SAP Manufacturing Service Oriented Architecture (SOA) Current and Future Strategy

Applies to:

SAP Manufacturing Software as of July 2009. For more information, visit the <u>Manufacturing homepage</u>

Summary

SAP software products have a strong focus around providing the ability to expose and consume services from multiple locations and systems within your corporate. The primary benefit from exposing various systems as "Services" is that you are abstracted from implementing point to point communication protocol specific capabilities to the underlying system. This may not seem like much until you apply it to a corporation with hundreds of individual systems with various versions and implementations of a variety of software products. This paper will discuss SAP's current and future Service Oriented Architecture (SOA) strategy related to the SAP Manufacturing Integration and Intelligence (MII) product. This paper will address how a service focused software environment can provide benefit for your business at both the Enterprise and Manufacturing level. It will also dive into the current and future manufacturing offerings to enhance the service integration capabilities of your existing manufacturing environment.

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Table of Contents

Executive Summary

When developing integrated business applications the need for simple communication from one system to another immediately presents itself. This fundamental requirement is the primary driving force for SAP Enterprise Service development and is targeted for the integration of both Enterprise and Manufacturing systems.

With the release of the SAP Service Repository a central system of record exists that provides a searchable interface to any standard or custom web service available to the application. When a system publishes to this repository it doesn't need to identify itself by product name or version, it only needs to provide a link to the service definition defined by the W3 standard Web Service Definition Language (WSDL), http://www.w3.org/2002/ws/desc, required to define the operation. The WSDL is a definition of the XML interface required to execute the service and it contains the target system information to send the XML payload to along with defining the XML response returned. This approach is comparable to registering your address and telephone number by your name in a phone book. The number is simply there to tell you how to call someone's phone based on their name but there's no indication on the service provider or brand of telephone.

So what does this mean for system integration and application development in your environment? One of the primary benefits of this design is a centrally managed system of record where Business Functions are defined and can be used by any service enabled application. This generic interface opens up these applications to a wide variety of business functions that previously would have required the development and maintenance of a variety of proprietary communication protocols. Furthermore this enterprise architecture provides an unprecedented level of abstraction from the underlying system or systems that are being integrated. With the generic XML interface it is possible to completely change the underlying systems involved without modifying the interface in which other integrated systems are using. This creates lower overhead and impact when decommissioning legacy systems & upgrading your current ones.

A service enabled corporate environment leads to a service enabled manufacturing, but the enterprise has to lead the way to ensure corporate execution standards. By providing easy to see benefit with little implementation overhead and a large return on investment (ROI) surrounding system integration a business case can quickly be developed. This is especially true when the integration of manufacturing facilities to the corporate enterprise systems is considered. A typical manufacturing environment includes an even larger conglomeration of systems than then enterprise does within a single facility and an even greater variety across locations. With the release of the MII product SAP has provided a path forward for manufacturing facilities to quickly and easily consume enterprise services and expose systems as services to the enterprise.

With SAP software in place it is possible to service enable a generic publish that exposes plant data metrics and its processes to provide a single unified version of the truth.

Enterprise Strategy

Overview

In a typical corporate environment for both large and small businesses it is common to see a conglomeration of systems from various vendors each with its own purpose for running your business. This hodge-podge of solutions occurs for a variety of reasons either through acquisitions or simply a "Best of Breed" software purchasing strategy. If you are one of the lucky ones with only one vendor for all of your software, and there are not many, then you still have a variety of solutions which are required to interact with each other. As a result of the system variety SAP has come up with a software solution strategy to reduce the overhead involved when streamlining your applications and business processes by integrating them together. The cross system integration allows your applications to leverage information from each other and provide you with a "Sum is greater than the parts" solution. One of the primary reasons for this is the time and talent overhead involved when manually combining information from a variety systems. What is meant by this is the time it takes for a person to perform the lookup combined with the training involved to teach them how to perform this task.

Technical Architecture

The implication of a single uniformed view of the business or "Single Version of the Truth" is a concept that has been and continues to be a cornerstone of the SAP software development strategy. From this the following system architecture has evolved around the integration model:
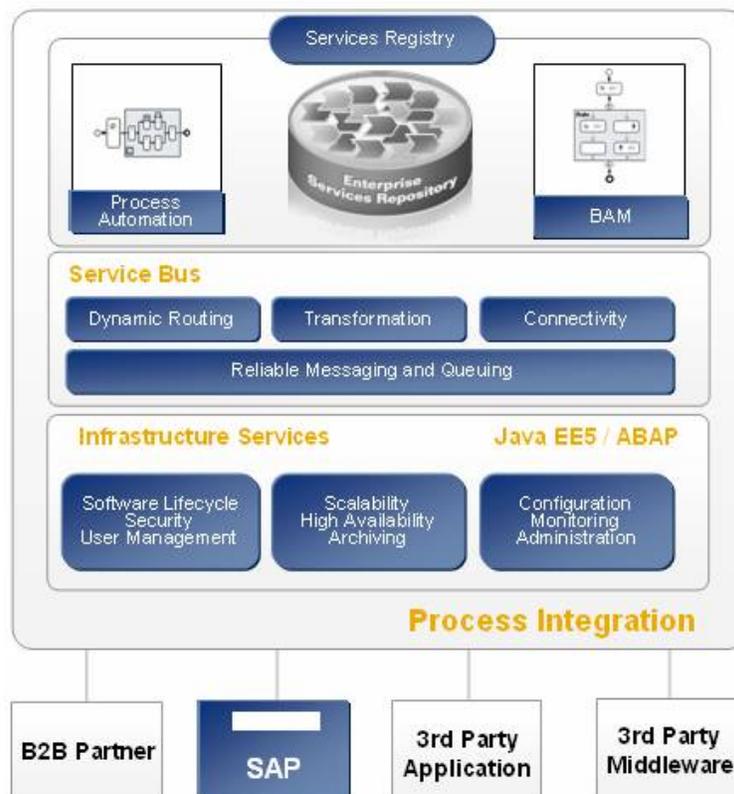

Diagram 1 - High-level SOA Integration

In the above image the reach of the Process Integration model touches each of the SAP and non-SAP applications through the same generic and standardized interface. Since the WSDL standard is not owned by any one company but rather is defined by the W3 organization, www.w3.org. The result of this is a technology standard is common ground for any application to interface to and provide interfaces for. With the release of the ECC 6.0 software there is support for standard and custom enterprise services to be provided to generically access corporate data. Up until this release a very similar but proprietary protocol for accessing corporate data was required through the use of the SAP BAPI/RFC interface.

Previously the business functions interface was via proprietary communication mechanisms (Business Connector, Java Connector, and Java Resource Adapter) are now exposed generically for all to consume, with proper security permissions. Since the previous technologies were still XML document based the transition from a BAPI/RFC call to a Service based one is relatively simple. The Enterprise Services (ES) documentation is provided in bundles in order to group them according to your business process needs and their documentation is provided on the SAP Developer Network (SDN) here: https://www.sdn.sap.com/irj/sdn/esworkplace. From this source it is possible to navigate to and display process information and along with scenario descriptions.

The various scenarios provided to the end user require the coordination of a wide variety of business users and roles in order to properly complete their execution. With the release of Business Process Management (BPM) as part of the NetWeaver Composition Environment (NW CE) a fully service enabled workflow tool is now available for process orchestration. The various BMP models can browse published services and consume them as needed. The workflow tool also provides task notification and the ability to trigger additional workflow operations. More information about this tool is available here: https://www.sdn.sap.com/irj/bpx?rid=/webcontent/uuid/90f7e38f-1169-2a10-d2bb-e3fbdd283a5a and a detailed description on workflow design standards and functionality can be found here: https://wiki.sdn.sap.com/wiki/display/BPX/Process+Modeling+With+BPMN. The workflow model is not limited to just the corporate environment and its intention is to span the boundaries of your business to enable people at the shop-floor to interact with the top-floor and vice-versa in a timely and traceable manner.

In looking at the current software offering the goals of future development become clear and they are to provide a standards-based environment that can be used as the foundation to unify your business applications and people.

Manufacturing Strategy

Overview

The current SAP manufacturing strategy utilizes but is not limited to this service approach as it is understood that there is still a need to support legacy customers. Since SAP utilizes the Manufacturing Integration and Intelligence product the service enablement of level 2 & 3 manufacturing systems has already been achieved. Any of these Web Services can be called synchronously or asynchronously and their results processed by the MII logic engine. Currently in MII v12.1 there is basic functionality available to the user to call any web service (SAP ECC, SAP PI, SAP BPM, or Third Party) as long as the WSDL is known during design or at runtime time. To obtain a WSDL from the Service Repository (SR) the user simply navigates to the web based front end via their internet browser, locates the service they wish to call, and copies and pastes the URL from their browser into the Web Service action. Once the action has finished configuration an XML reference structure is generated based on the WSDL which is very similar to how the JCo and JRA actions currently work. The following document provides detailed information on how to perform these steps, MII v12.1 How to Browse, Configure, Test and Consume an Enterprise Service. Since MII v12.1 runs on NetWeaver CE the integration to a site based BPM Workflow is also possible for local plant processes where multiple local people and local and remote systems are potentially involved. The integration landscape for MII looks like this where multiple systems can be communicated with through the use of the MII XML core:
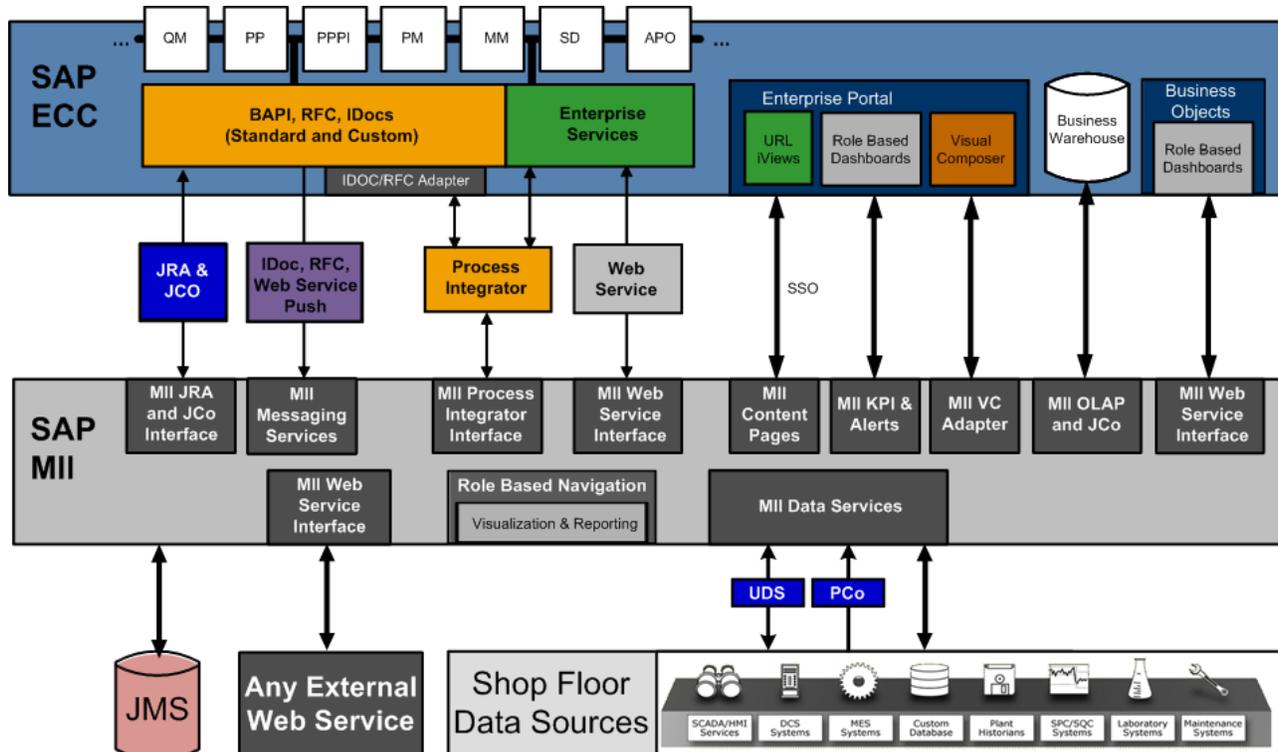
Diagram 2 - SAP Manufacturing Integration Landscape

The MII product provides a wide range of integration and presentation capabilities in order to fit the needs of a wide range of very diverse manufacturing environments. The ability to communicate, combine, and present information from one or more of the manufacturing systems can also be exposed by MII as a service or published in the central SR for other systems to consume. This capability further increases SAP's current offering of service enabled software products.

Future Development

Looking into the future of SAP manufacturing there is a lot of focus surrounding Services and simplifying the interface for consuming and providing services. These new features allow for business and not just technology savvy users to become more and more involved in the development of applications and processes.

One of the main improvements in the v12.2 release of MII is a semantic modeling layer known as Manufacturing Data Objects or simply MDO. These objects behave like a data staging area or a database table and are fully service enabled. One of the primary benefits is that their definitions will transport along with MII content and can be reported from in a generic fashion without requiring any deep technology knowledge as is required by a database. Each of these objects supports the ability to be registered in the Service Repository so that its contents can be shared at the enterprise level with other systems.

Another feature is support for Web Service Reliable Messaging (WSRM) in order to buffer service requests when communications are down. Reliable messaging is required for business critical data and there are specific actions designed to wrap this interface and present it in an easy to understand manner.

Also in v12.2, there is an additional Web Service action which has tighter integration with the SAP Service Repository (SR). This Enterprise Service action allows the user at design time from within the MII Workbench to Browse (Basic Tree Hierarchical Lookup) and Search (Advanced Pattern Matching) the SR for any registered Service (Standard and Custom). All of the aforementioned features of Asynchronous, Synchronous, and Buffered communication are available in this action block.

Each of these features plays an important role in service enabling an existing manufacturing environment in order to provide greater visibility into its operation at the local and global levels.

Technical Architecture

A typical manufacturing environment looks very different than a typical corporate environment when it comes to the focus of data and the total number and variety of systems. The application diversity present at a single manufacturing location typically exceeds the number of applications at the enterprise. Then if the cross site diversity is included the manufacturing environment quickly exceeds the corporate environment. Below is a typical manufacturing environment for only one location:
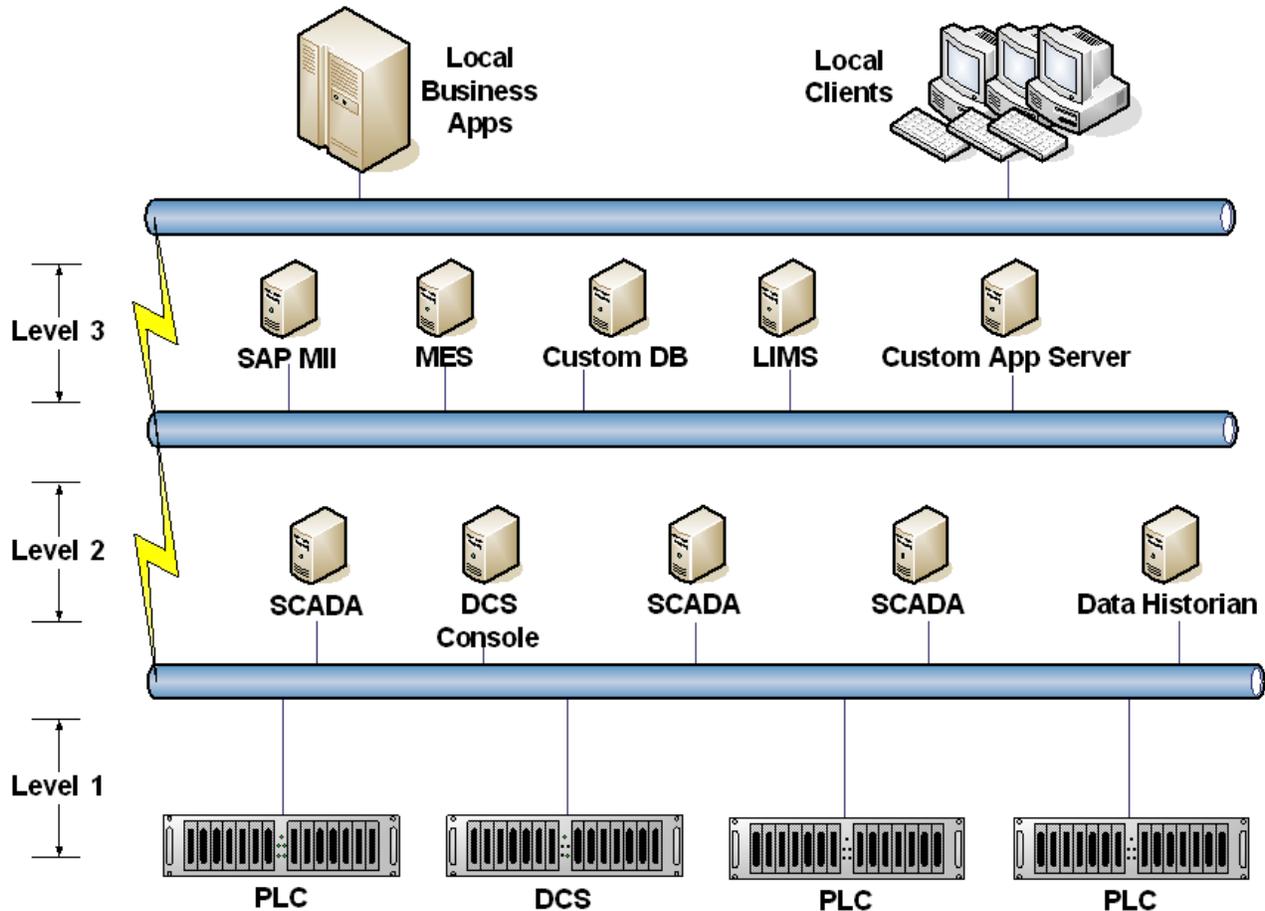
Diagram 3 - Typical Shop Floor Systems & Network Architecture

With this kind of diversity the need to provide some commonality and standard is even more valid when trying to provide a unified message or leverage data from multiple systems. This disconnect is the focus of the SAP Manufacturing strategy and will continue to be the focus of future software development.

The MII product has the ability to connect this wide ranging array of systems and present them in a generic form with no dependence on the underlying systems. This is achieved by the products ability to abstract itself from the nuances of these systems and communicate generically with them and also to allow its data to be generically consumed via services. The MII data services layer follows a one time setup and then a multi-reuse scenario so once communication with a system is established it can be used anywhere it is needed with the environment. This layer is powerful because it is based on open standards such as JDBC, OPC, OLEDB, JCo, JRA, and OLAP along with the ability to consume services and present all of this data internally as XML. It also provides both a synchronous query and asynchronous event triggering layer to fit a wide range of business needs and application logic and minimizes the impact on the underlying systems. Any application from a vendor whom supports these standards appears the same within MII as a generic XML data source. This allows for the data to be combined and manipulated from these sources without any knowledge required of these systems and only an understanding of the data values returned. As a result the ability to quickly involve business users in defining application integration requirements to drive ROI back to the business is possible.

Related Content

Enterprise Services Repository & Registry Help Documentation:
http://help.sap.com/saphelp_nwpi71/helpdata/en/c7/4ce1aa448945b5bdf51566b09b86e3/content.htm

Enterprise Services Wiki: https://www.sdn.sap.com/irj/sdn/esworkplace

MES Integration Services Wiki:
https://www.sdn.sap.com/irj/scn/wiki?path=/display/ESpackages/Integration+of+Manufacturing+Execution+Systems

MII v12.1 How to Browse, Configure, Test and Consume an Enterprise Service:
https://www.sdn.sap.com/irj/scn/go/portal/prtroot/docs/library/uuid/607557cd-37fc-2b10-9091-cb993c46b152

MII Forum: https://www.sdn.sap.com/irj/sdn/forum?forumID=237

- **Obtaining a Service WSDL URL**: https://forums.sdn.sap.com/thread.jspa?threadID=1130662

MII Wiki: https://wiki.sdn.sap.com/wiki/display/xMII

World Wide Web Consortium on WSDL: http://www.w3.org/2002/ws/desc/

Web Service Reliable Messaging: http://en.wikipedia.org/wiki/WS-ReliableMessaging

For more information, visit the Manufacturing homepage

Relevant SAP Notes

960040 **-** Using Enterprise Services

637388 **-** Enterprise Services Architecture: Delivery 6.20

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