



TerminatingT38 Real-Time IP Fax Relay

Commetrex' TerminatingT38™, a special combination of its ITU T.38 and T.30 ITU fax protocol engines, gives the developer of a network-service platform or an enterprise fax server the technology necessary to terminate T.38 (IP network) real-time fax transmissions the same as it would real-time faxes from the PSTN using analog modems. When combined with Commetrex' stand-alone T.38, the developer can implement both terminating and standard fax-gateway functions on the same platform, combining the functions of the service platform and the gateway. When combined with Commetrex' fax modems the server's application can send and receive faxes without regard to whether they are transported via TDM or packet networks, or gateways with and without T.38 support.

There are two primary ITU recommendations for transporting faxes across IP networks: T.37 and T.38. T.37 specifies how a fax image is encapsulated in e-mail and transported to the recipient using a store-and-forward technology. T.38 defines a protocol for transmitting a fax across an IP network in real time, requiring no behavioral changes on the part of the user. A gateway designed to offer the carrier a transport for corporate fax traffic at least as robust and capable as the PSTN must include T.38.

Commetrex' TerminatingT38 is available as licensed software for incorporation into your proprietary environment. TerminatingT38 makes no assumptions regarding the connection setup, such as H.323 or SIP, nor does it assume a particular call-control API for the application software.

Robustly transporting a fax that originates in a 'traditional' fax terminal over a packet network to a traditional receiving terminal in real time requires that a fax-relay entity be situated



between each terminal and the packet network. These entities—the relays—must render the delays and timing uncertainties of the packet network transparent to the protocol engines operating at the transmitting and receiving terminals (see figure on the following page).

Commetrex has developed a version of its PowerRelay T.38 gateway product that, rather than relaying the fax to the PSTN, terminates it in TerminatingT38's server-based T.30 protocol engine. One of the legacy fax terminals is removed and Commetrex' TerminatingT38 substituted so that the fax terminates in the service platform rather than a fax terminal.

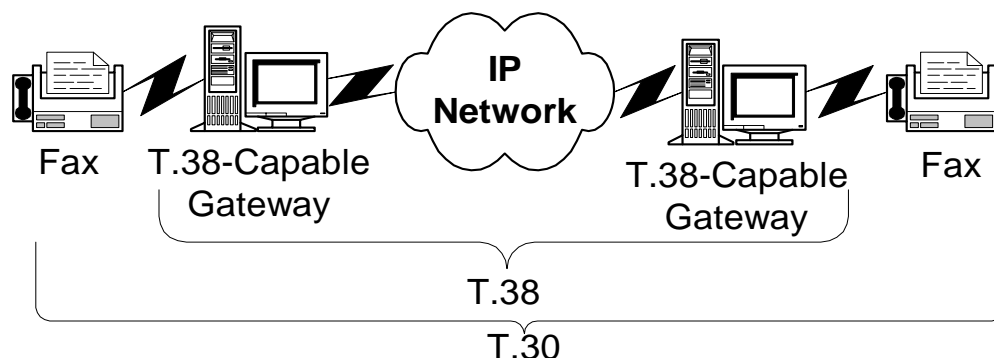
Features

- Terminates T.38 faxes in a server
- Commetrex' field-proven T.38 engine, the industry's standard for interoperability
- Support for ITU T.38 real-time fax over IP
- Field-proven T.30 engine
- Source- or object-code licenses
- Tolerates five seconds of packet latency
- Host-only or DSP based
- C-language portable
- TI TMS320C6000, plus Windows NT, POSIX Std 1003.1 host versions

Benefits

- Proven interoperability from the Commetrex T.38 Interop Lab
- Implement high-value functionality
- Reduced footprint and product price
- Reduced development expense
- Resource and vendor independent
- Combine gateway and service-platform functions
- Reduced maintenance costs

Figure 1, Real-Time Packet-Based Fax



TerminatingT38 includes Commetrex' acclaimed T.30 fax-protocol engine (PortableT30™), and a special version of PowerRelay T.38, which is used in gateway applications. TerminatingT38 may be licensed separately for a fee lower than the fee for PortableT30 and PowerRelay. It is available for no additional fee to the licensee of both PortableT30 and PowerRelay.

System Overview

The diagram above shows the typical real-time fax relay. Note that PSTN-connected fax terminals are at each terminus of the fax session. Each fax terminal hosts either the calling or answering portions of the T.30 protocol. If one of the terminals is removed, its portion of T.30 must be replaced by terminating T.38 technology since T.38 gateways do not include T.30.

In a gateway, the T.38 protocol engine implements the algorithm controlling the sequencing of modems and the transfer of signals across the data link. It also implements

the protocol "spoofing" required to handle the delays in the IP network. Spoofing refers to the logic implemented in the fax relay components that 'fools' the transmitting and receiving fax terminals into, for example, padding image lines or re-transmitting a message to render network delays transparent.

But for a T.38 that is not required to spoof legacy terminals and, instead, terminate (or originate) faxes into a co-located T.30 protocol engine, much of the typical T.38 engine is superfluous and is eliminated to reduce resource consumption.

The diagram below shows the same connection with one PSTN terminating fax terminal, but the terminal at the opposite end of the session has been replaced with TerminatingT38. It is helpful to think of the T.38 protocol engine as replacing analog fax modems in a PSTN terminating-fax application. The rest is the same: T.30 protocol engine, image-conversions, and API for the fax application.

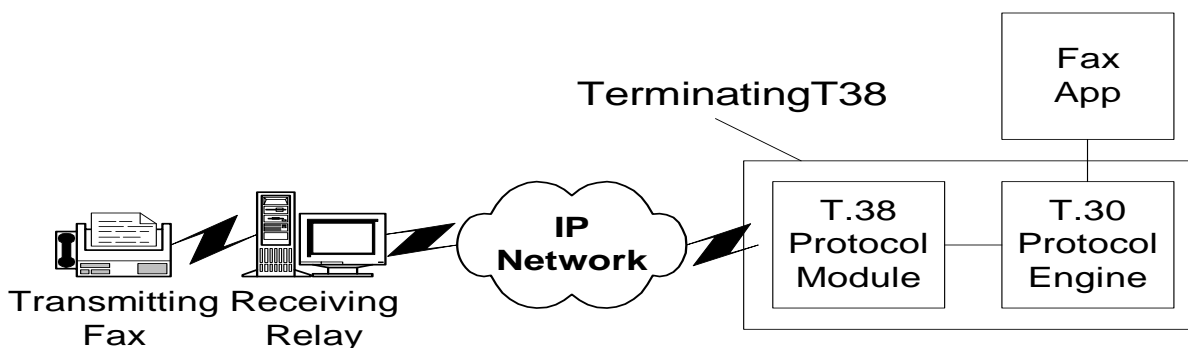


Fig. 2, General Diagram Real-Time Packet-Based Terminating T.38

Interoperability

Commetrex provides the telecommunications industry an interoperability testing service, the T.38 Interop Lab, which uses TerminatingT38 as the interoperability standard. No fee is charged to vendors of fielded T.38-capable gateways or to licensees of Commetrex PowerRelay for T.38 or TerminatingT38.

Licensees use the Lab's services, which are all delivered over the Internet, as a valuable tool in integration and validation testing.

Interfacing

TerminatingT38 is comprised of Commetrex' PortableT30 integrated with a special version of T.38. The T.38 recommendation is transport non-specific, so the packet interface point with T.38 is simply a way to transfer T.38 payload packets, as specified in T.38. This is a simple asynchronous buffer-passing interface. It is the responsibility of the implementor to interface this point with the IP transport. Note that jitter-buffer management is handled in the T.38 module.

Just as interfacing with the analog modems in a terminating PSTN application is less complex than interfacing with T.30 and its several adaptation packages, so too is interfacing with TerminatingT38 mainly a matter of interfacing with PortableT30, which is part of the package.

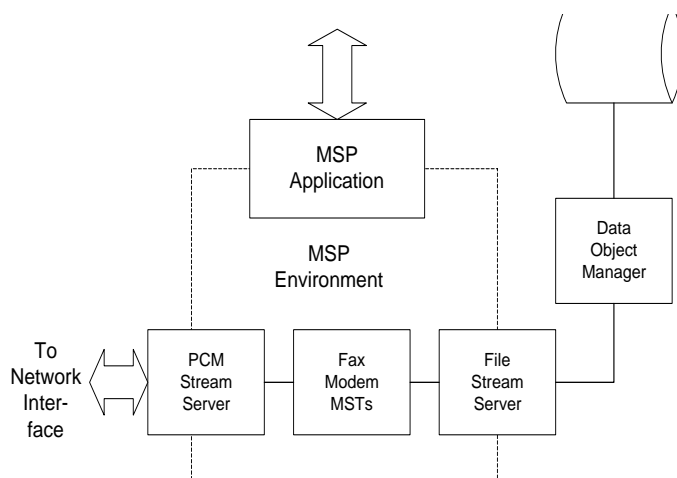


Fig. 3, PSTN Fax in an OpenMedia Environment

PortableT30 has several interface points, such as file I/O, image conversions, font conversions, timer package, and event pre-processor. The implementor also has the option of substituting his own application interface. The package includes a generic, yet comprehensive API, which may be used as is, extended, or substituted.

System Implementation Examples

Commetrex offers TerminatingT38 in combination with terminating PSTN fax on its Open Telecommunications Framework[®] (OTF) Kernel middleware product and MSP Media Gateway DSP-Resource Boards. Should the system require support for both IP and PSTN connectivity, the fax command will be routed to the appropriate resource. H.323 and SIP included in OTF for call control when establishing IP connections.

Commetrex uses its OpenMedia[™] MSP Consortium M.100-conforming media-processing software framework to host TerminatingT38 and related fax technologies, as shown in figure 4.

The major entities of an OpenMedia implementation of PSTN terminating fax are shown in figure 3. The MSP Application interfaces with the client through the fax API and hosts the T.30 protocol machine.

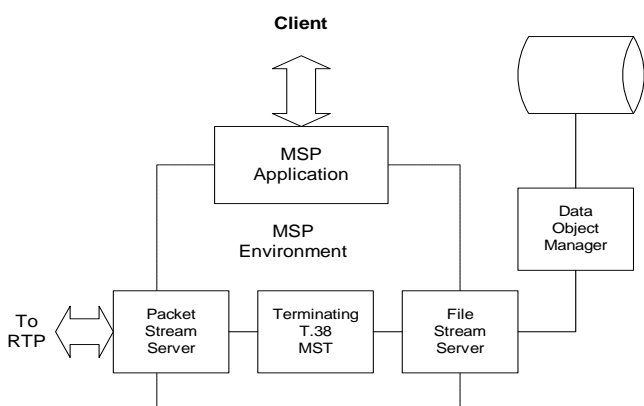


Fig. 4, Terminating T.38 in an OpenMedia Environment

There are two OpenMedia entities used to interface with external entities (see figure 4): The File Stream Server uses the OTF Container Manager's Data Object Manager to interface with spatial-media storage. The Packet Stream Server exposes a buffer-passing interface to the H.323 Call Control Agent, for example. For PSTN fax, analog fax modems replace the T.38 module, and a PCM Stream Server replaces the Packet Stream Server, as shown in figure 3. For clarity, the figures exclude control connections, the OTF Transport, and other details.

Note that OpenMedia makes no assumption as to the location of each of the entities shown in the diagrams. Many implementations will include three different types of processors that can host these entities: a DSP, an embedded scalar or network processor, and a system-level or host processor.

The fax MSP Application is logically part of a Resource Service Manager (RSM). Either it can be incorporated into an RSM process or can be a separate process under control of the RSM.

Call control is accomplished, for example, by adding H.323 or SIP for T.38 or the PSTN Call Control Agent (CCA) required by the PSTN network interface. A single RSM can implement both, in which case the fax MSP Application

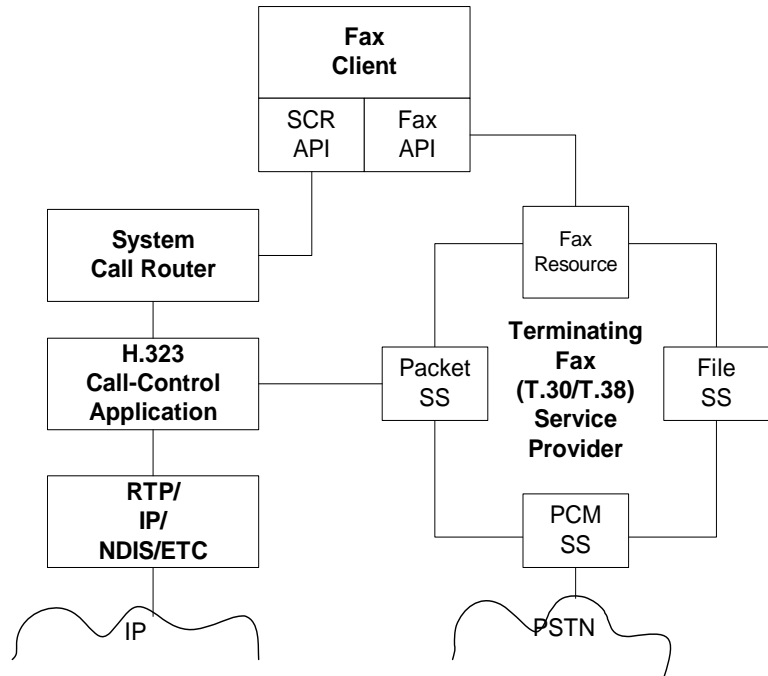


Fig. 5, Multi-Transport Terminating Fax in an OTF Environment

could be incorporated into the RSM. Separate CCAs in separate RSMs could be implemented, in which case the fax resource might be a separate process and OTF-addressable entity.

Figure 5 shows the TerminatingT38 system resource/service integrated with an H.323 Call Control Agent. The diagram for the PSTN version has a similar architecture. Those portions of the OTF Kernel included in the diagram are enclosed by the dashed line.

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