YSOFT SAFEQ®

A PLATFORM FOR GROWTH

A YSOFT SAFEQ 6 ARCHITECTURE OVERVIEW

INTRODUCTION

IT staff need to be flexible as an organization's needs can change rapidly. Whether a company's growth comes organically or through acquisitions, or whether contractions are a result of divestitures or changes in the market, smart IT organizations choose systems that help them adapt easily and quickly.

Today, organizations use print management and document capture solutions as key extensions to Managed Print Services (MPS). Y Soft's solution, YSoft SafeQ, is an Enterprise Workflow Solutions Platform that enables organizations to reduce print infrastructure costs, ensure security and privacy compliance, and support their organization's digital transformation initiatives.

Offering company-wide print, copy, scan, and fax services in a specific location or across multiple sites and geographies can involve a complex web of hardware and software infrastructures. With the pressure on IT to react quickly to change, the need to choose enterprise workflow solutions that can easily adapt has never been truer than for these office-critical services.

"How you envision the future state of your print architecture, your overall security state, and the maturity of your print or MPS program are all factors that need to be taken into consideration."

Gartner, Best Practices for Selecting a Pull-Print Vendor, Ivo Tsvyatkov, Kristin Merry Von Manowski, 16 February 2018, G00348126

ENTERPRISE WORKFLOW SOLUTIONS — BUILT FROM THE GROUND UP

With YSoft SafeQ 6, the entire enterprise workflow solution has been built from the ground up as a new, highly distributed system with global reach. This gave us the opportunity to set the stage for new features and capabilities and to focus on security as well as improve on our previous version. But most importantly, from an architectural perspective, we can better meet customers' needs for:

- **Scalability** – infrastructure and functionality can be added or removed easily
- **High availability with support for failover and redundancies** – the flexibility to have high availability, failover, and redundancy in every location or only in certain locations
- **Greater reliability** – high system throughput and network traffic optimization

Because each customer's infrastructure is unique, the YSoft SafeQ platform has been designed as a system of components that can be mixed and matched to meet an existing IT infrastructure and, as needs evolve, it can easily grow with them. The components in YSoft SafeQ are like building blocks that Y Soft solution architects, in collaboration with our partners, can use to build the ideal architecture for a company's print services environment.

This overview looks at the YSoft SafeQ architecture's building blocks, their purpose and benefits, and how they can be used in sample scenarios. As you will see, the entire architecture allows for both horizontal and vertical scaling. It can be designed as a centralized or very distributed system, and can plug into an existing infrastructure.

YSOFT SAFEQ 6 ARCHITECTURE

The YSoft SafeQ patented[1] architecture is a tiered architecture comprised of building blocks that can be designed to meet the technical needs of any customer within their current infrastructure and allow for growth at any level.

Each tier provides a means to ensure our three key quality requirements: scalability, high availability, and reliability — though each tier provides different options as is appropriate. For example, an organization may need different tools and services to facilitate high availability on the Client Services tier (working with end-user workstations and laptops) than on the Site Services tier.

ARCHITECTURAL PRINCIPLES

Before we start describing the tiers, we need to define two very important principles that drive YSoft SafeQ's architecture and its tiers.

The first principle is called **Upstream Connection Initiation.** A customer's network infrastructure is often a very complex set of elements and network access rules that stem from the customer's security policies and traffic optimization activities. Network resources, such as servers, workstations, and printers, should be locked down and only the traffic that is mandatory for proper system operation should be explicitly permitted.

Also, it is often crucial to protect users' workstations and laptops from arbitrary incoming connections as there is usually no reason why any system components should connect to applications and services running on users' workstations. For example, Windows Defender Firewall, by default, blocks most of the incoming traffic, and many customers are adopting even more restrictive schemes.

The Upstream Connection Initiation principle has been coined to support customers in this regard and eliminate the requirements for open ports and permissible firewall settings on workstations, laptops, and even site servers. This principle dictates that any YSoft SafeQ components from lower tiers always open and initiate network communication on the Network/Transport Layer (TCP and UDP/IP) to the higher tiers (green arrows) and not vice versa (red arrow).
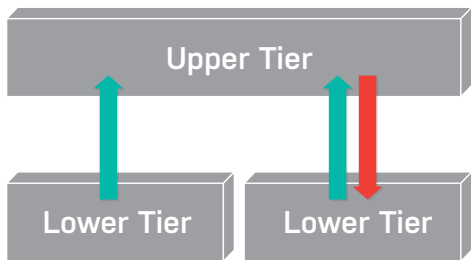
For instance, when you have YSoft SafeQ Client components running on an end-user workstation and any YSoft SafeQ service needs to communicate with it, a network connection is opened from the workstation to the appropriate server. You might be asking: in the case where information needs to be exchanged quickly or even in real time, how can this be done without initiating a proper network connection?

This is achieved by leveraging the concept of Overlay Networking, where a unidirectional connection on Network/Transport[2] layers is used to create a virtual peer-to-peer network on an application layer where all components may communicate with each other freely. This Overlay Networking is implemented between each

YSoft SafeQ tier using appropriate means. For example, Client Services use the YMQ component to communicate with Site Services, whereas Site Services use the YSoft SafeQ Communicator component to connect to the Management tier. Each is tailor-made and configured for its specific environment and provides different properties for optimal performance.

The Upstream Connection Initiation principle is aligned well with Y Soft's commitment to security. Although this paper does not cover YSoft SafeQ security in depth, a separate security white paper is dedicated to this topic and is available on the Y Soft Partner Portal or by contacting a Y Soft representative.

The second principle is called **Horizontal Scalability**. The Horizontal Scalability principle means that each tier of our architecture has scalability and reliability built in independently from the other tiers. This also means that when a service from a lower tier tries to connect to a service from any upper tier, it should not depend on any specific instance to be available.

Using Site Services as an example, Site Services is at one time connected to multiple Management Servers and should one of those connections break, Site Services communicates with another Management Sever. For most tiers, this is handled by the YSoft SafeQ application without the need for dedicated load balancers, except for the MFDs (multifunction devices) in the Client Services tier. As some of the MFDs are not capable of automated failover to an arbitrary server, we encourage customers to deploy load balancers between the MFDs and Site Services to make sure that the MFDs can always reach a live and available service instance.

Horizontal Scalability also means that any consistency or partitioning issues need to be handled within each tier and should not propagate to the lower tiers. Each tier has a specific set of techniques and safeguards built in to facilitate this and we are constantly working on improving the technology.

BUILDING BLOCK TIERS

With YSoft SafeQ, there are four main tiers:

- Reporting and Data Analytics
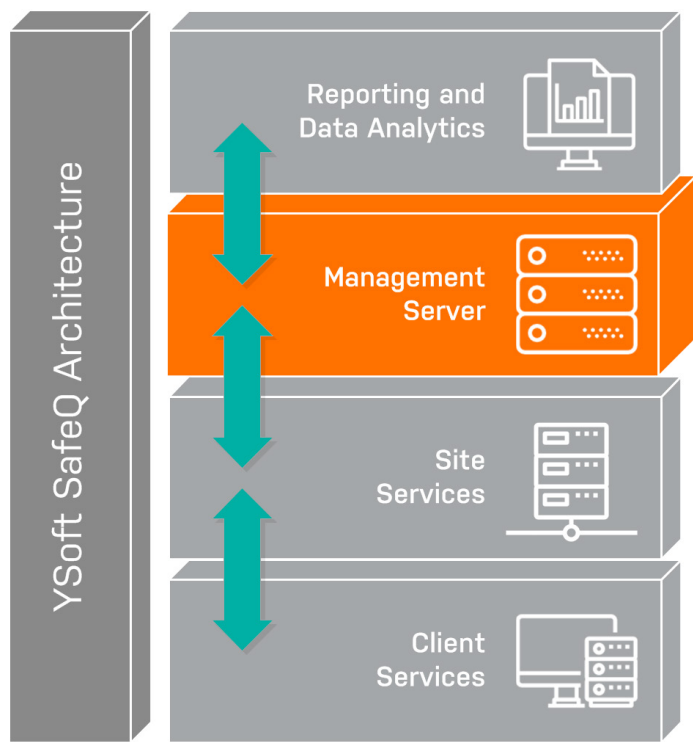- Management Server
- Site Services
- Client Services

REPORTING AND DATA ANALYTICAL

The Reporting and Data Analytical tier contains the YSoft SafeQ Reporting platform, an open platform that collects the metadata on print, scan, copy, and fax activities and stores it in an external database. The Reporting platform is open and with ODBC (Open Database Connectivity) or JDBC (Java Database Connectivity), the data can be integrated with other applications such as Tableau or PowerBI so that additional analysis can be performed. The data is also reusable and can be downloaded, for example, to Excel and is used in YSoft SafeQ standard web and management reports or customized reports.

When YSoft SafeQ is used in a multitenant scenario, the data for each company or division is isolated in individual data marts ensuring that data and access to the data are kept separate.

MANAGEMENT SERVER

There are many functions of Management Server. Primarily, Management Server provides internal services to other parts of the YSoft SafeQ system (mainly to Site Services and Reporting). It includes management of devices, users, billing codes, price lists, prints, scan workflows, and others. For larger deployments, Management Server supports clustering of the Site Services components (see Clusters on page 9). The User Management function of Management Server is an integration point for Active Directory or other identity management services.

Management Server keeps all configuration settings consistent across the entire installation. The set of system properties modifies the behavior of every component and allows adaption to the customer's needs.

Finally, Management Server manages the implementation of the YSoft SafeQ license. YSoft SafeQ 6's modularity is mirrored in the license structure. Management Server is responsible for applying the right application of the license's scope.

The web-based Management interface offers control to the YSoft SafeQ system. It provides the YSoft SafeQ administrator(s) a customizable dashboard of the entire YSoft SafeQ system. For example, from the dashboard, administrators can configure all main functions, run reports, define and view the devices in the system, check for database integrity issues, and implement YSoft SafeQ license information.

SITE SERVICES

You may wonder why the Site Services tier exists and why this tier is not part of the Management Server tier. The reason is that not all infrastructures are "created equal" and we want to deliver to varying customer needs. The Site Services tier represents the application logic, serving documents, print jobs, user interfaces for MFDs, providing authentication and authorization and other services. These parts of YSoft SafeQ need to provide high responsiveness and greatly influence the user experience. Site Services may run in your data centers, be deployed in the cloud or run in dedicated appliances — you have the flexibility to decide where to deploy Site Services to optimize latency, reliability, and availability of YSoft SafeQ to your users.

If remote locations have slow, high-latency network connections, you may want to deploy a Site Services tier locally so that users have perfectly fast and responsive printing and scanning experiences. If the connection to your cloud provider is good, you can deploy the Site Services tier in the cloud to optimize infrastructure costs. These are just two of the many options. Of course, you may combine different scenarios in a single deployment to fully support on-premise, hybrid, private cloud, and public cloud scenarios. It would be very difficult to achieve this level of flexibility without making the right architectural decisions.

We have also separated the concept of Management and Applications in YSoft SafeQ 6 to enable centralized management and the configuration of vast and widespread printer infrastructures. This enables YSoft SafeQ to be deployed as a single, logical system spanning countries and even continents, often managing thousands of MFDs in a single installation.

CLIENT SERVICES

Client Services generally serve two purposes, they provide the user interface to end users and some of the means to submit print jobs and receive documents from YSoft SafeQ.

There are two main types of Client Services:
1) **Embedded Terminals** – the YSoft SafeQ software that is embedded in the multifunction device and is used through the device's user interface screen (terminal). If the print device cannot support embedded software or if the customer wants a uniform experience across multiple brands of printers, Y Soft offers external terminals — hardware that easily attaches to the print device.

   It should be noted that some MFD user interfaces are browser-based, in which case, they are served from the Site Services tier.

2) **Workstation Clients** – desktop applications that offer additional services such as Client Based Print Roaming® or DeeControl, layering software used for printing 3D models in YSoft be3D eDee.

Note that the different tiers communicate only with their direct neighbors. As we will see in subsequent sections, an organization may, depending on their needs, have YSoft SafeQ as described in Figure 1 or multiple Management Servers, multiple Site Services, or multiple Client Services. In short, an organization, depending on their high availability, redundancy, and failover needs, has flexibility and scalability with YSoft SafeQ's architecture.
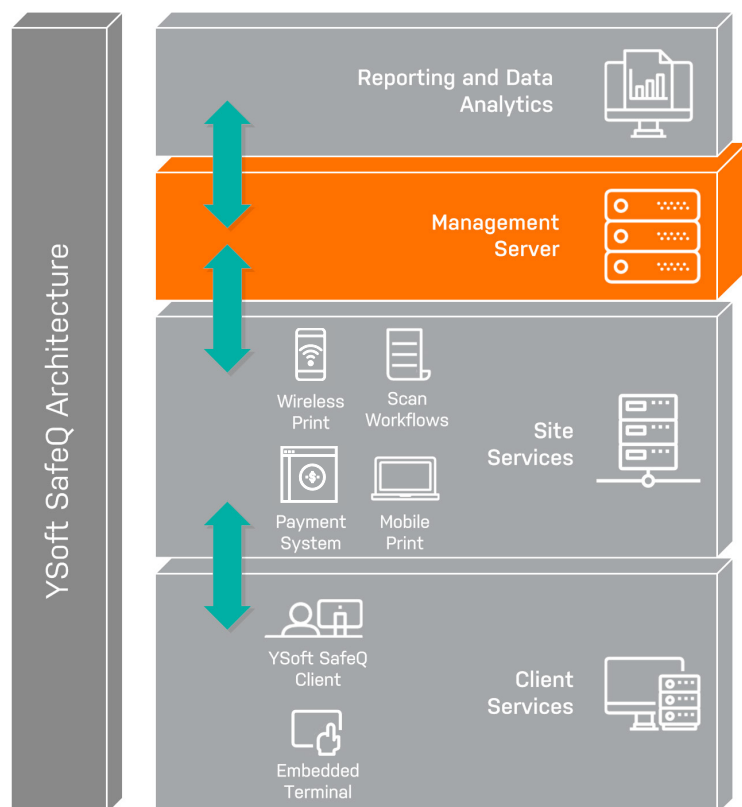
BUILDING BLOCK SERVICES

YSoft SafeQ offers a variety of services that, like building block tiers, can be added as needed. The services are 'hosted' in the Site Services tier, see Figure 2. They include:

• Mobile Print Services – supporting printing from laptops, tablets, and smartphones by uploading a file to a dedicated internal web page or emailing it to a dedicated email address
• Scan services – for scanning to email, file systems, or using YSoft SafeQ Automated Scan Workflows
• Payment services – supporting pay-to-print, user accounts, and quotas
• Wireless Print Services – native iOS and Android printing support for smartphones/tablets. For iOS, YSoft SafeQ supports Apple's wireless print standard; for Android, YSoft SafeQ supports Mopria print server (YSoft SafeQ is the first print server certified by Mopria[3])

[3] Y Soft announcement, November 29, 2017. Y Soft is a member of the Mopria alliance

THE ADVANTAGES OF A BUILDING BLOCK ARCHITECTURE

Keeping in mind IT's needs for scalability, flexibility, high availability with failover and redundancies, and greater reliability, the YSoft SafeQ architecture, as a set of building blocks, offers many advantages.

SCALABILITY

For many organizations, scalability is the largest concern. As noted in the introduction, an organization can change rapidly, and IT's greatest "insurance" against change is a system that can adapt easily and quickly.

The key to YSoft SafeQ's scalability lies within the building block tiers and services and how they communicate with each other. As shown in Figure 2, tiers represent a centralized infrastructure for a company with one location.

As the company grows, however, it may acquire another company in another city or on a different continent. The original site becomes the headquarters with a remote location or multiple remote offices — it becomes a highly distributed infrastructure. To support this growth, YSoft SafeQ's architecture can add building block tiers to the company's infrastructure, as shown in Figure 3.
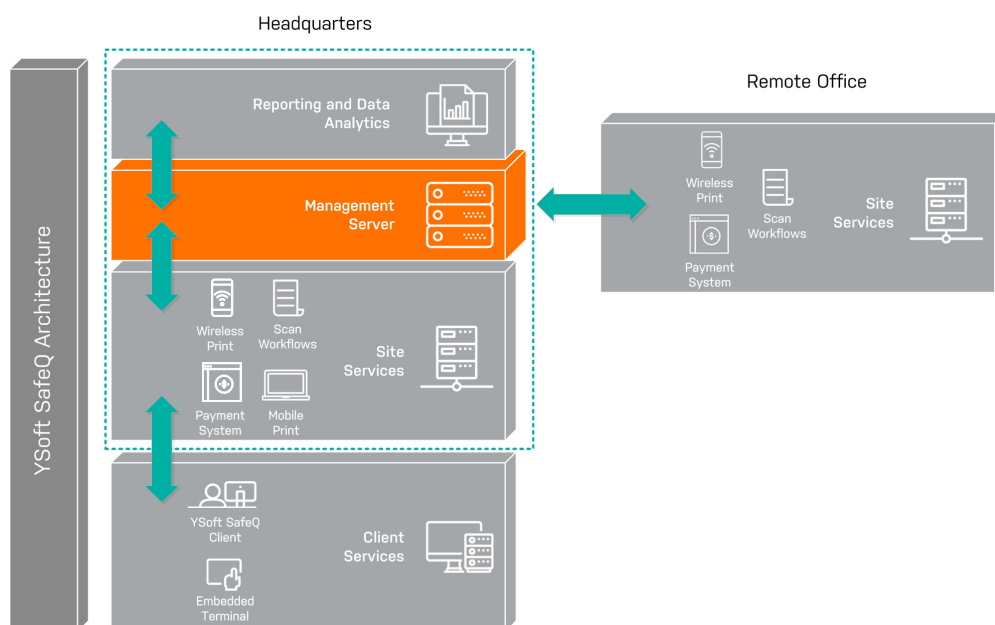

Figure 3
How YSoft SafeQ can scale as a company's organization grows.

As Figure 3 shows, when an organization grows, the new location uses only the tiers and services building blocks they need. Another scenario may be a headquarters' location with several remote branch offices, see Figure 4.

In Figure 4, we introduce the concept of "Clustering". We will talk about this in the next section. The important takeaway in Figures 3 and 4 is that YSoft SafeQ's architecture can scale vertically and horizontally very easily in what has now become a massively distributed infrastructure.
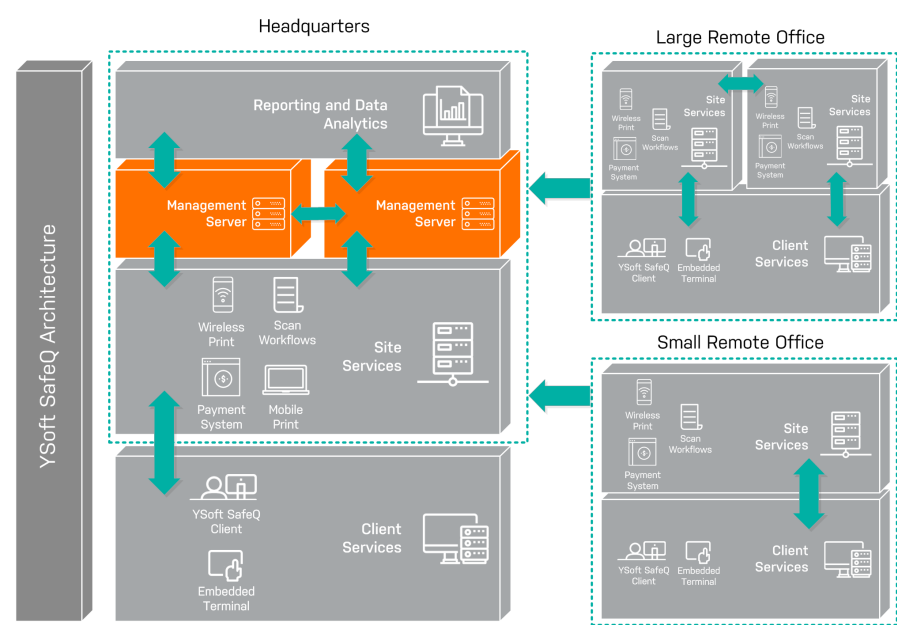
HIGH AVAILABILITY WITH SUPPORT FOR FAILOVER AND REDUNDANCIES

Not all remote locations have the same IT requirements. For example, an organization may have headquarters, regional offices, and district offices. The district offices may simply be satellite offices with few employees where no paper output is needed, and scan documents are routed directly to headquarters. Or, as Figure 4 shows, some remote offices have mission-critical printing and, therefore, high availability is required.

SITE SERVICES CLUSTERS – AN INNOVATION IN YSOFT SAFEQ 6

By building the YSoft SafeQ architecture with two synchronized Site Services tiers as a cluster, the company can be assured of a high level of availability, and should one Site Services tier be unavailable, print services can "fail over" to the other Site Services tier. In the event of one Site Services tier becoming unavailable, any jobs in progress continue uninterrupted and any new jobs are handled by the other Site Services tier.

Similarly, at headquarters, mission-critical print services can have failover and redundancy at the Management Server tier. By clustering multiple Management Servers, the services that they provide to Site Servers, such as identity management, can continue uninterrupted.

Clusters are created on the same tier (Management Server tier, Site Services tier, or both) and are the key reason YSoft SafeQ can offer high availability, failover and redundancy. Two (or more) Management Server tiers can be installed on different servers and connect to a single database. Two (or more) Site Services tiers, also installed on different servers, can be built and designed in any configuration in various site locations. Only one site, typically headquarters, needs to have at least one complete set of tiers, see Figure 1. All the building block tiers and services are managed from a web interface at the Management Server tier so that it is easily administered by IT.

While other solutions only allow redundancies as an all-or-nothing approach, YSoft SafeQ can accommodate an organization's need to have high availability, failover, and redundancies in place for locations that truly need it.

FLEXIBILITY

The entire building block architecture approach gives organizations flexibility. Instead of a solution that must be identical in every location, IT can decide — based on their IT governance for security, their level of IT staffing in each location and any other unique variable — how the print services infrastructure can be for each location. This flexibility applies to both tiers and services building blocks. Combined with the flexibility of YSoft SafeQ's software suites or individual modules, IT organizations can provide locations with different services.

GREATER RELIABILITY

Because YSoft SafeQ 6 was built from the ground up, we had the opportunity to improve its performance. The building block architecture allows for more throughput, decreasing the number of servers an organization needs. Lesser dependence on servers to provide print services means more reliability is gained. Additionally, with every software update, Y Soft measures the performance and meets or exceeds previous releases.

For example, Y Soft measures the reaction time from the point of user authentication at the MFD terminal to the software's reaction. While reaction time may vary depending on the print device brand and infrastructure, when measured on the same variables, our performance increases with every new release.

PULL PRINTING AT ANY SCALE

Pull printing, known as Print Roaming in YSoft SafeQ, allows users to submit jobs from their workstations and be able to print at any print device in the company network without IT having to worry about print drivers. Additionally, Print Roaming increases employee productivity and improves document security since print jobs do not print until the employee authenticates at the printer.

However, enabling pull printing at scale — across multiple devices and multiple locations — is beyond most print management solutions' capabilities. YSoft SafeQ is unique in its ability to offer Print Roaming in a scalable, highly distributed system. The difference is in how YSoft SafeQ processes print job data.

With YSoft SafeQ, a print job stays local when the job is printed from within the same location that the Site Services tier is located. We call that **Near Roaming,** see Figure 5. The job prints locally and the print job's metadata is sent to the Management Services tier, **which may be in a different location than the Site Services tier.**
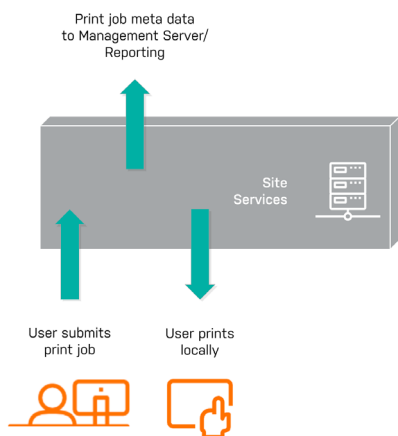
When the user submits a print job from the workstation or mobile device in one location and then travels to another site, the print job can be pulled to any printer in the company's network. When the job is pulled to a printer in a different location than where it was submitted, we call this Far Roaming. Figure 6 shows how print job data is processed between different site locations.

Whether pull printing is performed as Near Roaming or Far Roaming, YSoft SafeQ processes the print job so that the employee can print at any device and the print job metadata is sent to the Management Servers tier.
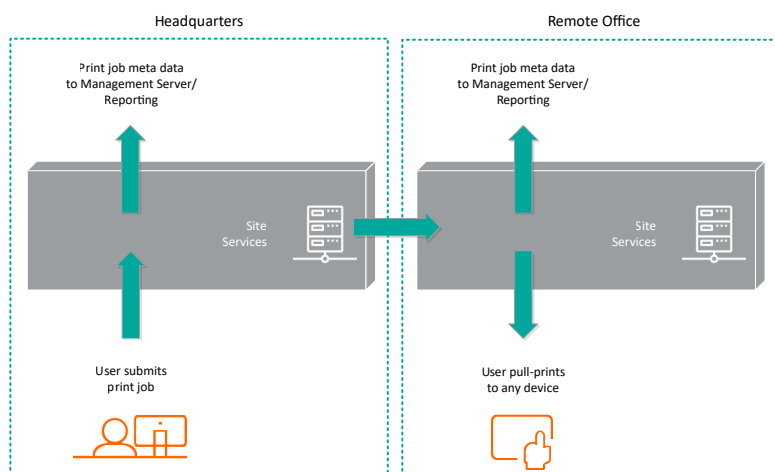
Additionally, pull printing can be offered with high availability, failover, and redundancy as required by adding multiple Site Services tiers at any location.

THE COMMUNICATIONS ARCHITECTURE

Thus far, we have examined the main structure of the YSoft SafeQ system in terms of building block layers and services. It is important to also look at the communication architecture within the YSoft SafeQ system and with external systems. As a comprehensive solution, YSoft SafeQ integrates with an organization's existing infrastructure as well as other systems that may be needed to offer additional services.

There are eight main communications pathways available in YSoft SafeQ 6, see Figure 7. Each is described below.

Figure 7
YSoft SafeQ Communications
Pathways
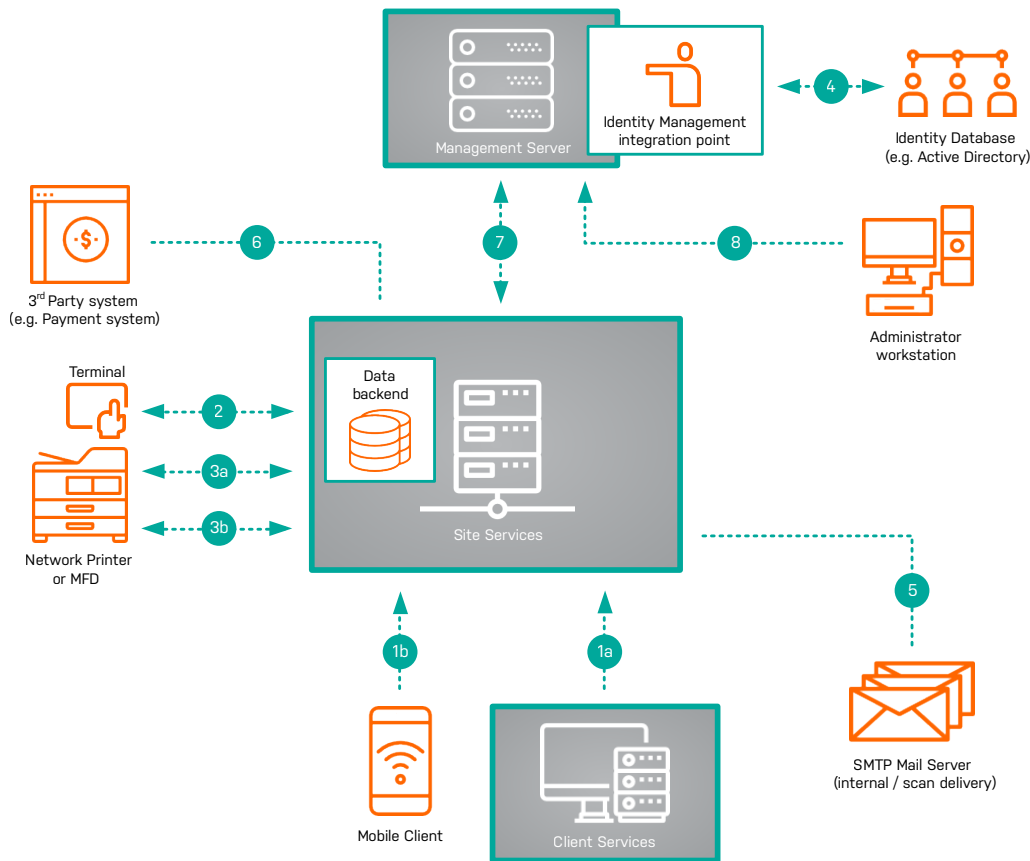
1. **Printing** – communications from YSoft SafeQ when:
    a. A print job is sent from the client's workstation
    b. A job is sent from a mobile client

2. **MFD (multifunctional device) authentication** — communication from the MFD's terminal to YSoft SafeQ for the purposes of verifying a user's login credentials.

3. **Communication from YSoft SafeQ to the networked MFD:**
    a. A pull-print release of a print job
    b. Authentication verification, authorization, and accounting

4. **Integration** with the identity management database or identity/authentication provider.

5. **Connection** from YSoft SafeQ to an SMTP mail server or shared network folder for data delivery of digital scans.

6. **Integration** with third-party applications or systems, for example, for delivery of digital scans to a cloud-based document repository.

7. **Inter-server communication.** Depending on an organization's redundancy and failover requirements, multiple Site Services tiers or Management Server tiers can be in multiple remote locations. Inter-communications between the tiers at the various locations are required for print release job processing and the transfer of print job metadata for reporting purposes.

8. **Administrator** access to the YSoft SafeQ Management interface.

THE YSOFT SAFEQ PLATFORM

YSoft SafeQ is an Enterprise Workflow Solution platform. This means our solutions — print management, document capture with Automated Scan Workflows, and 3D Print Management, can be offered separately or together. Each is tightly integrated and utilizes the same underlining software system. An organization can begin with Print Management and easily add document capture with Automated Scan Workflows, see Figure 8.

Y Soft offers YSoft SafeQ as individual modules for companies that want specific features, or as software suites where the modules are bundled together for a more comprehensive solution in either Print Management, Document Capture, or 3D Print Management.

With the tight integration between the solutions, many of the same modules are used across different solution areas. For example, Authentication, where a user's identity is verified against a corporate directory before access to a device is granted, is used across our entire portfolio. It is easily used when an organization adds other YSoft SafeQ products from the platform. This is another example of how YSoft SafeQ offers an organization the flexibility to purchase what they need knowing they can add to the platform as their needs grow, see Figure 9.
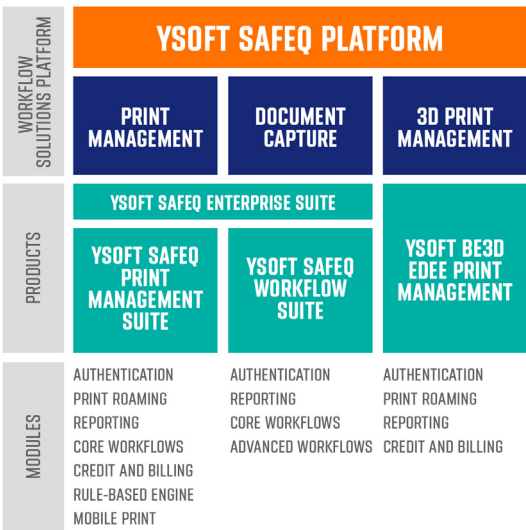
IN CONCLUSION

IT organizations need to be nimble to meet the changing needs of their company. Solutions that are architected for scalability and flexibility give IT staff the best options to insure against change. As an enterprise-wide solution, print services need to be highly available, network efficient, and hardware lean while providing options as needed for failover and redundancy.

YSoft SafeQ is designed as a Platform for Growth. Its building block approach gives an organization the scalability and flexibility it needs while delivering reliability and uptime. Additionally, YSoft SafeQ offers built-in redundancies and failover systems throughout the entire system or only where needed as defined by the company's IT governance.

GLOSSARY

The glossary is provided to help readers who are familiar with terms used in YSoft SafeQ 5 or earlier versions. Not all terms below are used in this document.

MAIN CONCEPT TERMS

YSoft SafeQ Tiers a 4-tiered (n-tier or multi-tier) architecture. Depending on customer needs, the tiers can be flexibly deployed to provide the scalable infrastructure required to support a single or multiple locations on-premises or hosted in a private or hybrid cloud, see page 5. The 4 tiers are:

Reporting and Data Analytics Tier contains the data processing, analytics and reporting tools, see page 5

Management Server Tier provides a single point of management for configuring and managing the YSoft SafeQ solution, defining access control policy, configuring workflows and more. For details, see page 5

Site Services Tier contains job processing functions including Spooler Controller (SPOC), FlexiSpooler and Terminal Server. Depending on customer needs, it may also contain building block services such as Automated Scan Workflows (Workflow Processing System), Mobile Print, Wireless Print (AP server) and the YSoft Payment System, see page 6

Client Services Tier consists of YSoft SafeQ software embedded in a multifunction device or printer (or as separate hardware terminal referred to as External Terminal) and the YSoft SafeQ Client, software that resides on the workstation and provides additional user services, see page 6.

ADDITIONAL TERMS

Building Blocks - Services YSoft SafeQ architecture services that can be used to build the desired print and document capture features in a company's locations, see pages 7.

Building Blocks – Tiers Once YSoft SafeQ is in use, typically in headquarters, and a company needs to scale horizontally to support other remote locations, additional tiers can be used as building blocks to support the functionality required for each office. Functionality required may differ between multiple remote offices, and the architecture's flexibility and scalability make this possible cost efficiently, see page 5.

Clusters Two or more Site Services or Management Server tiers. A cluster may be used to satisfy high availability performance, redundancy/failover and reliability requirements, see page 9

Clustering of the Site Services components Within Site Services or a Site Services cluster, two or more clusters of job processing components such as a SPOC group, or a WPS cluster

Horizontal Scaling When a company needs to expand its print services infrastructure to additional physical locations. Applies whether YSoft SafeQ is deployed on-premises, in a private cloud or hybrid cloud, See Building Blocks – Services and Building Blocks – Tiers in this glossary

Horizontal Scalability A YSoft SafeQ architecture design principle that provides scalability and reliability at each tier level independent of other tiers, see page 4

Overlay Networking a unidirectional connection on Network/Transport layers to create a virtual peer-to-peer network on an application layer where all components may communicate with each other freely, see page 3

Platform for Growth Describes Y Soft's approach to major feature sets where additional feature sets can be added using many of the underlying systems and/or modules already in use

Spooler Controller (SPOC for short) Main part of the Site Services tier which provides a central point for communication between its own components and also with any attached tiers - other Site Service tiers, Management Server tiers or any Client Services Tier.

SPOC group Two or more Spooler Controllers that synchronize their data, a backbone of a Site Services cluster. Equivalent to Near Roaming Group known in previous versions
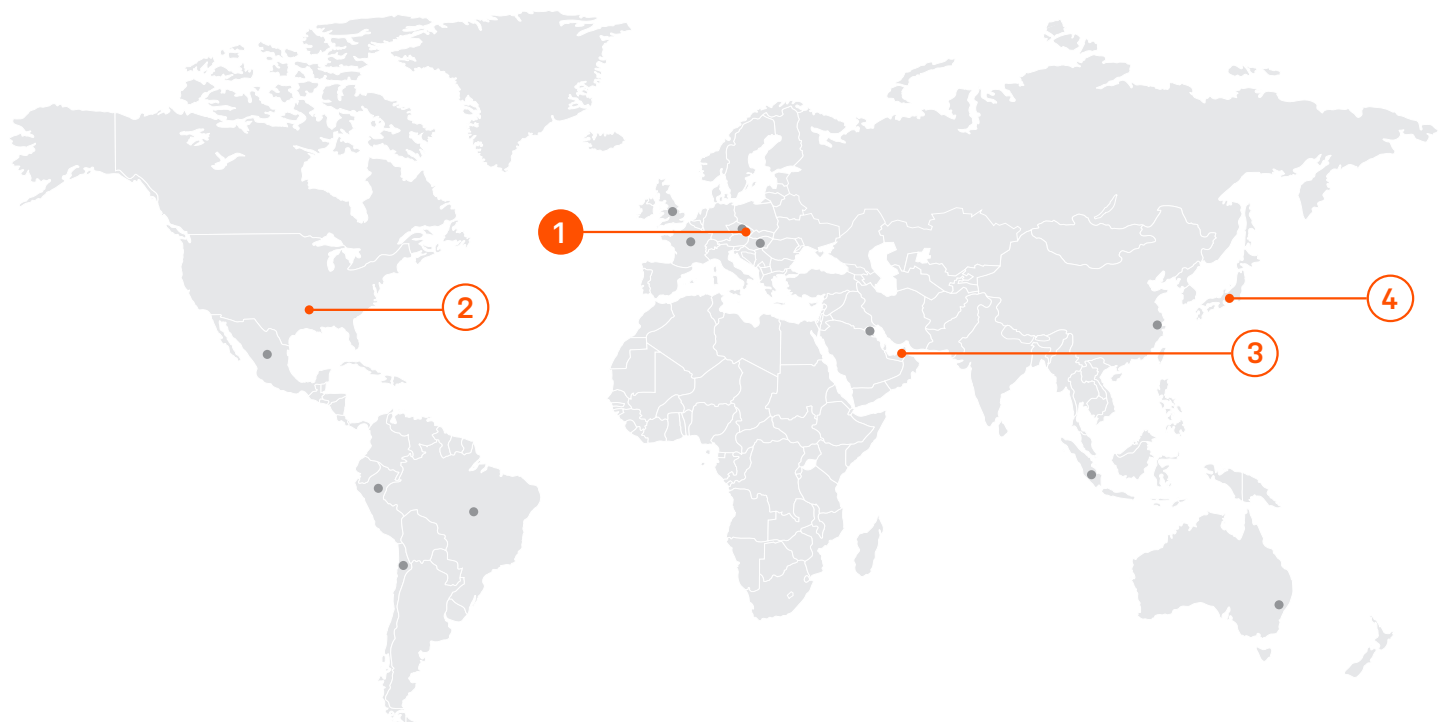
Upstream Connection Initiation A YSoft SafeQ architecture design principle regarding network communication between lower tiers and higher tiers, see page 3

Vertical Scaling When a company needs to expand its print services infrastructure in a single location usually due to more employees. Applies whether YSoft SafeQ is deployed on-premises, in a private cloud or hybrid cloud

Workstation Clients YSoft SafeQ Client or operating system printing subsystem. Usage of YSoft SafeQ Client is strictly optional and only required for more advanced features.

WPS Workflow Processing System that manages scan capture, processing and delivery as defined in the Automated Scan Workflow

LOCATIONS

Company Headquarters	Regional Headquarters
1 Y Soft Corporation, a.s. Technology Park, Technická 2948/13 616 00 Brno Czech Republic	**2** North and Latin America Y Soft North America, Inc. 1452 Hughes Rd, Suite 110 Grapevine, TX 76051 **3** Middle East Y Soft Middle East Office 107/108, Makateb 4 Building IMPZ, Dubai, UAE	**4** Asia Pacific Y Soft Japan, Ltd. KFM Building, 10th Floor 658-0032 Koyocho Higashinada Kobe, Hyogo Japan

For a complete list of more than 16 countries and locations, please visit our website.

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