# Push Internet Messaging and Oracle Event Processing

**A Pattern-First Approach to Real-Time Streaming Analytics**

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## Introduction

Today's data is constantly in motion, traveling in and out of databases, to and from connected devices, and across continents, all in less than the blink of an eye. This evolution of real-time data requirements represents a huge opportunity for app providers because it can power everything from critical health monitoring to in-game betting, as well as many new and growing use cases for the Internet of Things (IoT). In fact, the ability to properly manage real-time data will be a critical element for IoT success in general.

But, capturing the value of real-time data in a mobile app is proving to be quite a challenge for developers. Much like many companies first struggled to collect, transfer and store big data, they are now struggling to do the same for real-time data, primarily because the combination of speed and size is so difficult to ensure transit over a mobile connection. This is complicated by the fact that the Internet was designed to move documents, rather than data – so, it's not surprising that the Internet is now struggling to deliver data at a velocity of gigabytes per hour! And yet, developers still must find ways to guarantee that data is sent and processed as quickly as possible to support apps that require real-time information.

In this paper we will show how Push Technology's Internet Messaging technology, integrates with Oracle Event Processing (OEP) and Oracle Stream Explorer to deliver a real-time system for data analysis.

## Complex Event Processing

The technique of analyzing data events, how they relate to each and their consequences, is known as complex event processing (CEP). Event processing is most effective in real-time, so that actions and decisions can be made while the event is actually occurring. Much like reacting to an out-of-fuel warning, decisions and actions must be made as the event happens, rather than after it's too late. Events from the past are no more than a historical record – and while analyzing these past events can have value, the real-time opportunities (or threats) may have been lost. For this reason, event processing must focus on events while they are in motion, and this real-time nature of data transactions is the foundation of reactive applications on which modern business relies.

## Reactive Application Architecture

As described in the Reactive Manifesto, reactive development is fueling the new wave of applications. Only a few years ago a large application had tens of servers, seconds of response time, hours of offline maintenance and gigabytes of data. But now a new architecture has evolved to let developers conceptualize and build applications that satisfy today's demands. We call these reactive applications. This architecture allows developers to build systems that deliver highly responsive user experiences with real-time interactions, and backed by an elastic and resilient application stack.

To deliver reactive applications, organizations turned to event-driven architecture (EDA) to allow the exchange of events between different systems. But despite the usage of inherent EDA characteristics such as loose coupling and message routing; there is no actual event processing in place, only event delivery. Event delivery and event processing must be used in tandem to fully leverage the benefits of EDA and derive business value from reactive architecture. In some industries, such as Automated Trading and Online Gaming reactive applications are common. But those are event-driven industries by nature; event delivery and processing is part of their core business. Why then, if CEP is so critical, are other industries still failing to leverage it?

Big data is accelerating, now doubling in size every two years. In fact, global data is expected to reach **44 zettabytes** *(that's 44 trillion gigabytes!)* by 2020. And, with new opportunities to apply data to real-time apps and services, big data is no longer simply growing in volume – it's also growing in velocity.

The answer may lie with the complexity of event delivery and managing the barriers to scalability and speed that exist as more applications rely on the Internet to integrate clients and devices. Real-time data delivery to and from the processing layer is fundamental for event processing.

## Push Technology Architecture for Real-Time Streaming Analytics

A successful real-time event processing platform relies on two distinct components, event delivery and the event processing itself.

### Real-Time Event Delivery

Push Technology's Internet Messaging software is a platform to remove the complexity and associated challenges of developing for scale, coping with the explosion of data across networks, delivering a rich application experience and real-time conversational interactions.

Deployed in an organization's own data centrers or in the cloud, Internet Messaging gives developers the toolkit to create high performance, reactive and reliable web and mobile applications.

### Real-Time Event Processing

Oracle Event Processing (OEP) provides a modular platform for building applications based on an EDA.

As EDA and CEP have become prominent features of the enterprise computing landscape, more and more enterprises have begun to build mission-critical applications using CEP technology.

Both OEP and and Push Technology's Internet Messaging solutions target very similar markets with a common theme, data. As we've said, data in today's enterprise is getting bigger, faster and more complex all the time.

High velocity data is a complementary approach to big data for managing large quantities of "in-flight" data that helps organizations get a jump on those business-critical decisions. Fast data is the continuous access and processing of events and data in real-time for the purposes of gaining instant awareness and instant action. Fast data can leverage big data sources, but it also adds a real-time component of being able to take action on events and information before they even enter a Big Data system.

*Push Internet Messaging complements OEP by delivering the necessary data as fast and efficiently as possible.*

Oracle Event Processing is a complete solution for building applications to filter, correlate and process events in real-time so that downstream applications, service oriented architectures and event-driven architectures are driven by true, real-time intelligence, Push Internet Messaging complements this by delivering the necessary data as fast and efficiently as possible.

## Push Adapter for Oracle Event Processing

During the development of event processing applications, there are a set of common activities that must be performed to achieve some desired business goal, such as creating junctions, performing aggregation and filtering and customizing the output result.

Oracle Stream Explorer is delivered with an intriguing and large collection of both industry-specific and generic patterns: prebuilt, ready-to-use solutions for these common tasks. While the array of these solutions is substantial, the Oracle Stream Explorer tool provides an implementation methodology so that customers or partners can build their own patterns for a specific use case and distribute them for reuse globally – in many cases, adding their unique and compelling intellectual property to the tool.

OEP Custom adapters allow the exchange of event data with external components that aren't supported by adapters included with Oracle Event Processing. You can create adapters of different types, depending on the format of incoming data and the technology used in the adapter code to do the conversion.

In a typical example Push will replace the sample load generator with the Internet Messaging Adapter and receive data data from the Push Diffusion (the Push Technology on-premise solution) or Reappt (the Push Technology SaaS solution) by subscribing to topics.
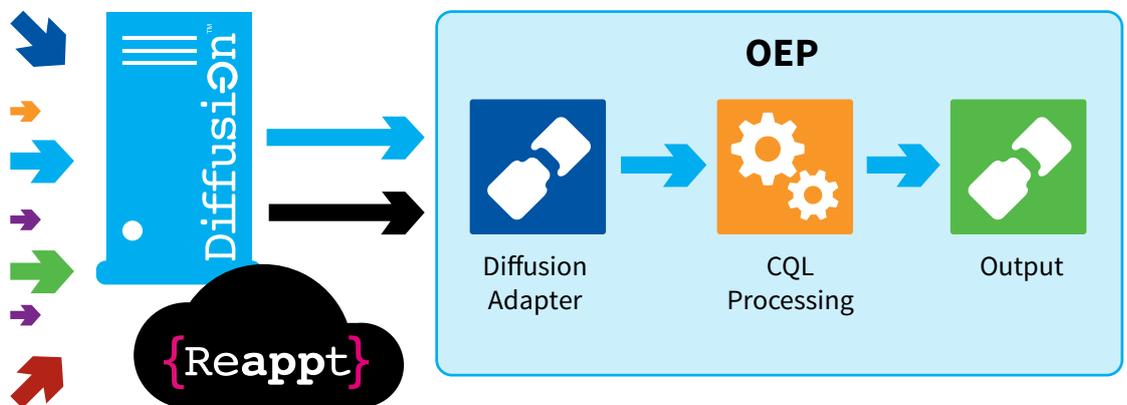


Push Internet Messaging provides a wide variety of architectural possibilities, which enables it to be integrated with virtually any data source. Typically data is pulled from an existing data source, such as a Web Service or database or data can be pushed via existing messaging sources such as JMS or MQTT.

Push Internet Messaging provides some useful features that minimize the amount of data that is transferred to and from OEP and Stream Explorer, these are delta messages and conflation;

### Delta Messages

A 'Topic Load' message is sent to a Client when it subscribes to a Topic. The purpose of it is to provide the Client with the current state of the topic data, subsequent messages are sent as delta's, that is only the changes to the topic data are sent. The benefit of this is that it reduces the required network bandwidth, reduces the latency in sending updates and enables the receiver to easily take action on changes without the need for comparisons of the data.

### Conflation

'Conflation' of Messages refers to the facility to treat two Messages as being essentially the same and thus avoiding sending duplicate information to Clients. This involves removing an existing message from the outbound Client queue and replacing it with a newer 'equivalent' Message either in-situ (at the position of the old Message) or at the end of the Client queue (thus preserving absolute Message order). Conflation can be done automatically by the Push server based on the topic data or via custom code.

## About Push Internet Messaging

*Internet Messaging from Push Technology started as a messaging technology and has evolved into something much more. It now includes a data caching layer on top that allows for live data on the server to be intelligently distributed – using the core messaging technology – to any clients, across any connection, at any scale.*

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Push Technology is focused on building the next generation platform for reactive applications.

## Push Messaging Layer

The Push messaging layer supports a number of key features, including the following:

- **Pub/Sub Hierarchical topics.** This allows for clients to subscribe to individual topics, topic wildcards, or any combination in-between.

- **Conflation.** This allows for multiple messages to be logically combined into a single message for an individual client queue. Clients will always get the most up-to-date data possible given their bandwidth.

- **Prioritization and message fragmentation.** Large messages can be broken up and de-prioritized to allow for further control over client experience across bandwidth.

- **Snapshot and deltas.** Custom messages can be sent when a client first subscribes to a topic, while deltas are sent to all subscribed clients.

- **Bidirectional.** Messages can be received from the client that can be interpreted by the application logic.

- **Customizable.** Full APIs are available for customizing all aspects of the messaging protocol, including custom messages, gathering statistics, custom conflation, and more.

## Push Memory Cache Layer

The Push memory cache layer allows data to be associated with topics. This supports some of the following features:

- **Complex data structures.** A number of different data types (Records and fields, Single Value, Protocol Buffers) are possible.

- **Automatic snapshot and delta messages.** As data is updated, appropriate delta messages (if required) are generated, and new clients will receive snapshot messages.

- **Automatic conflation.** Data will automatically be conflated by the most appropriate way (combine deltas together).

- **Customizable.** Custom data types are possible through available APIs.

- **Easy to Use.** Push Internet Messaging exposes developers to a publish/subscribe streaming paradigm,  while supporting rich server side capabilities to ensure data is handled the right way.

## Push Internet Messaging Scale

Push has proven to be able to scale to the largest of applications. This includes:

- **Concurrent Connections:** Individual Push servers have been scaled to 150,000 concurrent connections, and has been used to serve more than a million concurrent connections through horizontal scaling.

- **Throughput:** Push has managed to saturate four 10Gb NICs on a single server and has managed more than nine million messages a second.

- **Topics:** Push has scaled to millions of Topics, enabling fine-grained control of the client to determine the data of interest.

## Conclusion

Business decisions cannot be made by simply looking at events that happened in the past – and yet this is how many enterprises run their business today, trying to get insight using traditional data warehouse and business intelligence technologies. Looking at past information does not always provide the ability to react appropriately; this in turn leads to missing important opportunities or letting threats take advantage of our lack of awareness.

Push Technology - through our [Diffusion](#) and [Reappt](#) platforms - provides industry-leading scale and performance for delivering real-time data efficiently across a wide range of endpoints even when network conditions are unreliable.

*Push and Oracle have a natural fit, complementing each other with Internet Messaging delivering data as fast as possible and Stream Explorer analysing that data and taking actions based on the results by utilising its Continuous Query Language.*

Oracle Stream Explorer is a web-based application that leverages the capabilities found in Oracle Event Processing to provide a tool for business users to analyze streams of events in real-time, empowering them to gain insight and take appropriate actions when needed.

Push and Oracle have a natural fit, complementing each other with Internet Messaging delivering data as fast as possible and Stream Explorer analysing that data and taking actions based on the results by utilising its Continuous Query Language.

All businesses should be real-time, and some of the examples below describe where some real-time event processing requirements can make a difference to your organization.

**Financial Services:** Ability to capitalize on arbitrage opportunities that exist in millisecond or microsecond windows.

**Online Betting / Gaming:** In-play betting can be described as 'the live betting during the course of an event', as opposed to a bet that you place before the action starts. It is the fastest growing sector of the online gaming industry. With in-play betting, the Sporting Index traders update the spreads as the action unfolds so customers can challenge their opinions in a live environment, in real-time.

**Transportation:** Electronic ticketing and automated toll charging mean credit checks and charging need to be done in real-time. Traffic analysis for predicting jams and updating roadside information boards.

**IT systems:** Ability to detect events from various systems and decipher downstream systems failure affecting many users.

**Telco:** Many Telco organizations are faced by the challenges of managing their resources effectively, optimizing capital expenditure (CAPEX) on network infrastructure while lowering or maintaining operational expenditure (OPEX). This requires the ability to gain insights as they occur to understand allocation of network resources based on traffic and application requirements, network usage patterns.

## About Push Technology

We make the Internet work for our mobile-obsessed, everything-connected world. Leading brands like 888 Holdings, DAB Bank, Sporting Bet, Betfair and William Hill create Push Data Networks to power applications critical to revenue growth, customer engagement, and business operations. Deploy our enterprise-class technology the way that makes sense for your business: on premise, hosted, or in the cloud. Now you can deliver apps at scale and speed (and lower costs) and give your IT staff their weekends back. Learn how to fix your problem apps and bring your dream apps to life at www.pushtechnology.com and www.reappt.io.

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