Updated to reflect what is expect to be 2017 revision of OpenVPX (ANSI/VITA 65.0 and 65.1)

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11 January 2017

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Outline

• Introduction

• Cooling, form factors and copper connectors

• Blind mate optical and coax connectors

• Utility Plane including radial clocks and VITA 62 power supplies

• Slot, Backplane, Module Profiles

• Slot Profile and Backplane Profile examples

• Summary

Note: A new version of OpenVPX (ANSI/VITA 65.0 and 65.1) expected to be complete the standardization process in the first half of 2017. Most of this Tutorial is written as if it already has.

This tutorial along with some others is available at: http://www.vita.com/Tutorials
Subsection Outline: Introduction

• Introduction
  – Overview
  – Brief history of VME, VXS, VPX, and OpenVPX
  – Mezzanine Cards
  – Rear-Transition Modules (RTMs)
  – Terminology
  – Two-level maintenance

• Cooling, form factors and copper connectors
• Blind mate optical and coax connectors
• Utility Plane including radial clocks and VITA 62 power supplies
• Slot, Backplane, Module Profiles
• Slot Profile and Backplane Profile examples
• Summary
OpenVPX and Associated Standards

- These standards define interfaces between Plug-In Modules and chassis for products intended to be deployed in harsh environments.
OpenVPX Widely Used In Embedded Systems

Military & Aerospace Sept 11, 2013: Northrop Grumman orders airborne radar signal processors from Curtiss-Wright for Joint STARS

The Aviationist April 5, 2015: Photo Shows A U.S. reaper drone carrying "Gorgon Stare" wide area airborne Surveillance system pod in Afghanistan

Military & Aerospace Nov 25, 2012: Massive October ballistic missile defense test used Mercury's OpenVPX embedded computing

VITA Technologies Aug 3, 2012: OpenVPX platform delivers horsepower needed to revolutionize helicopter flying

COTS Journal Dec, 2013: Mercury to Provide Radar Subsystems for Patriot Air and Missile Defense Systems

COTS Journal July 2014: Figure caption: Project Missouri demonstrations successfully implemented and tested two data links between an F-22 and the F-35 Cooperative Avionics Test Bed (CAT-B) (shown).
Goals of This Tutorial

• If think of the OpenVPX specification as like a reference manual
  – Think of this material as a user’s manual
  – Help sort through the large number of options in the specification

• Further lock in common industry practices
  – This will help build a more consistent eco-system

• Give some suggestions for practices in emerging areas
Conduction Cooled OpenVPX Module

- 6U x 160 mm – 233.35 mm x 160 mm or 9.187” x 6.299” module shown
  - Other module size is 3U x 160 mm – 100 x 160 mm or 3.937 x 6.299” inches
- Module shown is designed for conduction cooling (ANSI/VITA 48.2)
- Two mezzanine sites for either PMCs or XMCs
Vision for Data Conversion Subsystem

- Changes in 2017 version of OpenVPX to support this vision
  - Radial clocks for high precision clocking of A/Ds and D/As
  - Optical (VITA 66.x) and coax (VITA 67.x) portions of backplane connectors
    - Organizational changes to handle significant expansion (2012 rev only has 2 coax Slot Profiles)
  - Control Plane Switch Profiles to support mix of:
    - Copper connections within the chassis – 1000BASE-KX and 10GBASE-KR
    - Copper connections to local ancillary devices – 1000BASE-T and 10GBASE-T
    - Fiber connections to rest of system – 10GBASE-SR
  - Data Plane Switch Profiles to support mix of:
    - Copper connections within the chassis – 40GBASE-KR4
    - Fiber connections to rest of system – 40GBASE-SR4
OpenVPX Profiles

- **Slot Profiles specify**
  - Pins associated with a backplane slot
  - Pins associated with a Plug-In Module’s connector to backplane
  - Pins assigned to particular ports
  - Example Slot Profile name: SLT6-PAY-4F1Q2U2T-10.2.1

- **Backplane Profiles specify**
  - Which Slot Profiles a particular backplane has
  - How its Slot Profiles are interconnected
  - Example Backplane Profile name: BKP6-CEN16-11.2.2-n

- **Module Profiles specify**
  - The protocols and number of lanes to be mapped to the ports defined by the Slot Profile (e.g. 1000BASE-KX Ethernet)
  - Example Module Profile name: MOD6-PAY-4F1Q2U2T-12.2.1-n

3U OpenVPX Slot Profile diagram
J0 – J2 are backplane connectors and P0 – P2 are Plug-In Module connectors

6U OpenVPX Slot Profile diagram
J0 – J6 are backplane connectors and P0 – P6 are Plug-In Module connectors

Backplane pictures courtesy of Elma
Slot Profiles Now Have Dash Options

• 2012 version of OpenVPX has tables of dash options for:
  – Backplane Profiles – baud rates of channels
  – Module Profiles – protocols mapped to Slot Profile’s ports

• 2017 version will add dash options for Slot Profiles
  – Slot Profiles can include aperture for optical/coax – for example: VITA 67.3 type C Connector Module
  – “-0” version of Slot Profile has aperture empty
  – Below are examples of Connector Modules that can go in a VITA 67.3 type C aperture. Each can be a dash option for Slot Profile.

• 6U Plug-In Module with two VITA 67.3 Connector Modules
  – 9 SMPM contacts each
  – Mate with connector below (flipped vertically)

• Backplane connector using VITA 67.3C footprint
  – Can mate with Plug-In Modules with VITA 66.4 (optical) and 67.1 (coax) connectors

• VITA 67.3C backplane connector
  – 9 SMPM contacts
  – Side which mates with Plug-in Module shown
VITA 65.0 and 65.1 Partitioning

- Adding dash options to Slot Profiles also increases dash options for Backplane and Module Profiles as well as adding tables for Slot Profiles.

- What is currently VITA 65 becomes VITA 65.0 without the tables of dash options.

- Tables of Backplane & Module Profile dash options move from 65.0 to 65.1
  - Associated text stays in VITA 65.0
  - With VITA 65.0, instead of referencing tables in VITA 65.0, reference VITA 65.1.

- VITA 67.3 standardizes Connector Module footprints but not contact locations
  - VITA 65.1 includes tables of contact locations.

- VITA 65.0 and 65.1 section numbers are be consistent with each other
  - VITA 65.1 has lots of skipped sections.

- VITA 65.1 written using Microsoft Excel in order to make dealing with tables easier
  - Many of the tables are wider than what will nicely fit in the width of a page.
  - Available in both Excel and .pdf.
VITA 65 Working Group Cultural Changing

- With 2012 version of OpenVPX profile dash options were put in even if no immediate plans to implement them
  - Done for consistency among profiles
  - Put in if someone thought they might implement
    - Due in part to how long the standardization process can take

- Planning to revise 65.1 more frequently than 65.0

- Have put in place a streamlined process for adding to 65.1
  - Slot Profiles with different Connector Modules
  - Backplanes Profiles with Slot Profiles using different Connector Modules
  - Backplanes Profiles with higher baud rate channels
  - Module Profiles with newer protocols

- Encouraging culture where dash options are only added when there is a plan to implement soon
Overview Wrap-Up

• OpenVPX and associated standards define interfaces between Plug-In Modules and chassis
  – For products intended to be deployed in harsh environments

• ANSI/VITA 65 becomes 65.0 with profile tables moving to 65.1
  – ANSI/VITA 65.0; OpenVPX™ System Standard
  – ANSI/VITA 65.1; OpenVPX™ System Standard – Profile Tables

• The next version of OpenVPX is expected to be completed in 1H2017
  – Most of this Tutorial is written as if 65.0 and 65.1 have already been completed

• Changes to support data acquisition and RF subsystems
  – Radial clocking for high precision clocking of A/D and D/As
  – Bind mate backplane optical and coax connectors to support 2-level maintenance

• Encouraging culture where dash options are only added when there is a plan to implement soon