Introduction
Fiber-to-the-home/Curb/Node/Premise (FTTX) is becoming an increasingly important distribution method for communications service providers. Although one of the more expensive access technologies to deploy, it offers an architecture that is flexible and scalable enough to deliver a combination of high quality broadband services to customers. This includes voice, internet, broadcast television and video-on-demand. Communications service providers are then enabled to meet current and future consumer demands while increasing their own average revenue per user (ARPU) and reducing customer churn.

New FTTX players are now entering into the communications market offering a business model and a bundling of these services to meet consumer expectations. The challenge for the traditional service providers is to deliver the same bundling and quality of service. Currently DSL is supporting their cause, but not without its own deployment costs as well as bandwidth limitations. So, many are beginning to evaluate and deploy FTTH as an alternative method of delivery.

Key Challenges
As demands increase for a “triple play” service, the challenge for communications service providers is to deliver voice, video and data via the same connection. FTTX provides this capability but deploying it requires new access network rollout. This takes careful network planning and design as several technologies can be used for FTTX. The most cost effective is considered to be based on Passive Optical Networks (PONs). Once the right technology has been selected, communications operators face the difficult prospect of rolling out the new physical infrastructure. They must also keep close control on the capital and operational expenditure required to support this activity.

Targeting FTTX rollout to achieve the highest returns also presents a challenge to communications service providers. This requires knowledge of the potential customer base. The same applies to sales and marketing as attempts are made to focus campaigns towards potential subscribers. As customer orders are received, the next challenge is recording and managing customer connections and provisioning the services quickly and cost effectively. Inevitably, problems occur in the network that will impact customers. Communications service providers will be judged by their customers on how quickly these network problems are managed and resolved and can be a key factor affecting churn rates.

Smallworld Solution
The Smallworld Network Inventory solution is focused on meeting the challenges facing communications service providers who are rolling out multiple broadband services over FTTX networks. This intelligent inventory solution provides a consolidated, cross-technology, end-to-end view of telecommunications networks upon which services are delivered to customers. This comprehensive and integrated view of the entire network combines the fully-connected inside and outside plant of the physical network with the connectivity and circuits of the logical network.

The planning and engineering of FTTX network infrastructure is supported by semi-automated design tools and engineering workflow within the Smallworld Network Inventory application. A detailed physical network model supports the layout of the fiber trunk and access network up to the optical termination points. A copper model then supports any xDSL customer connections, typically used for FTT/Curb/Node/Premise networks, including support for IP-DSLAMS at the optical nodes.
Whether the approach is to construct a point-to-point (P2P) network with active components or a Passive Optical Network (PON), the Smallworld Network Inventory product is able to support the layout of either network infrastructure.

Once the plans have been produced for the layout of the fiber-optic network, work orders are issued to the field engineers for construction. The scheduling of field engineers is managed via a workforce management system. A field information system is also available to document the as-built network actually deployed in the field. It also synchronizes the information back with the central network inventory system. As the network rolls out, fiber planners are able to manage the customer connections and circuits within the Smallworld Network Inventory application, allowing them to track the usage of individual fibers within the network.

Sales and marketing staff have access to the information in the Smallworld Network Inventory product allowing them to query customer and demographic data in context of the network rollout. This helps to determine the highest potential take up of services and to assist sales and marketing campaigns. Operations staff also have access to the same network information. The Smallworld Network Inventory product is an integral part of the Operations Support Systems (OSS) environment and provides valuable information to staff working in Network Operations Centers to help with the location of faults and to determine their impact on customers.

Benefits
Rapid return on investment can be achieved from the use of the Smallworld Network Inventory system:

- Reduced capital expenditure on network infrastructure through targeted build and better utilization of network resources
- Reduced operational expenditure through efficient planning and engineering and increased workforce productivity
- Faster return on investment for new network build due to targeted network expansion to areas of high demand/revenue
- Faster provisioning with fewer errors and reduced risk of failure due to accurate network data
- Reduced network downtime due to rapid and accurate location of faults in response to network alarms
- Reduced repair time due to rapid location of fiber breaks and faulty equipment
- Significantly improved customer satisfaction by meeting demand for services and reducing network downtime

Example Customers
Smallworld Network Inventory solution is used by global leaders in the communications industry to strategically control the deployment of their network. It can establish a “service ready” network that is in the right place at the right time to meet their customer’s needs. Examples of where GE Energy’s Smallworld Network Inventory is being used by FTTX operators to manage their network rollout include TriLink and Fastweb (case study below). TriLink is an operator based in The Netherlands deploying a dual fiber and copper access network. They use the Smallworld Network Inventory solution to design and manage their network architecture based on a new concept of blown fiber and blown copper.

The Smallworld Network Inventory solution is also used by leading MSOs as the critical support system for centralized FTTN inventory management. GE understands Fiber-to-the-Node network topologies and the associated operational demands a service provider must cope with to efficiently deploy and successfully manage.
the FTTH network in order to provide customer product bundles such as interactive video, digital voice and high speed Internet. The FTTH network, has afforded the cable MSOs both a technical and customer service advantage over the local exchange carriers in their markets.

Case Study
Fastweb has used the Smallworld Network Inventory application since the beginning of 2000 for the rollout of their high bandwidth “triple play” services using Ethernet over an optical fiber direct to the home. Today, the system is used in each of the network design centers located in the eight cities served by Fastweb. Milan is the main headquarters, and the largest of these offices, supporting both the planning of main transport network routes between the cities as well as the residential fiber network in Milan itself. The Smallworld system not only enables planners to determine the physical layouts of these networks, it is used earlier in the process to determine which areas that can be profitably served by fiber build. By using the Smallworld Network Inventory product for residential network planning, Fastweb has reduced the time taken to define the network and serviceable addresses from about one month to three days. And as a result of pre-provisioning residential addresses, Fastweb is able to respond to on-line placement of orders and offer their customers activation within a couple of days.

The Smallworld Network Inventory solution is also used by Network Operations at Fastweb. In the Network Operations Centers, the application supports a range of activities. Whether it is information needed about the fibers supporting a circuit, displaying the floor plans at POP sites, looking at splice information or viewing the fiber terminations at the cross connects, the information is available 24x7. The fault management process at Fastweb is also significantly improved by the use of the product in network operations. Where it used to take one or two days to identify the location of a fault, this is now achieved within an hour. The accuracy has also been improved. Prior to the Smallworld solution, faults would often be located incorrectly, resulting in additional costs for digging up the roads.

Since the initial deployment of the Smallworld system back in 2000, Fastweb has seen quantifiable benefits through improvements in their business processes. The system is now strategic to their business due to its flexibility as a centralized inventory management system, providing information to many different departments including planning and engineering, network operations, management and finance.