ITU-T Study Group 15

Optical and other Transport Networks

by

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Chairman SG 15

ITU-T Study Group 15

Optical and other transport networks

Dielectric-fibre surface waveguides for optical frequencies

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Synopsis

A dielectric fibre with a refractive index higher than its surrounding region is a form of dielectric waveguide which represents a possible medium for the guided transmission of energy at optical frequencies. The particular type of dielectric-fibre waveguide discussed is one with a circular cross-section. The choice of the mode of propagation for a fibre waveguide used for communication purposes is governed by consideration of loss characteristics and information capacity. Dielectric loss, bending loss and radiation loss are discussed, and mode stability, dispersion and power handling are examined with respect to information capacity. Physical-realisation aspects are also discussed. Experimental investigations at both optical and microwave wavelengths are included.

List of principal symbols

J_n = nth-order Bessel function of the first kind

K_n = nth-order modified Bessel function of the second kind

$\beta = \frac{2\pi}{\lambda_g}$, phase coefficient of the waveguide

J'_n = first derivative of J_n

K'_n = first derivative of J_n

h_l = radial wavenumber or decay coefficient

ε_r = relative permittivity

k_o = free-space propagation coefficient

a = radius of the fibre

y = longitudinal propagation coefficient

PROC. IEE Vol. 113, No. 7, JULY 1966

37 years later...

A limiting factor at present with the fibre guide is that the best readily available low-loss material has a loss of about **1000 dB/km**. However, it is foreseen that the present material can be improved, and our team have indications that materials having losses of only **tens of dB/km** should be forthcoming.

Geoffrey Charlish, 26.1.1966

ITU-T Study Group 15

This Presentation

- SG 15 overview
- Lead Study Group activities
- Work program and current challenges
- Cooperation with SDOs, Forums, Consortia
- Outlook, and more info?

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Responsibility and Mandate

- **Focal point** in ITU-T for studies on optical and other transport networks, systems and equipment. This encompasses the development of transmission layer related standards for access, metropolitan and long haul sections of communication networks.

- **Lead Study Group** on:
  - Access Network Transport (ANT)
  - Optical Technology

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Optical and other transport networks

SG15 Objectives

- Focal point for global standards on Transport Networks
- Market driven and timely standards in major work areas
- 'Value-added' coordination and cooperation effort
- Support ITU-T as preeminent Internat. Stds. Organization
- Promote SG 15 standardization activities

Organization

SG 15 - Optical and other Transport Networks

- WP 1 - Network Access
- WP 2 - Network Signal Processing
- WP 3 - OTN Structure
- WP 4 - OTN Technology
- WP 5 - Projects and Promotion

ITU-T Study Group 15

Optical and other transport networks

Some statistics

Work Program (Questions for study)	19
Recommendations under development	Approx. 100
Study Group meeting interval	Approx. 8 months
Rapporteur Group meetings	Frequently
Work by correspondence (EDH)	Continuous
Approval procedure	AAP
Rapporteurs	17
Editors	Approx. 60 - 70
SG Representatives	14
SG meeting participants (Avrg. 97-00/01-03)	347/299
Number of countries (Admin. and/or ROA)	39/26
Number of Scient. & Indust. Orgs. (SIO)	74/74
Recommendation texts approved	69/115

Major work areas

- Access network
  - Broadband optical access (B-PON and G-PON)
  - Refinements & enhancements xDSL
  - Home networking (data on in-premises wiring)
  - ANT standardization and work plan
- Network signal processing
  - CME in IP based networks
  - Enhancements Echo Cancellers
  - Equipment for GSTN and IP interconnection
  - Interaction of signal processing

Major work areas (cont'd)

- Optical Transport Network (OTN) structure
  - Protection & Restoration
  - Characteristics of equipment functional blocks
  - Architecture and interfaces
  - Network management and control
- OTN technology (terrestrial and submarine)
  - Fiber characteristics & test methods
  - Coarse and dense WDM applications
  - Optical interfaces
  - Optical components & amplifiers (e.g. tunable filters)
  - Transmission technology (Soliton/RZ), long reach

Major work areas (cont'd)

- Projects and promotion
  - Lead SG activities (Projects)
    - Access Network Transport
    - Optical Technology
  - Establish/maintain links inside and outside ITU-T
  - Promotion tools
    - SG 15 Web Site, public access
    - Workshops, seminars
    - Press Releases
    - Brochures
    - Tutorial material

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Lead Study Group activities (Projects)

- Mandate
  - Define, maintain overall framework (other SGs, SDOs, Forums/Consortia)
  - Own Questions
  - Coordinate, assign and prioritize work with other SGs
  - Consistent, complete, timely standards
- Implementation
  - Standardization Plan (who, what, when)
  - Work Plan (holes, lack of progress, priorities)
  - Provide 'value added'

Lead Study Group activities (Projects) (cont'd)

- Access Network Transport
  - Standardization and Work Plan established (issue 7 & 6 respectively)
    - ANT Standardization & Work Plan
  - Continuous updating
  - Road mapping future growth & requirements to year 2010
- Optical Technology
  - Standardization and Work Plan established (issue 3)
    - Optical Transport Networks & Technologies Standardization Work Plan
  - Continuous updating
  - Mapping of ASTN, GMPLS and OIF terminology
  - Description of Metropolitan Optical Network (MON)
  - Web based presentation planned

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OTNT related work in progress

- OTN
  - Broadband and Gigabit PON extensions (B-PON; G-PON)
  - Network protection and restoration (Generic, OTN)
  - Optical Cross-Connect and Switch functions
  - Synch. Dig. Hierarchy (SDH) enhancements
  - Architecture and interfaces for the OTN
  - Ethernet over Transport (incl. optical)
  - OTN Mgmt. Information Model (Protocol neutral and specific)
- ASTN/ASON
  - ASON enhancements
  - Distributed call and connection mgmt. (Prot. neutral and specific)
  - Routing; Link management
  - Framework for ASON management

OTNT related work in progress (cont'd)

- OTN Technology
  - Non-zero dispersion fibers for wideband transport
  - Test methods for installed single-mode fiber links
  - Optical interfaces
    - Single channel system (40Gbit/s, 80 km)
    - Multi-channel; Intra-office; Physical layer
  - DWDM and CWDM applications
  - Transverse compatibility
  - Optical performance monitoring
  - FEC for high bit rate DWDM submarine cable systems
  - Optical system design guidelines, terrestrial and submarine (Supplements)
- In total approx. 70 draft new/revised Recommendations

Some current challenges/issues

- Bottleneck network access → Fiber to the home
- Inconsistent OTN terminology/definitions (ITU-T, Industry, SDOs)
- Optical Supervisory Channel (diff. interpretations)
- Optical performance monitoring (parameters, use)
- Ethernet and OTN interworking
  - Ethernet in the first mile → PON
  - Ethernet in Metropolitan Optical Networks
  - Ethernet over Transport
- Optical control plane protocols for ASON addressed in several SDOs
- IP directly over fiber
- Optical Virtual Private Networks (OVPN)

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Cooperation with SDOs, Forums, Consortia

- Key SG 15 communication and cooperation partners:

Organization	Technical area/Topic
ATM Forum	Traffic & network management
DSL Forum	Access network
TM Forum	Network management
ATIS T1	Access network, SONET/SDH, OTN
ETSI	Access network, SDH
ISO/IEC	Optical fibers, components
ISOC/IETF	Optical transport network
	Network signal processing
TIA, OIF	Optical networks & technology
IEEE, MEF	Ethernet; Metro-Ethernet

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Cooperation with SDOs, Forums, Consortia (cont'd)

- Facts
  - Different motivations/objectives for different stds. Organizations
    - Implementation agreements; Specifications; Standards; Marketing; Other
  - Standards program delineation between SDOs difficult
  - Different cultures, working methods
  - A degree of overlap/duplication unavoidable
  - Communication and Cooperation necessary

- ITU-T recognition (meet qualifying criteria)
  - Communicate with Forums, Consortia (Rec. A.4)
  - Cooperate, info exchange, nat./regional SDOs (Rec. A.6)
  - Reference 'foreign' standards (Rec. A.5)

Cooperation with SDOs, Forums, Consortia (cont'd)

- Formal agreements
  - ITU-T Resolutions (Collab. with ISO/IEC)
  - IETF and ITU-T Collaboration Guidelines
    - (RFC 3356; ITU-T Supplement 3 to A-Series of Recommendations)
  - MoU (IEC, ISO, ITU and UN/ECE; ITU and ETSI)
- Communication tools
  - Liaison statements
  - Representatives
  - Common FTP area
  - Joint meetings

Cooperation with SDOs, Forums, Consortia (cont'd)

- Experience
  - Collaboration agreements clarify, guide, provide transparency
  - Personal acquaintance indispensable
  - Representatives (ambassadors) in each others' meetings conducive to mutual understanding
  - Work by correspondence via (joint) email lists
  - Easy access to each other's (draft) standards/documents is essential

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Outlook, and more info?

- Transport network standards development (optical, other)
  - Core competence area of ITU-T
  - Study Group 15 → Largest ITU-T SG
  - Continued strong participation, contributions, output
  - Evolution towards all-optical transp. ntwk. infrastructure
  - Possible refocusing after WTSA 2004 (pending TSAG discussions)
    - All transport and optical related standards work in one Study Group
    - Include transport network architecture
    - Concentrate on Broadband Access, Metro and Core Network
    - Layer 1 and Layer 2 aspects
    - OTN structure and technologies

SG 15

Web Site

http://www.itu.int/ITU-T/studygroups/com15/index.asp

ITU-T Activities - Microsoft Internet Explorer provided by Nortel Networks

Address http://www.itu.int/ITU-T/studygroups/com15/index.asp

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ITU-T Activities

ITU-T Study Group 15 (Study Period 2001 - 2004)

- - Select an ITU-T Activity - -

Optical and other transport networks

- Lead Study Group on access network transport
- Lead Study Group on optical technology

Contact for Study Group 15: tsbsg15@itu.int

Information

- Area of Responsibility
- Study Group Structure
- Lead Study Group Activities
- Study Group Management Team
- List of Rapporteurs
- List of Editors
- List of Questions under Study
- List of Recommendations approved during this Study Period
- List of Recommendations and Supplements deleted during this Study Period
- Standardization Areas and Domains
- Work Programme
- Last meeting results concerning Recommendations

Meeting Information

- Schedule of Meetings
- Meeting Sessions Room Allocation

TIES account required

Documents

- Circulars related to SG 15
- Collective Letters
- Contributions
- Delayed Contributions
- Reports

Documents by meetings

- Next Meeting: Geneva, 21-31 October 2003
  [All documents - Delayed Contributions - Temporary Documents]
- Last Meeting: Geneva, 20-31 January 2003
  [All documents - Delayed Contributions - Temporary Documents]
- All Meetings...

New system for meeting documents

ITU-T Study Group 15

Optical and other transport networks

SG 15 Web Site (cont'd)

ITU-T Activities - Microsoft Internet Explorer provided by Nortel Networks

Address http://www.itu.int/ITU-T/studygroups/com15/index.asp

Databases

- List of Recommendations and Supplements deleted during this Study Period
- Standardization Areas and Domains
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Meeting Information

- Schedule of Meetings
- Meeting Sessions Room Allocation
- Rapporteur Meetings
- Hotel booking at preferential ITU rates

Special Projects and Issues

- Optical Transport Networks SG15-IETF-T1X1.5 Common FTP area

Recommendations

- G-series, with the exception of those under the responsibility of Study Groups 4, 12, 13 and 16
- I.326, I.430 Series, I.414 and I.700-series
- Q.500-series except Q.513 (see SG 4)
- Maintenance of the R-series
- V.38
- X.50 series
- Recommendations of the Y-series having in the G-series a double number that falls under Study Group 15 responsability

Alternative Approval Process (AAP)

Documents by meetings

- Next Meeting: Geneva, 21-31 October 2003
  [All documents - Delayed Contributions - Temporary Documents]
- Last Meeting: Geneva, 20-31 January 2003
  [All documents - Delayed Contributions - Temporary Documents]
- All Meetings...

New system for meeting documents

Documents in the Informal FTP area

Guides, Tools and Templates

- Author's guide for drafting ITU-T Recommendations
- Manual for Rapporteurs and Editors
- Implementors' Guides
- ASN.1 Module Database
- New ITU-T Templates

EDH Information and Services

ITU-T Study Group 15 (Study Period 1997 - 2000)

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ITU-T Study Group 15

Optical and other transport networks

The Team

- SG Chair: P. Wery (CAN)
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    H. Okamura (J)
    S. Trowbridge (USA)
  - WP Chair: G. Bonaventura (I)
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    Y.Naito (J)
    S. Trowbridge (USA)
    - Rapporteurs, Editors, SG Representatives
- TSB Counsellor: P. Rosa
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