INTERNATIONAL STANDARD

ISO/IEC/ IEEE 18882

First edition
2017-02

Information technology — Telecommunications and information exchange between systems — Ubiquitous green community control network: Heterogeneous networks convergence and scalability

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Protocole de contrôle de la communauté verte omniprésente: convergence et extensibilité de réseaux hétérogènes

Reference number
ISO/IEC/IEEE 18882:2017(E)

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IEEE Standard for Ubiquitous Green Community Control Network: Heterogeneous Networks Convergence and Scalability

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Approved 27 March 2014

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Abstract: This standard describes heterogeneous networks convergence and scalability, specifies the requirements of network convergence, extends the system architecture defined in IEEE Std 1888™, IEEE Standard for Ubiquitous Green Community Control Network Protocol, with two new IEEE 1888™ Components, i.e., the reconfigurable resolution server (RRS) and the intelligent application resolver (IAR), and generalizes primitive data type expressions and explicit field-bus data type management in IEEE 1888 systems. This standard enables IEEE 1888 systems to interoperate with heterogeneous access networks efficiently and improves the efficiency, flexibility, scalability and manageability of IEEE 1888 systems.

Keywords: field-bus data type, heterogeneous network convergence, IEEE 1888.2™, intelligent application resolver, reconfigurable resolution server, scalability, primitive data type

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PDF: ISBN 978-0-7381-9026-6 STD98593
Print: ISBN 978-0-7381-9027-3 STDPD98593

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The P1888.2 Working Group gratefully acknowledges the contributions of the following participants. Without their assistance and dedication, this standard would not have been completed.

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Introduction

This introduction is not part of IEEE Std 1888.2™-2014, IEEE Standard for Ubiquitous Green Community Control Network: Heterogeneous Networks Convergence and Scalability.

IEEE 1888™ has enabled access interoperability with many standard and proprietary protocols for field-bus systems including BACnet™[a], LonWorks®[b], Modbus-based systems, ZigBee®[c] devices, etc. However, IEEE 1888 lacks translation schemes among different application data types, generalized primitive data type expressions, and ID mapping configuration between field-bus and IEEE 1888 systems. That is, there are no efficient and scalable solutions for heterogeneous network convergence in IEEE 1888 systems.

This standard aims to provide the standard criteria for network convergence and scalability that enhances the heterogeneous networks interconnection and improves the efficiency, flexibility, scalability and manageability of IEEE 1888.

This standard extends the system architecture defined in IEEE Std 1888™ [d], IEEE Standard for Ubiquitous Green Community Control Network, with two new Components, i.e., the reconfigurable resolution server (RRS) and the intelligent application resolver (IAR). With the RRS, IEEE 1888 systems can support remote and dynamic distribution of ID mapping configuration and translation rules. The IAR can perform automatic translation among different application data types. In addition, this standard generalizes primitive data type expressions, explicit field-bus data type management, and ID mapping configuration between field-buses and IEEE 1888 systems for heterogeneous networks convergence.

This document is organized as follows:

— Clause 4 identifies the background and the requirements that this standard enables.

— Clause 5 defines the IEEE 1888 system architecture with the RRS and the IAR.

— Clause 6 generalizes the primitive data type expression.

— Clause 7 defines the management rule for importing field-bus data type.

— Clause 8 describes the security consideration.

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1. Overview

1.1 Scope

Based on the protocol defined in IEEE Std 1888™[1], IEEE Standard for Ubiquitous Green Community Control Network Protocol, this standard extends component and data type definitions, message formats, and communication procedures for heterogeneous network convergence and scalability. This standard also describes heterogeneous networks interconnection issues and requirements. Also, this standard specifies system architecture and solutions to improve heterogeneous networks convergence and scalability while offering system robustness and supplying better performance in system operation and management.

1.2 Purpose

This standard describes the standard criteria for network convergence and scalability that enhances the Ubiquitous Green Community Control Network (UGCCNet) heterogeneous networks interconnection. This standard provides enhanced efficiency, flexibility, and scalability to construct a secure, manageable, and compatible system.

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IEEE Std 1888™, IEEE Standard for Ubiquitous Green Community Control Network Protocol.[2, 3]

IEEE Std 1888.3™, IEEE Standard for Ubiquitous Green Community Control Network Protocol: Security.

XML Schema Part 2: Datatypes Second Edition, P.V. Biron and A. Malhotra, eds., October 2008.[4]

3. Definitions, abbreviations, and acronyms

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause. [5]

application data type: A data type strongly associated to a specific application or a specific field-bus.

application data type domain: A set of application data types defined by a specific organization.

application domain: An alternative expression of application data type domain.

field-bus: An access network for sensors and actuators used in the field-levels. The term itself includes physical links, network-layer protocols, and application protocols on the physical links.

field-bus data type: An application data type associated to a specific field-bus.

ID mapping configuration: A content object that defines the binding between IEEE 1888™ Point IDs and field-bus level identifiers (e.g., identifiers for sensors and actuators on a field-bus).

translation rule: A content object that defines value projections from a set of application data types to another set of application data types between different application domains.

3.2 Abbreviations and acronyms

APP	application
CSV	comma-separated values
CUI	character-user interface

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DNS	domain name system
GUI	graphical-user interface
GW	gateway
HVAC	heating, ventilating, air-conditioning
IAR	intelligent application resolver
NAT	network address translation
PLC	programmable logic controller
RRS	reconfigurable resolution server
UGCCNet	Ubiquitous Green Community Control Network
URI	uniform resource identifier
XML	eXtensible markup language

4. Background and requirements

4.1 Background issues

4.1.1 Ungeneralized ID mapping configuration between field-bus and IEEE 1888 systems at Gateway (GW)

Gateway (GW) products can have different configuration interfaces by vendors. They might provide a graphical-user interface (GUI) or a character-user interface (CUI) for a configuration interface. The format of configuration might be comma-separated values (CSV), eXtensible markup language (XML), or any other format. Currently, there are no common interfaces and no data format for configuring ID mapping between field-buses and IEEE 1888 systems, thus ID mapping cannot be managed generally and configured remotely.

4.1.2 Various application data types co-exist in IEEE 1888

IEEE 1888 has enabled access interoperability with many standard and proprietary protocols for field-bus systems including building automation and control networks (such as BACnet™[6] [B1][7]), local operating networks (such as LonWorks®[8] [B3]), Modbus-based systems [B4], ZigBee®[9] devices [B6], ECHONET™[10] [B2], programmable logic controllers (PLCs), or other comparable networks. However, the

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