Emergent Architectures of Open Source: A Conjecture

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ABSTRACT

The virtues of open source software projects—*hundreds doing what one cannot*—are not exclusive to software. The Internet excels at facilitating the exchange of large "chunks" of information—fast. As we learn to harness interdisciplinarity—decision fusion, disease spread, public health—we need to create a philosophy converging new methodologies, ethics, strategy, and technology. In so doing, we can unleash great innovations. The revolution of Linux isn't its success in the result *but in the method*. Tapping open source methods, this paper explores innovation, sans restrictive licenses and defensive intellectual property, in the emergent paradigm of the collective intelligence.

INTRODUCTION

Nearly everyone would embrace the toolmaker's view of the world when it comes to the Internet. Simply put, the Internet Boom enabled the technologist's notion of progress to take root in the most unlikely places, but most profoundly in enshrined perspectives of the staid social order of things. Anyone invested in the logic of progress, authority of elders, status and compensation, hard work and credentials were forced to begin thinking about the social implications of the inverse. Thus, when anecdote and accident propel history as in the case of Jonathan Lebed, the fifteen-year-old who used the Internet to promote stocks from his bedroom in Cedar Grove, New Jersey (Lewis, 2002), we wonder about the traditional systems of doing things. But as it speeded up and became ubiquitous, the Internet exposed a lot of commercial and social rules as dated and inefficient. In fact, it has especially benefited a fringe character not invested in progress as skill accumulation and competition between individuals. Rather than put faith in the system to drag us up the social ladder, Open Source invests in the freedom and innovation that comes about when a question engages ideas from a range of disciplines and social stratum and a multitude of points along the design spectrum. This kind of relational idea development runs the risk of anarchy, as Neil Postman, in the *End of Education*, draws our attention to when he suggests that "[t]he first question is, of course, Is it possible to have a coherent, stable culture that allows the greatest possible freedom of… thought and expression?" (Postman, 1996). Be that as it may, this paper will conjecture on Open Source possibilities within a problem – that of food safety at an international scale – that is enormously vulnerable to compromise if we stay with the status quo of disciplines franchising outside of social implications.

Innovation is essential and calls for the democratization of knowledge, which indeed, was the premonition of the Internet. As we all know, it has both advantages and disadvantages. But I would argue that the social innovation of knowledge that is the point of Open Source is still largely unexploited in our academic and economic culture. Risking an inversion of traditional knowledge system goals may not only contribute to a creative solution but also, *quite possibly,* revolutionize a knowledge production paradigm. This is Open Source at its best.

Consider the public transcript that marked the beginning of Linux.

"Message – ID:
1991Aug25.2025708.9541@klaava.helsinki.fi
From:
torvalds@klaava.helsinki.fi
(Linus Benedict Torvalds)
To: Newsgroups: comp.os.inix
Subject: What would you like to see most in minix?
Summary: small poll for my new operating system

Hello everybody out there using minix-I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386 (486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat...

Any suggestions are welcome, but I won't promise I'll implement them ☺" (Goetz, 2003).

As a result of that one email, thousands of coders, hackers, and developers answered Linus Torvald's call—and helped him build a robust system that continues to pick up steam (Goetz, 2003). The social innovation of the work was the building, *and later improving*, of each contribution from a broad body of volunteers that drew from traditional and non-traditional cultures. Like neighbors helping neighbors build a barn, harvest a crop or quilt a blanket, the moment a call goes out, helping hands arrive with supplies, tools and skills-sets at the scene. There is peer-to-peer knowledge sharing *and* peer-to-peer production. In the instance of the Linux operating system, however, the production vehicle was the Internet. The rest is history. Marshalling the contribution of millions, experts and novices alike, Mars is surveyed, DNA is decoded, cars, ships, buildings and E. Coli are constructed, recipes and honeymoons are shared, and Chinese germs grow in U.S. bloodstreams. Having gone way beyond six degrees of separation, the "architecture of participation" via Open Source represents certain aspects of a search for an expanded potential of world problems. Yes! The potential of emerging world problems to permanently affect, *even invert*, our paradigms of "good" or "meaningful" progress, technological development, research and education.

A classic method of absorbing and transmitting ideas to invert meaning is delightfully told in Marcel Duchamp's famous "Fountain" (a standard urinal, signed R. Mutt; 1917/1964). The entry was first shown in the New York Independents Exhibition and forced viewers to confront issues of categorical legitimacy. "The Fountain" was obviously not hand-carved sculpture and did not reinforce the showcase expectations of an art gallery; it was, instead, the heretic act of selection and placement of a manufactured object shattering (and mocking to some) the conventions of an exhibition space. It acquired its meaning from an inversion of situation (Wines, 2000).

"The Fountain" by Marcel Duchamp, 1917/1964, Dimitris Daskalopoulos Collection, Greece

 Is this Art?

Again, to applaud the genius of insult, we need to be ready for *the horrific*, and the humorous. Applying this attitudinal approach to levels of ambivalence and a challenge to situational ethics, creativity (as the world has already experienced) via the newfound Open Source revolution enters the porous borders separating reason and madness. On September 21, 2000, the U. S. Securities and Exchange Commission settled its case against Jonathan Lebed, at fifteen years old the first minor ever charged with stock market fraud. But the shot heard around the world wasn't that a wrong had been committed (certainly no one likes to learn they've been duped); instead, there was a shared epiphany that inverting the system may actually improve it. Artists often hold a mirror up to an object to get a different perspective. Perhaps the lines can be redrawn and the borders defining problems made more "porous" as we learn to work together in a collective intelligence paradigm.

"Porous Borders": The Problem of Food Safety or *Who Reads Opportunities?*

In 1997, the Food and Drug Administration issued restrictions on animal feed to create a "firewall" against the spread of Bovine Spongiform Encephalopathy (BSE), known commonly as Mad Cow Disease. The 1997 rule prohibits the feeding of ruminant (cattle, sheep, deer, goat) material to other ruminants, but allows the feeding of ruminant material to pigs and chickens, and rendered pig and chicken material to ruminants. The same 1997 rule also permits cattle blood, poultry litter, and salvaged pet food to be fed to cattle and other ruminants (Center for Food Safety). So, in fact, the "firewall" that the FDA has implemented to protect the American public from BSE is full of loopholes, and animal feed remains a route by which the disease could be spread in the United States. In this scenario, we see the traditional emphasis on the end product at work, and the resulting instability of our knowledge application. *We have an opportunity to apply cutting edge "start-to-finish" crisis mitigation to food production to join an array of macro/micro sensor and tracking technologies with decision fusion systems. But we often fail to do so because of a fear of working outside the traditional methods of problem management in an industry traditionally focused on a production plant leaving any pre-harvest environment "outside." Our goal instead should be less on the final product of control of BSE, and more on a situation awareness of the food chain itself, proceeding from farm-to-table, thereby revolutionizing an information production process that truly is integrated and seamless. The world is waiting for interoperability that IS interoperable (Lindberg, et.al, 2004, Kokar, 2002).*

Continuing this notion, another "porous border" around this problem impacting safe food production is disease spread between animals and humans. For several reasons we are seeing an emergence of pleiotropic effects – on animals, on the environment, and on the health of humans, both directly, through the transfer of zoonotic agents, and also indirectly, through the potential compromise of the food supply (Brown, 2000). Some of

these reasons include the overall increase in global human population. Bodily ecosystems are introduced with all their microflora and potential pathogens to new areas and animals when new patterns of animal and human movement increase. With domestic sprawl, habitat destruction and fragmentation, we have seen the aggregation of wild animals (particularly migrating species that can harbor disease) into smaller and isolated patches, increasing the contact rate within species and exposing animals and humans to potentially new pathogens. Avian Influenza epidemics such as the recent one (H7N7) in the Netherlands in 2003 caused 80 confirmed cases of human H7N7 influenza virus infection. Symptoms include acute respiratory distress syndrome (ARDS). Since we also know the most toxic biological threats to the human race are protein toxins produced by bacteria derived from plants and animal protein toxins which target the human respiratory system, it goes without saying we can no longer ignore the emergence of possible zoonotic agents into our environment.

When we turn our attention to the porous border situation where humans impact other humans (potentially assisted by the Internet) it is the relative ease of home manufacture, collection and delivery of lethal biological agents that pose a threat not only to the food supply but also to several areas impacting health and well-being. World Directory of Collections of Cultures and Microorganisms, for instance, serves 453 worldwide repositories in 67 nations (ABSA/Eagleson, 2002). Fifty-four repositories ship or sell anthrax; eighteen ship or sell plague. Acquisition of etiologic agents can also be gained through field samples or clinical specimens, commercial biological supply houses, and university or foreign labs. Anthrax, for example, exists in soil as a spore. One hundred thousand whitetail deer die from anthrax annually in the United States. Cattle harboring anthrax appear healthy until a few hours before death. Rabbits can be carriers of *Francisella tularensis* (Tularemia), a highly infectious aerosol agent, and resistant to desiccation and extremes of temperature (a typically reliable decontamination method for many food process designs). Biological toxins such as *Ricinus communis* (Ricin) can be easily constructed from a home recipe including castor oil beans. Meat, dirt and wax are simple ingredients needed to create Botulinum. The quantity of *Botulinum Nerotoxins* (Botulism) found in the ink of one period (.) is enough to kill 30 people. One pound will kill the entire human race. The ability to harvest many agents lethal to humans (anthrax, tularemia, plague) or incapacitating (viral hemorrhagic fevers, or VEE) makes it virtually impossible to eliminate bio-threats. Four recent reports of the United States General Accounting Office (GAO) cited gaps in federal controls for protecting agriculture and the food supply. “The United States would be vulnerable to deliberate efforts to undermine its agriculture industries, deliberate tampering of food during production, and the release of deadly animal diseases, some of which also affect humans” (Dyckman, GAO-04-259T, 2003)**,** and there exists the potential for an enormous public health problem that, quite honestly, is not one limited to the shores of the U. S. alone. Containment issues targeting any farm-to-table (now a global start-to-finish) process suggest the need for a fundamental shift in how we view the general bio-safety playing field, with the consequent research and education related to other disciplines, political arenas and to other knowledge bases.

In fact, a threat to the world's breadbasket poses an equally larger threat to the world's economic health and subsequent ability to assist compromised situations. Conflict between First World prosperity and Third World poverty continues to be a volatile issue. It is projected that by 2050, 8 billion of the world's 9.5 billion people will live in developing countries; they will face the consequent rising social and environmental pressure with little infrastructure or direction (Wilson, 2000). This, along with other factors contributing to their resentment of economic imbalances, point to future wars conducted in a sphere dominated not by military actions but by the targeting of our bio-welfare or other major infrastructures, resulting in crippling economic consequences.

Part of the problem with the traditional model is that the FDA does not act alone on international food issues, and our basic cultural ingredients like food production, occurs in a global environment. Other governmental agencies play major roles in food production in the United States, including the U. S. Departments of Agriculture, State and Commerce, the Environmental Protection Agency, and the Office of the U. S. Trade Representative, among others. Further, all federal activities involving Codex Alimentarius, an international standards-setting group based in Rome, are managed within USDA's Food Safety and Inspection Service (FSIS). As much as anything else, consumer demand drives these changes, especially the shifts in where American companies and consumers get their food. "Food has become a global commodity," says Janice Oliver, deputy director of FDA's Center for Food Safety and Applied Nutrition (CFSAN). "We Americans have changed our eating habits. Today, food is international. It is from Central and South America or Europe or the Asian countries or the islands of the world" (Cohn 2004). But neither the FDA nor USDA can inspect every food package brought into the United States. Linda Horton, director of FDA's international agreements, notes in that same article, "We don't have the resources to examine all imported products or to inspect most overseas production facilities. We need to work with those who export food to the United States (to make sure it's safe leaving those countries)." *Since these various global agencies do share a mission to safeguard quality assurances, perhaps we can dig deeper and ratchet up their accountability to include comprehensive "start-to-finish" knowledge aggregation as a byproduct of existing checks and balances. If we look to "chunk teams" bringing together tiers of modular production from around the world to the process of design, engineering and fabrication of cars, ships and buildings to give us unprecedented quality (Kieran, Timberlake, 2004), we begin to conceive of other benefits of the collective intelligence paradigm. The result is a start-to-finish program where broader influence captures variety, delivered in less time, at lower cost, and within environmental safety considerations consumers expect.*

CONCLUSION

The "architecture of participation" of Open Source isn't rendered by the realized interests of research agencies funding traditional disciplines but by the well-conceived and delivered problem. We don't even have to be motivated by fame, hatred, or instant wealth. In fact, the youth have harnessed the ultimate free market in the music and computer and video game Industry. "Keep your enemies closer" inverts the problem maker; isolationism becomes the real loser and the hoarder of secrets is rapidly left behind. Charlie Feathers sings about his problem, that of searching for "That Certain

Female" in the soundtrack to the satire *Kill Bill. Vol. 1*. He puts out the call for simple clues, checkin' high and low. He's a single fella with lots on his mind. He asks his country cousin and checks the hottest spots in town. He's waiting and watching, *plans to make it worth your while*, if you'll mark her route. He's looking for you to help let him know, when that woman's gonna' show (Kill Bill Original Soundtrack, 2004).

The new collective intelligence paradigm is about vigilance and understanding of emergent behavior. Mark Buchanan in *Nexus* argues that the very aim of the science of complexity is to discover patterns in complex networks of all kinds, and to learn how we might use this understanding to better our selves and our world. Central to this task is the notion of emergence, the idea that meaningful order can emerge all on its own in complex systems made of many interacting parts. The study of emergence in all its forms (problems and innovations) is one of the most important scientific enterprises of our era and will remain that way for the next century. As one eminent physicist puts it, "the central task of theoretical physics in our time is no longer to write down the ultimate equations but rather to catalogue and understand emergent behavior in its many guises, including potentially, life itself (Buchanan, 2002).

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