



Experiência no uso da tecnologia GPON em ambiente acadêmico

GTER 41 | GTS 27

12 a 14 de maio de 2016, Uberlândia - UniAlgar



Área 485 mil m² e com aproximadamente 30 mil m² construídos, a Faculdade de Ciências Aplicadas da Unicamp (FCA) foi inaugurada em 2009.

Agenda

- Motivação
- Conceitos
- Cenário
- Testes realizados e resultados
- Considerações finais e Conclusão

Motivação

- Entender a tecnologia GPON e qual o seu comportamento e convívio com a estrutura de cabeamento metálico tradicional.
- Compreender o comportamento das VLAN e as questões sobre roteamento e segurança.
- Verificar o funcionamento, desempenho e compatibilidade quanto a utilização dos sistemas internos e externos da Unicamp.
- Melhorar o gerenciamento da rede.

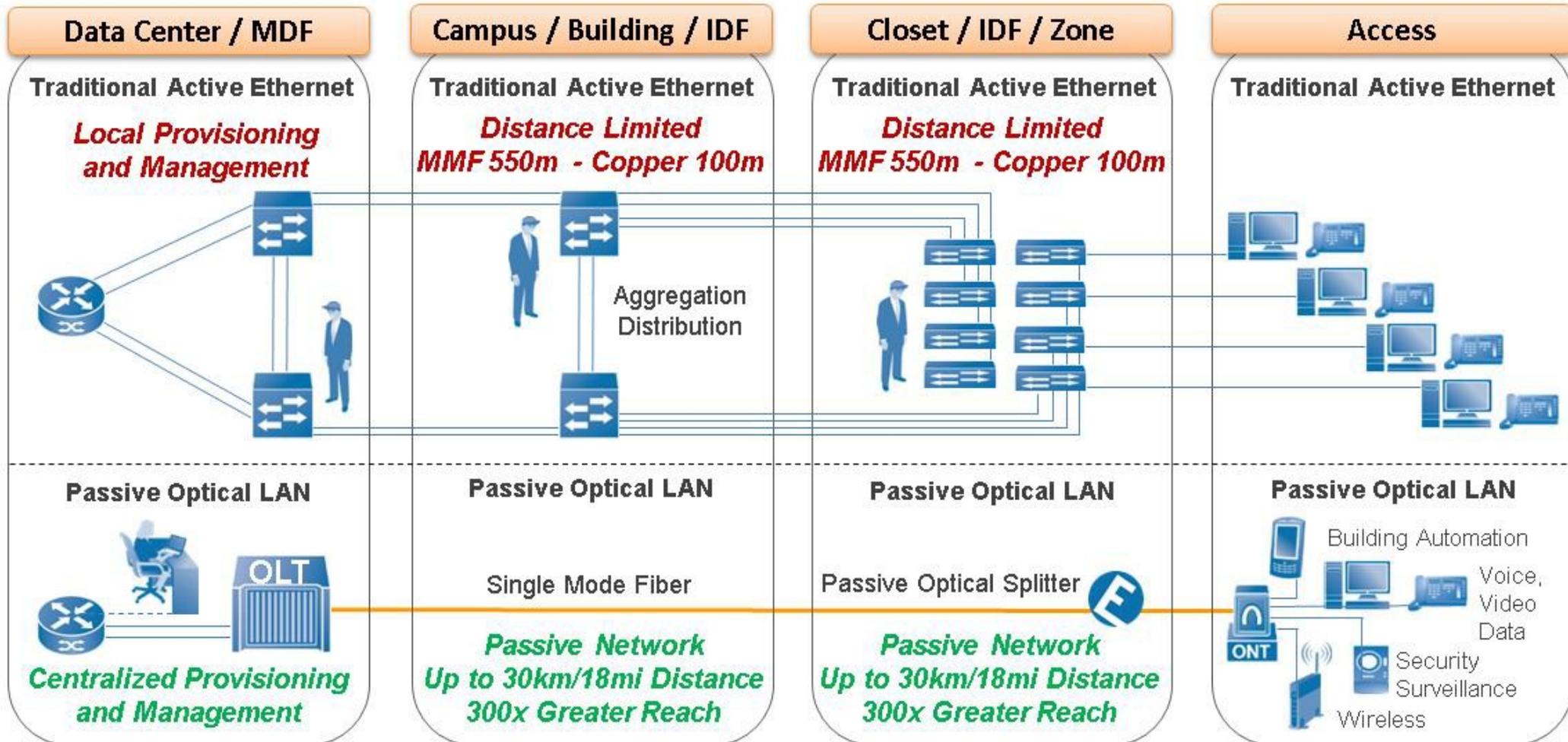
Conceitos

- Solução: Passive Optical LAN (POL)
- Tecnologia: GPON - ITU-T G.984.x
- Topologia: Fiber to the “x” – FTTx

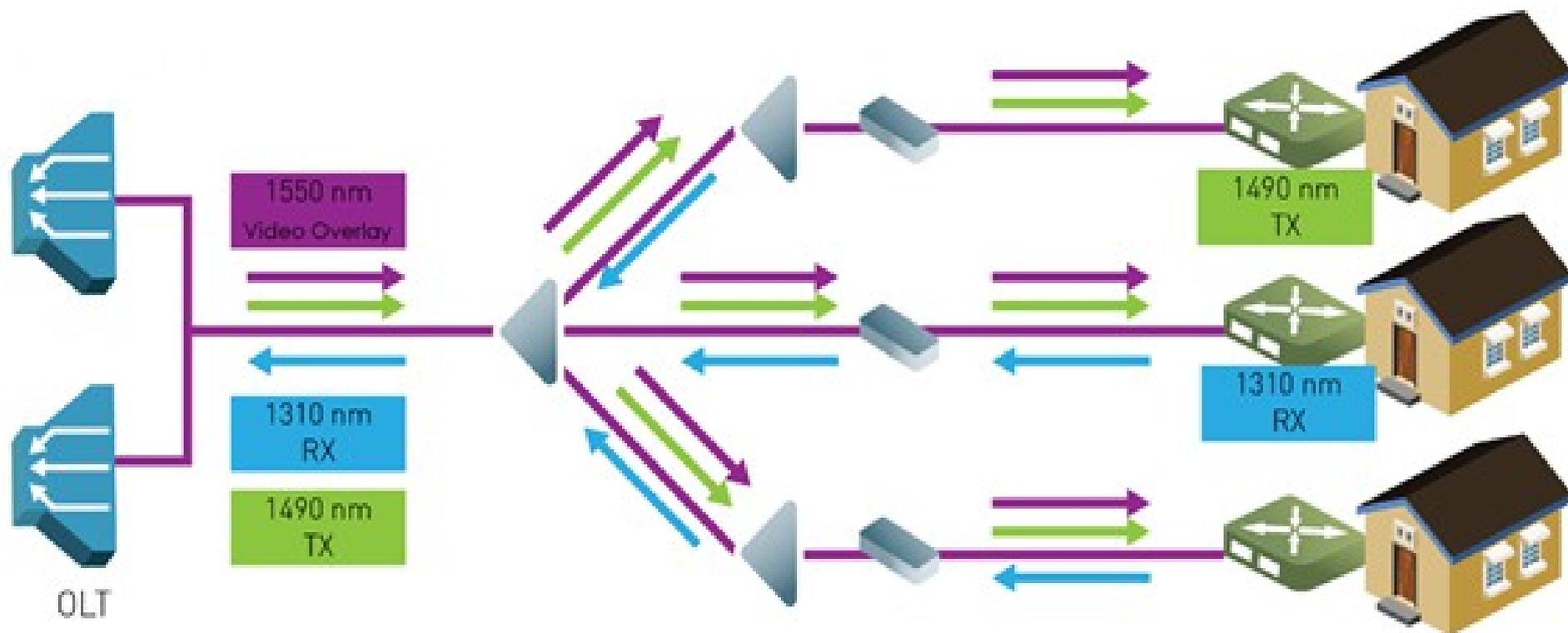
Conceitos

- OLT (Optical Line Terminal): terminal de linha óptica localizado normalmente no core da rede.
- ONU (Optical Network Unit): unidade de rede óptica localizado no usuário final.
- POS (Passive Optical Splitter): divisor passivo óptico.

Topologia



Topologia



Taxas de downstream de 2,5 Gbps e de upstream de 1,25 Gbps

Topologia

Splitters

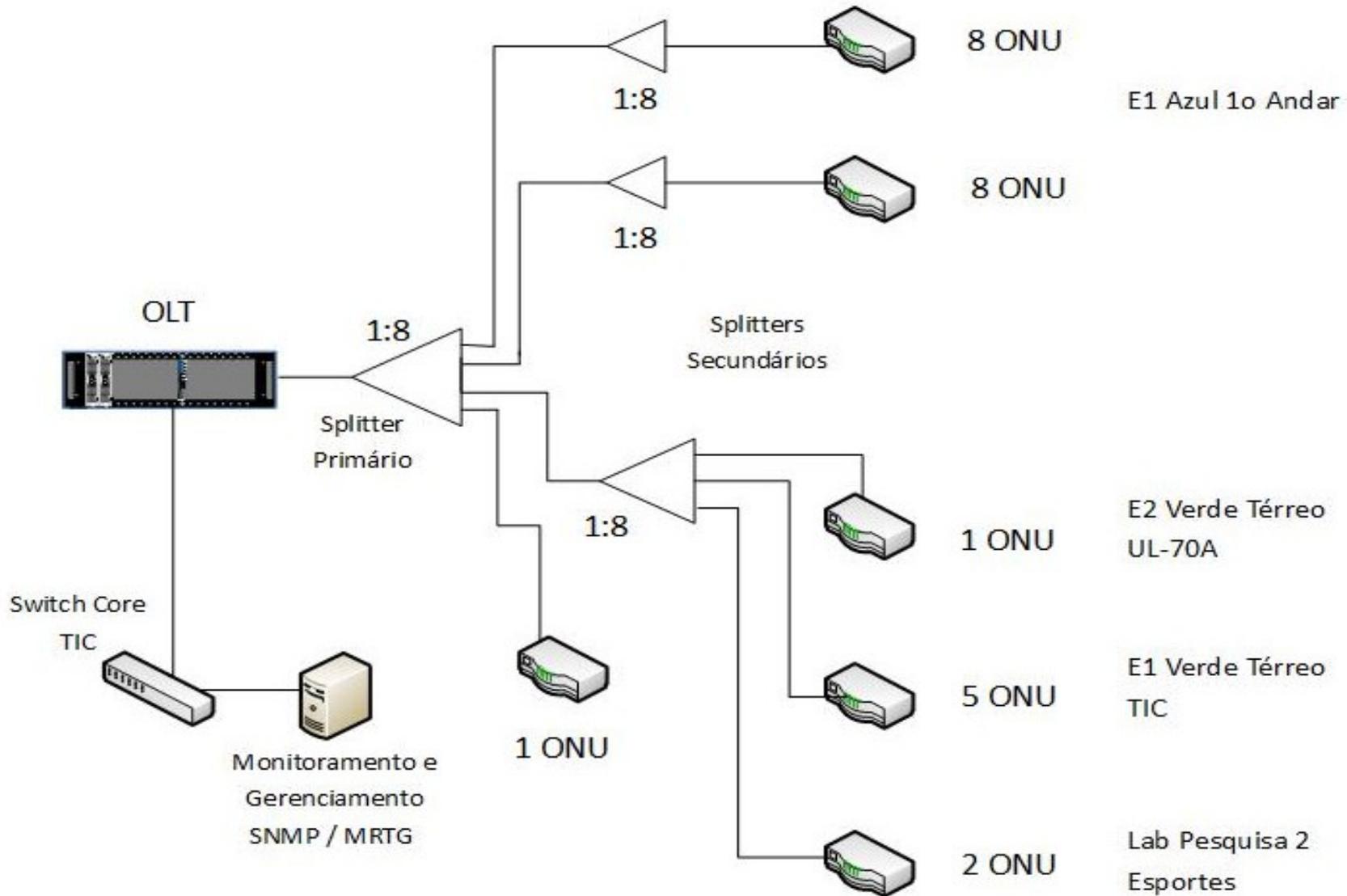
Especificação	1X2	1X4	1X8	1X16	1X32	1X64
Banda Óptica Passante	Full Spectrum - 1260 ~1650nm					
Perda de Inserção Máxima	3,7 dB	7,1 dB	10,5 dB	13,7 dB	17,1 dB	20,5 dB
Uniformidade	0,5 dB	0,6 dB	1,0 dB	1,3 dB	1,5 dB	1,7 dB

Potência Óptica de Recepção nas ONU para sincronia:
-8dBm ~ -28dBm

Cenário

- Convite oferecido as empresas que oferecem este tipo de solução.
- Participaram a Furukawa e a Parks / Prysmian
- Cenário proposto igual para as empresas participantes.
- Ser montado junto a infraestrutura de rede atual e não em um ambiente de teste separado.
- Focar no funcionamento da tecnologia e no convívio com os sistemas atuais e não nos equipamentos instalados.

Cenário



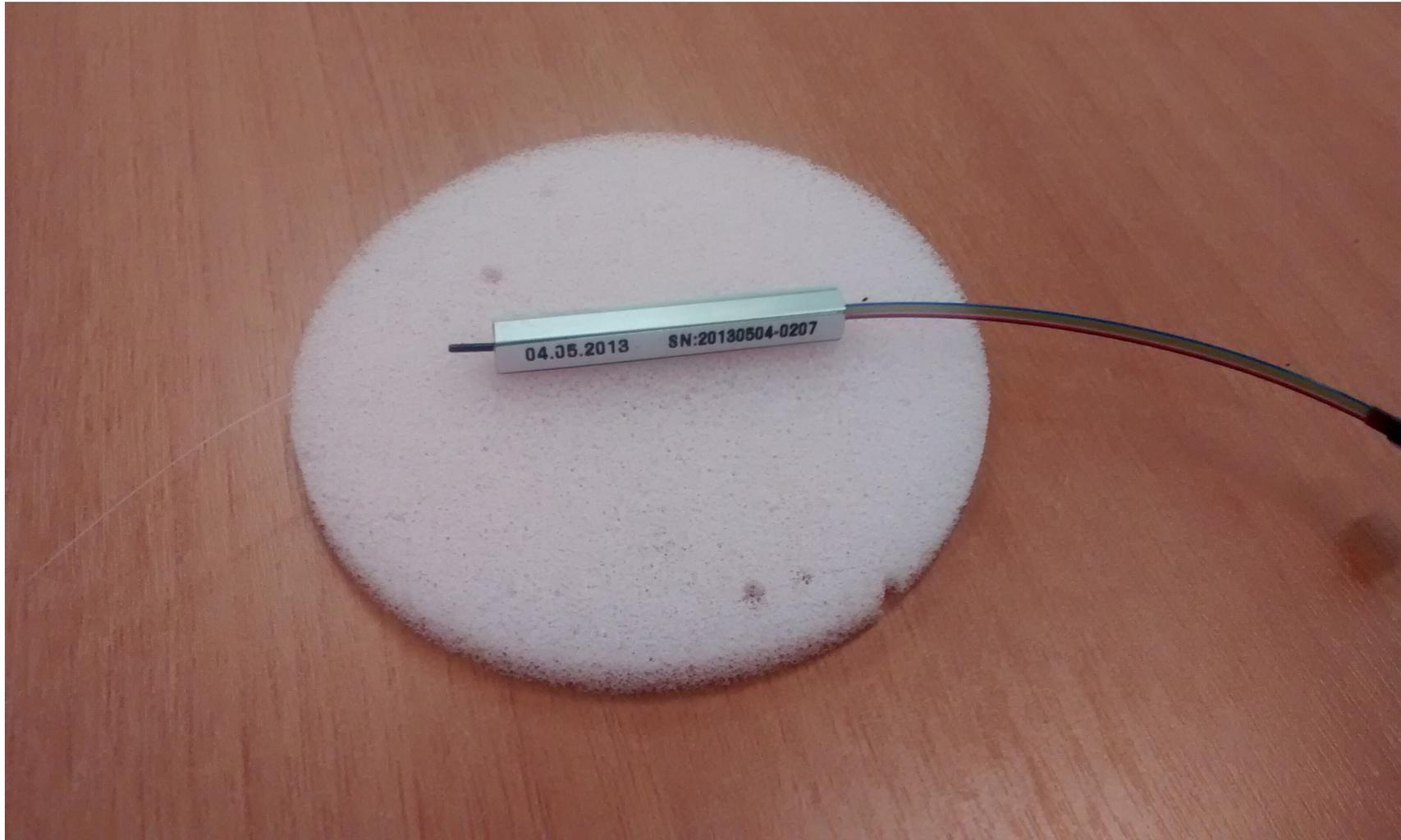
Cenário

- Laboratório Informática
 - 16 Desktops/Notebooks
- Helpdesk
 - 2 Impressoras
 - 2 Desktops Atendimento
- Biblioteca
 - 2 Telefones IP
 - 8 Desktops Consulta
 - 2 Desktops Atendimento

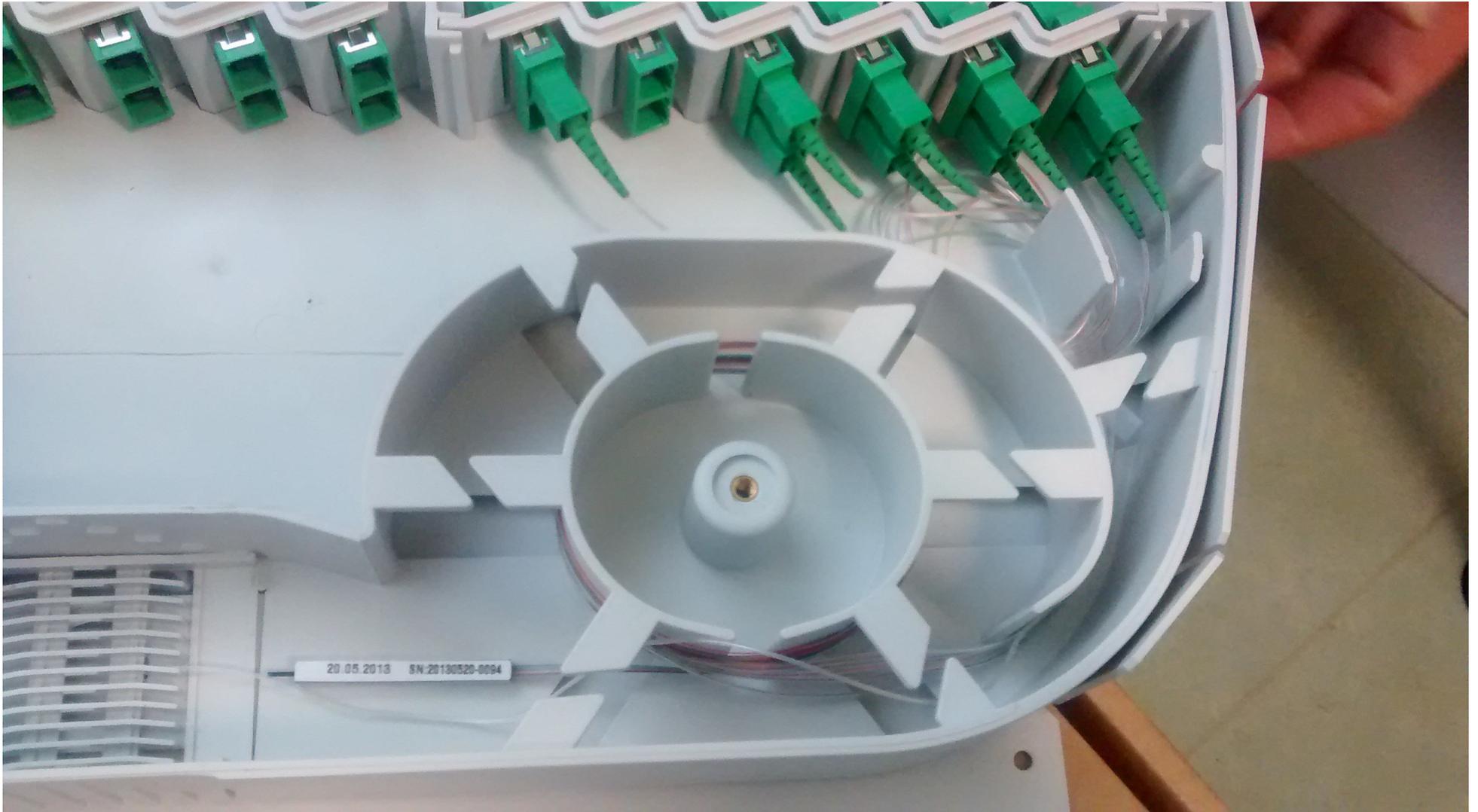
Cenário

- Videoconferência
 - 1 Equipamento de Videoconferência
 - 1 Desktop
- TIC
 - 2 Câmeras IP
 - 4 Telefones IP
 - 1 Access Point
 - 5 Desktops
 - 1 Controle de Acesso
- Laboratório Pesquisa
 - 2 Telefones IP
 - 2 Desktops

Parks / Prysman



Parks / Prysmian



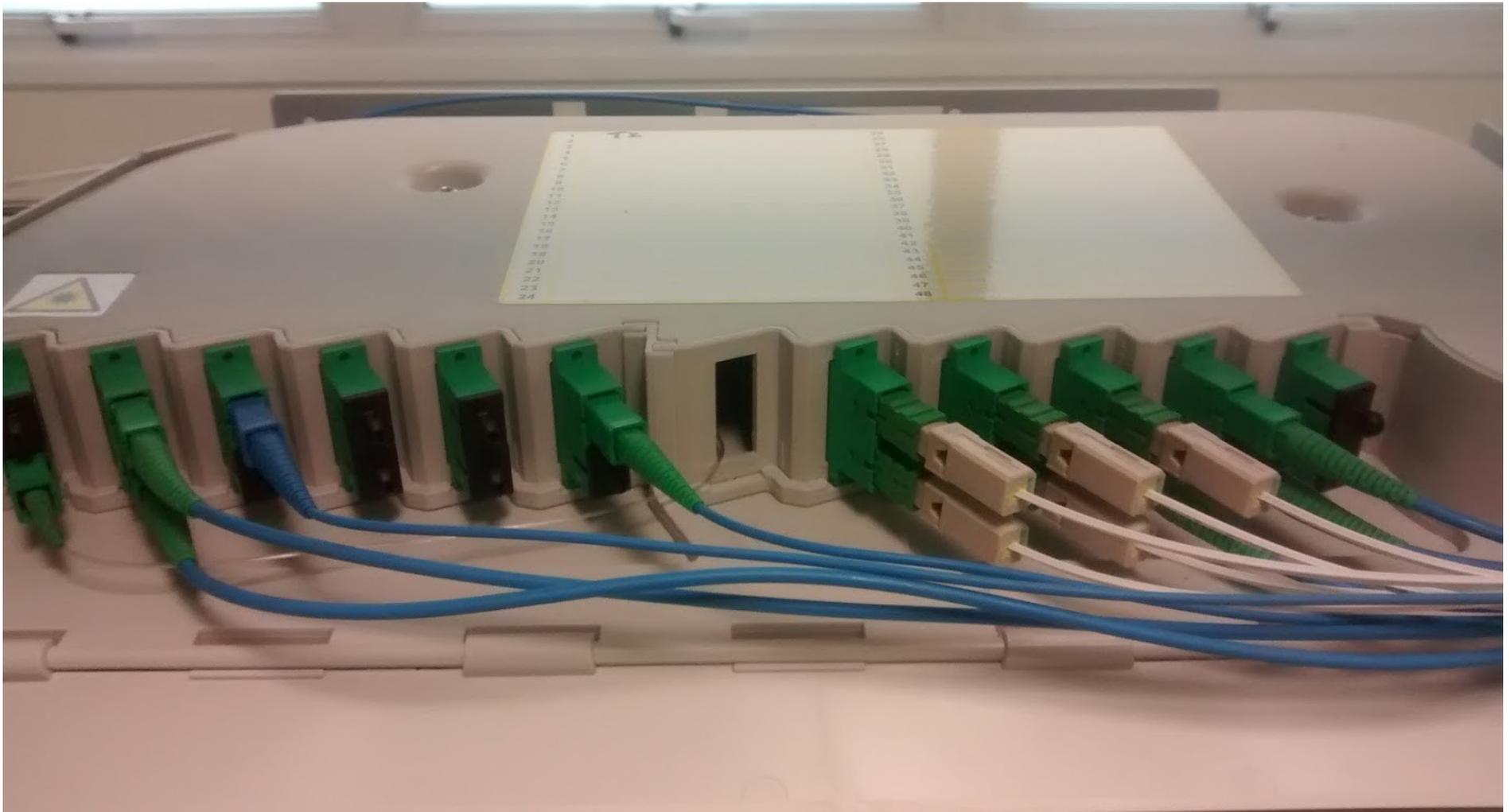
Parks / Prysmian



Parks / Prysmian



Parks / Prysmian



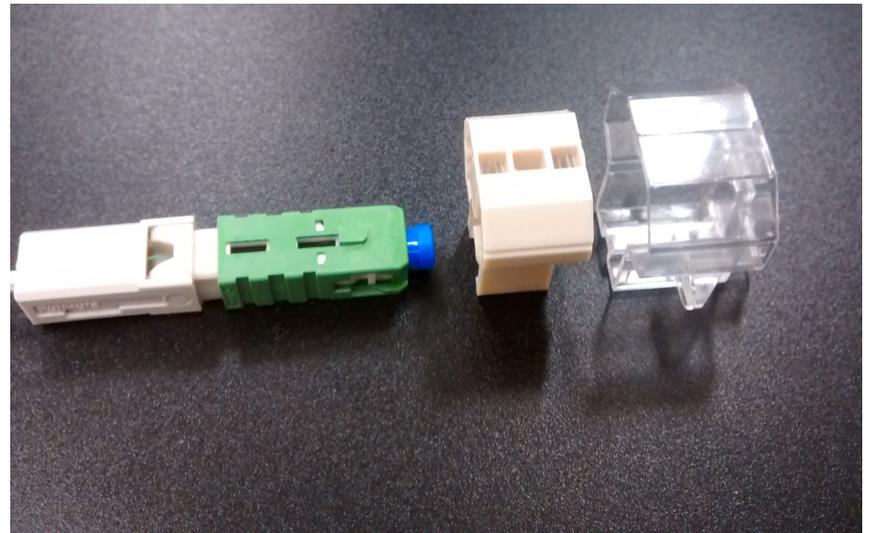
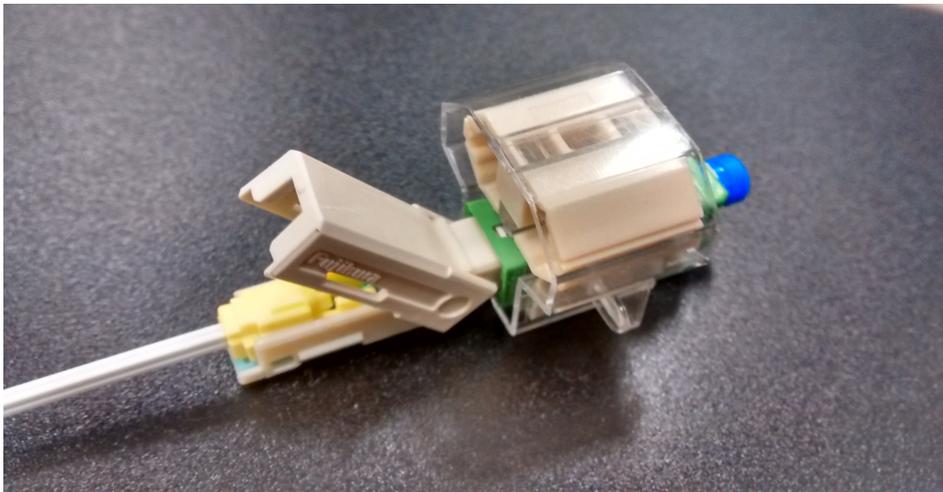
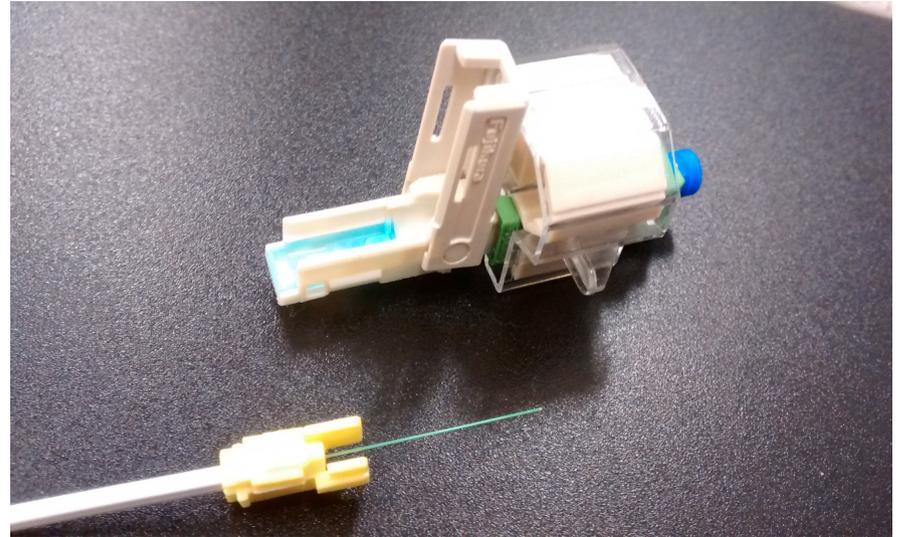
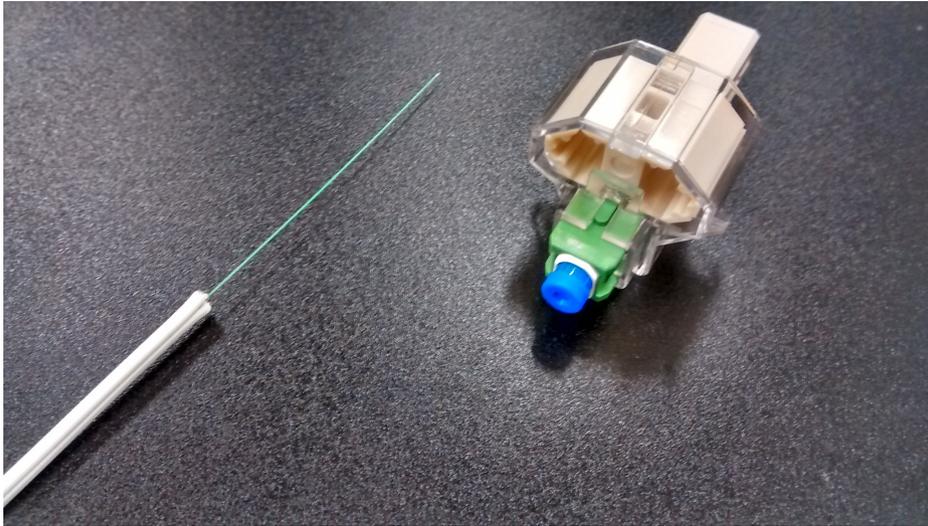
Parks / Prysmian



Parks / Prysmian



Parks / Prysmian



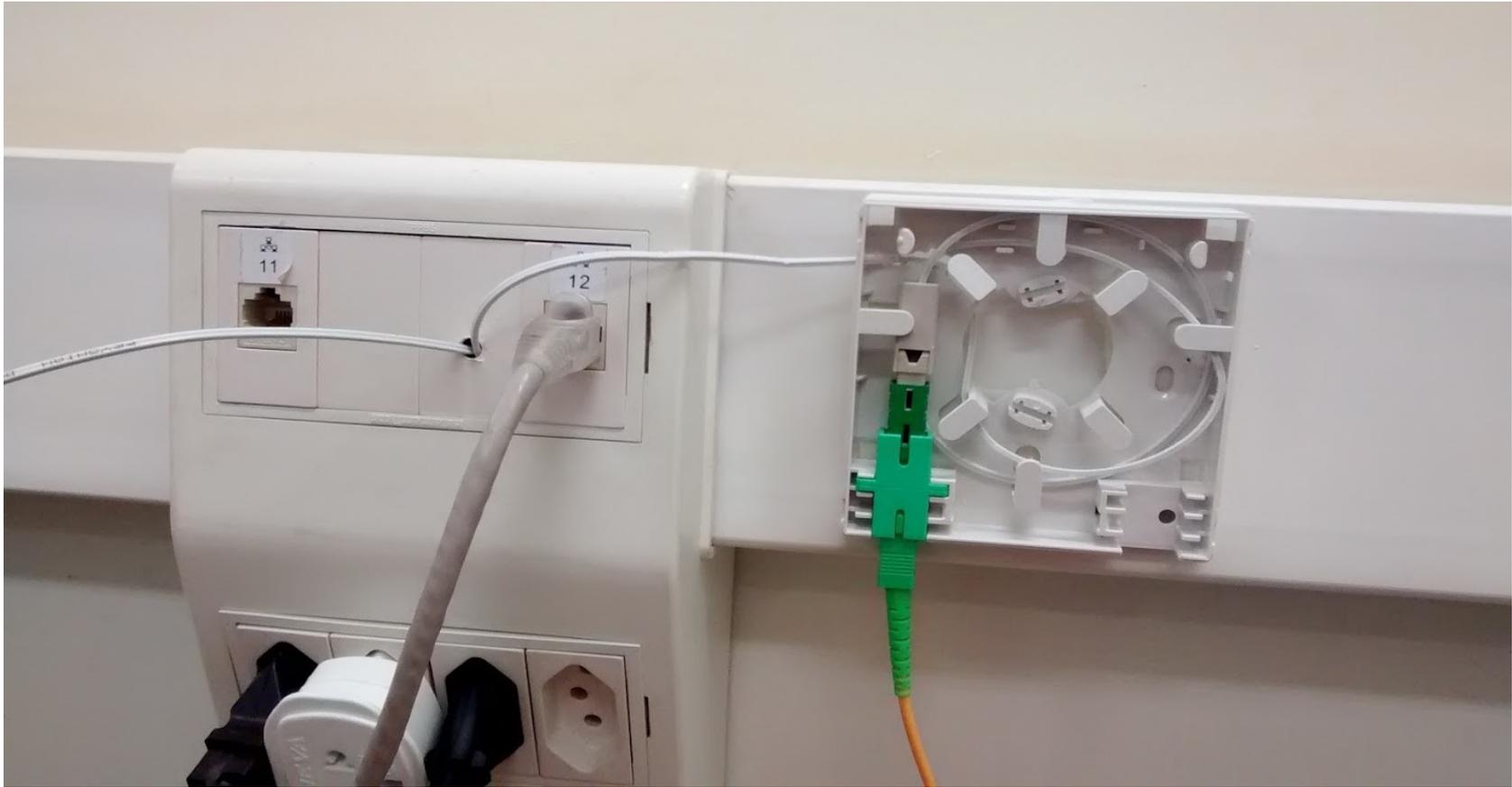
Parks / Prysmian



Parks / Prysmian



Parks / Prysmian



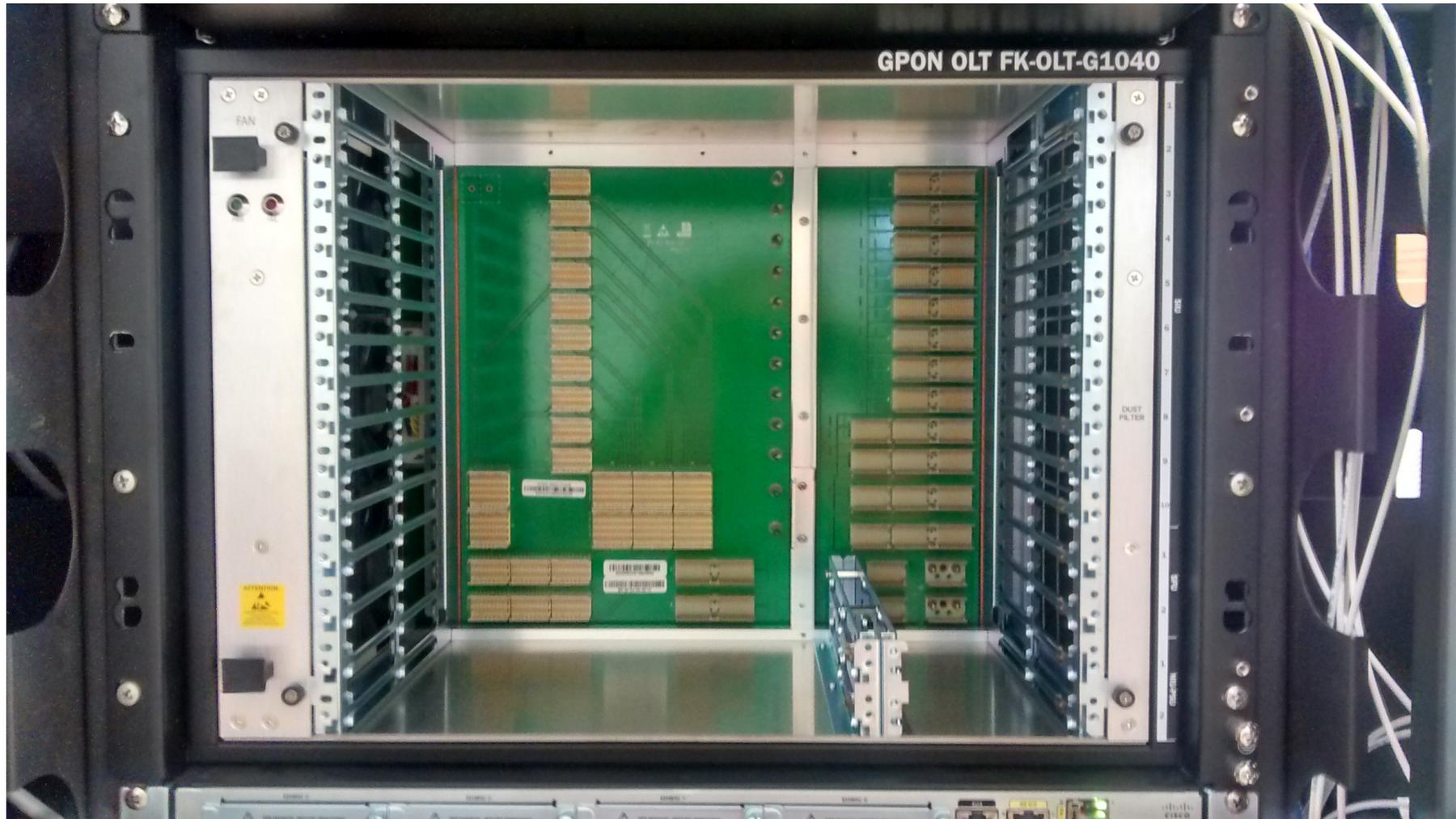
Parks / Prysmian



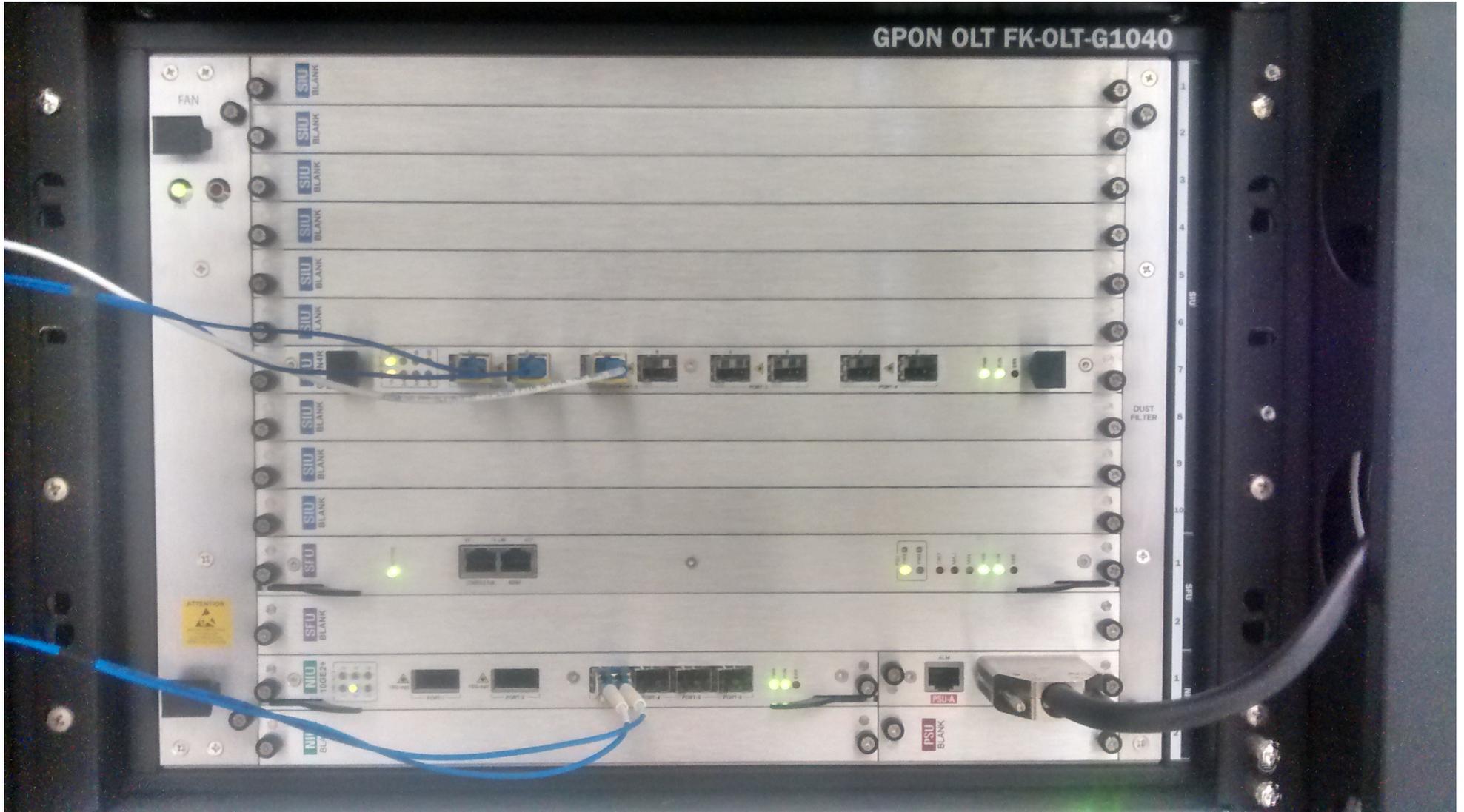
Parks / Prysmian



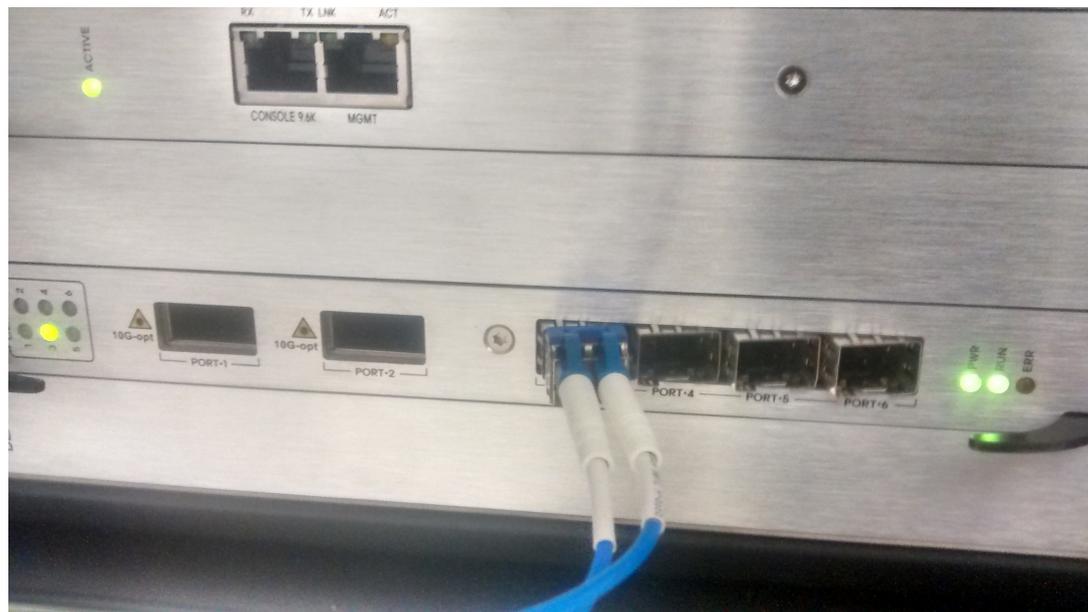
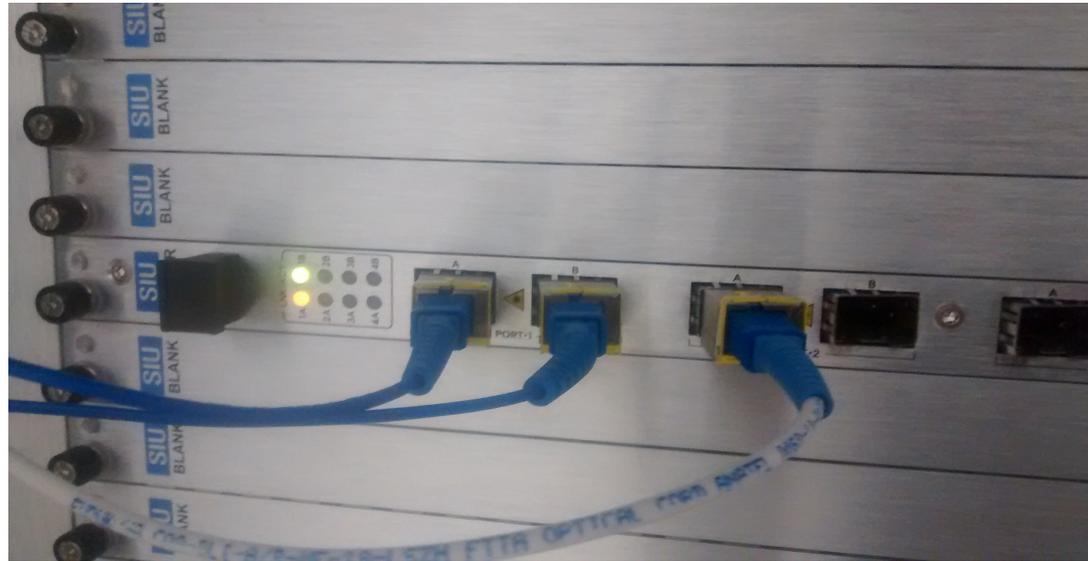
Furukawa



Furukawa



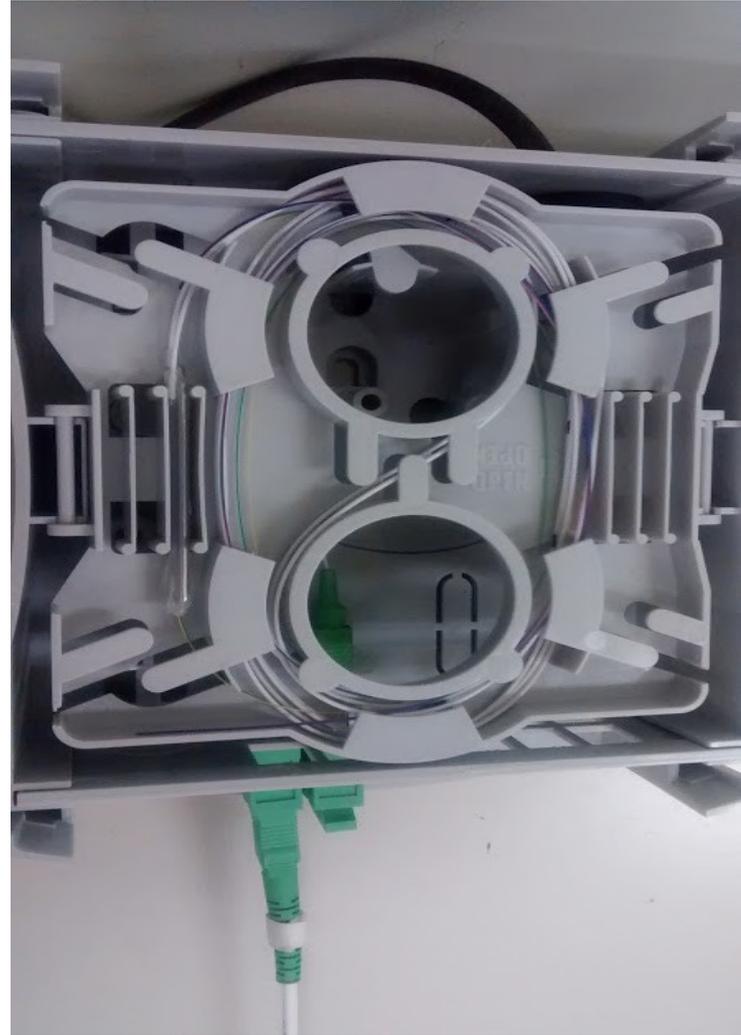
Furukawa



Furukawa



Furukawa



Furukawa



Furukawa



Furukawa



Furukawa



Parks / Prysmian e Furukawa



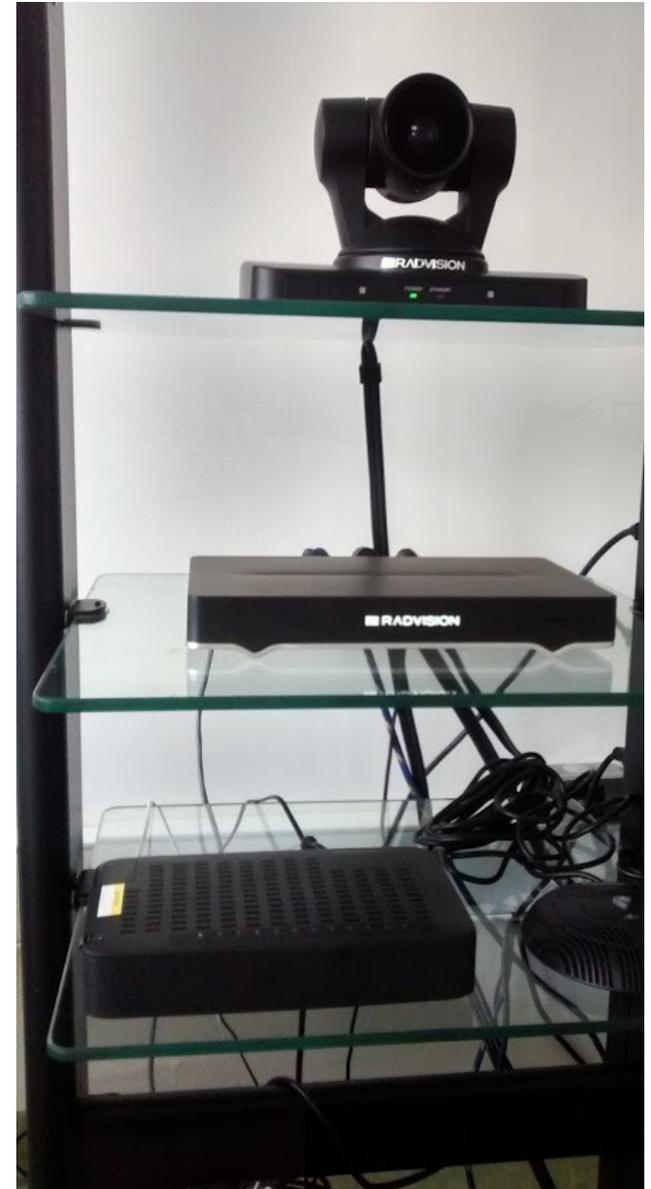
Parks / Prysman e Furukawa



Parks / Prysmian e Furukawa



Parks / Prysman e Furukawa



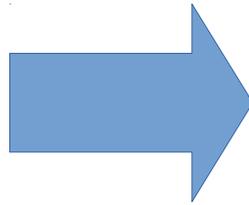
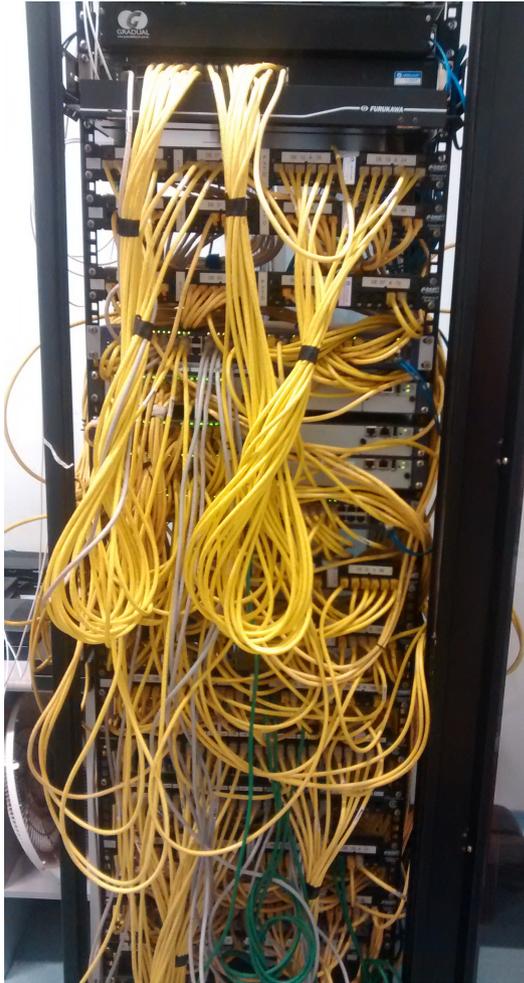
Parks / Prysmian e Furukawa



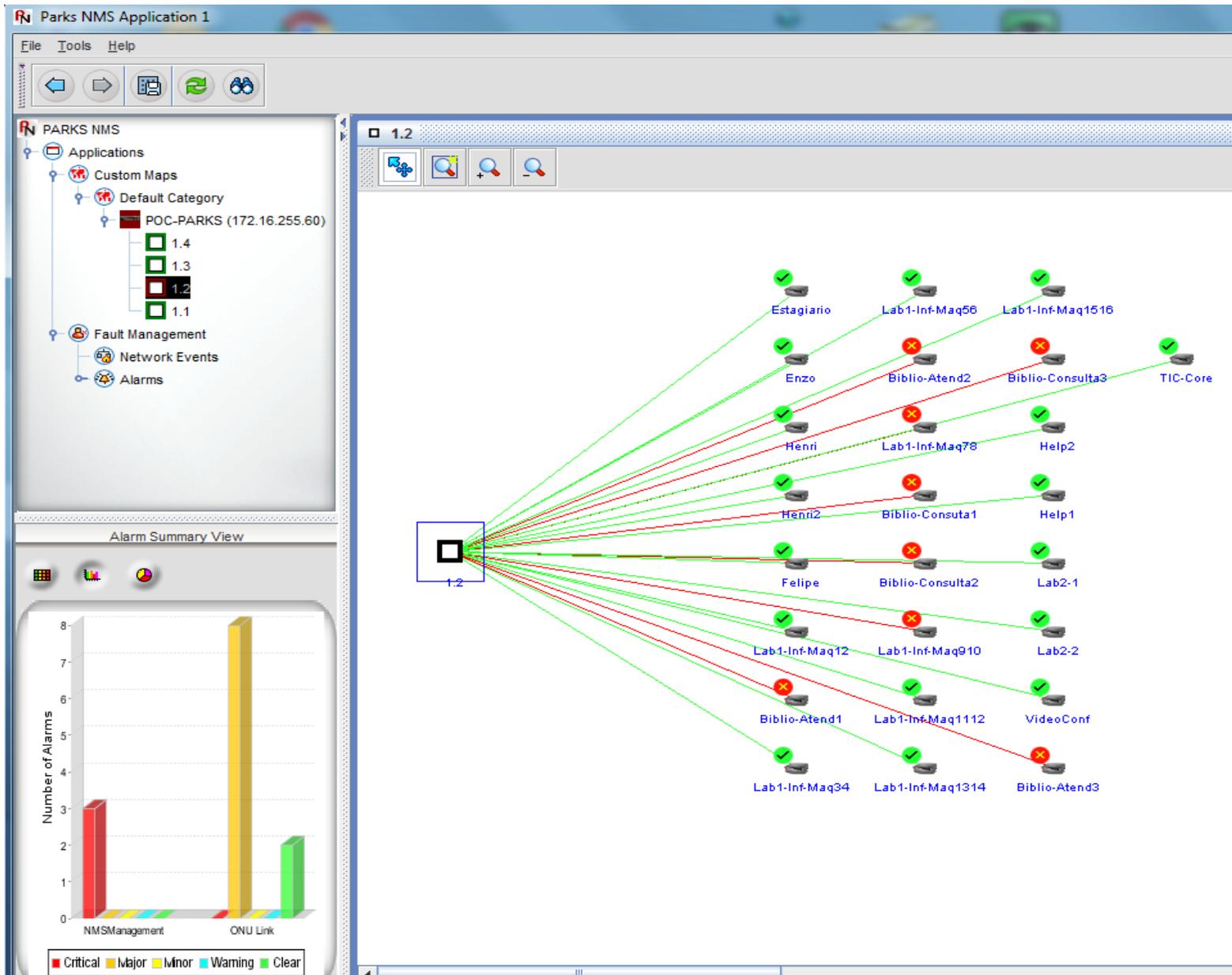
Parks / Prysmian e Furukawa



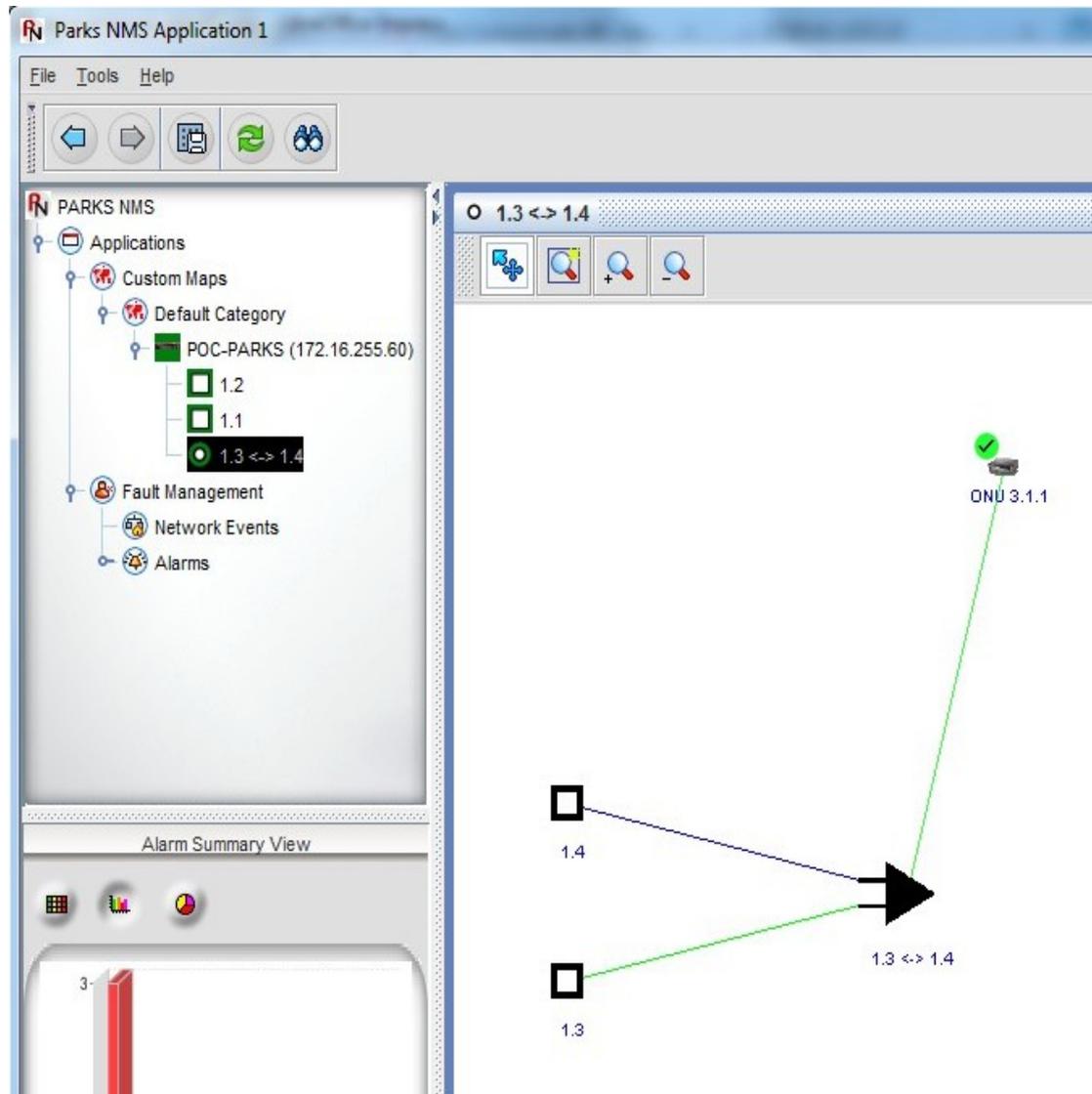
Rack / Splitter



Gerenciamento NMS Parks



Gerenciamento NMS Parks



Gerenciamento NMS Parks

Status: ✔ Active **Uptime:** 2 days, 1 hours, 0 minutes, 38 seconds.
Power Level (RX): -17.23 dBm **Power Level (TX):** +2dBm (Tolerance +/- 2dB)

Refresh

Basic Information

Model	Fiberlink 2100B (SFU)	Boot Version	1.0.6	Software Version	2.6.0
Alias	<input type="text" value="Henri2"/>				
IP	<input type="text"/>	Network Mask	<input type="text"/>	Gateway	<input type="text"/>
Serial Number	PRKS00B813C5	Password	<input type="password" value="....."/>		<i>Optional</i>
L2 Transparency	<input type="text" value="Disabled"/>	Enable PM	<input type="text" value="Disabled"/>		

Reset

Edit

Remove

Save ONU Information

Close

Telnet

SSH

Config Web

Gerenciamento NMS Parks

Add ONU Profile / Flow

Profile Name

ONU Flow

UNI Port

Uni Port Interfaces 1 2 3 4

IP Host

VEIP

E1

VLAN ... COS

Bandwidth Profile: ...

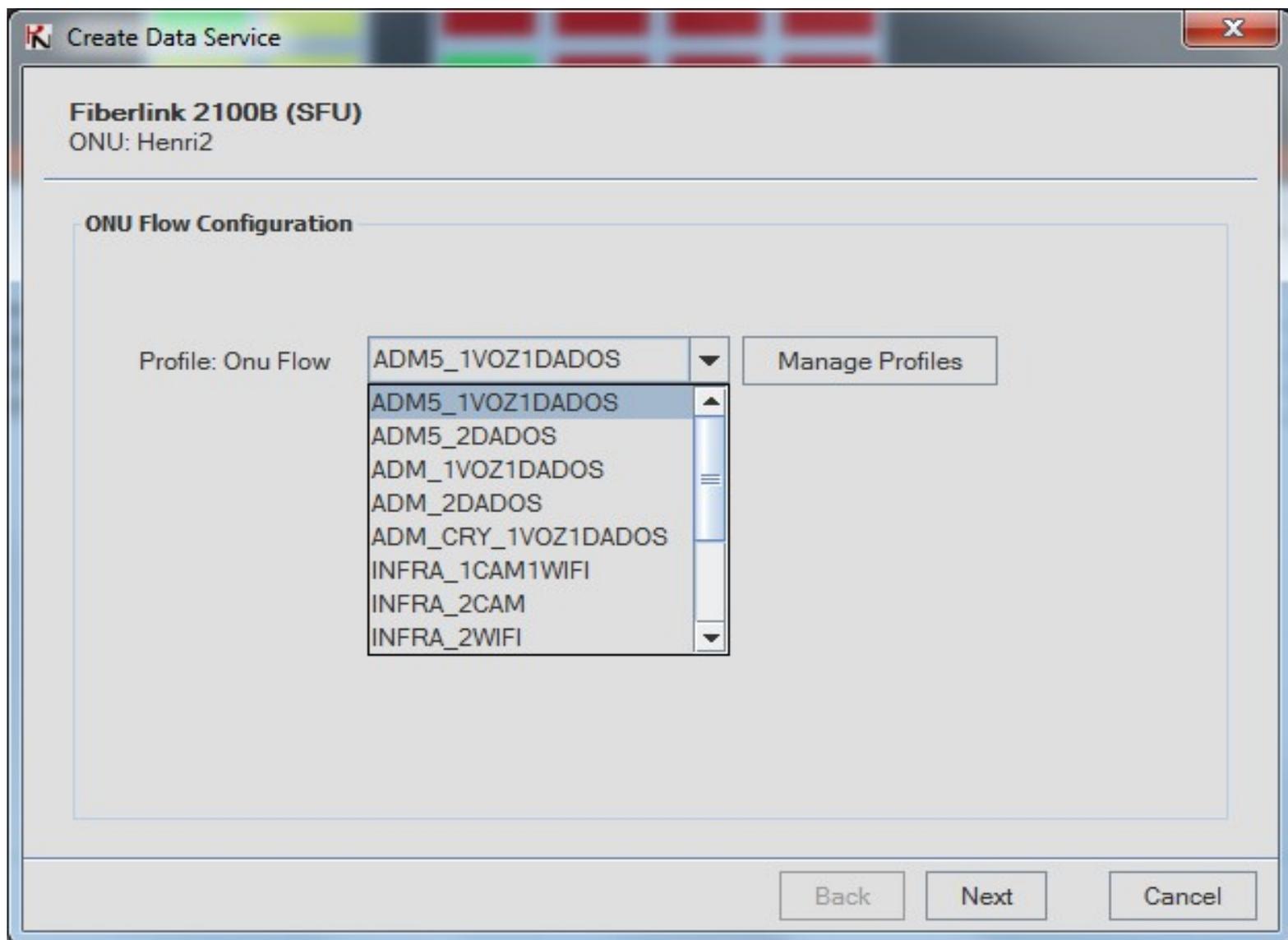
Service Shared

ONU Rate Limit

Downstream Bandwidth Kbps

Encryption Mode

Gerenciamento NMS Parks



Gerenciamento NMS Parks

The screenshot displays the NMS Parks interface for a device named "FiberLink 20004S". The top status bar shows power (PWR) and system (SYS) indicators, along with a console port icon. A grid of port status indicators is visible, with GP 1/2 and GP 1/4 in yellow, and GE 0/1, GE 0/3, GE 0/5, and GE 0/7 in red. The main area features a "Profiles" table and a left-hand navigation tree.

Index	Name	Traffic Type	Fixed Bandwidth	Assured Bandwidth	Maximum Bandwidth	Use
2	Gerencia	Management - T-CONT 3	-	1024	1152	ONUs
3	Dados_1G	Internet - T-CONT 4	-	-	1024000	ONUs
7	Dados_512M	Internet - T-CONT 4	-	-	512000	ONUs
8	Dados_128M	Internet - T-CONT 4	-	-	128000	ONUs
9	Voz	VOIP - T-CONT 1	4096	-	-	ONUs

Navigation Tree:

- Transceiver Information
 - Transceiver Information
- Loopback
- GPON
 - Device(1)
 - PON(1)
 - PON(2)
 - PON(3)
 - PON(4)
 - Profiles
 - Bandwidth
 - Flow

Gerenciamento NMS Parks

Fiberlink 20004S - [IP: 172.16.255.60 - Name: POC-PARKS]

Parks

GP 1/2 GP 1/4 GE 0/1 GE 0/3 GE 0/5 GE 0/7

GP 1/1 GP 1/3 GE 0/0 GE 0/2 GE 0/4 GE 0/6

RST MGT0

FiberLink
20004S

CONSOLE

0
1

PWR SYS

PM Stats
ONU Configuration
Blacklist
ONUs

- Enzo
- Henri
- Henri2
- Felipe
- Lab1-Inf-Maq12
- Biblio-Atend1
- Lab1-Inf-Maq34
- Lab1-Inf-Maq56
- Biblio-Atend2
- Lab1-Inf-Maq78
- Biblio-Consuta1
- Biblio-Consulta2
- Lab1-Inf-Maq910
- Lab1-Inf-Maq1112
- Lab1-Inf-Maq1314

ONU Serial Number	ONU Alias	Name	Traffic Type	Bandwidth (Fix/Ass/Max)	ONU Rate Limit	Encryption ...	VLAN	Ethernet Ports	Vlan (GEM P...	L...	S...
PRKS00B81574	Enzo	ADM_1VOZ1DADOS	Management -...	0 / 1024 / 1152	Disabled	Disabled	5	IP Host	1031	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B81574	Enzo	ADM_1VOZ1DADOS	Internet - T-C...	0 / 0 / 1024000	Disabled	Disabled	10	1	1032	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B81574	Enzo	ADM_1VOZ1DADOS	VOIP - T-CON...	4096 / 0 / 0	Disabled	Disabled	13	2	1033	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813DF	Henri	ADM_1VOZ1DADOS	Management -...	0 / 1024 / 1152	Disabled	Disabled	5	IP Host	1028	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813DF	Henri	ADM_1VOZ1DADOS	Internet - T-C...	0 / 0 / 1024000	Disabled	Disabled	10	1	1029	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813DF	Henri	ADM_1VOZ1DADOS	VOIP - T-CON...	4096 / 0 / 0	Disabled	Disabled	13	2	1030	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C5	Henri2	ADM_CRY_1VOZ1DADOS	Management -...	0 / 1024 / 1152	Disabled	Enabled	5	IP Host	1037	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C5	Henri2	ADM_CRY_1VOZ1DADOS	Internet - T-C...	0 / 0 / 1024000	Disabled	Enabled	10	1	1038	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C5	Henri2	ADM_CRY_1VOZ1DADOS	VOIP - T-CON...	4096 / 0 / 0	Disabled	Enabled	13	2	1084	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813FF	Felipe	ADM_1VOZ1DADOS	Management -...	0 / 1024 / 1152	Disabled	Disabled	5	IP Host	1034	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813FF	Felipe	ADM_1VOZ1DADOS	Internet - T-C...	0 / 0 / 1024000	Disabled	Disabled	10	1	1035	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813FF	Felipe	ADM_1VOZ1DADOS	VOIP - T-CON...	4096 / 0 / 0	Disabled	Disabled	13	2	1036	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813D6	Lab1-Inf-Maq12	LAB3_2DADOS	Management -...	0 / 1024 / 1152	Disabled	Disabled	5	IP Host	1043	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813D6	Lab1-Inf-Maq12	LAB3_2DADOS	Internet - T-C...	0 / 0 / 512000	Disabled	Disabled	8	1 / 2	1044	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C2	Biblio-Atend1	ADM_1VOZ1DADOS	Management -...	0 / 1024 / 1152	Disabled	Disabled	5	IP Host	1069	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C2	Biblio-Atend1	ADM_1VOZ1DADOS	Internet - T-C...	0 / 0 / 1024000	Disabled	Disabled	10	1	1070	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C2	Biblio-Atend1	ADM_1VOZ1DADOS	VOIP - T-CON...	4096 / 0 / 0	Disabled	Disabled	13	2	1071	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C7	Lab1-Inf-Maq34	LAB3_2DADOS	Management -...	0 / 1024 / 1152	Disabled	Disabled	5	IP Host	1055	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C7	Lab1-Inf-Maq34	LAB3_2DADOS	Internet - T-C...	0 / 0 / 512000	Disabled	Disabled	8	1 / 2	1056	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C0	Lab1-Inf-Maq56	LAB3_2DADOS	Management -...	0 / 1024 / 1152	Disabled	Disabled	5	IP Host	1057	<input type="checkbox"/>	<input checked="" type="checkbox"/>
PRKS00B813C0	Lab1-Inf-Maq56	LAB3_2DADOS	Internet - T-C...	0 / 0 / 512000	Disabled	Disabled	8	1 / 2	1058	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Apply Undo Refresh Save Configuration Refresh Shelf

Gerenciamento NMS Parks

Parks NMS Application 1

File Edit View Actions Tools Help

Network Events

Network Events

Total 71 Displaying 22 to 71 Page Length 50

Status	Hostname	Source	Date	Message
Major	POC-PARKS	172.16.255.60	Nov 18,2015 10:43:56 AM	ONU Status Link LOSI - Device 1, PON 2, Serial Number 00B813DF
Info	143.106.230.16	143.106.230.16	Nov 18,2015 10:15:33 AM	New primary server
Clear		Client_143.106.230.16	Nov 17,2015 01:18:32 PM	Threshold reset : Value: 37 Data: JVMPD_CLIENT_14500_MonitorThread
Info	POC-PARKS	172.16.255.60	Nov 17,2015 09:53:25 AM	Onu is Ready to Configuration - Device 1, PON 2, Serial Number 00B813C
Info	POC-PARKS	172.16.255.60	Nov 17,2015 09:53:25 AM	Onu is Ready to Configuration - Device 1, PON 2, Serial Number 00B813C
Info	POC-PARKS	172.16.255.60	Nov 17,2015 09:53:25 AM	Onu is Ready to Configuration - Device 1, PON 2, Serial Number 00B813C
Info	POC-PARKS	172.16.255.60	Nov 17,2015 09:53:25 AM	Onu is Ready to Configuration - Device 1, PON 2, Serial Number 00B813C
Info	POC-PARKS	172.16.255.60	Nov 17,2015 09:53:25 AM	Onu is Ready to Configuration - Device 1, PON 2, Serial Number 00B813C
Info	POC-PARKS	172.16.255.60	Nov 17,2015 09:53:25 AM	Onu is Ready to Configuration - Device 1, PON 2, Serial Number 00B813C
Info	POC-PARKS	172.16.255.60	Nov 17,2015 09:53:25 AM	Onu is Ready to Configuration - Device 1, PON 2, Serial Number 00B813C
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813DA
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813D7
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813D6
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813C8
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813C7
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813C0
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813BB
Clear	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	ONU Status Link UP - Device 1, PON 2, Serial Number 00B813D1
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813C7
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:37 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813D6
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:36 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813BB
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:36 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813C8
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:35 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813D7
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:35 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813DA
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:35 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813C0
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:34 AM	PON Discovery- Device 1, PON 2, Serial Number 00B813D1
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:14 AM	ONU Status Link LOSI - Device 1, PON 2, Serial Number 00B813BB
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:14 AM	ONU Status Link LOSI - Device 1, PON 2, Serial Number 00B813D7
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:14 AM	ONU Status Link LOSI - Device 1, PON 2, Serial Number 00B813DA
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:14 AM	ONU Status Link LOSI - Device 1, PON 2, Serial Number 00B813D1
Major	POC-PARKS	172.16.255.60	Nov 17,2015 09:52:14 AM	ONU Status Link LOSI - Device 1, PON 2, Serial Number 00B813C8

Alarm Summary View

Number of Alarms

NMSManagement ONU Link

Legend: Critical Major Minor Warning Clear

Gerenciamento Furukawa

Planos de Serviços Topologia **Equipamentos** Alarmes Usuários PreferênciasOlá, Henri
Minha Conta | Sair

Listar ONT
Listar OLT
Cadastrar OLT

Equipamento - Listar ONT

Busca

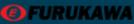
OLT: MAC: Plano CRM:

Buscar

Status ADM
● Provisionado/Provisionando ● Importado ● Inativo

Status OP
● Ativo ● Pendente ● Inativo

ADM	OP	Origem	MAC	Plano OLT	Plano CRM	ID			
●	●	POC-FURUKAWA > olt[26]	B8-26-D4-09-B4-40	Lab3-Inf			Detalhes	Provisionar	Desprovisionar
●	●	POC-FURUKAWA > olt[26]	B8-26-D4-09-B1-52	Lab3-Inf			Detalhes	Provisionar	Desprovisionar
●	●	POC-FURUKAWA > olt[26]	B8-26-D4-09-B7-20	Lab3-Inf			Detalhes	Provisionar	Desprovisionar
●	●	POC-FURUKAWA > olt[26]	B8-26-D4-09-B3-A8	Lab3-Inf			Detalhes	Provisionar	Desprovisionar

v. 1.21.9

Gerenciamento Furukawa

AllSys
GPON PROVISIONING

Olá, Henri
Minha Conta | Sair

Planos de Serviços | Topologia | Equipamentos | Alarmes | Usuários | Preferências

Listar ONT
Listar OLT
Cadastrar OLT

GPONAR
LMM/ICT
1A 1B 2A 2B 3A 3B 4A 4B
PORT 1 PORT 2 PORT 3 PORT 4
PWR RUN ERR

SFU
ACTIVE
FIX TXLINK ADT
CONSOLE MBMT
PSU
PWR A PWR B
CRIT M01 M02 M03
PWR RUN ERR

NUU
10G EP+
1 2 3 4 5 6
10G-opt 10G-opt
PORT 1 PORT 2
PWR RUN ERR
ALM 48/60V max 17A
PSU-A

BLANK

FURUKAWA v. 1.21.9

Gerenciamento Furukawa via CLI

```
traffic-profile 2DADOS_2VOZ create
tcont 1
  gemport 1/1-1/4
  dba-profile fca1
  mapper 1
  gemport count 4
  bridge 1
  ani mapper 1
  uni eth 1
    vlan-filter vid 10 untagged allow
    vlan-operation us-oper overwrite 10 0
    vlan-operation ds-oper remove
  uni eth 2
    vlan-filter vid 10 untagged allow
    vlan-operation us-oper overwrite 10 0
    vlan-operation ds-oper remove
  uni eth 3
    vlan-filter vid 13 untagged allow
    vlan-operation us-oper overwrite 13 0
    vlan-operation ds-oper remove
  uni eth 4
    vlan-filter vid 13 untagged allow
    vlan-operation us-oper overwrite 13 0
    vlan-operation ds-oper remove
apply
!
```

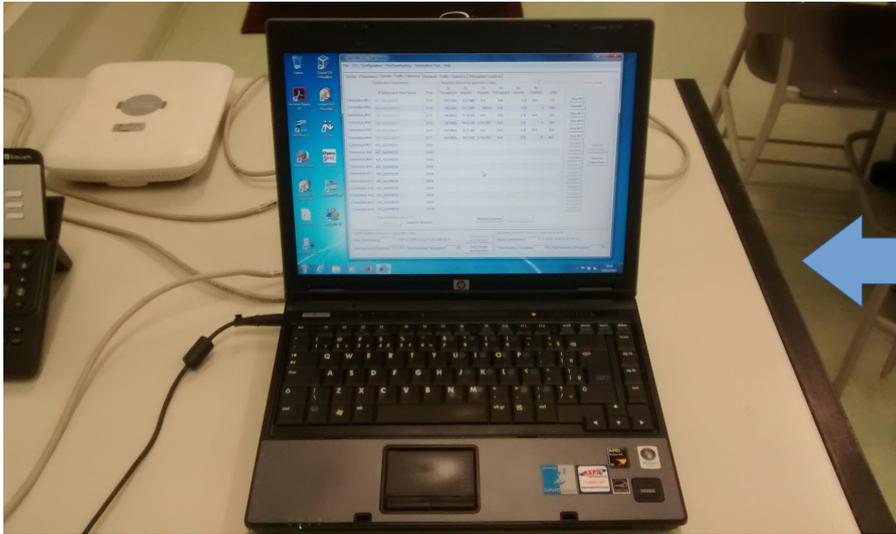
FURUKAWA(config-gpon-olt[7/1])# show onu info

OLT	ONU	STATUS	Serial No.	Distance	Rx Power	Profile
7/1	1	Active	FISA4f09d9b4	33m	- 17.1 dBm	Henri
7/1	2	Active	FISA4f09dd4c	34m	- 14.3 dBm	Estagiario2
7/1	3	Active	FISA4f09d9cc	33m	- 16.0 dBm	Enzo
7/1	4	Active	FISA4f09dde2	205m	- 17.9 dBm	VideoConferencia
7/1	5	Active	FISA4f09ddb8	243m	- 15.7 dBm	Lab2-Esportes
7/1	6	Active	FISA4f09dd34	32m	- 14.7 dBm	Felipe

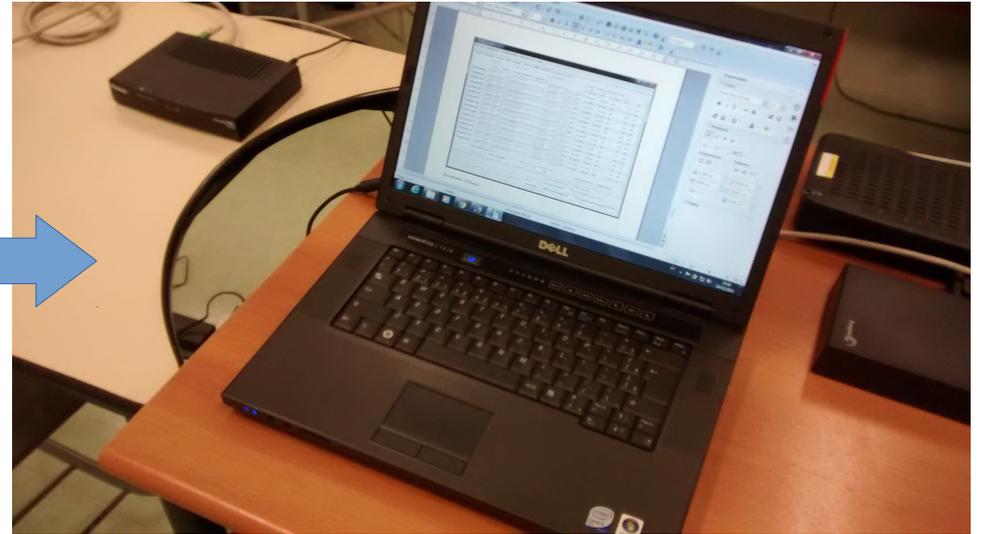
FURUKAWA(config-gpon-olt[7/2])# show onu info

OLT	ONU	STATUS	Serial No.	Distance	Rx Power	Profile
7/2	1	Active	FISA4f09ddbe	118m	- 15.9 dBm	BB-Atendimento
7/2	2	Active	FISA4a09b440	119m	- 14.2 dBm	Lab3-Inf
7/2	3	Active	FISA4f09ddb4	118m	- 13.6 dBm	BB-Consulta
7/2	4	Active	FISA4f09ddaa	117m	- 15.3 dBm	BB-Consulta
7/2	5	Active	FISA4f09dfae	159m	- 20.7 dBm	Helpdesk
7/2	6	Active	FISA4a09b152	120m	- 15.0 dBm	Lab3-Inf
7/2	7	Active	FISA4a09b3a8	118m	- 16.0 dBm	Lab3-Inf
7/2	8	Active	FISA4a09b720	119m	- 14.4 dBm	Lab3-Inf

Testes e Resultados



Furukawa

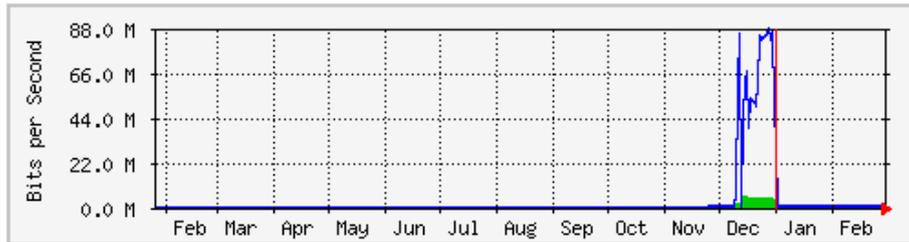


Parks / Prysmian

- Iperf
- MRTG/SNMP
- LanTraffic Trial
- SIMET NIC.br

Testes e Resultados

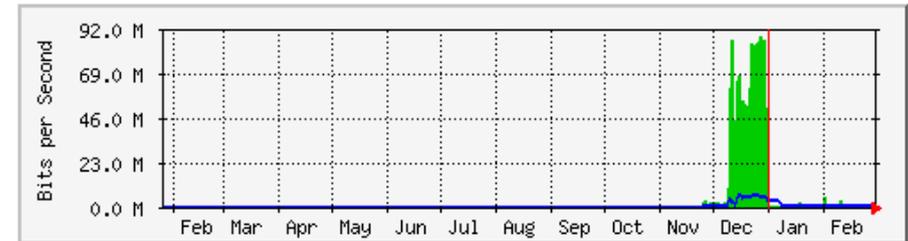
'Yearly' Graph (1 Day Average)



	Max	Average	Current
In	6131.2 kb/s (0.6%)	1021.7 kb/s (0.1%)	128.7 kb/s (0.0%)
Out	88.0 Mb/s (8.8%)	14.1 Mb/s (1.4%)	288.0 b/s (0.0%)

GREEN ### Incoming Traffic in Bits per Second
BLUE ### Outgoing Traffic in Bits per Second

'Yearly' Graph (1 Day Average)



	Max	Average	Current
In	88.2 Mb/s (8.8%)	15.1 Mb/s (1.5%)	907.6 kb/s (0.1%)
Out	6335.9 kb/s (0.6%)	1305.6 kb/s (0.1%)	113.4 kb/s (0.0%)

GREEN ### Incoming Traffic in Bits per Second
BLUE ### Outgoing Traffic in Bits per Second

MRTG Furukawa

MRTG Parks / Prysmian

Testes e Resultados

The screenshot displays the LanTraffic V2 software interface, which is used for network traffic analysis. The main window is titled "LanTraffic V2 - Trial Version" and features a menu bar with "File", "Edit", "Configuration", "File Downloading", "Automation Tool", and "Help".

The interface is divided into several sections:

- Sender - Parameters:** A table listing 16 connections. Each row includes a connection ID (e.g., Connection #01), a listening port (e.g., 2009), a protocol (e.g., TCP), and a "Coming From" remote IP address (all set to "ANY_ADDRESS").
- Working Mode:** A section with dropdown menus for "Absorber" and "Browse" for each connection, and a "Working Mode" column with IDs #01 through #16.
- Statistics (based on application data):** A table showing performance metrics for each connection. The columns are: Rx Throughput, Rx Volume, Tx Throughput, Tx Volume, and Jitter. For example, Connection #01 shows 203 kb/s Rx Throughput and 10.7 GB Rx Volume.
- Export Statistics into a File:** A section with a "Parameters" button and a status "Export is disabled".
- Start/Stop Receiving Traffic:** Two buttons labeled "Start Receiving Traffic" and "Stop Receiving Traffic".
- Choose Columns / Reset Display:** Two buttons for customizing the display.
- Sender Statistics (based on application data):** A summary section showing "Active Connections" (0) and "Total Sending Throughput".
- Receiver Statistics (based on application data):** A summary section showing "Active Connections" (16) and "Total Receiving Throughput" (493 Mb/s).

Connection	Port	Protocol	Remote IP Address or Host Name	Working Mode	Rx Throughput	Rx Volume	Tx Throughput	Tx Volume	Jitter
Connection #01	2009	TCP	ANY_ADDRESS	Absorber Browse #01	203 kb/s	10.7 GB	N/A	0 B	N/A
Connection #02	2010	TCP	ANY_ADDRESS	Absorber Browse #02	100 kb/s	5.51 GB	N/A	0 B	N/A
Connection #03	2011	TCP	ANY_ADDRESS	Absorber Browse #03	26.7 Mb/s	1.57 TB	N/A	0 B	N/A
Connection #04	2012	TCP	ANY_ADDRESS	Absorber Browse #04	46.4 Mb/s	2.10 TB	N/A	0 B	N/A
Connection #05	2013	TCP	ANY_ADDRESS	Absorber Browse #05	26.7 Mb/s	1.57 TB	N/A	0 B	N/A
Connection #06	2014	TCP	ANY_ADDRESS	Absorber Browse #06	46.4 Mb/s	2.10 TB	N/A	0 B	N/A
Connection #07	2015	TCP	ANY_ADDRESS	Absorber Browse #07	26.7 Mb/s	1.57 TB	N/A	0 B	N/A
Connection #08	2016	TCP	ANY_ADDRESS	Absorber Browse #08	46.4 Mb/s	2.10 TB	N/A	0 B	N/A
Connection #09	2009	UDP	ANY_ADDRESS	Absorber Browse #09	26.7 Mb/s	1.57 TB	N/A	0 B	N/A
Connection #10	2010	UDP	ANY_ADDRESS	Absorber Browse #10	46.4 Mb/s	2.09 TB	N/A	0 B	N/A
Connection #11	2011	UDP	ANY_ADDRESS	Absorber Browse #11	26.7 Mb/s	1.57 TB	N/A	0 B	N/A
Connection #12	2012	UDP	ANY_ADDRESS	Absorber Browse #12	46.4 Mb/s	2.09 TB	N/A	0 B	N/A
Connection #13	2013	UDP	ANY_ADDRESS	Absorber Browse #13	26.7 Mb/s	1.57 TB	N/A	0 B	N/A
Connection #14	2014	UDP	ANY_ADDRESS	Absorber Browse #14	46.4 Mb/s	2.09 TB	N/A	0 B	N/A
Connection #15	2015	UDP	ANY_ADDRESS	Absorber Browse #15	26.7 Mb/s	1.57 TB	N/A	0 B	N/A
Connection #16	2016	UDP	ANY_ADDRESS	Absorber Browse #16	27.3 Mb/s	2.09 TB	N/A	0 B	N/A

Geração de tráfegos TCP e UDP na rede.

Testes e Resultados

```
Administrador: C:\Windows\system32\cmd.exe

[132] local 143.106.230.212 port 49902 connected with 143.106.230.11 port 5001
[ ID] Interval      Transfer      Bandwidth
[132] 0.0- 1.0 sec   28.0 MBytes   235 Mbits/sec
[132] 1.0- 2.0 sec   28.3 MBytes   238 Mbits/sec
[132] 2.0- 3.0 sec   27.8 MBytes   233 Mbits/sec
[132] 3.0- 4.0 sec   18.3 MBytes   154 Mbits/sec
[132] 4.0- 5.0 sec   28.4 MBytes   238 Mbits/sec
[132] 5.0- 6.0 sec   28.5 MBytes   239 Mbits/sec
[132] 6.0- 7.0 sec   28.3 MBytes   237 Mbits/sec
[132] 7.0- 8.0 sec   17.4 MBytes   146 Mbits/sec
[132] 8.0- 9.0 sec   28.7 MBytes   241 Mbits/sec
[132] 9.0-10.0 sec   28.6 MBytes   240 Mbits/sec
[132] 10.0-11.0 sec  28.7 MBytes   241 Mbits/sec
[132] 11.0-12.0 sec  17.8 MBytes   149 Mbits/sec
[132] 12.0-13.0 sec  28.2 MBytes   236 Mbits/sec
[132] 13.0-14.0 sec  28.7 MBytes   241 Mbits/sec
[132] 14.0-15.0 sec  28.7 MBytes   241 Mbits/sec
[132] 0.0-15.0 sec   394 MBytes   220 Mbits/sec

C:\Users\Administrador\Downloads>
C:\Users\Administrador\Downloads>
C:\Users\Administrador\Downloads>
C:\Users\Administrador\Downloads>
C:\Users\Administrador\Downloads>
C:\Users\Administrador\Downloads>
C:\Users\Administrador\Downloads>iperf.exe -c 143.106.230.11 -i 1 -t 15

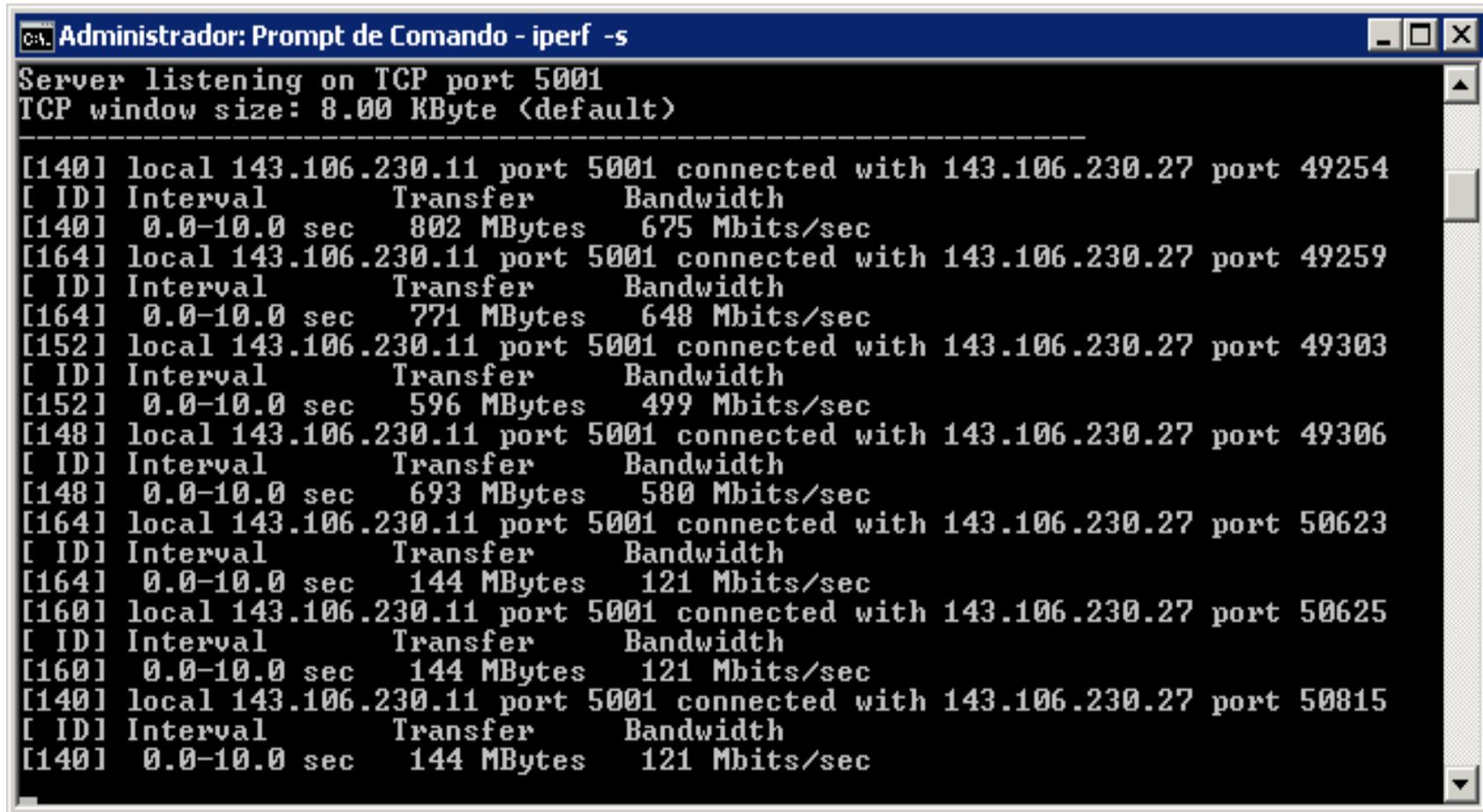
Client connecting to 143.106.230.11, TCP port 5001
TCP window size: 8.00 KByte (default)

-----
[132] local 143.106.230.212 port 49903 connected with 143.106.230.11 port 5001
[ ID] Interval      Transfer      Bandwidth
[132] 0.0- 1.0 sec   27.1 MBytes   228 Mbits/sec
[132] 1.0- 2.0 sec   27.1 MBytes   228 Mbits/sec
[132] 2.0- 3.0 sec   27.4 MBytes   230 Mbits/sec
[132] 3.0- 4.0 sec   26.0 MBytes   218 Mbits/sec
[132] 4.0- 5.0 sec   18.2 MBytes   153 Mbits/sec
[132] 5.0- 6.0 sec   27.3 MBytes   229 Mbits/sec
[132] 6.0- 7.0 sec   27.2 MBytes   229 Mbits/sec
[132] 7.0- 8.0 sec   26.9 MBytes   226 Mbits/sec
[132] 8.0- 9.0 sec   17.7 MBytes   149 Mbits/sec
[132] 9.0-10.0 sec   27.1 MBytes   227 Mbits/sec
[132] 10.0-11.0 sec  26.9 MBytes   226 Mbits/sec
[132] 11.0-12.0 sec  27.4 MBytes   230 Mbits/sec
[132] 12.0-13.0 sec  17.1 MBytes   144 Mbits/sec
[132] 13.0-14.0 sec  27.1 MBytes   227 Mbits/sec
[132] 14.0-15.0 sec  26.9 MBytes   226 Mbits/sec
[132] 0.0-15.0 sec   378 MBytes   211 Mbits/sec

C:\Users\Administrador\Downloads>
```

Transmissão de dados com a criptografia AES ativa.

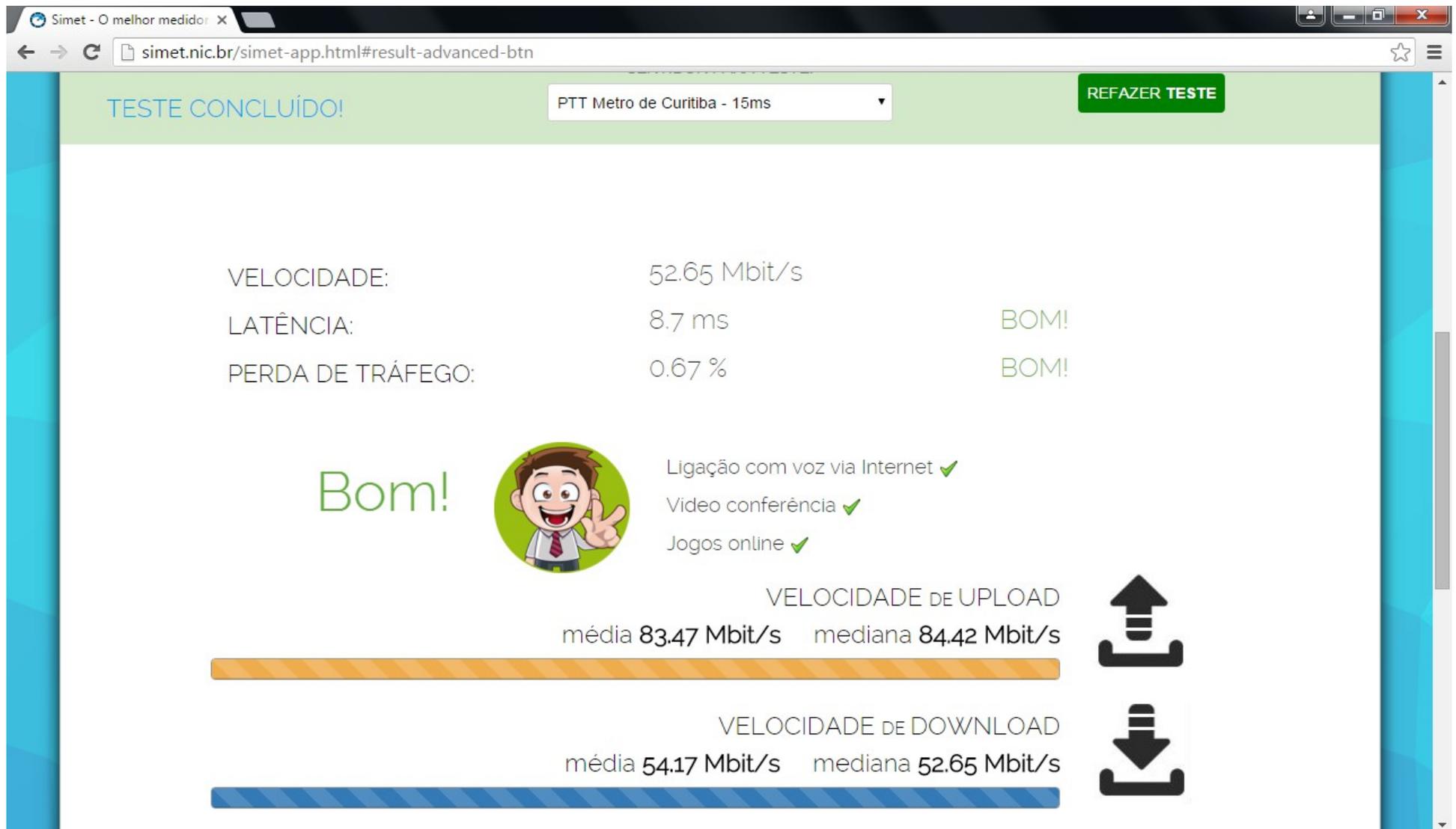
Testes e Resultados



```
Administrador: Prompt de Comando - iperf -s
Server listening on TCP port 5001
TCP window size: 8.00 KByte (default)
-----
[140] local 143.106.230.11 port 5001 connected with 143.106.230.27 port 49254
[ ID] Interval      Transfer    Bandwidth
[140] 0.0-10.0 sec  802 MBytes  675 Mbits/sec
[164] local 143.106.230.11 port 5001 connected with 143.106.230.27 port 49259
[ ID] Interval      Transfer    Bandwidth
[164] 0.0-10.0 sec  771 MBytes  648 Mbits/sec
[152] local 143.106.230.11 port 5001 connected with 143.106.230.27 port 49303
[ ID] Interval      Transfer    Bandwidth
[152] 0.0-10.0 sec  596 MBytes  499 Mbits/sec
[148] local 143.106.230.11 port 5001 connected with 143.106.230.27 port 49306
[ ID] Interval      Transfer    Bandwidth
[148] 0.0-10.0 sec  693 MBytes  580 Mbits/sec
[164] local 143.106.230.11 port 5001 connected with 143.106.230.27 port 50623
[ ID] Interval      Transfer    Bandwidth
[164] 0.0-10.0 sec  144 MBytes  121 Mbits/sec
[160] local 143.106.230.11 port 5001 connected with 143.106.230.27 port 50625
[ ID] Interval      Transfer    Bandwidth
[160] 0.0-10.0 sec  144 MBytes  121 Mbits/sec
[140] local 143.106.230.11 port 5001 connected with 143.106.230.27 port 50815
[ ID] Interval      Transfer    Bandwidth
[140] 0.0-10.0 sec  144 MBytes  121 Mbits/sec
```

Transmissão de dados com o perfil de tráfego 128 Mbits/sec aplicado.

Testes e Resultados



Vários testes de velocidade com o SIMET nic.br

Conclusão

- A tecnologia GPON é uma alternativa viável ao cabeamento metálico tradicional de rede.
- Facilidade na instalação, manutenção e principalmente o gerenciamento das ONU.
- Aproveita o legado da rede óptica existente de infraestrutura de fibras monomodo.
- Segurança no transporte de dados devido a criptografia AES 128 bits nativa no hardware.
- Aplicação de perfis de tráfego e QoS de maneira prática e rápida.

Conclusão

- Minimiza os impactos ao meio ambiente devido a ausência dos ativos na distribuição da rede.
Certificação LEED.
- Proporcionou um entendimento mais claro da tecnologia e uma maior tranquilidade com relação ao uso da solução.
- Os resultados dos testes com ambas as empresas foram satisfatórios, cada uma com suas particularidades e atenderam ao propósito inicial.
- Ambas as soluções preparadas para IPv6 via CLI apenas.

Conclusão

- Comparando o custo por porta de rede Gigabit entre uma rede tradicional de cabeamento metálico e uma rede óptica passiva conseguimos um empate a partir de 70 pontos de rede. (Cálculo realizado referente aos equipamentos já utilizados na Unidade FCA.)
- Perspectivas do uso da solução em novos projetos como por exemplo: construção do Centro Esportivo na FCA (500 pontos de rede) e dos novos prédios Administrativos, Docentes e Biblioteca. (2500 pontos de rede)

Obrigado !!!



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