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Hard Problems, Elegant Solutions, Big Impact

How we choose the "10 Emerging Technologies."
By Jason Pontin

Every year, *Technology Review* selects the 10 emerging technologies we think have the greatest potential to transform the world. Judging by Web traffic and by newsstand sales of the printed magazine, it is one of our most popular recurring features. But while readers like the 10 technologies, I don't know if they always understand our choices.

The most common question I receive from readers about the "10 Emerging Technologies" issue is "How do you choose the technologies?" (Among the next-most-frequently-asked questions is "Why didn't you choose *my* technology?" or "How can I get you to choose my technology next year?" or something of the kind.)

We look first for difficulty. We are interested in hard problems whose solutions would expand human possibilities—or, to consider things from a more negative perspective, whose intractability is a source of frustration or grief.

This year, for instance, we looked at the problem biologists have faced in trying to make large enough pieces of DNA to create an entire genome: "though living cells routinely make long stretches of DNA, a DNA synthesis machine can't do the same," writes Katherine Bourzac, *Technology Review*'s materials science editor, in "Synthetic Cells". If biologists could create entire genomes, they could design artificial microbes engineered to produce biofuels, drugs, or other useful products. Daniel Gibson of the J. Craig Venter Institute solved the problem by using yeast cells to stitch together thousands of fragments of DNA made by a machine, and then pooling the longer pieces and repeating the process until he had a complete genome. The result: bacteria that possess the first completely artificial genome.

Next, we look for elegant solutions to interesting problems. Consider the insecurity of cloud computing.

Cloud computing, a technology that lets organizations use the Internet to share computer resources such as applications and storage, is the next great sea change for computing, following personal computing and client-server computing. But organizations are wary of using the cloud for many serious purposes because they feel that giving a public cloud provider such as Amazon or Google access to unencrypted data poses too much of a security risk. It's possible to send data to and from a cloud provider's servers in encrypted form, but then the servers that power the cloud can't work on that data. Now Craig Gentry at IBM has found a way to analyze data without decrypting it. The trick, explains Erica Naone, our Web and social-networking editor, is "to encrypt the data in such a way that performing a mathematical operation on the encrypted information and then decrypting the result produces the same answer as performing an analogous operation on the unencrypted data" *("Homomorphic Encryption")*. A neat hack. Such correspondence could make enterprise applications secure on the Internet.

Finally, we look for emerging technologies that will have a major impact on business and society over the next decade.

A major emerging trend in social technology is "social indexing." Most Web users will be familiar with the "Like" button, but they may not be aware that the "likes" of Facebook's millions of users provide signals about what is valuable online. Bret Taylor, chief technology officer at Facebook, is leading efforts to use that information to make the Web smarter. In "Social Indexing", Tom Simonite, *Technology Review*'s information technology editor, writes, "Many sites have tried to personalize what they offer by remembering your past behavior and showing information they presume will be relevant to you." Social indexing is potentially more powerful, because it recalls not only your preferences but your friends' preferences, and over many different sites. The technology is important because it is so different from what we've grown accustomed to believing is the organizing principle of the Web: Google's index, which counts the links between Web pages to gauge their merit. Social indexing will not

replace search as the way we use the Web, but it will supplement it, and it will have an enormous social impact because it will tend to strengthen the already prevalent inclination of many Web users to focus on things similar to the things they and their friends have already seen.

This short explanation of how we select our 10 emerging technologies emphasizes what you already suspect: any list of a year's leading technologies is necessarily partial and subjective. Our list, curated by senior editor Stephen Cass, represents our biases and emphases; you may consider other problems more important, prefer different solutions, and look for impact elsewhere. Write to me and tell me what new technologies you think are the best at jason.pontin@technologyreview.com.