PrinterStacks

White Paper

Version 1.0

Date: 2026-03-03

Executive Summary

PrinterStacks is a modern print management platform built for secure, scalable, and identity-driven printer deployment. Designed for enterprise and on-premises environments, it provides centralized control of direct printing, secure pull printing, embedded device applications, and automated printer queue deployment across Windows and macOS systems.

PrinterStacks provides a future-ready platform aligned with Windows Protected Print Mode, driverless printing (IPP), hybrid identity integration, and high-availability architectures. It is engineered to simplify deployments while increasing security, reducing operational overhead, and enabling recurring service opportunities.

The Modern Print Management Challenge

Organizations today face increasing complexity in print environments:

• Driver conflicts and PrintNightmare-related security concerns

• Windows 11 Protected Print Mode restrictions

• Hybrid identity (Active Directory, Microsoft Entra ID, Google Cloud Directory)

• Distributed workforce and terminal server environments

• Multi-vendor printer fleets

• Compliance requirements (audit logging, GDPR)

• Demand for high availability and load-balanced infrastructure

Traditional print servers were not designed for today's security demands, hybrid identity environments, and high-availability requirements. As organizations move toward zero-trust networking and Windows 11 driver restrictions, legacy print infrastructures increasingly become operational and security bottlenecks.

PrinterStacks addresses these challenges with a modern, scalable architecture built around security, redundancy, and identity-driven deployment—ensuring reliable performance, centralized control, and enterprise-grade resilience.

Support for both native Windows printer drivers (Version 3 and Version 4), as well as Microsoft's IPP Class Driver and IPP Everywhere, ensures long-term compatibility and investment protection. This hybrid driver strategy makes PrinterStacks fully compatible with Windows Protected Print Mode while preserving flexibility for mixed or legacy environments.

PrinterStacks supports a wide range of printer devices, from large multifunctional systems to compact desktop printers and label printers. This versatility ensures the platform fits seamlessly into diverse environments, including enterprise offices, healthcare facilities, retail, logistics, and manufacturing.

Solution Overview

PrinterStacks Architecture

Core components include:

- PrinterStacks Server (Windows Server-based)
- Client applications (Windows and macOS)
- MongoDB database backend
- Redis backplane for horizontal scale-out
- Embedded printer applications (multi-brand support)
- Web-based Admin and User portals

The platform uses secure HTTPS communication and persistent WebSocket (SignalR) connections for real-time communication. Separate endpoints for printing and scanning enable advanced load-balancing strategies.

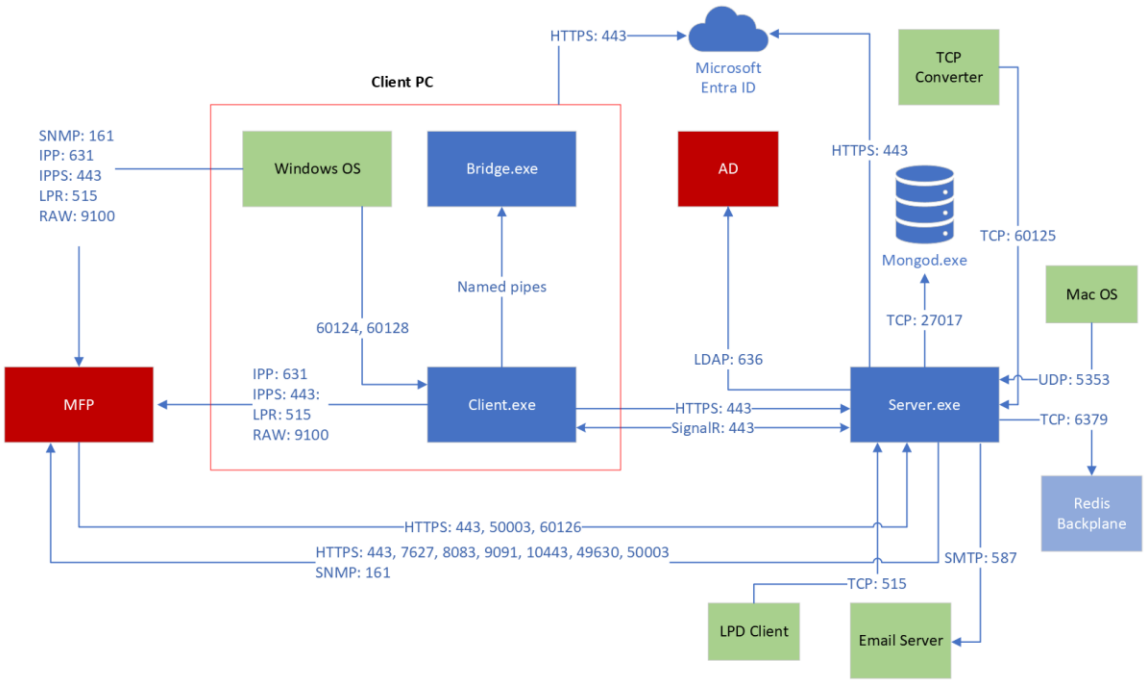

Figure 1: Architecture.

Key Capabilities

Print Management

• Direct printing

• Secure pull printing

• Delegated printing

• Kiosk mode for shared environments

• Terminal server support

• Redundancy mode for business continuity

• Printing support for Windows, macOS, Chromebook, iOS and Android

Driver Strategy

• Third-party driver support

• Driverless printing (Microsoft IPP Class Driver and IPP Everywhere)

• Windows Protected Print Mode compatibility

• Automated code-signing certificate distribution

Identity Integration

• Active Directory integration

• Microsoft Entra ID integration

• Google Cloud Directory integration

Automation & Lifecycle Management

• Auto-install based on user, group, hostname, MAC, or IP range

• Printer queue lifecycle management

• Migration of legacy printer queues

Scanning

• Document management

• OCR

Security

• Configurable TLS versions

• Proactive certificate expiry monitoring

• SNMP v2/v3 monitoring

• JWT-based authentication tokens

• Embedded authentication: card, PIN, access code, one-time code via email

PrinterStacks provides secure pull printing across all major printer brands, ensuring compatibility within heterogeneous enterprise environments. Currently supported brands include:

- Brother
- Canon
- Epson
- HP
- Konica Minolta
- Kyocera
- Ricoh
- Sharp
- Toshiba
- Xerox

Pull print jobs are encrypted while stored on disk and remain encrypted in transit when transmitted to the device using IPPS (IPP over TLS). This end-to-end protection safeguards sensitive documents against unauthorized access and ensures compliance with modern security standards.

The Delegated Printing feature enables users to submit pull print jobs on behalf of another user or a defined group of users. This allows documents to be securely released by the intended recipient at a compatible device.

This functionality is particularly valuable in environments such as healthcare, legal services, education, and executive support roles, where assistants or shared-service personnel frequently initiate print jobs for others while maintaining document security and accountability.

Kiosk Mode is designed for shared or public computers where individual users are not permanently logged in. In this mode, each pull print submission requires user authentication before the job is accepted.

This ensures that print jobs are correctly attributed to the authenticated user, maintaining security, accountability, and compliance in environments such as libraries, reception areas, healthcare facilities, and educational institutions.

PrinterStacks provides full support for terminal server environments. Printer drivers and printer queues are automatically installed on the terminal server based on the identity of the connecting user, ensuring that each user receives the correct printers dynamically at login.

This eliminates the need to pre-deploy drivers or maintain static printer mappings on terminal servers, significantly simplifying administration while improving the end-user experience.

PrinterStacks uses an IPP-based architecture, eliminating the need for legacy port monitors. As Microsoft phases out port monitor–based integrations in favor of IPP-only printing models, PrinterStacks remains fully aligned with Windows Protected Print Mode and future Windows releases.

By supporting PSA applications from device manufacturers for extended configuration, the platform maintains advanced functionality without compromising long-term compatibility.

PrinterStacks provides full support for IPP Everywhere on macOS, enabling seamless driverless printing without reliance on deprecated third-party PPD drivers.

By leveraging the native IPP Everywhere framework built into macOS, PrinterStacks ensures compatibility with modern Apple environments while maintaining a streamlined, secure, and future-ready printing architecture.

PrinterStacks supports secure printing from mobile devices, including iOS and Android platforms. By leveraging standard protocols such as AirPrint and IPP-based printing, users can seamlessly submit print jobs from smartphones and tablets without requiring third party applications, additional drivers or complex configuration.

This enables flexible, device-agnostic printing while maintaining centralized control, security, and compatibility across the organization’s printer fleet.

Besides deployment of printer queues via the client application PrinterStacks supports publishing printer queues via DNS Service Discovery (DNS-SD) as well as multicast DNS (mDNS). This enables automatic discovery of printers across both managed enterprise networks and local subnet environments.

By leveraging standards-based service discovery protocols, the platform simplifies printer visibility for Windows, macOS, and mobile devices while maintaining centralized administrative control.

PrinterStacks includes an integrated scanning solution that enables secure and flexible document distribution across multiple destinations, including:

- SMB network shares
- Email
- SFTP
- Microsoft OneDrive
- Google Drive

The scanning module supports metadata file generation to integrate seamlessly with external document management systems (DMS) and workflow platforms. Custom fields can be configured to capture structured information at the device, ensuring accurate document classification and automation.

A built-in OCR engine, based on Tesseract, enables text recognition and searchable document output, enhancing document indexing, retrieval, and compliance capabilities.

PrinterStacks eliminates the need for traditional Group Policy Objects (GPOs) to deploy printer queues. Instead, printer deployment is managed directly through the PrinterStacks client application using flexible, rule-based logic.

Each printer queue can be assigned using configurable rules based on:

- Username
- User group
- Computer group
- IP address range
- MAC address
- Computer hostname

This approach provides granular control without the administrative complexity and replication delays commonly associated with GPO-based deployments.

Users can also manually install authorized printer queues through the web-based user portal. Access to available printer queues is governed by configurable permission rules, ensuring that users only see and install printers they are entitled to use.

Scalability & High Availability

• Load balancer support with X-Forwarded-For handling

• Redis backplane for SignalR session distribution

• Primary node task ownership model

• Horizontal scale-out capability

• Dedicated scan node configuration

PrinterStacks is designed for enterprise-grade deployments ranging from single-server installations to fully redundant, multi-node clustered environments. The platform supports updating individual node servers during business hours. Built-in failover ensures traffic is automatically redirected to remaining nodes, allowing upgrades to be performed without service interruption. This enables seamless maintenance and significantly reduces operational downtime.

Drivers, print jobs, and scanned documents are streamed directly to disk and output devices rather than being fully loaded into memory. This streaming architecture significantly reduces CPU and memory consumption, making PrinterStacks highly resource-efficient and suitable for both small and large-scale deployments.

Deployment Scenarios

• Single-server deployment for SMB

• High availability for enterprise

• Terminal server farms

• Branch office deployments

PrinterStacks operates with a single server as its functional baseline and eliminates the need for traditional Windows print spool servers, removing common single points of failure associated with shared printer queues.

The platform is engineered to scale both vertically and horizontally, supporting growth from small deployments to large enterprise environments. In distributed deployments, a Redis backplane coordinates real-time communication between client PCs and server nodes, ensuring session consistency and load distribution.

If a server node becomes unavailable, clients automatically reconnect to another active node without user intervention. This built-in failover mechanism ensures uninterrupted operation and high availability across the environment.

If network connectivity to the server becomes unavailable, Redundancy Mode is automatically activated. In this scenario, users can continue printing without interruption. A dialog prompts the user to select from previously used printers, allowing the print job to be redirected directly to a local device during the outage.

This ensures business continuity even in the event of temporary network or server disruptions.

On-Device Redundancy Mode is an additional resilience feature designed for embedded environments. In the event of network failure, the device is automatically unlocked, allowing users to access standard device functions without uninstalling or disabling the embedded login application.

This ensures continued usability of the printer even when backend connectivity is temporarily unavailable, preserving productivity and simplifying recovery once connectivity is restored.

Business Benefits for Customers

- Reduced helpdesk incidents related to drivers and printer queues
- Improved document security with pull print
- Simplified onboarding and printer deployment
- Reduced infrastructure footprint
- Increased compliance visibility
- Improved user experience across devices

Conclusion

PrinterStacks represents a next generation print management platform purpose-built for secure, scalable enterprise infrastructures. Combining identity-based automation, standards-driven architecture, and high-availability design, it enables organizations to modernize their print environment while ensuring operational continuity and future compatibility.