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IEEE Standard for Distributed Interactive Simulation (DIS)—Communication Services and Profiles

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SISO Standards Activity Committee

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USA

IEEE Std 1278.2™-2015
(Revision of
IEEE Std 1278.2-1995)

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Abstract: Communication services to support information exchange between simulation applications participating in the distributed interactive simulation (DIS) environment are defined. These communication services describe a connectionless information transfer that supports real-time, as well as non-real-time, exchange. Several communication profiles specifying communication services are provided.

Keywords: communication service, DIS, distributed interactive simulation, IEEE 1278.2™, multicast, protocol data units (PDUs), simulation network

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Introduction

This introduction is not part of IEEE Std 1278.2™-2015, IEEE Standard for Distributed Interactive Simulation (DIS)—Communication Services and Profiles.

Distributed interactive simulation (DIS) is a government/industry initiative to define an infrastructure for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. This infrastructure brings together systems built for separate purposes, technologies from different eras, products from various vendors, and platforms from various services and permits them to interoperate. DIS exercises are intended to support a mixture of virtual entities with computer-controlled behavior (computer-generated forces), virtual entities with live operators (human-in-the-loop simulators), live entities (operational platforms and test-and-evaluation systems), and constructive entities (war games and other automated simulations). DIS draws heavily on experience derived from the simulation networking (SIMNET) program developed by the Advanced Research Projects Agency (ARPA), adopting many of SIMNET's basic concepts and heeding lessons learned.

In order for DIS to take advantage of currently installed and future simulations developed by different organizations, a means had to be found for assuring interoperability between dissimilar simulations. These means were developed in the form of industry consensus standards. The open forum (including government, industry, and academia) chosen for developing these standards was a series of semi-annual Workshops on Standards for the Interoperability of Distributed Simulations that began in 1989. The workshops resulted in several IEEE standards and recommended practices.

The relationship between the component documents constituting the set of IEEE DIS documents is shown in Figure 1. Used together, these standards and recommended practices will help produce an interoperable simulated environment.

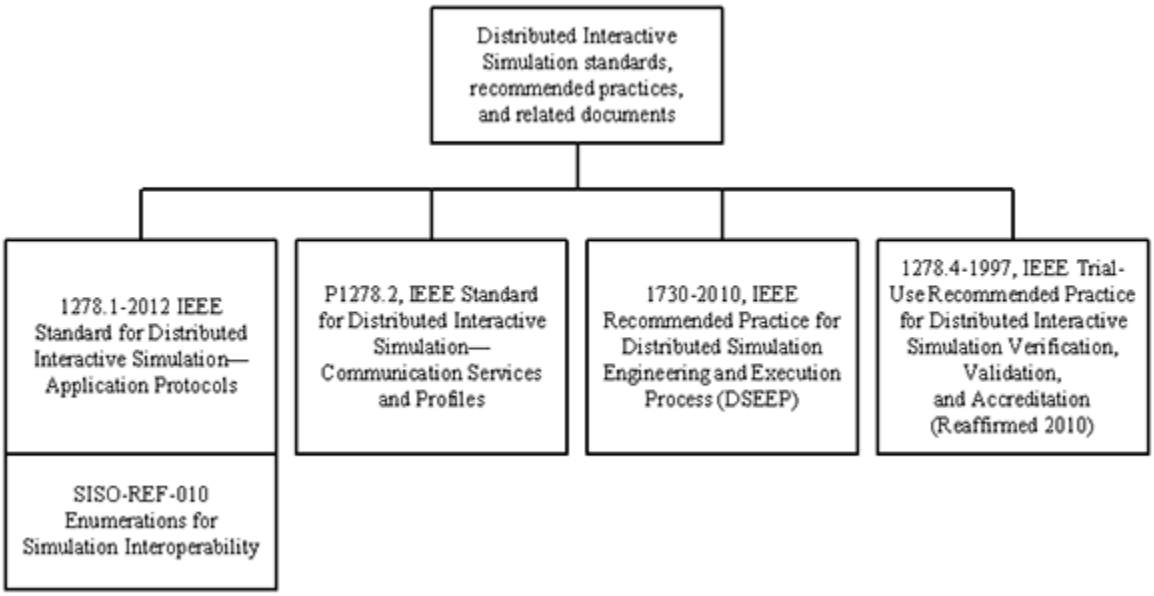

Figure 1—IEEE DIS documents

The interoperability components addressed by these standards and recommended practices are:

— Application protocols

— Communication services and profiles

— Distributed simulation engineering and execution

— Verification, validation, and accreditation

IEEE Std 1278.1™-2012 defines the format and semantics of data messages, also known as protocol data units (PDUs), that are exchanged among simulation applications and simulation management. The PDUs provide information concerning simulated entity states, types of entity interactions that take place in a DIS exercise, data for management and control of a DIS exercise, simulated environment states, aggregation of entities, and the transfer of ownership of entities. IEEE Std 1278.1-2012 also specifies the communication services to be used with each of the PDUs.

An additional non-IEEE document is required for use with IEEE Std 1278.1-2012. This document is entitled "Enumerations for Simulation Interoperability" and is available from the Simulation Interoperability Standards Organization, Orlando Florida.

This standard, IEEE Std 1278.2-2015, defines the communication services required to support the message exchange described in IEEE Std 1278.1-2012. In addition, IEEE Std 1278.2-2015 provides several communication profiles that meet the specified communications requirements.

IEEE Std 1730™-2010 is recommended practice defining the processes and procedures that should be followed by users of distributed simulations to develop and execute their simulations. It is intended as a higher-level framework into which low-level management and systems engineering practices native to user organizations can be integrated and tailored for specific uses. This recommended practice is intended to replace IEEE Std 1278.3™-1996. This recommended practice is used in conjunction with IEEE Std 1278.1-2012 and IEEE Std 1278.2-2015.

IEEE Std 1278.4™-1997, IEEE Trial-Use Recommended Practice for Distributed Interactive Simulation Verification, Validation, and Accreditation, provides guidelines for verifying, validating, and accrediting a DIS exercise. This recommended practice, used in conjunction with IEEE Std 1730-2010, presents data flow and connectivity for all proposed verification and validation activities and provides rationale and justification for each step.

The principal changes between IEEE Std 1278.2-1995 and the present standard are as follows:

a) Incorporation of rules on PDU bundling

b) Addition of section on the use of Multicast for Interest Management

c) Definition of Internet Protocol Version 4 (IPv4) multicast service profile

d) Definition of Internet Protocol Version 6 (IPv6) multicast service profile

e) Addition of rules on maximum transmission unit (MTU)

f) Reorganization of the document to aid readability and create a more logical place for new content such as IPv6 and interest management

g) Addition of annex providing guidance for using IP multicast addressing

Contents

IEEE Standard for Distributed Interactive Simulation (DIS)—Communication Services and Profiles

1. Overview

1.1 General

This standard specifies the communication service requirements and applicable profiles required for use with distributed interactive simulation (DIS) communication systems. This standard is divided into six clauses and associated informative annexes. Clause 1 provides the scope and purpose of the standard and key assumptions concerning the DIS applications using the standard. Clause 2 lists references to other standards that are required for use with this standard. Clause 3 provides a list of definitions of terms and acronyms that are used in this standard. It is imperative for the user of this standard to thoroughly review these definitions before proceeding on to other clauses. Clause 4 contains requirements concerning the communication services at the network and transport layers that are necessary to support DIS communications. Clause 5 contains requirements to support DIS communication in the application layer. Clause 6 details the profiles recommended for use by DIS systems. These profiles support the required communication services described in Clause 4 and Clause 5. Annex A provides guidance for using IP multicast addressing. A bibliography is provided in Annex B.

The communication services definition for DIS employs a layered model that supports both the four-layer Internet model defined in RFC 1122[1] and the seven-layer Open Systems Interconnection Reference Model (OSIRM) defined in ISO/IEC 7498-1:1994. The communication functions of the network are divided into a hierarchical set of layers. Each layer performs an integral subset of special functions required to communicate with another layer of similar type.

[1]Information on references can be found in Clause 2