Mapping A French Internet Experience: A Decade Of Unix Networks Cooperation (1983-1993)

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Introduction[1]

France's developments in computer communication networks were largely determined by a governmental choice in 1978 to back up Transpac, a telecom virtual circuit model, to the detriment of Cyclades, a datagram-based research model – in order to stimulate French telecommunication engineering at an international and competitive model (Schafer 2012; Vedel 1984). After a decade-long institutional battle between the national and monopolistic company France Telecom and the National Institute for Research in Computer Science and Control (Inria), TRANSPAC was launched and set up to host Minitel online services a few years later. While Cyclades' chief researcher Louis Pouzin was exporting across the Atlantic his datagrams technology to the Arpanet (then to become Internet) team, French computer researchers and engineers were at home, deploying an alternative network based on the Unix operating system. From 1983 on, they developed Fnet, an informal infrastructure used as the local branch of EUNet, the European Unix-based data network run from the Netherlands. Doing so, they "created a computer network social environment […] with the same ingredients that would make the Internet successful later"[1] (Bloch 2013). Open, decentralized,

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collaborative, heterogeneous, and worldwide: its qualities appealed to the community of computer research and engineering in academic and private labs. Fnet became their unofficial Internet network provider until the success of the Web brought along commercial and official governmental-promoted new solutions such as Renater from 1993 on (Schafer and Tuy 2013).

The history of Unixians' computer networking collaboration may have similarities to the Arpanet's "ideal scientific community" (Flichy [2001] 2007), but if we look at Usenet, ancestor to computerized social network initiated on Unix networks we might think differently. In France, starting and running the infrastructure was done in less than ideal conditions. I intend to show, beyond shedding light on a lesser-known part of computer networks history, that Fnet was a "shadow infrastructure": an informal, experimental, and unacknowledged network of machines annexed to the existing telecom network, as well as a network of peers using and rerouting public telecom resources from the academic world. I thus look into how Fnet was managed in terms of technical and administrative infrastructure, a difficult question given that it had no official existence. This can be read as a series of "tactical" practices (de Certeau 2011), as well as processes of negotiation, in a Science and Technology studies perspective, both of which providing basis for Actor-Network theory-type of mapping method (Latour 1987) – which I use as an analytic metaphor, but will not apply literally. Although the networking side of Unix's history is documented (Kelty 2008; Salus 1994), its local role in paving the way for the way for the Internet internationally, like in France remains just a hint, although vivid in protagonists' memory (Griset and Schafer 2012; Huitema 1995). Original sources in this chapter comprise archives from the Computer Lab at Cnam[2], which hosted Fnet's administration from 1983 to 1986, as well as Usenet mail archives and oral interviews with the protagonists who supported and promoted Fnet up until

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1993, when its missions shifted with the rise of the commercial Internet.

The Unixian Community and its French Members: Open Cooperation in the Margins

The Conservatoire national des arts et métiers [National Conservatory of Arts and Crafts, known as "Cnam"] is a higher education establishment based in Paris. It was created in the wake of the French Revolution in 1794 to stimulate industrial innovation, and has been since a privileged public institution for applied research and continuous education in the technological field. A computing center, called Laboratoire d'Informatique [Computer Lab] was created in the 1960s with support from the department of Applied Mathematics and Computing.[3] Its purpose was to support and manage the needs in computing resources for the teaching department, as well as general IT support for the administration. In the late 1970's and early 1980's, there was no official computer science research activity at Cnam, but a small, informal team of about four researchers calling themselves the "Systems lab" implemented and experimented with the Unix system within the laboratory. Led by Claude Kaiser, a professor at Cnam since 1974 with a research background from INRIA[4], and Gérard Florin, head of the Computing Lab, who had defended a thesis in computer networking in 1975, they "played a major part in the implementation Unix, but also similar experiments with Ethernet, VAX-VMS, Unix-BSD, UUCP and then TCP/IP."[5] This early interest in versions of the Unix operating systems (Unix-BSD), Unix compatible machines (VAX), and network protocols (Unix's UUCP and the Internet's TCP-IP), set the stage for the deployment of Internet networks in France.

A Unixian Case for Collaboration: Standardization and Negotiation

Unix was then a paradigm for operating systems, chosen by a myriad of academic and private computer departments and research laboratories internationally (Kelty 2008). Ken Thompson designed at his own initiative the system in 1969 along with Denis Ritchie at the Bell Labs, the R&D department of American telecommunication company AT&T, to foster the reuse of software on incompatible machines. AT&T was forbidden to sell the operating system by a 1956 anti-trust decree restricting the company to exploit anything other than telecommunication equipment. From 1975 on, it was thus distributed to universities for a small licensing fee, along with its full source code, and was largely adopted by academia as a predecessor of the free software movement (Kelty 2008; Paloque-Berges and Masutti 2013).

Unix's success is firstly rooted in then-emerging hacker ethics, a combination of informal cooperation, autonomy from traditional hierarchies placed under the banner of computer hardware, and software experimentalism. Victor A. Vyssotsky, then a Bell Labs' computer engineer, sums it up:

> When Unix evolved within Bell Laboratories, it was not a result of some deliberate management initiative. It spread through channels of technical need and technical contact. This was typical of the way Unix spread around Bell Laboratories. […] it was used, modified, and tinkered up in a whole variety of organizations (Vyssotsky, quoted in Hauben and Hauben 1997: 89).[6]

Yves Devillers[7] recalls how Unix traveled to France in a similar fashion: "It was driven by demand. If technology allowed to do it, then it was done. Everything that was doable or

appropriable was." At a time when the governmental Plan Calcul [Planning for Computing, 1966-1975] was still influential, requiring public institutions to use domestic technological equipment (Schafer and Tuy 2013; Schafer 2012; Mounier-Khun 2010a; 2010b), Unix was an alternative system for hands-on experiments in software, and accessing remote computers (Cornwall 1985). Moreover, Unix offered solutions in software portability and system standardizations to the 1970s computer industry problems (Campbell-Kelly and Aspray 1996). Doing so, it gave a sense of community beyond "user clubs", traditionally restricted to proprietary computer systems (Mounier-Kuhn 2010a; 2010b). It thus changed the face of software development, giving hacking culture a leading role in software cooperation for establishing norms and standards (Raymond 2000). At Cnam, Kaiser was one of the main advocate for Unix as an international normative system:[8]

From the point of view of software, we must avoid anarchy and incommunicability; an effort towards standardization must be made. [Unix is] a norm […] being established currently, and a lot of micro constructors offer or announce it.

Resort to Unix systems in France was complicated by the end of Plan Calcul policy, fueled by two decades of a strong-willed reorganization of technological research and development, as well as a significant drop in credit for technology equipment in the science field, and political and economic problems within Cnam: all this made the acquisition of Unix-compatible machines from American constructors difficult. Another factor was an American embargo in 1979, preventing French computer users to buy American equipment for fear it would be used to build nuclear weapons. However, the Computer lab needed to renew its computer park – having relied for a decade on the IBM 360 (Florin 2016[9]). The research team had been

familiarized with Unix machines thanks to a visiting engineer from the Netherlands and was looking to acquire a mini-computer compatible with the system, that would meet their budget and power needs (no French machine would be eligible, as testified by Florin, 2016). They acquired a DEC PDP 11/70 machine in 1979, and in 1980 a DEC VAX 11/780, PDP's successor, both "workhorse machines of the early Unix culture" (Raymond 2000), but this occurred only through a lengthy negotiation with the Cnam's administration (requiring the computer be used for administration and accounting needs) and a formal and legally signed declaration that the computer would only be used for research and education purposes. Unix was implemented in the summer of 1980, running "outside of working hours"[10]. Eventually, a third Unix-compatible machine was acquired with another bypass method. Indeed, a VAX 11/780 clone was produced by a British manufacturer specially to sell to countries under embargo, like France and South Africa: entitled Systime-8750, it was bought in 1981 and constructed by the Computer Lab one VAX rack at the time, "importing it piece by piece" under the radar (Florin 2016). This was the machine on which the Unix network was implemented, and coincidentally the only historic computer used Cnam preserved by the Museum of Arts and Crafts in its reserves [Cnam's Musée des arts et métiers, the French national museum of science and technology].

Protocols for Machine and Human Communication

At first, Unix was dedicated to sharing resources on time-sharing mini-computers. At the Bell Labs, Mike Lesk and David Nowitz had developed in 1976 a file transmission command into a distant machine communication protocol (Hauben and Hauben 1997: 206). Called UUCP (Unix-to-Unix Copy Protocol), it copied a file from one terminal to the other, or to a printer,

but was soon appropriated to send messages between user accounts, a makeshift tactic similar to the birth of email a few years before (Hafner and Lyons 1996). Implemented into a distant Unix machines network under a "store and forward" model, this point-to-point technique sent messages to a series of connected machine so as to reach its destination. It first ran on dial-up connectivity, thus needing a telecommunication network to dial into.

The UUCP protocol was encompassed with a hacker aura and do-it-yourself technical practice: "low-speed and unreliable, but cheap […] over ordinary phone lines" (Raymond 2000). Like the Arpanet, and the subsequent TCP-IP protocol that led to the Internet in 1983, UUCP was an open system running on an end-to-end model, meaning that a machine administrator could make a liaison without any authorization from a central authority. This determined the ease with which UUCP liaisons were created and spread all over the Unixian international community.

UUCP networks first entered Continental Europe thanks to cooperation between an academic lab and a corporate lab. The Centrum Wiskunde & Informatica (CWI[11]) of Amsterdam University had a partnership with Armando P. Strettner from the DEC Lab at Maynard (Massachusetts, USA), a founding member of DEC Unix Engineering Group who played a major role in creating UUCPnet in the US as well as in Europe and Asia. As DEC machines were Unix-compatible, a transatlantic connection was extended between DEC labs in Maynard and their counterparts in the computing center of CWI Amsterdam, at the instigation of Teus Hagen and Piet Berteema, a computer science researcher and an engineer.

UUCP experiments appeared at Cnam in 1982, with, in the works, the implementation of an

Ethernet local network with extensions to institutional partners. While Unix networks experiments were not qualified as research per se, they did fall under the category of distributed networks, process and data communication research.[12] Opening communication routes was aimed at (1) finding standards for computer networking, (2) experimenting critically with "file transfer software between connected systems on a permanent line or virtual circuit" and "certain distant commands, among which the 'Mail' command for electronic mail", and, last but not least, (3) building a network between French and American research centers.[13]

International Cooperation: A Social Network of Peers

The spreading of Unix relied on a socio-professional networks of peers, supported mainly by non-profit associations due to the non-commercial nature of Unix. Indeed the Computer Lab was strongly involved with the world of computer research[14] and user organizations, such as US-based Unix user group Usenix, or its European and French counterparts, the European Unix Users Group (EEUG), or AFUU (French Association for Unix Users) – the latter born in 1982. Thus, communication between distant peers was crucial in a small international community in which everyone knew everyone (Bloch 2013), fostered by events like the 11th "European Unix Systems User Group OPEN Meeting" held at Cnam in April 1982 and supported by EEUG.[15] Organized by Humberto Lucas and Bernard Martin, two engineers from the Computing Lab active in the "Systems lab", it was nicknamed "Spring in Paris". A focus of the meeting was the use of Unix for purposes of telecommunication and computer networks, with several presenting applications for Unix networking protocols (UUCP) and software (among which the news software called Usenet).[16] At this occasion, Teus Hagen and

Piet Berteema from CWI showcased their new UUCPnet node implemented in Amsterdam, and announced they had created an organization for supporting the spread of Unix networks in Europe, called EUnet, for European UNIX Network. T. Hagen also presented and distributed software for group discussions (then called "electronic conferences") on UUCP networks, a system called Usenet that he brought back to Europe on a tape from a Usenix conference in San Francisco. This stimulated the creation of local branches in several countries in Europe, among which Fnet a year later, with the Computer Lab at Cnam used as server backbone and administrative support. As Unixians from other establishments or organizations flocked to connect to the Cnam UUCP hub or open their own, a "hive phenomenon" triggered by the circulation of computer engineers and scientists in France and abroad: "Everyone leaving a workplace for another wanted to connect their new workplace so as to maintain the means of communications" (Devillers 2012).

The Unixians' Internet Experience amidst Other Technical and Social Networks

Unix networks emerged in cooperation but also competition with other networks of computers. In the 1970s, they were mostly centralized and proprietary. While IBM's BITNET (EARN in Europe), UUCPnet's main rival, used a similar point and forward technique, and was widely used and tinkered with within academia, it was not born as a heterogeneous network, but relied on IBM machines only, contrary to UUCPnet, compatible with any machines with the Unix system installed. Nor was DECnet, relying solely on DEC's PDP machines – although Unix could be installed on PDPs, thus allowing UUCP connection. Unix networks were based on an open, distributed, and collaborative model, keen on including new users from many professional backgrounds. This principle materialized through the implementation of UUCP-based Usenet software, the open electronic conference system it

hosted, effectively supporting "global conversations" from people beyond the computer science world up to the 1990s (Rheingold, 1993). Accordingly, at this point I will look more closely on the technical, but also social, constraints that accompanied the deployment of Unix networks.

Opposition and Compromise: Negotiating with "Authoritarian" Norms

The loose, informal structure of the Unixian community is key to understanding the spread of a technical network based on the social values of openness and cooperation. In a January 1984 AFUU meeting report, Humberto Lucas[17] recalls the initial project: to establish an "informal network of Unix systems with the UUCP/UUCICO protocols."[18] This informality was also political: the Unix community worked in the margins of government science and technology policies, "far from the decisions made in Bruxelles" (Schafer and Tuy 2013). Devillers (2012) stresses the importance of the human factor: "one person only in the hierarchy was needed to add a node to the network", contrary to a complex vertical process of decision-making imposed by institutional hierarchy. Resorting to other system and network standards such as Unix and UUCP was thus considered as against the general technological policies in France: "In France, this spirit doesn't exist, at least for now", underlines Lucas in the report, in regard to using foreign hardware equipment or software standards. This oppositional stance doesn't mention, however, that the problem with acquiring Unix-compatible machines relied on a United States government embargo on shipping computer equipment to certain countries (as decided in 1979); nor that the deployment of UUUCP would need to run on protocol layer in theory rejected by Unixians, the X25 protocol. Indeed, X25 was the official protocol used on European networks like Transpac, under the umbrella of the OSI normative model

recommended by the International Telecommunication Union (ITU)[19] after many negotiations and compromise (Schafer 2012). Compromise in technological negotiations is thus an important notion that is often shadowed by protagonists, amidst their strong emphasis on resisting and bypassing institutional constraints.

The ease of installation for UUCPnet was apparent only. One of the first obstacles was an auto-dialing modem necessary to "call" a peer's number and create a new node in the network: it was strictly limited by European telecom standards, and forbidden by national telecom companies. Such modems were distributed by Teus Hagen, initiator of EUnet at CWI in Amsterdam, at the occasion of Spring in Paris in 1982 to participants who took them home to their lab upon their return, allowing several places in Europe to connect to UUCPnet (Hauben and Hauben 1997: 128-130), but a step behind than in the United States as underlined by Lucas in the 1984 AFUU reunion report.

Following the makeshift spirit of the Unixians, the deployment of a UUCP network was to rely at first on the existing infrastructure of telephone lines, in an act of derouting considered as a misappropriation, just like a few years before at the Bell Labs (Hauben and Hauben 1997: 128). As a result, much of Usenet's news distribution was implemented without explicit approval wherever a UUCP site was born, and was mostly invisible to the organizations' authorities and accounting. French Unixians justified their derouting with a criticism of the archetypal model of hierarchical and central authority implemented in France's technological policy (and especially in the new field of computer-based telecom networks). According to Devillers and Bloch, Transpac was a "bureaucratic creation" based on a principle of "descending pyramid", which Unixians fought against. By derouting the national telecom

network, they also challenged post-war engineering work models, which applied new management and marketing techniques to shape the social (Vedel 1984) and the user itself with appropriate and closed technologies – the Transpac-based Minitel was an archetype in that regards (Thierry 2012). By contrast, Unixians defended an open model where users could shape back the technology they appropriated, and were doing so themselves by replacing Minitel terminal with computers.

Moreover, an effort was made to make EUnet and Fnet compatible with other norms and not a standalone network, as testified by memos from the Computer Lab. This challenge would prove acute for running messaging applications, one of the main uses of the UUCP networks. Transpac's use of the official mail protocol X400 supported by the European OSI norm, was mocked as too normative by Unixians, but was necessary nonetheless to allow dialog between different servers to establish the international mail transfer protocol SMTP.[20] The distributed nature of UUCP networks allowed the different terminals to connect to different types of liaisons, but international liaisons could only be made through the EUnet backbone in Amsterdam. Thus, one of the main challenges in the following years would be to maintain the use of the UUCP protocols while, at the same time, complying with French and European norms.

Openness and Exclusiveness: The Intricate Relationship between Unix and the Internet

1982 was also the year when the term "Internet" was officially released to name the state of computer networks interconnection made possible by the TCP-IP protocol (implemented on the Arpanet in January 1983). The convergence between Usenet and the Internet takes root

within a common technical ethics involving autonomy to install software from the hardware infrastructure, and "no global control at the operations level" (Leiner et al. 1997: 104). The Arpanet and Unix appeared complementary for the spread of computer internetworking technologies throughout the 1980's, because the system was compatible with many machines present on the international network. Internet protocols were integrated in the Berkeley version of Unix (BSD) in 1976: this gave a running start to computer network technologies in the Unixian world, "a key element in the Internet's successful widespread adoption" (Leiner et al. 1997: 105). As a result, an estimated 98 per cent of US computer science departments had adopted the code in the early 1990s (Kelty 2008).

Despite bridges to the Internet created from the EUnet node, allowing French Unix users to retrieve Internet-run STMP mail on Fnet, the first direct liaison from a French computer to the Internet waited until 1988. It was set up at INRIA, where the Fnet administration had migrated in 1986, through a partnership with the American National Science Foundation Network (NSFNet), the main Internet backbone from that year until the mid-1990's. One of the first non-US countries to benefit from a direct liaison, France's access was made possible in big part thanks to the reputation INRIA's Cyclades had acquired with the datagram model a decade earlier (Renard 2013). INRIA financed the transatlantic liaison for the profit of public research centers in France. Every public organism benefiting from the liaison had to be certified to NSF, while private clients had to continue using the Fnet network through the EUnet backbone in Amsterdam (Huitema 1994).

There was nonetheless a running rivalry between the Arpanet/Internet social world, considered the high-class of computer network research, and UUCP/Usenet's, described by its protagonists as the "Poor Man's Arpanet" for the "commonfolk of the computer community" (Hauben and Hauben 1997: 122-124; Hafner and Lyons 1996). Hacker folklore likes to

describe it as a network for “upstarts” with “primitive tools” (Raymond 2000) keen to perform hacker exploits (Cornwall 1985). There was only a faint echo of this rivalry during our interviews, alluding to the fact that great French researchers in network computing, like Cyclade’ Louis Pouzin and Gilles Khan were more interested in theoretical network models and the Internet than in using UUCP/Usenet. Nonetheless, a parallel can be drawn between American Unix users’ defiance towards the Arpanet/Internet, and Fnet users’ criticism of Transpac: while UUCP networks were completely decentralized and self-regulated at the servers’ level, Arpanet answered to the US Defense Communications Agency; in turn, French Unixians were critical of Transpac’s agreements with the French Defense department, creating a fear of general network surveillance (Devillers 2012), a decade after the SAFARI affair[21].

The network class struggle postulated by the first generation of Usenet users was also a way to create an identity based on social and technical differentiation towards other computer networks, in particular, to rethink the limits of the computer networks research and engineering to be more inclusive of general computer users outside of the Unix-oriented computer science community. Usenet was firstly aimed at Unix toolbuilders, a social network “for and by the users” (Rheingold 1993: 105, 126). The focus on “users” shows an acute and early understanding of what computer networks were bound to become, a communication media reinvented by users who are less and less specialized in computer technologies, and looking to expand applications and uses outside of the computer-centric world (Abbate 1999). As such, from the start Usenet prided itself to openness and inclusivity, as claimed by the first Usenet manual “Invitation to a General Access UNIX Network”, distributed as a handout to Usenix conferences participants in 1979, and circulating further into the many Unixian meetings (Hauben and Hauben 1997). The Usenet software itself was an exception to other

"electronic conferences" systems, usually closed and limiting the number of participants (Quarterman 1990). The network thus comprised diverse participants, mostly academic but also business-oriented, connecting from within their organization or, with the advances of micro-computers in the 1980s, from outside, as users could dial in the Usenet server at a distance.

French "Administratrivia" Networks: Beyond the Ideal "Commmonfolk of the Computer Community"

Principles of openness did not provide actual solutions to manage UUCP networks locally between the academia and corporate world. The history of Fnet as an informal organization shows the practical complexities of a human network running a technical network without formal support, and in a social environment where the organizational side of managing a network could be regarded as "administrativia" – a pun made by Devillers when reporting management problems on the Usenet Fnet group in the early 1990s.

The Computer Lab at Cnam handled Fnet from 1983 to 1986, with Humberto Lucas presiding over the *ad hoc* loose organization, running the backbone and managing subscriptions with the help of fellow engineer Daniel Lippman. Distributing different volumes of data to members and billing them was the main issue. Because of the UUCPnet decentralized model, some sites were bigger as they were servers rerouting data from the European EUnet hub in Amsterdam to end-user terminals (Fnet members). Unix machines at Cnam played that role; soon, Usenet data in particular became a burden, as the social computer network was expanding rapidly and internationally, adding many newsgroups each year. The Computer

Lab had to cover the cost of high-capacity servers and transmission lines on a tight budget, and kept Usenet groups subscription to a minimum (restricted to groups in the comp.* and sci.*, hierarchies, hosting discussions about computers and sciences). Moreover, because of administrative constraints, it could not bill Fnet members outside of a fixed rate rigid template. Lucas issued as soon as 1984 a call for participation (a financial supplement to cover the rise in traffic data), especially directed towards member organizations with looser accounting rules (industrial labs), but to no avail. This was a source of discord among the Fnet community – similar to the high bills problem produced by UUCP connections at the Bell Labs a decade earlier (Hauben and Hauben 1997: 128). This, as well as the lack of assistance and acknowledgment the Computer Lab and their employees received from within the establishment, drove Lucas to resign and leave the public sector. Fnet's administration was then transferred at INRIA, handled by Devillers' team, with about 40 machines in about 27 organizations connected to the network.[22] This is far more than the alleged 15 connections initially described in the official history of Inria, which also disregards the contribution of Cnam's team prior to 1986 (Beltran and Griset, 2007).

The resource and billing management problems continued after 1986, despite the INRIA team's choice to bill Fnet members according to their actual use. The high rise in subscription demands, yet scant effort shown by the members to participate in the technical management of Usenet, accentuated during the late 1980s and constituted a new administration problem. In 1985, the UUCP American network was requalified as a "commercial network" (like Transpac), while a new dedicated Usenet and mail service was opened to offer access to users outside of academia (Salus 1994; Quarterman 1990). This seems to have changed users' perceptions of the network, less as a collaborative project and more like a service for users. Fnet itself had become the first semi-commercial, although non-lucrative provider for the

French academia and beyond, and its managers were disappointed to see the Fnet members turning into clients. Recursively, members, considering the cost of subscription was high, were expecting better service without connection delays of bugs. Usenet's primary ethics of "open participation" was at stake: it was born as a toolbox, an unfinished code full of bugs tackled by users (Pfaffenberg 2003: 24), with a focus on informal use and tinkering rather than formal committees and arguments (Hauben and Hauben 1997). But the more the user base grew, the less participation was offered, which proved an acute problem as Fnet remained informal and experimental. Between 1986 and 1993, Fnet was administered by the small team of "Research and Development Expertise Committee"[23] at the INRIA headquarters, in addition to taking care of new functions since 1988: Internet's IP addressing, routing, and domain name systems. Moreover, supporting organizations like AFUU started to focus on developing services for commercial users, and started to move away from Fnet[24]. Eventually, with the growing success of the Internet and the general professional and popular turn towards TCP-IP Internet networks, UUCP networks were less and less used into the 1990s. Fnet's difficult management, with IT overload and high bills, was considered an abusive provider having taken advantage of their virtual monopoly in the pre-Web era (traces of these discussions and conflicts can be found in the fnet.* newsgroups on Usenet). This reputation increased as new providers (commercial like Oléane or non-profit like FDN – French Data Network) started to emerge in the early 1990s.[25] When the newly created RIPE organization (Europeans IP Networks) relieved the Fnet team of their IP attribution and routing functions in 1992, Fnet had just become a legal non-profit organization ("association loi 1901"). When INRIA decided to back up officially another, IP-based, academia network called RENATER in 1993 (Schafer and Tuy 2013), and after "five years of lengthy discussions" with the Fnet team (Renard 2013), Unixians' "Internet experience" had started a steep decline.

Mapping Unix Networks: Several Electronic Frontiers

The ethics of participative effort put forward by Unixians as a social and technical identity giving reason to the spread of their networks is in relative accordance to what will be formulated in the mid-1990s as the "electronic frontier", built by "pioneers":

> the few hardy technologists who can tolerate the austerity of its savage computer interfaces, incompatible communication protocols, proprietary barricades, cultural and legal ambiguities, and general lack of useful maps or metaphors (Kapor and Barlow 1990).

While the autonomous, anti-institutional cyberspace utopia has been reviewed critically by Internet studies researchers, it might useful to analyze how aspects of the so-called "electronic frontiers" actually did serve as "useful maps or metaphors" for organizing communication networks and pushing them towards institutional forms. To sum up, how did the shadow infrastructure of Fnet and Unix networks in France produce elements useful for mapping and reflecting on the new computerized communication networks outside of the state telecomm monopoly?

Early Usenet Maps: Keeping Up a Public Network Directory

The Google archive of Usenet, going back to 1981[26], reveals how Unix networks were spread

in the United states and in Europe through a network of Unix machines, a spread documented in the form of UUCP and Usenet logical maps (the network represented as links between machines) featured in a special "20 Year Usenet Timeline" compiled by Google at the moment of the archive release on the Web in 2001.[27]

The first logical maps were sent to Usenet users via the group net.general and net.news (general news about Usenet) as a way to track the progression of the network, and then through a dedicated group called net.news.map from January 1982 to January 1985 (net.news.map 1982-1985). They functioned as a utility tool, a directory to map out Usenet links for sites wishing to be grafted to the network, but they also reinforced Usenet as a public network:

> Public at all times, and so any site which is on Usenet is expected to make public the fact that they are on Usenet, their Usenet connection and their name, phone number and electronic address of the contact for that site for the Usenet directory (Hauben and Hauben 1997: 125).

The first Usenet map was produced and released by Bill and Karen Shannon from the Department of Zoology at University of Toronto in 1982[28]: "this is a USENET map, NOT a UUCP map. It shows only NEWS connections AS WE EXPECT THEM TO BE ON FEB. 1." (Shannon and Shannon 1982). In July that year, an update was provided by Mark Horton, offering the same reminder with instructions for reading the maps and using them as a probe to contact Usenet sites unsure of their status:

> Remember, USENET is defined as all sites getting net.all. If you are reading this, the machine you are reading it on should probably be on the map. But sites that only speak uucp for mail (not news) or that only get local groups or a select set of groups from net.all are not on the map.

The Shannons' and Horton's clarifications revel how intricate the network can be as a pile of protocols with common functionalities while operating through different systems and applications. The Usenet map message was used as a tool to verify if the logical map covered the territory of effective Usenet sites and users. Thus it was not only referential, but also pragmatically recursive, through recurrence and expansion every time the message was posted in the newsgroup.

The first European Usenet address appeared in a 1982 September update, a site called "ukc" for the University of Kent at Canterbury in England. In late December, the first official "USENET map for Europe" was sent, showing twelve nodes: one in the UK (Kent), one in Denmark (Copenhagen), and the other ten distributed all around the Netherlands, as CWI Amsterdam was becoming the central Usenet European backbone for EUnet. The February 1983 map showed a new site at the University of Edinburgh, a partner of the Computing Lab. Thanks to these maps, it is possible to identify exactly when the French UUCP-Usenet nodes were opened at Cnam in March 1983, at a moment when the European penetration of Usenet accelerated with 41 Usenet sites, featuring among then a cluster of 5 Unix machines at Cnam (Berteema 1983). Figure 1 shows the Usenet post announcing on March 10 the surge in European Usenet sites (we extracted the very first lines, with the announcement and confirmation of CWI Amsterdam as the EUnet backbone, and the very last lines, showing the

entrance of Cnam into the network).

Figure 1: Two extracts of an 18 March 1983 Usenet message, entitled "Europe map"

The map details the coordinates of the networked sites. The first coordinate is the name of the node through which point-to-point connection will go through. From here on are displayed the connection links for two different services of communication to the other machines on the network: UUCP-supported Usenet services (newsnet), and SMTP-supported email services (Mailnet), the first protocol bridge opened by the UUCP networks. The names of the nodes often include an abbreviation of the organization hosting the site ("mc" for Mathematical Center at CWI) that can be followed by the machine hardware type ("vax" for the Unix-compatible VAX 11), but variants also apply when there are several users from the same organization and the same machines. The now five Cnam machines (vmuCnam, sol11, lsiCnam, iieCnam, and sm0Cnam) connect to both newsnet (via mcvax) and Mailnet (via mcvax in Amsterdam or their own local node at Cnam, vmuCnam).

There were only a handful of machines on Usenet addresses, among which one named after Francis Martin,[29] a collaborator from INRIA, and located on a machine at the Computer lab. This shows the intricacy of Usenet accounts that are shared and rerouted though the UUCP network – and another one testifying of a node at IRCAM (the French Institute for Research and Coordination Accoustic/Music). Martin, along with Devillers at INRIA, Patrick Sinz of IRCAM, Pascal Levasseur, and Sylvain Langlois at their respective computer technology companies METROLOGIE and BULL, were the initiators of the expansion of Usenet through

Fnet, as accounted in AFUU's reports that compile the same information as in the logical maps. A year later, in 1984, Usenet French sites had effectively sprung from public organizations (CNET Issy Moulineau for instance) as well as corporate (CGE, Bull, Métrologie for instance). It is, though, possible to speculate that far more UUCP users would access to Usenet data through bulk transfer from the main sites.

A Territory of Confusing Routes

In the early 1990s, just before the Web started to attracted a mass of new users from the outside of the computer science and engineering world, mapping UUCP and Usenet networks was still a current practice, for instance, in the Usenet group comp.mail.maps, coordinated by the University of Rutgers, which listed the UUCP maps by country (UUCP Mapping Project) (comp.mail.maps n.d.). A search for Fnet maps yields long lists of French Usenet and UUCP subdomains with an international link outside Europe, but also bridges to other computer French networks, like EARN, running on IBM's native protocol as well as X25. Since Usenet had a new protocol replacing UUCP with the Internet friendly NNTP, and since France was directly connected to the Internet in 1988, mapping Unix network routes could be done via following the IP addresses as well. Celebrating a "routing folklore", users would analyze electronic messages routing metadata generated (a "traceroute" automatically inscribed in the message header) in which IP addresses could be read. Some cases of twisted routes were considered an absurd logic that users liked to qualify as a "routing game": messages emitted from France to France would take a detour through foreign countries via so called "exotic routes"; some were stuck in a loop between two IP addresses, thus entering a "ping pong game" (see the discussions on the topic of routing at Michot 1992). Michel Fingerhut, a

pioneer Fnet user at IRCAM, started to track in 1994 such traceroute absurdities[30] when he observed between other oddities that one message he sent to Ministère de la Culture would go out to the US, back to the Netherlands, and then to France. He jokingly qualified this routing with the code name "22 à Asnières", derived from a famous comical skit describing the intricate administrative and technical complexities of the old French telephone commuted system (Raynaud 1966).

The absurd routing games revealed a major issue of the computer network landscape. Indeed, public organizations did not have a common Internet provider: for instance, INRIA was provided by Renater (from 1993), while Ministère de la Culture was provided by Fnet. A Recourse to a simplification of Internet routage through a Commercial Internet Exchange hub (CIX), a precursor for internetwork connection architecture and business models for Internet providers already in use in the USA, was difficult and always delayed by the fear of a "cultural choc"[31] between the French national and centralized model, and the American commercial and decentralized model. 1993-1994 saw an active cooperation for a French CIX and the release of a first draft under the name "F-GIX", thanks to a formal agreement between Oléane and RENATER[32], but was not immediately implemented. In 1993, French early Fnet and Internet adopters had an insight view of the difficult construction of "the wonderful information highway that is bound to lead to us towards a Radiant Future"[33], as France was entering its own Information Highways decade[34]. But Fnet administrators themselves were lagging behind in terms of infrastructure building. At the same time, Usenet was going through an international crisis, known as the "Eternal September", which symbolized the popularization of Internet considered a risk for users of the pre-Web computer networks golden age (Schafer, Paloque-Berges and Georges 2014).

Epilogue: The Electronic Frontier as a Political Metaphor

From the start, Unixians were part of the self-perceived digital avant-garde willing to create new institutions supported by an "electronic democracy" (Huitema 1995, Lévy 1997). Expanding computer network by means of human and technical skills became synonymous for progress in a globalized world. Usenet aficionados defended a "netizen" identity (Hauben and Hauben 1997), considering the social network a "network nation" on its own (Raymond 2000), or even more radically a "worldnet" for "a society that hopes to progress" through the general access to technological tools and a cooperation helping to best wield these tools (Hauben and Hauben 1997: 133). Similar to the probing function of messages showing logical maps described earlier, Usenet news were thought of as a means to see how far and wide and to whom the network reached. A student experiment recounted by the Haubens show how this probing function was accompanied by a postulate: the more difficult electronic messages were to reach a destination, the less democratic the country was. Thus Usenet and the Internet were seen as an enlightenment process for parts of the world still under un-democratic darkness – a rationale vivid in the last years of the Soviet block, during which this experimentation was conducted. Within this experiment, a French perspective was given:

> A response from a French user explained how the government charged a lot of money for an Internet connection in France and thus discouraged usage: "It's cheaper to send a 'hello' to someone in the US than to someone 5 kilometers from my desk!," the French user wrote, "If you have a 'stupidity chapter' in your paper, this could fill a few lines" (quoted in Hauben and Hauben 1997: 38).

This government charge, stemming from Transpac's unwilling support of Fnet and the Internet, is one of the reasons for the "routing game" evoked earlier, and was a flaming topic of discussion on the Fnet Usenet groups. According to Christian Huitema, one of the instigators of the first TCP-IP connection within the Fnet network, France's access to the Internet was twice as low than Germany's, three time than the UK's, and twenty times than the USA:

> It's a shame. To be honest, I think this is proof of an underdevelopment, even of a reluctance again the modernization of the world and the huge openness provided by computers (Huitema 1995).

This techno-enlightenment ideology is present and diffused all through the Unixian networks. But it doesn't take into account "internal borders" re-created by Unixians and their peers on Usenet that have to do with actual inequality in terms of access, participation in arguments, and decision-taking (Johnson and Post 2001; Healy 1996). If Usenet was considered a virtual agora that would allow the Internet to open an electronic public sphere, its culture of flaming polemical debates makes the "electronic conference" network unreducible to a rationalistic, procedure-driven public discourse. Among "net.wars", power dominance of servers' administrator was strengthened, and old users were using experience and technical skills to ward off new users (Grossman 1998). In our interviews, genuine interest for the non-specialist user proved scarce, indeed; the UUCP / TCP-IP networks were seen first and foremost as a liberating tool from the constraints of the French institutional powers, to the benefit of the computer science (and computer businesses) community. Finally, following Fred Turner's study of the evolution of computer libertarian hobbyists and hackers and his analysis of their

participation in the rise of a new "virtual class" (Turner 2006a; 2006b), it would be important to follow the trajectories of Unixians to understand how the ideals of progress through the electronic frontier evolved in the 1990s and the 2000s Internet economy.

Conclusion

It is notable that the user figure has so much importance in Unix's own worldview on human-computer interaction and was a principle for founding Usenet, the biggest pre-Web computerized social network. Meanwhile, the Arpanet development processes were much more hesitant towards integrating inventions stemming from the user point of view, despite the great part it actually played in the success of its innovations (Abbate 1999; King, Grinter, and Pickering 1997). This is one of the main reasons why Unix networks were at the avant-garde of the Internet experience that we all share today. But the example of French Unix users connecting their community to an international communication computer network reveals how the idea of using the network remains a specialist perspective, relying on active participation and to the benefit of a professional community. However, this definition of network user engagement was political. Striving for autonomy and independence from national and local technological policies while engaging in smart tinkering and negotiation with hardware and software norms meant believing in bottom-up user innovation instead of relying on top-down planning.

The remapping of France with UUCP networks is one of these useful metaphors that show the empowerment of new technological expertise, original because they did not start from a power standpoint. Unixians themselves didn't "take power" as the Internet "founding fathers"

did, if we believe the power positions held currently by key figure Vinton Cerf, Vice President and Chief Internet Evangelist at Google. But they did, by diverting institutional authorities, contribute to create a new place for new power centralities. From the "Science: The Endless Frontier" (which gave, in 1945, a running start for the development of technoscience, among which global communication networks)[35] to the 1990s Information Highways plan, do computer networks give technological progress a new meaning, supported by an "endless electronic frontier"? Previous logics of domination (social, economical, political) did not disappear, but a space was open for information organization to thrive on a supra-national level, leading to the rise of organizations for Internet standards (such as RIPE, ICANN, and IETF), which independence from established institutional power is still being questioned. If it's tempting to call these organizations, or proto-institutions, a ground for technical democracy, we see them, through the prism of Unixians networked organizations, as ad-hocracies far from being independent from power relationships.

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[1] Interview with Laurent Bloch (2013), a computer engineer actively involved in Unix networks and the Fnet organization, in which he was vice-president between 1991 and 1992. Bloch coined the idea of Unix networks as a "first French Internet experience" arguing that they predated the Internet in France and had similar purposes (email and online discussion groups) despite their technical differences – a feeling confirmed by all the other interviewees. All quotes and extracts translated from French to English by the author.

[2] Administrative archives of « Laboratoire d'Informatique », 1981-1986 (34-02.11 B11-B12) and « Fonds Lippman » (34-02.03 1), donated by Daniel Lippman, engineer at the « Laboratoire d'Informatique » during the 1980's and 1990's. Accessible at the archives department of Conservatoire national des arts et métiers, Paris, France.

[3] First called "Computing Center", then "Computing lab" and "Computer lab", it evolved into an IT department in the 1990's, still in activity today.

[4] Kaiser was to become "Chair of Computing and Programming" in 1984, in line with predecessor François-Henri Raymond, an inventor and industrialist close to the research world who started the first French computer manufacturer. The informal "Systems lab" became official in 1988 with the creation of CEDRIC laboratory, still in activity today.

[5] According to an unpublished and un-dated article by Florin entitled "La première installation d'UNIX au Conservatoire National des Arts et Métiers", sent to the author by Kaiser. Florin also mentions the help brought by Kyrian O'Donnell, from Inria, that would start a long

Unixian collaboration between the two establishments.

[6] Vyssotsky developed Multics, an operating system instigator to Unix; he went on to become a Director of Research at the Bell Labs.

[7] Interview with Yves Devillers (2012), a computer science researcher working at Inria in the 1980s and the early 1990s in close partnership with the Unixians at Cnam and becoming Fnet's president between 1986 and 1993, when it was hosted at Inria.

[8] "Politique d'équipement et d'investissement pour le labo d'informatique", lab memo redacted in May 1981 ["Computer Lab's equipment and investment policy"].

[9] Interview with Gérard Florin (2016).

[10] Gérard Florin ("La première installation d'UNIX au Conservatoire National des Arts et Métiers"). Stéphane Natkin, currently Chair professor of Multimedia systems at Cnam, testified in an informal discussion with the author "it happened one summer at a moment when there was a grey area of law".

[11] It was originally called, from its creation in 1945, the Mathematische Centrum (Mathematics Center). Despite the fact computer science research was active early on, it was only in 1997 that it was renamed Centrum Wiskunde & Informatica ("National Research Institute for Mathematics and Computer Science").

[12] "Rapport scientifique du laboratoire" [Computer Lab's scientific report], July 1982 (CL archives). Kaiser's papers testify of this theoretical aspect, for instance, Kaiser 1979.

[13] (1) One recurring reference is the seminal AT&T article "A Dial-up Network of UNIX Systems" (Nowitz and Lesk 1979), asserting the need find a "conventional mechanism" for local networks. (2) From a 20 September 1982 letter from Kaiser to Professor Maurice Nivat of Université Paris 7 (Mathematics department) underlining the importance of UUCP

software in a collaborative project in which the two establishments are involved called “C3: Coopération, Concurrence et Communication”. (3) Lab memo: “Liaison Cnam – LERS”, November 5th 1981.

[14] In a 27 April 1981 letter to Ken Harrenstien at SRI International, Kaiser writes: “You ask to be informed about people that receives [sic] the package [of Unix software]. I expect to use your package and I am going to pass it along to: Mr. R.A. Mason, Dpt Computer Engineering, Heriot-Watt University, Edinburgh”.

[15] At this occasion, Kaiser defended the showcasing mission of the meeting to the then-director of Cnam, outlining its international reputation and its importance in domestic research collaborations like the SOL project with Inria, a French Unix version in the Pascal programming language.

[16] Notable presentations include: “Unix Telecommunications Applications and Evolution” by Ian Johnston (Bell Labs, New Jersey, USA), “Attaching Unix to the Edinburgh Computer Network” by Jim McKie (Edinburgh Regional Computer Network, Scotland) and “The Netherlands UUCP Network” by Teus Hagen (CWI Amsterdam, Netherlands).

[17] « Groupe de travail réseaux de l’association française des utilisateurs UNIX (AFUU) », January 1984. Lucas was part of the informal « Systems lab » research team.

[18] The UUCICO program runs the telephone call that will send a list of files to transfer when the connection is established with a remote Unix computer (Garfinkel and Spafford 1996).

[19] Defined by the United Nations-supervised Comité Consultatif International Téléphonique et Télégraphique (CCITT), which went to become the International Telecommunication Union (ITU) in 1992, it was adopted from 1975 and used by several countries for their respective national packet-commutated networks: France’s TRANSPAC, Great Britain’s EPSS, Canada’s DCS, and USA’s Telenet.

[20] Interview with Annie Renard (2013), an engineer at Inria in the late 1980 who took part in Fnet team and was particularly in charge of Domain Name System addressing after 1988.

[21] SAFARI (Système Automatisé pour les fichiers administratifs et le repertoire des individus) was a project released in 1974 by the French government but abandoned soon after after much criticism for created interconnecting indexes of nominative files for French citizens. The SAFARI affair prompted the creation of the Commission nationale informatique et libertés (Cnil) in 1978.

[22] A 1986 logical Fnet map shows 27 organizations connecting to Fnet – a lot of them having multiple connections in different labs or services, making the number of direct connection to Fnet higher – and not counting the bridged connections from other networks like EARN. 14 public sector research and education organisms: Centre d'Etudes et de Recherches de Toulouse (Deri – Département d'Etudes et de Recherches Informatique); CNET (Centre Structures et Logiciels pour la Commutation – Centre de Lannion, division Télématique Informatique Mathématique (TIM); Dpt. ATL Assistance Technique et Logicielle – Division Outils de gestion de l'exploitation OGE, Départements Systèmes Microprocesseurs et Logiciels); CNRS (LASS - Laboratoire d'Automatique et d'Analyse des Systèmes); Ecole nationale supérieure des mines de Paris (Centre de Mathématiques Appliquées); Ecole des mines de Saint Etienne; Ecole nationale supérieure des télécommunications; IMAG (Institut IMAG, LIFTIA - Lab. d'Informatique Fondamentale et d'Intelligence Artificielle; TIM3; INPG Architecture Group); Inria (IRISA - Institut de Recherche en Informatique et Systèmes aléatoires; Centre de Rocquencourt; Centre de Sophia-Antipolis); IRCAM; Supelec; Université de Nancy 1 (Lab. CRIN); Université de Paris (LITP - Lab. d'Informatique Théorétique et Pratique); Université de Paris 6 (Centre de calcul et de recherche); Université Paris Sud (LRI – Lab. de Recherche en Informatique). 4 public sector enterprises: Agence de l'informatique; EDF (Direction des études et Recherches); Compagnie Générale d'Electricité

(Centre de recherches, division Informatique); Caisse nationale du Crédit Agricole. 7 private sector businesses: ALCATEL (TELIC Unité de recherche : La téléphonie industrielle et commerciale); Axis Digital; Bull (SEMS); CAP Sogeti Innovation; CERCI; METROLOGIE; TRT (Service Central Logiciel). 2 non-profit organizations: Association pour la Création et la Recherche sur les Outils d'Expression; Centre Mondial de l'Informatique.

[23] Cellule Expertise Recherche et Développement, comprising Yves Devillers and Annie Renard among an odd five more computer engineers and technicians.

[24] AFUU's website, from 1996 to 2002, does not mention Fnet as an UUCP or Internet provider but competitors; it does not offer information on AFUU's activities in the 1980s.

[25] Interview with Stéphane Bortzmeyer (2012), an Unixian working at Cnam in the early 1990s, and who actively participated in the promotion of Web technologies in the old and new Internet user communities.

[26] It was gathered thanks to the previous Usenet archival initiative Giganews in 1995 (which Google bought in 2001) and institutional as well as individual donors. We studied how this archive was received and discussed by Internet hobbyists as an ambivalent heritage, between community experiential memories, historical sources for the Internet and communication strategy by Google (Paloque-Berges 2017).

[27] Recently renamed as "Memorable Usenet moments", it is now accessible at https://support.google.com/groups/answer/6003482?hl.

[28] The same department went on to gather the biggest collection of Usenet posts, donated to Google in 2001 (and making most of the first decade of their Usenet archive) as well to Internet Archive, in a zip file known as the "UTZOO Usenet archives", available at http://archive.org/details/utzoo-wiseman-usenet-archive.

[29] Not to be confused with Bernard Martin, Humberto Lucas' Unixian associate within Cnam's Computer Lab.

[30] *Cf.* a 1994 conversation on fnet.general started by Michel Fingerhut in 1994, and comprising discussions with the subjects "Routage en France" (18 April 1994), "Le 22 Asnieres derechef en reseaux" (13 August 1994), "Le 22 Asnieres (suite)" (18 August 1994), "Plus de liaison....." (18 October 1994), "Voila ce qui en coute de passer par les US" (29 October 1994), available at: https://groups.google.com/forum/?hl=fr&fromgroups=#!searchin/fr.network.divers/michel$20fingerhut.

[31] According to Stéphane Bortzmeyer, one of Fnet's administrators in 1993, in the previously mentioned Usenet discussion "Routage en France".

[32] News posted by Jean-Michel Planche from Oléane in a FAQ for Internet, Usenet, and UUCP access in France, available at: https://groups.google.com/forum/?hl=fr&fromgroups=#!topic/fr.network.divers/01NZh2WTIBI.

[33] See the recurrent and much discussed topic on "Autoroutes de l'information" between 3 November and 7 December 1994 in the fr.comp.infosystemes, available at: https://groups.google.com/forum/?hl=fr#!forum/fr.comp.infosystemes.

[34] The year 1993 is a turning point, with the release of the WWW software and protocol suite, the creation of the W3C, but also the launch of the programs "Information Highways" plan by US Secretary of State Al Gore, "Information society" by the European Commission, and a year later in France, the "Rapport Théry", homologous to Al Gore seminal plan.

[35] "Science: The Endless Frontier. A Report to the President by Vannevar Bush, Director of the Office of Scientific Research and Development", July 1945 (United States Government

Printing Office, Washington: 1945), hosted on the American National Science Foundation website, available at: http://www.nsf.gov/od/lpa/nsf50/vbush1945.htm.