PLM to ERP Integration – Impact to Manufacturing

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Presenter name:  Bryan Hanson
Presenter Title:  PLM Technologist @ Medtronic Inc.
Welcome
Introduction
Medtronic Overview
PLM -> ERP
EVERY 3 SECONDS ANOTHER PERSON’S
THAT’S ENOUGH TO REACH 10 MILLION
MEDIATEC PRODUCT OR THERAPY.
Founded in 1949
by engineer
Earl Bakken
and entrepreneur
Palmer Hermundslie
Less than a decade later

**Earl Bakken invented the world’s first wearable, battery-operated pacemaker**
Significant events in Earl Bakken’s life
A Pivotal Moment

When Earl saw the 1931 movie *Frankenstein*, he became fascinated with the idea that electricity could restore life.
Much of Earl’s childhood was spent wiring up his own creations, such as a cigarette-smoking robot and a private phone system to a friend’s house.
In 1957, University of Minnesota heart surgeon Dr. C. Walton Lillehei asked Earl to
develop a pacemaker that didn’t rely on AC (wall outlet) power.
An Unusual Influence

Earl’s inspiration for the new pacemaker was an electric metronome, which he had seen in *Popular Electronics* magazine. It took him only **four weeks** to create the device.
FROM HUMBLE BEGINNINGS

TO GLOBAL LEADERSHIP
140+ COUNTRIES
OUR MISSION has remained the same since co-founder Earl Bakken first wrote it more than 50 years ago.
THE MEDTRONIC MISSION
to contribute to human welfare by
application of biomedical engineering to
ALLEVIATE PAIN
RESTORE HEALTH
EXTEND LIFE
LEADING THE WAY

27,000+ PATENTS AND COUNTING

40+ MEDICAL CONDITIONS

1,000+ CLINICAL PROFESSIONALS

350+ CLINICAL TRIALS

5,600 SCIENTISTS AND ENGINEERS
CHANGING HEALTHCARE FOR THE BETTER
ALL OVER THE WORLD
AND ALL OVER THE BODY

- Spinal Conditions and Musculoskeletal Trauma
- Cardiovascular Disease
- Cardiac Rhythm Disorders
- Ear, Nose and Throat Conditions
- Neurological Disorders
- Urological and Digestive Conditions
- Diabetes
ADDRESSING THE NEEDS AND CHANGING HEALTHCARE FOR THE BETTER

IMPROVE CLINICAL OUTCOMES

EXPAND ACCESS

OPTIMIZE COST AND EFFICIENCY
“Across the world, we are in a continuous quest to improve healthcare.

People everywhere want better outcomes…

We’re developing medical technologies that not only improve healthcare, but do so while delivering better economic value.”

– OMAR ISHRAK
Chairman and Chief Executive Officer
Innovating for life.
Integrating from a PLM system to an ERP system impacts the manufacturing process with almost live integrations. Controlling the flow of data will avoid negative impact to ERP/MES systems for design changes, allow for ERP data setup, and manufacturing changes to be controlled.

Lessons learned from Engineering BOM changes at a productions status to controlling that change with the MCO process.
Medtronic has had ERP Integrations 20+ years

20 Years ago Medtronic had two main business units:
  Neurological
  Cardiac Rhythm Management.

The PLM system at that time was Sherpa
  Sherpa was integrated to JDE using flat file being sent to a FTP site where JDE would “process” the data. Basic Item and BOM data.

2003-4 Sherpa was retired for MatrixOne.
  ERP/JDE was updated to use XML Interface
  SAP Added to the ERP Integrations

2008 – MatrixOne upgrade to Enovia
  ERP Interface Redesign for SAP and Enovia XBOM (Mfg BOM)
Between 2003 & 2008, parts in Enovia underwent a number of lifecycle changes (Unreleased, In Review, Released, Obsolete) and design status (Conceptual, Development, Pre-Production, Production) changes.

“Conceptual” status is available for early design work.

“Development” status is required to make prototype build units.

“Pre-Production” status is required to make design verification and manufacturing process build units (Getting FDA Qualified).

“Production” status is required for human implants (clinical or market release).
The MatrixOne interface from 2003 had the following problems:

- No Effectivity date control on production level BOMs
- R&D Restricted in new component revisions by manufacturing.
- Shotgun change to ERP and MES systems.

Shotgun?
Engineering releases an ECO

- Medtronic’s ERP systems require Mfg facilities be identified at design for cost, supply chain and Mfg planning. The facilities are specified on the Engineering BOM.

- Engineering changes were immediately communicated upon ECO approval.

- Target systems can choose to accept the parts by filtering the data at the WebMethods level or business rules at the target system.

Note: WebMethods is Medtronic's Enterprise Applications Integration layer.
Between 2004 and 2008 Medtronic's manufacturing facilities on SAP had to implement a special team to prepare and review ALL ECO changes that impacted them.

These special teams:
- Cost Time
- Cost People
- Slowed down the process

Larger manufacturing facilities were moving to SAP, they demanded an improvement to the interface.
The 2008 Redesign Focused on:
• Design a PLM & ERP integration, which enables the effective synchronization between the engineering bill of material (BOM) and the manufacturing bill of material.
• Streamline the engineering and manufacturing change order process.
• Effective Date from PLM
• Free R&D to perform engineering changes without impacting manufacturing operations.
• SAP had no Queue

What's a Queue?
A Queue = Holds the data for preprocessing

Manufacturing (MES) always wants to control when manufacturing data is updated.
All Records stored in Staging Table (Staging Table is part of ERP functionality)
Record sequencing is done in Staging Table
Processing/ Transaction Logic is in ERP/Pre-processing Program
User Interface to select and apply Enovia Data
Custom error handling is built in pre-processing program
No automatic email Notification
Feeding the Queue

Control the Design Changes:

Enovia XBOM with Manufacturing Change Order Process.

MCO generation per plant from ECO. This allows Plants to control data flow. Engineering Changes will no longer immediately affect production.

Can use MCO rather than ECR/ECO to push out plant implementation date.
Engineering releases an ECO with design changes. Each Manufacturing facility can now control their change.

When the ECO is released, each facility specified on its parts will have an MCO generated.

The MCO will contain a MBOM which is a copy of the EBOM.

The MCO Coordinator will control the EBOM change to the ERP MBOM through the MCO.

Design and Manufacturing have separated their processes and now each control their changes through the system without impacting each other.
ECO or MCO will determine BOM Usage in SAP

Engineering version of Production BOM will exist in Enovia (System of Record)

- User can update PRTs in SAP BOM
- Partial BOM creation will not be allowed
- BOM status will be active in SAP
- User will compare BOM in Enovia prior to releasing to SAP
- Users can set different BOM Release date to SAP specific their Plant in Enovia

Part Status:
- Conceptual/Development
- Status Changes to Pre-production Production

Assign Template
Assign GFS R/C Code
BOM Comparison

MBOMs are Plant Specific. Users will compare the BOM for their site prior to releasing the BOM into SAP
The interface will only handle creation requests of Raw Materials (ROH), Semi-Finished Goods (HALB), Bulk Materials (FHMI), Non-Stock Items (ZLNG), and Operating Supplies (HIBE).

End Items/Package Assemblies (ZFRT) are NOT in scope.

The requested materials:
- will be unique in SAP
- will only have ‘Basic Data 1’ and ‘Basic Data 2’ view created
- will have Cross-plant Material Status of ‘10’ (i.e., Item Setup)

The description of requested materials will have maximum of 40 characters.

Enovia design status is stored in internal comment in SAP for information purpose only.

The maximum Base Character for a given Base Number is ‘Z’.

The maximum Base Tab for a give Base Number is ‘999’.

The cross reference tables (i.e., UOM, part sub-type, etc) must be maintained manually.

The master data (i.e., Base Character and Base Tab) must be maintained manually periodically.

BOMs will be created at Active status.
The Enovia Interface targets multiple systems sending the same data through a single interface.

- Enovia supports a common PLM Interface to ALL ERP and MES systems.
- ECO Process communicates Design BOM (Conceptual and Development status)
- MCO Process communicates Manufacturing intent (PreProduction and Production) per facility, with facility control of the data flow.

SAP (V6) and JDE both support an Interface designed to accept Item and BOM Information from multiple sources. Supports a Common PLM Strategy.
**SAP Queue – Red Light/Green Light**

![Image of SAP Queue interface]

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Challenges We Face

Assemblies that are Manufactured or Purchased:

MDT owns the design thus dictates the BOM components to the suppliers. PLM needs to define the BOM, but ERP doesn’t want the BOM because they don’t transact on the components.

• CMCO used to add Manufacturing Responsibility (MR). Problem is that component revs will generate an unwanted MBOM.

• Manufacturing switches from buy to make. Needs MBOM. IT has to clear MR/MBOM. Business re-adds MR to generate MBOM.
When implementing a Manufacturing BOM to an existing PLM system with an existing ERP integration, it would be nice if the system gave you a button to Generate the MBOM. Business does not always want a Change Order to generate a MBOM that already exists in ERP.

Adding MR to an Assembly causes MR to be added to the components, all the way to the bottom of the BOM. This “cascade” can result in humongous MCOs. MDT controlled this by making every Assembly an End Item. Need a better way.

Group Add Manufacturing Responsibility
PLM to ERP Integration – Impact to Manufacturing

PartNumber: eMatrix to SAP via WebMethods

done of a part w/ Family Number

Enovia → WebMethods → SAP → Enovia
- getPartNumber
- BaseNumber = ####### for legacy
  or =M###########X for SAP generated base number
- getPartNumber
- SAP scan for existing base number and increment the tab.

new Part w/ Family Number

Enovia → WebMethods → SAP → Enovia
- getPartNumber
- BaseNumber = ####### for legacy
  or =M###########X for SAP generated base number
- getPartNumber
- SAP scan for existing base number and increment the tab
- Create part with new number

New Part w/o base

Enovia → WebMethods → SAP → Enovia
- getPartNumber
- BaseNumber = ""
- getPartNumber
- SAP
- Since BaseNumber is an empty string, SAP creates a new BaseNumber