

Deployment News

By Masha Zager ■ *BBP Telecom Editor*

Verizon Signs up Millionth FiOS Customer

More than a million households and businesses across the country now subscribe to FiOS Internet, according to a recent announcement by Verizon (www.verizon.com). In addition, nearly half a million now subscribe to the FiOS TV service. FiOS services are delivered over Verizon's fiber-to-the-premises network.

Verizon offers FiOS Internet service in more than 1,700 communities in 16 states, and FiOS TV service is available to 3.1 million households in 11 states. Verizon continues to expand the service at a rapid clip. During the last month, the company launched FiOS Internet service in the Houston area and video service in dozens of communities in

Rhode Island, Florida, Massachusetts, California, New Jersey, Maryland, New York and Pennsylvania. Verizon also announced that it had been granted video franchises in additional communities in New York, Virginia, Maryland, Oregon, Pennsylvania and Delaware, and would move ahead to bring FiOS TV to those communities.

AT&T Upgrades to GPON

AT&T (www.att.com), now the largest telco in the U.S., has captured headlines by championing a network strategy based on fiber-to-the-node. Less well known is the fact that in greenfield areas U-verse, AT&T's high-speed service offering, is deployed on fiber-to-the-home networks. AT&T had been relying on BPON technology for its FTTH builds, but has now

announced that it will be migrating to GPON. Alcatel-Lucent (www.alcatel-lucent.com) and Ericsson (www.ericsson.com) have been selected as GPON equipment providers. Financial terms of the awards were not disclosed. As of this spring, AT&T had about 30,000 FTTH homes passed.

The Alcatel-Lucent and Ericsson

GPON solutions include equipment for central offices and customer premises. Both suppliers will soon begin lab testing and certification by AT&T Labs before field testing configurations for single-family residences, apartments and condominium complexes. General deployment of GPON is expected to begin in 2008.

Three Cable Systems Upgrade to Fiber

With the increasing availability of equipment that facilitates migration from hybrid fiber coax (HFC) networks to FTTH, more cable providers are making the leap to fiber. CityNet, a municipal cable system that provides triple play services in Tifton, Georgia, is deploying the Hybrid RF PON solution from Alloptic (www.alloptic.com) as its FTTH access technology. Alloptic's MicroNode technology will allow this provider to overlay PON technology on existing fiber, increasing bandwidth while cutting operational costs by eliminating amplifiers in the outside plant. Graybar (www.graybar.com) is helping CityNet develop and implement its upgrade and FTTx deployment.

Another new Alloptic cable-to-fiber customer is Armstrong, a division of Armstrong Group of Companies. Arm-

strong has selected Alloptic's MicroNode as its fiber-to-the-home technology for greenfield developments, with the first major project starting in Butler County, Pennsylvania. Mike Giobbi, Armstrong's CTO, says that MicroNode's use of coax inside the customer's home allows the company to preserve its investment in cable infrastructures and continue using the same in-home equipment that it uses in the rest of its service area. Giobbi also points to the cost savings from eliminating maintenance functions such as sweeping and signal leakage drive-outs.

The Glasgow (Kentucky) Electric Plant Board, a municipal utility that has provided cable TV and Internet services for more than a decade, is also rewiring 620 homes and businesses in its service area with fiber to the home, using GePON technology from Wave7

Optics (www.wave7optics.com). According to board superintendent William J. Ray, the deployment, which should be completed in November, will allow the utility to evaluate both the costs of deploying FTTH and the market response to new FTTH-enabled services. In addition to Internet access at speeds up to 16 Mbps, the GEPB will offer FTTH customers a VoIP product; Web-based security monitoring; and a Web portal leading to a variety of high-speed applications.

In addition, the electric power branch of the utility will be installing Ethernet-based electric meters and a Web portal to let consumers monitor energy consumption in real time, and it will offer time-of-day electricity rates so that consumers can adjust their consumption to cut their electricity bills.

Municipal FTTP Builds

In addition to the two municipal cable systems migrating to fiber, several other municipalities are moving forward with plans to begin offering telecom services for the first time, using fiber-to-the-premises.

- In Tennessee, the Tullahoma Utilities Board received approval for a

\$17.1 million bond issue to build a municipal network that would provide triple play services.

- In Louisiana, the Lafayette Utilities System received approval to issue \$110.4 million in revenue bonds for its fiber optic network, and closed the bond sale on June 28.

- The city of Powell, Wyoming, is negotiating funding to build a FTTP system, while the nearby city of Cody is negotiating with TCT West (an independent telco FTTH provider) to build and operate a fiber network there. The Cody network may be city-owned.

Connexion Adds Three New Projects

Cary, North Carolina-based Connexion Technologies (www.cnxntech.com) announced plans to build FTTH networks in three new developments: Sandy Creek Farms, an upscale neighborhood development in Gulf Shores,

Alabama (in partnership with Joe Raley Builders); Tunica National, a master-planned community in northern Mississippi (Dunn and Harrell Development, LLC); and Overlook at Camp Creek, a single-family home communi-

ty on the outskirts of Atlanta, Georgia (Trey Robinson Homes). Connexion announced this spring that it has had to more than double its staff to keep up with rapid growth in demand for its FTTH deployments.

Bridging the Digital Divide: Statewide Fiber Network in Goa

In Goa, a region on the west coast of India best known for its beautiful beaches, the state is moving ahead with an ambitious plan for connecting both government offices and private citizens to a fiber network. Goa's Statewide Area Network (SWAN) is being built by United Telecoms Limited (www.utlindia.com), a Bangalore-based ICT solutions company with wide experience in setting up telecom networks and e-governance networks. UTL is using GePON technology from UTStarcom (www.utstar.com), based in Alameda, California.

UTStarcom's solution, which includes both central office and customer-premises equipment, will provide up to 1 Gbps of connectivity to state government offices. The first phase of the project will connect about 180 major government locations; Phase 2 will extend the fiber network to households and businesses in the larger cities; and Phase 3 will extend the network to the panchayats, or village councils, throughout the state. Goa has about 80,000 households, 21,000 hotel rooms and more than 500 government offices. The entire project is scheduled to be completed by the end of 2009.

The government's plans for the network aim at improving the lives of ordinary citizens in Goa. "Bridging the digital divide is a global challenge many countries face as the availability of broadband services expand beyond metropolitan cities into remote regions of the world," says David King, senior vice president of international sales and marketing at UTStarcom. According to Vijay Yadav, managing director of UTStarcom in South Asia, both citizens and government officials will be able use the network to trace the status of applications for licenses, permits, and so forth. The government also plans to set up public-access terminals where citizens can book railway tickets, pay for water, electricity and other utilities, make video calls to government officials, access information about legal cases, obtain land ownership records, transfer money orders and apply for passports.

The network will also support an online agricultural market, enabling farmers and fishermen to get the best prices for their harvests or catches. Telemedicine applications will allow medical experts in the capital to extend their reach by consulting with local health workers in remote villages and towns that are medically underserved. And students in remote villages will be able to study with teachers in the larger towns, broadening their opportunities for education and economic advancement.

International Deployments

TVTel, a Portuguese multimedia service provider, has deployed a fiber-to-the-home network using a GePON solution from UTStarcom (www.utstar.com). Unitelco (www.unitelco.pt), a technology company in Portugal with expertise deploying fiber and cutting-edge access networks, is serving as the integrator for the contract.

TVTel's bundled service package consists of high-speed data, voice and both analog and digital QAM television. It is targeted initially at 5,000 subscribers in Oeiras, a city west of Lisbon.

NRGi Fibernet, a subsidiary of Århus Power Utility in Denmark, will deploy a GPON solution from Alcatel-Lucent

(www.alcatel-lucent.com) to deliver voice, IP video and data services by September 2007. Alcatel-Lucent will also be responsible for software integration, installation and commissioning, maintenance and advanced project management. Århus is Denmark's second largest city and the network is expected to have 20,000 users.

Focus on GPON Solutions

Verizon and many smaller companies are upgrading their BPON networks to the full-rate 2.4 Gbps GPON (Gigabit Passive Optical Network) standard, and GPON is also being used in a sizable percentage of today's new fiber builds. Though GPON is far from universal – alternatives such as GePON and variants of Active Ethernet are strong contenders – it seems poised to be the leading fiber-to-the-home technology in North America and Europe. Recently, PacketFront, Wave7 Optics, Zhone, ZTE and Alphion all entered the GPON market, and many other companies are enhancing their offerings to meet the 2.4 Gbps standard, increase capacity in other ways and/or drive down costs.

PacketFront Introduces GPON Solution

From BBP Wires

CHICAGO – PacketFront, which currently offers a FTTH solution using active equipment as well as broadband management software that is access technology-agnostic, has announced its intention to offer GPON in the first half of 2008. The GPON solution will consist of indoor and outdoor optical network terminals for customer premises and a

high-density optical line terminal for the central office. "With this GPON solution we will be able to offer FTTH access to a much broader market compared to today," said Niclas Sonesson, CTO of PacketFront. "We can achieve a passive FTTH access solution in cases where our current active solution is not a preferred alternative."

PacketFront says GPON technology's strength lies in its promise of higher density in the central office, and easier ways of carrying the fiber on aerial cables. The expected future growth of HDTV and video content drives the need for gigabit bandwidth speeds to the end users, an area where GPON will play an important role in the future.

Wave7 Optics Adds GPON Capability to Trident7 Platform

From BBP Wires

ATLANTA – Wave7 Optics (www.wave7optics.com), which has focused recently on its GePON solution, has announced support for GPON standard networks via its Trident7 Universal Access Platform.

The Trident7 platform's GPON support is consistent with Wave7 Optics' philosophy of supporting all access standards from a common optical line terminal installed in the central office or system head end. Wave7 says the Trident7 is the industry's only FTTP platform capable of

delivering standards-based GePON and GPON triple-play services from a common platform.

Trident7 incorporates fully standards-compliant chipsets to ensure interoperability, and features a diverse selection of optical network terminals, or customer premises equipment, for both residential and business customers. Wave7 Optics has been shipping the Trident7 platform since 2006 and its products are already deployed by over one hundred customers on

six continents. It is currently taking orders for its Trident7 GPON product line.

"GPON is the standard of choice for network operators in certain geographic areas and market segments, whereas others are deploying the [GePON] standard," said Emmanuel Vella, Chief Marketing Officer for Wave7 Optics. "By supporting multiple standards with Trident7, we can effectively cater to any customer regardless of which standard they might embrace."

Zhone Introduces GPON

From BBP Wires

OAKLAND, CA – Zhone Technologies (www.zhone.com), which had previously marketed a BPON FTTH solution, has added GPON to its product lineup. Zhone's GPON optical line terminal card is designed for use with its Multi-Service Broadband Loop Carrier (BLC), where it can be mixed with other service line cards for greater flexibility and network optimization. Each GPON line card allows up to 64 subscribers per link, with up to 2.5 Gbps bandwidth per subscriber.

At the customer premises, Zhone is offering the zNID, which is both an optical network terminal and an intelligent residential gateway, providing Layer 3 intelligence for remote monitoring and traffic prioritization of quality of service-sensitive media applications. Service changes or upgrades are managed remotely via a TR-069 Automatic Configuration Server, the same management standard already used for millions of DSL installations worldwide. zNID supports HomePNAv3 for multimedia home networking, using

standard coax cable and ordinary twisted pair phone line. Interfaces are intuitive to the end-user. VoIP phones plug into phone jacks and IPTVs are connected via regular coax. Service providers can deliver advanced triple play, including IPTV and HDTV over standard coax, phone lines or Ethernet with over 100 Mbps of available bandwidth. zNID is also the first gateway to derive its power from the existing phone lines in the home, further eliminating the risks and costs of hiring technicians to drill and run in-home cable.

Alphion Launches Complete GPON Family

From BBP Wires

CHICAGO --Alphion Corporation (www.alphion.com) launched a GPON product family consisting of the Broad-

band GPON Platform, AOLT-4000, a full lineup of customer premises optical network terminals (ONTs) for indoor

and outdoor applications, and passive splitter units. The AOLT-4000 features 40 GPON ports per shelf, a 200 Gbps backplane and 56 Gbps uplink capacity, and supports both passive ring and passive star network architectures. The ONT lineup includes terminals for single-family homes, small businesses and multiple dwelling units.

Alphion also announced PON.ext, a PON extender that can be used to extend network reach, increase split ratios or both. It regenerates both downstream and upstream signals using all-optical amplification, and is transparent to both data rate and protocol, allowing it to support BPON, GePON, GPON and even future FTTx standards, as well as making it interoperable with both the Alphion GPON family and other manufacturers' PON equipment.

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ZTE USA Unveils GPON Product Series

From BBP Wires

CHICAGO – ZTE USA (www.zte-usa.com), a subsidiary of Chinese-owned ZTE Corporation, announced the availability of its GPON solution, the ZX A10 product series. ZTE calls

the solution one of the most bandwidth-efficient GPON platforms available today, with a quality of service and network availability standard that meets the increasingly stringent

needs of the industry. ZTE USA also signed a multiyear partnership agreement with North American integrator L&W Technologies (<http://lwtechinc.com>).

Alcatel-Lucent Doubles Capacity of Its GPON System

From BBP Wires

CHICAGO – Alcatel-Lucent (www.alcatel-lucent.com), which is providing equipment for more than 30 GPON projects worldwide, released a new GPON line card and a compact optical network terminal (ONT) for multiple dwelling units. The new release of Alcatel-Lucent's 7342 ISAM GPON solution features quad port line cards that double system capacity; the four GPON ports can each support up to 64 subscribers with 2.5 Gbps downstream

and 1.25 Gbps upstream line rates. The new quad line cards occupy the same physical footprint as the previous two port line cards, offering service providers a tremendous capacity increase without compromising bandwidth. Release 4.4 also supports VoIP with SIP and H248, as well as IPTV with IGMPv3 for fast TV channel change.

The ONT is capable of serving up to 12 living units with traditional phone line services and either VDSL or Eth-

ernet data. It can deliver voice, video and data over the building's existing copper wires.

Alcatel-Lucent also signed an agreement with Corning Cable Systems (www.corning.com/cablesystems) to use Corning's OptiTap Connector and Adapter in its GPON system. Corning Cable Systems will be the exclusive supplier of OptiTap Connectors and Adapters for the Alcatel-Lucent system.

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Calix Adds New GPON Module

From BBP Wires

PETALUMA, CA – Calix (www.calix.com) announced the addition of a new GPON service interface module to its C7 multiservice access platform (MSAP). The GPON module provides 2.4 Gbps to each of four optical line terminal (OLT) ports, enabling the delivery of high-bandwidth services such as high-definition IPTV to 256 subscribers from a single module – 5,120 subscribers from a single C7 MSAP. The C7 can support GPON services from the same platform used to

support DSL, Gigabit Ethernet, BPON, SONET, and legacy copper services.

In addition to residential services such as IPTV, RF video, and VoIP, the Calix C7 equipped with GPON modules supports business services such as Ethernet transparent LAN services (TLS) as well as native T1 services. The Calix C7 also provides fully integrated POTS and VoIP gateway functionality, eliminating the need for cumbersome and costly external solutions.

Coupled with Calix's 700-Series ONTs, the new GPON module allows service providers to transition 622 Mbps BPON infrastructure to 2.4 Gbps Ethernet-based GPON infrastructure with as little as 17 seconds of downtime per subscriber. This transition, which is enabled via auto-detect optics on the 700-Series ONTs and a simple upgrade wizard in the Calix Management System (CMS), requires no visit to the subscriber premises.

Ericsson Upgrades GPON System

From BBP Wires

PLANO, TX – Ericsson (www.ericsson.com), which entered the GPON market in February with its acquisition of Entrisphere, announced an upgrade to its GPON system, the EDA 1500. The upgraded system can now include what Ericsson says is the fastest GPON switch on the market, able to switch bandwidth up to 320 Gbps. It also provides for the most

upstream bandwidth, with a card that includes two 10 Gbps Ethernet interfaces and eight 1 Gbps Ethernet interfaces. New software provides a 1:64 split ratio on the fiber and Dynamic Bandwidth Allocation (DBA), along with Quality of Service (QoS), security and other applications designed to enable carriers to deliver new services cost-effectively.

The increased capacity enables the move from multicast (one-to-many) to unicast (one-to-one) broadband connections. This allows end users to access individualized services such as video-on-demand and time-shifting TV streams. Once the system and switch interfaces are installed, future capacity upgrades simply require new software and service cards.

Motorola Launches Video-Optimized GPON Solution

From BBP Wires

CHICAGO – Motorola (www.motorola.com) announced an upgrade to its optical access platform's support for GPON: a 200 Gbps advanced switching architecture with onboard high-capacity 1 Gbps and 10 Gbps WAN interfaces and support of 10 Gbps to each application unit, resulting in full GPON line-rate throughput to the access network.

Motorola is also introducing a line of intelligent GPON optical network terminals for small businesses, high-density multi-dwelling units, and single-family homes (both indoor and outdoor units). Motorola says that both the platform hardware and software have already proven their high performance and reliability in successful large-scale

deployments of video, broadband Internet and voice services. Built to support high rates of growth in unicast video content and ultrabroadband Internet access, the GPON solution is optimized to support dynamic video traffic patterns and sustained subscriber throughput of 200 Mbps symmetrical, with burst rate capacity of up to 400 Mbps.

BroadLight Announces GPON Systems-on-Chip

From BBP Wires

MOUNTAIN VIEW, CA – Customer-premises equipment in FTTH networks is being consolidated into a single box combining the functions of optical network terminal and gateway to the in-home network. Broad-

Light (www.broadlight.com), which supplies GPON semiconductors and software, recently unveiled a GPON Residential Gateway System-on-Chip solution that integrates and combines these functions. The new gateway,

which will be available for testing at the end of the year, connects the high-speed digital home to FTTH services. It supports a variety of in-home networks including Ethernet, wireless, coax, powerline and USB.

Broadlight also announced another GPON System-on-Chip aimed at lowering the cost of residential optical network terminals. The BL2347 integrates

a VoIP digital signal processor (DSP) and a 4-port Ethernet switch, providing a throughput performance of 1 Gbps for any packet size on its gigabit Ether-

net port. ONT equipment vendors can use the chip to create an ONT that will interoperate with any standards-compliant Optical Line Terminal (OLT).

iamba Networks and K-micro Collaborate on GPON SoCs

From BBP Wires

CUPERTINO, CA and SAN JOSE, CA – iamba Networks (www.iamba.com) and Kawasaki Microelectronics America (K-micro, www.k-micro.us) are collaborating on developing a family of GPON

systems-on-chips, to be marketed as part of iamba's GPON solution suite. The new SoCs are being designed to enable equipment manufacturers to produce systems with full 1 Gbps wire speed at low cost

with a shorter time-to-market. They will power customer premises equipment at single-family homes, small businesses and multi-dwelling units, as well as central office equipment.

Micrel Announces 2.5 Gbps GPON ONT Transceiver

From BBP Wires

SAN JOSE, CA – Micrel (www.micrel.com) launched a single chip programmable SERDES (Serializer/Deserializer) that supports multiple PON standards and rates, including asymmetric GPON with data rates up to 2.5 Gbps on the

receive side and 1.25 Gbps on the transmit side. The device is currently available in volume and is priced at \$9.95 for 1K quantities. Because it requires the lowest cost field-programmable gate arrays, it drives down the cost of making optical

network terminals that are programmable or upgradeable. Micrel says the device manages all the high-frequency signals in an optical network terminal and allows customers to provide ONT solutions "only limited by their imaginations."

PMC-Sierra Introduces Low-Power Gigabit Fiber Access Gateway Solution

From BBP Wires

SANTA CLARA, CA – PMC-Sierra, Inc. (www.pmc-sierra.com) announced the availability of a new GePON/GPON gateway System-on-Chip for fiber to the home. This SoC delivers Gbps IPv4/v6 routing, Network Address Translation (NAT), Quality of Service (QoS), encryption and a multichannel VoIP terminal adaptor, and consumes less than 1.5W of power.

PMC-Sierra's fiber access gateway solutions provide manufacturers with a common platform architecture to support multiple high-speed access technologies. PMC-Sierra says the new gateway offers:

- Breakthrough performance and flexibility, while consuming less than 1.5 watts;
- Gigabit-per-second throughput;
- Performance to support new ultra-high

bandwidth LAN interface technologies;

- Fully programmable packet processing acceleration to accommodate future service models and home network configurations; and
- Headroom to support gateway-hosted applications, such as integrated storage/media server, fixed mobile convergence (FMC) clients, and remote access servers.

Internet IPTV Provider NeuLion Scores with Islanders Games; Launches Rangers On Demand

By Linda A. Schoener

PLAINVIEW, NY – NeuLion announced a new video service for New York Rangers ice hockey fans, and reported success for its IslandersTV service, which signed up more than 11,000 subscribers for free trials. It's been op-

erating only since the beginning of the 2006/2007 hockey season.

IslandersTV is a 24 hour channel providing original content created by the New York Islanders and its partners. NeuLion uses broadcast-quality

IPTV to subscribers' computers. Viewers can play, pause, fast-forward, rewind and stop action on their screen. "Community features" bring fans together by allowing them to upload their own videos, debate topics in public forums

and watch up to five videos at a time. To date, there are approximately 680 videos available on the service.

The Islanders launched their channel, ITV, at the start of the season and have had 11,000 subscribers sign up for a free trial. The Rangers launched their channel in time for the opening playoff game on April 12. Other National Hockey League teams are interested, NeuLion execs say.

NeuLion charges an upfront design fee and a monthly operational fee, then splits advertising and subscriber revenue. It handles subscription and digital asset management, and billing. To date, neither team has generated much revenue from the channels, but they are enthusiastic.

“The New York Islanders couldn’t be happier with the first season of IslandersTV...The reception we are getting from our fan base has been nothing short of overwhelming. We have always looked at finding new ways to satisfy our passionate fans from all over the world, and have never found a better way Season one was an incredible success, and we will be vibrant and aggressive in the off-season to give our fans new and exciting content each and every day,” said Josh Bernstein, Vice President of Marketing and Communications for the New York Islanders.

IslandersTV features include one-on-one with head coach Ted Nolan, in-depth interviews with General Manager Garth Snow, daily shows from Islanders’

practice, interviews with Islanders legends, weekly reporter roundtable shows, pre- and post-game coverage and rare behind-the-scenes footage.

The new Rangers service delivers similar content off its official website, www.newyorkrangers.com. “We welcome the opportunity to work with other hockey clubs and bring this amazing service to their fans,” said Chris Wagner, Executive Vice President and Co-Founder of NeuLion.

IslandersTV launched in September 2006 and is currently open to the public through the New York Islanders official website www.newyorkislanders.com. Advertisers have tested the new platform as well. See www.neulion.com for more information.

New Book on Underground Utility Projects

Thinking about combining fiber with a pipeline or electrical distribution project? Civil engineer and engineering educator Dr. Jey K. Jeyapalan, P.E., one of the world’s premier experts in the design, construction and management of underground pipeline, has published the most definitive book on the subject.

15 chapters and 10 appendices focus on:

- The need for the world’s leading universities to offer formal classes in underground pipeline design, construction and management.
- The need for a more adequate understanding of the principles underlying pipe/soil interaction.
- The wide-ranging and often misunderstood nature of pipe materials.
- The growing number of claims and counterclaims among the world’s pipe manufacturers.
- The lack of consistency in design standards for pipe materials by governing entities in the field.
- Cost-effective approaches when there is an acute shortage in funding to either build new pipelines or renovate leaking sewers, waterlines, oil, gas, and process pipelines around the world.



Bonus: Sample Excel spreadsheets for pipe designs and sample full-length technical specs.

For more information and an order form: <http://home.earthlink.net/~jkjeyapalan/intro/>.

Dr. Jeyapalan can be reached at 860-354-7299 or jkjeyapalan@earthlink.net. The price of the book is \$250, which includes all tax, shipping and handling within the United States. For delivery outside the US, \$280.

More Than 300 Underground Utility Projects Worldwide Assessed in Authoritative New Book

BBP Staff Report

NEW MILFORD, CT – Thinking about combining fiber with a pipeline or electrical distribution project? Civil engineer and engineering educator Dr. Jey K. Jeyapalan, P.E., one of the world's premier experts in the design, construction and management of underground pipeline, has published the most definitive book on the subject. *Advances in Underground Pipeline Design, Construction and Management* is a thorough compilation of Jeyapalan's projects, lectures and writings. Written over a 23-year period, during which Dr. Jeyapalan's group performed work for, advised and lectured to over 5,000 owners, utilities, regulators, pipe manufacturers, trade associations, engineers and contractors on every continent, the book is intended to be the one source needed to understand the pipeline industry in all its diversity

and complexity.

Dr. Jeyapalan's book, whose 15 chapters and 10 appendices include sample Excel spreadsheets for pipe designs and sample full-length technical specifications, allows engineers, contractors, and students to access the tools required to advance their own infrastructure expansion work.

Dr. Jeyapalan has focused on six key areas:

- The need for the world's leading universities to offer formal classes in underground pipeline design, construction and management.
- The need for a more adequate understanding of the principles underlying pipe/soil interaction.
- The wide-ranging and often misunderstood nature of pipe materials.

- The growing number of claims and counterclaims among the world's pipe manufacturers.
- The lack of consistency in design standards for pipe materials by governing entities in the field.
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More information and an order form is at <http://home.earthlink.net/~jkjeyapalan/intro/>. Dr. Jeyapalan can be reached at 860-354-7299 or jkjeyapalan@earthlink.net. The price of the book is \$250, which includes all tax, shipping and handling within the United States. For delivery outside the US, the price is US \$280.

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