Smart ATA® Product Bulletin

Smart ATA is an ATA that not only offers the service provider a high-function voice-fax ATA with FXO capability, but also includes patented technology (US patent 9,094,419) that finally makes FoIP calls as reliable as PSTN fax calls. Moreover, Smart ATA includes full support for T.38 version 3 with V.34, enabling it to send and receive faxes at twice the speed of non-V.34 capable ATAs. With Smart ATA, NetGen truly defines the next-generation ATA.

In testing with Commetrex, NetGen Communications, Inc. has found that significant practical problems with SIP negotiations for FoIP calls exist in carrier-based networks. After much testing and analysis, we have developed Smart FoIP, which improves the reliability of fax-session establishment for media servers, ATAs, and access gateways. The technology increases the likelihood of a session remaining in G.711 fax pass-through mode, so it also includes a major technology advance that eliminates PCM-clock synchronization problems, which are responsible for a large percentage of G.711 pass-through fax failures.

NetGen's technology has unequalled field experience. Its T.30 was developed in 1994, its T.38 relay in 1998, and terminating T.38 in 2001. This unsurpassed experience led us to discover that as much as 20% of FoIP transaction failures aren't caused by T.38 or other interop problems, but by the session negotiations that occur in carrier networks at the beginning of a SIP-based FoIP call. These problems are solved by Smart FoIP.

Features

- Commetrex' Smart FoIP®
- Two Ethernet ports on all models
- Smart ATA 411: 1 FXS and 1FXO
- Smart ATA 422: 2 FXS and 2 FXO
- Smart ATA 402: 2 FXS
- T.38 version 3
- V.34 fax
- Five-second round-trip delay for T.38
- T.38 ECM support
- T.38 UDP and TCP support
- Smart PCM clocking
- Peer-to-peer voice
- Caller ID
- Flexible configuration with Option 66 and TR-069
- Service-provider white label
- FXO hot line
- IVR with second-stage dialing
- G.711 μ- and A-law and G.729
- G.168 LEC
- Media-aware jitter buffer
- Voice QoS features
- Advanced call-control features
- Inbound call routing
- PSTN failover
- DHCP client
- DNS client
- VLAN support
- STUN client
- Comprehensive security features
- SNMP
- Management and debug features

FoIP and T.38 Background

Not all T.38 (the ITU protocol for real-time faxes in IP networks since 1998) implementations exhibit the same performance in the field, even if they conform to the T.38 recommendation. You could easily have a widely interoperable T.38 with an intolerably low transaction-success rate. It is difficult to verify interoperability, and it's even more difficult to determine performance. And to make matters worse, the parameters of T.38 performance aren't even widely known.

Beyond interoperability, much of what we call T.38 performance is inherent in its implementation, not the specification. It's safe to say that the best T.38 designs were developed by an engineer that has successfully fielded T.30, the protocol of terminating fax. This is because T.38 does not give any guidance on how to improve delay tolerance, for example, but, as we know, it is improved through so-called spoofing techniques implemented by skilled T.38-relay developers who thoroughly understand T.30. Better relays can handle up to five seconds of round-trip delay in the IP path.

The Problem

Through rigorous testing, NetGen has learned the effect on call set-up performance of how an ATA, a gateway, or a fax server handles late-arriving T.38 re-invites. Signaling delays within a carrier network can cause a gateway without Smart FoIP to effectively kill a fax session by blindly accepting a T.38 re-invite received from its off-ramp peer in a non-V.34 session.

The Solution

To solve this problem, we developed Smart FoIP, NetGen's licensed software that includes patent-approved technology that puts intelligence into whether to accept a T.38 re-invite, eliminating too-late re-Invites as a cause of failed sessions, boosting transaction success rates, often by 10%.

Smart ATA attaches a V.21 modem (along with other analysis algorithms) to the media streams at the beginning of a fax call. Smart ATA analyzes the decoded V.21 data to track the T.30 states of the calling and called terminals. The called terminal will repeatedly send its initial message (DIS) until Smart ATA sends its response. Once Smart ATA receives a complete DIS, it sends its response (DCS) within 75 milliseconds. Therefore, once this calling-terminal response (DCS) is received by the called terminal, uninterruptable G.711-based modem operations have begun, and the gateways can no longer switch the session to T.38 without possible corruption of the T.30 states being maintained in the endpoint terminals.

With Smart FoIP, once Smart ATA detects the preamble to the calling fax terminal's response, it will no longer accept the T.38 re-invite, continuing the transaction in G.711 mode and avoiding the session failures caused by the transition occurring during a modem session.

G.711 Pass-Through Fax

Of course, refusing a T.38 re-invite means continuing the session in what is called "G.711 pass-through mode." But, you may have wondered, doesn't Smart FoIP mean more G.711 pass-through faxes? And don't they inevitably fail? That's a good question because the answer is yes, G.711 fax sessions do often fail unless the session includes a fax relay with Smart FoIP's proprietary buffer-management technology.

Carriers have done a great job of virtually eliminating dropped packets, but PCM clock-synchronization problems remain. The problem results from jitter buffer under-run and over-run caused by the PCM clocks at opposite ends

of the link (the endpoint terminals) not being equal, which is always the case. The question, of course, is how unequal are they and how long is the fax? The more unequal they are, the quicker the session fails. Long-enough G.711 pass-through faxes and even long T.38 sessions can fail if the jitter buffers are not effectively handled. Smart ATA includes buffer-management technology that eliminates PCM-clock-synchronization problems in G.711 pass-through and T.38 fax sessions.

In relay-to-relay T.38 operations, there are two analog PCM sample clocks: one at the remote transmitting fax and the other at the local re-modulating modem. These two clocks always have a different rate. Bits generated at the transmitting endpoint fax terminal must be retransmitted by the off-ramp gateway's local modem. If the remote fax is generating bits faster than the off-ramp gateway's local modem can send them out to the fax terminal, off-ramp overflow eventually occurs. In the reverse case (off-ramp faster than transmitting fax terminal), the on-ramp modem will run dry since the off-ramp gateway is sending the bits out faster than it receives them, and T.38 relay will have to spoof some bits to keep the transmitter running (provided you have a well designed relay, of course). Underflow is not as much of a problem, since the relay can insert additional flags in V.21 data or padding bits at the end of a line of image data (Does your relay do that?). But overflow is a problem as valid data must be tossed (and modems just hate that).

Smart ATA includes patent-approved fax-aware jitter-buffer management that is specific to G.711 pass-through fax and eliminates PCM-clock sync problems in gateways.

Voice Support

But just because Smart ATA includes amazing fax technology, don't expect it to be short on voice performance, quality, and features. Smart ATA supports G.711 and G.729 with G.168 echo cancellation. There is a full complement of calling features such as transfer, forward-on-busy, call waiting, caller ID, caller blocking, DND, color ring-back tones, and many other call-routing options with 500-rule capacity. You can actually build a distributed PBX with Smart ATA.

System Management

Smart ATA is designed with the VoIP service provider in mind. The product is fully configurable with TR069- and Option 66-based remote management, SNMP with MIB V2, and Web utility for configuration and firmware upgrade. It has 8 levels of logging, a syslog, debugging and trace facilities, and status monitoring and statistics. And if your volumes justify doing so, we can customize the browser screens to include your company and logo.

Figure 1 - Smart ATA Case

Specifications

Port Configurations	HX411: 1 FXS and 1 FXO ports, 2 Ethernet ports HX422: 2 FXS and 2 FXO ports, 2 Ethernet ports HX402: 2 FXS port, 2 Ethernet ports
Case	Desktop and wall mountable, Size: 150 x 109 x 30mm, Weight: 300g, LED: power, Ethernet, FXS, FXO, device status, Ethernet: RJ45
Hardware Resources	ATMEL AT91SAM9G20B, 400MHz, 32MB SDRAM, 4MB Flash memory
Power Supply	AC/DC Adaptor with input: 100-240V AC, output: 9V/0.66A DC Power
Operating System	Linux kernel 2.6.27
SIP Registration	Per trunk, per gateway, expire setting, SIP trunk, up to 10 SIP proxies, P2P, SIP-to-SIP relay, Hook flash relay (INFO
FXS	Polarity reversal generation, caller ID generation (Bellcore and ETSI FSK, DTMF, before/after ring), ring cadence setting, ring frequency setting, volume control, hook-flash timing setting, message-waiting indicator (FSK, polarity inverse), hot line
FXO	Relay to FXS extension, redirect to SIP server, voice response and second-stage dialing, PSTN calls from either FXS or IP network, Battery reversal detection, caller ID detection (Bellcore and ETSI FSK, DTMF, before/after ring), DTMF out-pulsing timing setting, volume control, ring-parameter setting, busyout when FXS is not available
Codec/Fax/RTP	G.729, G.711ALaw, G.711Ulaw, T.38 Version 3 with Smart FoIP and V.34 fax at 33,600 bps, G.168 Echo cancellation, dynamic jitter buffer, static jitter buffer for modem (fax/data) pass-through with Smart FoIP, DTMF relay (RFC2833, SIP/INFO, in-band), adjustable packetization period, 10/20/30/40/50/60ms
Voice QoS	IEEE 802.1p tag, DiffServ code point (TOS) bits
Call Control	Blind transfer, explicit transfer, call forward busy, call forward no answer, call forward variable, call waiting, caller ID, caller ID blocking, caller ID on call waiting, distinctive ring, do not disturb, music on hold, color ringback tone, built-in 3-way calling, speed dialing, calling- and called-number-based routing, hunt group (sequential and circular selection), ring group, digit map, PSTN failover (upon IP network break or failure to reach SIP proxy, or power break), 500-rule call-routing capacity
Networking	DHCP client DNS/DDNS client, PPPoE client, NAT traversal (STUN), VLAN support
Security	IP filtering list (IP table), SIP/RTP/Telent/HTTP/TFTP port screening, Web-utility access privilege (admin and user), HTTPS, disable HTTP GUI, SIPS and SRTP.
System Management	Option 66- and TR069-based management (TR069, TR104, and TR106), SNMP agent (MIB v2), Web-utility for configuration, data import/export, and firmware upgrade, auto-provisioning for configuration and firmware upgrade, log management (8 levels), Syslog, debugging and call trace, TCP dump, system status monitoring and statistics (TR069, SNMP, Web) NetGen offers Smart ATA volume customers a no-charge Auto Configuration Server.

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