

# MDL: Metrics Definition Language\*

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**Abstract.** The paper presents Metrics Definition Language (MDL), a new format for metric definition. MDL is a flexible grammar based language, which clearly separates the idea of a data source from a metric. Hence, MDL provides ways to define complex metrics that can be defined over many data sources or even other metrics. It also supports basic mathematical operations, that can be used to define metric aggregations and transformations. The language is human readable, universal and data format agnostic. It can be easily used with every monitoring system.

## 1 Introduction

Heterogeneous computer systems tend to grow in terms of quantity of the components involved in the computation, as well as in terms of their overall complexity. Moreover heterogeneous paradigms, such as cloud computing and SOA, introduce additional layers of abstraction.

Services in SOA cooperate to form complex business processes, whereas in cloud computing virtual machines are used as an additional layer over the operating systems. Obviously, the amount of the monitoring information generated by such systems is increasing at even greater pace. With the new abstraction levels new challenges in monitoring appear, one of these challenges is the problem of defining metrics. Commonly used, statically defined metrics may now not be sufficient enough to fully describe complex and dynamic distributed systems. Monitoring and management should provide efficient and easy ways to dynamically define and create new metrics from the existing ones, e.g. for the needs of sophisticated load balancing, resource migration and business process orchestration.

Traditional monitoring systems can be categorised as probe focused. This means that values of gathered data are treated as a separate simple metric, additionally both the data source and the metric are semantically inseparable. The commonly known example is SNMP protocol and its agent. The agent provides many separate metrics, which are defined in a MIB (*Management Information Base*) format. To derive complex metrics,

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off-line analyses has to be carried out in a monitoring system or the agent itself. Its MIB has to be extended, in most of the scenarios by means of programming. Other monitoring systems seem to share this configuration model of defining metrics, which makes it hard to extend them dynamically.

This paper's contribution is a proposal of an universal format for defining metrics — Metrics Definition Language (MDL), which can be used to create dynamically new metrics on the top of monitoring data sources.

The paper is organised as follows. Section 2 presents a motivation for the Metrics Definition Language (MDL). Section 3 presents the Metrics Definition Language, its grammar and example documents with metrics definitions. Section 4 contains conclusions and an outline for a future work.

## 2 Motivation for Metrics Definition Language

Many monitoring systems use their own configuration system for data sources and metrics definition. Moreover, in most cases, the data source is inseparable from the metric, making them one entity in the context of configuration. This introduces unneeded complexity of the configuration, because every new metric has to be defined separately for the same data source. In Zabbix [10] monitoring system this problem is minimised by introducing so called Host Templates, which provide fairly easy way to define the configuration template for a given host and reuse it in the future for other machines. Nevertheless, this mechanism is Zabbix internal only and is not portable to other monitoring systems. Similar mechanisms can be found in most of the monitoring systems.

Traditional monitoring systems also lack flexibility in metric definition. None of them provides the means to define new complex metrics out of exiting ones. For example, one could need to easily add metric that is a sum of all of the system loads of every host in a network or be an average throughput of all the interfaces in a network. Moreover, such a mechanism should be easy to use and not need system restart or modification. It should also be human readable but at the same time easy to process by a machine.

There exist standards for management, such as WSDM [3,8,9], WS-Management [1], CIM (*Common Information Model*) [4]. However they focus on providing a framework for defining management interfaces and ways for describing managed elements and its interfaces. The substandard of WSDM — MUWS (*Monitoring Using Web Services*) gives some partial support for metrics definition, by extending the *Metric capability* object. This method is only suitable for defining metric metadata and does not tell how to measure the metric and what data to use. Similar approach is in CIM Metrics [5].

The above weaknesses of traditional approaches to metric definitions show a need of new solutions to configuration of monitoring systems.

## 3 Metrics Definition Language

For defining sources of monitoring data, as well as metrics we propose Metrics Definition Language (MDL) as a universal format. We state MDL's requirements and grammar along with examples of MDL's use. At last we compare the MDL to Event Processing