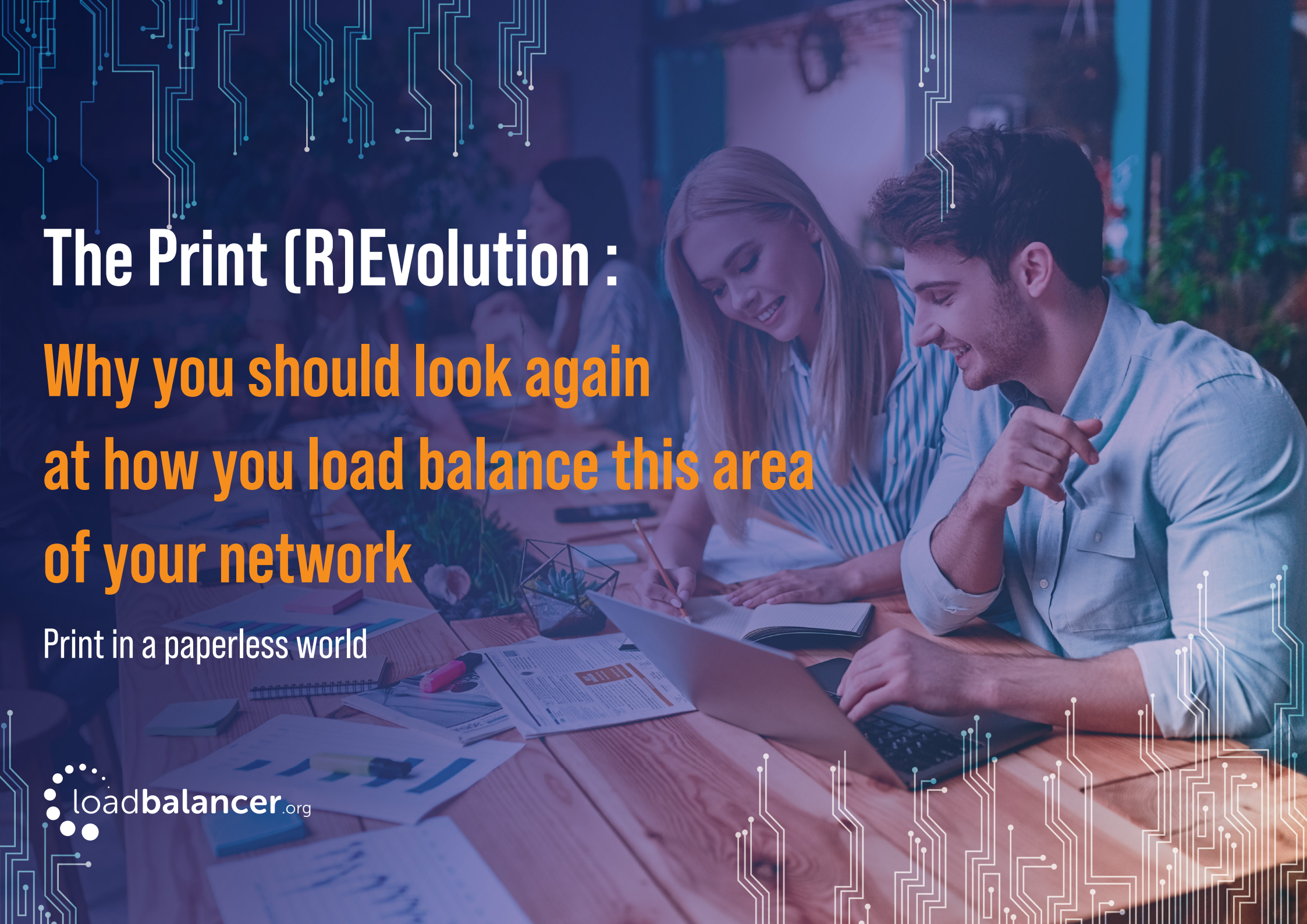


The Print (R)Evolution :

Why you should look again at how you load balance this area of your network

Print in a paperless world

loadbalancer.org

COVID-19 has taught the IT industry a valuable lesson: worst case scenarios really do happen.

"When the coronavirus emerged in early 2020, it not only seriously disrupted services; it also brought about a seismic shift in application usage. Critical and non-critical workers were required to work together in new ways, becoming increasingly reliant on collaboration applications and remote access services to continue to fulfil their roles. Application usage soared, as did network expectations - yet many IT teams had little or no access to their data centers.

The organizations that coped best in these extraordinary circumstances were those that had prepared for a worst case scenario, expecting it never to happen. They had load balancers in place, capable of managing the unprecedented surge in application traffic and maintaining uninterrupted services. Throughout national and local lockdowns, load balancers worked behind the scenes to keep vital collaboration tools, critical applications, platforms and communications services available for an unprecedented number of users.

As we learn to live in new, uncertain times, we cannot let our guard down. Disasters of all kinds can happen at any time. Next time, it might not be a disease, but a fire at a data center, a terrorist alert, or a cyber-attack. It's not what the disaster is that matters, but how ready you are.

Recent events have taught organizations that they need simpler load balancing solutions that they can set up quickly, manage remotely, and trust to deliver exceptional reliability for mission-critical applications. As everyone now knows, worst case scenarios can quickly become reality and we need to be ready for whatever happens next."

Malcolm Turnbull, Co-Founder, Loadbalancer.org

EXECUTIVE SUMMARY

Print in a paperless world

Print isn't the dinosaur you might think....

You might not have seen revolutionaries marching in the streets, but Print has been quietly breaking new ground and is changing the way industries think about their printing needs.

Here we look at where print came from - and, perhaps more importantly, where it's going:

SECTION ONE: How did we get to where we are?

SECTION TWO: Load balancing traditional print management solutions.

SECTION THREE: A brave new world.

SECTION FOUR: Why Loadbalancer.org?

In each section, we will examine the small but pivotal role load balancers play in delivering print solutions and mitigating some of the potential risks.

1. HOW DID WE GET TO WHERE WE ARE?

The complexity of print

What's hard about printing? You just press File > Print right? Wrong. Although it might not seem like it, getting toner or ink on paper can be harder than you think! How many times have we each felt like throwing our printer out of the window at home when it simply wouldn't work? And there could be so many reasons for this that even googling or troubleshooting the issue may not result in that magic printing sound. So imagine how much more complex the issue might be in an office. Untangling a print job error can feel a lot like trying to untangle that necklace you want to wear that has somehow become one impenetrable knot in your drawer. This happens in real offices every day because people still *need* to print. But what exactly are they now printing?

Do you need to control your print environment?

In an uncontrolled office environment, employees will print all sorts of things not related to their day job, such as garage sale or frat party flyers, church bulletins, etc. This could be a job for print management - determining the amount of personal printing tolerated from end users. For example, a company like PaperCut could assist the organization with a framework that ensures employees print work documents only.

In this eBook, we will not however concern ourselves with controlling the actual output. Instead we will assume that all printing will be necessary, and instead focus on organizations where they want printing to 'just work' - all of the time.

How are your print jobs spooled?

On the backend, printing can be very complex (depending on how important printing is in your environment). Printing is something that isn't taught either. There are very few colleges/Universities that offer any kind of 'print optimization' program. Microsoft has certainly never addressed printing in any of its certification classes - and nor have Apple or Linux. Indeed the fact that these print servers all have their own way of doing things also adds to the problem.

Have you ever *really* looked at print driver properties? There is a print processor section where you can select what you want - but how many people actually know what all of those processors are?! How about that 'enable advanced printing features' check box? This is in fact on by default. The problem is that these jobs are spooled in a different way, potentially creating undesirable output or performance. Then there are settings for separator pages, sharing, permissions, color management, preferences and printing defaults that look the same (why are there two places to set defaults?!).... It's no wonder printing problems exist.

What about worst-case scenarios?

A lack of understanding of the print environment is part of the reason we saw the PrintNightmare vulnerability, that needed emergency patching from Microsoft. This allowed hackers to take over the SYSTEM account, gaining full access to the server.

Standards are few and far between

Print has seen a metamorphosis in recent times. But what has and hasn't changed?

SOMETHING OLD

The first dot matrix printers were invented in 1968 and the first laser printer a year later. These initial printers were expensive and huge and while there were computers around, they were typically mainframe as the PC as we now know it didn't really start hitting consumer shelves until the 1980s.

These early printers were reliant on hardware cables to work, and proprietary software to produce the printed page. Then printers became small enough to fit on a desk and Apple produced the LaserWriter in 1985. It needed a different protocol too, which sparked the advent of desktop publishing. That took us to the late 90's when getting a printer to work with a personal computer required trying different drivers until you found one that worked with your operating system.

Microsoft became the dominant player and, finally in the 2000's or so, things became a bit easier with most printer manufacturers using either a PCL driver (developed by HP) with Microsoft, or a PostScript driver (developed by Adobe) for Mac OS.

SOMETHING NEW

Then things started getting messy again due to the rise of smartphones, tablets, and laptops, with people wanting to print from these devices. Add new cloud directory services such as G-Suite and/or IT Admins harnessing Linux servers, and standards become hard to manage. In fact, the standards for the two protocols are not really standards at all.

We do find that many PCL based printers can use just about any PCL driver. However, today's printer packages make it difficult to obtain the necessary files, without loading bloatware that is often included with the installation package. PostScript (PS) drivers are very reliable but different manufacturers (and sometimes even different products made by the same manufacturer) are not always compatible.

The only commonality that exists with PS drivers are quantity, color selection and whether you want two-sided printing or 'duplex' as it's called. When you add Multi-Function Devices (MFDs) into the mix and they have finishers, hole punch units and other accessories, you can throw compatibility out of the window.

Google Cloud Print was in beta for over 10 years with the intent of using the cloud to process print jobs. It would work for a while and then Google would change something which caused printing issues, so they abandoned the project.

Now Microsoft is entering the cloud arena with Universal Print, taking advantage of IPP(S) printing (the same protocol that CUPS uses which is driverless). This is a great concept (and indeed a PaperCut connector is already available so you can track Universal Print), but the issues here are finishing options again - and large print jobs won't travel nicely over the internet. Plus you need to be on the Azure platform for this to work. We'll see how this evolves, but this is unlikely to be a solution for high availability, as an internet outage would simply cause printing to stop, for example.

A MARRIAGE MADE IN HEAVEN?

The point here is that before you can even think about a High Availability printing system, you need to know the basics. And that means making sure that printing works BEFORE you start adding other things into the mix – like print management!

2. LOAD BALANCING PRINT

Do you need High Availability print solutions?

There's printing - and then there's 'High Availability' printing. While you don't need High Availability for your home printer; for organizations where print is integral to operations, then High Availability is a must. The question then, is whether or not printing is mission critical for your organization.

What is a mission critical print environment?

Examples of mission critical print environments are those for whom the cost of downtime would be disastrous e.g.

- Hospitals - Without a printer, they would struggle to check-in and discharge patients, print prescriptions, wristbands, orders; or medical notes for busy doctors with multiple patients, rushing from one ward to another, with no time to keep returning to a desk to consult electronic records.
- Banks - They need to print annual reports and other hard copy financial documents for investors.
- Legal firms - According to Marco Technologies, a single attorney generates an average of 60,000 pages per year. That's definitely a mission critical print environment that requires 99.99% uptime!

Do you need extras?

Fortunately, there are ways to ensure maximum uptime, and also allow for the addition of extras like print tracking and secure printing to satisfy government regulations (like HIPAA in the US), or other compliance needs throughout the world.

How much redundancy do you need?

As we are going to hear in later sections, it's not just printing that needs failover. A company that needs printing to be 'always-on' is also going to be concerned about other systems in their environment - so a fully comprehensive, Highly Available network is going to consist of a lot of redundancy to make it all work.

A high availability print solution deep dive

The focus here will be on using a named print management system and network load balancer. Specifically, this eBook focuses on using a Loadbalancer.org load balancer, with a PaperCut print management application, to create a High Availability print solution.

The emphasis will be on Microsoft, as most print servers exist on that platform. Linux uses CUPS, which presents other challenges that fall outside the scope of this publication.

How do you achieve High Availability printing?

Between the Loadbalancer.org and PaperCut experts, there is a plethora of detailed information and deployment guides to help you establish High Available printing. As in many publications, including this eBook, your particular system design may not be covered here, for one reason or another. Hence there's no substitute for speaking directly with both PaperCut and Loadbalancer.org, who can give you access to their Solutions Architects and other specialists to ensure your solution is following best practice and provides the level of failover you need.

Getting started

To begin with, we'll start with the assumption that you already have redundancy throughout the organization and are now considering adding printing. Certainly in the past you could cluster print servers, however that option has been debunked so we need to look at better ways to keep printing operational. Clustering can be used for a PaperCut application server, the database that it's using and even data storage - but not for print spooling.

The good news is that PaperCut is fully compatible with clustering and is supported at all levels of the application. The even better news is that adding a Network Load Balancer (NLB) takes High Availability to the next level. In fact, some aspects of PaperCut require a single host (such as an embedded app on a Multi-Function Device (MFD), or the User client that's sometimes needed on the workstation).

Isolating a single server

When you have multiple application servers set up for redundancy that then begs the question: how do you talk to just one server? This is where we take a copier, client or even secondary/site server, and place them in front of a load balancer for proper communication to the active PaperCut application server.

So yes, this uses an active/passive methodology where the load balancer automatically switches to the server marked 'active' for failover, ensuring printing continues uninterrupted for the end user. In fact, the end user won't even be aware that anything happened in the background, except perhaps a slight delay in retrieving their document.

Configuration prerequisites

For completeness, it should be noted that for this to work the main system must already be configured for High Availability with:

- A common data folder that's protected
- A Highly Available database (PaperCut supports most databases)
- Clustered application servers, configured with the same resources.

There may also be a few features in PaperCut that require additional configuration; such as when you are using Print Deploy, Web Print, Custom Reports and Branding.

Why do I need a Network Load Balancer?

Ultimately, whatever the organization is trying to achieve and whatever their print environment looks like, they want to achieve four things: zero downtime, simplified infrastructure, easy maintenance and optimal performance.

Implementing a Loadbalancer.org solution is key for the following reasons:

1. ALWAYS-ON PRINTING

When it comes to achieving zero downtime, load balancing grants the ability to failover without any impact on users.

2. SIMPLIFIED INFRASTRUCTURE

Infrastructure can be scaled up and down, mitigating the need for constant DNS and firewall configuration changes.

3. SIMPLIFIED CHANGE CONTROLS

Servers can be brought on and offline at the touch of a button, making change controls simpler.

4. OPTIMAL PERFORMANCE

Optimal performance is ensured, as the load balancer spreads network traffic across multiple servers.

Simple Environments

A Windows print server is the defacto when setting up a printing service within a Windows environment. It's as simple as installing the Print and Document Services via the server manager. This sort of environment might be found in a small business with two print servers and printers segmented by departments; in an enterprise with multiple sites across the globe; or in hospitals that require medical images to be sent to various devices such as printers, tablets or PCs.

Find out here how to load balance a Windows print server.

More Complex Environments

Moving on from simplistic environments to those that require a little more management; solutions such as PaperCut are deployed to enable exactly that. In PaperCut NG and MF v20.0, PaperCut introduced an active/passive Application Server Failover feature and support for using a Network Load balancer.

The passive Application server will automatically assume the role of active server if the primary Application server is offline. A Network Load Balancer is required to manage the re-routing of network traffic to the new active server.

In the event of the Application server going offline without a load balancer and High Availability, services are lost. With one, however, there's an automatic failover to ensure nominal downtime, and continuity of business. There are also notifications available at the load balancer level to alert the appropriate people who can then investigate and resolve the server failure.

Find out here how to load balance PaperCut.

Is a Network Load Balancer difficult to use?

As mentioned earlier, one of the largest expenses in maintaining High Availability is the Fault Tolerant Ethernet (FTE) industrial control network that ensures the network runs like a fine watch. For this reason any software that's deployed needs to be user friendly, without needing an extended learning curve.

The papercut setup

Using PaperCut for your print management system makes the entire network easy to set up.

You will want to make sure to use PaperCut version 20.0 or higher as this is an in-app solution that provides self-healing in the event of an application-level failure (the current version of PaperCut is 21.x where new installations will be ready out of the box). Existing PaperCut installations may therefore require an update, with new versions being available for free, providing your maintenance and service is up-to-date. You will also need at least 2 servers, virtual or physical, and a highly available database (PaperCut supports Microsoft SQL Server, PostgreSQL, MySQL and Oracle).

A network drive will need to be accessible by all servers and then you will need to set up external print servers (these can be secondary or site servers, depending on whether that server has a Multi-Function Device (MFD) attached or not). Either way, the licenses come with PaperCut, so you won't have to worry about purchasing any additional components to make this work - only the print servers themselves. These should be replicated servers with equal resources and queues as they sit behind the load balancer.

The loadbalancer.org setup

When working with Loadbalancer.org, the setup is also very simple.

It's GUI driven and you can easily select between virtual or physical servers. Layer 4 configurations with DR (also known as DSR) are recommended, and this setup is fully supported by PaperCut. PaperCut Authorized Solution Centers (ASC) have access to Loadbalancer.org as well, so your local vendor is the best way to get started as they can leverage these resources for you.

This may sound like a lot, however in reality, organizations that are interested in High Availability tend to already have a game plan. When Loadbalancer.org software is configured with PaperCut, it's truly one of those 'ah-ha' moments.

Easily select Layer 4, use the DR dropdown, turn off persistence and then copy the health check API from PaperCut into the NLB and you're pretty much good to go.

HELP!

And if you get stuck - just refer to the Loadbalancer.org PaperCut Deployment Guide, or reach out to their team of experts who are always happy to help.

Does it work with PaperCut's Find-Me printing?

Sure does! Just as in a regular PaperCut MF installation, Find-Me printing is configured by creating an additional virtual queue on the print servers (replicated on each one). In some cases this might be the only driver that gets pushed out to the end user, which will depend on whether you are using any finishing options on an Multi-Function Device (MFD).

If not, then this single queue will accomplish all your basic printing needs - and PaperCut provides a Global PostScript driver just for this purpose (of course your printer will need to be able to output a PostScript file so please check with the manufacturer to ensure PS printing is available). Any driver can be used - just test to ensure compatibility with all the devices you intend to print to.

With this setup, server affinity should be configured to make sure that the server that receives the job is the same one that sends the job to the printer. This will also help reduce unnecessary network traffic. Again, don't worry – get us involved so we can help steer you in the right direction.

"As a PaperCut Subject Matter Expert, I get involved in these discussions all day long. I'm grateful to Loadbalancer.org for providing this platform to help you understand High Availability as it relates to print - and how two important pieces of software can be deployed to greatly enhance your print uptime.

If you have any questions about these processes, kindly reach out to your favorite vendor or hit us up directly, we're happy to help."

Doc Ballje, Print Specialist, PaperCut

3. A BRAVE NEW WORLD

Reframing the solution

Yes, many organizations are now striving for paperless offices. But there are now two fundamental questions to consider:

Will we ever be 100% paperless?

The short answer is no, certainly not for a while!! The overall volume of printing in the world will reduce, but what we are going to be left with are documents that cannot be digitized. Documents that are crucial to retain in hard copy.

What's happening to documents we're no longer printing?

Make no mistake. These documents are still around - they just exist now in digital form. Rather than printing and passing, we're attaching and sending. And the more digital documents there are, the more significant the role of document workflow applications in managing the storing, and sharing of these documents and resources.

Digital print applications

Many digital print applications are now offering more workflow centred solutions and establishing themselves as the backbone of an organization's departmental workflows and communications.

New print devices

Many organizations have attempted to go paperless, but people definitely still like to print. The difference is that now they're printing in a very different way e.g. from a smartphone, tablet, mobile computer, desktop, or even virtual desktop. And so, if there's no print management in place, then employees are able to print ad nauseam - at your expense.

An ongoing need for load balancing

People have been printing in one way, shape, or form since languages first originated, we just happen to be doing it a bit differently now - with greater access and output from a single individual and their bevy of digital devices.

The bottom line is this.... if the company needs their employees to be able to print 24/7 (whether managed or not, hard copy or digital) then there needs to be a mechanism to provide that service.

It needs to work, be easy for administrators and end users to use, and it shouldn't get in the way of doing regular business. Load balancing therefore remains essential for a complete, High Availability printing system, with Loadbalancer.org facilitating an easy transition into this brave new world.

PaperCut and the future

There are so many things that we can do now, especially with virtual systems that look, act and feel like a physical system. A big takeaway from all of this material is therefore that 'it' can be done (whatever that 'it' is). And there are a few things to do to make sure it all works seamlessly:

STEP ONE

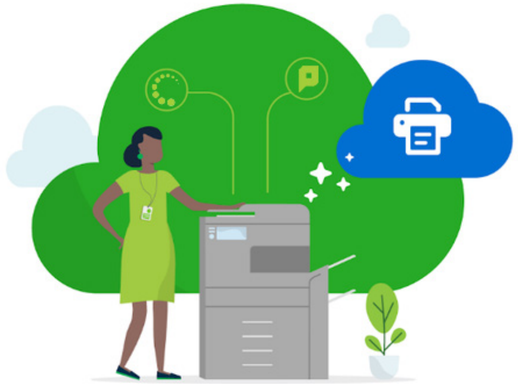
First off, make sure your basic printing is working correctly. This cannot be stressed enough, and this is not just true for a PaperCut install. If printing isn't working and then you start adding print management and load balancing and it doesn't work, you will probably have no idea where to start troubleshooting. So, make sure printing works first! Test color, two-sided printing, multiple copies, etc. Try to replicate what an average user is printing throughout the day.

STEP TWO

Then you can add PaperCut and your Loadbalancer.org load balancer. And when you add each piece, test again! Make sure that what you configured is doing what it's supposed to do, before moving to the next step. Then you can easily go back one step if it doesn't work, to figure out what checkbox you forgot or that you fumble-fingered an IP address.

STEP THREE

With consistent updates, improvements on the software, and a new version every year, you are assured of having a PaperCut product that will not go out of date. The same can be said of Loadbalancer.org - updating when and where necessary to provide a best-in-class product that will keep your organization up and running at all times. Without paying for features you don't need.



PaperCut™

PRINT IN FINANCE

Incompatible tech and compliance

Not only do banks and financial institutions print copious amounts of sensitive financial documentation and annual reports, they do so whilst still being stuck with old-school technology such as faxing that we just can't seem to get rid of! The expectation of faxing is that the transmission travels along one solid copper wire from one fax machine to another. However the reality is that somewhere on that journey transmission has most likely gone VoIP, no longer travelling along one continuous wire. Depending on the fax machine, many of them are received electronically and then printed on demand when needed. So a print management system is needed to police and aggregate both new and old technologies.

Financial institutions also rely heavily on High Availability printing for financial agreements such as mortgages, which often need to be printed and stamped in branch to confirm completion of the transaction. This is nearly always time-sensitive to ensure funds are then approved for transfer.

Furthermore, employment contracts typically need to be signed on hard copy printed documents, with real ink signatures and/or initials on each page - and not digital representations. Again the print and signature exchange is typically time-sensitive, to seal the deal and prevent top talent joining a competitor. Losing a key hire to a faulty printer can therefore have catastrophic strategic as well as financial consequences, especially given the substantial cost and time to hire.

This vertical can therefore certainly take advantage of not only a load balancer, but also a print management system that allows better control of what, where, when, why and how paper is being handled.

PRINT IN HEALTHCARE

Accelerating print to improve patient services

PaperCut is scalable enough to fit any environment and works on just about every printer manufacturer out there. Nowhere is this more true than in healthcare where hospitals are now enjoying the benefits a PaperCut solution, with the latest Epic integration.

Healthcare was pointed out a few times in this publication, and rightly so. Hospitals and supply chains for healthcare have been stretched to the limit in so many ways that they need to have solutions that just 'work' and can be implemented without any disturbance to the existing conditions. Many are finding that their current printing methods are slowing the process of moving people in and out of the hospital, and may not be compliant with Government regulations.

In fact printed notes now follow patients around the hospital, printed wristbands with barcodes help nurses scan prescribed medication prior to administration, to ensure they're giving the right patient the right medicine and dosage. Discharge papers now include all the doctors that visited you while you were in the hospital so you can share the information with your general physician when you get home, or use it to check that you were billed correctly. All of this information needs to be printed NOW so the clinician can get to the next patient or open up a room for someone else quickly.

In addition, in the US, the Health Insurance Portability and Accountability Act (HIPAA), has introduced a host of digital and hard copy print controls that need to be complied with, to ensure patient medical records are kept secure.

4. WHY LOADBALANCER.ORG

Tech vendors and organizations work with us because...

Embedded print specialists

Print is not a stand-alone vertical. Instead, it is an embedded solution that cuts across all industries. At Loadbalancer.org, our experienced engineers develop customized solutions for print applications that are unbreakable and easy to use. We work closely with existing and prospective customers to provide load balancers that facilitate High Availability, scalability, and zero downtime in any setting.

Part of the open source community

Our suite of appliances and virtualized load balancer solutions are all based on well-established open source technologies, including HAProxy, LVS and ModSecurity. We believe this makes them the most secure, flexible, efficient and powerful load balancers available. We are however not beholden to any one open source platform. This allows us the flexibility to cherry-pick the best components of each open source technology and also from different technologies. All of this while providing the support services, documentation and SLAs that you would expect of a proprietary solution.

A unique and refreshing approach

We pride ourselves on developing fully featured, high performing products, that are easy to configure, use and manage - backed up by a top-notch, tireless support desk. At Loadbalancer.org, we want you to be in control, so we don't do end-of-life. So we will always support your product - and that is a promise. Our products run on any platform, so you don't need to learn, test and integrate an unfamiliar load balancer if you want to migrate.

And thanks to our unique consultative approach, we can also get involved with a lot more than just load balancing issues e.g. IT infrastructure, network and third-party solutions.

Flexible pricing and licensing

We understand that in today's world your plans can change quickly. That's why we launched our Freedom License, to give our customers the flexibility to migrate across different platforms easily, quickly and without any financial penalty. Loadbalancer.org gives you the freedom to pay and deploy exactly how you want to, with clear pricing and no penalties for moving across plans or even platforms.

About the company

Loadbalancer.org's mission is to ensure that its clients' businesses are never interrupted. The load balancer experts ask the right questions to get to the heart of what matters, bringing a depth of understanding to each deployment. Experience enables Loadbalancer.org engineers to design less complex, unbreakable solutions - and to provide exceptional personalised support.

To discuss your load balancer requirements with load balancer experts, contact Loadbalancer.org on:

US Headquarters

Loadbalancer.org, Inc.
4550 Linden Hill Road,
Suite 201
Wilmington, DE 19808
USA

EMEA Headquarters

Loadbalancer.org Ltd.
Compass House
North Harbour Business Park
Portsmouth, PO6 4PS
England, UK

Canada

Loadbalancer.org Appliances Ltd.
300-422 Richards Street
Vancouver, BC
V6B 2Z4
Canada

Germany

Loadbalancer.org GmbH.
Tengstraße 27
80798
München
Germany