

[PRODUCT PORTFOLIO]

Platform: MONITOR MASTER

- Find problems before your customers do
- Get the diagnostics you need to fix them
- Keep services available



MONITOR MASTER STATIONARY TEST PORTFOLIO

YOUR NETWORK: THE CUSTOMER PERSPECTIVE

Understanding, measuring, and improving the quality of your network services is vitally important to keeping your customers happy and ultimately, subscribed. We all know this, but how can we achieve it?

The simple answer: Monitor Master. With over ten years of development and experience behind it and over 100 customers worldwide, Monitor Master is the best Quality of Service measurement and service monitoring tool on the market.

YOUR CHALLENGES

- You want to know your subscribers are getting a good service – and be able to prove it
- Some problems can't be detected from inside the network
- If there's a problem, you need to know immediately
- When there is a problem, you need detailed information to fix it – fast
- You need to monitor a wide range of services now and even more in the future

OUR SOLUTION

- Monitor Master for end-to-end monitoring, regression testing, content testing, roaming, and revenue assurance
- Used by regulators, operators, and content providers
- Active test probes run 24x7 to test any service on any bearer
- Supports LTE devices
- Provides detailed diagnostic information for root cause analysis
- Threshold-based alarms for automatic problem alerts
- Centralized reporting and data warehouse for short-term, long-term, and trend analysis reports

KEY POINTS

- End-to-end service monitoring
- Centrally managed
- Extensive bearer support
- Wide variety of services supported
- Multi-modal
- Central SIM server
- Highly flexible and configurable reporting
- Monitor your services from the most important viewpoint: the customer's
- Configure automatic alerts
- Forecast problems before they happen
- Adapt easily to emergent technologies without product upgrades
- Diagnose and resolve faults fast with detailed trace information
- Triple play, IMS, and convergence testing

MONITOR MASTER OVERVIEW

Monitor Master is a software and hardware product for measuring the end-to-end quality and user experience of wireless and fixed line data and voice services. Monitor Master forms part of Ascom's Symphony network testing product range, which includes mobile drive-testing and optimization solutions.

Flexibility

Monitor Master has been designed to be a highly flexible product. It has been used by our customers around the world for a variety of activities including large-scale revenue assurance testing, content testing, prelaunch multi-modal service testing and roaming solutions. Monitor Master is the perfect solution for all your testing needs.

Proprietary Hardware

The Monitor Master platform consists of stationary remote agents which run tests over numerous different types of wireless and fixed bearers (LTE, GSM, GPRS, UMTS, HSDPA, CDMA, PSTN, WiFi, or LAN). These agents can be situated anywhere in the world and are centrally controlled by the Quality Manager management system.

Central Management

Quality Manager provides easy access to test scheduling, test script editors, data warehousing, and reporting engines – a single point of access to control and benefit from the whole system.

SIM Multiplexing

Each modem in an agent uses a local SIM card or a SIM stored in a centrally located SIM server. Any SIM in the SIM server can be delivered to any one of the remote agents over an IP connection and used for testing. This approach allows SIMs and agents to be located in totally different countries or continents, with easy SIM management from a central location.

SUPPORTED SERVICES

Monitor Master supports a wide range of technologies and services available to your customers.

Monitor Master has been developed with flexibility in mind. It is not fixed in its capabilities or scope of testing, but can test almost any service and provide a wide variety of metrics and diagnostic information at the same time.

With its ability to simulate a user performing a wide range of activities on a mobile device, Monitor Master is the most comprehensive test and monitoring platform on the market.



VOICE

- Voice calls
- Voice quality PESQ
- Voicemail
- iPhone Visual Voicemail
- Ringback tones
- IVR/DTMF
- Voice over IP



MESSAGING

- SMS
- EMS
- MMS
- Instant messaging
- Email (POP3, SMTP, IMAP)
- Blackberry



DATA

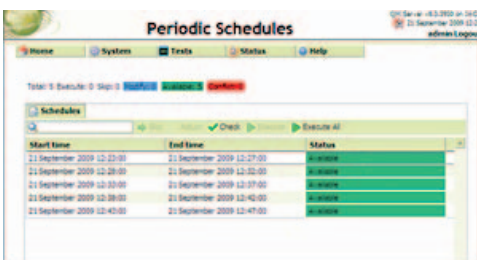
- Web browsing
- Web 2.0
- IP testing
- Video streaming
- Video quality MOS
- Mobile broadband

Some of the services and technologies supported by Monitor Master

MONITOR MASTER ARCHITECTURE

Monitor Master components are built using our Quality Manager architecture, which provides the level of flexibility, reliability, and performance demanded by production environments. Over 100 customers worldwide use this proven architecture to provide their network quality of service measurements.

The platform architecture has been designed with scalability in mind, with a central processing and management server, Quality Manager, which can manage and control a large number of test probes via IP.



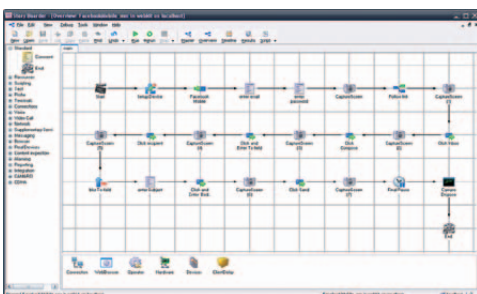
Resource checks are performed by Quality Manager to ensure that scheduling conflicts do not occur

Quality Manager – Central Management System

Quality Manager forms the central hub of the system. It performs the following functions in the system:

- System administration:
 - SIM management
 - Probe and modem management (including remote SW updates)
 - User management (roles/permissions/access)
- Test script management
- Test creation (through web-based deployment of Story Boarder tool)
- Reporting (through Box Office)
- Scheduling of individual test cases and complex test sequences

The Quality Manager server itself is a modular platform, built from a number of subcomponents responsible for different tasks. Each of these components can be placed on different servers to increase performance and availability.



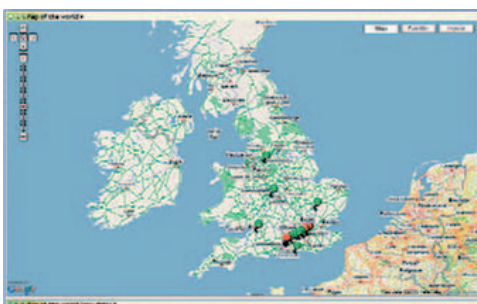
Model test scenarios quickly and easily with drag-and-drop. No programming needed!

Story Boarder – Test Modeling

Story Boarder enables quick and easy test modeling through its drag-and-drop interface, allowing prewritten modules (such as "Download FTP" and "Browse Page") to be linked together and appropriately configured, forming a deployable test scenario.

With hundreds of prewritten modules to choose from, it's easy to create a test that closely matches the interactions you wish to emulate.

Story Boarder can also run VBScript directly, allowing the test creator to customise a script in any way they please. This also provides an interface to control and run other third-party software.



Monitor Master has carrier grade alarming capabilities that integrate easily with your existing OSS platform

Alarm Manager – OSS integration

Alarm Manager plugs seamlessly into Quality Manager to enable authorized users to create alarms based on test criteria such as a KPI crossing a threshold, or a particular diagnostic message being generated.

Alarm Manager supports SNMP v2c. Heartbeats are supported, as well as multiple northbound recipients. Alarm Manager can also generate email alerts.

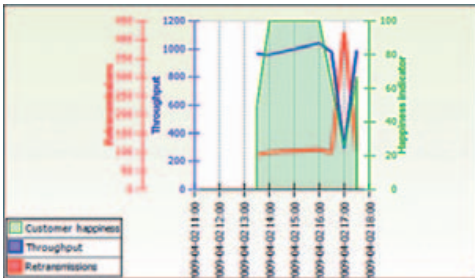
Monitor Master has been integrated with various OSS products such as HP Openview, BMC Patrol, IBM Tivoli Netcool, and Vallent ServiceAssure.

Projector – Data Consolidation

Projector is a server that processes measurement data from the distributed probes and consolidates it into a data warehouse structure for long-term storage and analysis.

Projector is a highly scalable and robust data warehouse solution based on Microsoft® SQL Server. It can handle hundreds of incoming reports per minute, from hundreds of agents simultaneously.

For smaller installations Projector can use a single SQL Server instance; for large installations there is full support for distributed SQL Server farms.



Box Office Reporting Tool

Box Office – Reporting Platform

Box Office is our tool for creating and running reports based on test data.

Box Office uses a scalable, secure, and customisable framework that allows developers to modify existing standard reports or create new reports to suit the exact requirements of the end users.

Some of the benefits of Box Office:

- Easily customizable
- Wide variety of report types and graphs available
- View data from multiple sources
- Reports can auto-update – ideal for network monitoring dashboards
- User access and security control implemented
- Users only need Microsoft® Internet Explorer to view and modify reports
- Format data according to your rules (e.g. color code cells in tables according to value)

See the separate section on Box Office (below) for more details.

MEASUREMENT PROBES

Monitor Master software can run on a number of different platforms. The simplest platform is a PC/Laptop running only a Monitor Master Software Agent: this implementation is for customers who only require LAN/IP testing capabilities. To test over-the-air service, one of Ascom's proprietary hardware agents is required.

Three different types of agent hardware are available at present, to meet the varied requirements that you may have. Although each agent is different in terms of capacity and size, they all support or implement the following common technologies:

- Microsoft® Windows XP based operating system
- Support for LTE, GSM, UMTS, HSDPA, CDMA, EV-DO, WLAN, LAN, PSTN, and ISDN interfaces
- SIM multiplexing in conjunction with the SIM server platform
- USB interface control allowing integration of USB devices, such as modems for mobile broadband testing

Each agent is capable of running tests developed with Story Boarder, the test creation tool, and automatically updates the data warehouse with test data and metrics once a test has completed.



Agent X1100



Agent X219

Agent X1100

The Agent X1100 is a rack-mountable (19" rack, 3U high) hardware appliance designed for large-volume service testing. It is capable of controlling up to eight modems or phones simultaneously. The modem "blades" (four slots) can be swapped and are easily inserted and allows for easy field upgrades as new faster modems are available.

Agent X219

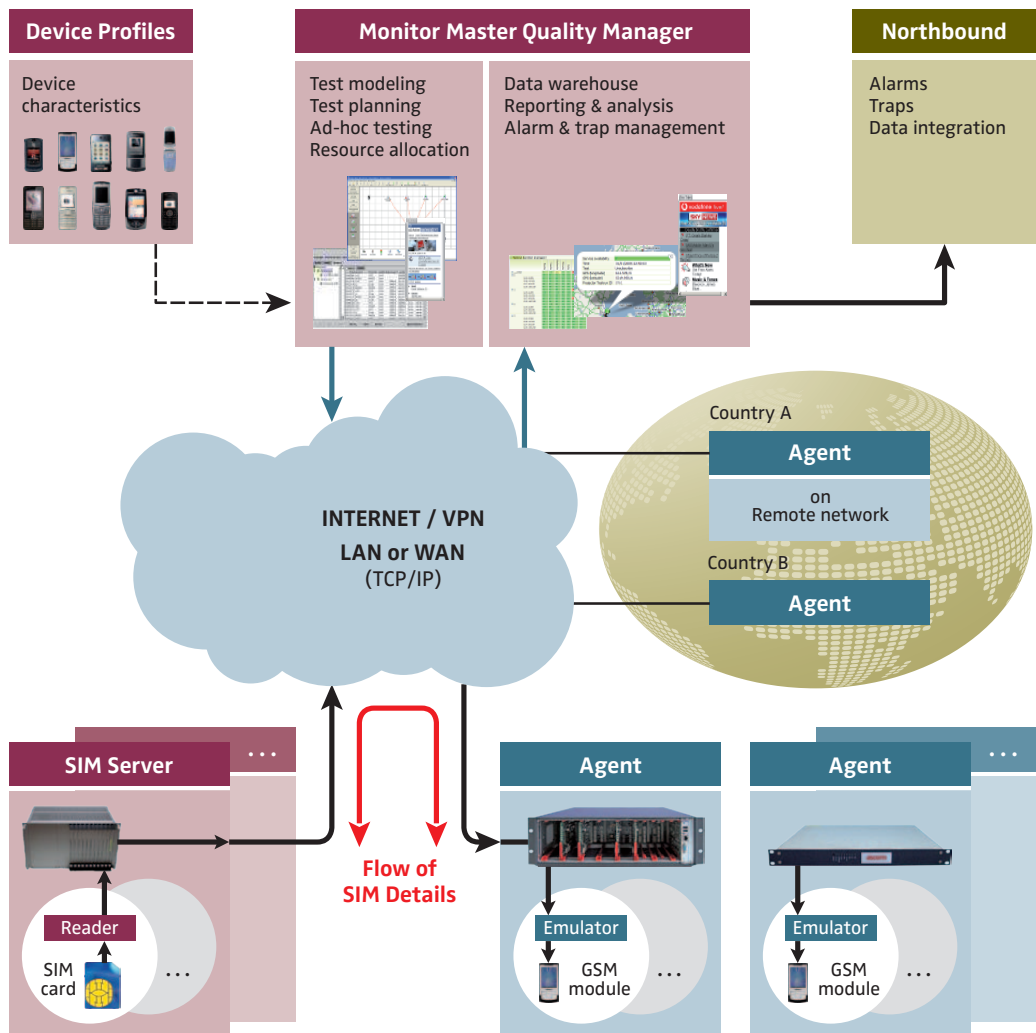
The Agent X219 is a 1U high hardware appliance designed for mounting in a standard 19" rack. It can contain up to three modem modules and a PSTN modem, as well as WiFi connection.

SIM MULTIPLEXING

SIM Server

The Monitor Master SIM Server is the key to a flexible and highly scalable SIM multiplexing solution enabling central SIM storage and distribution. A single SIM Server can store up to 336 SIM cards. The architecture allows for easy plug-and-play expansion. There is no limit on the number of SIM Servers and the system has been proven in live operations supporting more than 300 probes delivering several hundreds of SIM images.

The SIM multiplexing platform supports SIM cards and Universal SIM cards (USIMs).



Overview of the Monitor Master architecture and SIM multiplexer
 SIM details are delivered to any agent via an IP connection



KEY POINTS

- PSTN, CSD, and VoIP support
- Voice Quality PESQ
- Multi-party calls across geography (probe-to-probe)
- Voicemail deposit and retrieval
- IVR/DTMF capability
- Audio recording, playback, and storage
- Call waiting, barring, forwarding, and holding; CLIP and CLIR support
- Ringback tones

TYPICAL KPIS

- Call Setup Time
- Call Answer Time
- Call Duration
- Call Quality Measurement (PESQ)
- Voicemail Answer Time
- Voicemail Notification Time

VOICE

Voice Calling

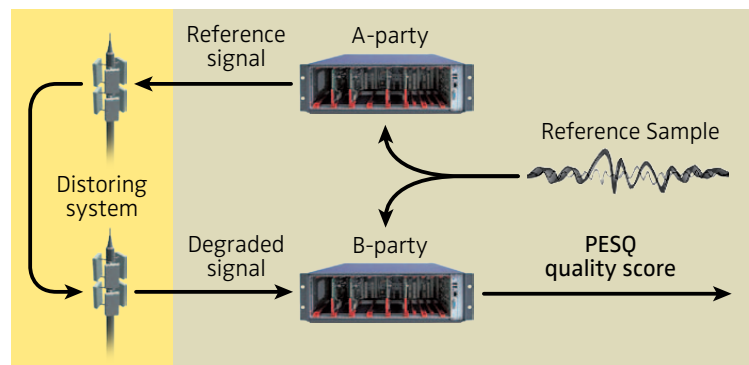
Monitor Master has full support for peer-to-peer voice calling on and between all available voice bearers, including public switched telephone networks (PSTN), circuit switched dialing (CSD), and voice over IP (VoIP).

The calling and receiving parties can be on the same or different probes, which can be in different locations. This allows you to create any voice call situation you require. Monitor Master records a variety of KPIs (see Typical KPIs) for each party.

Voice Quality

Monitor Master can be used to measure the perceived quality of a voice call in full compliance with ITU-T standard P.862, using the Perceived Evaluation of Speech Quality (PESQ) algorithm.

PESQ provides an objective measurement that predicts the results of subjective listening tests on telephony systems. The PESQ algorithm compares the original unprocessed signal with the degraded version recorded on the voice call and can return either PESQ, PESQ-LQ (MOS), or PESQ-le score.



The PESQ system for analysis of degraded voice calls

IVR , DTMF and Voicemail

Monitor Master can automatically navigate IVR systems, sending DTMF tones and recording and comparing audio where required.

This capability allows Monitor Master to dial up voicemail systems, leave voicemails, wait for notifications and retrieve voicemail, checking the automated audio played by the voicemail system along the way. It provides KPIs for each interaction made. In a similar way Ringback tone services can be tested, from subscription phase to verification.

Voice Supplementary Services

The platform also has full support for supplementary voice services such as: Calling Line Identification Presentation (CLIP), Calling Line Identification Restriction (CLIR), Call Barring, Call Forwarding, Call Waiting, and Call Holding.

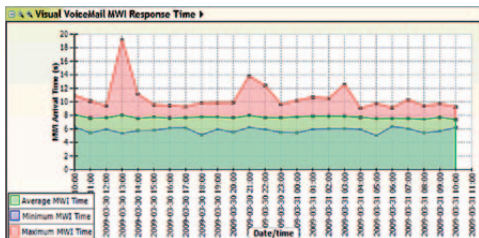


KEY POINTS

- SMS, EMS, and MMS
- iPhone Visual Voicemail
- Instant Messaging (MSN, Skype)
- Email
- Blackberry
- USSD
- SIM Toolkit

TYPICAL KPIS

- SMS Send, Delivery Time (End-to-End)
- MMS Send, MMS Notification, and MMS Retrieval Times
- Email Send, Delivery Time
- Blackberry Email Round Trip Time
- Visual Voicemail Connect, Download Time



Graph showing the min/avg/max time over time to receive the VVM notification SMS

MESSAGING

SMS, EMS, and MMS

Monitor Master comes with comprehensive support for SMS and EMS, providing accurate timings and KPIs for sending and receiving messages.

SMS-based applications are also supported, such as horoscope or lottery updates, sport notifications, or similar content in which the platform requests SMS-based data by sending an SMS with a particular key word.

Monitor Master also has full support for MMS scenarios such as transmission/receipt of MMS via email or Web-based applications, and can also inject MMS traffic via the MM3, MM4, and MM7 interfaces.

Visual Voicemail (VVM)

Although branded a voicemail service, this is actually an email-based messaging system. Apple developed VVM for the iPhone, deciding an IMAP email system would provide greater flexibility and more features to the iPhone user.

Monitor Master has been fully integrated with the VVM system and is capable of sending, receiving, listening (and performing PESQ scores on), and deleting VVM messages.

Instant Messaging

Monitor Master supports Skype, MSN, and Wireless Village instant messaging applications. As with all Monitor Master tests, it can interact as a user would, and record data about a variety of interactions, such as: presence checking, login/logout, and message delivery and receipt.

Email

SMTP, POP3, and IMAP email protocols including IMAP SSL (secure email) are all supported with the system.

BlackBerry

Monitor Master can check email trip times to and from BlackBerry devices under its control. This provides accurate timing information for your BlackBerry email network.

USSD and SIM Toolkit

There is also support for Unstructured Supplementary Services Data (USSD). This is commonly used by pre-paid subscribers to obtain their balance. Monitor Master can process the balance before and after any network transactions to verify that the correct amount has been billed to the customer. Monitor Master can also create test scenarios that interact with the SIM Toolkit.



PREPAY

Monitor Master can test prepaid subscriber services. Prepay specific services, like balance checking and prepay top-up can also be tested.

Balance Checks

Monitor Master can be used to perform prepay balance checks via USSD, IVR/SMS combination, and Web/WAP portal. These are just some of the common options, but many more are available.

Auto Top-Up

Automated IVR top-up services can be tested with Monitor Master.

For example, a list of prepay voucher numbers, provided either in file format or in a database table, can be accessed sequentially by Monitor Master and entered as DTMF tones in a call to the automated IVR top-up system. By checking the balance before and after this interaction, Monitor Master can decide if the top-up has worked successfully.

KEY POINTS

- Balance checks
- Auto top-up
- Revenue Assurance

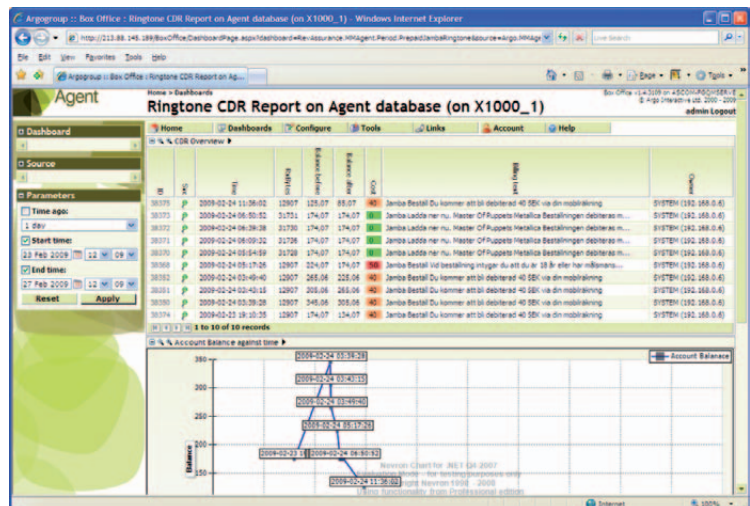
TYPICAL KPIS

- Balance Check Duration & Amount
- Automatic Top-Up Time

Revenue Assurance

Revenue Assurance can be tested for prepay subscribers, by checking the balance before and after a service test, to ensure that the subscriber has been charged correctly. Any combination of the services mentioned in previous sections can be used for this purpose.

For more ways to test revenue assurance, please see section “Revenue Assurance” on page 20.



An example of an account balance status report. A ringtone content download test including a balance check to verify that the correct amount was charged for each item



KEY POINTS

- Video Streaming
- Video Call
- Video PING
- YouTube support
- Mean Opinion Score measurements
- Non-intrusive testing

TYPICAL KPIS

- Audio and Video Mean Opinion Score
- Jitter %
- Blockiness %
- Blurriness %
- Loudness %
- Buffering Time
- Bandwidth

VIDEO

Video Streaming

Monitor Master comes with extensive video streaming test support. The system can connect to a variety of video stream sources, such as YouTube, and analyze the quality of the received video stream. A range of metrics and KPIs are calculated including buffering, bandwidth, and various other perceived quality measurements (see Video Quality below).

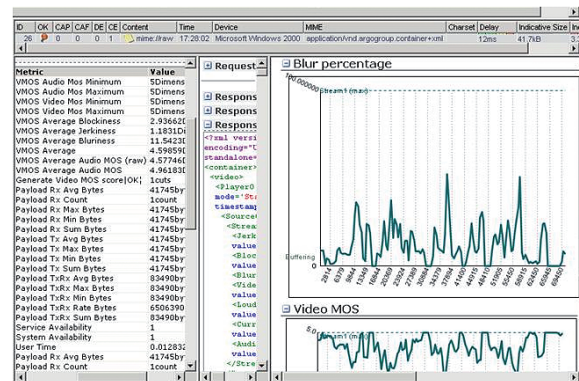
Using Monitor Master you can also quickly verify the availability of all your video feeds through Video PING (VPING).

As with all IP-based Monitor Master tests, IP packet level trace information is captured allowing detailed diagnostic work to be performed in the event of a failure or poor performance.

Video Quality

Monitor Master has full support for Video Mean Opinion Score (VMOS) calculations on streamed video content in order to verify the quality as perceived by the end user.

The Mean Opinion Score (MOS) was originally defined by the ITU-T for voice calls. The standard provides a numerical indication of the perceived quality of the call.



The MOS approach is now applied to video content using a number of algorithms to calculate a video MOS based on a non-intrusive analysis of received content.

Monitor Master dynamically accesses video stream content over the air or via a LAN connection and calculates the video MOS as would be experienced by an end user.

Monitor Master measures and analyzes content using a non-intrusive approach. Reference content is not required, making it ideally suited to monitoring streaming services in general as well as for services where no reference content is available, such as mobile TV.

3G CS Video Call

Using Monitor Master you can test circuit switched video calls on a 3G network. Monitor Master can simulate a 64kbps circuit switched video call from a UMTS modem on one Agent to a UMTS modem on another Agent.

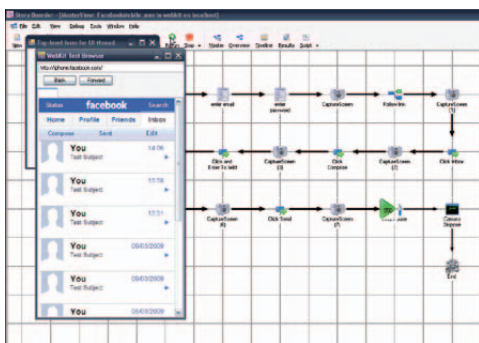


KEY POINTS

- Simulates real users accessing the real services using real devices
- Full Web 2.0 support based on Web-kit
- WAP 1.x/2.0
- Internet Explorer (IE6,7,8) support
- Digital Rights Management (DRM) support
- Cascading Style Sheet support
- Auto-browsing (spidering)
- Content analysis
- Dynamic browsing – to access other services & subscriptions

TYPICAL KPIS

- Response Time
- Downloaded Bytes
- HTTP Response Codes
- Service Availability by Device
- Device Interoperability
- Content Conformance



Example script browsing Facebook

BROWSING

Monitor Master is the most powerful platform on the market for testing and monitoring browsing services. With its user-transaction recording features, auto-browse capabilities, full support for WAP and Web, and extensive device simulation support, measuring any portal-based application is made extremely easy.

The platform supports secure traffic and comes with low-level features such as segmentation and reassembly (SAR) of large data transmissions, socket reuse, and parallel HTTP fetches.

WAP

Monitor Master simulates real handsets using a handset emulation from our virtual device repository with hundreds of different devices. All major characteristics of the real device are stored in the virtual profile which allows Monitor Master to mimic the behavior of the real device.

Monitor Master will automatically select the correct WAP profile (WAP1 or 2) for the selected device and will browse a WAP site as a real user using a real handset.

Internet Explorer

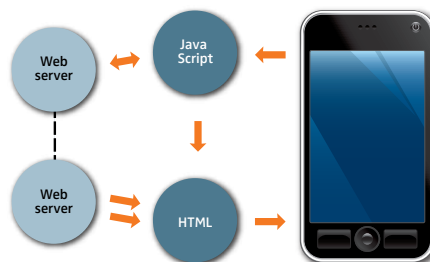
Monitor Master can also execute Internet Explorer Web transactions exactly like a user would – going to URLs, following links, entering information into forms and submitting data. This is done by driving Internet Explorer directly from the operating system.

WEB 2.0

Web 2.0 is a term that encompasses user-generated content, communication, interoperability, and collaboration using a host of different access technologies and devices. The future will involve more and more third parties delivering services through these technologies.

Web 2.0 is here now and this translates to real challenges for testing and monitoring. For example, how would you test Twitter performance between a mobile handset such as an iPhone and a PC to prove that tweets are getting through in a timely way? How would you compare Facebook performance on an Android/Google handset with performance on a PC so you could see how the radio network affects the end user experience?

Web 2.0 is fully implemented in Monitor Master using the Web-kit engine and our Camaro browser, providing support for client-side JavaScript and AJAX.



Web 2.0 uses more technologies to deliver a richer experience



KEY POINTS

- Automatically check downloaded content for text and images
- Analyze document formatting
- Check location of content using XPath or regular expressions
- Check HTTP header content
- Validate site structure
- Branding verification

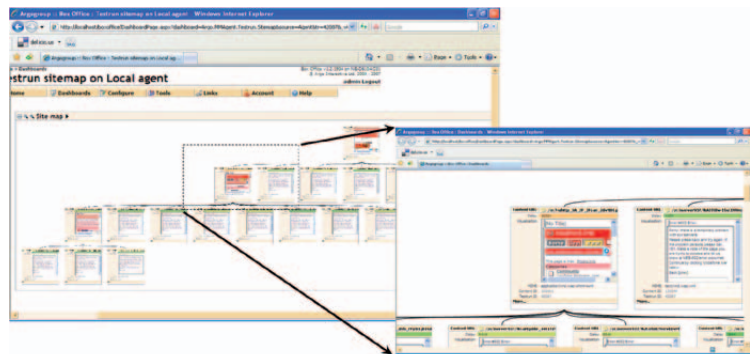
CONTENT ANALYSIS

Monitor Master is the leading platform on the market for mobile content analysis. With its unique analysis engine it can analyze all available content using the same methodology.

In addition to the comprehensive support of content types, the flexible architecture of Monitor Master makes it possible to extend the analysis engine, to deal with the latest content types.

Markup and Text Analysis

Using Monitor Master, not only can you measure the availability and performance of content services, you can also verify that the content returned is correct and of the right quality.



Using techniques such as simple text matching, regular expressions, and XPath you can verify the quality and positioning of your content.

In addition to markup technologies you can also parse and verify Cascading Style Sheets.

This allows us to perform deck verification tests including brand verification (such as is the correct logo always available in the top-right corner)

Image Analysis

Using Monitor Master’s powerful image analysis capabilities you can verify logos and images on your portal.

Monitor Master supports all image formats used by mobile content today and can extract and test aspects such as: image dimensions, color depth and animation frames.

Methods are also available for scoring an image against a reference image to test content adaptation engines.

Music and Tunes Analysis

Music and ringtone downloads are popular services for mobile users. Using Monitor Master’s multi-modal capabilities and music and tunes analysis features you can monitor and verify all of your applications regardless of the delivery mechanism.

Monitor Master supports MP3, WAV, MIDI, and various other music and ring-tone formats.

Domain	KPI	Device			
		LG 8888	Nokia 770	Samsung SCH-D600	Sony Ericsson W900i
http://advisorygroup.mobi	Error percentage	100 %	100 %	100 %	100 %
http://betertainment.com	Error percentage	0 %	0 %	0 %	0 %
http://bluepulse.com	Error percentage	0 %	0 %	0 %	0 %
http://c.admob.com	Error percentage	100 %	100 %	100 %	100 %
http://cwire.microsite.mobi	Error percentage	0 %	0 %	0 %	0 %
http://dev.mobi	Error percentage	3,45 %	3,7 %	3,7 %	3,7 %
http://dotmobi.mobi	Error percentage	100 %	100 %	100 %	100 %
http://m.reporo.com	Error percentage	0 %	0 %	0 %	0 %
http://mbet.com	Error percentage	0 %	0 %	25 %	25 %
http://mobile.time.com	Error percentage	0 %	0 %	0 %	0 %
http://mobjadpot.tv	Error percentage	0 %	0 %	0 %	0 %
http://mtd.mobi	Error percentage	5,56 %	5,56 %	5,56 %	5,56 %
http://ready.mobi	Error percentage	100 %	100 %	100 %	100 %
http://reporo.com	Error percentage	100 %	100 %	100 %	100 %
http://showcase.mtd.mobi	Error percentage	100 %	100 %	100 %	100 %
http://site.mobi	Error percentage	0 %	0 %	0 %	0 %
http://time.crispadvertising.com	Error percentage	100 %	100 %	100 %	100 %
http://time.mobi	Error percentage	0 %	0 %	0 %	0 %
http://uk.crushorflush.com	Error percentage	0 %	0 %	40 %	0 %
http://uk.mofobox.com	Error percentage	0 %	0 %	0 %	0 %
http://wao.casinotropez.com	Error percentage	0 %	0 %	0 %	0 %
http://www.advisorygroup.mobi	Error percentage	0 %	0 %	0 %	0 %
http://www.crushorflush.com	Error percentage	0 %	0 %	0 %	0 %
http://www.mywives.com	Error percentage	16,67 %	0 %	0 %	0 %
http://www.pocketfreefun.co.uk	Error percentage	0 %	0 %	0 %	0 %
http://www.reporo.com	Error percentage	0 %	0 %	0 %	0 %

Using Monitor Master it is easy to analyze mobile content for conformance, interoperability, usability, and performance

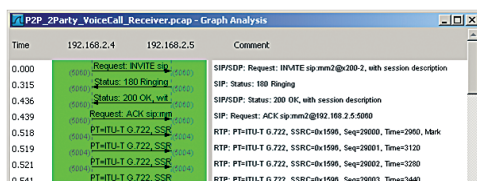


KEY POINTS

- Variety of IP based services supported such as FTP, ping, DNS, HTTP
- Can integrate with third-party tools
- Packet capture available with Wireshark
- Layer 3 trace diagnostic data available

TYPICAL KPIS

- Throughput rates for FTP and HTTP
- Ping round trip time
- Packet loss %
- DNS Lookup response time
- Three-way handshake time
- Download/upload time



You are able to analyze the VoIP session in Wireshark

DATA

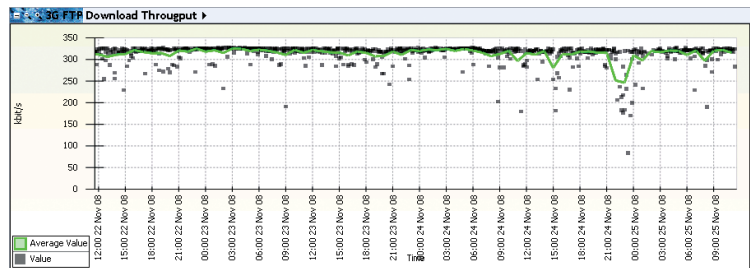
Monitor Master can test a number of different IP-based services, such as FTP, HTTP, ping, and DNS lookup. These tests can be conducted over-the-air, or via a LAN connection or broadband DSL line.

FTP and HTTP

Monitor Master can connect to, upload, and download files from both FTP and HTTP servers.

HTTP interactions can be managed through the methods described in the Browsing section.

FTP and HTTP tests both record a number of KPIs, such as connection time, throughput, download, and upload time.



Box Office report showing FTP throughput over time

DNS

Monitor Master can also perform domain name queries on domain name servers. For each lookup, the user can specify which connection and which domain name server to use. Testing returns a list of IP addresses or resolved host names and the time taken to return the information.

Ping

Ping is widely used to test both availability of your network servers and the latency experienced in the network. Ping tests can be configured to send any number of packets to a destination server and will calculate the average, minimum, and maximum round trip times along with the percentage packet loss.

Third-Party Integration

Due to the flexibility of Monitor Master, other data-centric services can easily be integrated into a test scenario. Skype, SyncML, VPN connectivity, and iTunes are just a few examples of these.

VoIP

Monitor Master can test VoIP, either peer-to-peer between two VoIP parties where no SIP server is involved, or via a SIP Server which also enables VoIP to Mobile or fixed testing. Many interesting KPIs can be recorded including a speech quality PESQ score. You can also configure different codecs such as G.711 u-Law and A-Law, G.723.1 / G.722 / G.726 / G.729, Speex (8 and 16 kHz) / GSM 6.10 / iLBC. IP tracing (PCAP) is integrated into the VoIP solution to allow detailed analysis of the a VoIP session.



PROTOCOL ANALYSIS

IP tracing

All IP-based Monitor Master tests can be used to capture packet data in the PCAP format, which can be easily viewed with standard packet capture tools such as Wireshark. This allows for in-depth analysis of all the IP traffic that passes through the modem or LAN interface.

116	2.317383	41.20.198.7	196.43.2.109	TCP	bitspeer > ftp-data [ACK] Seq=1 Ack=80041
117	2.328125	196.43.2.109	41.20.198.7	FTP-DATA	FTP Data: 1380 bytes
118	2.330078	196.43.2.109	41.20.198.7	FTP-DATA	FTP Data: 1380 bytes
119	2.330078	41.20.198.7	196.43.2.109	TCP	bitspeer > ftp-data [ACK] Seq=1 Ack=82801
120	2.332032	196.43.2.109	41.20.198.7	FTP-DATA	FTP Data: 1380 bytes
121	2.348633	196.43.2.109	41.20.198.7	FTP-DATA	FTP Data: 1380 bytes
122	2.348633	41.20.198.7	196.43.2.109	TCP	bitspeer > ftp-data [ACK] Seq=1 Ack=85561
123	2.350586	196.43.2.109	41.20.198.7	FTP-DATA	FTP Data: 1380 bytes
124	2.357422	196.43.2.109	41.20.198.7	FTP-DATA	FTP Data: 1380 bytes
125	2.357422	41.20.198.7	196.43.2.109	TCP	bitspeer > ftp-data [ACK] Seq=1 Ack=88321

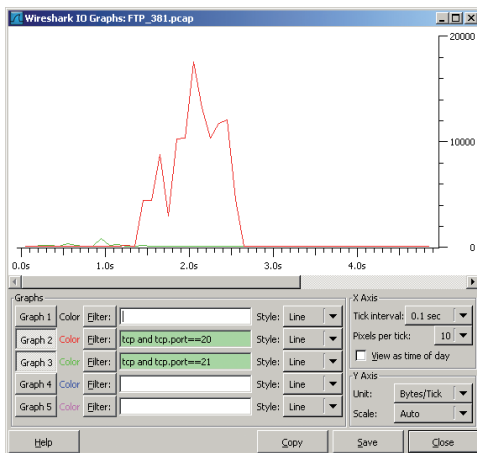
Example PCAP trace

KEY POINTS

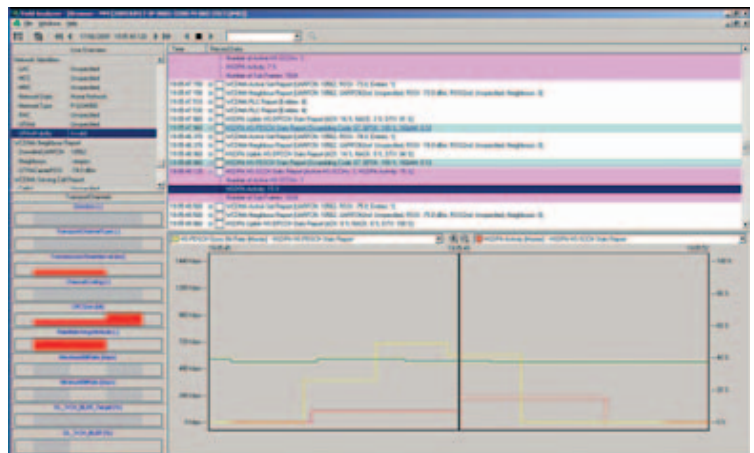
- PCAP – Wireshark support
- Layer 3 tracing
- Chipset statistics
- Analysis with Field Analyzer
- Root-cause analysis

Layer 3 Trace and Chipset statistics

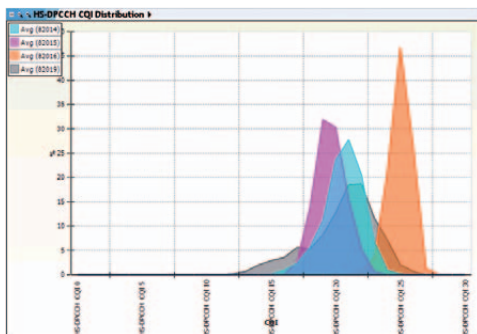
GSM Layer 3, WCDMA NAS Signaling, WCDMA RRC Signaling, and CDMA Phone Messages are available for tracing on each modem on the agent. Chipset statistics, such as Idle Reports, Neighbor Reports, and HSDPA Channel statistics are also recorded in the trace files. This data can be analyzed using Ascom’s powerful Field Analyzer tool, allowing users to drill down to pinpoint the exact cause of failed or poorly performing tests.



Wireshark IO graphs



Field Analyzer



Summarized HS-DPCCH CQI Stats

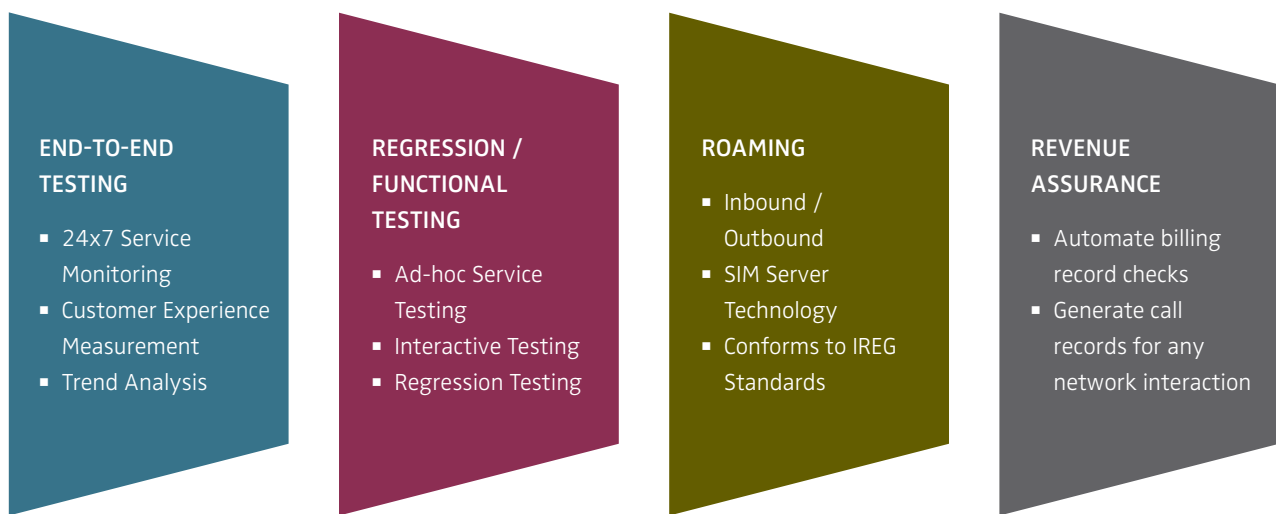
The signaling messages can also be processed by Monitor Master to produce:

- Precision timing points for KPI metrics, e.g. ETSI PDP Context Activation Time
- Error cause analysis
- Customized Box Office reports showing summarized trace data statistics

APPLICATION AREAS

Due to the wide variety of tasks that Monitor Master can perform, it is sometimes simpler to describe the value that Monitor Master can provide by grouping its capabilities into application areas.

The main application areas for Monitor Master that we see with our customers are End-to-End Testing, Functional Testing, Roaming, and Revenue Assurance. The diagram below outlines the types of testing associated with each application area:



Main application areas for Monitor Master

Our clients often require a mix of more than one application area. For example a network monitoring team may require end-to-end service testing, but also require ad-hoc testing to ensure new releases of VAS platforms function correctly with particular device profiles. The flexibility of Monitor Master makes this possible.

Application areas describe a general type of application for Monitor Master, but Monitor Master is not limited to just these areas; its flexibility means that more and more ways of deploying Monitor Master arise each year, and the number of application areas and type of testing is always expanding.

KEY POINTS

- Assess the quality of your services from the customer perspective
- 24x7 round-the-clock automated monitoring
- Instant notification of service issues via SNMP and auto-refresh reports
- Benchmark services against competitors
- Analyze trends in service response times and availability

END-TO-END MONITORING

Modern services are complex and often involve third parties that you cannot control. All the parts may appear to work properly and yet the service still fails from the customer’s point of view. So it’s not enough to monitor the parts of the delivery chain, it’s vital to test each service from end to end.

Instant Awareness of Issues

If a service is not working correctly every second costs you money – and subscribers. So when something does go wrong, you need to know immediately – and preferably, you want the information to diagnose and fix it quickly.

Benchmarking

Even if your services are working, are they working well enough to meet customer expectations? Does it matter if your average SMS round trip time is 15 seconds or 10 seconds? By benchmarking against your competitors, you can better understand your position in the market in terms of service quality and availability – and if need be, improve it.

Summary

Monitor Master is widely deployed to meet these needs and concerns for many operators around the world. With its strong flexibility and dynamic reporting and alarm system, Monitor Master helps our customers keep track of their services on a 24x7 basis. In addition, Layer 3 and IP traces, combined with Monitor Master’s analysis logic, enables the user to see where the failure occurred and resolve the issue swiftly.

All service failures and samples by hour

Time (hour)	11/25/2008 00:00:00 AM	11/25/2008 01:00:00 AM	11/25/2008 02:00:00 AM	11/25/2008 03:00:00 AM	11/25/2008 04:00:00 AM	11/25/2008 05:00:00 AM	11/25/2008 06:00:00 AM	11/25/2008 07:00:00 AM	11/25/2008 08:00:00 AM	11/25/2008 09:00:00 AM	11/25/2008 10:00:00 AM	11/25/2008 11:00:00 AM	11/25/2008 12:00:00 PM	11/25/2008 01:00:00 PM	11/25/2008 02:00:00 PM	11/25/2008 03:00:00 PM	11/25/2008 04:00:00 PM	11/25/2008 05:00:00 PM	11/25/2008 06:00:00 PM	11/25/2008 07:00:00 PM	11/25/2008 08:00:00 PM	11/25/2008 09:00:00 PM	11/25/2008 10:00:00 PM	11/25/2008 11:00:00 PM
APN	0	7	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9
GPRS	0	5	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
I-Mode	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
MMS	0	24	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30
SMS	10	13	13	16	13	16	13	16	13	16	13	16	13	16	13	16	13	16	13	16	13	16	13	16
VOICE	0	29	3	32	3	32	1	32	1	32	1	32	1	32	4	32	4	32	5	32	5	32	5	32
WAP	10	28	32	31	32	31	32	31	32	31	32	31	32	31	32	31	32	31	32	31	32	31	32	31
WEBTEXT	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

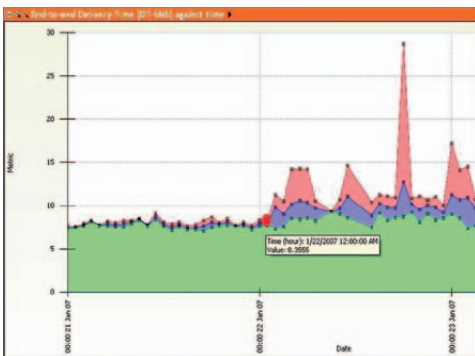
Success % by service for past 24 hours

Service Type	Total	Success	Completion %
APN	203	202	99.5
GPRS	144	143	99.3
I-Mode	144	129	89.6
MMS	718	652	90.8
SMS	372	71	19.1
VOICE	767	728	94.9
WAP	727	414	56.9
WEBTEXT	46	0	0

Example Box Office report highlighting service availability, with failures in red/amber. Below is a summary of service availability by service type for the previous 24 hours.

KEY POINTS

- Test new and upgraded services prior to launch
- Interactively test services at any location
- Tailor reports to meet the needs of your new services
- Before and after trend comparison
- Trace level data for diagnosis of issues



Upgrade to SMS infrastructure resulted in degraded end-to-end performance.

REGRESSION TESTING

Regression testing is essential when you need to know that new or upgraded services are safe to launch to your customers.

Modern, next-generation services involving Web 2.0 components or VoIP services interact in such complex ways, even simple changes can cause faults. Even traditional, hardened services like SMS or voice can fail given the number of elements involved in delivering them.

The only way to be sure that your service is ready is to test it from the end user's point of view. Manual testing is expensive, time-consuming, and error prone, and a real handset can't give you the technical detail needed to diagnose a problem and fix it quickly.

Test Before and After

Either by using our prepackaged Standard Scripts, or by creating your own, regression testing is a simple case of running your test(s) before and after the installation/upgrade of your new service and seeing the difference in results (easy to do with the built-in reporting tool, Box Office).

A typical regression test suite for testing an MMS-C would send different content types to all your important handsets and verify that the content adaptation engine successfully transcoded all MMS messages depending on the receiving device. For example: if the receiving handset can't handle video has it been transcoded to an animated GIF image?

Interactive Control

In addition, Monitor Master supports live interactive control of test agents, called Interactive Mode, allowing test engineers to interact with the network and perform voice, text, or data functions. This is perfect for quick ad-hoc testing, to give a real, live impression of the performance of your services.

Summary

Monitor Master is the perfect tool to test and diagnose any problems you may have with your new and upgraded services.

Many customers have used Monitor Master for regression testing, and have been able to isolate issues quickly and resolve them. In one particular instance, after a customer upgraded their SMSC platform, Monitor Master reported increased MMS notification times. On further investigation, it was noticed that the new SMSC Push Proxy Gateway (PPG), used to handle these notifications, had not been configured correctly after the upgrade. By correcting this before the new SMSC platform went live, the operator made sure their subscribers did not experience the problem.

KEY POINTS

- Centralized SIM Server allows SIMs to be deployed to any agent
- Geographically distributed agents
- Test between different agents in different locations
- IREG support
- Mosaic™: Ascom's managed roaming service

ROAMING

Roaming scenarios add far more complexity to already complex mobile systems:

- Multiple operators, multiple carriers, and multiple network elements
- Ever-changing technologies, both in the VAS and network infrastructure areas – both locally and within roaming partners
- Physical distance, language barriers, and differing time zones can make manual methods of fault finding extremely time-consuming

With its excellent SIM-Server technology and the capability to deploy agents to anywhere in the world, Monitor Master provides state-of-the-art inbound and outbound roaming testing capabilities.

Managed Service

Ascom also offers Mosaic™, the managed service option for customers who want to test outbound roaming scenarios without hosting their own Monitor Master probes in other countries.

Mosaic offers an easy-access solution for all your outbound roaming requirements where you can either run our standard scripts or provide your own custom scripts.

Mosaic is available in a wide variety of countries and locations around the globe – contact your sales representative for more details.

Services Tested

Any service supported by Monitor Master can be tested in a roaming scenario. The most common roaming test requirements are for voice and messaging services, but more complex services such as VoIP, Blackberry, and Visual Voice Mail are becoming more important.

IREG

Monitor Master can be used to test IREG scenarios, and as with all Monitor Master tests, they can be automated and set to run on a schedule.

IREG reports are generated automatically and can be emailed or exported as a PDF.

Item	Response
Mobile ORIGINATED AND Terminated Short Message Service	
(a) MSISDN of MS1(a)	07795842186
(b) E.164 address of HPLMN SMS - Service Centre	+447785016005
(c) Time of transmitting to SMS - Service Centre	Hr 10 Min 47 Sec 42
(d) MSISDN of MS2(a)	07795842170
(e) Time of switching on MS2(a)	Hr 10 Min 48 Sec 12
(f) Time of receipt of SMS at MS2(a)	Hr 10 Min 48 Sec 29
(g) Was message correctly received? [Yes = ✓ / No = ✗]	✓
(h) If the message was not received, repeat test with MS2(a) switched on. Was message correctly received this time? [Yes = ✓ / No = ✗]	
(i) Comments:	Scheduled test
(j) Test Case Result: [Pass / Fail / Not Performed]	PASS
Signature of Tester:	(Monitor Master)
Time	10:48:35
Date:	07 May 2009

Report generated by Ascom® BoxOffice on 07/05/2009 11:53:30.
BoxOffice server: JACO.
Projector test run 61 93160.

Example IREG Conformance Report, automatically generated by Box Office

KEY POINTS

- Monitor Master creates CDRs for all test interactions
- Correlate CDR records against network charging center CDRs
- Automatic notification of billing irregularities
- Integrated with CashBack, for a complete turnkey revenue assurance solution

REVENUE ASSURANCE

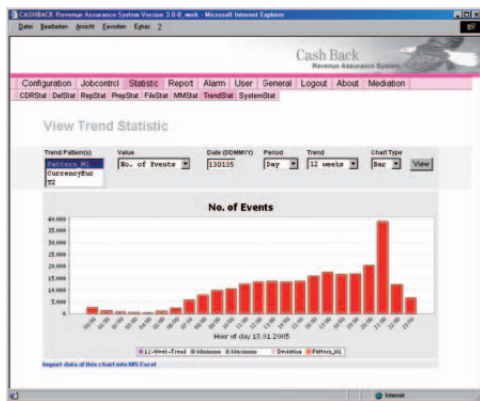
Getting the bill right is important. Charging too much upsets your customers and gets the undivided attention of regulators; charging too little upsets your company and partners.

As networks and services evolve and expand, unforeseen errors can introduce charging problems, and proving that the bill is correct is not easy.

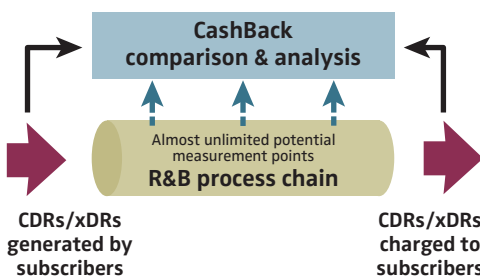
Monitor Master can provide revenue assurance by testing your network services and generating Call Detail Records (CDRs) which can be compared against your internal network CDRs.

		MEASUREMENT											
		Start time	A Party details	B Party details	Duration	Bytes up	Bytes down	Success fail indicator	IP address	Quality of Service	APN	Prepay Postpay SIM	URL
SERVICES	Voice	■	■	■	■			■		■		■	
	WAP	■	■		■	■	■	■	■	■	■	■	■
	Web	■	■		■	■	■	■	■	■	■	■	■
	IM	■	■	■	■	■	■	■	■	■	■	■	
	VoIP	■	■	■	■	■	■	■	■	■	■	■	
	SMS	■	■	■	■	■	■	■	■	■	■	■	
	MMS	■	■	■	■	■	■	■	■	■	■	■	
	Content download	■	■		■	■	■	■	■	■	■	■	
	Mobile TV	■	■		■	■	■	■	■	■	■	■	

Typical CDR KPIs



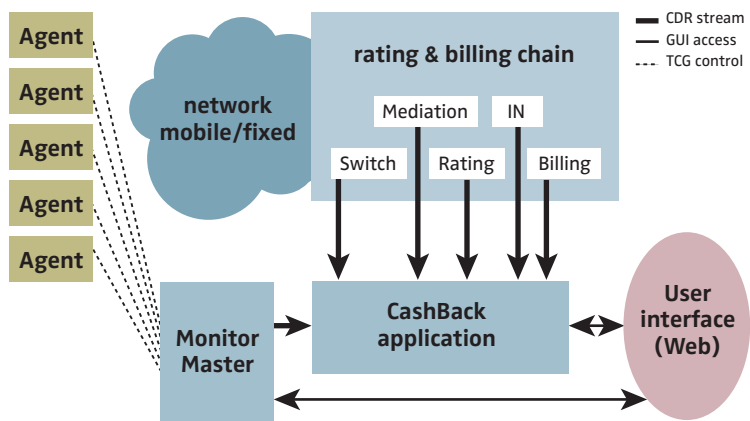
CashBack report of CDR statistics



CDR Reconciliation

Complete Call Detail Record Reconciliation

Monitor Master test CDRs can be correlated automatically with the real CDRs using either Monitor Master or a third-party system of your choice. Monitor Master is integrated with the CashBack revenue assurance platform. Combining Monitor Master and CashBack we can provide a complete turnkey solution, where Monitor Master is used as the active component to trigger calls according to a test plan and generate test CDRs, and CashBack as the passive component, used to trace the calls throughout the billing chain to identify revenue leakage and tariff consistency.



Integration with Monitor Master

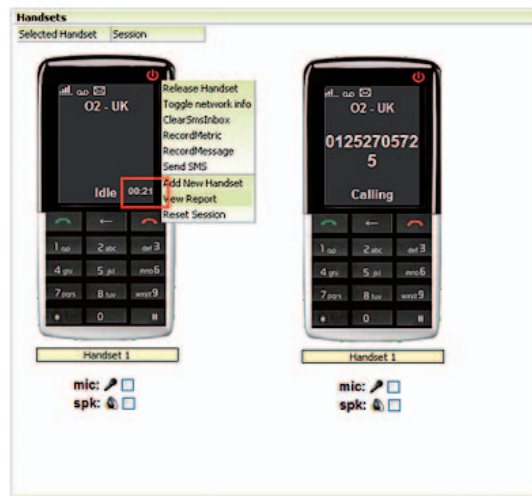
KEY POINTS

- Control a modem anywhere using Web browser, in real time
- Make calls
- Send and receive SMS
- Browse Web
- Generate CDR records
- Ad-hoc testing
- IREG testing

INTERACTIVE MODE

Interactive Mode is a unique feature of Monitor Master providing direct control of up to four modems via a Web-based interface.

By selecting an agent, modem and SIM, the user can effectively “be” any user in any location, making phone calls, sending messages, and browsing the Web. All of this can be done from a desk with a PC running a Web browser.

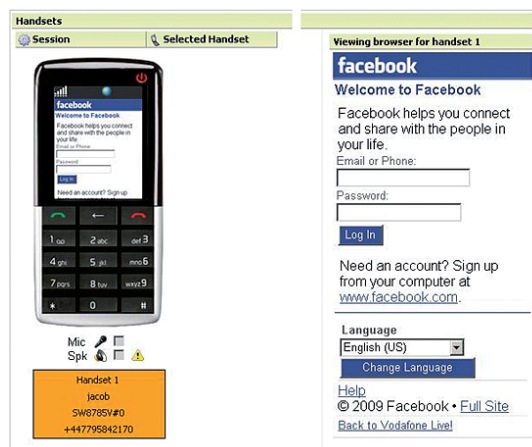


Making a voice call using two modems

Not only is this perfect for ad-hoc testing of network services, but it is also an excellent method for testing roaming services and IREG conformance.

When making a call in Interactive Mode, the audio is linked to your PC microphone and speaker, allowing you to listen and speak, as if you were using a real phone. Calls can be made between two handsets in the same interactive session.

Once an Interactive Mode session has finished, call details are recorded in the central server database just like for a normal test, allowing the user to view metrics and KPIs for the interactions they performed.



Using Interactive Mode to browse Facebook

KEY POINTS

- Web-based
- Provides wide variety of reports (see below)
- Drill down capability
- Direct access to media produced by tests, such as audio, trace, and logfiles
- User group control
- Automated report distribution
- Flexible structure allows users to create custom reports
- Auto-refresh capability
- iPhone interface

REPORT TYPES

- Standard tables
 - Pivot tables
 - Maps
 - Scatter graphs
 - Frequency distributions
 - Bar charts and histograms
 - Pie charts
 - Gauges
 - Gantt charts
 - Freeform (with user defined CSS)
- And more...

REPORTING

Box Office

Monitor Master’s reporting tool, Box Office, delivers outstanding reports and information based on data gathered by the test probes, including KPIs, metrics, messages, and trace information.

Box Office comes with a wide array of standard reports, but can also be customized quickly and easily to produce new reports that meet any specific requirement you may have.

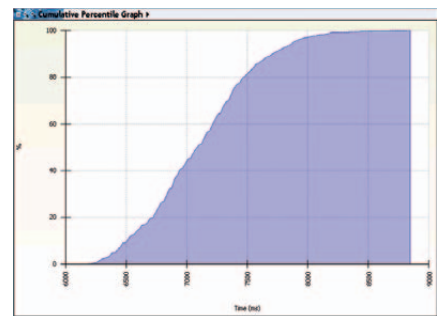
Reports are edited via the same interface as used to view reports – there is no need for a separate tool.

Security is managed by granting specific rights to users through role management. This feature can be used to separate users into groups that can access specific reports relevant to them. It can also be used to grant editing rights to Box Office report developers.

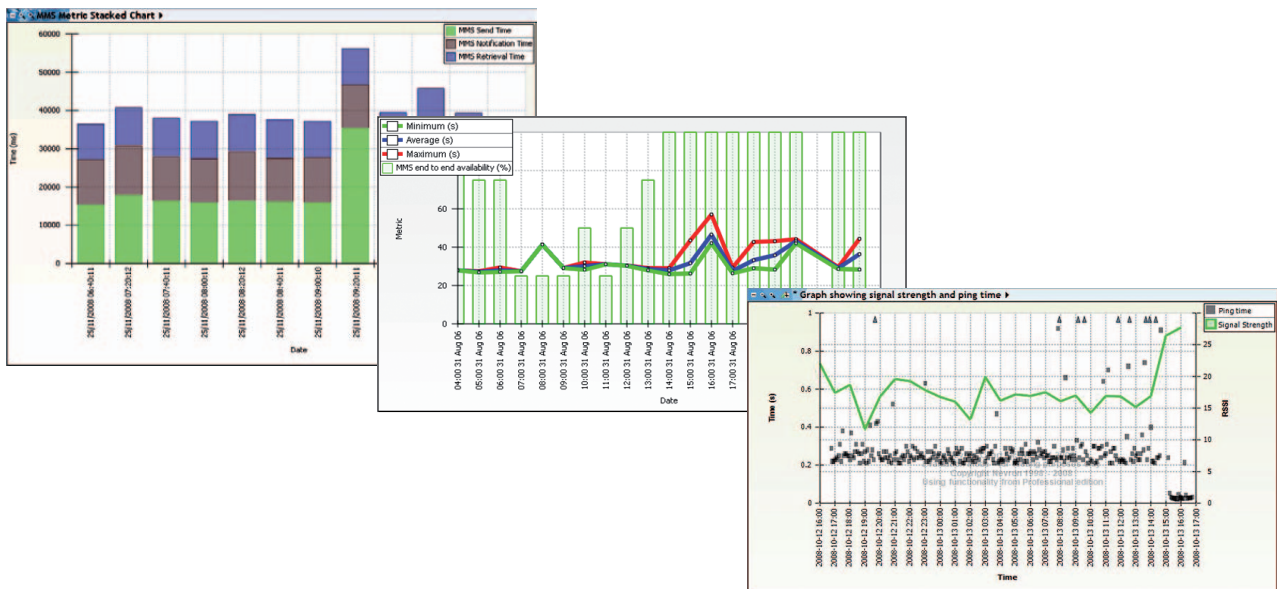
Reports can also be viewed on the Safari browser on the iPhone, for users on the move.

Source Data

In addition to querying and displaying data stored in the Monitor Master data warehouse, Box Office can query data from other databases and other database types (SQL Server and Sun’s MySQL™).



Scatter graph showing drop in Ping time after network upgrade



KEY POINTS

- Meet your requirements without hardware or software upgrades
- Develop complex scripts in-house
- Wide variety of pre-canned test steps available for use
- Execute custom VBScript code
- Integrate with third-party tools and platforms

CUSTOMIZATION

Monitor Master has the unique ability to be modified to suit unusual or complicated requirements without any additional hardware or software, or involvement of Ascom developers.

Our test creation tool, Story Boarder, allows customers to create custom test scenarios by joining together a path of test steps, such as "Send SMS," "Receive Email," and "Make Data Connection," in an easy, visual, drag-and-drop manner.

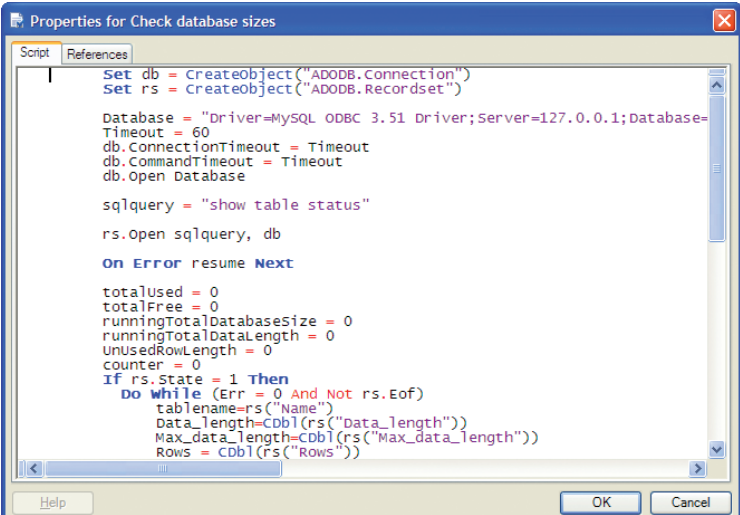
In addition to these pre-canned test steps, Monitor Master can execute raw VBScript added using Story Boarder. This opens up a whole world of customization and third-party integration capabilities. The VBScript language is easy to learn and write, and gives an extra edge to the test creation tool. Here are some typical applications:

- Manipulating files in a file system
- Executing windows command line programs (which could be other custom programs that perform specific tasks)
- Performing complex regular expression matching and XPath analysis

This kind of functionality has allowed our customers to integrate Monitor Master with their systems – without extra cost. For example:

- Connect to a UNIX charging server, download billing files via FTP, parse them, and create KPIs from the results
- Read prepaid voucher numbers from a text file, store them in a local database, then load each voucher onto a SIM card using an IVR service and DTMF tones, checking the balance before and after

Monitor Master's flexibility also permits you to create new KPIs, metrics, and messages in each test. So, not only can you integrate with a third-party system, perform a unique Windows®-based operation, or interact with other operating systems directly, but you can also measure how long it takes and report it as a KPI with any name you require. If a user can do it, Monitor Master can measure it.



```

Script
References
Set db = CreateObject("ADODB.Connection")
Set rs = CreateObject("ADODB.Recordset")

Database = "Driver=MySQL ODBC 3.51 Driver;Server=127.0.0.1;Database=
Timeout = 60
db.ConnectionTimeout = Timeout
db.CommandTimeout = Timeout
db.Open Database

sqlquery = "show table status"

rs.open sqlquery, db

On Error resume Next

totalUsed = 0
totalFree = 0
runningTotalDatabaseSize = 0
runningTotalDataLength = 0
unusedRowLength = 0
counter = 0
If rs.State = 1 Then
Do While (Err = 0 And Not rs.EOF)
tablename=rs("Name")
Data_length=Cdbl(rs("data_length"))
Max_data_length=Cdbl(rs("Max_data_length"))
Rows = Cdbl(rs("Rows"))

```

Advanced Scripting Scene in Story Boarder – connect to DB

PROFESSIONAL AND EDUCATIONAL SERVICES

In addition to providing a speedy standard Monitor Master deployment using our standard scripts and reports, we also offer the option of customizing the system to meet any specific requirements you have.

Professional Services

Ascom can provide a turnkey solution with all the professional services necessary to assure a successful deployment, including design, installation and commissioning, scripting, report configuration, training, testing and acceptance, and documentation.

Our experienced consultants have been working with Quality of Service testing for many years and will be able to provide all the assistance you need.

We can also provide experienced full-time on-site Engineers who will remain on-site at your premises to assist in the day-to-day testing and manage the system as one of your employees.

Training Courses

Ascom offers a variety of training courses. We can provide training at a location of your choice, or at one of our training centers.

Standard Courses – three-day courses:

- User Training – how to use the system
- Administration & Maintenance Training – how to manage operation
- Reporting Training – how to develop and configure new Box Office reports
- Advanced Scripting Training – how to develop new advanced scripts based on VBScript

On top of these trainings we offer a huge variety of add-on packages which provides training on niche topics tailored for your needs.

We work very hard to provide a very professional and interesting training experience to help you learn how to fully utilize your solution and get the most out of it.



Webinars

Webinars offer us a chance to get in touch with our customers to discuss and demonstrate the latest features and developments in our products. Webinars are varied and are given often, to keep you up to date with the latest information.

Managed Services

Ascom can also provide a managed service solution where we operate the solution for you.

CUSTOMER REFERENCE



“Quality is extremely important to us. To ensure this we have implemented Monitor Master throughout our entire product service lifecycle, from testing a new service in pre-launch mode to regression testing and monitoring on launched services. Monitor Master has really been a key component, and enabler, for improving our revenues, costs and of course customer satisfaction!”

Jose Gonzalez, Director Products, Services & Innovation, Vodafone Spain, Madrid

Vodafone Spain

Based in Madrid, Vodafone Spain is a wholly owned subsidiary of Vodafone International. At the end of 2008 Vodafone Spain served more than 16 million customers via GSM & UMTS. Vodafone’s innovative wireless products and services help empower people to connect to those who matter most. Vodafone Spain is the second-largest operator in Spain and multiple independent quality studies continue to rank Vodafone Spain as the best operator in Spain for call and data quality.

Vodafone Spain currently has more than 20 Monitor Master probes in their network, and has plans to add more. They use Monitor Master for service monitoring 7x24, network performance monitoring 7x24, revenue assurance testing, roaming testing, provisioning testing, service audits, and quality assurance.

They test and monitor many services within the national network, including:

- Service monitoring, performance, and quality assurance:
 - Transfer balance
 - Customer care assistance menus
 - Query balance
 - Vodafone live (Mobile TV [radio and network interfaces], Real tones download, Games download, MP3 download, and advertising)
 - Instant Messaging
 - MMS (P2P, P2P [inter-carrier] and Premium services [MO and MT])
 - Web applications
 - Product provisioning
 - MVNOs services
- Revenue Assurance in local and roaming (calls, messaging, data sessions and roaming services)
- Service audits (VF live and provisioning)
- Regression testing (IT releases)

Some of the specific test cases used in the above tests include:

- USSD stage 2 for interactive menus
- Voice quality testing using the PESQ algorithm to produce MOS scores in a full mesh configuration
- Video quality testing using the VMOS algorithm to produce scores in a full mesh configuration
- VF live browsing and content audit to produce a list of failures inside the portal
- General purpose test scenarios (voice, video, USSD Stage 1 and 2, USSD Callback, SMS, MMS, data sessions) allow us to test most of the services locally and roaming using different devices, A and B subscribers, carriers, bearers, etc.

Monitor Master is used by over 100 operators world-wide as well as regulators and major content providers, with systems ranging from a single probe to large-scale deployments with over 460 distributed probes. Monitor Master's unique customization capability is one of the key factors explaining why so many have chosen Monitor Master.

Monitor Master is undoubtedly a safe investment, with native support for all basic and complex test scenarios as well as the ability for users to develop unique testing scenarios, fast and easily without further investment or product changes. Monitor Master is a cost-effective solution which can test what you want, when you want it – always able to adapt to your current testing requirements.

Ascom is the market leader within Quality of Service testing, benchmarking, and optimization, with product solutions such as QVoice for drive testing and benchmarking and TEMS for optimization. Box Office is used to display data from all products providing a unique umbrella solution for all your long-term trend analysis requirements.

- Provisioning testing and audit integrates the provisioning protocols for IT systems, service platforms, and network nodes in order to know the status of a customer
- Every test case is integrated with the Supervision Management Centre which is in charge of issue management

Some examples of Monitor Master's ability to diagnose and troubleshoot network related issues:

- Top Deck: Monitor Master was able to discover an issue with content control, which was then corrected in a timely manner.
- VF live (MP3 download): Monitor Master was able to discover MP3 download related issues that Vodafone Spain could then correct and minimize network downtime.
- DSL Provisioning Testing: Monitor Master was able to identify during provisioning testing on pre-launch DSL services an issue with data translation that was then corrected, preventing customers from experiencing call routing problems.

Some examples of Monitor Master's ability to adapt to specific customer needs:

VF live: When Vodafone launched their WAP portal, they integrated the content download to allow customers to use their handsets to play games, music, etc. They tried to supervise VF live services with their current solution but in the end they chose to implement it with Monitor Master.

Roaming testing: After trying a couple of other solutions, Vodafone implemented Monitor Master for roaming testing in order to test their service from the customer's point of view. Their previous solutions had only been able to test the services from a technological perspective, providing no insight into the customer's experience.



ABOUT ASCOM



The Ascom Group is an international solution provider with comprehensive technological know-how in Mission-Critical Communication. The company concentrates on the core areas of Wireless Solutions (high-value, customer-specific on-site communications solutions) and Security Solutions (applications for security, communication, control systems for infrastructure operators, public security institutions and the army). The company has subsidiaries in 17 countries and a workforce of some 2300 employees worldwide.

With a wealth of experience in implementing complex projects for discerning customers, Ascom has established itself in many key markets. Offerings range from analysis and consulting to system design and system integration, project management, engineering and implementation, through to maintenance and support.

The Mission Critical Communication Company

Ascom's corporate strategy focuses on four key elements:

- Mission-critical communication – solutions tailored to meet individual communication requirements in particularly challenging environments
- Organic growth – innovative products and solutions as growth drivers
- Strategic acquisition policy – aimed at ensuring the ongoing technological development of the Wireless Solutions and Security Solutions divisions
- Increased operational efficiency and consistent cost management

Mission-critical communication is the first focal point of our corporate strategy. We see mission-critical communication as comprising client-specific communication solutions that optimally address time-critical requirements in the daily business and function quickly, reliably and smoothly even in extreme conditions.

The second mainstay of our strategy is our **focus on organic growth**. By offering innovative products and solutions, we want to promote further growth and thus achieve a lasting increase in Ascom's enterprise value. Innovation enables us to maintain our technological advantage over our competitors. Our products and solutions offer the utmost security and reliability. They also offer the flexibility required to ensure quick and cost-efficient integration in our clients' existing systems environments. In their development work, the specialists at Wireless Solutions and Security Solutions use the latest communications technologies and create special functionalities tailored to the respective client environment and requirements.

The third focal point of our corporate strategy is a **diligent and clearly defined acquisitions strategy** aimed at bolstering organic growth in the Wireless Solutions and Security Solutions divisions by way of smaller, strategically appropriate acquisitions aimed at expanding the leading market positions we hold.

The fourth strategic mainstay focuses on **consistent cost management and increasing operational performance**. The streamlined organiza-

[MONITOR MASTER – PRODUCT PORTFOLIO STATIONARY TESTING]

tional structure that Ascom has today, will be further optimized on both, group as well as divisional levels. As part of the concentration on the two divisions Wireless Solutions and Security Solutions, internal processes will be reassessed and additional improvements and simplifications made. Our short and efficient information channels allow us to react quickly and flexibly to client needs and changes in the market environment.

Ascom reserves the right to change specifications without notice. Ascom acknowledges all registered trademarks appearing herein.
