

Software Accuracy Evaluation – Examples

For software systems, the accuracy of data transmission or the accuracy of storing, maintaining, and retrieving data correctly to/from a database can be evaluated. Accuracy is also one aspect typically used as a criterion for interoperability testing by the Joint Interoperability Test Command.

Evaluation of Data Transmission Accuracy

Critical technical parameters (CTPs) should be used during DT to address engineering goals to identify, isolate, and fix data transmission channels that may not be working correctly. During OT, the accuracy KPP should measure a critical aspect of performance to ensure the operational mission can be accomplished.

Evaluation of Data Storing, Maintaining, or Retrieval Accuracy

When addressing storing, maintaining, and retrieving data correctly to/from a database, CTPs could be used to address individual aspects. If the system has built-in redundancy or accuracy correction methods to help address accuracy problems, then CTP testing could focus on each method separately. KPP testing during OT should account for the redundancy or correction methods provided users use them correctly, with the overall focus on a critical aspect of performance to ensure the operational mission can be accomplished.

An accuracy measure is particularly subject to data skewing during operational testing because users tend to avoid known failures and instead rely on methods that seem to work correctly. Data accuracy is routinely and incorrectly tested as

<number of errors> / <number of transmissions>

When measuring accuracy, the correct metric is

< **number of elements with any error** > / < **number of elements** >

An element is typically considered a data record, consisting of a number of data fields. Requirements are often ambiguous concerning data accuracy, and OTAs should seek clarification from the user representative so that the TEMP can be used to unambiguously build failure definition scoring criteria.

Hypothetical Example

Suppose our system transmits 100 data records, and each data record has 50 data fields. Suppose we observe the following: only 99 data records are received, and of those, 98 are totally correct (i.e. all 50 data fields correct in each of the 98 records). The one record received, but not totally correctly, has 5 data fields not correct. What is the point estimate of data accuracy, and how many data samples are counted? DOT&E interprets this as having 98 correct records, and 2 records not correct (1 not received, 1 containing errors). The point estimate would be 0.98, and there are 100 samples. The method of counting successes and failures should not be left ambiguous in the TEMP.

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Accuracy measures are particularly prone to skewing of samples during OT, since users tend to not repeat known errors. The following hypothetical example demonstrates this.

Hypothetical example of data skewing when testing accuracy:

Suppose the requirement is to return accurate track information to the user 95 percent of the time when the user clicks on a track displayed on the GCCS Common Operational Picture. Suppose the COP is displaying half ship tracks, half air tracks. Suppose if the user clicks on a ship track, the user receives an accurate data record, but whenever the user clicks on an air track, the user receives a record with incorrect data. Severe skewing would occur if the user were to click on an air track, note the error, and then click on one more air track to verify the error. Then the user might proceed to click on 85 ship tracks. While 85 successes out of 87 trials may meet 95 percent success rate with 80 percent level of confidence, the problem is that the data samples themselves are not independent, since the selection of tracks on which to click was not random and not representative of the population of tracks.

A key engineering goal of these KPPs is to identify, isolate, and fix the channels or software that are not working correctly. Accordingly, testers should also report any inaccuracies at the data field level. A report that details the errors found in each element will provide the PM with information needed to fix issues and will also be easily summarized with the correct metric.

Accuracy and the Net-Ready KPP

Both the first and third attributes of the Net-Ready KPP may require accuracy measures to help resolve the NR-KPP. Shown below are several accuracy KPPs, with a brief note about how they might be related to the NR-KPP. A separate note indicates if an ambiguity of how to measure data accuracy should be clarified.

Example 1

From Air Operations Center – Weapon System (AOC-WS): 99 percent of original content conveyed [assume correctly] to other divisions & process stations.

This KPP could be aligned under the third attribute of the NR-KPP, which requires the IT system to effectively exchange information. It is not clear whether the “content” is measured at the data field, or data record, level. This ambiguity should be resolved.

Example 2

From AOC-WS: Match air, space and information support resources to operations, Accuracy \geq 95 percent (threshold).

This KPP could be aligned under the first attribute of the NR-KPP, which requires the IT system to be able to support military operations.

Example 3

From Global Combat Support System – Joint: Provide 95 percent accurate data from authoritative source.

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This KPP could be aligned under the third attribute of the NR-KPP, which requires the IT system to effectively exchange information. It is not clear whether the data accuracy is measured at the data field, or data record, level. This ambiguity should be resolved. If not specified, DOT&E would assume at the data record level.

Example 4

From Global Combat Support System – Army: GCSS-Army must maintain an accurate funds available balance; allow verification of funds availability, and provide alerts for transactions that will exceed fund authorizations. Threshold: Based on a sampling, GCSS-Army achieves funds accuracy 95 percent of the time.

This KPP could be aligned under the first attribute of the NR-KPP, which requires the IT system to be able to support military operations.

Example 5

Joint Command and Control (JC2): Track to asset level visibility: Reports or queries will be delivered in less than 7 seconds from the time query is issued at 99.999 percent accuracy.

This KPP could be aligned under the third attribute of the NR-KPP, which requires the IT system to effectively exchange information. It is not clear whether the data accuracy is measured at the data field, or data record, level. This ambiguity should be resolved. If not specified, DOT&E would assume at the data record level. Even with no failures, 160,943 successful samples would be required to meet the accuracy requirement at the 80 percent level of confidence. DOT&E would recommend adjusting the requirement to a level that is affordable to test.