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Sandia National Laboratories

IDC Reengineering Phase 2

Elaboration Iteration E1 Deliverables Status

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U.S. DEPARTMENT OF ENERGY
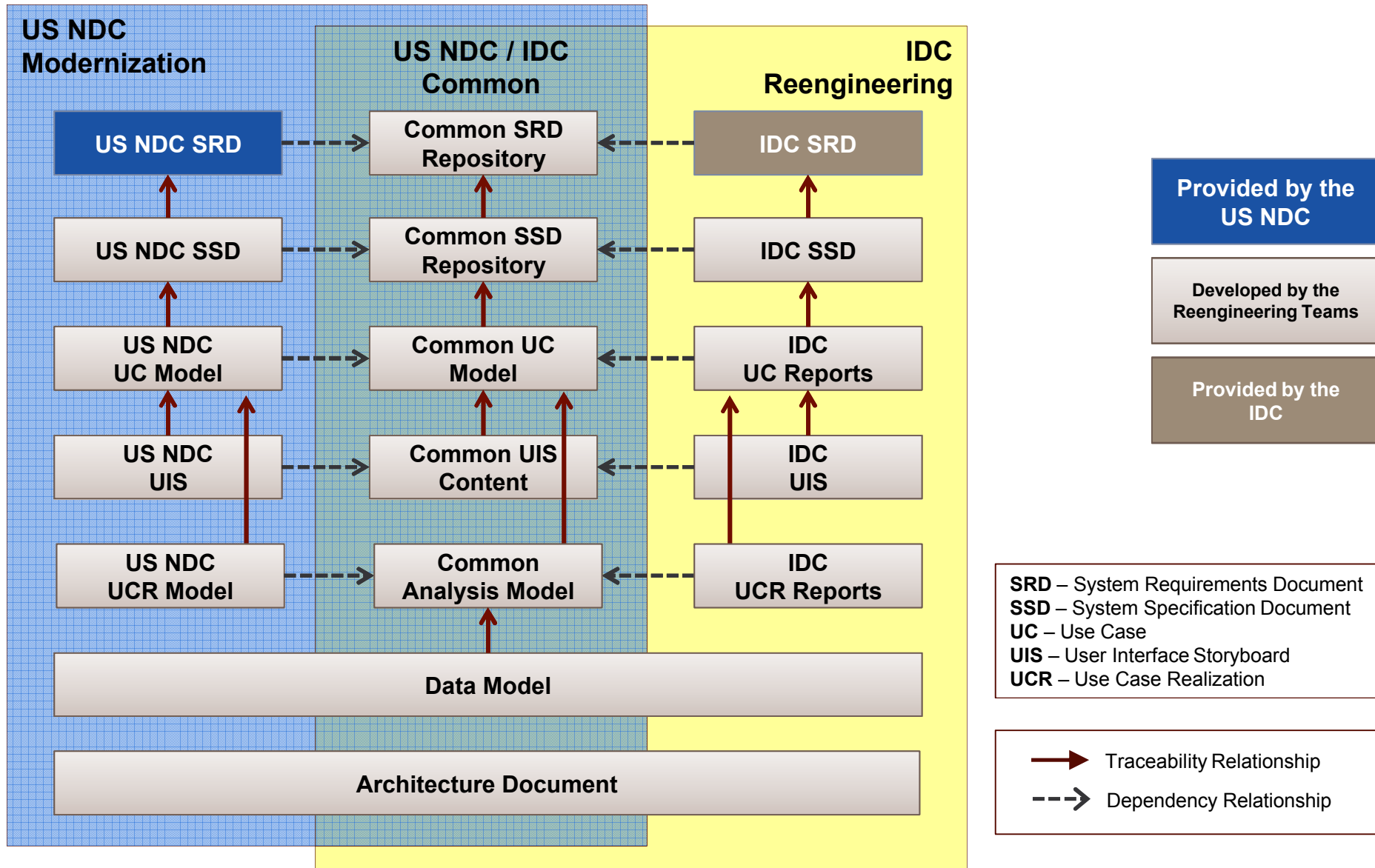
NNSA
National Nuclear Security Administration

Executive Summary

- Completed all E1 deliverables identified in the Statement of Work

- New deliverables:
  - 21 Use Cases
  - 12 User Interface Storyboards
  - 4 Use Case Realizations
  - Data Model Report & IDC Schema Mapping
  - Draft Architecture Document
  - Component Interface Definition Briefing

- Updated deliverables:
  - System Specification Document
  - Use Case Model Survey
  - Glossary

Iteration E1 Deliverables

Artifact	E1 Delivery
System Requirements Document (SRD): Baseline system requirements developed by the IDC with support from SNL	Updated
System Specification Document (SSD): Detailed specification statements, with traceability to the IDC System Requirements Document	Updated
Use Case Descriptions: Reports for each use case with traceability to the IDC System Specifications (21)	Initial Delivery
Use Case Model Survey: Brief descriptions of the Use Cases defined for the IDC system	Updated
User Interface Storyboards: Reports of user interface requirements defined for interactive use cases (12)	Initial Delivery
Use Case Realizations: Reports of analysis-level architecture defined for architecturally significant use cases [portion of total (4)	Initial Delivery
Architecture Document: Documents architecture methodology, decisions, patterns, and guidance	Initial Delivery
Executable Architecture Reports: Documents studies and prototypes demonstrating performance of technology decisions and architecture frameworks	N/A*
Data Model Report: Defines the primary data elements used within the System, specifying element content and relationships	Initial Delivery
Data Model to IDC Schema Mapping: Provides a mapping between the Data Model content & the IDC schema	Initial Delivery
Component Interface Definition: Software interface definition for replaceable components of the automated and interactive frameworks	Definition Briefing
Glossary: Definitions for technical terms used in other deliverables	Updated
Cost Estimate Update: updates to the cost estimate for the complete project, both with and without continued leverage of the common USNDC Modernization components	N/A*

Leveraging Analysis & Design Artifacts

SRD Status

- E1 release version: v1.3

- Version history:
    - v1.0: initial baseline completed July, 2014
    - v1.1: I2 release completed November, 2014
    - v1.2: updates addressing Event consistency requirements completed May, 2015

- US NDC feedback reviewed at 9/2015 working meeting

- Summary of updates since the I2 release (v1.1):

Change	Summary of E1 Changes
Added SRD-624 – SRD-627	Addressed **event consistency** requirements
Updated SRD-83	Added a note to define **late arriving detections**
Updated SRD-395	Clarified **moment tensor** calculation
Updated SRD-137	Updated the note to clarify **interactive selection of earth models**
Updated SRD-262	Clarified performance for **origin beams**
Removed SRD-345	Remove explicit **Training Subsystem availability** performance requirement
Renumbered SRD-448 to SRD-653	Renumbered to eliminated duplicate SRD-448

SSD Status

- E1 release version: v1.3

- Version history:
  - v1.0: initial baseline released at completion of I2 (November, 2014)
  - v1.1 & 1.2: updates from the I2 review (February 2015)
  - V1.2.1: additional updates from the IDC team (May 2015)

- Additional updates incorporated since 1.2.1 reflect elaboration of analysis products (use cases, storyboards)

SSD E1 Summary of Updates

SSD Section	Summary of E1 Changes
3.2.1.1 Data Sources	Added specs about configuring, acquiring, processing and storing **bulletin** (S-5972-5975) **& meteorological data** (S-5976-5979), viewing station information (S-5965)
3.2.1.3 Data Acquisition Control	Added and updated specs about retrospective **signed data authentication** (S-1192, 5946)
3.2.1.5 Data Forwarding	Added specs about viewing the **waveform data authentication status** (S-5582, 5964)
3.2.1.6 Waveform Formats	Added specs to accept waveform data in **GSE2.1/IMS1.0 format or SAC format** (S-5970,5971)
3.2.2 Waveform Quality Control	Added specs about **masking** data that fails data authentication. (S-6219, 6220)
3.2.3.1 Waveform Filtering	Added specs for filtering waveforms using **phase match filters**, **autoregressive filters and pseudo-correlation filters** (S-6199, 6200, 6201); configuring/using dispersion models for phase match filtering (S-6195, 6196); pre-defined filters, **user designed filters** (S-6202, 5955, 5956)
3.2.3.3 Beamforming	Added specs about viewing a **maximum F-statistic time-series** for specified time windows. (S-6197,6198)
3.2.4 Signal Detection	Added specs about **viewing signal detections** and phase designations (S-5953,5954) and **selecting signal detection parameters** (S-6305)
3.2.6.1 Network Signal Association	Added specs about **signal detection templates** (S-5968, 6241, 6242, 6010)
3.2.6.7 Event Consistency	Added specs about performing **event consistency checks** and Analyst ability to correct (S-5816, 6292, 6221)
3.2.7.3 Relative Event Hypothesis Relocation	Added a spec about methods of performing **multiple event relocation** (S-6290)
3.2.9.1.1 Earth Model Predictions	Changed specs to refer to "**depth / elevation**" instead of just "depth" to generalize for **infrasound** processing
3.2.9.3 Basemodel Temporal Variation	Removed specs about computing information that is provided directly by **meteorological models**; consolidated specs about computing **infrasound travel-time** for different phases (S-5655, 5657); replaced "slowness" in infrasound specs with "**trace velocity**"
3.2.11.1 Waveform Interaction	Added specs for using **detection feature maps for infrasound** signal detection (S-6295, 6437, 6438, 6439)
3.2.11.2 Event Interaction	Added specs for **viewing preferred event hypothesis & analyst statistics** including event counts, accuracy statistics and performance metrics (S-5957, 5958, 5959, 5960)
3.2.14 Event Bulletins and Reports	Added specs about **Authorized External Users** accessing System products & data (S-6237, 6238, 6239, 6456, 6429, 6434); **user-specified processing** (S-5764); **distributing radionuclide data** (S-6384); distributing event reports and **State Requested Methods Reports** (S-6457, 6458, 6459, 6460); **station configuration data distribution formats** (S-5704, 5705)
3.2.16.1 Mission Performance Monitoring	Added specs about viewing **station mag detection thresholds** & **ambient noise probability density functions** (S-6455, 5993); viewing **station calibration results** (S-5674)
3.2.19 Testing	Added specs for **replaying Analyst actions** during testing (S-6203, 6204, 6218)
3.2.23.5 Standalone Subsystem	Added spec about **authorized party access** to SW distribution (S-6442)

Use Case Descriptions Status

- **21 Use cases delivered in Iteration E1**

- **Reviewed draft versions with the IDC team during the Iteration**

  - September 2015 (10 UCs): UC-02.03, UC-02.06, UC-03.02, UC-03.02.08, UC-03.05, UC-05.03, UC-08.02, UC-08.05, UC-11.02, UC-13.02

  - October 2015 (10 UCs): UC-01.01, UC-01.04, UC-02, UC-02.08, UC-02.12, UC-03.03, UC-06.03, UC-06.07, UC-07.01, UC-09.03

- **Feedback from the IDC reviews has been addressed in the E1 release**

UC ID	UC Title
UC-01.01	System Receives Station Data
UC-01.04	System Acquires Meteorological Data
UC-02	System Detects Event
UC-02.03	System Detects Events Using Waveform Correlation
UC-02.06	System Builds Events Using Signal Detections
UC-02.08	System Refines Event Location
UC-02.12	System Predicts Signal Features
UC-03.02	Refines Event
UC-03.02.08	Compares Events
UC-03.03	Scans Waveforms and Unassociated Detections
UC-03.05	Marks Processing Stage Complete
UC-05.03	Views System Results
UC-06.03	Defines Processing Sequence
UC-06.07	Views System Configuration History
UC-07.01	Analyzes Mission Performance
UC-08.02	Controls the System
UC-08.05	Views Event History
UC-09.03	Replays Test Data Set
UC-11.02	Develops New Algorithms and Models
UC-13.02	Performs Standalone Analysis
UC-14.05	Performs Expert Technical Analysis

Use Case Model Survey Status

- I2 Baseline version released December, 2014
- Update addressing I2 Review feedback released February, 2015
- Summary of E1 updates:

UCMS Section	Summary of Changes
1.1 Actor Descriptions	Updated the **Analyst actor** description; replaced the Duty Officer actor with the **Fusion and Review Officer actor**;
2.1 System Acquires Data	Updated brief description to address **meteorological data** and synchronization of acquired **station data** between Primary and Backup.
2.2 System Receives Station Data	Updated brief description to address acquisition of both **continuous and requested station data**
2.8 System Detects Events	Updated brief description to include signal **feature prediction**, **similar event search** and **moment tensor** evaluation
2.9 System Determines Waveform Data Quality	Updated brief description to address **data authentication errors** and configuration of System responses to data quality errors
2.12 System Detects Signals 2.13 System Measures Signal Features	Updated brief description to address iterative, **feedback-based processing**
2.23 Refines Event	Updated brief description to address **moment tensor** evaluation and Analyst comparison of events
2.30 Evaluates Moment Tensor	Updated brief description to provide more detail
2.35 Reports Event of Interest	Removed (UC replaced with UC: Performs Expert Technical Analysis for the IDC)
2.44 Configures Data Acquisition	Added brief description
2.51 Analyzes Mission Performance	Refined the brief description
2.54 Monitors System Performance	Updated the brief description, enumerating system performance components
2.55 Monitors Mission Processing	Added brief description
2.66 Views Security Status	Refined brief description
2.67 Prints Output	Removed (currently a USNDC-only UC)
2.77 Monitors Security	Refined brief description
2.86 Views Training Feedback	Removed (merged into Trains Analysts)
2.94 Performs Expert Technical Analysis	Added brief description

User Interface Storyboards Status

- 12 UI Storyboards delivered in Iteration E1

- SNL reviewed draft versions of these use cases with the IDC team November, 2015

- Feedback from the review has been addressed in the E1 release

- Additional feedback from IDC Analysts received December 2015 will be addressed in E2

Use Case	UI Storyboard Title
UC-03.02	Refines Event
UC-03.02.08	Compares Events
UC-03.03	Scans Waveforms and Unassociated Detections
UC-03.05	Marks Processing Stage Complete
UC-05.03	Views System Results
UC-06.03	Defines Processing Sequence
UC-06.07	Views System Configuration History
UC-08.02	Controls the System
UC-08.05	Views Event History
Common	Map UIS Component
	Tables UIS Component
	Waveform Display UIS Component

Use Case Realizations Status

- Four UCRs delivered in Iteration E1

- SNL reviewed draft versions of the UCRs with the IDC team October, 2015

- Feedback from the review has been addressed in the E1 release

UCR ID	UCR Title
UCR-02	System Detects Events
UCR-02.08	System Refines Event Location
UCR-03.03	Refines Event
UCR-08.05	Views Event History

Glossary Status

Glossary Term	Summary of E1 Changes
Area of Interest	Removed
Atmospheric Model	Added
Beam, Virtual Origin	Removed
Compute Resource	Added
Data Acquisition Partition Data Source	Remove parenthetical examples
Earth Model	Refined the definition language
Event	Updated the definition – "estimate by the System or Analyst of the"
Event Hypothesis	Rewritten to align with Data Model
Event Hypothesis Location Solution	Enumerated location solution components (to include origin time)
Event Signal Detection Template	Removed
Flat Lined Waveform	Added
F-Statistic	Changed to "F-Statistic (Fisher Statistic)
Green's Function	Changed to "Green Function"
IRIS DMC	Removed
Latency	Added
Meteorological Data	Added
Mission Transfer	Replaced with Pipeline Processing Transfer
Multiple Event Location	Replaced Relative Event Location with Multiple Event Location
Processing Component	Added
Processing Unit	Replaced with Processing Step
Random Binary Calibration	Added
Signal Detection Template	Reworded
Signal of Interest	Removed
Standalone Subsystem	Reworded
Trace Velocity	Refines Event
Waveform Format, Storage	Added

- E1 release version: v1.1
- Includes various updates resulting from elaboration of analysis products (Use Cases, Storyboards)

Data Model Report Status

- Released initial Data Model Report and Data Model-to-IDC Schema Mapping documents in E1 (version v1.0)
  - The Data Model Report includes UML class diagrams and textual descriptions defining the IDC RP2 conceptual Data Model
  - The IDC Schema Mapping document provides a mapping between the data fields defined in the RP2 conceptual model and the current IDC physical schema
- Reviewed draft Data Model Report with the IDC November, 2015
- Ongoing refinement of the Data Model and IDC Schema Mapping November 2015 – January 2016
  - Current working version is ahead of the E1 release version

Other Deliverable Status

- Delivered an initial draft of the IDC RP2 Architecture Document, based on content from the US NDC Modernization Architecture document
    - E1 release intended to provide context for UCR discussions

- Delivered a briefing discussing the proposed scope and content of Component Interface Definitions to be developed in the Elaboration and Development phases of the project

E2 Deliverables Plan

- System Specification Document – updated as needed
- Use Case Descriptions – 20 additional UCs
- User Interface Storyboards – 12 additional Storyboards
- Use Case Realizations – 4 additional UCRs
- Architecture Document – updated
- Component Interface Definitions
  - Initial release of draft Component Interface Definition(s) for select Components of the System
- Data Model
  - Updated Data Model Report
  - Updated IDC Schema Mapping (as needed)
- Executable Architecture Reports
  - Additional reports detailing ongoing prototyping efforts and results

Summary

- IDC RP2 Elaboration Iteration E1 is complete

- IDC RP2 E1 deliverables released

- Proposed E2 deliverables plan complete