

**AJM-3122 – Enterprise Product Support
Schema Description Document
For
Enterprise Service Monitor (ESM)**



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1. Preamble: Health Model

In reporting the health of a Business Service, it is important to employ the concept of a health model. This model defines what characterizes a service as either healthy (operating normally) or unhealthy (operating abnormally). While ESM facilitates the reporting of this health status, it does **NOT** define the health model for a business service. It is required that each SIP that is implementing ESM status messaging defines their own health model, and bases the reporting requirements on that model. ESM will aggregate, correlate, and display health data received from SIPs, but it is beyond the scope of ESM to dictate what constitutes a healthy versus an unhealthy state or the events that will trigger reporting of health status.

2. ESM Status Event Messages

Status Event Messages are derived from the WSDM ManagementEvent definition. As such, an ESM Status Event Message must contain the elements of the ManagementEvent Global Element Declaration. The Situation Element must be present as a child of the ManagementEvent element.

Status events are asynchronous notifications which may indicate a significant change in the state of a monitored resource, or may simply be a heartbeat to indicate general system health. These messages have a defined format as specified by ESM, and include the following properties:

- EventID
- Information regarding the source of the event
- The reporter of the event
- A message about what happened to the resource
- Date and time of the event

Notification messages will contain additional information specific to the event. For example, a StateTransition event will include the following properties:

- Time
- TransitionIdentifier
- EnteredState
- PreviousState

3. XML Representation of the event

The status event message must contain the following elements:

```

<xs:element name="MsgType" type="xs:string" />
<xs:element name="ReportTime" type="xs:dateTime" />
<xs:element name="EventID" type="xs:string" />
<xs:element name="SendTo" type="xs:string" />

<xs:element name="ReporterComponent" type="esm:ResourceIdType" />
<xs:element name="SourceComponent" type="esm:ResourceIdType" />

<xs:element name="OperationalState" type="esm:StateType" />
<xs:element name="LastOperationalStateTransition"
  type="esm:StateTransitionType" minOccurs="0" maxOccurs="1" />

<xs:element name="BusinessServiceOperationalStatus"
  type="esm:OperationalStatusType" />

<xs:element name="SituationReport" type="esm:SituationType" />

<xs:element name="EndpointReport" type="esm:EndpointReportType"
  minOccurs="0" maxOccurs="1" />

```

Table 1 ESM Message Types

Message Type	Description
StatusEventMessage	Provides a notification of the status of a monitored resource. This status may be that a significant change in the state of a monitored resource has occurred, or may simply be a heartbeat message. The exact situation that caused the message to be published is detailed in the SituationCategory element.

Table 2 StatusEventMessage Format

Element	Description	Required / Optional
MsgType	String indicating the type of the message. Default is 'SE' for ESM Status Event messages. Other message types may be introduced in the future, however this designator is required and is the only	Required

	valid value for the initial implementation of ESM.	
Report Time	Date and Time in UTC of the message generation	Required
EventId	String uniquely identifying the message	Required
SendTo	Text description of authorized recipients of the message	Optional
Reporter Component	Identifying information about the source of the message (the reporter)	Required
Source Component	Identifying information about the source of the event (the component being reported on)	Required
Operational State	The current operational state of the component being reported on	Required
Last Operational State Transition	Information about the last operational state transition (for example, a report on when component last transitioned from DOWN to UP)	Optional
Business Service Operational Status	The current operational status of the business service	Required
Situation Report	Details regarding the current situation being reported on	Required
Endpoint Report	Details on the subcomponents of the business service or source component, including status and metrics	Optional

4. Representation of Identity

The Identity property establishes whether two entities are the same. This is a required element and it must be provided in every message by every monitored resource. The following constraints are applicable to ResourceId:

- 1) Globally unique: A monitored endpoint must create the ResourceId in a way that ensures that the ResourceId is unique to the resource being monitored.
- 2) Uniqueness in time: A ResourceId cannot be used for a different monitored endpoint, even if the original target of the ResourceId no longer exists or is no longer being monitored.
- 3) Consistency across endpoints: An implementation of a monitored endpoint should use a ResourceID that is suggested by the characteristics of a resource.
- 4) Persistence: A monitored endpoint should retain the same ResourceID during the entire lifetime of the endpoint.

- 5) Equality: If two reported ResourceIds are equal, then the ESM consumer will correlate those reported ResourceIds as belonging to the same monitored endpoint.

SAMPLE SCHEMA

```
<xsd:complexType name="ResourceIdType">
  <xsd:sequence>
    <xsd:element name="SystemID" type="xs:string"/>
    <xsd:element name="LocID" type="xs:string"/>
  </xsd:sequence>
</xsd:complexType>
```

5. Representation of Situation

SituationCategory

Required: categorizes the type of the situation that caused the event message. The permissible values represent the names of elements in the ESM namespace. The categories are listed in the order of precedence. In a case where there may be some ambiguity about which category to use, the higher precedent category SHOULD be used. The use of a higher precedent category permits more effective and timely correlation and analysis of events that may indicate the presence of a serious problem. This is a required element.

- AvailabilitySituation – deals with situations regarding operational state and availability. Examples of situations of this nature include:
 - Performance related – some event occurred that does not fall into another category that has affected performance in some way.
 - Exception related – some exception occurred that is not covered by another category
- ConfigurationSituation – deals with components identifying configuration changes. Any changes a component makes to its configuration should be logged using this category. This category includes Security related events generated when some security issue has been detected
- StopSituation – deals with the shutdown process for a component. Messages that indicate a component has begun to stop, has stopped, or that stopping has failed all fall into this category.
- StartSituation – deals with the startup process of a component. Messages that indicate that a component has begun the startup process, that it has finished the startup process, or that it has aborted startup fall into this category.
- ConnectSituation – deals with the situations related to aspects about a connection attempt from one component to another. Messages that say a connection failed, that a connection was created, or that a connection was terminated fall into this category.
- ReportSituation – deals with situations that occur as a result of some setting or occurrence that causes the resource to report various types of data. Situations of this nature are considered informational only, and as such this situation category should not be used for any events that an operator should be alerted to. Examples of this situation are:
 - Heartbeat related – the resource has been configured to periodically report a heartbeat
 - Status related – some change of status that does not affect availability or capability of the resource has been detected.

- Log related – the resource has been configured to generate a log entry based on some event or at a fixed interval. This category identifies this event as a requested log entry.

SituationTime

Required: represents the date and time of the event.

Priority

Optional: Represents the importance of an event. Predefined priorities are:

- Low (10)
- Medium (50)
- High (70)

Other priorities may be used but **MUST NOT** be less than 0 or greater than 100.

Severity

Required: Represents the perceived severity of the status the event is describing. Severity levels are based upon the DMTF CIM Alert Indications Perceived Severity, and are defined as follows:

- 6 (Fatal): a condition is unrecoverable and the service is no longer available.
- 5 (Critical): a condition affecting the service has occurred. Immediate corrective action is required.
- 4 (Major): a problem of relatively high severity has occurred. It is likely that normal use of the service is impeded.
- 3 (Minor): a problem of relatively low severity has occurred. It is unlikely that normal use of the service is impeded.
- 2 (Warning): a problem affecting the service may occur. Diagnostic and corrective action is recommended.
- 1 (Information): a message output considered as normal and expected. For example, a process begins, a process finishes, or status information is displayed.

Message

Optional: represents the text associated with the event. This should be a human readable description of the event.

6. Representation of Operational States

A state is a representation of top level state. The WSDM specification does not define a state model, rather the specification is of the mechanism used to relay the state category in XML. The specification is as follows:

```
<xsd:simpleType name="StateType">  
  <xsd:restriction base="xsd:string">  
    <xsd:enumeration value="Available" />  
    <xsd:enumeration value="Degraded" />  
    <xsd:enumeration value="Jeopardy" />  
    <xsd:enumeration value="Failed" />  
    <xsd:enumeration value="Unavailable" />  
    <xsd:enumeration value="Maintenance" />  
    <xsd:enumeration value="Unknown" />  
  </xsd:restriction>  
</xsd:simpleType>
```

```
</xsd:restriction>  
</xsd:simpleType>
```

The esm:StateType type is used to declare an XML element containing an instance of state. A state MUST be declared as follows:

- An XML element declaring which QName identifies the semantics of the state.
- The XML element has an XML Schema type of esm:StateType.
- The contents of the XML element MUST be one of the predefined states.

As an example, if a Status Event is used to indicate that a Business Service is in the “Failed” state, and was previously in the “Jeopardy” state, then the following would accurately represent an instance of the state transition:

```
<LastOperationalStateTransition Time="2016-10-01T10:04:37Z">  
  <EnteredState>Failed</EnteredState>  
  <PreviousState>Jeopardy</PreviousState>  
</LastOperationalStateTransition>
```

The reporting of operational state consists of the following:

- 1) CurrentOperationalState (mandatory)
- 2) LastOperationalStateTransition (optional)

SCHEMA SAMPLE

```
<xsd:simpleType name="StateType">  
  <xsd:restriction base="xsd:string">  
    <xsd:enumeration value="Available" />  
    <xsd:enumeration value="Degraded" />  
    <xsd:enumeration value="Jeopardy" />  
    <xsd:enumeration value="Failed" />  
    <xsd:enumeration value="Unavailable" />  
    <xsd:enumeration value="Maintenance" />  
    <xsd:enumeration value="Unknown" />  
  </xsd:restriction>  
</xsd:simpleType>
```

```
**      Operational State Properties      **  
<xsd:element name="OperationalState" type="esm:StateType" />  
<xsd:element name="LastOperationalStateTransition"  
  type="esm:StateTransitionType" minOccurs="0" maxOccurs="1" />
```

7. Representation of Operational Status

Operational Status is reported as State Type at the Business Service level. Individual components of the Business Service may be unavailable without impacting the availability of the Business Service as a whole. The Web Service Lifecycle (WSLC) states defined by the W3C Web Services Architecture Management Task Force map to the ESM State values as follows:

Table 3 Property: OperationalStatus

Property Value	Description	Corresponding WSLC State
Available	This value indicates that a monitored resource is operating normally within any configured operating parameters, and is able to perform all functional tasks.	WSLC UP and sub-states
Degraded	This value indicates that a monitored resource is operating, but outside of configured operating parameters. A monitored resource reporting this operational status is able to perform some, but not all, functional tasks.	WSLC DOWN sub-state SATURATED
Jeopardy	This value indicates that a monitored resource is operating, but is danger of becoming non-operational.	WSLC DOWN sub-state SATURATED
Failed	This value indicates that a monitored resource is not operating, and is not able to perform any functional tasks. A monitored resource reporting this status is unavailable do to an error or problem, and was not intentionally terminated.	WSLC DOWN and all sub-states other than SATURATED
Unavailable	This value indicates that a monitored resource is not operating, and is not able	WSLC DOWN and all sub-states other than

	to perform any functional tasks. A monitored resource may have stopped intentionally, or may have failed.	SATURATED
Maintenance	This value indicates that a monitored resource is not operating, and is not able to perform any functional tasks. A monitored resource reporting this status is unavailable do to a scheduled maintenance event and was terminated intentionally.	WSLC DOWN and all sub-states other than SATURATED
Unknown	This value indicates that a monitored resource is unable to report status at this time.	N/A

SAMPLE SCHEMA

```
<xsd:element name="BusinessServiceOperationalStatus" type="esm:StateType" />
```

8. Representation of Endpoints

Endpoint reporting is optional, and the decision to provide endpoint data as well as the granularity of the data is at the discretion of the ESM implementing SIP (E-SIP). In the reporting hierarchy, this corresponds to the lowest level of reporting deconstruction. In a Status Event message, one or more metrics may be reported for a given endpoint. In relation to a Business Service, an Endpoint is the lowest level component that can be derived from the service topology from a status reporting perspective. The ESM Schema implements a limit of 500 endpoints for each Status Event message.

SAMPLE SCHEMA

```
<xsd:complexType name="EndpointType">
  <xsd:sequence>
    <xsd:element name="Component" type="esm:ResourceIdType" />
    <xsd:element name="Status" type="esm:StateType" />
    <xsd:element name="Metric" type="esm:MetricType"
      minOccurs="0" maxOccurs="500" />
  </xsd:sequence>
</xsd:complexType>
```

```
<xsd:complexType name="EndpointReportType">
  <xsd:sequence>
```

```

<xsd:element name="Endpoint" type="esm:EndpointType"
  minOccurs="0" maxOccurs="500" />
</xsd:sequence>
</xsd:complexType>

```

9. Representation of Metrics

Metrics reporting is optional, and the decision to provide metrics as well as the granularity of the data is at the discretion of the ESM implementing SIP (E-SIP). If reported, metrics are reported at the endpoint level. In the reporting hierarchy, this corresponds to the lowest level of reporting deconstruction. In a Status Event message, one or more metrics may be reported for a given endpoint. The schema limits the number of metrics reported for a given endpoint to 500. The following guideline outlines the reporting of metrics as part of the ESM status message.

The following schema fragment declares the (reusable) data type used to expose the metrics of a resource. All attributes defined in the esm:MetricAttributes attribute group are OPTIONAL.

SAMPLE SCHEMA

```

<xsd:attributeGroup name="MetricAttributes">
<xsd:attribute name="ResetAt" type="xsd:dateTime" />
<xsd:attribute name="LastUpdated" type="xsd:dateTime" />
<xsd:attribute name="Duration" type="xsd:duration" />
</xsd:attributeGroup>

<xsd:complexType name="MetricType">
  <xsd:sequence>
    <xsd:element name="Name" type="xsd:string" />
    <xsd:element name="Value" type="xsd:string" />
  </xsd:sequence>
  <xsd:attributeGroup ref="esm:MetricAttributes" />
</xsd:complexType>

```

Attribute	Description
ResetAt	Indicates the time when a metric value was reset. Time values MUST be reported as UTC.
LastUpdate	Indicates the last update time of a metric value. Time values MUST be reported as UTC.
Duration	Indicates the measurement period relative to the value of the LastUpdated metric attribute. This is the time over which a metric value was collected, counted, or measured. This attribute

	is only valid for metrics covered by a time interval.
--	---

10. Example: ESM Status Message

Note: In this example, STDDS-ISMC is the reporter of the event. STDDS-TAIS is the Business Service. The TAIS Business Service is being fed by ABQ, A11, A80, and A90 Endpoints. One of the STARS links to A80 has gone down, indicating that the A80 endpoint is operating with partial availability (i.e. degraded mode). Therefore, A80 is listed as the Source Component of the event, while the ISMC located in Atlanta is listed as the Reporter Component. This message was triggered by the producer monitoring service (STDDS-ISMC) receiving notification of the link outage. In this case, the producer has chosen to provide not only the data about the outage, but also an endpoint report providing status and metrics for additional Business Service component endpoints (ABQ, A11, A80, and A90).

```
<?xml version="1.0" encoding="utf-8"?>

<StatusEventMsg xmlns="https://www.faa.gov/nextgen/programs/swim/esm" >

<!-- Message Header -->

    <MsgType>SE</MsgType>
    <ReportTime>2016-10-27T15:45:00Z</ReportTime>
    <EventID>stdds-ismc-event-id-201610271545</EventID>
    <SendTo>authorized</SendTo>

    <ReporterComponent>
        <SystemID>STDDS-ISMC</SystemID>
        <LocID>ATL</LocID>
    </ReporterComponent>

    <SourceComponent>
        <SystemID>STDDS-TAIS</SystemID>
        <LocID>A80</LocID>
    </SourceComponent>

<!-- End Message Header -->

    <OperationalState>Available</OperationalState>

    <LastOperationalStateTransition Time="2016-10-01T10:04:37Z">
        <EnteredState>Available</EnteredState>
        <PreviousState>Failed</PreviousState>
    </LastOperationalStateTransition>

    <BusinessServiceOperationalStatus>Degraded</BusinessServiceOperational
Status>

    <SituationReport>
        <SituationCategory>AvailabilitySituation</SituationCategory>
        <SituationTime>2016-10-27T15:43:00Z</SituationTime>
        <Severity>4</Severity>
```

```
<Message>The STARS feed from MGM to A80 has gone
offline.</Message>
</SituationReport>

<EndpointReport>
  <Endpoint>
    <Component>
      <SystemID>STDDS-TAIS</SystemID>
      <LocID>ABQ</LocID>
    </Component>
    <Status>Available</Status>
    <Metric ResetAt="2016-10-30T23:59:59Z" LastUpdated="2016-
10-27T15:45:00Z">
      <Name>"Messages Received"</Name>
      <Value>9375</Value>
    </Metric>
  </Endpoint>
  <Endpoint>
    <Component>
      <SystemID>STDDS-TAIS</SystemID>
      <LocID>A11</LocID>
    </Component>
    <Status>Available</Status>
    <Metric ResetAt="2016-10-30T23:59:59Z" LastUpdated="2016-
10-27T15:45:00Z" >
      <Name>"Messages Received"</Name>
      <Value>9375</Value>
    </Metric>
  </Endpoint>
  <Endpoint>
    <Component>
      <SystemID>STDDS-TAIS</SystemID>
      <LocID>A80</LocID>
    </Component>
    <Status>Degraded</Status>
    <Metric ResetAt="2016-10-30T23:59:59Z" LastUpdated="2016-
10-27T15:45:00Z" >
      <Name>"Messages Received"</Name>
      <Value>9375</Value>
    </Metric>
  </Endpoint>
</EndpointReport>

</StatusEventMsg>
```

11. ESM Schema

```
<?xml version="1.0" encoding="utf-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
            xmlns:esm="https://www.faa.gov/nextgen/programs/swim/esm"
            targetNamespace="https://www.faa.gov/nextgen/programs/swim/esm"
            elementFormDefault="qualified"
            attributeFormDefault="unqualified">

  <xsd:annotation>
    <xsd:documentation xml:lang="EN">
      This schema declares XML elements for defining a Status Event
      Message
      to be reported to the Enterprise Service Monitor.
    </xsd:documentation>
  </xsd:annotation>

  <xsd:complexType name="ResourceIdType">
    <xsd:sequence>
      <xsd:element name="SystemID" type="xsd:string"/>
      <xsd:element name="LocID" type="xsd:string"/>
    </xsd:sequence>
  </xsd:complexType>

  <xsd:complexType name="CategoryType">
    <xsd:sequence>
      <xsd:any minOccurs="0" namespace="##targetNamespace"
        processContents="strict" />
    </xsd:sequence>
  </xsd:complexType>

  <xsd:simpleType name="SituationCategoryType">
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="AvailabilitySituation" />
      <xsd:enumeration value="ConfigurationSituation" />
      <xsd:enumeration value="StopSituation" />
      <xsd:enumeration value="StartSituation" />
      <xsd:enumeration value="ConnectSituation" />
      <xsd:enumeration value="ReportSituation" />
    </xsd:restriction>
  </xsd:simpleType>

  <xsd:simpleType name="StateType">
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="Available" />
      <xsd:enumeration value="Degraded" />
      <xsd:enumeration value="Jeopardy" />
      <xsd:enumeration value="Failed" />
    </xsd:restriction>
  </xsd:simpleType>

```

```
<xsd:enumeration value="Unavailable" />
<xsd:enumeration value="Maintenance" />
<xsd:enumeration value="Unknown" />
</xsd:restriction>
</xsd:simpleType>

<xsd:complexType name="StateTransitionType">
<xsd:sequence>
  <xsd:element name="EnteredState" type="esm:StateType" />
  <xsd:element name="PreviousState" type="esm:StateType"
minOccurs="0" />
</xsd:sequence>
  <xsd:attribute name="Time" type="xsd:dateTime" use="required" />
</xsd:complexType>

<xsd:complexType name="SituationType">
  <xsd:sequence>
    <xsd:element name="SituationCategory"
type="esm:SituationCategoryType" />
    <xsd:element name="SituationTime" type="xsd:dateTime" />
    <xsd:element name="Priority" type="xsd:short" minOccurs="0" />
    <xsd:element name="Severity" type="xsd:short" />
    <xsd:element name="Message" type="xsd:string" minOccurs="0" />
  </xsd:sequence>
</xsd:complexType>

<xsd:attributeGroup name="MetricAttributes">
<xsd:attribute name="ResetAt" type="xsd:dateTime" />
<xsd:attribute name="LastUpdated" type="xsd:dateTime" />
<xsd:attribute name="Duration" type="xsd:duration" />
</xsd:attributeGroup>

<xsd:complexType name="MetricType">
  <xsd:sequence>
    <xsd:element name="Name" type="xsd:string" />
    <xsd:element name="Value" type="xsd:string" />
  </xsd:sequence>
  <xsd:attributeGroup ref="esm:MetricAttributes" />
</xsd:complexType>

<xsd:complexType name="EndpointType">
  <xsd:sequence>
    <xsd:element name="Component" type="esm:ResourceIdType" />
    <xsd:element name="Status" type="esm:StateType" />
    <xsd:element name="Metric" type="esm:MetricType"
minOccurs="0" maxOccurs="500" />
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="EndpointReportType">
```

```
<xsd:sequence>
  <xsd:element name="Endpoint" type="esm:EndpointType"
    minOccurs="0" maxOccurs="500" />
</xsd:sequence>
</xsd:complexType>

<!-- Status Event Message Definition -->

<xsd:complexType name="StatusEventType">
  <xsd:sequence>
    <xsd:element name="MsgType" type="xsd:string" />
    <xsd:element name="ReportTime" type="xsd:dateTime" />
    <xsd:element name="EventID" type="xsd:string" />
    <xsd:element name="SendTo" type="xsd:string" minOccurs="0"
maxOccurs="1" />

    <xsd:element name="ReporterComponent" type="esm:ResourceIdType"
/>
    <xsd:element name="SourceComponent" type="esm:ResourceIdType" />

    <xsd:element name="OperationalState" type="esm:StateType" />
    <xsd:element name="LastOperationalStateTransition"
type="esm:StateTransitionType" minOccurs="0" maxOccurs="1" />

    <xsd:element name="BusinessServiceOperationalStatus"
type="esm:StateType" />

    <xsd:element name="SituationReport" type="esm:SituationType" />

    <xsd:element name="EndpointReport" type="esm:EndpointReportType"
minOccurs="0" maxOccurs="1" />

  </xsd:sequence>
</xsd:complexType>

<xsd:element name="StatusEventMsg" type="esm:StatusEventType" />

</xsd:schema>
```