

Network diagnostics for industrial Ethernet

Integrating Ethernet with industrial automation has challenged both users and suppliers. Everyone recognises the need to reduce the complexity of using a network equipment mix from different suppliers but specialised Ethernet network software can ease the task considerably.

By Mark Fondl

Network support tools are usually divided into physical cable testing, communications evaluation, device set up and port configuration. The associated software tends to be designed for specific people and applications. Lower level tools can materially assist network technology dilettantes to fix problems fast where a more comprehensive set may simply sow confusion. A sort of negative analogy would be not having to send a PLC software programmer to fix a broken wire on the machine.

In early applications the PLC program was always blamed for a machine shutdown. Later it was found that providing basic tools for the plant floor offered a better means to support this equipment. Summoning up an IT person to handle simple Ethernet connection problems is definitely overkill. The evolution of network management has its roots in commercial user and network architectures. Traditional IT packages for front office applications fall short of ideal when applied at plant level for a number of reasons:

Architecture. The architecture of the front office is more centralised with most network wiring coming back to centralised equipment or IT

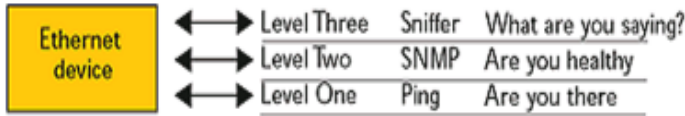
closets. On the plant floor the equipment tends to be distributed in electrical enclosures which contain the network switches as well as the automation devices communicating via Ethernet. Such enclosures can often be out-of-bounds to IT personnel since networking issues may also involve end node devices such as the PLCs, drives, and I/O.

Traffic patterns. The office environment typically has 80% of the devices connected acting as independent clients (individuals PC) and 20% as server devices (printers and application servers). On the factory floor there is a complete reversal in which 80% are serving information (PLCs, drives, bar code, etc.) and 20% clients (operator stations). The data flow is accelerating upwards from the lower levels, the reverse the office situation as multicast messaging at the I/O level increases with applications such as Ethernet/IP, ModbusTCP, etc.

Network support. Individuals in an office are not encouraged to troubleshoot their network problems. Plant floor people traditionally support their own networks and fieldbus applications. Many of industrial network glitches arise through connec-

tion problems caused by the harsh environment. Such Level One issues can easily be resolved with proper network tools.

Typical commercial packages list device information in a table. This may be suitable for networks with switches having large numbers of ports brought back to central locations but it barely deals with representation of relationships in large distributed networks.

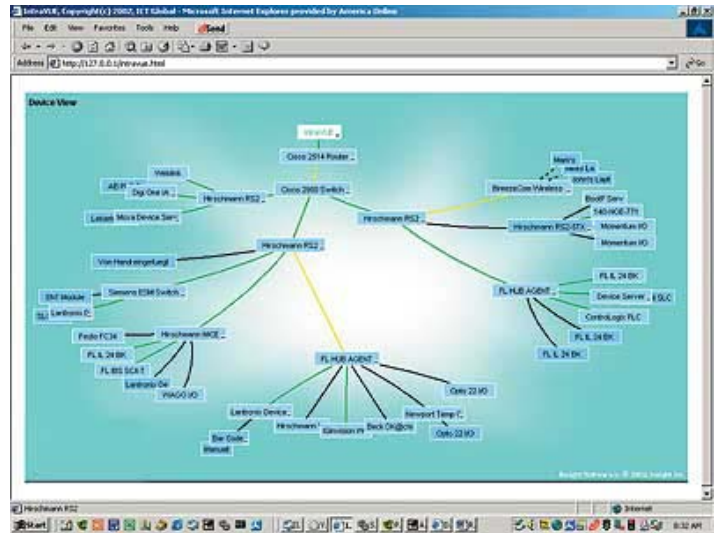


Simplified forms of network management functions. Plant floor network software tools will use Ping and SNMP to gain the necessary information for Level One support.

Distributed applications may be viewed with greater clarity if the identifying interrelationships between devices are made explicit. The screenshot from *Intravue* shows an example of a network displayed using hyperbolic visualisation. Clicking on a device opens up an embedded web page revealing the network management embedded in most devices. A web link could also direct the user to support documentation such as manuals, wiring diagrams, and operating procedures for each device.

Common problems

Intermittent communication loss brought on by a hostile environment tops the list of common plant floor problems. Dealing with it can be difficult and sometimes mystifying as it may appear and quickly disappear randomly. Typical faults include poor connections, failing NIC cards, bad ports on a switch. The origins of the problem are mostly mechanical: vibration and heat, but simple ageing of components or a combination of all may occur. EMI issues leading to intermittent communication failure are also high on the list of common culprits. Continually monitoring the network state by creating and writing to an event log can be very helpful. s check will highlight the problems as they occur over time for easier diagnostics.



A live graphical network view can help to sort out connections by colour coding and allows designation of switch identifiers such as IP, device name, location for troubleshooting (screenshot: IntraVUE).

Level One support for industrial networks should be able to spotlight problems in at least the following areas:

- Loss of device communication;
- Intermittent communications at or through a device;
- Connection information between devices;
- Indication of devices added or removed or moved;
- Network response times;
- Device IP address changes.

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