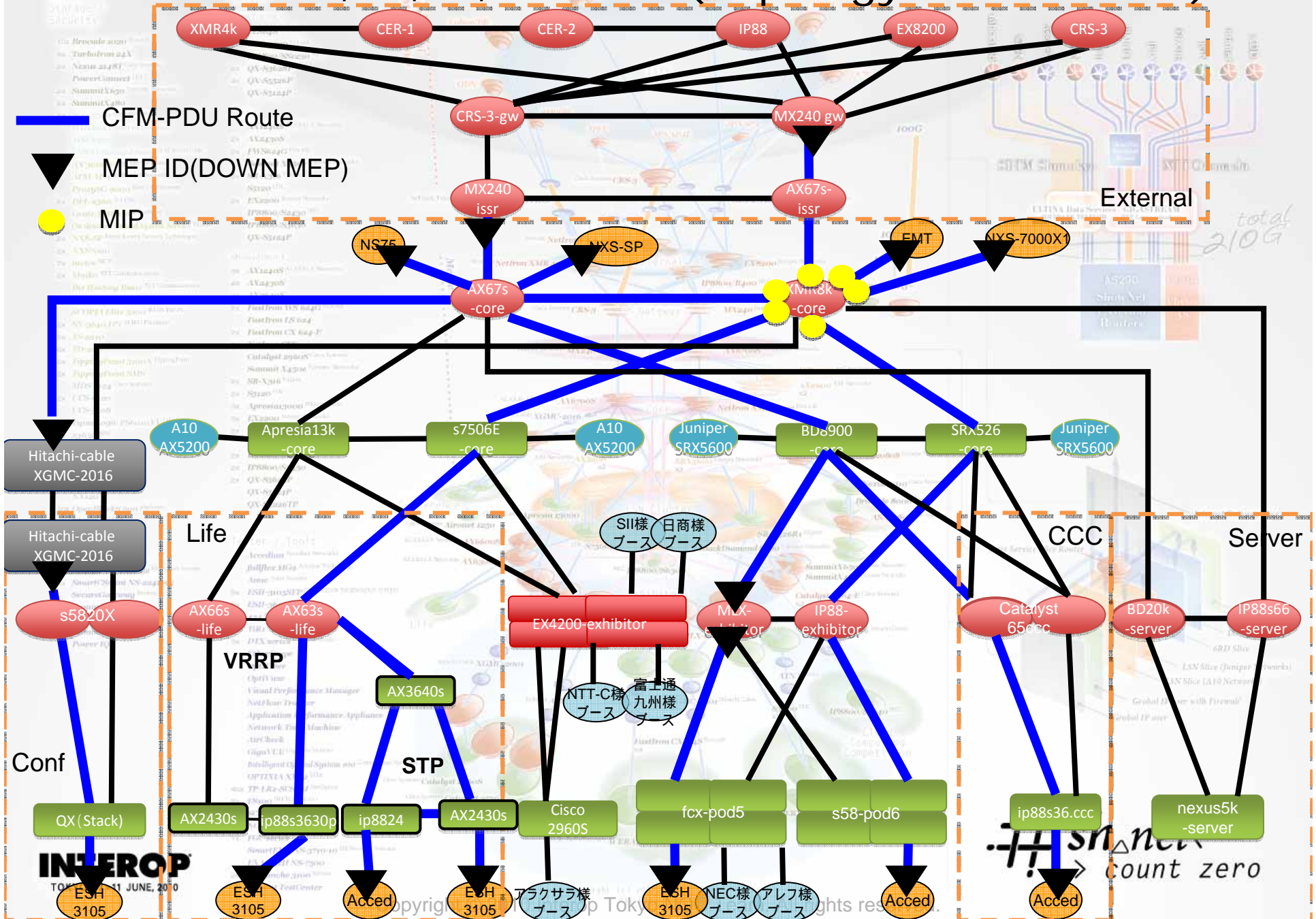
## LT確認画面結果

```
Linktrace to 00:12:e2:*:*:*, Interface xe-0/*/*.*
Maintenance Domain: *****, Level: *
Maintenance Association: ****, Local Mep: *
Transaction Identifier: ***
```

Hop	TTL	Source MAC address	Next-hop MAC address
1	62	00:12:e2:*:*:*	*:~*:~*:~*:~*
2	61	00:0f:e2:*:*:*	*:~*:~*:~*:~*
3	60	00:12:e2:*:*:*	*:~*:~*:~*:~*
4	59	00:12:e2:*:*:*	*:~*:~*:~*:~*
5	58	00:12:e2:*:*:*	*:~*:~*:~*:~*



# Y.1731 CC, LB, LT, DM Test (Topology MEG Level 5)



# DM確認画面例

```
Two-way ETH-DM request to 00:06:19:*:*:*, Interface xe-0/*/*.*
DMR received from 00:06:19:*:*:* Delay: 3159 usec Delay variation: 0 usec
DMR received from 00:06:19:*:*:* Delay: 3171 usec Delay variation: 12 usec
DMR received from 00:06:19:*:*:* Delay: 3218 usec Delay variation: 47 usec
DMR received from 00:06:19:*:*:* Delay: 3187 usec Delay variation: 31 usec
DMR received from 00:06:19:*:*:* Delay: 15435 usec Delay variation: 12248 usec
DMR received from 00:06:19:*:*:* Delay: 4459 usec Delay variation: 10976 usec
DMR received from 00:06:19:*:*:* Delay: 11972 usec Delay variation: 7513 usec
DMR received from 00:06:19:*:*:* Delay: 3377 usec Delay variation: 8595 usec
DMR received from 00:06:19:*:*:* Delay: 3990 usec Delay variation: 613 usec
DMR received from 00:06:19:*:*:* Delay: 11599 usec Delay variation: 7609 usec
```

--- Delay measurement statistics ---

Packets transmitted: 10, Valid packets received: 10  
Average delay: 6356 usec, Average delay variation: 4764 usec  
Best case delay: 3159 usec, Worst case delay: 15435 usec

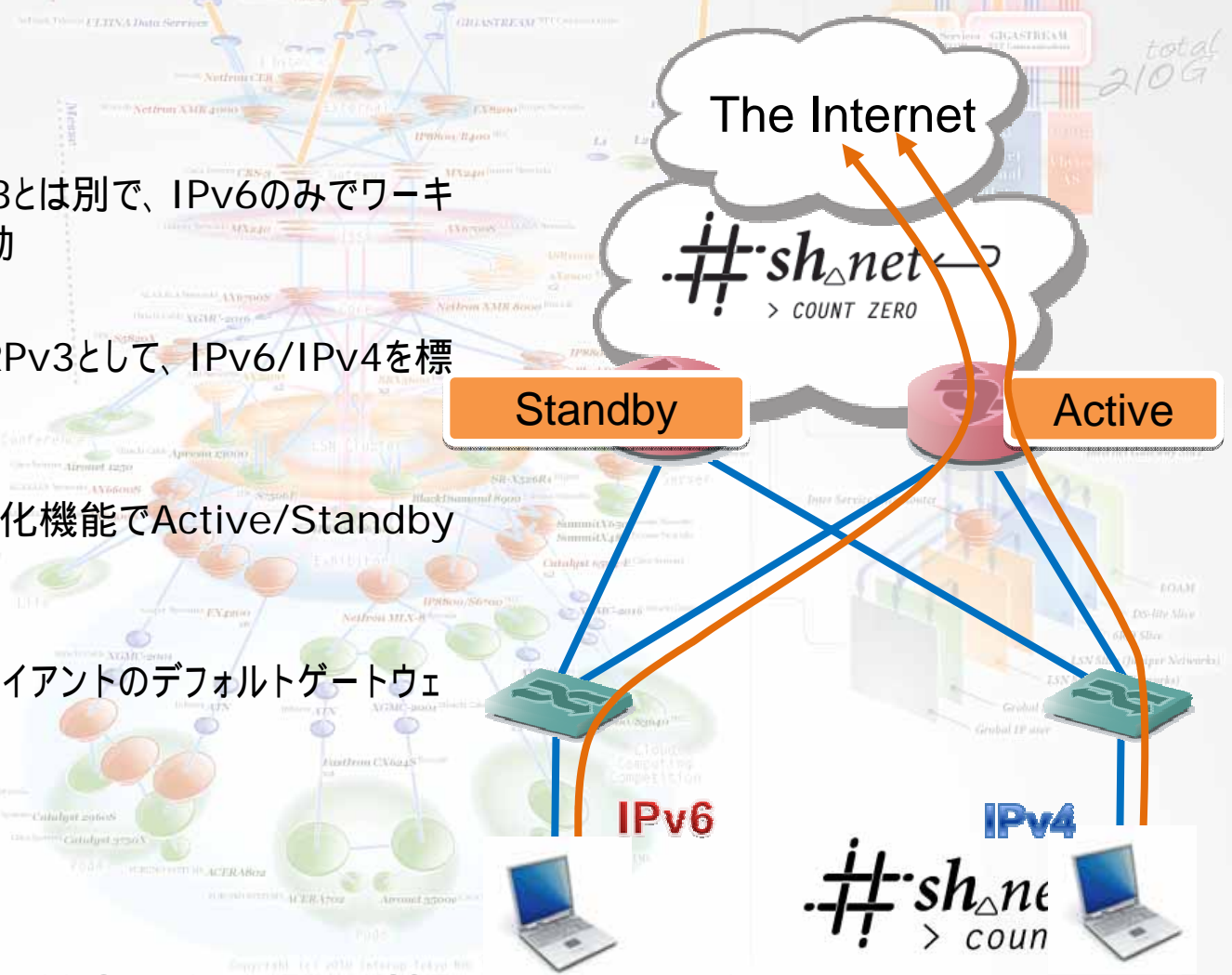


# IPv6移行に必要なルータ冗長化機能

## Virtual Router Redundancy Protocol (VRRP) Version 3 for IPv4 and IPv6

### ◆ 動向

- RFC5798で標準化
- 当初はIPv4のRFC3768とは別で、IPv6のみでワーキンググループで標準化活動
- ドラフトで、Unified VRRPv3として、IPv6/IPv4を標準化
- IPv6/IPv4のルータ冗長化機能でActive/Standbyで動作
- 通常時はActive側がクライアントのデフォルトゲートウェイとして仮想IPを提供

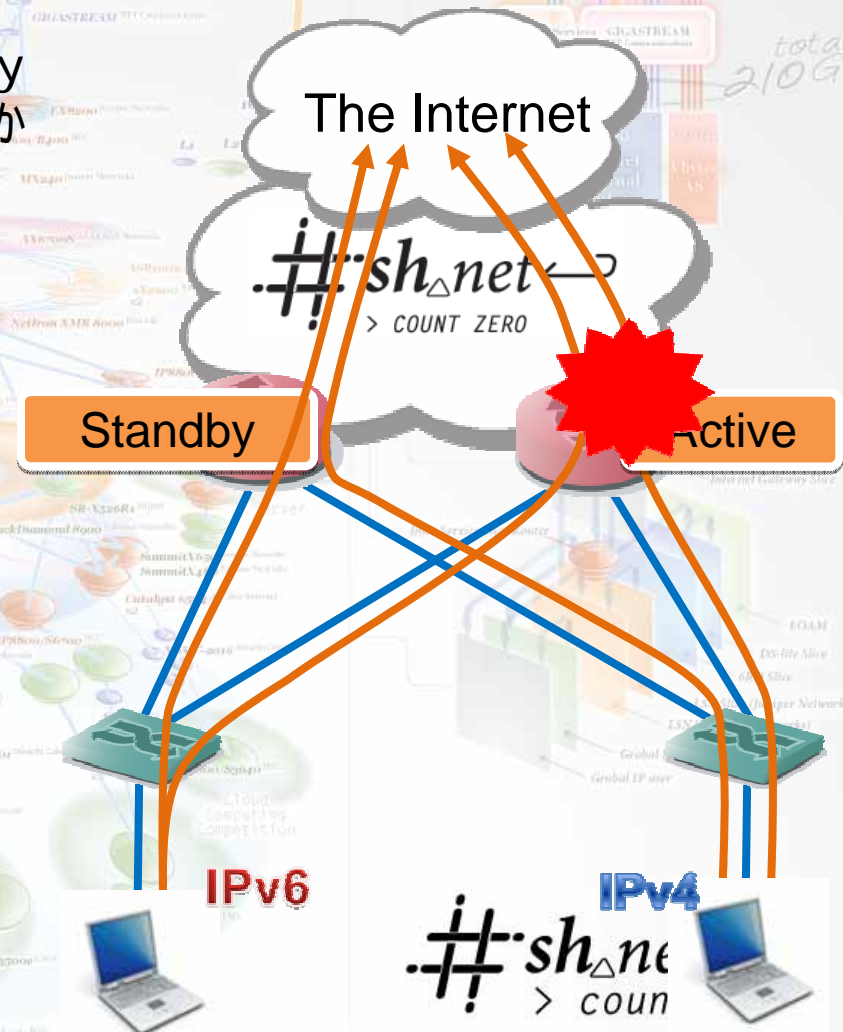


# IPv6移行に必要なルータ冗長化機能

## Virtual Router Redundancy Protocol (VRRP) Version 3 for IPv4 and IPv6

- ◆ ActiveのVRRPルータがDown、又はエッジからActiveへのパスがDownした場合は、StandbyのVRRPルータが仮想IPと仮想MACをActiveから引き継ぐ
- ◆ これによりクライアントに提供するルータを冗長化することが可能
- ◆ 今年のshownetでは、国内で初めてのクロスベンダーによるVRRPv3の相互接続試験を実施。
- ◆ 対応スタンダード
  - NEC : draft-ietf-vrrp-unified-spec-05
  - Brocade : draft-ietf-vrrp-unified-spec-07

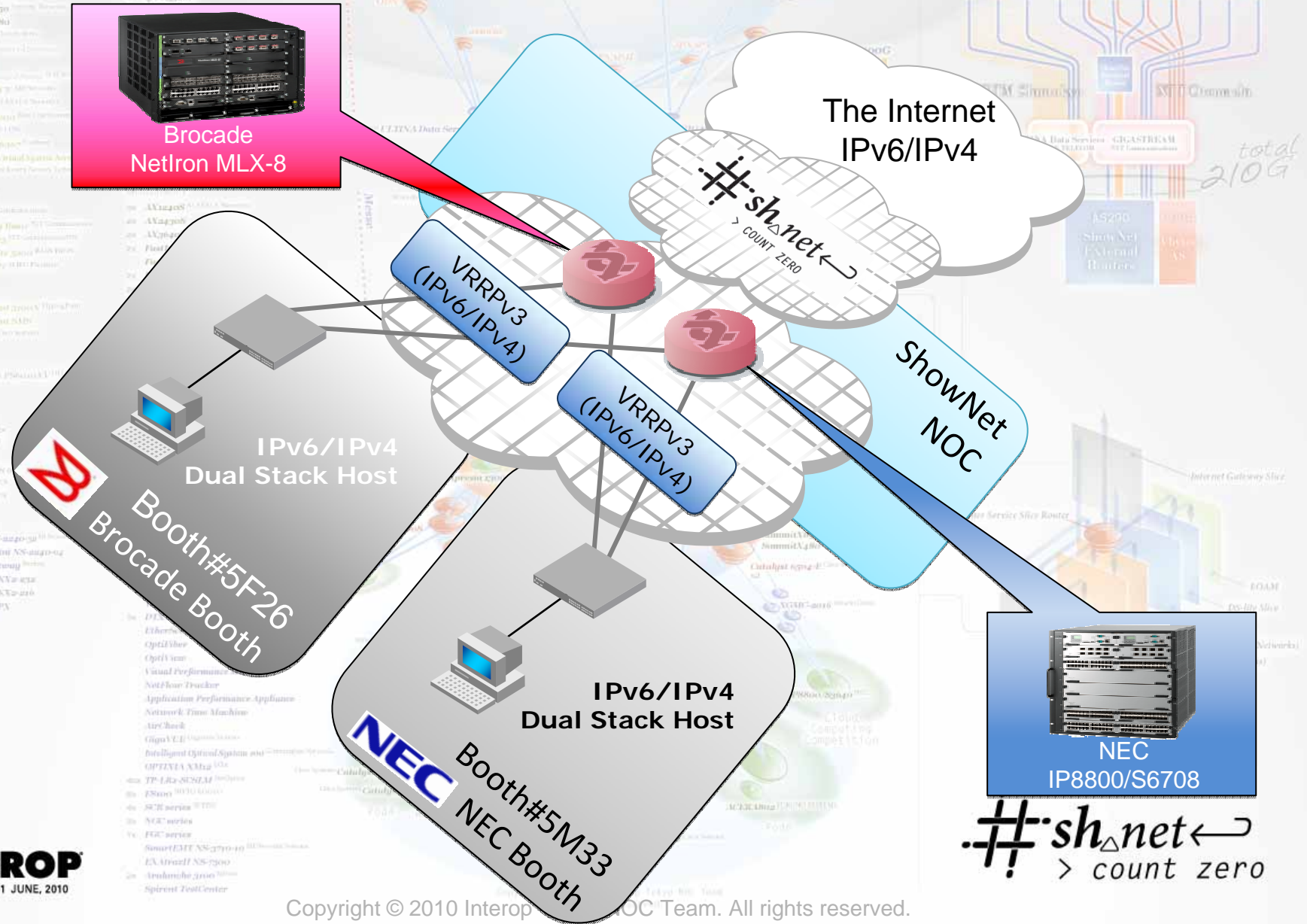
NECブースとブロードブースで  
ShowNetライブデモを実施中



# VRRPv3 ShowNet ライブデモ実施中



Brocade  
Netron MLX-8



NEC  
IP8800/S6708

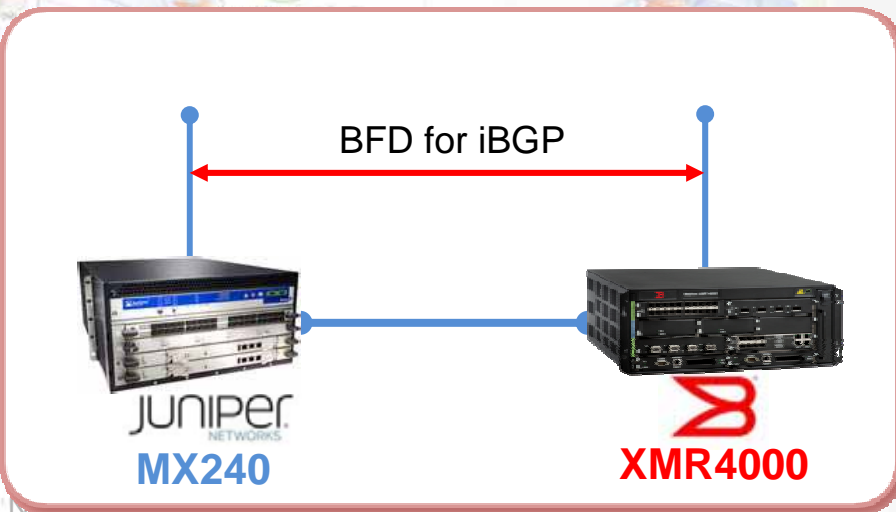
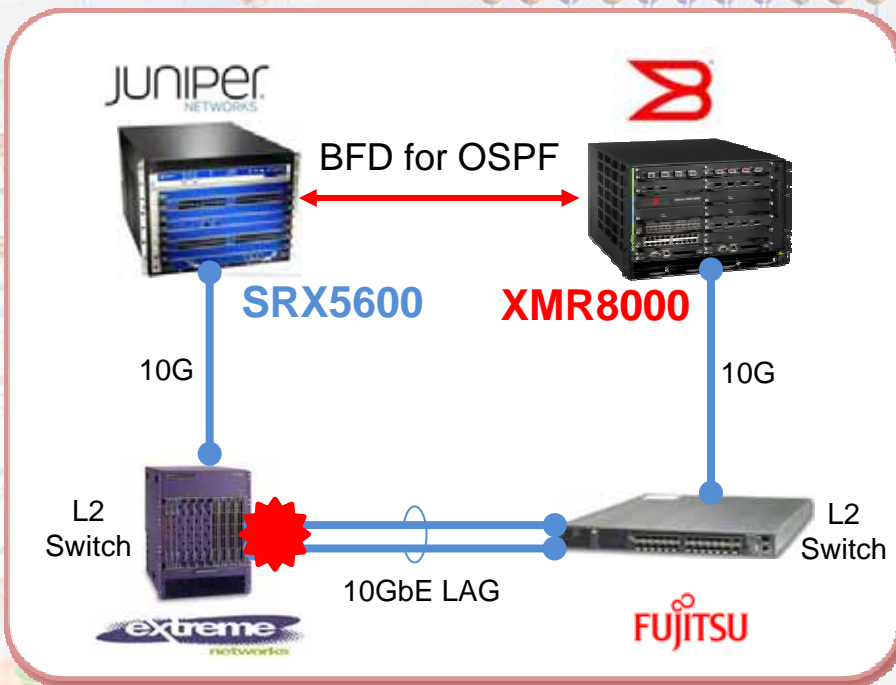
#sh.net > count zero





# BFD相互接続実験

- ◆ BFD相互接続実験
- ◆ 検証機器(OSPFv2, v3)
  - Juniper SRX5600
  - Brocade XMR8000
- ◆ 利用プロトコル
  - OSPF Version2
  - OSPF Version3
- ◆ 設定内容
  - Interval : 100msec
  - HoldDown : 300msec
- ◆ L2スイッチ間を切断した時のダウン時間
  - 320msec
- ◆ BGP4プロトコルでもBFDの相互接続を実施

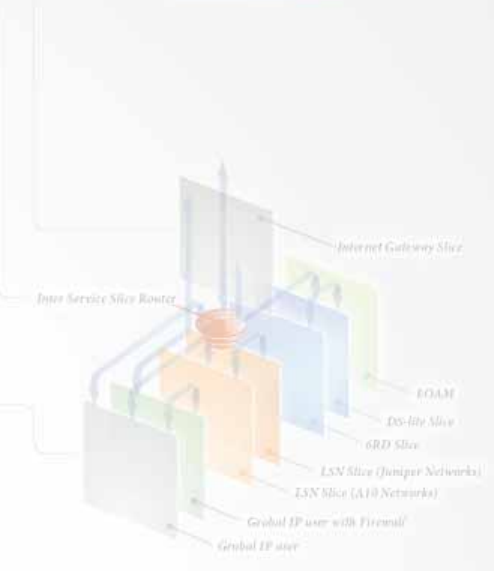
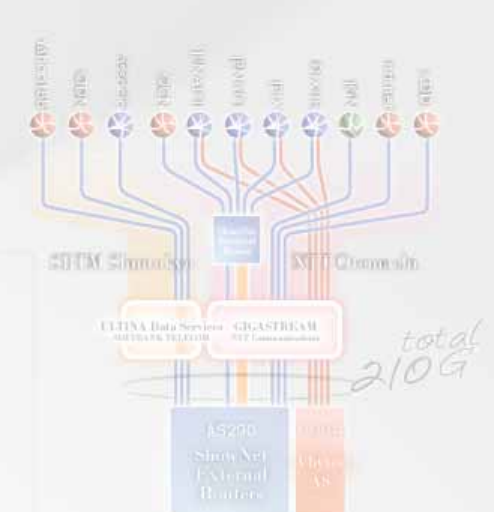


# ShowNet2010 4バイトASへの取り組み

Service  
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SAP  
SAP

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- 02. TurboIron 24X
- 03. Nexus 2248T
- 04. PowerConnect 111
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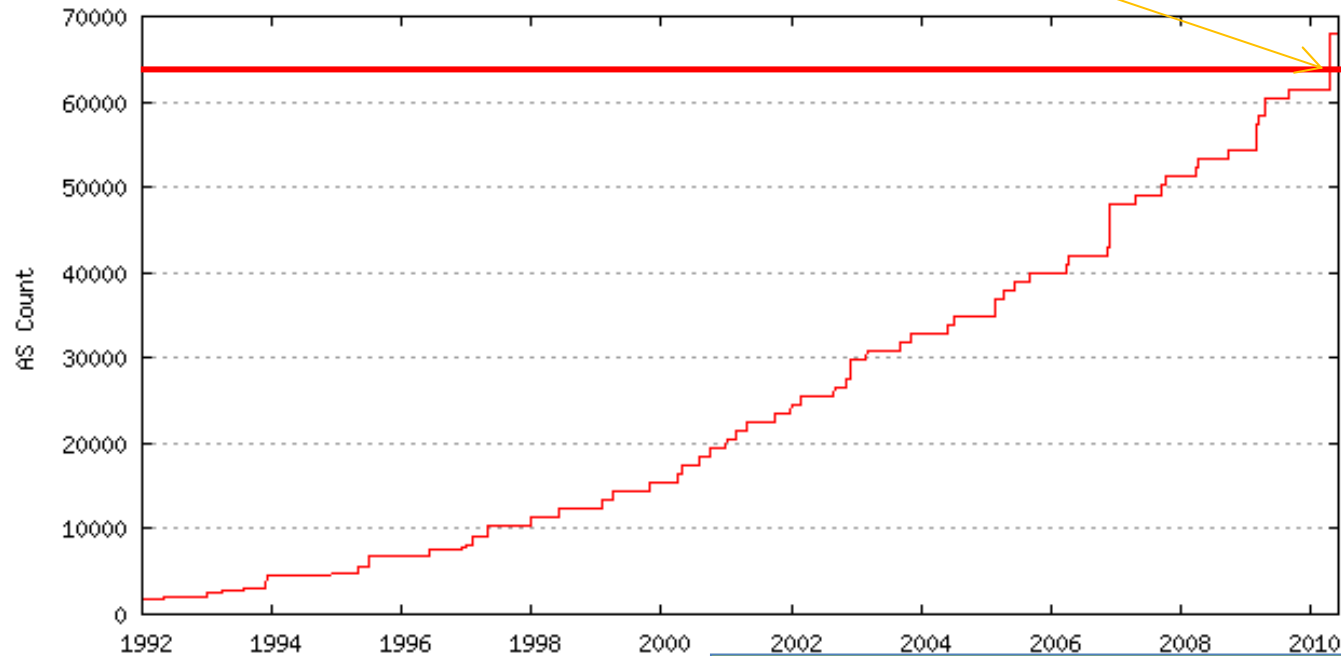
#sh<sub>Δ</sub>net ← ↷  
> count zero



# AS番号も枯渇しそう

枯渇が近い

Time Series of IANA AS Allocations



<http://www.potaroo.net>より引用

IANA Allocations

**INTEROP**  
TOKYO | 7-11 JUNE, 2010

sh<sub>△</sub>net ←  
> count zero

# 4バイトAS

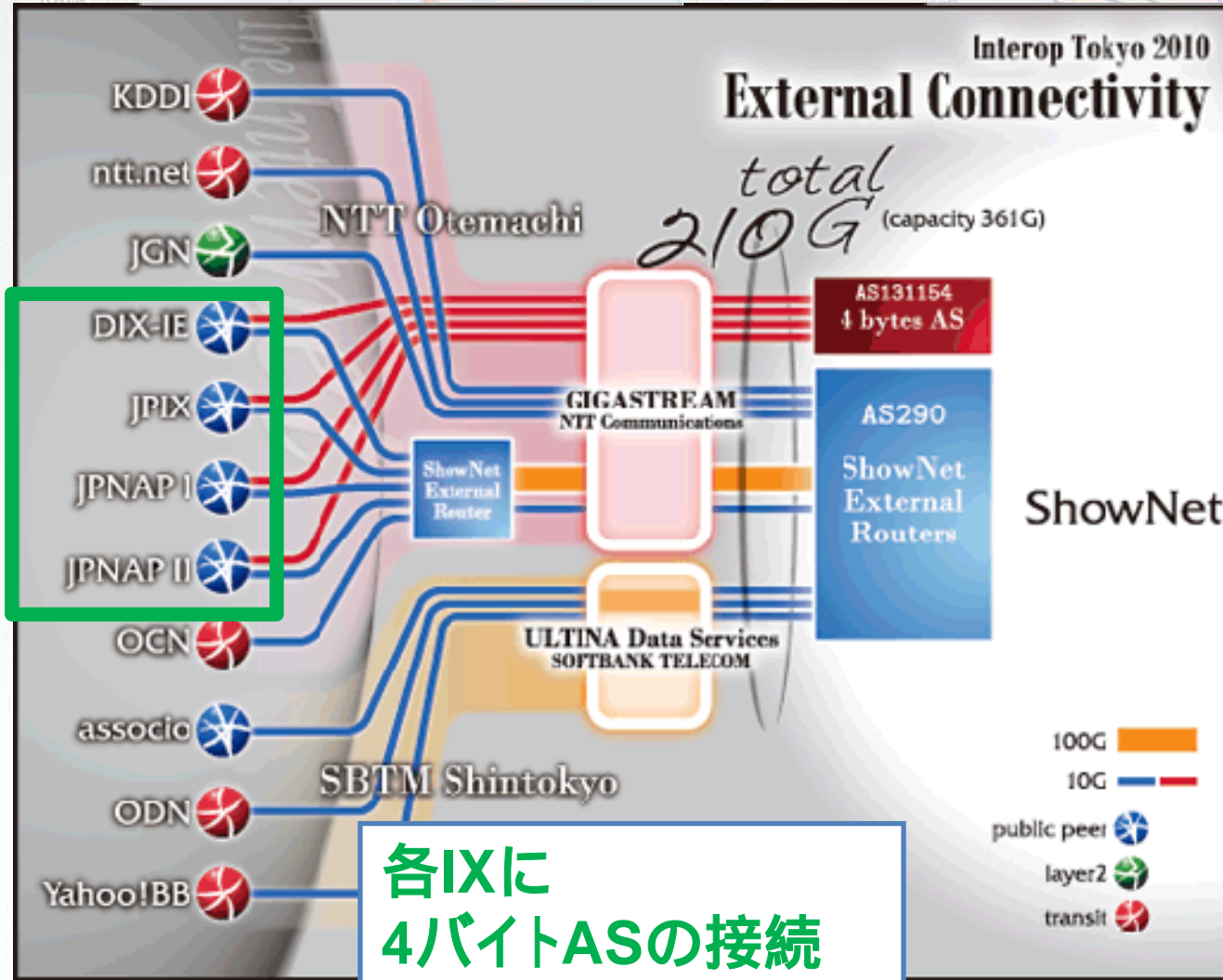
- AS番号

- 組織、企業といった、同じ運用ポリシーによって管理されたNWの集合単位
- BGPによる経路制御がされている

- 4バイトAS

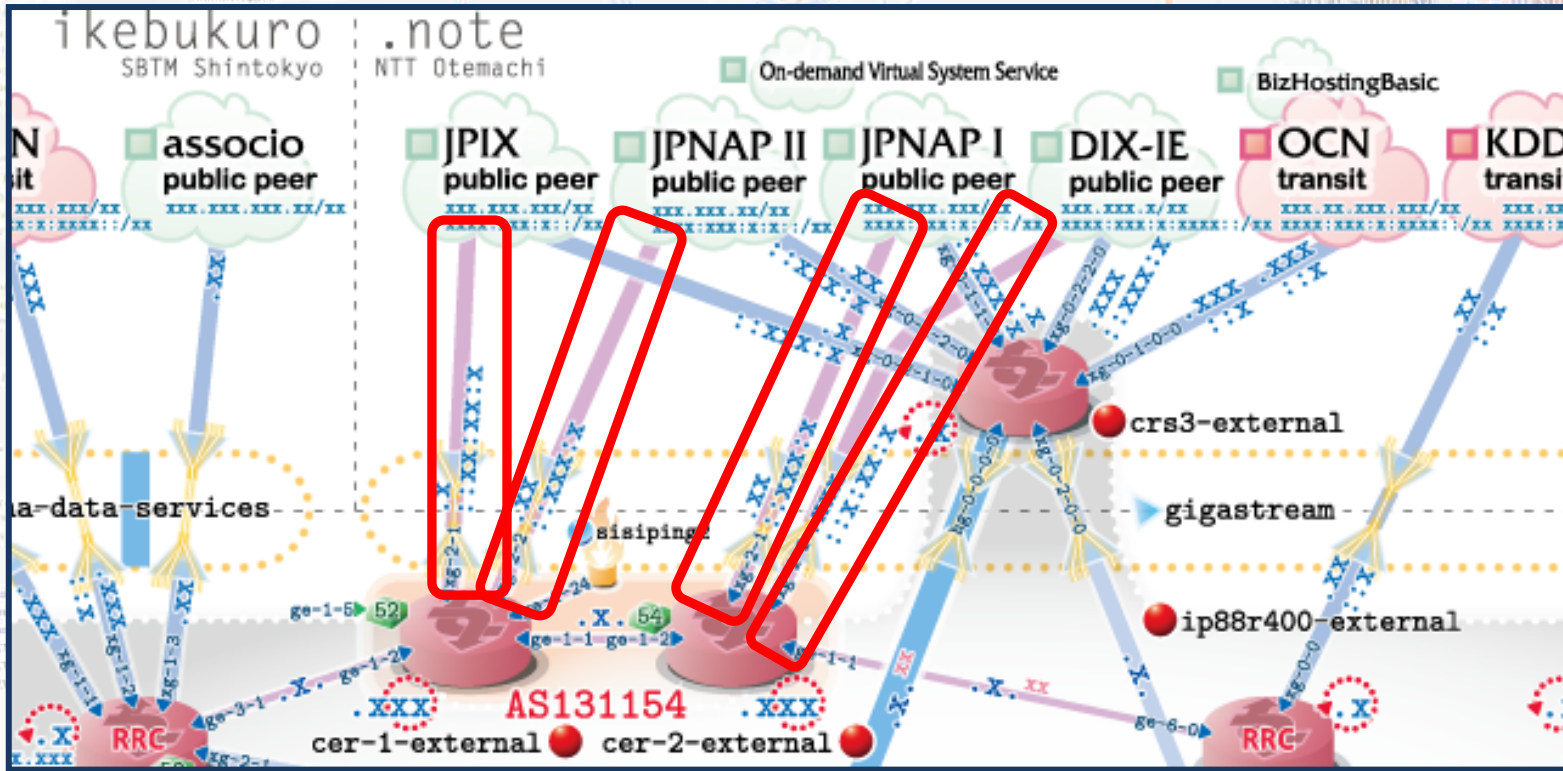
- AS番号の需要増加に伴い枯渇が予想され、4バイト (約43億個)まで拡張された

# 4バイトASでの接続



# 4バイトASでの接続

- 各IXと、OCNと接続



プロケード社のCERが4byteASを担当

4バイトAS対応ルータ

#sh<sub>Δ</sub>net ←  
> count zero

# 4バイトASでの接続状況

- JPNAP、JPIX、Dix-ieにおいて4バイトASと接続している事業者 (6/9 AM2:00現在)

- 21 peer

事業者にとっては  
4バイトASとの接続はまだまだ不慣れ  
機器の動作の確認や、運用課題の洗い出しへ





