Cellular Networking Perspectives

Editor: David.Crowe@cnp-wireless.com Vol. 11, No. 3 March, 2002

In This Issue . . .

Next Issue: April 3rd, 2002

Wireless Priority Service: An Inside View

Wireless Priority Service (WPS) is a service that US carriers may decided to implement to provide priority access to public wireless communications channels (e.g. cellular and PCS traffic channels) in times of emergency. It can be expected that, once equipment is available to support WPS, other countries may request similar systems.

The Office of the Manager, National Communications System (OMNCS – www.ncs.gov) is charged with the development and administration of a national telecommunications infrastructure within the USA that is available under all conditions, including natural and man-made disasters. As part of that effort, the Wireless Priority Services (WPS) program was enacted with the following objectives:

- To provide priority commercial mobile radio service (CMRS – Cellular, PCS, ESMR etc.) communications during and after national emergencies to key national security and emergency preparedness (NS/EP) personnel in government and industry, and to those with leadership responsibilities.
- To acquire a service that will be available nationwide with existing CMRS handsets.
- To provide end-to-end priority service for national security and emergency preparedness calls.
- To evolve the priority service concepts by exploiting advancements in technologies.

In response to the September 11th, 2001 attacks on the United States, the National Security Council instructed the OMNCS to implement an immediate wireless solution in Washington, DC, targeted for operation within 60 days. This was later expanded to include New York City and Salt Lake City. This immediate solution will provide improved call completion to NS/EP users over CMRS handsets and existing technology.

The National Security Council also directed the OMNCS to proceed with a priority access queuing system for wireless nationwide, targeted for operation within one year. This initial operating capability (IOC) solution is under development in a government/industry expert group, and it is expected to closely adhere to the Federal Communication Commission's Second Report and Order, Establishment of Rules and Requirements for Priority Access Service (PAS), FCC 00-242

hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-00-242A1.pdf/doc/txt

This FCC ruling was adopted on July 3rd, 2000 to provide for priority access for NS/EP personnel. The rule establishes the priority levels for NS/EP PAS service, and it addresses liability under Federal and State law.

A nationwide end-to-end capability is scheduled for December 2003. This will provide mobile to mobile, mobile to fixed, and fixed to mobile priority service. WPS is intended to support national emergency communications. The full operating capability (FOC) solution is intended to be a standards-based solution.

Cellular Networking Perspectives (issn 1195-3233) is published monthly by Cellular Networking Perspectives Ltd., 2636 Toronto Crescent NW, Calgary AB, T2N 3W1, Canada. **Phone:** 1-800-633-5514 (+1-403-274-4749) **Fax:** +1-403-289-6658 **Email:** cnpsales@cnp-wireless.com **Web:** www.cnp-wireless.com
Subscriptions: CDN$350 in Canada (incl. GST), US$350 in the USA and US$400 elsewhere. Payment by cheque, bank transfer, American Express, Diners Club, MasterCard or Visa. **Delivery**: Email or 1st class mail.
Back Issues: Single issues are $40 in the US and Canada and $45 elsewhere, or in bulk at reduced rates.
Discounts: Educational and small businesses: 25% off any order. **Copies**: Each subscriber is licensed to make up to 10 copies of each issue or back issue. Please call for rates to allow more copies.

In addition to the work of developing an immediate and nationwide solution, OMNCS efforts will continue to develop standards that can satisfy all the NS/EP wireless requirements, including data. Wireless networks are still evolving. 3G technologies now being developed, and future wireless developments, will offer enhancements to improve wireless NS/EP communications.

Carol-Lyn Taylor
US National Communications Systems (NCS)

Cibernet MXP

MXP (Mobile Xchange Protocol), also known as CIBER 3, is a new XML-based protocol from Cibernet Corporation (www.cibernet.com) designed to replace the CIBER record format used for billing record exchange between most AMPS, TDMA and CDMA carriers.

MXP records will primarily be transmitted electronically, with CD as a backup. CIBER, by contrast, was designed for 9-track tape transmission, but it is now usually transmitted electronically.

A benefit of using XML is its extensibility, although CIBER has proven to be extensible through the addition of new record types.

MXP provides support for all CIBER capabilities, along with more support for m-commerce and wireless internet applications. According to Parry Snow, VP Marketing for Cibernet, CIBER and TAP are 'minute of use' oriented, whereas MXP can capture a variety of rated items – e.g. micro purchases and packet, byte and hit counts.

XML has a number of drawbacks. Since it is encoded in ASCII in an HTML-like fashion, records will be several times larger than in binary. The inclusion of tags, as in HTML, also increases the size of records, compared to CIBER where the identity of a field is implied by its position in the record. The size of XML-based records can be a problem considering the vast number of billing records that are processed. With compression, Snow estimates that MXP records will be less than double the size of their CIBER equivalent.

The extensibility of XML is an advantage, but perhaps less than is often claimed. If a new type of parameter or record is added, applications that generate records will often need to be updated and applications that receive records will definitely need to be updated to avoid rejection or incorrect rating of incoming records. Some encoding changes will still require a simultaneous protocol upgraded by all MXP users.

XML leads to a great deal of flexibility in how records are generated, which is not necessarily a good thing. An error in a parser (e.g. rejection of a blank in a certain location) may not be found for some time, but when triggered (e.g. by a change in encoding by a record generator), it may result in the incorrect processing of huge numbers of records before the problem can be diagnosed and fixed. CIBER usually only has a single correct encoding for a particular record, but XML-based protocols like MXP have a large number of valid encodings.

Unlike CIBER, MXP was developed internally by CIBER, not by a committee of industry representatives. Its use is going to be expensive for small companies, as the annual license fee for MXP is US$30,000. An evaluation license is available for US$1,000.

Competition to MXP will come from CIBER (as some carriers may be unwilling to change, and Cibernet is committed to supporting this format), TAP (an extensible protocol used by GSM carriers, based on the more efficient ASN.1 encoding method) and IPDR, being developed as an IETF protocol (www.ipdr.org).

Comments

We welcome comments on the format or contents of *Cellular Networking Perspectives*. We can be reached via email at:

cnpsales@cnp-wireless.com

Circumnavigating SS7: MTP – Message Transfer Part Level 2

MTP is the foundation of the SS7 family of protocols; it is the one protocol that is always present in an SS7 protocol stack. Major capabilities it provides are:

- Reliable transmission of messages from one signaling point to another
- National routing, using point codes
- Identification of higher level protocols (e.g. ISUP, SCCP)

MTP is conceptually divided into 4 layers, although Levels 1 and 4 are not defined by MTP and Levels 2 and 3 are not separable (i.e. they must always be used together).

Level 1 (Physical/Data Link)

Level 2 (Link)

Level 3 (Network)

Level 4 (MTP Users – ISUP, SCCP and higher level protocols)

The structure of these protocol levels is illustrated in Figure 1.

Level 1: Physical

The physical layer of SS7 is defined outside the SS7 standard. Traditionally, SS7 ran over 64 kbps data links known as DS0. These may be aggregated in groups of 24 in T1 facilities or 32 in E1 facilities. Link speeds are often limited to 56 kbps in North America, because of 'bit robbing' for in-band signaling.

SS7 has been adapted to occupy a complete T1 facility (1.536 Mbps) or to run over ATM. The use of higher speed facilities is not transparent unless transmission is restricted to the 272 octet message size limitation of lower speed links.

MTP Level 2: Link Layer

The Link Layer of MTP provides reliable transportation of messages on a link between two Signaling Points (SP). Parameters at this level, unlike Level 3, terminate at the ends of the link.

MTP Level 2 Messages

Level 2 has three different message types, distinguished by the value of the Length Indicator (LI):

FISU – Fill In Signal Unit (LI=0)

This message carries no user data, but it can be used to ensure traffic continues on the link (for error monitoring) and to acknowledge received messages when there is nothing to transmit.

LSSU – Link Status Signal Unit (LI=1 or 2)

This type of message contains a 3-bit status field indicating a change in the status of a link:

Value	Name	Meaning
0 0 0	O	Out of alignment
0 0 1	N	Normal alignment
0 1 0	E	Emergency alignment
0 1 1	OS	Out of service
1 0 0	PO	Processor outage
1 0 1	B	Busy (congested)

MSU – Message Signal Unit (LI > 2)

This message contains data for MTP Level 3 and higher protocol layers. On 56/65 kbps links, the LI indicates the true length of messages, up to 62 octets in length. The value 63 indicates "63 or more octets", with lengths up to 272 octets allowed. On higher speed links, the 9-bit LI always indicates the true length of the message, up to 512 octets.

Level 3 contents of the MSU will be described in our April, 2002 issue.

Framing

SS7 messages are framed (delimited) by a special bit pattern known as a flag (01111110). If this pattern occurs within the frame, a technique known as bit-stuffing is used to obscure it. After any sequence of 5 consecutive 1 bits, a 0 is inserted upon transmission. Upon receipt, the 0 is removed before error detection.

Error Detection

Every MTP frame ends with 16 check bits derived from the contents of the frame using a polynomial algorithm. If the check bits are not correct when the frame is received, it will be discarded.

Retransmission

Loss of a message is detected through sequence numbers. Every frame contains its own (FSN – Forward Sequence Number). If a message is received with any sequence number except the next expected, it will be discarded.

Frames also contain the sequence number of the last message successfully received (in sequence) at the other end (BSN – Backward Sequence Number). This is an implicit acknowledgement of all outstanding messages with sequence numbers up to and including the BSN.

Frames are transmitted until a maximum number of unacknowledged frames is reached. At this point, frames will be retransmitted, starting with the oldest, until the frames are acknowledged by an increase in the received BSN.

Retransmission can also be triggered by a change in state of the Backward Indicator Bit (BIB), indicating that a frame was received out of sequence and that retransmission must occur. A corresponding change in state of the Forward Indicator Bit (FIB) acknowledges the start of retransmissions. All frames received with mismatched BIB/FIB are discarded.

Error Rate Monitoring

The error rate of SS7 links is continually monitored. One method subtracts 1 from a counter whenever a frame is acknowledged (but not below 0), and adds a larger number when an error is encountered. When a threshold is reached, the link will be taken out of service.

Flow Control

An SP receiving SS7 messages over a link may become congested and unable to receive any more messages (e.g. unable to forward them on). When this occurs, it stops acknowledging incoming messages and sends an LSSU containing a status of "B" (Busy).

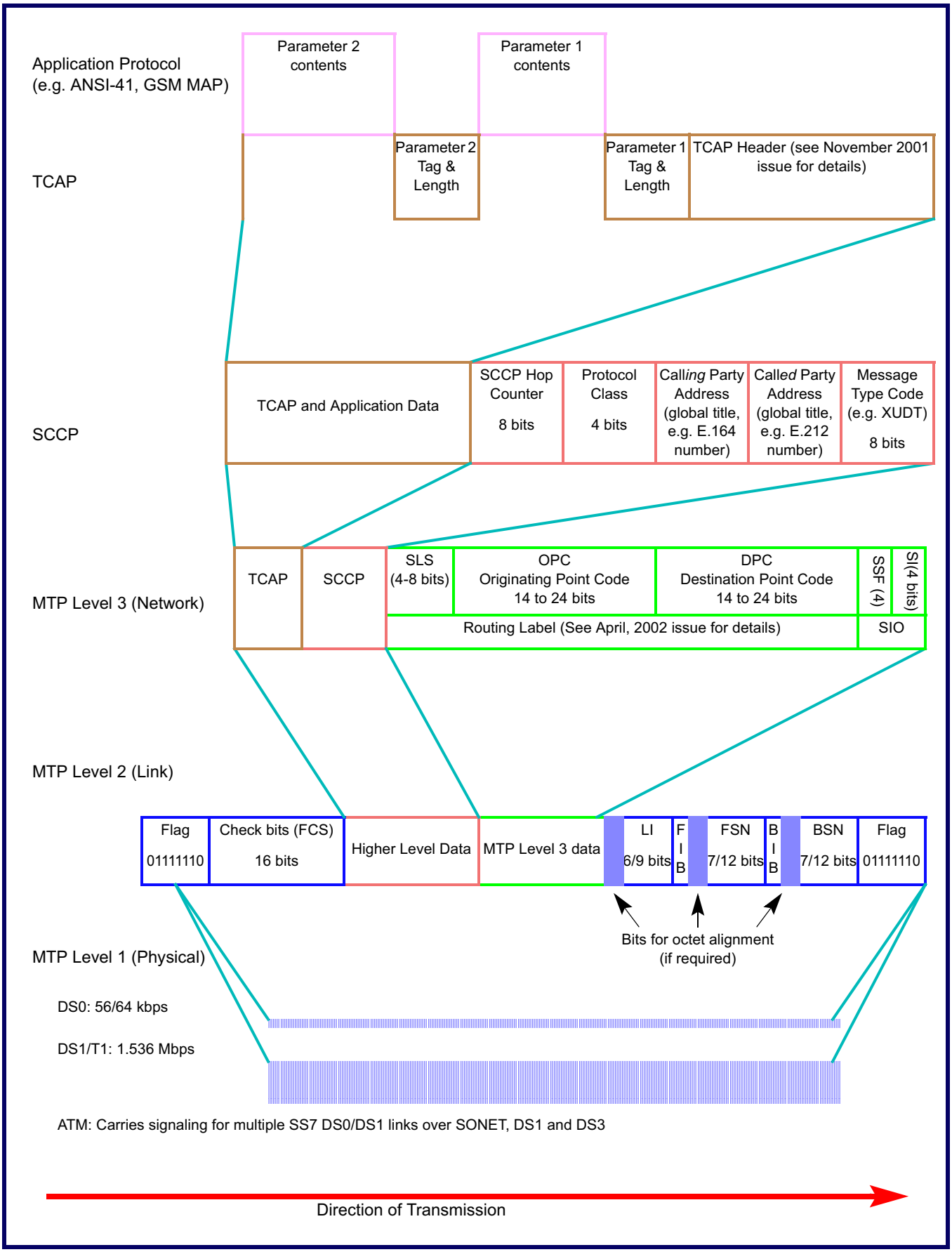
Link Establishment (Alignment)

SS7 links are brought into service by a process known as 'proving'. Messages (FISU) are transmitted for error rate monitoring purposes. If the proving period expires without the error threshold being reached, the link is brought into service. This process normally lasts for the time required to transmit 2^{14} octets (16,384), but an emergency proving period can be used to bring the link into service almost immediately.

To Be Continued . . .

We will continue our series on SS7 in our April 2002 issue, with a discussion of MTP Level 3. This level provides network services such as routing and sequencing of messages through multiple signaling points.

Figure 1: SS7 Protocol Levels (Example)



Overview of 3GPP TSG SA: Service & System Aspects

This is the second in a series of articles on 3GPP Technical Specification Groups (TSGs) which are responsible for the ongoing development of GSM standards and the emerging W-CDMA standards. For more detailed information on 3GPP activities, please contact us to discuss consulting services.

3GPP TSG SA (Service and System Aspects) is responsible for the overall architecture and service capabilities of systems based on 3GPP specifications. This includes responsibility for cross TSG coordination. Any difficulty that may appear in this role is reported to the PCG (3GPP Project Coordination Group).

The structure of TSG SA is illustrated in Figure 2.

TSG SA Responsibilities

Architecture

- Definition, evolution and maintenance of the overall system architecture, including the assignment of functions to particular subsystems (UTRAN, GERAN, CN, terminal, SIM/USIM), identification of key information flows and definition of required bearers and services offered by these different sub-systems
- In co-operation with the other TSGs, define required services, service capabilities and bearer capabilities offered by the different subsystems, including Quality of Service requirements for access to both packet and circuit switched networks.
- Development of service capabilities and a service architecture for cellular, fixed and cordless applications.
- Development of a framework for services, service capabilities, service architecture, charging and consideration of need for «default» services and/or applications.
- Definition of a security framework and review of security aspects of the overall system.

Coordination

- Management of work items, including assignment of tasks to other TSGs and monitoring of progress.

Stage 1 and 2 Descriptions:

- Charging and Accounting (Billing)
- Network Management
- Security (e.g. authentication, privacy)

Codec (Voice Coders etc.)

- Principles for definition of end-to-end transmission.
- Definition, evolution and maintenance of voice and multimedia codec specifications.

Working Group 1: Services

3GPP TSG SA WG1 (SA1 – Services) is responsible for defining 3G services and features. The group sets high level requirements for the overall system, and it provides this in a Stage 1 description.

SA1 Responsibilities

- Definition of service and feature requirements
- Framework for services
- Specification of services and service capabilities
- Identification of technical and operational issues to meet market requirements
- Charging and accounting requirements.

SA1 Work Items

- UMTS/WLAN interworking
- Presence Service (e.g. for Instant Messaging)
- Multimedia Broadcast/Multicast service
- Priority Service
- Digital speech recognition
- Digital intellectual property rights management
- User Equipment (UE) functionality split
- Multimedia Messaging Service (MMS)
- Open Service Access (OSA)
- Generic user profile
- Push services
- Location service

Updated SA2 Specifications

TSG SA WG1 presented the following specifications for information at the December 2001 meeting:

- TS 22.233 Transparent End-to-End Packet Switched Streaming Service
- TS 22.243 Distributed Speech Recognition
- TR 22.944 UE Functionality Split

SA1 Progress

Progress was made on revised specifications on the following topics:

- Circuit Teleservices supported by a Public Land Mobile Network (PLMN)
- Service accessibility
- Handover Requirements between UMTS and GSM and other radio systems
- Stage 1 descriptions for Location Services (LCS), CAMEL, Open Services Access (OSA), Multimedia Messaging Service (MMS), Presence Service and Multimedia Broadcast/ Multicast Service

What is Stage 1?

Stage 1 is a high level description of a feature, service or capability. They describe 'what' it does, and not 'how'.
Stage 2 describes the network messaging, often diagramatically.
Stage 3 is the protocol specification, including precise definitions of messages, parameters and procedural specifications of how they are used.

Working Group 2: Architecture

TSG SA WG2 (SA2 – Architecture) is responsible for developing the Stage 2 description of the 3GPP network architecture (network reference model). Based on services requirements from SA1, SA2 identifies the main functions and entities of the network, how they are linked to each other and the information they exchange. The output of SA2 is used by the groups defining the precise format of messages in Stage 3. The only exception is the Stage 2 for the Radio Access Network, which is TSG RAN's responsibility.

Updated SA2 Specifications

TSG SA WG2 presented the following specifications for information at the December 2001 meeting:

- TR 23.815 Charging implication of IMS architecture (Release 5)
- TR 23.871 Enhanced support for User Privacy

New or Revised Work Items

- New: Unequal Error Protection for PS conversational multimedia service
- Revised: Release 5 Location Services (LCS)

SA2 Progress

Progress was made on revised specifications on the following topics:

- Network Architecture
- General Packet Radio Service (GPRS) Service description; Stage 2
- Virtual Home Environment (VHE); Stage 2
- End-to-end quality of service concept and architecture
- Architectural requirements
- Global text telephony; Stage 2: Architecture
- IP multimedia subsystem (IMS); Stage 2
- Intra-domain connection of radio access network nodes to multiple core network nodes
- Functional stage 2 description of location services (LCS)

Working Group 3: Security

TSG SA WG3 (SA3 – Security) is responsible for the security of the 3GPP system. This includes defining security requirements for the overall 3GPP system, performing analyses of potential security threats and considering new threats introduced by IP-based services and systems. SA3 aims to provide at least the same level of security and confidentiality as GSM, with better security in many areas. SA3 analyses the security implications of new services as they are developed. It has one sub-working group studying legal intercept (often known as lawfully authorized electronic surveillance, LAES).

SA3 Responsibilities

- Determining the objectives and priorities for UMTS security, considering the needs of users, operators, regulators and manufacturers.
- Accommodating, when possible, regional regulatory variations in security objectives and priorities and regional regulatory requirements related to the processing of personal data and privacy.
- A threat analysis for UMTS.
- Security requirements for UMTS, including:
  - security requirements for services
  - user access to services
  - billing and accounting
  - operations and maintenance
  - fraud control.
- Security requirements for the physical elements of UMTS, including:
  - Radio access network (RAN)
  - Core network (CN) and its interfaces to non-UMTS networks
  - Terminals
  - User identity modules (UIM)
  - Interfaces between UMTS networks.
- Defining how the specifications for security elements are to be integrated into the physical elements of UMTS, listed above.
- Security architecture for UMTS which meets the security requirements and aligns with the UMTS system architecture.
- Specifications for all the elements in the security architecture and their operations and management.
- Specifications for the operations and management of the security elements.
- Requirements specifications for any cryptographic algorithms needed for the security elements.
- Ensuring the availability of any cryptographic algorithms which need to be part of the common specifications.
- Requirements for lawful interception in UMTS, including specifications needed to meet those requirements. This work will be performed in conjunction with regional standards bodies.
- A time and milestones plan for the introduction of various elements of the security architecture which aligns with the security priorities and the phasing of UMTS.
- Guidelines on the use of the UMTS security elements, including any requirements for operator specific algorithms.
- Guidelines on the limitations of UMTS security, including the implications of not activating the security elements that are provided.

SA3 Updated Specifications

TSG SA WG3 presented the following specifications for information at the December 2001 meeting:

- TS 33.203 Access Security for IP-based Services (Release 5)
- TS 33.200 MAP Security (Release 5)
- TS 33.210 Network Domain Security

New SA3 Work Item

- Support for subscriber certificates.

SA3 Progress

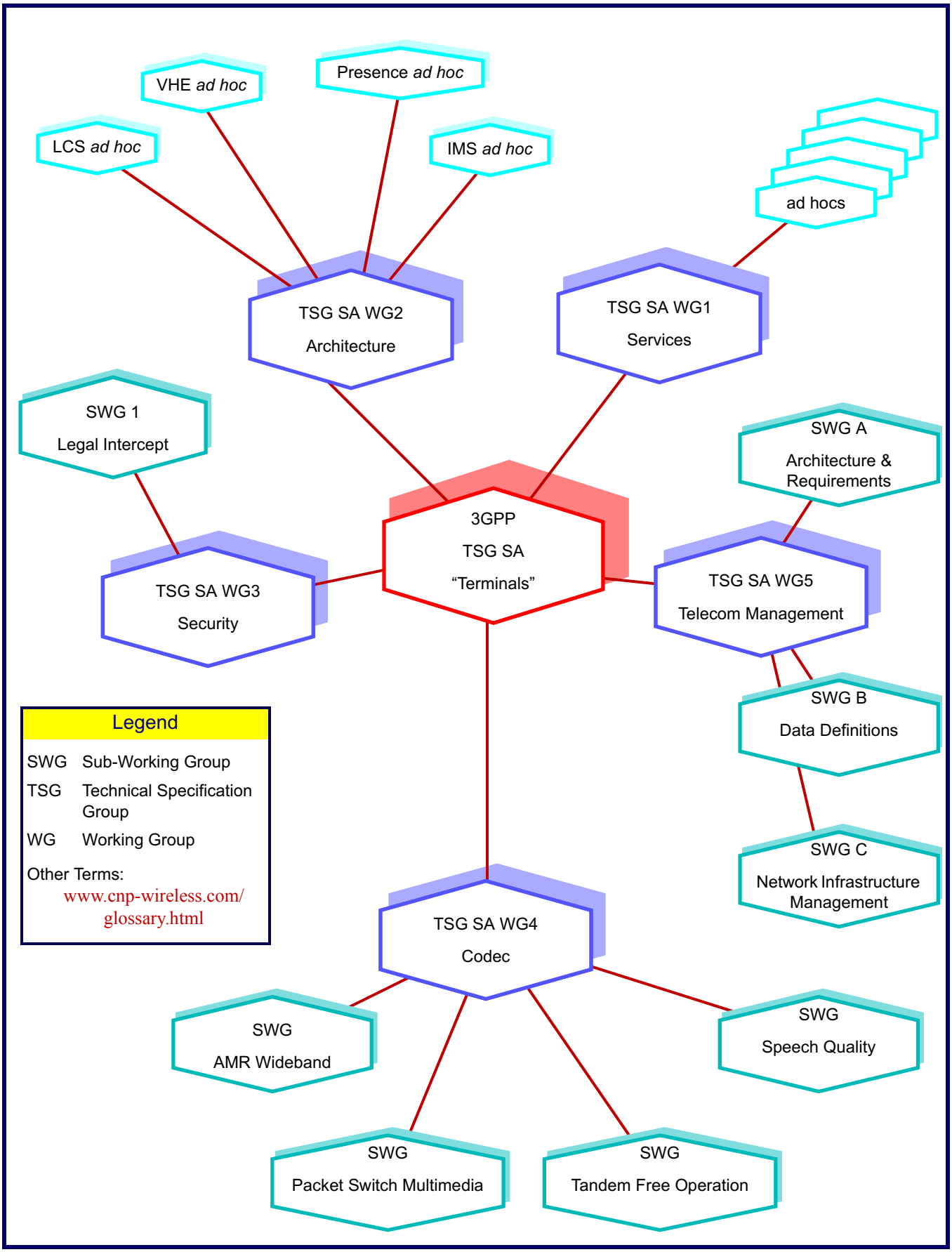
- 3G security; Security architecture
- Lawful interception architecture and functions
- Network Domain Security – MAP
- Access domain security

Working Group 4: Codecs

TSG SA WG4 (SA4 – Codecs) is responsible for the specification of speech, audio, video, and multimedia codecs, in both circuit-switched and packet-switched environments. This includes quality evaluation, end-to-end performance, and interoperability aspects with existing mobile and fixed networks. SA4 has four sub-working groups:

- SWG Speech Quality
- SWG AMR-WB (Adaptive Multi-rate voice coder for Wideband CDMA)
- SWG Tandem Free Operation (TFO)
- SWG Packet Switch Multimedia (PSM).

Figure 2: TSG SA Organization



SA4 Responsibilities

- Development and maintenance of specifications for speech, audio, video, and multimedia codecs, as required to enable services specified for 3G terminals and systems.
- Providing guidance to other 3GPP groups concerning required QoS parameters and other system implications, including channel coding requirements, imposed by different multimedia codecs in both circuit-switched and packet-switched environments.
- Evaluating speech, audio, video, and multimedia quality. This includes the development of new evaluation methods, testing, verification, characterization and selection criteria.
- Defining end-to-end performance, including terminal characteristics, of speech, audio, video, and multimedia services.
- Interoperability of codecs with existing mobile and fixed networks.

SA4 Updated Specifications

SA4 presented the following specification for information at the December 2001 meeting:

- TR 26.976 AMR-WB Speech Codec Performance Characterization (Release 5)
- TS 26.204 ANSI-C code for the floating-point AMR Wideband Speech Codec (Release 5)
- TS 26.236 Update Transport Protocol Specification for PS Conversational Multimedia (Release 5)
- TS 26.140 Multimedia Messaging Service (MMS) Media formats and codecs (Release 5)

SA4 Progress

- C source code for AMR speech codec
- Codec lists
- C source code for AMR-WB speech codec
- Test sequences for AMR-WB
- Mandatory speech codec speech processing functions
- Transcoding functions for AMR-WB
- General description, protocols and codecs for end-to-end transparent streaming service
- Stage 3 service description for Inband Tandem Free Operation (TFO)

Working Group 5: Telecom Management

SG SA WG5 (SA5 – Telecom Management) is responsible for the framework and requirements for management of the 3G system, delivering the architecture descriptions of the telecommunication management network (TMN) and coordinating work of all TSGs that is pertinent to the 3G system telecom management. SA5 is organized into 3 subgroups:

- Sub Working Group A (SWG-A) – Telecom management architecture and requirements
- Sub Working Group B (SWG-B) – Telecom management data definition
- Sub Working Group C (SWG-C) – Telecom Network Infrastructure Management.

SA5 Work Items

- Charging and OAM&P
- Subscription Management
- User Equipment Management
- Network Management Architecture

SA5 Status

At the December 2001 meeting, the SA5 chairman announced that he would not be continuing his Chairmanship. SA5 was also requested to determine the time it would take to complete its Release 5 Work Items so that it can be decided, at the March 2002 meeting, which should remain in the Release 5 schedule.

New SA5 Work Item

- Charging Management and Performance Management under OAM&P.

SA5 Progress

Progress has been made on revised specifications on the following topics:

- Charging and billing; 3G call and event data for the Packet Switched (PS) domain
- 3G Performance Management
- Fault Management; Part 2: Alarm Integration Reference Point: Information Service
- Configuration Management
  - Part 4: Notification Integration Reference Point: CMIP Solution Set, Version 1:1
  - Part 7: Basic Configuration Management IRP CMIP Solution Set, Version 1:1
  - Name convention for Managed Objects
  - Notification Integration Reference Point; Information Service, Version 1
  - Basic Configuration Management IRP CMIP Solution Set
  - Generic Network Resources IRP: CORBA Solution Set

TIA TR-45.3 TDMA Digital Air Interface Standards

Cellular Networking Perspectives

Editor: David.Crowe@cnp-wireless.com *Last published September, 2001*

Note: 1. IS- Interim Standard, TSB- Telecommunications Systems Bulletin, PN- Project Number, SP- ANSI Standards Proposal.
2. Bold Type indicates a modification since the previous publication of this information.
3. Published TIA standards can be obtained from TIA at www.tiaonline.org/standards/search_n_order.cfm

Thanks to Peter Nurse (Chair, TR-45.3) for his assistance compiling the information in this table.

First Generation (IS-54)

Standard	Description	Status
TIA/EIA-627	ANSI version of TDMA Dual-Mode Air Interface Standard	Published 06/96
TIA/EIA-627-1	Addendum to TDMA dual-mode air interface standard	Published 04/98 Rescinded 06/00
TIA/EIA-628	TDMA mobile station minimum performance standards	Published 06/96 Rescinded 06/00
TIA/EIA-629	TDMA base station minimum performance standards	Published 06/96 Rescinded 06/00
TIA/EIA-635	TDMA full-rate voice coder (3:1)	Published 06/96 Rescinded 06/00
IS-54-B	Original TDMA Dual-Mode Air Interface Standard (replaced by TIA/EIA-627)	Published 01/92 Rescinded 09/96
IS-55	TDMA mobile station minimum performance standards (Replaced by TIA/EIA-628)	Published Rescinded 09/96
IS-56	TDMA base station minimum performance standards (replaced by TIA/EIA-629)	Published Rescinded 09/96
TSB46	Verification of Authentication for IS-54-B Mobiles	Published 03/93 Rescinded 10/00
TSB47	IS-54 Implementation Issues	Published 05/94 Rescinded 10/00
TSB50	User Interface for Authentication Key Entry	Published 03/93

Second Generation (IS-136 Revision 0 - Digital Control Channel)

Standard	Description	Status
IS-130	Data services radio link protocol (RLP)	Published 04/95
IS-135	Asynchronous data and fax services	Published 04/95 Rescinded 04/00
IS-137	TDMA/analog mobile minimum performance standards	Published 12/94
IS-138	TDMA/analog base station minimum performance standards	Published 12/94
IS-136.1	Digital Control Channel (DCCH)	Published 12/94
IS-136.1/2-1	Addenda to IS-136 Rev. 0	Published 12/94
IS-136.2	FSK control channel, analog voice channel, TDMA traffic channel	Published 12/94

Third Generation - IS-136 Revision A (ACELP Voice Coder)

Standard	Description	Status
IS-130-A	Data Services Radio Link Protocol (RLP)	Published 09/97 Rescinded 04/00
IS-137-A	Mobile minimum performance standards for IS-136-A	Published 07/96 Rescinded 04/00
IS-138-A	Base station minimum performance standards for IS-136-A	Published 07/96 Rescinded 04/00
IS-641-A	**Enhanced full-rate (ACELP) voice coder, Revision A**	**Published 05/96 Rescinded 02/02**
IS-684	Isochronous radio link protocol for data (for STU-III). Replaced by TIA/EIA-136-320	Published 07/96 Rescinded 04/00
IS-686	Enhanced full rate voice coder performance standards	Published 12/96 Rescinded 04/00
IS-727	**Discontinuous transmission (DTX) with ACELP (IS-641) voice coder, including generation of comfort noise**	**Published 07/98 Rescinded 02/02**
IS-136.1-A	Enhanced digital control channel (9-1-1, OTA, Calling Name ID, One-button Callback, Private Networks (enhanced), PACA)	Published 10/96 Rescinded
IS-136.1-A-1/2	IS-136 Rev. A corrections (two addenda)	Published 11/96, 12/97
IS-136.2-A	FSK control channel, analog voice channel, TDMA traffic channel	Published 10/96 Rescinded
TSB73	IS-136 Rev. 0/Rev. A compatibility issues	Published 07/96
TSB77	Interoperable Implementation Issues in IS-641 (ACELP voice coder)	Published 07/97
TSB105	Audit order clarification	Published 03/99
TSB108	Determining when R-DATA is encrypted	Published 03/99

Fourth Generation - TIA/EIA-136 Revision 0

Standard	Description	Status
TIA/EIA-136	SMS enhancements and double/triple rate channels (symmetrical/asymmetrical)	Published 03/99
TIA/EIA-136-010	Optional mobile station facilities	
TIA/EIA-136-020	SOC, BSMC and carrier specific HLPI assignments	
TIA/EIA-136-100	Introduction to channels	
TIA/EIA-136-110	RF channel assignments	
TIA/EIA-136-12x	Digital control channel (DCCH) layer 1 (136-121), 2 (136-122) and 3 (136-123)	
TIA/EIA-136-13x	Digital traffic channel (DTC) layer 1 (136-131), 2 (136-132) and 3 (136-133)	
TIA/EIA-136-140	Analog (FSK) control channel	
TIA/EIA-136-150	Analog voice channel	
TIA/EIA-136-2x0	Minimum performance requirements for ACELP voice coder (136-210), VSELP voice coder (136-220), mobile station (136-270) and base station (136-280)	
TIA/EIA-136-410	ACELP voice coder	

TIA/EIA-136-420	VSELP voice coder
TIA/EIA-136-510	Authentication and encryption of signaling information, user data and voice
TIA/EIA-136-7x0	SMS: Introduction to teleservices (700), text/numeric messaging (710), Over-the-Air Activation (OATS; 720) and Over-the-Air Programming for intelligent roaming (OPTS; 730)
TIA/EIA-136-910	Informative information

Fifth Generation - TIA/EIA-136 Revision A

Standard	Description	Status
TIA/EIA-136-A	Revised parts include 136-010, 020, 100, 121,131,133,140,150,270, 280, 510, 700, 710, 720 and 910. New parts are listed separately	Published 12/99
TIA/EIA-136-310-1	Radio link protocol 1 (for data services)	
TIA/EIA-136-310-A	**Addendum to RLP**	**Published 06/01**
TIA/EIA-136-350-A-1	**Data services control addendum**	**Published 06/01**
TIA/EIA-136-410-1	**ACELP voice coder, addendum 1**	**Published 09/01**
TIA/EIA-136-430	US1 voice coder (GSM compatible)	
TIA/EIA-136-511	List of messages subject to encryption	
TIA/EIA-136-620-1	TSAR: teleservice allowing segmentation and reassembly	
TIA/EIA-136-630	BATS: broadcast short message	
TIA/EIA-136-730-1	OPTS: over-the-air programming teleservice to support intelligent roaming	
TIA/EIA-136-750	GUTS: general UDP transport service	

Sixth Generation - TIA/EIA-136 Revision B - UWC-136 - ITU-R 3G Specification

Standard	Description	Status
TIA/EIA-136-B	Revision B. Only new parts are listed. Includes EPE and charge rate indicator	Published 03/00
TIA/EIA-136-230	US1 (GSM) voice coder minimum performance requirements	
TIA/EIA-136-270-1	MS minimum performance standards (Addendum)	
TIA/EIA-136-290	RF minimum performance for 200 kHz and 1.6MHz bearers (136HS)	
TIA/EIA-136-330	Packet data service - overview	
TIA/EIA-136-331	Packet data service - physical layter	
TIA/EIA-136-332	Packet data service - medium access control (MAC)	
TIA/EIA-136-333	Packet data service - logical link control. Based on GSM 04.64.	
TIA/EIA-136-334	Packet data service - subnetwork dependent convergence protocol. Based on GSM 04.65.	
TIA/EIA-136-335	Packet data service - radio resource management	
TIA/EIA-136-336	Packet data service - mobility management	
TIA/EIA-136-337	Packet data service - tunneling of signaling messages. Subset of GSM 09.18	
TIA/EIA-136-34X	Outdoor high-speed packet data service: Overview (340), Physical layer (341) and MAC (342)	
TIA/EIA-136-36X	Indoor high-speed packet data service: Overview (360), Physical layer (361) and MAC (362)	
TIA/EIA-136-511	Messages subject to encryption	
TIA/EIA-136-610	R-DATA/SMDPP Transport	
TIA/EIA-136-760	Charge-rate indication teleservice (CIT)	
TIA/EIA-136-900	Introduction to Annexes and Appendixes	

TIA/EIA-136-905	Normative information	
TIA/EIA-136-932	Packet data services - Stage 2 description	
TIA/EIA-136-933	Packet data services - Description of MAC layer	
TIA/EIA-136-940	Capacity and performance characteristics of UWC-136 (TIA/EIA-136-B)	
IS-839	R-UIM Overview, Operation, and File Structure Support in TIA/EIA-136, Rev B	Published 11/00
IS-842	**GSM Hosted SMS Teleservice (GHOST)**	**Replaced by TIA/EIA-136-71**

Seventh Generation - TIA/EIA-136 Revision C

Standard	Description	Status
TIA/EIA-136-C	**Revised parts include 000-C, 005-B, 010-C, 020-C, 100-B, 110-B, 123-C, 131-C, 133-C, 210-A, 270-C, 280-C, 290-A, 350-B, 610-A, 620-A, 700-C**	**Published 06/01**
TIA/EIA-136-030	R-UIM (Smart Card) overview and operation	
TIA/EIA-136-033	R-UIM/ME file structure	
TIA/EIA-136-033-1	**R-UIM/ME file structure addendum 1**	**Published 10/01**
TIA/EIA-136-034	R-UIM/ME interface procedures	
TIA/EIA-136-036	Personalization of mobile equipment (ME)	
TIA/EIA-136-037	R-UIM/ME application toolkit	
TIA/EIA-136-240	AMR (Adaptive Multi-Rate Vocoder) minimum performance	
TIA/EIA-136-250	VAD (Voice Activity Detection) minimum performance	
TIA/EIA-136-350-C	Data services control addendum	Ballot
TIA/EIA-136-351	EGPRS-136 - AT commands	
TIA/EIA-136-370	EGPRS-136 - Overview	
TIA/EIA-136-376	EGPRS-136 - Mobility management	
TIA/EIA-136-377	EGPRS-136 - Gs interface specifications	
TIA/EIA-136-440	AMR adaptive multirate codec (also used in GSM and UMTS)	
TIA/EIA-136-440-1	**Revision to AMR adaptive multirate codec**	**Published 09/01**
TIA/EIA-136-670	Broadcast teleservices over GSM SMS (TOGS)	
TIA/EIA-136-740	SAMPS - System assisted MS positioning through satellite (i.e. GPS)	
TIA/EIA-136-972	EGPRS-136 - Stage 2 descriptions	
IS-823	**Modification to ACELP voice coder to transmit 45.45 and 50 bps TTY/TDD tones**	**Published 05/00 Rescinded 02/02**
IS-823-A	**Modification to ACELP voice coder to transmit 45.45 and 50 bps TTY/TDD tones**	**Published 09/01**
IS-840	**Minimum performance for TTY/TDD detector and regenerator**	**Published 05/00 Rescinded 02/02**
IS-840-A	**Minimum performance for TTY/TDD detector and regenerator**	**Published 09/01**
IS-869	**Analog SAMPS support in TIA/EIA-136-C**	**Replaced by TIA/EIA-136-74**
TSB138	**Clarification of IS-823-A (ACELP voice coder)**	**Ballot 03/02**

Eighth Generation - TIA/EIA-136 Revision D

Standard	Description	Status
TIA/EIA-136-271	MS minimum performance for global circulation	Ballot 12/01
TIA/EIA-136-710	Cellular messaging teleservice (text SMS)	Re-ballot 03/02
TIA/EIA-136-711	GSM hosted SMS teleservice (GHOST)	Ballot 12/01
TIA/EIA-136-741	Analog SAMPS (System Assisted Mobile Positioning through Satellite)	Ballot 12/01
TIA/EIA-136-D	Revised parts 000-D, 020-D, 030-A, 033-A, 034-A, 037-A, 123-D(reballot), 133-D, 280-D, 350-C, 610-B, 700-D, 720-C, 730-A, 760-A, 910-C	Re-ballot 03/02
TSB132	UIM elementary file alignment issues in TIA/EIA-136-033	Published