VDMA 40550-1

ICS 35.240.50; 79.120.10

OPC UA for Woodworking Machines – Part 1: Vertical Interface

OPC UA für Holzbearbeitungsmaschinen – Teil 1: Vertikale Schnittstelle

VDMA 40550-1:2021-11 is identical with OPC 40550-1 (Release 1.00)

Document comprises 41 pages

VDMA

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Foreword

The OPC 40550-1 specifications contain OPC UA Information Models of several industry sectors and are developed by members of VDMA and/or the OPC Foundation. OPC UA includes communication technology and Information Modelling to transmit characteristics of products (e.g. manufacturer name, device type or components) and process data (e.g. temperatures, pressures or feed rates). To enable vendor independend interoperability the description of product characteristics and process data has to be standardized utilizing technical specifications, the OPC UA companion specifications.

Associations

VDMA Woodworking Machinery

VDMA represents over 3,300 mainly small and medium size member companies in the engineering industry, making it one of the largest and most important industrial associations in Europe. As part of VDMA, VDMA Woodworking Machinery unites more than 90 members: companies offering machines, cutting tools, machine components, turnkey productions systems and related services for the primary and secondary woodworking industries.

The objective of this industry-driven platform is to support the woodworking machinery industry through a wide spectrum of activities and services such as standardization, statistics, marketing, public relations, trade fair policy, networking events and representation of interests. VDMA Woodworking Machinery works closely with *EUMABOIS*, of which it is a member, to pursue these objectives on European and international level.

EUMABOIS

EUMABOIS is a non-profit organisation, aimed at promoting the European woodworking machinery industry, protecting its business interests and dealing with all matters of relevance to its members. *EUMABOIS* represents more than 850 companies and 56% of the world production of woodworking machinery.

Technical, marketing and fair policy issues are among the main tasks of the Federation. **EUMABOIS** plays a major role in the international market, hosts qualified experts to address technical and economical problems, and has created an information and interaction network involving the most experienced entrepreneurs in business.

At the technical level, *EUMABOIS* promotes a research and innovation strategy oriented towards the present and future needs of the market. In this context, international cooperation in all questions of standardization is of increasing importance.

To pursue these goals, *EUMABOIS* coordinates European and international standardization in the field of woodworking machinery and promotes cooperation with other international organizations.

OPC Foundation

OPC is the interoperability standard for the secure and reliable exchange of data and information in the industrial automation space and in other industries. It is platform independent and ensures the seamless flow of information among devices from multiple vendors. The OPC Foundation is responsible for the development and maintenance of this standard.

OPC UA is a platform independent service-oriented architecture that integrates all the functionality of the individual OPC Classic specifications into one extensible framework. This multi-layered approach accomplishes the original design specification goals of:

- Platform independence: from an embedded microcontroller to cloud-based infrastructure
- Secure: encryption, authentication, authorization and auditing
- Extensible: ability to add new features including transports without affecting existing applications
- Comprehensive information modelling capabilities: for defining any model from simple to complex

1 Scope

For the communication between different machines, manufacturer independent information models are required. For woodworking machinery, these information models are based on OPC UA, a communication framework developed and provided by the OPC Foundation. While OPC UA provides the technology for the transfer of information, the definition which information is transferred in which form is defined in Companion Specifications.

This documentation defines a Companion Specification for general information regarding woodworking machines. The intention is that ObjectTypes which can be used for several machines and applications are defined only once.

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 and errata) applies

OPC 10000-1, *OPC Unified Architecture - Part 1: Overview and Concepts*

http://www.opcfoundation.org/UA/Part1/

OPC 10000-2, *OPC Unified Architecture - Part 2: Security Model*

http://www.opcfoundation.org/UA/Part2/

OPC 10000-3, *OPC Unified Architecture - Part 3: Address Space Model*

http://www.opcfoundation.org/UA/Part3/

OPC 10000-4, *OPC Unified Architecture - Part 4: Services*

http://www.opcfoundation.org/UA/Part4/

OPC 10000-5, *OPC Unified Architecture - Part 5: Information Model*

http://www.opcfoundation.org/UA/Part5/

OPC 10000-6, *OPC Unified Architecture - Part 6: Mappings*

http://www.opcfoundation.org/UA/Part6/

OPC 10000-7, *OPC Unified Architecture - Part 7: Profiles*

http://www.opcfoundation.org/UA/Part7/

OPC 10001-7, *OPC Unified Architecture V1.04 - Amendment 7: Interfaces ad AddIns*

http://www.opcfoundation.org/UA/Amendment7/

OPC 10000-100, *OPC Unified Architecture - Part 100: Devices*

http://www.opcfoundation.org/UA/Part100/

OPC 40001-1 - UA CS for Machinery Part 1 - Basic Building Blocks

http://www.opcfoundation.org/UA/Machinery/

3 Terms, definitions and conventions

3.1 Overview

It is assumed that basic concepts of OPC UA information modelling are understood in this document. This document will use these concepts to describe the Woodworking Information Model. For the purposes of this document, the terms and definitions given in OPC 10000-1, OPC 10000-3, OPC 10000-4, OPC 10000-5, OPC 10000-7, OPC 10000-100, OPC 40001-1 as well as the following apply.

Note that OPC UA terms and terms defined in this specification are *italicized* in the specification.

3.2 OPC UA for Woodworking terms

3.2.1
Automatic mode
Operational mode in which the machine operates in automatically without *operator* commands.

3.2.2
Axis
mechanical joint of a manipulator that performs a linear or a rotational movement

3.2.3
Client
receiver of information

Note: Requests services from a server, usually OPC UA system.

3.2.4
Line Controller
device, which controls a process by computing control data

3.2.5
Maintenance
action for the achievement of machine-preserving measures

3.2.6
Manual activity
activity to be performed manually by the *operator*

3.2.7
Operator
person designated to start, monitor and stop the intended operation of a machine.

3.2.8
Run
the single, complete execution of a *recipe*

3.2.9
Tool
exchangeable components used in a machine to execute the production process

Note: They may for example be drills, ball milling heads, cutting inserts, pinching tools and so forth. May be a non-contact tool, for example a processing laser.

3.2.10
Tool change
Tool change in context of this interface is the action of inserting a *tool* into the machine. There are two reasons this is done or necessary: 1) *tool* life of one group of *tools* has expired and machining cannot continue until a new *tool* with sufficient *tool* life for the next operation is inserted (causing a *tool* change) 2) a *tool* for a given *job* is not available (or defined as "hand *tool*" and) must be provided.

3.3 Abbreviated terms

CNC Computerized Numerical Control

EUMABOIS European Federation of Woodworking Machinery

PLC Programmable Logic Controller

3.4 Conventions used in this document

3.4.1 Conventions for Node descriptions

3.4.1.1 Node definitions

Node definitions are specified using tables (see Table **2**).

Attributes are defined by providing the *Attribute* name and a value, or a description of the value.

References are defined by providing the *ReferenceType* name, the *BrowseName* of the *TargetNode* and its *NodeClass*.

- If the *TargetNode* is a component of the *Node* being defined in the table the *Attributes* of the composed *Node* are defined in the same row of the table.
- The *DataType* is only specified for *Variables*; "[<number>]" indicates a single-dimensional array, for multi-dimensional arrays the expression is repeated for each dimension (e.g. [2][3] for a two-dimensional array). For all arrays the *ArrayDimensions* is set as identified by <number> values. If no <number> is set, the corresponding dimension is set to 0, indicating an unknown size. If no number is provided at all the *ArrayDimensions* can be omitted. If no brackets are provided, it identifies a scalar *DataType* and the *ValueRank* is set to the corresponding value (see OPC 10000-3). In addition, *ArrayDimensions* is set to null or is omitted. If it can be Any or *ScalarOrOneDimension*, the value is put into "{<value>}", so either "{Any}" or "{*ScalarOrOneDimension*}" and the *ValueRank* is set to the corresponding value (see OPC 10000-3) and the *ArrayDimensions* is set to null or is omitted. Examples are given in Table 1.

Table 1 – Examples of DataTypes

Notation	Data-Type	Value-Rank	Array-Dimensions	Description
0:Int32	0:Int32	-1	omitted or null	A scalar Int32.
0:Int32[]	0:Int32	1	omitted or {0}	Single-dimensional array of Int32 with an unknown size.
0:Int32[][]	0:Int32	2	omitted or {0,0}	Two-dimensional array of Int32 with unknown sizes for both dimensions.
0:Int32[3][]	0:Int32	2	{3,0}	Two-dimensional array of Int32 with a size of 3 for the first dimension and an unknown size for the second dimension.
0:Int32[5][3]	0:Int32	2	{5,3}	Two-dimensional array of Int32 with a size of 5 for the first dimension and a size of 3 for the second dimension.
0:Int32{Any}	0:Int32	-2	omitted or null	An Int32 where it is unknown if it is scalar or array with any number of dimensions.
0:Int32{ScalarOrOneDimension}	0:Int32	-3	omitted or null	An Int32 where it is either a single-dimensional array or a scalar.

- The TypeDefinition is specified for *Objects* and *Variables*.
- The TypeDefinition column specifies a symbolic name for a *NodeId*, i.e. the specified *Node* points with a *HasTypeDefinition Reference* to the corresponding *Node*.
- The *ModellingRule* of the referenced component is provided by specifying the symbolic name of the rule in the *ModellingRule* column. In the *AddressSpace*, the *Node* shall use a *HasModellingRule Reference* to point to the corresponding *ModellingRule Object*.

If the *NodeId* of a *DataType* is provided, the symbolic name of the *Node* representing the *DataType* shall be used.

Note that if a symbolic name of a different namespace is used, it is prefixed by the *NamespaceIndex* (see 3.4.2.2).

Nodes of all other *NodeClasses* cannot be defined in the same table; therefore only the used *ReferenceType*, their *NodeClass* and their *BrowseName* are specified. A reference to another part of this document points to their definition.

Table **2** illustrates the table. If no components are provided, the DataType, TypeDefinition and ModellingRule columns may be omitted and only a Comment column is introduced to point to the *Node* definition.

Table 2 – Type Definition Table

Attribute	**Value**				
Attribute name	Attribute value. If it is an optional Attribute that is not set "--" will be used.				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
ReferenceType name	*NodeClass* of the target *Node*.	*BrowseName* of the target *Node*.	*DataType* of the referenced *Node*, only applicable for *Variables*.	*TypeDefinition* of the referenced *Node*, only applicable for *Variables* and *Objects*.	Additional characteristics of the *TargetNode* such as the *ModellingRule* or *AccessLevel*.
NOTE Notes referencing footnotes of the table content.					

Components of *Nodes* can be complex that is containing components by themselves. The *TypeDefinition*, *NodeClass* and *DataType* can be derived from the type definitions, and the symbolic name can be created as defined in 3.4.3.1. Therefore, those containing components are not explicitly specified; they are implicitly specified by the type definitions.

The Other column defines additional characteristics of the Node. Examples of characteristics that can appear in this column are show in Table 3.

Table 3 – Examples of Other Characteristics

Name	**Short Name**	**Description**
0:Mandatory	M	The Node has the Mandatory ModellingRule.
0:Optional	O	The Node has the Optional ModellingRule.
0:MandatoryPlaceholder	MP	The Node has the MandatoryPlaceholder ModellingRule.
0:OptionalPlaceholder	OP	The Node has the OptionalPlaceholder ModellingRule.
ReadOnly	RO	The *Node AccessLevel* has the *CurrentRead* bit set but not the *CurrentWrite* bit.
ReadWrite	RW	The Node AccessLevel has the CurrentRead and CurrentWrite bits set.
WriteOnly	WO	The Node AccessLevel has the *CurrentWrite* bit set but not the *CurrentRead* bit.

If multiple characteristics are defined they are separated by commas. The name or the short name may be used.

3.4.1.2 Additional References

To provide information about additional *References*, the format as shown in Table 4 is used.

The components of the *ObjectType* have additional references which are defined in Table 4.

Table 4 – <some> Additional References

SourceBrowsePath	**Reference Type**	**Is Forward**	**TargetBrowsePath**
SourceBrowsePath is always relative to the *TypeDefinition*. Multiple elements are defined as separate rows of a nested table.	*ReferenceType* name	True = forward *Reference*	TargetBrowsePath points to another *Node*, which can be a well-known instance or a *TypeDefinition*. You can use *BrowsePaths* here as well, which is either relative to the *TypeDefinition* or absolute. If absolute, the first entry needs to refer to a type or well-known instance, uniquely identified within a namespace by the *BrowseName*.

References can be to any other *Node*.

3.4.1.3 Additional sub-components

To provide information about sub-components, the format as shown in Table 5 is used.

Table 5 – <some>Type Additional Subcomponents

BrowsePath	**Reference**	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**Others**
BrowsePath is always relative to the *TypeDefinition*. Multiple elements are defined as separate rows of a nested table	NOTE Same as for Table 2					

3.4.1.4 Additional Attribute values

The type definition table provides columns to specify the values for required Node *Attributes* for *InstanceDeclarations*. To provide information about additional *Attributes*, the format as shown in Table 6 is used.

Table 6 – <some>Type Attribute values for child nodes

BrowsePath	<Attribute name> Attribute
BrowsePath is always relative to the TypeDefinition. Multiple elements are defined as separate rows of a nested table	The values of attributes are converted to text by adapting the reversible JSON encoding rules defined in OPC 10000-6. If the JSON encoding of a value is a JSON string or a JSON number then that value is entered in the value field. Double quotes are not included. If the DataType includes a NamespaceIndex (QualifiedNames, NodeIds or ExpandedNodeIds) then the notation used for BrowseNames is used. If the value is an Enumeration the name of the enumeration value is entered. If the value is a Structure then a sequence of name and value pairs is entered. Each pair is followed by a newline. The name is followed by a colon. The names are the names of the fields in the DataTypeDefinition. If the value is an array of non-structures then a sequence of values is entered where each value is followed by a newline. If the value is an array of Structures or a Structure with fields that are arrays or with nested Structures then the complete JSON array or JSON object is entered. Double quotes are not included.

There can be multiple columns to define more than one *Attribute*.

3.4.2 NodeIds and BrowseNames

3.4.2.1 NodeIds

The *NodeIds* of all *Nodes* described in this standard are only symbolic names. Annex A defines the actual *NodeIds*.

The symbolic name of each *Node* defined in this document is its *BrowseName*, or, when it is part of another *Node*, the *BrowseName* of the other *Node*, a ".", and the *BrowseName* of itself. In this case "part of" means that the whole has a *HasProperty* or *HasComponent Reference* to its part. Since all *Nodes* not being part of another *Node* have a unique name in this document, the symbolic name is unique.

The *NamespaceUri* for all *NodeIds* defined in this document is defined in Annex A. The *NamespaceIndex* for this *NamespaceUri* is vendor-specific and depends on the position of the *NamespaceUri* in the server namespace table.

Note that this document not only defines concrete *Nodes*, but also requires that some *Nodes* shall be generated, for example one for each *Session* running on the *Server*. The *NodeIds* of those *Nodes* are *Server*-specific, including the namespace. But the *NamespaceIndex* of those *Nodes* cannot be the *NamespaceIndex* used for the *Nodes* defined in this document, because they are not defined by this document but generated by the *Server*.

3.4.2.2 BrowseNames

The text part of the *BrowseNames* for all *Nodes* defined in this document is specified in the tables defining the *Nodes*. The *NamespaceUri* for all *BrowseNames* defined in this document is defined in 9.2.

For *InstanceDeclarations* of *NodeClass Object* and *Variable* that are placeholders (*OptionalPlaceholder* and *MandatoryPlaceholder ModellingRule*), the *BrowseName* and the *DisplayName* are enclosed in angle brackets (<>) as recommended in OPC 10000-3. If the *BrowseName* is not defined by this document, a namespace index prefix is added to the *BrowseName* (e.g., prefix '0' leading to '0:EngineeringUnits' or prefix '2' leading to '2:DeviceRevision'). This is typically necessary if a *Property* of another specification is overwritten or used in the OPC UA types defined in this document. Table 44 provides a list of namespaces and their indexes as used in this document.

3.4.3 Common Attributes

3.4.3.1 General

The *Attributes* of *Nodes*, their *DataTypes* and descriptions are defined in OPC 10000-3. Attributes not marked as optional are mandatory and shall be provided by a *Server*. The following tables define if the *Attribute* value is defined by this specification or if it is server-specific.

For all *Nodes* specified in this specification, the *Attributes* named in Table 7 shall be set as specified in the table.

Table 7 – Common Node Attributes

Attribute	Value
DisplayName	The *DisplayName* is a *LocalizedText*. Each server shall provide the *DisplayName* identical to the *BrowseName* of the *Node* for the LocaleId “en”. Whether the server provides translated names for other LocaleIds is server-specific.
Description	Optionally a server-specific description is provided.
NodeClass	Shall reflect the *NodeClass* of the *Node*.
NodeId	The *NodeId* is described by *BrowseNames* as defined in 3.4.2.1.
WriteMask	Optionally the *WriteMask Attribute* can be provided. If the *WriteMask Attribute* is provided, it shall set all non-server-specific *Attributes* to not writable. For example, the *Description Attribute* may be set to writable since a *Server* may provide a server-specific description for the *Node*. The *NodeId* shall not be writable, because it is defined for each *Node* in this specification.
UserWriteMask	Optionally the *UserWriteMask Attribute* can be provided. The same rules as for the *WriteMask Attribute* apply.
RolePermissions	Optionally server-specific role permissions can be provided.
UserRolePermissions	Optionally the role permissions of the current Session can be provided. The value is server-specifc and depend on the *RolePermissions Attribute* (if provided) and the current *Session*.
AccessRestrictions	Optionally server-specific access restrictions can be provided.

3.4.3.2 Objects

For all *Objects* specified in this specification, the *Attributes* named in Table 8 shall be set as specified in the table. The definitions for the *Attributes* can be found in OPC 10000-3.

Table 8 – Common Object Attributes

Attribute	Value
EventNotifier	Whether the *Node* can be used to subscribe to *Events* or not is server-specific.

3.4.3.3 Variables

For all *Variables* specified in this specification, the *Attributes* named in Table 9 shall be set as specified in the table. The definitions for the *Attributes* can be found in OPC 10000-3.

Table 9 – Common Variable Attributes

Attribute	Value
MinimumSamplingInterval	Optionally, a server-specific minimum sampling interval is provided.
AccessLevel	The access level for *Variables* used for type definitions is server-specific, for all other *Variables* defined in this specification, the access level shall allow reading; other settings are server-specific.
UserAccessLevel	The value for the *UserAccessLevel Attribute* is server-specific. It is assumed that all *Variables* can be accessed by at least one user.
Value	For *Variables* used as *InstanceDeclarations,* the value is server-specific; otherwise it shall represent the value described in the text.
ArrayDimensions	If the *ValueRank* does not identify an array of a specific dimension (i.e. *ValueRank* <= 0) the *ArrayDimensions* can either be set to null or the *Attribute* is missing. This behaviour is server-specific. If the *ValueRank* specifies an array of a specific dimension (i.e. *ValueRank* > 0) then the *ArrayDimensions Attribute* shall be specified in the table defining the *Variable*.
Historizing	The value for the *Historizing Attribute* is server-specific.
AccessLevelEx	If the *AccessLevelEx Attribute* is provided, it shall have the bits 8, 9, and 10 set to 0, meaning that read and write operations on an individual *Variable* are atomic, and arrays can be partly written.

3.4.3.4 VariableTypes

For all *VariableTypes* specified in this specification, the *Attributes* named in Table 10 shall be set as specified in the table. The definitions for the *Attributes* can be found in OPC 10000-3.

Table 10 – Common VariableType Attributes

Attributes	Value
Value	Optionally a server-specific default value can be provided.
ArrayDimensions	If the *ValueRank* does not identify an array of a specific dimension (i.e. *ValueRank* <= 0) the *ArrayDimensions* can either be set to null or the *Attribute* is missing. This behaviour is server-specific. If the *ValueRank* specifies an array of a specific dimension (i.e. *ValueRank* > 0) then the *ArrayDimensions Attribute* shall be specified in the table defining the *VariableType*.

3.4.3.5 Methods

For all *Methods* specified in this specification, the *Attributes* named in Table 11 shall be set as specified in the table. The definitions for the *Attributes* can be found in OPC 10000-3.

Table 11 – Common Method Attributes

Attributes	Value
Executable	All *Methods* defined in this specification shall be executable (*Executable Attribute* set to “True”), unless it is defined differently in the *Method* definition.
UserExecutable	The value of the *UserExecutable Attribute* is server-specific. It is assumed that all *Methods* can be executed by at least one user.

4 General information to Woodworking and OPC UA

4.1 Introduction to Woodworking

EUMABOIS is the pan European industrial federation grouping 13 national associations which represent the major European manufacturers of machines, plants, tooling and ancillary equipment for the forestry and woodworking industries.

Encompassing some 850 industrial companies with a total turnover of 6 billion euro. The European industry can count on a work force of more than 35,000 employees. *EUMABOIS* members produce specialized machinery, cutting *tools* and auxiliary equipment for the forestry and primary timber processing sectors, incorporating plants for sawing, drying, veneer production, plywood and all timber-based boards and panels, e.g. chipboard, MDF, OSB, LVL panels.

EUMABOIS members manufacture standard and specialized machinery, plants and tooling for secondary processing for the production of all types of solid wood and panel products including furniture, chair frames, doors and windows.

Members also design, build and supply state of the art numerical control systems, sensors for robots and flexible manufacturing systems (FMS). Technologies that facilitate environmental protection and occupational safety within the woodworking industry and a comprehensive range of services complete the unique offer of the European manufacturers.

The mission of *EUMABOIS* is to facilitate a business environment (legislation, innovation, technology, environment, skilled workforce, financing, supply chain and infrastructure) to market the most competitive manufacturing solutions worldwide.

4.2 Introduction to OPC Unified Architecture

4.2.1 What is OPC UA?

OPC UA is an open and royalty free set of standards designed as a universal communication protocol. While there are numerous communication solutions available, OPC UA has key advantages:

- A state of art security model (see OPC 10000-2).
- A fault tolerant communication protocol.
- An information modelling framework that allows application developers to represent their data in a way that makes sense to them.

OPC UA has a broad scope which delivers for economies of scale for application developers. This means that a larger number of high-quality applications at a reasonable cost are available. When combined with semantic

models such as Woodworking, OPC UA makes it easier for end users to access data via generic commercial applications.

The OPC UA model is scalable from small devices to ERP systems. OPC UA *Servers* process information locally and then provide that data in a consistent format to any application requesting data - ERP, MES, PMS, Maintenance Systems, HMI, Smartphone or a standard Browser, for examples. For a more complete overview see OPC 10000-1.

4.2.2 Basics of OPC UA

As an open standard, OPC UA is based on standard internet technologies, like TCP/IP, HTTP, Web Sockets.

As an extensible standard, OPC UA provides a set of *Services* (see OPC 10000-4) and a basic information model framework. This framework provides an easy manner for creating and exposing vendor defined information in a standard way. More importantly all OPC UA *Clients* are expected to be able to discover and use vendor-defined information. This means OPC UA users can benefit from the economies of scale that come with generic visualization and historian applications. This specification is an example of an OPC UA *Information Model* designed to meet the needs of developers and users.

OPC UA *Clients* can be any consumer of data from another device on the network to browser based thin clients and ERP systems. The full scope of OPC UA applications is shown in Figure 1.

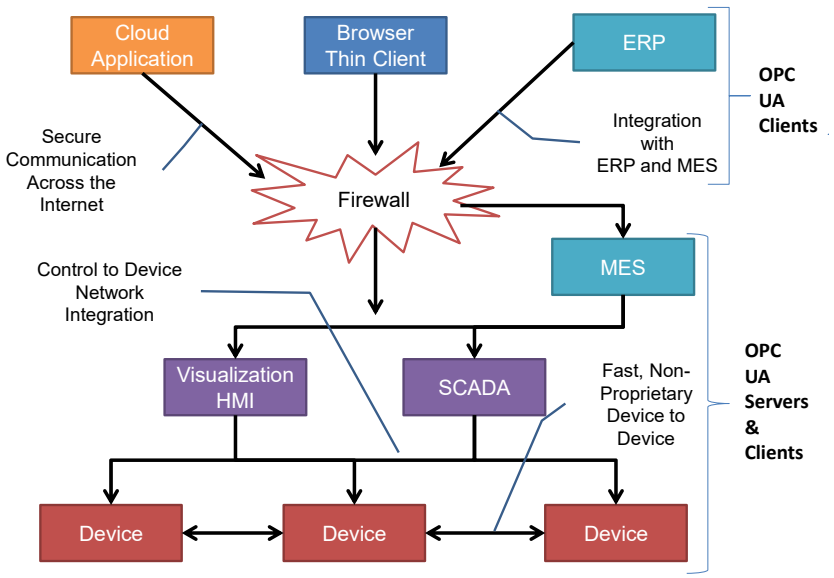


Figure 1 – The Scope of OPC UA within an Enterprise

OPC UA provides a robust and reliable communication infrastructure having mechanisms for handling lost messages, failover, heartbeat, etc. With its binary encoded data, it offers a high-performing data exchange solution. Security is built into OPC UA as security requirements become more and more important especially since environments are connected to the office network or the internet and attackers are starting to focus on automation systems.

4.2.3 Information modelling in OPC UA

4.2.3.1 Concepts

OPC UA provides a framework that can be used to represent complex information as *Objects* in an *AddressSpace* which can be accessed with standard services. These *Objects* consist of *Nodes* connected by *References*. Different classes of *Nodes* convey different semantics. For example, a *Variable Node* represents a value that can be read or written. The *Variable Node* has an associated *DataType* that can define the actual value, such as a string, float, structure etc. It can also describe the *Variable* value as a variant. A *Method Node* represents a function that can be called. Every *Node* has a number of *Attributes* including a unique identifier

called a *NodeId* and non-localized name called as *BrowseName*. An *Object* representing a 'Reservation' is shown in Figure 2.

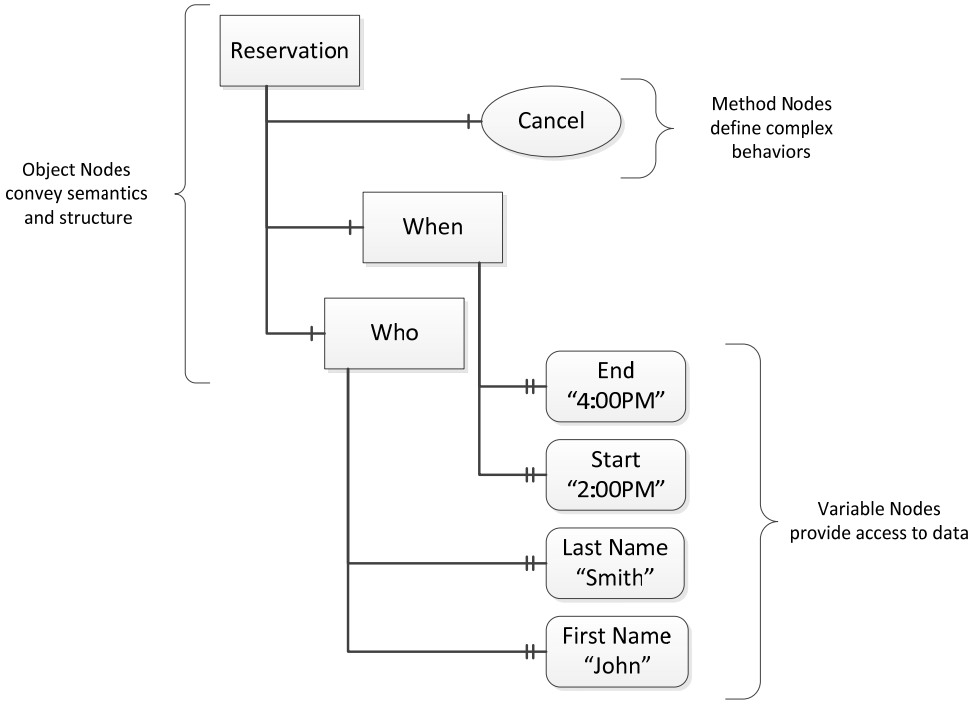


Figure 2 – A Basic Object in an OPC UA Address Space

Object and *Variable Nodes* represent instances and they always reference a *TypeDefinition* (*ObjectType* or *VariableType*) *Node* which describes their semantics and structure. Figure 3 illustrates the relationship between an instance and its *TypeDefinition*.

The type *Nodes* are templates that define all of the children that can be present in an instance of the type. In the example in Figure 3 the PersonType *ObjectType* defines two children: First Name and Last Name. All instances of PersonType are expected to have the same children with the same *BrowseNames*. Within a type the *BrowseNames* uniquely identify the children. This means *Client* applications can be designed to search for children based on the *BrowseNames* from the type instead of *NodeIds*. This eliminates the need for manual reconfiguration of systems if a *Client* uses types that multiple *Servers* implement.

OPC UA also supports the concept of sub-typing. This allows a modeller to take an existing type and extend it. There are rules regarding sub-typing defined in OPC 10000-3, but in general they allow the extension of a given type or the restriction of a *DataType*. For example, the modeller may decide that the existing *ObjectType* in some cases needs an additional *Variable*. The modeller can create a subtype of the *ObjectType* and add the *Variable*. A *Client* that is expecting the parent type can treat the new type as if it was of the parent type. Regarding *DataTypes*, subtypes can only restrict. If a *Variable* is defined to have a numeric value, a sub type could restrict it to a float.

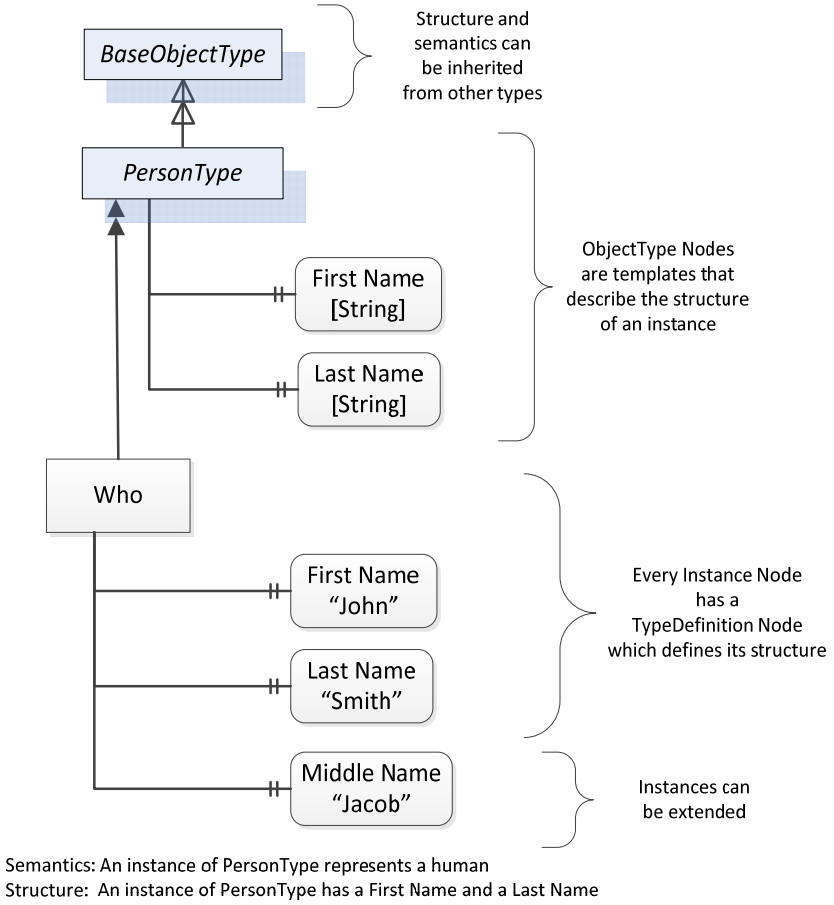


Figure 3 – The Relationship between Type Definitions and Instances

References allow *Nodes* to be connected in ways that describe their relationships. All *References* have a *ReferenceType* that specifies the semantics of the relationship. *References* can be hierarchical or non-hierarchical. Hierarchical references are used to create the structure of *Objects* and *Variables*. Non-hierarchical are used to create arbitrary associations. Applications can define their own *ReferenceType* by creating subtypes of an existing *ReferenceType*. Subtypes inherit the semantics of the parent but may add additional restrictions. Figure 4 depicts several *References,* connecting different *Objects*.

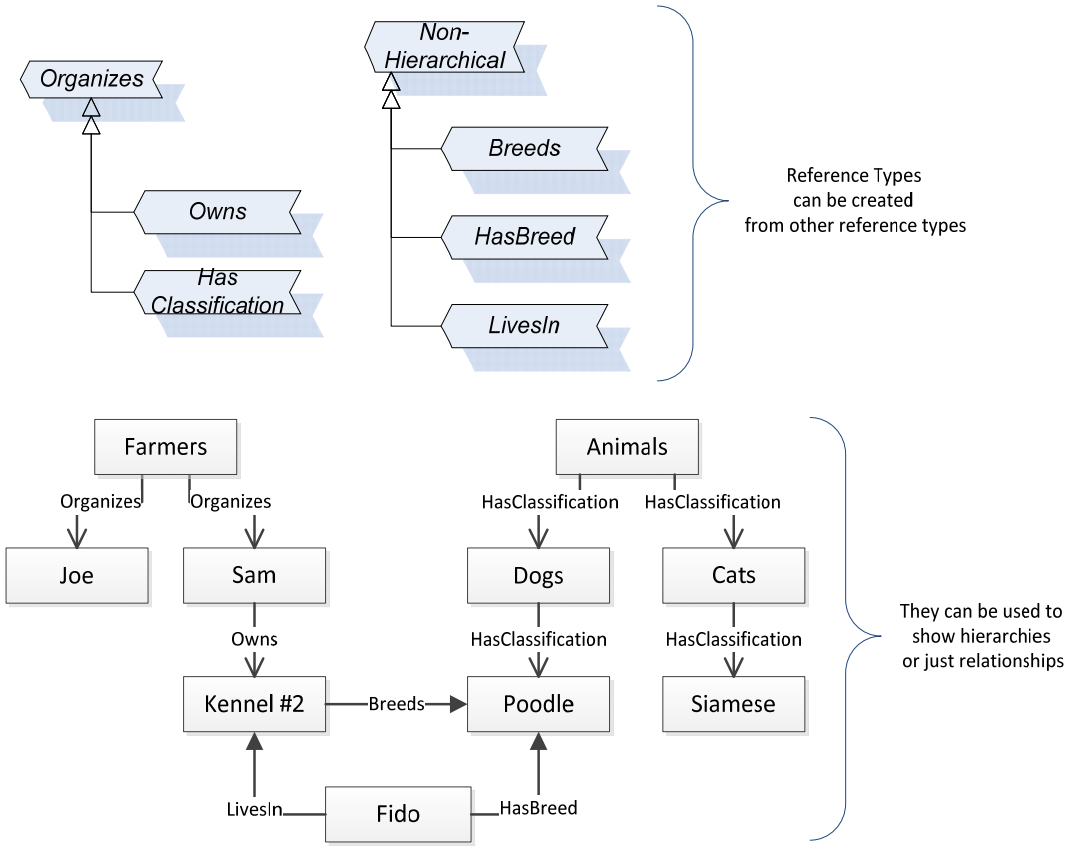


Figure 4 – Examples of References between Objects

The figures above use a notation that was developed for the OPC UA specification. The notation is summarized in Figure 5. UML representations can also be used; however, the OPC UA notation is less ambiguous because there is a direct mapping from the elements in the figures to *Nodes* in the *AddressSpace* of an OPC UA *Server*.

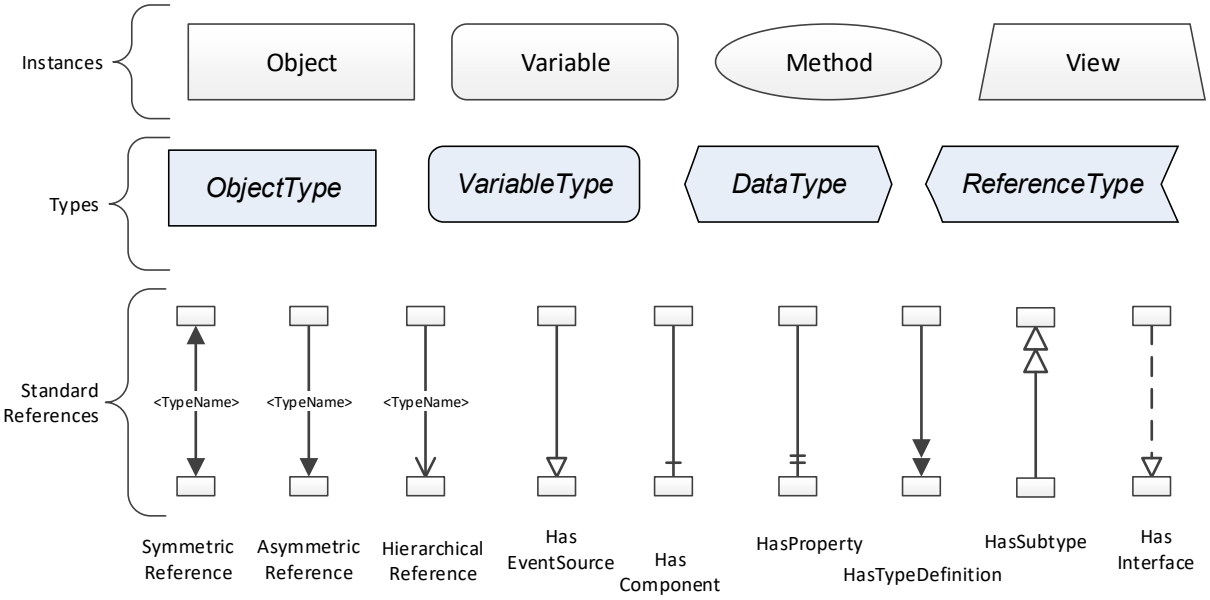


Figure 5 – The OPC UA Information Model Notation

A complete description of the different types of Nodes and References can be found in OPC 10000-3 and the base structure is described in OPC 10000-5.

OPC UA specification defines a very wide range of functionality in its basic information model. It is not required that all *Clients* or *Servers* support all functionality in the OPC UA specifications. OPC UA includes the concept of *Profiles*, which segment the functionality into testable certifiable units. This allows the definition of functional subsets (that are expected to be implemented) within a companion specification. The *Profiles* do not restrict functionality, but generate requirements for a minimum set of functionality (see OPC 10000-7)

4.2.3.2 Namespaces

OPC UA allows information from many different sources to be combined into a single coherent *AddressSpace*. Namespaces are used to make this possible by eliminating naming and id conflicts between information from different sources. Each namespace in OPC UA has a globally unique string called a NamespaceUri which identifies a naming authority and a locally unique integer called a NamespaceIndex, which is an index into the *Server's* table of *NamespaceUris*. The *NamespaceIndex* is unique only within the context of a *Session* between an OPC UA *Client* and an OPC UA *Server*- the *NamespaceIndex* can change between *Sessions* and still identify the same item even though the NamespaceUri's location in the table has changed. The *Services* defined for OPC UA use the *NamespaceIndex* to specify the Namespace for qualified values.

There are two types of structured values in OPC UA that are qualified with *NamespaceIndexes*: NodeIds and *QualifiedNames*. NodeIds are locally unique (and sometimes globally unique) identifiers for *Nodes*. The same globally unique *NodeId* can be used as the identifier in a node in many *Servers* – the node's instance data may vary but its semantic meaning is the same regardless of the *Server* it appears in. This means *Clients* can have built-in knowledge of of what the data means in these *Nodes*. OPC UA *Information Models* generally define globally unique *NodeIds* for the *TypeDefinitions* defined by the *Information Model*.

QualifiedNames are non-localized names qualified with a Namespace. They are used for the *BrowseNames* of *Nodes* and allow the same names to be used by different information models without conflict. *TypeDefinitions* are not allowed to have children with duplicate *BrowseNames*; however, instances do not have that restriction.

4.2.3.3 Companion Specifications

An OPC UA companion specification for an industry specific vertical market describes an *Information Model* by defining *ObjectTypes*, *VariableTypes*, *DataTypes* and *ReferenceTypes* that represent the concepts used in the vertical market, and potentially also well-defined Objects as entry points into the AddressSpace.

5 Use cases

5.1 Use case 1: Identification of Machines of different Manufacturers

The machines of different manufacturers shall be identifiable in a standardized manner. To realize this, a number of basic and static information like manufacturer name and model number are offered on the interface.

5.2 Use case 2. Overview of Machine States

The machines of different manufacturers offers their states in a standardized manner.

5.3 Use case 3. Overview of Machine Messages

The machine is expected to offers all current messages such as alarms, warnings and information over the interface. These errors and warnings shall be mapped to OPC UA event types accordingly.

5.4 Use case 4. Providing Information for KPI calculations

To facilitate the calculation of different KPIs like for example OEE, the interface offers different item values with their changing times. These times allow to calculate the durations of different machine modes.

All of these relevant times are transferred with OPC UA mechanisms. Each state change is sent to the OPC UA *client*, and the timestamp can be used to calculate the time durations needed for KPI compilation.

6 Woodworking Information Model overview

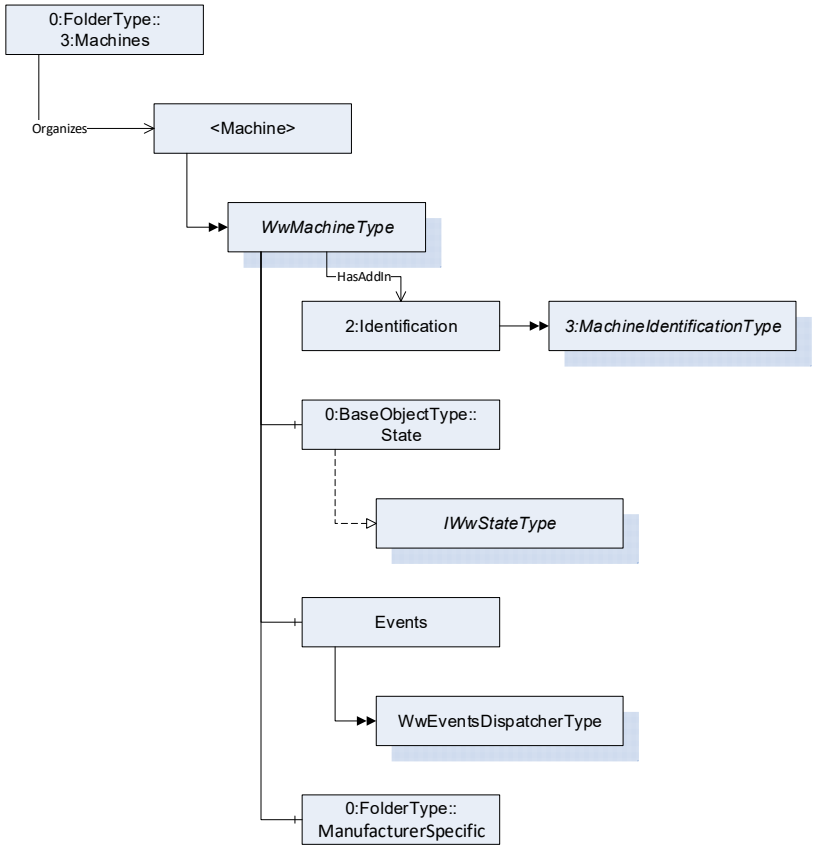


Figure 6 – Overview of the OPC UA Woodworking information model

7 OPC UA Types and Instances

7.1 Finding Woodworking Machines in a Server

All instances of *WwMachineType* in a Server shall be referenced from the *3:Machines Object* as defined in OPC 40001-1. This provides the capability to easily find all woodworking machines managed in a Server. The *3:Machines Object* may contain other *Nodes* than instances of *WwMachineType*.

Each <*Machine*> Object represents an instance of a machine. In the simplest case, there is only one machine. The *BrowseName* of <*Machine*> should be unique within the Server. For woodworking machines it could be the *2:ProductInstanceUri* of the *2:Identification Object* of the *2:IVendorNameplateType*.

7.2 WwMachineType ObjectType Definition

The *WwMachineType* represents a woodworking machine and is formally defined in Table 12. There may be non-woodworking machines with different types below the 3:Machines instance, too.

Table 12 – WwMachineType Definiton

Attribute	Value				
BrowseName	WwMachineType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseObjectType defined in OPC 10000-5					
Properties of the OPC UA for Machinery.					
0:HasAddIn	Object	2:Identification		3:MachineIdentificationType	M
Woodworking Properties					
0:HasComponent	Object	State		0:BaseObjectType	M
0:HasComponent	Object	Events		WwEventsDispatcherType	O
0:HasComponent	Object	ManufacturerSpecific		0:FolderType	O

The *2:Identification* Object provides identification information of the machine. It is specified in OPC 10000-100 and OPC 40001-1 (see chapter 2 Normative references).

The *State* Object provides information about the states of the machine.

The *Events* Object provides events.

The *ManufacturerSpecific* Object provides manufacturer specific functionality.

The components of the *WwMachineType* have additional subcomponents which are defined in Table 13.

Table 13 – WwMachineType Additional Subcomponents

Source Path	Reference	NodeClass	BrowseName	DataType	TypeDefinition	Others
State	0:HasInterface	ObjectType	IWwStateType			
Additional Properties for 2:Identification						
2:Identification	0:HasProperty	Variable	LocationPlant	0:String	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	LocationGPS	0:String	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	CustomerCompanyName	0:LocalizedText	0:PropertyType	O, RO
Properties from 3:MachineIdentificationType and overwritten Mandatory Flags						
2:Identification	0:HasProperty	Variable	2:ProductInstanceUri	0:String	0:PropertyType	M, RO
2:Identification	0:HasProperty	Variable	2:Manufacturer	0:LocalizedText	0:PropertyType	M, RO
2:Identification	0:HasProperty	Variable	2:ManufacturerUri	0:String	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	2:Model	0:LocalizedText	0:PropertyType	**M**, RO
2:Identification	0:HasProperty	Variable	2:ProductCode	0:String	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	2:HardwareRevision	0:String	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	2:SoftwareRevision	0:String	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	2:DeviceClass	0:String	0:PropertyType	**M**, RO
2:Identification	0:HasProperty	Variable	2:SerialNumber	0:String	0:PropertyType	M, RO
2:Identification	0:HasProperty	Variable	3:YearOfConstruction	0:UInt16	0:PropertyType	**M**, RO
2:Identification	0:HasProperty	Variable	3:MonthOfConstruction	0:Byte	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	3:InitialOperationDate	0:DateTime	0:PropertyType	O, RO
2:Identification	0:HasProperty	Variable	2:AssetId	0:String	0:PropertyType	O, RW
2:Identification	0:HasProperty	Variable	2:ComponentName	0:LocalizedText	0:PropertyType	O, RW
2:Identification	0:HasProperty	Variable	3:Location	0:String	0:PropertyType	O, RW

The properties of the *3:MachineIdentificationType* are listed here, too. The mandatory changes are marked bold.

The *DeviceClass* provides the classification of the machine. So far it is defined as follows for Woodworking:

- “SawingMachine”
- “ProfilingMachine”

- “EdgebandingMachine”
- “BoringMachine”
- “SandingMachine”
- “MachiningCenter”
- “Press”
- “HandlingMachine”

The customer can set the following properties through the manufacturer HMI. Therefore, on the OPC UA interface they may be readable only.

The *LocationPlant* provides the location of the plant. This is the city where the machine is located, e.g. "Frankfurt".

The *LocationGPS* provides the location of the plant in GPS coordinates. The format is decimal degrees with north and east coordinates. For example, Hannover Messe has "52.3235858255059, 9.804918108600956".

Southern latitudes have a negative value, western longitudes as well. For example, Quito has the coordinates “-0.21975073282167099, -78.51255572531042”.

The *CustomerCompanyName* provides the customer name of the Woodworking manufacturer.

7.3 IWwStateType InterfaceType Definition

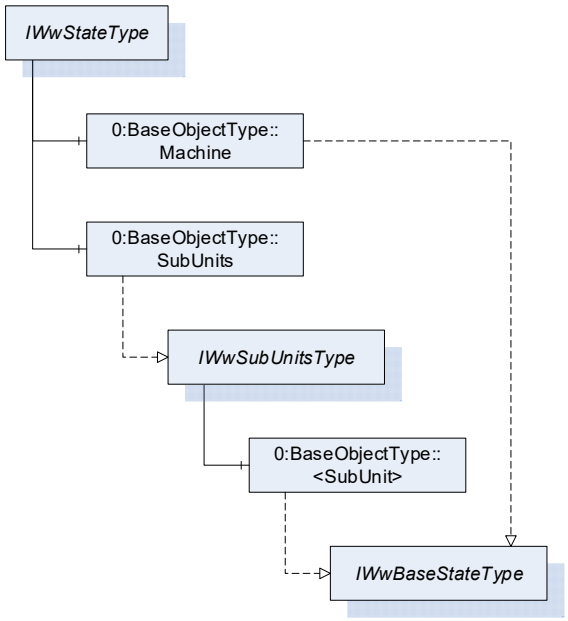


Figure 7 – Overview IWwStateType

The *IWwStateType* provides provides the machine state and is formally defined in Table 14.

Table 14 – IWwStateType Definiton

Attribute	**Value**				
BrowseName	IWwStateType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseInterfaceType defined in OPC 10001-7					
0:HasComponent	Object	Machine		0:BaseObjectType	M
0:HasComponent	Object	SubUnits		0:BaseObjectType	O

Each instance of an *IWwStateType* represents an instance of a machine state. In the simplest case, there is only the *Machine Object*. The *SubUnits* Object is used when a machine has multiple states. For example, a *CNC* machine can have several places where independent *jobs* are produced.

The *Machine* state does not summarize the *SubUnits* states. It does not have to be based on the *SubUnits* states. It is a decision of the machine manufacturer.

The KPI calculation has to be done individually based on the special machine instance and its states.

The units of the *IWwStateType* have additional subunits which are defined in Table 15.

Table 15 – IWwStateType Additional Subunits

Source Path	Reference	NodeClass	BrowseName	DataType	TypeDefinition	Others
Machine	0:HasInterface	ObjectType	IWwBaseStateType			
SubUnits	0:HasInterface	ObjectType	IWwSubUnitsType			

7.4 IWwSubUnitsType InterfaceType Definition

The *IWwSubUnitsType* provides a list of subUnits and is formally defined in Table 16.

Table 16 – IWwSubUnitsType Definiton

Attribute	Value				
BrowseName	IWwSubUnitsType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseInterfaceType defined in OPC 10001-7					

Each <*SubUnit*> object with *Interface IWwBaseStateType* shall be put into this object. It represents an instance of a state. For example, a *CNC* machine can have two places where independent *jobs* are produced. Then there are two <*SubUnit*> Objects. They may be named “Place_1” and “Place_2”.

The components of the *IWwSubUnitsType* have additional subunits which are defined in Table 17.

Table 17 – IWwSubUnitsType Additional Subcomponents

Source Path	Reference	NodeClass	BrowseName	DataType	TypeDefinition	Others
<SubUnit>	0:HasInterface	ObjectType	IWwBaseStateType			

7.5 IWwBaseStateType InterfaceType Definition

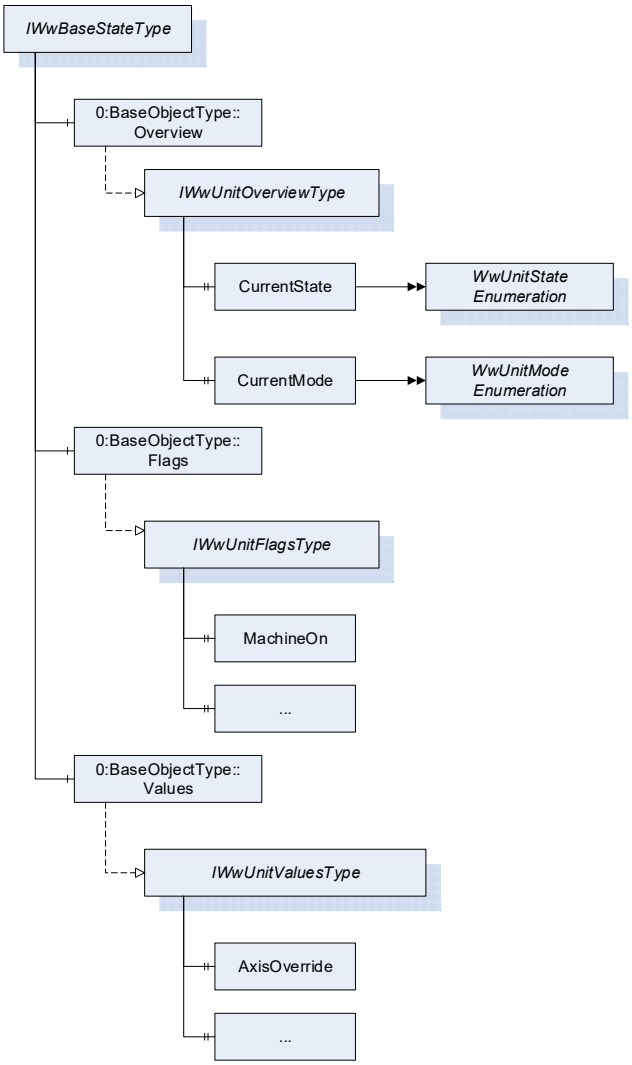


Figure 8 – Overview of IWwBaseStateType

The *IWwBaseStateType* represents the state of a unit and is formally defined in Table 18. An unit can be a machine or part of a machine.

Table 18 – IWwBaseStateType Definiton

Attribute	**Value**				
BrowseName	IWwBaseStateType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseInterfaceType defined in OPC 10001-7					
0:HasComponent	Object	Overview		0:BaseObjectType	M
0:HasComponent	Object	Flags		0:BaseObjectType	O
0:HasComponent	Object	Values		0:BaseObjectType	O

The *Overview* Object provides a general overview of the unit.

The *Flags* Object provides the flags of the unit.

The *Values* Object provides the counters and values of the unit.

The components of the *IWwBaseStateType* have additional subcomponents which are defined in Table 19.

Table 19 – IWwBaseStateType Additional Subcomponents

Source Path	Reference	NodeClass	BrowseName	DataType	TypeDefinition	Others
Overview	0:HasInterface	ObjectType	IWwUnitOverviewType			
Flags	0:HasInterface	ObjectType	IWwUnitFlagsType			
Values	0:HasInterface	ObjectType	IWwUnitValuesType			

7.6 IWwUnitOverviewType InterfaceType Definition

The *IWwUnitOverviewType* represents the generalized overview of a unit and is formally defined in Table 20.

Table 20 – IWwUnitOverviewType Definiton

Attribute	Value				
BrowseName	IWwUnitOverviewType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseInterfaceType defined in OPC 10001-7					
0:HasComponent	Variable	CurrentState	WwUnitStateEnumeration	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	CurrentMode	WwUnitModeEnumeration	0:BaseDataVariableType	M, RO

The *CurrentState* Variable provides the generalized state of the unit.

The *CurrentMode* Variable provides the generalized mode of the unit.

7.7 WwUnitStateEnumeration

This enumeration *WwUnitStateEnumeration* represents the generalized state of a unit. The enumeration is defined in Table 21.

Table 21 – WwUnitStateEnumeration Items

Name	Value	Description
OFFLINE	0	The unit is offline.
STANDBY	1	The unit is in standby.
READY	2	The unit is ready to start working.
WORKING	3	The unit is working.
ERROR	4	The unit is not able to work. The cause can be an alarm or error or user intervention. The cause can be an alarm or error or user intervention.

A unit state depends on the unit flags (see 7.9). Even if the unit flags are not provided in the address space they exist internally in the machine. If the device does not support EnergySaving, it is assumed that the variable value is false. Therefore they are always the basis for the state:

- *OFFLINE:*

  !MachineOn
- *STANDBY:*

  MachineOn && (!MachineInitialized || !Calibrated || EnergySaving)
- *READY:*

  MachineOn && MachineInitialized && Calibrated && !EnergySaving &&

  !Error && !RecipeInRun
- *WORKING:*

  MachineOn && MachineInitialized && Calibrated && !EnergySaving &&

  !Error && RecipeInRun
- *ERROR:*

MachineOn && MachineInitialized && Calibrated && !EnergySaving &&

Error

This is the state diagram of the UnitState:

Note: Since the unit state is an enumeration do not rely on the transitions. Only the logic of the unit flags counts.

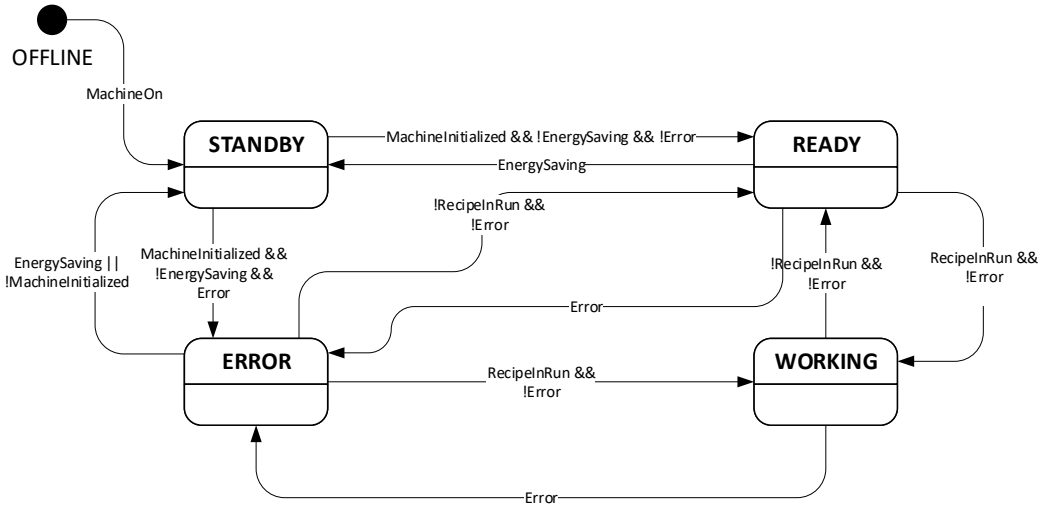


Figure 9 – State Machine of the unit state

Its representation in the *AddressSpace* is defined in Table 22.

Table 22 – WwUnitStateEnumeration Definiton

Attribute	**Value**				
BrowseName	WwUnitStateEnumeration				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumValues	0:EnumValueType[]	0:PropertyType	

7.8 WwUnitModeEnumeration

This enumeration *WwUnitModeEnumeration* represents the generalized mode of a unit. The enumeration is defined in Table 23.

Table 23 – WwUnitModeEnumeration Items

Name	**Value**	**Description**
OTHER	0	This state is used if none of the other states below applies.
AUTOMATIC	1	The unit is in *automatic mode*.
SEMIAUTOMATIC	2	The unit is in semi-*automatic mode*.
MANUAL	3	The unit is in manual mode.
SETUP	4	The unit is in setup mode.
SLEEP	5	The unit is in sleep mode. Unit is still switched on, energy consumption reduced by e.g. reducing heating, switching drives off. Production is not possible.

Its representation in the *AddressSpace* is defined in Table 24.

Table 24 – WwUnitModeEnumeration Definiton

Attribute	Value				
BrowseName	WwUnitModeEnumeration				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0: EnumValues	0: EnumValueType []	0:PropertyType	

7.9 IWwUnitFlagsType InterfaceType Definition

The *IWwUnitFlagsType* provides the flags of a unit and is formally defined in Table 25.

Table 25 – IWwUnitFlagsType Definiton

Attribute	Value				
BrowseName	IWwUnitFlagsType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseInterfaceType defined in OPC 10001-7					
0:HasComponent	Variable	MachineOn	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	MachineInitialized	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	PowerPresent	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	AirPresent	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	DustChipSuction	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	Emergency	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	Safety	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	Calibrated	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	Remote	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	WorkpiecePresent	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	Moving	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	Error	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	Alarm	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	Warning	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	Hold	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	RecipeInRun	0:Boolean	0:BaseDataVariableType	M, RO
0:HasComponent	Variable	RecipeInSetup	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	RecipeInHold	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	ManualActivityRequired	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	LoadingEnabled	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	WaitUnload	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	WaitLoad	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	EnergySaving	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	ExternalEmergency	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	MaintenanceRequired	0:Boolean	0:BaseDataVariableType	O, RO
0:HasComponent	Variable	FeedRuns	0:Boolean	0:BaseDataVariableType	O, RO

The *MachineOn* Variable is true if the machine is switched on. If the OPC UA Server runs on the machine this value is always true.

The *MachineInitialized* Variable is true if the *MachineOn* is true, the *PLC* and the control processes are running. The machine is ready for usage for the operator.

The *PowerPresent* Variable is true if the power supply is present (the drives are ready to move).

The *AirPresent* Variable is true if the air pressure is present in the machine.

The *DustChipSuction* Variable is true if the dust and chip suction is ready.

The *Emergency* Variable is true if at least one emergency button is pressed.

The *Safety* Variable is true if at least one safety device (light curtain, safety mat, …) has intervened.

The *Calibrated* Variable is true if all components of the machine that need to be calibrated are calibrated.

The *Remote* Variable is true if the machine is working with programs sent by the supervisor or other external application.

The *WorkpiecePresent* Variable is true if at least one piece is inside the machine.

The *Moving* Variable is true if at least one *axis* is moving.

The *Error* Variable is true if at least one reason exists which prevents the machine from working.

The *Alarm* Variable is true if at least one alarm exists.

The *Warning* Variable is true if at least one warning exists.

The *Hold* Variable is true if the movements are paused by the operator.

The *RecipeInRun* Variable is true if the machine runs its program. However, if the machine is paused by the program, the machine is considered to still be running its program, i.e. while the *RecipeInHold* Variable is true, the *RecipeInRun* cannot be false.

The *RecipeInSetup* Variable is true if the *RecipeInRun* is true and the machine is in the setup phase (example: automatic *tool change*).

The *RecipeInHold* Variable is true if the machine is paused by the program. This is only possible if the RecipeInRun Variable is also true.

The *ManualActivityRequired* Variable is true if a *manual activity* by the *operator* is required. The *RecipeInRun* is not affected.

The *LoadingEnabled* Variable is true if the unit is ready to get the next new part. If this is false no part can get into the unit.

The *WaitUnload* Variable is true if the machine is waiting to unload pieces.

The *WaitLoad* Variable is true if the machine is waiting for pieces.

The *EnergySaving* Variable is true if energy saving is activated on the machine.

The *ExternalEmergency* Variable is true if there is an emergency from the *line* .

The *MaintenanceRequired* Variable is true if *maintenance* is required.

The *FeedRuns* Variable is true if the feed is running on a throughfeed machine.

7.10 IWwUnitValuesType InterfaceType Definition

The *IWwUnitValuesType* represents the values of a unit and is formally defined in Table 26.

Table 26 – IWwUnitValuesType Definiton

Attribute	Value				
BrowseName	IWwUnitValuesType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseInterfaceType defined in OPC 10001-7					
0:HasComponent	Variable	AxisOverride	0:UInt32	0:BaseAnalogType	O, RO
0:HasComponent	Variable	SpindleOverride	0:UInt32	0:BaseAnalogType	O, RO
0:HasComponent	Variable	FeedSpeed	0:Double	0:BaseAnalogType	O, RO
0:HasComponent	Variable	ActualCycle	0:Double	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteMachineOffTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteStandbyTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeStandbyTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteReadyTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeReadyTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteWorkingTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeWorkingTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteErrorTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeErrorTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteMachineOnTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeMachineOnTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsolutePowerPresentTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativePowerPresentTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteProductionTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeProductionTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteProductionWithoutWorkpieceTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeProductionWithoutWorkpieceTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteProductionWaitWorkpieceTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeProductionWaitWorkpieceTime	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteRunsGood	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeRunsGood	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteRunsTotal	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeRunsTotal	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteRunsAborted	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeRunsAborted	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsoluteLength	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativeLength	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsolutePiecesIn	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativePiecesIn	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	AbsolutePiecesOut	0:UInt64	0:BaseAnalogType	O, RO
0:HasComponent	Variable	RelativePiecesOut	0:UInt64	0:BaseAnalogType	O, RO

Note: For OEE or KPI calculations the absolute and relative values might not be good enough. The term "*Absolute*" depends on the manufacturer. It may be reset on the machine or the *InitialOperationDate* is used for the start. The reset function can usually only be done by the service or the manufacturer. Therefore it cannot be done by the OPCUA client. Maybe one manufacturer has this feature.

The *AxisOverride* Variable provides the override for the *axis* in percent.

The *SpindleOverride* Variable provides the override for the spindle in percent.

The *FeedSpeed* Variable provides the feed speed in m/min for throughfeed machines.

The *ActualCycle* Variable provides the parts per minutes.

The *AbsoluteMachineOffTime* can be calculated by the machine. The shutdown time and the starting time have to be stored on the machine.

The *AbsoluteStandbyTime* Variable provides the absolute time of the *STANDBY* state in msec.

The *RelativeStandbyTime* Variable provides the relative time since startup of the *STANDBY* state in msec.

The *AbsoluteReadyTime* Variable provides the absolute time of the *READY* state in msec.

The *RelativeReadyTime* Variable provides the relative time since startup of the *READY* state in msec.

The *AbsoluteWorkingTime* Variable provides the absolute time of the *WORKING* state in msec.

The *RelativeWorkingTime* Variable provides the relative time since startup of the *WORKING* state in msec.

The *AbsoluteErrorTime* Variable provides the absolute time of the *ERROR* state in msec.

The *RelativeErrorTime* Variable provides the relative time since startup of the *ERROR* state in msec.

The *AbsoluteMachineOnTime* Variable provides the absolute time in msec the machine is turned on based on the *MachineOn* state.

The *RelativeMachineOnTime* Variable provides the relative time in msec since startup the machine is turned on based on the *MachineOn* state.

The *AbsolutePowerPresentTime* Variable provides the absolute time in msec the machine has power on based on the *PowerPresent* state.

The *RelativePowerPresentTime* Variable provides the relative time in msec since startup the machine has power on based on the *PowerPresent* state.

The *AbsoluteProductionTime* Variable provides the absolute time in msec of the machine is working at least with one *workpiece* based on the *RecipeInRun* and *WorkpiecePresent* state.

The *RelativeProductionTime* Variable provides the relative time in msec since startup of the machine is working at least with one *workpiece* based on the *RecipeInRun* and *WorkpiecePresent* state.

The *AbsoluteProductionWithoutWorkpieceTime* Variable provides the absolute time in msec of the machine is working but without *workpieces* inside based on the *RecipeInRun* and !*WorkpiecePresent* state.

The *RelativeProductionWithoutWorkpieceTime* Variable provides the relative time in msec since startup of the machine is working but without *workpieces* inside based on the *RecipeInRun* and !*WorkpiecePresent* state.

The *AbsoluteProductionWaitWorkpieceTime* Variable provides the absolute time in msec of the machine is in working mode, bring the consent out to insert *workpiece* but no *workpiece* incoming from the previous machine based on the *ReceipeInRun* and *WaitLoad* state.

The *RelativeProductionWaitWorkpieceTime* Variable provides the relative time in msec waiting for *workpieces* since startup of the machine is in working mode, bring the consent out to insert *workpiece* but no *workpiece* incoming from the previous machine based on the *ReceipeInRun* and *WaitLoad* state.

The *AbsoluteRunsGood* Variable provides the absolute count of finished *runs*.

The *RelativeRunsGood* Variable provides the relative count of finished *runs* since the machine has started.

The *AbsoluteRunsTotal* Variable provides the absolute count of total *runs*.

The *RelativeRunsTotal* Variable provides the relative count of total *runs* since the machine has started.

The *AbsoluteRunsAborted* Variable provides the absolute count of aborted *runs*.

The *RelativeRunsAborted* Variable provides the relative count of aborted *runs* since the machine has started.

The *AbsoluteLength* Variable provides the absolute produced length in mm.

The *RelativeLength* Variable provides the relative produced length in mm since the machine has started.

The *AbsolutePiecesIn* Variable provides the absolute count of pieces which came into the machine.

The *RelativePiecesIn* Variable provides the relative count of pieces which came into the machine since the machine has started.

The *AbsolutePiecesOut* Variable provides the absolute count of pieces which came out of the machine.

The *RelativePiecesOut* Variable provides the relative count of pieces which came out of the machine since the machine has started.

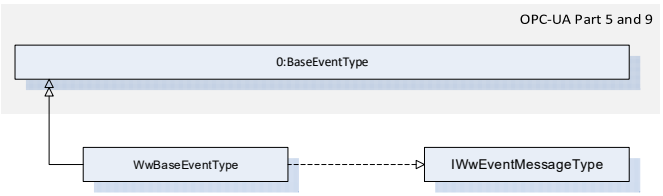
7.11 WwEventsDispatcherType ObjectType Definition

The *WwEventsDispatcherType* represents a container that is an event dispatcher for machine events and is formally defined in Table 27.

Table 27 – WwEventsDispatcherType Definiton

Attribute	Value				
BrowseName	WwEventsDispatcherType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the BaseObjectType defined in OPC 10000-5					
0:GeneratesEvent	ObjectType	0:BaseEventType			
0:GeneratesEvent	ObjectType	WwBaseEventType			

A wide variety of events and states can trigger messages on a plant, machine or component. Events and the associated messages are rather temporary and therefore cannot be subscribed directly.



The woodworking events shall implement the interface *IWwEventMessageType*. Therefore the *WwBaseEventType* can be used.

Figure 10 – Overview of Event Types

Woodworking machines do not need to provide the woodworking Types like *WwBaseEventType*. Instead it can be an object of any OPC UA *0:BaseEventType* or a subtype of it and additionally can implement the interface *IWwEventMessageType*. So it is possible to use the full range of OPC UA AlarmTypes like *0:LimitAlarmType*:

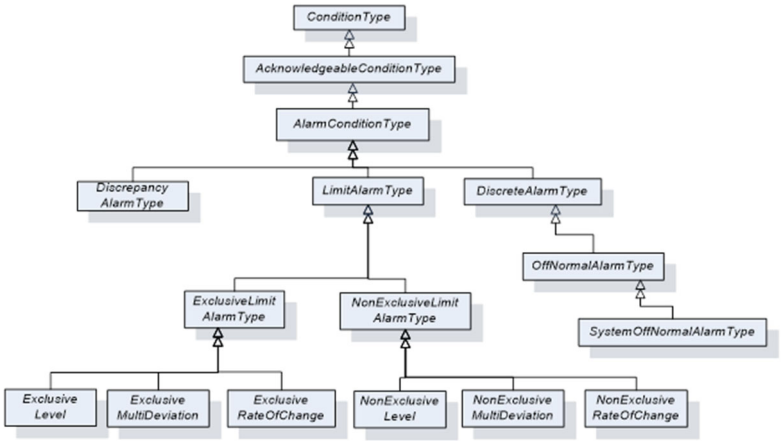


Figure 11 – OPC UA AlarmTypes

7.12 IWwEventMessageType InterfaceType Definition

The *IWwEventMessageType* provides the common extensions for all events and conditions and is formally defined in Table 28. Each instance definition that includes this interface with a HasInterface reference defines the predefined extensions.

Table 28 – IWwEventMessageType Definiton

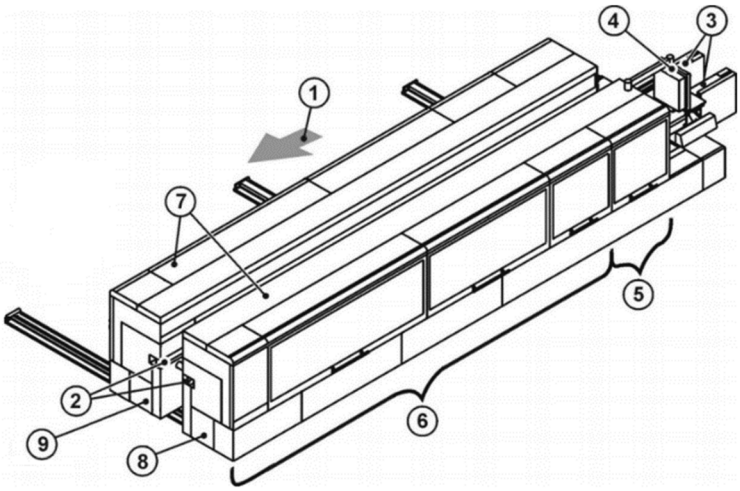
Attribute	Value				
BrowseName	IWwEventMessageType				
IsAbstract	True				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:BaseInterfaceType defined in OPC 10001-7					
0:HasProperty	Variable	EventCategory	WwEventCategoryEnumeration	0:PropertyType	M, RO
0:HasProperty	Variable	MessageId	0:String	0:PropertyType	M, RO
0:HasProperty	Variable	MessageName	0:String	0:PropertyType	O, RO
0:HasProperty	Variable	PathParts	0:String[]	0:PropertyType	M, RO
0:HasProperty	Variable	Group	0:String	0:PropertyType	O, RO
0:HasProperty	Variable	LocalizedMessages	0:LocalizedText[]	0:PropertyType	O, RO
0:HasProperty	Variable	Arguments	WwMessageArgumentDataType[]	0:PropertyType	O, RO

The *EventCategory* Variable provides the category of the event.

The *MessageId* Variable is a unique Identifier like a number or name of the message in the cause path (*PathParts*) determined Module. Example: “A4711” or “1”

The *MessageName* Variable is a short name like a number or title to reference a translation of the general message text. Example: “ID_MSG_EmergencyAlarm”.

The *PathParts* Variable is an array of Path information strings based on a server independent hierarchical structure of modules or an application specific expansion of that. It is an additional location information beside the *SourceName*. Example:



Key

1 = Machine with feed direction
2 = Top preasure beam
3 = Chain beam
4 = Control
5 = Sizing with
Milling 1 and
Milling 2 inside
6 = Addition operation zone
7 = Integrated enclosure
8 = Fixed side
9 = Movable side

“Machine”	“FixedSide”	“Sizing”	“Milling1”

Figure 12 – PathParts

The *Group* Variable specifies the class or group of the Message. The contents are set by the machine manufacturer. Examples are “safety”, “emergency”, “consumable”.

The *LocalizedMessages* Variable contains an array of localized messages corresponding to the installed server languages. The *0:Message* property contains the content of of the *LocalizedMessages* entry, which corresponds to the currently set language of the session. There are no placeholders in the messages. The *0:Message* property and the *LocalizedMessages* are all resolved.

The *Arguments* Variable is an argument that can be used to parameterize the message. The number of the indexing in the array corresponds to the placeholder number in the message text. This ensures that the formatting functions of the implementations enable the localized message texts to be created. If a client wants to use this feature, it has to use the *MessageId*. With this Id the raw message can be taken from a repository of the woodworking manufacturer. Then the placeholders can be resolved using the *Arguments*. The format of the raw message is up to the manufacturer.

7.13 WwEventCategoryEnumeration

This enumeration *WwEventCategoryEnumeration* represents the category of an event. The enumeration is defined in Table 29.

Table 29 – WwEventCategoryEnumeration Items

Name	Value	Description
ERROR	5	This category is used for error messages associated with problems that need human interaction. An Error occurs if the situation has critical consequences for the machine process. For example, the protection of human life, of the environment, or of the machine itself, through safety mechanisms that block the process to prevent any harmful situation. This kind of situation cannot be solved automatically and confirmation by an operator is mandatory.
ALARM	4	The goal of an alarm is to inform operators about conditions in a timely manner and allow the operator to take some action before some consequences occur. The consequences may be economic (product is not usable and must be discarded), may be physical (overheating), may be related to safety (fire or destruction could occur) or any of a number of other possibilities. Typically, if no action is taken related to an alarm for some period of time the process will cross some threshold at which point consequences will start to occur, likely causing an Error condition. According to this definition an alarm message usually requires an acknowledgement and it may be decided that also a confirmation is needed.
WARNING	3	This category describes messages that in general could have moderate importance. Missing or ignoring such a message has no serious consequences. The woodworking system could request acknowledgement or acknowledgement and confirmation if needed. (Warning message to operator, e.g. “tool life will soon be reached”)
INFORMATION	2	Messages of this category do not require a client to read them for normal operation. The woodworking system can safely continue normal operation even if this message is ignored. (Help messages to operator, e.g. "select Auto mode and press Start")
DIAGNOSTIC	1	This category is used for messages for debugging and diagnostic purposes. They can be ignored by clients (Diagnostic messages to operator, e.g. "system is ready")
OTHER	0	No other event category applies or it is unknown.

This specification does not intend to determine in which manner acknowledgement and confirmation are given by operators: this could be done directly on a machine (e.g. through a SCADA or HMI) or/and by an OPC UA Client through OPC UA Alarms and Conditions mechanisms, if available.

Its representation in the *AddressSpace* is defined in Table 30.

Table 30 – WwEventCategoryEnumeration Definiton

Attribute	Value				
BrowseName	WwEventCategoryEnumeration				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the Enumeration type defined in OPC 10000-5					
0:HasProperty	Variable	0:EnumStrings	0:LocalizedText[]	0:PropertyType	

7.14 WwMessageArgumentDataType

This structure definition extends the argument structure with an argument value. The structure is defined in Table 31.

Table 31 – WwMessageArgumentDataType Structure

Name	Type	Description
WwMessageArgumentDataType	structure	Subtype of the 0:Argument defined in OPC UA Part 3
Value	WwMessageArgumentValueDataType	The variable contains the value of the argument

Its representation in the *AddressSpace* is defined in Table 32.

Table 32 – WwMessageArgumentDataType Definiton

Attribute	Value				
BrowseName	WwMessageArgumentDataType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:Argument defined in OPC UA Part 3					

7.15 WwMessageArgumentValueDataType

This union defines the possible types of an argument value. The structure is defined in Table 33.

Table 33 – WwMessageArgumentValueDataType Structure

Name	Type	Description
WwMessageArgumentValueDataType	structure	Subtype of the 0:Union defined in OPC UA Part 3
Array	WwMessageArgumentValueDataType[]	The content of the value as an array of the own type
Boolean	Boolean	The content of the value as a boolean
Int16	Int16	The content of the value as a 16 bit integer
Int32	Int32	The content of the value as a 32 bit integer
Int64	Int64	The content of the value as a 64 bit integer
SByte	SByte	The content of the value as a 8 bit integer
UInt16	UInt16	The content of the value as a 16 bit unsigned integer
UInt32	UInt 32	The content of the value as a 32 bit unsigned integer
UInt64	UInt64	The content of the value as a 64 bit unsigned integer
Byte	Byte	The content of the value as a 8 bit unsigned integer
DateTime	DateTime	The content of the value as a datetime
Guid	Guid	The content of the value as a GUID
LocalizedText	LocalizedText	The content of the value as a localized text
Double	Double	The content of the value as a double
Float	Float	The content of the value as a float
String	String	The content of the value as a string
Other	String	The content of the value has no standard format and is instantiated as a string

Its representation in the *AddressSpace* is defined in Table 34.

Table 34 – WwMessageArgumentValueDataType Definiton

Attribute	Value				
BrowseName	WwMessageArgumentValueDataType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:Union defined in OPC UA Part 3					

7.16 WwBaseEventType ObjectType Definition

The *WwBaseEventType* represents a message event from a module and is formally defined in Table 35.

Table 35 – WwBaseEventType Definiton

Attribute	Value				
BrowseName	WwBaseEventType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of the 0:BaseEventType defined in OPC UA Part 5					
0:HasInterface	ObjectType	IWwEventMessageType			
Applied from IWwEventMessageType					
0:HasProperty	Variable	EventCategory	WwEventCategoryEnumeration	0:PropertyType	M, RO
0:HasProperty	Variable	MessageId	0:String	0:PropertyType	M, RO
0:HasProperty	Variable	MessageName	0:String	0:PropertyType	O, RO
0:HasProperty	Variable	PathParts	0:String[]	0:PropertyType	M, RO
0:HasProperty	Variable	Group	0:String	0:PropertyType	O, RO
0:HasProperty	Variable	LocalizedMessages	0:LocalizedText[]	0:PropertyType	O, RO
0:HasProperty	Variable	Arguments	WwMessageArgumentDataType []	0:PropertyType	O, RO

IWwEventMessageType and its members are described in 7.12.

8 Profiles and ConformanceUnits

8.1 Conformance Units

This chapter defines the corresponding *Conformance Units* for the OPC UA Information Model for Woodworking.

Table 36 – Conformance Units for Woodworking

Category	Title	Description
Server	Woodworking WwMachineType Mandatory Nodes	All nodes declared as mandatory in the WwMachineType are available in the AddressSpace. The nodes declared as optional may be included in the AddressSpace. Identification must not be writeable.
Server	Woodworking Machine Identification Writeable	If the writeable properties of the" WwMachineType Additional Subcomponents" are provided they must be writeable. If they are written the new value must be provided by the server. The new value must still be provided by the server after the restart.
Server	Woodworking Machine Monitoring	All nodes declared in the IWwUnitFlagsType and in IWwUnitValuesType may be included in the AddressSpace for the machines.
Server	Woodworking Machine Events	The Events node implementing the ObjectType WwEventsDispatcherType exists in the Address Space.
Server	Woodworking Custom Extensions Functionality	The folder node ManufacturerSpecific must exist below the <Machine> node (See Figure 6 – Overview of the OPC UA Woodworking information model)
Server	Woodworking SubUnits Monitoring	If sub units exist the "SubUnits" node must be listed below the "State" node of a machine. For each unit an entry of the type "IWwBaseStateType" must exist. All nodes declared as mandatory in the IWwBaseStateType are available in the AddressSpace for each unit of the machine. The nodes declared as optional for this type may be included in the AddressSpace.
Server	Woodworking Unit State	In the machine or sub unit the CurrentState of IWwUnitOverviewType and the Flags of IWwUnitFlagsType must exist. The CurrentState must be the result of the Flags as described in 7.7 WwUnitStateEnumeration.
Server	Woodworking Event Propagation	When Events are generated by a node, all nodes connected with inverse hierarchical References that have SubscribeToEvents set in the EventNotifier Attribute, shall also generate the Event. This propagates events over all inverse hierarchical References up to the instance of WwMachineType. Each instance of WwMachineType shall have SubscribeToEvents set in the EventNotifier Attribute and thus propagate all Events generated by nodes aggregated by this instance.
Server	Woodworking Event Messages	The Events node shall have SubscribeToEvents set in the EventNotifier Attribute.

8.2 Profiles

8.2.1 Profile list

Table 37 lists all Profiles defined in this document and defines their URIs.

Table 37 – Profile URIs for Woodworking

Profile	URI
Woodworking Basic Server Profile	http://opcfoundation.org/UA/Woodworking/Server/Basic
Woodworking Monitoring Server Facet	http://opcfoundation.org/UA/Woodworking/Server/Monitoring
Woodworking Machine Events Server Facet	http://opcfoundation.org/UA/Woodworking/Server/MachineEvents
Woodworking Custom Extension Server Facet	http://opcfoundation.org/UA/Woodworking/Server/CustomExtensions

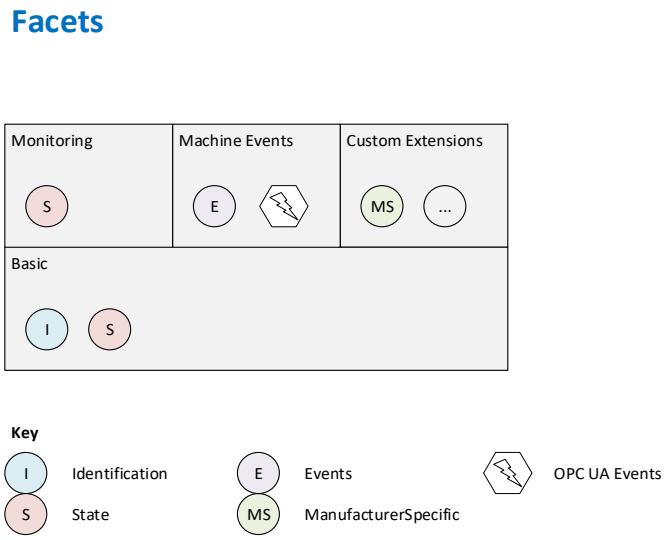


Figure 13 – Profiles and Facets

8.2.2 Server Facets

8.2.2.1 Overview

The following sections specify the *Facets* available for *Servers* that implement the Woodworking companion specification. Each section defines and describes a *Facet* or *Profile*.

8.2.2.2 Woodworking Basic Server Profile

Table 38 defines a *Profile* that describes the minimum required content and address space functionality any Woodworking server shall at least provide.

Table 38 – Woodworking Basic Server Profile

Group	Conformance Unit / Profile Title	Mandatory / Optional
Profile	0: Micro Embedded Device 2017 Server Profile http://opcfoundation.org/UA-Profile/Server/MicroEmbeddedDevice2017	M
Profile	0:SecurityPolicy [B] – Basic256Sha256 Profile http://opcfoundation.org/UA/SecurityPolicy#Basic256Sha256	M
Woodworking	Woodworking WwMachineType Mandatory Nodes	M
Woodworking	Woodworking Machine Identification Writeable	O
Machinery	3:Machinery Machine Identification Server Facet	M

8.2.2.3 Woodworking Monitoring Server Facet

Table 39 defines a *Facet* that provides a definition for monitoring the machine.

Table 39 – Woodworking Monitoring Server Facet

Group	Conformance Unit / Profile Title	M / O
Woodworking	Woodworking Machine Monitoring	M
Woodworking	Woodworking SubUnits Monitoring	O
Woodworking	Woodworking Unit State	M

8.2.2.4 Woodworking Machine Events Server Facet

Table 40 defines a *Facet* that provides a definition for providing messages to *clients*.

Table 40 – Woodworking Machine Events Server Facet

Group	Conformance Unit / Profile Title	M / O
Woodworking	Woodworking Machine Events	M
Woodworking	Woodworking Event Propagation	M
Woodworking	Woodworking Event Messages	M
Profile	0:Standard Event Subscription Server Facet http://opcfoundation.org/UA-Profile/Server/StandardEventSubscription	M
Profile	0:Address Space Notifier Server Facet http://opcfoundation.org/UA-Profile/Server/AddressSpaceNotifier	M

8.2.2.5 Woodworking Custom Extension Server Facet

Table 41 defines a *Facet* that provides customer specific functionality.

Table 41 – Woodworking Custom Extension Server Facet

Group	Conformance Unit / Profile Title	M / O
Woodworking	Woodworking Custom Extensions Functionality	M

9 Namespaces

9.1 Namespace Metadata

Table 42 defines the namespace metadata for this document. The *Object* is used to provide version information for the namespace and an indication about static *Nodes*. Static *Nodes* are identical for all *Attributes* in all *Servers*, including the *Value Attribute*. See OPC 10000-5 for more details.

The information is provided as *Object* of type *NamespaceMetadataType*. This *Object* is a component of the *Namespaces Object* that is part of the *Server Object*. The *NamespaceMetadataType ObjectType* and its *Properties* are defined in OPC 10000-5.

The version information is also provided as part of the ModelTableEntry in the UANodeSet XML file. The UANodeSet XML schema is defined in OPC 10000-6.

Table 42 – NamespaceMetadata Object for this Document

Attribute	Value	
BrowseName	**http://opcfoundation.org/UA/Woodworking/**	
Property	**DataType**	**Value**
NamespaceUri	String	http://opcfoundation.org/UA/Woodworking/
NamespaceVersion	String	1.00
NamespacePublicationDate	DateTime	2021-10-03
IsNamespaceSubset	Boolean	False
StaticNodeIdTypes	IdType []	{Numeric}
StaticNumericNodeIdRange	NumericRange []	Null
StaticStringNodeIdPattern	String	Null

9.2 Handling of OPC UA Namespaces

Namespaces are used by OPC UA to create unique identifiers across different naming authorities. The *Attributes NodeId* and *BrowseName* are identifiers. A *Node* in the UA *AddressSpace* is unambiguously identified using a *NodeId*. Unlike *NodeIds*, the *BrowseName* cannot be used to unambiguously identify a *Node*. Different *Nodes* may have the same *BrowseName*. They are used to build a browse path between two *Nodes* or to define a standard *Property*.

Servers may often choose to use the same namespace for the *NodeId* and the *BrowseName*. However, if they want to provide a standard *Property*, its *BrowseName* shall have the namespace of the standards body although the namespace of the *NodeId* reflects something else, for example the *EngineeringUnits Property*. All *NodeIds* of *Nodes* not defined in this document shall not use the standard namespaces.

Table 43 provides a list of mandatory and optional namespaces used in an Woodworking OPC UA *Server*.

Table 43 – Namespaces used in a Woodworking Server

NamespaceURI	Description	Use
http://opcfoundation.org/UA/	Namespace for *NodeIds* and *BrowseNames* defined in the OPC UA specification. This namespace shall have namespace index 0.	Mandatory
Local Server URI	Namespace for nodes defined in the local server. This may include types and instances used in Woodworking machine represented by the Server. This namespace shall have namespace index 1.	Mandatory
http://opcfoundation.org/UA/DI/	Namespace for *NodeIds* and *BrowseNames* defined in OPC 10000-100 (OPC UA Devices). The namespace index is *Server* specific.	Mandatory
http://opcfoundation.org/UA/Machinery/	Namespace for *NodeIds* and *BrowseNames* defined in OPC 40001-1 (OPC UA Machinery). The namespace index is *Server* specific.	Mandatory
http://opcfoundation.org/UA/Woodworking/	Namespace for *NodeIds* and *BrowseNames* defined in this document. The namespace index is *Server* specific.	Mandatory

Table 44 provides a list of namespaces and their indices used for *BrowseNames* in this document. The default namespace of this document is not listed since all *BrowseNames* without prefix use this default namespace.

Table 44 – Namespaces used in this document

NamespaceURI	Namespace Index	Example
http://opcfoundation.org/UA/	0	0:EngineeringUnits
http://opcfoundation.org/UA/DI/	2	2:DeviceRevision
http://opcfoundation.org/UA/Machinery/	3	3:YearOfConstruction

Annex A
(normative)

Woodworking Namespace and mappings

A.1 Namespace and identifiers for Woodworking Information Model

This appendix defines the numeric identifiers for all of the numeric *NodeIds* defined in this specification. The identifiers are specified in a CSV file with the following syntax:

`<SymbolName>, <Identifier>, <NodeClass>`

Where the *SymbolName* is either the *BrowseName* of a *Type Node* or the *BrowsePath* for an *Instance Node* that appears in the specification and the *Identifier* is the numeric value for the *NodeId*.

The *BrowsePath* for an *Instance Node* is constructed by appending the *BrowseName* of the instance *Node* to the *BrowseName* for the containing instance or type. An underscore character is used to separate each *BrowseName* in the path. Let's take for example, the *IWwUnitFlagsType InterfaceType Node* which has the *PowerPresent Property*. The **Name** for the *PowerPresent InstanceDeclaration* within the *IWwUnitFlagsType* declaration is: *IWwUnitFlagsType_PowerPresent*.

The *NamespaceUri* for all *NodeIds* defined here is http://opcfoundation.org/UA/Woodworking/

The CSV released with this version of the specification can be found here:

– http://www.opcfoundation.org/UA/schemas/Woodworking/1.0/NodeIds.csv

NOTE The latest CSV that is compatible with this version of the specification can be found here:

– http://www.opcfoundation.org/UA/schemas/Woodworking/NodeIds.csv

A computer processible version of the complete Information Model defined in this specification is also provided. It follows the XML Information Model schema syntax defined in OPC 10000-6.

The Information Model Schema for this version of the document (including any revisions, amendments or errata) can be found here:

– http://www.opcfoundation.org/UA/schemas/Woodworking/1.0/Opc.Ua.Woodworking.NodeSet2.xml

NOTE The latest Information Model schema that is compatible with this version of the specification can be found here:

– http://www.opcfoundation.org/UA/schemas/Woodworking/Opc.Ua.Woodworking.NodeSet2.xml

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Annex B
(informative)

Examples

B.1 Overview

This appendix provides an informal example on how the building blocks defined in the machinery specification can be used.

B.2 Finding Machines

In Figure 14 – Example of finding machines, an example is given, showing the finding all Machines in Server use cases. The server provides information about an Edge Banding as well as a *CNC* machine defined by Woodworking

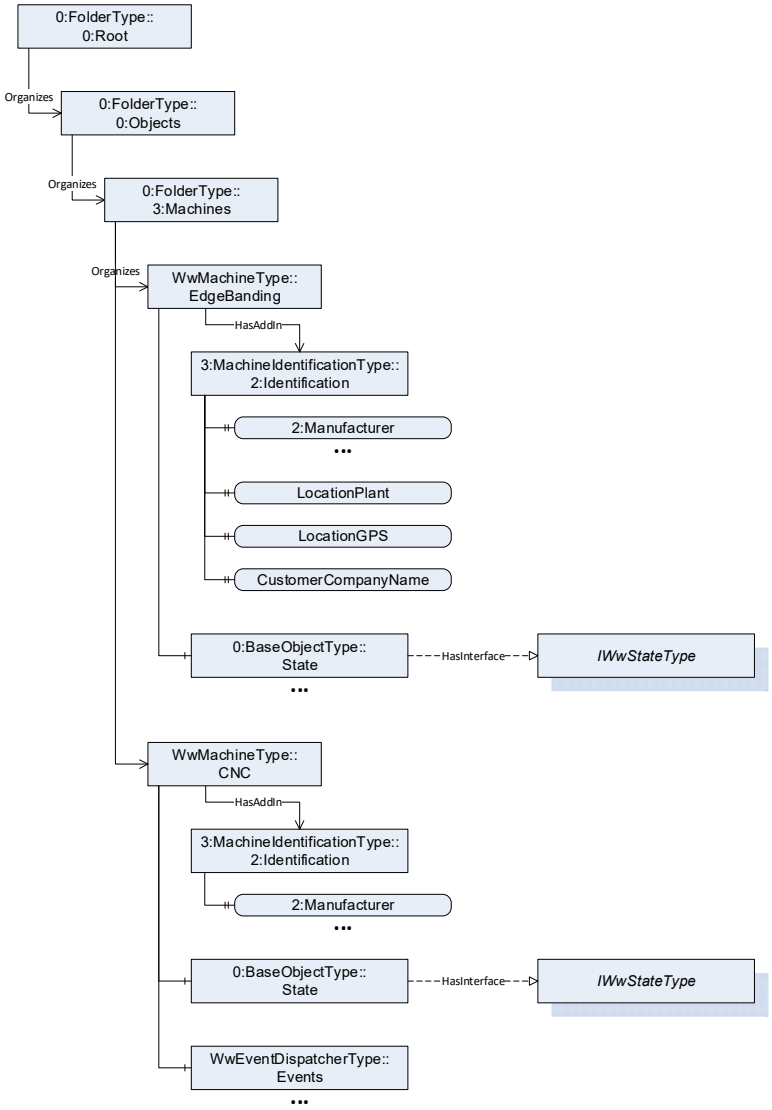

Figure 14 – Example of finding machines