Miercom

Lab Testing Summary Report

May 2016

Report 150502B

Product Category:

Carrier Class SBC

Vendor Tested:

sansay

Products Tested:

VSXi Session Controller ~ MST3 Media Server

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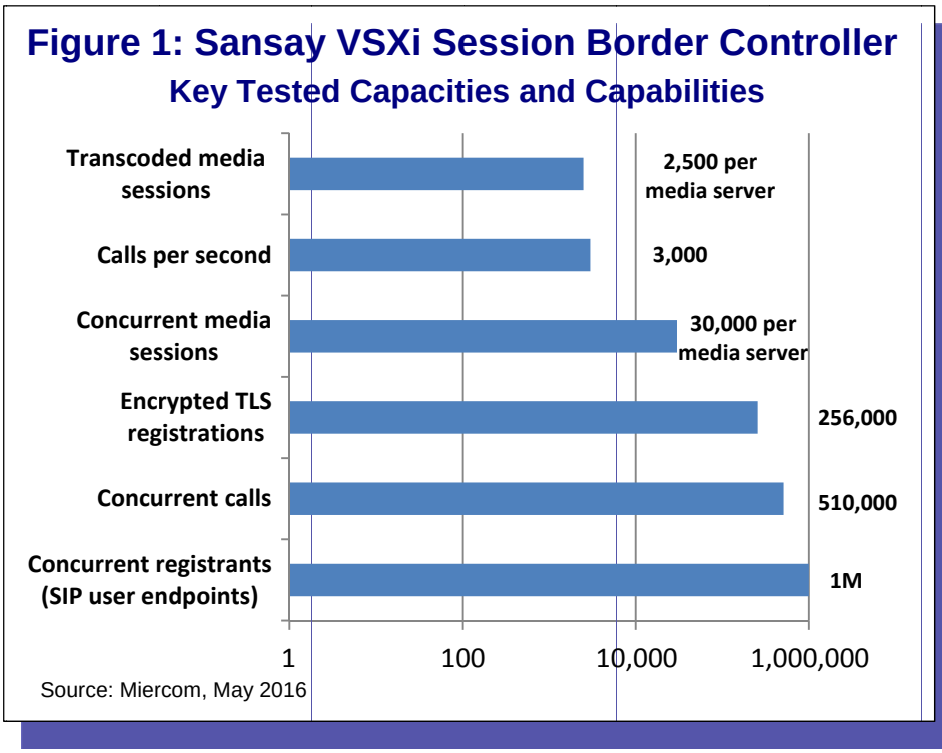
Key findings and conclusions:

- **Sansay's VSXi session controller delivers exceptional VoIP performance, scalability and resilience. Testing verified the Linux-based, 1U, off-the-shelf-server system supports:**
  - **Over 510,000 concurrent calls with media paths**
  - **1 million concurrent SIP user registrations, or up to 250,000 secure TLS-based registrations**
  - **Sustained switching of over 3,000 calls per second (cps).**
- **Separate MST3 media servers can each handle 30,000 concurrent RTP media channels and, up to 2,500 transcoded VoIP streams. Super-scalable: Up to 32 media servers can be incrementally added to a single VSXi system.**
- **High-availability failover of VSXi controllers; withstands DoS attacks; most critical components redundant, hot-swappable.**
- **Flexibly deployable: VSXi systems are integral in cellular and cable networks, in retail and wholesale VoIP markets, in access and interconnect roles. The VSXi is also virtualized in cloud services such as AWS, Terremark or Softlayer.**

Sansay, Inc. engaged Miercom to conduct an independent performance assessment of its VSXi, a carrier-grade Session Border Controller (SBC), and its accompanying MST3 media server. Both are CentOS-based systems that run on commercial off-the-shelf (COTS) servers. The testing focused on performance, capacity and reliability.

The VSXi turned in some of the best performance results we have seen to date, especially for VoIP-control equipment that runs on affordable,

Figure 1: Sansay VSXi Session Border Controller
Key Tested Capacities and Capabilities



Source: Miercom, May 2016

***High capacity and scalable**. The Sansay VSXi handles over 500,000 concurrent calls, due to separate media servers that are added incrementally.*

commercial off-the-shelf servers. The most impressive result, the ability to concurrently handle over a half-million sessions, sets a new high bar in the industry.

Sansay's distributed architecture makes this possible. First, the VSXi Session Controller was tested on a 1U server – an Intel 6-core Xeon ES-1650, 3.5-GHz system with 96GB of RAM memory. The software was running on a secure Linux operating system, CentOS release 6.4.

Secondly, while a single VSXi server can also handle some amount of RTP media streams – in fact thousands of concurrent calls, it seems – real scalability comes in by relegating media processing to Sansay's MST3 Media Server, which we also tested. It, too, is built on a COTS Linux server but contains an optional card full of Digital Signal Processors (DSPs).

Scalability

The MST3 media server handles only RTP or SRTP media streams, as directed by the VSXi call controller, and it can do a lot of them. As discussed later, we confirmed that a single MST3 can handle the media streams of 30,000 concurrent calls, on a sustained basis.

Generally this call volume would overwhelm most other VoIP-control systems. The MST3 features a 10-Gigabit/s Ethernet (10GE) connection, which is essential. With G.711 sessions, 30,000 concurrent media streams fills nearly half of a 10GE link.

Also, the MST3 can be set-up with multiple Virtual IP (VIP) addresses. This is required because many RTP streams exceed the IP and UDP port capacity of a single IP address.

Finally, MST3 media servers can be added incrementally. With the VSXi's concurrent call capacity more than 500,000, that would entail 18 of the MST3 media servers to handle the concurrent media streams of all 500,000 calls.

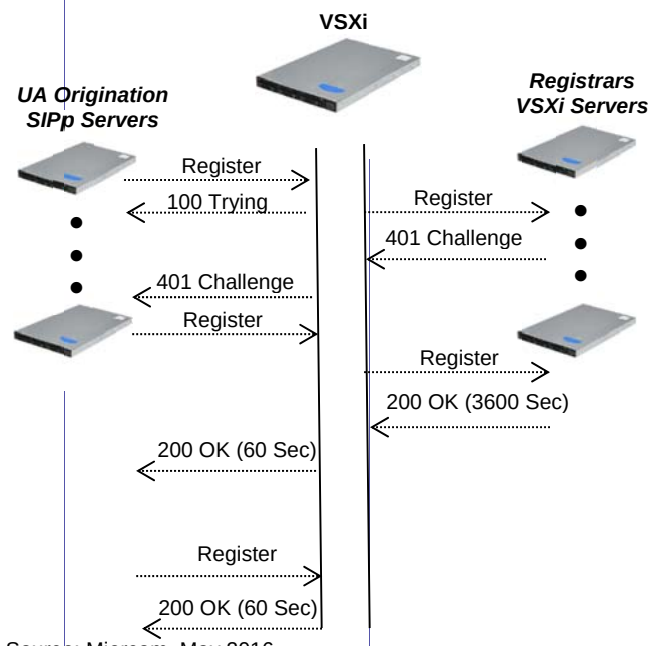
Our testing confirmed that a VSXi can handle more than 500,000 concurrent calls, including the set-up and shut-down of media paths for each one. We also confirmed that an MST3 media server can handle the media streams of 30,000 calls concurrently. Our test bed was unable, however, to generate the traffic – 500,000 calls **with** full RTP media for each.

Registration Performance

To determine the VSXi's maximum supported registration capacity, a set of powerful servers was loaded with SIPp, an Open Source test tool and traffic generator for the SIP protocol. SIPp is quite versatile: it contains user agent scenarios (UA client and server components), performs high volumes of registrations and calls, and can also generate corresponding RTP media.

For registration, one set of SIPp servers ran as UA clients, requesting registration through the VSXi, to

Figure 2: Registration testing



Source: Miercom, May 2016

***One million concurrent registrants**. The above test bed and message exchange show how the max concurrent registration testing was conducted.*

a number of VSXi systems running as Registrars. (See figure above).

For initial registrations, we observed that an average of 8,000 registrations per second (RPS) could be processed through the VSXi with no errors. On a sustained basis, handling 8,000 (RPS), the VSXi achieved 1 million new registrations in about 2.1 minutes. The totals were verified both by the VSXi control GUI and by aggregating the totals of the SIPp server counts.

The test configuration was set-up to re-register each user every 30 seconds. We ran this and confirmed

that all 1 million registered users had indeed re-registered within 30 seconds. The VSXi thus handled re-registrations at an impressive rate of 33,333 per second (see table below).

VSXi Registration Results

Max concurrent registrations	1,000,000
New registration rate	8,000 / sec
Time for 1M registrations	~ 2 mins

Re-registration rate	33,333 / sec
Time for 1M re-registrations	30 seconds

We note that, while maintaining the 1 million registrants, the VSXi's CPU utilization hovered at only about 13 percent.

Max TLS registrations	256,000
Time for 256k TLS connections	~47 minutes

The same test-bed configuration was then used to confirm that the VSXi could sustain 256,000 secure registrations via encrypted, TCP-based TLS (Transport Layer Security) connections. These were set-up at a rate of 90 new TLS registrations per second, taking 2,800 seconds, or about 47 minutes for all 256,000 TLS sessions.

Call-Completion Performance

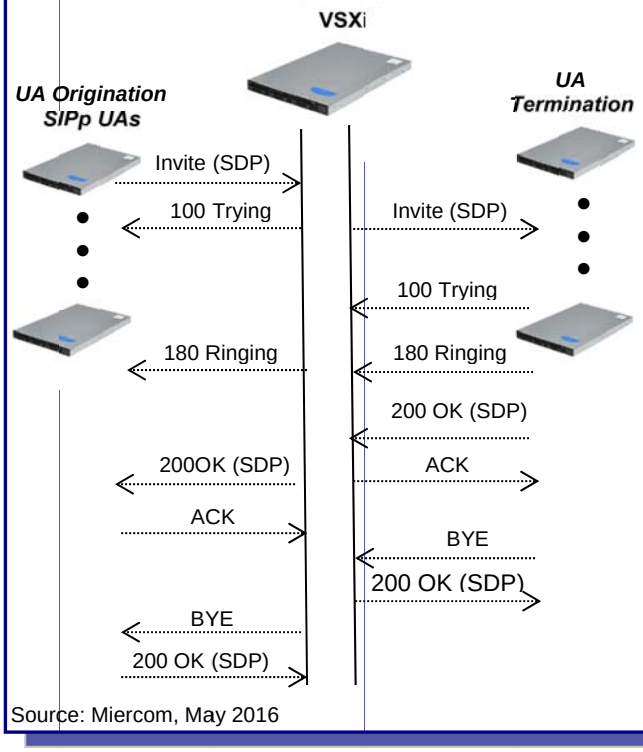
Our testing then sought to verify the VSXi's capacity for call completion – specifically, calls per second, or cps, handling performance, and the maximum number of concurrent calls that could be switched (set-up) and maintained on a sustained basis.

For this testing a similar battery of SIPp servers provided UA (user agent) call requests to the VSXi session controller, and another set of SIPp servers provided the destination UAs. The standard SIP call set-up was used, as illustrated in Figure 3. The call duration was set at 170 seconds – a realistic call duration but also enough time to establish a respectable number of concurrent calls before the first wave of calls started to close down.

Calls were delivered at a combined rate of 3,000+ cps. The peak was 3,074 cps. There were no errors and no dropped calls. Calls continued and, after several minutes, the VSXi was maintaining over 510,000 concurrent calls, all being delivered with 170-second duration and at an average rate of 3,021 cps.

It's noteworthy that the max calls per second and max concurrent calls reported here were derived at the same time, from the same test. The VSXi was

Figure 3: VSXi Call-Completion Testing Standard SIP Call Flows



Source: Miercom, May 2016

***Call set-up**. The diagram above shows the test bed and message flow for measuring cps and maximum concurrent calls.*

humming; there were no failed calls, dropped calls or errors. The testers decided to conduct a stress test and run the same test for a protracted period.

So for 15 hours, call requests were delivered to the VSXi at a cps rate of 3,000+, all with 170-second duration, and a sustained level of 500,000+ concurrent calls was continually sustained. When the test was finally stopped 160 million calls had been successfully set-up and closed, and there were no call drops or errors. There were a very small number of retransmissions – just 470, out of 160 million calls – but this is normal in a busy SIP network. It serves as a testament to the reality of the test bed and call load.

We note that, for all the call-completion testing, no actual media streams accompanied the calls. As stated earlier, media sessions go through the

separate MST3 media servers, and the test bed was not equipped with enough MST3s or RTP-stream-generation capacity to exercise 500,000 concurrent calls with full media. We confirmed that the VSXi was opening and then closing media paths for each of the 500,000+ concurrent calls, but no media accompanied the calls.

The below chart summarizes the results of the call-handling and call-completion testing.

VSXi Call-Completion Results

Max calls per second observed	3,074
Max concurrent calls	510,368
Stress test duration: 3,000 cps and 500,000+ concurrent calls	15 hours
Completed calls with no failed calls or errors (1)	159,900,000 100 percent

(1) Minimal SIP retransmissions occurred during call set-up, which is normal in a busy SIP network.

Media Handling Performance

There were two objectives in the testing of the media-handling capabilities of the VSXi with its associated MST3 media server, which features a full 10-Gigabit/s Ethernet network connection:

- To confirm that a single MST3 can handle the media streams of 30,000 concurrent calls,
- To verify that an MST3 can sustain 2,500 transcoded media streams.

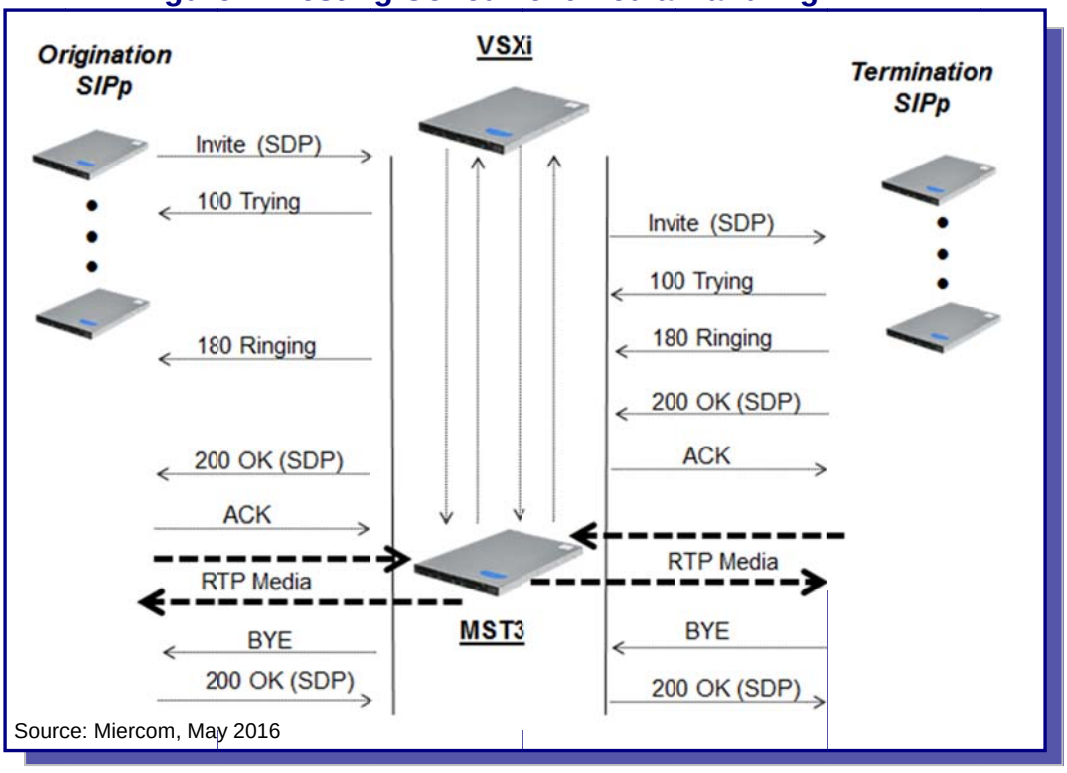
First, for the 30,000 media streams, three Virtual IP (VIP) addresses were assigned to the MST3. That's because 10,000 media calls require 40,000 UDP ports (two RTP and two RTCP per call), and only 65,000 UDP ports are available per IP address. Although the VSXi natively supports video it was not part of the test call flows and requires two more UDP ports per session.

As shown in the test-bed diagram below, the VSXi sets up paths for the sending and return RTP streams, and then tears these down on receipt of a BYE message. So, using three VIPs and after a few minutes ramp-up, the MST3 was indeed sustaining 30,000 concurrent, one-minute calls with full G.729 media sessions.

A DSP card within the MST3 provides additional processing power used for transcoding. In our test case, we observed by monitoring the media server's GUI that 2,500 concurrent transcoded calls were being sustained – delivered to the MST3 as G.729 streams and then transcoded to and from G.711.

The chart on the next page summarizes the results of the concurrent media-handling testing.

Figure 4: Testing Concurrent Media Handling



Source: Miercom, May 2016

Media Handling. *An MST3 Media Server was deployed in the test bed, with all media streams directed by the VSXi call controller. Calls were 1-minute duration. The MST3 media server handled the bidirectional media streams of 30,000 G.729 calls on a sustained basis. It would take 17 media servers to handle the media of 500,000 concurrent calls – the capacity of the VSXi.*

MST3 Concurrent Media-Handling Results

Concurrent, sustained media streams (sending and receiving) for 30,000 calls	30,000 confirmed
Concurrent transcoded calls (bidirectional G.729<->G.711)	2,500 confirmed

Resiliency, High-Availability Testing

Several tests were conducted to assess the survivability of the VSXi Session Controller in the face of intentional and unexpected network events.

Various malicious attacks were launched against a VSXi while it was handling high volumes of call traffic. These included:

- SIP fuzzing – inundating the call controller with malformed SIP messages.
- Denial-of-Service (DoS) attacks, including a "ping flood" (ICMP attack) which lasted overnight.

In all cases, no malicious attack that we launched had any perceptible effect on calls in progress or call set-up or completion. The MOS tests of calls in progress during attacks showed no degradation in call quality.

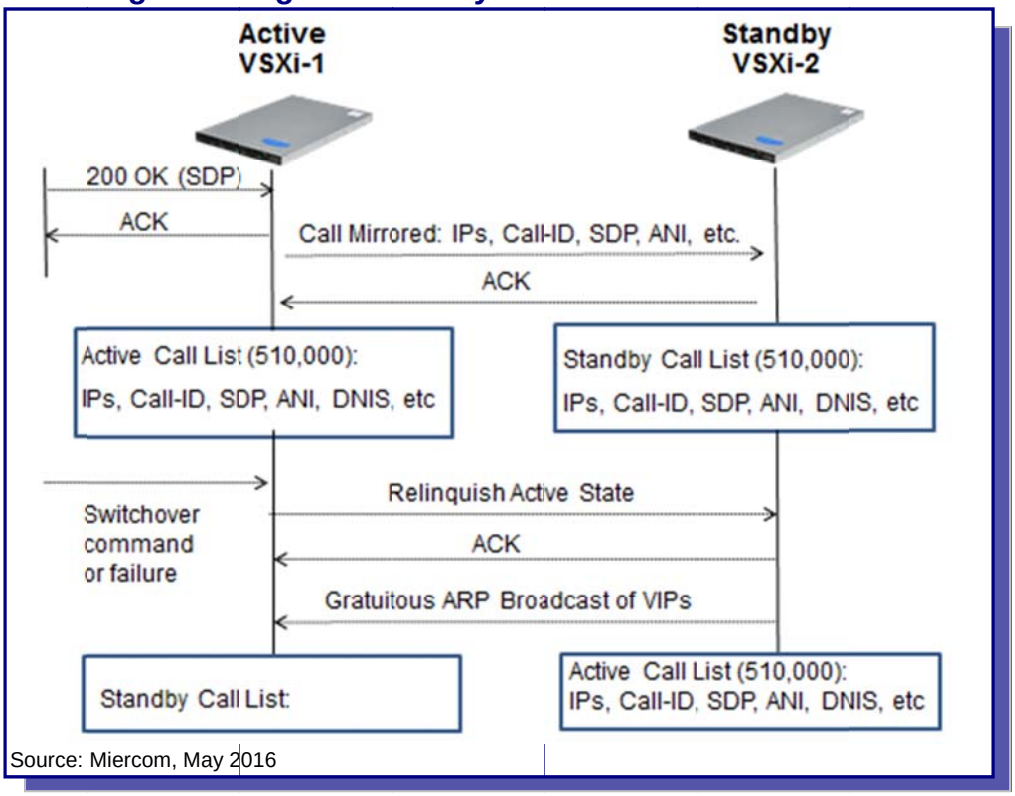
The most impressive resiliency result came from testing the failover of active and standby VSXi controllers in a High Availability (HA) configuration. As shown in the below diagram, failing an active VSXi controller – even while sustaining 500,000 concurrent calls and receiving a 3,000-cps call load – resulted in no dropped calls and just a half-second interruption of call set-up activity.

Bottom Line

The Sansay products tested – the VSXi Session Controller and MST3 Media Server – exhibited impressive capacities and capabilities, as detailed in this report. In addition, testing showed the VSXi call controller able to fend off malicious attacks and to fail-over during heavy call activity with no dropped calls. We credit Sansay for delivering exceptionally high-performance and highly resilient VoIP network equipment.

The tests in this report are intended to be reproducible for current or prospective customers who want to recreate them with the appropriate test and measurement equipment. Readers interested in repeating these results can contact reviews@miercom.com for details on the configurations applied to the equipment and test tools used in this evaluation. Miercom recommends that current and prospective customers conduct their own needs analysis study and test specifically for the expected environment for product deployment before making a product selection.

Figure 5: High Availability Failover Test



Source: Miercom, May 2016

No dropped calls during failover. *Sansay supports deployment of active and standby VSXi call controllers in a highly efficient, HA configuration. As shown in the diagram, the salient information of all calls is mirrored from active to standby controller immediately upon call set-up. We tested the failover while the active VSXi was handling an incredible traffic volume. The result: No calls were lost or dropped, and new call set-up was interrupted for only about half a second.*

Miercom Performance Verified

Based on the results of this testing, Miercom proudly presents Sansay with the Miercom Performance Verified Certification for the VSXi Session Controller and MST3 Media Server products. Packaged in a compact, 1U, Linux-based, commercial-off-the-shelf server, the VoIP call controller delivers among the highest call-handling capacities we have seen in testing to date.

Besides call processing, the company's MST3 Media Server delivers exceptional media handling and provides impressive scalability. What's more, the VSXi has demonstrated solid robustness and resilience, especially with its high-availability failover capability. We commend Sansay on its solid, high-performing product design.

Sansay VSXi
Session Controller

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