

Password

[Forgot Password?](#)

[SIGN IN](#)

web account to access premium content on this site.

[CREATE A WEB ACCOUNT](#)

Join the ACM

Become a member to take full advantage of ACM's outstanding computing information resources, networking opportunities, and other benefits.

[BECOME A MEMBER](#)

Subscribe to Communications of the ACM Magazine

Get full access to 50+ years of CACM content and receive the print version of the magazine monthly.

[GET A SUBSCRIPTION](#)

Purchase the Article

Non-members can purchase this article or a copy of the magazine in which it appears.

[PURCHASE THIS ARTICLE](#)