Enterprise Core Systems Engineering Reference Manual: how to monitor network bandwidth using sFlow

PRODUCT IDENTIFICATION

Document Code: TEL-OEM-sFLOW-2408-EN

Revision: 3.1

Product Series: SentinelFlow Monitoring Fabric

Technology Focus: In-band Network Telemetry (INT) & sFlow Export Engine

This engineering reference manual details the architectural implementation, hardware acceleration, and configuration logic for monitoring network bandwidth using sFlow. The SentinelFlow series integrates a dedicated, line-rate sFlow sampling engine directly into the forwarding ASIC, enabling observability without impacting switching capacity.



CORE INTERNAL TOPOLOGY

sFlow Monitoring Subsystem Architecture:

The switching silicon incorporates a parallel Monitoring Tunnel (MT) pipeline. Unlike traditional CPU-bound polling, the hardware-based sFlow engine performs three discrete actions at wire speed:

1. Packet Header Decapsulation (L2 to L4)

2. Statistical Sampling based on configurable 1/N rate

3. Time-stamping with nanosecond precision (IEEE 1588v2 sync)

4. Export of sFlow datagrams (RFC 3176) to external collectors

The architecture guarantees zero packet loss on the forwarding plane while simultaneously generating up to 1.4 million sFlow datagrams per second from a single 48-port aggregation switch.

SWITCHING SUBSYSTEM CAPABILITIES

- Hardware sFlow (h-sFlow): Full offload of sampling and export to the Packet Processing Engine. CPU intervention is zero.
- Dual Sampling Mechanisms:
  a) Statistical Packet Sampling (1/512 to 1/16,384)
  b) Time-based Counter Sampling (5 to 120 seconds intervals)
- Flow Direction Monitoring: Ingress, Egress, or Bidirectional analysis.
- Tunnel Awareness: Native decoding of VXLAN, GRE, and MPLS headers before sampling.
- Filtering: Hardware ACL-based inclusion/exclusion lists to focus bandwidth monitoring on specific traffic classes.

OPERATIONAL ADVANTAGES

- Non-blocking visibility: Unlike SPAN/mirror ports, sFlow does not require dedicated monitor ports; any port can be monitored at line rate.
- Scalable bandwidth monitoring: A single collector can ingest data from hundreds of switches; sampling rate reduces data volume without losing anomaly visibility.
- Real-time traffic heatmaps: Enables tracking of top talkers, micro-bursts, and

DDoS patterns.

- Jitter-free telemetry: Deterministic export latency of < 200 microseconds.

- Multi-tenant safety: sFlow datagrams strip payload data; only headers are exported.

SPECIFICATION MATRIX

sFlow Engine Specifications:

- Sampling Granularity: 1 to 65,535 packets

- Maximum Export Rate: 1,400,000 datagrams/sec

- Datagram Format: sFlow v5 (backward compatible with v4)

- Collector Support: Up to 8 simultaneous collector IPs (IPv4/IPv6)

- Encapsulation: UDP/6343 (configurable port)

- Supported Header Capture Depth: 64 to 256 bytes

Monitoring Scalability:

- Maximum sFlow-enabled ports: 1,152 (on modular chassis)

- Concurrent Flow Records: 128,000

- Export Queues: 4 dedicated hardware queues (strict priority)

Parameter	**Specification**
Form Factor	1RU Fixed / 4RU Modular Chassis

Switching Capacity	2.56 Tbps (non-blocking)
Power Supply	Dual Hot-Swappable Redundant AC/DC (110-240V)
sFlow Sampling Rate Range	1/512 to 1/16384 packets
Export Protocol	sFlow v5 over UDP/6343
Max Collectors	8 simultaneous IPv4/IPv6 destinations
Header Capture Depth	Configurable 64, 128, 256 bytes
Operating Temp	0°C to 45°C (32°F to 113°F)

REGULATORY COMPLIANCE

- sFlow.org Implementation Conformance: Version 5 Complete
- RFC 3176 (sFlow MIB) Compliance
- IEEE 802.1Q (VLAN) Visibility
- RoHS 3 (2015/863/EU) – Hardware components
- NEBS Level 3 – Carrier-grade environmental stability
- ETSI EN 300 386 – Electromagnetic compatibility



DEPLOYMENT NOTE: For precise bandwidth monitoring in high-speed fabrics, configure the hardware sampling rate no lower than 1/2048 on 100GbE interfaces to maintain sub-1% collector CPU utilization.