Standards, Networks, and Critique

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Editor: Nathan Ensmenger

From a technical point of view, standards make it possible to combine a variety of components into a functional system or network, thus creating the ''network effects'' with which we are all familiar. From a strategic point of view, stories about standards are necessarily about power and control—they always either reify or change existing conditions and are always conscious attempts to shape the future in specific ways.

I have come to see the production of standards for new computer networks, one of my particular areas of interest in the history of computing, as acts of critique. One reference point here is Michel Foucault, who observed in 1978 that ''critique only exists in relation to something other than itself''—that is, it is always a response to external phenomena and existing power relations. Therefore, critique ''must be an instrument for those who fight, resist, and who no longer want what is. It must be used in processes of conflict, confrontation, and resistance attempts. . . . It is a challenge to the status quo.''[1]

The philosopher Gerald Raunig, writing in 2008, agreed with Foucault that critique resists the status quo. Raunig further emphasized the potential of critique to serve as a foundation for action: ''critique,'' he wrote, ''also means re-composition [and] invention.'' In the hands of the cultural theorists Foucault and Raunig, critique sounds less like a traditional mode of literary or art criticism and more like a synonym for innovation. The goal is not only to resist or challenge what is, but to take action and make what could be.[2]

I think we can use these theoretical discussions to understand the diverse, and often conflicting, interests and worldviews of the engineers who made new network standards. In some cases, engineers offered explicit critiques in published works, conference presentations, and statements to the press—candid commentary on existing market, regulatory, and technical controversies. In other cases, engineers challenged the status quo implicitly, not by dwelling on existing conditions but by building new standards, network architectures, and institutions. Attention to both explicit and implicit forms of critique can help historians to situate innovations in computer networking more deeply in the social worlds that created and used them.

Challenging the Status Quo

Consider the emergence of ''open systems'' in the nascent data-networking industry of the 1970s and 1980s.[3] The most daunting challenges for network architects and engineers in the early 1970s stemmed from multifaceted forms of convergence. As the technical foundations of telecommunication and computer networks converged around new techniques for digital data transmission, the old, clear market boundaries between the respective telecommunication and computing industries blurred. Distinct legal categories and regulatory jurisdictions also converged and conflicted. Amidst the chaos, no organization had the authority to create standards that would be obeyed across diverse technical, political, and economic communities. Competition was intense, technological trajectories were uncertain, and there were few incentives to cooperate.

In the absence of uncontested authority, two powerful actors were poised to dominate data networking in the mid-1970s: IBM and the monopoly telecommunication carriers that together set standards under the auspices of the International Telegraph and Telephone Consultative Committee (CCITT). The sources of IBM's potential power were well understood. By the early 1970s, IBM could boast of a large installed customer base, a dominant share of international computer markets, and a new product (Systems Network Architecture) designed to facilitate data communications among IBM mainframes, terminals, and other devices.

Europeans, more than Americans, also understood the sources of the CCITT's power because most CCITT members came from national post, telegraph, and telephone administrations (PTTs). The PTTs were both network operators and network regulators. (The American analogy would have been if the monopoly Bell System and the Federal Communications Commission were combined into a single organization.) The PTTs therefore were incredibly powerful institutions, particularly in countries such as France that sought to constrain the destabilizing forces of competition and promote the fortunes of domestic ''national champion'' companies.

Throughout 1975, CCITT prepared to issue its X.25 Recommendation for packet-switched networks. A small group of computer researchers, eager to exploit the data-processing capabilities of their rapidly improving machines, proposed a radical new design for X.25 that was based on the experimental American Arpanet and French Cyclades packet-switched networks. It did not take much imagination to see that Arpanet and Cyclades researchers—as well as their allies in small computer manufacturing firms—hoped to preserve space to experiment with end-to-end applications on

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 Published by the IEEE Computer Society 1058-6180/12/$31.00

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heterogeneous equipment, beyond the control of the monopoly network operators. It was likewise not much of a surprise that the ultimate design of X.25 heavily favored the economic interests of the telecom companies that sponsored its international standardization.[4]

Louis Pouzin, the charismatic director of Cyclades, emerged in the mid-1970s as a strident critic of the status quo. In 1976, Pouzin declared X.25 to be ''the first in a bag of tricks devised to give carriers a captive market of terminal access and services.... Standards are a weapon used by the carriers to expand their territory,'' he continued. ''National monopolies belittle the opinion of customers and minor manufacturers, since they can exercise enough arm-twisting to keep the latter in line.''[5] But Pouzin had also learned a strategy of resistance—''to behave a little bit more like an American,'' as he put it in a recent interview—during his experience at MIT in the early 1960s. ''When I was in my first month at MIT,'' Pouzin recalled, ''sometimes there were technical points to discuss. Like the French, I was criticizing things. They said 'Well, if you have another idea, then do it.' And I said 'Well, OK.' So I started doing things without criticizing.''[6]

Pouzin was both technically prolific and unusually outspoken, but he was not alone in his desire to prevent IBM and the telecom monopolies from imposing their self-serving designs on users, suppliers, and competitors. A key institutional breakthrough occurred in 1977 when the International Organization for Standardization (ISO) accepted a British proposal to create a new subcommittee on Open Systems Interconnection (OSI) to investigate the need for ''standardization in the area of open systems.'' According to the British computer engineer Jack Houldsworth, the proposal aimed to provide ''the ability of the user or program of any computer to communicate with the user or the program of any other.'' This vision of ''open working'' stood in stark contrast to ''the traditional computing scene,'' that as Houldsworth complained, was ''dominated by installations that were planned and implemented as self-contained, 'closed' systems with little regard for the possibility of their interworking with each other.''[7]

Before OSI began its existence as a technological project to create standards, it was thus already alive in the imaginations of its makers as a political and economic project—a critique of closed systems and an attempt to alter the existing order and future trajectory of computer internetworking. The first chairman of the ISO/OSI committee, American database expert Charles Bachman, made OSI's implicit leveling intent explicit in 1978: ''the adjective 'open' means to imply that all participants come to the system as equal partners.'' In other words, ISO's identity and structure embodied a critique of the existing order in which market actors were anything but equal partners.[8]

Cultures of Openness

The project to create OSI standards faltered in the early 1990s, but the underlying appeal of open systems struck a deeper and more resonant chord. ''Open systems'' such as the Unix operating system and plug-compatible personal computers let users mix and match software or hardware components that adhered to publicly available standards and interfaces. The ideology of openness continued to flourish in the late 1990s and early 2000s as millions of users embraced the ethos of open source software and conflated the distinct discourses of openness and freedom. ''Open'' soon became a buzzword and a prefix to denote transparency, participatory democracy, and public accessibility—evident, for instance, in contemporary campaigns for open science, open government, open access publishing, the open Internet, and so on. At the same time, powerful incumbents such as IBM and American Express learned to mobilize the rhetoric and technologies of ''openness'' to reify their positions as market leaders and advance their own proprietary ambitions.

The movement for open systems provides but one example of a more general historical pattern: standards for new networks—and the new networks themselves—emerge through a process of critique. They are components of broader visions that respond to the past and present and that seek to redistribute power and control in the future.

The history of networking—a category that, as this discussion indicates, must consider both computer and telecommunication networks—seems to hold many more examples of this historical pattern. The American lawyer Gardiner Hubbard sponsored Alexander Graham Bell's telephone experiments in the 1870s because he hoped to free middle-class Americans from dependence on the Western Union telegraph monopoly.[9] More recently, engineers and regulators created the pan-European GSM (Global System for Mobile

Communications) cellular standards in the 1980s to break with the past and sustain the integration of the fractured and nationalist political economies of post-war Europe. These examples of standards and networks are noteworthy as critiques because they did more than simply criticize the status quo; they also proposed and built alternatives intended to advance particular cultural, ideological, and economic interests. Do other examples of innovation fit this pattern?

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