Model finds optimal fiber optic network connections 10,000 times more quickly

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Designing fiber optic networks involves finding the most efficient way to connect phones and computers that are in different places – a costly and time-consuming process. Now researchers from North Carolina State University have developed a model that can find optimal connections 10,000 times more quickly, using less computing power to solve the problem.

"Problems that used to take days to solve can now be solved in just a few seconds," says Dr. George Rouskas, computer science professor at NC State and author of a paper describing the new method. The model could solve problems more than 10,000 times faster when data is routed through larger "rings," in the network, Rouskas says.

Every time you make a phone call or visit a website, you send and receive data in the form of wavelengths of light through a network of fiber optic cables. These data are often routed through rings that ensure the information gets where it needs to go. These ring networks are faced with the constant challenge of ensuring that their system design can meet user requirements efficiently. As a result, ring network designers try to determine the best fiber optic cable route for transmitting user data between two points, as well as which wavelength of light to use. Most commercial fiber optics handle approximately 100 different wavelengths of light.

Solving these design challenges is difficult and time-consuming. Using existing techniques, finding the optimal solution for a ring can take days, even for smaller rings. And a ring's connections are modified on an ongoing basis, to respond to changing use patterns and constantly increasing traffic demands.

But the new model developed by Rouskas and his team should speed things up considerably. Specifically, the researchers have designed a mathematical model that identifies the exact optimal routes and wavelengths for ring network designers. The model creates a large graph of all the paths in a ring, and where those paths overlap. The model then breaks that graph into smaller units, with each unit consisting of the paths in a ring that do not overlap. Because these paths do not overlap, they can use the same wavelengths of light. Paths that overlap cannot use the same wavelengths of light – because two things cannot occupy the same space at the same time.

By breaking all of the potential paths down into these smaller groups, the model is able to identify the optimal path and wavelength between two points much more efficiently than previous techniques.

"This will significantly shorten the cycle of feedback and re-design for existing rings," Rouskas says. "It also means that the ring design work can be done using fewer computer resources, which makes it less expensive. This should allow network providers to be more responsive to user demands than ever before."

More information: The paper, "Fast Exact ILP Decompositions for Ring RWA," is published in the July issue of the *Journal of Optical Communications and Networking.*

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