FUJITSU

Data Sheet
Virtuora® Network Controller

Software-Defined Network Control Platform

The Virtuora platform suite provides an SDN/NFV solution that turns the network into a continuous, innovative service that delivers carrier-grade reliability. This means end-to-end operational automation, service orchestration and network programmability. From a business standpoint, the Virtuora platform is a foundation for building resilient networks capable of self-repair and able to make the fullest possible use of resources and capacity. Perhaps most of all, Virtuora can facilitate moment-by-moment responsiveness to customer needs and set up services in a few minutes rather than hours, weeks or days.

About the Virtuora Product Suite
Virtuora Network Controller (NC) is the platform for a comprehensive, adaptable, highly modular suite of software products that enable you to build and grow a virtualized, programmable network. The Fujitsu Virtuora SDN product suite encompasses control, planning and design, operations and management, and service fulfillment and assurance functions.

How the Virtuora Product Suite Benefits Your Business
Networks based on the Virtuora product suite can help you:
- Cut long-term operational and capital costs
- Speed up service launch and delivery
- Maintain support for current revenue-bearing services
- Preserve the useful life of existing network assets
- Choose equipment and technology without vendor dependence
- Build a resilient network that increases SLA compliance
- Improve quality of service and customer experience
- Quickly identify, anticipate, and meet customer needs
- Open up a rich ecosystem of new revenue opportunities

Virtuora NC — the Control and Management Center of your Network
Built on an open-source foundation such as OpenDaylight or ONOS, Virtuora NC provides a framework for a collection of applications and interfaces that enables the control and management center of the virtual network. This powerful, standards-based software platform delivers a full-featured, lower-cost, scalable environment that extends the capabilities of a basic network controller or even a vendor-proprietary controller.

Component-Based Structure Gives you Freedom of Choice
By separating the applications, controller and southbound interface components, Virtuora NC enables you to rapidly upgrade the controller or even move to another controller platform entirely, with little or no impact to southbound interfaces and applications. This layered functional separation offers complete freedom to choose equipment and software from any vendor—with minimal cost, reduced testing and smooth business continuity.

One Controller, One Control Plane, One Network Vision
Virtuora NC centralizes the network control plane by logically consolidating it into a single software system connected to the diverse devices, tools, and interfaces that make up the network's infrastructure. Regardless of physical location, traffic route or data delivery mechanism, Virtuora NC communicates with and controls network elements automatically, effectively and reliably.

This virtually centralized control plane architecture delivers unified operations and resource orchestration, with universal abstractions that enable global network programmability and automation. Virtuora NC also provides for decision-making based on up-to-the minute information about the characteristics of the network itself.

A Rich Application Ecosystem

Just-in-Time, Pay-as-you-Grow Networking
"Network agility" means meeting fluctuating and often unpredictable demand with a network that's available precisely when needed, for as long as needed. It also means being able to expand your network rapidly when new demand or opportunity arises. Virtuora NC lets you act fast, scale to meet demand, and "pay-as-you-grow."

Virtuora NC uses software-defined networking to deliver new services to market faster and more economically. It also enables control of management, integration and simplified application administration within a network construct that is dynamic, efficient, scalable, and that promises improved capacity and resilience. With Virtuora NC, you can count on a best-in-class controller that is modular, open, interoperable, and designed to grow with you.

Modular, Standards-Based Architecture
The Virtuora product suite comprises three distinct, functional "layers" of software that interface with each other via open APIs and YANG models.

Application Layer
The heart of Virtuora NC is the rich variety of modular applications that provide the network control functions. Network design, control, management, fulfillment, service assurance, and northbound interfaces are all delivered via the Virtuora applications. Each application provides a set of external interfaces to the controller, data collection and analytics engines, active and available inventory, and next-generation OSSs. Because these external interfaces comply with open REST standards, Virtuora applications can be used with any controller that supports the same open REST standards.

Platform Layer
The open SDN control framework forms the middle layer. Built on OpenDaylight (ODL), ONOS, or a vendor-proprietary controller, the modular nature of Virtuora NC provides for rapid upgrades and migration to other controllers.

Network-Centric Layer
The southbound interfaces make up the foundation layer, which directly enables multivendor equipment to communicate with the network. These interfaces to network elements are abstracted via YANG models and XML. These interfaces also support NETCONF and other management protocols, and provide multivendor support.

Get to Market Faster and More Economically
With Virtuora NC controlling your network, it is quicker and easier to provision new or upgraded equipment into service. Virtuora NC also enables you to knit together heterogeneous devices dynamically. You can holistically provision data centers across distributed networks and virtual environments with automated, vendor-agnostic network elements. The system gets services to market faster and more competitively because it is modular, flexible and simple—bringing diverse, dispersed resources together as a unified, integrated whole. Virtuora NC also Interfaces with the Virtuora Path Computation application (PCE) to build optimal routes for services, ensuring they are highly resilient and quick to restore if an interruption occurs.

Integrating Multivendor Devices and Third-Party Applications
Virtuora NC retains the openness of the platform so that you can seamlessly integrate multivendor devices and develop applications using standard interfaces. The southbound interfaces are described using YANG models and abstracted for simple integration and access by the controller and network applications. All the data stores in the platform database, in addition to other platform services, can be accessed by any application via standardized REST-based APIs and data-modeling. Thus, if you can develop open-platform applications, you can develop and implement applications for Virtuora NC.

Fast, Easy Service Provisioning with High Availability
- Includes graphical topology and link views
- Provides greater security with role-based user access
- Delivers dynamic service activation and end-to-end provisioning
- Links dispersed systems and processes automatically
- Instantiates services and functions on-demand
- Integrates existing, new, and mixed-wavelength services
- Supports disaster recovery
- Integrates external subsystems with REST interfaces

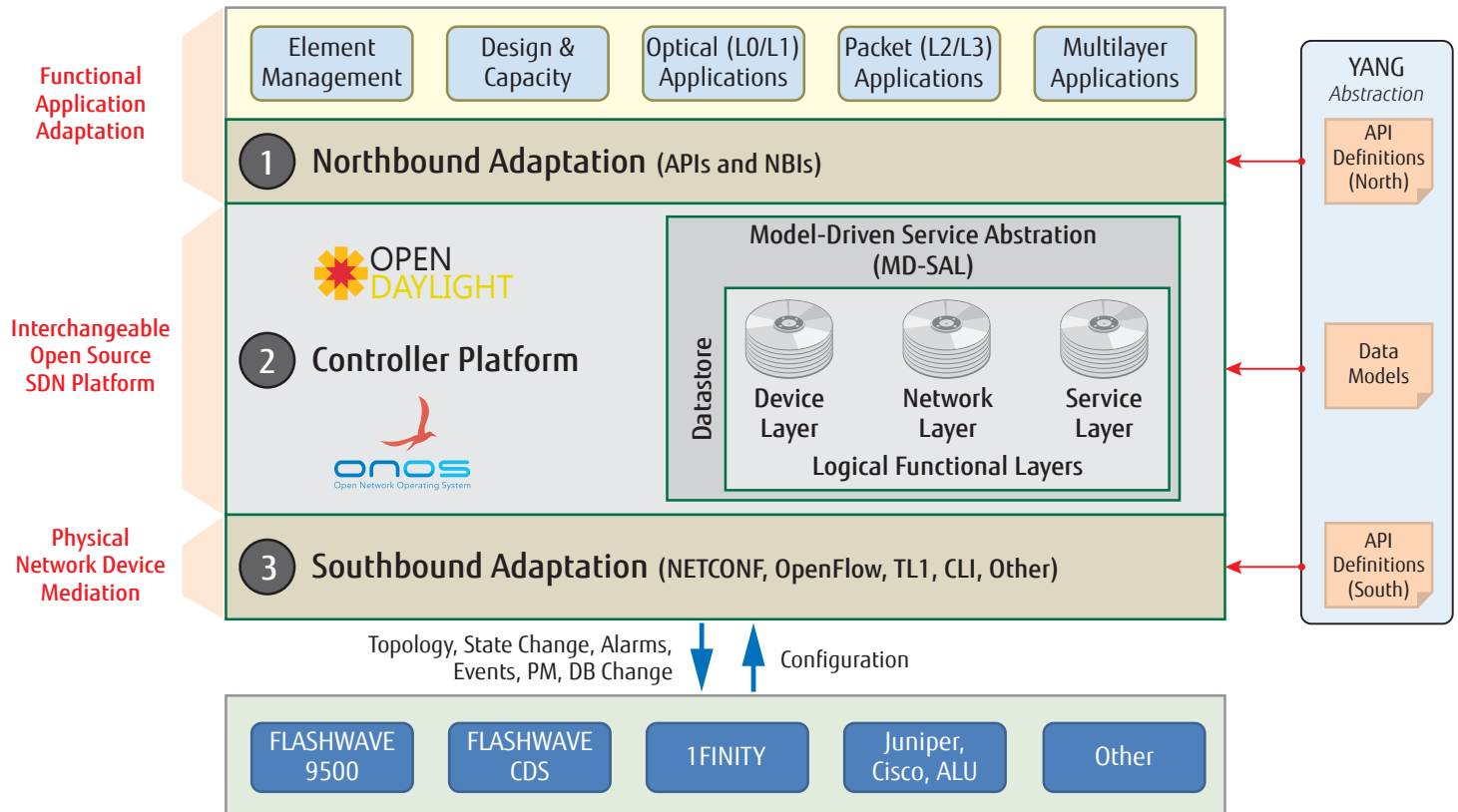**Transform and Innovate—Continuously and Competitively**
A network based on open standards and a modular architecture is able to reinvent itself quickly when needs and opportunities arise. Virtuora NC is built to a service-driven model based on open-source technology. It is part of an ecosystem of current and future network technology that supports cooperative innovation and freedom of choice.

With Virtuora NC powering your network, you can quickly identify and capitalize on your customers' needs and improve business outcomes by adopting continuous improvement practices in a tightly coupled development/operations organization.

With Virtuora NC, you can:
- Escape vendor lock-in with multilayer, multidomain or multivendor networks
- Ensure consistent service quality and continuity
- Effectively manage and utilize growing amounts of network data
- Recover service fast across multiple tiers and vendors
- Take advantage of "crowd-sourced" innovation on open-source platforms
- Keep costs in check by using open source technology
- Do away with configuration tracking and undocumented, localized, manual processes and procedures

Fewer Constraints, More Choices

Functional Application Adaptation

Element Management	Design & Capacity	Optical (L0/L1) Applications	Packet (L2/L3) Applications	Multilayer Applications

1 **Northbound Adaptation** (APIs and NBIs)

OPEN DAYLIGHT

Interchangeable Open Source SDN Platform

2 **Controller Platform**

ONOS
Open Network Operating System

Model-Driven Service Abstration (MD-SAL)

Datastore

Device Layer | Network Layer | Service Layer

Logical Functional Layers

Physical Network Device Mediation

3 **Southbound Adaptation** (NETCONF, OpenFlow, TL1, CLI, Other)

YANG *Abstraction*

API Definitions (North)

Data Models

API Definitions (South)

Topology, State Change, Alarms, Events, PM, DB Change ↓ ↑ Configuration

FLASHWAVE 9500	FLASHWAVE CDS	1FINITY	Juniper, Cisco, ALU	Other

Virtuora NC provides a unifying framework for network control and management applications and interfaces

Real Benefits from a Programmable, Automated Network

Globalized, programmable and automated networks will ultimately become commonplace as a direct consequence of virtualizing the control plane. The result is progressively fewer vendor constraints on both hardware and software; better access to meaningful real time performance metrics and topology data; and reduced dependence on tedious or machine-by-machine local tasks. Virtuora NC organizes and presents easy-to-read routing information for each service and for virtual network operations.

Improve Efficiency and Quality
- Fewer time-consuming command line procedures
- Less frequent truck rolls
- Automation of repetitive tasks
- Reduced power consumption when demand is low
- KPI data analysis for choke points and fragmentation
- What-if analysis for re-grooming services or adding capacity

Expert Integration Services for Custom SDN/NFV Solutions

Beyond the Baseline: Value-Added SDN Services Integration

Fujitsu offers expert support to assist with end-to-end automation and integration of all system elements, including network elements, management functions, controllers and orchestrators.

Verification

Validation testing in a multivendor environment presents complex challenges because of the unpredictable ways in which components from multiple vendors interact, as well as the need to engage different design and engineering groups to analyze issues. As new products are identified for deployment, Fujitsu can conduct validation testing in a secure, vendor neutral laboratory under your direction and control.

Fujitsu takes the lead in developing test plans based on customer requirements, executing the test program, and reviewing final reports with all parties involved. All interoperability testing is structured to ensure the combinations meet all customer requirements and planned deployment guidelines.

Platform Integration

Virtuora NC provides a REST interface supporting all functionality available in a Fujitsu SDN solution. These REST interfaces can be used to integrate into other components within the SDN ecosystem. The Fujitsu team can analyze the systems to be integrated and develop interface mapping to support custom functionality beyond that of the Virtuora platform.

YANG Model Development and Maintenance

YANG modeling is utilized to model behavior between various layers of the SDN solution. As new services and components are added to the SDN architecture, the YANG models need to be updated to include support for these changes. Fujitsu can provide new or updated YANG models based on new service definitions, new or updated equipment, and other changes. The new YANG models can then be used in the SDN environment to provide the new or updated functionality.

Virtuora Network Management Suite Requirements

Hardware platform
- Standard x86 server
- 8 multi-threaded CPU cores (or 16 vCPU)
- 32 GB RAM
- 200 GB disk (CPU: Intel Xeon E5 series or higher)

Operating System
- Server: Red Hat Enterprise Linux version 7.2 or compatible
- Client: HTML5-compatible browsers such as Mozilla Firefox or Google Chrome

Platform Architecture
- OpenDaylight or ONOS SDN platform for configuration and provisioning
- Northbound APIs and southbound device drivers
- YANG models
- Apache HDFS (Hadoop) data store
- Apache Spark analytics engine
- Apache Karaf environment with Apache Karaf Cellar clustering
- Apache Kafka distributed streaming platform

Interfaces
- Northbound: Shared HTTPS port for GUI and REST API
- Southbound: TL1, NETCONF, SNMP, CLI

Clustering
- Supported

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