

# COMPUTERS AND THE TRAGEDY OF THE COMMONS

People who use computers and networks are very comfortable with discussing questions of how these resources are to be used, but are very uncomfortable discussing what they should be used for, or why. The technical mind-set prefers to dwell on considerations of means over ends, and computers are very much utilitarian objects. Computers are how-to devices, and computer users and administrators and programmers prefer to be how-to problem solvers using them.



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We can't avoid the questions of what we should do with computers or why we need them, though, and the sooner we ask these questions the better. The reason for the urgency is that computers and networks face the classic dilemma of all shared resources known as the "tragedy of the commons." Technical advances and innovation can only delay the inevitable, and put off the day when we must come to terms with this tragedy.

What is the tragedy of the commons? Simply put, it is the idea that any resource that is held in common, or shared by individuals, will ultimately be destroyed. The reason this is so is that we have a private experience of the benefits of a common resource, and do not immediately perceive the effect that will be produced when all individuals maximize their self-interest with respect to what is ultimately a limited resource.

The classic model of the tragedy of the commons is presented as follows. Suppose there is a village where everyone has a cow, and where there is a common pasture for grazing cattle. The

pasture is a shared and a limited resource, and it is in the interest of the village that its benefits be apportioned equitably and with a view to the sustainability of the pasture over many seasons. Each villager actually owns only one cow, though, and nobody owns the pasture. It is in the interest of every individual to graze his own cow for the maximum amount of time over the widest possible area of the common pasture. That way, he can maximize his return on investment in his cow. But every individual who rationally pursues his own best interest will be doing the same thing. The net result will be over-grazing, likely leading to the starvation of all the cattle and the ruin of the village. This will happen because each individual does what is right and proper for him to do in his own self-interest. Hence the term tragedy.

This is not some abstract exercise. Real economic and political crises can be understood using this model. One example that comes to mind is the collapse of the cod fishery in Newfoundland. Nobody owns a fish in the sea, and only by catching a fish does someone gain an economic interest in it. Cod were once as abundant as air in the seas around Newfoundland. It is said that the explorer Cabot dropped wooden buckets from the sides of his ship and each one he pulled up was filled with cod. Catching these fish, salting them, and shipping them to Europe became the economic mainstay of Newfoundland. But this common resource was ultimately destroyed. It is in the interest of every individual fisherman to catch as many fish as he can, and advances in technology such as thin-mesh nets, gill nets, and vacuuming fish from the sea bed became cruelly efficient means of wiping out the cod stocks. Now, there is no commercial cod fishery at all. No individual did anything wrong, but collectively the short-sightedness of all destroyed their livelihoods.

So where do computers come in? Computers have resources like CPU cycles, memory, data storage capacity, and network bandwidth to transmit data over a distance. All of these are common resources, but all of them are experienced by the user individually. Since the days of mainframes, computers have been timesharing devices. They do a “juggling act” with the jobs they are asked to do, doing a few milliseconds of work at a time before shuffling off to do some work on another user’s task. Each individual user experiences progress in his own job, as if the computer was dedicating itself to his needs alone, but in fact the computer is a true multi-

tasker. The user is fooled into thinking he is being given continuous attention by the computer, much like a movie-goer is fooled into thinking he is watching a “moving picture” — when in fact he is watching a slide show with photographs presented at a rate of 24 frames per second, accompanied with a sound track.

Here’s where the tragic element comes in. If we all prioritized our jobs, we will hog CPU cycles to the detriment of all users, including ourselves. If we run our programs while stuck in memory they run much faster and more efficiently, but if we all do that then we quickly run out of room for all the processes. If we save everything we think might be useful in the future, we will use up a lot of disk capacity, and if we all do that we will ultimately run out of space. If we all hog network bandwidth for important downloads, then we all suffer from poor performance. The consequences of computers being a collective resource come back to haunt us, but that isn’t factored in when we use them in the first place.

The reason we have not come to terms with the tragedy of the commons with respect to computers is that we have effectively avoided that by simply throwing more resources into the pool. CPUs get faster, physical memory on workstations gets greater, disk capacity grows, and network bandwidth gets better. Google Mail can tell its users to “never delete another email!” because they keep adding disk capacity. No one needs to ever come to terms with the fact that saving that latest viral joke mail message has taken up bytes in a shared and finite space held in common with all the other users of Google Mail. Can this go on forever? Logic says no. We can build more and more freeways, for example, but we won’t “solve” the problem of traffic congestion that way. We’ll only put off the day when we need to come up with a real transit plan to move people efficiently between home and work.

Ultimately the way around the tragedy of the commons is to condition the morality of maximizing individual self interest. Politically, the ways of doing that have been coercively through domination or co-operatively through agreement. Cod fishermen in Newfoundland have been forced not to fish, and there is some evidence that the cod stocks may be recovering. Individual companies that maintain effective control over collections of computers

and networks have done considerably better at avoiding the tragedy of the commons than has “the Internet”, which is owned by and controlled by no one. Advances in technology might paper over the crisis, but the Internet faces destruction unless a change is made in the “every man for himself” morality. IP addresses will run out, email inboxes will be choked with spam, network bandwidth will be saturated with real-time movie downloads, and so on — all because each individual in the privacy of his own home or office does the most that he can with what is technically feasible, and is never brought to mind the collective force of what it is that he is doing.

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