An Alternative to the Neoliberal Model for the Spread of Net Access to All

> Neither the original ARPAnet nor Usenet would have been commercially viable. Today there are great forces battling to structure and control the information superhighway, and it is invaluable that the Internet and Usenet exist as working models. Without them it would be quite easy to argue that the information superhighway should have a top-down hierarchical command and control structure. After all there are numerous working models for that.
>
> Tom Truscott 1995

Introduction

In this paper I will indicate by a few case studies how the internet was developed and spread by a public, collaborative, scientific model of development shielded from commercial and political pressures. Starting in 1947 when John von Neumann argued that computer development be at a university and in the public domain, continuing with the open source development and spread of the unix operating system, the research based open development of the ARPAnet, the NSF model of grant receivers spreading of the NSFnet connectivity to local communities, the amateur BBS movement, the Freenet movement, etc, most of the developed world's network connectivity was fueled by participation of the users in regulated public processes creating a tradition of sharing and crossing borders that is a characteristic of computer development and computer science.

The people and events that I will describe fit a model different than *homo economicus*. They are clues that the model *homo neticus* or netizen (net citizen) may more appropriately and more scientifically describe the emerging internet-impacted society.

John von Neumann and the Public Domain

If we look back at the emergence of the stored program electronic computer we find the Hungarian-born scientist and mathematician John von Neumann setting a solid scientific foundation for computer development in his work for the US government during the Second World War. In 1945, he wrote the *First Draft*[1], a report presenting detailed arguments for the axiomatic features that have characterized computers ever since. But when the war ended there began to be a battle over who would get the patent for the basic ideas that were embodied in the ENIAC one of the first successful electronic digital computers. Von Neumann saw a potential conflict between scientific and commercial development of computers.

He was not opposed to commercialism. But when it really counts, when something important is possible von Neumann argued it must be "done differently."[2] Herman

[1] The *First Draft of a Report on the EDVAC* was an incomplete 101-page document written by John von Neumann and distributed on June 30, 1945 by Herman Goldstine, security officer on the classified ENIAC project. It contains the first published description of the logical design of a computer using the stored-program concept, which has come to be known as the von Neumann architecture.

[2] Norman Macrae quotes von Neumann saying in 1954, "In planning anything new . . . it is customary and very proper to consider what the demand is, what the price is, whether it would be more profitable to do it in a bold way or a cautious way, and so on. This type of consideration is certainly necessary. Things would very quickly go to pieces if these rules were not observed in 99 cases out of a 100. It is very important

Goldstein, a US Army mathematician assigned to the ENIAC project, judged the *First Draft* to be so important that he "generously gave copies of it to people who asked for them, from all corners of the world."[3] He was essentially putting the Report into the public domain, as was judged in a court decision in 1947. Von Neumann and Goldstine thus made documentation concerning electronic high speed computers public at the very beginning of their development.

Von Neumann wanted to insure that a computer would be developed that could be used as a research tool by mathematicians and scientists. He wrote that he was concerned that if a government lab developed a computer it would be for its own limited purpose and if there was commercial development it would be linked to past products and practices and not have a fresh start. Von Neumann had been at the Institute for Advanced Study (IAS) in Princeton, NJ since his appointment there as a Fellow in 1933. As the war was ending von Neumann conceived of developing such a computer at the Institute. He argued that a computer for scientists should be developed in an institute devoted to pure research and it would have many imitators. Based on his arguments and his prestige he won the approval of the Institute and found funding including from the US Army and Navy. His military funders accepted that its use would be restricted to experimental scientific research. He wrote: "It is . . ., very important to be able to plan such a machine without any inhibitions and to run it quite freely and governed by scientific considerations." The computer became known as the Institute for Advanced Studies or IAS computer.

Von Neumann also set the pattern in the very beginning that the fundamental principles of computing would not be patented but should be put in the public domain. He wrote:

"… [W]e are hardly interested in exclusive patents but rather in seeing that anything that we contributed to the subject, directly or indirectly, remains accessible to the general public… [O]ur main interest is to see that the government and the scientific public have full rights to the free use of any information connected with this subject." [4]

He was here placing his contributions to computer development into the long tradition of the public nature of science, the norm of sharing scientific results. That norm had been interrupted by the war even among scientists.

Von Neumann gathered a team of scientists and engineers at the Institute for Advanced Studies to design and construct the IAS computer. He and his team documented their theoretical reasoning and logical and design features in a series of reports. They submitted the reports to the US Patent Office and the US Library of Congress with affidavits requesting that the material be put in the public domain. They sent these reports – 175 copies – to scientist and engineer colleagues in the US and around the world. The

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however that there should be one case in 100 where it is done differently ... to write specifications simply calling for the most advanced machine which is possible in the present state of the art. I hope this will be done again soon and that it will never be forgotten." *John von Neumann*, 1992, New York, Pantheon Books, pages 294-295.

[3] Ibid, page 288.

[4] Quoted in William Aspray, *John von Neumann and the Origins of Modern Computing*, 1990, Cambridge Massachusetts, MIT Press, page 45. Also, see notes 92 and 93 on page 266.

reports included full details how the computer was to be constructed and how to code the solution to problems.[5]

Aided by the IAS reports, researchers designed and constructed computers at many institutions in the US, and in Russia, Sweden, Germany, Israel, Denmark, and Australia. Also, scientific and technical journals began to contain articles describing computer developments in many of these countries. Visits were exchanged so the researchers could learn from each other's projects. This open collaborative process in the late 1940s laid a solid foundation for computer development. That development was international from its early days. It was only upon that scientific foundation that commercial interests were able to begin their computer projects starting by the early 1950s.

Internationalism in the 1950s

Describing the mid 1950s, Isaac Auerbach, an American engineer active organizing the Joint Computer Conferences in the US, reports that "In those days we were constantly talking about the state of the art of computers . . . I suggested then that an international meeting at which computer scientists and engineers from many nations of the world might exchange information about the state of the computer art would be interesting and potentially valuable. I expressed the hope that we could benefit from knowledge of what was happening in other parts of the world . . . The idea was strongly endorsed. . ." Auerbach projected such a conference would be a "major contribution to a more stable world." This line of thought helped suggest approaching UNESCO, the United Nations Educational, Scientific and Cultural Organization to sponsor such a conference.

UNESCO was receiving proposals from other countries as well. The result was the first World Computer Conference, held in 1959 in Paris. Nearly 1800 participants from 38 countries and 13 international organizations attended. Auerbach wrote that "by far, the most important success of the conference was the co-mingling of people from all parts of the world, their making new acquaintances, and their willingness to share their knowledge with one another." Computers and computing knowledge was treated at this conference as an international public good. The level of development reported from around the world was uneven but sharing was in all directions.

During the UNESCO conference, many attendees expressed an interest in the holding of such meetings regularly. A charter was proposed and by Jan 1960 the International Federation for Information Processing (IFIP) was founded. IFIP's mission was to be an "apolitical world organization to encourage and assist in the development, exploitation and application of Information Technology for the benefit of all people." Eventually, IFIP subgroups sponsored annually hundreds of international conferences on the science, education, impact of computers and information processing.

The success of the IFIP in fulfilling its mission is attested to by the fact that all during the Cold War, IFIP conferences helped researchers from East and West to meet together as

[5] Herman Goldstine, *The Computer: from Pascal to Von Neumann*, 1972, 1993, Princeton, NJ, Princeton University Press, pages 255-256, notes 3-5.

equals to report about their computing research and eventually about their computer networking research and activities.

Sharing Gets Built into Computers

The sharing among researchers by letter and at conferences was also soon to be built directly into the computer technology itself. The 1960s were ushered in by the beginning of development of the time-sharing mode of computer operations. Before time-sharing, computers were used mostly in batch processing mode where users left jobs at the computer center and later received back the results. From the point of view of computer efficiency, the great calculating speed of the computer would be wasted if slower humans were to interact with it. First at the UNESCO conference and then at MIT the idea was proposed that computer calculating time could be broken up into intervals with different users having access to their own milli-second intervals on a rotating basis. Such computer time-sharing technology could make possible the simultaneous and efficient use of a single computer by many users. In this way more people could be using computers and each user could interact with the computer directly. When finally developed this sharing was so fast that each user had the illusion he or she was the sole user.

The first successful time sharing experiments were at MIT. By the end of 1962, the CTSS (Compatible Time Sharing System) was available to a growing community of users. The developers, Robert Fano and Fernando Corbato, report that the biggest surprises were one, that more than 50% of the improvements made to the system were suggested and developed by the users not the development team. And two, that a strong bound of friendship and collaboration developed among the users especially because they made themselves available to each other to share problem fixes and other experiences.

Fano explained, "I am really talking about the interaction of users in the sharing. That's important. . . Friendships being born out of using somebody else's program, people communicating through the system and then meeting by accident and say `Oh, that's you.' All sorts of things. It was a nonreproducible community phenomenon," he concluded.[6]

Offering his summary of the achievements, Corbato explained: "Two aspects strike me as being important. One is the kind of open system quality, which allowed everyone to make the system kind of their thing rather than what somebody else imposed on them....So people were tailoring it to mesh with their interests. And the other thing is, I think, we deliberately kept the system model relatively unsophisticated (maybe that's the wrong word - uncomplicated), so we could explain it easily."[7]

The human-computer interactivity made possible by time-sharing suggested to JCR Licklider, an American psychologist and visionary, the possibility of human-computer thinking centers. A computer and the people using it forming a collaborative work team.

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[6] "The Project MAC Interviews," *IEEE Annals of the History of Computing*, Vol 14 no 2, 1992, p. 35 as quoted in Michael Hauben and Ronda Hauben, *Netizens: On the History and Impact of Usenet and the Internet*, Los Alamitos, CA, IEEE Computer Science Press, 1997, Chapter 6. Also online at: http://www.columbia.edu/~rh120/ch106.x06

[7] Ibid, page 33.

He then envisioned the interconnection of these centers into what he called in the early 1960s the “intergalactic network”, all people at terminals everywhere connected via a computer communications system. Licklider also foresaw that all human knowledge would be digitized and somehow made available via computer networks for all possible human uses.

In 1962, Licklider was offered the opportunity to start the Information Processing Techniques Office a civilian office within the US Defense Department. As its director he gave leadership insuring the development and spread of time-sharing interactive computing which gave raise to a community of time-sharing researchers across the US.

Computer time-sharing on separate computers led to the idea of connecting such computers and even how to connect them.

Sharing Makes Computer Communications Possible

Donald Davies, a British computer scientist, visited the time-sharing research sites that Licklider supported in the US. Later he invited time-sharing researchers to give a workshop at his institution. Davies reports that after the workshop he realized that the principle of sharing could be applied to data communication. He conceived of a new technology which he called packet switching. The communication lines could be shared by many users if the messages were broken up into packets and the packets interspersed. Davies’ new technology treated each user’s message and each packet equally. By sharing the communication system in this way a major efficiency was achieved over telephone technology.

By 1968 Licklider foresaw that packet switching networking among geographically separated people would lead to many communities based on common interest rather than restricted to common location. Licklider expected that network technology would facilitate sharing across borders.

Licklider and his co-author Robert Taylor also realized that there would be political and social questions to be solved. They raised the question of access, of ‘haves’ and ‘have nots’. They wrote:

“For the society, the impact will be good or bad, depending mainly on the question: Will ‘to be on line’ be a privilege or a right? If only a favored segment of the population gets a chance to enjoy the advantage of ‘intelligence amplification,’ the network may exaggerate the discontinuity in the spectrum of intellectual opportunity.”

Licklider and Taylor were predicting that the technology would have built into it the capacity to connect everyone but spreading the connectivity would encounter many obstacles.

Open Code Unix

Von Neumann’s putting his computer code in the public domain was repeated. In 1969, mathematicians at the US telephone company AT&T Bell Telephone laboratories (Bell

Labs) started to build a computer time-sharing operating system for their own use. They called it Unix.

Bell Labs can trace its origin to the beginnings of telephony. As the original Bell patents were going to expire in the late 19^{th} century, the AT&T Board made the decision to base its business success on the introduction of ever more advanced technology based not on legal defense of old patents, but rather on scientific research. Eventually this decision was manifested in the development of Bell Labs as a university-like science and technology research institute. Based on the success of research at Bell Labs, AT&T was able to fulfill its obligations under the US Communications Act of 1934.[8] Section 1 of the Act charged the Federal Communications Commission and thus AT&T as a regulated communications utility to make "available, so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges . . ."

In the 1960s, AT&T participated in a government, academic and industry effort with MIT and the General Electric to create a prototype public computer utility to make access to computing as universal as telephony. The project had the name MULTICS.[9] It ran into many problems some of which stemmed from the conflicting interests of the partner organizations. It could not meet its deadlines. AT&T was withdrawing from the MULTICS project by 1969.

When AT&T withdrew from the MULTICS project, Bell Labs researchers Ken Thompson and Dennis Ritchie did not want to lose the communal programming environment based on CTSS that had been part of MULTICS. At Bell Labs, researchers were encouraged to develop patterns of work and projects of their own choosing. In that spirit, Thompson and Ritchie started creating the programming environment they wanted for themselves and their colleagues.

They appealed to management to buy for them a substantial computer for their operating system development work. Management was reluctant to make such an investment considering the recent collapse of the MULTICS project. That may have been one of the world's best management decisions. It forced Thompson to work with a little-used small PDP-7 computer and work very carefully. Starting from scratch, along side his other projects, he worked to build the system he wanted but as a minimal operating system. He based it on a very general file system that he and his co-researchers sketched out on a chalkboard keeping in mind that it had to be shared among multiple users.

Other Bell Labs researchers made their input. Doug McIlroy kept suggesting pipes, syntax for the output of one program to become the input of another while both programs are running simultaneously, until pipes were added. All users were eager to write small

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[8]Public Law No. 416, June 19, 1934, 73d Congress. An Act to provide for the regulation of interstate and foreign communication by wire or radio, and for other purposes. Available online at http://www.criminalgovernment.com/docs/61StatL101/ComAct34.html

[9] Multiplexed Information and Computing Service

programs called tools to facilitate their own work and made these available to other users. In this process of self directed work and free interchange of ideas the operating system Unix emerged, a shared system around which a community of users could form.

“What we wanted to preserve," Ritchie wrote, "was not just a good programming environment in which to do programming, but a system around which a fellowship could form. We knew from experience that the essence of communal computing, as supplied by remote-access, time-shared machines, is not just to type programs into a terminal instead of a keypunch, but to encourage close communication."[10]

The researchers’ request for a substantial computer on which to develop Unix was finally granted when they agreed they would use it to develop what we today call office software especially a word processor. Bell Labs purchased for them a DEC PDP-11/45. For the PDP11, they had to rewrite the Unix code completely in C, a higher level coding language written by Ritchie specifically to facilitate systems programming. The use of C made Unix the first operating system implementable on computers independent of who manufactured them. That allowed AT&T to break the problem of vendor dependency

Using the Unix environment themselves for their own work and fun, the researchers experienced its strengths and weaknesses. They wanted the best environment possible for their development work so they worked hard to improve it. They also were happy to share the code with their friends elsewhere. One story is that Thompson sent the code on magnetic tape and to colleagues. They were able to get it up and running based on the open code. Within the C code he and others had put remarks about what a section of code was doing. In that way the code was self-documented. Because the code was open, it could be understood and modified and customized. That gave Unix a vibrant life and led to many varieties called ‘flavors’.

AT&T allowed Unix source code on tape and manuals to be available to academic computer scientists for a nominal license fee. AT&T was restricted from offering Unix as a commercial product because as a regulated communication utility it had settled a Sherman anti-trust act complaint agreeing not to engage in manufacturing or sales outside of telephone, telegraph, and “common carrier communications”. Open code Unix spread rapidly as the environment of choice on most PDP-11s, and many other systems. The use of Unix also spread within Bell Labs and the Bell system. Development of the million plus lines of code for the 5ESS all computerized telephone switching system was done in a Unix environment distributed over 16 computers from 3 manufactures. Outside of AT&T, Bell Labs offered no support. Users were on their own.

In 1974, Thompson and Richie published a journal article, “The Unix Time Sharing System.”[11] John Lyons a professor in Australia read it and wrote them for a copy of the tape. His school paid $150 and signed a license agreement and received the code. "We

[10] "The Evolution of the UNIX Time-sharing System,” *AT&T Bell Labs Technical Journal*, vol 63 no 8, part 2, October, 1984, page 1578.

[11] *Communications of the ACM, **17**, No. 7 (July 1974), pp. 365-375*

needed help," he told an interviewer, "but we couldn't get any from outside sources so we ended up generating our own expertise." Lions thought to use some sections of the code in his Operating Systems course. The students rebelled saying they needed to see the source code for the whole kernel to understand the sections he offered them. He prepared two books, one *Source Code* and the other *A Commentary on the Unix Operating System*. He wrote the commentary based on analyzing the code until he understood why it was chosen. Those books circulated all over the world. At some point AT&T forbad further distribution, arguing it the code was proprietary. That did not stop the Unix community. From then on they were photocopied and continued to circulate and help introduce the principles of Unix and operating system coding.

One more piece of the Unix story is the desire in 1991 by a Finnish student, Linus Torvalds to have a Unix like environment on his small PC. There was available a minimal teaching operating system, Minix which Torvalds used but it was only a starting place. He set out to give himself the environment he wanted by analyzing what an operating system does and then writing a Unix like system from scratch. At the beginning of his work, Torvalds posted online a request for some specific help. The positive response led him to put his code online when he had made some progress with it. The result was a few people contacted him offering some suggestions or comments. He welcomed their help and some began to collaborate with him.

In a short time, a community of individual remote developers adopted the project and worked with Linus. The result is an ever expanding Unix-like, freely available, open operating system, Linux. The developers of Linux collaborate voluntarily to develop a public good for themselves and whoever else wants to use it. Between 2005 and 2008, over 3700 individual developers contributed to the Linux kernel code. The kernel is the core which determines how well the system will work and is the piece which is truly unique to Linux. On top of this core many companies have added features and commercialized the result as a named distribution of Linux.[12]

Resource Sharing Yields ARPANET

The time-sharing scientists that Licklider supported also began in 1969 an experiment to connect their time-sharing centers across the US. Their project resulted in the first large scale network of dissimilar computers. Its success was based on packet switching technology. That network became known as the ARPANET, named after the parent agency that sponsored the project, the Advanced Research Project Agency (ARPA). The ARPANET was a scientific experiment among academic researchers not as is often stated a military project[13]. ARPA was created 1958 just after the launch of Sputnik by the Soviet Union.

The goal of the ARPANET project was "to facilitate resource sharing". The biggest surprise was that the ARPANET was used mostly for the exchange of text messages

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[12] See "Linux Kernel Development (April 2008)" on the Linux Foundation website at http://www.linuxfoundation.org/publications/linuxkerneldevelopment.php

[13] See, Michael Hauben, "The Untold History of the ARPANET", http://www.columbia.edu/~rh120/ch106.x07

among the researchers about their common work or unrelated to work. Such message exchanges occurred in every time sharing community. The ARPANET only increased the range and number of users who could be reached. Thus was born email, an effective and convenient added means of human communication.

The ARPANET started with four nodes in early 1970 and grew monthly. Early technical work on it was reported at the joint conferences in the US and in the open technical literature. Similar packet switching experiments took place elsewhere especially France and the UK. Visits were exchanged and each other's literature was eagerly read. When in 1971 AT&T was offered the opportunity to take over, own and operate ARPANET. as a commercial operation and sell back its service to the government. AT&T could have owned the network as a monopoly service. But in the end AT&T declined the official offer. "They finally concluded that the packet technology was incompatible with the AT&T network,"[14]

The thought of interconnecting networks seemed a natural next step. Again the technology itself invited sharing and connecting, all of which requires collaboration.

The spark toward what we know today as the internet emerged seriously in October 1972 at the first International Computer Communications Conference in Washington DC. Not well known is the fact that the internet was international from its very beginning. At this conference researchers from projects around the world discussed the need to begin work establishing agreed upon protocols. The International Working Group (INWG) was created which helped foster the exchange of ideas and lessons. Consistent with IFIP purposes this group became IFIP Working Group 6.1

The problem to be solved was how to provide computer communication among technically different computer networks in countries with different political systems and laws. From the very beginning the solution had to be sought via an international collaboration. The collaboration that made possible the TCP/IP foundation of the internet was by US, Norwegian and UK researchers.

Divided Europe and Networking

Throughout the 1970s the ARPANET grew as did computing and computer centers in many countries. Schemes were proposed to connect national computer centers across geographic boundaries. In Europe, a European Informatics Network was proposed for Western Europe. A similar networked called IIASANET was proposed for Eastern Europe. The hope was to connect the two computer networks with Vienna as the East-West connection point. IIASANET got its name from the International Institute for Advanced System Analysis which was an East-West institute for joint scientific work. When the researchers met for joint work in the IIASA Computer Project or at IFIP conferences, they were pointed to or had already read the journal articles describing the details of the ARPANET. The literature had crossed the Iron Curtain and now the researchers tried to get networks to cross too. At this they failed. The reason seemed both commercial and political. The networks depended on telephone lines and the telephone

[14] Larry Roberts, Director of IPTO, quoted at http://www.cybertelecom.org/notes/internet_history70s.htm

companies were reluctant to welcome new technology. Also, with the coming of Ronald Reagan to the US Presidency, neo-con politics derailed East-West cooperative projects.

Usenet, the Poor Man's ARPANET

In the US, the advantage of being on the ARPANET especially email and file transfer attracted the attention of computer scientists and their graduate students. But most universities could not afford the estimated $100,000 annual cost nor had the influence to get connected. A common feeling was that those not on the ARPANET missed out on the collaboration it made possible.

To remedy the situation two graduate students Tom Truscott and Jim Ellis developed a way to use the uucp remote copy function built into the Unix operating system to pass messages on from Unix computer to Unix computer over telephone lines. The messages could be commented on and the comments would then be passed on with the messages. In that way the messages became a discussion. They called the system Usenet short for Unix Users Network. Since Unix was wide spread on computers in many countries, Usenet spread around the world. Based at first on telephone connections between computers the costs could be substantial. Some help with phone costs was given by AT&T the regulated US phone company. Computer tapes containing a set of messages were sometimes mailed or carried between say the US and Europe or Australia as a less expensive means of sharing the discussions.

At the same time, Larry Landweber, a computer scientist in the US, gathered other computer scientists who lacked ARPANET connectivity. The ARPANET connected universities were pulling ahead of the others in terms of research collaboration and contribution. Landweber and his colleagues made a proposal to the US National Science Foundation (NSF) for funding for a research computer network for the entire computer science community.

At first the NSF turned the proposal down. There were favorable reviews, but some reviewers thought the project would have too many problems for the proposers to solve and that they lacked sufficient networking experience. Although disappointed, Landweber and his colleagues continued to work to put together an acceptable proposal. They received help from many researchers in the computer science community. By 1981 they had support for their Computer Science Research Network (CSNET) project which would allow for connection with the ARPANET, telephone dialup connections and what was called public data transmission over telephone lines.

Landweber's group got funding and management help from the NSF. Piece by piece they solved the problems. A gateway was established between CSNET and the ARPANET and CSNET spread throughout the US.

But it didn't stop there. Landweber and his co-workers supported researchers in Israel soon followed by Korea, Australia, Canada, France, Germany, and Japan to join at least the CSNET email system. Also, CSNET was a critical driver in helping the NSF see the importance of funding an NSFNET and this contributing to the transition to the modern

Internet. About its NSFNET, the Office of Inspector General for the National Science Foundation wrote in its "Review of NSFNET" that, "We are convinced that relying on demand-driven market forces would have advanced neither networking technology nor use as rapidly as both have advanced under the direct funding approach taken by NSF." They explained saying, "We believe that the funding approach taken by NSF supporting the creation of the NSFNET backbone directly, rather than giving grants to the users of the network in the hope that the availability of buyers would inspire network providers to enter the market -- was reasonable. When NSFNET came on-line at.T1 it was pushing the envelope of large-scale networking technology, and the same was true when it advanced to T3. This is a field that is rediscovering the scope of its usefulness virtually on a daily basis, **as it is used**, which in turn inspires more use."[15]

China-CSNET Email Link

How did the CSNET and eventually the internet get to China? An email link was established in 1987 between the People's Republic of China and the Federal Republic of Germany. Many factors contributed to make that connection possible.

In 1982-1986, the World Bank made available to Chinese universities $200 million in loans and credits. China had joined the Bank in 1980. The University Development Project was its first loans. Nineteen universities used the loans to import Siemens computers.[16] The Bank insisted that some of the loan money be used for manpower training. In 1983, 18 speakers from various German universities, major research institutes, and industry were brought to China to participate in the first Chinese Siemens Computer Users Conference (CASCO)[17]. That is when Werner Zorn, a computer science professor at the University of Karlsruhe in western Germany, first met Yunfeng Wang, the Senior Advisor of the Institute for Computer Applications (ICA) in Beijing. Wang had lived in the 1930s and 1940s in Germany where he worked for the Siemens Company. He returned to China in 1949 to contribute to the development of new China.

[15] http://www.nsf.gov/pubs/stis1993/oig9301/oig9301.txt

[16] By 1978, the "pragmatic" forces in China, which had prevailed as the Cultural Revolution was ended, consolidated their dominance. They began a long, complicated process of "Reform and Opening Up", repudiating China's effort at an autonomous, noncapitalist development which it had begun in 1949, the process of opening up included negotiating and establishing full diplomatic relations with the United States and applying for memberships in the World Bank and the IMF in 1979. The memberships were achieved in 1980. But even earlier, after replacing Taiwan in the UN in 1971, Chinese officials had been studying and preparing for a relation with the Bretton Woods institutions.

The first World Bank development loan for which China applied was for a $200 million higher education project. The Chinese ministry of education wanted the $200 million to be spent entirely on equipment for the universities. Previously, the World Bank made education loans predominantly for minimum basic education for children or for adult literacy. The Bank relaxed some of its usual procedures and approved the Project but insisted 20% of the loan be devoted to manpower training. On Nov 4, 1981 the University Development Project I agreement was signed.

See Harold K. Jacobson and Michael Oksenberg, *China's Participation in the IMF, the World Bank, and GATT: Toward a Global Economic Order*, Ann Arbor, University of Michigan Press, 1991, pages 66-69 and 109-112.

[17] In German Chinesische Anwender von Siemens Computern

At the first CASCO symposium in Beijing, Zorn gave a keynote speech on the German Research Network (DFN) project. He also led a seminar on the same topic. One of the Chinese interpreters challenged Zorn, remarking that lecturing was not enough. Would Professor Zorn also do something more for China? That comment planted a seed that grew as the warmth and friendship developed between the German visitors and their Chinese hosts. They wondered if they could continue to do something together. Professor Wang encouraged a Chinese-German computer collaboration.

In the period after returning to Germany, Zorn worked on network projects. One with Michael Rotert used their computer center computer to make the first connection in Germany with the American computer science email network CSNET.[18] With help from Landweber in the US, they succeeded in setting up the first German CSNET node, adding Germany as the fifth country to join CSNET. Zorn writes that "we had made electronic mail service available for the first time, and were quickly convinced of its advantages."[19] They were excited having email connectivity with many other computer scientists and wanted to spread it. They accepted requests from other computer scientists for help and connected them via Karlsruhe to the whole international CSNET. At that time Zorn notes, "With provision of the CSNET service both within and outside Karlsruhe University, there began a lively 'mission activity,' whose reputation also gave impulse to our colleagues in the direction of China."

Communicating with China for his 1985 trip to the second CASCO conference required two or more weeks of turn around time between letters. Zorn concluded, "From a mixture of frustration, belief in progress and staying power, the obvious desire became ever stronger to have a computer connection with China."

Real preparatory work for a China-Germany email link only began after Zorn surprisingly received funding in autumn 1985 from the German government. He had written a letter a few months earlier requesting the money but did not expect it. With the money, Zorn's computer center bought a VAX computer because it ran Unix. Unix was available in China and that would allow a hookup using the Unix remote copy command uucp which did not require anyone's approval. Also, other computer scientists had already implemented for Unix the necessary communications instructions that would allow CSNET email to be exchanged among Unix running computers. Zorn was worried however that, "we were perhaps doing something illegal in linking-up to China, which might damage our linkup to America." The plan to have a uucp point-to-point connection relieved that concern. The problem remaining was when might ICA in China have a similar computer to be its node? They saw no way to influence this to happen.

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[18] CSNET was the result of a proposal in 1979 submitted by Lawrence Landweber at the University of Wisconsin-Madison in the US to make computer network connections among US and other university computer science departments. It started as a simple telephone-based email relay network which became known as PhoneNet. In February, 1984, Israel became the first international node on the CSNET, soon followed by Korea, Australia, Canada, France, Germany, and Japan.

[19] "How China was Connected to the International Computer Networks", 1988, http://www.hpi.uni-potsdam.de/zorn/publikationen/china.html?L=1. For the German language version see http://www.hpi.uni-potsdam.de/zorn/publikationen/china.html?L=2

In 1986 and 1987, Zorn and his colleagues and students did a great deal of work to be prepared should a link become possible with China but only as side projects in addition to their other tasks. When preparing to participate in the third CASCO conference, the idea arose of trying to build the Germany-China email link using Siemens computers. Since 1985, Michael Finken, an IT student at Karlsruhe, had been working on an implementation of CSNET protocols that would make it possible to do email via such computers. Again Zorn feared trouble with the US but Finken assured him very little American software code remained in what he developed. Zorn sent an email message to Landweber in the US just to be sure, asking whether there might be a problem. The next morning he had his answer in an email message encouraging and supporting him to try an experimental trial link between Beijing and Karlsruhe. Zorn saw even on the American side among his network peers a pronounced interest in a computer link up with China.

In early September Zorn and Finken and another Karlsruhe colleague left for the CASCO conference but also with the equipment and code they thought might make the email link possible. For three hard weeks they fought day and night along side a team of 5 Chinese engineers and computer scientists to get the link up and functional. A few months later, Zorn documented the pain and joy of their work for the world to see including an hour by hour log of their efforts.[20] The result was a successful email message sent on September 20, 1987 to Karlsruhe and from there to the US and Ireland. Two months later, Stephen Wolff of the US NSF gave his approval one day before people above him in the US government were to tell him to deny the approval. Thus the first permanent email link was made between China and the rest of the email world.

Conclusion

To sum up, there is a solid tradition associated with computers and computer networks. That tradition has been international from the very beginning. When von Neumann sent out his reports or Thompson sent out his tapes, or Torvalds put his code online, they were not making a selfish or a local or a national judgment. They acted as citizens of the world. When Zorn and Wang and their colleagues spent four years preparing for a chance to make an email link with China, they also were acting in this tradition. The internet itself serves to give more people the chance to be part of this larger world identity.

All the examples show a high level of sharing. None of the people mentioned had any reluctance making public their findings or a description of their innovations by publishing or by posting or by sending out copies. This sharing was a reflection of and is reflected in the time sharing and packet sharing technical essence of the internet Most situations described had a passing on what was received or better an adding to and passing on
All of the examples show valuing of the public domain. The evidence from hunter-gatherer archaeology is that hominids have carried on social exchange for at least two million years. The history of culture shows that social exchange is universally human and not a recent cultural invention.[21] The example of Linux which is upgrades every few

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[20] Ibid

[21] Robin Dunbar, Chris Knight, and Camilla Power. *The Evolution of Culture*. New Brunswick, NJ: Rutgers University Press. 1999, as cited in Human Nature and Social Networks. By Dr. John H. Clippinger, online at]http://ww.dodccrp.org/files/Human_Nature.pdf

months shows that the internet is making possible successful collaboration on a large scale. The examples suggest that sharing will play large part of any model that replaces homo economicus.

In some of the examples AT&T plays a special role. For example, the mission of Bell Labs was communication. A mission very close to the essence of computing. Bell Labs was supported to fulfill that mission by treating its scientists as self-motivated citizens of the scientific community. In such an environment, Thompson and Richie were able to develop Unix which creates a programming environment similar to Bell Labs itself. Since the breakup of AT&T, Bell labs has been shrunk to a manufacturing design lab. There is no similar Bell Labs today.

All the people I describe above were not lacking in subsistence. They were able to do and share their work with a public purpose and for society because by one means or another society was taking care of them. They were subsidized or supported by governments or AT&T, or their parents or by their own other work. As part of a search for a new model perhaps a lesson here is that creative or scientific or public work needs to be subsidized if it is to for social not private good.

We are searching for a theoretical frame work to see what direction the future should take.[22] There are people who actively contributed towards the development of the internet and the networked society that is emerging. These people understood the value to all of public goods and of collective work. Especially what their contributions led to is the communal aspects of public communications. In the 1990s, Michael Hauben realized these peoples were citizens of the networked society. He contracted net.citizen to netizens. The people and events I have described are a small subsegment of such netizens. They do not fit the homo economicus model. The model homo neticus or netizen (net citizen) may more appropriately and more scientifically describe the emerging internet-impacted society and thus help to replace the disintegrating homo economicus model?

[22] Disclaimer: I feel it is imperative to succeed at this task because the future being shaped by large commercial and political power holders and their economists and philosophers is appearing more obviously portending disaster.

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