Extreme Density Networks
Are You Ready?

Derek Whitehurst
Director, Global Applications Marketing
Corning Optical Communications

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ex·treme
ikˈstrēm/
adjective

reaching a high or the highest degree; very great.

synonyms:

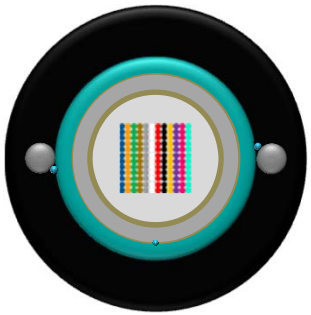
utmost, very great, greatest, greatest possible, maximum, maximal, highest, supreme, great, acute, enormous, severe, high, exceptional, extraordinary

Extreme defined through fiber counts

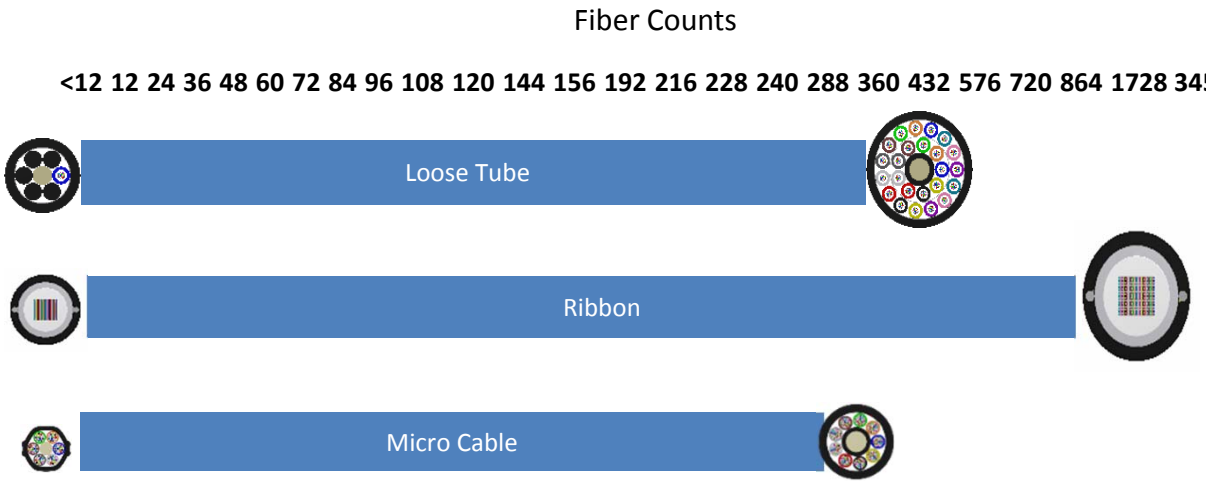
LOOSE TUBE

MICRO CABLES

RIBBON



Loose tube, ribbon and micro cables can support very low to very high fiber counts



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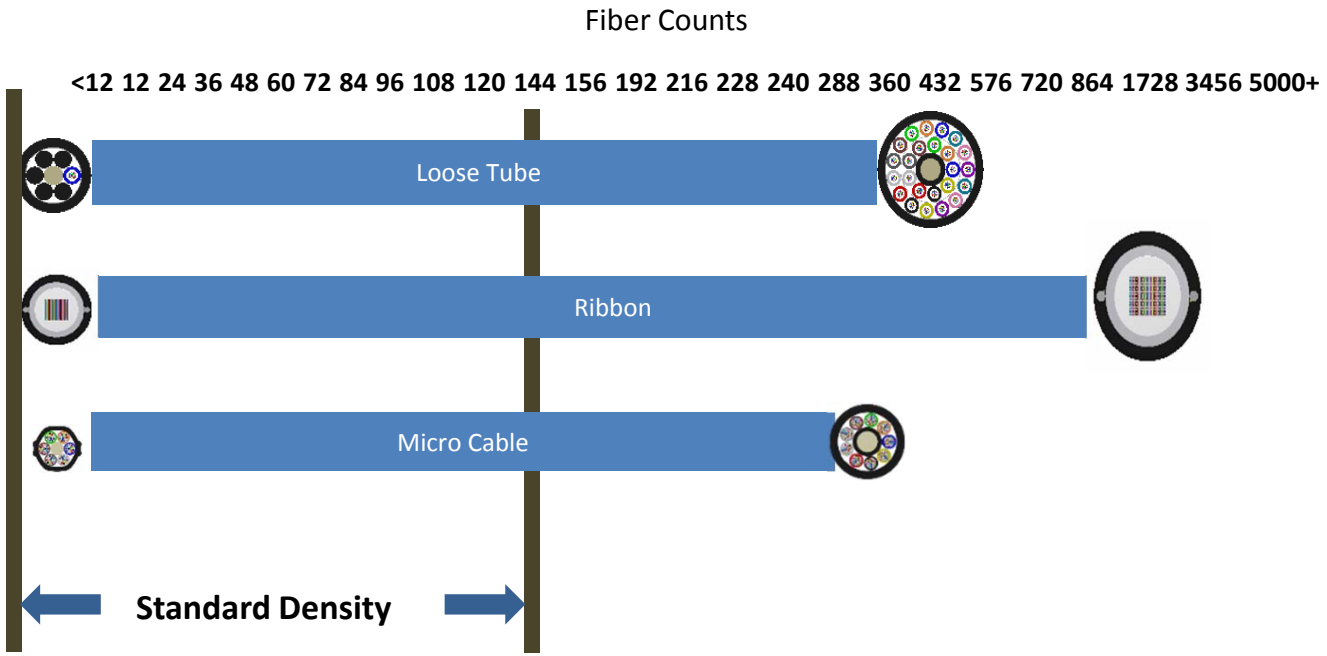

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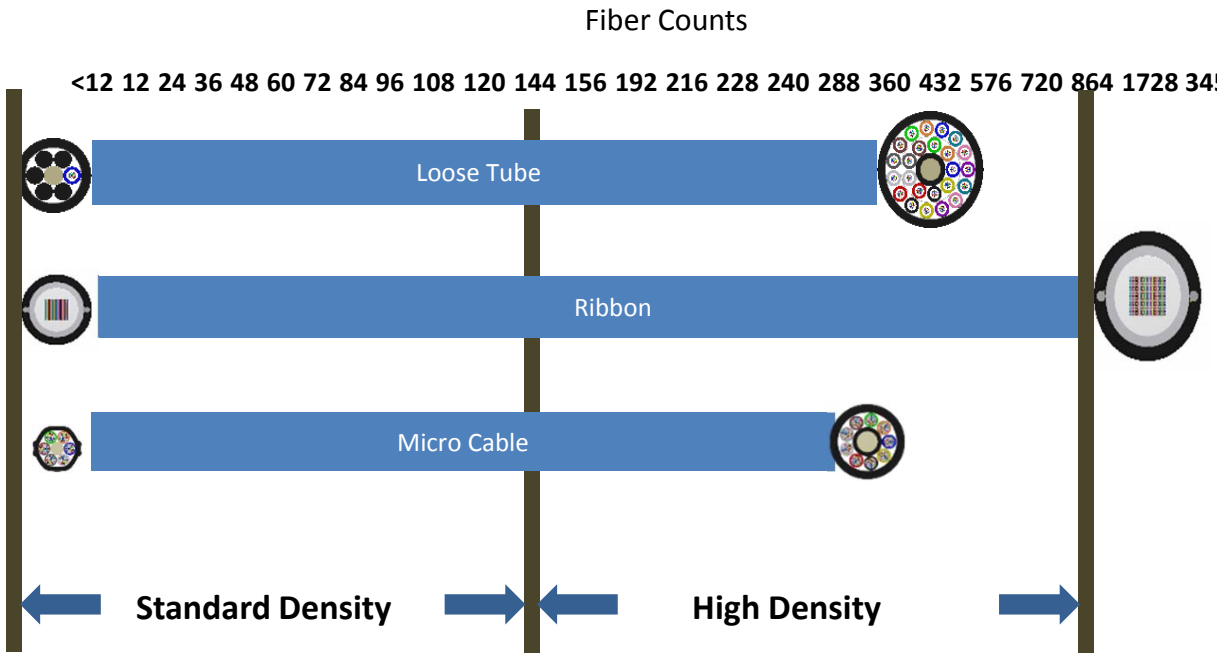

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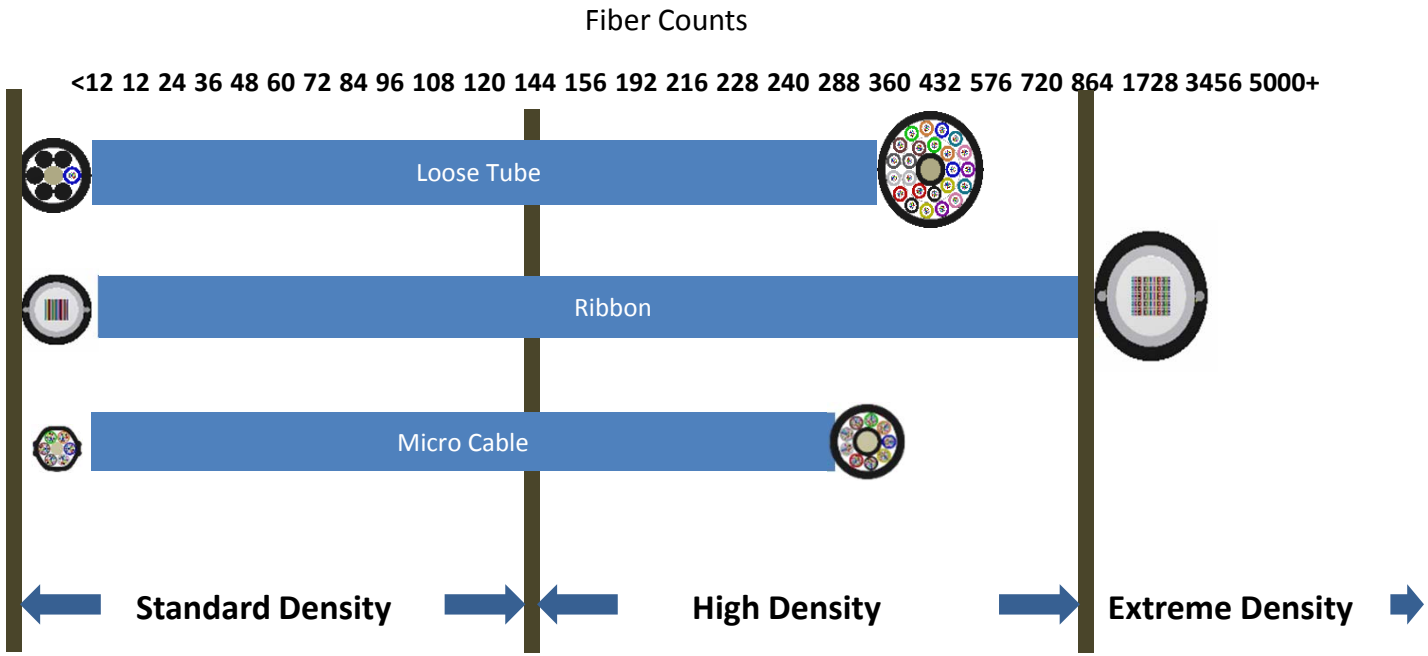


Extreme density network

reaching the highest degree of network density forcing a change in how to deploy the network

Past network inflection points

Example 1:

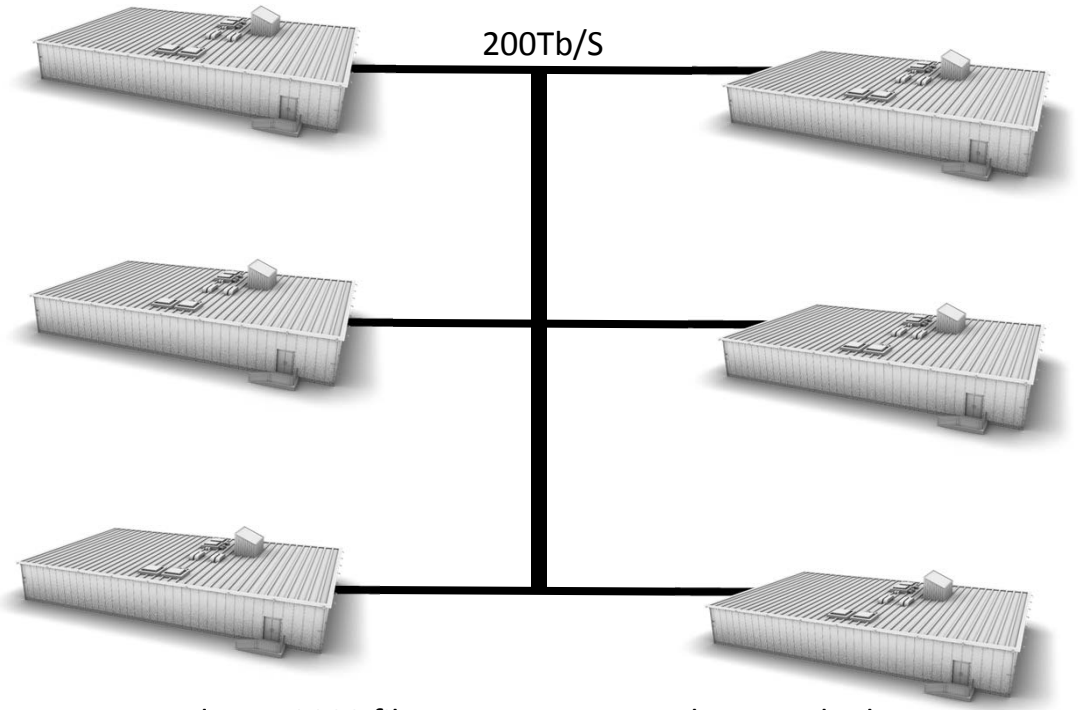
FTTH Deployment: Standard OSP network deployment practices to the house were not cost effective or fast enough

Example 2

Data Center products were not designed to handle the fiber counts in a rack footprint that was necessary to support growth

Inside the data center,
speeds are running from 1G
up to 400G

Huge bandwidth required to carry data between data centers



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

Planning for extreme density

- Traditional solutions get very crowded
- Experienced crews
- Solutions matched to handle fiber counts
- Installation deployment times
- Keeping track of fibers
- Emergency restoration

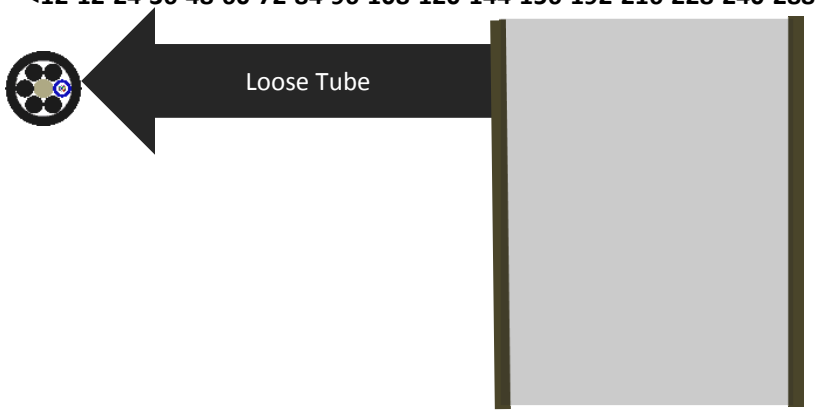
Quick math shows staggering splicing labor

	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

Serious tradeoffs in cable selection

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 3456 5000+



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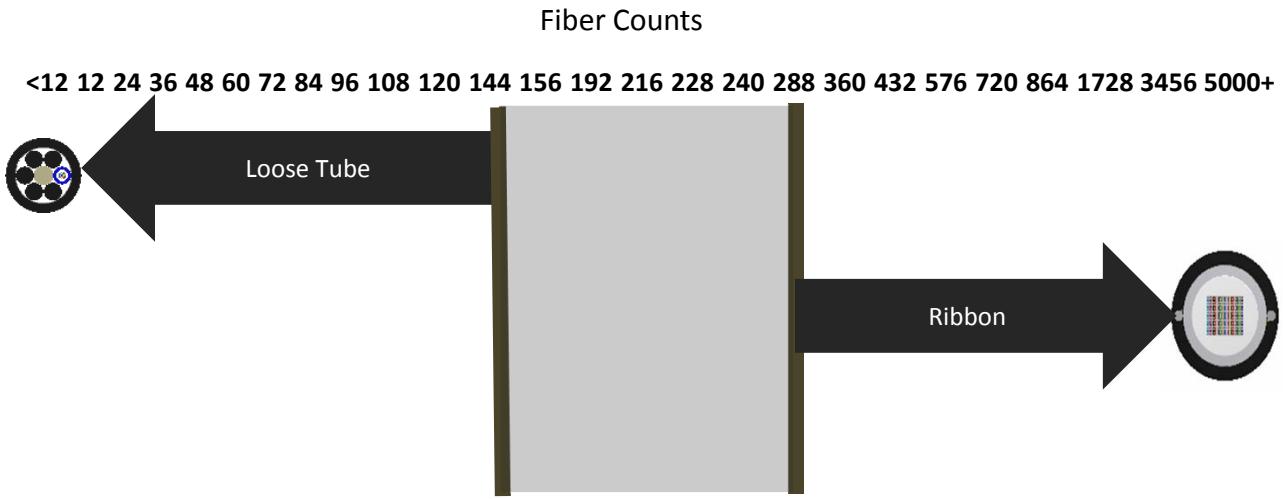

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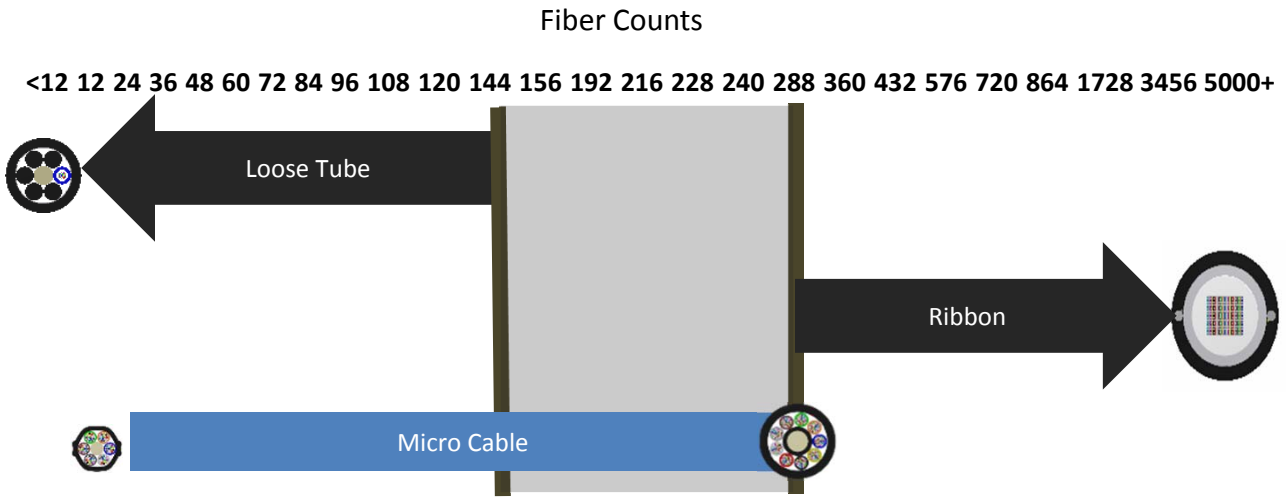

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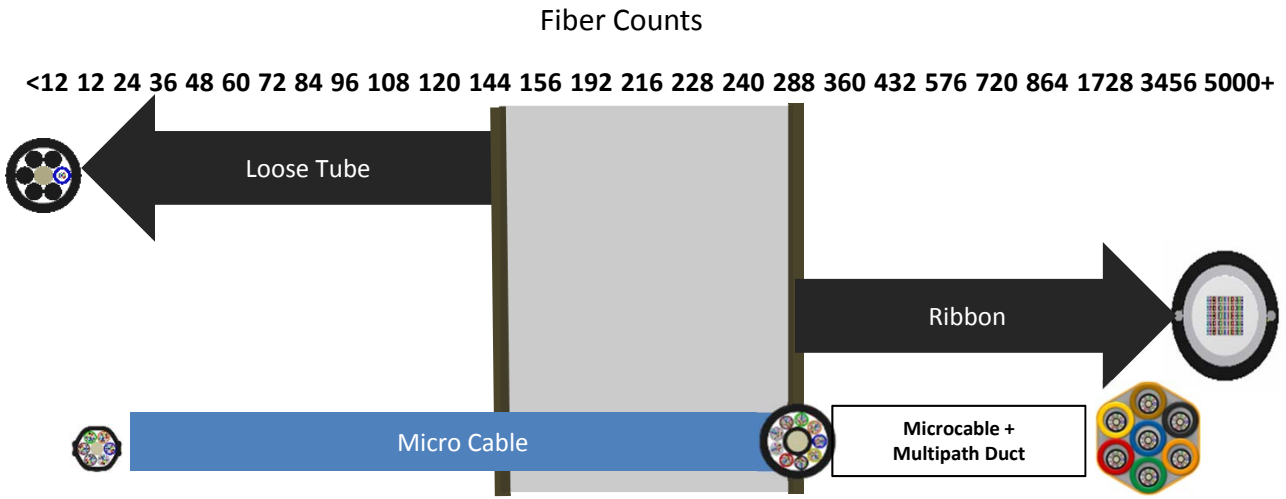


Micro cables offer scalability and pay as you go model

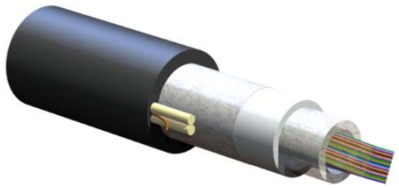
Day One: 2 x 288 = 576F

Micro cables offer scalability and pay as you go model

Cable designs using single fibers may make sense when extreme density is required over time

Ribbon cables can provide extreme density but cable diameter grows

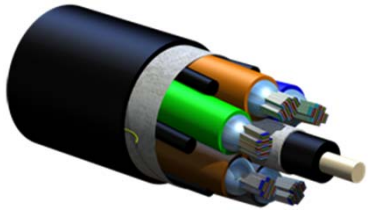
Central Tube Ribbon Cable



Ribbon stacks contained within a single, central buffer tube

- Most commonly-used outdoor ribbon cable design
- 12 to 864 fibers
- Max OD: 23.4 mm / 0.92 in.
- First manufactured in 1996

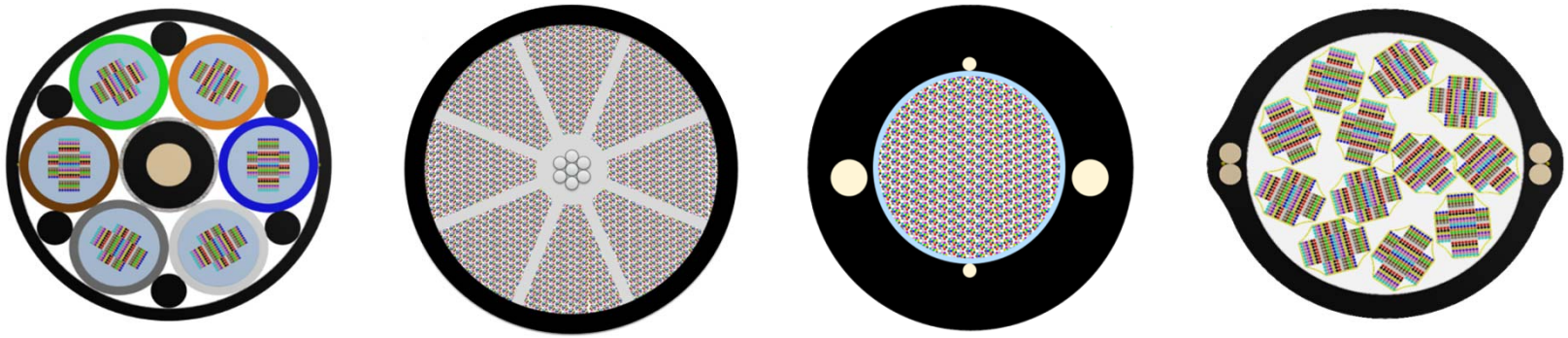
Stranded Tube Ribbon Cable



Ribbon stacks contained within stranded buffer tubes

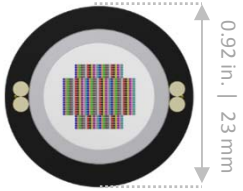
- Previously, the highest-fiber-count cable for outdoor use
- 288 to 1,728 fibers
- Max OD: 32 mm / 1.26 in.
- First manufactured in 1996

New extreme density cable designs double density at same size

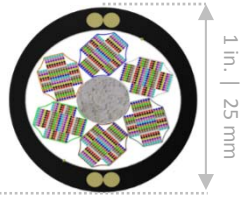


Double down on density

Largest Central Tube
864 Fibers



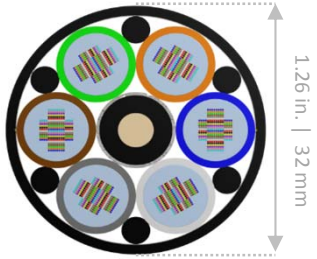
Extreme Density
1,728 Fibers



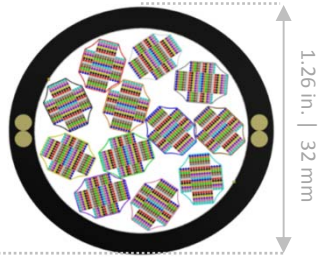
Extreme density cable delivers:

2x the fibers at similar OD

Largest Stranded Tube
1,728 Fibers



Extreme Density
3,456 Fibers



Extreme density cable delivers:

2x the fibers at same OD

Examining the general cable family options using 2 inch duct

	Loose Tube Cable	Micro Cables in Microduct	Legacy Ribbon Cable	Extreme Density Cable
				
Fibers in a 2 inch duct	720	1,008	1,728	3,456
Cable combination	1 x 432 F 1 x 288 F	7 x 144 F micro cables	1 x 1,728 F stranded tube ribbon	1 x 3,456 F
Single cable solution?	✗	✗	✓	✓
Mass-fusion splicing?	✗	✗	✓	✓

RocketRibbon™ extreme-density cables: up to 3,456 fibers and fast, efficient splicing in a single cable solution

Similar results using 4 inch duct

In brand new campus DCI deployments, 4 inch ducts are recommended for max. fiber capacity

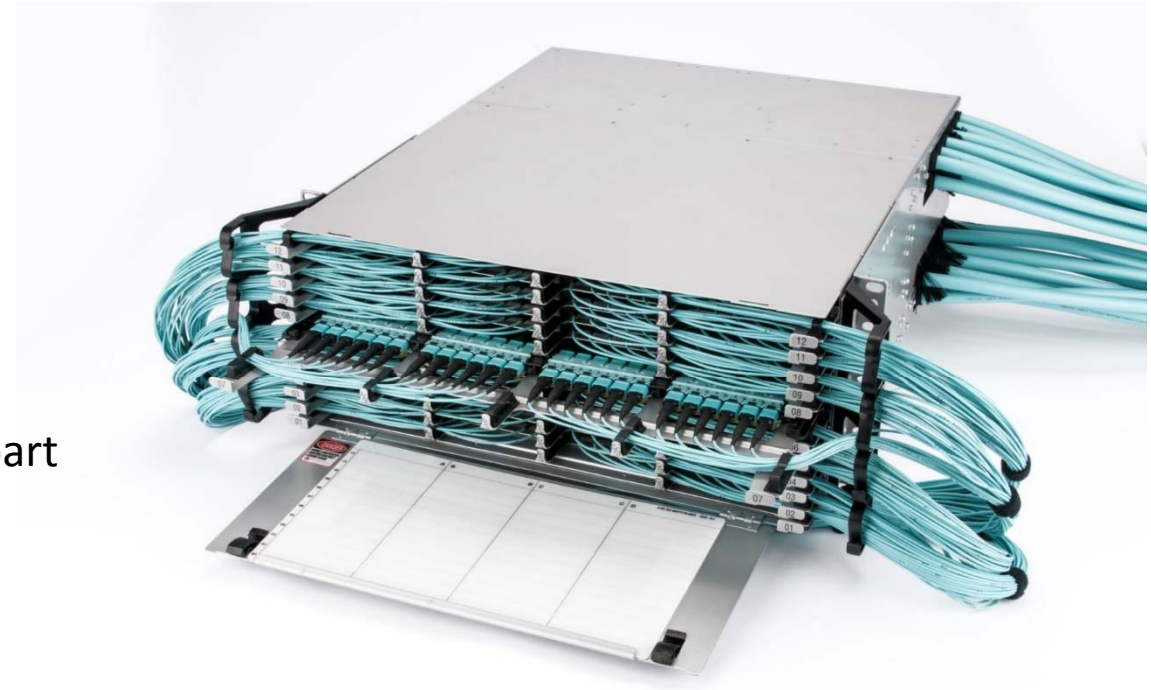
	Legacy Ribbon Cables	Extreme Density Cables	Extreme Density Cables
			
Fibers in a 4 inch duct	6,048	10,368	12,096
Cable combination	3 x 1,728 F 1 x 864 F	6 x 1,728 F	3 x 3,456 F 1 x 1,728 F

70% more fibers than legacy ribbon

100% more fibers than legacy ribbon

Lessons learned from inside the data center

Getting to the right fiber density may be the easy part of the equation

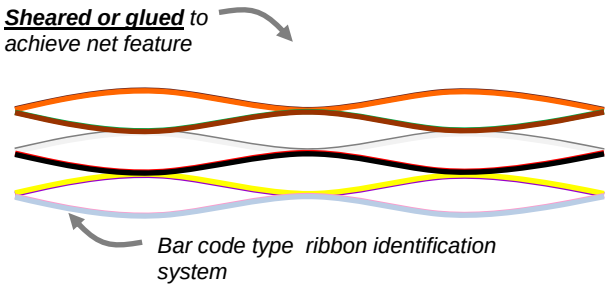


Things you should consider beforehand

- Do I have the fiber capacity?
- How many cables will be entering the hardware and can I manage them?
- How will I manage the fiber once I access the cable?
- How many splices can my splice trays hold?
- Will I need transport tubing for routing?
- Will I need to hop trays?
- How will I label and keep track of my ribbons?

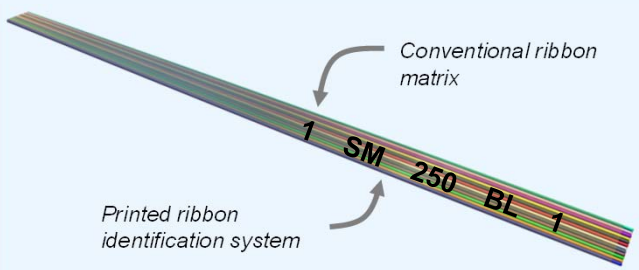
Ribbon construction will impact installation choices

Net Design Fiber Ribbon



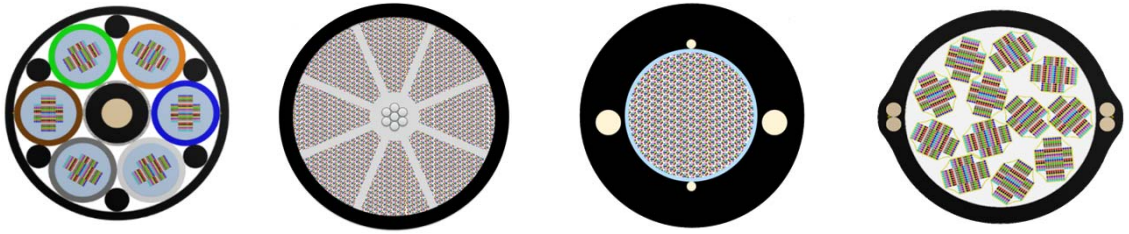
- 12 fibers intermittently connected: ribbons are not solid
- Ribbons are rolled to achieve total required fiber count
- Ribbons require a furcation tube for protection against sharp edges in closure/hardware

Standard Design Fiber Ribbons



- Conventional ribbons: 12 fibers encapsulated in an array
- Ribbons are stacked and joined to achieve total required fiber count
- Conventional matrix provides additional protection so ribbons can be used outside closure/hardware

Ribbon cable construction will impact installation choices

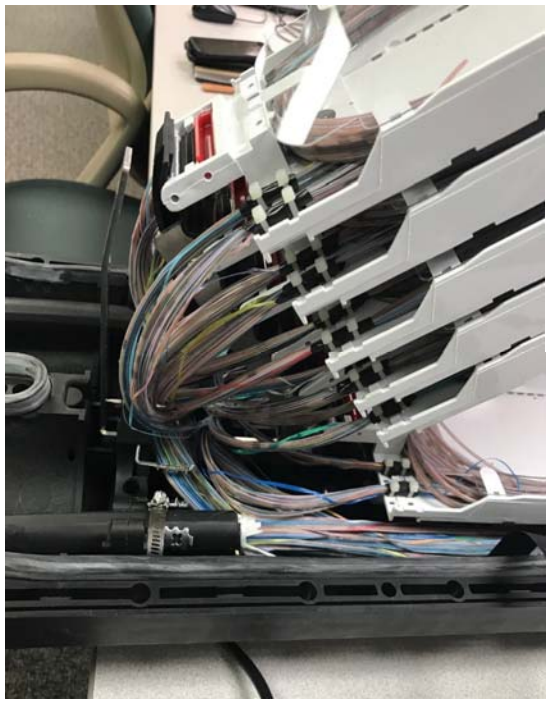


- Cable styles are very different so understanding required cable accessories is important before you open up the cable
- Have process in place to keep fibers ordered before you open the cable. Incredible fiber volumes to manage
- Installer must maintain fiber bundling during installation process
- Furcation tubing may be necessary
- Ribbonizing tools may be necessary

Having the ribbon stacks protected is very important

Routing	Slack Management	Protection
		

Not using furcation tubing can be catastrophic



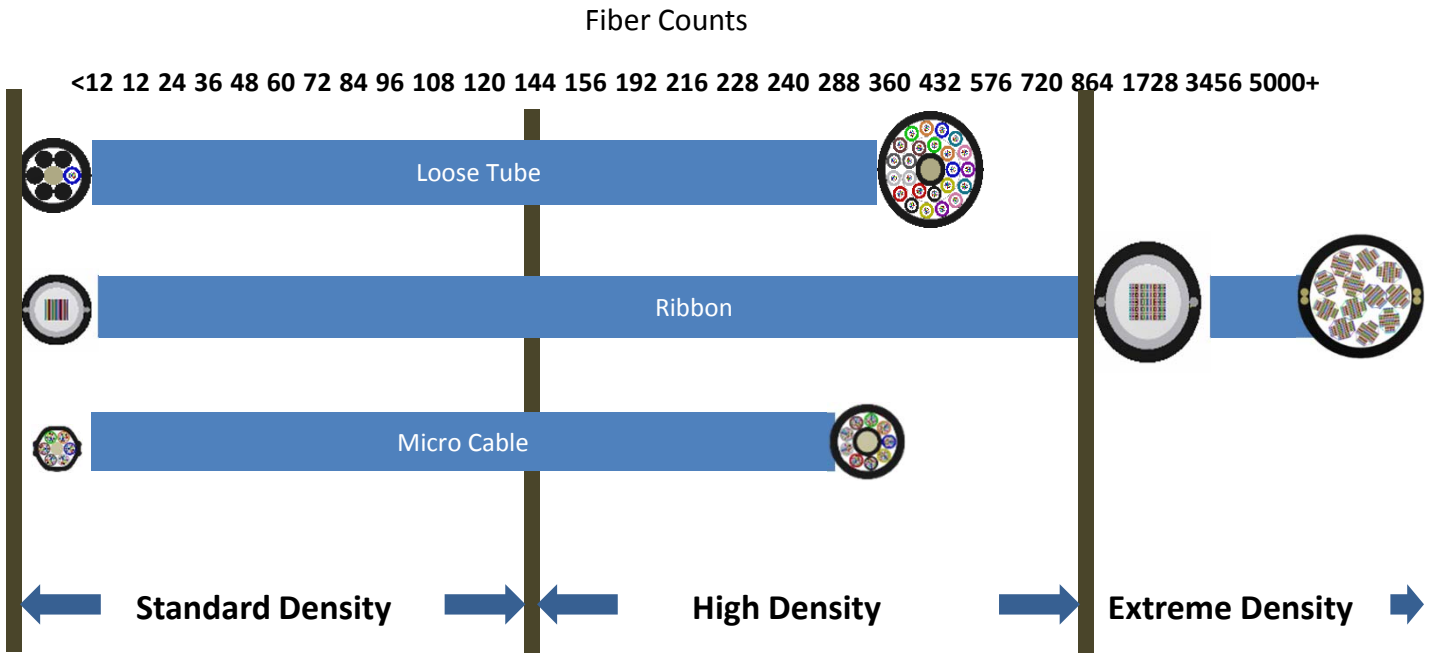
- Routing unprotected ribbons risks damage
- Difficult to determine ribbon ID after installation

Extreme density networks mean planning for lengthy installation times

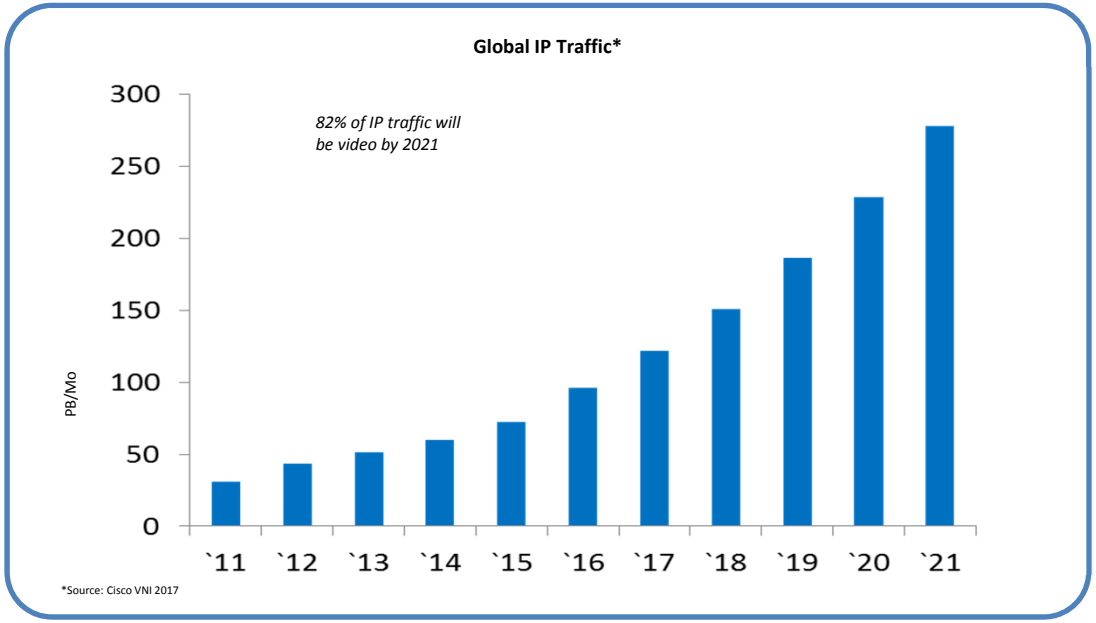
10-15 hours for 1728F splice points

20-30 hours for 3456F splice points

How extreme will future networks get?



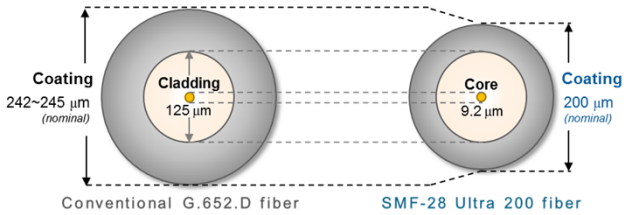
The need for extreme density grows as data demands grow



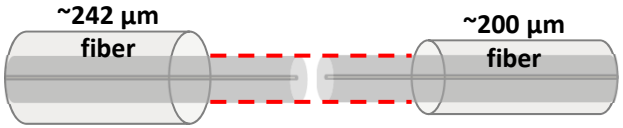
There is already interest in cables above 3456F

200um coated fiber is the next step in driving greater fiber cable density

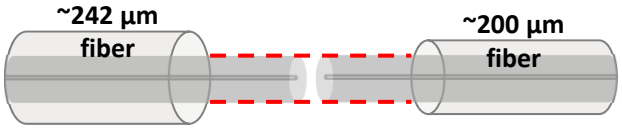
- 200 micron fibers retain the 125 µm glass cladding diameter of conventional fibers for compatibility in splicing operations



- SMF-28 Ultra 200 is compatible with both cladding- and core-alignment modes in fusion splicing:



Cladding alignment

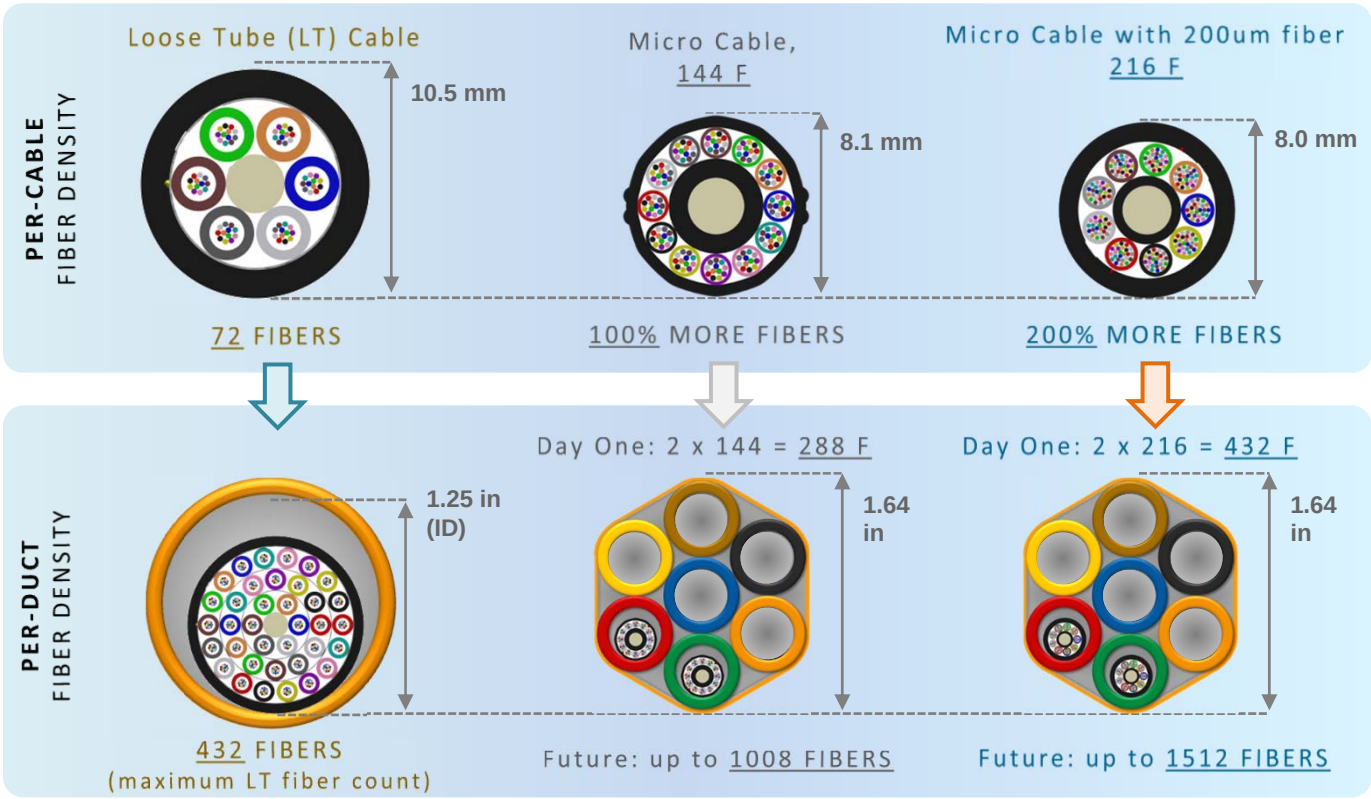


Core alignment

- Once coating has been stripped and fiber ends cleaned, 200 µm fiber splice performance is exactly the same as for ~242 µm fiber

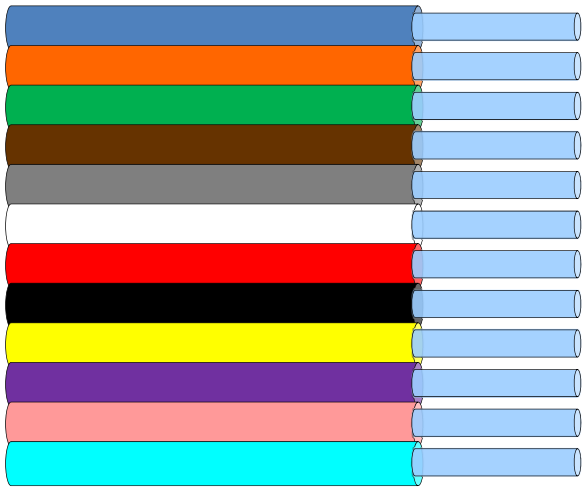
- As the coating thickness is reduced, extra care should taken when handling 200 µm fiber

Micro cables are already leveraging 200um fiber technology

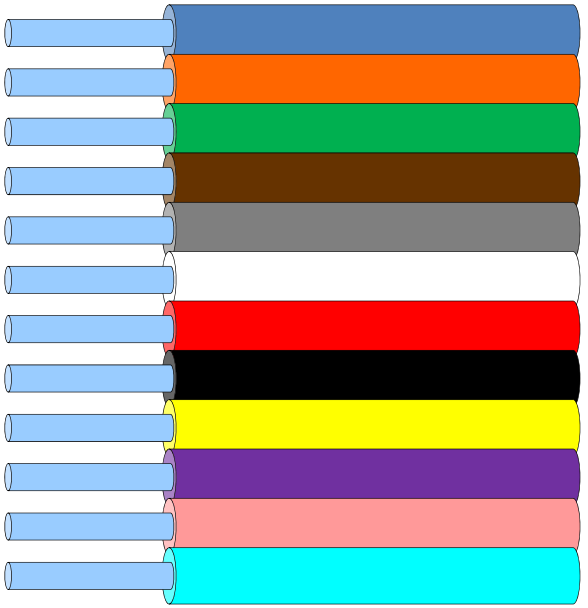


Compatibility with existing ribbons is the main hurdle

200um coated fiber ribbon



242um coated fiber ribbon



Backward compatibility requires splicing differently spaced ribbons together

Note: Ribbons not to scale

Extreme density networks are here to stay

- As bandwidth increases and service offerings increase, more fiber will be pushed deeper into the network
- Many aspects in an extreme density network are the same as existing networks
- As fiber counts grow and cables get smaller, other components of the network must scale and shrink as well
- Scaling with solutions designed for smaller counts will prove to be difficult as the network grows
- Extra planning up front to match cable, hardware and connectivity solutions is required to scale effectively

QUESTIONS?