2025

WISPAMERICA™

BROADBAND WITHOUT BOUNDARIES

Meet the Panel

KANIKSU

President

Fibersmith

Vice President

Cambium Networks™

System Architect

LermanSenter

Attorney

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Getting Started

Key Considerations for launching a fiber deployment, including evaluating your market and selecting deployment models.

Deployment Models

- Aerial vs. Underground
- Standard vs. Microduct Assemblies
- Connectorized vs. Patch & Splice
- Distributed Split Vs. Centralized Vs. Cascading

Most deployment choices come down to CapEx vs. OpEx!

Aerial vs. Underground

- Constr. Labor (++UG)
- Material Costs (+/-)
- Engineering Costs (+Aer)
- Pole Attachment Fees (+Aer)
- Make Ready (+Aer)

CapEx

- Pole Rentals (+Aer)
- Maintenance (+Aer)
- Plant Access (+/-)

OpEx

Standard vs. Microduct

- Constr. Labor (+Standard)
- Material Costs (+/-)
- Splicing Labor (+Standard)
- Engineering Costs (+Microduct)

CapEx

- Pole Rentals (+Aer)
- Maintenance (+/-)
- Plant Access (+/-)

OpEx

Connectorized vs Patch & Splice

Connectorized vs. Patch & Splice is about up front vs. success-based CapEx.

Connectorized is higher up front to make each subsequent turn-up faster and less expensive.

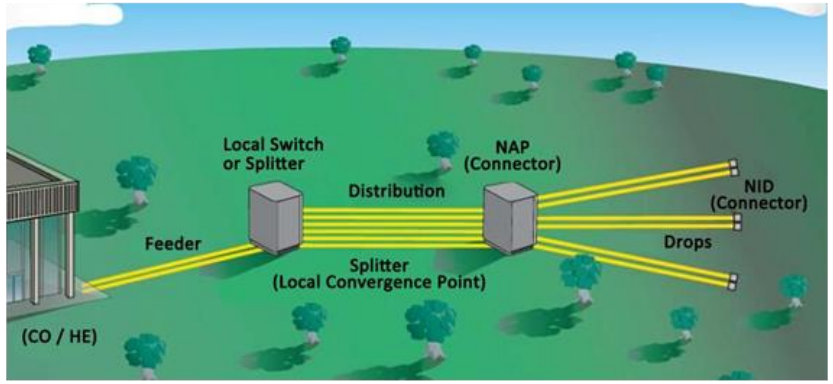
Patch & Splice is lower up front, and each install is the same or *more* expensive than the last.

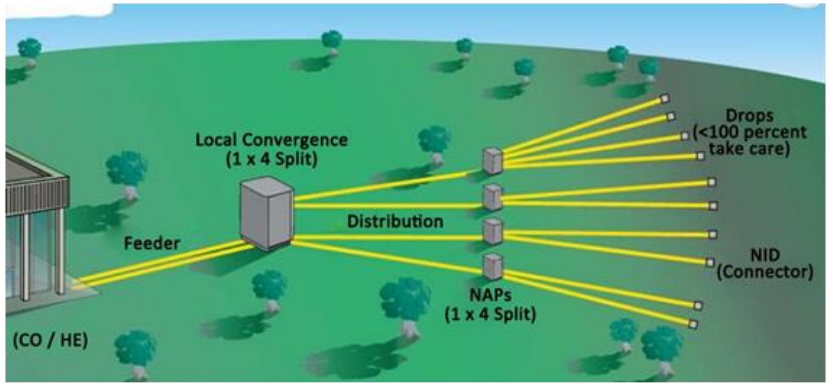
Centralized Vs. Distributed Vs. Cascading Split

Centralized brings all splits to a cabinet. Central management, fewer SFPs up front, bigger cable sizes, more spaghetti.

Distributed puts the splits in the center of a PON area. All your SFPs up front, smaller cable sizes, more planning, no spaghetti.

Cascading splitters put the splits to the farthest edges of the network. No SFPs up front, smallest cable sizes, MAX planning, no spaghetti.



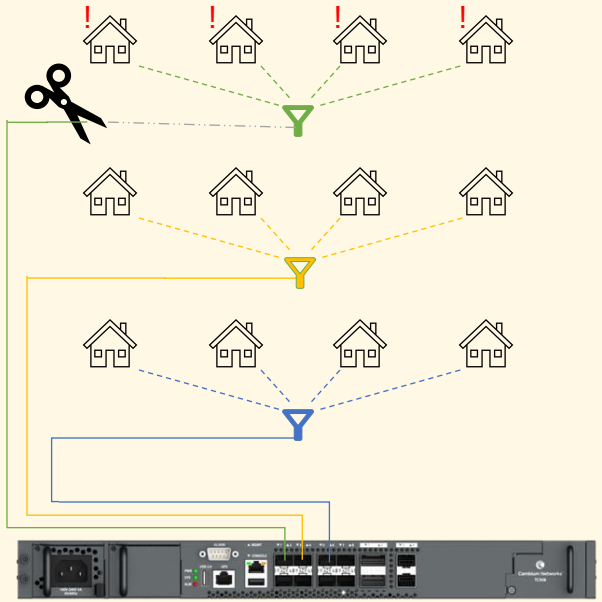


Fiber is *Fast* and *Reliable*—Until a tree or backhoe decides otherwise.

But outages don’t have to mean downtime, truck rolls, and headaches.

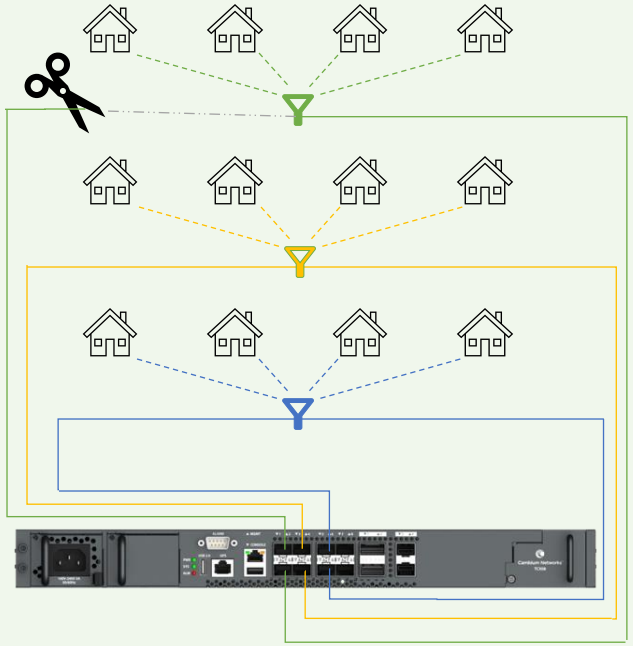
Truck Roll

Type B PON Protected
2 x N Splitters with Return Path

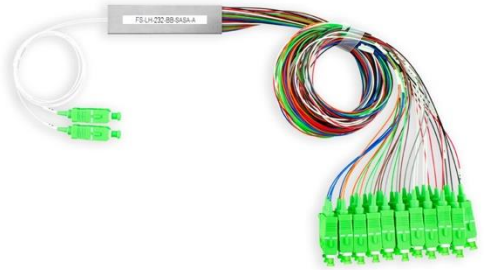


Protected

Type B PON Protected
2 x N Splitters with Return Path



2 x N PLC Splitter



Solution

Two uplinks, one active, the other ready to jump in automagically.

Design Fit

Best with distributed splits, simply close the loops.

Specialized Needs

- 2 x N Splitter

✓ **Increase Uptime** ✓ **Minimize Costs** ✓ **Increase Satisfaction**

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Evaluating the Market

- First Build? Consider Professionals to Assist
  - Fibersmith & Others
- Cost per Passing vs Customer ARPU
  - What ROI are you looking for?
- What Installation methods are best/most economical?
- Grants vs Self Funded
- Costs of Maintenance

Operations Training

- OJT vs Formal training?
  - Can you learn on the job? --YES*
  - You will make mistakes – some timely/costly
- Formal Training
  - Can be done in relatively short period
  - Fiber Optics Association (FOA) Certifications
    - Do you need the cert? It depends, but probably not
    - Multiple Companies offer certifications
- Job Shadowing

Cost Modeling

Learn how to accurately model the costs of a fiber build, form initial construction to long-term maintenance.

CapEx

- Begin to build a model built on variables.
- Remember the basic variables are labor and materials.
- Start by categorizing all of your assumptions into these fundamental categories.
- Just like politics, all builds are local. Your insight into local labor costs will make or break a project.

	Labor	Materials	Total
Outside Plant - Mainline			
Outside Plant - Drop			
ONT, CPE, Inside House			
Inside Plant - Switching Equipment			
Inside Plant - Routing			
Inside Plant - Access			
Total			

CapEx

- Think of all your inputs as costs per unit, then discover what those units actually are.
- Construction units are either broken down to linear feet (boring, plowing, blowing) or discrete points (pole, hand hole, closure)
- Models are not where we sharpen pencils. Numbers should be defensible and reproduceable. It's harderNot one-offs based on salvage favors and eBay.
- The urge is to focus on materials costs, but remember labor makes up more than %80 of most builds.

Design Model Inputs

Aerial Construction Inputs

Fiber Construction costs/ Mile	12	24	48	72	144	288
Fiber Price per foot	$ 0.42	$ 0.53	$ 0.74	$ 0.89	$ 1.42	$ 2.00
Fiber Labor per Foot	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 1.50
Strand/Anchors per Foot	$ 0.35	0.35	0.35	0.35	0.35	0.35
MST Per Mile	-	0	0	0	0	0
MST Cost	$ 650.00	650	650	650	650	650
Splice Cases per Mile	4	4	4	4	4	4
Splice Cannister Cost (w/Labor)	$ 550.00	550	550	550	550	550
ML Splices Per Mile	6	12	24	36	72	144
Customer Splices per Mile	16	16	16	16	16	16
Node Splicing	2	2	2	2	2	2
Splicing Overage	0%	0%	0%	0%	0%	0%
Splice Rate	$ 30.00	30	30	30	30	30
Make Ready per Pole	$ 150.00	150	150	150	150	150
Poles per Mile	26	26	26	26	26	26
Fiber Price	$ 2,550.24	$ 3,218.16	$ 4,493.28	$ 5,404.08	$ 8,622.24	$ 12,144.00
Labor	$ 9,108.00	$ 9,108.00	$ 9,108.00	$ 9,108.00	$ 9,108.00	$ 9,108.00
Strand and Anchors	$ 2,125.20	$ 2,125.20	$ 2,125.20	$ 2,125.20	$ 2,125.20	$ 2,125.20
MST	$ -	$ -	$ -	$ -	$ -	$ -
Splice cases					$ 2,200.00	$ 2,200.00
Splicing					$ 2,700.00	$ 4,860.00
Fiber Dollars per Mile					$ 24,755.44	$ 30,437.20
Make ready/ mile						

Fiber Distribution Percentages

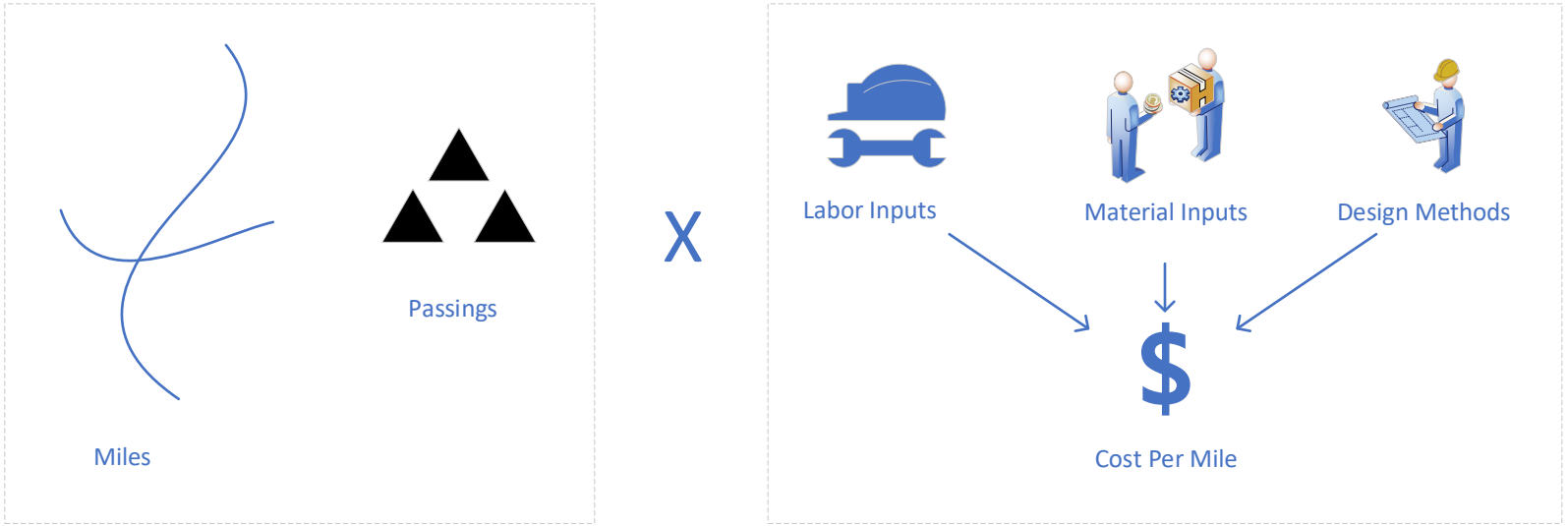
	Current	Default Values
12 Count	0%	25%
24 Count	40%	30%
48 Count	25%	15%
72 Count	20%	10%
144 Count	15%	15%
288 Count	0%	5%
Total	100%	

CapEx

- You model will become reusable and applicable to any project you'd like to chase, simply by changing the relevant inputs.
- This also give you a road map as you move from planning to funding and construction.
- Your model will also be ***very*** helpful in explaining your vision to lenders.

CAPEX SUMMARY	
Category	**Total**
Outside Plant - Mainline	$ 30,574,302
Outside Plant - Drop	$ 1,549,498
ONT, CPE, Inside House	$ 1,629,432
Inside Plant - Access	$ 270,270
Engineering	$ 8,505,876
Total	**$ 42,529,378**

PROJECT STATISTICS	
Project Cost per Passing	$ 10,174.49
Project Cost per Mile	$ 77,608.35
Project OSP Cost per Mile	$ 55,792.52
Total Miles	548
Total Passings	4,180
Passings per Mile	7.63
Total Customers	2,928



Equipment & Installation

Explore the essential equipment used for fiber deployments and gain insights into best practices for installation

A PON system functions like a fixed wireless access point but over fiber. The OLT connects multiple subscribers, while the ONT/ONU acts as a media converter, bridging PON to Ethernet at the customer's location. Each port typically supports 32 to 64 subscribers, with a maximum of 256.

Network Access 1U OLT

Cambium Fiber OLT

TCX16 - 16 Port
(ONUs Max: 4096, Typical: 1024)

TCX08 - 8 Port
(ONUs Max: 2048, Typical: 512)

Subscriber Equipment ONT/ONU

Pluggable ONU
for Fiber to the X

10 Gbps

Outdoor ONT

Indoor ONT

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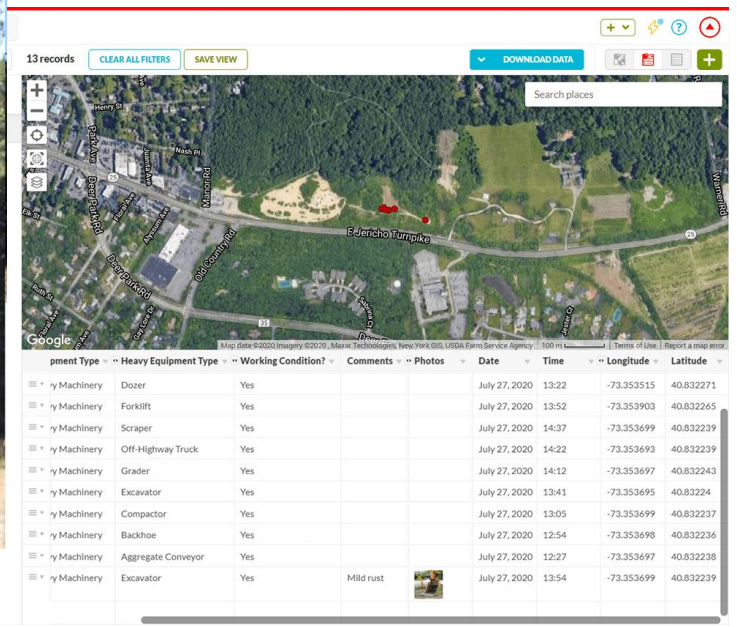
Equipment – Field Collection Software



katapult

Fulcrum

ArcGIS Field Maps

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Equipment – Design & Plant Records

- Fiber Plant Owners/Operators has historically designed and built and managed in at least three different systems. **This may not be necessary for you.**
- Contemplate a cradle to grave strategy that lets you design build and manage in the same suite.

IQGeo

VETRO

3-GIS BY SSP INNOVATIONS

MAPIT RIGHT

GEOGRAPH

Equipment – Design & Plant Records

- Fiber Plant Owners/Operators has historically designed and built and managed in at least three different systems. **This may not be necessary for you.**
- Contemplate a cradle to grave strategy that lets you design build and manage either in the same suite, or with integrations(not people) between them.

IQGeo

VETRO

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OCIUS-X

MAPIT RIGHT

GEOGRAPH

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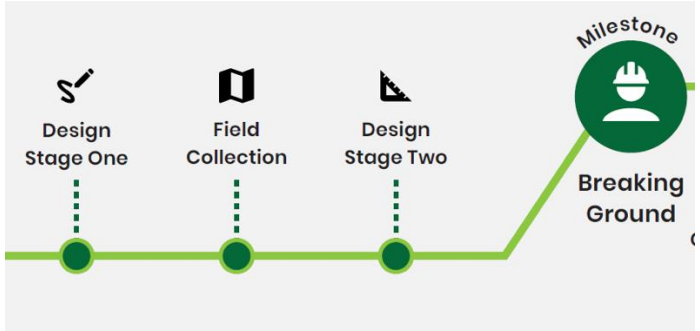
Network Design Criteria

Learn basic design principles for fiber networks, including planning for scalability and reliability.

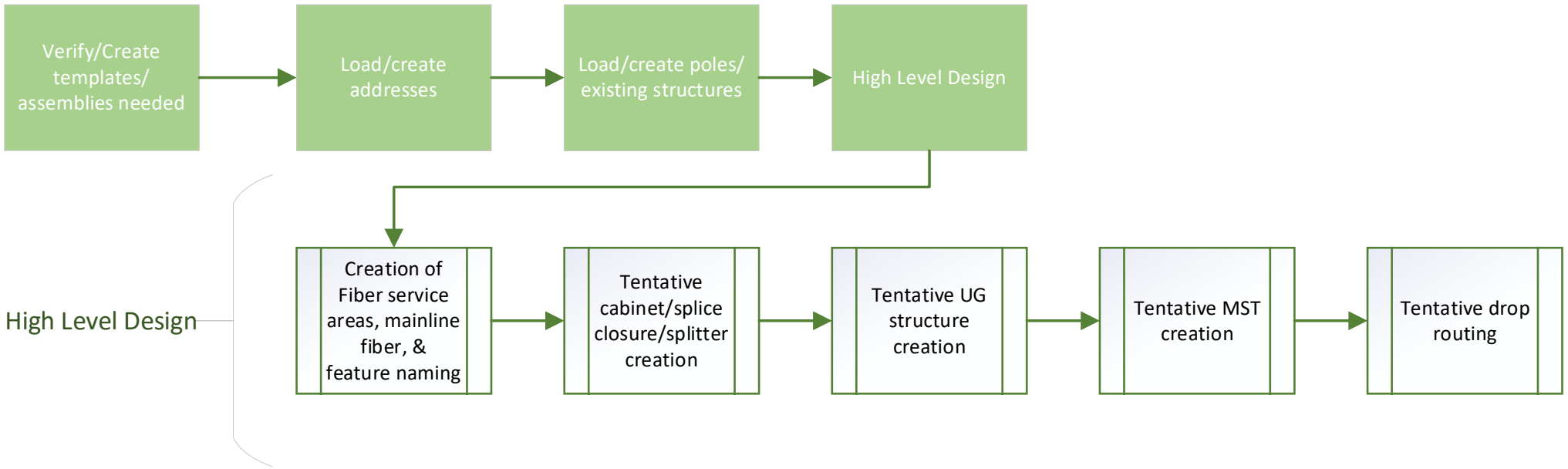
Designing a fiber network requires collecting data from a variety of sources to produce a high-quality and accurate design.

Design stage one (high level) creates a working outline of your fiber network.

- Assess rights of way and easements for usability
- Leverage imagery, property records and street-level data to outline and size the main routes and identify hub locations
- Generate initial bill of material specifications and field collection maps



Designing a fiber network requires collecting data from a variety of sources to produce a high-quality and accurate design.



Designing a fiber network requires collecting data from a variety of sources to produce a high-quality and accurate design.

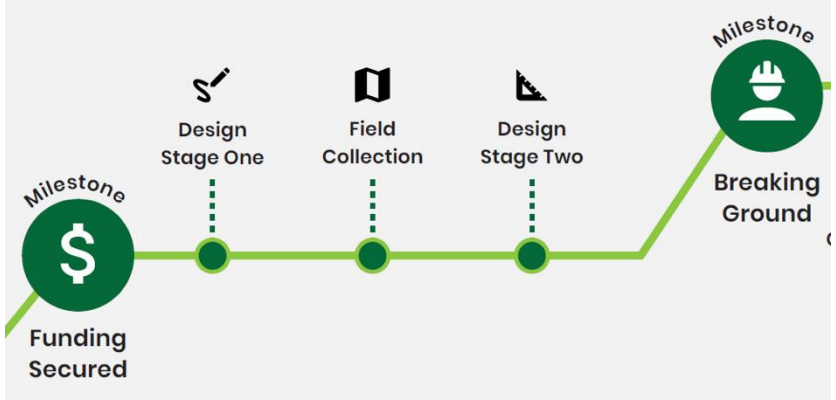
We’re applying many of the decisions we made in modeling, no to real world conditions. This is where our decisions matter most!

- Aerial vs. Underground
- Active vs. Passive
- Connectorized vs. Patch & Splice
- Pedestals vs. Handholes
- Naming conventions
- Fiber strand range

Designing a fiber network requires collecting data from a variety of sources to produce a high-quality and accurate design.

Field collection establishes a design's feasibility and is crucial when it comes time to evaluate ground truth.

- Assess and compare the virtual design to the ground truth requirements like roads, rocks, trees and water
- Execute field collection and staking
- Conduct Pole Loading Analysis (as needed)



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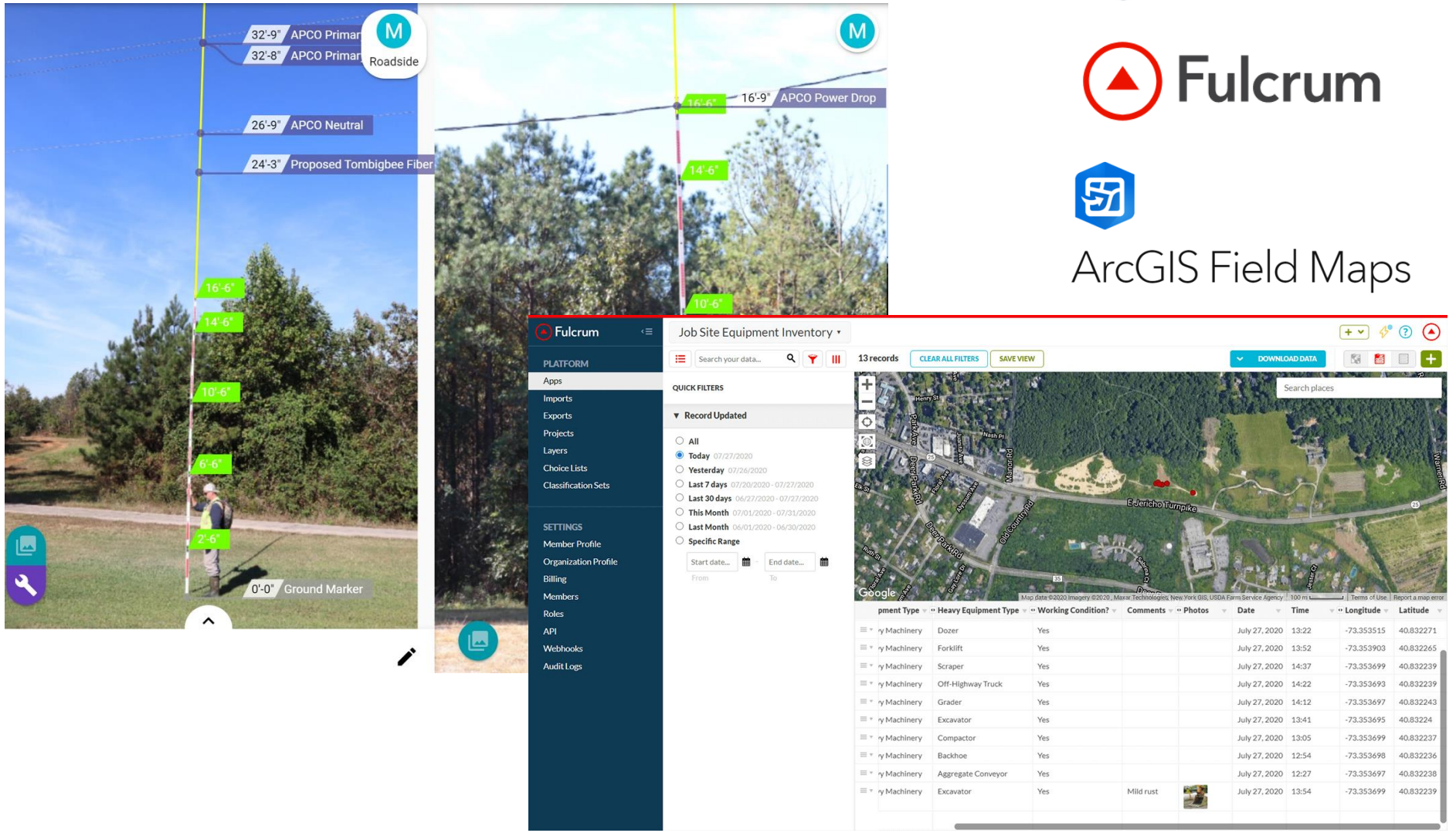
Fulcrum

ArcGIS Field Maps



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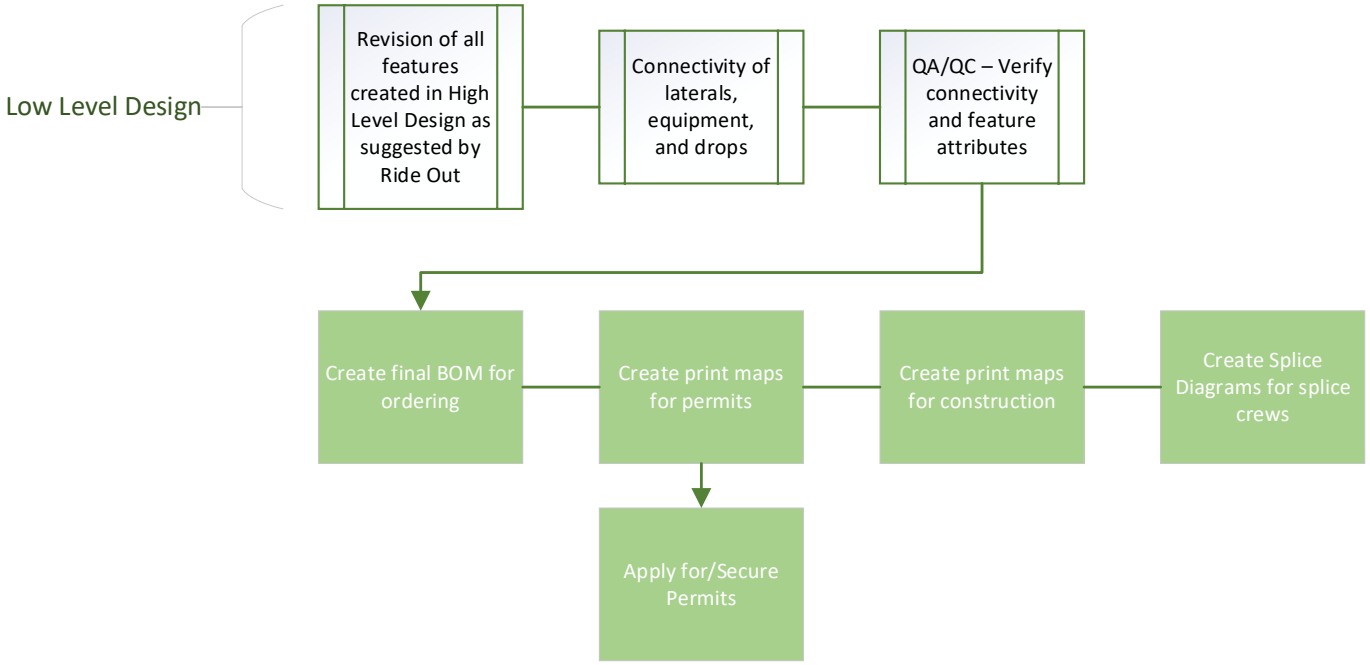
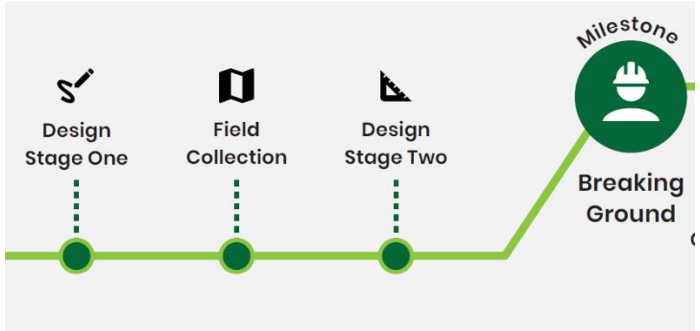
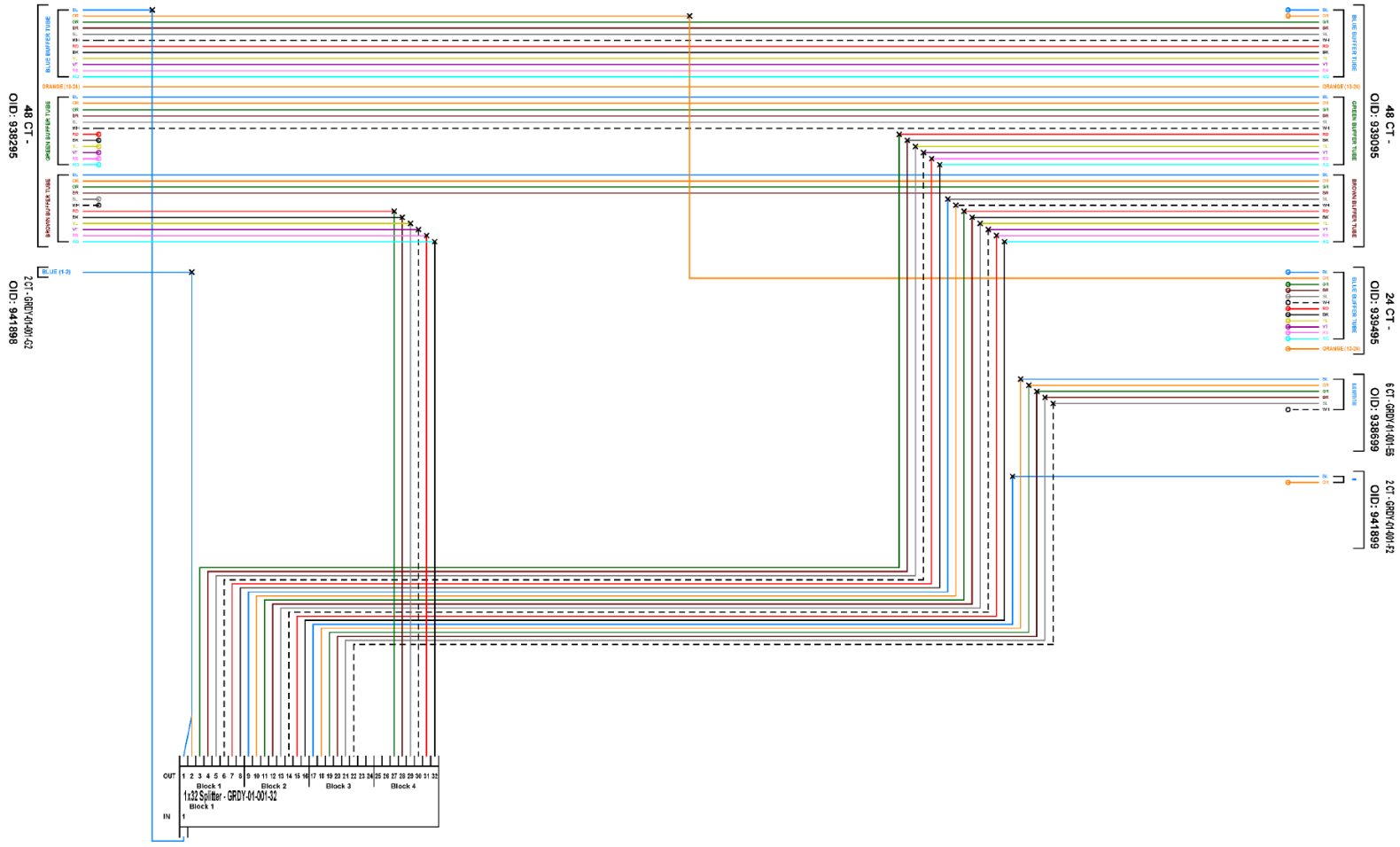
Design stage two: The final design stage (low level) incorporates necessary revisions from field collection.

- Verify the design follows the path of least cost and provides a high level of serviceability while supporting growth and expansion
- Expand the design to include connectivity from the premises to the headend
- Secure permitting and pole attachment







6. Managing Contractors & Training Employees

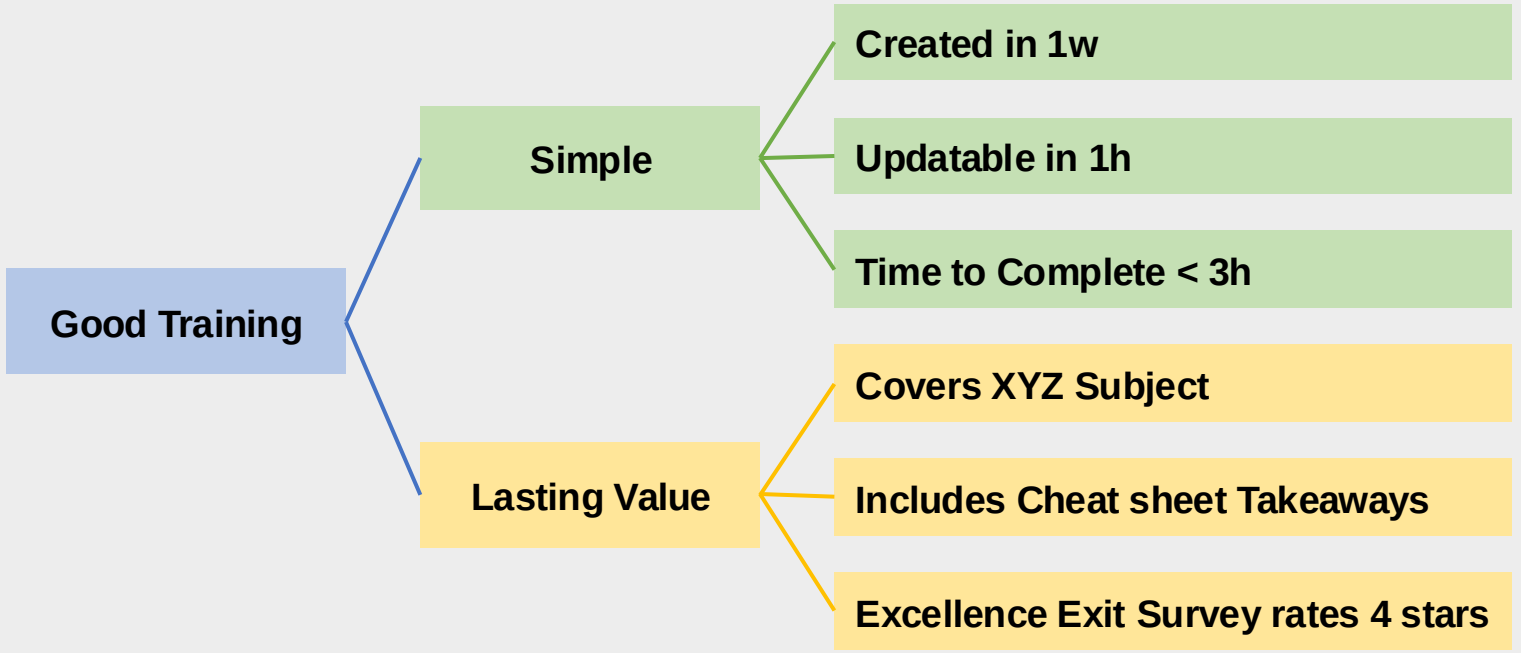
Discover best practices for managing contractors during fiber builds, from contract negotiation to quality assurance. Learn how to effectively train employees to ensure they have the skills and knowledge needed for fiber installation and maintenance.

Equip for Success

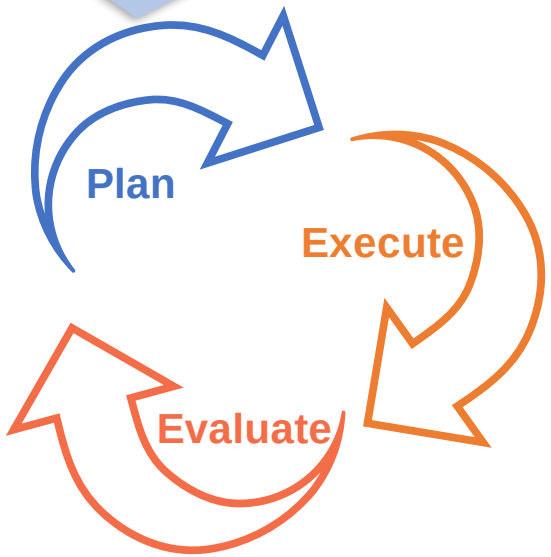
How to Develop Training (or anything really)

3 Steps of a CTQ Tree (lots of info online)

1	2	3
Define The Need	**Determine Drivers**	**Develop Metrics**



Your **CTQ Tree** is your guide for ***structured repeatable training***.



Manage Flexibility Without Complexity

Fiber to Micro-POP

For faster customer acquisitions

Pluggable ONU into ePMP 4500/4600

- ✓ Jump Over right-of-way Issues
- ✓ Launch Gigabit Wireless Today
- ✓ Capture Subscriptions Now
- ✓ Convert to Fiber Tomorrow

ONE Network

See and *manage* your fiber with

ZERO Recurring Fees

Fiber to the Wi-Fi

For Full Campus Wi-Fi coverage

- ✓ Serve MDUs, Parks, and Campuses
- ✓ Deliver Seamless Coverage
- ✓ Eliminate Interference
- ✓ Simple Setup & Easy Management

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Contractors

- They are your Brand Ambassador – Pick Wisely!
- T&M vs Linear Feet
  - Change Orders
- Contracts are a must!
- Licenses, Insurance & Liability

Contractor vs In House

- Typically, cheaper to do in house
  - Project based- do you really want the employee costs?
- Risk vs Reward
  - Do you want to assume the risk of damage to ROW or utilities?
  - Safety – Contractors should be responsible for Traffic control, etc.
- Contractors for ROW, In-house for drops/installation
- Process for documenting plant with contractors

So you have a contractor. Now what?

Structure!

- Define expectations.
- Expectations begin with the RFP.
- Contracts have beginnings and endings. Define these as well.
- What happens when you exceed the end? Liquidated damages.

So you have a contractor. Now what?

Manage!

- Construction management platform is a must.
  - Ocius-X, Render, Vitruvi etc.
  - Find what works best for your team.
- Define retainage!
- Don’t delay payment.
- Don’t pay without inspection.
- Define your contract dates and liquidated damages.
- Be timely with payment AND notices.

So you have a contractor. Now what?

Materials!

- Owner furnished materials are now the standard.
- Assign materials values before transfer.
- Manage transfers precisely.
- Define transfer processes.
- Materials differences cost money. Assign cost sbefore transfer.
- Make materials check-in/out part of your contract.

So you have a contractor. Now what?

Changes!

- Change happens. Assign field representatives for any given contract and given limited authority.
- Change of side vs. change of size vs. change of type
- Deviations are separate from change orders.

Industry Acronyms & Terminology

Get familiar with the key acronyms used in the fiber industry to enhance your technical understanding and communication

PON Terms to Know

PON – Passive Optical Network, it is a physical topology and due to having passive splitters it also requires a protocol.

GPON – A standard implementation of PON good for gigabit to the home.

XG-PON – The 10 Gbps downlink with limited uplink.

XGS-PON – The 10 Gbps symmetrical evolution of GPON.

EPON – Ethernet instead of GPON protocol. More interoperability but less protocol efficiency.

Any PON – The OLT can use GPON or XGS-PON Transceivers

Combo PON – In addition to Any PON, Combo has Dual channel support, having 2 TX and 2 RX switch path lanes.

Split Ratio – The number of ONTs served per OLT port (e.g., 1:32, 1:64).

Distance Limit – The max range of a PON network, typically up to 20-40 km.

Wavelengths – Optical frequencies used in different PON standards (e.g., 1490nm for GPON downstream).

Dying Gasp – A signal sent by an ONT before power loss.

TCONT & GEM Port – PON resources are used to allocate access to the shared medium and transport Ethernet or other flows of traffic. (Cambium abstracts this so you don't need to know these).

DBA (Dynamic Bandwidth Allocation) – A mechanism for distributing bandwidth efficiently on the shared medium.

For the exhaustive list check out pages 4-10 of the XGS-PON Spec: **ITU-T G.9807.1**

Navigating Legal & Regulatory

Understand the legal forms, permits, and issues specific to fiber, including working with homeowner associations and securing government right of ways

Permitting

- Private Utility Easement vs License
  - Consider License if unable to get easement
- Pole Attachment Agreements
  - Make Ready Costs
  - Attachment Fees
- HOA Permissions
  - Newer ones often have conduit installed
- Franchise Agreements
  - Exclusive vs Non-Exclusive

Deep Dive: ABC

Steve Coran – Lerman Senter PLLC

March 2025

Disclaimer

- This presentation is **not** intended to create an attorney-client relationship.
- The information contained in this presentation is general and is **not** offered as legal advice.
- You are strongly encouraged to consult with your attorney(s), consultant(s), or financial advisor(s) if you have specific questions.
- Any reliance on the information in this presentation is taken at your own risk.

New Congressional Leadership

Senate Commerce, Science, & Transportation Committee

- Sen. Ted Cruz – Chairman
- Sen. Maria Cantwell – Ranking Member

House Energy & Commerce Committee

- Rep. Brett Guthrie – Chairman
- Rep. Frank Pallone – Ranking Member
- Rep. Richard Hudson – Chairman of Communications & Technology Subcommittee
- Rep. Doris Matsui – Ranking Member of Communications & Technology Subcommittee

Congressional Short-Term Agenda

- Spectrum Auction Re-Authorization
- BEAD reform
  - SPEED For BEAD Act
  - NOFO and NTIA Guidance
- USF reform
  - Supreme Court case

New Agency Leadership

FCC

- Brendan Carr – Chairman
- Olivia Trusty – Commissioner nominee
  - Longtime service on Senate Commerce and Armed Services Committee
- Geoffrey Starks has announced he will be departing
- Nathan Simington (Rep) and Anna Gomez (Dem) are other commissioners
- Staff appointments currently consist primarily of existing FCC leadership, with some new faces

Commerce/NTIA

- Howard Lutnick confirmed as Commerce Secretary
- Arielle Roth nominated to be NTIA Administrator; Senate confirmation hearing Thursday

Expectations at FCC

Deregulation and light-touch regulation

- “Delete, Delete, Delete”
- Net neutrality gone, but watch states
- Digital discrimination and data breach expansion rules at risk

Competition and innovation

- Higher volume of deals across the board expected
- Mergers of very large industry actors much more likely
- More lenient and quicker M&A review
- But regulatory uncertainty makes growth estimates more unpredictable

Expectations at FCC

Infrastructure

National Security

Spectrum for mobile and satellite

- FCC needs auction authority

Reform of broadband funding programs

- Contributions from Big Tech
- Outcome of Supreme Court case will impact next steps

Enforcement Priorities

- Beware!
- DEI
- National security

FCC Applications

- **Form 601** for new wireless authorizations → prior FCC approval required for most authorizations
- **Form 602** ownership report if you have a wireless license in an auctioned service → must update when filing for new wireless authorization or assignment/transfer
- **Form 603** for assignment and transfers of control of wireless licenses
  - Yes, you need prior FCC approval for equity transfers even if the licensee's name doesn't change
  - Yes, you need prior FCC approval for conversions
- **Form 608** for spectrum lease approvals → prior approval required for some leasing arrangements
- **Section 214** transfer for common carriers, including CAF and RDOF → prior FCC approval required

Compliance Calendar

Item	Date	Frequency	Service Program	Filed with . . .
FRN	Startup	Once	All FCC	FCC
CALEA SSI Plan	Startup	Once	Broadband and voice providers	FCC
DMCA “Safe Harbor” Notice	Startup	Once	Broadband providers (recommended)	Copyright Office
Open Internet Transparency Statement	Startup	Once, update as necessary	Broadband providers	Post on website
Broadband Label	Since October 10, 2024	Once, update as necessary	Broadband providers	Post on website
Privacy Policy	Startup	Once, update as necessary	Broadband providers	Post on website
Terms of Service/Acceptable Use Policy	Startup	Once, update as necessary	Broadband and voice providers (recommended)	Post on website

Compliance Calendar

Item	Date	Frequency	Service Program	Filed with . . .
Form 555	January 31	Annual	Lifeline providers	USAC
Form 499-Q	February 1 May 1 August 1 November 1	Quarterly	Common carriers/ETCs and Interconnected VoIP providers if above de minimis threshold	USAC
CPNI Compliance Certification	March 1	Annual	Common carriers/ETCs and Interconnected VoIP providers	FCC – requires training and manual
Robocall Mitigation Database Certification	March 1 (not yet effective)	Annual, update RMD as necessary	Voice providers, intermediate providers and gateway providers	FCC
Supply Chain Report	March 31	Annual	Broadband providers	FCC

Compliance Calendar

Form 499-A	April 1	Annual	Common carriers/ETCs and Interconnected VoIP providers	USAC
Disability Access Reporting Certification	April 1	Annual	Common carriers/ETCs and Interconnected VoIP providers	FCC
Form 395 Employment Discrimination Report	May 31	Annual	Common carriers/ETCs holding wireless licenses with 16 or more employees	FCC
Form 481	July 1	Annual	Lifeline providers	USAC

Compliance Calendar – CAF + RDOF

Item	Date	Frequency	Service Program	Filed with . . .
Milestone non-compliance notice	January 15	Annual, if necessary	CAF and RDOF	FCC, USAC, governor and Tribe
Performance testing	January 15 April 15 July 15 October 15	Quarterly	CAF and RDOF	USAC
Section 54.316(b) Report	March 1	Annual	CAF and RDOF	USAC
Form 481	July 1	Annual	CAF and RDOF	USAC
Section 54.314 Certification	October 1	Annual	CAF and RDOF	FCC and USAC, if FCC designated ETC


THANK YOU