Vertical integration

TwinCAT OPC connected with SAP-R3

Without additional middleware software the connectivitiy between SAP-R3 system and Beckhoff TwinCAT could be accomplished by using OPC

*By Stefan Hoppe**

If it comes to high end components and systems for the automotive industry, the German Albert Weber GmbH is at its best: the product portfolio completes with cylinder blocks, cylinder heads, crankshafts, chargers, gearbox housings and other cubic parts.

To change a crankshaft production to a fully automated three shift system, the company started a pilot project with the manufacturing system suppliers SAP, Guedel in Switzerland and Beckhoff, in order to achieve a tight integration between the SAP/R3-System with the cell controller automation system, provided by Beckhoff on basis of standardized communication and computing technologies.

In case of the Albert Weber crankshaft production, seven cell computers control the manufacturing machines of the individual production cells with TwinCAT; the Beckhoff automation software for PLC and Motion tasks. Parts are transferred overhead via a transfer system – the primary loop – from machine to machine. Carrier robots travel autonomously on a rail system and communicate job orders via Wireless LAN (IEC802.11b). The Roboloop robots made by Guedel, are controlled by Beckhoff as well – in this case TwinCAT is used in an Industrial PC with Embedded NT operating system with a size of about 20 Mbyte on a flash drive media.

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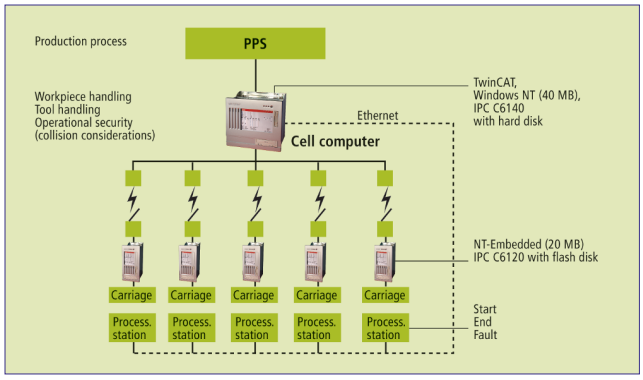

Basic communication principle of the "roboLoop" system

To exchange production data, a direct connection between the SAP/R3 system and the cell controller OPC servers was established, connecting about 3000 data tags.

New feature of this pilot implementation

New feature of this pilot implementation was the premiere of the OPC-Alarm&Event-Client of SAP: for SAP, Beckhoff's Alarm&Event server builds the reference. With the help of this technology, finished production steps create an event driven communication directly to the PPS system to initiate the sequence of commands for the individual production steps.

The OPC server of the production cell controller communicates via TwinCAT ADS layer with the automation software system. The TwinCAT IEC 61131-3 PLC and the motion control software with PLCopen compatible command interface build software control modules on a PC platform without further hardware use for sequence or motion tasks. To create a highly deterministic real time tick, TwinCAT does not require any additional hardware other than a PC. Messages are exchanged between software servers (for PLC or NC) via a standardized ADS-interface and protocol by a message router. The TwinCAT message router distributes messages system wide based on TCP/IP. The advantage of ADS proves in its flexibility: ADS allows for horizontal and vertical application-to-application communication throughout various platforms (Windows NT/CE, TCP/IP, various fieldbuses).

ADS enables the OPC server to communicate locally, network wide, or via fieldbus protocols to various automation software modules e.g. PLC, Motion Control. etc. In this way, TwinCAT avoids the well known OPC-DCOM problems: some platforms, e.g. Windows CE, do restrictive support DCOM, additionally, timeout events for interrupted media are not handled by DCOM in a way that would be appropriate for automation tasks.

With TwinCAT, the OPC-server has access to e.g. a Pocket PC like the IPAQ via a wireless LAN for diagnostic purposes. ADS allows for a wider variety of data compared to OPC: next to the typical PLC variables, complex operating system commands can be issued as well.

In this pilot project SAP collects PLC variable data via the TwinCAT OPC server and a dedicated OPC client, both running on the cell controllers. Status information of the assembly line, of individual manufacturing cells and machines as well as the E-Stop system status are communicated into the SAP PPS system. For material handling tasks, source and destination of product palettes cruising on the primary loop and the insertion of parts via the loop and cell interfaces are communicated by the PPS. Manufacturing and quality data, linked by serial number to each individual part, are documented and stored in the SAP-R3 system during the manufacturing process.

Without additional middleware software the complex interfacing task between the powerful SAP-R3 system and the manufacturing software TwinCAT could be accomplished by using standardized mainstream software technologies. The real time execution of automation tasks and the efficient ADS router guarantee fast data transmission without overhead and unnecessary load of threads to the Windows operating system. Interfacing problems are avoided by using the OPC standards for communication. The design of such a complex interface through a proprietary software driver would have resulted in a significantly longer implementation time.

PC based Control as an automation platform and the use of standardized communication technologies like OPC together with mainstream, powerful Industrial PC hardware with IEC 61131-3 automation software and Windows operating systems show their power end efficiency once it comes to deliver on the promise of integrated manufacturing.