Windows Kernel Exploitation Tutorial Part 1: Setting up the Environment

June 19, 2017 rootkit

Intro

Recently, I had the pleasure to attend the training on Windows Kernel Exploitation at nullcon by the Hack-SysTeam. The training was well executed, and I got the intro into the world of kernel. But, as you know, nobody could teach you internals about Kernel Exploitation in a couple of days. So I thought of diving into the kernel, and share everything that I learn in the process. The series would be coming in parts, as I find the time to learn and document everything that I encounter.

Prerequisites

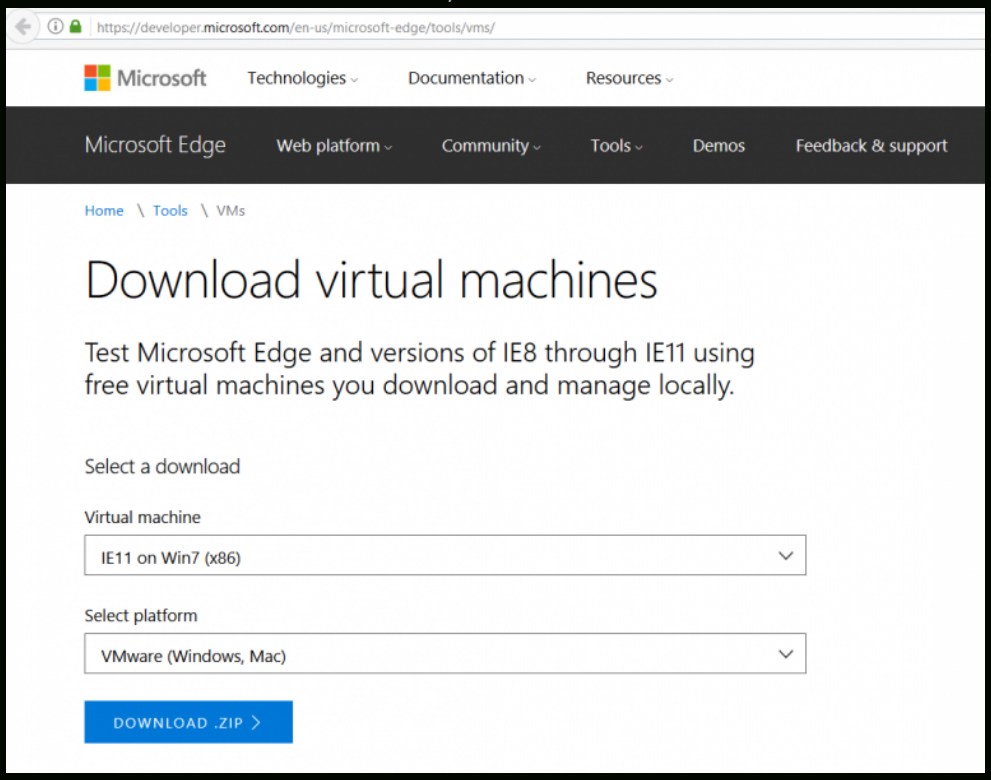
- VMWare or Virtualbox (I'll be using VMWare for this series)
- Windows 7 x86 VM
- Internet Connection for downloading symbols
- Powerful enough machine to run the VMs
- Basic know-hows in day to day computing tasks.

Why VMs?

Visualize kernel as the heart of OS. Now, if you have done any application exploitation in the past, you'd know that you basically crash the application and try to exploit the crash. Applications can easily be recovered once crashed, just double click to run again. Now, if you accidentally crash the kernel, it's like stopping the heart, the OS would just halt/crash/BSOD, and could lead to loss of data, corruption etc. in your machine, and you'd be constantly rebooting the whole machine. VMs are easily setup, isolated and causes no harm if corrupted. Many people just run the Debugee VM (the machine which you'd be crashing alot) in the VM, and keep their host as the Debugger machine. I'd be running the setup where both of them would be VM, just to keep things neat and tidy.

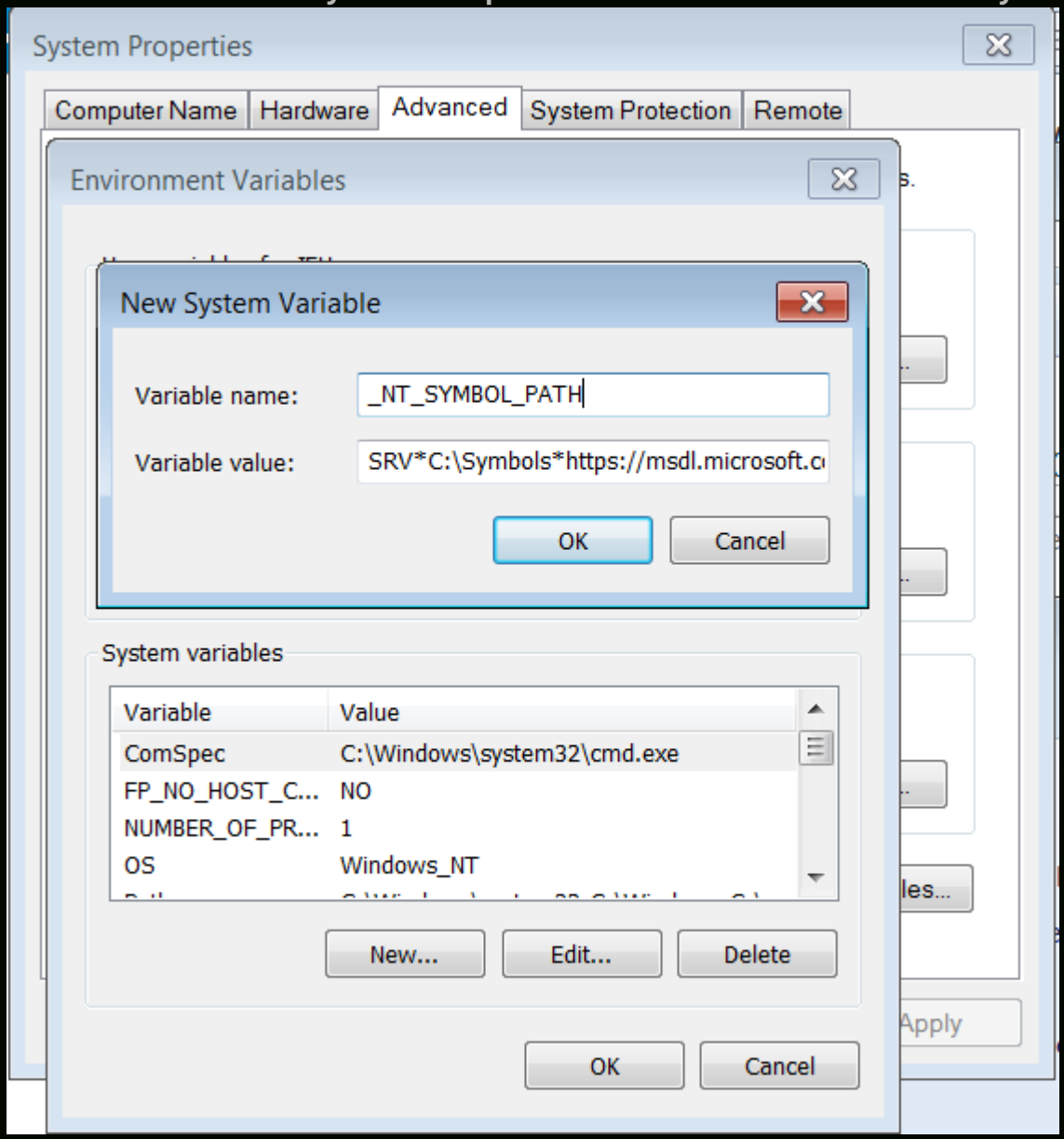
Steps

1. Install Windows 7 x86 in the VM, free download is available at Microsoft VM download page.



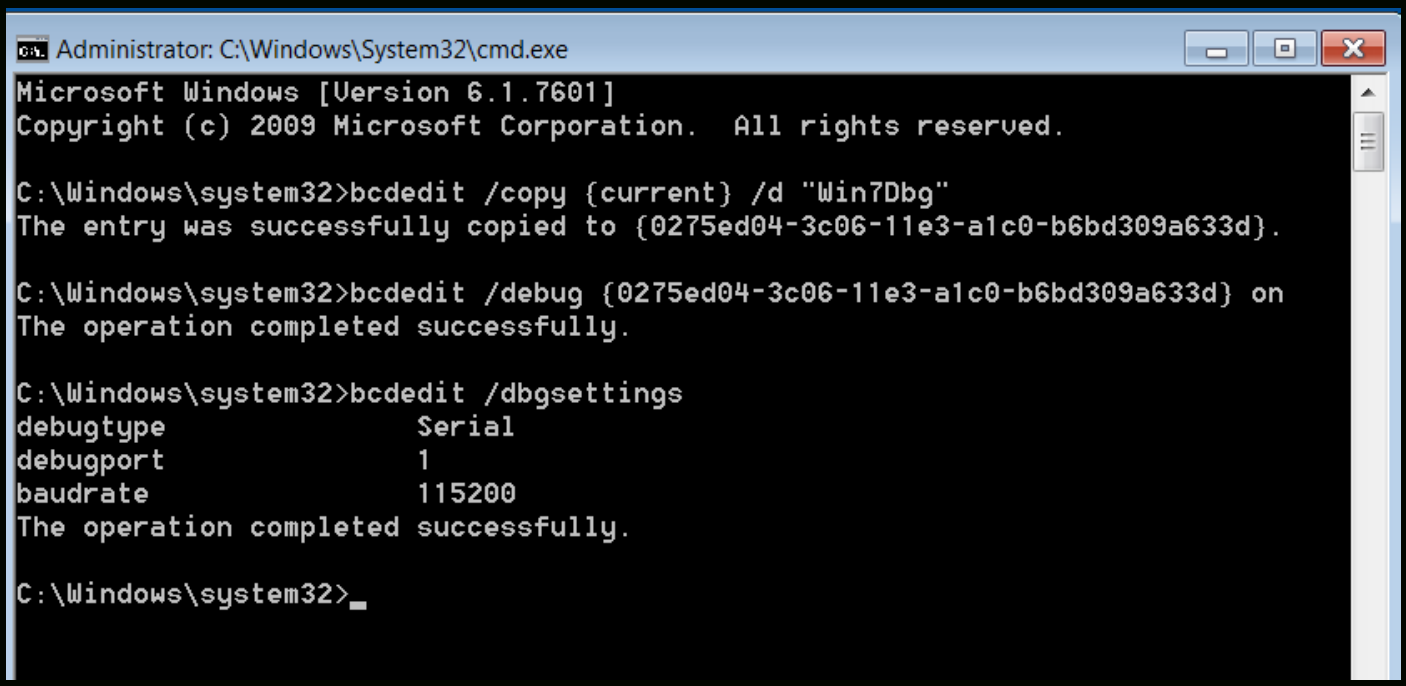
2. After the Debugger VM is setup and ready to boot, we'd need to install WinDbg, get it here.
3. We'd also need to setup Debugging Symbols in the Debugger VM. Fortunately, Microsoft provides public debugging symbols.
    - Go to Computer –> Properties –> Advanced system settings –> Environment Variables.
    - Create a new System Variable as follows:
        - Variable Name: **_NT_SYMBOL_PATH**

- Variable Value: **SRV*C:\Symbols*https://msdl.microsoft.com/download/symbols**

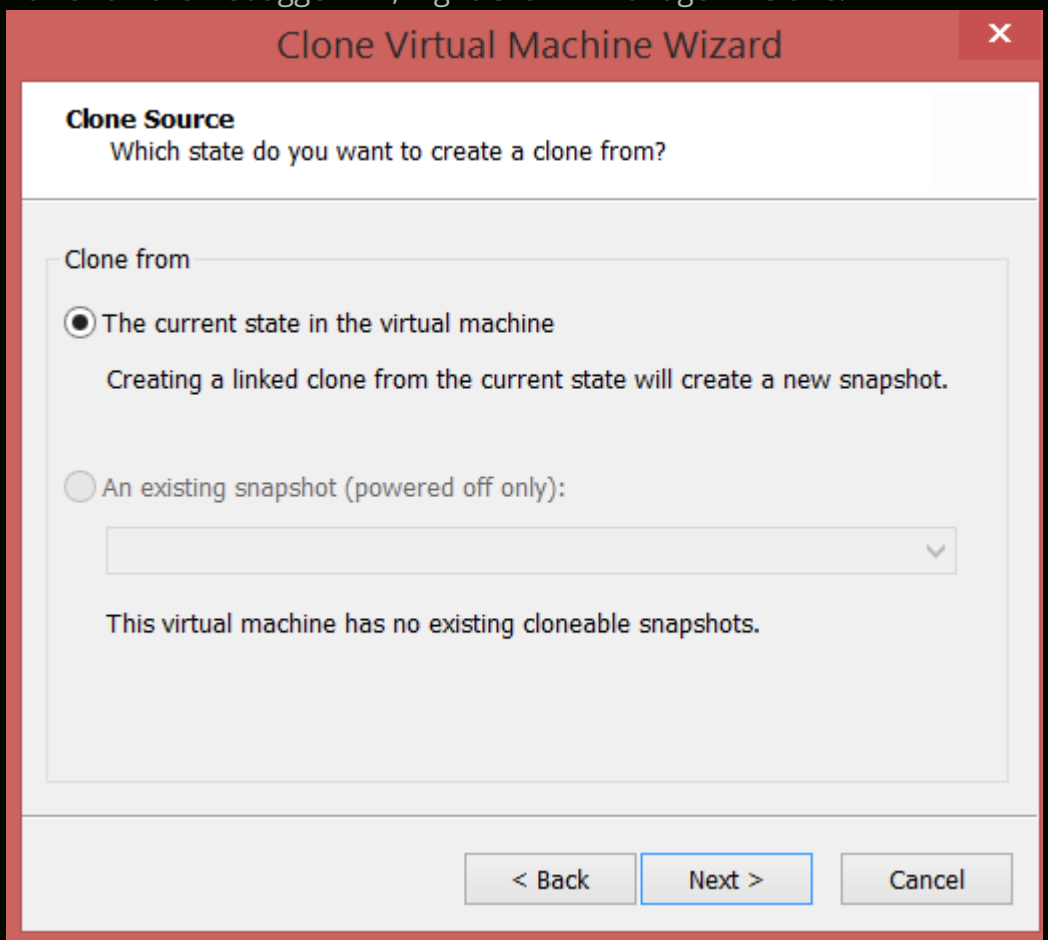


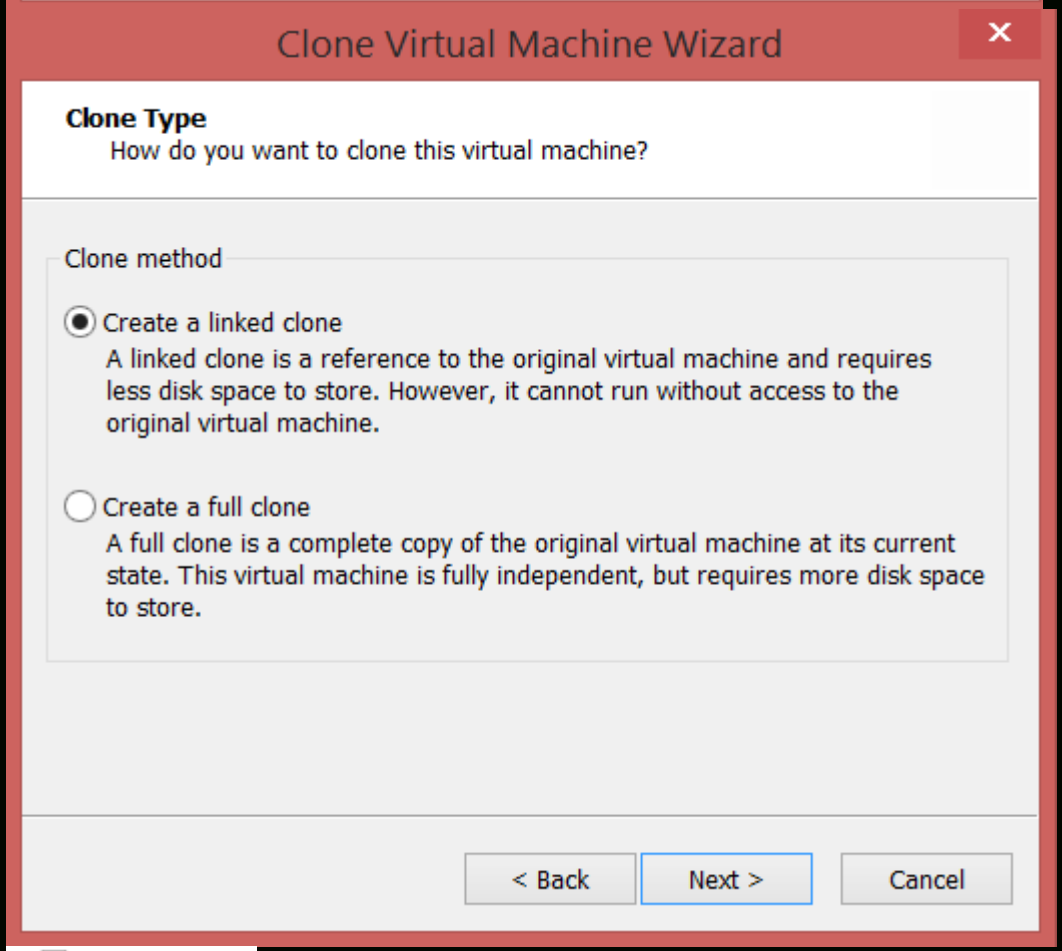
4. After WinDbg is installed, we would need to enable debugging in *BCD*:
   - Run *cmd* as administrator, and execute the following commands:

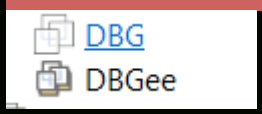
```
bcdedit /copy {current} /d "Win7Dbg"
bcdedit /debug {0275ed04-3c06-11e3-a1c0-b6bd309a633d} on
bcdedit /dbgsettings
```



5. Now, we'll create the Debugee VM, by creating a linked clone of the Debugger VM.
6. Power off the Debugger VM, Right Click –> Manage –> Clone.

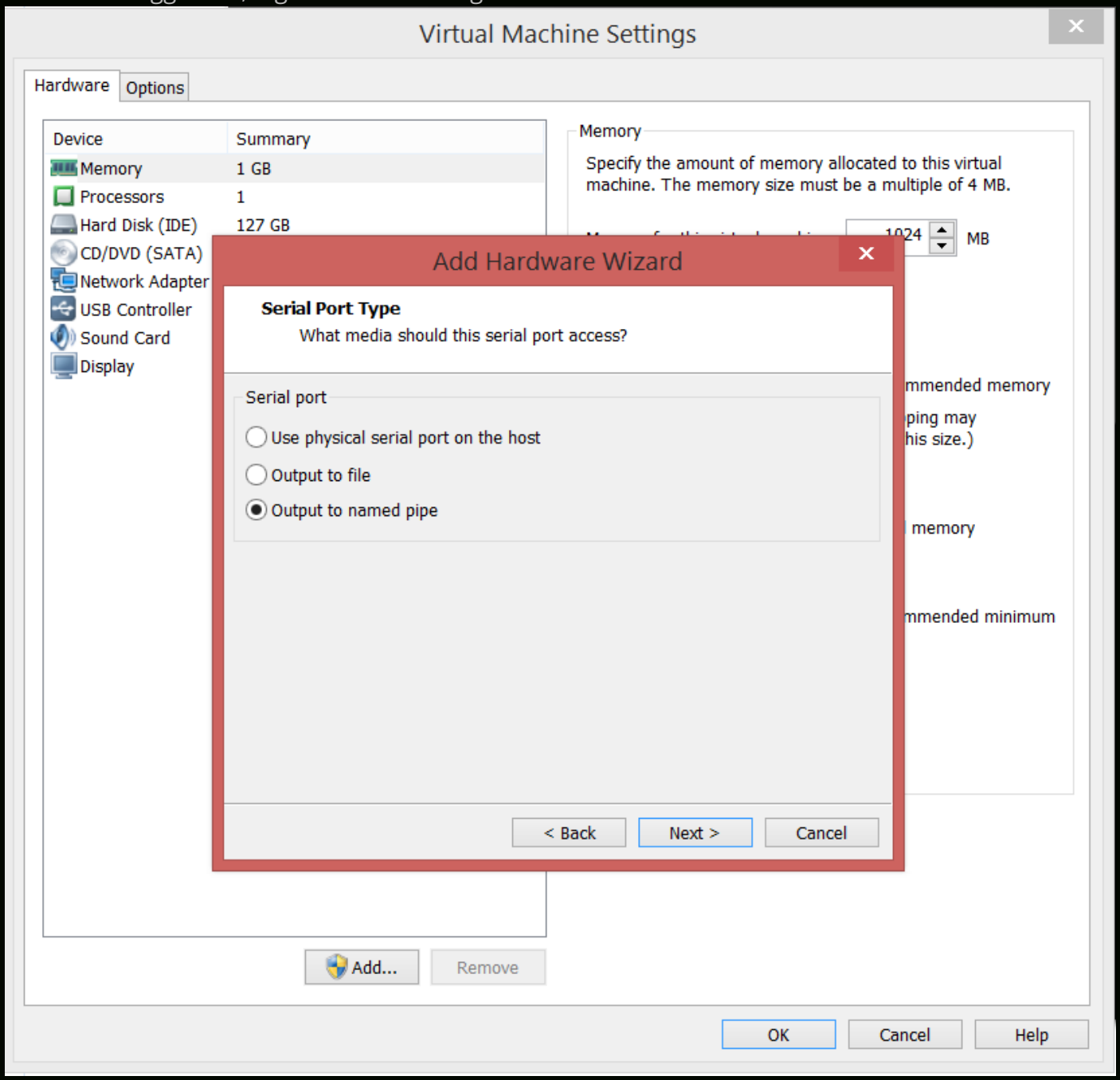


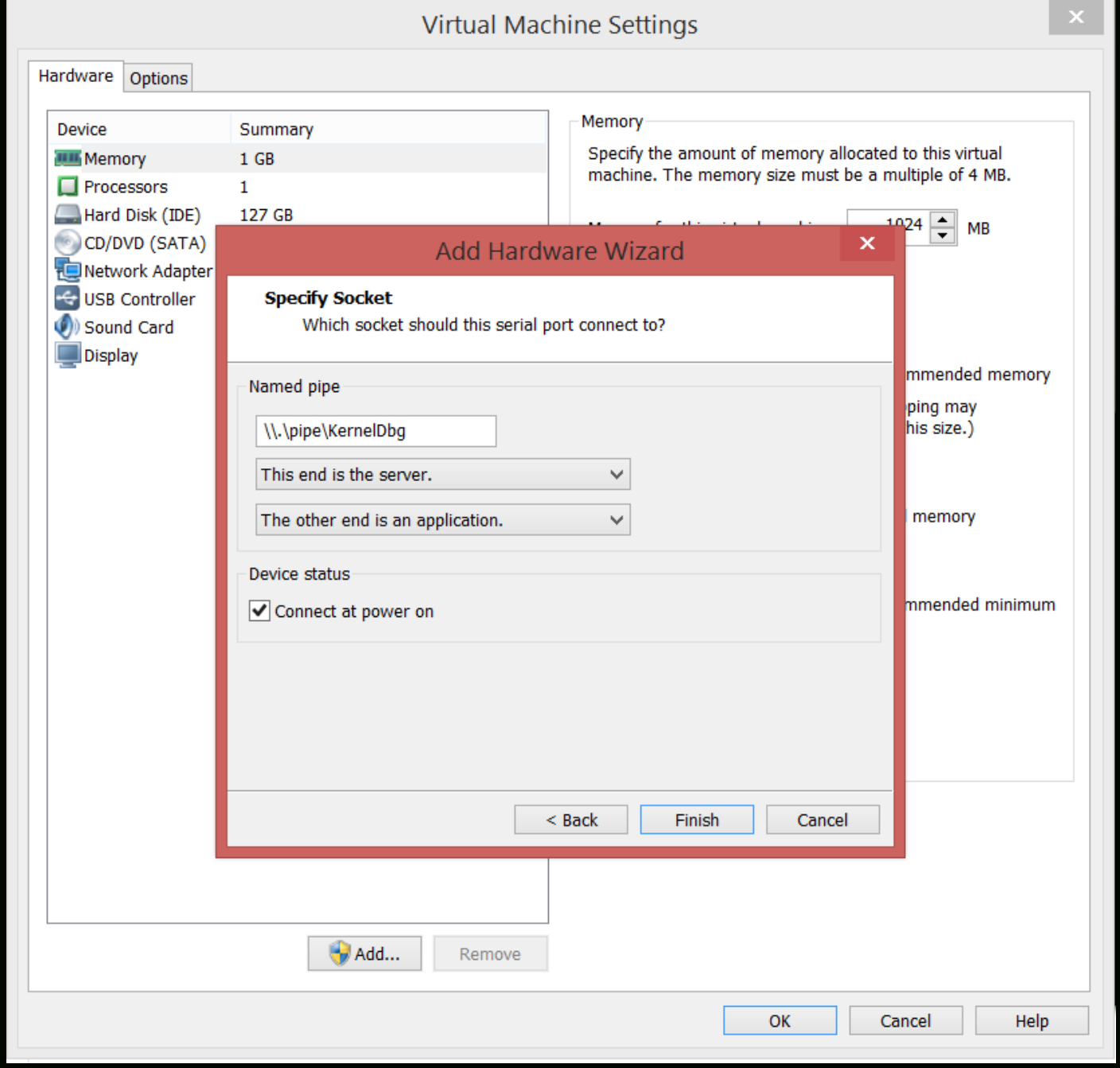


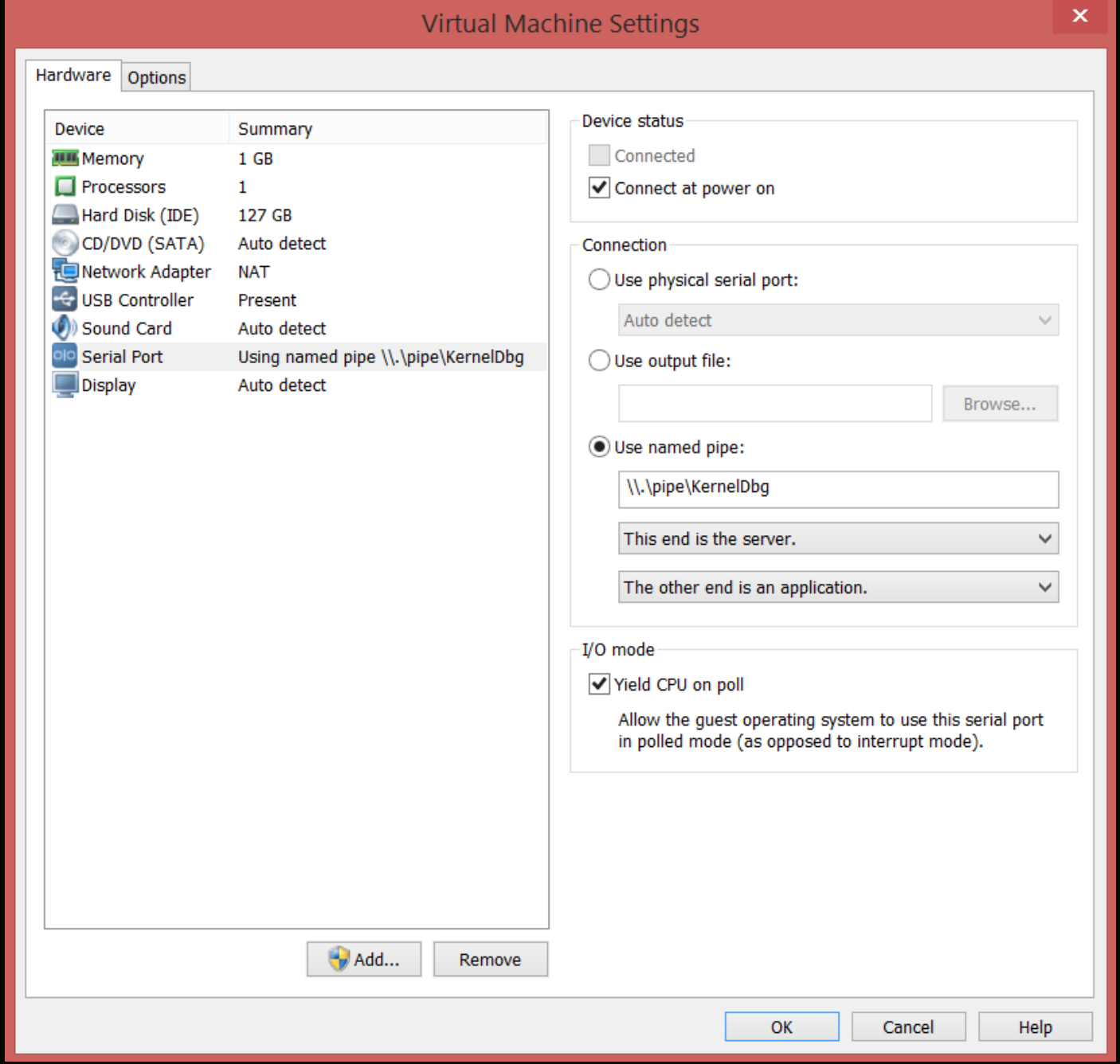


7. Now, we need to enable Serial Ports on both the VMs, so as to make them communicate using a Virtual Serial Port.

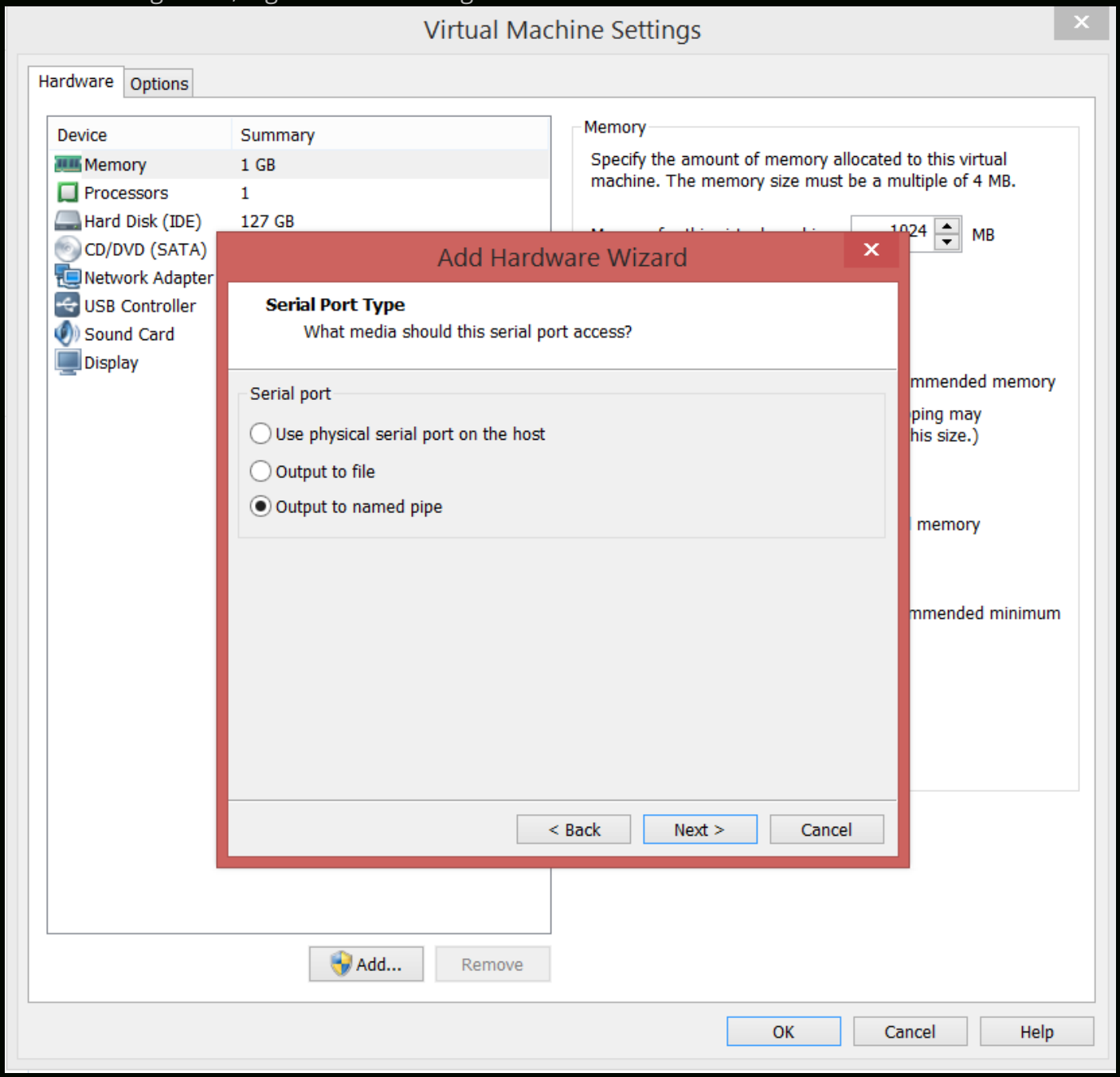
- For the Debugger VM, Right Click –> Settings –> Add –> Serial Port

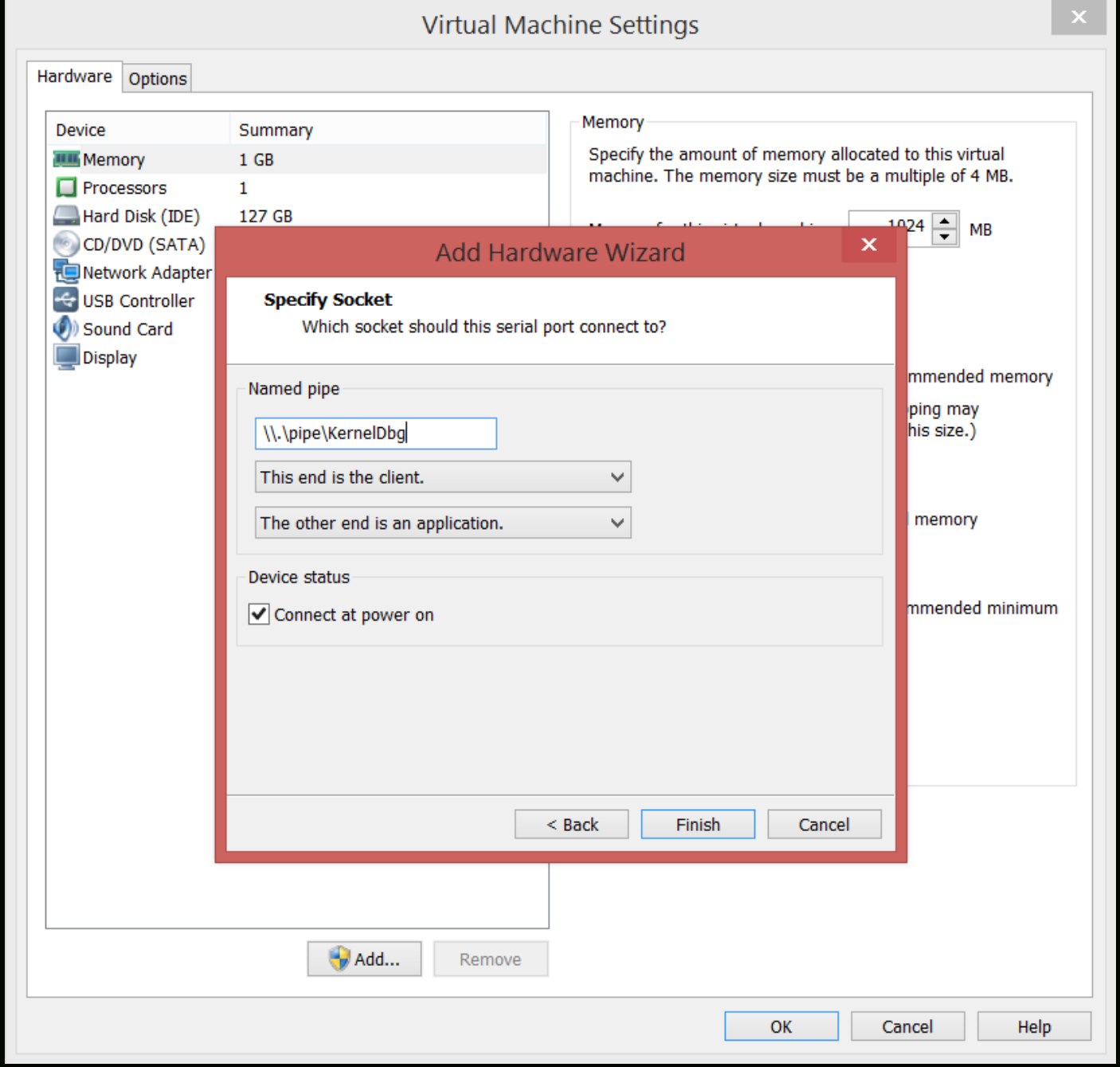


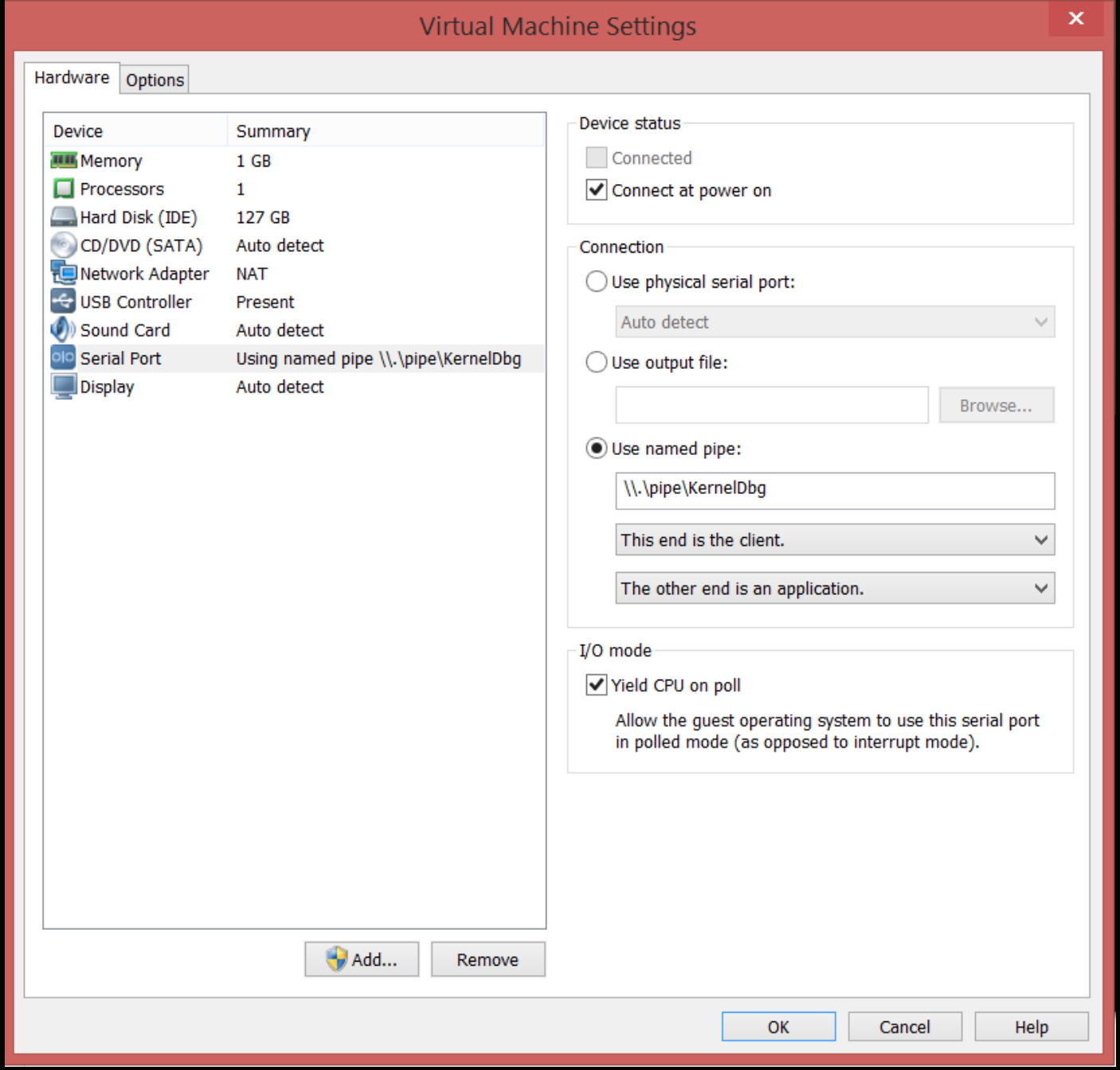

Virtual Machine Settings
Hardware
Options
Device
Summary
Memory
1 GB
Processors
1
Hard Disk (IDE)
127 GB
CD/DVD (SATA)
Network Adapter
USB Controller
Sound Card
Display
Memory
Specify the amount of memory allocated to this virtual machine. The memory size must be a multiple of 4 MB.
1024
MB
mmended memory
ping may
his size.)
memory
mmended minimum
Add Hardware Wizard
Specify Socket
Which socket should this serial port connect to?
Named pipe
\\.\pipe\KernelDbg
This end is the server.
The other end is an application.
Device status
Connect at power on
< Back
Finish
Cancel
Add...
Remove
OK
Cancel
Help


Virtual Machine Settings
Hardware
Options
Device
Summary
Memory
1 GB
Processors
1
Hard Disk (IDE)
127 GB
CD/DVD (SATA)
Auto detect
Network Adapter
NAT
USB Controller
Present
Sound Card
Auto detect
Serial Port
Using named pipe \\.\pipe\KernelDbg
Display
Auto detect
Add...
Remove
Device status
Connected
Connect at power on
Connection
Use physical serial port:
Auto detect
Use output file:
Browse...
Use named pipe:
\\.\pipe\KernelDbg
This end is the server.
The other end is an application.
I/O mode
Yield CPU on poll
Allow the guest operating system to use this serial port in polled mode (as opposed to interrupt mode).
OK
Cancel
Help

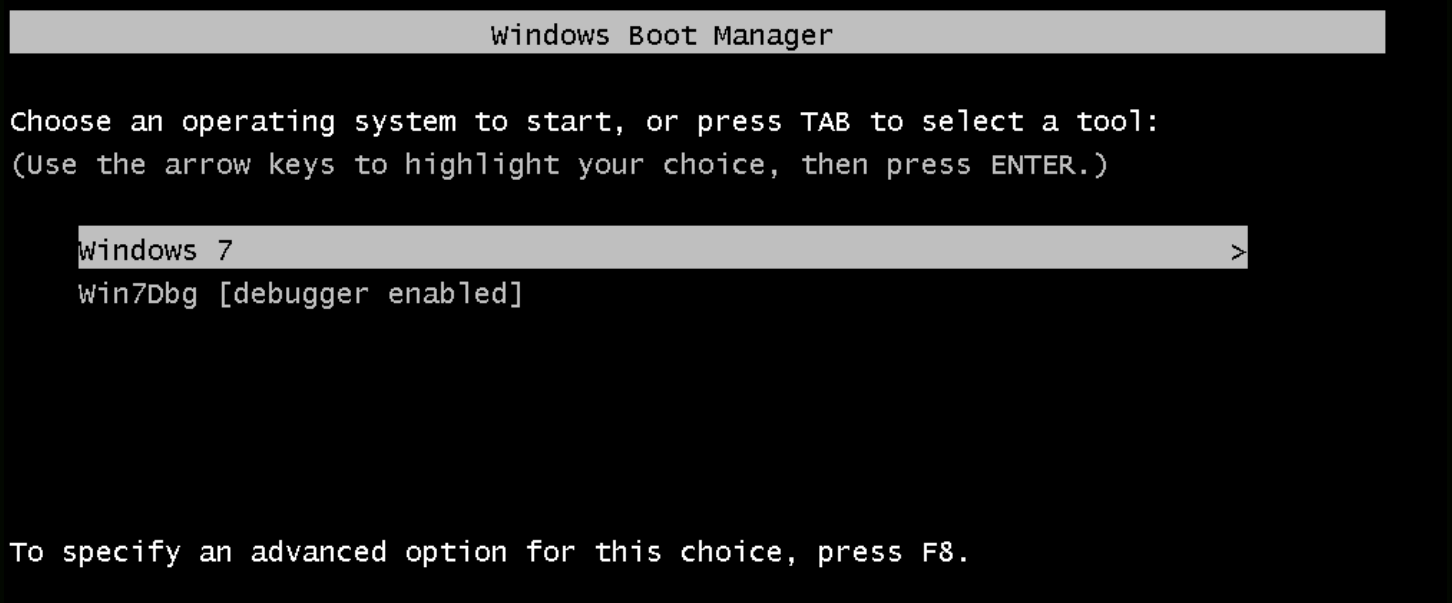
- For the Debugee VM, Right Click –> Settings –> Add –> Serial Port



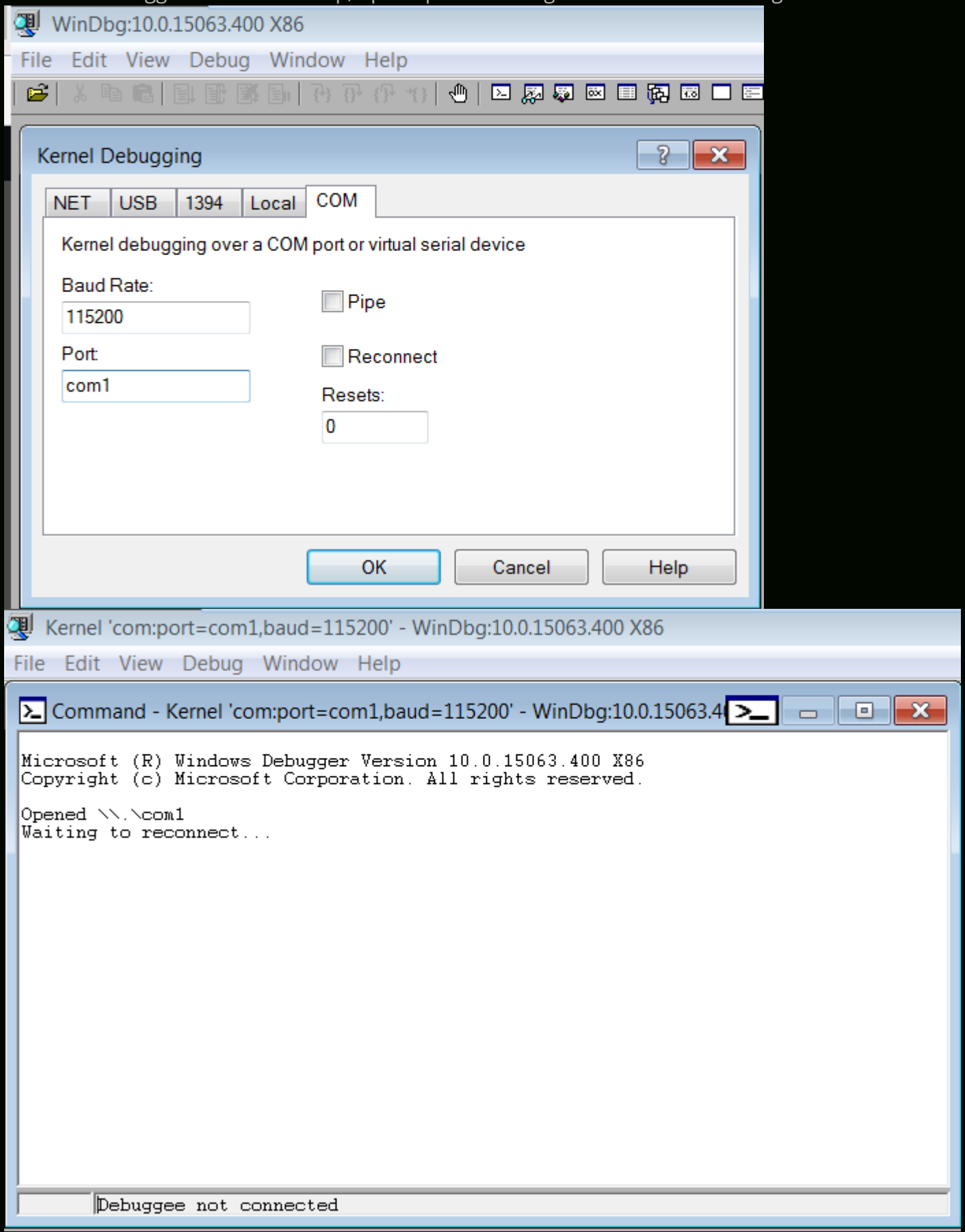

Virtual Machine Settings
Hardware
Options
Device
Summary
Memory
1 GB
Processors
1
Hard Disk (IDE)
127 GB
CD/DVD (SATA)
Network Adapter
USB Controller
Sound Card
Display
Memory
Specify the amount of memory allocated to this virtual machine. The memory size must be a multiple of 4 MB.
1024
MB
mmended memory
ping may
his size.)
memory
mmended minimum
Add...
Remove
OK
Cancel
Help
Add Hardware Wizard
Specify Socket
Which socket should this serial port connect to?
Named pipe
\\.\pipe\KernelDbg
This end is the client.
The other end is an application.
Device status
Connect at power on
< Back
Finish
Cancel



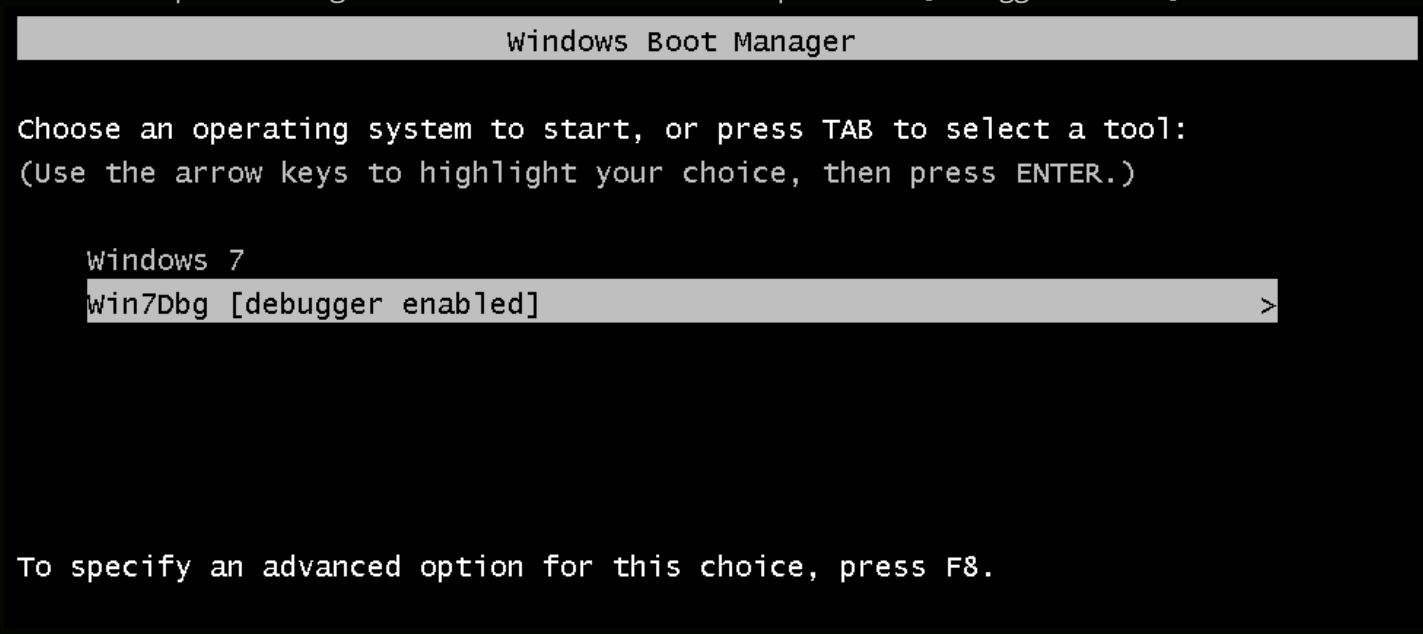
8. Now, turn on the Debugger VM first **(always)**, and select the first option without the *[debugger enabled]*.



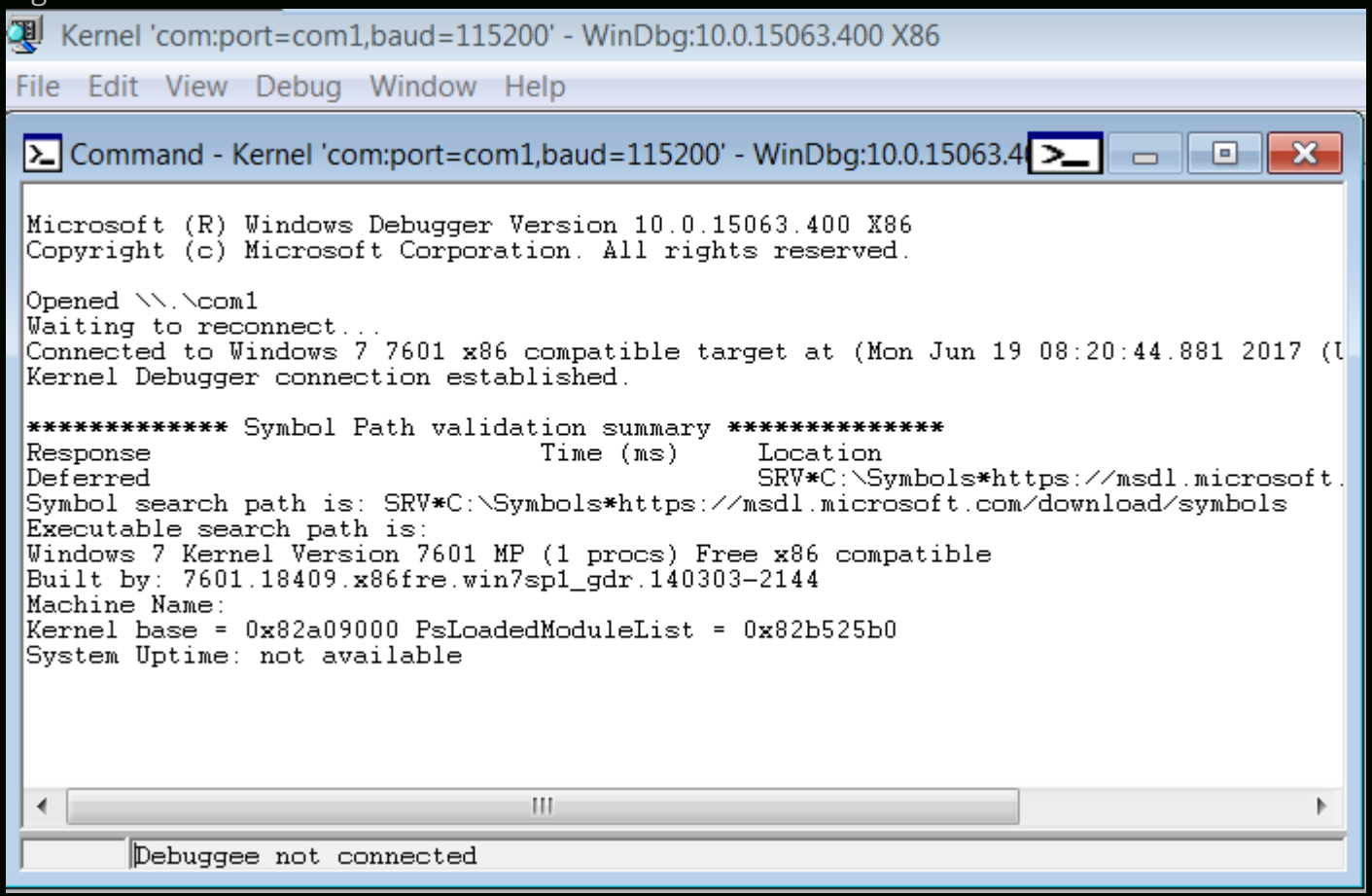
9. After the Debugger VM is booted up, open up the WinDbg –> File –> Kernel Debug –> COM.



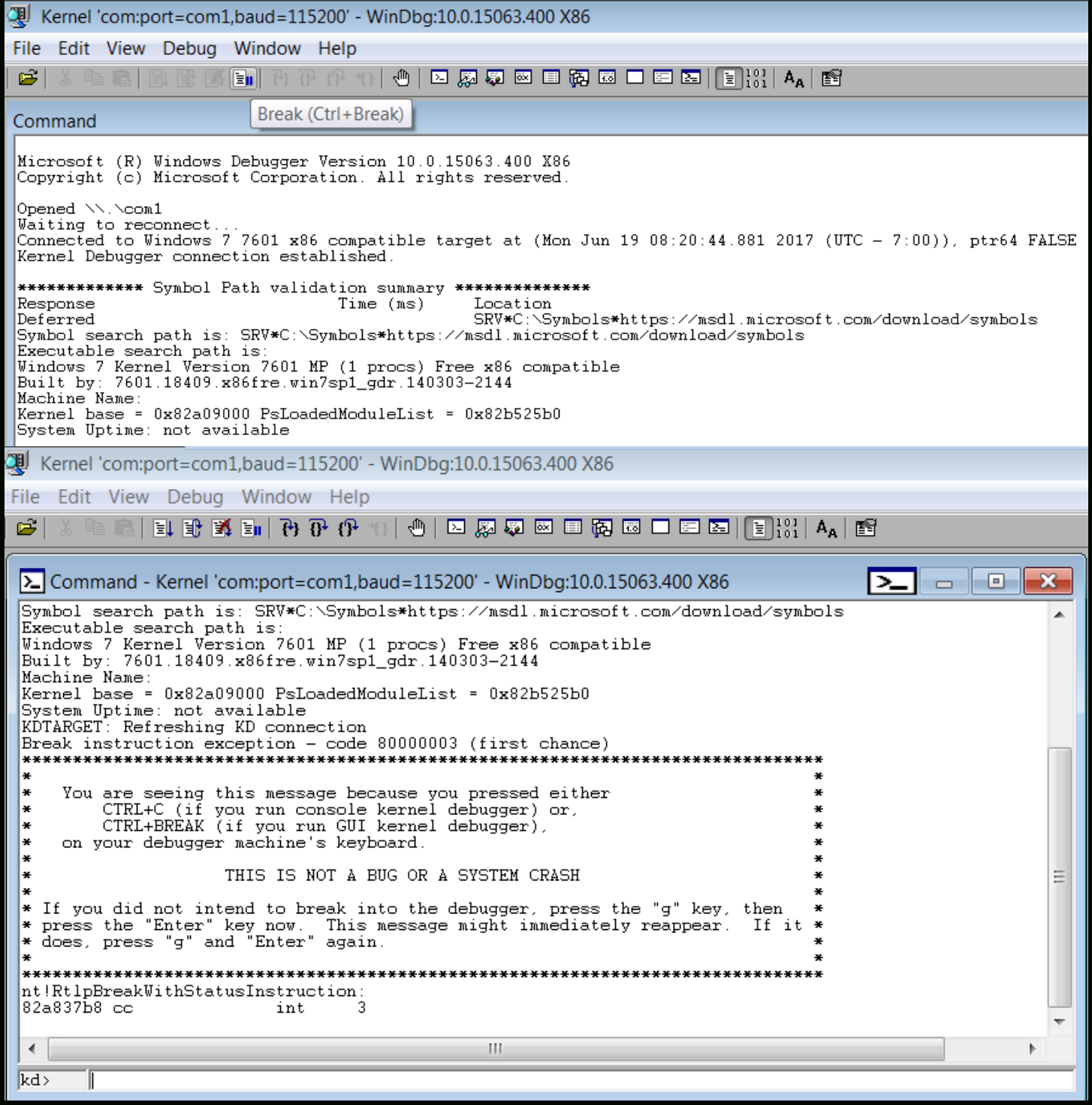
10. Now, boot up the Debugee VM, and select the second option with *[debugger enabled]*.



11. Now, if you see the following output in the WinDbg in your Debugger VM, congrats, everything is working fine.

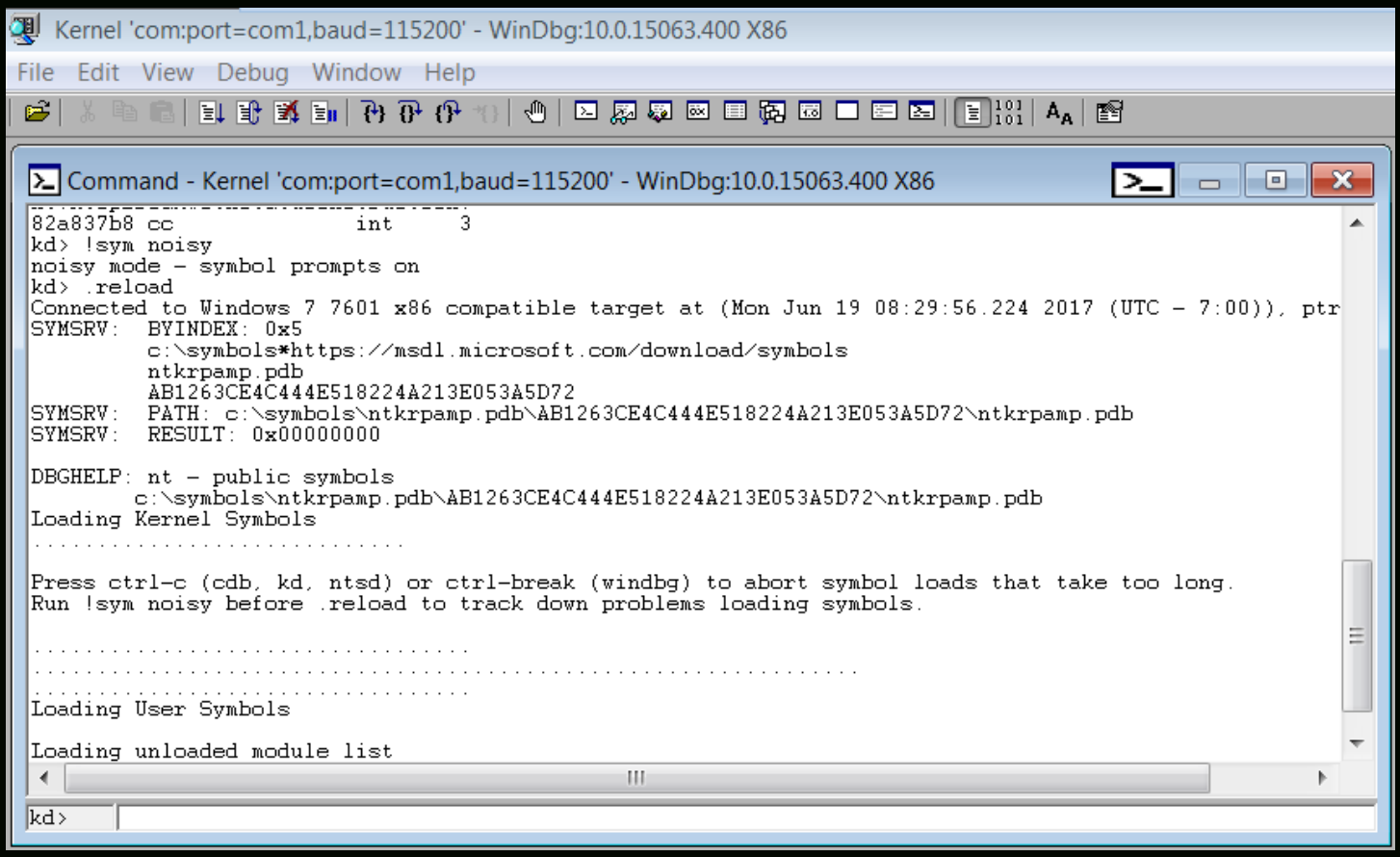


12. Now, after the Debugee VM is booted up, hit the *Break* button, and you should get an interactive *kd>* prompt, ready to take commands.



13. Now, just to be sure that the symbols have been loaded correctly, run the following commands:

```
!sym noisy
.reload
```



Conclusion

Congrats, we have successfully setup Kernel Debugging. The next part would be coming up soon, digging deeper into the kernel, and analyzing the Stack Overflow in Kernel Space.

Posted in Kernel, Tutorial Tagged Exploitation, Kernel, Tutorial, Windows

© rootkit 2018