ISP Data Usage Meter Specification Best Practices for MSOs

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February 2013
Update to the original September 2012 document

Many ISPs track subscriber data usage for the purpose of imposing a cap or charging for usage. All such meter systems operate within a set of measurement and operational rules. NetForecast refers to these rules as the usage meter specification. Most ISPs do not write a usage meter specification, but they should because it enables them to define proper operation and assess whether their meter is operating as it should.

This document describes the aspects of meter operation that should be included in a formal usage meter specification, and it identifies best practices for each specification factor. The usage meter specification is a de facto agreement between an ISP and its subscribers that voluntarily subjects the ISP to ethical standards that protect the subscriber.

This best practices specification is designed for Multiple System Operator (MSO) ISPs, commonly referred to as cable ISPs. This report is meant as a guide for ISPs to plan and validate the accuracy of their usage meter. Each ISP's specification may be different, and ISPs are welcome to add to or improve on what is presented in this report.

MSO Usage Meter System Tiers

There are three typical processing tiers in an MSO meter system: traffic counting, Internet Protocol Detail Record (IPDR) processing, and usage presentation as shown in Figure 1.

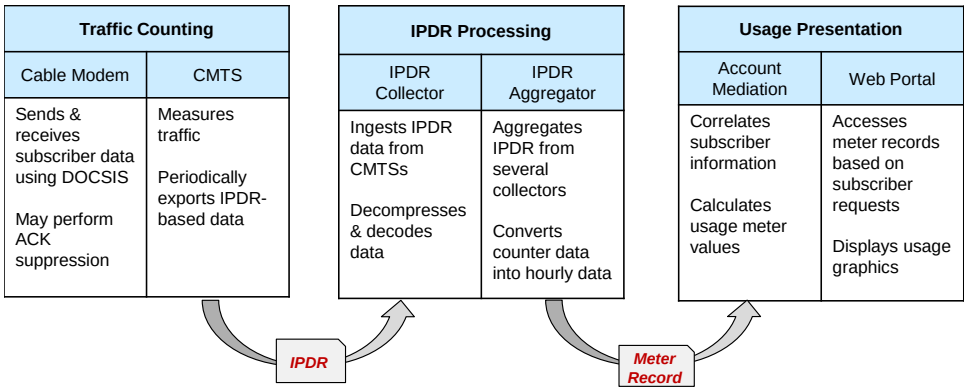

Figure 1 – Subscriber Usage Meter Processing Tiers

The cable modem shares data about subscribers with the CMTS, which counts the actual traffic to and from the subscriber, and puts that count into an IPDR, which it sends to the IPDR collector in IPDR processing tier. The IPDRs are then aggregated from multiple collectors and the data is converted into hourly data counts and put into meter records that are forwarded to the account mediation function in the usage presentation tier. Within this function the data usage is correlated with subscriber information. Then the data is presented in graphical form via the customer portal.

NetForecast Report NFR5110

Meter Specification Factors

NetForecast defines the following critical factors and describes the best practices ISPs should follow based on experience gained from auditing the accuracy of MSO meter systems at four ISPs over the past four years.

What Is Counted

All IP traffic traversing the cable modem/CMTS HFC connection (up plus down) can be counted by the CMTS and reported within IPDR records. The ISP controls what is actually counted and sets the CMTS counter policy.

Best practice is that subscriber data traffic is counted, including all TCP/Ethernet overhead as carried in the DOCSIS protocol. ISPs should not count the following traffic classes as they do not reflect subscriber usage:

- Internal ISP management traffic
- Cable modem control traffic
- Voice traffic for telephone service supplied by the ISP
- Video traffic for services supplied by the ISP such as movies, or television

Usage data is sent periodically by the CMTS to an IPDR collection system. The ISP is responsible for operating the CMTS with sufficient capacity and software capabilities to transmit IPDR records on a defined-time basis. Most CMTS models transmit the IPDR every 15or 20 minutes. The reporting time period must be adhered to because erratic reporting leads to meter inaccuracy.

Data Accumulation Period

Traffic counter data from the CMTS constitute the foundation for individual subscriber usage counts accumulated by the meter system. The data accumulation time period must be longer than the CMTS sampling interval. Longer accumulation time reduces variance introduced by the CMTS or subsequent system elements, thus improving meter accuracy. The meter data accumulation period defines the accuracy timespan, e.g., a meter specification can be stated as +/- x% accurate over each hour, day, or month.

Error Bounds

No large-scale, real-time measurement system is perfect. However, the ISP must strive to design, build, validate, and maintain the meter system with an acceptable specific error range. Errors can be introduced by all parts of the end-to-end system from cable modem to subscriber view and/or bill.

Best practices are that the meter should operate within +/- 1% at the total daily traffic view. Positive error means that the meter over-reports subscriber traffic. Negative error means that the meter under-reports subscriber traffic.

Timeliness

Timeliness is defined as the time delay between a traffic event occurrence on the cable modem to/from the CMTS link and the appearance of the measured value on the subscriber's online usage meter view. With proper timeliness, an ISP will not display usage later than the maximum specified time. This allows the subscriber to see usage numbers within a reasonable time after the usage accrues.

Best practices are that an online meter should update with a typical delay of four hours and a maximum delay of 24 hours after the traffic event.

Exception Handling
The meter system may fail from time to time. If a failure occurs, the meter system must assure the subscriber that the usage value benefits the subscriber. Best practices are to state a zero value (with notation like *) for the time period when the failure or error occurred. The notation states "Due to technical difficulties with the traffic counting system, we do not have a correct usage value, therefore the entry for this time period is set to zero."

Granularity
The usage data is counted in binary bytes. However, the usage meter aggregates the individual IPDR values into totals representing usage within the defined reporting period. The mathematical basis of the value reported must be defined. Best practices are that values are accumulated using binary math and displayed as whole Megabytes (MB) or Gigabytes (GB). The fractional value can be handled one of two ways.

1. Typically the values are displayed as whole number which truncate the decimal digits (5.9 becomes 5). If truncation is used it must be stated.
2. Some ISPs can support displaying a single decimal digit value (5.9 remains 5.9). Under these conditions the ISP must use standard mathematical rounding (no truncation).

Mathematical Consistency
Various views of a subscriber's meter must provide a consistent traffic consumption value(s). For example, detailed views by day must sum up to the total value presented for the month.

Accessibility
The subscriber portal shows an online view of the meter. This is an important tool with which subscribers can manage their usage to avoid charges. The ISP must make it clear and simple for a subscriber to access their data. Best practices are that the meter appears within less than three clicks after logging into the subscriber portal.

Availability
Usage information must be reliably available to each subscriber.

Best practices are that meter must be accessible from any browser (not just browsers directly connected to the ISP). Furthermore the ISP website must be available at least 99.5% over a month (permits 1 hour of maintenance down-time each week).

Clarity
The ISP usage meter system must be explained to subscribers on the Web page where they see the meter value, or in subsequent directly-linked pages.

Best practices are to clearly answer the following questions:

- What is a usage meter?
- What is and is not counted in the meter?
- What are the usage limits (if any)?
- What are the consequences of exceeding those limits?
- How can I learn more about the usage meter?

Each usage view and description must be easy to understand and augmented with simple clear graphics.

Mapping Specification Factors to System Elements

Figure 2 shows how the meter specification factors map to various elements of the meter system. Each of the green cells shows the intersection of meter system element and a meter specification factor it influences. It is important that the accuracy and efficacy of the meter system be assessed in a comprehensive, end-to-end fashion. Focusing on one element (e.g., is the IPDR aggregator properly converting incremental counters to hourly values?), or focusing on one factor (e.g., are the graphics clear?) does not give the complete picture.

Generally, different groups within an ISP--often supported by different suppliers--operate and manage the various elements (columns in Figure 2). This can lead to classic IT silo management.

	Traffic Counting		IPDR Processing		Usage Presentation	
	Cable Modem	CMTS	IPDR Collector	IPDR Aggregator	Account Mediation	Web Portal
What Is Counted						
Data Accumulation Period						
Error Bounds						
Timeliness						
Exception Handling						
Granularity						
Mathematical Consistency						
Accessibility						
Availability						
Clarity						

Figure 2 – Mapping Which Subsystem Delivers Each Factor

The linchpin of a meter system is the IPDR processing subsystem. Many ISPs focus on ensuring that part is accurate. However, as Figure 2 shows, the IPDR processing subsystem represents about one-quarter of the total meter system solution (sum of green cells). An accurate IPDR processor can nest within a meter system in which other elements are inaccurate or misleading. In such cases the meter is not accurate.

An accurate meter system is one in which all of the green boxes in Figure 2 can be shown to operate properly relative to the applicable specification factors. Furthermore all of the green boxes must meet the specification on an end-to-end basis at the same time. This comprehensive approach is the only way to assure that a meter system is delivering proper information to subscribers and the billing system.

About the Author

Peter Sevcik is President of NetForecast and is a leading authority on Internet traffic and performance. Peter has contributed to the design of more than 100 networks, including the Internet, and is the co-inventor of two patents on application response-time prediction and congestion management. He works extensively with the SamKnows system in support of the FCC Measuring Broadband America project, analyzing operational integrity and performing deep data analysis. He can be reached at peter@netforecast.com.

NetForecast provides deep insights into difficult network performance problems.

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