



Once the call-flow diagram is created, the Automatic Test Generator uses a highly efficient algorithm to find an optimal set of test paths through the call-flow diagram. The generated test scripts cover all call-flow icons and all data at least once. In addition, a brief textual description of each test is produced for review, documentation, or manual test execution purposes. As requirements change or new features are added, regression test scripts can be built in minutes, guaranteeing that new application elements will not conflict with existing features.

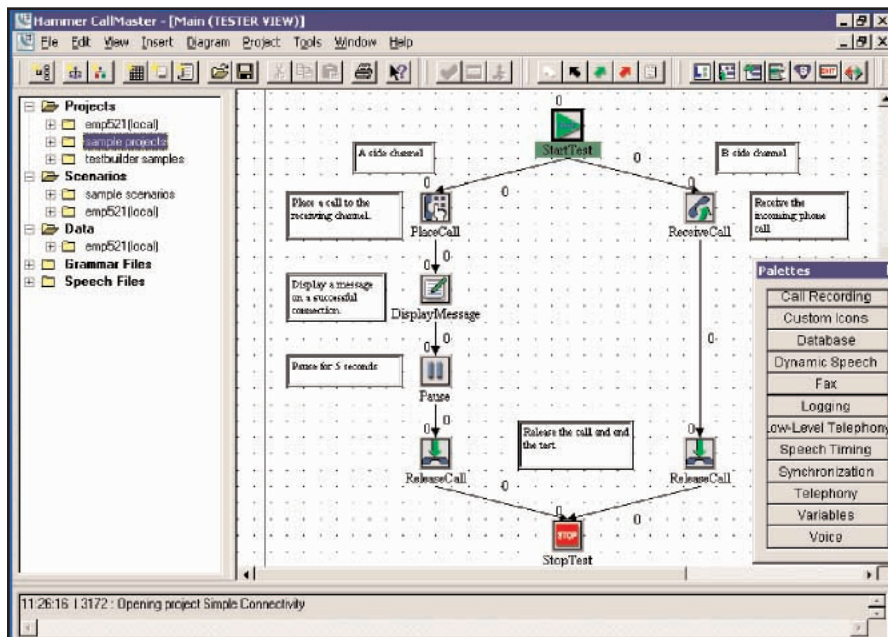


Figure 1: Creating Test Scripts in CallMaster

## Leverage Test Scripts for Performance Testing and Production Management

You can identify specific paths in the call-flow diagram that represent the high-volume paths through the application under test and generate a suite of load test scripts for these designated paths. You can then define the relative mix of call volume that Hammer will generate for each path. For example, a banking application might have 50% of the load test calls going down an account balance path, 30% doing an account transfer, and 20% checking current rates. Once the mix is set, you can specify the load ramp profile. While the test runs, data is automatically collected for easy recall and provided in a variety of different reports.

Using a single call-flow diagram for generating feature, regression, load and production management simplifies the maintenance of scripts. If any application changes, you simply edit the call-flow diagram once which then automatically re-generates all of the scripts. Any of the scripts developed for feature testing can also be used for managing your contact center applications in production with Empirix's OneSight contact center management system.

## Automated Reporting

The Hammer Test System offers a broad range of built-in reports. These reports include failure summaries, failure type distributions, trending charts of key performance parameters over time, graphical correlation that show both failure rate and response time for any step in a call flow as function of call volume, and many more.

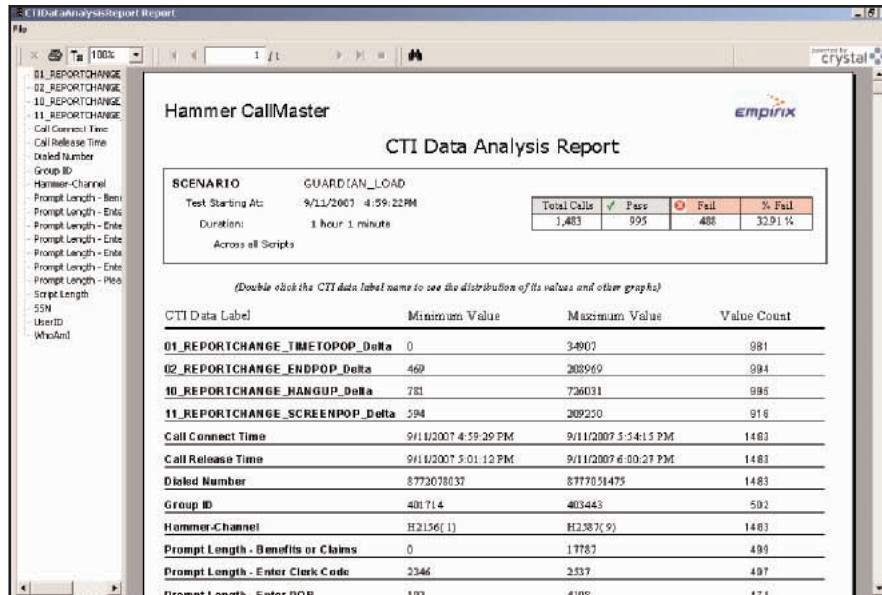


Figure 2: Sample Test Results Report

## Optional Components

### Dynamic Prompt and Speech Recognition

Hammer Dynamic Speech enables automated testing for continuous, speaker-independent, host-based speech recognition. Expected prompts are updated by editing text in a grammar-builder instead of actually recording a prompt and saving it in a vocabulary. This process greatly simplifies prompt maintenance, especially for complex applications that have different prompts for different conditions.

Also, use of grammar libraries and dynamic “slots” within each prompt make it possible to leverage the same script across the entire testing lifecycle. Instead of re-recording expected prompts anytime test data is changed, the same script works as long as the expected response is contained in a grammar library. For example, the same script used to test an account balance application with static test data can also be used for production management by setting up the account balance portion of the prompt as a dynamic slot using a standard dollar amount grammar library.

Speech recognition services are fully integrated into the graphical programming environment and include a web interface for easy access to grammar libraries, grammar builders and tuning tools.

### Voice Quality Testing

The Hammer Voice Quality Test Suite (VQTS) is a software-based solution for measuring and characterizing the voice quality of VoIP/NGN/IMS devices and networks. It provides extensive Quality of Experience (QoE) metrics including: industry standard voice quality scoring algorithms (PESQ (ITU P.862), PAMS, PSQM (ITU P.861), PSQM +, & MOS correlation), Voice Activity Detection measurement, and speech latencies. Hammer VQTS utilizes a wide range of real human voice prompts to provide the most accurate measure of voice quality and also includes extensive post process analysis tools for in-depth diagnosis of voice quality degradations.

### Audio Diagnostics

Audio Diagnostics provides easy access for listening to two way audio of a recorded call and diagnosing problems with the audio. Audio Diagnostics reports on the full context of an error to pinpoint the exact place of failure in a call. For example, it can detect problems with call connection including problems at the carrier level such as busy circuits or misrouted calls. Additionally, being able to provide a full recording of a failed call, enables users to straight-forwardly document and demonstrate real problems for application developers and vendors.

Audio Diagnostics includes a server, Callmaster icons for controlling recording functions and new reports that provide easy navigation from identified failures to the recordings of the calls that document them.

## A Complete Solution in a Single, Easy-to-Use Package

Hammer Test System is a complete testing solution for contact center applications and includes everything needed to test your own environment. In fact, thanks to Hammer Test System’s distributed architecture development, run-time control, access to failure information, and report generation is enabled from remote clients that can be anywhere on your network.

## Improved Customer Experience

With Hammer Test System, your customers will appreciate a new level of reliability while accessing the enterprise. By identifying performance bottlenecks and call handling errors before new or modified applications are deployed, you will significantly reduce the costs of detecting and correcting problems—and help maintain the loyalty of your customers.

## System Specifications

### Call Master System Server specifications: (Based on Dell 2950)

- Processor Dual 2 Ghz (dual core)
- Memory 2GB
- Disk 2x 100 GB SATA with Raid 1 configuration
- Network Gigabit Ethernet

### Hammer FX-IP and Hammer TDM are provided on the following hardware configurations:

#### Hammer FX-IP

##### 2U Rack-Mount Chassis Configuration:

- Dual 2.33 GHz Xeon CPUs (Dual-Core), 1333 MHz FSB
- Dual 160 GB SATA hard drives (RAID 1)
- 2 GB DDR2-667 RAM
- Windows 2003 Server
- Dimensions: 3.44"(H) x 19"(W) x 27.75"(D)
- Power (50/60 Hz): 100-127 Vac @ 12A max, 200-240 Vac @ 6A max
- Includes rack mounting hardware

#### Hammer FX-TDM

##### 4U Rack-Mount Chassis:

- 2.8 GHz Pentium 4 CPU
- 1 GB PC2100 RAM
- 80 GB 7200RPM IDE hard drive
- 10/100/1000 Ethernet NIC
- Windows 2003 Server
- 400 Watt Power Supply (100 ~ 240 VAC @6.3A max; 50/60 Hz)
- Dimensions: 7" (H) x 19" (W) x 20.5" (D)

### Hammer FX-IP Features

#### Interfaces, Signaling and Media

##### Network Interfaces:

- Rack Mount: (4) 10/100/1000 Ethernet ports

##### Channels and Capacity:

- Up to 288 channels with media
- Capacity up to 100 cps, call rate dependent on protocol and application

##### Signaling Protocols

- Supports SIP (including IMS UE), MGCP, H.323, Cisco Skinny (SCCP), PacketCable NCS
- UDP and TCP transport protocols
- Mixed-protocol configurations supported
- Highly configurable message content and sequence

### Hammer TDM Features

#### Interfaces, Signaling and Media

##### TDM Interfaces:

- 2 to 28 T1 or E1 spans (T1/E1 is software-selectable)
- 8 to 192 Analog FSK ports

##### Channels: Up to 672 per system, depending on test application

##### Signaling: Capacity over 60 cps, call rate dependent on test application

##### Analog: Pulsed E & M, Analog Loop Start

##### CAS: MFC R2, R1.5, Wink start, Digital Loop and Ground Start

##### ISDN: PRI, NFAS

##### Clear Channel Support

##### SS7

##### Media Capabilities

- G.711 A-law and  $\mu$ -law
- Real voice prompts (provided or user-supplied), tones, DTMF, fax
- Individual channel control for all media features including play and record
- Full access to server features such as speech recognition or voice quality options