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Bidirectional Communication: The backbone of the modern printing infrastructure

White Paper

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Executive summary

Bidirectional printing communication is a typical underappreciated technical development. Although it is the literal backbone of any advanced printing system that leans on IT support to control printing errors and production performance, it is not well known or much talked about even in the professional printing industries.

The lack of knowledge about bidirectional communication hinders creative approaches to using its benefits in current and future solutions, and in gathering information for this white paper, the author found that even general online resources in the industry proved appallingly lacking on the topic.

This white paper aims to educate the intermediate to advanced technical reader on the basic structure of bidirectional printing communication in printing infrastructures supported by NiceLabel products. While other printing solutions that include bidirectional communication are not approached in detail, there are few (if any) differences in the basic approach to the technical structure.

The white paper will provide the reader with a birds-eye view of what bidirectional communication in labeling entails, providing a base to build upon and hopefully, a resource to draw from in the development of new and creative label printing solutions.

What is Bidirectional Printer Communication

Practical Application

Bidirectional printer communication allows the printer to communicate its status with the computer it is connected to. As a result of this, networked printing infrastructures can share the printer's and print job's status information to any computer in the network, or make this information available online.

The introduction of bidirectional printing has opened the gateway to truly integrated label printing, and the inclusion of the printing process into the IT-supported business infrastructure.

Types and levels of bidirectional communication

In spite of similar naming, bidirectional communication does not equal bidirectional printing (print heads printing as they pass over the print surface in both directions).

The bidirectional communication concept revolves around the communication between the printer, its driver, and the software controlling the printing. As the printer sends out information about its own status and the status of print jobs, it becomes an integral part of the broader IT system.

There are two basic types of bidirectional printer communication:

Basic bidirectional communication – the printer coordinates the flow of print jobs from the computer, essentially telling the computer when it has completed a previous job and is ready for a new one. This is intended to prevent overburdening the printer and causing it to lock up.

On the practical level, this is done by leveraging the printer internal memory buffer so that the printer does not interrupt printing while waiting for a new job, but also does not allow buffer overflow.

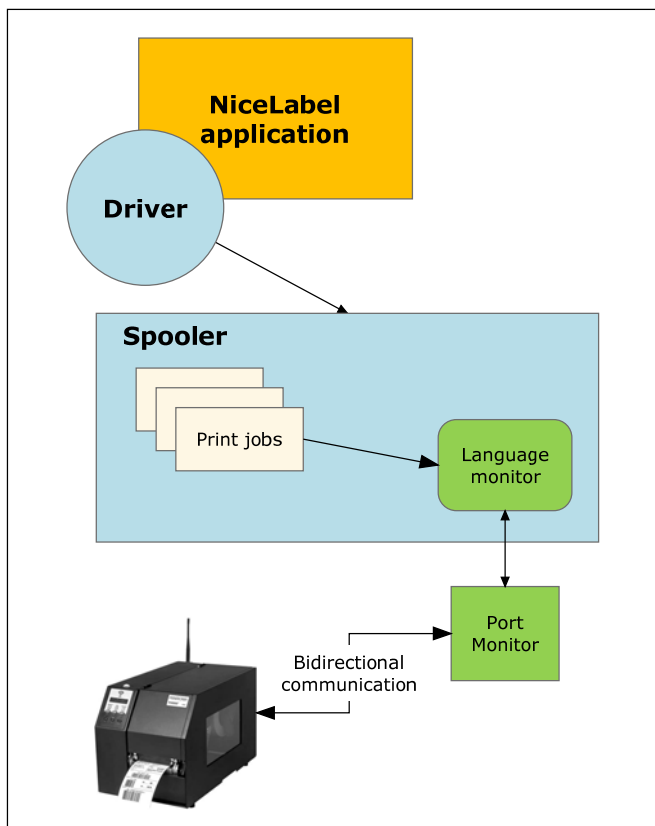
Advanced bidirectional communication – the printer reports its statuses to the computer (through the driver), and allows the computer to keep track of printer and job statuses, log past print events and reported errors, prioritize printing on »available and ready« printers, as well as to coordinate printing efforts remotely.

Bidirectional communication is a modular functionality in the sense that it can be disabled for a particular printer, and the printing to that printer will be performed with no status checking, notification, or other functionalities offered by the bidirectional infrastructure.

Technical Structure

The bidirectional communication concept must be supported by all 3 crucial players in the printing system in order to function.

- The **printer** itself must have bidirectional communication capability (most mainstream labeling printer manufacturers offer a broad array of such printers)
- The **printer driver** must be able to receive the communication from the printer and forward it to the platform where the data is processed
- The **printing software** must support bidirectional communication to the extent that the data received from the driver is processed and presented to the user in a useful format



The complete path of label data from the NiceLabel printing application to its printed result. The individual stages and technology will be described in brief below.

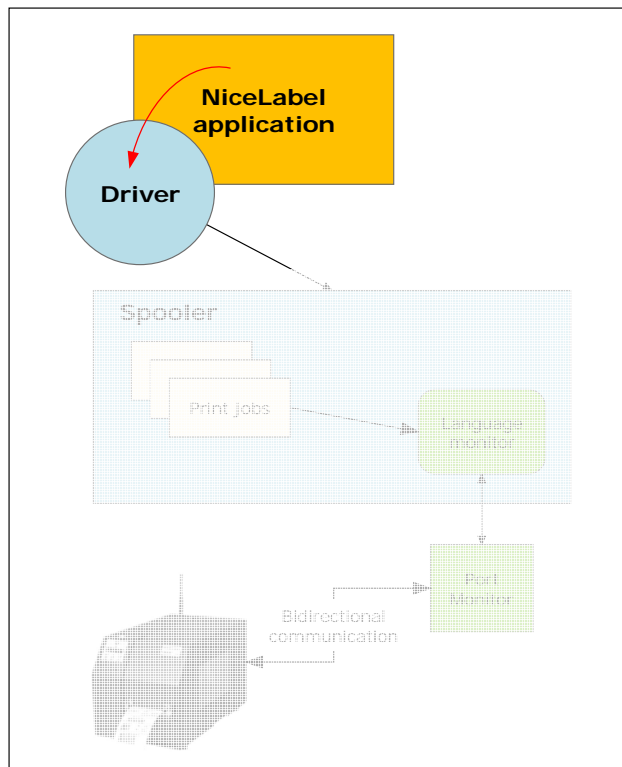
NiceLabel Information Flow

Application to Driver

The software uses a combination of GDI (Graphical Design Interface) and internal interface calls to communicate all of the label information, including the printer to which it should be printed, to the driver.

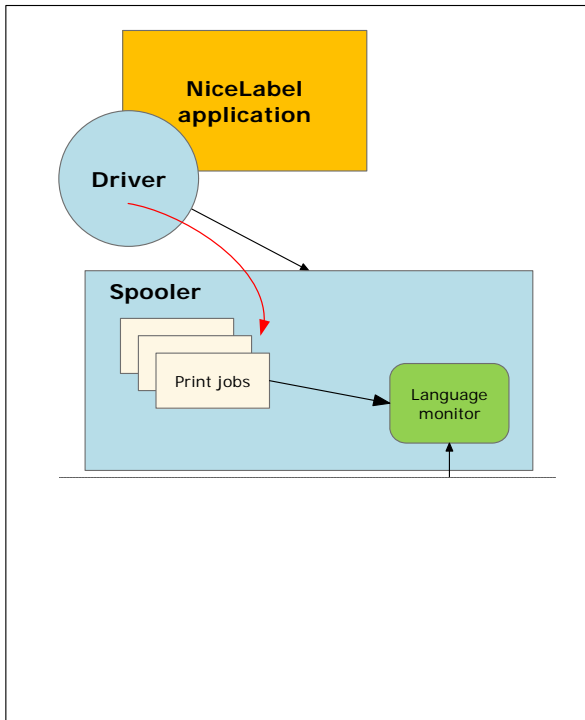
The driver processes this information and converts it into the language of the selected printer, and creates a print stream.

The print stream is a file which includes a **header** with all the necessary printer commands describing label size, print darkness, print speed, print offsets, media type, and individual label data. The header is followed by the **data for individual pages**, which includes the elements on the label, their values, images, etc.



Driver to Spooler

The driver checks for the presence of the **NiceLabel Language Monitor** in the spooler. If the service is present, »**metadata**« is added to the print stream. Metadata is used for several tracking and routing operations, and one of its purposes is delimiting the incremental stages in a multi-page stream. The metadata strings are the stream segmentation instructions for the Language Monitor, and are removed before the stream is sent to the printer.



The Language Monitor, which is installed with NiceDrivers, breaks the stream down into increments, based on the metadata it detects in the stream.

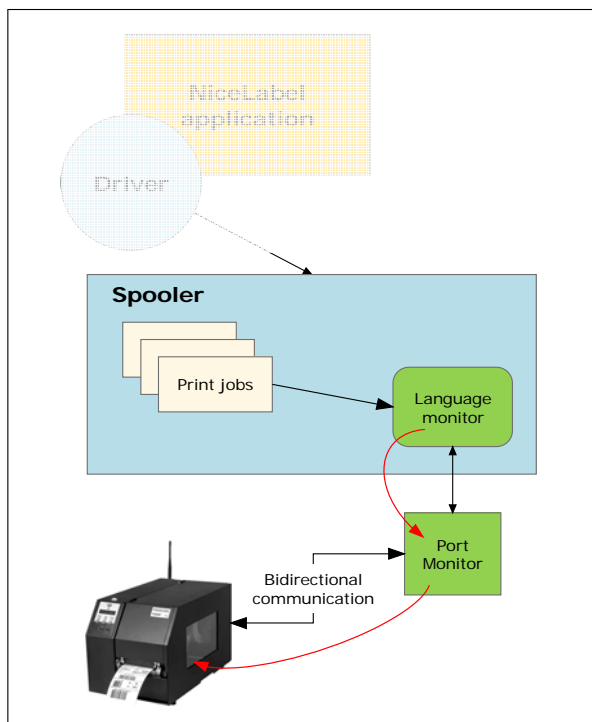
The Language Monitor performs a printer status query **at some metadata positions** as it processes the stream. In this way, any failure of the printer stops the processing of the stream until the error is resolved. This means that the complete stream is not lost to a failure, and the output can be reviewed in the exact area where the failure occurred.

The Language Monitor is a key component of the infrastructure, working in unison with the driver to connect the data sending process with the printer status. As part of the spooler, it analyses the print stream data and segments it, removing all metadata before it sends individual pages to the printer with alternating status checks.

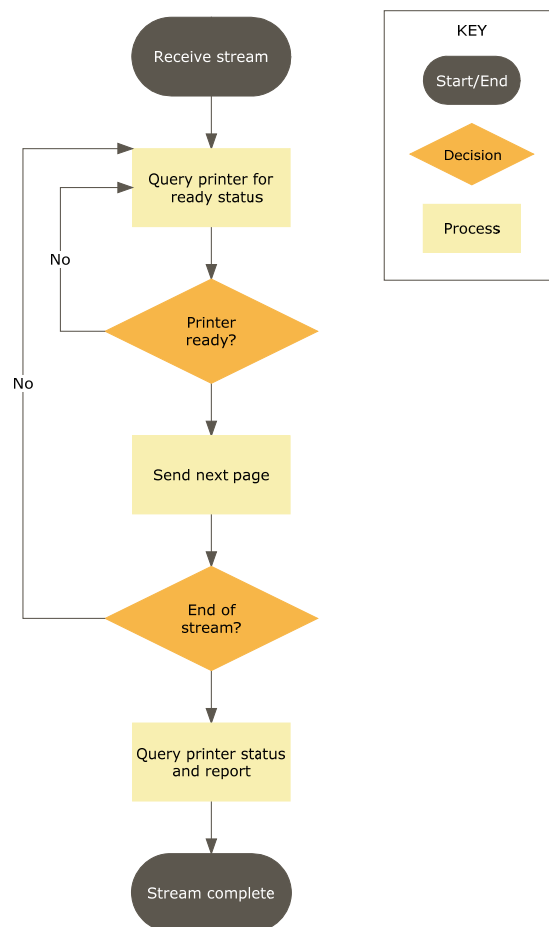
The Language Monitor also receives the bidirectional communication replies from the status queries and reports them to the appropriate applications.

Language Monitor to Port Monitor

When sending the data to the printer, the Language Monitor actually communicates individual page data from the stream to the **Port Monitor**. The Port Monitor acts as a bridge between the language monitor and the particular interface, to which the printer is connected (COM, LPT, USB, LAN, etc).



Language Monitor Workflow



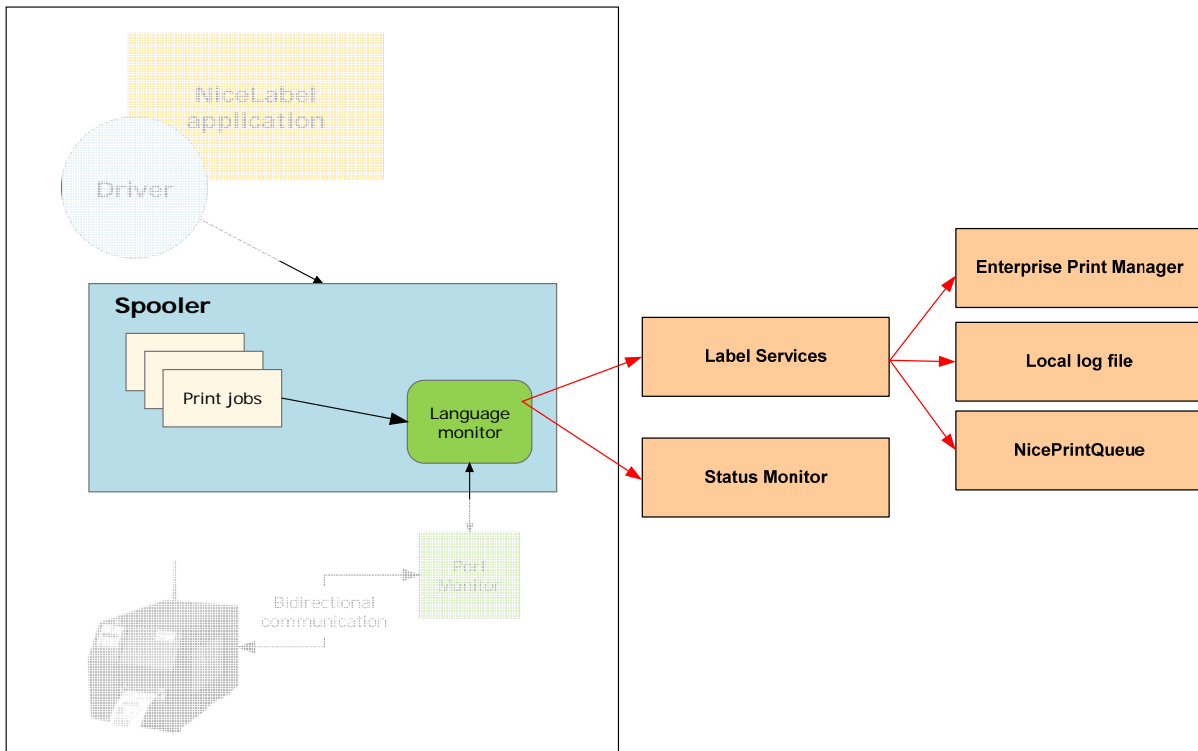
The port monitor is a perfectly functioning component of the Windows operating system, with one exception. If the selected label printer is a **Network printer**, the Advanced Port Monitor must be used to facilitate bidirectional communication. The default Standard TCP/IP Port Monitor included with Microsoft Windows does not include bidirectional capabilities, and will not return status reports to status queries by the Language Monitor.

Language Monitor and status reports

The Language Monitor reports the statuses it gathers from printers and print job statuses to various applications and services which convert this information into a format that is useful to the user.

These range from immediate status updates for local printers (**NicePrintQueue**, **Status Monitor**) to a service providing status reports to the **Enterprise Print Manager**, a centrally connected platform for distributed printing system control.

Additionally, the print jobs are logged in a **Log File** in NiceLabel and the Enterprise Print Manager, which enables the user to access past print jobs and reprint them to the same printer or a different printer.



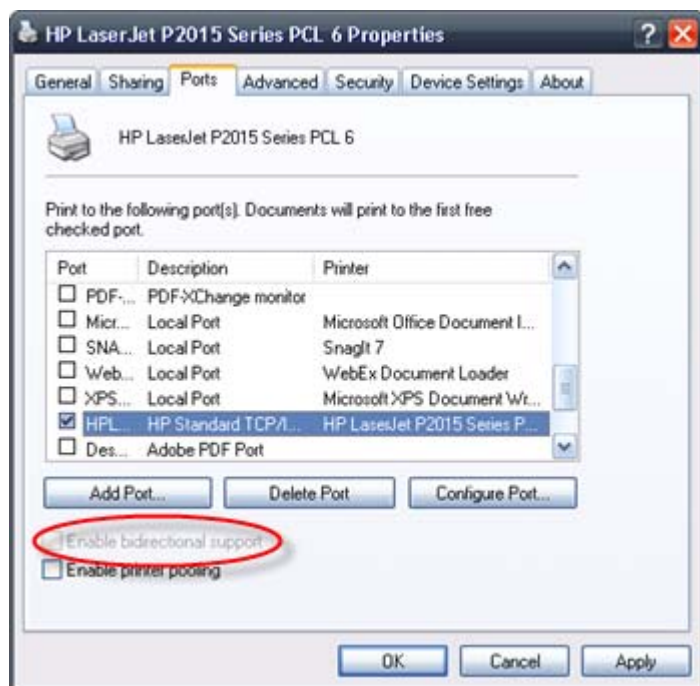
Common issues

Bidirectional printing communication doesn't cause any difficulties for the majority of users, however one issue does tend to surface with advanced users.

As explained above, bidirectional printing in NiceDrivers depends on the Advanced Language Monitor to remove the metadata from the print stream before its parts are sent to their final destination.

Some advanced users circumvent the Language Monitor in their printing process by printing to file, and then copying that file directly to the printer port. As the stream was prepared for bidirectional printing, it still includes metadata, causing errors in the printer.

In these cases, the issue can be resolved simply by **clearing** the *Enable Bidirectional Support* checkbox in the printer driver settings. That will prevent the driver from adding metadata to the stream, and the print file will include the stream in the printer's native language, which will be compatible with the printer even if it is copied directly to the port.



Conclusion

The bidirectional communication infrastructure may seem fairly trivial, but the implications of its use reach throughout the printing process. A printing process supported by bidirectional communication not only receives commands, but reports feedback and status reports.

This allows the system to not only log the prints that were initiated, but also the prints that were completed or failed. Output control and error control provide the printing infrastructure with the layer of management that has long been expected and demanded of most other business or production processes.

For bidirectional communication to be effective, it requires the coordinated exchange of data between the software, driver, and language monitor, as well as a system of not only gathering, but displaying the status information in a format that is of practical value to the user. Once the data describing the user's action is connected with the data on the printer result that followed, the information is rounded into a manageable event.

Appendix

Additional Resources

Additional documentation is available, detailing the individual NiceLabel products and industry solutions. As any detailed documentation of these processes also depends on the individual solution, the examples and workflows in specific documentation are based on NiceLabel products and the NiceLabel methodology of label printing technology and automation. The documents are available at <http://www.nicelabel.com/Learning-center>.

Papers:	<ul style="list-style-type: none">▪ NiceLabel Advanced Printing Control Solutions▪ White Paper: Managing the hidden costs of enterprise printing
General NiceLabel resources	<ul style="list-style-type: none">▪ NiceLabel Web site Learning Center▪ NiceLabel Tutorials▪ NiceLabel Technical FAQ▪ NiceLabel Technical Support site▪ NiceLabel forums

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