Hentzenwerke Whitepaper Series

Reconfiguring the MBR for Multiple Boot Installations

By Whil Hentzen

I've written a couple of articles on multiple boot configurations. Upon adding a third operating system to a dual-boot machine, I managed to overwrite the machine's MBR (master boot record) so that it pointed to the wrong bootloader. This paper addresses the solution.

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1. Preface

1.1 Copyright

1.2 Revisions

1.2.1 History

Version	Date	Synopsis	Author
1.0.0	2007/12/03	Original	WH

1.2.2 New version

The newest version of this document will be found at www.hentzenwerke.com.

1.2.3 Feedback and corrections

If you have questions, comments, or corrections about this document, please feel free to email me at 'booksales@hentzenwerke.com'. I also welcome suggestions for passages you find unclear.

1.3 Acknowledgments

Thanks to MLUG members Ron Bean, Glenn Holmer, Gary Kramlich, among others, for pointers and suggestions, and to Ted Roche, for patiently reviewing version 1.0 and nitpicking every misplaced git.

1.4 Disclaimer

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Before making any changes to your system, ensure that you have backups and other resources to restore the system to its state before making those changes.

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1.5 Prerequisites

This document was written using Windows XP, Fedora Core 6.0, and Fedora 8, but the concepts discussed here are distribution non-specific.

2. The original configuration

I created a dual-boot machine with XP and Fedora Core 6 a while back. See the articles, Dual Boot with Fedora Core 6 and Windows XP, and, to a lesser extent, Installing Multiple Linux Distributions on a Single Box, for details. The end result was a machine with the following particulars:

- Initial installation of Windows XP using a factory rescue CD. The machine had three partitions. Partition 1 was the XP operating system. Partition 2 was a bit of spare room in a hidden partition. And the third partition was a hidden partition t at the end of the disk where the rescue CD tools were installed. A large amount of space was left unpartitioned to allow for later installs.. Note that it was "partition 3" only for a short time; as other partitions were created out of the unpartitioned space, so this hidden rescue partition was nudged to the end of the list and renumbered.

- The MBR was initialized to point to Windows XP installed in partition 1 and that was that.

- Next, installation of Fedora Core 6 created five new partitions. Since a PC BIOS partition scheme can only handle a maximum of four partitions on a disk, an extended partition was created to hold them. The other four partitions were /boot, /, /home, and a Linux swap.

- Important here are three new pieces. First is that the /boot partition contained the bootloader for Linux. (The bootloader contains the /boot/grub/grub.conf configuration file. Second is that the Linux installation process pointed the MBR to the Linux bootloader in partition 3. Third is that the Linux installation process added a pointer to the Windows bootloader (identified as 'other') so that when the machine boots, the user will see a choice of both Linux and Windows.

- I then modified the /boot/grub/grub.conf file so that the description of the "other" operating said something more expressive, like "Windows XP".

The boot menu looked like **Figure 1**.

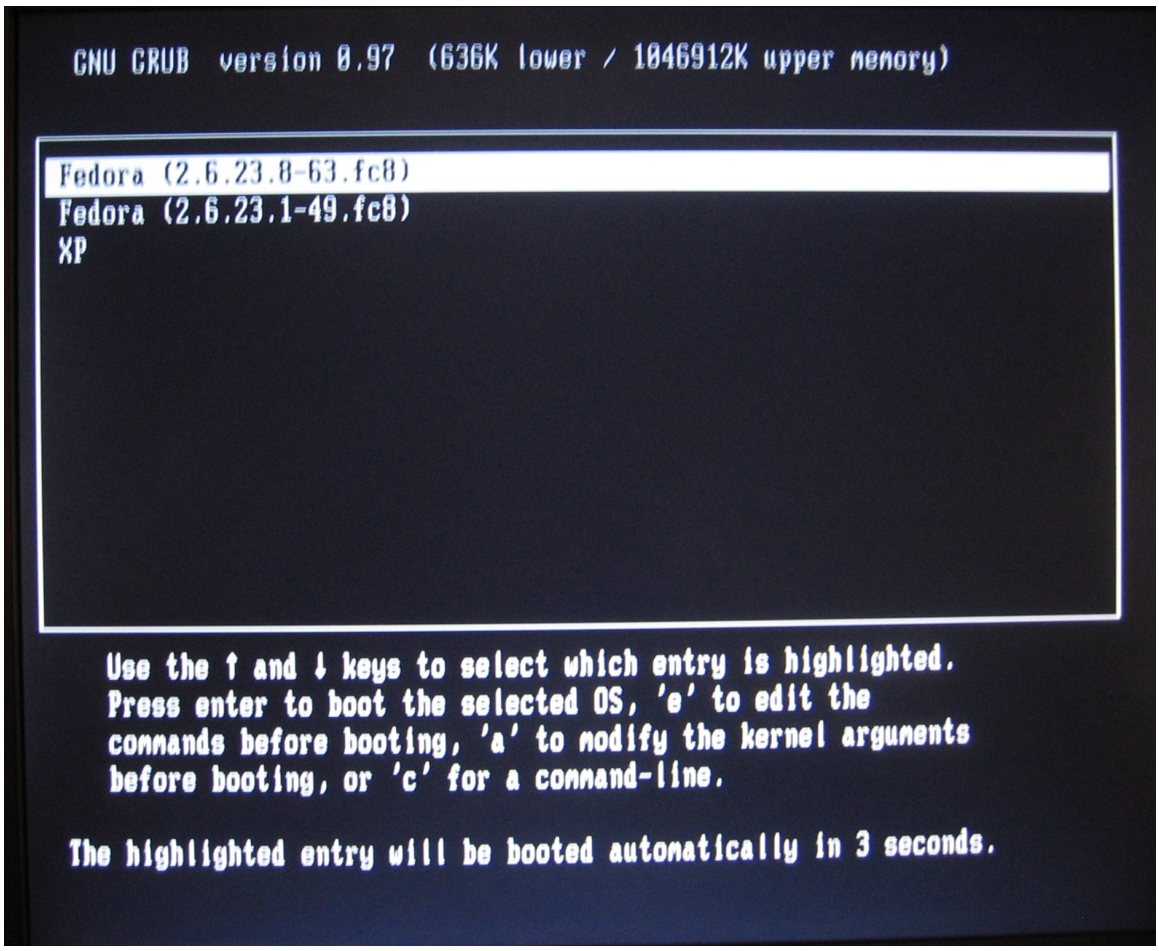

***Figure 1**. The original boot menu for Fedora Core 6 and Windows XP.*

- I left about 20 GB for future use.

3. Installing a third operating system

That 20 GB was just burning a hole in my pocket, and when Fedora 8 was released, I figured it was high time to stuff that open space with it.

Popped a brand new Fedora 8 disk into the drive, rebooted, and ran the install process. At one point, the installation process gives you choices on how to handle the bootloader for Fedora 8.

Choice 1: If the existing boot loader was installed by a Linux distribution, the installation system can modify it to load the new Fedora system. To update the existing Linux boot loader, select **Update boot loader configuration**. This is the default behavior when you upgrade an existing Fedora or Red Hat Linux installation.

Choice 2: If your machine uses another boot loader, such as BootMagic™, System Commander™, or the loader installed by Microsoft Windows, then the Fedora installation system cannot update it. In this case, select **Skip boot loader updating**.You will need to manually update your bootloader.

Choice 3: Install a new boot loader as part of an upgrade process only if you are certain you want to replace the existing boot loader. If you install a new boot loader, you may not be able to boot other operating systems on the same machine until you have configured the new boot loader. Select **Create new boot loader configuration** to remove the existing boot loader and install GRUB.

Evidently I made the wrong choice (probably the third one.) The end result was a bootloader being installed in the Fedora 8 /boot partition , and the MBR being repointed to this new partition. I ended up two more partitions: Partition 8 held the /boot partition for Fedora 8 and partition 9 held the Fedora 8 / partition.

The final machine partition layout is shown in **Figure 2**.

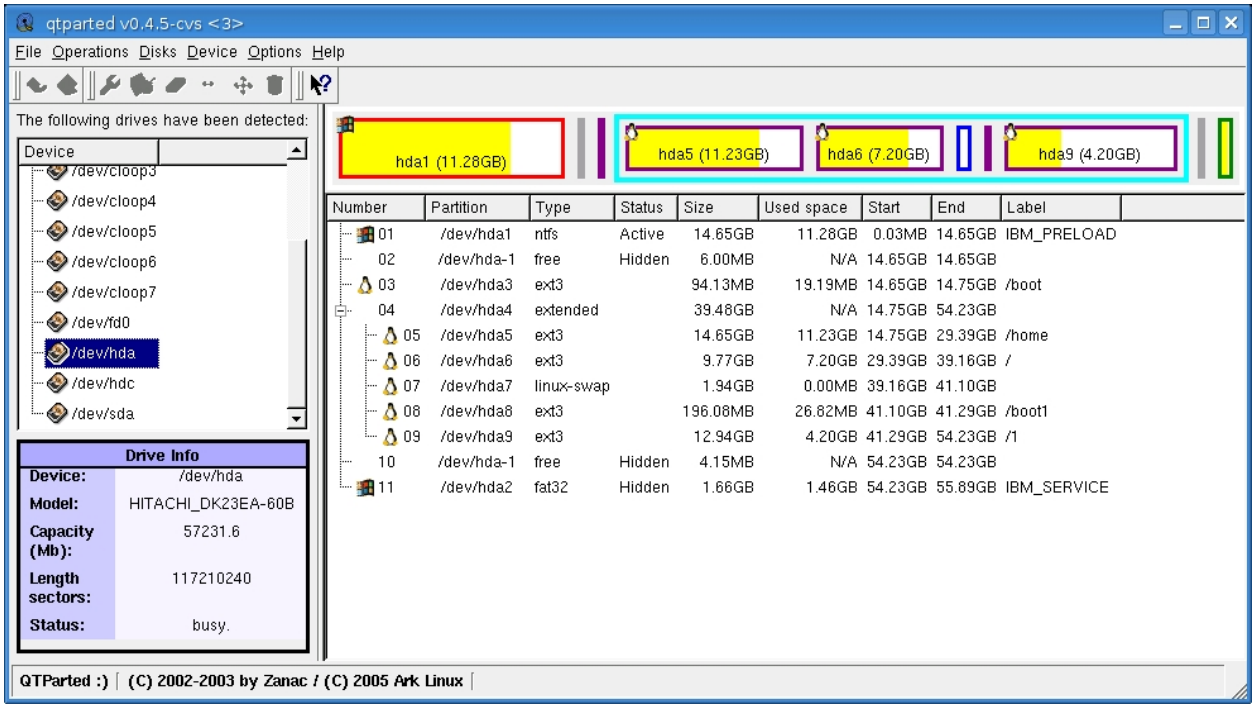

***Figure 2**. The final partition layout with XP, Fedora Core 6 and Fedora 8.*

There was one more partition created - partition 10, like partition 2, consisted of a bit of spare room that filled up the rest of the cylinder to partition 11.

4. The problems therein

The problem that showed up after the installation of Fedora 8 was that the MBR now pointed to the Fedora 8 boot loader. This boot loader's grub.conf held entries for Fedora 8 and XP but not for the Fedora Core 6 installation - which was a problem.

I had two possible solutions. The first was to edit the Fedora 8 grub.conf file and add a pointer to the Fedora 6 kernel. After Fedora 8's installation, grub.conf looked like this (non-essential lines edited out):

```
# grub.conf generated by anaconda
default=0
splashimage=(hd0,7)/grub/splash.xpm.gz
title Fedora 8 (2.6.23.1-49.fc8)
  root (hd0,7)
  kernel /vmlinuz-2.6.23.1-49.fc8 ro root=LABEL=/1
  initrd /initrd-2.6.23.1-49.fc8.img
title Windows XP
  rootnoverify (hd0,0)
  chainloader +1
```

As you can see from the (hd0,7) identifier, the bootloader is located in partition 8 (partitions are referenced with a zero-based index).

Editing the grub.conf would result in this:

```
# grub.conf generated by anaconda
default=0
splashimage=(hd0,7)/grub/splash.xpm.gz
title Fedora (2.6.23.8-63.fc8)
  root (hd0,7)
  kernel /vmlinuz-2.6.23.8-63.fc8 ro root=LABEL=/1
  initrd /initrd-2.6.23.8-63.fc8.img
title Fedora (2.6.23.1-49.fc8)
  root (hd0,7)
  kernel /vmlinuz-2.6.23.1-49.fc8 ro root=LABEL=/1
  initrd /initrd-2.6.23.1-49.fc8.img
title FC 6 (2.6.20-1.2948.fc6)
  root (hd0,2)
  kernel /vmlinuz-2.6.20-1.2948.fc6 ro root=LABEL=/
  initrd /initrd-2.6.20-1.2948.fc6.img
title Windows XP
  rootnoverify (hd0,0)
  chainloader +1
```

The (hd0,2) identifier for the Fedora Core 6 installation comes from the /boot partition which, as we saw earlier, was on hda3.

While this technically works, as shown in **Figure 3**, it wasn't satisfactory for me.

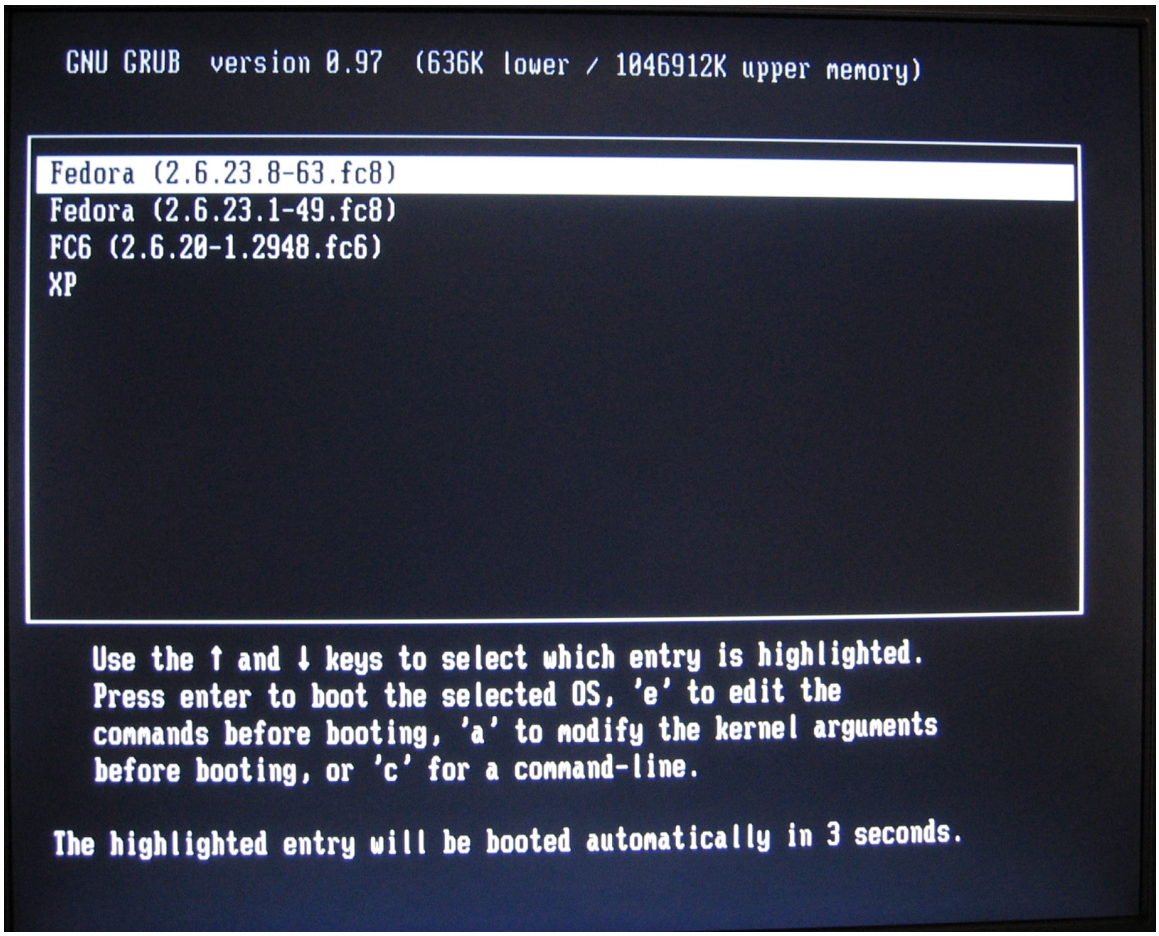

***Figure 3**. The resulting boot menu after editing the Fedora 8 boot loader.*

The reason is that the Fedora 8 install was a testbed, and I didn't want to have the /boot partition be at risk when I started monkeying with the install. I had plans to uninstall and reinstall Fedora 8 in a variety of configurations, and I didn't want to have the /boot partition possibly damaged or erased.

My goal, then was to have the MBR point to the original boot loader in partition 3 (for Fedora Core 6) and then add a reference to the Fedora 8 install in the grub.conf file in partition 3.

5. The solution - reconfiguring the MBR

There are two steps to reconfiguring the MBR. The first is to back it up, just in case an errant keystroke or stray electron got involved where it oughtn't.

5.1 Back up the MBR

Open a terminal window as root and issue the command

```
dd if=/dev/sda of=/location/of/mbrbackup bs=512 count=1
```

where 'if' is the input file and 'of' is the output file. The input file is the location of the master boot record. '/dev/sda' or '/dev/hda' are typical choices; the first more likely in modern systems. The output file is where you want the copy of the MBR. Put it someplace you'll be able to get to if your machine becomes unbootable natively. a USB memory stick, or /root or /home/yourname are possible places - you can later boot the machine with a Live CD and access that file.

5.2 Rewrite the MBR

Now that you've got it backed up, time to rewrite the MBR so that it points to the Fedora Core 6 bootloader that is located on partition 3. Open a terminal window as root and load up the GRUB editor. Then issue the following commands:

```
root> grub
grub> root (hd0,2)
grub> setup (hd0)
grub> quit
```

The boot loader consists of two pieces - stage 1, which is where GRUB starts, and stage 2, which contains the pointers to the various operating system kernels that will be available in the menu.

The first command loads the GRUB editor. The second command says "Look here for the stage2 file that will load the boot menu." hd0,2 refers to the boot record of the third partition.

The third command says "Put stage1 here - this is where GRUB will start." hd0 refers to the MBR. And the fourth command closes the GRUB editor.

6. Add the new Fedora 8 kernel to the original grub.conf file

Finally, edit grub.conf in partition 3 to reflect the Fedora 8 entry. It'll look something like this:

```
# grub.conf generated by anaconda
#
# Note that you do not have to rerun grub after making changes to this file
# NOTICE:  You have a /boot partition.  This means that
#          all kernel and initrd paths are relative to /boot/, eg.
#          root (hd0,2)
#          kernel /vmlinuz-version ro root=/dev/hda6
#          initrd /initrd-version.img
#boot=/dev/hda
default=0
timeout=10
```

```
splashimage=(hd0,2)/grub/splash.xpm.gz
title Fedora Core (2.6.20-1.2948.fc6)
  root (hd0,2)
  kernel /vmlinuz-2.6.20-1.2948.fc6 ro root=LABEL=/
  initrd /initrd-2.6.20-1.2948.fc6.img
title Fedora Core (2.6.19-1.2911.6.4.fc6)
  root (hd0,2)
  kernel /vmlinuz-2.6.19-1.2911.6.4.fc6 ro root=LABEL=/
  initrd /initrd-2.6.19-1.2911.6.4.fc6.img
title Fedora EIGHT (2.6.23.8-63.fc8)
  root (hd0,7)
  kernel /vmlinuz-2.6.23.1-49.fc8 ro root=LABEL=/1
  initrd /initrd-2.6.23.1-49.fc8.img
title Fedora EIGHT (2.6.23.1-49.fc8)
  root (hd0,7)
  kernel /vmlinuz-2.6.23.1-49.fc8 ro root=LABEL=/1
  initrd /initrd-2.6.23.1-49.fc8.img
title Windows eXtremely Ploated
  rootnoverify (hd0,0)
  chainloader +1
```

The next time you reboot, you'll see the menu as shown in **Figure 4**.

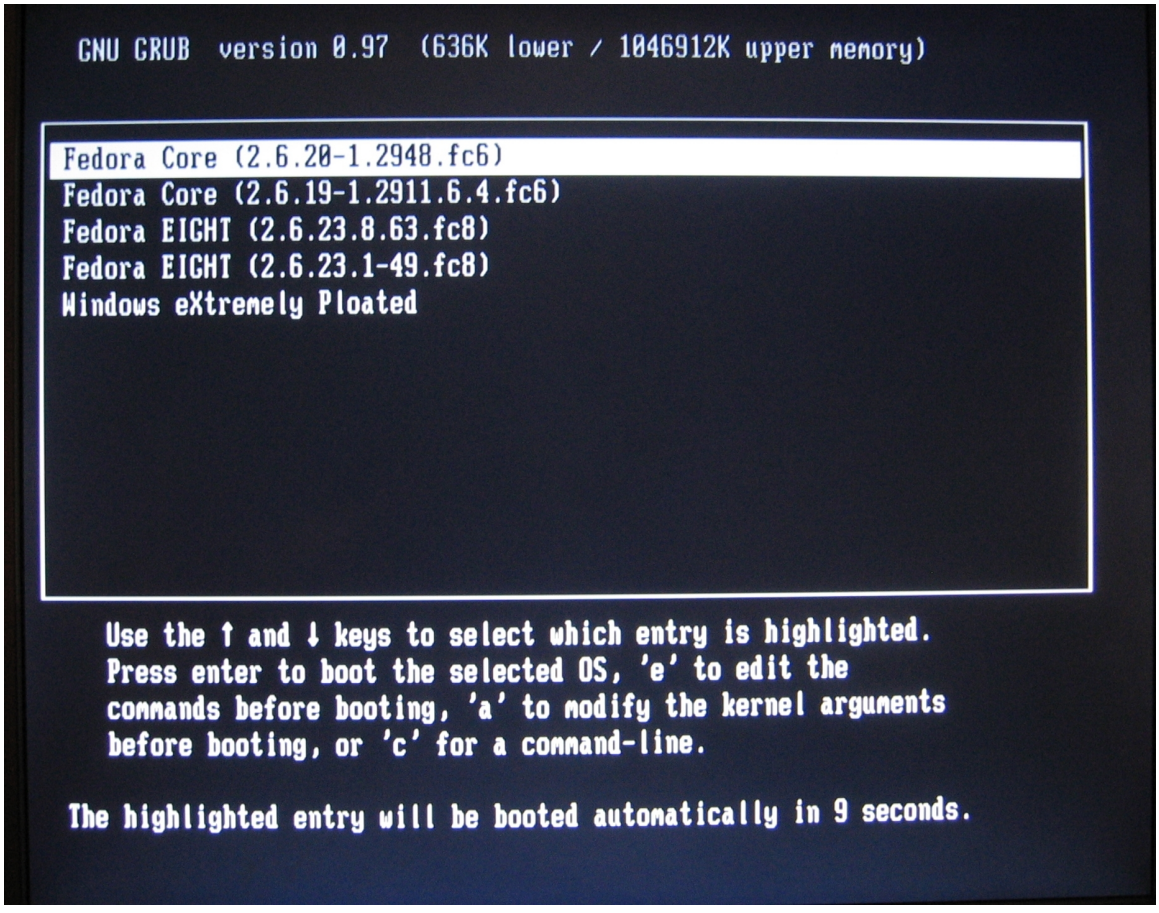

***Figure 4**. The final boot menu from the Fedora 6 boot loader.*

Note that updates to the Fedora 6 kernel will be reflected automatically in this menu, but updates to the Fedora 8 kernel will need to be added to this menu manually.

7. Options for the future

One option occasionally mentioned when the topic of multiple installations on a single machine arises is that of having a dedicated boot partition that's independent of any single operating system install. First, you'd need a dedicated partition. Second, the GRUB stage files need to be copied to that partition, and, finally, point the MBR to this new GRUB partition. (Of course, you'd also have to modify the menu file in the GRUB partition to reflect the available operating systems.)

The details on doing so will be forthcoming in another paper when I feel like experimenting some more.

8. Where to go for more information

Glenn Holmer has a great article on how the boot process works, all the way from hard-coded bits on Intel chips to working with a variety of exotica.

http://lyonlabs.org/booting.html

The end of Glenn's article contains even more useful links.

9. About the author

Whil Hentzen started out life in the early '80's as a custom software developer using dBASE II (he still has the original 8 1/2 x 11 grey binder of documentation, much to the chagrin of his wife), and switched to FoxPro in 1990. Besides billing 15,000 hours in the 90's, he presented more than 70 papers at conferences throughout North America and Europe, edited FoxTalk, Pinnacle Publishing's high end technical journal for 7 years, hosted the Great Lakes Great Database Workshop since 1994. He's written 8 books and published 30 more on a variety of software development topics. He was a Microsoft Most Valuable Professional from 1995 through 2003 for his contributions to the FoxPro development community, and received the first Microsoft Lifetime Achievement Award for Visual FoxPro in 2001.

Whil began using Linux on the desktop when OpenOffice.org became a standard in the mainstream distributions, as it spelled potential for custom application development in the future, and has been a Linux user, developer, and evangelist ever since. His first book on Linux, Linux Transfer for Windows Power Users, was published in early 2004.

He is available for new and legacy Visual FoxPro application development as well as Web and desktop development on Linux.

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