



MOC Best Practices Whitepaper:

MOC Data Content

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MOC's Data Content is Large

Even a cursory inspection of any company's MOC form reveals a large number of fields calling for substantial data collection and editing and numerous approval signatures.

What is all this data?

A number of MOC forms, from different sites, were examined and the data elements were extracted and summarized. A model, constructed from these data elements, appears in Figure 1. While this diagram may appear excessively or even overwhelmingly complex, at first glance, the following discussion will proceed with a step-by-step explanation of everything on this diagram, will explain why it's important, and will provide tips for your own implementation.

ER Diagram Notation

Figure 1 is known as an "Entity-Relationship Diagram" or, more simply, a "data model". There are numerous textbooks¹ and websites² which explain data modeling and entity-relationship diagrams in great detail. For the purposes of this whitepaper, a rudimentary understanding should be sufficient.

The elements shown in the Figure 1 are:

Entity: An entity is "a thing that can be distinctly identified", such as PERSON, CAR and, of course, MOC. It's also important to note that an entity represents a set of similar or like things, like {Ford Mustang, Chevrolet Camaro, Plymouth Barracuda} which would all be instances of the CAR entity. The MOC entity would contain instances such as {MOC_1234, MOC_1235, MOC_1236, etc.} An entity is represented by a rectangle, in the ER diagram, with a label which indicates the entity's name.

Attribute: Each entity is composed of a number of attributes. Attributes are descriptive elements of an entity. For instance, the entity PERSON may have attributes like {Last_Name, First_Name, Middle_Initial, Date_Of_Birth}. An attribute is represented by an oval, in the ER diagram, with a label which indicates the attribute's name.

Relationship: A relationship is an association among various objects. For example, each MOC has a person who originates the MOC. This can be represented by a relationship between the MOC entity and the PERSON entity, shown as a line in Figure 1.

¹ Reingruber, M.C., and Gregory, W.W., *The Data Modeling Handbook*, John Wiley & Sons, New York, 1994.

² www.wikipedia.org

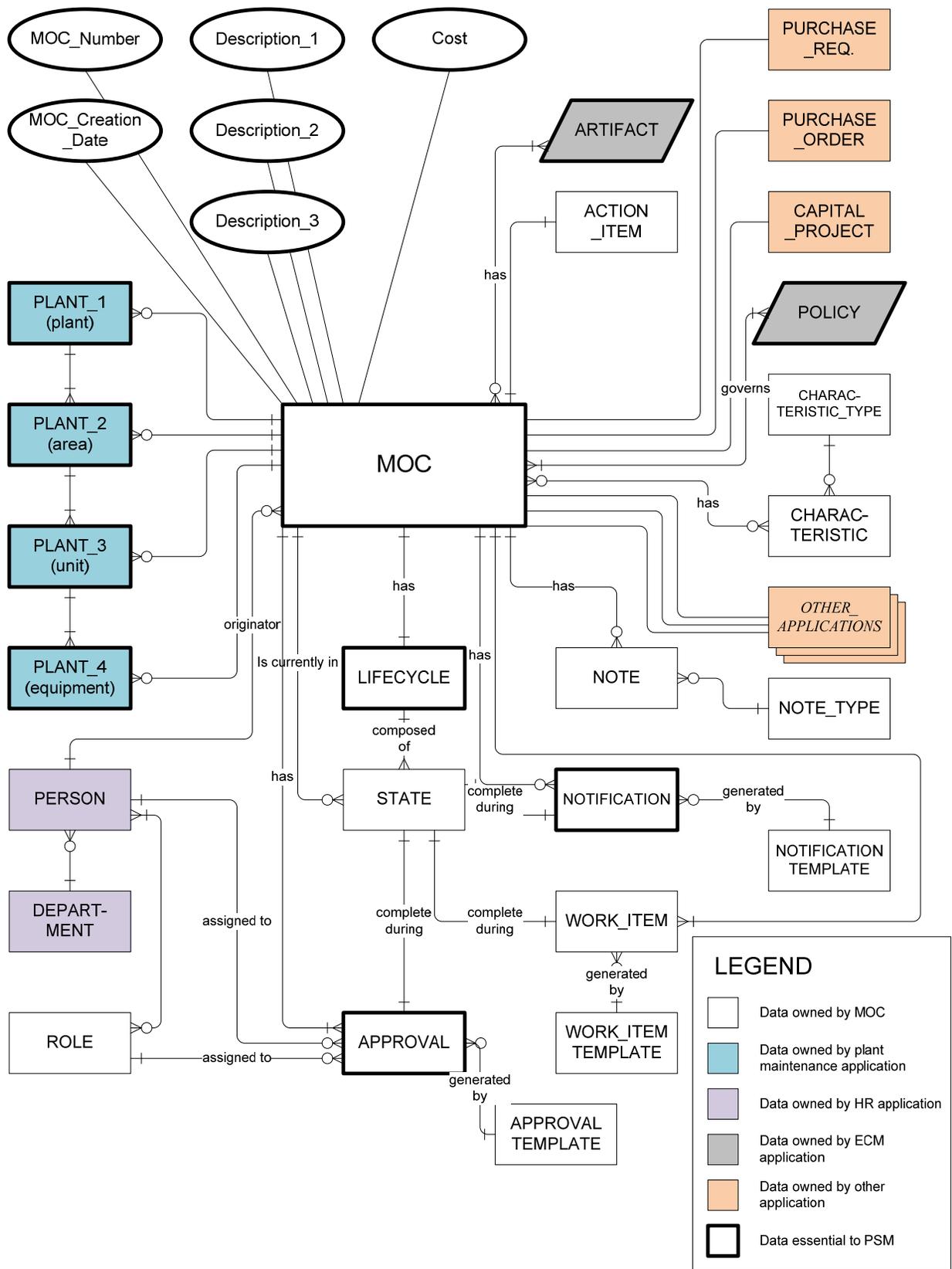


Figure 1. MOC data model.

Relationship Cardinality: Cardinality represents how “many” of one thing relate to how “many” of another thing. Returning to the PERSON to MOC relationship, each MOC must have one, and only one, originator. The single stroke, at the end of the line between MOC and PERSON, represents the fact that there is only one person who originates any given MOC. In contrast, a given person may generate zero, one or even many MOC’s. The “zero or many” aspect is represented by the circle followed by 3 short line segments at the MOC end of the relationship. There are several different diagramming conventions for ER diagrams. Figure 1 uses the “crow’s feet” diagramming due to the perceived similarity between the zero-or-many symbol with crow footprints in the snow.

As a final note about Figure 1, the mission of this whitepaper is to describe and illustrate certain concepts. The details of a real, implemented eMOC system will be different from this diagram, since Figure 1 ignores certain operational constraints like security and access control.

Data Owned by the MOC Business Process

The MOC has some data that is unique to the MOC, and arguably “belongs” to the MOC.

Attributes

Attributes are descriptive elements of an MOC, as described previously. MOC’s typically have the following attributes:

- MOC Number
- MOC Creation Date
- Various descriptive fields, which contain various elements of the technical basis for change
- Cost

Lifecycle, State

Last month’s newsletter³ was devoted to the issue of MOC lifecycle. The lifecycle of each MOC must be specified. At a minimum, there must be a distinction between a temporary change lifecycle and a permanent change lifecycle—other MOC lifecycles, like Short or Emergency may also be possible.

A lifecycle is composed of a number of states. Common states for permanent MOC’s include: Initiation, Classification, Design Change, Impact Analysis, Approvals, Mechanical Integrity, PSSR and Close-Out.

³ Hoff, R., *MOC Best Practices*, Vol. 1, No.2, Gateway Consulting Group, Inc. East Amherst, NY, Dec 2007.

Approval, Approval Template

Each change must be approved by, typically, several individuals. An approval event contains information such as:

- Who performed the approval? E.g. Francisco Gonzales
- In what capacity were they acting, or what was their role? E.g. mechanical reliability engineer.
- During which state is this approval supposed to occur? E.g. Initiation
- When did the approval occur? E.g. 10:52:43 on 25-Jan-2008.
- What was the result of the approval activity? Typically, approved or rejected.

The first two elements (who, role) can be represented by relationships to entities such as PERSON and ROLE, respectively. The latter two elements are typically attributes of APPROVAL.

When a specific approval is enabled, the details of what the approver is supposed to do and when are copied the APPROVAL_TEMPLATE.

Work Item, Work Item Template

Each change typically involves many work items. A work item is “something that a person is expected to accomplish within the scope of the MOC” (contrast with “Action Item”, below). A work item entity contains information such as:

- What needs to be done? E.g. Update P&ID
- Who is/was the work item assigned to? E.g. Mary Jones
- During which state is/was the work item to be completed? E.g. during the Design Change state
- In what capacity was the resource acting? E.g. as an area environmental rep
- When was the work item completed? E.g. 11:53:54 on 26-Jan-2008
- What blank documents, template documents, or blank forms might be helpful in completing this work item? E.g. the Environmental Review form

When a specific work item is enabled, the details of the work item are copied from the WORK_ITEM_TEMPLATE.

Notification, Notification Template

When any person is required to perform a function (i.e. complete a work item, approve), a notification is sent out to announce this requirement. Each notification will have the following properties:

- Who is to be notified? E.g. Francisco Gonzales, Mary Jones
- In what capacity are they acting, or what was their role? E.g. mechanical reliability engineer, area environmental rep.
- During which state is this notification supposed to be sent out? E.g. Initiation

- When was the notification sent? E.g. 9:41:32 on 25-Jan-2008.
- A subject line that describes, in reasonable detail, what the notification recipient is supposed to do.
- A link to the MOC, usually a URL embedded in the body of the notification message.

The first two elements (who, role) can be represented by relationships to entities such as PERSON and ROLE, respectively. The latter two elements are typically attributes of APPROVAL.

When a specific notification is enabled, the details of the intended notification are copied from the NOTIFICATION_TEMPLATE.

Note, Note Type

A note is a chunk of free-form text, that doesn't belong in any other part of the MOC. A note is also a mechanism for one MOC participant to communicate ad hoc thoughts and ideas to another participant.

An MOC typically has a running commentary of these helpful notes. Notes appear like a threaded discussion or blog, in an eMOC system, while in a paper system, the notes appear in notes fields on the paper MOC form.

Notes are often categorized into one or more of the following types:

- Comments
- Notes
- Recommendations

Characteristic, Characteristic Type

Most MOC forms, whether paper or electronic, have some mechanism to classify the scope and work needed to complete the MOC. Often this is expressed as checklists: are P&ID's to be updated {Y|N}; are relief valves to be changed {Y|N}; does the RMP need to be updated {Y|N}; etc. In fact, the MOC initiator is selecting certain subset of characteristics (i.e. the checked boxes) of the MOC from a universe of all possible characteristics (i.e. all the boxes on the form, checked or unchecked).

The CHARACTERISTIC_TYPE includes both a list of all possible characteristics, and some descriptive information about them.

Normally, the MOC characteristics are used to select the work items, the approvers and notifications.

Action Item

Action items are used in two contexts in MOC's:

1. Action items may generate MOC's.
2. MOC's may generate Action items.

Various activities take place in a plant, which identify deficiencies and consequently generate action items: audits, periodic procedure or document review, process hazards analyses, routine inspection, engineering studies. When appropriate, an MOC may be raised to address the issue described by the action item. The generating action item is closed, typically, either when the MOC is initiated or when the MOC is closed.

During the course of an MOC there are many instances where “things to do” are identified. If the activity must be completed before the MOC is closed, then this activity would be considered just another work item. If the activity doesn’t need to be completed before the MOC is closed, then the activity is considered an action item. One example of an MOC generating an action item concerns painting for aesthetic purposes. Since pretty paint has no safety implications, and isn’t documented on any Process Safety Information, painting may be documented as an action item, and completed at some time after the MOC is closed out.

Role

Company procedures are normally written in such a way that work items and approvals must be accomplished by a person acting in a specific role, e.g. area manager.

Data Owned by the Plant Maintenance Application

The MOC has some data that is similar to data in the plant maintenance application.

Plant 3 (Unit)

MOC’s are typically associated with a process unit. In a paper-based MOC system, the same information is often presented in many different ways. Consider the following sequence of “names”, which all refer to the same unit: Cat Cracker #2, #2 Cat, #2 Crude Unit, Crude #2, Unit 400, Unit 0400, 400, 402. And this list doesn’t even include the variations of punctuation and spaces. Obviously, any kind of reporting or data trending is thwarted by this diversity of descriptions.

A better solution is to use a “standard” set of unit names. Making up a new list of “standard” names essentially defeats the notion of standardization. The computerized maintenance management system is usually the largest and most stable application at most plants. The maintenance system, of necessity, maintains a representation of plant structure, so this is often the best source for this kind of information.

Plant 1 (Plant), Plant 2 (Area), Plant 4 (Equipment)

The same logic, as discussed for Plant 3 (Unit), applies to these levels of the plant hierarchy.

Data Owned by the Enterprise Content Management Application

Many companies have Enterprise Content Management, “ECM”, applications installed to maintain plant-centric and other documentation. Formerly, these systems were known as Electronic Document Management, “EDM”, applications.

Artifact

All of the supporting documentation, forms, reports, folders, files, etc. are grouped together under the heading of “Artifact”. Artifacts are represented in Figure 1 by a parallelogram symbol, to signify that this is an abstraction and not a specific document or folder.

The artifacts would generally have a document type. And then, depending on the document type, the artifacts would have additional attributes.

Person

Every person who needs to retrieve documents and other data from the ECM system needs an account. The personal information, e.g. first name, last name, street address, phone number, etc., can be downloaded from the human resources system. Unfortunately, HR systems typically only contain entries for employees—contractors are not included. Therefore, as a practical matter, the ECM system will have a larger number of userID’s than the number of employees would suggest.

Policy

The MOC process is governed by certain policies. Furthermore, the MOC process itself is governed by applicable procedures. These would reasonably be stored in the ECM system. These policies and procedures contain the rules associated with initiating, processing and closing out the various kinds of MOC’s: permanent, temporary, short, etc.

Data Owned by the HR Application

Many companies have Human Resource, “HR”, applications that manage data related to people, especially employees.

Person

As described in a previous section, an ECM system, and by extension, an electronic MOC system, may only accept logins from authorized individuals. The HR system is usually considered the “master list” of name, address, phone number, email, etc. information for employees.

Department

Management structure is often relevant to MOC approvals (e.g. MOC initiation may need to be approved by a person’s manager), so it’s important for an electronic MOC system to have access to reporting data, like who a person’s manager might be.

Data Owned by Other Applications

The previous list of related applications is not exhaustive. Other, common, related applications are listed below:

Purchase Requisition

MOC's frequently require the purchase and installation of equipment, often with long lead times. A person shepherding the MOC through its steps, is often interested in the status of purchased items. While a search in the purchasing system is possible, a link from the MOC system is often a quick way of retrieving this information.

Purchase Order

The same logic applies for purchase orders, as previously described for purchase requisitions.

Capital Project

Larger, more expensive MOC's are often implemented as a capital project. A link to the relevant project in the capital project tracking system may be helpful.

Other Applications

The data model in Figure 1 shows "Other Applications". This is a catch-all for applications not previously explicitly described, including training systems.

Data Essential to PSM

The previous pages have provided a comprehensive list of the elements of an MOC. Some of these are provided for data integrity purposes, others are provided for convenience (e.g. links to capital project systems).

Strictly speaking, the regulatory requirements of an MOC system are simply to ensure that process safety information has been updated. The process safety information-related items are shown by the bold outline in Figure 1.

Figure 1 suggests that less than half of the data on an MOC is for strict compliance purposes. The remainder is for business process efficiency purposes. At this point, we'll just state that the additional data is to improve efficiency, although proof will have to wait for future editions of the newsletter.