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Building automation and control systems (BACS) —

Part 5: Data communication protocol

Systèmes d'automatisation et de gestion technique du bâtiment —
Partie 5: Protocole de communication de données

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This sixth edition cancels and replaces the fifth edition (ISO 16484-5:2014), which has been technically revised. See the detailed list of changes on pages 1 312 to 1 327.

A list of all the parts in the ISO 16484 series, can be found on the ISO website.

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Introduction

BACnet, the ASHRAE building automation and control networking protocol, has been designed specifically to meet the communication needs of building automation and control systems for applications such as heating, ventilating, and air-conditioning control, lighting control, access control, and fire detection systems. The BACnet protocol provides mechanisms by which computerized equipment of arbitrary function may exchange information, regardless of the particular building service it performs. As a result, the BACnet protocol may be used by head-end computers, general-purpose direct digital controllers, and application specific or unitary controllers with equal effect.

The motivation for this Standard was the widespread desire of building owners and operators for "interoperability," the ability to integrate equipment from different vendors into a coherent automation and control system - and to do so competitively. To accomplish this, the Standard Project Committee (SPC) solicited and received input from dozens of interested firms and individuals; reviewed all relevant national and international data communications standards, whether de facto or the result of committee activity; and spent countless hours in debate and discussion of the pros and cons of each element of the protocol.

What has emerged from the committee deliberations is a network protocol model with these principal characteristics:

(a) All network devices (except MS/TP slaves) are peers, but certain peers may have greater privileges and responsibilities than others.

(b) Each network device is modeled as a collection of network-accessible, named entities called "objects." Each object is characterized by a set of attributes or "properties." While this Standard prescribes the most widely applicable object types and their properties, implementors are free to create additional object types if desired. Because the object model can be easily extended, it provides a way for BACnet to evolve in a backward compatible manner as the technology and building needs change.

(c) Communication is accomplished by reading and writing the properties of particular objects and by the mutually acceptable execution of other protocol "services." While this Standard prescribes a comprehensive set of services, mechanisms are also provided for implementors to create additional services if desired.

(d) Because of this Standard's adherence to the ISO concept of a "layered" communication architecture, the same messages may be exchanged using various network access methods and physical media. This means that BACnet networks may be configured to meet a range of speed and throughput requirements with commensurately varying cost. Multiple BACnet networks can be interconnected within the same system forming an internetwork of arbitrarily large size. This flexibility also provides a way for BACnet to embrace new networking technologies as they are developed.

BACnet was designed to gracefully improve and evolve as both computer technology and demands of building automation systems change. Upon its original publication in 1995, a Standing Standards Project Committee was formed to deliberate enhancements to the protocol under ASHRAE rules for "continuous maintenance." Much has happened since the BACnet standard was first promulgated. BACnet has been translated into Chinese, Japanese, and Korean, and embraced across the globe. BACnet devices have been designed, built and deployed on all seven continents. Suggestions for enhancements and improvements have been continually received, deliberated, and, ultimately, subjected to the same consensus process that produced the original standard. This publication is the result of those deliberations and brings together all of the corrections, refinements, and improvements that have been adopted.

Among the features that have been added to BACnet are: increased capabilities to interconnect systems across wide area networks using Internet Protocols, new objects and services to support fire detection, other life safety applications, lighting, physical access control, and elevator monitoring, capabilities to backup and restore devices, standard ways to collect trend data, new tools to make specifying BACnet systems easier, a mechanism for making interoperable extensions to the standard visible, and many others. The successful addition of these features demonstrates that the concept of a protocol deliberately crafted to permit extension of its capabilities over time as technology and needs change is viable and sound.

All communication protocols are, in the end, a collection of arbitrary solutions to the problems of information exchange and all are subject to change as time and technology advance. BACnet is no exception. Still, it is the hope of those who have contributed their time, energies, and talents to this work that BACnet will help to fulfill, in the area of building automation and control, the promise of the information age for the public good!

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1 PURPOSE

The purpose of this standard is to define data communication services and protocols for computer equipment used for monitoring and control of HVAC&R and other building systems and to define, in addition, an abstract, object-oriented representation of information communicated between such equipment, thereby facilitating the application and use of digital control technology in buildings.

2 SCOPE

2.1 This protocol provides a comprehensive set of messages for conveying encoded binary, analog, and alphanumeric data between devices including, but not limited to:

(a) hardware binary input and output values,
(b) hardware analog input and output values,
(c) software binary and analog values,
(d) text string values,
(e) schedule information,
(f) alarm and event information,
(g) files, and
(h) control logic.

2.2 This protocol models each building automation and control computer as a collection of data structures called "objects," the properties of which represent various aspects of the hardware, software, and operation of the device. These objects provide a means of identifying and accessing information without requiring knowledge of the details of the device's internal design or configuration.

3 DEFINITIONS

3.1 Terms Adopted from International Standards

The following terms used in this standard are defined by international standards or draft standards for open system interconnection (OSI). The definitions are repeated here and a reference to the appropriate standard is provided. Clause 25 contains the titles of all national and international standards referenced in this clause and elsewhere in this standard. Words or phrases in italics refer to terms defined elsewhere in this clause.

abstract syntax: the specification of application layer data or application-protocol-control-information by using notation rules which are independent of the encoding technique used to represent them (ISO 8822).

application: a set of a USER's information processing requirements (ISO 8649).

application-entity: the aspects of an application-process pertinent to OSI (ISO 7498).

application-process: an element within a real open system which performs the information processing for a particular application (ISO 7498).

application-protocol-control-information: information exchanged between application-entities, using presentation services, to coordinate their joint operation (ISO 9545).

application-protocol-data-unit: a unit of data specified in an application protocol and consisting of application-protocol-control-information and possibly application-user-data (ISO 9545).

application-service-element: that part of an application-entity which provides an OSI environment capability, using underlying services when appropriate (ISO 7498).

concrete syntax: those aspects of the rules used in the formal specification of data which embody a specific representation of that data (ISO 7498).

confirm (primitive): a representation of an interaction in which a service-provider indicates, at a particular service-access-point, completion of some procedure previously invoked, at that service-access-point, by an interaction represented by a request primitive (ISO TR 8509).

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indication (primitive): a representation of an interaction in which a service-provider either
(a) indicates that it has, on its own initiative, invoked some procedure; or
(b) indicates that a procedure has been invoked by the service-user at the peer service-access-point (ISO TR 8509).

peer-entities: entities within the same layer (ISO 7498).

real open system: a real system which complies with the requirements of OSI standards in its communication with other real systems (ISO 7498).

real system: a set of one or more computers, the associated software, peripherals, terminals, human operators, physical processes, information transfer means, etc., that forms an autonomous whole capable of performing information processing and/or information transfer (ISO 7498).

request (primitive): a representation of an interaction in which a service-user invokes some procedure (ISO TR 8509).

response (primitive): a representation of an interaction in which a service-user indicates that it has completed some procedure previously invoked by an interaction represented by an indication primitive (ISO TR 8509).

(N)-service-access-point: the point at which (N)-services are provided by an (N)-entity to an (N+1)-entity (ISO 7498).

(N)-service-data-unit: an amount of (N)-interface-data whose identity is preserved from one end of an (N)-connection to the other (ISO 7498).

service-user: an entity in a single open system that makes use of a service through service-access-points (ISO TR 8509).

service-primitive; **primitive**: an abstract, implementation-independent representation of an interaction between the service-user and the service-provider (ISO TR 8509).

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service-provider: an abstract of the totality of those entities which provide a service to peer service-users (ISO TR 8509).

transfer-syntax: that concrete syntax used in the transfer of data between open systems (ISO 7498).

user element: the representation of that part of an application-process which uses those application-service-elements needed to accomplish the communications objectives of that application-process (ISO 7498).

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3.2 Terms Defined for this Standard

access control: a method for regulating or restricting access to network resources.

access rights (physical access control): the access privileges granted to a credential.

access user (physical access control): the person or asset holding one or more credentials.

alarm: 1. An annunciation, either audible or visual or both, that alerts an operator to an off-normal condition that may require corrective action. **2.** An abnormal condition detected by a device or controller that implements a rule or logic specifically designed to look for that condition.

alarm-acknowledgment: the process of indicating that a human operator has seen and responded to an event notification.

algorithmic change reporting: the detection and reporting of an alarm or event, based on an algorithm specified in an Event Enrollment object. See intrinsic reporting.

authentication: the act of verifying identity

authentication factor: a data element of the credential which is used to verify a credential's identity.

authorization (network security): the control of access to network resources based on known identity and access rules.

authorization (physical access control): the process of determining whether the access user is permitted to enter a protected zone through an access controlled point.

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