

# BUILDING BUSINESS INTELLIGENCE FROM THE NETWORK



## Accounting for Network Traffic

### Summary

Billing is just one of the many reasons why effective gathering of business intelligence data is required. Most network equipment lack the facility to deliver these essential data or delivered these data with severe impact to network performance. Today, Foundry's VM1 for the BigIron and the newly released FastIron 4802 with its JetCore ASIC delivers the panacea for building business intelligence from the network without any impact to network performance.

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# BUILDING BUSINESS INTELLIGENCE FROM THE NETWORK



## Overview

Transforming network usage data into a competitive advantage, and effectively employing new business models and management policies based on accurate, real-time accounting for the use of network resources, is critical to increased profitability for service providers, carriers, and large enterprises. Foundry Networks' usage-management solutions allow network operators to dramatically improve the efficiency and cost effectiveness of their infrastructure investments. In addition, these solutions allow service providers and carriers to migrate their customers from single-fee, flat-rate billing to more flexible plans, including separate service billing options based on time, traffic volume and/or resource usage.

Foundry Networks offers its customers a best-of-breed collection of usage-management solutions featuring the industry's most common metering technologies, including SNMP and NetFlow(TM) compatibility, as well as new technologies, including sFlow(TM), for true wire-speed performance. By combining these solutions with its end-to-end switching and routing product portfolio, Foundry delivers a high-performance platform for converging on-demand voice, data, and other services onto a single network and tracking usage and billing for these services, helping next-generation networks become a reality.

Foundry's scalable and highly-available solutions allow service providers and carriers to establish flexible business models, identify and expand new revenue sources, verify and measure traffic flows against customer Service Level Agreements (SLAs), analyze traffic patterns, predict traffic changes, and forecast resource requirements. By taking advantage of cutting-edge metering and usage analysis technologies, network operators can simultaneously increase customer satisfaction, network efficiency, and overall profitability.

Historically, businesses have required effective gathering of business intelligence data on how their customers are using valuable company resources. The dramatic growth of the Internet and modern networks has created new challenges for gathering business intelligence data and, as a result, network equipment must be enabled meet these challenges.

Gathering business intelligence data are required by the following businesses:

- Metro and Internet Service Providers.
- Incumbent and Competitive Carriers.
- Enterprise networks.

These establishments demand business intelligence information from their network infrastructure for the following:

- To meter and bill for resource usage.
- To forecast new revenue sources.
- To verify and measure Service Level Agreements (SLAs).
- To analyze traffic patterns and predict the ever-changing business climate.
- To strategically forecast resource requirements, allowing business establishments to meet newer business demands.

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To meet these requirements, network equipment must be enabled to meter network traffic without negative impact on network performance, which plagues existing network equipment vendors.

This document describes the numerous technology enablers that can be employed to gather business intelligence from a network composed of Foundry's products. Employing a robust set of technology enablers allows network operators to gather specific data based on their business requirements and goals.

## Gathering Business Intelligence from Foundry's Products

Varying business establishments have varying needs. For example, a Metro Service Provider, who delivers services such as Ethernet-based high-speed bandwidth solutions, Virtual Data Centers, or on-demand video conferencing, requires usage metering for these services. These Metro Service Providers deploy Ethernet connectivity, which requires network traffic accounting based on MAC addresses and 802.1q (or VLANs), to their customers.

Similarly, extremely large enterprise networks with a pure IP infrastructure or an Internet Service Provider offering Internet services require usage management based on IP. This can be based on metering IP addresses, IP subnets, Autonomous System paths, and TCP/UDP services.

Business intelligence can be gathered from Foundry's products using the following solutions:

1. SNMP and RMON – All of Foundry's products support SNMP and RMON, which allow traditional SNMP-based byte accounting from a port level.
2. NetFlow<sup>®1</sup> – Cisco's metering technology, which allows for gathering IP traffic information.
3. sFlow<sup>™2</sup> – an InMon technology, based on packet-based sampling, which gathers information from Layer 2 to Layer 7.

Both NetFlow and sFlow are supported in the following Foundry products:

- Within any port of a Network Processor Architecture (NPA) interface module, which is available for the NetIron family.
- Within any LAN port<sup>3</sup> in a BigIron chassis product with the Velocity Management I (VMI) module as its management module.
- Within any port within the FWS4802 (support for sFlow only), which is equipped with the JetCore ASIC.

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<sup>1</sup> NetFlow<sup>™</sup> is a registered trademark of Cisco Systems, Inc.

<sup>2</sup> sFlow<sup>™</sup> is a trademark of InMon Corporation. See <http://www.inmon.com>

<sup>3</sup> This excludes all SONET (see part number B2P\*) and ATM (see part number B2A\*) interface modules.

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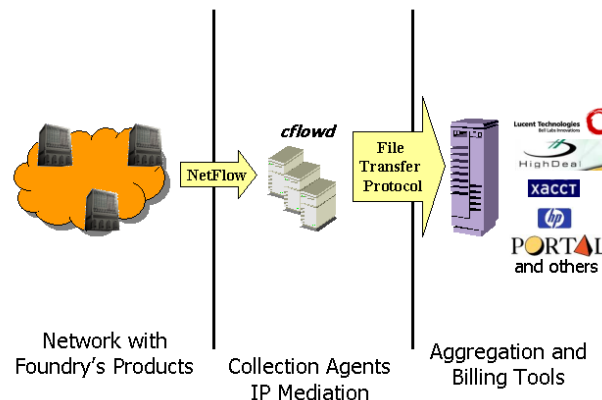
## *SNMP and RMON*

All of Foundry's products support SNMP and RMON-I, allowing customers to query SNMP-based byte information for each port within a Foundry product. Byte information can be used for direct usage-based billing.

Additional information can also be queried from the port, such as port errors, which can be used for fault and performance analysis. This analysis can be used by Metro Service Providers to deliver extended service offerings for their Managed Service offering.

Foundry's support for SNMP-based byte accounting also includes RFC 2233, which supports byte counting for high-speed interfaces including 100 Mbps and above. This allows Metro Service Providers to offer bandwidth increments from 1 Mbps up to 10 Gbps, and still account for their customers' traffic based on usage.

## *NetFlow*



**Figure 1 - Data Collection Process for NetFlow.**

NetFlow acquires IP traffic flows by counting every packet that comes into a port. The packet is analyzed by extracting the IP header and portions of the IP data (TCP and UDP header) for information. NetFlow requires every IP packet to be captured and analyzed, and the results sent to a server for further data aggregation (see figure 1).

Foundry's support NetFlow version 1, 5, and 8, ensuring network traffic accounting based on the following:

- TCP and UDP ports
- Source and Destination IP Subnet
- Source and Destination IP address
- Source and Destination AS/Peer AS

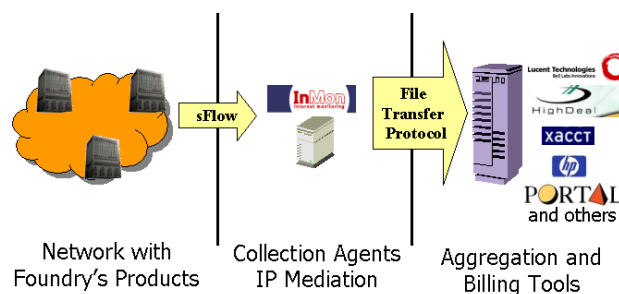
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The processing of collected NetFlow data enables accounting/billing, network planning and analysis, and network monitoring.

The following is a list NetFlow features and benefits, which are available only within Foundry's products:

- Support for up to ten NetFlow collectors. When you add additional NetFlow collectors, NetFlow packets are then "load balance" among all the other NetFlow collectors based on a flow's source IP to ensure even traffic load distribution and to simplify NetFlow traffic aggregation.
- Allow network managers to selectively export traffic flows based on TCP or UDP protocols, which can be helpful in eliminating protocols that are not being used for billing or accounting.
- By default, Foundry's VM1 can support up to six million aggregated flows and can be configured to support up to 15 million aggregated flows.
- Support for the following aggregation scheme, ensuring efficient data export and minimizing impact to network traffic:
  - IP Protocol and Application Port (UDP or TCP)
  - Source Prefix
  - Destination Prefix
  - Source and Destination Prefix
  - Autonomous System

## *sFlow*



**Figure 2 - Data Collection Process for sFlow.**

Foundry's BigIron Velocity Management (VM1) module and the new FastIron 4802, which is built with Foundry's JetCore ASIC, support the creation of an sFlow datagram. With a BigIron chassis equipped with a VM1 module, an sFlow datagram is created for every packet flow where ports are enabled for sFlow capture.

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With the FastIron 4802, the JetCore ASIC uses Hewlett-Packard's patented<sup>4</sup> Extended RMON technology to capture sampled frame headers for inclusion into an sFlow datagram where ports are enabled for sFlow capture. The HP Labs Technical Report<sup>5</sup> describes how to tune the accuracy of results based on sampled data using confidence intervals.

sFlow datagrams are sent to an sFlow collector (e.g. InMon Traffic Server) for analysis. This process allows traffic monitoring to scale to gigabit speeds on all ports without impacting network performance, and enables network-wide traffic analysis. sFlow provides network traffic accounting based on the following:

- Port-based byte accounting
- MAC-based accounting and traffic matrix based on MAC Addresses
- Inter-VLAN accounting
- IP Subnet, IP addresses, and IP traffic matrix
- ICMP-based, TCP-based and/or UDP-based level accounting
- AS-based Accounting and AS Path Analysis

InMon's Traffic Server and sFlowTools<sup>6</sup>, which captures sFlow packets and performs data correlation, can deliver network latency analysis and automatic path-trace analysis. Data correlation, which can be customized for billing based on Layer 3 (IP) or Layer 2 (MAC-based or inter-VLAN), can be transferred to any billing application without extensive application programming.

## ***SNMP/RMON, NetFlow, and sFlow: The Differences At A Glance***

The table below shows the differences among these methods. Each method has specific advantages.

For an enterprise network, simplifying or standardizing on a single collection mechanism, such as SNMP/RMON collection, can be an advantage because it simplifies efforts for the data collection server. Enterprise networks also do not require detailed billing information, which makes SNMP and RMON ideal for their needs.

On the other hand, most Metro Service Providers or any service providers will require extensive network traffic accounting for their networks.

sFlow supports more features (802.1q/p or VLANs, AS Path, and more) for accounting than port-based byte accounting or NetFlow. sFlow also supports high-speed interfaces easily than NetFlow because it does not "touch" every packet for network traffic analysis. "Touching" every

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<sup>4</sup> Hewlett-Packard's patent entitled "Network Monitoring Device and Systems", patent number 5,315,580.

<sup>5</sup> See <http://www.hpl.hp.com/techreports/92/HPL-92-35.html>

<sup>6</sup> See <http://www.inmon.com/sflowTools.htm>

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packet at 10 Gbps, which can deliver a packet throughput of 14.88 MPPS, requires extensive computation.

NetFlow, on the other hand, is widely used and familiar to most network engineers, as well as end-user billing applications from companies such as Portal or HighDeal. This makes NetFlow a viable solution for some service providers.

Foundry's products allow for all three features to be enabled at one time<sup>7</sup>, allowing for flexibility and extensive solutions for network traffic analysis and billing.

## Transforming Network Accounting Into Revenue

Foundry partners with premier companies that enable service providers to rapidly deploy new services, define optimal business models and price plans, and bill their users. These partners include Portal, XACCT, HighDeal, Hewlett-Packard, and Lucent.

Figure 3 shows the process for moving network accounting into revenue, which requires only a simple CLI activation (SNMP is on by default) for Foundry's products. Once activated, sFlow and NetFlow data are then pushed into servers that collect these packets.

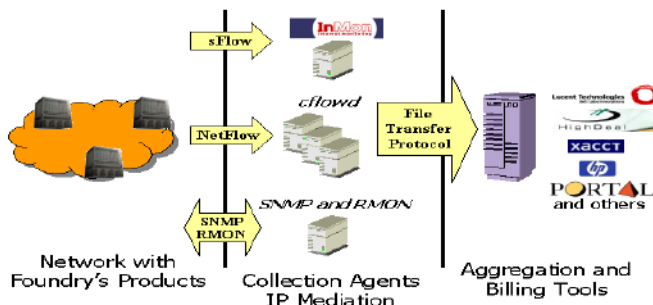
	SNMP/RMON I	NetFlow®	sFlow™
<b>Packet Capture</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Interface Counters</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Protocols<sup>8</sup></b>			
Packet headers	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Ethernet/802.3/802.1q/p	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
IPv4/ICMP/UDP/TCP	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IPv6	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
IPX	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Appletalk	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Layer 2</b>			
Input/output port	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input/output priority	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Input/output VLAN	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Layer 3</b>			
Source subnet/prefix	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Destination subnet/prefix	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Next hop	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>BGP 4</b>			
Source AS	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Source Peer AS	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Destination AS	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Destination Peer AS	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
AS Path	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
BGP Community	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Real-time data collection</b>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Configuration</b>			
Configurable without SNMP	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Configurable via SNMP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Low Cost</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Scalable (switch ports/collector)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Wire-speed</b>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

<sup>7</sup> Foundry's BigIron VM1 module supports port-based byte accounting, NetFlow, and sFlow within the same system.

<sup>8</sup> AppleTalk and IPX are currently not supported within the Velocity Management One (VM1) module.

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Finally, data are then aggregated and sent to any billing product.



**Figure 3 - Transforming Network Accounting into Revenue.**

## Summary

A rapidly growing subscriber or user base is increasing the demand for network bandwidth, performance and predictable quality of service. To remain competitive, service providers must continually make substantial investments in their networks and services infrastructure. As a result they need new and sustainable sources of revenue. The availability of this data creates the opportunity to develop new revenue sources and strategic differentiators.

With Foundry's robust usage management and network traffic accounting features, port-based byte accounting, NetFlow, and sFlow, service providers, both Metro and Internet Service Providers, can now build revenue based on their customer's usage data. This allows Foundry's customers to enjoy the following benefits:

- Collect, correlate, and aggregate customer usage data – enabling integrated billing and data mining solutions.
- Create new services and accurately bill for them – leading to new and increased revenues.
- Standardize usage data and allow multiple applications easy access to the data.
- Increase revenues and customer satisfaction with strategic marketing:
  - Simplify advertiser billing by tracking subscriber usage and hit rates.
  - Develop focused marketing programs based on knowledge of subscriber behavior.
  - Model new billing plans against actual subscriber usage data.
- Exploit other data mining opportunities including capacity planning, fraud management, and network latency analysis.

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