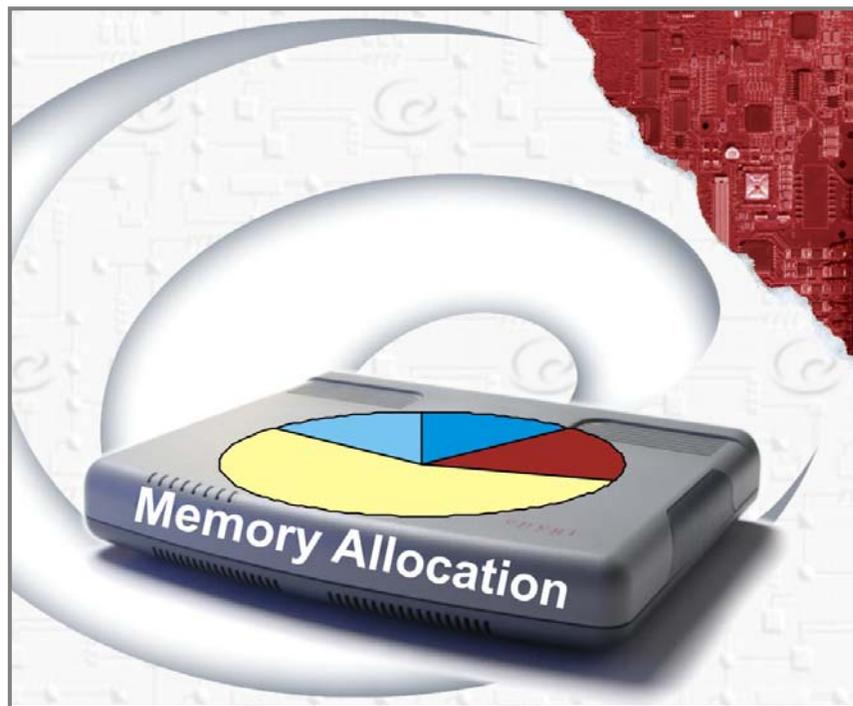

Memory Management on Quadro IP PBXs



Revision: 1.0

Abstract: This document gives information on memory management on Quadro IP PBXs.

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Document Revision History

Revision	Date	Description	Applicable to SW	Applicable to models
1.0	25-Dec-06	Initial release	4.0.x	IP PBXs

1 Introduction

This document gives information on memory size and memory allocation on Quadro IP PBXs. It specifically describes the total storage space available on Quadro2x, Quadro4x, Quadro16x models and the default distribution of storage among extensions on those models. A scheme is provided to estimate the space required for storing custom system messages of a given length on extensions.

2 Assumptions

The following assumptions are made in this document:

- SW 4.0.x is running on the Quadro IP PBX.
- No language pack is installed on the Quadro IP PBX. The use of a language pack reduces the total available memory size by about 50%.

Except Section [7](#), other sections will additionally assume that no USB flash drive is installed on the Quadro.

3 Total Memory Sizes on Quadro IP PBXs

The total memory size of a Quadro IP PBX varies depending on the Quadro *model and software version*.

[Table 1](#) lists the total memory sizes available on basic models of a Quadro IP PBX.

Table 1 Total Memory Sizes

Quadro IP PBX Model	Memory Size in Megabytes (MB)
Quadro2x	5.3 MB
Quadro4x	11.7 MB
Quadro16x	11.7 MB

The total memory size of a Quadro IP PBX can be viewed on the **System→Status→Memory Status** page (see Figure 1). The size displayed on this page is expressed in terms of duration and is calculated using a specific recording codec selected on the **Telephony→Voice Mail Common Settings** page (see Figure 2).

The screenshot shows the 'Quadro Status - Memory Status' page. At the top, there is a navigation menu with 'Main', 'System', 'Users', 'Telephony', 'Internet Uplink', and 'LAN Services'. The 'System' menu item is highlighted. The Epygi logo and 'TQuadro268' are in the top right corner, with a 'Refresh in 509 seconds!' indicator. The main heading is 'Quadro Status - Memory Status'. Below it, a 'General Information' section shows 'Memory size: 3 hour 24 min 8 sec'. A table displays memory usage for various components. The 'Memory Status' link in the left sidebar is highlighted in red. At the bottom, there are 'Back' and 'Help' buttons, and a copyright notice for 2006 Epygi Technologies, Ltd.

User Space for Extension	Voice Mailbox	System Messages	Free Space	Total Space
System memory	0 sec	1 sec	2 min 1 sec	2 min 2 sec
00	0 sec	1 sec	2 min 1 sec	2 min 2 sec
11	0 sec	0 sec	4 min 4 sec	4 min 4 sec
12	0 sec	0 sec	4 min 4 sec	4 min 4 sec
13	0 sec	0 sec	4 min 4 sec	4 min 4 sec
14	0 sec	0 sec	2 min 2 sec	2 min 2 sec
75	0 sec	0 sec	2 min 2 sec	2 min 2 sec
76	0 sec	0 sec	2 min 2 sec	2 min 2 sec
	0 sec	2 sec	2 hour 50 min 46 sec	2 hour 50 min 48 sec

Figure 1 Viewing the Memory Status

The screenshot shows the 'Voice Mail Common Settings' page. The navigation menu is the same as in Figure 1. The 'System' menu item is highlighted. The Epygi logo and 'TQuadro268' are in the top right corner. The main heading is 'Voice Mail Common Settings'. Under 'Recording Codec:', a dropdown menu is open, showing 'G.729a (CS-ACELP speech coding at 8 kbit/s rate)'. Under 'Memory Allocation:', there are two radio buttons: 'Embedded Memory Storage' (which is selected) and 'External USB Flash'. At the bottom, there are 'Save', 'Back', and 'Help' buttons, and a copyright notice for 2006 Epygi Technologies, Ltd.

Figure 2 Selecting the recording codec

[Table 2](#) summarizes the memory sizes on basic Quadro IP PBX models expressed in terms of duration for different recording codecs. Note that codecs that provide a higher rate of compression increase the storage size in terms of time.

Table 2 Memory sizes in time units for different recording codecs

Quadro Model Recording codec	Quadro2x	Quadro4x	Quadro16x
G.711u	22m 3s	20m 19s	16m 48s
G.711a	22m 3s	20m 19s	16m 48s
G.726-16	1h 28m 15s	1h 21m 18s	1h 7m 15s
G.726-24	58m 50s	54m 12s	44m 50s
G.726-32	44m 7s	40m 39s	33m 37s
G.726-40	35m 18s	32m 31s	26m 54s
G.729a	2h 56m 30s	2h 42m 37s	2h 14m 30 s
G.723	3h 42m 51s	3h 25m 20 s	2h 49m 49 s
iLBC	1h 46m 58s	1h 38m 33s	1h 21m 30s

4 Memory Allocation on a Quadro IP PBX

By default, the Quadro IP PBX assigns a certain default percentage of the total memory to all extensions: user extensions and auto attendants. For user extensions this is shared memory to be used for storing the user’s voice mails and custom voice messages.

Table 3 lists the default distribution of the total memory among user extensions and the default auto attendant on basic models of a Quadro IP PBX. The **System memory** is used for storing universal extension recordings (see Section 5.4).

Table 3 Default distribution of memory on basic models of Quadro IP PBXs

Quadro Model	Memory size as a percentage of the total memory			
	Extension		Attendant	System memory
	Onboard	IP line		
Quadro2x	5%		1%	1%
Quadro4x	1%		1%	1%
Quadro16x	2%	1%	1%	1%

The administrator can manually modify the default memory size allocated for an extension. This is done from the **Users→Extensions Management→Edit Entry** page (see Figure 3). The maximum value in the **Percentage of System Memory** drop-down list on this page equals to the maximum free space currently available on the Quadro IP PBX.

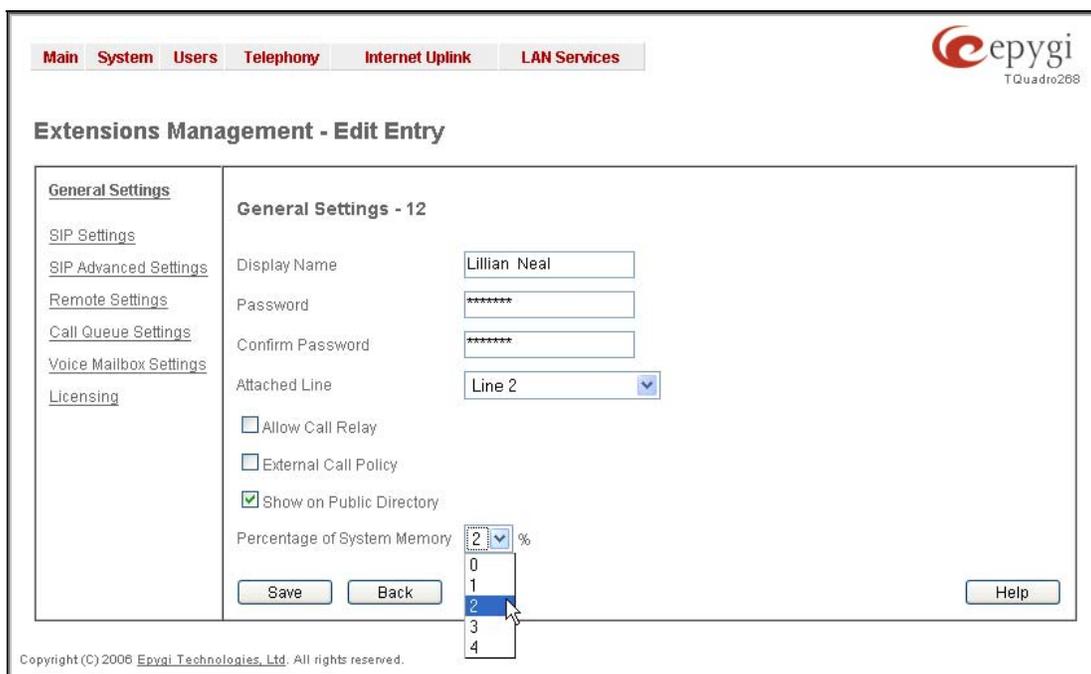


Figure 3 Modifying the default percentage

The memory size in time units corresponding to the assigned percentage can also be viewed on the **System→Status→Memory Status** page (see Figure 1, the **Total Space** parameter for an extension).

Please note: The memory size displayed on the **Memory Status** page is calculated according to the selected voice mail recording codec (see Figure 2), which is set to G.729a by default. Custom system messages are recorded using the PCMU (G.711u) codec (see Section 5.2). Therefore, to estimate the duration corresponding to an assigned percentage of memory using the PCMU codec (see Section 5.3), change the recording codec to PCMU and view the **Memory Status** page (see Figure 4).

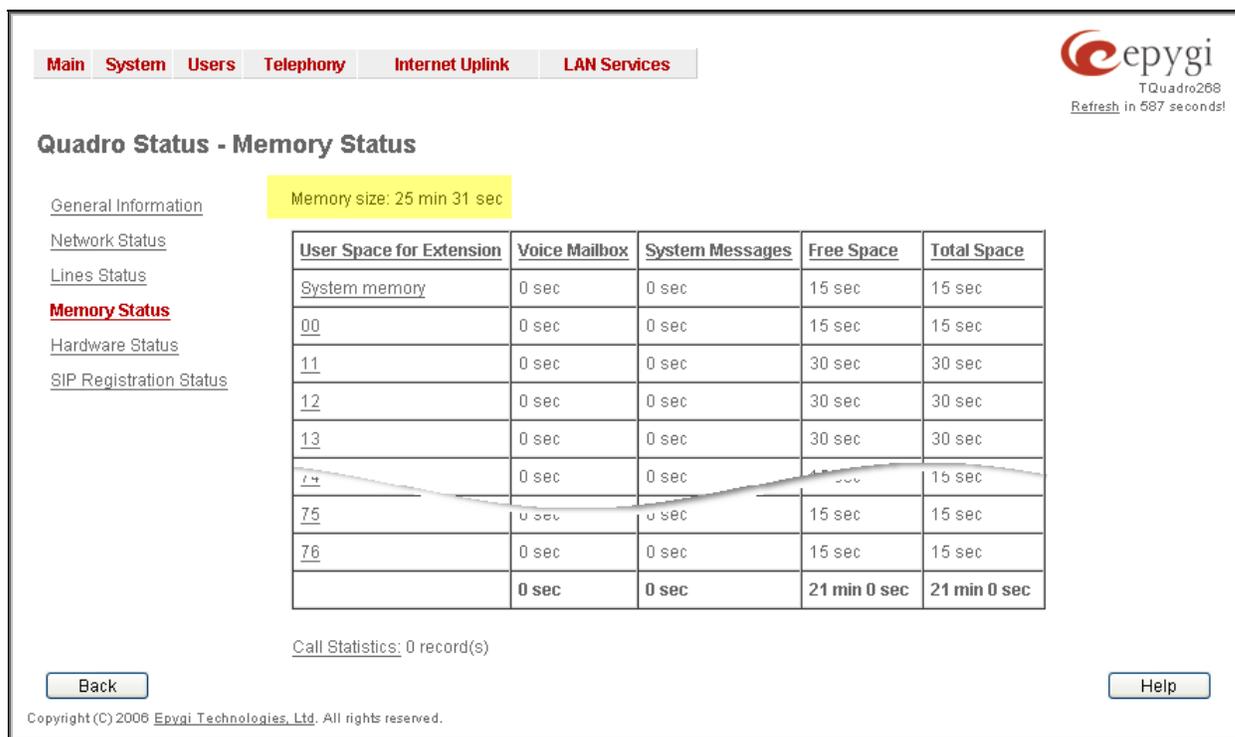


Figure 4 Memory sizes calculated with the G.711u codec

5 Custom System Messages

The complete list of system messages that can be changed to a user-defined (custom) message is given in [Table 4](#).

The Voice Mail Greeting, Incoming Blocking, Outgoing Blocking, Out of Office messages and Extension User's Name can be recorded directly from the phone handset or uploaded from the Quadro web management, whereas the Hold Music, Call Queue Welcome, Call Queue and New Voice Message Notification messages can be uploaded from the web management only. To ensure an acceptable quality, it is recommended to upload previously recorded voice messages, rather than recording them from the handset. For more information on uploading custom voice messages, please refer to the Quadro IP PBX manuals and online help.

Table 4 The list of custom voice messages

Messages	Description
Voice Mail Greeting	Played to callers that reach the extension's VM.
Incoming Blocking Message	Played to callers that call from numbers blocked by the extension user.
Outgoing Blocking Message	Played to the extension user when they dial a number that has been blocked by the administrator.
Extension User's Name	Played in the Extensions Directory.
Out of Office Message	Played to callers that call an extension with the Out of Office feature enabled.
Hold Music	Played to callers on hold.
Call Queue Welcome Message	Played when a caller joins the extension's call queue.
Call Queue Message	Played when a caller is being held in the queue.
New Voice Message Notification	Informs about the receipt of a new voice mail message.

5.1 Limitation on Message Durations

All the custom voice messages, except the hold music, are limited to 5 minutes in duration. The duration of the hold music is limited to the maximum space available for an extension.

Please note: There is a general limitation when uploading custom voice messages. The maximum size of an uploaded file is limited to 7.5 MB.

5.2 Requirements on the Format

All custom voice messages on a Quadro IP PBX must comply with the following requirements to be accepted by the Quadro:

- **File format** - The name of the file format varies depending on the recording tool used. In Cool Edit Pro or Adobe Audition, for example, the required format is called *A/mu Law Wave*, whereas in Windows Sound Recorder it is called *CCITT*(see below).
- **Sample Rate** – 8000
- **Resolution** – 16 bit
- **Channels** – mono

The following instructions describe how to record a custom system message using Windows Sound Recorder:

1. Go to Start→Programs→Accessories→Entertainment→Sound Recorder.
2. Use a microphone or headset to record a message or open existing recording to change it to the required format.
3. Once recording is complete, click on File→Save As.
4. Use the **Change** button below **Save as type** to change the **Format** to *CCITT A-Law*, and the attributes to *8,000 Hz; 8/16 Bit; Mono*.
5. Save the file locally on your PC to upload it later to the Quadro.

5.3 Computing the Required Percentage of Space

To estimate the percentage of total space required for storing custom system messages of a given duration (for example, 3 minutes), follow these steps:

1. Multiply the desired duration expressed in minutes by 480 KB that is the space required to store one-minute recording using the PCMU codec:
$$3 \times 480 \text{ KB} = 1,440 \text{ KB} \sim 1.4 \text{ MB}.$$
2. Calculate what percentage of the total memory the required space takes. To do this, divide the required space in MB by the total space on the Quadro (see Table 1) and multiply the result by 100. For example, on the Quadro16x the required percentage for a 3-minute custom system message will be the following:
$$(1.4 \text{ MB} / 11.7 \text{ MB}) \times 100 \% \sim 12 \%$$

If the user also needs some space for voice mail, compute the required percentage in the following way:

3. Divide the desired duration for voice mail by the total space on the Quadro expressed in minutes and multiply the result by 100. For example, on the Quadro16x, the required percentage for a 4-minute voice mailbox will be computed like this, assuming that the G.729 is used as the recording codec:
$$(4 / 162) \times 100\% \sim 3 \%$$

Thus, to allow the user to store a 3-minute custom system message and a 4-minute voice mailbox, the administrator should assign at least 15 % of the total space to the extension. If this value is not listed in the **Percentage of System Memory** drop-down list, the administrator should free some space on the system (for example by reducing the storage allocated for other extensions).

[Table 5](#) summarizes the memory sizes in MB and the corresponding percentage of the total memory required to store custom hold music of 1 to 12 min durations on the Quadro16x.

Table 5 Memory Size for recorded Hold music

Duration of custom hold music in minutes	Approximate memory size in MB	Approximate percentage of memory on Quadro16x
1	0.5 MB	4 %
2	1 MB	8 %
3	1.5 MB	12 %
4	2 MB	16 %
5	2.5 MB	20 %
6	3 MB	24 %
7	3.5 MB	28 %
8	4 MB	32 %
9	4.5 MB	36 %
10	5 MB	40 %
11	5.5 MB	44 %
12	6 MB	48 %

5.4 Universal Extension Recordings

Universal extension recordings are intended to replace the default system messages on all extensions on the Quadro IP PBX. Once uploaded, they are used on all extensions unless the extension user uploads/records their own custom system message(s).

The list of default system messages, and thus the universal extension recordings, coincides with the list given in [Table 4](#). The exception is the Extension User's Name recording that is specific to each extension.

To replace any default system message with universal extension recording, open the **Users→Extensions Management** page and click on the **Upload Universal Extension Recordings** link (see Figure 5). On the **Upload Universal Extension Recordings** page, click the appropriate **Upload** link to replace the corresponding default system message (see Figure 6). The **Percentage of System Memory** setting on this page indicates the total space allocated for storing the above-listed messages.

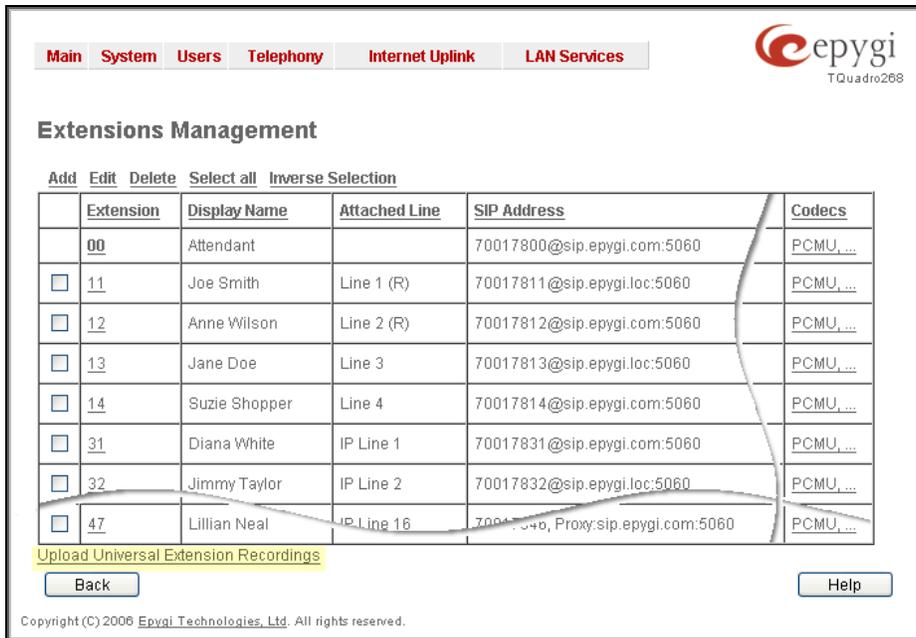


Figure 5 Opening the Upload Universal Extension Recordings page

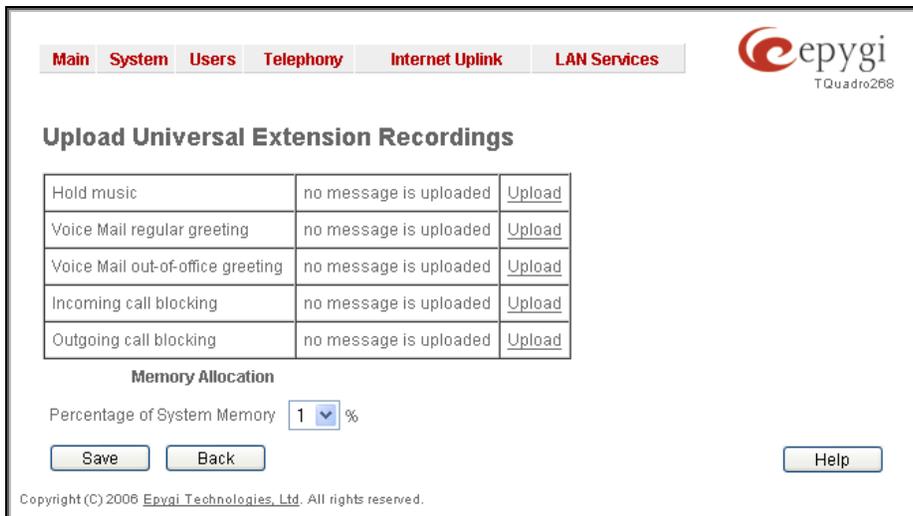
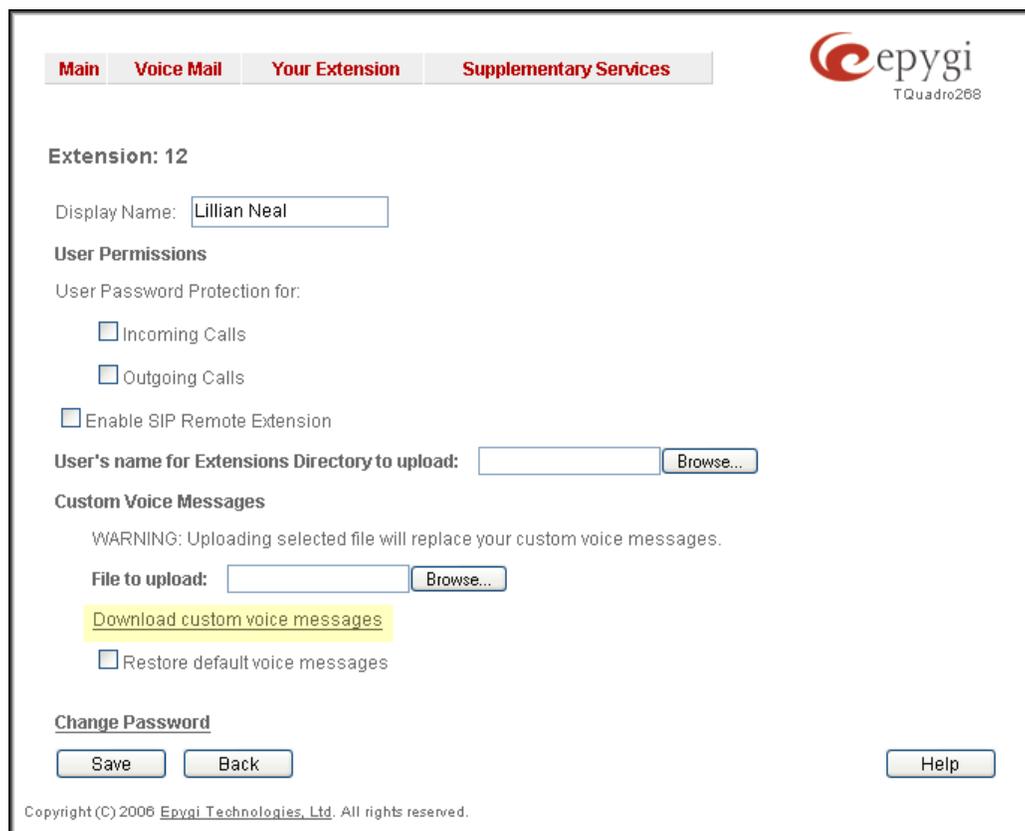


Figure 6 Uploading universal extension recordings

6 Downloading all Config & Voice Data File of over 7.5 MB

When the Quadro IP PBX configuration file is backed-up it will save the Quadro system configuration settings as well as all of the extension system messages (ie. Greetings, Music on Hold, etc.). The saved configuration file cannot exceed 7.5 MB. The Quadro will give an error message to the administrator when attempting to save the configuration and the combined system configuration and extension system messages exceeds 7.5 MB. If this occurs the system configuration will need to be saved separately from the voice files. The configuration file alone can be downloaded from the *backuprestoreconf.cgi?is_old_style=1* hidden CGI. The custom voice messages should be saved for each extension separately from the **User Login→Your Extension→Account Settings** page (see Figure 7).



The screenshot shows the Epygi Quadro268 web interface for extension 12. The navigation menu includes Main, Voice Mail, Your Extension, and Supplementary Services. The extension name is 12, and the display name is Lillian Neal. Under User Permissions, there are checkboxes for Incoming Calls, Outgoing Calls, and Enable SIP Remote Extension. There is a field for the user's name for the Extensions Directory to upload, with a Browse... button. Under Custom Voice Messages, there is a warning that uploading a file will replace custom voice messages, a File to upload field with a Browse... button, a highlighted link for Download custom voice messages, and a checkbox for Restore default voice messages. At the bottom, there is a Change Password section, Save and Back buttons, and a Help button. The footer contains the copyright notice: Copyright (C) 2006 Epygi Technologies, Ltd. All rights reserved.

Figure 7 Downloading custom system messages of extension 14

7 Increasing Quadro's Memory with a USB Flash Drive

Please note: This section applies only to Quadro models that have USB ports on the rear panel.

By default, all voice data on the Quadro is stored on the system embedded memory. The voice data includes universal extension recordings, custom system messages used on auto attendants and extensions as well as voice mails of extensions. If the size of the embedded memory is insufficient to hold the needed amount of voice data, the administrator may install a USB flash drive and configure the Quadro to use it.

The following step-by-step instructions describe how to install a USB flash drive on a Quadro:

1. Insert the USB flash drive into the USB port on the rear panel of the Quadro.
2. Open the **Telephony** → **Voice Mail Common Settings** page and select the **External USB Flash** checkbox (see Figure 2). Click **Save**.
3. Click **"yes"** when asked for the USB flash drive formatting.

As a result of formatting, the Quadro will do the following:

1. Erase all data on the drive and create the file structure of the Quadro extensions on it.
2. Copy all voice data from the embedded memory to the drive.

The first step – formatting the drive without copying the voice data - can also be executed by pressing the **Clear USB Flash** button.

Once a USB flash drive is formatted, the Quadro will automatically mount the drive each time it is plugged in again with no request for formatting.

To switch over to the embedded memory again, first unmount the drive and only afterward unplug it. Removing the drive without unmounting it first may result in the voice data corruption stored on the USB flash drive. To unmount the drive, select the **Embedded Memory Storage** on the **Voice Mail Common Settings** page and click **Save**. Once the Quadro starts using the embedded memory again, it will restore the voice data available at the time the USB flash drive was installed.