SAND2017-0048R

IDC RE-ENGINEERING REPORT

SAND2017-XXXX R
Unlimited Release
January 2017

IDC Re-Engineering Phase 2 Glossary

Version 1.3

Christopher J. Young, James Mark Harris

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

Sandia National Laboratories is a multi-mission laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

This page intentionally left blank.

Issued by Sandia National Laboratories, operated for the United States Department of Energy by Sandia Corporation.

SAND2017-XXXX R
Unlimited Release
January 2017

IDC Re-Engineering Phase 2 Glossary

Christopher J. Young, James Mark Harris
Next Generation Monitoring Systems Department
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-MS0401

Abstract

This document contains the glossary of terms used for the IDC Re-Engineering Phase 2 project. This version was created for Iteration E3.

REVISIONS

Version	Date	Author/Team	Revision Description	Authorized by
0.1	7/31/2014	SNL IDC Re-Engineering Team	Initial Release for I1	M. Harris
1.0	12/15/2014	SNL IDC Re-Engineering Team	Release for I2	M. Harris
1.1	12/17/2015	SNL IDC Re-Engineering Team	Release for E1	M. Harris
1.2	06/28/2016	SNL IDC Re-Engineering Team	Release for E2	M. Harris
1.3	01/30/2017	SNL IDC Re-Engineering Team	Release for E3	M. Harris

TABLE OF CONTENTS

1. Active Review 13
2. Aftershock Sequence 13
3. Agglomerative Hierarchical Clustering 13
4. Alphanumeric Data 13
5. Alphanumeric List 13
6. ALT (Alternate Subsystem) 13
7. Amplitude Correction Factor 13
8. Analysis Time Interval 14
9. Array 14
10. Array Coherence 14
11. Aseismic Region 14
12. Association 14
13. Atmospheric Model 14
14. Attenuation 14
15. Automatic Processing 15
16. Azimuth 15
17. Backup 15
18. Basemodel 15
19. Beam 15
20. Beam, Coherent 15
21. Beam, Continuous 15
22. Beam, Detection 15
23. Beam, fk 16
24. Beam, Incoherent 16
25. Beam, Origin 16
26. Beam Steering 16
27. Beamforming (Beaming) 16
28. Beamforming (Beaming), Coherent 16
29. Beamforming (Beaming), Incoherent 17

30. CD-1.0 Format and Protocols 17
31. CD-1.1 Format and Protocols 17
32. Catalog Event 17
33. Cepstral Domain Measurements 17
34. Channel 18
35. Channel, Derived 18
36. Channel Mask 18
37. Channel, Raw 18
38. Compensated Linear Vector Dipole 18
39. Compute Resource 18
40. Continuous Automated Testing Subsystem (CATS) 18
41. Correlation Coefficient 18
42. CSS 3.0 Format 19
43. Data Acquisition 19
44. Data Acquisition Partition 19
45. Data Authentication 19
46. Data Processing Partition 19
47. Data Provider 19
48. Data Quality Errors 19
49. Data Source 19
50. Database Backup 20
51. Database Restore 20
52. Defining/Non-Defining 20
53. Detection Feature Map 20
54. Development Subsystem (DEV) 20
55. Deviatoric Component (of Moment Tensor) 20
56. Double Couple Component (of Moment Tensor) 20
57. Earth Model 21
58. Earth Model, 1D 21
59. Earth Model, 2D 21
60. Earth Model, 3D 21

61. Empirically Derived Corrections 21
62. Event 21
63. Event Bulletin 22
64. Event Catalog 22
65. Event Change History 22
66. Event Epicenter 22
67. Event Hypocenter 22
68. Event Hypothesis 22
69. Event Hypothesis Location Solution 22
70. Event Hypothesis Quality Metric 22
71. Event Location 23
72. Event Magnitude, Network 23
73. Event Magnitude, Station 23
74. Event Quality Metric 23
75. Event Report 23
76. Event Set 23
77. Expected Signal Detection 23
78. F-statistic (Fisher Statistic) 24
79. False Event 24
80. Filter Cascade 24
81. Filter, Waveform 24
82. Flat Lined Waveform 24
83. Focal Mechanism 24
84. Focal Sphere Plot 25
85. Frequency Domain Measurements 25
86. Frequency-Wavenumber (fk) Measurements 25
87. Frequency-Wavenumber (fk) Power Spectrum 25
88. Frequency-Wavenumber (fk) Processing 25
89. Geographic Data 25
90. Geographic Information System (GIS) 25
91. Geographic Region 26

92. Geometric Spreading 26
93. Geospatial Data 26
94. Green Function 26
95. Historical Data 26
96. Hydroacoustic Arrival Group (HAG) 26
97. Hydroacoustic Time Domain Measurements 26
98. Hydrophone Station 27
99. IDC (International Data Centre) 27
100. IMS (International Monitoring System) 27
101. IMS 2.0 Format 27
102. Interactive Processing 27
103. Isotropic Component (of Moment Tensor) 27
104. Late Signal Association 27
105. Late-Arriving Waveform 28
106. Latency 28
107. Magnitude Estimation 28
108. Magnitude Type 28
109. Master Event Relocation 28
110. Maximum Likelihood Magnitude Estimation (MLE) 28
111. Meteorological Data 29
112. Mini-SEED Format 29
113. Missed Event 29
114. Moment 29
115. Moment Tensor 29
116. Moment Tensor Inversion 29
117. Monitoring Mission Performance 30
118. Multiple Event Relative Relocation 30
119. Near Real Time 30
120. Network 30
121. Network Magnitude Detection Threshold 30
122. Network Processing 30

123. Noise 30
124. OPS (Operational Subsystem) 30
125. Operational Processing Time Period 31
126. Operational Subsystem (OPS) 31
127. Operations Log 31
128. Origin 31
129. Phase 31
130. Phase Grouping 31
131. Pipeline Processing 31
132. Pipeline Processing Transfer 31
133. Pixel Family 32
134. PKI (Public Key Infrastructure) 32
135. PKI Credentials 32
136. Playback 32
137. Polarization Features 32
138. Power Detector 32
139. Preliminary Phase Label 32
140. Primary 33
141. Processing Component 33
142. Processing Sequence 33
143. Processing Stage 33
144. Processing Step 33
145. Progressive Multi-Channel Correlation (PMCC) 33
146. Q (Quality Factor) 34
147. QC Mask 34
148. QuakeML 34
149. Quality Control (QC) 34
150. Radiation Pattern 34
151. Radionuclide Data 34
152. Random Binary Calibration 34
153. Reference Event 34

154. Regression Testing 35
155. Rejected Event Hypothesis 35
156. Relative Event Magnitude Estimation 35
157. Remote Operations Center (ROC) 35
158. Rotation 35
159. SC3XML Format 35
160. SEED Format 35
161. Seed Event 36
162. Sensor Orientation 36
163. Signal 36
164. Signal Association 36
165. Signal Characterization 36
166. Signal Detection 36
167. Signal Detection Feature 36
168. Signal Detection Feature Measurement 37
169. Signal Detection Feature Prediction 37
170. Signal Detection Template 37
171. Signal Detector Threshold 37
172. Signal Enhancement 37
173. Single-Station Event Hypothesis 37
174. Site 37
175. Slowness 37
176. Source Type 37
177. Source Type Plot 38
178. STA/LTA 38
179. Standalone Subsystem 38
180. Station 38
181. Station Data 38
182. Station Data Acquisition Statistics 38
183. Station Magnitude 38
184. Station Magnitude Detection Threshold 39

185. Station Processing....39
186. Station State-Of-Health (SOH) 39
187. StationXML Format....39
188. Subspace Detector....39
189. Sustainment (SUS)/Test (TST) Subsystem....39
190. Swarm Sequence 40
191. System Backup....40
192. System Configuration....40
193. System Message 40
194. System Performance....40
195. System Restore 40
196. Test Data Set....40
197. Three Component Station....41
198. Time Domain Measurements....41
199. T-Phase Station....41
200. Trace Velocity 41
201. Training Data Set 41
202. Training Subsystem....41
203. Unit Testing....41
204. Virtual Event Hypothesis....41
205. Virtual Origin 41
206. Waveform....42
207. Waveform Correlation Event Processing 42
208. Waveform, Derived....42
209. Waveform Format, Storage 42
210. Waveform Processing 42
211. Waveform QC Mask....42
212. Waveform Quality Control....42
213. Waveform, Raw 43
214. Z-Detector....43

1. Active Review

The state of a set of data indicating an Analyst is reviewing the data. The set of data in Active Review is defined by either an event being refined and its associated signal detections and waveforms, or the time interval of visible waveforms and signal detections being scanned. The System prevents changes by automated processing to data in Active Review. Analysts are notified of relevant data in Active Review by other analysts.

2. Aftershock Sequence

A set of smaller events following a large earthquake (the mainshock) that are caused by the Earth adjusting to the new state of stress on the main fault and surrounding medium. Aftershocks occur within the spatial extent of the mainshock fault rupture and have similar source mechanisms. The overall trend is for aftershocks to decrease in frequency and size with time after the mainshock. An aftershock sequence can last days, weeks, or months depending on the size of the mainshock.

3. Agglomerative Hierarchical Clustering

A method to find clusters of similar individuals within a population. The population is the set of waveforms recorded at a single station for a set of events and the measure of similarity is the correlation coefficient. Agglomerative hierarchical clustering iteratively clusters waveforms into a single tree-like structure called a dendrogram. For more information on the agglomerative hierarchical clustering algorithm, see the book *Cluster Analysis*, by Everitt et al.

4. Alphanumeric Data

Data that are displayed to an analyst as numbers or letters (e.g., the latitude and longitude of an event hypothesis). This is in contrast to waveform data.

5. Alphanumeric List

Alphanumeric data presented in a multi-column table. A list of events, a list of signal detections for an event, or a list of stations, are all examples.

6. ALT (Alternate Subsystem)

A duplicate of the Operational Subsystem (OPS) software and hardware at a geographically separate location. The ALT is continuously available to assume mission responsibilities.

7. Amplitude Correction Factor

A phase- and frequency-specific multiplicative factor, which represents the decrease in the amplitude of a wavefront due to attenuation, as it travels from source to receiver. Amplitude correction factors are applied in conjunction with corrections due to geometric spreading.

8. Analysis Time Interval

The time interval bounding the data reviewed by an analyst. Those data include waveforms, event hypotheses and their associated signal detections, and unassociated signal detections.

9. Array

A group of stations (sometimes referred to as "elements") deployed with the intent of processing waveform data with specialized techniques exploiting signal coherence between the stations. This processing improves the signal-to-noise ratio (SNR) and also provides estimates of the direction (azimuth and slowness /velocity) of signals. Arrays are used for seismic, infrasonic, and hydroacoustic monitoring.

10. Array Coherence

A measure of the similarity of waveforms during a given time interval between the elements of an array. High array coherence indicates that a signal is propagating across the array.

11. Aseismic Region

A region of the Earth where no seismic events have ever been recorded. Many seismic monitoring techniques (e.g., magnitude estimation, estimating station magnitude detection threshold, waveform correlation event processing) leverage results from past events, so aseismic regions present additional challenges.

12. Association

See signal association.

13. Atmospheric Model

A model of the atmosphere that can be used to predict the location-specific atmospheric properties that are needed to model infrasound signal propagation. An atmospheric model can either be static or dynamic.

14. Attenuation

The decrease in amplitude of a signal due to loss of energy as the signal propagates away from its source. Attenuation consists of two components: intrinsic attenuation, which is the phenomenon in which kinetic energy is converted to heat by anelastic processes or internal friction, and scattering attenuation, which is caused by energy reflecting off of small scale material heterogeneities. In addition to attenuation, geometric spreading also acts to modify the amplitude of seismic signals.

15. Automatic Processing

Data processing that is performed by the system without analyst interaction. This type of processing is initiated by a configurable trigger such as availability of data or the completion of a previous processing step. Includes station processing, network processing, post-analysis processing, post-evaluation processing, and late data processing.

16. Azimuth

The angle in degrees measured clockwise from geographic North of a signal arriving at a station. Azimuth and slowness completely describe the vector direction of arrival for a signal at a station.

17. Backup

The Subsystem acting as the backup location for the System. The pipeline and analyst processing do not actively run on the Backup. May be either OPS Subsystem or ALT Subsystem. The Primary always synchronizes data to the Backup. During a pipeline transfer, the Primary and Backup roles switch.

18. Basemodel

An Earth model used to compute base-level predictions (e.g., seismic travel time) that can be made more accurate by applying empirically derived corrections developed specifically for that basemodel. An Earth model is only referred to as a basemodel when predictions are further refined using empirically derived corrections.

19. Beam

The product of beamforming; a single derived channel (see channel, derived) representing the sum of the raw channels (see channel, raw) for all the elements of an array.

20. Beam, Coherent

The derived channel (see channel, derived) resulting from coherent beamforming (see beamforming [beaming], coherent).

21. Beam, Continuous

A beam channel formed continuously in time (i.e., without any specified start time or end time).

22. Beam, Detection

The beam on which a signal detection occurs. When detecting signals for data from an array, a set of beams is formed spanning the regions of monitoring interest. Detectors are run on all of these beams to look for signals. If a signal is detected, the beam on which the detection

occurred is known as the detection beam. If there are detections on more than one beam, then the best of these will be selected (e.g., best SNR) as the detection beam.

23. Beam, fk

A beam steered to point to the maximum fk power spectrum direction (azimuth and slowness) in 2D fk space (see frequency-wavenumber [fk] processing) corresponding to a signal detection on an array. The fk beam should show the best possible signal for a signal detection, and hence is the beam that is automatically shown to an analyst reviewing an event hypothesis.

24. Beam, Incoherent

The derived channel (see channel, derived) resulting from incoherent beamforming (see beamforming [beaming], incoherent).

25. Beam, Origin

A beam steered to the location of an event hypothesis. A particular phase (typically, first arriving P [compressional wave]) must be assumed for each origin beam. When an event hypothesis is displayed for an analyst to review, frequency-wavenumber (fk) beams are shown for detecting stations, and origin beams are shown for non-detecting stations. Assuming the Event hypothesis is well-located, the origin beams should allow the analyst to manually add any signal detections that were missed.

26. Beam Steering

See beamforming (beaming).

27. Beamforming (Beaming)

Beamforming (also known as beaming) is a multichannel signal processing technique taking advantage of the direction-dependent arrival of a signal across the elements of an array. Beamforming sums the waveform data from the elements of an array to produce a single derived channel (see channel, derived). The intent is to boost SNR.

28. Beamforming (Beaming), Coherent

A method for increasing the SNR of signals arriving at an array from a particular azimuth and slowness. Coherent beamforming (also known as beam steering) time shifts the waveforms from an array's elements before summing, under the assumption that a plane wave is arriving from that direction. The shifting is done for each element by subtracting the time delay relative to the array beampoint (a reference location for the array) that would be expected for a plane wave arriving from that azimuth and slowness. If there is a signal arriving from the specified azimuth and slowness, an SNR gain occurs when summing the time delayed waveforms, due to the simultaneous constructive interference of coherent directional signals, and destructive

interference of incoherent background noise. In theory, a gain of SNR equal to the square root of the number of elements can be achieved (e.g., a factor of 3 for a 9 element array). In practice, the realized gain is usually less.

29. Beamforming (Beaming), Incoherent

The same as coherent beamforming except that the waveforms are rectified (i.e., absolute values) before summing.

30. CD-1.0 Format and Protocols

A standard used for transmitting continuous waveform data from stations of the International Monitoring System (see IMS [International Monitoring System]) to the International Data Centre (see IDC [International Data Centre]) and for transmitting these data from the IDC to National Data Centers (NDCs). CD-1.0 uses a TCP/IP program-to-program socket communication to send binary formatted waveform data (frames). The CD-1.0 standard has been superseded by the CD-1.1 standard (see CD-1.1 Format and Protocols). The format and protocols are described in the document "Formats and Protocols for Continuous Data CD-1.0" from the CTBTO.

31. CD-1.1 Format and Protocols

A standard used for transmitting continuous waveform and state-of-health (see Station State-of-Health [SOH]) data from stations of the International Monitoring System (see IMS [International Monitoring System]) to the International Data Centre (see IDC [International Data Centre]) and for transmitting these data from the IDC to National Data Centers (NDCs). This protocol is designed to support multicasting of continuous data, which entails more complex data flow topologies. The format and protocols are described in the document "Formats and Protocols for Continuous Data CD-1.1" from the CTBTO.

32. Catalog Event

An event added to an event catalog. This is commonly done for an event recognized by an analyst as containing unique or important characteristics that may help in the analysis of future related events. For example, a nuclear test could be added to an event catalog, to aid in analysis of any subsequently detected nearby events thought to be tests.

33. Cepstral Domain Measurements

Measurements made in the cepstral domain for characterizing a signal of interest, in particular, hydroacoustic signals. The cepstral domain highlights periodicities in the spectrum (frequency domain). A cepstrum of a waveform is the Fourier transform of the waveform's power spectrum. The independent variable of the cepstrum is called quefrency, expressed in units of time, but representing the period of harmonic features of the waveform.

34. Channel

A generic term for either a raw channel (see channel, raw) or a derived channel (see channel, derived). A time interval of data from a channel is a waveform.

35. Channel, Derived

A source for time series data created by processing one or more raw channels (see channel, raw). Examples of common types of processing to form derived channels are filtering (see filter, waveform), beaming (see beamforming [beaming]), and rotation. Derived channels are generally created to enhance the SNR of signals.

36. Channel Mask

A type of Waveform Quality Control (QC) Mask (see Waveform QC Mask) that is created on a data channel for a period of time that can extend into the future, for instance for channels that have known, continuing data quality issues. Only authorized users can create channel masks.

37. Channel, Raw

A source for unprocessed time series data from a seismic, hydroacoustic, or infrasonic sensor (e.g., the output from a short period, vertical component seismometer).

38. Compensated Linear Vector Dipole

The sub-portion of the deviatoric component of the moment tensor remaining after subtraction of the double couple component.

39. Compute Resource

The generic term for any of a variety of types of computer hardware available on the system (e.g., workstation, server, tape backup).

40. Continuous Automated Testing Subsystem (CATS)

The portion of the System that supports System build and integration testing. The CATS Subsystem tests software on a regular basis at user-defined time intervals.

41. Correlation Coefficient

A measure of similarity between two waveforms. The absolute value of the correlation coefficient ranges from 0 (no similarity) to 1 (a perfect match). Formally, the correlation coefficient for two entities is the covariance divided by the square root of the product of the variances. For waveforms, this is the cross-correlation of the two waveforms, divided by the square root of the product of the auto-correlations.

42. CSS 3.0 Format

A schema that was developed by the former Center for Seismic Studies (CSS) in ~1990 to facilitate storage and retrieval of seismic data used for seismic monitoring of test ban treaties. It consists of 21 relations (database tables) that describe parametric data associated with seismic events, including station information. The CSS3.0 Format is described in the document "Center for Seismic Studies Database Schema Version 3.0," June 1990, SAIC-90/1235.

43. Data Acquisition

Receiving data from a data provider and storing it for subsequent access by the System. Data can be acquired in a variety of formats including CD-1.0, CD-1.1, IMS 2.0, Standard for the Exchange of Earthquake Data (SEED), and miniSEED.

44. Data Acquisition Partition

The portion of the System where data are acquired and re-distributed.

45. Data Authentication

The corroboration that data have not been altered in an unauthorized manner by using such mechanisms as digital signatures, PKI (public key infrastructure), etc.

46. Data Processing Partition

The portion of the System where data are processed, analyzed, and evaluated, and where data processing products are distributed and archived.

47. Data Provider

See data source.

48. Data Quality Errors

Errors in waveforms that can lead to problems with processing and analysis. Data quality errors include data gaps, amplitude spikes, repeated amplitude values, linear trends, and invalid gain. Prior to signal processing, data are analyzed by quality control (QC) software to identify and record any errors (see Waveform QC Mask).

49. Data Source

A source of waveform and/or event data for the System. Data sources can be stations or external data centers.

50. Database Backup

The copying or archiving of the contents and state of database at a particular point in time. The purpose of making a database backup is to provide the information needed for a database restore, should that be necessary.

51. Database Restore

The restoration of a database's previous state. To restore a database, a particular database backup must be selected.

52. Defining/Non-Defining

Any observation that contributes to the determination of an event attribute is considered to be "defining" for that attribute. The detection of an event, the location of an event (see event location), the magnitude of an event (see event magnitude, network), and the source type assigned to an event are all determined by specific types of defining observations (travel time, azimuth, slowness, amplitude) from one or more phases recorded by one or more stations. If an observation is linked to an event (associated), but does not contribute to the calculation of an event attribute, then it is considered to be non-defining for that attribute.

53. Detection Feature Map

A matrix of values for a particular feature as measured at a particular station over time. The matrix contains a feature vector calculated for each point in time based on the processing of one or more waveforms from the station. The feature vector is a set of values indexed by secondary independent variables, for example, frequency. Detection feature maps are used to detect and identify signals. A spectrogram is an example of a detection feature map where the feature is signal amplitude and the index is frequency. Array coherence is another example where the feature is coherence (or another feature gated by a coherence threshold) and the index is frequency.

54. Development Subsystem (DEV)

The portion of the System that supports System development. The DEV Subsystem provides a software development and component test environment.

55. Deviatoric Component (of Moment Tensor)

The portion of the moment tensor remaining after subtraction of the isotropic component. The moment tensor for an idealized earthquake has only a deviatoric component.

56. Double Couple Component (of Moment Tensor)

The sub-portion of the deviatoric component of the moment tensor that represents two paired but opposing force couples.

57. Earth Model

A representation of one or more physical properties of the Earth, generally used for calculating a predicted value for an observation measured at a station for a particular event (e.g., travel time, azimuth, and slowness). Earth models are used to predict observables for seismic, infrasonic, or hydroacoustic signals.

58. Earth Model, 1D

An Earth model in which the physical properties represented vary only with one dimension. Generally, this dimension is depth for seismic and hydroacoustic models, and elevation for infrasonic models. 1D depth/altitude varying models are effective, because gradients of physical properties are generally much stronger in the vertical direction, due to gravitational effects on the solid Earth, oceans, and atmosphere.

59. Earth Model, 2D

An Earth model in which the physical properties represented vary with two dimensions. Generally, these dimensions are latitude and longitude. There are not many examples of physical properties that vary only with latitude and longitude and not with depth, so 2D models are less common than 1D or 3D models. Examples of types of 2D models are surface wave group velocities (for predicting dispersion) and body or surface wave attenuation (for predicting amplitude).

60. Earth Model, 3D

An Earth model in which the physical properties represented vary with three dimensions. Generally, these dimensions are latitude, longitude, and depth. 3D Earth models represent the highest level of fidelity of static (non-time varying) Earth models.

61. Empirically Derived Corrections

Corrections that are applied to predictions (e.g., seismic travel time) calculated using basemodels to improve fidelity of the predictions. Empirically derived corrections are based on measurements from ground-truth events and are developed specifically for a particular basemodel. Empirically derived corrections are only used by entities that have a need for accuracy beyond what can be provided by an Earth model.

62. Event

The estimate by the System or Analyst of the occurrence of some transient source of energy within the Earth's body, oceans, or atmosphere that can be detected by seismic, hydroacoustic, and/or infrasonic sensors. For the same event, many different event hypotheses may be created at different processing stages. One of these event hypotheses must be designated as preferred.

63. Event Bulletin

A list of event hypothesis location solutions, with or without the associated signal detections. The primary product of most seismic monitoring agencies (e.g., IDC, National Earthquake Information Center [NEIC]) is an event bulletin. Event bulletins can be constrained by region, by time, by magnitude, etc.

64. Event Catalog

A named collection of events.

65. Event Change History

A complete record of the evolution of the event hypotheses corresponding to a single event, from the initial detection of the event, through the final version approved for release.

66. Event Epicenter

An event's 2D geographic location as described by latitude and longitude (i.e., the position on a map). This is in contrast to an event hypocenter, which refers to latitude, longitude, and depth.

67. Event Hypocenter

An event's 3D spatial location as described by latitude, longitude, and depth. This is in contrast to an event epicenter, which refers only to the latitude and longitude (i.e., the position on a map).

68. Event Hypothesis

A proposed solution for an Event. Each event consists of a sequence of event hypotheses that describe an evolution to a final best model of the event. Each event hypothesis is composed of a set of associated signal detections and has one or more event hypothesis location solutions, one of which must be designated as preferred.

69. Event Hypothesis Location Solution

An estimate of an event location (latitude, longitude, depth, origin time) that is tied to a particular event hypothesis. Each location solution is based on a set of defining signal detection feature measurements (e.g., time, azimuth, slowness).

70. Event Hypothesis Quality Metric

See event quality metric.

71. Event Location

The combination of an event's spatial location (see event hypocenter), temporal location, spatial location uncertainty, and temporal location uncertainty.

72. Event Magnitude, Network

An estimate of the size of a seismic event determined by combining the set of available station event magnitudes (see event magnitude, station). Separate network event magnitudes can be calculated for each available station magnitude type (e.g., mb, Ms).

73. Event Magnitude, Station

An estimate of the size of a seismic event determined by processing the waveform data recorded by one station. Separate station event magnitudes can be calculated for different magnitude types (e.g., mb, Ms).

74. Event Quality Metric

A quality metric computed as a number in the closed interval [0.0, 1.0] (low to high) for each event hypothesis formed on the System. This metric indicates the quality of the event hypothesis as a function of the event hypothesis's associated signal detections and related measurements, location solution, station state-of-health, and network state-of-health information. The System computes a new event quality metric whenever any parameter used for calculating the metric is updated and stored.

75. Event Report

An automatically- or manually-prepared document providing detailed information about a particular event. Could include text, tables, figures, and maps.

76. Event Set

The set of one or more event hypotheses that an analyst selects for analysis.

77. Expected Signal Detection

A signal detection that is anticipated to exist but has not been detected by the System. Expected signal detections are typically acquired from empirical knowledge. An Expected Signal Detection is associated with a station, a phase label, and an event hypothesis, and may include an expected waveform and/or a set of signal detection feature measurements. It may also contain information about parameters that were used in the past to detect the signal, such as filter settings, fk parameters, etc. An expected signal detection cannot become an observed signal detection directly, but can guide the processes that search waveform data for observed signal detections.

78. F-statistic (Fisher Statistic)

The power on a beam, divided by the average, computed over all the array elements of each element's residual power. The F-statistic can be used as the basis for a signal detector for data from an array or to characterize the coherence of the signal detection on a particular beam. Because each point in a frequency-wavenumber (fk) power spectrum corresponds to an azimuth and slowness pair, calculating an F-statistic for each point in the spectrum can help identify the peaks. See Blandford, "An automatic event detector at the Tonto Forest Seismic Observatory," Geophysics 39, (1974): 633-643.

79. False Event

An event detected by the System that does not actually correspond to a real source of energy (i.e., an artifact of the data processing). Adjustments can be made to the system to reduce the number of false events, but usually only with a corresponding increase in the number of missed events built by the system.

80. Filter Cascade

The application of two or more waveform filters (see filter, waveform) in series. Complex filters can be designed to meet a set of specific needs by applying a series of simple filters, each of which is designed to meet a more basic need. Once the sequence of filters is known, the successive filter operations can be replaced with a single filter operation equivalent to the filter cascade.

81. Filter, Waveform

An algorithm that operates on a waveform to produce a derived waveform with enhanced signal content relative to the background. The most common type of filtering limits frequency content (e.g., low-pass, high-pass, or band-pass). More complex types of waveform filters compare incoming data against a model, either of the background noise (autoregressive filter), or of the expected signal (phase match filter, pseudo-correlation filter).

82. Flat Lined Waveform

When displaying waveform data in a software application, performance decreases with the number of data points shown. Thus, when zoomed out to a time extent where data details would be difficult to see anyway, the actual waveform data are replaced with straight lines indicating only times where data are available, not the actual data values.

83. Focal Mechanism

A representation of the deformation in the source region of a seismic event. The focal mechanism is diagnostic of the type of event (earthquake or explosion).

84. Focal Sphere Plot

A plot of the focal mechanism for a seismic event that emphasizes the direction of motion of the P wavefront (away from or towards the event). Focal sphere plots are sometimes referred to as "beach ball" plots. In the case of an earthquake, the focal sphere plot makes evident the orientation and displacement of the fault.

85. Frequency Domain Measurements

Measurements made in the frequency domain for characterizing a signal of interest, including: total energy, total power, average power, power spectral density, and signal cepstrum. A segment of waveform data (a time-series) is transformed to the frequency domain using a Fourier transform.

86. Frequency-Wavenumber (fk) Measurements

Measurements made from the fk transformed data (see frequency-wavenumber [fk] processing) of an array: azimuth, azimuth uncertainty, slowness, slowness uncertainty, and array coherence.

87. Frequency-Wavenumber (fk) Power Spectrum

The representation in the frequency-wavenumber domain of coherent signal power in the waveform data from an array for a specified time interval. Calculation of fk power spectrum requires three Fourier transforms to convert time-sampling to frequency (designated by f), and longitude and latitude sampling to x and y wavenumbers (designated by k). Typically, fk power spectra are represented as 2D plots (not 3D), by collapsing the frequency information to a single value for each x and y slowness, by averaging values across the range of frequencies.

88. Frequency-Wavenumber (fk) Processing

A signal processing technique that can be applied to a short interval of waveform data from an array to determine if a signal is present and estimate the signal's azimuth and slowness. Waveform data are first converted to a frequency-wavenumber power spectrum and then further processing is done in the fk domain.

89. Geographic Data

See geospatial data.

90. Geographic Information System (GIS)

A software application designed to capture, store, manipulate, analyze, manage, and present geospatial data.

91. Geographic Region

An area on the surface of the Earth defined by either a polygon in geographic coordinates or an ellipse. Geographic regions are used to visualize information on a map, for geospatial analysis, and in configuration of processing operations. Examples of geographic regions are Flinn-Engdahl seismic and geographical regions, but may be any arbitrary closed polygon or ellipse useful in the system. An "active geographic region" is a region definition that is valid in the system at a particular time. Regions may be created, changed, or made inactive.

92. Geometric Spreading

The decrease in signal amplitude as a wavefront expands away from its source that accounts for the increasing wavefront size.

93. Geospatial Data

Data that identify the geographic location and characteristics of natural or constructed features and boundaries on the Earth, typically represented by points, lines, polygons, and/or complex geographic features, and may contain information attached to a location. Geospatial data are often accessed, manipulated, or analyzed through Geographic Information Systems.

94. Green Function

The modeled ground motion at one location produced by a unit force at another location. For moment tensor inversion, it is necessary to calculate Green functions corresponding to each of the fundamental force couples in the moment tensor, for each seismic station.

95. Historical Data

Waveform and alphanumeric data referenced to times prior to the operational processing time period.

96. Hydroacoustic Arrival Group (HAG)

A group of signal detections on different hydrophones from a single hydroacoustic station that have been determined to come from the same event and that can be used to determine azimuth back to the event. HAGs can only be formed for multiple element (array) stations, and hence apply to hydrophone stations (see hydrophone station), but not T-phase stations (see T-phase station).

97. Hydroacoustic Time Domain Measurements

Measurements made directly on waveforms from hydroacoustic sensors, including: signal termination time, signal summation time, signal time spread, signal skewness, signal kurtosis, peak energy in a defined time period, intensity average time in a defined time period, peak

energy in a defined time period, and crossing counts (the number of times a waveform crosses a threshold in a defined time period).

98. Hydrophone Station

A monitoring station using an array of underwater microphones (hydrophones). The station receives and records underwater acoustic signals originating from submarines, volcanic eruptions, earthquakes, and underwater explosions. The data, sent out via cable to the shore station for analysis, are used to distinguish between underwater explosions and other phenomena.

99. IDC (International Data Centre)

The data processing component of the monitoring system associated with the proposed Comprehensive Nuclear Test Ban Treaty (CTBT). The IDC processes the data from a global sensor network known as the International Monitoring System (IMS) (see IMS [International Monitoring System]). The National Data Centers (NDCs) receive IMS station data and bulletins from the IDC.

100. IMS (International Monitoring System)

The global network of seismic, hydroacoustic, infrasound, and radionuclide stations deployed as part of the CTBT verification regime.

101. IMS 2.0 Format

The International Monitoring System (IMS) 2.0 version of the formats and protocols used for discrete message exchange, including bulletin and waveform data. The formats and protocols are described in the IMS document "Format and Protocols for Messages, IDC-3.4.1 Revision 6."

102. Interactive Processing

Analyst directed data processing. Interactive processing can be performed to review and refine existing event hypotheses (automatic or analyst-built) or to build new event hypotheses missed by prior processing.

103. Isotropic Component (of Moment Tensor)

The portion of the moment tensor that represents a purely explosive/implosive source. The moment tensor for an idealized explosion has only an isotropic component.

104. Late Signal Association

A network signal association process triggered when a signal detection is made on a waveform after a normal network signal association has occurred. Late signal association includes

associating the new signal detections to previously formed event hypotheses as well as using them to form new event hypotheses.

105. Late-Arriving Waveform

Waveform data acquired by the System after pipeline processing has been initiated.

106. Latency

The difference in time from when data were sampled at the sensor and when the data were available for processing in the system. Latency may be calculated on both the Data Acquisition Partition (see Data Acquisition Partition) and the Data Processing Partition (see Data Processing Partition).

107. Magnitude Estimation

The process whereby the magnitude (size) of an event is estimated based on the observed waveform characteristics for a specified seismic phase at one or more stations. Magnitude is calculated for each station observing the event (see event magnitude, station) and these results are combined to come up with a network magnitude (see event magnitude, network). The magnitude calculation requires that the location of the event (see event location) be known, so location must be estimated before magnitude. A magnitude estimation calculation formula must account for the decreases in signal amplitude between source and receiver due to geometric spreading and anelastic attenuation. These factors are determined empirically based on the observed amplitudes for a set of events of well-known sizes.

108. Magnitude Type

A particular magnitude estimation method based on a specified phase, frequency band, and instrument.

109. Master Event Relocation

A method of relative event relocation where the new location is determined relative to an event with a known, fixed location (the master event). The location of the new event is determined by minimizing the travel time differences between the signal detections of the new event and the master event. Assuming the two events are in fact close to each other, this relative location can be determined with significantly greater precision than a standard relocation. However, the location accuracy depends completely on the location accuracy of the master event.

110. Maximum Likelihood Magnitude Estimation (MLE)

A method of estimating the magnitude of an event using information from both detecting and non-detecting stations. For the latter, an amplitude measurement is made at the theoretical arrival time of the phase used for the type of magnitude being calculated (see magnitude type);

the assumption is that the amplitude for that phase from the event must be less than or equal to the amplitude measured at the theoretical arrival time.

111. Meteorological Data

The set of location-specific predicted atmospheric properties that result from numerical modeling of the atmosphere at a weather forecasting agency. The primary use of meteorological data is weather forecasting, but for infrasound monitoring, meteorological data are used to build infrasound-specific dynamic atmospheric models for modeling signal propagation.

112. Mini-SEED Format

A format used to identify SEED data records without any control header information, also known as Data Only SEED. The Mini-SEED format is described in Appendix G of the "SEED Reference Manual," from the Incorporated Research Institutions for Seismology (IRIS), found at fdsn.org/seed_manual/SEEDManual_V2.4.pdf.

113. Missed Event

An event that was known to have occurred but that was not detected by the System (automatic processing and/or analyst review). Adjustments can be made to the system to reduce the number of missed events, but usually only with a corresponding increase in the number of false events built by the system.

114. Moment

The amount of energy released by a seismic event. Moment is the scalar size of the moment tensor.

115. Moment Tensor

A 3 x 3 matrix of the 9 fundamental force couples that describe the focal mechanism for a particular event. A moment tensor can be decomposed into various components to provide insight into the focal mechanism. The most basic decomposition is into isotropic and deviatoric components.

116. Moment Tensor Inversion

The process of determining the values of the force couples in the moment tensor. Moment tensor inversion is based on fitting the observed waveforms at a set of seismic stations with modeled waveforms based on a sum of the properly scaled Green functions. The scaling factors are the elements of the moment tensor.

117. Monitoring Mission Performance

A measure of how well the System is performing the monitoring mission. This is based on the System's metrics and statistics supporting sensor state-of-health, geophysical network capability, algorithmic performance, and detected event statistics.

118. Multiple Event Relative Relocation

The process of simultaneously estimating the relative locations of a set of event hypotheses in a localized source region by using precise relative values of observations (usually travel times). Relative event locations calculated in this manner are more accurate than locations produced by relocating each event hypothesis independently.

119. Near Real Time

An implication that the delay between a triggering action and response of the system to that action is not significant. Depending on the type and amount of processing required to produce a result, this delay could range from seconds to 30 minutes.

120. Network

A group of stations used for monitoring. For example, the IMS network is the group of stations used by the IDC to monitor the CTBT. Spacing between stations in a network is much larger than in an array, and array processing techniques are generally not applied across a network.

121. Network Magnitude Detection Threshold

The geographically varying magnitude below which events monitored by a specified network can no longer be detected with a specified level of confidence (generally 90% or 95%). This threshold can either be determined empirically (if a sufficient number of events spanning a range of sizes have occurred in a region) or by modeling.

122. Network Processing

Integrated processing of data from two or more stations within a network. If the network processing requires processed station data, then station processing must be completed for all required stations before network processing can begin. Types of network processing include: signal association, event location refinement, and magnitude estimation.

123. Noise

Portions of a waveform not containing event information (i.e., without apparent signals).

124. OPS (Operational Subsystem)

See Operational Subsystem (OPS).

125. Operational Processing Time Period

The time during which analysts may refine and save events without special procedures (currently 45 days).

126. Operational Subsystem (OPS)

The portion of the System residing at the principal location that supports the operational mission. This subsystem can serve as Primary or Backup. To insure there is no impact on mission capability, development and testing are supported with separate subsystems (DEV [see Development Subsystem (DEV)] and SUS [see Sustainment (SUS)/Test (TST) Subsystem]).

127. Operations Log

A log for capturing operational activities (e.g., significant events, station outages, shift changes).

128. Origin

See event hypothesis location solution.

129. Phase

An indication of the path and type of a signal originating from an event traveling through the body of the Earth, the oceans, or the atmosphere. For example, the seismic P phase refers to a compressional wave refracting within the mantle of the Earth, while the seismic ScS phase refers to a shear wave reflecting off the outer core boundary.

130. Phase Grouping

The process of grouping all of the signal detections from one station that are assumed to come from the same event. Each signal represents a different phase. The system bases grouping on signal detection measurements (e.g., relative timing, azimuth, slowness). Various operations can be made on signal detections after placing them in groups, including phase assignment, and creation of a single station event hypothesis.

131. Pipeline Processing

The sequence of real-time automatic data processing by the System, which begins after acquisition of raw waveform data, and results in a set of event hypotheses with associated signal detections.

132. Pipeline Processing Transfer

The process of transferring the execution of System operations from the Primary to the Backup.

133. Pixel Family

A group of adjacent time-frequency vs signal attribute values (attributes can be: azimuth, trace velocity, correlation, etc.) created by progressive multi-channel correlation (PMCC) processing of waveform data from an infrasound array (see Progressive Multi-Channel Correlation [PMCC]). PMCC processing results in spectrogram-type plots (time on the x-axis, frequency on the y-axis, and attributes indicated with a colored pixel), and pixel families represent contiguous regions on the spectrograms. A pixel family is interpreted as indicating the detection of a wave moving across the array.

134. PKI (Public Key Infrastructure)

Infrastructure used for the secure exchange of information.

135. PKI Credentials

Digital keys used for authenticating messages exchanged between systems.

136. Playback

The insertion of a previously captured waveform data acquisition feed in place of the real time raw waveform feed.

137. Polarization Features

Features derived from the analysis of three component data (see three component station) that characterize how a signal has been partitioned across the components. Polarization features can be used to identify phase type and for association with an event hypothesis. Polarization features include: azimuth, azimuth uncertainty, slowness, slowness uncertainty, rectilinearity, planarity, horizontal-to-vertical power ratio, and short and long axis incidence angles.

138. Power Detector

A signal detector that triggers on changes in waveform amplitude, which is proportional to power. The most well-known of these is the STA/LTA detector (see STA/LTA).

139. Preliminary Phase Label

A seismic phase label determined using only station signal detection feature measurements (i.e., prior to network signal association). The possible preliminary phase labels are: compressional (P), shear (S), teleseismic (Tx), regional (Rx), and noise (N).

140. Primary

The system role defining the location of the active pipeline and analyst processing; may be either OPS or ALT. The Primary is always syncing data to the Backup. During a pipeline transfer, the Primary and Backup roles switch.

141. Processing Component

Any of the data processing modules that make up the processing pipeline. Each processing component is designed to accept some form of data and produce another form. For example, a filter component inputs raw waveforms and outputs filtered waveforms, a signal detector component inputs waveforms (raw or derived) and outputs discrete signal detections.

142. Processing Sequence

An ordered grouping of processing steps or other nested processing sequences connected by logic elements that specify sequencing, branching, concurrency, and entry and exit criteria. Processing sequences may specify control parameters such as data buffering and data source, and must adhere to an interface standard for invocation, status return, data access, logging, messaging, etc.

143. Processing Stage

A named group of data processing and analysis functions, used to track status of increments of work performed on time intervals and events through the System. The flow of data through the System, from data acquisition, through automated processing and multiple reviews, to reporting of an event, is defined as a series of processing stages (e.g., Pipeline, traditional analysis roles). A processing stage may define automatic sequences (see processing sequence), interactive-only activities, or interactive and automatic sequences. A stage description includes a list of functions that are performed, entry criteria (time, event, or data availability triggers), and exit criteria (completion of processing, recognition of an important event, or declaration by an Analyst).

144. Processing Step

A basic processing action with defined inputs and outputs. Processing steps may specify control parameters such as data buffering and data source, and must adhere to an interface standard for invocation, status return, data access, logging, messaging, etc.

145. Progressive Multi-Channel Correlation (PMCC)

An array processing technique in which coherency of signals between pairs of sensors within an array is used to detect the presence of a wave propagating across the array. PMCC has proven efficient at detecting low-amplitude, coherent infrasonic signals within incoherent noise. The "progressive" term refers to the idea that the calculation begins with a subnetwork of the array, and progressively adds in more distant sensors to confirm the presence of a wave moving across the entire array. The addition of more distant sensors helps to reject false detections that are

not coherent across the entire array, reject sensors with poor, degraded quality (high local wind noise or sensor issues), and improves the estimation of parameters for true detections. The PMCC processing is performed consecutively in several frequency bands and in adjacent time windows covering the whole period of analysis.

146. Q (Quality Factor)

A parameter used to characterize intrinsic attenuation for signals propagating through a particular type of material. Q is inversely proportional to intrinsic attenuation. Strictly speaking, while Q does not include scattering attenuation, tomographic Q models generally include the effects of both scattering and intrinsic attenuation.

147. QC Mask

See waveform QC mask.

148. QuakeML

A flexible, extensible, and modular XML representation of seismological event data.

149. Quality Control (QC)

See waveform quality control.

150. Radiation Pattern

A geometric description of the amplitude and direction of motion for the P and S wavefronts near the source.

151. Radionuclide Data

Spectra of gamma and/or beta radiation associated with radioactive particulates and noble gases.

152. Random Binary Calibration

A method to determine the frequency response of a sensor using a random binary signal applied to the sensor calibrator input. A random binary signal is a sequence of step functions of identical amplitude but randomly varying polarity. The random binary signal may be a known signal or may be recorded as an independent channel at the sensor. The sensor frequency response is calculated using the cross-spectrum of the sensor output to the input random binary signal.

153. Reference Event

An event recognized by an analyst as containing unique or important characteristics that may help in the analysis of future events that are related. For example, a nuclear test could be

designated as a reference event for any subsequently detected nearby events thought to be tests.

154. Regression Testing

Testing of a modified software component that compares current results against past results prior to the modification (for the same inputs) to find unexpected changes (regressions).

155. Rejected Event Hypothesis

An event hypothesis determined to be invalid by either the System or an Analyst. The history of rejected event hypotheses, including signal detection associations, are available on the System, and rejected event hypotheses can be reopened by Analysts. All signal detections are unassociated from an event hypothesis when it is rejected, making those signal detections available to form other event hypotheses.

156. Relative Event Magnitude Estimation

The process of estimating magnitudes (see magnitude estimation) for events in a localized source region, by scaling relative to a designated master event with a well-established magnitude.

157. Remote Operations Center (ROC)

A facility used for short-term data analysis and processing control. The workstations in the ROC allow for remote presentation of displays from either OPS or ALT.

158. Rotation

A coordinate system transform that rotates raw channel (see channel, raw) data from a three component station to align the data's axes parallel and perpendicular to a specific azimuth and slowness (i.e., ray path). Rotation produces derived channels corresponding to an arriving signal's radial and transverse ground motion. The purpose of rotation is to enhance the SNR of signals of interest.

159. SC3XML Format

An Extensible Markup Language (XML) schema that contains station metadata. SC3XML is based on the schema used in SeisComP, a seismological software used for data acquisition, processing, distribution, and interactive analysis.

160. SEED Format

Standard for the Exchange of Earthquake Data (SEED) Format. An international standard format for the exchange of digital seismological data. It was designed for use by the earthquake

research community, primarily for the exchange of unprocessed waveform data between institutions. The SEED Format is described in the document "SEED Reference Manual," from the Incorporated Research Institutions for Seismology (IRIS), found at fdsn.org/seed_manual/SEEDManual_V2.4.pdf.

161. Seed Event

Event information (e.g., event location, event magnitude, detecting stations) provided to a signal association algorithm as a hint about an event hypothesis the algorithm should attempt to build.

162. Sensor Orientation

The orientation of the axis of ground motion recorded by a sensor relative to vertical (inclination) and to geographic North (declination).

163. Signal

A portion of a waveform containing information from an event.

164. Signal Association

The process of linking (associating) a set of signal detections from a network of stations to an event hypothesis, either existing or new. Association is based on consistency of observed and predicted signal detection feature measurements (e.g., arrival time, azimuth, slowness). Signal association can be done automatically by the system (see pipeline processing), or manually by an analyst.

165. Signal Characterization

The process of measuring signal detection features for the purpose of determining the phase of a signal detection, and for determining whether or not a signal detection is consistent with an event hypothesis (see signal association).

166. Signal Detection

A specific interval on a waveform marking the arrival of a signal of interest. Other portions of the waveform are noise.

167. Signal Detection Feature

A feature associated with a signal detection (e.g., arrival time, back azimuth, horizontal slowness, amplitude, frequency content).

168. Signal Detection Feature Measurement

A measurement of a signal detection feature, including measurement uncertainty.

169. Signal Detection Feature Prediction

A prediction of a signal detection feature, including prediction uncertainty.

170. Signal Detection Template

The set of signal detections associated with an event. The relative timing of the signal detections is indicative of the location of the event. Shifting the timing of a signal detection template, and matching it with signal detections on current waveforms, can help determine whether a similar event has occurred, and aid in identifying and associating signal detections to existing events. These templates can be particularly helpful for building events in an aftershock or swarm sequence.

171. Signal Detector Threshold

The threshold that determines when a signal detection will be declared for a given data channel for a given signal detection algorithm.

172. Signal Enhancement

Signal processing techniques including filtering (see filter, waveform), beamforming, and three component waveform data rotation, used to enhance the signal content, and reduce the noise content of waveform data.

173. Single-Station Event Hypothesis

An event hypothesis with associated signal detections coming from only a single station.

174. Site

See station.

175. Slowness

A measure of the inverse apparent velocity of a wave moving across the surface of the Earth at a station. The inverse of slowness is the apparent velocity of such a wave. Slowness is often used in phase identification and is sometimes used for determining event location.

176. Source Type

An assessment of the cause of an event (e.g., deep earthquake, shallow earthquake, explosion, mine collapse). Source type can be determined automatically or by an analyst.

177. Source Type Plot

A plot used to differentiate different types of seismic sources based on their moment tensor decompositions. The coordinates of a source type plot are based on parameters derived from the relative size of the moment tensor components.

178. STA/LTA

A signal detection method that is based on a sudden change in signal power resulting from the onset of a signal. STA/LTA is calculated as a ratio of short-term average (STA) signal power (or energy) to a long-term average (LTA) power (or energy). The STA time window typically precedes the LTA time window. When there is no signal present, hence only noise in both windows, the STA/LTA ratio is ~1. When a signal is present in the STA time window, and noise is present in the LTA time window, the STA/LTA ratio is > 1. A detection is declared when the STA/LTA ratio exceeds a specified threshold.

179. Standalone Subsystem

A distribution of the System containing a selected set of system components used for standalone analysis and site surveys. The Standalone Subsystem may receive data from the Operational Subsystem but does not provide system results to the Operational Subsystem.

180. Station

An installation where monitoring sensors are installed. Multiple sensors can be installed at the same station (see channel). An array is a group of stations, but is sometimes referred to as a station.

181. Station Data

Data sent to the System by contributing stations. This includes both the ground-motion data (see waveform) as well as state-of-health (SOH) station data (see Station State-Of-Health [SOH]).

182. Station Data Acquisition Statistics

Statistics that quantify the availability and quality of the waveform data acquired from a station. The information covered includes completeness, latency, and waveform QC masking related to acquisition problems.

183. Station Magnitude

See event magnitude, station.

184. Station Magnitude Detection Threshold

The geographically-varying event magnitude below which a station is not expected to detect events. This can be empirically estimated as the magnitude at which a station's signal detections no longer follow the Gutenberg & Richter frequency-magnitude relationship, predicting that for every decrease in size of 1 magnitude unit, the number of events detected should increase by a factor of 10. The highest magnitude at which a station's detected events deviate from this prediction indicates the threshold below which the station does not detect events presumed to have occurred.

185. Station Processing

Processing of data from a station that is independent of processing of data from any other stations. Types of station processing include: waveform quality control, waveform filtering (see filter, waveform), beamforming, signal detection, signal characterization, and phase grouping.

186. Station State-Of-Health (SOH)

An assessment of how well a station is functioning for a specified time interval. Station SOH is based on station SOH data, which may include any type of data that can be time indexed, and that can be used to determine the capability of a station to meet mission requirements (e.g., status of sensor channels, site temperature, power status, security status).

187. StationXML Format

An Extensible Markup Language (XML) schema designed for sharing station information. The schema is an XML representation of the most important and commonly used structures of SEED metadata.

188. Subspace Detector

A special class of waveform correlation signal detector (see waveform correlation event processing) in which the incoming data are compared against a suite of similar template waveforms (i.e., a subspace) rather than a single template waveform. The comparison is to a linear combination of the separate waveforms; the weights for each are determined dynamically as part of the detection processing, to achieve the best composite match. Using a subspace detector instead of a single template can make the correlation more robust to differences in source mechanism or source location.

189. Sustainment (SUS)/Test (TST) Subsystem

The portion of the System that supports System validation testing. The SUS/TST Subsystem is a functionally redundant copy of the OPS Subsystem.

190. Swarm Sequence

A sudden increase in seismic activity within a focused area that is not associated with a mainshock (i.e., not an aftershock sequence). As with an aftershock sequence, the source mechanisms of the events within a swarm tend to be very similar, reflecting the underlying cause. Swarms are often associated with volcanic phenomena (e.g., the upward movement of magma from deep in the Earth before an eruption) and may be monitored to track potential hazards.

191. System Backup

The archiving of data, files, software, etc., required to restore the System to a previous state.

192. System Configuration

The complete set of parameters that define the operation of the System software for one subsystem (OPS, ALT, DEV, SUS). Examples include sensor thresholds, filters (see filter, waveform), the particular version of an earth model in use, and processing sequences. Each instance of a system configuration is saved so the state of all parameters at any time can be recalled.

193. System Message

A message generated on the System and distributed to system users. System messaging is controlled by setting various parameters including level (failure, warning, notification), target (intended recipient), and triggering criteria.

194. System Performance

The overall performance of the system as measured by CPU usage, disk space usage, system up-time, network usage, and status of software processes.

195. System Restore

The restoration of the System to a previous state (see system backup).

196. Test Data Set

A group of artifacts that comprise the required components to define a single test. This group contains a test name, a list of the station(s) associated with the waveform data to be used for replay, the replay start time and stop time for the waveform data, and the System state start time (the state start time is prior to the replay start time), to allow the System to establish a System state baseline enabling consistent replay test runs. Optionally, this group contains a set of expected test results (this set can include expected number of signal detections, events, etc. to be constructed during the replay test), or a set of Analyst actions.

197. Three Component Station

A seismic station with separate instruments measuring ground motion in three perpendicular directions: up-down, north-south, and east-west. These directions are often referred to as Z, N, and E. Also referred to as a 3C station.

198. Time Domain Measurements

Measurements made directly on time-series data (i.e., waveforms). Examples of general time domain measurements include onset time, amplitude, and period.

199. T-Phase Station

A three component seismic station to monitor hydroacoustic waves. A T-phase station is typically located on a steep-sloped island, and detects seismic signals that were converted from underwater sound waves or hydroacoustic waves, when hitting land.

200. Trace Velocity

The apparent horizontal velocity of a wave moving across a set of sensors (e.g., a seismic or infrasonic array).

201. Training Data Set

Raw waveforms (see waveform, raw) and alphanumeric data (processing results) for a specific time period that provide a good selection of known events suitable for analyst training.

202. Training Subsystem

A subset of the event analysis portion of the System that is used to interactively teach analysts how to perform the mission.

203. Unit Testing

A method by which individual units of source code (sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures) are tested to determine if they are fit for use.

204. Virtual Event Hypothesis

A trial event hypothesis created for analyzing waveform and alphanumeric data in an attempt to discover evidence supporting the existence of an actual event.

205. Virtual Origin

See virtual event hypothesis.

206. Waveform

A generic term for either a raw waveform (see waveform, raw) or a derived waveform (see waveform, derived).

207. Waveform Correlation Event Processing

A technique used to find events by matching current waveforms to waveforms of known historical events. Waveform similarity is determined using the correlation coefficient. When a match is found, there is high probability that a new event has occurred, which is of the same source type and near the same location (see event location) as the historical event.

208. Waveform, Derived

Output from a derived channel (see channel, derived) during a particular time interval (e.g., a bandpass filtered version of a raw waveform [see waveform, raw]; a beam created by summing multiple raw waveforms from the elements of an array).

209. Waveform Format, Storage

The persistent waveform storage format used by the System, as described in the Database Design Document (DBDD).

210. Waveform Processing

Any operation on waveform data involving signal detection (see signal detection), polarization measurements (see polarization features), time domain measurements, frequency domain measurements, beamforming, magnitude measurements (see magnitude estimation), filtering (see filter, waveform), waveform correlation (see waveform correlation event processing), and ambient noise calculations.

211. Waveform QC Mask

The tag applied to a segment of waveform data with a QC (see waveform quality control) problem. Each QC mask includes a start time and stop time and a description of the type of problem. Subsequent waveform processing algorithms may use this information to mask (i.e., ignore) these segments.

212. Waveform Quality Control

The processing of waveform data to identify problems related to data acquisition and/or transfer (e.g., dropouts, spikes). In particular, waveform quality control is focused on identifying problems that can lead to false signal detections and/or to missed true signal detections.

213. Waveform, Raw

Output from a raw channel (see channel, raw) during a particular time interval.

214. Z-Detector

A signal detection method that statistically estimates the distance of the signal from the mean in units of the standard deviation. The Z-Detector produces a constant false alarm rate rather than a constant detection rate and is essentially independent of the noise field behavior. It has the advantage of automatic adjustment to variance in the background noise. If the background variance is small, a small change in input is required for a large change in output. If the background variance is large, a large input change is required for a significant output change.

This is the last page of the document.