INTEL® SELECT SOLUTION FOR OPEN CLOUD REFERENCE DESIGN VERSION 1.0

October 23, 2019

Intel® Select Solution - Introduction

SIMPLIFIED EVALUATION

Validated HW and SW components, eliminating guesswork

FAST AND EASY TO DEPLOY

Pre-defined settings and system-wide tuning, enabling smooth deployment

WORKLOAD OPTIMIZED

Designed and benchmarked to perform optimally for specific workloads

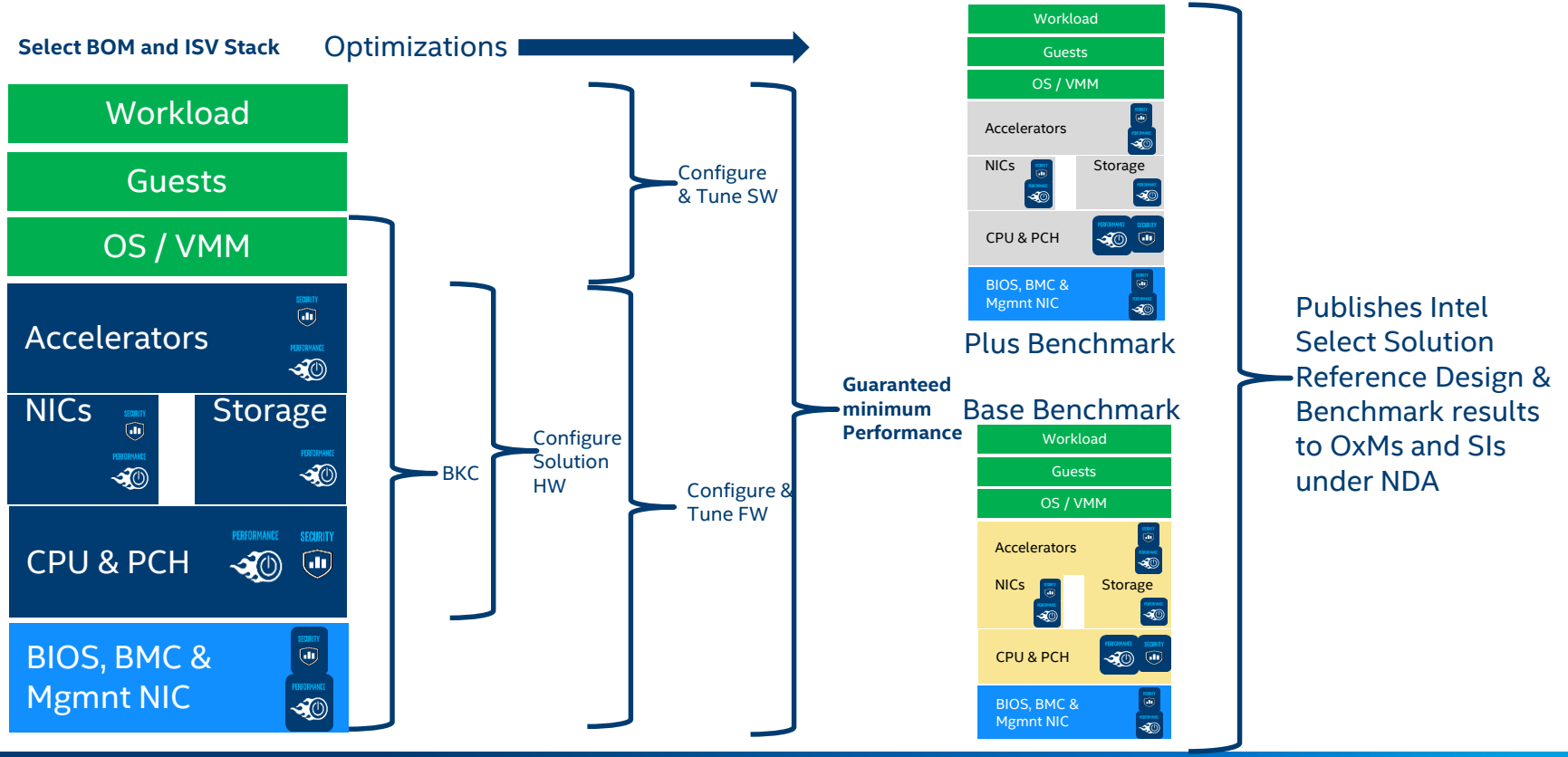
All Intel® Select Solution configurations and benchmark results are

VERIFIED BY INTEL

What are Intel® Select Solutions?

- A family of workload-optimized, pre-certified solutions, based on the Xeon® processor scalable family and targeting today's complex workloads.
- Balanced configurations, optimized for the workload. "Balanced" means that the infrastructure supports benchmark workload scaling with nearly equal performance of compute, network and storage to the maximum performance of the system.

Intel® Select Solution Reference Design



Open Cloud Reference Design - Base Configuration

6 nodes	3 controller	3 compute/storage
Processor	**2x Intel® Xeon® Gold 5118/5218 CPU at 2.30 GHz, 12C/16C or higher**	**2x Intel® Xeon® Gold 5118/5218 CPU at 2.30 GHz, 12C/16C or higher**
Memory	192 GB or higher	192 GB or higher
Persistent Memory	NA (optional)	NA (optional)
Boot Drive	**1x Intel® SSD DC S4510 or higher series at 480 GB or larger capacity drives**	**1x Intel® SSD DC S4510 or higher series at 480 GB or larger capacity drives**
Storage Cache	NA (optional)	NA (optional)
Storage Drive	**1x Intel® SSD DC S4510 or higher series at 1.92 TB or larger capacity drives**	**4x Intel® SSD DC S4510 or higher series at 1.92 TB or larger capacity drives**
Data Network	2x 10GB Dual-Port Intel® Ethernet Converged Network Adapter X710-DA2 SFP+ or better	2x 10GB Dual-Port Intel® Ethernet Converged Network Adapter X710-DA2 SFP+ or better

*Font in bold = minimum required components to be included in partner solution to verify as Select Solution

Open Cloud Reference Design - Plus Configuration

6 nodes	3 controller	3 compute/storage
Processor	**2x Intel® Xeon® Gold 5118/5218 CPU at 2.30 GHz, 12C/16C or higher**	**2x Intel® Xeon® Gold 6222V CPU at 1.80 GHz, 20C or higher**
Memory	192 GB or higher	384 GB or higher
Persistent Memory	NA (optional)	1.0TB (8 x 128GB, 288-pin Intel Persistent Memory DIMM) or higher
Boot Drive	**1x Intel® SSD DC S4510 or higher series at 480 GB or larger capacity drives**	**1x Intel® SSD DC S4510 or higher series at 480 GB or larger capacity drives**
Storage Cache	NA (optional)	**1x Intel® Optane™ SSD DC P4800X or higher series at 375GB or larger capacity drives**
Storage Drive	**1x Intel® SSD DC S4510 or higher series at 1.92 TB or larger capacity drives**	**4x Intel® SSD DC P4510 or higher series at 2.0 TB or larger capacity drives**
Data Network	2x 10GB Dual-Port Intel® Ethernet Converged Network Adapter X710-DA2 SFP+ or better	2x 10GB Dual-Port Intel® Ethernet Converged Network Adapter X710-DA2 SFP+ or better

*Font in bold = minimum required components to be included in partner solution to verify as Select Solution

Open Cloud Performance KPI – Minimal Requirements

Workload	Benchmark Methodology	Base Configuration	Plus Configuration
Storage	VDBench • 30 VM (m1.large, 4CPU, 8GB RAM, 2x 50GB volume) • IOPS / Latency (ms) • 8k block, 70% read /30% write	• 8k block: >40K / <25ms	• 8k block: >70K / <14ms
VM Orchestration/ Virtualization	OpenStack Rally • VM type (m1.small - 2GB RAM, 1CPU, 5GB volume) • # VM • VM launch time (including Cinder volume attachment)	• 100% success rate • >200 VM • <150 sec (95%ile) @100 concurrency rate	• 100% success rate • >1000 VM • <150 sec (95%ile) @100 concurrency rate
In-memory Database	Redis / Memtier • Instance type (16GB Memory) • # instance • Ops / sec @<1ms latency SLA	• >20 instances • >450,000 ops / sec @1ms SLA	• >60 instances • >600,000 ops / sec @1ms SLA

* Partners are expected to demonstrate the solutions provide better performance than the numbers stated in the table.
* Benchmark methodology and test scripts will be provided to partners.

Configure DCPMM as Memory Mode (Plus Config)

Install IPMCTL and dependencies

$sudo yum install yum-utils
$sudo yum-config-manager --add-repo https://copr.fedorainfracloud.org/coprs/jhli/ipmctl/repo/epel-7/jhli-ipmctl-epel-7.repo
$sudo yum-config-manager --add-repo https://copr.fedorainfracloud.org/coprs/jhli/safeclib/repo/epel-7/jhli-safeclib-epel-7.repo
$sudo yum -y install libsafec ipmctl ndctl

Configure all DCPMM capacity for Memory Mode usage

$sudo ipmctl create -goal MemoryMode=100

Note: system reboot is required.

References:
https://docs.pmem.io/getting-started-guide
https://docs.pmem.io/ipmctl-user-guide

Storage Workload Benchmark – Prepare Client VM

1. Launch 30 Client VMs m1.large (CentOS 7.6, 4 vCPU, 8GB RAM)
2. For each Client VM, attach 2x 50GB volume
3. Install VDBench on each Client VMs
   - $yum install –y java-1.8.0-openjdk
   - $unzip vdbench50407.zip
4. Run VDBench process on each Client VMs
   - $./vdbench rsh

Storage Workload Benchmark – Run VDBench

1. Launch 1 Master VM (CentOS 7.6, 8 vCPU, 16GB RAM, 20GB Volume)
2. Install VDBench on Master VM
   - $yum install –y java-1.8.0-openjdk
   - $unzip vdbench50407.zip
3. Run VDBench benchmark with parameter file
   - $./vdbench –f paramfile –o output-result-dir

Zip and sent output-result-dir for ISS Open Cloud Verification

Storage Workload Benchmark – Param File (part 1)

```
* VDBench sample definition
*
* HD:     Host Definition
* SD:     Storage Definition
* WD:    Workload Definition
* RD:     Run Definition
*

hd=default,vdbench=/root/vdbench,user=root,shell=vdbench,jvms=8
** Remember to update the IP addresses **
hd=hd1,system=10.0.0.30
hd=hd2,system=10.0.0.20
……
hd=hd30,system=10.0.0.12

sd=sd1,host=hd*,lun=/dev/vdb,openflags=o_direct
sd=sd2,host=hd*,lun=/dev/vdc,openflags=o_direct
```

Storage Workload Benchmark – Param File (part 2)

```
wd=wdpre,sd=sd*,xfersize=(128k,100),rdpct=70,seekpct=100,streams=16
wd=wd4k7r,sd=sd*,xfersize=(4k,100),rdpct=70,seekpct=100,streams=16
wd=wd4k10r,sd=sd*,xfersize=(4k,100),rdpct=100,seekpct=100,streams=16
wd=wd4k10w,sd=sd*,xfersize=(4k,100),rdpct=0,seekpct=100,streams=16
wd=wd8k7r,sd=sd*,xfersize=(8k,100),rdpct=70,seekpct=100,streams=16
wd=wd8k10r,sd=sd*,xfersize=(8k,100),rdpct=100,seekpct=100,streams=16
wd=wd8k10w,sd=sd*,xfersize=(8k,100),rdpct=0,seekpct=100,streams=16
wd=wd128k7r,sd=sd*,xfersize=(128k,100),rdpct=70,seekpct=100,streams=16
wd=wd128k10r,sd=sd*,xfersize=(128k,100),rdpct=100,seekpct=100,streams=16
wd=wd128k10w,sd=sd*,xfersize=(128k,100),rdpct=0,seekpct=100,streams=16

rd=runpre,wd=wdpre,iorate=max,elapsed=30,interval=1,warmup=5,threads=512
rd=run4k10r,wd=wd4k10r,iorate=max,elapsed=600,interval=1,warmup=5,threads=512
rd=run4k7r,wd=wd4k7r,iorate=max,elapsed=600,interval=1,warmup=5,threads=512
rd=run4k10w,wd=wd4k10w,iorate=max,elapsed=600,interval=1,warmup=5,threads=512

rd=run8k10r,wd=wd8k10r,iorate=max,elapsed=600,interval=1,warmup=5,threads=512
rd=run8k7r,wd=wd8k7r,iorate=max,elapsed=600,interval=1,warmup=5,threads=512
rd=run8k10w,wd=wd8k10w,iorate=max,elapsed=600,interval=1,warmup=5,threads=512

rd=run128k7r,wd=wd128k7r,iorate=max,elapsed=600,interval=1,warmup=5,threads=512
```

VM Workload Benchmark – OpenStack Rally

1. Refer OpenStack Rally installation guide.
   - https://rally.readthedocs.io/en/latest/quick_start/tutorial.html
2. Run OpenStack Rally Benchmark
   - $rally task start boot-server-attach-volume-and-list-attachments.json --task-args 'flavor_name: m1.small'
   - $rally task report <rally-task-id> --out output.html

Sent Rally html task report output for ISS Open Cloud Verification

VM Workload Benchmark – Rally Template (Part 1)

```
{% set flavor_name = flavor_name or "rally" %}
{
   "NovaServers.boot_server_attach_volume_and_list_attachments": [
      {
         "args": {
            "flavor": {
               "name": "{{flavor_name}}"
            },
            "image": {
               "name": "CentOS"
            },
            "volume_size": 5,
            "volume_num": 1,
            "boot_server_kwargs": {},
            "create_volume_kwargs": {}
         },
         "runner": {
            "type": "constant",
            "times": 200,
            "concurrency":100
         },
```

VM Workload Benchmark – Rally Template (Part 2)

```
"context": {
        "users": {
          "tenants": 10,
          "users_per_tenant": 2
        },
        "quotas": {
          "neutron": {
            "network": -1,
            "subnet": -1
          },
          "nova": {
            "instances": 10000,
            "ram": -1,
            "cores": -1
          },
          "cinder": {
            "volumes": 10000
          }
        }
      },
```

VM Workload Benchmark – Rally Template (Part 3)

```
"sla": {
            "failure_rate": {
               "max": 0
            }
         }
      }
   ]
}
```

IMDB Workload Benchmark – Prepare Redis VMs

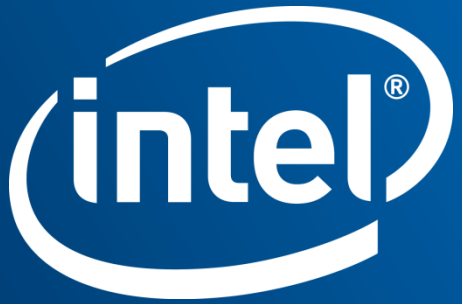
1. Launch 20 (or 60 for Plus config) Redis VMs (CentOS 7.6, 8 vCPU, 16GB RAM, 40GB Volume)
   - Install Redis server
   - Modify /etc/redis.conf
     - Uncomment #bind 127.0.0.1
     - Disable protected mode “protected-mode no”

IMDB Workload Benchmark – Prepare Memtier

1. Launch 20 (or 60 for Plus config) Memtier VMs (CentOS 7.6, 8 vCPU, 8GB RAM, 20GB Volume)
   - Install memtier
2. For each Memtier VM, run memtier_benchmark to each Redis VM
   - $memtier_benchmark --server <ip> -p 6379 --threads 8 --clients 1 --test-time 300 --ratio 1:10 --data-size 1024 --key-pattern S:S --random-data

     Update <ip> to each Redis VM's IPaddress for each Memtier VM.

Sent all memtier output result for ISS Open Cloud Verification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