Cellular Networking Perspectives

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Comments

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

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Next Issue: November 1st, 2000

Priority Access Service: A Dissenting Opinion

A well-placed source, who wishes to remain anonymous, has some valuable feedback on our September, 2000 article on the Priority Access Service.

- PAS is not PACA! PAS is just a requirement that a Priority Access Service be provided to qualified and authorized national security and emergency preparedness (NS/EP) users in emergencies. PAS can be achieved through PACA, Channel reservation, WIN queuing or proprietary implementations.
  [ed. Yes, but without a standard queuing methodology (of which PACA is the only one available) it is unlikely that phones will work in the coverage area of all US carriers, and therefore manufacturers will be unlikely to build phones, and emergency workers will not necessarily able to roam.]
- Although the FCC Ruling does not specifically address priority access to outgoing trunks, can we extrapolate and view egress as the mirror image of access or even view egress as access to the PSTN and thus use the same/similar solutions on both ends?
  [ed. PACA egress is not explicitly included or excluded by the FCC order, so it could be provided if carriers felt that it was worth their while, perhaps as an extra-cost service].
- The support for analog systems although desirable will not be a driver in the provisioning of PAS. The NCS has to commit its limited resources to future technology. In as much as any implementations can include the support of analog systems, such implementations would be welcome, but, the NCS is not likely to focus their efforts on "old" technology.
  [ed. If analog is not supported, then PAS-capable phones will not be able to carry their capabilities between carriers with different choices of digital technology.]
- By the way *NCS* standards for National Communications *System*, not *Service*. [ed. oops!]
- Finally, although the FCC order mentions "A feature code (*XX)" as the means by which PAS is invoked, we do not believe that service providers are limited to this mechanism.

Wiretap Troubles: Not just the American Way

Much of the attention in the telecommunications industry has focused on the very public development of lawfully authorized surveillance ('wireless wiretap') to meet US CALEA legislative requirements, through the combined bickering of the US Congress, the telecom industry, law enforcement, FCC and most recently the courts.

But these controversies are not limited to the USA. On September 28, 2000 in Russia, the Supreme Court overturned a Communications Ministry order that would have allowed law enforcement access to all communications, with these

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organizations, not telecom carriers, being responsible for the minimization of communications (i.e. determining what can lawfully be monitored and what must be discarded).

SAMPS – Assisted GPS for TDMA

Hans Carlsson, Ericsson

SAMPS (System Assisted Mobile Positioning through Satellite) is a standard for positioning using assisted GPS. In assisted GPS technologies the Mobile Station (MS) is equipped with a GPS receiver and utilizes assistance from the wireless network to improve its sensitivity and reduce the time to the first position fix.

SAMPS is part 740 of revision C of TIA/EIA-136. This revision of the standard is currently in ANSI and TIA ballot. SAMPS started out in 1999 as a UWCC initiative. In December of 1999, UWCC submitted proposals for the new feature to TIA TR-45.3 and also provided draft text for the SAMPS Stage I and Stage II documents.

Positioning related services are currently receiving a lot of interest in the wireless industry. One reason is the FCC E911 phase 2 mandate which requires wireless operators to be able to locate 67% of 911 calls within 100 meters and 95% within 300 meters if they use a network based solution to fulfil the requirements. Wireless operators that use a handset-based solution have to locate 67% of 911 calls within 50 meters and 95% within 150 meters.

However, another possibly even more important reason why positioning is getting attention is the possibility of value-added applications for positioning that are possible, especially in connection with the Wireless Internet. This includes new services like location sensitive yellow pages, wireless chat where you can keep track of your friends and a map that "follows" you. There are endless possibilities for applications integrating positioning and data services.

An assisted GPS technology is a very good way to fulfil the needs for value-added positioning applications and the FCC E911 mandate. GPS provides a very high accuracy for positioning. With the recent removal of Selective Availability (SA) in the GPS system, the accuracy is even better than before. The SAMPS standard is created to fulfill the need for an assisted GPS standard in TDMA.

SAMPS – A Flexible Positioning Solution

Only one thing is certain about the future, we can never know for sure what it will bring. This is very true for future positioning applications. There are many guesses about which ones will be successful and what kind of applications will be designed, but nobody knows for sure. This was taken into account during the creation of SAMPS, which has been designed to be flexible and able to meet future needs.

The main goal of SAMPS is to provide a GPS solution for value-added positioning services. A secondary goal is that it should be one possible technology to fulfil the FCC E911 mandate. Another is to utilize the data capabilities of TDMA wireless networks to enhance the performance of GPS-equipped Mobile Stations.

The network achieves enhanced performance by providing *GPS Assistance Data* to the MS. Compared to conventional GPS receivers, this improves the sensitivity of the GPS receivers in the MS. This also allows a SAMPS capable MS to determine its position faster than with a conventional GPS receiver.

The SAMPS service was designed to allow an application to requests a mobile station's position with a specified Quality of Service (defined as accuracy and response time). The mobile station is able to allow or deny each request. SAMPS was also developed to support both TDMA networks that are synchronized to GPS time and TDMA networks that are not.

TDMA Convergence

There is an ongoing convergence of TDMA and GSM where, for example, both technologies use GPRS for packet-data, and both use EDGE as an air-interface technology. In line with this, another design goal of SAMPS was to build on GSM Location Services (LCS) work that had already been completed. Many benefits were found by using this approach. An obvious one was that the SAMPS standard was developed quickly, because there was a clear direction to follow in the development work. Another big benefit is that synergies can be used in product development for GSM and TDMA mobile stations and network infrastructure. It will also simplify future support for positioning in EGPRS-136 networks (EGPRS-136 is a network using ANSI-41/ANSI-136 for circuit services and EGPRS for packet services and is defined in TIA/EIA-136-370).

Architecture and Capabilities

The main elements that are used to perform the functions of the SAMPS service are the MS and the SAMPS Teleservice Server (SAMPS TS), which is a specialized kind of short message center (MC). All SAMPS messages are exchanged between the MS and the SAMPS TS.

There are two different types of SAMPS Teleservice Servers, the Serving SAMPS TS and the Home SAMPS TS. The Serving SAMPS TS provides the MS with GPS Assistance Data and delivers requests for positioning to the MS. The Home SAMPS TS positioning client contains subscription and authorization information and handles authorization of positioning requests. In terms of the Network Reference Model in J-STD-036, the Serving SAMPS TS is equivalent to a PDE and the Home SAMPS TS is equivalent to an MPC.

Building on SMS

SAMPS utilizes TDMA teleservices (SMS) as a transport mechanism for its messages, as shown in Figure 1, it is merely another teleservice to TIA/EIA-136. This allows SAMPS to take advantage of the teleservice support that already exists and means that there are almost negligible impacts on the MSC, VLR and HLR nodes.

The use of teleservices also provides SAMPS with support features like seg-

mentation (using TSAR) and encryption. TDMA teleservices can be used in either a point-to-point mode or broadcast mode, and thus, SAMPS can be used to deliver GPS assistance data either via point-to-point messages (i.e. directed at a single MS) or as broadcast information (i.e. directed to all listening mobiles).

Signaling for SAMPS is supported both on the Digital Traffic Channel (DTC) and the Digital Control Channel (DCCH), so SAMPS may be utilized both for MSs in idle mode and for MSs engaged in a call.

For networks that are not synchronized to GPS, an additional optional capability has been defined for the MS that allows it to report the timing relationship between time on a DCCH and GPS time as well as frame offsets between a DCCH and a DTC. This function is equivalent to the Location Measurement Unit (LMU) function in GSM LCS.

Several different capabilities have been defined for Mobile Stations supporting SAMPS. A MS may include one or several of the following capabilities:

- The capability to determine and send Position Information as a stand-alone GPS receiver (MS-Based stand-alone)
- The capability to determine and send Position Information after obtaining information from the network (MS-Based with network assistance)
- The capability to determine and send the GPS Measurement Data (MS-Assisted)
- The capability to determine and send Reference Time for a DCCH (LMU function)

In the MS-Based options the MS determines its own position and report it to the SAMPS TS. The MS-Based option contains two flavors, one where the MS is truly stand-alone, and another one where the MS utilizes assistance from the SAMPS TS in order to calculate its position.

In the MS-Assisted option, the MS makes GPS measurements and sends them to the SAMPS TS which calculates the position of the MS.

Usage Scenarios

There are five main usage scenarios with associated messages for SAMPS:

- Mobile Terminated Positioning Request
- Mobile Originated Positioning Assistance Request
- Autonomous Mobile Originated Positioning Delivery
- Mobile Originated Positioning Request
- Emergency Position Report

Mobile Terminated Positioning Request

This procedure allows a SAMPS TS to ask a MS for its position. Requests may be for an immediate answer. They may also request one or more deferred responses (e.g. regular position updates). The procedure is also used to ask the MS that is capable of reporting timing about the timing relationship between time on a DCCH and GPS time as well as frame offsets between a DCCH and a DTC. The Mobile Terminated Positioning Request procedure utilizes the Measure Position Request and the Measure Position Response messages and is shown in Figure 2 below. It may also utilize the Positioning Assistance Request and Positioning Assistance Response messages.

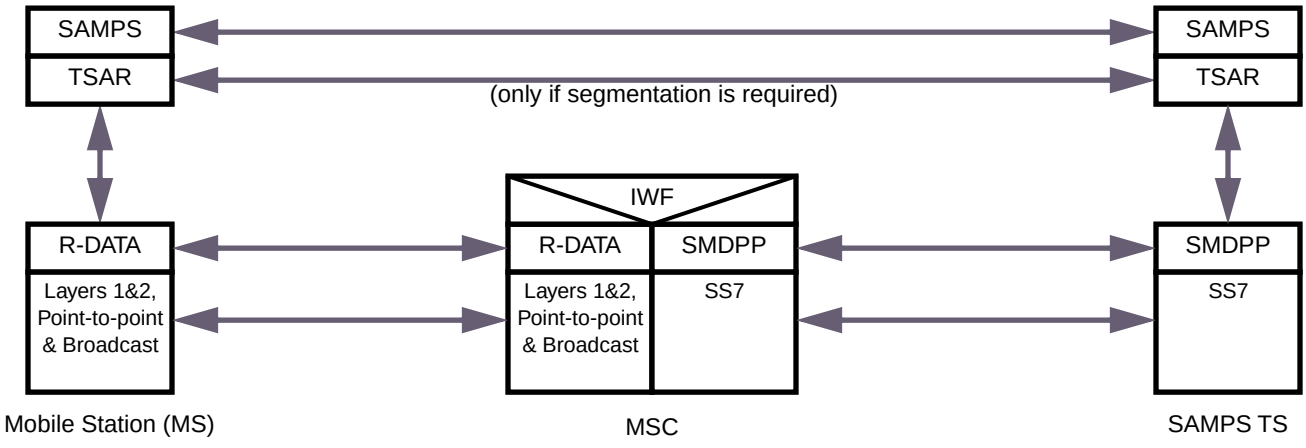
Mobile Originated Position Assistance

This request allows the MS to ask the Serving SAMPS TS for GPS assistance data. The MS uses the Positioning Assistance Request message to ask for assistance from the Serving SAMPS TS, which is delivered in the corresponding Response message. This procedure is also used by an MS that has only implemented the MS-Assisted option to send GPS measurements to the Serving SAMPS TS and get its own position back in the response.

Mobiles Autonomously Reporting Position

For applications that need the MS to report its own position at the discretion of the MS, there is the Autonomous Mobile Originated Positioning Delivery procedure. The MS sends the Autonomous Position Response message to the Home SAMPS TS in this procedure.

Figure 1: SAMPS Protocol Architecture



Mobile Requesting Position of Another Mobile

The Mobile Originated Positioning Request procedure is used by the MS to request the position of another (the target) MS. The MS sends this message to the Home SAMPS TS, which determines if the MS is authorized to ask for the position of the Target MS, and if so, returns the position of the Target MS to the requesting MS. This procedure may be part of a special-purpose application within an MS.

Emergency Calls

Finally, there is the Emergency Position Report procedure that is a possible procedure for the MS to use when delivering the position or GPS measurements to the Serving SAMPS TS for position determination for an emergency call. The Emergency Position Report message is used for this procedure. An alternative procedure that may be used to deliver the position or GPS measurements to the Serving SAMPS TS in connection with an emergency call is the Mobile Terminated Positioning Request procedure.

Summary

SAMPS is a versatile positioning feature that provides many "tools" for designing positioning applications. There are a variety of procedures to use and various capabilities of the mobile stations and the TDMA network. This should allow SAMPS to be a very useful service no matter which positioning applications

and services are successful in the future.

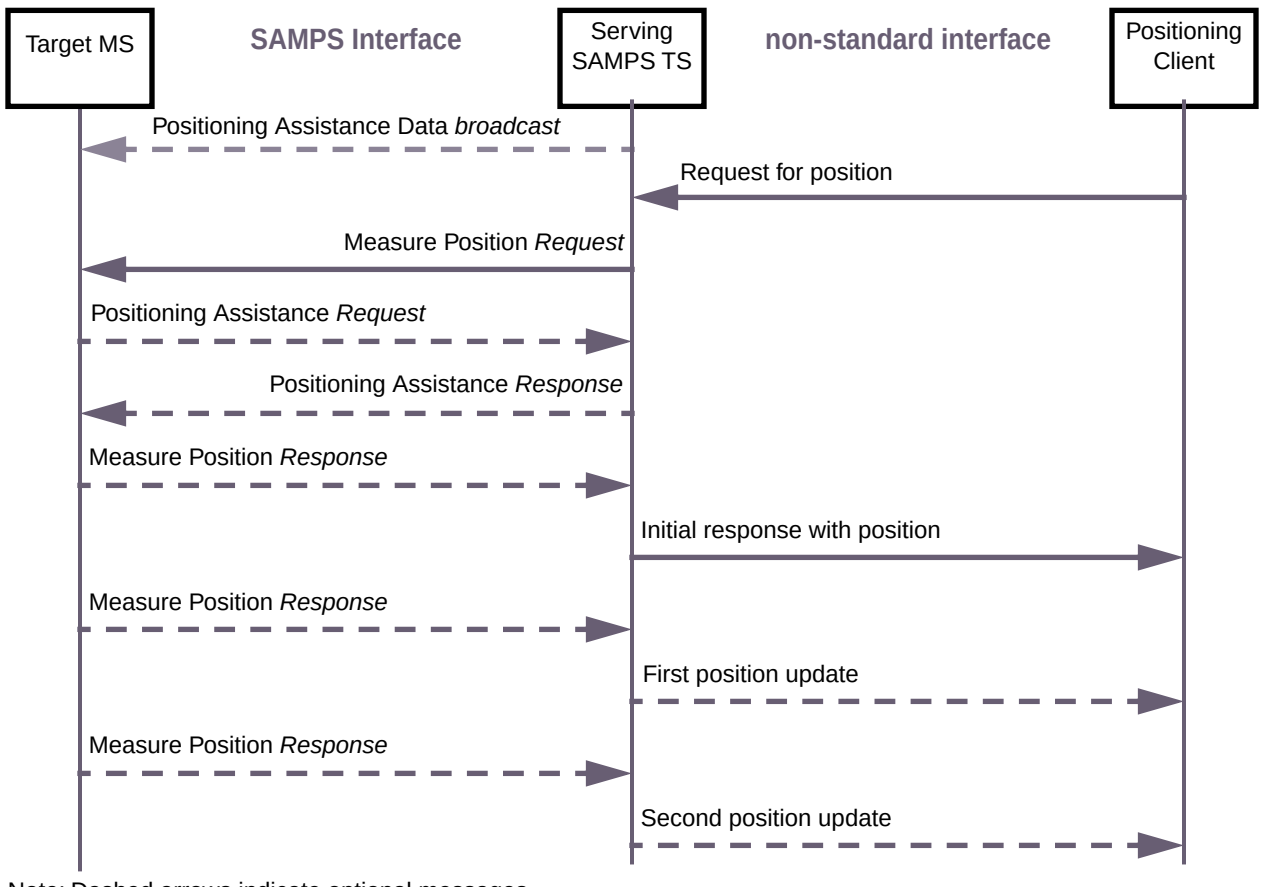
For the future of the standard itself, an analog version of SAMPS is included in the work-plan for TIA/EIA-136 revision D. There is also a need to develop positioning solutions for the packet-data side of EGPRS-136 systems. This work will be handled in 3GPP TSG-GERAN, where the GPRS standards is continually developed and improved. The EGPRS-136 positioning solution will be based on the existing GSM LCS.

About the Author

Hans Carlsson has worked for Ericsson in the "TDMA Air-interface Standards" group as a Consulting Engineer for the past two years. He works within TIA TR-45.3 as well as 3GPP TSG GERAN. Before then he worked for Ericsson in software development and system management for GSM network protocols (e.g. GSM MAP) and even earlier with Class 5 End-Office development.

Hans obtained a Master of Engineering Physics from the Royal Institute of Technology in Stockholm, Sweden and a Master of Mechanical Engineering from the University of Houston.

Figure 2: Mobile Terminated Positioning Request



TIA TR-45.4 *Radio to Switching Technology ("A" Interface)* Standards

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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 Steve Jones (MALR) for his assistance compiling the information in this table.

Published Standards

Standard	Project	Description	Status
TIA/EIA-634-B	SP-4277	"A" interface supporting analog, CDMA, SMS, data services, frame relay and 1800MHz PCS	Published 04/99
TIA/EIA-829	**PN-4683**	**Tandem free operation (eliminates intermediate vocoders in mobile-to-mobile calls with compatible vocoders)**	**Published 06/00**
IS-94		**Mobile Station - Land Station Compatibility Specification for Analog Cellular Auxiliary PCS**	**Published 05/94**
IS-634-0		MSC-BS "A" Interface Standard	Published 12/95
IS-634-A	PN-3539	MSC-BS Interface, including support for IS-95-A, EIA/TIA-553-A, IS-41-C, SMS, data and frame relay	Published 10/98
TSB-80		IS-634-0 Addendum (corrections, SMS, subrate voice frame format)	Published 11/96
TSB-104		PCS Service Description (now IS-104 in committee TR-46)	Published 06/94

Completed Internal Documents

Project	Description	Status
PN-3142	Cellular Microcell/Microsystems Requirements Document	Internal project
PN-3296	MSC-BS Interface (A-Interface) Requirements for Public 800 MHz	Internal project

Active TR-45.4 Projects

Standard	Project	Description	Status
TIA/EIA-2001	PN-4546	cdma2000 Access Network Interface (ANSI version)	Ballot
TIA/EIA-634-C	SP-4377	Revision of BS-MSC "A" interface	Project cancelled
IS-2001	**PN-4545**	**cdma2000 Access Network Interface ("A" Interface) based on 3GPP2 TSG-A IOS V4.0**	**Ballot**
IS-828	PN-4604	BTS-BSC (A bis) interface for cdma2000 systems	Ballot
	PN-3964	Use of A-Interface standards in Wireless Local Loop	Project cancelled
	PN-4276	Fixed Wireless Access (Stage I Description)	On hold pending review by CDG
PN-4376	**PN-4376**	**Addendum to TIA/EIA-634-B to Address 3G Extensions**	**Replaced by PN-4545**
	PN-4378	Addendum to TIA/EIA-634-B for TIA/EIA-136-B (TDMA)	Project cancelled
	PN-4379	Addendum to TIA/EIA-634-B for TIA/EIA-95-B (CDMA)	Replaced by PN-4545