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OPC unified architecture – Part 4: Services

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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OPC UNIFIED ARCHITECTURE –

Part 4: Services

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62541-4 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

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

a) Added ability to resend all data of monitored items in a Subscription using the ResendData Method.
b) Added support for durable Subscriptions (lifetime of hours or days).
c) Added Register2 and FindServersOnNetwork Services to support network-wide discovery using capability filters.
d) Removed definition of software certificates. Will be defined in a future edition.
e) Extended and partially revised the redundancy definition. Added sub-range definitions for ServiceLevel and added more terms for redundancy.
f) Added a section on how to use Authorization Services to request user access tokens.
g) Added JSON Web Tokens (JWTs) as a new user token.
h) Added the concept of session-less service invocation.
i) Added a generic structure that allows passing any number of attributes to the AddNodes Service.
j) Added requirement to protect against user identity token attacks.
k) Added new EncryptedSecret format for user identity tokens.

The text of this standard is based on the following documents:

FDIS	Report on voting
65E/716/FDIS	65E/732/RVD

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

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

Throughout this document and the other parts of the IEC 62541 series, certain document conventions are used:

Italics are used to denote a defined term or definition that appears in Clause 3 in one of the parts of the series.

Italics are also used to denote the name of a service input or output parameter or the name of a structure or element of a structure that are usually defined in tables.

The *italicized terms and names* are also, with a few exceptions, written in camel-case (the practice of writing compound words or phrases in which the elements are joined without spaces, with each element's initial letter capitalized within the compound). For example the defined term is *AddressSpace* instead of Address Space. This makes it easier to understand that there is a single definition for *AddressSpace*, not separate definitions for Address and Space.

A list of all parts of the IEC 62541 series, published under the general title *OPC Unified Architecture*, can be found on the IEC website.

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

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

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OPC UNIFIED ARCHITECTURE –

Part 4: Services

1 Scope

This part of IEC 62541 defines the OPC Unified Architecture (OPC UA) *Services*. The *Services* ~~described~~ defined are the collection of abstract Remote Procedure Calls (RPC) that are implemented by OPC UA *Servers* and called by OPC UA *Clients*. All interactions between OPC UA *Clients* and *Servers* occur via these *Services*. The defined *Services* are considered abstract because no particular RPC mechanism for implementation is defined in this document. IEC 62541-6 specifies one or more concrete mappings supported for implementation. For example, one mapping in IEC 62541-6 is to XML Web Services. In that case the *Services* described in this document appear as the Web service methods in the WSDL contract.

Not all OPC UA *Servers* will need to implement all of the defined *Services*. IEC 62541-7 defines the *Profiles* that dictate which Services need to be implemented in order to be compliant with a particular *Profile*.

2 Normative references

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

IEC TR 62541-1, *OPC Unified Architecture – Part 1: Overview and Concepts*

IEC TR 62541-2, *OPC Unified Architecture – Part 2: Security Model*

IEC 62541-3, *OPC Unified Architecture – Part 3: Address Space Model*

IEC 62541-5, *OPC Unified Architecture – Part 5: Information Model*

IEC 62541-6, *OPC Unified Architecture – Part 6: Mappings*

IEC 62541-7, *OPC Unified Architecture – Part 7: Profiles*

IEC 62541-8, *OPC Unified Architecture – Part 8: Data Access*

IEC 62541-11, *OPC Unified Architecture – Part 11: Historical Access*

IEC 62541-12[1], *OPC Unified Architecture – Part 12: Discovery and Global Services*

IEC 62541-13, *OPC Unified Architecture – Part 13: Aggregates*

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[1] Under preparation. Stage at the time of publication: IEC CDV 62541-12:2018.

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OPC unified architecture – Part 4: Services

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OPC UNIFIED ARCHITECTURE –

Part 4: Services

FOREWORD

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International Standard IEC 62541-4 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

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

a) Added ability to resend all data of monitored items in a Subscription using the ResendData Method.
b) Added support for durable Subscriptions (lifetime of hours or days).
c) Added Register2 and FindServersOnNetwork Services to support network-wide discovery using capability filters.
d) Removed definition of software certificates. Will be defined in a future edition.

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e) Extended and partially revised the redundancy definition. Added sub-range definitions for ServiceLevel and added more terms for redundancy.

f) Added a section on how to use Authorization Services to request user access tokens.

g) Added JSON Web Tokens (JWTs) as a new user token.

h) Added the concept of session-less service invocation.

i) Added a generic structure that allows passing any number of attributes to the AddNodes Service.

j) Added requirement to protect against user identity token attacks.

k) Added new EncryptedSecret format for user identity tokens.

The text of this standard is based on the following documents:

FDIS	Report on voting
65E/716/FDIS	65E/732/RVD

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

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

Throughout this document and the other parts of the IEC 62541 series, certain document conventions are used:

Italics are used to denote a defined term or definition that appears in Clause 3 in one of the parts of the series.

Italics are also used to denote the name of a service input or output parameter or the name of a structure or element of a structure that are usually defined in tables.

The *italicized terms and names* are also, with a few exceptions, written in camel-case (the practice of writing compound words or phrases in which the elements are joined without spaces, with each element's initial letter capitalized within the compound). For example the defined term is *AddressSpace* instead of Address Space. This makes it easier to understand that there is a single definition for *AddressSpace*, not separate definitions for Address and Space.

A list of all parts of the IEC 62541 series, published under the general title *OPC Unified Architecture*, can be found on the IEC website.

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

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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OPC UNIFIED ARCHITECTURE –

Part 4: Services

1 Scope

This part of IEC 62541 defines the OPC Unified Architecture (OPC UA) *Services*. The *Services* defined are the collection of abstract Remote Procedure Calls (RPC) that are implemented by OPC UA *Servers* and called by OPC UA *Clients*. All interactions between OPC UA *Clients* and *Servers* occur via these *Services*. The defined *Services* are considered abstract because no particular RPC mechanism for implementation is defined in this document. IEC 62541-6 specifies one or more concrete mappings supported for implementation. For example, one mapping in IEC 62541-6 is to XML Web Services. In that case the *Services* described in this document appear as the Web service methods in the WSDL contract.

Not all OPC UA *Servers* will need to implement all of the defined *Services*. IEC 62541-7 defines the *Profiles* that dictate which Services need to be implemented in order to be compliant with a particular *Profile*.

2 Normative references

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

IEC TR 62541-1, *OPC Unified Architecture – Part 1: Overview and Concepts*

IEC TR 62541-2, *OPC Unified Architecture – Part 2: Security Model*

IEC 62541-3, *OPC Unified Architecture – Part 3: Address Space Model*

IEC 62541-5, *OPC Unified Architecture – Part 5: Information Model*

IEC 62541-6, *OPC Unified Architecture – Part 6: Mappings*

IEC 62541-7, *OPC Unified Architecture – Part 7: Profiles*

IEC 62541-8, *OPC Unified Architecture – Part 8: Data Access*

IEC 62541-11, *OPC Unified Architecture – Part 11: Historical Access*

IEC 62541-12[1], *OPC Unified Architecture – Part 12: Discovery and Global Services*

IEC 62541-13, *OPC Unified Architecture – Part 13: Aggregates*

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[1] Under preparation. Stage at the time of publication: IEC CDV 62541-12:2018.

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ARCHITECTURE UNIFIÉE OPC –

Partie 4: Services

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Cette troisième édition annule et remplace la deuxième édition parue en 2015. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) ajout de la capacité à renvoyer toutes les données des éléments surveillés dans un abonnement à l'aide de la méthode ResendData;
b) ajout de la prise en charge pour les abonnements durables (durée de vie en heures ou en jours);

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c) ajout des services Register2 et FindServersOnNetwork pour prendre en charge le mécanisme de découverte sur l'ensemble du réseau à l'aide de filtres de capacités;

d) suppression de la définition des certificats de logiciel (seront définis dans une édition ultérieure);

e) enrichissement et révision partielle de la définition de la redondance; ajout de définitions des sous-plages pour ServiceLevel et ajout de termes supplémentaires pour la redondance;

f) ajout d'un paragraphe expliquant comment utiliser les Services d'autorisation pour demander des jetons d'accès utilisateur;

g) ajout des jetons JSON Web (JWT) comme nouveau jeton d'utilisateur;

h) ajout du concept d'invocation de service sans session;

i) ajout d'une structure générique permettant de transmettre n'importe quel nombre d'attributs dans le service AddNotes;

j) ajout d'une exigence relative à la protection contre les attaques de jeton d'identité utilisateur;

k) ajout du nouveau format EncryptedSecret pour les jetons d'identité utilisateur.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
65E/716/FDIS	65E/732/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

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Dans l'ensemble du présent document et dans les autres parties de la série IEC 62541, certaines conventions de document sont utilisées:

Le format *italique* est utilisé pour mettre en évidence un terme défini ou une définition qui apparaît à l'Article 3 dans l'une des parties de la série.

Le format *italique* est également utilisé, à quelques exceptions près, pour mettre en évidence le nom d'un paramètre d'entrée ou de sortie de service, ou le nom d'une structure ou d'un élément de structure habituellement défini dans les tableaux.

Par ailleurs, les *termes* et les *noms en italique* sont souvent écrits en camel-case (pratique qui consiste à joindre, sans espace, les éléments des mots ou expressions composés, la première lettre de chaque élément étant en majuscule). Par exemple, le terme défini est *AddressSpace* et non Espace d'adressage. Cela permet de mieux comprendre qu'il existe une définition unique pour *AddressSpace*, et non deux définitions distinctes pour Espace et pour Adressage.

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ARCHITECTURE UNIFIÉE OPC –

Partie 4: Services

1 Domaine d'application

La présente partie de l'IEC 62541 définit le modèle de communication *Services* de l'architecture unifiée OPC (OPC UA). Les *Services* définis sont le recueil d'appels de procédures abstraites distantes (RPC, *Remote Procedure Call*) qui sont mises en œuvre par les *Serveurs* OPC UA et qui sont appelées par les *Clients* OPC UA. Toutes les interactions entre *Clients* et *Serveurs* OPC UA ont lieu via ces *Services*. Les *Services* définis sont dits abstraits, car aucun mécanisme RPC particulier n'est spécifié dans le présent document pour leur mise en œuvre. L'IEC 62541-6 spécifie un ou plusieurs mécanismes concrets de mapping pour la mise en œuvre. Par exemple, dans l'IEC 62541-6, l'un des mécanismes de mapping repose sur l'utilisation des Services Web XML. Dans ce cas, les *Services* décrits dans le présent document apparaissent comme les méthodes de services Web dans le contrat WSDL.

Il n'est pas nécessaire que l'ensemble des *Serveurs* OPC UA mettent en œuvre toutes les correspondances avec les messages et les protocoles de transport. L'IEC 62541-7 définit les *Profils* qui dictent les Services qu'il est nécessaire de mettre en œuvre afin d'être conforme à un *Profil* particulier.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC TR 62541-1*, OPC Unified Architecture – Part 1: Overview and Concepts* (disponible en anglais seulement)

IEC TR 62541-2, *OPC Unified Architecture – Part 2: Security Model* (disponible en anglais seulement)

IEC 62541-3, *Architecture unifiée OPC – Partie 3: Modèle d'espace d'adressage*

IEC 62541-5, *Architecture unifiée OPC – Partie 5: Modèle d'information*

IEC 62541-6, *Architecture unifiée OPC – Partie 6: Mappings*

IEC 62541-7, *Architecture unifiée OPC – Partie 7: Profils*

IEC 62541-8, *Architecture unifiée OPC – Partie 8: Accès aux données*

IEC 62541-11, *Architecture unifiée OPC – Partie 11: Accès à l'historique*

IEC 62541-12[1], *Architecture unifiée OPC – Partie 12: Services globaux et de découverte*

IEC 62541-13, *Architecture unifiée OPC – Partie 13: Agrégats*

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