

# Event Governance At Scale

## *A Practical Guide To Effective Event Message Design*

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# Colophon

**NOTE: This book is an early draft of this manuscript**

Working Draft V0.9.03 June 2022

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# Preface

This document defines a standard for asynchronous messaging for any company's Event Architecture. It is a programming language-agnostic interface description for asynchronous message processing. It is also intended to be message platform-agnostic. All messages published by any producer must conform to these standards. The specification also provides consumer of the messages with the detailed information they need to properly understand, consume and process these messages.

## What's in the Book?

Chapter 1 - Why is Event Driven Architecture critical to tomorrow's application?

Chapter 2 - What are the types of message in Event Driven Architecture?

Chapter 3 - What are the Event Message Specification?

Chapter 4 - Domain Event Example - Consumer Business Process Events

Chapter 5 - System Event Example - Runtime Operations Events

Chapter 6 - What are the Command Message Specification?

Chapter 7 - Domain Command Example

Chapter 8 - What are the Audit Message Specification?

Chapter 9 - Domain Audit Example

# Chapter 1

## Why is Event Driven Architecture critical to tomorrow's applications?

Today's web based architectures use HTTP and REST API to communicate with back end systems. Since this is the primary interaction model, it is a synchronous based Request-Reply paradigm. This is driving this user experience, where the user presses a button or link and then waits for a response. As more applications are calling multiple services in a single request, this is causing longer wait times to respond back to the user. UX Designers feel strongly that an immediate response is the best user interaction model.

However, there are many application models in practice today that do not fit this model. People may not think of it in this way, but email and text are really disconnected (asynchronous) interaction models. The user makes a request or submission and then can perform other actions, while they wait for a notification that their request was completed (e.g. waiting for an email response). If the asynchronous request is fast enough, the user does not know the difference. So there is precedence for user interface design using an asynchronous model.

This also has a major impact on the computing resources required for the application. Instead of having to provision threads for maximum requests, that may sit idle, one can have fewer workers in the background continuously managing the work. An event driven architecture following an asynchronous approach is always a more efficient use of computing resources.

### IMPORTANT

*The key to designing these type of applications is establishment of a set of event design standards and governances within the organization, along with using asynchronous messaging technologies (IBM MQ, Kafka, RabbitMQ).*

The purpose of this document is to provide a set of event specifications that can work at the scale of a large organization.

Asynchronous technologies have been around for a very long time. The IBM mainframe environment had MQ middleware that allowed inter-machine communication and intra-platform integration (primarily distributed platform). There are even more modern technologies, like Kafka and RabbitMQ. In prior application designs and even today, these technologies were used for inter-platform communication and more balanced resource allocation and management. They were mostly used for underlying application interaction, but not used in an interface design.

So, why are interface designers not using a disconnected paradigm like email or text? These types of interactions are very hard to design for. There are some situations where the user expects an immediate response. It is hard in an asynchronous event driven model to simulate a synchronous response to the user. It requires a very low latency interaction approach, which was hard to do with older technologies. It was just easier to design a synchronous model when all the interactions were within the company computing ecosystem and there weren't available technologies other than HTTP to provide the user response.

*What is different in today's environment?*

- More and more of the domain services are being provided by external parties who are outside of the control of the organization and the central application. This leads to more interactions and increases user experience wait time as the services are executed in a sequential manner.
- More modern messaging technologies are available to application architects to lower time latency. There is also more practical real life experience in Event Driven Architecture for architect and designers to leverage
- User are becoming more comfortable with a disconnected interaction model, where they submit a request, work on a different task and then act on the response they get after the fact. Techniques, like deep linking from the response to the specific page within the application are becoming more prevalent.

As with any other scaled integration strategy, the key to success is standards and event design needs to follow this strategy.

## **Why are event design standards critical for organizational success?**

As the organization's application portfolio continues to grow, so does its integration requirements between these applications. In some cases, it is very difficult to create tightly integrated solutions. In addition, users are expecting their objectives to move faster and having their entire process completed in a single session. Multiple applications are interested in the same events leading to reducing complexity using publish-subscribe approaches versus point to point. More integrations, reduced complexity and low latency integration is leading to more and more use of event driven architecture.

The design of Events can come in all shapes and sizes. They can be as low level as a single data element changing to an entire business process completing. With the move to more domain oriented organizational structures, independent autonomous groups will be designing events. This will cause a proliferation of events being created by an organization. Without organizational design standards and guidelines, it will lead to chaos losing all the benefits of integration.

Event design standards are critical to the success of an Event Driven Architecture as the strategy is scaled up within the organization. It isn't enough to commit to using events as a key integration standards, the organization needs governance in the design of event. To support friction-less governance, the organization needs comprehensive design guidelines to support the event designers and give rubrics to the governance groups on how to judge the quality of the design.

# Chapter 2 - Message Types

## Overview

This chapter provide the key definitions related to the messages supported within the ecosystem. It will :

- define the types of message and some of the guiding principles about them.
- describe the message formats available for both internal and secure external usage.

## Messages

A general-purpose data structure with no special intent. In the integration world, these are typically just streamed between the systems for logging, searching, and for other operational and regulatory reasons.

## Message Types

As a component of the event architecture, there are 3 types of asynchronous messages:

### Events

An Event is a message which informs various listeners about something which has happened in the past. It is sent by a producer which doesn't know and doesn't care about the consumers of the event. This type of Messages promotes highly decoupled systems using pub/sub architectures.

**An Event is an immutable record of a single event at a moment in time.**

### Commands

Commands trigger something which should happen in the future. It's typically a one-to-one connection between a producer (who sends the command) and a consumer (who takes and executes the command) and, few times, the order of commands is also of utmost importance. Commands are usually performed by actors outside the current system. However, commands can also be rejected, requiring new error handling patterns.

The difference in thinking between an event and a command is an event-X has occurred, rather than command-Y which should be executed.

### Audit (Proposed)

An Audit message is an adhoc publishing of a domain business objects state. There is no true triggering action, either from a business process or straight data change. It would typically be triggered in batch fashion with a query predicate. There will be situations where there are failures in the pipeline, which might lead to data inconsistencies with systems of record. Since some of the business objects are very stable and don't change often, the audit message is used to get to eventual data consistency. A full business object for a bounded context can be published on a periodic basis



and then any consumer caches can be updated. Thus, can also be used to seed new consumers with domain data.

## Event - Something of interest that has happened in the past

- Represents something that has happened
  - Has a defined timepoint
- Events are both a historical fact and a notification;
  - Notification - a call for action, this is considered a stateless event
  - A state transfer - pushing data wherever it is needed, known as an Event-Carried State Transfer
- Events are immutable
- Name should indicate a past tense action - past-participle verb
- Should be action oriented
- Definition:
  - result of some outcome
  - Collins: a happening or occurrence, esp. when important
  - Can't be rejected, but can be ignored; no expectation of any future action
- Never includes a response
- Sometimes could be the result of a business process (i.e. completed enrollment) or command (i.e. Change medical plan election)

## Command - Represents a request to perform an important action task

- Webster Definition: *to direct authoritatively*
- Other Definitions
  - Represents an intent to perform some sort of action
- The action has not yet happened
  - HasExample: Change medical plan election
- Named with an imperative Verb
  - Can't be rejected, but can be ignored
  - Example: Change medical plan election
- Has an explicit expectation that something (a state change or side effect) will happen in the future
- Can be rejected

- Typically, a one-way request or fire message with no response
  - However, this can be used in situations where an async request/reply is desired
  - Not to be confused with a synchronous Request/reply like REST API Message provides a call back
- Can generate one or more events as part of its processing

## **Audit - Represents the current state of a business object - Published on specific schedule - Proposed**

- To be defined

# Chapter 3 Event Message Specifications

## Overview

Key features of Event Message Specification are:

- Provides Unique and Global Message Identifier
- Provides important auditing data, date, time, as to when the message was created. Also can contain a history of where the logical message has been processed
- Is Independent, stand alone and self-contained; The message contains all the information a consumer might need
- Provides simple headers and metadata to facilitate routing and filtering within the event processing network
- Provides provenance for the message
  - *Where and When did the event happen*
  - *Who the source/processor is, both system of record and publishing platform*
  - *Who or What was the caused of the event*
- Supports schema version control and message validation
- Provides the ability to store and find the key of the key business object or subject in a system of record
  - Related business object can be attached to the message
- Provides correlation for cross event processing.
- Provides the ability to submit test or synthetic event for testing

## Event Types

The follow sections provide the specification for the types of event support by the architecture. (Note: Some event types are in the prototype stage)

The event types are:

### Consumer

- Business Process State Change Event
- Business Object Data Change Event
- User Experience Action Event
- Generic Goal Event

### Runtime

- Platform Processing Event

# Event Message Overview

The standard event message is a JSON document containing one main JSON object named **message**. The **message** JSON object contains 3 child JSON objects:

- **header**: Common Message Header - Common across all messages, independent of event type and event
- *Event Type Header*: Common header for specific event types: Name based on event type
- **body**: Event Message Body - Free form body (i.e. schema would vary by event) for each event defined with the event type

## Common Message Header

The Common Message Header provides the following key features:

- Message Metadata
  - Message Identifier
  - Message typing
- Event Metadata
  - Name
  - Schema Definition
- Event Context
  - Event Context Metadata
  - Subject Type and Id
  - Related Resources
- Audit History/Chain of Custody
  - Publishers
  - System of Record/Source Publisher
- Every message type, events, commands or audit, will have a common standard message header
- There will only be one format or schema for the common message header and the object is required
- The name of the JSON object is **header**
- It contains fields that describe the message at the highest levels and it identifies the source and type of the message
  - These fields determine the format and names of the fields that follow in the message object.
- Since this is JSON, routing or filtering consumers can use only the header to determine routing of message or if the consumer is interested in processing the message

## Event Type Header

- It is a secondary header that contains the common elements for all messages of a given event type
- Each event type will have its own header name and structure. Examples:
  - `uxEventHeader` - for Ux events
  - `bpEventHeader` - for business process events
- The `messageNamespace` field in the header will indicate which event type header is in the message
- There will be a structured format/schema for each event type
- For an organization, the goal is a small bounded list of event types
  - There can be an unlimited number of event definitions within a type
  - The goal is to have as much standardization in the headers as much as possible.
  - The variations are meant for the body JSON object.

## Event Message Body

- Contains the fields that are specific to a given event definition within an event type
  - The system will have a large unbounded set of events. The body represents the specific fields for a given event type
- The `eventBodyNamespace` in the Event Type Header will describe the schema for the fields in the body
- The name of the JSON object is **body**
- Each body should have its own schema that can be placed in a schema repository and retrieved by the `bodyNamespace` field.
  - The schema can then be used for validation and code generation.

## Internal Event JSON Structure

In order to keep the processing of a message simple and easy to produce and consume, the event message has a very flexible structure and is basically an unstructured document. The goal is to have a schema for the header, each event type header and every event data (i.e body) itself. We would like to have a schema dictionary which has a JSON or AVRO schema as its values and it's keyed by some name. The hierarchy is as follows:

- There is only one header schema (key name: header)
- To determine the `<eventTypeHeader>` name, the `header.messageNamespace` field contains the name of the event type
- To determine the body schema name, the `header.eventBodyNamespace` field determines the name for the body schema

<b>NOTE</b>	The internal event structure looks as follows:
-------------	--

```

{"message" :
"header" : { ... },
"eventTypeHeader" : { ... },
"body" : { ... } }

```

#### Samples

```

{"message" : "header" : { "messageNamespace": "com.hilco.messages/uxEvent",
"eventName" : "PageABC:clicked", ... }, "uxEventHeader" : { ... }, "body" : { ... } }

```

```

{"message" : "header" : { "messageNamespace": "com.hilco.messages/bpEvent",
"eventName" : "ContributionRateChange:Completed" ... }, "bpEventHeader" : { ... },
"body" : { ... } }

```

## Common Message Header Field Specification

Table 1. Schema Fields Table

Field Name	Attributes
messageId	String; Required
messageType	String; Required
messageNamespace	String; Required
messageVersion	String; Required
messageTopic	String
eventName	String
eventBodyNamespace	String
contextTag	String; Required
action	String; Required
messageTimestamp	String; Required
businessDomain	String; Required
correlationId	String; Required
correlationIdType	String; Required
globalBusinessObjectIdentifier	String
publisherId	String; Required
publisherApplicationName	String; Required
publisherApplicationInstanceId	String
publishingPlatformsHistory	Object; Array; Required
- publisherId	String; Required
- publisherApplicationName	String; Required
- publisherApplicationInstanceId	String
- messageId	String; Required; Required

Field Name	Attributes
- messageTopic	String; Required
- eventName	String; Required
- messageTimestamp	String; Required
- sequenceNumber	String
businessObjectSystemOfRecord	Object; Array; Optional
- systemOfRecordSystemId	String; Required
- systemOfRecordApplicationName	String; Required
- systemOfRecordApplicationInstanceId	String
- systemOfRecordDatabaseSchema	String
- platformInternalId	String; Required
- platformExternalId	String
correlatedResources	Object; Array; Optional
- correlatedResourceType	String
- correlatedResourceIdentifier	String
- correlatedResourceState	String
- correlatedResourceDescription	String
isSyntheticEvent	String

#### *Schema Field Definitions*

##### **messageId**

Globally Unique (UUID) Identifier of message.

##### **messageType**

Describes the type of message. Valid Values:

- Event
- Command
- Audit

**messageNamespace**

Namespace is used to distinguish between the different types of messages (events or commands), source (internal vs external), and schema versions to avoid collision and help in processing the messages. They also identify the type of Event Header contained in the full message. The namespace can be used as an external endpoint to provide the schema and other machine-readable information for the event type and the latest major version. Used to provide message definition and validation. Valid Values:

- com.hilco.messages/events/uxEvent
- com.hilco.messages/events/businessProcessEvent
- com.hilco.messages/events/dataChangeEvent
- com.hilco.messages/events/goalEvent
- com.hilco.messages/events/platformProcessingEvent

**messageVersion**

Conveys the version number (major.minor) of the message, and describes the structure of the overall message at hand. Valid values managed by governance

- Example: 1.1

**messageTopic**

Logical name to describe the type of event. Note: this is not the physical topic name (i.e kafka topic) of the messaging system. Sample Valid Values:

- BusinessProcess
- DomainDataChange
- UserExperience
- Goal
- PlatformProcess

**eventName**

Provides a standard name of the actual event that occurred in the publishing system. It will be treated as a label/code and used for filtering, routing, general analytics and simple processing of events in the ecosystem. It should be a combination of the business object or process name and action taken on that entity. There are specific naming conventions used to determine the value of the field. It is a field that will require governance approval.



<b>eventBodyNamespace</b>	Describes the specific schema and version of the <b>body</b> field in the message. The body structure and metadata details are understood based on this name. This field is optional and only be set if there is a structure or schema for the body. If there is not body, then this field should not be sent.
<b>contextTag</b>	Machine readable generic label for the event type. The purpose of the contextTag is to provide a label that encoded some additional context for the event. It is highly structured, follows a specific format and provides valid values to allow programs and applications, like analytics, to easily consume the values. See event type for more details on the values. To reduce the complexity in trying to capture all the levels and details of components that produced the event, the recommendation is to use encode all contextual or hierarchical information into a single label or tag. This tag along with the <b>action</b> and *on this tag should reduce the complexity of the event structure and make it easier for the consuming tools to do their work without having to get into the details of the body structure To make it more human readable, there will be an encoding standard in place to mke it easier to read and make it easier to parse the tag if necessary.
<b>action</b>	Represents the actual logical action or happening based on the event type. See event type for more details on the valid values. For events,the action should be described in the past tense and the name should be initial caps. For commands, the action should be present tense with initial cap. The organization should have a bounded set of actions and try to minimize the number.
<b>messageTimestamp</b>	Describes the date and time at which the actual event was generated by publishing systems. To be provided by producer component and should not be derived by message publishing framework(s) or component(s) The timestamp must be in the RFC 3339/ISO 8601 date format standard. See Appendix for details.

<b>businessDomain</b>	<p>Describes the business domain under which the event/command was generated. Sample Valid Values in HR/Benefits:</p> <ul style="list-style-type: none"> <li>• Person</li> <li>• Worker</li> <li>• PersonWorker</li> <li>• Health</li> <li>• DefinedContribution</li> <li>• DefinedBenefit</li> <li>• Operations</li> <li>• N/A (for domains that do not match up to an organization service domains.</li> </ul>
<b>correlationId</b>	<p>Describes the globally unique identifier (UUID) typically generated within the publishing application. This is used to correlate multiple messages across a logical process. The messageId is unique for the individual message, but the correlationId can be repeated across multiple messages</p>
<b>correlationIdType</b>	<p>Describes the type of correlation identifier. Valid Values:</p> <ul style="list-style-type: none"> <li>• SessionId - for participant Ux actions and sessions</li> <li>• BatchId - for batch processing jobs. This is the actual instance id of a job type.</li> <li>• PublisherCorrelationId - for publisher specific correction type (Typically used if the above two does not apply)</li> </ul>
<b>globalBusinessObjectIdentifier</b>	<p>Describes the global identity of the business object being acted upon. In the HR/Benefits domain, an example would be the person.</p>
<b>publisherId</b>	<p>Identifies the publishing company entity of the message.</p>
<b>publisherApplicationName</b>	<p>Describes the name of the publisher application platform or service.</p>
<b>publisherApplicationInstanceId</b>	<p>Describes the specific instance of the publisher application or service.</p>

## **publishingPlatformsHistory**

This is the historic details and providence of the message, the audit trail for the message. It is an array, describing the internal platforms that have been processing a given message from the edge platforms to any internal consumer applications. If the consume message is being augmented (i.e new information is being added) it is important that the consumer/publisher or program add its own auditing information to the history. It has similar fields to the overall message (see above).

### **publisherId**

Identifies the publishing company entity of the message.

### **publisherApplicationName**

Describes the name of the publisher application platform or service

### **publisherApplicationInstanceId**

Describes the specific instance of the publisher application or service.

### **messageId**

Describes the messageId for the given prior message instance. See above for field details

### **messageTopic**

Describes the messageTopic for the given prior message instance. See above for field details

### **eventName**

Describes the eventName for the given prior message instance. See above for field details

### **messageTimestamp**

Describes the messageTimestamp for the given prior message instance. See above for field details

### **sequenceNumber**

The sequence should be from earliest to latest in chronological order. The publisher should only append to the array. If the array is provided as input from a message, then the new publisher should increase the sequence number and append the consumed/input header data to the array. If this is the originating or edge processor, then the sequence number should be set to one (1), not zero

**businessObjectSystemOfRecord**

System of Record containing details related to finding the related business object.

**systemOfRecordSystemId**

Identifies the system of record company entity of the message. Sometimes referred to as the partner ID.

**systemOfRecordApplicationName**

Describes the name of the publisher application platform or service.

**systemOfRecordApplicationInstanceId**

Describes the specific instance of the system of record containing the person

**systemOfRecordDatabaseSchema**

Describes the database schema instance of the system of record containing the business object

**platformInternalId**

Describes the internal identity of the business object within the platform. Only provided if the publishing platform is a source system of record and not a pure publisher application

**platformExternalId**

Describes the external identity of the business object within the platform. Only provided if the publishing platform is a source system of record and not a pure publisher application

**correlatedResources**

Describes a list of the related resources also being accessed during the processing creating the event. These are key *bounded contexts* associated with the primary business entity during processing.

**correlatedResourceType**

Describes the type of the related resource.

**correlatedResourceIdentifier**

Identifies the primary key of related resource. This can be the external or internal unique identifier of the resource.

**correlatedResourceState**

Identifies the state or status of related resource at the time the event occurred.

**correlatedResourceDescription**

Description of related resource at the time the event occurred.

**isSyntheticEvent**

Is this a synthetic or fake event? If true, assumes this is an event that should be processed under special circumstance, meaning don't change state or issue commands. Used for testing/monitoring in production by sending in fake events

Potential Extensions: *dataContentType* - This will be helpful if the body is not JSON. The current best practice is that all body payloads, should be JSON. The values would follow HTTP mime types

# Chapter 4 - Domain Event Example - Consumer Business Process Events

This chapter discuss the following consumer related events:

- Business Process State Change events
- Business Domains Object data changes
- Consumer Ux interactions events
- Consumer Activities event

All of these event would use the Event Header described in the prior chapter.

## Business Process State Change Event

The purpose of this event type is capture events related to the processing of business events. These events are sometimes known as transaction and are used to manage the changes in business domain objects. Upon the completion of a business process, it will typically also create a Business Object Data Change event.

It supports two types of business processes. The first is a long running transaction that has many states and has time gaps in between the actions of the business process. The second is a straight through or single task, where the action is completed in a single unit of work

*Business Process examples:*

- Contribution Rate Change
- Annual Enrollment
- Defined Benefit Retirement
- State changes includes:
- Start
- Complete
- Valid
- In Error

## Business Process State Change Header Specification

JSON Name: **bpEventHeader**

<b>businessProcessReferenceId</b>	Describes the primary key or Business Process Reference Identifier of the business process person instance as described in platform(s). businessProcessId::Describes the internal identifier of the business process. It is the template used to create the person specific instances of the business process.
<b>rawBusinessProcessName</b>	Describes the pre-normalized Business Process Name as described in platform(s). This could be the client specific business process name or a normalized name across clients. It would be used primarily for reporting, filtering and aggregating businessProcessDescription::Describes the long more formal description of the business process. businessProcessStatus::Business Process status.Valid Values: <ul style="list-style-type: none"> <li>• Created</li> <li>• Valid</li> <li>• Invalid</li> <li>• Completed</li> <li>• Canceled</li> </ul>
<b>businessProcessEffectiveDate</b>	Effective date of the business process
<b>businessProcessChangeTimestamp</b>	Timestamp of when the business process was changed. The timestamp must be in the ISO 8601 date format standard.

#### *EventName Standards*

For the eventName, the standard will be the following fields separated by a colon (":") in camel case.

- *tag* which represents the business process name, hopefully normalized and
- *action* which represents the business process action

#### *Tag Definition*

The tag represents the business process name. It should be the normalized version of the business process name.

- Format
  - Free format single alpha numeric value
  - No formal specification is defined

#### *Action Definition*

The action represents the types of actions that result from the change in status of the business process during the processing of the consumer's business process.

- Action Component Valid Values
  - Started
  - Updated
  - Completed
  - Canceled

#### *Body Definition Considerations*

The body section is named **body**. The **body** can be any valid JSON schema

## Business Object Data Change Event

The purpose of this event type is to capture the changes to key domain business objects.

- Business Objects include:
  - Person
  - Person Defined Contribution
  - Person Health Management
  - Person Defined Benefit
  - Person Document[TH1]
- Data actions Include:
  - Creation
  - Updates
  - Deletion
  - Master Data Management Document Merge/Split

## Business Objects Data Change Event Specifications

Business Objects Data Change Header .JSON Name: boEventHeader

### **businessObjectResourceType**

Describes the primary domain data object type that was changed. Valid Values:

- person
- personDefinedContribution
- personHealthManagement
- personDefinedBenefit
- personDefinedBenefitCalculation
- personDocument Editor:Think about moving this to 'tag'. Need to determine in the Identifier is included in the tag



## **businessObjectIdentifier**

Provides the primary domain data object key of the business object that was changed

## **additionalBusinessObjectResource**

Provides any additional resource type and key to help further identify the component that changed. This is similar to the pathing (`/resource/{id}`) in a REST URL

### **additionalBusinessObjectResourceType**

Additional resource type

## **additionalBusinessObjectResourceIdentifier**

Additional resource identifier or primary key

## **dataChangeTimestamp**

Timestamp of the data change in the source platform. The timestamp must be in the RFC 3339/ISO 8601 date format standard. See Appendix for details.

### *EventName Standards*

For the eventName, the standard will be the following fields separated by a colon (":") in camel case.

- *tag* which represents the business object name and
- *action* which represents the CRUD operation taken against the business object

### *Tag Definition*

The tag represents the business object name. Editor Note: Should tag replace 'businessObjectResourceType'.

- Format
  - Free format single alpha numeric value
  - No formal specification is defined

### *Action Definition*

The action defines the type of data maintenance (CRUD) action taken on the business object. Editor Note: action is replacing the dataAction field in prior versions.

- Action Component Valid Values

### **dataAction**

Describes the data change or CRUD action performed on business object.- Create, Update, Delete. Also includes an primary key changes and MDM document merging.

- Create
- Update
- Delete
- MdmDocumentMerge
- MdmDocumentSplit

### *Body Definition Considerations*

- The body section is named 'body'
  - body can be any valid JSON schema
  - Contains one predefined element 'extension'
  - Extension is a private area that can contain its own schema
  - The field is an map/array with:
    - Namespace as a key and,
    - Any valid JSON schema as its value

### *Data Fields Best Practices by Data Action*

- Update

The recommendation for data fields to report is to provide only the fields that changed providing both old and new Best practice recommendations:

- PII
  - Fields: Bank/Credit Account Numbers,
  - Provide old/new unchanged from CustomerMaster; no masking required
- Arrays
  - Provides Lowest Level Detail field, include all cascading keys
  - Example: Contact → streetAddress → { AddrID → OldZipcode, newZipcode }
  - Include all the fields at the same level as the changed field in entire array data object
  - For fields in a high level/hierarchy, include all keys and simple primitive types (strings, numbers,etc ) at the same hierarchy
- Do not include objects or arrays in the higher levels Do not include non-changing arrays at the same level
- Create
  - Provide the entire New document
  - Alternate: Keys Only
- Delete
  - Only provide a delete event if the entire document is being deleted, not if one of the source systems deleted a person
  - In the body, provide the primary document key (UniversalId or Mongo \_id ) and any IdMapping table
  - If the object/person is being delete in a given platform, but the person still exists in another platform, treat as an Update
  - Only delete when no more IdMappings exist in the document

### *Master Data Management Platforms/CustomerMaster*

- Merge

- Treat as an MDM Merge Update event with two sections of data, one for survivor and one for deleted
- Both sections
- Survivor \_id & Deleted \_id
- Id Mapping for both survivor and deleted
- Survivor document section contains the update record for the survivor document (see Update section)
- Deleted document section
- Reason for merge
- The Platform that caused the change to occur
  - System Instance
  - Merge Field Change (old, new)
- Split - No new events, just two new event being generated
  - Web service call to deletePersonId service, which cleans up IdMapping and domain sections
  - Generates a Normal Update event
  - Web Service call refreshPersonForInternalId service, which causes a refresh through Ingest
  - Generates a Normal Update event

## User Experience Action Event

Events related to the behavioral actions taken by the participant in our user experience channels. Channel include web/Upoint, mobile, IVA/chat and other future user devices like Voice Assistants.

The purpose of this event type is to capture the pure behavioral events related to the interactions of the users on our various channels - displaying pages, clicking button or links. These events are not the result of any business process or data change events. They are used for:

- Behavior actions for data reporting and analytics
- Provide notifications to non-domain processes (document management, campaigns) to drive their underlying processes
- Actions may include, but not limited to:
  - Button clicks
  - Link or action selections
  - Page or screen displays
  - Hover
  - IVA or chat intents

### User Experience Action Event Specifications

*JSON Name: uxEventHeader*

**channel**

Describes the channel (or UI application) where the event generated.

**userDevice**

Identifies the device used by end-user.

**deviceTimestamp**

Represents the timestamp on the device (May be different from the publisher timestamp). The timestamp must be in the RFC 3339/ISO 8601 date format standard. See Appendix for details.

**sessionId**

Represents the unique session of end user on our channels.

**sessionCreateTimestamp**

Session created time. The timestamp must be in the RFC 3339/ISO 8601 date format standard. See Appendix for details.

**applicationName**

User Experience application name

**applicationVersion**

Version of the application

*EventName Standards*

For the eventName, the standard will be the following fields separated by a colon (":") in camel case.

- UxControlName
- UserAction

*Tag Definition*

In the Ux channels, there are an unbounded set of device actions a user can take: pressing buttons, displaying pages, starting process flows. In addition, they are an unbounded set of specific controls (buttons, etc) throughout the interface. For reporting and other activities, there is a need to capture that a specific control has been acted upon: pressing a specific button within a specific group of controls within a page within a business process flow.

To reduce the complexity in trying to capture all the level and types of components, we are going to encode all hierarchical information into a single label or tag. This tag along with the user action on this tag should reduce the complexity of the event structure and make it easier for the consuming tools to do their work.

To make it more human readable, there will be an encoding standard to make it more human readable and make it easier to parse the tag if necessary. The tag values need to take into account all types of user interfaces and devices. We need to support new and emerging interfaces beyond web and mobile channels. The following sections discuss the naming approach.

*Tag Component Valid Values*

\*Channel

- Web
  - Flow - A user's perceived outcome process or unit of work
    - Denotes flow of interaction (pages) or conversation between user and system
  - Page
  - Widget or Multiple Control Component
  - Elemental Ux Control
    - Button, includes clickable icons - Clickable
    - Link - Clickable
    - CheckBox - Selectable
    - Text - Display, Hover, Table Element
    - TextBox - Keyboard Actions → Tabbing ,Enter pressed
    - Bounded Lists → Radio Buttons or checkboxes or DropDown Lists or Dials - Selectable
- Mobile - TBD
- Smart Assistant/Alexa
- IVA/Chat
- Other on Non-Channel - Treatment or Theme Example xxxA/xxxB

#### *Format*

- Ordered sets of tuples separated by underscore '\_'
- The tuple is the following fields separated by dash '-'
  - LogicalName determined by Ux Designer and Data Analyst
  - UxControl Valid Value in all caps
- The order is from highest level (aFlow) to specific UX Control, (Button)

Example: <Flow\_Name>-FLOW\_<Page\_Name>-PAGE or Retirement-FLOW\_HubPage-PAGE

#### *Action Definition*

The action defines the type of user actions taken by the user when interacting with the channel/device. Valid Values for userAction:

- Displayed
- Clicked
- Entered

#### *Body Definition Considerations*

- The body section is named **body**
  - **body** can be any valid JSON schema
  - Contains one predefined element **extension**

- Extension is a private area that can contain its own schema
- The field is an map/array with:
  - Namespace as a key and,
- Any valid JSON schema as its value
- This can be any significant data or data of interest for reporting at the time of the UX Event

## Consumer Goal Event

Events related to the action taken by the consumer in the context of reaching a personal goal.

A goal is non-transactional outcome the consumer is trying to attain. For example, the person wants to lose 20lbs as a health goal

- Actions may include:
  - Started
  - Completed

### *Personal Goal Action Header*

Note: The Personal goal only requires the main header

JSON Name: pgEventHeader

### *Tag Definition*

The tag represents the name of the personal goal in a machine readable format.

- Format
  - Free format single alpha numeric value
  - No formal specification is defined

### *Action Definition*

The action defines the type of task actions taken against a personal goal.

- Action Component Valid Values
  - Started
  - Completed

### *Body Definition Considerations*

- The body section is named **body**
- body can be any valid JSON schema
  - Contains one predefined element **extension**
  - Extension is a private area that can contain its own schema
    - The field is an map/array with:
    - Namespace as a key and,

- Any valid JSON schema as its value
- This can be any significant data or data of interest for reporting at the time of the UX Event

# Chapter 5 - System Event Example - Runtime Operations Events

Events occurring during the running of the application on a specific platform or system resource (server, data base, etc). Focused mostly on system resource issues. Debug events would also fall into this category

Platform Processing Event - Events related to the action of completing a discreet process or unit of work and providing the resource computation of that unit of work.

These events reflect the fact that (1) the process occurred, which is used for counting instances of the process (2) the time stamps of then it occurred, which is used for elapse time and windows of time, (3) additional resource usage, which is used for more detailed resource consumption analytics and (4) any additional status and metadata related to the process of the unit of work. They event can be used for both operational and application event where counting, and resource utilization reporting is of interest to the business

- Platform processing units of work being metered include:
  - Docker Containers → Service API calls
  - Enterprise CI/CD Build pipeline → API Service builds

System Resource Manager Event (Under consideration) - Events related to the actions of managing a system resource manager. This includes the overall operations of the resource manager and the system administrator actions to administer the resource manager.

A resource manager has the following characteristics. Example of a resource manager is a server, JVM, Web Server, Docker container, data base manager and queue manager. \* The platform contains important application data \* The resource is shared by multiple applications \* The resource is managed centrally by an system operations staff, who is responsible for the installation, upgrade and overall operations of the resource \* Privileged access authority is required to perform system administration functions

Resource manager operational event actions include: \* Start \* Stop \* Abort \* Restart

System Administrator event actions include: \* Logon \* Password change \* Commands (?) \* Group Functions (?)

Potential Future Operational Events \* Runtime System Error Events - Runtime Events because of hardware or software issues \* Code Deployment Events - DevOps Events because of program/business logic development. Include both code and configuration \* Client Deployment Events - Events related to the deployment of client assets, in particular provision migrations. \*\* Might also include client level processing runtime errors

*Operations Platform Process Event*

Event Header See the above header section for definition of the event message header

*Platform Process Event Header*



JSON Name: oppEventHeader

Note: Mandatory fields are highlighted in bold.

**platformProcessStartTimestamp**

Timestamp of when the resource consumption started. The timestamp must be in the RFC 3339/ISO 8601 date format standard. See Appendix for details.

**platformProcessEndTimestamp**

Timestamp of when the resource consumption ended. The timestamp must be in the RFC 3339/ISO 8601 date format standard. See Appendix for details.

**platformProcessElapsedTime**

Elapse time in milliseconds

**platformProcessEffectiveDate**

Effective Date of process

**platformProcessStatus**

Process status. Valid Values:

- Aborted
- Completed
- Canceled

*Potential Platform Process Header Fields*

- API/Program call Request and Response size
- Memory size at event publication
  - Heap sizes , etc
- CPU utilization for process
- Thread count at event publication

*EventName Standards*

For the eventName, the standard will be the following fields separated by a colon (':') in camel case.

- PlatformProcess
- Action

*Tag Definition*

- Format
  - Ordered sets of tuples separated by underscore '\_'

*Action Definition*

The action defines the type of action or state changes of the process.

*Action Component Valid Values*

Action Valid Values processAction \* Started \* Completed \* StateChanged

#### *Body Definition Considerations*

- The body section is named 'body'
  - 'body' can be any valid JSON schema
  - Contains one predefined element 'extension'
    - Extension is a private area that can contain its own schema
    - The field is an map/array with:
      - Namespace as a key and,
      - Any valid JSON schema as its value
- This can be any significant data or data of interest for reporting at the time of the process state change.

#### Other Operational Events

# Chapter 6 Command Message Specifications

## Overview

Key features of Command Message Specification are:

## Command Types

The follow sections provide the specification for the types of commands support by the architecture. (Note: Some command types are in the prototype stage)

The command types are:

## Command Message Overview

The standard messageevent message is a JSON document containing one JSON object named **message**. The **message** object contains 3 child JSON objects:

- Common Message Header - Common across all messages, independent of command type and event
- Command Type Header - Common header for specific command types
- Command Message Body - Free form body for each command defined with the command type

## Internal Command JSON Structure

To keep it simple and easy to produce and consume, the event message has a very flexible structure and is basically an unstructured document. The goal is to have a schema for the header, each event type header and every event data (i.e body) itself. We would like to have a schema dictionary which has a JSON or AVRO schema as it values and it's keyed by some name. The hierarchy is as follows:

- There is only one header schema (key name: header)
- To determine the <eventTypeheader> name, the header.messageNamespace field contains the name of the event type
- To determine the body schema name, the header.eventBodyNamespace field determine the name for the body schema

### NOTE

The internal event structure looks as follows:

```
{"message" :  
  "header" : { ... },  
  "eventTypeHeader" : { ... },  
  "body" : { ... } }
```

# Chapter 7 - Domain Command Example

This chapter ....

# Chapter 8 Audit Message Specifications

## Overview

Key features of Audit Message Specification are:

## Audit Types

The follow sections provide the specification for the types of Audits support by the architecture.  
(Note: Some Audit types are in the prototype stage)

The Audit types are:

## Audit Message Overview

The standard messageevent message is a JSON document containing one JSON object named **message**. The **message** object contains 3 child JSON objects:

- Common Message Header - Common across all messages, independent of Audit type and event
- Audit Type Header - Common header for specific Audit types
- Audit Message Body - Free form body for each Audit defined with the Audit type

## Internal Audit JSON Structure

To keep it simple and easy to produce and consume, the event message has a very flexible structure and is basically an unstructured document. The goal is to have a schema for the header, each event type header and every event data (i.e body) itself. We would like to have a schema dictionary which has a JSON or AVRO schema as it values and it's keyed by some name. The hierarchy is as follows:

- There is only one header schema (key name: header)
- To determine the <eventTypeheader> name, the header.messageNamespace field contains the name of the event type
- To determine the body schema name, the header.eventBodyNamespace field determine the name for the body schema

### NOTE

The internal audit structure looks as follows:

```
{"message" :  
  "header" : { ... },  
  "eventTypeHeader" : { ... },  
  "body" : { ... } }
```

# Chapter 9 - Domain Audit Example

This chapter ....

# Appendix A: Appendix

## CloudEvents Comparision

id → messageId source → eventName and Namespace specVersion → messageVersion  
dataContentType → JSON only dataSchema → messageNamespace, eventNamespace (body) subject  
→ Subject/Business Object time → messageTimestamp