Are You Leaving Money on the Table? Making Strategic OSP Cable Choices

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Black Cable is Black Cable

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Five Flavors of Black Cable

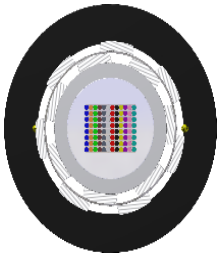
LOOSE TUBE

MICRO CABLES

RIBBON

DROP

INDOOR/
OUTDOOR

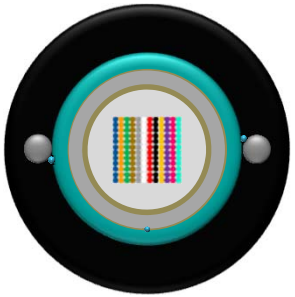


Focus on Three Cable Families That Overlap

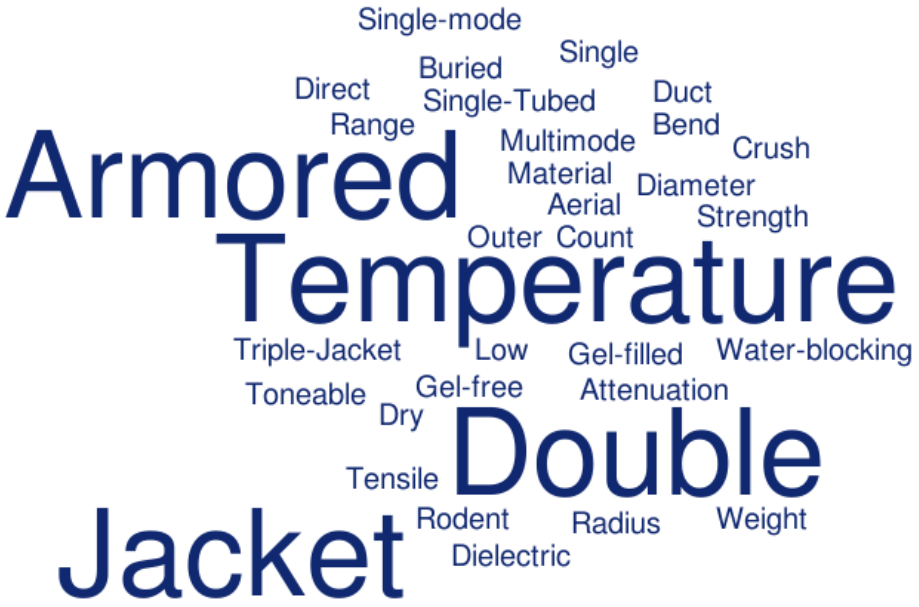
LOOSE TUBE

MICRO CABLES

RIBBON



NOT…



Strategic Choices That Matter

- Scalability
- Signal Latency
- Signal Loss
- Deployment Velocity

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General Overprovisioning Guidance

25% Rule

If future network applications are defined and potential demand for unanticipated service is low

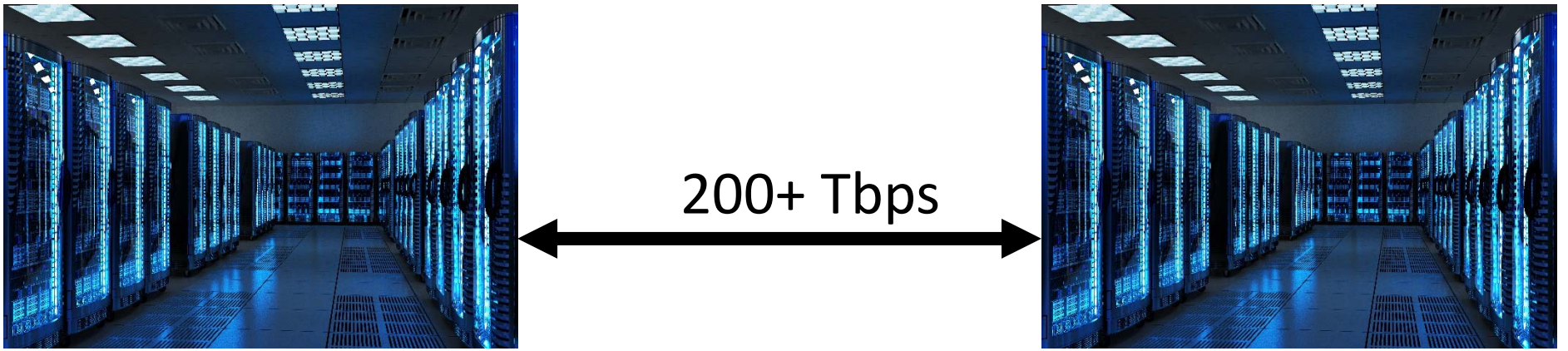
50% Rule

If future network applications are defined and potential demand for unanticipated service is high

100% Rule

If future network applications are uncertain and potential demand for unanticipated service is very high or subsequent installations are extremely difficult

Average Fiber Counts Are Growing Very Fast



Day 1: You need over 3000 fibers to connect two hyperscale data centers together

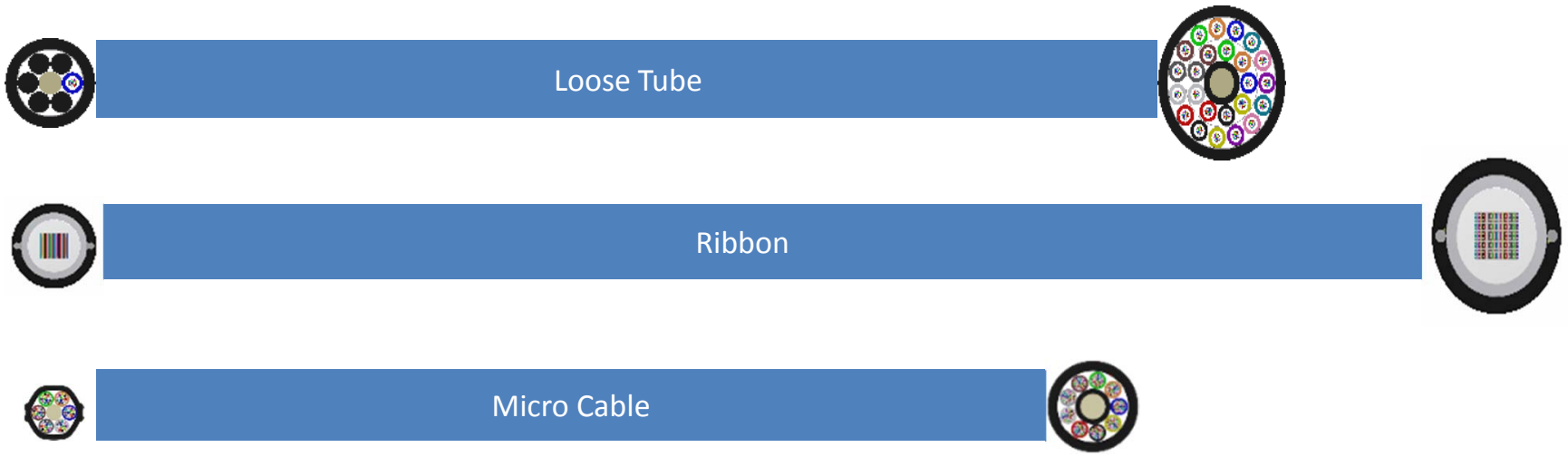
Quick Math Shows Staggering Splicing Labor

	Ribbon	Single Fiber
Fiber Count	1728F	1728F
Number of splices	144	1728
Time per splice	8 minutes ($40 per splice)	4 minutes ($25 per splice)
Total Splicing Time(hrs.)	19 hours	115 hours

Loose Tube, Ribbon and Micro Cables Can Support Low to Very High Fiber Counts

Fiber Counts

<12 12 24 36 48 60 72 84 96 108 120 144 156 192 216 228 240 288 360 432 576 720 864 1728



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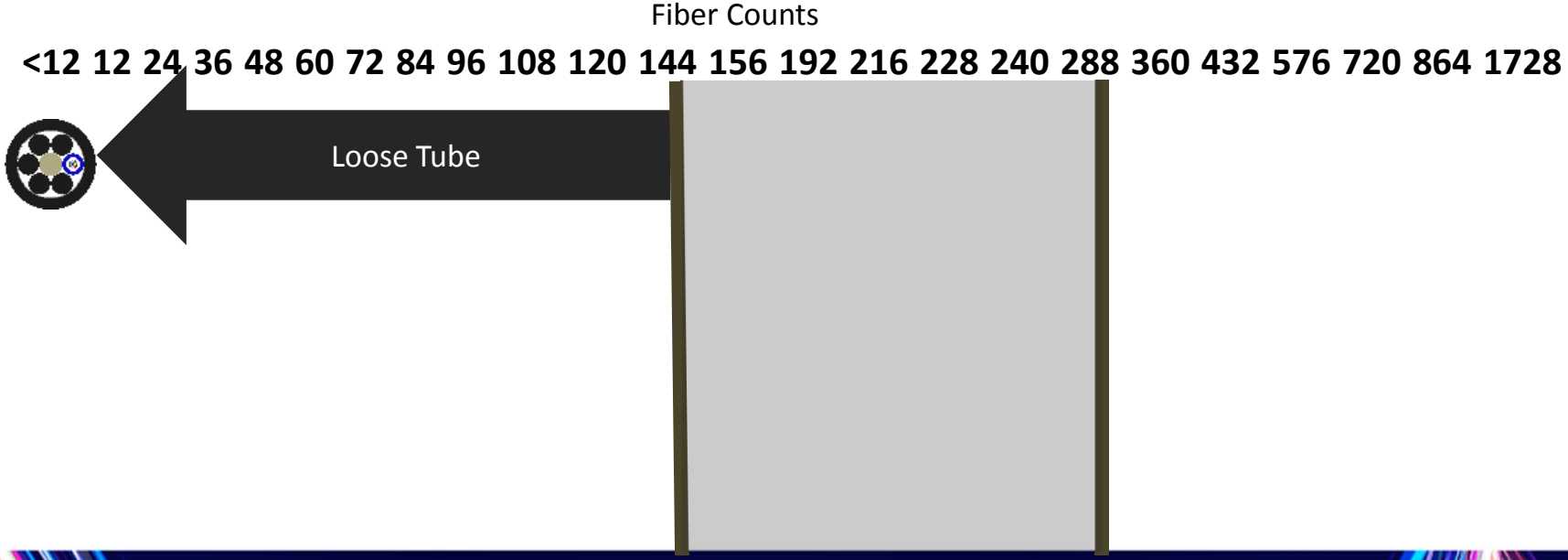

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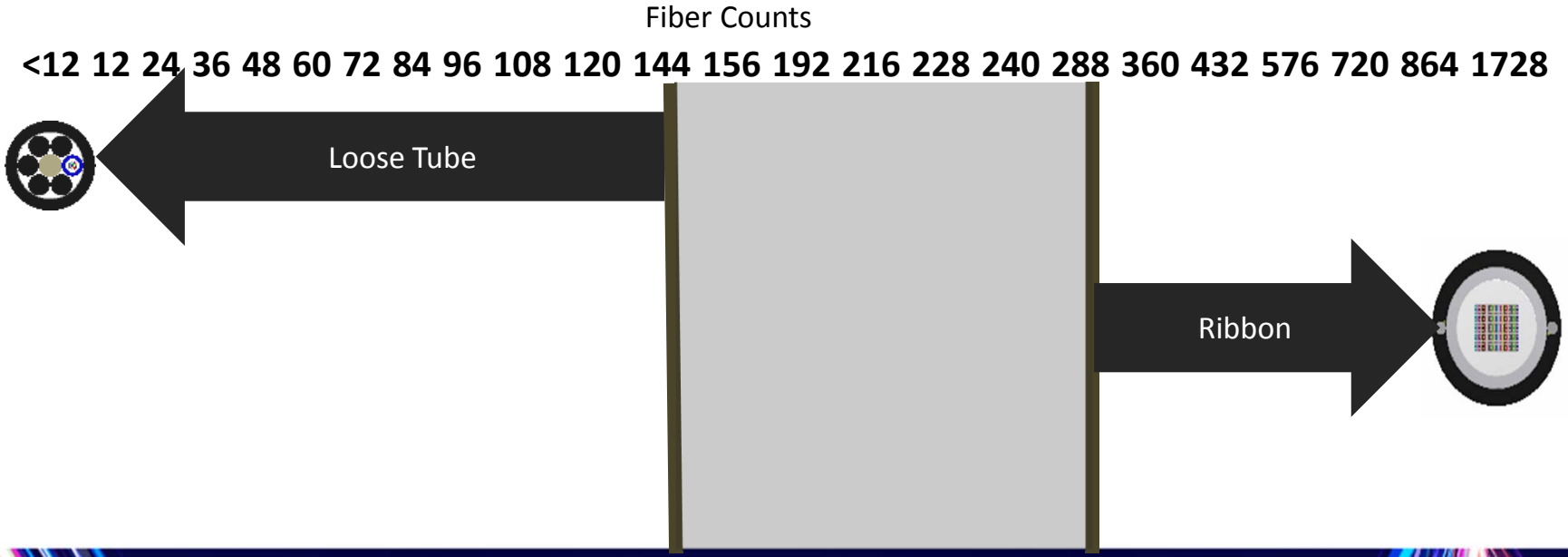

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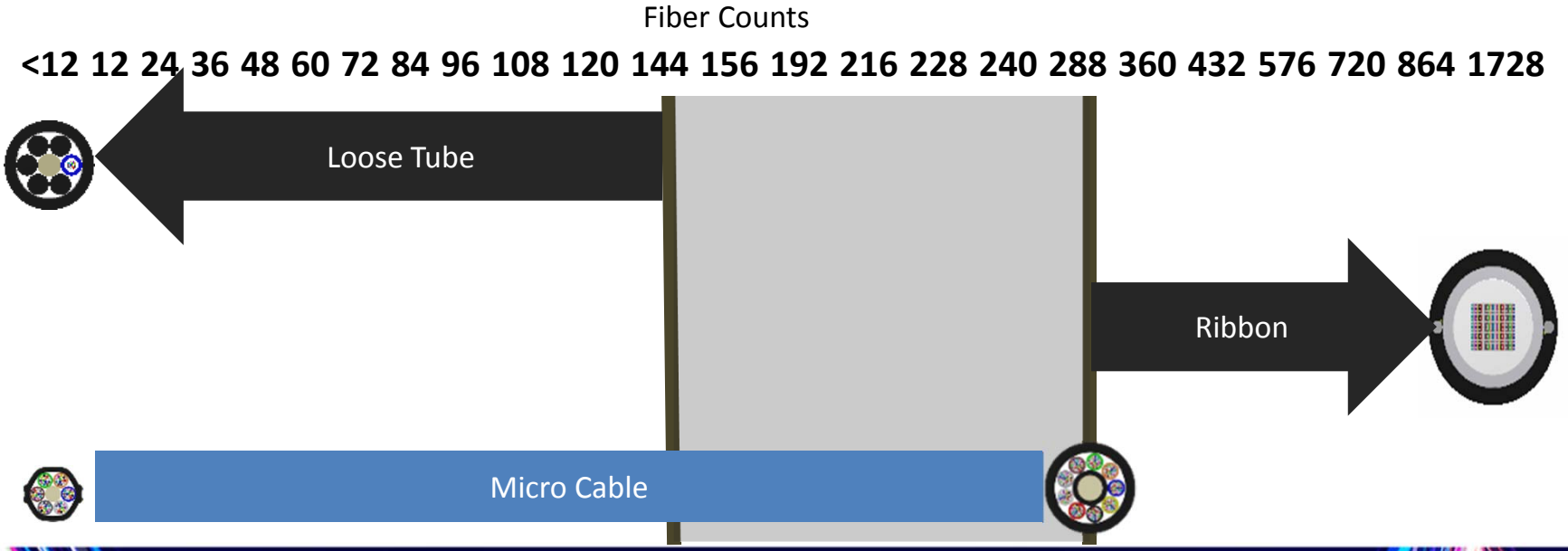
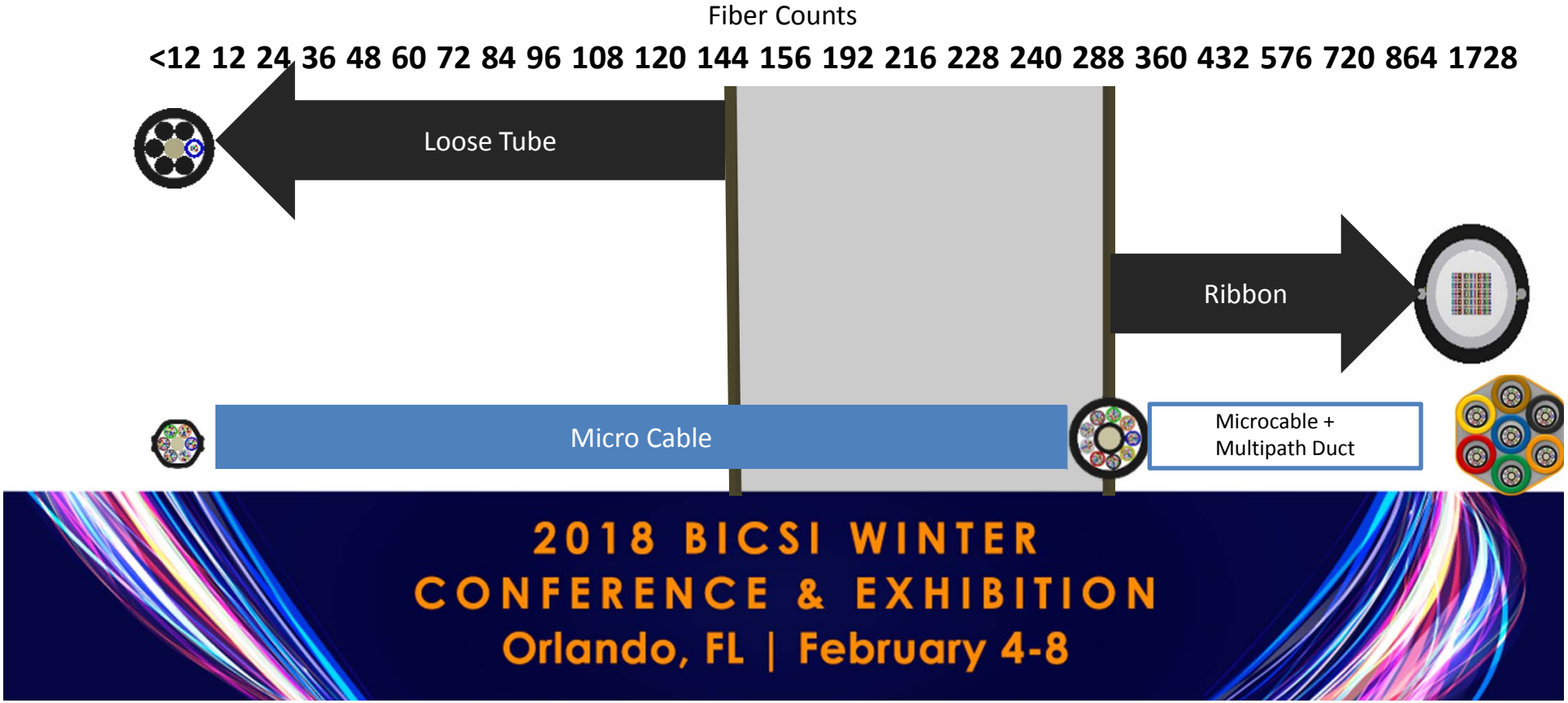


Loose Tube, Ribbon and Micro Cables Can Support Low to Very High Fiber Counts



Micro Cables Offer Scalability and Pay as You Go Model

Day One: 2 x 288 = 576F

Micro Cables Offer Scalability and Pay as You Go Model

Day One: 2 x 288 = 576F

Future: 7 x 288 = 2016F

Strategic Choices That Matter

When Latency Really Matters

In the world of high-frequency trading, a 1 ms advantage can be worth $100M/year to a financial institution*

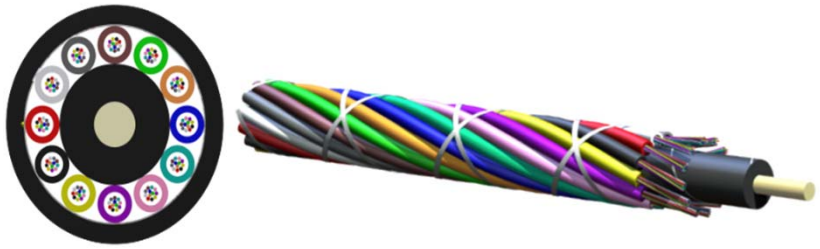
**Source: Infinera, 2010*

- NYSE measures latency in **microseconds (µs)**, not ms
- With 22.4B messages and 15B trades daily, even a 100 µs latency advantage can help

Excess Fiber Length (EFL)

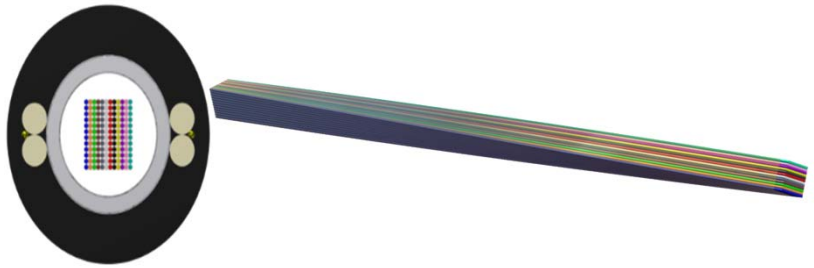
- In any cable design, the length of the fiber must be longer than the cable itself to protect the fiber against stress under cable tension.
- This is known as **Excess Fiber Length (EFL)**

Stranded Loose Tube (LT) Cable



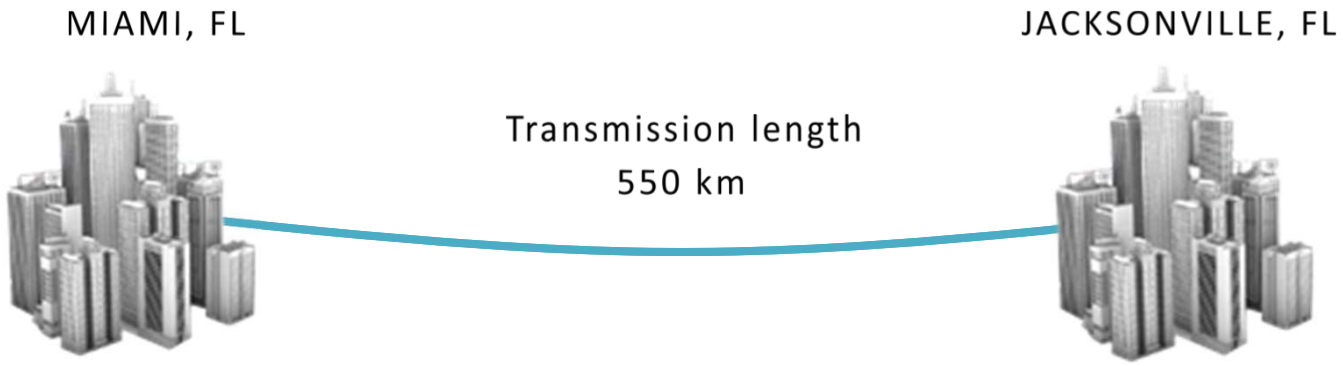
EFL = Typically 2-8 percent of cable length

Ribbon Cable (Central Tube)



EFL = Typically ~0.2 percent of cable length

Time of Flight Comparison



Loose Tube Cable, 144 F

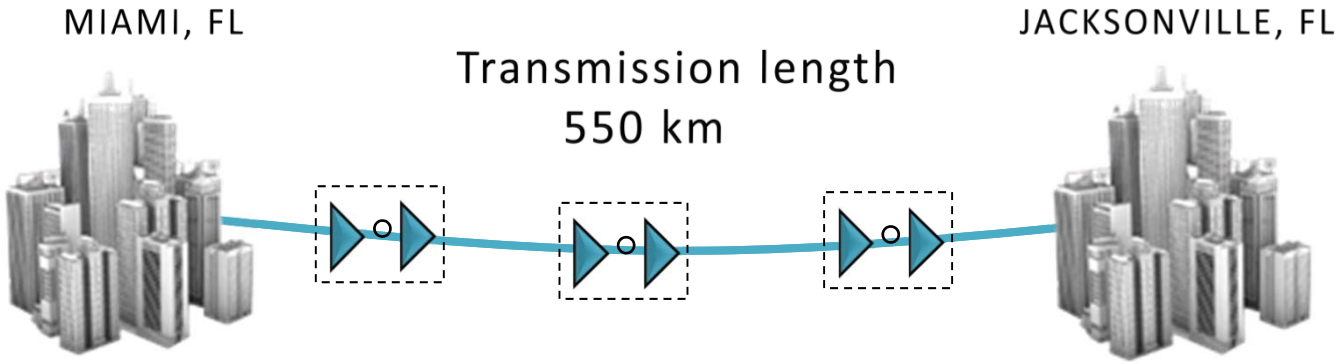
Excess fiber length	5% (typical range 2-8%)
Time of flight	2826 µs

Ribbon Cable, 144 F

Excess fiber length	0.2%
Time of flight	2697 µs
Latency advantage	**129 µs**

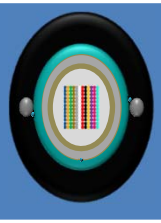
Strategic Choices That Matter

When Loss Really Matters

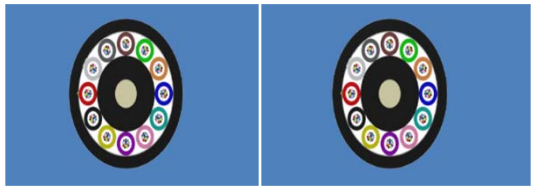


1. Signal generation= # of lit fibers x # of wavelengths per fiber x transceiver cost
2. Regeneration= # of lit fibers x # of wavelengths per fiber x transponder cost
3. Amplification= number of lit fibers x amplifier cost

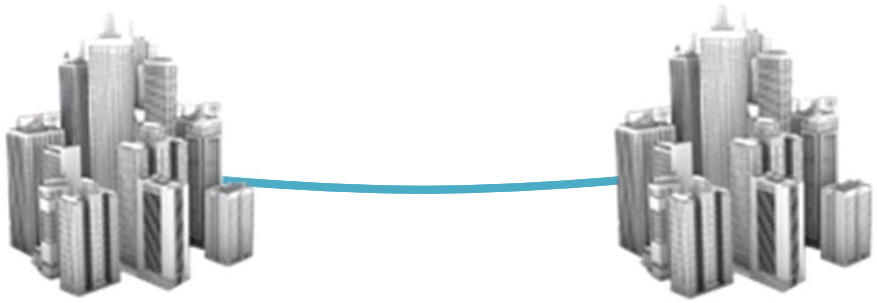
Generally, Loose Tube Cables Will Have Lower Attenuation Values Than Equivalent Ribbon Cables

			
Wavelengths	**Loose Tube**	**Micro Cable**	**Ribbon**
1310nm	0.34	0.34	0.40
1550nm	0.22	0.22	0.30

Low Loss Fiber Can Help Lower System Costs



Wavelengths	Standard SMF (db/km)	Low Loss SMF (db/km)
1310nm	0.34	0.33
1550nm	0.18	0.17



If system link is > 100km, it is worth the discussion

Strategic Choices That Matter

- Scalability
- Signal Latency
- Signal Loss
- Deployment Velocity

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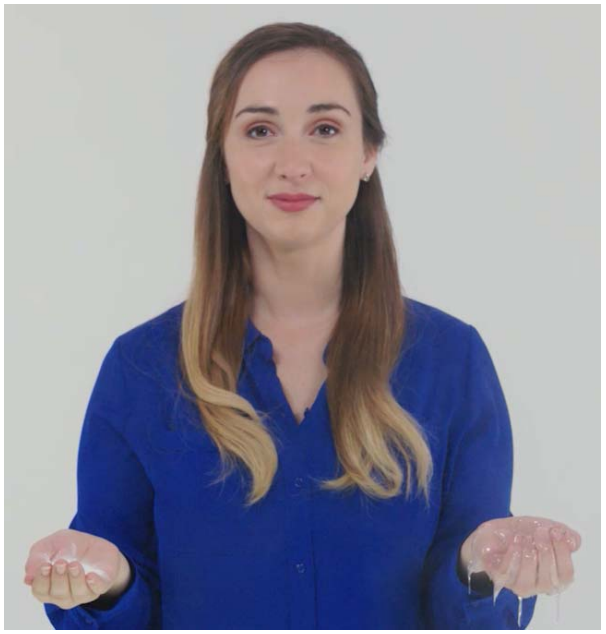
Cable Choices Can Impact Deployment Velocity

- Cable Construction
- Brownfield Capacity Adds
- Greenfield Capacity



Top Five Water Cooler Optical Cable Gel Myths

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Top Five Water Cooler Optical Cable Gel Myths

5. Gel filled cables provide more water block protection than dry

Top Five Water Cooler Optical Cable Gel Myths

4. Gel filled cables work best in harsh environments
5. Gel filled cables provide more water block protection than dry

Top Five Water Cooler Optical Cable Gel Myths

3. Gel works great for styling your hair
4. Gel filled cables work best in harsh environments
5. Gel filled cables provide more water block protection than dry

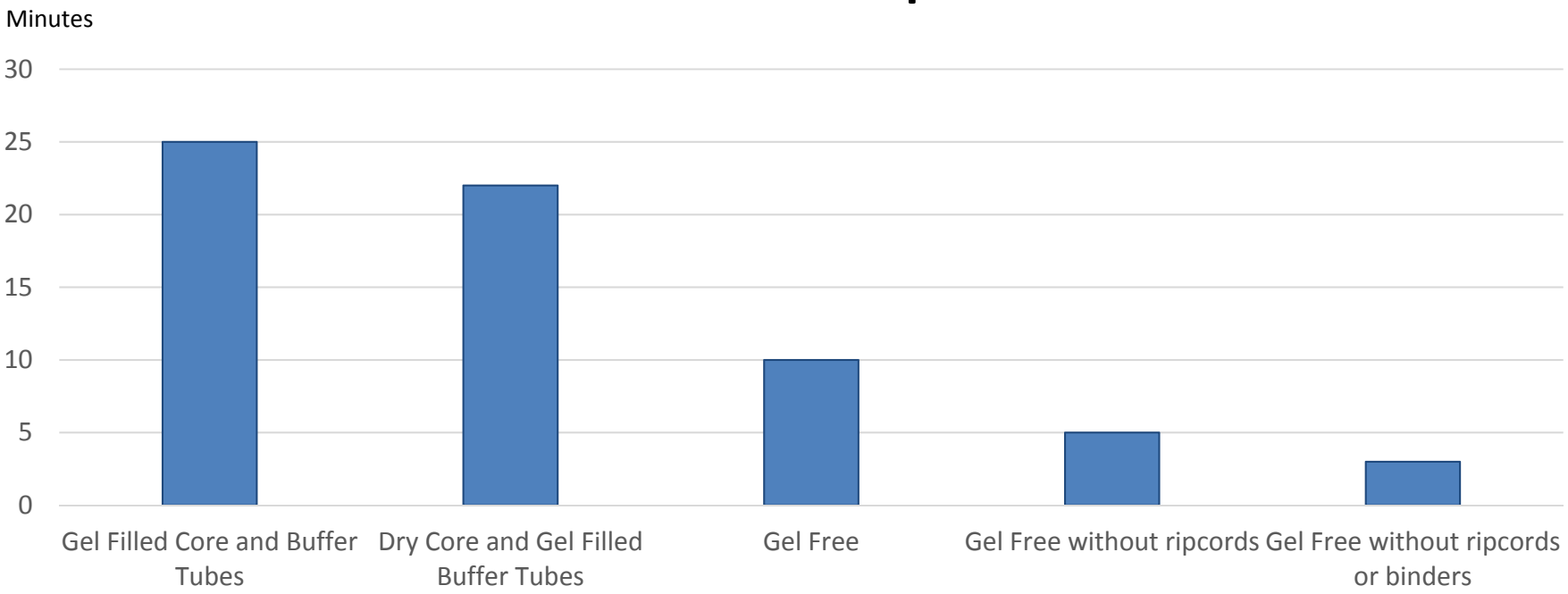
Top Five Water Cooler Optical Cable Gel Myths

2. Gel is necessary to prevent the fiber from delaminating over time
3. Gel works great for styling your hair
4. Gel filled cables work best in harsh environments
5. Gel filled cables provide more water block protection than dry

Top Five Water Cooler Optical Cable Gel Myths

1. Gel on fibers makes them splice better
2. Gel is necessary to prevent the fiber from delaminating over time
3. Gel works great for styling your hair
4. Gel filled cables work best in harsh environments
5. Gel filled cables provide more water block protection than dry

Reduction of Prep Time



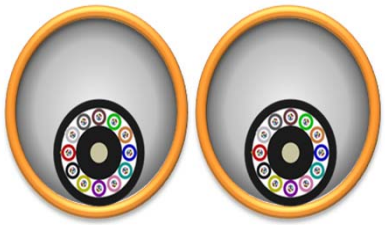
Simple Cable Prep Can Add Up

	Gel filled	Gel free no ripcords/ binders
Cable ends to prep	100	100
Time to prep	23 minutes	3 minutes
Total Time to splice	37 hours	5 hours
Total labor cost at $20 an hour	$720	$100

Cost-Effective Capacity Upgrades in a Brownfield

Standard Loose Tube Cable

Day 1 capacity = 2 x 144 F = 288 F



Day one cost of
10 km installation:
$1.34M

Duct OD/ID: 1.25 in
Cable OD: 15.8 mm

Assumptions

10 km METRO route

Civil Works
$120k/km

Cable Blowing

$3k/km

Duct and
144 F Loose Tube
Cable

$4k/km

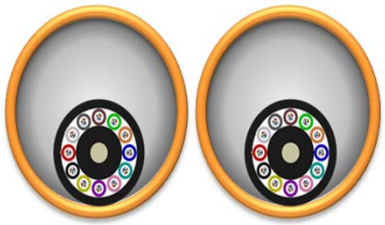
Microduct Bundle and
2 x 144 F Micro Cables

$9.3k/km

Same Upgrade Approach Cost a Fortune

Standard Loose Tube Cable

Day 1 capacity = 2 x 144 F = 288 F



Day one cost of
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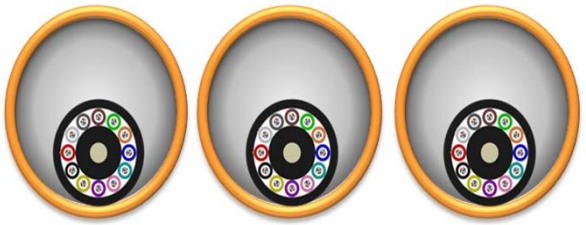
Standard Loose Tube Cable Upgrade



Duct OD/ID: 1.25 in
Cable OD: 15.8 mm

Capacity (fiber count) increase requires retrenching and installation of additional 10 km duct and new cable

Upgrade Cost = **$1.27M**
Upgrade Time = **7-10 months**

Assumptions

10 km METRO route

Civil Works
$120k/km

Cable Blowing

$3k/km

Duct and 144 F Loose Tube Cable

$4k/km

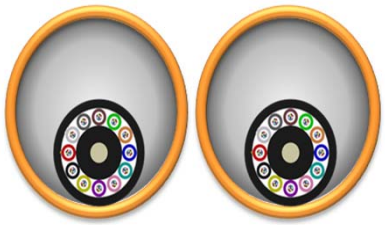
Microduct Bundle and 2 x 144 F Micro Cables

$9.3k/km

Override With Microduct Can Reduce Future Upgrade Cost

Standard Loose Tube Cable

Day 1 capacity = 2 x 144 F = 288 F



Day one cost of
10 km installation:
$1.34M

Duct OD/ID: 1.25 in
Cable OD: 15.8 mm

Microduct override

A **microduct override** can be a simple, faster and more cost-effective alternative to digging…

Assumptions

10 km METRO route

Civil Works
$120k/km

Cable Blowing

$3k/km

Duct and 144 F Loose Tube Cable

$4k/km

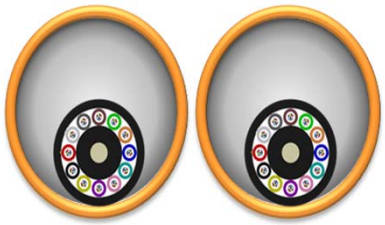
Microduct Bundle and 2 x 144 F Micro Cables

$9.3k/km

Better Greenfield Approach

Standard Loose Tube Cable

Day 1 capacity = 2 x 144 F = 288 F



Day one cost of 10 km installation: **$1.34M**

Duct OD/ID: 1.25 in
Cable OD: 15.8 mm

Microducts and Micro Cables

Day 1 capacity = 2 x 144 F = 288 F

Day one cost of 10 km installation: **$1.35M**

Microducts: 7 x 12.7/10 mm
Bundle OD: 1.64 in
Micro cable OD: 8.1 mm

Assumptions

10 km METRO route

Civil Works
$120k/km

Cable Blowing

$3k/km

Duct and 144 F Loose Tube Cable

$4k/km

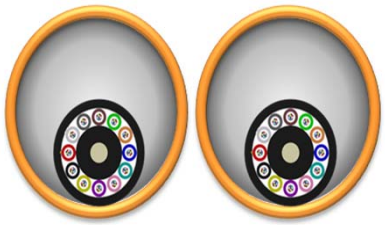
Microduct Bundle and 2 x 144 F Micro Cables

$9.3k/km

Future Upgrade Costs Are Dramatically Reduced

Standard Loose Tube Cable

Day 1 capacity = 2 x 144 F = 288 F



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Microducts and Micro Cables

Day 1 capacity = 2 x 144 F = 288 F

Day one cost of 10 km installation: **$1.35M**

Microducts: 7 x 12.7/10 mm
Bundle OD: 1.64 in
Micro cable OD: 8.1 mm

Capacity (fiber count) increase requires blowing of additional micro cable into vacant microduct only

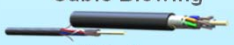
Upgrade Cost = **$0.06M**
Upgrade Time = **1-2 days**

Assumptions

10 km METRO route

Civil Works $120k/km

Cable Blowing



$3k/km

Duct and 144 F Loose Tube Cable

$4k/km

Microduct Bundle and 2 x 144 F Micro Cables

$9.3k/km

Strategic Choices That Matter

- Strategy depends on which hat you wear
- Most choices will have trade-offs
- The right choice can provide a long-term advantage

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