

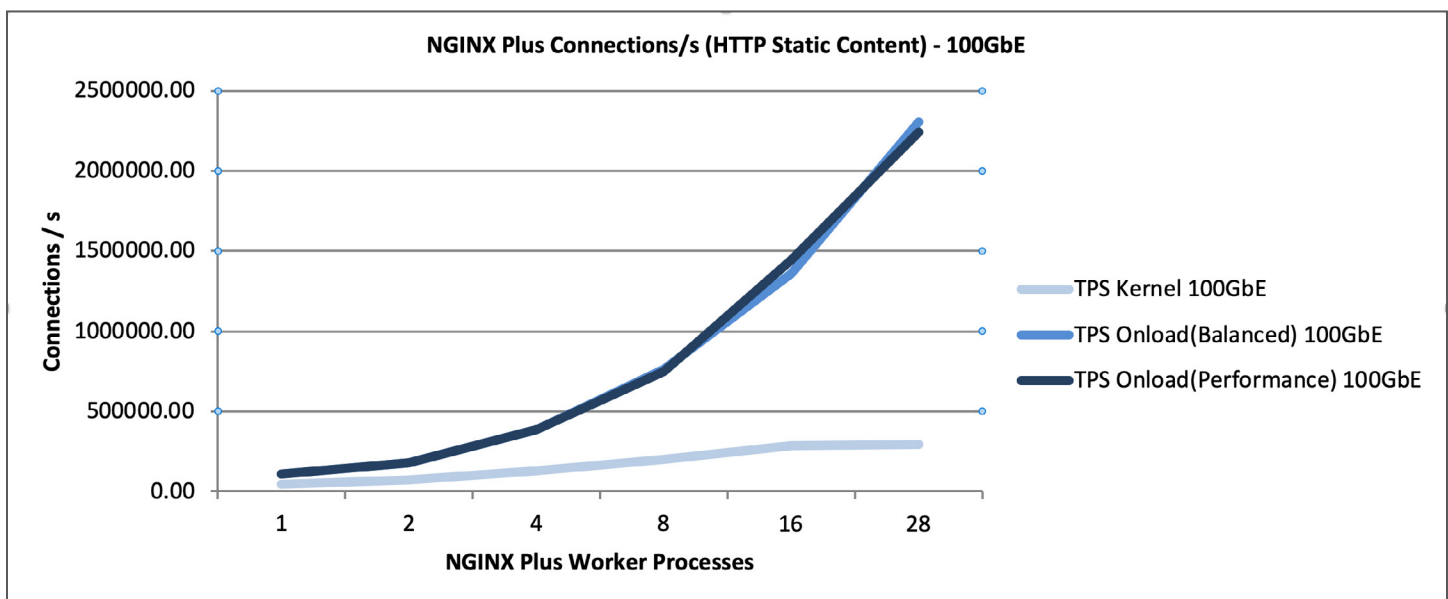
NGINX Plus Web Server with Cloud Onload[®] Sees a 700% Performance Gain



What is NGINX?

Open source NGINX is an HTTP and reverse proxy server, and a generic TCP/UDP proxy server. NGINX Plus is a software load balancer, web server and content cache built on top of open source NGINX. NGINX Plus has exclusive enterprise-grade features beyond what's available in the open source offering, including session persistence, configuration via API, and active health checks.

NGINX Plus is heavily network dependent by design, so its performance can be significantly improved through enhancements to the underlying networking layer. NGINX has been used extensively to host some of the biggest websites including Dropbox, Netflix and Wordpress.com.

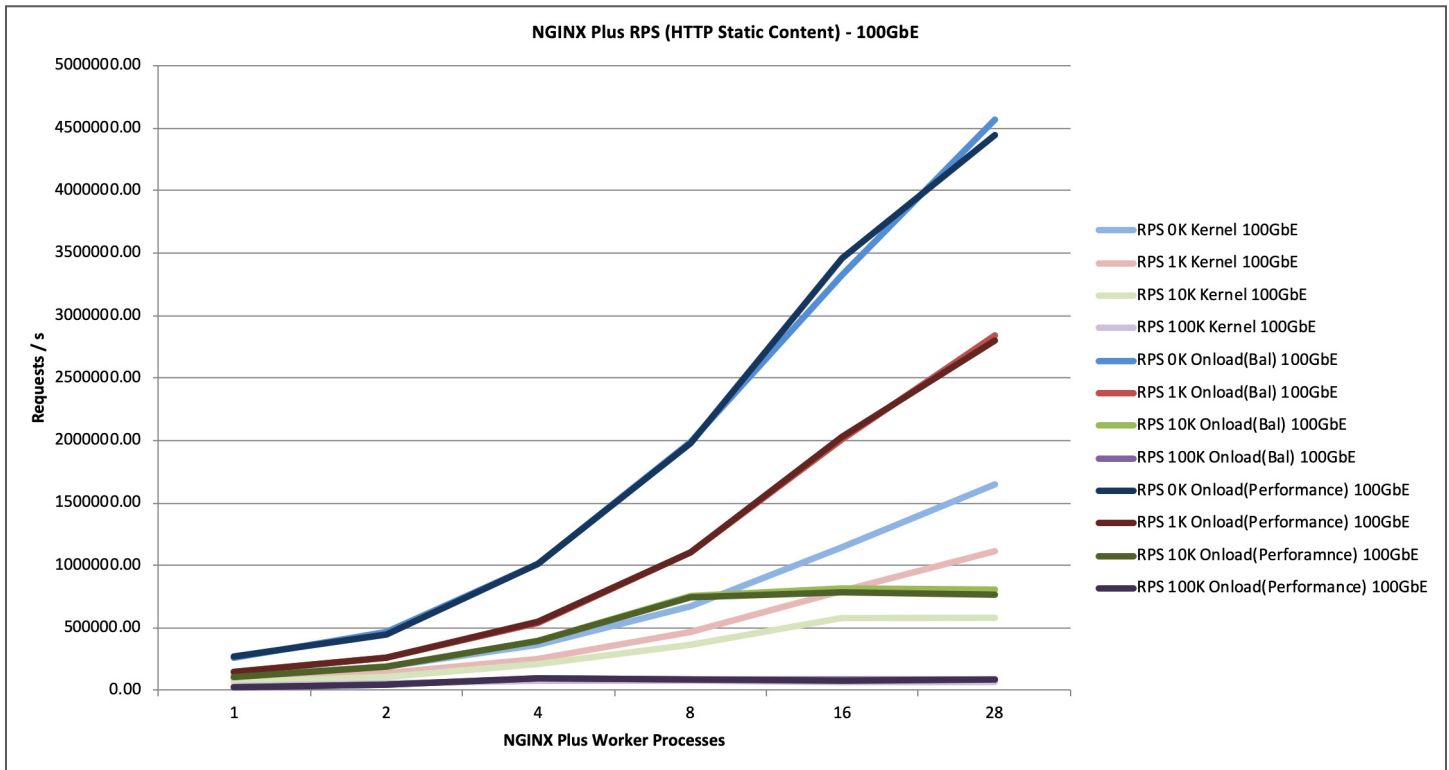


Key Observations from Performance Testing

- Solarflare's Cloud Onload delivers a 698% performance gain in connections per second for NGINX Plus as a web server when using 25GbE with 28 NGINX Plus workers. With 100GbE the connection per second gains top out at 676%.
- When processing requests per second using 28 or fewer NGINX Plus workers using Cloud Onload on 25GbE with both 0KB and 1KB payloads, it consistently delivers between 102-258%. At 100GbE the benefit range is 70-202%.
- We can see from the graph above that the kernel reaches an asymptote at 290K connections/second while Cloud Onload enables scaling to 2,334K connections/second. In this case both the balanced and performance profiles for Cloud Onload performed the same.
- When we review the requests/second graph below at 100GbE we can see that for 0KB payloads Cloud Onload achieves a performance benefit of 126-202%. As we move up to 1KB payloads the gain is 70-155%.

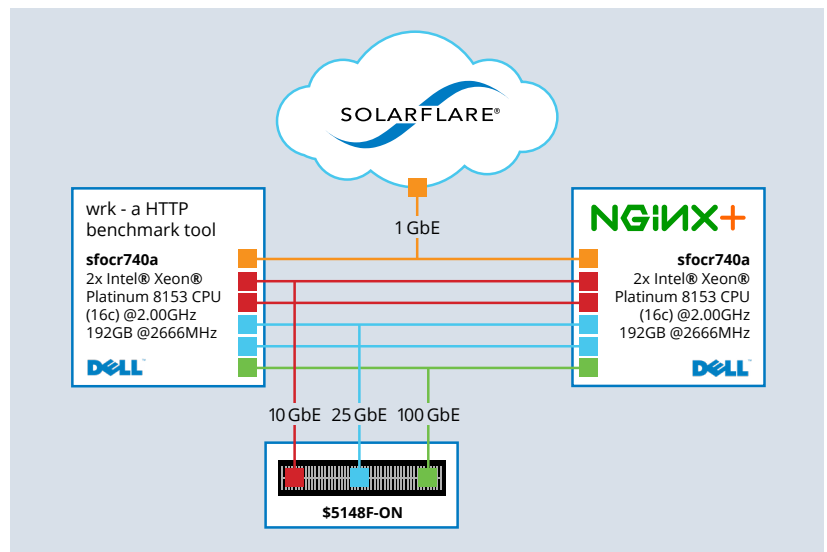
Why NGINX Plus Benefits from Kernel Bypass

Since NGINX Plus is network intensive, every connection and every request includes network processing overhead. Whenever an application like NGINX Plus touches hardware, other than the CPU or memory, and in this case the network, it must make at least one, and sometimes several calls to the operating system kernel. Each request is additional overhead that requires both CPU cycles and processing time. Solarflare's Cloud Onload moves the network processing required by NGINX Plus from the kernel into NGINX Plus's own application space in memory. This single modification improves NGINX Plus performance by anywhere from 70% to as much as 698% as seen in these graphs.



Description of Test Platforms

For this testing we used two dual socket Intel Xeon systems labeled "A" and "B", and three production networks, 10GbE, 25GbE and 100GbE, leveraging a single switch dedicated to this testing, no other traffic exists on this switch. The "A" system was used as the server and it had two Platinum 8153 CPUs clocked at 2GHz with 16 cores per processor, the "B" system was used as the client utilizing two Gold 5120 CPUs clocked at 2.2Ghz but with 14 core processors. Both systems contain 192GB of memory, they boot from an NVMe flash drive, and have three Solarflare network cards: SFN8522 dual port 10GbE, X2522-25G dual port 25GbE and an X2541 single port 100GbE. This enables us to test performance against a range of shipping Solarflare adapters as shown above.



Tuning Configuration

Here are the changes we made to the standard install beyond simply leveraging Cloud Onload.

- We increased the port range to use 9000 to 65000
- Set huge pages equal to 10000
- We increased the maximum number of open files from 1,024 to 8,388,608
- Increased the number of files a process can open to 8,388,608.

Observations

As a web server, the performance of NGINX Plus can be gated by both networking and storage performance. For these tests everything was from memory so we could more accurately study the benefit that Cloud Onload could provide to this application. NGINX Plus relies on the operating system's communications stack to process network I/O requests, but in high core count environments, this stack has become the new bottleneck. Here are some additional points to consider:

- NGINX Plus with 28 workers and Cloud Onload can service up to 4.5 million requests/second, while NGINX Plus using the operating system kernel can only handle 1.7 million requests/second, a 170% improvement.
- Therefore, NGINX Plus with Cloud Onload can potentially reduce your capex by 62%. In simple terms every two NGINX Plus servers leveraging Cloud Onload can service the same number of requests as five NGINX Plus servers using the standard Linux kernel.
- Conversely, adding Cloud Onload and a Solarflare 25GbE or 100GbE NIC to existing servers will provide additional headroom for growth or unanticipated business peaks as shown above.

For More Testing Details

Check out Solarflare's **Cloud Onload NGINX Web Server Cookbook** for the exact installation and testing process along with the specific tuning and tweaking commands executed above.

The above benefit statements are the result of benchmarking designed to focus on the value of optimizing networking through Cloud Onload kernel bypass. Real world use cases are not the same as benchmarks and as such the role that networking plays may vary, so your overall measurable benefits may be different.

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SF-122197-CD Issue 2
NGINX Plus Benchmark Results 06102019