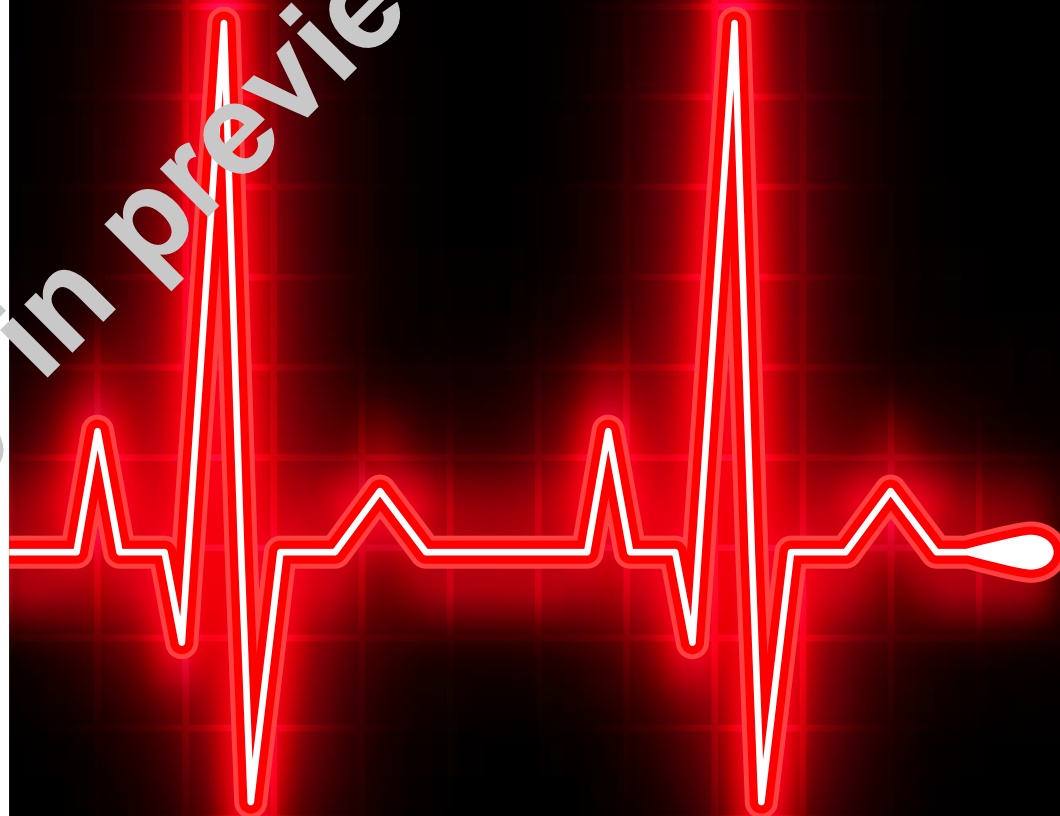


STANDARDS

an American National Standard

ANSI/BICSI 004-2018

**Information Communication
Technology Systems Design and
Implementation Best Practices
for Healthcare Institutions
and Facilities**



ANSI/BICSI 004-2018

Information Communication Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities

**Committee Approval: March 2018
ANSI Final Action: April 5, 2018
First Published: April 2018**



Currently in preview, click buy full version

BICSI International Standards

BICSI international standards contain information deemed to be of technical value to the industry and are published at the request of the originating committee. The BICSI International Standards Program subjects all of its draft standards to a rigorous public review and comment resolution process, which is a part of the full development and approval process for any BICSI international standard.

The BICSI International Standards Program reviews its standards at regular intervals. By the end of the fifth year after a standard's publication, the standard will be reaffirmed, rescinded, or revised according to the submitted standards and comments from all interested parties.

Suggestions for revision should be directed to the BICSI International Standards Program, care of BICSI.

Copyright

This BICSI document is a standard and is copyright protected. Except as permitted under the applicable laws of the user's country, neither this BICSI standard nor any extract from it may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, photocopying, recording, or otherwise, without prior written permission from BICSI being secured.

Requests for permission to reproduce this document should be addressed to BICSI.

Reproduction may be subject to royalty payments or a licensing agreement.

Violators may be prosecuted.

Published by:



BICSI
8610 Hidden River Parkway
Tampa, FL 33637-1000 USA

Copyright © 2018 BICSI
All rights reserved
Printed in U.S.A.

Notice of Disclaimer and Limitation of Liability

BICSI standards and publications are designed to serve the public interest by offering information communication and technology systems design guidelines and best practices. Existence of such standards and publications shall not in any respect preclude any member or nonmember of BICSI from manufacturing or selling products not conforming to such standards and publications, nor shall the existence of such standards and publications preclude their voluntary use, whether the standard is to be used either domestically or internationally.

By publication of this standard, BICSI takes no position respecting the validity of any patent rights or copyrights asserted in connection with any item mentioned in this standard. Additionally, BICSI does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the standard or publication. Users of this standard are expressly advised that determination of any such patent rights or copyrights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard does not purport to address all safety issues or applicable regulatory requirements associated with its use. It is the responsibility of the user of this standard to review any existing codes and other regulations recognized by the national, regional, local, and other recognized authorities having jurisdiction (AHJ) in conjunction with the use of this standard. Where differences occur, those items listed within the codes or regulations of the AHJ supersede any requirement or recommendation of this standard.

All warranties, express or implied, are disclaimed, including without limitation, any and all warranties concerning the accuracy of the contents, its fitness or appropriateness for a particular purpose or use, its merchantability and its non-infringement of any third party's intellectual property rights. BICSI expressly disclaims any and all responsibilities for the accuracy of the contents and makes no representations or warranties regarding the content's compliance with any applicable statute, rule, or regulation.

BICSI shall not be liable for any and all damages, direct or indirect, arising from or relating to any use of the contents contained herein, including without limitation any and all indirect, special, incidental, or consequential damages (including damages for loss of business, loss of profits, litigation, or the like), whether based upon breach of contract, breach of warranty, tort (including negligence, product liability or otherwise, even if advised of the possibility of such damages). The foregoing negation of damages is a fundamental element of the use of the contents hereof, and these contents would not be published by BICSI without such limitations.

TABLE OF CONTENTS

	PREFACE	xi
1	Introduction	1
1.1	General	1
1.2	Purpose	1
1.3	Categories of Criteria	1
2	Scope	1
3	Required Standards and Documents	3
4	Definitions, Acronyms, Abbreviations, and Units of Measurement	5
4.1	Definitions	5
4.2	Acronyms and Abbreviations	6
4.3	Units of Measurement	7
5	Regulatory Bodies and Regulations	9
5.1	Authorities Having Jurisdiction (AHJ's)	9
5.1.1	Centers for Medicare & Medicaid Services (CMS)	9
5.1.2	Department Of Health, Ministry Of Health	9
5.1.3	Accrediting Organizations	9
5.2	Patient Information Privacy	10
5.2.1	Health Insurance Portability and Accountability Act (HIPAA)	10
5.3	Disability Access	10
5.3.1	Americans with Disabilities Act (ADA)	10
5.3.2	Disability Discrimination Act [Australia]	10
5.4	Other Organizations	11
6	Communications Infrastructure	13
6.1	Overview	13
6.2	OSP Pathways and Spaces	13
6.2.1	Requirements	13
6.2.2	Recommendations	13
6.3	Entrance Facilities	13
6.3.1	Location	13
6.3.2	Cabling Entrance	14
6.3.3	Design Requirements	14
6.4	Equipment Rooms	14
6.4.1	Requirements	14
6.4.2	Recommendations	14
6.4.3	Additional Information	15
6.5	Telecommunications Rooms	15
6.5.1	Requirements	15
6.5.2	Recommendations	15
6.5.3	Additional Information	16
6.6	Cabling Pathways	18
6.6.1	Requirements	18
6.6.2	Recommendations	18

6.7	Work Areas	19
6.7.1	Telecommunication Outlets	19
6.7.2	Patient Care Areas	19
6.7.3	Water and Wet Areas	19
6.8	Cabling	19
6.8.1	Requirements	19
6.8.2	Recommendations	19
6.9	Transmission Performance Field Testing	19
6.9.1	Introduction	19
6.9.2	Requirements	19
6.9.3	Recommendations	19
6.10	Wireless Networks	20
6.10.1	Overview	20
6.10.2	General Design Considerations	20
6.10.3	Distributed Antenna Systems	21
6.10.4	Discrete Antenna Systems	22
6.10.5	Wireless System Grades of Service	23
6.11	Passive Optical Networks	24
7	General Design Considerations	25
7.1	Architectural	25
7.1.1	Overview	25
7.1.2	NFPA 99, Healthcare Facilities Code	25
7.1.3	FGI Guidelines	25
7.1.4	Ceilings	25
7.1.5	Patient Rooms	25
7.1.6	Controlled and Sterile Environments	26
7.2	Redundancy	27
7.2.1	Space Redundancy	27
7.2.2	Network and System Redundancy	29
7.3	Electrical Power	29
7.3.1	Overview	29
7.3.2	Power Supply Units	29
7.3.3	Uninterruptible Power Supplies	29
7.4	Security Control Frameworks	30
7.4.1	Introduction	30
7.4.2	HIPAA Security Rule	30
7.4.3	National Institute of Standards and Technology (NIST) Cybersecurity Framework	31
7.4.4	NIST Special Publication (SP) 800-53	31
7.4.5	ISO/IEC 27001:2013 and 27002:2015	32
7.4.6	Center for Internet Security (CIS) Critical Security Controls (aka “Top Twenty”)	32
8	Healthcare Systems	33
8.1	Nurse and Code Call Systems	33
8.1.1	Overview	33
8.1.2	System Architecture	33
8.1.3	Devices	34
8.1.4	Communications Interface	36
8.1.5	Wireless Nurse Call Systems	36
8.1.6	Code Call Systems	36
8.2	Connected Medical Imaging	37
8.2.1	Overview	37
8.2.2	Imaging Modalities	37
8.2.3	Imaging Infrastructure and Communication Systems	37
8.2.4	Network Bandwidth and Service Level Agreement Considerations	39

8.3	Patient Monitoring (Telemetry)	41
8.3.1	Overview	41
8.3.2	System Connections	41
8.3.3	Cabling	42
8.3.4	Power Recommendations	43
8.3.5	Monitors	43
8.3.6	Additional Information	43
8.3.7	Wireless Medical Telemetry System (WMTS).....	44
8.4	Physician Dictation	44
8.4.1	Overview	44
8.5	At-Risk Human Perimeter Systems	44
8.5.1	Overview	44
8.5.2	Infant Abduction Prevention.....	44
8.5.3	Supervised Care Elopement Prevention	45
8.6	Interactive Patient Television System	46
8.6.1	Overview	46
8.6.2	System Description.....	46
8.6.3	Design with Coaxial Cabling Systems.....	47
8.6.4	Design with Balanced Twisted-Pair Cabling Systems.....	48
8.7	Alarm Management	49
8.7.1	Overview	49
8.7.2	Devices	49
8.7.3	Design Overview	49
8.7.4	Building Automation and Management Systems	50
8.7.5	Medical Systems.....	50
8.7.6	Electronic Safety and Security (ESS) Systems	50
8.8	Emergency Medical Services Radio	50
8.8.1	Overview	50
8.8.2	Requirements	50
8.8.3	Recommendations	50
8.9	Telemedicine, Communication and Notification Suites	51
8.9.1	Telemedicine	51
8.9.2	Communication and Notification Suites	51
9	Other Information Communication Technology Systems	52
9.1	Notification Systems	52
9.1.1	Overview	52
9.1.2	System Types.....	52
9.1.3	Notification System Inputs	53
9.1.4	Connectivity Arrangements	53
9.1.5	Design Considerations	53
9.1.6	Integration	54
9.2	Intercom Systems	54
9.2.1	Overview	54
9.2.2	Components	54
9.2.3	System Types.....	55
9.2.4	Healthcare Applications	56
9.2.5	Operation	56
9.2.6	Integration.....	57
9.2.7	Wireless Intercoms	57

9.3	Sound and Acoustical Systems	57
9.3.1	Purposes of Sound Systems:	57
9.3.2	Sound Systems	57
9.3.3	Sound System Design Conditions:	58
9.3.4	Integration	58
9.3.5	Code and AHJ Requirements	58
9.4	Sound Masking/Privacy Systems	58
9.4.1	Overview	58
9.4.2	Requirements	59
9.4.3	Recommendations	59
9.5	Emergency Communication Telephone	59
9.5.1	Overview	59
9.5.2	Components	59
9.5.3	Location	59
9.6	Digital Signage and Wayfinding	59
9.6.1	Overview	59
9.6.2	Digital Displays	60
9.6.3	Usage Conditions	60
9.6.4	Design Considerations	61
9.6.5	Wayfinding Recommendations	61
9.7	Clock and Time Systems	61
9.7.1	Master Clock System	61
9.7.2	Elapsed Time Clock	62
9.7.3	Time and Attendance System	62
9.8	Electronic Safety and Security Systems	63
9.8.1	Overview	63
9.8.2	Requirements	63
9.9	Radio Frequency Identification (RFID)-Based System	63
9.9.1	Overview	63
9.9.2	Retail/Asset Management	63
9.10	Real Time Locations System (RTLS)	63
9.10.1	Overview	63
9.10.2	Active vs Passive Systems	63
9.10.3	Common Methods of Transmission	64
10	Integration of Systems	65
10.1	Overview	65
10.2	Integrated Operating Rooms	65
10.2.1	Overview	65
10.2.2	Devices	65
10.2.3	Design Considerations	66
10.3	Procedure Rooms	68
10.3.1	Overview	68
10.3.2	Operational Requirements	68
10.3.3	Devices	69
10.3.4	Coordination	70
10.3.5	Procedure Room Integration	70
10.3.6	Procedure Room Pathways	70
10.3.7	Grounding	71
10.3.8	Commissioning	71
10.3.9	System Training	71

Appendix A	Infectious Control Risk Assessment (ICRA) (Informative)	73
A.1	Overview	73
A.2	Background	73
A.3	Policy	73
A.4	Products	74
A.5	Infection Control Training	74
A.6	Contractor Work Schedule	74
A.7	Storage of Building Materials	75
A.8	Protective Clothing for Contractors	75
A.9	Contractor's Access to Occupied Areas	75
A.10	Construction of Short Duration Barriers	75
A.11	Construction of Long Duration Barriers	75
A.12	Negative Pressurization of Work Zone	75
A.13	HEPA-Filtered Fan Units and HEPA-Filtered Vacuums	76
A.14	Construction in Occupied Areas	76
A.15	Enforcement	76
Appendix B	Network Security (Informative)	77
B.1	Overview	77
B.2	Risks	78
B.3	Control Measures	79
B.4	General Security Recommendations	85
B.5	Trends	87
B.6	Network Security for Facility and IT Networks	87
Appendix C	Network Design Principles (Informative)	89
C.1	Overview	89
C.2	Systems Integration and Interfacing	89
C.3	Scalability	89
C.4	Resource Sharing	89
C.5	Reliability	90
C.6	Resiliency	90
C.7	Standardization	91
C.8	Network Management and Administration	91
C.9	Bandwidth and Quality of Service (QoS)	91
C.10	Intelligence to the Edge Devices	92
Appendix D	Related Documents (Informative)	93

This page intentionally left blank

INDEX OF FIGURES

Section 6	Communications Infrastructure	
Figure 6-1	Typical TR Layout	17
Figure 6-2	Typical Healthcare TR	17
Figure 6-3	Typical Healthcare TR (Split Rooms)	18
Section 7	General Design Considerations	
Figure 7-1	Redundancy Examples for ICT Spaces and Cabling Backbone	28
Section 8	Healthcare Systems	
Figure 8-1	Main PACS Functions	38
Figure 8-2	Example of a Stand-Alone Patient Monitoring Station	42
Figure 8-3	Example Interactive Patient Television System Infrastructure	47
Figure 8-4	Broadband Video Distribution Over Balanced Twisted-Pair Cabling	48
Appendix B	Network Security (Informative)	
Figure B-1	Stand-Alone Network	80
Figure B-2	Enterprise Network	81
Figure B-3	Example of Security Zones	82
Figure B-4	Example of Facility & IT Network Topology	88

INDEX OF TABLES

Section 6	Communications Infrastructure	
Table 6-1	Example of Applied Service Grades	23
Table 6-2	Service Assurance Requirements	24
Section 8	Healthcare Systems	
Table 8-1	Typical Study Size for Differing Image Modalities	40
Table 8-2	Example Transmission Times of Image Modalities for Differing Transmission Technologies	40
Table 8-3	Example of Study Size and Expected Annual Load	41

This page intentionally left blank

PREFACE

Revision History

- December 4, 2012** First publication of this standard, titled BICSI 004-2012, *Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities*
- April 12, 2013** Published as an American National Standard, with the designation of ANSI/BICSI 004-2012
- April 25, 2018** Revision of ANSI/BICSI 004-2012, retitled and published as ANSI/BICSI 004-2018, *Information Communication Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities*

Major revisions include:

- Expansion of Section 5, *Regulatory Bodies and Regulations*
- Expansion of content for communication and ICT infrastructure
- Expansion of content for wireless systems
- Addition of passive optical networks
- Expansion of content for architectural aspects of healthcare facilities
- Addition of content for telemedicine and communication suites
- Content revision for notification and intercom systems
- Addition of content for emergency medical services radio, sound and acoustical systems, sound masking, and digital signage and wayfinding
- Addition of Appendix B, *Network Security*
- Addition of Appendix C, *Network Design Principles*

Minor revisions include:

- Restructure of former Sections 1-8 with relevant content relocated into the new structure
- Added content for electrical power
- Added content for security control frameworks
- Minor revisions of healthcare systems
- Revision of real time location systems
- Other content updates and editorial corrections

Document Format (Usability Features)

This standard has the following usability features as aids to the user:

- Additions and changes, other than those for editorial purposes, are indicated with a vertical rule within the left page margin.
- Deletion of one or more paragraphs within unrevised content is indicated with a bullet (•).