INTERNATIONAL STANDARD

ISO/IEC 16500-9

First edition
1999-12-15

Information technology — Generic digital audio-visual systems —

Part 9:
Usage information protocols

Technologies de l'information — Systèmes audiovisuels numériques génériques —

Partie 9: Protocoles d'informations d'usage

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 16500 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 16500-9 was prepared by DAVIC (Digital Audio-Visual Council) and was adopted, under the PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

ISO/IEC 16500 consists of the following parts, under the general title *Information technology — Generic digital audio-visual systems*:

— *Part 1: System reference models and scenarios*

— *Part 2: System dynamics, scenarios and protocol requirements*

— *Part 3: Contours: Technology domain*

— *Part 4: Lower-layer protocols and physical interfaces*

— *Part 5: High and mid-layer protocols*

— *Part 6: Information representation*

— *Part 7: Basic security tools*

— *Part 8: Management architecture and protocols*

— *Part 9: Usage information protocols*

Introduction

ISO/IEC 16500 defines the minimum tools and dynamic behavior required by digital audio-visual systems for end-to-end interoperability across countries, applications and services. To achieve this interoperability, it defines the technologies and information flows to be used within and between the major components of generic digital audio-visual systems. Interoperability between these components and between individual sub-systems is assured through specification of tools and specification of dynamic systems behavior at defined reference points. A reference point can comprise one or more logical (non-physical) information-transfer interfaces, and one or more physical signal-transfer interfaces. A logical interface is defined by a set of information flows and associated protocol stacks. A physical interface is an external interface and is fully defined by its physical and electrical characteristics. Accessible reference points are used to determine and demonstrate compliance of a digital audio-visual subsystem with this international standard.

A summary of each part follows.

ISO/IEC 16500-1 (DAVIC 1.3.1a Part 2) defines the normative digital audio-visual systems technical framework. It provides a vocabulary and a Systems Reference Model, which identifies specific functional blocks and information flows, interfaces and reference points.

ISO/IEC 16500-2 (DAVIC 1.3.1a Part 12) defines system dynamic behavior and physical scenarios. It details the locations of the control functional entities along with the normative protocols needed to support the systems behavior. It is structured as a set of protocol walk-throughs, or *"Application Notes",* that rehearse both the steady state and dynamic operation of the system at relevant reference points using specified protocols. Detailed dynamics are given for the following scenarios: video on demand, switched video broadcast, interactive broadcast, and internet access.

ISO/IEC 16500-3 (DAVIC 1.3.1a Part 14) provides the normative definition of DAVIC Technology Contours. These are strict sets of Applications, Functionalities and Technologies which allow compliance and conformance criteria to be easily specified and assessed. This part of ISO/IEC 16500 contains the full details of two contours. These are the Enhanced Digital Broadcast (EDB) and Interactive Digital Broadcast (IDB). ISO/IEC 16500-3 specifies required technologies and is a mandatory compliance document for contour implementations.

ISO/IEC 16500-4 (DAVIC 1.3.1a Part 8) defines the toolbox of technologies used for lower layer protocols and physical interfaces. The tools specified are those required to digitize signals and information in the Core Network and in the Access Network. Each tool is applicable at one or more of the reference points specified within the Delivery System. In addition a detailed specification is provided of the physical interfaces between the Network Interface Unit and the Set Top Unit and of the physical interfaces used to connect Set Top Boxes to various peripheral devices (digital video recorder, PC, printer). The physical Delivery System mechanisms included are copper pairs, coaxial cable, fiber, HFC, MMDS, LMDS, satellite and terrestrial broadcasting.

ISO/IEC 16500-5 (DAVIC 1.3.1a Part 7) defines the technologies used for high and mid-layer protocols for ISO/IEC 16500 digital audio-visual systems. In particular, this part defines the specific protocol stacks and requirements on protocols at specific interfaces for the content, control and management information flows.

ISO/IEC 16500-6 (DAVIC 1.3.1a Part 9) defines what the user will eventually see and hear and with what quality. It specifies the way in which monomedia and multimedia information types are coded and exchanged. This includes the definition of a virtual machine and a set of APIs to support interoperable exchange of program code. Interoperability of applications is achieved, without specifying the internal design of a set top unit, by a normative Reference Decoder Model which defines specific memory and behavior constraints for content decoding. Separate profiles are defined for different sets of multimedia components.

ISO/IEC 16500-7 (DAVIC 1.3.1a Part 10) defines the interfaces and the security tools required for an ISO/IEC 16500 system implementing security profiles. These tools include security protocols which operate across one or both of the defined conditional access interfaces CA0 and CA1. The interface CA0 is to all security and conditional access functions, including the high speed descrambling functions. The interface CA1 is to a tamper resistant device used for low speed cryptographic processing. This cryptographic processing function is implemented in a smart card.

ISO/IEC 16500-8 (DAVIC 1.3.1a Part 6) specifies the information model used for managing ISO/IEC 16500 systems. In particular, this part defines the managed object classes and their associated characteristics for managing the access network and service-related data in the Delivery System. Where these definitions are taken from existing standards, full reference to the required standards is provided. Otherwise a full

description is integrated in the text of this part. Usage-related information model is defined in ISO/IEC 16500-9.

ISO/IEC 16500-9 (DAVIC 1.3.1a Part 11) specifies the interface requirements and defines the formats for the collection of usage data used for billing, and other business-related operations such as customer profile maintenance. It also specifies the protocols for the transfer of Usage Information into and out of the ISO/IEC 16500 digital audio-visual system. In summary, flows of audio, video and audio-visual works are monitored at defined usage data collection elements (e.g. servers, elements of the Delivery System, set-top boxes). Information concerning these flows is then collected, processed and passed to external systems such as billing or a rights administration society via a standardised usage data transfer interface.

Additional Information

ISO/IEC TR 16501 is an accompanying Technical Report. Further architectural and conformance information is provided in other non-normative parts of DAVIC 1.3.1a (1999). A summary of these documents is included here for information.

ISO/IEC TR 16501 (DAVIC 1.3.1a Part 1) provides a detailed listing of the functionalities required by users and providers of digital audio-visual applications and systems. It introduces the concept of a contour and defines the IDB (Interactive Digital Broadcast) and EDB (Enhanced Digital Broadcast) functionality requirements which are used to define the normative contour technology toolsets provided in ISO/IEC 16500-3.

DAVIC 1.3.1a Parts 3, 4 and 5 are DAVIC technical reports. They provide additional architectural and other information for the server, the delivery-system, and the Service Consumer systems respectively. Part 3 defines how to load an application, once created, onto a server and gives information and guidance on the protocols transmitted from the set-top user to the server, and those used to control the set-up and execution of a selected application. Part 4 provides an overview of Delivery Systems and describes instances of specific DAVIC networked service architectures. These include physical and wireless networks. Non-networked delivery (e.g. local storage physical media like discs, tapes and CD-ROMs) are not specified. Part 5 provides a Service Consumer systems architecture and a description of the DAVIC Set Top reference points defined elsewhere in the normative parts of the specification.

DAVIC 1.3.1a Part 13 is a DAVIC technical report, which provides guidelines on how to validate the systems, technology tools and protocols through conformance and / or interoperability testing.

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Information technology — Generic digital audio-visual systems — Part 9: Usage information protocols

1. Scope

This part of ISO/IEC 16500 provides the interface requirements for Usage Information provided by the DAVIC System to support External Support Systems (ESS) such as billing systems, pricing systems and market research systems. DAVIC Elements that need to communicate with External Support Systems shall conform to this specification. It is not required that all DAVIC Elements communicate with External Support Systems.

2. Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 16500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 16500 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau (TSB) maintains a list of currently valid ITU-T Recommendations.

2.1 ISO/IEC and ITU-T normative references

ITU-T Recommendation M.3100, *Generic Network Information Model*, 1995

ITU-T Recommendation Q.2931, *Broadband integrated services digital Network – Digital subscriber signalling system no.2 (DSS2) – User-network interface (UNI) – Layer 3 specification for basic call/connection control,* 1995

CCITT Recommendation X.680 (1994) | ISO/IEC 8824-1:1995, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

CCITT Recommendation X.690 (1994) | ISO/IEC 8825-1:1995, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).*

CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information.*

CCITT Recommendation X.730 (1992) | ISO/IEC 10164-1:1993, *Information technology – Open Systems Interconnection – Systems management: Object management function.*

CCITT Recommendation X.731 (1992) | ISO/IEC 10164-2:1993, *Information technology – Open Systems Interconnection – Systems management: State management function.*

CCITT Recommendation X.733 (1992) | ISO/IEC 10164-4:1993, *Information technology – Open Systems Interconnection – Systems management: Alarm reporting function.*

CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems management: Event report management function.*

CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems management: Log control function.*

CCITT Recommendation X.742 (1992) | ISO/IEC 10164-10:1995, *Information technology – Open Systems Interconnection – Systems management: Usage metering function for accounting purposes.*

CCITT Recommendation X.746 (1995) | ISO/IEC 10164-15:1995, *Information technology – Open Systems Interconnection – Systems management: Scheduling function.*

2.2 Other normative references

RFC 791, *Internet Protocol (IP).*

RFC 793, *Transmission Control Protocol (TCP).*

RFC 959, *File Transfer Protocol (FTP).*

RFC 1155, *Structure and Identification of Management Information for TCP/IP-based Internets.*

RFC 1157, *A Simple Network Management Protocol (SNMP).*

3. Definitions

This clause defines new terms, and the intended meaning of certain common terms, used in this part of ISO/IEC 16500. Annex A of ISO/IEC 16500-1 defines additional terms and, in some cases, alternative interpretations that are appropriate in other contexts. For convenience, the normative definitions below are included in the annex.

3.1. Bulk Usage Data Transfer Interface: The portion of the interface between a DAVIC System Manager and an External Support System by which the External Support System receives a bulk download of a collection of Usage Data in the form of a Usage Data File.

3.2. DAVIC Element : A component of a DAVIC System. A possible source generator of Usage Data.

3.3. DAVIC System Manager: A component that supports the overall management of the DAVIC System, of which Usage Data management (or Accounting Management) is a part.

3.4. External Support System : A component external to the DAVIC System which receives Usage Data through the Usage Data Transfer Interface (Interactive or Bulk).

3.5. Interactive: The portion of the Usage Data Transfer Interface used for transactional transfer of Usage Data Records.

3.6. Support Data: Data, such as prices and account (e.g., credit card) numbers, needed dynamically by DAVIC Elements or External Support Systems. This data is required or provided by an Service Consumer during the billing-related part of a service session (e.g., when the price of a service is being provided, or when the Service Consumer chooses a method of payment).

3.7. Usage Data: Data relating to usage of services and resources, typically needed for financial transactions involving Service Consumers, Network Providers, Service Providers and Content Providers. This data is collected from DAVIC Elements by DAVIC System Managers using the Usage Data Collection Interface, and is delivered to External Support Systems by DAVIC System Managers using the Usage Data Transfer Interface.

3.8. Usage Data Accumulation: The process of summarizing raw Usage Data.

3.9. Usage Data Assembly: The process of gathering together all of the Usage Data generated by a specific DAVIC Element for a specific use of a service

3.10.   Usage Data Collection Element: The portion of each DAVIC Element which generates Usage Data and transmits the data to the DAVIC System Manager over the Usage Data Collection Interface. This element could also perform Usage Data Accumulation, Usage Data Validation, Usage Data Assembly and Usage Data Formatting.

3.11.   Usage Data Collection Interface: The interface between a DAVIC Element and a DAVIC System Manager. This interface supports the delivery of Usage Data to the DAVIC System Manager.

3.12.   Usage Data Collection Administration: The process of determining the disposition of logged Usage Data, providing External Support Systems access to the Usage Data, and scheduling the reporting of Usage Data based on pre-determined rules about the data needed for the External Support Systems.

3.13.   Usage Data Correlation Support: The process of supporting the correlation (i.e., association) of Usage Data generated by different DAVIC Elements for the same service usage instance. This support includes producing correlation keys, administering correlation keys, exchanging correlation keys, inserting correlation keys into Usage Data Records and correlating Usage Data based on correlation keys.

3.14.   Usage Data File: A collection of Usage Data Records sent by a DAVIC System Manager to an External Support System over the Usage Data Transfer Interface.

3.15.   Usage Data Formatting: The process of creating a structured representation of unformatted Usage Data using a pre-defined format.

3.16.   Usage Data Functions: The functions that the Usage Data Collection Element and the DAVIC System Manager perform on Usage Data. These functions are Usage Data Generation, Usage Data Accumulation, Usage Data Assembly, Usage Data Validation, Usage Data Formatting, Usage Data Correlation Support and Usage Data Collection Administration.

3.17.   Usage Data Generation: The process of determining what Usage Data must be measured and recorded, and producing this data.

3.18.   Usage Data Record: A set of associated Usage Data. These records are sent in transactional messages over the Usage Data Collection Interface, and in transactional messages and files over the Usage Data Transfer Interface.

3.19.   Usage Data Transfer Interface: The interface between a DAVIC System Manager and an External Support System. This interface has two subparts for different modes of data transfer. The bulk transfer part is used to transfer a collection of Usage Data Records in the form of a file. The interactive transfer part is used for transactional transfer of Usage Data Records.

3.20.   Usage Data Validation: The process of editing Usage Data to ensure that it meets specific integrity checks and conforms to semantic and syntactic rules.

4. Acronyms and abbreviations

This clause defines the acronyms and abbreviations used in this part of ISO/IEC 16500. Annex B of ISO/IEC 16500-1 defines acronyms and abbreviations used within ISO/IEC 16500.

API	Application Program Interface
ASCII	American Standard Code for Information Interchange
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
BAF	Bellcore Automatic Message Accounting Format
B-UDTI	Bulk Usage Data Transfer Interface
CMIP	Common Management Information Protocol
DE	DAVIC Element
DSM	DAVIC System Manager
DSM-CC U-U	Digital Storage Media - Control Commands User-User
DSM-CC U-N	Digital Storage Media - Control Commands User-Network
DSUR	Delivery System Usage Records
EBCDIC	Extended Binary Coded Decimal Interchange Code
EFD	Event Forwarding Discriminator
ESS	External Support System
FTP	File Transfer Protocol
GIOP	Generic Inter-ORB Protocol
IDL	Interface Definition Language
IIOP	Internet Inter-ORB Protocol
IP	Internet Protocol
ITU	International Telecommunications Union
I-UDTI	Interactive usage data transfer interface
MF	Management Function
NE	Network Element
NEF	Network Element Functionality
OMG	Object Management Group
OS	Operations System
OSF	Operations System Functionality
RFC	Request for Comments
RPC	Remote Procedure Call
SMF	System Management Function

SNMP	Simple Network Management Protocol
STU	Set Top Unit
SUR	Service Usage Records
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
TMN	Telecommunications Management Network
UDCE	Usage Data Collection Element
UDCI	Usage Data Collection Interface
UDTI	Usage Data Transfer Interface
UMD	Usage Metering Data
UMR	Usage metering Record
VOD	Video on Demand

5. Conventions

The style of this part of ISO/IEC 16500 follows the *Guide for ITU-T and ISO/IEC JTC 1 cooperation. Appendix II: Rules for presentation of ITU-T | ISO/IEC common text (March 1993)*.

6. Introduction to Usage Information Protocols

6.1 Purpose

This specification establishes the protocols for the transfer of Usage Information into and out of the DAVIC System with entities that are outside of the DAVIC System. There are two types of data exchange that can be considered under the general heading of Usage Information:

- *Usage Data*—data relating to events and usage of resources, typically needed for financial transactions involving Service Consumers, Network Providers, Service Providers, and Content Providers. This data is not interactive, but collected from the system by an DAVIC System Manager and made available at the Usage Data Transfer Interface.

- *Support Data*—data, such as prices and account numbers, exchanged dynamically with External Support Systems (ESSs). This data is requested as needed and delivered promptly through the Support Data Interface.

The DAVIC System shall provide for the collection and output of Usage Data from all of the appropriate DAVIC System elements in support of the needs of ESSs (e.g., Billing Systems, Market Research Systems and Network Planning Systems). While the DAVIC System also needs to support the access to such ESSs by DAVIC Elements to obtain Support Data (e.g., pricing information and subscriber billing status), as well as the provision of Support Data (e.g., account number for chosen payment method) to ESSs, this part of ISO/IEC 16500 covers only the Usage Data Interface. It does not define the Support Data Interface nor does it define the External Support Systems themselves, which are outside of the DAVIC System.

6.2 Telecommunications Management Network (TMN)

A Telecommunications Management Network (TMN) is defined in ITU Recommendation M.3010 as follows:

> A TMN provides management functions for telecommunications networks and services and offers communications between itself and the telecommunications networks, services and other TMNs. In this context a telecommunications network is assumed to consist of both digital and analogue telecommunications equipment and associated support equipment. A telecommunications service in this context consists of a range of capabilities provided to customers.

The Usage Data protocols defined in this part of ISO/IEC 16500 are intended to follow as closely as possible the definition of TMN protocols as given in the ITU TMN documents. ITU Recommendation M.3400 specifies the TMN management functional areas to include:

- Performance management
- Fault management
- Configuration management
- Accounting management
- Security management

Usage Data measurement is classified as a function of accounting management in the TMN model.

This part of ISO/IEC 16500 is confined to Usage Data. The architecture of the protocols defined is consistent with the TMN model so that when future releases deal with other management areas they will be architecturally compatible.

7. Architecture of Usage Data Management

ESSs have data requirements that are unique, as well as data requirements that are common. This specification standardizes the handling of such data via open interfaces to enable ESS implementors to undertake their designs without having detailed knowledge of the specific implementation of the DAVIC System. DAVIC application designers will also have the ability to access ESSs via standardized interfaces that will give the owners of legacy systems the opportunity to preserve their investment simply by developing new interfaces.

7.1 Usage Data Management Overview

According to the TMN model (subclause 6.2) system management is composed of five functional areas: Fault, Configuration, Performance, Security and Accounting. The Usage Data solution presented herein is considered to define part of Accounting Management for the DAVIC System. It is anticipated that solutions for the other four management domains will be provided in a future version of this document.

In order to be consistent with the anticipated full support of system management, the Usage Data architecture includes a general system management component, called a DAVIC System Manager (DSM), which supports Accounting Management (and will support the other four management domains). Figure 11-1 illustrates the location of the DSM within the Usage Data architecture. As shown, the DSM is composed of the following components:

- Data Manager

  The Data Manager is the repository for data received from DAVIC Elements. Each participating DAVIC Element is required to send Usage and Event Data to the Data Manager. The DAVIC System Managers use the data in the Data Manager to perform their functions. For example the Accounting component formats data for the external Billing Systems.

- System Management Elements
  - Accounting
  - Fault
  - Configuration
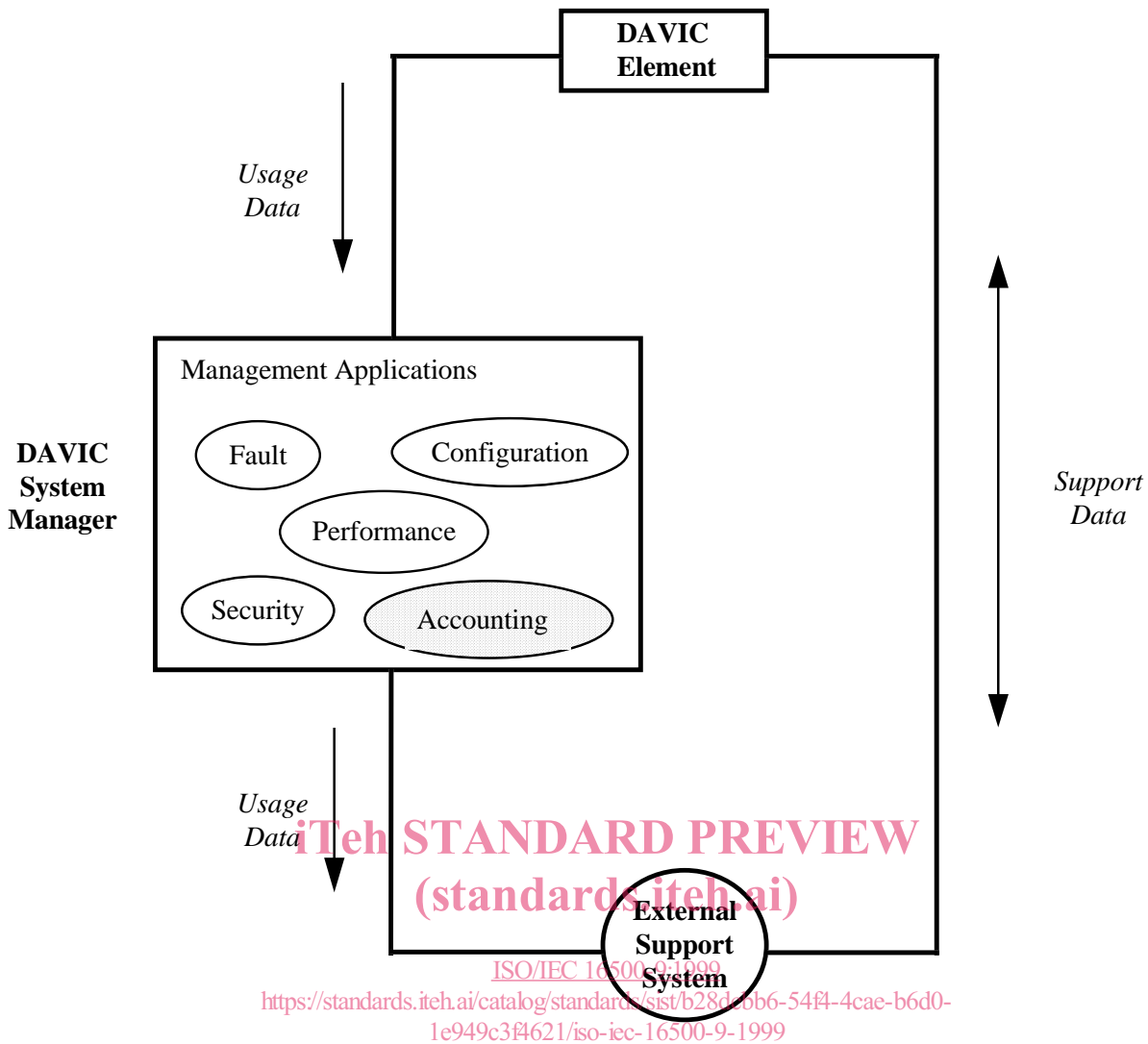 - Performance
  - Security

Figure 11-1 — DAVIC System Manager

The solution contained herein serves as a definition of part of the Accounting Management application. It also addresses the functionality of the Data Manager component of the DSM.

Figure 11-2 illustrates the architecture of the Usage Data environment. Each DAVIC Element (e.g., STU, Gateway, Server) contains an Usage Data Collection Element (UDCE) which has the responsibility for collecting and aggregating usage events local to that element. The UDCE communicates Usage Data to the DAVIC System Manager (DSM) after first registering the events for which Usage Data will be sent to the DSM. The Usage Data Collection Interface (UDCI) is the interface between Usage Data Collection Elements and DAVIC System Managers used to transfer Usage Data between these components. External Support Systems, such as Billing Systems, Market Research Systems, Operations, Administration, Maintenance and Planning (OAM&P) Systems, Network Planning Systems, Regulatory Reporting Systems and others systems, access the Usage Data through the Usage Data Transfer Interface (UDTI). The properties of External Support Systems are not specified by DAVIC. The UDTI is the single interface point for all of the ESSs to access Usage Data from outside the DAVIC System boundary. The UDTI supports two modes of communication: interactive transaction-based communication and bulk, file-based communication.
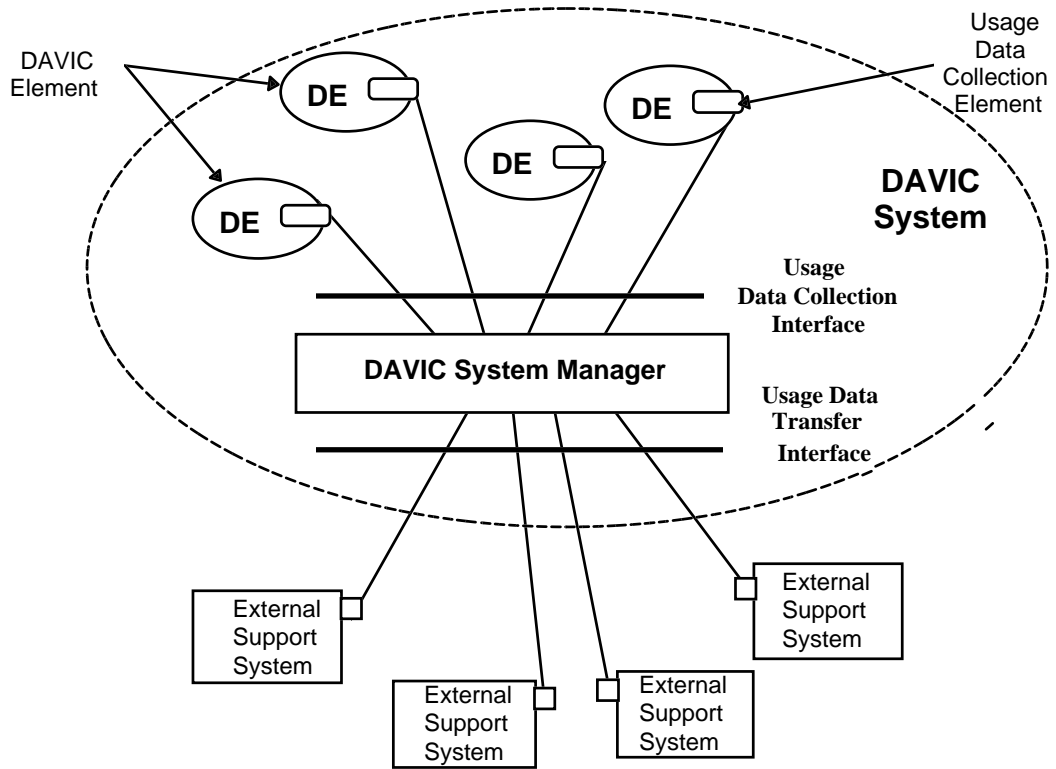
Figure 11-2 — Usage Data Environment

Figure 11-3 shows a typical ordering of the Usage Data Functions and how they may be divided between the DAVIC elements and the DAVIC System Manager.

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