R&S®CRTU-W Protocol Tester

Test cases for IMS validated

The IP multimedia subsystem (IMS) is a 3GPP-standardized architectural framework for mobile radio networks that provides end users with most diverse services via an IP network. Rohde & Schwarz is the only supplier who is already now offering test cases for related mobile conformance tests.

IMS: more than only voice over IP

The next generation mobile networks (NGMN), based on WiMAX or LTE, will differ from the existing networks not only by higher data rates and shorter latencies but, from today's point of view, also by the fact that they will exclusively support purely packet-oriented network protocols. The IP multimedia subsystem (IMS, see box below) is a 3GPP-standardized architectural framework for mobile radio networks that provides end users with most diverse services via an IP network, e.g. services for voice, videotelephony or multimedia applications.

The IMS has been placed between the transport and the application layer and so isolates the underlying transport network from the application. Therefore, applications and services may be provided for and billed to different terminals without forcing the provider to worry about the connection type of the respective terminal. Services such as voice, video and data, which used to be strictly separated, will now move closer together owing to this Internet protocol. So a video connection may be set up or a short text message sent concurrently with a voice call.

These two fundamental principles lead to the fixed mobile convergence (FMC) of networks and applications. The services will unite at the upper layers while, on the underlying transport network, the differences between wireless and wireline networks will vanish. Users can in the future be reached at their telephones at home, en route on their mobile phones or at their laptops in a hotel room via one single number or identity.

Details on IMS

The call session control functions (CSCF) are the core components of the IMS. There are three different CSCFs: proxy CSCF, interrogating CSCF and serving CSCF (FIG 1). In this context, terminals supporting IMS are referred to as user agents (UA). These UAs always communicate with the P-CSCF as their central access point to the IMS. The P-CSCF performs access control, for example, and sets up a secure connection to the UA. During the registration of a UA in the IMS via the session initiation protocol (SIP), the P-CSCF determines the appropriate I-CSCF by means of the user ID that the UA wants to register. For this purpose, the P-CSCF may use either preconfigured entries or DNS procedures. The I-CSCF will then contact the home subscriber server (HSS) that is comparable to the home location register in mobile radio networks. The HSS stores user preferences and settings and the associated S-CSCFs. An S-CSCF may be associated with different services and is to be selected depending on the service to be used. The S-CSCF serves to authenticate the user. The AKA algorithm known from WCDMA is used in the IMS to authenticate and generate keys. To this end, the S-CSCF inquires the necessary keys from the HSS. Via the I-CSCF and P-CSCF it returns an authentication request to the UA in the form of a negative reply to the initial SIP-REGISTER request. As soon as the UA has correctly responded to this request with another REGISTER request, it has been successfully registered in the IMS, which the S-CSCF confirms by a positive reply. This complicated architecture with its three different CSCFs may appear unnecessary and exaggerated but its purpose becomes clear in the case of roaming: Network providers are, of course, unwilling to disclose their internal network structure and want to prevent any access to their own user databases. Since the UA always communicates with the local P-CSCF in the accessed network, this P-CSCF must be denied access to the HSS. The I-CSCF is thus in charge of hiding the network architecture from other providers.

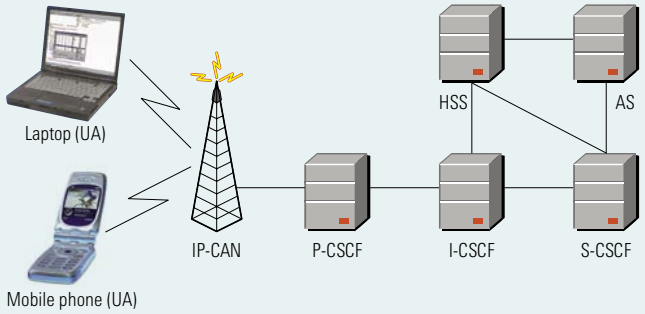

FIG 1 Schematic view of a part of the IMS architecture: On the left, IMS terminals setting up, via the IP-CAN, a connection to the IMS with the central CSCFs.

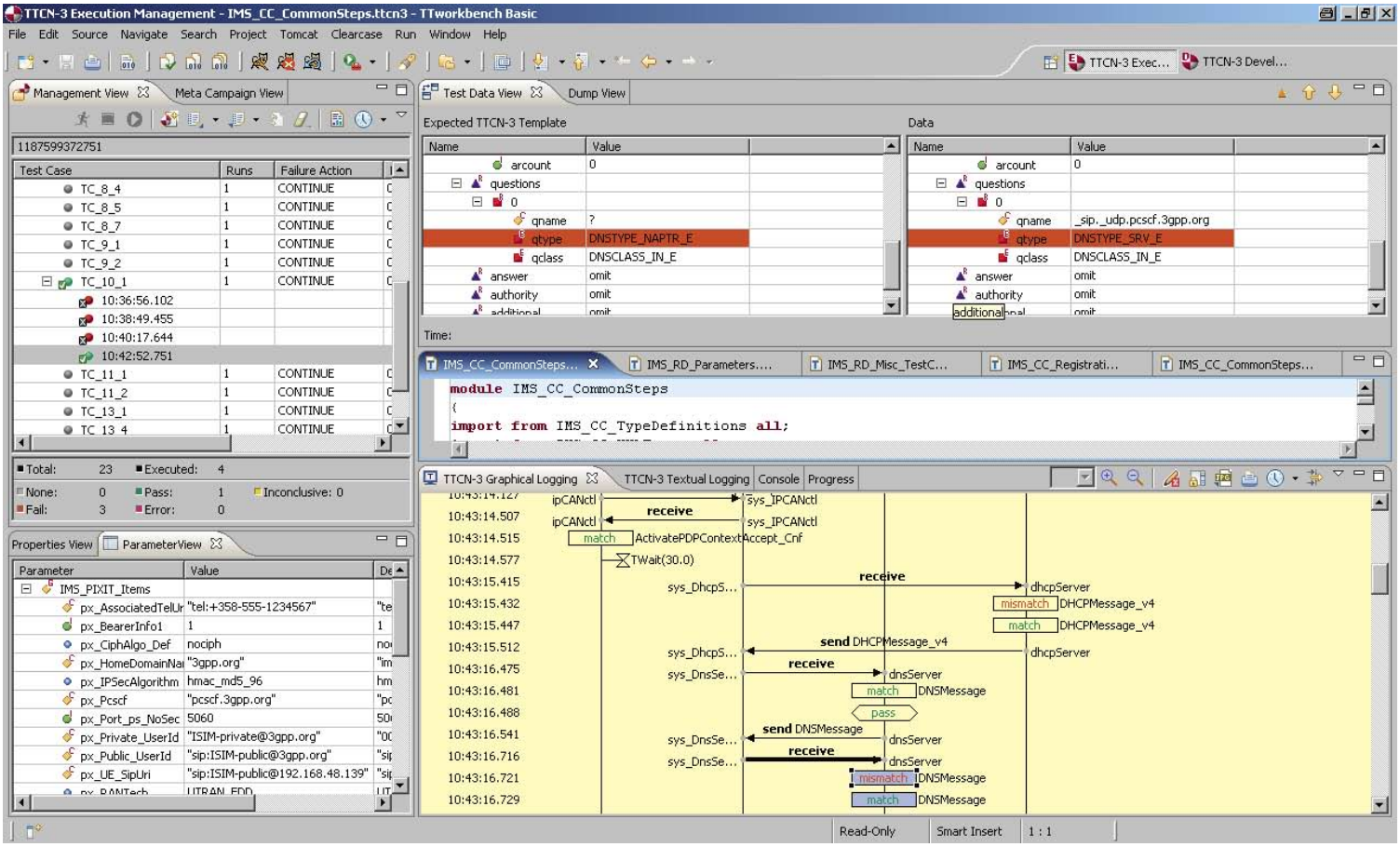

FIG 2 Highlights of the integrated TTCN-3 development environment for the analysis of results are a realtime message sequence chart and a sophisticated feature for comparing received and expected messages.

The complete conversion to IMS-based networks involves considerable efforts and must be seen as a long-term goal. However, there are already first approaches to provide IMS-based services in existing networks. For example, the US operator AT&T has launched video sharing on the market. This service allows transmitting a live video stream via the IMS in parallel to a circuit-switched voice connection. Here, 3GPP has not re-specified the protocols required for communications between the different network components and the terminals. Instead, already established Internet protocols (SIP, SDP, RTP) will be used.

In early 2006, 3GPP started to specify test cases to test the conformance of the basic IMS functionality of mobile devices and commissioned ETSI to translate these test cases into the TTCN test specification language. The Global Certification Forum (GCF) has already included these test cases in its mobile device certification program. Rohde & Schwarz is closely cooperating with ETSI and has developed the R&S®CA-AC05 product specifically tailored to the R&S®CRTU-W protocol tester to carry out conformance tests and to pass certification tests. The test cases cover, for example, registration and authentication procedures, P-CSCF discovery and specific error cases. Rohde & Schwarz is the only supplier who has already validated some of these test cases with GCF. TTCN-3 has for the first time been used in a Rohde & Schwarz product. The R&S®CRTU-WT23 option provides an integrated development environment including editor, compiler and execution environment (FIG 2). During execution, for example, a message sequence chart is set up and continuously updated to allow the realtime examination of the signaling procedure between mobile device and protocol tester. Expected and actually received messages can very conveniently be compared which speeds up the identification of signaling errors.

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