



Computer Networking Breakthroughs... Yes, In Electrical Protection Measures!


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 **PEG** PROTECTION
ENGINEERS
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Electrical Protection of Communications Networks

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 **Telecom Problem Solvers, LLC**

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"...an invaluable contribution to the field and encouraged for both the young student learning as well as the experienced field engineer looking for information."— DR. JOHN CIOFFI, PROFESSOR EMERITUS OF ELECTRICAL ENGINEERING STANFORD UNIVERSITY "FATHER OF DSL"

FOREWORD BY DON MCCARTY

COMPUTER NETWORKING BREAKTHROUGHS YOU'VE ALWAYS WANTED

**WITHOUT NEEDING FIBER OPTIC CABLES...
EVEN IN THE AGE OF THE INTERNET OF THINGS!**



BY RUSS GUNDRUM

www.computernetworkingbreakthroughs.com

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“...existing copper facilities in the telecom and computer networking industry can be operated **reliably and **economically** in providing high bandwidth applications **without being replaced by fiber optic cables.**”**

A flavor of the book can be seen by some of the 22 chapter titles:

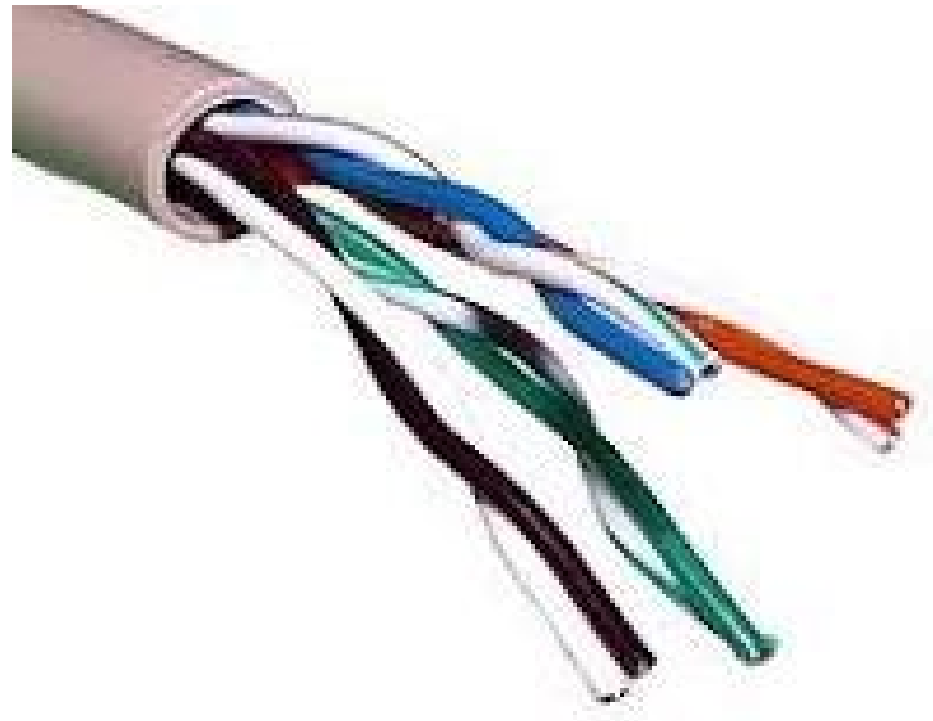
- **That **Antiquated and Obsolete** Copper Network...**Really?****
- **Understanding the Physical Layer**
- **Wasn't **Twisted Pair** Supposed to be the Answer?**
- **Wasn't **Shielded Cable** Supposed to be the Answer?**
- **My One Year Stint with the Cable Guys...and This Neat Little '**One Wire**' Coaxial System"**
- **What does the IEEE have to say about All of This?**
- **G.fast, MGfast, XG-FAST and **TDSL****
- **Wi-Fi is THE Network!**
- **But What About **5G**?**
- **Oh, and Have You Heard About the **EMP** Threat?**

Re-Inventing Wires: The Future of Landlines and Networks



National Institute for Science, Law & Public Policy
Washington, DC

There really is a “**copper phobia**” in the industry!



Category 5 UTP



Heavily Shielded Okonite Railroad Signaling Cable



Russ Gundrum and His EMI Demo in July 2018 for His Telecom Class at UH



Telecom
power

With customer-owned equipment and use of telephone lines for data, it is more important than ever to eliminate noise and disturbances.

Get 'RID' of glitches

By Russ Gundrum

Diversification and deregulation of the telephone industry in the United States has brought the public a bewildering array of sophisticated telecom equipment, service options and choices of vendors of these products. However, this has not come without a few problems—especially in the area of quality of service and in deciding who is responsible for solving a problem.

The art of finger-pointing has reached a new crescendo in the industry! Is the problem in the manufacturer's equipment, in the interconnect company's wiring and installation, in the telephone company's local network, or the long distance carrier's facility?

Telephone companies have done too good a job recently in convincing the business and residential consumer that *all* they have to provide is "dial tone." This message and corresponding employee attitude has led many companies down the road of poor customer service—a distinct departure from the days when service was all the telephone company claimed to provide.

Telephone lines are not just for voice transmission anymore. This is really nothing new, but the wide scale application of the entire telephone network as a computer data link is. As many now know, the distinction between a telephone set and a computer terminal/VDT is being blurred as the "information age" becomes a reality.

A line may have a loud and clear dial tone that connects accurately to another party and sound fine with no audible noise, but still be totally unusable from a data transmission standpoint. This can occur for many reasons, but one of the biggest may be the level

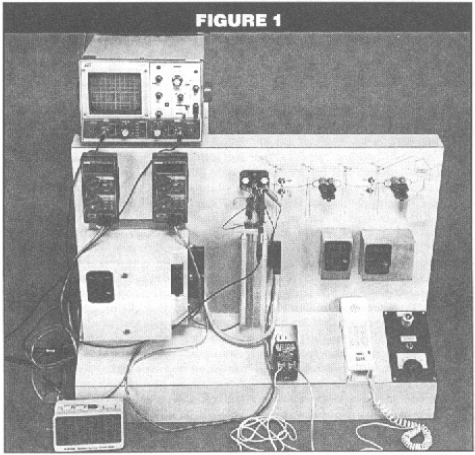
Russ Gundrum is vice president, Telecommunications Utility Division, SNG Manufacturing Co., Oshkosh, Wis.

of induced AC voltage or current from power lines paralleling telephone trunk, local loops and, yes, even stations off of the PBX or in a Local Area Network (LAN) configuration!

Due to increased sensitivities of newer electronic devices being utilized in the telecom business, very low levels of longitudinal AC can make the equipment fail or give sporadic operational malfunctions and "glitches" in transmission.

Higher level surges or transients from power lines or lightning can even damage the equipment before the teleco-provided "primary" protector operates. Whether this spark-gap type

FIGURE 1



A collection of end user equipment. Telecommunications Interference Filter (white box center left) has reduced induced AC voltage on the telephone line from 122 to 1.2 volts, for a 99% suppression.

protector is a carbon block or a gas tube, the device usually doesn't operate until it sees more than 300 volts—as required by the National Electrical Code.

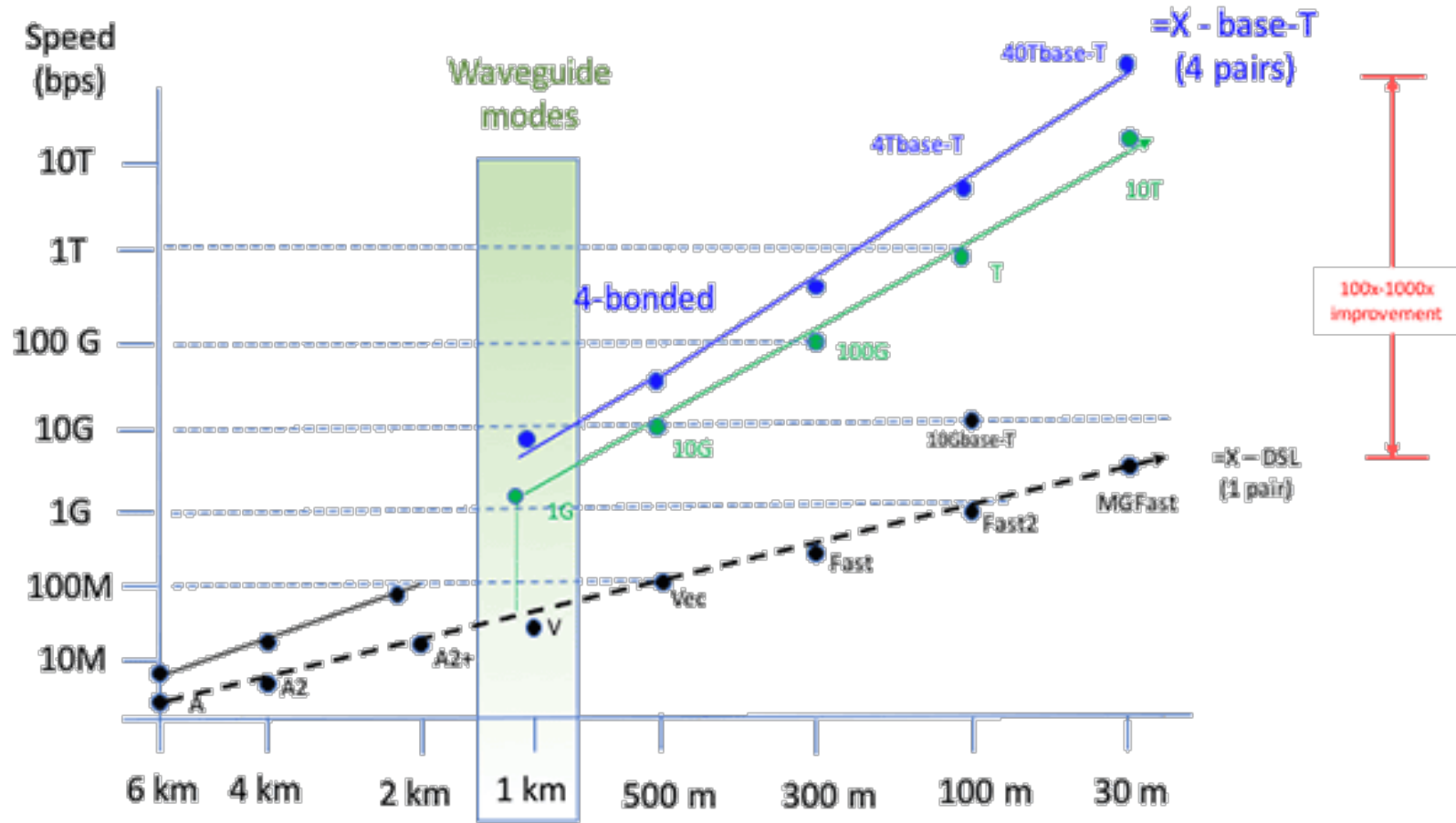
This 300-volt level of "brute force" protection really has nothing to do with response time although many manufacturers are fond of promoting the speed of operation with solid-state type protectors or diverters, such as Metal Oxide Varistors (MOVs), diodes, etc. This 300-volt design criteria is mainly one of electrical safety and is aimed at preventing basic telephone instruments from being "blown off the wall" or burning up.

Russ Gundrum's "Get 'RID' of glitches" October 15, 1985, TE&M Article First Page





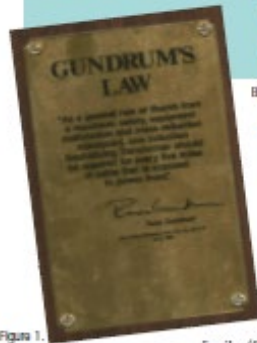
Bring on the DOCSIS!



“Will DSL Destroy 5G in the Battle Over the Last Mile?”



“The Data Center's Hidden Threat: EMPs”



Why Gundrum's Law Still Applies to VDSL2/G.fast and IPTV Services

By Russ Gundrum

What does Gundrum's Law have to do with today's challenges in deploying high-bandwidth services over short copper loops? In one word: everything.

When the book, *art of the Telephone Volume 14 on Power Line Interference; Problems and Solutions*, was first published in 1982, my recommendation was this: "As a general rule of thumb from a maximum safety, equipment malfunction and noise reduction standpoint, one Induction Neutralizing Transformer should be required for every five miles of cable that is exposed to power lines."

This configuration usually yields the best overall results and represents the most economical approach in controlling inductive interference on loops up to

Figure 1
Gundrum's
Law
Plaque.

5 miles (8 Km) in length. I also recommended placing 3 mitigative devices on the copper loop, most notably the Induction Neutralizing Transformer (INT).

Later, as a result of my trip to the Far East in 1983, I amended that advice for loops exceeding this 5-mile (8 Km) length. They should have multiple INTs.

Though I had never previously referred to it as Gundrum's Law, my experience in the jungle outside of Bangkok, Thailand, changed that. I was asked to meet with one of the telephone company's managers on a hot, humid Saturday, where he had brought his technicians together. Though I thought I was going to give a training

"Until there is no more copper, this law is relevant. Read why."



Questions??????

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