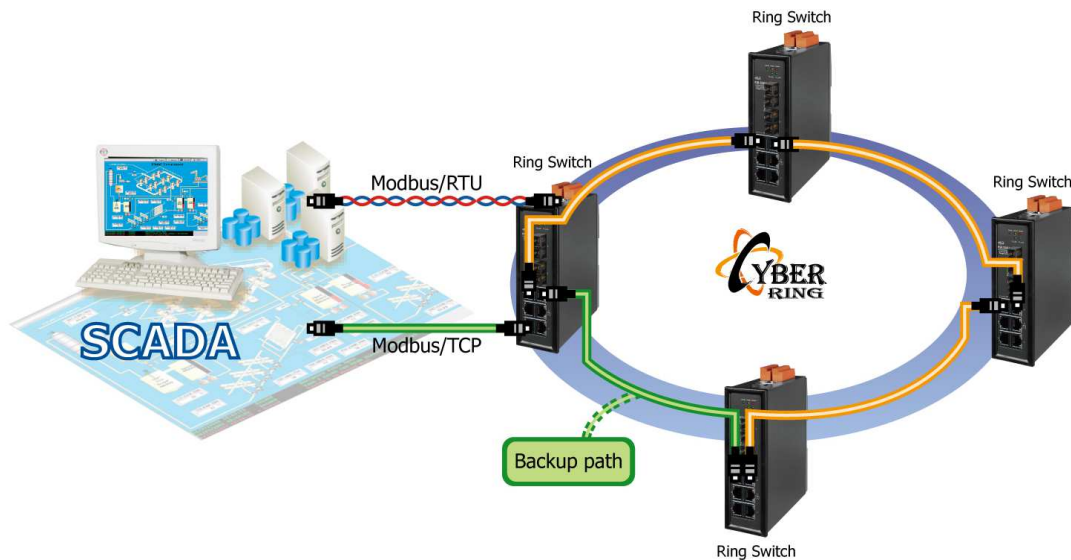# Cyber-Ring Ethernet Self-healing Technology

It is undoubted that the power of an Ethernet LAN (Local Area Network) is tremendous when applied to factory floor or industrial automation applications. However, you cannot just use commercial Ethernet switch there. Harsh environment will become a challenge to your switch, and, in many case, fault-tolerant network is also a must. To satisfy these, ICPDAS's Cyber-Ring technology provides you a rugged fault-tolerant, plug and play Ethernet solution.
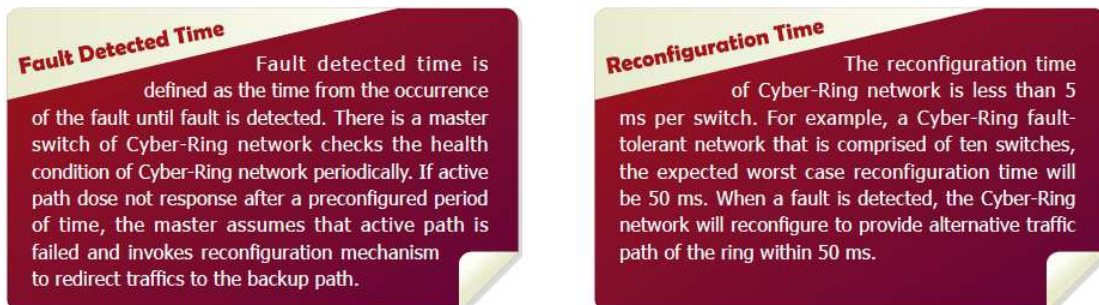

Cyber-Ring self-healing Ethernet technology is a proprietary developed by ICP DAS that can be used to help establish industrial-grade Ethernet with high reliability and fault-tolerance capabilities, and can be used to implement a ring topology network of either copper or fiber optic cable. While standard STP typically requires around 20 to 30 seconds before the network structure is reconfigured following a link failure, Cyber-Ring technology reduces this downtime to within half a second. Experience indicates that the typical recovery time is 20 ms on average for a Cyber-Ring fault-tolerant network.

Features

- High reliability and fault-tolerant
- Real-time performance
- Scalable and fl exible ring topology
- Cost-effective industrial redundant Ethernet solution
- Plug and play

Recovery Time

The recovery time of Cyber-Ring network consists of two parts, fault detected time and reconfiguration time. Recovery time of Cyber-Ring network is associated with the number of switches of the network and Cyber-Ring technology offers a variable preconfigured recovery time to support a wide range of number of switches. Typically, the recovery time of Cyber-Ring network is less than 100 ms.

Fault Detected Time
Fault detected time is defined as the time from the occurrence of the fault until fault is detected. There is a master switch of Cyber-Ring network checks the health condition of Cyber-Ring network periodically. If active path dose not response after a preconfigured period of time, the master assumes that active path is failed and invokes reconfiguration mechanism to redirect traffics to the backup path.

Reconfiguration Time
The reconfiguration time of Cyber-Ring network is less than 5 ms per switch. For example, a Cyber-Ring fault-tolerant network that is comprised of ten switches, the expected worst case reconfiguration time will be 50 ms. When a fault is detected, the Cyber-Ring network will reconfigure to provide alternative traffic path of the ring within 50 ms.

Network Topology of Cyber-Ring

Network topology refers to the way in which the network of switches and other network nodes is connected. In a Cyber-Ring network, every switch or network node has two adjacent neighbors for communication purposes. Cyber-Ring supports a variety of ring network topologies including Single Ring, Dual Ring and Double Ring Coupling with fault-tolerant capability. The following sections describe in more detail the benefit of those topologies.

■ Single Ring

Figure 1

A Single Ring network topology based on Cyber-Ring technology is an effective solution to meeting the requirements for link-loss backup in industrial field

applications(refer to figure 1). In normal operations, traffic on the backup path is either blocked or ignored, so that if there is a failure in any of the network nodes or within a cable segment on the active path, Cyber-Ring will automatically redirect the disrupted traffic to the backup path. After the affected path is repaired, the network will again be reconfigured to normal operational status.
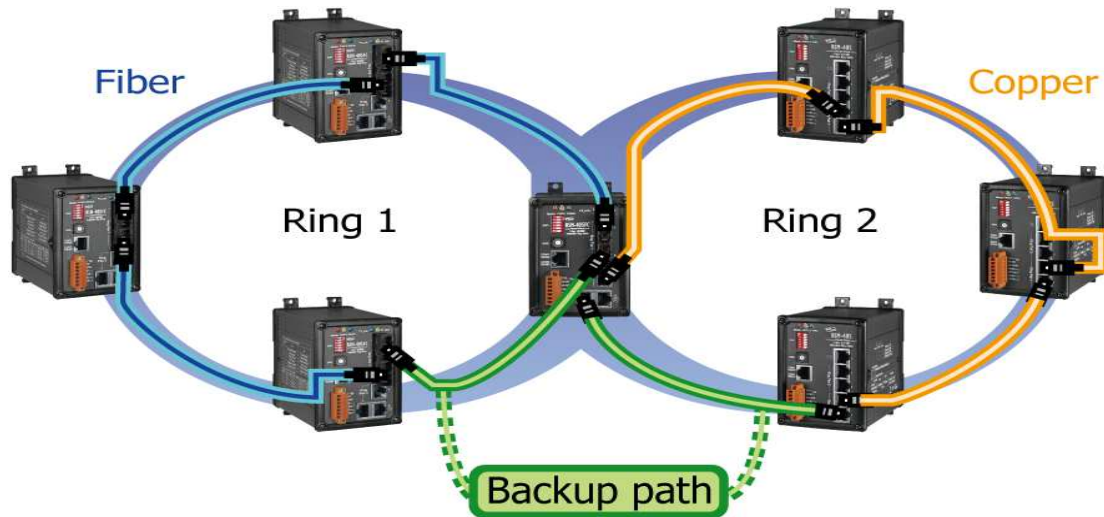
■ Dual Ring

Figure 2

The Dual Ring topology can connect separate Cyber-Ring network together (refer to figure 2). It is ideal for two-floor application scene. The Dual Ring topology not only construct individual Cyber-Ring network for each floor but also provide backup path to each other. It is a cost-effective solution to coupling ring topology.
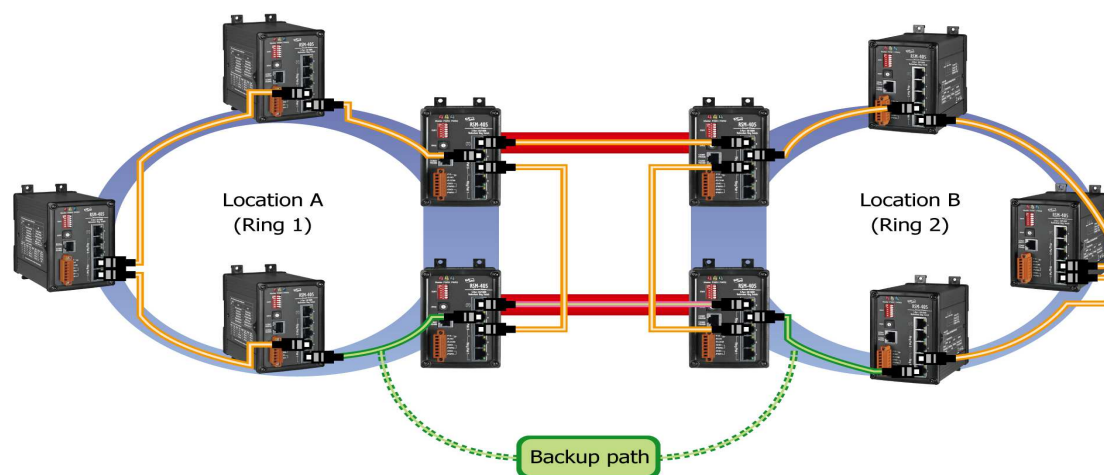
■ Double Ring Coupling

Figure 3

Double Ring Coupling is the enhanced version of Ring Coupling topology (refer to figure 3). It improves the reliability of Ring Coupling topology. In Double Ring Coupling topology, there are two coupling points providing redundant coupling path of two rings.
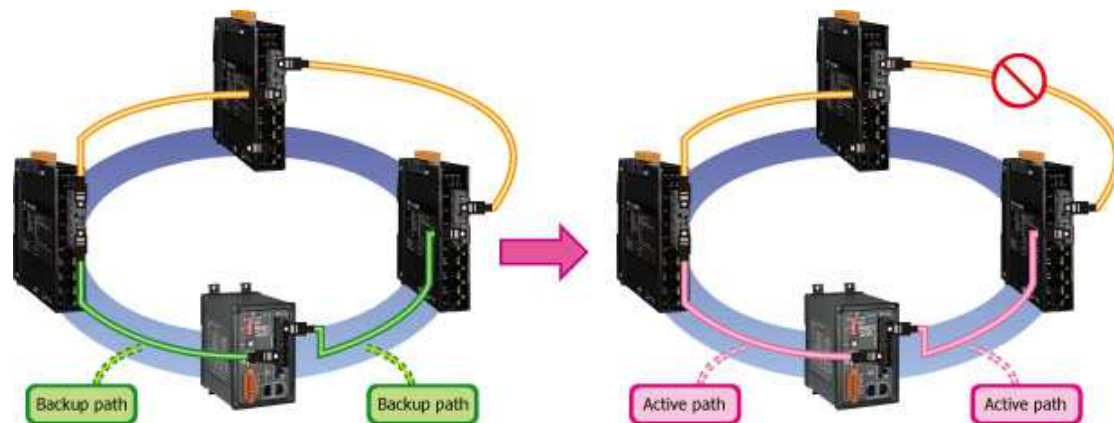
■ Solo Ring

Figure 4

A Solo Ring network topology based on Cyber-Ring technology is a cost-effective solution to meet the requirements for link-loss backup in redundant network applications (refer to figure 4). Compared with other ring topology, Solo Ring is composed of ONE ring switch and unmanaged switches (NS series), there is some limit of this topology - longer recovery time and the ring switch is used to close ring topology only. The Solo Ring is most cost-effective redundant topology of Cyber-Ring technology.