Honeywell

Fault Tolerant Ethernet Delivers Robust Networking Solution for Experion PKS

Fault Tolerant Ethernet (FTE) is the control network of the Experion® Process Knowledge System (PKS). FTE is dedicated to providing not only fault tolerance, but also the performance and security required for industrial control applications.

Industrial Network Robustness

FTE unites Honeywell's expertise in designing robust control networks with Ethernet technology in a patented advanced networking solution. FTE leverages commercial Ethernet technology found in IT networks to lower the costs of the FTE network infrastructure, connections to IT networks, connections to third-party Ethernet devices and ongoing maintenance and support.

Features and Benefits

- Four communication paths between FTE nodes

- Tolerates multiple failures in cables and electronics

- Rapid fault detection and recovery

- Transparent to PC applications

- Allows normal (non-FTE) Ethernet nodes

- Online addition/removal of nodes

- No proprietary hardware

- Minimal overhead—no duplicate messages

- Fully distributed—no master node

- Easy configuration

- Fast 100/1000 Mbps performance

- Fiber optic or shielded copper cable for noise protection

- CE-Mark compliant

- Full suite of services available for network engineering, installation and management

Fault Tolerant Ethernet components

Single Network Provides Rapid Response

Conventional Ethernet redundancy schemes commonly employ two separate Ethernet networks with each node (server or station) connected to both networks. If a communication failure occurs, the elapsed time for a particular node to switch to the other network can be over 30 seconds, depending upon the network complexity and the equipment used.

Honeywell's FTE solution employs a single network and does not require a server or station to re-establish its network connection. As a result, the switchover time is typically under one second.

Full Hardware Redundancy in a Single Network

FTE's single network offers significant advantages. Two independent networks will inevitably have some differences in configuration and performance. A single network is simpler to manage because its configuration and performance are consistent. Analytical, diagnostic and security tools can access all equipment in the network from a single connection and can readily provide a perspective of the entire communication system. Nodes can typically switch much faster between ports on the same network than between ports on different networks.

FTE's hardware redundancy provides multiple-path capability through its unique topology: two parallel trees of switches and cabling are linked at the top in order to form one fault-tolerant network. In this way, switches and cables are fully redundant within a single network. The separate identity of each tree is maintained by color coding and tagging cables, switches and FTE node ports.

Each FTE node has two ports that connect to a switch in each tree. Ethernet nodes can connect to either tree. There may be one or more levels of switches, as well as multiple pairs of switches at each level, according to the needs of the application.
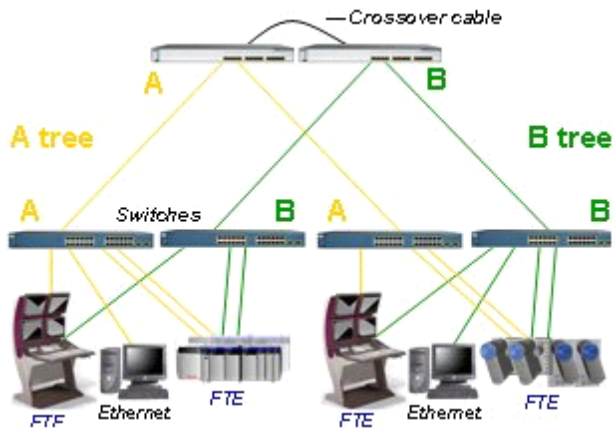
FTE's parallel tree topology provides full redundancy in a single network

The parallel tree topology provides multiple paths between an FTE node and any other node, as well as allowing every Ethernet node to communicate with every other Ethernet node—no matter where in the network the nodes may be connected.

## Multiple Communication Paths

With twice as many communication paths between nodes as dual LANs, FTE tolerates more faults—all single faults, as well as many multiple faults. Nodes in an FTE community continually check the status of each path.

| Connectivity	FTE	dual
Number of networks	1	2
Number of communication paths between:		
- FTE nodes	4	2
- FTE and Ethernet nodes	2	1
- Ethernet nodes on same tree/network	1	1
- Ethernet nodes on different trees/networks	1	0

FTE provides more communication paths with one network than conventional dual LAN redundancy

Each FTE node has two connections to the FTE network. Even singly connected Ethernet nodes with no FTE hardware or software benefit from being in an FTE network. Though Ethernet nodes are not aware of the FTE community, the FTE nodes are aware of them and support two communication paths to each Ethernet connection. Ethernet nodes also enjoy a more available communications environment. In conventional dual-network redundancy schemes, single-connection nodes on different networks cannot communicate. In an FTE network, all nodes can communicate wherever they are connected.
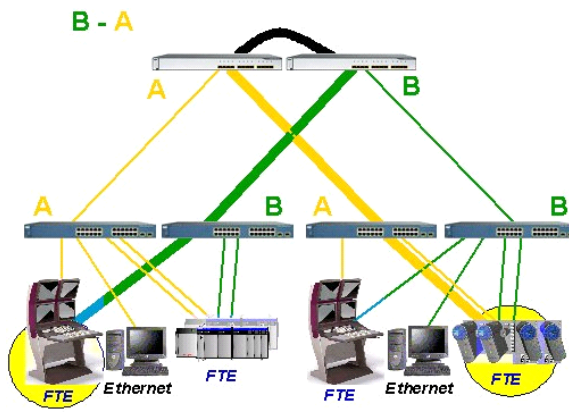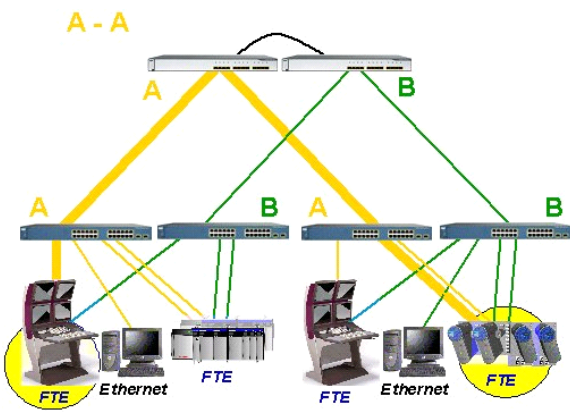
FTE is also transparent to higher level application programs in FTE nodes. Without requiring additional software configuration, those applications also benefit from the high network availability that FTE provides.
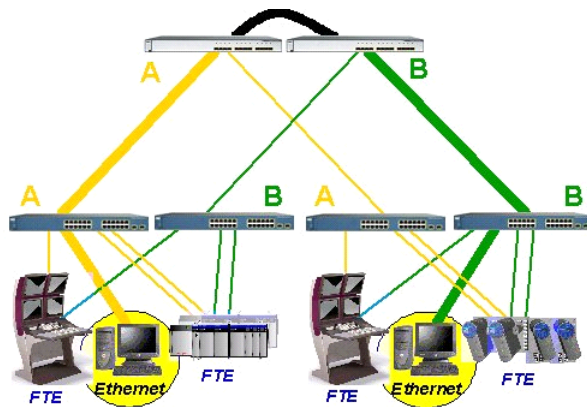
FTE provides one path between Ethernet nodes
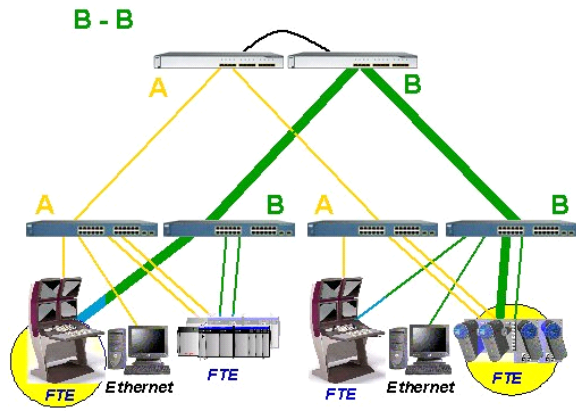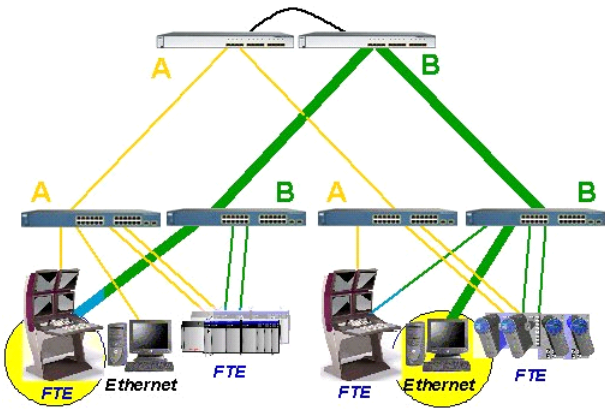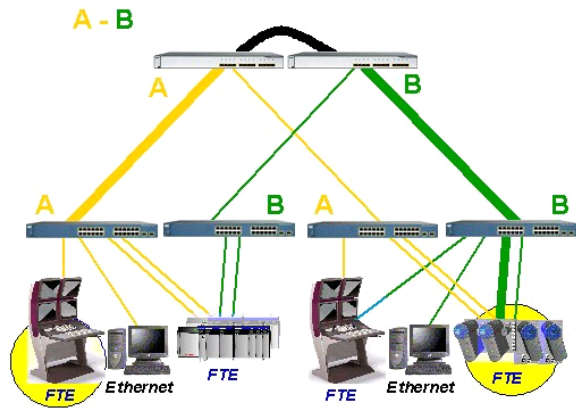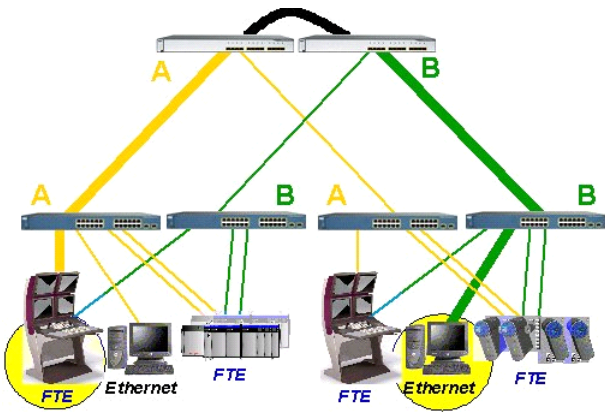
FTE provides two paths between an FTE node and an Ethernet node

FTE provides four paths between FTE nodes

Flexibility and Performance

Each switch port can be configured for 10 or 100 Mbps as needed for its node. Because FTE is a fully switched network (no hubs), multiple messages can be processed at the same time. For example, a 24-port FTE switch can support up to 12 simultaneous device-device conversations.

An FTE network can be implemented with copper or fiber optic cabling. Both 100 and 1000 Mbps connections are available for uplinks between switches for distances ranging up to 70 km, to support a wide range of application topologies.

Honeywell offers fiber optic and shielded copper cables for reliable operation in high-noise industrial environments, and to meet CE Mark requirements where applicable.

Designed for Determinism and Security

An Experion system may include loop controllers, fieldbus and I/O modules, operator stations, supervisory controllers and servers. For determinism, the FTE network ensures that each device only sends and receives message traffic appropriate for its type, so that all devices can have the required bandwidth.

Security is designed into the FTE network, not added on. The Series C Control Firewall blocks inappropriate messages from reaching Level 1 control and I/O devices. FTE switches are configured so that only the servers can be accessed from a higher level network such as the Plant Information Network (PIN). Firewall/router configuration ensures that only designated PIN nodes can access Experion servers.

Honeywell's network services organization can provide consulting, installation and support services for firewalls and routers, as well as other network components.

## FTE Equipment Summary

FTE Software

- Patented fault tolerance logic
- Fast switchover
- Multiple communication paths for multiple fault tolerance
- Extensive diagnostics to reduce maintenance costs and troubleshooting time
- Network status and node status displays

Network Interface Controller (NIC)

- Dual port card for performance and minimal PCIe slot consumption

Switches

- 10/100 Mbps ports
- 100/1000 Mbps uplink options
- Powerful multiple processors for high performance operation
- Runtime diagnostics to detect and isolate noisy cables and jabbering nodes
- Remote management functions for remote diagnostics and configuration
- Advanced functions for determinism and security
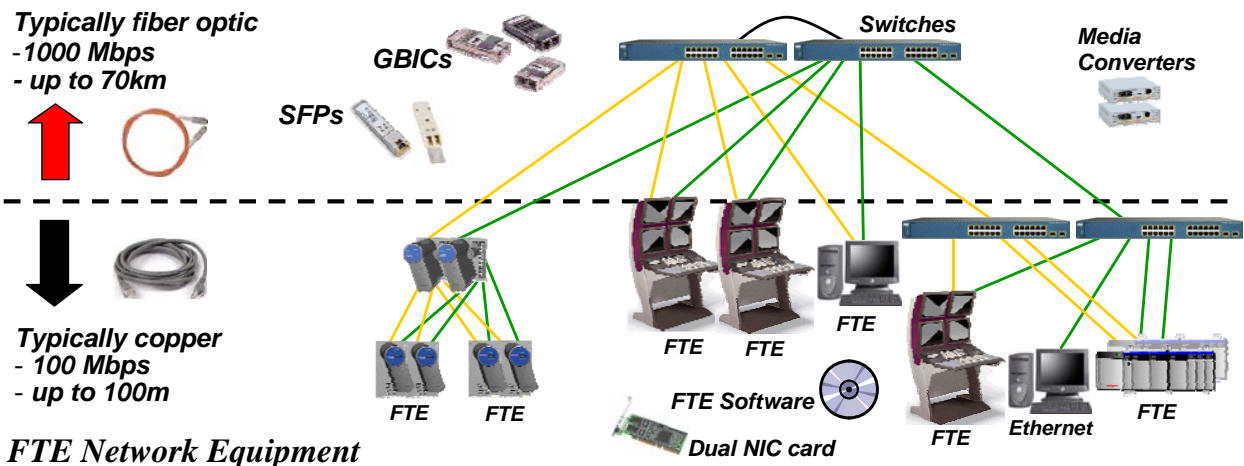
FTE Network Equipment

Media Converters

- Convert between copper and multimode fiber optic media

- Provide flexibility for varied application requirements

Cables

- Shielded copper cable for reliable operation under plant electrical noise

- Single- or multi-mode fiber optic cable for complete electrical isolation and longer distances

Each FTE node contains software that reports the status of its four communication paths to each other node as determined by short messages that are regularly sent along each path. The status of each node's paths can be viewed from the FTE Status Display.

The FTE Status Display is a component of the Honeywell System Management Display software, which operates within the Windows Microsoft Management Console (MMC) environment.

The System Management Display can show not only FTE status but also many other types of system information. It is a software package separate from FTE which can be loaded onto any node in the FTE network.

Shown below is an example of an FTE Status Display. Since node FTE-APP59 has been selected, the columns A->A, A->B, B->A and B->B show the status of FTE-APP59's communication paths to every other node (A and B refer to the A and B trees of the FTE network).

If another node such as FTE-GUS34 were selected, the FTE Status Display would change to show the status of FTE-GUS34's paths to other nodes.

The FTE Status Display can monitor not only the communication paths from an FTE node to other FTE nodes, but also to Ethernet (non-FTE) nodes. In the FTE Status Display, a 1 in the column Num Interfaces indicates an Ethernet node with a single connection, so some communication paths to it are shown as N/A (not applicable).

It is also possible for the FTE Status Display to monitor the status of the communication paths from an Ethernet node to other nodes. Even though an Ethernet node has no FTE hardware or operating software, the FTE status reporting software can be loaded into it so that it too can send messages and report the status of its communication paths. The FTE status reporting software is available free of charge in order to facilitate providing the status of all nodes in the FTE network to the System Management Display.

Network Services Available for all FTE Needs

Honeywell has an outstanding network services organization that manages all aspects of Ethernet systems, from a small process control system to a total enterprise. Honeywell's network services organization can meet all your needs for FTE, as well as for all other networks in your plant.

PdTag	Device Index	A -> A	A -> B	B -> A	B -> B	Num Interfaces	Interval	Dup State
FTE-APP59	59	OK	OK	OK	OK	2	1000	No Duplicates
FTE-GUS34	34	OK	OK	OK	OK	2	1000	No Duplicates
BC1-APP62	0	OK	OK	N/A	N/A	1	1000	No Duplicates
BC1-GUS28	0	OK	OK	N/A	N/A	1	1000	No Duplicates
BC2-APP61	0	OK	OK	N/A	N/A	1	1000	No Duplicates
BC2-GUS31	0	OK	OK	N/A	N/A	1	1000	No Duplicates

FTE Status Display

Honeywell Network Services include:

- Network planning, design, installation, and integration—including all cabling, racks, testing, training and documentation.

- Security assessment and engineering—including authorization, authentication, encryption, activity logging, intrusion detection and virus protection.

- Firewall engineering, configuration, testing and management—providing secure remote access to a customer's network from anywhere in the world.

- Remote monitoring of customer networks around the clock—ensuring all components are operating properly, including:

  - Networks (switches, routers, firewalls)

  - Systems (Experion, TPS, PlantScape, PHD, servers, any type of PC)

  - PC applications (running and responding)

- Network Performance Management--supporting optimum operation by proactive tracking of network component performance.

- Remote Network Administration—ensuring correct installation of updates and configuration changes for components such as servers, switches, firewalls and routers.

- Procurement and support of PCs and network equipment in order to provide consistent operation.

- FTE Architecture Consulting Service—review and consultation via telephone on proposed FTE network designs.

- Firewall Design Service—a firewall secures and controls access to an FTE network from other networks. Honeywell's extensive expertise in firewall technology provides a firewall that is completely engineered and tested to meet project requirements for small networks of up to 20 nodes. Firewalls for larger networks can be quoted on request.

More Information

For more information on Honeywell's Fault Tolerant Ethernet, visit www.honeywell.com/ps, or contact your Honeywell account manager.

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