
E-Rate for Dark and Lit Fiber

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Fiber WAN types

- **Third-party network, aka bandwidth:** You pay the service provider a set amount, and the service provider gives you a port and transports packets that hit that port. Includes MPLS, eLAN, MetroEthernet, etc. Expensive, extremely flexible, highly managed.
- **Leased lit fiber:** Often used to describe the above service, but really it's dark fiber that's lit by the service provider. Rarely found outside E-Rate. Less expensive, less flexible, less managed.
- **Leased dark fiber:** a service provider with existing fiber plant gives exclusive use of a fiber pair. That pair is then lit by the applicant. Lease is usually called an IRU. Less expensive, not managed, flexible on bandwidth but not locations.
- **Self-provisioned fiber:** A service provider hangs fiber on telephone poles, and then the applicant lights it. "Self-provisioned" seems to be a term only inside the E-Rate service providers just call this "dark fiber." Least expensive, not managed, flexible on bandwidth but not locations.

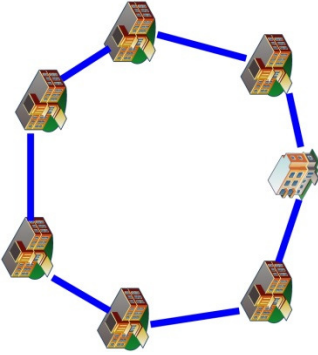
Application timeline

- Design: November?
- Bid: January? Leave more than 28 days for bidders
- Award: March?
- Special construction:
 - May begin 6 months before start of service
- Lighting: by June 30th (last day of funding year)

Allowable Capacity

- Self-provisioned: 12 strands
- Leased dark: 2 strands
- Disclaimer: USAC's Special Construction Excess Capacity training slide uses an example stating, "If an applicant currently needs 2 strands of fiber, but wishes to install 12 strands of fiber for future expansion, it may install the 12 strands of fiber if it allocates the cost of the 10 excess strands of fiber out of its funding request."

Eligibility of Rings

- Benefit: Traffic can flow both directions. If one site drops, traffic can reverse and the network can remain operational
 - Because there is built in resiliency, are rings eligible?
- 
- While USAC has yet to fund any rings, there has been no guidance prohibiting ring construction.

Engineering

- USAC expects engineering to be completed before bid
 - Pre-bid design work not eligible for E-Rate funding
- Only the simplest projects can be bid without precise engineering

Estimating Future Bandwidth

- For Internet Access the FCC endorsed [SETDA standard](#) is 1 Gbps/1,000 users (1.5 Gbps/1,000 users for small districts, 0.7 Gbps/1,000 users for large districts)
- For WAN service the FCC endorsed SETDA standard is 10 Gbps/1,000 users
- Cisco's latest [whitepaper](#) is projecting an approximate 20% increase in bandwidth needs year over year until 2020.
- ESH's model anticipated an annual increase of 40% for IA and 30% for WAN for the first five years.
 - After the first five years, the increase decreased by half in five year increments. E.g. 40% increase in years 1-5, 20% increase in years 6-10, 10% in years 11-15 and 5% in years 16-20.

Project Timing

- Allow a longer bid period; 60 days?
- Fiber must be lit by June 30th, but with approvals not coming quickly, how to proceed?
 - Approach 1: Start work before receiving the FCDL. Risk: that the project will not be funded
 - Approach 2: Finish it late and file an appeal to move the lit date. Risk: appeal not granted.
 - Approach 3: File a duplicate FRN in the following year, and cancel the original. Risk: it may just recreate the timing problem in the next year.

Extra fees

- How to get E-Rate for government and other fees?
 - Make all fees the vendor's responsibility

One school's path through PIA

- First round:
 - Excel [template](#) requesting:
 - Latitude and longitude of all locations
 - Aerial/buried, electronics, speed
 - Explanation of cost-effectiveness determination
 - Why doesn't the FRN include electronics?
 - Will WAN be lit by June 30th
 - Explanation of how cost of lit was compared to cost of self-provisioned
 - Bidding Selective Review: selection process, vendor communications, all bids

One school's path through PIA

- Second round:
 - A .kmz or .json map file of the route being constructed. (A PDF seemed acceptable.)
 - Costs per foot for
 - Fiber Material
 - Fiber Placement
 - Structure Material
 - Structure Placement

Calculating Return on Investments

- Dark or self-provisioned fiber's return on investment (ROI) is determined when the total cost to date for the dark or self-provisioned fiber is less than lit fiber.
- In the example below, dark fiber is cheaper starting in year one.

Lit Fiber	1	2	3	4	5	6	7	8	9	10
Monthly Recurring Cost (Projected)	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198
Annual Recurring Cost (MRC x 12)	\$14,377	\$14,377	\$14,377	\$14,377	\$14,377	\$14,376	\$14,376	\$14,376	\$14,376	\$14,376
Special Construction Charge	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Lit Fiber Cost	\$14,377	\$28,753	\$43,130	\$57,507	\$71,884	\$86,260	\$100,636	\$115,012	\$129,388	\$143,764
Difference Leased Dark/Lit	(\$1,070)	(\$7,140)	(\$13,210)	(\$19,281)	(\$25,351)	(\$27,954)	(\$35,557)	(\$43,160)	(\$50,763)	(\$58,366)
Leased Dark Fiber	1	2	3	4	5	6	7	8	9	10
Annual Recurring Cost (MRC x 12)	\$8,307	\$8,307	\$8,307	\$8,307	\$8,307	\$6,773	\$6,773	\$6,773	\$6,773	\$6,773
Equipment Cost	\$5,000	\$0	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0
Special Construction Charge	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Leased Dark Fiber Cost	\$13,307	\$21,613	\$29,920	\$38,226	\$46,533	\$58,306	\$65,079	\$71,852	\$78,625	\$85,398

Calculating ROI continued

- In the following example, the special construction charges push the ROI to the right.

Lit Fiber	1	2	3	4	5	6	7	8	9	10
Monthly Recurring Cost (Projected)	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198	\$ 1,198
Annual Recurring Cost (MRC x 12)	\$14,377	\$14,377	\$14,377	\$14,377	\$14,377	\$14,376	\$14,376	\$14,376	\$14,376	\$14,376
Non-recurring Cost (to District)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Lit Fiber Cost	\$14,377	\$28,753	\$43,130	\$57,507	\$71,884	\$86,260	\$100,636	\$115,012	\$129,388	\$143,764
Difference Build/Lit	\$84,223	\$73,447	\$62,670	\$51,893	\$41,116	\$35,340	\$24,564	\$13,788	\$3,012	(\$7,764)
Self-Provisioned Fiber	1	2	3	4	5	6	7	8	9	10
Annual Recurring Cost (Maintenance x 12)	\$3,600	\$3,600	\$3,600	\$3,600	\$3,600	\$3,600	\$3,600	\$3,600	\$3,600	\$3,600
Equipment Cost	\$5,000	\$0	\$0	\$0	\$0	\$5,000	\$0	\$0	\$0	\$0
Non-recurring Cost (Fiber Build)	\$90,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total Self-Provisioned Fiber Cost	\$98,600	\$102,200	\$105,800	\$109,400	\$113,000	\$121,600	\$125,200	\$128,800	\$132,400	\$136,000

Case Studies

- Marshfield School District
 - Self-Provisioned Fiber
 - Network Electronics
- Liberty-Benton School District
 - Network Electronics only

Case Studies

- Marshfield School District
 - Screenshot of 470- 160021955:

Services Requested

Category 1: Internet Access and/or Telecommunications

Type	Function	Number Entities	Quantity	Unit	Min Capacity	Max Capacity	Installation and Initial Configuration?	Maintenance Indicator	Associated RFP
Internet Access and/or Telecommunications	Self- provisioning	1	Detailed in RFP	Detailed in RFP	Detailed in RFP	Detailed in RFP	Yes	Yes	View RFP Documents
Internet Access and/or Telecommunications	Lit Fiber Service	1	1	Circuits	10 Gbps	25 Gbps	Yes	Yes	

Category One Narrative

Lit Fiber service from Nasonville Elementary, 11044 US 10, Marshfield, WI 54449 to Washington Elementary 1112 W 11th, Marshfield, WI 54449

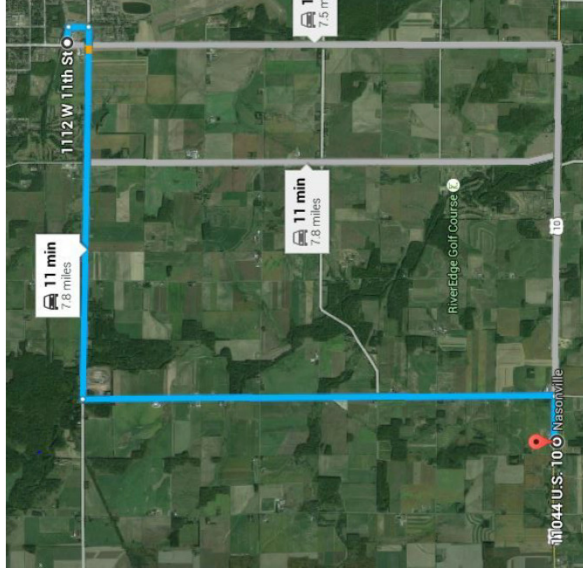
Case Study: Marshfield SD

Request for Proposal – Dark Fiber Lateral to Community Area Network

The School District of Marshfield is requesting to connect dark fiber to Nasonville Elementary School. This dark fiber lateral extends the school district WAN to the Nasonville Elementary School located at 11044 US Highway 10, Marshfield, WI 54449. The nearest school WAN location for the dark fiber attachment is at Washington Elementary School, 1112 W. 11th Street, Marshfield, WI 54449.

This fiber will be 12 count, armored single-mode fiber optic cable. Termination and splicing will be completed at the demark point inside the Nasonville Elementary School. The minimum capacity will be 10 Gbps, maximum capacity 100 Gbps. The estimated distance is 40,000 linear feet.

As per USAC ERATE guidelines, please address all proposals and questions to the following contact person.



[illegible]

Case Study: Marshfield SD

- FRN 1699064173 requested 1x48 port switch, 1x24 port switch, and two 10gb cards

Product and Service Details

Purpose	Internet access service that includes a connection from any applicant site directly to the Internet Service Provider	Type of Connection
Function	Switches	
Make	Cisco	Model WS-C3850-48P-E

Product and Service Details

Purpose	Internet access service that includes a connection from any applicant site directly to the Internet Service Provider	Type of Connection
Function	Switches	
Make	Cisco	Model WS-C3850-24P-E

Product and Service Details

Purpose	Internet access service that includes a connection from any applicant site directly to the Internet Service Provider	Type of Connection
Function	Connectors/Couplers	
Make	Cisco	Model SFP-10G-LR-S=
	..	

Case Study: Marshfield SD

Funding Request Details

FRN 1699064173 Service Type Data Transmission and/or Internet Access
Nickname Self Provisioning Fiber Electronics Service Provider Heartland Technology Group, Inc. (SPIN: 143010763)
FCC Form 471 #161031162 Service Start Date 7/1/2016
Applicant MARSHFIELD SCHOOL DISTRICT (BEN: 133223) Contract 6/30/2017
Expiration Date

Status Denied

Fiber Request Key Information

Fiber Type Self-provisioned
Fiber Sub-type Network Equipment

Narrative

Switches and Optical Interfaces to light the Fiber.

FRN Calculation

Monthly Charges		Total Requested Amount
Total Monthly Recurring Charges	\$0.00	\$0.00
Total Monthly Ineligible Charges	- \$0.00	+ \$17,080.00
Total Monthly Eligible Charges	= \$0.00	= \$17,080.00
Total Number of Months of Service	x 12	60%
Total Eligible Pre-Discount Recurring Charges	= \$0.00	= \$10,248.00

One-Time Charges	
Total One-Time Charges	\$17,080.00
Total Ineligible One-Time Charges	- \$0.00
Total Eligible Pre-Discount One-Time Charges	= \$17,080.00

No.	Comment
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DR1 The FCC Form 470 that established the competitive bidding process for this FRN did not include service of this type (Network Equipment); therefore it does not meet the 28 day competitive bidding requirement.

Lessons Learned

- It appears OK to not post for dark fiber when seeking self-provisioned fiber
- Post for Network Electronics on the 470.

Case Study: Liberty-Benton SD

- Category One – Network Electronics
- Screenshot of 470 #160002605 :

Category 1: Internet Access and/or Telecommunications

Type	Function	Function Other Description	Function Other Description	Function Other Description	Number Entities	Quantity	Unit	Min Capacity	Max Capacity	Installation and Initial Configuration?	Maintenance Indicator	Associated RFP
Internet Access and/or Telecommunications	Cellular Voice				5	10	Lines			No	No	
Internet Access and/or Telecommunications	Other	Upgrade of Lit Fiber Cap - Switch - HP 5406-44G- POE+-2XG v2 sl (or equivalent)	Upgrade of Lit Fiber Cap - Switch - HP 5406-44G- POE+-2XG v2 sl (or equivalent)	Upgrade of Lit Fiber Cap - Switch - HP 5406-44G- POE+-2XG v2 sl (or equivalent)	2	2	Lines	10 Gbps	10 Gbps	No	No	View RFP Documents
Internet Access and/or Telecommunications	Other	Upgrade of Lit Fiber Cap - Module - HP 8-port 1-GbE SFP= v2 zl (or equivalent)	Upgrade of Lit Fiber Cap - Module - HP 8-port 1-GbE SFP= v2 zl (or equivalent)	Upgrade of Lit Fiber Cap - Module - HP 8-port 1-GbE SFP= v2 zl (or equivalent)	2	2	Lines	10 Gbps	10 Gbps	No	No	View RFP Documents
Internet Access and/or Telecommunications	Other	Upgrade of Lit Fiber Cap - UPS - HP 1500W PoE+ zl Power Supply (or equivalent)	Upgrade of Lit Fiber Cap - UPS - HP 1500W PoE+ zl Power Supply (or equivalent)	Upgrade of Lit Fiber Cap - UPS - HP 1500W PoE+ zl Power Supply (or equivalent)	2	2	Lines	10 Gbps	10 Gbps	No	No	View RFP Documents
Internet Access and/or Telecommunications	Other	Upgrade of Lit Fiber Cap - Transceiver - HP X 132 10G SFP+ LC ER (or equivalent)	Upgrade of Lit Fiber Cap - Transceiver - HP X 132 10G SFP+ LC ER (or equivalent)	Upgrade of Lit Fiber Cap - Transceiver - HP X 132 10G SFP+ LC ER (or equivalent)	2	2	Lines	10 Gbps	10 Gbps	No	No	View RFP Documents

Case Study: Liberty-Benton SD

Summary of Request

Liberty-Benton SD is seeking proposals for the upgrade of lit fiber connections components necessary to provide comprehensive upgrade of the District Network to ultimately accommodate up to 10 Gbps broadband and Wi-Fi services to our elementary, middle, and high school buildings. The timeline of this project will be contingent upon the e-rate process guidelines and funding commitment. Proposals will be accepted for equipment only.

Proposals must be itemized and any e-rate ineligible services must be listed separately as such. Proposals must be effective for a period of 3 months.

All proposed equipment must function effectively with existing network infrastructure and systems. Equipment must have sufficient specifications and be expandable. Component specifications must be included in proposals. Equipment must be new and provided by an authorized seller. No used or refurbished equipment will be considered.

It is the service provider's responsibility to ensure that components and services meet the manufacturer's performance specifications and Liberty Benton SD's service requirements.

Case Study: Liberty-Benton SD

Evaluation Process

Following E-rate requirements, “Cost of eligible goods and services” will be the single highest-ranked criterion as part of the proposal evaluation and vendor selection process but will not be the only criterion utilized.

Upgrade of Lit Fiber Hardware Requirements

1. Upgrade district owned lit fiber between two building locations

Equipment Required:

- 2 HP 5406-44G-PoE+-2XG v2 zl Switch J9533A (or equivalent)
- 2 HP 8-port 10GbE SFP+ v2 zl Module J9538A (or equivalent)
- 2 HP 1500W PoE+ zl Power Supply J9306A (or equivalent)
- 2 HP X132 10G SFP+ LC ER Transceiver J9153A (or equivalent)

General RFP Conditions

- All contracts are contingent upon USAC/SLD approval of the E-rate Form 471 and the District having sufficient funding at the time of contracting.
- Service Providers must include their USAC “Service Provider Identification Number (SPIN)” with any proposals submitted.

Case Study: Liberty-Benton SD

Funding Request Details

FRN	1699061136	Service Type	Data Transmission and/or Internet Access
Nickname	Fiber Lighting Hardware	Service Provider	Total Systems Integration (TSI), Inc. (SPIN: 143011790)
FCC Form 471	#161017417	Service Start Date	7/1/2016
Applicant	LIBERTY-BENTON SCHOOL DISTRICT (BEN: 130123)	Contract Expiration Date	6/30/2017
		Status	Funded

Fiber Request Key Information

Fiber Type	Self-provisioned
Fiber Sub-type	Network Equipment

Narrative

This FRN consists of 11 fiber connections components necessary to provide comprehensive upgrade of the District Network to ultimately accommodate up to 10 Gbps broadband and Wi-Fi services to our elementary, middle, and high school buildings across the District's self-owned fiber lines. The requested hardware consists of: 2 Aruba 5406R 44GT PoE+4SFP+ v3 zl2 Swch, 4 Aruba 5400R 1100W PoE+ zl2 PSU, 2 Aruba 8p 1G/10GbE SFP+ v3 zl2 Mod and 2 HP X132 10G SFP+ LC ER Transceivers.

FRN Calculation

Monthly Charges	
Total Monthly Recurring Charges	\$0.00
Total Monthly Ineligible Charges	- \$0.00
Total Monthly Eligible Charges	= \$0.00
Total Number of Months of Service	x 12
Total Eligible Pre-Discount Recurring Charges	= \$0.00

One-Time Charges	
Total One-Time Charges	\$12,737.26
Total Ineligible One-Time Charges	- \$0.00
Total Eligible Pre-Discount One-Time Charges	= \$12,737.26

Total Requested Amount	
Total Eligible Pre-Discount Recurring Charges	\$0.00
Total Eligible Pre-Discount One-Time Charges	+ \$12,737.26
Total Pre-Discount Charges	= \$12,737.26
Discount Rate	60%
Funding Commitment Request	= \$7,642.36

Case Study: Liberty-Benton SD

- Review of FRN Line Items:

FRN Line Item Number	Function	Type of Connection	Quantity	Total Eligible Line Item Cost
1699061136.001	Switches	0	0	\$5,881.12
1699061136.002	UPS	0	0	\$2,465.80
1699061136.003	Switches	0	0	\$3,728.84
1699061136.004	Other	0	0	\$661.50

Function Switches

Make Aruba (Hewlett-Packard)

Model Aruba 5406R 44GT PoE+/4SFP+ v3 z12 Swch - JL003A

Function UPS

Make Aruba (Hewlett-Packard)

Model Aruba 5400R 1100W PoE+ z12 PSU - J9829A

Function Switches

Make Aruba (Hewlett-Packard)

Model Aruba 8p 1G/10GbE SFP+ v3 z12 Mod - J9993A

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Make Hewlett-Packard

Is lease or non- No
purchasing agreement?

Model HP X132 10G SFP+ LC ER Transceiver - J9153A
Network Transceiver
Equipment Description

Resources

- USAC's "[Fiber Options](#)" Training deck
- USAC's "[Before you Begin Fiber](#)" page
- USAC's "[Requirements for Leased Dark Fiber](#)" page
- USAC's "[State Matching Provision](#)" page
- USAC's "[FAQs: Dark & Lit Fiber](#)" page
- FCC's [Fiber Build Workshop](#)
- USAC's Fiber Lead: [Leslie Frelow](#)
- [SETDA bandwidth recommendations](#)