Information Infrastructures for Utilities Management in the Brewing Industry

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Abstract. There is an increasing focus on sustainability in manufacturing industries. Operations management and plant/process control have a significant impact on production efficiency and hence environmental footprint. Information systems are an increasingly important tool for monitoring, managing and optimising production efficiency and resource consumption.

An advanced Utilities Management System (UMS), that operates on the G2® real-time intelligent systems platform, has been developed at the Yatala brewery, Australia. An important characteristic of the UMS is its strong integration with the existing information and automation systems at the plant. The tight integration was required to maximise effectiveness and ease of use as well as to minimise development effort and cost.

Keywords: Green manufacturing, Sustainability, Manufacturing, Interoperability, Industrial informatics.

1 Introduction

There is growing concern about the impact of anthropogenic emissions on the environment. It has been estimated that manufacturing is responsible for around 20% of anthropogenic greenhouse gas emissions [9]. While there is still considerable scope for traditional energy management programs, real-time information systems have the potential to improve the efficiency of operations. The convergence of resource management and plant control is an emerging area of focus. In

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general it is not well supported by the existing enterprise-control system integration hierarchy or by the contemporary automation toolkits. The presented information infrastructure has been specifically designed to address this opportunity. It facilitates the operation of existing manufacturing assets in a more efficient manner, presenting a financially appealing pathway to reduced consumption.

2 Utilities Management System

A Utilities Management System (UMS) has been developed at the Carlton & United Breweries plant in Queensland Australia. The purpose-built information system was seen as a way to monitor, manage and further improve the plant's emissions and utilities consumption.

The UMS operates on the G2® real-time intelligent system platform and is tightly integrated into the plant's existing automation infrastructure. It provides an array of modules that both directly and indirectly support various aspects of utilities management [6]. Some of the key modules are listed in Table 1.

Table 1. UMS modules

Modules
Energy management
Clean-In-Place (CIP) management
Operator decision support [5]
Automated assessment & reporting
Alarm notification & escalation
Operations management: brewing and process
Intelligent real-time diagnostics
Support for plant scheduling (automated data feed)

2.1 Information System Integration and Interoperability

While the UMS functionality predominantly presides on level 3 of the *ISA-95 Enterprise-control system hierarchy* [8] (along with Manufacturing Execution Systems) it also provides some of the resource management metrics that have traditionally been hosted by level 4 Enterprise Resource Planning systems. The UMS is based on a centralised client-server architecture that utilises an array of bridges to interface to the existing automation landscape at the brewery. At a functional level system integration is somewhat simplified as the relevant aspects of the plant's automation infrastructure are based on S88 and ISA-95 standards.

Some of the key features that are supported by the tight integration of the UMS with existing systems include:

1. **Data acquisition:** Autonomous access to real-time plant data
2. **Minimise data duplication, maintenance work and error:** (eg recipe information only has to be updated once in its primary application)

3. **Information delivery:** Integration with the Human Machine Interface (HMI) and standard platforms (including web, email and SMS) enables cost-effective and practical information delivery to users. The UMS supports information push: automated reports, real-time notifications and SMS as well as information pull (browsing).
4. **Machine to machine interface:** Wherever possible there should be no requirement for human input into data acquisition or information delivery. Current interface methods include CSV files (UMS to spreadsheet) and SQL (UMS to other databases/systems).
5. **Documentation & training:** Wikis are becoming successful and effective documentation tools in the modern enterprise [3]. Wiki links are embedded throughout the UMS to provide seamless access to documentation for the area/context that is required.

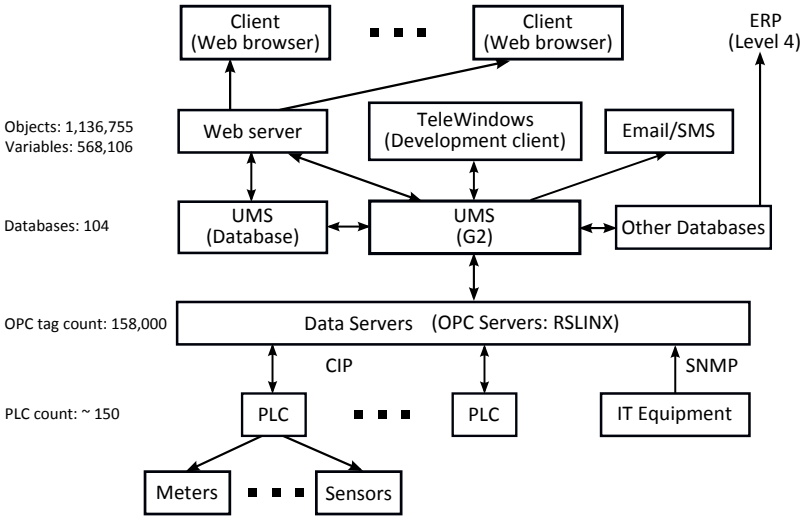

Fig. 1. Topology of the UMS illustrating integration with existing automation infrastructure. The figures on the left provide an indication of scale.

The topology of the UMS is depicted in Fig. 1. Some of the methods and protocols of system integration are illustrated in Table 2.

The UMS is used in a number of ways including: 1) Automated assessment and reporting of plant and process operations - to identify abnormal situations and to reduce the time taken to monitor plant performance, 2) Provision of an automated data-feed (of context-specific plant information) to improve the efficiency and accuracy of stocktaking and scheduling functions, 3) Automated mass/energy balance information with context-specific drill-down to support the user-pays utility consumption program across the plant.

Table 2. System integration

Information source/sink	Function	Method
Documentation	On-line context sensitive	Wiki (MediaWiki)
Sensor/meter	Real-time plant data	OPC, SNMP
Databases	Machine to machine transfer	SQL
Notifications	Information push	Email, SMS
Information presentation	Browsing (information pull)	Web (HTTP, JSP, Javascript)

3 Business Impact and Future Opportunities

The UMS has had a significant impact on the operational efficiency of the plant. Without it, additional resources would be required to achieve the plant's current level of productivity for scheduling, stocktaking and just-in-time production.

It has been instrumental in the Yatala brewery operating at or near world's best practice in a number of utilities indices including mains water at 2.2hl-water/hl-beer [7]. It has also recently facilitated a reduction in service water consumption of 0.14hl/hl. The UMS also facilitated a 57% reduction in caustic consumption (kg-NaOH per hl of beer) at the site [4].

Current activities include the implementation of functionality to monitor product loss and carbon emissions [6]. Work is also progressing on the deeper integration of the UMS with the existing RSView HMI platform. This includes using the HMI platform to present context-specific information (from the UMS) to the operators at the actual point of plant control.

Automation equipment manufacturers are continuing to host higher-level systems in the Programmable Logic Controllers (PLC) chassis. While this practice continues to blur the lines between the functional separation of the *ISA-95 Enterprise-control system integration hierarchy* layers, it has the potential to simplify the integration of systems at the point of actual plant control [2]. The application of the Internet and information systems to manufacturing (e-manufacturing) will also drive (and require) tighter integration between MES and supply chain systems [1].

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