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**Integration von Anwendungen in Anlagen der Elektrizitätsversorgung –
Systemschnittstellen für Netzführung –
Teil 4: Schnittstellen für Berichtswesen und Asset Management
(IEC 57/2059/FDIS:2018);
Englische Fassung FprEN IEC 61968-4:2018**

Application integration at electric utilities –
System interfaces for distribution management –
Part 4: Interfaces for records and asset management
(IEC 57/2059/FDIS:2018);
English version FprEN IEC 61968-4:2018

Intégration d'applications pour les services électriques –
Interfaces système pour la gestion de la distribution –
Partie 4: Interfaces pour la gestion des dossiers et des actifs
(IEC 57/2059/FDIS:2018);
Version anglaise FprEN IEC 61968-4:2018

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2019-04-12 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.

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Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 170 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE

Nationales Vorwort

Die Englische Fassung des europäischen Dokuments FprEN IEC 61968-4:2018 „Integration von Anwendungen in Anlagen der Elektrizitätsversorgung – Systemschnittstellen für Netzführung – Teil 4: Schnittstellen für Berichtswesen und Asset Management“, (Schluss-Entwurf) ist unverändert in diesen Norm-Entwurf übernommen worden.

Die Internationale Elektrotechnische Kommission (IEC) und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dem entsprechend ist das internationale Dokument IEC 57/2059/FDIS:2018 „Application integration at electric utilities – System interfaces for distribution management – Part 4: Interfaces for records and asset management“ unverändert in den Schluss-Entwurf FprEN IEC 61968-4:2018 übernommen worden.

Das internationale Dokument wurde vom TC 57 „Power systems management and associated information exchange“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet.

Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

Für dieses Dokument ist das nationale Arbeitsgremium K 952 „Netzelektrotechnik“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (www.dke.de) zuständig.

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Der Zusammenhang der zitierten Dokumente mit den entsprechenden deutschen Dokumenten ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für den vorliegenden Normentwurf erfüllt.

Da sich die Benutzer der vorliegenden Normentwurfs der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der FprEN IEC 61968-4:2018 veröffentlicht. Zu deren Abschnitt 1, der den Anwendungsbereich festlegt, und Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Normentwurfs hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Dieser Normentwurf steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

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Das Original-Dokument enthält Bilder und Tabellen in Farbe, die in der Papierversion in einer Graustufen-Darstellung wiedergegeben werden. Elektronische Versionen dieses Dokuments enthalten die Bilder und die Tabellen in der originalen Farbdarstellung.

Änderungen

Gegenüber DIN EN 61968-4:2007-12 und DIN EN 61968-4 Berichtigung 1:2008-08 wurden folgende Änderungen vorgenommen:

- a) Entfernung der Profile der 1. Ausgabe, deren Funktion durch andere Teile der Normen IEC 61970 und 61968 ersetzt wurde. Insbesondere „NetworkDataSet“ und „ChangeSet“ wurden durch Normen wie z. B. CDPSM (IEC 61968-13) sowie andere kontinuierliche Bemühungen wie z. B. Änderungsmodellierung ersetzt; die Darstellung wurde durch ein Diagramm-Anordnungsprofil (IEC 61970-453) ersetzt;
- b) Überarbeitung der Profile der 1. Ausgabe „AssetList“, „AssetCatalogue“ und „TypeAssetCatalogue“ zur Anpassung an aktuelle Anwendungsfälle und die neueste CIM-UML-Version. Diese Profile basieren auf einer alten Version von CIM UML und viele der Klassen in diesen Profilen sind nicht mehr in den aktuellen CIM UMLs vorhanden;
- c) Ergänzung von einigen neuen Profilen, um den Austausch von Daten über den Anlagenzustand, analytische Ergebnisse und Benachrichtigungen, physische und funktionelle Einzelheiten sowie Einzelheiten zum Lebenszyklus und Anlagentätigkeiten zu ermöglichen;
- d) Informative Anhänge darüber, wie diese Norm angewendet werden kann, um ein strategisches Anlagenmanagement zu ermöglichen;
- e) Informative Anhänge mit anschaulichen Beispielen für die Anwendung dieser Norm;
- f) Der Anwendungsbereich wird koordiniert durch IEC 61968-13, sofern anwendbar;
- g) Anwendungsfälle in der Anwendungsfallvorlage IEC 62559-2;
- h) Rückverfolgbarkeit von Anwendungsfällen auf Anwendungsfälle von IEC 62913-2-1.

Nationaler Anhang NA (informativ)

Auszugsweise Übersetzung

Reihenfolge und Inhalt der folgenden Abschnitte sind identisch mit denen in den jeweiligen Abschnitten der Englischen Fassung.

1 Anwendungsbereich

Dieser Teil von IEC 61968 legt den Informationsgehalt von einem Satz an Meldungstypen fest, die zur Unterstützung von vielen Unternehmensfunktionen im Zusammenhang mit Berichtswesen und Anlagenmanagement angewendet werden können. Die typische Anwendung von Meldungstypen, die in diesem Teil von IEC 61968 definiert werden, umfasst Netzwerkerweiterungsplanung, Kopiereinzug oder andere Netzwerkdaten zwischen Systemen, Netzwerk- oder Diagrammänderungen sowie Anlagenprüfung. Meldungstypen, die in anderen Teilen von IEC 61968 festgelegt werden, können für diese Anwendungsfälle auch relevant sein.

3 Begriffe

Es werden keine Begriffe in diesem Dokument angegeben.

ISO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

- IEC Electropedia: verfügbar unter <http://www.electropedia.org/>
- ISO Online Browsing Platform: verfügbar unter <http://www.iso.org/obp>

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**APPLICATION INTEGRATION AT ELECTRIC UTILITIES –
SYSTEM INTERFACES FOR DISTRIBUTION MANAGEMENT –**

Part 4: Interfaces for records and asset management

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61968 has been prepared by subcommittee IEC technical committee 57: Power systems management and associated information exchange.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) removal of edition 1 profiles whose functionality has been superseded by other parts of IEC 61970 and IEC 61968 standards. In particular, NetworkDataSet and ChangeSet have been superseded by standards such as CDPSM (IEC 61968-13) and other ongoing efforts such as change modelling; and Presentation has been superseded by Diagram Layout Profile (IEC 61970-453);
- b) revision of the edition 1 profiles AssetList, AssetCatalogue and TypeAssetCatalogue to realign with current use cases and the latest CIM UML release. These profiles are based

on an old version of CIM UML and many of the classes in these profiles are no longer in the recent CIM UMLs;

- c) addition of several new profiles to enable the exchange of asset condition data, analytics results and alerts, assets' physical, functional and lifecycle details, and assets' work;
- d) informative annexes on how this document can be used to enable strategic asset management;
- e) informative annexes with illustrative examples for the application of this document;
- f) scope coordinated with IEC 61968-13 where applicable;
- g) use cases in IEC 62559-2 use case template;
- h) traceability of use cases to IEC 62913-2-1 use cases.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
57/XX/FDIS	57/XX/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

The IEC 61968 standard series, taken as a whole, defines interfaces for the major elements of an interface architecture for Distribution Management Systems (DMS). IEC 61968-1, *Interface architecture and general recommendations*, identifies and establishes requirements for standard interfaces based on an Interface Reference Model (IRM). IEC 61968-3 to -9 define interfaces relevant to each of the major business functions described by the Interface Reference Model.

As used in IEC 61968, a DMS consists of various distributed application components for the utility to manage electrical distribution networks. These capabilities include monitoring and control of equipment for power delivery, management processes to ensure system reliability, voltage management, demand-side management, outage management, work management, automated mapping and facilities management.

This series of standards is limited to the definition of interfaces and is implementation independent. They provide for interoperability among different computer systems, platforms, and languages. Methods and technologies used to implement functionality conforming to these interfaces are considered outside of the scope of these standards; only the interface itself is specified in these standards.

The purpose of this part of IEC 61968 is to define a standard for the integration of Records and Asset Management (AM), which would include Geographic Information Systems and Asset Risk Management Systems, with other systems and business functions within the scope of IEC 61968. The scope of this document is the exchange of information between Records and Asset Management Systems and other systems within the utility enterprise. The specific details of communication protocols those systems employ are outside the scope of this document. Instead, this document will recognize and model the general capabilities that can be potentially provided by records and asset management systems including asset risk assessment, asset planning, and condition-based asset management. In this way, this document will not be impacted by the specification, development and/or deployment of next generation records and asset management systems, either through the use of standards or proprietary means.

The IEC 61968 series of standards is intended to facilitate inter-application integration as opposed to intra-application integration. Intra-application integration is aimed at programs in the same application system, usually communicating with each other using middleware that is embedded in their underlying runtime environment, and tends to be optimised for close, real-time, synchronous connections and interactive request/reply or conversation communication models. IEC 61968, by contrast, is intended to support the inter-application integration of a utility enterprise that needs to connect disparate applications that are already built or new (legacy or purchased applications), each supported by dissimilar runtime environments. Therefore, these interface standards are relevant to loosely coupled applications with more heterogeneity in languages, operating systems, protocols and management tools. This series of standards is intended to support applications that need to exchange data every few seconds, minutes, or hours rather than waiting for a nightly batch run. This series of standards, which are intended to be implemented with middleware services that exchange messages among applications, will complement, not replace, utility data warehouses, database gateways, and operational stores.

As used in IEC 61968, a Distribution Management System (DMS) consists of various distributed application components for the utility to manage electrical distribution networks. These capabilities include monitoring and control of equipment for power delivery, management processes to ensure system reliability, voltage management, demand-side management, outage management, work management, automated mapping and facilities management. Standard interfaces are defined for each class of applications identified in the Interface Reference Model (IRM), which is described in IEC 61968-1.

This part of IEC 61968 contains the clauses listed in Table 1.

Table 1 – Document overview for IEC 61968-4

Clause	Title	Purpose
1	Scope	The scope and purpose of the document are described.
2	Normative references	Documents that contain provisions which, through reference in this text, constitute provisions of this International Standard.
3	Terms and definitions	Description of concepts and terms pertinent to records and asset management.
4	Reference and information models	Description of general approach to records and asset management systems, reference model, use cases, interface reference model, records and asset management functions and components, message type terms and static information model.
5	Records and asset management message types	Message types related to the exchange of information for documents related to records and asset management.
Annex A	Description of message type verbs	Description of the verbs that are used for the message types.
Annex B	Use cases	Description of use cases pertaining to this standard.
Annex C	Asset management	Description of an example asset management framework that leverages this standard.
Annex D	Asset models and information exchange – The case for formal instance templates	Description of the use of CIM to model typical electrical power utility assets.
Annex E	Asset Models and information exchange	Illustration of asset related messages and typical information exchanges.
Annex F	Asset measurements models and information exchange	Illustration of asset measurements related messages and typical information exchanges.
Annex G	Analytics models and information exchange	Illustration of asset analytics related messages and typical information exchanges.

APPLICATION INTEGRATION AT ELECTRIC UTILITIES – SYSTEM INTERFACES FOR DISTRIBUTION MANAGEMENT –

Part 4: Interfaces for records and asset management

1 Scope

This part of IEC 61968 specifies the information content of a set of message types that can be used to support many of the business functions related to records and asset management. Typical uses of the message types defined in this document include network extension planning, copying feeder or other network data between systems, network or diagram edits and asset inspection. Message types defined in other parts of IEC 61968 may also be relevant to these use cases.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61968-1:2012, *Application integration at electric utilities – System interfaces for distribution management – Part 1: Interface architecture and general recommendations*

IEC 61968-3:2017, *Application integration at electric utilities – System interfaces for distribution management – Part 3: Interface for network operations*

IEC 61968-6:2015, *Application integration at electric utilities – System interfaces for distribution management – Part 6: Interfaces for maintenance and construction*

IEC 61968-9:2013, *Application integration at electric utilities – System interfaces for distribution management – Part 9: Interfaces for meter reading and control*

IEC 61968-11:2018, *Application integration at electric utilities – System interfaces for distribution management – Part 11: Common information model (CIM) extensions for distribution*

IEC 61968-100:2013, *Application integration at electric utilities – System interfaces for distribution management – Part 100: Implementation profiles*

IEC 61970-301:2016, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

IEC 62361-100:2016, *Power systems management and associated information exchange – Interoperability in the long term – Part 100: CIM profiles to XML schema mapping*

IEC TR 62361-103:2018, *Power systems management and associated information exchange – Interoperability in the long term – Part 103: Standard profiling*

ISO 55000:2014, *Asset management – Overview, principles and terminology*

ISO 55001:2014, *Asset management – Management systems – Requirements*

ISO 55002:2014, *Asset management – Management systems – Guidelines for the application of ISO 55001*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Reference and information models

4.1 General

The message types defined in this document are based on a logical partitioning of the utility enterprise business functions and components called the IEC 61968 Interface Reference Model. The contents of the message types are based on a static information model to ensure consistency of field names and data types. Each message type is defined as a set of fields copied from the information model classes in IEC 61968-11 and IEC 61970-301. This message definition is performed in accordance with IEC 62361-100 and IEC 62361-103. In particular, starting from the canonical model as described in IEC 61968-11 and IEC 61970-301, the contextual model is defined, and the profile/syntactic model is generated in the form of XSD schema.

The message types defined in this document are intended to satisfy a majority of typical applications. In some particular project implementations, it may be desirable to modify the set of fields using a methodology such as that described in IEC 61968-1.

4.2 Reference model

4.2.1 General

The diagrams shown in Figure 1 through Figure 3 serve as reference model and provide example of the logical components and data flows related to this document. The said diagrams describe the flows between the components in the reference model. The numbers in brackets provide linkages to the flow definitions. The reference architecture reflects several main logical components (potentially realized as systems or subsystems) that are part of records and asset management or are related to it through the need to exchange information. The logical components illustrated are:

- a) Network Operation Monitoring (NMON)
- b) Asset Monitoring and Measurement (AMM)
- c) Asset Decision Support (ADS)
- d) Substation and Network Inventory (EINV)
- e) Geographical Inventory (GINV)
- f) Maintenance and Inspection (MAI)
- g) Work Scheduling and Dispatching (SCHD)

The data flows are split into three diagrams, each one depicting the data flow pertaining to a major area of this document. Figure 1 shows the data flows pertaining to Assets, such as their lifecycle information, location, ownership, nameplate information, and model information. Figure 2 shows the data flows pertaining to Measurements, such as procedures performed on assets or measurements made on them, and the corresponding datasets and measurement

values. Figure 3 shows the data flows pertaining to Analytics, such as the details of an analytic and the scores from an analytic.

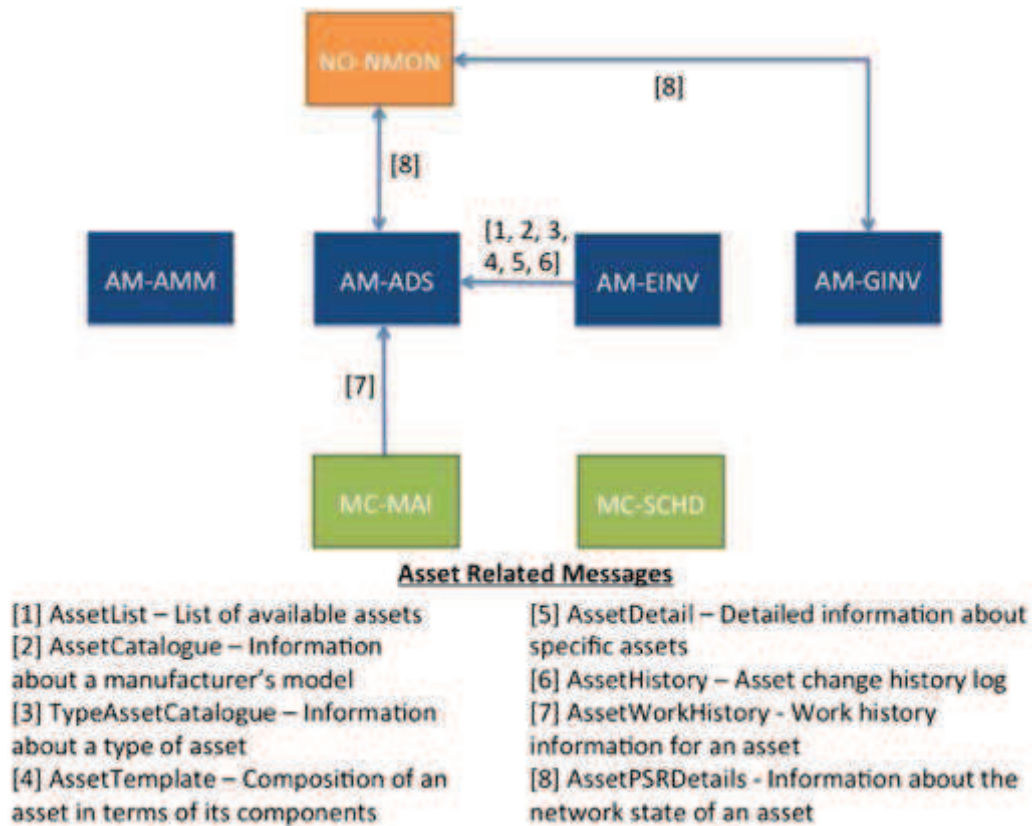
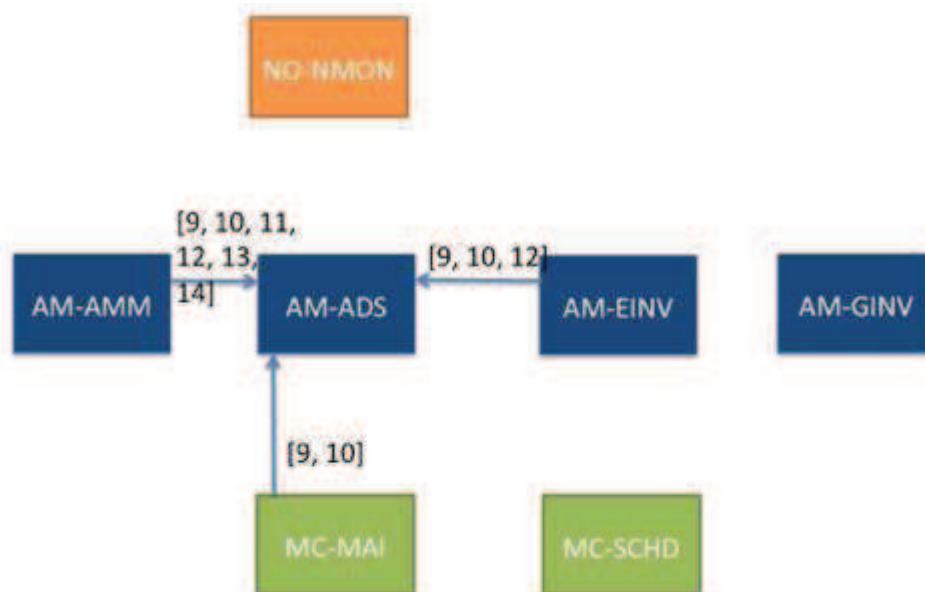


Figure 1 – Illustration of Asset-related message flows



Measurements Related Messages

- [9] AssetProcedures – Procedures that apply to an asset
- [10] Procedures – Details of procedures and the assets to which they apply
- [11] ProcedureDataSets – Information about data sets produced by procedures
- [12] AssetMeasurements – Measurements pertaining to an asset
- [13] MeasurementDetails – Detailed information about measurements
- [14] MeasurementValues – Measurement values

Figure 2 – Illustration of Measurements-related message flows

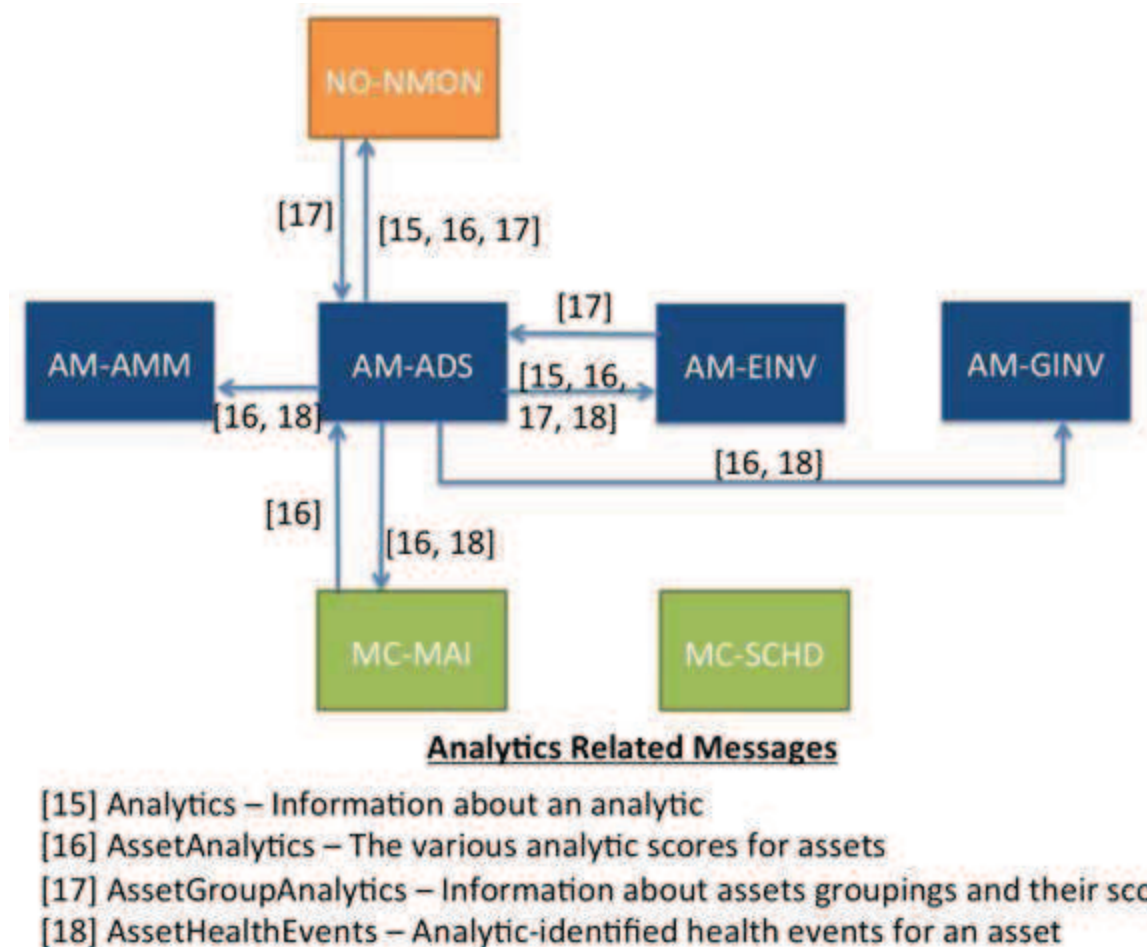


Figure 3 – Illustration of Analytics-related message flows

In Subclauses 4.2.2 to 4.2.8, we describe the logical components that participate in the illustrated data flows.

4.2.2 Network Operation Monitoring (NMON)

Provides the means for supervising main substation topology (breaker and switch state) and control equipment status. It also provides the utilities for handling network connectivity and loading conditions. It also makes it possible to locate customer telephone complaints and supervise the location of field crews.

4.2.3 Asset Monitoring and Measurement (AMM)

Asset monitoring and measurement involves inspection, testing, measurement, and monitoring of the assets in order to understand, assess and manage their condition and performance.

4.2.4 Asset Decision Support (ADS)

Asset decision support involves strategy definition and prioritisation, maintenance strategy planning, risk management, programme management and decision-making. The central aspect of asset decision support is analytics. It drives the condition, configuration, performance, operating costs, and flexibility of the asset base, with the aim of maximising value.

4.2.5 Substation and Network Inventory (EINV)

The electrical substation and network assets that a utility owns, or for which has legal responsibility, and will maintain an accurate asset register developed around an asset hierarchy that supports advanced asset management functions.

4.2.6 Geographical Inventory (GINV)

Management of geospatial data, typically by utilizing computer graphics technology to enter, store, and update graphic and non-graphic information. Geographic depictions and related non-graphic data elements for each entity are typically stored in some form of a data store. The graphic representations are referenced using a coordinate system that relates to locations on the surface of the earth. Information in the data store can be queried and displayed based upon either the graphic or non-graphic attributes of the entities.

4.2.7 Maintenance and Inspection (MAI)

Work involving inspection, cleaning, adjustment, or other service of equipment to enable it to perform better or to extend its service life. Examples of maintenance work are routine oil changes and painting. Examples of inspection work are pole inspections, vault inspections, and substation inspections.

4.2.8 Work Scheduling and Dispatching (SCHD)

Work scheduling and dispatching makes it possible, for a defined scope of work, to assign the required resources and keep track of work progress.

4.3 Interface Reference Model

It is not the intention of this document to define the applications and systems that vendors should produce. It is expected that a concrete (physical) application will provide the functionality of one or more abstract (logical) components as listed in this document. These abstract components are grouped by the business functions of the Interface Reference Model.

In this document, the term abstract component is used to refer to that portion of a software system that supports one or more of the interfaces defined in IEC 61968-3 to -9. It does not necessarily mean that compliant software is delivered either as separate modules or as a single system.

IEC 61968-1 describes infrastructure services common to all abstract components while IEC 61968-3 to -9 define the details of the information exchanged for specific types of abstract component.

IEC 61968 defines that:

- a) An inter-application infrastructure is compliant if it supplies services defined in IEC 61968-1 to support at least two applications with interfaces compliant to IEC 61968-3 to -9.
- b) An application interface is compliant if it supports the interface standards defined in IEC 61968-3 to -9 for the relevant abstract components defined in the Interface Reference Model.

An application is only required to support interface standards of the applicable components listed under abstract components. An application is not required to support interfaces required by other abstract components of the same business sub-function or within the same business function. While this document primarily defines information exchanged among components in different business functions, it will occasionally also define information exchanged among components within a single business function when a strong market need for this capability has been realised.

4.4 Records and asset management

It should be noted that the message types defined in this document may be sent or received by any type of component within a distribution management system (DMS). Table 2 shows these functions and typical abstract components that are expected to be producers of information for these message types. Typical consumers of the information include, but are not restricted to, the other components as listed in IEC 61968-1.

Table 2 – Business functions and abstract components

Business Functions	Business Sub-functions	Abstract Components
Records and asset management (AM)	Substation and network inventory (EINV)	Equipment characteristics
		Connectivity model
		Substation display
		Telecontrol database
	Geographical inventory (GINV)	Network displays
		Geographic maps
	General inventory management (GIM)	Non-electrical asset inventory
		Materials inventory
		Vehicle inventory
	Asset decision support (ADS)	Maintenance strategy
		Life-cycle planning
		Reliability centered analysis
		Engineering and design standards
		Compliance standards and regulations management
		Performance measurements
		Risk management
		Environmental management
		Decision support systems
		Thermal ratings of network equipment and lines
		Maintain work triggers
		Asset maintenance groups (lists)
		Asset failure history
		Asset financial performance
		Budget allocation
	Asset monitoring and measurement (AMM)	Time and event series data management
		Laboratory information management
		Asset test information management
		Security configuration and event logs
		Field crew information visualization
		Compliance management and reporting

5 Records and asset management message types

5.1 General

The following are some general conventions in the message definitions provided in this document:

- Objects are identified by mRID and a multiplicity of Name.name members inherited from IdentifiedObject. Transacting systems may use one or both of the attributes to uniquely identify the objects being exchanged.
- Several CIM classes have a member called type to provide a string description of an instance of the class. Some CIM classes (such as Asset) also have an enumerated member called "kind". This is a recent addition for better interoperability. Messages in this document that incorporate such classes include both the "type" and "kind" members. Where an appropriate value is not available for "kind", the transacting systems may use the value "other" for "kind" in order to indicate that the string description in the "type" attribute should be used.
- The attributes in the message payloads are all optional. It is up to the transacting systems to implement the logic for any required fields.

The following are some general considerations regarding the artifacts in this document.

- The XSD schema were generated in accordance to IEC 62361-100 and IEC 62361-103. CIMTool¹ was used in this task.
- The diagrammatic description of the schema, such as Figure 5, Figure 7, etc., were generated in XMLSpy² from the XSD schema.
- The XML instance examples, such as those provided in Clause 5.2.3, 5.3.3, etc. were generated in XMLSpy from the XSD schema.

5.2 AssetList messages

5.2.1 General

An AssetList message can contain the list of utility assets. The retrieved Asset objects only contain identification information such as mRID, name, and type. AssetDetail message should be used to get detailed information about specific Asset objects of interest.

5.2.2 Applications

The purpose of AssetList message is to obtain a list of all the assets available in a system. For instance, a substation inventory system may have information about substation assets. Planning and analytics functions that are interested in a specific subset of the assets, such as power transformers, can use this message to obtain the list of all Asset objects in the substation inventory system. The planning and analytics functions can then use other messages such as AssetTemplate and AssetDetail to obtain more details about the Asset objects that are identified as power transformers. This message, in short, is intended to be a simple query to obtain the list of available assets so that the receiving system can then identify a subset of the available assets for further investigation. An example of an AssetList exchange is shown in Figure 4, where AM-ADS requests and gets an AssetList from AM-EINV.

¹ CIMTool is the trade name of a product supplied by Langdale Consultants. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

² XMLSpy is the trademark of a product supplied by Altova. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

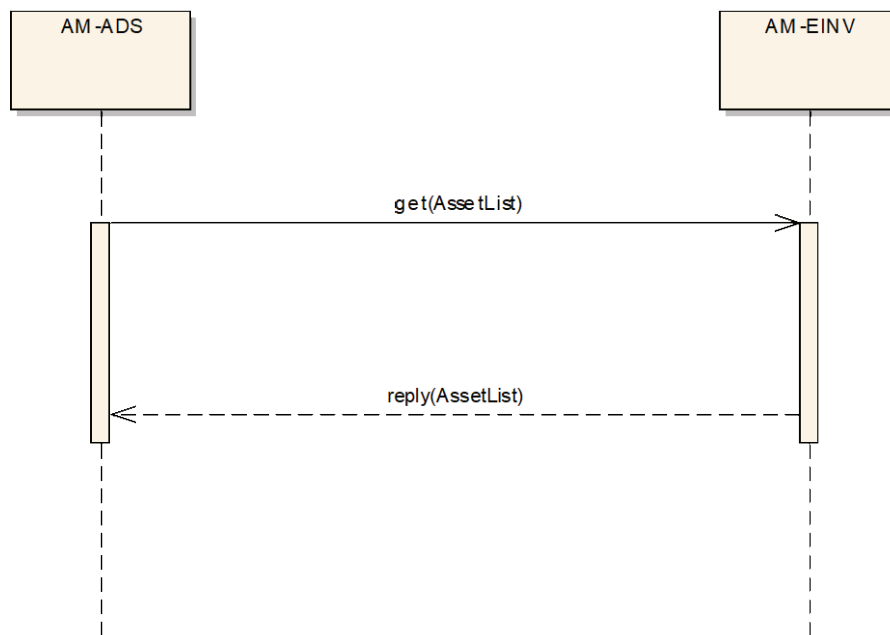


Figure 4 – AssetList message exchange

5.2.3 Message format

Figure 5 shows the message format used to obtain AssetList from a system that has a database of Asset objects. The responding system will return the list of Asset objects, which are identified by mRID and/or name. In addition, the asset's "kind" attribute (which is a selection from an enumerated list of assets) or "type" attribute (which is a string description of what the asset is) may be included. If a classification of the asset (such as PowerTransformer) is not available in the enumerated list, a value of "other" is typically used for the "kind" attribute to indicate that the description contained in the "type" attribute should be used instead.

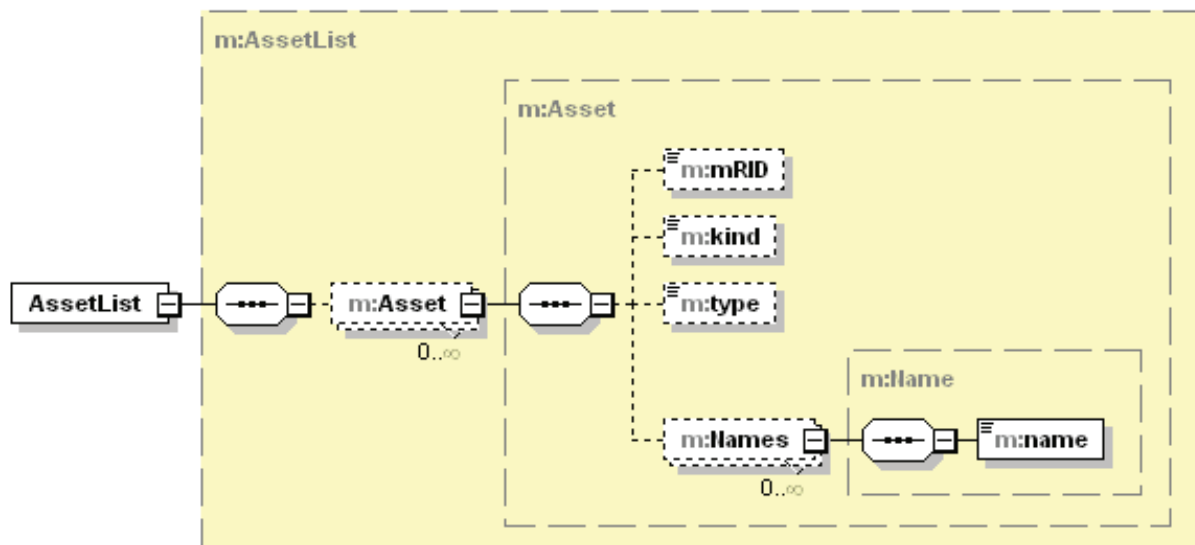


Figure 5 – AssetList message format

The following is an XML example for an AssetList.

```
<?xml version="1.0" encoding="UTF-8"?>
<m:AssetList xmlns:m="http://iec.ch/TC57/2007/profile#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2007/profile# AssetList.xsd">
  <m:Asset>
    <m:mRID>e0be245f-92d8-4817-8672-48710e3835f2</m:mRID>
    <m:kind>breakerSF6DeadTankBreaker</m:kind>
  </m:Asset>
  <m:Asset>
    <m:mRID>9ea05e0a-024a-495d-85bd-f2553b89dcaa</m:mRID>
    <m:kind>other</m:kind>
    <m:type>twoWindingTransformer</m:type>
  </m:Asset>
  <m:Asset>
    <m:mRID>6a9fb099-e67d-4c33-88f4-aa3e479ec1da</m:mRID>
  </m:Asset>
</m:AssetList>
```

5.3 AssetCatalogue messages

5.3.1 General

An AssetCatalogue is a collection of information regarding available types of products and materials that are used to build or install assets, to maintain assets or to operate assets. Each catalogue item is for a specific product available from a specific manufacturer. An AssetCatalogue message may contain reference information, such as drawingNumber and modelNumber about a specific ProductAssetModel, as well as the AssetInfo rating information for it.

5.3.2 Applications

The AssetCatalogue message is used to exchange asset catalogue information. Example applications include replacement of generic assets and long-term planning. While installing assets, a maintenance person may query the catalogue for a specific product model of interest. In long term planning, a project may have a set of requirements and the organisation's catalogue of approved product models is used as a basis of decision-making. An engineer or analytic queries the catalogue and applies the selection rules in order to identify catalogue items with specifications that meet the project requirements. A typical application for this message is for an asset analytic system to query and discover the desired catalogue information, as shown in Figure 6.

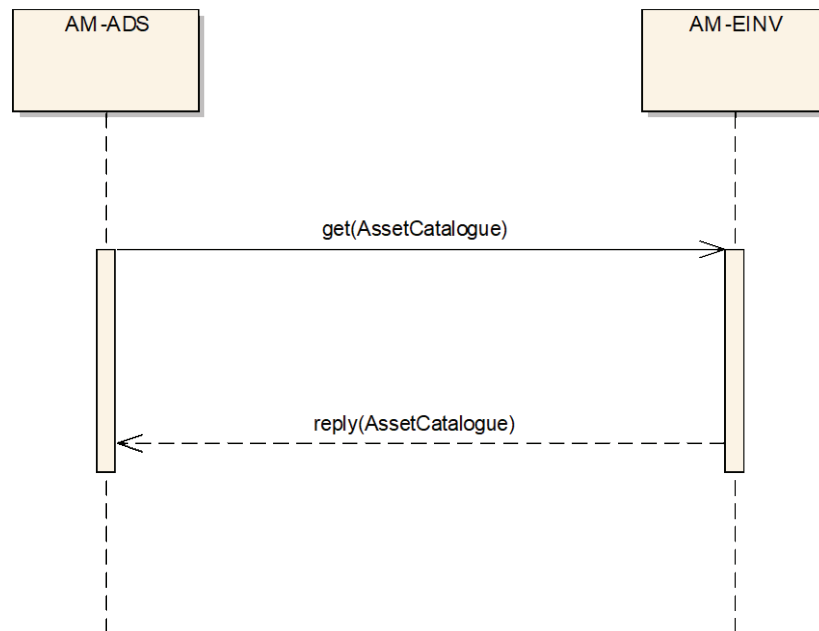


Figure 6 – AssetCatalogue message exchange

5.3.3 Message format

Figure 7 shows the message payload format used to obtain AssetCatalogue information. The message payload consists of a multiplicity of ProductAssetModel objects. In addition to the attributes of ProductAssetModel, the message can also contain the list of Asset objects that correspond to the product model. Figure 8 shows the Asset element. In addition to the identifying information, state information such as inUseState and lifecycleState can be provided, so that a querying system can identify if, for instance, the asset is an inventory item available for installation.

The message payload can also contain rating information from a child class of AssetInfo that the ProductAssetModel is associated with. Figure 9 shows the ratings information pertaining to a busbar section. Figure 10 shows the PowerTransferInfo element. Whereas the other AssetInfo child elements contain the attributes of the element, PowerTransformerInfo has a unique structure in that it contains a multiplicity of TransformerTankInfo elements, which in turn can contain a multiplicity of TransformerEndInfo elements.

The ProductAssetModel message can also contain the CatalogueAssetType pertaining to the ProductAssetModel. Figure 11 shows the CatalogueAssetType element. This CatalogueAssetType is the generic type of product corresponding to functionally equivalent ProductAssetModel objects. This information can be used to discover, through the use of TypeAssetCatalogue message described in 5.4, equivalent product models.

Furthermore, the ProductAssetModel message can contain Manufacturer information, which is shown in more detail in Figure 12.

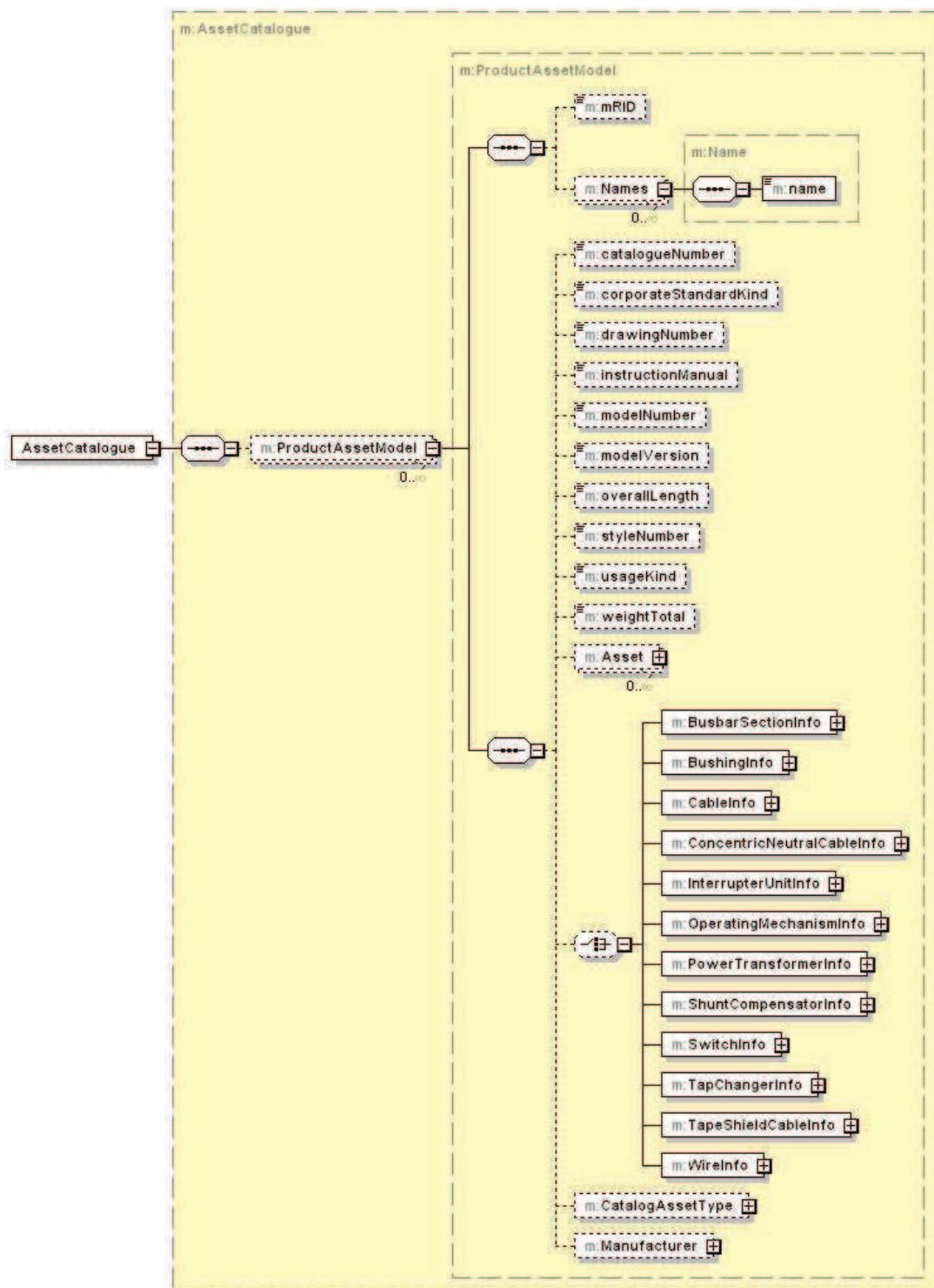


Figure 7 – AssetCatalogue message format

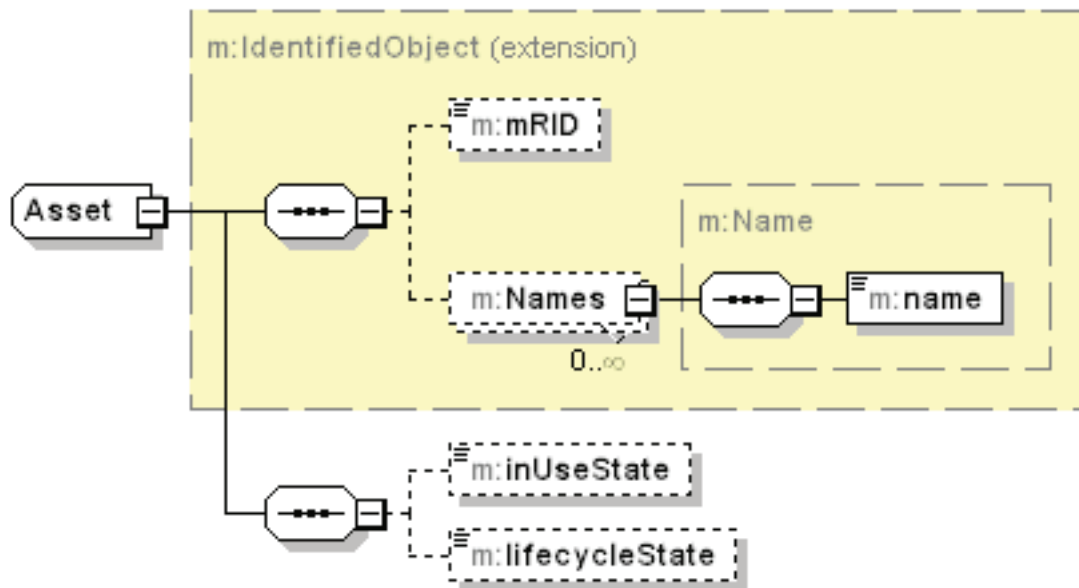


Figure 8 – AssetCatalogue message: Asset element

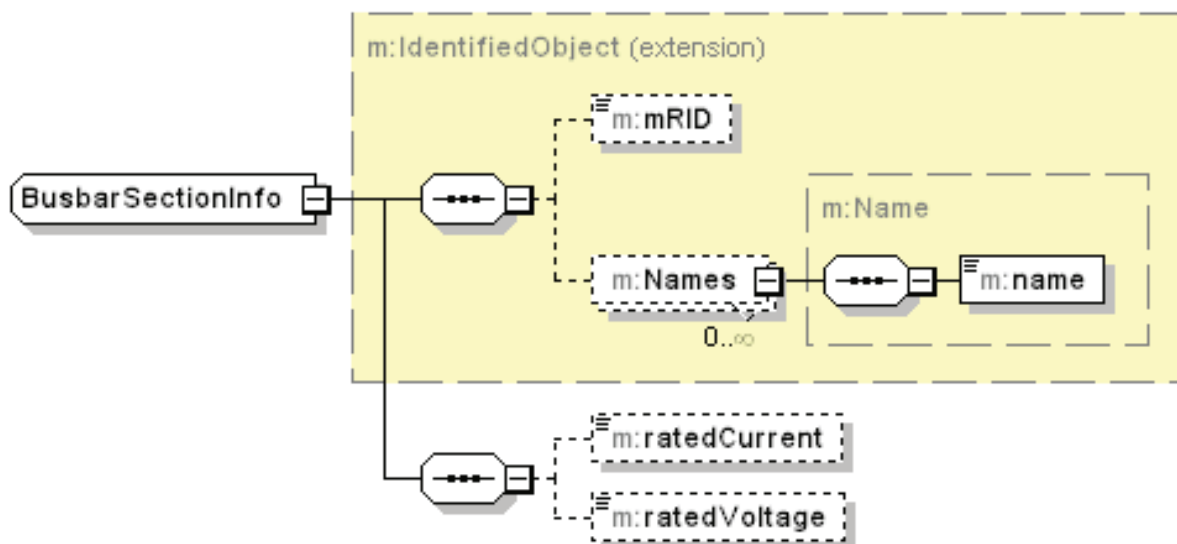


Figure 9 – AssetCatalogue message: BusbarSectionInfo element

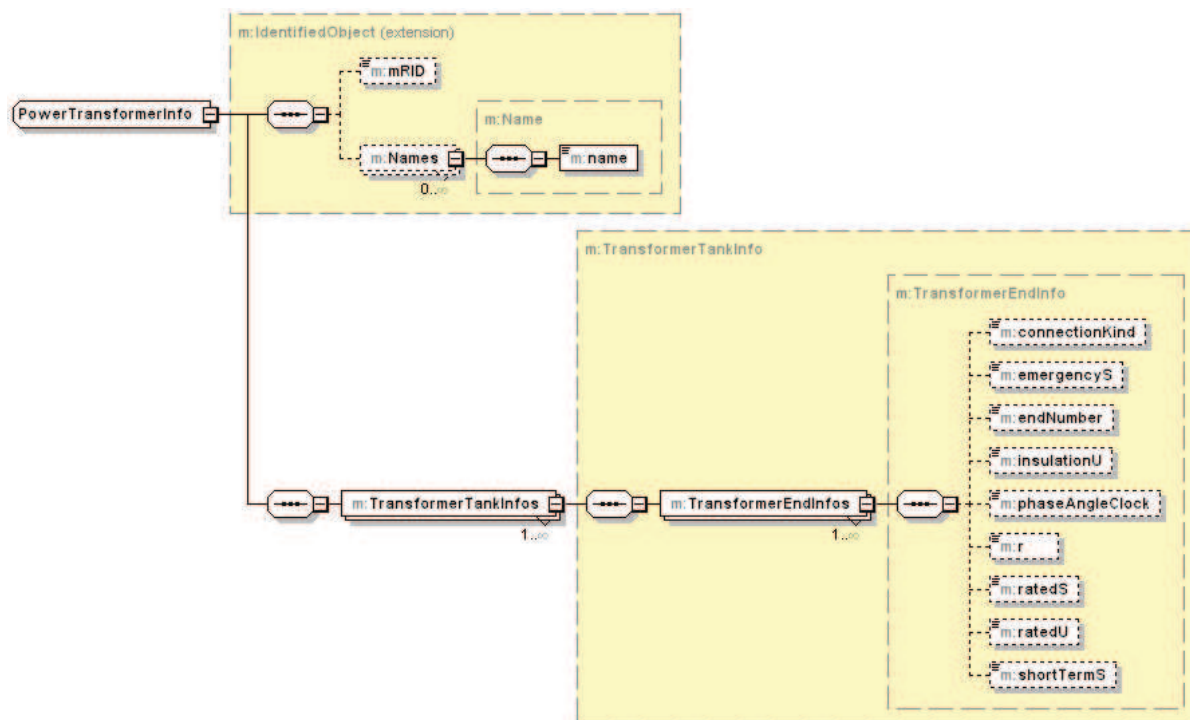


Figure 10 – AssetCatalogue message: PowerTransformerInfo element

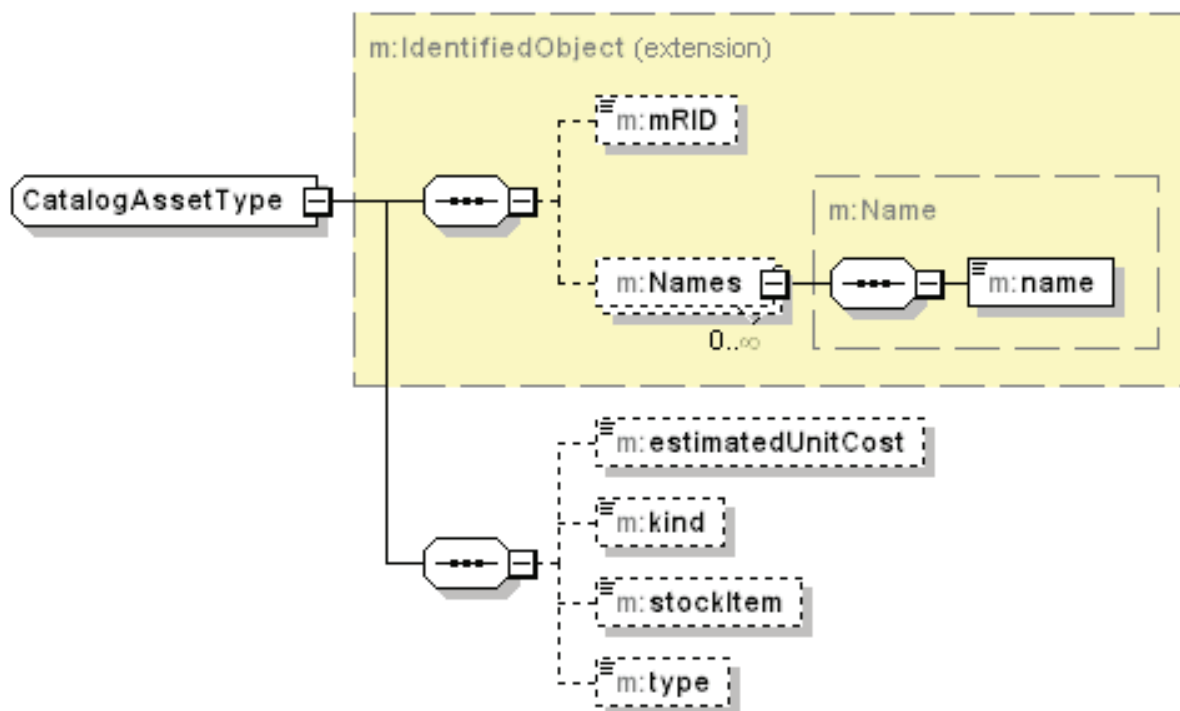


Figure 11 – AssetCatalogue message: CatalogAssetType element

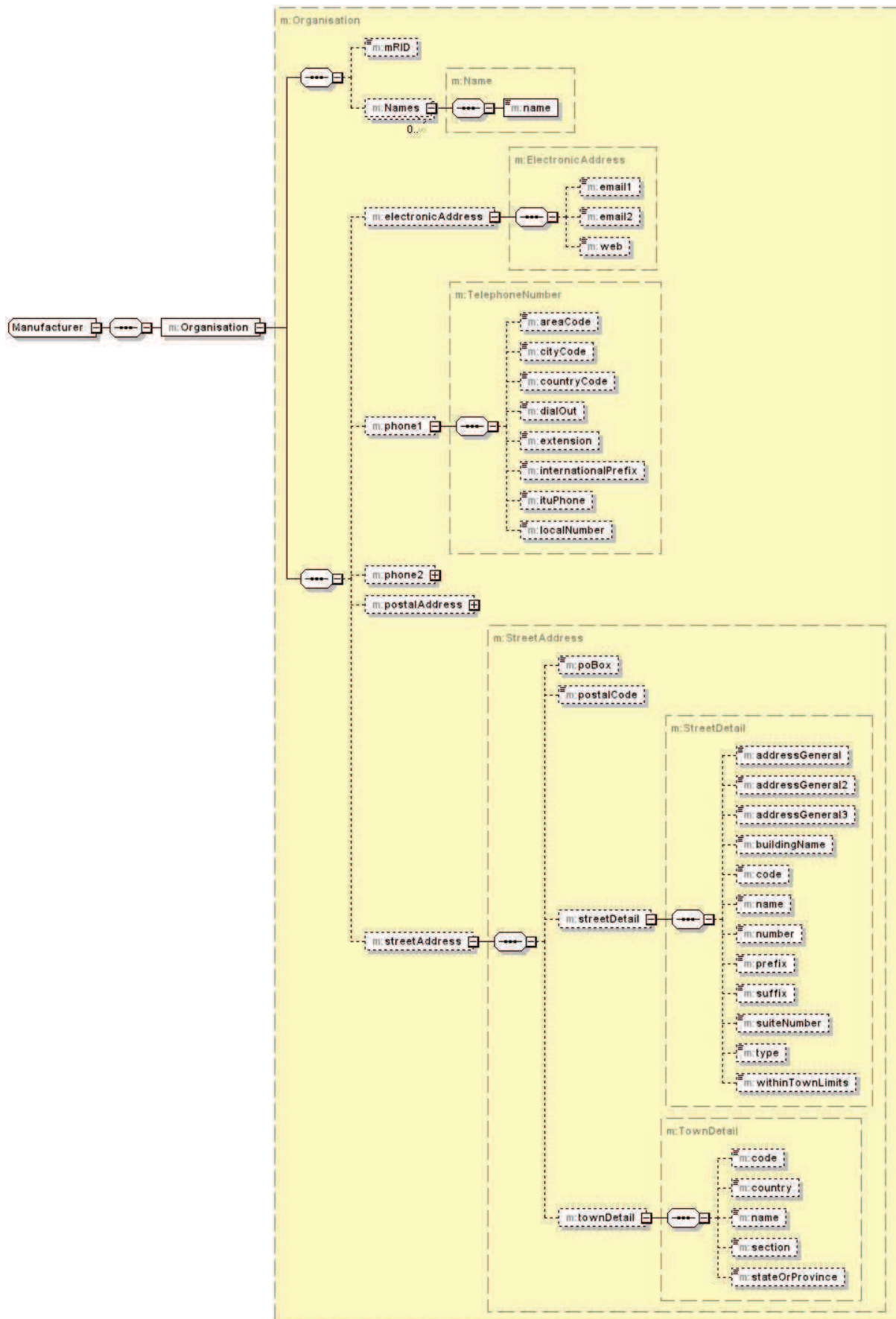


Figure 12 – AssetCatalogue message: Manufacturer element

The following is an XML example for an AssetCatalogue. It contains the model and rating information for a circuit breaker.

```
<?xml version="1.0" encoding="UTF-8"?>
<m:AssetCatalogue xmlns:m="http://iec.ch/TC57/2007/AssetCatalogue#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2007/AssetCatalogue# AssetCatalogue.xsd">
  <m:ProductAssetModel>
    <m:mRID>25fc985e-b658-11e5-9f22-ba0be0483c18</m:mRID>
    <m:modelNumber>UN45D3000</m:modelNumber>
    <m:modelVersion>2</m:modelVersion>
    <m:SwitchInfo>
      <m:breakingCapacity>50000</m:breakingCapacity>
      <m:ratedCurrent>3150</m:ratedCurrent>
      <m:ratedFrequency>60</m:ratedFrequency>

      <m:ratedImpulseWithstandVoltage>1050000</m:ratedImpulseWithstandVoltage>
      <m:ratedInterruptingTime>3</m:ratedInterruptingTime>
      <m:ratedVoltage>253000</m:ratedVoltage>
    </m:SwitchInfo>
  </m:ProductAssetModel>
</m:AssetCatalogue>
```

5.4 TypeAssetCatalogue messages

5.4.1 General

A TypeAssetCatalogue message can contain data for a set of utility asset types. It is a collection of information regarding generic types of assets that may be used for design purposes, analysis, and so on. The CatalogAssetType in a TypeAssetCatalogue message is not associated with a particular manufacturer, but the message may contain references to ProductAssetModels that describe manufacturer-specific versions associated with the CatalogueAssetType.

5.4.2 Applications

The TypeAssetCatalogue message is used to exchange generic asset models. Example applications include design and analysis. In exploratory design, generic asset model may be used initially, which may then be replaced by specific product model information as the design advances. In analysis, the generic asset model may be utilized for exploratory coarse-grained analysis. In these cases, the generic model for the asset of interest may be obtained from a custodian system. A typical application for this message is for an asset analytic system to query and discover the desired TypeAssetCatalogue information, as shown in Figure 13.

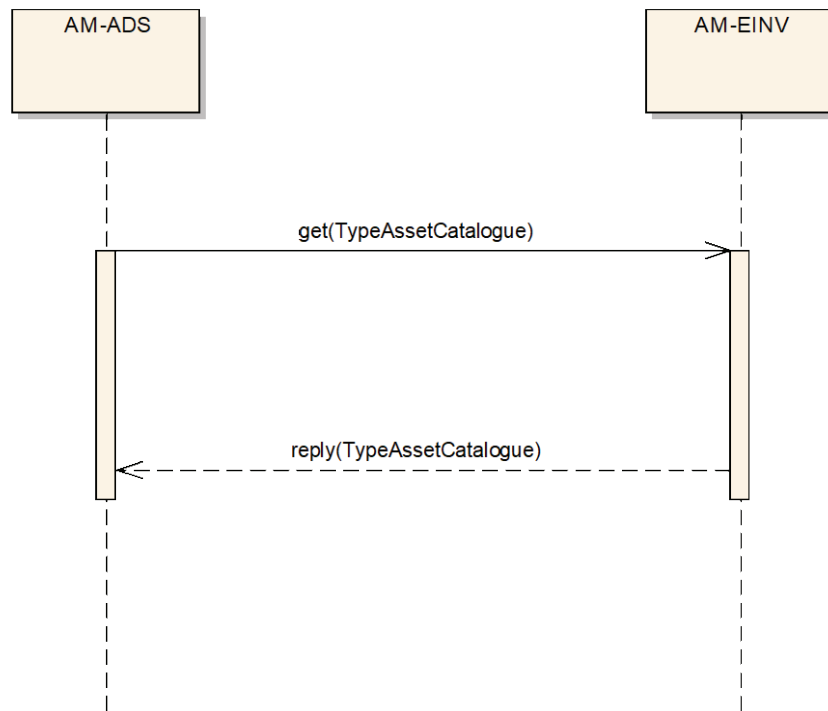


Figure 13 – Type Asset Catalogue message exchange

5.4.3 Message format

Figure 14 shows the message format used to obtain TypeAssetCatalogue information. The message payload consists of a multiplicity of CatalogueAssetType objects. In addition to the attributes of CatalogueAssetType, the payload can also contain ratings information for the CatalogueAssetType in the form of AssetInfo child classes such as BusbarSectionInfo and BushingInfo. Furthermore, the message can contain reference to the ProductAssetModels that the CatalogueAssetType is associated with.

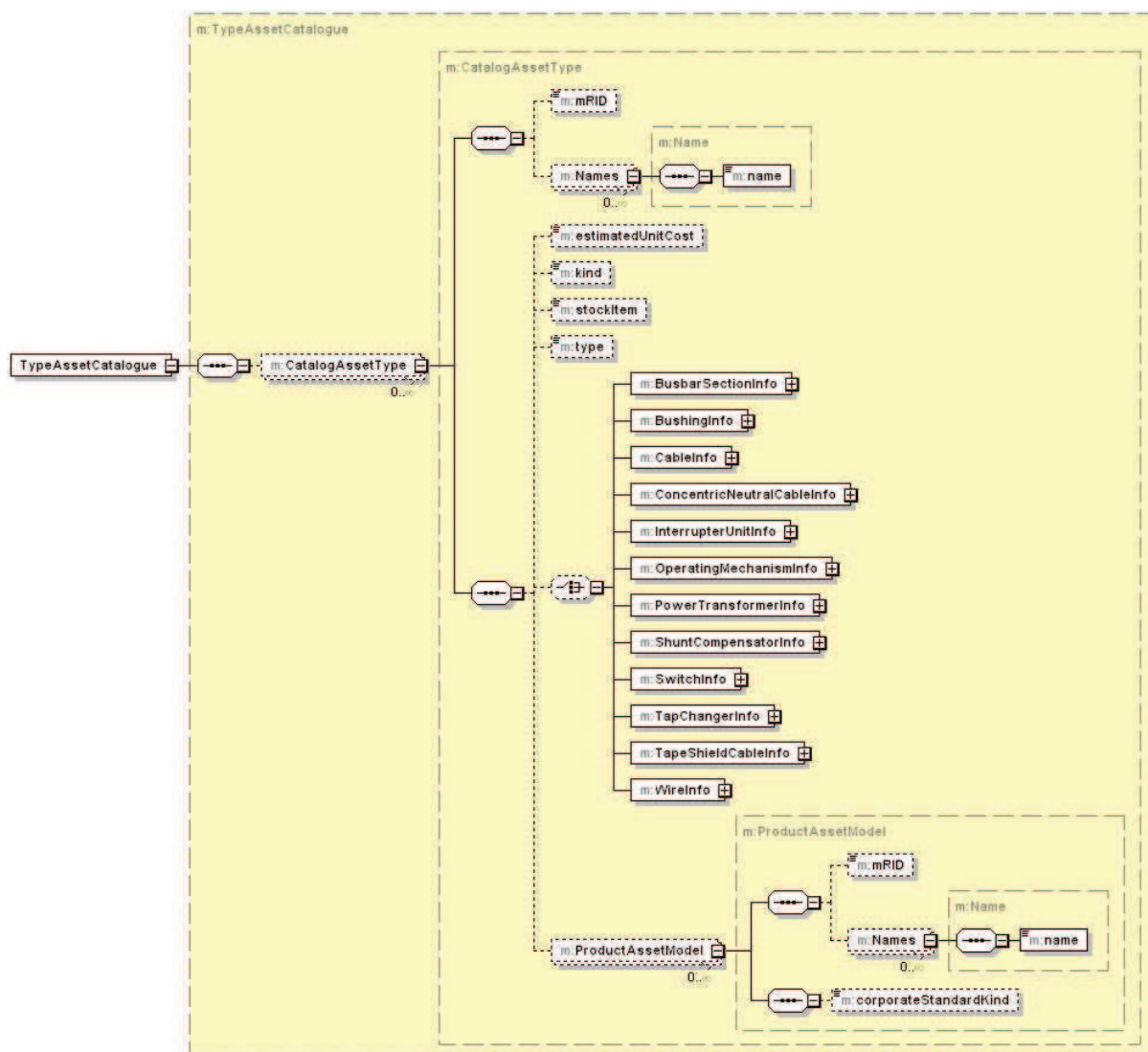


Figure 14 – TypeAssetCatalogue message format

The following is an XML example for a TypeAssetCatalogue.

```
<?xml version="1.0" encoding="UTF-8"?>
<m:TypeAssetCatalogue xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:m="http://iec.ch/TC57/2007/TypeAssetCatalogue#"
  xsi:schemaLocation="http://iec.ch/TC57/2007/TypeAssetCatalogue#
  TypeAssetCatalogue.xsd">
  <m:CatalogAssetType>
    <m:mRID>b4ca7c94-ca02-4f9a-b405-31209ccbe1d1</m:mRID>
    <m:estimatedUnitCost>10000</m:estimatedUnitCost>
    <m:stockItem>true</m:stockItem>
    <m:ProductAssetModels >
      <m:mRID>cfc68fef-ae54-408f-baa7-aaf04bdb3c92</m:mRID>
    </m:ProductAssetModels >
    <m:ProductAssetModels>
      <m:mRID>25fc985e-b658-11e5-9f22-ba0be0483c18</m:mRID>
    </m:ProductAssetModels>
  </m:CatalogAssetType>
</m:TypeAssetCatalogue>
```

5.5 AssetTemplate messages

5.5.1 General

An AssetTemplate message contains data regarding the logical and informational composition of a particular asset kind. This message contains the information objects that comprise the asset and the relationships of the information objects with each other. The purpose of this message is to describe the specific manner in which the infinitely nested AssetContainer-Asset classes have been used in order to describe a specific utility asset. This would reveal to the querying system – e.g. an analytic that is assessing the condition of the asset – the object hierarchy for that asset, i.e. what information objects may be available for the various components of the asset and how they are related to each other.

5.5.2 Applications

The AssetTemplate message is used to discover the components that make up the information model of an asset kind. This information model is generally expected to reflect the logical composition of an asset. For instance, a Dead Tank SF6 circuit breaker may be comprised of one tank, six bushings, three interrupters, and one operating mechanism. Each one of these components may be modeled as an Asset or an Asset child class. The AssetTemplate message for this asset kind would then return the Asset objects pertaining to these components and how they associate with each other – i.e. which of these Asset/Asset child classes associate with which other Asset/Asset child classes – and which Asset object the Medium is associated with, when applicable.

A typical application for this message is for an asset analytic system to query and discover the composition and object hierarchy of an asset type it is assessing, as shown in Figure 15, wherein an asset analytic system is querying a network and substation inventory system to discover the information objects that comprise a particular asset type and their relationship.

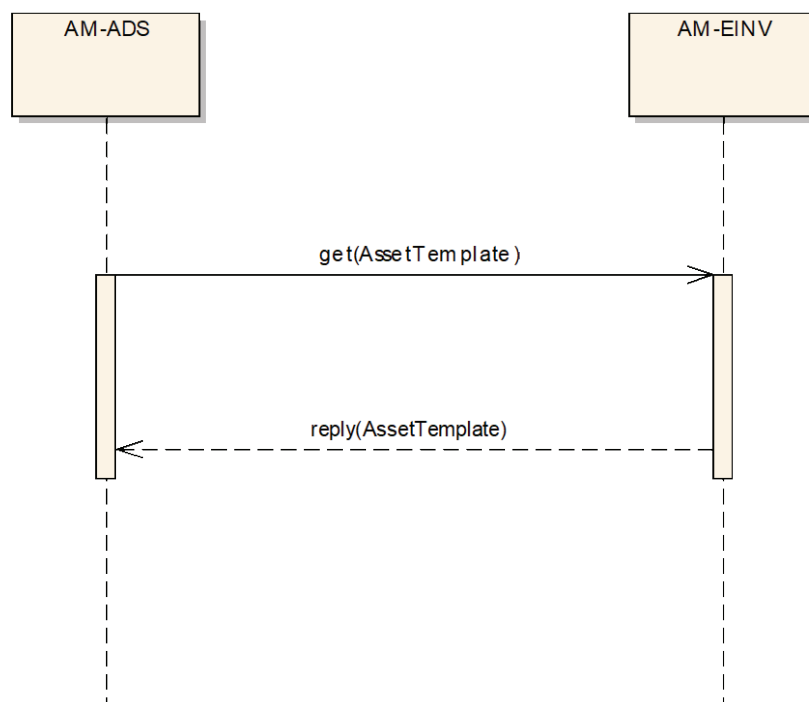


Figure 15 – Asset Template query exchange

Yet another application for this message is for an asset analytic system to create the composition and object hierarchy of an asset type, as shown in Figure 16, wherein an asset analytic system, which might be incorporated in a design software, is providing a network and

substation inventory system the information objects that comprise a particular asset type and their relationship.

Informative object hierarchies for some typical assets are provided in Annex D.

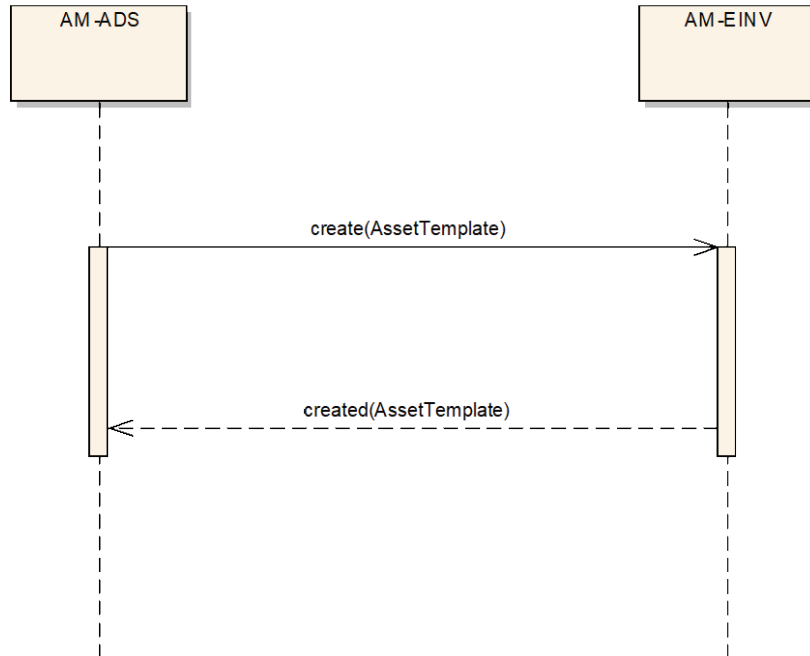


Figure 16 – Asset template creation exchange

5.5.3 Message format

Figure 17, Figure 18, and Figure 19 show the AssetTemplate message format. A root level AssetContainer object, as shown in Figure 17, can contain other AssetContainer objects in a nested fashion, with the hierarchical description terminating in Asset objects. Figure 18 shows the Asset and Medium elements of the AssetTemplate message. Figure 18 shows circuit breaker elements with the unique associations such as Bushing ends that are connected to FixedContact and MovingContact ends of an InterrupterUnit.

The AssetTemplate message can be used to describe the information object template for assets of varying complexity:

- complex assets such as substation main power transformers that have multiple nested levels of AssetContainer;
- simpler assets such as poletop transformers that may be one nested level of an AssetContainer with its component assets such as Bushing;
- component assets such as Bushing.

The AssetTemplate message has two possible realizations:

- 1) It only contains the "kind" and/or "type" attribute of the Asset, Asset child classes (AssetContainer, Bushing, etc.), and Medium. This realization allows for the description of the object hierarchy of a general asset.
- 2) It contains the identifying information such as mRID or unique name of instances of Asset, Asset child classes (AssetContainer, Bushing, etc.), and Medium. This realization allows for the description of the object hierarchy of a specific asset.

In the case of the second realization, i.e. the object hierarchy of a specific asset, the AssetDetail message can be utilized to obtain the properties of the asset's component objects.

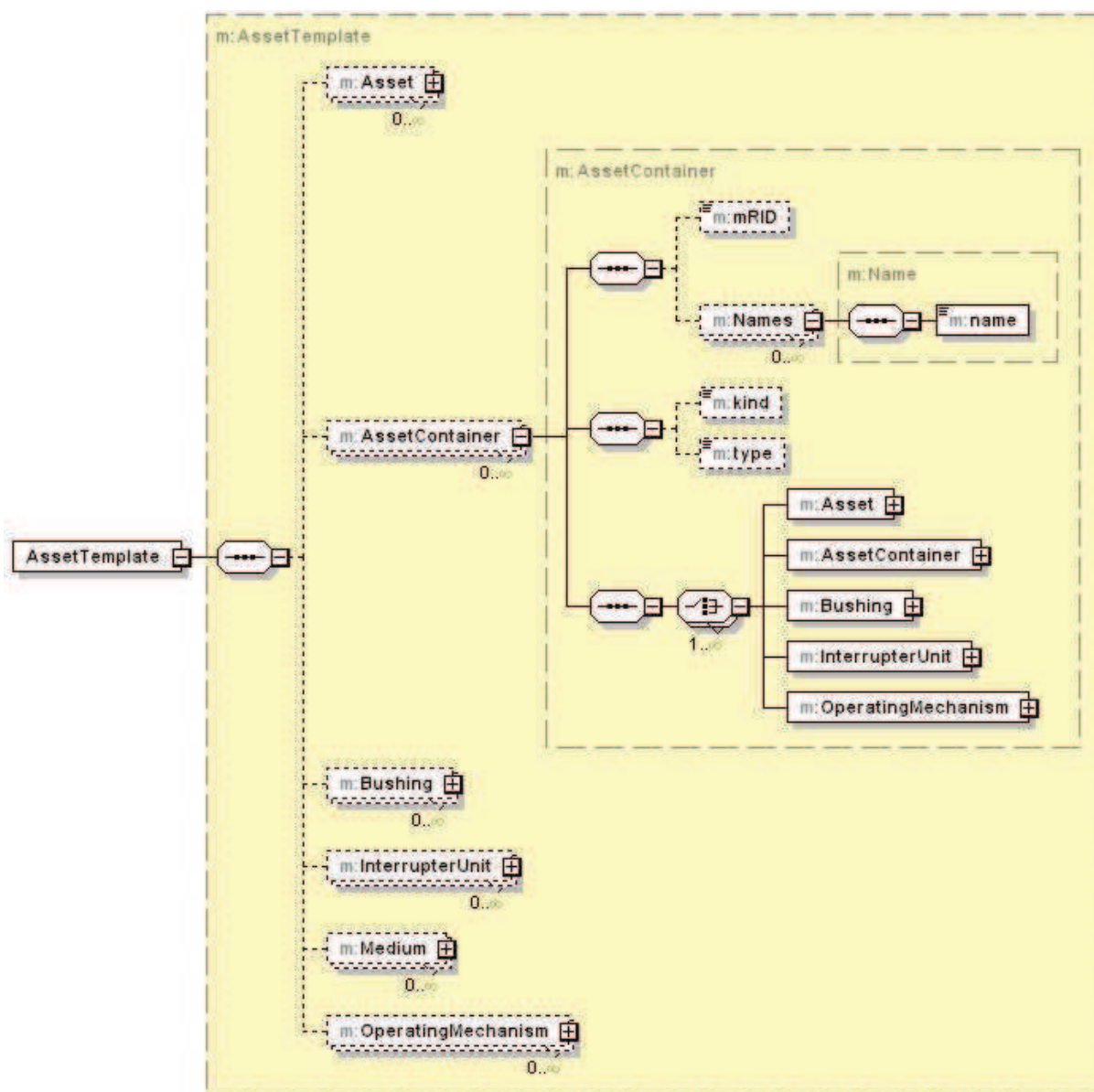


Figure 17 – AssetTemplate message showing the AssetContainer element

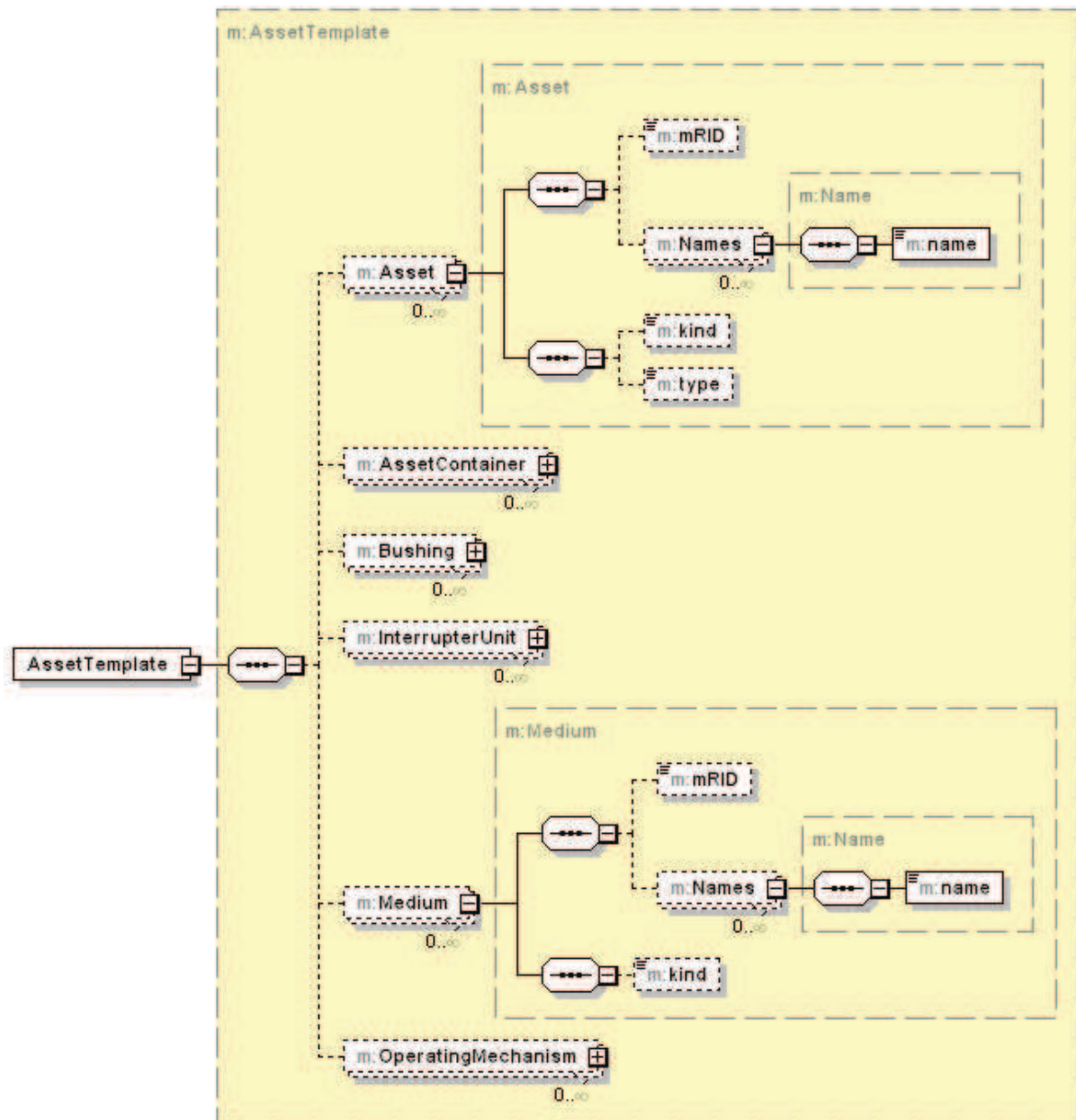


Figure 18 – AssetTemplate message showing the Asset and Medium elements

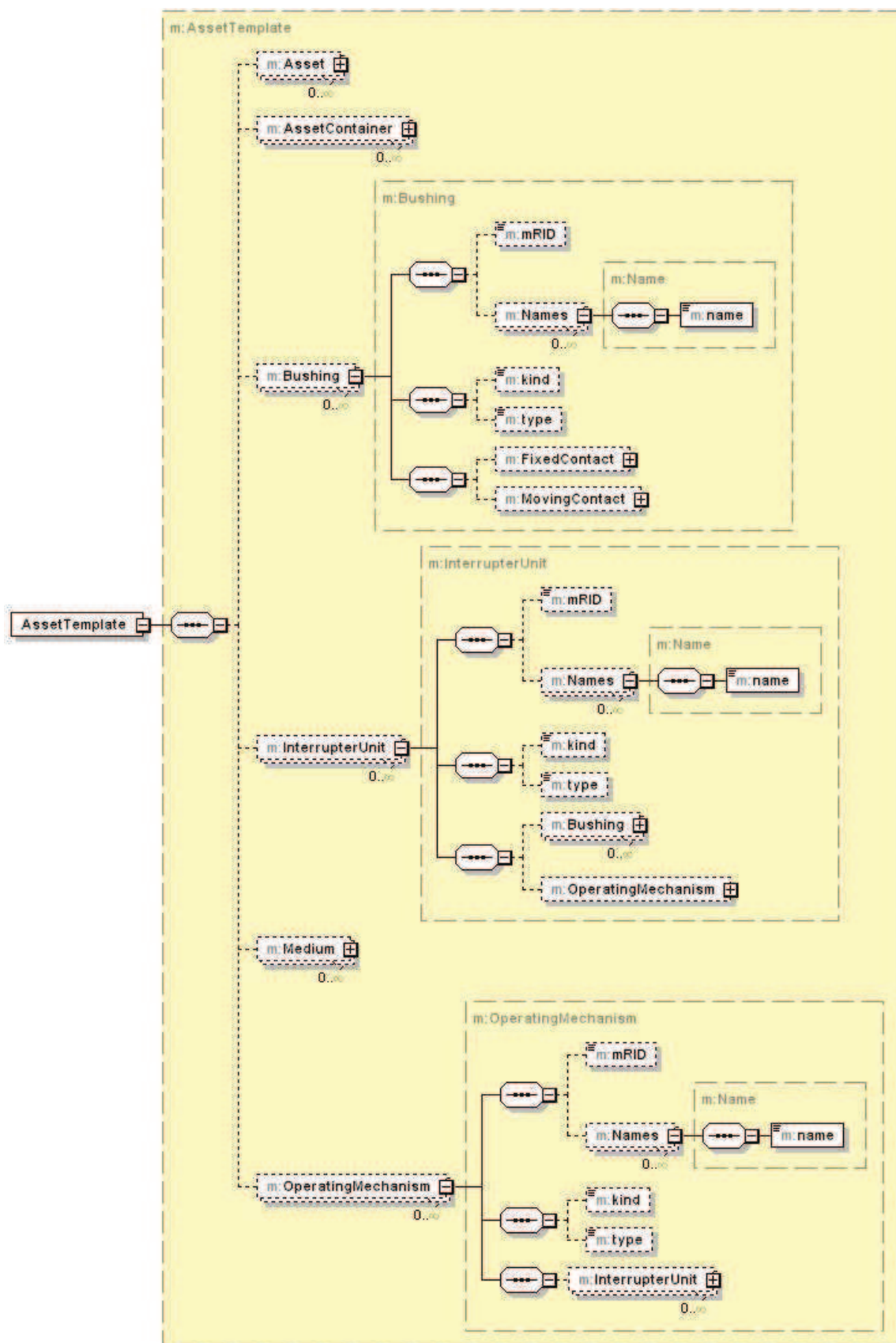


Figure 19 – AssetTemplate message showing the Bushing, InterrupterUnit, and OperatingMechanism elements

The following is an XML example for an AssetTemplate that describes an SF6 dead tank breaker.

```
<?xml version="1.0" encoding="UTF-8"?>
<m:AssetTemplate xmlns:m="http://iec.ch/TC57/2007/profile#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2007/profile# AssetTemplate.xsd">
  <m:AssetContainer>
    <m:mRID>63eb750e-1360-4a73-acd5-d5638045f78e</m:mRID>
    <m:kind>breakerSF6DeadTankBreaker</m:kind>
    <m:AssetContainer ref="a49bd9e3-abba-4140-a202-200af5e134f8"/>
  </m:AssetContainer>
  <m:AssetContainer>
    <m:mRID>a49bd9e3-abba-4140-a202-200af5e134f8</m:mRID>
    <m:kind>breakerTankAssembly</m:kind>
    <m:Mediums ref="f5d3fc3d-041e-44c7-bda1-0c75b7c89a05"/>
    <m:Bushing ref="9343e63b-fcb1-4fb3-9e9a-e9b519754c13"/>
    <m:Bushing ref="fe37a60e-d8b7-49e5-8c12-93af7c58d223"/>
    <m:Bushing ref="c278ccba-3c18-4634-a54a-6d42379407a2"/>
    <m:Bushing ref="d5f14947-72b7-456b-8695-18577aebcc9e"/>
    <m:Bushing ref="0b2407fb-cd83-45f4-ba06-3cafc68f1f6d"/>
    <m:Bushing ref="1e98268b-411a-407a-813b-9a13abeab21e"/>
    <m:InterrupterUnit ref="397e055a-b6e1-469f-86bc-46235a67d638"/>
    <m:InterrupterUnit ref="5d4df34b-88d2-4d06-9116-c7bd3d6a9cfc"/>
    <m:InterrupterUnit ref="312f340c-d430-4e52-8fef-7f4ead013493"/>
    <m:OperatingMechanism ref="e643467f-7c72-4384-9da2-b61956524cd5"/>
  </m:AssetContainer>
  <m:Bushing>
    <m:mRID>9343e63b-fcb1-4fb3-9e9a-e9b519754c13</m:mRID>
    <m:insulationKind>oilImpregnatedPaper</m:insulationKind>
    <m:FixedContact ref="397e055a-b6e1-469f-86bc-46235a67d638"/>
  </m:Bushing>
  <m:Bushing>
    <m:mRID>fe37a60e-d8b7-49e5-8c12-93af7c58d223</m:mRID>
    <m:insulationKind>oilImpregnatedPaper</m:insulationKind>
    <m:MovingContact ref="397e055a-b6e1-469f-86bc-46235a67d638"/>
  </m:Bushing>
  <m:Bushing>
    <m:mRID>c278ccba-3c18-4634-a54a-6d42379407a2</m:mRID>
    <m:insulationKind>oilImpregnatedPaper</m:insulationKind>
    <m:FixedContact ref="5d4df34b-88d2-4d06-9116-c7bd3d6a9cfc"/>
  </m:Bushing>
  <m:Bushing>
    <m:mRID>d5f14947-72b7-456b-8695-18577aebcc9e</m:mRID>
    <m:insulationKind>oilImpregnatedPaper</m:insulationKind>
    <m:MovingContact ref="5d4df34b-88d2-4d06-9116-c7bd3d6a9cfc"/>
  </m:Bushing>
  <m:Bushing>
    <m:mRID>0b2407fb-cd83-45f4-ba06-3cafc68f1f6d</m:mRID>
    <m:insulationKind>oilImpregnatedPaper</m:insulationKind>
    <m:FixedContact ref="e643467f-7c72-4384-9da2-b61956524cd5"/>
  </m:Bushing>
  <m:Bushing>
    <m:mRID>1e98268b-411a-407a-813b-9a13abeab21e</m:mRID>
    <m:insulationKind>oilImpregnatedPaper</m:insulationKind>
    <m:MovingContact ref="e643467f-7c72-4384-9da2-b61956524cd5"/>
  </m:Bushing>
  <m:InterrupterUnit>
    <m:mRID>397e055a-b6e1-469f-86bc-46235a67d638</m:mRID>
    <m:OperatingMechanism ref="e643467f-7c72-4384-9da2-b61956524cd5"/>
    <m:Bushing ref="9343e63b-fcb1-4fb3-9e9a-e9b519754c13"/>
    <m:Bushing ref="fe37a60e-d8b7-49e5-8c12-93af7c58d223"/>
```

```

</m:InterrupterUnit>
<m:InterrupterUnit>
  <m:mRID>5d4df34b-88d2-4d06-9116-c7bd3d6a9cfc</m:mRID>
  <m:OperatingMechanism ref="e643467f-7c72-4384-9da2-b61956524cd5"/>
  <m:Bushing ref="c278ccba-3c18-4634-a54a-6d42379407a2"/>
  <m:Bushing ref="d5f14947-72b7-456b-8695-18577aebcc9e"/>
</m:InterrupterUnit>
<m:InterrupterUnit>
  <m:mRID>312f340c-d430-4e52-8fef-7f4ead013493</m:mRID>
  <m:OperatingMechanism ref="e643467f-7c72-4384-9da2-b61956524cd5"/>
  <m:Bushing ref="0b2407fb-cd83-45f4-ba06-3cafc68f1f6d"/>
  <m:Bushing ref="1e98268b-411a-407a-813b-9a13abeab21e"/>
</m:InterrupterUnit>
<m:Medium>
  <m:mRID>f5d3fc3d-041e-44c7-bda1-0c75b7c89a05</m:mRID>
  <m:kind>sF6</m:kind>
</m:Medium>
<m:OperatingMechanism>
  <m:mRID>e643467f-7c72-4384-9da2-b61956524cd5</m:mRID>
  <m:InterrupterUnit ref="397e055a-b6e1-469f-86bc-46235a67d638"/>
  <m:InterrupterUnit ref="5d4df34b-88d2-4d06-9116-c7bd3d6a9cfc"/>
  <m:InterrupterUnit ref="e643467f-7c72-4384-9da2-b61956524cd5"/>
</m:OperatingMechanism>
</m:AssetTemplate>

```

5.6 AssetDetail messages

5.6.1 General

An AssetDetail message can contain the properties of an Asset as well as other related objects that describe its characteristics such as the ratings information, ownership, and location. This message is the principal means of exchanging detailed information about asset characteristics, whose unique identity may have been obtained using messages such as AssetList and AssetTemplate. Note that this message is for only asset characteristic information. For exchange of asset test and measurement data, use AssetProcedures and AssetMeasurements messages.

5.6.2 Applications

The AssetDetail message is used to obtain the details pertaining to one or more assets. These details include the attributes of Asset class as well as those of associated classes such as AssetInfo, Location, and Ownership.

A typical application for this message is for an asset analytic system to query and discover the details of the assets it is interested in assessing, as shown in Figure 20. In this figure, an asset analytic system is querying a network and substation inventory system to discover the detailed information pertaining to the assets of interest.

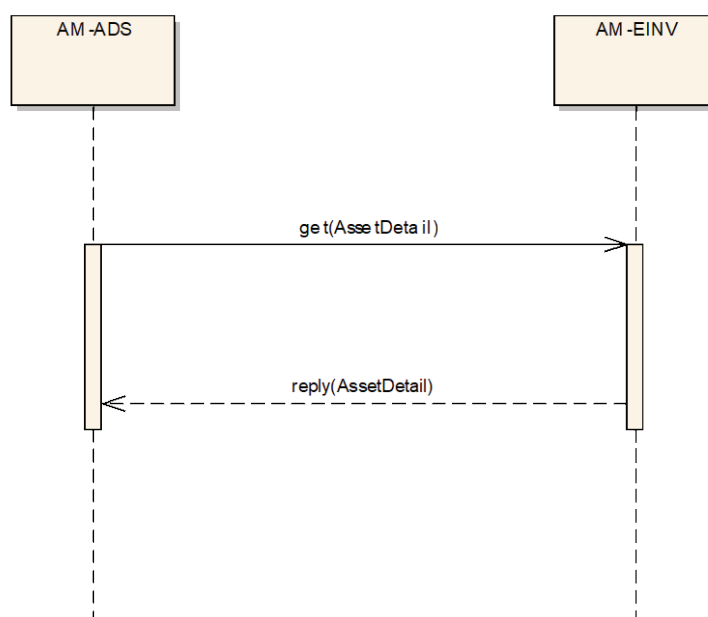


Figure 20 – Asset Detail message exchange

5.6.3 Message format

Figure 21 through Figure 30 show the AssetDetail message format. The message payload shown in the figure consists of a multiplicity of Asset or Asset child objects. The Asset object may contain attributes of the Asset class, nameplate information in the form of AssetInfo child classes, Location information, and a multiplicity of Ownership information (to account for assets that are co-owned by more than one entity.) In the case of the Asset element, shown in Figure 22, AssetDeployment details could be provided as well (Figure 23). If this Asset is a breaker, SwitchOperationSummary could also be included (Figure 24).

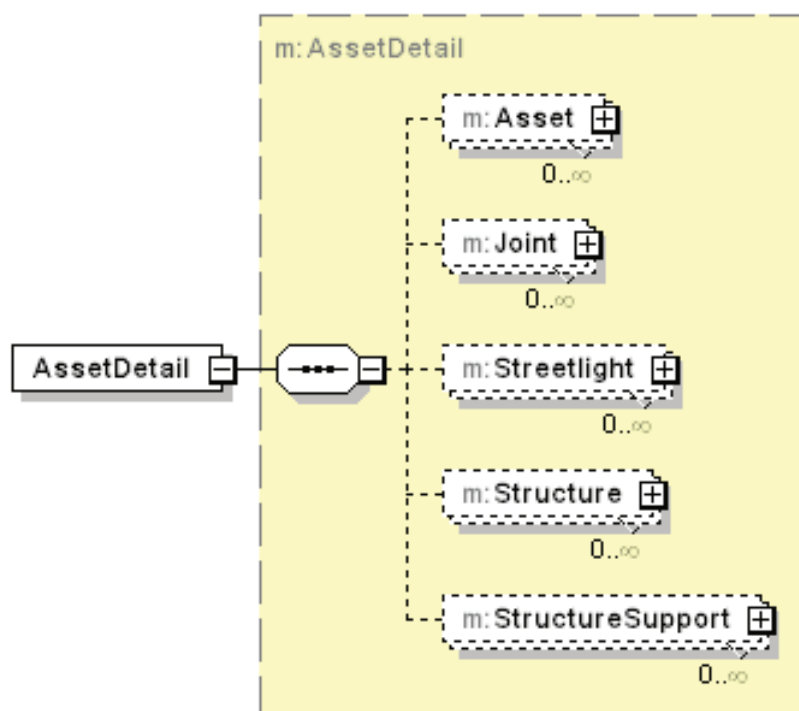


Figure 21 – Asset Detail message format

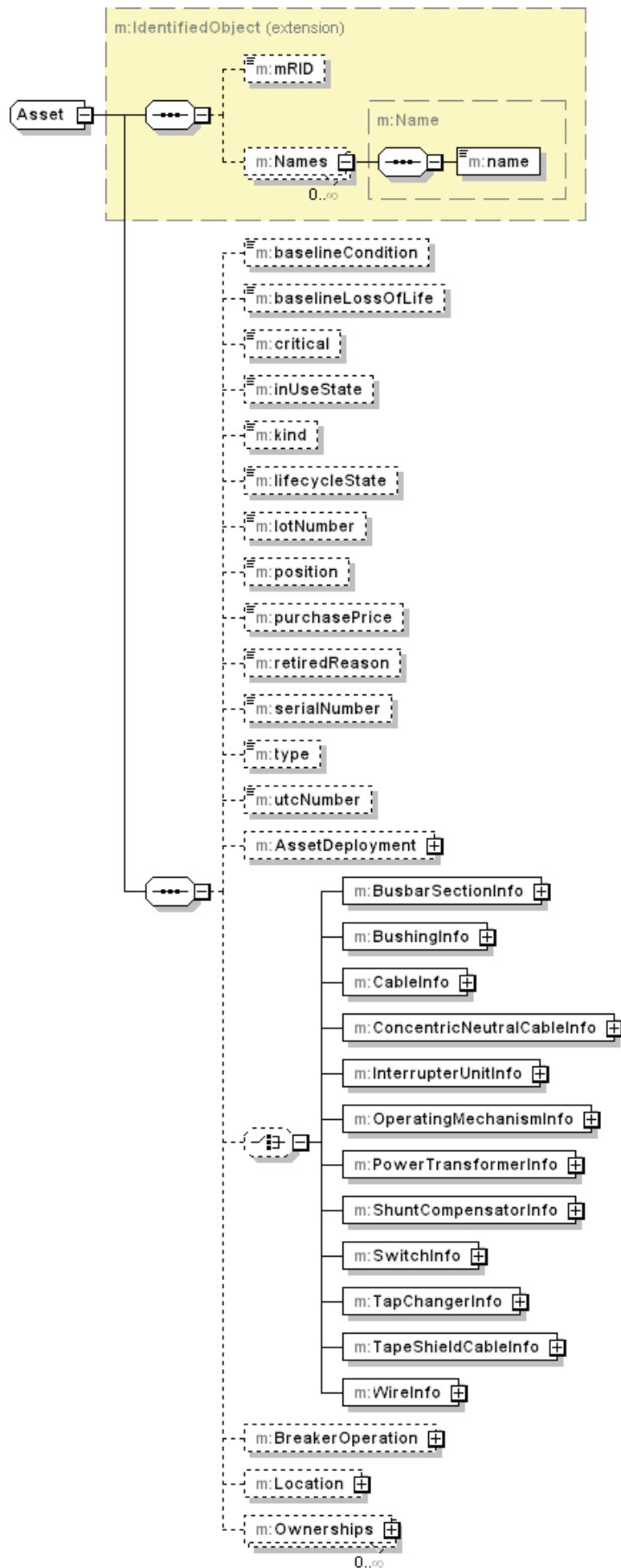


Figure 22 – AssetDetail message: Asset element

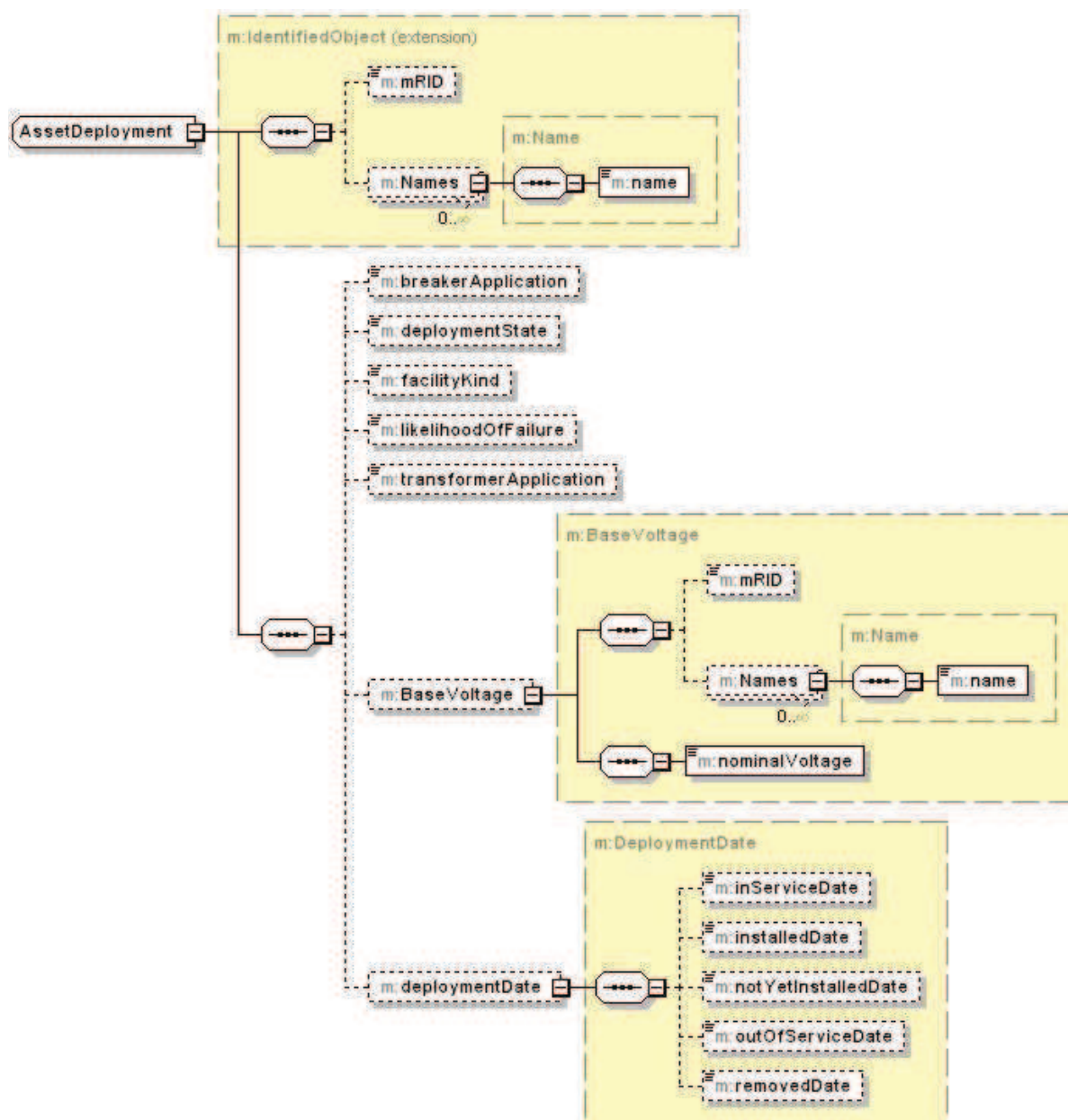


Figure 23 – AssetDetail message: AssetDeployment element (included in the Asset element shown in Figure 22)

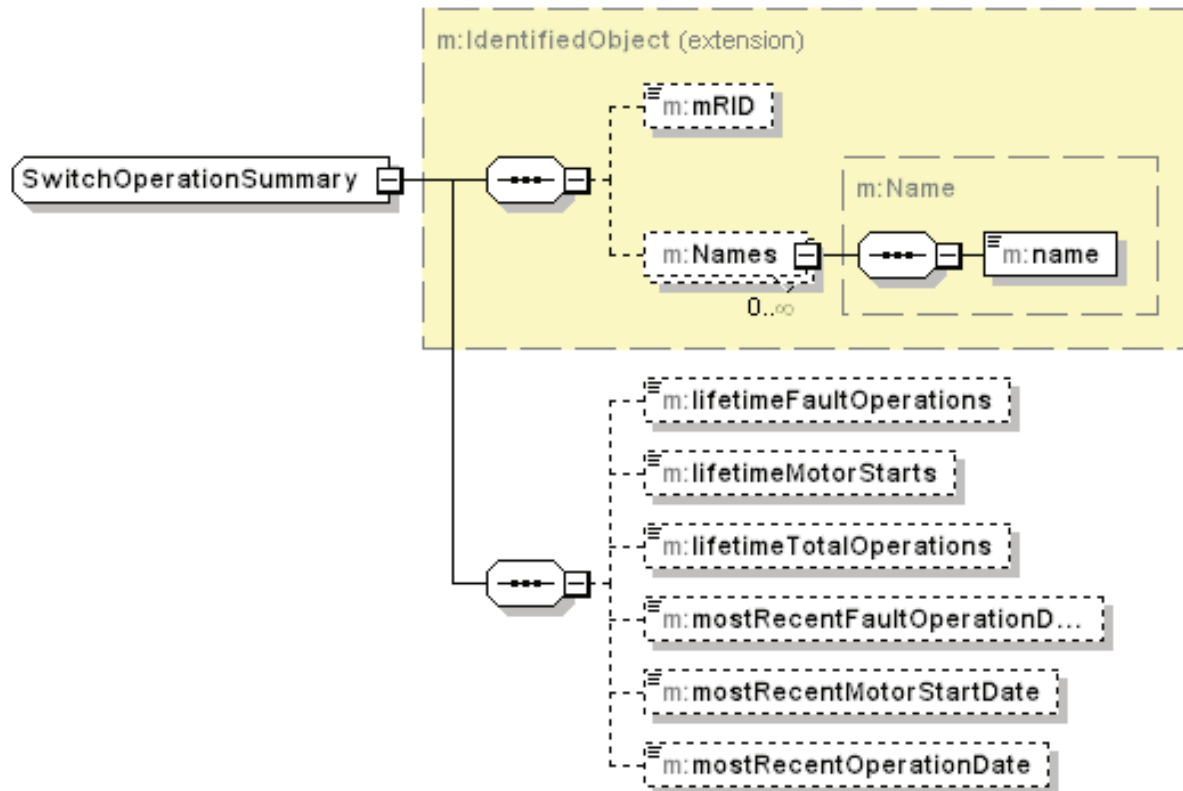


Figure 24 – AssetDetail message: SwitchOperationSummary element (included as BreakerOperation association within the Asset element shown in Figure 22)

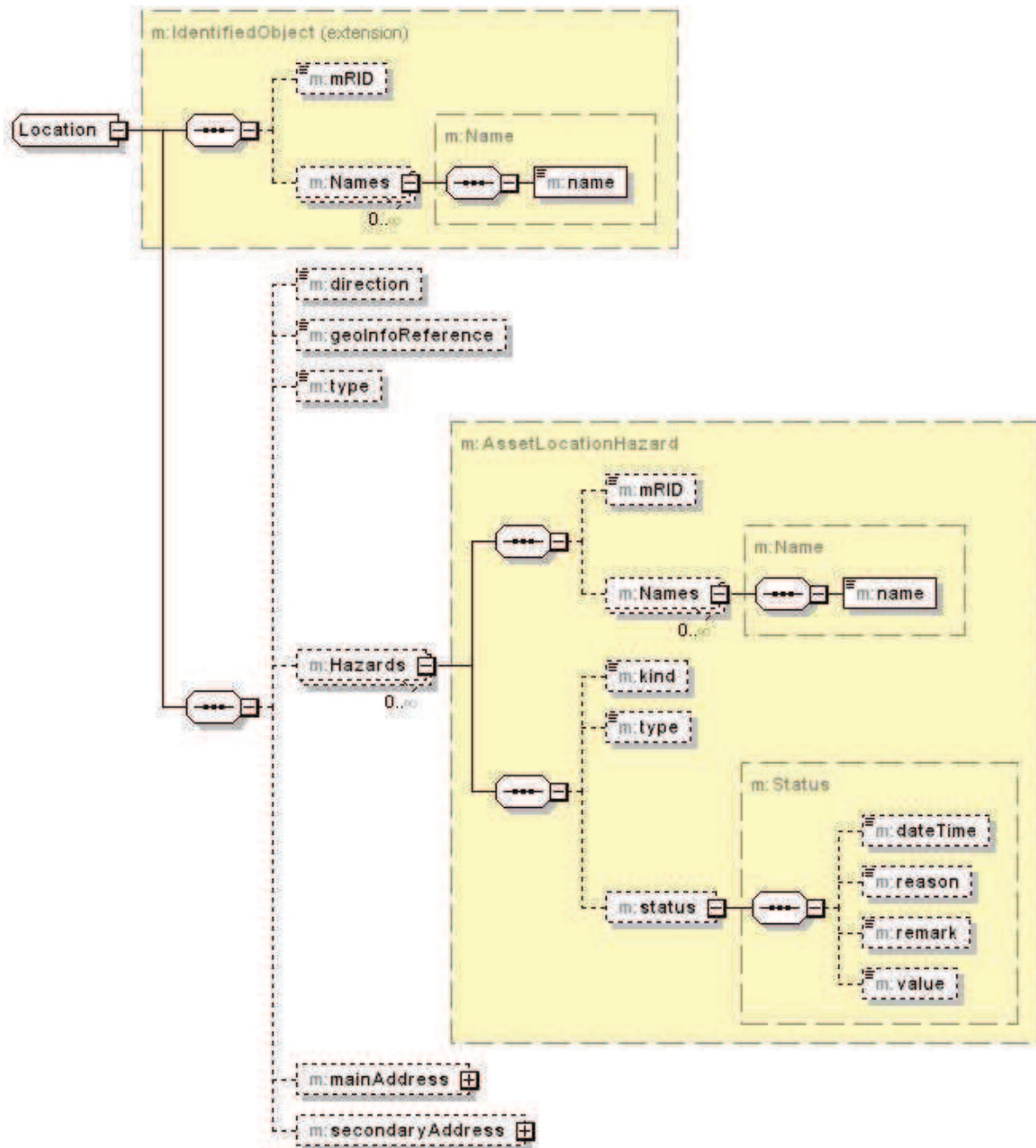


Figure 25 – AssetDetail message: Location element

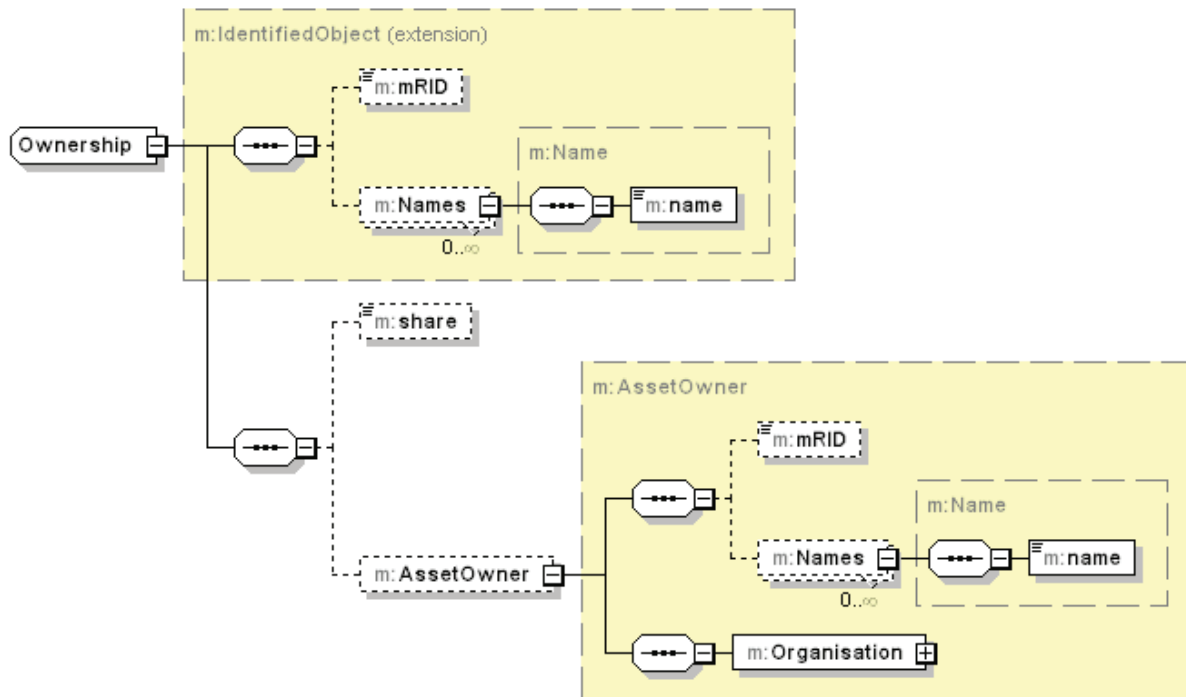


Figure 26 – AssetDetail message: Ownership element

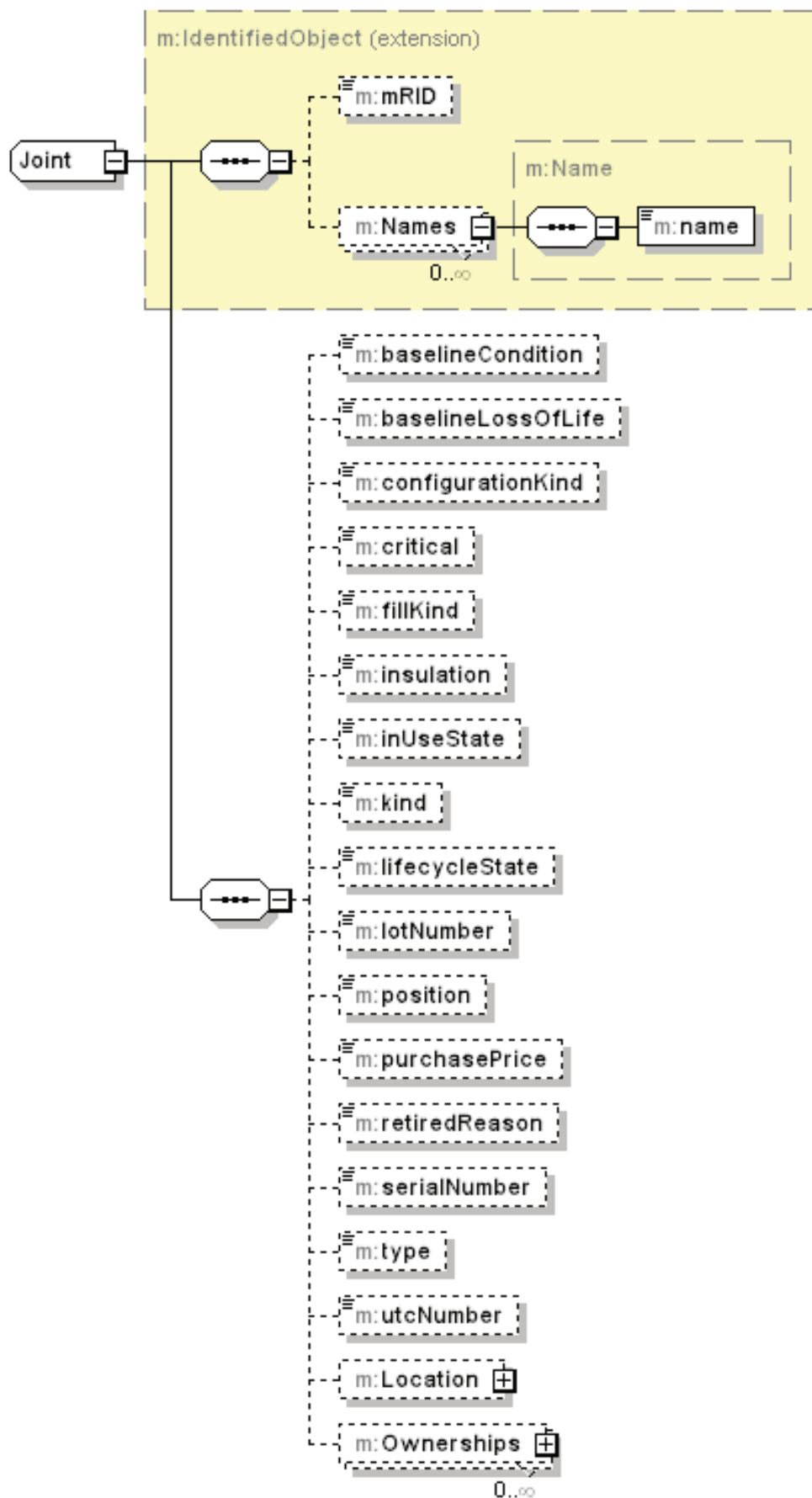


Figure 27 – AssetDetail message: Joint element

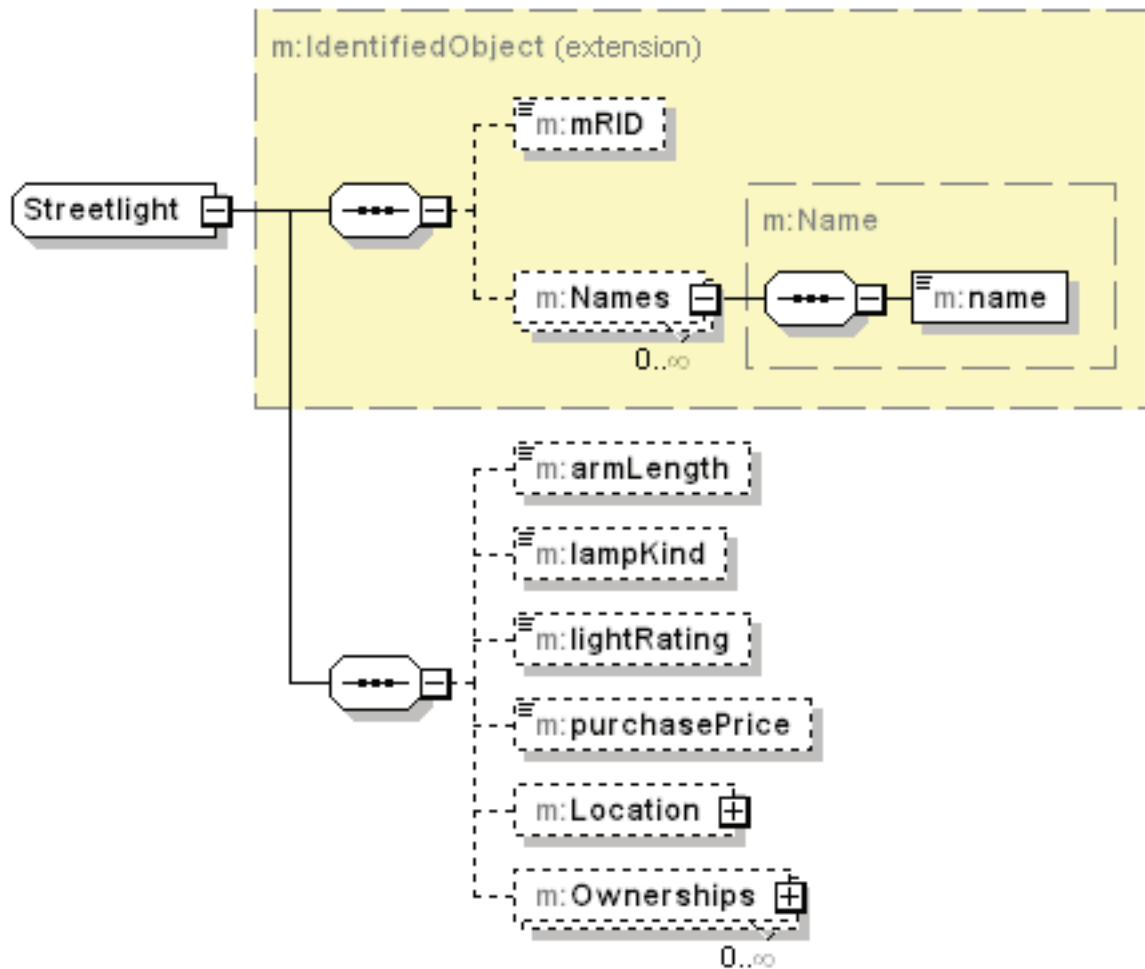


Figure 28 – AssetDetail message: Streetlight element

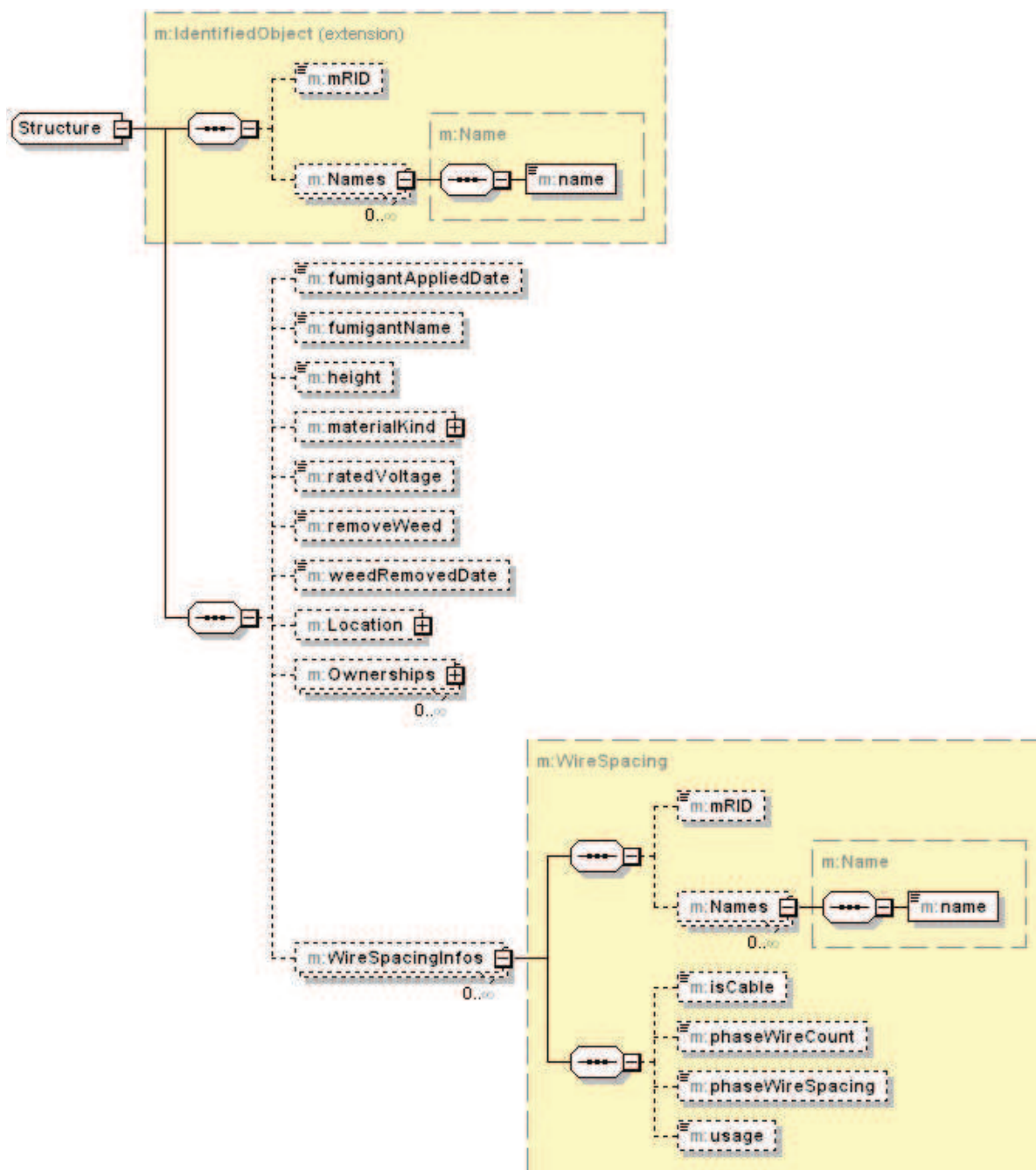


Figure 29 – AssetDetail message: Structure element

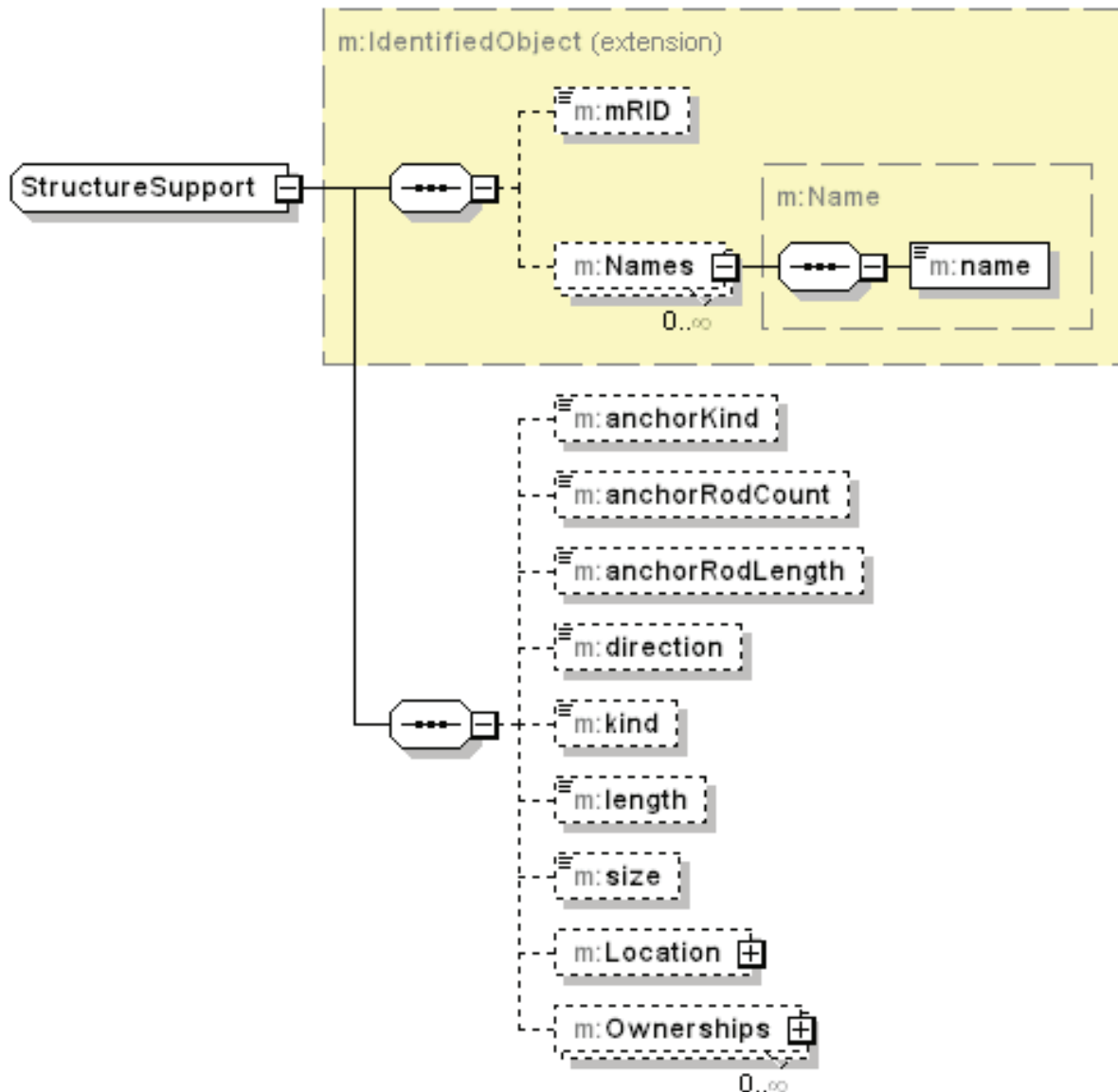


Figure 30 – AssetDetail message: StructureSupport element

The following is an XML example for an AssetDetail, which contains the details of a 550 kV SF6 live tank breaker.

```
<?xml version="1.0" encoding="UTF-8"?>
<m:AssetDetail xmlns:m="http://iec.ch/TC57/2007/AssetDetail#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2007/AssetDetail# AssetDetail.xsd">
  <m:Asset>
    <m:mRID>63eb750e-1360-4a73-acd5-d5638045f78e</m:mRID>
    <m:baselineLossOfLife>50</m:baselineLossOfLife>
    <m:critical>true</m:critical>
    <m:kind>breakerSF6LiveTankBreaker</m:kind>
    <m:lifecycleState>inService</m:lifecycleState>
    <m:name>ElectricSomervilleCB8</m:name>
    <m:SwitchInfo>
      <m:breakingCapacity>63000</m:breakingCapacity>
      <m:isSinglePhase>true</m:isSinglePhase>
      <m:isUnganged>true</m:isUnganged>
      <m:ratedCurrent>5000</m:ratedCurrent>
      <m:ratedFrequency>60</m:ratedFrequency>
    </m:SwitchInfo>
  </m:Asset>
</m:AssetDetail>
```

```

    <m:ratedImpulseWithstandVoltage>1175000</m:ratedImpulseWithstandVoltage>
  </m:SwitchInfo>
  <m:Location>
    <m:mainAddress>
      <m:streetDetail>
        <m:name>Electric</m:name>
        <m:number>88</m:number>
        <m:type>Avenue</m:type>
        <m:withinTownLimits>true</m:withinTownLimits>
      </m:streetDetail>
      <m:townDetail>
        <m:code>02144</m:code>
        <m:country>USA</m:country>
        <m:name>Somerville</m:name>
        <m:stateOrProvince>Massachusetts</m:stateOrProvince>
      </m:townDetail>
    </m:mainAddress>
  </m:Location>
  <m:Ownerships>
    <m:share>100</m:share>
    <m:AssetOwner>
      <m:mRID>f5d3fc3d-041e-44c7-bda1-0c75b7c89a05</m:mRID>
      <m:Names>
        <m:name>Grid Corporation</m:name>
      </m:Names>
    </m:AssetOwner>
  </m:Ownerships>
</m:Asset>
</m:AssetDetail>

```

5.7 AssetHistory message

5.7.1 General

An AssetHistory message can contain the history of an asset – i.e. log entries on changes to the states of Asset, as well as the Location and Ownership of a particular asset. While the AssetDetail message enables the exchange of the current details of assets, the AssetHistory message enables for the exchange of the history of the assets.

5.7.2 Applications

The AssetHistory message is used to obtain the historical details pertaining to assets. These details include changes made to attributes of Asset class as well as those of the associated classes Location and Ownership.

A typical application for this message is for an asset analytic system to query and discover the historical details of the asset it is interested in assessing, as shown in Figure 31. In this figure, an asset analytic system is querying a network and substation inventory system to discover the historical information pertaining to the asset of interest.