

**Integrating the Healthcare Enterprise**



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**IHE Technical Frameworks  
General Introduction**

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## 1 IHE Overview

70 Integrating the Healthcare Enterprise (IHE) is an international initiative driven by healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards (both healthcare and general IT) to address specific clinical needs in support of optimal patient care. Systems developed in accordance with IHE communicate with one another better, are easier to implement, and enable care providers to use information more effectively.

75 IHE is organized by clinical and operational *domains*. Examples of IHE Domains include clinical specialty areas such as Radiology, Cardiology and Eye Care, as well as operational areas such as IT Infrastructure and Patient Care Coordination. Each domain consists of a planning committee, whose primary tasks are identifying the important interoperability problems to be addressed, long-term scope planning and supporting deployment activities; and a technical committee, whose primary task is developing and documenting the standards-based solutions to the interoperability problems identified by the planning committee.

80 A key part of the IHE development process is regularly scheduled testing events called *Connectathons*. These events provide a hands-on forum for vendors and developers to test their implementations of the IHE specifications and verify interoperability with other vendors' implementations.

85 General information about IHE, including its governance structure, sponsorship, member organizations and work processes, is available at [www.ihe.net](http://www.ihe.net). There are different methods of participation in IHE ranging from committee membership and public comment review to webinar and presentation introductions and updates. These methods are described at <http://www.ihe.net/Participate>.

90 Information on the activities of each of the IHE domain committees, including their committee rosters, annual cycle dates and how to participate, is available at <http://wiki.ihe.net/index.php?title=Domains>.

## 2 Purpose and Audience

95 This document is a general introduction to the Technical Framework of each of the IHE domains. It is intended to provide context and conventions for those documents.

The intended audience of IHE Technical Frameworks is:

- Those interested in integrating healthcare information systems and workflows
- IT departments of healthcare institutions
- 100 • Technical staff of vendors participating in the IHE initiative
- Experts involved in standards development
- National/Regional deployment committees
- Standards Development Organizations (e.g., DICOM<sup>®</sup>, HL7<sup>®</sup>, LOINC<sup>®</sup>, SNOMED<sup>®</sup> CT)

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### 3 Important IHE Terminology

IHE has developed a standard vocabulary across domains. These terms are usually abstract terms used to describe systems and interoperability. It is crucial to understand these terms prior to reading a Technical Framework document.

#### 110 3.1 Profiles, Actors, Transactions, and Content Modules

IHE's interoperability solutions are documented in implementation guides, called IHE Profiles.

115 IHE Profiles are implementable specifications describing how to use established standards to meet specific healthcare needs. Referencing profiles offers a common language that healthcare professionals and vendors can use to discuss the needs of healthcare providers and the integration capabilities of Health Information Technology (HIT) systems in precise terms backed by detailed specifications.

120 IHE Profiles define the behavior of IHE Actors, which are information systems or components of information systems that produce, manage, or act on health information. Actors exchange information through standards-based transactions. Examples of actors include Order Filler, Order Placer, Content Creator or Image Manager. Examples of transactions include Query Modality Worklist, Retrieve Images, Register DocumentSet, or Communicate Infusion Order. See Appendix A for a complete list of all IHE actors and definitions. See Appendix B for a complete list of all IHE Transactions.

125 IHE Actors rely upon a consistent understanding of the data they are exchanging. Some IHE Profiles focus heavily upon the data definitions. Complex or large data sets are defined in IHE Content Modules. IHE Content Module descriptions for final text profiles are contained within a domain's Technical Framework Volumes (typically Volume 3). Content Module descriptions for trial implementation profiles are contained within a specific Technical Framework Supplement or in the PCC domain's *CDA Content Modules Supplement*.

130 The aforementioned documents, as well as the IHE Glossary, are available on ihe.net [here](#).

#### 3.2 Technical Frameworks, Connectathons, and Integration Statements

135 IHE publishes each new profile as a supplement using a well-defined process of public review and trial implementation. Once profiles have undergone sufficient testing and deployment in real-world care settings and have reached final text (approved) status, they are published in specification documents called the *IHE Technical Frameworks*. There is one Technical Framework per IHE domain, with each framework comprised of multiple volumes. These documents are made freely available for the healthcare community worldwide. The Technical Frameworks provide a unique resource for developers and users of HIT systems: a set of proven, standards-based solutions to address common interoperability issues. For more detail about the IHE publication process and the documents it produces, see [Section 8](#).

140 Current versions of all IHE Technical Framework documents and Trial Implementation Supplements are available at [http://www.ihe.net/Technical\\_Frameworks](http://www.ihe.net/Technical_Frameworks). Documents currently published for public comment are available at [http://www.ihe.net/Public\\_Comment](http://www.ihe.net/Public_Comment).

145 As a service to vendors and providers, Connectathon inter-vendor testing events are sponsored  
and managed by IHE. Test cases and expected results are written and monitored by independent  
IHE representatives. Vendors bring products and test their compliance with profile requirements  
determined by the actors and options they have chosen to implement. There are several  
Connectathons held annually in different regions around the world. More information about  
150 Connectathons is available [here](#).

Another benefit of IHE for healthcare providers is a simplified “language” to request the  
inclusion of interoperability features in products. Purchasers can require conformance with  
appropriate IHE profiles/actor/content module combinations in requests for proposals (RFPs).  
Vendors who have successfully implemented IHE profiles in their products can publish  
155 conformance statements, called IHE Integration Statements, in the IHE Product Registry at  
[http://www.ihe.net/IHE\\_Product\\_Registry](http://www.ihe.net/IHE_Product_Registry) to document their capabilities in a consistent format.  
However, it should be noted that IHE is not a certifying body.

160 **4 The IHE Approach**

IHE profiles facilitate *interoperability* – “is a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems, present or future, in either implementation or access, without any restrictions.” (Wikipedia.com, 2017, “Interoperability”).

165 In HIT systems, interoperability typically involves the following aspects:

- **Content** - a defined format for composing a unit of exchanged information supporting a specific function, often using standard nomenclature, a controlled vocabulary or terminology for representing semantic concepts.
- **Transport** – standard messaging for communicating information (often composed of  
170 standard content) from one system to another
- **Workflow** - a set of interactions among multiple users and systems to achieve a specific task or use case, often using standard messaging

Each IHE profile emphasizes and addresses these aspects of integration to a different degree. For example, the Radiology Scheduled *Workflow* Profile concentrates on workflow and messaging  
175 but also addresses limited content and nomenclature, while the Cardiology Imaging Report *Content* Profile is primarily about content and nomenclature.

Workflow is documented in IHE in the body of the profile, often in the form of a process flow diagram. Transport is documented in IHE in the form of transactions. Content is documented in the form of content modules, and sometimes directly in the body of transactions when the  
180 message payload is relatively fixed. Content may include nomenclature, which is documented in profiles, transactions, content modules, or the underlying standards as appropriate.

## 5 Structure of the IHE Technical Frameworks

185 The IHE Technical Frameworks define specific use of established standards. They are updated annually and maintained regularly through the identification and correction of errata. The Technical Framework volumes are augmented by supplements and change proposal documents as described in [Section 8](#). The latest versions of Technical Framework documents are always available at [http://www.ihe.net/Technical\\_Frameworks](http://www.ihe.net/Technical_Frameworks).

190 The Technical Framework for each domain consists of several volumes:

- Volume 1 provides high-level overviews of each profile, the use cases it addresses, the actors involved, and references to the Transactions and Content Modules used.
- Volume 2 provides detailed technical descriptions of each IHE Transaction.
- Volume 3 provides detailed technical descriptions of each IHE Content Module.

195 • Volume 4 describes National Extensions to the Technical Framework such as country-specific code sets or national patient privacy requirements.

As volumes are expanded, they may be divided for maintainability into sub-volumes, such as 2a, 2b, and 2x.

200 While each domain's Technical Framework is developed independently, profiles in one domain's Technical Framework may reference the Transactions and Content Modules defined in another domain's Technical Framework.



## 6 External Relationships

### 6.1 Relationship of IHE to Standards

- 205 IHE promotes the use of established standards. Conformance claims for products must still be made in direct reference to specific standards. IHE Technical Frameworks specify the use of standards maintained by Standards Development Organizations (SDOs) such as ISO, IEEE, IHTSDO, Regenstrief, NEMA, HL7, IETF, OASIS and W3C. As the scope of IHE expands, specifications based on other standards may be included as well.
- 210 The Technical Frameworks constrain these standards, but do not contradict conformance. If IHE identifies any errors in or extensions needed to existing standards, its policy is to report them to the appropriate standards bodies for resolution.

Appendix E describes documentation conventions used by IHE when profiling these standards.

### 6.2 Relationship of IHE to Real-world Products and Architectures

- 215 A key goal that underlies the structure of the IHE Technical Frameworks is to define and constrain details necessary for integration and interoperability, while permitting as much flexibility as possible for all other details. Most products will have many other features, behaviors and design details that are outside the scope of IHE. Product designers are encouraged to consider IHE requirements as a baseline and to build user-beneficial features that make
- 220 creative use of the information provided through IHE integration. There is ample opportunity for creativity, ingenuity and differentiation.

- IHE assigns transactions to actors, which are abstractions of components found in the real-world healthcare information system environment. While some transactions are traditionally performed by a certain category of product (e.g., a HIS, a PACS, a Clinical Data Repository, or a
- 225 Cardiology Information System), IHE intentionally avoids assigning actors to a specific product category. IHE profiles depend on the defined actors being present, not on how the actors are allocated to products (one large system or multiple specialized systems, a single vendor or multiple vendors). This preserves freedom for users and vendors in how HIT components are implemented, purchased and deployed. IHE demonstrations emphasize the integration of
- 230 multiple vendors' systems based on the IHE Technical Frameworks.

- Products may implement a wide variety of IHE actor combinations. A single physical product might implement only a single actor in a single profile. It is also common for a product to implement multiple actors in multiple profiles. When those actors communicate internally, IHE permits them to use proprietary methods that are equivalent to the IHE transactions; however,
- 235 IHE requires the actors to be capable of communicating with actors on other systems using the defined IHE interfaces. This maintains reliable interoperability, while staying out of internal product design and allowing performance optimizations.

### 6.3 Relationship of IHE Actors to Product Implementations

Developers implementing IHE profiles must:

- 240
- Select which profiles the product will support

- For each profile, select which actors and/or content modules to implement
- For each actor, select which defined options to implement

245 To comply with an actor in an IHE profile, a system must perform all the transactions and/or content modules required for that actor in that profile. A given product may implement more than one actor and more than one integration profile. When more than one actor is implemented in a single product, IHE refers to the actors as being “grouped”. Certain actor groupings are mandated by IHE, sometimes as a way of bringing necessary information or features together in a single system, sometimes as a way of binding content with transport or workflow.

250 A product implementation that incorporates a combination of IHE actors may combine those actors so that the internal communication is achieved by means other than transactions defined by IHE. For example, in the Radiology Scheduled Workflow Profile, a single system could be implemented as a RIS-PACS, encompassing the Department System Scheduler/Order Filler and the Image Manager Actors. The internal communications of this product have no bearing on the compliance of that system with the Scheduled Workflow profile. However, all required  
255 transactions of each actor must also be externally exposed for the system to claim IHE conformance for those actors.

At a Connectathon testing event, all the IHE transactions, options, or content modules for each actor are tested, even when the actors are combined in a single product. All required groupings are also tested.

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## 7 Technical Framework Document Conventions

265 The IHE Technical Frameworks have adopted the following conventions for representing the framework concepts and specifying how the standards upon which they are based should be applied.

### 7.1 Diagrams and Tables of IHE Actors and Transactions

Each integration profile models a real-world capability in terms of actors that interact through transactions.

270 The *Actors and Transactions* table in each profile in Volume 1 specifies which transactions each actor is required to support in that profile.

275 The *Required Actor Groupings* table in each profile in Volume 1 specifies actors the implementer is required to implement together. Such requirements combine capabilities necessary for the system to function properly and achieve the profile integration goals. For example, the Client Authentication Agent of the ITI Enterprise User Authentication (EUA) Profile is required to be grouped with the Time Client of the ITI Consistent Time (CT) Profile.

Note: In previous versions of technical framework documents, additional Grouping requirements were specified in a "Profile Dependencies" section that required actors in one profile to also implement the same actor in another profile on which the first depended. These are now folded into the Required Actor Groupings table.

280 The *Actors and Options* table in each profile in Volume 1 specifies Named Options for each actor. Implementers that choose to claim support for a named option are required to implement the specification sections referenced in the table.

The *Actor Diagram* in each profile in Volume 1 provides an overview of the actors in the profile and the transactions between them. Grouped actors will be shown as boxes that share a side. Rarely, actors from other profiles may be shown for context as dashed line boxes.

### 285 7.2 Process Flow Diagrams

Integration profiles often include process flow diagrams that illustrate how the profile functions as a sequence of transactions between relevant actors.

290 These diagrams are intended to provide an overview so the transactions can be seen in the context of an institution's workflow. Certain transactions and activities not defined in detail by IHE are shown in these diagrams in *italics* to provide additional context on where the relevant IHE transactions fit into the broader scheme of healthcare information systems.

These diagrams are not intended to present the only possible scenario. Often, other actor groupings are possible and transactions from other profiles may be interspersed.

295 In some cases, the sequence of transactions may be flexible. Where this is the case there will generally be a note pointing out the possibility of variations. Transactions are shown as arrows oriented according to the flow of the primary information handled by the transaction and not necessarily away from the initiator.

## 7.3 Security Implications

300 IHE transactions often contain information that must be protected in conformance with privacy laws, regulations and best practices. This protection is documented in a Security Considerations section of each profile, which communicates security and privacy concerns that the implementers need to be aware of, assumptions made about security and privacy pre-conditions and, where appropriate, key elements of a risk mitigation strategy to be applied.

305 IHE includes several security and privacy-focused profiles. Other IHE profiles generally do not have specific privacy protections, but rather require a grouping of actors in one or more of the security profiles. It should be understood that institutions must implement policy and workflow steps to satisfy enterprise needs and to comply with regulatory requirements.

## 7.4 Content Modules

310 There is often a very clear distinction between the transactions in a messaging framework used to package and transmit information and the information content actually transmitted in those messages. In these cases, the same transactions may be used to support a wide variety of use cases in healthcare, such that the content needs to be profiled separately from the transaction itself. To this end, IHE has developed the concept of a Content Module.

315 Content Modules may be defined in a number of different standards, the two most prevalent being HL7 Clinical Document Architecture (CDA<sup>®3</sup>) and DICOM Information Object Definitions (IODs).

Content profiles are typically defined with two actors, a Content Creator and a Content Consumer, which exchange the well-defined content module information.

320 For Content Creators and Content Consumers to function in the real world; however, those actors must be grouped with actors from a workflow or transport profile. For example, the Cardiology Imaging Report Content (CIRC) Profile defines the discrete content of a cardiology report. Typically, some of the data for the report is created and accessible from another machine such as a modality or other electronic health record. In this case, the Content Creator would be grouped with the Image Enabled Office (IEO) Report Creator. Once an instance of a content module is  
325 created, it is typically intended to be sent to another location or person. In this case, a Content Consumer could be grouped with an ITI Cross Enterprise Document Sharing (XDS.b) Document Consumer or a Cardiology Displayable Reports (DRPT) Report Manager. These potential actor groupings are defined in Volume 1 of a content module profile.

330 In addition to groupings, Content Consumers also have the following common set of options defined by the Patient Care Coordination (PCC) domain:

- View Option
- Discrete Data Import Option
- Document Import Option
- Section Import Option

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<sup>3</sup> CDA is the registered trademark of Health Level Seven International.

335 These options are defined in PCC TF-2: 3 and should be reviewed in detail.

Finally, when an actor that supports a content module is grouped with an actor that supports a transaction, some of the data from the content module must be carefully mapped into the metadata of the transaction used by the transport actor. This data mapping of a content module to a transaction is called “data binding”. For example, the XDS Document attribute “authorPerson” is explicitly defined to be the concatenation of several CDA attributes beginning with “ClinicalDocument/author/assignedPerson/name/family”, etc. The data bindings of CDA content modules to Cross Enterprise Document Sharing (XDS.b) Profiles is defined in the PCC domain. PCC TF-2: 4 should be reviewed in detail.

Appendix E of the General Introduction (this document) defines important content module conventions such as cardinality constraints and optionality constraints for DICOM, HL7 v2 messages, and HL7 CDA documents.

## 7.5 Technical Framework Cross-references

When references are made to another section within a Technical Framework volume, a section number is used by itself. When references are made to other volumes or to a Technical Framework in another domain, the following format is used:

- <domain acronym> TF-<volume number>: <section number>, where
  - <domain acronym> is the short designator for the IHE domain (e.g., ITI = IT Infrastructure, RAD = Radiology)
  - <volume number> is the applicable volume within the given Technical Framework (e.g., 1, 2a, 2b, 2x, 3), and
  - <section number> is the applicable section number.

For example:

- *PCC TF-1: 3.1* refers to Section 3.1 in Volume 1 of the IHE Patient Care Coordination Technical Framework.
- *RAD TF-3: 4.33* refers to Section 4.33 in Volume 3 of the IHE Radiology Technical Framework.
- *ITI TF-2x: Appendix B* refers to Appendix B in Volume 2x of the IHE IT Infrastructure Technical Framework.

When references are made to transaction numbers in the Technical Framework, the following format is used:

- [<domain designator>-<transaction number>], where
  - <transaction number> is the transaction number within the specified domain.

For example:

- [*ITI-1*] refers to Transaction 1 from the IHE IT Infrastructure Technical Framework.

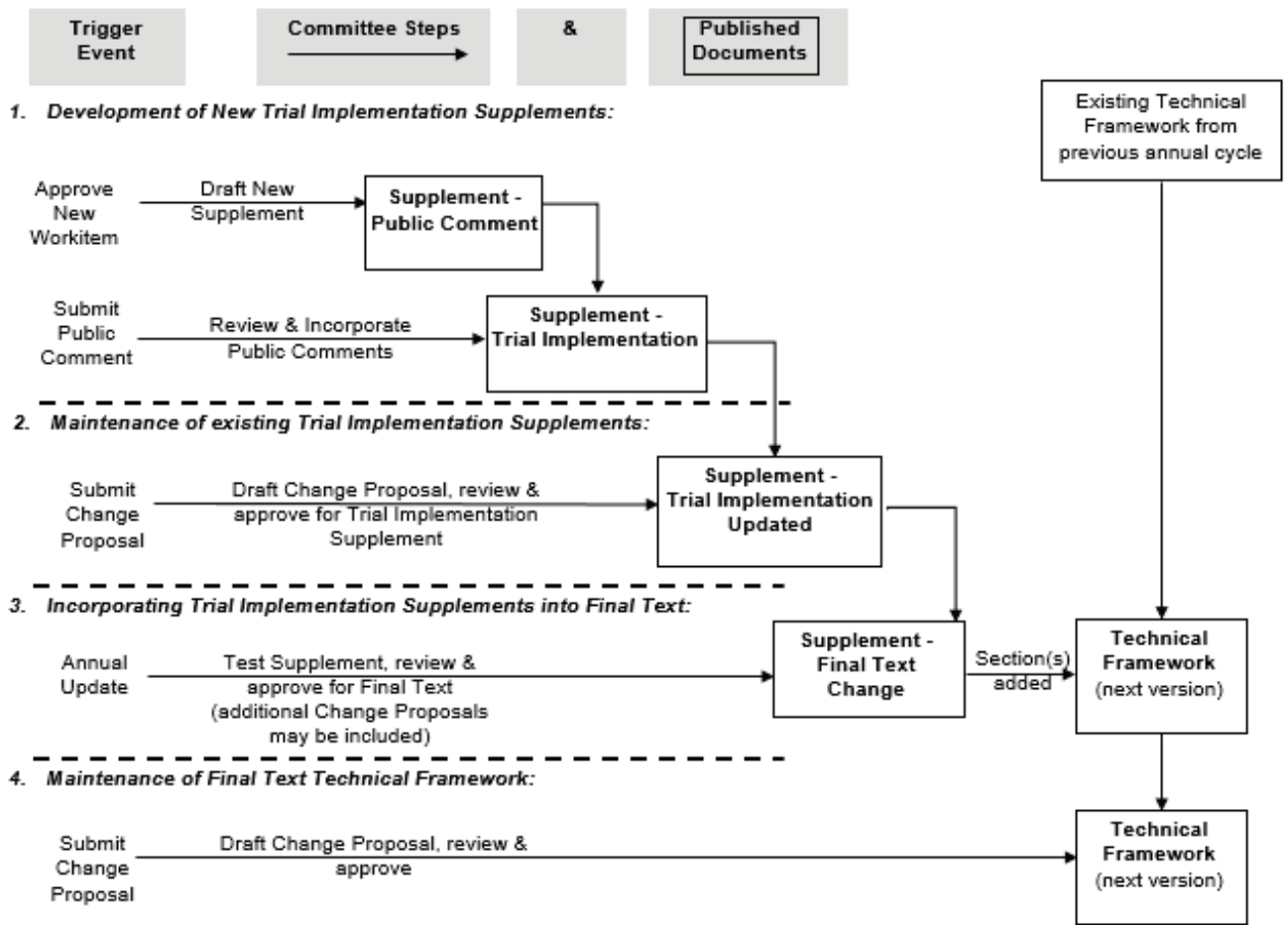
## 8 IHE Technical Framework Development and Publication Process

375 Typically, IHE technical frameworks are maintained and expanded on an annual basis by each IHE domain's technical committee. The development and maintenance process of the framework follows a number of principles to ensure stability of the specification so that both vendors and users may use it reliably in specifying, developing and acquiring systems with IHE integration capabilities.

The technical frameworks are expanded through incorporating *supplements*. Each supplement goes through three phases: *public comment*, *trial implementation* and *final text*. *Change Proposals* are used to document changes to either trial implementation supplements or to final text technical framework documents.

The publication process is explained in more detail below as well as in Figure 8-1.

- 385 1. Each domain technical committee develops supplements to support new functionality identified by the IHE planning committees and issues the supplement(s) for public comment. The technical committee addresses all comments received during the public comment period and publishes an updated version of the supplements for trial implementation. This version of the specification is used by vendors in developing trial implementation software for annual IHE Connectathon testing events.
- 390 2. The technical committee considers change proposals to the trial implementation version of the supplements, including those from implementers who participate in the Connectathon. After resolution of all change proposals, the supplement is re-published as "Trial Implementation".
3. Annually, supplements are reviewed for resolution of all change proposals and sufficient implementations and may reach the final text phase. All supplements that reach the final text phase are incorporated into the technical framework volumes.
- 395 4. On an on-going basis, change proposals may still be submitted for potential incorporation into future versions of the technical framework volumes.



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**Figure 8-1: The process of developing and maintaining the IHE Technical Framework**

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### 9.1 Copyright of Base Standards

IHE technical documents refer to and make use of a number of standards developed and  
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standards are reserved by these organizations. This agreement does not supersede any copyright  
420 provisions applicable to such base standards. Copyright license information for frequently  
referenced base standards is provided below.

#### 9.1.1 DICOM (Digital Imaging and Communications in Medicine)

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435 created by the College of American Pathologists. SNOMED CT is a registered trademark of the  
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## 11 Disclaimer Regarding Patent Rights

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## 12 Comment Process

IHE International welcomes comments on this document and the IHE Technical Frameworks General Introduction Appendices. They may be submitted using the web-based comment form at 465 [http://www.ihe.net/Templates\\_Public\\_Comments](http://www.ihe.net/Templates_Public_Comments) or by sending an email to [templates@ihe.net](mailto:templates@ihe.net).

# Appendices

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## **Appendix A: Actor Descriptions**

475 Published at [http://ihe.net/Technical\\_Frameworks/#GenIntro](http://ihe.net/Technical_Frameworks/#GenIntro)

## **Appendix B: Transaction Descriptions**

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## **Appendix C: Namespaces**

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## **Appendix D: Glossary**

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## **Appendix E: Standards Profiling and Documentation Conventions**

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## **Appendix F: Integration Statements**

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