

LAWFUL INTERCEPTION: A MOUNTING CHALLENGE FOR SERVICE PROVIDERS AND GOVERNMENTS



Executive Summary

Lawful interception is the legally grounded process by which a communications network operator or service provider gives authorised officials access to the communications of individuals or organisations.

The regulatory mandates for lawful interception have evolved over the years, but owing to international co-operation, far reaching standardisation has been achieved. Most countries in the world share the view that legal interception must be standards-based in order to achieve interoperability and smooth co-operation between the Police and operators and between the police forces of different countries. Standards also enable lower costs of products and ensure adequate data protection.

Most countries in the world have some sort of regulation in place that covers interception. We distinguish between heavily regulated countries and countries with emerging legislation. In all heavily regulated countries, network and service providers have a statutory obligation to ensure and maintain interception capabilities. They must be able to intercept all applicable communications of a certain target without any gaps in coverage, and they must provide a network to transmit the intercepted information to the Police.

Traditionally, lawful interception was straightforward and uncomplicated because it was confined to circuit-switched networks carrying voice traffic. Meanwhile, the communication patterns have changed. Today's lawbreakers have a wide range of sophisticated, encrypted communication channels available to them, and with the changing communication patterns, the scope of interception has widened. The trend is unmistakable: service providers will be required to support law enforcement and intelligence gathering with an increasing amount of data across the entire array of service offerings and technologies.

The challenges facing network operators and service providers are such that they cannot meet the fundamental requirements of lawful interception without dedicated lawful interception solution. From the perspective of the network operator or service provider, the primary obligations and general requirements for developing and deploying a lawful interception solution are: Cost effectiveness; minimal impact on the network infrastructure; compatibility and compliance; support of future technologies; reliability; and security.

In most countries, each operator will deploy its own lawful interception solution, but in countries with emerging regulation, where the individual operators have yet to build up (or upgrade) their interception capabilities, an umbrella systems makes a lot of sense. An umbrella system is a single, integrated lawful interception system that covers all or several operators in a country.

There are many valid lawful interception solutions on the market. The best way to introduce best practice is to partner with a solution vendor with many years of experience of designing and implementing lawful interception solutions. A good solution should interface with as many network elements as possible and support all standards. Operators should consider the long-term implications of the investment, as they will need regular updates and support and must adapt to future requirements. The long-term perspective makes it important to partner with a vendor to whom lawful interception is fundamental part of the product offering, and who is likely to be around in the long run.

Table of Contents

The “Lawfulness” of Lawful Interception	4
Standardisation and International Co-operation	4
National Regulation around the World.....	5
The LEAs and Interception Warrants	8
The Mounting Challenges of Lawful Interception.....	9
Changing Communication Patterns	9
Protection and Ethics	11
The Difficult Future of Lawful Interception	12
Managing the Cost of Maintaining Inception Capabilities	13
Using Technology to Address the Challenges.....	14
Meeting the Fundamental Requirements	14
Monitoring Networks with Dedicated Solutions	14
Umbrella Systems.....	18
Utimaco LIMS™, a Leading-edge Solution	19
Main Components of Utimaco LIMS™	20
Benefits delivered to Network Operators and LEAs.....	21
Conclusion	22

List of Abbreviations

3GPP	3rd Generation Partnership Project: A work group developing technical specifications for a 3rd Generation Mobile System based on the evolved GSM core networks.
AAA	Authentication, Authorisation, Accounting: A network server used for access control.
ANSI	American National Standards Institute
AP	Access Provider
ATIS	Alliance for Telecommunications Industry Solutions: A work group under ANSI.
BRAS	Broadband Remote Access Server
CALEA	Communications Assistance for Law Enforcement Act: A United States wiretapping law from 1994
CDMA	Code Division Multiple Access: A radio channel access method used by several mobile communication technologies.
CMTS	Cable Modem Termination System
CPU	Central Processing Unit
DPI	Deep Packet Inspection
ETSI	European Telecommunications Standards Institute: An independent organisation developing telecommunications standards to be used throughout Europe.
HI	Handover Interface
IIF	Internal Interception Function
IRC	Internet Relay Chat
IRI	Interception Related Information: Information pertaining to an on-going interception other than the communication content (incl. metadata).
ISP	Internet Service Provider
LEA	Law Enforcement Agency: National or local government agencies responsible for the enforcement of laws (e.g. police forces).
LEMF	Law Enforcement Monitoring Facility
LI	Lawful Interception
NWO	Network Operator
SORM	Система Оперативно-Розыскных Мероприятий (System for Operative Investigative Activities): A Russian law passed in 1995 allowing the FSB to monitor telephone and internet communications.
SSL	Secure Sockets Layer: An encryption protocol
SvP	Service Provider
TDM	Time-division Multiplexing
TLS	Transport Layer Security: An encryption protocol
TSM	Trusted Service Manager

The “Lawfulness” of Lawful Interception

“Interception” is an ancient concept – at least as old as the postal system – and we can safely assume that a systematic interception of messages will have been organised already at the time of the Emperor Augustus. Today, a modern scholarly definition of “lawful interception” is that it is the legally grounded process by which a provider of networks and/or communications services gives authorised officials access to the communications of individuals or organisations.

Standardisation and International Co-operation

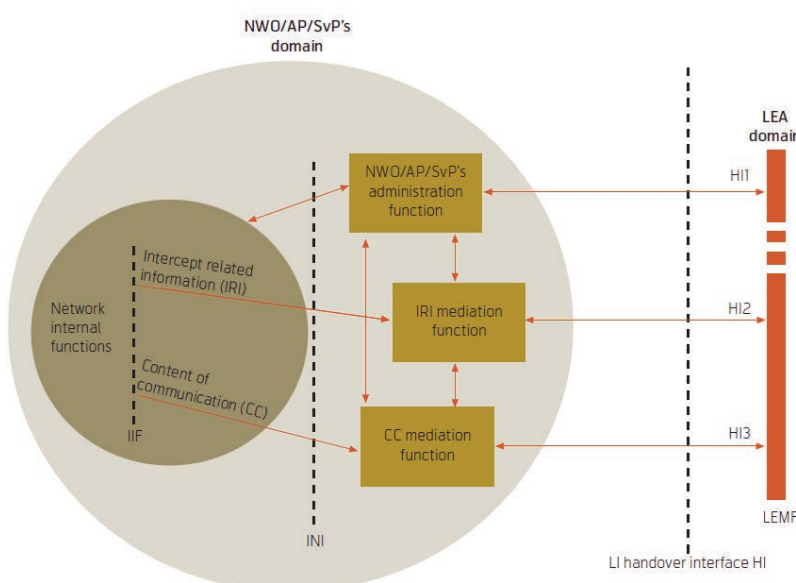
The United States were pioneers of lawful interception when the Omnibus Crime Control and Safe Streets Act was introduced in 1968. Since then, the Western countries have worked together to develop the LI concept. The European Council resolution from 1995¹ – which forms the basis of all modern EU implementations of lawful interception – was a result of European governments working together with Australia, New Zealand, Canada and the USA.

Owing to this international co-operation, far reaching standardisation has been achieved, and most countries in the world share the view that legal interception must be standards-based. Many standards have been adopted or emulated by many more countries than the ones that had originally sponsored their development. The international co-operation to define standards has had four objectives:

- Achieving interoperability and smooth co-operation between LEAs and operators as well as codifying the separation of duties between LEAs and operators;
- Enabling lower costs of products;
- Facilitating international co-operation between LEAs; and
- Ensuring adequate data protection

ETSI

The European Telecommunications Standards Institute (ETSI) enjoys a leading role in standardisation, not only in Europe but world-wide.



ETSI has been a major driver behind the specification of hand-over interfaces and of the flow that intercepted data should follow. It specifies a general architecture for lawful interception that allows systematic and extensible communication between network operators and LEAs over defined interfaces and in compliance with national legislation.

This general architecture applies to any kind of circuit- or packet-switched voice and data network.

¹ COUNCIL RESOLUTION of 17 January 1995 on the lawful interception of telecommunications (96/C 329/01)

Under the terms of the ETSI standards, compliance is achieved by meeting the requirements for all provisions of lawful interception, and, in particular, the requirements for the Handover Interfaces (HIs) to the LEAs. Mandatory compliance with this ETSI standard has been enacted in a number of countries.

3rd Generation Partnership Project (3GPP)

In addition to the ETSI specifications, a consortium of technology organisations called the 3rd Generation Partnership Project (3GPP) has defined the technical specifications for lawful interception in 3G and future mobile networks. The standards 3GPP TS 33.106-108, establish a compliance framework that has been embraced by many industry participants.

The 3GPP agreement, formalised towards the end of 1998, includes input from ETSI, the Association of Radio Industries and Businesses/Telecommunication Technology Committee (ARIB/TTT) in Japan, CCSA China, the Alliance for Telecommunications Industry Solutions (ATIS) in North America, and the Telecommunication Technology Association (TTA) in South Korea.

ANSI/ATIS

ATIS, the Alliance for Telecommunications Industry Solutions, which is a work group under the American standardisation institution (ANSI), has defined a number of interception standards that help network operators and service providers comply with CALEA – one of the four US laws that regulate lawful interception – passed in 1994 in order to help the US government foster interaction with network operators to make wiretapping easier. Solutions compliant with ANSI/ATIS standards provide a ‘Safe Harbour’ for the fulfilment of the LI obligations of the US network operators and service providers. This interaction was necessary due to the growth in new types of communications, like wireless phones and e-mail, along with rapid advances in technology. CALEA has been relatively successful and operators have been co-operative.

ATIS has published new standards for broadband Internet access and VoIP services, as well as updates to existing standards for voice and CDMA interception.

CableLabs (PacketCable)

PacketCable standards by CableLabs provide the standards for hybrid fibre-coax networks used by cable television companies to provide telecommunications services (e.g. internet access, VoIP). LI standards provided by CableLabs are the de-facto standard for these types of networks, predominantly in the Americas.

SORM

SORM-1 was a Russian system, established in 1996 to monitor telephone communications. It was replaced in 1998 by SORM-2 to allow the monitoring of the internet, in addition to telephone communications.

National Regulation around the World

The majority of the World’s countries have a legal framework in place that regulates interception. Often those legal frameworks consist of several acts of parliament, directives and other legal texts (in the USA, for example, there are four main laws).

Where lawful interception is heavily regulated, the regulatory mandates are fairly similar, whereas the situation for network and service providers is materially different in countries with emerging or no regulation.

Heavily Regulated Countries

In all heavily regulated countries, network and service providers have a statutory obligation to ensure and maintain interception capabilities. They must be able to intercept all applicable communications of a certain target without any gaps in coverage, and they must provide a network to transmit the intercepted information to the LEAs.

Reliability and integrity

The network and service providers must deliver precise and accurate results with the highest levels of data integrity. The interception capabilities must be as reliable as the service(s) to be intercepted, and all interception activities must be recorded and logged.

Separation of Intercepted Data

Communications data should be divisible into individual components; for example, the metadata included in the Interception Related Information (IRI) should be separable from the communication content (CC).

Transparent Surveillance

The target must not be able to detect that he or she is being monitored.

All countries allow legal interception in relation to serious crime such as murder, kidnapping and hijacking, to aid the police in investigating and construction a prosecution case. Most countries now also allow the monitoring of criminal behaviour, especially relating to suspected terrorism and mafia activity.

White-collar crime is an interesting case. Some heavily regulated countries (e.g. the USA) allow lawful interception in relation to computer fraud and financial offences; some countries (e.g. Italy) make widespread use of lawful interception to fight corruption; and others again (e.g. Russia) explicitly allow lawful interception to combat tax fraud.

Immediate Activation and Real-time Responsiveness

Following the receipt of a warrant, the interception, must be activated within a few hours, and the network and service providers must ensure real-time delivery of the intercepted data.

Sufficient Capacity

The network and service providers must have adequate capacity to handle the scope and scale of all warranted activities. The UK, for example, requires capacity to intercept 1 in every 10,000 subscribers.

Data Security and Privacy

Network and service providers must protect sensitive data during interception and transmission. They must safeguard an individual's records.

Decryption

Network and service providers must deliver encrypted content in plain text format if the encryption keys are available to them.

Other differences from country to country involve the communication services for which network and service providers must maintain interception capabilities. In Europe, the requirement is to intercept the access to the networks (circuit-switched or packet switched) plus some services (e.g. SMS, VoIP and e-mail), but not all kinds of other Internet services ... yet. It is up to the LEA to extract the application data (services) from the IP data. In Germany, a warrant typically remains in force for just 3 months, whereas a Swedish warrant can last 11 months. UK law stresses the responsibilities of the police forces and prevents most intercepted content from being used as evidence.

Countries with Emerging Regulation

Different countries have different political traditions in relation to privacy and the rights of citizens, but a complete absence of interception regulation is incompatible with a modern democratic society.

During the last few years, the rate of adoption of new technology in many parts of the world has exploded (in the Arab world, for example, the rate of adoption has doubled), but the legislative framework of those countries has not necessarily kept up.

This is now beginning to change. We are seeing a tendency for increasingly comprehensive regulation to emerge in countries that have not previously had any. Frost & Sullivan believes that this tendency will continue, because one of the main drivers behind regulation and standardisation is democratisation and an enhancement of the general democratic understanding of people around the World.

Where new regulation emerges, it follows international standards and established principles. Lebanon, for example, in 2009, implemented new lawful interception legislation “The Telecommunication Interception Act”. The Lebanese Act establishes that the interception of telecommunications requires a judicial or administrative decision. Namibia is an example of an African country that has recently done the same. The regulation follows the direction given by the country’s Information Technology Policy, published in September 2008, in which lawful interception features very prominently.

India is an interesting example of a country whose legislation is out of date. The Indian supreme court attorney and technology legal expert Praveen Dalal considers that India has no constitutionally sound lawful interception law, because telephone tapping is still regulated by a law that goes back to the days of British rule, the Indian Telegraph Act, from 1885. According to Mr Dalal, interception is possible without a Court warrant, and he does not consider the Information Technology Act from 2000 to be a constitutionally sound law to regulate e-surveillance.

There is growing distrust and anger in India regarding privacy violations and violations of other civil liberties, and the Supreme Court has dealt with the issue several times.

Africa is another region characterised by incomplete of regulation. Before the development of mobile communications, only the richest city dwellers in most African nations had access to telecommunication, but this picture has changed. Numerous mobile network operators and service providers exist even in the poorest countries, and modern communications have become much more accessible to people.

Frost & Sullivan believes that there will be many implications for lawful interception in regions such as the Middle East and Africa, not only because lawful interception regulation guarantees privacy and civil liberties, but because lawful interception is also a powerful tool against corruption and similar evils which are often the first targets of democratisation movements.

The LEAs and Interception Warrants

The right to privacy is enshrined in many constitutions and conventions. The European Convention on Human Rights (specifically article 8), for example, protects the individual against arbitrary interference by public authorities in his or her private or family life.

This principle is potentially at odds with lawful interception, so, in order to protect the individual, all legal frameworks define in detail what bodies can authorise interception orders and for what purposes.



In heavily regulated countries, there is complete legal and functional separation between the NWOs/SvPs/APs; the authorisation of interception orders; and the LEAs.

The legal test for authorising an interception order (viz. issuing an interception warrant) varies from country to country, and not in all countries will it be a Court that applies that legal test. In the United Kingdom, for example, interception warrants are in the hands of the Secretary of State, who, for domestic surveillance, is the Home Secretary of the day.

Heavily regulated countries will also precisely define what agencies (and what ranks of personnel in those agencies) are authorised to apply for interception orders.

The Police will always be able to apply, but many countries go further and include security services, secret intelligence services, inland revenue, other authorities of the interior ministries, border protection, customs authorities etc.



The Mounting Challenges of Lawful Interception

The requirement to assist the Police and other LEAs in their duties is not new. Call record retrieval in support of a subpoena is a common occurrence, and the US CALEA statute and similar laws in the European Union and elsewhere direct network operators and service providers to provide the content of communications (CC) and related information (IRI).

Criminal and terrorist activity of the past few years has hastened a widening in LEA powers. CALEA has been updated several times to recognise broadband and VoIP services and the scope of the required interception capabilities in the EU has widened even more.

The trend is unmistakable: service providers will be required to support law enforcement and intelligence gathering with an increasing amount of data across the entire array of service offerings and technologies. The need to intercept traffic, occasionally store the traffic, correlate it with subscriber data and quickly deliver it to an LEA will drive operational expense, causing network operators and service providers to reconsider their information management practices.

In Frost & Sullivan's opinion, governments also need to realise that it may be in their best interest to take responsibility for guaranteeing the lawful interception capabilities, rather than just piling requirements on top of service providers. There is no arguing that lawful interception is an incredibly powerful tool in the fight against crime, and numerous potentially devastating terrorist plots have been foiled thanks to intelligence gathered via lawful interception of telecommunications.

Changing Communication Patterns

Traditionally, lawful interception was straightforward and uncomplicated because it was confined to circuit-switched networks carrying voice traffic. LEAs would collect lists of numbers called and calls received by a target, and they would wire tap relevant fixed telephone lines.

Meanwhile, the communication patterns have changed. Today's lawbreakers have a wide range of sophisticated, encrypted communication channels available to them, and many of those channels rely on resources located outside the jurisdiction of the body issuing the interception warrant. With the changing communication patterns, the scope of interception has widened, presenting a real challenge to network operators and service providers.

Moreover, the use of anonymous services over the Internet (e.g. hotspots and internet cafés) and mobile or nomadic use of telecom services across national borders make it difficult to locate and intercept targets.

Addressing the Widening Interception Scope

In the previous chapter we saw how network operators and service providers must be able to intercept all applicable communications of a certain target without any gaps in coverage. Considering that modern telecommunications networks offer access through a tremendous range of technologies (including PSTN, ISDN, xDSL, WLAN, WiMAX, GSM, GPRS, UMTS, CDMA, cable, LTE and other IP-based technologies), eliminating gaps in coverage is a challenge.

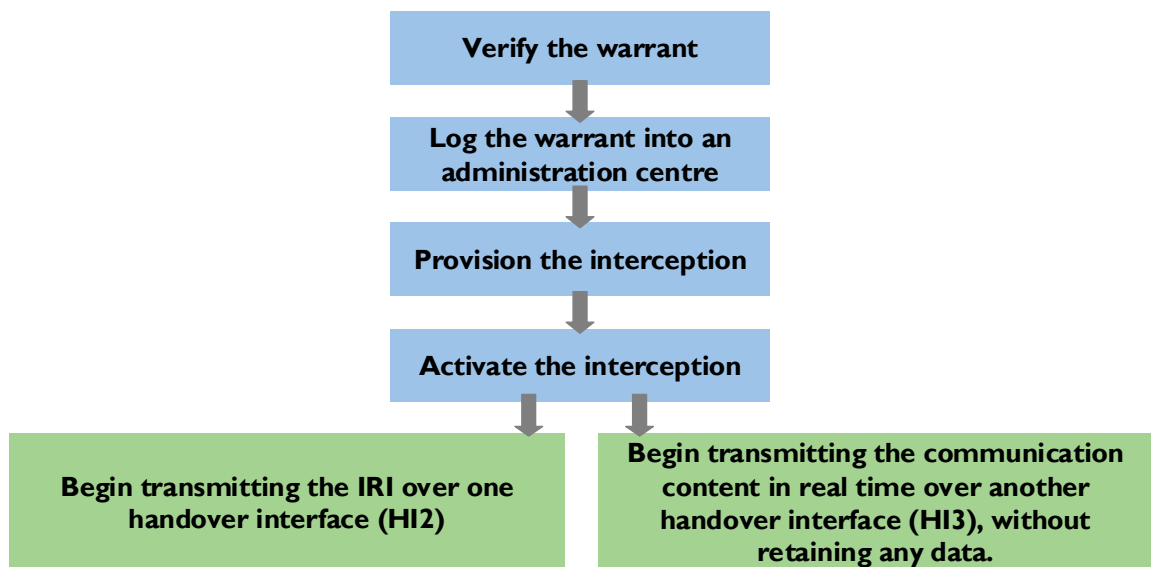
Most major network operators have always pursued a dual supplier policy in order to maximise their bargaining power in relation to the infrastructure vendors and to avoid excessive dependence on any one vendor. When network operators implement new communication technologies, the deal goes out to tender, and that often leads to the introduction of new vendors. Network operators may even award contracts for the expansion of existing networks to new vendors, because they are eager to take advantage of the aggressive pricing of emerging vendors. Consequently, most operators have highly heterogeneous networks across which to maintain interception capabilities. This, in itself, is a formidable challenge.

Networks aside, an even greater challenge is the surveillance of applications. In Europe, user IDs (e.g. Internet logins), VoIP and e-mail are covered by the regulatory mandate. Service providers must be able to decrypt the communication content and supply it to the LEA in clear text if the encryption is provided by the network operator or service provider, or if the provider has access to the encryption key.

Quality, Speed and Capacity

Despite the technical complexity, the network operators and service providers must deliver accurate and reliable content and related information.

What is more, there is little time to react and strict protocol must be followed. Once they have received a warrant, operators have less than a day (typically just a few hours) to:



At the expiration of a warrant, the operator must immediately deactivate the interception. Naturally, multiple interceptions will operate simultaneously, and everything must be concealed to the target and to operator staff not directly involved.

Network operators and service providers that fail to meet the requirements are fined by the authorities, and repeated shortfalls could even endanger their licences, as many countries write the interception requirements into their licensing criteria.

Protection and Ethics

Lawful interception is a powerful tool to fight crime, but it is an equally powerful tool to commit crime, if the necessary protections are not available.

It would be a big mistake to assume that interception only took place in countries that have a well developed regulatory mandate for lawful interception. In countries with no regulation, interception can be used by governments to secure power by spying on its citizens, not to prevent crime but to control behaviour. Although one could argue that network operators are not legally obligated to carry out interception when there is no regulatory mandate, local operators will not find it in their best interest to withstand political pressure, and the network operators are often under the effective control of the government apparatus.

Even in the so-called democratic world, illegal interception takes place, and it takes very little fantasy to imagine the damage that it can do to an individual.

The so-called “Greek Watergate” scandal which erupted in 2005, is one of the highest profile case of illegal interception in Europe. It involved 106 mobile connections on the Greek Vodafone network. The victims were high-ranking civil servants and members of the Greek cabinet². Four mobile switches (MSC) used by Vodafone were compromised, and 6,500 lines of rogue software code were installed directly on the switches, allowing the illegal interception to go undetected for a year. The perpetrators were never found.

The fact that Vodafone’s lawful interception solution did not include an interception management system was one of the reasons why the malicious tap was not detected earlier.

Vodafone Greece was fined a total of €95 million by the Greek authorities.

Elsewhere in the EU, it is alleged that one third of all interceptions carried out in Bulgaria are illegal, and the country is currently under investigation by the European Commission³. In England, Scotland Yard has reopened its investigation of the tabloid newspaper News of the World which has allegedly gained access to the voicemail messages of two private individuals.

Although maintaining lawful interception capabilities represents a cost to most network operators and service providers, not implementing the necessary data and privacy protection measures could represent an even greater cost. In addition to hefty fines, operators that fail to meet their privacy challenges leave themselves wide open to litigation which could lead to punitive damages and PR disasters.

² The Athens Affair, IEEE Spectrum Magazine, July 2007

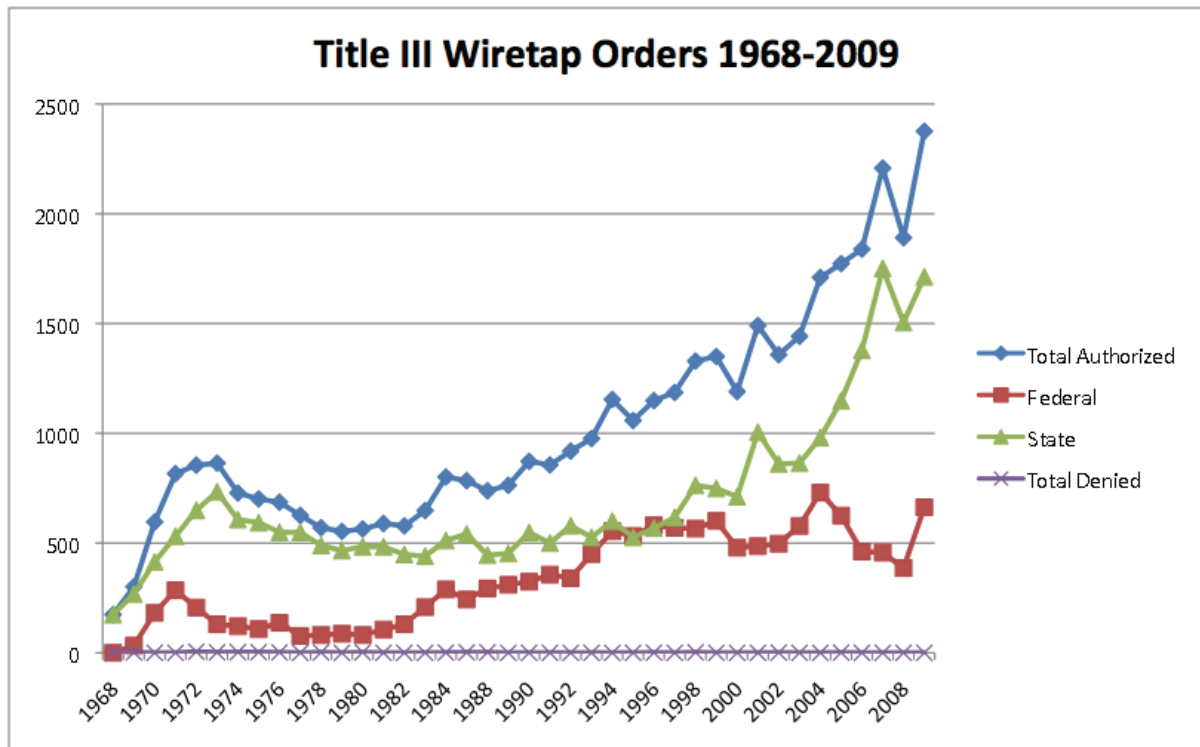
³ Dnevnik, 21 January 2011

The Difficult Future of Lawful Interception

Dramatic Increase in Interception Warrants

Other than dealing with the technological complexity of interception, network operators and service providers must address the challenge of the growing number of interception warrants which are issued.

In all the countries analysed by Frost & Sullivan, we recognise the same trend as illustrated by the Title III Wiretap Orders (interception of CC) from the United States:



Source: Administrative Office of the US Courts and Electronic Privacy Information Center, 2010

In Germany, the development is even more explosive: Between 1998 and 2007, the number of interception activities grew by 308%, and the share of interceptions targeting mobile connections grew from 59% to 89% exemplifying the changing communication patterns.

Frost & Sullivan is convinced that the number of interception warrants will continue to rise. Although the legislation of some countries provide relief for very small service providers, the challenge for network operators and service providers is that they essentially have no way of knowing how many parallel interceptions they may be called upon to facilitate at any given time. This means that they need to maintain significant over capacity, in order to deal with peaks.

The Delicate Position of ISPs

Frost & Sullivan believes that the future of government surveillance of its citizens will be based on the original CALEA act (and similar laws around the world) and will impact all new communications mediums and technologies.

Internet-based communications have become ubiquitous and have grown far beyond the basic capabilities of e-mail, and the nature of the Internet also suggests that new applications and innovative tools will be developed in the future to extend communication options in unpredictable ways.

What is fairly certain is that the development of the regulatory mandates will follow the communication patterns; and that the ISPs will find themselves right at the heart of that development. In other words, new regulatory requirements may have a bigger impact on ISPs than on network operators.

It is easy to imagine how the interception capabilities may expand to applications such as Facebook and Twitter; to peer-to-peer networks, chat rooms and instant messaging applications; and to low-cost voice communication through a variety of companies and emerging technologies such as VoIP (Voice-over-IP) and Skype.

Because the infrastructure on which those applications rely will typically be located outside the jurisdiction of a single country, updates of national regulatory mandates will need to focus on the one element which national legislation can control: the access. This puts the ISPs in a very delicate position, because the majority of the interception obligations will fall to them.

Considering that many ISPs are small companies that do not have the experience and capabilities of the large network operators to deal with lawful interception, the challenges are daunting.

Managing the Cost of Maintaining Inception Capabilities

In the United States, after CALEA was passed, Congress allocated \$500 million to subsidise the cost of implementing new interception-capable switches in the telecommunications infrastructure of the US network operators. With that money spent, the network operators and service providers must meet the infrastructure costs and the operational costs of maintaining the capabilities.

In the rest of the world, the situation varies from country to country, but the prevailing trend is that network operations and service providers must carry the cost burden themselves.

Lawful interception is a straight cost, not associated with any revenue stream whatsoever, at any point in time. The challenge is, therefore, to keep the costs as low as possible but not to accept shortcuts that might compromise the ability to comply with the regulatory mandate.

Using Technology to Address the Challenges

Meeting the Fundamental Requirements

As we have seen in the previous chapters, the challenges facing network operators and service providers are such that they cannot meet the fundamental requirements of lawful interception without using technology.

Routers and switches are intelligent, and theoretically it would be possible to manually provision an interception, directly at a router or switch and redirect a copy of the traffic from there. This was exactly what happened during the “Greek Watergate”, because the perpetrators exploited the interception-capability of the switches in Vodafone’s network.

If operators allow interceptions to be provisioned manually at a network element, they leave themselves wide open to abuse, because they are not able to perform consistency checks (i.e. verifying that the active interceptions exactly match the interceptions that have been warranted). This again means that those operators would be in breach of the regulatory mandates of most countries.

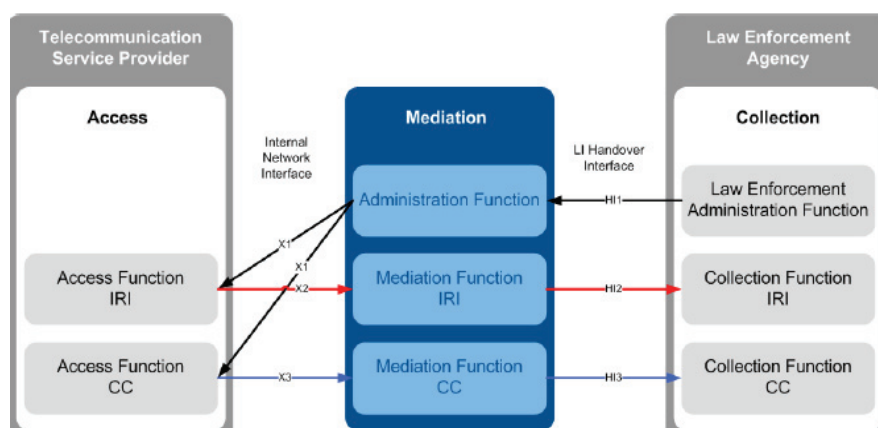
In reality, no real-world operator in a highly regulated country presumes to handle lawful interception without some kind of dedicated solution: it is simply not possible.

Monitoring Networks with Dedicated Solutions

There have been lawful interception solutions on the market for the better part of two decades. Some solutions are supplied by the network infrastructure suppliers, other solutions have been developed by independent software vendors and system integrators. Utimaco LIMS™, the dedicated solution we analyse in this whitepaper, was originally developed in the beginning of the nineties to help mobile operators fulfil their LI obligations. Since then, LIMS has continuously been extended to support additional network technologies and telecom services.

Key Components of a Dedicated Lawful Interception Solution

Most dedicated solutions on the market today are similar in architecture and functionality. The main difference lies in the ability to interface with network elements and in the business model proposed by the solution vendor.



The figure shows the typical functional flow of lawful interception on which the dedicated LI solutions are built.

A monitoring centre, staffed by LEA personnel, relies on standardised interfaces (e.g. ETSI or ANSI) to gain access to communications provided over fixed networks, mobile networks, and IP-related channels. The monitoring interface handles interception warrants, IRI and communications content separately.

provided over fixed networks, mobile networks, and IP-related channels. The monitoring interface handles interception warrants, IRI and communications content separately.

From the perspective of the network operator or service provider, the primary obligations and general requirements for developing and deploying a lawful interception solution are:

- **Maintaining cost effectiveness:** The solution minimises the time and effort involved in meeting the interception obligations.
- **Minimising impact to the network infrastructure:** The solution should not negatively impact the performance or behaviour of the network.
- **Ensuring compatibility and compliance:** The solution meets the requirements of national and international standards and is compatible with all network elements that make up the infrastructure.
- **Supporting future technologies:** The solution adapts to evolving standards and specifications as they are introduced throughout the world, and can scale to accommodate the bandwidth increases and performance requirements associated with increased service levels.
- **Maintaining reliability:** The solution delivers accurate results and maintains data integrity at every stage of the workflow.
- **Enforcing security:** At all points in the lawful interception system, data is protected against abuse. Surveillance activities are not detectable in any way by targets.

Active v. passive interception

We can distinguish between three types of interception: Active, passive and hybrid:

Active interception means that the interception solution is an integral part of the network infrastructure. The interception management system is able to directly control the network elements (e.g. the routers, switches) and to filter and retrieve the IRI and CC directly at the network node. The IRI and content are then sent to the interception management system, where they are mediated, and from there to the LEA monitoring centre.

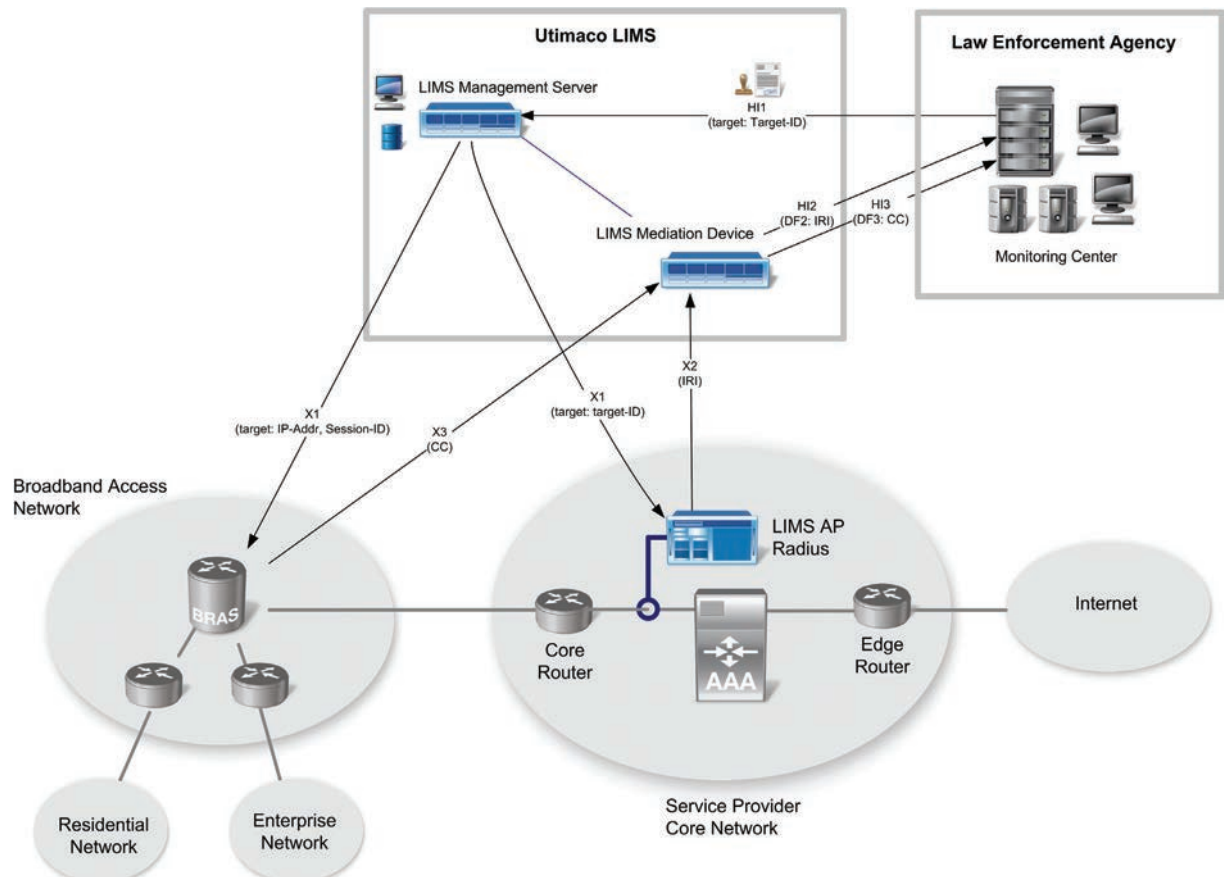
Passive interception means that the network elements transmit a copy of all network traffic to the interception management system. The filtering takes place on the copy of the traffic within the management system, the traffic belonging to non interception targets is discarded whereas the IRI and communication content of targets is passed on to the LEA monitoring centre.

Frost & Sullivan believes active interception to be the better option of the two, due to the lower capital costs and lower complexity involved. However, active interception is not an option when, for example, the network elements are not interception-capable. Also, active interception can have a negative impact on the performance of the network element that executes the interception function.

Hybrid Interception

As its name suggests, hybrid interception is a combination of active and passive interception techniques, and it is becoming increasingly common. In the figure below, we illustrate hybrid interception of the basis of the Utimaco LIMS™ solution.

Straightforward circuit-switched traffic on a network with modern switches can easily be intercepted using the active technique, because most telephone switches (MSCs) today support integrated interception functions. Most carrier-grade routers (e.g. BRAS, CMTS) also support integrated interception functions.



Despite the capabilities of modern switches and routers, there are many situations where passive probes are required. A good example of such a situation is the provisioning of an IP intercept. First, the user login must be detected at the central AAA server of the service provider. Seeing that most AAA servers do not support integrated intercept features, the active technique cannot be used. Another reason for using passive probes could be that access to the MSC or router is prohibited (because the LI system is run by another party).

In other words, when MSCs and routers are interception capable but the traffic that needs to be intercepted cannot be immediately identified (e.g. on the basis of a telephone number), then hybrid interception is the best solution. On an IP network, this would mean probing for the dynamic IP address of a particular target (using the passive technique); instructing the router to intercept traffic from that particular IP address (using the active technique); and relaying the traffic to the monitoring centre.

Monitoring Applications using Deep Packet Inspection

With the development of the communication patterns and resulting expansion of the regulatory mandates we discussed in the previous chapter, network operators and service providers can no longer meet their obligations without using deep packet inspection technology.

In an IP network, the packets that pass through a network are identified by headers. The network routers capture the headers, but it is not possible to identify the communication content or applications used by looking at the headers alone.

DPI is a technology that can be used passively to analyse IP traffic at the application level. DPI equipment consists of network elements that can control entire classes of traffic on a per user or per group basis, because they are able to read below the header information as packets pass through them. That is what the "deep" in deep packet inspection means.

DPI can look inside all IP traffic, drill into the so-called payload (the substance) of the packets, identify the applications used, pick out specific types of traffic (e.g. HTTP traffic), isolate a particular application (e.g. Hotmail) and then decode application attributes and content (e.g. webmails sent and received by the user). The same principle would apply to VoIP, peer-to-peer and any other traffic that would need to be intercepted. In other words, DPI can create clear-text records for various types of applications and protocols which are effectively not interceptable by the network nodes (routers and switches). It is also important to highlight that deep packet inspection is done in real-time (at full line rate speed).

Many ISPs also rely on DPI for other purposes, mainly to manage congestion and give privileges to certain types of traffic. Traffic shaping can be used to differentiate service levels and to create broadband subscriptions that might exclude certain types of traffic (e.g. video streaming or VoIP).



BT is a good example of an operator using DPI. According to BT⁴, deep packet inspection enables it to better monitor its network and to give priority to particularly important services. BT offers a VoIP and IPTV service in the UK. VoIP traffic needs to move quickly, and IPTV must always have a certain amount of bandwidth available to avoid distortions to the TV signal. BT accomplishes that using DPI.

When DPI is used for lawful interception purposes, additional features are needed (e.g. the correlation of information between protocol levels and the intermediate storage of connection status information) to identify and extract the relevant traffic. This is why most DPI equipment that was installed for traffic shaping purposes is not suitable for use in an LI solution. DPI probes used in LI solutions must be interception capable and be integrated into a

lawful interception management and mediation system.

DPI equipment can also be used to pick apart any unencrypted protocol including instant messaging, chat rooms, and even online gaming. Challenges still exist, however. Internet Relay Chat (IRC) and instant messaging are relayed through a third-party server, so the chat server is at the centre of the conversations. This means that the DPI equipment would only identify that Person A interacts with the IRC third party server, not that Person A communicates with Person B, unless Person B is also an active interception target.

⁴ Ars Technica, 25 July 2007

So, although DPI may be able to flag that some sort of suspect activity might be taking place, it is up to the Police to analyse the content received and to understand what is going on.



In Frost & Sullivan's opinion, although no one will dispute that lawful interception is a powerful tool, the real concern is whether or not the Police will be able to make sense of data it receives.

Communication data is difficult to interpret outside its operational context, and the LEAs might not understand that context. In other words, as communication patterns and regulatory mandates become more sophisticated, every LEA that receives intercepted data will need to become more sophisticated. There is a real risk that in-

sufficiently trained police officers will draw the wrong conclusions and, effectively, do more damage than good by orientating an investigation in the wrong direction.

Umbrella Systems

We said in the beginning that Frost & Sullivan would advise governments to take more direct responsibility for maintaining lawful interception capabilities, instead of just assuming that network operators and service providers will be able to meet the increasingly difficult challenges.

Certainly, many governments (e.g. in France and the UK) will pay a contribution towards the cost of lawful interception, but in many countries, a government-sponsored umbrella system would be an even better solution.

An umbrella system is an integrated lawful interception system that covers all operators in a jurisdiction (typically a country). An umbrella system is a model by way of which the network operators and service providers outsource their lawful interception activities to a third party, sometimes known as a "Trusted Third Party" or a "Trusted Service Manager" (TSM).

The element of trust is important because the operators must be confident that their legal obligations are being met, and because all operators and providers in the eco system must trust the same third party. This again means that the TSM must be once removed from the competitive environment of the country and not have stakes or other vested interests in any of the market players. Naturally, a government itself could very well be a trusted service manager.

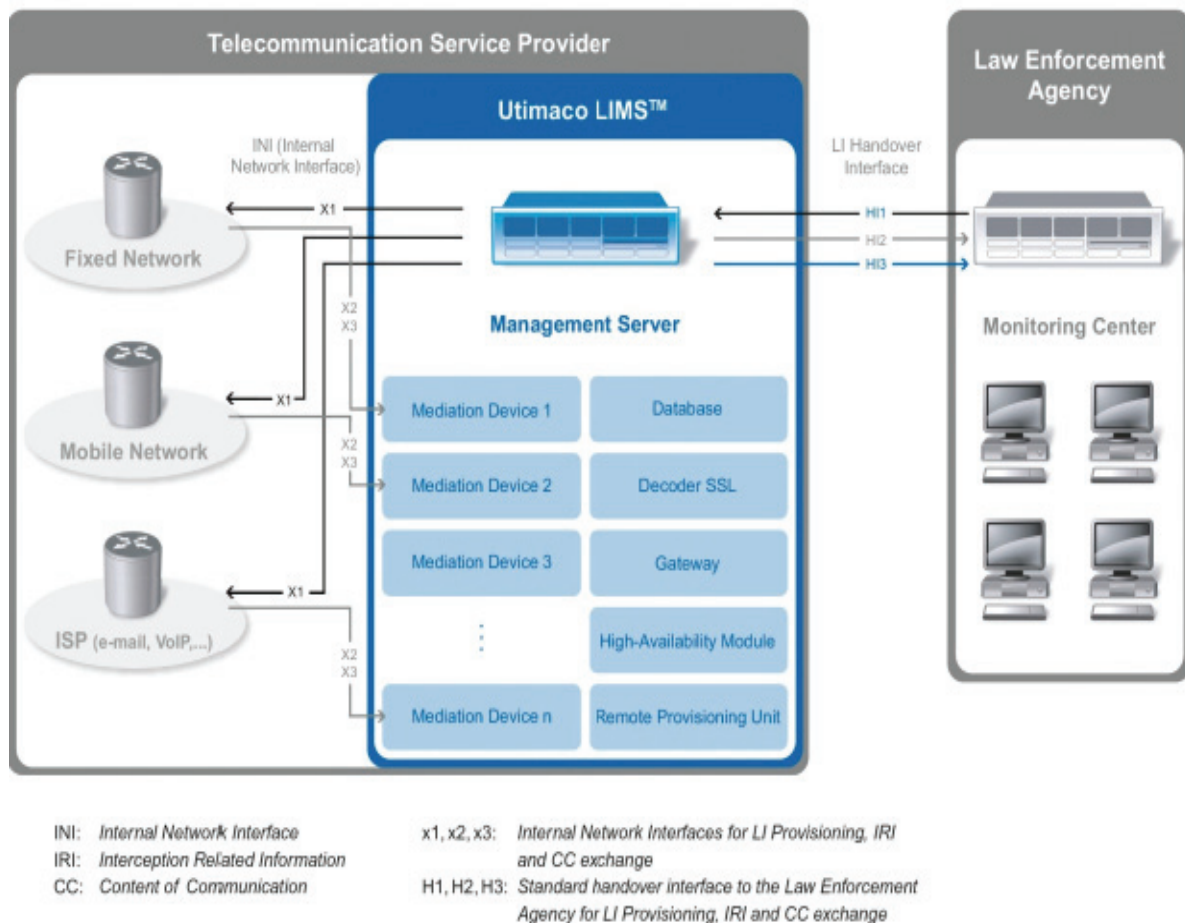
In Frost & Sullivan's opinion, umbrella systems make a lot of sense in countries with emerging regulation, where the individual operators have yet to build up (or upgrade) their interception capabilities. Many countries in Africa and Asia could benefit from umbrella systems, accomplishing a lawful interception "quantum leap".

Frost & Sullivan also believes that umbrella systems make sense from a capital and operational cost perspective, because establishing and maintaining a single lawful interception system will be cheaper than the combined cost of separate systems for each network operator and service provider. An umbrella system can be used by multiple LEAs, who manage their warrants independently of each other. Interception activities from different LEAs are segregated, and duplicated IRI and communication content are delivered to multiple LEAs in the case of multiple activities against the same target.

Utimaco LIMS™, a Leading-edge Solution

Utimaco LIMS™ is one of the most significant LI solutions available today, with more than 160 installations in service with operators around the world. In this chapter, we shall analyse Utimaco LIMS™ as a good example of a leading-edge solution.

Utimaco LIMS™ is a central management system for all tasks related to the lawful interception of telecommunication services in mobile and fixed networks. It is a software-based solution consisting of the elements shown in the figure below.



Utimaco LIMS runs on industry-standard servers with UNIX operating system. Customers can choose between small systems with a single CPU and medium and large-rack configurations with multiple CPUs and multiple servers.

The LIMS portfolio comprises purpose-built DPI probes (LIMS Access Points) that support real-time monitoring of broadband IP networks. The probes provide wire-speed scalability from 10 Mbps to multiple 10 Gbps, with the flexibility to filter IP traffic from link layer to application level. LIMS Mediation Devices enable the integration of DPI probes and network nodes of various kinds.

Utimaco LIMS currently supports over 250 different network elements and continues to develop new mediation devices and probes (respectively new protocol plug-ins for the DPI probes) to respond to emerging network technologies and upcoming lawful interception standards. Utimaco LIMS provides mediation in accordance with all major LI standards by ETSI, 3GPP, ANSI/ATIS, and CableLabs.

Main Components of Utimaco LIMS™

There are five main components of the Utimaco LIMS™.

LIMS Management Server

The Management Server is the core component of the LIMS system. It provides a graphical interface for all users of Utimaco LIMS to administrate, operate and audit the system. Key functions of the LIMS Management Server are the administration of intercepts, network nodes (IAPs), authorities and monitoring centres and users. The server maintains a central database to securely store all sensitive information, like target data, authority settings and audit logs.

LIMS Mediation Device

The LIMS Mediation Devices perform all tasks related to the delivery of intercepted communications to the LEA monitoring centre. Mediation encompasses the conversion and mapping of interception data received from the internal network to the appropriate formats, protocols, and interfaces as required by the LEAs. Sometimes intercepted data must be stored intermediately in the Mediation Device before it can be forwarded to its final recipient. Utimaco offers the industry's most comprehensive list of mediation devices supporting a wide range of technologies, services, protocols, and standards. There are LIMS Mediation Devices for more than 250 different network nodes of all major vendors. The delivery of intercepted data is compliant to various national regulations and international standards including CALEA, ATIS, ETSI, and 3GPP standards.

LIMS Access Point

The access points are the deep-packet-inspection probes. In passive interception, non-intrusive network probes are integrated into the operator's network to filter, decode, and forward intercepted data to the LIMS, respectively to the appropriate LIMS Mediation Device. Utimaco provides a range of network probes for all common telecom protocols and network types.

LIMS Gateway

The LIMS Gateway is a modular device that converts packet-switched calls to circuit-switched calls and vice versa. The media gateway is often needed in VoIP and next generation networks where the handover interface to the LEAs requires a TDM-connection. In addition to the media conversion, the LIMS Gateway can also act as a signalling gateway between SS7, ISDN/DSS1, and other protocols. The modular hardware concept enables customised solutions for small and large networks.

LIMS Remote Provisioning Unit

All of the Management Server's operator tasks can be accessed remotely in the same way, using the same graphical user interface and functions as from the local management console. The LIMS Remote Provisioning Unit ensures that the same security policies apply to both remote sessions and to local operation.

Benefits delivered to Network Operators and LEAs

Flexibility and Versatility

Utimaco LIMS™ can interface with some 250 network elements from a whole host of equipment suppliers. It has more interfaces than any other LI solution on the market today. Network operators are able to expand their networks and implement best-of-breed technology, without worrying about adverse effects on their LI capabilities.

Owing to its modular software and hardware architecture Utimaco LIMS can be modified to support upcoming network technologies and services. The system scales from small networks with only few intercept targets to large networks with tens of thousands of simultaneous targets.

Low OPEX and CAPEX

Utimaco LIMS reduces the operational costs of providing lawful interception services to LEAs by automating the interception processes and by using centralised administration.

Capital expenditure is minimised by using one single management system for many different networks and services. One LIMS can serve multiple tenants to support managed service models and MVNOs (Mobile Virtual Network Operator).

Certified Compliance

Utimaco LIMS has been tested for compliance with all common international LI standards from ETSI, 3GPP, ANSI/ATIS, and CableLabs. LIMS has been installed and certified in more than 60 countries worldwide. Utimaco has never failed to bid for a lawful interception deal due to an inability to comply with international or local standards.

Short Time-to-Market

Utimaco has been developing lawful interception solutions for more than 16 years. The LIMS system has been integrated and tested with network nodes of all leading telecom and Internet infrastructure vendors. For operators this means shortest implementation times at minimum costs.

High Security Standards

Having been a leading IT security company for 25 years, Utimaco has implemented highest security standards throughout the LIMS system. This prevents misuse and provides the legal certainty to network operators and service providers that they can live up to their LI obligations without breaching their privacy protection obligations.

Conclusion

The need for surveillance to combat crime and terrorism has never been greater than it is today, and the terrorists and other criminals have become extremely sophisticated in their use of today's communications technologies. For the police and intelligence agencies, this creates an urgent need to monitor and collect data from sources other than traditional circuit-switched voice traffic.

The regulatory mandates have expanded to interception capabilities for traffic that scarcely existed twenty years ago. No one is arguing that lawful interception is not a powerful law enforcement tool, but it does impose a huge burden on network operators and service providers. In this whitepaper we have shown that operator challenges are mounting and that many network operators and service providers will be struggling to meet their obligations.

In Frost & Sullivan's opinion, there is hardly an alternative to deploying a dedicated, complete LI solution. Without a complete solution, compliance can be a lot of work and there is an inherent risk of abuse and other failures to protect the privacy of the users. As we saw in the Greek scandal, it was the absence of an interception management system that made the illegal interception possible.

There are many valid lawful interception solutions on the market. To realise the greatest benefits from the investment, Frost & Sullivan recommends that network operators and service providers should also implement best practice (i.e. overhaul procedures and streamline LI operations) to keep the operational costs down. The best way to introduce best practice is to partner with an LI vendor with many years of experience of designing and implementing LI solutions.

Large network operators are likely to have highly heterogeneous networks. They are also likely to have several legacy LI systems in place, typically controlling different network elements supplied by different infrastructure vendors. Because most operators accrue no revenue from lawful interception, continuous stop-gap upgrades to the various legacy solutions at an incremental cost may seem like the obvious choice, but it may be the entirely wrong policy to pursue.

In the long run, and although the initial investment would be higher, Frost & Sullivan believes operators should consider migrating to a single, future-proof lawful interception platform.

Frost & Sullivan has analysed Utimaco's LIMS™ solution, and we are satisfied that it is one of the most complete and versatile solutions on the market today. We are confident that migrating to a single Utimaco LIMS™ platform or introducing a Utimaco LIMS™ solution for the first time would enable most network operators and service providers to meet their lawful interception challenges, now and in the future.

Utimaco LIMS™ is not unique in the marketplace, but Frost & Sullivan's believes that its strategy to focus on interfacing with as many network elements as possible and supporting all international and local standards does give it a competitive advantage. The decision to design Utimaco LIMS™ around commercial, off-the-shelf hardware adds to the flexibility of the solution and keeps the incidental IT costs down.

Network operators and service providers looking to select a lawful interception vendor should consider the long-term implications of the investment. They will need regular updates and support, and they will need to adapt to future requirements, so it is important to partner with a vendor to whom lawful interception is fundamental part of the product offering and who is likely to be around in the long run. Frost & Sullivan believes that Utimaco is one such vendor.

Beijing

Bengaluru

Bogotá

Buenos Aires

Cape Town

Chennai

Delhi

Dubai

Frankfurt

Kolkata

Kuala Lumpur

London

Melbourne

Mexico City

Milan

Mumbai

New York

Oxford

Paris

San Antonio

São Paulo

Seoul

Shanghai

Silicon Valley

Singapore

Sophia Antipolis

Sydney

Tel Aviv

Tokyo

Toronto

Warsaw

London

4 Grosvenor Gardens
London SW1W 0DH
Tel. +44 (0)20 7343 8383
Fax +44 (0)20 7730 3343

Oxford

Oxford Business Park South
Oxford OX4 2GX
Tel. +44 (0)1865 39 8600
Fax +44 (0)1865 39 8601

Frankfurt

Clemensstraße 9
60487 Frankfurt a.M.
Tel. +49 (0)69 7 70 33-0
Fax +49 (0)69 23 45 66

Paris

24, rue de Londres
75009 Paris
Tel. +33 (0)1 42 81 54 50
Fax +33 (0)1 42 81 54 52

Milan

Via Mario Pagano, 38
20145 Milano
Tel. +39 02 4651 4819
Fax +39 02 4802 7054

Warsaw

ul. Domaniewska 41A
02-672 Warszawa
Tel. +48 (0)22 390 4135
Fax +48 (0)22 390 4160

Silicon Valley

331 East Evelyn Avenue, Suite 100
Mountain View, California 94041-1538
Tel. +1 650 475 4500
Fax +1 650 475 1570

San Antonio

7550 IH 10 West, Suite 400
San Antonio, Texas 78229-5616
Tel. +1 210 348 1000
Fax +1 210 348 1003

Toronto

2001 Sheppard Avenue East, Suite 504
Toronto, Ontario M2J 4Z8
Tel. +1 416 490 1511
Fax +1 416 490 1533

About Utimaco

For more than 25 years Utimaco has been a leading global provider of data security solutions. Since 1994 Utimaco has been providing lawful interception systems for mobile and fixed network operators and Internet service providers. The Utimaco Data Retention Suite was introduced in response to the EU directive 2006/24/EC and at the request of telecom customers for integrated LI and DR solutions. With more than 160 installations in 60 countries, Utimaco is truly a leading supplier in the worldwide lawful interception market.

Utimaco participates actively in a range of standardization institutes and is an active member of ETSI (European Telecommunications Standards Institute) and various other associations like eco, VATM, Bitkom, Breko and the WiMAX forum. In this way, Utimaco participates in market developments and supports other members with its competence.

Since 1 July 2009, Utimaco Safeware AG has been part of the Sophos Group, a world leader in IT security and data protection with headquarters in Boston, US and Oxford, UK. While Utimaco data security products are now distributed by Sophos, the business units "Lawful Interception and Monitoring Solutions" and "Hardware Security Module" form Utimaco's operating businesses. For more information please visit <http://lims.utimaco.com>.

About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages almost fifty years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from 40 offices on six continents. To join our Growth Partnership, please visit www.frost.com.