MTConnect® Standard

Part 4.2 – File Asset Information Model
Version 1.7.0

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.

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

41

Child Element

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

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

Component

47 General meaning:

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

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

51 Used in *Information Models*:

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

54 • When used as an XML container to organize *Lower Level* `Component` ele-
55 ments.
56 Appears in the documents in the following form: `Components`.

57 • When used as an abstract XML element. `Component` is replaced in a data
58 model by a type of *Component* element. `Component` is also an XML con-
59 tainer used to organize *Lower Level* `Component` elements, *Data Entities*, or
60 both.
61 Appears in the documents in the following form: `Component`.

Current Request

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

Data Entity

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

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

71 **_Devices Information Model_**

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

74   Appears in the documents in the following form: _Devices Information Model_.

75 **_Equipment Metadata_**

76   See _Metadata_

77 **_Information Model_**

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

80   For example, an information model is used to define the structure for each _MTCon-_
81   _nect Response Document_; the definition of each piece of information within those
82   documents and the relationship between pieces of information.

83   Appears in the documents in the following form: _Information Model_.

84 **_Lower Level_**

85   A nested element that is below a higher level element.

86 **_Metadata_**

87   Data that provides information about other data.

88   For example, _Equipment Metadata_ defines both the _Structural Elements_ that rep-
89   resent the physical and logical parts and sub-parts of each piece of equipment, the
90   relationships between those parts and sub-parts, and the definitions of the _Data En-_
91   _tities_ associated with that piece of equipment.

92   Appears in the documents in the following form: _Metadata_ or _Equipment Metadata_.

93 **_MTConnect Agent_**

94   See definition for _Agent_.

95 **_MTConnect Asset_**

96   An _MTConnect Asset_ is an _Asset_ used by the manufacturing process to perform
97   tasks.

98   Note 1 to entry: An _MTConnect Asset_ relies upon an _MTConnect Device_ to
99   provide _observations_ and information about itself and the _MTConnect Device_
100   revises the information to reflect changes to the _MTConnect Asset_ during their
101   interaction. Examples of _MTConnect Assets_ are Cutting Tools, Part Information,
102   Manufacturing Processes, Fixtures, and Files.

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

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

109

MTConnect Device
110

111 An *MTConnect Device* is a piece of equipment or a manufacturing system that pro-
112 duces *observations* about itself and/or publishes data using the *MTConnect Infor-*
113 *mation Model*.

MTConnect Information Model
114

115 See *Information Model*

MTConnectDevices Response Document
116

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

MTConnectStreams Response Document
119

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

observation
122

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

Observations Information Model
124

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

organize
127

128 The act of containing and owning one or more elements.

Parent Element
129

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

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

133 ***Probe Request***

134 A *Probe Request* is a *Request* to an *Agent* to produce an *MTConnectDevices Re-*
135 *sponse Document* containing the *Devices Information Model*.

136 ***Request***

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

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

140 ***Response Document***

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

143 ***Sample Request***

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

147 ***semantic data model***

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

150 It provides the rules for encoding electronic information such that it can be inter-
151 preted by a software system.

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

153 ***sequence number***

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

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

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

159 ***Streaming Data***

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

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

163 **Structural Element**

164   General meaning:

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

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

168   Used to indicate hierarchy of Components:

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

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

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

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

175 **Top Level**

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

178 2.2 Acronyms

179 **AMT**

180 The Association for Manufacturing Technology

181 2.3 MTConnect References

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185   Version 1.7.0.

186 3   Files Information Model

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

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

199 3.1   AbstractFile

200 An `AbstractFile` is an abstract `Asset` type model that contains the common proper-
201 ties of the `File` and `FileArchetype` types.
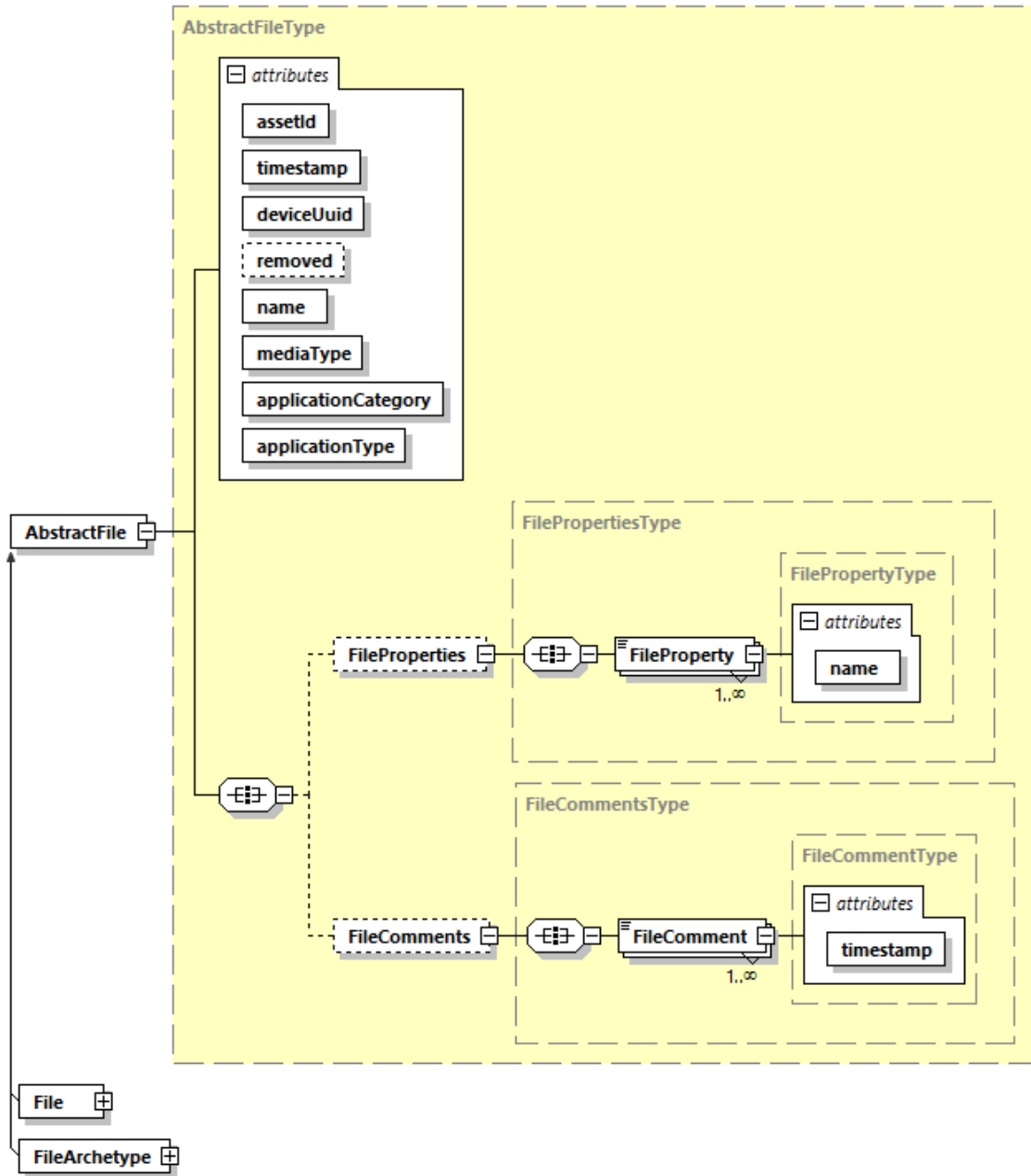
Figure 1: AbstractFile Diagram

202 3.1.1 Attributes for AbstractFile

203 *Table 1* lists the attributes for an `AbstractFile` element in addition to attributes inher-
204 ited 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

205 3.1.1.1 AbstractFile applicationCategory types

206 *Table 2* lists the types for `applicationCategory` attribute of `AbstractFile` ele-
207 ment.

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.

208 **3.1.1.2 AbstractFile applicationType types**

209 *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.

210 ## 3.1.2 Elements for AbstractFile

211 *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

212 ## 3.1.3 FileProperty

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

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

215 **3.1.3.1 Attributes for FileProperty**

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

Table 5: Attributes for FileProperty

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

217 3.1.4 FileComment

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

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

220 3.1.4.1 Attributes for FileComment

221 *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

222 3.2 File

223 The `File Asset` is an `AbstractFile` with information about the `File` instance and
224 its URL.
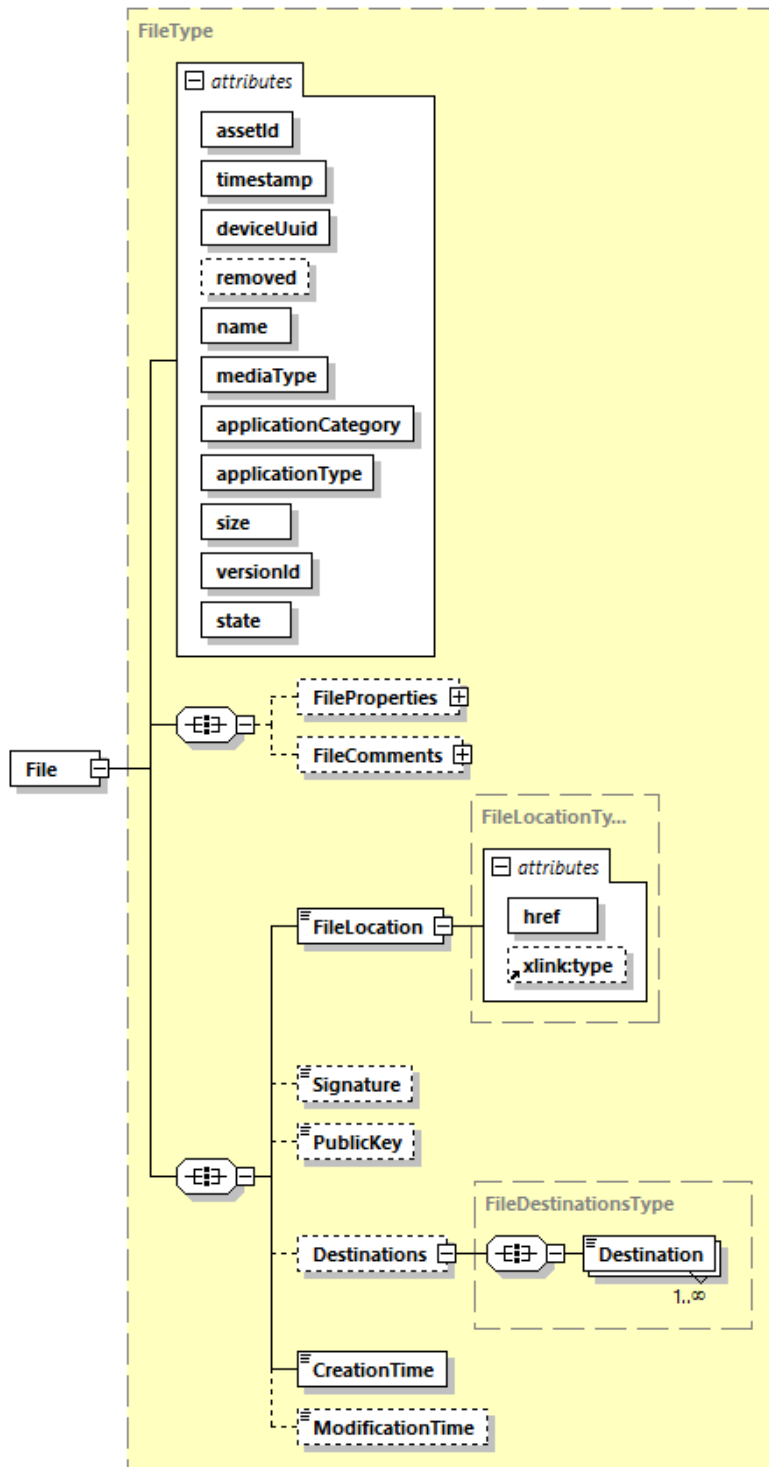
Figure 2: File Diagram

225 3.2.1   Attributes for File

226 *Table 7* lists the attributes for a `File` element in addition to attributes inherited from
227 `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

228 3.2.1.1   File states

229 *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`.

230 3.2.2   Elements for File

231 *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

236 ## 3.2.4   Destination

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

238 ### 3.2.4.1   Attributes for Destination

239 *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

240 ## 3.3   FileArchetype

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

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

Appendices

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