CableLabs
KYRIO | SCTE

Methodology for Intelligent Network Discovery (MIND™)

A reliable data foundation for artificial intelligence (AI) tools

Unveiling HFC Network Elements and Topology

In hybrid fiber-coaxial (HFC) networks, many elements don't have a way to communicate or report their identity, location, characteristics and health. Manual intervention by technicians is often required to gather and verify such information.

Potential applications of MIND include map generation and verification, fraud detection and more.

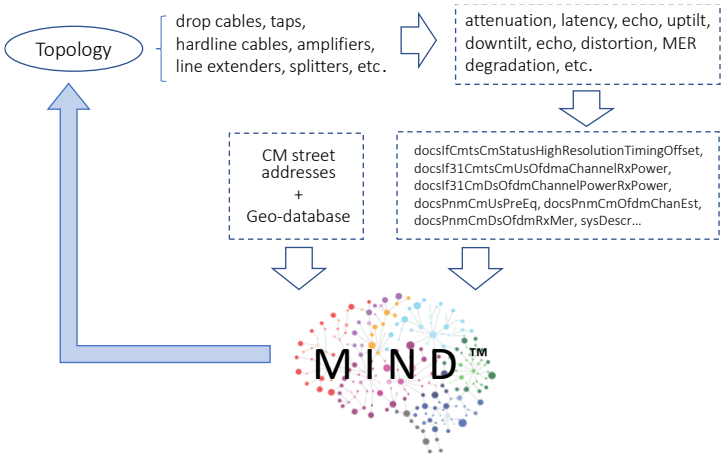
Logical Network Presentation: Making Data Work for You

MIND leverages multiple sources of information and tools—including DOCSIS®, proactive network maintenance (PNM), geodata, direct analysis and AI—to discover the HFC network elements and identifies the network's parameters, location and connectivity. This information becomes available in a logical format so that it can be used for numerous applications, including map generation and verification, identification and localization of network problems, fraud detection, what-if scenarios, 1.8/3+ GHz planning, device localization, on-demand network characterization and so on.

Geodata, PNM, RF and DOCSIS Feeding Intelligent Algorithms

The basic assumption in MIND is that an operator has a minimal amount of information available. This enables a universal solution when different pieces of information may be missing or have errors. To get started, we leverage the latitude-longitude information of an HFC network element used as an anchor point. The anchor point could be a fiber node, for example. We then leverage DOCSIS management information base (MIB) data of the cable modem termination system (CMTS) and cable modems (CMs) in the fiber node serving area being analyzed, and the physical street addresses associated with the CMs in the serving area. This information plus geodata that may be publicly available is needed to feed the intelligent algorithms in MIND and discover the HFC network. Additional information could allow faster convergence to a solution and greater confidence in the results.

Machine Learning Techniques



MIND information and analysis flow.

MIND takes advantage of the granular monitoring tools available in DOCSIS. In DOCSIS 3.1, new tools have been added (e.g., PNM), and many of these tools have much greater resolution. In traditional PNM, a network operator could detect network characteristics when there were problems in the network. In MIND, we must reach to the next level of sensitivity because we need to detect these network characteristics on a clean, healthy plant. This is why we rely heavily on machine learning (ML) techniques to detect features not apparent through direct analysis and observation of the management metrics. As the DOCSIS signals traverse the plant, they are impacted by the plant characteristics leaving an imprint or signature on the signals. It is the analysis and correlation of all these signal signatures that allow the discovery of the network elements, their connectivity and characteristics. To further enhance the knowledge of the network and to be able to discriminate one topology from another, geodata information and common network deployment practice information is included. This includes common practices of where pedestals are typically located, underground versus aerial deployment practices, etc.

Other Potential Applications

- Drop amps localization
- Fiber deeper planning
- Optimal efficiency configuration (highest modulation/Profile Management Application [PMA])
- Plant troubleshooting
- Small cells/hotspots deployment
- Accurate service level agreement (SLA) estimation
- Migration from as-built to as-is network data
- Network birth certificate (and acceptable deviation from it)

Watch the Demo Video

Click here to watch a demonstration of MIND on CableLabs' YouTube channel.

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