



RCTS

Novidades Tecnológicas da Rede Académia Portuguesa

Platina

reallife CROWDSTRIKE aruba a Hewlett Packard Enterprise company SECURNET LOGICALIS Clarivate™ Westcon

SPARKLE Microsoft aws rackspace technology SYSCRUM PAESSLER THE MONITORING EXPERTS EBSCO

warpcm cisco Yelco FORTINET paloalto ELIXIR Extreme networks

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Apoios

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AGENDA



Serviços RCTS Fibra e Lambda

- Emanuel Massano

Serviços RCTS IP e Plus

- Sérgio Gonçalves

Ligações Externas

- Sérgio Gonçalves

Gigapix e CDN

- Clayton Costa

Noc – Network Operations Center

- Joel Ferreira

Share FCCN

- Gonçalo Lopes

Automatismos Operacionais

- Edgar Inácio

RCTS100 – Rede DWDM

- Tiago Antunes

RCTS100 - Backbone e Acesso IP

- Pedro Lorga

Inside Job – Part II

- João Silva



Serviços RCTS Fibra e Lambda

Emanuel Massano

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VEJA
Ascozes

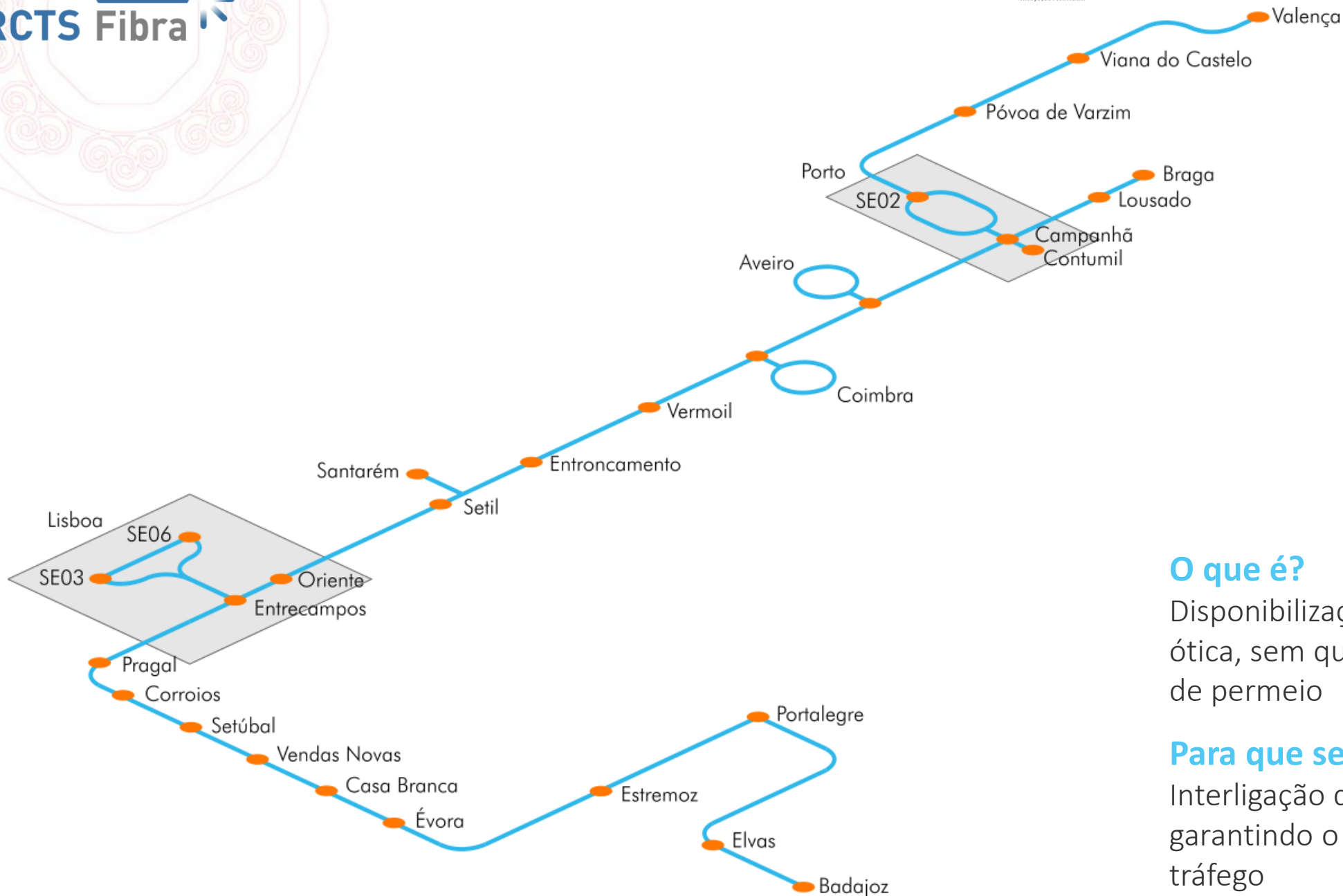
CTD

Dobalo
3kg/10kg
5kg/10kg
Reservado!

Pescada
Realceus
Realceus
Reservado!

Cabo Verde
Pescada
Reservado!





O que é?

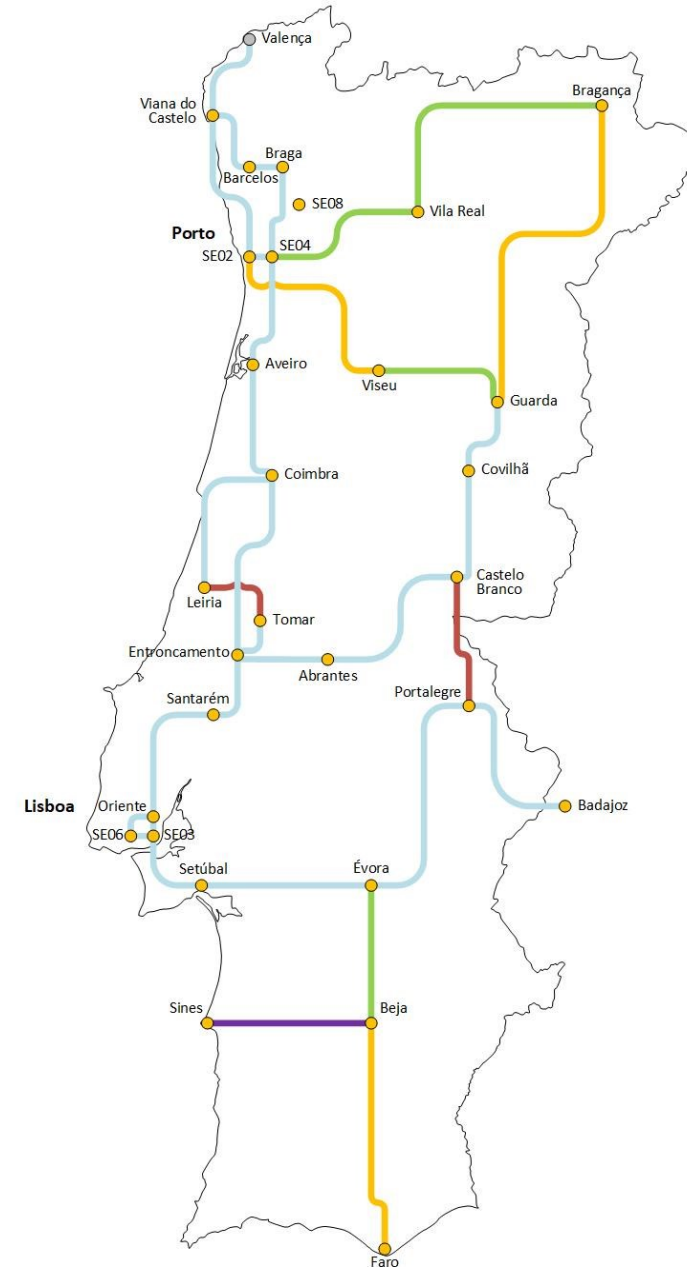
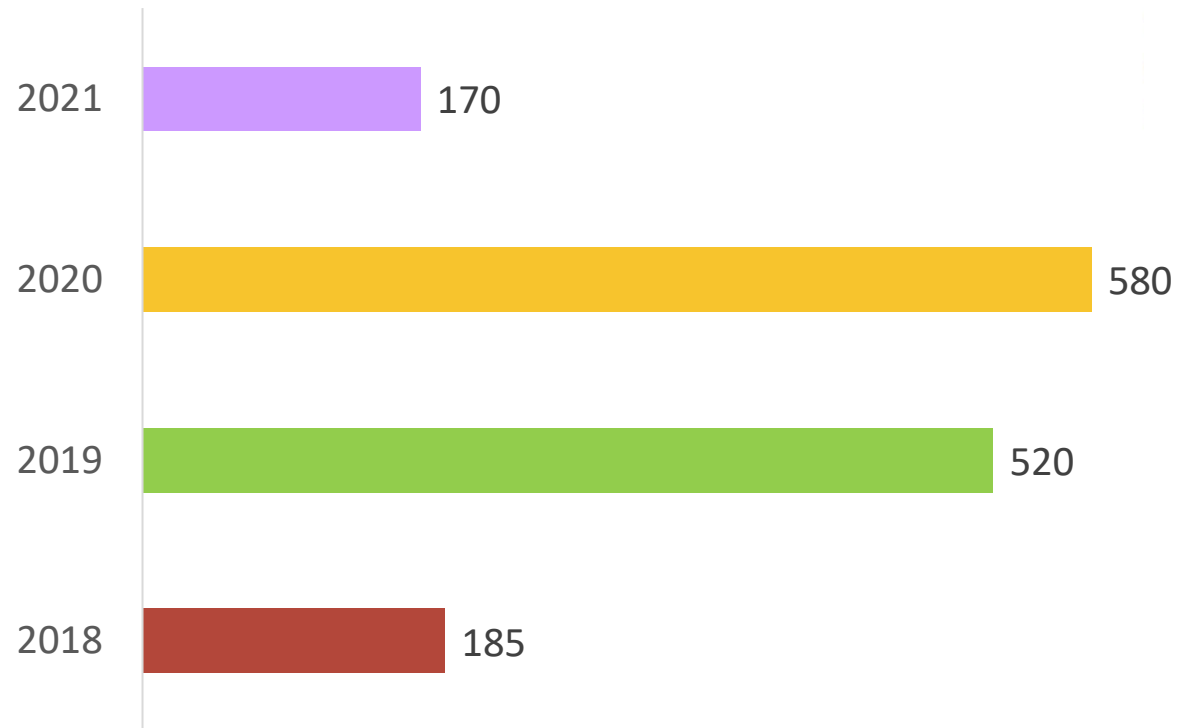
Disponibilização de um par de fibra ótica, sem qualquer equipamento ativo de permeio

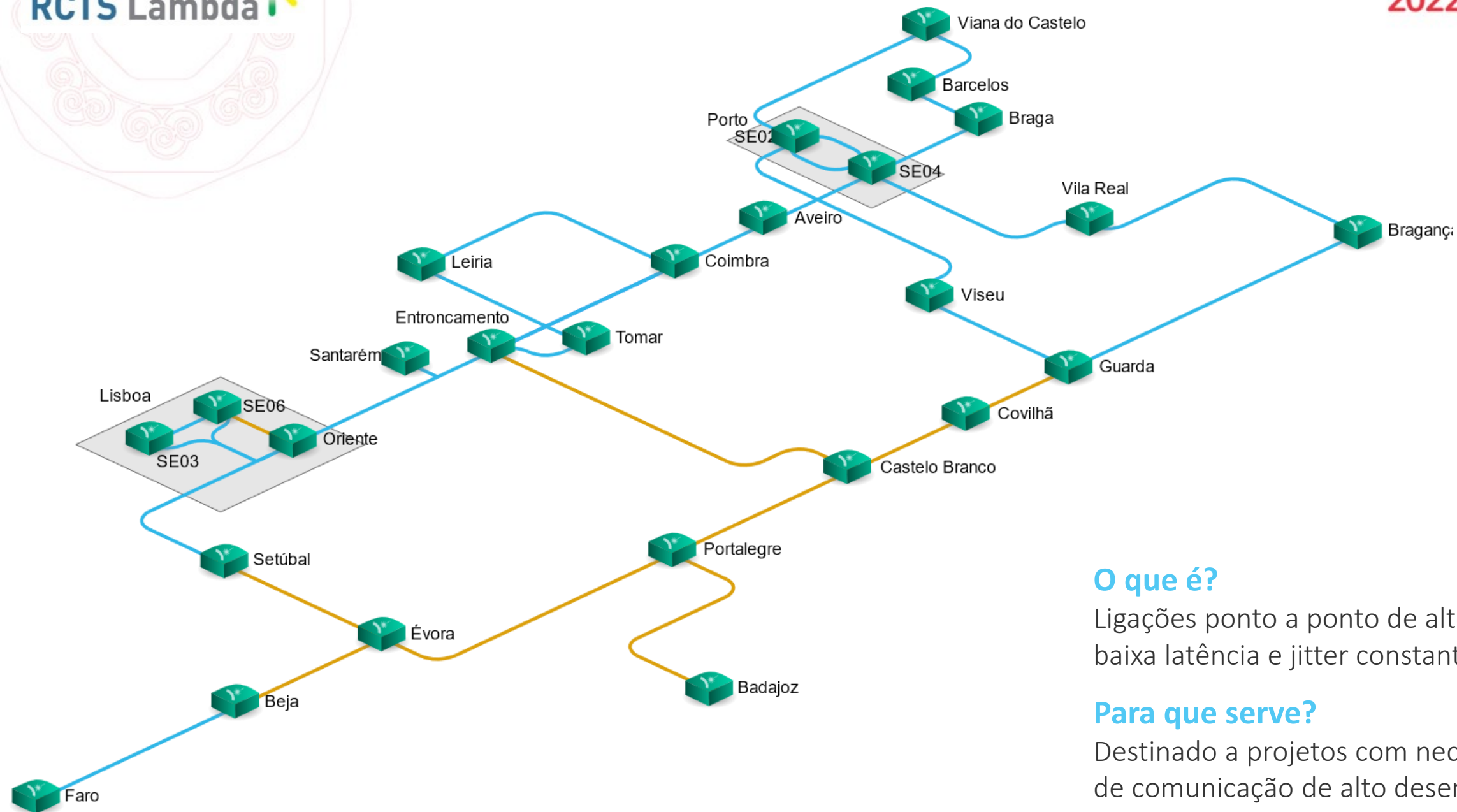
Para que serve?

Interligação de diferentes localizações, garantindo o isolamento total do tráfego

Fibra

Fibra por ano de aquisição (km)



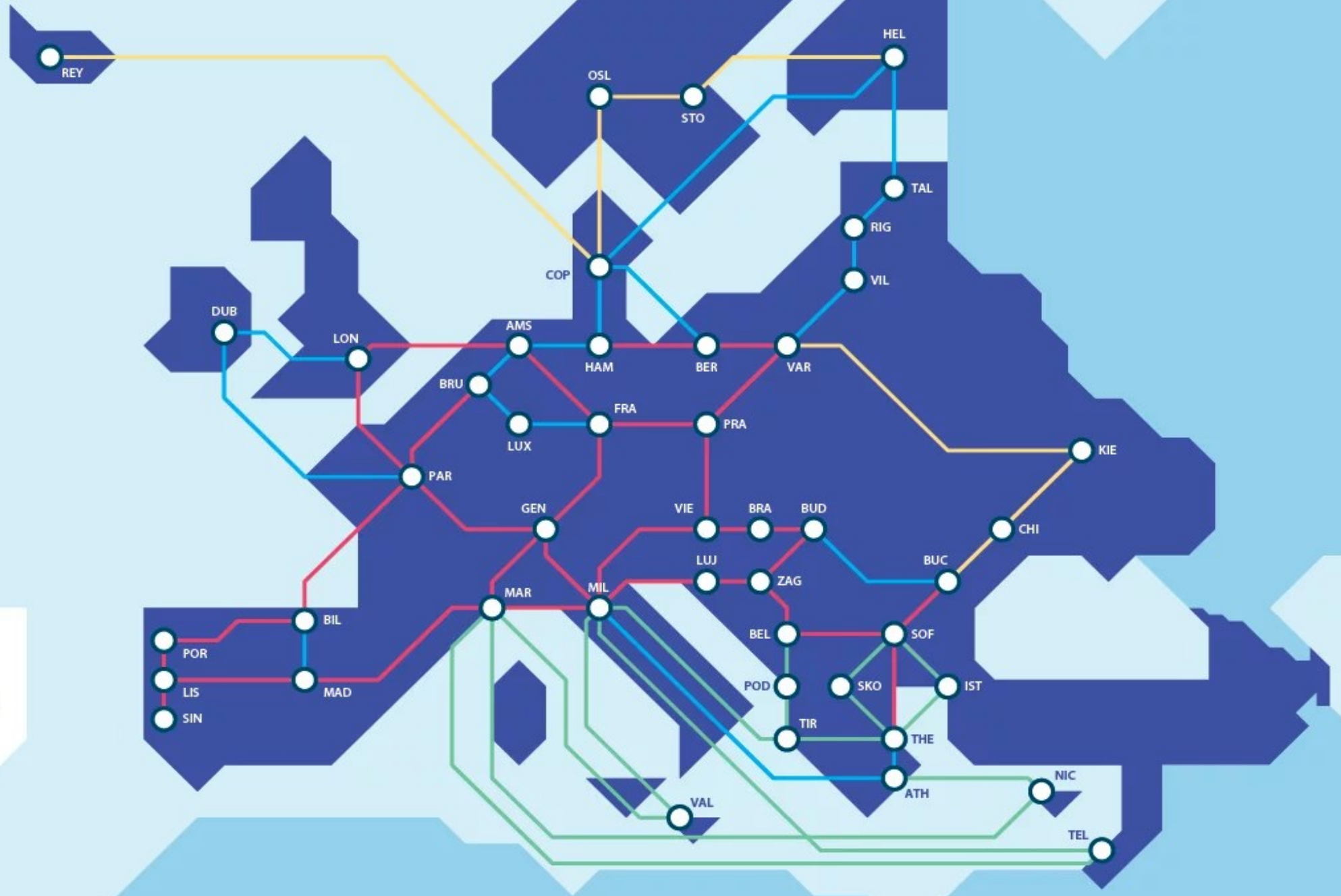


O que é?

Ligações ponto a ponto de alto débito, baixa latência e jitter constante.

Para que serve?

Destinado a projetos com necessidades de comunicação de alto desempenho.



- Fibre
- Spectrum
- Connected Regional Network
- Leased Capacity



Serviços RCTS IP e PLUS

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warpcorn, cisco, Yelco, FORTINET, paloalto, ELSEVIER, Extreme networks

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RCTS IP



O que é?

Serviço de comunicação de dados que liga as entidades de ensino e ciência à Internet global.

86

Entidades utilizadoras

8

Upgrades de ligações

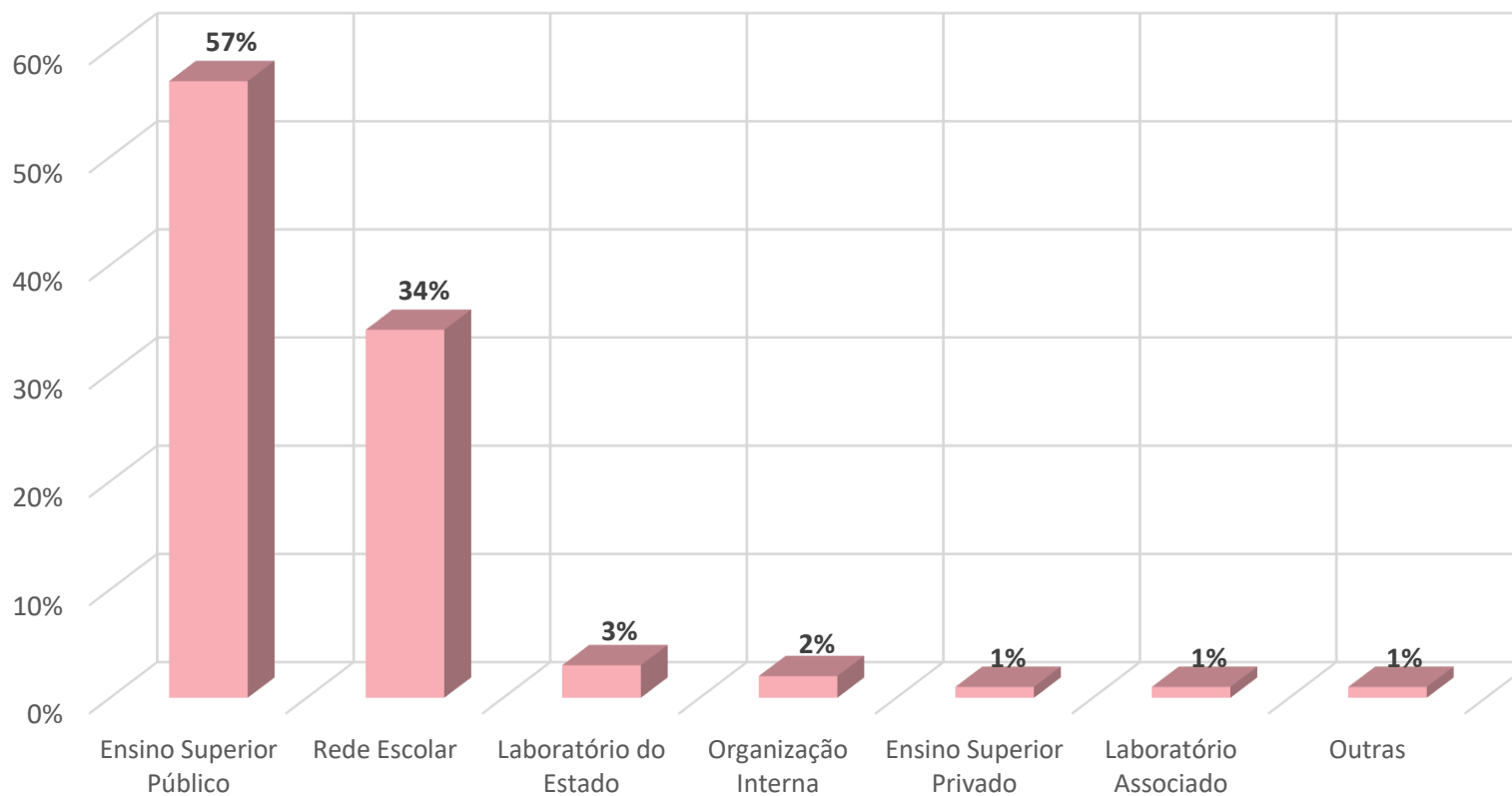
2

Novos serviços ativados

RCTS IP



Tráfego IP - Distribuição





RCTS Plus



O que é?

Assegura a criação de VPNs ethernet para troca de elevados fluxos de informação.

40

Instâncias do serviço

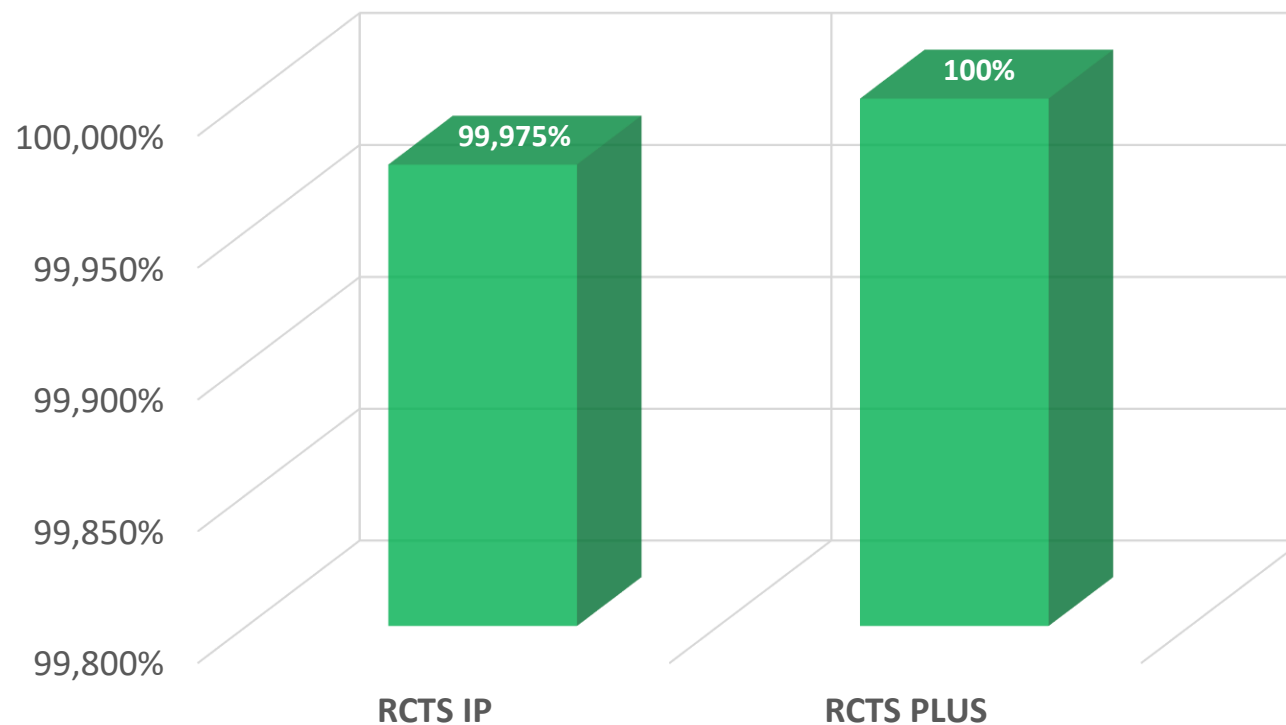
5

Novas ativações

Disponibilidade



Disponibilidade dos serviços RCTS IP e PLUS





Serviços - Capacidade



556 Gbps
Capacidade

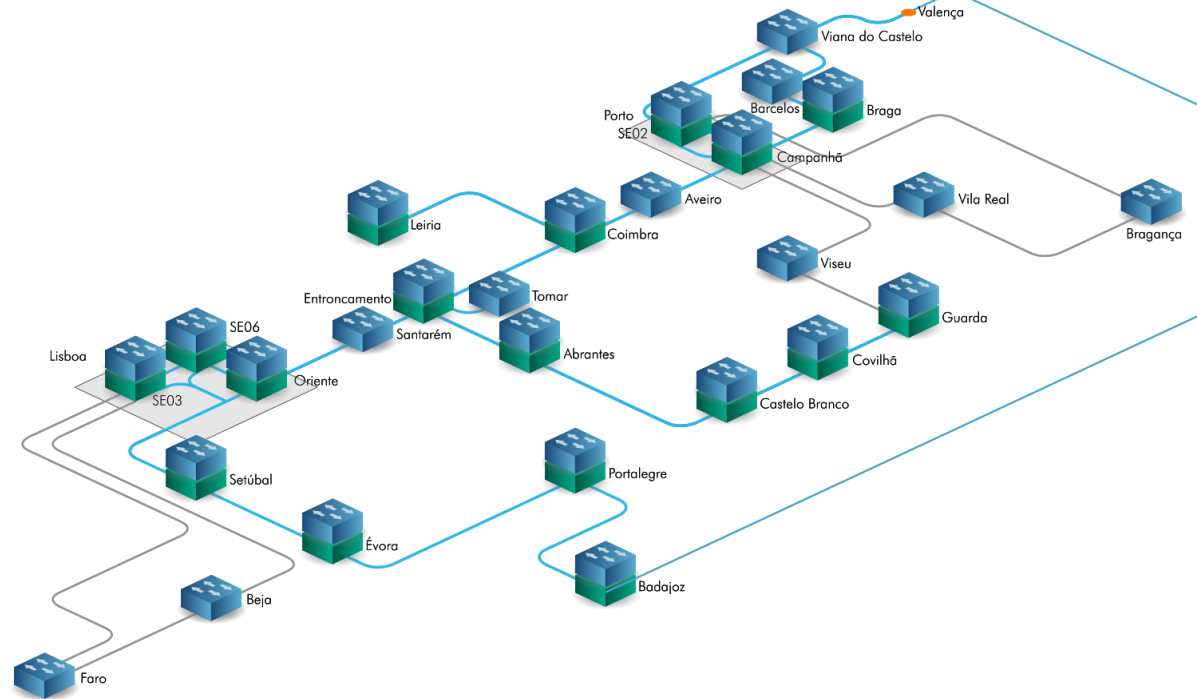
28,7%

Aumento de Capacidade em 2021

657 Gbps

18,2%

Aumento de Capacidade até abril 2022



222 Gbps
Capacidade

6,7%

Aumento de Capacidade em 2021

222 Gbps

Sem aumento de Capacidade até abril de 2022



Ligações Externas

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warpcorn, cisco, Yelco, FORTINET, paloalto, ELSEVIER, Extreme networks

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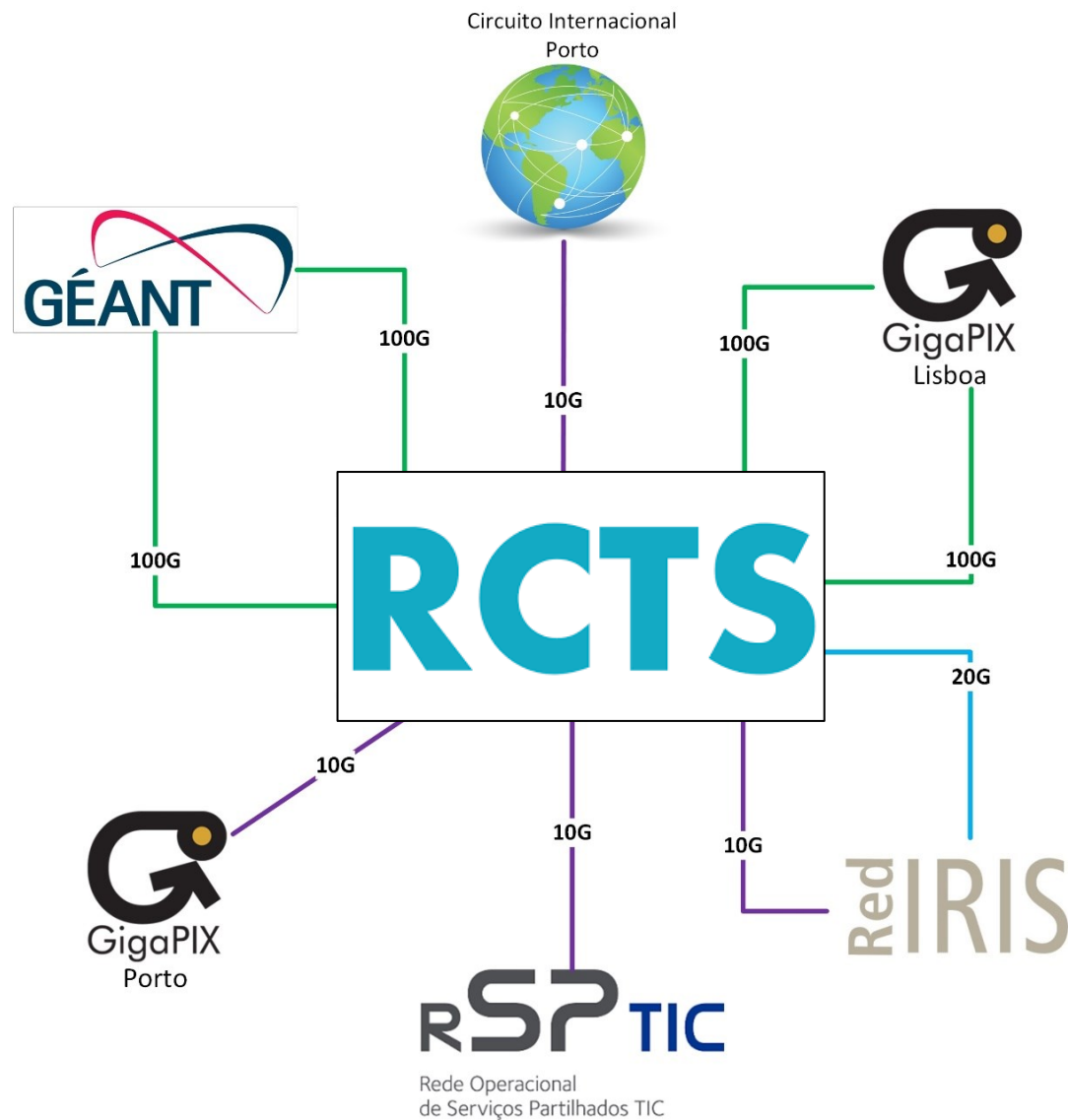
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Ligações Externas





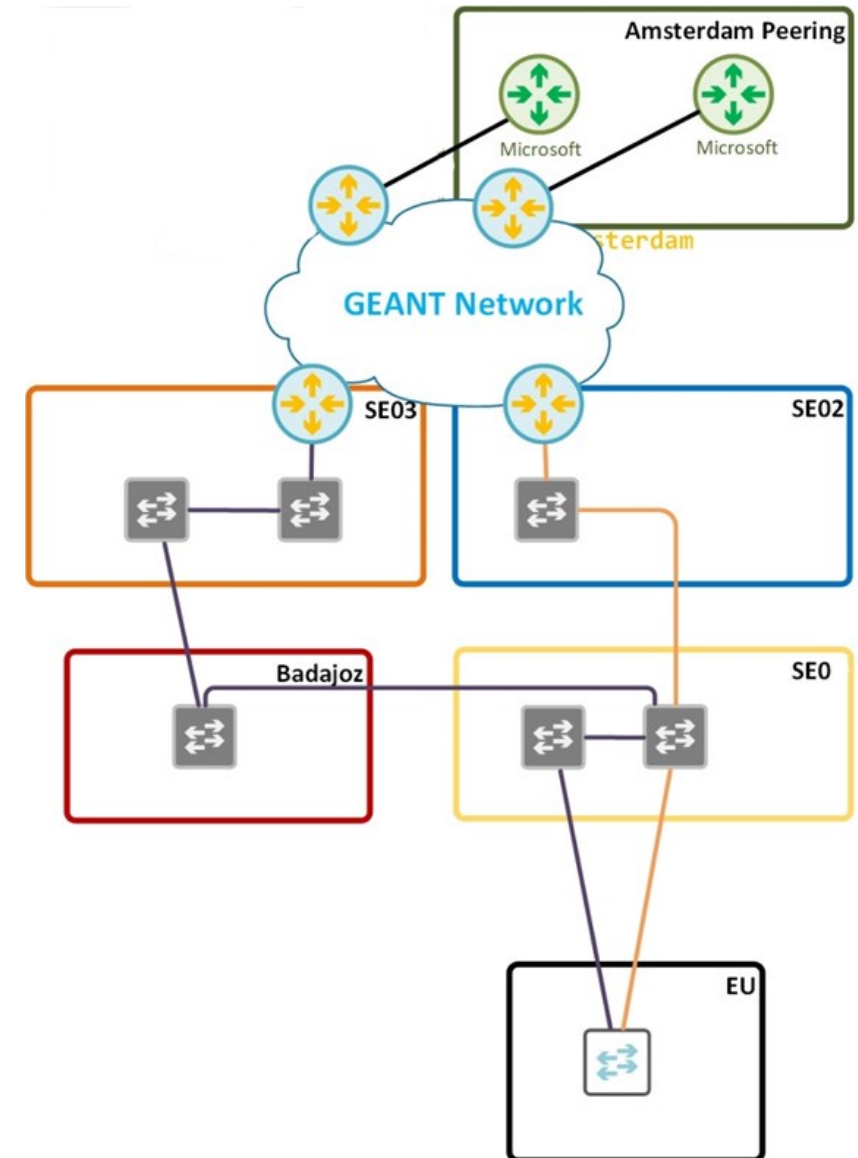
Ligações Externas – Disponibilidade 2021

✓ 100%	GÉANT
✓ 100%	REDIRIS
✓ 100%	GIGAPIX
✓ 100%	RSPTIC



Ligações Externas - Serviços

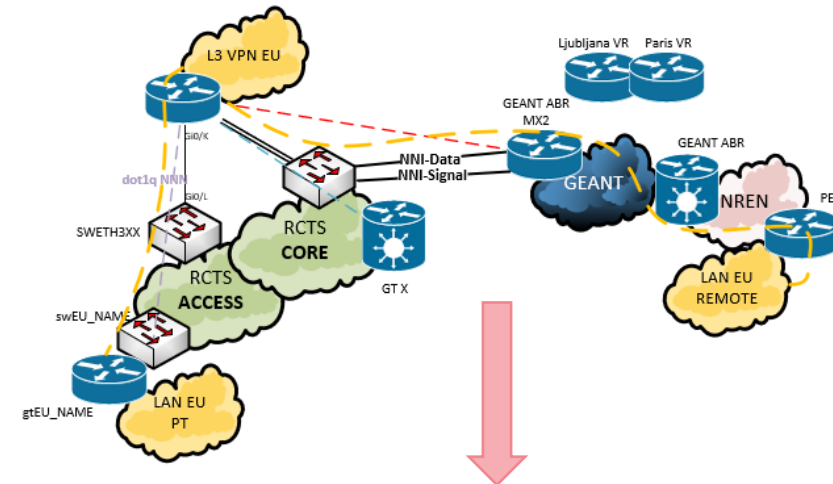
- Express Route
 - Semelhante ao RCTS Plus
 - EU com ligação dedicada à Azure
 - Qualidade de serviço melhorada
 - Maior capacidade e segurança



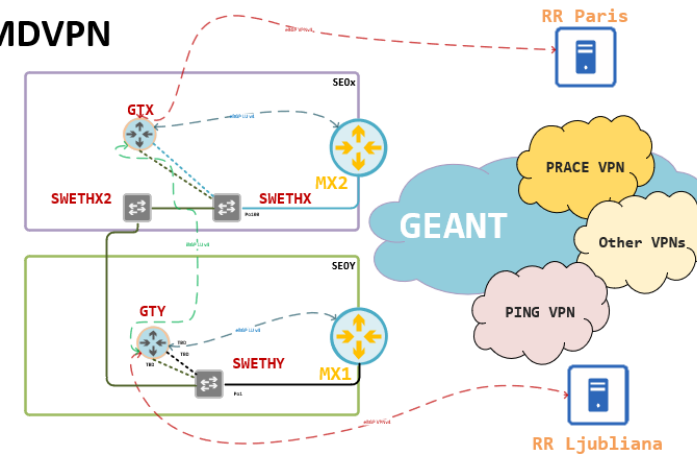


Ligações Externas - Serviços

- MD-VPN
 - Multi-Domain Virtual Private Network (MD-VPN)
 - Permite colaboração de cientistas na Europa numa rede privada comum
 - Liga clusters, grids, cloud e centros HPC (High-Performance Computing)
 - Permite entrega rápida de VPNs até aos utilizadores finais para projetos de investigação



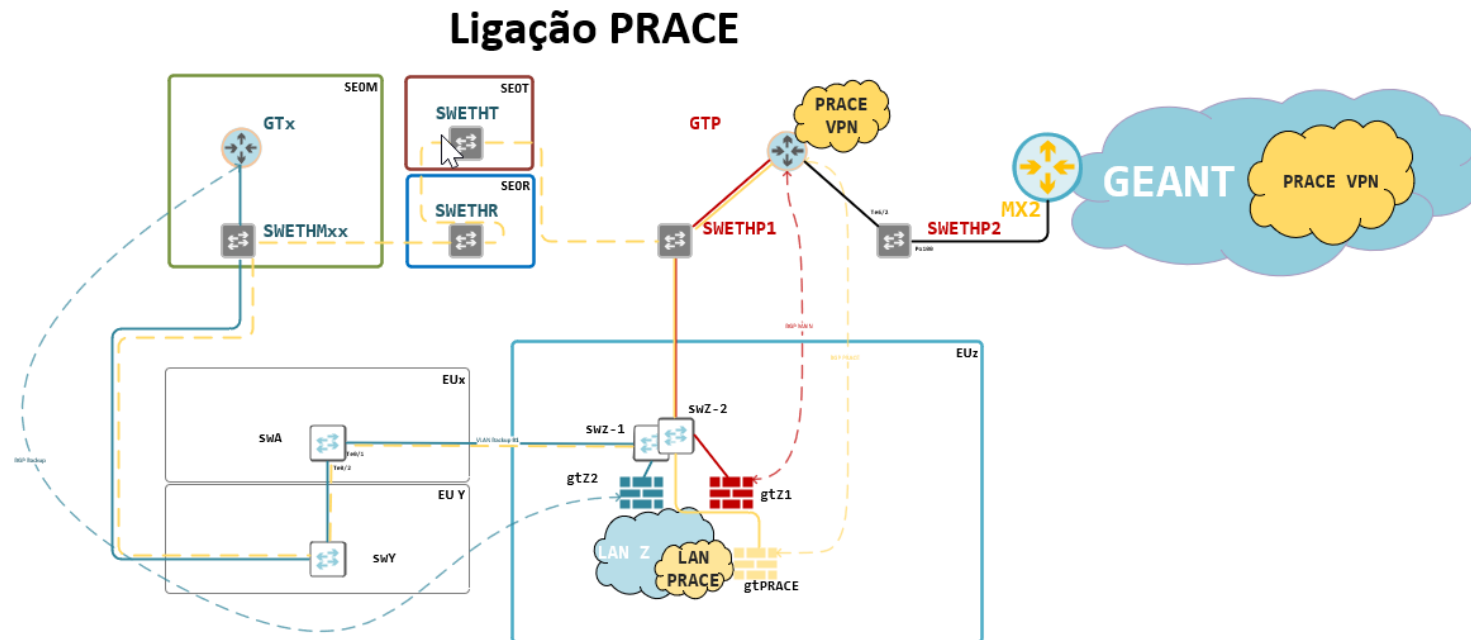
Ligação MDVPN





Ligações Externas - Serviços

- MD-VPN
 - PRACE – Infraestrutura de Supercomputação Europeia





GigaPIX e CDNs

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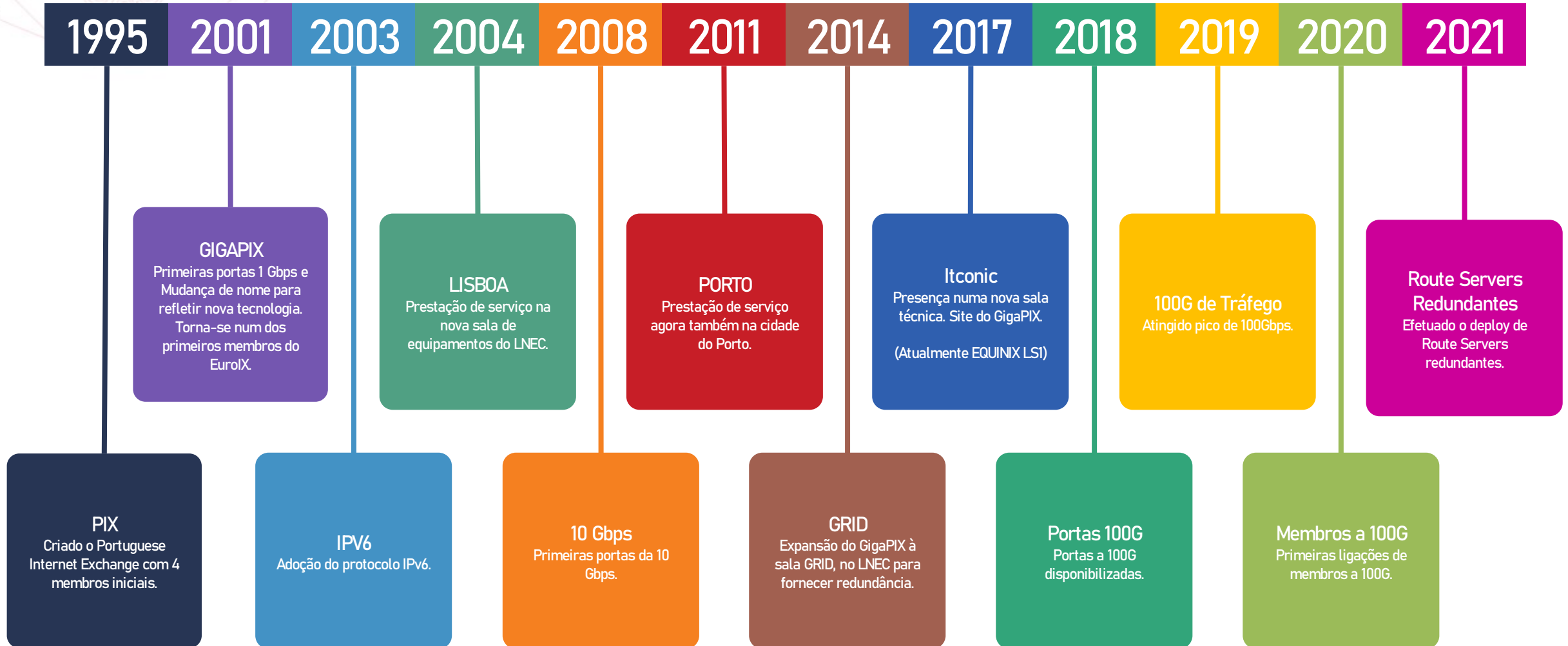
GIGAPIX

- Desde 1995 a melhorar a internet em Portugal
- Membro fundador do EuroIX
- Ponto de Troca de Tráfego português
 - Neutro e sem fins lucrativos
 - Objetivo de melhorar a qualidade da interligação das redes IP em Portugal
- Troca de tráfego entre varias organizações
- Realizada com recurso ao protocolo BGP

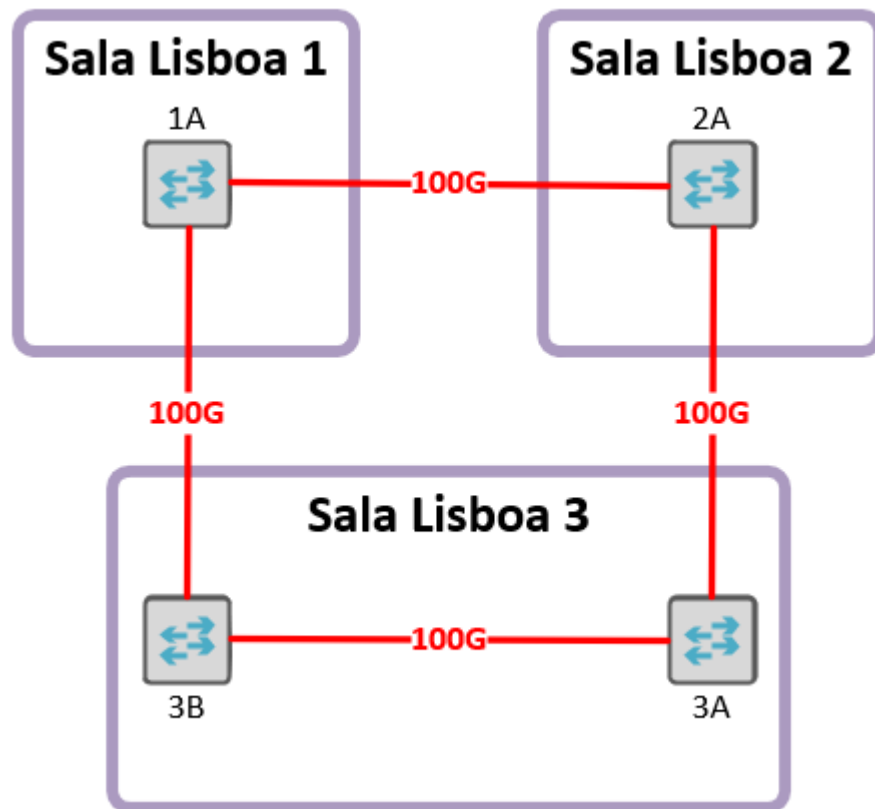




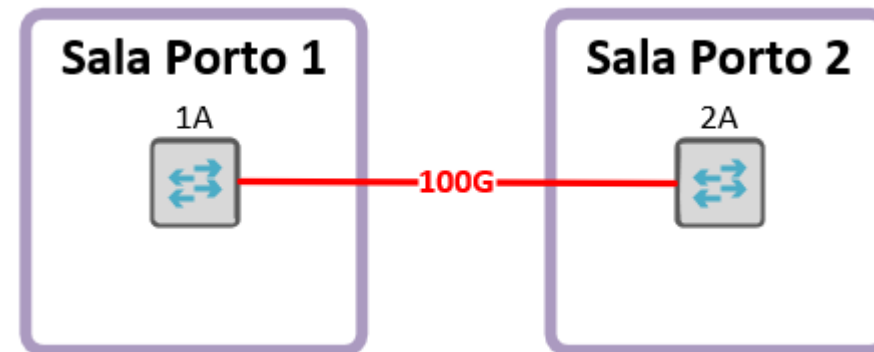
GIGAPIX - História



GIGAPIX – Futuro



Anel a 100G Lisboa em 2022



Melhorias para o Porto



GIGAPIX EM NÚMEROS

4

CENTROS DE DADOS

- 3 x Lisboa
- 1 x Porto

0

€ POR PORTA

Preço de ligações até 4x10G

49

MEMBROS

Incluindo ISPs de vários continentes, CDNs e serviços de cloud

1/3

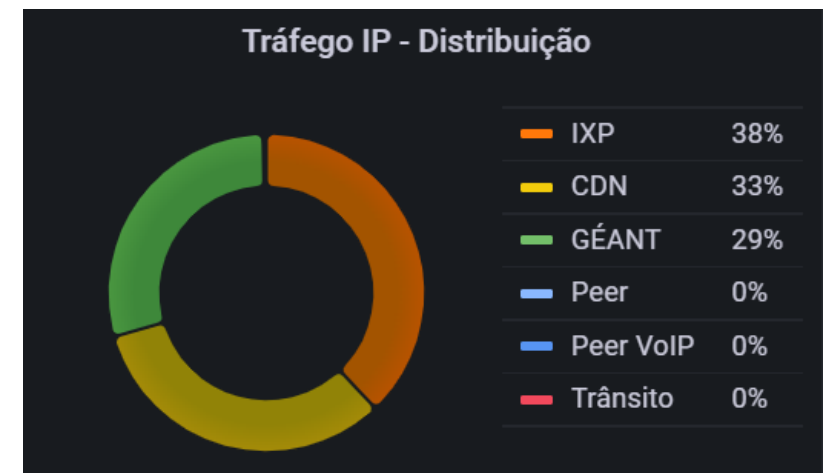
Tráfego RCTS

De todo tráfego RCTS é via GigaPix

125

Gb/s de Tráfego

Média dos valores diários mais altos até o momento em 2022





GIGAPIX – MEMBROS





Content Delivery Network (CDN)

1/3

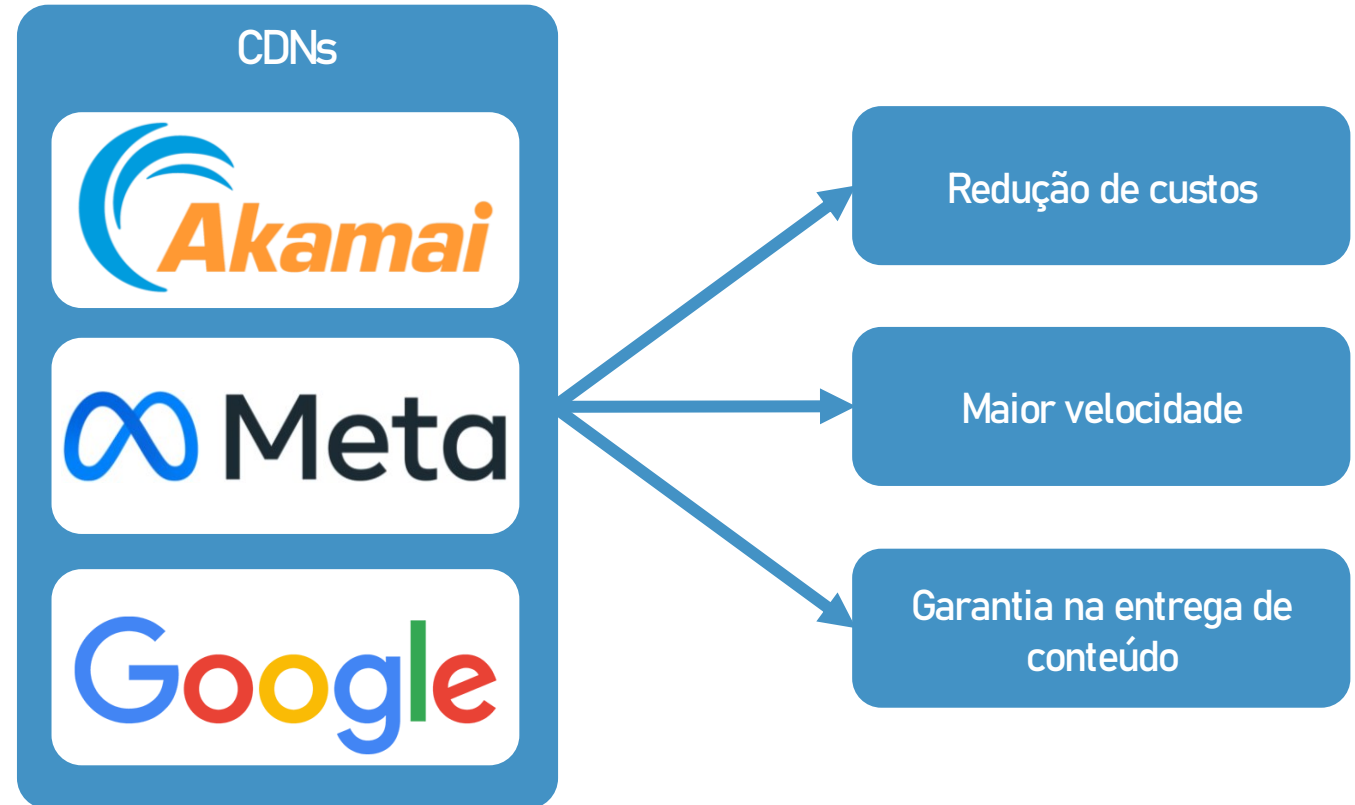
Tráfego RCTS

De todo tráfego RCTS é via CDN

Tráfego IP - Distribuição



IXP	38%
CDN	33%
GÉANT	29%
Peer	0%
Peer VoIP	0%
Trânsito	0%





NOC FCCN

Network Operations Center
Centro de Operações de rede

Joel Ferreira

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Equipa NOC FCCN

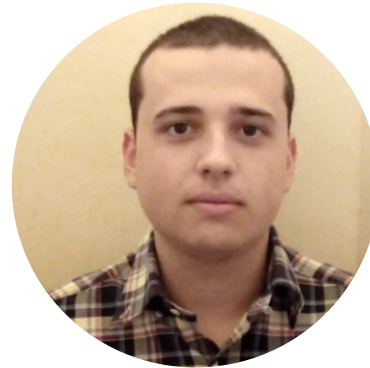
Emanuel Massano
Gestor de Equipa



André Alves



Guilherme Xavier João Conceição



Joel Ferreira



Supervisão Noturna



Sistema Monitorização do NOC

Vários netop.fccn.pt

Network Support System

The dashboard displays a grid of network components, each represented by a cube icon with a status indicator (checkmark, question mark, or exclamation mark). The components are grouped into four categories:

- VIP MAESTRO:** MAESTRO21, MAESTRO31, MAESTRO61, CONFIG31, ORION.
- VIP PORTAL:** PORTAL31, PORTAL61, PORTAL62.
- Consola:** BUTES, CLORIS, PATO, POCOYO, SUPERVISAO24.
- Xtra:** CHAVEIRO, NETNS, TRANSPORT-AUX, ALIEN1, ALIEN2.

FCCN NOC

Tecnologia para o Conhecimento

Sex, Mai 27, 2022 17:53

0

Incidentes Registados

18

Incidentes em Tratamento

- Pendente - FCCN (6)
- Pendente - Entidade Utilizadora (3)
- Pendente - Fornecedor (9)

8

Pedidos de Serviço em Tratamento

- Pendente - FCCN (1)
- Pendente - Entidade Utilizadora (3)
- Pendente - Fornecedor (4)
- Registado (0)

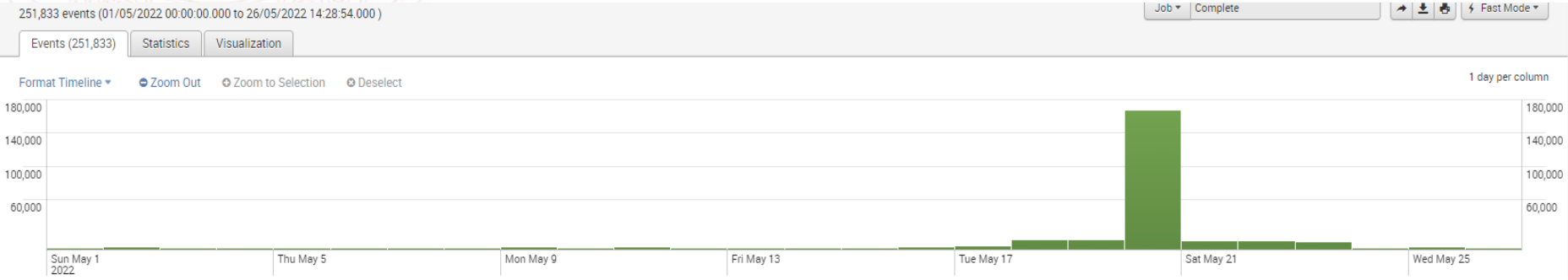
0

Pedidos de Serviço em Triagem

Host Problems	Service Problems	Business Processes
<p>DOWN 5h24m gtani-prt-backup ✓</p> <p>DOWN 6h30m gtani-prt ✓ ●</p> <p>DOWN 07-02-2022 es-api1 ✓</p> <p>DOWN 13-11-2021 gtipcb-backup ✓ ●</p> <p>DOWN 09-02-2021 confluence ✓ ●</p> <p>DOWN 01-01-1970 gtani-lx-backup ✓</p> <p>DOWN 01-01-1970 gtani-lx ✓</p>	<p>UNKNOWN NOW mysqld_2 em sirens.fccn.pt ! ✕</p> <p>UNKNOWN NOW nagiosd em sirens.fccn.pt ! ✕</p> <p>CRITICAL 4h20m ifstatus em sweth320.fccn.pt ✓</p> <p>CRITICAL 5h25m ping4 em gtani-prt-backup.fccn.pt ✓</p> <p>CRITICAL 6h2m ping4 em gtani-lx.fccn.pt ✓ ●</p> <p>CRITICAL 6h3m ping4 em gtani-lx-backup.fccn.pt ✓</p> <p>CRITICAL 6h10m bgp - ANI-PRT 1 em gt41.fccn.pt ✓</p>	<p>CRITICAL 6h30m SERVIP-ANI-PORTO em RCTS-IP ✓</p> <p>CRITICAL 1d7h SERVIP-ANI-LISBOA em RCTS-IP ✓</p> <p>CRITICAL 02-05-2022 SERVIP-IPCB em RCTS-IP ✓</p> <p>UNKNOWN 4d1h PIX-ANGOLACABLES em IXP-GIGAPIX ✓</p> <p>UNKNOWN 4d1h PIX-HUAWEI em IXP-GIGAPIX ✓</p> <p>UNKNOWN 4d1h PIX-ICANN em IXP-GIGAPIX ✓</p> <p>UNKNOWN 4d1h PIX-INTERFIBER-UK em IXP-GIGAPIX ✓</p>



Sistema Monitorização do NOC



Futuro!?

- Desenvolver dashboards atuais
- Implementar novos dashboards
- Implementar novo sistema de Service Desk
- Desenvolvimento/formação constante da equipa
- Manter serviço de excelência





SHARE FCCN

Gonçalo Lopes

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<https://share.fccn.pt/sites/rcts-geral>



Apresentação

Nesta área privada é possível aceder a informação relativa ao serviço RCTS IP, nomeadamente ao arquivo dos relatórios mensais e a gráficos de utilização do serviço, em tempo real.

Para informação sobre outros serviços, aceda às áreas abaixo:

 RCTS Certificados

 RCTS aai  RCTS VoIP

Quaisquer questões ou comentários deverão ser endereçadas a noc@fccn.pt.

**Os Meus Grupos****Grupos Institucionais**ORDENADO POR: **NOME** ▾MOSTRAR: **TODOS** ▾

Procurar todos os grupos públicos...

**ADICIONAR +****NOME DO GRUPO****DESCRIÇÃO****O MEU PERFIL****MEMBROS** [share-rcts-ipv](#)

Acesso à área de informações

Supervisor

4

 [share-rcts-ipv](#)

Acesso à área de informações

Supervisor

3

 [share-rcts-iscte](#)

Acesso à área de informações

Supervisor

0

 [share-rcts-isec-lisboa](#)

Acesso à área de informações

Supervisor

2

 [share-rcts-isp](#)

Acesso à área de informações

Supervisor

0

 [share-rcts-ispa](#)

Acesso à área de informações

Supervisor

0

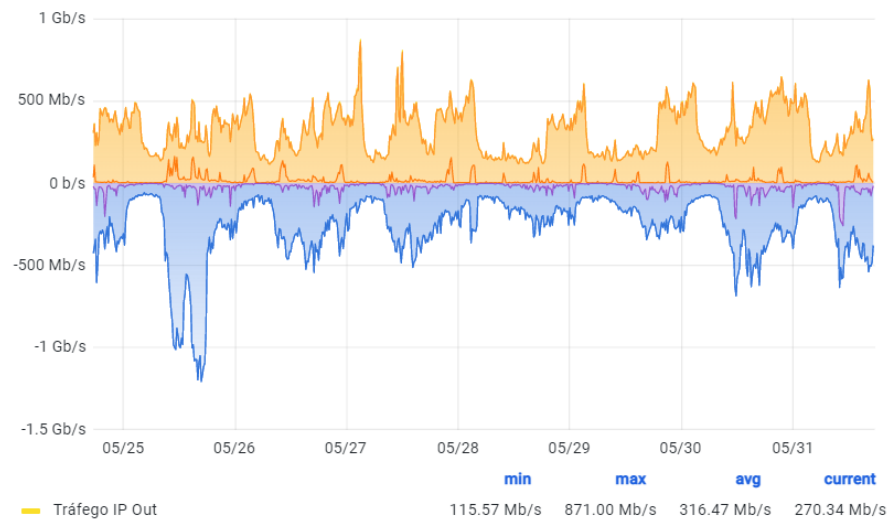




Dados em Tempo Real

SERVIP-FCCN

Gráfico Semanal



SERVIP-FCCN

Gráfico Semanal

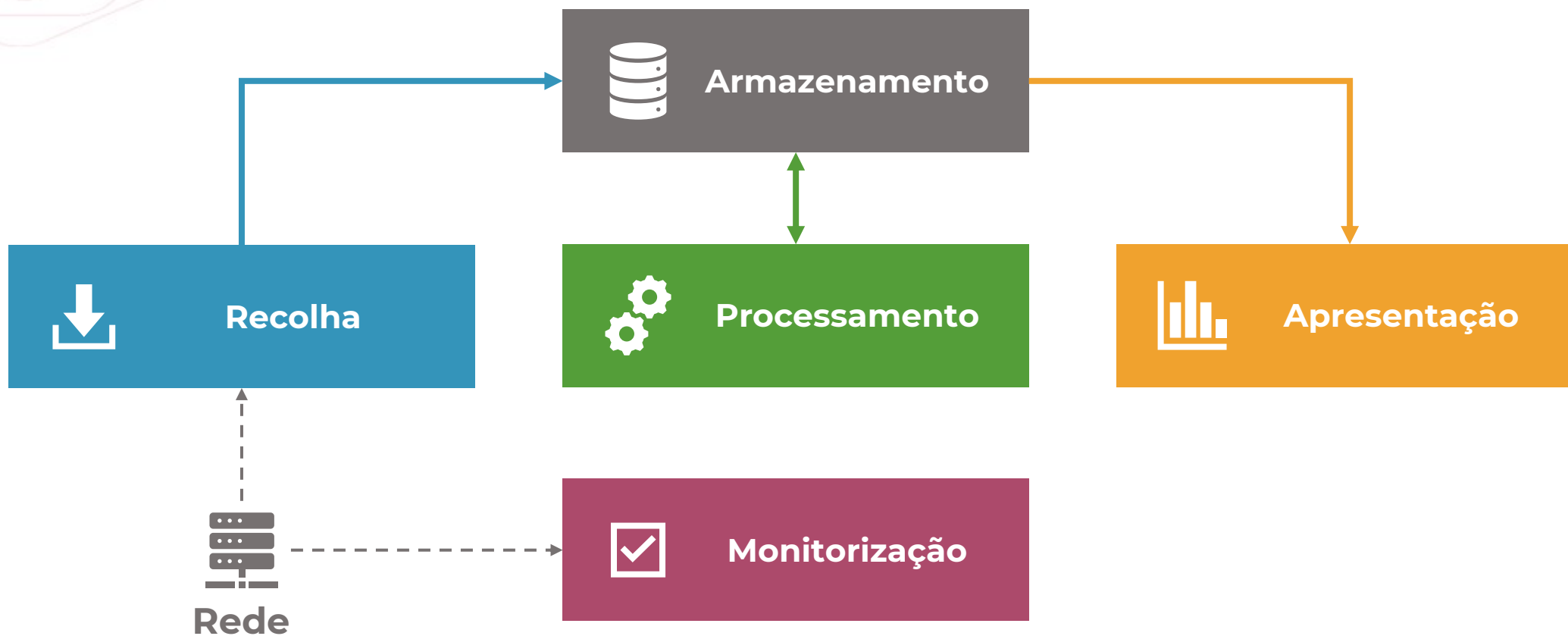
Gráfico Anual

SERVIP-FCCN-PORTO

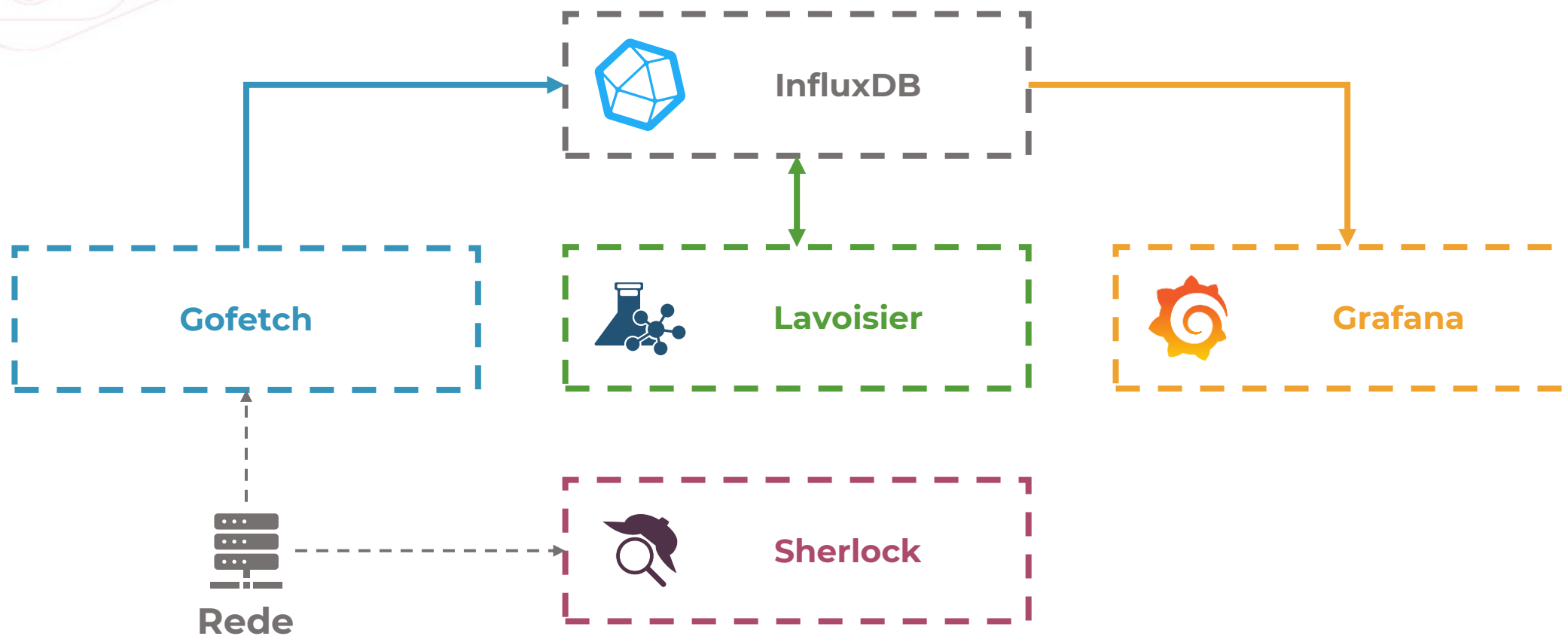
Gráfico Semanal

Gráfico Anual

Arquitetura



Arquitetura



Sherlock



Revisão das descrições
das interfaces



Relatório de problemas
encontrados



GERAR RELATÓRIO

Procurar



Equipamento

Descrição

Problemas

router-exemplo.fccn.pt

[Te0/0/0/0]=====#SERVIP-TESTE#
[PRIM]

A tag "PRIM" não é válida. Tem de ser "PRI" ou "SEC".

router-exemplo.fccn.pt

[Te0/0/0/0.123].....#CIRC-TESTE#

Encontrada(s) 0 tag(s), esperada(s) 1 ou 2 tag(s).

router-exemplo.fccn.pt

[Bundle-e10]=====#EXEMPLO#

Encontrado(s) 17 caracter(es) de indentação, esperados 20 caracteres.

Gofetch



Recolha via SNMP



Todo o tipo de métricas



Execuções minuto a
minuto



GOFETCH



ROUTER-EXEMPLO.FCCN.PT

ROUTER TESTES + TAG

GENERAL

IP
127.0.0.2

Version
2c

SNMP

FEATURES

Port
161

Transport
udp

Retries
3

Timeout
2

Exponential Timeout

Community

SWITCH-EXEMPLO.FCCN.PT

SWITCH TESTES + TAG

GENERAL

Name
switch-exemplo.fccn.pt

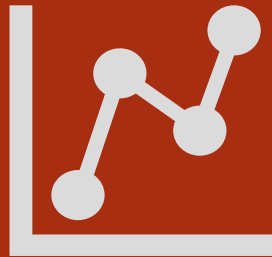
SNMP

FEATURES

Cisco IOS



InfluxDB

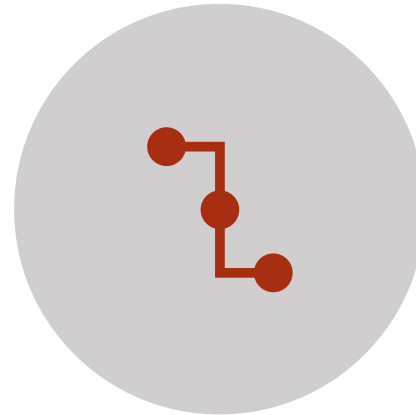


Base de dados de séries
temporais

Lavoisier



Processamento dos dados em bruto



Mapeamento com serviços da CMDB



Médias de 5 minutos



Processamento de dados de tráfego

Categoria

RCTS IP



Serviço

Todos



10h

Tempo

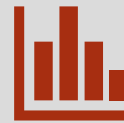


PROCESSAR

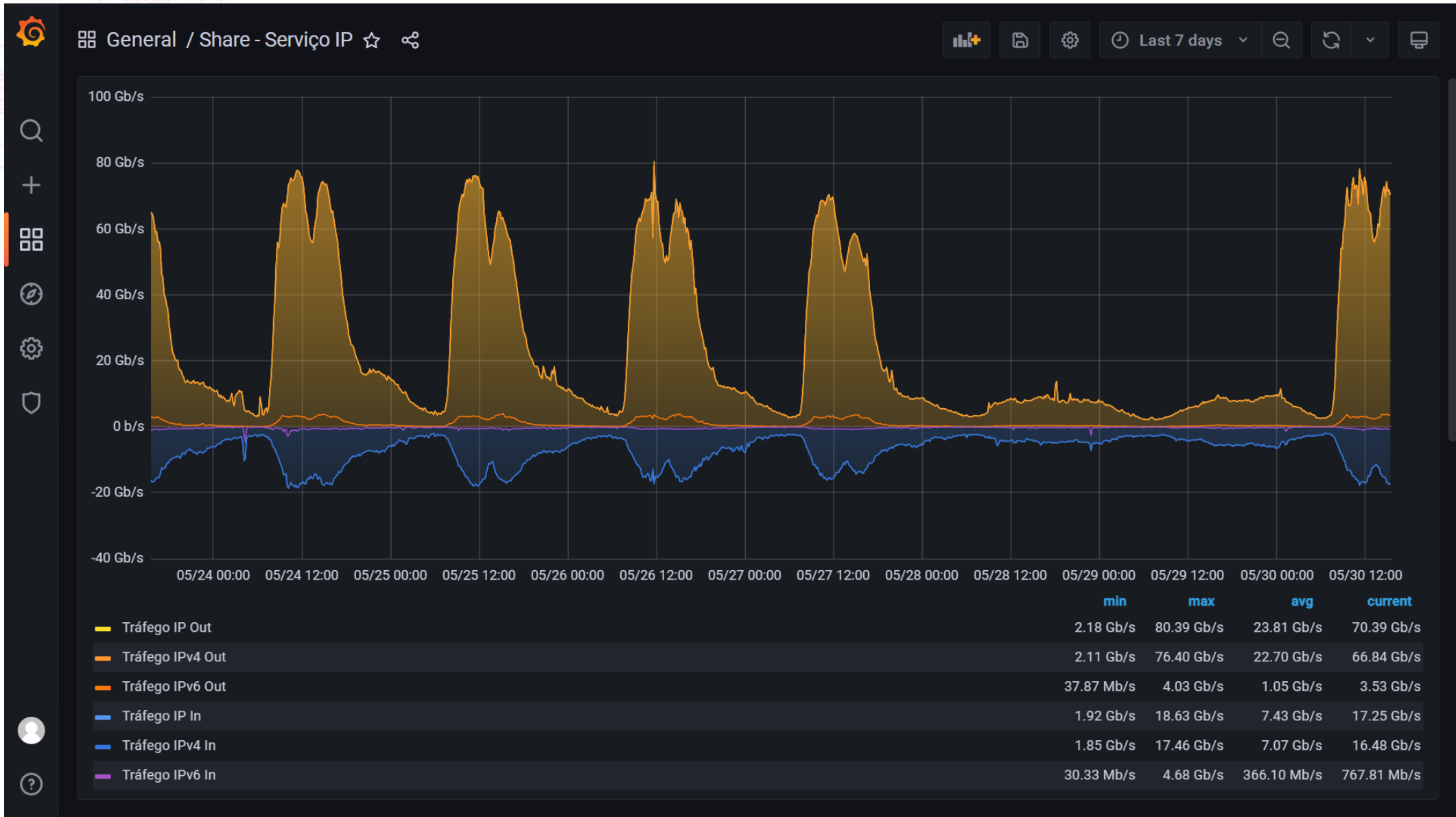
Grafana



Criação de *dashboards*



Incorporação de gráficos
em páginas web





Automatismos Operacionais

Edgar Inácio

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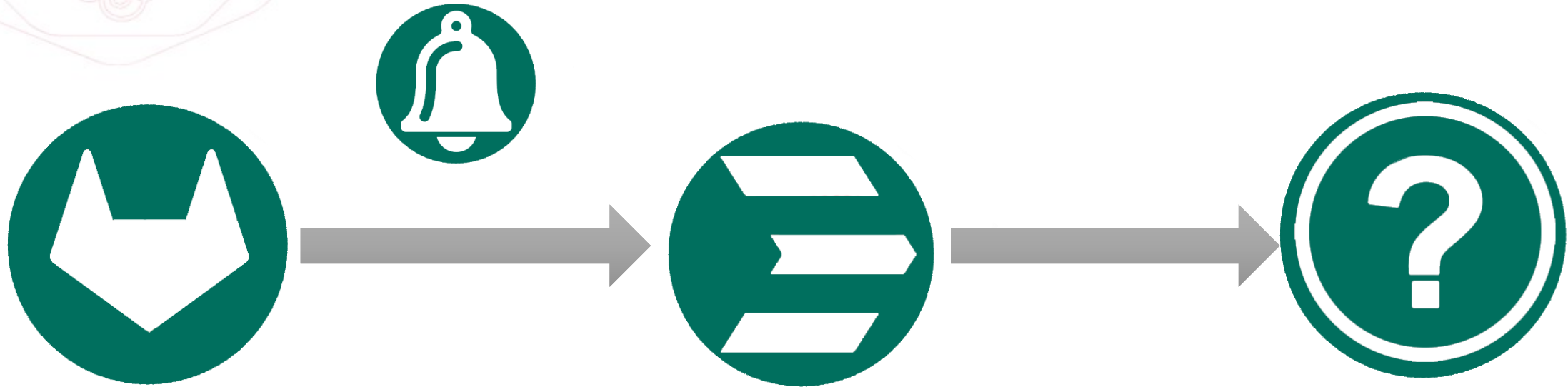
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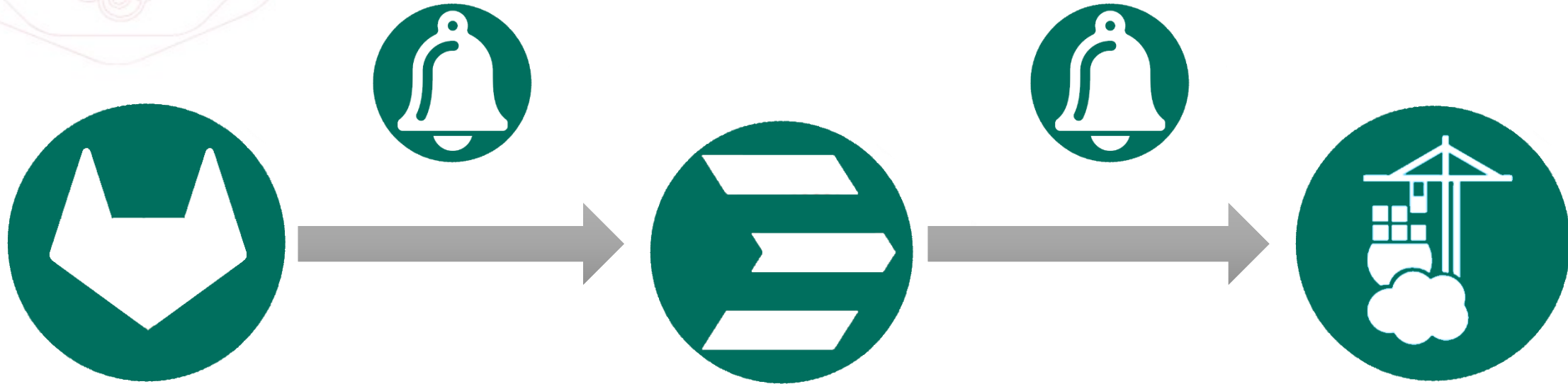


AUTOMATISMOS OPERACIONAIS











RCTS100

Rede DWDM

Tiago Antunes



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RCTS100

DWDM

Tecnologia

Nova Transmissão Ótica

- Solução DWDM com suporte de 96 canais de 100/200Gbps
- Possibilidade de canais de 600Gbps ou mais no futuro

50 Nós

35 OADM
15 ILA

6,8 Tbps

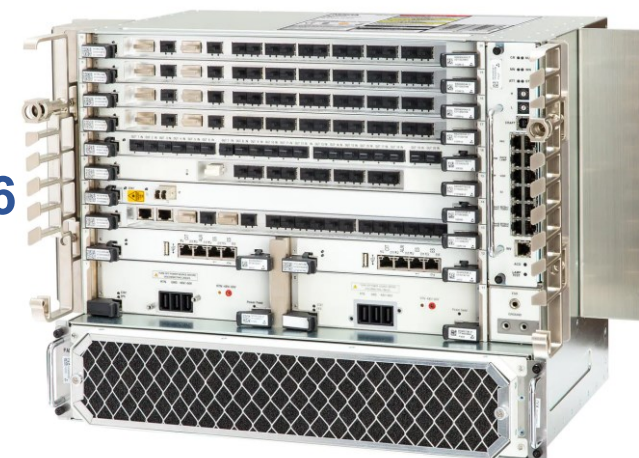
68 SERVIÇOS DE 100 GBPS
CAPACIDADE INSTALADA DIA 1

RCTS100

NOKIA



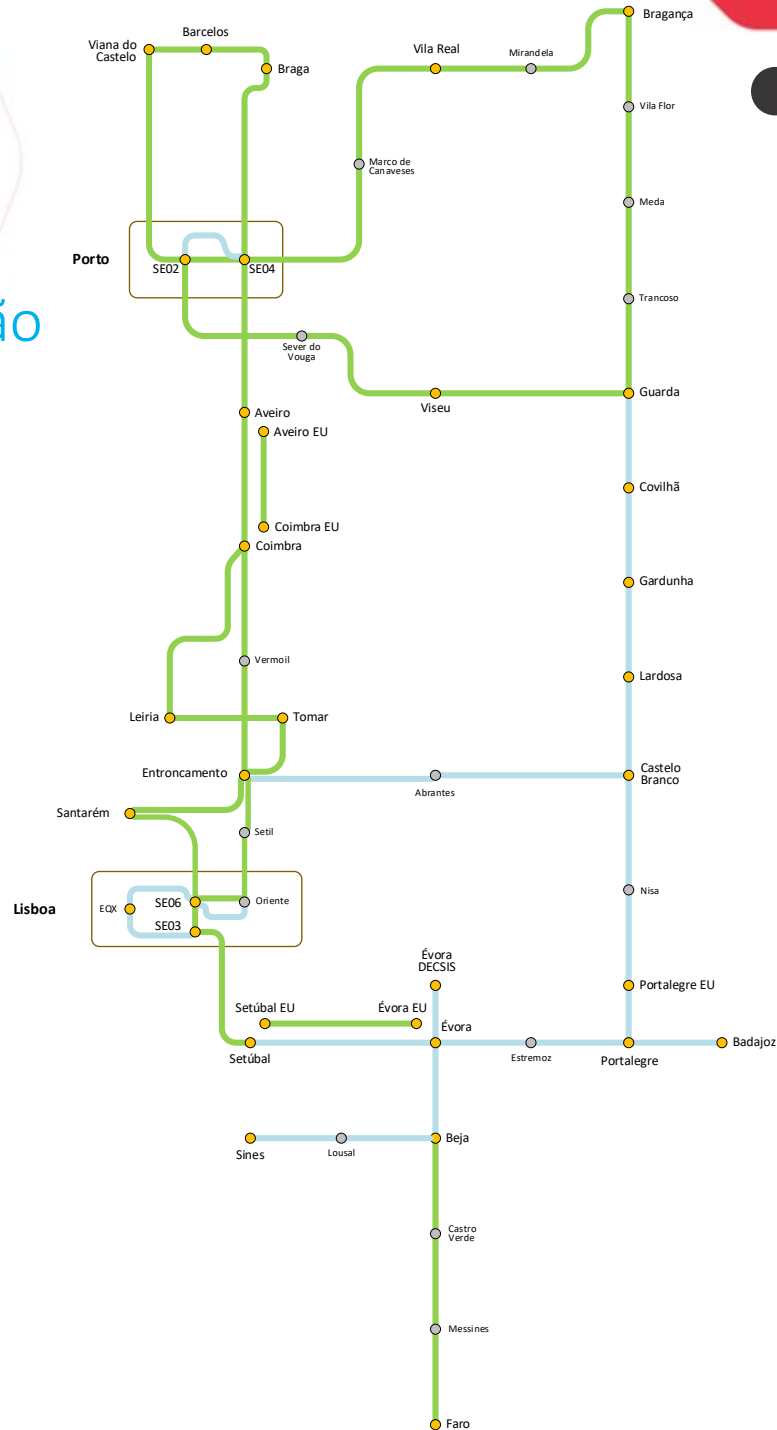
1830 PSS8



1830 PSS16



RCTS 100 DWDM Implementação



Jornadas
2022



70% Implementado

50 Nós

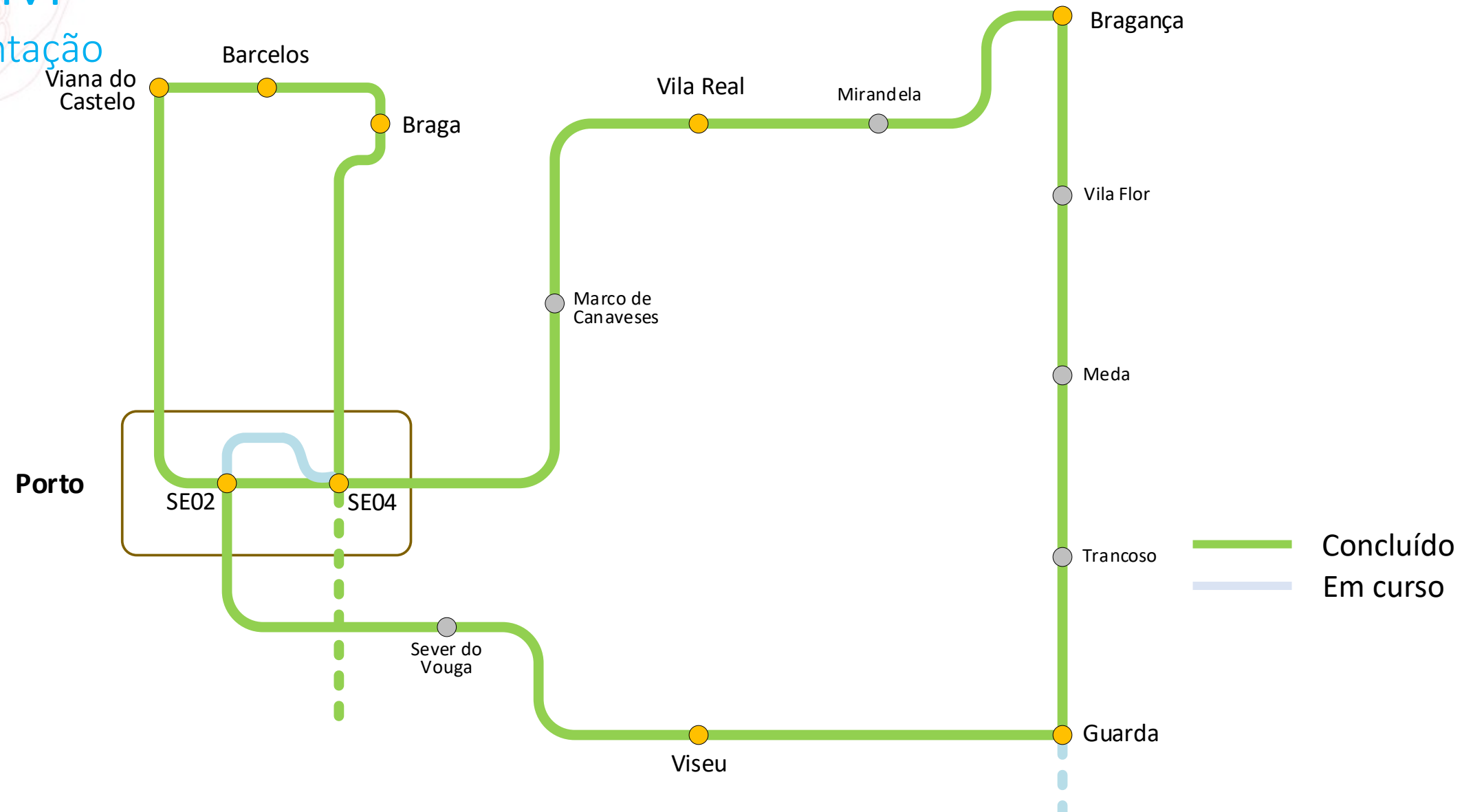
35 NÓS IMPLEMENTADOS

Concluído
Em curso

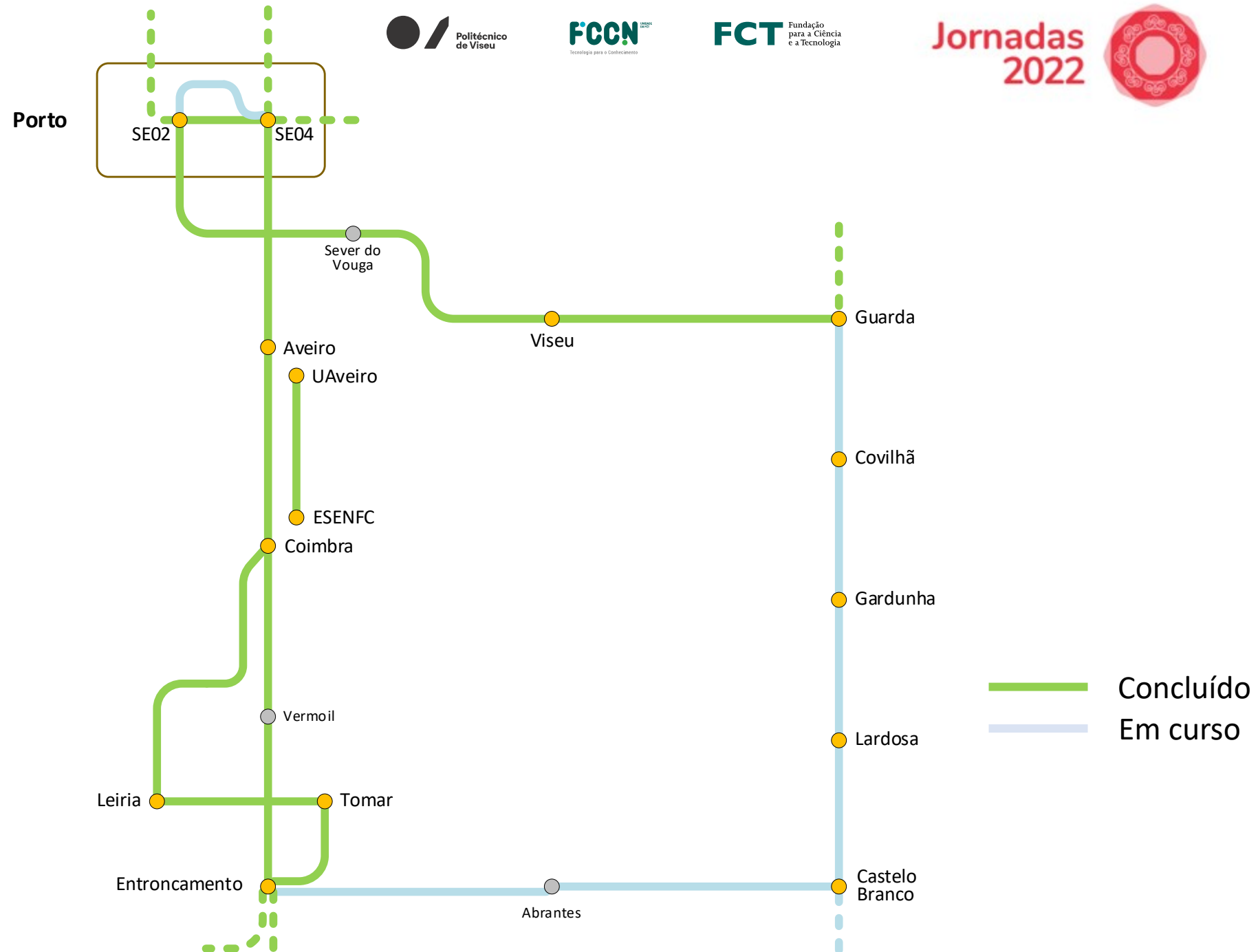
RCTS 100 DWDM Implementação



Jornadas
2022



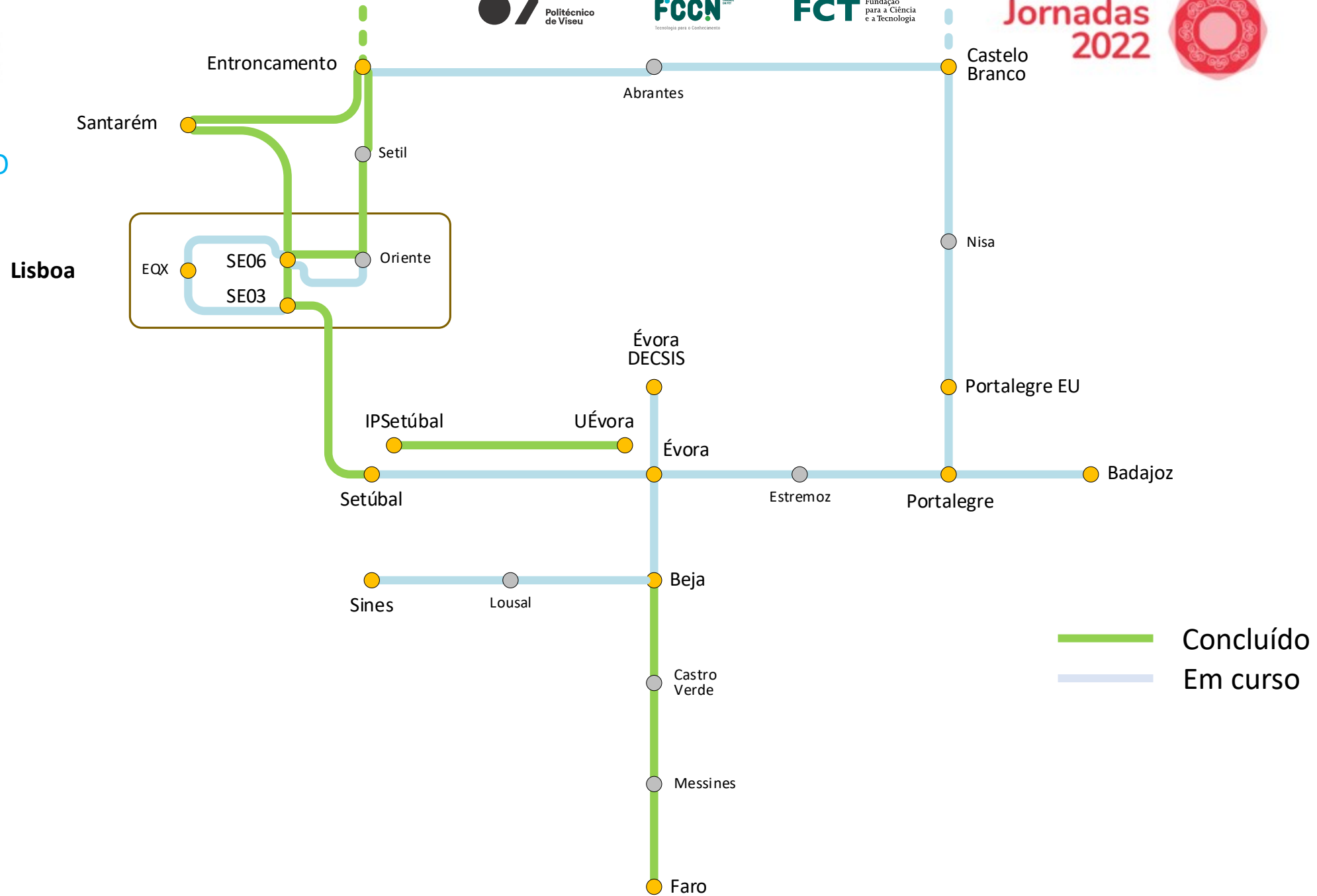
RCTS 100 DWDM Implementação



RCTS 100 DWDM Implementação



Jornadas 2022

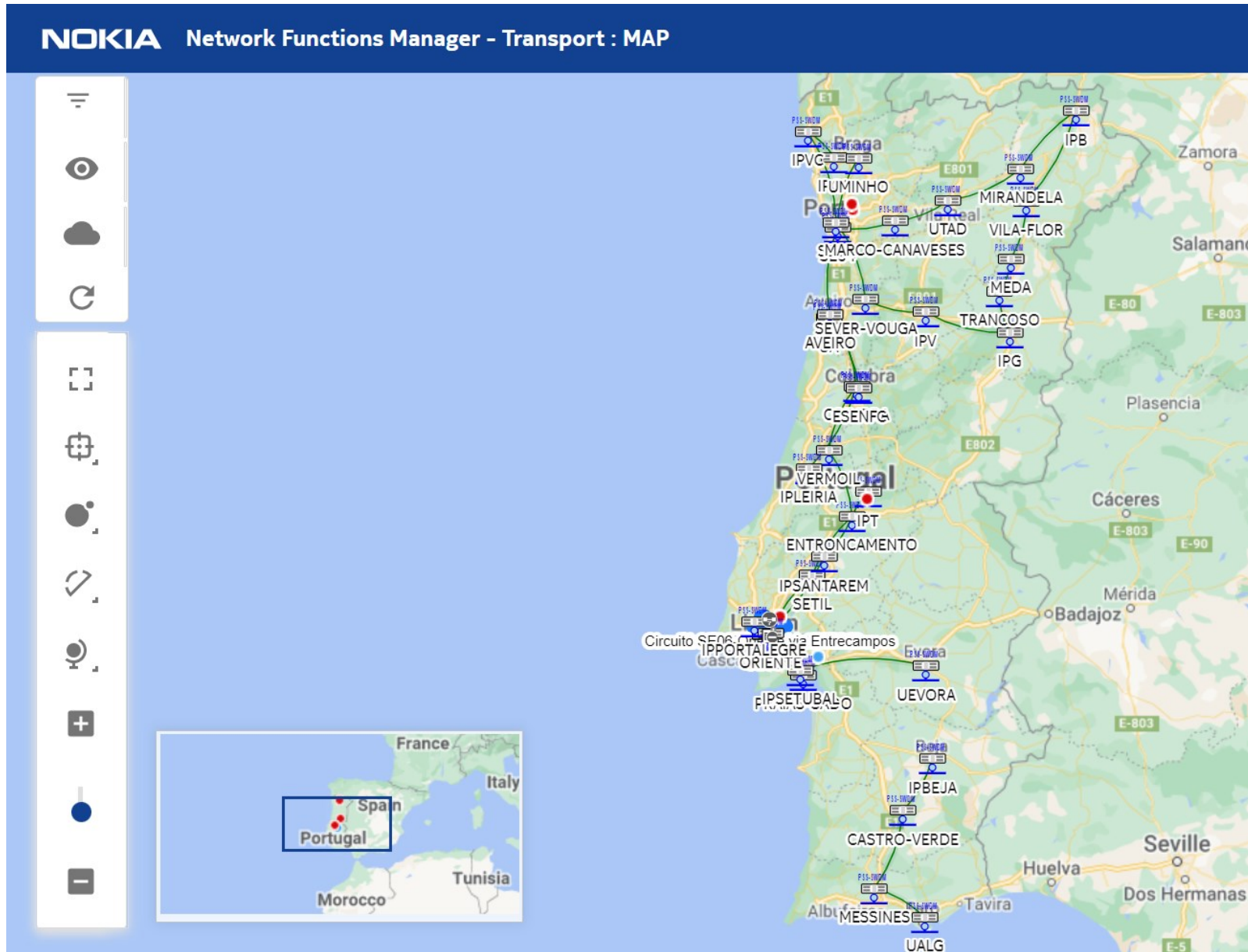




RCTS100



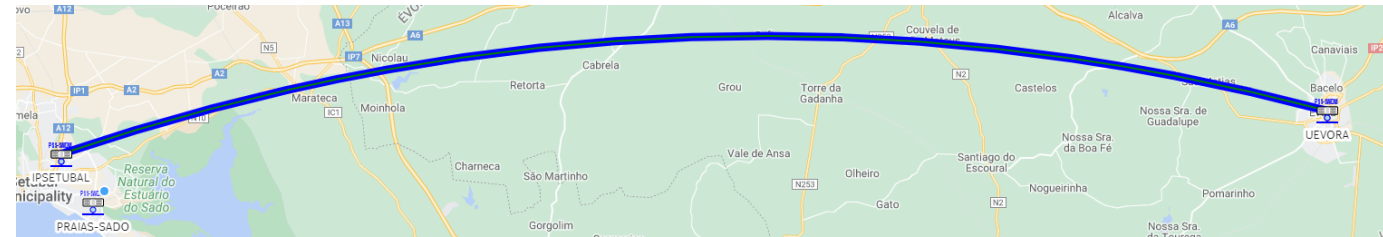
RCTS 100 DWDM Implementação



RCTS100

DWDM

Curiosidades



Ligação entre dois nós com maior distância:

- IPSetúbal – UÉvora
 - Distância 123km
 - Atenuação 32dB
 - Latência 1.28ms RTD/640us OWD
 - Jitter <= 10ns

Enhanced RFC 2544: Latency Test Results			
Frame Length (Bytes)	Latency RTD (us)	Measured L1 Rate (Mbps)	Measured L1 (% Line Rate)
66	1280.72	100000.0	100.000
82	1280.72	100000.0	100.000
146	1280.72	100000.0	100.000
274	1280.72	100000.0	100.000
508	1280.72	100000.0	100.000
786	1280.72	100000.0	100.000
1020	1280.72	100000.0	100.000
1496	1280.72	100000.0	100.000
1518	1280.72	100000.0	100.000
9618	1280.72	100000.0	100.000

Enhanced RFC 2544: Jitter Test Results					
Frame Length (Bytes)	Max Avg Jitter (us)	Measured L1 Rate (Mbps)	Measured L1 (% Line Rate)	Measured Rate (frms/sec)	Pause Detect
66	0.00	100000.0	100.000	145,348,838	No
82	0.00	100000.0	100.000	122,549,021	No
146	0.00	100000.0	100.000	75,301,206	No
274	0.00	100000.0	100.000	42,517,007	No
508	0.00	100000.0	100.000	23,674,243	No
786	0.01	100000.0	100.000	15,508,685	No
1020	0.01	100000.0	100.000	12,019,231	No
1496	0.01	100000.0	100.000	8,245,383	No
1518	0.01	100000.0	100.000	8,127,439	No
9618	0.01	100000.0	100.000	1,296,950	No

Serviço com mais saltos:

- Lisboa (SE03) – Porto (SE02)
 - 9 seções OTS
 - 2 ILAs e 6 ROADMs
 - Distância total cerca de 370km
 - Latência 3.66ms RTT/1.83ms OWD
 - Jitter <= 50 ns

Mas não será o maior:

- Lisboa (SE06) – Porto (SE04) pelo interior:
 - Lisboa – Portalegre – Guarda - Viseu



Frame Loss - FLR, Lost Frames	0
Frame Loss - FLR, Frame Loss Ratio	0.0
Round Trip Delay - FD (us), Average	3,658.370
Round Trip Delay - FD (us), Current	3,658.350
Round Trip Delay - FD (us), Maximum	3,658.410
Packet Jitter - FDV (us), Average	0.000
Packet Jitter - FDV (us), Max Average	0.010
Packet Jitter - FDV (us), Peak	0.050
Packet Jitter - FDV (us), Instantaneous	0.000





RCTS100

Backbone IP e Acesso



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Backbone IP

+10

ROUTERS CORE/DISTRIBUIÇÃO
E INTERNACIONAIS

+2

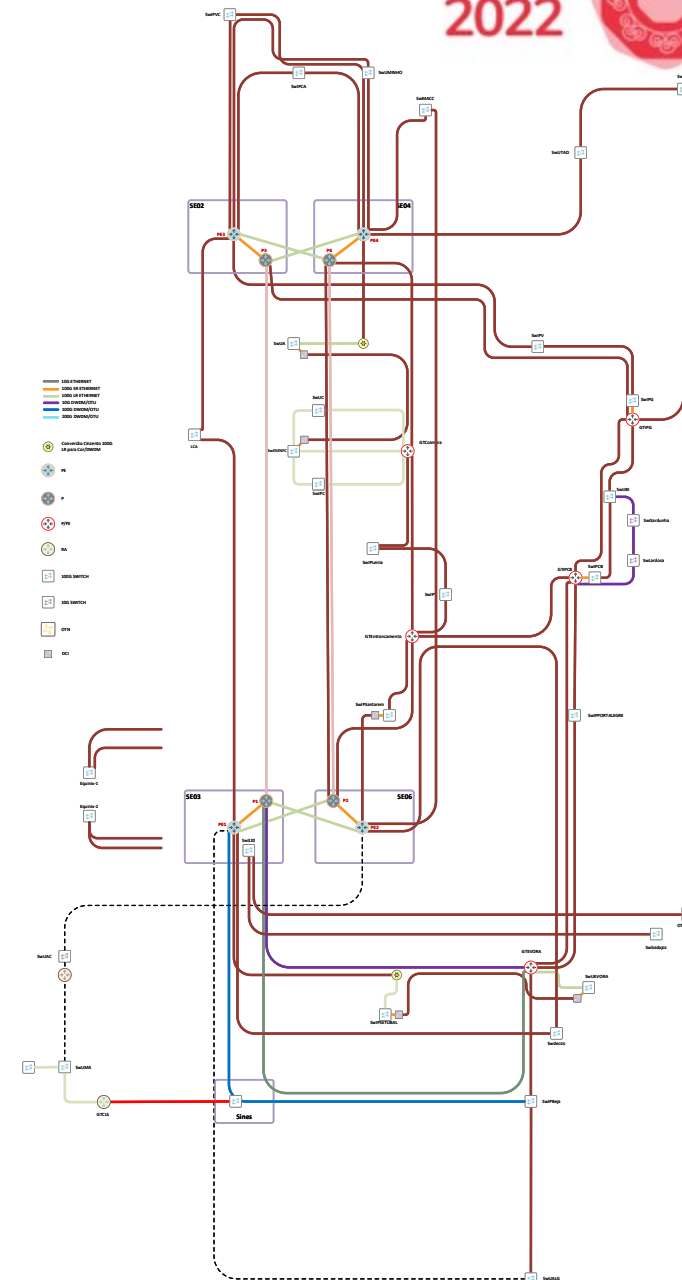
ROUTERS VIRTUALIZADOS

+ 100

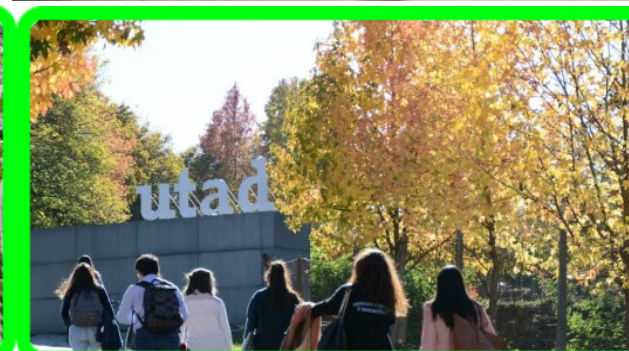
EQUIPAMENTO DE ACESSO
(CPE)

+ 700

LASERS



RCTS100 - Ongoing



RCTS 100



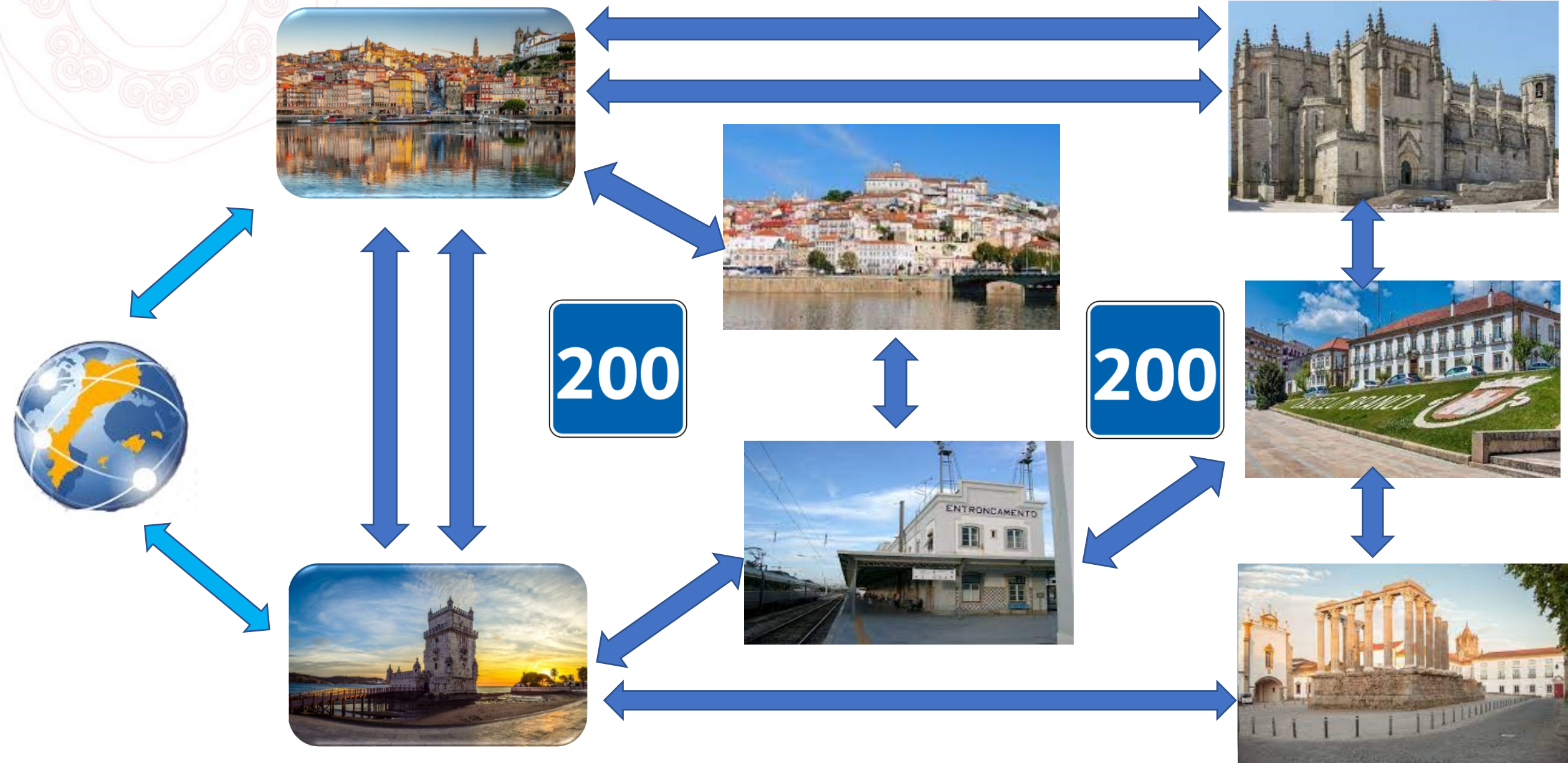
Ativação de CPEs a 100G

- Fontes redundantes
- Ventoinhas hot swappable
- Funcionalidades avançadas (MPLS, routing, virtual stack)



17 EUs com interfaces a 100G

Backbone RCTS



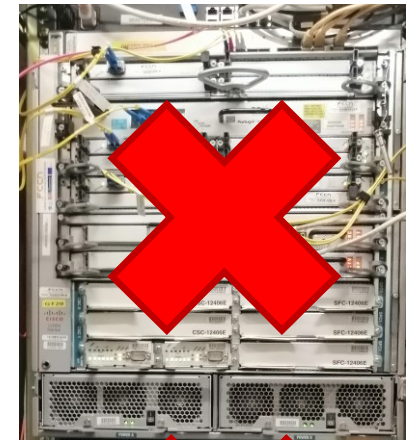
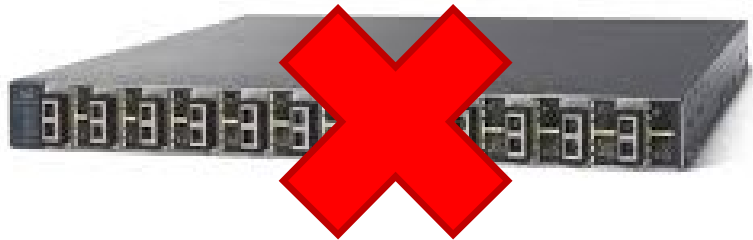
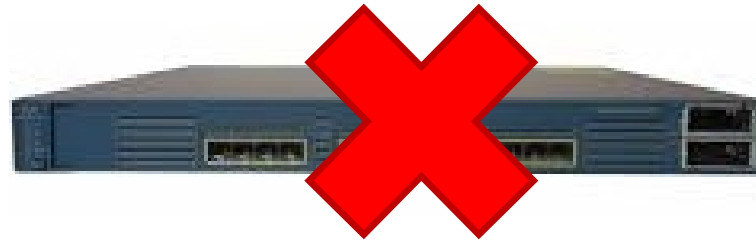
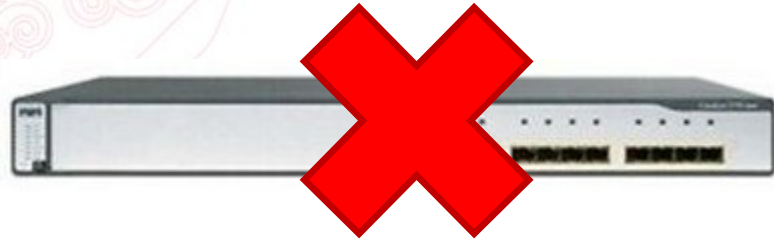


RCTS

Outros trabalhos



RCTS – eliminação equipamento antigo





RCTS – Atualização CPE

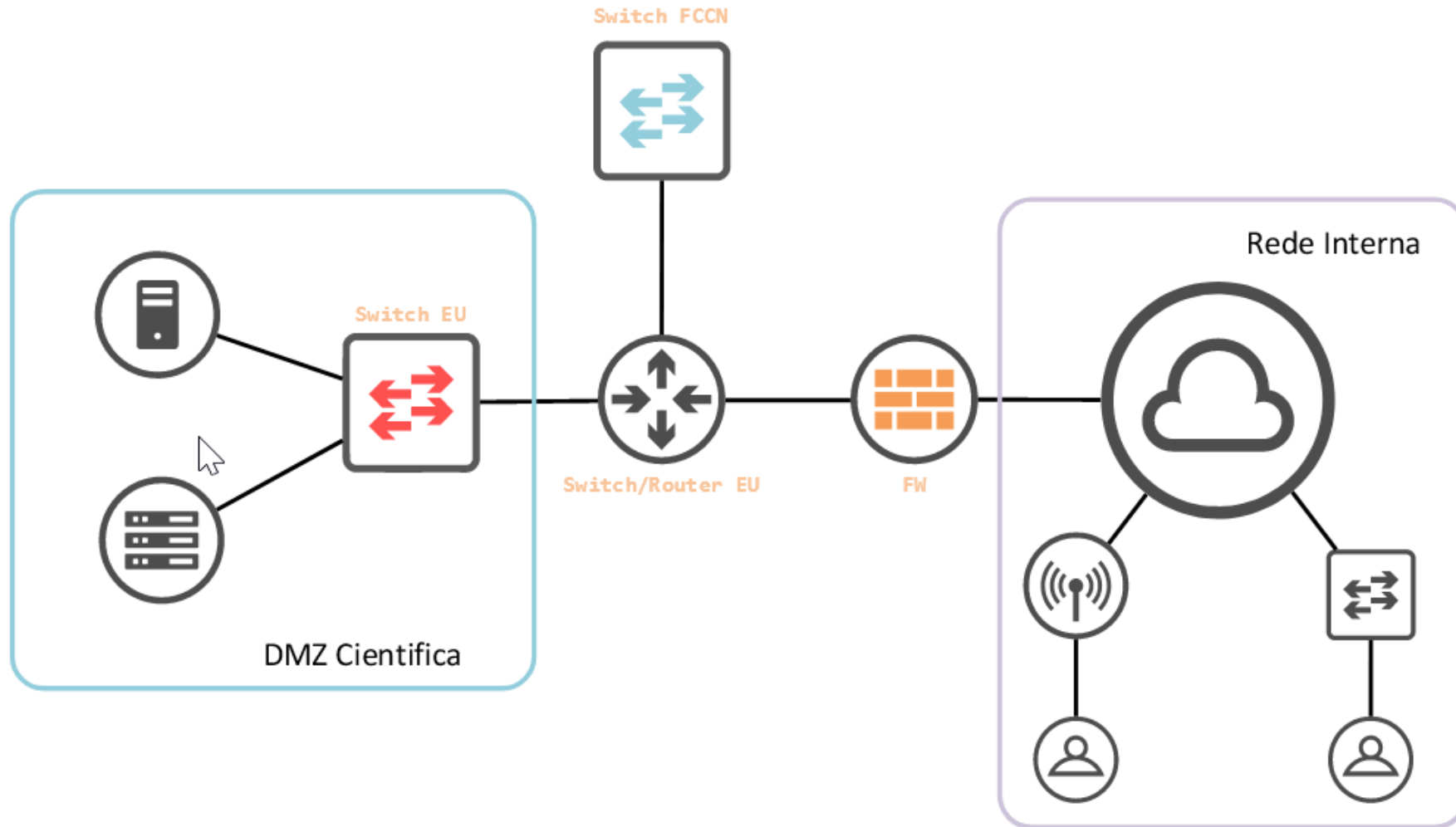
Substituição por novos CPEs

- Fontes redundantes
- Mais funcionalidades
- Disponibilização de stack sempre que possível





RCTS – Modelo de Interligação





RCTS entrega dos serviços 100G / 10G

100G

- Entrega em MPO multimodo – 100G-SR4
- Fibras multicores OM3/4/5



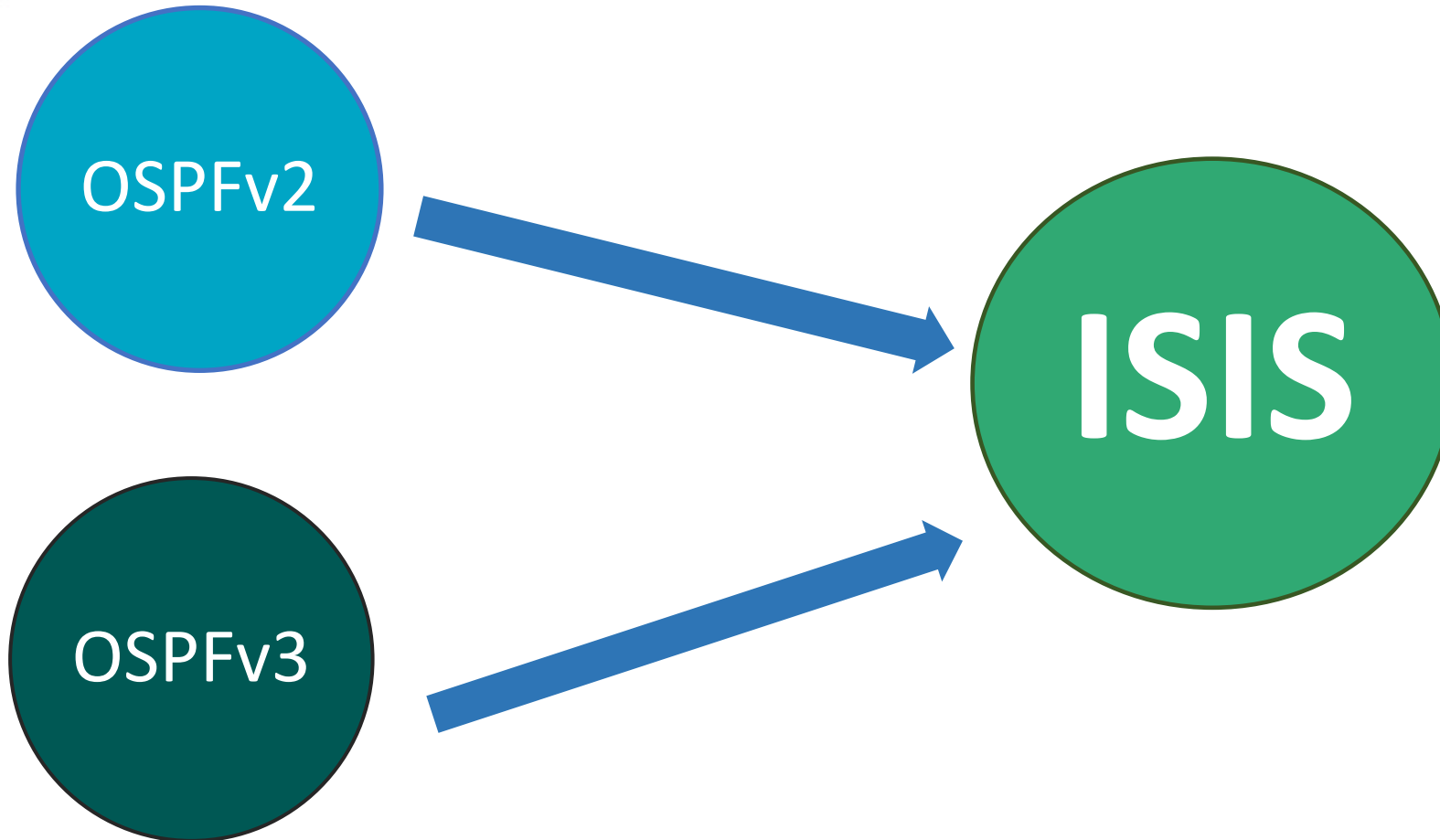
10G

- Entrega em LC monomodo – 10G-LR
- Entrega em LC multimodo – 10G-SR (onde houver equipamento de transmissão)



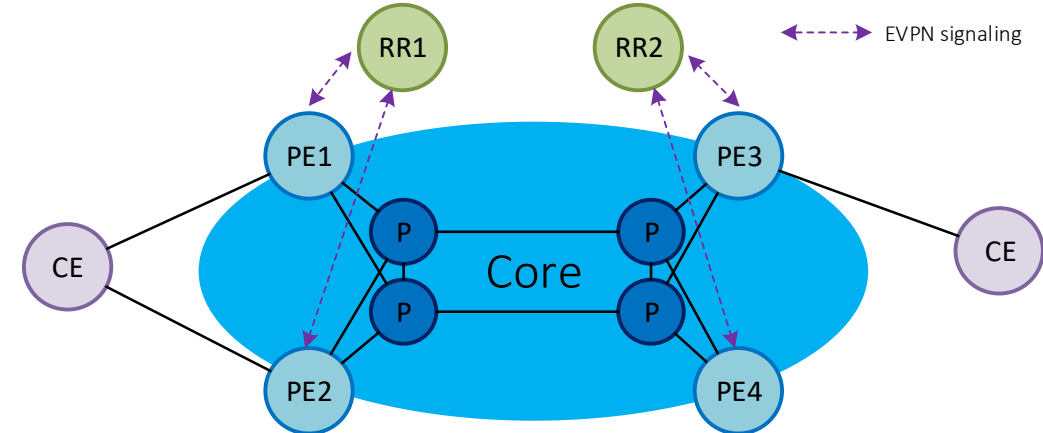


RCTS – Encaminhamento IP



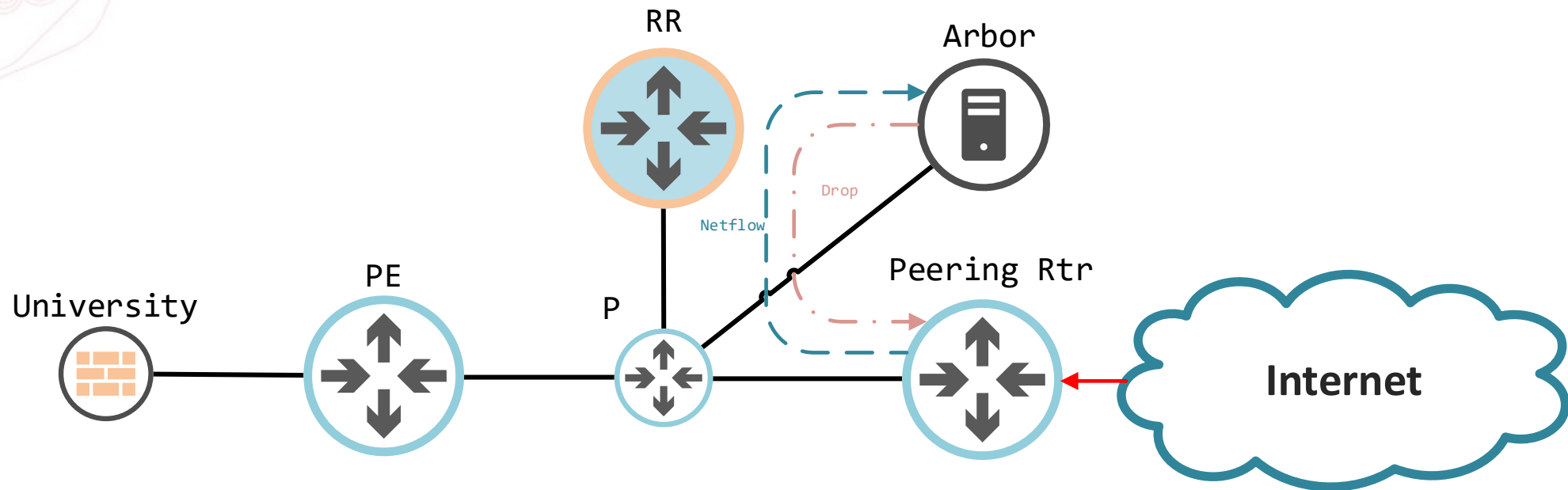


Ativação de Segment Routing e Serviços Avançados





FLOWSPEC - ATUALIZAÇÃO



- Filtragem por IP Destino na RCTS
- Novo – Filtragem por IP Origem fora da RCTS
- Complemento ao FoD do Géant



RCTS – Supercomputação

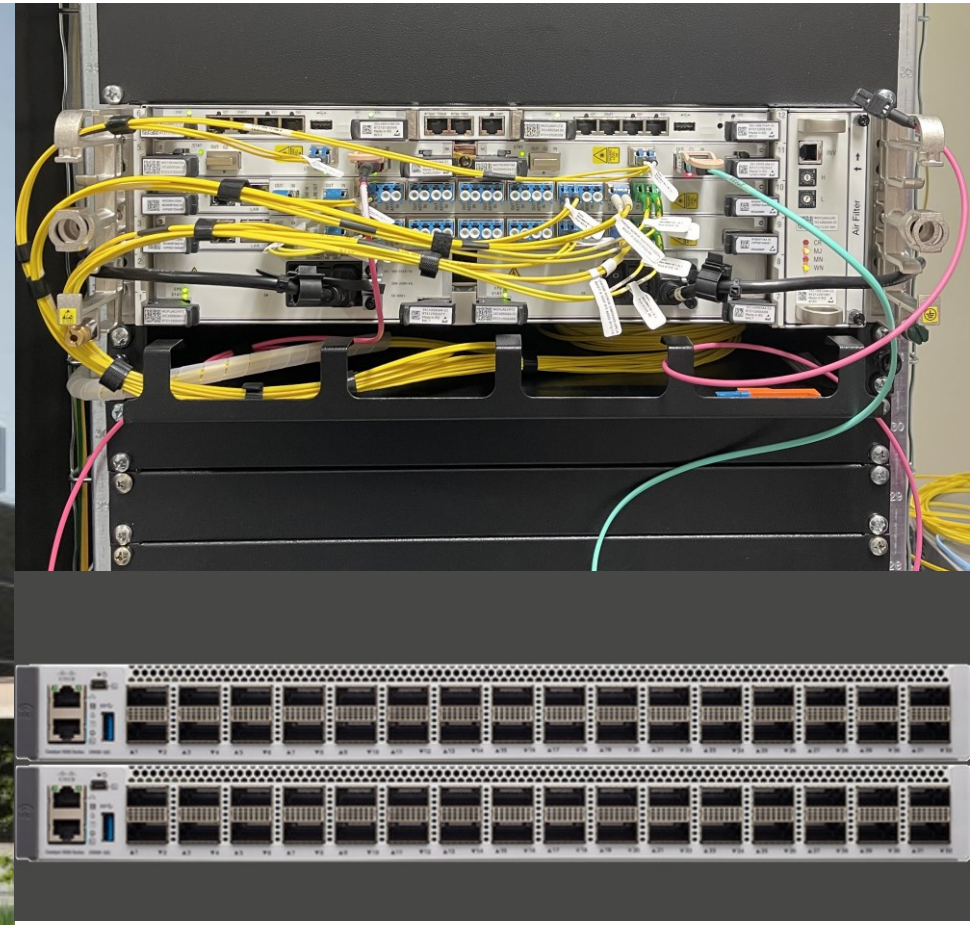
Ligar Supercomputadores

- Interligação dos vários centros de supercomputação
- Ligação à rede Géant
- Modelo de conetividade





POP RCTS em Sines



RCTS

Pontos de Presença
(PoPs)

105

Interfaces 100G L3

180

Interfaces 100G L2

308

Interfaces 10G L3

400

Fornecedores
Trânsito IP

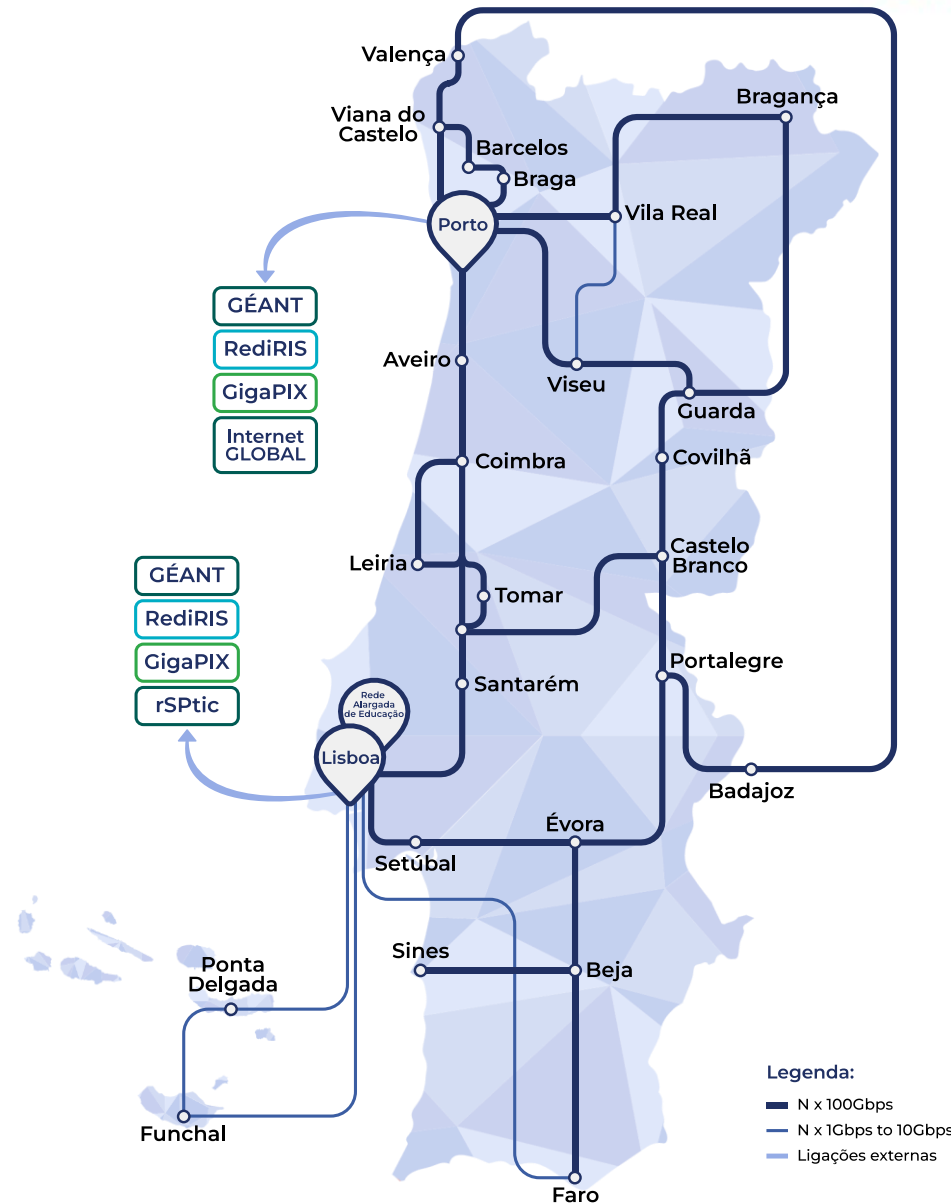
2 em 2 locais

Peerings em IXPs

+ 50

Network Operations
Centre (NOC)

24x7



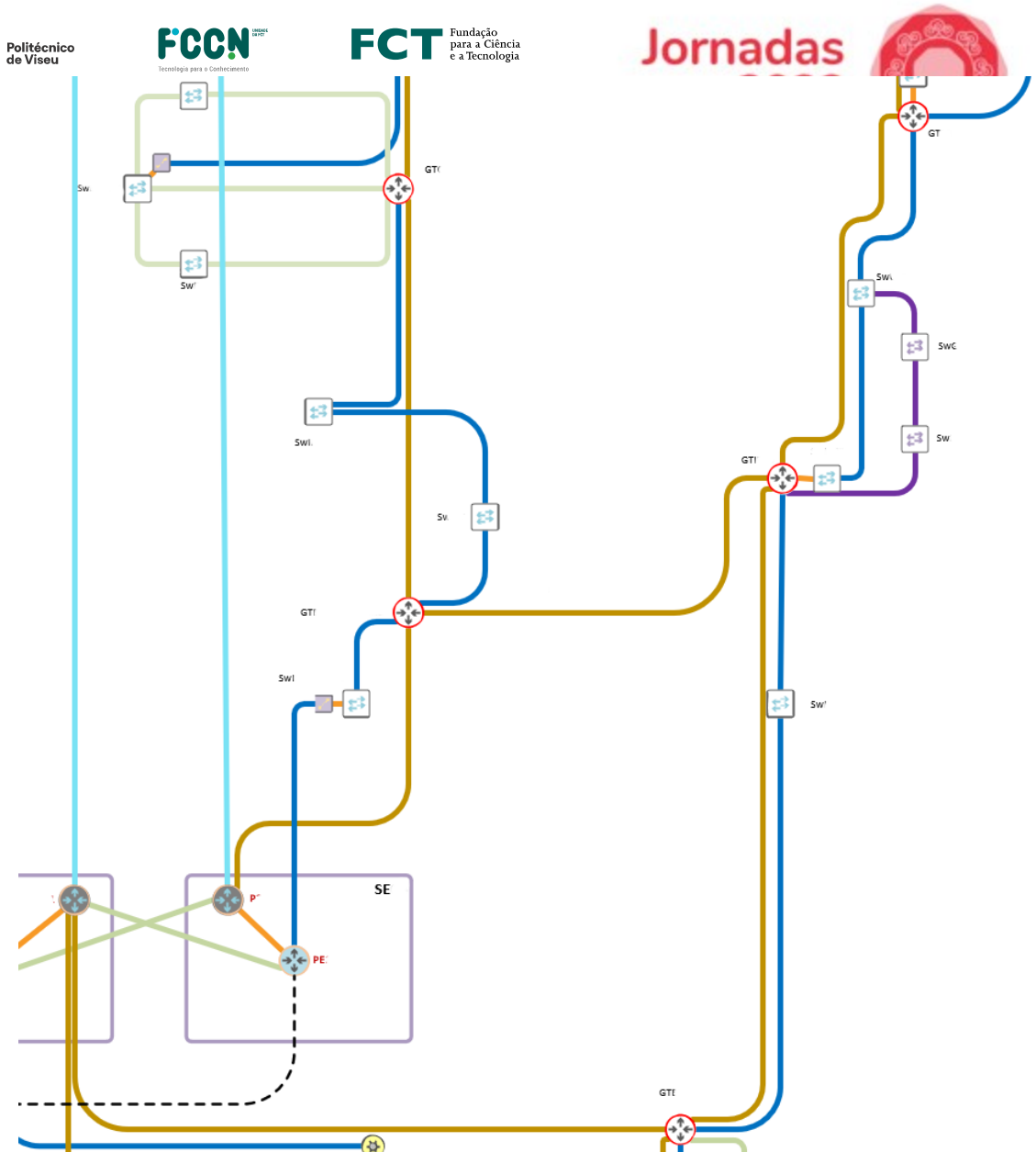
100G Winners



RCTS 2022 - melhoramentos

Routing

- 5 Routers Full Routing
- Melhor caminho até ao destino garantido
- Descentralização da rede
- Otimização dos recursos de rede existentes





RCTS 2022 - melhoramentos

Switching

- Agregar de Cores em Lisboa e Porto
- Evoluir arquitetura antiga para a nova
- Robustecer os serviços de L2 e L3
- Novos serviços





RCTS 2022 - Desafios

Recursos Humanos

- Dificuldade em encontrar perfis adequados
- Muita procura por pessoas qualificadas
- Eng. de Redes em vias de Extinção?





RCTS 2022 - Desafios

Técnicos

- Tecnologias cada vez mais complexas
- Troubleshooting
- Erros com elevado impacto
- Modelos de licenciamento vs o que precisamos
- Monitorizar novos serviços





Inside Job Part 2

João Silva

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The Art of Route Reflection

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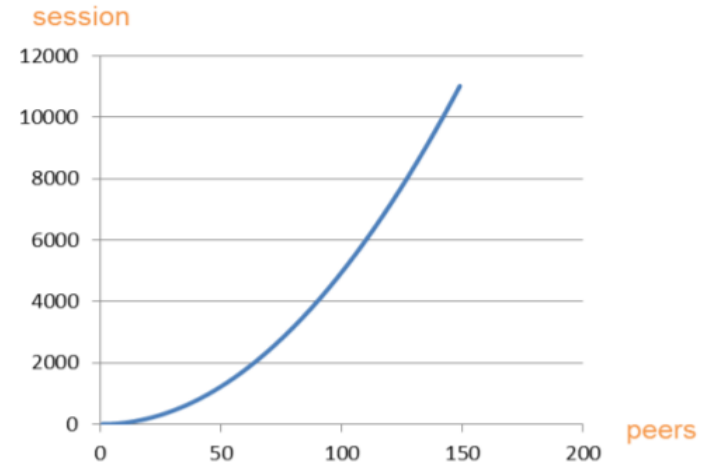
Politécnico de Viseu FCCN FCT



THE ART OF ROUTE REFLECTION

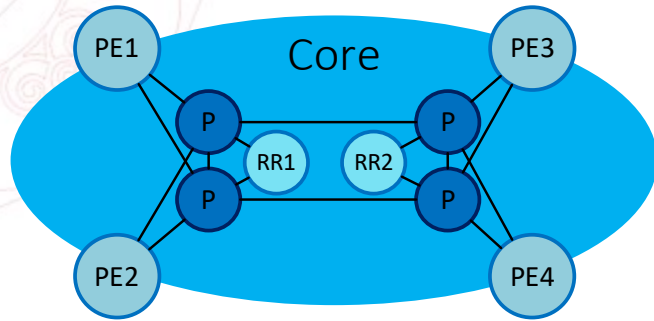
Is full mesh iBGP scalable?

- If n is the number of routers;
- Sessions per BGP speaker = $n - 1$
- Total iBGP sessions = $n * (n-1) / 2$
- 20 routers = 19 sessions per router and 190 sessions total!



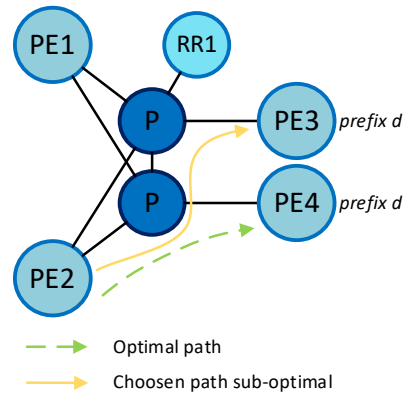
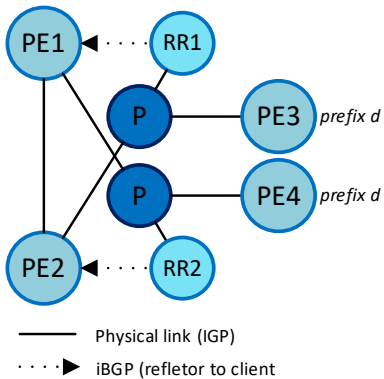
Benefits of Route Reflection

- Reduced number of iBGP sessions
- Reduced operational cost
- Reduced RIB-in size
- Reduced number of BGP updates
- Incrementally deployable



Caveats of Route Reflection

- Robustness
- Prolonged routing convergence
- Data forwarding loop
- Reduced path diversity
- Sub-optimal routes



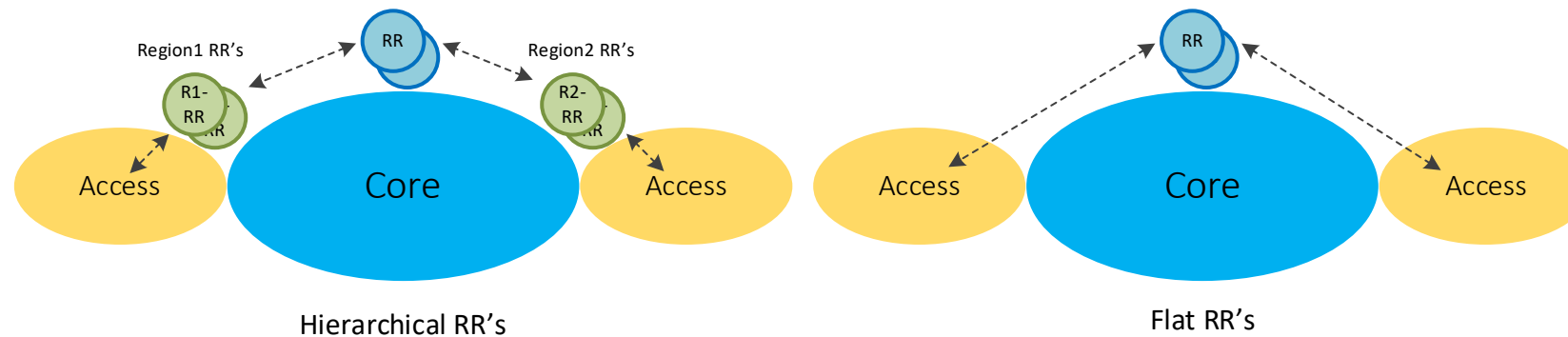


RCTS RR'S DESIGN: HIERARCHICAL OR NOT!

A hierarchical RR design employs a set of redundant RR's in each Tier/POP to **add scalability**

While it solves one problem, it can create other. **A Flat RR design** has the following **advantages**:

- Convergence improvements by eliminating chain of RRs
- Reduce number of policy control points
- Decouple RIB/FIB, FIB programming on in-path RR can cause issues
- Simplify network forwarding path routers by removing RR function



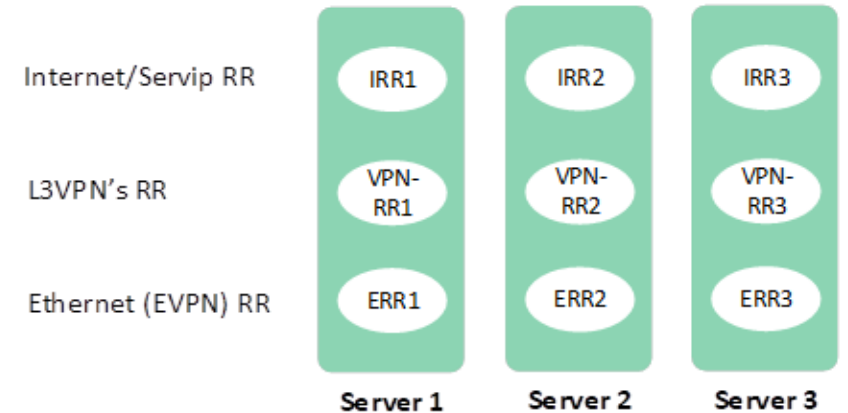
Our network doesn't have the size to justify a Hierarchical RR Design, nor is such design always the best option, instead we will proceed with a Flat design, protecting the future scalability by splitting the RR's by functions if desired.



RCTS RR'S DESIGN: PER FUNCTION/SERVICE RR'S OR NOT!

Separating RR's for each service addresses the following concerns:

- Scalability
- Convergence
- Security
- Resiliency



Transport RR's (T-RR): The PCE's, where the client routers will get a custom policy. The clients are the ABR's and the ones that feed the access topology to the T-RR through the link state address-family.

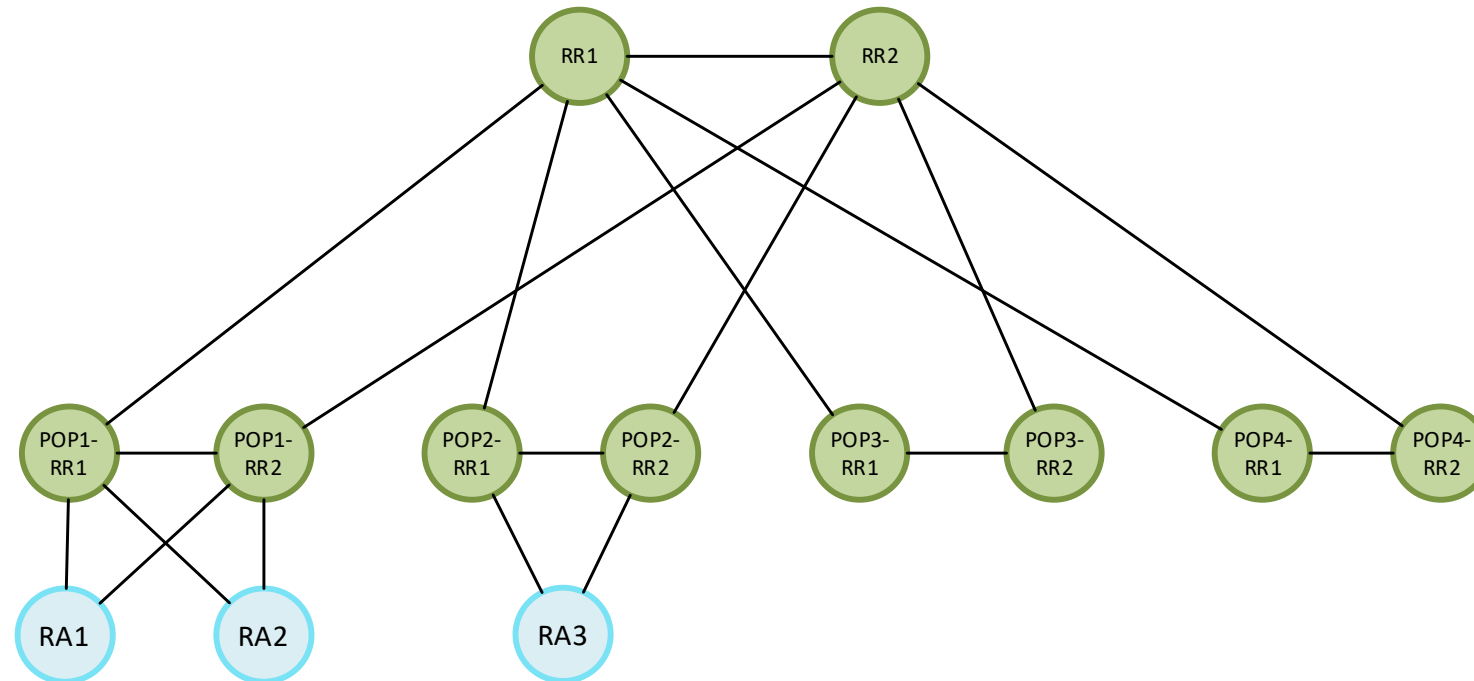
Service RR's (S-RR): S-RR is used to reflect the routes of a certain type of service. S-RR clients are all the routers in the network, independent of the domain.

Nevertheless, normally, simpler and less complex solutions are always better!!



RCTS RR'S DESIGN: SAME CLUSTER OR NOT!

But when are cluster's useful -> Hierarchical RR's designs

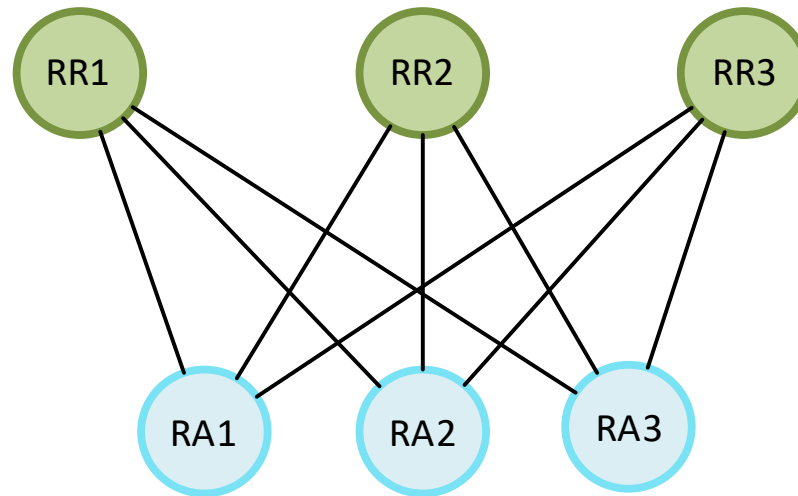


Key concept: If a RR receives a prefix which has the same cluster ID, it drops the update, because by design the RR already knows the prefix since a client router should be connected to both RR's in the same cluster.



RCTS RR'S DESIGN: SAME CLUSTER OR NOT!

In a flat design the connection between the RR's is not needed since each RR connects to all the client routers.



Initial question: to be cluster or not to be!

In this design it's indifferent but to safeguard the future we are projecting each RR with a different cluster ID.



RCTS RR'S DESIGN: VIRTUALIZED RR'S (VRR) OR NOT!

Virtualized out of path route reflectors is the growing trend in route reflection. Virtualized Route Reflectors (vRR) on x86 hardware has the following benefits:

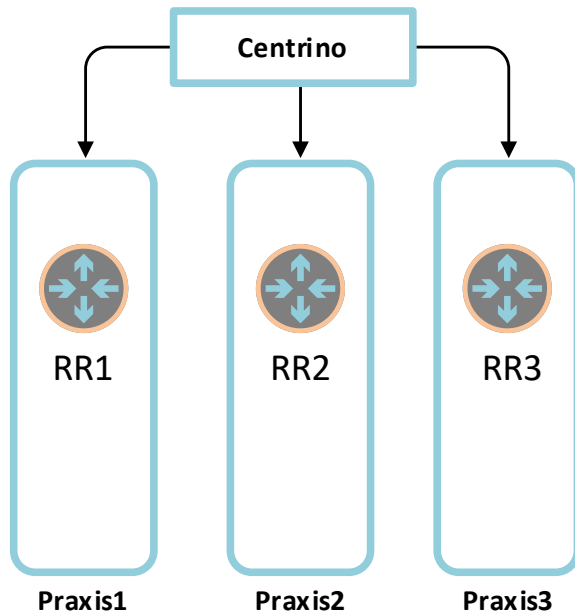
- Route reflection is a software control-plane function
- Stable, starting to see more widespread deployment
- Scale, speed, automation. XRv-9000 vRR has a RIB capacity of 70M prefixes, eliminating the hardware limitations and addressing control plane memory requirements
- Flexible deployment options, IE: RR per service
- Feature velocity, innovating through software
- Save on infrastructure space
- Leverage the commodity hardware



RCTS RR'S DESIGN: VIRTUALIZED RR'S (VRR) OR NOT!

The kit:

- Cisco UCS C220 M5SX 1U servers
- 2x 10 core 2.20GHz Xeon 4210 64 bit CPU's
- 64GB DRAM & 2x 320GB SSD's in RAID 1
- 4-port 1Gbps Ethernet card & 2-port 10Gbps SFP+ card
- VMware ESXi 6.7.0 & Cisco IOS-XRv 9000 software





DESIGN AND TECHNOLOGIES SUMMARY: Q&A

- **How many?** 3
- **In which locations?** Lisbon, Porto and Castelo Branco
- **Hierarchical or flat design?** Flat
- **Out of path or in-line?** Out of Path
- **Same or different cluster's?** Different, each RR has its own cluster ID.
- **Virtualized hardware?** Yes
- **Per function separation?** No, but with the ability to evolve.



DESIGN AND TECHNOLOGIES SUMMARY: Q&A

- **How to avoid the identified caveats in route reflection?**
 - i. **Robustness:** By implementing 3 RR's instead of a normal set of just 2
 - ii. **Prolonged routing convergence:** RR placement near/on the primary RCTS sites and implementing BGP multipath (ADD-PATH), effectively adding a backup ready path for each prefix, improving the convergence time immensely at the cost of memory.
 - iii. **Data forwarding loop:** Validated network design
 - iv. **Reduced path diversity:** By sending more than 1/the best path (BGP Multipath/ADD PATH)
 - v. **Sub-optimal routing:** This can be accomplished by Optimal Route Reflection (ORR) or BGP multipath (ADD-PATH). By sending all the routes to a client, he can make his own decision of what path is the best based on his location. Because ADD-PATH deals with reduced path diversity, guarantees not only optimal routing but also improves convergence times, ADD-PATH was chosen.



Services Surface Scratching

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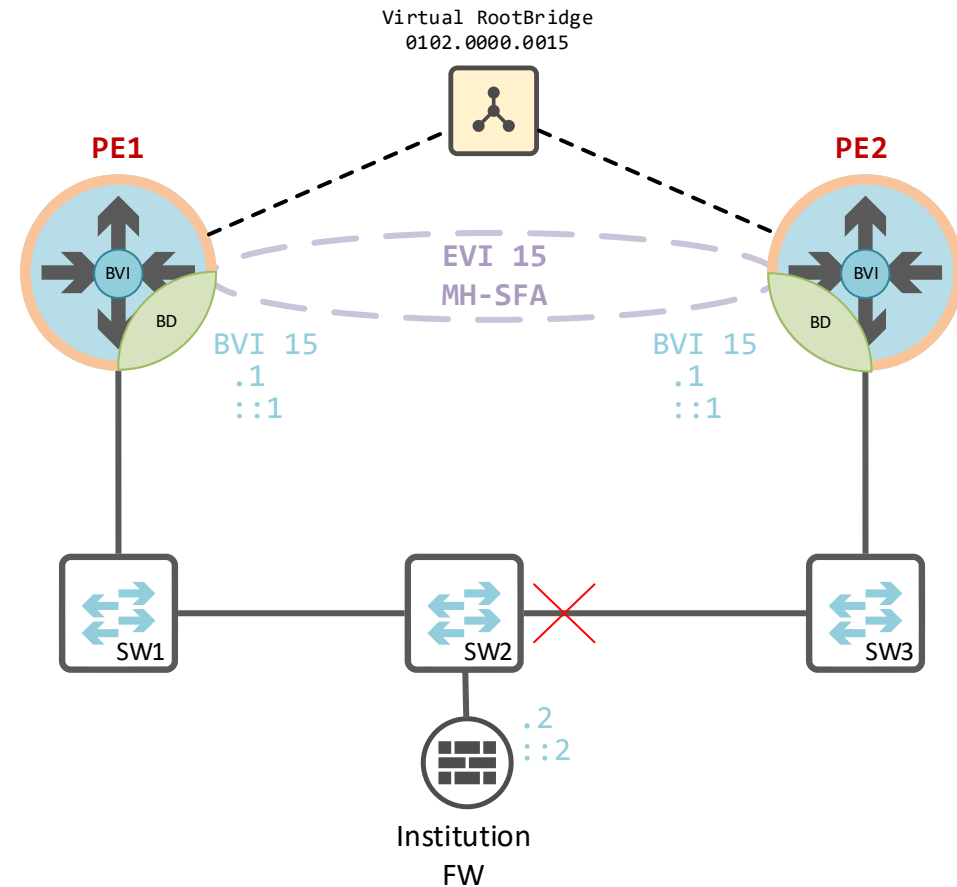
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STATIC SERVIP REDESIGNED

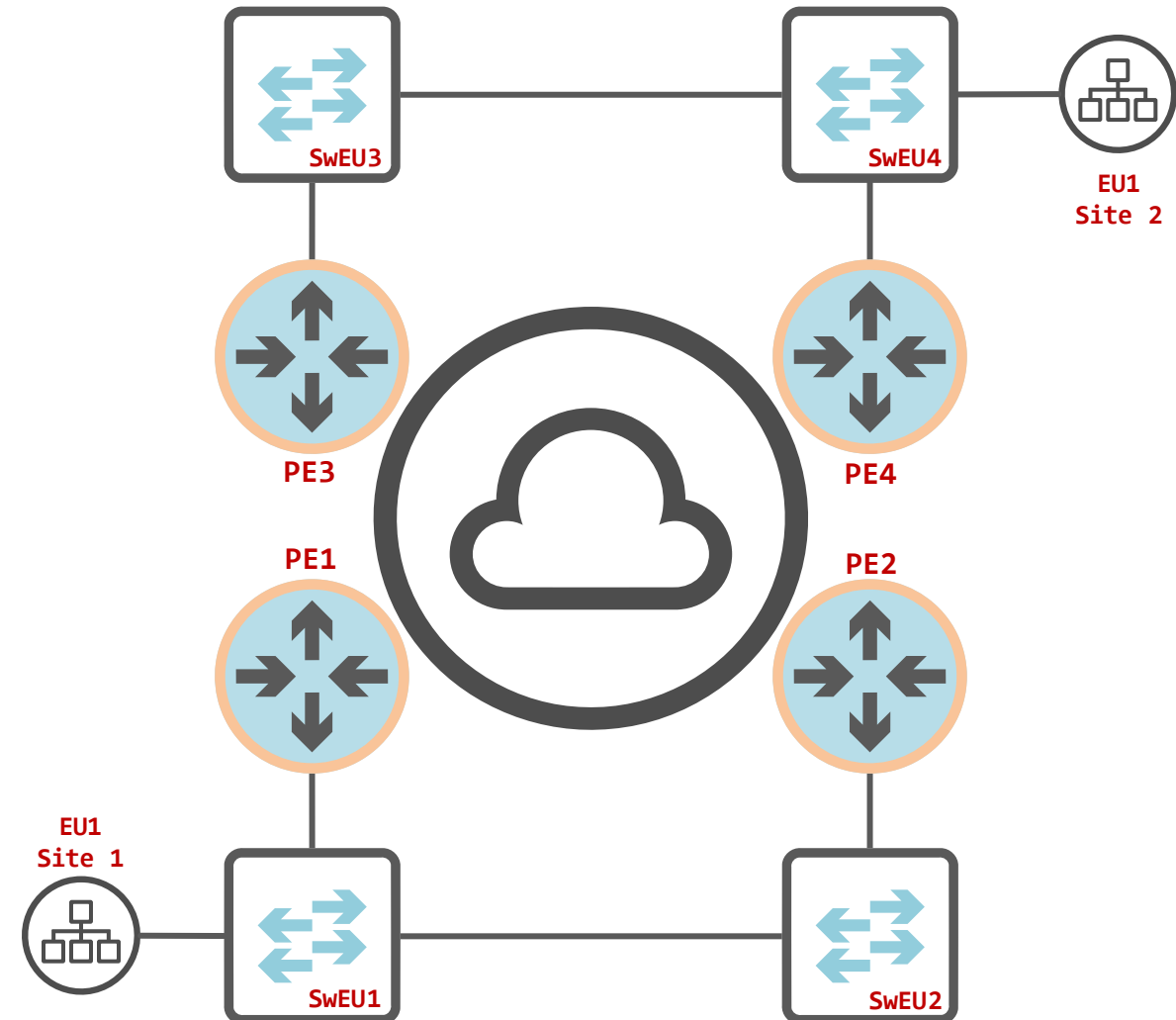
- EVPN MH SA/SFA based service: Anycast Gateway
- Migration transparent to the Institution
- L3 Redundancy with static routing
- Can accommodate redundant EU equipment's
- Sub-second convergence timers
- Single interconnect network (/30 | /64)



So... is BGP still the way to go?

SERVICE DISASTER RECOVERY

- Mac Mobility
 - No Firewall
 - L3 Redundancy
 - Fast Convergence
-
- GW Address is always the same and is distributed & Redundant
 - If VM Down in site 1, VM in site 2 Up with same ip address and GW
 - Routers 3 and 4 announce VM mac with a higher sequence number
 - No NAT needed
 - No DNS changed needed
 - **Service host/VM needs to also provide filtering (Iptables)**





Thanks Over and out

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