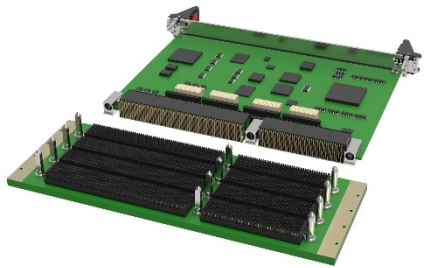




6U of Connectivity in a 3U Bag

Meeting the Demand for Density and Speed



Michael Walmsley

Global Product Management

Aerospace Defense and Marine Business Unit

EVERY CONNECTION COUNTS



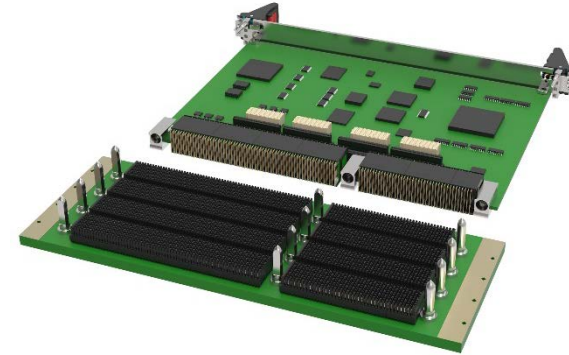
Drive for increased functional density

Embedded Computing Industry Trends

- Faster processors, more cores
- Increased I/O count and functionality within a plug-in module
- Reduced SWAP (Size Weight And Power)
 - smaller packaging
 - lighter weight solutions
 - more efficient power
- Open systems architecture
- Modular, scalable systems

Interconnect Challenges

- Connector signal integrity and board terminations for higher data rates
- More functionality within modules
- Higher density contacts
- Lightweight materials, solutions
- Expand interconnect configurations – add flexibility while using standard solutions

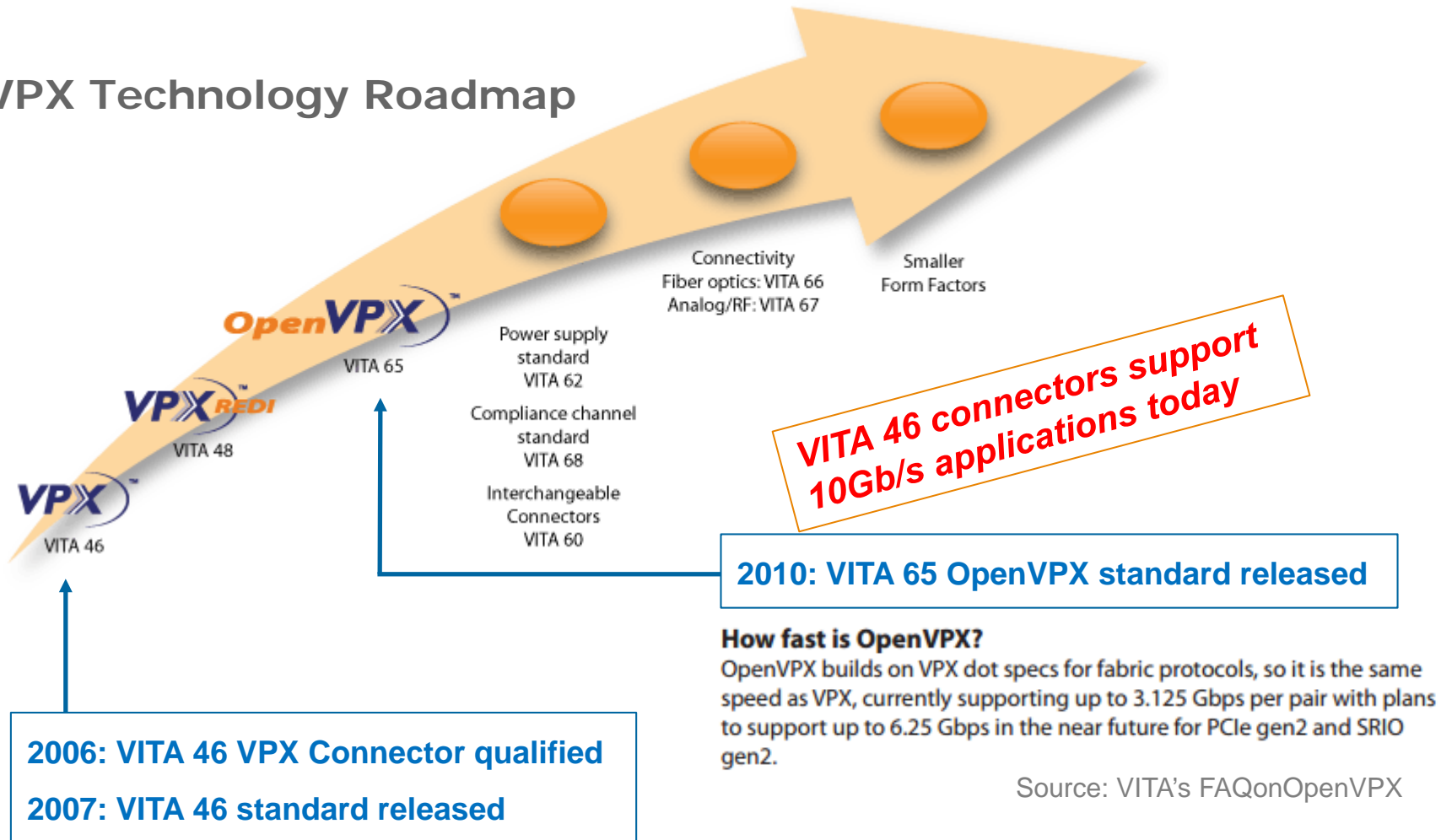


How to stuff 6U of interconnect in a 3U bag?



The evolution of VPX data rates

VPX Technology Roadmap



Speed Roadmaps for PCIe, InfiniBand, Ethernet


Next generation thresholds for VPX:

- InfiniBand FDR (14Gb/s) and PCIe 4.0 (16Gb/s)
- Ethernet 100GBASE-KR4 (4x25Gb/s)

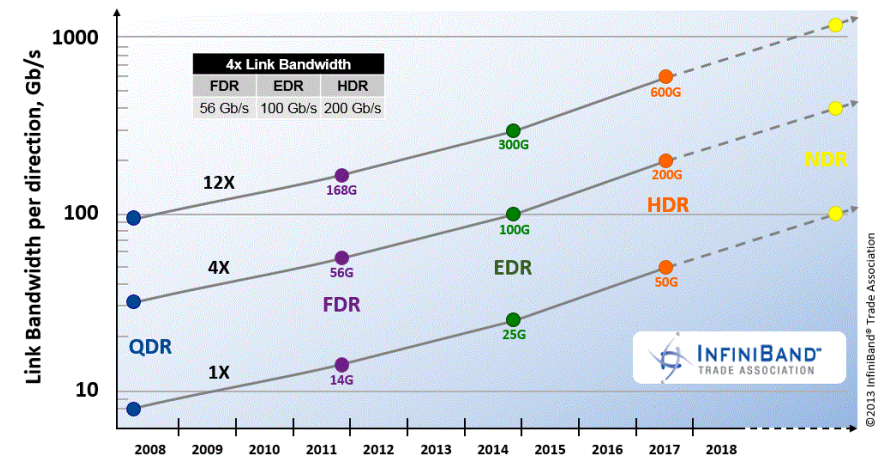
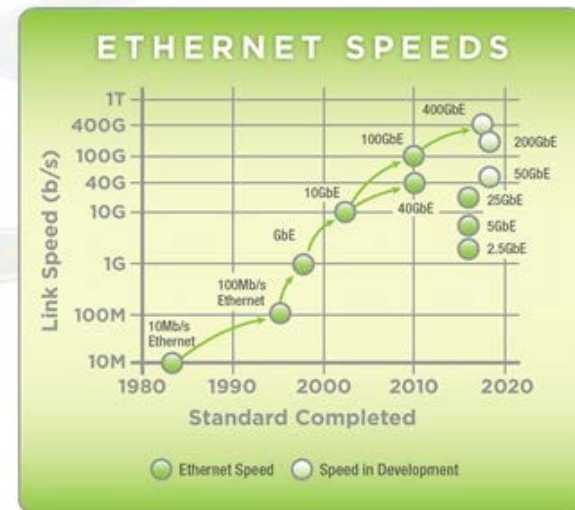
PCI SIG PCIe 4.0 – Increased Performance

- **PCIe 4.0 evolution to 16GT/S**
 - ✓ Will address big data applications pushing for increased bandwidth at a low cost
 - Server, workstation, desktop PC, notebook PC, tablets, embedded systems, peripheral devices, high-performance computing markets and more
 - ✓ 16GT/s doubles I/O bandwidth over the PCIe 3.0 specification
 - Preserves backward compatibility with previous PCIe specifications
 - ✓ Low-cost, high-performance I/O technology
 - Provides increase in clock rates, enabling narrower link width implementations, thus saving cost through pin reduction
 - ✓ Rev 0.5 targeted for Q1 2014, Rev 0.9 targeted for Q1 2015

	Raw Bit Rate	Link BW	BW/Lane/Way	Total BW x16
PCIe 1.x	2.5GT/s	2Gb/s	~250MB/s	~8GB/s
PCIe 2.x	5.0GT/s	4Gb/s	~500MB/s	~16GB/s
PCIe 3.x	8.0GT/s	8Gb/s	~1GB/s	~32GB/s
PCIe 4.0	16GT/s	16Gb/s	~2GB/s	~64GB/s

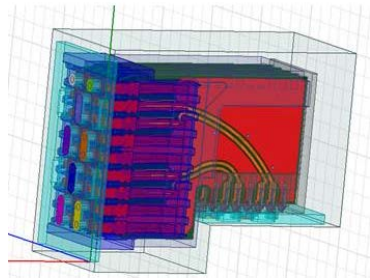


PCIe 4.0 is preparing to go head-to-head with InfiniBand

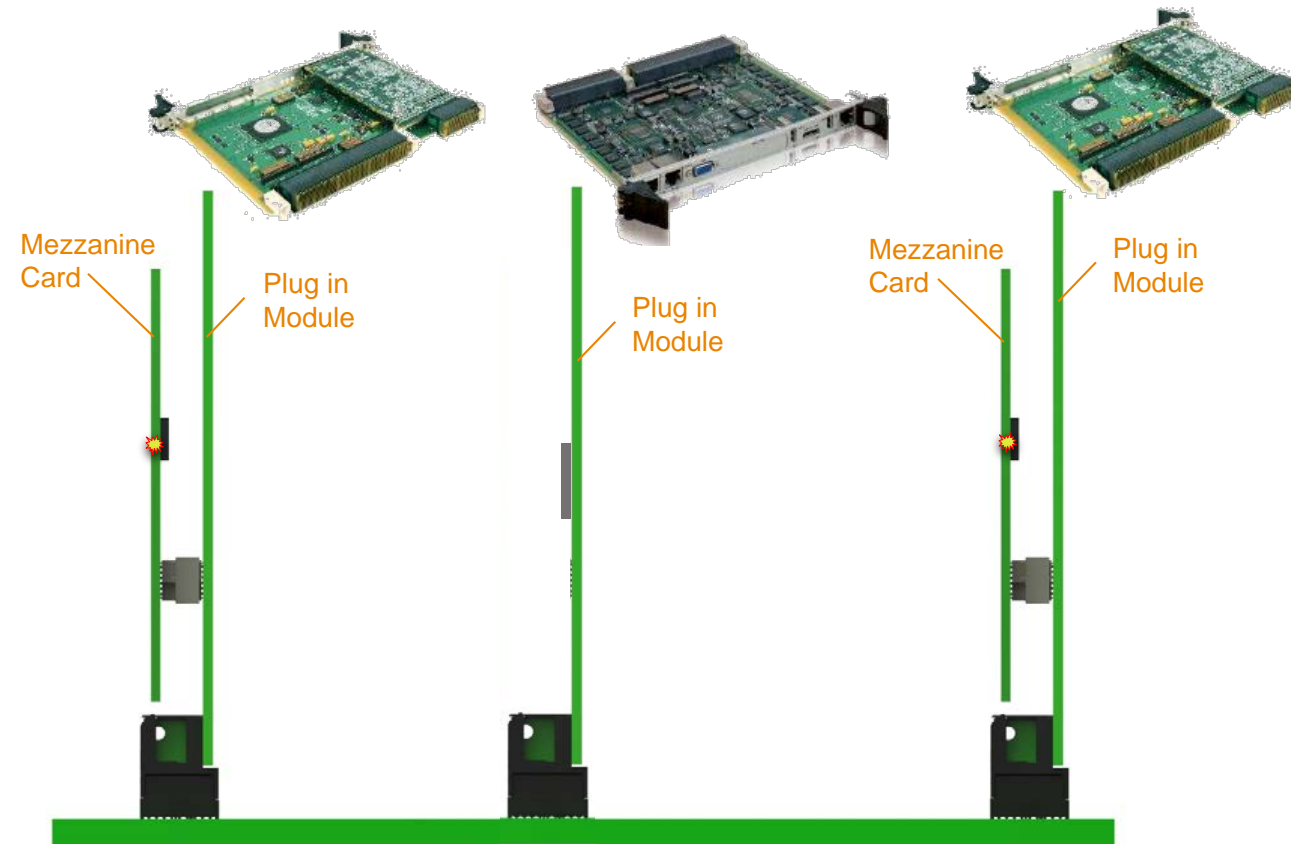


Evaluating the VPX Channel for next gen speeds

It's not just the connector...



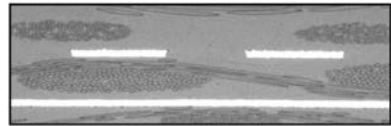
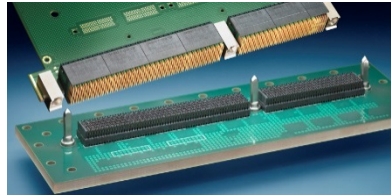
... it's the channel:



VITA 68: VPX Compliance Channel – defining requirements for signal integrity compliance for VPX systems and components, to assure interoperability at higher baud rates.

Considerations in Board Design

Board materials



Dielectric constant
Dissipation factor
Glass weave, size and uniformity
Copper roughness

Via design



Drilled Thru Via



Drilled Thru Via (bottom route)



Back-drilled Thru Via



Blind Via



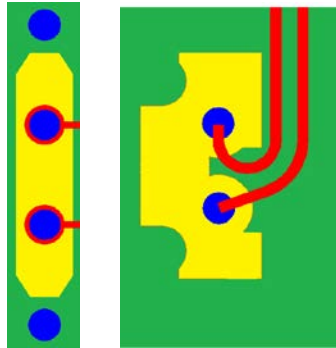
Buried Via



Laser Drilled Micro Via

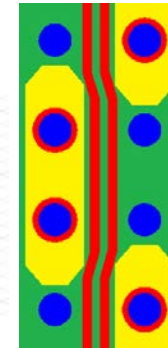
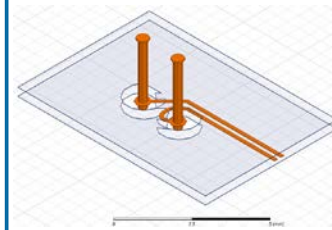
Backdrilling
Blind vias
Buried vias
Micro-vias
Dual diameter vias

Antipad layout



Antipad size
Nub-in designs
Skew compensation

Trace routing



Pad size
Trace width vs loss
Trace to antipad clearance

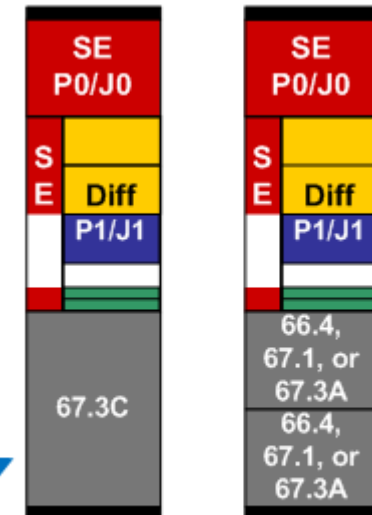
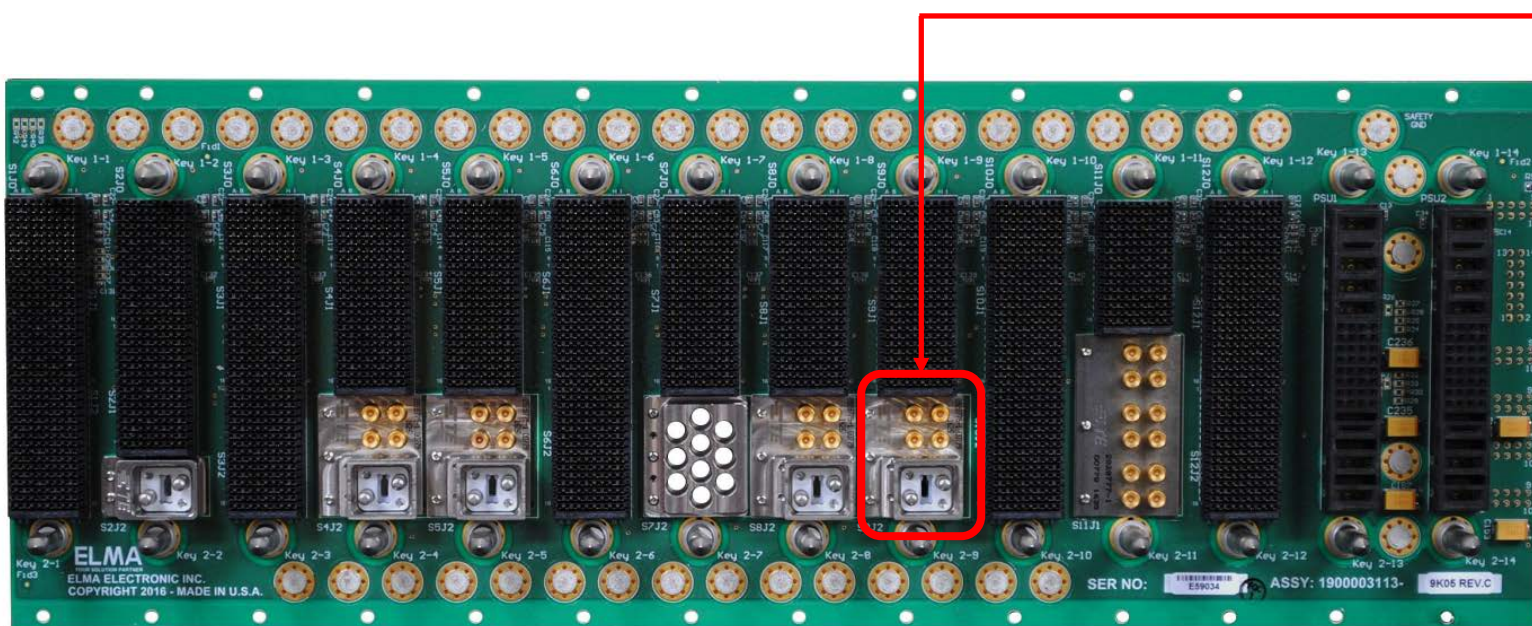
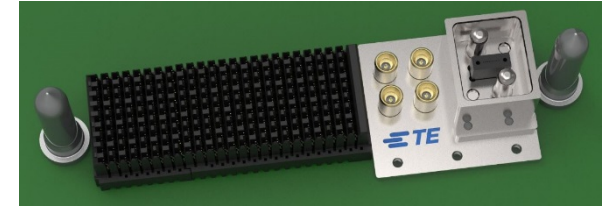
Integration of RF, Optics in VPX Slot Profiles

Increasing integration of RF and optical links in computing modules.

VITA 46 – digital high speed connectors

VITA 66 – optical modules

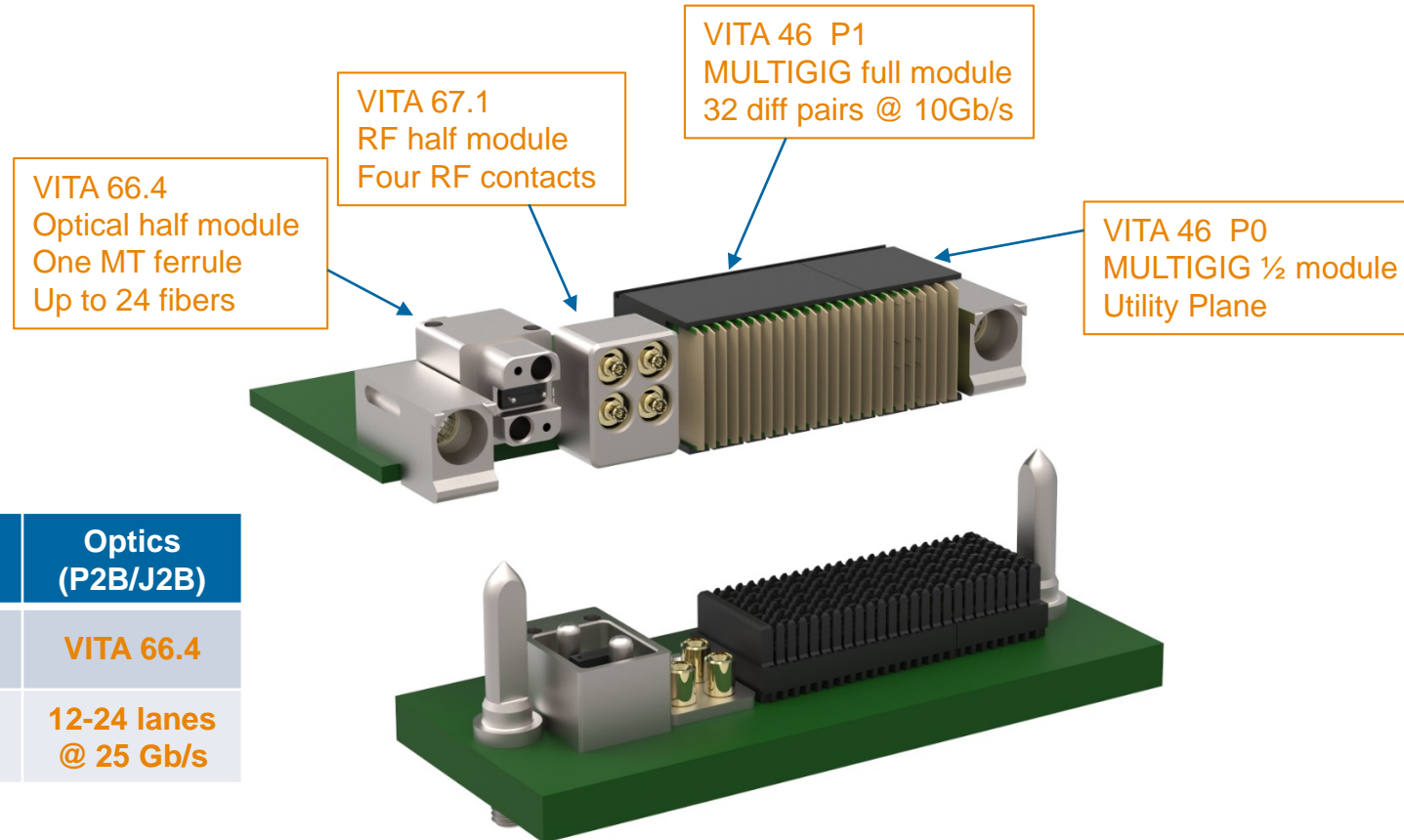
VITA 67 – RF modules



SLT3-PAY-2F1F2U1H-14.6.3-n
SLT3-PAY-2F1F2U2E-14.6.4-n

Image courtesy of Elma Electronic Inc.

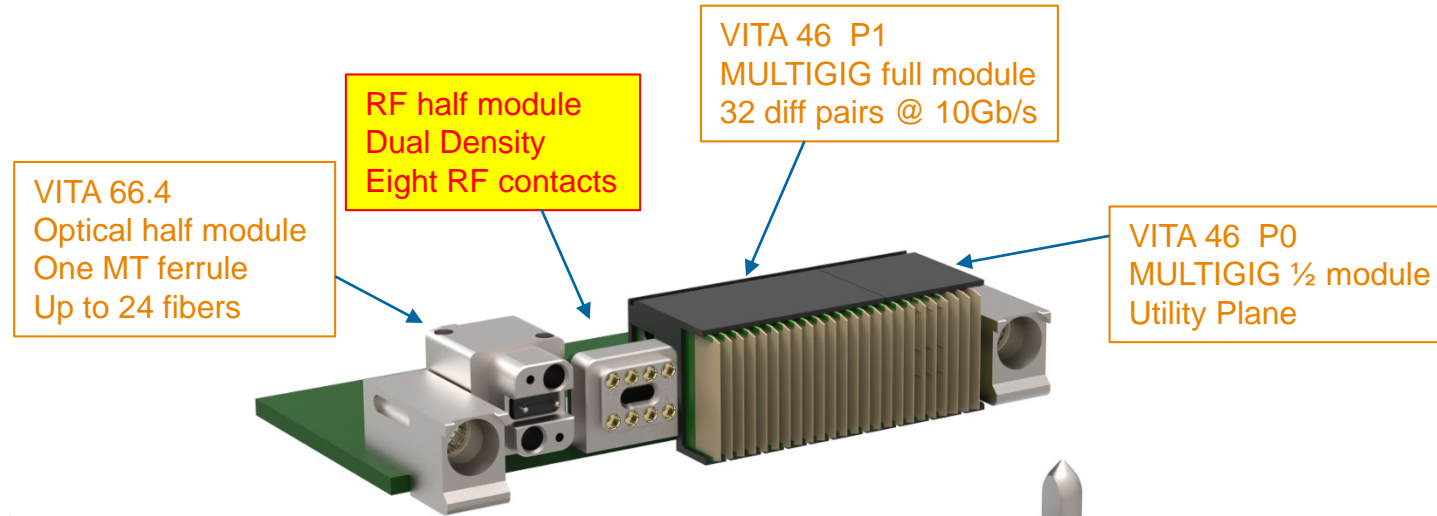
Today's 3U VPX



Digital (P1/J1)	RF (P2A/J2A)	Optics (P2B/J2B)
VITA 46	VITA 67.1	VITA 66.4
32 diff pairs @ 10 Gb/s	4 contacts @ 26.5 GHz	12-24 lanes @ 25 Gb/s

SLT3-PAY-2F1F2U1H-14.6.3-2

Expanding Speed / Density in 3U VPX

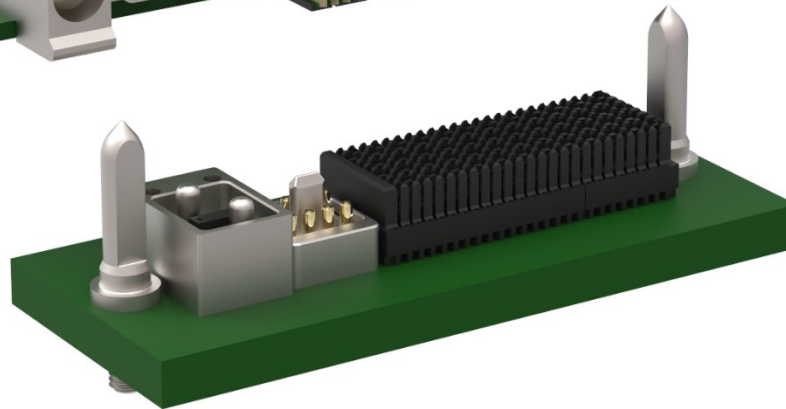


High density RF contacts

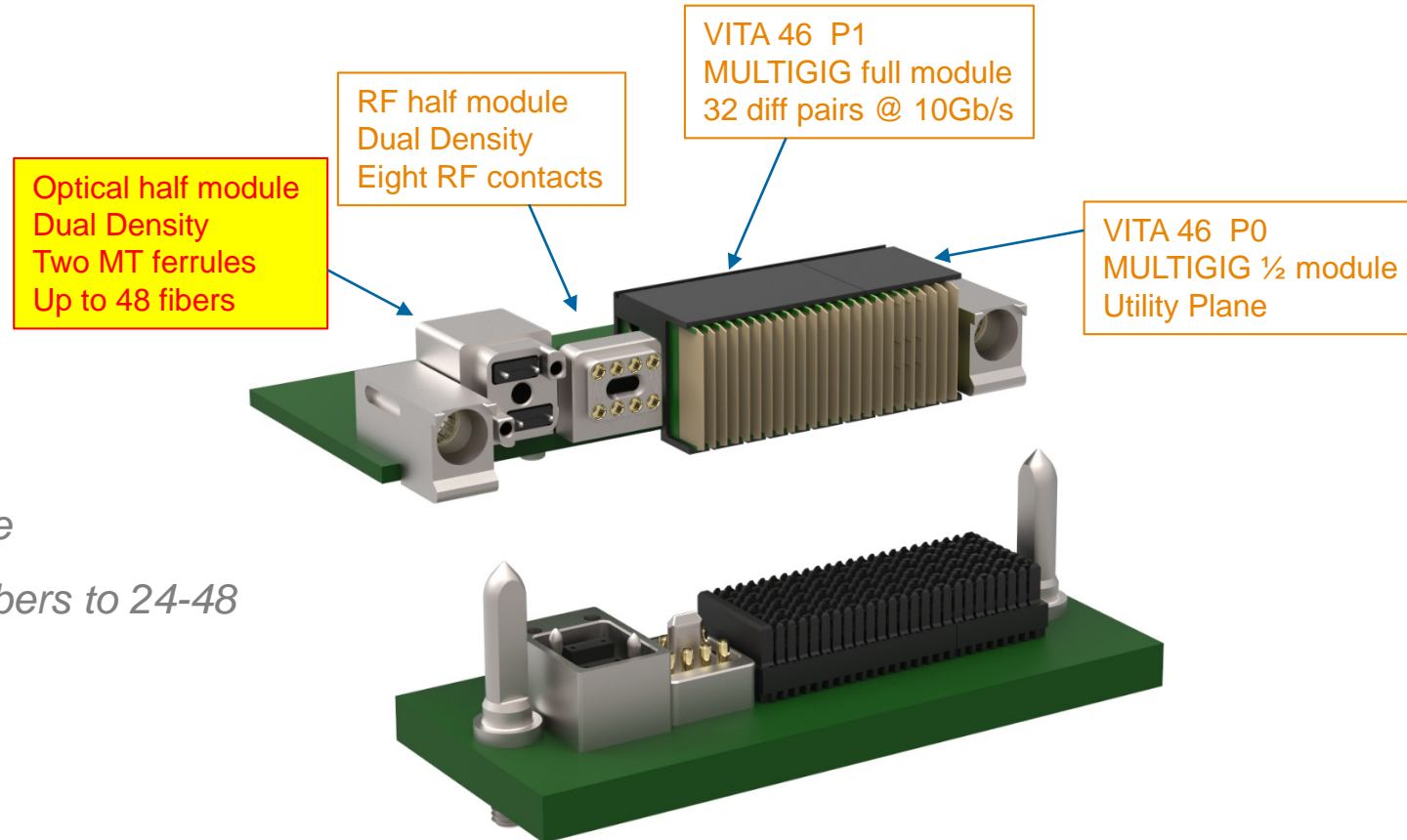
Extends frequency from 27 GHz to 60 GHz

*Capability for cable or direct board attach
(fits with VITA 67.3)*

With 1" slot pitch we can fit 12+ contacts



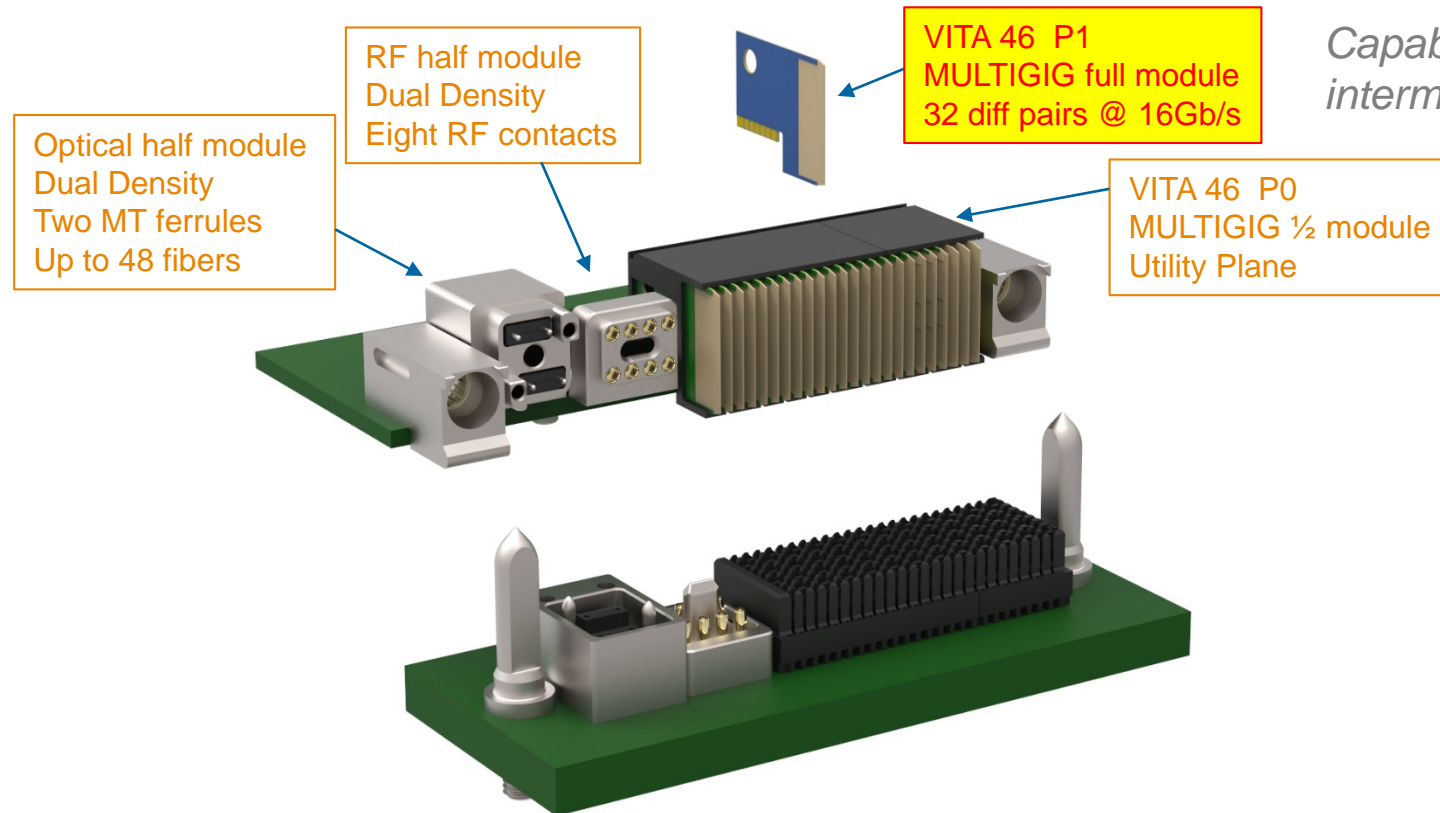
Expanding Speed / Density in 3U VPX



2 MT's in a half module

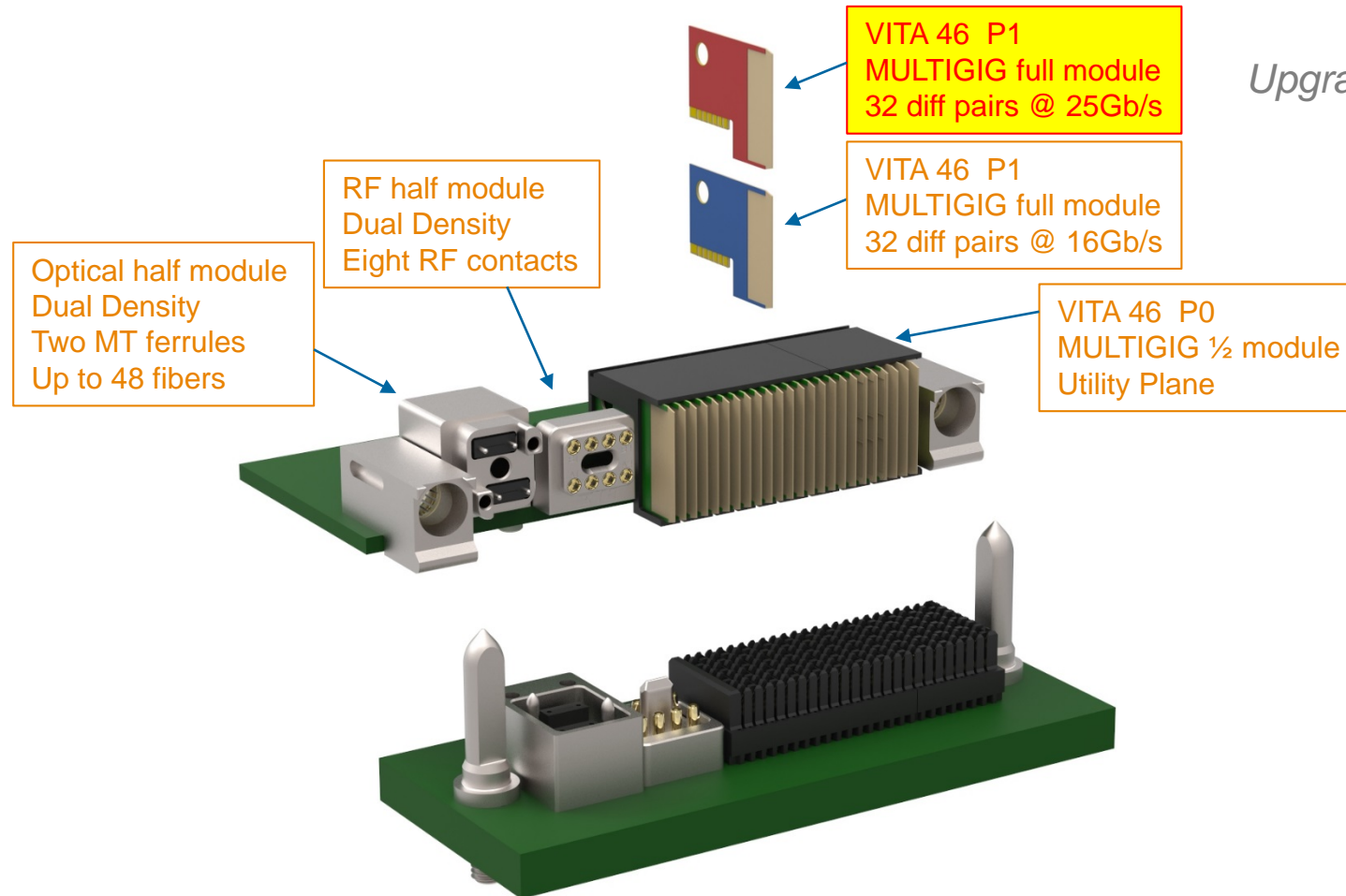
Expands from 12-24 fibers to 24-48

Expanding Speed / Density in 3U VPX



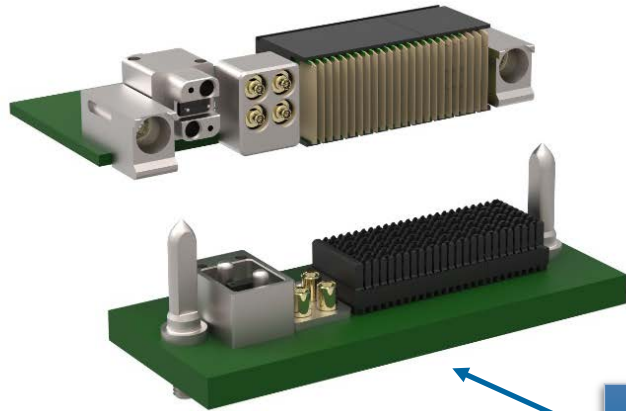
*Capability to upgrade with VITA 46
intermateable designs at 16Gb/s*

Expanding Speed / Density in 3U VPX

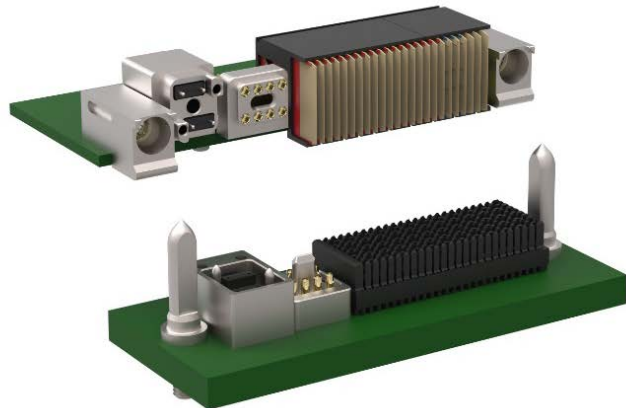


Upgrade path to 25Gb/s

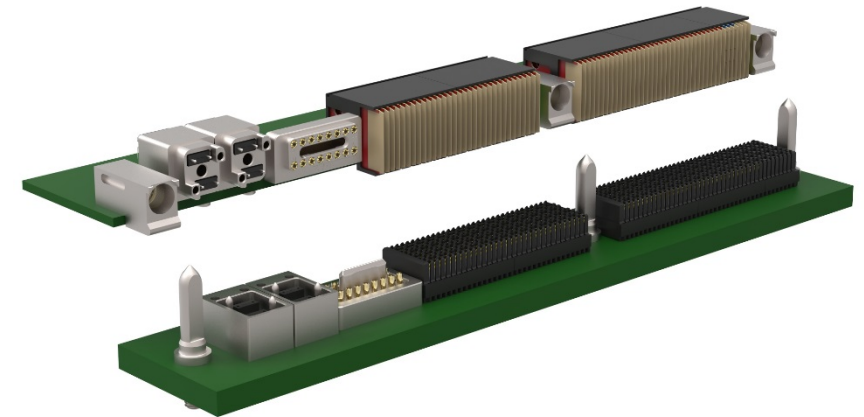
A boost in interconnect density and speed is imminent



Today	32 diff pairs @ 10 Gb/s	4 RF contacts @ 26.5 GHz	12-24 optical lanes @ 25 Gb/s
Tomorrow (not literally)	32 diff pairs @ 25 Gb/s	8+ RF contacts @ 60 GHz	24-48 optical lanes @ 25 Gb/s



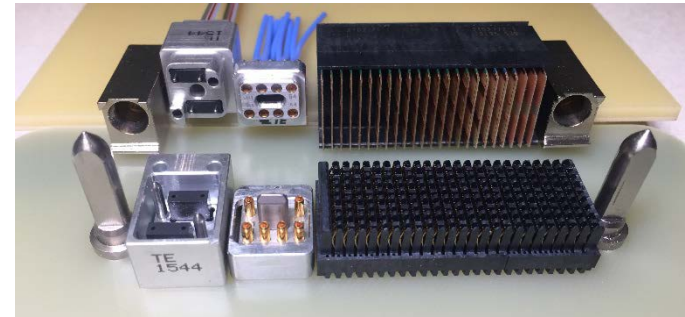
The evolution is not limited to 3U...



Data rates are increasing
Functionality is increasing
Physical size and weight is a premium



Image courtesy of Pentek, Inc.



Offers tremendous potential for
emerging interconnect technologies
Interconnect will not be the bottleneck

Thank You

Michael Walmsley
Global Product Management
717-985-2835
mjwalmsl@te.com

