50 & 25 YEARS AGO

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Computer Networks and Communications; A. F. Hartung — Guest Editor (p. 11): "Made possible through advances in communication technology and network concepts, these new configurations of telecommunications networks vary from simple arrangements of a minicomputer plus a few remote interactive terminals to complex arrangements involving minicomputers slaved to very large computers. This issue of *Computer* focuses on three critical aspects of the telecommunications environment: network evolution, network security, and telecommunications standards." *[Editor's note: As you can see, the important concerns that we still have today were already present 50 years ago. In particular, security has not made the progress that was envisioned then. But as I have explained earlier, major driving forces were and are not too eager to find real solutions.]*

Telecommunications Turbulence and the Computer Network Evolution; Dixon R. Doll (p. 13): Insight into the potential communications requirements of computer networks is gained by noting that switched services are currently unavailable at bit rates faster than 3600-4800 bits/sec, and that current tariffs necessitate the average expenditure of $10 per mile per month for each leased line capable of data transmission at speeds of 40-50 kilobits/sec." (p. 15) "However, very substantial interest has been materializing in the commercial world over last year, as evidenced by the increasing number of computer networks being planned or implemented … Three categories of network organization—centralized, distributed, and loop structures—are employed in configuring computer networks." (p. 16) "At least five modes of computer network usage with important functional differences can be identified: • remote job entry (jobs transferred only) • remote batch processing (jobs and data sets transferred) • interactive console (user controlled) • dynamic file access/transfer • load sharing." *[Editor's note: An interesting article as it analyzes the different approaches to networks and their usage quite extensively. However, in the discussion, it does not foresee the overwhelming use it will find in user-"controlled" networks, the forerunners of today's Internet.]*

Data Security in the Computer Communication Environment; Stanley Winkler et al. (p. 23): "Today, computer communication systems are used to meet the demand, which our societal structure has created, for much more data and for convenient and rapid access to that data." (p. 24) "In addition to adequate physical, personnel, and administrative security, data in the computer system must be protected against unauthorized disclosure, modification, restriction or destruction." (p. 25) "Each of the functional aspects of data security described above (identification, authorization, controlled access, surveillance, and integrity) will be discussed below where unique problems are introduced by a particular computer communication environment. … • The Multi-terminal Computer System … • The Computer System With Intelligent Terminals … The Computer Network." (p. 32) "The need for data security is in direct conflict with the requirement for increased accessibility and sharing of data banks. The only certainty in this rapidly developing field of data security appears to be that technical solutions to avert known threats will be developed. With equal certainty, new threats will evolve." *[Editor's note: A detailed analysis of security techniques for the aforementioned three fields of threats, but as the article already foresees and we now know, conflicts of interests and new threat technologies have created a situation where security is still an issue that needs better solutions.]*

A Multiminiprocessor System Implemented Through Pipelining; Leonard E. Shar et al. (p. 42): "This paper considers choosing the appropriate architecture for a multiminiprocessor system and illustrates some inherent cost advantages of configuring a system which appears to the users as a multiprocessor but is in fact a single pipelined processor." (p. 50) "In order to take full advantage of this technique it is necessary for each instruction phase to be broken up into a number of minor cycles which can be performed in sequence. … Similar methods can be used to imitate, at lower cost, most systems which utilize multiple

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identical units in parallel and should I be seriously considered by the designers of any highly parallel systems." *[Editor's note: A very detailed article that investigates in depth the advantages of pipelining. Pipelining is still important today, not only for instruction streams but also for graphics, storage access, software, and HTTP.]*

New Products; Milton G. Bienhoff (p. 52): "New Capabilities Announced for Remote Data Processing: The IBM 3790 communications system, with self-contained logic and nearly 28 million characters of disk storage, can control a cluster of up to 16 terminals. … In addition, the stand-alone capabilities built into the system allow users to process transactions more completely at the remote sites, freeing the central computer for other tasks." *[Editor's note: However, as advertised, the 3790 with four terminals, two keyboard printers, and one line printer would have cost around $US100,000—in 1974 dollars!!]*

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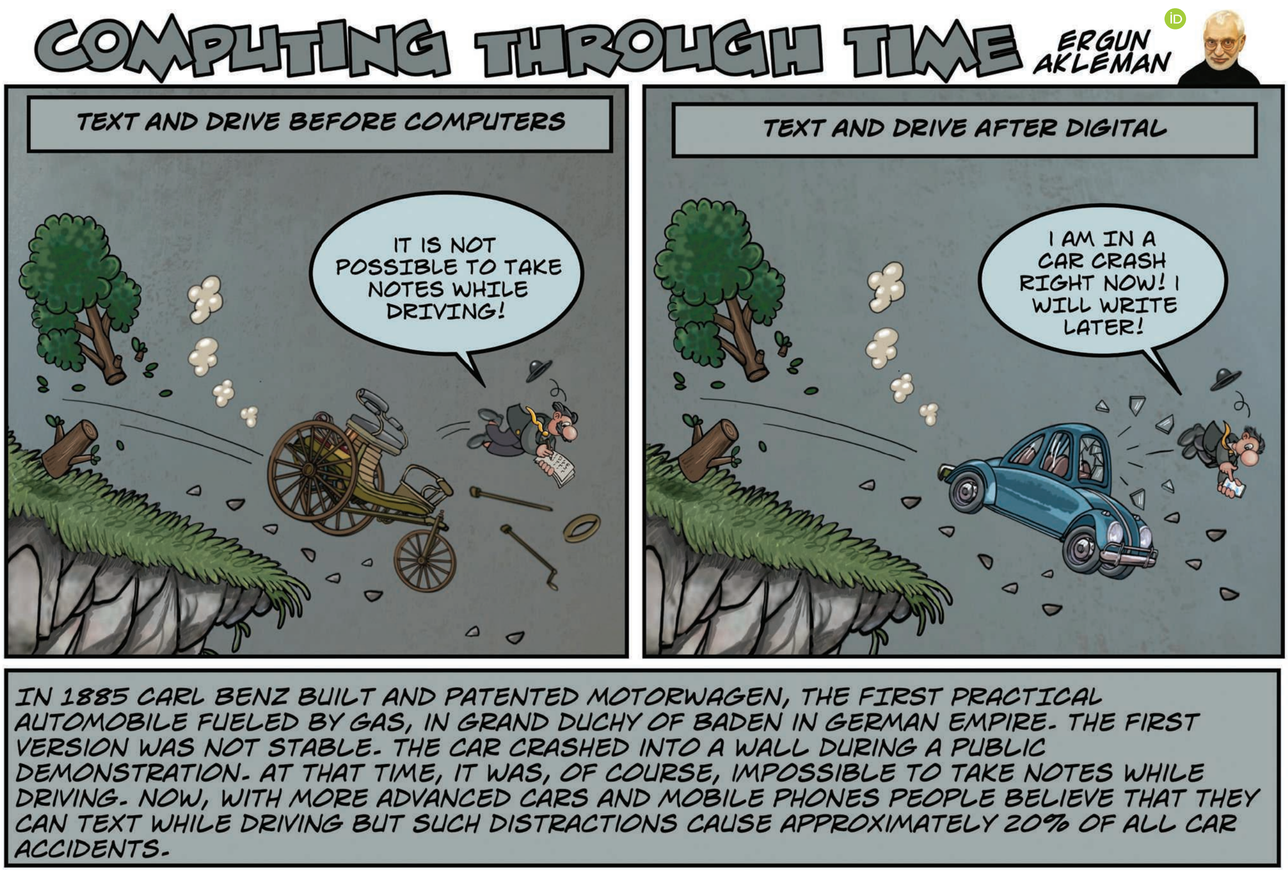
Vendors Battle Over Mobile-OS Market; George Lawton (p. 13): "These small devices have computing and communications capabilities, and provide users with mobile access to, for example, phone communications, the Web, e-mail, and even faxes. … The battle in the mobile-OS market is intense because the stakes and possibility of success are high." (p. 14) "The critical issues include interoperability, portability, scalability, support for multiple processors, ability to handle mission critical applications, user-interface quality, and real-time performance. Another important issue is the devices' ability to connect to PCs and LANs." *[Editor's note: This interesting article identifies a number of vendors, among them Microsoft and Palm. Of course, the article does not mention Android as Andy Rubin developed it only in 2003, and it took off when Google bought it in 2005 and, so far, it is the dominating OS for handheld devices.]*

Cyber Square: What Has Influenced Computing Innovation?; Thomas P. Hughes et al. (p. 33): "Over the years, a particular blend of government, industry, and academia has been the foundation of computing innovation. If the US is to sustain its past growth in computing, researchers, business leaders, and policy makers need to understand the elements of this synergy." *[Editor's note: This excellent historical survey analyzes the sometimes quite confusing and competitive developments of, in the end, highly innovative research and technical and commercial contributions. Among them are relational databases,*



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the Internet and web, theoretical computer science, artificial intelligence, and virtual reality. The stories are detailed and show how research, industry, and governmental funding and cooperation led to success. But some of them, even today, are still in strong need of further development. ***Well worth the read****!]*

Guest Editor: Digital Libraries: Technological Advances and Social Impacts; Bruce Schatz et al. (p. 45): "Many believe that we are approaching the start of the Net Millennium, a time when the Net forms the basic infrastructure of everyday life. … Digital libraries are a form of information technology in which social impact matters as much as technological advancement." (p. 47) "The articles in this issue are careful retrospectives on multiyear digital library research projects, which discuss large-scale testbeds for text documents and fundamental technologies for semantic interoperability beyond text." *[Editor's note: This introductory article that explains many international digital library projects and the theme articles following it raise many questions that the Semantic Web concept (introduced by Berners-Lee, Hendler, and Lassila only in 2001) wanted to solve.]*

Federated Search of Scientific Literature; Bruce Schatz et al. (p. 51): "The Illinois Digital Library Project has developed an infrastructure for federated repositories. …The DLI Testbed supports full text in SGML *[Editor's note: Standard Generalized Modeling Language]* format, associated article metadata, and bit-mapped figure images for scientific journal articles." (p. 52) "Future versions of our DLI Testbed are planning to use XML *[Editor's note: Extensible Modeling Language]* to represent structure. The DTD (Document Type Definition), which accompanies each publisher's SGML file, specifies the semantics and syntax of the SGML tags." *[Editor's note: An interesting article that, despite all the positive results presented, already illustrates why SGML and DTDs were not really successful but were taken over by HTML (Hypertext Markup Language) and XML and XML Schema.]*

Technology Choices for the JSTOR Online Archive; Spencer W. Thomas et al. (p. 60): "What new feature or capability should be integrated into a working system? … Our development of the JSTOR (Journal Storage) online scholarly journal archive … has challenged us to make such choices, even as we have been providing continuous access to a growing database and user community." (p. 62) "Thus we are conservative in our client-side use of new technologies, but aggressively upgrade our server technology." (p. 65) "Authenticating users to authorize their access to JSTOR is a continuing challenge for us." *[Editor's note: An interesting article that was written 25 years ago but is still relevant for today's wide community of JSTOR users.]*

Lessons Learned From Building a Terabyte Digital Video Library; Howard D. Wactlar et al. (p. 66): "Digital video presented a number of interesting challenges for library creation and deployment: the way it embeds information, its voluminous file size, and its temporal characteristics. … We used artificial intelligence techniques to create metadata, the data that describes video content. We found that all the AI techniques we used were applicable to both the news corpus and the documentary corpus. These techniques included speech recognition, image processing, and information retrieval." *[Editor's note: The article then analyzes technology existing in 1999, its effects, and its shortfalls. Among the most serious ones are transmission speed and fast image analysis algorithms. As we now know, many of those have become less important, but still, video analysis has many shortfalls today.]*

Managing Complexity in a Distributed Digital Library; Ian H. Witten et al. (p. 74): "With multiple collections, languages, and media, digital libraries are becoming more difficult to maintain and develop. Researchers at New Zealand's University of Waikato have developed a software architecture that deals with this complexity." (p. 77) "Our macro language, however, allows many variants of the same macro, each with different parameter values. Our three basic parameters are collection name, text-and-graphics or text-only format, and language. … Because collections run on different computers, our system is distributed, but searching is not distributed: Each collection handles its own searches." *[Editor's note: This overview article of an existing working system is interesting as it elaborates in some detail about choices to be made in building such a system. It argues that for many parts, on-the-shelf components would not be flexible enough to satisfy the requirements.]*

Using Distributed Objects to Build the Stanford Digital Library Infobus; Andreas Paepcke et al. (p. 80): "In our view, a digital library comprises widely distributed resources that can be maintained autonomously by different organizations and will not require adherence to uniform interfaces. In defining an infrastructure, we wanted to consider all aspects, from user interface to low-level transport layers. … The Infobus is implemented as a distributed, CORBA-based *[Editor's note: Common Object Request Broker Architecture]* object system using Xerox PARC's Inter-Language Unification (ILU) implementation." (p. 83) "Digital libraries, like their traditional cousins, must represent both documents and metadata about the documents. We quickly decided to model documents as objects, partly because we wanted to be able to give documents behavior. We decided to store document attributes in the instance variables." p. 84) "Computationally, attribute models are implemented as LSPs *[Editor's note: Library Service Proxies]* whose "document" objects represent metadata attributes." (p. 86) "The underlying issue for digital libraries that combine diverse collections is to find the right integration of traditional library facilities and current Web-based approaches." *[Editor's note: A very detailed and interesting description of all the issues and problems that come up when building a digital library for many collections and many diverse* *users. Even today, many such issues remain, especially when integrating library and web services.]*

The Web Can Be Suitable for Learning; Gary C. Kessler et al. (p. 114): "One caveat that we must mention here that we deliver Web-based distance learning courses in what we sometimes call an asynchronous mode. ...Our designs require that learners be self-directed but that they also interact heavily with other learners, the course content, and the instructor through the Web-based learning system." (p. 115) "Most teachers—for whatever reason— have not adapted their curricula to take advantage of the Internet, but rather have merely modified their curricula to be Internet-tolerant. ... This virtual-classroom interaction has the added benefit of requiring learners to express their thoughts in writing, which we believe to be an important benefit, given the often poor quality of written communication we see in both school and work." *[Editor's note: Unfortunately, the concerns expressed in this article—but not the optimism—have proven true over time. As the COVID crisis has shown, children, even students, have lost a large amount of the education they would have received in real instead of virtual settings.]*

Reframing Requirements Analysis; James Bach (p. 120): "Software development is an exploratory and self-correcting dialogue, complete with stuttering, hemming and hawing, and Freudian slips." (p. 121) "Many people focus on requirements as existing in a requirements specification. Requirements are the drivers of design choices—the reasons why we decide to build what we build. ... A requirements document is only a model of the information in that mind space, but it helps us manage the risk of misunderstood, impractical, and undesirable requirements." *[Editor's note: It is interesting that this article actually argues both sides of a coin—requirements are only guides, but they may also be detailed. Modern development techniques, that is, power programming or off-the-shelf programming, do not rely on detailed specifications but general ones that allow the adoption of preexisting components or some advantageous development experience.]*

The Open Source Acid Test; Ted Lewis (p. 128): "In the late 1970s, AT&T openly licensed the source code for its fledgling Unix operating system to universities and government research labs. ... By literally giving away the source code—with restrictions— AT&T seeded several industries. ... Can Linux's source code giveaway repeat the UNIX success story? I don't think so. To qualify as a world-class success and not just a fad, each new product or method must pass the acid test of "crossing the chasm" that separates early adoption from mainstream acceptance. Linux, and open source in general, fails this acid test." *[Editor's note: The author then gives many and quite valid arguments about why open software will not be successful and uses Linux as an example. Despite the fact that his observations have been true for many open software packets, they completely failed with Linux. Linux still exists as the most widely used operating system. It is used in servers and embedded systems, and it is underlying Android.]* ■

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