Handbook of Fiber Optic Data Communication

Handbook of Fiber Optic Data Communication

A Practical Guide to Optical Networking

Third Edition

Edited by Casimer DeCusatis

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Preface to the Third Edition

SONET[1] on the Lambdas[2]

(by C. DeCusatis, with sincere apologies to Milton[3])

When I consider how the light is bent
By fibers glassy in this Web World Wide,
Tera- and Peta-, the bits fly by
Are they from Snell and Maxwell sent
Or through more base physics, which the Maker presents
(lambdas of God?) or might He come to chide
"Doth God require more bandwidth, light denied?"
Consultants may ask; but Engineers to prevent
that murmur, soon reply "The Fortune e-500 do not need
mere light alone, nor its interconnect; who requests
this data, if not clients surfing the Web?" Their state
is processing, a billion MIPS or CPU cycles at giga-speed.
Without fiber-optic links that never rest,
The servers also only stand and wait.

As this book goes to press, I am pleased to say that the world of optical data communication is well established and continues to thrive. Mature technologies combined with high-volume, low-cost manufacturing have made high-performance optical data links more affordable than ever before and have turned some of the early technologies into commodities. Applications for fiber-optic networking have grown significantly. This goes beyond Internet and Web traffic to encompass areas such as disaster recovery, video distribution, massively parallel clustered computing, and networked storage. (Large corporations now boast multi-terabyte, petabyte, or even exabyte databases interconnected with their core business functions.) The distinction between datacom and telecom technologies continues to blur, with the encapsulation of traditional data center protocols over

[1]Synchronous Optical Network.
[2]The Greek symbol "lambda" or λ is commonly used in reference to an optical wavelength.
[3]The original author of the classic sonnet "On His Blindness."

metropolitan and wide area networks designed for voice traffic. Network convergence and the triple or quadruple play for service providers have entered common usage, but the unique requirements of data communication networks remain (including very low error rates, long unrepeated distances, ease of use for untrained staff, and an unprecedented combination of high reliability and low cost in demanding environments). These many developments, coupled with the continued success of previous editions, led to the decision that the time was right to update this Handbook once again.

Since the first edition was published over 10 years ago, I have tried to continually incorporate feedback and comments from readers to improve this book and ensure that it continues to provide a single, indispensable reference for the optical data communication field. Previous editions had experimented with a two-volume set of Handbooks. But you, the readers who make use of this book every day, have consistently emphasized the importance of having a single volume as your one-stop reference source. In this edition, I have taken your advice and have returned the Handbook to its original design. This one book contains an overview of the entire optical data communication field, broken down into basic technology, link design, planning, installation, testing, protocols, applications, and future directions.

A great deal of new material has been added, and many familiar chapters have been updated to reflect new types of optical components, connectors, cables, and other devices. Some legacy applications that are not as widely used have been edited to their essential material only, such as FDDI and ESCON. Others have been expanded, and we have added the latest updates to Fibre Channel/FICON, InfiniBand, and SONET/SDH. Some technologies that were just emerging when the previous edition was published are now commonplace; among these are pluggable small form factor transceivers. Completely new chapters deal with issues that did not exist when the last edition was published, including Enhanced Ethernet for the data center, silicon photonics, and nanofibers. Throughout I have tried to maintain a focus on practical applications. This edition includes about a dozen case studies that either provide numerical examples of the principles discussed in the text or discuss real-world applications using grid computing, triple-play networks, optically interconnected supercomputers, and other areas. Our industry is just beginning to see the promise of all-optical networking emerge—application-neutral, distance-independent, infinitely scalable, user-centric networks that catalize real-time global computing, advanced streaming multimedia, distance learning, telemedicine, and a host of other applications. We hope that those who build and use these networks will benefit in some measure from this book.

An undertaking such as this would not be possible without the concerted efforts of many contributing authors and the publisher's supportive staff, to all of whom

I extend my deepest gratitude. As always, this book is dedicated to my mother and father, who first helped me see the wonder in the world; to the memory of my godmother Isabel; and to my wife, Carolyn, and my daughters Anne and Rebecca, without whom this work would not have been possible.

Dr. Casimer DeCusatis, Editor
Poughkeepsie, New York
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