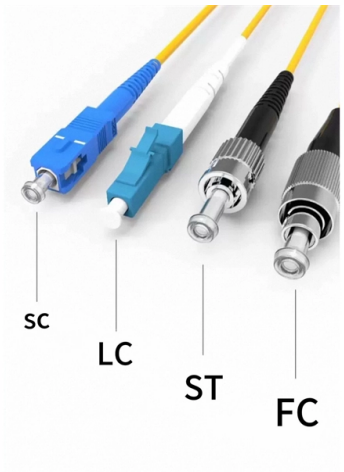
Intelligent Customization Process for Fiber Optic Arrays in Carrier Backbone Networks



Overview

South Africa''s national broadband infrastructure company Broadband Infraco (BBI) has partnered with Huawei to build a national intelligent all-optical backbone network.

Key Takeaways

The intelligent customization of fiber optic arrays in carrier backbone networks leverages AI-driven design, GIS and LiDAR integration, and SDN-enabled automation to optimize routing, deployment, and operational efficiency. AI-Driven Fiber Network DesignIntelligent customization begins with AI-driven network design, which uses machine learning and geospatial intelligence to optimize fiber routes, material planning, and network scalability.

A

I algorithms analyze terrain, infrastructure, demand density, and construction constraints to generate build-ready FTTH and FTTX network designs, reducing cost variability and minimizing construction rework while improving capital forecasting accuracy (CHR Solutions). This approach ensures that every design decision is data-driven, aligning engineering precision with financial performance. GeoAI and LiDAR IntegrationModern fiber planning incorporates GeoAI and LiDAR-based 3D models to validate designs against real-world conditions before construction.



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GeoAI optimizes routes under cost, risk, and regulatory constraints, while LiDAR provides accurate 3D representations of terrain and existing infrastructure. This creates a closed feedback loop, where field insights continuously improve planning outcomes, deployment speed, and constructability (Infosys). SDN-Enabled Intelligent Backbone NetworksCarrier backbone networks benefit from Software-Defined Networking (SDN) to enable intelligent, automated control of fiber arrays.

SD

N allows dynamic provisioning of network paths, differentiated services, and real-time flow detection, supporting cloud-network convergence and deterministic service experiences.

Intelligent SD

N layers provide northbound interfaces to expose network capabilities to enterprise users, enabling flexible and scalable network management (H3C).

Overcoming Non-

Technological Barriers

Deploying AI-powered fiber networks also requires addressing non-technological challenges, such as legacy infrastructure, cost constraints, workforce expertise, data accessibility, and regulatory standardization. Overcoming these barriers ensures that machine learning models for network optimization, quality of transmission estimation, and optical performance monitoring can be effectively deployed in real-world carrier networks (Tsinghua University).

Workflow Summary

Data Consolidation: Integrate GIS, OSS/BSS, CAD, and field data to create a unified network dataset. AI-Driven Route Optimization: Use machine learning to generate multiple viable fiber routes, balancing cost, risk, and performance. 3D Validation: Apply LiDAR-based models to verify constructability and detect potential conflicts.

SD

N Deployment: Implement intelligent SDN control for dynamic provisioning, service differentiation, and real-time monitoring. Continuous Feedback: Loop field data back into AI models to refine future network designs and operational strategies.

Benefits

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Reduced deployment costs and construction reworkOptimized fiber utilization and network performanceScalable and repeatable design workflows for FTTH, FTTX, and backbone networksEnhanced operational efficiency through automated SDN controlImproved compliance with regulatory and standardization requirements By combining AI-driven design, GeoAI/LiDAR validation, and SDN-enabled automation, carriers can achieve a highly intelligent, customized, and scalable fiber optic backbone network capable of supporting modern cloud, 5G, and smart city applications.

Article Content

Revolutionizing optical networks: The integration and impact of large ...

This article provides a comprehensive survey of current automation approaches in optical networks, including software-defined networking (SDN), intent-based networking (IBN), machine

DCI Backbone Network Solution

Huawei''s data center interconnect (DCI) backbone network solution meets the requirements in the cloud era and provides customers with backbone networks featuring high capacity, long-haul transmission,

National Optical Backbone Network

South Africa''s national broadband infrastructure company Broadband Infraco (BBI) has partnered with Huawei to build a national intelligent all-optical backbone network.

Optical Fiber Technology | Artifical Intelligence for Optical Fibers ...

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As the telecom industry advances toward 5G, edge computing, and hyperscale cloud connectivity, the optical transport layer—often the silent backbone of the network—must evolve from

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Engineers recorded information about fiber To construct the intelligent ODF system, optic ports on paper labels that they stuck onto Shaanxi Mobile had to transform existing ODFs

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Solutions for realizing AI-powered intelligent fiber-optic ...

The article highlights key non-technological impediments to the broad deployment of machine learning-based solutions in commercial fiber-optic networks and offers an extensive set of

Modular and Integrated AI Control Framework across Fiber and

This paper proposes a comprehensive and modular framework for AI controllers, designed to be highly flexible and adaptable for use across both fiber optical and radio networks.

Transforming Networks: Building an Intelligent Optical ...

This project develops machine learning-driven optical network architectures to meet future demands for ultra-high capacity, resilience, and energy efficiency.

Harnessing AI for Smart Fiber Rollout Lifecycle Management

The integration of AI and ML into fiber optic network design and management transforms these systems into highly efficient, responsive, and customer-centric networks.

A Guide to Fiber Optic Network Planning and Design

Comprehensive tools and fiber optic management software are essential for achieving end-to-end network lifecycle management. These tools facilitate physical network asset planning,

Using Artificial Neural Networks to Evaluate the Capacity and ...

A possible solution to address the enormous increase in traffic demands faced by network operators is to rely on multi-fiber optical backbone networks. These networks use multiple

What Is a Fiber Optic Backbone Network and Why for

Do you know what a fiber optic backbone network is? It may sound like a hard term, but, it is actually quite impressive. Read our blog to find out why.

World Bank Document

Modern broadband deployment can take many forms—diferentiated by reach (that is, wide area and local area networks) and technology (for example, optical fiber, copper wire, mobile cellular, Wi-Fi,

Optical Fibre Infrastructure

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Optical Fiber Backbones Figure 2.18 depicts how an optical fiber infrastructure is used in a packet network; some of the terminology in this diagram is from the Internet, the currently most popular

DCI Backbone Network Solution

The end-to-end latency of a backbone network is the sum of the fiber latency and service processing and forwarding latency of devices. Huawei''s simplified network architecture with one-hop

Integrated sensing and communication in an optical fibre

A scheme of integrated sensing and communication in an optical fibre (ISAC-OF) using the same wavelength channel for simultaneous high-speed data transmission and distributed

National Optical Backbone Network Solution

The national all-optical backbone network solution leverages the high bandwidth, long distance, and high reliability empowered by Huawei''s advanced optical

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