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IDC Use Case Model Survey

Version 1.0

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Prepared by
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Abstract

This document contains the brief descriptions for the actors and use cases contained in the IDC Use Case Model Survey.

REVISIONS

Version	Date	Author/Team	Revision Description	Authorized by
V1.0	12/2014	IDC Re-engineering Project Team	Initial delivery	M. Harris

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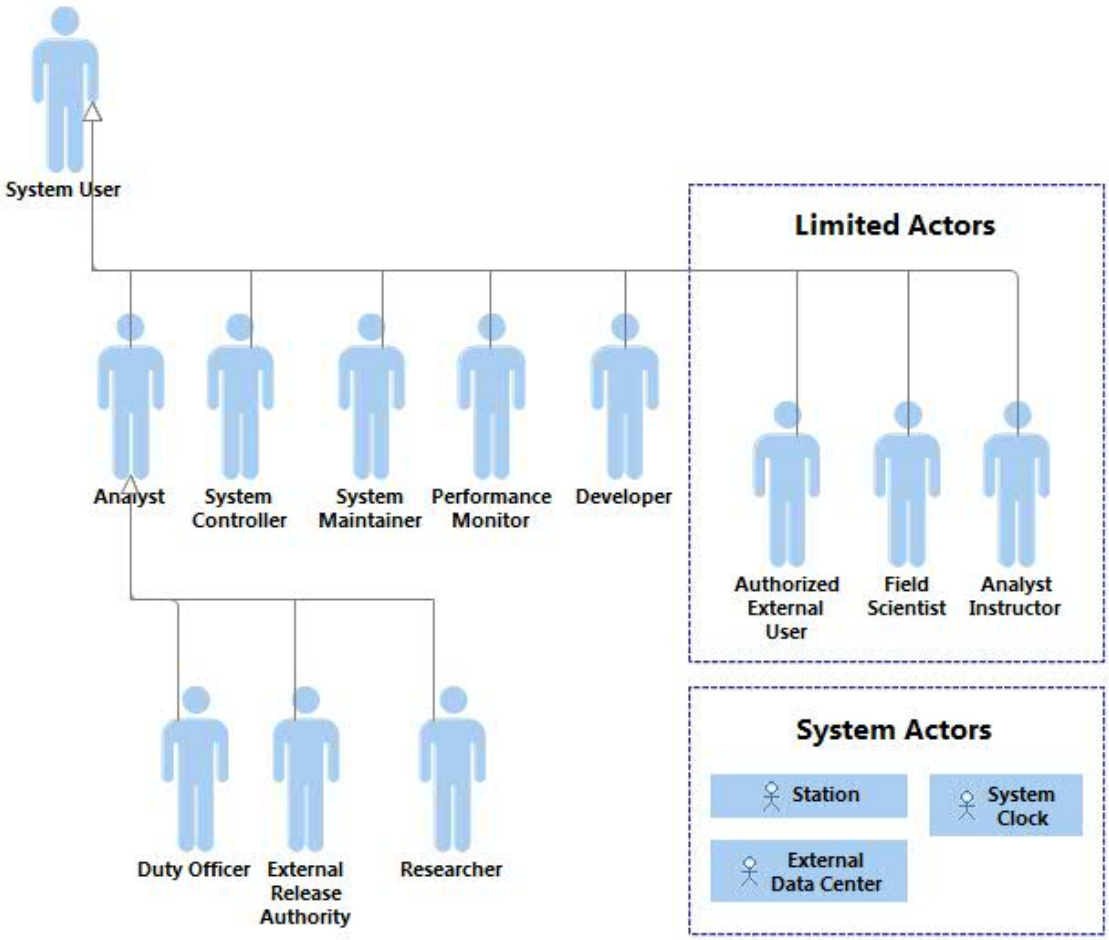
1. ACTORS



This diagram shows the hierarchy of actors in the system.

1.1. Actor Descriptions

Analyst - The Analyst actor is a System User who analyzes events. This actor includes the traditional event analysis roles, including for example, AL1, AL2, Operations Manager, Evaluator, Duty Officer, External Release Authority, and Researcher. Any Analyst can access all System event analysis capabilities but use may be limited by operational role.

Analyst Instructor - The Analyst Instructor actor is a System User who trains new Analysts using the Training Subsystem.

Authorized External User - The Authorized External User actor is a System User who has limited access to request and receive System data, view System results, or provide data for import into the System.

Developer - The Developer actor is a System User who develops and tests System components.

Duty Officer - The Duty Officer actor is an Analyst who performs special event analysis.

External Data Center - The External Data Center actor is an external system that sends waveform data and bulletin data to the System or receives waveform data and bulletin data from the System.

External Release Authority - The External Release Authority actor is an Analyst who reviews and approves System event data for external release.

Field Scientist - The Field Scientist actor is a System User who conducts site surveys of potential sensor locations using a Standalone Subsystem.

Performance Monitor - The Performance Monitor actor is a System User who monitors performance of the System.

Researcher - The Researcher actor is an Analyst who performs research to optimize performance of the System, to provide more detailed information about events of interest, and to develop new algorithms.

Station - The Station actor is an external system that sends waveform data to the System.

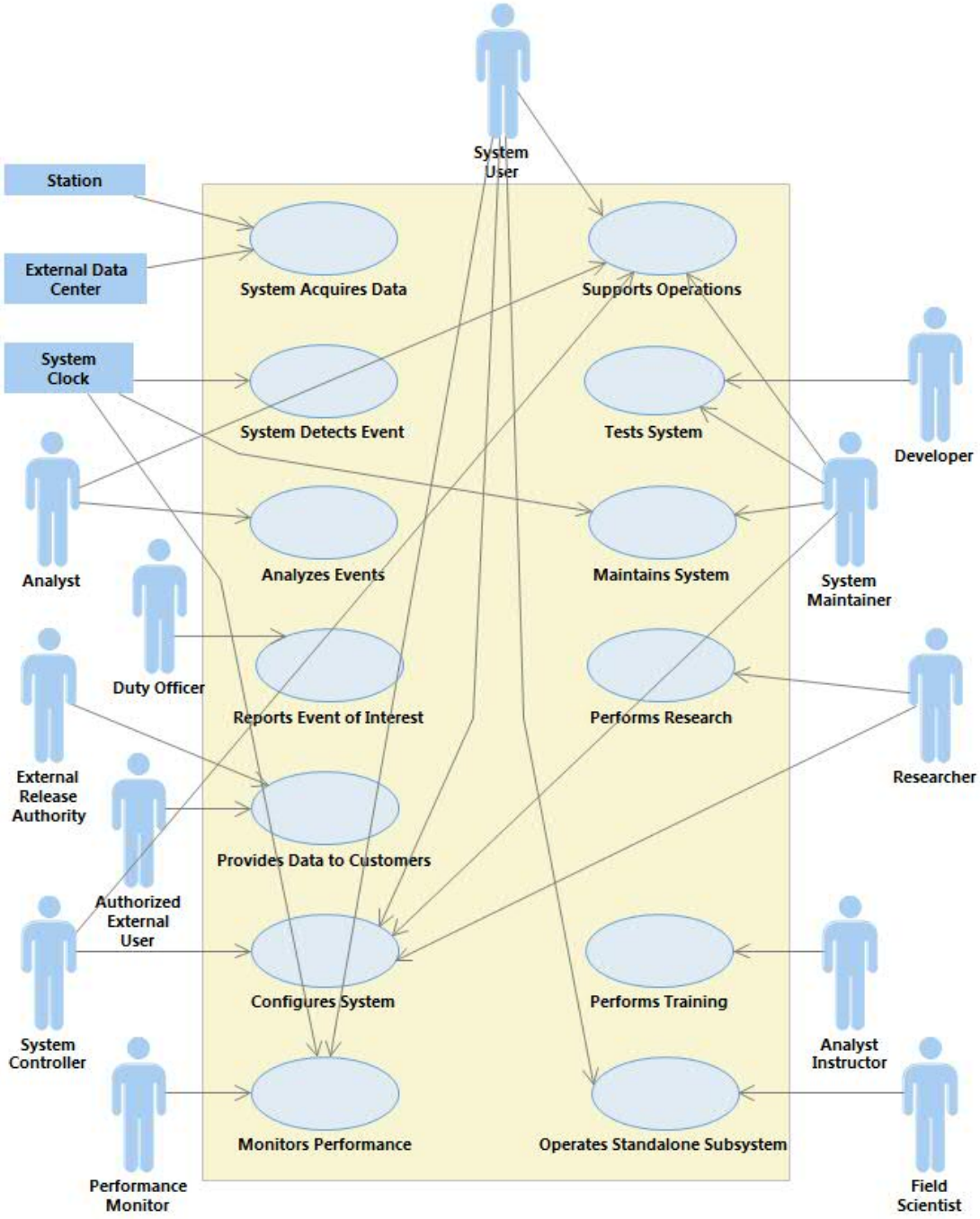
System Clock - The System Clock is an internal clock that provides the system with the ability to periodically execute activities.

System Controller - The System Controller actor is a System User who monitors and controls the System and external data connections.

System Maintainer - The System Maintainer actor is a System User who installs, tests, and configures the System.

System User - The System User actor is any user who accesses the System.

2. USE CASES



This diagram shows the top level use cases the System provides. Each of these top-level use cases are further subdivided into smaller use cases (not depicted on the diagram).

UC-01 System Acquires Data

This use case describes how the System acquires waveform, station state-of-health (SOH) and event bulletin data. The System receives seismic, hydroacoustic and infrasound waveform data and SOH data from Stations. The System confirms that it receives the data from the different sources, authenticates the data and converts it into a standard format (see 'System Receives Station Data' UC). The System also receives event bulletin data from External Data Centers (see 'System Receives Bulletin Data' UC). The Data Acquisition Partition moves the waveform, SOH and event bulletin data to the Data Processing Partition for automatic and interactive processing. The System forwards waveform and event bulletin data to External Data Centers that are authorized to receive the data (see 'System Automatically Distributes Data' UC).

2.2. UC-01.01 System Receives Station Data

This architecturally significant use case describes how the System acquires station data and puts it into the correct formats for automatic and interactive processing. Stations send seismic, hydroacoustic and infrasound data to the System in a variety of formats. The System converts the data into the CD1.1 format and authenticates the data. The System parses the data into waveform data, station data, and state-of-health (SOH) data and puts it in the data storage format. The Data Acquisition Partition moves the data to the Data Processing Partition for automatic and interactive processing. The System Controller can request retransmission of data from the Data Acquisition Partition to the Data Processing Partition.

This use case is architecturally significant because it deals with the storage of data in CD1.1 format and the timeliness for transferring data to the Data Processing Partition.

2.3. UC-01.02 System Receives Bulletin Data

This use case describes how the System acquires bulletin data and puts it into the correct formats. External Data Centers provide event bulletins and event messages. The System converts the information to the data storage format. The Data Acquisition Partition moves event bulletin data to the Data Processing Partition where it is stored with the bulletins.

2.4. UC-01.03 System Automatically Distributes Data

This use case describes how the System forwards station data to External Data Centers authorized to receive the data. The System sends station data in CD1.1 format. The System sends bulletins authorized for release to External Data Centers. The System forwards USGS event messages to a specified list of addresses. The system forwards station data to the SUS/TST Subsystem.

2.5. UC-01.04 System Acquires Meteorological Data

This architecturally significant use case describes how the System acquires meteorological data to build atmospheric models used in automatic and interactive processing of infrasound data. The System requests the latest available high-resolution global meteorological data from external data centers and puts it into the correct formats for generation of infrasound propagation models. The system moves the meteorological data from Data Acquisition Partition to the Data Processing Partition and stores the meteorological data. The System builds a new atmospheric model based on the meteorological data.

This use case is architecturally significant because it deals with acquisition, storage and processing of meteorological data.

2.6. UC-02 System Detects Events

This use case describes how the System pipeline processes the raw seismic, hydroacoustic, and infrasound waveform data from a time interval to form event hypotheses. The System first checks the quality of arriving waveform data and creates data quality control masks for waveform sections containing data that is unsuitable for processing (see 'System Determines Waveform Data Quality' UC). The System then processes waveforms to enhance signal content while reducing noise (see 'System Enhances Signals' UC).

The System follows two simultaneous paths after enhancing signals. When following the first path, the System uses channel based waveform correlation techniques to form single-station or network event hypotheses (see 'System Detects Events using Waveform Correlation' UC). The System measures signal features for the event hypotheses on waveform channels across the network (see 'System Measures Signal Features' UC). When following the second path, the System detects signals (see 'System Detects Signals' UC), measures features on the signal detections (see 'System Measures Signal Features' UC), and then uses the signal detections and feature measurements to build both single station and network event hypotheses (see 'System Builds Events using Signal Detections' UC).

After forming event hypotheses, the System resolves conflicting event hypotheses (see 'System Resolves Event Conflicts' UC) and then refines each event hypothesis' location (see 'System Refines Event Location' UC) and magnitude (see 'System Refines Event Magnitude' UC). Finally, the System uses all available event information to find and notify Analysts of potential events of interest (see 'System Finds Potential Event of Interest' UC).

The System pipeline follows a sequence configured by the System Maintainer when pipeline processing raw waveform data to form event hypotheses (see 'Configures Processing Sequence' UC).

2.7. UC-02.01 System Determines Waveform Data Quality

This use case describes how the System determines quality of waveform data. The system masks data with data quality errors. QC masked sections are not used in subsequent waveform processing if configured (see 'Configures Processing Components' UC).

2.8. UC-02.02 System Enhances Signals

This use case describes how the System processes waveform data to enhance event signals while suppressing background noise. The System creates derived channels from input channels using signal enhancement techniques including filtering, rotation and beaming. The System also resamples channels and deconvolves instrument response to convert raw channel sample counts to earth displacement.

The System filters raw channels to isolate frequency content in the presumed bandwidths of arriving signals. The System uses various filter configurations to both optimize the enhancement of different signal arrival types and to account for the unique characteristics of individual raw channels.

The System rotates raw channel data from 3-component seismic stations to align the data's axes to a specific azimuth and slowness rather than to the physical instrumentation's coordinate system. Rotation

produces derived channels corresponding to an arriving signal radial, transverse horizontal and transverse vertical (3-dimensional rotation only) ground motion components.

The System forms continuous and non-continuous beams for array stations using array element channel data. The System computes beams for each array providing targeting on specific areas of interest, specific event hypotheses, and wide area coverage.

The System uses default signal enhancement parameters configured by the System Maintainer for pipeline processing (see ‘Configures Processing Components’ UC) or override parameters set by the Analyst (see 'Enhances Signals' UC).

2.9. UC-02.03 System Detects Events using Waveform Correlation

This architecturally significant use case describes how the System detects both single station and network event hypotheses using waveform correlation. The System forms an event hypothesis corresponding to a historical event when the waveform data from one or more channels has high correlation with the same channels' waveform data from the historical event.

This use case is architecturally significant due to the potential for high levels of processing and memory resource consumption.

2.10. UC-02.04 System Detects Signals

This use case describes how the System detects signals in waveform data. The System automatically and continuously detects signals on raw and derived channels (see 'System Enhances Signals' UC) with an acceptable data quality (see 'System Determines Waveform Data Quality' UC). Multiple signal detection algorithms are used to detect signals. The System declares detections when these time series signals exceed a threshold value. The System uses threshold values for signal detectors configured by System Maintainer (see 'Configures Processing Components' UC). Threshold values are configurable by type of detector and channel. The System stores all detections and respective attributes (such as type of detector).

If expected signal detections are available, they are used to help guide the signal detection process.

2.11. UC-02.05 System Measures Signal Features

This use case describes how the System measures signal detection features on waveform data. Several types of feature measurement are possible depending on the type of station making the detection (seismic, infrasonic, and hydroacoustic). For all types of stations, on a station-by-station basis, the System forms groups of signal detections that correspond to different events. The System measures general time and frequency domain features of signal detections for all types of stations. The System extracts polarization features for 3-component seismic station signal detections. For signal detections from seismic and infrasound array stations, the System measures azimuth and slowness in the frequency-wavenumber domain. For hydroacoustic stations, the System makes a variety of specialized time domain, frequency domain, and cepstral domain measurements and groups signal detections from multiple hydrophones at the same station to determine azimuth. For all types of stations, the System assigns preliminary phase labels to signal detections using available signal features.

If expected signal detections are available, they are used to help guide the signal feature measurement process.

The System uses default signal detection feature measurement parameters configured by the System Maintainer (see ‘Configures Processing Components’ UC) or override parameters set by the Analyst (see 'Measures Signal Features' UC and 'Identifies Event' UC).

2.12. UC-02.06 System Builds Events using Signal Detections

This architecturally significant use case describes how the System uses signal detections and features measured from those signal detections to build single station event hypotheses, build network event hypotheses, and associate previously unassociated signal detections to existing event hypotheses.

To build an event hypothesis, the System associates signal detections from one or more seismic, hydroacoustic, or infrasound stations. The System builds event hypotheses meeting predefined event formation criteria and associates previously unassociated signal detections to existing event hypotheses using signal detections, feature measurements based on those signal detections (see ‘System Measures Signal Features’ UC), and single station signal detection groups. The System references empirical knowledge from past events and geophysical models when forming event hypotheses and when associating previously unassociated signal detections to existing event hypotheses. The System makes signal detection phase assignments using information available when considering signal detections in the context of event hypotheses. The System validates event hypotheses and phase assignments using empirical and geophysical model based parameters. The System computes quality metrics for all event hypotheses.

The System Maintainer configures the phase assignment parameters, signal detection association parameters, and event hypothesis quality metric parameters (see ‘Configures Processing Components’ UC). The Analyst has the option to select values for these parameters during interactive review (see 'Builds Event' UC).

This use case is architecturally significant due to the potential of integrating new algorithms to build events.

2.13. UC-02.07 System Resolves Event Conflicts

This use case describes how the System uses conflict resolution to reconcile event hypotheses built by multiple association processes (see ‘System Detects Events Using Waveform Correlation’ UC and ‘System Builds Events Using Signal Detection’ UC). During conflict resolution the System forces signal detections to be associated to at most one event hypothesis, corrects erroneously associated signal detections, and merges duplicate event hypotheses. The System verifies all event hypotheses formed or modified during conflict resolution meet the event hypothesis formation criteria (see ‘System Builds Events Using Signal Detection’ UC) configured by the System Maintainer (see 'Configures Processing Components' UC).

2.14. UC-02.08 System Refines Event Location

This architecturally significant use case describes how the System refines event hypothesis location solutions. The System locates events by finding the event location minimizing the difference between signal detection feature measurements and signal detection feature predictions (see 'System Measures

Signal Features' UC). The System references both empirical knowledge from past events and geophysical models to form the signal detection feature predictions. The System also computes an uncertainty bound for each event hypothesis location solution describing a region bounding the event hypothesis' hypocenter and origin time at a particular confidence level. The System creates a variety of location solutions for each event hypothesis. These location solutions vary from one another in either the input parameters the System uses or in the location solution components the System restrains to fixed values (e.g. depth) during event location calculations. The System computes location solutions using input parameters configured by the System Maintainer (see 'Configures Processing Components' UC). The Analyst has the option to override input parameters originally configured by the System Maintainer (see 'Refines Event Location' UC).

This use case is architecturally significant due to the processing and memory resource consumption of 3D earth model calculations.

2.15. UC-02.09 System Refines Event Magnitude

This use case describes how the System estimates event hypothesis magnitudes. The System determines magnitude as a function of signal detection feature measurements (see 'System Measures Signal Features' UC), the distance between the event hypothesis' location (see 'System Refines Event Location' UC) and the locations of observing and non-observing stations, and knowledge of Earth structure (e.g. signal attenuation factors and geometric spreading).

2.16. UC-02.10 System Evaluates Moment Tensor

This use case describes how the System evaluates the moment tensor for an event. The System uses Greens functions to invert observed ground motion data from the event to determine the moment tensor. The System decomposes the moment tensor into deviatoric and isotropic components. The System decomposes the deviatoric component into best-fitting double couple and compensated linear vector dipole (CLVD) components.

2.17. UC-02.11 System Finds Similar Events

This use case describes how the System finds events that are similar to a specified event. The System uses event parameters (e.g., latitude and longitude), patterns of associated signal detections, or waveform correlation as similarity metrics. The System uses default similarity parameters configured by the System Maintainer (see 'Configures Processing Components' UC) or override parameters set by the Analyst (see 'Compares Events' UC).

2.18. UC-01 System Predicts Signal Features

This use case describes how the System predicts signal features. Signal features include phase identification, probability of detection, arrival time, azimuth, slowness, amplitude and spectral content. The System references both empirical knowledge from past events and geophysical models to form the signal detection feature predictions. The System applies empirical corrections to predictions. The System provides uncertainties for predictions as appropriate. The System uses default signal prediction parameters configured by the System Maintainer (see 'Configures Processing components' UC) or override parameters set by the Analyst (see 'Refines Event' UC).

2.19. UC-03 Analyzes Events

This use case describes how the Analyst analyzes event hypotheses created by either pipeline processing or a previous Analyst and builds new events. The Analyst selects data to analyze (see 'Selects Data for Analysis' UC), refines event hypotheses for selected events (see 'Refines Event' UC), reviews waveforms and unassociated detections (see 'Scans Waveforms and Unassociated Detections' UC) and builds new event hypotheses for events missed by the System or previous Analysts (see 'Builds Event' UC). When finished with the analysis, the Analyst marks the processing stage as complete for the selected data (see 'Marks Processing Stage Complete' UC) to prepare the event hypotheses for further analysis in subsequent processing stages.

2.20. UC-03.01 Selects Data for Analysis

This use case describes how the Analyst selects data for analysis consistent with the current processing stage. The Analyst creates an Analysis Time Interval based on an actual time interval or an Event Set. The Analyst selects the Analysis Time Interval to facilitate the analyzing of waveform data, unassociated detections, and system-built and Analyst-reviewed events within an Analyst specified time frame. The system updates relevant displays to indicate the selected data is being analyzed.

2.21. UC-03.02 Refines Event

This architecturally significant use case describes how the Analyst refines an event hypothesis. The Analyst checks waveform quality (see 'Determines Waveform Data Quality' UC). For waveforms of sufficient quality, the Analyst enhances signals and suppresses noise on waveforms for relevant stations (see 'Enhances Signals' UC), adds and associates missing detections, and modifies or unassociates detections already associated with the event hypothesis (see 'Detects Signals' UC). The Analyst rejects event hypotheses that are invalid. For valid event hypotheses, the Analyst measures signal features associated with the detections (see 'Measures Signal Features' UC). The Analyst uses these signal features to refine the location (see 'Refines Event Location' UC) and magnitude (see 'Refines Event Magnitude' UC) of the event hypothesis. The Analyst repeats these steps until satisfied with the results. Analysts may provide feedback for previous Analysts during any of these steps (see 'Provides Analyst Feedback' UC).

This use case is architecturally significant because it captures the interplay between all of the Analyst activities.

2.22. UC-03.02.01 Determines Waveform Data Quality

This use case describes how the Analyst determines the quality of the waveform data being analyzed. The Analyst reviews waveform data to determine data quality. The Analyst masks waveform data of insufficient quality that should not be used during event processing. The Analyst modifies or removes masks created by the System (see 'System Determines Waveform Data Quality' UC).

2.23. UC-03.02.02 Enhances Signals

This use case describes how the Analyst processes waveforms to enhance event signals while suppressing background noise. The Analyst enhances signals using the same algorithms as pipeline processing (see ‘System Enhances Signals’ UC), but the Analyst has the option to select the input parameters rather than using the predefined parameters used during pipeline processing.

2.24. UC-03.02.03 Detects Signals

This use case describes how the Analyst detects new signals and modifies previously created signals in waveform data to refine an existing event. The Analyst detects signals on raw and derived channels. The Analyst views, updates and removes signal detections associated to an event. The Analyst associates unassociated signal detections to events. The Analyst assigns phase names to detections.

2.25. UC-03.02.04 Measures Signal Features

This use case describes how the Analyst measures signal features on waveform data. The Analyst measures the same signal features as are measured in pipeline processing (see 'System Measures Signal Features' UC), but the Analyst has the option to select the input parameters rather than the predefined parameters used during pipeline processing.

2.26. UC-03.02.05 Refines Event Location

This use case describes how the Analyst refines event hypothesis location solutions. The Analyst generates location solutions using the same algorithms as pipeline processing (see 'System Refines Event Location' UC), but the Analyst has the option to select the input parameters rather than using the predefined parameters used during pipeline processing. The system indicates which measurements are invalidated by the relocation (e.g. beams, magnitudes) and recalculates the same magnitude estimates that are calculated during pipeline processing.

2.27. UC-03.02.06 Refines Event Magnitude

This use case describes how the Analyst refines estimated event magnitudes for an existing event hypothesis. The Analyst invokes the same magnitude algorithms used in pipeline processing (see 'System Refines Event Magnitude' UC) or additional magnitude estimation algorithms. The Analyst configures input parameters for estimating magnitude.

2.28. UC-03.02.07 Evaluates Moment Tensor

This use case describes how the Analyst evaluates the moment tensor for an event. The Analyst determines which observed waveforms to include in the inversion. The Analyst selects which Earth model to use for the inversion (i.e. which Greens functions). The Analyst invokes the system to evaluate the moment tensor (see 'System Evaluates Moment Tensor' UC).

2.29. UC-03.02.08 Compares Events

This architecturally significant use case describes how the Analyst compares events to determine how similar events were constructed. The Analyst compares waveforms from comparison events by visually inspecting an overlay of the waveforms to determine if the events are from a similar source. The Analyst searches for comparison events or creates agglomerative hierarchical clusters of waveforms from events and determines that the events are from a similar source if the correlation coefficient is above a selected threshold. The Analyst selects waveforms and signal detections for master event relocation (see 'Refines Event Location' UC).

This use case is architecturally significant due to the introduction of the capability to compare events within an operational context.

2.30. UC-03.03 Scans Waveforms and Unassociated Detections

This architecturally significant use case describes how the Analyst scans waveforms and unassociated signal detections to build new events. The Analyst scans unassociated signal detections to find signal detections that should be associated to existing event hypotheses, and scans waveforms to find signal detections missed by prior processing. The Analyst uses two data scanning methods. The Analyst scans waveforms through time to detect new signals and associate unassociated signal detections to existing event hypotheses (see 'Detects Signals' UC). The Analyst scans unassociated signal detections to associate signal detections to existing event hypotheses (see 'Detects Signals' UC). The Analyst builds new event hypotheses from unassociated signal detections (see 'Builds Event' UC).

This use case is architecturally significant due to the user interface design considerations for displaying and interacting with waveforms and unassociated signal detections.

2.31. UC-03.04 Builds Events

This use case describes how the Analyst builds a new event hypothesis missed by prior processing. The Analyst builds event hypotheses using the following methods: manual signal association, invoking waveform correlation algorithms, invoking signal association algorithms, and specifying an event time and location to build a virtual event hypothesis.

The Analyst manually builds a new event hypothesis by finding collections of signal detections representing observations of the same event and associating those signal detections as a new event hypothesis.

The Analyst invokes the same waveform correlation and signal association algorithms as pipeline processing (see 'System Detects Events using Waveform Correlation' UC and 'System Builds Events using Signal Detections' UC), but the Analyst has the option to select the input parameters rather than the predefined parameters used during pipeline processing.

The Analyst builds a virtual event hypothesis for a specified time and location by first creating an event hypothesis with no associated signal detections and then using Analyst tools (see 'Refines Event' UC) to find evidence supporting existence of an event at that time/location.

The System indicates to the Analyst if an event hypothesis does not meet event formation criteria configured by the System Maintainer (see 'Configures Processing Components' UC). The Analyst views event quality metrics computed by the System for all Analyst built event hypotheses.

2.32. UC-03.05 Marks Processing Stage Complete

This architecturally significant use case describes how the Analyst marks a processing stage complete upon completing analysis of an Event Set or an Analysis Time Interval. The Analyst marks an Event Set or Analysis Time Interval complete to allow the Event Set or Analysis Time Interval to proceed to the next processing stage.

This use case is architecturally significant due to expected changes to the analysis process (including operational concept changes).

2.33. UC-04 Reports Event of Interest

This architecturally significant use case describes how the Duty Officer assesses and reports an Event of Interest. After receiving notification of a Potential Event of Interest, the Duty Officer remotely views the event hypothesis to determine if it should be assessed immediately [Extensibility]. The Duty Officer locally assesses event hypothesis details, including available infrasound and hydroacoustic data, to determine if the event is reportable. The Duty Officer creates a report that contains geographic location, time, depth, magnitude, source type determination, waveforms, the signal detection list and a map. The Duty Officer makes the Event Report available.

This use case is architecturally significant as it involves high consequence decisions occurring within tight time constraints.

2.34. UC-05 Provides Data to Customers

This use case describes how the System provides event bulletins, waveforms, and reports to Authorized External Users. The External Release Authority reviews and approves event hypotheses for release to Authorized External Users (see 'Approves Events for External Release' UC). An Authorized External User requests data from the System (see 'Requests System Data' UC) or accesses processing results through a web interface (see 'Views System Results' UC).

2.35. UC-05.01 Requests System Data

This use case describes how an Authorized External User requests data from the System. Authorized External Users access web servers to request approved waveform data, reports, station SOH, and station data acquisition statistics. The Authorized External User subscribes for data to be sent as it becomes available.

2.36. UC-05.02 Approves Events for External Release

This use case describes how the External Release Authority reviews and approves event hypotheses for release to Authorized External Users. The External Release Authority reviews an event hypothesis and if it meets specific criteria, approves the event hypothesis for external release.

2.37. UC-05.03 Views System Results

This architecturally significant use case describes how an Authorized External User views current and past reports through the System web servers. An Authorized External User views event reports, event bulletins, station state-of-health (SOH) and event web pages originating from the System. An Authorized External User views event reports and event bulletins from third parties.

This use case is architecturally significant because it provides an interactive interface for external customers.

2.38. UC-06 Configures System

This use case describes how the System User configures the system. The System Maintainer configures station data usage, processing components, system messages, system permissions, and security markings for printed output and defines processing sequences (see ‘Configures Station Usage’, ‘Configures Processing Components’, ‘Configures System Messages’, 'Configures System Permissions', ‘Configures Information Security Markings for Printed Output’, and ‘Defines Processing Sequence’ UCs). The System Controller controls data acquisition and forwarding (see 'Controls Data Acquisition’ UC). The System User views system configuration history and configures analysis interfaces (see ‘Views System Configuration History’, and ‘Configures Analysis Interfaces’ UCs).

2.39. UC-06.01 Controls Data Acquisition

This use case describes how the System Controller selects to acquire and forward Station Data (waveform data and SOH data) and Event Bulletin data. If more than one data source is available for station data, the System Controller selects which data source to use. The System Controller generates and installs PKI credentials needed for data that requires authentication.

2.40. UC-06.02 Configures Station Usage

This use case describes how the System Maintainer configures station data usage within the System. The System Maintainer adds or removes stations or modifies station parameters. The System Maintainer configures the usage of each station's data including availability to interactive processing, automated station processing, and automated network processing

2.41. UC-06.03 Defines Processing Sequence

This architecturally significant use case describes how the System Maintainer defines System Processing Sequences. At the highest level, a Processing Stage is associated with a Processing Sequence. The System Maintainer defines a Processing Sequence to be executed, which includes other Processing Sequences and/or Processing Units. Once the system verifies that the configuration is valid, the System Maintainer saves all changes made to the Processing Sequence. The configuration changes do not take effect until they are installed as a software update (see ‘Installs Software Update’ UC).

This use case is architecturally significant due to the fundamental changes to the system it introduces including the interactive interfaces provided and the specification of the elements that are available for sequence customization.

2.42. UC-06.05 Configures Processing Components

This use case describes how the System Maintainer configures processing components that are part of the pipeline processing sequence (see 'Defines Processing Sequence' UC). The System Maintainer configures the components used for performing QC, signal enhancement, signal detection, signal detection feature extraction, continuous beam formation, signal association, event hypothesis creation, event location, and magnitude estimation.

2.43. UC-06.06 Configures System Messages

This Use Case describes how the System Maintainer configures System messages. The System Maintainer configures the message category and threshold criteria used to determine message level (Failure, Warning or Notification).

2.44. UC-06.07 Views System Configuration History

This architecturally significant use case describes how the System User views the system configuration change history. The system stores each configuration change and can present a list of configuration changes or a trend display of configuration values over time. The System User can also view the system configuration at a selected time. The configuration history contains information on the user who modified the configuration and when the configuration changed.

This use case is architecturally significant because it covers a new feature of the system to store and view all system configuration information.

2.45. UC-06.09 Configures System Permissions

This use case describes how the System Maintainer enables users to access selected system features. The System Maintainer configures user permission to access and modify selected data and execute selected system functions. The System only allows the authorized users to access the limited system features.

2.46. UC-06.10 Configures Analyst Interfaces

This use cases describes how the System User makes customizations to their System analysis environment. The System User configures the default displays provided by the System and where they appear on the user's screen. The System User configures keyboard shortcuts. The System User configures playback sounds.

2.47. UC-07 Monitors Performance

This Use Case describes how the System User oversees System performance. The Performance Monitor analyzes mission performance (see 'Analyzes Mission Performance' UC). The System User monitors station state-of-health (see 'Monitors Station State-of-Health' UC). The System User monitors system performance (see 'Monitors System Performance' UC). The System computes and stores metrics and statistics and reports on the System mission performance (see 'System Monitors Mission Performance' UC).

2.48. UC-07.01 Analyzes Mission Performance

This architecturally significant use case describes how the Performance Monitor analyzes System mission performance. The Performance Monitor reviews station processing statistics. The Performance Monitor views and compares event bulletins originating from seismic, hydroacoustic, and infrasonic data to characterize such criteria as event location, depth, event associations. The Performance Monitor uses trending tools to spot patterns in the collected statistics to tune system performance. The Performance Monitor views historic and simulated monitoring mission performance. The Performance Monitor views either current or historic Analyst tool usage statistics.

This use case is architecturally significant because it provides the interface for measuring System event detection performance and tuning the system.

2.49. UC-07.02 Monitors System Performance

This use case describes how the System User monitors current and historic System performance. The System User views System performance (including the common error log) and Analyst tool usage statistics.

2.50. UC-07.03 Monitors Station State-of-Health

This use case describes how the System User monitors station state-of-health. The System User views current station state-of-health (e.g., state-of-health values reported by the station, timeliness of waveform data intervals, station processing statistics and thresholds, and QC masks) to detect problems with station data quality and availability.

2.51. UC-07.04 System Monitors Mission Performance

This use case describes how the System computes, stores, and reports on System mission performance. The System computes and stores station processing statistics capturing total signal detections, residuals of measured attributes (i.e., signal detection, amplitude, azimuth, slowness, and magnitude), and rate of detections. The System computes and stores empirical station magnitude detection thresholds. The System computes and stores event hypothesis statistics for a geographic region. Station processing statistics, event hypothesis statistics, and empirical station magnitude detection thresholds are captured over a configurable time period. The System reports when measured attributes exceed configurable thresholds indicating a possible need for further station tuning.

2.52. UC-08 Supports Operations

This use case describes how the System User supports operations of the System. Various System Users access and control the system, export and import data, review event history, maintain the Operations Log, provide and view analyst feedback, view analyst performance metrics, view security status, and print output.

2.53. UC-08.01 Accesses the System

This use case describes how the System User gains access to a subsystem from a collocated workstation or from a remote workstation. The System User enters their logon credentials, i.e., username and password, to gain access to the subsystem.

2.54. UC-08.02 Controls the System

This architecturally significant use case describes how the System Controller starts and stops the System, switches pipeline processing from the Primary to the Backup and shuts down the System hardware. When the System Controller starts the System, the System data processing starts and automatically accepts connections for acquiring data. The Primary synchronizes processing results with the Backup (see 'Synchronizes Processing Results' UC). When the System Controller stops the System, the System data processing stops and automatically disconnects all incoming data connections and outgoing data connections. When the System Controller switches pipeline processing to the Backup, the Backup becomes the Primary. When the System Controller shuts down the System hardware, the System Controller stops the System and powers off the entire system.

This use case is architecturally significant due to the System's timeliness requirements to start and stop the System and to transfer mission assignment from the Primary to the Backup.

2.55. UC-08.03 Exports Data

This use case describes how the System User selects and exports data from a Subsystem. Exports support training, standalone analysis, synchronizations between subsystems and provide data to external systems.

2.56. UC-08.04 Imports Data

This use case describes how the System Maintainer imports data onto the System, including the Training Subsystem and the Standalone Subsystem.

2.57. UC-08.05 Views Event History

This architecturally significant use case describes how the Analyst observes the change history of a given event. The change history is a series of one or more saved event hypotheses. Analysts can view all the event hypotheses and the set of location solutions for each hypothesis. The analyst can view the relationship between event hypotheses including the preferred hypothesis for each processing stage. The event change history persists across work sessions for subsequent review.

This use case is architecturally significant because it covers review of stored versions of event hypotheses.

2.58. UC-08.06 Maintains Operations Log

This use case describes how the Analyst displays and edits the Operations Log. The Analyst edits and saves system status information in the Operations Log. The Analyst views the Operations Log for current or past system status.

2.59. UC-08.07 Provides Analyst Feedback

This use case describes how the Analyst provides feedback for analyzed events. Each subsequent Analyst provides comments on analyzed events as events are analyzed, refined, and ultimately assessed. The System notifies the original Analyst once comments are entered (see ‘Views Analyst Feedback’ UC).

2.60. UC-08.08 Views Analyst Feedback

This use case describes how the Analyst views feedback provided by Analysts (see 'Provides Analyst Feedback' UC).

2.61. UC-08.09 Views Analyst Performance Metrics

This use case describes how the Analyst views performance metrics calculated from System information for any set of Analysts for a specified time range.

2.62. UC-08.10 Views Security Status

This use case describes how the System Maintainer views System security status to enforce access control to System hardware and software resources. The System Maintainer selects to view current or past security status of auditable events including user logins, file and data access, network access, application process requests, virus scans, and security credentials authentication requests.

2.63. UC-08.11 Prints Output

This use case describes how the System User selects and prints hardcopy System information. The System User can select to print a display, a report, or the entire screen.

2.64. UC-08.12 Views Messages

This use case describes how the System User views messages available on the System. The System User views messages from sources configured by the System Maintainer (see 'Configures System Messages' UC) or subscribed by the System User (see 'Configures Analysis Interfaces' UC).

2.65. UC-09 Tests System

This use case describes how the System User tests the System. The System Maintainer executes BIT (built-in-test) on the OPS and ALT Subsystems (see 'Performs Built-In-Test' UC). The System User tests the SUS/TST and DEV Subsystem processing components individually or in sequence (see ‘Performs Software Component Testing’ UC). The Developer creates and replays test data sets (see ‘Creates Test Data Set for Replay’ UC, ‘Replays Test Data Set’ UC and 'Replays Analyst Actions' UC).

2.66. UC-09.01 Performs Built-In-Test

This use case describes how the System Maintainer executes Built-In-Test (BIT) on the System. The System Maintainer selects tests to run and the System performs the test and presents the results. The BIT does not interrupt operational processing. The System Maintainer views the test results to detect and isolate failures in system software and hardware.

2.67. UC-09.02 Performs Software Component Testing

This use case describes how the Developer executes regression testing of the System processing components individually or in sequence. The Developer tests System processing components with repeatable regression and unit tests organized into test suites. The Developer maintains a baseline of expected results for comparison against newly generated test results.

2.68. UC-09.03 Creates Test Data Set for Replay

This use case describes how the Developer creates Test Data Sets within the System. The Developer defines the Test Data Set and the required Test Data Set parameters and the System creates the Test Data Set. Test Data Sets may contain waveform data, waveform acquisition time tags, and station information to support tests that replay the waveform data into the System (see 'Replays Test Data Set' UC). The Test Data Set may also contain the steps that an Analyst takes while analyzing the data, including the captured time sequence information to support tests that replay Analyst actions (see 'Replays Analyst Actions' UC).

2.69. UC-09.04 Replays Test Data Set

This architecturally significant use case describes how the Developer replays a waveform Test Data Set into the System processing pipeline. The Developer selects a previously created waveform test data set (see ‘Creates Test Data Set for Replay’ UC) and initiates the data set replay. The System plays back the waveform Test Data Set using the captured data acquisition time sequence information, substituting the waveform Test Data Set feed for the actual real time waveform data. The Developer can terminate the playing waveform Test Data Set manually or allow it to self-terminate after it completes its duration time.

This use case is architecturally significant due to the introduction of new capability and the concept of playing back time synchronized captured data.

2.70. UC-09.05 Replays Analyst Actions

This use case describes how the Developer replays a set of Analyst actions into the System. The Developer selects a previously created Analyst action data set (see 'Creates Test Data Set for Replay' UC) and initiates the data set replay. The System inputs the Analyst actions using the captured time sequence information, responding to the Analyst actions as if manually initiated.

2.71. UC-10 Maintains System

This use case describes how the System Maintainer maintains the System, how the System synchronizes acquired station data and processing results, and monitors security The System Maintainer performs periodic system backups (see ‘Performs System Backups’ UC) in order to recover the System, system restores (see ‘Performs System Restores’ UC) due to a system failure or catastrophic event, and installs software updates (see ‘Installs Software Update’ UC) due to OS updates or system-related fixes. The System synchronizes acquired station data (see 'System Synchronizes Acquired Station Data' UC) and processing results (see 'System Synchronizes Processing Results' UC) in near real-time in order to maintain synchronicity between the Primary and Backup. The System monitors security (see 'System Monitors Security' UC).

2.72. UC-10.01 Performs System Backups

This use case describes how the System Maintainer performs System backups. The System Maintainer periodically conducts a system backup which copies all system-related data, software (source and object), and files to a separate storage media enabling System to be restored in the event of a system failure or catastrophic event. The System Maintainer also conducts a database backup which backs up the entire database enabling a System database to be recovered in the event of data loss, data corruption, etc.

2.73. UC-10.02 Performs System Restores

This use case describes how the System Maintainer performs System restores. The System Maintainer conducts a system restore due to a system failure or catastrophic event enabling the System to return to

operational status. The System Maintainer also conducts a database restore due to data loss, data corruption, etc., enabling the System database state to be restored to a specific point in time.

2.74. UC-10.03 Installs Software Update

This use case describes how the System Maintainer installs software versions and software configuration changes on the System, Training Subsystem, and Standalone Subsystems. The System Maintainer periodically installs software due to OS and other COTS software updates or system-related fixes on the System. The System Maintainer periodically installs System software versions on the Training Subsystem supporting Analyst training. The System Maintainer also installs System software versions on the Standalone Subsystems supporting sensor orientation, sensor analysis, and sensor calibration verification.

2.75. UC-10.04 System Synchronizes Acquired Station Data

This use case describes how the System synchronizes acquired station data between the Primary and Backup. The System synchronizes acquired station data in Near Real Time when communications are functional. Following a communication outage, the System backfills acquired station data feeds without impeding the ongoing Near Real Time synchronization.

2.76. UC-10.05 System Synchronizes Processing Results

This use case describes how the System synchronizes processing results between the Primary and Backup. The System synchronizes processing results in Near Real Time when communications are functional. Following a communication outage, the System backfills processing results without impeding the ongoing Near Real Time synchronization.

2.77. UC-10.06 System Monitors Security

This use case describes how the System monitors security to enforce access control to System's hardware and software resources. The System automatically records all auditable events. These auditable events include: user logins, file and data access, network access, application process requests, and security credentials authentication requests. The System collects and monitors the record of auditable events notifying the System Maintainer of security related events (e.g., intrusions).

2.78. UC-11 Performs Research

This use case describes how the Researcher performs extended event analysis and research to enhance mission capability. The Researcher analyzes special events outside of the operational processing stages (see 'Analyzes Special Events' UC). The Researcher develops and tests new algorithms and models for potential improvement of the System (see 'Develops New Algorithms and Models' UC). The Researcher tunes existing algorithms for optimal performance (see 'Determines Optimal Processing Component Configuration' UC).

2.79. UC-11.01 Analyzes Special Events

This use case describes how the Researcher analyzes special events outside of operations. The Researcher retrieves System data and analyzes the data using Researcher tools without impacting operational performance.

2.80. UC-11.02 Develops New Algorithms and Models

This architecturally significant use case describes how the Researcher develops and tests new algorithms and models for potential improvement of the System. The Researcher retrieves the data needed for developing and testing new algorithms and models. The Researcher compares the output from these tests to the System output. The Researcher recommends updates to the System.

This use case is architecturally significant as the Researcher requires access to System data and algorithm implementations used in pipeline processing and interactive processing through command line interfaces and a Common Object Interface (COI).

2.81. UC-11.03 Determines Optimal Processing Component Configuration

This use case describes how the Researcher optimizes the configuration of pipeline processing component performance. The Researcher optimizes the configuration of processing components to achieve optimal balance of false alarms vs. missed events while ensuring events of interest are not missed during pipeline processing (see 'System Detects Event' UC). The Researcher selects control data (results of waveform data formerly processed and reviewed by Analysts), conducts tests and compares test results to the control data.

2.82. UC-11.04 Performs Multiple Event Location

This use case describes how the Researcher refines location solutions for multiple event hypotheses simultaneously to achieve greater accuracy. The Researcher selects a set of event hypotheses, a multiple event location algorithm and associated parameters, and updates the location solution of each event hypothesis.

2.83. UC-12 Performs Training

This use case describes how the Analyst Instructor configures the Training Subsystem and trains Analysts to look at waveform data and interactively find event solutions. The Analyst Instructor imports training data sets to the Training Subsystem and configures the data so it can be accessed by students (see 'Configures Data for Training Subsystem' UC). The Analyst Instructor trains Analysts by demonstrating all components of the Analyst user role, and observing student workstations as they work on training exercises (see 'Trains Analyst' UC).

2.84. UC-12.01 Configures Data for Training Subsystem

This use case describes how the Analyst Instructor configures data on the Training Subsystem for training of students. The Analyst Instructor chooses a representative training data set (raw waveforms, processing results), imports it (see 'Imports Data' UC), and configures the data so students can access it.

2.85. UC-12.02 Trains Analysts

This use case describes how the Analyst Instructor executes an Analyst training scenario, observes and evaluates Analysts, and collects training feedback. The Analyst Instructor executes training scenarios on the Training Subsystem and covers all components of the Analyst user role (see ‘Analyzes Event’ UC). The Training Subsystem automatically stores all event solutions created by the Analysts. The Analyst Instructor observes and interacts with individual Analyst's computer workstation screens remotely from the Analyst Instructor’s computer workstation screen. The Analyst Instructor allows each Analyst to remotely observe the Analyst Instructor’s screen. The Analyst Instructor creates and views Analyst training performance reports.

2.86. UC-12.03 Views Training Feedback

This use case describes how the Analyst views feedback reports that highlight the differences between processing results of the Analyst and the processing results of the Analyst Instructor.

2.87. UC-13 Operates Standalone System

This use case describes how the System User operates the Standalone Subsystem to support site surveys (see ‘Conducts Site Survey’ UC) and perform standalone analysis (see ‘Performs Standalone Analysis’ UC). The Standalone Subsystem operates with reduced computing infrastructure enabling single machine operation.

2.88. UC-13.01 Conducts Site Survey

This use case describes how the Field Scientist conducts site surveys using the Standalone Subsystem to assess potential placement of sensors, sensor stations, and sensor networks. The Field Scientist collects waveform data originating from the geophysical hardware deployed for the survey and converts that data to the System format. The Field Scientist accesses event data for the region from the System or other sources for comparison to events detected at the site. The Field Scientist analyzes the waveform data to assess characteristics of signals and noise at the site. The Field Scientist captures the analysis results and produces a report.

2.89. UC-13.02 Performs Standalone Analysis

This architecturally significant use case describes how the System User performs analysis using the Standalone Subsystem. The Standalone Subsystem acquires station data and external bulletin data (see 'System Receives Station Data' UC and 'System Receives Bulletin Data' UC) or the System User imports data (see 'Imports Data' UC). The Standalone Subsystem detects events (see ‘System Detects Events’ UC). The System User analyzes events (see 'Analyzes Events' UC) using analysis components that are available on the Standalone Subsystem and exports the processing results (see 'Exports Data' UC). The System User configures, operates, monitors, and maintains the Standalone Subsystem as needed (see 'Configures System' UC, 'Supports Operations' UC, 'Monitors System' UC, and 'Maintains System' UC).

This use case is architecturally significant since it requires the System architecture to support configurable software distributions at various scales of data processing, computing hardware, and personnel.

2.90. UC-14 IDC Unique

This use case includes use cases that are unique to an IDC System distribution.

2.91. UC-14.01 System Assesses Event Consistency

This use case describes how the System assesses the consistency of observations for an event with expected observations for an event of comparable size in the same general location. The System calculates any event characteristics needed for assessing event consistency. The System compares event characteristics against expected values and quantifies inconsistencies. The System provides a summary of inconsistencies. The System attempts to correct inconsistencies. The event characteristics that are calculated, the expected values, and the inconsistencies that can be automatically corrected are configured by the System Maintainer (see 'Configures Processing Components' UC).

2.92. UC-14.02 Assesses Event Consistency

This use case describes how the Analyst assesses the consistency of observations for an event with expected observations for an event of comparable size in the same general location. The Analyst selects an event or set of events. The Analyst invokes the system to assess event consistency for each event (see ‘System Assesses Event Consistency’ UC). The Analyst reviews the summary of inconsistencies and corrective actions.

2.93. UC-14.03 System Screens Event

This use case describes how the System creates a screened event list (ideally containing no non-nuclear events) by processing the list of Analyst-reviewed events. The System automatically calculates event characteristics for all events designated as having completed Analyst review. The System uses these event characteristics to screen events that are non-nuclear. The event characteristics that are calculated and the screening criteria are configured by the System Maintainer (see 'Configures Processing Components' UC).

2.94. UC-14.04 Controls Monitoring Stations

This use case describes how the System Maintainer controls Monitoring Stations. The System Maintainer securely issues commands to Monitoring Stations and monitors response to support sensor calibration, authentication key maintenance, and station diagnostics.

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