ARC White Paper

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Transparent Factory Meets Today's Emerging Automation Requirements

End Customer

Remote access to process & machine data
- **Production planning**
- **Quality management**
- **Supply chain management**
- **Collaboration**

Remote maintenance
- **Diagnostics**
- **Predictive maintenance**
- **Asset management**

Remote access to OEM / supplier database
- **Documentation**
- **User manual**
- **Spare parts inventory**

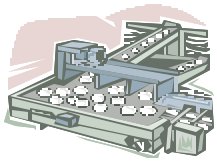
Transparent Factory

Support Global Operations

Improve Return on Assets

Maximize Machine Uptime

Continuous Improvement



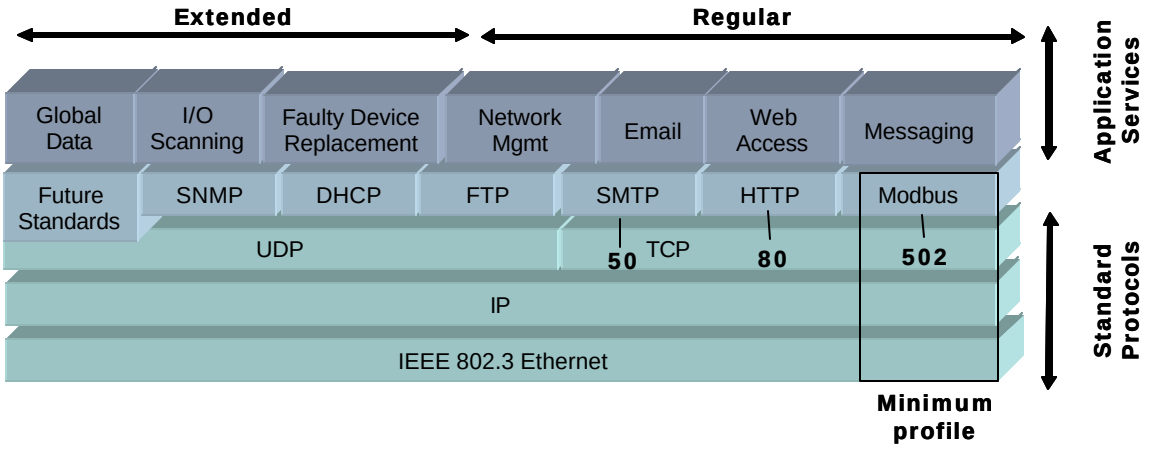
OEM Machine Builder

Remote support capabilities
- **Diagnostics, troubleshooting**
- **Remote alarming**
- **Predictive maintenance**
- **Download program updates**

Reduced support costs
- **Remote machine access**
- **Documentation, support materials available via web**
- **Multi-media (sound, video) for remote instruction**

Reduced development time & cost
- **Industry standard visualization**
- **Easily build custom views**

Transparent Factory Enables Both Manufacturers and OEMs to Achieve their Business Objectives



The Standards-Based Transparent Factory Architecture Offers a Tiered Approach that Enables Scalability and Migration of Legacy Systems

Executive Overview

Manufacturers today exhibit a renewed commitment to the need for automation systems to contribute to the strategic business objectives of the overall enterprise. Whether the mantra is Lean Manufacturing, Operational Excellence, or maximized Return on Assets, today's automation systems are expected to help fulfill high-level corporate objectives. This return to an emphasis on business contribution lies in stark contrast to the frequent pursuit of automation technology for technology's sake that characterized many purchases over the last decade.

Whether the mantra is Lean Manufacturing, Operational Excellence, or maximized Return on Assets, today's automation systems are expected to contribute to achievement of high-level corporate objectives.

In order to ensure that future automation systems enable achievement of corporate-wide objectives, manufacturers are increasingly translating the means of achieving these objectives into functional requirements that in turn drive automation system architecture and ultimately supplier selection. Consequently, traditional functional requirements such as stability, flexibility, and maintainability are now accompanied by the need to support global operations, enable global collaboration, and capture and dispense process knowledge wherever it is required throughout the global enterprise.

These emerging functional requirements are driving migration towards a new automation system architecture that is able to deliver the means necessary to assist manufacturers with achievement of their business objectives. This new automation architecture is distributed, modular, open, and standards-based. It is heavily reliant on IP-based Ethernet communications that allow it to provide remote capabilities and leverage the numerous advances taking place in the Internet and commercial networking realms. From an industrial automation perspective, it also provides the global data access necessary for efficient, collaborative communications.

Industrial Ethernet and the Internet are two of the key enabling technologies available today to assist manufacturers with interfacing their plant floor systems to other portions of the enterprise. Intelligent implementation strategies and increasing availability of industrial hardware have largely dispelled the myth that industrial Ethernet is not suitable for plant floor operation. The Internet's enablement of remote monitoring and diagnostic capabilities and the associated promise of maximum machine uptime

has alone driven many manufacturers, their OEM machine builders, and technology suppliers to investigate this technology for their installations. The good news is that both industrial Ethernet and web-based automation systems are available today from Schneider Electric, a pioneer who first brought Industrial Ethernet to the plant floor in 1996. Today, Schneider's Transparent Factory architecture offers an open automation framework based on Internet technologies that provides seamless communication between the plant floor and business systems.

Focus on Business Objectives Drives Automation System Requirements

Enterprise-wide emphasis on contributions to business objectives such as Lean Manufacturing, Operational Excellence, and Return on Assets (ROA) is forcing manufacturers to update the functional requirements of their plant floor control systems. These new functional requirements are spelled out in public documents, such as the OMAC User Group's *Baseline Architecture Functional Requirements*, as well as numerous private Requests for Quotation (RFQs) issued by individual manufacturers.

Functional Requirements

- **Supports global operations**
- **Able to capture process knowledge**
- **Enables collaboration**
- **Flexible, easy to use**
- **Stable**
- **Upgradeable**
- **Low Integration Cost**
- **Reliable; maximum uptime**
- **Maintainable, easy diagnostics**
- **Low cost**

Functional Requirements for Today's Automation Systems Reflect the Need to Contribute to Corporate Business Objectives

Functional requirements for today's plant floor automation systems continue to include stalwarts such as reliability, stability, and maintainability, but the emphasis on contribution to enterprise-wide business objectives has expanded this list to include capabilities that enable this renewed mandate. Manufacturers recognize that, in order to deliver on the promise of the global enterprise, today's automation systems must also be able to support global operations, capture and disseminate process knowledge throughout

the enterprise, and facilitate horizontal and vertical collaboration with both internal and external entities. Systems must also allow scalability in order to enable their application across a wide variety of potential installations.

For global manufacturers, this functionality is necessary to execute a common, proven strategy throughout their global operations. In recent years, expansion of the global marketplace and continuing refinement of manufacturing strategies has driven the desire to capture and commonize manufacturing processes and then export this common footprint to anywhere on earth. This globalization is concurrent with the need to collaborate internally and externally, as well as horizontally and vertically, using common business models, processes, and strategies as the enterprise-wide knowledge foundation.

When these emerging automation system functional requirements are translated into automation system architectures, they reveal the characteristics necessary for plant floor systems to fulfill their role in the collaborative enterprise. High on the list of requirements are aspects such as IP capabilities, global data access, and a standards-based architecture that allows automation systems to function as enabling platforms for enterprise initiatives.

System Architecture

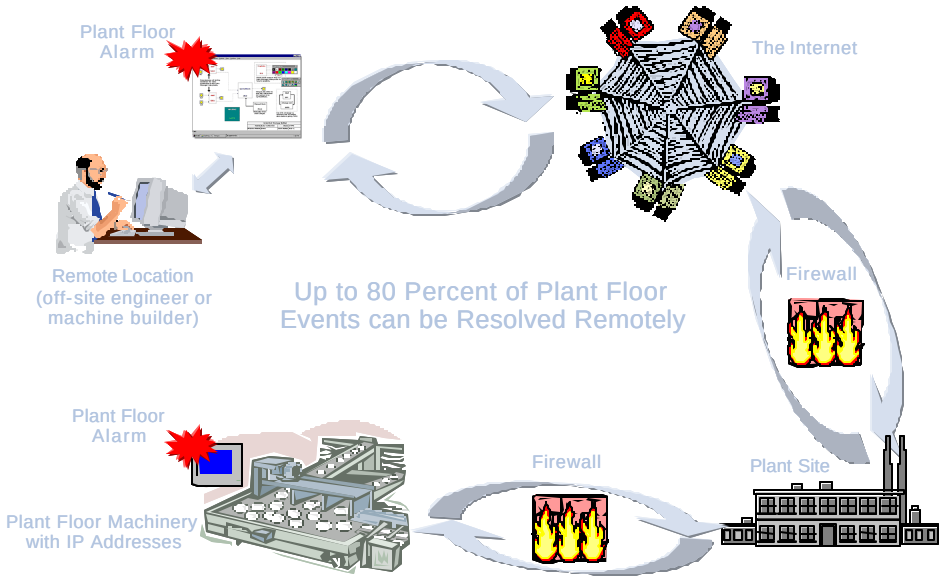
- **Distributed**
- **Modular**
- **IP-based Remote management**
- **Open or Common**
- **Multi-level security**
- **Global Data Access**
- **Standards-based**
- **Organizational implications**
- **Legacy migration**

Automation System Architectures Must Enable Fulfillment of Today's Emerging Functional Requirements

Remote Capabilities Enable Value-added Functionality and Deliver Cost Savings

IP-based remote management capabilities are a key emerging functional requirement for today's automation systems and one that is central to fulfilling the role of the plant floor in the context of the overall enterprise. This

capability, which leverages both industrial Ethernet and commercial Internet technology, benefits both manufacturers and the OEM machine builders who support them. IP addressing and the remote, web-based functionality it enables are a significant incremental value-add for industrial Ethernet relative to competing industrial or non-IP based Ethernet networks that cannot support this type of Internet functionality. In addition, an automation system architecture that relies on industrial, IP-based Ethernet throughout allows manufacturers to maximize these benefits relative to cascading industrial network architectures where Ethernet stops at the system level.



IP Capability Enables Remote Monitoring, Diagnosis, and Troubleshooting of Plant Floor Events by the Manufacturer and/or the OEM

Remote Capabilities Extend Operations Footprint

Internet-based remote capabilities are a key functional requirement for today's automation systems because they provide a platform for supporting global operations, improving ROA, facilitating collaboration, and continually improving operations. With remote access to data relating to both the process and its supporting machinery, manufacturers are able to globally and remotely monitor and manage issues such as production planning, materials replenishment, quality, and supply chain logistics. This type of remote capability also provides the means for commonizing operations and procedures to the extent possible on a global basis.

Significant near-term benefits are also available for manufacturers who have not yet reached the point of global collaboration. In fact, at ARC we find that most manufacturers are pursuing Internet capabilities in the near term solely to enjoy the numerous benefits associated with remote monitoring, diagnostics, and troubleshooting. This capability is pursued not purely for convenience, but also for the numerous cost saving benefits it offers.

Internet-based remote capabilities directly contribute to maximum machine uptime and improved ROA.

Internet-based remote capabilities help maximize machine uptime and thereby improve ROA by allowing remote personnel to assist in key tasks such as alarm response, diagnostics, troubleshooting, and predictive maintenance. Both manufacturers and their OEM machine builders know the high cost of physically sending someone to the scene of an offending machine or line, plus the cost of the associated downtime and lost productivity embodied in metrics such as Mean Time to Repair (MTTR). When you consider that up to 80 percent of plant floor downtime problems can be solved remotely, the potential savings of remote capabilities are readily apparent.

Manufacturers and/or their OEMs can use the Internet to set up remote alarming systems that alert personnel to current or potential problems via email. This capability can be used to push information ranging from alerts that the machine is off-line to prompts for scheduled maintenance. It also provides further example of how adoption of automation systems based on industrial Ethernet and the Internet brings the plant floor closer to the rest of the enterprise in terms of common platforms employed.

Remote capabilities are multi-dimensional in that they can provide remote access to the OEM or supplier's off-site database and its associated information about the system in question. This capability includes not only access to documentation and user manuals, but in some cases also extends to ability to access the supplier's spare parts inventory to determine availability of needed replacements.

OEMs Maximize Uptime and Reduce Support Costs

Remote access capabilities are a tremendous boon to OEM machine builders charged with following their manufacturing customers into the global marketplace while at the same time trying to lower their support costs. Internet-based automation systems offer OEMs the same benefits of remote

access for troubleshooting and diagnostics, but they also enable incremental functionality associated with ongoing support, such as the ability to periodically download program updates. A robust Ethernet infrastructure further allows OEMs to deliver high-value capabilities in the form of web-based remote instruction using multi-media sound and video.

Migration to a platform based on COTS standards can contribute to an OEM's bottom line by reducing development time and cost associated with machine configuration. For example, OEMs can implement browser-based visualization that is both easy to use and inexpensive to develop and deploy. Reliance on standards also makes it easier and less expensive to build customer-specific views on top of the standard technology.

Transparent Factory Delivers on Today's Automation Requirements

Schneider Electric's Transparent Factory (TF) platform is one of the few industrial automation architectures available today that delivers the functionality necessary to meet emerging manufacturing requirements. Standard interfaces that enable seamless integration between the plant floor and the rest of the enterprise are key enablers behind the collaborative automation architectures required today. The Transparent Factory architecture embodies Schneider's commitment to two primary technologies that enable enterprise-wide collaboration: Industrial Ethernet and the Internet.

Requirement	Transparent Factory Attribute
Remote Access	IP-based
Global Data Access	Publish-Subscribe Messaging (RTPS)
Standards-based	Ethernet IEEE 802.3, TCP/IP Suite, Modbus TCP, etc.
Stable	Close to 100k Modbus TCP/IP devices installed Over 1 Million serial Modbus devices installed
Scalable	Tiered service levels, low entry cost
Legacy Migration	Modular and stable architecture Modbus to protect installed base
Modular	Services embedded in communication modules
Maintainable	Web-based configuration, diagnostics, maintenance

Transparent Factory Meets Key Emerging Requirements of Today's Automation Systems

The TF concept marries the popular Modbus protocol with Ethernet TCP/IP, real-time publish-subscribe messaging with its associated Global Data Access, plus plug-and-play capabilities within the context of an open, standards-based automation environment that embraces third parties. Each of these attributes directly enables plant floor systems to deliver on the requirement to contribute to overall enterprise objectives by meeting the functional and architectural requirements of collaborative automation systems.

Reliance on a standards-based architecture lowers total cost of ownership through use of commercial components, lower training costs, and more widely applicable skill sets.

Transparent Factory's reliance on a standards-based architecture lowers total cost of ownership relative to proprietary architectures through commercial availability of components, lower training costs, and more widely applicable skill sets. Manufacturers and their OEMs are able to bring applications on-line faster through availability of standard browsers and pre-existing protocols and interfaces that eliminate the need to develop these typically non value-add components.

Ethernet Commitment Extends Throughout Architecture

While other automation suppliers may offer the option of Ethernet-based devices down to the I/O level, Schneider has made a definitive commitment to industrial Ethernet throughout the Transparent Factory architecture. This commitment enables vertical collaboration with the entire enterprise by providing seamless integration between the plant floor and IT. It also ensures that a full breadth of Ethernet-based products will be available – a feature that is already evident by the variety of TF-compatible PLCs, IPCs, drives, gateways, and other devices available now.

In manufacturing, the prospect of a single common network physical layer alone represents a huge improvement relative to past experience with proprietary networks, plus the larger Ethernet bandwidth allows the plant floor to pipe more information to data-intensive, enterprise-level applications. Transparent Factory heightens this value proposition by offering

both throughput monitoring of communication devices via the web capabilities embedded in the devices and enhanced network monitoring via a standard tool set.

Ethernet continues to penetrate the industrial networking marketplace due to its potential to provide a common enterprise network architecture, its status as an IEEE standard, and the prospects for potential savings and continual improvement as a COTS technology. A standards-based architecture is a necessity for future automation systems, and the combination of IEEE 802.3 Ethernet and Modbus TCP in the Transparent Factory platform addresses this requirement.

Modbus TCP Offers Low-Cost Entry to TF Architecture

Transparent Factory employs the Modbus TCP/IP protocol that is well-known in the industrial realm. Originally developed by Modicon in 1979, the cost-effective and easy to deploy Modbus protocol is now a de facto standard that rests in the hands of the Modbus organization. Modbus is enshrined in the IP protocol as Port 502, and therefore the protocol and its implementation are driven by the Internet Engineering Task Force (IETF). Long popular in the industrial automation space, there are over one million serial Modbus devices installed and close to 100 thousand Modbus TCP/IP devices. Over 300 Modbus-compatible devices are already available and a full 90 percent of 3rd party I/O suppliers support Modbus TCP/IP. Reliance on Modbus allows for a low entry cost into the TF architecture, since any Modbus TCP device or gateway is considered a TF device, the protocol itself is free, and information on it is widely available.

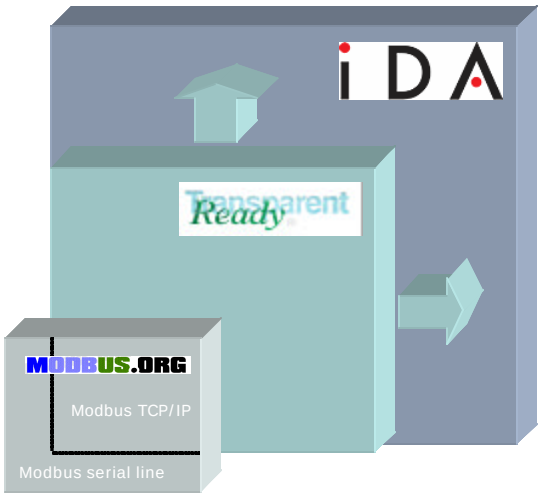
1.	Make Modbus a real standard that addresses interoperability issues rather than a de facto standard
2.	Make Modbus the only Industrial Internet protocol by making it part of the TCP/IP Internet Suite
3.	Promote use of the Modbus Protocol

Goals of Modbus.org

Global Data Access via Publish-Subscribe Messaging

Transparent Factory takes a step further with the addition of incremental services like publish-subscribe messaging and faulty device replacement. Publish-subscribe is a means to an end for manufacturers, with efficient Global Data Access as the ultimate objective. Global Data Access is necessary to enable today's automation systems to meet the current mantra of enterprise infrastructures: availability of any data, any time, anywhere, from any place, for any valid purpose.

Publish-subscribe is the current state-of-the art in industrial network communications. TF incorporates the RTPS publish-subscribe protocol from Real-Time Innovations (RTI), which is based on UDP/IP multicast technology already employed in Internet-based broadcasts of both audio and video. NDDS has already achieved widespread industry acceptance and is embodied in the Interface for Distributed Automation (IDA) group's industrial Ethernet specification.



Transparent Ready Leverages Standard Technologies to Cover a Range of Application Requirements

Publish-subscribe technology is elegant and efficient in that it allows devices to publish their information for use by whatever other devices on the network may subscribe to it, but the source device does not need to know what other devices are subscribing to its "publication." Conversely, devices subscribing to information from other devices on the network do not need to know what device(s) are publishing it. With the real-time publish-subscribe functionality employed in Transparent Factory, devices can be added to the network in real-time and receive their subscribed data the next time it is published.

Publish-subscribe is particularly attractive in automation applications because of its ability to support deterministic many-to-many communications and synchronization of the distributed applications required in today's automation architectures. The technical benefits of this approach are numerous and include the ability to publish to numerous devices with a single transaction, reduced network and PC load, automatic data transfer without the need for additional control or network code, and the automatic node discovery and reconfiguration capability commonly referred to as "Plug and Play." When combined with the IP-based Transparent Factory infrastructure, system developers can use the Internet to configure variables to be published from or subscribed to.

Faulty Device Replacement Enables Hot Swap

The addition of Faulty Device Replacement (FDR) capability in the Transparent Factory architecture brings Ethernet's capabilities closer to traditional industrial automation networks by allowing end users and machine builders to "hot swap" network devices as needed. FDR reduces the amount of Ethernet/Internet configuration knowledge required by the plant floor maintenance staff and allows for faster replacement of faulty devices, thereby minimizing machine downtime.

Faulty Device Replacement makes Ethernet look more like traditional automation networks in the ability to hot-swap devices.

The Transparent Factory implementation includes automatic parameter configuration that significantly reduces the amount of time and skill required to bring a device back on-line. Without this capability, a technician is required to either reconfigure the BOOTP server or enter the Device's IP address. In either instance device parameters have to be re-entered. In an FDR-configured system, the parameters of the client device are set and then automatically written to the FDR server, eliminating the need for re-entry.

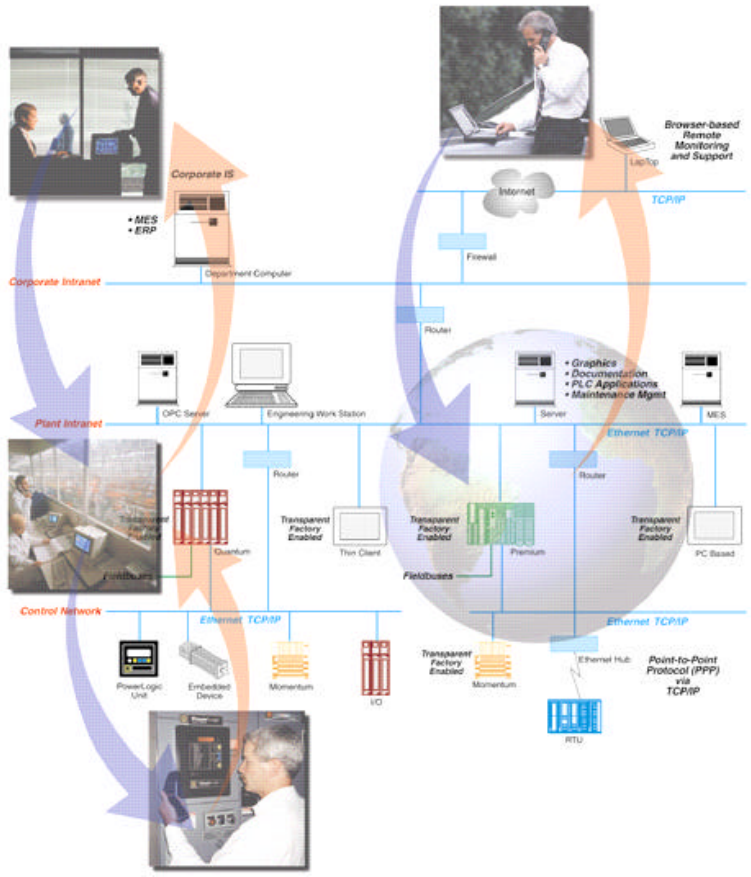
IP-Based Platform Enables Collaboration

Enablement of horizontal and vertical collaboration throughout the manufacturing enterprise is a central tenet of the Transparent Factory (TF) architecture. TF's combination of industrial Ethernet, the Internet, and overall reliance on standards enables both interoperability with other plant floor devices and vertical integration with business systems.

Manufacturers and their OEMs can use the Transparent Factory platform's enhanced, embedded web diagnostics for remote configuration and troubleshooting that improves maintenance response times and ultimately machine uptime. In the Transparent Factory environment real-time data for maintenance and diagnostics can be easily accessed via either predefined, embedded web pages or easily-defined custom pages developed by the OEM and/or end user.

Reliance on a standard IP-based infrastructure provides a significant incremental value proposition to manufacturers and OEMs, particularly

relative to the legacy practice of attaching serial modems to equipment in order to achieve remote access. With IP-based Ethernet systems, there is no custom software or drivers to develop and maintain in order to achieve the connectivity. Instead, users can employ standard browsers and the associated skill set that is increasingly common to both the automation and IT organizations.



Transparent Factory Enables Collaboration throughout the Enterprise

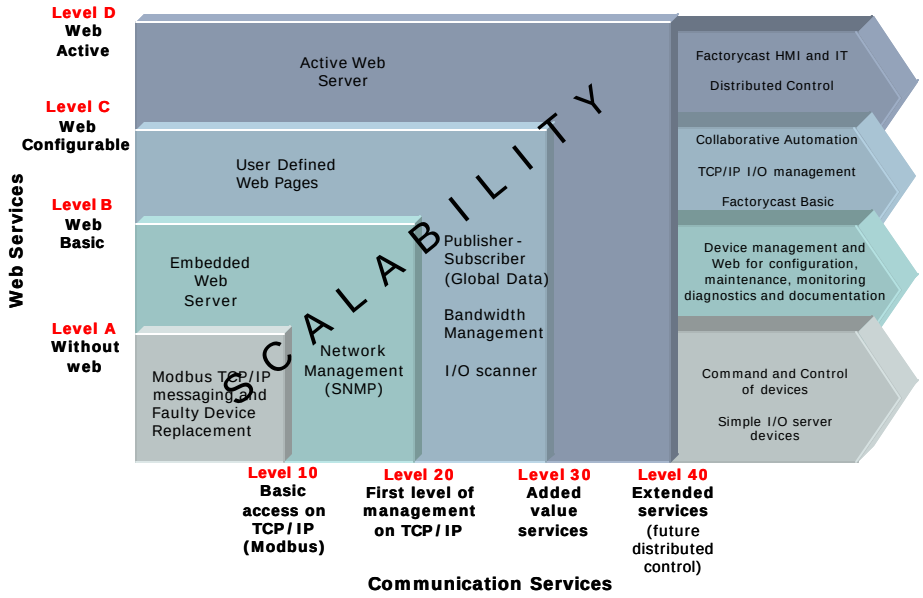
In a significant differentiation relative to the Internet offerings of other large automation suppliers, web access in the Transparent Factory environment extends all the way to the I/O level. The architecture further extends its potential functionality by allowing authorized remote personnel to perform tasks such as turning I/O on and off, which is distinct from the information-only capabilities of many of today's current Ethernet offerings.

At the CPU level, web servers reside separately from the control operating system, relieving concerns of some users as to the impact of web services on control execution. Almost every Transparent Factory device comes with

embedded web capabilities for configuration, monitoring, and diagnostics. Devices with Factorycast allow you to deploy your own web pages using either the out-of-the-box graphical data editor or any HTML editor.

Tiered Offering Enables Scalability

Transparent Factory's functionality is packaged in the form of tiered service offerings relating to both web services and communication services. In the TF architecture, the level of service compliance determines the level of interoperability. Service implementation classes range from basic interoperability over Modbus TCP/IP to full-blown, web-based distributed control and IT. Tiering the service offerings and the cost associated with them in this fashion allows for a low entry cost into the TF architecture, much of which is free due to its reliance on the commercial Internet. It also allows a wide variety of devices to be incorporated into the architecture, some of which could not justify the overhead associated with higher-level services.



Transparent Factory's Tiered Service Offerings Enable Scalability

For the Schneider Electric offerings, this means that Ethernet and the Internet are or will be available in most of the industrial automation and electrical distribution offerings, ranging from the small Momentum and distributed I/O products to the large Premium and Quantum PLCs, POW-

ERLOGIC Power Monitors, Altivar Speed Drives, and other products. This scalability allows the architecture to further extend to products such as circuit breakers, motor control centers, and other devices and systems.

For manufacturers and their OEMs, this translates to a decision as to what level of web and communication services to specify in your automated devices. For modular products, the various levels of compliance are available as options for the communications module while non-modular products have version numbers that reflect various combinations of services. Web services options range from web clients and basic web servers to active or distributed web servers. Communication services options range from basic Modbus TCP/IP services to expansive distributed services.

Modular Approach Incorporates Legacy Devices

Transparent Factory is delivered to modular products in the form of a communications module that contains all of the web and communication services associated with a particular level of value-added services. This modular approach means that legacy systems can be incorporated into the architecture either by replacing the communications module or via a gateway.

Given the maturity of today's installed base, ability to incorporate and/or migrate legacy systems, even via a gateway, is a crucial requirement. With the modular Transparent Factory approach, web servers can be added to existing installations. Within the Schneider legacy, Modbus 485 and other installed devices can be incorporated into the architecture through a gateway. Given the large installed base of Modicon products, it is not surprising to hear that the company recently integrated 30 year old 200 series I/O into a Transparent Factory installation!

End User and OEMs Validate the Transparent Factory Value Proposition

Transparent Factory embodies the automation architecture of the future, but it is already at work today in manufacturing applications. While the architecture contains universally-applicable tools and technology, Schneider Electric is specifically targeting the platform for use in four key

industry sectors: automotive, microelectronics, food and beverage, and pharmaceuticals.

Company	Application
Cargill Nutri Products	Processing Vitamin E from soybean oil
City of Holland	Water treatment
Energie Ouest Suisse, Grande Dixence S.A.	World's largest peak demand hydro electric power plant
Ford Motor	Material call system
Glaxo Wellcome	Validated pharmaceutical manufacturing
Hooper Engineering	Packaging machinery
Jaquar	Shop floor control
Lyonnaise des Eaux	Water treatment
Woolworth PLC	Building Management
Harpak	Packaging Machines
London Electric Services	Substation Monitoring

Transparent Factory is Targeted at Applications in Automotive, Microelectronics, Food & Beverage, and Pharmaceuticals

Automaker Jaguar relied on the Transparent Factory architecture in their migration from a centralized hierarchical production control system, like that used in production of their S type cars, to the modular distributed architecture desired for their £300 million X-type production plant in Halewood, UK. Control of the 236 robots in the new plant, which is capable of producing up to 45 cars an hour, requires thousands of control interlocks.

Jaguar felt that the modular systems connected via TCP/IP would take up less space and be easier to maintain. Ethernet's higher bandwidth means that plant engineers are no longer restricted to a maximum number of interlocks or nodes per section, plus any modular controller can interlock a signal to any other controller on the network without a physical change.

Transparent Factory gives Jaguar complete visibility and control throughout their X-Type plant in Halewood, UK.

The Transparent Factory architecture gives Jaguar complete visibility and control throughout the entire plant. For example, the Ethernet–based HMIs can access information from any device on the network. Reliance on commercially available

technology and tools made it easy to integrate, a key benefit in this large installation, and the simplicity of the architecture meant it could be implemented by traditional automation installers and not IT. One of the most telling aspects of this last point is that the installers relied on a simple *10 page* reference manual containing standard procedures, allowable configurations, and technical documentation – without relying on external references! Along with these present-day benefits, reliance on commercial technology is perceived as reducing the company's risk of technology obsolescence as they move into the future.

UPS Maximizes Limited Resources to Support Global Operations

United Parcel Service (UPS) has standardized on the Transparent Factory architecture due to its simplicity, openness, and reliance on commercially available components. For this global operation, these attributes, plus the remote access capability inherent in an IP-based infrastructure, translate to the ability to leverage a small resource pool to provide global support. The larger pool of available global support in the industry, plus the greater flexibility inherent in the architecture, are further key benefits.

Transparent Factory's simplicity allows both local and remote UPS personnel to easily build customized applications. The architecture's reliance on standard web tools translates to further cost savings in that some of their applications no longer require a dedicated HMI. Instead, simple applications can use the built-in browser-based capabilities.

Manufacturing's enterprise counterparts provided further impetus to migrate to an Ethernet TCP/IP-based architecture. Given the nature of the UPS application and the vast amount of data collection it entails, the enterprise team saw the tremendous amount of data available in plant floor devices. Transparent Factory's seamless architecture provides the infrastructure necessary for this type of vertical collaboration.

Remote Access Enables Packaging OEM to Extend Reach

The Transparent Factory architecture offers particular benefits to OEM machine builders looking to lower their support costs while broadening and quickening their support capabilities. OEMs with large global accounts are also better able to follow these global customers as they expand their operations around the world.

As a supplier to the pharmaceutical industry, Harpak leverages Transparent Factory's remote capabilities for clean room access.

Packaging OEM Harpak (fka Hooper Engineering) finds that using the Transparent Factory architecture in their machines translates to faster response times and lower cost of service. Ability to leverage IP-based remote access capabilities reduces the time to respond to, diagnose, and remedy a customers problem, plus they are able to provide remote downloads and modifications as needed. Given that the company specializes in packaging machines for food and pharmaceutical manufacturers, Harpak has further leveraged the remote access capability as a means of providing clean room access for machine servicing. This approach eliminates the prior need, cost, and aggravation of sending service personnel into customer's clean rooms.

Harpak's applications further validate Transparent Factory's ease of use, a key attribute in OEM applications. Reliance on a standard web browser largely eliminates the need for custom HMI generation, and no specialized software application or associated driver is required. As an OEM, the benefit of ease of use extends to Harpak's ability to have virtually instant access to any customer installation.

Schneider Electric is Transparent Ready

The Transparent Factory concept was first brought to market by Schneider Electric's Automation Business in 1996, but now the company as a whole has adopted the concept and made it a major corporate program called Transparent Ready. Transparent Ready integrates web technologies into Schneider Electric products to make them transparent for all authorized users, allowing fast, easy, shared information access from anywhere in the world at any time.

Architecture Component	Transparent Ready Common Elements
Network Infrastructure Components	Gateways, switches, hubs, wire, connectors
Components	Schneider Electric Products: PLCS, Power Monitors, Speed Drives, MCCs, Motor Starters, etc.
Services	Embedded Web Services, Communication Services, Network Certification Services, etc.
Software Engineering Tools	Embedded Web Tools (Bandwidth monitoring, etc.), standalone diagnostic tools, etc.
Ergonomics	Look & feel, displays

Transparent Factory Devices Apply Common Elements in Industrial, Energy, Building, & Infrastructure Applications

Transparent Ready products are deployed in solutions targeted at Schneider Electric's four strategic markets: Transparent Factory (Industry), Transparent Building (Buildings), and Transparent Energy (Energy and Infra structure).

Transparent Ready Describes the Integration of Web Technologies into Schneider Electric Products

A key value proposition behind this corporate-wide adoption of the Transparent Ready concept is that manufacturers will be able to implement a common, standards-based, tiered services architecture throughout their facilities. As the responsibilities of engineering groups increase in scope, this commonality across industrial automation, building automation and power distribution systems will result in lower support and training costs and higher facility availability.

Extending Capabilities beyond the Control System

Transparent Ready technology can be applied to the electrical power system, allowing the entire issue of power quality to be addressed by third party specialists rather than in-house.

Applying Transparent Ready technology for monitoring the electrical power system that supplies machinery and/or the process makes a wealth of valuable power data available to aid diagnostics and trouble-shooting. For example, an express shipping enterprise discovered that a drive had faulted due to a low-voltage condition. Using Transparent Factory's capabilities, this condition was instantly correlated with disturbance monitoring records that showed no such power-quality

event. The problem was then quickly determined to be a false indication due to a faulty sensor. Transparent Factory allows the entire issue of power quality to be addressed by third party specialists, avoiding the costs of developing such expertise in-house.

Schneider Electric Continues to Move in the Right Direction

Transparent Factory delivers the type of open Ethernet and Internet interfaces necessary to meet the requirements of today's automation systems. Since their first move toward Ethernet-based architectures in the mid-1990s, the company has added numerous additional capabilities to what is now called Transparent Factory.

This open, flexible, standards-based architecture is already helping manufacturers and their OEMS to achieve primary business objectives in areas such as Lean operations, higher return on assets, and ongoing Operational Excellence. Transparent Factory helps companies achieve these objectives by enabling global collaboration, support for worldwide operations, and providing a flexible, easy to use, and widely supported infrastructure that has a low integration cost and is easily maintainable.

Transparent Ready's open, standards-based architecture is already helping manufacturers and their OEMs achieve primary business objectives. Planned enhancements will only further this value proposition.

Transparent Factory will benefit from Schneider's continued evolution of the architecture, particularly the pending introduction of a high-level software tool for use by their Schneider Alliance partners and OEMs that enables system-level configuration. These emerging engineering environments allow developers to configure at the system level, rather than on a controller-by-controller basis. For example, in the current Transparent Factory architecture the developer must log in and out of each individual controller. Availability of a universal configuration environment will make developers' jobs even easier.

The next step for the Ethernet stack is to specify the upper layers of the Ethernet protocol stack that contain the object model, device profiles, and other elements necessary to deliver true device interoperability in a distributed control environment. ARC believes these capabilities will result from

the company's activities with the industrial Ethernet IDA group and its decision to embrace the Modbus TCP protocol.

Based on the group's current direction, their technology will further industrial Ethernet's incursion into the realm of real-time control as well as information collaboration. This type of support within the industry will add further to the pool of resources, tools, and products available to manufacturers interested in leveraging a standards-based architecture based on commercially available products.

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Editor: Dick Hill

Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/arcweb/Community/terms/indterms.htm

ANSI	American National Standards Institute
API	Application Program Interface
APS	Advanced Planning & Scheduling
B2B	Business-to-Business
BPR	Business Process Reengineering
CAN	Controller Area Network
CMM	Collaborative Manufacturing Management
CNC	Computerized Numeric Control
COTS	Commercial Off-the-Shelf
CPG	Consumer Packaged Goods
CPM	Collaborative Production Management
EAM	Enterprise Asset Management
ERP	Enterprise Resource Planning
HMI	Human Machine Interface
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPC	Industrial Personal Computer
IT	Information Technology
LAN	Local Area Network
OEM	Original Equipment Manufacturer
OLE	Object Linking & Embedding
OMAC	Open Modular Architecture Control (Users Group)
OPC	OLE for Process Control
PAS	Process Automation System
PLC	Programmable Logic Controller
ROA	Return on Assets
RFQ	Request for Quotation
ROI	Return on Investment
RTPS	Real-time Publish-Subscribe
SCE	Supply Chain Execution
TF	Transparent Factory
TMS	Transportation Management System
TR	Transparent Ready
WMS	Warehouse Management System

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