FreeBSD on Hyper-V

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The Project

- Support FreeBSD running as a guest on Hyper-V
- Collaboration between Microsoft, NetApp and Citrix started in Fall of 2011
  - Each company with a vested interest
  - Microsoft: Support more guests on Hyper-V
  - NetApp & Citrix: Eventually support our appliances on Hyper-V
- FreeBSD 8.2 based development
  - Github repository
  - Dedicated developers and QA
Microsoft’s **Open Source Technology Center** is the development hub for mixed source solutions.
Hyper-V Architecture

Root Partition
  VMWPs
  VMMS
  WMI
  VSPs
  VID
  I/O Stack
  WinHv
  Drivers
  VMBUS

Enlightened Windows Child Partition
  User applications
  VSCs/ICs
  I/O Stack
  WinHv
  Drivers
  VMBUS

Enlightened BSD Child Partition
  User applications
  BSD VSCs/ICs
  I/O Stack
  WinHv
  Drivers
  VMBUS

Unenlightened Child Partition
  User applications

Hypervisor
  Hypercalls
  MSRs
  APIC
  Scheduler
  Address Management
  Partition Manager

Processes

Memory
Hyper-V is a Type-1 Hypervisor for the x86 Instruction Set Architecture

Requires Hardware Assist for Virtualization

Emulates a standard x86 platform for guest Operating Systems

Supports both 32-bit and 64-bit Guest Operating Systems
Hyper-V Architecture

- Full Virtualization with selective enlightenments:
  - Enlightened I/O Paths
  - Other low-level enlightenments
    - Time keeping
    - Context switching
    - TLB shoot-down etc.
FreeBSD hosted as a Fully virtualized guest with I/O enlightenments:
- Standard kernel binaries supported
- I/O enlightenments packaged as driver modules
- x86 64bit kernel support

Will support on Hyper-V for Windows Server 2008 R2 and Windows Server 8

We can potentially leverage additional Hyper-V specific enlightenments
Changes to FreeBSD

- Driver source under sys/dev/hyperv
  - vmbus
  - storvsc
  - netvsc
  - utilities
  - include

- Minimal changes to FreeBSD kernel
  - IRQ vector element added to intr_event structure
  - bootarg to enable/disable ata driver

- Approximately 6500 lines of new code
Vmbus Driver – hv_vmbus
Storage Driver – hv_storvsc

VMBUS - SCSI PROTOCOL

DISK
VHD
VSP
CAM
StorVSC
StorVSC Storage HBA

- Interface between CAM layer and VMBUS SCSI protocol
- Each device is a SCSI controller
  - Supporting 64 LUNs and 1 Target
  - /dev/daX
- Optional replacement for emulated IDE
  - Fast IDE: better boot performance
  - Bootarg controlled hw.ata.disk_enabled
- A disk may be configured as coredump device
Network Driver – hv_netvsc

- VMBUS - RNDIS PROTOCOL
- VSP
- FreeBSD ifnet
- Netvsc-netdev
- RNDIS CLIENT
- Host Bridge
Util Driver – hv_util

Windows Mgmt. Stack

VSP

KVP
Shutdown
Heartbeat
Time-synch

VMBUS
Challenges

- No published protocol specifications
- Microsoft Style to freebsd style(9)
- Device unit and peripheral mapping
- Mounting root using enlightened storage driver
- Debugging hypervisor issues
Status

- Development complete milestone reached for primary functionality
- Internal QA and performance testing
- Addressing outstanding bugs, reviews and FreeBSD style changes
Next Steps

- Port changes to appropriate CURRENT
- Work with FreeBSD committers
- Release Target: Summer 2012
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