

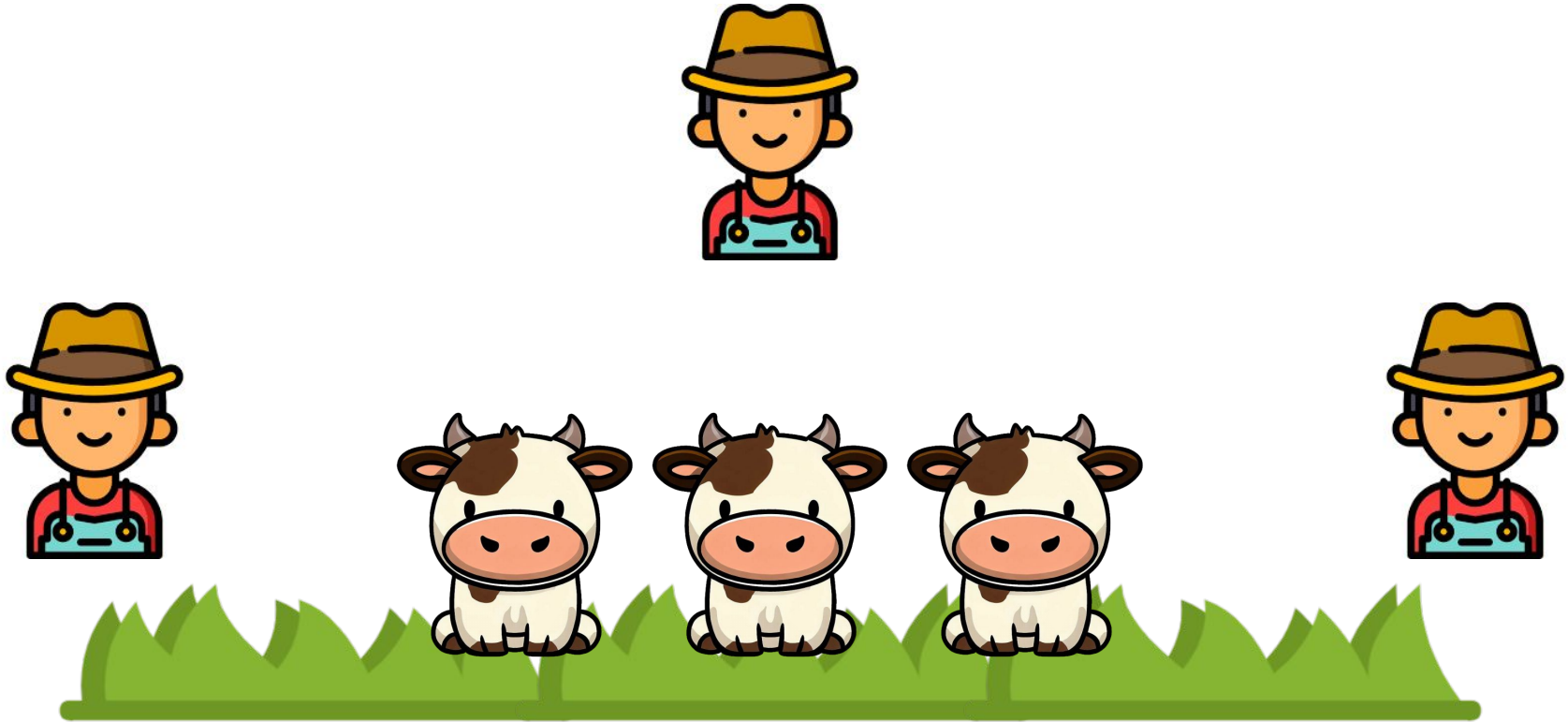
To what extent can we overcome the
tragedy of the commons with digital
goods?

On the example of open-source software

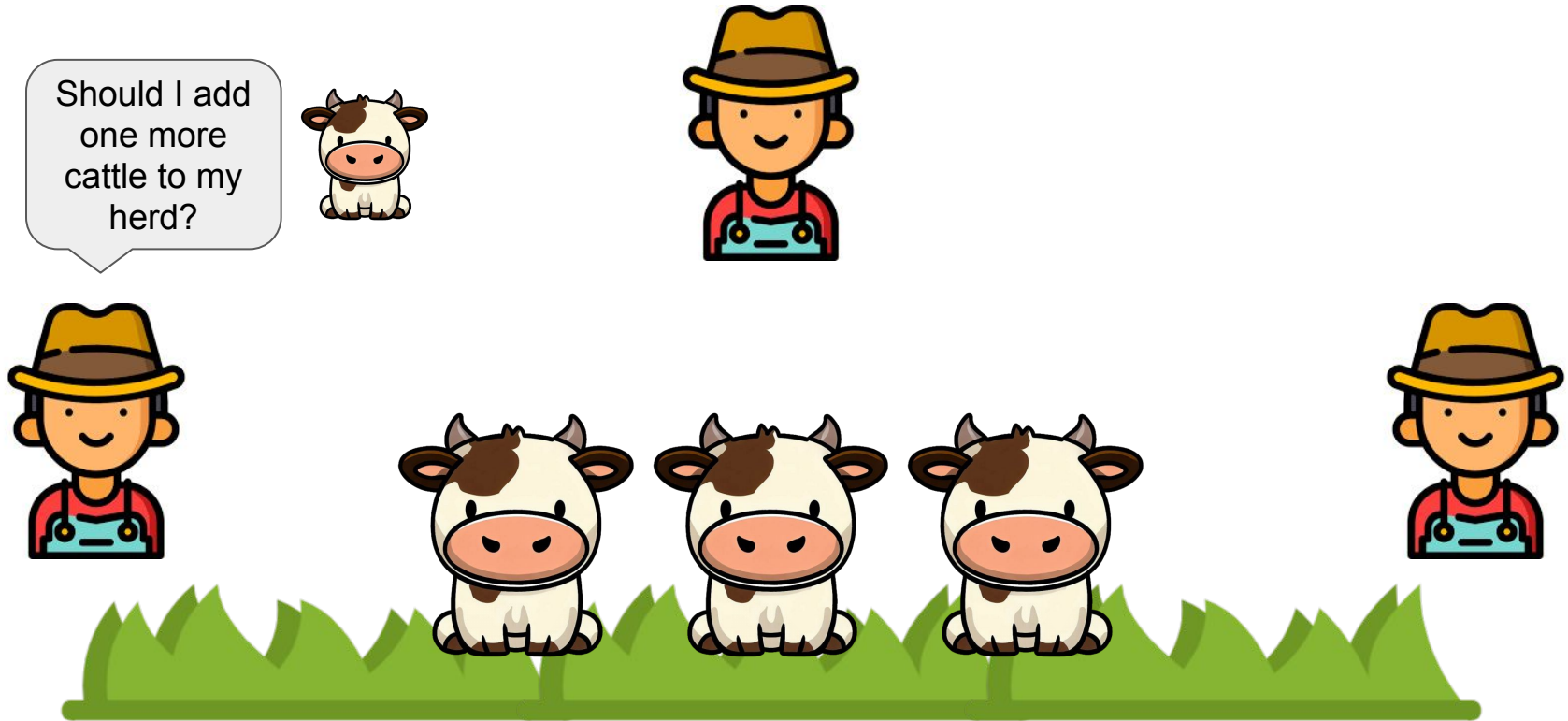
Outline

- “Traditional” tragedy of the commons
 - Definitions
- Open source software (OSS)
 - Definitions
- Does the tragedy apply to open source software?
 - Application of tragedy of the commons
 - Free Rider Problem
 - New problems
- Conclusion:
 - Do we overcome the tragedy?
 - Approaches to overcome the new problems?
 - How do we use OSS ethically?

“Traditional” Tragedy of the commons



“Traditional” Tragedy of the commons

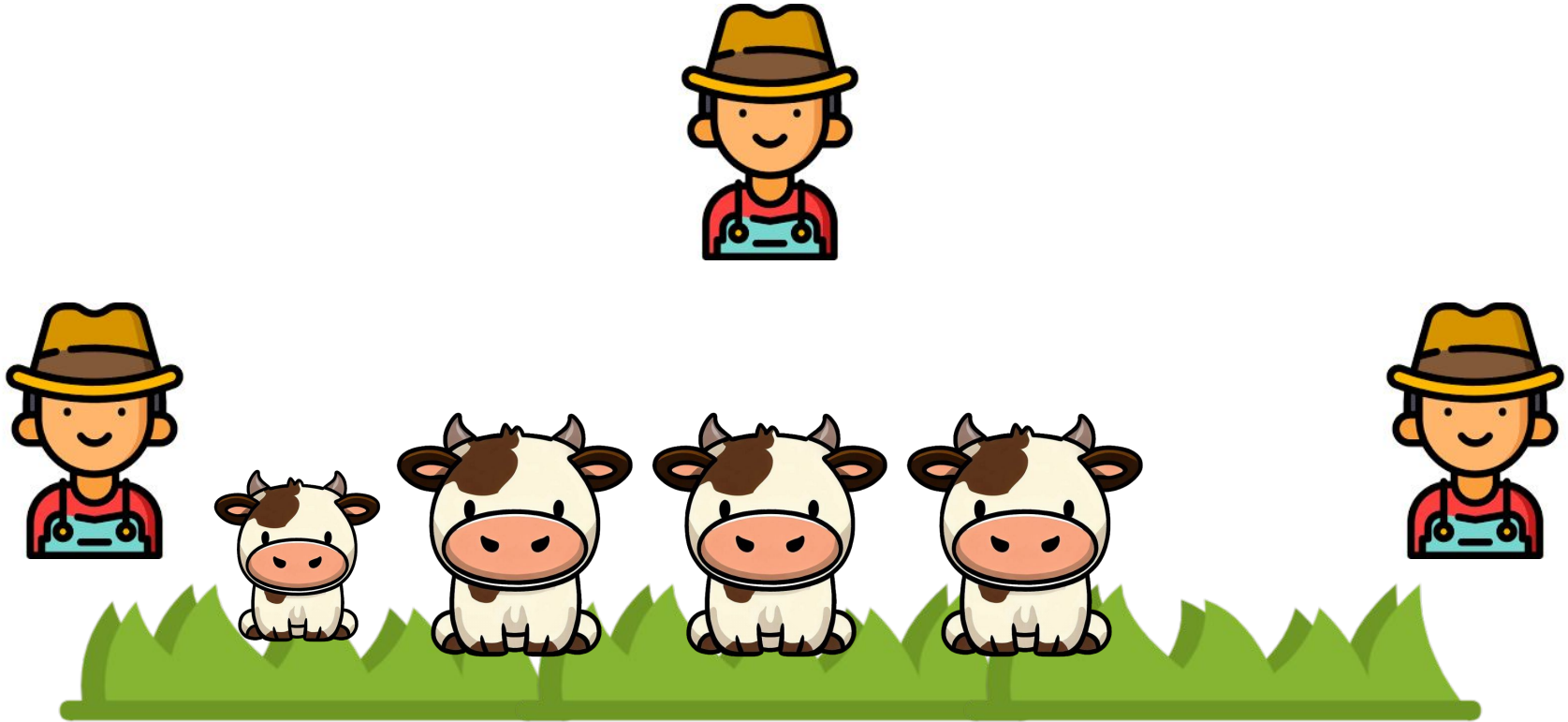


“Traditional” Tragedy of the commons

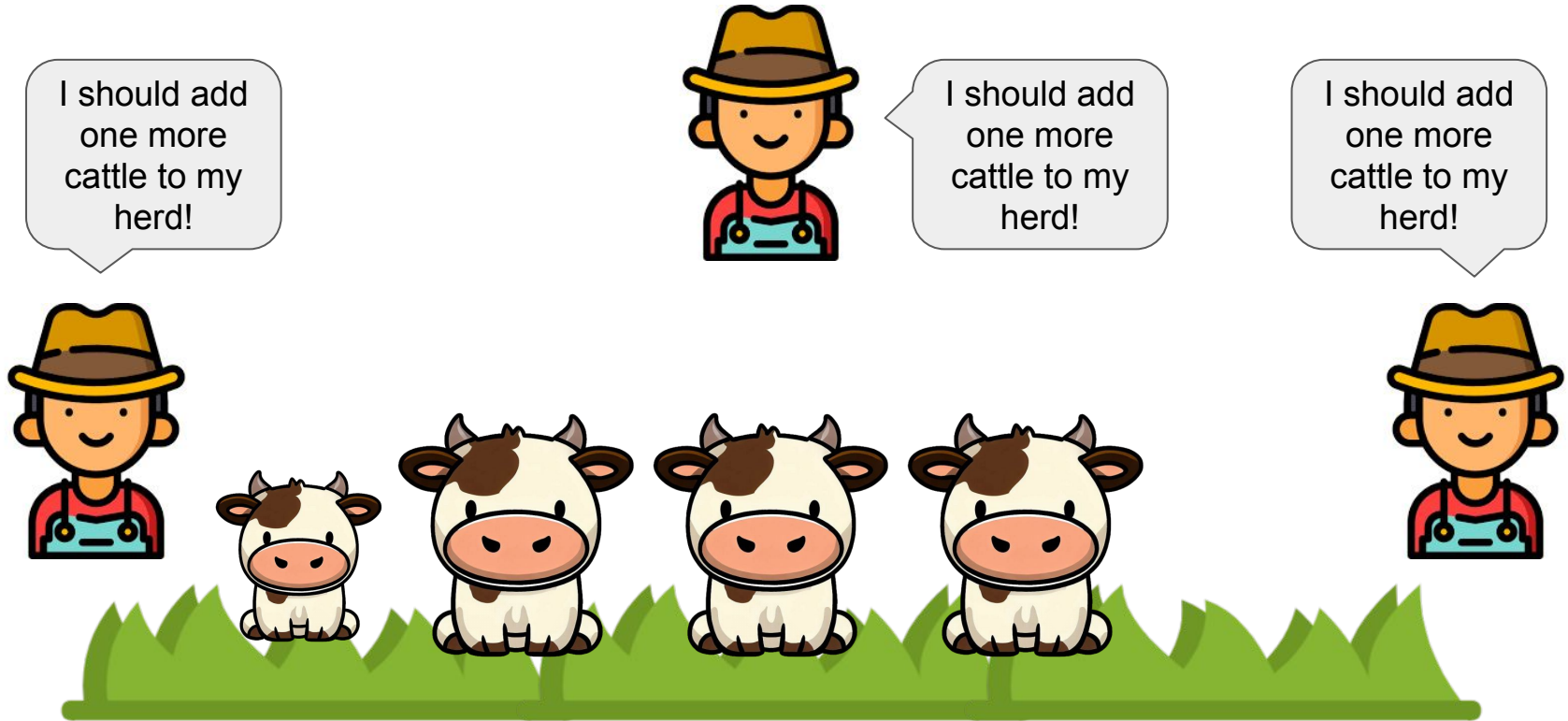
Yes, because I get the benefits while the cost is shared



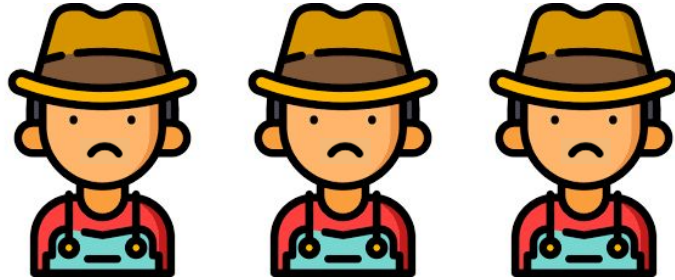
“Traditional” Tragedy of the commons



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“Traditional” Tragedy of the commons

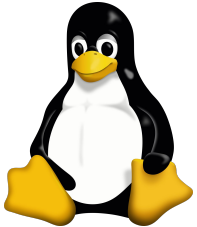


“Traditional” Tragedy of the commons

- “Unrestricted access to common-pool resources such as a pasture inevitably leads to their depletion by overuse”
- Formalized in a 1968 article by Garet Hardin, later published in Science as an argument for population control
- Reviewed by other scholars such as Elinor Ostrom
 - True in specific conditions with real life consequences, such as deforestation and overfishing
 - BUT: communication and self-governance can resolve the tragedy (ethics)

Open-source software (OSS)

- Software released under a license in which users have the rights to use, study, change, and distribute the software and its source code to anyone and for any purpose
- Usually developed in a collaborative manner with contribution by various internet users and maintained on platforms like github
- 97% of codebases in the industry contain some amount of open source code
- Examples:



Open-source software (OSS) as part of the digital commons

- Source code and executable
 - Non excludable and non rivalrous
 - Publicly available to download for free
 - -> Pure common good
- Maintenance
 - Everyone can contribute by submitting pull requests, collaboration and communication on platforms like github
 - BUT: Maintainer has the authority to approve pull requests
 - -> Not entirely a public good

OSS as a whole an imperfect common good, only the code and executable comparable to a digital pasture

Application of “Tragedy of the commons” to OSS

“Each man is locked into a system that compels him to increase his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons”

- “Locked into a system” to use the good?
 - Competitive advantage in using OSS if it is better than proprietary software -> technological imperative
 - Proprietary alternatives often better -> Adobe CC vs GIMP, MS Office vs Libreoffice, Google Chrome vs Mozilla Firefox
- “World that is limited”?
 - Software code has (theoretically) infinite reproducibility and non-rivalry
 - Maintenance is limited to the number of PRs the maintainer approves
- “Ruin is the destination”?
 - No depletion through overuse, rather more stable and secure software due to more testing opportunities

Traditional Tragedy of the commons does not necessarily apply in its original form

Free rider problem in OSS

- Rights to use the software and its source code to anyone
 - People can use software without paying anything for it
- Cost question
 - Cost of fixing bugs is incurred by the maintainers and cannot be shifted to users
 - Paying for bug fixes as a user would mean other users get the patches for free
 - -> Incentive to free ride
- Maintenance and sustainability
 - OSS is sustained by voluntary code contributions and monetary donations
 - 91% of projects used components outdated more than two years
 - Maintenance requirements usually too high compared to the available resources

-> Free rider problem perseveres and results in underfunding of OSS

New problems

- High dependence on open source code
 - 97% of industry software uses open source
 - 40% of all business networks were attacked as a result from the Log4Shell a vulnerability
- Lack of monitoring and careless use
 - 11% of industry software not updated 2 years after Log4Shell was patched
 - Easy to quickly generate value - Intransparency as OSS license does not specify where and how OSS is used
 - No “push notification” to install vulnerability patch - many consumers fail to install updates
- Not a self-sustaining system
 - Technology is always evolving thus OSS automatically loses its value with time
 - OSS requires constant maintenance to stay relevant - maintenance and further development requires intervention for the software to stay relevant
- Vulnerability and modifiability by everyone
 - Everyone can voluntarily or involuntarily try to inject vulnerable code in a Pull Request
 - Most of software contain at least 1 known vulnerability that needs to be patched

-> Security risks appear as a result of the high dependence on OSS and improper use

Do we overcome the tragedy of the commons with OSS?

- OSS overcomes most of the problems of the traditional “Tragedy of the commons”
- BUT: Being a widely used digital common good, OSS introduces new challenges
- These problems in the “Tragedy of the digital commons” require different solutions and mistakes could be even more severe

OSS issues result from improper user actions and less by economic incentives

-> How to use OSS in an ethical way?

Ethical open-source software

- OSS needs its community to survive
 - Communication solves the original “Tragedy of the commons”
 - It is ethical to be part of the OSS community and contribute
- Our reliance on OSS makes it an integral component of critical software
 - Widespread use and thus high dependence on OSS in all of software used
 - It is ethical to report bugs and fix them if you can to keep the software infrastructure safe
 - Proposed solution -> Minimal safety standard
- The underfunding of OSS is a pressing concern
 - Lack of resources for projects, more users than maintainers, free-rider problem
 - It is ethical to contribute or donate to keep the OSS alive
 - Proposed solution -> Public funding as critical infrastructure

OSS is not a self-sustaining system but rather dependent on the community, contribute to the community!

Questions for discussion

- Do you agree that we can overcome the traditional “tragedy of the commons” with digital goods?
- Do you think the new challenges cause an even bigger issue than the “tragedy of the commons”?
- What is in your opinion an “ethical use of OSS”?
- What do you think of the suggested interventions to overcome the security and underfunding issues of OSS?