CHAPTER 11

Obtaining Measurements

Introduction

The Statistics module on the Cisco Billing and Measurements Server (BAMS) computes, augments, generates, and maintains performance indicators. Performance indicators amount to a history of traffic statistics on a telephone or data network. Counters are calculated for various events (for example, number of call attempts, call duration) for a particular time period. Each counter is associated with a time stamp and a key formed by the concatenation of several fields copied out of the Call Detail Record (CDR) being processed.

Counters that correspond to the same key within the same time period are added together, producing an accumulated count. For this reason, performance indicators are also known as accumulators. That is, "accumulators" and "counters" are used interchangeably to refer to performance indicators.

BAMS maintains counters for three different interval categories (real time, hourly, and daily intervals).

BAMS also maintains a flat file for each collection interval. In order for information to be timely, as soon as an interval boundary is reached, the buckets for that interval are written to disk. As the measurements are written, each measurement is checked against a user-defined threshold value and test condition.

Types of Measurements

Each measurement value represents an accumulation of activity that took place during the measurement interval. At any point in time, three intervals are being collected in parallel, in real-time, hourly, and daily. Measurement values are organized into measurement groups. There are two types of measurement groups: non-carrier and carrier-based. For each non-carrier group, 45 different measurements are accumulated. For each carrier-based group, eight different measurements are accumulated.

Types of Measurement Intervals

The Accumulation (ACC) task generates measurements for one variable, real-time interval, or period and two fixed-time intervals. At any moment in time, two collection windows are open for updating, the current window called "N," and the most recent window called "N–1." Each N and N–1 collection window consists of real-time, hourly, and daily counters. The two open windows are necessary because the Cisco Media Gateway Controller (MGC) does not produce a CDR at the first Initial Address Message (IAM) or seizure. Instead, it produces the CDR at the time of answer or abandonment of the call.

Because of the particular time points that are recorded by the Cisco MGC, an event might not be reported until after the collection interval has been closed, even though the event should have been credited to that interval. The one exception to the two-window rule is at startup, where only the current window is open. That remains the case until after the first interval boundary is crossed.

Real-Time Intervals

You can configure the real-time interval to any of the following durations: 5 minutes, 10 minutes, 15 minutes, 20 minutes, or 30 minutes. The default real-time interval is 15 minutes. All real-time measurements are stored in files whose names have the prefix acc_r.

Hourly Intervals

The hourly interval contains the sum of all of the real-time intervals that took place during the hour. For this reason, 60 minutes must be evenly divisible by the real-time interval length. All hourly measurements are stored in files whose names have the prefix acc_h.

Daily Intervals

The daily interval contains the sum of all of the hourly intervals that took place during the day. All daily measurements are stored in files whose names have the prefix acc_d.

Noncarrier Measurements

Noncarrier measurements are organized by trunk group. Table 11-1 lists these measurements and their mnemonics. It also describes each measurement's trigger time point and tag, derivation, and mapping.

Table 11-1 Noncarrier Measurements

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Call Attempts Incoming	IGR CALL ATT	1010 or 1030 received, Tag 4100 or 4101.	Pegged when a 1010 CDB is recorded w/4008 or when 1030 recorded w/4008.
Call Attempts Outgoing	EGR CALL ATT	1010 or 1030 received, Tag 4100 or 4101.	Pegged when a 1010 CDB is recorded w/4015 or when 1030 recorded w/4015.
Outgoing Attempts Blocked	EGR CALL BLKD	1030 or 1040 received, Tag 4100 or 4101.	4015 populated, 1030 or 1040 with (cause code) Tag {2008,3008}== {21, 25, 27, 29, 34, 38, 41, 42, 44, 46, 47, 53, 63}.
Failed Calls Congestion	TTL FAILED CONGEST	1030 or 1040 received, Tag 4100 or 4101.	Peg for all 1030 or 1040 where {2008 or 3008} == {42, 44, 47}.

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Successful Calls Incoming	IGR TERM NORM	1040 or 1030 received, later of Tag 4106 or 4107.	Peg for all 1040 CDB or 1030 CDB where 4008 is populated and {2008 or 3008} == {16, 17, 18, 19, 31}.
Successful Calls Outgoing	EGR TERM NORM	1040 or 1030 received, later of Tag 4106 or 4107.	Pegged when 1040 or 1030 CDB recorded w/4015 populated and {2008 or 3008} == {16, 17, 18, 19, 31}.
Percent Trunk Group Usage Incoming	IGR PCT TRK USE	Starts when 1010 received (Tag 4100 or 4101). Closes when interval is closed or 1040 received.	Measured as a percentage of time that circuits are occupied, based on the total number of circuits belonging to a trunk group over the provisioned interval of measurement. Any circuit on Tag 4008 triggers this measurement from CDB Tag 1010. The starting time point is the earlier of Tag 4100 or 4101; the end time point is in the 1040 CDB, the later of Tag 4108 or 4109.
Percent Trunk Group Usage Outgoing	EGR PCT TRK USE	Starts when 1010 received (Tag 4100 or 4101). Closes when interval is closed or 1040 received.	Measured as a percentage of time that circuits are occupied, based on the total number of circuits belonging to a trunk group over the provisioned interval of measurement. Any circuit on Tag 4015 triggers this measurement from CDB Tag 1010. The starting time point is the earlier of Tag 4100 or 4101; the end time point is in the 1040 CDB, the later of Tag 4108 or 4109.

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Note When the measurement Percent Trunk Group Usage (PCT TRK USE) is specified, it is possible for the measurement to be recorded in the real-time acc_r file but not recorded in the hourly acc_h or daily acc_d files. For example, trunk group usage that is as low as 1% for a real-time duration set for 10, 15, or 30 minutes, will be recorded in the acc_r file. However, such low usage will fall below 1% for the greater hourly and daily time periods and, therefore, will not be recorded in the acc_h or acc_d files. Similarly, a measurement can meet the minimum usage percentage to be recorded in the real-time and hourly files but not the daily file.			
Percent Trunk Group Maintenance Usage	TTL MAINT USE	Starts when 1070 received (Tag 4100 or 4101). Closes when interval is closed or 1070 with unblock.	Measured as a percentage of time that circuits are occupied, based on the total number of circuits belonging to a trunk group over the provisioned interval of measurement. In the Maintenance (1070) CDB, Tag 4077 indicates how many circuits are involved in the blocking or unblocking event.
Total Traffic in Erlangs	TTL ERLANGS	Starts when 1010 received (Tag 4100 or 4101). Closes when interval is closed or 1040 received.	Measured in Erlangs for both ingress and egress for a trunk group. Use total seconds duration, from 1010 CDB; use time point in earlier of Tag 4100 or 4101. For the end of the duration, use the later of Tag 4108 or 4109. Erlangs = (total seconds) / (seconds in measured interval). Example: for a 1-hour measurement, with 99,000 seconds measured, the formula is (99,000)/(3600 secs) = 27.5 Erlangs. If the same measurement occurs over a 15-minute interval, the formula is (99,000)/(900 secs) = 110 Erlangs.
Total Calls Terminated Normally	TTL TERM NORM	1040 received (Tag 4106 or 4107).	Pegged when 1040 CDB recorded and release code in the set {16, 17, 18, 19}

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Total Calls Terminated Abnormally	TTL TERM ABNORM	1030 or 1040 received (Tag 4106 or 4107).	Pegged for any 1040 where {2008 or 3008} != {16, 17, 18, 19, 31} or for 1030 CDB with any release code.
Total Calls Terminated, Failed MGW or NAS	TTL TERM FAILED MGW	1030 or 1040 received (Tag 4106 or 4107).	Pegged for any 1030 or 1040 CDB where {2008 or 3008} == {29}.
Total Calls Rejected	TTL CALLS REJECTED	1030 CDB received (Tag 4100 or 4101).	Pegged for any 1030 CDB where {2008 or 3008} == {21}.
Total Calls Rejected, Unknown Dialed Number	TTL REJECTED DIALNUM	1030 CDB received (Tag 4100 or 4101).	Pegged for any 1030 CDB where {2008 or 3008} == {1, 5, 22, 28}.
Total Calls Rejected, Other Reasons	TTL REJECTED OTHER	1030 CDB received (Tag 4100 or 4101).	Pegged for any 1030 CDB where {2008 or 3008} != {1, 5, 16, 17, 18, 19, 21, 22, 28, 29}.
Overflow, Outgoing Attempts Blocked	EGR OFL BLKD	1030 CDB received (Tag 4100 or 4101).	Pegged for 1030 CDB where 4015 is populated and {2008 or 3008} == {27, 34, 41, 42, 44, 47, 53, 63}.
Total Sum of Usage Pegs per Trunk Group	TTL TRAFFIC USAGE PEGS	1010 or 1030 CDB received (Tag 4100 or 4101).	Pegged for any 1010 or 1030 CDB.
Tandem Routing Attempts, Outgoing	EGR TANDEM ATT	1010 or 1030 CDB received (Tag 4100 or 4101).	Pegged when Tag 4015 (trunk group) is marked T (tandem connection) for 1010 or 1030 CDB.
Tandem Completions, Outgoing	EGR TANDEM COMPLT	1010 CDB received (Tag 4100 or 4101).	Pegged when Tag 4015 (trunk group) is marked T (tandem connection) for 1010 CDB.
Tandem Attempts, Incoming	IGR TANDEM ATT	1010 or 1030 CDB received (Tag 4100 or 4101).	Pegged when Tag 4008 (trunk group) is marked T (tandem connection) for 1010 or 1030 CDB.
Tandem Completions, Incoming	IGR TANDEM COMPLT	1010 CDB received (Tag 4100 or 4101).	Pegged when Tag 4008 (trunk group) is marked T (tandem connection) for 1010 CDB.
Tandem Duration, Outgoing	EGR TANDEM DUR	1010 CDB received (Tag 4100 or 4101).	Duration measured when Tag 4015 (trunk group) is marked T (tandem connection) for 1010 CDB.

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Tandem Duration, Incoming	IGR TANDEM DUR	1010 CDB received (Tag 4100 or 4101).	Duration measured when Tag 4008 (trunk group) is marked T (tandem connection) for 1010 CDB. Start with earlier of time point in Tag 4100 or 4101 of 1010 CDB, end with later of 4108 or 4109 in 1040 CDB.
Conversation Duration, Ingress	IGR CONV DURATION	1010 CDB received (Tag 4104 or 4105).	Duration measured from the later of Tag 4104 or 4105 in the 1010 CDB, till the earlier of Tag 4106 or 4107 (from 1040 CDB), when Tag 4008 is populated with the valid trunk group number.
Conversation Duration, Egress	EGR CONV DURATION	1010 CDB received (Tag 4104 or 4105).	Duration measured from the later of Tag 4104 or 4105 in the 1010 CDB, until the earlier of Tag 4106 or 4107 (from 1040 CDB), when Tag 4015 is populated with the valid trunk group number.
Setup Duration, Ingress	IGR SETUP DURATION	1010 or 1030 CDB received (Tag 4100 or 4101).	Duration measured from time point in earlier of Tag 4100 or 4101 of 1010 CDB, end with later of Tag 4102 or 4103 in 1010 CDB. For 1030 CDB, start with earlier of Tag 4100 or 4101, end with earlier of Tag 4106 or 4107, when Tag 4008 is populated with the valid trunk group number.

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Setup Duration, Egress	EGR SETUP DURATION	1010 or 1030 CDB received (Tag 4100 or 4101).	Duration measured from time point in earlier of Tag 4100 or 4101 of 1010 CDB, end with later of Tag 4102 or 4103 in 1010 CDB. For 1030 CDB, start with earlier of Tag 4100 or 4101, end with earlier of Tag 4106 or 4107, when Tag 4015 is populated with the valid trunk group number.
Teardown Duration, Ingress	IGR TEARDOWN DURATION	1030 or 1040 CDB received (Tag 4106 or 4107).	Duration measured from time point in earlier of Tag 4106 or 4107, end with the later of Tag 4108 or 4109, when Tag 4008 is populated with the valid trunk group number.
Teardown Duration Egress	EGR TEARDOWN DURATION	1030 or 1040 CDB received (Tag 4106 or 4107).	Duration measured from time point in earlier of Tag 4106 or 4107, end with later of Tag 4108 or 4109, when Tag 4015 is populated with the valid trunk group number.
Call Routing I Peg Total	TTL CALL ROUTING I	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when ingress and egress traffic terminations are maintained by the same gateway. When Tag 4038 and Tag 4039 are equal and neither Tag 4069 nor Tag 4073 equals 6 (EISUP).
Call Routing II Peg Total	TTL CALL ROUTING II	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when ingress and egress traffic terminations are maintained by the different gateways, but under control of the same MGC. When Tag 4038 and Tag 4039 are not equal, and neither Tag 4069 nor 4073 equals 6.

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Call Routing III Peg Total	TTL CALL ROUTING III	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when one side of a call originates or terminates under the control of a gateway connected to the MGC, but the other side of the call terminates in another network not under the control of the MGC. When either Tag 4069 or 4073 equals 6.
Successful H.323 Terminating Peg	EGR SUCCESSFUL H.323	1010 CDB received (Tag 4100 or 4101).	Pegged when a 1010 CDB is received with a Tag 4073 with a value of 7. **Note** The H.323 measurements are output only when the enable-H323 parameter is set to 1 in the Node Parameters table.
Successful H.323 Originating Peg	IGR SUCCESSFUL H.323	1010 CDB received (Tag 4100 or 4101).	Pegged when a 1010 CDB is received with a Tag 4069 with a value of 7. **Note** The H.323 measurements are output only when the enable-H323 parameter is set to 1 in the Node Parameters table.
Unsuccessful H.323 Terminating Peg	EGR UNSUCCESS FUL H.323	1030 CDB received (Tag 4100 or 4101).	Pegged when a 1030 CDB is received with a Tag 4073 with a value of 7. **Note** The H.323 measurements are output only when the enable-H323 parameter is set to 1 in the Node Parameters table.

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Unsuccessful H.323 Originating Peg	IGR UNSUCCESS FUL H.323	1030 CDB received (Tag 4100 or 4101).	Pegged when a 1030 CDB is received with a Tag 4073 with a value of 7. **Note** The H.323 measurements are only output when the enable-H323 parameter is set to 1 in the Node Parameters table.
Successful Terminating ISDN User Part (ISUP) Requests	EGR SUCCESSFUL ISUP	1010 CDB received (Tag 4100 or 4101).	Pegged when a 1010 CDB is received with a Tag 4073 with a value of 0.
Unsuccessful Terminating ISUP Requests	EGR UNSUCCESS FUL ISUP	1030 CDB received (Tag 4100 or 4101).	Pegged when a 1030 CDB is received with a Tag 4073 with a value of 0.
Successful ISUP Originating Requests	IGR SUCCESSFUL ISUP	1010 CDB received (Tag 4100 or 4101).	Pegged when a 1010 CDB is received with a Tag 4069 with a value of 0.
Unsuccessful ISUP Originating Requests	IGR UNSUCCESS FUL ISUP	1030 CBD received (Tag 4100 or 4101).	Pegged when a 1030 CDB is received with a Tag 4069 with a value of 0.
Terminating ISUP Setup Message Response Delay	EGR ISDN SETUP MSG DELAY	1010 or 1030 CDB received (Tag 4100 or 4101).	Pegged when a 1010 or 1030 CDB is received with a Tag 4069 with a value of 0 and when the setup duration is greater than 3 seconds. The setup duration is measured from the timepoint beginning with the earlier of Tag 4100 or 4101 of the 1010 CDB, and ending with the later of Tag 4102 or 4103.
Originating ISUP Setup Message Response Delay	IGR ISDN SETUP MSG DELAY	1010 or 1073 CDB received (Tag 4069).	Pegged when a 1010 or 1030 CDB is received with a Tag 4073 with a value of 0 and when the setup duration is greater than 3 seconds. The setup duration is measured from the timepoint beginning with the earlier of Tag 4100 or 4101 of the 1010 CDB, and ending with the later of Tag 4102 or 4103.

Table 11-1 Noncarrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Total Number of Defined CICs	TTL CIC DEFINED	Start of interval.	Number of circuits provisioned in the Trunk Group table. **Note** No corresponding threshold crossing alert exists for this measurement.
Total Number of Available CICs	TTL AVLBL CIC	1070 received.	Total - maintDuration / intervalLength Where total = total number of provisioned circuits; maintDuration = total maintenance duration in seconds (see "TTL MAINT USE" in Table 11-1 for details); and intervalLength = total number of seconds for the measurement period.

Carrier-Based Measurements

Carrier-based measurements are grouped by Trunk Group/Interexchange Carrier (IC). Table 11-2 lists these measurements with their mnemonics. It also describes each measurement's trigger time point and tag, derivation, and mapping.

Table 11-2 Carrier Measurements

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
IC Destined Calls	IC EGR CALLS	1010 CDB received (Tag 4100 or 4101).	Pegged per IC for CDB 1010 where Tag 2014 is populated with a valid carrier ID and Tag 4008 (trunk group) is marked T (tandem connection) for 1010 CDB.
IC Destined calls, No Circuit	IC EGR NOCKT	1030 CDB received (Tag 4100 or 4101).	Pegged per IC for 1030 CDB where Tag 2008 = {42, 44, 47} and Tag 4008 (trunk group) is marked T (tandem connection) for 1010 CDB.
IC Duration	TTL DURATION	1010 CDB received (Tag 4100 or 4101).	Duration measured per IC when CDB 1010 Tag 2014 is populated with a valid carrier ID and Tag 4008 (trunk group) is marked T (tandem connection) for 1010 CDB. Start with earlier of time point in Tag 4100 or 4101 of 1010 CDB, end with later of Tag 4108 or 4109 in 1040 CDB.
Total Carrier Select, No Indication	TTL CARRIER SELECT NO INDICATION	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when Tag 2015 != {1, 2, 3, 4} and marked T for tandem connection in the Trunk Group table. Output by trunk group and carrier.
Total Carrier Select Presubscribed, Not Input	TTL CARRIER SELECT PRE-SUBSCRIBED NO NIPT	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when Tag 2015 = {1} and marked T for tandem connection in the Trunk Group table. Output by trunk group and carrier.
Total Carrier Select, Presubscribed and Input	TTL CARRIER SELECT PRE-SUBSCRIBED INPT	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when Tag 2015 = {2} and marked T for tandem connection in the Trunk Group table. Output by trunk group and carrier.

Table 11-2 Carrier Measurements (continued)

Measurement	Mnemonic	Trigger Time Point and Tag	Derivation and Mapping
Total Carrier Select, Presubscribed with No Indication	TTL CARRIER SELECT PRESCRIBED WNI	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when Tag 2015 = {3} and marked T for tandem connection in the Trunk Group table. Output by trunk group and carrier.
Total Carrier ID Code, Not PreSubscribed but Input by Customer	TTL CARRIER SELECT NOT PRE-SUBSCRIBED	1030 or 1010 CDB received (Tag 4100 or 4101).	Pegged when Tag 2015 = {4} and marked T for tandem connection in the Trunk Group table. Output by trunk group and carrier.

Storage of Measurements

Both carrier-based and noncarrier measurements are stored internally in groups. Each group consists of all the measurements that belong to a particular key. These measurements are then put in subgroups according to interval. Each measurement group contains real-time, hourly, and daily measurements. There are two types of keys or measurement groups. These are noncarrier measurements and carrier-based measurements. Regardless of group type, measurements are held in memory for performance reasons. Up to two time periods for each key can reside in memory simultaneously. These are the current time period and the one preceding the current time period. Because memory is somewhat volatile, the counters must be written to disk to prevent loss of data. At the end of each real-time time period, the contents of memory are written to disk. This disk file is then available to be read at the next startup.

Noncarrier Measurement Production

Noncarrier measurements consist of 45 measurements or accumulators for each of the three intervals kept in memory. This results in 135 measurements for the current time period, plus a possible additional 135 measurements for the preceding time period.

Carrier-Based Measurement Production

Carrier measurements consist of eight measurements or accumulators for each of the three intervals kept in memory. This results in 24 measurements for the current time period, plus a possible additional 24 measurements for the preceding time period.

Memory Allocation

Depending on the operating mode, the system either preallocates counters for all of the configured measurement groups or it allocates counters as activity is detected in each measurement group.

Threshold Crossing Alarms

TCA Table

The Threshold Crossing Alarms (TCA) table contains values and conditions for each measurement that you wish to link to an alarm. These values and conditions are organized by trunk group or Trunk Group/IC (measurement group). Enter the measurement groups that are of concern. You need not populate every value and condition for a specified measurement group. A global measurement group can be specified to be used for all measurement groups that are not specifically entered.

Threshold String Values

Table 11-3 lists the condition value strings and the threshold value strings that you use to identify the condition and threshold values you set in an MML provisioning session with the TCA-TBL tag ID. For more information, see the "Updating the Threshold Crossing Alarms Table" section on page 5-21.

Table 11-3 Threshold String Values

Threshold	Condition Value String	Threshold Value String	Entered By
Call Attempts Incoming	igr-call-att-cond	igr-call-att	TAG/TRK
Call Attempts Outgoing	egr-call-att-cond	egr-call-att	TAG/TRK
Outgoing Attempts Blocked	egr-call-blkd-cond	egr-call-blkd	TAG/TRK
Failed Calls Congestion	ttl-failed-cong-cond	ttl-failed-cong	TAG/TRK
Successful Calls Incoming	igr-term-norm-cond	igr-term-norm	TAG/TRK
Successful Calls Outgoing	egr-term-norm-cond	egr-term-norm	TAG/TRK
Percent Trunk Group Usage Incoming	igr-pct-trk-use-cond	igr-pct-trk-use	TAG/TRK
Percent Trunk Group Usage Outgoing	egr-pct-trk-use-cond	egr-pct-trk-use	TAG/TRK
Maintenance Duration per Trunk Group	ttl-maint-use-cond	ttl-maint-use	TAG/TRK
Total Traffic Erlangs	ttl-erlangs-cond	ttl-erlangs	TAG/TRK
Total Calls Terminated Normally	ttl-term-norm-cond	ttl-term-norm	TAG/TRK

Table 11-3 Threshold String Values (continued)

Threshold	Condition Value String	Threshold Value String	Entered By
Calls Terminated Abnormally	ttl-term-abnorm-cond	ttl-term-abnorm	TAG/TRK
Calls Terminated, Failed MGW or NAS	ttl-term-failed-mgw-cond	ttl-term-failed-mgw	TAG/TRK
Calls Rejected	ttl-calls-rejected-cond	ttl-calls-rejected	TAG/TRK
Calls Rejected, Unknown Dialed Number	ttl-rejected-dialnum-cond	ttl-rejected-dialnum	TAG/TRK
Calls Rejected, Other Reasons	ttl-rejected-other-cond	ttl-rejected-other	TAG/TRK
Overflow, Outgoing Attempts Blocked	egr-ofl-blkd-cond	egr-ofl-blkd	TAG/TRK
Total Sum of Usage Pegs per Trunk Group (not including maintenance pegs for Release 2.xx)	ttl-traffic-usage-pegs-cond	ttl-traffic-usage-pegs	TAG/TRK
Tandem Routing Attempts, Outgoing	egr-tndm-att-cond	egr-tndm-att	TAG/TRK
Tandem Completions, Outgoing	egr-tndm-cmplt-cond	egr-tndm-cmplt	TAG/TRK
Tandem Routing Attempts, Incoming	igr-tndm-att-cond	igr-tndm-att	TAG/TRK
Tandem Completions, Incoming	igr-tndm-cmplt-cond	igr-tndm-cmplt	TAG/TRK
Tandem Duration, Outgoing	egr-tndm-dur-cond	egr-tndm-dur	TAG/TRK
Tandem Duration, Incoming	igr-tndm-dur-cond	igr-tndm-dur	TAG/TRK
IC Destined Calls, Outgoing	egr-ic-calls-cond	egr-ic-calls	TAG/TRK/IC
IC Destined Calls, No Circuit	egr-ic-nockt-cond	egr-ic-nockt	TAG/TRK/IC
IC Usage	ttl-ic-usage-cond	ttl-ic-usage	TAG/TRK/IC
Conversation Duration, Incoming	igr-conv-dur-cond	igr-conv-dur	TAG/TRK

Table 11-3 Threshold String Values (continued)

Threshold	Condition Value String	Threshold Value String	Entered By
Conversation Duration, Outgoing	egr-conv-dur-cond	egr-conv-dur	TAG/TRK
Setup Duration, Incoming	igr-setup-dur-cond	igr-setup-dur	TAG/TRK
Setup Duration, Outgoing	egr-setup-dur-cond	egr-setup-dur	TAG/TRK
Tear Down Duration, Incoming	igr-teardown-dur-cond	igr-teardown-dur	TAG/TRK
Tear Down Duration, Outgoing	egr-teardown-dur-cond	igr-teardown-dur	TAG/TRK
Call Routing I Peg Total	ttl-route-1-cond	ttl-route-1	TAG/TRK
Call Routing II Peg Total	ttl-route-2-cond	ttl-route-2	TAG/TRK
Call Routing III Peg Total	ttl-route-3-cond	ttl-route-3	TAG/TRK
Total Carrier Select No Indication	ttl-ic-sel-noind-cond	ttl-ic-sel-noind	TAG/TRK/IC
Total Carrier Select Presubscribed Not Input	ttl-ic-sel-pr-nipt-cond	ttl-ic-sel-pr-nipt	TAG/TRK/IC
Total Carrier Select Presubscribed and Input	ttl-ic-sel-pr-inpt-cond	ttl-ic-sel-pr-inpt	TAG/TRK/IC
Total Carrier Select Presubscribed with No Indication	ttl-ic-sel-pr-wni-cond	ttl-ic-sel-pr-wni	TAG/TRK/IC
Total Carrier Id Code Not Presubscribed but Input by Customer	ttl-ic-sel-no-pr-cond	ttl-ic-sel-no-pr	TAG/TRK/IC

Table 11-3 Threshold String Values (continued)

Threshold	Condition Value String	Threshold Value String	Entered By
Successful H.323 Terminating Peg	egr-scfl-h323-cond	egr-scfl-h323	TAG/TRK **Note** The H.323 measurements are checked only when the enable-H323 parameter is set to 1 in the Node Parameters table.
Successful H.323 Originating Peg	igr-scfl-h323-cond	igr-scfl-h323	TAG/TRK **Note** The H.323 measurements are checked only when the enable-H323 parameter is set to 1 in the Node Parameters table.
Unsuccessful H.323 Terminating Peg	egr-unscfl-h323-cond	egr-unscfl-h323	TAG/TRK **Note** The H.323 measurements are checked only when the enable-H323 parameter is set to 1 in the Node Parameters table.
Unsuccessful H.323 Originating Peg	igr-unscfl-h323-cond	igr-unscfl-h323	TAG/TRK **Note** The H.323 measurements are checked only when the enable-H323 parameter is set to 1 in the Node Parameters table.
Total Successful Terminating ISUP Requests	egr-scfl-isup-cond	egr-scfl-isup	TAG/TRK
Unsuccessful Terminating ISUP Requests	egr-unscfl-isup-cond	egr-unscfl-isup	TAG/TRK
Successful ISUP Originating Requests	igr-scfl-isup-cond	igr-scfl-isup	TAG/TRK

Table 11-3 Threshold String Values (continued)

Threshold	Condition Value String	Threshold Value String	Entered By
Unsuccessful ISUP Originating Requests	igr-unscfl-isup-cond	igr-unscfl-isup	TAG/TRK
Terminating ISUP Setup Message Response Delay	egr-isdn-su-msg-delay-cond	egr-isdn-su-msg-delay	TAG/TRK
Originating ISUP Setup Message Response Delay	igr-isdn-su-msg-delay-cond	igr-isdn-su-msg-delay	TAG/TRK
Total Number of Available CICs	ttl-avlbl-cic-cond	ttl-avlbl-cic	TAG/TRK

Threshold Crossing Conditions

Each threshold crossing condition is a code that checks the difference (if any) between the user-specified value and the current real-time measurement value. The condition is specified as a number between 0 and 4. Any other value is invalid. Table 11-4 defines the meaning of each condition value.

Condition Value Relationship

Table 11-4 lists condition values used for measurements.

Table 11-4 Condition Values

Value	Condition Description
0	Ignore
1	Less Than (<)
2	Equal To (=)
3	Greater Than (>)
4	Not Equal To (!=)

Threshold Values

With the TCA-TBL tag ID, you specify the threshold value and the condition value to so that they generate an alarm if a specific measurement condition is reached. For example, for a given measurement, if the condition is set to 4 and the threshold value is set to 10, an alarm is generated if the measurement value is greater than 10. Threshold values are specified as positive integers.

Trunk Group Identification (Threshold Key)

Each threshold specification (threshold value and condition value) must be associated with a measurement group. If the Entered By tag specifies TAG/TRK, the measurement is organized by the trunk group number. If the Entered By tag specifies TAG/TRK/IC, the measurement is organized by trunk group number and an interexchange-carrier number. A special measurement group can be specified to apply to all TAG/TRK measurement groups that are not otherwise specified. This measurement group is identified by the name “global/0,” where the TAG is “global” and the trunk group is “0.”

Processing Logic

The same logic is used for processing all accumulation periods: computation is based on the time stamps from call detail records generated by the switch. The distinguishing factor among the different accumulation periods is the time period in which two events are considered to occur for the same counter. Counts for any given event are added to the accumulators for the time period that matches the time stamp of the event. More specifically, Table 11-2 identifies the time point for each event that is used to match the accumulator time period.

Three different levels at which statistics can be generated are as follows:

- Using the CDR details
- Using the aggregate CDRs
- Using the correlated CDRs

There are advantages and disadvantages to each of the above approaches. Statistics computed from CDR details result in more frequent updates, and thus a finer granularity of reporting. However, more records must also be processed. Thus, the volume of connections and the length of the switch-reporting interval can dramatically drive up the amount of processing required to make the statistics available. Conversely, computing statistics from aggregated or correlated CDRs provides a more efficient computation, but less timely statistics.

The following section applies to all accumulation types, periods, and levels.

Statistics Subsystem Functions

The Statistics subsystem provides the following functionality:

- Obtains the chain of aggregated CDR details.
- Receives the CDR details in time order from the Augmentation (AUG) task. The CDRs arrive in two types of files: aug_acei and aug_acbc. The aug_acei files contain complete CDRs taken from fmt files. For each fmt file, at least one aug_acei file exists. An aug_acbc file exists for each threshold crossing. The aug_acbc files contain all partial CDRs (CDRs that did not complete during the interval).
- Assigns the usage in real-time, hourly, and daily intervals. For cumulative count fields, a call that began before the start of the interval and has not ended adds the full length of the real-time interval to the count. Any CDR that begins in the interval (but has not ended) adds the time from the start of CDR to the end of the interval. Any CDR that ends in the interval (but did not start in the interval) adds the time from the start of the interval to the end time of the CDR. Any CDR that both begins and ends in the same interval adds the delta between the start and end time of the CDR.
- Calculates hourly counters.
- Monitors check points at the end of every file interval (complete reading of all aug_acei files and the aug_acbc file for the given interval).
- Summarizes the hourly counters and produces daily counters. These tables should be stored in table sets.
- Manages the daily counters so that counters older than a specified retention period are purged regularly.

At any moment in time, two collection intervals are open for updating, the current interval, called “N,” and the most recent interval, called “N–1.” The two open intervals are necessary because the Cisco MGC does not produce a CDR at the first IAM or seizure; rather, it creates the first indication of a call at

answer or abandonment. Because of the particular time points that are recorded by the Cisco MGC, there are some cases where an event is not reported until after the collection interval has been closed, yet the event should be credited to that interval. A bucket or interval shall never be credited for more than the total duration that is available during that interval, regardless of when the indication of the call was received.

A flat file is maintained for each collection interval. In order to provide timely information, buckets for an interval (the current interval, or N) are written as soon as an interval boundary is reached. At the same time, the previous interval (N–1), which may have been updated because of late reports for call abandonment, is rewritten to disk and is not updated again. Very late reports are written to the oldest collection period that is still open, which is always the N–1 interval. The one exception to this rule is at startup, when only the current period is open, until after the first interval boundary is crossed.

Keys and Counters

Keys and counters are stored in memory and written to a checkpoint file on a regular basis.

The key is a unique sequence number used to identify the specific collection of counters. The key fields are the trunk group number and the IC. Table 11-5 lists the key field names and their descriptions.

Table 11-5 Key Field Name Descriptions

Field	Description
Trunk Group	Taken from the sigpath to trunkgroup configuration. • For Ingress, use the Terminating Trunk Group. • For Egress, use the Originating Trunk Group. The values are 1–9999 for BAF, 4096 for ITU, and 1684 for ANSI. The default is 0 if no information is available.
IC	Carrier ID: 2014.

Counter Sets

Each counter set is made up of three groups of counters, one group for real time, one for hourly, and one for daily. The counters in each group represent running tallies of the specified statistics. Each group of counters represents only the current interval of the counter type (current real time interval, the current hour, the current day). Each counter statistic is credited to the time period in which it occurred. Note that there are different time periods. Hourly counters keep track of the statistics on hourly boundaries. If an event spans multiple hours, one counter for each hour spanned is created. For example, if a call is established at 11:50 and is disconnected at 12:15, one counter for the 11:00 hour is created with 10 minutes of conversation time credited to it, and a second one is created for the 12:00 hour with 15 minutes of conversation time.

Similarly, daily counters credit statistics on daily boundaries.

Frequency of Statistics

In addition to the rollup hourly and 24-hour statistics, which are tabulated with any of the previous options, the system also supports 5-, 10-, 15-, 20-, and 30-minute (real-time), hourly, and daily statistics.

Note You can configure the measurements interval by editing the interval-minutes field in the Node Parameters table. For more information, see the "Updating the Node Parameters Table" section on page 5-10.

Statistics Output

After statistics have been collected, they are output to a flat file. For each real-time interval, an acc_rYYYYMMDDHHMM00 file is created. For each hourly interval, an acc_hYYYYMMDDHH0000 file is created. For each daily interval, an acc_dYYYYMMDD000000 file is created. These files are stored in the opt/CiscoBAMS/data/s0x/Measurements directory.

Note All times are in Universal Coordinated Time, which is taken from the CDR record.

The output files are generated as soon as the ACC task has finished processing the aug_acbc file (last file) for the given interval. This means that the ACC task generates a flat file for the real-time interval at the end of each set of files for the real-time interval (5, 10, 15, 20, or 30 minutes). The hourly output file is generated when the last interval file is processed for that hour. The daily output file is generated as soon as the last interval file for the day is processed. Each file is created on a real-time, 1-hour, and 24-hour basis. Each file contains all of the statistics gathered in the previous period.

In the following section, the term "trunk groups" is used to represent both TAG/Trunk Group and TAG/Trunk Group/IC.

Statistics are generated from CDBs produced by the Cisco MGC. Since the output is reported by TAG/Trunk Group or by TAG/Trunk Group/IC, measurements are produced only for trunk groups that have call activity starts (unless the system is running in configured mode and trunk groups are specified). Therefore, when the system is started, the statistics output files are empty until call activity begins. Regardless of call activity, the appropriate acc_x files are generated. These files can, however, be empty.

Note If CDB files produced by the Cisco MGC software on a Cisco PGW are not available for processing, the acc_x files will not be written for that interval.

Over the course of the day, the system continues to add to the trunk groups that are reported on, as call activity is received. Once added, a trunk group is reported on in every interval that follows, until the end of the day. At midnight, the system generates the acc_d (daily) file. This file contains all of the activity for the day for any trunk group that had call activity during the 24-hour period. Once the daily counts have been reported, the system attempts to clear out as many trunk groups from memory as possible. This step eliminates the need to report on trunk groups that are no longer active. The system purges any trunk group that does not currently have a threshold alarm asserted. These trunks groups must be retained so that the system does not assert additional alarms before the current alarm clears. If the system is running in configured mode, trunks specified in the Trunk Group table are not purged either.

Acc_x files produced after midnight contain only trunk groups that have had call activity after midnight and trunk groups that have threshold crossing alarms asserted. If the system is running in configured mode, trunks specified in the Trunk Group table are also reported.

Since the data is stored in flat files, you can configure MSC to purge outdated statistics.

Example from a MGC acc_h file:

```
0,972477302,3600,203,"occurrences","BAM:EGR CALL ATT","TG8004"
```

Statistics Output Format

The format for the statistics output mirrors the SS7-type statistics format created on the Cisco MGC. The format is comma-delimited, and appears in the order shown in Table 11-6.

Table 11-6 Output Format Order

Column	Description	Comments
Field 1	Record release level (version, 0 (zero) initially).	Constant: Set to 0
Field 2	Time when the measurement interval started. The time is based on UNIX time format (seconds elapsed since January 1, 1970).	
Field 3	Elapsed time of collection interval, in seconds.	
Field 4	The value of the measurement at the end of the interval.	
Field 5	Measurement unit.	

Table 11-6 Output Format Order (continued)

Column	Description	Comments
Field 6	The measurement category. The direction is identified by EGR for egress, IGR for ingress, or TTL for total. The measurements are either carrier-based or non-carrier-based. The measurement name is one of the following: **Carrier-based Measurements** **Field Name** — **Full Name** IC EGR CALLS — IC Destined Calls IC EGR NO CKT — IC Destined Calls, No Circuit TTL DURATION — IC Duration TTL CARRIERSELECT NO INDICATION — Total Carrier Select, No Indication TTL CARRIERSELECT PRESUBSCRIBED NO NIPT — Total Carrier Select Presubscribed, Not Input TTL CARRIERSELECT PRESUBSCRIBED INPT — Total Carrier Select, Presubscribed and Input TTL CARRIERSELECT PRESUBSCRIBED WNI — Total Carrier Select, Presubscribed with No Indication TTL CARRIERSELECT NOTPRESUBSCRIBED — Total Carrier ID Code, Not PreSubscribed but Input by Customer	

Table 11-6 Output Format Order (continued)

Column	Description		Comments
Field 6 *(continued)*	**Noncarrier-based Measurements**		
	Field Name	**Full Name**	
	IGR CALL ATT	Call Attempts Incoming	
	EGR CALL ATT	Call Attempts Outgoing	
	EGR CALL BLKD	Outgoing Attempts Blocked	
	TTL FAILED CONGEST	Failed Calls Congestion	
	IGR TERM NORM	Successful Calls Incoming	
	EGR TERM NORM	Successful Calls Outgoing	
	IGR PCT TRK USE	Percent Trunk Group Usage Incoming	
	EGR PCT TRK USE	Percent Trunk Group Usage Outgoing	
	TTL MAINT USE	Percent Trunk Group Maintenance Usage	
	TTL ERLANGS	Total Traffic in Erlangs	
	TTL TERM NORM	Total Calls Terminated Normally	
	TTL TERM ABNORM	Total Calls Terminated Abnormally	
	TTL TERM FAILED MGW	Total Calls Terminated, Failed MGW or NAS	
	TTL CALLS REJECTED	Total Calls Rejected	
	TTL REJECTED DIALNUM	Total Calls Rejected, Unknown Dialed Number	
	TTL REJECTED OTHER	Total Calls Rejected, Other Reasons	
	EGR OFL BLKD	Overflow, Outgoing Attempts Blocked	
	TTL TRAFFIC USAGE PEGS	Total Sum of Usage Pegs per Trunk Group	
	EGR TANDEM ATT	Tandem Routing Attempts, Outgoing	
	EGR TANDEM COMPLT	Tandem Completions, Outgoing	
	IGR TANDEM ATT	Tandem Attempts, Incoming	
	IGR TANDEM COMPLT	Tandem Completions, Incoming	
	EGR TANDEM DUR	Tandem Duration, Outgoing	
	IGR TANDEM DUR	Tandem Duration, Incoming	
	IGR CONV DURATION	Conversation Duration, Ingress	
	EGR CONV DURATION	Conversation Duration, Egress	
	IGR SETUP DURATION	Setup Duration, Ingress	
	EGR SETUP DURATION	Setup Duration, Egress	
	IGR TEARDOWN DURATION	Teardown Duration, Ingress	
	EGR TEARDOWN DURATION	Teardown Duration Egress	
	TTL CALL ROUTING I	Call Routing I Peg Total	
	TTL CALL ROUTING II	Call Routing II Peg Total	
	TTL CALL ROUTING III	Call Routing III Peg Total	
	EGR SUCCESSFUL H.323	Successful H.323 Terminating Peg	
	IGR SUCCESSFUL H.323	Successful H.323 Originating Peg	
	EGR UNSUCCESSFUL H.323	Unsuccessful H.323 Terminating Peg	
	IGR UNSUCCESSFUL H.323	Unsuccessful H.323 Originating Peg	

Table 11-6 Output Format Order (continued)

Column	Description		Comments
Field 6 *(continued)*	EGR SUCCESSFUL ISUP	Successful Terminating ISDN User Part (ISUP) Requests	
	EGR UNSUCCESSFUL ISUP	Unsuccessful Terminating ISUP Requests	
	IGR SUCCESSFUL ISUP	Successful ISUP Originating Requests	
	IGR UNSUCCESSFUL ISUP	Unsuccessful ISUP Originating Requests	
	EGR ISDN SETUP MSG DELAY	Terminating ISUP Setup Message Response Delay	
	IGR ISDN SETUP MSG DELAY	Originating ISUP Setup Message Response Delay	
	TTL CIC DEFINED	Total Number of Defined CICs	
	TTL AVLBL CIC	Total Number of Available CICs	
	Note For IC calls, the string "IC:xxxx" where xxxx is the carrier number, precedes the EGR, IGR, or TTL.		
Field 7	Trunk Group "TG," followed by the zero-padded trunk group number.		
Field 8	TCA flag "*" if a threshold crossing alarm is asserted for this measurement, otherwise blank.		

Threshold Crossing Alarms

Each measurement instance can be monitored with a threshold crossing alarm. Threshold values that are permitted are Ignore, Less Than, Equal To, and Greater Than. The system identifies threshold value sets by the TAG and the trunk group number. Each threshold value set consists of a value and a check or test for each measurement category. Threshold value sets can be partially populated to check only one or any number of categories for a trunk group. Any unpopulated category is treated as an Ignore condition.

If no threshold value set has been specified for a given TAG/trunk group, the measurements are checked against a global threshold value set. Like trunk group-specific threshold value sets, the global threshold value set can be partially populated. There is no requirement to specify a global threshold value set. If none is specified, and no specific threshold value set has been entered, then no threshold checks are performed. If a threshold value set has been specified for a given TAG/trunk group, no global test is performed on any categories in that TAG/trunk group.

As measurements are tested against the threshold value set, each time a measurement crosses the threshold value, a minor alarm is generated (ACC227). The text of the alarm contains the strings defined in Appendix A, "Troubleshooting Cisco BAMS," the measured value, the test condition, and the threshold value.

When the threshold is crossed in the opposite direction, a clear alarm is generated containing the same text as the ACC227 alarm. For example, if the test is greater than 5 and the measurement is 8, the minor alarm is generated. If on the next check, the measurement is 10, no new minor alarm is generated. If the measurement drops to 3, the clear alarm is generated. When the system is started, the memory of all alarms is cleared. For example, suppose the measurement is 8 and the system is stopped. When the system first tests the measurement (after restarting), if the value is 8, a minor alarm is generated.

The following special conditions apply to threshold crossing alarms:

- No error is detected if a carrier is applied to a noncarrier-based measurement.

- No error is detected if no carrier is applied to a carrier-based measurement.
- A global threshold exists for TAG/trunk group measurements. The global threshold is specified by "global/0" (as the TAG/trunk group).
- Only those specific thresholds that are entered are checked; all other thresholds are set to ignore.
- If a trunk group-specific threshold is specified, the global thresholds are not checked for that TAG/trunk group.
- A carrier ID of 0 indicates that the carrier should be ignored. Entering abc/8003/0 is the same as entering abc/8003, thus making it a TAG/trunk group specification.
- All thresholds must be entered as integers.
- Conditions must be entered as a value from 0 through 4 (0 = Ignore, 1 = Less Than, 2 = Equal, 3 = Greater Than, 4 = Not Equal)

Note If there is no global/0 defined, any measurement that does not have a specific threshold set for it simply is not checked. The measurement is still reported in the acc_x file, but no alarm is generated, regardless of the value. If global/0 is defined, it is used when no specific thresholds have been specified for a trunk group. If the user sets thresholds for a specific trunk group, only those values specified are checked. Any unspecified measurements within the TAG/TRK are treated as an ignore condition. A trunk group can have a maximum of 43 measurements. A global TCA can be set up with a maximum of 43 measurements, which are listed in Table 11-3. Any trunk group that does not have a specific threshold crossing alarm (TCA) is checked against the global TCA. For some measurements, users can specify TAG/TRK/IC, where TAG is a user identifier, TRK is the trunk, and IC is the interexchange carrier. The user needs to know the carrier codes, such as 0288 for AT&T. Three-digit codes must be entered as four digits with a leading 0.

Zero Counts

The ACC task can operate in several different configurations with respect to zero counts. One configuration parameter outputs or suppresses all measurements that are equal to zero. The other configuration parameter selects all dynamic measurement group output or configured measurement group output regardless of activity.

Zero Count Suppression

Within each trunk group or trunk group/IC (measurement group), some measurements might not accumulate. For instance, if a trunk group is configured as an outgoing trunk, the ingress measurements are never pegged and the ingress durations are never anything other than zero. The ACC task provides a command-line switch to suppress these values. By default, if a measurement group has one measurement that is greater than zero, all measurements for the group are included in the output file. A command-line switch can override this feature and only non-zero values within each measurement group are output. If rounding or truncation causes an output measurement value to be zero, the ACC task treats the measurement as a zero and suppresses it if that feature is active.

Configured vs. Dynamic Trunk Group Output

Measurement groups are output only if they contain at least one non-zero measurement since midnight or have an alarm asserted. This is known as dynamic output. In BAMS, an MML option is available to output all configured measurement groups, regardless of measurement values (configured mode), or to operate in dynamic mode. This is a dynamic parameter that is reread at the start of each measurement interval. The trunk groups are also dynamic and are reloaded at the start of each measurement interval. If BAMS is set for configured mode, any activity detected on a nonconfigured trunk causes the trunk group to be added dynamically (as if in dynamic mode) and measurements are output.

If a trunk group is removed from the configuration, it no longer generates output if it has no counts accumulated for the day. The trunk group continues to be output if any counts for the day have accumulated. Likewise, if a trunk group is not configured and counts accumulate for that unconfigured trunk group (dynamic addition), the measurements for that trunk group are output for the remainder of the day.

The only distinction between a configured trunk with counts removed and a dynamic trunk with counts is that at the end of the day, the dynamic trunk has its pending alarms cleared if there are any. If a dynamically added trunk has an alarm pending at the end of the day, it continues to be reported into the next day and the alarm clears only when the threshold is crossed in the reverse direction.

Changing the overall mode to dynamic from configured causes any trunk groups with no counts accumulated for the day and no alarms to be removed from the output list. All other trunks are changed to dynamic. At midnight, all trunks are then treated as dynamic in the manner described above.

If the system is changed from dynamic to configured, all of the configured trunks are marked as configured, and any other trunks being reported prior to the mode change remain dynamic. All carrier-based measurements are dynamic. These cannot be preconfigured.

Rounding of Measurements

All measurements that are output as a percentage are rounded up or down to the nearest percent. This causes any percentage measurement that is less than 0.5 to round down to zero. The displayed value is zero, internally, but the ACC task maintains the decimal portion of the percentage. Under this condition, the ACC task considers the group to have at least one non-zero measurement. If the system is configured to suppress zero counts (with the NODEPARMS tag ID), the measurement is not displayed.

Truncation of Measurements

All measurements that are output as a duration are truncated to seconds. The ACC task performs all calculations to the millisecond. The truncation is applied only to the output measurement value. Any real-time duration that contains milliseconds is added to the hourly and daily totals with the milliseconds intact.

Last Interval Update

Introduction

Due to the manner in which the VSC produces data, BAMS must sometimes update the measurement data that was output in the previous interval. The VSC does not generate an event when a line is seized. The first event produced is an answer or an abort. Because of this, it is possible for a seizure to take place in one interval, and the answer or abort to take place in the next interval. When this happens, the ACC task determines what pegs or setup durations should be credited to an interval that has already been processed. Then the ACC task applies the measurements to the previously closed interval.

Preliminary vs. Final Measurements

The measurements for each interval are written twice. The first time the measurement file is written, the values are as accurate as possible, given the data provided by the VSC to that point. This write takes place as quickly as the system can process the data following the detection of data that belongs to the next interval. Because some events might not have been signaled by the VSC (seizure), the counts might not be 100 percent accurate.

When the system detects data from the following interval, the system again processes the measurements. At this time, if events are present for calls that began in an interval prior to the current one, the prior interval measurement data is updated. This is the last time that the ACC task writes to the previous interval. Since during any interval, the ACC task will make the final write to the previous interval before making the preliminary write to the current interval, the data in any output file is final when a measurement file exists for a later interval.

Interval-Update Rules

BAMS follows these rules when performing last-interval updates:

- Only the interval prior to the current interval can be updated.
- If pegs are detected that apply to an interval older than the previous interval, those pegs are applied to the previous interval. This ensures that the pegs are included in the hourly and daily totals. This also ensures that the sum of the intervals equals the daily and hourly totals.
- If durations are detected that apply to an interval older than the previous interval, those durations are dropped. This prevents any interval from possibly exceeding 100 percent utilization. The duration is not applied to the hourly or daily totals in order to ensure that the sum of the intervals equals the hourly and daily totals.
- On startup, there is no previous interval; therefore, the current interval is treated as the previous interval.
- The previous interval is updated before the preliminary measurements are written for the current interval.
- When a previous interval ends an hour, the hourly measurement file is also updated.
- When a previous interval ends a day, the daily measurement file is also updated.