



# Experience Intelligence™ for VoIP Networks

## Ditech Platform

Ditech's Experience Intelligence™ (EXi) solution for VoIP is available on the Packet Voice Processor.



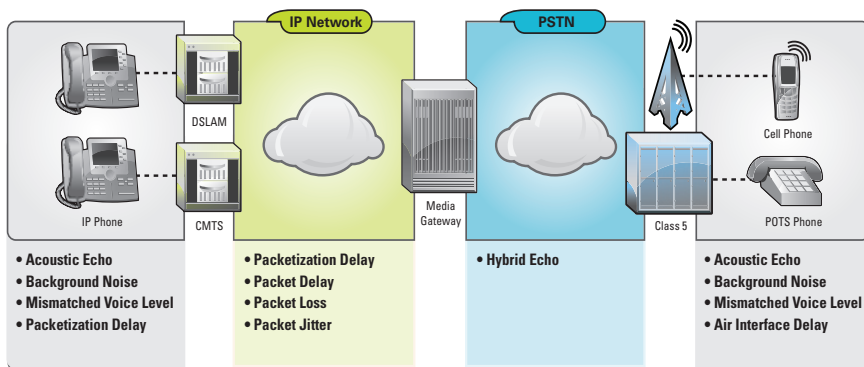
Packet Voice Processor™

The deployment of Voice-over-IP (VoIP) technology in voice networks has introduced a number of new voice quality issues. IP problems such as packet loss, packet delay, and packet jitter reduce voice quality and increase the annoyance of traditional network impairments, such as hybrid echo, acoustic echo, differing voice levels, and background noise. The aggregation of these quality impairments can be significant enough to affect customer satisfaction and retention rates. To exacerbate the issue, carriers have not had a view into the complete set of voice quality impairments within the VoIP network, until now.

## A Comprehensive View of Network Impairments

Ditech's EXi solution is a powerful tool that measures and reports a comprehensive set of voice quality statistics generated from live calls in a VoIP network. Unlike competing voice quality monitoring solutions that require intrusive test tools, Ditech's EXi non-intrusively monitors every call that passes through a Packet Voice Processor. Other solutions only report on test calls or packet impairments, while EXi offers a full suite of quality information including speech and noise levels, echo delay, return loss, MOS scores, and R values, as well as packet impairment data for actual customer calls.

The extended visibility offered by EXi allows VoIP service providers to proactively identify and address network quality issues in great detail to improve the customer experience. In addition, the ability to retrieve and analyze records of call quality statistics allows customer issues to be addressed easily through simple queries and analysis. This view of customer experience – looking at the total voice quality within a VoIP call – gives service providers the knowledge and intelligence to improve customer satisfaction and reduce customer churn.



Voice Quality Impairments in a VoIP Network

## SPEECH QUALITY MEASUREMENTS

EXi measures and reports the following voice quality statistics:

- Noise levels
- Speech levels
- Hybrid echo delay
- Hybrid echo return loss
- Acoustic echo delay
- Weighted acoustic echo path loss
- Transmission Rating (R) Factors
  - Listening Quality (R-LQ)
  - Conversational Quality (R-CQ)
- Mean Opinion Scores (MOS)
  - Listening Quality (MOS-LQ)
  - Conversational Quality (MOS-CQ)
- Packet jitter
- Packet delay
- Packet counts

## The EXi Architecture

Ditech's EXi solution has three parts: the EXi-Agent, which resides on the Packet Voice Processor, and the EXi-Collector and EXi-Reporter, which reside on the Element Management System (EMS). The EXi-Agent is responsible for collecting individual call data, calculating R Factors, and correlating MOS values. The EXi-Collector is responsible for gathering the EXi data from all Packet Voice Processor nodes and storing to a database. The EXi-Reporter analyses the data and provides a graphical display of networkwide voice quality statistics.

### EXi-Agent – Live Call Measurement

The EXi-Agent leverages Ditech's expertise in echo cancellation and voice enhancement by utilizing voice processing DSP resources to continuously and non-intrusively measure and record voice quality impairments that are traditionally ignored by passive VoIP test tools. This level of quality analysis provides an unparalleled approach to understanding true voice quality, as it happens, within live calls.

#### Noise and Speech Levels

An increasing number of calls originate from noisy urban environments where call quality can be negatively affected by background noise. Ditech's EXi-Agent measures per-call speech level, noise level, and signal-to-noise ratio (SNR) in both directions to identify and report unwanted noise in a call.

#### Echo and Delay

Transporting voice over IP networks usually results in greater and more variable latency than TDM. The majority of legacy hybrid echo cancellers are unable to handle this added delay, leaving callers unprotected from annoying hybrid echo.

In addition, the proliferation of user choices in terminal equipment (handsets, headsets, PC-based softphones, and speakerphones) continues to expand rapidly without necessarily providing adequate acoustic isolation, exposing more users to acoustic echo.

The EXi-Agent monitors from 0 to 400 ms in both directions, ensuring complete and accurate measurement of echo.

#### Transmission Rating Factors and Mean Opinion Scores

Per-call listening and conversational R Factor and MOS values are computed continuously and non-intrusively based on the measured voice quality impairments (speech, noise, and echo) as well as codec type. EXi's objective scores follow the ITU-T G.107 E-Model standard and use a unique DSP-based

approach to analyze live voice streams. The EXi-Agent determines R Factors for the following:

- **Listening Quality (LQ)** – This score includes speech quality, noise, and voice level. It does not include impairments that affect conversation, such as delay.
- **Conversational Quality (CQ)** – This score includes the impairments measured for the LQ score and adds echo and delay, which affect conversational quality.

These R values are then correlated to subjective MOS values from Absolute Category Rating (ACR) MOS listening tests.

### EXi-Agent – Packet Measurements

In VoIP networks, packet characteristics can have a significant impact on the quality of a call. Ditech's EXi-Agent non-intrusively measures and collects these statistics on an ongoing, per-call basis to quickly identify the source of IP issues that are affecting voice quality.

#### Packet Jitter

The variation of inter-arrival time between packets adds to delay because the jitter buffer adjusts to establish a constant input for decoding voice packets. EXi-Agent provides a packet jitter profile for each call.

#### Packet Delay

Congestion, queuing, packet processing, and routing all affect the amount of delay a packet experiences when crossing an IP network. The packet delay affects the overall delay of the call and the amount of noticeable echo within a call. EXi-Agent provides packet delay information on a per-call basis.

#### Packet Counts

Per-call packet count measurements help determine whether speech quality issues are related to the packet network or are a result of other issues. Ditech's packet count statistics include:

- **Total Packets** – The total packets received per call.
- **Discarded Packets** – The number of discarded packets received per call.
- **Packet Loss** – The number of packets lost per call.

### EXi-Collector and EXi-Reporter – Networkwide Analysis

Ditech's EXi-Collector gathers voice quality statistics from Ditech network elements and, based on chosen thresholds and filters, the EXi-Reporter analyzes and summarizes networkwide statistics, including:

- Summary views of voice quality measurement results
- Detailed views of specific voice quality impairments, based on voice quality thresholds and filters
- Historical data for trend analysis

In addition to aggregated reports on voice quality EXi enables the delivery of per call data through Ditech's EXi Data Record (XDR) format. These records contain information about each call including calling and called number, duration, and full EXi statistics. When combined with Ditech's industry-leading Voice Quality Assurance (VQA™) solution, Ditech's EXi solution becomes a powerful tool to measure, monitor, and improve voice quality issues in a VoIP network.

For more information on Ditech Networks' solutions and feature availability, contact your local sales representative or Ditech's headquarters at the phone number and address below.



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