

Brocade vEPC

HIGHLIGHTS

- Significantly reduces infrastructure deployment costs with a microservice-based modular architecture, allowing throughput, transaction, and session capacity to be added independently
- Optimizes resource usage and increases business agility through on-demand scalability
- Provides granular scalability across various functions, preventing overprovisioning and allowing operators to grow at market speed
- Minimizes packet core TCO by leveraging a highly optimized architecture with full Evolved Packet Core (EPC) functionality to achieve maximum performance across the control plane and user plane
- Leverages horizontal and vertical scaling options to support networks of any size
- Provides a flexible NFV and SDN-ready framework that delivers control plane and user plane separation
- Supports low-latency use cases by placing the user plane at the network edge
- Enables rich application integration using built-in data correlation and streaming capabilities

A Cloud-based Virtual Evolved Packet Core

Brocade® vEPC is an innovative Evolved Packet Core (EPC) specifically designed from the ground up for virtualized environments. Organized in independent slices of the control, user, and management planes, Brocade vEPC is free of the architectural restrictions posed by traditional, physical node-based packet cores. Running on Intel x86 servers, it can efficiently support networks of any size and scale. Brocade vEPC provides the lowest total cost of ownership and ensures that all the benefits of running a virtualized network function get passed on to operators and their customers, leading to a renewed focus on business growth.

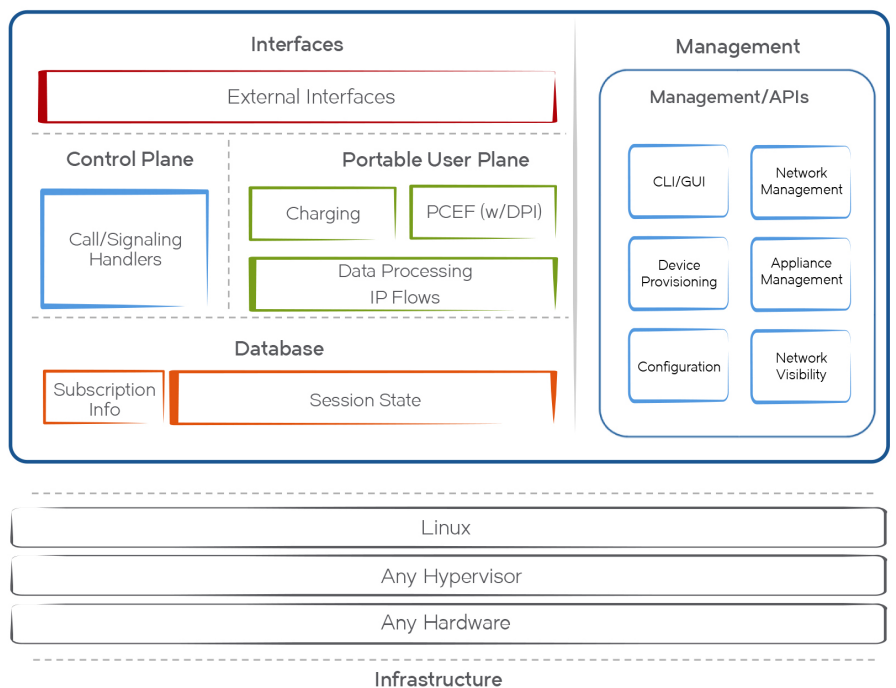


Figure 1: Brocade vEPC logical architecture.

BROCADE VIRTUAL CORE FOR MOBILE

Brocade Virtual Core for Mobile (VCM) architecture transforms mobile networks through a feature-rich and highly scalable virtualized Evolved Packet Core (EPC) implementation. This approach eliminates the expensive hardware, long upgrade cycles, overprovisioning, and years-in-advance budgeting that traditionally characterize mobile service provider networks. As a result, operators can experience the benefits of a fully virtualized EPC implementation.

The Brocade VCM product family consists of Brocade vEPC, Brocade vHSS, Brocade vPGW, Brocade vSAE-GW, and Brocade vC-SGN.

Key benefits include:

- Lower total cost of ownership
 - Greater business agility
 - Adaptiveness to multiple deployment use cases (fixed LTE, private LTE, public safety LTE, NB-IoT DCNs)
-

Innovative Architecture

Brocade has transformed the old, physical node-based, vertical architecture into a service-based, horizontal architecture consisting of independent interface, service logic, database, and management modules (see Figure 1). This holistic approach to functional virtualization optimizes performance and efficiency—compared to the traditional approach of replicating existing physical nodes as a software asset—and is the fundamental difference between Brocade vEPC and other virtualized products. By leveraging this innovative architecture, Brocade vEPC provides a robust, high-performance, scalable, and fault-tolerant solution capable of supporting diverse use cases.

Optimized for Processing, Transactions, and Sessions

The Brocade vEPC framework provides control plane and user plane separation, with each plane functioning and scaling independently and elastically according to the respective load factor. With this framework, Brocade vEPC is optimized for processing control plane transactions and user plane session data.

On-Demand, Granular Scalability

Brocade vEPC components are fully distributed and tiered by function, such as signaling, interface, service logic, and data management. This modular design allows for greater flexibility in designing solutions for a range of industry use cases. Moreover, no barriers exist in terms of subscriber, throughput, or virtual resource minimums that must be deployed. Such on-demand, granular scalability eliminates the need for long-range advance budget planning and expensive overprovisioning.

Optimized User Plane Performance

Brocade vEPC has been optimized to enable packet core user plane functions on general purpose Intel x86-based servers. With its unique architecture, Brocade vEPC provides best-in-class performance and has been benchmarked for full duplex 10 GbE line-rate data processing and minimal data plane latencies.

Brocade vEPC utilizes data plane acceleration technologies, such as Intel DPDK in PCI passthrough or SR-IOV mode, to guarantee high performance in a virtualized environment. Key aspects of delivering user plane services over a virtualized platform include overcoming the non-real-time nature of the x86 hardware processing pipeline and providing alternative solutions to traditional

interrupt-driven packet processing approaches. By using batch-based packet processing models and poll-mode-based drivers, Brocade vEPC achieves faster memory access and packet processing. This allows operators to service a user plane that provides deterministic packet forwarding using a combination of synchronous run-to-completion and inline asynchronous threads, thereby maximizing throughput levels.

Higher Service Velocity

As an open, highly adaptable solution, Brocade vEPC can provide higher service velocity than traditional, physical node-based architectures, which are far more rigid and complex. Its service-based, modular design, combined with open API support, enables operators to quickly create and implement new features for maximum business agility. Operators can add infrastructure to support new users or new services in just days, instead of months. The fully virtualized deployment allows operators to grow their mobile networks at market speed.

BROCADE vEPC: KEY FEATURES

- Carrier-grade high availability
 - Linear scaling
 - Stateless control plane architecture
 - Intel DPDK-enabled data plane
 - Full duplex line-rate performance
 - Cloud-ready innovative design
 - Multiple hypervisor support: VMware ESXi, KVM
 - Integration with cloud tools: OpenStack, VMware vCenter, VMware vCloud Director, Cloudify TOSCA-based orchestration
 - Commercial cloud-ready: AWS, GCE, Microsoft Azure
 - Supported on Intel x86-based general purpose servers
 - Management API support, including SNMP, REST, and XML
-

Support for Various Deployment Options

The hardware-centric approach of traditional EPC infrastructure has forced service providers to create expensive, large-capacity nodes that are cost-prohibitive to deploy in a flexible manner. Brocade vEPC decouples network functions from hardware to provide a service-based, modular design that can also provide control plane and user plane separation. As a result, a wide range of industry use cases can be addressed using the same platform software. For example, the same Brocade vEPC software can be custom-scaled to meet the requirements of a low-density, high-throughput Fixed LTE for rural/remote broadband coverage, or a high-density, low-throughput NarrowBand IoT (NB-IoT) deployment.

Form-Factor Miniaturization

The scale-in capabilities of the Brocade vEPC allow the same Brocade VCM-based EPC software used in larger networks to be miniaturized and used for small form-factor applications. This means that a Brocade vEPC-based network-in-a-box-type solution inherits the same fully qualified and interoperability-tested

software that is available for larger, carrier-grade networks. In its miniaturized version, Brocade vEPC can scale down to operate on as few as two cores while servicing up to a hundred subscribers.

Built-in Load Balancing

Brocade vEPC provides a configuration tool to set the criteria and threshold for instantiating more Virtual Machines (VMs) to run vEPC modules. These criteria include CPU usage, memory usage, the number of queues in the system, and the number of incoming requests. Brocade vEPC uses intelligent logic in configuring the threshold to prevent the “ping pong” effect of instantiating and removing VMs. Once Brocade vEPC detects that the value(s) for the criteria has passed the threshold, it instantiates particular VMs to support the demand. The added VMs participate in the corresponding cluster without requiring any additional configuration. Internal load balancing within the clusters helps ensure that each VM is optimally loaded based on the capacity it can support.

Streamlined Management and Orchestration

Brocade vEPC provides all aspects of fault, configuration, accounting,

performance, and security information to an external orchestrator and/or NMS using various APIs, including REST, SNMP, XML, and CLI. It also can work with multiple industry-leading orchestrators across a range of fields and environments.

Maximum Reliability

Each component of Brocade vEPC is designed for high availability and has no single point of failure. A well-distributed deployment of multiple instances of Virtual Network Function Component (VNFC) VMs at each tier allows clusters to detect a failure and route subsequent requests to available instances. Brocade vEPC can detect and address a failure at the process, network interface, VM, and server level. Each VNFC VM is modeled to support 99.999 percent availability.

High Performance

Brocade vEPC is a software-based, fully virtualized packet core and is not bound to any proprietary hardware. Its capacity and performance depend mainly on the number of cores. It supports linear scalability to meet any capacity and performance requirement, allowing service providers to deploy Brocade vEPC in various use cases (see Table 1).

Table 1: Examples of Brocade vEPC performance with different numbers of physical cores.

		21 cores ¹	36 cores ¹	54 cores ¹
Control Plane Performance	Simultaneous Attached Users (SAUs)	1 million	2 million	3 million
	Number of bearers	1.2 million	2.4 million	3.6 million
	Attaches per second	3,500	7,000	10,500
Data Plane Performance	Throughput ² (Gbps)	10	20	30

Notes:

¹ Physical cores.

² Throughput measured with IMIX traffic.

Brocade vEPC Specifications

Features

Mobility management	<ul style="list-style-type: none"> • EMM NAS Procedure • Attach/Detach • Paging • X2, S1 Handover Tracking Area Update 	<ul style="list-style-type: none"> • Multi-PLMN support • 3G-LTE IRAT Handover • S10 Handover
NAS security	<ul style="list-style-type: none"> • Encryption <ul style="list-style-type: none"> - EEA0 (NULL) - EEA2 (AES-128) 	<ul style="list-style-type: none"> • Integrity protection <ul style="list-style-type: none"> - EIA2 (AES-128)
Session management	<ul style="list-style-type: none"> • Default bearer management • Multiple EPS bearer support • QCI to DSCP mapping • UE-AMBR, APN-AMBR, GBR • Dedicated bearer management 	<ul style="list-style-type: none"> • ESM NAS Procedure • Packet Filter Support • Downlink Data Buffering • GTPv1, v2
APN support	<ul style="list-style-type: none"> • Multiple APN support • Static and dynamic IP address allocation 	<ul style="list-style-type: none"> • UE IPv4 or IPv6 addressing support
Roaming	<ul style="list-style-type: none"> • Inbound and outbound roaming • Gp 	<ul style="list-style-type: none"> • S8
Networking functions	<ul style="list-style-type: none"> • Dual stack IPv4 and IPv6 support • VLAN tagging • Static routes 	<ul style="list-style-type: none"> • IPv4 fragmentation and reassembly • Jumbo frames • NTP Synchronization
Lawful intercept	<ul style="list-style-type: none"> • 3GPP Rel 12 Compliance • X1_1 (administration) • X2 (IRI) 	<ul style="list-style-type: none"> • X3 (CC) • TLS v1.2
Policy and charging	<ul style="list-style-type: none"> • PCRF interworking: Gx • Local Policy Control • Time and volume CDR generation (ASN.1 format) 	<ul style="list-style-type: none"> • GTP' (GTP prime) support • Online charging: DCCA, Gy • Offline charging: Gz
RADIUS	<ul style="list-style-type: none"> • RADIUS authentication • AAA server configuration 	<ul style="list-style-type: none"> • RADIUS accounting • RADIUS-based rate-limiting
Voice support	<ul style="list-style-type: none"> • CS Fallback: MO/MT call • VoLTE: MO/MT call 	<ul style="list-style-type: none"> • CS Fallback: MO/MT SMS
DPI	<ul style="list-style-type: none"> • L3/L4 DPI • 5-tuple SDF detection • URL filtering 	<ul style="list-style-type: none"> • L7 DPI • P2P protocol detection • X-Header enrichment
Subscriber provisioning	<ul style="list-style-type: none"> • Optional EPC HSS function • CLI-based subscriber provisioning • Internal or external S6a 	<ul style="list-style-type: none"> • Geo-redundant database clustering • APN and QoS templates
Geographical distribution	<ul style="list-style-type: none"> • Control plane MME function relocation 	<ul style="list-style-type: none"> • S10
3GPP interface support	<ul style="list-style-type: none"> • S1-MME • S1-U • S5/S8 • S10 • S11 • SGi • S2a 	<ul style="list-style-type: none"> • S6a/S6d • Gx • Gy • Gz • Gn/Gp • SGs

Brocade vEPC Specifications *(continued)*

OAM aspects	<ul style="list-style-type: none">• GUI-based EMS• Follows ITU-T X.733• Manages multiple Brocade VCM instances• User management• In-service software patching	<ul style="list-style-type: none">• FCAPS• SNMP, XML, REST• CLI support• Graphical display of VNFC topology• Real-time resource usage charts
-------------	---	--

Standards Compliance

3GPP	<ul style="list-style-type: none">• 3GPP TS 23.003: Numbering, addressing and identification• 3GPP TS 23.007: Restoration Procedures• 3GPP TS 23.060: General Packet Radio Service (GPRS); Service description; Stage 2• 3GPP TS 23.107: Quality of Service (QoS) concept and architecture• 3GPP TS 23.203: Policy and charging control architecture• 3GPP TS 23.207: End-to-end Quality of Service (QoS) concept and architecture• 3GPP TS 23.272: Circuit Switched (CS) fallback in Evolved Packet System (EPS); Stage 2• 3GPP TS 23.401: General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access• 3GPP TS 24.301: Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3• 3GPP TS 29.060: General Packet Radio Service (GPRS); GPRS Tunneling Protocol (GTP) across the Gn and Gp interface• 3GPP TS 29.061: Interworking between the Public Land Mobile Network (PLMN) supporting packet-based services and Packet Data Networks (PDN)• 3GPP TS 29.118: Mobility Management Entity (MME) – Visitor Location Register (VLR) SGs interface specification• 3GPP TS 29.210: Charging rule provisioning over Gx interface• 3GPP TS 29.211: Rx Interface and Rx/Gx signaling flows• 3GPP TS 29.212: Policy and Charging Control (PCC); Reference points• 3GPP TS 29.213: Policy and charging control signaling flows and Quality of Service (QoS) parameter mapping• 3GPP TS 29.274: 3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunneling Protocol for Control plane (GTPv2-C); Stage 3• 3GPP TS 29.281: General Packet Radio System (GPRS) Tunneling Protocol User Plane (GTPv1-U)• 3GPP TS 32.215: Telecommunication management; Charging management; Packet Switched (PS) domain charging• 3GPP TS 32.295: Telecommunication management; Charging management; Charging Data Record (CDR) transfer• 3GPP TS 32.296: Telecommunication management; Charging management; Online Charging System (OCS): Applications and interfaces• 3GPP TS 32.297: Telecommunication management; Charging management; Charging Data Record (CDR) file format and transfer• 3GPP TS 32.298: Telecommunication management; Charging management; Charging Data Record (CDR) parameter description• 3GPP TS 33.102: 3G security; Security architecture• 3GPP TS 33.106: 3G security; Lawful interception requirements• 3GPP TS 33.107: 3G security; Lawful interception architecture and functions• 3GPP TS 33.401: 3GPP System Architecture Evolution (SAE); Security architecture• 3GPP TS 36.410: E-UTRAN: S1 general aspects and principles• 3GPP TS 36.412: Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 signaling transport• 3GPP TS 36.413: Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)• 3GPP TS 36.414: Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 data transport
------	---

Brocade vEPC Specifications *(continued)*

- IETF
- IETF RFC 1994: PPP Challenge Handshake Authentication Protocol (CHAP)
 - IETF RFC 2474: Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
 - IETF RFC 2865: Remote Authentication Dial-In User Service (RADIUS)
 - IETF RFC 2866: RADIUS Accounting
 - IETF RFC 2867: RADIUS Accounting Modifications for Tunnel Protocol Support
 - IETF RFC 2868: RADIUS Attributes for Tunnel Protocol Support
 - IETF RFC 2869: RADIUS Extensions
 - IETF RFC 2882: Network Access Servers Requirements: Extended RADIUS Practices
 - IETF RFC 4006: Diameter Credit-Control Application
 - IETF RFC 4960: Stream Control Transmission Protocol
 - IETF RFC 6733: Diameter Base Protocol
-

License Information

Brocade vEPC is available with simple, flexible, and scalable perpetual licensing options designed to support different use cases. Contact Brocade for more information about ordering and licensing.

Brocade Global Services

Brocade Global Services has the expertise to help organizations build scalable, efficient cloud infrastructures. Leveraging 20 years of expertise in storage, networking, and virtualization, Brocade Global Services delivers world-class professional services, technical support, and education services, enabling organizations to maximize their Brocade investments, accelerate new technology deployments, and optimize the performance of networking infrastructures.

Acquisition Options That Match Balance Sheet Objectives

Successful network deployments drive business forward, providing technical and financial agility. Brocade offers the broadest financing models, from traditional leasing to Brocade Network Subscription. Network-as-a-Service allows organizations to subscribe to network assets today then upgrade on demand, scale up or down, or return them with 60-day notification. Brocade Network Subscription plans can be structured to meet IASC guidelines for OpEx or CapEx treatment to align with financial goals. Learn more at www.nonetworkcapex.com.

Maximizing Investments

To help optimize technology investments, Brocade and its partners offer complete solutions that include professional services, technical support, and education. For more information, contact a Brocade sales partner or visit www.brocade.com.

Corporate Headquarters

San Jose, CA USA
T: +1-408-333-8000
info@brocade.com

European Headquarters

Geneva, Switzerland
T: +41-22-799-56-40
emea-info@brocade.com

Asia Pacific Headquarters

Singapore
T: +65-6538-4700
apac-info@brocade.com



© 2017 Brocade Communications Systems, Inc. All Rights Reserved. 02/17 GA-DS-5245-01

Brocade, the B-wing symbol, and MyBrocade are registered trademarks of Brocade Communications Systems, Inc., in the United States and in other countries. Other brands, product names, or service names mentioned of Brocade Communications Systems, Inc. are listed at www.brocade.com/en/legal/brocade-Legal-intellectual-property/brocade-legal-trademarks.html. Other marks may belong to third parties.

Notice: This document is for informational purposes only and does not set forth any warranty, expressed or implied, concerning any equipment, equipment feature, or service offered or to be offered by Brocade. Brocade reserves the right to make changes to this document at any time, without notice, and assumes no responsibility for its use. This informational document describes features that may not be currently available. Contact a Brocade sales office for information on feature and product availability. Export of technical data contained in this document may require an export license from the United States government.

BROCADE 