The Open Group Series

Nictiz

THE Open GROUP

Hospital Reference Architecture Guide: The Complete and Expanded English Translation of the Dutch ZiRA

Prepared by Members of The Open Group Healthcare Forum, in Collaboration with Nictiz and the ZiRA Governance Board

Foreword by: Jason S. Lee, PhD

Van Haren PUBLISHING

Hospital Reference Architecture Guide:
The Complete and Expanded English translation of the Dutch ZiRA

The Open Group Publications available from Van Haren Publishing

The TOGAF® Standard, 10th Edition:
Introduction and Core Concepts
Architecture Development Method
Content, Capability, and Governance
Leader's Guide
ADM Practitioners' Guide
Business Architecture
Enterprise Agility and Digital Transformation
A Pocket Guide
TOGAF® Business Architecture Foundation Study Guide
TOGAF® Enterprise Architecture Foundation Study Guide

The TOGAF Series:
The TOGAF® Standard, Version 9.2
The TOGAF® Standard, Version 9.2 – A Pocket Guide
TOGAF® 9 Foundation Study Guide, 4th Edition
TOGAF® 9 Certified Study Guide, 4th Edition

The Open Group Series:
The IT4IT™ Standard, Version 3.0
IT4IT™ for Managing the Business of IT – A Management Guide
IT4IT™ Foundation Study Guide, 2nd Edition
The IT4IT™ Reference Architecture, Version 2.1 – A Pocket Guide
Cloud Computing for Business – The Open Group Guide
ArchiMate® 3.1 Specification – A Pocket Guide
ArchiMate® 3.2 Specification
The Digital Practitioner Pocket Guide
The Digital Practitioner Foundation Study Guide
Open Agile Architecture™ – A Standard of The Open Group
Hospital Reference Architecture Guide: The Complete and Expanded English translation of the Dutch ZiRA

The Open Group Press:
The Turning Point: A Novel about Agile Architects Building a Digital Foundation
Managing Digital
Ecosystems Architecture

The Open Group Security Series:
O-TTPS – A Management Guide
Open Information Security Management Maturity Model (O-ISM3)
Open Enterprise Security Architecture (O-ESA)
Risk Management – The Open Group Guide
The Open FAIR™ Body of Knowledge – A Pocket Guide

All titles are available to purchase from:
www.opengroup.org
www.vanharen.net
and also many international and online distributors.

Hospital Reference Architecture Guide: The Complete and Expanded English translation of the Dutch ZiRA

Prepared by Members of The Open Group Healthcare Forum,
in Collaboration with: Nictiz and the ZiRA Governance Board

Foreword by Jason S. Lee, PhD

Title:	Hospital Reference Architecture Guide:
	The Complete and Expanded English translation of the Dutch ZiRA
Subtitle:	Prepared by Members of The Open Group Healthcare Forum, in Collaboration with: Nictiz and the ZiRA Governance Board
Series:	The Open Group Series
A Publication of:	The Open Group
Publisher:	Van Haren Publishing, 's-Hertogenbosch, www.vanharen.net
ISBN Hard copy:	978 94 018 1104 0
ISBN eBook (pdf):	978 94 018 1105 7
ISBN ePub:	978 94 018 1106 4
Edition:	First edition, first impression, December 2023
Layout:	The Open Group
Copyright:	© 2023, The Open Group. All rights reserved.

This work is based on the Dutch *Ziekenhuis Referentie Architectuur (ZiRA)* developed by Nictiz.
No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior permission of the copyright owner.
Document Number: G23A
Published by The Open Group, September 2023.

Comments relating to the material contained in this document may be submitted to:
The Open Group
Apex Plaza
Forbury Road
Reading
Berkshire, RG1 1AX
United Kingdom
or by electronic mail to: ogspecs@opengroup.org

Contents

1 Introduction 1
- 1.1 What is the ZiRA? 1
- 1.2 Audience 2
- 1.3 Objective 2
- 1.4 Assumptions 2
- 1.5 ZiRA Construction 3
- 1.6 The ZiRA Metamodel 5
- 1.7 Metamodel Example 6
- 1.8 Clarification of Concepts 7
- 1.9 Derivations/Specializations 9
- 1.10 Parts of the ZiRA 9
- 1.11 The Common Structure of ZiRA Reference Models 9

2 Architecture Principles 11
- 2.1 What are Architecture Principles? 11
- 2.2 Purpose and Application of Architecture Principles 12
- 2.3 ZiRA Architecture Principles 12
- 2.4 ZiRA Basic Principles 13
- 2.5 Basic Principle 1: The Patient Comes First 14
  - 2.5.1 Motivation 14
  - 2.5.2 Rationale 14
  - 2.5.3 Implications 14
- 2.6 Basic Principle 2: The Hospital Function in a Network of Care Providers 15
  - 2.6.1 Motivation 15
  - 2.6.2 Rationale 15
  - 2.6.3 Implications 15
- 2.7 Basic Principle 3: Clear and Unambiguous Data Capture at the Point of Care 16
  - 2.7.1 Motivation 16
  - 2.7.2 Rationale 16
  - 2.7.3 Implications 16
- 2.8 Basic Principle 4: Information Provision is Flexible, Secure, and Sustainable 17
  - 2.8.1 Motivation 17
  - 2.8.2 Rationale 17
  - 2.8.3 Implications 17
- 2.9 Basic Principle 5: Quality can be Deduced from the Care Process 18
  - 2.9.1 Motivation 18
  - 2.9.2 Rationale 18
  - 2.9.3 Implications 18
- 2.10 Knowledge Model and ZiRA Principles 19

3 Hospital Business Model Canvas 20
- 3.1 Application 21
- 3.2 Additional Resources 22

4 Business Function Model 23
4.1 Introduction 23
4.2 What is a Business Function? 23
4.3 The ZiRA Business Function Model 23
4.3.1 Subdividing the Healthcare Domain 25
4.3.2 Specializations 25
4.4 Purpose and Application of the Business Function Model 26

5 Service Model 27
5.1 Introduction 27
5.2 Service Model 27
5.3 Service Characteristics 28
5.4 Application 29
5.5 Service Catalog 29
5.6 Explanation 31

6 Process Model 33
6.1 Introduction 33
6.2 Process Model 33
6.3 Explanation 33
6.4 Process Model Principles 34
6.5 Process Model Structure 34
6.6 Application 35
6.7 Decomposing (Specifying) Business Processes 35
6.7.1 Business Process Diagrams 36

7 Information Model 50
7.1 Introduction 50
7.2 Healthcare Information Model 50
7.2.1 Purpose 50
7.2.2 Application 51
7.2.3 Basic Design Pattern (BDP) 51
7.2.4 Types of Information Objects 52
7.3 Information Domain Model 55
7.3.1 Information Domain *versus* Business Function 56
7.3.2 Coherence of Information Objects and Business Activities in Healthcare 77
7.4 Information Objects in the Care Processes 77
7.4.1 Application 78
7.5 Relationship of Information Objects to Healthcare Information Building Blocks (ZIBs) 79
7.5.1 Healthcare Information Building Blocks 79

8 Application Function Model 81
8.1 Overview of Features 82
8.2 Applications 88
8.3 Further Explanation 89
8.3.1 Features *versus* Services 90
8.3.2 IT Change and Service Management *versus* Generic IT Functions 90

8.3.3 Generic IT Functions, Not the Infrastructure Itself 90
8.3.4 Granularity 90

A Consensus Statement of the FHIM Transition Council 91

B Nictiz Interoperability Model and the TOGAF ADM 92

C Derived Principles 93

D Business Functions and Business Activities 96

Preface

The Open Group

The Open Group is a global consortium that enables the achievement of business objectives through technology standards. Our diverse membership of more than 900 organizations includes customers, systems and solutions suppliers, tool vendors, integrators, academics, and consultants across multiple industries.

The mission of The Open Group is to drive the creation of Boundaryless Information Flow™ achieved by:

- Working with customers to capture, understand, and address current and emerging requirements, establish policies, and share best practices
- Working with suppliers, consortia, and standards bodies to develop consensus and facilitate interoperability, to evolve and integrate specifications and open source technologies
- Offering a comprehensive set of services to enhance the operational efficiency of consortia
- Developing and operating the industry's premier certification service and encouraging procurement of certified products

Further information on The Open Group is available at www.opengroup.org.

The Open Group publishes a wide range of technical documentation, most of which is focused on development of Standards and Guides, but which also includes white papers, technical studies, certification and testing documentation, and business titles. Full details are available at www.opengroup.org/library.

The Healthcare Forum

The Open Group Healthcare Forum (HCF) provides a vendor-neutral environment where members from diverse organizations in the global healthcare sector share experiences, gain insights, strengthen professional networks, and collaborate to produce useful products for their organizations.

Members have defined the Forum's mission and vision as follows:

- Mission: Imagine a world in which protected health information is available when and where you need it
- Vision: The Forum is grounded in the conviction that health information should follow the person in a timely, accurate, and secure manner

  When healthcare systems interoperate, they achieve a higher degree of efficiency and create value by providing better care to patients and enhanced revenue to stakeholders.

Membership is open and encouraged across the vast healthcare sector, including healthcare IT, hospitals and healthcare services, health insurance, biotechnology, pharmaceuticals, and medical devices. Forum participants apply system-wide perspectives and adaptable approaches to better understand and communicate the needs, requirements, and interdependence of key stakeholders.

The HCF aims to develop, test, and implement tools that foster Digital Transformation, agility, risk management, and improved quality and efficiency in healthcare enterprises. Through weekly meetings and quarterly events, members gain skills they can use to help their employers (and the membership of The Open Group in general) avoid fragmented, short-sighted, or needlessly expensive solutions to business problems.

Nictiz

Nictiz is the competence center for digital information management in healthcare in the Netherlands. Committed to developing a vision for the healthcare information system and the architecture supporting that system, Nictiz develops and maintains standards for digital information management, ensuring that healthcare information can be recorded and exchanged in an unambiguous manner. In addition, Nictiz has an advisory function and shares knowledge about digital information management in healthcare, focusing not only on the Netherlands, but also on international developments. Nictiz is an independent knowledge organization supported by the Dutch Ministry of Health, Welfare and Sport with the mission: Better health through better information.

For more information, refer to: https://nictiz.nl/about-nictiz/.

This Document

The main body of this document, Chapters 1 to 8, contains the full English translation of the Dutch *Ziekenhuis Referentie Architectuur* (ZiRA). The ZiRA is a hospital reference architecture used to streamline and optimize the design and implementation of systems, applications, and technology solutions in hospitals. It includes customizable templates and models that provide guidelines, best practices, and a set of design principles for making hospitals more effective and efficient. It includes links to configuration files for modeling and documentation using a standard application, such as the ArchiMate® modeling language.[1]

The Open Group produced this translation in close collaboration with Nictiz, which manages the ZiRA. The ZiRA is "from, for, and developed by hospitals". Its value has been widely demonstrated in The Netherlands and parts of Scandinavia; however, it is largely unknown elsewhere. The objective of this document is to fill this significant gap by expanding awareness and understanding of the ZiRA and establishing its relevance to thousands of hospitals worldwide.

Two terms in the subtitle of this document, "The Complete and Extended English Translation of the Dutch ZiRA", call for elaboration. First, this translation is "complete" in the sense that it faithfully conveys the content, meaning, and style of the source text, which is contained in a series of webpages available at: www.ziraonline.nl. Where possible, it is a verbatim rendering of the original language. But when preserving the ZiRA's exact wording and structure produced awkward or unnatural phrasing, the source text was modified to foster clarity and understanding.

Second, this translation is "extended" in the following ways:

[1] A configuration file, also called a modeling tool file, serves as a container for various elements of an Enterprise Architecture reference model, such as diagrams, objects, relationships, attributes, and documentation. There are other modeling tools. The ArchiMate modeling language is mentioned here for two main reasons. One, because the Dutch ZiRA was created using the ArchiMate Specification (which is not surprising given that ArchiMate modeling language was initially developed in The Netherlands, and at about the same time.) Two, because it is managed and maintained by The Open Group. It bears noting that Enterprise Architecture modeling tools enable users to organize, visualize, and document complex information about an organization. This is the key benefit, or one of the key benefits of using Enterprise Architecture; the structures, processes, systems, and resources of an organization can be viewed together and in relation to one another, as its architecture.

- It fills intermittent gaps in the original content[2]
- It uses source material, including information referenced in hyperlinks in the original text, to weave a compelling narrative or "story" about the Dutch ZiRA[3]
- It clarifies, elaborates, or otherwise explains elements in the original text that The Open Group and Nictiz collaborators agreed were unclear, vague, ambiguous, or obscure

This document is The Open Group Guide to Hospital Reference Architecture. It has been developed and approved by The Open Group.

Who is this Document for?

This document is for healthcare IT and healthcare systems professionals who combine their knowledge of operations and expertise in technology to drive improvements and optimize systems within hospitals and related healthcare organizations.

At the operational level, the ZiRA is useful for enterprise and information architects, information managers, solution architects, functional and technical designers, and functional managers. These roles primarily deal with practical implementation and maintenance of systems to ensure smooth and efficient operations.

At the strategic level, the ZiRA is useful for policy officers, Chief Medical Information Officers (CMIOs), consultants and others who are involved in organizational and process changes. These roles often have a broader perspective and include responsibilities for driving strategic initiatives, aligning technology with business goals, and overseeing transformational projects.

[2] Indeed, the Nictiz and The Open Group collaborators are using this translation- especially its figures and tables- to update the Dutch online version of the ZiRA.

[3] A substantial number of references point to projects undertaken in The Netherlands that contribute valuable insights to, and serve as cornerstones for, the ZiRA. Informed Dutch readers may know about such work, but most English readers will not be familiar with it. One example is the National Reference Architecture (NORA) for the Dutch Government.

Trademarks

ArchiMate, FACE logo, Making Standards Work, Open O logo, Open O and Check certification logo, OSDU, Platform 3.0, The Open Group, TOGAF, UNIX, UNIXWARE, and X logo are registered trademarks and Boundaryless Information Flow, Build with Integrity Buy with Confidence, Commercial Aviation Reference Architecture, Dependability Through Assuredness, Digital Practitioner Body of Knowledge, DPBoK, EMMM, FACE, FHIM Profile Builder, FHIM logo, FPB, Future Airborne Capability Environment, IT4IT, IT4IT logo, O-AA, O-DEF, O-HERA, O-PAS, Open Agile Architecture, Open FAIR, Open Footprint, Open Process Automation, Open Subsurface Data Universe, Open Trusted Technology Provider, Sensor Integration Simplified, SOSA, and SOSA logo are trademarks of The Open Group.

Archi is a registered trademark of Phillip Beauvoir.

Business Model Canvas is a trademark of Alexander Osterwalder.

CDA, FHIR, and HL7 are registered trademarks of Health Level Seven International.

DICOM is a registered trademark of the National Electrical Manufacturers Association (NEMA).

Google Translate and YouTube are trademarks of GOOGLE LLC.

Microsoft and Excel are a registered trademarks of Microsoft.

LOINC is a registered trademark of Regenstrief Institute, Inc.

RxNorm is a registered trademark of the National Library of Medicine.

SNOMED CT is a registered trademark of the International Health Terminology Standards Development Organisation (IHTSDO).

All other brands, company, and product names are used for identification purposes only and may be trademarks that are the sole property of their respective owners.

Acknowledgements

(Please note affiliations were current at the time of approval.)

The Open Group gratefully acknowledges the contributions of the following people in the development of this document:

- Chimeless Baltcha, Gainwell Technologies
- Peter Beijer, Digital Architects NetWork, formerly DXC
- Laura Hugill Belken, Belken Consulting, formerly Mayo
- Tony Black – Kyndryl
- Alec Blair, Alberta Health Services
- Antje Derksen, Nictiz
- David Gordon, NHS, University Hospitals of Leicester, formerly Leeds Teaching Hospitals
- Jim Griffith, NTT Data Services
- Jan-Joost van Walsum, University Medical Center Groningen
- Oliver Kipf, Boehringer Ingelheim, formerly Philips
- Alvin Marcello, MD, UP Manila National Telehealth Center and AeHIN
- Gerda Meijboom, Nictiz
- Oscar Miranda, Trace3, formerly with Armis
- Kishore Ravilla, OhioHealth
- Padma Roy, DXC
- Scott Sloan, Kyndryl
- Ashley van der Toom, Philips
- Danny Williams, IBM
- Michael van der Zel, University Medical Center Groningen

The Open Group gratefully acknowledges the following members of the ZiRA Governance Board who participated in the review of this document:

- Daniel Woning, Isala
- Dennis Groen, Elisabeth-TweeSteden Ziekenhuis
- Erik Bosgra, Medisch Centrum Leeuwarden
- Koos Folkersma, Ziekenhuis Gelderse Vallei

- Michael van der Zel, University Medical Center Groningen
- Mikis van Dijk, Haaglanden MC
- Thiemo Steen, OLVG
- Niek Poppe, Nictiz

Referenced Documents

The following documents are referenced in this guide.

(Please note that the links below are good at the time of writing but cannot be guaranteed for the future.)

Adams — Bringing the Fourth Industrial Revolution to Healthcare, by Helen Sydney Adams, published by Healthcare, December 2022; refer to: https://healthcare-digital.com/technology-and-ai/bringing-the-fourth-industrial-revolution-to-healthcare

Agarwal et al. — Using a Plan-Build-Run Organizational Model to Drive IT Infrastructure Objectives, by Himanshu Agarwal, Nagendra Bommadevara, and Allen Weinberg, McKinsey Digital, December 2013; refer to: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/using-a-plan-build-run-organizational-model-to-drive-it-infrastructure-objectives

Bizzdesign — Annual Report: State of Enterprise Architecture 2023, published by Bizzdesign, 2023; refer to: https://content.bizzdesign.com/lp-state-of-enterprise-architecture-2023/p/1?utm_source=google&utm_medium=cpc&utm_term=enterprise%20architecture&utm_content=651365874436&utm_campaign=Search-Non_Brand-Collateral&gclid=Cj0KCQjw1_SkBhDwARIsANbGpFtGFBBMI9S8v3mF5jNkvGqzAbCvOSGN4-dAvDUo7t4pnbTS393QZ0EaAv0HEALw_wcB

Bossert and Van der Wildt — How Enterprise Architects Need to Evolve to Survive in a Digital World, Oliver Bossert, Niels Van der Wildt, McKinsey Digital, July 2021; refer to: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/how-enterprise-architects-need-to-evolve-to-survive-in-a-digital-world (accessed July 2023)

C220 — The TOGAF® Standard, 10th Edition, a standard of The Open Group (C220), published by The Open Group, April 2022; refer to: www.opengroup.org/library/c220

C226 — ArchiMate® 3.2 Specification (C226), published by The Open Group, October 2022; refer to: www.opengroup.org/library/c226

CMS — National Health Expenditure Data, published by Centers for Medicare & Medicaid Services (CMS), refer to: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData (accessed August 2023)

CMS — NHE Fact Sheet, published by Centers for Medicare & Medicaid Services (CMS), June 2023; refer to: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NHE-Fact-Sheet (accessed July 2023)

FAIR — FAIR Principles, published by GO FAIR; refer to: https://www.go-fair.org/fair-principles/ (accessed August 2023)