

**CELLULAR NETWORKING  
AUTOMATIC MESSAGE ACCOUNTING  
FEATURE DOCUMENT  
1A ESS™ SWITCH  
AUTOPLEX™ SYSTEM 100**

CONTENTS	PAGE	CONTENTS	PAGE
1. INTRODUCTION . . . . .	2	RECORDS FOR ROAMERS . . . . .	26
SCOPE . . . . .	2	SPECIAL PLANNING CONSIDERATIONS. . . . .	26
DEFINITION. . . . .	2	3. HARDWARE AND SOFTWARE ENGINEERING . . . . .	26
BACKGROUND . . . . .	2	4. IMPLEMENTATION . . . . .	26
ECONOMIC WORTH. . . . .	2	5. TRAFFIC MEASUREMENTS . . . . .	26
AVAILABILITY. . . . .	3	6. SUPPLEMENTARY INFORMATION . . . . .	27
FEATURE GROUPS . . . . .	3	GLOSSARY. . . . .	27
FEATURE ASSIGNMENT . . . . .	3	REFERENCES TO AT&T PRACTICES . . . . .	28
2. USER PERSPECTIVE . . . . .	3	7. COMMENT FORM . . . . .	28
GENERAL . . . . .	3	8. ISSUING ORGANIZATION . . . . .	28
DATA GROUPS . . . . .	4		
MULTIPLE RECORD GENERATION. . . . .	4	Figures	
CONTROL POINT SWITCH RECORDS. . . . .	10	1. Basic Call Events Scenario . . . . .	8
SLAVE SWITCH RECORDS . . . . .	12	2. Timeline of Master and Slave Switch Records . . . . .	9
HANDBACK RECORDS . . . . .	15	Tables	
CUSTOM CALLING RECORDS . . . . .	18	A. AMA Data Groups . . . . .	5
		B. Data Group Formats. . . . .	6

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CONTENTS	PAGE
C. Control Point Switch Records . . . . .	11
D. Slave Switch Records . . . . .	14
E. CPS and Slave Switch Handback Records .	16

**1. INTRODUCTION**

**SCOPE**

**1.01** This practice provides information about multiple AMA (Automatic Message Accounting) records that are generated separately in each MTSO (Mobile Telephone Switching Office) for calls that use CN (Cellular Networking) services.

**Note:** This practice does not describe the standard hardware and software facilities and single entry AMA records generated in a MTSO for calls that do not use CN services. For information about standard hardware and software and single entry AMA record formats, see reference (1) in Part 6.

**DEFINITION**

**1.02** The AMA feature automatically formats billing information on magnetic tape at the MTSO that serves a cellular call. Since each call that uses CN services is served by more than one MTSO, each MTSO involved in a CN call generates one or more AMA records for the same call. The CNAMA (Cellular Networking Automatic Message Accounting) feature provides the capability to identify and correlate multiple AMA records that are generated separately in each MTSO that processes a CN call.

**BACKGROUND**

**1.03** The CN feature allows a System 100 MTSO to be interconnected with other System 100 MTSOs and/or System 10/1000 MTSOs to form a network of cellular systems. Each MTSO is associated with a CGSA (Cellular Geographic Service Area). A CGSA is a region served by a cellular system. The CN feature allows continuity of services among the CGSAs that are served by a network of cellular systems.

**1.04** Cellular networking services include intersystem call termination and intersystem call handoff services as follows:

(a) Intersystem call termination service allows a cellular subscriber to be paged and receive calls in any host MTSO that is part of a cellular network that includes the subscriber's home MTSO.

(b) Intersystem call handoff service allows a stable two-party call to be handed off (without interruption) from the MTSO currently serving the call to another MTSO within the same cellular network due to subscriber unit movement between adjacent MTSOs. There are two types of intersystem call handoffs that are defined as follows:

(1) With CN, the term *handoff* refers to the *addition* of an interswitch link (i.e., another MTSO) to the network path that already exists for an established call. In other words, service for an existing call is automatically extended to an adjacent MTSO as necessary due to subscriber unit movement. Multiple handoffs are possible for one call.

(2) With CN, the term *handback* refers to the *removal* of an interswitch link that had been added due to a handoff or intersystem call termination. For example, after an intersystem handoff occurs, if the subscriber unit returns to the area served by the MTSO that previously (before handoff) served the call, service for the existing call is handed back (i.e., returned) to that same MTSO. Since handback removes an interswitch link, cellular network facilities (i.e., inter-MTSO voice trunks) are conserved, and network looping is avoided.

**Note:** Depending on a cellular network arrangement, a variety of network path configurations are possible for CN calls. For detailed CN information, see references (2) and (3) in Part 6.

**ECONOMIC WORTH**

**1.05** The CNAMA feature provides billing information in each MTSO that processes a CN call. Since no MTSO formats all AMA data necessary for billing, CNAMA also provides the capability to identify and correlate billing information formatted separately in each MTSO that processes a CN call. The billing information contains data necessary to generate revenues.

**AVAILABILITY**

**1.06** The CNAMA feature is initially available in the System 100 Release 3 generic program. The System 100 Release 3 generic program is initially available in the 1AE9.03 generic program.

**FEATURE GROUPS**

**1.07** No feature groups and/or feature packages are required for the CNAMA feature, per se. The CNAMA feature is provided as part of the CN feature. For CN feature group requirements, see references (2) and (3) in Part 6.

**FEATURE ASSIGNMENT**

**1.08** The CNAMA feature is provided as part of the CN feature on a per-MTSO basis.

**2. USER PERSPECTIVE****GENERAL**

**2.01** The CNAMA feature is available for any cellular service provider who provides CN services using a System 100 MTSO. No new hardware or software facilities are required for CNAMA. The existing standard hardware and software facilities for recording and formatting single entry AMA records are used for CNAMA records. In fact, the standard single entry AMA data formatted for a non-CN call (i.e., call served by one MTSO) are also formatted for a CN call. The major differences in formatting AMA data for a non-CN call and a CN call are as follows:

- (a) All AMA data required for a non-CN call are formatted in the MTSO that serves the call. Since a CN call is served by more than one MTSO, all required AMA data are not formatted in one MTSO. Collectively, the multiple AMA records formatted separately in each MTSO that handles a CN call provide all required AMA data for that call.
- (b) In addition to the standard and optional AMA data formatted for a non-CN call, each CNAMA record for a CN call contains additional data to identify and correlate all CNAMA records formatted for that particular call.

**2.02** The multiple CNAMA records formatted separately in each MTSO for call originations, terminations, and intersystem handoffs and handbacks are described in this practice. For detailed information

about single entry AMA record formats generated by a MTSO for non-CN calls, see reference (1) in Part 6.

**2.03** Unique terminology associated with CNAMA is as follows:

(a) **Control Point Switch:** A CPS (control point switch) is the first switch (i.e., MTSO) that is involved with a subscriber unit call origination or termination. A CPS retains its status for the duration of a call. The term "CPS" is synonymous with the term "master switch".

(b) **Extended System Identification:** Each MTSO in a CN arrangement is assigned a unique ESID (extended system identification) number. An ESID number consists of the following:

(1) A DCSID (digital cellular switch identification) number is assigned to uniquely identify each System 10/1000 DCS that is part of a CN arrangement.

(2) A MTSOID (MTSO identification) number is assigned to uniquely identify each MTSO that serves the same CGSA. Usually, with a System 100, only one MTSO serves a CGSA.

(3) A SID (system identification) number is assigned by the FCC (Federal Communications Commission) to identify a particular CGSA. Each MTSO that serves the same CGSA has the same SID number.

**Note:** Each MTSO in a CN arrangement contains a list of ESID numbers for all MTSOs in the same CN arrangement.

(c) **Home Switch:** A home switch is the MTSO that is associated with a subscriber's DN (directory number). A home switch serves a subscriber's home CGSA.

(d) **Host Switch:** A host switch is any switch in a CN arrangement that provides a cellular service subscriber with direct roamer service.

(e) **Interswitch Call Termination:** Interswitch call termination refers to the automatic network connections (via inter-MTSO voice trunks between a home switch and host switch) that are used to complete incoming calls to subscribers who are located in a host switch CGSA.

(f) *Interswitch Handoff*: Interswitch handoff refers to the addition of an interswitch link to the network path that already exists for an established call.

(g) *Interswitch Handback*: Interswitch handback refers to the removal of an interswitch link that had been added due to a handoff.

(h) *Master Switch*: A master switch is the first switch involved in a cellular call origination or termination. A master switch can be either a home switch or host switch. A master switch retains its status for the duration of a call. The term "master switch" is synonymous with the term "CPS".

(i) *Cellular Network*: A cellular network is two or more cellular switches (i.e., MTSOs) that are associated with and directly connected to each other to provide CN services. A MTSO within a cellular network can serve as a home switch or a host switch.

(j) *Roamer Call*: A roamer call, within the context of CN, refers to a cellular call that is served by a host switch within the roamer's cellular network.

(k) *Serving Switch*: A serving switch is the cellular switch that is currently providing a voice channel connection.

(l) *Slave Switch*: A slave switch is any cellular switch involved in a call within a cellular network that is not the master switch. A slave switch can be either a home switch or a host switch.

(m) *Transaction Code*: A transaction code is part of the AMA data formatted in each CNAMA record. It uniquely identifies and provides the means to correlate all CNAMA records formatted for a particular call. A transaction code consists of two items. One item is a unique transaction number assigned for the call. The other item is the ESID number of the CPS for the call.

## DATA GROUPS

**2.04** The data groups applicable to CNAMA records are listed in Table A. Only data groups W4, W10, W40, and W200 are unique to CNAMA records. All other data groups listed are applicable to any call served by a System 100 MTSO. For a detailed description of all data groups except W4, W10, W40, and W200, see reference (1) in Part 6. Table B lists

detailed format information for data groups W4, W10, W40, and W200.

## MULTIPLE RECORD GENERATION

### A. Overview

**2.05** One or more AMA records are formatted at each MTSO involved in a CN call. A separate record is defined for origination, termination, intersystem call termination, and each handoff and/or handback. Depending on call events (i.e., handoffs and handbacks), the records may be written at various times during a call. Records are written in any of the following three circumstances.

(a) When a call ends, an AMA record is written at each MTSO that is currently involved with the call.

(b) An airtime record is written at an MTSO that receives a handback if that MTSO previously recorded airtime for the call.

(c) A record for the facility (i.e., MTSO and interswitch trunk) time and the most recent airtime usage segment is written at a MTSO that is removed from the network path for the CN call due to a handback.

**2.06** Each AMA record is generally considered as either a FT (Facility Time) record, a FAT (Facility and Airtime) record, or an AT (Airtime) record. Part of the basic information included in these records for a CN call is as follows:

(a) A FT record is written at a MTSO that provides facilities (i.e., switched connections), but no airtime, for a CPS interswitch call termination. A FT record includes the subscriber DN, transaction code, and facility timing information for the switched connection.

(b) A FAT record is written at a MTSO that provides both facilities and airtime. A FAT record includes the subscriber DN, transaction code, facility timing, and airtime information.

(c) An AT record is written at a MTSO that receives a handback, and provides airtime, but no facility time. An AT record includes the subscriber DN, transaction code, and airtime information.

**TABLE A**  
**AMA DATA GROUPS**

DATA GROUP	AMA INFORMATION
A2	Call type information
A3	Connect time
B2	Calling or billing number
C	Disconnect time
D	Called number
J	Calling or billing NPA (optional data group)
L	Entry extender (letter "Y" indicates additional data groups)
M	Indicator for optional data groups N, P, Q, R, S, and T
N	IDDD digits 11 and 12
P	Indicator for optional U data groups (sum of U data groups)
Q	Trunk network number
S	Indicator for optional W data groups (sum of W data groups)
T	Carrier interconnection information
U2	Customer dialed PAS number
U10	Call class (answer status)
U100	Indicator for MRD (minimum recordable duration)
U400	Mobile information
U1000	Host SID
U2000	Voice channel usage
U4000	Mobile identification
U10000	Home SID (optional)
W4	Transaction Code I (transaction number)
W10	Transaction Code II (ESID number)
W40	Total voice channel timing
W200	Switch timing

TABLE B			
DATA GROUP FORMATS			
DATA GROUP	INFORMATION	DIGITS PER ITEM	DIGITS PER GROUP
W4	Transaction Code I (8-digit transaction number)	8	8
W10	Transaction Code II (ESID number): Control Point SID (identifies CGSA) Control Point MTSOID (identifies MTSO) Control Point DCSID (System 10 switch identifier) Airtime Segment for Continuing Switch Connection: 0 = No airtime segment 1 = First airtime segment 2 = Another airtime segment 3 = Last airtime segment 4 = Only airtime segment Switch Indicator: 0 = Control point switch 1 = Slave switch	5 2 2 1     1	11
W40	Total Voice Channel Timing: Midnights Passed First Channel Seizure Time: hours minutes seconds tenths of second Final Channel Release Time: hours minutes seconds tenths of second	1  2 2 2 1  2 2 2 1	15
W200	Switch Timing: Midnights Passed Called Party Answer Time: hours minutes seconds tenths of second Called Party Disconnect Time: hours minutes seconds tenths of second	1  2 2 2 1  2 2 2 1	15

**2.07** The AMA record(s) written at each MTSO involved in a CN call depends on the call scenario. Generally, any MTSO writes AT records as necessary. A slave switch writes at least one FAT record. A master switch (i.e., control point switch) writes only one FT or FAT record and one or more AT records as necessary. Examples of records written at each MTSO based on call events are as follows:

- (a) An interswitch call termination causes one record to be written at the CPS and one record to be written at the slave switch. Since the CPS provides no airtime for an interswitch call termination, the CPS record is an FT record. In this case, the slave switch record is a FAT record.
- (b) An interswitch handoff causes a CPS record and a slave switch record to be written. In this case, since the CPS provides initial airtime, the CPS record is a FAT record. The slave switch record is also a FAT record.
- (c) An interswitch handback to a CPS requires either one or two CPS records and one slave switch record to be written. If the CPS provided initial airtime, an AT record is written. The slave switch record is a FAT record. The CPS record for the final airtime is a FAT record.

**2.08** Numerous call scenarios are possible with CN services; however, the basic call events (i.e., intersystem call termination, handoff, and handback) that can occur at any MTSO within the cellular network are the same. Figure 1 contains simplified block diagrams that illustrate the basic call events that can occur involving a CPS and a slave switch. Figure 2 illustrates the CNAMA records written at the CPS and slave switch based on a timeline of call events. For this scenario, the following events are assumed.

- (a) A call is terminated to a subscriber unit that is located within the home CGSA. In this case, the home switch is the CPS.
- (b) During the call, the subscriber unit enters a host CGSA and the call is handed off to a slave switch.
- (c) The subscriber unit reenters the home CGSA and the call is handed back to the CPS. Handback causes an AT record to be written at the CPS and a FAT record to be written at the slave switch.

(d) Again, the subscriber unit enters a host CGSA and another handoff occurs. Airtime information is saved and facility information is continuously collected at the CPS. Facility and airtime information is being collected at the slave switch.

(e) The call ends while the subscriber unit is in the host CGSA. When the call ends, a FAT record is written at both the slave switch and CPS.

**Note:** The four separate records written for this call include one AT and one FAT record written at the CPS and two FAT records written at the slave switch.

## B. Entry Codes

**2.09** No new type entry codes are required for CNAMA records. The existing type entry codes applicable to CN calls are as follows:

- (a) V01 Mobile Originated Toll Wireline Call
- (b) V15 Mobile Originated Local Wireline Call
- (c) V32 Mobile-to-Mobile Call
- (d) V33 Mobile Terminated Call
- (e) V36 Operator Assisted Mobile Call.

**2.10** The AMA data groups and fields that are applicable to each of these type entry codes for AMA records for non-CN calls are also applicable to CNAMA records for CN calls unless specified otherwise in this practice. In addition, *all* CNAMA records, regardless of the type entry code, contain data groups M, S, W4, and W10. Data group W40 is formatted only for the CPS for FAT CNAMA records. Data group W200 (switch timing) is included for type entry codes V32, V33, and V36.

**2.11** The use of type entry codes has a broader application in a CN environment. For example, type entry code V15 (normally used for cellular originated local calls) is used for CNAMA records for interswitch handoffs since there is a need to record interswitch facility connect and disconnect times. Such a record should not be interpreted to mean that the call being handed off from the CPS began as a cellular originated call. Also, type entry code 34 (mobile security entry) does not involve the use of any CN specific field. Only a networked slave switch will write

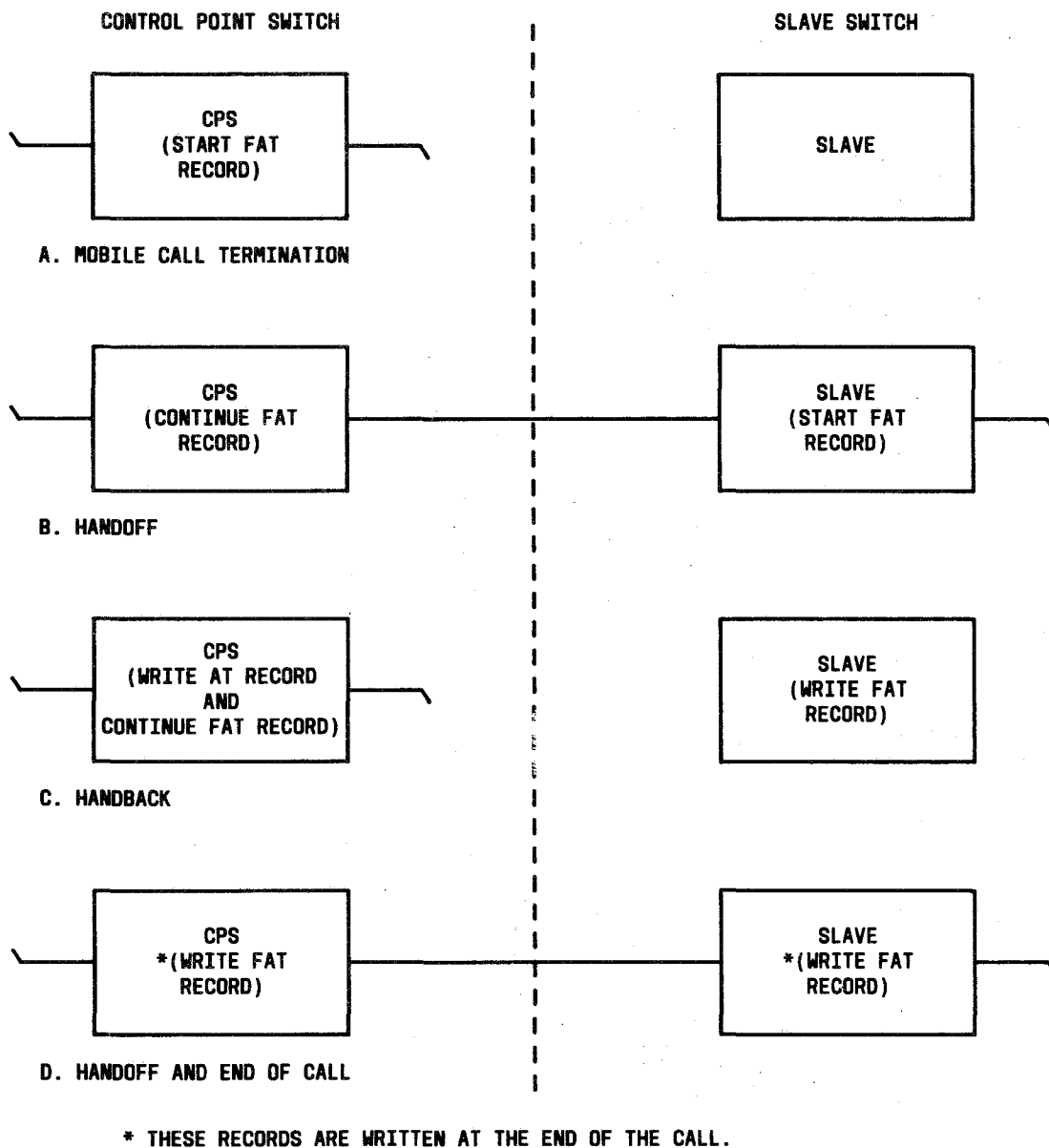


Fig. 1—Basic Call Events Scenario

the security entry for an incoming failure. The CPS does not write any record.

2.12 Since multiple CNAMA records are formatted separately at each switch involved in a CN call, type entry codes have both a literal and a generic application as follows:

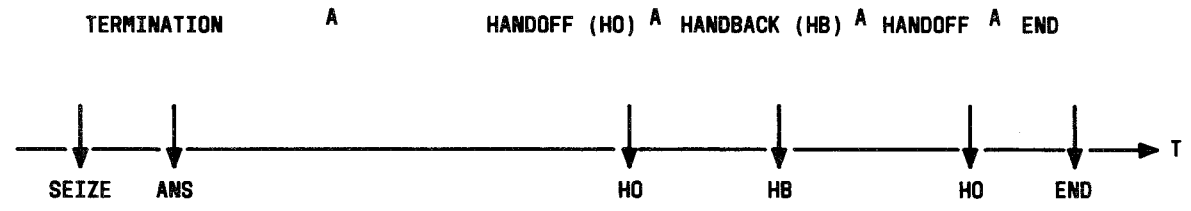
(a) A FT or FAT record formatted at a CPS provides the literal type entry code for any CN call. The literal entry code for a CPS FT or FAT record is either a V01, V15, V32, V33, or V36 entry code.

(b) A FAT record formatted at a slave switch for an interswitch handoff has a V15 generic entry code.

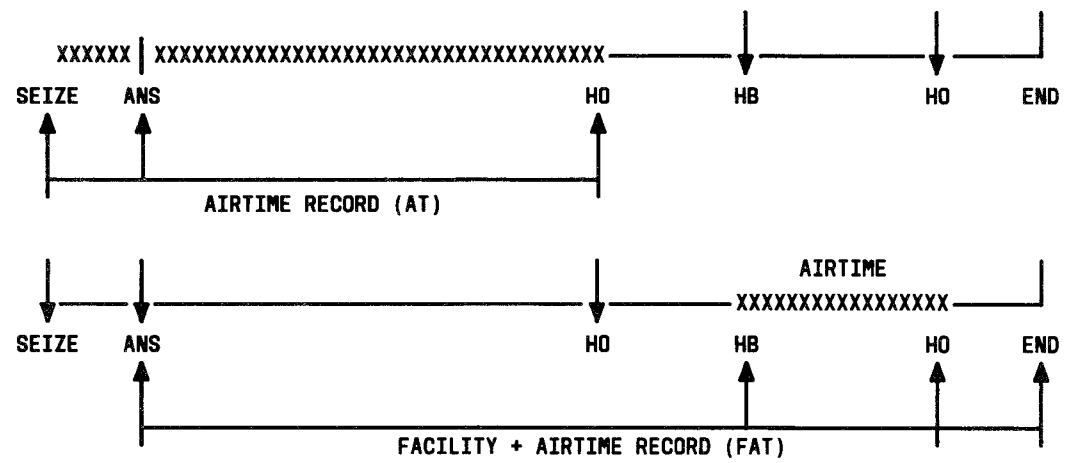
(c) A FAT record formatted at a slave switch for an interswitch call termination has a V33 literal entry code.

(d) An AT record formatted at either a CPS or slave switch for an interswitch handback has a V33 literal entry code.

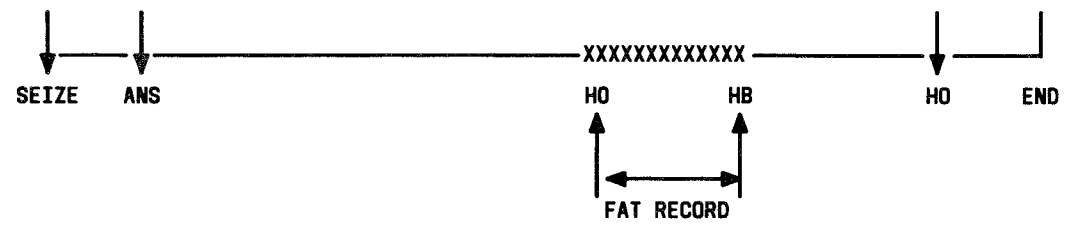




A. CALL EVENT TIMELINE



B. MASTER SWITCH RECORDS



C. SLAVE SWITCH RECORDS

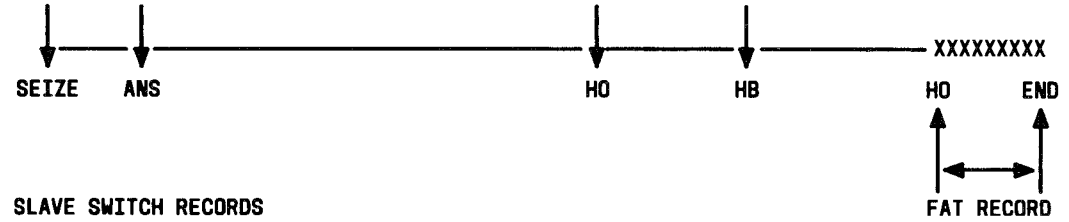


Fig. 2—Timeline of Master and Slave Switch Records

## CONTROL POINT SWITCH RECORDS

2.13 The CNAMA records formatted by a CPS are defined for CN calls as follows:

- (a) A subscriber originated call that is subsequently handed off to a slave switch causes either a V01, V32, or V36 record to be formatted.
- (b) A subscriber terminated call that is subsequently handed off to a slave switch causes a V33 record to be formatted.
- (c) An interswitch call termination to a subscriber causes a V33 record to be formatted.

**Note:** Handback records are described separately from CPS and slave switch records since handback records can be formatted at either a CPS or slave switch.

2.14 Table C lists the data groups that are applicable to each type of record (except handback) made at a CPS. Special considerations for particular data groups are described for each type of record in the following paragraphs.

### A. Subscriber Originated Call and Handoff

2.15 A subscriber originated call that is handed off causes either a V01, V32, or V36 record to be formatted. The data groups applicable to these records are listed in Table C. Data groups that require special consideration are as follows:

- (a) **Data Group U2000 (Voice Channel Usage):** The VCST (voice channel seizure time) and VCANS (voice channel answer time) are formatted as usual. The time written in the VCRT (voice channel release time) field is the time the call is handed off to a slave switch. This is the time that the subscriber unit is no longer tuned to a voice channel associated with the CPS.
- (b) **Data Group W10 (Transaction Code II):** A value of 4 is written in the tenth digit position. A value of 0 is written in the eleventh digit position. Table B lists information provided in the W10 data group.
- (c) **Data Group W40 (Total Voice Channel Timing):** The first channel seize time is the seizure time of the first voice channel segment.

(d) **Data Group W200 (Switch Timing):** This data group is applicable to V32 and V36 records for originations involving handoffs. The times written in the two fields (Table B) are as follows:

- (1) The called party answer time is the time indicated by answer supervision for the called party.

**Note:** The time written in the called party answer time field for V32 and V36 records is defined the same as the time written in data group A3 (connect time) for V01 and V15 records.

- (2) The called party disconnect time is the time indicated by disconnect supervision.

**Note:** The time written in the called party disconnect time field for V32 and V36 records is defined the same as the time written in data group C (disconnect time) for V01 and V15 records.

### B. Subscriber Terminated Call and Handoff

2.16 A subscriber terminated call that is handed off causes a V33 record to be formatted. The data groups applicable to this V33 record are listed in Table C. Data groups that require special consideration are as follows:

- (a) **Data Group U2000 (Voice Channel Usage):** The VCST and VCANS times are formatted as usual. The time written in the VCRT field is the time the call is handed off to a slave switch. This is the time that the subscriber unit is no longer tuned to a voice channel associated with the CPS.
- (b) **Data Group W10 (Transaction Code II):** A value of 4 is written in the tenth digit position. A value of 0 is written in the eleventh digit position. Table B lists information provided in the W10 data group.
- (c) **Data Group W40 (Total Voice Channel Timing):** The first channel seize time is the seizure time of the first voice channel segment.
- (d) **Data Group W200 (Switch Timing):** The answer and disconnect times are written in the called party answer and disconnect time fields.

TABLE C							
CONTROL POINT SWITCH RECORDS (NOTE 1)							
ORIGINATION-HANDOFF (NOTE 2)				T-HO (NOTE 3)	ICT (NOTE 4)	BCD CHARS (NOTE 5)	DATA GROUPS
V01	V15	V32	V36	V33	V33		
X	X	X	X	X	X	1	(V) Start of Entry Character
X	X	X	X	X	X	2	(XX) Entry Code
X	X	X	X	X	X	4	A2 - Call Type Information
X	X	—	—	—	—	8	A3 - Connect Time
X	X	X	X	—	—	7	B2 - Calling/Billing Number
X	X	—	—	—	—	8	C - Disconnect Time
X	X	X	X	X	X	10	D - Called Number
X	X	X	X	X	X	3	J - Calling/Billing NPA
X	X	X	X	X	X	1	L - Entry Extender
X	X	X	X	X	X	2	M - N, P, Q, R, S, and T Indicator
C	—	—	—	—	—	2	N - IDDD Digits 11 and 12
X	X	X	X	X	C	5	P - Sum of U Data Groups
X	X	X	X	—	—	6	Q - Trunk Network Number
X	X	X	X	X	X	5	S - Sum of W Data Groups
C	—	—	—	—	—	25	T - Carrier Interconnection
C	C	C	C	C	C	8	U2 - PAS Account Number
—	—	—	—	—	C	2	U10 - Call Class (ans. status)
—	—	—	—	—	—	1	U100 - MRD Indicator
X	X	X	X	X	C	7	U400 - Mobile Information
C	C	C	C	C	C	5	U1000 - Host SID (roamers)
X	X	X	X	X	C	23	U2000 - Voice Channel Usage
C	C	C	C	C	C	15	U4000 - Mobile ID (roamers)
C	C	C	C	C	C	5	U10000 - Home SID (roamers)
—	—	—	—	—	—	1	W2 - Local Service Area
X	X	X	X	X	X	8	W4 - Transaction Code I
X	X	X	X	X	X	11	W10 - Transaction Code II
X	X	X	X	X	X	15	W40 - Total Voice Channel Timing
—	—	X	X	X	X	15	W200 - Switch Timing
126	126	125	125	112	77	—	Min. No. of BCD Characters
190	163	162	162	146	147	205	Max. No. of BCD Characters

See notes on next page.

**TABLE C (Contd)**  
**CONTROL POINT SWITCH RECORDS (NOTE 1)**

**Notes:**

1. V01, V15, V32, V33, and V36 entry codes for CPS records are the literal entry codes.  
 "X" — Indicates the data group is applicable to the entry code.  
 "—" — Indicates the data group is not applicable to the entry code.  
 "C" — Indicates the data group is conditionally applicable to the entry code.
2. An origination-handoff record is the CPS FAT (facility and airtime) record for a call that began as an origination, then became a CN call via an interswitch handoff.
3. A T-HO (termination-handoff) record is the CPS FAT record for a call that began as a termination, then became a CN call via an interswitch handoff.
4. An ICT (interswitch call termination) record is the CPS FT (facility time) record for a call that began as an ICT call via the CPS to a slave switch.
5. The minimum and maximum numbers of BCD (binary coded decimal) characters must be adjusted to include the NCDs (noncheck dummy characters) required to pad the entry to a multiple of five BCD characters.

**C. Interswitch Call Termination**

**2.17** An ICT (interswitch call termination) causes a V33 record to be formatted. The data groups applicable to this V33 record are listed in Table C. Data groups that require special consideration are as follows:

- (a) **Data Group U10 (Call Class):** This data group indicates (as necessary) the answer status according to answer supervision on the interswitch trunk.
- (b) **Data Group U100 (MRD [Minimum Recordable Duration] Indicator):** This field is not formatted.
- (c) **Data Group U400 (Mobile Information):** This field is not formatted.
- (d) **Data Group U2000 (Voice Channel Usage):** This field is not formatted.
- (e) **Data Group W10 (Transaction Code II):** A value of 0 is written in the tenth digit position.

A value of 0 is written in the eleventh digit position. Refer to Table B.

(f) **Data Group W40 (Total Voice Channel Timing):** The first channel seize time is the time when the interswitch page response message is received.

(g) **Data Group W200 (Switch Timing):** The answer and disconnect times are written in the called party answer and disconnect time fields.

**SLAVE SWITCH RECORDS**

**2.18** The CNAMA records formatted by a slave switch are defined for CN calls as follows:

- (a) A slave switch that receives a handoff from either a CPS or another slave switch formats a V15 record for the handoff call.
- (b) A slave switch that receives an interswitch call termination from the CPS formats a V33 record for the call.

**Note:** Handback records are described separately from CPS and slave records since handback records can be formatted at either a CPS or slave switch.

**2.19** Table D lists the data groups that are applicable to each type of record (except handback) made at a slave switch. Special considerations for particular data groups are described for each type of record in the following paragraphs.

**A. Record for Received Handoff**

**2.20** A slave switch formats a V15 record for a received handoff. The data groups applicable to this record are listed in Table D. Data groups that require special consideration are as follows:

- (a) *Data Group A3 (Connect Time)*: The time the subscriber unit tunes to the new (i.e., slave) voice channel is written in this field to indicate the interswitch facility connect time.
- (b) *Data Group B2 (Subscriber Number)*: The subscriber DN is written in this data group.
- (c) *Data Group C (Disconnect Time)*: The time written is either the time of disconnect or the time the subscriber left the voice channel as a result of handback.
- (d) *Data Group D (Called Number)*: This data group is formatted with NCDs (noncheck dummy characters).
- (e) *Data Group J (Subscriber's NPA [Number Plan Area])*: When this optional data group is used, the subscriber's NPA is written.
- (f) *Data Group Q (TNN [Trunk Network Number])*: The TNN of the interswitch trunk is written in this data group.
- (g) *Data Group U400 (Mobile Information)*: The cell site number and radio number of the slave switch serving the call are written in this data group.
- (h) *Data Group U1000 (Host SID)*: The host SID is written in this data group for the slave switch handoff records.
- (i) *Data Group U2000 (Voice Channel Usage)*: The information formatted in this data group is as follows:
  - (1) The time that the subscriber unit tunes to the new (i.e., slave) voice channel is written in the VCST field.

- (2) The VCANS field is formatted with NCDs.
- (3) The time that the subscriber unit releases or is released, or the time the subscriber unit leaves the voice channel is written in the VCRT field. This may occur due to either a handoff, a handback, or the call ending with the current airtime segment.

- (j) *Data Group U4000 (Mobile ID)*: This data group is formatted for the slave switch handoff record.
- (k) *Data Group U10000 (Home SID)*: This data group is formatted if the option is set.
- (l) *Data Group W10 (Transaction Code ID)*: A value of 4 is written in the tenth digit position. A value of 1 is written in the eleventh digit position.

**B. Interswitch Call Termination Record**

**2.21** A slave switch formats a V33 record for an ICT. The data groups applicable to this record are listed in Table D. Data groups that require special consideration are as follows:

- (a) *Data Group Q (TNN)*: The TNN of the interswitch trunk is written in this data group.
- (b) *Data Group U400 (Mobile Information)*: The cell site number and radio number of the slave switch serving the call are written in this data group.
- (c) *Data Group U1000 (Host SID)*: The host SID is written in this data group for the slave switch records for ICT.
- (d) *Data Group U2000 (Voice Channel Usage)*: The information formatted in this data group is as follows:
  - (1) The time that the subscriber unit was alerted is written in the VCST field.
  - (2) The time that the subscriber unit answered is written in the VCANS field.
  - (3) The time that the subscriber unit releases or is released, or the time the subscriber unit leaves the voice channel is written in the VCRT field. This may occur due to either a handoff, a handback, or the call ending with the current airtime segment.

TABLE D			
SLAVE SWITCH RECORDS (NOTES 1, 2, AND 3)			
HO	ICT	BCD CHARS	DATA GROUPS
V15	V33	(NOTE 4)	
X	X	1	(V) Start of Entry Character
X	X	2	(XX) Entry Code
X	X	4	A2 - Call Type Information
X	—	8	A3 - Connect Time
X	—	7	B2 - Subscriber DN
X	—	8	C - Disconnect Time
X	X	10	D - Called Number
X	X	3	J - Calling/Billing NPA
X	X	1	L - Entry Extender
X	X	2	M - N, P, Q, R, S, and T Indicator
—	—	2	N - IDDD Digits 11 and 12
X	X	5	P - Sum of U Data Groups
X	X	6	Q - Trunk Network Number
X	X	5	S - Sum of W Data Groups
—	—	25	T - Carrier Interconnection
—	—	8	U2 - PAS Account Number
—	C	2	U10 - Call Class (answer status)
—	C	1	U100 - MRD Indicator
X	X	7	U400 - Mobile Information
X	X	5	U1000 - Host SID
X	X	23	U2000 - Voice Channel Usage
X	X	15	U4000 - Mobile ID
C	C	5	U10000 - Home SID
—	—	1	W2 - Local Service Area
X	X	8	W4 - Transaction Code I
X	X	11	W10 - Transaction Code II
—	—	15	W40 - Total Voice Channel Timing
—	X	15	W200 - Switch Timing
131	123	—	Min. No. of BCD Characters
136	131	190	Max. No. of BCD Characters

See notes on next page.

TABLE D (Contd)
SLAVE SWITCH RECORDS (NOTES 1, 2, AND 3)
<p><i>Notes:</i></p> <ol style="list-style-type: none"> <li>1. V15 and V33 entry codes for slave switch records are generic (i.e., not literal) entry codes.  "X" — Indicates the data group is applicable to the entry code.  "—" — Indicates the data group is not applicable to the entry code.  "C" — Indicates the data group is conditionally applicable to the entry code.</li> <li>2. An HO (handoff) record is the slave switch FAT (facility and airtime) record for a received interswitch handoff.</li> <li>3. An ICT (interswitch call termination) record is the slave switch FAT record for an ICT call at a slave switch.</li> <li>4. The minimum and maximum numbers of BDC (binary coded decimal) characters must be adjusted to include the NCDs (noncheck dummy characters) required to pad the entry to a multiple of five BCD characters.</li> </ol>

(e) *Data Group U4000 (Mobile ID)*: This data group is formatted for the slave switch records for an ICT.

(f) *Data Group U10000 (Home SID)*: This data group is formatted if the option is set.

(g) *Data Group W10 (Transaction Code II)*: A value of 4 is written in the tenth digit position. A value of 1 is written in the eleventh digit position.

(h) *Data Group W200 (Switch Timing)*: The answer and disconnect times are written in the called party answer and disconnect time fields.

#### HANDBACK RECORDS

**2.22** Generally, handback records are formatted to provide airtime information. Either a CPS or a slave switch may format a handback record, depending on the CN call scenerio. A handback record may be

formatted at a switch that provided the initial answered segment or an intermediate segment. Handback records use a V33 format. Table E lists the data groups applicable to a handback record associated with an initially answered segment and the data groups applicable to any other handback record.

**2.23** If a handback occurred to a switch that had previously provided a voice channel, the handback record contains information related to the previous airtime segment in the following data groups:

- (a) U400 (Mobile Information)
- (b) U2000 (Voice Channel Usage)
- (c) W4 (Transaction Code I)
- (d) W10 (Transaction Code II).

If a handback occurred to a CPS that had not previously provided a voice channel, more information is written in addition to airtime information.

**TABLE E**  
**CPS AND SLAVE SWITCH HANDBACK RECORDS**  
**(NOTE 1, 2, AND 3)**

HB ANS	HB OTHER	BCD CHARS (NOTE 4)	DATA GROUPS
V33	V33		
X	X	1	(V) Start of Entry Character
X	X	2	(XX) Entry Code
X	X	4	A2 - Call Type Information
—	—	8	A3 - Connect Time
—	—	7	B2 - Calling/Billing Number
—	—	8	C - Disconnect Time
X	X	10	D - Subscriber DN
X	X	3	J - Calling/Billing NPA
X	X	1	L - Entry Extender
X	X	2	M - N, P, Q, R, S, and T Indicator
—	—	2	N - IDDD Digits 11 and 12
X	X	5	P - Sum of U Data Groups
—	—	6	Q - Trunk Network Number
X	X	5	S - Sum of W Data Groups
—	—	25	T - Carrier Interconnection
—	—	8	U2 - PAS Account Number
—	—	2	U10 - Call Class (answer status)
—	—	1	U100 - MRD Indicator
X	X	7	U400 - Mobile Information
—	—	5	U1000 - Host SID
X	X	23	U2000 - Voice Channel Usage
—	—	15	U4000 - Mobile ID
—	—	5	U10000 - Home SID
—	—	1	W2 - Local Service Area
X	X	8	W4 - Transaction Code I
X	X	11	W10 - Transaction Code II
—	—	15	W40 - Total Voice Channel Timing
—	—	15	W200 - Switch Timing
82	82	—	Min. No. of BCD Characters
82	82	190	Max. No. of BCD Characters
See notes on next page.			



TABLE E (Contd)
CPS AND SLAVE SWITCH HANDBACK RECORDS (NOTE 1, 2, AND 3)
<p><i>Notes:</i></p> <ol style="list-style-type: none"> <li>1. The V33 entry code for a handback record is a generic (i.e., not literal) entry code.  "X" — Indicates the data group is applicable to the entry code.  "—" — Indicates the data group is not applicable to the entry code.  "C" — Indicates the data group is conditionally applicable to the entry code.</li> <li>2. An HB ANS (handback answer) record is either a CPS or slave switch AT (airtime) record that contains the information for the answered segment of a CN call as a consequence of a handback received by that switch.</li> <li>3. "Handback other" refers to a CPS or slave switch AT record that contains the information for a segment other than the answered segment of a CN call as a consequence of a handback received by that switch.</li> <li>4. The minimum and maximum numbers of BCD (binary coded decimal) characters must be adjusted to include the NCDs (noncheck dummy characters) required to pad the entry to a multiple of five BCD characters.</li> </ol>

#### A. Answered Segment Airtime Record

**2.24** An answered segment airtime record is formatted by the switch that provided the initial voice channel for the answered segment of a call, and then received a handback. The switch may be a CPS, or it may be a slave switch that provided the initial voice channel for an interswitch call termination. The data groups applicable to this V33 record are listed in Table E. Data groups with special considerations are as follows:

- (a) *Data Group A2 (Call Type Information)*: If the answered segment was associated with a three-port call, then the service feature code contains a value of 10 for this record only.
- (b) *Data Group W10 (Transaction Code II)*: A value of 1 is written in the tenth digit position.

#### B. Intermediate Segment Airtime Record

**2.25** An intermediate segment airtime record is formatted by any switch (i.e., CPS or slave) that provided a voice channel for a call segment other than the answered segment, and then received a handback. The data groups applicable to this V33 record are listed in Table E. Data group W10 will indicate a value of either 1 or 2 in the tenth digit position.

#### C. Subsequent Record for Received Handback

**2.26** Any switch that receives a handback must retain the information that it previously collected (including the entry code) and update information for a subsequent record that is formatted when the call ends or another handback occurs. Special considerations for data groups containing updated information for subsequent records are as follows:

- (a) *Data Group U400 (Mobile Information)*: The cell site number and radio number of the serving switch are written in this data group.

(b) *Data Group U2000 (Voice Channel Usage):*

Information formatted in the fields of this data group is as follows:

- (1) The time that the subscriber unit tunes to a new voice channel of the serving switch is written in the VCST field.
- (2) The VCANS field is formatted with NCDs.
- (3) The time that the subscriber unit releases or is released, or the time the subscriber unit leaves the voice channel is written in the VCRT field. This may be due to either a handoff, a handback, or the call ending with the current airtime segment.

(c) *Data Group W10 (Transaction Code II):* A value of either 3 or 4 is written in the tenth digit position. The value of the eleventh digit position indicates either a CPS or slave switch, as appropriate.

(d) *Data Group W40 (Total Voice Channel Timing):* The original information collected for first channel seizure time for this data group is not updated.

(e) *Data Group W200 (Switch Timing):* The original information collected for connection time for this data group is *not* updated.

#### CUSTOM CALLING RECORDS

**2.27** The CNAMA capability for custom calling basically involves the inclusion of data groups W4 and W10 in the AMA records that are otherwise generated for custom calling calls in a non-CN environment. For detailed information concerning AMA records for custom calling in a non-CN environment, see reference (1) in Part 6. Currently, custom calling features in a CN environment that cause CNAMA custom calling records to be generated are as follows:

- (a) The CFBL (Call Forwarding Busy Line) and CFDA (Call Forwarding Don't Answer) features are conditional call forwarding features that require CNAMA custom calling records to be generated for call forwarding usage and call forwarding feature activation/deactivation. For detailed information about the conditional call forwarding features, see reference (4) in Part 6.

**Note:** There is no change in AMA records generated for immediate call forwarding in a CN environment. For detailed information about immediate call forwarding, see reference (5) in Part 6.

(b) The Three-Way Calling feature requires CNAMA custom calling records to be generated for three-way calls served in a CN environment. For detailed information about three-way calling, see reference (6) in Part 6.

(c) The Call Waiting feature requires CNAMA custom calling records to be generated for call waiting calls served in a CN environment. For detailed information about call waiting, see reference (7) in Part 6.

**2.28** The CNAMA records generated for call forwarding usage, call forwarding activation/deactivation, three-way calling, and call waiting are discussed in the following paragraphs under the corresponding heading.

#### A. Call Forwarding Usage

**2.29** There is no change in AMA for conditional call forwarding if the serving switch is the home/host switch. If the home/host switch is not the serving switch, a CFDA call has the following special considerations.

(a) The home/host switch formats a CNAMA record for a CFDA call served by a non-home/host switch (i.e., slave switch). The home/host switch record for CFDA has the same format as a CPS record for a subscriber originated call (see paragraph 2.15) with the following special considerations:

- (1) The U400 data group is formatted with zeroes.
- (2) The time that the call was forwarded is written in the VCST field of data group U2000 (voice channel usage). This will occur after the alerting times at the networked (slave) switch.
- (3) Data groups W4 and W10 (transaction codes I and II) are included in the record. A value of 4 is written in the tenth digit position of data group W10.

(4) Data group W40 contains the first channel seize time, which is the time when the interswitch page response message is received.

(b) The slave switch serving a CFDA call formats a CNAMA record for the call. The slave switch record has the same format requirements as a record for an ICT. (See paragraph 2.21.) This record has the appearance of a record for an unanswered segment.

## B. Call Forwarding Activation/Deactivation

**2.30** There is no change in AMA for call forwarding activation/deactivation if the serving switch is the home/host switch. Even though two switches are involved in a call forwarding activation/deactivation to a home/host switch via a networked (slave) switch, no transaction codes are retained to link the two records. If the home/host switch is not the serving switch, call forwarding activation/deactivation has the following special considerations.

(a) The home/host switch formats a CNAMA record for a call forwarding activation/deactivation similar to the record that is formatted in a non-CN case. [See reference (1) in Part 6 for non-CN records.] The special considerations for both activation and deactivation are as follows:

(1) Service feature code 55 is written in data group A2 (call type information).

(2) The following data groups are not formatted.

- U100 (MRD indicator)
- U400 (mobile information)
- U2000 (voice channel usage).

(b) The slave switch serving an activation/deactivation call formats a CNAMA record similar to the record that is formatted in a non-CN case. The special considerations for both activation and deactivation are as follows:

(1) Service feature code 89 is written in data group A2.

(2) Data group D is formatted with NCDs.

(3) Information is formatted in data group U2000 the same as for any cellular originated call attempt.

## C. Three-Way Calling

**2.31** The type of CNAMA records formatted for three-way calls in a CN environment depends on which switch (i.e., CPS or slave switch) generates the records. General information about three-way calls in a CN environment is as follows:

(a) Only a CPS can provide a three-port connection for a three-way CN call. A CPS that provides a three-port connection for a three-way CN call is referred to as a three-port switch. An AMA record formatted at a three-port switch for a three-way CN call is similar to an AMA record formatted at a MTSO for a three-way call in a non-CN environment.

(b) A slave switch cannot provide a three-port connection. Therefore, a slave switch involved in a three-way call does not format a separate CNAMA custom calling record for a three-way call. A slave switch involved in a three-way call formats the appropriate type of CNAMA record applicable to only that segment of the three-way call served by that slave switch.

**Note:** In other words, CNAMA records formatted at a three-port switch (i.e., CPS) may indicate custom calling service. The CNAMA records formatted at a slave switch do not indicate custom calling service since a slave switch cannot provide a three-port connection.

**2.32** A CNAMA custom calling record is formatted at the three-port switch for a three-way call. The custom calling record contains an indication of a three-way call in data group A2 and the corresponding airtime segment. A three-way call is indicated in data group A2 by the service feature indicator digits (i.e., third and fourth digits of data group A2), which have a value of 10.

**Note:** There is no provision to associate a CNAMA custom calling record formatted at a three-port switch for a three-way call with the corresponding CNAMA record formatted at a slave switch for the original two-party call.

**2.33** There is no requirement for the custom calling record to contain updated data for data group U400 while there is no transaction code assigned to the added (i.e., third) leg of the call. This means that if a three-way call begins during a CN call, data group U400 record will be suppressed.

**2.34** Special considerations are required for dropback of a three-way (i.e., three-party) call to a two-party call. The term "dropback" refers to the transition from a three-party call to a regular two-party call. When dropback occurs the three-port switch releases the three-port connection and establishes a two-way connection for the two remaining parties. The term "dropback switch" refers to the three-port switch when a three-way call reverts back to a two-party call. Several scenarios are possible for dropback of a three-way call. Different circumstances that may occur before and after a dropback are discussed in the following paragraphs.

**Pre-Dropback Considerations**

**2.35** The following information presents a framework for defining the generation of CNAMA records before a dropback occurs:

- (a) The CPS for three-way calls is the three-port switch. This switch is also the network interface switch.
- (b) If the three-way call is handed-off, the transaction code for the original call is used for the new CNAMA record generated at the switch that serves the handoff call.
- (c) No CNAMA custom calling records are generated for interswitch handoffs or handbacks associated with *three-port calls*; however, additional CNAMA records are generated for the original leg of the call.

**2.36** A scenario for a typical three-way call is as follows:

- (a) The three-port switch (i.e., CPS) is the only cellular switch currently involved with the call.
- (b) An interswitch handoff occurs causing the call to be networked with another switch.
- (c) The networked switch (i.e., slave switch) generates a standard CNAMA record for the received handoff. This record is formatted the same as any other record formatted at a slave switch for a received handoff. The record generated at the

networked switch for a received handoff is independent of the custom calling record generated at the three-port switch.

**Note:** If a handback to the three-port switch occurs, there is no requirement to update data group U400 for the custom calling record at the three-port switch as a result of the handback.

**Post-Dropback Considerations**

**2.37** The following information presents a framework for defining the generation of CNAMA records during and after a dropback:

- (a) The time that dropback occurs is recorded at the three-port switch as the TWT (three-way-transition) time. Unless stated otherwise, the TWT time is the time the three-port circuit is released and the three-party call reverts to a two-party call at the CPS.
- (b) If the originating party of a three-way call disconnects first, the TWT time is recorded in the first channel seizure time field of data group W40. If the originating party is not the first to disconnect, the CNAMA custom calling record formatted for the three-way call does not involve data group W40.
- (c) The CPS generates a unique transaction code for a custom calling call when necessary. After dropback, if the three-port switch is the CPS for the remaining two-party call, any subsequent CNAMA handoff records indicate the transaction code associated with the remaining call.

**2.38** The following paragraphs present various scenarios for post-dropback considerations.

**First Scenario**

**2.39** The CPS is providing a three-port connection. It is the only switch currently involved with the call, although other switches may have been previously networked to it for the same call. A dropback occurs at the CPS followed by an interswitch handoff (i.e., the call is networked with another switch). The networked switch generates a CNAMA record. The

transaction code used for the networked switch CNAMA record depends on which party remains connected after the dropback as follows:

(a) If the original party remains connected, then CNAMA processing occurs as usual, independent of the dropback. Examples are as follows:

(1) If a previous interswitch handoff required a transaction code, then that same transaction code is also used at this time for the networked switch CNAMA record.

(2) If no previous interswitch handoff occurred for this call, then a unique transaction code is created at this time at the CPS. This transaction code is used for both the CPS CNAMA custom calling record and the networked switch CNAMA record.

**Note:** Data group W200 is not formatted for the CPS CNAMA custom calling record.

(b) If the custom calling party remains connected, then a unique transaction code is created at this time at the CPS even if a transaction code previously existed for the original leg of the call. This transaction code is used for both the CPS CNAMA custom calling record and the networked switch CNAMA record.

**Note:** In this case, data group W200 is formatted for the CPS CNAMA custom calling record since the call is now a CN call.

**2.40** If a networked switch (other than the CPS) serving the call provides a handoff to another switch, then any subsequent record generated at the new networked switch formats the transaction code provided with the charge recording information that is passed to the new networked switch from the networked switch that previously served the call.

### **Second Scenario**

**2.41** The CPS is providing a three-port connection. It is not the serving switch currently involved with the call. The charge recording process at the serving switch contains the transaction code associated with the original call. A dropback occurs at the CPS

followed by an interswitch handoff from the serving switch to a new networked switch.

**2.42** The new networked switch serving the call formats a CNAMA record using the transaction code provided with the charge recording information that is passed to the new networked switch from the networked switch that previously served the call.

**Note:** This transaction code is associated with the original call regardless of who the remaining party is.

**2.43** Special considerations when the custom calling party remains connected are as follows:

(a) Within the constraints of this scenario, data group W200 is not formatted for the CNAMA custom calling record generated at the CPS.

(b) If the custom calling party remains connected, and if the CPS (i.e., three-port switch) is serving the call, then a CNAMA custom calling record is not written at this time. The continuing CNAMA custom calling record indicates exclusive airtime for the custom call. (In this simple case, the scenario is an R2 AMA issue.)

(c) If a subsequent handoff occurs, then a new transaction code is generated at the CPS to link the CNAMA custom calling record with the handoff record.

(d) A complete CNAMA FAT record (containing facility usage and airtime) for the original call is written at this time at the CPS. Data group W10 contains the appropriate airtime segment indication for a continuing switch connection. In this case, the tenth digit position in data group W10 contains either a value of 3 (to indicate the last airtime segment) or a value of 4 (to indicate the only airtime segment).

### **Third Scenario**

**2.44** The CPS is providing a three-port connection. It is the only switch currently involved with the call, although other switches may have been previously networked to it for the same call. A dropback occurs at the CPS leaving the custom calling party connected. At this time, the CPS formats a final CNAMA record for the original call and records the TWT time for the CNAMA custom calling record.

**2.45** If the custom calling party remains connected and another networked switch is serving the call, then a CNAMA custom calling record is not written at this time. When dropback occurs, the TWT time is set equal to the channel release time since the CNAMA custom calling record does not indicate any exclusive airtime for the custom call. The first channel seizure time is also set when dropback occurs.

**2.46** In this scenario, the first channel seizure time and the final channel release time for data group W40 are recorded and formatted for the CNAMA custom calling record generated at the CPS. No new transaction code is required. Special considerations for data group W40 are as follows:

- (a) Some of the time spanned by the times entered in data group W40 for the CNAMA custom calling record generated at the CPS is included in the CNAMA record that is generated at the networked (i.e., slave) switch for that leg of the call. The slave switch CNAMA record contains the transaction code for the original leg of the call. Consequently, the time spanned by data group W40 in the CPS FAT record for the original leg of the call is less than the sum of the times spanned by the U2000 data groups in the CNAMA records associated with the transaction code for the original leg of the call.
- (b) Conversely, the time spanned by data group W40 in the CNAMA custom calling record is greater than the sum of the post-dropback time(s) spanned by the U2000 data group(s) in the CNAMA record(s) associated with the custom calling leg.
- (c) The sum of the times spanned by both W40 data groups is equivalent to the sum of the times spanned by the U2000 data groups in the CNAMA records containing the transaction code of the original leg and the post-dropback time(s) spanned by the U2000 data group(s) in the CNAMA record(s) associated with the custom calling leg.

**2.47** Data group W200 is included in the CPS CNAMA records for entry codes V32, V33, and V36 as a consequence of a dropback involving either a

three-way call or a call waiting call. Data group W200 is recorded as follows:

- (a) For a dropback involving a three-way call, data group W200 is recorded for the appropriate entry code (i.e., V32 or V36) as follows:

- (1) *Called-Party Answer Time*: The time that the three-way call was answered is formatted in this field.
- (2) *Called-Party Disconnect Time*: The time that the three-way call ended is formatted in this field.

- (b) Call waiting call delivery requires a three-port connection similar to a three-way call. For a call waiting call, data group W200 is recorded for entry code V33 as follows:

- (1) *Called-Party Answer Time*: The time that the call waiting call was answered is formatted in this field.
- (2) *Called-Party Disconnect Time*: The time that the call waiting call ended is formatted in this field.

**2.48** Within the constraints of this scenario, data groups W4 and W10 are not applicable to the CNAMA custom calling record generated at the CPS (i.e., dropback switch). When dropback occurs, a complete CNAMA record for the original call is written at the dropback switch. At this time, no CNAMA record is written at the serving (i.e., slave) switch.

#### **Fourth Scenario**

**2.49** The CPS is providing a three-port connection. It is not the serving switch currently involved with the call. The charge recording process at the serving switch contains the transaction code associated with the original call. A dropback occurs at the CPS leaving the custom calling party connected. In this scenario, CNAMA processing at the serving switch is unaffected by the dropback.

**2.50** Special considerations for CNAMA records generated at the CPS are as follows:

- (a) When dropback occurs, the CPS formats a final CNAMA record for the original call.
- (b) The TWT time, channel release time, and first channel seizure time are recorded for the CNAMA custom calling record, but this record is not written at this time.
- (c) At this time, no transaction code is required for the custom calling leg of the call.
- (d) The CNAMA custom calling record includes data groups W40 and W200 for entry codes V32, V33, and V36 even though a transaction code may not be included.

**Note:** If the call ends without a subsequent handback occurring, then data groups W4 and W10 are not formatted. With the exception of this special case, data groups W4, W10, W40, and W200 are always formatted for CPS FAT record entry codes V32, V33, and V36.

**2.51** After dropback to a two-party connection at the CPS, the slave switch remains the serving switch. If a handback to the CPS occurs, then the handback record generated at the CPS contains a new transaction code and other information applicable to the custom calling call. The new transaction code is also included in the continuing charge recording processing.

**Note:** The conditions for formatting data group W200 are the same as those described in the previous (i.e., third) scenario.

#### **Fifth Scenario**

**2.52** The CPS is providing a three-port connection. It is not the serving switch currently involved with the call. The charge recording process at the serving switch contains the transaction code associated with the original call. A dropback occurs at the CPS leaving the custom calling party connected. The custom calling party is being served by the slave switch.

**2.53** If the original party remains connected after dropback, then the CNAMA custom calling record is generated at the CPS when dropback occurs. This record does not indicate any exclusive airtime for the custom call (i.e., the TWT time is set equal to the channel release time).

**2.54** An interswitch handback from the slave switch to the CPS occurs. Special considerations for this case are as follows:

- (a) A new transaction code is generated at the CPS to link the continuing charge recording information with the handback record. The CPS handback record indicates that the call was a custom call; however, the subsequent CNAMA record for continuing charge recording information does not indicate custom calling.
- (b) The reason for not indicating custom calling in the subsequent CNAMA record is that the indicator in data group A2 is consistent with the airtime information for the CNAMA record. Airtime information in the subsequent CNAMA record does not include three-port facility usage for this part of the call.

**Note:** In this case, both the handback record and the subsequent CNAMA record generated at the CPS contain the same transaction code. The transaction code for these records is different than the transaction code for the CNAMA records for the original call.

**2.55** There is no requirement to update data group U400 in the handback record; however, the continuing charge recording information must contain updated data group U400 mobile information for the subsequent CNAMA record. In this case, data group U400 is suppressed (or contains NCDs) in the handback record. The subsequent CNAMA record for the continuing charge recording information contains updated mobile information in data group U400.

#### **Sixth Scenario**

**2.56** The CPS is providing a three-port connection. The CPS may or may not be the serving switch. A dropback occurs at the CPS with the original party

connected. Considerations for the CPS and any possible networked switch are as follows:

- (a) When dropback occurs, the CPS generates a CNAMA custom calling record. The TWT time is set equal to the channel release time. In this case, there is no requirement to format data group W200 for the CNAMA custom calling record.
- (b) Within the constraints of this scenario, dropback at the CPS has no affect on CNAMA processing at any possible networked switch.

**D. Call Waiting**

**2.57** Call waiting calls in a CN environment require three-port connections similar to three-port connections required for three-way calls. A call waiting call is a custom call that requires a CNAMA custom calling record to be generated at the CPS (i.e., three-port switch).

**2.58** A CNAMA custom calling record generated at a CPS (i.e., three-port switch) for a call waiting call is similar to a CNAMA record for a regular terminating call except as follows:

- (a) The service feature code in data group A2 indicates that the call is a call waiting call. In this case, the service feature code has a value of 10.

**Note:** A service feature code value of 83 indicates call delivery from a home/host switch to call waiting at the CPS. Call delivery to call waiting is discussed in subsequent paragraphs.

- (b) Data group U400 contains the usual mobile information.
- (c) Data group U2000 (voice channel usage) contains the following information:
  - (1) The voice channel seizure time indicates the time the three-port connection was made and the call waiting tone was sent to the busy (i.e., called) party.
  - (2) The voice channel answer time indicates the time that the waiting party is first connected to the called party.
  - (3) The voice channel release time indicates the time that the calling party disconnects or is disconnected by the called party.

**Note:** This same time is also recorded as the called party disconnect time in data group W200.

**2.59** During an active call waiting call, if the called party disconnects while the calling party is on hold, the called party is automatically called back in an attempt to reestablish the call as a two-party call between the called party and the held party. If the callback is successful (i.e., called party answers), a separate CNAMA record is generated for the callback call. The callback call record is formatted in the same manner as any other CNAMA terminating call record for a two-party call.

**Call Waiting Considerations**

**2.60** Generally, CNAMA custom calling records generated for call waiting calls depend on whether or not the home/host switch is the CPS. Special considerations for these records are discussed in the following paragraphs based on various switch scenarios.

**Home/Host Switch Is the CPS**

**2.61** If the home/host switch is also the CPS, but not the serving switch, then data group U400 in the CNAMA custom calling record generated at the CPS is formatted with the current information for the original leg of the call waiting call.

**Home/Host Switch Is Not the CPS**

**2.62** If the home/host switch is not the CPS, then separate CNAMA custom calling records are required at the home/host switch (for call delivery to call waiting) and the CPS (for the call waiting call). Special considerations for each of these records are discussed in the following paragraphs.

**2.63 Call Delivery to Call Waiting:** If the home/host switch is not the CPS, then the CNAMA custom calling record generated at the home/host switch for call delivery at the home/host switch to call waiting at the CPS has the following exceptions:

- (a) **Data Group A2—Call Type Information:** The service feature code in data group A2 indicates 83 for call delivery to call waiting.
- (b) **Data Group D—Called Number:** Either the TLDN (temporary local directory number) or the PTLDN (pseudo-TLDN) is formatted for the



called number in data group D. If applicable, the NPA number is also included.

(c) *Data Group Q—TNN*: The TNN for the interswitch trunk from the home/host switch to the CPS is formatted in data group Q.

(d) *Data Group U400—Mobile Information*: Data group U400 is suppressed since no mobile information exists at the home/host switch.

**2.64** *Call Waiting at the Control Point Switch*: If the CPS is the serving switch, a standard CNAMA custom calling record is generated at the CPS for the call waiting call. If the CPS is not the current serving switch, then data group U400 in the CNAMA custom calling record at the CPS is formatted with the current information for the original leg of the call.

#### **Callback Considerations**

**2.65** Callback occurs when a called party disconnects while the calling party is on hold. Callback is an attempt to reestablish a two-party connection between the calling party and the called party. A callback call is independent of any call (e.g., three-way call) that existed prior to callback. Prior to callback, any existing call is disconnected and each switch involved with that call generates a FAT record.

**2.66** A callback call is treated as a new call attempt to the called party. There is no provision to link a CNAMA record generated for a callback call with any other CNAMA record generated prior to callback. Data group W200 is formatted in a CNAMA record for a callback call. Special considerations that depend on whether the serving switch is the CPS or a networked switch are discussed in the following paragraphs.

#### **Callback Via the CPS**

**2.67** If the CPS is the serving switch in a callback scenario, a standard CNAMA record is generated at the CPS for the callback call. In this case, no transaction code is required.

#### **Callback Via a Networked Switch**

**2.68** If a networked switch is the serving switch, a separate CNAMA record is generated at the networked switch and the CPS. In this case, a transaction code is formatted to associate the CNAMA records generated in each switch.

**Note:** If the serving switch is not directly networked with the CPS, then no callback is possible.

**2.69** If the CPS is not the serving switch, then the CNAMA record generated for a callback call completed via a networked switch has the following exceptions:

(a) The CPS formats an entry code V33 CNAMA record if callback is to a call waiting party; otherwise, the type entry code is the same as the type entry code of the original call.

(b) The first channel seizure time in data group W40 indicates the time that the interswitch page response message was received by the CPS from the serving switch.

(c) Data group W200 (switch timing) is formatted for entry codes V32, V33, and V36.

**Note:** If no handback to the CPS occurs, then this record has the appearance of an ICT record (i.e., entry code V33). If a handback to the CPS occurs, then the affected fields are updated.

#### **Call Waiting—Call Forwarding Don't Answer Considerations**

**2.70** The Call Waiting feature has an interaction with the CFDA (Call Forwarding Don't Answer) feature. If a called party with CFDA activated is busy on another call and does not answer a call waiting call within 30 seconds after being alerted for the waiting call, then the waiting call is automatically forwarded to a remote DN preassigned to receive CFDA forwarded calls for the called party. In this case, the CNAMA records generated depend on whether or not the home/host switch is also the CPS.

#### **Home/Host Switch Is the CPS**

**2.71** If the home/host switch is also the CPS, then there is no change in the CNAMA records generated at the CPS for a call waiting call that is forwarded via CFDA.

**Home/Host Switch Is Not the CPS**

**2.72** If the home/host switch is not the CPS, then separate records are generated at the home/host switch and the CPS as discussed in the following paragraphs.

**2.73 Call Delivery to Call Waiting:** If the home/host switch for the call waiting call is not the CPS, then the CNAMA record generated at the home/host switch is the same as discussed previously for call delivery to call waiting.

**2.74 Call Forwarding After Call Waiting Time-Out:** If the called party doesn't answer the call waiting call and CFDA is activated at the home/host switch, then the home/host generates a second CNAMA record for the CFDA call.

**2.75 Control Point Switch:** Special considerations for the CNAMA record generated at the CPS (i.e., three-port switch) for a call waiting call depend on whether or not the CPS is the serving switch.

(a) If the CPS is the serving switch, data group U400 is formatted with the current information for the original leg of the call.

(b) If the CPS is not the serving switch, then the CPS generates a CNAMA custom calling record for a three-way call. Special considerations for this three-way call record are as follows:

(1) Data group U400 is formatted with the current information for the original leg of the call.

(2) No transaction code is generated unless the nature of the call changes.

(3) Data group W200 is formatted.

**Note:** If the original party leaves the call and a subsequent handoff occurs, then a standard CNAMA record is generated for the handoff.

**RECORDS FOR ROAMERS**

**2.76** Roamer calls in a CN environment cause CNAMA records to be formatted in the same manner as for any other CN call. A CNAMA record for a roamer call includes the data groups applicable to

roamers. Slave switch records always format the roamer data groups. The U1000, U4000, and optional U10000 data groups are roamer data groups.

**Note:** For information about the Roamer I and Roamer II features, see references (8) and (9) in Part 6.

**SPECIAL PLANNING CONSIDERATIONS**

**2.77** Each cellular service provider in a cellular network will have to exchange billing information in order to coordinate charging and AMA processing. A method to coordinate and process AMA records must be mutually established by all cellular service providers in a cellular network.

**2.78** Each CNAMA record formatted for a particular CN call contains a transaction code (data groups W4 and W10). The transaction code can be used to correlate CNAMA records formatted separately at each MTSO involved in a particular CN call. The method used to process and correlate multiple CNAMA records that are contained on different MTSO AMA tapes is the mutual responsibility of the cellular services providers.

**3. HARDWARE AND SOFTWARE ENGINEERING**

**3.01** No new hardware or software is required for the CNAMA capability. For a description of standard hardware and software used for AMA, see reference (1) in Part 6.

**4. IMPLEMENTATION**

**4.01** The CNAMA capability is implemented as part of the CN feature. For detailed information about the CN feature and implementation, see references (2) and (3) in Part 6.

**5. TRAFFIC MEASUREMENTS**

**5.01** No traffic measurements are provided for CNAMA per se; however, traffic measurements are provided at each MTSO for CN call terminations and handoffs. Traffic measurements applicable to the CN feature are described in reference (2) in Part 6.

## 6. SUPPLEMENTARY INFORMATION

### GLOSSARY

**AT Record**—An AT (Airtime) record is written at a MTSO that receives a handback. An AT record provides airtime, but no facility time. An AT record includes the subscriber DN, transaction code, and airtime information.

**Cellular Network**—A cellular network is the network of cellular switches (i.e., MTSOs) that are associated with and directly connected to each other to provide CN services. A MTSO within a cellular network can serve as a home switch or a host switch.

**Control Point Switch**—A CPS (control point switch) is the first switch (i.e., MTSO) that is involved with a subscriber unit call origination or termination. A CPS retains its status for the duration of a call. The term "CPS" is synonymous with the term "master switch".

**Extended System Identification**—Each MTSO in a CN arrangement is assigned a unique ESID (extended system identification) number. An ESID number consists of a DCSID field, a MTSOID number, and a SID number. In a System 100 MTSO, the DCSID field contains zeroes.

**FAT Record**—A FAT record is written at a MTSO that provides both facilities and airtime. A FAT record includes the subscriber DN, transaction code, facility timing, and airtime information.

**FT Record**—A FT record is written at a MTSO that provides facilities (i.e., switched connections) for a CPS interswitch call termination, but provides no airtime. A FT record includes the subscriber DN, transaction code, and facility timing information for the switched connection.

**Home Switch**—A home switch is the MTSO that is associated with a subscriber's DN. A home switch serves a subscriber's home CGSA.

**Host Switch**—A host switch is any switch in a CN arrangement that provides a subscriber with direct roamer service.

**Interswitch Call Termination**—Interswitch call termination refers to the network connections (via inter-MTSO voice trunks between a home switch and host switch) that are used to complete incoming calls to subscribers who are located in a host switch CGSA.

**Interswitch Handoff**—Interswitch handoff refers to the addition of an interswitch link to the network path that already exists for an established call.

**Interswitch Handback**—Interswitch handback refers to the removal of an interswitch link that had been added due to a handoff.

**Master Switch**—The master switch is the first switch involved in a subscriber unit call origination or termination. The master switch can be either a home switch or host switch. A master switch retains its status for the duration of a call. The term "master switch" is synonymous with the term "CPS".

**Roamer Call**—A roamer call, within the context of CN, refers to a cellular call that is served by a host switch within the roamer's cellular network.

**Serving Switch**—A serving switch is the cellular switch that is currently providing a voice channel connection.

**Slave Switch**—A slave switch is any cellular switch involved in a call within a cellular network that is not the master switch. The slave switch can be either a home switch or a host switch.

**Transaction Code**—A transaction code is part of the AMA data formatted in each CNAMA record generated for a CN call. It uniquely identifies and provides the means to correlate all CNAMA records generated for a particular call. A transaction code consists of two parts. One part is a unique transaction number associated with a particular call. The other part is the ESID number of the control point switch for that call.

**REFERENCES TO AT&T PRACTICES**

- (1) 231-290-620—Automatic Message Accounting Feature Document
- (2) 231-290-619—Cellular Networking Feature Document
- (3) 231-252-000—Cellular Networking Implementation, Operation, and Maintenance Procedures
- (4) 231-290-608—Conditional Call Forwarding Features
- (5) 231-290-607—Immediate Call Forwarding Feature
- (6) 231-290-609—Three-Way Calling Feature
- (7) 231-290-610—Call Waiting Feature
- (8) 231-290-615—Roamer I Feature
- (9) 231-290-616—Roamer II Feature.

**7. COMMENT FORM**

**7.01** A comment form is located at the back of this practice to provide a communications channel from the user to the writer.

**8. ISSUING ORGANIZATION**

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