



**OPC Unified Architecture**

**Specification**

**Errata**

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## OPC FOUNDATION

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### UNIFIED ARCHITECTURE –

#### FOREWORD

This specification is the specification for developers of OPC UA applications. The specification is a result of an analysis and design process to develop a standard interface to facilitate the development of applications by multiple vendors that shall inter-operate seamlessly together.

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## OPC Unified Architecture Specification

### Errata

#### 1 Scope

This Errata document contains all of the known corrections to OPC UA Specification Parts 1 through 13 for version 1.02. This document is updated regularly when issues are found between major releases of the Specification.

#### 2 OPC UA Specification: Part 4 – Services

<b>Topic</b>	Clarification regarding relation of Call service parameters
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 4 Clause 5.11.2 Call – Tables 61 and 63
<b>Mantis Reference</b>	<a href="#">0002720</a>
<b>Problem Statement</b>	The error handling of Call Service parameters requires more definitions.
<b>Solution</b>	<p>Table 61, parameter inputArgumentResults:</p> <p>Added:</p> <p>This list is empty unless the operation level result is Bad_InvalidArgument.</p> <p>If this list is populated, it has the same length as the inputArgument list.</p> <p>Table 63</p> <p>Added:</p> <p>Bad_TooManyArguments - The client specified more input arguments than defined for the method.</p> <p>Bad_InvalidArgument.</p> <p>Used to indicate in the operation level results that one or more of the input arguments are invalid. The inputArgumentResults contain the specific status code for each invalid argument.</p>

<b>Topic</b>	Clarified host name substitution by clients
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 4 Clause 5.4.1 Overview and 5.5.2 OpenSecureChannel
<b>Mantis Reference</b>	<a href="#">0002639</a>
<b>Problem Statement</b>	There is the general issue that a server may return a different host name in GetEndpoints than the one that was used by the client to call GetEndpoints. This happens if a NAT is used or if an IP address is used to call GetEndpoints but the server returns the host name and name resolution does not work.
<b>Solution</b>	<p>Added following text to 5.4.1 Overview</p> <p>Servers shall add all possible HostNames like MyHost and MyHost.local into the Server Certificate. This includes IP addresses of the host or the HostName exposed by a NAT router used to connect to the Server.</p> <p>Added following text to 5.5.2 OpenSecureChannelServers shall add all possible HostNames like MyHost and MyHost.local into the Server Certificate. This includes IP addresses of the host or the HostName exposed by a NAT router used to connect to the Server.</p> <p>Clients should be prepared to replace the HostName returned in the EndpointDescription with the HostName or the IP addresses they used to call GetEndpoints.</p>

<b>Topic</b>	Application instance certificate exchange if SecurityPolicy = None
<b>Errata Version</b>	1.02.1, further clarification in 1.02.3
<b>Spec Reference</b>	Part 4 Clause 5.6.2 CreateSession, 5.4.3 GetEndpoints and 5.5.2 OpenSecureChannel
<b>Mantis Reference</b>	<a href="#">0002198</a>
<b>Problem Statement</b>	In OPC UA Version 1.01 the handling of instance certificates in the CreateSession Service when using SecurityPolicy None is ambiguous. While our lowest level profile does not require an instance certificate, the CreateSession service in Version 1.01 requires the exchange of certificates. Version 1.02 removes this ambiguity. As a consequence however, connectivity between 1.01 and 1.02 applications may be impacted.
<b>Solution</b>	<p>The following additional rules to V1.02 are introduced to minimize connectivity problems.</p> <p>The new 1.02 requirement to not provide an application instance certificate for securityPolicyUri is NONE was removed since it created different interoperability issues with V1.01 clients.</p> <p><u>Recommendations:</u></p>

Servers that have application instance certificates available may still choose to provide them when SecurityPolicy = None since this insures interoperability with older 1.01 Clients.

Servers that do not have certificates available (e.g. nano-embedded devices) need not provide them when SecurityPolicy = None. Such Servers will be interoperable with all 1.02 Clients, but not necessarily with older 1.01 Clients.

Concrete changes are:

5.4.3 GetEndpoints

Replaced: If the securityPolicyUri is NONE and none of the UserTokenPolicies requires encryption, the Server shall not send an ApplicationInstanceCertificate and the Client shall ignore the ApplicationInstanceCertificate.

With: If the securityPolicyUri is NONE and none of the UserTokenPolicies requires encryption, the Client shall ignore the ApplicationInstanceCertificate.

Table 7 – OpenSecureChannel Service Parameters

Parameter clientCertificate

Replaced: If the securityPolicyUri is None, the Client shall not send an ApplicationInstanceCertificate and the Server shall ignore the ApplicationInstanceCertificate.

With: If the securityPolicyUri is None, the Server shall ignore the ApplicationInstanceCertificate.

Table 11 – CreateSession Service Parameters

Parameter clientCertificate

Replaced: If the securityPolicyUri is None, the Client shall not send an ApplicationInstanceCertificate and the Server shall ignore the ApplicationInstanceCertificate.

With: If the securityPolicyUri is None, the Server shall ignore the ApplicationInstanceCertificate.

Parameter serverCertificate

Replaced: If the securityPolicyUri is NONE and none of the UserTokenPolicies requires encryption, the Server shall not send an ApplicationInstanceCertificate and the Client shall ignore the ApplicationInstanceCertificate.

With: If the securityPolicyUri is NONE and none of the UserTokenPolicies requires encryption, the Client shall ignore the ApplicationInstanceCertificate.

Topic	Certificate validation steps																								
Errata Version	1.02.1 and updated in 1.02.4																								
Spec Reference	Part 4 Clause 6.1.3 Determining if a Certificate is Trusted																								
Mantis Reference	<a href="#">0002534</a> and <a href="#">0002822</a>																								
Problem Statement	Security reviews recommended always checking all certificates in the chain and to return unspecific errors for certificate check failures.																								
Solution	<p>The rule to stop certificate checks if a trusted certificate is found was removed since trusted CA certificates may be revoked by their issuers and therefore a full check of the certificate chain is required.</p> <p>The certificate validation steps in Table 101 got reordered to first check Certificate Structure, Signature and Trust List. If one of the tree checks fails the unspecific status Bad_SecurityChecksFailed is returned. It the certificate is trusted, the remaining checks will return the specific error as defined in V1.02.</p> <p style="text-align: center;"><b>Table 101 – Certificate Validation Steps</b></p> <table><tr><th>Step</th><th>Error/AuditEvent</th><th>Description</th></tr><tr><td>Certificate Structure</td><td>Bad_SecurityChecksFailed AuditCertificateInvalidEventType</td><td>The <i>Certificate</i> structure is verified. This error may not be suppressed.</td></tr><tr><td>Signature</td><td>Bad_SecurityChecksFailed AuditCertificateInvalidEventType</td><td>A <i>Certificate</i> with an invalid signature shall always be rejected. A <i>Certificate</i> signature is invalid if the Issuer <i>Certificate</i> is unknown. A self-signed <i>Certificate</i> is its own issuer.</td></tr><tr><td>Trust List Check</td><td>Bad_CertificateUntrusted AuditCertificateUntrustedEventType</td><td>If the <i>Application Instance Certificate</i> is not trusted and none of the CA <i>Certificates</i> in the chain is trusted, the result of the <i>Certificate</i> validation shall be Bad_CertificateUntrusted. If this check fails on the <i>Server</i> side, the error Bad_SecurityChecksFailed shall be reported back to the <i>Client</i>.</td></tr><tr><td>Validity Period</td><td>Bad_CertificateTimeInvalid Bad_CertificateIssuerTimeInvalid AuditCertificateExpiredEventType</td><td>The current time shall be after the start of the validity period and before the end. This error may be suppressed.</td></tr><tr><td>Host Name</td><td>Bad_CertificateHostNameInvalid AuditCertificateDataMismatchEventType</td><td>The <i>HostName</i> in the URL used to connect to the <i>Server</i> shall be the same as one of the <i>HostNames</i> specified in the <i>Certificate</i>. This check is skipped for CA <i>Certificates</i>. This check is skipped for <i>Server</i> side validation. This error may be suppressed.</td></tr><tr><td>URI</td><td>Bad_CertificateUriInvalid AuditCertificateDataMismatchEventType</td><td><i>Application</i> and <i>Software Certificates</i> contain an application or product URI that shall match the URI specified in the <i>ApplicationDescription</i> provided with the <i>Certificate</i>. This check is skipped for CA <i>Certificates</i>. This error may not be suppressed. The <i>gatewayServerUri</i> is used to validate an <i>Application Certificate</i> when connecting to a <i>Gateway Server</i> (see Part 4 clause 7.1).</td></tr><tr><td>Certificate</td><td>Bad_CertificateUseNotAllowed</td><td>Each <i>Certificate</i> has a set of uses for</td></tr></table>	Step	Error/AuditEvent	Description	Certificate Structure	Bad_SecurityChecksFailed AuditCertificateInvalidEventType	The <i>Certificate</i> structure is verified. This error may not be suppressed.	Signature	Bad_SecurityChecksFailed AuditCertificateInvalidEventType	A <i>Certificate</i> with an invalid signature shall always be rejected. A <i>Certificate</i> signature is invalid if the Issuer <i>Certificate</i> is unknown. A self-signed <i>Certificate</i> is its own issuer.	Trust List Check	Bad_CertificateUntrusted AuditCertificateUntrustedEventType	If the <i>Application Instance Certificate</i> is not trusted and none of the CA <i>Certificates</i> in the chain is trusted, the result of the <i>Certificate</i> validation shall be Bad_CertificateUntrusted. If this check fails on the <i>Server</i> side, the error Bad_SecurityChecksFailed shall be reported back to the <i>Client</i> .	Validity Period	Bad_CertificateTimeInvalid Bad_CertificateIssuerTimeInvalid AuditCertificateExpiredEventType	The current time shall be after the start of the validity period and before the end. This error may be suppressed.	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Certificate	Bad_CertificateUseNotAllowed	Each <i>Certificate</i> has a set of uses for																							

	Usage	Bad_CertificateIssuerUseNotAllowed AuditCertificateMismatchEventType	the <i>Certificate</i> (see Part 6). These uses shall match use requested for the <i>Certificate</i> (i.e. Application, Software or CA). This error may be suppressed unless the <i>Certificate</i> indicates that the usage is mandatory.
	Find Revocation List	Bad_CertificateRevocationUnknown Bad_CertificateIssuerRevocationUnknown AuditCertificateRevokedEventType	Each CA <i>Certificate</i> may have a revocation list. This check fails if this list is not available (i.e. a network interruption prevents the application from accessing the list). No error is reported if the <i>Administrator</i> disables revocation checks for a CA <i>Certificate</i> . This error may be suppressed.
	Revocation Check	Bad_CertificateRevoked Bad_CertificateIssuerRevoked AuditCertificateRevokedEventType	The <i>Certificate</i> has been revoked and may not be used. This error may not be suppressed. If this check fails on the <i>Server</i> side, the error Bad_SecurityChecksFailed shall be reported back to the <i>Client</i> .

<b>Topic</b>	Changes to sampling and publishing intervals
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 4 Clause 5.12.3 ModifyMonitoredItems and 5.13.3 ModifySubscription
<b>Mantis Reference</b>	<a href="#">0002107</a>
<b>Problem Statement</b>	According to V1.02 changes to sampling and publishing intervals take effect the next time the timer expires. This is an issue if the interval is changed from a long period to a short period and it requires additional special handling in most server implementations.
<b>Solution</b>	<p>5.12.3 ModifyMonitoredItems</p> <p>Replaced: Changes to the sampling interval and filter take effect at the beginning of the next sampling interval (the next time the sampling timer expires).</p> <p>With: Changes to the MonitoredItem settings shall be applied immediately by the Server. They take effect as soon as practical but not later than twice the new revisedSamplingInterval.</p> <p>5.13.3 ModifySubscription</p> <p>Replaced: Changes to the publishing interval become effective the next time the publishing timer expires.</p> <p>With: Changes to the Subscription settings shall be applied immediately by the Server. They take effect as soon as practical but not later than twice the new revisedPublishingInterval.</p>

<b>Topic</b>	OpenSecureChannel SecurityToken renew
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 4 Clause 5.5.2 OpenSecureChannel
<b>Mantis Reference</b>	<a href="#">0001731</a>
<b>Problem Statement</b>	<p>Servers should use the existing SecurityToken to secure outgoing Messages until the SecurityToken expires or the Server receives a Message secured with a new SecurityToken.</p> <p>Not following this recommendation can cause communication interruptions on embedded clients that need a long time to finish SecurityToken renew.</p>
<b>Solution</b>	<p>To ensure all Servers side stacks behave the same way and slow embedded clients have no communication interruption, the 'should use' was changed to 'shall use'. The update rule is now:</p> <p>Servers shall use the existing SecurityToken to secure outgoing Messages until the SecurityToken expires or the Server receives a Message secured with a new SecurityToken.</p>

<b>Topic</b>	Protect against resource exhaustion in OpenSecureChannel
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 4 Clause 5.5.2 OpenSecureChannel
<b>Mantis Reference</b>	<a href="#">0002484</a>
<b>Problem Statement</b>	<p>Clients can create secure channels without security for discovery on a server. Misbehaving clients or a denial of service attack can use all possible secure channels.</p>
<b>Solution</b>	<p>Added the following rule to protect against misbehaving clients or a denial of service attack:</p> <p>A Server application should limit the number of SecureChannels. To protect against misbehaving Clients and denial of service attacks, the Server shall close the oldest SecureChannel that has no Session assigned before reaching the maximum number of supported SecureChannels.</p>

<b>Topic</b>	Discarding of queued values if monitored item queue size is reduced
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 4 Clause 5.12.3 ModifyMonitoredItems
<b>Mantis Reference</b>	<a href="#">0002494</a>
<b>Problem Statement</b>	V1.02 does not specify what happens with queued values if the sampling queue size is reduced.
<b>Solution</b>	<p>Added the following clarification to requestedParameters of ModifyMonitoredItems:</p> <p>If the number of notifications in the queue exceeds the new queue size, the notifications exceeding the size shall be discarded following the configured discard policy.</p>

<b>Topic</b>	FindServers for redundant servers
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 4 Clause 5.4.2 FindServers
<b>Mantis Reference</b>	<a href="#">0002360</a>
<b>Problem Statement</b>	V1.02 does add additional requirements for FindServers for redundant servers but FindServers definition is inconsistent with the definition in redundancy.
<b>Solution</b>	<p>Second paragraph in 5.4.2 FindServers must be change to:</p> <p>Every Server shall provide a Discovery Endpoint that supports this Service. The Server shall always return a record that describes itself, however in some cases more than one record may be returned. Gateway Servers shall return a record for each Server that they provide access to plus (optionally) a record that allows the Gateway Server to be accessed as an ordinary OPC UA Server. Non-transparent redundant Servers shall provide a record for each Server in the redundant set.</p>

### 3 OPC UA Specification: Part 5 – Information Model

<b>Topic</b>	Improve the description for the situation where collection of diagnostic information is disabled.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 5 Clause 6.3.3 – ServerDiagnosticsType, last paragraph
<b>Mantis Reference</b>	<a href="#">0003219</a>
<b>Problem Statement</b>	The current description is ambiguous about what nodes have to exist in the AddressSpace if the EnabledFlag is FALSE (collection disabled).
<b>Solution</b>	<p><u>Add the following statement:</u></p> <p>When diagnostics are turned off, the Server can return Bad_NodeIdUnknown for all static diagnostic <i>Nodes</i> except the <i>EnabledFlag Property</i>. Dynamic diagnostic <i>Nodes</i> (such as the <i>Session Nodes</i>) will not appear in the <i>AddressSpace</i>.</p> <p>If collection of diagnostic information is not supported at all, the <i>EnabledFlag Property</i> will be <i>ReadOnly</i>.</p> <p>It replaces the following paragraph:</p> <p style="padding-left: 40px;">Static diagnostic <i>Nodes</i> that always appear in the <i>AddressSpace</i> will return Bad_NotReadable when the <i>Value Attribute</i> of such a <i>Node</i> is read or subscribed to and diagnostics are turned off. Dynamic diagnostic <i>Nodes</i> (such as the <i>Session Nodes</i>) will not appear in the <i>AddressSpace</i> when diagnostics are turned off.</p>

### 4 OPC UA Specification: Part 6 – Mappings

<b>Topic</b>	SOAP action name does not conform to Part 6.
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 6 Clause 7.2.2 XML Encoding
<b>Mantis Reference</b>	<a href="#">0002190</a>
<b>Problem Statement</b>	V1.02 specifies a URL which is not consistent with the published WSDL for the SOAP actions.
<b>Solution</b>	Clause 7.2.2 now uses the URL prefix for actions that is used in the WSDL ( <a href="http://opcfoundation.org/UA/2008/02/Services.wsdl">http://opcfoundation.org/UA/2008/02/Services.wsdl</a> ).



Topic	Additional XML attribute for Method nodes											
Errata Version	1.02.1											
Spec Reference	Part 6 Clause E.8 UAMethod											
Mantis Reference	<a href="#">0002304</a>											
Problem Statement	V1.02 is missing an attribute that allows a link between a <i>Method Node</i> and the <i>InstanceDeclaration</i> in the associated <i>TypeDefinition</i> .											
Solution	<div>Add Clause E.8 UAMethod</div> <div>A <i>UAMethod</i> is a subtype of the <i>UAInstance</i> defined in E.6. It represents a <i>Method Node</i>. The fields in the <i>UAMethod</i> type are defined in Table E6.</div> <div>Table E6 – UAMethod</div> <table><tr><th>Element</th><th>Type</th><th>Description</th></tr><tr><td colspan="3">All of the fields from the <i>UAInstance</i> type described in Part 6 clause E.6.</td></tr><tr><td>MethodDeclarationId</td><td>NodeId</td><td>May be specified for <i>Method Nodes</i> that are a target of a <i>HasComponent</i> reference from a single <i>Object Node</i>. It is the <i>NodeId</i> of the <i>UAMethod</i> with the same <i>BrowseName</i> contained in the <i>TypeDefinition</i> associated with the <i>Object Node</i>.  If the <i>TypeDefinition</i> overrides a <i>Method</i> inherited from a base <i>ObjectType</i> then this attribute shall reference the <i>Method Node</i> in the subtype.</td></tr></table>			Element	Type	Description	All of the fields from the <i>UAInstance</i> type described in Part 6 clause E.6.			MethodDeclarationId	NodeId	May be specified for <i>Method Nodes</i> that are a target of a <i>HasComponent</i> reference from a single <i>Object Node</i> . It is the <i>NodeId</i> of the <i>UAMethod</i> with the same <i>BrowseName</i> contained in the <i>TypeDefinition</i> associated with the <i>Object Node</i> .  If the <i>TypeDefinition</i> overrides a <i>Method</i> inherited from a base <i>ObjectType</i> then this attribute shall reference the <i>Method Node</i> in the subtype.
Element	Type	Description										
All of the fields from the <i>UAInstance</i> type described in Part 6 clause E.6.												
MethodDeclarationId	NodeId	May be specified for <i>Method Nodes</i> that are a target of a <i>HasComponent</i> reference from a single <i>Object Node</i> . It is the <i>NodeId</i> of the <i>UAMethod</i> with the same <i>BrowseName</i> contained in the <i>TypeDefinition</i> associated with the <i>Object Node</i> .  If the <i>TypeDefinition</i> overrides a <i>Method</i> inherited from a base <i>ObjectType</i> then this attribute shall reference the <i>Method Node</i> in the subtype.										

<b>Topic</b>	ExtraPadding byte should be at the end of the padding.
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 6 Section 6.7.2 Table 33
<b>Mantis Reference</b>	<a href="#">0002312</a>
<b>Problem Statement</b>	V1.02 specifies ExtraPadding byte at the beginning of the padding which only works for single byte padding values.
<b>Solution</b>	<p>Section 6.7.2 Table 33</p> <p>The ExtraPadding Byte has been moved to the end of the padding to facilitate decoding.</p>

<b>Topic</b>	Security Validation checks expect detailed error codes.
<b>Errata Version</b>	1.02.1
<b>Spec Reference</b>	Part 6 Clause 6.7.6 Verifying Message Security
<b>Mantis Reference</b>	<a href="#">0002504</a>
<b>Problem Statement</b>	V1.02 requires that the Bad_SecurityChecksFailed error code be returned if the client is not trusted. The text is ambiguous and could imply that specific security codes are never returned to the client.
<b>Solution</b>	Clause 6.7.6 now states that Certificate Trust shall be checked first. The other steps are the same. This allows more specific error codes to be returned only to trusted <i>Clients</i> .

## 5 OPC UA Specification: Part 7 – Profiles

<b>Topic</b>	Diagnostic Information not mandatory in some Profiles.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 7 Clause 6.5.44 – Nano Embedded Device Server Profile Clause 6.5.45 – Micro Embedded Device Server Profile Clause 6.5.46 – Embedded UA Server Profile
<b>Mantis Reference</b>	<a href="#">0002445</a>
<b>Problem Statement</b>	It is not clearly stated that Diagnostic Information is optional for some of the low-end profiles, although it is defined as “mandatory” in UA Part 5.
<b>Solution</b>	Added following statement in relevant Profiles: The support of Diagnostic Objects and Variables is optional for this Profile despite it being defined as “mandatory” in UA Part 5. <b>This means the ServerDiagnostics node (and all nodes beneath it) might not exist for that Profiles.</b> Support of Diagnostic Objects and Variables is mandatory in some higher level Profiles. See also: <a href="http://opcfoundation.org/UA-Profile/Server/NanoEmbeddedDevice">http://opcfoundation.org/UA-Profile/Server/NanoEmbeddedDevice</a> <a href="http://opcfoundation.org/UA-Profile/Server/MicroEmbeddedDevice">http://opcfoundation.org/UA-Profile/Server/MicroEmbeddedDevice</a> <a href="http://opcfoundation.org/UA-Profile/Server/EmbeddedUA">http://opcfoundation.org/UA-Profile/Server/EmbeddedUA</a>

## 6 OPC UA Specification: Part 11 – History Access

<b>Topic</b>	How to handle requests for both timestamps when only source exists.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 4.3 Timestamps
<b>Mantis Reference</b>	<a href="#">0002445</a>
<b>Problem Statement</b>	Timestamps: Client requests TimestampsToReturn.Both, what if server supports Source only?
<b>Solution</b>	Added statement “If a request is made requesting both <i>ServerTimestamp</i> and <i>SourceTimestamp</i> and the <i>Server</i> is only collecting the <i>SourceTimestamp</i> the <i>Server</i> shall return <i>Bad_TimestampsToReturnInvalid</i> .”

<b>Topic</b>	Should original values be returned when asking for modified values?
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 6 Clause 6.7.6 Verifying Message Security
<b>Mantis Reference</b>	<a href="#">0002446</a>
<b>Problem Statement</b>	Read Modified Functionality: Para 1 is confusing; should original value be returned?
<b>Solution</b>	Clause 6.4.3.3 has two edits.  Paragraph 1 was “...it reads the values, <i>StatusCodes</i> ,...” now reads “...it reads the modified values, <i>StatusCodes</i> ,...”  Paragraph 1 has this sentence appended “See 6.8 <i>HistoryUpdateDetails</i> parameter for details on what <i>updateTypes</i> are available.”

Topic	Server timestamp support is now a property for clients to discover.																	
Errata Version	1.02.4																	
Spec Reference	Part 11 Clause 5.2.2 HistoricalDataConfiguration Type  and  Part 11 Clause 5.4.2 HistoryServerCapabilities Type																	
Mantis Reference	<a href="#">0002469</a>																	
Problem Statement	ServerTimestamp support, possibly make available as a property for clients to discover?																	
Solution	<p>Table 3 has the following row appended.</p> <table><tr><td>HasProperty</td><td>Variable</td><td>ServerTimestampSupported</td><td>Boolean</td><td>PropertyType</td><td>Optional</td></tr></table> <p>Clause 5.2.2 has the following appended.</p> <p>“The <i>ServerTimestampSupported Variable</i> indicates support for the <i>ServerTimestamp</i> capability. A value of True indicates the <i>Server</i> supports <i>ServerTimestamps</i> in addition to <i>SourceTimestamp</i>. The default is False.”</p> <p>Table 8 has the following row appended.</p> <table><tr><td>HasComponent</td><td>Variable</td><td>ServerTimestampSupported</td><td>Boolean</td><td>PropertyType</td><td>Optional</td></tr></table> <p>Clause 5.4.4 has the following appended.</p> <p>“The <i>ServerTimestampSupported Variable</i> indicates support for the <i>ServerTimestamp</i> capability. A value of True indicates the <i>Server</i> supports <i>ServerTimestamps</i> in addition to <i>SourceTimestamp</i>. The default is False.”</p>						HasProperty	Variable	ServerTimestampSupported	Boolean	PropertyType	Optional	HasComponent	Variable	ServerTimestampSupported	Boolean	PropertyType	Optional
HasProperty	Variable	ServerTimestampSupported	Boolean	PropertyType	Optional													
HasComponent	Variable	ServerTimestampSupported	Boolean	PropertyType	Optional													

<b>Topic</b>	How is validation done when inserting records exceeds the bounds of the database?
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 6 Historical Access specific usage of Services
<b>Mantis Reference</b>	<a href="#">0002471</a>
<b>Problem Statement</b>	Validation on inserting records exceeding the bounds of the database
<b>Solution</b>	<p>Clause 6.8.2.2, 6.8.2.4, 6.8.3.3, and 6.8.3.5 have each had the following appended.</p> <p>"If the <i>Time</i> does not fall within range that can be stored then the related <i>operationResults</i> entry shall indicate <i>Bad_OutOfRange</i>."</p>

<b>Topic</b>	Clarifications on how to make unique keys for annotations.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 6.8.3.2 Specified Uniqueness of Structured History Data
<b>Mantis Reference</b>	<a href="#">0002531</a>
<b>Problem Statement</b>	Uniqueness of Annotation records - do not include message for uniqueness
<b>Solution</b>	<p>The sentence "Another <i>Server</i> may allow for multiple <i>Annotations</i> to exist per user, so a combination of a username, timestamp, and message may be used as the unique key for the structure."</p> <p>was changed to</p> <p>"Another <i>Server</i> may allow <i>Annotations</i> to exist per user, so a combination of a username and timestamp may be used as the unique key for the structure."</p>

<b>Topic</b>	Clarification to how DeleteAtTimeDetails "all entries" is handled.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 6.8.6.2 Delete at time functionality
<b>Mantis Reference</b>	<a href="#">0002584</a>
<b>Problem Statement</b>	DeleteAtTimeDetails "all entries" clarification
<b>Solution</b>	<p>The sentence "The DeleteAtTime structure deletes all entries in the history database for the specified timestamps for one or more <i>HistoricalDataNodes</i>."</p> <p>was modified to</p> <p>"The DeleteAtTime structure deletes all raw values, modified values, and annotations in the history database for the specified timestamps for one or more <i>HistoricalDataNodes</i>."</p>

<b>Topic</b>	Change to continuation point description to make it consistent with the other UA specifications.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 6.3 Continuation Points
<b>Mantis Reference</b>	<a href="#">0002667</a>
<b>Problem Statement</b>	Description of Continuation Point (6.3) does not match general concept
<b>Solution</b>	<p>The sentence "If the <i>Client</i> specifies a <i>ContinuationPoint</i> that does not correspond with the last returned ContinuationPoint from the Server, then the Server shall return a <i>Bad_ContinuationPointInvalid</i> error."</p> <p>was changed to</p> <p>"If the <i>Client</i> specifies a <i>ContinuationPoint</i> that is no longer valid, then the Server shall return a <i>Bad_ContinuationPointInvalid</i> error."</p>

<b>Topic</b>	Clarification on what is meant when the <i>ProcessingInterval</i> is equal to zero.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 6.4.4.2 Read processed functionality
<b>Mantis Reference</b>	<a href="#">0002784</a>
<b>Problem Statement</b>	What does ' <i>ProcessingInterval=0</i> ' mean.
<b>Solution</b>	<p>Paragraph 3 has the following sentence appended.</p> <p>"If the <i>ProcessingInterval</i> is specified as 0 then <i>Aggregates</i> will be calculated using one interval starting at <i>startTime</i> and ending at <i>endTime</i>."</p>

<b>Topic</b>	Continuation point usage in Read Requests has been expanded.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 6.4
<b>Mantis Reference</b>	<a href="#">0002887</a>
<b>Problem Statement</b>	Continuation point handling for large <i>HistoryRead</i> requests
<b>Solution</b>	<p>The following has been added for clarification to 6.4.2.2 Read Event functionality, 6.4.3.2 Read raw functionality, and to 6.4.3.3 Read modified functionality.</p> <p>"If the request takes a long time to process then the <i>Server</i> can return partial results with a <i>ContinuationPoint</i>. This might be done if the request is going to take more time than the <i>Client</i> timeout hint. It may take longer than the <i>Client</i> timeout hint to retrieve any results. In this case the <i>Server</i> may return zero results with a <i>ContinuationPoint</i> that allows the <i>Server</i> to resume the calculation on the next <i>Client HistoryRead</i> call."</p> <p>The following has been added for clarification to 6.4.5.2 Read at time functionality.</p> <p>"If the read request is taking a long time to calculate then the <i>Server</i> may return zero results with a <i>ContinuationPoint</i> that allows the <i>Server</i> to resume the calculation on the next <i>Client HistoryRead</i> call."</p>

<b>Topic</b>	Security Validation checks expect detailed error codes.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 5.6.4 AuditHistoryDeleteEventType
<b>Mantis Reference</b>	<a href="#">0002985</a>
<b>Problem Statement</b>	Typo in 5.6.4 AuditHistoryDeleteEventType.
<b>Solution</b>	<p>The sentence “The <i>NodeID</i> identifies the <i>NodeId</i> that was used for the delete operation.”</p> <p>was changed to</p> <p>“The <i>UpdatedNode property</i> identifies the <i>NodeId</i> that was used for the delete operation.”</p>

<b>Topic</b>	Ambiguity on what to do with the MaxNodesPerHistoryUpdateXxx paramters.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 11 Clause 6.8.1 Overview
<b>Mantis Reference</b>	<a href="#">0003091</a>
<b>Problem Statement</b>	OperationLimitsType - MaxNodesPerHistoryUpdateXxx issues
<b>Solution</b>	<p>The following text was appended to the clause.</p> <p>“If the <i>HistoryUpdate Service</i> is called with both <i>DataValues</i> and <i>Events</i> in the same call the <i>Server</i> operational limits <i>MaxNodesPerHistoryUpdateData</i> and <i>MaxNodesPerHistoryUpdateEvents</i> (See UA Part 5) may be ignored. The <i>Server</i> may return the service result code <i>Bad_TooManyOperations</i> if it is not able to handle the combination of <i>DataValues</i> and <i>Events</i>. It is recommended to call the <i>HistoryUpdate Service</i> twice, once with <i>DataValues</i> and then with <i>Events</i>.”</p>



## 7 OPC UA Specification: Part 13 – Aggregates

Topic	Example Aggregate for Count is wrong.																																						
Errata Version	1.02.4																																						
Spec Reference	Part 13 Appendix A.19																																						
Mantis Reference	0003067																																						
Problem Statement	Count Aggregate: When there is no good data in the interval, value is null instead of zero																																						
Solution	The table for historian 1 has changed from																																						
	<table><tr><th colspan="4">Historian1</th></tr><tr><th>Timestamp</th><th>Value</th><th>StatusCode</th><th>Notes</th></tr><tr><td>12:00:00.000</td><td>1</td><td>Good, Calculated, Partial</td><td></td></tr><tr><td>12:00:16.000</td><td>2</td><td>Good, Calculated</td><td></td></tr><tr><td>12:00:32.000</td><td></td><td>Bad</td><td></td></tr><tr><td>12:00:48.000</td><td>2</td><td>Good, Calculated</td><td></td></tr><tr><td>12:01:04.000</td><td>0</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:20.000</td><td>2</td><td>Good, Calculated, Partial</td><td></td></tr><tr><td>12:01:36.000</td><td></td><td>BadNoData</td><td></td></tr></table>			Historian1				Timestamp	Value	StatusCode	Notes	12:00:00.000	1	Good, Calculated, Partial		12:00:16.000	2	Good, Calculated		12:00:32.000		Bad		12:00:48.000	2	Good, Calculated		12:01:04.000	0	UncertainDataSubNormal, Calculated		12:01:20.000	2	Good, Calculated, Partial		12:01:36.000		BadNoData	
	Historian1																																						
	Timestamp	Value	StatusCode	Notes																																			
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	12:00:16.000	2	Good, Calculated																																				
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	12:01:36.000		BadNoData																																				
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	<table><tr><th colspan="4">Historian1</th></tr><tr><th>Timestamp</th><th>Value</th><th>StatusCode</th><th>Notes</th></tr><tr><td>12:00:00.000</td><td>1</td><td>Good, Calculated, Partial</td><td></td></tr><tr><td>12:00:16.000</td><td>2</td><td>Good, Calculated</td><td></td></tr><tr><td>12:00:32.000</td><td>0</td><td>Bad</td><td></td></tr><tr><td>12:00:48.000</td><td>2</td><td>Good, Calculated</td><td></td></tr><tr><td>12:01:04.000</td><td>0</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:20.000</td><td>2</td><td>Good, Calculated, Partial</td><td></td></tr><tr><td>12:01:36.000</td><td></td><td>BadNoData</td><td></td></tr></table>			Historian1				Timestamp	Value	StatusCode	Notes	12:00:00.000	1	Good, Calculated, Partial		12:00:16.000	2	Good, Calculated		12:00:32.000	0	Bad		12:00:48.000	2	Good, Calculated		12:01:04.000	0	UncertainDataSubNormal, Calculated		12:01:20.000	2	Good, Calculated, Partial		12:01:36.000		BadNoData	
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12:01:20.000	2	Good, Calculated, Partial																																					
12:01:36.000		BadNoData																																					

<b>Topic</b>	Resulting status code isn't clear when there is no data in the interval.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 13 Clause 5.4.3.2.1 StatuCode calculation General
<b>Mantis Reference</b>	0003000
<b>Problem Statement</b>	It is not clear from aggregates what the status code is when there is no data in the interval.
<b>Solution</b>	<p>The following paragraph was added as the fifth paragraph in the clause.</p> <p>"If there is no data in the interval and the interval is inside the range [StartOfData, EndOfData] and the <i>Aggregate</i> return data type is raw data type then the <i>StatusCodes</i> for the interval will be Bad_NoData unless an alternate status code is defined for a specific <i>Aggregate</i>."</p>

Topic	Example Aggregates for Standard Deviation are incorrect.																																																																																				
Errata Version	1.02.4																																																																																				
Spec Reference	Part 13 Appendix A.35 through A.38																																																																																				
Mantis Reference	<a href="#">0002962</a>																																																																																				
Problem Statement	The examples shown in the appendix cannot be reproduced using the calculations defined in the Part 13.																																																																																				
Solution	<p>The examples for Historian 1-3 for A.35 StandardDeviationSample, A.36 VarianceSample, A.37 StandardDeviationPopulation, and A.38 VariancePopulation have all been recalculated and updated.</p> <p>The new examples are as follows:</p> <p><b>A.35 StandardDeviationSample</b></p> <p>A.35.1 Description</p> <p>The following examples demonstrate StandardDeviationSample Aggregate scenarios. <b>ProcessingInterval:</b> 00:00:20, <b>StartTime:</b> 12:00:00, <b>EndTime:</b> 12:01:40.</p> <p>A.35.2 StandardDeviationSample data</p> <table><tr><th colspan="4">Historian1</th></tr><tr><th>Timestamp</th><th>Value</th><th>StatusCode</th><th>Notes</th></tr><tr><td>12:00:00.000</td><td>0</td><td>Good, Calculated, Partial</td><td></td></tr><tr><td>12:00:20.000</td><td>7.071</td><td>Good, Calculated</td><td></td></tr><tr><td>12:00:40.000</td><td>0</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:00.000</td><td>7.071</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:20.000</td><td>7.071</td><td>Good, Calculated, Partial</td><td></td></tr></table> <table><tr><th colspan="4">Historian2</th></tr><tr><th>Timestamp</th><th>Value</th><th>StatusCode</th><th>Notes</th></tr><tr><td>12:00:00.000</td><td>0</td><td>Good, Calculated, Partial</td><td></td></tr><tr><td>12:00:20.000</td><td>5</td><td>Good, Calculated</td><td></td></tr><tr><td>12:00:40.000</td><td>7.071</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:00.000</td><td>0</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:20.000</td><td>10</td><td>Good, Calculated, Partial</td><td></td></tr></table> <table><tr><th colspan="4">Historian3</th></tr><tr><th>Timestamp</th><th>Value</th><th>StatusCode</th><th>Notes</th></tr><tr><td>12:00:00.000</td><td>0</td><td>Good, Calculated, Partial</td><td></td></tr><tr><td>12:00:20.000</td><td>5</td><td>Good, Calculated</td><td></td></tr><tr><td>12:00:40.000</td><td>7.071</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:00.000</td><td>0</td><td>UncertainDataSubNormal, Calculated</td><td></td></tr><tr><td>12:01:20.000</td><td>10</td><td>Good, Calculated, Partial</td><td></td></tr></table>	Historian1				Timestamp	Value	StatusCode	Notes	12:00:00.000	0	Good, Calculated, Partial		12:00:20.000	7.071	Good, Calculated		12:00:40.000	0	UncertainDataSubNormal, Calculated		12:01:00.000	7.071	UncertainDataSubNormal, Calculated		12:01:20.000	7.071	Good, Calculated, Partial		Historian2				Timestamp	Value	StatusCode	Notes	12:00:00.000	0	Good, Calculated, Partial		12:00:20.000	5	Good, Calculated		12:00:40.000	7.071	UncertainDataSubNormal, Calculated		12:01:00.000	0	UncertainDataSubNormal, Calculated		12:01:20.000	10	Good, Calculated, Partial		Historian3				Timestamp	Value	StatusCode	Notes	12:00:00.000	0	Good, Calculated, Partial		12:00:20.000	5	Good, Calculated		12:00:40.000	7.071	UncertainDataSubNormal, Calculated		12:01:00.000	0	UncertainDataSubNormal, Calculated		12:01:20.000	10	Good, Calculated, Partial	
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12:01:00.000	7.071	UncertainDataSubNormal, Calculated																																																																																			
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12:01:20.000	10	Good, Calculated, Partial																																																																																			

**A.36 VarianceSample****A.36.1 Description**

The following examples demonstrate VarianceSample *Aggregate* scenarios. **ProcessingInterval:** 00:00:20, **StartTime:** 12:00:00, **EndTime:** 12:01:40.

**A.36.2 VarianceSample data**

Historian1			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	50	Good, Calculated	
12:00:40.000	0	UncertainDataSubNormal, Calculated	
12:01:00.000	50	UncertainDataSubNormal, Calculated	
12:01:20.000	50	Good, Calculated, Partial	

Historian2			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	25	Good, Calculated	
12:00:40.000	50	UncertainDataSubNormal, Calculated	
12:01:00.000	0	UncertainDataSubNormal, Calculated	
12:01:20.000	100	Good, Calculated, Partial	

Historian3			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	25	Good, Calculated	
12:00:40.000	50	UncertainDataSubNormal, Calculated	
12:01:00.000	0	UncertainDataSubNormal, Calculated	
12:01:20.000	100	Good, Calculated, Partial	

**A.37 StandardDeviationPopulation****A.37.1 Description**

The following examples demonstrate StandardDeviationPopulation *Aggregate* scenarios. **ProcessingInterval:** 00:00:20, **StartTime:** 12:00:00, **EndTime:** 12:01:40.

**A.37.2 StandardDeviationPopulation data**

Historian1			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	5	Good, Calculated	
12:00:40.000	0	UncertainDataSubNormal, Calculated	
12:01:00.000	5	UncertainDataSubNormal, Calculated	
12:01:20.000	5	Good, Calculated, Partial	

Historian2			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	4.082	Good, Calculated	

12:00:40.000	4	UncertainDataSubNormal, Calculated	
12:01:00.000	0	UncertainDataSubNormal, Calculated	
12:01:20.000	8.165	Good, Calculated, Partial	

Historian3			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	4.082	Good, Calculated	
12:00:40.000	5	UncertainDataSubNormal, Calculated	
12:01:00.000	0	UncertainDataSubNormal, Calculated	
12:01:20.000	8.165	Good, Calculated, Partial	

### A.38 VariancePopulation

#### A.38.1 Description

The following examples demonstrate VariancePopulation *Aggregate* scenarios. **ProcessingInterval:** 00:00:20, **StartTime:** 12:00:00, **EndTime:** 12:01:40.

#### A.38.2 VariancePopulation data

Historian1			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	25	Good, Calculated	
12:00:40.000	0	UncertainDataSubNormal, Calculated	
12:01:00.000	25	UncertainDataSubNormal, Calculated	
12:01:20.000	25	Good, Calculated, Partial	

Historian2			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	16.667	Good, Calculated	
12:00:40.000	25	UncertainDataSubNormal, Calculated	
12:01:00.000	0	UncertainDataSubNormal, Calculated	
12:01:20.000	66.667	Good, Calculated, Partial	

Historian3			
Timestamp	Value	StatusCode	Notes
12:00:00.000	0	Good, Calculated, Partial	
12:00:20.000	16.667	Good, Calculated	
12:00:40.000	25	UncertainDataSubNormal, Calculated	
12:01:00.000	0	UncertainDataSubNormal, Calculated	

	12:01:20.000	66.667	Good, Calculated, Partial	
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<b>Topic</b>	Behaviour when PercentDataGood and PercentDataBad parameters do not result in a valid calculation.
<b>Errata Version</b>	1.02.3
<b>Spec Reference</b>	Part 13 Clause 4.2.1.1 AggregateConfigurationType
<b>Mantis Reference</b>	<a href="#">0002502</a> <a href="#">0002503</a>
<b>Problem Statement</b>	The PercentDataGood and PercentDataBad parameters do not describe the behaviour if the values specified are not valid.
<b>Solution</b>	A clarification was added stating: "If the values entered for <i>PercentDataGood</i> and <i>PercentDataBad</i> do not result in a valid calculation (e.g. Bad=80; Good=0) the result will have a StatusCode of Bad_AggregateInvalidInputs."

<b>Topic</b>	Meaning of negative AnnotationCount numbers.				
<b>Errata Version</b>	1.02.3				
<b>Spec Reference</b>	Part 13 Table 31 AnnotationCount Aggregate Summary				
<b>Mantis Reference</b>	<a href="#">0002490</a>				
<b>Problem Statement</b>	The count data type is a signed value (Int32) and can have negative numbers.				
<b>Solution</b>	<p>The table row pertaining to data type was changed from:</p> <table border="1"> <tr> <td>Data Type</td><td>Int32</td></tr> </table> <p>To:</p> <table border="1"> <tr> <td>Data Type</td><td>Int32 (Negative values are not allowed)</td></tr> </table>	Data Type	Int32	Data Type	Int32 (Negative values are not allowed)
Data Type	Int32				
Data Type	Int32 (Negative values are not allowed)				

<b>Topic</b>	Interval contains the wrong StatusCode in Delta example.
<b>Errata Version</b>	1.02.4
<b>Spec Reference</b>	Part 13 Appendix A.27.2 Delta Data, Historian 1
<b>Mantis Reference</b>	<a href="#">0002302</a>
<b>Problem Statement</b>	Delta Aggregate example for Historian1 has UncertainDataSubnormal value instead of BadNoData.
<b>Solution</b>	The third interval for historian 1 has been corrected to show the correct StatusCode of "BadNoData".

## 8 OPC UA Specification: Part 100 – Devices

<b>Topic</b>	Browse names for OptionalPlaceholder components are inconsistent.
<b>Errata Version</b>	1.02.3
<b>Spec Reference</b>	Part 100 – clause 5.2 TopologyElementType, 5.6, DeviceType, 6.2, Network, 6.3, ConnectionPoint.
<b>Mantis Reference</b>	<a href="#">0002708</a>
<b>Problem Statement</b>	<p>In the TopologyElementType the specification uses "GroupName" in Table 4 but "GroupIdentifier" in Figure2.</p> <p>For the ConnectionPoint the specification uses "CPIIdentifier" in one occurrence and "Identifier" in another.</p>
<b>Solution</b>	<p>Make it consistent:</p> <ul style="list-style-type: none"><li>• Changed GroupName to GroupIdentifier in Table 4.</li><li>• Always use "CPIIdentifier".</li><li>• Changed ProfileId to ProfileIdentifier.</li></ul>