

18

A READING FROM THE BOOK OF GENEBITS

If a history of computer networking were to be written in the form and fashion of the King James Bible, the book of Genesis (Genebits . . .) might describe the final 40 years of the present millennium in this manner:

In the beginning, God created the heavens and the earth. He performed wonders of every sort and created Man in His own image. Unfortunately, Man screwed up big time, and God sent him packing (Gen. 1, 2). Generations followed generations (Gen. 3–10), and Man frequently crossed the line and God doled out punishment accordingly.

Through these generations, all men used the same language and the same words. One sunny morning, Man aspired to reach the heavens and began to build towers and such. God said, “Not!,” confused the language of the whole earth, and towers have by and large been modest efforts since then (Gen. 11).

Man ever after sought to have the whole earth use the same language and the same words. He struggled ages upon ages until he discovered electricity and mined copper, and wed the two together with devices of a curious nature, and conducted the electricity over copper wire in every manner and kind until finally Man said, “Let there be carrier.”

And Man saw that carrier was good and that digits of binary could ride the carrier. The “bits” were formed into words, first in the language of Morse and later of Baudot, which

enhanced the language. And the devices were telexes and wondrous indeed. But the language was constraining, the bits numbering only 5, and Man saw that more bits were needed and saw also that the bits must travel *faster*.

But Man saw also that the carrier had not the strength, for bits were indeed lost or destroyed as they traveled over the copper wire—verily, at the dizzying rates of 300–1,200 bits per second—so Man grouped the bits into 8, and *framed* the bits first with start bits and stop. After a time, the 8-bit *bytes* themselves framed the bits of good and noble use, and the framing bytes were called *header* and the noble bits *user data*, respectively, and Man saw that this, too, was good. And the devices were mainframes and wondrous indeed. Now copper connected the mainframes, two by two, and the whole earth used very nearly the same language and the same words, for the mainframes were but either blue or from the BUNCH.

And Man used the language, and the language grew and yet more bits were needed, and no longer could the mainframes be connected two by two, for amongst the devices were now minis and micros, and they were plentiful indeed, and the bandwidth of one copper pair was indeed too small, and copper pairs continued to be added, and the copper became a real mesh (sorry . . .), and among Men there were sorcerers and apprentices—Roberts, Cerf, Postel, Crocker, Kahn, and more—who created *more header* and caused IMPish devices to *switch*, and the devices and the copper were one and the one was called *network*, and it was wondrous indeed. Now among the devices, there were those that computed routes and switched *packets* or *circuits* (for among Men, there remained those who thought circuits were better, but switching was generally recognized as a good thing, so Men agreed to disagree for a time, but this was not a good idea, as was later revealed).

And so the networks grew. But the whole earth no longer used the same language and the same words, and Man was saddened, deflated, but not yet defeated. So Man caused there to be interconnection, relay, and translation among the networks in various, sundry, and occult forms and thereby concealed the differences for a time (where Man could not conceal the differences, he made them tolerable), and Man saw that this was not as good as he had hoped, but it was OK.

And Man used the languages for more and diverse purposes, and the purposes were good (mostly). But the bits of noble use became lost and arrived out of order, and the users complained. Now *more header* was applied, and among Men there now came sorcerers—Karn, Nagle, Clark, Jacobson, and more—who brought with them windows, timers, and positive acknowledgments. These were applied *end-to-end* and the transport of bits was *reliable* and sources were quenched, and Man saw that this, too, was *really* good (although there remained still purposes for which this was not an issue, and so Man agreed that along with reliable transport, datagrams should be universal and both were indeed good).

Above the transports, the purposes became more potent indeed. Now messaging grew, and the applications multiplied and became distributed. The devices were now PCs and workstations and transaction-processing machines, and they were more plentiful still. Ever more bandwidth was needed and copper yielded to fiber and the network grew and was divided into occasionally manageable and always autonomous pieces of many and diverse names, and Man used the languages, and the languages grew, and the network became an interconnected set of networks, and it was called first a catenet and later an internet. (Among Men, there persisted those who believed in circuits, and their networks were public, and these, too, were subsumed within the Internet, and the role they played was good, for they too were links among many.)

Yet Man aspired still to have the whole earth use the same language and the same words, though the differences in the languages of the networks were not small. Carried away once more, Man proclaimed, “Let us build for ourselves a model and a tower with seven layers whose top will reach into heaven, and let us make for ourselves an *open network*, lest our mail and files and databases be scattered abroad over the face of the whole earth” (Gen. 11:4). And those among Men who saw this to be good labored to make it so, some honestly and some not, since there remained among them Men with *agendae obscura*, and policy and compromise often burdened the Men of technology. The labor continued, but the progress was slow, indeed so much so that among Men, many turned to the language of DARPA, for it was

open *de facto*, and the language of PARC nearly equally so, for it was novel (sorry . . .). And for a period of time, there was much acrimony and contempt, which caused much sadness indeed. Even those among Men who studied not rocket science saw that this was not good at all.

After a time, intellectual curiosity infected even the most zealous and extreme of the varied communities of Man, and among Men, those called implementers began to share and cooperate, and gossip had less effect on these than on others, and with abandon, they *implemented* so that they could know more. They took from the language of the open network one whose syntax was abstract, and among them came Four who asserted that Simple was better and repetition was key, and so made the technology tractable rather than common. And network operators embraced the fruit of their efforts and made the technology *available*, and the Internet grew and the languages became strong. Now others joined, and the languages used were both pure and hybrid, for the words of one became the words of the others, especially the simple ones. Doing useful work took precedence even over purity of religion, and so the languages grew. Man saw that this was actually far better across the whole earth than one language and one word, and agreed that the network should embrace the many and useful languages, and the network should be multiprotocol indeed.

Among Men, there are now those who believe that the whole earth doesn't really have to use the same language and the same words after all; they must merely share one word, and that word is *cooperation*. And the Lord looked upon Man and said, "Truly, this is what they began to do, and now nothing which they propose to do will be impossible for them" (Gen. 11:6).

This historical account is, of course, allegorical and largely whimsical. Much of the actual histories of OSI and TCP/IP are interrelated, and for better or worse, their futures are now inextricably intertwined. It may be that by the end of the millennium, we will all know just how farfetched the final verses of "Genebits" truly were. It will be our collective good fortune if the future of open systems networking is guided by open-mindedness, and one purpose of this book has been to contribute to that goal.