



Quality of Experience Measurement

A New Solution for Service Providers to Improve Revenues and Reduce Costs



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Abstract

In this paper Epitiro explores how new Quality of Experience Measurement solutions can address the 'revenue gap' now facing operators as growth in traditional revenues decline.

Quality of Experience (QoE) Measurement is the process of understanding the actual performance of services, as delivered to the customer, for the purpose of ensuring those services meet customer expectations and requirements.

The benefits of effective QoE measurement include:

- Customer retention through increased satisfaction with services
- Increased consumer take-up of new discretionary-spend services such as pay-per-media
- Reduced operational costs through reduced customer complaints
- Efficiencies in capacity planning through increased knowledge

Traditionally, operators have dedicated significant resources to managing network Quality of Service (QoS). While QoS management remains necessary, it stops short of understanding the actual customer experience, leaving operators without critical knowledge.

Quality of Experience measurements are made at the point of delivery - directly from the subscriber' smartphone or PC. New solutions from Epitiro has made QoE Measurement possible and practical, on a very large scale, for fixed and mobile networks.

The paper highlights 3 key requirements for successful QoE Measurement;

Comprehensive KPI data collection - detailed individual technical performance metrics (data) needs to be gathered from the end user computer or smartphone

Business Analysis – Data needs to be analysed in a format that brings obvious benefit to decision makers.

Efficiency - The vast volume of data collected needs to be analysed swiftly in order that timely business decisions can be made.

Other topics include how to test QoE, who can benefit from the intelligence gathered and considerations for embracing Quality of Experience Measurement throughout a service provider's organisation.

Why Measure Quality of Experience?

Service providers and industry analysts acknowledge that with the communications market maturing, revenue opportunities and growth in profits will increasingly depend on the uptake of new services by the existing subscriber base.

Yet many of the new services forecasted to generate revenue are subject to discretionary spend, as opposed to being stable revenue secured from annual subscriber contracts.

To ensure maximum uptake of fee-based additional services, such as over-the-top IPTV, service providers need to look beyond traditional network management and adopt Quality of Experience Management practices.

Market Dynamics

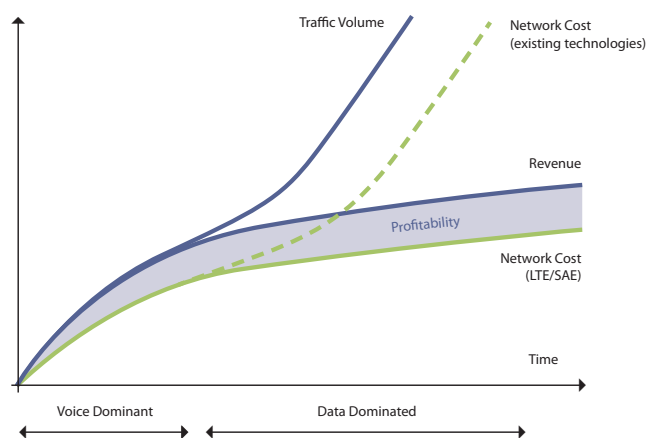
Two market dynamics are driving market changes for both mobile and fixed line operators;

- i) rising operational costs and
- ii) stagnating subscription revenue growth.

Rising operational costs are forecasted in both the areas of network infrastructure spend (Fibre, LTE and Backhaul) and customer support for both voice and data. Potential profit can be eroded if operational (OPEX) costs are excessive.

Further, subscription revenues for home and mobile broadband have peaked in value and are now under price pressure, as with any common commodity that is available from multiple vendors.

Clearly retaining the subscriber base and raising ARPU is desirable; two things made possible by effective QoE.



The cost per bit must be reduced for operators to remain profitable
Source: Nokia Siemens Networks

Raising ARPU with OTT

Operators are now looking for new sources of revenue such as over the top (OTT) services (e.g. pay-for-media). However, even ‘free’ OTT applications such as Skype, YouTube, BBC iPlayer etc. are only used by subscribers if the service is satisfactory. For operators to benefit from new pay-for-content services, assurances must be made to ensure acceptable customer experience is achieved.

That OTT pay-for services will be popular is in little doubt, according to evidence published by Sandvine. NetFlix is a new-era OTT service company that provides movies and other TV services for a monthly fee. Available in the U.S. and recently Canada, NetFlix traffic has displaced BitTorrent (known for providing ‘free’ movies) as the number 1 source of internet traffic in North America, during peak periods. The trend is clear that subscribers will pay for OTT services if they are successfully delivered.

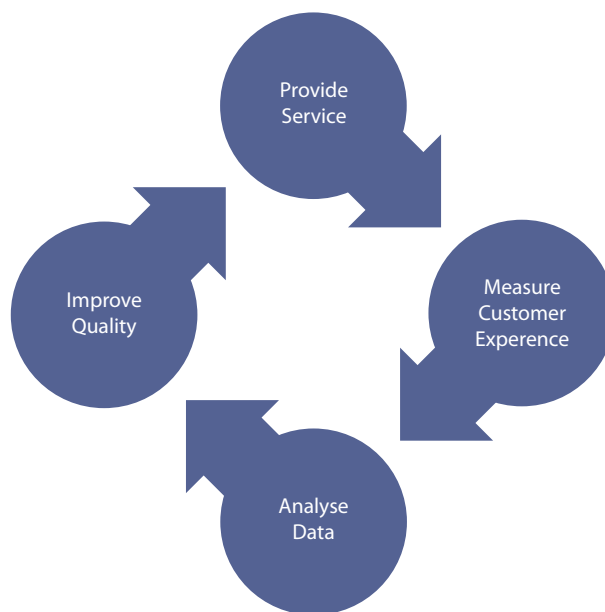
| Rank | Upstream | | Downstream | | Aggregate | |
|------|----------------|--------------|----------------|---------------|----------------|---------------|
| | Application | Share | Application | Share | Application | Share |
| 1 | BitTorrent | 52.01% | Netflix | 29.70% | Netflix | 24.71% |
| 2 | HTTP | 8.31% | HTTP | 18.36% | BitTorrent | 17.23% |
| 3 | Skype | 3.81% | YouTube | 11.04% | HTTP | 17.18% |
| 4 | Netflix | 3.59% | BitTorrent | 10.37% | YouTube | 9.85% |
| 5 | PPStream | 2.92% | Flash Video | 4.88% | Flash Video | 3.62% |
| 6 | MGCP | 2.89% | iTunes | 3.25% | iTunes | 3.01% |
| 7 | RTP | 2.85% | RTMP | 2.92% | RTMP | 2.46% |
| 8 | SSL | 2.75% | Facebook | 1.91% | Facebook | 1.86% |
| 9 | Gnutella | 2.12% | SSL | 1.43% | SSL | 1.68% |
| 10 | Facebook | 2.00% | Hulu | 1.09% | Skype | 1.29% |
| | Top 10 | 83.25% | Top 10 | 84.95% | Top 10 | 82.89% |

Source: Sandvine Ltd

What is QoE Measurement?

In the context of this paper, QoE Measurement is the practice of understanding how well a popular internet activity works from a subscriber viewpoint, then using that information to deliver a service that meets requirements in an efficient manner.

Quality of experience measurement looks at how well applications such as web browsing, emailing, VoIP telephony, game playing and video streaming perform as a whole, in the hands of the subscriber. Underlying key performance indicators (KPIs) such as throughput, latency and packet loss are certainly measured and analysed. However these are assessed in terms of their combined effect on the subscriber's experience.



How does QoE Intelligence differ from QoS metrics?

Quality of Service (QoS) management considers the network up to, but not including, individual subscribers. It's useful for understanding system-wide performance and 3rd party services which may include;

- DNS Resolution Services (3rd party service)
- Email services (3rd Party service)
- Traffic Management /Net Neutrality Policy

Quality of Experience Intelligence is analysis from the customer inwards. Quality of Experience mirrors the customer's actual experience in spite of how well (or poor) the core network handled the associated traffic.

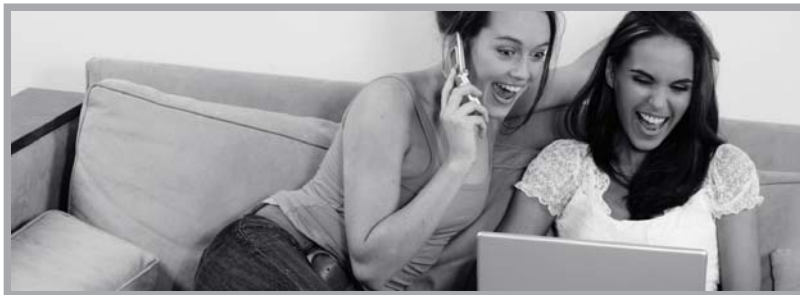
Quality of Service

“How well does the network perform?”



Quality of Experience

“Did the service meet customer expectations?”



What is the Effect of Unsatisfactory Customer Experience?

Service providers will inevitably be blamed by subscribers for poor experiences with the internet, whether the fault is on-net or a result of circumstances beyond their control. Worse, it's unlikely subscribers will complain about poor service – they will just leave.

An Accenture survey showed that 29 out of 30 dissatisfied customers never call to complain, and 90% of customers will not complain before defecting. Further, studies by EPSI (Extended Performance Satisfaction Index¹), which covers over 20 European and Asian countries, indicates that subscribers are growing slightly more dissatisfied with mobile and broadband services.

1: http://www.epsi-rating.com/images/stories/results/Press_EPSI-10_economy.pdf

How is Quality of Experience measured?

There are 5 areas to consider when measuring Quality of experience.

1. Measure at the Customer Device

Quality of experience must be measured at the ultimate point of delivery – the end user’s computer or smartphone – typically using an embedded testing app. The further benefit of using an embedded test app is that it can scale practically and rapidly across an entire subscriber base.

2. Test the Application as a Whole Experience

Quality of experience test scripts go beyond individual technical measurements to analysis of KPIs that affect an application. For example, to measure how well video streaming works, metrics such as packet loss, latency and jitter are subjectively weighted through a video quality algorithm to determine their combined effect of the actual customer experience.

3. ‘Real Life’ Traffic

The type of traffic used when testing quality of experience needs to be representative of the application being analysed. For example, analysis of VoIP performance cannot be taken from general TCP traffic, commonly used for speed tests. VoIP uses UDP traffic thus understanding its quality requires the use of this distinctive traffic during a test. While VoIP only requires very low bandwidth (speed), UDP traffic may be throttled by some ISPs.

Further more, when analysing a specific service such as BBC iPlayer, Skype or World of Warcraft, the signature of the traffic must be representative of that service, and performance needs to be considered under the load of real-life conditions. A simple ping measurement does not conclusively determine if a specific on-line game works well for a subscriber.

4. Flexible and Large Scale Deployment

Operators need to have the flexibility to rollout quality of experience measurement technology to selected groups or individuals, as required.

Ideally thousands of subscribers are monitored on a continuous basis in order to understand trends and proactively manage experience through demographic analysis. A panel of thousands of users is preferred to identify and categorise user types, and address any issues common to all. Easy-to-deploy, non-invasive data collection and retrieval technology is required.

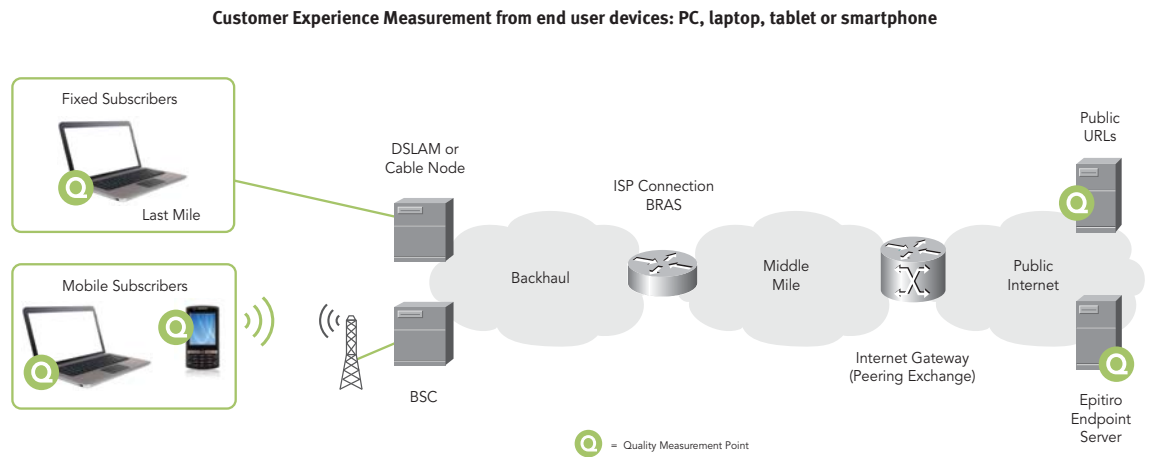
5. No Subscriber Impact

When using people as part of a test strategy consideration needs to be given on the impact the testing may have to their normal use of broadband services. The embedded test app needs to ensure it does not interfere with the subscriber’s ability to use their service or inadvertently compromise the subscriber’s phone or computer.

6. Test script design needs to consider the impact of data caps and battery usage for mobile panellists, or avoid appearing as an “unfair usage” subscriber through excessive P2P testing (for example) for fixed lines.

Who can benefit and how?

Numerous departments throughout Operations can use QoE intelligence to positively impact subscribers. Moreover, QoE intelligence enables more informed strategic business decisions concerning new services and infrastructure expansion.



| Who | Area of Benefit | Result |
|----------------------------------|---|--|
| Customer Support Agents | <p>Embedded test apps give subscribers the ability to self diagnose issues, which leads to reduced calls and increased first call resolution rates.</p> <p>Making the test apps available on a web page and promoting that option while a subscriber is 'on hold' in a customer support queue can immediately reduce the number of a calls.</p> <p>For callers that do require contact with an agent, agents can quickly see subscriber faults on their screens, acknowledge the fault and immediately action a remedy.</p> | <p>OPEX Saving Fewer repeat calls, less escalation, faster resolution of faults all result in less support resources being required.</p> <p>Revenue Assurance Many customers choose to churn during or directly after a negative experience with a Customer Support experience. Rectifying an issue during the first call will greatly reduce churn.</p> |
| Network Operations Centre | <p>NOC engineers usually have on-going indications that there are aspects of the network operating out of tolerance. Often the dilemma they face is choosing which faults should be prioritised for repair.</p> <p>QoE intelligence allows NOC staff to prioritise subscriber-affecting faults over general network faults.</p> | <p>OPEX Saving Resources can be managed efficiently, focused on subscriber-affecting faults. Unimportant faults can be delayed until resources are available. No need for overtime, outside resources etc.</p> |

| Who | Area of Benefit | Result |
|--------------------------------|---|--|
| Quality Management | <p>With QoE intelligence to hand, Quality Managers can now use a meaningful metric to ensure minimum quality levels are provided to subscribers.</p> <p>The ability to have this information means brand values are maintained, and discretionary spend OTT services are more readily adopted.</p> | <p>Revenue Generation Subscribers are more likely to receive a satisfactory service, purchase pay-per services and recommend the network.</p> |
| Marketing | <p>Quality of Experience intelligence provides marketers with the analysis required to create people-focused campaigns. “Our customers enjoy the fastest web surfing over any other major provider” may be a claim based on competitive insight through like-for-like performance measurement.</p> | <p>Revenue Generation Marketers can execute subscriber recruitment campaigns based on proof of superior performance to their competitors.</p> <p>Competitor advantages can be readily identified and steps taken to redress the balance.</p> <p>Business decisions can be undertaken to make Quality of Experience improvements compared to competitors, and promote the advantage accordingly.</p> |
| Capacity Planning | <p>QoE intelligence can assist operators in accurately predicting the need for adequate capacity. For example, the amount of wholesale bandwidth purchased can be done so to ensure it meets minimum subscriber quality targets. i.e. 95% of subscribers will always get a service of 2Mbps or more throughput the day.</p> | <p>OPEX Saving Without knowing the speeds being delivered operators have to over-spend on wholesale bandwidth.</p> |
| Infrastructure Planning | <p>Historical QoE data can be used for accurate forecasting of infrastructure requirements as a result of the introduction of new services, new subscribers (a new estate for example), or changes to policy etc.</p> | <p>CAPEX Saving Adequate but not excessive infrastructure can be added, as required, when required leading to more controlled CAPEX.</p> |

Visualising the Data

QoE data can be viewed at a network-wide level and then subsequently mined to understand further detail. It may be best illustrated by a typical example.

A network operator (fixed or mobile) wants to investigate dropped connections.

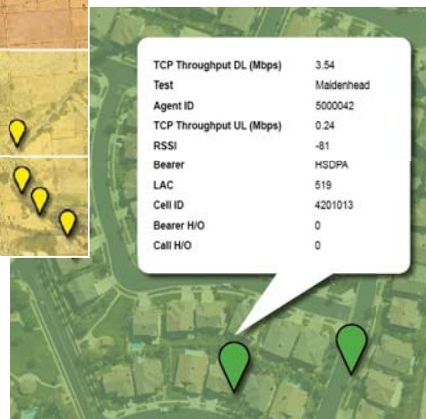
1. Initially a whole network view is taken, illustrated by the red grid tiles below (Step 1). Each red tile indicates a higher-than-acceptable rate of dropped connections is occurring.
2. Drilling down (Step 2) into a single tile shows the number of occurrences and the physical location of each subscriber.
3. Now, individual analysis can be taken on each subscriber to find out if there are common issues or a local network problem affecting these users.

This approach can be applied to fixed or mobile networks. For fixed lines it could be that their CPE needs upgrading, or there is a computer compatibility issue. If it were a mobile network being analysed the drops may indicate 'black spots'.

In either case quality of experience measurements can be used to proactively improve services.



Step: 1



Step: 2



Step: 3

Quality of Experience Data Analysis

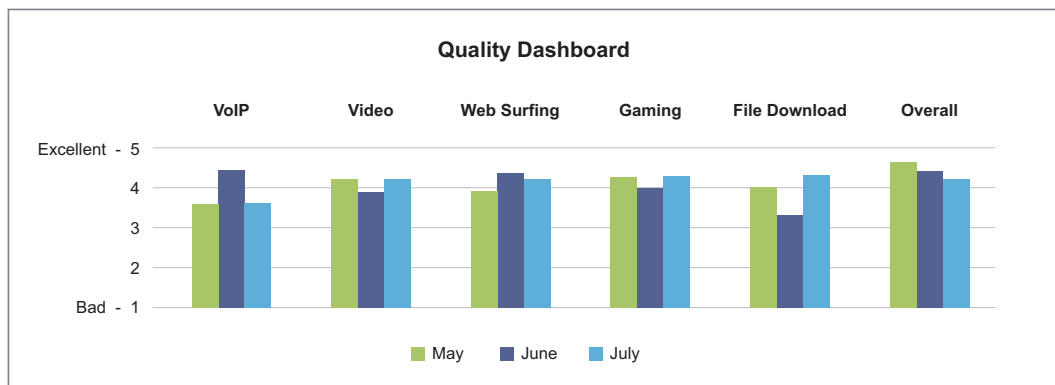
Analysis of the data needs to go beyond simple averaging to arrive at a view that reflects Customer Experience.

For example, technical QoS analysis usually reports packet loss as an average, in percent, over a period of time. The average packet loss over an hour may be very low at 0.5%.

However, packet loss normally occurs as a ‘burst’ where virtually all packets – over a very thin time slice – are lost. ‘Bursty’ packet loss results in lost video frames and dropped words in VoIP calls. Thus average packet loss may not be a meaningful metric whereas knowing the frequency of packet loss bursts would be quite informative as to actual customer experience.

The same could apply to a basic analysis of speed.

A trick question; ‘Which is better – an average speed of 8Mbps or 10 Mbps?’. The answer would depend on whether the question was from a customer experience or technical performance viewpoint. Customers may prefer a service that reliably and continuously provides an 8Mbps speed service. Yet they may complain about a service that unpredictably varies from being dead slow to lightning fast, but on average delivers 10Mbps.



Of course the main obstacle to analysing quality of experience data is handling the sheer volume of information collected from thousands of subscribers posting results. Specialist data storage and retrieval systems are required for analysis to be completed in a timely fashion.

What Factors Affect the Values of the Quality of Experience Analysis?

The main reason for measuring Quality of Experience is to obtain the Business Intelligence required to make swift, informed business decisions.

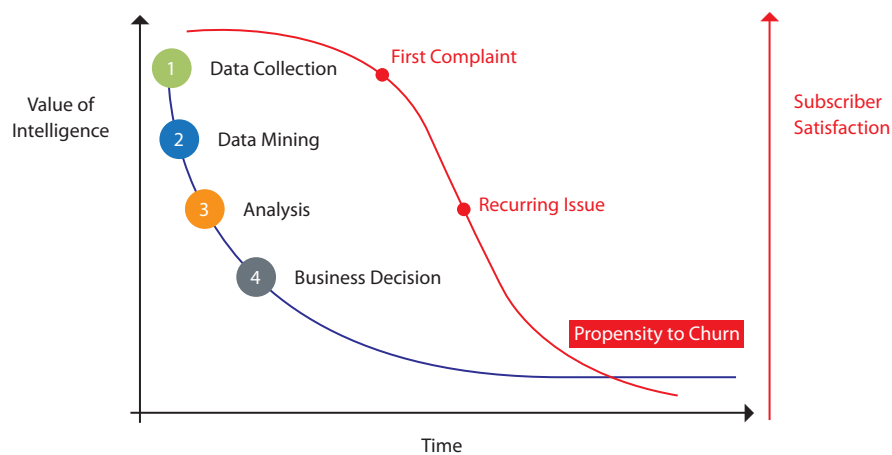
Thus the data collected needs to be relevant and of breadth that provides valid statistical and analytical insight. The analysis of the data and subsequent presentation needs to be meaningful to the eventual decision makers. Finally, the time it takes to collect and analyse the data affects the overall value of the intelligence.

Data + Integrity = Valuable Business Intelligence

Time

The illustration below shows the (blue line) process of quality of experience data being collected and analysed with a business decision ultimately being made against the (red line) decrease on user satisfaction and Propensity to Churn.

The time to proactively address the information, in this case 1st line support or Call Centre Agents, is critical. Early attention to issues can prevent Churn and also reduce the costs to manage recurring complaints, product returns etc.



Getting Started with Quality of Experience Management

Being customer-aware is not a new idea for broadband service providers who are driven by subscriber trends, demands and behaviour. Using QoE intelligence as a centre-point for managing business operations is an evolutionary step however, and the transition process needs to be considered.

Becoming customer-centric is a philosophy that best works top-down. Executive commitment to setting and meeting customer quality targets which can be simply and accurately measured is fundamental for supporting departments to in turn establish a new modus operandi.

Departments tasked with invoking QoE management practices then need to develop (or have developed) reporting processes that are applicable and add value to resolving the core challenges they routinely face.

Yet quick wins using QoE management can be expected. Service providers that have initially invoked programs in Marketing, Network Operations Centres or Customer Care centres have benefitted.

Regardless, the increasing importance of securing discretionary spend from subscribers will continue as traditional subscription revenues level. With new capabilities in data capture directly from the end user devices, service providers finally have a practical solution to realise the benefits of QoE Management.

About Epitiro

Epitiro provides quality of experience (QoE) intelligence and competitive analysis to leading internet service providers, mobile network operators and government regulators around the globe.

The company designs and implements data collection solutions that measure end-to-end performance quality of applications such as web surfing, file downloading, on-line game play, VoIP telephony and email reliability, in addition to technical key performance indicators.

Offered as a managed service with flexible configuration, Epitiro's QoE Intelligence solutions empowers clients to meet service assurance objectives and efficiently manage customer experience.

Founded in 2000, Epitiro is based in Cardiff, Wales, UK.

ipQ – The QoE Solution

ipQ is a scalable, end user device-based broadband measurement solution that allows network operators to 'see' IP service quality as experienced by fixed and mobile customers. Using embedded test apps that download to smartphones, tablets and PC's, ipQ provides real-time insight into the performance of services from a customer viewpoint. Performance data can also be collected using hardware probes from all key aggregation points within the network.

The results are gathered centrally and made accessible to operators for data mining and analysis via an on-line web interface, north-bound data feeds, fault alerts. Epitiro also provides bespoke analysis and reports.

For mobile networks, both radio (coverage) and IP performance is measured from Android-based smartphones or PC's equipped with dongles. No other solution available today matches this ability to understand all aspects of mobile broadband.

Fixed network operators can readily see 'past the CPE' and understand how services are experienced in the home to PC's that are wired or connected via WiFi. Used for network management or solving a single subscriber's fault, ipQ puts quality of experience data at your fingertips.

ipQ easily scales to provide national coverage and information about service quality that is out of reach with conventional testing and measurement methods. Offered as a full managed service, ipQ is truly a complete Quality of Experience and Quality of Service intelligence solution.

For more information see www.epitiro.com/products/ip

Epitiro (UK)

Epitiro House, 10/11 Raleigh Walk
Waterfront 2000, Brigantine Place
Cardiff CF10 4LN

Tel: +44 (0) 870 850 6563

