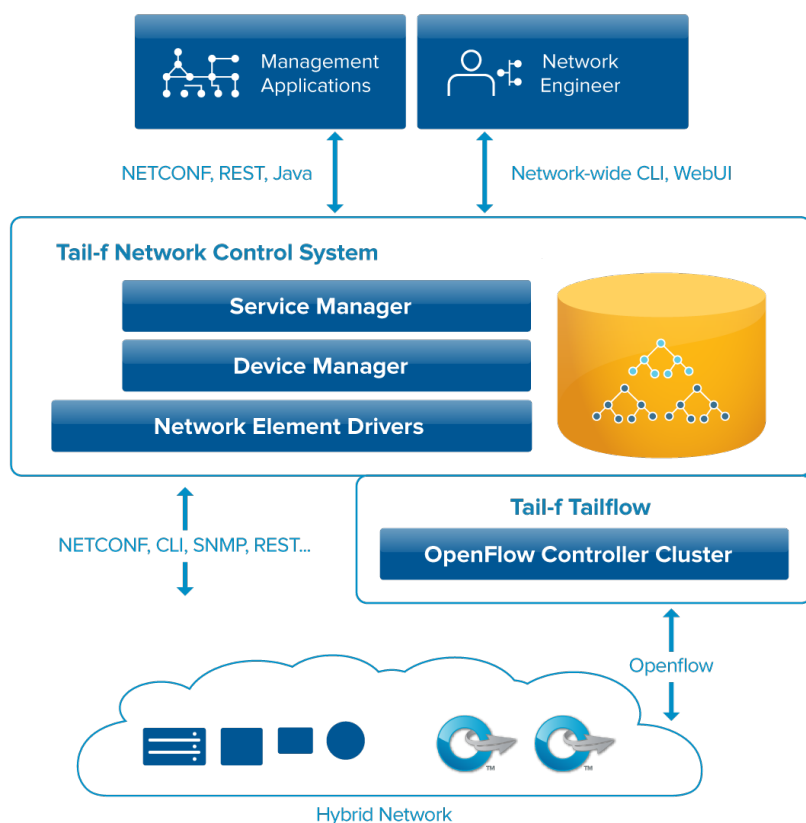


# TAIL-F TAILFLOW - DATASHEET

OpenFlow Controller Module of Network Control System (NCS)

Tailflow is an Openflow controller that is tightly integrated with the Tail-f Network Control System (NCS). NCS provides a transaction-safe interface towards a multi-vendor, multi-technology network. Tailflow adds the capability for NCS to perform service provisioning and transactional changes across a network that includes OpenFlow switches.



## NCS with Tailflow Module

- Network services can span a heterogenous network of OpenFlow switches, hybrid switches and traditional networking devices.
- NCS provides a logically centralized API to this heterogenous network for management applications, such as orchestration systems, workflow systems, policy engines, and operational support systems.

## Tailflow Features

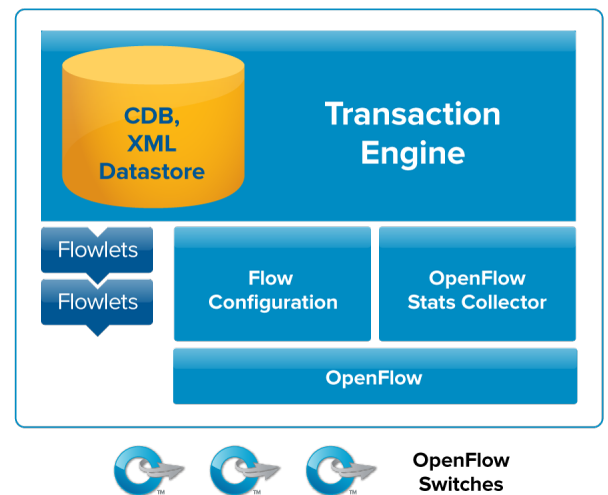
The key benefit of the close integration between NCS and Tailflow is that NCS can manage a cluster of Tailflow controllers, with centralized distribution of both configuration data and application code from NCS to the Tailflow controllers. NCS communicates with the Tailflow controllers using the NETCONF protocol.

Openflow-specific features:

- *Programming Model*: Tailflow provides a high-level programming model for OpenFlow using “Flowlets”. A Flowlet encapsulates a YANG data model and associated code. Flowlets are ordered in execution stacks to form applications that control Openflow switches.
- Support for both *reactive* and *proactive* models: Tailflow controllers can proactively or reactively push flow rules to Openflow switches.
- Flow behavior analysis and collection of Openflow counters.
- Support for OpenFlow 1.0.

Tailflow is built upon Tail-f ConfD, the market leading on-device management framework. Leverageing ConfD, Tailflow provides the following management functions:

- *Transactions*: All configuration changes are transaction-safe. Integrity constraints and network policies are validated as part of the transaction management.
- *High-availability*: Embedded clustered fault-tolerant datastore for configuration data.
- *AAA*: All user sessions and user actions goes through a centralized AAA system, with external PAM-based authentication, role-based access control, and audit trailing.
- *Monitoring*: Built-in SNMP agent for alarm management.



## The Flowlet Programming Model

The Flowlet programming model provides an abstraction of the low-level OpenFlow protocol. Rather than using OpenFlow directly towards the OpenFlow switches the application programmer defines and implements Flowlets. Flowlets define configuration data in YANG data models and associated functions in a simple subset of the Erlang programming language.

The Tailflow controller maintains a Flowlet execution stack, which contains one or more Flowlets that are executed, in order, when a pre-defined event occurs (such as a new switch connecting to the controller, or a packet being received by the controller). The idea is to decompose Openflow applications into simple self-contained micro-applications that, when executed in a certain order and passing state information to each other, implements the desired functionality.

Each Flowlet implements the a set of callback functions that gets invovoked when certain events occur (a switch ia added or removed, a packet arrives from a switch, a flow rule is added or removed, etc). The callback functions typically executes the first Flowlet in the execution stack and instructs Tailflow on how to execute the rest of the stack.



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