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The Printer Working Group

# The Printer Working Group (PWG) Standardized Imaging System Counters 1.1

Status: Approved

**Abstract:** This document defines the usage counters for an Imaging System, such as a network spooler, a printer or a multifunction device, and the services such a system offers. This document does not describe mapping of these semantics to XML Schema, MIB or any protocol. Such mappings may be provided in separate documents.

This document is a PWG Candidate Standard. For a definition of a "PWG Candidate Standard", see:  
<ftp://ftp.pwg.org/pub/pwg/general/pwg-process20.pdf>

This document is available electronically at:  
<ftp://ftp.pwg.org/pub/pwg/candidates/cs-wimscount11-20070427-5106.1.pdf>, .doc

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# 1 Introduction

The Imaging System Counters defined within this document are designed to support basic monitoring and accounting needs in environments such as fleet management across the Internet by outside service providers, enterprise management within an administrative domain by in-house staff and production management in commercial and transaction production print workflows. Some of the defined counters indicate the amount of work performed by the imaging system; other counters are used to monitor system utilization, data flow, errors and warnings.

## 1.1 Classification of Counters

The counters in this specification are focused on the service aspect of Imaging Systems. Counters measure the utilization of the imaging system and the amount of work performed in terms of impressions produced for printing and copying, and kilobytes of data interfaced for non-printing imaging services. The counters are measured on a per service basis as well as in the form of system totals that aggregate counters from the individual services. (See Figure 2 for the individual services.) Whether describing a service or a system total, a counter is defined as a member of one of 4 major groups:

- **Work Counters:** This category measures work that is produced by the imaging service or system as its primary function. The Work counters are subdivided into five groups: See section [2.2 Imaging Terminology](#)
  - **Datastream Counters:** Counters associated with work performed directly in processing datastream content. See section [2.2 Imaging Terminology](#)
  - **Auxiliary Counters:** Counters associated with auxiliary content (e.g. banner sheets, confirmations, and separator sheets), or units of work generated internally by the system or service (e.g. reports, start-up, calibration). See section [2.2 Imaging Terminology](#)
  - **Waste Counters:** Counters associated with non-productive work or waste generated by the Imaging System. See section [2.2 Imaging Terminology](#)
  - **Maintenance Counters:** Counters associated with all work performed and waste generated while the system is in maintenance mode. See section [2.2 Imaging Terminology](#)
  - **Other:** Increments accumulated in a WorkTotals counters that are not otherwise discriminated as Datastream, Auxiliary, Waste or Maintenance. See section [2.2 Imaging Terminology](#)
- **Media Used Counters.** Measure of the sheets of defined media types used by an imaging service or consumed across multiple services during the imaging process. See section [2.2 Imaging Terminology](#)
- **Monitoring Counters:** Measure of raw traffic and record of error and fault information associated with a service used to determine workload and operating conditions at a high level.
- **Availability Counters:** Measure of the number of times a service is in a particular state. Availability counters are used to measure availability of a system or service.

## 2 Terminology

This section defines terminology used throughout this document.

### 2.1 Conformance Terminology

Capitalized terms, such as **MUST**, **MUST NOT**, **REQUIRED**, **SHOULD**, **SHOULD NOT**, **MAY**, and **OPTIONAL**, have special meaning relating to conformance as defined in RFC 2119 [rfc2119].

### 2.2 Imaging Terminology

This document imports all of the terms defined in section 2 of the PWG Semantic Model [PWG5105.1] (e.g., "**Element**", "**Printer**", and "**Data Class**").

In addition, the following terms are imported or generalized from other source documents:

**Auxiliary** - Auxiliary content (e.g. banner sheets, confirmations, and separator sheets) that is associated with a user job, but is not part of the Datastream content. This includes work generated internally by the system or service (e.g. reports, start-up, and calibration). Auxiliary counters are not incremented when the system is in maintenance mode. An Auxiliary counter tracks the work performed processing Auxiliary content. Auxiliary is separated from Datastream content because accounting for Auxiliary content is often the result of site policy rather than an explicit user job request.

Source: This document imports this definition of Auxiliary content from the Auxiliary Sheet group in the Printer MIB v2 [RFC3805].

**Availability** – Relating to the particular state of a service which allows the service to be available for use (or not). Availability counters are used to measure availability of a system or service.

Source: This document defines Availability consistent with the usage in the Printer MIB v2 [RFC3805] and the Host Resources MIB [RFC2790].

**Blank Image** - A Blank Image is an Image requiring zero pixel colors to represent.

Source: This document originates this definition of Blank Image by analogy to Blank Impression.

**Blank Impression** - A Blank Impression is an Impression requiring zero colorants (i.e., no marks are impressed on the media sheet side by the processing Service). Pre-printed media do not affect Blank Impression counters (i.e., it is the lack of any content marked by the processing Service that distinguishes a Blank Impression).

Source: The document originates this definition of Blank Impression as an extension of the other impression types.

**Blank Sheet** - A Blank Sheet is a Sheet with no Impression marked on either side.

Source: This document originates this definition of Blank Sheet by analogy to Blank Impression.

**Datastream** - Datastream content is the logical content of a user job document or image stream, including associated job processing instructions (e.g., job ticket.) A Datastream counter tracks the work performed processing Datastream content. For example: (a) the content of a word processing document and all of its transformations as an end user creates and ultimately prints the document (from application source format to page description language or raster format and finally to impositions impressed on media sheets); (b) the content of an image stream created when a stack of media sheets is copied (i.e., scanned and printed).



Source: This document imports this definition of Datastream content from the Printer MIB v2 [RFC3805] and IPP/1.1 [RFC2911] (which sometimes uses the term 'print-stream').

**Device** - An abstract object that represents a hardware component of a network host system that supports one imaging function (e.g., copy) and may be associated with one or more upstream Service objects. A Device object exposes for monitoring and management every associated Subunit (e.g., Marker) on that network host system.

Source: This document defines the Device object as an extension and generalization of the Printer object in the Printer MIB v2 [RFC3805].

**Down Mode** - A condition where a System or Service cannot perform either user jobs or maintenance jobs. Down Mode corresponds to a 'hrDeviceStatus' of 'down' in the Host Resources MIB [RFC2790].

Source: This document defines Down Mode consistently with the usage in the Printer MIB v2 [RFC3805] and IPP/1.1 [RFC2911].

**Duplex** - The printing of impressions on both sides of a media sheet, as opposed to Simplex. Also called "two-sided" printing. Duplex operation is considered a "mode"; one side of a media sheet cannot be printed in Duplex while the other is printed in Simplex. Therefore, total impressions produced in duplex mode must always be a multiple of "2". However, both sides do not necessarily have the same type of impression.

Source: This document imports this definition of Duplex printing from IPP/1.1 [RFC2911].

**Full Color Image** - A Full Color Image is typically defined as an Image requiring three or more pixel colors to represent, but this MAY vary by implementation.

Source: This document originates this definition of Full Color Image by analogy to Full Color Impression.

**Full Color Impression** - A Full Color Impression is typically defined as an Impression requiring three or more colorants, but this MAY vary by implementation. In any case, the value of a Full Color Impression counter MUST increment by one for each media sheet side that is marked in full color, not by the number of colorants used. Full color takes precedence over monochrome or highlight color on a given media sheet side (i.e., the most complex process MUST be counted).

Source: This document imports this definition of Full Color Impression from the Job Monitoring MIB [RFC2707].

**Full Color Sheet** - A Full Color Sheet is a Sheet with a Full Color Impression marked on one or both sides.

Source: This document originates this definition of Full Color Sheet by analogy to Full Color Impression.

**Highlight Color Impression** - A Highlight Color Impression is typically defined an Impression requiring a black colorant plus one other colorant, but this MAY vary by implementation. In any case, a Highlight Color Impression counter MUST increment by one for each media sheet side that is marked in highlight color. Full color takes precedence over monochrome or highlight color on a given media sheet side (i.e., the most complex process MUST be counted).

Source: This document imports this definition of Highlight Color Impression from the Job Monitoring MIB [RFC2707].

**Highlight Color Sheet** - A Highlight Color Sheet is a Sheet with a Highlight Color Impression (but not full color) marked on one or both sides.

Source: This document originates this definition of Highlight Color Sheet by analogy to Highlight Color Impression.

**Idle State** – The state of a System or Service in which new user or maintenance jobs can start processing without waiting. Idle state corresponds to a 'printer-state' of 'idle' in IPP/1.1 [RFC2911] and an 'hrDeviceStatus' of 'running' or 'warning' in the Host Resources MIB [RFC2790].

Source: This document imports this definition of Idle state from IPP/1.1 [RFC2911].

**Image** - A digital representation of a virtual media sheet side.

Source: This document defines Image consistently with the usage in the Job Monitoring MIB [RFC2707] and IPP/1.1 [RFC2911].

**Imaging Service** - A synonym for Service, used for clarity in the model and design requirements.

Source: See definition of Service below.

**Imaging System** - A synonym for System, used for clarity in the model and design requirements.

Source: See definition of System below.

**Impression** - An Impression is the content imposed upon a one side of a Media Sheet by a marking engine, independent of the number of times that the sheet side passes any marker. An Impression may contain more than one logical page. See Number-up.

Source: This document defines Impression consistently with the usage in the Job Monitoring MIB [RFC2707] and IPP/1.1 [RFC2911].

**Job** – A unit of work whose results are expected together without interjection of unrelated results. A Job is the work to be done in response to a request for an imaging service, often (but not always) defined in a Datastream.

Source: This document defines Job content consistently with the usage in the Job Monitoring MIB [RFC2707] and IPP/1.1 [RFC2911].

**Maintenance Mode** - A condition where a System or Service may perform only diagnostic, repair, calibration or other non-user maintenance jobs. Maintenance Mode corresponds to a 'hrDeviceStatus' of 'testing' in the Host Resources MIB [RFC2790]. Maintenance counters measure work performed and waste generated while the system is in maintenance mode.

Source: This document defines Maintenance Mode consistently with the usage in the Printer MIB v2 [RFC3805] and IPP/1.1 [RFC2911].

**Media Sheet** - Synonym for Sheet (see definition of Sheet below).

Source: See definition of Sheet below.

**Media Used** - The sheets of defined media types used by an imaging service or consumed across multiple services. Media Used counters are intended to measure the primary consumable of a service employed during the imaging process but do not provide any job-specific information.

Source: This document defines Media Used consistently with the usage in the Job Monitoring MIB [RFC2707] and IPP/1.1 [RFC2911].

**Message** - A single application protocol request or response (that may consist of multiple application protocol data units) received or sent by Service such as EmailIn or FaxOut.

Source: This document defines Message consistently with the OSI Basic Reference Model [ISO7498-1].

**Monitoring** – Relates to the measure of raw traffic or recording of error and fault information associated with a service. Used to determine workload and operating conditions at a high level.

Source: This document defines Monitoring consistent with the usage in the Printer MIB v2 [RFC3805] and the Host Resources MIB [RFC2790].

**Monochrome Image** - A Monochrome Image is an Image requiring a single pixel color (typically black, but this MAY vary by implementation).

Source: This document originates this definition of Monochrome Image by analogy to Monochrome Impression.

**Monochrome Impression** - A Monochrome Impression is an Impression requiring a single colorant (typically black, but this MAY vary by implementation). In any case, a Monochrome Impression counter MUST increment by one for each media sheet side that is marked in monochrome. Full color takes precedence over monochrome or highlight color on a given media sheet side (i.e., the most complex process MUST be counted).

Source: This document imports this definition of Monochrome Impression from the Job Monitoring MIB [RFC2707].

**Monochrome Sheet** - A Monochrome Sheet is a Sheet with a Monochrome Impression (but not full color or highlight) marked on one or both sides.

Source: This document originates this definition of Monochrome Sheet by analogy to Monochrome Impression.

**Number-up (N-up)** - The number of user Job logical pages to be imposed on each side of a single media sheet.

Source: This document imports this definition of Number-up from the 'number-up' attribute in IPP/1.1 [RFC2911].

**Other** - Increments accumulated in a WorkTotals counter which are not otherwise discriminated as Datastream, Auxiliary, Waste or Maintenance. The value of Other can be derived from the difference between WorkTotals and the sum of Datastream, Auxiliary, Waste, and Maintenance counters.

Source: This document defines the 'Other' counter class to clarify the aggregation of individual work counters into the WorkTotals counter.

**Page** - A page is a logical division of an original source document.

Source: This document defines a logical Page consistently with the usage in the Printer MIB v2 [RFC3805] and IPP/1.1 [RFC2911].

**Processing State** - A System or Service is in the Processing state when one or more user or maintenance jobs are currently processing. Processing state corresponds to a 'printer-state' of 'processing' in IPP/1.1 [RFC2911] and an 'hrDeviceStatus' of 'running' or 'warning' in the Host Resources MIB [RFC2790].

Source: This document imports this definition of Processing state from IPP/1.1 [RFC2911].

**Raw Traffic** - The total data transferred (including all protocol headers) on a physical network interface or a logical network channel (e.g., IPP).

Source: This document imports this definition of Raw Traffic from MIB-II [RFC1213].

**Service** - An abstract object that represents a software component of a network host system that supports one or more imaging functions (e.g., copy, print, and scan) and may be associated with one or more downstream Device objects. A Service object exposes for monitoring and management every associated Subunit (e.g., Channel) on that network host system.

Source: This document defines the Service object as an extension and generalization of the Printer object in IPP/1.1 [RFC2911].

**Single-Sided** - A synonym for Simplex.

Source: This document imports this definition of Simplex printing from IPP/1.1 [RFC2911].

**Sheet** - A media sheet is a single instance of a medium, whether printing on one or both sides of the medium. See Impression and Page.

Source: This document imports this definition of a media sheet from the Job Monitoring MIB [RFC2707].

**Simplex** - The printing of impressions on only one side of each media sheet, as opposed to Duplex. Also termed single-sided.

Source: This document imports this definition of Simplex printing from IPP/1.1 [RFC2911].

**Subunit** - Subunits are components that make up the physical device or Imaging System. Subunits do not necessarily relate directly to any physically identifiable mechanism such as an input tray. Subunits can also be a set of definable logical processes, such as Interpreters that process page description languages.

Source: This document imports this definition of Subunit from the Printer MIB v2 [RFC3805].

**System** - An abstract object that represents a network host system and that may support one or more configured Services or Devices on that network host system. A System object exposes for monitoring and management every configured Subunit (e.g., Console) on that network host system.

Source: This document defines the System object as an extension and generalization of the System group in IETF MIB-II [RFC1213] and the System group in Host Resources MIB [RFC2790].

**Two-Sided** - A synonym for Duplex

Source: This document imports this definition of Duplex printing from IPP/1.1 [RFC2911].

**User Mode** - A condition where a System or Service can perform user jobs (i.e., non-maintenance jobs). User Mode corresponds to a 'hrDeviceStatus' of 'running' or 'warning' in the Host Resources MIB [RFC2790].

Source: This document defines User Mode consistently with the usage in the Printer MIB v2 [RFC3805] and IPP/1.1 [RFC2911].

**Waste** - Non-productive work generated by the Imaging System while processing in User Mode (not in Maintenance Mode). Waste is always associated with a user job and is typically the result of a condition or problem in an Imaging System.

Source: This document defines Waste consistently with the usage in the Printer MIB v2 [RFC3805] and IPP/1.1 [RFC2911].

**Waste Impressions** – Impressions which are recorded as Waste (e.g. jam impressions, purged jam recovery impressions, process run out, fuser clean up impressions) rather than Datastream or Auxiliary.

Source: This document defines Waste consistently with the usage in the Printer MIB v2 [RFC3805] and IPP/1.1 [RFC2911].

**Work** - The product of an Imaging Service or System as measured in performing its primary function. For example, the Work produced by a print service is measured in terms of Impressions; the Work produced by a scan service is measured in terms of Images. Work is subdivided into four discernable types (Datastream, Auxiliary, Maintenance and Waste) and one nondiscernable group (Other.)

Source: This document originates this definition of Work as an extension of IPP 1.1 [RFC2911].

## 3 Requirements

### 3.1 Rationale for Counters

The IETF and PWG standards for the Internet Printing Protocol (IPP), the Job Monitoring MIB, and the Printer MIB define:

- (a) A rationale for an abstract model of printing (to support alternate encodings and protocols) in section 3 of the IETF IPP Rationale [RFC2568], which led to the later development of the PWG Semantic Model/1.0 [PWG5105.1].
- (b) A set of design goals for status monitoring in a printing protocol in section 3.1.3 'Viewing the status and capabilities of a printer' (for End User), section 3.2.1 'Alerting' (for Operator), and section 3.3 'Administrator' (the bullet requirement to 'administrate billing or other charge-back mechanisms') of the IETF IPP Design Goals [RFC2567].
- (c) An abstract model of a Print Service in section 2.1 of IETF IPP/1.1 [RFC2911].
- (d) A set of multifunction Service types for Imaging Systems in the 'JmJobServiceTypesTC' textual convention in section 4 of the IETF Job Monitoring MIB [RFC2707].
- (e) An abstract model of a multifunction Job in section 2 of the IETF Job Monitoring MIB [RFC2707].
- (f) An abstract model of a Print Job in section 2.2 of IETF IPP/1.1 [RFC2911].
- (g) A set of abstract Print Job counter attributes in section 4.3.18 of IETF IPP/1.1 [RFC2911], section 3.8 of PWG IPP Production Printing Attributes [PWG5100.3], section 5.1 of PWG IPP Job Extensions [PWG5100.7], and section 4 of the IETF Job Monitoring MIB [RFC2707].
- (h) An abstract model of a Print Device in section 2.2 of the IETF Printer MIB v2 [RFC3805].
- (i) A set of abstract Print Device counter attributes in section 6 of the IETF Printer MIB v2 [RFC3805].

Over the past decade, network printers have evolved into multifunction Imaging Systems. In order to support monitoring, maintenance, and administration of these Imaging Systems, this document defines:

- (1) New abstract System and Service objects with Status element groups (containing Counters element groups) as a framework extension to the PWG Semantic Model/1.0 [PWG5105.1].
- (2) A set of abstract counters for these new System and Service objects.
- (3) A set of conformance requirements for implementation of the abstract counters for these new System and Service objects.

### 3.2 Use Model for Counters

#### 3.2.1 Service Providers - Monitoring and Billing

Outside service providers may lease and maintain imaging software and imaging equipment in remote customer enterprise networks (in different administrative domains).

Note: Typically monitoring proxies within customer enterprise networks are required for scalability of this use model. However, the deployment of monitoring proxies and of security credentials is outside the scope of this document.

- (1) To support basic usage billing, outside service providers may read System-level Work and Media Used counters from imaging systems (e.g., every month).
- (2) To support detailed usage billing, outside service providers may read System and/or Service Work and Media Used counters from imaging systems (e.g., every month).
- (3) To support reordering of supplies, outside service providers may read System-level Work and Media Used counters from imaging systems (e.g., every week).
- (4) To support preventive maintenance, outside service providers may read System-level Availability, Work, and Monitoring counters from imaging systems (e.g., every week).
- (5) To support downtime guarantees, outside service providers may read System and/or Service Availability and Monitoring counters from imaging systems, especially for configuration changes, critical alerts, and allocation errors (e.g., every 15 minutes).

### **3.2.2 System Administrators - Network Management**

Network System administrators configure and manage Services and Subunits on imaging systems in local enterprise networks.

- (1) To support basic configuration, network system administrators may read System-level Monitoring counters from imaging systems for configuration checkpoints (e.g., every month).
- (2) To support detailed configuration, network system administrators may read Service and/or Subunit Monitoring counters from imaging systems for configuration checkpoints (e.g., every month).
- (3) To support preventive maintenance, network system administrators may read System-level Availability, Work, and Monitoring counters from imaging systems (e.g., every week).
- (4) To support emergency maintenance, network system administrators may read System and/or Service Availability and Monitoring counters from imaging systems, especially for configuration changes, critical alerts, and allocation errors (e.g., every 15 minutes).

### **3.2.3 Network Applications - Accounting**

Network accounting applications monitor Services and Jobs on imaging systems in local enterprise networks.

- (1) To support basic accounting, a network accounting application may read System-level Work and Media Used counters from imaging systems (e.g., every month).
- (2) To support detailed accounting, a network accounting application may read Service-level Work and Media Used counters from imaging systems (e.g., every month).
- (3) To support user accounting, a network accounting application may read Service and/or Job Work and Media Used counters from imaging systems (e.g., every month).

## **3.3 Design Requirements for Counters**

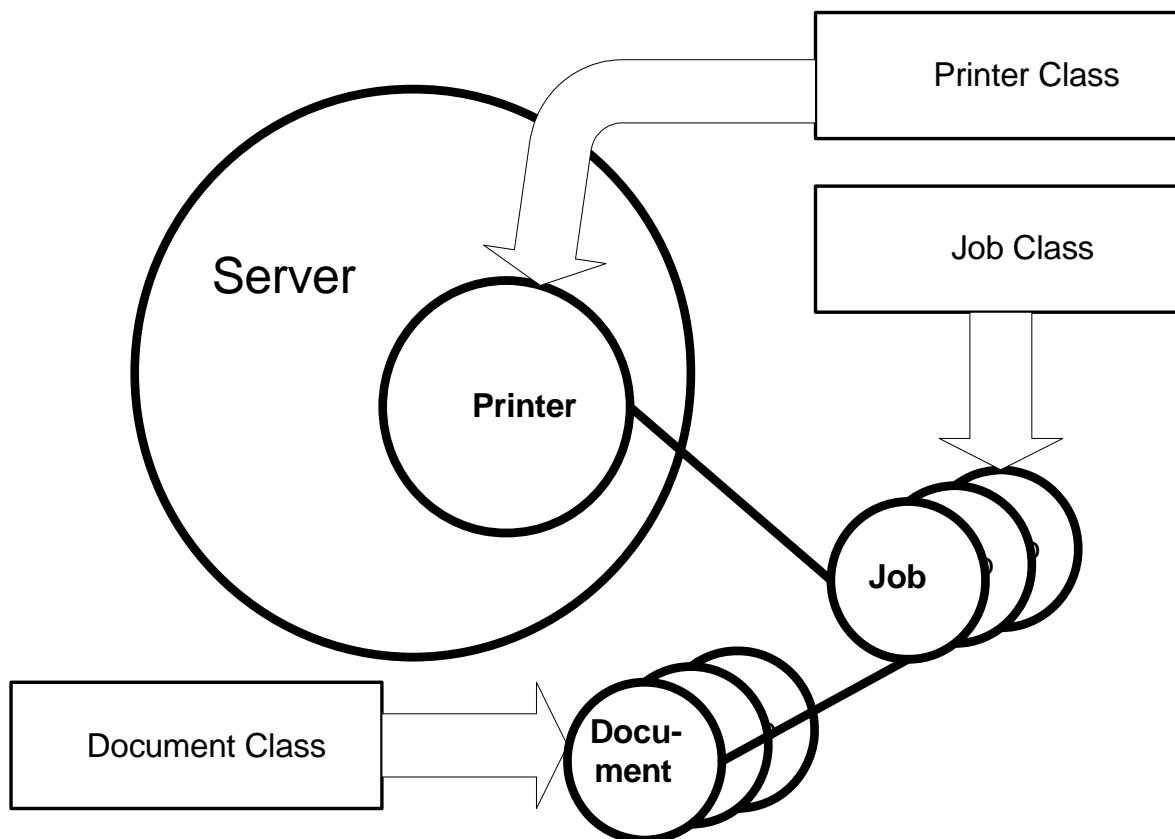
- (1) The PWG Imaging System Counters design MUST follow the naming conventions and element structuring requirements defined in the PWG Semantic Model/1.0 [PWG-5105.1], including group and element containment, counter datatype, and counter precision requirements.
- (2) The PWG Imaging System Counters design MUST NOT depend on the implementation of any specific management protocol (see sections 3.2.1 and 3.2.2).

- (3) The PWG Imaging System Counters design MUST support mappings to multiple management protocols (e.g., OASIS WSDM and SNMP) and data modeling languages (e.g., XML Schema and MIBs) (see section 3.2.1).
- (4) The PWG Imaging System Counters design MUST support Service counters corresponding to counters defined in the Printer object in IETF IPP/1.1 [RFC2911] (see all use models in section 3.2).
- (5) The PWG Imaging System Counters design MUST support Work counters corresponding to counters defined in the IETF Job Monitoring MIB [RFC2707] and the Job object in IETF IPP/1.1 [RFC2911] (see all use models in section 3.2).
- (6) The PWG Imaging System Counters design MUST support Media Used counters corresponding to counters defined in the IETF Job Monitoring MIB [RFC2707] and the Job object in IETF IPP/1.1 [RFC2911] (see sections 3.2.1 and 3.2.3).
- (7) The PWG Imaging System Counters design MUST support Availability and Monitoring counters corresponding to counters defined in the IETF Host Resources MIB [RFC1514] [RFC2790] IETF Printer MIB [RFC1759] [RFC3805] (see sections 3.2.1 and 3.2.2).
- (8) The PWG Imaging System Counters design MUST support Work counters for Datastream (user jobs), Auxiliary (e.g., cover sheets), Waste (e.g., paper jams), and Maintenance (e.g., offline testing jobs) (see section 3.2.3).
- (9) The PWG Imaging System Counters design MUST support System-level counters (see all use models in section 3.2).
- (10) The PWG Imaging System Counters design MUST support Service-level counters (see all use models in section 3.2).
- (11) The PWG Imaging System Counters design MUST support explicit counter persistence corresponding to 'prtMarkerLifeCount' and 'prtMarkerPowerOnCount' in IETF Printer MIB [RFC1759] [RFC3805] (see section 3.2.3).
- (12) The PWG Imaging System Counters design SHOULD support extensions for Subunit-level counters (see section 3.2.2).
- (13) The PWG Imaging System Counters design SHOULD support extensions for Job-level counters (see section 3.2.3).

## 4 Model Overview

### 4.1 PWG Object Model Overview

The Printer Working Group (PWG) has defined a simplified model for a Printer object. It represents a Printer for Web Services, traditional client/server or peer-to-peer print paradigms. The PWG model describes a Printer object that may contain zero or more Jobs. A Job is contained in only one Printer object. A Job can contain zero or more Documents and a Document is contained in only one Job. Note that although the container object “Server” is shown in the diagram below, it is not part of the PWG Semantic Model and there is no associated data class.



**Figure 1 Original PWG Printer Model**

Note that the PWG SM/1.0 term “Printer” is a legacy term from IPP/1.1. The preferred term for this Imaging Service is "Print Service" or just “Print”, analogous with Scan, Fax and Copy. (See section 4.2 and Figure 2 below).

### 4.2 Imaging System Services

The counters described in this document are focused on the services offered by Imaging Systems such as Multifunction Devices. The Multifunction Device is represented in the model as an Imaging System and its contained services. The service based model for an Imaging System permits the addressing of software implementations with the work performed by separate devices as well as implementations co-located on a single device set. Although this document does not specifically address usage counters for the devices and subunits of



the devices implementing these services, the counter elements defined may be applied to such physical objects as well as to services.

The figure below shows the services for which counters are being defined. The Print Service has been defined in detail by the PWG Semantic Model [PWG5105.1]. A concrete protocol mapping for the Print Services is specified in IPP [rfc2910] [rfc2911]. The Print Service model, and protocol mapping, define the objects and attributes for the service itself and the Jobs and Documents it processes. The Print Service model includes descriptions of the methods that can be invoked on those objects.

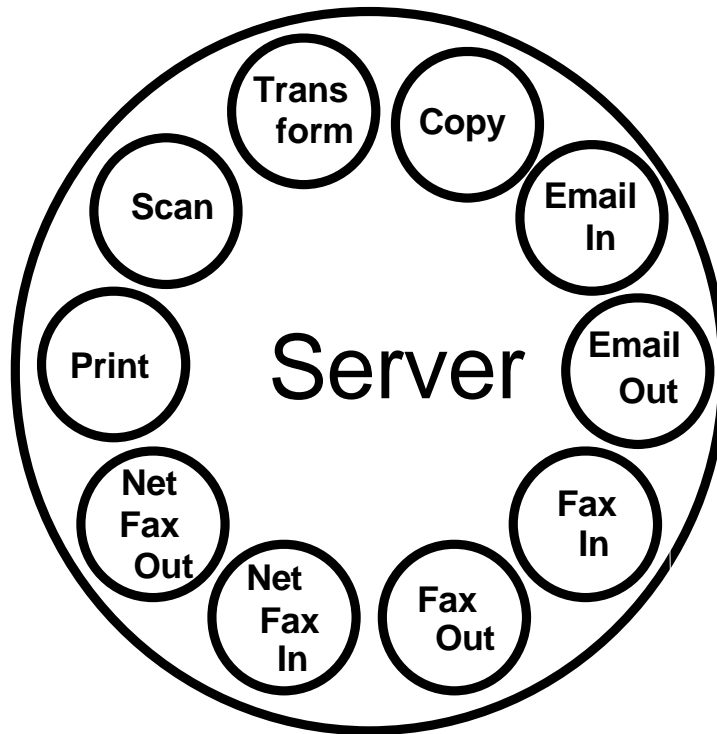


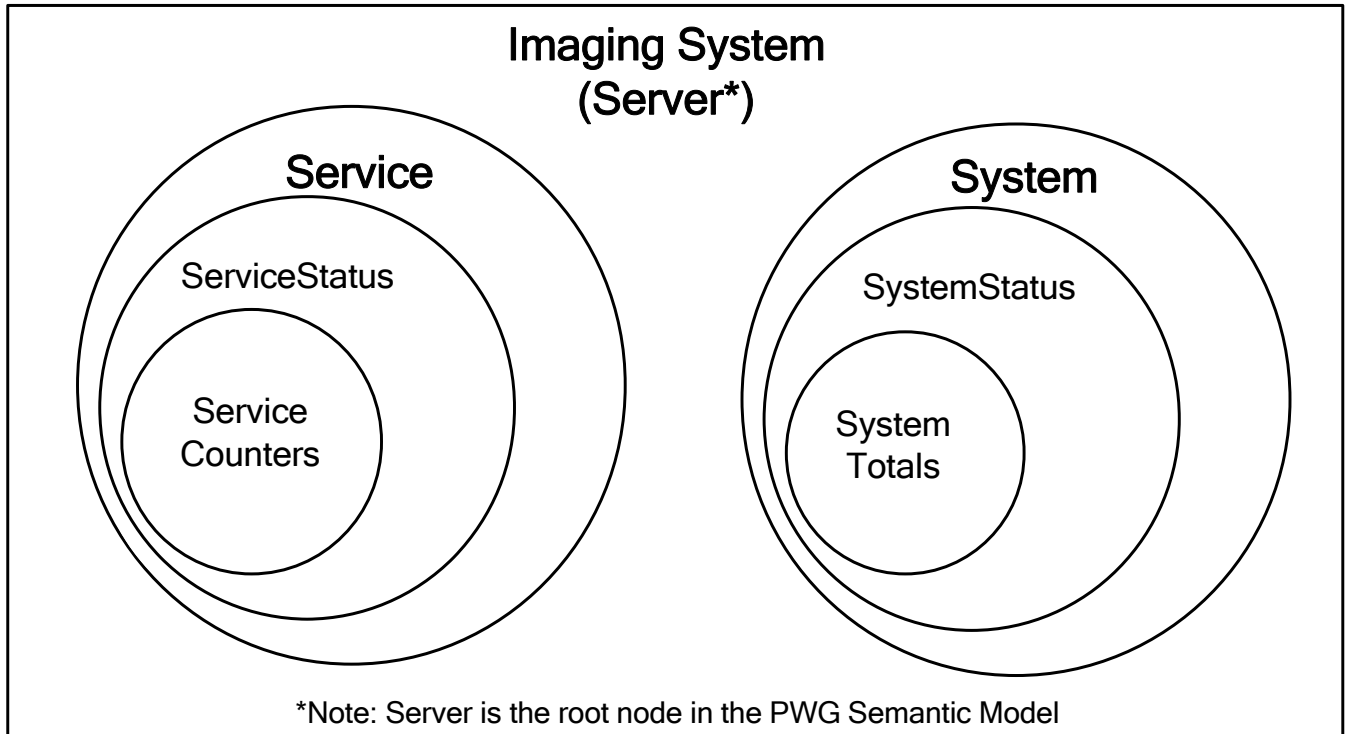
Figure 2 Imaging Services

This document only defines the counters and does not model the underlying services. The service counters provide a measure of the amount of work performed by the associated service. Examples include the number of impressions printed or the number of images scanned. This document does not model how those services are represented (e.g. fax job) other than their counters. This document does not address the relationship between a service and the devices and subunits (e.g. input tray, media path) that are used to perform the service. Even though the services themselves are not modeled, the counters defined should not conflict with service definitions.

### 4.3 PWG Object Model Extension for Counters

This document defines counters specific to each service and counters representing the aggregate measure for all the services system wide. The PWG Semantic Model root container (i.e. Imaging System) is the logical place to add the extension for each new service so they are peers of the existing print service. The counters for the service are an extension to the status element since counters are maintained by automata as are all other status elements.

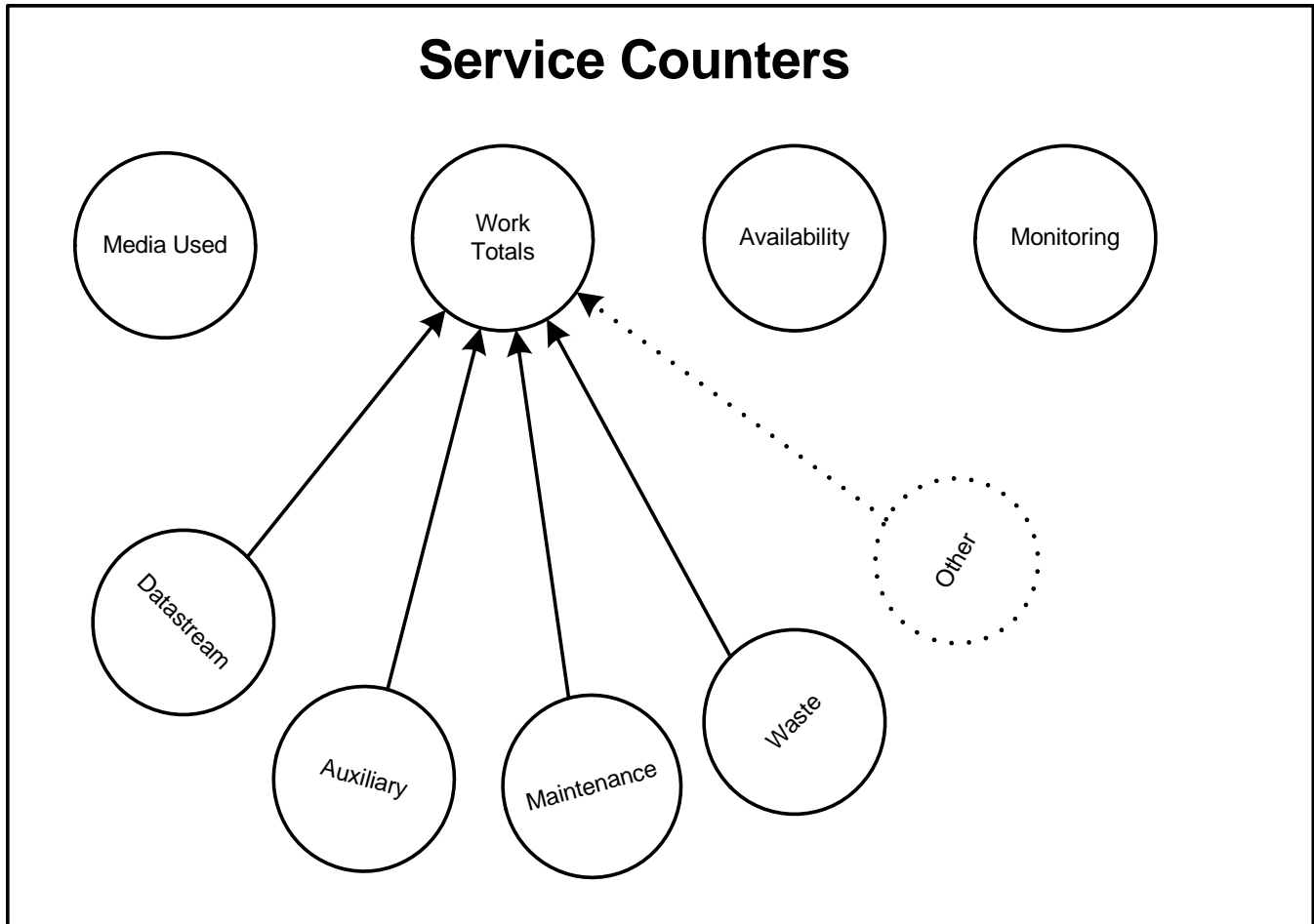
This approach extends the PWG Semantic Model by identifying the Imaging System and adding new containers for all the services (e.g. Copy, FaxIn) implemented in the Imaging System. Figure 3 depicts how counters are added to the Semantic Model. Each Service (e.g., Copy) will have a Status element (e.g., CopyStatus) that contains the counter elements (e.g., CopyCounters). A System element is included as a peer of the services, but System is not a service. This element contains the system-wide counters aggregate that total like counters in all supported services (e.g., Impressions, including those for Copy, EmailIn, FaxIn, NetworkFaxIn, and Print)



**Figure 3 Imaging System Semantic Model**

#### 4.4 Counter Overview

A Service's Status element contains the counters relating to the services offered by the Imaging System. All the supported services have counters; that is, there are CopyCounters, PrintCounters, FaxInCounters, etc. The System counters represent the aggregate of all the services. In the figure below the sub-elements of counters are shown. Counters are persistent for the lifetime of the Service, Subunit or Imaging System. A counter for a service is initialized to zero when the service is installed and continues to increase as the service is used. The counters MUST NOT be reset when a service is shutdown and restarted.



**Figure 4 Structure of Service Counters**

The counter classes that cover the amount of work performed are WorkTotals, Datastream, Auxiliary, Waste, Maintenance and Other. WorkTotals is equal to or greater than the sum of its subclasses because an implementation may not instrument all Work subclasses. For example, an implementation may not be able to differentiate Auxiliary from Maintenance and may therefore not record in either of those counter classes. In this case WorkTotals would be greater than the sum of its subclasses.

The MediaUsed element tracks the consumption of consumable media. Monitoring and Availability elements cover the utilization of services and the incidence of problems. Section 5 describes the counters within these elements.

Individual counters in each service counter class are summed into their corresponding individual counters in System Totals. Availability counters do not always follow a simple summation process. See [section 6](#) for complete details.

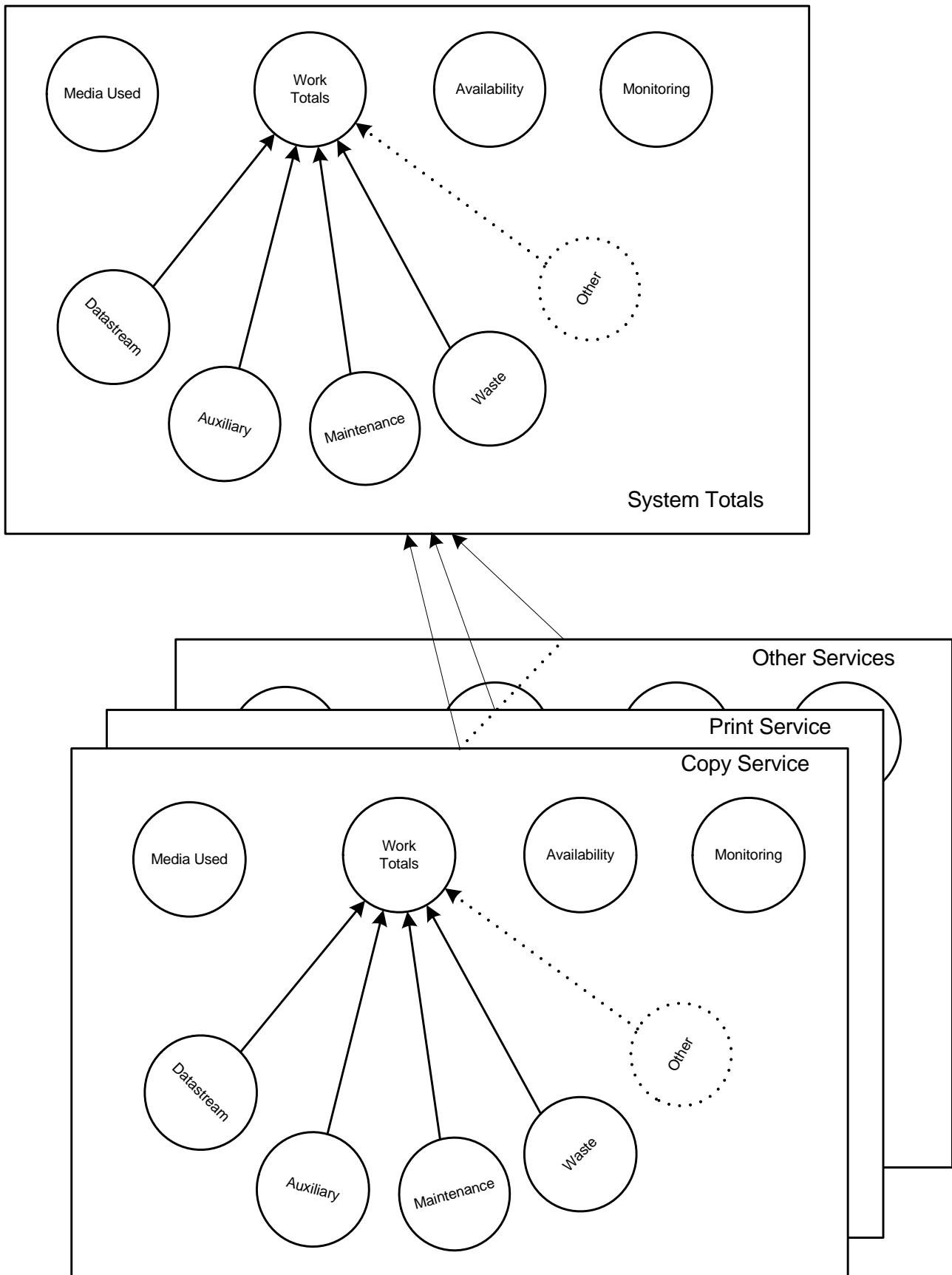


Figure 5 - System Totals as the summation of Service Counters

## 5 Counters

### 5.1 General

This section contains normative counter semantics and syntax. For a full definition of terms see [Section 2.2](#)

#### 5.1.1 Counter Element Naming

Specific counter elements are hierarchically named as follows:

##### **Object.Application.Unit**

Where:

1. **Object:** This first level identifies the object (System or Service -see Figure 3) that contains each Counter element (see 'Simplified Notation' below). Each System Totals counter is contained in a System object and is at the same logical level as the corresponding specific Service counters. Each System Totals counter aggregates across all the corresponding specific Service counters (see Figure 2).
2. **Application:** This second level identifies the application purpose (Monitoring, Availability, Media Used, or Work - see Figure 4) for each Counter element. The WorkTotals counter is further partitioned into DataStream, Auxiliary, Maintenance, Waste, and Other.
3. **Unit:** This third level identifies the unit (e.g., Impressions or Images) for each Counter element and may be further qualified (e.g., BlankImpressions or FullColorImages).

This section identifies the standardized Counter elements in terms of the Application and Unit names.

#### 5.1.2 Simplified Notation

There are places in this document which reference counter elements specific to a given Service. In such instances, this document uses a short generalized notation for the "object" rather than the full formal identification string that may be used in a hypothetical schema or MIB mapping. For example, the counter referred to in this document as:

##### **'Copy.WorkTotals.Impressions'**

may correlate to an XML schema qualified name of:

*'CopyService.CopyStatus.CopyCounters.WorkTotals.Impressions'* .

or

*'Service.ServiceStatus.ServiceCounters.WorkTotals.Impressions'* ,

depending on the structure used when adding Imaging Services to [PWG-SM]). Although the notation used in this document appears to be simpler, it would lead to a vastly larger XML schema set and would be error-prone during any XML schema maintenance.

#### 5.1.3 Persistence

Counter elements may persist as follows:

1. **Lifetime** - since installation of imaging system or service (see 'prtMarkerLifeCount' in IETF Printer MIB v2 [RFC3805]).
2. **PowerOn** - since last power cycle of imaging system or service see 'prtMarkerPowerOnCount' in IETF Printer MIB v2 [RFC3805]).
3. **Reset** - since last administrative reset of imaging counter (e.g., a software reset by an accounting application).

The protocol used to access counter elements must provide access to elements identifying the persistence characteristics of the counter elements. Conforming Imaging Systems MUST implement System Totals counters with Lifetime persistence. Conforming Imaging Systems SHOULD implement specific Service counters with Lifetime persistence.

## 5.2 Work Counters

This section defines system total and per service groups of Work counters. The per service counters are specific to the associated service and are contained in a counter element in the service's status element. For example the Copy service contains a CopyStatus element that contains the CopyCounters element. The SystemTotals counters are aggregates across all services and are contained in the SystemTotals element.

### 5.2.1 WorkTotals Counters Table

These counters reflect all classes of work performed by an imaging system or service.

WorkTotals Counters Element Name			reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
WorkTotals.Impressions			
The total number of Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.MonochromeImpressions			
The total number of Monochrome Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.BlankImpressions			
The total number of Blank Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.FullColorImpressions			
The total number of Full Color Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.HighlightColorImpressions			
The total number of Highlight Color Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.Images			
The total number of Images processed.			
(image)	(integer)	(0:2147483647)	
WorkTotals.MonochromeImages			
The total number of Monochrome Images processed.			
(image)	(integer)	(0:2147483647)	
WorkTotals.FullColorImages			
The total number of Full Color Images processed.			
(image)	(integer)	(0:2147483647)	
WorkTotals.ImpressionsTwoSided			
The total number of Two-Sided Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.MonochromeImpressionsTwoSided			
The total number of Two-Sided Monochrome Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.BlankImpressionsTwoSided			
The total number of Two-Sided Blank Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.FullColorImpressionsTwoSided			
The total number of Two-Sided Full Color Impressions generated.			

WorkTotals Counters Element Name			reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
(impression)	(integer)	(0:2147483647)	
WorkTotals.HighlightColorImpressionsTwoSided			
The total number of Two-Sided Highlight Color Impressions generated.			
(impression)	(integer)	(0:2147483647)	
WorkTotals.InputKOctets			
The total amount of data received by the service in integral units of 1024 octets			
(koctets)	(integer)	(0:2147483647)	
WorkTotals.OutputKOctets			
The total amount of data sent by the service in integral units of 1024 octets			
(koctets)	(integer)	(0:2147483647)	
WorkTotals.InputMessages			
The total number of messages received by the indicated service (Email, Fax or NetworkFax)			
(message)	(integer)	(0:2147483647)	
WorkTotals.OutputMessages			
The total number of messages sent by the indicated service (Email, Fax or NetworkFax)			
(message)	(integer)	(0:2147483647)	

### 5.2.2 Datastream Counters Table

These counters are associated with work generated from the content of the user's document or image stream.

Datastream Counters Element Name			reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
Datastream.Impressions			
The number of Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode.			
(impression)	(integer)	(0:2147483647)	
Datastream.MonochromeImpressions			
The number of Monochrome Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .			
(impression)	(integer)	(0:2147483647)	
Datastream.BlankImpressions			
The number of Blank Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .			
(impression)	(integer)	(0:2147483647)	
Datastream.FullColorImpressions			
The number of Full Color Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .			
(impression)	(integer)	(0:2147483647)	
Datastream.HighlightColorImpressions			
The number of Highlight Color Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode			
(impression)	(integer)	(0:2147483647)	
Datastream.Images			
The number of Images generated from Datastream content which are processed while the service is in User Mode			
(image)	(integer)	(0:2147483647)	
Datastream.MonochromeImages			
The number of Monochrome Images generated from Datastream content which are processed while the service is in User Mode			
(image)	(integer)	(0:2147483647)	
Datastream.FullColorImages			

Datastream Counters Element Name		reference
Description		
(unit of measure)	(DataType)	(Min/Initial:MAX)
	The number of Full Color Images generated from Datastream content which are processed while the service is in User Mode .	
(image)	(integer)	(0:2147483647)
Datastream.ImpressionsTwoSided		
	The number of Two-Sided Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .	
(impression)	(integer)	(0:2147483647)
Datastream.MonochromeImpressionsTwoSided		
	The number of Two-Sided Monochrome Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .	
(impression)	(integer)	(0:2147483647)
Datastream.BlankImpressionsTwoSided		
	The number of Two-Sided Blank Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .	
(impression)	(integer)	(0:2147483647)
Datastream.FullColorImpressionsTwoSided		
	The number of Two-Sided Full Color Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .	
(impression)	(integer)	(0:2147483647)
Datastream.HighlightColorImpressionsTwoSided		
	The number of Two-Sided Highlight Color Impressions generated from Datastream content which are successfully delivered as output while the service is in User Mode .	
(impression)	(integer)	(0:2147483647)
Datastream.InputKOctets		
	The amount of data received in integral units of 1024 octets while the service is in User Mode	
(koctets)	(integer)	(0:2147483647)
Datastream.OutputKOctets		
	The amount of data sent in integral units of 1024 octets while the service is in User Mode	
(koctets)	(integer)	(0:2147483647)
Datastream.InputMessages		
	The total number of messages received by the indicated service (Email, Fax or NetworkFax) while the service is in User Mode	
(message)	(integer)	(0:2147483647)
Datastream.OutputMessages		
	The total number of messages sent by the indicated service (Email, Fax or NetworkFax) while the service is in User Mode	
(message)	(integer)	(0:2147483647)



### 5.2.3 Auxiliary Counters Table

The Auxiliary Counters count the items explicitly or implicitly requested by end user that are not part of the user's Datastream. Examples of items normally delivered as part of the user's job are cover sheets, separator sheets or a confirmation page. Other examples normally not considered as part of a job include start-up or configuration sheets.

Auxiliary Counters Element Name			reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
Auxiliary.Impressions			
The number of Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode			
(impression)	(integer)	(0:2147483647)	
Auxiliary.MonochromeImpressions			
The number of Monochrome Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode.			
(impression)	(integer)	(0:2147483647)	
Auxiliary.BlankImpressions			
The number of Blank Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode .			
(impression)	(integer)	(0:2147483647)	
Auxiliary.FullColorImpressions			
The number of Full Color Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode.			
(impression)	(integer)	(0:2147483647)	
Auxiliary.HighlightColorImpressions			
The number of Highlight Color Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode.			
(impression)	(integer)	(0:2147483647)	
Auxiliary.ImpressionsTwoSided			
The number of Two-Sided Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode			
(impression)	(integer)	(0:2147483647)	
Auxiliary.MonochromeImpressionsTwoSided			
The number of Two-Sided Monochrome Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode .			
(impression)	(integer)	(0:2147483647)	
Auxiliary.BlankImpressionsTwoSided			
The number of Two-Sided Blank Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode .			
(impression)	(integer)	(0:2147483647)	
Auxiliary.FullColorImpressionsTwoSided			
The number of Two-Sided Full Color Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode.			
(impression)	(integer)	(0:2147483647)	
Auxiliary.HighlightColorImpressionsTwoSided			
The number of Two-Sided Highlight Color Impressions generated from Auxiliary content which are successfully delivered as output while the service is in User Mode .			
(impression)	(integer)	(0:2147483647)	

### 5.2.4 Waste Counters Table

The Waste counters count the items produces that are not requested by the end user and that are not normally delivered to the end user. Waste items are not part of the user's job or it is work that is not successfully delivered as output. Waste is used as a catch-all to count anything not included in the Work, Auxiliary and Maintenance counter groups. Examples are jam, purge and fuser clean-up.

Waste Counters Element Name			reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
Waste.Impressions			
The number of Waste Impressions.			
(impression)	(integer)	(0:2147483647)	
Waste.MonochromeImpressions			
The number of Monochrome Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.BlankImpressions			
The number of Blank Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.FullColorImpressions			
The number of Full Color Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.HighlightColorImpressions			
The number of Highlight Color Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.ImpressionsTwoSided			
The number of Two-Sided Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.MonochromeImpressionsTwoSided			
The number of Two-Sided Monochrome Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.BlankImpressionsTwoSided			
The number of Two-Sided Blank Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.FullColorImpressionsTwoSided			
The number of Two-Sided Full Color Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	
Waste.HighlightColorImpressionsTwoSided			
The number of Two-Sided Highlight Color Impressions that are Waste.			
(impression)	(integer)	(0:2147483647)	

### 5.2.5 Maintenance Counters Table

The Maintenance counters record items generated while the service is in maintenance mode. These counters are for all supported services.

Maintenance Counters Element Name			reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
Maintenance.Impressions			
The number of Impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.MonochromeImpressions			
The number of Monochrome Impressions generated while the service is in Maintenance Mode.			

Maintenance Counters Element Name			reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
(impression)	(integer)	(0:2147483647)	
Maintenance.BlankImpressions			
The number of Blank Impressions generated while the service is in Maintenance Mode			
(impression)	(integer)	(0:2147483647)	
Maintenance.FullColorImpressions			
The number of Full Color Impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.HighlightColorImpressions			
The number of Highlight Color Impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.ImpressionsTwoSided			
The number of Two-Sided Impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.Monochrome ImpressionsTwoSided			
The number of Two-Sided Monochrome Impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.BlankImpressionsTwoSided			
The number of Two-Sided Blank impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.FullColorImpressionsTwoSided			
The number of Two-Sided Full Color impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.HighlightColorImpressionsTwoSided			
The number of Two-Sided Highlight Color impressions generated while the service is in Maintenance Mode.			
(impression)	(integer)	(0:2147483647)	
Maintenance.InputKOctets			
The amount of input data received in integral units of 1024 octets while the service is in Maintenance Mode			
(koctets)	(integer)	(0:2147483647)	
Maintenance.OutputKOctets			
The amount of output data sent in integral units of 1024 octets while the service is in Maintenance Mode			
(koctets)	(integer)	(0:2147483647)	
Maintenance.InputMessages			
The total number of messages received by the indicated service (Email, Fax or NetworkFax) while the service is in Maintenance Mode			
(message)	(integer)	(0:2147483647)	
Maintenance.OutputMessages			
The total number of messages sent by the indicated service (Email, Fax or NetworkFax) while the service is in Maintenance Mode			
(message)	(integer)	(0:2147483647)	

### 5.3 Media Used Counters

The MediaUsed counters count the units of media used. A sheet of media is used when it has been pulled from the input supply (e.g. tray) regardless of whether it has been delivered to the output destination. The type of media is identified by the element MediaUsed.MediaSizeName. Where it is necessary to distinguish between more than one media type with the same MediaUsed.MediaSizeName, unique identification is provided by the additional non-localized element MediaUsed.MediaAccountingKey.

For example if there are two different letter sized media, one plain and the other with a letterhead, both would have a MediaUsed.MediaSizeName value of "na\_letter\_8.5x11in". The two media types would be differentiated by MediaUsed.MediaAccountingKey, which would have values unique within and appropriate to the environment in which the media must be distinguished. The MediaUsed.MediaAccountingKey values could follow a well-defined format facilitating machine-detectability and interoperability across different vendors and different client software tools. In the above example, values could be:

"moid=1.3.18.0.4.3.1.50;mtyp=stationery" and "moid=1.3.18.0.4.3.1.50;mtyp=stationery-letterhead"

However, the MediaUsed.MediaAccountingKey values could also be safe vendor custom tags such as 'chp-tooth=fine'; functional tags such as "vellum-with-holes" or designators such as "USAB700045".

### 5.3.1 Media Used Counters Table

Note that, in the table below, the entries in the "Min/Initial:MAX" column for string types specify the minimum/maximum length of the element string rather than the element value.

Media Used Counters Element Name		(MediaUsedCounters)	reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
MediaUsed.MediaSizeName			
The media size self-describing name for this specific media. (e.g. na_letter_8.5x11in) See: PWG Media Standardized Names' (IEEE/ISTO PWG 5101.1)			
	(string)	0 to 63*	
MediaUsed.MediaInfo			
The human readable description of this specific media. (e.g. Light blue deckle-edge letter stock)			
	(string)	0 to 255*	
MediaUsed.Sheets			
The total number of pieces of this specific media that have been used.			
(media sheets)	(integer)	(0:2147483647)	
MediaUsed.MonochromeSheets			
The total number of Monochrome Sheets of this specific media that have been used.			
(media sheets)	(integer)	(0:2147483647)	
MediaUsed.BlankSheets			
The total number of Blank Sheets of this specific media that have been used			
(media sheets)	(integer)	(0:2147483647)	
MediaUsed.FullColorSheets			
The total number of Full Color Sheets of this specific media that have been used.			
(media sheets)	(integer)	(0:2147483647)	
MediaUsed.HighlightColorSheets			
The total number of Highlight Color Sheets of this specific media that have been used			
(media sheets)	(integer)	(0:2147483647)	
MediaUsed.MediaName			
The name of the media as presented to the user.			
	(string)	0 to 63*	
MediaUsed.MediaAccountingKey			
A non-localizable element ensuring machine readable, locally unique identification of a specific media when MediaUsed.MediaSizeName by itself is not unique. This element MUST clearly distinguish different instances of the same media size (for example, by including specific media color, weight, etc.)			
	(string)	0 to 255*	

\* Length of the string in octets

### 5.4 Availability Counters

These counters indicate the availability of imaging services by measuring the down time, processing time, time in maintenance mode and total time. Idle time can be derived by subtracting the down, processing and maintenance times from total time.

#### 5.4.1 Availability Counters Table

Availability Element Name (Availability Counters)		reference
Description		
(unit of measure)	(DataType)	(Min/Initial:MAX)
Availability.DownTime		
The amount of time, in seconds, that the System or Service has been in Down Mode. DownTime is intended to be a low overhead metric that enables (via inverse) calculation of availability time. This information can be useful for service level validation in a managed environment.		
(seconds)	(integer)	(0:2147483647)
Availability.MaintenanceTime		
The amount of time, in seconds, that the System or Service has been in Maintenance Mode. MaintenanceTime can be useful for service level validation in a managed environment.		
(seconds)	(integer)	(0:2147483647)
Availability.ProcessingTime		
The amount of time, in seconds, that the System or Service has been processing jobs while in User Mode. ProcessingTime is intended to be a low overhead metric that enables (via inverse) calculation of idle time. This information can be useful for capacity planning in a managed environment.		
(seconds)	(integer)	(0:2147483647)
Availability.TotalTime		
The amount of time, in seconds, that the System or Service has been powered on. This includes DownTime, MaintenanceTime, ProcessingTime and the time the system is idle. Note that idle time can be derived by subtracting DownTime, MaintenanceTime and ProcessingTime from TotalTime.		
(seconds)	(integer)	(0:2147483647)

## 5.5 Monitoring Counters

These counters give a high level view of the imaging systems workload and conditions by recording data flow and warnings and errors conditions.

### 5.5.1 Monitoring Counters Table

Monitoring Element Name		(Availability Counters)	reference
Description			
(unit of measure)	(DataType)	(Min/Initial:MAX)	
Monitoring.ConfigChanges			
The number of configuration changes (eg, changes to service attributes) that have occurred on this Service. See prtGeneralConfigChanges in Printer MIB v2 RFC3805 for a normative reference.			
(changes)	(integer)	(0:2147483647)	
Monitoring.TotalAlerts			
The number of critical (e.g. output bin full) and non-critical alerts (e.g. output bin nearly full) that have occurred on this Service. See prtAlertAllEvents in Printer MIB v2 RFC3805 for a normative reference.			
(alerts)	(integer)	(0:2147483647)	
Monitoring.CriticalAlerts			
The number of critical alerts (e.g. output bin full) that have occurred on this Service. See prtAlertAllEvents in Printer MIB v2 RFC3805 for a normative reference. See prtAlertCriticalEvents in Printer MIB v2 RFC3805 for a normative reference.			
(alerts)	(integer)	(0:2147483647)	
Monitoring.AbortedJobs			
The total number of jobs that have been aborted (by the system software) on this Service. See jmJobState and JmJobStateTC in Job Mon MIB (RFC 2707) for a normative reference.			
(jobs)	(integer)	(0:2147483647)	
Monitoring.CanceledJobs			
The number of jobs that have been canceled by an authorized user on this Service. See jmJobState and JmJobStateTC in Job Mon MIB (RFC 2707) for a normative reference.			
(jobs)	(integer)	(0:2147483647)	
Monitoring.CompletedJobs			
The number of jobs that completed (successfully or with warnings or errors) on this Service. See jmJobState and JmJobStateTC in Job Mon MIB (RFC 2707) for a normative reference.			
(jobs)	(integer)	(0:2147483647)	
Monitoring.CompletedFinisherJobs			
The number of jobs completed (successfully or with warnings and errors) and for which any finishing process was performed on this Service. See finishing and JmFinishingTC in Job Mon MIB (RFC 2707) for a normative reference.			
(jobs)	(integer)	(0:2147483647)	
Monitoring.MemoryAllocErrors			
The number of times that data stored by this Service to local Imaging System memory caused a memory allocation failure. See hrStorageSize, hrStorageUsed, and hrStorageAllocationFailures in Host Resources MIB (RFC 1514/2790) for a normative reference.			
(errors)	(integer)	(0:2147483647)	
Monitoring.MemoryAllocWarnings			
The number of times that data stored by Service to local Imaging System memory exceeded an implementation-defined (or administratively configured) memory allocation threshold. Usage: This counter is intended to support increasing the available memory on an Imaging System before job failures. The counter may be moderated (i.e. dampened) to handle brink conditions. See hrStorageSize, hrStorageUsed, and hrStorageAllocationFailures in Host Resources MIB (RFC 1514/2790) for a normative reference.			

<b>Monitoring Element Name (Availability Counters)</b>		<b>reference</b>
<b>Description</b>		
<b>(unit of measure)</b>	<b>(DataType)</b>	<b>(Min/Initial:MAX)</b>
(warnings)	(integer)	(0:2147483647)
<b>Monitoring.StorageAllocErrors</b>		
The number of times that data stored by this Service to a local or remote file system caused a storage allocation failure. See: hrStorageSize, hrStorageUsed, and hrStorageAllocationFailures in Host Resources MIB (RFC 1514/2790) for a normative reference..		
(errors)	(integer)	(0:2147483647)
<b>Monitoring.StorageAllocWarnings</b>		
The number of times that data stored by this Service to a local or remote file system exceeded an implementation-defined (or administratively configured) storage allocation threshold. The counter may be moderated (i.e. dampened) to handle brink conditions. Usage: This counter is intended to support increasing the available storage on an Imaging System before job failures. See hrStorageSize, hrStorageUsed, and hrStorageAllocationFailures in Host Resources MIB (RFC 1514/2790) for a normative reference.		
(warnings)	(integer)	(0:2147483647)
<b>Monitoring.LocalStorageKOctets</b>		
The amount of data, in integral units of 1024 octets, stored by this Service to the local file system of this Imaging System. See hrStorageSize and hrStorageUsed in Host Resources MIB (RFC 2790) for a normative reference..		
(koctets)	(integer)	(0:2147483647)
<b>Monitoring.RemoteStorageKOctets</b>		
The amount of data, in integral units of 1024 octets, stored by Service to a remote file system from this Imaging System. See hrStorageSize and hrStorageUsed in Host Resources MIB (RFC 2790) for a normative reference.		
(koctets)	(integer)	(0:2147483647)

## 6 Per Service and System Totals Counters Lists

Service specific counters count items associated with the services of an Imaging System. Service-specific counters include an identification of the service prepended to the counter name. System Totals counters aggregate the identified count across all the services of the Imaging System. Such aggregate counters have "SystemTotals" prepended to the counter name. This section identifies the counter elements, as defined in Section 5 that are applicable to the SystemTotals and the individual Services. Note that, as described in paragraph 5.1.2 this document uses a short generalized notation for the Service rather than the full formal identification string that may be used in hypothetical schema.

### 6.1 System Totals Counters List

The System Totals counters aggregate counters from all the services offered by the Imaging System. The Service Totals group includes the following counters.

<b>WorkTotals.Images</b>	<b>Maintenance.FullColorImages</b>
<b>WorkTotals.MonochromeImages</b>	<b>Maintenance.Impressions</b>
<b>WorkTotals.FullColorImages</b>	<b>Maintenance.MonochromeImpressions</b>
<b>WorkTotals.Impressions</b>	<b>Maintenance.BlankImpressions</b>
<b>WorkTotals.MonochromeImpressions</b>	<b>Maintenance.FullColorImpressions</b>
<b>WorkTotals.BlankImpressions</b>	<b>Maintenance.HighlightColorImpressions</b>
<b>WorkTotals.FullColorImpressions</b>	<b>Maintenance.ImpressionsTwoSided</b>
<b>WorkTotals.HighlightColorImpressions</b>	<b>Maintenance.MonochromeImpressionsTwoSided</b>
<b>WorkTotals.ImpressionsTwoSided</b>	<b>Maintenance.BlankImpressionsTwoSided</b>
<b>WorkTotals.MonochromeImpressionsTwoSided</b>	<b>Maintenance.FullColorImpressionsTwoSided</b>
<b>WorkTotals.BlankImpressionsTwoSided</b>	<b>Maintenance.HighlightColorImpressionsTwoSided</b>
<b>WorkTotals.FullColorImpressionsTwoSided</b>	<b>Maintenance.InputKOctets</b>
<b>WorkTotals.HighlightColorImpressionsTwoSided</b>	<b>Maintenance.InputMessages</b>
<b>WorkTotals.InputKOctets</b>	<b>Maintenance.OutputKOctets</b>
<b>WorkTotals.InputMessages</b>	<b>Maintenance.OutputMessages</b>
<b>WorkTotals.OutputKOctets</b>	<b>Waste.Impressions</b>
<b>WorkTotals.OutputMessages</b>	<b>Waste.MonochromeImpressions</b>
<b>Datastream.Images</b>	<b>Waste.BlankImpressions</b>
<b>Datastream.MonochromeImages</b>	<b>Waste.FullColorImpressions</b>
<b>Datastream.FullColorImages</b>	<b>Waste.HighlightColorImpressions</b>
<b>Datastream.Impressions</b>	<b>Waste.ImpressionsTwoSided</b>
<b>Datastream.MonochromeImpressions</b>	<b>Waste.MonochromeImpressionsTwoSided</b>
<b>Datastream.BlankImpressions</b>	<b>Waste.BlankImpressionsTwoSided</b>
<b>Datastream.FullColorImpressions</b>	<b>Waste.FullColorImpressionsTwoSided</b>
<b>Datastream.HighlightColorImpressions</b>	<b>Waste.HighlightColorImpressionsTwoSided</b>
<b>Datastream.ImpressionsTwoSided</b>	<b>MediaUsed.Sheets</b>
<b>Datastream.MonochromeImpressionsTwoSided</b>	<b>MediaUsed.MonochromeSheets</b>
<b>Datastream.BlankImpressionsTwoSided</b>	<b>MediaUsed.BlankSheets</b>
<b>Datastream.FullColorImpressionsTwoSided</b>	<b>MediaUsed.FullColorSheets</b>
<b>Datastream.HighlightColorImpressionsTwoSided</b>	<b>MediaUsed.HighlightColorSheet</b>
<b>Datastream.InputKOctets</b>	<b>Availability.DownTime</b>
<b>Datastream.InputMessages</b>	<b>Availability.MaintenanceTime</b>
<b>Datastream.OutputKOctets</b>	<b>Availability.ProcessingTime</b>
<b>Datastream.OutputMessages</b>	<b>Availability.TotalTime</b>
<b>Auxiliary.Impressions</b>	<b>Monitoring.ConfigChanges</b>
<b>Auxiliary.MonochromeImpressions</b>	<b>Monitoring.TotalAlerts</b>
<b>Auxiliary.BlankImpressions</b>	<b>Monitoring.CriticalAlerts</b>
<b>Auxiliary.FullColorImpressions</b>	<b>Monitoring.AbortedJobs</b>
<b>Auxiliary.HighlightColorImpressions</b>	<b>Monitoring.CanceledJobs</b>
<b>Auxiliary.ImpressionsTwoSided</b>	<b>Monitoring.CompletedJobs</b>
<b>Auxiliary.MonochromeImpressionsTwoSided</b>	<b>Monitoring.CompletedFinisherJobs</b>
<b>Auxiliary.BlankImpressionsTwoSided</b>	<b>Monitoring.MemoryAllocErrors</b>
<b>Auxiliary.FullColorImpressionsTwoSided</b>	<b>Monitoring.MemoryAllocWarnings</b>
<b>Auxiliary.HighlightColorImpressionsTwoSided</b>	<b>Monitoring.StorageAllocErrors</b>
<b>Maintenance.Images</b>	<b>Monitoring.StorageAllocWarnings</b>
<b>Maintenance.MonochromeImages</b>	<b>Monitoring.LocalStorageKOctets</b>



**Monitoring.RemoteStorageKOctets**

## 6.2 Copy Service Counters List

The Copy service counters count the subset of items that are directly associated with the Copy service (i.e. when using the Imaging System as a copier.) The Copy service has the following counters.

- |  |   |
|--|---|
| <b>WorkTotals.Impressions</b>                    | <b>Maintenance.FullColorImpressionsTwoSided</b> |
| <b>WorkTotals.MonochromeImpressions</b>          | <b>Maintenance.InputKOctets</b>                 |
| <b>WorkTotals.BlankImpressions</b>               | <b>Maintenance.OutputKOctets</b>                |
| <b>WorkTotals.FullColorImpressions</b>           | <b>Waste.Impressions</b>                        |
| <b>WorkTotals.ImpressionsTwoSided</b>            | <b>Waste.MonochromeImpressions</b>              |
| <b>WorkTotals.MonochromeImpressionsTwoSided</b>  | <b>Waste.BlankImpressions</b>                   |
| <b>WorkTotals.BlankImpressionsTwoSided</b>       | <b>Waste.FullColorImpressions</b>               |
| <b>WorkTotals.FullColorImpressionsTwoSided</b>   | <b>Waste.ImpressionsTwoSided</b>                |
| <b>WorkTotals.InputKOctets</b>                   | <b>Waste.MonochromeImpressionsTwoSided</b>      |
| <b>WorkTotals.OutputKOctets</b>                  | <b>Waste.BlankImpressionsTwoSided</b>           |
| <b>Datastream.Impressions</b>                    | <b>Waste.FullColorImpressionsTwoSided</b>       |
| <b>Datastream.MonochromeImpressions</b>          | <b>MediaUsed.Sheets</b>                         |
| <b>Datastream.FullColorImpressions</b>           | <b>MediaUsed.MonochromeSheets</b>               |
| <b>Datastream.ImpressionsTwoSided</b>            | <b>MediaUsed.BlankSheets</b>                    |
| <b>Datastream.MonochromeImpressionsTwoSided</b>  | <b>MediaUsed.FullColorSheets</b>                |
| <b>Datastream.FullColorImpressionsTwoSided</b>   | <b>Availability.DownTime</b>                    |
| <b>Datastream.InputKOctets</b>                   | <b>Availability.MaintenanceTime</b>             |
| <b>Datastream.OutputKOctets</b>                  | <b>Availability.ProcessingTime</b>              |
| <b>Auxiliary.Impressions</b>                     | <b>Availability.TotalTime</b>                   |
| <b>Auxiliary.MonochromeImpressions</b>           | <b>Monitoring.ConfigChanges</b>                 |
| <b>Auxiliary.BlankImpressions</b>                | <b>Monitoring.TotalAlerts</b>                   |
| <b>Auxiliary.FullColorImpressions</b>            | <b>Monitoring.CriticalAlerts</b>                |
| <b>Auxiliary.ImpressionsTwoSided</b>             | <b>Monitoring.AbortedJobs</b>                   |
| <b>Auxiliary.MonochromeImpressionsTwoSided</b>   | <b>Monitoring.CanceledJobs</b>                  |
| <b>Auxiliary.BlankImpressionsTwoSided</b>        | <b>Monitoring.CompletedJobs</b>                 |
| <b>Auxiliary.FullColorImpressionsTwoSided</b>    | <b>Monitoring.CompletedFinisherJobs</b>         |
| <b>Maintenance.Impressions</b>                   | <b>Monitoring.MemoryAllocErrors</b>             |
| <b>Maintenance.MonochromeImpressions</b>         | <b>Monitoring.MemoryAllocWarnings</b>           |
| <b>Maintenance.BlankImpressions</b>              | <b>Monitoring.StorageAllocErrors</b>            |
| <b>Maintenance.FullColorImpressions</b>          | <b>Monitoring.StorageAllocWarnings</b>          |
| <b>Maintenance.ImpressionsTwoSided</b>           | <b>Monitoring.LocalStorageKOctets</b>           |
| <b>Maintenance.MonochromeImpressionsTwoSided</b> | <b>Monitoring.RemoteStorageKOctets</b>          |
| <b>Maintenance.BlankImpressionsTwoSided</b>      |   |

## 6.3 EmailIn Service Counters List

The EmailIn service counters count subset of items that are directly associated with the inbound Email service (i.e. when the Imaging System is receiving email to process). The EmailIn service has the following counters.

- |   |   |
|---|---|
| <b>WorkTotals.Images</b>                            | <b>Datastream.MonochromeImages</b>                  |
| <b>WorkTotals.MonochromeImages</b>                  | <b>Datastream.FullColorImages</b>                   |
| <b>WorkTotals.FullColorImages</b>                   | <b>Datastream.Impressions</b>                       |
| <b>WorkTotals.Impressions</b>                       | <b>Datastream.MonochromeImpressions</b>             |
| <b>WorkTotals.MonochromeImpressions</b>             | <b>Datastream.BlankImpressions</b>                  |
| <b>WorkTotals.BlankImpressions</b>                  | <b>Datastream.FullColorImpressions</b>              |
| <b>WorkTotals.FullColorImpressions</b>              | <b>Datastream.HighlightColorImpressions</b>         |
| <b>WorkTotals.HighlightColorImpressions</b>         | <b>Datastream.ImpressionsTwoSided</b>               |
| <b>WorkTotals.ImpressionsTwoSided</b>               | <b>Datastream.MonochromeImpressionsTwoSided</b>     |
| <b>WorkTotals.MonochromeImpressionsTwoSided</b>     | <b>Datastream.BlankImpressionsTwoSided</b>          |
| <b>WorkTotals.BlankImpressionsTwoSided</b>          | <b>Datastream.FullColorImpressionsTwoSided</b>      |
| <b>WorkTotals.FullColorImpressionsTwoSided</b>      | <b>Datastream.HighlightColorImpressionsTwoSided</b> |
| <b>WorkTotals.HighlightColorImpressionsTwoSided</b> | <b>Datastream.InputKOctets</b>                      |
| <b>WorkTotals.InputKOctets</b>                      | <b>Datastream.InputMessages</b>                     |
| <b>WorkTotals.InputMessages</b>                     | <b>Auxiliary.Impressions</b>                        |
| <b>Datastream.Images</b>                            | <b>Auxiliary.MonochromeImpressions</b>              |

<b>Auxiliary.BlankImpressions</b>	<b>Waste.ImpressionsTwoSided</b>
<b>Auxiliary.FullColorImpressions</b>	<b>Waste.MonochromeImpressionsTwoSided</b>
<b>Auxiliary.HighlightColorImpressions</b>	<b>Waste.BlankImpressionsTwoSided</b>
<b>Auxiliary.ImpressionsTwoSided</b>	<b>Waste.FullColorImpressionsTwoSided</b>
<b>Auxiliary.MonochromeImpressionsTwoSided</b>	<b>Waste.HighlightColorImpressionsTwoSided</b>
<b>Auxiliary.BlankImpressionsTwoSided</b>	<b>MediaUsed.Sheets</b>
<b>Auxiliary.FullColorImpressionsTwoSided</b>	<b>MediaUsed.MonochromeSheets</b>
<b>Auxiliary.HighlightColorImpressionsTwoSided</b>	<b>MediaUsed.BlankSheets</b>
<b>Maintenance.Images</b>	<b>MediaUsed.FullColorSheets</b>
<b>Maintenance.MonochromeImages</b>	<b>MediaUsed.HighlightColorSheet</b>
<b>Maintenance.FullColorImages</b>	<b>Availability.DownTime</b>
<b>Maintenance.Impressions</b>	<b>Availability.MaintenanceTime</b>
<b>Maintenance.MonochromeImpressions</b>	<b>Availability.ProcessingTime</b>
<b>Maintenance.BlankImpressions</b>	<b>Availability.TotalTime</b>
<b>Maintenance.FullColorImpressions</b>	<b>Monitoring.ConfigChanges</b>
<b>Maintenance.HighlightColorImpressions</b>	<b>Monitoring.TotalAlerts</b>
<b>Maintenance.ImpressionsTwoSided</b>	<b>Monitoring.CriticalAlerts</b>
<b>Maintenance.MonochromeImpressionsTwoSided</b>	<b>Monitoring.AbortedJobs</b>
<b>Maintenance.BlankImpressionsTwoSided</b>	<b>Monitoring.CanceledJobs</b>
<b>Maintenance.FullColorImpressionsTwoSided</b>	<b>Monitoring.CompletedJobs</b>
<b>Maintenance.HighlightColorImpressionsTwoSided</b>	<b>Monitoring.CompletedFinisherJobs</b>
<b>Maintenance.InputKOctets</b>	<b>Monitoring.MemoryAllocErrors</b>
<b>Maintenance.InputMessages</b>	<b>Monitoring.MemoryAllocWarnings</b>
<b>Waste.Impressions</b>	<b>Monitoring.StorageAllocErrors</b>
<b>Waste.MonochromeImpressions</b>	<b>Monitoring.StorageAllocWarnings</b>
<b>Waste.BlankImpressions</b>	<b>Monitoring.LocalStorageKOctets</b>
<b>Waste.FullColorImpressions</b>	<b>Monitoring.RemoteStorageKOctets</b>
<b>Waste.HighlightColorImpressions</b>	

## 6.4 EmailOut Service Counters List

The EmailOut service counters count subset of items that are directly associated with the outbound Email service (i.e. when the Imaging System is sending email). The EmailOut service has the following counters.

<b>WorkTotals.Images</b>	<b>Availability.MaintenanceTime</b>
<b>WorkTotals.MonochromeImages</b>	<b>Availability.ProcessingTime</b>
<b>WorkTotals.FullColorImages</b>	<b>Availability.TotalTime</b>
<b>WorkTotals.OutputKOctets</b>	<b>Monitoring.ConfigChanges</b>
<b>WorkTotals.OutputMessages</b>	<b>Monitoring.TotalAlerts</b>
<b>Datastream.Images</b>	<b>Monitoring.CriticalAlerts</b>
<b>Datastream.MonochromeImages</b>	<b>Monitoring.AbortedJobs</b>
<b>Datastream.FullColorImages</b>	<b>Monitoring.CanceledJobs</b>
<b>Datastream.OutputKOctets</b>	<b>Monitoring.CompletedJobs</b>
<b>Datastream.OutputMessages</b>	<b>Monitoring.CompletedFinisherJobs</b>
<b>Maintenance.Images</b>	<b>Monitoring.MemoryAllocErrors</b>
<b>Maintenance.MonochromeImages</b>	<b>Monitoring.MemoryAllocWarnings</b>
<b>Maintenance.FullColorImages</b>	<b>Monitoring.StorageAllocErrors</b>
<b>Maintenance.OutputKOctets</b>	<b>Monitoring.StorageAllocWarnings</b>
<b>Maintenance.OutputMessages</b>	<b>Monitoring.LocalStorageKOctets</b>
<b>Availability.DownTime</b>	<b>Monitoring.RemoteStorageKOctets</b>

## 6.5 PSTN FaxIn Service Counters List

The FaxIn service counters count subset of items that are directly associated with the inbound fax service over the Public Switched Telephone Network (PSTN); i.e. when the Imaging System is receiving a facsimile product using International Telecommunications Union (ITU) recommendation T.30). The FaxIn service has the following counters.

<b>WorkTotals.Images</b>	<b>WorkTotals.Impressions</b>
<b>WorkTotals.MonochromeImages</b>	<b>WorkTotals.MonochromeImpressions</b>
<b>WorkTotals.FullColorImages</b>	<b>WorkTotals.BlankImpressions</b>

<b>WorkTotals.FullColorImpressions</b>	<b>Maintenance.FullColorImpressions</b>
<b>WorkTotals.ImpressionsTwoSided</b>	<b>Maintenance.ImpressionsTwoSided</b>
<b>WorkTotals.MonochromeImpressionsTwoSided</b>	<b>Maintenance.MonochromeImpressionsTwoSided</b>
<b>WorkTotals.BlankImpressionsTwoSided</b>	<b>Maintenance.BlankImpressionsTwoSided</b>
<b>WorkTotals.FullColorImpressionsTwoSided</b>	<b>Maintenance.FullColorImpressionsTwoSided</b>
<b>WorkTotals.InputKOctets</b>	<b>Maintenance.InputKOctets</b>
<b>WorkTotals.InputMessages</b>	<b>Maintenance.InputMessages</b>
<b>Datastream.Images</b>	<b>Waste.Impressions</b>
<b>Datastream.MonochromeImages</b>	<b>Waste.MonochromeImpressions</b>
<b>Datastream.FullColorImages</b>	<b>Waste.BlankImpressions</b>
<b>Datastream.Impressions</b>	<b>Waste.FullColorImpressions</b>
<b>Datastream.MonochromeImpressions</b>	<b>Waste.ImpressionsTwoSided</b>
<b>Datastream.BlankImpressions</b>	<b>Waste.MonochromeImpressionsTwoSided</b>
<b>Datastream.FullColorImpressions</b>	<b>Waste.BlankImpressionsTwoSided</b>
<b>Datastream.ImpressionsTwoSided</b>	<b>Waste.FullColorImpressionsTwoSided</b>
<b>Datastream.MonochromeImpressionsTwoSided</b>	<b>MediaUsed.Sheets</b>
<b>Datastream.BlankImpressionsTwoSided</b>	<b>MediaUsed.MonochromeSheets</b>
<b>Datastream.FullColorImpressionsTwoSided</b>	<b>MediaUsed.BlankSheets</b>
<b>Datastream.InputKOctets</b>	<b>MediaUsed.FullColorSheets</b>
<b>Datastream.InputMessages</b>	<b>Availability.DownTime</b>
<b>Auxiliary.Images</b>	<b>Availability.MaintenanceTime</b>
<b>Auxiliary.MonochromeImages</b>	<b>Availability.ProcessingTime</b>
<b>Auxiliary.FullColorImages</b>	<b>Availability.TotalTime</b>
<b>Auxiliary.Impressions</b>	<b>Monitoring.ConfigChanges</b>
<b>Auxiliary.MonochromeImpressions</b>	<b>Monitoring.TotalAlerts</b>
<b>Auxiliary.BlankImpressions</b>	<b>Monitoring.CriticalAlerts</b>
<b>Auxiliary.FullColorImpressions</b>	<b>Monitoring.AbortedJobs</b>
<b>Auxiliary.ImpressionsTwoSided</b>	<b>Monitoring.CanceledJobs</b>
<b>Auxiliary.MonochromeImpressionsTwoSided</b>	<b>Monitoring.CompletedJobs</b>
<b>Auxiliary.BlankImpressionsTwoSided</b>	<b>Monitoring.CompletedFinisherJobs</b>
<b>Auxiliary.FullColorImpressionsTwoSided</b>	<b>Monitoring.MemoryAllocErrors</b>
<b>Maintenance.Images</b>	<b>Monitoring.MemoryAllocWarnings</b>
<b>Maintenance.MonochromeImages</b>	<b>Monitoring.StorageAllocErrors</b>
<b>Maintenance.FullColorImages</b>	<b>Monitoring.StorageAllocWarnings</b>
<b>Maintenance.Impressions</b>	<b>Monitoring.LocalStorageKOctets</b>
<b>Maintenance.MonochromeImpressions</b>	<b>Monitoring.RemoteStorageKOctets</b>
<b>Maintenance.BlankImpressions</b>	

### 6.6 PSTN FaxOut Service Counters List

The FaxOut service counters count subset of items that are directly associated with the outbound fax service over the Public Switched Telephone Network (PSTN);i.e. when the Imaging System is sending a facsimile product using International Telecommunications Union (ITU) recommendation T.30). The FaxOut service has the following counters.

<b>WorkTotals.Images</b>	<b>Availability.MaintenanceTime</b>
<b>WorkTotals.MonochromeImages</b>	<b>Availability.ProcessingTime</b>
<b>WorkTotals.FullColorImages</b>	<b>Availability.TotalTime</b>
<b>WorkTotals.OutputKOctets</b>	<b>Monitoring.ConfigChanges</b>
<b>WorkTotals.OutputMessages</b>	<b>Monitoring.TotalAlerts</b>
<b>Datastream.Images</b>	<b>Monitoring.CriticalAlerts</b>
<b>Datastream.MonochromeImages</b>	<b>Monitoring.AbortedJobs</b>
<b>Datastream.FullColorImages</b>	<b>Monitoring.CanceledJobs</b>
<b>Datastream.OutputKOctets</b>	<b>Monitoring.CompletedJobs</b>
<b>Datastream.OutputMessages</b>	<b>Monitoring.CompletedFinisherJobs</b>
<b>Maintenance.Images</b>	<b>Monitoring.MemoryAllocErrors</b>
<b>Maintenance.MonochromeImages</b>	<b>Monitoring.MemoryAllocWarnings</b>
<b>Maintenance.FullColorImages</b>	<b>Monitoring.StorageAllocErrors</b>
<b>Maintenance.OutputKOctets</b>	<b>Monitoring.StorageAllocWarnings</b>
<b>Maintenance.OutputMessages</b>	<b>Monitoring.LocalStorageKOctets</b>
<b>Availability.DownTime</b>	<b>Monitoring.RemoteStorageKOctets</b>

## 6.7 NetworkFaxIn Service Counters List

The NetworkFaxIn service counters count subset of items that are directly associated with the inbound network fax service (i.e. when the Imaging System is receiving Internet Fax [rfc2305] or IPP Fax [IPPFAX]). The FaxIn service has the following counters

<b>WorkTotals.Images</b>	<b>Maintenance.MonochromeImpressions</b>
<b>WorkTotals.MonochromeImages</b>	<b>Maintenance.BlankImpressions</b>
<b>WorkTotals.FullColorImages</b>	<b>Maintenance.FullColorImpressions</b>
<b>WorkTotals.Impressions</b>	<b>Maintenance.ImpressionsTwoSided</b>
<b>WorkTotals.MonochromeImpressions</b>	<b>Maintenance.MonochromeImpressionsTwoSided</b>
<b>WorkTotals.BlankImpressions</b>	<b>Maintenance.BlankImpressionsTwoSided</b>
<b>WorkTotals.FullColorImpressions</b>	<b>Maintenance.FullColorImpressionsTwoSided</b>
<b>WorkTotals.ImpressionsTwoSided</b>	<b>Maintenance.InputKOctets</b>
<b>WorkTotals.MonochromeImpressionsTwoSided</b>	<b>Maintenance.InputMessages</b>
<b>WorkTotals.BlankImpressionsTwoSided</b>	<b>Waste.Impressions</b>
<b>WorkTotals.FullColorImpressionsTwoSided</b>	<b>Waste.MonochromeImpressions</b>
<b>WorkTotals.InputKOctets</b>	<b>Waste.BlankImpressions</b>
<b>WorkTotals.InputMessages</b>	<b>Waste.FullColorImpressions</b>
<b>Datastream.Images</b>	<b>Waste.ImpressionsTwoSided</b>
<b>Datastream.MonochromeImages</b>	<b>Waste.MonochromeImpressionsTwoSided</b>
<b>Datastream.FullColorImages</b>	<b>Waste.BlankImpressionsTwoSided</b>
<b>Datastream.Impressions</b>	<b>Waste.FullColorImpressionsTwoSided</b>
<b>Datastream.MonochromeImpressions</b>	<b>MediaUsed.Sheets</b>
<b>Datastream.BlankImpressions</b>	<b>MediaUsed.MonochromeSheets</b>
<b>Datastream.FullColorImpressions</b>	<b>MediaUsed.BlankSheets</b>
<b>Datastream.ImpressionsTwoSided</b>	<b>MediaUsed.FullColorSheets</b>
<b>Datastream.MonochromeImpressionsTwoSided</b>	<b>Availability.DownTime</b>
<b>Datastream.BlankImpressionsTwoSided</b>	<b>Availability.MaintenanceTime</b>
<b>Datastream.FullColorImpressionsTwoSided</b>	<b>Availability.ProcessingTime</b>
<b>Datastream.InputKOctets</b>	<b>Availability.TotalTime</b>
<b>Datastream.InputMessages</b>	<b>Monitoring.ConfigChanges</b>
<b>Auxiliary.Impressions</b>	<b>Monitoring.TotalAlerts</b>
<b>Auxiliary.MonochromeImpressions</b>	<b>Monitoring.CriticalAlerts</b>
<b>Auxiliary.BlankImpressions</b>	<b>Monitoring.AbortedJobs</b>
<b>Auxiliary.FullColorImpressions</b>	<b>Monitoring.CanceledJobs</b>
<b>Auxiliary.ImpressionsTwoSided</b>	<b>Monitoring.CompletedJobs</b>
<b>Auxiliary.MonochromeImpressionsTwoSided</b>	<b>Monitoring.CompletedFinisherJobs</b>
<b>Auxiliary.BlankImpressionsTwoSided</b>	<b>Monitoring.MemoryAllocErrors</b>
<b>Auxiliary.FullColorImpressionsTwoSided</b>	<b>Monitoring.MemoryAllocWarnings</b>
<b>Maintenance.Images</b>	<b>Monitoring.StorageAllocErrors</b>
<b>Maintenance.MonochromeImages</b>	<b>Monitoring.StorageAllocWarnings</b>
<b>Maintenance.FullColorImages</b>	<b>Monitoring.LocalStorageKOctets</b>
<b>Maintenance.Impressions</b>	<b>Monitoring.RemoteStorageKOctets</b>

## 6.8 NetworkFaxOut Service Counters List

The NetworkFaxOut service counters count subset of items that are directly associated with the outbound network fax service (i.e. when the device is sending Internet Fax [rfc2305] or IPP Fax [IPPFAX]). The FaxOut service has the following counters.

<b>WorkTotals.Images</b>	<b>Maintenance.MonochromeImages</b>
<b>WorkTotals.MonochromeImages</b>	<b>Maintenance.FullColorImages</b>
<b>WorkTotals.FullColorImages</b>	<b>Maintenance.OutputKOctets</b>
<b>WorkTotals.OutputKOctets</b>	<b>Maintenance.OutputMessages</b>
<b>WorkTotals.OutputMessages</b>	<b>Availability.DownTime</b>
<b>Datastream.Images</b>	<b>Availability.MaintenanceTime</b>
<b>Datastream.MonochromeImages</b>	<b>Availability.ProcessingTime</b>
<b>Datastream.FullColorImages</b>	<b>Availability.TotalTime</b>
<b>Datastream.OutputKOctets</b>	<b>Monitoring.ConfigChanges</b>
<b>Datastream.OutputMessages</b>	<b>Monitoring.TotalAlerts</b>
<b>Maintenance.Images</b>	<b>Monitoring.CriticalAlerts</b>

Monitoring.AbortedJobs  
 Monitoring.CanceledJobs  
 Monitoring.CompletedJobs  
 Monitoring.CompletedFinisherJobs  
 Monitoring.MemoryAllocErrors

Monitoring.MemoryAllocWarnings  
 Monitoring.StorageAllocErrors  
 Monitoring.StorageAllocWarnings  
 Monitoring.LocalStorageKOctets  
 Monitoring.RemoteStorageKOctets

## 6.9 Print Service Counters List

The Print service counters count subset of items that are directly associated with the print service (i.e. when the Imaging System is printing jobs submitted via a network local or remote print protocol (e.g. LPD/LPR, IPP)). The Print service has the following counters.

WorkTotals.Impressions  
 WorkTotals.MonochromeImpressions  
 WorkTotals.BlankImpressions  
 WorkTotals.FullColorImpressions  
 WorkTotals.HighlightColorImpressions  
 WorkTotals.ImpressionsTwoSided  
 WorkTotals.MonochromeImpressionsTwoSided  
 WorkTotals.BlankImpressionsTwoSided  
 WorkTotals.FullColorImpressionsTwoSided  
 WorkTotals.HighlightColorImpressionsTwoSided  
 WorkTotals.InputKOctets  
 Datastream.Impressions  
 Datastream.MonochromeImpressions  
 Datastream.BlankImpressions  
 Datastream.FullColorImpressions  
 Datastream.HighlightColorImpressions  
 Datastream.ImpressionsTwoSided  
 Datastream.MonochromeImpressionsTwoSided  
 Datastream.BlankImpressionsTwoSided  
 Datastream.FullColorImpressionsTwoSided  
 Datastream.HighlightColorImpressionsTwoSided  
 Datastream.InputKOctets  
 Auxiliary.Impressions  
 Auxiliary.MonochromeImpressions  
 Auxiliary.BlankImpressions  
 Auxiliary.FullColorImpressions  
 Auxiliary.HighlightColorImpressions  
 Auxiliary.ImpressionsTwoSided  
 Auxiliary.MonochromeImpressionsTwoSided  
 Auxiliary.BlankImpressionsTwoSided  
 Auxiliary.FullColorImpressionsTwoSided  
 Auxiliary.HighlightColorImpressionsTwoSided  
 Maintenance.Impressions  
 Maintenance.MonochromeImpressions  
 Maintenance.BlankImpressions  
 Maintenance.FullColorImpressions  
 Maintenance.HighlightColorImpressions  
 Maintenance.ImpressionsTwoSided

Maintenance.MonochromeImpressionsTwoSided  
 Maintenance.BlankImpressionsTwoSided  
 Maintenance.FullColorImpressionsTwoSided  
 Maintenance.HighlightColorImpressionsTwoSided  
 Maintenance.InputKOctets  
 Waste.Impressions  
 Waste.MonochromeImpressions  
 Waste.BlankImpressions  
 Waste.FullColorImpressions  
 Waste.HighlightColorImpressions  
 Waste.ImpressionsTwoSided  
 Waste.MonochromeImpressionsTwoSided  
 Waste.BlankImpressionsTwoSided  
 Waste.FullColorImpressionsTwoSided  
 Waste.HighlightColorImpressionsTwoSided  
 MediaUsed.Sheets  
 MediaUsed.MonochromeSheets  
 MediaUsed.BlankSheets  
 MediaUsed.FullColorSheets  
 MediaUsed.HighlightColorSheet  
 Availability.DownTime  
 Availability.MaintenanceTime  
 Availability.ProcessingTime  
 Availability.TotalTime  
 Monitoring.ConfigChanges  
 Monitoring.TotalAlerts  
 Monitoring.CriticalAlerts  
 Monitoring.AbortedJobs  
 Monitoring.CanceledJobs  
 Monitoring.CompletedJobs  
 Monitoring.CompletedFinisherJobs  
 Monitoring.MemoryAllocErrors  
 Monitoring.MemoryAllocWarnings  
 Monitoring.StorageAllocErrors  
 Monitoring.StorageAllocWarnings  
 Monitoring.LocalStorageKOctets  
 Monitoring.RemoteStorageKOctets

## 6.10 Scan Service Counters List

The Scan service counters measure a subset of items that are directly associated with the Scan service (i.e. when the Imaging System is scanning, storing or transmitting an image). These counters are not affected by the Copy, FaxOut or NetworkFaxOut Services. The Scan service has the following counters.

WorkTotals.Images  
 WorkTotals.MonochromeImages  
 WorkTotals.FullColorImages  
 WorkTotals.InputKOctets

WorkTotals.OutputKOctets  
 Datastream.Images  
 Datastream.MonochromeImages  
 Datastream.FullColorImages

**Datastream.InputKOctets**  
**Datastream.OutputKOctets**  
**Maintenance.Images**  
**Maintenance.MonochromeImages**  
**Maintenance.FullColorImages**  
**Maintenance.InputKOctets**  
**Maintenance.OutputKOctets**  
**Availability.DownTime**  
**Availability.MaintenanceTime**  
**Availability.ProcessingTime**  
**Availability.TotalTime**  
**Monitoring.ConfigChanges**

**Monitoring.TotalAlerts**  
**Monitoring.CriticalAlerts**  
**Monitoring.AbortedJobs**  
**Monitoring.CanceledJobs**  
**Monitoring.CompletedJobs**  
**Monitoring.CompletedFinisherJobs**  
**Monitoring.MemoryAllocErrors**  
**Monitoring.MemoryAllocWarnings**  
**Monitoring.StorageAllocErrors**  
**Monitoring.StorageAllocWarnings**  
**Monitoring.LocalStorageKOctets**  
**Monitoring.RemoteStorageKOctets**

## 6.11 Transform Service Counters List

The Transform service counters count subset of items that are directly associated with the transform service (i.e. when the Imaging System is being used to transform data from one form to another). The Transform service has the following counters.

**WorkTotals.Images**  
**WorkTotals.MonochromeImages**  
**WorkTotals.FullColorImages**  
**WorkTotals.InputKOctets**  
**WorkTotals.OutputKOctets**  
**Datastream.Images**  
**Datastream.MonochromeImages**  
**Datastream.FullColorImages**  
**Datastream.InputKOctets**  
**Datastream.OutputKOctets**  
**Maintenance.Images**  
**Maintenance.MonochromeImages**  
**Maintenance.FullColorImages**  
**Maintenance.InputKOctets**  
**Maintenance.OutputKOctets**  
**Availability.DownTime**

**Availability.MaintenanceTime**  
**Availability.ProcessingTime**  
**Availability.TotalTime**  
**Monitoring.ConfigChanges**  
**Monitoring.TotalAlerts**  
**Monitoring.CriticalAlerts**  
**Monitoring.AbortedJobs**  
**Monitoring.CanceledJobs**  
**Monitoring.CompletedJobs**  
**Monitoring.CompletedFinisherJobs**  
**Monitoring.MemoryAllocErrors**  
**Monitoring.MemoryAllocWarnings**  
**Monitoring.StorageAllocErrors**  
**Monitoring.StorageAllocWarnings**  
**Monitoring.LocalStorageKOctets**  
**Monitoring.RemoteStorageKOctets**

## 7 Counter Relationships

This section highlights some of the important relationships between the defined counters. When describing the relationships, the service specific counters are identified by using the simple service name as the “object” component of the counter name. For example the impression counter for the copy service is called Copy.Impressions. As indicated in paragraph 4.1.2, these simple names are not necessarily the same as the full counter element names that may be used in hypothetical schema. The aggregate counters that are bound to the System are named by prepending “SystemTotals” to the counter name. For example the total number of impressions for all the services on the Imaging System would be named SystemTotalsImpressions.

### 7.1 Relationships Common to All Services

The relationships in this section are common to all services that contain the associated counters. For example the relationship for Impression applies to Copy, EmailIn, FaxIn, NetworkFaxIn, Print and SystemTotals because “impressions” is applicable to these services. The relationship for Impression does not apply to EmailOut, FaxOut, NetworkFaxOut, Scan or Transform because “impressions” is not applicable to these services.

#### 7.1.1 Impressions

*Impressions = MonochromeImpressions + BlankImpressions + FullColorImpressions + HighlightColorImpressions*

An Impression counter contains the total number of impressions for the service to which it is bound or the total of all the impressions on the Imaging System if it is bound to SystemTotals. All Impression counters include both one sided and two sided impressions.

### 7.1.2 ImpressionsTwoSided

$$\text{ImpressionsTwoSided} = \text{MonochromeImpressionsTwoSided} + \text{BlankImpressionsTwoSided} + \text{FullColorImpressionsTwoSided} + \text{HighlightColorImpressionsTwoSided}$$

An ImpressionsTwoSided counter contains the total number of two sided impressions for the service to which it is bound or the total of all the two sided impressions on the Imaging System if it is bound to SystemTotals. ImpressionsTwoSided is always an even number. NOTE: TwoSided Impression counters do not include one sided impressions.

### 7.1.3 ImpressionsOneSided (virtual counter)

$$[\text{ImpressionsOneSided}] = \text{Impressions} - \text{ImpressionsTwoSided}$$

A one-sided impression virtual counter may be calculated using the relationship above.

### 7.1.4 Images

$$\text{Images} = \text{MonochromeImages} + \text{FullColorImages}$$

### 7.1.5 IdleTime (virtual counter)

$$\text{IdleTime} = \text{TotalTime} - \text{DownTime} - \text{MaintenanceTime} - \text{ProcessingTime}$$

An idle time virtual counter may be calculated using the relationship above.

## 7.2 SystemTotals Counters Simple Relationships

The relationships in this section apply to a SystemTotals aggregate for all services that contain the associated counters. For example the relationship for SystemTotalsImpressions is the sum of the impressions generated by the Copy, EmailIn, FaxIn, NetworkFaxIn and Print services since they all produce hard copy output (i.e. impressions). The SystemTotalsImpressions does not include EmailOut, FaxOut, NetworkFaxOut, Scan or Transform since they do not produce hard copy output (i.e. impressions). Note that in the paragraphs below, xxx represents the application designator of the counter (work, auxiliary, maintenance, waste).

### 7.2.1 SystemTotals.xxx.Impressions

$$\text{SystemTotals.xxx.Impressions} = \text{Copy.xxx.Impressions} + \text{EmailIn.xxx.Impressions} + \text{FaxIn.xxx.Impressions} + \text{NetworkFaxIn.xxx.Impressions} + \text{Print.xxx.Impressions}$$

### 7.2.2 SystemTotals.xxx.MonochromeImpressions

$$\text{SystemTotals.xxx.MonochromeImpressions} = \text{Copy.xxx.MonochromeImpressions} + \text{EmailIn.xxx.MonochromeImpressions} + \text{FaxIn.xxx.MonochromeImpressions} + \text{NetworkFaxIn.xxx.MonochromeImpressions} + \text{Print.xxx.MonochromeImpressions}$$

### 7.2.3 SystemTotals.xxx.BlankImpressions

$$\text{SystemTotals..xxx.BlankImpressions} = \text{Print.xxx.BlankImpressions} + \text{EmailIn.xxx.BlankImpressions}$$



### 7.2.4 *SystemTotals.xxx.FullColorImpressions*

*SystemTotals.xxx.FullColorImpressions* = *Copy.xxx.FullColorImpressions* + *EmailIn.xxx.FullColorImpressions* + *FaxIn.xxx.FullColorImpressions* + *NetworkFaxIn.xxx.FullColorImpressions* + *Print.xxx.FullColorImpressions*

### 7.2.5 *SystemTotals.xxx.HighlightColorImpressions*

*SystemTotals.xxx.HighlightColorImpressions* = *EmailIn.xxx.HighlightColorImpressions* + *Print.xxx.HighlightColorImpressions*

### 7.2.6 *SystemTotals.xxx.ImpressionsTwoSided*

*SystemTotals.xxx.ImpressionsTwoSided* = *Copy.xxx.ImpressionsTwoSided* + *EmailIn.xxx.ImpressionsTwoSided* + *FaxIn.xxx.ImpressionsTwoSided* + *NetworkFaxIn.xxx.ImpressionsTwoSided* + *Print.xxx.ImpressionsTwoSided*

### 7.2.7 *SystemTotals.xxx.MonochromeImpressionsTwoSided*

*SystemTotals.xxx.MonochromeImpressionsTwoSided* = *Copy.xxx.MonochromeImpressionsTwoSided* + *EmailIn.xxx.MonochromeImpressionsTwoSided* + *FaxIn.xxx.MonochromeImpressionsTwoSided* + *NetworkFaxIn.xxx.MonochromeImpressionsTwoSided* + *Print.xxx.MonochromeImpressionsTwoSided*

### 7.2.8 *SystemTotals.xxx.BlankImpressionsTwoSided*

*SystemTotals.xxx.BlankImpressionsTwoSided* = *Print.xxx.BlankImpressionsTwoSided* + *EmailIn.xxx.BlankImpressionsTwoSided*

### 7.2.9 *SystemTotals.xxx.FullColorImpressionsTwoSided*

*SystemTotals.xxx.FullColorImpressionsTwoSided* = *Copy.xxx.FullColorImpressionsTwoSided* + *EmailIn.xxx.FullColorImpressionsTwoSided* + *FaxIn.xxx.FullColorImpressionsTwoSided* + *NetworkFaxIn.xxx.FullColorImpressionsTwoSided* + *Print.xxx.FullColorImpressionsTwoSided*

### 7.2.10 *SystemTotals.xxx.HighlightColorImpressionsTwoSided*

*SystemTotals.xxx.HighlightColorImpressionsTwoSided* = *EmailIn.xxx.HighlightColorImpressionsTwoSided* + *Print.xxx.HighlightColorImpressionsTwoSided*

## 7.3 SystemTotals Counters Complex Relationships

SystemTotals of "Availability" counters do not follow the simple summation relationships for "Work" counters. For example, the *SystemTotals.Availability.TotalTime* is obviously not the sum of the times that each of the services are up. The following relations are defined.

### 7.3.1 *SystemTotals.Availability.TotalTime*

*SystemTotals.Availability.TotalTime* is the cumulative amount of time since the Imaging System has been initialized (i.e. not reset to zero on system restart). It is considered a primary counter, not derivable from other counters.

### 7.3.2 *SystemTotals.Availability.DownTime*

*SystemTotals.Availability.DownTime* is the period of time that the entire system has been down; i.e., all services have been down at the same time.

### *7.3.3 SystemTotals.Availability.MaintenanceTime*

SystemTotals.Availability.MaintenanceTime is the period of time the entire system is in Maintenance Mode; i.e., all services have been in maintenance mode at the same time.

### *7.3.4 SystemTotals.Availability.ProcessingTime*

SystemTotals.Availability.ProcessingTime is the period of time that at least one service has been processing a request.

### *7.3.5 SystemTotals.Availability.IdleTime (virtual counter)*

*SystemTotals.Availability.IdleTime*: =  
*SystemTotals.Availability.TotalTime* - *SystemTotals.Availability.ProcessingTime* -  
*SystemTotals.Availability.MaintenanceTime* - *SystemTotals.Availability.DownTime*

A system totals availability virtual counter may be calculated using the existing counters by the above relation, not by summing the calculated idle time for each service.

## 8 Conformance

This section lists the elements that must be supported for an implementation to claim conformance to this document. As discussed in section 4, an implementation, as in a Multifunction Device product, is termed an Imaging System. A given Imaging System may include some subset of the identified Imaging Services. Following the “conditionally mandatory” precept, elements applicable to the services not supported by a given Imaging System need not be supported to claim conformance to this document. However, in addition to those elements specific to the services included, the Imaging System must support the System Total elements applicable to the set of services supported. These System Total elements, identified in paragraph 7.1, consist of aggregate totals of counters with like units, associated with all included services. For example, a Simplex Monochrome Imaging System including Printing, incoming PSTN Fax and Copy services must support the mandatory elements identified for the included services and must also support the elements identified in paragraph 7.1.1 which represent total impressions and times associated with all supported services.

Note that the mandatory counters include those for total Impressions, MonochromeImpressions and BlankImpressions although, as indicated in section 7, one of the three can be derived. This was done to accommodate management applications by ensuring that the potentially most interesting counters are readily available without need for calculation.

### 8.1 Mandatory System Total Counters

#### 8.1.1 Mandatory for all Simplex Monochrome Hard Copy Imaging Systems

SystemTotals.WorkTotals.Impressions	SystemTotals.Availability.DownTime
SystemTotals.WorkTotals.MonochromeImpressions	SystemTotals.Availability.ProcessingTime
SystemTotals.WorkTotals.BlankImpressions	SystemTotals.Availability.TotalTime

#### 8.1.2 Mandatory for all Simplex Color Hard Copy Imaging Systems

SystemTotals.WorkTotals.Impressions	SystemTotals.Availability.DownTime
SystemTotals.WorkTotals.MonochromeImpressions	SystemTotals.Availability.ProcessingTime
SystemTotals.WorkTotals.BlankImpressions	SystemTotals.Availability.TotalTime
SystemTotals.WorkTotals.FullColorImpressions	

#### 8.1.3 Mandatory for all Duplex Monochrome Hard Copy Imaging Systems

SystemTotals.WorkTotals.Impressions	SystemTotals.WorkTotals.BlankImpressionsTwoSided
SystemTotals.WorkTotals.MonochromeImpressions	SystemTotals.Availability.DownTime
SystemTotals.WorkTotals.BlankImpressions	SystemTotals.Availability.ProcessingTime
SystemTotals.WorkTotals.ImpressionsTwoSided	SystemTotals.Availability.TotalTime
SystemTotals.WorkTotals.MonochromeImpressionsTwoSided	

#### 8.1.4 Mandatory for all Duplex Color Hard Copy Imaging Systems

SystemTotals.WorkTotals.Impressions	SystemTotals.WorkTotals.BlankImpressionsTwoSided
SystemTotals.WorkTotals.MonochromeImpressions	SystemTotals.WorkTotals.FullColorImpressionsTwoSided
SystemTotals.WorkTotals.BlankImpressions	SystemTotals.Availability.DownTime
SystemTotals.WorkTotals.FullColorImpressions	SystemTotals.Availability.ProcessingTime
SystemTotals.WorkTotals.ImpressionsTwoSided	SystemTotals.Availability.TotalTime
SystemTotals.WorkTotals.MonochromeImpressionsTwoSided	

### 8.2 Mandatory Copy Service Counters

#### 8.2.1 Mandatory for Simplex Monochrome Copy Services

Copy.WorkTotals.Impressions	Copy.MediaUsed.Sheets
Copy.WorkTotals.MonochromeImpressions	

#### 8.2.2 Mandatory for Simplex Color Copy Services

Copy.WorkTotals.Impressions	Copy.WorkTotals.FullColorImpressions
Copy.WorkTotals.MonochromeImpressions	Copy.MediaUsed.Sheets

### 8.2.3 Mandatory for Duplex Monochrome Copy Service

Copy.WorkTotals.Impressions  
 Copy.WorkTotals.MonochromeImpressions  
 Copy.WorkTotals.ImpressionsTwoSided

Copy.WorkTotals.MonochromeImpressionsTwoSided  
 Copy.MediaUsed.Sheets

### 8.2.4 Mandatory for Duplex Color Copy Services

Copy.WorkTotals.Impressions  
 Copy.WorkTotals.MonochromeImpressions  
 Copy.WorkTotals.FullColorImpressions  
 Copy.WorkTotals.ImpressionsTwoSided

Copy.WorkTotals.MonochromeImpressionsTwoSided  
 Copy.WorkTotals.FullColorImpressionsTwoSided  
 Copy.MediaUsed.Sheets

## 8.3 Mandatory EmailIn Service Counters

### 8.3.1 Mandatory for Simplex Monochrome EmailIn Services

EmailIn.WorkTotals.Images  
 EmailIn.WorkTotals.Impressions  
 EmailIn.WorkTotals.MonochromeImpressions  
 EmailIn.WorkTotals.BlankImpressions

EmailIn.WorkTotals.InputKOctets  
 EmailIn.WorkTotals.InputMessages  
 EmailIn.MediaUsed.Sheets

### 8.3.2 Mandatory for Simplex Color EmailIn Services

EmailIn.WorkTotals.Images  
 EmailIn.WorkTotals.Impressions  
 EmailIn.WorkTotals.MonochromeImpressions  
 EmailIn.WorkTotals.BlankImpressions

EmailIn.WorkTotals.FullColorImpressions  
 EmailIn.WorkTotals.InputKOctets  
 EmailIn.WorkTotals.InputMessages  
 EmailIn.MediaUsed.Sheets

### 8.3.3 Mandatory for Duplex Monochrome EmailIn Services

EmailIn.WorkTotals.Images  
 EmailIn.WorkTotals.Impressions  
 EmailIn.WorkTotals.MonochromeImpressions  
 EmailIn.WorkTotals.BlankImpressions  
 EmailIn.WorkTotals.InputKOctets

EmailIn.WorkTotals.InputMessages  
 EmailIn.WorkTotals.ImpressionsTwoSided  
 EmailIn.WorkTotals.MonochromeImpressionsTwoSided  
 EmailIn.WorkTotals.BlankImpressionsTwoSided  
 EmailIn.MediaUsed.Sheets

### 8.3.4 Mandatory for Duplex Color EmailIn Services

EmailIn.WorkTotals.Images  
 EmailIn.WorkTotals.Impressions  
 EmailIn.WorkTotals.MonochromeImpressions  
 EmailIn.WorkTotals.BlankImpressions  
 EmailIn.WorkTotals.FullColorImpressions  
 EmailIn.WorkTotals.ImpressionsTwoSided

EmailIn.WorkTotals.MonochromeImpressionsTwoSided  
 EmailIn.WorkTotals.BlankImpressionsTwoSided  
 EmailIn.WorkTotals.FullColorImpressionsTwoSided  
 EmailIn.MediaUsed.Sheets  
 EmailIn.WorkTotals.InputKOctets  
 EmailIn.WorkTotals.InputMessages

## 8.4 Mandatory EmailOut Service Counters

### 8.4.1 Mandatory for EmailOut Services

EmailOut.WorkTotals.Images  
 EmailOut.WorkTotals.OutputKOctets

EmailOut.WorkTotals.OutputMessages

## 8.5 Mandatory PSTN FaxIn Service Counters

### 8.5.1 Mandatory for Simplex Monochrome FaxIn Services

FaxIn.WorkTotals.Images  
 FaxIn.WorkTotals.Impressions  
 FaxIn.WorkTotals.MonochromeImpressions  
 FaxIn.WorkTotals.BlankImpressions

FaxIn.WorkTotals.InputKOctets  
 FaxIn.WorkTotals.InputMessages  
 FaxIn.MediaUsed.Sheets

### 8.5.2 Mandatory for Simplex Color FaxIn Services

FaxIn.WorkTotals.Images  
 FaxIn.WorkTotals.Impressions  
 FaxIn.WorkTotals.MonochromeImpressions  
 FaxIn.WorkTotals.BlankImpressions

FaxIn.WorkTotals.FullColorImpressions  
 FaxIn.WorkTotals.InputKOctets  
 FaxIn.WorkTotals.InputMessages  
 FaxIn.MediaUsed.Sheets

### 8.5.3 Mandatory for Duplex Monochrome FaxIn Services

FaxIn.WorkTotals.Images

FaxIn.WorkTotals.Impressions

FaxIn.WorkTotals.MonochromeImpressions  
 FaxIn.WorkTotals.BlankImpressions  
 FaxIn.WorkTotals.ImpressionsTwoSided  
 FaxIn.WorkTotals.MonochromeImpressionsTwoSided

FaxIn.WorkTotals.BlankImpressionsTwoSided  
 FaxIn.WorkTotals.InputKOctets  
 FaxIn.WorkTotals.InputMessages  
 FaxIn.MediaUsed.Sheets

*8.5.4 Mandatory for Duplex Color FaxIn Services*

FaxIn.WorkTotals.Images  
 FaxIn.WorkTotals.Impressions  
 FaxIn.WorkTotals.MonochromeImpressions  
 FaxIn.WorkTotals.BlankImpressions  
 FaxIn.WorkTotals.FullColorImpressions  
 FaxIn.WorkTotals.ImpressionsTwoSided

FaxIn.WorkTotals.MonochromeImpressionsTwoSided  
 FaxIn.WorkTotals.BlankImpressionsTwoSided  
 FaxIn.WorkTotals.FullColorImpressionsTwoSided  
 FaxIn.WorkTotals.InputKOctets  
 FaxIn.WorkTotals.InputMessages  
 FaxIn.MediaUsed.Sheets

**8.6 Mandatory PSTN FaxOut Service Counters**

*8.6.1 Mandatory for all Monochrome FaxOut Services*

FaxOut.WorkTotals.Images  
 FaxOut.WorkTotals.OutputKOctets  
 FaxOut.WorkTotals.OutputMessages

FaxOut.Availability.DownTime  
 FaxOut.Availability.ProcessingTime  
 FaxOut.Availability.TotalTime

*8.6.2 Mandatory for all Color FaxOut Services*

FaxOut.WorkTotals.Images  
 FaxOut.WorkTotals.MonochromeImages  
 FaxOut.WorkTotals.FullColorImages  
 FaxOut.WorkTotals.OutputKOctets

FaxOut.WorkTotals.OutputMessages  
 FaxOut.Availability.ProcessingTime  
 FaxOut.Availability.TotalTime  
 FaxOut.Availability.DownTime

**8.7 Mandatory Network FaxIn Service Counters**

*8.7.1 Mandatory for all Simplex Monochrome Network FaxIn Services*

NetworkFaxIn.WorkTotals.Images  
 NetworkFaxIn.WorkTotals.MonochromeImages  
 NetworkFaxIn.WorkTotals.Impressions  
 NetworkFaxIn.WorkTotals.MonochromeImpressions  
 NetworkFaxIn.WorkTotals.BlankImpressions  
 NetworkFaxIn.WorkTotals.InputKOctets

NetworkFaxIn.WorkTotals.InputMessages  
 NetworkFaxIn.MediaUsed.Sheets  
 NetworkFaxIn.Availability.DownTime  
 NetworkFaxIn.Availability.ProcessingTime  
 NetworkFaxIn.Availability.TotalTime

*8.7.2 Mandatory for all Simplex Color Network FaxIn Services*

NetworkFaxIn.WorkTotals.Images  
 NetworkFaxIn.WorkTotals.MonochromeImages  
 NetworkFaxIn.WorkTotals.FullColorImages  
 NetworkFaxIn.WorkTotals.Impressions  
 NetworkFaxIn.WorkTotals.MonochromeImpressions  
 NetworkFaxIn.WorkTotals.BlankImpressions  
 NetworkFaxIn.WorkTotals.FullColorImpressions

NetworkFaxIn.MediaUsed.Sheets  
 NetworkFaxIn.WorkTotals.InputKOctets  
 NetworkFaxIn.WorkTotals.InputMessages  
 NetworkFaxIn.Availability.DownTime  
 NetworkFaxIn.Availability.ProcessingTime  
 NetworkFaxIn.Availability.TotalTime

*8.7.3 Mandatory for all Duplex Monochrome Network FaxIn Services*

NetworkFaxIn.WorkTotals.Images  
 NetworkFaxIn.WorkTotals.MonochromeImages  
 NetworkFaxIn.WorkTotals.Impressions  
 NetworkFaxIn.WorkTotals.MonochromeImpressions  
 NetworkFaxIn.WorkTotals.BlankImpressions  
 NetworkFaxIn.WorkTotals.ImpressionsTwoSided  
 NetworkFaxIn.WorkTotals.MonochromeImpressionsTwoSided  
 ided

NetworkFaxIn.WorkTotals.BlankImpressionsTwoSided  
 NetworkFaxIn.MediaUsed.Sheets  
 NetworkFaxIn.WorkTotals.InputKOctets  
 NetworkFaxIn.WorkTotals.InputMessages  
 NetworkFaxIn.Availability.DownTime  
 NetworkFaxIn.Availability.ProcessingTime  
 NetworkFaxIn.Availability.TotalTime

*8.7.4 Mandatory for all Duplex Color Network FaxIn Services*

NetworkFaxIn.WorkTotals.Images  
 NetworkFaxIn.WorkTotals.MonochromeImages  
 NetworkFaxIn.WorkTotals.FullColorImages  
 NetworkFaxIn.WorkTotals.Impressions  
 NetworkFaxIn.WorkTotals.MonochromeImpressions  
 NetworkFaxIn.WorkTotals.BlankImpressions  
 NetworkFaxIn.WorkTotals.FullColorImpressions  
 NetworkFaxIn.WorkTotals.ImpressionsTwoSided

NetworkFaxIn.WorkTotals.MonochromeImpressionsTwoSided  
 NetworkFaxIn.WorkTotals.BlankImpressionsTwoSided  
 NetworkFaxIn.WorkTotals.FullColorImpressionsTwoSided  
 NetworkFaxIn.MediaUsed.Sheets  
 NetworkFaxIn.WorkTotals.InputKOctets  
 NetworkFaxIn.WorkTotals.InputMessages  
 NetworkFaxIn.Availability.DownTime  
 NetworkFaxIn.Availability.ProcessingTime

NetworkFaxIn.Availability.TotalTime

## 8.8 Mandatory Network FaxOut Service Counters

### 8.8.1 Mandatory for all Monochrome Network FaxOut Services

NetworkFaxOut.WorkTotals.Images  
 NetworkFaxOut.WorkTotals.MonochromeImages  
 NetworkFaxOut.WorkTotals.OutputKOctets  
 NetworkFaxOut.WorkTotals.OutputMessages

NetworkFaxOut.Availability.DownTime  
 NetworkFaxOut.Availability.ProcessingTime  
 NetworkFaxOut.Availability.TotalTime

### 8.8.2 Mandatory for all Color Network FaxOut Services

NetworkFaxOut.WorkTotals.Images  
 NetworkFaxOut.WorkTotals.MonochromeImages  
 NetworkFaxOut.WorkTotals.FullColorImages  
 NetworkFaxOut.WorkTotals.OutputKOctets

NetworkFaxOut.WorkTotals.OutputMessages  
 NetworkFaxOut.Availability.DownTime  
 NetworkFaxOut.Availability.ProcessingTime  
 NetworkFaxOut.Availability.TotalTime

## 8.9 Mandatory Print Service Counters

### 8.9.1 Mandatory for all Simplex Monochrome Print Services

Print.WorkTotals.Impressions  
 Print.WorkTotals.MonochromeImpressions  
 Print.WorkTotals.BlankImpressions  
 Print.MediaUsed.Sheets

Print.Availability.DownTime  
 Print.Availability.ProcessingTime  
 Print.Availability.TotalTime

### 8.9.2 Mandatory for all Simplex Color Print Services

Print.WorkTotals.Impressions  
 Print.WorkTotals.MonochromeImpressions  
 Print.WorkTotals.BlankImpressions  
 Print.WorkTotals.FullColorImpressions

Print.MediaUsed.Sheets  
 Print.Availability.DownTime  
 Print.Availability.ProcessingTime  
 Print.Availability.TotalTime

### 8.9.3 Mandatory for all Duplex Monochrome Print Services

Print.WorkTotals.Impressions  
 Print.WorkTotals.MonochromeImpressions  
 Print.WorkTotals.BlankImpressions  
 Print.WorkTotals.ImpressionsTwoSided  
 Print.WorkTotals.MonochromeImpressionsTwoSided

Print.WorkTotals.BlankImpressionsTwoSided  
 Print.MediaUsed.Sheets  
 Print.Availability.DownTime  
 Print.Availability.ProcessingTime  
 Print.Availability.TotalTime

### 8.9.4 Mandatory for all Duplex Color Print Services

Print.WorkTotals.Impressions  
 Print.WorkTotals.MonochromeImpressions  
 Print.WorkTotals.BlankImpressions  
 Print.WorkTotals.FullColorImpressions  
 Print.WorkTotals.ImpressionsTwoSided  
 Print.WorkTotals.MonochromeImpressionsTwoSided

Print.WorkTotals.BlankImpressionsTwoSided  
 Print.WorkTotals.FullColorImpressionsTwoSided  
 Print.MediaUsed.Sheets  
 Print.Availability.DownTime  
 Print.Availability.ProcessingTime  
 Print.Availability.TotalTime

## 8.10 Mandatory Scan Service Counters

### 8.10.1 Mandatory for all Scan Services

Scan.WorkTotals.Images  
 Scan.WorkTotals.OutputKOctets  
 Scan.Availability.DownTime

Scan.Availability.ProcessingTime  
 Scan.Availability.TotalTime

## 8.11 Mandatory Transform Service Counters

### 8.11.1 Mandatory for all Transform Services

Transform.WorkTotals.InputKOctets  
 Transform.WorkTotals.OutputKOctets  
 Transform.Availability.DownTime

Transform.Availability.ProcessingTime  
 Transform.Availability.TotalTime

## 9 PWG and IANA Considerations

This document requires that the new elements identified in Section 4 be added to the PWG Semantic Model. There is no requirement for additional IANA registration support.

## 10 Internationalization Considerations

Because this document only defines integer abstract elements and does not define any string abstract elements, there are no applicable internationalization considerations.

The abstract elements defined in this document may be mapped to a concrete syntax (e.g., XML schema, SNMP MIB, or IPP/1.1 [RFC2911]), but there would still be no applicable internationalization considerations.

User applications (e.g., accounting or monitoring) displaying counters SHOULD conform to all the best practice recommendations in "IETF Policy on Character Sets and Languages" [RFC2277]. For example, counter labels and help text should be stored in message catalogs indexed by language tags [RFC3066].

## 11 Security Considerations

Although all of the counters elements defined in this document are intended as monitoring rather than management elements, and therefore do not allow reconfiguration of devices or disruption of services, the information contained in these counters should be considered privileged. Therefore, the protocols used to access these counters must provide for mutual authentication of the accessor and the source and should allow for encryption of the counter data communicated.

## 12 Normative References

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[RFC2911]	Hastings, Herriot, deBry, Isaacson, Powell. "Internet Printing Protocol/1.1: Model and Semantics", RFC 2911, September 2000.
[PWG5105.1]	Zehler, Hastings, Albright. "PWG Semantic Model Version 1.0", cs-sm10-20040120-5105.1.pdf, January 2004.
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[RFC3805]	Bergman, Lewis, McDonald. "Printer MIB v2", RFC 3805, June 2004 (obsoletes [RFC1759]).

## 13 Informative References

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	Printing Attributes - Set1", PWG 5100.3, February 2001.
[PWG5100.7]	Hastings, Zehler. "Internet Printing Protocol (IPP): Job Extensions", PWG 5100.7, October 2003.
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[RFC1759]	Smith, Wright, Hastings, Zilles, Gyllenskog. "Printer MIB v1", RFC 1759, March 1995 (obsoleted by [RFC3805]).
[RFC2567]	Wright. "Design Goals for an Internet Printing Protocol", RFC 2567, April 1999.
[RFC2568]	Zilles. "Rationale for the Structure of the Model and Protocol for the I Internet Printing Protocol", RFC 2568, April 1999.
[RFC2910]	Herriot, Butler, Moore, Turner, Wenn. "Internet Printing Protocol/1.1: Encoding and Transport", RFC 2910, September 2000.
[RFC2305]	Toyoda, Ohno, Murai, Wing. " A Simple Mode of Facsimile Using Internet Mail", RFC 2910, March 1998.
[IPPFAX]	Zehler, Hastings, Albright. " Standard for IPPFAX/1.0 Protocol", wd- ifx10-latest.pdf, May 2004. Work in progress
[ISO7498-1]	Information technology -- Open Systems Interconnection -- Basic Reference Model -- Part 1: The Basic Model, ISO 7498-1:1994.
[XML]	See [XML1.0] and [XML1.1] below.
[XML1.0]	"Extensible Markup Language (XML) 1.0 (Second Edition)", W3C Recommendation, October 2000.
[XML1.1]	"Extensible Markup Language (XML) 1.1", W3C Candidate Recommendation, October 2002.
[XSD]	See [XSD-1] and [XSD-2] below.
[XSD-1]	"XML Schema Part 1: Structures", W3C Recommendation, May 2001.
[XSD-2]	"XML Schema Part 2: Datatypes", W3C Recommendation, May 2001.



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