Downtime can be catastrophic. In today’s wired world, the disruption of a critical telecommunications service for even a few minutes can result in millions of dollars of lost revenue and irreversible damage to customer relationships. On the other end of the spectrum, failure of a less critical system may result only in significant inconvenience. The vast majority of telecommunications, data communications, and industrial command and control applications lie somewhere in between the two extremes, with acceptable downtime windows shrinking all the time.

The gap between the inconvenient and the truly catastrophic has spawned a spectrum of systems designed to provide elevated levels of availability, such as:

- Standard systems
- High availability systems
- Fault resilient systems
- Fault tolerant systems
- Continuously available systems.

The existence of this range of solutions makes it possible for companies to address their availability, or uptime needs, application by application. One hundred percent availability is not a universal requirement, any more than 100 percent hardware fault tolerant systems are a universally practical or economical choice.

**Defining Availability Requirements**

System requirements for critical applications need to be analyzed in order to balance tolerable downtime, affordability, scalability and manageability, including the ability to minimize planned downtime.

Does an application require 99.999 percent availability (equating to approximately five minutes of downtime a year), or will 99.95 percent uptime suffice?

Fault tolerant and continuously available systems capable of delivering more than 99.999 percent uptime are notably expensive, and their value is debatable for all but the most mission-critical or life-
critical applications. While fault tolerant systems might use commodity processors and even off-theshelf operating systems, their architectures are anything but off-the-shelf. This not only adds up to expense, but also means that new technology spins are comparatively slow. Non-standard architectures cannot handle rapid chip spins.

On the other hand, high availability systems built from commodity components and based on standard bus architectures can now supply sufficient availability for the vast majority of critical applications without incurring the costs of a fully fault tolerant system. These systems include high availability clusters based on the CompactPCI bus architecture, as well as emerging CompactPCI-based N+1 servers that combine redundant system slot support with CompactPCI Hot-Swap to provide 99.999 percent, or five-nines, uptime.

**CompactPCI-Foundation for High Availability**

The robust CompactPCI bus architecture, PCI’s industrial computing extension, has made rapid inroads into demanding telecommunications applications in the Intelligent Network, Central Office, hosted Internet environments, and dark office applications.

Eminently open, the CompactPCI architecture is supported by Microsoft Windows NT as well as UNIX and real-time operating systems. With its rugged Eurocard form factor, passive backplane and option of NEBS-compliant packaging, CompactPCI provides a reliable foundation on which to construct an off-the-shelf, high availability solution.

Using a standard CompactPCI base, it is now possible to achieve elevated levels of availability using several standards-based techniques, including:

- Scalable redundancy-leveraging Hot-Swap and redundant system slot support
- Dual node (2N) clustering.

These techniques can be implemented to cost-effectively meet a broad range of mission-critical telecommunications application needs.

![Figure 1: Improving System Availability for Telecom](image-url)
Part 2: Architecting High Availability Systems

Multiple Paths to Availability

1. Redundancy
2. Compact PCI Hot-Swap
3. High Availability Software

CompactPCI Platforms for High Availability

1. Base CompactPCI System
2. High Availability Clusters
3. Redundant System Slot Platform

Part 3: Implementing High Availability CompactPCI

Ideal Cluster Applications

CompactPCI Hot-Swap at Work

1. Basic and Full Hot-Swap Systems
2. High Availability Hot-Swap Systems

Host CPU Redundancy and Hot-Swap

1. Minimizing Planned and Unplanned Downtime
2. Everything on the Bus

Let the Applications Dictate the Architecture