

The ECSTATIC Project's Novel Sensing Approach

Combined sensing architectures for global tectonic and infrastructure modelling.

BIRMINGHAM, UNITED KINGDOM, March 11, 2025 /EINPresswire.com/ -- Optical communications networks are undergoing a transformative phase, driven by the dual demands for increased connectivity and real-time data acquisition. Recent developments in the field have highlighted the potential of integrating high-speed optical communication and sensing, offering an ambitious holistic approach to data acquisition, monitoring, and

network state analysis. There is now a real opportunity to transform the telecommunications networks, producing the enormous amount of data, into a globe-spanning distributed sensing system with applications ranging from environmental surveillance, such as earthquake and tsunami tracking, to infrastructure monitoring and anomalies detection. However, this requires reconsideration of the specifications of communications techniques, signal characteristics and devices, as well as system designs and architectures to realise the potential for exploitation in other contexts, thereby leveraging considerable value from the significant costs of network installation.

To address this opportunity, ECSTATIC will design and develop novel interferometry and polarisation-based sensing technologies that substantially advance the state of the art in vibration and acoustic fibre-optic sensing techniques in terms of reach, sensitivity, and localization capabilities, by offering a wide palette of effective solutions that can be tailored in different use cases, while guaranteeing the coexistence of the sensing signal with live data traffic. New light-based technologies will be integrated with advanced DSP and machine learning techniques enhancing their performance. Furthermore, the project will produce systems for real-time digital signal acquisition capable to detect and characterise environmental effects and monitor in real-time the properties of the communication channel - including its nonlinear



Image source: WireTechWorld

characteristics. These developments are essential for the envisaged real-world application of the ECSTATIC technologies and will enable monitoring of different events (natural events, mechanical vibrations, ambient noise, structural health) and channel quality (power, nonlinear effects, etc.) in real time.

ECSTATIC is a unique initiative that seeks to evaluate the most important fibre-optic sensing techniques in real-life telecommunication infrastructures, integrating high-speed optical communication with distributed sensing, offering real-time data acquisition, monitoring, and analysis. This integration promises to enhance the intelligent functionalities of ubiquitous optical networks, pushing the boundaries of what is achievable with traditional optical communication systems. At the end of the project, a thorough understanding of the capabilities, cost, and compatibility with telecom infrastructure will have been acquired to initiate standardization of fibre-optic sensing in operational network environments.

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