

Integration of Production, Diagnostics, Capability Assessment, and Maintenance Information Using ISO 18435

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ABSTRACT

Emerging standards for the integration of production, diagnostics, and maintenance information (ISO 18435) will enable opportunities for improved supply chain collaboration and interoperability of diagnostics, control, and maintenance applications to support dynamic production requirements. Changing production requirements and disruptions encountered in the manufacturing process can be managed more effectively by using applications that are interoperable. ISO 18435 facilitates interoperability by defining a set of integration models and interfaces based on the enterprise-control system integration approach of ISO/IEC 62264 (ISA S95) and emerging standards for condition-based monitoring (ISO 13374). The recent publication of ISO 15745, Application Integration Framework standard, provides the basic integration framework for the interoperability of applications.

This paper will describe integration models and interfaces currently defined in ISO 18435 and identify applications that can utilize these interfaces to improve interoperability. Benefits of using these models and schemas are improved visibility to manufacturing management not only of the current state of the manufacturing assets, but also information about the capability of those assets to meet future manufacturing requirements. In addition, the use of common descriptions for asset types, locations, status, and capabilities will enable the use of standardized services to locate, assess, and repair manufacturing disruptions. Another added benefit is the ability to enable new technology insertion with minimal system design disruption. These models will present different user views for the manufacturing life cycle, as well as different use cases and interaction scenarios depending upon the role of the user (management, operator, maintenance personnel) involved in the system in order to improve the system reconfiguration management process.

INTRODUCTION

As manufacturers face more competitive demands on their enterprises, production efficiency improvements demand more visibility into and better management of manufacturing assets. Improved awareness about the capability of those assets to meet changing manufacturing requirements is equally important. These changing requirements can be caused by new customer demands, process upsets, or changes in equipment or process capability. In response to these changing requirements, a manufacturing system can be responsive and be dynamically reconfigured if it can have current information about the status and capability of the deployed resources. The information can be available if the deployed resources provide the required interfaces.

As shown in Figure 1, the production capacity for the manufacturing resources, excluding consumed materials, is depicted over time. The variations in height of the current available capacity indicate changes due to projected asset availability. The current unattainable capacity is due to down time for maintenance, mismatch in production capability and product mix, and other resource related issues. Ideally, the closer one can operate with the current committed capacity to the current available capacity, the more efficient the resources are utilized. Better management of the factors impacting unattainable capacity can improve confidence in the available capacity in the future.

$$\text{Production Capacity} = \text{Committed} + \text{Available} + \text{Unattainable}$$

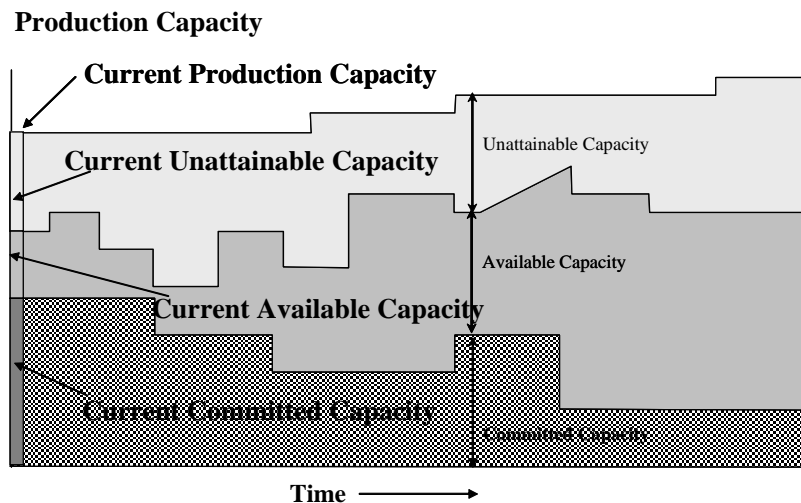


FIGURE 1 - PRODUCTION CAPACITY

Different operational and maintenance strategies can be used to ensure that the resources deployed are available when needed. In the past, preventive or reactive maintenance strategies were used to ensure the manufacturing assets were available when needed. More recently, the Condition Based Maintenance (CBM) approach introduced the ability to diagnose and perform maintenance based upon actual asset conditions and has enabled more responsive maintenance strategies. A goal of the emerging ISO 18435 standards activity is integrating CBM related information along with other operating environment information to optimize operating decisions for effective and efficient manufacturing.

The ISO 18435 project in ISO/TC 184/SC 5/WG 7 is intended to describe an integration model to identify the interfaces needed to improve and facilitate the interoperability of diagnostics, control, and maintenance applications. This ISO working group is collaborating with the related efforts of MIMOSA (Machinery Information Management Open System Alliance), ISA S95, and OPC.

Integration Benefits

While a typical asset management system can provide the current status of manufacturing assets to support a reactive maintenance strategy, better asset utilization can be further achieved by integrating information about current capability of these assets and their performance during production. Ideally, the effective and timely maintenance of these assets will enable these to provide the services required by the manufacturing production system.

Diagnostics and maintenance applications can use the information about the process, equipment, operator and materials that are already provided by many devices used for production automation and control. With the increasing use of digital signal processing in these devices, the analysis and processing of information can be performed closer to the manufacturing process. Information content originally considered as "noise" in the manufacturing process can now be more effectively analyzed. The information can be presented to other asset health and capability assessment tools via interfaces already present in the control system, without adding additional sensors.

Other benefits using the ISO 18435 framework that may be gained are as follows:

- Facilitate procurement of open, integrated systems by referencing pre-defined diagnostics and maintenance application interoperability profiles;
- Reduce time to assess the suitability of components to develop diagnostics and maintenance solutions using the framework;
- Provide and develop new diagnostics and maintenance products and services using the framework;

In Chapter 2, the approach, purpose, and scope of the ISO 18435 project is briefly described. Chapter 3 describes specific extensions to the IEC 62264[1][2] and the ISO 15745[3] standards to be used in the ISO 18435 project. In Chapter 4, a use case of this proposed scheme is presented. Conclusions and some future work are noted in Chapter 5.

2 ISO 18435 - Diagnostic, Capability Assessment, and Maintenance Applications Integration

2.1 Purpose and approach

ISO 18435 is intended to provide a framework for harmonized use of selected industry and international standards in order to enable device suppliers, system integrators, and application designers to apply common terms and rules for integrating control, diagnostics, prognostics, capability assessment, and maintenance applications. By using a common application integration modeling approach, key interoperability interfaces can be identified and concisely documented in terms of profiles. These application interoperability profiles can be used when evaluating whether applications can readily integrate with each other.

