



Creanord PULScore™ Integrations via North-bound Interfaces Data Sheet

Creanord PULSure™, which consists of PULSensor probes and PULScore monitoring toolset provides service providers with an accurate visibility to their network and service performance and quality. Network performance monitoring solution, like the Creanord PULSure, is one specific part of the service provider network management systems and needs to interface with multiple other systems in the service provider ecosystem. In practise the integration need may refer to importing or exporting information to be consumed by another system. Application Programming Interfaces (API) and standard protocols are used for simplifying the integration work.

In Creanord system the PULScore collects the raw measurement data from the PULSensor probes, analyses and calculates the SLAs and stores all that data to the database in near real-time. The accurate performance monitoring data provided by PULScore can be provided to external systems via North-bound interfaces including:

- Kafka API
- REST API
- CSV

The Kafka is becoming a common preference for service providers thanks to its massive scalability for streaming information in real-time. The benefit of the CSV API is its simplicity for integration, while still maintaining fairly good scalability properties. The REST API is well-suited when querying the system for specific

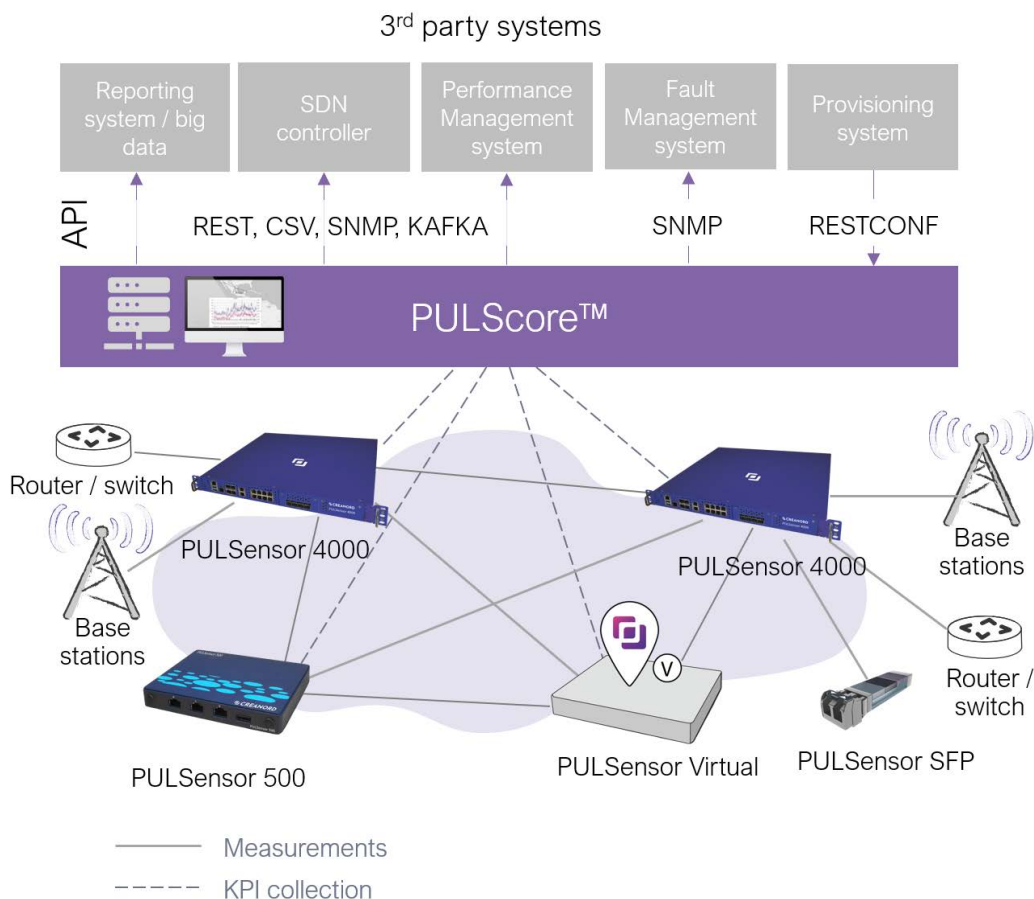
Highlights

- Flexible integration options for any third-party system
- Modern REST APIs available as well as standard SNMP traps and CSV
- Highly scalable Kafka-based interface for real-time monitoring integrations
- North-bound interfaces run on the PULScore server, no need to install a separate server for the north-bound interface

data, for instance, in automation/closed-loop integrations.

PULScore is also able to generate alarms from threshold crossing events, platform issues, and similar. These alarms can be sent to external systems through SNMP Traps or the REST Events API. There is also an option to send the alarms as emails if required.

In some cases, there may also be a need to import data or commands from external systems, which could be the case when performance monitoring should be provisioned as an automated action e.g. with SDN or via an umbrella system. PULScore provides a RESTCONF interface, which can be used by an umbrella overlay for setting up the performance monitoring sessions as part of an automated workflow. Creanord provides a comprehensive set of integration options, either as part of the basic product or under a specific license, and has vast experience on different integrations from numerous customer deployments throughout the years. Creanord has vast experience on such integrations from numerous customer deployments throughout the years. With the license the service provider gets access to the API interface as well as support and documentation with examples on how to streamline the implementation.



PULScore REST API interfaces

Through the PULScore REST API the service provider can extract real-time information of the network state and quality. This information may include for instance calculated metrics such as SLA metrics and specific KPI values on bandwidth, loss, latency and jitter as well as event notifications. Also, via the RESTCONF interface the PULScore can be integrated for provisioning of tests or maintenance windows from an external system. Using the Swagger tool, the integration can be learnt about and performed rapidly.

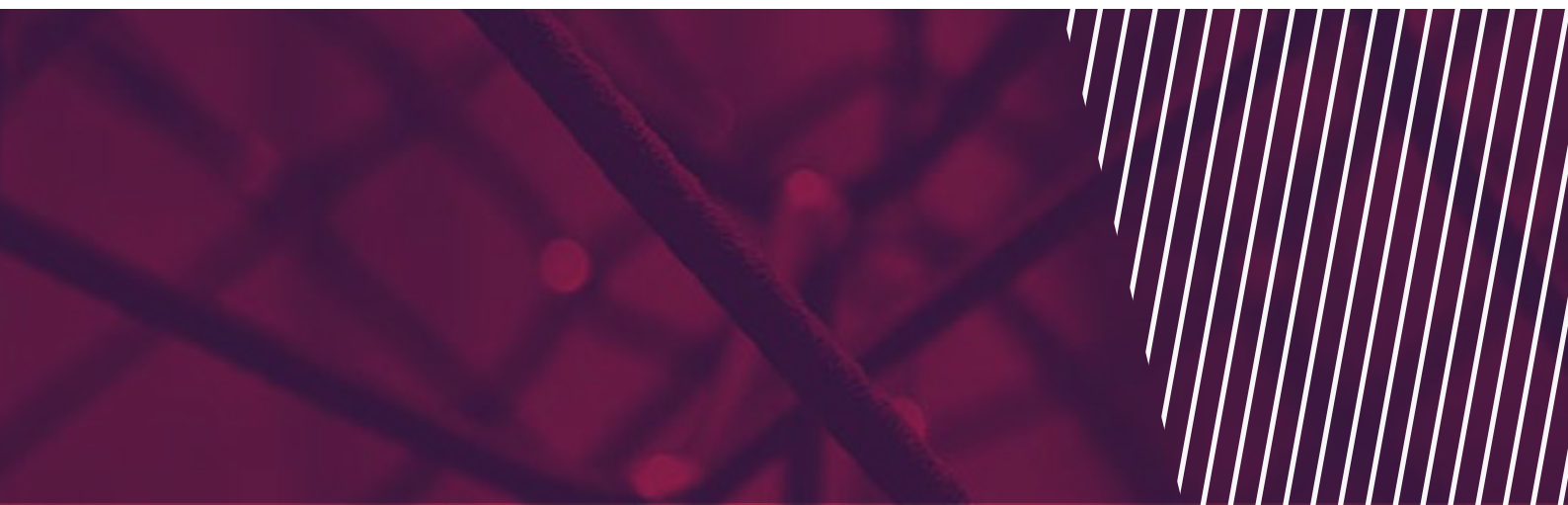
These RESTful interfaces, both for data exporting as well as for system, measurements, and reporting provisioning, are being extensively utilized by Creanord customers.

PULScore Kafka API

Apache Kafka has become a popular option for doing integrations within the service provider environment. The main advantages of Kafka are its high throughput, low latency and fault tolerance. Additionally, Kafka reduces the service provider need for multiple integrations as all the required data can go via the Kafka bus to all consumers that need it.

PULScore offers a Kafka API, which is a scalable streaming API for reporting or producing RAW KPI values from the PULScore to other systems. For analytics data, such as SLA metrics, the REST KPI Interface should be used instead.

From the PULScore, which is the producer, the messages are pushed to the Kafka cluster at the same time when they are stored into the PULScore database. Consequently, the consumer client systems receive the messages in real-time. The datas can be pushed either in Avro binary format or JSON.



Summary of Integration interfaces

The table provides a summary of all integration options, the data provided and a typical use case available in PULScore.

| Interface | Data | Typical use case |
|--|---|---|
| Kafka Streaming API* | Supports AVRO binary, AVRO JSON, and simplified (no schema in message) formats. Also supports both Apache Kafka and Confluent platforms. For data encryption, you may use no encryption or SSL encryption. For authentication you can use no authentication, SASL/PLAIN or SSL Client authentication. | Real-time monitoring, and data warehousing for custom dash boards especially in large networks |
| RESTful KPI Interface* | Includes Swagger REST Developer Tool | Retrieval of SLA data and RAW Measurement Data as JSON objects for SDN controllers, applications, and alike |
| RESTful Event Interface* | Includes Swagger REST Developer Tool | Active (push) event delivery as JSON objects to subscribed SDN controllers, applications, and alike |
| RESTful Maintenance Window Provisioning Interface* | Includes Swagger REST Developer Tool | Maintenance Window provisioning automation in PULScore from an external system using JSON format API |
| RESTCONF Provisioning Interface* | Topology, Measurement, SLA, Reporting and Metadata operations (e.g., GET, PUT, POST, PATCH, DELETE) included | YANG defined RESTCONF API for software defined provisioning automation of Topology entities, measurements, and SLA reporting in PULScore |
| CSV Export Interface* | SLA, RAW and configuration data export including Node Information, Engine Information, Policy Information, SLA Data and RAW Measurement Data | KPI, SLA, topology, and bandwidth utilization export to other systems when CSV format is required |
| SNMP traps | SNMP traps and clears about performance and platform events. Supports SNMP v2 and v3, as well as using custom port number(s) | The most common interfacing option for Northbound fault management integration. Commonly used also for North-bound performance management integration |
| Email notifications | Performance and platform events | Alerting of especially admin level operators on most critical Performance and platform events |

*requires a specific PULScore license

About Creanord

Creanord designs and delivers network performance quality solutions that build confidence and readiness for communications service providers to create and sell services with service level agreements (SLAs) and quality guarantees.

Creanord PULSure™ is a design framework used for network performance and experience-tracking to customer-specific needs at a fraction of the cost, time and effort of conventional systems. The PULSure solution enables you to set, offer and track network experience-based SLAs and key performance indicators (KPIs) with superior accuracy, giving you insights about the metrics such as speed, latency, jitter, and availability that go far beyond those reported by conventional systems. With the PULSure the service provider gains and preserves end-to-end situational awareness, performance visibility and control needed to automate, continuously optimize network performance and prevent negative impacts, to meet the most demanding service needs.

Already since 2000 Creanord has served customers globally, operating the most demanding networks and connectivity applications.

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