Introducing IBM DataPower Appliances

IBM DataPower Gateway is the latest variant of DataPower and helps organizations meet the security and integration needs of a digital business in a single multi-channel gateway. It provides security, control, integration and optimized access to a full range of mobile, web, application programming interface (API), service-oriented architecture (SOA), B2B and cloud workloads.

In a service orientated architecture, applications are loosely coupled services connected by using the XML markup language and the web services that are built on top of XML. This introduces a number of management challenges around the disciplines of ease of use, security and performance. These management challenges are addressed by using DataPower appliances.

Middleware is a carefully controlled environment with many layers of configuration that have to be carefully controlled. Basic functionality such as upgrades need to be very carefully coordinated to ensure that they don’t cause issues with existing business processes that are architected on these middleware services.

From a security perspective, it is critical that the exchange of XML documents between applications is carefully controlled. It is possible for
malicious code (malware) or malformed XLS code if passed (injected) into and through the middleware stack to harm a business or impact security or privacy.

The process of parsing (reading, analyzing) XML is a timely and process intensive process (task) and unless the appropriate processing power is available systems and therefore business processes can be negatively impacted.

DataPower appliances address these challenges by providing a high-performance firmware-based enterprise service bus otherwise known as an ESB, so deployments are both easier and more secure. DataPower systems have been seen to be up to 70 times faster than systems that are based purely on software.

DataPower appliances also introduce protocol independent message processing. This means that business services can be accessed using different protocols than the ones on which they’re were built. For example, DataPower Appliances can be used to add a web service front end in front of a legacy application. Imagine a scenario when incoming messages from client applications using a protocol such as SOAP over an HTTP layer can be converted into another protocol such as COBOL.
copybook over the MQ transport.

**How does DataPower Appliance work?**

When a DataPower appliance gets a message there is a whole sequence of activity that takes place before a message gets to its destination.

First the message is inspected before it is passed to a DataPower service like a web service proxy and then the message is passed on to the processing policy for that service. This is the list of rules that contains a series of actions. And these actions are applied to the message according to certain conditions in a
sequence and when a response is received from the back-end server, there are then actions that are applied to the message in the opposite direction.

Processing policies can be configured to have separate rules for request process and separate rules for response processing.

When we look at this in more detail a policy rule starts with a “match” action (which defined whether or not an input will be processed by the subsequent processing action) which is followed by one or more “processing” actions (defined what happens next to the input). There is a lot of different actions that can be taken, such as:

✦ filters that accept or reject incoming documents,
✦ transform actions that transforms XML using a style sheet
✦ Encrypt & Decrypt
✦ Conditional actions
✦ Results actions which can send results onto a remote server. And results actions can be defined to wait for a response from a server or to be asynchronous.

Monitoring DataPower performance metrics

Capture data-points to monitor DataPower appliances and place this information into application context.

DataPower appliances are sophisticated pieces of technology that must be carefully managed and monitored.

There are many tools and techniques that the DataPower admin can use to manage DataPower SOA appliances.

The DataPower appliance is a middleware appliance, and middleware is not an easy subsystem to make an appliance out of. Any company this Is using a DataPower gateway appliance to run any kind of serious production workload is bound to encounter their share of complex problems sooner or later. The most common DataPower issues are in these areas:

✦ Configuration changes
✦ Misconfigured service policies
✦ XML formatting issues
✦ Transaction Latency issues
✦ High CPU usage
Memory growth
High load
Fire system space issues
Network connectivity issues
Unexpected restart

These kinds of issues are a common result of the rapid implementations that people use these appliances for.

The people who are responsible for designing DataPower service processes will find themselves having to get involved in troubleshooting tasks.

Several of these tasks can be performed directly on the appliance, for example you can:

- generate an error report to get a snapshot of system status and debug information or
- you can view log files to look at details about processing behavior and information about transaction flows
- you can try and correlate this information with any errors you are dealing with.
- You can enable statistics for things like CPU or memory usage or transaction rates.
- You can look for latency messages in logs that measure the elapsed time of transactions.

However, some of the most granular troubleshooting tools, such as setting the log level to debug or using the multi-step probe were not really designed to be used at run-time. These tools are really only recommended to be used using deployment and testing, because these tools are “intrusive”. They generate a huge amount of data, and actually degrade the performance of the appliance when they are used. The volume of data the generate can quickly overwhelm the administrator of the appliance.

Troubleshooting DataPower issues with the tools that come with the appliance can be a very daunting experience, and middleware experts often find themselves spending many hours scanning and analyzing logs, tracing transaction flows and measure application performance metrics.

This manual analysis of logs and application metrics can be a very slow and error-prone process that can be a very costly endeavor.

It can be very challenging to try and piece together the “story” the data tries to tell you when you have a problem or misbehavior with a DataPower service. It is not very easy to view the flow of execution because the information that gets recorded in logs does not always appear to the investigating admin in a linear fashion. Which can make it very difficult to discover the relationship between cause and effect within issues and logged events (for example).
On an appliance where there is a large number of services that are deployed that situation rapidly becomes unmanageable.

And while you are spending time troubleshooting issues, you are not spending time to do the work that is required grow and enhance your enterprise and the business such as deploying new services and innovating on the appliance.

*How do we respond to these challenges?*

*Nastel has a three-pronged approach:*

**Monitoring**
- collecting events and metrics from across the entire application stack (across silos) in near to real time.
- This information has to be current
- This information must be the data that matters most to you

**Tracking**
- Instrumentation of applications and the middleware, since modern SOA applications communicate through the middleware, this is critical information about how the applications are performing.
- Correlation & Stitching together all the events that makeup a transaction workflow

**Analytics**
- Insights into what is actually going on, where any anomalies are hiding within the data you are collecting
- Identify the most meaningful metrics from both operations and transactions
- Discover situations and trends
- A meaningful picture that can be shared with users in the form of a dashboard.

To respond to these needs, Nastel has created a product called Nastel XRay, which is an enterprise class solution that delivers real-time operational intelligence, by monitoring, tracking and analyzing. At the core of Nastel XRay is an analytics engine with a complex event processor (CEP) that delivers extreme scalability, capable of processing many millions of events per second, and is used to identify the most meaningful events, analyze their impact and deliver “360 degree situational awareness” to users, administrators and line of business owners alike.
Nastel XRay delivers “near to real-time” visibility of transactions that span an application stack and uses auto-discovery to build transaction flow diagrams with very detailed information about the events that make up each individual workflow. And uses analytics strategies to detect patterns and trends from collected events and metrics from logs and applications and can identify run-time problems that could lead to compromised business performance.

It's worth mentioning that Nastel XRay gets its information from a very diverse set of resources across the entire application stack from the user all the way to the mainframe (and all points in between) and is capable of delivering interactive dashboards that can help to identify and analyze performance issues before the business is impacted.

**Truly both predictive and proactive**

Nastel XRay consolidates all of this information to a web-based dashboard that can use configured and customized so suit your purpose. And through this single pane of glass (SPOG), application support teams, dev-ops teams and even line of business users don’t have to piece together stories from disparate logs and monitoring tools.

Nastel XRay includes an easy to use query language that allows users to analyze application behavior. Users can create queries using very simplified logic to ask questions and perform 'ad-hoc' analysis of a very broad range of metrics and events and can get answers in graphic dashboards which we call “view-lets”
Applying Nastel XRay to DataPower

DataPower appliances have several management API’s and interfaces that provide access to detailed information about system operations and performance, the health and activity of the appliance, that can be monitored through several management protocols including SNMP, XML based API’s such as SOAP and WSDM or simply SYSLOG. There is also a command line interface (CLI) that is integrated with the appliance. By using these interfaces, we can capture a very broad range of configuration and status data.

These interfaces are very tightly controlled, and usage is carefully controlled by user and account security credentials and IP address-based access lists. The appliance was engineering with remote monitoring and management functionality, so all the details of the operation of appliance can be accessed through authorized remote monitoring tools. By using these interfaces, we can “subscribe” to a wide range of information of the DataPower appliance. Information about throughput, CPU usage, memory usage, transaction latency, and all kinds of information about the general “responsiveness” of the appliance.

By exposing what is happening inside if the DataPower appliance by the use of these management API’s, the appliance is effectively “instrumented”. Instrumentation is a very important first step as we need to collect accurate data about the things that are pertinent. But just getting the accurate data in a timely manner, while critical is not enough, we must gain an awareness of what is actually going on within the appliance and be able to detect where any potential problems may be brewing before they progress. And most importantly we want to be able to understand the data, and interpret it easily, and this is where analytics comes into play.

Analytics can be used to quantify the amount of variation or dispersion in a set of collected data and can help us to identify trends and can give us insights into performance issues and show us where anomalies are hiding. It can alert us about situations that are statistically abnormal.

Performing analytics on a large volume of data that is constantly changing can be a very challenging endeavor because there is an overwhelming quantity of time sensitive data that is published by DataPower appliances and if you were to apply the sheer amount of raw data that comes from an appliance, the effort that is required to do diagnostics on that data in a “procedural” way, you would quickly realize that that is an unmanageable undertaking, unless you are helped by automated analytics. Another important aspect of analytics is presentation, when information is presented, it must be in a way that allows the data to be understood, so you need actionable dashboards, that can be used to deliver the alerts to the right people in the right format at the right time before they can become cascading failures.
Tracking DataPower message flows

Tracking message flows that run on DataPower appliances, requires that you take into consideration the other application metrics that are important in understanding application workflows and performance.

This extends the complete visibility that you receive to the entire business transaction to be able to track and trace the complete transaction workflow that runs on the DataPower appliance.

To Track DataPower message flows you must instrument the service processing policies that run on the appliance.

Nastel XRay does this by initiating two key actions that we inject into the policies rules of DataPower service policies:

1. The first action is to transform messages that are input into a service into the form of a tracking event that contains vital information about the workflow.

2. The second action is a results asynchronous action – this sends this tracking event to an external processing point.

The key advantage of this approach is that DataPower transaction processing is able to continue without any performance impact, because the transaction analysis and reporting is all done separately outside of the actual appliance. This approach gives us a certain measure of flexibility and control and allows you to determine how and when these actions are inserted into a workflow depending on your requirements.
Let’s take a look at these processing actions in a little more detail.

To collect data about the processing flow, we start by collecting data about the tracking event. This tracking event is a lot like a bar code sticker that is on the outside of a package that gets shipped by a courier service such as FEDEX or UPS. This tracking event contains information about the shipment, including the sender and the receiver, a unique identity number and maybe other vital characteristics such as the weight and size of the package. The tracking event we are creating has a similar purpose and it’s created with the help of an XSLT style sheet which gathers pertinent information about the transaction flow using DataPower variables and functions.

Any information that is available in the processing policy can be included in this tracking event.

Once we have built this tracking event with the use of the transform action, it is then used as an input into the subsequent steps, and that is the result – asynchronous action.

The purpose of this results Asynchronous action is to send the tracking event on to a “listener” at some external processing point for transaction monitoring. So, in this example this results action is configured to send the tracking event on to a messaging queue. We can send this onto a messaging queue or topic or any protocol that is supported by both the sender and the receiver (in other words the DataPower policy, which is the sender and the listener which is the receiver).

That’s really it, the DataPower workflow is instrumented and then we can proceed to see how our service processes are performing.

With these two actions we have effectively instrumented the service policy that runs on the DataPower appliance for transaction monitoring!
So what happens next?

The data that’s captured from these tracking events is sent on to a listener that intercepts information about transaction workflows.

It’s important to consider in most cases the DataPower appliance is part of a global transaction that involves other parts of the application infrastructure such as webservices, java applications, messaging middleware or ESB’s. The Nastel XRay analytics engine subscribes to all these tracking events and it correlates the relationships between multiple senders and receivers using a technique known as stitching. The analytics engine presents a series of events that takes place at various places within the application infrastructure, and can now be visualized as a global transaction.

And in the final step this information that has been collected is rendered to the user in the form of actionable dashboards that includes things such as summaries and detailed analysis of the business transaction performance.

Here are some examples
One of the key objectives that operators and administrators are tasked with is to ensure that transactions are operating at peak performance. And key to this is ensuring that any issue that impacts performance negatively is prevented. Doing this demands near to real time visibility of transaction events as they happen.

Stitching connects these transaction events together to describe a narrative of activities, a flow of events that can be seen to execute across the enterprise, across servers, across applications. The result of this is a very high-resolution view of the transaction flow that can be seen in the form of a topology graph, but also as trace views of the activities of the events as they happened during the execution of each part of the flow.

It’s also essential to be able to present these transaction analytics in business context
This means categorizing transactions based on business criteria.

This is especially important for organizations with very large volumes of transactions. To do this we create a named set of transactions for a specific business process, like in the example shows here, where we can see complete delivery orders. We do this by choosing any common criteria that appears anywhere within the transaction thread, such as the name or one or more applications or any other names resource that appears in that transaction workflow e.g. The name of a DataPower service could be used.

In addition to visualization we also need to have alerts. When any kind of application failure or bottlenecks appear, or even when there are patterns detected in transaction activity that indicate there is an up-trend or down-trend that is happening.

Business users are interested in knowing when specific events happen or sometimes when expected events don’t happen within a transaction workflow. By getting this information in a timely manner provides the ability to improve root cause analysis and consequently reduce the time it takes to resolve a problem and thus improve the key metric of MTTR or Mean Time to Resolution. As well as make significant improvements to service levels across the entire enterprise.

Once these users have been alerted about these situations, we need to give them the ability to filter and search the list of recorded transactions to be able to quickly locate workflows that have issues and examine the detail to quickly understand exactly what is impacting the experience. This directly allows the applications teams to be more responsive to the business as they can now very quickly discover runtime problems and resolve them.

Users within the IT organization need to be able to access the complete details of transaction workflows, including execution times, wait times, see what resources are involved and they also
need to see the details of the messages to be able to understand the impact of specific events within the transaction workflow.

**Getting Insights into DataPower performance through Analytics**

Situational analytics for proactive monitoring of business transactions that run on DataPower appliances

Effective transaction monitoring requires the capturing and reporting of transaction details and also about delivering analytics and being able to summarize findings. For example, a summary of overall transaction processing, where the information is aggregated into time intervals allows us to look at transaction volumes for a set of business processes over time. So, we can see how many complete transactions are have completed (let’s say) over the last five minutes or the last three hours or the last fourteen days or over any time in the past. We may need (want) to know how long these transactions took to run on average and compare this to the maximum execution time during a given time period.

We can make use of these real time metrics that are actually a by product of transaction monitoring using summarized information that is presented in business context. And from these summarized views we can drill down into the details of application events.

This is an area that most traditional (classic) IT monitoring tools generally fall short.

Most of the tools that monitor networks or servers or monitor middleware components provide a very siloed view of the area they are designed to be responsible for. These tools were specifically engineered to assist IT practitioners, but they are not designed to go further than that for example to help architects or application owners. To get the maximum benefit from a
monitoring solution it must give a holistic view of potential performance issues and [place this information into “application context”, “business context”

This is exactly what Nastel XRay is designed to do! To Deliver visibility of run time performance of all of the components that make up the application and its infrastructure.

To Summarize

Nastel XRay is a complete solution that ensures the peak performance of business processes where DataPower appliances play an important role by doing three key things:

1. Capture performance metrics from the DataPower appliance as well as from other middleware.

2. Instrument the DataPower workflows and collect time-series data about the important events that happen (or even should have but didn’t happen) in these workflows.

3. Make use of all this data by subjecting it to analytics to be able to summarize the impact on business applications visually in ways that are meaningful to all the areas of the business. With the ability to understand at a glance how these issues impact the business so that efforts can be prioritized to resolve issues efficiently and effectively.
Common Questions and Answers about monitoring and tracking DataPower

Aren’t DataPower Appliances supposed to be self-monitoring?

while the DataPower appliance does publish performance metrics which you can view using the administrative console, the shear amount of content that is exposed and the ways it is visualized limits its usefulness of the DataPower appliance as a monitoring tool.

DataPower is designed with a number of different interfaces that allow performance data to be monitored externally because it is recognized that there are better ways to monitor DataPower than just using the built-in tools.

Capturing the data alone is not enough it must be presented in business context and then further analyzed and summarized to provide meaningful root cause level problem solving abilities.

The built in tools do not provide insights into what is going on, for this you need an analytics engine to identify issues and place them into a business context to be able to be proactive and even predictive in your efforts to maximize performance.

Nastel XRay gets information about transactions through auto-discovery, what does this mean?

Nastel XRay uses light weight performance measurement instrumentation tools that are deployed strategically within the application infrastructure during build time. These are placed with DataPower, Java apps, messaging middleware and others. And during runtime these tools act as listeners, capturing information about transaction events and timings and interpret their content which is published to the Nastel XRay analytics engine.

This information gets rendered to the user in the form of dashboards to make sense of all this to the user, in a format that they can use, as visualizations and summarizations that are easy to use, and drill into the relevant details.
How do I categorize DataPower transaction information so that users can see this information in business context?

We “present” information in a business context by creating sets of datapoints that have common attributes, based on application criteria. This allows us to monitor specific transactions, get alerts about them and view details about them.

Nastel XRay allows this to be done with just a few clicks. You select data (criteria) from dropdown lists using built in menus, that lets you create a set of transactions based on that applications criteria such as the application name or an application resource. Once you have done that every transaction that corresponds to that criteria will then be reported as part of that set, allowing you to focus on that set and drill into the information, search it as needed.

When you want to build monitoring dashboards using Nastel XRay that business users or application architects would find useful you need the this ability to present information in business context so that they can focus on the transactions that matter to them quickly.

How much training is required for Nastel XRay for DataPower?

The learning curve for a user of Nastel XRay for DataPower is relatively mild. Learning to use the visualization and dashboards can be done very quickly. And the query language is designed to be as close to natural English as practical, meaning that a user can read and understand a query very easily and can then start to build queries almost immediately.

The process of installing and configuring data collectors is easy, but process must be followed (as with all enterprise installations) to ensure that compliance to standards are followed, and training as well as services are available to help with all of this.

We have an established training curriculum available and most courses take a couple of days depending on user requirements.

Nastel XRay is delivered pre-configured with dashboards to meet many of the most common requirements, so users can start to feel the value almost immediately.
Is Nastel XRay a cloud hosted solution?

Yes - Nastel XRay is available for on-premise, Cloud (docker) and also as SaaS

Can Nastel XRay be installed on-premise?

Yes - Nastel XRay is available for on-premise, Cloud (docker) and also as SaaS

What kind of analytics does Nastel XRay provide?

A very wide range including minimum, maximum, average value, number of updates, number of changes, exponential moving average, standard deviation, bollanger bands, ratios, historical rate of change, transaction analytics, topology views, and many more. The full list can be reviewed at https://www.nastel.com/nastel-xray/ and we are continually adding more, based on user requests as well as those being innovated by research work of our own team.