Ultra-Fast 3G Videotelephony Session Setup

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Abstract

The establishment of a typical 3G videotelephony (video calls) session is a process that lasts around 5 seconds between today's deployed 3G video-call enabled terminals. The delay is due to the need to complete several protocol procedures as prescribed by the ITU-T H.324 standard and its annex C, including mobile level detection and H.245 messaging to open logical channels and define multiplexing modes. This paper presents AnswerFast Plus (AF+), a technique that accelerates the 3G videotelephony session setup to make it almost as fast as voice calls (around 1 second). AF+ establishes a video telephony session in a ½ round-trip trip of information transmission on the bearer channel, which is the minimum that can be achieved. AF+ offers major benefits not only from a user experience point of view, but also in terms of minimising infrastructure overheads, and reducing subscribers billing concerns. Another important advantage of AF+ is its interworking with deployed handsets. Because it is a 3G circuit-switched bearer based technology, and because AF+ information appear as noise to terminals that do not support it, it has a perfect interworking with existing deployed terminals. Extensive experiments on live 3G networks in a number of countries have been conducted and confirm our claims.

1 Introduction

The H.324M standard recommendation (H.324 recommendation with Annex C extension) [4] has been adopted by the third generation partnership program (3GPP) as the 3G-324M technical specification [2][3] for the provision of conversational videotelephony services over the circuit switched bearer of 3G networks [1]. H.324 suffers from long session setup delays and, unlike H.323 or SIP, has not benefited from enhancements for the fast establishment of video sessions. The AF+ technique described in this paper offer a number of key advantages and benefits:, including

- Ultra-fast session setup: about one second session setup time from accepting calls until video is displayed on terminal;
- Improved user experience whether the user makes call to other mobile subscribers or enhanced services such as video mailbox, conferencing, streaming, etc…
- Reduced billing issues for operators. Subscribers will not feel they are billed for time the service was not available to them.
- Reduce network overhead. Network infrastructure efficiency is used as wasted session setup time is eliminated.
- Perfect Interoperable with legacy terminals. The AnswerFast Plus technology perfectly interoperates with existing terminal with negligible fallback time.
- Immunity to errors on mobile channels, achieved through a redundant transmission scheme.

The AF+ procedure transmits the preferred operation mode as the first bits transmitted on the bearer channel. Because these bits are prevented from emulating existing mobile level flags, including the base-line H.324 mode, they are ignored by existing terminals and hence maintaining interoperability by existing terminals. The procedure allows significant reduction of the session setup time to 0.5 round trip time from the best of 2.5 round trip time typically achieved by conventional session setup approaches, which results in the minimum gain of 250%.

2 Working Mechanism

AF+ is a method for speeding up the call setup by communicating the preferred ***session profiles*** on the bearer channel. The ***session profiles*** are messages that reuse the key fields from H.245 ASN.1 syntax including **MultiplexCapability** from **TerminalCapabilitySet**, **MultiplexEntrySend** and **OpenLogicalChannel**. They are further encoded for noise immunity purposes using error control techniques to improve error detection. The session profile information is transmitted on the bearer channel as soon as it is established, and can be repeated before AF+ Response or AF+ fallback phase begins to enhance error resilience.

The session profiles of both connecting terminals contain media preferences. Once each terminal detects the peer AF+ Request, it analyses the request to determine the inferred common mode (ICM). It transmits an AF+ Response to confirm the AF+ completion and starts voice and video exchange immediately.

The AF+ Request and AF+ Response frames are octet aligned and have the structure shown in *Figure 1*.

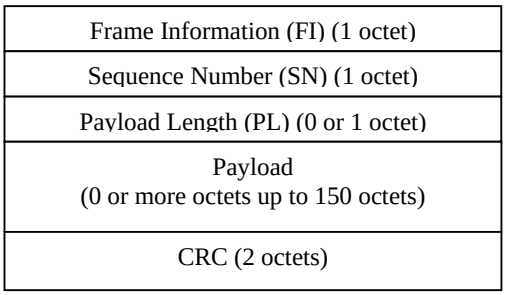

Figure 1: Structure of an AF+ frame.

The **Frame Information** (FI) field consists of a **Payload Marker** (PM) flag, a **Last SSN** (LS) flag, a **Segment Sequence Number** (SSN), and the **Frame Type** (FT) code. The **Payload Marker** (PM) field if set to 1 indicates the presence of the **Payload Length** (PL) field. The FT field has the values shown in the table below:

Frame Type (FT) (3 bits)	**Description**
0x0	Request Frame Type
0x1	Response Frame Type
0x2..0x7	Reserved

Table 1: Description of the Fast Session Setup Frame Type field.

The **Payload**, when present, corresponds to either an AF+ Request message, an AF+ Response message, or a single ITU-T H.223 multiplex payload data unit (MUX-PDU). When the payload is present, the PM field is set to 1.
The AF+ Synchronization Flag is defined as:

0xA3	1 0 1 0 0 0 1 1
0x35	0 0 1 1 0 1 0 1

Figure 2. Structure of the AF+ Synchronization Flag.

One AF+ Synchronization Flag is inserted immediately before and after each AF+ Frame.

3 Procedures

Once the bearer is established, if a terminal supports AF+, it immediately sends an AF+ Request frame. The frame is immediately repeated until one of the following situations occurs:

- An AF+ Request frame is detected;
- A valid mobile level stuffing flag is detected, as described in Section C.6 in [4].

When valid mobile level stuffing flags are detected, normal H.324 session procedure are used according to Annex C in [4].
When an AF+ Request is detected, the payload is processed. If the payload is interpreted successfully, the terminal accepts it by sending AF+ Response frame. The frame is immediately repeated, except the payload field which may contain media data if sent, until one of the following situations occurs:

- An AF+ Response is detected;
- A valid mobile level stuffing flag is detected, as described in C.6 in [4].

During transmission of AF+ Response, media may be transmitted in the payload field of the AF+ Response frame. The payload content contains a MUX-PDU which is in accordance with the specification of H.223 using the finally agreed mobile level.
It is easy to see that the AF+ technique establishes a session in the shortest possible time over the bearer of 0.5 round-trip.

4 Fallback Mechanism

If a calling terminal does not receive AF+ response but a normal H.245 **TerminalCapabilitySet** message, it must assume that the called terminal does not support AF+, or has not accepted any of the specified profiles. In this case, the calling terminal will continue to use the conventional **TerminalCapabilitySet**, **MasterSlaveDetermination**, **MultiplexEntrySend** and **OpenLogicalChannel** procedures of H.324 and its Annex C to create the session.

5 Implementation and Experiments

The AF+ technique has been implemented in handsets and emulators and tested over live 3G networks. Typical setup-time, including time to receive, decode and display video was about 1 second. Resilience to noise in bad reception conditions was exceptionally good, in that session setup time variations amounted to a small fraction of a second. The fallback mechanism described above was tested with a wide variety of deployed handsets and show that the penalty of the fallback is negligible.

6 Conclusions

From the user experience aspect, one of the key factors of the success of the 3G videotelephony service launch is the rapid start of video call session. Subscribers are not accustomed to extended session setup time. The AF+ technique proposed in this paper significantly reduces the session setup time from 2.5 round-trips to 0.5 roundtrip (about 1 second) while providing high immunity to noise and perfect interworking with deployed terminals which consider the AF+ burst of bits as channel errors.

References

[1] 3GPP TS 24.008, “Mobile radio interface layer 3 specification; Core Network Protocols”, R.6.8.0.
[2] 3GPP TS 26.110, “Codec for circuit switched multimedia telephony service; General description”, R.6.0.0.
[3] 3GPP TS 26.111, “Codec for circuit switched multimedia telephony service; Modifications to H.324”, R.6.1.0.
[4] ITU-T H.324 Recommendation, “Terminal for low bit-rate multimedia communication”, 03/2002.