Productivity Enhancement and Protection Improving Business IT Resilience Using Virtual Machines

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Better Use Of Hardware plus Resilience

Typical modern computers can run multiple VMs, and distributing the overall processing load over more than one VM is a common use of the technology.

It's simple to maintain (on another machine) a 'warm spare' of each active VM, which can quickly take over in the event of an active VM outage. We have a document which explains how to do it.

Moving a VM to another computer involves just copying a set of files to it.

What A Virtual Machine Is

A Virtual Machine is comprised of emulated computer hardware which is provided by Hypervisor software running on a physical computer.

The scheme is made possible by software being unable tell directly what hardware it's running on. It has to discover it by sending queries to a variety of destinations and evaluating the responses. For software running on a VM the Hypervisor sees all the queries and responds appropriately.

Software uses a particular hardware device by reading from, or writing data to, memory addresses associated with the device. For software running on a VM the Hypervisor sees all such reads and writes and responds as the actual hardware device would.

Operating systems and application software get installed and run on a VM the same way as on actual hardware.

The Hypervisor

Hypervisor software is installed on the actual computer hardware. When creating a VM you specify such things as how much disk storage you want, how many CPU cores to use, how to do networking, etc. Which results in a configuration file, plus a VHD (Virtual Hard Disk) file for each storage device.

When a hypervisor boots a VM it uses the configuration file details to set up the hardware emulation appropriately.

Suitable Hardware

A computer with a recent Intel or AMD CPU that has multiple cores and hardware virtualisation capability, at least 32GB RAM, at least one GigaBit Ethernet port, and a suitable amount of disk storage.

To reduce SSD wear consider adding hard disk(s) and putting busy VMs on them.

Machines that run server VMs typically are run headless (no display, keyboard, or mouse). It's technically possible to run a Desktop VM on such a machine and use it from another machine.

Recommended Hypervisor
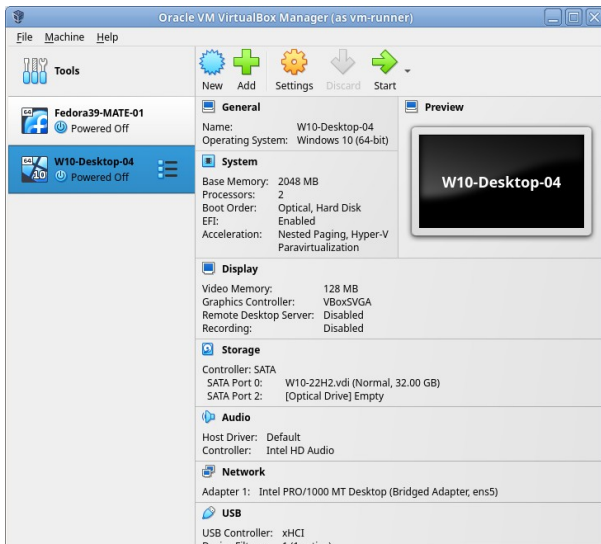
We strongly recommend using the hypervisor setup that we use : AlmaLinux or Rocky Linux 9 (minimal, with SELinux running in Enforcing mode) plus VirtualBox 7.

Shown is the VirtualBox 7 GUI as seen on a machine running AlmaLinux or Rocky Linux with a MATE (mah-tay) desktop.

For safety the hypervisor **must not** be based on MS Windows, because of the serious risk of VM files getting attacked by some of the vast amount of Windows-targetted malware.

A Real World Example of Business IT Resilience

Prior to the Christchurch NZ 2010/2011 earthquakes we ran our Internet servers (web, email, messaging, VPNs) on machines in our CBD office and had a fast 1.5 km 5.8 GHz WiFi network link between our office and our Internet connection provider's Data Centre.

The disruptions caused by the quakes forced us change to having those servers run by a VM hosted in that Data Centre. The Data Centre subsequently changed hands twice, resulting in some unwelcome changes following the second one. Fortunately widespread fibre deployment happened in the city and around mid 2021 our Internet connection changed from VDSL to fibre.

In August 2022, for safety, and reliability and regaining-control reasons, we progressively moved our Internet services to servers on a VM that was being run on our own hardware. Initially we used a relatively old spare machine, which was more than adequate. We closed our hosting account at the end of the month.

In mid-October 2022 we found that PB Tech (https://pbtech.co.nz) were offering an 'Upgrade Box (no OS)', which was a very suitable upgrade. We bought one and set up a hypervisor as above and got it running the VM.
https://www.pbtech.co.nz/product/WKSPB14509/PB-14509-Intel-Upgrade-Box-Intel-Core-i5-12400-6-C

About 5 weeks later we were alerted to a serious problem with its SSD. Within a few minutes we had switched to the warm spare Internet VM running on the old machine. Then, with pressure reduced, we tackled the recovering of as much data as possible from the SSD, in particular so that we could fill in the small email gap between the primary and warm spare VMs. Thanks to the ddrescue software we lost just 3 totally unimportant small files.

On the primary machine we replaced the SSD and took the opportunity to add a 'spare' HDD (previously used only for backups) to it and put our Internet VM on it. For two reasons : To reduce SSD wear, and because HDDs generally fail more gradually than SSDs. Moving to RAID with multiple HDDs is a possibility, but is not a priority since RAID isn't a backup mechanism.

Then we switched back to the VM running on the primary machine.

Business lessons from this include :

- Warm spare VMs really can enable rapid recovery from major hardware problems.

- When buying a computer to run VMs, the absence of an OS (i.e. MS Windows) can easily make the total cost less than the Capital Expenditure threshold, making it a 100%-deductable expense. To the machine we bought from PBTech we added 16 GB RAM (to get 32 GB total) and a Gigabit Ethernet card (Internet interface for Internet VM) and the total cost was NZD 854 (GST-excluded). The NZ CapEx threshold is NZD 1000.

- Hosting important stuff on systems owned by others is not a good idea.

For our purposes the new machine has huge processing capacity. Most software development is now done on VMs being run by it, from workstations via the network. Typically 6 VMs are running in addition to the Internet one, and there's still plenty of unused capacity.

Our Motivation For Producing This

We want businesses to achieve better outcomes, regardless of whether we're directly involved in making them happen. Such outcomes can produce effects that benefit many, including ourselves.