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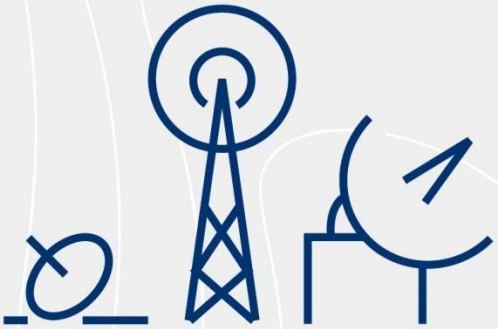


Opportunities for Education via SATCOM

Boundless Communications

Gilat

Introduction

In the field of education, a communications network is essential for improving access for underserved communities. The question is – what technology makes the most sense for powering these networks?

In this paper, we will focus on the educational capabilities and opportunities offered by satellite networks and communications (SATCOM). We will explain the broad range of possibilities that open up as a result of utilizing a satellite network and the potential additional value to be derived. We will also demonstrate the solution offered by Gilat, and illustrate the implementation and other aspects, including various case studies.

Bridging the Digital Divide

The digital divide refers to the virtual borders that separate those who have broadband access from those who do not. SATCOM contributes significantly to bridging this gap.

SATCOM is especially suited to providing broadband access to remote and sparse areas. Other advantages are the reliable nature of its implementation and the speed with which it can be rolled out.

The practical upshot of connecting schools to broadband means that schools have stable and steady communication access. Students have an equality of access to knowledge, across a range of ages from kindergarten to college. Not only this, but a richer and more enhanced range of material is available for the benefit of teaching staff, and the data provided is more unified.

The path from broadband to increased GDP is easily traced. Local investment grows, and populations become upwardly mobile. Other benefits of connectivity further contribute to improved quality of life, including education, political freedom, eco-friendliness and health care. Once broadband coverage is viewed as inevitable rather than a first-world luxury, the viability equation changes.

When a VSAT modem is set up in a rural school, it represents an event far weightier than merely being a piece of equipment that transmits and receives a signal. When exposed to the wider world for the first time, the minds of students open; they recalculate the limits of what they thought possible. Exposure to a broad swath of ideas and cultures helps foster tolerance and a sense of belonging to the outside world.

Teachers also reap the benefits of connectivity. They gain exposure to the latest education materials and methodology, enhancing their skills and broadening their students' horizons. IPTV, videoconferencing, and Internet searching all become part of the educational toolbox.

Satellite technology plays a key role in closing the digital divide, largely by bringing distance learning to schools, regardless of geographic location. It enables schools in remote or rural areas to obtain similar educational materials and content via SATCOM, meaning that entire countries have a balanced approach to education, and commensurate opportunities. Gilat has implemented such systems in a variety of locations, including Colombia, Peru, Russia, Argentina and Africa.

What is a Satellite Network?

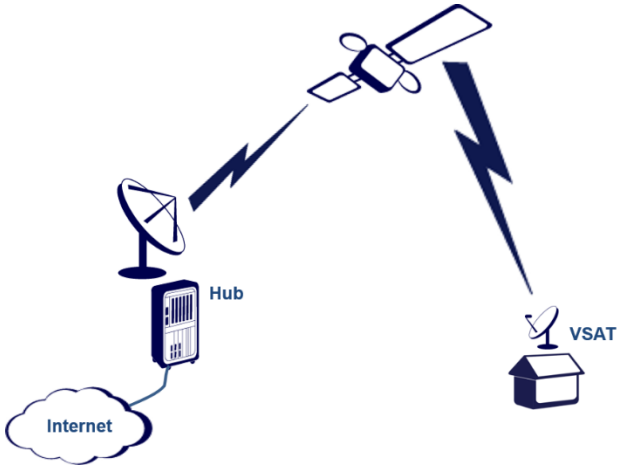
Satellite networks offer the ability to transmit and receive data from a relatively small satellite dish on Earth and communicate with an orbiting geostationary satellite 22,300 miles above Earth's equator. The orbiting satellite transmits (and receives) its information to (from) a teleport. The teleport itself is connected to a communications network, so all communication made from a satellite dish to the orbiting satellite will flow through the teleport before it reaches its destination (for example, the Internet).

The "Bent Pipe"

The satellite functions as a bridge in space, connecting two communication points on the ground. The term “bent-pipe” is used to describe the shape of the data path between sending and receiving antennas, with the satellite positioned at the point of the bend. Simply put, the satellite's role in this network arrangement is to relay signals from the end user’s terminal to the ISP’s gateways, and back again.

Global and Reliable

Today, satellite communication can deliver a terrestrial-grade experience with voice, video, and data that can be accessed anywhere in the world. Ubiquitous coverage can be obtained with a global network of multiple satellites all tying into one central network management system. Satellite networks are dependable, providing constant connectivity even when terrestrial networks fail. With satellite networks, service continuity is assured, with built-in redundancy and automatic back-up service.



Fast Deployment and Savings on Cost

Satellite technology is an ideal solution for quick deployment, immune to the challenges posed by difficult terrain, remote locations, harsh weather, and terrestrial obstacles. In this rapidly expanding market, satellite allows a service provider to get to market quickly and efficiently and provide immediate connectivity in disaster and emergency relief scenarios. Additionally, laying copper wire, coax cable or fiber optic cable is expensive, plus the cables themselves are prone to sabotage and theft. In light of these obstacles, it’s perhaps unsurprising that an overwhelming majority of consumer connections are mobile-based. Satellite technology can deliver a communications infrastructure to areas where terrestrial alternatives are unavailable, unreliable or simply too expensive.

Satellite allows service providers to insure scalability, profitability and maintain low operating expenses, all while overcoming a lack of existing infrastructure.

Satellite vs Terrestrial Networks

When designing a network, planners have three main choices to connect to the core network – fiber optic cable, microwave or satellite. The terrestrial solutions - fiber and microwave - represent substantial capital expenditures (CAPEX), are time-consuming and are often not feasible when spanning long distances or difficult terrain. Satellite, on the other hand, bypasses many of the logistical obstacles to deployment. As the network extends geographically further from the core network, the business justification for a satellite-based solution grows ever stronger.

While satellite has a relatively high CAPEX – mainly the investment in hub infrastructure – this is mitigated by several factors. One is the significantly lower operational expense (OPEX); satellite networks do not require regular cable and tower maintenance. Another is the advent of High Throughput Satellites (HTS). These multi-spot-beamed satellites are designed and optimized for broadband applications. In a typical deployment, multiple narrow spot beams cover a geographic area rather than the wide beams implemented in traditional satellites. By reusing frequencies, in a method similar to that of cellular networks, spot beam satellites provide much more capacity than standard wide-beam satellites. These satellites exponentially increase bandwidth availability, further reducing OPEX.

Some of the primary advantages of satellite over terrestrial data transport methods are summarized in the table below:

	Terrestrial	Satellite
Licensing	License needed per site	One license per country
Number of Hops	Multiple hops from end user to core network	Single hop
Portability	No	Yes
Deployment Time	Years	Weeks
Operational Expense	High	Low
Bandwidth per link	Dedicated	Dedicated or shared

With the flexibility to adjust bandwidth according to traffic patterns, to be deployed quickly and with minimal bureaucratic hassle or technical complexity, satellite networks are a winning proposition.

Until now we've compared satellite to terrestrial. But satellite has other advantages specific to education, particularly in rural areas that due to remoteness or terrain are not suited to terrestrial solutions.

SATCOM: Technology for Education

SATCOM allows you to utilize all the capabilities that broadband has to offer, including high-speed data, Internet, and voice, video and multimedia broadcast, conferencing and streaming. SATCOM networks have the inherent ability to transmit digital content to multiple sites at remote locations. SATCOM networks also have the advantage of being ideal for deployment in rural locations, further underlining the suitability of the satellite technology for ensuring enhanced educational solutions for all schools, regardless of location.

Because VSAT (satellite-powered) networks are entirely independent of terrestrial infrastructure, they can be expanded with ease and as fast as necessary. This makes it possible for a VSAT network for schools to begin at an initial pilot stage, connecting only a small group of schools, and then expand to a large-scale network encompassing many thousands of schools. This also allows governments to develop school connectivity projects within the initial budget constraints and to grow the project as soon as funds become available, without waiting for infrastructure to be built. In addition, VSATs can be easily redeployed as needed if demand patterns change.

The technological solution for education using SATCOM means that the range of pedagogic options available is greatly enhanced, comprising computer-based instruction, Interactive Distant Learning (IDL) and lesson streaming, digital schoolbooks and exams.

Since SATCOM networks are entirely independent of terrestrial infrastructure, SATCOM deployment can be installed and configured with ease and speed, incorporating a level of scalability for the network that renders it an ideal solution. Further to this, having a SATCOM network installed at school locations means that the infrastructure can serve optional additional e-government projects that require connectivity.

Bringing digital information to remote classrooms

All educational technology systems share a common goal: to bring digital information to remote classrooms.

The following table shows the purpose of the communications system in each of these cases:

Educational Technology	System Requirements for a Communication Network
Computer-based instruction	• Transmit digital instruction modules to schools. • Send software updates and new content.
Digital schoolbooks and exams	• Transmit updated content to schools. • Collect digital exam result statistics and summaries.
Interactive Distant Learning (IDL)	• Transmit live video broadcasts of the lessons to the schools. • Enable remote pupil interaction with the instructor.

Beyond the fundamental role of the communications system in supporting education, implementing broadband communications in schools serves as a platform for:

- Broadcasting educational TV channels directly to the schools
- Enabling pupils to participate in distance learning sessions
- Connecting the school to students, parents, and to the world at large
- Developing Internet literacy
- Accessing remote libraries
- Training teachers

Multicast

Satellite-based VSAT networks have the inherent ability to transmit digital content to multiple sites at remote locations without the need to duplicate the transmitted traffic. This capability translates into significant cost savings in networks where multicast traffic is required. Communications for schools is particularly suited to a multicast model. Here are some examples:

- Distance Learning systems allow curriculum equity throughout schools in all regions. These systems often broadcast live video of the instructor to several schools simultaneously. VSAT networks have this integrated multicast capability.
- Offline learning applications such as recorded video, podcasts and electronic learning material can be simultaneously uploaded to all of the schools in parallel via the VSAT using multicast transmission.

Caching

By caching frequently-used data locally, VSAT networks can reduce demand on bandwidth. An example would be downloading key data, such as the next day's lesson plan or an educational video, at off-peak hours, enabling faster access during peak hours, when school is in session.

Infrastructure for Additional Government Projects

Having a VSAT network installed at school locations can serve additional projects requiring connectivity, for example:

- **Elections** – polling sites are commonly located at schools. For countries that plan to deploy automated election systems, having a government-owned VSAT network in place the rural schools is highly beneficial. On Election Day, the school VSAT network can be used without investing in a dedicated network for the elections.
- **Telemedicine** – a VSAT network deployed at rural schools can also be used to enable the government to provide telemedicine services to rural communities in the vicinity of the school.
- **Government Portal** – the school network can be used to provide government services to remote rural communities as well as keeping them informed of important developments in health, agriculture, employment, economics and citizenship.

Gilat's End-to-End Solution

Enterprises, governments and operators that take on projects need to create a high quality efficient solution within a minimal timeframe. Organizations need to have access to up-to-date technologies required and have a dedicated team of professionals to support the logistic demands of the project. This is especially true for projects that involve connecting of many remote locations in rural areas. In these cases Gilat provides the organization with a full turnkey service for the management and deployment of the project, no matter how remote the sites. Gilat's skilled project professionals handle the project management, solution design, equipment procurement, installation and integration. Gilat delivers a fully operational system, including all subsystems, within the desired timeframe.

This model ensures:

- Project success
- Full control of budget and schedule – no last minute surprises
- Fast return on investment at minimal risk
- Receipt of a complete, integrated solution

Our professional project personnel, worldwide presence and local support enable us to successfully deliver large-scale turnkey projects around the world.

Gilat employs a group of skilled project managers, experienced in accompanying customers through all of the phases of a project. Our project managers work closely with the customer in understanding and clearly defining the requirements and the constraints. Gilat has acquired experience in large-scale rural projects which have required a great deal more than just delivering a technology. These projects involve designing customized solutions, provision and integration of multiple systems, development of management and monitoring tools, logistics, training and on-site support.

Gilat's Global Reach for Educational Projects

Our educational connectivity solutions span the globe:

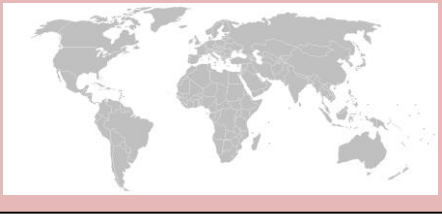
Brazil – 13,000 sites

Angola – National broadband network for educational infrastructure

Argentina – 16,000 schools

Mexico – 140,000 connected classrooms nationwide

Russia – Ministry of Education broadband-to-schools project

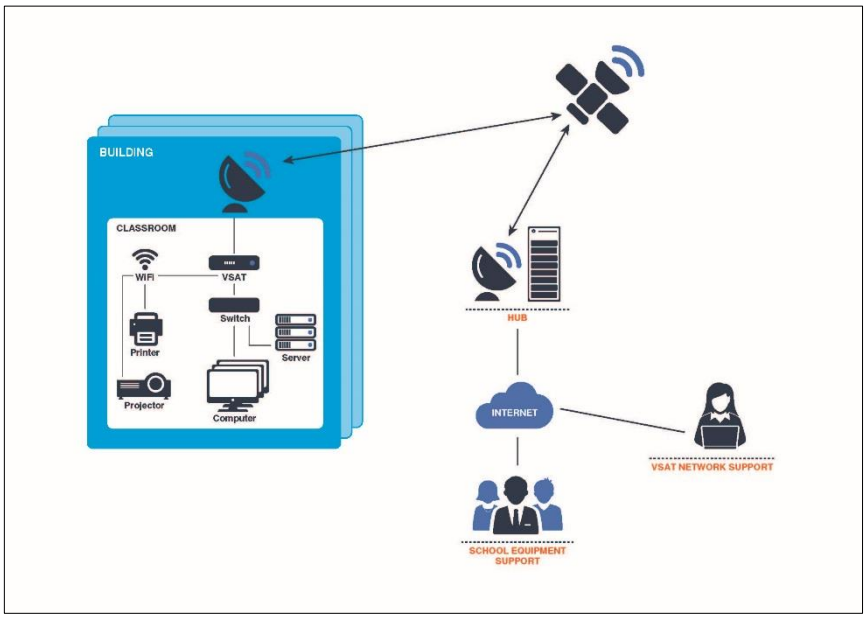


Solution design is a key factor in the success of a project. Creating a well formulated design and project plan is the best way to ensure that the system will be deployed on time and within the budget constraints. The design phase is a step-by-step process the first stage of which is analyzing and defining the solution requirements. Then the solution is broken down into subsystems (e.g. hardware, applications, communications, logistics, security etc.) and the available products are evaluated. The next stage is the system topology planning to reach the required number of units for the system. Then the most suitable products are evaluated, selected and finally tested to ensure that they meet the system requirements.

Implementation and Integration

Gilat's end-to-end solution includes installation and integration. This involves the delivery of a system that includes third-party equipment for various purposes such as connectivity, telephony, power, security and application and the development of management and monitoring systems that integrate the separate components of the system.

Typical Gilat Satellite Deployment for the Classroom



Case Study: Enciclomedia, Mexico

The Mexican government, through Mexico's Secretariat of Public Education (SEP), is investing in the future of the country's children by moving primary school education into the digital age, with the goals of providing access and inclusion regardless of location, physical limitations or social status, and raising and leveling the educational playing field for all of Mexico's children.

The Enciclomedia project is fundamental to SEP's advancement of Mexican primary school education. It is an interactive learning project begun with the goal of reaching every 5th and 6th grade classroom in the country.

The issues that needed to be addressed were that of schools in outlying rural areas, requiring modern infrastructure, coping with intermittent and inconsistent power, and being unable to afford the expense of Internet coverage.

> *"The integration of Gilat's flexible VSAT platform into a full wireless monitoring solution ensures we will achieve fast deployment and 100 percent coverage. It also provides additional, critical applications such as broadband Internet access and VoIP services. These attributes, combined with their industry-leading technology and extensive experience in the Mexican market, led us to select Gilat for this project."*
>
> Benjamin Aguilar,
> General Manager of Corporativo Lanix

In response to these requirements, Gilat provided a satellite communications solution that ensured rural needs were met, as well as achieving a quick deployment timetable in a cost-efficient manner. This solution had the lowest costs for both CAPEX and OPEX. A strong centralized hub and integrated multi-service VSATs provided for low CAPEX, while the inherent network's efficiencies allowed for low OPEX, especially in the critical area of satellite space segment usage. The VSATs were easy to install and maintain, ran the variety of

applications needed for the project, and were built and tested to high standards, adding additional savings due to long MTBF (Mean Time Between Failures) offering lower hardware and support costs.

Gilat developed a monitoring solution specific to the Enciclomedia equipment, utilizing two monitoring devices to poll the status of the Enciclomedia equipment. The system communicates via a Wireless LAN to the VSAT, thus eliminating the need to deploy LAN cables in schools. Both types of monitors communicate with a single VSAT per school, reducing the total number of VSATs needed. Another cost saving was found in Gilat's advanced power saving techniques, which enabled the use of smaller UPSs (Uninterruptible Power Supply), reducing the cost of the deployment without compromising functionality.

Satellite networking means full data and voice support regardless of terrestrial phone line availability. VoIP, inexpensively supplied via a standard telephone and a Residential Gateway (RG), provides instant assistance and support to solve problems in the field. The network enables quick, live support to the schools, helping solve technical problems and minimize downtime. It also means that teachers have regular and reliable access to *el Sitio del Maestro* (Enciclomedia's teacher portal). As an additional benefit, the Internet connection is also used by students for research and activities.

Gilat was able to work quickly to provide a custom solution for the consortium's SEP implementation. Along with the full system providing classroom Internet connections and teacher support via telephones, Gilat provides monitoring devices that inform the network operator about the conditions of classroom devices. Using Gilat's network, the consortium provided SEP with a solution that gives the Mexican government a clear path to the goal of an equal and quality education for all its country's children.

Facts and Figures

Number of schools: 16,000.

Number of classrooms: 140,000.

Number of children per school: Rural schools typically have approximately 20 students in a classroom, with one class per level. Elementary schools have six levels.

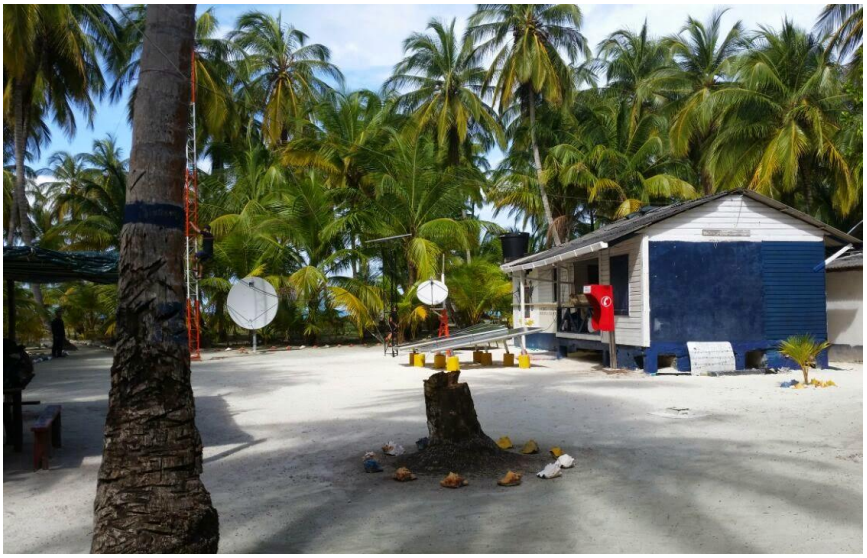
School network topology: Star

Purposes of connectivity utilized by the school: Mainly for internet access and monitoring remote devices.

Storage of content distributed over satellite: In a local server in the classroom.

Case Study: MinTic Kioscos Digital Vive Colombia

The Ministry of IT and Telecommunication in Colombia established a project to deploy and to operate 1,900 rural Internet kiosks, 98% of which are within schools. The purpose of this project is to connect rural Colombians to a variety of educational and governmental services that would otherwise not be possible, or require long and tiresome commutes across the country.



These kiosks provide a variety of electronic online communication services for the people of rural Colombia, including public telephony, faxes, scanners, printers and other value-added services that can be developed on site. These kiosks offer a lifeline to the local community, providing a stable connection that allows rural dwellers to avail themselves of a variety of services, but saving them long treks or unnecessary financial expenditure.

Kiosks are commonly deployed in rural schools, providing Internet connectivity to teachers and students during school hours, and to the community during the evenings and over weekends. Dedicated and proficient administrators, as well as regional supervisors, are charged with operating these kiosks on a day-to-day basis.

Deployment of the Solution

The SATCOM solution deployed offer comprehensive broadband access and IP prepaid telephony services, ensuring high availability, full compliance with SLA contractual requirements and efficiency in the utilization of space segment resources.

A proficient and experienced Helpdesk operated by the NOC, with well-defined processes to remotely handle connectivity issues and troubleshooting, ensures compliance with performance indicators and significantly reduces the number field visits and its respective costs. Concurrently, a QA unit handles the continuous and systematic control of performance, ensuring early detection and proactive correction of deficiencies.

A Turnkey Educational Project

This project was executed as a turnkey project. Approximately 1900 administrators were hired to maintain the day-to-day operation of the kiosks, education (both within the classroom and on a virtual level), social events and socialization of the program.

The benefits of all this included a highly reliable network with elevated availability and reliability, all of which enabled the customer to comply with the goals and objectives of the program, as defined by the Ministry of IT and Telecommunications:

- To provide at least one point of Internet/telephony access to all populated centers (villages) with more than 100 inhabitants countrywide.
- To support the Ministry of Education in enabling rural schools to carry out its educational programs related to IT assimilation

Summary

SATCOM, with its rural reach and ease of deployment, is inherently suited to bridging the digital divide. Our satellite-powered educational solutions translate these benefits into tangible results. We design, install, and operate your network, and provide service delivery management at every step along the way. As your single point of contact, we take responsibility for every aspect of project implementation.

Tapping into nearly 30 years of experience delivering broadband connectivity to schools, Gilat leverages its experience to estimate costs, offer technical solutions, and even suggest sources of funding. Our mission is to ensure that regardless of terrain, weather or geography, educational opportunity can be delivered anywhere.

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