Reinventing the NETWORK ROADSHOW

ADTRAN®

Our Focus

Today's Agenda

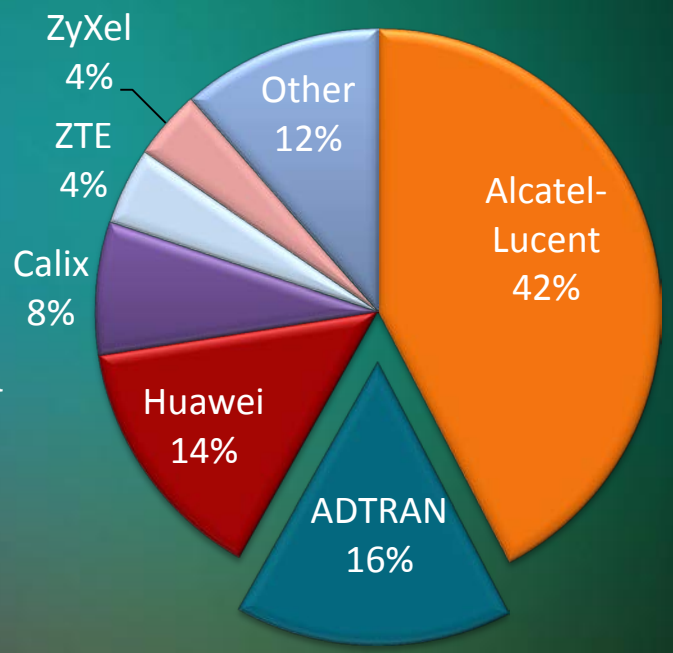
- ✓ **ADTRAN® At a Glance (9:00 AM)**
  - Corporate Summary
- ✓ ADTRAN in Frontier (9:15)
  - What is Approved and Deployed
  - Total Access 5000 Technical Leadership
- ✓ What's Next With ADTRAN? (10:00)
  - New Software Features and Hardware platforms for 2014 approval
  - ADTRAN's Mobile Planning Tool for Frontier Solutions
- ✓ Break (10:45 AM)
- ✓ Planning With ADTRAN in 2014 (11:00 AM)
  - Total Access 5000 Ultra Broadband Updates
  - Effective FTTN – FTTH Migration
  - Gigabit Services Architectures
- ✓ Lunch (12:30 PM)
- ✓ Equipment Displays (1:15 PM)
  - Open Q&A

ADTRAN at a Glance

ADTRAN is *Reinventing the Network*

- Broad Portfolio of Solutions
  - More than 1,700 products
- Strong Financials
  - Over 25 years of continuous profitability
  - 2013 revenue $641M
- Leading Supplier to Tier 1 Global Carriers
  - #2 DSL Global Revenue
  - #3 in broadband revenue (PON & DSL) excluding Asia
- Strong Enterprise Business
  - Cloud connectivity and Enterprise Communication
- Global Presence
  - Headquartered in Huntsville, Alabama
  - R&D centers:
    - Huntsville, Alabama
    - Phoenix, Arizona
    - Ottawa, Canada
    - Hyderabad, India
    - Boston, MA
    - Berlin, Germany
    - Greifswald, Germany

#2 DSL Global Revenue



Source: Infonetics 2013 Reports

ADTRAN's Global Offices

AMERICAS

Canada
- Quebec (Montreal)

Ontario
- Ottawa
- Mississauga

Latin America
- Peru (Lima)
- Mexico (Mexico City)
- Brazil (Sao Paulo)

United States
- Burlington, MA
- Denver, CO
- Huntsville, AL
- Kansas City, MO
- Phoenix, AZ

EUROPE, MIDDLE EAST, AFRICA (EMEA)

- Croatia
- Finland

Germany
- Berlin
- Bruchsal
- Frankfurt
- Greifswald
- Leipzig
- Munich

- Greece
- Ireland
- Italy
- Israel
- Lebanon
- Poland
- Portugal
- Russia
- Saudi Arabia
- Slovakia
- South Africa
- Spain
- Switzerland
- Tunisia
- United Arab Emirates

United Kingdom
- Ipswitch
- Reading

ASIA PACIFIC (APAC)

Australia
- Melbourne
- Sydney

China
- Beijing
- Hong Kong

- India (Hyderabad)
- Indonesia
- Japan
- New Zealand
- South Korea
- Singapore
- Taiwan
- Thailand
- Vietnam

ADTRAN Leadership

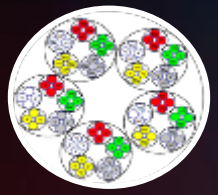
- Leadership in focused industry and standards organizations
  - Board of Directors
  - Vice chair
  - Policy chair positions
  - Technical chair positions
  - Editors
  - Contributors

- Leadership in Innovation
  - 470 granted patents
  - Over 270 pending patents
  - 60 percent US patents and US pending applications
  - 40 percent spread globally across 25 countries.
  - 0.4 patent applications per $1M R&D Investment (industry average is 0.25)

ADTRAN FTTx Innovation

Advancing FTTN Capabilities

- New advancements in FTTN technology deliver up to 300M over a single pair
- Solutions interoperable with 100M vectored VDSL2 solutions



Next-Gen PON Solutions

- Accelerating delivery of 10G PON solutions
- Advanced traffic management techniques better support co-existence of enterprise, residential and mobile backhaul services

Innovative Mechanical Solutions for FTTx

- Industry leader in sealed DSLAM solutions
- Small footprint enclosures for FTTx aggregation

FTTdp/FTTB Solutions

- Small footprint G.Fast solutions for near-Gigabit service delivery
- 4x10G, 24x1G building basement switches for residential and enterprise service delivery
- Sealed ONUs and building basement solutions

Carrier Ethernet over FTTx

- Multi-pair Bonded VDSL2 gateways allow for up to 800M service delivery
- Fibre gateways for CE 2.0 services over GPON or GE

2008 ADTRAN Total Access 5000 Accounts

Tier III Market Share

Accounts Represent Over 22% of Total IOC Market Share

2013 ADTRAN Total Access 5000 Accounts

Tier III Market Share

Accounts Represent Over 52% of Total IOC Market Share

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Supporting Frontier

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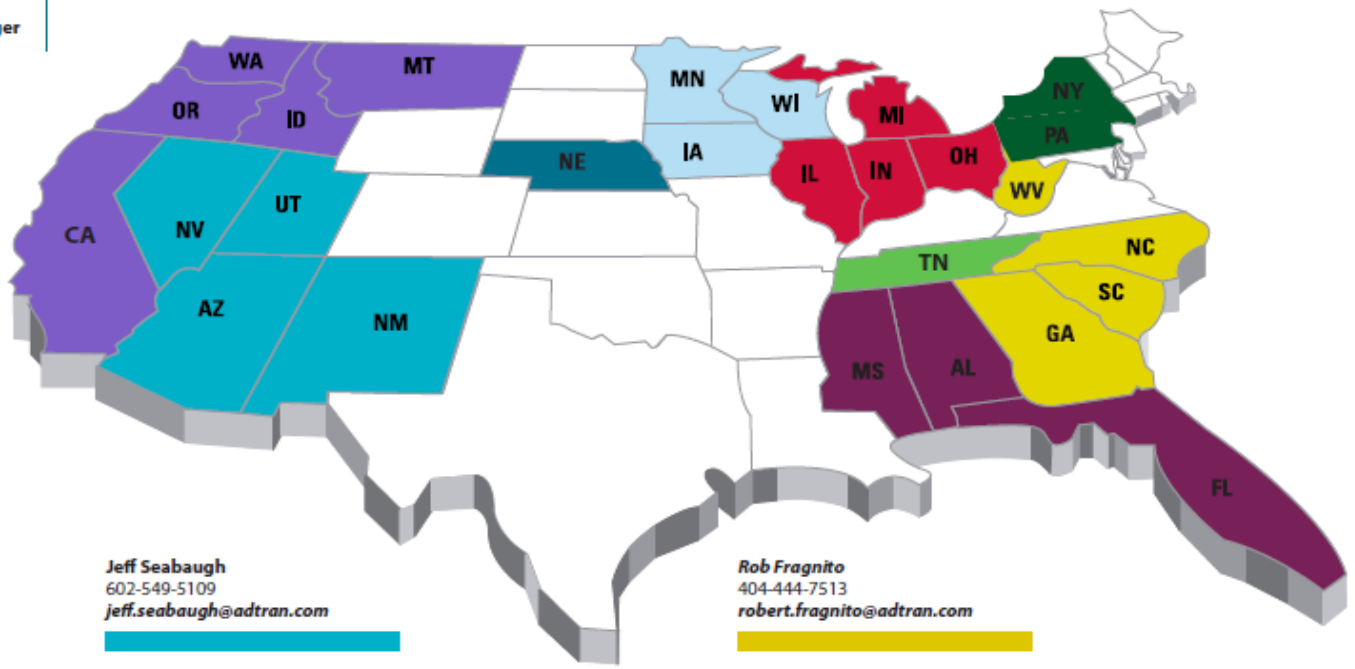

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CN100C
04/22/2013

Adtran aligned with Frontier's objectives

Growing Business & Broadband Revenues

- Standardizing on service offerings
- Service qualification/enablement
- Network standardization
- Vendor consolidation
- Network focus
  - Broadband
    - Network improvement
      - Broadband Congestion
      - Speed & Capacity
      - ATM to IP Conversion
    - Expanding service (Connect America Funds)
- Business Edge sales strategy underway
    - Service Level Agreement (SLA) Based Services

ADTRAN in Frontier

- Approved Residential Applications
  - HSI
    - DSLAM, DLC, Pair bonding
  - CAF
    - DSLAM Augment, Retrofit Cabinet
    - DSLAM cabinet, OSP DSLAM
  - Broadband DLC
  - Fiber to the Home
    - GPON OLT and ONTs,
    - MDU – DSL
  - Fiber to the Node
    - Total Access 1148A/V (Chaining)
    - Total Access 1248A/V (Chaining)
  - Switch Collapse / Switch Migration
- Approved Business Applications
  - Metro Ethernet
    - Bonded Copper, Fiber,
  - Carrier Ethernet
  - DS1 over Ethernet / Pseudowire
- Approved Transport / Backhaul Applications
  - Bonded SHDSL Copper Backhaul
  - Bonded SHDSL Repeatered Loops
  - Broadband Congestion/ Aggregation (TDM, ATM and IP)
  - Ethernet Aggregation
  - SLC2000 Replacement Cabinet
- Totals NE's Deployed in Frontier
  - Total Access 5000 MSAN = 3600+
  - Total Access 12xxA/V DSLAM = 3200+
  - Total Access 11xxA/V DSLAM = 3000+

ADTRAN in Frontier (Cont.)

Overview: Multi-Service Applications in the CO and RT

- **Aggregator**
  - Ethernet/IP Aggregation
  - TDM and ATM Aggregation
- **Copper Metro Ethernet**
  - EoCU - e.SHDSL
  - EoTDM - T1, DS3
- **CO IP DSLAM**
  - ADSL2+ VDSL2 Overlay (today)
  - RT DSLAM (ADSL2+/VDSL2)
- **BBDLC**
  - VDSL2, ADSL2+,HDSL4, POTS, etc.
- **FTTP**
  - GPON OLT and ONT's

Total Access 5000

ADTRAN in Frontier

Overview: DSLAMs Deployed

- **DSLAM (Rack Mount)**
  - Total Access 1248A/V
    - 48 Lines of ADSL2+/VDSL2 (Overlay)
    - Host or Client
    - RT Cabinet Mount
    - Currently providing CAF services

Total Access 1248V

- **DSLAM (Sealed)**
  - Total Access 1148A/V
    - 48 lines of ADSL2+/VDSL2 (Overlay)
    - Host or Client
    - RT Pedestal
    - Currently providing CAF services

Total Access 1148V

Total Access 5000 SmaRT Cabinet

4th Generation SmaRT Configurations

- **Total Access 1248V Configuration for 384 Lines of VDSL2 Overlay**
  - -Up to Eight 48-Line Blades
- **Total Access 5000 Configuration for 288 Lines of VDSL2 Overlay**
  - -Ability to Add GPON and Active Ethernet Cards
- **Total Access 5000 Configuration for 504 Lines via VDSL2 Combo**
  - -Ability to add GPON and Active Ethernet Cards

Total Access 5000 SmaRT Cabinet

Key Cabinet Features

- GR-487 Core Tested and Certified
- Pad, Pole, or H-Frame Mounting Options
- High Capacity Heat Exchanger Cooling System – 2000W
- High Capacity Battery String – 100A-Hr
- Simultaneous Support of xDSL, GPON, AE, Copper Spans, POTS, Specials, Wavelengths, etc.
- Generator Connector
- CAT5 Cabling
- Battery Warmer and Temperature Compensated Charging

Valere Rectifier Shelf

Total Access 5000
or
Total Access 1248V

Total Access1500 (Optional)

-DS0 Special Circuits

SmaRT Enclosure

Total Access 5000 SmaRT Cabinet

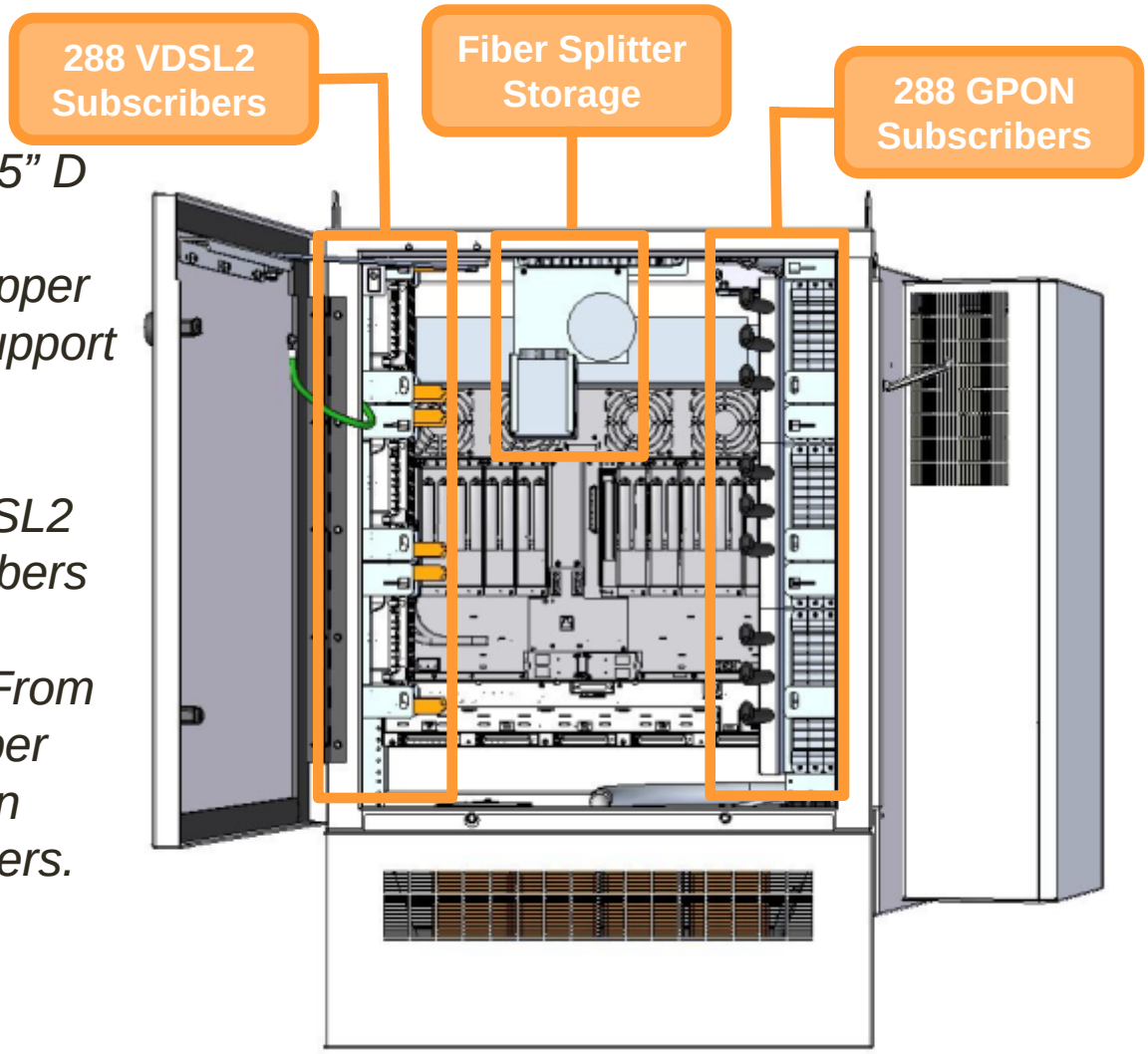
Copper + Fiber Combo

Ultra Compact - *42”H x 28”W x 25” D*

Backwards Compatibility *for Copper and Fiber Service Delivery and Support for Legacy DS0 Circuits.*

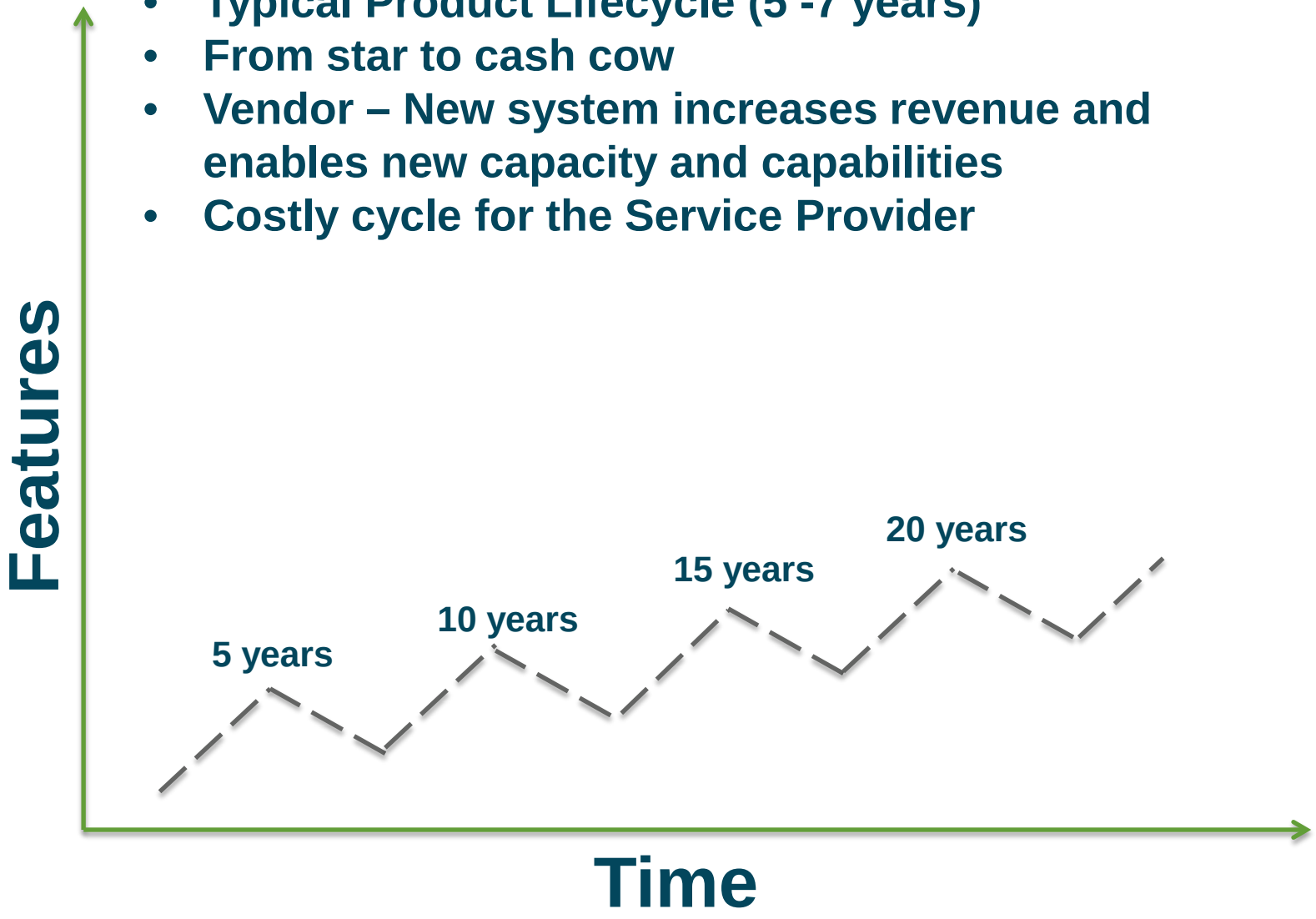
Simultaneously *Support 288 VDSL2 Subscribers + 288 GPON Subscribers*

Seamless *“Pluggable” Migration From FTTN to FTTP With Integrated Fiber Splitters. No Loss of Service When Adding GPON or VDSL2 subscribers.*



Product Lifecycle

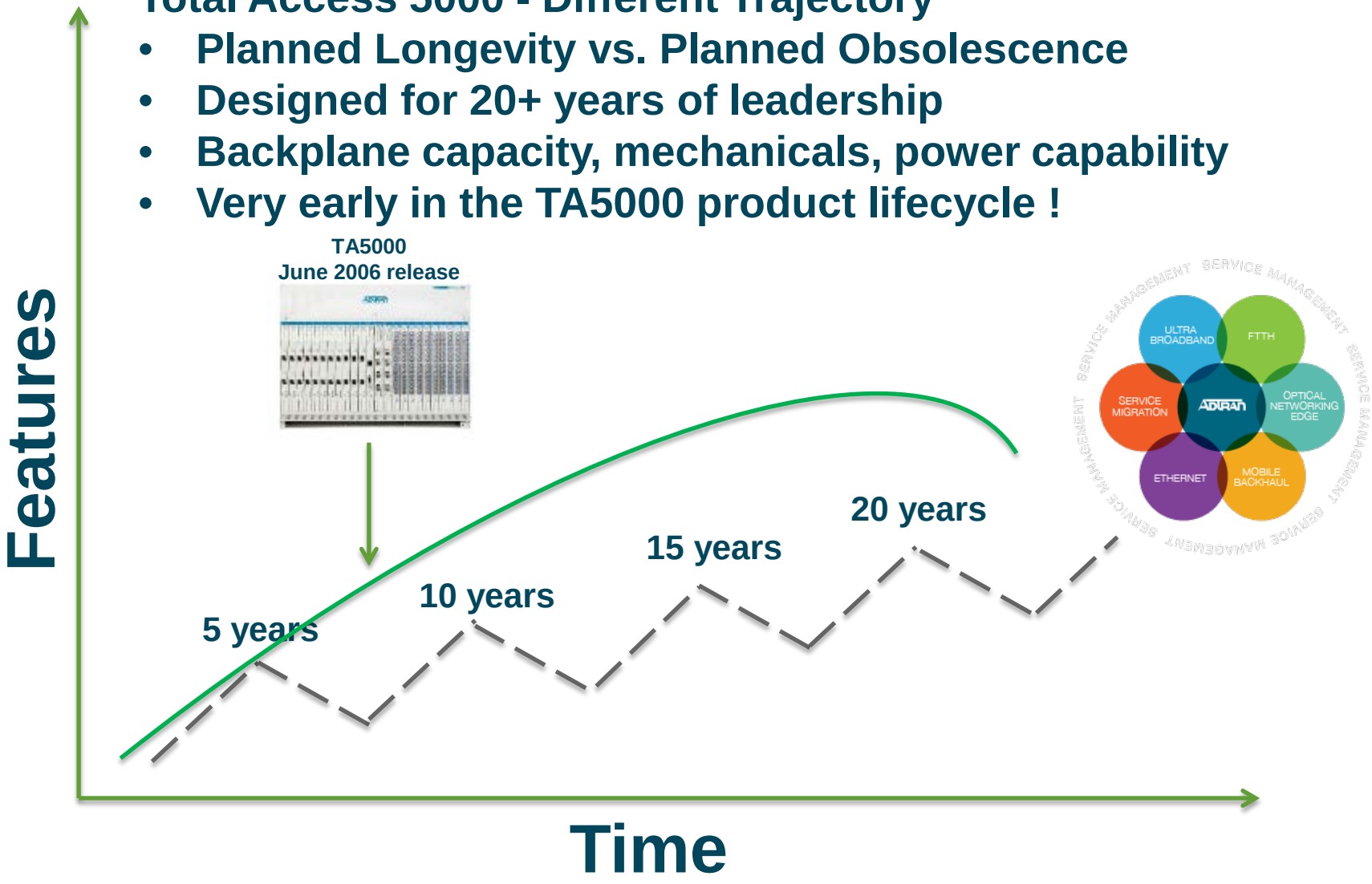
- Typical Product Lifecycle (5 -7 years)
- From star to cash cow
- Vendor – New system increases revenue and enables new capacity and capabilities
- Costly cycle for the Service Provider



Product Lifecycle

Total Access 5000 - Different Trajectory

- Planned Longevity vs. Planned Obsolescence
- Designed for 20+ years of leadership
- Backplane capacity, mechanicals, power capability
- Very early in the TA5000 product lifecycle !



New Applications, New Architecture

Scalable

- 10 to 10,000 subscribers
- Neighborhood copper nodes to CO-based FTTP hubs

Non-Blocking

- Top performance for gigabit (and beyond) services

Carrier-Class

- For triple-play and SLA-based business services
- Robust, resilient, redundant

TA5000 Features and Capabilities

- System designed for massive bandwidth delivery
  - Ethernet-based architecture
  - 2.2 Terabit Backplane capacity and non-blocking switch fabric
  - Industry's highest GPON density at over 18 PONs per RU
  - 504 Point-to-point Gigabit Ethernet subs per system
  - Integrated ROADM and DWDM
  - Enable premium business services, mobile backhaul and demanding broadband services

- Full Service FTTP System
  - True Gigabit throughput per sub
  - IPTV
  - High Speed Internet
  - SLA based data services
  - **Voice**

Total Access 5000 Family

Broadband Access | Services Migration | Carrier Ethernet | Optical Networking Edge

Total Access 5000
High capacity MSAN
9RU, 21 Access Modules
CO, RT

Total Access 5006
Medium capacity MSAN
5RU, 6 Access Modules
RT, cabinet retrofit

Coming 2014

Total Access 5004
Compact MSAN
2RU, 4 Access Modules
Small RT, cabinet retrofit

ONT Solutions

Indoor SFU ONT Products

Total Access 324

	Total Access 324 1287735G1	Total Access 324 1287735G2	Total Access 324E 1287737G1	Total Access 324E 1287737G2	Total Access 324 Gen 3 1287735G3	Total Access 334 1287736G1	Total Access 334 1287736G2	Total Access 334 Gen 3 1287736G3
Access Technology	GPON	GPON	AE	AE	GPON	GPON	GPON	GPON
Type	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor
POTS	2	2	2	2	2	2	2	2
10/100/1000 Ethernet	4	4	4	4	4	4	4	4
RF Video (GPON Only)	–	-	-	-	-	1	1	1
Special Features		UPS Connector		UPS Connector	UPS Connector		UPS Connector	UPS Connector

Green = Frontier Approved

Total Access 324/334 Indoor ONT's

- Desk, Wall or "Slack-" Mount
- BBU or AC Wall-Wart Options
- 10"W x 6"D x 1.25"T

Outdoor SFU ONT Products

Total Access 352

	Total Access 351 1287701G1	Total Access 352 1287702G1	Total Access 352H 1287702G3	Total Access 354E 1287704G1	Total Access 361 1287711G1	Total Access 362 1287712G1	Total Access 362R 1287715G1
Access Technology	GPON	GPON	GPON	AE	GPON	GPON	GPON
Type	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
POTS	2	2	2	2	2	2	2
10/100/1000 Ethernet	1	2	2	4	1	2	2
RF Video (GPON Only)	-	-	-	-	1	1	1
Special Features			HPNA				RFoG

Total Access 352/362/362R Outdoor ONTs

Green = Frontier Approved

- Mounting - Corning Housings
  - Splice or OptiTap
- BBU Option

SBU / MDU Products

Total Access 372

	Total Access 372 1287722G1	Total Access 372E 1287723G1	Total Access 372RF 1287722G2	Total Access 374 1287703G1
Access Technology	GPON	AE	GPON	GPON
Type	Outdoor	Outdoor	Outdoor	Outdoor
POTS	8	8	8	4
10/100/1000 Ethernet	2	2	2	4
RF Video (GPON Only)			1	

Green = Frontier Approved

Total Access 374

Total Access 372 SBU ONT

- 4 DS1s (PWE)
- AE and GPON Versions
- Mounting: Corning Housings
  - Splice or OptiTap
- BBU Option
- Snap in Electronics
- 16.2”H x 10.6”W x 5”D

Total Access 374 MDU ONT

- Mountings:
  - Wall Bracket with Corning Housings
    - Splice or OptiTap
  - Total Access 480 4-Slot ONT Enclosure
- BBU Option

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What is New for Deployment in 2014?

Total Access 5000 Software

- **Release 8.0.2.2**
  - TA5004 chassis and MSM module
  - New Switch module 1187040F1
  - New Octal OLT GPON module 1187503F1
  - Cross Slot LAG on SM020, SM025 and SM030 with LACP support
  - Redundant Octal GigE Modules for Subtending
  - Next Gen GPON ONT's
  - GPON Enhancements
  - E.SHDSL Repeater Enhancements, Repeater to Repeater T-SCAN
  - VDSL PTM Fallback to ADSL2+
  - EFM Nodal Transport
  - Bulk Performance Monitoring Support for Octal and Quad GigE

Bandwidth Delivery Evolution

Add a card add a service…
Next generation platform…

8-Port GPON OLT

168 PONs and 10,752 subscribers per shelf

4-Port GPON OLT

84 PONs per Total Access 5000

2-Port GPON OLT

21 OLTs/42 PONs per Total Access 5000

OLT

SM40

Up to 80 Gbps network uplink

Carrier Class

Flexible transport

Non-blocking FTTH platform

SM2 / SM5

Up to 40 Gbps network uplink

Carrier Class

Flexible transport

Optimized for DSL to fiber migration

SM

SM1

Up to 8 Gbps network uplink

Carrier Class

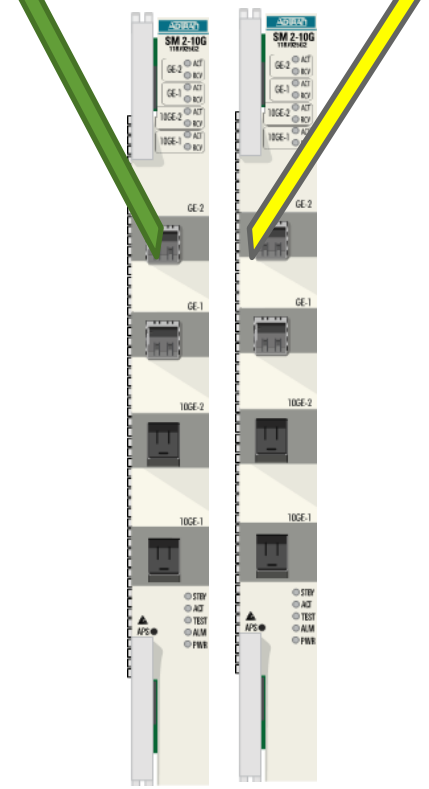
Flexible transport

Optimized for DSL and legacy services

SM Data Uplink Options

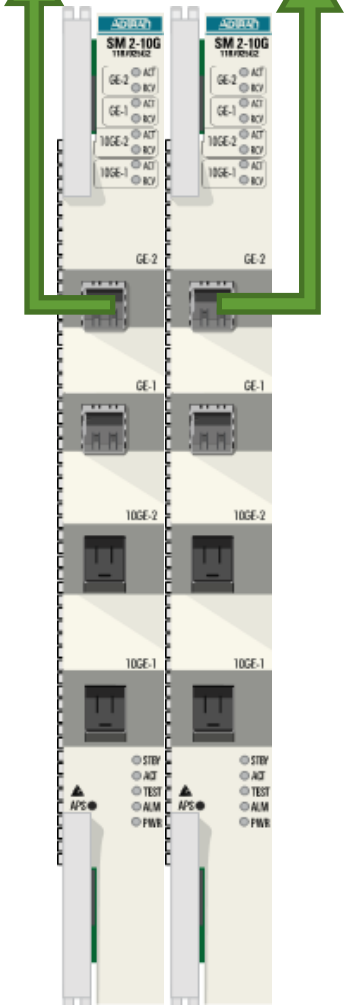
Y-fiber
1G Active

SR6.2 GA



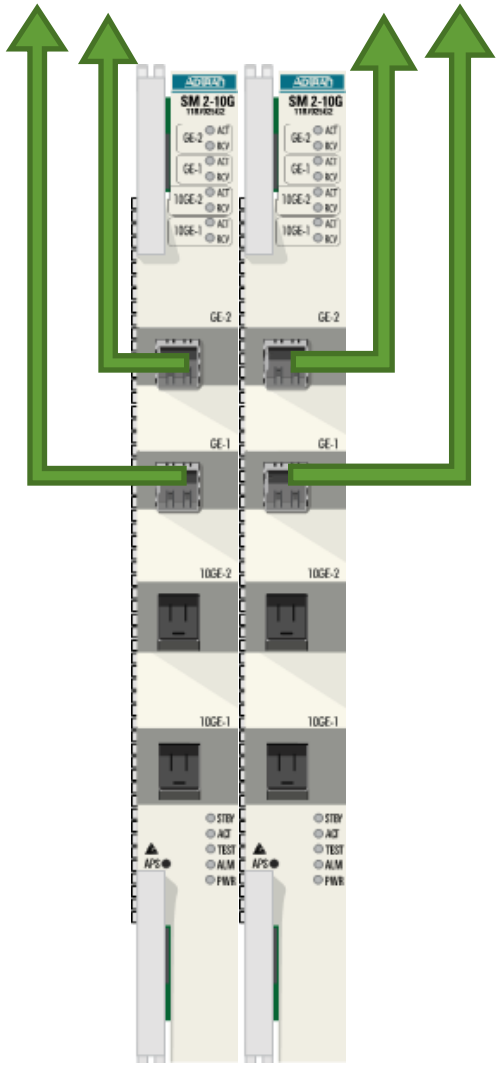
GA SR 8.0

LAG
2G Active



GA SR 8.0

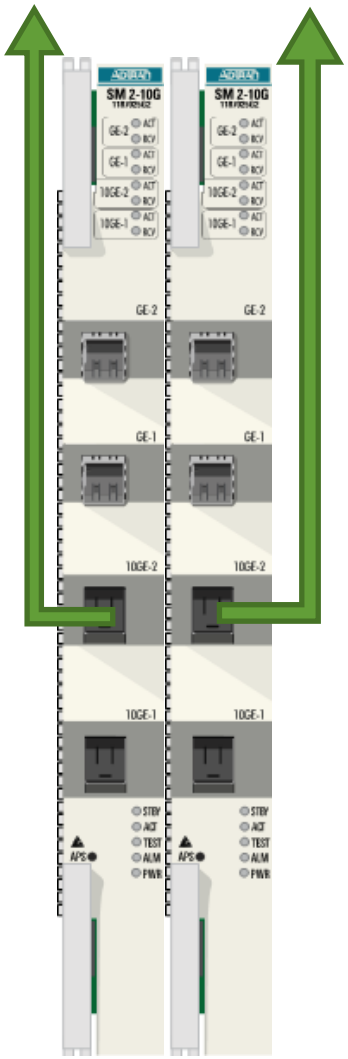
LAG
4G Active



SM Data Uplink Options

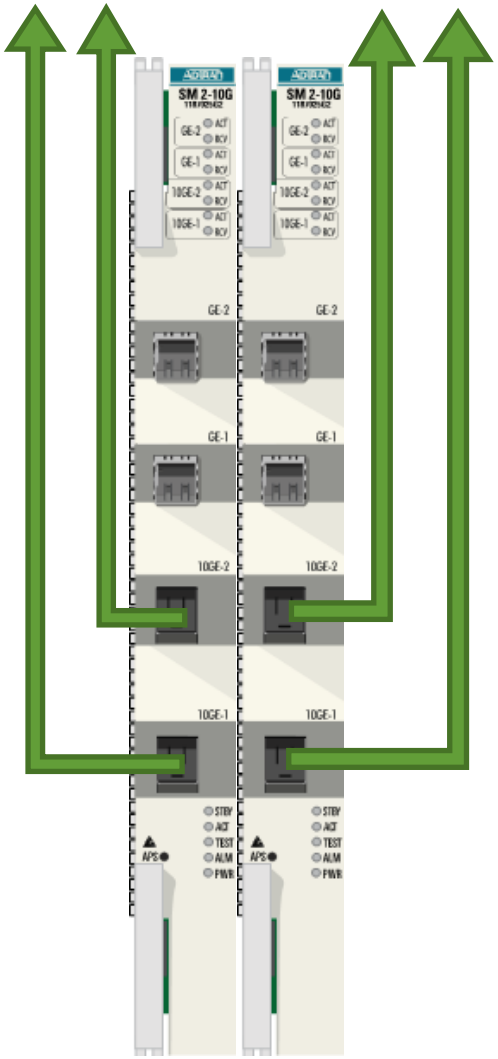
GA SR 8.0

LAG
20G Active



GA SR 8.0

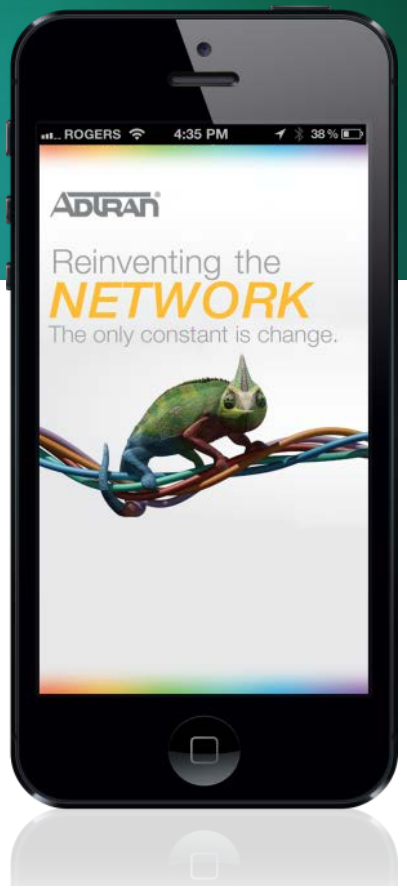
LAG
40G Active



Modules Planned for
Cross-slot LAG
GA TA5K 8.0

- 1187025Gx
- 1187030Gx
- 1187040F1

Mobile Planning Tool



ADTRAN Mobile Planning Tool

ADTRAN Solutions Right at your Fingertips

Apple App Store

Google® App Store

Events

- Check out important events including roadshows, tradeshows, webinars, etc.

Key Contacts

- ADTRAN® contacts (account managers, sales engineers and others)
- Click to email, Click to call

Applications

- Selection of various Frontier® applications and how approved ADTRAN products can help you reach your goal

What's New

- Specific news for Frontier (new approved products, FOA's, lab updates, etc.) to keep you updated

Products

- Link to data sheets of approved ADTRAN products relevant to Frontier

Twitter

- Direct link to **http://twitter.com/adtran**

Notifications

- New field approval notifications
- Pops-up even if app isn't open

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  - **Total Access 5000 Ultra Broadband Updates**
    - 100 Mbps Delivery Using Vectored VDSL2
    - FTTdp and FTTB – Gigabit over Existing Home Wiring
  - **Effective FTTN – FTTH Migration**
    - Total Access 5004 and Crossover Enclosure
    - FTTN Cabinet Portfolio
  - **Gigabit Services Architectures**
    - Multi-Dwelling Unit Broadband Solutions
    - Micro ONT verses Integrated RG ONTs
    - Next Generation PON planning
    - Supporting both Gigabit Broadband Aggregation and Video and SLA-based Services Delivery
- ✓ Lunch (12:30 PM)
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FTTP is the Goal

- Physical infrastructure
  - Fiber has virtually unlimited bandwidth
- Network infrastructure
  - Gigabit services platform that can last for decades reduces future access CapEx
- Reduces OSP maintenance cost
- Competitive leapfrog

Reaching the FTTP Goal

- Greenfield is no-brainer
- Brownfield is expensive! How to get there?
  - External investment (stimulus)
  - All at once
    - If you have the capital
  - Incremental build
    - Match fiber build to CapEx budget, ROE, and competitive needs
    - Fully leverage existing copper assets in the medium-term
- Let the business case drive the right speed and depth of fiber deployment

The all-fiber future belongs to those who survive long enough to reach it

It All Fits Together

Deep fiber is making loops shorter….

Remote Terminal or Street Cabinet

Small Form-factor sealed DSLAMs

100Mbps
Vectored VDSL2

And shorter…

100Mbps+
Vectored VDSL2

500Mbps+
G.fast

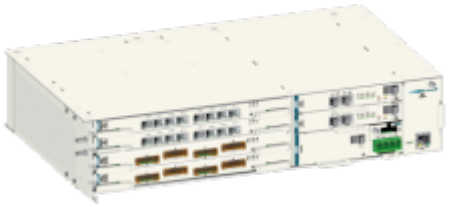
Distribution Point

Until the FTTP goal is a reality

1Gbps+
AE/GPON

Small Form Factor: A Toolkit Approach

- TA5004
  - Multiple services
  - Carrier-class redundancy, serviceability, availability
  - Copper feed options for low-bandwidth CAF
  - FTTN-FTTP migration in cabinet
  - DLC cabinet retrofits
  - Crossover for new sites

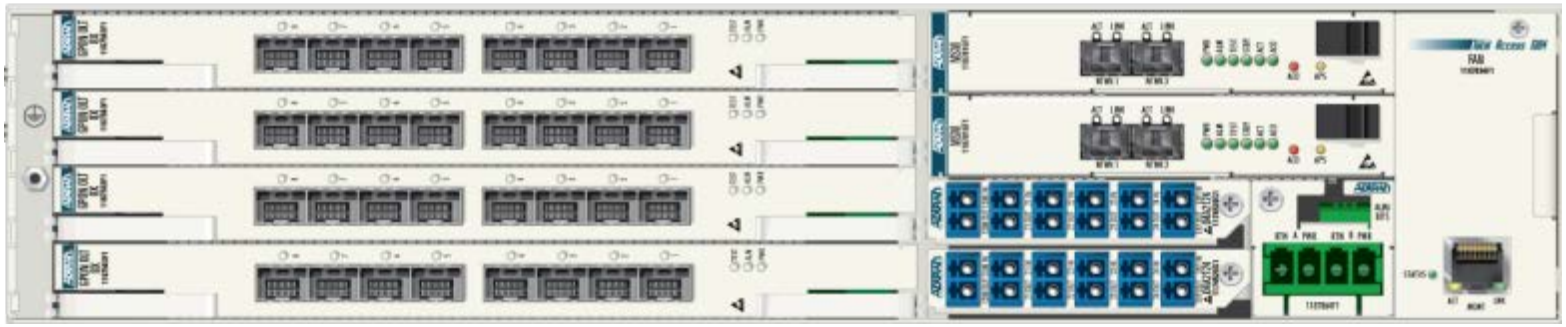


- OSP DSLAM
  - Absolute minimum initial cost for smaller sites
  - FTTP migration plan focused on CO OLTs

Compact without Compromise

4 Access Modules
Supports full range of services from TA5000 access modules

2 Management & Switching Modules
Fully redundant switch fabrics with integrated chassis management



Small form factor
19” 2RU

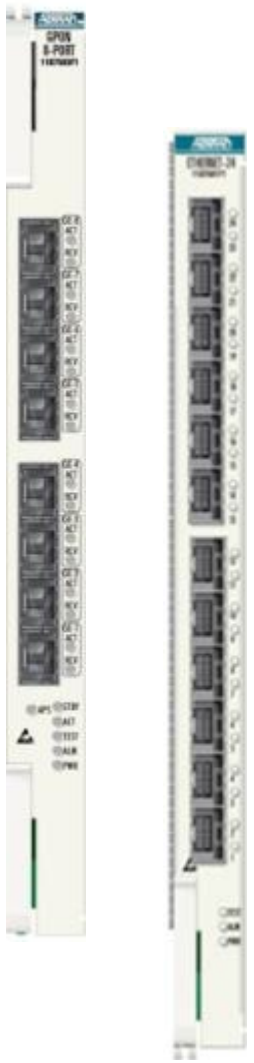
Resource Slot
VDSL2 system-level vectoring or DWDM modules

Management & Switching Module

- MSM20 (1187016F1)
  - Two 1G/10G SFP+ ports
    - Up to 20G network backhaul (40G across both MSMs)
    - Built for no-compromises FTTP performance
- MSM10 (1187015F1)
  - Two 1G/10G SFP+ ports
    - Built for cost-effective xDSL aggregation
- Common features
  - Integrated system controller
  - Completely redundant (facility and equipment)
  - G.8032 ERPS rings
  - Complete Layer 2 feature-set
  - >32k MACs for scalable IPTV deployments
  - CLI and web interfaces available
- Leverages design from OSPs and TA5000
  - Fastest time to market
  - Common code for quick feature adds and bug fixes

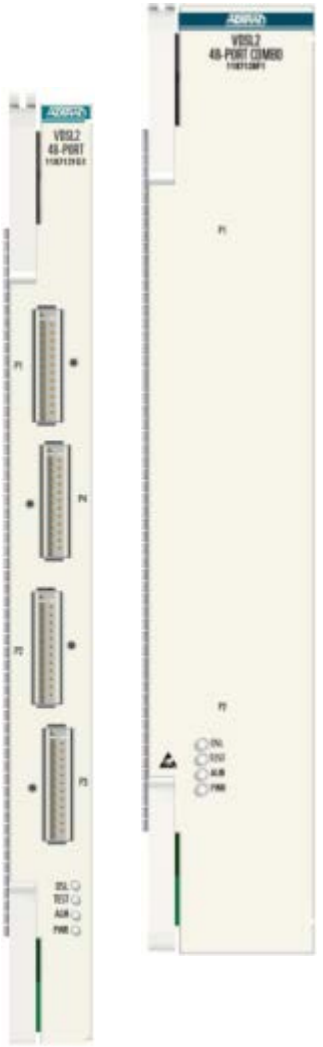
FTTP Solutions

- High-performance FTTP platform
  - 40Gbps total uplink capacity
  - 20Gbps per slot of actual throughput with MSM20
  - Designed for Gigabit service delivery
- Industry leading density
  - GPON: 4 OLTs/32 PONs per Total Access 5004
    - 2,048 subscribers per chassis (1:64 split)
  - Active Ethernet: 96 subscribers per shelf
    - Point-to-point Gigabit Ethernet
    - Dual BiDi SFPs
- Features
  - 4 and 8 port GPON OLT options
    - SFP based, pay as you grow
    - Class B+ enhanced optics
      - 32 splits at 30km
- ONT options for every need
  - SFU, SBU, MDU
  - ADTRAN and ACP versions available



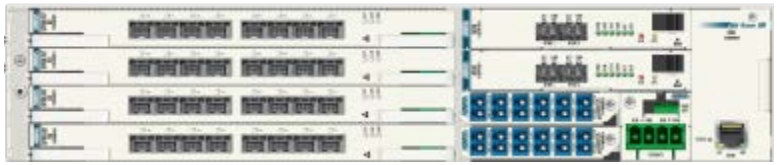
Fiber to the Node

- Compact remote node for overlay and combo applications
  - 192 ports overlay or 96 ports combo with VDSL2 system level vectoring
- Loop shortening
  - 100Mbps to 3500ft 24AWG with bonding and vectoring
- BBDLC
  - VDSL2+POTS combo for legacy DLC replacement and softswitch migration
  - SIP, MGCP, TDM voice gateway
- New Access Modules
  - Single-slot 48p VDSL2 overlay-Aug GA *Not in the Lab*
  - Dual-slot 48p VDSL2 combo-Aug GA *Not in the lab*
  - Backwards compatible to ADSL2+
  - Any-port ATM and EFM bonding
- All Access Modules are supported in all TA5000 systems

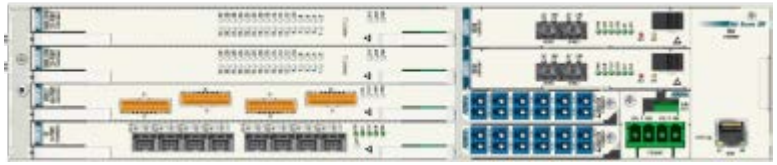


Multi-Service Flexibility

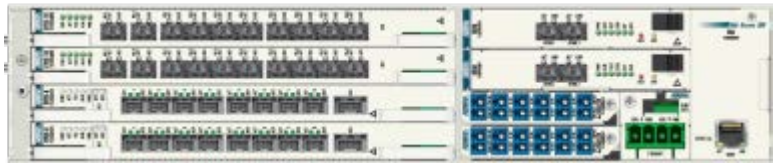
- FTTP
  - 40Gbps network uplink
  - 32 PONs (2048 subscribers)
  - 96 point-to-point Gigabit Ethernet



- FTTN
  - 192 ports VDSL2
  - Overlay & combo
  - System-level vectoring



- Carrier Ethernet over X
  - Ethernet over Copper via SHDSL and bonded VDSL2/ADSL2+
  - Ethernet over Fiber (GigE)
  - MEF-certified solutions



- Optical Networking Edge
  - 1G/10G Ethernet aggregation and transport
  - Ethernet over OTN and DWDM
  - Fixed OADM/Mux/Demux typical
  - Standalone ROADM package

TA5004 Cross-Over Enclosure

Bridges the gap between a pedestal and a traditional cabinet

Economics of a Pedestal

- Stake Down Mounting w/ Gravel Bed (no pad required)
- No Boom Truck Required – 2 men and a pick up
- Compact Design Eases Placement in Right of Way

Durability of a Cabinet

- Hermetically Sealed Equipment Chamber
- Heat Exchanger Conditioned Equipment Chamber
- Fully Secure to Protect Investment
- GR-487 Issue 4 compliant

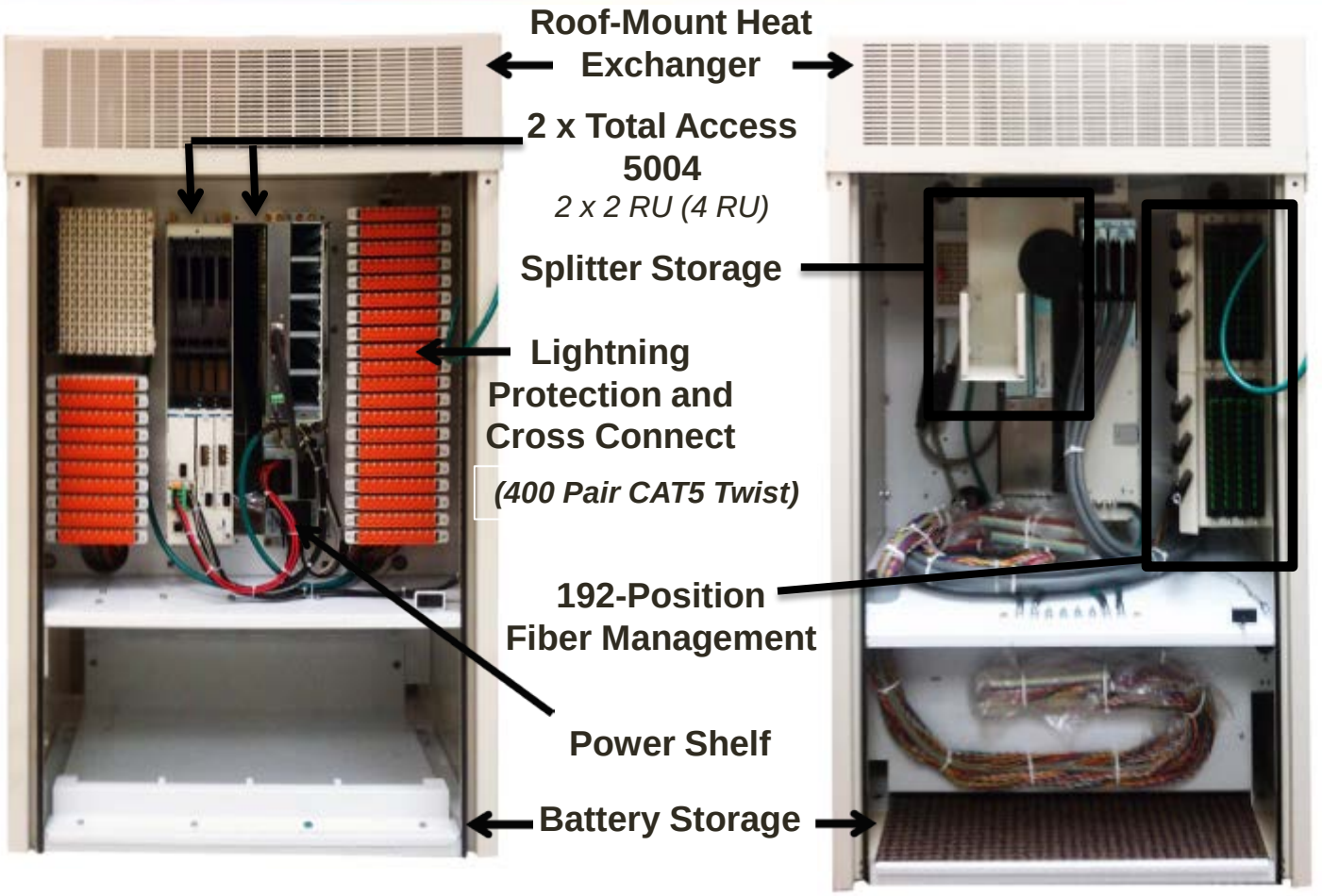
Flexibility of an MSAP

- Capture Customers with VDSL2 Today
- Migrate to GPON or Active E Tomorrow
- Be Ready for Next Gen PON in the Future

Total Access 5004 in Cross-Over Enclosure

Features

- Stake-Down, Pad, Pole, or H-Frame Mounting Options
- High Capacity 1000W Heat Exchanger Cooling System
- High Capacity 8 Hr. Battery String – 100 A-hr
- Temperature Hardened to Full Outdoor Ambient Range
- Generator Connector
- CAT5 Cabling
- Battery Warmer & Temperature Compensated Charging
- Internal and External Cross Connect options
- Fiber Management
- AC or Line Powered



- *Capture Customers With VDSL Today*
- *Migrate to GPON or AE Tomorrow*
- *Ready for Next-Generation PON in the Future*

The Gigabit Service Reality

- Gig service puts a tremendous strain the network
- Subscribers want “as advertised”
- Be prepared to deliver!

Breaking Down the Bottlenecks

The bottlenecks that emerge…

- PON
- Backplane
- Transport

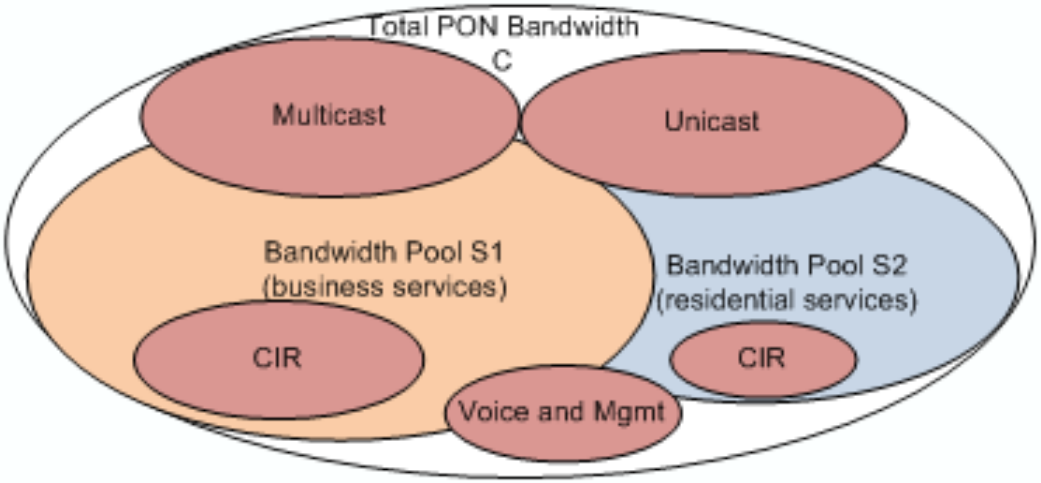
Addressing the PON bottleneck

- PON
- Backplane
- Transport

Addressing the PON bottleneck

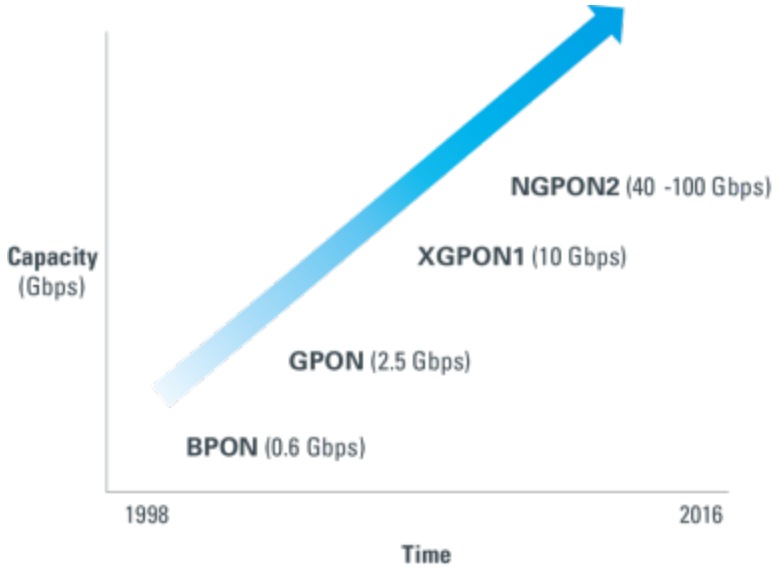
- Advanced Dynamic Bandwidth Allocation

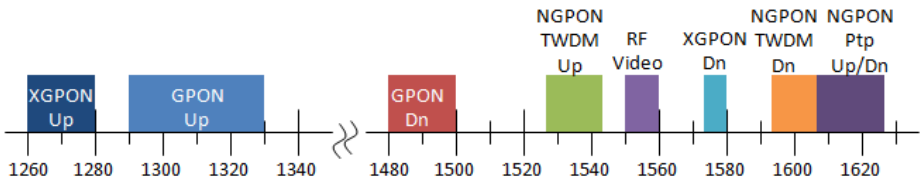
- DBA across the PON – across the card – across the system

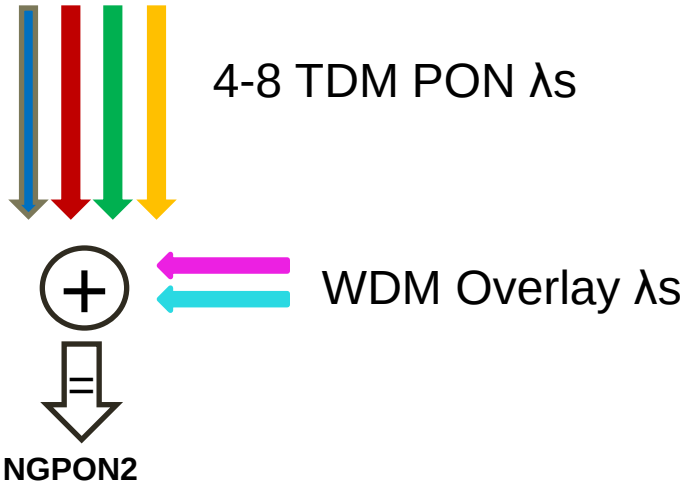


PON Evolution (GPON Family)

- GPON
  - 2.5G downstream, 1.25G upstream
  - Widely deployed today
- XGPON1
  - 10G downstream, 2.5G upstream
  - Only trial deployments to date
- NGPON2
  - 10G downstream, 10G upstream
  - Standard finalized in 2014







Addressing the backplane bottleneck

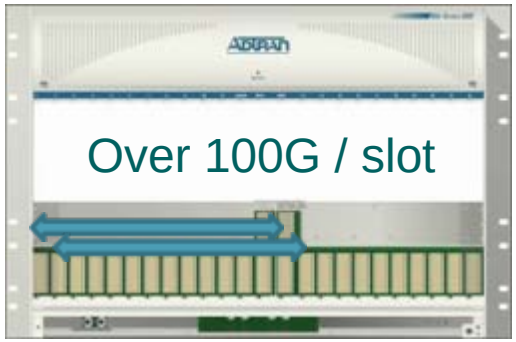
PON

Backplane

Transport

Addressing the backplane bottleneck

Do the math – non-blocking architectures



8-port GPON OLT
x 2.5G GPON per port
= ***20G*** per access slot to egress chassis
(Minimum)

4-port XGPON1 OLT
x 10G GPON per port
= ***40G*** per access slot to egress chassis
(Minimum)

Addressing the transport bottleneck

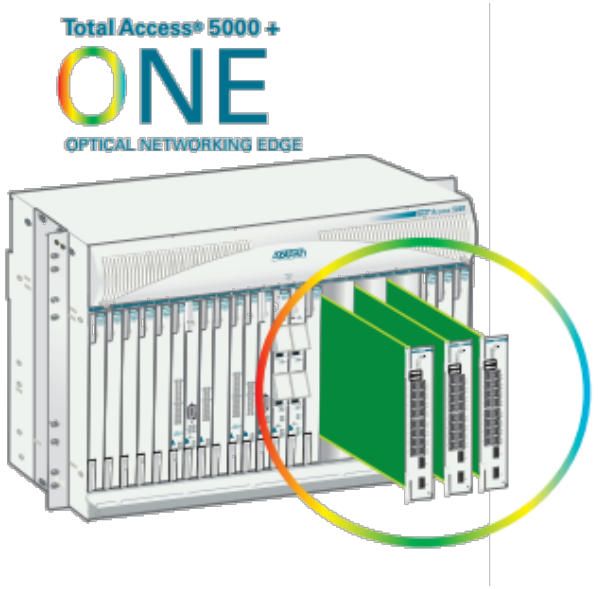
PON

Backplane

Transport

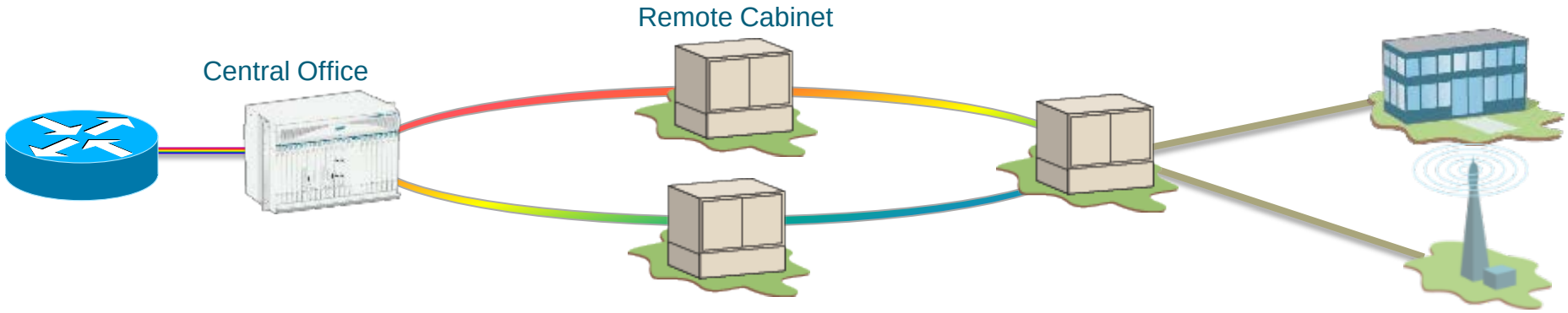
Addressing the transport bottleneck (NOT APPROVED)

- Cost effective 10G aggregation
- An answer to exhausted 10G rings
- Dedicated fiber support to cell towers

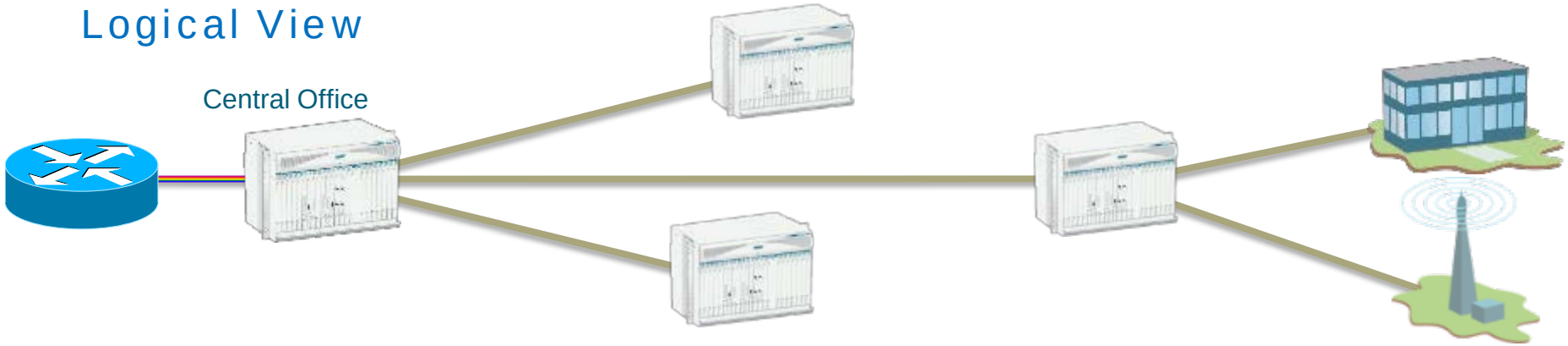


Addressing the transport bottleneck (NOT APPROVED)

Physical View



Logical View



Bandwidth *– Dedicated 10G pipe per node*

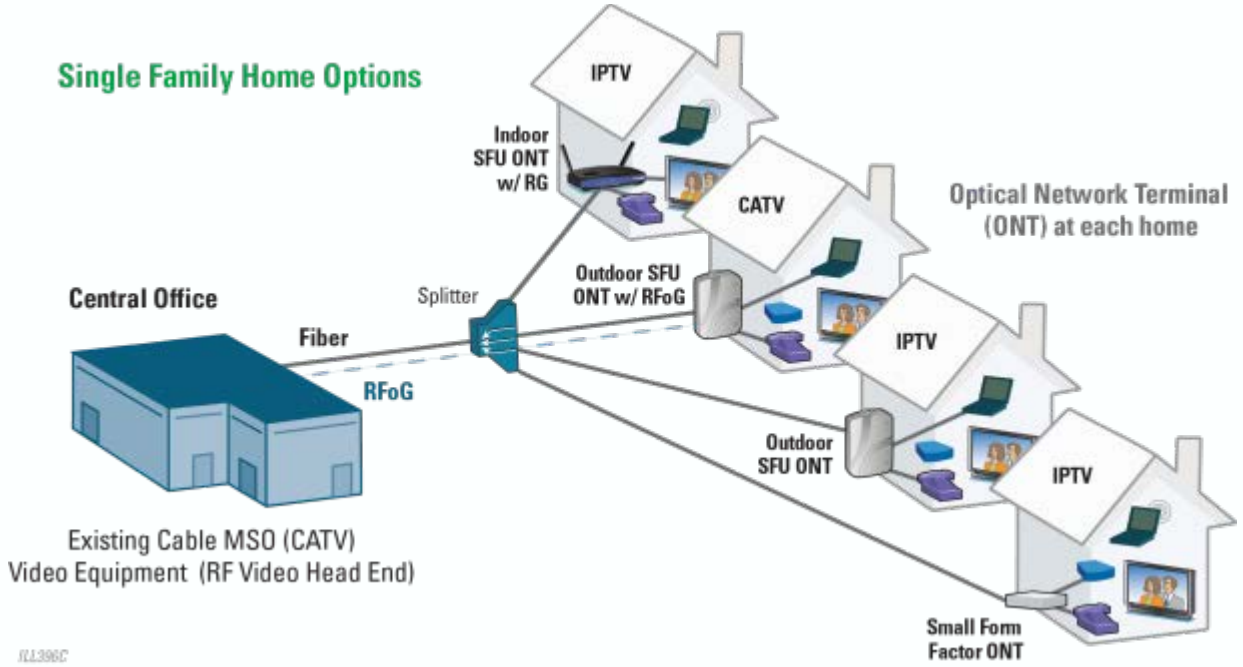
Fiber Availability *– Pair gain for your fiber plant*

Breaking Down the Bottlenecks

- PON
- Backplane
- Transport

ONT Portfolio Direction

Lots of deployment types, ONT options



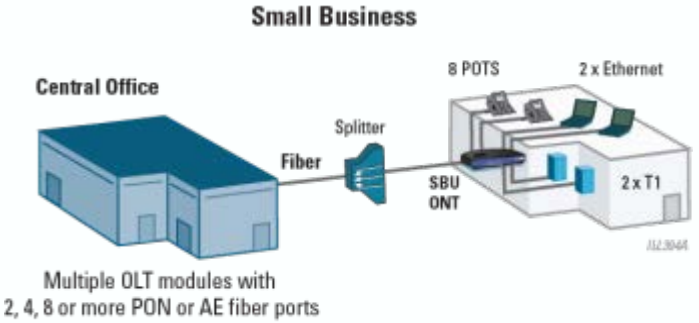
Outdoor Single Family Unit (SFU)

Indoor Single Family Unit (SFU)

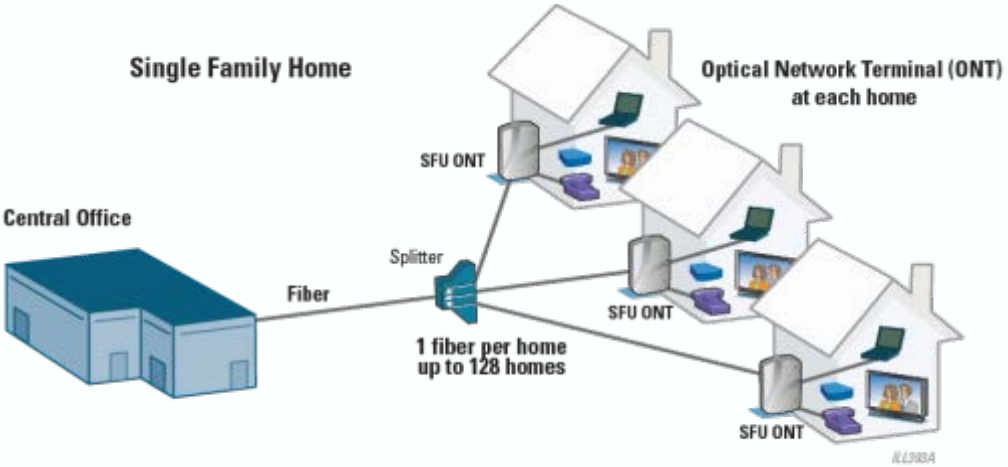
Indoor Single Family Unit (SFU) with Integrated Residential Gateway

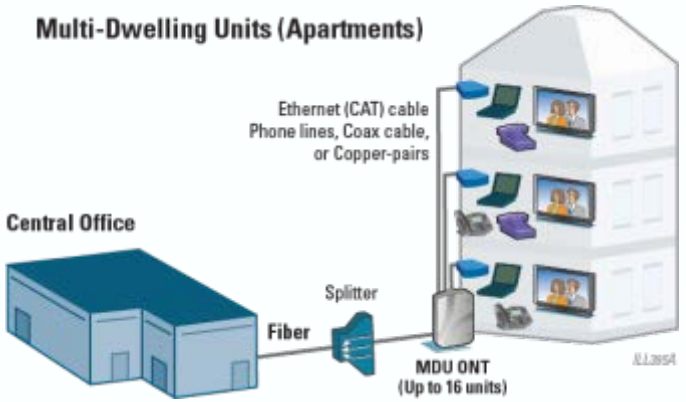
Factors determining ONT construction

- Packaging
  - House, Business or Apartment
  - Outdoor or Indoor
- Services
  - Voice, Video, Data
  - CATV, IPTV
- Integration
  - WiFi, Residential Gateway/Router
  - Home wiring type



Types of ONTs





ONT Market Trends

- Migration from outdoor to indoor
- Reduced request for sub gig options – HPNA, MoCA 1.1
- Reduce power and battery backup size
- Lower the cost of installation

Reducing the cost per sub;
Accelerating the path to revenue

Simplifying customer premises installs

“Cost of Waiting" study from TOA Technologies (2011).

$37.7B in time wasted waiting for installer

No truck roll: Support customer self-install

- Eliminating high cost areas of deployment
- Mitigate fiber right of way issues
- Eliminate truck rolls

Improving the profitability of your business

Emerging Indoor ONT options

Micro ONTs

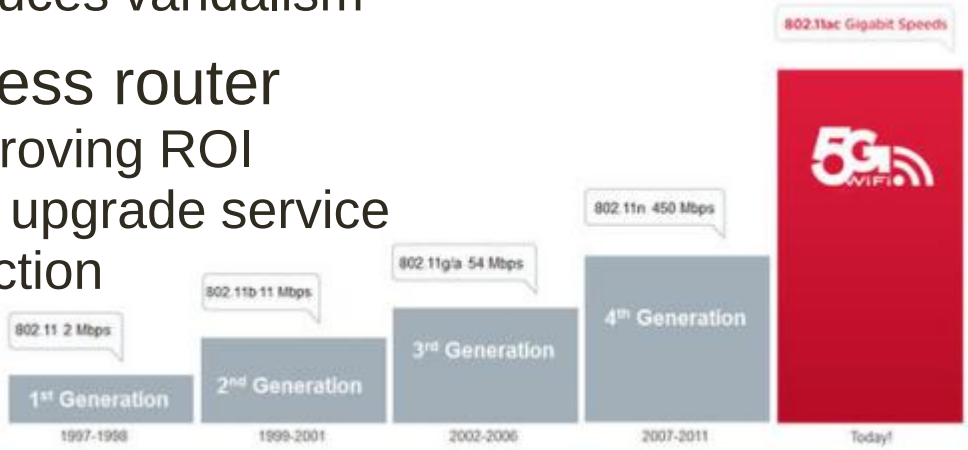
- Drastically lower ONT cost
- Ultra-compact size
- Ideal for MDUs
- Facilitates flexible installation
- Leave at the residence

Residential Gateway ONTS

- Single box solution
- Integrated wireless radios
- Managed in home services

The Value of a Micro ONT Strategy

- Can be left at residence
  - Great for MDU
  - Save cost of a truck roll to retrieve
  - Enables instant activation for next resident
- Flexible and discrete installation
  - Simplify, streamline installation procedures
  - Improves security and reduces vandalism
- Independent of the wireless router
  - Increases life of ONT, improving ROI
  - Save cost of a truck roll to upgrade service
  - Increase customer satisfaction



Improving the economics without reducing function

Micro ONTs

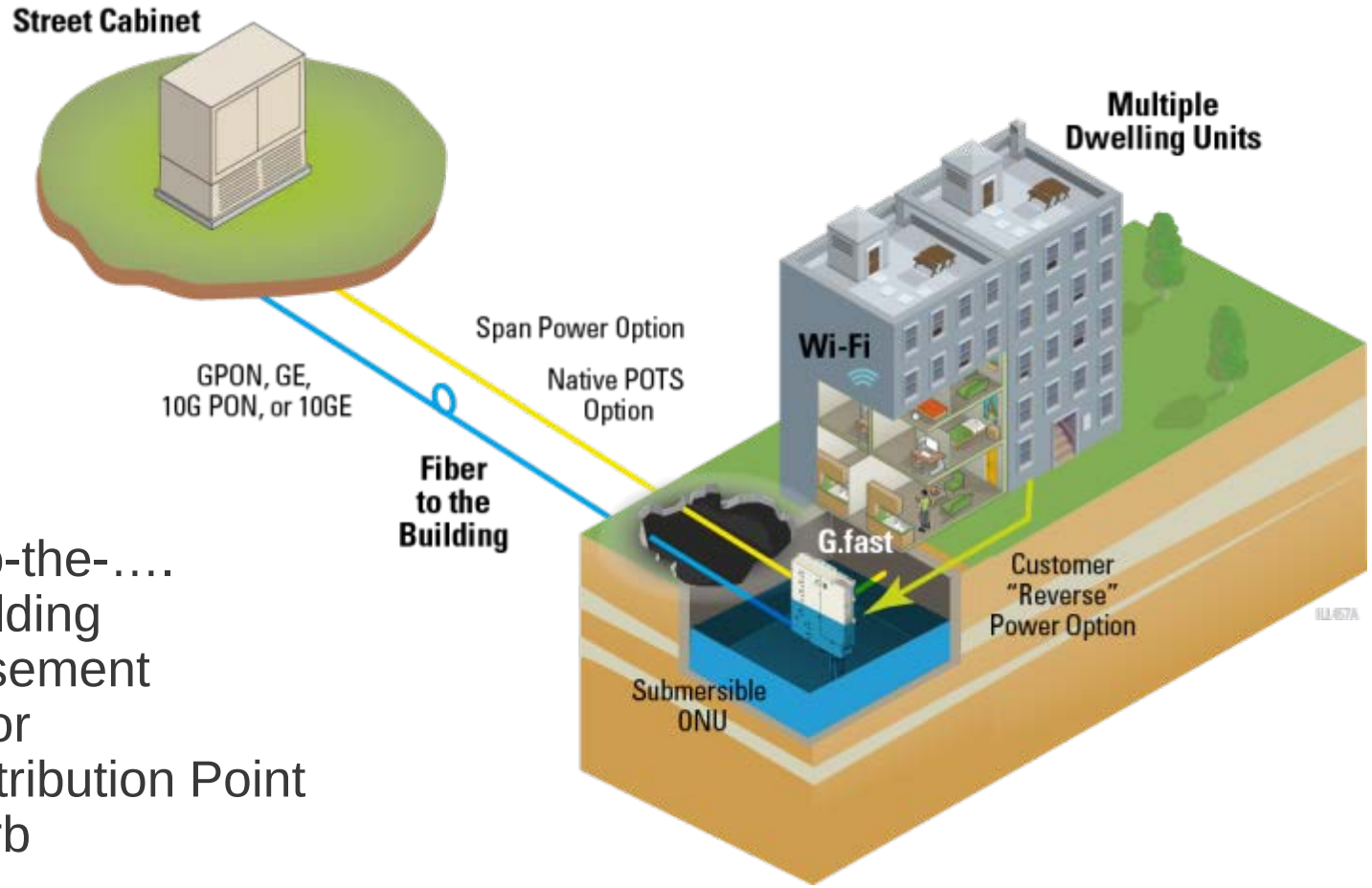
- **Total Access 401 – Micro ONT**
  - GPON or AE Fiber Uplink – SC-APC
  - ADTRAN Custom Plastic Housing
  - Wall Plate Design with AC/DC Converter
  - Auto-Negotiating/Sensing 10/100/1000Base-T Ethernet Port
  - Full 1 Gigabit Symmetric Throughput
  - Cost Effective Indoor Design
  - 12V DC Power

- **Total Access 411 – Micro ONT Voice**
  - GPON or AE Fiber Uplink – SC-APC
  - ADTRAN Custom Plastic Housing
  - Wall Plate Design with AC/DC Converter
  - Auto-Negotiating/Sensing 10/100/1000Base-T Ethernet Port
  - Full 1 Gigabit Symmetric Throughput
  - Voice Support – GR-303/TR-008/SIP
  - Cost Effective Indoor Design
  - 12V UPS Connection

Micro Residential Gateway

- **Total Access 424 Residential Gateway**
  - GPON or AE Fiber Uplink – SC-APC
  - 2 POTS + 4 GE + Wi-Fi
  - Auto-Negotiating/Sensing 10/100/1000Base-T Ethernet Ports
  - Full 1 Gigabit Symmetric Throughput
  - Voice Support – GR-303/TR-008/SIP
  - IEEE 802.11ac Dual-Band Wireless - 2.4/5Ghz - 3x3 MIMO
  - Full Layer 3 Support with NAT
  - USB 2.0 Compliant
  - TR-69 Managed
  - 12V UPS Connection

Fiber-to-the-Home (Building)



Fiber-to-the-….
- Building
- Basement
- Door
- Distribution Point
- Curb

Delivering Gigabit services over your phone line

G.fast and FTTB summary

- Delivers higher speeds over existing home wiring
  - Need to deliver fiber to/near home
- Provides alternative, lower cost deployment model
  - MDU, Apartments; duct issues
- Provides opportunity to eliminate truck rolls
  - No in-home visits
- Operationally aligned with FTTH

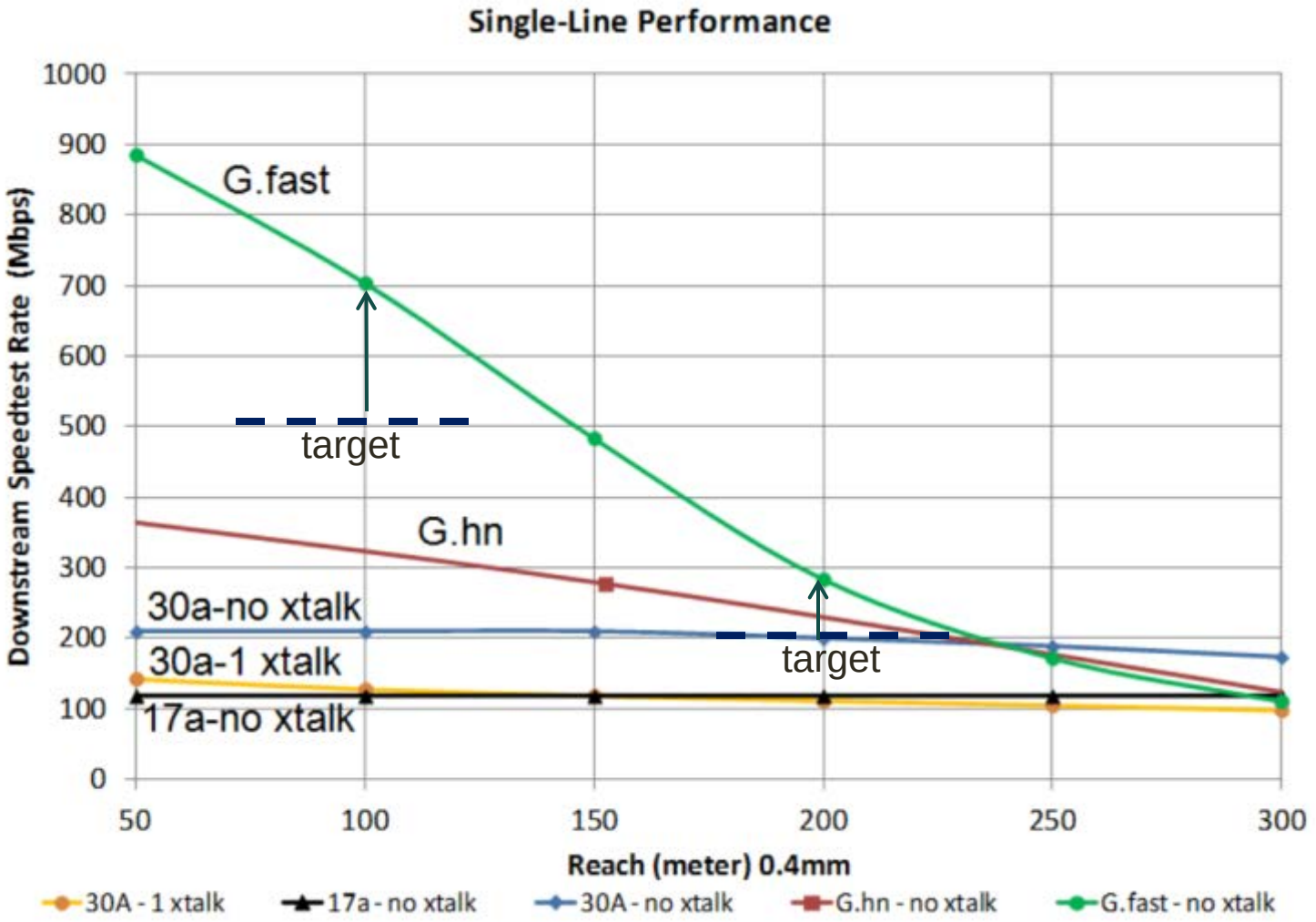
A global solution for a global challenge: Gigabit delivery

What is G.fast? Gigabit over the Phone line

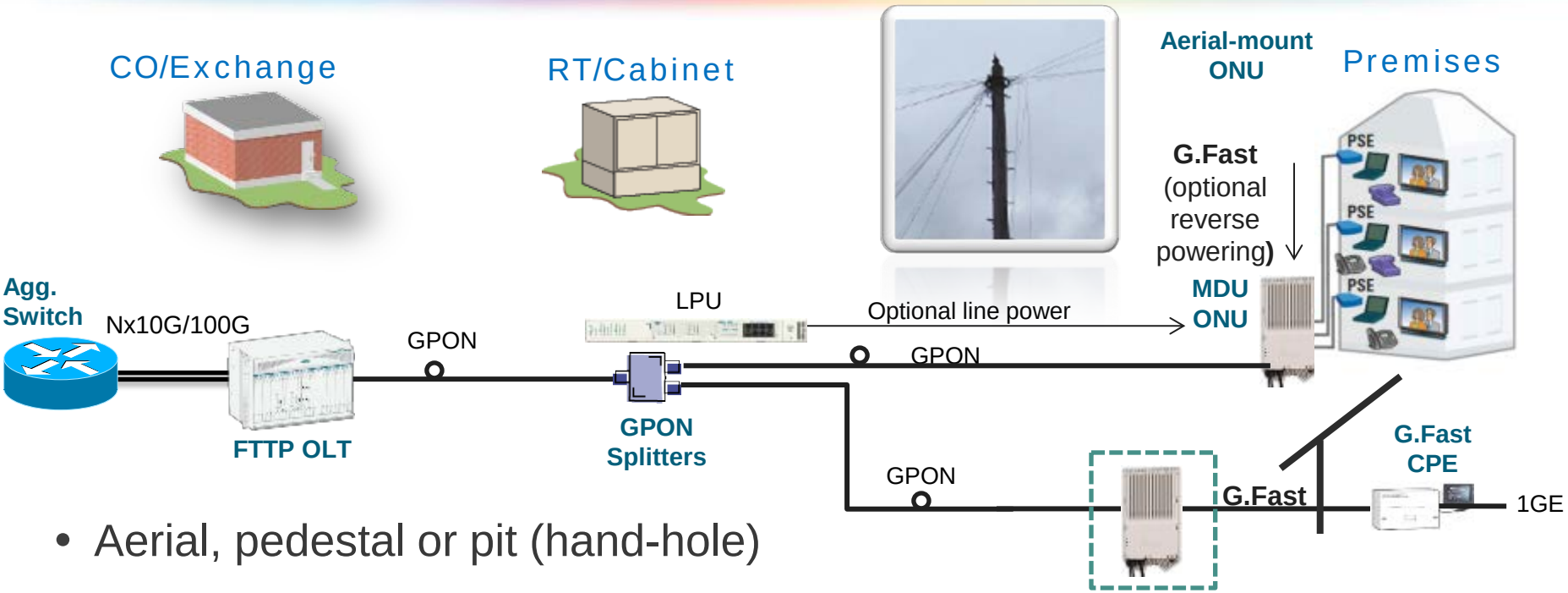
- Gigabit service over Phone line
  - Provisionable (a)symmetric rates
  - Gig alternative to lower speed MoCA and HPNA technologies.
- The G.fast standard outlines these rate/reach targets:
  - Gigabit @ <<100m (FTTB)
  - 500Mbps @ 100m
- VDSL2 (17a) with vectoring:
  - 100Mbps @ 550m (FTTN)
  - 150Mbps @ <200m

FTTB is part of an operators Gigabit services tool kit

Real world rates should beat targets



Optimizing FTTdp deployment options



- Aerial, pedestal or pit (hand-hole)
- MDU or SFU, 8-port or 16-port
- RFT-C, local, or reverse powering
- Integrated GE or GPON uplinks
- FTTH (OMCI) or SNMP/IP managed
- Native POTS or VoIP
- Vectored VDSL2 (17a) or G.fast chipsets

Pit-mount ONU

Ped-mount ONU

G.fast standards and availability timeline

Milestone	Date
Consented standard	YE 2013
Approved standard	2H 2014
Beta chipset availability	Mid 2014
Beta solution availability	2H 2014
GA chipset, CPE availability	YE 2014
Field and inter-op trials	1H 2015
Commercial deployment	2016

Commercial G.fast coming in 2016

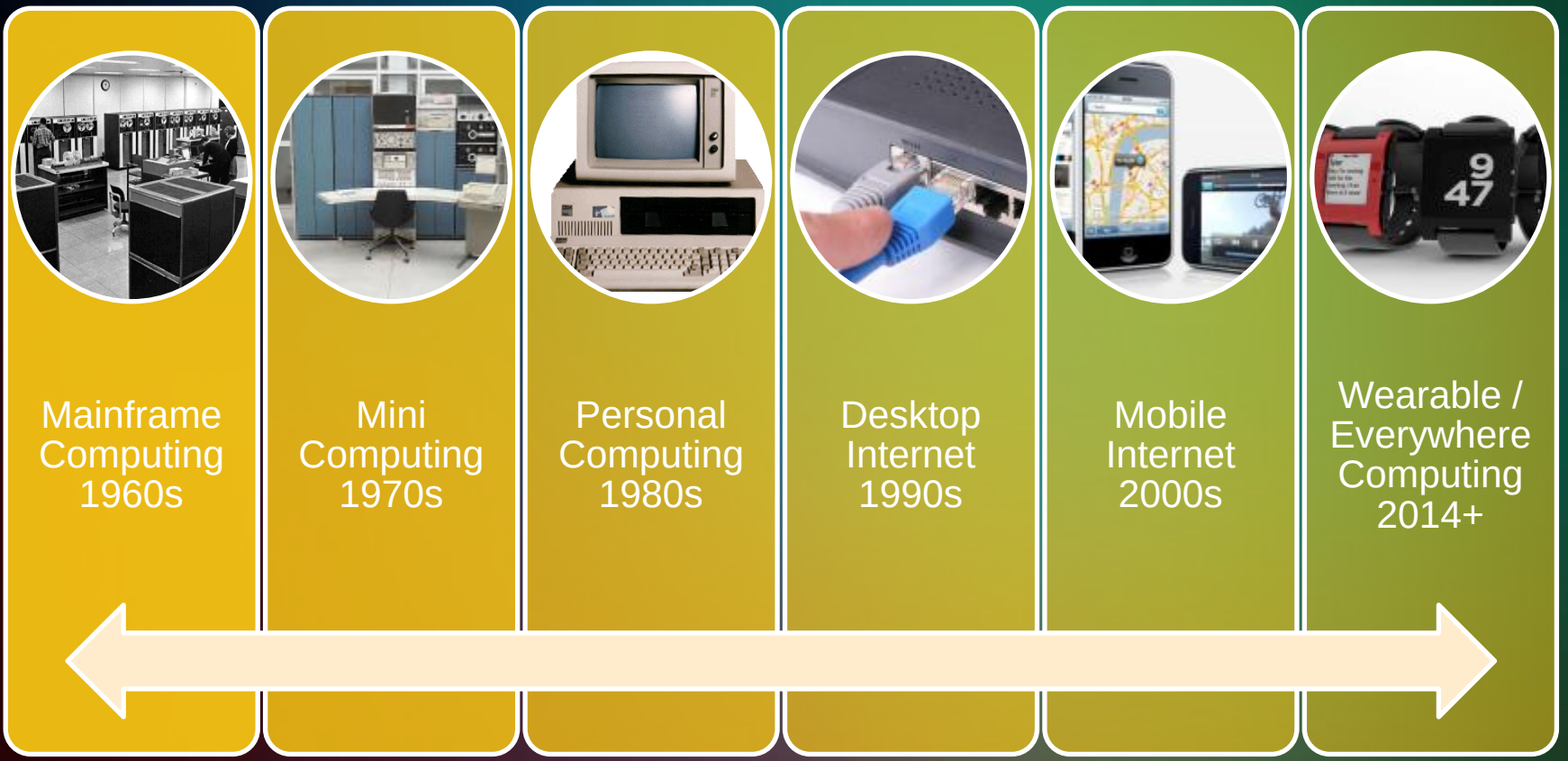
Today's Agenda

- ✓ ADTRAN® At a Glance (9:00 AM)
  - Corporate Summary
- ✓ ADTRAN in Frontier (9:15 AM)
  - What is Approved and Deployed
  - Total Access 5000 Technical Leadership
- ✓ What's Next With ADTRAN? (10:15 AM)
  - New Software Features and Hardware platforms for 2014 approval
  - ADTRAN's Mobile Planning Tool for Frontier Solutions
- ✓ Break (10:30 AM)
- ✓ Planning With ADTRAN in 2014 (10:45 AM)
  - Total Access 5000 Ultra Broadband Updates
  - Effective FTTN – FTTH Migration
  - Gigabit Services Architectures
- ✓ Lunch (12:00 PM)
- ✓ **Equipment Displays (1:15 PM)**
  - **Open Q&A**

Principles of Reinventing Network

1. Use Ethernet and wavelength services at any point in the network
2. Solutions with the lowest DEPLOYED cost per bit
3. Leverage NFV to be fully Service Aware and Scalable
4. Utilize SDN for automation to simplify and standardize devices on the network

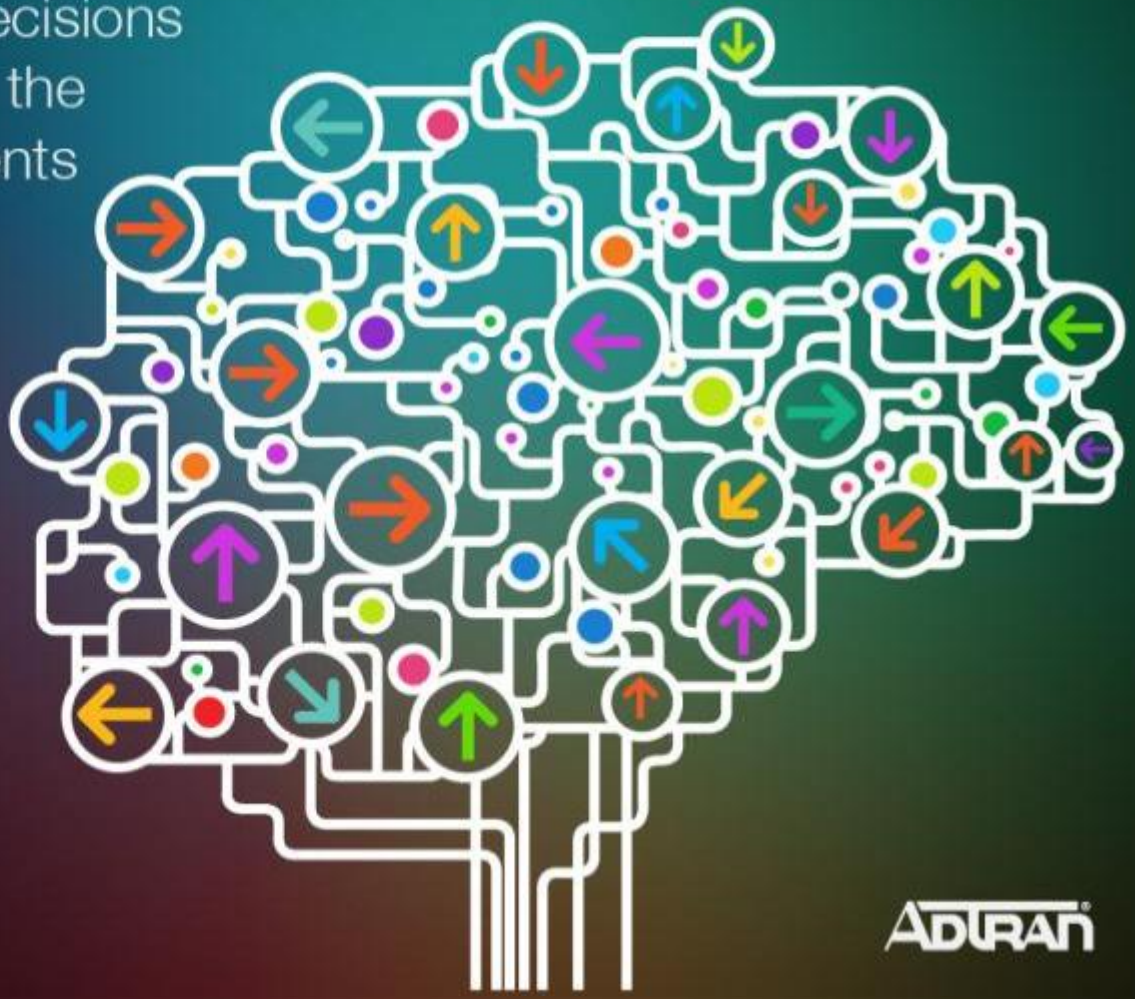
Historical Technology Cycles - 10+ years



The pace of change is accelerating…

The Challenge

Organizations are making decade long network decisions without clear visibility to the future service requirements of their customers.




Reinventing the
NETWORK
ADTRAN solutions enable
service providers and
businesses around the world
to evolve, change and grow.
ADTRAN

Fiber Access Acronyms

Acronym	Description	Acronym	Description
ACP	ADTRAN Certification Program	**MoCA**	Multimedia over Coax Alliance
AE	Active (or Point to Point) Ethernet	**NGPON 2**	Next Generation PON (4 to 16 wavelengths)
AON	Active Optical Network	**OEM**	Original Equipment Manufacturer
ARRA	American Recovery and Reinvestment Act	**OLT**	Optical Line Terminal
ATM	Asyschronous Transfer Mode	**ONT**	Optical Network Terminal
BBF	Broadband Forum	**OTT**	Over the Top
BPON	Broadband Passive Optical Networks	**PON**	Passive Optical Networking
CATV	Community Access or Cable Television	**RF**	Radio Frequency
CO	Central Office	**RFoG**	Radio Frequency over Glass
DOCSIS	Data Over Cable Service Interface Specification	**RG**	Residential Gateway
DSL	Digital Subscriber Line	**ROI**	Return on Investment
EPON	Ethernet Passive Optical Network	**RT**	Remote Terminal
FiOS	Fiber Optic Services	**RUS**	Rural Utilities Service
FTTH	Fiber to the Home	**SBU**	Small Business Unit
GPON	Gigabit Passive Optical Network	**SFU**	Single Family Unit
HPNA	Home Phoneline Networking Alliance	**SLA**	Service Level Agreement
ILEC	Independent Local Exchange Carrier	**USF**	Universal Service Fund
IPTV	Internet Protocol Television	**VDSL2**	Very-high-bit-rate Digital Subscriber Line 2
ITU	International Telecommunications Union	**VoIP**	Voice over Internet Protocol
LTE-A	Long Term Evolution - Advancced	**WDM**	Wavelength Division Multiplexing
Mbps	Megabits Per Second	**WDM PON**	Wavelength Division Multiplexing Passive Optical network
MDU	Multi-Dwelling Unit		
MSAN	Multi-Service Access Node	**XGPON 1**	10 Gigabit Passive Optical Network

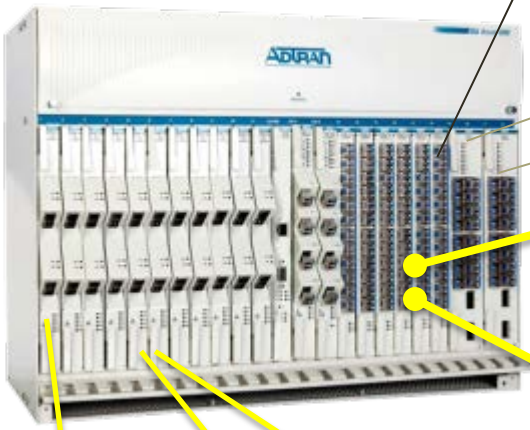
Equipment Display

The Network Layout

NetVanta 838

SHDSL

Total Access 5000

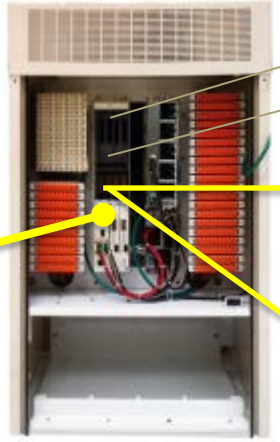


VDSL2

VDSL2/POTS

1G

Cross-Over Cabinet with
Total Access 5004 or 1424S-CE



VDSL2

VDSL2/POTS

AE

Total Access 362

GPON

Total Access 372

10G

SmaRT Cabinet with
Total Access 5000 or Total Access1248V

VDSL2

VDSL2/POTS

GPON

Total Access 374

GPON

Total Access 334

GE

AE

VDSL2

Total Access 1148V

Total Access 352

Question and Answers

Cabinet Solutions

SmaRT Cabinet

DSLAM Applications Using the Total Access 1248V

SmaRT Specifications

Line Sizes
- 384 lines VDSL2 Overlay (eight 1248V blades)

Dimensions
- Height: 42”
- Width: 28”
- Depth: 28”

AC Power
- Main Feed: 30A, 120/240V
- Generator Connector: Nema L14-30P

DC Power
- Power Shelf: Valere C Series
- Controller: BC 2000 with Ethernet

Fiber Management
- 288 Position Internal Fiber Management
- Internal GPON Splitter Storage

Battery Capacity
- 100 Ah (Front Terminal)

Cable Type
- CAT5

Additional Vacant Rack Space
- 12 RU
- Total Access 1500 (Specials Option)

Ordering Information

Part Number	Description
	ADTRAN SmaRT-192 Total Access 1248V Cabinet
	ADTRAN SmaRT-192 Total Access 1248V Cabinet
*For the above items L1/L3=MS2 Splice modules, L2/L4=710 type	
1190901L1	SmaRT Cabinet Pad Mount Template
1353PLH001	SmaRT Cabinet Pole/H-Frame Mount Kit
1353PWR003	20A Power Module
1353BAT100	100Ah Battery String
1179805G1	100 Pack 5-Pin Gas Tube Modules
1353BAT190	100Ah Battery String
1179805G1	100 Pack 5-Pin Gas Tube Modules

SmaRT Cabinet

DSLAM and FTTP Applications Using the Total Access 5000

SmaRT Specifications

Line Sizes
- 288 lines VDSL2 Overlay
- 504 lines VDSL2 Combo
- 84 GPON drops or 5376 lines of FTTP

Dimensions
- Height: 42”
- Width: 28”
- Depth: 28”

AC Power
- Main Feed: 30A, 120/240V
- Generator Connector: Nema L14-30P

DC Power
- Power Shelf: Valere C Series
- Controller: BC 2000 with Ethernet

Fiber Management
- 288 Position Internal Fiber Management
- Internal GPON Splitter Storage

Battery Capacity
- 100 Ah (Front Terminal)

Cable Type
- CAT5

Additional Vacant Rack Space
- 12 RU
- TA1500 (Specials option)

Ordering Information

Part Number	Description
4192S5K192L1/L2*	ADTRAN SmaRT-192 Total Access 5000 Cabinet
4192S5K192L3/L4*	ADTRAN SmaRT-192 Overlay Total Access 5000 Cabinet
*For the above items L1/L3=MS2 Splice modules, L2/L4=710 type	
1190901L1	SmaRT Cabinet Pad Mount Template
1353PLH001	SmaRT Cabinet Pole/H-Frame Mount Kit
1353PWR003	20A Power Module
1353BAT100	100Ah Battery String
1179805G1	100 Pack 5-Pin Gas Tube Modules
1353BAT190	100Ah Battery String
1179805G1	100 Pack 5-Pin Gas Tube Modules

SmaRT Cabinet

DSLAM and FTTP Applications with Meter

Note – Requires PEG Approval (Must Also Be Approved By Local Power Company).

Figure 19. Meter Socket/External AC Load Center

Dimensions:

Height: 42”
Width: (Without Meter Socket): 28”
Width: (With Meter Socket): 34”
Depth: (Without Heat Exchanger): 24.84”
Depth: (With Heat Exchanger): 33.58”

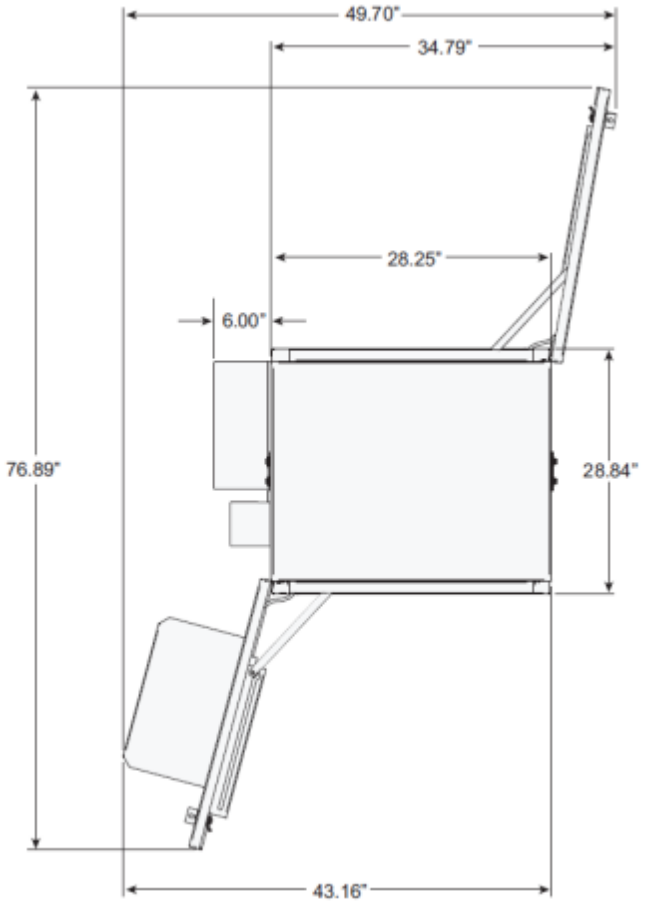


Figure 6. Cabinet Clearance Requirements

Pole- and Pad-Mount Options Available - See I&Ms and Job Aids For Details

MC500 Cabinet

BBDLC Applications Using the Total Access 5000

MC500 Specifications

Line Sizes
- 288 – 504 Lines POTS, VDSL2, VDSL2/POTS, Etc.

Dimensions
- Height: 54”
- Width: 43”
- Depth: 36”

AC Power
- Main Feed: 60A, 120/240V
- Generator Connector: Nema L14-30P

DC Power
- Power Shelf: Eltek-Valere CD10D-ANL-VC
- Controller: BC 2000 with Ethernet

Additional Vacant Rack Space
- 6 RU (Front)
- 15 RU (Back)
- Total Access1500 (Specials option)

Battery Capacity
- 190 Ah (Front Terminal)

Cable Type
- CAT5

Ordering Information

Part Number	Description
4192A5K288L1/L2*	ADTRAN MC500-288 Total Access 5000 Cabinet
4192A5K504L1/L2*	ADTRAN MC500-504 Total Access 5000 Cabinet
4192RKPP504L1/L2*	288-504 Line Upgrade Kit
*For the above items L1=MS2 Splice modules, L2=710 type.	
4192RK5K5L1	Total Access 1500 Upgrade Kit
1190902L1	MC500 Pad Mount Template
1190802L1	MC500 Pole Mount Kit
1353PWR003	20A Power Module
1353BAT190	190Ah Battery String
1179805G1	100 Pack 5-Pin Gas Tube Modules