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Service Management Functions

Print and Output Management

patterns & practices

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Document Purpose

This guide provides detailed information about the print and output management service management function (SMF) for organizations that have deployed, or are considering deploying, Microsoft technologies in a data center or other type of enterprise computing environment. This is one of the more than 20 SMFs defined and described in Microsoft® Operations Framework (MOF). The guide assumes that the reader is familiar with the intent, background, and fundamental concepts of MOF as well as the Microsoft technologies discussed.

An overview of MOF and its companion, Microsoft Solutions Framework (MSF), is available in the *Introduction to Service Management Functions* guide. This overview guide also provides abstracts of each of the service management functions defined within MOF. Detailed information about the concepts and principles of each of the frameworks is also available in technical papers available at <http://www.microsoft.com/solutions/msm/>.

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Executive Summary

All business processes create some form of output. Examples of output include faxes, e-mails, Web pages, electronic transactions, and computer files. However, the most common form of output is the printed page, examples of which include invoices, customer statements, payroll checks, and financial reports. In fact, much of the value of an activity is measured in terms of the output, and the management of this business asset (referred to as "print and output management") is very important.

Print and output management deals with all data that is printed or compiled into reports that are distributed to various members of the organization. The print and output management process must also ensure that any sensitive printed material is properly secured. The goal of print and output management is to manage data and other printed output in line with service

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Process and Activities

Print and Output Management Overview

What is output? For the purposes of this document, output is defined as the conversion of data into a format suitable for viewing. Examples include the generation of simple American Standard Code for Information Interchange (ASCII) or Extended Binary Coded Decimal Interchange Code (EBCDIC) characters and control codes for an impact printer, creation of Printer Control Language (PCL) output for a laser printer, and generation of Hypertext Markup Language (HTML) data to be viewed in a browser.

People commonly think of output as human-readable for example, documents. However, barcodes (intended for machines), and optical character recognition (OCR) and magnetic-ink character recognition (MICR) output (intended for both humans and machines) also certainly fall into the broad category of "output."

To these lists of different formats and intended uses, add the concepts of delivery, reliability, and security to get a sense of the scope of this service management function.

Note: Although output refers to both documents and the other forms of output previously described, the primary emphasis in this paper is on printed documents; therefore, the term document is used extensively, although in most cases the activity, task, or concept being described applies to other forms of output as well. Non-printed forms of output will be touched on only briefly in this paper.

The management of output encompasses all the activities necessary to deliver output to a specific destination in the appropriate format and with the desired speed. Given this, the activities that encompass a print and output management process fall into three categories:

- Development activities that result in the creation of output.
- Configuration activities designed to prepare the environment for the delivery of output.
- Operational activities designed to maintain the flow of output.

In developing the print and output management infrastructure, it is useful to generalize many business applications in terms of the documents produced. Creating a common process workflow enables the sharing of tasks and resources across multiple applications.

If it is determined, for example, that the use of electronic forms facilitates the production of multiple application documents, a cross-functional organization specializing in forms design, implementation, and management may be the most efficient way to approach such a requirement. **Note:** The intended purpose of each document determines the phases, or primary activities, within the major steps of the print and output management process (development, configuration, delivery, and maintenance and support) that it must go through. One, two, or more of the phases may be involved—the important point is that each document has a defined life cycle.

The print and output management process has four major steps, each containing consists several primary activities. These activities reflect the life cycle stages of the document (or other form of output) and are listed in the

following table.

Table 1 Print and Output Management Process

Process Step	Activity	Activity Description
Print and Output Development	Initiation	During a normal design process, identify the specific need for document output. Establish and prioritize value criteria for each document.
	Requirements Definition	Create the specific requirements for each document. These requirements cover content, form, and flow of the document.
	Design	Given the requirements, design the document to accomplish the stated goals. Special considerations may include bar codes, optical marks for special applications, and so on.
	Generation	Determine how the document will be created. This may be very complex and may require multiple inputs from multiple sources.
	Print Application Development	Construct the supporting programs and procedures used to create the document.
Print and Output Configuration	Device Administration	Establish control and monitor printer configuration, micro-code levels, and hardware settings.
Print and Output Delivery	Distribution	Documents that serve multiple internal or external business functions determine the distribution strategy. Also address delivery confirmation and security issues in this step.
	Receipt	When distributed documents are

		received, initiate actions such as "return receipt".
Print and Output Maintenance and Support	Archive	Most organizations require the retention of documents for a certain period of time due to business or legal reasons. Retrieve and/or destroy the document/output in this step.
	Supplies Replenishment	Coordinate the delivery of paper, toner, ink, and other printing supplies.
	Service Desk	Coordinate hardware repair, and provide end-user and configuration support for output devices.

A "process" approach to print and output management utilizes common activities and tasks to facilitate the flow of information throughout an organization in a cost-effective manner.

The usual impediments to this approach are a lack of knowledge at the proper levels of the organization that a common process is available and the difficulty of using the process (if it is poorly designed). Care should be taken to design a process that is easy to use in order to perform the three necessary activities involved in achieving successful process management: communicate, communicate, communicate!

Goals and Objectives

The goal of print and output management is to ensure that all printed and electronic material is produced in the most efficient and cost-effective manner, using the most appropriate hardware and software available.

Scope

Print and output management is concerned with the design, implementation, security and management of an organization's output in order to meet the stated business requirements:

- Standards and standardization (such as corporate branding, page description language, graphics, multimedia, change control, and output devices)
- Output development (such as design of documents, print application development, and print resources)
- Production printing and high-volume printing
- Distributed printing
- Central reprographics

- Print-on-demand (such as digital prepress, color, and Internet printing)
- Mailroom automated document factory (ADF) processing
- Output environment management (such as queues, spoolers, data stream transforms, and character code translation)
- Print management
- Document management
- Forms management
- Document finishing

Key Definitions

American Standard Code for Information Interchange (ASCII). A standard single-byte character-encoding scheme used for computer text-based data. ASCII uses designated 7-bit or 8-bit number combinations to allow either 128 or 256 possible characters to be represented. Standard ASCII uses 7 bits to represent all uppercase and lowercase letters, the numbers 0 through 9, punctuation marks, and special control characters used in U.S. English. Most current Intel-based systems support the use of extended (or "high") ASCII. Extended ASCII allows the eighth bit of each character to be used to identify an additional 128 special symbol characters, foreign-language letters, and graphic symbols.

Font. A graphic design applied to a collection of numbers, symbols, and characters. A font describes a certain typeface, along with other qualities such as size, spacing, and pitch.

Hypertext Markup Language (HTML). A simple markup language used to create hypertext documents that are portable from one platform to another. HTML files are simple ASCII text files with codes embedded (indicated by markup tags) to denote formatting and hypertext links.

Intellectual property. Non-tangible property that is the result of creativity.

Optical character recognition (OCR). Identification of printed characters by using photoelectric devices.

Printer control language (PCL). Because of the widespread use of laser printers, this command language from Hewlett Packard has become a standard in many printers.

Page description language (PDL). A computer language developed by Hewlett Packard for their laser and inkjet printers that describes the arrangement of text and graphics on a printed page.

Plug and play. A set of specifications developed by Intel that allows a computer to automatically detect and configure a device and install the appropriate device drivers.

PostScript. A page-description language (PDL) developed by Adobe Systems for printing on laser printer's that offers flexible font capability and high-quality graphics. PostScript is the standard for desktop publishing because it is supported by imagesetters, the high-resolution printers used by printing services for commercial typesetting.

Printer driver. A program designed to allow other programs to work with a particular printer without being concerned with the specifics of the printers hardware and internal language. By using printer drivers to handle the subtleties of each printer, programs can work properly with a variety of

printers.

Print job. The source code that contains both the data to be printed and the commands for printing. Print jobs are classified into data types based on what modifications, if any, the spooler must make to the job for it to print correctly.

Print server. A computer that is dedicated to managing the printers on a network. The print server can be any computer on the network.

Print spooler. Computer software that accepts a document sent to a printer by the user and then stores it on disk or in memory until the printer is ready for it. This collection of dynamic-link libraries (DLLs) receives, processes, schedules, and distributes documents for printing. The term spooler is an acronym created from "simultaneous print operations on line."

Simple Network Management Protocol (SNMP). A network protocol used to manage TCP/IP networks. In Windows, the SNMP service provides status information about a host on a TCP/IP network.

Major Processes

Print and output management comprises of six main processes and a number of sub-processes as follows:

- Business requirements
 - Business strategy and tactics
 - Measurements
 - Manage intellectual property value
- Development activities
 - Initiation
 - Requirements definition
 - Document design
 - Electronic forms document finishing
 - Document generation
 - Print resources
 - Print application development
- Configuration activities
 - Printer properties
 - Assigning printer permissions
 - Enabling printer location tracking
 - Establishing a naming convention for locations
 - Setting standards when printer location tracking is disabled
 - Sizing and choosing printers
 - Deciding where to locate printers
 - Managing printers
 - Managing printer drivers

- Setting document printing defaults
- Managing printing traffic
 - Scheduling printing times
 - Setting print spooler options
 - Creating a printing pool
- Delivery activities
 - Distribution
 - Physical versus electronic distribution
 - Presentation resources
 - Document receipt
 - High volume printing
 - Distributed printing
 - Alternative forms of output
 - XML format
 - HTML format
 - PDF format
 - E-mail
 - Faxing
 - Mobile devices
 - Short messaging services
 - Print anything anywhere
 - Mailroom automated document factory (ADF) processing
 - Pre-processing for workflow management
 - Post-processing for workflow management
- Maintenance and support activities
 - Supplies replenishment
 - Document repository and archiving
 - Document retention
 - Archiving systems
 - The central document repository
 - Storage and retrieval
 - Indexing
 - Viewing
 - Reprint
- Capture

- Spoolers
 - Printer queues
 - Data stream transforms
 - Life cycle management
- Standards and standardization
 - Page description language
 - Printer naming considerations
 - Consideration for output internationalization and migration
 - Font standards and international code pages
 - Barcodes, paper sizes and post-processing

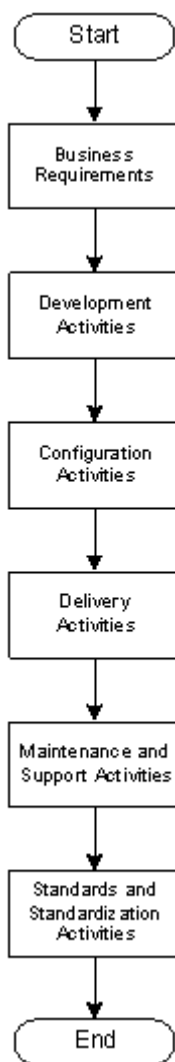


Figure 1: Print and output management process flow diagram

Business Requirements

An effective and efficient print and output management process is a

necessary part of a company's business strategy today. In fact, the critical starting point for the design of a successful print and output management process is the business strategy or operational plan. Using well-defined print and output management procedures helps companies run their business, meet their targets, and achieve overall positive results. The underlying functions of the print and output management process should be well thought out beforehand—with the printers placed in the correct physical location for maximum results. It is important that these functions exist or be accounted for, even though their physical locations might vary from one organization to another.

Using the information provided by the business strategy, an effort should be made to prioritize output (print, fax, e-mail, Web pages) by value. In this context, value refers to the output's effect on business functions. For example, invoices have a high value because cash flow is directly affected. Financial reports also have high value because of investor expectations. With the resulting prioritized list, the next step is to construct a workflow for high value documents. Operations can then use the workflow to look for opportunities to consolidate print and output management resources and still meet business needs.

All organizations need to plan for change and potential disruptions to the normal business environment. This applies to the print and output management process and requires the capability to perform as-needed printing and to respond to both short- and long-term changes. (This planning activity needs to be an ongoing activity to keep the environment updated.)

The following are some of the areas that need careful consideration.

Let Business Strategy and Tactics Drive Output Requirements

Today's successful businesses and companies extend beyond traditional areas such as marketing their business strategies to address IT infrastructure and computing-related practices. They gain competitive advantages by developing business-to-business and business-to-customer relationships based on fast and efficient practices. For example, such organizations use good, efficient, electronic services to build customer relationships, retain customers, and perform one-to-one marketing. The ability to direct marketing and other materials to a specific customer is often a competitive advantage. To take full advantage of this ability, business process and printing capabilities must be aligned.

Measure the Value of Output Management—Not Just the Costs

In planning a print and output management strategy, it is important to focus on the value of the information itself, not just on the cost of producing it. A prime example of this concept is found in investment banking. Investment bankers construct proposals to present to clients in order to interest them in investing in business ventures. Although the cost of these proposals can run into the thousands of dollars, the investment, if it is secured, may represent millions of dollars of business in investments and commissions.

Similarly, the cost of producing and distributing an invoice may be less than a dollar, but if the invoice represents hundreds of dollars of income for the business (or could affect the customer's perspective of the company) attention definitely should be paid to these values.

In the past, junk mail was an example of mass marketing. But in today's

information age there is a trend to try to construct marketing components that provide personal value to the recipient. If one can determine that the individual receiving an invoice might purchase a specific category of products, then that person should be sent specific information on those products. This approach saves production costs, but it can also result in better returns and hopefully avoid negative reactions on the customer's part.

Alternatively, it might be possible to assemble a repository of relevant literature and allow the individual to request that material on demand. The goal here is to make the most valuable information available to the most interested parties. Getting the right information to the right people in the right time frame is the essence of creating a high-value print and output management strategy.

Manage Intellectual Property (IP) Value

As value is measured by the types of output, a layer of management must be created to protect that information. This involves recognizing that output is considered to be intellectual property (IP) and invoking copyright and other government regulations to protect this property.

In some cases, intellectual property cannot be adequately protected by copyright laws, and business standards and processes must be put in place to restrict distribution of information, unless stronger measures are taken; "for example - nondisclosure contracts. In other cases, these processes must be supported by tracking and auditing standards to know who gets what information when," for example, nondisclosure contracts. A revision control capability might also be required to maintain output value and disallow the retrieval of incorrect or out-of-date information.

Controls and protections are critical in maintaining control of intellectual property and knowledge assets. Often the value of these assets is directly affected by the speed of dissemination. The format of output may affect this value by facilitating prompt delivery to the target consumer. This must be part of the planning process to achieve maximum results.

Print and Output Development Activities

Initiation

The initiation phase associated with document output refers to its conceptual origin. During the initiation phase, the purpose and relevance of the document should be clearly determined. This is the time when the business case and the need for the document become aligned. The longevity of the document should also be specified.

Requirements Definition

During the requirements definition phase, the content of the document is prepared. A list of data elements, any special characteristics, the document flow, and rough format are laid out. As more detailed information from the initiation phase is determined, it is included as well—in an iterative manner.

Document Design

The design of an electronic document is an important phase because this is when the document's physical characteristics and format are decided and recorded. (Although the presentation of the electronic document can take different forms, such as either print or Web view, the focus here is on printed documents.) The physical size of the document and whether it is to be electronic or printed is determined during this phase. If printed, it may be on letter size paper or A4 size paper (or both, if customized for

worldwide consumption), for example. Logos, signatures, and other graphics might also need to be placed strategically to aid in further communication, for example product branding or presenting the organization's design "look" or style.

Fonts convey information in and of themselves, making the selection of typeface, weight, shading, point, pitch, and other characteristics important. The document designer should take this, as well as the placement of information on the page, into consideration.

Some documents require the use of special features. Often these are used to encode machine-readable information into the document. Examples include:

- Bar codes
- Glyphs
- Optical marks
- Magnetic ink

In general, the document design is primarily concerned with the visual characteristics of the document. The most important constraint is the intended audience. For example, is this a financial report for in-house accounting staff, or is this an advertisement directed to a randomly selected audience? In the former case, one can assume that the audience is familiar with the data and is also locked-in; that is, they will not be going anywhere else for their data. In the latter example; however, the audience may have no familiarity with the product or the company and the presentation of the material must convey more than just the basic characteristics of the product in order to be successful. The first document could fulfill its purpose if printed with an impact printer on plain paper. The second document may well require full-color rendering and professional graphic design.

The intended delivery media must also be considered in the design of the document. Some documents may work well on both physical and electronic media, others may work well on only one type, and still others may work on multiple media types with slight alterations. For example, part of the document might be a photograph that looks acceptable only when printed in full color on glossy paper by an offset press. If a decision is then made to provide this output to customers over the Internet, is it acceptable for the customer to be printing the output at home on a low-cost (perhaps monochrome) printer? Or does the document need a design that is more compatible with a wider variety of output devices?

It is not the intention of this paper to answer such questions, but rather to raise them. In particular, the most important consideration regarding document design is the likelihood that the output will require delivery to customers in a variety of media formats. The design of the document should take this into account.

Electronic Forms Document Finishing

In planning a document, decisions need to be made about its final form. Will the document be duplex and stapled? Will it be bound into a book? Will it have a spiral or glued binding? Is a separate cover required for it? In the life cycle of a document, these features are added in the finishing stage, but are planned for in the design stage.

There is a wide variety of finishing options available for a document. Finishing operations require physical handling of documents, which can have a substantial effect on a document's cost and availability. The finishing

process is essentially a manufacturing process, and decisions made at the time of document inception can facilitate this manufacturing process, for example, lower costs and reduced production time.

Document Generation

During the generation phase, documents are created in a variety of ways with many different tools. The manually created document is the most basic and familiar to everyone. Documents generated using pencil and paper, typewriters, and printing presses have been available for many years and are characteristic of this class. It is only in recent history that electronic devices and software have been used to create documents.

Today, a wide variety of tools are used to create documents, including: Microsoft Word and Microsoft Excel, among others. In some instances, many individual documents are generated from a single template, gathering additional information from an external source. The mail merge capability in Microsoft Word is such an example.

Some documents are generated "automatically" under the control of computer programs. In many instances, large reports of thousands of pages can be produced. (Maintaining operational control over large reports can be very complex.) Paper documents can also be produced electronically by using a scanning device that transforms a physical document from printed to electronic image form. The document can then be further transformed into a text format by optical character recognition (OCR) software.

Print Resources

Print resources naturally include printers, but also fonts and overlay forms. In some cases, these resources are in the form of software and can be downloaded once, or with each print job. In other cases, these resources are on firmware that has to be installed in the printer.

Typically, the management of print resources is associated with large, centralized printers used in mainframe operations. Fonts and form overlays are managed directly on these printers and mainframe print jobs invoke the required resources at the printer.

The benefits of such an approach include the offloading of processing from the computer and a reduction in network traffic. Only the data is sent to the printer, not the form and font information. This concept works well with centralized printing.

However, it is uncommon to see this type of output solution in a distributed print environment for two reasons:

- The print resources are synchronized over a potentially large number of printers.
- Distributed print environments are likely to have printers from multiple manufacturers, supporting different page-description languages (PDLs). It may be impractical, if not impossible, to implement a printer-based resource strategy in this case.

Of course, a company that generally supports a distributed print architecture may have special cases where printer-based resources are used. A typical example might be a device used for printing checks that have magnetic toner and firmware or software-based fonts for magnetic-ink character recognition (MICR) and signatures.

Print Application Development

The trend today is the separation of business applications and output

formatting. The main reason for this trend is that it facilitates the "re-purposing" of the output. The concept behind it is that the business application does not need to know, and in fact, should not need to know, the ultimate destination of the output. The ideal scenario is a business application that produces a device-independent data format, such as Extensible Markup Language (XML), and an output application that transforms that XML into the appropriate destination format (for example, PCL, PostScript, Portable Document Format (PDF), or HTML).

In output development, the most interesting questions are:

- How will this output be presented to the customer?
- How monolithic to make the delivery chain?

The answer to the second question has a direct impact on the flexibility of the answer to the first question. Why? Because the more monolithic the delivery chain, the more difficult it is to change the way the data is presented.

Note: A related best practice is that data should be kept in the most device-independent format for as long as possible.

Consider an application that directly generates output in a PDL format (for example, PCL, or Postscript). The output is delivered directly to a compatible printer. Now suppose that the company no longer wants its output to be printed, but wants it to be published on the Web in a commonly readable format. The company now has a problem, because it is dependent on the PDL format.

To think of it another way: should the generation of PCL or Postscript output be the core competency of a company that wrote the general ledger system? And is it not more appropriate to have a financial application generate output without formatting information (for example, XML) and let an external formatting package create the destination-specific output?

Constraints on print application development include: the intended audience, the volume of output, and cost.

Many print applications with flexible capabilities are available. Most of these have easy-to-use graphic user interface (GUI) design environments in which to lay out the finished design. Some directly query databases to extract the report data. Others act upon data streams passed to them. Select the method that best addresses the business needs.

Print and Output Configuration Activities

In general, output destinations include e-mail and Web environments as well as physical devices such as printers. Because the administration of computer systems, Web servers, and e-mail applications is beyond the scope of this document, this section will focus on printers.

Network printers are directly attached to the network, either via an internal network card or a dedicated external network device. These devices are typically located in work areas and can be geographically dispersed, even worldwide.

The first set of administrative activities for a network printer is the initial configuration. The exact steps depend on the type of network. In general, initial configuration activities can take place using the front panel of the printer or a network software utility.

The printer configuration can be password protected. It is recommended that operations protect the printer configurations so that users do not

inadvertently (or maliciously) modify the settings.

System administrators should use available network configuration software for existing network printers. This software allows system administrators to check the printer status and modify any printer configuration attributes over the network. Since this software is commonly freely available from the manufacturer's Web site, it is relatively easy to download and run.

Remember, if passwords are not configured on the printers, then any user can potentially remotely change the configuration of the printer.

Denying configuration through the printer's control panel is another method that prevents inadvertent or malicious re-configuration of printers. Denying panel configuration changes on all printers should be implemented. All configuration information can still be viewed on the front panel.

It is also recommended to use power-saving timeout settings whenever possible. Generally, a choice of time settings is allowed. The best time setting for each printer will vary, but utilization and warm-up times are usually factors in the decision.

Network monitoring software may also allow you to configure alerts. Alerts can be used to generate notices to administrators about conditions that may require intervention (for example, paper jams, out of toner, and so on).

Assigning Printer Permissions

After a printer has been configured, verify that users have the appropriate permissions. Printer permissions control not only who can print, but also which printing tasks a user can perform. For security reasons, one might need to limit user access to certain printers. In large organizations, one might need to delegate printer administration.

Locating Printers

In network environments, most users do not need to know the physical location of files, databases, and Web sites. However, they do need to know the physical location of hardware devices such as printers, scanners, copiers, and facsimile (fax) machines.

Place printers close to the people who are using them. However, printers also need to be placed in relation to the location of the print server and user's computers within your network. Another goal should be to minimize the impact of printing on the network environment.

Check the network infrastructure and try to prevent print jobs from hopping through multiple inter-network devices. In addition, a group of users with high-volume printing needs can be isolated with their own printer on their segment of the network, thereby minimizing the effect on other users.

Sizing and Choosing Printers

When planning the printing strategy for an organization, estimate the number and type of printers needed now and in the future. To do so, consider the following:

- Determine how printing resources will be divided and allocated. High-volume printers generally have more features but affect more users if they break down.
- Consider the printer features needed, such as color, duplex printing, envelope feeders, multi-bin mailboxes, internal disks, and staples. Determine who needs these features and where these users are physically located.

- Although cost is a factor, laser printers are usually a good choice for both black-and-white and color printing. However, many less expensive laser printers do not support larger page size, which might be required.
- Generally, fewer maintenance problems occur if the printing volume is matched with a printer's duty cycle (the number of pages the printer was designed to print per month).
- Consider what type of graphics the organization needs. Windows, TrueType, and other technologies make it possible to print complex and sophisticated graphics and fonts on most printers.
- Consider printing speed requirements. Generally, printers that attach directly to the network with network adapters offer faster throughput than printers attached with parallel buses. However, print throughput rates also depend on network traffic, the type of network adapter, and the protocol used, not just the type of the printer.
- Check that the printers chosen are listed in the Microsoft Hardware Compatibility List, at the Microsoft Web site at <http://www.microsoft.com/hwdq/hcl/>.

Managing Printers

When managing printers, the entire workload of the printer is affected, not just individual documents. Typical tasks include pausing, resuming, and purging the queue for a printer.

If a printer becomes faulty, one might need to send documents in its queue to another printer. This prevents users from having to resubmit print jobs that are already in the queue. Redirect documents to a printer on the same print server or on a different print server. However, both printers must use the same printer driver.

Managing Printing Traffic

The management of print traffic offers an organization one way to optimize its printing resources.

Scheduling Printing Times

One way to maximize the use of printers is to schedule alternate printing times for long documents or certain types of documents. For example, if printer traffic is heavy during the day, postpone the printing of long documents by routing them to a printer that prints only during off-hours. The print spooler continues to accept documents, but it does not send them to the destination printer until the designated start time.

Instead of dedicating an actual print device for only off-hour printing, which is not an efficient use of resources, one can set different logical printers for the same print device and configure each with different available times. One printer might be available from 6:00 P.M. to 6:00 A.M., while the other is available 24 hours a day. One can then tell users to send long documents to the printer available only during off-hours, and all other documents to the printer available all the time.

One can also configure the two printers with different priority levels to print certain types of documents before any other types, regardless of time of day.

Creating a Printing Pool

One can create a printing pool to automatically distribute print jobs to the next available printer. A printing pool is one logical printer connected to

multiple printers through multiple ports of the print server. The printer that is idle receives the next document sent to the logical printer. This is useful in a network with a high volume of printing because it decreases the time users wait for their documents. A printing pool also simplifies administration because multiple printers can be managed from the same logical printer on a server.

With a printing pool created, the user prints a document without having to find out which printer is available. The logical printer checks for an available port and sends documents to ports in the order that they are added. Adding the port connected to the fastest printer first ensures that documents are sent to the printer that can print the fastest before they are routed to slower printers in the printing pool.

Before setting a printing pool, consider that users will not know which printer in the pool prints a given document, so ensure that all printers in the pool are located together.

Print and Output Delivery Activities

This section discusses the alternatives for, issues involved in, and procedures for delivering printed documents and other output to the person or persons who need them.

Distribution

Once a document has been created, it must be delivered to the person or organization needing the information. There are essentially two ways that documents are delivered: electronically and physically.

Physical vs. Electronic Distribution

Physical distribution is the delivery of paper via a manual process, such as mailing or shipping, whereas electronic distribution is the delivery of documents via a computer network, which may be followed by printing at the remote location. (Occasionally, a combination of these two approaches is done with the information put on an electronic medium—for example, a CD, which is in turn delivered via mailing.)

In either case there are common issues that must be addressed in the delivery process:

- *Consistency*. Delivery of the document the same way each time.
- *Accuracy*. Delivery of the document to the proper recipient.
- *Authenticity*. Delivery of the document without change.
- *Security*. Delivery of information only to the recipient.
- *Timeliness*. Delivery of the document according to established schedule.

In the case of electronic distribution, additional security may be required. The data can be encrypted before it enters the network and decrypted after arrival at its destination, further assuring authenticity. Encryption techniques can also be used when the electronic data is sent to an output device, such as a printer.

Data compression techniques are also available to reduce the size of the files flowing over a network. Additional computing resources are required to compress and decompress. Each situation is different, but in each situation, a balance between machine resources and network utilization should be sought.

Presentation Resources

Perhaps the largest issue in distribution of documents relates to resources used in the presentation of the information, which include fonts, images, forms, formatting information, and so on. One approach is to have the resources reside where the document is created and transmit the resources with the data. At the other end of the spectrum, the resources reside at the destination independent of the data. They can then be accessed as needed. There are a variety of solutions combining elements of these approaches, each with advantages and disadvantages.

Managing the output resources is an important function. Elaborate systems are sometimes required to ensure the resources are where they are needed. Fonts are especially abundant, and vary with resolution, presentation language, and vendor. Many fonts may look the same to the ordinary person, but substituting a similar font for the original may result in a distorted document.

Document Receipt

At the conclusion of the distribution process, the document arrives at its destination. In many cases, no notification of receipt of the document is returned to the sender. In others, a return receipt is issued and may be returned by either the intended receiver or an authorized agent.

Sent documents that are not delivered may present a serious issue, requiring a non-delivery action to be specified.

High Volume Printing

High volume printing is usually done at a centralized location. The key criterion is the maximum throughput rate, determined by the length of the allowable print window and the volume of output. Once the overall print throughput is determined, the company can determine whether its printing needs can best be served by a small number of high volume printers, or a larger number of slower printers.

Advantages of high volume printers include:

- *Easier operational procedures.* A print job is likely to be produced on one printer rather than being split among many, which reduces complexity.

Advantages of low volume printers include:

- *Redundancy.* If a single printer fails, the majority of the print capacity is retained.
- *Acquisition cost.* It is typically far less expensive to purchase the same aggregate throughput using slower printers.

The use of multiple low volume printers for a large job requires that the job be split among the printers. This is typically performed by software that analyzes the data, splits it, and distributes the data to the individual printers.

Questions to ask when considering the use of such software include:

- What input formats does the software handle (for example, plain text, printer control language (PCL), PostScript)?
- Does the software correctly and efficiently use printers of different speeds?
- Does the software correctly and efficiently handle restarts due to printer

jams or other failures?

- How are the jobs that are split among multiple printers reassembled?

If there is limited need for high-speed printers, it may be more appropriate to outsource short-duration, high-volume jobs. High-speed printers can be very expensive and it is usually not cost effective to own them if they are idle or seldom used most of the time.

Distributed Printing

The traditional view of internally directed output from large, centralized business applications is that the output is printed on high-volume printers in a centralized location. The output is then burst (meaning the continuous sheet printout is cut into individual sheets) and shipped to the recipients.

As stated previously, low-volume printers offer much lower acquisition costs and superior redundancy. In the distributed printing scenario, they also eliminate the need for shipping. Eliminating shipping increases speed of delivery and decreases cost.

The key enablers of this scenario are:

- A network printer near the recipient.
- Network connectivity from the print application to the printer.
- Software to split the output so that the appropriate data is directed to each recipient.

A variation of this scenario would have the output placed on a Web site or e-mailed to the recipient. The recipient could then view the data on his or her computer and elect to print the data if desired.

Alternative Forms of Output

Although printed output is the focus of this document, it should be noted that output can take several different forms. The following are some of the more popular output forms used today.

XML Format

XML output can be generated for display in a browser. However, one must keep in mind that XML is merely a textual data stream. An XSL style sheet will also have to be generated to provide the layout information for the data. This XSL (Extensible Stylesheet Language) sheet does not need to be modified unless the XML grammar changes. For Web display, the output of the XSL would be HTML.

HTML Format

HTML output can be generated for immediate display in a browser. The main issue here is compatibility among browsers. If the user population is internal, all users may be using the same browser. In that case, output can be tailored to the features the browser supports. But, if customers use a variety of browsers, for example, then the output must either be tailored for the lowest common denominator or it must sense and react to the browser being used for display.

PDF Format

PDF output can be generated and stored as files to be retrieved using a browser. Whereas HTML is a format designed for screen display, PDF is designed for print output. However, PDF viewers integrate seamlessly with Web browsers, giving the user a convenient method of viewing such a

document on the Web. The document can then be printed at the user's discretion.

E-mail

Originally e-mail could contain only plain text. If application output is generated as simple ASCII text, then this data can directly be used as the body of a message. Many e-mail readers today also support rich text and HTML encoding in the message body. However, many readers do not support such formats and if it is not certain that users use such a compatible reader, these formats should not be used in messages.

In this case, one should send the output in the form of an attachment. Attachments are simply data files and can be in any format. It is common today to attach documents in the PDF format since PDF viewing and printing software is freely available for almost every computer platform.

Faxing

There are three main ways of faxing outbound information:

- Printing and faxing the data.
- Submitting the data to a device on the network, called a network fax server.
- Submitting the data to a service on the Internet, called an Internet fax server.

Network fax servers are devices that receive documents over the computer network and transmit those documents over the telephone network to a receiving fax machine (or fax server).

A network fax server takes output from faxing using a unique encoding called G3-FAX (or Group 3-FAX which designates how the data is transmitted and received). Organizations that have their own hardware fax servers need to convert the data to G3-FAX.

Mobile Devices: WAP (Wireless Application Protocol)

Output may be directed toward mobile devices such as mobile phones or personal digital assistants (PDAs). The issues here are limited storage and display capabilities, as well as potential costs incurred by the recipient for the data transfer. Output to these devices should be important, timely, and short.

The Wireless Application Protocol (WAP) Forum is an industry association of over 500 companies that is creating the WAP standards. Output directed to WAP devices must be in WML (Wireless Markup Language). WML is analogous to HTML, but uses a smaller set of tags that are appropriate to handheld devices.

Short Messaging Service (SMS)

SMS is an e-mail-based communication standard for wireless devices. The main limitations are that the messages must be text only and are limited to 160 characters.

Print Anything Anywhere

It seems desirable that a print and output management architecture for an organization should allow anyone to print anything anywhere. Such an architecture would include a global spooling system and the use of device-independent formats (for example, PDF, XML) wherever possible.

However, in real life, it is not usually desirable to actually give all users such capabilities. For example, no one wants Word documents to be directed to a dedicated label printer on a loading dock. Just because it can be done, doesn't mean it should.

Therefore, it is desirable that the global spooling solution provides access limitations to devices. For example:

- A user can print only to certain devices.
- A device can print only from certain applications.
- A device can print only jobs within certain size limits.

The more capabilities that the spooling software provides, the better control one has over the environment.

Mailroom (ADF) Processing

In medium to large organizations there is normally a need to mail or ship substantial volumes of documents. The typical example is the mailing of customer invoices. Mailing requirements need to be considered at the very inception of the document. The mail handling equipment, depending on type, may require special markings on the document to allow for automatic insertion.

Because of postal authority regulations, significant savings may be achieved by printing special codes on the documents or envelopes. The sequence of document printing might also have an effect on postage costs. If multiple documents are addressed to the same location, how can the output process consolidate these documents into a single envelope?

The utilization of special markings and sequencing can reduce costs, but can also affect the speed of delivery—and this could have an effect on business operations. Consider the impact on accounts receivables if the invoices arrive at the customer site prior to an extended weekend.

Because of the physical handling of the documents, damage may occur and must be planned for as part of the business process planning effort.

- If a document is damaged, how will a reprint be obtained?
- If the output documents have value (for example, checks, PIN, gift certificates, and coupons), how will they be protected?
- Are there auditing requirements?

The document's life cycle plan must include the transition to the mailroom and into the postal authority domain. Also, mailroom equipment must be considered as part of a disaster recovery.

Automated Document Factory (ADF) is a concept used by The Gartner Group for automating the previously-mentioned functions. This process is not complete until all the documents are printed and accounted for. All duplication can be discovered and all damaged mail pieces (documents) are reprinted, making the loops complete. At this point the print job is marked completed. ADF provides tracking, tracing, and a complete history of the mailroom processes.

Outbound mailing and shipping are the physical delivery mechanisms still practiced, even though electronic delivery of documents is becoming popular. These delivery mechanisms can be monitored electronically. Tracking, tracing, and providing receipts are imperative.

Pre-processing for Workflow Management

Insertion, sorting, extraction, merging, splitting, metering, quality, and charge back—these terms are widely used with pre- and post-processing workflow management.

The pre-processing function is directly related to printing data. The data must carry within itself information that can be used to identify the documents and measure quality, as well as information about the recipient and the type of processes required. Sometimes this information is not an integral part of the document from the application that generates it. In most cases, the information is inserted during the document re-engineering process or pre-processing phase.

This process has two parts:

- Data re-engineering for business application.
- Data re-engineering for post-processing.

Data re-engineering for business application includes the following types of processing:

- Data stream conversion to get uniform data streams for types of printers or pre-processing documents.
- Merging multiple data-streams to be able to send multiple mail pieces to the same recipient (for example, to reduce number of mailings to the same person).
- Data splitting or extractions to create new print data streams (for example, separating or combining statements, letters, or coupons).
- Sorting data by postal codes to achieve discounts with postal authorities.
- Targeting mailing for specific groups of people who will receive special inserts of brochures or coupons.
- Extracting recipient data with names and addresses for printing on the envelopes (if not using window envelopes).
- Adding personalization data for different types of customers.
- Adding data for administration (for example, charging back to internal departments for costs or postal metering).
- Adding track and trace information.

Data re-engineering for post-processing is targeted for computers in order to trigger processes on printing and finishing equipment. Examples include:

- Data that can trigger scanning devices to measure document quality.
- Data to trigger capabilities of matching recipient address on the letter and the envelope.
- Insertion of barcodes, OCR and optical mark reading data to record and use information for workflow control.
- Activation of different mechanical functions on machines that provide perforation, insertion, bursting, paper trimming, punching, stapling, shrink wrapping, and packaging.

Post-processing Workflow Management

This information is then used for post-processing workflow management. A

central system records all processing information in databases. History of the jobs, documents, and all the processes engaged by a document are noted. This workflow manager also provides statistics on all machines such as peak loads, stops on different printers and inserters, number of documents destroyed, number document reprinted, printing quality, consumables for printing and finishing, paper and much more depending on volumes and the size of the print production environment. Much of this data can be used for logistics or production shifts or capacity planning.

Print and Output Maintenance and Support Activities

Print and output management does not end with document delivery. The discussions in this section address the need to replenish the consumable resources that printers require and to store original documents after they have gone through the reproduction and delivery processes. The legal, indexing, retrieval, viewing, and other issues involved in storage are also discussed.

Supplies Replenishment

Printers have a habit of consuming paper and toner (or ink). Each organization must decide how to handle the replenishment of these supplies. Both the physical replenishment and the ordering process must be considered.

Under central management, a group is responsible for the management of many devices. This group orders supplies, physically distributes them to the printer locations, and might install toner cartridges and perform other standard preventive maintenance activities. Using remote device monitoring software to check page counts and toner levels over the network may allow proactive dispatching of supplies. The group can be notified of unusual printer conditions with the alert capabilities found within newer devices and monitoring software. The centralized ordering of supplies can result in better inventory control and lower cost due to larger orders. Centralized storage can also lead to better performance of supplies because the temperature and humidity of the inventories can be better controlled.

Distributed management puts more control in the hands of individual units within the business. Paper and toner fall into whatever process is being used for ordering general business supplies. The main concern is that the quality of supplies varies, and damage from the use of non-approved supplies may even void product warranties. For these reasons, it is important to develop a list of company-approved part numbers even if ordering is local. The other difficulty is that it becomes much more difficult to understand the utilization of consumables on a corporate level.

Considering individual devices, some applications may be designed to pull paper from specific bins. The person loading paper must be aware of any such requirements and must be kept aware of any application changes that affect the paper stock. It is helpful to clearly label bins so as to indicate the media type.

Generally, the fewer device types in the organization, the easier it is to maintain supply inventories under central management. Limiting the device types also makes it easier for service desk and company repair personnel to be proficient at problem diagnosis.

Toner and ink cartridges, as well as media, are typically recyclable, and part of the supplies management policy should include recycling.

Document Repository and Archiving

A document repository is an electronic archive from which documents can

be retrieved. The following sections describe the important considerations when designing a repository.

Archiving of documents refers to filing them for later retrieval, which can be done either physically or electronically. Documents in an archive are of little value if they cannot be easily retrieved when wanted. Thus it is important to index the documents as they enter the archive. Processes for viewing and printing are usually included as well. The primary reasons for electronic archiving include flexible indexing and ubiquity of information.

Document Retention

Retention is concerned with how long documents are retained in the repository. The document life cycle concept implies that a document is useful for a specific time period. Both legal and business requirements influence this decision, with legal requirements sometimes taking precedence. Retention periods vary by the type of document and its level within the repository hierarchy, and can last from a few minutes to many years. Absolute retention limits are established for deletion of the document, although some documents are kept indefinitely.

For archive retention purposes, documents can be classified into groups by frequency of access, retention period, and other attributes. It is useful to establish retention profiles based on the attributes.

Without purge criteria the archive will grow indefinitely. To keep the archive at an appropriate size, a retention period is specified for each document. When the retention period expires, the document is removed from the archive and disposed of according to its retention plan.

Archiving Systems

Some archiving software is oriented towards output that is plain text on pre-printed forms. The archiving software maintains a copy of all the data, but only captures a copy of the form when it changes. Thus, only a few copies of the form are maintained and they are associated with the captured data.

With more modern electronic forms technology, the forms themselves are dynamic and data-driven. One can no longer think of the form simply as a static overlay. It is important that the archiving system be able to capture this information, and it must capture the document as a whole and not consider the form and data separately.

The Central Document Repository

There is also a more advanced and comprehensive concept called a central document repository. Its function is much deeper than the one described so far. It is a platform-independent location to store and manage all documents. This can be a large database that keeps track of version control, change management, when the document was last printed, by whom, and provides other benefits such as access control and secure printing. This repository can also be used for data mining to support knowledge management endeavors. It becomes the premium central reference point for all documents within an organization and a common point for backup making this a major company asset.

Storage and Retrieval

It is necessary to determine the data storage requirements of the repository. An estimate should be obtained based on business requirements, that is, how many documents must be retained for how long. Then, example documents need to be gathered and stored in the repository so that an

estimate can be obtained of the storage required for each document.

The storage format also has to be determined. Generally, faster retrieval costs more, so, for example, magnetic disk is more expensive than optical disk and optical disk is more expensive than tape. A tradeoff must be made between cost and speed of retrieval. Generally a hierarchical scheme is used. The most commonly retrieved documents are kept in the fastest media. If the storage needs are such that a hierarchy is likely, then it is important to select archive software that supports hierarchical storage.

Indexing

Indexing is the means by which documents are identified in the repository. Effective indexing can reduce both the human and machine time necessary for document retrieval. The types of indexing are directly dependent on the type of repository used. A simple type of repository might be the file system on a computer and the corresponding indexing might simply consist of the name of the file. A more sophisticated indexing strategy might require analysis of the documents so users can search based on criteria found within the document.

Viewing

Viewing software should allow the user to see a reasonable facsimile of the original document. A comprehensive viewing system allows the user to enter the document search criteria while taking the user to the correct page of the report. For example, consider a report consisting of thousands of customer statements. It would not be sufficient for the viewing software only to locate the document if the user would have to manually search the report for the desired statement. Depending on the business requirements, it may also be necessary to select a repository and viewing combination that supports electronic markup of the document so that users can make electronic notations on the documents and have those notes stored in the archive.

Reprint

There are two major types of reprint: spool and archive. A spool reprint takes place when a document fails to complete its original destination. An archive reprint occurs sometime after the original print. An archive reprint might take place if a customer requests a copy of a statement that is several months old, for example. This capability might introduce a business requirement to print a watermark on a reprint indicating that it is a copy.

Capture

Document capture is the translation of a document from hardcopy to electronic format. Optical scanning of the document must be performed. Many aspects of document capture also apply to documents that are in an electronic format. A typical example of the latter is performing an OCR analysis of a document in Joint Photographic Experts Group (JPEG) format, but it also might include the capture of a Microsoft Word document into PDF format.

Spoolers

The spooling system receives output requests from applications and inserts those requests into queues. Every common computer operating system provides some type of spooling. In some, the capabilities are quite primitive.

External spool applications provide capabilities not usually found in operating system spoolers: reprint, data stream transforms, event notification, reliable delivery, printer farms, and so on. The fact that

external spoolers can be used along with operating system spoolers can lead to confusion for end users, administrators, and service desk personnel. Therefore, it is important to investigate the usability and supportability of the environment when considering an external spooler.

Print jobs are placed in the following categories:

- *Real-time business critical.* These are jobs that are typically short, but have a time-critical constraint with implicit financial penalties if they fail. An example is a loading dock pick list.
- *Scheduled business critical.* Examples include large financial statements that print overnight. No one is at the printer waiting for the printed material, but if they're not there by morning, its a problem.
- *On-demand.* This category would include most typical desktop printing. The output may not be critical, but it is time-sensitive from a user point of view.

The spooling solution should be delivered in a manner that is consistent with the needs of the organization.

Printer Queues

Queues exist to hold output jobs that have been submitted and are awaiting delivery. Generally, a spooler manages multiple queues.

Typically, one queue feeds one printer. However a "printer pool" configuration is one in which multiple printers drain a single queue. Printer pools are typically used to increase throughput by using a cluster of lower-speed printers in place of a high-speed printer.

Queues should provide the capability to use first in, first out (FIFO), shortest job first, or assigned priorities.

Data Stream Transforms

Data Stream Transforms are used to translate output data from one format to another. In some cases, this might be for translation from one Page Description Language (PDL) to another (for example, PCL to Postscript). In other cases, this might be from a more generic data format (for example, ASCII text, XML) to a PDL.

Some spoolers have built-in capabilities to transform data streams; others may provide user exits to supply transforms. The importance of this functionality is it allows re-purposing of documents and allows documents to be moved from one device queue to another even if the document has already been formatted for the first device.

Because of possible inaccuracies in translation from one PDL to another, it is preferable to avoid this when possible. Data stream transforms are best used to translate from a data or plain text format to a PDL.

Life Cycle Management

Documents need to be managed and tracked throughout their life cycle. A formal plan for the enterprise is useful in managing documents. Some ideas to assist in this process include:

- Establish and enforce naming conventions.
- Implement revision control.
- Prepare a document management statement for each document.

- Monitor usage for capacity planning.
- Control costs by implementing billing and/or charge-back systems.
- Maintain document monitoring and tracking systems.
- Classify problems to identify areas for improvement.

Print and Output Management Standardization Activities

When developing a sound print and output management process, organizations must apply standards wherever possible. Increased use of standards results in less complexity and reduces support costs. This can lead to increased productivity and lower cost.

Standards should support the following general output administration principles:

- If the output is important, there should be a relationship between the size of the document and the speed of the printer to which it is sent.
- There should be configurable limits on the size of print jobs sent to each printer.
- There should be configurable limits on the size of print jobs submitted by each user.
- There should be configurable limits on the destinations available to each user.
- Real-time business-critical output should have dedicated printers.
- Output should remain in a device-independent format as long as possible.
- The spooling environment should provide for jobs to be suspended, deleted, moved, and reprinted starting at any page.

Page Description Language

A page description language (PDL) is the language that a printer interprets to create the marks on paper that result in a finished document. The two most common PDLs supported by printers in the workplace are PCL and PostScript. For consistent output, it is highly recommended that the company standardize on a single PDL. The goal is to choose applications and output devices compatible with that PDL.

Printer Naming Considerations

A printer naming strategy should be established for the organization, as too many names for the same devices can lead to confusion. The printer itself can usually store a name, and the network may also have a name for the printer. On top of this, each computer referencing that printer will have a name for the printer. Even applications may have their own names for the printer. Develop a naming strategy that makes sense and is easy to use, and then implement it.

The service desk is likely to be familiar only with the network name for a printer because it is typically the network name that is used by diagnostic software to check the printer. If an end user calls the service desk, that user may be familiar only with their application's name for that printer. If the names don't match, the service desk may not be able to identify the actual printer. Thus, there is significant motivation for keeping all printer names the same, or at least similar.

It may be appropriate to determine which name space (printer, network,

OS, or application) is the most restrictive. Then develop a naming strategy based on that space. The naming strategy typically attempts to integrate one or more of the following attributes: printer model, usage (for example, check, invoice, or statement), location, or capability (for example, color or duplex).

The two most important criteria in printer naming are:

- Will users be able to understand enough from the printer name to select the correct printer from the namespace (typically the application or operating system)?
- Will users be able to communicate the correct printer identity to the service desk when they are having problems?

Consideration for Output Internationalization and Migration

In any computing environment, sending documents or printing to a foreign or remote geographical location can become a challenge. This is typically true of legacy applications or applications from software that does not support internationalization. It is recommended to give internationalization and migration a place in the overall output strategy for your business right from the start. If it isn't in the strategy, it can become an obstacle or a major cost factor at a later stage.

Some of the key issues for consideration are font standards and international code pages, barcodes, paper sizes, post processing, and national and international standards. The following sections take a brief look at these issues.

Font Standards and International Code Pages

Font standards and international code pages are usually implemented by most software producers but system fonts for computing platforms can still be a problem. Compliance to the Unicode font standard in printing is common today for most computing platforms. But print data migration between UNIX, Microsoft® Windows and the mainframe can still be a problem today. These problems can be based on differences in ASCII codes or EBCDIC codes not only within the same country but internationally as well. Most data transfer packages provide the facility of translating character codes from system to system and country to country. It is recommended to make sure the output strategy outlines these issues. It is necessary to have all font sets present in all required formats for all devices if they are not already compliant.

Barcodes, Paper Sizes and Post-Processing

Each country has national standards for barcodes, paper, and banking checks. Postal authorities set some of these standards, while other standards are set by industry and government.

Barcodes vary from country to country. Some countries prefer a certain type of barcode while others state specifically the type to use and where to place it physically on the paper or envelope.

It is important to be prepared for changing types of barcodes or their physical locations in print applications. For many companies, the paper issues can be a major headache when printing from one country to another. For example, American letter and legal size cannot print on most printers in Europe because these printers are set up to print the narrower and longer A4-size paper. The printer stops and awaits intervention, thus creating a bottleneck. This problem can be avoided by recognizing it in the output strategy and building in a solution that is based on the knowledge of

printing or formatting of documents.

Post-processing can be an issue in cases where a letter has to be automatically inserted in an envelope, and the envelope contains windows where the address does not appear or fit. In some countries there are multiple windows on envelopes for set purposes.

The issue is the placement of data on different parts of the paper from country to country on pre-printed or blank paper, where the information has to be displayed applying national standards. This can very quickly escalate into a problem if printing resources mismatch or are not created in the correct format. It is; therefore, also important to control them. It is good practice to make sure that all current and correct print resources are either migrated or kept up-to-date in the local country format. The naming convention for these resources and documents must also be considered. OCR placed in wrong position on a document or the wrong OCR font can render the document useless. This can cost more money rather than saving it. Other issues to watch for include incorrect or missing:

- Date formats
- Logos
- Signatures
- Addresses
- Fax and phone numbers

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Print and Output Management Roles and Responsibilities

Principal roles and their associated responsibilities for print and output management have been defined according to industry best practices. Organizations might need to combine some roles, depending on organizational size, organizational structure, and the underlying service level agreements existing between the IT department and the business it serves.

"Role descriptions" in the context of the print and output management process should not be confused with "job descriptions." Depending on the size and structure of the IT organization, one person may assume more than one role. However, a best practice for process management dictates that although different people may be involved in performing a process, there should be only one "process owner" per process. This ensures that one individual is always accountable for overall process performance and can intercede to "make things happen" when a process breaks.

Operations Manager

The operations manager sets up and manages operations to:

- Deliver quality services.
- Absorb change at a rate consistent with business need.
- Develops and maintains controls and procedures to ensure efficient service operations.
- Drive the efficiency and effectiveness of the operations processes.
- Produce management information.

- Monitor business-critical services to ensure compliance with agreed service levels.
- Understand business goals of the users and the company in general.

Print Administrator

The print administrator is responsible for the installation and configuration of printing hardware and software, and all paper reports. The print administrator has the following responsibilities:

- Manages the acquisition, retiring, and repair of printing assets in order to meet business needs.
- Ensures that printing assets are represented in the Definitive Hardware Store (DHS).
- Ensures that sufficient hardware is on-hand to meet service level requirements.
- Creates printer standards to minimize spare parts requirements.
- Manages the acquisition, configuration, and location of new printers.
- Manages the creation and distribution of reports, both print and electronic forms.
- Manages hard-copy output and physical paper assets and records.
- Manages the storage, retention, and destruction of paper archives.

Print Support Technician

The print support technician is responsible for troubleshooting and repairing printers, print queues, and so forth, whenever an incident occurs. The print support technician typically is a part of a "tier 2" resolver group to assist front-line service desk personnel. For more information about the service desk and resolver groups, refer to the service desk SMF guide. The print support technician has the following responsibilities:

- Ensures that sufficient hardware spare parts are on-hand to meet service level requirements.
- Creates printer standards to minimize spare parts requirements.
- Handles service requests.
- Monitors incident details, including the configuration items (CI) affected.
- Investigates and provides diagnosis for incidents and problems (including resolution where possible).
- Detects possible problems and notifies problem management.
- Resolves and recovers assigned incidents.
- Acts as a restoration team member, if required, during major incidents.
- Acts to correct known errors.

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Relationship to Other Processes

Various IT processes depend upon, or are affected in other ways, by what occurs during the day-to-day performance of the print and output management process in the data center. This section articulates the

relationships between print and output management and these other IT processes.

Every process within the Microsoft Operations Framework benefits from some aspect of monitoring and control, as these functions are inherent to ongoing process improvement. This is especially true in the Operating quadrant of the MOF process model. Print and output management is considered one of the foundational SMFs of the MOF Operating quadrant. The following graphic depicts relationship between print and output management and other MOF SMFs.

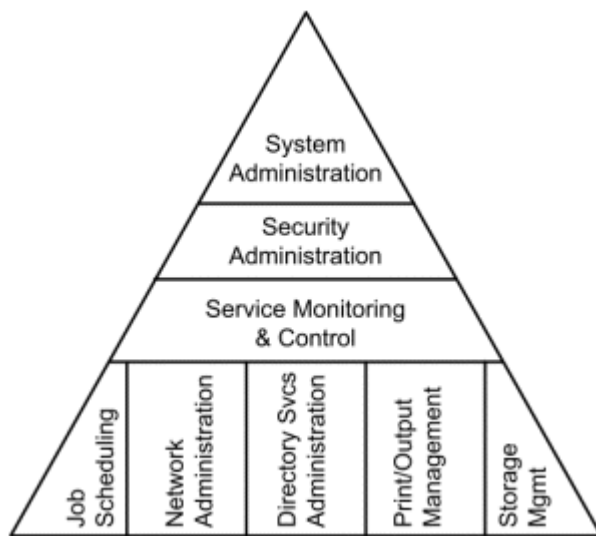


Figure 2: Relationship to other SMFs in the Operating quadrant

System Administration

System administration deals with the administration model used by an organization. Some organizations prefer a model where all IT functions are performed at a single site with a team of IT professionals collocated at that site. Other organizations prefer a distributed branch-office model where both technologies and support staff are geographically distributed. System administration examines the trade-offs of each model. Each type of system administration model has unique printer administration requirements.

Security Administration

Security administration is an IT process concerned with implementing and managing security controls that enforce corporate security policies, thereby ensuring data and system security within the production IT environment. Print and output management and security administration have a relationship because some forms of corporate output (reports, for example), the primary concern of the print and output management process, must remain secure. System administrators and the security administrator need to work together to ensure the corporate data security policies are followed closely.

Service Monitoring and Control

Service monitoring allows operations to observe the "health" of a service in real time.

Although important, this type of observation is purely reactive in nature, and in today's competitive marketplace, it is not enough for service monitoring to allow operations to merely react to service problems in the IT

environment. In addition, it is extremely important that service monitoring provide operations with the ability to observe service behavior in such a way as to allow it to be proactive by, for example, finding problems and potential service outages before they occur. Providing operations with both a sound reactive and proactive monitoring capability can be defined as a service monitoring best practice.

But knowing the current health of a service or determining that a service outage may occur is not worth much unless operations has the ability to do something about it, or at the very least notify the appropriate group that a specific type of reactive or proactive action needs to occur. This is what is meant by the term control. When combined and implemented properly, service monitoring and control gives operations the critical capability it needs to ensure that service levels are always in a state of compliance. Without proper service monitoring and control, service level agreements are of little use.

Most companies rely completely on the quality of the daily print and output information. For this reason, print and output management is closely related to and service monitoring and control. Printers and various other output devices, when part of an overall service delivery capability, have to be monitored and managed carefully.

Network Administration

Network administration is an IT process concerned with managing all production networks under change management and configuration management control. Network administration is closely related to print and output management because specific change management work orders may occasionally require network configurations for various print and output resources to be altered. In such cases, the network administrator and the system administrator need to coordinate efforts to fulfill the work order and ensure strict adherence to both print and output management and network administration service level objectives.

Service Desk

Service desk activities apply to many areas of data center administration, including print and output management. For instance, the service desk might receive questions ranging from, Why didn't my print show up? to My printer is out of ink.

Standard diagnostic scenarios should be developed and made available to service desk personnel. The service desk personnel must be familiar with the printing functionality of the end user's applications and with diagnosing any enterprise-level spooling and distribution software. Finally, they should be able to use remote diagnostic and monitoring software for the printers themselves.

Availability Management

Availability management is an IT process concerned with assuring continual user access to IT services and addresses issues such as service availability, reliability, maintainability, security, and the ability of services to meet availability service level objectives (defined within a service level agreement). Print and output management has a strong relationship to availability management because of availability management's focus on service availability. In order for meet service availability objectives to be met, print output is required (in the form of reports, for example) and must be addressed when developing service availability plans.

System administrators and the availability manager will have to work together to develop appropriate print and output availability plans. This

effort should be driven by defined service level objectives.

Capacity Management

Capacity management is an IT process concerned with ensuring that IT resource capacities meet business requirements and are being appropriately optimized. Print and output management has a strong relationship to capacity management due to capacity management's focus on overall service capacity. When capacity management personnel are developing service capacity plans, they must address the output capabilities inherent in the print and output management process because these capabilities have a direct impact on hardware and network capacity requirements.

System administrators and the capacity manager have to work together to develop appropriate printer capacity plans. This effort should be driven by defined service level objectives.

Change Management

Change management is an IT process that manages (logs and approves) and controls (tracks and coordinates) all changes to the production IT environment. The relationship between print and output management and change management is no different from change management's relationship to any other process; that is, no changes can be made to critical print and output management resources without a request for change (RFC) being duly processed and approved. Further, certain non-scheduled requests affecting printers, reports, and so on may be required to go through the change management process (that is, through an RFC submittal).

The change manager owns the change management process and typically relies on various change domain coordinators for specific expertise in the different areas (domains) of technologies and applications that may come under change control. The change manager and one or more change domain coordinators periodically have to interact with system administration personnel when changes are proposed either directly to print and output management systems and applications, or in conducting risk and impact assessments when such systems may be impacted by changes to related infrastructure components (for example, a server, local area networks (LAN), new printer, and so on).

Configuration Management

Configuration management is an IT process used to specify, track, and report on each IT component under configuration control, referred to as configuration items (CIs). Data is stored in a logical entity known as the configuration management database (CMDB), which typically consists of multiple distinct databases.

Print and output management is related to configuration management through the CMDB entries that must be processed every time a change is initiated (through change management) to any print and output management CIs (for example, printers). System administrators and the configuration manager (owner of the configuration management process) need to come to an agreement regarding the print and output management CMDB structures (that is, attributes and relationships) for print and output management CIs (for example, hardware, software, network components, users, and so on). Note that no changes should occur to any print and output management CIs without a request for change (RFC) being processed and approved.

System administrators may have to interact with various configuration domain coordinators who are responsible for various aspects of the CMDB.

For example, one or more domain coordinators may be responsible for tracking different print and output management infrastructure components, such as the network, the associated printers, and so on.

Service Continuity Management

Service continuity management is an IT process for developing a coherent and well-defined plan that specifies how IT can recover from a disaster and safeguard systems to prevent incidents from becoming disasters. Service continuity management is related to print and output management through the development, testing, and actual execution of the disaster recovery plan. This plan, involving the service continuity manager, is created as a result of the service continuity management process. Such a plan must dictate print and output recovery requirements and capabilities in the event of a disaster. Operations must therefore ensure that the plans requirements can be met.

Release Management

The release management process is concerned with the building, testing, and implementation of changes to the IT production environment. See the MOF change management operations and release management operations guides for details.

Prior to introducing a new release into the production environment, the release manager must provide operations with an appropriate notification that such a release is going to occur. This enables system administrators to install and configure the necessary print and output components associated with the new release.

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