ENHANCED NETWORKING IN AWS

Typically enhanced networking is the jargon given by aws to SRIOV interface enabled devices.So, we have heard that SRIOV improves network performance and gives consistency to latency and jitteR

What is SRIOV?

What does it do to optimize the network performance?

What is the underlying architecture?

SRIOV

SRIOV was created by PCI-SIG which is an electronic industry association which specifies underlying specs of PCI buses.So, before we jump into SR-IOV we need to understand what PCIe is.

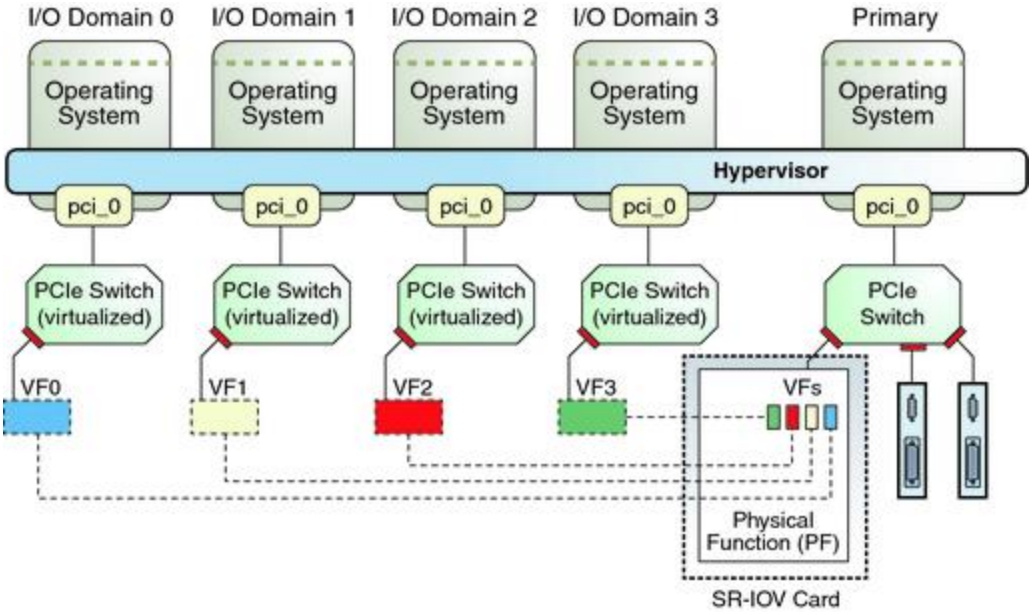
PCIe

PCI is a bus ,while PCIe is a point-to-point connection between two devices,no other devices can share this connection.On the motherboard there is a PCIe slot with a dedicated lane not sharing the lane with other PCIe slots.These slots give high speed connections.So these can be grouped together to create high bandwidth connections.

So what does SRIOV do?

SR-IOV introduces the concept of virtual and physical functions (PF'S and VF's) . A VF is a lightweight functions which lacks configuration recources of a PF. A VF does only data in and out and it is configured from a PF PFs are full-featured PCIe functions; they are discovered, managed, and manipulated like any other PCIe device. PFs have full configuration resources, meaning that it's possible to configure or control the PCIe device via the PF, and (of course) the PF has full ability to move data in and out of the device. So basically enabling SR-IOV makes the PCI device to split into PF's and VF's and it presents multiple

instances of itself to the OS. Imagine each PF and VF can do data in and out and this will boost up the network performance by a significant amount.



HOW TO ENABLE SR-IOV ON AWS INSTANCE:

SR-IOV requires not only the support of the hardware but also of the OS and hypervisor.Why?

Since VF's are not full PCIe devices in itself ,the OS should be known of this fact and hypervisor support is required to detect and initialize PF's and VF's properly.

Choosing an Instance :

It is of upmost importance for SR-IOV to be enabled the ami should support HVM virtualization,otherwise the network driver will never be able to utilize SR-IOV.Centos 6.5 is a PV ami and hence we use the Centos 6 ami and upgrade it to 6.7 to use HVM.

Only specific instance types support enhanced networking.

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- C3
- C4
- D2
- I2
- M4
- R3

So we make sure our instance is one of these types.

Enabling enhanced networking :

Any ami having HVM support can be used ,we chose Centos 6(x86_64) –With updates HVM (ami id is ami-45844401 in us-west-1 region).

We launch the ami and do a sudo yum update on the instance and then reboot and follow the steps given in the documentation.

http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/enhanced-networking.html

PERFORMANCE TESTING ON AN SR-IOV enabled instance :

We took a c3.8x large instances with and without enhanced netorking enabled and ran iperf tests on them.

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Note:AWS by default sets the MTU in its instances to 9001 and this causes packet loss when we run iperf tests between two VPC's. So we have to first reset the mtu to 1500 before testing out the instances.

```
sudo ip link set dev eth0 mtu 1500
```

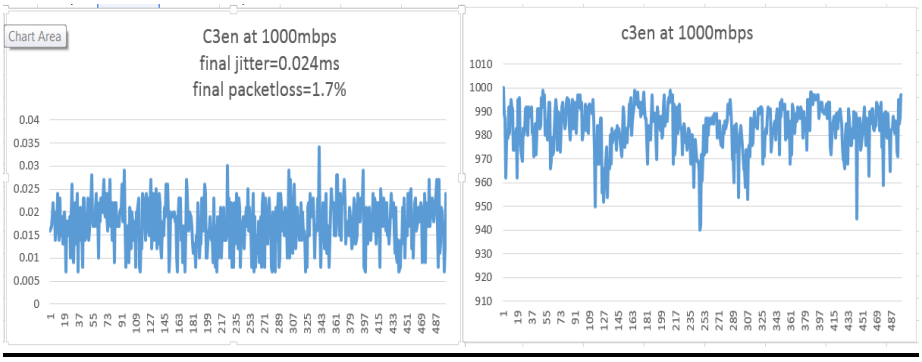
Performance Results:

We see a significant performance improvement after enabling SR-IOV.The bandwidth is much better and jitter and packet losses are reduced.

NOTE:The maximum bandwith obtained with an SR-IOV enabled instance on a c3.8x large cpu between two VPC's is **3.6gbps**.

Whereas ,the maximum bandwidth obatined for the same instance within the same subnet is **9.6gbps**

C3 with en at 1 gbps:



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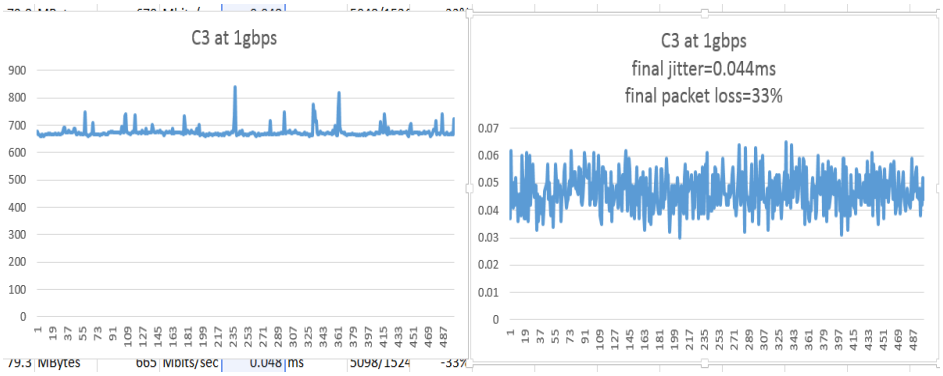
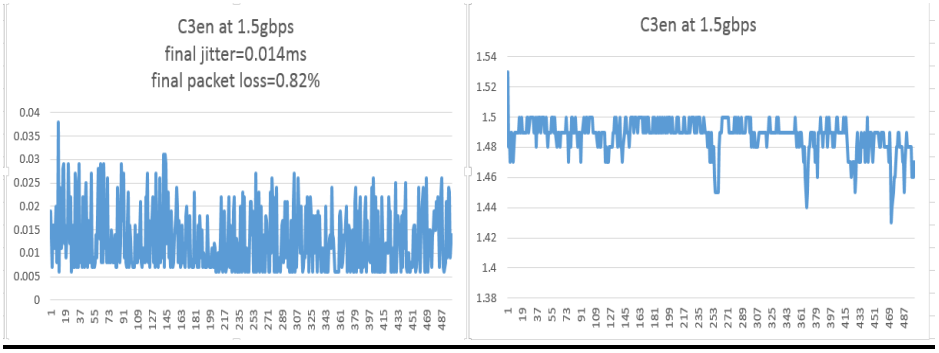
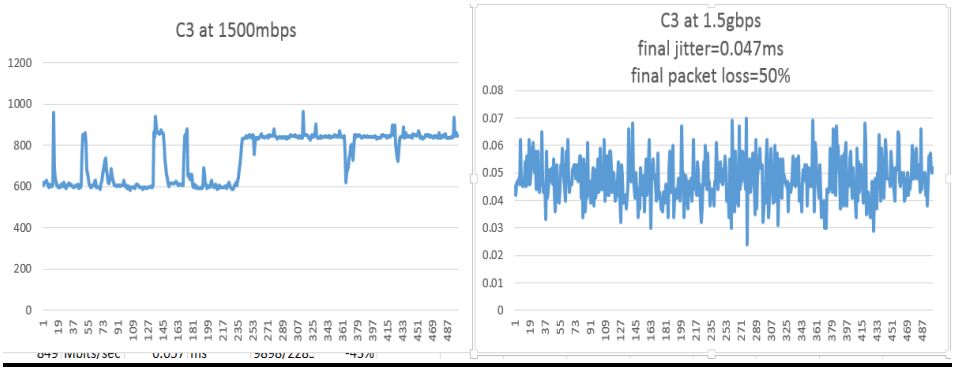
C3 without en at 1gbps:



C3 with en at 1.5gbps



C3 without en at 1.5gbps



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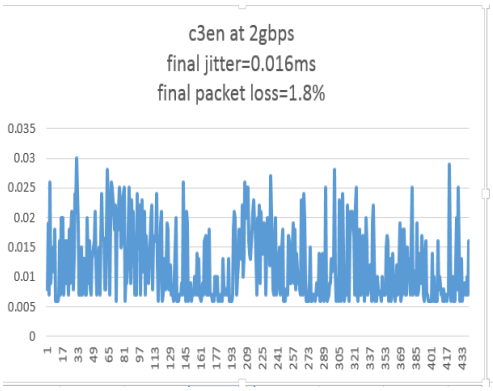
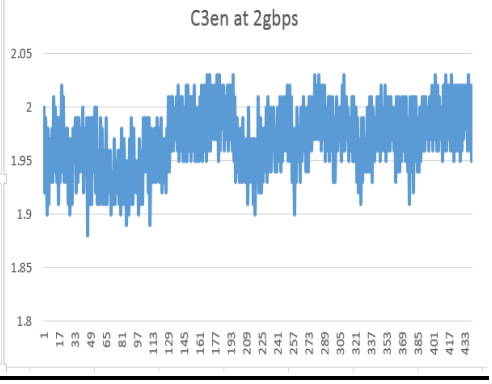
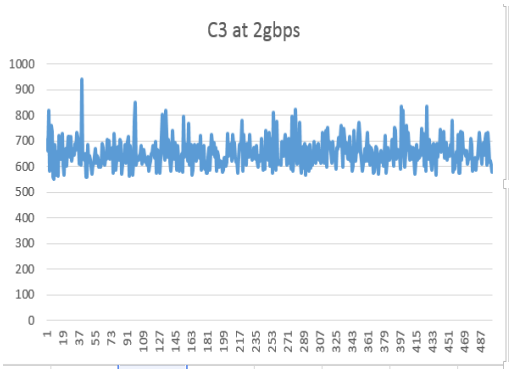
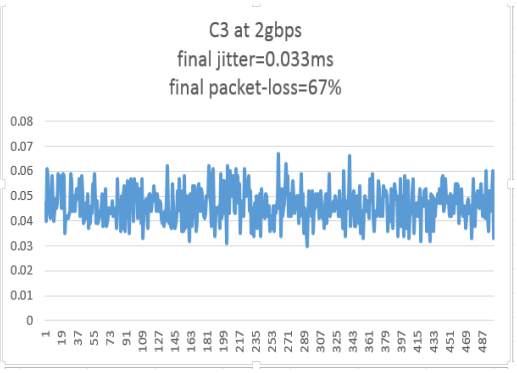
C3 with en at 2gbps





C3 without en at 2gbps





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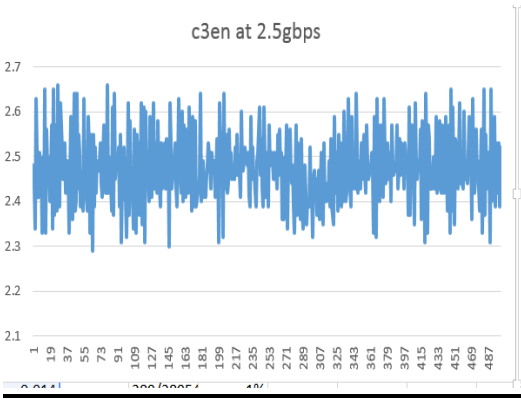
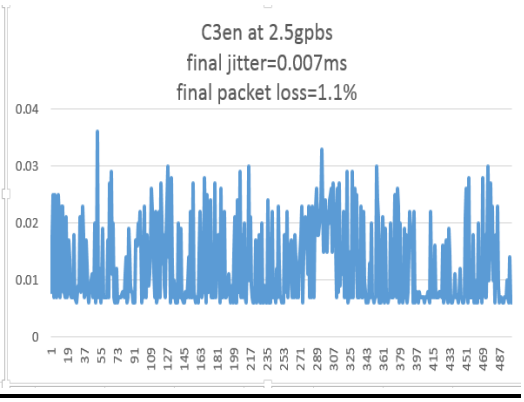
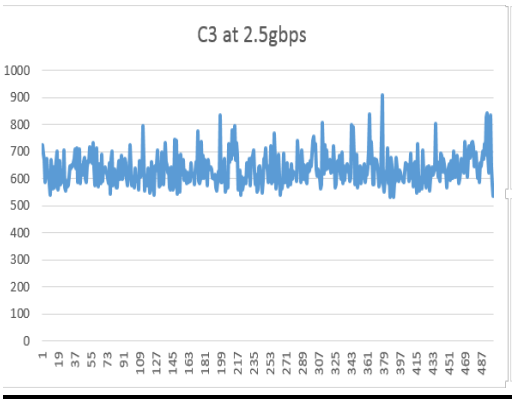
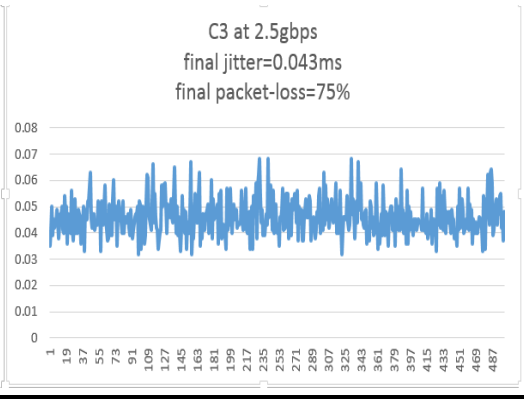
C3 with en at 2.5gbps





C3 without en at 2.5gbps





So ,from the graphs we can observe that by enabling SR-IOV we see a very good increase in bandwidth ,low jitter and very minimal packet-loss. Though there is no good case to prove the consistency with SR-IOV ,testing out in the real time scenario will help validate this claim.

Edit:Testing on shoretel architecture,enhanced networking really kicks in after 700 to 800 mbps.That is when packet loss increases drastically in non SR-IOV enabled instances.This validates our findings.Enabling enhanced networking does improve the overall performance.