

# ISO/IEC 20237:2023-10 (E)

## Information technology - Sparkplug® version 3.0

---

Contents	Page
1. Introduction.....	2
1.1. Rationale and Use Case .....	2
1.1.1. Define an MQTT Topic Namespace.....	2
1.1.2. Define MQTT State Management.....	2
1.1.3. Define the MQTT Payload.....	2
1.1.4. Background .....	3
1.2. Intellectual Property Rights .....	4
1.2.1. Disclaimers .....	4
1.3. Organization of the Sparkplug Specification.....	4
1.4. Terminology.....	5
1.4.1. Infrastructure Components .....	5
1.5. Normative References .....	8
1.6. Consolidated List of Normative Statements .....	9
1.7. Security .....	9
1.7.1. Authentication.....	9
1.7.2. Authorization.....	9
1.7.3. Encryption .....	9
1.8. Normative Keywords .....	10
1.9. Leveraging Standards and Open Source .....	10
2. Principles.....	10
2.1. Pub/Sub.....	10
2.2. Report by Exception .....	10
2.3. Continuous Session Awareness .....	11
2.4. Birth and Death Certificates.....	11
2.5. Persistent vs Non-Persistent Connections for Edge Nodes.....	12
3. Sparkplug Architecture and Infrastructure Components.....	12
3.1. MQTT Server(s).....	13
3.2. MQTT Edge Node.....	13
3.3. Device/Sensor.....	14
3.4. MQTT Enabled Device (Sparkplug).....	14
3.5. Primary Host Application.....	14
3.6. Sparkplug Host Application.....	14
4. Topics and Messages.....	14

4.1.	Topic Namespace Elements.....	15
4.1.1.	namespace Element.....	15
4.1.2.	group_id Element.....	15
4.1.3.	message_type Element.....	15
4.1.4.	edge_node_id Element.....	16
4.1.5.	device_id Element.....	16
4.2.	Message Types and Contents.....	17
4.2.1.	Edge Node.....	17
4.2.2.	Device/Sensor.....	21
4.2.3.	Birth Certificate Message (STATE).....	24
4.2.4.	Death Certificate Message (STATE).....	25
5.	Operational Behavior.....	26
5.1.	Timestamps in Sparkplug.....	26
5.2.	Case Sensitivity in Sparkplug.....	26
5.3.	Host Application Session Establishment.....	27
5.4.	Edge Node Session Establishment.....	30
5.5.	Edge Node Session Termination.....	34
5.6.	Device Session Establishment.....	36
5.7.	Device Session Termination.....	39
5.8.	Sparkplug Host Applications.....	40
5.9.	Sparkplug Host Application Message Ordering.....	40
5.10.	Primary Host Application STATE in Multiple MQTT Server Topologies.....	41
5.11.	Edge Node NDATA and NCMD Messages.....	43
5.12.	MQTT Enabled Device Session Establishment.....	46
5.13.	Sparkplug Host Application Session Establishment.....	46
5.14.	Sparkplug Host Application Session Termination.....	47
5.15.	Sparkplug Host Application Receive Data.....	48
5.16.	Data Publish.....	49
5.17.	Commands.....	50
6.	Payloads.....	52
6.1.	Overview.....	52
6.2.	Google Protocol Buffers.....	53
6.3.	Sparkplug A MQTT Payload Definition.....	53
6.4.	Sparkplug B MQTT Payload Definition.....	53
6.4.1.	Google Protocol Buffer Schema.....	54
6.4.2.	Payload Metric Naming Convention.....	59
6.4.3.	Sparkplug B v1.0 Payload Components.....	60
6.4.4.	Payload Component Definitions.....	60
6.4.5.	Payload.....	60
6.4.6.	Metric.....	61

6.4.7.	MetaData.....	64
6.4.8.	PropertySet.....	64
6.4.9.	PropertyValue .....	65
6.4.10.	PropertySetList.....	66
6.4.11.	DataSet.....	66
6.4.12.	DataSet.Row .....	67
6.4.13.	DataSet.DataSetValue.....	67
6.4.14.	Template.....	68
6.4.15.	Template.Parameter .....	70
6.4.16.	Data Types .....	71
6.4.17.	Datatype Details .....	72
6.4.18.	Payload Representation on Host Applications .....	77
6.4.19.	NBIRTH .....	78
6.4.20.	DBIRTH.....	80
6.4.21.	NDATA.....	83
6.4.22.	DDATA.....	84
6.4.23.	NCMD .....	85
6.4.24.	DCMD .....	86
6.4.25.	NDEATH.....	87
6.4.26.	DDEATH.....	89
6.4.27.	STATE.....	89
7.	Security.....	90
7.1.	TLS.....	90
7.2.	Authentication .....	91
7.3.	Authorization .....	91
7.4.	Implementation Notes.....	91
7.4.1.	Underlying MQTT Security.....	91
7.4.2.	Encrypted Sockets .....	91
7.4.3.	Access Control Lists .....	91
8.	High Availability .....	92
8.1.	High Availability for MQTT Servers .....	92
8.1.1.	MQTT Server HA Clustering (non-normative).....	93
8.1.2.	High Availability Cluster .....	93
8.1.3.	High Availability Cluster with Load Balancer .....	94
8.2.	Multiple Isolated MQTT Servers (non-normative).....	94
9.	Acknowledgements .....	96
10.	Conformance .....	97

10.1.	Conformance Profiles .....	97
10.1.1.	Sparkplug Edge Node .....	97
10.1.2.	Sparkplug Host Application .....	97
10.1.3.	Sparkplug Compliant MQTT Server.....	98
10.1.4.	Sparkplug Aware MQTT Server.....	98
11.	Appendix A: Open Source Software (non-normative).....	99
11.1.	OASIS MQTT Specifications .....	99
11.2.	Eclipse Foundation IoT Resources.....	100
11.3.	Eclipse Paho .....	100
11.4.	Google Protocol Buffers.....	100
11.5.	Eclipse Kura Google Protocol Buffer Schema.....	100
11.6.	Raspberry Pi Hardware.....	100
12.	Appendix B: List of Normative Statements (non-normative).....	100
12.1.	Host Applications.....	100
12.2.	Sparkplug Identifiers.....	101
12.3.	Report by Exception .....	101
12.4.	Birth and Death Certificates .....	101
12.5.	Persistent vs Non-Persistent Connections for Edge Nodes.....	101
12.6.	Sparkplug Host Application.....	101
12.7.	Topic Namespace Elements.....	101
12.8.	namespace Element.....	102
12.9.	group_id Element.....	102
12.10.	edge_node_id Element .....	102
12.11.	device_id Element.....	102
12.12.	Topic (NBIRTH).....	102
12.13.	Payload (NBIRTH).....	102
12.14.	Topic (NDATA).....	103
12.15.	Payload (NDATA).....	103
12.16.	Topic (NDEATH).....	103
12.17.	Payload (NDEATH).....	104
12.18.	Topic (NCMD).....	104
12.19.	Payload (NCMD).....	104
12.20.	Topic (DBIRTH).....	104
12.21.	Payload (DBIRTH) .....	104
12.22.	Topic (DDATA).....	105
12.23.	Payload (DDATA).....	105
12.24.	Topic (DDEATH).....	105

12.25.	Payload (DDEATH).....	105
12.26.	Topic DCMD).....	105
12.27.	Payload (DCMD).....	105
12.28.	Birth Certificate Message (STATE) .....	106
12.29.	Birth Certificate Topic (STATE).....	106
12.30.	Birth Certificate Payload (STATE) .....	106
12.31.	Death Certificate Message (STATE) .....	106
12.32.	Death Certificate Topic (STATE) .....	106
12.33.	Death Certificate Payload (STATE).....	106
12.34.	Case Sensitivity in Sparkplug.....	107
12.35.	Host Application Session Establishment.....	107
12.36.	Edge Node Session Establishment.....	108
12.37.	Edge Node Session Termination.....	109
12.38.	Device Session Establishment .....	110
12.39.	Device Session Termination .....	111
12.40.	Sparkplug Host Application Message Ordering.....	111
12.41.	Primary Host Application STATE in Multiple MQTT Server Topologies .....	112
12.42.	Sparkplug Host Application Session Establishment.....	112
12.43.	Sparkplug Host Application Session Termination .....	113
12.44.	Data Publish .....	113
12.45.	Commands .....	114
12.46.	Payload.....	115
12.47.	Metric.....	115
12.48.	PropertySet .....	116
12.49.	PropertyValue .....	116
12.50.	Quality Codes.....	116
12.51.	DataSet .....	116
12.52.	DataSet.DataSetValue.....	117
12.53.	Template.....	117
12.54.	Template.Parameter .....	118
12.55.	NBIRTH .....	118
12.56.	DBIRTH .....	119
12.57.	NDATA.....	119
12.58.	DDATA.....	120
12.59.	NCMD .....	120
12.60.	DCMD .....	120
12.61.	NDEATH.....	120

12.62.	DDEATH .....	121
12.63.	STATE .....	121
12.64.	Sparkplug Host Application.....	122
12.65.	Sparkplug Compliant MQTT Server .....	122
12.66.	Sparkplug Aware MQTT Server .....	122