Foreword

Network consolidation has been an industry trend since the turn of the century. Reducing capital investment by converging data, voice, video, virtual private networks (VPNs), and other services onto a single shared infrastructure is financially attractive; but the larger benefit is in not having to maintain and operate multiple, service-specific infrastructures. Fundamental to network consolidation—supporting a diverse set of services with a single infrastructure—is a common encapsulating protocol that accommodates different service transport requirements. The Internet protocol (IP) is that protocol.

Everything over IP

Things move fast in the networking industry; technologies can go from cutting edge to obsolete in a decade or less (think ATM, frame relay, token ring, and FDDI among others). It is therefore amazing that TCP/IP is 35 years old and evolved from ideas originating in the early 1960s.

Yet while the protocol invented by Vint Cerf and Bob Kahn in 1973 has undergone—and continues to undergo—hundreds of enhancements and one version upgrade, its core functions are essentially the same as they were in the mid 1980s. TCP/IP's antiquity, in an industry that unceremoniously discards technologies when something better comes along, is a testament to the protocol's elegance and flexibility.

And there is no sign that IP is coming to the end of its useful life. To the contrary, so many new IP-capable applications, devices, and services are being added to networks every day that a newer version, IPv6, has become necessary to provide sufficient IP addresses into the foreseeable future. As this foreword is written, IPv6 is in the very early stages of deployment; readers will still be learning from this book when IPv6 is the only version most people know.

The story of how TCP/IP came to dominate the networking industry is well known. Cerf, Kahn, Jon Postel, and many others who contributed to the early development of TCP/IP did so as a part of their involvement in creating ARPANET, the predecessor of the modern Internet. The protocol stack became further embedded in the infant industry when it was integrated into Unix, making it popular with developers.

But its acceptance was far from assured in those early years. Organizations such as national governments and telcos were uncomfortable with the informal "give it a try and see what works" process of the Working Groups—primarily made up of enthusiastic graduate students—that eventually became the Internet Engineering Task Force (IETF). Those cautious organizations wanted a networking protocol developed under a rigorous standardization process. The International Organization for Standardization (ISO) was tapped to develop a "mature" networking protocol suite, which was eventually to become the Open Systems Interconnection (OSI).

The ISO's *modus operandi* of establishing dense, thorough standards and releasing them only in complete, production-ready form took time. Even strong OSI advocates began using TCP/IP as a temporary but working solution while waiting for the ISO standards committees to finish their work. By the time OSI was ready, TCP/IP was so widely deployed, proven, and understood that few network operators could justify undertaking a migration to something different.

OSI survives today mainly in a few artifacts such as IS–IS and the ubiquitous OSI reference model. TCP/IP, in the meantime, is becoming an almost universal communications transport protocol.

The Illustrated Network

I am a visual person. I admire the capability of my more verbally oriented colleagues to easily discuss, in detail, a networking scenario, but I need to draw pictures to keep up.

When the first volume of the late W. Richard Stevens's *TCP/IP Illustrated* was released in 1994, it immediately became one of my favorite books, and continues to be at the top of my list of recommended books both for the student and for the reference shelf. Stevens's use of diagrams, configurations, and data captures to teach the TCP/IP protocol suite makes the book not just a textbook but a comprehensive set of case studies. It's about as visual as you can get without sitting in front of a protocol analyzer and watching packets fly back and forth.

But while the Stevens book has always been excellent for illustrating the behavior of individual TCP/IP components, it does not step back from that narrow focus to show you how these components interact at a large scale in a real network.

This is where Walt Goralski steps up. The book you are holding takes the same bottom-up approach (Stevens' words) to teaching the protocol suite: Each chapter builds on the previous, and each chapter gives you an intimate look at the protocol in action. But through an unprecedented collaboration with Juniper Networks, Goralski shows you not just interactions between a few devices in a lab but a production-scale view of a modern working network. The result is a practical, real-life, highly visual exploration of TCP/IP in its natural state.

The Illustrated Network: How TCP/IP Works in a Modern Network is destined to become one of the classics on practical IP networking and a cornerstone of the required reading lists of students and professionals alike.

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