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IEEE Standard Design Criteria of Complex Virtual Instruments for Ocean Observation

IEEE Instrumentation and Measurement Society

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Sensor Technology Committee

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USA

IEEE Std 2402™-2017

IEEE Standard Design Criteria of Complex Virtual Instruments for Ocean Observation

Sponsor

Sensor Technology Committee
of the
IEEE Instrumentation and Measurement Society

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Abstract: The framework of building a distributed ocean observing software system based on complex virtual instruments (CVIs), which are used for processing and displaying the collected data from ocean instruments and the related metadata, is defined in this standard. This framework provides the guidelines for the CVI-based development process, in which CVI structure design covers management of observed data and metadata, virtual instrument engine based on geospatial information, and service interfaces for CVI interactions. CVI mapping schemes describe the correspondence from observed objects to CVIs. CVI relations define the relationships between CVIs and describe the methods of extending and compositing multiple CVIs.

Keywords: CVI (complex virtual instrument), IEEE 2402™, ocean observation, software development

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Introduction

This introduction is not part of IEEE Std 2402™-2017, IEEE Standard Design Criteria of Complex Virtual Instruments for Ocean Observations.

An ocean observing system (OOS) plays an important role in improving the knowledge of oceans. An OOS involves software and hardware. The hardware part consists of various observing instruments; the software part consists of a series of applications that are responsible for data collection, data management, and data visualization. Traditional developments are time-consuming due to code programming and testing while components usually need to be modified and assembled, which results in low development efficiency.

Traditional virtual instruments display the observed data without considering the related metadata, such as the descriptive information of observed objects. A complex virtual instrument (CVI) is a software element having the following functions:

— It realizes unified management of observed objects and observed data.

— It connects with different acquisition applications and process measurements from one or multiple types of instruments.

— It provides data access interfaces which are designed based on observed objects.

— It can be extended and combined into a larger-scale CVI as a reusable software unit.

This standard describes functions of the data management module, lists the requisite functions in a CVI engine, and provides CVI interface design criteria for ocean observing. Following this standard, CVIs are homogeneous and different types of CVIs can be composited into a larger system without code programming. This standard also describes the mapping schemes, which enables easy mapping between CVIs and physical instruments. CVIs can be reused in different systems through adjusting the mapping schemes, contributing to higher-level software re-use. This standard plays an important role in improving development efficiency and standardizing development procedures for OOS software.

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1. Overview

1.1 Scope

This standard defines the framework of building distributed ocean observing software systems based on complex virtual instruments (CVIs), which are used for processing and displaying the collected data from ocean instruments and the related metadata (Guo, et al. [B1]). This framework provides the guidelines for a CVI-based development process, in which CVI structure design covers management of observed data and metadata, virtual instrument engine based on geospatial information, and service interfaces for CVI interactions. CVI mapping schemes describe the correspondence from observed objects to CVIs. CVI relations define the relationships between CVIs, and describe the methods of extending and compositing multiple CVIs.

1.2 Purpose

The purpose of this standard is to advise and assist developers in adopting a CVI-based development method in building ocean observing software systems. Implementation of this standard simplifies the software development process greatly, which is turned into compositing CVIs that are customized according to specific requirements by means of CVI interfaces. Implementation of this standard also forms a set of reusable CVIs that can be shared among ocean communities. The development efficiency is improved because customization tools are provided to avoid code programming.

2. Definitions, acronyms, and abbreviations

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* shall be consulted for terms not defined in this clause.[1]

2.1 Definitions

acquisition main program: An independent program module that communicates with the acquisition module by standard function. It also needs to communicate with the application layer by TCP/IP protocol.

[1] *IEEE Standards Dictionary Online* subscription is available at: http://dictionary.ieee.org.