MTConnect® Standard
Part 4.2 – File Asset Information Model
Version 1.8.0

Prepared for: MTConnect Institute
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MTConnect Specification and Materials

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1 Purpose of This Document

This document, *MTConnect Standard: Part 4.2 - File Asset Information Model* of the MTConnect Standard, establishes the rules and terminology to be used by designers to describe the function and operation of files used within manufacturing and to define the data that is provided by an *Agent* from a piece of equipment. This part of the Standard also defines the structure for the XML document that is returned from an *Agent* in response to a `probe` request.

The data associated with these files will be retrieved from multiple sources that are responsible for providing their knowledge of an *MTConnect Asset*.

2 Terminology and Conventions

Refer to Section 2 of *MTConnect Standard Part 1.0 - Overview and Fundamentals* for a dictionary of terms, reserved language, and document conventions used in the MTConnect Standard.

2.1 Glossary

URL

: Stands for Uniform Resource Locator.

: See http://www.w3.org/TR/uri-clarification/#RFC3986

W3C

: The World Wide Web Consortium (W3C) is an international community that develops open standards to ensure the long-term growth of the Web.

: See *https://www.w3.org/*.

Agent

: Refers to an MTConnect Agent.

: Software that collects data published from one or more piece(s) of equipment, organizes that data in a structured manner, and responds to requests for data from client software systems by providing a structured response in the form of a *Response Document* that is constructed using the *semantic data models* defined in the Standard.

: Appears in the documents in the following form: *Agent*.

Asset

: item, thing or entity that has potential or actual value to an organization *Ref:ISO 55000:2014(en)*

> Note 1 to entry: Value can be tangible or intangible, financial or non-financial, and includes consideration of risks and liabilities. It can be positive or negative at different stages of the asset life.

> Note 2 to entry: Physical assets usually refer to equipment, inventory and properties owned by the organization. Physical assets are the opposite of intangible assets, which are non-physical assets such as leases, brands, digital assets, use rights, licences, intellectual property rights, reputation or agreements.

Note 3 to entry: A grouping of assets referred to as an asset system could also be considered as an asset.

Child Element

A portion of a data modeling structure that illustrates the relationship between an element and the higher-level *Parent Element* within which it is contained.

Appears in the documents in the following form: *Child Element*.

Component

General meaning:

A *Structural Element* that represents a physical or logical part or subpart of a piece of equipment.

Appears in the documents in the following form: *Component*.

Used in *Information Models*:

A data modeling element used to organize the data being retrieved from a piece of equipment.

- When used as an XML container to organize *Lower Level* `Component` elements.

  Appears in the documents in the following form: `Components`.

- When used as an abstract XML element. `Component` is replaced in a data model by a type of *Component* element. `Component` is also an XML container used to organize *Lower Level* `Component` elements, *Data Entities*, or both.

  Appears in the documents in the following form: `Component`.

Current Request

A *Current Request* is a *Request* to an *Agent* to produce an *MTConnectStreams Response Document* containing the *Observations Information Model* for a snapshot of the latest *observations* at the moment of the *Request* or at a given *sequence number*.

Data Entity

A primary data modeling element that represents all elements that either describe data items that may be reported by an *Agent* or the data items that contain the actual data published by an *Agent*.

Appears in the documents in the following form: *Data Entity*.

Devices Information Model

A set of rules and terms that describes the physical and logical configuration for a piece of equipment and the data that may be reported by that equipment.

Appears in the documents in the following form: *Devices Information Model*.

Equipment Metadata

See *Metadata*

Information Model

The rules, relationships, and terminology that are used to define how information is structured.

For example, an information model is used to define the structure for each *MTConnect Response Document*; the definition of each piece of information within those documents and the relationship between pieces of information.

Appears in the documents in the following form: *Information Model*.

Lower Level

A nested element that is below a higher level element.

Metadata

Data that provides information about other data.

For example, *Equipment Metadata* defines both the *Structural Elements* that represent the physical and logical parts and sub-parts of each piece of equipment, the relationships between those parts and sub-parts, and the definitions of the *Data Entities* associated with that piece of equipment.

Appears in the documents in the following form: *Metadata* or *Equipment Metadata*.

MTConnect Agent

See definition for *Agent*.

MTConnect Asset

An *MTConnect Asset* is an *Asset* used by the manufacturing process to perform tasks.

Note 1 to entry: An *MTConnect Asset* relies upon an *MTConnect Device* to provide *observations* and information about itself and the *MTConnect Device* revises the information to reflect changes to the *MTConnect Asset* during their interaction. Examples of *MTConnect Assets* are Cutting Tools, Part Information, Manufacturing Processes, Fixtures, and Files.

Note 2 to entry: A singular `assetId` uniquely identifies an *MTConnect Asset* throughout its lifecycle and is used to track and relate the *MTConnect Asset* to other *MTConnect Devices* and entities.

Note 3 to entry: *MTConnect Assets* are temporally associated with a device and can be removed from the device without damage or alteration to its primary functions.

MTConnect Device

An *MTConnect Device* is a piece of equipment or a manufacturing system that produces *observations* about itself and/or publishes data using the *MTConnect Information Model*.

MTConnect Information Model

See *Information Model*

MTConnectDevices Response Document

A *Response Document* published by an *MTConnect Agent* in response to a *Probe Request*.

MTConnectStreams Response Document

A *Response Document* published by an *MTConnect Agent* in response to a *Current Request* or a *Sample Request*.

observation

The observed value of a property at a point in time.

Observations Information Model

An *Information Model* that describes the *Streaming Data* reported by a piece of equipment.

organize

The act of containing and owning one or more elements.

Parent Element

An XML element used to organize *Lower Level* child elements that share a common relationship to the *Parent Element*.

Appears in the documents in the following form: *Parent Element*.

Probe Request

A *Probe Request* is a *Request* to an *Agent* to produce an *MTConnectDevices Response Document* containing the *Devices Information Model*.

Request

A communications method where a client software application transmits a message to an *Agent*. That message instructs the *Agent* to respond with specific information.

Appears in the documents in the following form: *Request*.

Response Document

An electronic document published by an *MTConnect Agent* in response to a *Probe Request*, *Current Request*, *Sample Request* or *Asset Request*.

Sample Request

A *Sample Request* is a *Request* to an *Agent* to produce an *MTConnectStreams Response Document* containing the *Observations Information Model* for a set of time-stamped *observations* made by *Components*.

semantic data model

A methodology for defining the structure and meaning for data in a specific logical way.

It provides the rules for encoding electronic information such that it can be interpreted by a software system.

Appears in the documents in the following form: *semantic data model*.

sequence number

The primary key identifier used to manage and locate a specific piece of *Streaming Data* in an *Agent*.

sequence number is a monotonically increasing number within an instance of an *Agent*.

Appears in the documents in the following form: *sequence number*.

Streaming Data

The values published by a piece of equipment for the *Data Entities* defined by the *Equipment Metadata*.

Appears in the documents in the following form: *Streaming Data*.

Structural Element

General meaning:

An XML element that organizes information that represents the physical and logical parts and sub-parts of a piece of equipment.

Appears in the documents in the following form: *Structural Element*.

Used to indicate hierarchy of Components:

When used to describe a primary physical or logical construct within a piece of equipment.

Appears in the documents in the following form: *Top Level Structural Element*.

When used to indicate a *Child Element* which provides additional detail describing the physical or logical structure of a *Top Level Structural Element*.

Appears in the documents in the following form: *Lower Level Structural Element*.

Top Level

Structural Elements that represent the most significant physical or logical functions of a piece of equipment.

2.2 Acronyms

AMT

The Association for Manufacturing Technology

2.3 MTConnect References

[MTConnect Part 1.0] *MTConnect Standard Part 1.0 - Overview and Fundamentals*. Version 1.8.0.

[MTConnect Part 4.2] *MTConnect Standard: Part 4.2 - File Asset Information Model*. Version 1.8.0.

3 Files Information Model

Manufacturing processes require various documents, programs, setup sheets, and digital media available at the device for a given process. The File and FileArchetype Assets provide a mechanism to communicate specific "Files" that are relevant to a process where the media is located on a server and represented by a Universal Resource Locator (URL).

The FileArchetype contains metadata common to all File Assets for a certain purpose. The File Asset references the file specific to a given device or set of devices. The File Asset does not hold the contents of the file, it contains a reference to the location (URL) used to access the information. The metadata associated with the File provides semantic information about the representation (mime-type) and the application associated with the File. The application of the file is an extensible controlled vocabulary with common manufacturing uses provided.

3.1 AbstractFile

An AbstractFile is an abstract Asset type model that contains the common properties of the File and FileArchetype types.

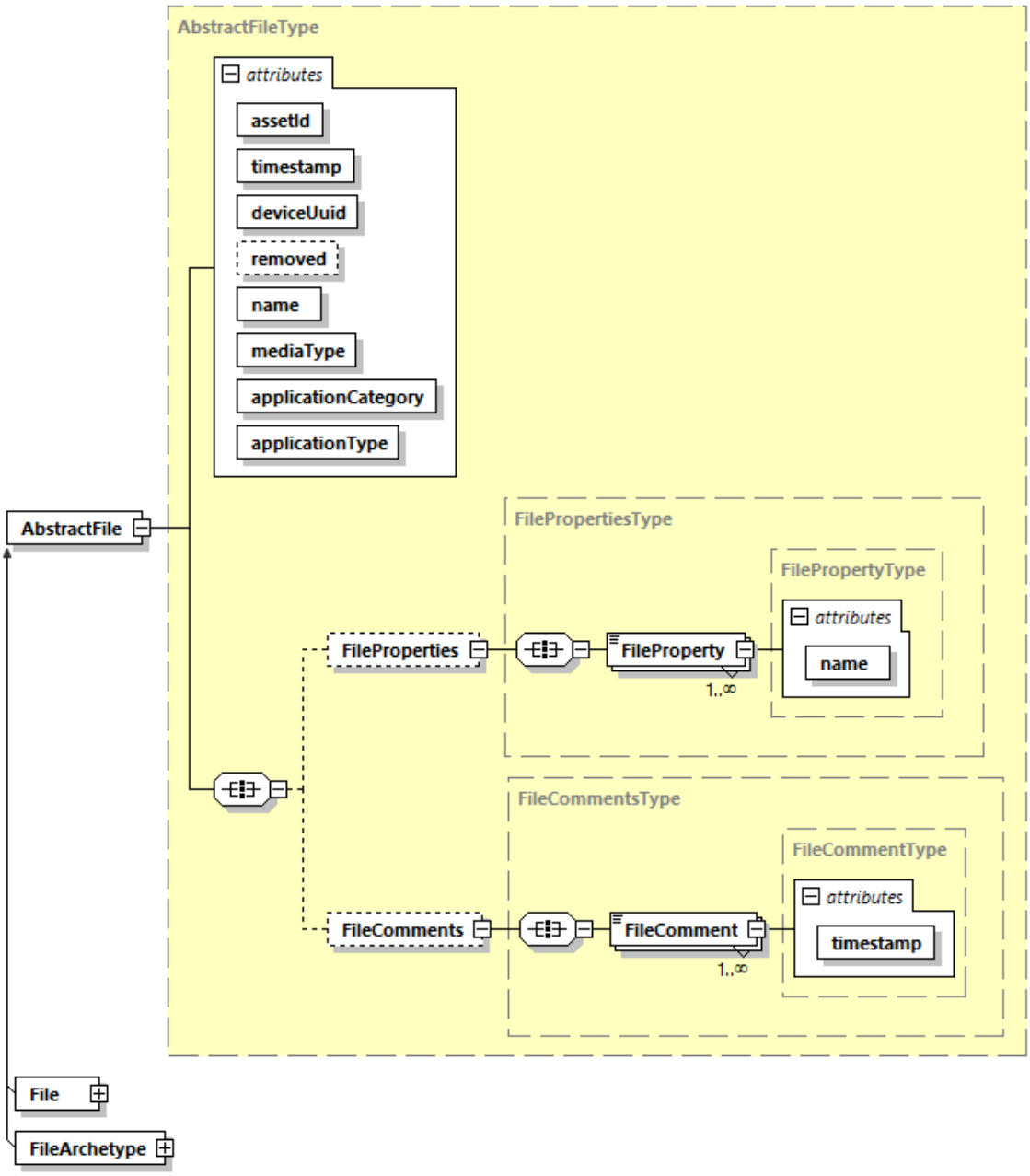

Figure 1: AbstractFile Diagram

3.1.1 Attributes for AbstractFile

Table 1 lists the attributes for an `AbstractFile` element in addition to attributes inherited from `Asset` element.

Table 1: Attributes for AbstractFile

Attribute	Description	Occurrence
`name`	The name of the file. The value of `name` **MUST** be a string.	1
`mediaType`	The mime type of the file. The value of `mediaType` **MUST** be a string.	1
`applicationCategory`	The category of application that will use this file.	1
`applicationType`	The type of application that will use this file.	1

3.1.1.1 AbstractFile applicationCategory types

Table 2 lists the types for `applicationCategory` attribute of `AbstractFile` element.

Table 2: AbstractFile applicationCategory types

type	Description
`ASSEMBLY`	Files regarding the fully assembled product.
`DEVICE`	Device related files.
`HANDLING`	Files relating to the handling of material.
`MAINTENANCE`	File relating to equipment maintenance.
`PART`	Files relating to a part.
`PROCESS`	Files related to the manufacturing process.
`INSPECTION`	Files related to the quality inspection.
`SETUP`	Files related to the setup of a process.

3.1.1.2 AbstractFile applicationType types

Table 3 lists the types for `applicationType` attribute of `AbstractFile` element.

Table 3: AbstractFile applicationType types

type	Description
`DESIGN`	Computer aided design files or drawings.
`DATA`	Generic data.
`DOCUMENTATION`	Documentation regarding a category of file.
`INSTRUCTIONS`	User instructions regarding the execution of a task.
`LOG`	The data related to the history of a machine or process.
`PRODUCTION_PROGRAM`	Machine instructions to perform a process.

3.1.2 Elements for AbstractFile

Table 4 lists the elements for an `AbstractFile` element.

Table 4: Elements for AbstractFile

Element	Description	Occurrence
`FileProperties`	`FileProperties` *organizes* one or more `FileProperty` entities for `Files`.	0..1
`FileComments`	`FileComments` *organizes* one or more `FileComment` entities for `Files`.	0..1

3.1.3 FileProperty

A key-value pair providing additional metadata about a `File`.

The value for `FileProperty` **MUST** be a string.

3.1.3.1 Attributes for FileProperty

Table 5 lists the attributes for a `FileProperty` element.

Table 5: Attributes for FileProperty

Attribute	Description	Occurrence
`name`	The name of the `FileProperty`	1

3.1.4 FileComment

A remark or interpretation for human interpretation associated with a `File` or `FileArchetype`.

The value for `FileComment` **MUST** be a string.

3.1.4.1 Attributes for FileComment

Table 6 lists the attributes for a `FileComment` element.

Table 6: Attributes for FileComment

Attribute	Description	Occurrence
`timestamp`	The time the comment was made. The value for `timestamp` **MUST** be reported in ISO 8601 format.	1

3.2 File

The `File Asset` is an `AbstractFile` with information about the `File` instance and its URL.

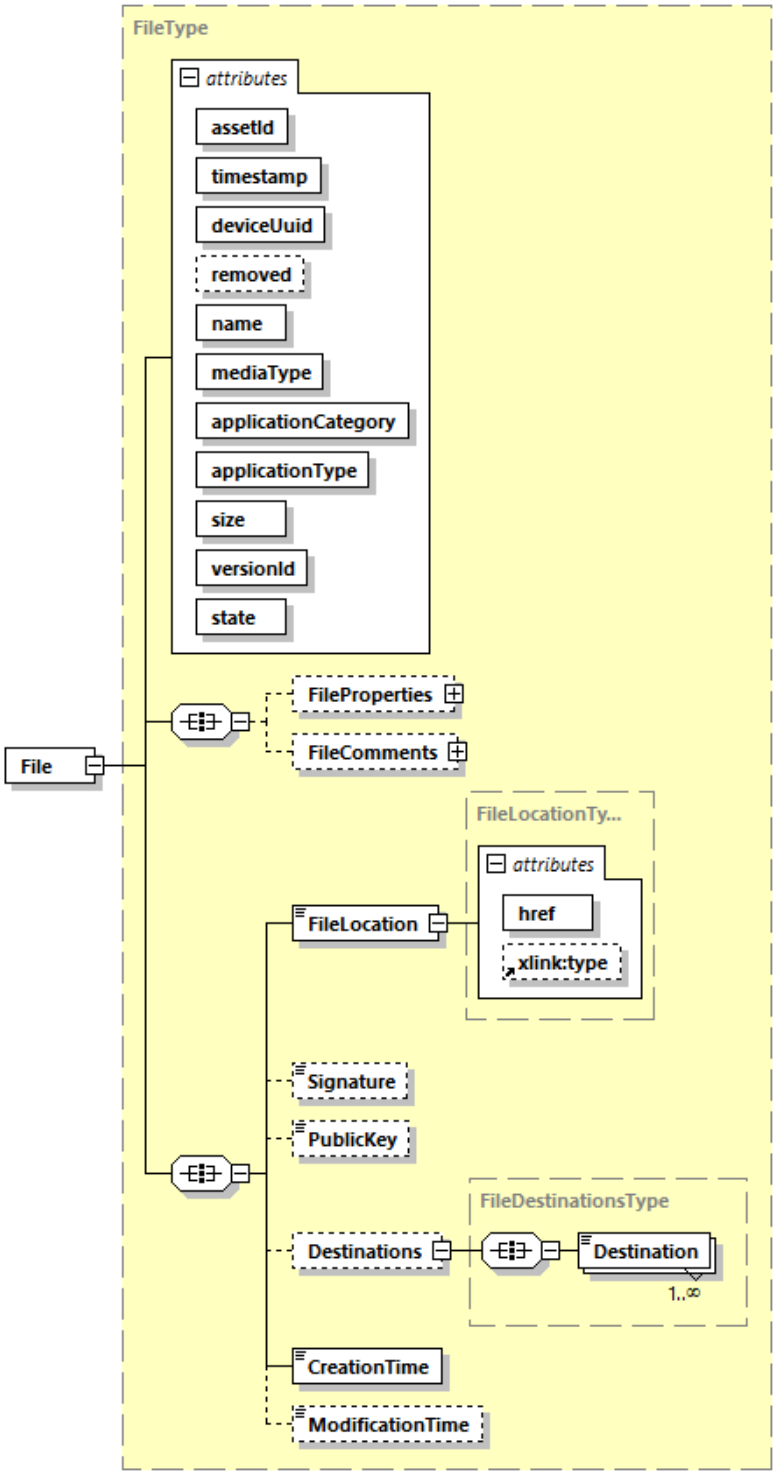

Figure 2: File Diagram

3.2.1 Attributes for File

Table 7 lists the attributes for a `File` element in addition to attributes inherited from `AbstractFile` (See *Section 3.1 - AbstractFile*).

Table 7: Attributes for File

Attribute	Description	Occurrence
`size`	The size of the file in bytes. The value of `size` **MUST** be an integer.	1
`versionId`	The version identifier of the file. The value of `versionId` **MUST** be a string.	1
`state`	The state of the file.	1

3.2.1.1 File states

Table 8 lists the values for `state` attribute of `File` element.

Table 8: File states

type	Description
`EXPERIMENTAL`	Used for processes other than production or otherwise defined.
`PRODUCTION`	Used for production processes.
`REVISION`	The content is modified from `PRODUCTION` or `EXPERIMENTAL`.

3.2.2 Elements for File

Table 9 lists the elements for a `File` element.

Table 9: Elements for File

Element	Description	Occurrence
`Signature`	A secure hash of the file. The value for `Signature` **MUST** be an x509 data block.	0..1
`PublicKey`	The public key used to verify the signature. The value for `PublicKey` **MUST** be an x509 data block.	0..1
`CreationTime`	The time the file was created. The value for `CreationTime` **MUST** be reported in ISO 8601 format.	1
`ModificationTime`	The time the file was modified. The value for `ModificationTime` **MUST** be reported in ISO 8601 format.	0..1
`FileLocation`	The URL reference to the file location.	1
`Destinations`	`Destinations` *organizes* one or more `Destination` elements.	0..1

232 3.2.3 FileLocation

233 The URL reference to the file location.

234 3.2.3.1 Attributes for FileLocation

235 *Table 10* lists the attributes for a `FileLocation` element.

Table 10: Attributes for FileLocation

Attribute	Description	Occurrence
`href`	A URL reference to the file. `href` is of type `xlink:href` from the W3C XLink specification.	1

Continuation of Table 10		
Attribute	Description	Occurrence
`xlink:type`	The type of href for the xlink href type. **MUST** be `locator` referring to a URL.	0..1

3.2.4 Destination

The `Destination` is a reference to the target `Device` for this `File`.

3.2.4.1 Attributes for Destination

Table 11 lists the attributes for a `Destination` element.

Table 11: Attributes for Destination

Attribute	Description	Occurrence
`deviceUuid`	`uuid` of the target device or application.	1

3.3 FileArchetype

`FileArchetype` `Asset` is an `AbstractFile` providing information common to all versions of a file.

See *Section 3.1 - AbstractFile* for details on the `FileArchetype` model.

Appendices

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