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Electronic Frontier Foundation decodes printer tracking dots

Humphrey Cheung 19 Oct 2005 14:59

The next time you use the office printer, you may be printing up a lot more than sales figures or quarterly reports. Many color laser printers are secretly embedding tracking dots, minute and almost invisible yellow specks, on documents. While many have speculated on the meaning of the dots, the Electronic Frontier Foundation (EFF) appears to have decrypted the code.

For the better part of the last year, computer experts have known about the existence of printer tracking technology. Last November, PC World published the article, **Government Uses Color Laser Printer Technology to Track Documents**, which discussed the existence of printer tracking dots. Seth Schoen, staff technologist at the EFF, told us that the PC World article spurred EFF to investigate further. Initially Schoen, like PC World, speculated that the dots would only contain the printer's serial and model number, but now it is confirmed that there is much more information included. "As it turned out, there is also the date and time, which is accurate to the minute. We didn't expect that," says Shoen.

Schoen says that these tracking dots are "all over" every page printed from many printer models. The dots are almost invisible, but can be seen by shining a simple blue LED light on the page. The blue light increases the contrast of the yellow dots and causes them to appear black against the paper background. In the case of one particular printer, the Xerox DocuColor, the dots appear as an eight by fifteen grid that is repeated throughout the page.

Schoen told us that he and four other people decoded the dots. Two volunteers, Patrick Murphy and Joel Alwen, and summer intern Robert Lee did much of the work. Andrew Huang, author of "Hacking the Xbox" helped out by modifying a scanner to shine extra blue light on the printouts. To gather enough data, EFF asked volunteers from around the world to send in printouts from as many printers as possible. "We got several hundred sets from about 100 different models and the documents are still arriving," says Schoen.

Initially the team had to look at every printout by hand, but Murphy and Alwen started transcribing the dots into text files. This made it easier to compare dot patterns without destroying the team members' eyesight. The team also repeatedly printed the same page on one printer and Shoen told us that he started noticing that the rightmost part of the grid would stay the same, while other parts would "incrementally change".

The team discovered that the dot pattern contains the serial number of the printer along with the date and time that the paper was printed. The dots are either on or off and represent a binary 1 or 0. Each column of dots adds up into a decimal equivalent and there are even parity dots on each row and column for error correction. Schoen says, "If you brought me two pages, I can tell

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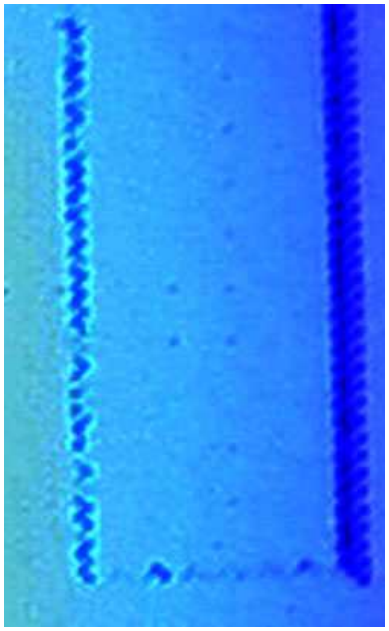
you if they came from the same printer and which one was printed earlier than the other."

So far, EFF has only decoded the tracking dots on the Xerox DocuColor line of printers/copiers. The DocuColor is an expensive high-volume printer used in many major print shops such as Kinko's, but Schoen warns that the tracking dots are also produced on more down to Earth printers. "The tracking dots appear in all models from low end to high end. We've seen them on some Dell printers costing as little as $299," says Schoen.

Schoen encourages everyone to try this out saying, "People don't have to take our word for it. Go down to Kinko's yourself. They will see that the tracking dots are all over the page and probably has been done for at least a decade."

Of course, we were curious ourselves and went to a nearby Kinko's in Thousand Oaks, California. With EFF's **list of printers that print tracking dots** , we walked up to an unused Xerox DocuColor 12 and ironically made two copies of EFF's document. Afterwards, we bought a keychain sized blue LED light from Radio Shack and headed back to the office.



The dot pattern created by a Xerox DocuColor 12 printer

At first we couldn't see the dots, but after turning off the overhead fluorescent lights we saw what appeared to be small, almost microscopic dots throughout the page. The dots look like toner dust, but unlike random stray toner, they arranged in a definite pattern throughout the page. We managed to take a photo and made the dots stand out by playing around with the histogram. Schoen told us that they photographed the dots using a $60 children's microscope.

Decoding the pattern was neither hard nor expensive for the EFF team. Schoen estimates that EFF spent less than $1000 investigating and decoding the tracking dots. After receiving the printouts, it took the team about one week to solve the puzzle and Schoen adds, "computer experts like to solve puzzles".

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