CT LABS
TESTING SERVICES

Testing Results Report

Unified Messaging Review
for CommWeb Supersite

June 2000

The Unified Messaging Tests

CT Labs was commissioned by CommWeb to test three mainstream, first-tier unified messaging (UM) products from AVT, Nokia, and Siemens. These tests included evaluations of the products and their ease of installation, ease of use, and performance in a variety of areas. Most UM products are installed at enterprise sites as customer-provided equipment (CPE), meaning that there is actual equipment that gets installed inside the company. As an interesting side tour in this report, we also decided to test one popular free UM service bureau—ONEBOX.COM—and see how much functionality they deliver as compared to the more classical UM systems. In fact, we wondered before the test if it was feasible for a small business enterprise to somehow use such a service as a replacement for an in-house UM system.

Some of the results from the ONEBOX evaluation are presented in test tables throughout the main report. However, most of the content of this report is contained in Appendix B attached to the end of this report.

Executive Summary

We found all three products (AVT, Nokia, and Siemens) to be credible unified messaging offerings. While each product has its own strengths and weaknesses, our reviewers felt that there were none that had critical problems that would prevent us from recommending their use in the field. The final scoring shows Siemens on top although Nokia was very close behind followed closely by AVT.

Regarding installation, we found the Nokia product to be the quickest and easiest to install (we were provided with a fully loaded and ready to configure system) although both AVT and Siemens did not take an excessive amount of time. Unfortunately, we were not able to get the AVT fax server installed within the allotted time, so we had to downgrade their install score somewhat.

We found the product user guides and on-line help to be the best from Siemens. In fact, their on-line help was perhaps the best of any we have tested at the labs to date.

While Siemens won the "best" score for Outlook client integration by a hair, the integration from AVT and Nokia were in fact extremely good. We found all vendors to have mature and fully functional implementations that work well.

The administrative client interface was provided in either proprietary form or as an extension of the outlook client. We found the overall best to come from vendor Siemens who produced a very nice web-

based client although AVT was right behind them with a very credible offering that was only marred by their method of implementing a security feature that we found somewhat annoying. Nokia was scored down for only having a text-based interface although we found it easy to use.

Our product performance automated and manual tests have a reputation for "finding things" and this test was no exception. While no vendor escaped with a perfect score, Siemens came out on top with the best overall performance.

Units Tested

The following is information about the units and version numbers that were provided to CT Labs for this test.

Phone servers	AVT	Nokia	Siemens		Onebox
Product model	CallXpress	IntegraX	Xpressions 470		Onebox
Version number	5.30	6.2	1.1.0		N/A
Product serial number	1067111091181	0004008BX3003	SRB06396		N/A
Product pricing	8 Port CXNT Enterprise with Fax and UM TURNKEY: $35K. MSRP Same shipped as a kit: $32K. Includes: 8 Port Advanced UM License 4 Port Dialogic SCSA card x2 2 Port Brooktrout Fax Card: Compaq ProLiant 800	Nokia would not supply any MSRP figures. They indicated that pricing is generally calculated on a per user basis with volume discounts. Assuming 100 users, the estimated per user price is about $350 for software only based on: 8 ports voice mail 2 ports fax 6 ports text-to-speech	List Price = $17,700 8 port Xpressions Server Package including: Xpressions server software, voice mail port license, fax integration, 250 users, 5 Desktop Clients, Dell server		Free

Fax servers	AVT	Nokia	Siemens		Onebox
Product model	RightFax	N/A (N1)	Fax Sr.		N/A (N2)
Version no.	7.0		3.1 SP2		

Notes:
1. The Nokia fax server is a fully integrated feature of their phone server software and unit.
2. The Onebox fax server is a fully integrated feature of the Onebox service.

Product Review Results Grid

The following is the test results grid derived from data from all tests that were performed for this product review:

Product Evaluation Category (rate each out of possible 10)	Relative Weight	AVT	Nokia	Siemens
Product user guides, help	5	7.7	7.5	9.2
Ease of installation	10	7.8	9.8	9.3
Product features	20	9.2	8.9	8.3
Outlook client integration	10	9.6	9.8	10.0
Administrative graphical user interface	5	8.5	7.5	8.8
Product performance	50			
Phone server/TUI tests (25)		8.8	9.1	9.5
Quality tests (Email TTS, recordings) (15)		7.9	8.0	8.0
All other performance tests (10)		7.4	9.3	9.1
Total:	100	8.5	8.9	9.0

Note that the relative weights for each evaluation category are given so that readers may re-calculate the scores for each vendor based on their own weightings if desired. Scores may be footnoted to explain unusually high or low scores.

Although Onebox is a unified messaging product, the differences in target customer and application of the program differed sufficiently from the other products tested that we scored them on a different basis. Following is the breakdown we used for scoring Onebox:

Product Evaluation Category (rate each out of possible 10)	Relative Weight	Onebox
Ease of installation	10	10.0
Online help (web, TUI)	10	8.5
Product features	20	8.5
Product performance (web, TUI)	30	8.5
Graphical user interface (web client)	10	9.5
TUI analysis	10	8.0
Technical support	10	8.5
Total:	100	8.7

General questions we set out to answer in these tests
Questions:

- How easy are these systems to install and set up?

- How easy are these systems to maintain? (e.g. user adds, moves, and deletes?) Are multiple user directories required (e.g. separate one for voice, fax, and email servers) or can a single directory entry handle all message types? How many administrative tools are there, and how effective are they?

- How effective are the fax-accessing and email-reading features of these products?

- How do the voice messaging and auto attendant features compare with typical enterprise voice mail systems?

- How does the phone server perform under multiple telephone line call loads?

- How intuitive are the telephone user interface (TUI) and graphical user interface (GUI) portions of the product?

- How "seamless" is the integration with Microsoft Outlook?

- How do the product features compare? (e.g. is there email integration support for other email clients?)

- How effective are the user guides and online help?

Vendors were asked to:

- Ship a unified messaging phone server to CT Labs pre-assembled and equipped with:
  - ✓ 8 analog phone ports,
  - ✓ PBX integration support for the test PBX (2 used in this test series),
  - ✓ 4 fax line resources, partitioned as 2 send / 2 receive.

- Ship a compatible fax server unit to CT Labs if integral fax support is not available as part of the Phone Server unit.

- Provide CT Labs with 2 days of onsite assistance in setting up the equipment in our Roseville, CA office.

Vendors were invited here

Each UM vendor was encouraged to bring their experts here to install and fine-tune their systems for best possible performance. Each vendor had ample time before the tests to review the test summary document that defined the tests to be performed as well as the scoring percentages for each category. All vendors sent representatives to our facilities for the tests.

"Ease" of installation

This area of testing involved the evaluation of how easy it is for a typical factory installer to install and configure a system to the point where it is ready to accept calls. This includes installing the phone server, fax server if separate, and the user and administrative clients. The test rating and comments below are results from our observations of the vendor reps who accompanied their units and installed each system into our testing environment.

Because we invited representatives from each company to be present when these units were tested, CT Labs testers mostly watched the installers configure the systems and prepare them for testing. Even so, from this we formed definite opinions about how easy each system might be to set up and configure in the field. Installation of a unified messaging system as demonstrated by these three vendors can be roughly broken down into the following activities:
  1. Check to make sure everything is present before the install starts
  2. If not, call the home office and request a FedX shipment
  3. Install phone server software
  4. Configure the phone server ports and other options

5. Install software extensions to Exchange Server, if any
6. Import the user information from Exchange into the messaging admin structures (or manually enter user information if no import facility is provided)
7. Perform PBX integration configuration
8. Install the fax server hardware & software
9. Configure the fax server component
10. Import the user information into the fax server
11. Install client software on workstations
12. Verify call and workstation functionality

Installation experience required

All three vendors explained that a normal customer installation would be performed by a trained installer, either from their company, or from one of their trained resellers. This individual would perform all major installation tasks required to set up the system. The customer would be expected to participate to select options, specify configuration needs for PBX and/or fax integration that currently existed at the customer site, and perform administrative duties on existing systems to be integrated.

Installation Results

The table below presents the time it took each factory installer (or installation team) to perform a complete installation of their server and related components. A complete installation is one where the system was ready to accept calls and process messages for all message types. To be fair to all vendors, we subtracted any time that could be attributed to PBX, Exchange server, NT server, or LAN infrastructure issues that were not directly under control of the installer. We also subtracted any time that we thought was not "typical" for a given install sequence such as having to start over because a wrong software component was mistakenly installed.

Installation Activity	AVT	Nokia	Siemens
Number of factory reps present	1	2	4
Install & configure voice & fax server, including integration with Exchange			
Number of programs	4	1	2
Time to complete	3 hrs.	30 min.	5.25 hrs.
Time to install & configure Outlook client	4 min.	4 min.	3 min.
Time to install & configure call-handling desktop client	9 min.	8 min.	N/A

Table Notes: Please note that the standard installation required varied greatly with each product. Please read the descriptions below for details.

The Onebox service had a completely different installation procedure as compared to the hardware-based products, so we rated the installation from the viewpoint of a computer-savvy customer. The following chart reflects the Onebox installation results:

Installation Activity	Onebox
Time to install (sign up for) client	5 min.
Time to configure client	5 min.

Comments from review results meeting and reports:

AVT

General comments – The installation of CallXpress was the most difficult of the group. There were a total of six different installation programs, and quite a bit of configuration effort required. Even the installer needed to call for technical support in order to complete the installation.

Voice & fax server – The voice server unit came with Windows NT pre-installed. Even so, our installation of CallXpress required running 4 different installation programs to set up the system: the CallXpress program on the voice server; the Outlook client enabling software on the voice server; the RightFax program on the fax server; and the Directory Agent for Exchange on the CT Labs Exchange server. We found the level of operating system knowledge needed to be minimal for all of the installation programs, but we noted that medium CT knowledge was required for the CallXpress program, and medium networking knowledge was required for the Outlook client enabling software.

When we were trying to install and configure the RightFax program, the installer discovered that the server unit he requested built by AVT to house the voice and fax boards had not been certified to work with the fax boards, so AVT had to build and send us an additional server with the fax board installed. (Note: AVT has since certified the fax board with the Proliant 800 chassis, so we should not have needed a different fax server). Since the fax server arrived a few days after the installer left, this required us to do the installation of RightFax with the installer helping out via the phone. After we thought we had the fax system installed and configured correctly, we discovered that we could not complete the fax tests, as the PBX would not route the faxes through to the fax server. After troubleshooting with AVT technical support, it was recommended that we reinstall the fax software with a different configuration. At this point in the test, we had run out of our allotted time and had to abort the fax test for AVT.

User clients – The Call Manager client was easy to install and configure once we figured out that the user must have gone through the TUI setup program to activate their mailbox first. The Outlook client was also easy to install, but is recommended that the administrator perform the installation and configuration in order to correctly enter the server and user account information. Both required minimal operating system, CT, and networking knowledge.

Nokia

General comments – The IntegraX was the quickest and easiest installation of the group. We were ready to accept calls into our system in about half an hour. The system they provided was the standard unit they sell, which is a turnkey solution.

Voice & fax server – There were two major reasons that this installation was so quick and easy. First, all the necessary software came pre-installed on the system, so all we needed to do was plug it in, perform some site-specific configuration tasks, and create our user accounts. Second, since the fax server was an integrated part of the IntegraX, and since the fax board was pre-installed in the same unit, the fax integration process was very easy.

User clients – The IntegraMail Outlook client was easy to install and configure, as was the desktop IntegraCall client. The only minor annoyance we noted was the need to reboot the PC after installing each client application, so that meant two reboots per PC.

Siemens

General comments – We were amazed when four installers showed up to install the Xpressions product and asked if this was something that every customer could expect. We were told that depending on the size of the installation, and whether the customer purchased the fax server option, a typical customer could expect anywhere from 1 to 3 installers. In our case, one installer was a PBX expert who was needed to install and configure the CorNet PBX. A typical user would probably be integrating with an existing PBX system which would obviate the need for this person coming from Siemens. The second installer was the fax expert, and the third installer performed the actual installation and configuration of the Xpressions system, which would be a requirement for every installation. The fourth installer took the role of installation project manager.

Voice & fax server – The Xpressions installations are fully performed at the client site – not even NT is pre-configured on the base system. However, the complexity of the installation task is greatly reduced by an installation program that requires the site administrator to answer a number of questions about the setup and then creates a diskette with these options/answers. This diskette is then used to automate the installation process. So while the installation took almost 5 hours, the difficulty level was low in all categories (operating systems, CT, and networking). The Fax Sr. server did come pre-installed, but there was a short (3 minute) installation required on the CT Labs Exchange server and approximately 30 minutes of configuration work to integrate Fax Sr. into the system.

User clients –Xpressions has a client web GUI that can be run from any PC on the network where the users can customize their preferences. Xpressions Viewer is the Outlook client that can be installed either from CD or posted on the network to a shared directory. The Outlook client was fast and simple to install, and did not require a reboot of the system for it to become active.

Misc. Installation Information

	AVT	Nokia	Siemens
How is the fax server component provided in the product?	RightFax fax server installed on a separate fax server PC	GammaLink fax board in the IntegraX server	Fax Sr. installed on a separate fax server PC
Outlook client release tested (for Win 98 and NT workstations)	Outlook 98	Outlook 98	Outlook 98
Required install of software on Exchange Server PC?	Yes	No	Yes (for Fax Sr. only)
Required install of software on client desktops?	Outlook and proprietary client	Outlook and proprietary client	Outlook only
How many admin. clients are needed to maintain voice, fax, and email user directories?	1 or 2 -- AVT allows you to choose if you want to administer the users from CallXpress or if you want to do it through Exchange	1 -- All user maintenance is done through the IntegraX client	2 -- Some of the user maintenance is done through Exchange, and the remainder is done through the Xpressions client.
How do you create the initial phone server user directory?	Can create on CallXpress server, or you can install the Directory Agent which adds a CallXpress tab to Exchange. Exchange users with unique extension numbers would synchronize with CallXpress to create accounts. If the site has CallXpress but is adding Exchange, you can also batch import qualifying mailboxes from CallXpress to Exchange by running a DOS command from the command prompt.	Can create on IntegraX, or can import users from Exchange as long as they have a unique extension number. You can set up IntegraX to synchronize with Exchange user list on a regular basis.	Xpressions users must have an Exchange account before an Xpressions account can be set up. There is a batch import utility that will pull in up to 2500 Exchange accounts at a time to a selected template type and create Xpressions accounts. For smaller numbers of users, you can access them through the Xpressions admin GUI by choosing the accounts one by one to set up Xpressions accounts.

Telephone user interface tests and analysis

The telephone user interface for each product was evaluated with specific comments for each product given below. Generally, we found the products to implement the TUI well, especially given the TUI interface for unified messaging products is among the most complex among all classes of CT equipment. There are a lot of options when you have 3 different message types to manage. The following table presents the results of our TUI analysis for each product:

TUI Parameter	AVT	Nokia	Siemens		Onebox
Default system prompt set					
Prompt gender (M/F) -	F	F	F		F
Quality of prompts (1-10) -	10	10	10		8
Continuity of concatenated prompts (1-10) -	10	10	10		8
Expert system prompt set:					
Quality of prompts (1-10)-	(N5)	N/A	10		N/A
Efficiency (brevity) of prompts (1-10)-			10		
TUI Keystroke efficiency (keystroke counts)					
Log into mailbox (N1)	8	8	10		8
Perform review of 3 messages (N2, N4)	9	6	10		7
Record-a-message sequence (N3, N4)	19	18	18		50
Switch personal greetings (N4)	8	4	4		14
TUI User Friendliness					
Consistent use of menu keys (1-10)-	10	10	9		10
Descriptive nature of system prompts (1-10) –	10	10	10		9
TUI menu counts					
Total TUI menus --	21	18	25		11
Maximum selections/menu –	12	11	7		7
Average selections/menu -	4.6	4.8	4.5		4.4

Table Notes:
1. Assumes a 4-digit password is used.
2. The sequence of TUI operations for this test is: Review 3 messages by playing 1st msg. to the end, back up 10 seconds, play to end; delete 1st MSG; play & reply to 2nd MSG; play & save 3rd msg.
3. The sequence of TUI operations for this test is: record a msg., review it, and send it as urgent to 3 mailboxes.
4. This keystroke count assumes that the user is already logged into their mailbox.
5. We did not detect any difference between the normal English prompt set and the Concise English prompt set. When we talked to AVT about this, they indicated that the major difference between the prompt sets was that the concise set only gave shortened confirmation prompts. In our opinion, this does not qualify as a true expert prompt set.

Comments from review results meeting and reports:

AVT – The CT Labs reviewer found this TUI to be quite user-friendly and provided user control for recording (e.g. we liked the "2" to start, "2" to stop recording feature). One area we found somewhat awkward was in the message notifications area where a caller is stepped through a series of single-option "menus." We felt that it would have been somewhat easier to put everything in one menu. There is also a

use of the "0" key for something other than "Operator" or "Help" in the send options menu which had other available numeric keys that, in our opinion, would have been better choices.

Nokia – We found this to be the most user-friendly TUI. We particularly liked the fact that every significant TUI-based command asks the user for verification. Nokia had the lowest menu count and the most efficient keystroke counts in our tests. The biggest negative we found in their TUI was that when you are adding recipients for a message, you can only add one at a time, after which you need to indicate that you would like to add another recipient. Most messaging TUIs allow the user to enter as many recipients as they like, and indicate when they are done with a special key like "#".

Siemens – We found the Xpressions prompt voice to be the most pleasant of the prompt voices we reviewed. We also noted that this was the only product reviewed that would not allow the interruptions of error messages, which is a good thing and helps prevent the caller from getting confused if they inadvertently make a touch-tone error. On the downside, there were so many options dealing with private lists in this TUI that the CT Labs tester found it difficult to navigate this area. As for the general TUI navigation, we had a comment from one of the installers that he had set up speed dial numbers to take him to a specific place in the TUI—not a bad idea in our opinion. In the non-expert mode each menu announces a function summary for the menu before it gives you the individual options. Because of this, we feel few users would put up with that inefficiency for very long. Instead, most users will opt for expert mode which omits the summary and uses shortened prompts as well, making the TUI much more user-friendly and efficient.

Product User Guides and On-line Help

As the products were installed and used throughout these review tests, the quality and usability of the product's documentation and help was evaluated and summarized below. The analysis was broken down into administrative and end-user documentation and on-line help. On-line help includes that help which is accessible from the running client programs. Documentation includes both printed as well as electronic guides and learning programs and tutorials.

Product User Guides, Online Help	AVT	Nokia	Siemens		Onebox
Admin. user guides	7.8	9	8.5		N/A (N3)
End-user user guides	8	8.5	9		8.5
Admin. on-line help	8	N/A (N1)	9.8		N/A (N3)
End-user on-line help	7	9	9.5		8.5
Overall weighted score:	7.7 (N2)	7.5	9.2		8.5

Table Notes:
1. There was no online help available for the Nokia administrative GUI.
2. There are noticeable differences in some of the scores for AVT from their scores in the Unified Messaging test we performed in 1999 for CT Magazine. We would like to note the following changes that might help explain the difference: this review is on a newly-released version, our testing standards and methods have been revised since the last U.M. review, and the COACH user tutorial which we reviewed last year was not provided for our review this year.
3. Since Onebox is a product that only supports one user per account, each account is responsible for their own administration through the client user interface.

Notes from Reviewers:

AVT – Overall, we found the online help and documentation to be adequate. In both help and printed documentation, there was good information presented in a format that was easy to navigate. Several times, however, we were caught looking for information but were unable to find it using the index or help contents list. We did find a few areas that were a bit lean. For example, we found a lack of information about how to change the routing configuration for the night attendant menu (we finally figured it out by trial and error), and we had a hard time figuring out why we couldn't put a call on hold using the call-handling desktop client (we finally figured it out). Our major complaint about the client on-line help is that there is no context-sensitive or "what's this?" help. The "printed" documentation consists of a number of Adobe Acrobat documents on the CallXpress CDs, including a 172-page Admin Guide and a 112-page Install Guide. There is also a 25-page client User Guide that mentions a COACH program, a multimedia tutorial for new users, but it was not included in our materials so it was not reviewed.

Nokia – The Nokia administrative "GUI" is text-based and has no on-line help available. Even though it was not Windows-based, we found the GUI to be pretty self-explanatory, and we were able to perform all normal functions without any on-line help. The client online help and the written documentation were well-written and we were able to find answers for everything we needed. There were two administrative reference manuals: a 373-page Technical Reference Manual and a 248-page Switch Integration Notes guide. There is also a 28-page IntegraMail guide that covers using UM functions from Outlook and using the IntegraCall for handling incoming calls. There is also a wallet-sized Quick Reference TUI guide. The IntegraCall program runs a nice CBT program that guides first-time users through the basic functionality of the program and familiarizes them with handling incoming calls.

Siemens – We found the online help for Xpressions to be among the best online help systems we have tested at CT Labs. There are plenty of figures, diagrams, and pictures to enhance the help content. Also, there is context-sensitive field help. There is also context-sensitive online documentation that will open to the appropriate section based on the current active dialog box. Besides the standard content list and index, the Xpressions on-line help also has a glossary and plenty of hot-spots within the text to move to related topics. We found the written documentation to also be very informative and easy to use. We reviewed the 348-page System Administration Guide, the 56-page Customer Site Planning Guide, the 157-page Installation and Service Guide, and the 40-page Subscriber Import Procedures. The one major area for improvement--the System Administration Guide lacked a troubleshooting section. The user guides consisted of a 17-page Quick Reference Guide, and a 58-page User Guide, both of which we found to adequately address customer needs.

Outlook Client evaluation

As the product was installed and used during these review tests, impressions relating to the functionality, consistency, and ease-of-use of the end-user Outlook graphical user interface were noted.

The Outlook client integration was examined in detail. We rated how seamless the fax and voice message integration was; in other words, how easy it was to manipulate those message objects within the Outlook interface.

Outlook client interface	Factor	AVT	Nokia	Siemens
Fax integration ease of use	10%	9.5	9.5	10
Fax integration dialog layout	10%	10	10	10
Voice player dialog ease of use	10%	9	10	10
Voice player dialog layout	10%	10	10	10
Virtual sound card operation	10%	10	10	10
Overall ease of use	50%	9.5	9.7	10
Score:		*9.6*	*9.8*	*10*

Since Onebox uses a proprietary web client instead of Outlook, the following table shows the Onebox score for their client interface:

Web client interface	Onebox
Overall ease of use	9.5

Notes from Reviewers:

AVT – This Outlook integration gives the Outlook user easy and complete control over playing voice-mails and viewing faxes by adding a fax message form and a voice message form. It also adds icons on the Outlook menu bar for recording a voice message, live reply (calling the person back who sent the selected message), and for hanging up the phone. The only problem we had with the voice form was the "voice reply" button. When the system routes a voice mail, it logs it into the system by the caller ID, not the extension. So, unless a user is logged into the voice mail system before sending a voice mail, the system doesn't know the identity of the caller, and sends the voice mail as coming from the default setting for CallXpress. This causes the "voice reply" button to send the response to CallXpress, not the caller. If the user isn't paying close attention to the To: line, they won't notice that it's not going back to the person who left the message. Also, when you use the phone to play a message from Outlook, you have to indicate that you have hung up the phone to the program, or it still thinks your phone is in use, and won't respond to the next attempt to play something to the phone.

Nokia – This Outlook integration adds two icons to the Outlook task bar – a New IntegraX Voice Mail button, and a Callback button. The Callback button can be used when a voice mail is from an identified source with a phone number. The New IntegraX Voice Mail button will bring up an IntegraMail form and will allow the user to record a voice message and send it to another IntegraX user. We found the Nokia Outlook client to be a quick and simple way to work with voice messages and faxes.

Siemens – The Outlook integration installs six fax forms: FaxContact to enter Fax addresses, a FaxPreview fom, a FaxPreviewWithViewer form, a FaxStatus form, a ReceivedFaxWithViewer form, and a SendFax form. It also installs an Xpressions Voice Message form that can be used for either sending or receiving voice messages on the PC. The Xpressions Voice Message form contains message playback controls including speed and volume. While we found all three products to be easy to use for

fax integration, we used this as the benchmark in this group because of the ability to easily create a fax to send, and the ability for the user to track the status of a sent fax.

Administrative Client evaluation

As the product was installed and used during these review tests, impressions relating to the functionality, consistency, and ease-of-use of the administrative graphical user interface were noted. We rated these interfaces by looking at a variety of factors, including:

- How many administrative programs must be run to administer the system?
- How easy they are to use?
- How easy it is to create a block of new users?

Admin. client interface	AVT	Nokia	Siemens
Overall ease of use	8.5	7.5	8.8

Notes from Reviewers:

AVT – This is a Windows-style GUI that provides basic functionality in a reasonably easy to navigate format, and we found had no defects. One very nice feature of this GUI is that it provides functionality to modify a block of users. Since we chose to set up the Directory Agent for Exchange, we were able to perform all of the user maintenance on the Exchange server instead of on their proprietary GUI, so we didn't need to use it much after our original system configuration was complete. We did mark their score down for one major annoyance: there is a security feature with this GUI that will log the administrator off after approximately 20 minutes of non-use. The problem is that the GUI doesn't show any obvious indicator that it is no longer logged in. So there were many times that we tried to perform a function in the GUI, only to find out that when we tried to save the change we were no longer logged on. At that point, we had to log on and redo whatever function we were trying to perform. When we asked AVT about this, they indicated that this was the way the program worked, and that the administrator should get in the habit of logging off the administrative GUI immediately after they had completed the task.

Nokia – This is a text-based interface that packs a lot of functionality into a limited number of screens. While we had occasional problems locating the correct menu option for the function we wanted, for the most part this program was easy to understand and use. It was almost like rediscovering a lost art when we had to relearn using key strokes to move through the menu structure, the return key to toggle between field options, and the escape key to exit back to the previous screen. But with just a little practice, it became mostly second nature. One thing that we found very helpful: if you were editing a mailbox, you could use the PageUp or PageDown keys to move to the next or previous mailboxes. We encountered no defects in this product, and our only real complaint aside from the fact that it was not Windows-based is the fact that there are so many options and subcategories in some of the deeper menus (like the mailbox maintenance screen). While this product will synchronize user information with the Exchange user directory (for users with unique extension numbers), user maintenance still must be performed through the IntegraX administrative GUI.

Siemens – This is a web-based GUI that is robust and full-featured, with good organization and quick command execution and response times. The product is mostly administered through the Xpressions administrative GUI, which is synchronized with the Exchange user directory, but fax information is maintained through a tab on the Exchange server added during the install of Fax Sr. We encountered two problems that caused us to mark this GUI down slightly: (1) the fax reports failed to run properly, and (2)

there are several field help topics that come up blank. Both of these problems have been identified by Siemens and we are told they are slated to be fixed in the next release. Other than that, we were impressed with this GUI and liked the way that it used the domain logon for the computer to determine the user access rights to the web GUI functionality. This way, an administrator can use any domain PC to access the administrative functions with no installation necessary. Very slick. The user accounts are based on templates, so changes to a template will change the displayed functionality of the GUI for entire groups of users.

Product features

Unified messaging systems by definition for this report provide both telephone call and single-screen desktop access to voice, fax, and email message types. Among the additional features that all products in this test shared were: email text-to-speech capabilities to "hear" your email through the TUI; choice of listening to your voice messages from the desktop by either phone or PC sound card; graphical user interface for the user to set personal mailbox options; and TUI options to forward emails or faxes to a nearby fax machine.

The following is a summary of notable features for each product:

AVT – We found their feature list to be very complete and included the following:
  - Flexible message ordering – in addition to chronological or message type sorting, users also can choose to order their messages by outside caller or by specific mailbox
  - Integrates with Microsoft Outlook
  - Provides a proprietary desktop message client for customers not using Outlook
  - Message recipient can augment the subject line text or add text notes to voice messages
  - Rules based message management – greater control over message notification and forwarding
  - Bookmarks can be placed in messages to mark important sections
  - Fax from any Windows application (Note: since we were not able to get the fax server configured, we were not able to test any fax features)
  - Directory Agent adds a CallXpress tab to the Exchange Administrator, allowing user maintenance from Exchange
  - Multilingual capability available in up to 5 languages

Nokia – We found their feature list to be complete and included the following:
 - Desktop call handler – provides desktop call control
  - Web-based user interface
  - Provides integration with Microsoft Outlook or Lotus Notes
  - Provides a proprietary desktop message client for customers not using Outlook or Lotus Notes
  - Fax server integration with stand-alone fax servers (or can utilize an internal fax service on an internal fax board)
  - Multilingual capability of IntegraVM+ available in up to 9 languages

Siemens – This product did not have a desktop call handling GUI like the other two contenders.
  - Downloadable voice file reader for non-Xpressions users who receive Xpressions voice mail as email attachments
  - Web-based administrative and user interfaces
  - Site-delineated user administrator rights – can set several levels of administrative access
  - Ability to create, send, and receive fax documents in Outlook and track their status
  - Multilingual capability available in up to 3 languages (with 2 more to be added by the end of 2000)

Product performance

The heart of the CT Labs effort is performing product performance tests. This section describes those tests and the test conditions that were applied to each product.
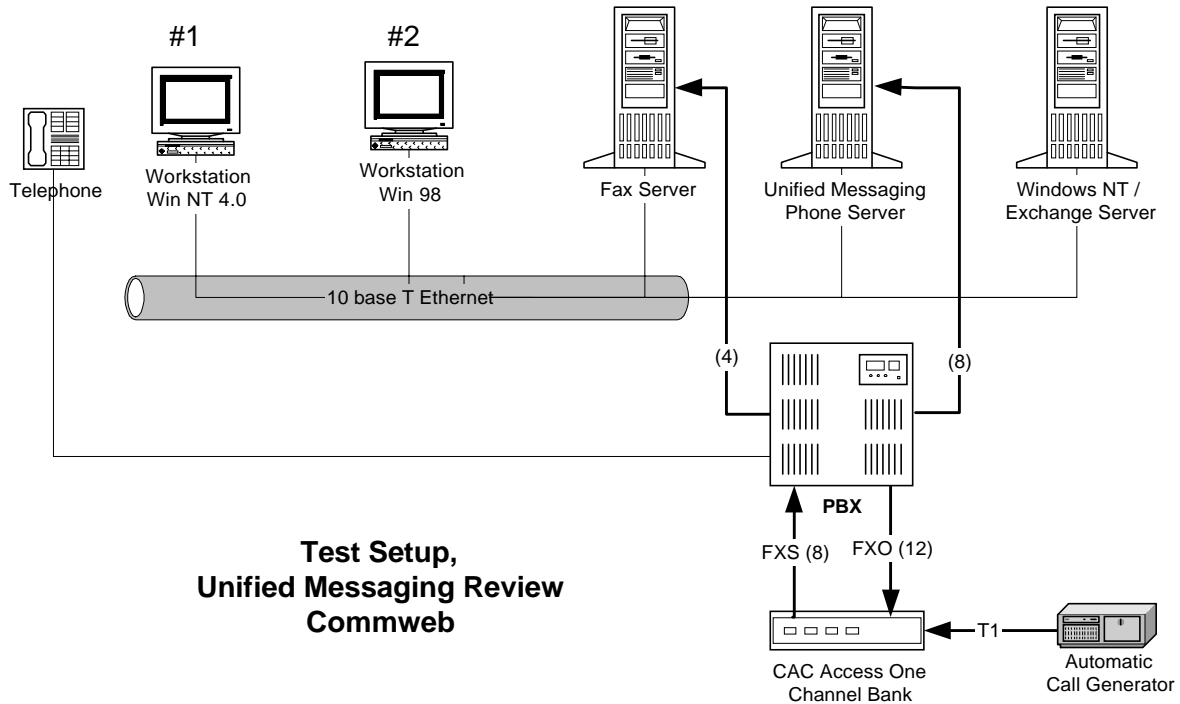
**Test Setup,
Unified Messaging Review
Commweb**

Test Setup

As the above figure illustrates, the tests for this review were conducted in an environment designed to simulate an actual medium-sized office environment. A Windows NT server with Exchange installed on the same NT server was connected to the 10-Base-T LAN. Siemens provided a CorNet 30ECX PBX with a T-1 trunk interface for their tests so the channel bank was not used in this configuration. Nokia provided a Samsung DCS PBX with analog trunk interfaces that was used for both the Nokia and AVT testing. The PBX systems were configured to support our testing needs of 8 incoming trunk lines and 16 analog station ports. The Unified Messaging (UM) Phone Server was connected to the PBX via 8 analog station lines. Only the Nokia system utilized an internal fax server, while Siemens and AVT utilized external fax servers. The fax server (or phone & fax server) was attached to the same LAN and the PBX via 4 analog phone lines configured as 2 send, 2 receive (for AVT, we only set up 1 fax line). The remaining lines were connected to the Hammer via an FXO channel bank.

Workstations on the LAN were used to test both user and administrative client features of the unified messaging systems. One workstation was configured as a Windows NT system while the other workstation was set up with Windows 98. The workstations were accompanied by a plain 2500 (touch tone) station phone set which was used in live tests.

Load and performance test calls to the Phone Server were generated by a Hammer Technologies IT call generator. Outside calls were simulated by the Hammer on 8 FXS analog lines driven by the CAC Access One channel bank. Inside calls were simulated by the Hammer on the 12 FXO analog lines driven by the channel bank. Simulated outside calls that tested the auto attendant features of the Phone Server were answered via the 12 FXO analog lines terminating into the same channel bank (the 'inside' lines).

Performance testing conditions

Condition #1: 1 phone line handling calls
Condition #2: 8 phone lines handling calls

All phone server performance tests for this review were done with:
- 16 users entered into Exchange server
- Microsoft Exchange server V5.5
- Windows NT Server 4.0 with Service Pack 5
  Server specs: 300 MHz Celeron; 64MB RAM; 9.8GB hard drive w/ 9.2GB free
- Fully automated Hammer-generated phone calls, ensuring uniform test call conditions.

What we did not test for this review due to time limitations:
- any additional web administration or web user client features (since Siemens ONLY had web-based administrative and client options features, we did review them)
- any email server integration other than Microsoft Exchange

The Product Performance Tests

This section presents the test procedures, the purpose of each test used from this suite, and how it was performed.

The Phone server Automated Exercise Tests

CT Labs drew from its Voice Messaging Test Suites for these tests although significant modification had to be performed on the scripts for each vendor to achieve the consistent testing results needed for this review. These tests were developed to run on one of our Hammer Technologies testing platforms.

Each of the tests were run on 16 mailboxes that were created and active on each phone server. On all 8-line single scenario tests (scenarios PO, LM, SM, and DL explained below) we generated 48 calls (1 call per mailbox, for a total of 12 calls per line). These tests each take about 15 minutes to complete. On all single-line tests, each scenario was run for 12 calls on 12 different mailboxes. These tests also took about 15 minutes per test run. Normally, each test waits 6-10 seconds after a call has been completed before generating a new call on a given line. If the test script detects a busy signal when trying to generate a call, the test waits 45 seconds before dialing into the PBX hunt group again.

Simply exercising the phone servers to verify no obvious crashes is not enough for CT Labs to be satisfied that all is well; we also verify that each and every message that was sent to a specific mailbox gets received in the proper destination mailbox, in the correct time order, and with a verification of the actual message content, too. This is done by recording simulated messages from callers by using multi-frequency tone digit sequences as the recorded audio. That way we can play the mailbox message back and verify the unique and correct message ID for that mailbox message slot. We track all this mailbox activity under control of our testing script that is driven by a Microsoft Access database that can be inspected at any time during or after the test to verify proper operation.

Here is a summary of the simulated caller operations for each of the test scenarios for these systems:

Mailbox Personal Options Exercise – This exercise generates a simulated call for each mailbox user, logging into the mailbox and setting the "Do Not Disturb" mode for each mailbox.

Mailbox Outside Caller Exercise – A simulated outside call is generated for each user mailbox on the system. During each call a single message of a known content, including MF tagging for which mailbox the message is sent to and the number of the message, and duration is left in the mailbox of each user. For this exercise, all users must be configured as "Do Not Disturb" via the preceding Personal Options exercise. There may be multiple calls generated for each mailbox.

Mailbox User Message Retrieval Test – This exercise generates a simulated call for each mailbox user, logging into the mailbox, retrieving all messages in the box and verifying that the correct number of messages is present via the MF tagging, verifying that the length and content of each message is correct. This test is ended by saving each message.

Mailbox User Message Deletion Test – This exercise generates a simulated call for each mailbox user, logging into the mailbox, retrieving all messages in the box and verifying that the correct number of messages is present via the MF tagging, verifying that the length and content of each message is correct. This test is ended by deleting all messages in each mailbox.

Multi-scenario tests, 8 lines
This test ran a pre-defined sequence of all the above 4 test scenarios with 8 trunk lines active. Note that this test runs multiple scenarios during a single call, thus exercising the voicemail features in a more "real world" manner.

The following table presents test results for the TUI automated exercise test suite. The following is a description of some of the table items:
- Busy (blocked) calls – This parameter measures the number of times that a generated call encountered a busy signal. This occurs when a phone server line is still off-hook after the end of a previous call which is likely due to the phone server performing post-call message management tasks (like sending a message to Exchange Server and awaiting a response). Lower counts are better.
- Detected errors – If any automated scenario encountered an unexpected error during a call, this parameter takes those occurrences into account. Early call termination, incorrect mailbox message contents, and other things are all logged as failures by the CT Labs test scenarios.
- DTMF performance – This parameter measures the time that it takes for the phone server to play the resulting system prompt after a touch tone command was issued. Shorter is better.
- Call answer performance – This parameter measures the time it takes from when a new call is generated by the Hammer to when the target phone server has answered the call. This delay includes a 2 second script delay waiting for PBX dial tone, at least one ring cycle, sending of the PBX integration digits, and the answering of the call by the target system. Shorter is better.

Phone Server Automated Test Results	AVT	Nokia	Siemens		Onebox
Single scenario tests, 1-line exercise					
Detected errors, all scenarios -	0	0	0		0
Single scenario tests, 8-line exercise					
Busy (blocked) calls	0	0	0		N/A (N3)
Detected errors, all scenarios --	4 (N1)	0	0		
Multi-scenario test, 8-line exercise					
Busy (blocked) calls	0	0	0		N/A (N3)
Detected errors	20 (N2)	0	0		
DTMF performance (in seconds)					
Average response delay	0.62	0.83	0.41		0.95
Call answer performance (in seconds)					
Average answer delay	2.70	2.82	2.04		2.69

Table Notes:
1. One error was caused by early call termination, one was caused by a DTMF performance failure where the system didn't respond within 5 seconds of a DTMF command being issued, and two were caused by DTMF detection failure, where the AVT phone server failed to detect a DTMF tone when we tried to dial an extension number. The Auto Attendant failed to recognize the extension and immediately gave an error message that we had entered an invalid extension. On the original run of the test, we ran into a large quantity of DTMF detection failures, and contacted AVT. AVT responded that the auto attendant prompt may have been too loud, so we re-recorded the prompt and reran the test. The above results are from this second test, and show only two DTMF detection failures.
2. One error was caused by early call termination by the AVT phone server, five were caused by DTMF performance errors (> 5 seconds of delay from dtmf command to the playing of the next prompt), and the remaining fourteen were caused by apparent DTMF detection failures while dialing an extension into the auto attendant menu of the AVT system. When we first contacted AVT support regarding these failures, they suggested that the auto attendant greeting message that was playing when we interrupted it with dialed extension digits may have somehow been interfering with the ability of their system to detect the DTMF digits. Our engineer then re-recorded the auto attendant greeting and noted reduced (but not zero) errors of this type. The reported error counts are the best we were able to achieve with their unit.
3. Since Onebox is a system set up for individual user needs, we did not exercise Onebox with more than 1 incoming call at a time.

Recording Bandwidth Test
This test indicates the amount of storage that the target phone server system uses when it takes recordings from callers. The greater the bandwidth, the fewer minutes of storage can be maintained on the server for a given size of hard disk. Using the resulting recorded speech files from the recording quality test, the bandwidth of the recording storage is calculated. This is performed on the recorded files that are resident on the target phone server system. Recorded files from two channels are analyzed to eliminate any possibility of a single-channel anomaly in the measurement data.

Recording Bandwidth	AVT	Nokia	Siemens		Onebox
Mailbox	#101	#101	#101		
File Size (kbytes) for message 42.8 seconds long	134	73	359		65
kbytes/sec (lower is better)	**3.1**	**1.7**	**8.4**		**1.5**
Mailbox	#201	#201	#108		
File Size (kbytes) for message 42.8 seconds long	134	73	358		65
Kbytes/sec (lower is better)	**3.1**	**1.7**	**8.4**		**1.5**

The phone servers often have the capability to change the recording bandwidth but CT Labs evaluated the default setting as installed by the factory personnel. The winner in this category is Nokia with 1.7 kbytes per second of recording. The downside of selecting lower disk consumption can be lower recorded speech quality so these scores should be correlated against the recording quality scores in the next section.

Recording Quality Test

This test determines the quality of recordings that are made by users who record and send voice messages using the TUI. It was performed with an automated Hammer testing script that logs into a system mailbox, records a message that was generated by having the Hammer play a high-quality reference 20-second speech prompt into the target system when it was recording. This reference speech prompt is a 16 bit / sample 8k sampling rate speech file that has been bandwidth-limited to 3 kHz to simulate a typical telephone line connection. Then, the recorded message is played back on the same Hammer channel and the resulting playback audio is recorded as a Hammer speech file for off-line quality analysis using the PAMS (Perceptual Analysis Measurement System) technique. PAMS compares the reference and processed (degraded) samples and determines Mean Opinion Score for both listening quality and listening effort. The calculated scores are designed to track a typical live listener MOS test in laboratory conditions. The listening quality and listening effort score is based upon a five point category judgment scale as follows:

Score	Listening Quality	Listening Effort
5	Excellent	Complete relaxation possible; no effort required
4	Good	Attention necessary; no appreciable effort required
3	Fair	Moderate effort required
2	Poor	Considerable effort required
1	Bad	No meaning understood with any feasible effort

The test results are thus presented below:

PAMS Recording Speech Quality OMOS Scores (higher is better)	AVT	Nokia	Siemens		Onebox
Speech listening quality (1-5, higher is better)	3.24	3.22	3.67		3.01
Speech listening effort (1-5, higher is better)	4.22	4.15	4.82		3.73

While all vendors had adequate speech quality, the winner in the speech quality category is Siemens, which is not surprising given that they are running with much greater recording bandwidth as compared to the other vendors. Since Nokia is recording using much fewer bytes/sec, it is logical to expect their recording quality to be lower, as the above numbers bear out. Whether the difference is significant remains as a judgement call for the user.

Email "Text-to-speech" Quality Test

This test evaluates the quality of each phone server's ability to read email messages to callers. That is, a caller can log into their mailbox and literally listen to their email. This is accomplished using Text to Speech technology. This test was performed by first sending a special "torture test" email message (see Appendix A) to a system mailbox and then listening to the message using the text-to-speech feature. The resulting audio from each vendor's system was captured in an audio file. Each vendor's audio file was then level-equalized and played to a group of 6 listeners in a live-listener quality scoring session.

One of the important "tricks" of electronically reading an email message is that emails use special abbreviations and formatting that would sound strange when read back (e.g. FYI, BTW, <g>, etc.). So a good TTS engine should "expand" these abbreviations such as FYI into real words. Email formatting oddities include the need to skip over any ">" characters that often precede new lines in email message replies. Other common formatting errors should, in the ideal case, also be intelligently skipped over by a good TTS engine (things like missing spaces after periods, double capital letters in the first word of a new sentence, etc.). Not one of the vendors performed perfectly with our torture test, an admittedly tough test.

Two separate evaluations were made in the email-to-TTS test: (1) we counted the number of incorrect email "expansions," and (2) we scored the "listening quality" of a clip of speech taken from the spoken test email message. In the quality scoring session, we prepared a single audio file that contained each level-equalized clip and played them in randomized succession to a group of listeners, asking them to rate each on a scale of 1-10, where:

Score	Listening Quality
10	Excellent
8	Good
6	Fair
4	Poor
2	Bad

The listeners who did the scoring did not know beforehand which vendor was associated with which clip. It is important to note that these scores are not to be considered traceable to Mean Opinion Scores as the tests were not conducted in such a controlled environment.

Email TTS Quality Test	AVT	Nokia	Siemens		Onebox
TTS listening quality (1-10, higher is better)	6.3	6.2	6.1		7.5
No. of "expansion" errors (lower is better)	5	5	5		5

Note that we did not count multiple occurrences for a specific type of expansion error more than once for a given vendor. For example, if a ">" character at the start of each new line is spoken more than once this was counted as a single error. Each of the three vendors had the same expansion errors: there was no translation for IMHO (in my humble opinion); no translation for BTW (by the way); no translation for ASAP (as soon as possible); <g> (grin) was translated just as "g"; and a sentence with no spaces after the

period was treated as web address with the period stated as a "dot." The occurrence of the exact same errors for each vendor could indicate that they are using the same TTS engine.

We found the three turnkey system vendors to all be remarkably close in the final scoring although Onebox came away with the winning score for best TTS quality. During this evaluation, our listeners noted a variety of speech quality anomalies such as word clipping, graininess, slurring, and warbling. One consistent comment was that our reviewers felt that all products sounded "robotic." While TTS technology is definitely improving every year, CT Labs felt there was still room for improvement in the core TTS technology itself. On the positive side, the implementation of today's TTS technology was found to be good across all vendors.

Fax Send Test

This test verified that we could send a fax from a fax machine connected to our test PBX into the fax server component of the unified messaging system. By dialing into the phone server system TUI using touch tone keys on the fax machine, we directed two reference faxes into two separate mailboxes. Then, we verified that these faxes appeared in the Outlook desktop for each mailbox as new message icons. We also monitored the received faxes for any receiving anomalies.

Fax Send/Receive Test	AVT	Nokia	Siemens		Onebox
Delay from Fax A send to Outlook new message icon (in seconds, lower is better)	N/A	1	5		1
Delay from Fax B send to Outlook new message icon (in seconds, lower is better)	N/A	1	5		1
Received fax quality (1-10, both faxes, higher is better)	N/A	10	10		10

Received fax quality was excellent for both Nokia and Siemens with no detected anomalies. AVT was not tested for fax because we were not able to get the fax configured in the allotted testing time. While Siemens had a slightly longer delay in transmitting the fax to the Outlook client, these are both excellent delay times.

Notes from Reviewers:

AVT – As noted in the installation evaluation, the fax server could not be set up by the vendor within the available testing time. Because of this, we were not able to run this test.

Nokia – While Nokia had almost instantaneous delivery to the Outlook client once transmission was completed, we noticed that in both fax send attempts, the fax server took a long time to acknowledge the completion of the fax transmission, which held the sending fax machine in a longer-than-usual sending cycle after the page was done scanning through it.

Siemens – The faxes were received very quickly with no errors.

Exchange Server LAN Disconnect Test

This test is designed to show what happens to voice and email message handling to dial-in users when the Exchange Server system is disconnected temporarily from the LAN. This includes cases where the LAN cabling might fail as well as cases where the Exchange Server PC itself goes off-line. This test was performed by placing calls into the phone server from a PBX station phone, logging into a mailbox,

disconnecting the Exchange Server LAN cable, and starting to review new messages in the inbox for that user. After reviewing as many messages as possible, and after attempting to reply to one of those messages (i.e. send an outgoing voice message), the LAN cable was replaced and we logged how long it took to restore proper call and message handling after the reconnect. We also tracked how long it took for the sent message to actually appear at the user's Outlook client after the LAN reconnection.

There are many different ways a vendor can handle this case. For example, a vendor may choose to cache all messages for a mailbox user at the phone server so if the Exchange Server goes down it would still be able to play them out to a caller. However, this could cause synchronization problems between the two servers and result in different message lists on different servers.

The results of this test are presented below:

Exchange Server LAN Disconnect Test	AVT	Nokia	Siemens
Time to restore call handling on LAN reconnect (in secs, lower is better)	20	30	10
Time for sent messages to arrive in Outlook inbox after LAN reconnect (in secs, lower is better)	10	10	N/A (N1)
Errors encountered?	0	0	0

Table Notes:
1. The Siemens system does not allow TUI access while the Exchange server is disconnected.

Notes from Reviewers:

AVT – Excellent performance. The current test calls were not interrupted after the Exchange Server was disconnected, nor were there any error messages during the test call.

Nokia – The caller would hear only silence at the point where we tried to access any type of message. Since this system does not allow users to access their messages when the Exchange server is disconnected, their score was downgraded. The one anomaly we encountered was minor stuttering of the voicemail TUI prompt at the moment when the Exchange server was disconnected.

Siemens – The current caller would hear the error message, "The system is unavailable – try your call again later," 30 seconds after LAN disconnection, and then the call would be terminated. Since the system would not accept calls into voice mail at all when the Exchange server was down, it would play the error message "The system is unavailable – try your call again later " which explains why we were unable to measure the response time for messages sent during the outage to reach the inbox after reconnection. Otherwise, there were no errors noted. However, their system was marked down for not being able to access the voice mail system during such a temporary outage.

Phone Server LAN Disconnect Test

This test is designed to demonstrate what happens to message review and send operations from the Outlook client when the phone server unit dies or is disconnected from the LAN. To perform this test, a mailbox was sent 3 new voice messages. Then, from one of the workstations the first voice message is accessed and played. While this play is happening, the LAN connection on the phone server is severed.

To the degree that message objects are stored on the Exchange Server, unified messaging systems should be able to continue allowing client-based message review and send operations for voice messages. As we found with all 3 of the other vendors, no problems were experienced with this test.

Simulated Power Outage Test

This test demonstrates how quickly the phone server units are able to handle another call after having the AC power to the unit turned off for 30 seconds, then turned back on. While CT Labs recommends that any systems be installed with a UPS, should a power outage occur this test shows the amount of time to expect during which the units will be unable to handle calls.

Simulated Power Outage Test	AVT	Nokia	Siemens
Restart time (in secs, lower is better)	232/277	300+/181	270
No. of detected errors	1	1	0

Notes from Reviewers:

AVT – During this test the CallXpress phone server service could not start on its own, since the Dialogic driver installed was not starting correctly. The first time shown for this test is the duration before the service error occurred. At that point, we had to login to the computer and manually start the Dialogic service. The second time shows the time that the CallXpress service actually was able to start. We would expect if the Dialogic service was configured correctly, the first time would be the approximate restart time. AVT commented that this was not the way the system was supposed to work but were unable to fix the problem before the test concluded.

Nokia –When we performed the test with the automated call generator driving calls into all 8 lines, it took over 5 minutes (300+ seconds) for the system to answer one call. We waited for over 20 minutes after it answered on the first line, and all eight lines were not yet able to answer. In order to test if this performance problem was caused by the load on the system, we also ran this test by calling in manually on one line, and found that the system restarted much faster at 181 seconds.

Siemens – We detected no problems while running this test.

Phone server Performance Results Summary

On the whole, all testing went well with few serious problems detected.

Random comments from review results meeting and reports:

AVT – If we had more time we are confident that AVT fax server install issue could have been resolved. They also received the best score of the turnkey systems in the Email TTS Quality Test.

Nokia – A solid performer. While their recording bandwidth was approximately half the size of AVT's, their recording quality was very comparable. The Nokia system didn't recover well from a power outage when it was under heavy call load, but the system did well with the bulk of our tests.

Siemens – Siemens had the best recording quality at the expense of using the most disk storage. They had excellent scores on the fax delay and fax quality test. Their system also had the best AC power recovery time.

Quality, responsiveness, and accessibility of technical support

Because CT Labs requested that each vendor send a technical rep from their company to assist in the setup and running of the tests, the evaluation of factory tech support was not made for these products.

Appendix A – The CT Labs Email Torture Test

This is the email message that is used in our email-to-Text-to-Speech quality test. Intentional typos, typical errors, and common email abbreviations are used so that a real-world analysis can be made as to how well each vendor can ""speak"" these messages to callers.

To: Craig Williamson [craig.williamson@hotcompany.com]

From: Chris Broadway [cbroadway@ct-labs.com]

Subject: Re: Request for information

Dear Craig,

THanks for your query for info about our labs.I will answer your specific questions in a moment but first I wanted to tell u about our certification program

FYI, our program offers certification for a wide variety of CT application types., this includes IP telephony, unified messaging, and much more. IMHO we are the best! <g>

Now for your questions:

> -----Original Message-----
> From: Craig Williamson [craig.williamson@hotcompany.com]
> Sent: Friday, June 25, 1999 5:47 PM
> To: Chris Broadway (E-mail)
> Subject: Request for information
>
>> Is there any way I can get your testing help at
>>   our location in Chicago, IL?
>
>
[chris broadway] Absolutely! We have staff engineers that travel to your site for special projects.

> ~~~~How do you suggest I get the details of your
>   CT/TestView
> program?

[chris broadway] I suggest you check out our website at http://www.ct-labs.com for FAQs and further information. Btw we also have information about our CT/JumpStart libraries for the Hammer test platform that you should check out asap.

Regards,

Chris Broadway
CT Labs
916-784-7870

Appendix B – The Onebox Test Results Report

Product Description

Onebox is a free service available at Onebox.com that allows anyone access to a unified messaging system that will allow the customer to access voice mail messages, email messages, and faxes through web access or a dial-in phone number. This service is available to individuals all across the United States. Onebox currently has phone numbers available for locations in the following states:

58 in California	6 Massachusetts	8 in Texas
5 in Colorado	6 in New Jersey	1 in Virginia
6 in Florida	5 in New York	2 in Washington D.C.
5 in Georgia	2 in Ohio	7 in Washington state
5 in Illinois		

Executive Summary

We found the Onebox unified messaging service to be very well implemented, especially since it is a free service. While enterprise solutions for unified messaging contain more features and options and have more powerful systems capable of better DTMF and call answer performance, the Onebox access software is very easy to install, there is no need for any hardware maintenance, and (did we mention?) it's free! Onebox offers this service to any individual or business, but we did not find that the product had features to truly support a multi-person business: First, Onebox offers no call routing or auto-attendant features, so only individuals voice mail boxes can be accessed by a caller. Another limitation is the lack of availability of local phone numbers in many parts of the nation. The more densely-populated areas of some states have local access numbers (users outside of these area are still allowed to use the Onebox service, but the number a user chooses will then result in toll or long-distance charges in order to access their Onebox account by phone). There are a large number of features and options available for users, and technical support is provided free of charge for any problems the customer might encounter.

So, if you find yourself in need of a service to unify your personal messages, we recommend checking out the Onebox site to see if they have local service in your area. You can't beat the price!

Product Review Results Grid

The following is the test results grid derived from data from all tests that were performed for this product review:

Product Evaluation Category (rate each out of possible 10)	Relative Weight	Onebox
Ease of installation	10	10.0
Online help (web, TUI)	10	8.5
Product features	20	8.5
Product performance (web, TUI)	30	8.5
Graphical administrative interface (web client)	10	9.5
TUI analysis	10	8.0
Technical support	10	8.5
Total:	100	8.7

Note that the relative weights for each evaluation category are given so that readers may re-calculate the scores for each vendor based on their own weightings if desired. Scores may be footnoted to explain unusually high or low scores.

General questions we set out to answer in these tests
Questions:

- How easy is the system to install and set up?

- How do the message notification features compare with typical enterprise voice mail systems?

- How effective is the fax-accessing and email-reading features of this product?

- How do the voice messaging, email messaging, and fax messaging features compare with typical enterprise voice mail systems?

- How intuitive are the telephone user interface (TUI) and graphical user interface (GUI) portions of the product?

- How effective is the online help?

- What type of technical support is offered, and how does it rate compared to typical technical support?

"Ease" of installation

This area of testing involved the evaluation of how easy it is for a typical customer to install and configure a system. This includes installing all necessary components to utilize the unified messaging capabilities of the system.

Installation Results

The table below presents the time it took to perform a complete installation of the system.

Installation Activity	Onebox
Time to install (sign up for) client	5 minutes
Time to configure client	5 minutes

Onebox "installation" consists of signing up for a Onebox account by entering user information and choosing an area code and prefix for a local Onebox number if one is available. The Onebox account is immediately created and available for use via the web-browser and by phone. The web client requires no downloading onto the client computer, as all functionality is driven from the Onebox web server. Once the account is created, the user is shown a screen with basic account information and is requested to print it, fill in the password and phone PIN, and save it in a safe place. The system also sends an email to the alternate email address specified that contains more detailed instructions of how to access and use your Onebox account.

Configuration of the product consists of entering your name and selecting a prerecorded greeting or creating a personal greeting through the TUI, and setting any options desired in the GUI. We included creating a personal signature and setting email preferences as our configuration of the web client.

All in all, the account setup and configuration could not have been quicker and easier. We were very pleasantly surprised to find the account completely active immediately upon completing the account request. There was no necessity to wait for anything to show up in an email account, or wait for the phone extension to become active.

Telephone user interface tests and analysis

The TUI interface for unified messaging products is among the most complex among all classes of CT equipment. There are a lot of options when you have 3 different message types to manage. The following table presents the results of our TUI analysis for each product:

TUI Parameter	Onebox
Default system prompt set	
Prompt gender (M/F) -	F
Quality of prompts (1-10) -	8
Continuity of concatenated prompts (1-10) -	8
Expert system prompt set:	
Quality of prompts (1-10)-	N/A
Efficiency (brevity) of prompts (1-10)-	
TUI Keystroke efficiency (keystroke counts)	
Log into mailbox (N1)	8
Perform review of 3 messages (N2)	7
Record-a-message sequence (N3)	50
Switch personal greetings	14
TUI User Friendliness	
Consistent use of menu keys (1-10)-	10
Descriptive nature of system prompts (1-10) –	9
TUI menu counts	
Total TUI menus --	11
Maximum selections/menu –	7
Average selections/menu -	4.4

Table Notes:
6. Assumes a 4-digit password is used.
7. The sequence of TUI operations for this test is: Review 3 messages by playing 1st msg. to the end, back up 10 seconds, play to end; delete 1st MSG; play & reply to 2nd MSG; play & save 3rd msg.
8. The sequence of TUI operations for this test is: record a msg., review it, and send it as urgent to 3 mailboxes.

The Onebox TUI has a compact menu structure that still manages to contain a lot of functionality for the user. The TUI will support sending messages either to Onebox phone accounts, or to email addresses the user has listed in their personal address book. Taking this fact into consideration when we look at the extraordinarily large number of 50 for the keystrokes in the Record-a-message sequence, we realize that 42 of the keystrokes are used for entering the destination Onebox account numbers which consist of an area code, phone number, and extension. Extra digits are needed because a message can only be sent to one Onbox user at a time, so to send the same message to different Onebox users, the entire process of sending the message must be repeated. The interesting thing is that choosing email addresses allows you to choose more than one recipient for each message, while choosing a Onebox voicemail recipient only allows you to choose one recipient.

We found the TUI to be well-constructed and easy to use. The major detriment to their score in this category was the error handling of the system. There are no error messages when you press an incorrect digit – the result of one touch tone command error (including no response) is that it plays the menu again, and the result of two subsequent errors (including no responses) automatically returns the user to the previous menu. If the user is at the main mailbox menu, two touch tone command errors will log them

off their mailbox. We found this lack of error messages to be rather harsh and reduced their TUI score by a full point.

Any caller to a Onebox extension hears a short prompt "To get your own Onebox, go to Onebox.com" only if they do not immediately enter an extension number after the system answers with "Welcome to Onebox." Once the caller enters the extension, they are invited to either leave a message or send a fax after the tone.

Product Online Help

As the product was installed and used throughout these review tests, the quality and usability of the product's documentation and help was evaluated and summarized below:

Product Online Help	Onebox
On-line help system	8.5

We found the online help for Onebox to contain a large amount of useful information in a format that is fairly easy to use. The user can access FAQs, a Spotlight page with information on the newest changes, and a structured help system organized by a table of contents that can also be searched by keyword or an alphabetical list of topics. The items that caused us to downgrade the system were the lack of context-sensitive help, "what's this" help, and troubleshooting help. However, the system is very easy to understand and use. We would expect that a computer-literate user would seldom need to use the help system. There is also a quick-reference sheet that provides a TUI map for users to print out and reference.

Web-based client evaluation

As the product was installed and used during these review tests, impressions relating to the functionality, consistency, and ease-of-use of the web graphical user interface were noted.

Admin. client interface	Onebox
Overall ease of use	9.5

As we noted above in the online help notes, the Onebox web client is very easy to use, and is well-constructed to let the user quickly get to the functionality they need. There are descriptions of most of the functions right on the screen, so they are easy to figure out and use. We did not discover any defects, and were very pleased at the number of options and ease of configuration. We were also happily surprised to find no advertising banners on the Onebox client. Since this is a free product, we expected annoying advertising left and right. Onebox has recently been acquired by Phone.com, headquartered in Silicon Valley, California, but the site claims that this will not result in any changes to the Onebox service.

Product features

Unified messaging systems by definition are expected to have certain features included, for example, having one user interface to access email, voice mail, and faxes. The Onebox service allows access to these messages via a web browser, or via the mailbox phone number. Following is a list of additional

features included with the product, optional features available for a monthly fee, and features that we would expect to find in a unified messaging product that were not found.

Standard features: These are included in the free Onebox product
- Multiple accounts can be created for any user
- Forwarding messages to another email, and notification to email or ICQ
- Check email from other POP3 accounts into Onebox
- Vacation messages
- Email blocking and filtering
- Electronic signature and v-card
- Change phone number (once a year)
- Calendar and tasks
- Send email or voice mail from web client
- Spell check

Optional features: Onebox.Extra has an introductory price of $4.95/month (half-price) and for a limited time, subscribers receive 2 months free
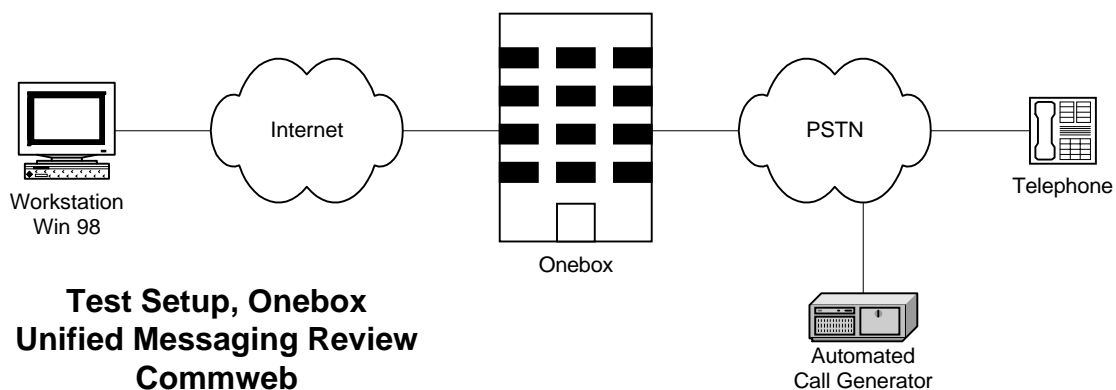- Direct dial number – no extension to remember
- Extra message storage – allows 25MB of storage instead of 3MB
- Personalized voice greeting – no Onebox system greeting for your phone number

Missing features as compared to a typical customer-premise unified messaging product:
- Creating and sending faxes from the web client
- Ability to call into a central number to access any mailbox instead of dialing the Onebox number
- Automated attendant features that would support small-business needs

Product performance

The heart of the CT Labs effort is performing the tests of product performance. This section describes the tests performed and the test conditions that were applied to each product.

**Test Setup, Onebox
Unified Messaging Review
Commweb**

Test Setup

As the above figure illustrates, the tests for this review were conducted in an environment designed to simulate an individual personal or business environment. Onebox provides an unknown configuration of

the phone server and fax server that provide the unified messaging capabilities, so for our purposes we will just represent them as Onebox.

A Windows 98 workstation with Netscape Navigator version 4.71 was used to test client features and performance of the unified messaging systems.. The workstation was be accompanied by a plain 2500 (touch tone) station phone set which is used in live tests of the TUI. Manual GUI testing techniques will be utilized to evaluate the ease of use of the product.

Load and performance test calls to the Onebox phone server are generated by a Hammer Technologies IT call generator.

Performance testing conditions

1 phone line handling calls

All phone server performance tests for this review were done with:
- Fully automated Hammer-generated phone calls, ensuring uniform test call conditions.

The Product Performance Tests

This section presents the test procedures, the purpose of each test used from this suite, and how it was performed.

The Phone server Automated Exercise Tests

CT Labs drew from its Voice Messaging Test Suites for these tests although significant modification had to be performed on the scripts to achieve the consistent testing results needed for this review. These tests were developed to run on one of our Hammer Technologies testing platforms. Each of the tests were run on 1 mailbox that was created and active as a Onebox account. The personal options test ran for a total of 6 calls, the leave message test ran for a total of 6 calls, and the save message and delete message tests were each run for 1 call. These tests took a total of 20 minutes to run. Normally, each test waits 6-10 seconds after a call has been completed before generating a new call on a given line.

Simply exercising the phone servers to verify no obvious crashes is not enough for CT Labs to be satisfied that all is well; we also verify that each and every message gets received in the correct time order, and with a verification of the actual message content, too. This is done by recording simulated messages from callers by using multi-frequency tone digit sequences as the recorded audio. That way we can play the mailbox message back and verify the unique and correct message ID for that mailbox message slot. We track all this mailbox activity under control of our testing script that is driven by a Microsoft Access database that can be inspected at any time during or after the test to verify proper operation.

Here, is a summary of the simulated caller operations for each of the test scenarios for these systems:

Mailbox Personal Options Exercise – This exercise generates a simulated call for each mailbox user, logging into the mailbox and setting the "Do Not Disturb" mode for each mailbox.

Mailbox Outside Caller Exercise – A simulated outside call is generated for each user mailbox on the system. During each call a single message of a known content, including MF tagging for which

mailbox the message is sent to and the number of the message, and duration is left in the mailbox of each user. For this exercise, all users must be configured as "Do Not Disturb" via the preceding Personal Options exercise. There may be multiple calls generated for each mailbox.

Mailbox User Message Retrieval Test – This exercise generates a simulated call for each mailbox user, logging into the mailbox, retrieving all messages in the box and verifying that the correct number of messages is present via the MF tagging, verifying that the length and content of each message is correct. This test is ended by saving each message.

Mailbox User Message Deletion Test – This exercise generates a simulated call for each mailbox user, logging into the mailbox, retrieving all messages in the box and verifying that the correct number of messages is present via the MF tagging, verifying that the length and content of each message is correct. This test is ended by deleting all messages in each mailbox.

The following table presents test results for the TUI automated exercise test suite. The following is a description of some of the report items:
- Busy (blocked) calls – This parameter measures the number of times that a generated call encountered a busy signal. This occurs when a phone server line is still off-hook after the end of a previous call which is likely due to the phone server performing post-call message management tasks (like sending a message to Exchange Server and awaiting a response). Lower counts are better.
- Detected errors – If any automated scenario encountered an unexpected error during a call, this parameter takes those occurrences into account. Early call termination, incorrect mailbox message contents, and other things are all logged as failures by the CT Labs test scenarios.
- DTMF performance – This parameter measures the time that it takes for the phone server to play the resulting system prompt after a touch tone command was issued. Shorter is better.
- Call answer performance – This parameter measures the time it takes from when a new call is generated by the Hammer to when the target phone server has answered the call. This delay includes a 2 second script delay waiting for PBX dial tone, at least one ring cycle, sending of the PBX integration digits, and the answering of the call by the target system. Shorter is better.

Phone server Automated Test Results	Onebox
Single scenario tests, 1-line exercise	
Detected errors, all scenarios -	0
DTMF performance (in seconds)	
Minimum response delay	0.172
Maximum response delay	1.532
Average response delay	0.954
Call answer performance (in seconds)	
Minimum answer delay	0.156
Maximum answer delay	6.515
Average answer delay	2.691

We encountered no errors for any of the scenarios contained in this test. The DTMF and Call Answer performance measures are very acceptable scores.

Recording Bandwidth Test
This test indicates the amount of storage that the Onebox system uses when it takes recordings from callers. The greater the bandwidth, the fewer minutes of storage can be maintained on the Onebox system for the space allotted for the user (3 MB for the standard account). Using the resulting recorded speech

files from the recording quality test, the bandwidth of the recording storage is calculated. This is performed on the recorded files that are resident in the Onebox users web client Inbox.

Recording bandwidth	Onebox
File Size (kbytes)	65
kbytes/sec (lower is better)	**1.5**

This is a rather low file size for this recording, and could have been caused by compressing the data for quicker Internet transmission. Read on to see if the recording quality is affected by the file size.

Recording Quality Test

This test determines the quality of recordings that are made by users who record and send voice messages using the TUI. It was performed as an automated Hammer testing script that calls the Onebox phone number, logs into a system mailbox, records a message that was generated by having the Hammer play a high-quality reference 20-second speech prompt into the target system when it was recording. This reference speech prompt is a 16 bit / sample 8k sampling rate speech file that has been bandwidth-limited to 3 kHz to simulate a typical telephone line connection. Then, the recorded message is played back on the same Hammer channel and the resulting playback audio is recorded as a Hammer speech file for off-line quality analysis using the PAMS (Perceptual Analysis Measurement System) technique. PAMS compares the reference and processed (degraded) samples and determines Mean Opinion Score for both listening quality and listening effort. The calculated scores are designed to track a typical live listener MOS test in laboratory conditions. The listening quality and listening effort score is based upon a five point category judgment scale as follows:

Score	Listening Quality	Listening Effort
5	Excellent	Complete relaxation possible; no effort required
4	Good	Attention necessary; no appreciable effort required
3	Fair	Moderate effort required
2	Poor	Considerable effort required
1	Bad	No meaning understood with any feasible effort

In practice with voice mail systems, scores above 4 are not often found. The test results are thus presented below:

PAMS Recording Speech Quality OMOS Scores (higher is better)	Onebox
Speech listening quality (1-5, higher is better)	3.01
Speech listening effort (1-5, higher is better)	3.73

Since the recording for the Onebox sample was made by using the actual public switched telephone network (PSTN) instead of a laboratory controlled environment, we expect the scores to be lower than our in-house tests, and this proved true. However, the scores are still very acceptable, and accurately reflect how the Onebox customer would hear the calls over the PSTN.

Email "Text-to-speech" Quality Test

This test evaluates the ability of the phone server to read email messages to callers. That is, a caller can log into their mailbox and literally listen to their email. This is accomplished using Text to Speech technology. This test was performed by first sending a special torture test email message (see Appendix A) to a system mailbox and then playing back the message using the text-to-speech feature to six evaluators. The resulting audio was captured in a Hammer audio file for later analysis.

One of the important "tricks" of electronically reading an email message is that emails use special abbreviations and formatting that would sound "weird" when read back (e.g. FYI, BTW, <g>, etc.). So a good TTS engine will "expand" these abbreviations such as FYI into real words. Email formatting oddities include the need to skip over any ">" characters that precede new lines in reply email messages. Other common formatting errors should, in the ideal case, also be intelligently skipped over by a good TTS engine (things like missing spaces after periods, double capital letters in the first word of a new sentence, etc.). Not one of the vendors performed perfectly with our torture test, an admittedly tough test.

Two separate evaluations were made on the TTS feature: (1) we counted the number of incorrect email "expansions," and (2) we analyzed the "listening quality" of a clip of speech taken from the spoken test email message. In the quality evaluation, we prepared a single audio file that contained each level-equalized clip and played them in succession to a group of listeners, asking them to rate each on a scale of 1-10, where:

Score	Listening Quality
10	Excellent
8	Good
6	Fair
4	Poor
2	Bad

Email TTS Quality Test	Onebox
TTS listening quality (1-10, higher is better)	7.5
No. of "expansion" errors (lower is better)	5

Note that we did not count multiple occurrences for a specific type of expansion error more than once for a given vendor. For example, if a ">" character at the start of each new line is spoken more than once this was counted as a single error.

This is a very good TTS score as compared to other CPE unified messaging systems.. The evaluators commented that the voice was very and natural-sounding, and that it was easy to understand. The only flaws noted were that there were two long pauses during the playing of the test email message, indicating perhaps a resource "issue" at the Onebox server, and that the timing of some of the speech segments were a little awkward.

Fax Send Test

This test verified that we could send a fax from a fax machine connected to our test PBX into the fax server component of the unified messaging system. By dialing into the phone server system TUI using touch tone keys on the fax machine, we directed two reference faxes into two separate mailboxes. Then,

we verified that these faxes appeared in the Outlook desktop for each mailbox as new message icons. We also monitored the received faxes for any receiving anomalies.

Fax Send/Receive Test	Onebox
Delay from Fax A send to Outlook new message icon (in seconds, lower is better)	1
Delay from Fax B send to Outlook new message icon (in seconds, lower is better)	1
Received fax quality (1-10, both faxes, higher is better)	10

Received fax quality was excellent with no detected anomalies. There was almost immediate access through the web client to the fax once it was sent.

Browser Access Messages Test

This test verified the amount of time necessary to download a typical 1-page fax and a typical 60-second voice mail through our T-1 Internet connection. We also rated the quality of the fax and voice recordings.

Browser Access Messages Test	Onebox
Fax messages	
Delay from clicking on fax to viewing on-screen (in seconds, lower is better)	2
Amount of time to download fax to hard drive (in seconds, lower is better)	2
Received fax quality (1-10, higher is better)	10
Voice messages	
Delay from clicking on voice mail to start of message playback (in seconds, lower is better)	2
Amount of time to download voice mail to hard drive (in seconds, lower is better)	2
Received voice mail quality (1-10, higher is better)	9.5

We found that the delay to download a fax or voice mail is negligible and saving to the hard drive for future reference is also very quick. We also found the fax and voice mail were of good quality.

Performance Results Summary

Overall, we found that Onebox performed very well in our variety of tests. All of the performance measurements were within an acceptable range for enterprise solutions, so this service should be very satisfactory for an individual user.

Quality, responsiveness, and accessibility of Technical Support

The technical support for Onebox is only initially accessible by sending an email into the technical support address supplied on the Onebox site. We received a generic response immediately from Onebox stating that they had received our email. Approximately 2.25 hours later, we received a custom reply from their technical support department that gave us more information, but did not solve our problem. When we responded that we still had issues, we were then called back by a technical support

representative who was very helpful in working with us and the phone company to solve the problems we were having with accessing our Onebox phone number.

While we found the initial support to be a little slow and cumbersome via email, their response after we indicated that their return email had not solved our problem was exemplary. The willingness of the representative to work with us and solve the problem went well above and beyond what we would expect from a free service. Overall, we felt that Onebox provides a very good level of technical support.