ELMA
Your Solution Partner

Trends in Packaging and Infrastructure for DOD Modular Systems

Ken Grob
Elma Electronic Inc.

ETT 1/28/19

Background

ELMA
Your Solution Partner

- **Packaging standards – driven by VITA and PICMG around Eurocard for decades**
- **DoD introduces Modular Open Systems Approach *(MOSA)* to address future needs**
  - **Improve systems capability, compatibility and cost**
  - **Leads to other standards**

Standards Driving Embedded Systems

ELMA
Your Solution Partner

SOSA™
Sensor Open Systems Architecture

OpenVPX™

CMOSS

C4ISR/EW Modular Open Suite of Standards

HOST
HARDWARE OPEN SYSTEMS TECHNOLOGIES

FACE™
Future Airborne Capability Environment

VICTORY
VEHICULAR INTEGRATION FOR C4ISR/EW INTEROPERABILITY

Vehicular Integration for C4ISR/EW interoperability

MORA

Modular Open Radio Frequency Architecture

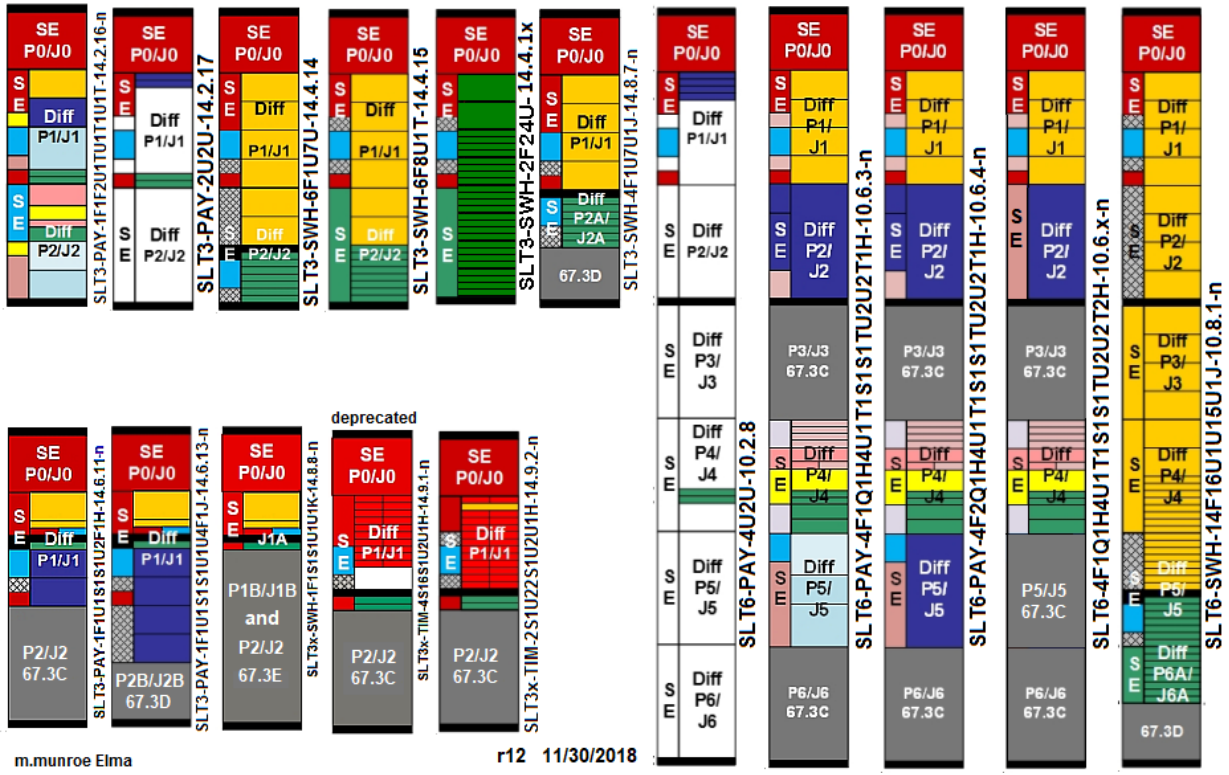
MOSA Objectives

ELMA
Your Solution Partner

Collaboration between Government and Industry
Specify base system architectures for common systems
Select a hardware standard OpenVPX™
Promote interoperability thru more constrained Slot and Module Profiles
System Management thru VITA 46.11
Normalize the Power Module interface definition
Support higher power modules through new cooling techniques

VITA / SOSA Aligned Slot Profiles

ELMA
Your Solution Partner



Emerging development backplanes keep pace with the introduction of new slot / module profiles

System Infrastructure Requirements

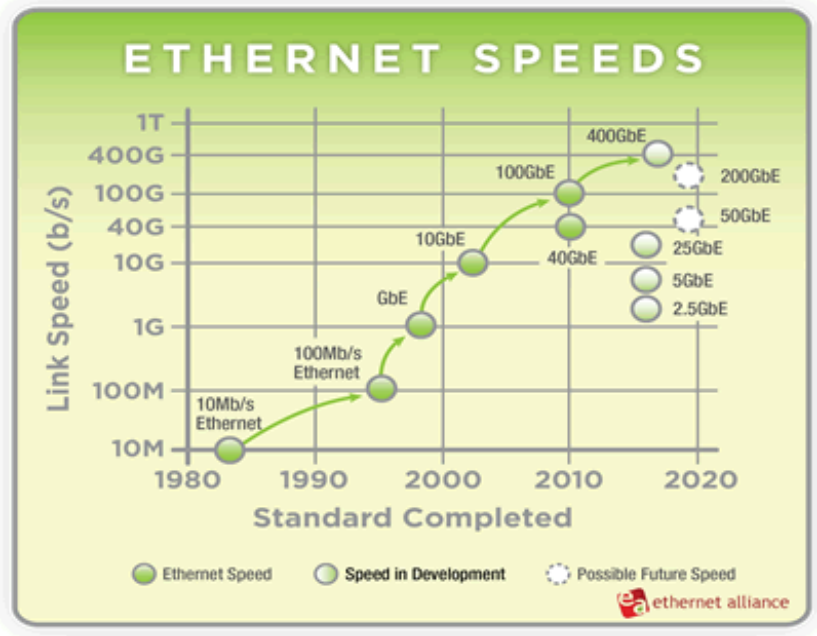
ELMA
Your Solution Partner

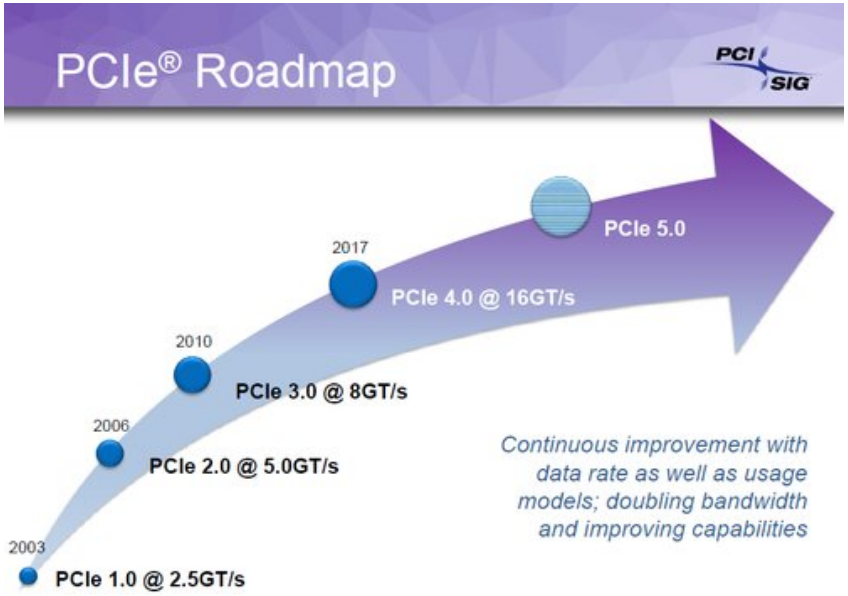
System Infrastructure	
Network	High Speed Switching
Timing	Precision Nav and Timing Module
System Management	Chassis Management via VITA 46.11
Power Systems	Updated Power Rails defined by VITA 62

Ethernet / PCIe Link Speed Trends

ELMA
Your Solution Partner

- **Drives signaling rate from 10Gb to 25Gb lanes**
- **25Gb enables 100Gb Ethernet via 4 backplane lanes**



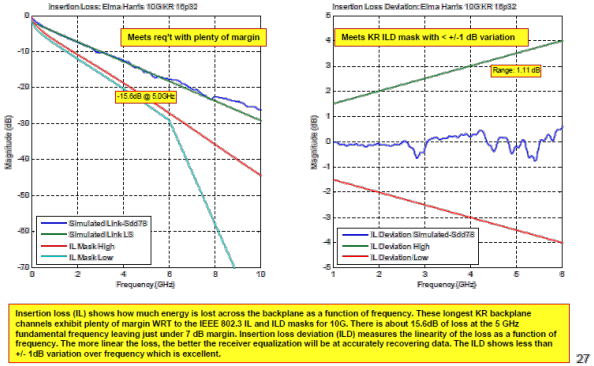


Implementation Challenges

ELMA
Your Solution Partner

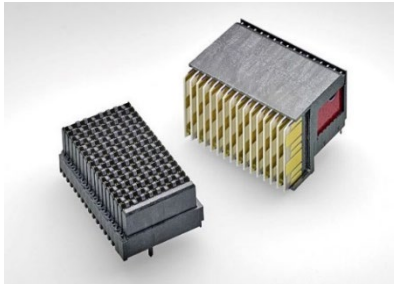
- **Backplanes to operate 2.5 times faster**
- **Design requires signal integrity modeling and simulations**
- **Implementation requires new high-speed PCM material like Megtron 7**
- **Higher speed VPX connectors like Tyco RT3 backwards compatible with RT2**

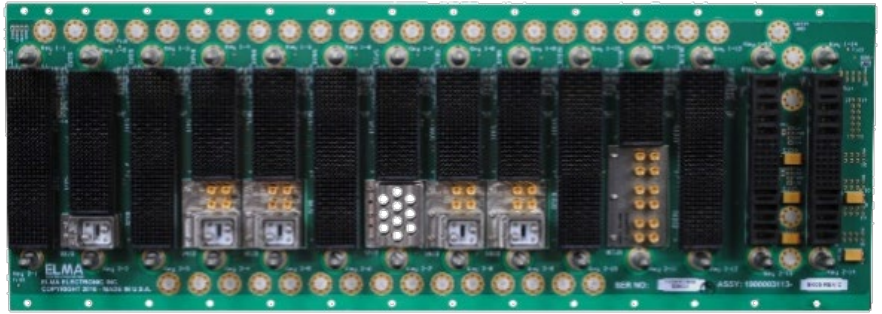
Insertion Loss and ILD: 16.32" Longest KR Backplane Channel Topology
(IEEE 802.3 KR Masks)



Insertion loss (IL) shows how much energy is lost across the backplane as a function of frequency. These longest KR backplane channels exhibit plenty of margin WRT to the IEEE 802.3 IL and ILD masks for 10G. There is about 15.6dB of loss at the 5 GHz fundamental frequency leaving just under 7 dB margin. Insertion loss deviation (ILD) measures the linearity of the loss as a function of frequency. The more linear the loss, the better the receiver equalization will be at accurately recovering data. The ILD shows less than +/- 1dB variation over frequency which is excellent.

27

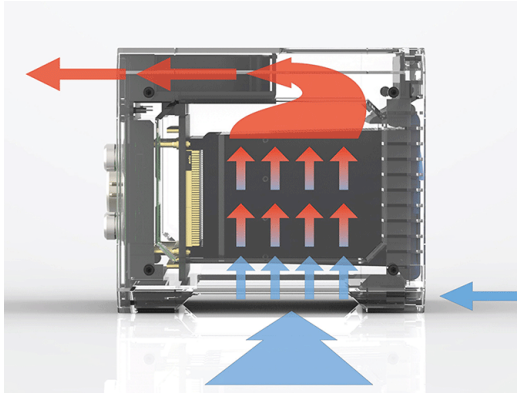




Thermal Cooling Techniques Evolve

ELMA
Your Solution Partner

- **High power density per module**
  - 60 to 130 watts and higher
  - Requires new cooling techniques
- **New approaches**
  - VITA 48.8 Air flow-through (AFT) cooling
  - VITA 48.4 Liquid flow-through cooling
- **Requires new card guide technology**
- **Modules require new heat sink designs**

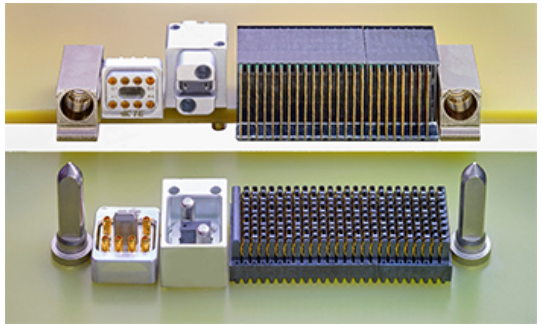


Annapolis Microsystems
WildStar FPGA board

System Connectors : Copper and Fiber

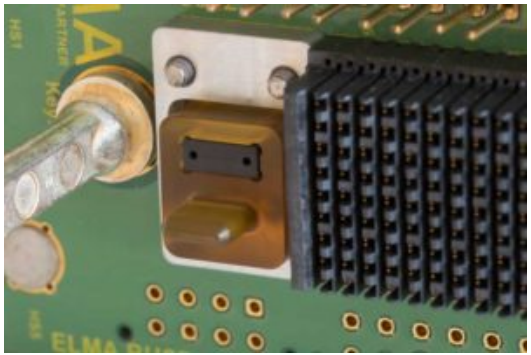
ELMA
Your Solution Partner

- **New connectors to support higher Ethernet and RF speeds**
  - Ethernet needs copper interconnect in backplane
  - Fiber interconnect via VITA 66.4, VITA 66.5, and MT ferrules
- **Transceivers embedded in edge-mount fiber-optic based connectors**



TE Nano RF Module

Elma 3U VPX
VITA 66.4



Reflex Photonics LightConex

Power Systems Evolve

ELMA
Your Solution Partner

- **Reduce number of system rails**
  - New scheme is two voltages: +12V & +3.3V AUX
  - Make current sharing more practical
- **Introduces VITA 46.11 to power supply module**
  - For reporting and control

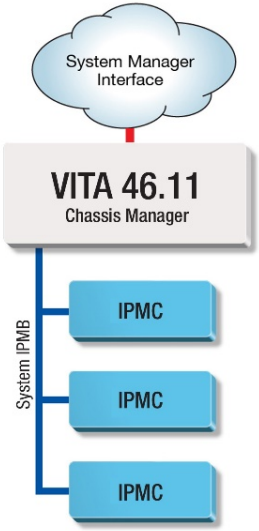
3U VPX

Behlman
VITA 62 power modules

6U VPX

System Management

- **VITA 46.11 System Management applied**
  - Chassis & system management strategy
  - Modules to support IPMB



Elma Chassis Manager Module

Summary

ELMA
Your Solution Partner

- **New technology and standards have a significant impact on chassis, backplane, and power system design**
  - Backplanes will need to operate at 25Gb/s and beyond
  - Networks will use 100Gb in 3U and 6U Ethernet switches
  - PCIe interfaces will support PCIe Generation 4 at 16 GT/s
- **Chassis cooling design will support VITA 48.1, VITA 48.2 and Air Flow Through VITA 48.8 and Liquid Flow Through cooling VITA 48.4**
- **Power solutions will evolve to +12V & 3.3V Aux two-rail design**
- **Fiber optics based connectors will be implemented between backplane and module**
- **Reference designs will be produced to provide chassis and backplane test beds for new modules and systems**


ELMA
Your Solution Partner