Anybody take a guess, when I am showing you these slides on a computer, how much percentage of CPU am I using?

Let's check it out. See, user, which is me, takes up 3 percent. System takes up another 3 percent. And 94 percent of CPU is idle.

This is the case for most of the PCs. It is a huge waste of computational resources. What's worse, we are wasting it on a very large scale. Guess how many PCs are in use today in the world? Over two billion. If we can somehow collect these idle CPU power, we can really do something big.

On the other hand, many research groups are struggling to improve their abilities to do intensive computations. Nowadays in many fields the work required on computers is astronomical. Everyone here is familiar with LHC. It produces about one Gigabyte of data per second, which means filling up 15 thousand DVDs each day. Many other projects such as climate prediction and gravitational wave studies are also incredibly computationally intensive. The LHC team is large and rich enough to establish their own worldwide computing grid. But a lot of small groups do not have that much money and manpower.

That's why volunteer computing comes into play. Scientists break a big project down to millions of small chunks, which are distributed through the Internet to PCs owned by volunteers, who are just ordinary people like you and me. These volunteers do not need any professional knowledge. What they do is they simply install a software that automatically uses the idle CPU power to receive new work units, calculate them and report the results back to the server.

In order to popularize volunteer computing, in 2002, Berkeley set up a platform called Berkeley Open Infrastructure for Network Computing, or BOINC, that hosts volunteer computing projects. After more than a decade, now everyday BOINC has over 200 thousand active users, creating a computational power about one third of the fastest supercomputer in the world.

Despite of the progress of volunteer computing over the past decade, the volunteer rate is far from being high enough. Today among 10 thousand computers in the world, only 3 or 4 of them are actively participating in a project. I am just wondering how many of you here are volunteers in a project? Great, we are above the average. But even the rate in an MIT classroom is low, isn't it? According to a BOINC survey, here is why people won't participate.

I would conclude that a lot of them are due to scientists providing insufficient information to volunteers or potential volunteers. Take the safety issue as an example, which accounts for 40 percent on the left chart. Volunteers are concerned that hackers may break into a project and use it to distribute malware. In fact, researchers have applied advanced technology to prevent such things from happening, and up till now, such things have never happened. But this is not enough. What scientists need to do is to convey this information to the public and gain their trust. Unfortunately, scientists often fail to do this. Also a great share in these charts are about technical issues. I would suggest that more detailed documentation or tutorial should be available to the public, telling people how to set everything up and how the software works.