Atrenne®
A Celestica Company



Flexible D2D Chassis Reduce Costs & Simplify Schedules

DESIGN › DEVELOP › DEPLOY

EST. 1972 50+ Years

WHITE PAPER

FLEXIBLE D2D CHASSIS REDUCE COSTS & SIMPLIFY SCHEDULES

Introduction

Requirements change and designs evolve as a program moves from development to demonstration and, finally, deployment but some functionality is constant; a system chassis needs a backplane, power supply and a way to remove excess heat. Despite these common needs, programs typically pay, in full, for new chassis technology at each phase because available options lack the flexibility to make configuration adaptations.

The need for chassis flexibility and configurability is now addressed in the D2D (Development to Deployment) chassis, designed for easy upgrade as programs progress. It is possible to reduce program costs for chassis and payload content by 30-50% while simplifying program management and reducing lead times relative to custom solutions. This white paper will discuss chassis requirements across program phases and then describe the details of the flexible, affordable D2D approach.

COSTS OFTEN DUPLICATED AT EACH PROGRAM PHASE

As programs move through the development phase into a demonstration phase and, finally, into deployment, system characteristics change, especially for chassis. Today's common approach is to address the needs for each phase separately, buying new chassis and other equipment. Development teams must allocate resources for all these unique acquisitions, despite a high degree of commonality in components like backplanes and enclosures.

DEVELOPMENT SYSTEMS

Development systems typically use air-cooled, lab-style equipment for maximum flexibility and lowest cost

Flexibility is required because, at this stage, developers rarely know the exact configuration they will need. Often algorithms are still being tested and choices of processing elements – general purpose CPUs, FPGAs or GPUs – and I/O channels are still being made. Cost sensitivity is imposed by the limited IRAD budgets applied to development. For this lab-style equipment, aesthetics are unimportant and external cables between components or subsystems are common.

DEMONSTRATION SYSTEMS

Demonstration systems move programs to another level and are often built using rugged and/or custom equipment

Demo systems create a proof of concept that meets "show and tell" purposes or addresses more rigorously defined tests. A polished appearance is important, as it helps convince end user customers that the solution is mature and the move to deployment is a small step. Operational performance for a demo is, of course, essential and this includes a sufficient level of ruggedness to withstand field tests, flight tests or sea trials.

30–50%

By upgrading and reconfiguring, rather than buying multiple sets of completely new equipment, D2D chassis will reduce a program's chassis and payload card budget by 30-50%.

READ ABOUT

- Program cost reduction
- Flexible chassis
- Configurable fans
- Configurable power supplies
- Meritec VPX+™ cables
- VPX connectors

DEPLOYABLE SYSTEMS

Deployable systems are complete, optimized for final program requirements and are ready to move into production

They must pass full performance and environmental qualification.

Limited IRAD budgets are strained by being hit multiple times to buy chassis, until full program-level funding takes over.

In general, a multi-phase chassis should meet a level of light ruggedization, enough to support field tests, flight tests in large aircraft or sea trials. Higher levels of ruggedization, for harsh environments such as the unprotected pods in fighter aircraft or UAVs, will typically require a custom solution.

MEETING MULTI-PHASE NEEDS WITH FLEXIBLE & CONFIGURABLE CHASSIS

Overall program costs can be reduced and phase-to-phase transitions streamlined by selecting a multi-phase chassis solution that is flexible and configurable. By reusing most of the chassis components for all phases, and only replacing or adding pieces as needed, the overall program cost will be sharply reduced. Additional benefits are simplified program management, with fewer purchases and less equipment to manage, as well as avoiding the schedule impact of lead times for custom purchases.

ATRENNE'S D2D CHASSIS OFFER COST-EFFECTIVE OPTIONS

Atrenne Development to Deployment (D2D) Chassis are designed to be easily configured and reconfigured for the development phase, demonstration phase and deployment phase. They minimize both the overall program cost of chassis acquisition and total amount of hardware that has to be acquired.

The D2D chassis generally have a number of common characteristics. First and foremost they are designed with configurable elements so that they can be adapted to lab development requirements, demonstration or light deployment.

Features include:

- ATR or rack-mount form factors
- Air-cooled or conduction-cooled
- Available with pass-through backplane option to allow fabric and I/O configuration with Meritec VPX+ cables
- Removable top/bottom hat for cable routing. The top hat for front panel I/O cabling and the bottom hat for backplane I/O cables.
- Commercial or MIL Standard fans
- Commercial or MIL Standard power supplies
- 6U and 3U OpenVPX backplanes

During development a D2D chassis can be configured with commercial fans and a commercial power supply. These are less costly and more easily sourced than MIL Standard items. Cabling can be exposed, easily moved, connected and disconnected as situations require.

When the program transitions to the demo phase, fans and power supplies are easily upgraded to MIL Standard components. Top hat and bottom hat extensions are added to protect and secure front panel and backplane cabling.

D2D chassis support either air-cooled or conduction-cooled payload modules. The conduction-cooled versions typically use forced-air cooling through fins to maintain the conduction-cooled sidewall temperature. Forced-air over conduction works perfectly well in the lab and transitions seamlessly to a rugged environment. Significant budget savings can be achieved by using the same set of modules for all project phases instead of buying L0 (lab grade)



Industrial Grade Fan



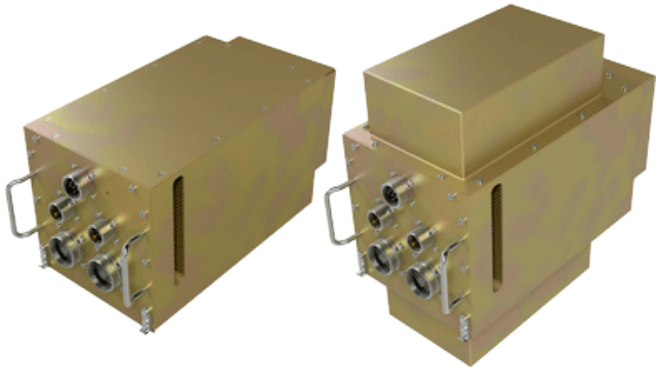
MIL Grade Fan



External Power Supply



MIL Grade Internal Power Supply



¾ ATR D2D chassis, with and without 'hats'

payload boards for development and rugged modules for the later project phases.

By upgrading and reconfiguring, rather than buying multiple sets of completely new equipment, D2D chassis will reduce a program's chassis and payload card budget by 30-50%.

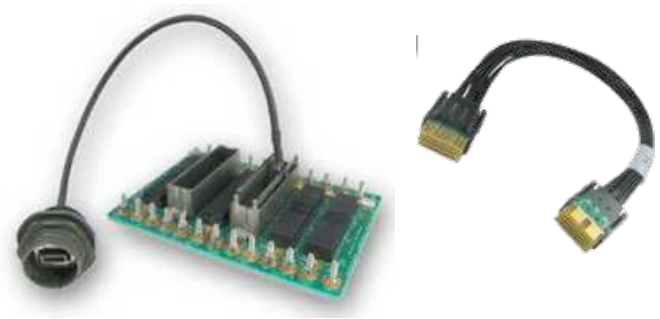
A HIGHLY FLEXIBLE D2D EXAMPLE

The Atrenne ¾ ATR Development to Deployment (D2D) enclosure offers new programs a range of cost saving and schedule shrinking options. It is configurable with 3U OpenVPX conduction cooled payload modules, using forced air cooling and offers a choice of internal or external power supplies. The chassis also offers multiple options in terms of fans, power supplies, backplanes and I/O connectivity.

The enclosure eliminates the need to obtain air-cooled payload for the development phase and enables addition of a "top hat" to support I/O from module and mezzanine faceplates. It also offers add-on "bottom hat" to support I/O cabling or custom backplane connectivity by way of backplane RTM connectors for development and demonstration. It supports custom backplanes for deployed applications as well as an off-the-shelf 6-slot OpenVPX™ 1" pitch backplane.

MERITEC* CABLES

Meritec VPX+ cables are used with a VPX pass-through backplane to create virtually any fabric topology, connecting and reconnecting slots as designs evolve. In addition, Meritec makes cables with a VPX connector on one side and an I/O protocol interface, such as 38999 or USB, on the other. This flexibility makes it advantageous to use a standard VPX pass-through backplane early in



Meritec cables support configuration flexibility

a program's development phase, when I/O and fabric topology needs are not yet finalized.

There are Meritec VPX+ cables that support ultra-thin, thin, fat and double fat pipe VPX connections, ranging from 1 to 8 differential pairs. At Atrenne we have extensive experience using Meritec cables successfully with both Gen-2 (6.25 Gbaud) and Gen-3 (10.3 Gbaud) signaling.

In general, a multi-phase chassis should meet a level of light ruggedization, enough to support field tests, flight tests in large aircraft or sea trials. Higher levels of ruggedization, for harsh environments such as the unprotected pods in fighter aircraft or UAVs, will typically require a custom solution.

* Meritec is an Atrenne ecosystem partner

D2D SUMMARY

Program development budgets are faced with repeated purchasing costs for similar components as a program moves from development to demonstration and then to deployment. These costs can be slashed, program management simplified and schedule impacts reduced, by using flexible chassis that are designed to be reconfigured as the program moves between phases. The Atrenne D2D chassis are available now, with a range of form factor and backplane options.

D2D CHASSIS OPTIONS

Backplanes

- COTS 3U OpenVPX backplane
- COTS Power Supply backplane with 2x Power supply slots

Power supply

- Supports external power supply (option)
- Internal power supply slots support a total of 200W or 400W, 28 VDC input power supply(s) compliant to MIL-STD-704F and MIL-STD-1275B (option)

Cooling

- Front-to-rear cooling path with brazed finned sidewalls
- Industrial grade fan option for lower cost demonstration use (option)
- MIL grade fan option for rugged environments (option)
- Brazed and bolted construction suitable for moderately rugged deployed applications with application-specific backplane & I/O
- Ready for qualification testing
- TRL5

LEARN MORE

- White Paper: COTS Enabled Rapid Development to Deployment
- Fact Sheet: D2D ¾ ATR Forced Air Conduction-Cooled Enclosure
- Chassis Solutions Guide
- Backplane Solutions Guide

ABOUT ATRENNE

For more than 50 years, Atrenne Computing Solutions has been designing, developing, and deploying rugged electronic packaging, chassis, backplanes, and integrated assemblies for mission-critical applications.

We provide fully tested, reliable electromechanical solutions with a design-to-build model and custom engineering capabilities that support programs from concept through production and lifecycle management. Atrenne embedded computing platforms are deployed across aerospace, defense, and other demanding applications worldwide.

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