

# REINVENTING INTERNATIONAL DARK FIBER

BY FREDRIK HANE



As anyone who reads this publication knows, the explosion in data traffic around the world is pushing many fiber backbones to their limits. However, the surging demand for dark fiber, both on short-haul and long-haul stretches, cannot be explained merely as a function of increasing traffic volumes. Of equal importance is the fact that a growing number of heavy users of data communication – not just carriers and hyperscalers but also major corporations and other types of organizations – have come to demand a level of security, independence and overall control that only comes from having your own dedicated dark fiber, on top of which you install your own active equipment of your own choice over which you have total control.

In many places today, dark fiber is abundant on the local level, but along international stretches there is much less fiber than most people think. For example, in the Nordic region, an enormous amount of fiber has been deployed over the last fifteen years, extending to companies and consumers in both cities and the countryside, but during the same period international fiber build-out has more or less stood still. When Eastern Light built its new sea cable between Sweden and Finland two years ago, it was the first cable between the countries to be built in more than a decade, and the situation is similar for most international stretches in the region.

Stockholm-based Eastern Light is one of the players that has assumed the role of correcting the lack of long-haul international dark fiber infrastructure in its part of the

world. Eastern Light is a Swedish independent company that builds, owns and operates its own long-haul dark fiber infrastructure in northern Europe, and our expansion plans for the coming years include a number of new backbone stretches in this area, both on land and at sea, across the Nordic and Baltic countries, as well as Poland and Germany.

## THE BALTIC RING

One of our currently ongoing projects is the “Baltic ring”, the construction of a regional fiber optic sea cable system in and around the southern half of the Baltic Sea, built with the express purpose of providing international long-haul dark fiber along the most efficient routes between major data centers and key communication hubs in the region. The first part of this ring, Eastern Light’s new sea cable system between Sweden and Finland in operation today, goes from Stockholm in the west, to Kotka in Finland, 600 km to the east, going on shore at a number of locations along the way, including several addresses in Helsinki. The rest of this ring will be built in stages over the coming three-year period, and includes a new sea cable system south from Stockholm along the Swedish east coast to Copenhagen in Denmark and Rostock in Germany, as well as a sea cable system going south from Kotka and Helsinki in Finland via a number of locations along the Baltic and Polish coasts to northern Germany, where the systems will join to complete the ring structure and connect further inland through Eastern Light’s own land-based infrastructure.

## BEING INNOVATIVE ON THE DARK FIBER LAYER

Eastern Light has chosen to narrowly focus on the pure physical fiber infrastructure, and leaves the active services to be handled by its customers, so one may naturally ask – just how innovative is it possible to be when you work with something as basic as dark fiber?

Quite a lot, we have come to realize. Many of the features that are now at the core of Eastern Light's business are things that were not obvious to us when the company was first started. Instead, they evolved step by step out of our discussions with our first customers, which include some of the world's largest Internet companies. Throughout the planning and construction of Eastern Light's Sweden-Finland sea cable system, several of our anchor customers had very specific wishes and requirements as to how a modern cable system specifically built for the purpose of providing international long-haul dark fiber should optimally be built and operated. We listened carefully and made many of these suggested features an integral part of our standard offering going forward. The story of how we found innovation at the most fundamental infrastructure level is what I would like to share more about below.

## STAYING FOCUSED

One key insight was how important it was to stay really focused. In order to successfully build and operate long-haul international dark fiber infrastructure the optimal way, one has to have a razor-sharp focus and do only just that, and nothing else. For Eastern Light, the reasons behind this focus has been both technical and commercial. We wanted to build an infrastructure that was technically fully optimized for long-haul dark fiber, and we also did not want to get into a situation where we were competing with our operator customers by selling lit services to end customers.

## TERRESTRIAL NETWORKS AT SEA

One result of our focus on dark fiber is that all our cable systems are passive, i.e. non-repeated, and have a high fiber count (beginning at 144 fibers). Therefore, we build our sea cable systems so as to always go onshore at regular intervals, on average every 100 km, into the same type of ILA sites that are used on terrestrial routes, where our customers are free to install their own active equipment of their own choosing. In a sense, we are always building terrestrial networks, some of which just happen to go into the water from time to time between the ILA sites.

## RESISTING THE TEMPTATION TO MAKE DETOURS

Another major decision was to focus exclusively on the

long, international backbone stretches, and to deliberately stay away from everything in between the end-points as much as possible. This requires a lot of discipline and can be hard if you are used to building networks catering to a wide variety of customers distributed over extended geographical areas. In that case the ground rule is to always plan the route so as to pass by as many potential customers as possible on your way from A to B, but if your goal is to build the optimal long-haul system, you have to do the opposite and resist the temptation to make any local connections along your way. In the case of our cable between Sweden and Finland, our singular focus on creating the most efficient international route ended up cutting the fiber distance between Stockholm and Helsinki by around 20% compared to other existing routes.

## REACHING THE BEACH IS NOT ENOUGH

When we first began the planning of our Sweden-Finland system, we thought of it as a pure sea cable system, traditionally built from one beach to another. Behind the beaches we would build cable landing stations and connect to existing local land infrastructure, which our customers could then use to reach their final destinations. However, our first customers wanted something different. They made clear that they did not want to be left on a beach somewhere, but that it was important that we could deliver a completely new independent fiber infrastructure not only at sea but also on land, the entire way into the inside of some key data centers and communication hubs both in Stockholm and Helsinki. As a result of this, we adapted the scope of our business to include the local terrestrial connections – in the form of deploying entirely new independent ducts and fiber from scratch – into key data centers in the cities that we connect. This so as to be able to provide our own dark fiber seamlessly all the way from the inside of one data center in one country to the inside of a different data center in another country, without being dependent on any other last-mile supplier.

## TREATING PHYSICAL SEPARATION SERIOUSLY

Staying physically separated from other existing fiber infrastructure, for redundancy reasons, has always been an important matter of principle when building networks, but it is a principle that is in practice often difficult to live by every step of the way. Many new cables maintain separation for hundreds of kilometers along the main stretches, but then fail at the end by giving in to the temptation to share the canalization or trench with other cables the last little distance into the data center or in the pavement outside. Our experience is that these issues are becoming more of

a priority each year for demanding buyers of fiber infrastructure, and Eastern Light's customers encouraged us to go to extreme lengths to ensure full physical separation from other long-haul cable infrastructure, up to the last boreholes through the walls of the respective data centers. In Stockholm, the connection of our cable into one of the major data centers in this way – through a new and completely unique route – was only possible by digging through a neighboring property, which turned out to be a cemetery on the UNESCO world heritage list, something that gave us a whole new kind of challenge to navigate.

## HOMOGENOUS ILA SITES

Another area where we believe that we have been able to differentiate ourselves is our ILA sites. In order to attain the highest level of security and control, all ILA sites are located in premises wholly owned by Eastern Light, and we do not sublease space anywhere. All ILA sites are brand new and adhere to the highest security standards, and the fact that they are homogenous and identically equipped does in itself serve to provide additional security and reliability as well as convenience for our customers.

## NO CONNECTORS

Another way in which we have innovated over time is that we have completely gotten rid of all connectors and traditional ODFs. This is certainly nothing to recommend more generally, but for Eastern Light's purposes, as a pure long-haul dark fiber provider, this is both performance and reliability enhancing. For all the flexibility that comes from using long-haul fiber stretches made up of many separate parts stitched together through connectors and ODFs, every connector constitutes a potential source of error, and for the type of services that Eastern Light provides – long-haul dark fiber the most efficient way, point-to-point, between major international data centers – any connector along the way is just an unnecessary obstacle. We did not fully appreciate the importance of this issue until one of our first large customers asked for the total number of connectors between our sea cable landing points and the final delivery points inside the data centers. We were happy to answer that there would be no connectors anywhere, except for the usual ODFs in the ILA sites, from where each customer would use a short patch cable to their respective cabinets to connect to their own equipment. When this customer asked if it would be possible for us to take away also these last connectors and instead supply fully spliced fiber all the way to their equipment, we quickly decided to make this our new standard – no connectors anywhere, but only your

own, fully spliced fiber – from your own equipment in one city to your own equipment in a different city.

## FULLY SEPARATE INFRASTRUCTURE FOR ILA SITE OPERATIONS

Since Eastern Light is a pure provider of physical dark fiber infrastructure, most issues related to cyber security are handled by our customers themselves. However, one security aspect that we believe is often overlooked, and one that we have taken very seriously, is the security of our own internal data network that connects our NOC with the ILA sites. In other words, the internal data network that we use not just to passively monitor, but also to actively control the systems for power, HVAC, passage control, etc, in our ILA sites. Any outside malicious intrusion into such systems could have potentially disastrous consequences, and therefore we decided early on to have all such communication completely physically separated and disconnected from all other networks and systems. This means that we are using separate dark fiber pairs dedicated solely for the communication related to the monitoring and control of the ILA sites. Our systems to control them at our NOC are also physically separate and disconnected from other networks, meaning that there's an air-gap that makes it physically impossible for anyone to gain access to such systems from the outside.

What I have briefly outlined above are some of the basic principles that will guide Eastern Light's continued expansion in northern Europe going forward, of which the new sea cable ring in the Baltic sea is one part. Eastern Light foresees that the growth in demand for dark fiber will, on many routes, outpace the increase in bandwidth in the years to come, as a result of an increasing demand for control, security and independence which goes over and beyond the sheer traffic volumes. Eastern Light believes that a plurality of dark fiber routes, not just locally and nationally but internationally as well, is needed to enhance the robustness and security of the world's data networks and we are excited to continue to make our contribution to this development. **STF**



**FREDRIK HANE** is the co-founder and CTO of Eastern Light, and is a pioneer within fiber optic infrastructure in the Nordic region. In 1995, he co-founded the telecom and internet operator Ulfors which built the first large-scale private fiber network in Scandinavia, and in 1999 he co-founded fiber infrastructure company IP-Only. Fredrik has also worked for many years as an officer in the Swedish Defence within the area of satellite and telecommunication management systems, and in 2007 he was awarded by the Swedish king a silver medal as well as a monetary prize from the War Science Academy for his contributions in the telecommunication area for the country's defence.