



Sea Softswitch and Wave Gateway

Abstract:

Tadiran Telecom Ltd. presents a comprehensive VoIP solution consists of advanced Softswitch and robust VoIP gateways.

As part of the market trends and customer's needs, Tadiran offers a cost-effective solution which is based on **migration path, enabling customers to retain their investment.**

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1 General

The Coral Sea is a powerful Softswitch which provides Class 5 and IP PBX services for MLE (Medium Large Enterprise) market segment.

The Sea Softswitch provides cost-effective solution for Enterprise to take advantage of converged infrastructure, and to provide telephony services over the data network to multiple branches.

In most cases, the Enterprise needs an access to the PSTN (Public Switching Telephony Network) to interconnect with the TDM based environment.

Furthermore, there is a need to combine into the NGN (Next Generation Network) the existing traditional Plain Ordinary Terminals (POTs).

For these purposes, there is a need for the VoIP Gateway.

Tadiran provides the required solution- the **Wave Gateway**.

The Wave gateway provides interface options for the software based Sea Softswitch. It provides telephony connectivity or access points to integrate the IP based Softswitch with popular telephone digital circuits such as PRI, E1, and T1 as well as analog trunks and single-line analog stations.

The Wave gateway line circuits have been certified in over 40 countries world wide. The Wave gateway can also support Tadiran digital telephones. This is a practical alternative for existing Coral sites migration to the Sea Softswitch or new sites where infrastructure might favor digital telephones.

The Wave gateway is a scalable solution that can utilize certain existing Coral cabinets and cards.

Existing Tadiran customers, that have the Coral system as part of their communication network, can easily migrate the network to NGN topology by transform the Coral system into a Wave Gateway.

For Green-field customers, Tadiran offers the Sea Softswitch in conjunction with the Wave gateway.

2 Migration concept

Existing Coral customers can easily migrate their TDM based switch into VoIP gateway.

In order to execute the migration process, it is recommended that the customer will approach to his local representative and verify if there is a need to add/replace the main controller card for software upgrade capability, add a MAP (Management Application Platform) to provide the connectivity and Call control commands from CSS and PUGW card for sending the Media over RTP (Real Time Transmission Protocol).

The Coral Software should be upgraded to Wave Gateway software version 3.0 or above.

3 Wave Gateway (WG) values

The Wave gateway is Standard-compliant solution which supports multiple interfaces to the PSTN.

Migration of the Coral into the Wave gateway enables customers to establish a distributed network which is controlled by the centralized Sea Softswitch.

The Dialing Plan (NPL) can be controlled for all sites from the NOC (Network Operation Center).

The distributed concept enables user's mobility between the different Enterprise branches and still maintains their original DN (Directory Number).

Tadiran Wave gateway contains powerful QoS mechanism to provide the top media quality over the IP network.

The migration path between the Coral and the Wave GW retain the same telephony functionality that he was used to as the Coral user.

The distributed topology consists of multiple Wave gateways, enables the Enterprise to use a centralized unified messaging system (the Sea Mail) and other services and applications as unified common resources.

Stand-alone Coral switch can be connected to the Sea Softswitch through the IPNET interface (QSIG over IP), however the branch does not appear as integrated part of the network and can not be managed through the Sea Softswitch unified management system.

Note: Wave Gateway can not be connected through IPNET.

4 WG Centralized management system

All the Wave gateways can be fully controlled by the Sea Softswitch centralized management system.

Network Managers can access remotely to each one of the Wave Gateways and configure different parameters per each card.

Screen captures 2 and 3 present the access process and drill-down capabilities to each card of the selected Wave gateway.

Gateway Name: TG-SINAI

Country: Israel Location: Default location

Setup Synchronization Card List

Delete		Shelf / Slot	PType	IType	Status	Version	Subversion	Card Configuration
<input type="checkbox"/>	<input type="checkbox"/>	0 / 1	8T-CID	8T-C	ACTIVE	1	9	
<input type="checkbox"/>	<input type="checkbox"/>	0 / 2	NO_CARD	8SLS	-----	---	---	
<input type="checkbox"/>	<input type="checkbox"/>	0 / 3	16SFT	16SDT	ACTIVE	3	4	
<input type="checkbox"/>	<input type="checkbox"/>	0 / 4	PRI30	PRI30	ACTIVE	52	45	Configure
<input type="checkbox"/>	<input type="checkbox"/>	0 / 5	8TBR	8TBR	ACTIVE	5	22	Configure
<input type="checkbox"/>	<input type="checkbox"/>	0 / 6	UGW	UGW	ACTIVE	9	18	Configure
<input type="checkbox"/>	<input type="checkbox"/>	0 / 13	RMI-F	RMI-F	ACTIVE	4	19	
<input type="checkbox"/>	<input type="checkbox"/>	0 / 14	URC2	URC2	ACTIVE	1	21	

Screen capture: 2

Type Location

Signaling >>

Signaling QoS >>

Media <<

MAC Subnet Mask

Local IP Address Default Router Address

Global IP Address Echo Cancellation period

Media QoS <<

Diff Serv 802.1Q/p

Security Type >>

Physical Capacity >>

Required Capacity >>

Screen capture: 3

As it can be seen, Screen capture 3, it is possible to configure different vital parameters such as: QoS, Codecs, Security, The Wave Gateway's endpoints (POTs, Trunks and smart Digital Phones) are inherent entities of the Sea Softswitch and therefore can be controlled from the centralized Sea Softswitch management system.

User's profile and Class of Service can be configured from the centralized Sea Softswitch management system..

The Wave Gateway entities can be remotely configured as CUG (Close User Group) for hierarchic topology.

5 Quality of Service and Media Quality

Tadiran presents an innovative VoIP solution, which complies with demanding requirements for best Voice quality, QoS (Quality of Service) and GoS (Grade of Service).

Utilizing sophisticated algorithms and powerful hardware-based DSP (Digital Signaling Processor), Tadiran meets these challenges while effectively handling network service impairments.

5.1 Bandwidth-saving methodologies

The WG includes different modules for gaining optimal bandwidth utilization:

- Media compression
- Multiple frames per RTP packet
- Silence suppression mechanisms using Voice Activity Detection (VAD)

5.2 Media Compression Methods

Different compression methods can be configured according the network condition and bandwidth availability.

Available compression methods:

G.711A, G.711u, G.723.1_5.3, G.723.1_6.4, G.729A CS-ACELP

The Tadiran solution negotiates the best match of its available high quality compression methods to current network and traffic conditions. Tadiran's dynamic bandwidth utilization assures maintenance of top voice quality in spite of varying network conditions (which may include high packet loss, jitter, etc).

5.3 Multi-Frames per RTP Packet

Minimization of RTP overhead is essential to making the widest possible Bandwidth available to customers. Coral Sea Port can be configured to define the number of multi-frames per Media packet in order to keep RTP overhead as low as possible.

When the number of multi-frames per Media packet is large, the probability of packet loss is reduced at the cost of greater network latency. High latency may influence the overlap phenomenon and may cause problematic echoes over the network.

In order to meet the challenges of high voice quality and carrier class QoS, Tadiran uses a sophisticated Echo cancellation mechanism that complies with G.168 (Extended Echo Cancellation), and an efficient Echo tail mechanism (up to 128 ms).

The Tadiran solution requires less bandwidth and is less vulnerable to bandwidth congestion. These advantages are the results of using longer packets (including large payloads) and the consequent reduction in the RTP packets rate.

5.4 Silence Suppression Mechanisms

Tadiran's solution enables the activation of silence suppression mechanisms based on Voice Activation Detection (VAD) mechanisms. Silence suppression results in more efficiency and an overall reduction in bandwidth use. Using Tadiran's VAD mechanism, voice quality is not affected by possible high frequency background noise, front-end clipping or back-end clipping. During noise suppression, the comfort noise generator is activated to ensure that voice naturalness is un-affected by the noise suppression.

5.5 Delay

Delay is a common IP environment impairment. Talker overlap becomes significant when latency increases to more than 250ms (one-way delay), and high latency influences perceptual quality, with phenomena such as echo becoming a major problem.

In order to limit latency and assure superior performance, Tadiran uses non-blocked powerful resources such as hardware-based DSP for efficient compression, VAD, DTMF detection, and an RTP Packet-structure controller.

5.6 Echo

Echo phenomenon is measured in several frequency ranges:

- SRL-Low: 300-500 Hz
- SRL-High: 2200-3400 Hz
- ERL: 560-1965 Hz

Tadiran's built in echo cancellation mechanisms comply with the G.168 standard (Extended Echo Cancellation) and successfully handle two important aspects of the echo phenomenon: echo tail and return loss.

Echo tail is the amount of time that passes from the sending of media until correlated media is received at the destination. Tadiran's cancellation mechanism treats correlated media in a predefined interval that is shorter than the echo tail (in ms).

Return loss is the echo attenuation, i.e. the ratio between the transmitted signal and the received echo (in dB).

5.7 JITTER

Since packet switches are connectionless, the one-way delays of packets vary. Variations in inter-packet delay result in the jitter phenomenon. In real-time applications such as voice, the jitter phenomenon requires treatment.

In order to overcome jitter, the WG includes a jitter buffer. The length of the jitter buffer may prevent packet loss and increase the ability to control a constant media rate. However, there may also be an undesirable effect on latency. The

longer the jitter buffer is in use, the higher the latency that will be imposed into the system.

To optimize jitter-buffering, Tadiran's system uses an adaptive dynamic jitter buffer with the following features and characteristics:

- Individual engagement of multiple channels
- User-tuned dynamics and tradeoffs
- Suitable for both delay sensitive and error sensitive applications

The application controls the operational mode of the jitter buffer and the way it responds to network behavior by its selection of the available optimization factors. These are determined in light of application objectives and the network mode.

If the optimization factor is set to the maximum value, the jitter buffer delay tracks the network latencies to their maximum and stays there, thus minimizing the packet error ratio but causing high voice path delay. If the lowest value is used, the jitter buffer increases the delay only to compensate for clock drifts, reverting each time to the minimal setting. This minimizes the delay at the cost of higher packet loss rates.

5.8 Congestion

In order to minimize Congestion phenomenon, which may lead to packet loss, Tadiran's system works in conjunction with existing routers (on the VoIP network) that include built-in QoS mechanisms such as MPLS, DiffServe, RSVP, etc.

By tagging the RTP packets using TOS (Type of Service) bits, the system can define packet priority and the proper treatment by the QoS mechanism.

Then, by matching the length of the packets to the network conditions, using some of the methods already mentioned, e.g. multi-frames per packet, Voice Compression, etc., Tadiran's solution minimizes the congestion phenomenon.

5.9 Tadiran WG QoS mechanisms

- Front-end or back-end clipping: efficient VAD
- Minimization of packet loss
- Dynamic jitter buffer
- Priority or congestion problems over network (in conjunction with the routers)
- Echo cancellation compliance with G.168
- Effective echo tail – up to 128ms
- Reduction of background noise aimed at maintenance of top voice quality using effective VAD
- Treatment of cross-talk
- Reduction of latency: packets structure controller, effective dynamic jitter buffer
- High performance hardware DSPs for voice compression
- Effective embedded handling of harmonic distortion (for 2nd & 3rd harmonic of 1004 Hz at 0 dBm)
- Effective embedded mechanism to handle any Quantization distortion

6 WG advantages

1. Wave Gateway's End-Points are Sea Soft Switch' End-Points and have the same view/GUI as any other Sea end point
2. Same Look and Feel for Administrators
3. Numbering Plan (NPL) can be defined for all Wave Gateways from the unified management system. It can not be done if the customer has the Coral switch and the migration process has not been executed.
4. Network maintenance becomes very simple in the migrated network
5. Wave Gateway Users have the same Identity & Aliases concept, the same User Configuration and Profiles concept as any other Sea Softswitch' User
6. Wave Gateway "Users" can be a member of any kind of Sea Group like: ACD, Call and ULA and may activate features or being activated by features like: Auto Answer and Voice Page.
7. BLF (Busy Lamp Field) Support - Wave Gateway Users, as any other Sea Users, provides BLF indication for all Sea Users.
8. Investment preservation- Wave Gateway supports all the existing Coral Trunk interfaces and part of Coral station*
9. Supported Trunks - OSIG/ETSI/Australian ISDN (PRI and BRI) User and Network Side, NONE-ISDN Digital Trunks (30T, 30TM, T1), Analog Trunks, (4/8T not support Power Fail), Analog E&M, DTMF E&M and MFC interfaces.
10. Relays/UNA- Wave Gateway' Relays and UNA ports are recognized as general Sea Softswitch' endpoints and they are activated by dialing to their User's aliases.
11. Local Music on IDLE- Wave Gateway recognizes one music source as general Sea Softswitch' endpoints and it can be activated ONLY by Human users of the same Wave Gateway by dialing to the music source user's alias.

Note: The only music source that is recognized is the first PAGE port of the first DRCM/RMI/URC that was installed in the system.

7 The incentives for migration process

Before migration process, the Softswitch can inter-work with Coral IPx switches utilizing the IPNET.

In this hybrid topology limited Networking features can work:

1. End-Points have several networking functionalities between the different branches utilizing the IPNET such as "Make Call", "Connect", Transfer, Message, Voice page, Page Queue and Camp-On.

Networking features that can not work in Hybrid topology:

1. Coral IPNET stations do not provide BLF indications for Sea Users and Sea Users do not provide BLF indications for Coral stations (IPNET Protocol does not support BLF information).

2. Auto Answer, pickup, distributed ACD.

3. Centralized Management is not supported in Hybrid networks

4. Portability between the branches (INCLUDING Numbering, CoS, Prife)- it should be done manually.

8 Wave GW interfaces and protocols

Tadiran Wave GW enables interoperability with various PSTN interfaces including PRI (Primary Rate Interface) and BRI (Basic Rate Interface) supporting different protocols flavors such as EuroISDN, AT&T, QSIG, and Q931 over Q921.

Furthermore the Wave GW supports E1 and T1 interface using the CAS (Cannel Associated Signaling) supporting different protocols flavors such as E&M, MFC, R2, MFC/R2.

Using the T1 interface, Tadiran supports the Robbed Bit method.

These interfaces can be provided with the required impedance per country standard: 120 or 100 ohms.

The Wave GW supports a selection of country specific tone plans and other parameters as presented in Screen capture 1:



Screen capture: 1

As any component of Tadiran NGN concept, the Wave GW can be remotely managed using the Sea Softswitch centralized management system.

Each Softswitch can work in conjunction with multiple Wave Gateways to support the required traffic capacity and to provide the required Grade of Service.