

# Early experiences installing Tivoli on Linux

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Various Tivoli products have been made available on various Linux platforms since the introduction of the Tivoli Tier 2 Linux Endpoint in Framework 3.7. Today (April 2005), most core products are available on several Linux platforms; however, some Linux platforms have more support than others.

Linux is in the forefront of the Open Source movement with a number of players supplying variations of the Operating System. Some are absolutely free; others are available wrapped around a support contract and come with a price tag. RedHat Enterprise Linux (RHEL) Enterprise Server (ES) and Advanced Server (AS), along with SuSE Linux Enterprise Server (SLES) are examples of the chargeable varieties; RedHat 7.2 and SuSE 9.1 Professional are a small sample of the free versions. Although the free versions do not have an explicit support contract, software updates are freely available from the internet and there is a wealth of experience out there. Always remember - "Google is your friend"!

The plethora of Unix variations means that a company like IBM has to decide which variations of Linux to formally support. Although there is still support for some Tivoli products on the free operating system versions, it would appear that there is now a strong move to only support Tivoli on the chargeable varieties of RedHat and SuSE.

Determining exactly what is supported is rather a minefield, especially when you need to also determine what databases are supported, what databases are supported by the Framework RDBMS Interface Module (RIM) and, potentially, what versions of WebSphere Application Server are supported.

This article describes my experiences installing Framework, TEC, NetView and ITM, with a DB2 database on an old, supported Linux variant (RedHat 7.2) and a newer unsupported variant (SuSE 9.1 Professional). Although Tivoli also has support for some Linux variants on zSeries, iSeries and pSeries systems, these will not be discussed in this paper. All testing has been done on Intel platforms, in fact run within VMWare Workstation 4.5 virtual machines.

## **Officially supported Linux versions for Tivoli products**

The following table provides a cross-section of Linux support for various products and Fixpacks. This information has been taken from Tivoli installation manuals and Release Notes. Database support is generally available for DB2, Sybase, Oracle, Informix and MS SQL; however, only DB2 support will be shown here.

Database support for Tivoli products is particularly complex. DB2 8.1 is only officially supported on RHEL 3 and SLES 8 platforms. TEC 3.9 FP02 *only* officially supports DB2

## 8.1 FP02.

	<i>RedHat 7.2</i>	<i>RedHat 7.3</i>	<i>RedHat 8.0</i>	<i>RHEL AS 2.1</i>	<i>RHEL AS 3.0</i>	<i>SuSE 8.1 Pro</i>	<i>SLES 7</i>	<i>SLES 8</i>	<i>SLES 9</i>
Framework 4.1.1	Y	Y	Y	Y	Y	Y	Y	Y	N
FP02	Y	Y	Y	Y	Y	Y	Y	Y	N
RIM DB2 support	7.2	7.2	7.2	7.2	8.1	7.2	7.2	7.2 or 8.1	N
TEC 3.9	N	N	N	Y	N	N	Y	Y	N
TEC 3.9 DB2 support	7.2 FP7	7.2 FP7	7.2 FP7	7.2 FP7	N	N	7.2 FP7	7.2 FP7 or 8.1	N
TEC 3.9 FP02	N	N	N	Y	Y	N	N	Y	Y
TEC 3.9 FP02 DB2 support	N	N	N	N	8.1 FP2	N	N	8.1 FP2	N
NetView 7.1.4	Y	N	N	Y	N	7.2	Y	Y	N
FP02	Y	N	N	Y	Y	7.2 & 8.0	N	Y	Y
ITM 5.1.2	Y	Y	Y	Y	N	Y	Y	Y	N
WAS 5.0.2	N	N	Y	Y	N	7.3	Y	Y	N

To run the TEC 3.9 FP02 Web Console, WebSphere Application Server 5.0.1 or 5.0.2 is required.

The net of this is that the only combination that is strictly supported today, is SLES 8!

## General comments for installing Tivoli products on Linux systems

### Linux Kernel Versions

More recent Tivoli products and Fixpacks tend to specify the Linux kernel versions that have been tested. To ascertain the level of your running Linux kernel, use the **uname -r** command. I have a RedHat 7.2 system that reports kernel version 2.4.7-10 and a SuSE 9.1 Professional system reporting 2.6.5-7.145-default.

There are two major different Linux kernel versions around at present. Most are based on a 2.4 kernel. RHEL 3.0 is based on 2.4.21 but has a number of enhancements from the 2.6 strand. SuSE 9.1 and RedHat 4.0 are based on the 2.6 kernel. The 2.6 based kernels have a large number of enhancements, especially to improve the range of hardware support and performance, notably:

- Support for larger servers
- Support for smaller servers (embedded systems)
- Support for Simultaneous Multi Threading (SMT)
- Support for the Native Posix Threading Library (NPTL)

See <http://www.kniggit.net/wwol26.html> for a good comment on Linux kernel versions and their differences.

Most of these enhancements are invisible to user-space Linux applications (such as Tivoli); however the support for NPTL in the 2.6 kernels can affect whether Tivoli applications run or not. NPTL can give the kernel a major performance boost for multi-threading applications, especially in a multi-processor environment. Another benefit of NPTL is that if a process does spawn multiple threads, a **ps** command only shows the primary thread, not all of them. For example, a RedHat 7.2 system shows 3 **lcmd** processes whereas SuSE 9.1 shows 1; a RedHat 7.2 shows 14 **ITM engine java** processes whereas a SuSE 9.1 system shows 1. A good reference for the different thread libraries is <http://linuxdevices.com/articles/AT6753699732.html>

To make applications binary-compatible across multiple versions of Linux and multiple underlying architectures, an Application Binary Interface (ABI) is specified. An ABI is the interface by which a compiled binary gets access to an operating system and its services. See <http://www-128.ibm.com/developerworks/eserver/library/es-bincomp/> for a discussion on application binary compatibility.

For applications to take advantage of the NPTL, they need to be recompiled and tested with the new libraries. Most Tivoli applications do not appear to have had this updating performed yet; this means that some Tivoli applications will not run if the system dynamic linker in the GNU C Library (glibc) picks up the new NPTL libraries on 2.6 kernel systems. To circumvent this issue, an environment variable **LD\_ASSUME\_KERNEL** exists so that applications can access the correct library version. Use this link for an explanation of LD\_ASSUME\_KERNEL - <http://people.redhat.com/drepper/assumekernel.html>

Basically:

- If LD\_ASSUME\_KERNEL is set to a value between 2.2.5 and 2.4.0, the old Linux threads library with a fixed stack size will be used (found in **/lib**)
- If LD\_ASSUME\_KERNEL is set to a value between 2.4.1 and 2.4.19 then the newer Linux threads library with floating stacks will be used (found in **/lib/i686**)
- If LD\_ASSUME\_KERNEL is set to 2.4.20 or newer then the NPTL thread library will be used (found in **/lib/tls**)

By default, these library paths are searched in the order:

- **/lib/tls**
- **/lib/i686**
- **/lib**

My SuSE 9.1 system has lines in **/etc/Tivoli/setup\_env.sh** that, for linux-ix86

architectures, sets:

```
LD_ASSUME_KERNEL=2.4.1
export LD_ASSUME_KERNEL
```

Similarly, the various NetView startup scripts include similar lines to set LD\_ASSUME\_KERNEL to 2.4.1.

A general recommendation when installing Tivoli products on 2.6 kernel systems. would be to ensure that LD\_ASSUME\_KERNEL is set to 2.4.1 and exported.

## Prerequisite Linux utilities and configurations for Tivoli applications

Some Linux systems do not automatically install the **compress** and **uncompress** utilities which some Tivoli application installations require to find in **/usr/bin**. For example, a default RedHat 7.2 will not install compress but it is available as the **ncompress** package on CD2. Without these utilities, Tivoli backups hang for ever and TEC installs fail. Always ensure these utilities are available before starting a Tivoli installation.

Most default Linux installations will not enable the "r" utilities - **rexec**, **rsh** and **rlogin**. These utilities are used by default to install both Tivoli Managed Nodes and Tivoli Endpoints. Either the "r" utilities will need installing and enabling or a better solution would be to use Secure Shell (ssh) to perform node installations. Framework 4.1.1 supports ssh installations for both Managed Nodes and Endpoints - this is documented in the Tivoli Framework 4.1.1 Installation Guide.

Many **Java** runtimes that are shipped with Tivoli products, do not work with SuSE 9.1. This also extends to DB2 and WebSphere products. Since many Tivoli products now use Java as the installation mechanism, many installs fail. Here is the process I have used to circumvent problems.

1. TEC 3.9 FP2 seems to have a good version of the Java Runtime Environment (JRE). You can use the following commands to query the version of a java runtime (note that sometimes only one of the commands seems to work):
  - java -version
  - java -fullversion
2. The java with TEC 3.9 FP2 reports itself as **JRE 1.3.1 (JIT enabled) cxia32131-20031021** so, to test a process for fixing the JRE with Framework:
  - a. tar up jre under \$BINDIR/TME/TEC (from a TEC 3.9 FP2)
  - b. tar up jre under any bad products eg. \$BINDIR/JRE/1.3.0 (for backup purposes)
  - c. remove jre subtree from offending product eg. \$BINDIR/JRE/1.3.0
  - d. untar the good tec jre bundle back where required eg. \$BINDIR/JRE/1.3.0
  - e. restart oserv
3. As a more manageable and scalable solution, I have now created a separate directory **/usr/local/Tivoli/jane\_java/jre** with the TEC 3.9 FP2 tree in it ,and symlink all Tivoli requirements for java to this, eg.
  - a. cd \$BINDIR/JRE/1.3.0

b. In -s /usr/local/Tivoli/jane\_java/jre jre

## Hints and tips for installing DB2 on Linux

RedHat 7.2 supports DB2 7.2 FP7. SuSE 9.1 does is not apparently support either DB2 7 or 8. I have installed DB2 7.2 FP7 on both these architectures and have not observed any issues once running.

### Installing DB2 on RedHat 7.2

#### 4. Prerequisites

a. pdksh required - I used the one that comes with NetView - 5.2.14-8

b. libncurses.so.4 required

i. If you have libncurses.so.5 installed then use a symlink

- cd /usr/lib
- In -s libncurses.so.5.2 libncurses.so.4

c. glibc 2.1 required - if you have version 2.2 then install the following from RedHat CD 2:

- compat-glibc-6.2-2.1.3.2.i386.rpm
- compat-egcs-6.2-1-1-2-16.i386.rpm

d. Ensure root has /sbin and /usr/sbin in PATH

5. Install DB2 721 Extended Edition with the db2setup command and then apply Fixpack 7.

6. An entry gets put into /etc/inittab to run /etc/rc.db2 on startup but not for run level 5 (full multi-user with network and X-Windows). Edit inittab and add this entry (second field should read 2345)

7. Increase maximum number of message queues

a. Edit the /etc/sysctl.conf file to add line to end of file

- i. kernel.msgmni=128
- ii. This sets the maximum number of message queues available to 128
- iii. Reboot the system - **shutdown -hfr now**
- iv. Logon as root and open a new console window.
- v. Enter the command **ipcs -l** and look for

-----Messages: Limit ----- max queues system wide = 128

### Installing DB2 on SuSe 9.1

8. DB2 8.1 doesn't seem to work with SuSe 9.1 because of Java problems - you get a segmentation fault at the **db2setup** command with wings about JAVACLASSPATH. Note that this may be fixable using the Java documented above and an **is:javahome <java dir>** parameter at the end of the install command (but I have not tried it).

9. No extra pre-requisites were installed. `pdcksh`, `libncurses` and `glibc` were already installed.
10. Install DB2 7.2 Extended Edition with the `db2setup` command and then apply Fixpack 7.
11. An entry gets put into `/etc/inittab` to run `/etc/rc.db2` on startup but not for run level 5 (full multi-user with network and X-Windows). Edit `inittab` and add this entry (second field should read 2345)
12. Follow RedHat instructions to increase maximum number of message queues. **You may need to create `/etc/sysctl.conf`**. This file is activated with
  - a. `sysctl -p`
  - b. Check in `/proc/sys/kernel` for values
  - c. To ensure `/etc/sysctl.conf` is read at boot time, use **Yast -> System -> Runlevel editor** in **Expert** mode and set `boot.sysctl` to **B**.
13. Use the `ipcs -l` command to view parameters
14. I periodically experienced complete hangups on the **db2** command (as the user `db2inst1`), with a “DB21018E system error message. Can't stop or start db2.” Fixed with system reboot! I believe this was because the message queues described above did not persist beyond reboot as I had not done (5c) above.

## Hints and tips for installing Framework on Linux

Framework 4.1.1 Fixpack 2 is currently the latest version of Framework. It supports most RedHat and SuSE Linux versions **except** SLES 9. I have this version working happily on a RedHat 7.2 system and, with a few glitches, on SuSE 9.1 Professional.

One problem that occurs with several Linux variants is that the **odadmin start** command doesn't work because of quirks with `xinetd`. This is a known issue on the Tivoli Support website - [http://www-1.ibm.com/support/docview.wss?rs=769&context=SSXLSW&q1=xinetd\\_config.sh&uid=swg21109261&loc=en\\_US&cs=utf-8&lang=en](http://www-1.ibm.com/support/docview.wss?rs=769&context=SSXLSW&q1=xinetd_config.sh&uid=swg21109261&loc=en_US&cs=utf-8&lang=en) . Download `xinetd_config.sh` from this website. Edit the top line from `/bin/sh` to `/bin/bash`. Make executable and run as root via “`bash xinetd_config.sh`”.

Framework 4.1.1 has the “-j” parameter for **winstlcf** which specifies Tivoli Endpoint installation via ssh. The documentation says you need openSSH 3.6.1 but I have it working with 2.9p2-7 on RedHat 7.2 and 3.8p1-37.17 on SuSE 9.1 . You need to modify the ssh client configuration file in `/etc/ssh/ssh_config` to ensure that the **StrictHostKeyChecking** parameter is set to no (the default is yes ). See the TMF 4.1.1 Installation Guide, Chapter 4 for more information on configuring ssh.

## Framework anomalies on SuSE 9.1 Professional

Strictly, SuSE 9.1 Professional is not a supported platform for Framework (indeed neither is SLES 9). I have observed two anomalies on SuSE 9.1.

15. The Java shipped with FW411 and FW411-FP02 do not work on SuSE 9.1 – this means both `mdist` and `SIS` GUIs fail. If you have followed the instructions above about creating a standard Java directory, then simply put in a symlink:
  - a. `cd $BINDIR/JRE/1.3.0`

b. In -s /usr/local/Tivoli/jane\_java/jre jre

16. I seem to experience quite a lot of unexplained Tivoli Desktop crashes. Most seem to be random and simply reopening the Desktop and repeating the action works fine. The only repeatable glitch is running the **Desktop -> Installation** menu. If you select to install a product from a media directory that only has patches, and vice versa then it dies every time. I have not got to the bottom of this yet.

## Hints and tips for installing TEC on Linux

Here are some general comments applicable to installing TEC 3.9 Fixpack 2 (the latest current version), on both RedHat 7.2 and SuSE 9.1.

17. Ensure compress and decompress utilities are installed
18. Beware if Framework 4.1.1 is installed then the Install Wizard with base TEC 3.9 gives errors - you will need to use the Install Wizard from TEC 3.9 Fixpack2.
19. TEC 3.9 lists DB2 7.2 FP7 and DB2 8.1 FP2 as supported; TEC 3.9 FP2 only lists DB2 8.1 FP2 as supported.
20. The logfile adapter for Linux seems to be based on an old Solaris one with some modifications for RedHat 6! It does not match well with /var/log/messages on either RedHat 7.2 or SuSE 9.1 Professional. This is documented on the Tivoli support database with a comment that it will be fixed in TEC 3.9 Fixpack 3.

## TEC on SuSE 9.1 Professional

TEC 3.9 installations do not run cleanly with SuSE 9.1. Here are the steps I took to install TEC 3.9 and Fixpack 2. Once installed, the TEC system has run very well for several weeks.

1. DB2 8.1 doesn't install on SuSE 9 – this seems to be a known Java issue. DB2 7.2 and Fixpack 7 seem to install fine. Taking all the defaults creates users db2inst1, db2fenc1 and db2as, all with password ibmdb2
2. Add db2inst1 as a login for the Root Tivoli Administrator
3. Logon as db2inst1 (Use **su db2inst1** Note that using “**su – db2inst1**” causes X authorisation problems)
4. Use the Install Wizard directory tree from TEC 3.9 FP2 if Framework 4.1.1 is installed.
5. Run the tec\_install.sh script and choose to install the TEC database. Ensure that the directory supplied to hold the database manipulation scripts, is writeable and known. Select to generate the scripts but **don't** execute them.
6. If the scripts are run as-is, it bombs out after running the cr\_db.db2 script when trying to re connect to the tec database. The problem seems to be with the parameter in cr\_db.db2 which sets num\_ioservers to 12. If you comment this line out it runs fine and num\_ioservers defaults to 3. You will then need to run the cr\_tbl.db2 script.
7. Create the tec rim – don't omit the hostname parameter and do put double quotes

around the database home directory:

- `wcrtrim -v DB2 -h `hostname` -d tec -u db2inst1 -H "/usr/IBMdb2/V7.1" -s TCPIP -I /home/db2inst1 tec`

8. Check the rim with "**wrimtest -l tec**"

9. Installing base TEC 3.9 products from `tec_install.sh` on the TEC 3.9.1 FP2 code tree, produces errors on the UI Server install when trying to run the `wconsole` command (this seems to be because the TEC java is broken). TEC Server seems to run fine.

10. Base TEC 3.9 Console is broken because java is broken.

`$BINDIR/TME/TEC/jre/bin/java -version` produces a segmentation fault!

11. To avoid problems with TEC java, install products in the following order. This is documented in TEC 3.9 FP2 as being applicable to Linux on zSeries but it also appears necessary for SuSE 9.1 on Intel:

- TEC JRE 3.9
- TEC JRE 3.9 FP2
- Base 3.9 TEC Server, UI Server, Sample Event Info, Console, ACF
- TEC 3.9 FP2 TEC Server, UI Server, Console, ACF

12. If installation is done via Desktop or command line, there does not appear to be the issue that there is with the Installation Wizard with Framework 4.1.1; however you must remember to explicitly install the TEC JRE first.

## Hints and tips for installing NetView on Linux

When installing NetView on any Linux variant, you must ensure that you read the Release Notes, especially those pertaining to Linux Software Prerequisites and Linux Installation Notes. Also check the Product Notes section for NetView features that are not supported on Linux (like Mid Level Manager (MLM) and Agent Policy Manager (APM) ).

You MUST install the `pdksh` that comes on the NetView CD. Many (me included), have omitted this step or used a later version `pdksh`. The result is that the install generally works but lots of quirky things may happen subsequently; for example, some `serversetup` options hang forever.

NetView on Linux platforms has to be a non-TME install. This means that there is no Framework RIM support to export NetView databases to SQL databases. Tivoli Data Warehouse support is available for Linux platforms.

NetView for Linux variants prior to RedHat 3.0 or SLES 9 have been shipped with the standard bundle of NetView CDs since NetView 7.1.1 (on a separate Linux CD). NetView 7.1.4 Fixpack 2 announced support for these later flavours of Linux and a new, separate CD was made available for them (as a fresh installation CD rather than simply a Fixpack). NetView 7.1.4 and Fixpack 2 installed fine on my RedHat 7.2 system and perform well. Installation on SuSE 9.1 was more fraught and is documented below but appears to be stable once established.

### NetView on SuSE 9.1 Professional

21. The new Linux CD doesn't document pre-requisites very well. You DO need the



prerequisites documented under the standard “Linux Software Prerequisites” section in the standard Release Notes. I used the following on a 2.6.5-7.145 kernel:

- a. binutils 2.15.90.0.1.1-31
- b. inetd or **xinetd** 2.3.13-39
- c. net-snmp 5.1-80
- d. XFree86-Xvfb 4.3.99.902-40
- e. pdksh 5.2.14-8
- f. glibc 2.3.3-97

22.Ensure that xinetd is running. If not turn it on with chkconfig and start it:

- a. chkconfig xinetd on
- b. /etc/init.d/xinetd start

23.By default, the SNMP agent on SuSE 9.1 is shipped with a standard configuration file in **/etc/snmpd.conf**. This file **only** permits access from the loopback address using public. Modify this file to permit access from the NetView machine's external address - you can duplicate the loopback line and modify it. For example, for the machine tino:

- a. rocommunity public tino

24.Ensure that net-snmpd runs from reboot and is currently running:

- a. chkconfig snmpd on
- b. /etc/init.d/snmpd start

25.Check that the agent (tino) responds to SNMP:

- a. snmpwalk -v 1 -c public tino

26.The pre-install check script, **NVprereq.sh** in the CD TOOLS directory checks explicitly for a sub-release of Linux. For SuSe, the check is for /etc/SuSE-release to contain “8.0”, “8.1” or “ 9 “. The latter is really <space>9<space>. A 9.1 version does not pass this test. I copied NVprereq.sh and modified the above test to remove the surrounding spaces around the “9”, and ran my “**NVprereq.sh server**”. This does *not* circumvent the unedited check that gets run on actual installation. Once you are confident that the prerequisites *are* met, to avoid installation failure, create the file **/tmp.noNVPrereqCheck** and then run the **instalnv -k SERVER** command and the **instalnv -k BOOKS**.

27.When first starting the NetView GUI it failed and there were lots of winges about “GLIBC\_2.0 not defined in libc.so.6”. This seemed to go away after exporting **LD\_ASSUME\_KERNEL=2.4.19**, even after this environment variable was reset. In general, NetView background and GUI processes now run with **LD\_ASSUME\_KERNEL=2.4.1**.

28.The NetView online manuals assume that there is a /usr/bin/netscape. The standalone command for the online manuals is **/usr/OV/service/onlinebookchk** (a shellscript). This script makes a symlink to /usr/local/bin/mozilla if /usr/bin/netscape doesn't exist. To use Firefox, simply delete /usr/bin/netscape and put in a new symlink:

**In -s /opt/MozillaFirefox/bin/firefox.sh /usr/bin/netscape**

It is not necessary to set the MOZILLA\_HOME environment variable

29. The online manuals don't work because the **man** command expects to find files with names ending in a numeric suffix. For example, netmon man pages are under **/usr/OV/man/man8** so the man command expects the file for netmon to be called **netmon.8**. To make the man pages work, rename all the files.
30. The new script, **/usr/OV/service/nvPerms** can be run to help lock down NetView security. It takes one parameter - a group name, members of which will still enjoy operator privileges. Note that there is no manual page for nvPerms (even though the Fixpack 2 Release Notes say there is!). There is also no backup of the original settings. This script breaks various things including the online manuals. Ordinary users lose execute permission to all directories, including **/usr/OV/man** so that man pages still don't work even if you have renamed all the files as documented above!
31. The SuSe 9.1 net-snmp agent has OID 1.3.6.1.4.1.8072.3.2.10 which is not in the **/usr/OV/conf/C/oid\_to\_sym** file. Modify the file to add it - there is a suitable Linux entry right at the end of the file to copy.
32. Configuring TEC integration through serversetup seems to hang forever – the processes finally need killing. Create **/usr/OV/conf/tecint.conf** manually. This was resolved by installing the pdksh that comes on the NetView CD (5.2.14-8.i386.rpm).
33. The snmpserver daemon sometimes seems to get unparented which results in **ovstart snmpserver** failing to start the daemon. Check to see if a java snmpserver is already running, parented by process 1, and kill it manually.
34. itmquery appears not to work. “**itmquery --dump-endpoints**” returns a message saying “A JSSE provider is not available. Verify security.provider in java.security file correctly set. java.security file at **/usr/OV/jre/lib/security/java.security**”. The command seems prepared to list endpoints but not Resource Models that are running.

## Hints and tips for installing ITM on Linux

There is one main issue that appears to affect all versions of Linux when installing ITM.

1. Installing ITM 5.1.1 gives problems as it has issues with cpp. This work-around has to be applied before the installation process of ITM 5.1.1. The steps for the work-around are:
  - a. Ensure cpp is installed - it should come in with gcc (I have gcc-3.3.3-41 on SuSE 9.1 and have installed cpp-2.96-98 on RedHat 7.2)
  - b. Rename the preprocessor file: **mv /usr/bin/cpp /usr/bin/cpp.orig**
  - c. Create a link to cat (symbolic or not) with the command:  
**ln -s /bin/cat /usr/bin/cpp**
  - d. Install the ITM 5.1.1 and ITM 5.1.1 FP6 (I had this combination rather than ITM 5.1.2)
  - e. Remove the link **/usr/bin/cpp**:  
**rm /usr/bin/cpp**
  - f. rename **/usr/bin/cpp.orig** to the original name:

```
mv /usr/bin/cpp.orig /usr/bin/cpp
```

### ITM on SuSE 9.1 Professional

A couple of extra quirks showed up with the SuSE 9.1 system, one of which is easily circumvented:

2. ITM Tivoli Endpoints require a Java link. I have used the generic Java trick described earlier in this document. Run the supplied ITM task to link to an existing JRE, specifying `/usr/local/Tivoli/jane_java/jre` as the directory
3. The dmunix engine ITM endpoint agent sometimes seems to go walkabout and grab all the CPU. Kill it with `wdmcmd -stop -e <endpoint>`. I have not yet got to the bottom of this issue.

### A few comments on WAS and IBM HTTP Server

I have not attempted to install WebSphere Application Server (WAS) on my RedHat 7.2 system. I did have a go on the SuSE 9.1 Professional system and eventually gave up.

The Web Console with TEC 3.9 requires WAS 5.0.1 / 2 and the TEC Installation Wizard provides a menu option to install WAS and the console application, but these options do not run cleanly (it says it has installed successfully but, in fact, hasn't). I also had several attempts at installing WAS and the IBM HTTP Server separately but never got WAS to run. Java versions was a constant issue. For anyone who wishes to see the hacking around that I attempted, go to <http://www.nv-l.org/twiki/bin/view/Netview/TivoliLinux> .

### Conclusions

Linux is a viable platform on which to run Tivoli. If your organisation insists on formal Tivoli Support (and if Tivoli insists on formal adherence to their published Operating System versions), then you need to be very careful about choosing your version of Linux.

In practise, most applications run well even on "unsupported" Linux variants. Hopefully, the next release of Tivoli application products and fixpacks will have better support for the newer Linux kernel variants.