

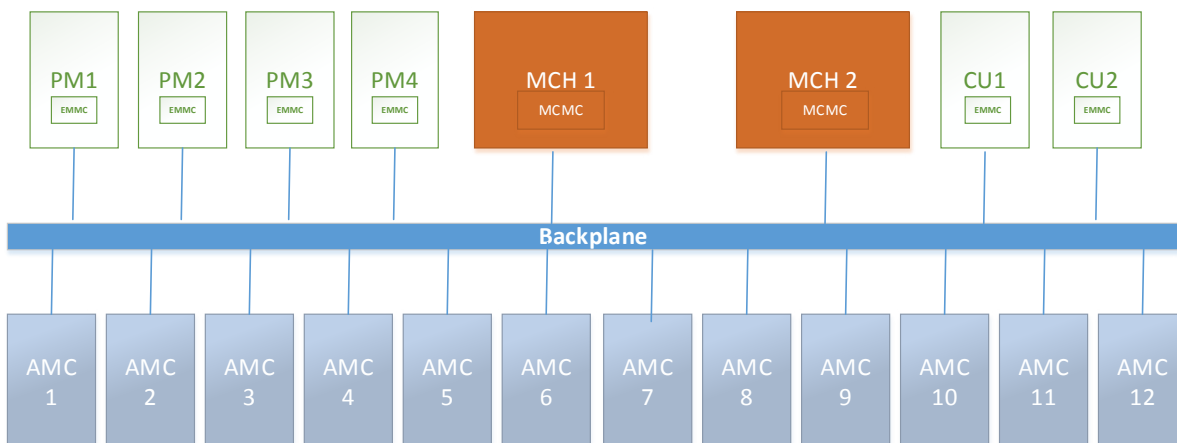
WHITE PAPER

POWER MODULE REDUNDANCY

MicroTCA (μ TCA) is designed to build flexible and reliable (high availability) embedded systems. A μ TCA system consists of up to 12 Advanced Mezzanine Cards (AMC), 2 cooling units (CU), 2 MicroTCA Carrier Hub (MCH) and 4 Power Modules (PM). A single power module is unlikely to meet the power requirements of a fully loaded μ TCA system; hence load sharing mode is used in these systems, where the power requirements are met by having multiple PM. Power Modules can also be configured to improve reliability by redundancy, but this will increase the number of PMs required in a system. Often load sharing is required, and PM redundancy is very desirable to improve the reliability of the system. However PM redundancy is sometimes disregarded due to increased costs, and in some cases it is not possible to achieve redundancy due to system constraints – for example, a chassis which has 2 PM slots and require them to be in load-sharing mode. For these systems, we discuss the additional costs of having PM redundancy - the number of additional PMs required, and how a cost-effective solution can be achieved. In many cases PM redundancy can be achieved at no additional cost.

The power module is an integral part of the μ TCA system. The PM’s primary function is to provide management and payload power, but like any other FRU, it must be IPMI compliant. Although the PM has the intelligence to autonomously bring up the MCH and the CU, the MCH is required to provide sophisticated features such as PM redundancy. Figure 1 shows a typical μ TCA system consisting of 12 AMCs, 2 MCHs and 2 CUs and highlights the parts of the power system.

Figure 1: μ TCA System with 12 AMCs, 4 PMs, 2 MCH, 2 CU



CONVENTIONAL SOLUTION

Consider the system in Figure 1, with each of 12 AMCs drawing 80W of power. Today's PMs are able to deliver between 400 to 600W of power in the single module size; some very good ones are able to deliver up to 792W. So the total power required (~1000W) can't be met by a single PM, load-sharing mode is adopted where the total power requirements can be satisfied by having 2 PMs. We could configure the PM 1 to power AMCs1-6, MCH1, CU1 and PM2 to power AMC7-12, MCH2 and CU2. To achieve PM redundancy we could have PM3 and PM4 which mirrors PM1 and PM2 respectively. So in order to have a fully populated power hungry system, with PM redundancy, we will require 4 PMs for these systems. Using a N+1 redundancy, we can bring this down the number of PM to 3. In this case PM3 would be a redundant PM to either PM1 or PM2.

PROBLEM

Both load sharing and redundancy are very important concerns for building a system, but redundancy increases the number of power modules required, and hence increases the total costs.

SCENARIO 1

Let's suppose that we would like to have AMC6, AMC7, MCH1, MCH2, CU1, and CU2 to have redundant power supply in the system shown in Figure 1

We need one additional PM to achieve this using conventional solution (N+1 redundancy scheme), where:

PM1 to power AMC1-6, MCH1, CU1

PM2 to power AMC7-12, MCH2, CU2

PM3 (Redundant) AMC6, AMC7, MCH1, MCH2, CU1, CU2

Could we do any better? (in terms of minimizing number of PMs used/total costs)

Yes, we could do this by what we term "mixed redundancy" - an intelligent, efficient, and cost-effective solution to achieve load sharing and PM redundancy developed by VadaTech. Note that the PM is still compliant to the μ TCA specifications, and this nifty feature is incorporated in VadaTech MCH.

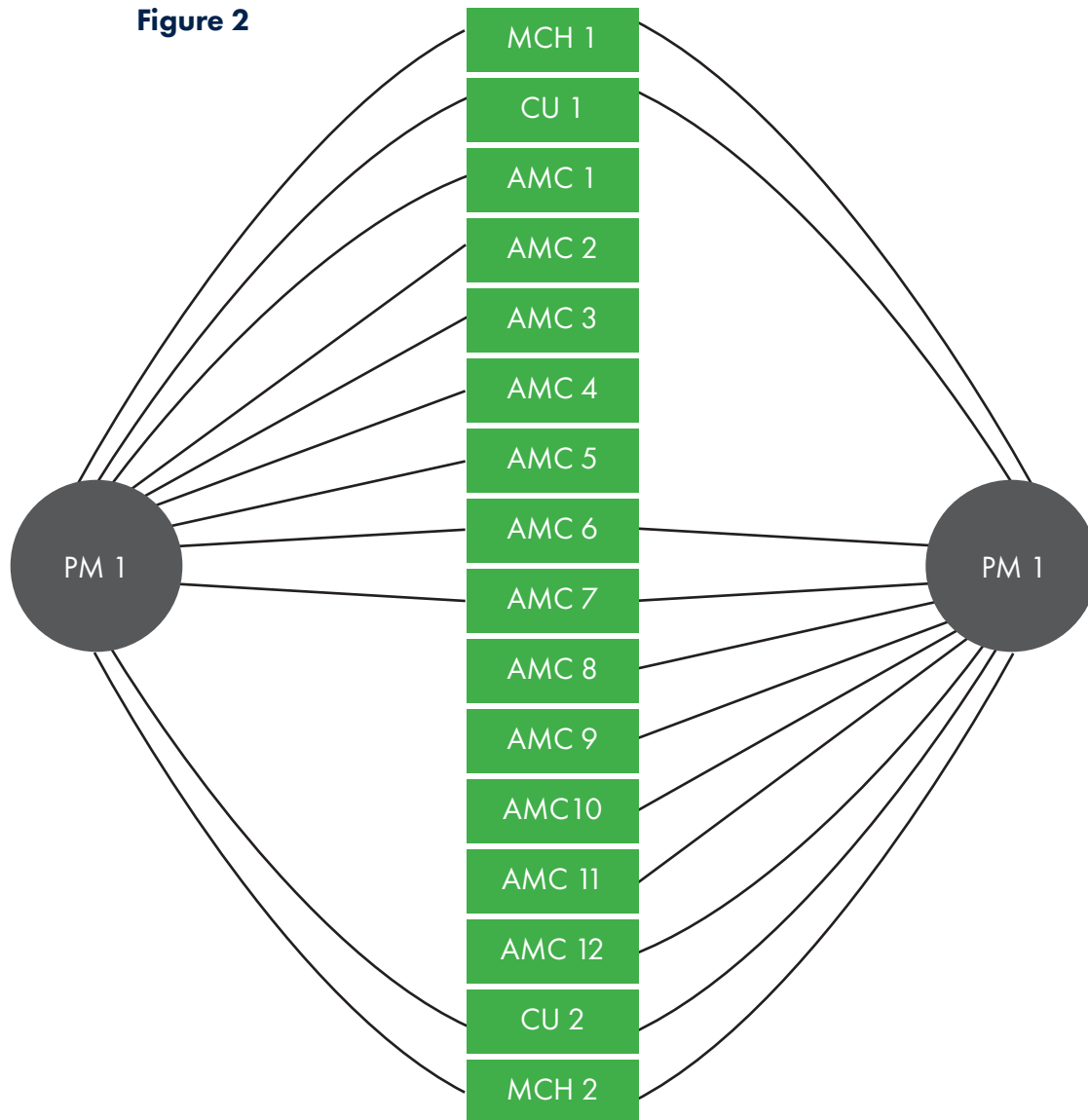
In this mode, both the PMs are primary, and the Power Module can power the system as follows.

PM1 to power AMC1-6, AMC7, MCH1, MCH2, CU1, CU2

PM2 to power AMC6, AMC7-12, MCH1, MCH2, CU1, CU2

The AMC6, AMC7, MCH1, MCH2, CU1, and CU2 have redundant power supply, but without requiring additional power modules. See Figure 2.

Figure 2



PROBLEM

Many chassis have just 2 power module slots, so load sharing and redundancy can't both be achieved at the same time.

Also, the PMs are getting denser and able to deliver more power (VadaTech's UTC020 delivers 936W in the single module size), so the high-capacity redundant PMs aren't utilized to the fullest. [Note that to achieve redundancy, all the PMs must be identical, so all the PMs are high capacity power modules]

SCENARIO 2

Consider a system with a chassis with CU, MCH, AMCs and 2 PM slots. There are many such chassis in the market which will offer 10/12 AMC slots with one MCH and one Cooling Unit. Some of the chassis are low profile (1U or 2U), offer dense and efficient solutions, and hence quite popular. As discussed before, if the total power requirements exceed the capability of a single PM, the chassis is powered up using

2 PMs in load sharing mode. Now suppose PM redundancy is required for the critical components of this system (let's say the Disk AMC, PrAMC, and the MCH, CU), there isn't a third PM slot in the chassis to plug into; achieving PM redundancy won't be possible using conventional solution – as they require using additional PM. Mixed Redundancy is the only solution in such cases, as these PM can do both load-sharing and redundancy at the same time, without requiring additional PM and at no additional costs.

So, by mixed-redundancy, we are able to offer PM redundancy on systems which was not possible, and in many cases, PM redundancy can be realised without using additional Power modules.

ABOUT VADATECH

VadaTech provides innovative embedded computing solutions from board-level products, chassis-level platforms, to configurable application-ready systems. With a focus on MicroTCA and AdvancedTCA solutions, the company offers unmatched product selection and expertise in the full xTCA ecosystem. With our unique combination of electrical, mechanical, software, and system-level expertise, VadaTech can provide customized commercial or rugged computing solutions to meet the most complex customer requirements. VadaTech also offers specialized product solutions for VPX/VME, CompactPCI, and other architectures. A member of PICMG and VITA, VadaTech is headquartered in Henderson, NV with offices in Europe and Asia Pacific.

TERMS USED: **μTCA/MTCA/MicroTCA** – Micro Telecom Computing Architecture, **MCH** – MicroTCA Carrier Hub, **PM** – Power Module, **CU** – Cooling Unit, **AMC** – Advanced Mezzanine Cards, **FRU** – Field Replaceable Unit, **IPMI** – Intelligent Platform Management *Interface*



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