

DIN SPEC 16593-1:2018-04 (E)

RM-SA - Reference Model for Industrie 4.0 Service Architectures - Part 1: Basic Concepts of an Interaction-based Architecture; Text in English

Inhalt	Seite
Foreword	4
Introduction.....	6
1 Scope.....	8
1.1 RAMI4.0 dimensions.....	8
1.2 SOA reference models.....	9
1.3 Value chains	10
2 Normative references	10
3 Terms and definitions.....	11
4 Symbols and abbreviated terms	14
5 Architectural foundation	15
6 Reference Models for Service-oriented Architecture	16
6.1 Overview	16
6.2 ISO/IEC 10746-1:1998 reference model for open distributed processing.....	16
6.3 OASIS Reference Model for Service-oriented Architectures	17
7 Conceptual interaction model.....	19
7.1 General.....	19
7.2 Basic considerations	20
7.2.1 Object worlds.....	20
7.2.2 Systems and components.....	20
7.2.3 Intra-component view: behavior, states, procedures and change events.....	22
7.2.4 Extra-component view: signal events, call events and interfaces	24
7.2.5 Inter-component view: primitives and notifications.....	25
7.2.6 Inter-component view: interactions, interaction patterns and interaction policies.....	25
7.3 Service.....	28
7.3.1 Definition	28
7.3.2 Service types	29
7.3.3 Infrastructure services.....	30
7.3.4 Interaction-based services	31
8 Characterization of interactions.....	36
8.1 Classification of interactions	36
8.1.1 General.....	36
8.1.2 Determinism	36
8.1.3 Synchronicity	36
8.1.4 State handling.....	36
8.2 Interaction patterns	37
8.2.1 General.....	37
8.2.2 Unicast	37
8.2.3 Multicast.....	38
8.2.4 Request-response.....	39
8.2.5 Multicast request-response	40
8.2.6 Use and observation.....	41
8.2.7 Publish-find-bind-execute	42
8.3 Characterization of interaction classes.....	43

9	Compliance	44
	Annex A (informative) Terminological Service Discussion	45
	Annex B (informative) Mapping examples to OPC UA	46
B.1	General	46
B.2	OPC UA read service	46
B.3	OPC UA PublishRequest	47
	Bibliography	48

Figures

	Figure 1 — RAMI4.0 dimensions and I4.0 component abstraction	8
	Figure 2 — Reference models enable architecture specifications	9
	Figure 3 — Influencing Factors of the RM-SA	15
	Figure 4 — Concepts of OASIS SOA reference model	17
	Figure 5 — IBA Conceptual interaction model	19
	Figure 6 — RM-SA system model	20
	Figure 7 — Component and its associated object worlds (derived from DIN SPEC 91345:2016-04, Figure 1) (left-hand side complete, right-hand side restricted for simplification reasons)	21
	Figure 8 — Graphic representation of a UML state machine diagram (example)	23
	Figure 9 — Projection of the functionality (in terms of procedures) and states of a component	24
	Figure 10 — Exchange of primitives and notifications between components	25
	Figure 11 — Interaction policies and domains	27
	Figure 12 — Service types in an Industrie 4.0 System	29
	Figure 13 — Mapping of interaction-based services to infrastructure services	30
	Figure 14 — Infrastructure services according to ISO/IEC 7498-1:1994 OSI Model	31
	Figure 15 — Spectrum of architectural styles of interaction-based services	32
	Figure 16 — Functional services as remote operations	33
	Figure 17 — Procedure-based interaction mapped to infrastructure services (note: illustration restricted to a procedure call)	34
	Figure 18 — State machine-based interaction mapped to infrastructure services	35
	Figure 19 — Interaction pattern “unicast”	37
	Figure 20 — Interaction pattern “multicast”	38
	Figure 21 — Interaction pattern “request-response”	39
	Figure 22 — Interaction pattern “multicast request-response”	40
	Figure 23 — Interaction pattern “use and observation”	41
	Figure 24 — Interaction pattern “publish - find - bind - execute”	42
	Figure B.1 — OPC UA Read Service	46
	Figure B.2 — OPC UA PublishRequest	47