



## System Monitor Specification

*Confidential*

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**I-Technology Inc.**  
System Monitor Specification

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## Document Revision History

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# 1 Introduction

A System Monitor is a web application that participates in an I-Technology Inc. Central Data environment. It acts to handle System Messages and provide oversight on the operation of the components of the system.

## 1.1 Application Operation

Central Data Applications participate in a publish and subscribe regime whereby they publish data to a wider audience and subscribe to data coming from other participants. In aid of this, the application needs a Publisher object that will establish a connection with a Data Broker and transmit the data to be published.

The application also requires a Subscriber Task that establishes a socket connection to the Broker, informs it of the data types that it is subscribing to and watches the socket for any published data. When data is received, the subscriber passes it on in an inter-task queue.

The System Monitor is a Python application that stores and displays operating information.

System messages are described in Appendix A and B. Some generated by applications and subscribed to by the System Monitor. Some are generated by the System Monitor to elicit responses from applications.

The System Monitor provides a user interface to allow the user to monitor various aspects of the systems operation and to effect changes.

### 1.1.1 System Monitor Functions

The System Monitor will be a web application deployed on an Apache Tomcat server. It will perform the following functions:

1. Monitor the status of applications in the system.
2. Keep a record of and provide when required, the parameters for each application.
3. Monitor error messages from applications and generate alerts.
4. Provide debug logging information from applications.
5. Synchronize applications by acting as a Time Server.
6. Keep track of the versions of the applications running in the system.

These functions are made possible by the System Messages. Event Types (9000000.00 – 9999999.99) are reserved for System Data. These events are defined in the table below. Those relevant to the System Monitor are marked with an asterisk



## System Events

Type	Name	Issuing Event
9000000.00*	Started	Issued when an application has started
9000001.00*	Stopping	Issued when an application is shutting down
9000010.00*	Ping	Issued by the System Monitor to determine if an application is still operating.
9000011.00*	Ping Response	Response from the application being pinged.
9000020.00*	Error	Used to alert about faults an application has experienced.
9000025.00	Notice of Failure	Issued by a dependant micro-service when an expected response is not received.
9000030.00*	Status	Used to send a global message to all applications.
9000040.00*	Time	A Timestamp used to synchronize an application with other applications in the system. Issued by the System Monitor on request.
9000041.00*	Time Request	Issued by an application when it needs to synchronize with the system.
9000060.00*	Parameter Request	Issued by an application requesting it's parameters from the System Monitor
9000061.00*	Parameters	Sent by the System Monitor in response to a Parameter Request
9000080.00*	Data Definition	A Subscriber when connecting with a Broker. The System Monitor in response to a Version Request. The data will be the XML documents that describe each version of the data type in the Version Request
9000085.00	Query Report	Published by the Librarian when it receives a query

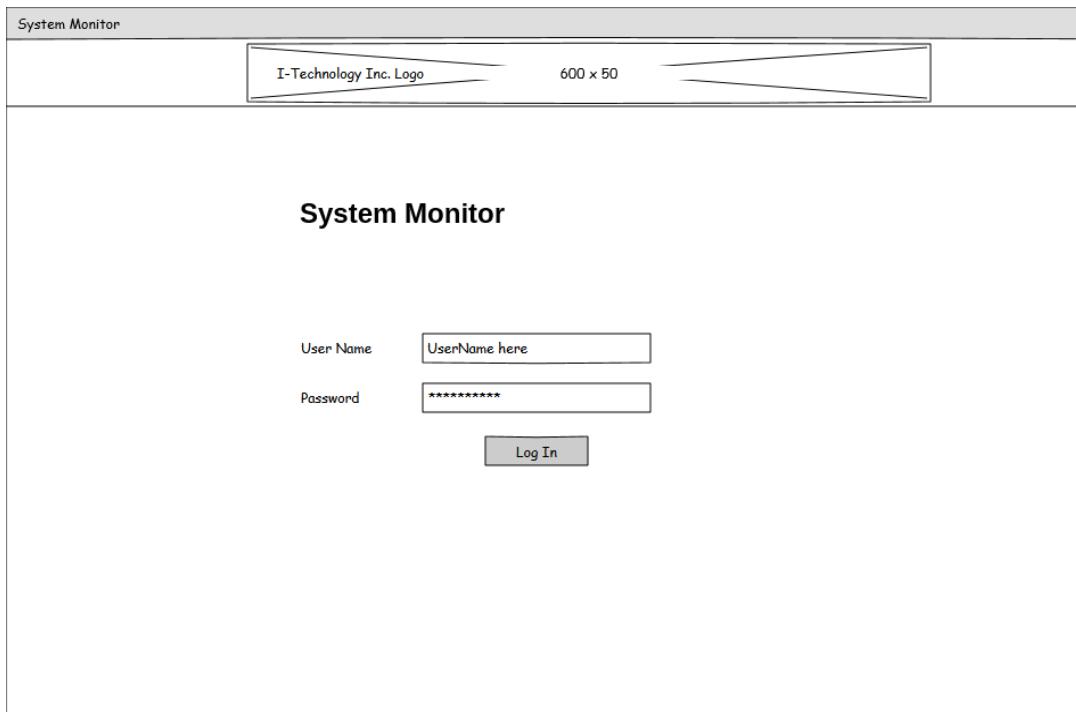
Note:

Appendix I will detail the syntax of these various messages.

### 1.1.1.1     **System Monitor Application**

#### 1.1.1.1.1     *Log On*

The Log on screen is shown in the markup below.



*Illustration 1: System Monitor Log On Screen*

#### 1.1.1.2 Devices /Applications Monitoring

Devices and Applications are handled on the Devices/Applications Screen.



Illustration 2: System Monitor Devices &amp; Applications

The screenshot shows the 'System Monitor' application window. At the top, there's a header bar with a logo placeholder ('I-Technology Inc. Logo' at 600x50 pixels), a 'File' menu, and a 'Logout' button. Below the header is a navigation bar with tabs: 'Devices/Applications', 'Error Alerts', 'Data Definitions', 'Subscriptions', and 'Parameters'. The main area is divided into three sections:

- Devices:** A grid showing door controllers. Columns include Location, Name, I.P., and Status (Stopped or Running). Data:

Location	Name	I.P.	Status
Main Office	N Door Controller	192.168.1.55	Running
Main Office	E Door Controller	192.168.1.56	Running
Main Office	W Door Controller	192.168.1.57	Stopped
- Applications:** A grid showing applications. Columns include Device, Application, Version, Status, Level, Started, and Action (Ping, Stop, Start). Data:

Device	Application	Version	Status	Level	Started	Action
N Door Controller	Door Lock	1.00	FIRE	1	2013-02-03T04:05:00-0500	Ping Stop Start
Security Controller	Glass Break Monitor	3.2	FIRE	1	2013-02-03T04:05:00-0500	Ping Stop Start
Comms Module	Phone Dialler	2.53	FIRE	1	2013-02-03T04:05:00-0500	Ping Stop Start
- Alerts:** A grid showing error messages. Columns include Type, Level, Action, Time, and Description. Data:

Type	Level	Action	Time	Description
25	Normal	2	2013-02-03T04:05:00-0500	Unable to Connect
404	Normal	2	2013-02-03T04:05:00-0500	Page not found
58	Verbose	34	2013-02-03T04:05:00-0500	No records found

**Grids:**

1. **Devices** – A table of devices compiled from deviceName and location fields in Started [9000000.00] or Ping Response [9000011.00] messages or Ping Response [9000011.00].
2. **Applications** – A table of applications compiled from deviceName and application Name fields in Started [9000000.00] or Ping Response [9000011.00] messages or Ping Response [9000011.00].
3. **Alerts** – From a table of alert messages from Error [9000020.00] messages.

**Buttons:**

1. Search – Filters the associated grid based on the contents of the text fields.
2. Ping – Publishes a Ping [9000010.00] message addressed to the device and application.
3. Ping All - Publishes a Ping [9000010.00] message addressed to the all the known devices and



applications.

4. Reset – Resets the Alerts grid filter to show only new messages.
5. Clear – Clears the Alerts grid filter. (Shows all alerts).

#### 1.1.1.3 Parameter Inventory

The Set Parameters and Get Parameters buttons on the Devices and Applications tab will handle the parameters for the selected application.

The screenshot shows the 'Parameters' tab of the System Monitor. At the top, there are search fields for 'Device' (text) and 'Application' (text), with a 'Search' button. Below these are two grids. The left grid, titled 'Parameters', has columns for 'Device', 'Application', and 'Parameters'. It contains three rows: 'Broker Server' (Broker, 12), 'Archive Server' (Archivist, 16), and 'Librarian Server' (Librarian, 12). The right grid, titled 'Key', has columns for 'Key' and 'Value'. It contains three rows: 'cassandra.host' (127.0.0.1), 'cassandra.port' (9160), and 'cassandra.keyspace' (archive). At the bottom are buttons for 'New', 'Update', and 'Delete'.

*Illustration 3: System Monitor - Parameters*

#### Grids:

1. **Parameters** – A table of parameters compiled from the fields in Parameters [9000061.00] messages.
2. **Parameter Values** – A table of parameter values compiled from the fields in Parameters [9000061.00] messages. (Linked to the table above)
3. **Alerts** – From a table of alert messages from Error [9000020.00] messages.

#### Buttons:

1. Search – Filters the associated grid based on the contents of the text fields.



2. Get Parameters – Publishes a Parameter Request [9000060.00] message addressed to the device and application.
3. Set Parameters - Publishes a Parameter Set [9000062.00] message addressed to the device and application based on the current values in the parameters and parameter values tables.
4. New – Creates a new record in the associated grid.
5. Update – Changes data in the selected row of the associated grid..
6. Delete – Deletes the selected parameter or parameter value from the associated grid.

#### 1.1.1.4 Error Reporting

A library will be provided similar to log4j. It will send all log messages defined in code by the programmer out as a system message [9000020.00]. These messages are subscribed to by the System monitor and handled by the error logger.

Errors will be handled on the Error Alerts Page.

The screenshot shows the 'System Monitor' application window. At the top, there's a placeholder for 'I-Technology Inc. Logo' with dimensions '600 x 50'. Below the menu bar ('File > Help > Logout') is a navigation bar with tabs: 'Devices/Applications', 'Error Alerts' (which is selected), 'Data Definitions', 'Subscriptions', and 'Parameters'. The main area is titled 'Error Alerts' and contains a search/filter section with fields for 'Device', 'Application', 'Type', 'Time', and dropdowns for 'Show Alerts for the last' time period (set to 10 Hrs). There are 'Reset' and 'Clear' buttons. Below this is a table of error records:

No.	Device	Application	Type	Level	Time	Action	Description	Details
1	N Door Controller	Door Lock	25	Normal	2013-02-03T04:05:00-0500	2	Unable to Connect	<input checked="" type="checkbox"/>
2	Security Controller	Glass Break Monitor	404	Normal	2013-02-03T04:05:00-0500	2	Unable to Connect	<input type="checkbox"/>
3	Comms Module	Phone Dialler	50	Warning	2013-02-02T04:05:00-0500	234	Unable to Connect	<input checked="" type="checkbox"/>

A right-click context menu is open over the third record (Comms Module). It displays two lines of text: 'Comms Module: 00-14-22-01-23-45' and 'Phone Dialler: 046b6c7f-0b8a-43b9-b35d-6489e6daee91'. A 'Close' button is at the bottom of the menu. A callout bubble points to the 'Details' column of the third record with the text: 'Dialog box launched on a right click. Shows detail of selected record'.

At the bottom of the table area are 'Clear Selected' and 'Clear All' buttons.

Illustration 4: System Monitor Error Alerts

**Grids:**

1. **Error Alerts** – From a table of alert messages from Error [9000020.00] messages.

**Buttons:**

1. Search – Filters the associated grid based on the contents of the text fields.
2. Reset – Resets the Alerts grid filter to show only new messages.
3. Clear – Clears the Alerts grid filter. (Shows all alerts).
4. Clear Selected – Clears those messages selected using the check-boxes.
5. Clear All – Clears all messages from the grid.

**1.1.1.5      *Debug/Trace Monitor***

Debug messages will be sent to the System Monitor if the application status is set to Verbose. These messages will appear on the Error Alert tab.

**1.1.1.6      *Time Server***

The System Monitor will respond to Time Request message by replying with a Time message. Systems will be time synchronized with an error proportionate to the transaction delay.

**1.1.1.7 Data Definitions**

Data Definitions are catalogued on the Data Definitions Tab.

Data Type	Name	Password	Fields
50050200.00	invoiceDetail	A5485;34	3
50050300.00	inventory	DD8957'bb	10
50050300.01	inventoryCount	DC8957.bc	11

No.	Name	Default Value
1	id	0
2	description	''
3	category	null

*Illustration 6: System Monitor - Data Definitions*

**Grids:**

1. **Data Definitions** – From a table of Data Definitions from Data Definition [9000080.00] messages.
2. **Data Definition Field Values** - From a table of Data Definition Field Values from Data Definition [9000080.00] messages. Shows those fields associated with the selected Data Definition.

**Buttons:**

1. Search – Filters the associated grid based on the contents of the text fields.
2. Delete Selected Definition – Deletes the selected data definition from the table.
3. Clear All – Clears all messages from the grid.

**1.1.1.1.8 Subscription Monitor**

Subscriptions are tracked on the Subscriptions tab.

The screenshot shows the 'System Monitor' application window. At the top, there is a header bar with the I-Technology Inc. logo and a placeholder text '600 x 50'. Below the header is a menu bar with 'File', 'Help', and 'Logout'. Underneath the menu is a navigation bar with tabs: 'Devices/Applications', 'Error Alerts', 'Data Definitions', 'Subscriptions' (which is selected and highlighted in blue), and 'Parameters'. The main content area is titled 'Subscriptions'. It contains several input fields: 'Device' (text input), 'Application' (text input), 'Date' (text input), 'Data Type' (text input), 'I.P. Address' (text input), and a 'Search' button. Below these inputs is a data grid table with the following data:

Device	Application	Date	Data Type	I.P. Address	Local Port
N Door Controller	Door Lock	2013-02-03T04:05:00-0500	50050400.00	192.168.1.56	8003
Security Controller	Glass Break Monitor	2013-02-03T04:05:00-0500	50050400.00	192.168.1.56	8003
Comms Module	Phone Dialler	2013-02-03T04:05:00-0500	50050400.00	192.168.1.56	8003

*Illustration 7: System Monitor Subscriptions Tab*

**Grids:**

1. **Subscriptions** – From a table of Subscriptions from Subscription List [9000056.00] messages received in response to System List Request [9000055.00] messages.

**Buttons:**

1. Search – Filters the associated grid based on the contents of the text fields.



## Appendix A XML Message Formats

### A 1. Publication

Each publisher is identified by its socket information (IP Address and Port). If multiple applications are deployed (on a web server for example) the developer must make each one unique by using different ports.

#### A.1.1 Publication DTD

The DTD below describes the xml for a publication:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE packet[
  <!ELEMENT packet (publisherId, metadata, dataRecord)>
  <!ELEMENT publisherId (date, ipAddr, localPortNo)>
  <!ELEMENT metadata (recordNo, type, date, status, creator, link, tenant, fieldCount)>
  <!ELEMENT recordNo (#PCDATA)>
  <!ELEMENT type (#PCDATA)>
  <!ELEMENT date (#PCDATA)>
  <!ELEMENT status (#PCDATA)>
  <!ELEMENT creator (#PCDATA)>
  <!ELEMENT link (#PCDATA)>
  <!ELEMENT tenant (#PCDATA)>
  <!ELEMENT fieldCount (#PCDATA)>
  <!ELEMENT dataRecord (field+)>
  <!ELEMENT field (fieldNo, data)>
  <!ELEMENT fieldNo (#PCDATA)>
  <!ELEMENT data (#PCDATA)>
  <!--The IP address of the source-->
  <!ELEMENT ipAddr (#PCDATA)>
  <!--The local port number of the source-->
  <!ELEMENT localPortNo (#PCDATA)>
]>
```



example:

```
<packet>
  <publisherId>
    <date> 2013-02-03T04:05:00-0500 </date>
    <ipAddr>192.168.1.68</ipAddr>
    <localPortNo>4003</localPortNo>
  </publisherId>
  <metadata>
    <recordNo>dfe010d0-e805-11e2-8ba9-68b599e2e914</recordNo>
    <type>50050200.00</type>
    <date>2011-02-03T04:05:00-0500</date>
    <status>0</status>
    <creator>"DemoUser"</creator>
    <link>0</link>
    <tenant>5</tenant>
    <fieldCount>3</fieldCount>
  </metadata>
  <dataRecord>
    <field>
      <fieldNo>1</fieldNo>
      <data>"12345"</data>
    </field>
    <field>
      <fieldNo>2</fieldNo>
      <data>"Smith"</data>
    </field>
    <field>
      <fieldNo>3</fieldNo>
      <data>"Robert"</data>
    </field>
  </dataRecord>
</packet>
```

## Appendix B Librarian Queries

The following example details a query to the Librarian.

```
<9000010.00>          # Query for data records of type 9000010.00
<0>                  # Query for all records in the Archive
```

Proposal:

```
<applicationId>
<applicationName>
<deviceId><
deviceName>
<userName>
```



<tenantId>  
<74beb9bf-b314-458f-bdbe-bc5e2dfede28>



## Appendix C System Data Messages

System Data Messages are created in the same format as Publications which are detailed in Section 1 above. The tables below detail the fields in the various System Data Messages. The identity of an application will be determined using two fields:

1. The MAC address of the application's host
2. A UUID generated by the application developer that will uniquely identify the application

The application may have several implementations on different machines and a web server may host several applications.

### C.1.1 Started [9000000.00]

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	deviceName	String	Device name
3	location	String	Device Location
4	applicationID	byte(16)	UUID assigned by developer
5	applicationName	String	The name of the application
6	StartTime	Timestamp	Local Start Date/Time
7	Subscriptions	String	List of records subscribed to
8	Publications	String	List of records published
9	pid	Integer	The Process ID

### C.1.2 Stopping [9000001.00]

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	deviceName	String	Device name
3	Location	String	Device Location
4	applicationID	byte(16)	UUID assigned by developer
5	applicationName	String	The name of the application
6	stopTime	Timestamp	Local Stop Date/Time
7	pid	Integer	The Process ID

**C.1.3 Power Loss [9000005.00]**

Field #	Field Name	Data Type	Description
1	vin	float	Voltage In
2	vbat	float	Battery Voltage
3	vout	float	Voltage Out

**C.1.4 Power Restored [9000006.00]**

Field #	Field Name	Data Type	Description
1	vin	float	Voltage In
2	vbat	float	Battery Voltage
3	vout	float	Voltage Out

**C.1.5 Powering Off [9000007.00]**

Field #	Field Name	Data Type	Description
1	vin	float	Voltage In
2	vbat	float	Battery Voltage
3	vout	float	Voltage Out

**C.1.6 Ping [9000010.00]**

Field #	Field Name	Data Type	Description
1	pingType	Integer	0 = all, 1 = device, 2 = application
2	deviceID	String	Mac Address
3	applicationID	byte(16)	UUID assigned by developer
4			

**C.1.7 Ping Response [9000011.00]**

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	deviceName	String	Device Name
3	location	String	Device Location
3	applicationID	byte(16)	UUID assigned by developer
4	applicationName	String	The name of the application
5	pingTime	timestamp	UTC Date/Time of response
6	pid	Integer	The Process ID

**C.1.8 Error [9000020.00]**

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	deviceName	String	Device Name
3	applicationID	byte(16)	UUID assigned by developer
4	applicationName	String	The name of the application
5	errorType	Integer	Error Code defined by Developer
6	errorLevel	Integer	Error Level for Verbosity filtering
7	ErrorAction	Integer	Action code: 0 – Display 1 – Email Alert Level 1 2 – Email Alert Level 2 3 – Email Alert Level 3 4 – Page Alert 5 – Syslog Alert
8	errorText	String	Description of the Error

**C.1.9 Notice of Failure [9000025.00]**

Field #	Field Name	Data Type	Description



1.	Message I.D.	UUID	I.D. of the initiating message
2.	Session I.D.	UUID	Session Identifier
3.	Response List	List	Expected Response(s)
4.	Responding Service	UUID	Application I.D. of responding service
5.	Initiating Message	String	The message not responded to

### C.1.10 Status [9000030.00]

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	applicationID	byte(16)	UUID assigned by developer
3	StatusLevel	Integer	Priority – 10 = highest
4	StatusNumber	Integer	A unique number identifying the kind of status.
5	StatusMessage	String	Text of the Status Message

### C.1.11 Time [9000040.00]

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	applicationID	byte(16)	UUID assigned by developer
3	Time	Timestamp	System Time for synchronization
4			

**C.1.12 Time Request [9000041.00]**

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	applicationID	byte(16)	UUID assigned by developer
3			
4			

**C.1.13 Parameter Request [9000060.00]**

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	applicationID	byte(16)	UUID assigned by developer
3			
4			

**C.1.14 Parameters [9000061.00]**

Field #	Field Name	Data Type	Description
1	deviceID	String	Mac Address
2	deviceName	String	Device Name
3	applicationID	byte(16)	UUID assigned by developer
4	applicationName	String	The name of the application
5	parameterCount	Integer	# of Parameters
6	Parameter*		
	parameterKey	String	Key name of Parameter
	parameterValue	String	Parameter Value

\* Repeating Key-Value Pair

**C.1.15 Configuration Update/Read File [9000070.00]**

Field #	Field Name	Data Type	Description
	deviceId	String	Mac Address
	deviceName	String	Device Name
	location	String	Device Location as set by installer
	applicationId	byte(16)	UUID assigned by developer
1	applicationName	String	The name of the application
2	authorization	Integer	0 = non required, 1 = required
3	action	Integer	0 = do nothing, 1 = compare, 2 = update only, 3 = update and reboot, 4 = readFile only
4	fileName	String	The name of the file to be updated
5	fileLocation	String	Path to the file to be updated
6	checksum	Integer	Checksum of the file to be read for readFile command

**C.1.16 Configuration Update/Read Status [9000071.00]**

Field #	Field Name	Integer	Description
1	errorCode	String	0 = successful, x = error code
2	fileName	String	The name of the file to be updated
3	checksum	Integer	Checksum of the file to be read for readFile command

**C.1.17 Data Definition [9000080.00]**

Field #	Field Name	Data Type	Description
1	recordId	Double	The data type and version
2	date	timestamp	Date the definition was created
3	dataDefinition	String	JSON encoding of an object describing this data type (See Appendix C1)
4			
5			
6			

**C.1.18 QueryReport [9000085.00]**

Field #	Field Name	Data Type	Description
1	user	String	User ID/ Name
2	limit	Integer	Number of results limit
3	tenant	UUID	UUID assigned by developer
4	startDate	timestamp	Date/ Time for range start
5	endDate	timestamp	Date/ Time for range end
6	queryTerms	String	String representation of filter conditions
7	Results	Integer	Number of results returned



## Appendix D Change Management Strategy

The definition of a data record could undergo the following changes:

- A field could be **added** to the record.
- A field could be **deleted** from the record.
- A field in the record could be **changed** to a different data type.

In order to determine that one record type replaces another, we will alter the record version number.

New fields will always be **appended** to the definition so as to minimize disruption to existing code. This will maintain backward compatibility.

### D.1 Merge

The Broker will handle the translation of data from one version to another. If a subscription is for one version, and another version is published, the Broker will implement the merge strategy for that data type and supply the Subscriber with data compatible with its requested version. It is the responsibility of the Application Developer to supply conversion syntax whenever a new version of the data is implemented. The map will consist of an XML string that is a copy of the data type's normal string except that the data supplied will be the default values.

e.g.

#### Original Version

```
<data Definition>
  <type>50050200.00</type>
  <recordName>invoiceDetail</recordName>
  <fieldCount>3</fieldCount>
  <dataRecord>
    <field>
      <fieldNo>1</fieldNo>
      <name>id</name>
      <data>0</data>
    </field>
    <field>
      <fieldNo>2</fieldNo>
      <name>description</name>
      <data>""</data>
    </field>
    <field>
      <fieldNo>3</fieldNo>
      <name>units</name>
      <data>""</data>
    </field>
  </dataRecord>
</data Definition>
```

**New Version**

```
<data Definition>
  <type>50050200.01</type>
  <recordName>invoiceDetail</recordName>
  <fieldCount>4</fieldCount>
  <dataRecord>
    <field>
      <fieldNo>1</fieldNo>
      <name>id</name>
      <data>0</data>
    </field>
    <field>
      <fieldNo>2</fieldNo>
      <name>description</name>
      <data>""</data>
    </field>
    <field>
      <fieldNo>3</fieldNo>
      <name>units</name>
      <data>""</data>
    </field>
    <field>
      <fieldNo>4</fieldNo>
      <name>quantity</name>
      <data>0</data>
    </field>
  </dataRecord>
</data Definition>
```

**Notes:**

1. Java data type conversions are handled by the Subscriber since all data is received as ascii and is translated by the application into the appropriate data type.
2. When a new version omits a field, the original field numbering is retained with a gap for the missing data.