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United States Government
Memorandum

To: William F. Caton
Acting Secretary

From: James R. Keegan
Chief, Domestic Facilities Division
Common Carrier Bureau

OCT 2 8 1994

Subject: CC Docket 94-102, Revision of Commission rules to ensure compatibility with enhanced 911 emergency calling systems

Date: October 28, 1994

The attached documents relate to matters addressed in the above-referenced docketed proceeding. They are hereby submitted for inclusion in the record of that proceeding.

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TR45

Emergency Services

Joint Experts Meeting Report

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1. Executive Summary

The TR45 Joint Experts Meeting (JEM) on *Public 800 Mobile and Personal Communications* Support of Basic 9-1-1 (9-1-1) and Enhanced 9-1-1 (E9-1-1) Emergency Services was held in Chicago, IL. The JEM was convened on August 1, 1994 at 9:07AM and was adjourned on August 5, 1994 at 11:47AM. Terry Jacobson (AT&T) was the chair and Jeff Crollick (GTE) was the co-chair.

The purpose of the JEM was to:

- Define and prioritize the Emergency Services call taker features for Wireless Cellular,
- Define the requirements for the information flow between the Wireless System and the Public Safety Answering Point (PSAP), and to associate this information flow with the 9-1-1 call by the Mobile Station (MS). MS is a collective term that includes vehicular, portable, transportable, fixed, aircraft and other wireless subscriber stations.

The outcome of the JEM was:

- A prioritized list of Emergency Services call taker features.
- The mapping of the call taker features to four evolutionary paths:

Path	Wireless Cellular System	Mobile Stations	9-1-1 E9-1-1 System
A	Existing	Existing	Existing
B	Expanded	Existing	Expanded
C	Enhanced	Existing	Enhanced
D	Enhanced	Expanded or Enhanced	Enhanced

Existing: No change to existing equipment or protocols.
Expanded: Minor changes to existing equipment or protocols.
Enhanced: Major changes to existing equipment or protocols.

- The information elements needed between the Wireless System and the Emergency Services System to support the call taker features.
- The identification of radio location techniques that may provide more accurate Mobile Station location information.

The views expressed in this report represent an evolutionary path. The public safety and cellular service provider communities each have a unique set of challenges that includes economic, operational and

technological feasibility. These factors should be considered in the use of this report.

2. Introduction

2.1 Background

The basic 9-1-1 (9-1-1) and Enhanced 9-1-1 (E9-1-1) systems in existence today have been designed to provide rapid response to calls for emergency services from wireline subscribers. Basic 9-1-1 Emergency Services Systems establish routing of calls to a Public Safety Answering Point (PSAP). E9-1-1 provides added capabilities including selective routing of a call to the appropriate PSAP for rapid response to emergency calls and the display of calling number, address, and in most cases, the name of the subscriber at the calling number. However, these Emergency Services Systems do not address the unique characteristics of wireless communications.

The mobile nature of wireless communications and the unique characteristics of Radio Frequency (RF) propagation may require modification of existing Emergency Services Systems and the development of special capabilities in wireless systems.

Emergency services access (9-1-1/E9-1-1) by a wireless caller requires that the MS location information (at least the serving cell site or sector) be used to assist in routing the call to the appropriate PSAP. The location information may be used to dispatch an emergency vehicle to the incident site.

2.2 Perspective

The views expressed in this report represent an evolutionary path. The public safety and cellular service provider communities each have a unique set of challenges that includes economic, operational and technological feasibility. These factors should be considered in the use of this report.

2.3 JEM Methodology

Tutorials were presented on Mobility, Emergency Services, Current Industry Practices, TR45 Standards, and Emergency Services for Wireless Cellular. The tutorials established a common frame of reference and terminology for the JEM participants.

The tutorials and contributions provided a basis for discussion of:

- Call taker features and feature priorities.
- Information flows between the Wireless System and the Emergency Services System.

- Radio location techniques that may provide more accurate Mobile Station location information.

A prioritized list of call taker features was generated. The list was reviewed and the features were mapped to the four evolutionary paths.

The flow of information needed between the Wireless System and the Emergency Services System to support the call taker features was identified. Information elements were identified and information flow models were defined.

3. E9-1-1 Call Taker Feature Priority

3.1 Call Taker Feature Descriptions

The following is a list of call taker features and a high level description and requirements. The list is in priority order.

1. Emergency Services Reached by Dialing [9]-[1]-[1]-[SEND]

- A Mobile Station user dialing [9]-[1]-[1]-[SEND] shall access Emergency Services.
- [*]-[9]-[1]-[1]-[SEND] should be treated as a 9-1-1 call. (This non-preferred sequence should not be publicized.)
- Dialing [9]-[1]-[1]-[SEND] shall bypass other call origination restriction features (e.g., PIN access, PIN intercept).
- A Mobile Station may have an emergency service or [9-1-1] call button to speed dial the [9]-[1]-[1]-[SEND] sequence.
- Mobile Stations should allow [9]-[1]-[1]-[SEND] to be dialed at all times (even when locked or when served by a restricted system).

2. 9-1-1 Call Precedence

- An originating 9-1-1 call should be given priority over other non-emergency call originations.
- The alternate Priority Access and Channel Assignment (Alt. PACA) procedures described in PN-2977 (the proposed IS-53A Cellular Feature Descriptions) provides an interim solution for precedence of 9-1-1 calls:
  - — three levels of priority are established designated A, B, and C.
  - — a number of channels are reserved for A (highest), B and C (lowest) priority calls.
  - — a caller with "A" priority has access to the A, B, C channels.
  - — a caller with "B" priority has access to the B, C channels.
  - — a caller with "C" priority has access to the C channels.
  - — a 9-1-1 call may be treated as a priority call subject to local operating practices or regulations.
- Priority Queuing could be considered as another mechanism to provide access for an emergency call. If a traffic channel is not available when the Mobile Station user attempts to originate the 9-1-1

call, the call would be "queued" and the Mobile Station would be paged and alerted when a radio channel becomes available.

- Future 800 MHz air interface standards should support the Priority Access and Channel Assignment (PACA) feature defined in PN-2977 (the proposed IS-53A Cellular Feature Descriptions).

3. Identify Caller's Initial Location

- Obtaining location information shall not require overt action on the part of the caller.
- The method of sending location information from the Wireless System to the Emergency Services System shall be standardized. The location information should describe the Mobile Station's position in terms of:
  - Longitude.
  - Latitude.
  - Altitude.
  - Resolution or Accuracy.
- Location information should be obtainable for all callers.
- Accuracy Goals:[1]
  - Near term goal: within 400 feet (longitude, latitude, resolution).
  - Long term goal: within 40 feet (longitude, latitude, altitude, resolution).

4. Subscriber Identity Information

- Name.
- Address.
- Home Phone Number.
- Other Subscriber Information (e.g., medical condition).
- The source of the subscriber identity information is the subscriber's "Home" System.

5. 9-1-1 Call Related Information

- Serving Wireless System ID.

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[1] It is important to note that these are goals and are not requirements. The realization of these goals are contingent on economic and technical feasibility.

- Mobile Identification Number (MIN), International Mobile Station Identification (IMSI).
- Electronic Serial Number (ESN).
- Callback Number. one or more of the following:
  - — Emergency Services Access Port Number.
  - — Temporary Local Directory Number (TLDN) associated with this 9-1-1 call.
  - — Mobile Directory Number.

6. Ability to Request Updated Caller Location Information

- PSAP may request the Wireless System to provide the updated location information.
- PSAP may request the Wireless System to report updated location information periodically.

7. Ability to Communicate With and Determine the Type of Emergency Services Needed

- The MSC shall provide a standard voice connection (or data connection for a data terminal) to the PSAP.
- Air interface encryption may be used, however, it must be removed before delivery of the call to the PSAP.

8. Receive 9-1-1 calls at the Appropriate PSAP

- The 9-1-1 caller's location should determine the PSAP to which the call is routed.

9. Originate 9-1-1 calls from the Current Serving System

- If the Mobile Station user is engaged in a call and dials [9]-[1]-[1]-[SEND], the Serving Mobile Switching Center shall initiate a 9-1-1 call.
- After handoff, the current serving Mobile Switching Center (MSC) shall route the 9-1-1 call toward the PSAP (not the Anchor MSC per normal procedures).
- The caller may use flash to add a held party to a three-way (or conference) call.

10. Ability to detect and communicate with TDD callers

- TDD callers shall be able to use cellular telephones in the 30 kHz analog mode.

11. Ability to Hold the Line After the Caller Has Disconnected or the Call Has Dropped, Under Direction of the Controlling PSAP

- The Mobile Station is precluded from receiving other calls.
- The Mobile Station is precluded from originating another call.
- Any origination attempt is connected to the Call Taker.
- Automatically "ring back" the caller.

12. Suspend Flash Privileges for New Service Requests

- The Mobile Station is precluded from receiving another call.
- The Mobile Station is precluded from originating another call.

13. Ability to Call Back if the Call is Disconnected or the Call is Ended Prior to Completion of the Event

- Local callback number.
- Emergency Services access port.
- *Exact* location information is more important than a callback number; however, if only an *approximate* location can be provided, then a callback number is more important.

14. Ability to Transfer the Caller to the Appropriate PSAP

- While communicating with the caller, bridge on another PSAP; transfer the call and call control upon disconnect by the controlling PSAP.

15. Ability to Provide ALI Information and Information Captured During the Call, to Another PSAP

- When a call is transferred all information regarding the call (including subscriber information, location information, service provider information, and information captured during a call) should be transferred with the call.

16. Ability of the PSAP to Force Disconnect for MS-to-PSAP Calls

- When a PSAP disconnects the Mobile Station (MS) is disconnected regardless of its switchhook state.

17. Area Cell Congestion Control

- The Wireless System should be able to "throttle" 9-1-1 calls from the same area since the calls may be related to a single incident. Throttling is a concept for constricting flow by discarding or delaying selected call attempts.

18. System Congestion Control

- The PSAP should be able to request MSC to "throttle" 9-1-1 calls.
- The PSAP should be able to "broadcast" messages regarding conditions (perhaps using a broadcast short message service).

19. Silent Callback

- The PSAP should be able to call back specialized Mobile Stations silently, provided that the special Mobile Station does not alert audibly and automatically answers.

20. Authorization Override

- Serving System option to block or allow 9-1-1 calls from:
  - — Unauthorized Mobile Stations.
  - — Specific Mobile Stations.
  - — Specific locations.
- New Mobile Stations that utilize Identity Modules may be able to initiate 9-1-1 calls if the Identity Module is not present.
- Mobile Stations should allow the caller to initiate a 9-1-1 call when locked.
- Mobile Stations should allow the caller to initiate a 9-1-1 call when the Mobile Station's programming prevents it from accessing the system for other wireless services.

3.2 Impact of Call Taker Feature Priority

The amount of changes required to implement a particular feature were analyzed to determine if the changes required are:

Existing: No change to existing equipment or protocols.

Expanded: Minor changes to existing equipment or protocols.

Enhanced: Major changes to existing equipment or protocols.

The changes were analyzed for the wireless cellular system (the Home Location Register, the Visitor Location Register, the Mobile Switching Center, and other required functions), Mobile Stations, and the 9-1-1 and E9-1-1 systems (selective routers, PSAPs, etc.).

The changes and the degree of the changes were applied to select a particular migration path as shown in the following table:

Path	Wireless Cellular System	Mobile Stations	9-1-1 E9-1-1 System
A	Existing	Existing	Existing
B	Expanded	Existing	Expanded
C	Enhanced	Existing	Enhanced
D	Enhanced	Expanded or Enhanced	Enhanced

The following table summarizes the Call Taker Feature Priorities and maps them onto four evolutionary migration paths based on the amount of changes required for implementation. Where possible the required technology is indicated (with possible limitations).

TR45 EMERGENCY SERVICES JEM CALL TAKER FEATURE PRIORITY					
NUM	DESCRIPTION	PATH A	PATH B	PATH C	PATH D
	MSC:	Existing	Expanded	Enhanced	Enhanced
	MS:	Existing	Existing	Existing	Enhanced
	PSAP:	Existing	Expanded	Enhanced	Enhanced
1	Emergency Services Reached by Dialing [9]-[1]-[1]-[SEND]	Now			
2	9-1-1 Call Precedence		Alt. PACA		PACA
3	Identify Caller's Initial Location*				
	- Location technology should not require overt action on the part of the user.	Cell/Sector (precludes callback)			
	- Location information shall be available for all calls	Now			
	- Near Term Goal:** Within 400 ft. (Lat., Long., Resolution).			Network based	MS based
	- Long Term Goal:** Within 40 ft. (Lat., Long., Alt., Resolution).			Network based	MS based
	* Method of sending location information should be "universal." ** It is important to note, this is a goal and not a requirement; realization of the goal is contingent on economic and technical feasibility.				
4	Subscriber Identity Information - Source (home). - Name, Address, MIN, IMSI.		Pseudo-ANI	Information Transfer	
5	Terminal Identity Information - ESN, type.		Pseudo-ANI	Information Transfer	
6	Ability to Request Location Update Information - single report. - automatically reported by the serving system at periodic intervals. - Same resolution as initial request.			Information Transfer	
7	Ability to Communicate with and Determine the Type of Emergency Services Needed	Voice			Data
8	Receive 9-1-1 Calls at the Appropriate PSAP	Cell/Sector resolution		Latitude & Longitude	Latitude & Longitude
9	Originate 9-1-1 Call from the Current Serving System (mobile is given flash privilege to add held party to call)		Modify MSC		
10	Ability to Detect and Communicate with TDD and Data Callers	TDD			Data
11	Ability to Hold Line after the Caller Disconnected or the Call Was Dropped, Under Direction of the PSAP - precluded from receiving other calls. - precluded from originating other calls. - call originations are connected to the call taker. - automatically "ring back" the caller.		Modify MSC		

TR45 EMERGENCY SERVICES JEM CALL TAKER FEATURE PRIORITY					
NUM	DESCRIPTION	PATH A	PATH B	PATH C	PATH D
	MSC:	Existing	Expanded	Enhanced	Enhanced
	MS:	Existing	Existing	Existing	Enhanced
	PSAP:	Existing	Expanded	Enhanced	Enhanced
12	Suspend Flash Privileges for New Service Requests		Modify MSC		
13	Ability to Call Back If The Call is Disconnected, or Ended Prior to Finalization of the Event				
	- Local Callback Number.	Pseudo-ANI (precludes location)	Pseudo-ANI	Information Transfer	
	- Roamer Port Number.		Pseudo-ANI	Information Transfer	
14	Ability to Transfer* Caller to the Appropriate PSAP * While communicating with the caller, bridge on another PSAP, transfer the call and call control upon disconnect by the controlling PSAP.	PSAP switchhook flash controlled		PSAP ISUP control	
15	Ability to Provide ALI and Information Captured During the Call to Another PSAP			Information Transfer	
16	Ability Of PSAP To Force Disconnect For Mobile Station To PSAP Calls	Now			
17	Area Congestion Control - MSC "throttles" 9-1-1 calls from same area.		Modify MSC		
18	System Congestion Control				
	- PSAP can request MSC to "throttle" incoming calls.			Information Transfer	
	- PSAP can request MSC to "broadcast" messages regarding conditions.				Short Message Service (SMS)
19	Silent Callback				
	- Specialized Mobile Station provides no alert tones and automatically answers.				Modify MS and signalling
20	Authorization Override				
	- Serving MSC may block or allow 9-1-1 calls from: > Unauthorized Mobile Stations. > Specific Mobile Stations. > Specific locations.		Modify MSC		
	- New Mobile Stations that utilize Identity Modules should be able to initiate 9-1-1 calls if the Identity Module is not present. - Locked terminals. - Mobile Station access restrictions (e.g., A-side only, B-side only, blocked list).				Modify MSC

4. Information Elements

The following is a list of possible information elements for transfer between a wireless cellular system and an emergency service system.

A. Subscriber Information

1. Mobile Identification Number–Electronic Serial Number (MIN-ESN)
2. International Mobile Station Identifier (IMSI)
3. Billing number
4. Subscriber name
5. Subscriber billing address
6. Subscriber home telephone number
7. Subscriber priority indication
8. Priority Access and Channel Assignment (PACA) level (A, B, or C)
9. Preferred Language
10. Personally provided medical information
11. Home wireless service provider information

B. Callback Number

1. Temporary Local Directory Number (TLDN)
2. Roamer Port Number
3. Emergency Service Access Port Number
4. Mobile Directory Number (MDN) (may be international)

C. Terminal Information

1. Electronic Serial Number (ESN)
2. Mobile Station Type
   a) Fixed
   b) Automobile
   c) Transportable
   d) Portable
   e) Aircraft

D. Caller Geographic Location

1. Latitude
2. Longitude
3. Altitude
4. Resolution
5. Source
   a) Mobile Station (MS)
   b) Base Station Controller (BSC)
   c) Mobile Switching Center (MSC)
   d) Home Location Register (HLR) —for fixed mobiles
   e) Selective Router

E. Caller Street Location

1. Street address
2. City
3. Source
   a) Mobile Station (MS)
   b) Base Station Controller (BSC)
   c) Mobile Switching Center (MSC)
   d) Home Location Register (HLR) —for fixed mobiles
   e) Selective Router
4. Serving Wireless Service Provider Information
5. Access Directions
6. In-house security number

F. PSAP Information

1. Primary PSAP
2. Alternate PSAP(s)
3. Up to 6 Emergency Service Providers including:
   a) Directory Number
   b) Type, such as:
      - Fire
      - Local Law Enforcement
      - Highway Law Enforcement
      - Medical
      - Poison Control
      - Suicide Prevention Hot Line

G. Call Information

1. Type of emergency information
2. Additional location information
3. Source of information

5. Information Flow Scenarios

These are generic information flow models, no single model will solve all of the requirements.

5.1 CAMA ANI

The emergency service call is made over a CAMA (Centralized Automated Message Accounting) trunk. Only 7 (or 8) digits of ANI (Automatic Number Identification) information are conveyed. The ANI may identify non-roaming callers only. It is not specified how roamers are to be identified over the interface.

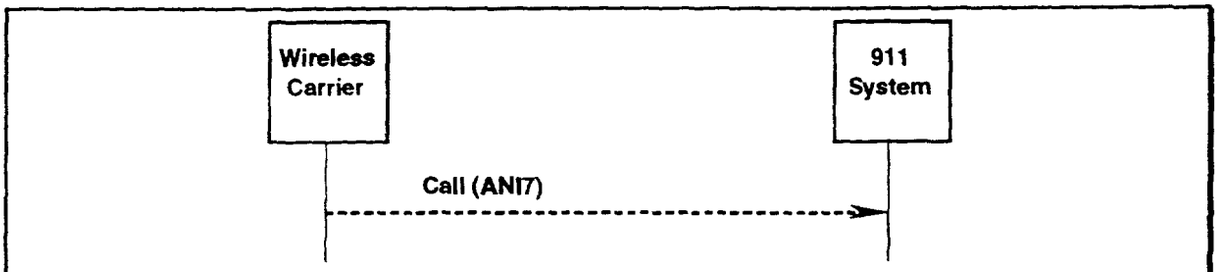

Figure 1: Information Flow with CAMA ANI

5.2 CAMA with Pseudo ANI

The emergency service call is made over a CAMA trunk. The 7 (or 8) digits of ANI information are used to convey a pseudo ANI (pANI). The pseudo ANI is usually used to identify the caller's serving cell (or sector) and indirectly the serving service provider.

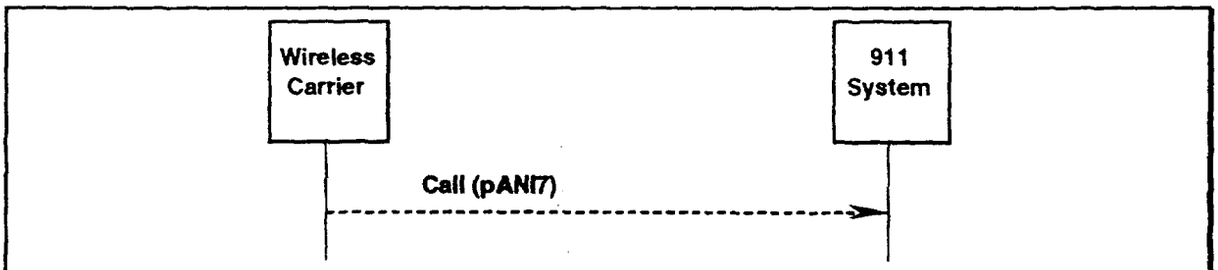

Figure 2: Information Flow with CAMA and a Pseudo ANI

5.3 CAMA with Subscriber Specific Pseudo ANI

The emergency service call is made over a CAMA trunk. The 7 (or 8) digits of ANI information are used to convey a pseudo ANI. The pseudo ANI is usually used to identify the caller's serving cell (or sector) and the caller. The caller's identity is temporary, but it allows other information to be correlated. For instance, a directive could be used to convey specific information about the call (caller identification information, location information, etc.) This information may be correlated using the pseudo

ANI. The information may be stored in a Automatic Location Information (ALI) database and be retrieved using normal E9-1-1 call procedures.

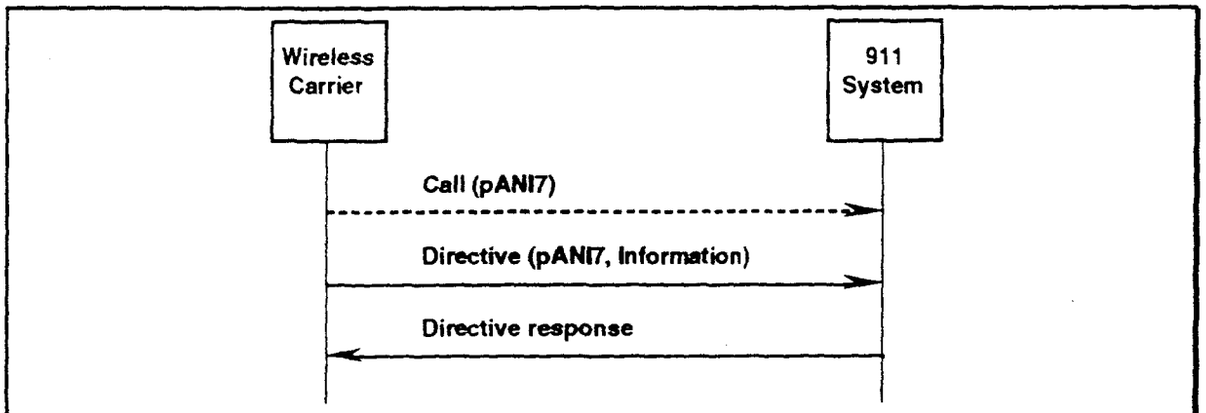

Figure 3: Information Flow with CAMA Pseudo ANI and an Information Bearing Directive

5.4 Call Setup with Additional Information

The emergency service call is made over a ISUP (ISDN (Integrated Services Digital Network) User Part) trunk modified to carry additional information about the call (caller identification information, location information, etc.). This method for information transfer is direct and does not require correlation of other messages. ISUP may not have sufficient bandwidth for the intended information flow and ISUP does not have procedures for additional messages to request and deliver location information.

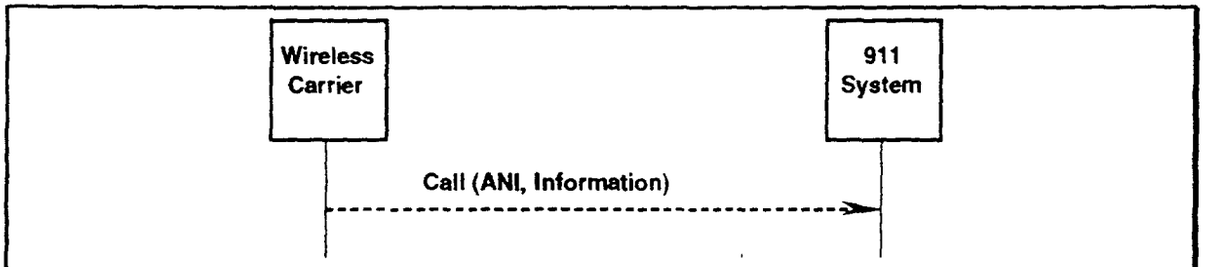

Figure 4: Information Flow with ISUP Call Associated Signalling to Carry Information

5.5 Call Setup with Additional Information

The emergency service call is made over a CAMA trunk. The 7 (or 8) digits of ANI information are used to convey a pseudo ANI. The pseudo ANI is usually used to identify the caller's serving cell (or sector) and the caller. The caller's identity is temporary, but it allows other information to be retrieved. For instance, more information may be requested that could be used to convey specific information about the call (caller identification information, location information, location updates, etc.).

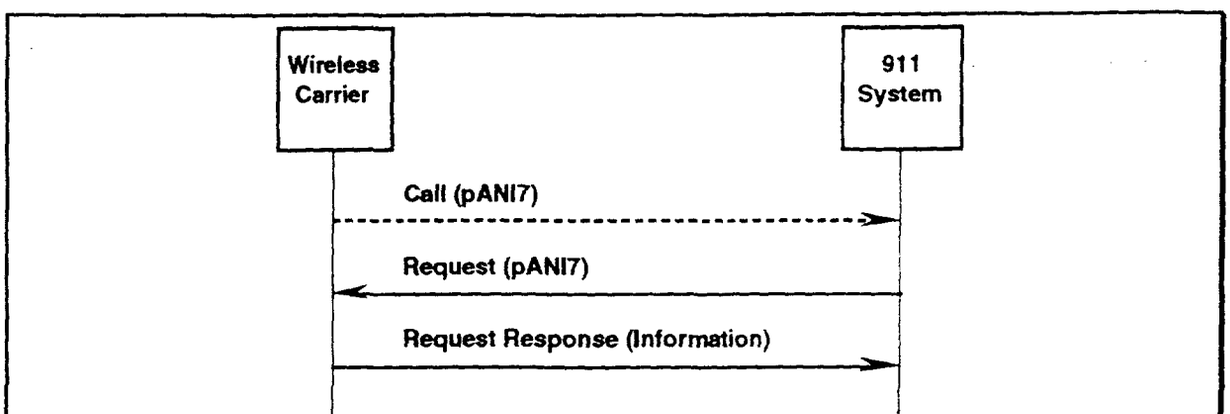

Figure 5: Information Flow with CAMA and Non-Call Associated Retrieval of Information

5.6 Call Setup with Additional Information

The emergency service call is made over a ISUP trunk. The ANI information identifies a caller. The caller's identity is temporary for some mobile subscribers, but it allows other information to be retrieved. For instance, more information may be requested that could be used to convey specific information about the call (caller identification information, location information, location updates, etc.).

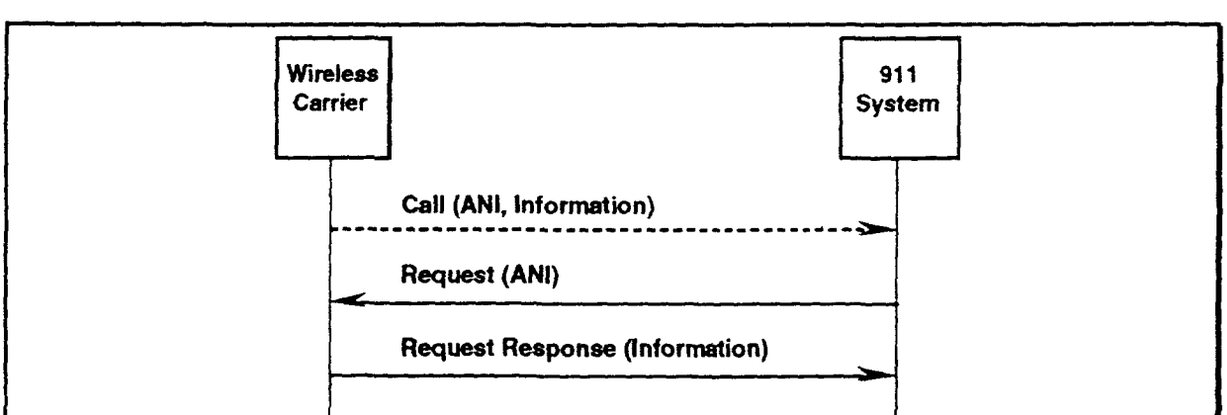

Figure 6: Information Flow with ISUP and Non-Call Associated Retrieval of Information

6. Information Element Locations

Note: reference points and network elements not germain to emergency service information element sources have been excluded for the sake of clarity. ANI refers to a full 10-digit (or greater) identification of the calling subscriber. ANI7 refers to a restricted 7- and 8-digit ANI.

The A, B, D, U_m, D_i, and A_i are existing interfaces.

X_a, X_b, X_c, X_d, X_f, X_h, X_i, X_k, and X_m are possible new interfaces.

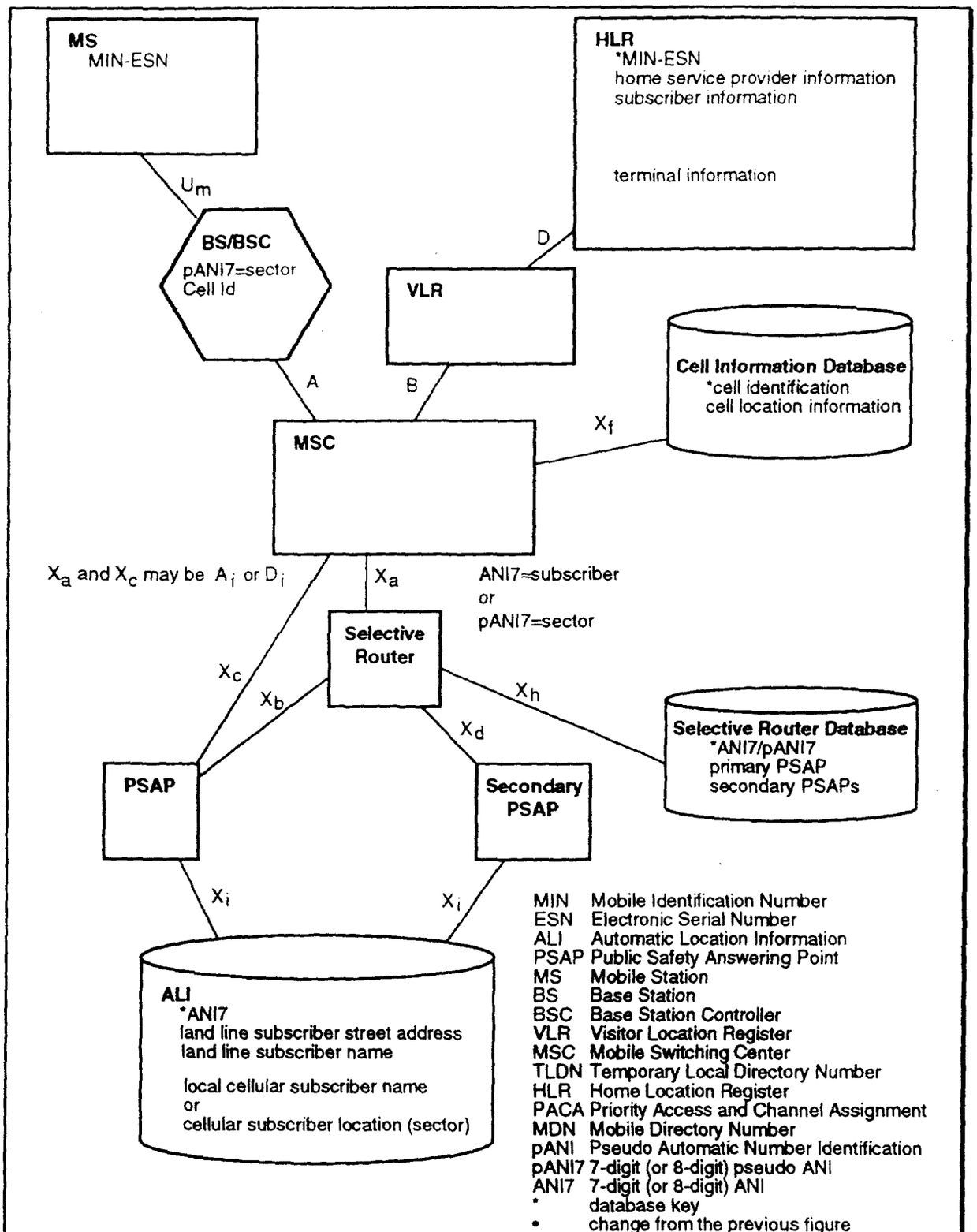

Figure 7: Evolutionary Path A Information Element Sources

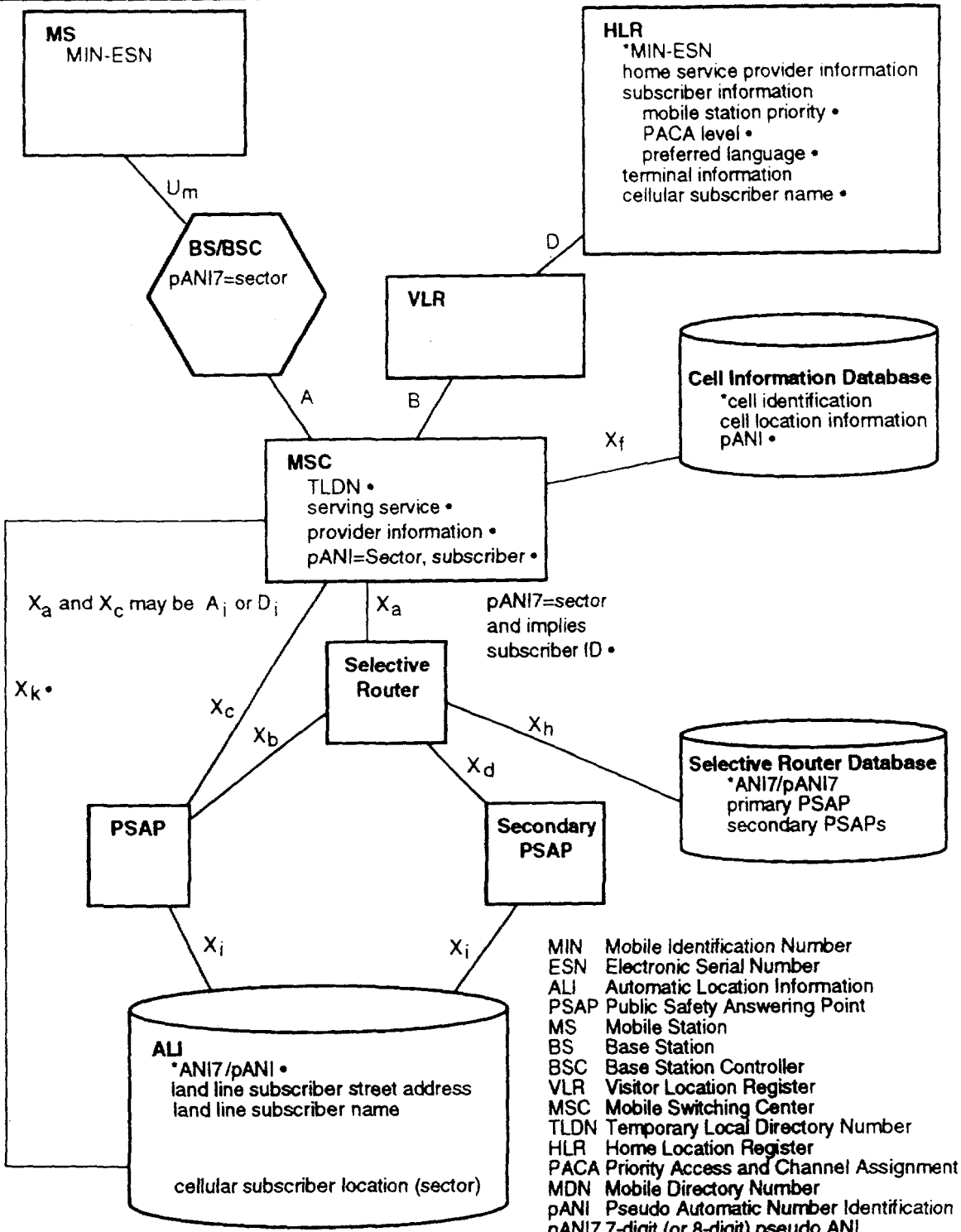

Figure 8: Evolutionary Path B Information Element Sources

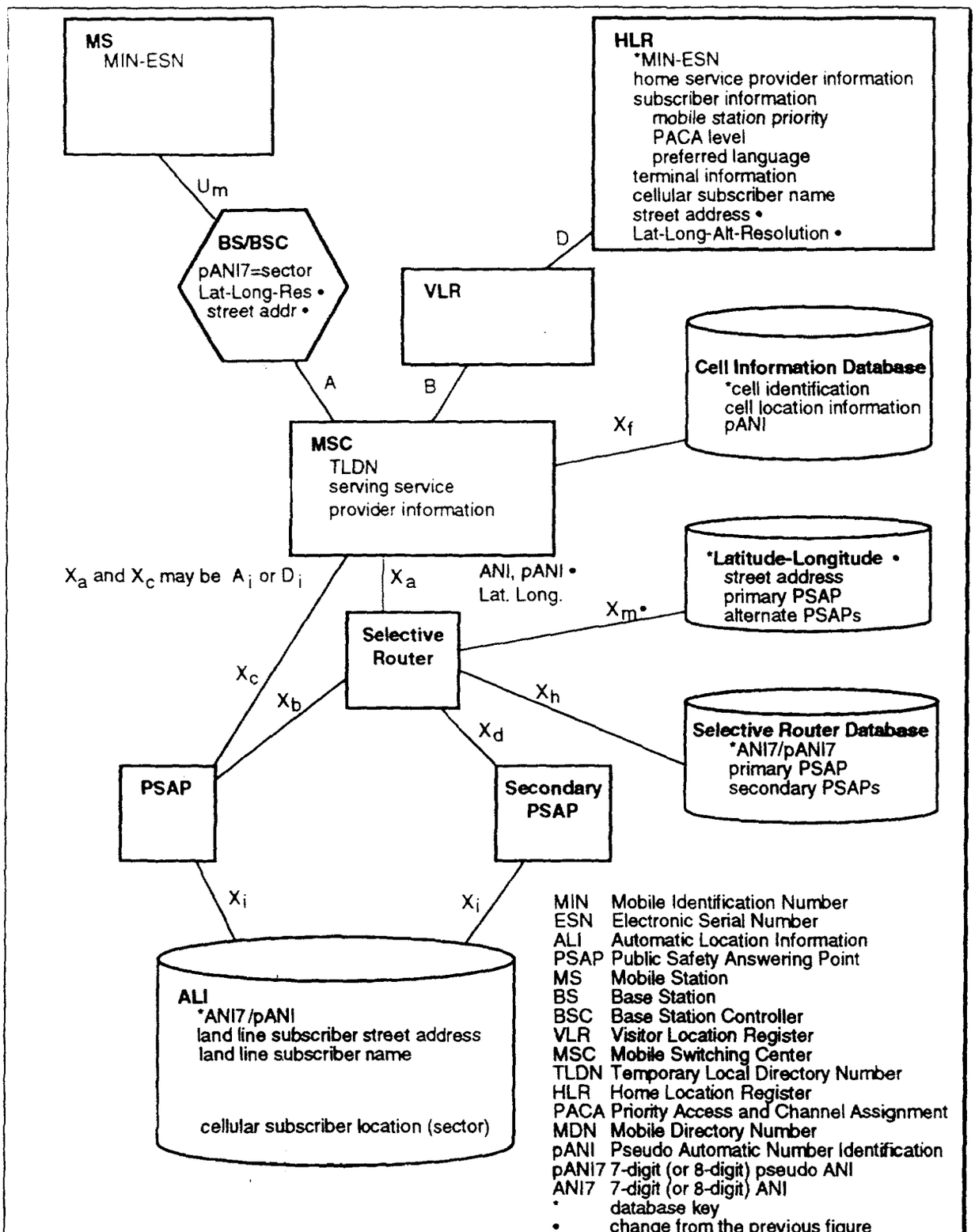

Figure 9: Evolutionary Path C Information Element Sources

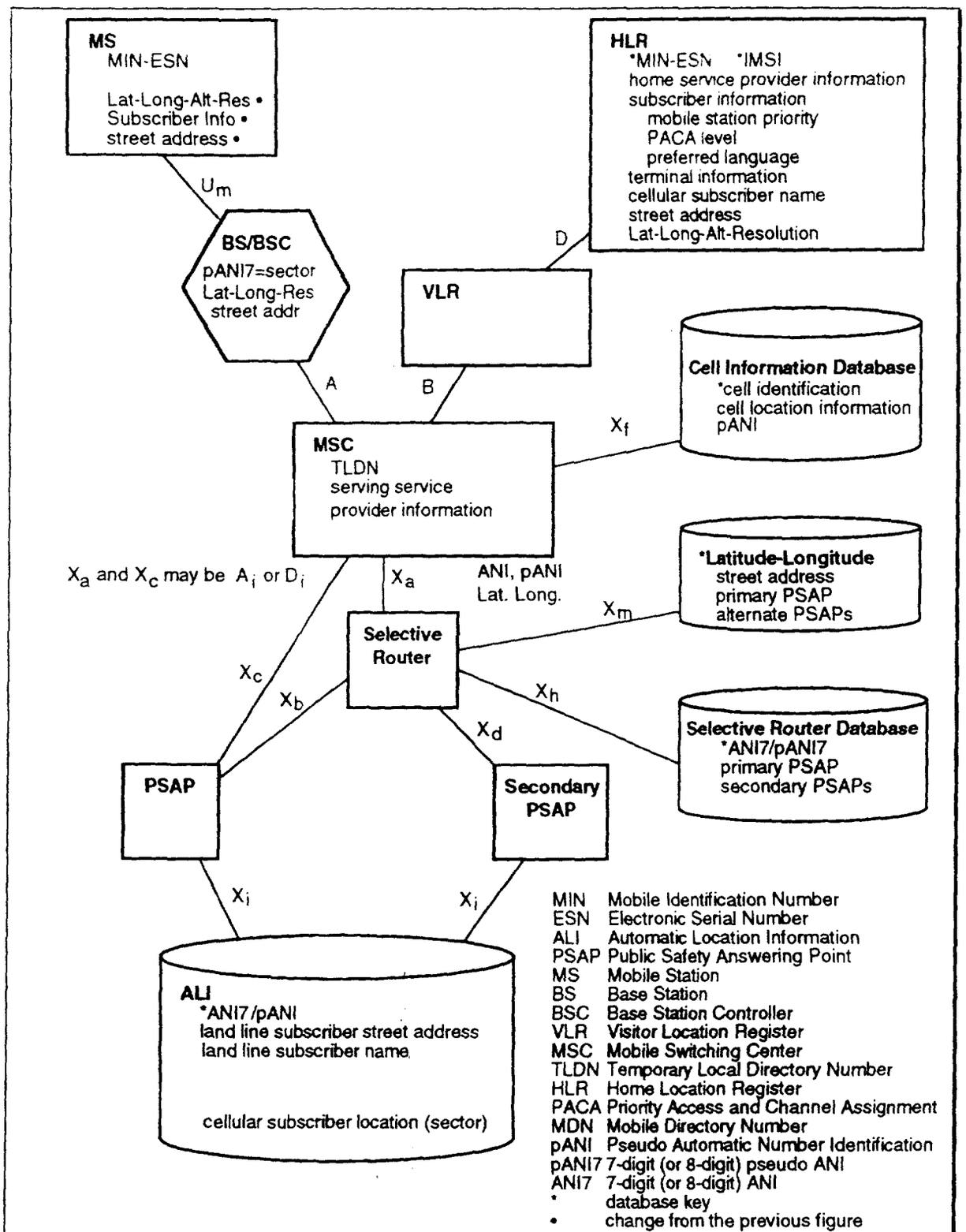

Figure 10: Evolutionary Path D Information Element Sources