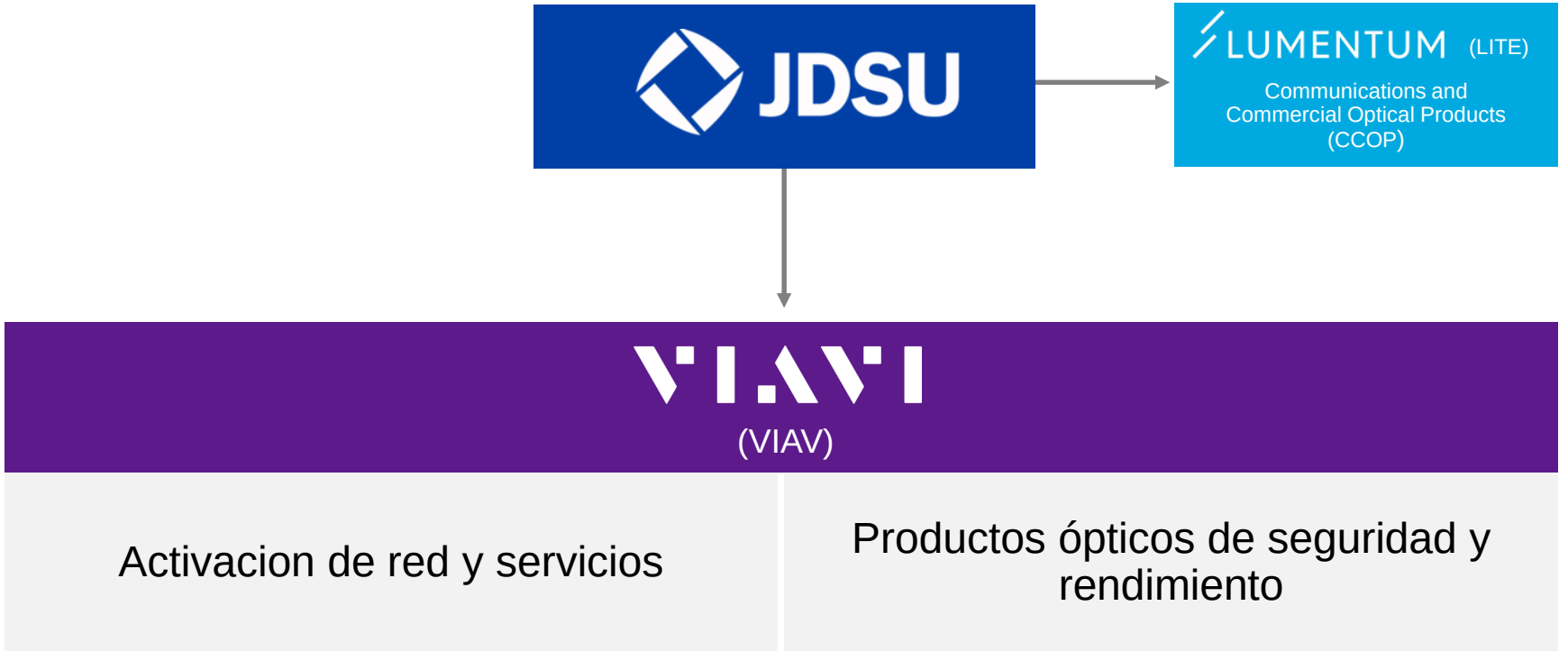
La Era Gigabit

5G, FTTx, G.Fast & DOCSIS 3.1

Caio Donega
Gerente Regional – Sur America Latina
26 de Septiembre de 2017, Telesemana en Lima, Peru.

Viavi Solutions Creada

Agosto de 2015



Viavi Solutions, NSE (Activacion de redes y servicios)

Mas de 90 años en la creacion

1923	1974	1998	1999	2000	2005	2006 to 2009	2010 to 2013	2014
Wandel & Goltermann founded in 1923, begins to develop and manufacture test sets for communications	**TTC** Founded	**Wandel & Goltermann merges with Wavetek**	**TTC acquires Applied Digital Access**, provider of service assurance systems **JDS Fitel acquires Uniphase**	**Acterna created by merger of WWG and TTC**, combining the world's 2nd and 3rd largest T&M companies	**Acterna acquired**	**Test-Um**: enter home networking test market **Innocor**: expands portfolio for NEMs **Casabyte**: enter wireless service assurance **Circadiant**: adds stress test **Westover Scientific**: adds fiber inspection & cleaning **Finisar's Network Tools**: adds Storage Network Test	**Agilent's Network Solutions Division**: adds mobile LTE test **GenComm**: adds wireless base station test **Dyaptive Systems**: adds wireless capacity test **Trendium**: adds mobile assurance solutions for 4G/LTE networks **Arieso**: adds location aware software solutions for 2G/3G/4G	**Network Instruments**: adds optimization for enterprise networks

Viavi Solutions - participación en la industria

Viavi Solutions contribuye activamente al desarrollo de normas bien definidas y armonizadas, pruebas de prueba de concepto y despliegues de campo en etapas tempranas.

ETSI MEMBER

Millimetre Wave Transmission
Network Functions Virtualization
Mobile Edge Computing

IEEE
Advancing Technology for Humanity

2020 NETWORLD

one M2M

HORIZON 2020

3GPP

5GMF
The Fifth Generation Mobile Communications Promotion Forum

atis

Wi Fi ALLIANCE

150 ITU 1865-2015

openstack
CLOUD SOFTWARE

I E T F

SMALL CELL FORUM
HOME | ENTERPRISE | URBAN | RURAL

MEF
METRO ETHERNET FORUM

Alcatel·Lucent

THE PLATFORM FOR NFV
CLOUDBAND™

JUNIPER NETWORKS

tmforumzoom

CISCO

broadband forum

Intel® Network Builders

vmware

Viavi Solutions en numeros

Over 1,600,000
instrumentos en uso alrededor del mundo

100,000
data centers confian en VIAVI

200+
redes de proveedores de servicios a traves de 7 continentes

1,617
patentes

49
global offices

$1.1B
ingresos FY16

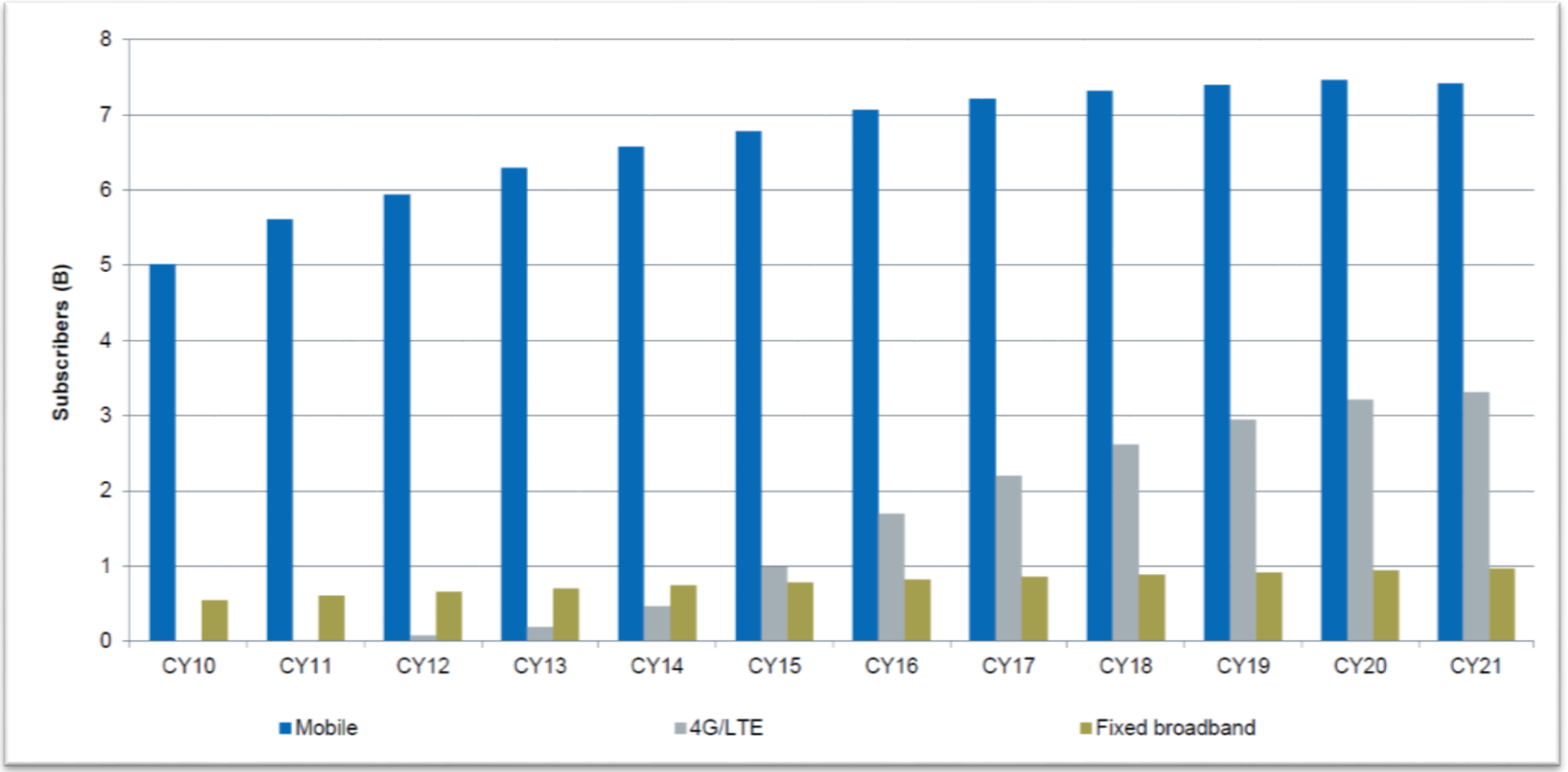
250
Socios

3000+
empleados


1 NEW DEFINITION IS ADDED ON URBAN
1,600+ READS ON Scribd
13,000+ HOURS MUSIC STREAMING ON PANDORA
12,000+ NEW ADS POSTED ON craigslist
370,000+ MINUTES VOICE CALLS ON skype
98,000+ TWEETS
20,000+ NEW POSTS ON tumblr.
THE LARGEST SOCIAL READING PUBLISHING COMPANY!!
New Craigslist Ads
320+ NEW twitter ACCOUNTS
13,000+ iPhone APPLICATIONS DOWNLOADED
100+ NEW Linked in ACCOUNTS
IN 60 SECONDS...
1 associatedcontent NEW ARTICLE IS PUBLISHED
THE WORLD'S LARGEST COMMUNITY CREATED CONTENT!!
QUESTIONS ASKED ON THE INTERNET...
100+ Answers.com
40+ YAHOO! ANSWERS
6,600+ NEW PICTURES ARE UPLOADED ON flickr
600+ NEW VIDEOS
50+ WordPress DOWNLOADS
25+ HOURS TOTAL DURATION
70+ DOMAINS REGISTERED
695,000+ facebook STATUS UPDATES
125+ PLUGIN DOWNLOADS
60+ NEW BLOGS
168 MILLION EMAILS ARE SENT
694,445 SEARCH QUERIES
1,700+ Firefox DOWNLOADS
1,500+ BLOG POSTS
79,364 WALL POSTS
510,040 COMMENTS
Google
Google Search
GO-Globe.com

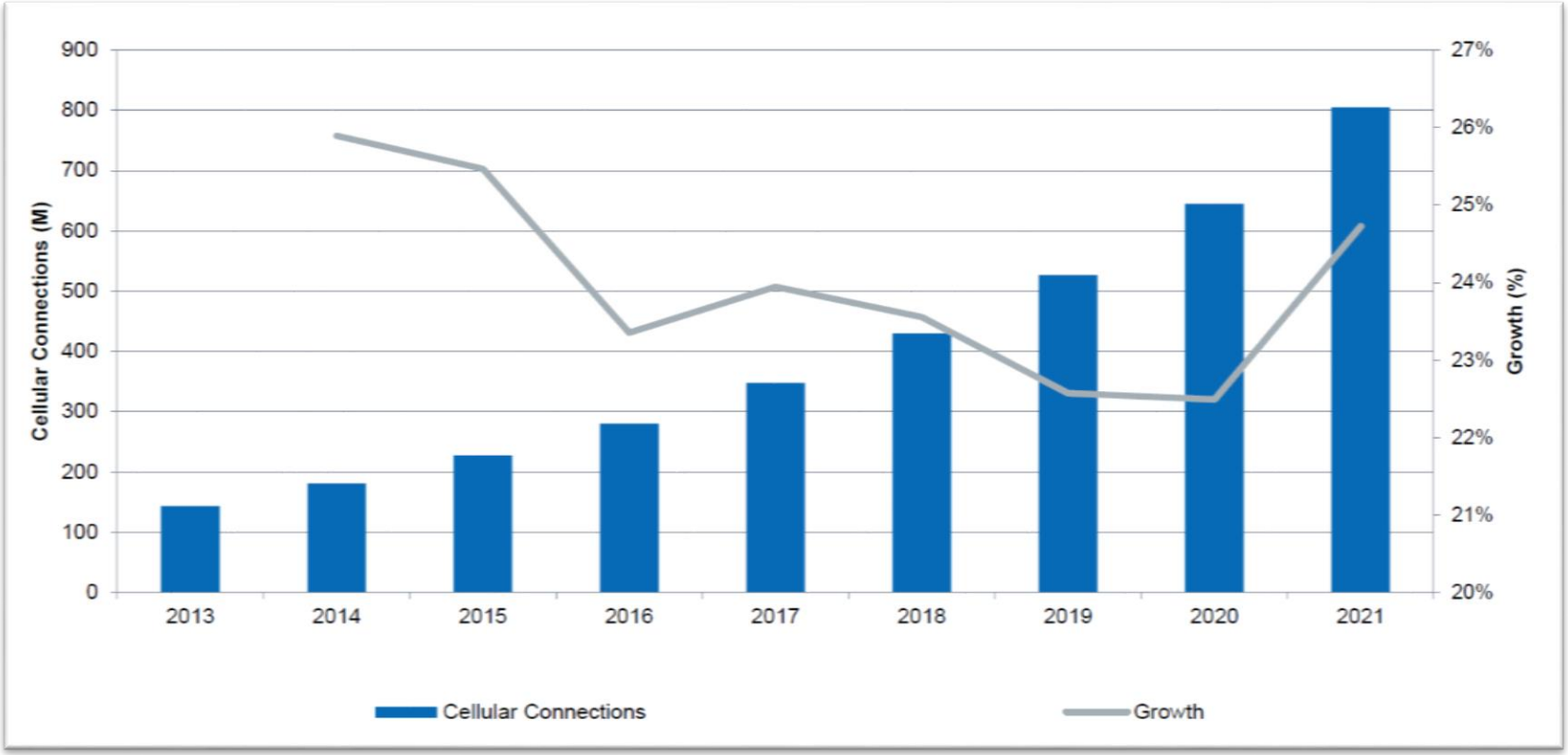
Móvil satura la tierra

La banda ancha móvil supera la banda ancha fija del pasado

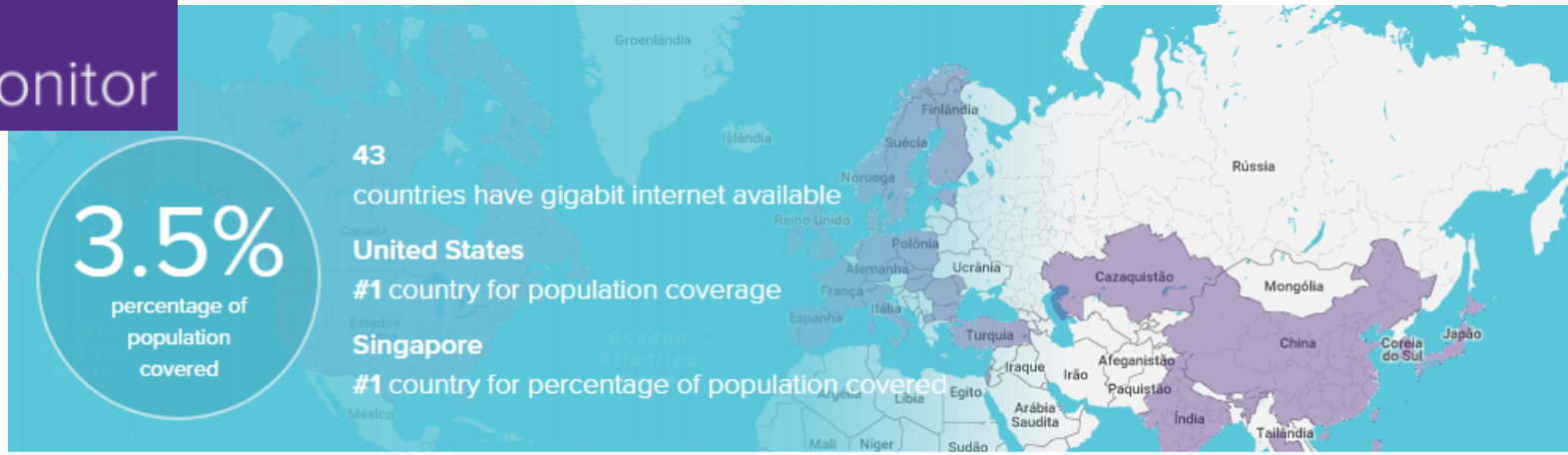


Incesante crecimiento del tráfico

Aceleración de video, centros de datos, más suscriptores y IoT requieren cambios arquitectónicos



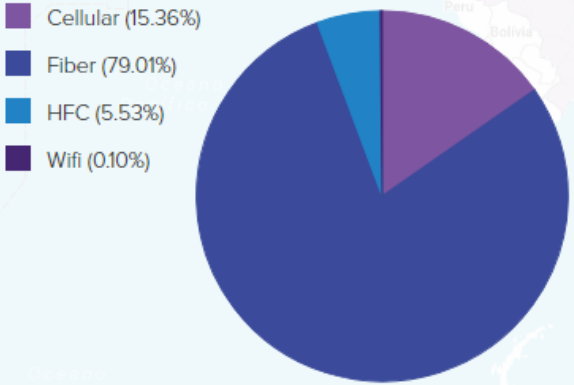
Gigabit Monitor



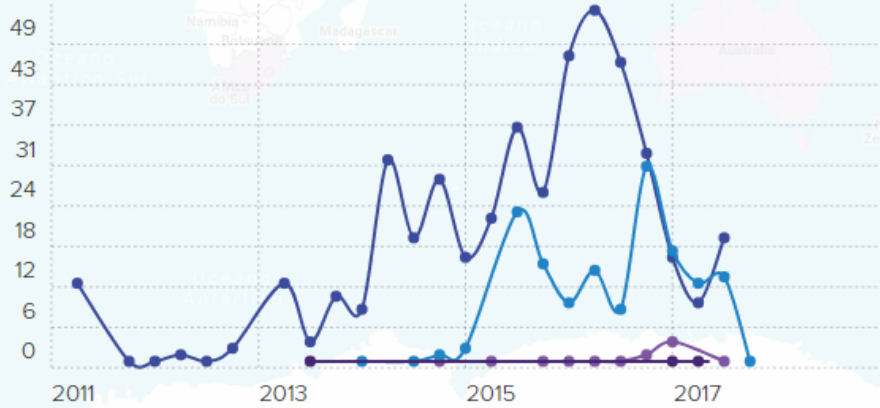
Gigabit
Despliegue actual

Data:
gigabitmonitor.com

Breakdown by technology



Gigabit launches over time



VIAVI Gigabit Monitor

Gigabit
Países lideres

Data:
gigabitmonitor.com

Gigabit country leaderboard Click the titles to switch results

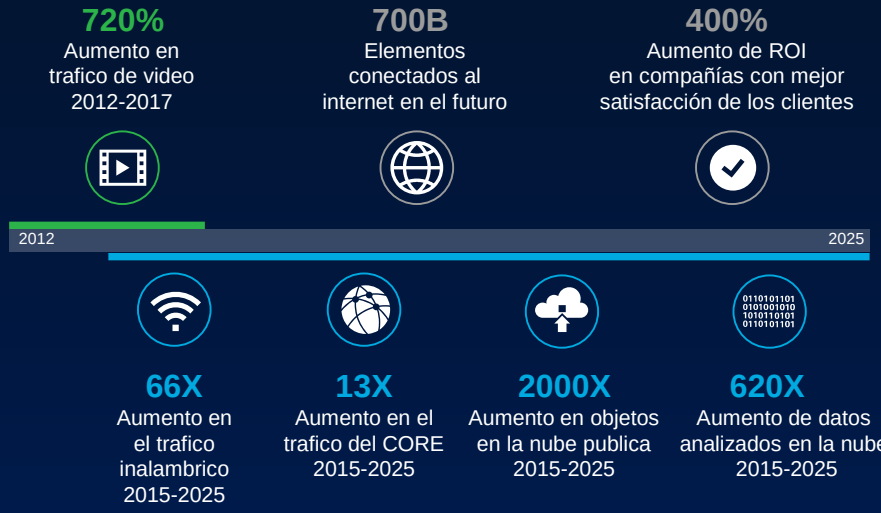
Rank	Country	Population Coverage (estimate)	Percentage Coverage (estimate)
1	Singapore	5,411,700	95%
2	South Korea	46,716,100	93%
3	Moldova	3,656,600	90%
4	Portugal	6,728,800	64%
5	New Zealand	2,883,100	63%
21	Spain	7,754,600	17%
22	Finland	785,000	14%
23	France	8,251,800	13%
24	Hungary	1,200,500	12%
25	Macedonia	243,000	12%
26	Thailand	7,856,700	12%
27	Israel	308,900	3.8%
28	Japan	4,293,000	3.4%
29	Estonia	40,000	3.1%
30	United Kingdom	1,917,800	3.0%
31	Poland	868,000	2.3%
32	Netherlands	163,200	0.96%
33	Brazil	1,975,000	0.94%

Ha comenzado la Carrera para la entrega de conectividad a velocidad de gigabit y para satisfacer la demanda de servicios intensos en datos, conexión y/o latencia

Gigabit | Cambios tecnológicos exigen mas ancho de banda

Gigabit | Necesidad de LTE Avanzado y 5G (Radio Acceso Gigabit)

- Convergencia fija e inalámbrica
- Nubeficacion del “Edge” basado en Ethernet C-RAN (Cloud-Radio Access Network)
- Nueva Radio: cmWave, mmWave
- Procesamiento de bordes E2E
- Programación: Numerología flexible



- Nuevos modelos de negocios
- Auto-configurable, Auto-optimizable, auto-correctiva
- Una red E2E automatizada y auto programable
- Solucion virtualizada basada en la nube

Gigabit | Necesidad de HDTV y definición 4K (Red fija/móvil Gigabit)

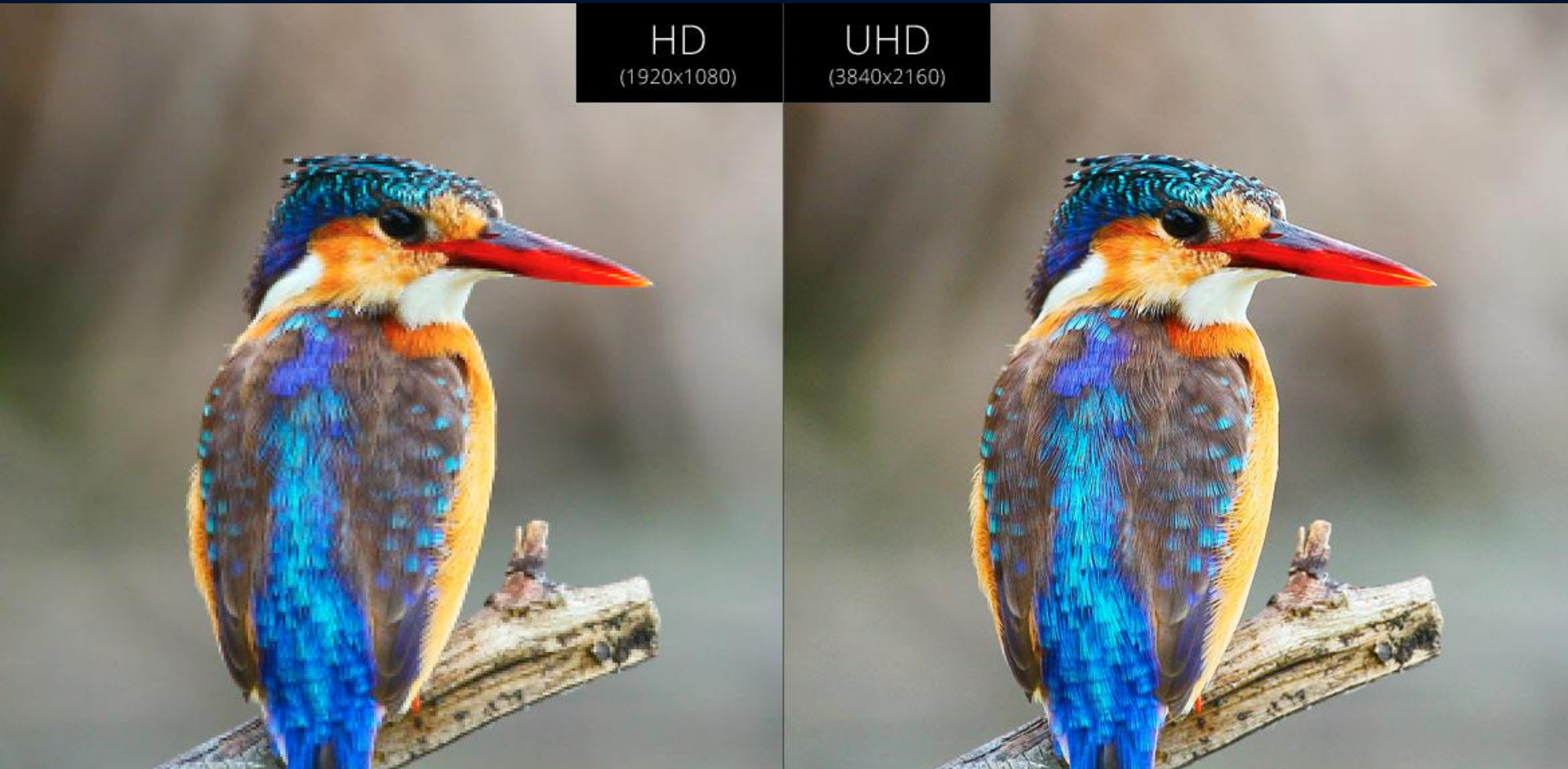
HDTV	Hulu
VOD	Skype
Multiples TV	YouTube
4k	Juegos en linea
NetFlix	DVR
Amazon Video	Seguridad

Gigabit | Necesidad de HDTV y definición 4K (Red fija/móvil Gigabit)

La cantidad de ancho de banda requerido dependerá de la calidad del flujo. Netflix proporciona una guía a sus usuarios:

- 500 Kbps - la velocidad más baja requerida para el “streaming”
- 1.5 Mbps - velocidad recomendada para ver la calidad
- 3 Mbps - Vídeo de definición estándar
- 5-8 Mbps - 720p y 1080p de alta definición
- 25 Mbps - 4K Ultra Alta Definición

Gigabit | Necesidad de HDTV y definición 4K (Red fija/móvil Gigabit)



Gigabit | Necesidad de ancho de banda (Red fija Gigabit)

TV Difundida	Video de Alta definicion
Internet de alta velocidad	Transmision de Video sobre IP
Sistema de riego	Voz sobre IP
Refrigeradores	Video Conferencias
Control de Acceso, Cerraduras inteligentes	Manejo de Iluminacion y energia
Camaras de Seguridad	Control de Iluminacion

Gigabit | Necesidad de ancho de banda (Red fija Gigabit)

Gartner cree que habrá 500 dispositivos compatibles con IoT en todos los hogares para el 2022.

1. Camera Stream	MJPEG
2. Camera Resolution	10 Megapixels (3648 x 2752)
3. Video Quality	High
4. Frame Rate per Camera	30 fps
5. Number of Cameras	4

Calculate Bandwidth Needed

Bandwidth Required:

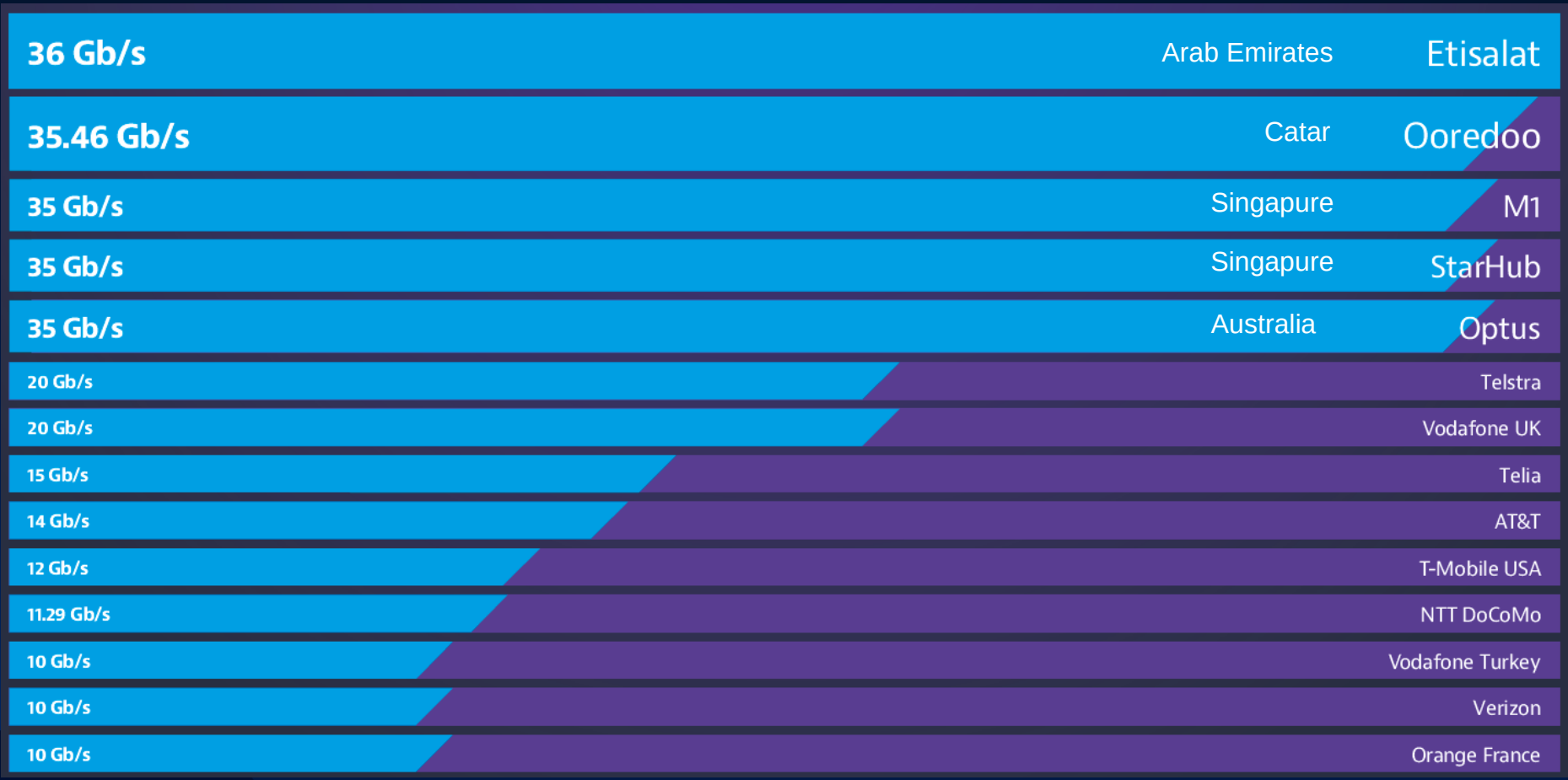
2.69 Gbps

http://www.gartner.com/newsroom/id/2839717

Gigabit | Necesidad de ancho de banda (Red fija/móvil Gigabit)

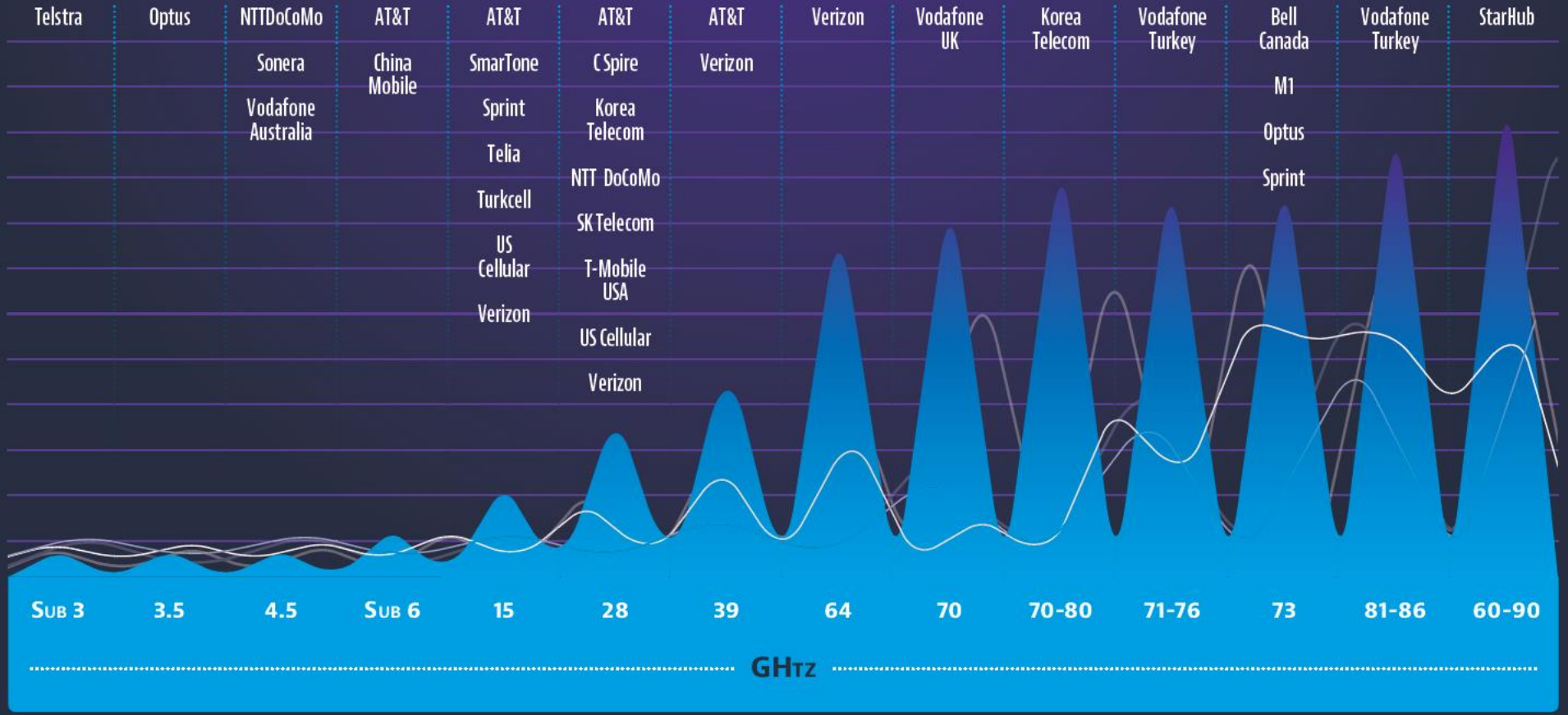
Resguardo “Back-up”	Seguridad
Almacenamiento	Compartir documentos
Acceso remoto y disponibilidad	

Espectro 5G a prueba

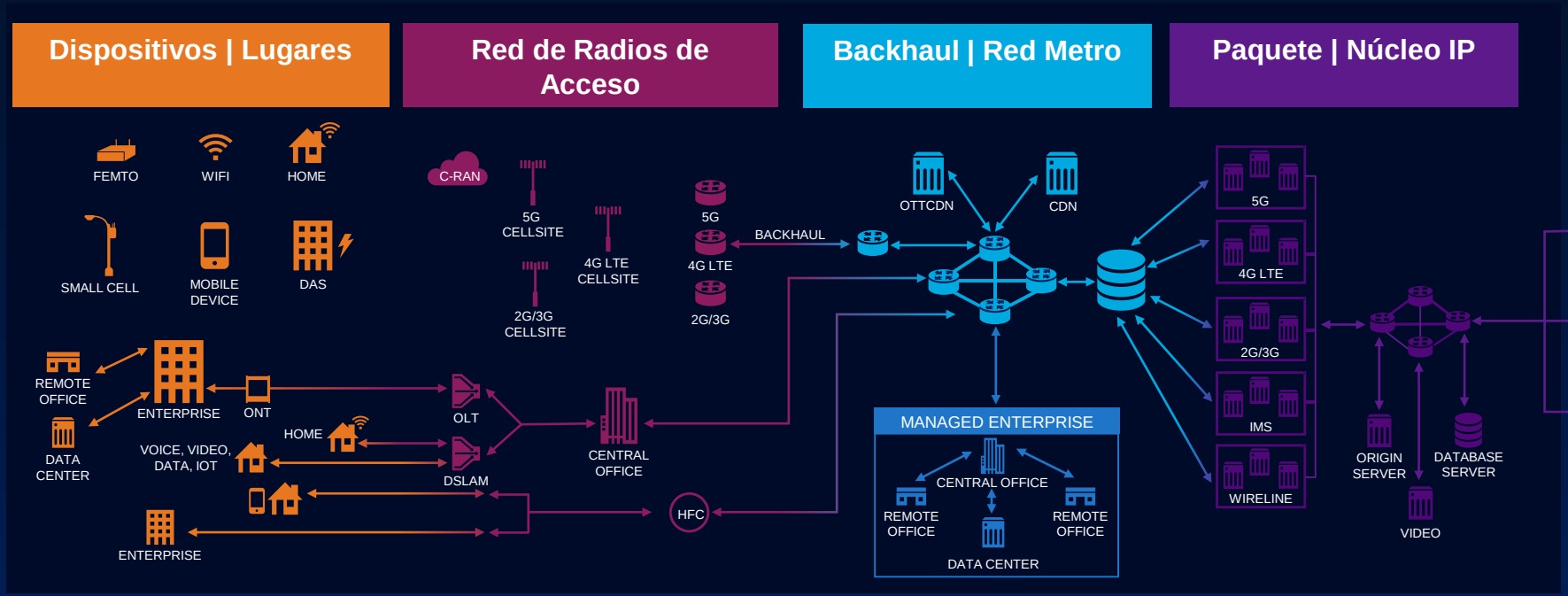


5G Trial Spectrum

Shows the spectrum used by operators during 5G trials, where disclosed



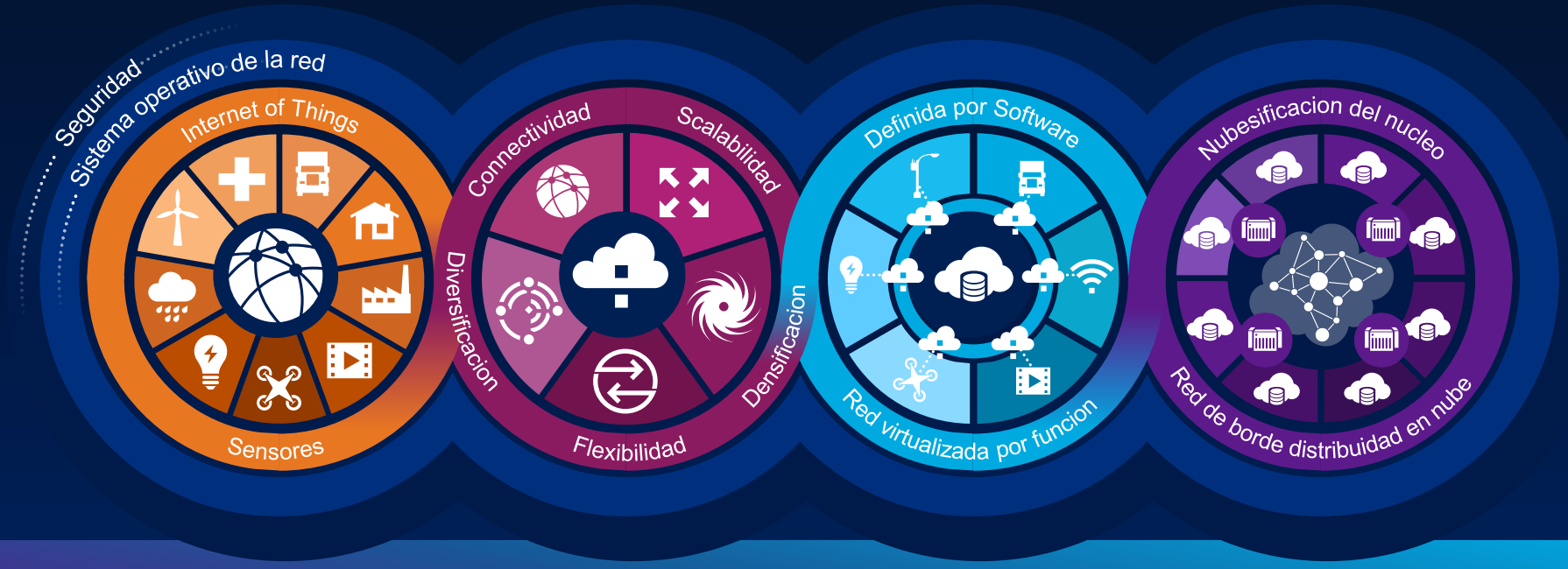
La Evolución de la red 2016-2018



Punto de inflexión del Tráfico móvil | Convergencia de redes y contenidos | La Red se convierte en TI

Revolución de la red 2019+

Dispositivos | Lugares	Red de acceso Radial "RAN"	Backhaul | Red Metro	Paquete | Nucleo IP



Rebanadas de red automatizadas y programables | Requisitos únicos de rendimiento y recursos

Porque los clients piensan en fibra primero?

TURNING 5G INTO A REALITY

Fibra es la clave para el futuro

"We can't do it if we don't drive fiber deeper in the network"

CORNING TO SELL 12.4M MILES OF FIBER TO VERIZON EACH YEAR

“necesitamos 2-6 veces mas fibra para 5G que para FTTH"

FIBER DEAL WILL IMPROVE 4G LTE, SPEED DEPLOYMENT OF 5G

VERIZON, CORNING AGREE TO $1.05B, 3-YEAR FIBER DEAL

Construir una nueva planta en fibra para cumplir con la demanda.

VERIZON CEO: FIBER DEAL WITH CORNING CRUCIAL TO 5G

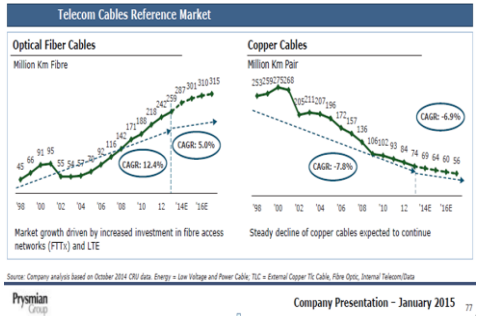
Nadie tiene la fibra optica necesario hoy para entregar 5G

"Verizon la construira comenzando este año"

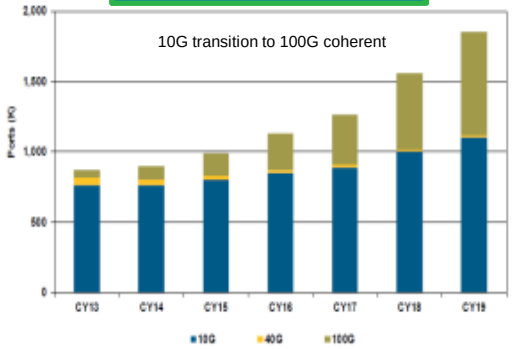
Para que todo esto funcione bien es necessária una red de acceso tan buena que practicamente NO EXISTE hoy

Impulsadores del crecimiento del mercado Fibra Optica

Fiber deployments: +5% CAGR (14-19)

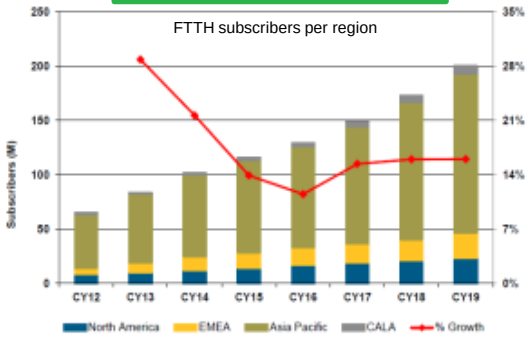


DWDM Metro/Core: Transition to 100G



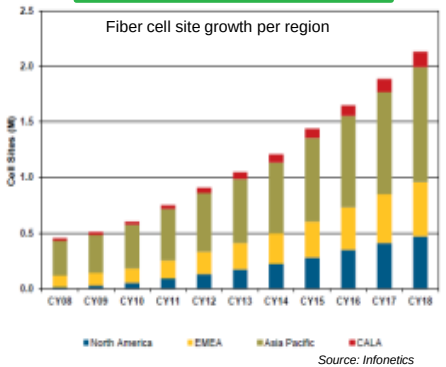
Source: Infonetics

FTTH Subscribers +21% in CY14
Strong growth expected, with China leading



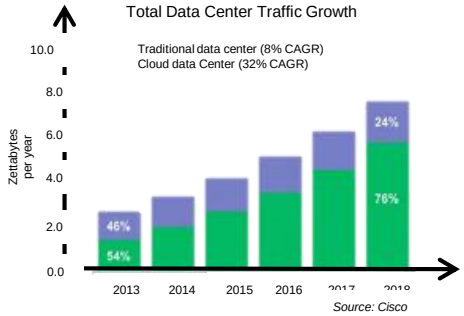
Source: Infonetics

Mobile: Fiber cell site from 35% in CY13 to 44% in CY18



Source: Infonetics

Enterprise-Data Centers, SAN, 100G
Mostly multimode connect. +23% CAGR



Source: Cisco

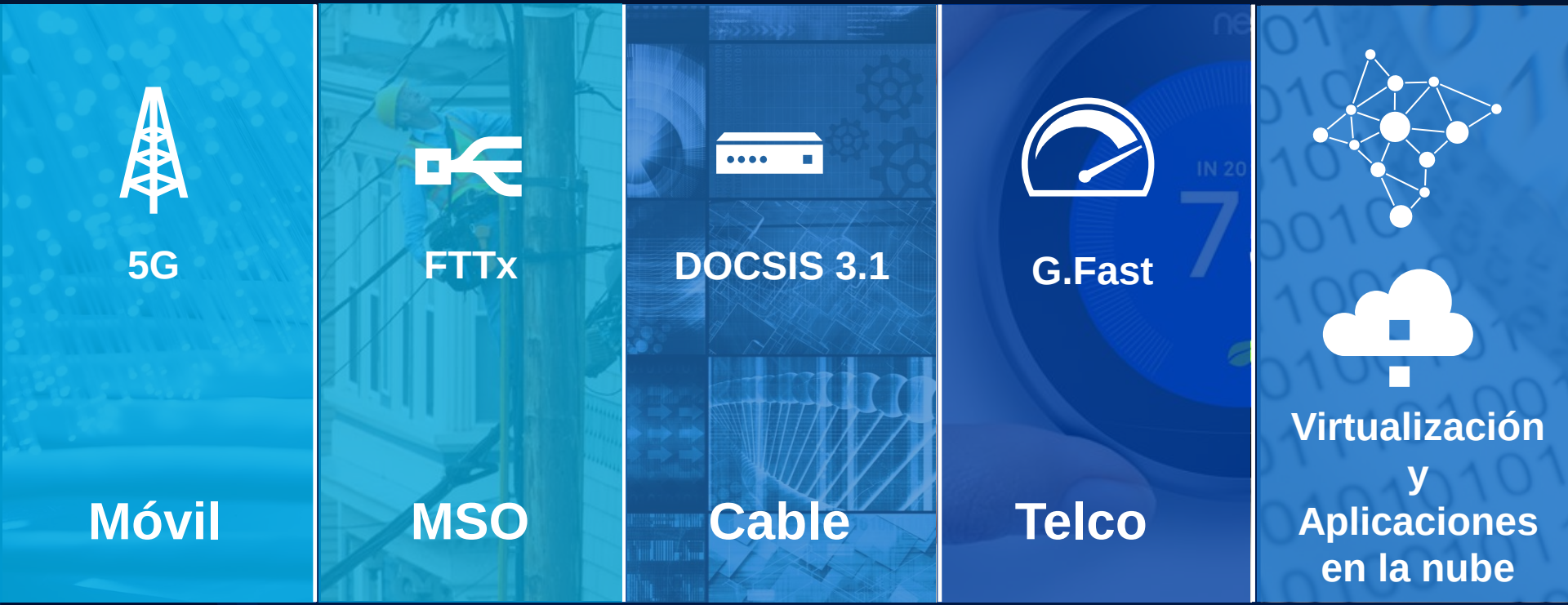
Puntos importantes:

- Aumento de instalacion de Fibra Optica: Metro Backhaul, FTTA, FTTx, Empresarial, Submarino
- Migracion a 100G
- Cuadrillas de fibra en aumento (Mobile, FTTx)

→ CAGR~5% Mercado de Prueba de fibra optica

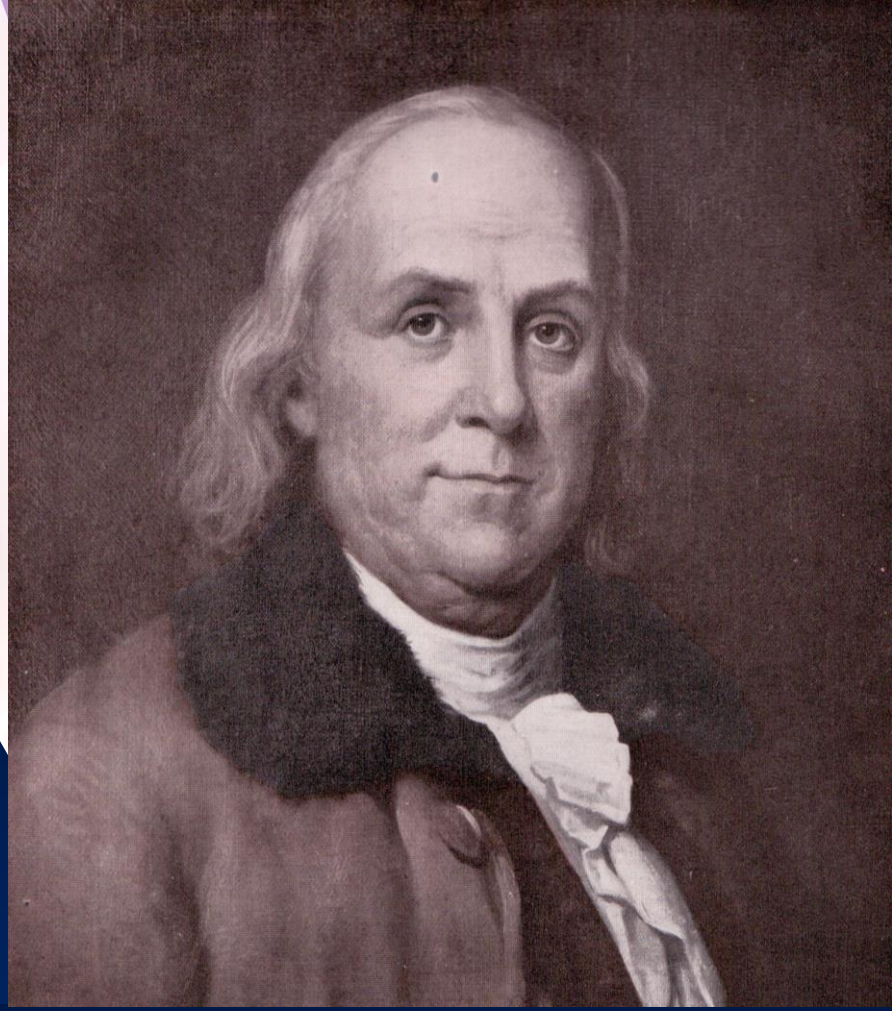
Requerimientos para el Gigabit ?

Gigabit | Las Tecnologías que permiten su entrega



“By failing to prepare, you are preparing to fail.”

Benjamin Franklin



Alcanzando velocidad del Gigabit

Muchos elementos pueden causar problemas entre la red y el equipo del cliente.

Para entregar velocidades de Gigabit, necesita**:**

- Eliminar las fallas ocultas
- Identificar problemas a través de arquitecturas híbridas complejas
- Ejecutar pruebas rápidas, consistentes y completas (para hacerlo bien la primera vez)
- Optimizar el flujo de trabajo y ejecución operacional

Café?

www.viavisolutions.com

Desafios en Red
Acceso Fibra con FTTH/PON

Sabia usted?

- Los conectores sucios causan el 80% de los fallos en las pruebas de campo
- Los desechos microscópicos degradan significativamente el rendimiento de la señal y pueden causar daños permanentes
- Los conectores sucios de acoplamiento pueden romperse, separarse y migrar partículas
- Una partícula de polvo típica es de 2 a 15 µm y sólo es visible con un microscopio

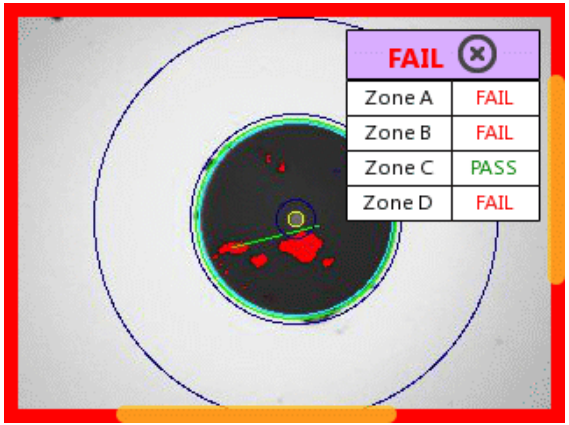
Prevención de Degradación de los conectores de la Fibra

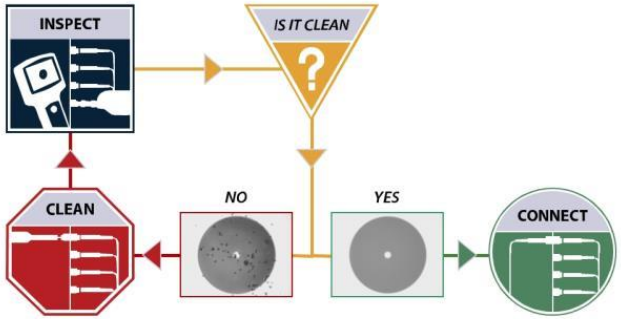
- **Desafio:** Están sus técnicos siguiendo las buenas practicas?

✓ Hay que contar con un miscroscopio de inspección que permita hacer análisis objetivo

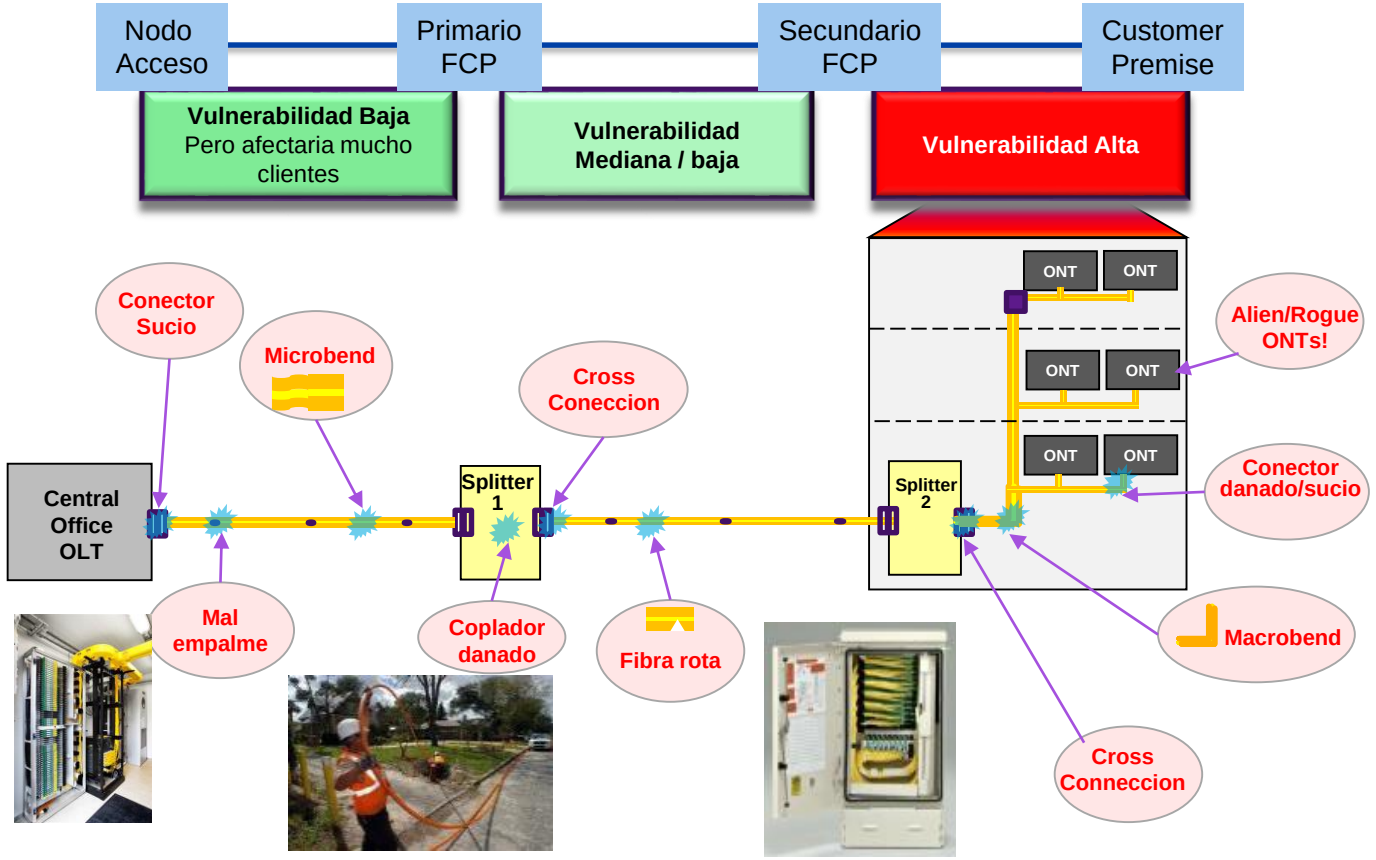
✓ Que el resultado sea um simple PASA/FALLA

- Eso dirije a que los técnicos tengan que seguir las buenas práticas de manejo de fibra



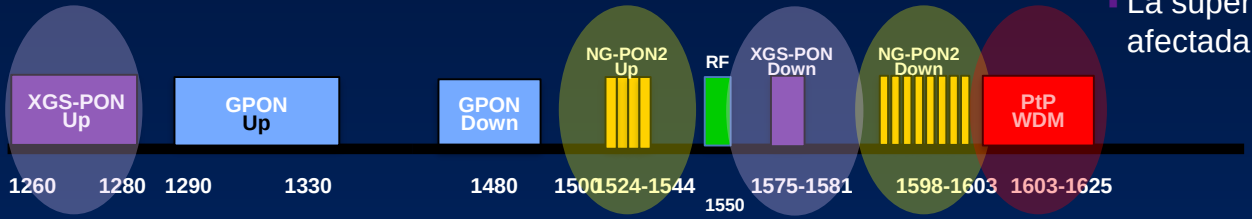


Puntos de vulnerabilidad en una red FTTH



Asignación de longitudes de onda PON

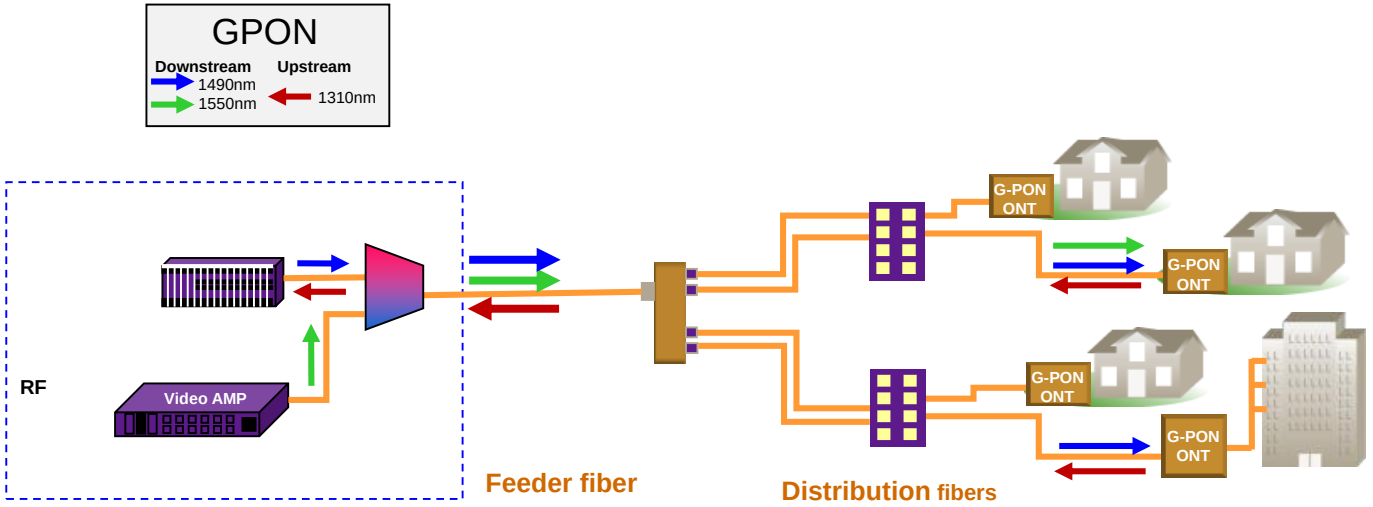
- Los sistemas GPON de hoy utilizan 2 longitudes de onda para la comunicación.
- Downstream 2,5 Gbps a 1490 nm y corriente arriba 1,2 Gbps a 1310 nm
- Superposición de 2 nuevas λ para servicios de 10 Gbps de XGS-PON
- 10 Gbps aguas abajo a 1578 nm y aguas arriba 10 Gbps a 1270 nm



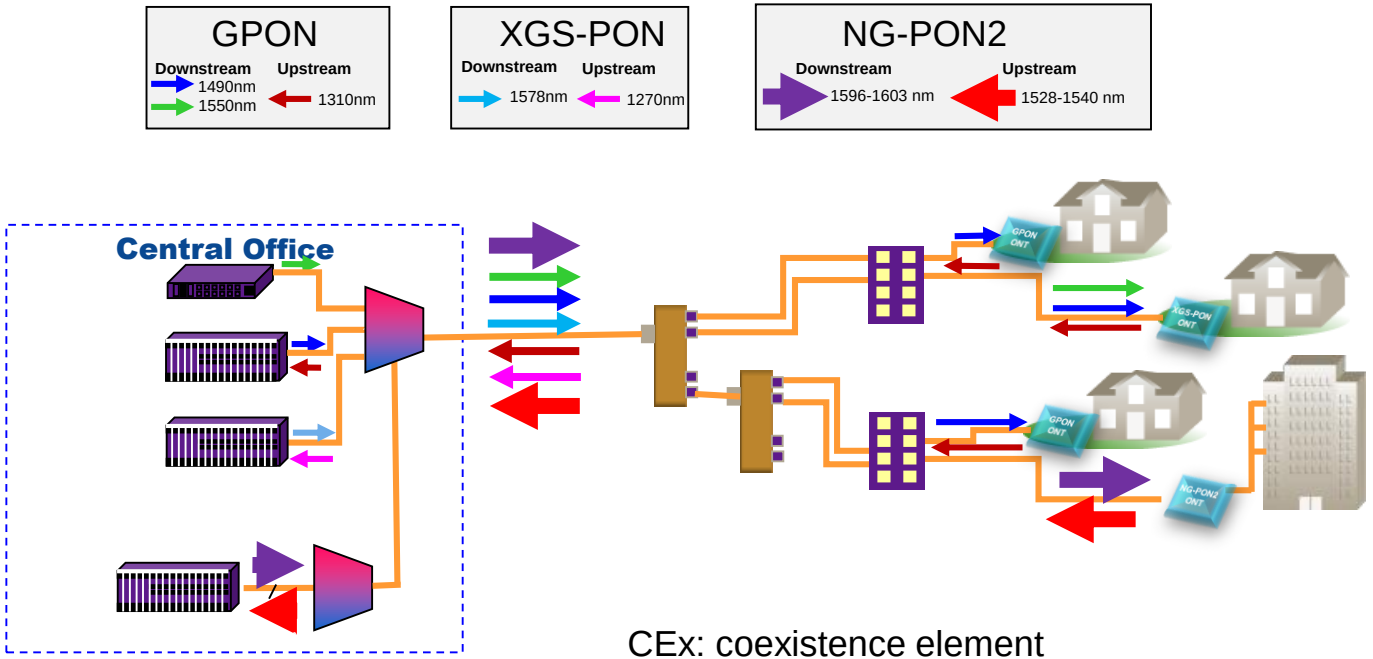
Fuente: FTTH EMEA D&O Committee FTTH Poland 2015

- NG-PON2 admite múltiples longitudes de onda de 10 Gbps
- Corriente descendente 40 (hasta 80) GBps a 4 (hasta 8) longitudes de onda TWDM entre 1598 - 1603 nm
- Upstream 10 (hasta 20 GBps) a 4 (hasta 8) longitudes de onda TWDM entre 1524 - 1544 nm
- Ventana adicional para canales WDM PtP de alta velocidad: 1603 - 1625 nm
- La superposición de RF a 1550 nm no se ve afectada por el servicio PON

Arquitectura GPON



Arquitectura en Coexistencia



CEx: coexistence element
WM: Wavelength Multiplexer

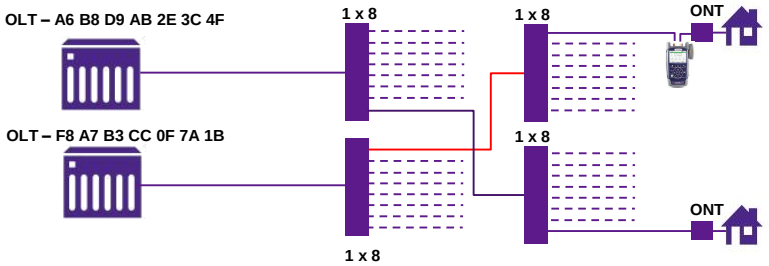
Desafios que los operadores encuentran en FTTx

- Generales
  - Falta del número de expertos necesários para manejar fibra;
  - Conectores sucios;
  - Falta de certificados de nascimiento confiables para pobrar la calidad de la instalación;
- Técnicos
  - Mediciones incorrectas de calificación de nível segundo estándares;
  - Están las ONTs conectadas en el punto correcto?
  - Has la ONT se entrado en operacción correctamente?
  - Hay dispositivos Rogue o Alien poniendo en riesgo de baja mi servicio ?
- Que necesitan
  - Mejorar la eficiéncia para crescer la rapidez del despliegue al mismo tiempo que aseguran tener informaciones confinables de los despliegues hechos;
- Solución
  - Uso de un activador complete de servicios PON

“First-time right” service activation-> Correct Fiber Connection

Challenge: No or incorrect labeling of fiber cables in splitter cabinet can lead to wrong customer/ONT connection. How making sure the ONT is connected to the right OLT?

- ✓ Identify the type of OLT (G-PON or non G-PON) and detects the OLT-ID at any network location
  - Ensures the right fiber cable is connected to the right ONT.
  - Enables handling installation error tickets more easily

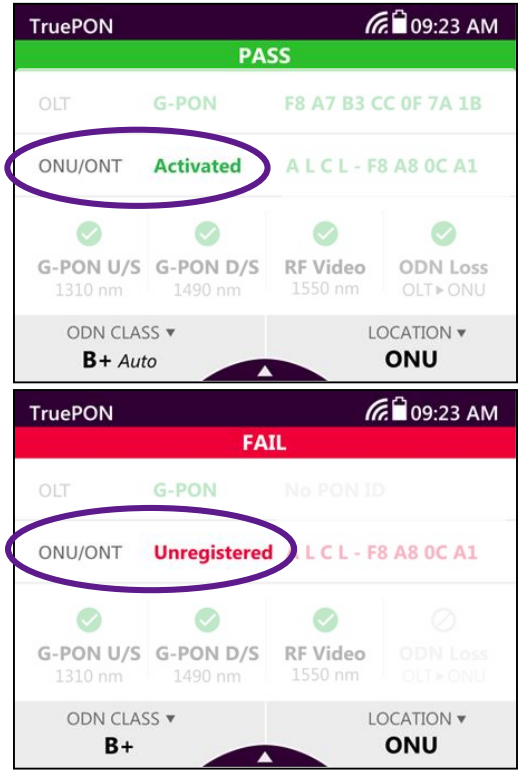


PON-ID carries OLT-ID

ONT provisioning-> Verify ONU/ONT operation

Challenge: When installing a new ONU/ONT in a PON network, the device needs to be activated from the OLT to join operations on the PON. Until now this could only be done by logging into the PON management system. How making sure that the ONU/ONT is activated and properly working?

- ✓ Identify ONT's serial number and extracts service parameters from the OLT that indicate the activation status of the ONU/ONT:
  - Activated = operations OK
  - Deactivated = Rogue ONU/ONT operations stopped
  - Unregistered = serial number not known at OLT operations stopped
  - Alien = not compliant to standards operations stopped



GPON data provides ONU/ONT status

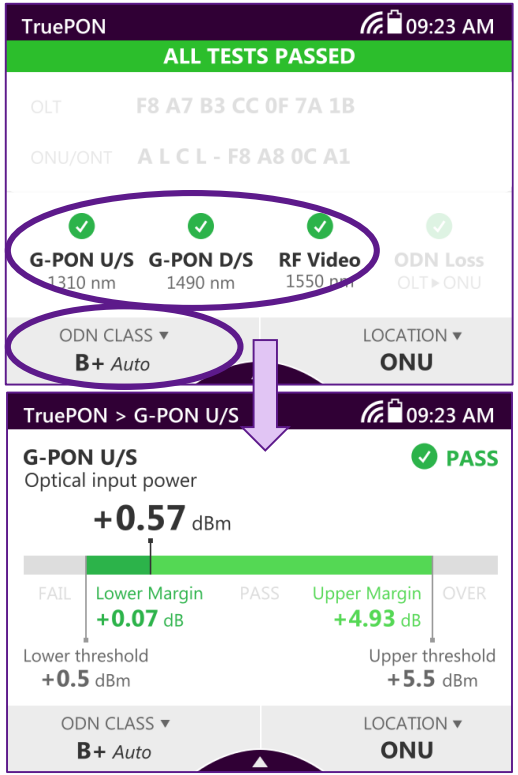
“First-time right” service activation-> Automatic Certification

Challenge: While performing a power-level verification at a customer ONT, how can I certify the service meet the specifications?

Need to perform:

- ✓ Downstream and upstream PON power level measurements (1310/1490nm and 1550nm)
- ✓ Auto setting of pass/fail thresholds in GPON systems with PON-ID

- Certification fully automatic -> No manual user interaction to select or enter pass/fail thresholds



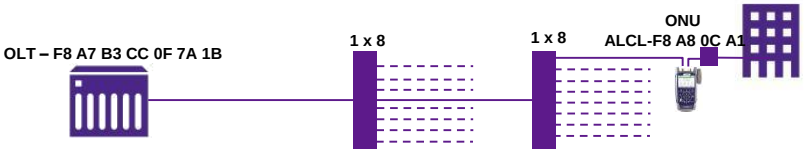
PON-ID carries ODN Class Information

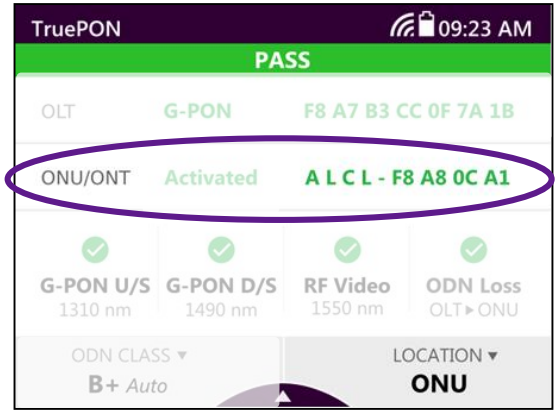
“First-time right” service activation-> Reduced Workflow Complexity

Challenge: Since the service-activation phase is often performed by subcontractors, they must provide test reports for each turn-up. How making sure reports corresponds to the jobs they are paid for?

- ✓ Extract ONU/ONT serial number using GPON data analysis

- Allocate ONU/ONT serial number to customer service contract.
- Links automatically service-activation results to ONT/customer -> Ensures authenticity of test results



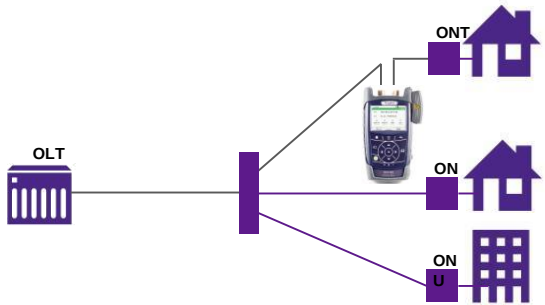


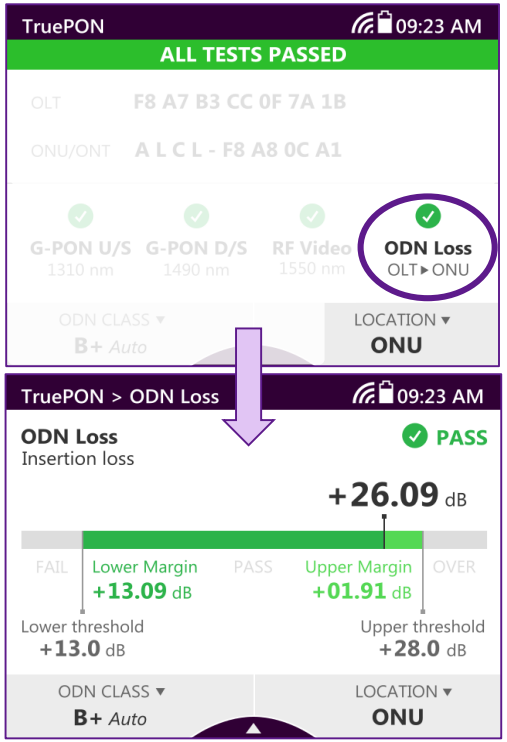
GPON data carries ONU/ONT serial number

“First-time right” service activation-> Fiber Plant Qualification

Challenge: During the construction phase, the fiber plant is qualified: end-to-end loss testing ensures that the fiber link complies with the loss budget. Is this still the case several years later when new customers subscribe to FTTH services?

- ✓ Perform real time in-service end-to-end loss measurement
- \- Fastest way to qualify the fiber link in an already-running network





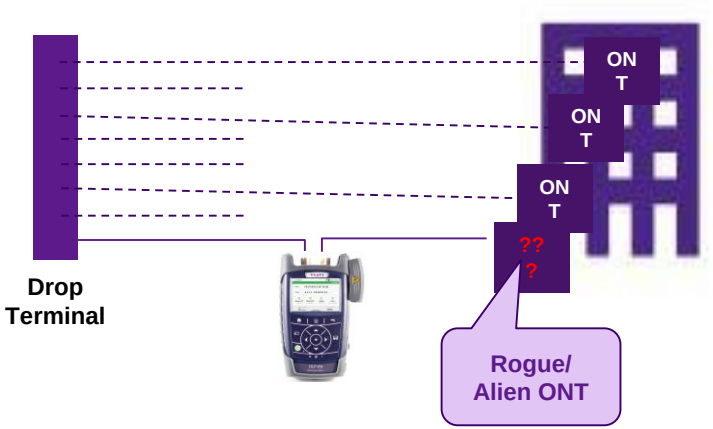
PON-ID carries OLT transmit level info

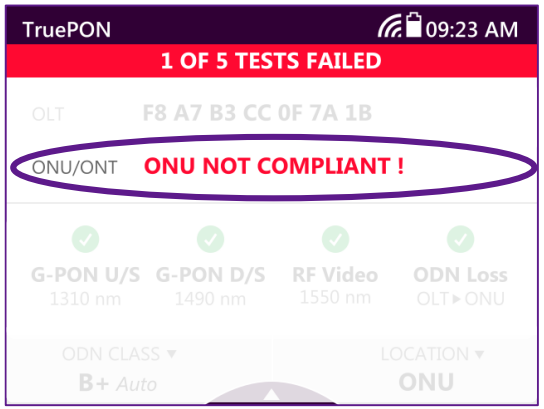
Avoid service failure -> Rogue/Alien ONU/ONT detection

- **Challenge:** How can I easily identify and localize a Rogue ONU (ITU-T G 49) that degrades or disables the service of other customers?

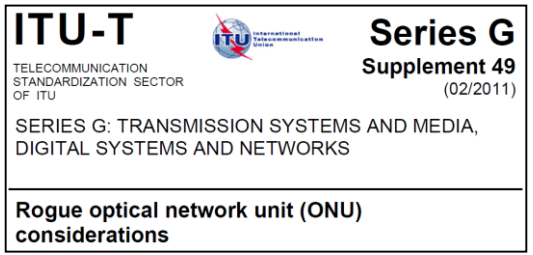
✓ Detect the presence of a Rogue or Alien ONU/ONT

- Facilitates service recovery by isolating the faulty ONU/ONT and replacing it in time.





✓ Detection of non standard ONUs/ONTs (Rogue or Alien)



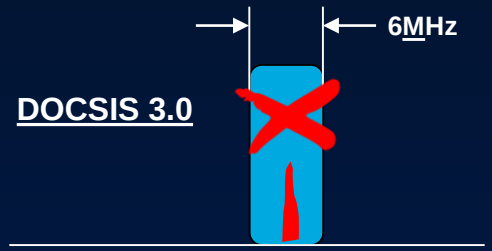
Desafios en Red Acceso Cable con DOCSIS 3.1

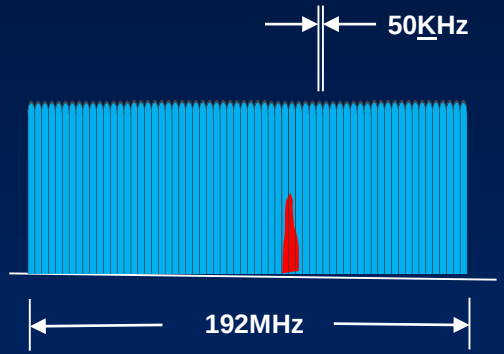
State Of The HFC: 2017

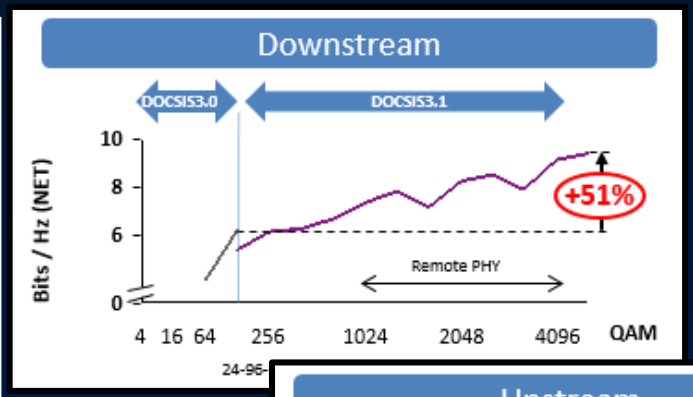
- **Broadband Demand Growing At Unprecedented Rate**
  - Drastic service group reduction drives explosive node count growth
- **Traditional Node Splits Can’t Keep Up**
  - Cost, hub power/cooling/rack space constraints
- **DOCSIS 3.1 Has Arrived!**
  - Higher modulation orders possible, but SNR still matters
- **And 5G Is Coming**
  - Advantage: Cable (Great Wires Make Great Wireless)

Adopción de DOCSIS 3.1

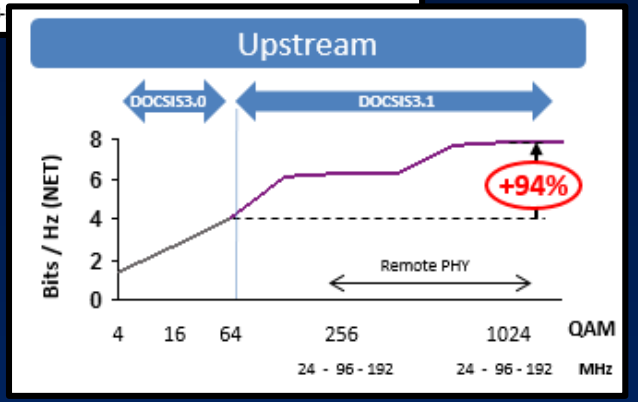
Sacar casi 100% mas "bits" de cada Hz del espectro







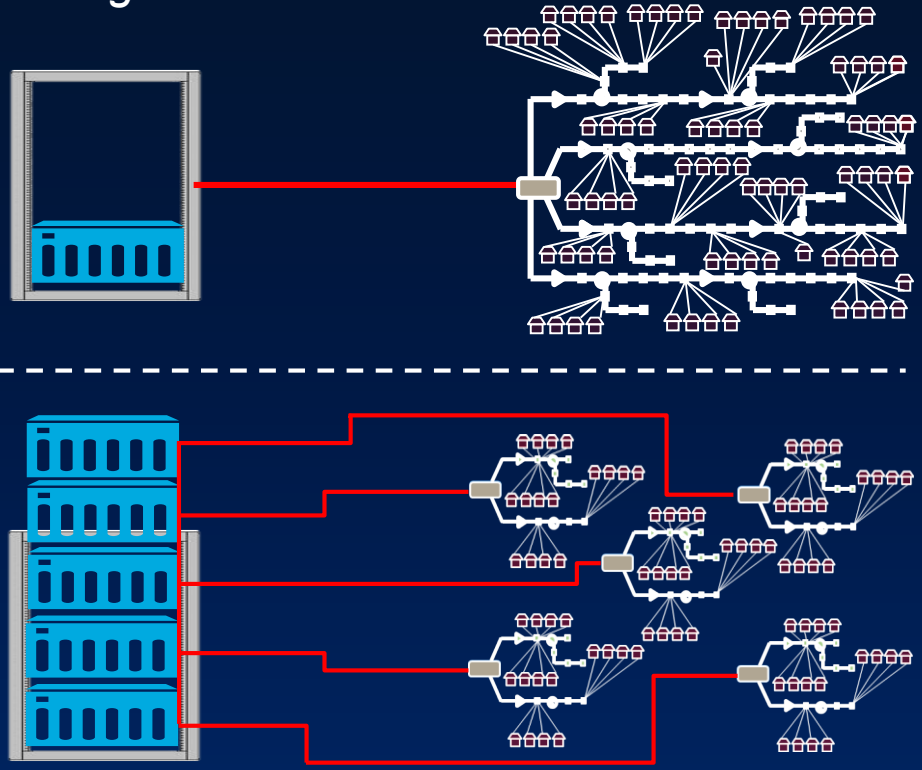
Resulta:
Mayor capacidad de la red



Source: Hans Wambach - SCTE Expo 2015 International Breakfast

Adopción de Arquitectura de Acceso Distribuido

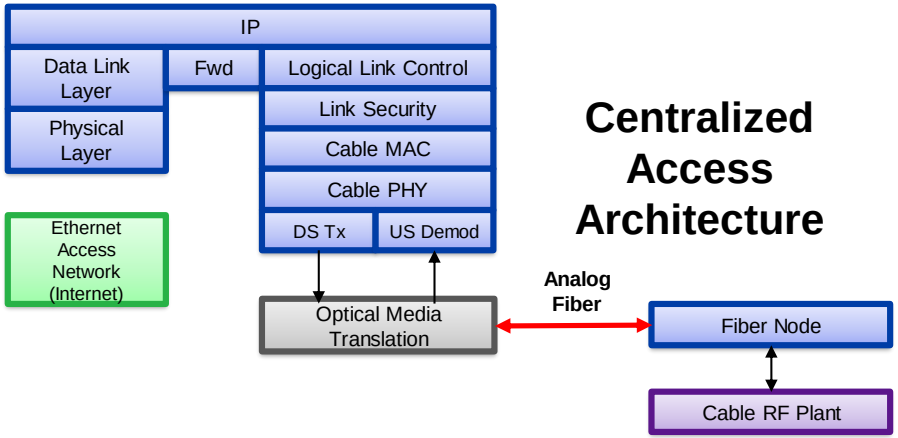
Permite crecimiento exponencial de nodos sin importar el espacio y el consume energético de los “hubs”



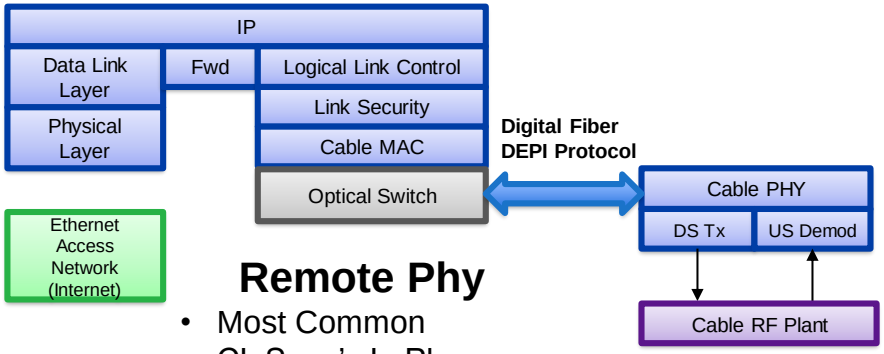
DAA Benefits/Challenges

- Vencer las limitaciones por espacio/energía
- Menor costo total de adquisición
- Enlace óptico mas robusto
- Flexibilidad – profundidad Ethernet
- Interrumpe el mantenimiento de HFC

Most Common Distributed Access Architecture Variants

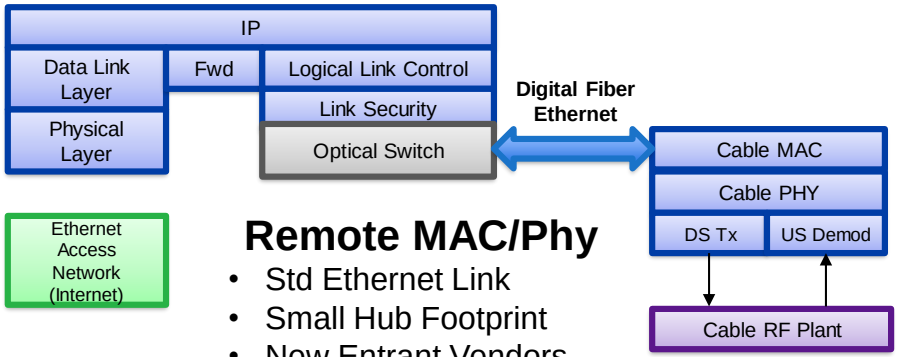


Centralized Access Architecture



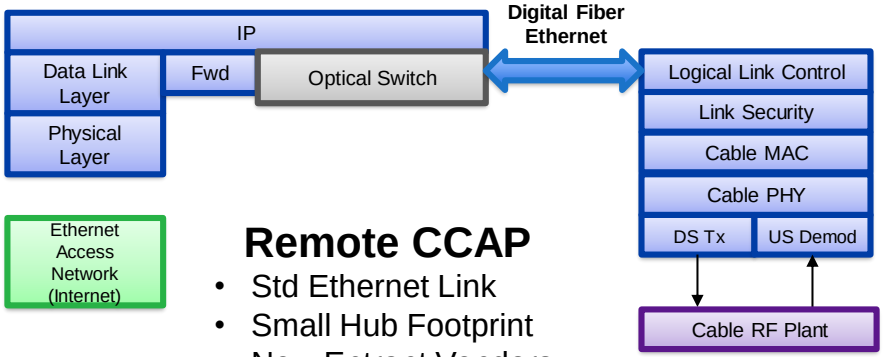
Remote Phy

- Most Common
- CL Spec's In Place
- CMTS Vendors Choice



Remote MAC/Phy

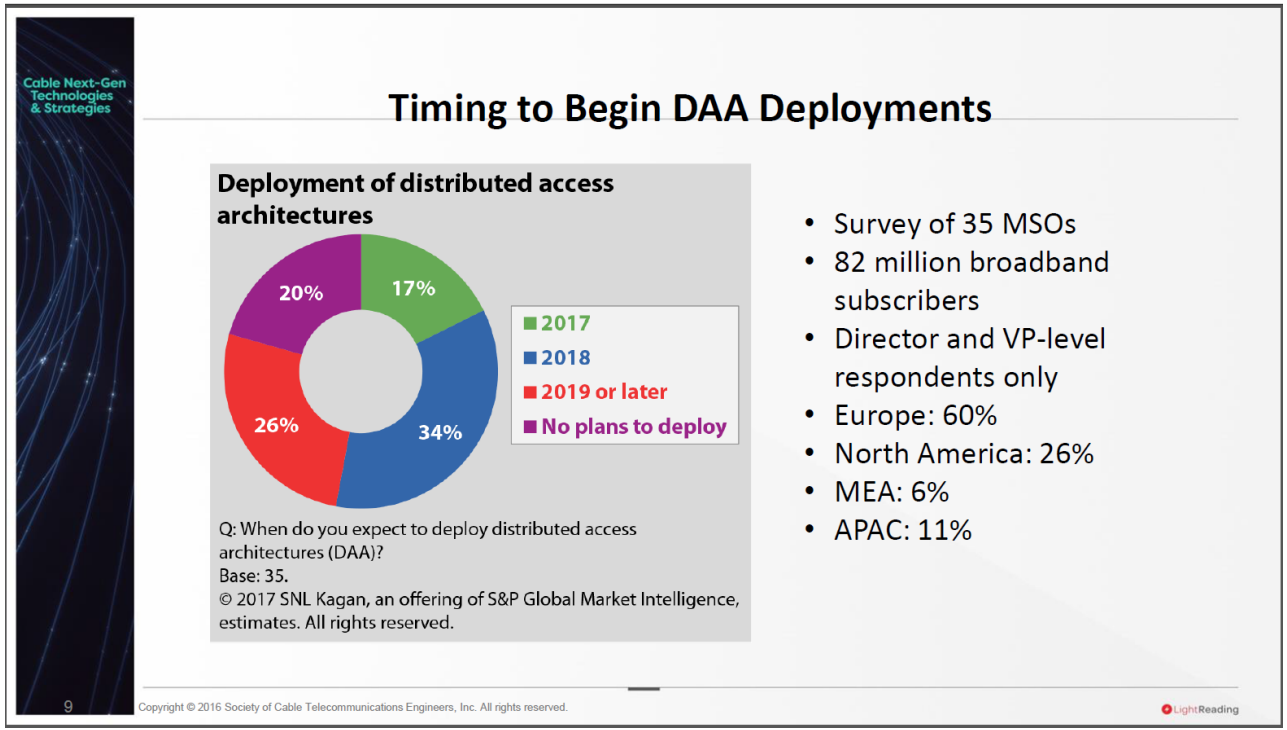
- Std Ethernet Link
- Small Hub Footprint
- New Entrant Vendors



Remote CCAP

- Std Ethernet Link
- Small Hub Footprint
- New Entrant Vendors

DAA es la solución preferida para aumento de nodos



- 80% tienen planes
- 50% comienzan en 2018

Retos por resolver

Gestión del cambio continuo
- Comprobar la continuidad de la capacidad
- Mantenimiento de procesos estándar

→ Sistemas Flexibles / Herramientas
→ Diseños Modulares
→ Virtualización

Haciendo más con menos
- Aumento de la carga de trabajo del personal
- El conocimiento de tecnología entrante no es

→ Automatización de pruebas
→ Análisis centralizado
→ Ejecución Rápida de Pruebas

La calidad importa más que nunca
Pobre QoE & Churn
Concéntrese en asuntos que importan

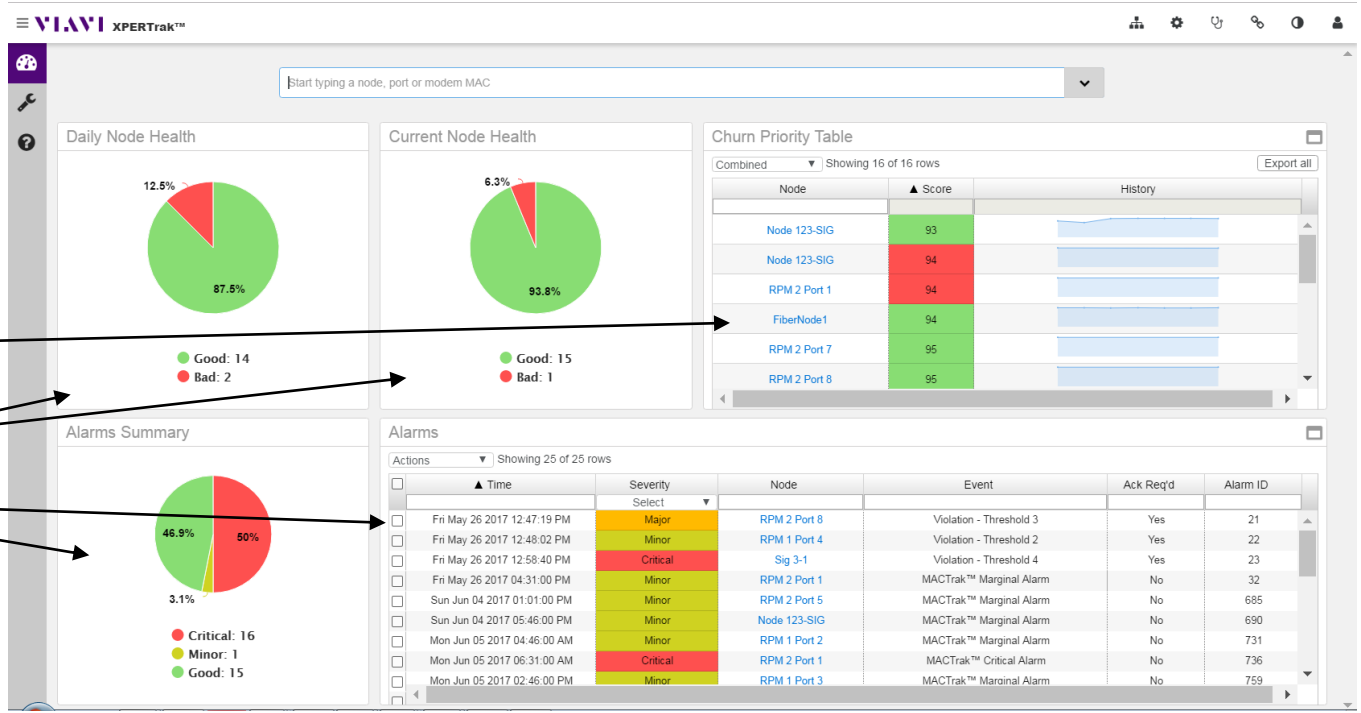
→ Visibilidad QoE
→ Problema / correlación de impacto
→ Búsqueda y arreglo más rápidos

Executive

Service Dashboard

At-a-glance determine:

- Worst performing nodes based on adjustable QoE thresholds
- Node quality vs time
- Nodes violating performance thresholds



Drill down using mobile or desktop device to:

- Determine root cause of QoE problem
- Map impaired subscribers with plant map overlay
- Trend problems over time
- Generate live displays to resolve issue, verify fix

Correlated

Node Analysis

- **Problem Segmentation**
  - Upstream
    - Spectrum/MACTrak
    - CMTS
  - Downstream
    - Spectrum/CPE

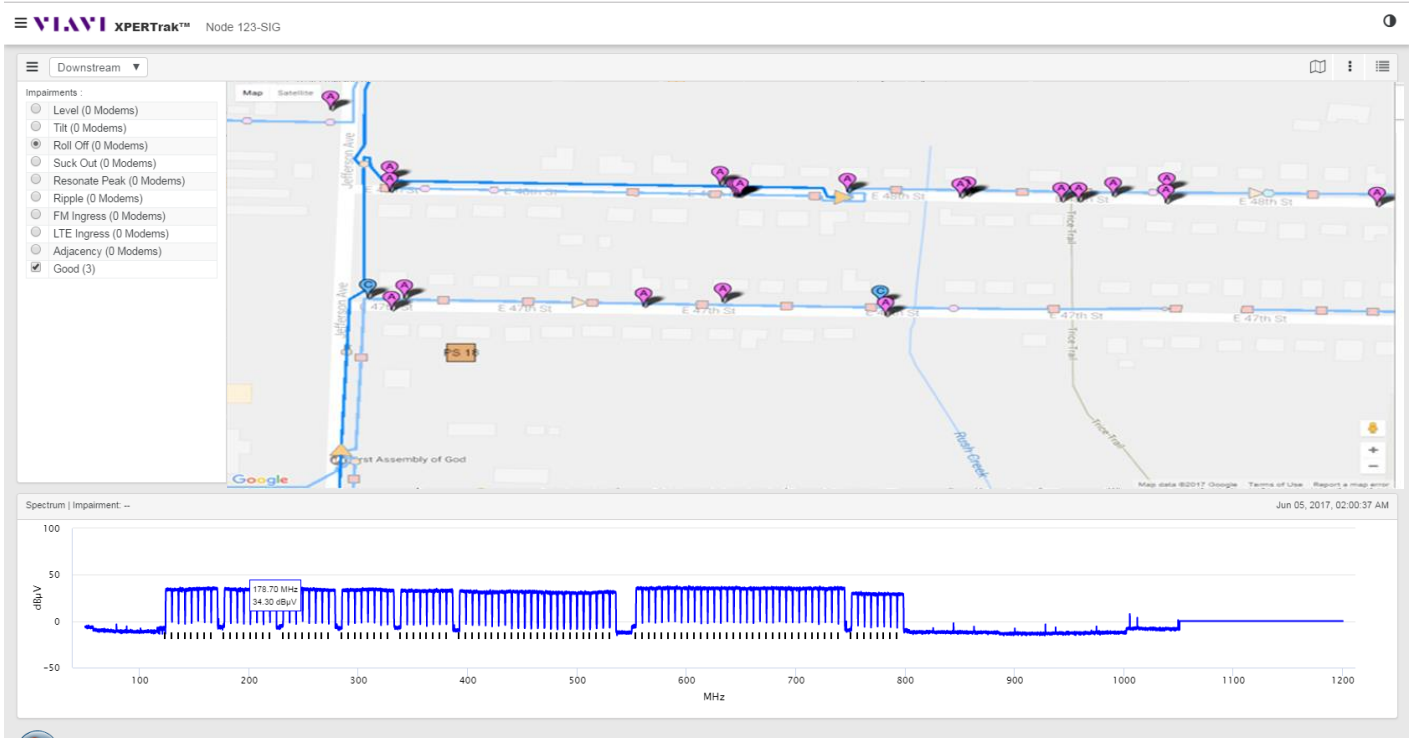
- **Focused on Subscriber impact**
  - Metrics driven by subscriber health

- **Branches workflow to right tool**
  - Ingress suppression
  - Localized US HFC issues
  - Localized DS impairments
  - Sweep

Locate

Impairments

- **Localize issues**
  - Upstream
  - Downstream
  - Plant maps

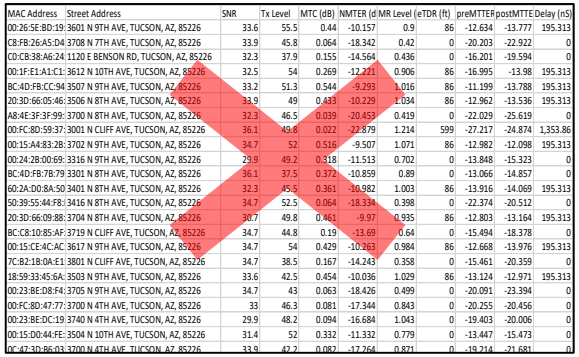


- **Prioritize issues**
  - Fix the worst/most subscribers first
  - Fix low-hanging fruit while techs are there

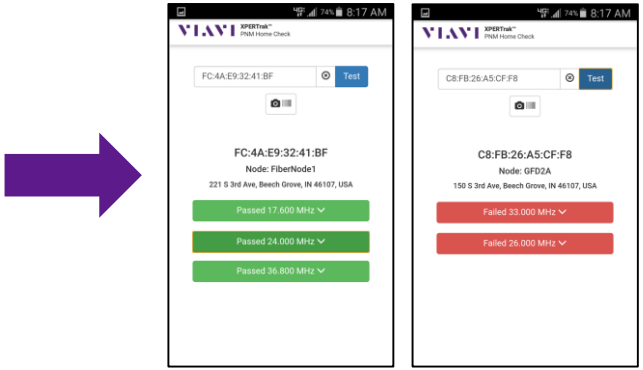
- **Validate fix**
  - Verify issues resolved before techs move on

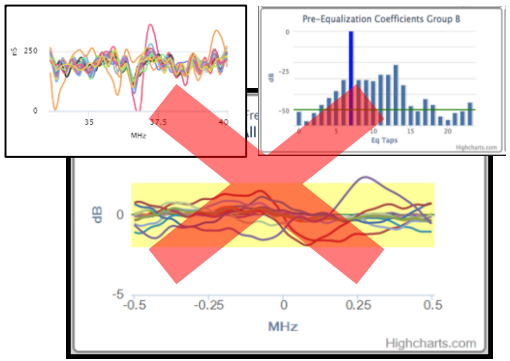
Tools Tailored To The Specific Needs Of Field Techs

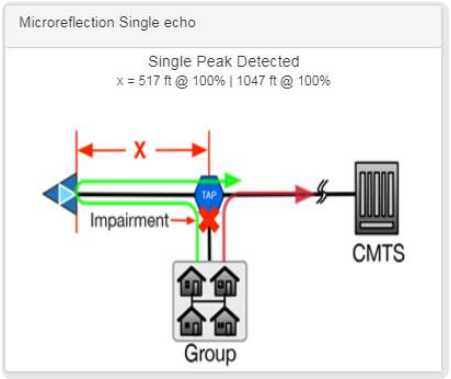
Truck rolls are still required, how to maximize effectiveness of each



MAC Address	Street Address	SNR	Tx Level	MTC (dB)	NMTER (d	MR Level (e	TDR (ft)	preMTTER	postMTTE	Delay (nS)
00:26:5E:BD:19:	3601 N 9TH AVE, TUCSON, AZ, 85226	33.6	55.5	0.44	-10.157	0.9	86	-12.634	-13.777	195.313
C8:FB:26:A5:D4	3708 N 7TH AVE, TUCSON, AZ, 85226	33.9	45.8	0.064	-18.342	0.42	0	-20.203	-22.922	0
C0:CB:38:A6:24	1120 E BENSON RD, TUCSON, AZ, 85226	32.3	37.9	0.155	-14.564	0.436	0	-16.201	-19.594	0
00:1F:E1:A1:C1:	3612 N 10TH AVE, TUCSON, AZ, 85226	32.5	54	0.269	-12.221	0.906	86	-16.995	-13.98	195.313
BC:4D:FB:CC:94	3507 N 9TH AVE, TUCSON, AZ, 85226	33.2	51.3	0.544	-9.293	1.016	86	-11.199	-13.788	195.313
20:3D:66:05:46:	3506 N 8TH AVE, TUCSON, AZ, 85226	33.9	49	0.433	-10.229	1.034	86	-12.962	-13.536	195.313
A8:4E:3F:3F:99:	3700 N 8TH AVE, TUCSON, AZ, 85226	32.3	46.5	0.039	-20.453	0.419	0	-22.029	-25.619	0
00:FC:8D:59:37:	3001 N CLIFF AVE, TUCSON, AZ, 85226	36.1	49.8	0.022	-22.879	1.214	599	-27.217	-24.874	1,353.86
00:15:A4:83:2B:	3702 N 9TH AVE, TUCSON, AZ, 85226	34.7	52	0.516	-9.507	1.071	86	-12.982	-12.098	195.313
00:24:2B:00:69:	3316 N 9TH AVE, TUCSON, AZ, 85226	29.9	49.2	0.318	-11.513	0.702	0	-13.848	-15.323	0
BC:4D:FB:7B:79	3301 N 8TH AVE, TUCSON, AZ, 85226	36.1	37.5	0.372	-10.859	0.89	0	-13.066	-14.857	0
60:2A:D0:8A:50	3401 N 8TH AVE, TUCSON, AZ, 85226	32.3	45.5	0.361	-10.982	1.003	86	-13.916	-14.069	195.313
50:39:55:44:F8:	3416 N 8TH AVE, TUCSON, AZ, 85226	34.7	52.5	0.064	-18.334	0.398	0	-22.374	-20.512	0
20:3D:66:09:88:	3704 N 8TH AVE, TUCSON, AZ, 85226	30.7	49.8	0.461	-9.97	0.935	86	-12.803	-13.164	195.313
BC:C8:10:85:AF:	3719 N CLIFF AVE, TUCSON, AZ, 85226	34.7	44.8	0.19	-13.69	0.64	0	-15.494	-18.378	0
00:15:CE:4C:AC:	3617 N 9TH AVE, TUCSON, AZ, 85226	34.7	54	0.429	-10.263	0.984	86	-12.668	-13.976	195.313
7C:B2:1B:0A:E1:	3801 N CLIFF AVE, TUCSON, AZ, 85226	34.7	38.5	0.167	-14.243	0.358	0	-15.461	-20.359	0
18:59:33:45:6A:	3503 N 9TH AVE, TUCSON, AZ, 85226	33.6	42.5	0.454	-10.036	1.029	86	-13.124	-12.971	195.313
00:23:BE:D8:F4:	3705 N 9TH AVE, TUCSON, AZ, 85226	34.7	43	0.063	-18.426	0.499	0	-20.091	-23.394	0
00:FC:8D:47:77:	3700 N 4TH AVE, TUCSON, AZ, 85226	33	46.3	0.081	-17.344	0.843	0	-20.255	-20.456	0
00:23:BE:DC:19	3740 N 4TH AVE, TUCSON, AZ, 85226	29.9	48.2	0.094	-16.684	1.043	0	-19.403	-20.006	0
00:15:D0:44:FE:	3504 N 10TH AVE, TUCSON, AZ, 85226	31.4	52	0.332	-11.332	0.779	0	-13.447	-15.473	0
0C:47:3D:B6:03:	3700 N 4TH AVE, TUCSON, AZ, 85226	33.9	42.2	0.082	-17.264	0.871	0	-19.214	-21.681	0

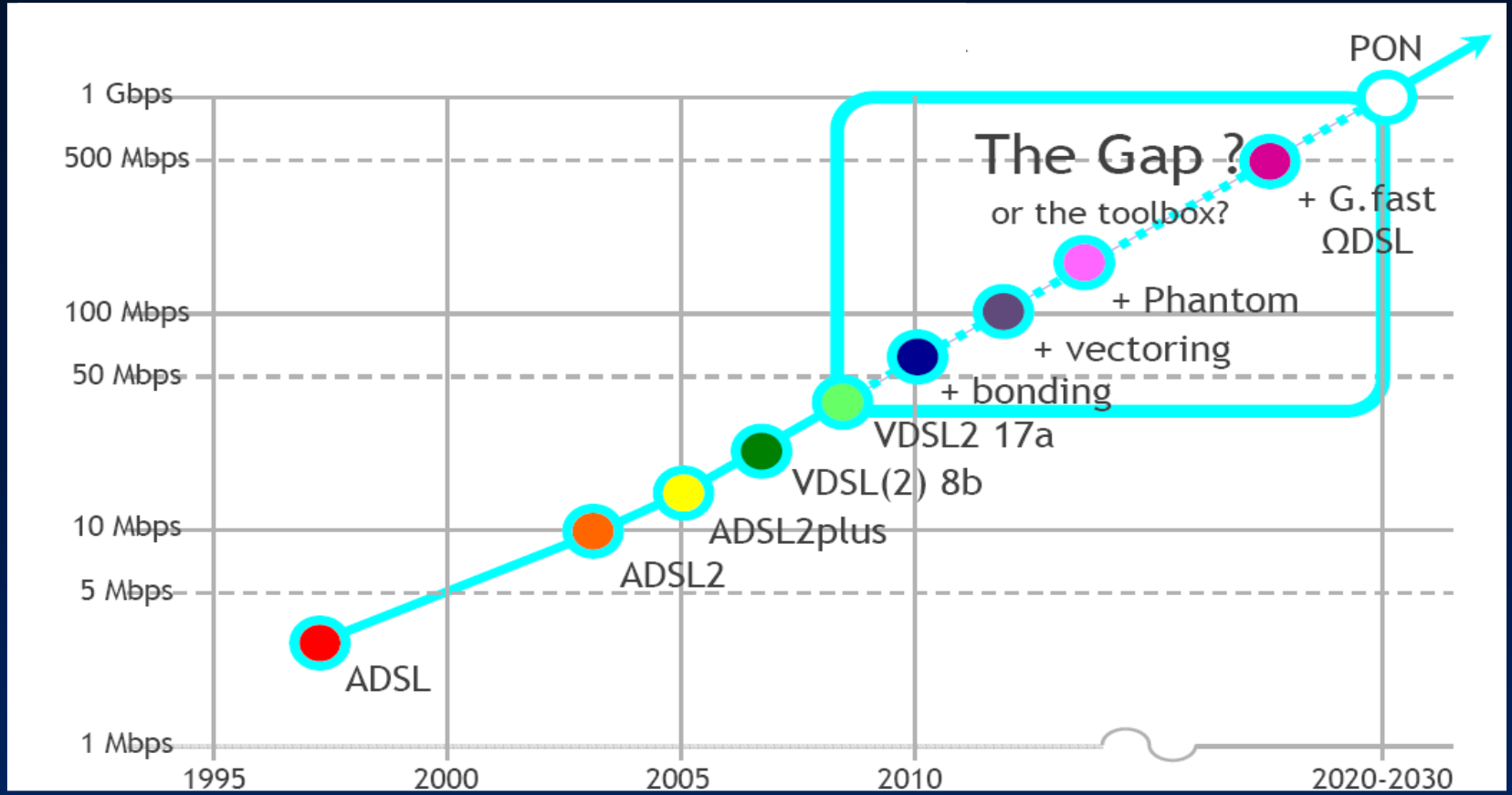




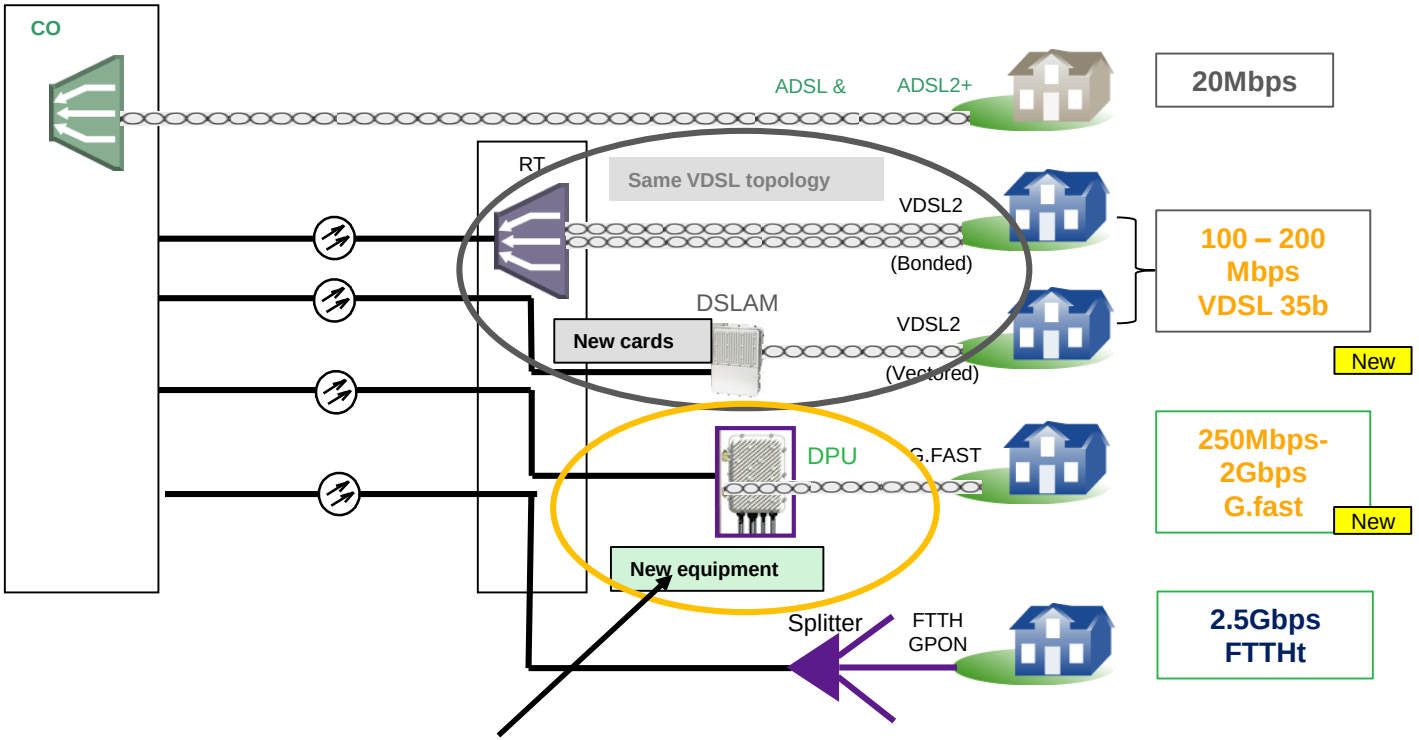


Desafios en Red Acceso Cobre con G.fast

Repaso tecnológico



xDSL and FTTH Network Topologies with Speeds



Extended fiber, new DPU, and G.fast over short copper loop over pristine line (820ft/250m)

Maximizing Profit for G.fast Rollouts

Promises: Premium Service and Speed for Less Cost than FTTH

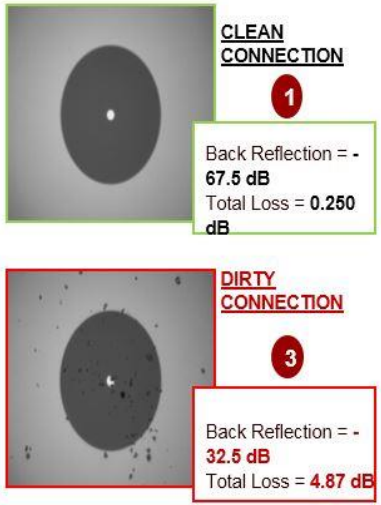
- Aggregated speeds up to 2Gbps with 10Gbps on the horizon
- Dynamically set up and downstream bandwidth via Dynamic Timeslot Assignment
- Great option for apartment dwellings

Pitfalls: OPEX Spikes and QoE issues IF Procedures Are Inefficient

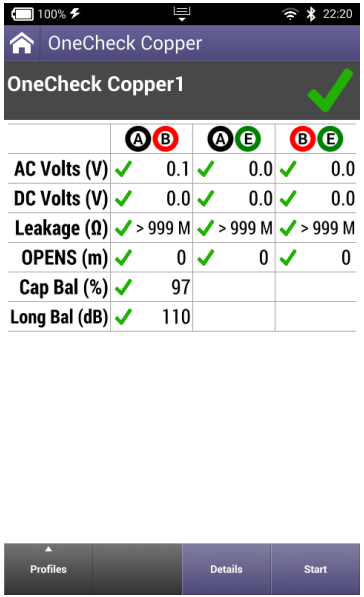
- Realizing speed across hybrid architecture and CPE to the WiFi client
- High speed transmissions are more sensitive to physical faults
- Staff need to learn new technologies/tasks and should minimize hand-offs
- Copper expertise is diminishing while network complexity is increasing
- Unresolved/hidden issues can reduce profit by increasing repeat calls

Automated test procedures eliminate interpretation errors and repeats

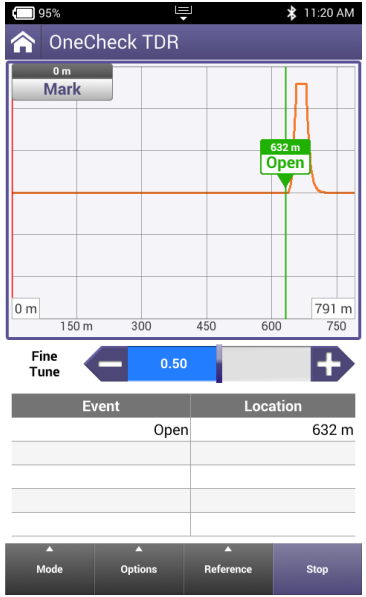
Automation Accelerates and Simplifies Test



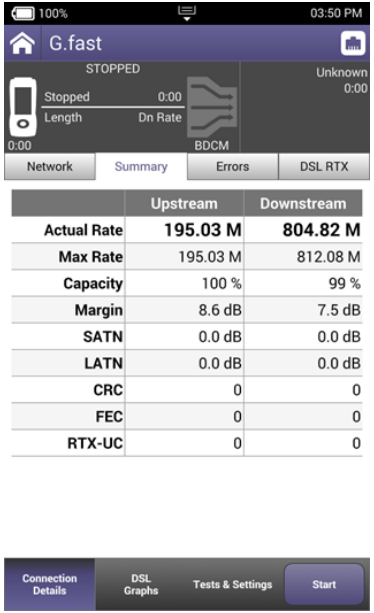
Fiber inspection



Copper verification



Copper TDR for faults or RFL for lack of grounding



G.fast modem sync

Hay que mejorar la Eficiencia de los trabajos en la Red!

Eficiencia de Flujo de Trabajo

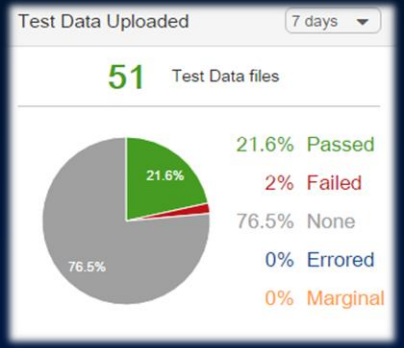
- Los desafíos más grandes son que sus procesos son los mejores y cómo medir eficacia (mantenimiento a cero)
- FTTH - proceso / validación de todo está funcionando

¿Sus iniciativas realmente están moviendo la aguja?
¿Cómo medir sus mejoras?

- Las iniciativas de mejora de procesos pueden ser perturbadoras
- ¿Estás cambiando las cosas sólo por el bien del cambio?

Que es el flujo de trabajo y porque es importante?

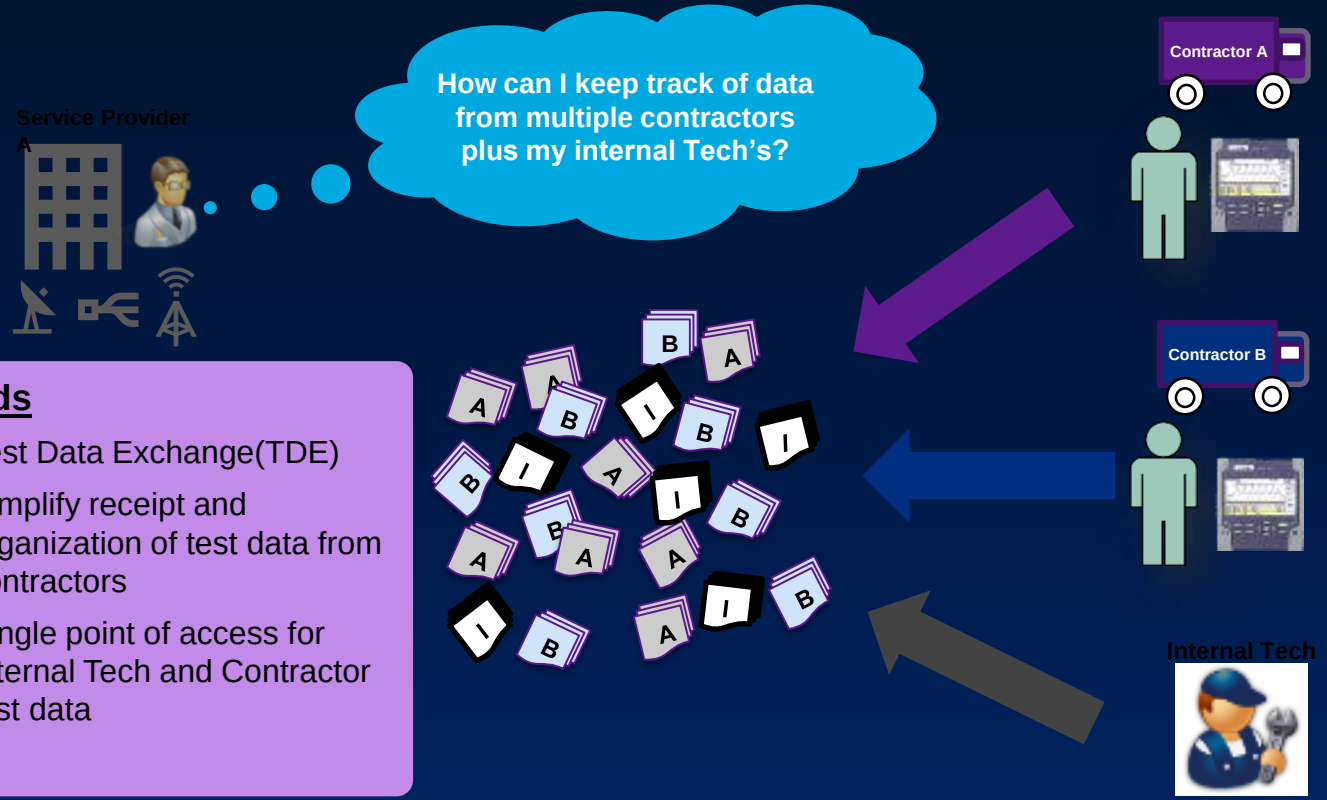
- **Rastreo y Reporte en:**
  - # de ordenes asignadas a un tecnico (o grupo, o region, etc)
  - #/% de ordines de trabajo completadas
  - #/% de pruebas que pasaron y/o fallaron



- **Why It Matters:**
  - Identificar tecnico de bajo desempeño, corregir
  - Comparar desempeño en regiones
  - Detectar tendencias rapidamente, corregir la raiz de la causa
    - Configuraciones incorrectas ocacionan alto gasto en pruobar la red
    - Geograficar areas de problemas (problemas de planta externa)
    - Identificar problemas sistematicos y sus patrones.

Common Challenges: Service Provider

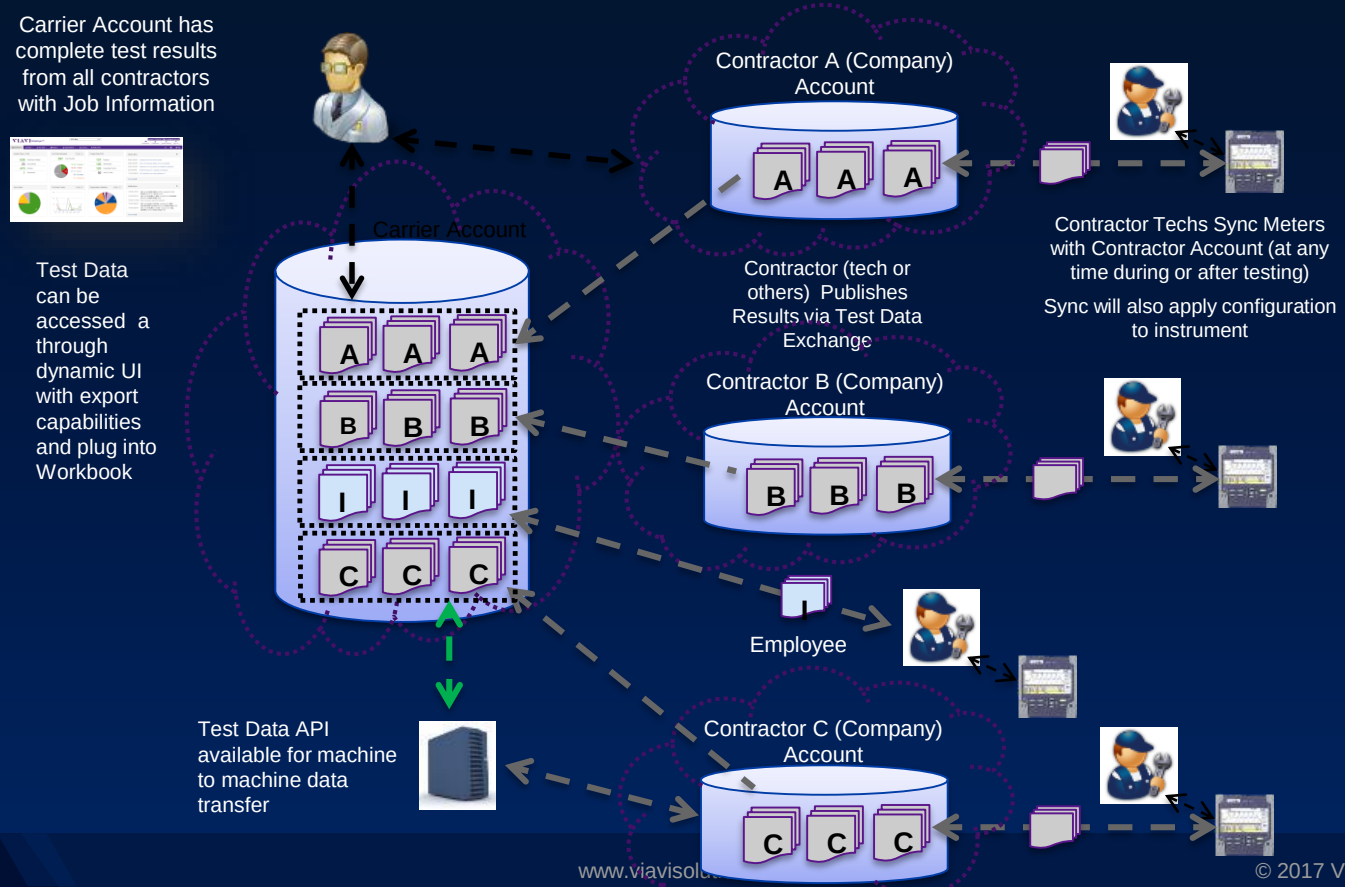
Multi-Contractor Data Management



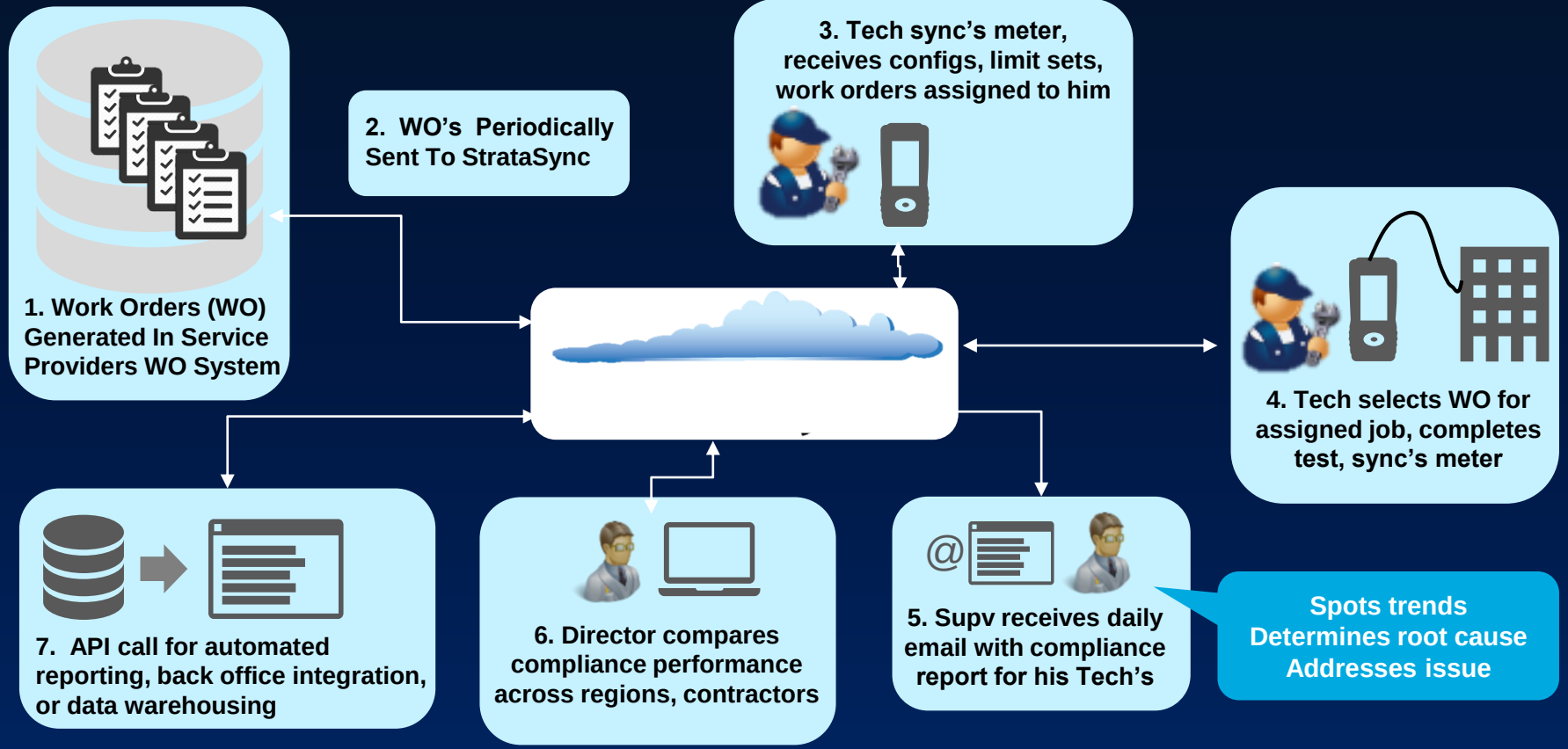
Needs

- Test Data Exchange(TDE)
- Simplify receipt and organization of test data from contractors
- Single point of access for Internal Tech and Contractor test data

Test Data Exchange Use Case



Ejemplo de proceso de flujo de trabajo en funcion



Recursos en VIAVI (Gigabit)

- Gigabit Monitor: a web-based tool intended to showcase the state-of-play of gigabit internet provision across the world, based on publicly available data.
- Race is on to Deliver Gigabit Broadband Services to the Home:
  Learn more about the future of gigabit services and how VIAVI can enable deployment and testing over any network.
- Do You Inspect Before You Connect? (Poster): Contamination — The #1 Reason to Troubleshoot Optical Networks. Learn what you need to do before connecting.
- Understanding OTDR (Poster): Learn how to interpret OTDR results.
- Optimizing DOCSIS 3.1 Performance (Poster): Learn valuable tips on how to optimize DOCSIS 3.1 performance, including OFDM and profiles, testing and turn-up, and optimizing service.

Preguntas ?

www.viavisolutions.com