HIGHLIGHTS
• Simple, flexible, and reliable communication for oil and gas rigs, platforms, vessels, pipelines, and offices
• Built-in motility and Quality of Service (QoS)
• Quick and easy end-to-end network deployment
• Scalable solution that can grow as business demand grows
• Ability to choose small cell or macro radio depending on location and coverage
• Line rate throughput at 10 Gbps through Intel DPDK integration
• Higher than 99.999% availability through independent modular redundancy architecture with no single point of failure

Efficient and Agile LTE-based End-to-End Communications Solution
An efficient communications network is a fundamental requirement in most modern oil and gas operations, to support process control and other field applications. In many of these facilities, wired networks are difficult to install or are not flexible enough to support quick process reconfiguration, making wireless an ideal choice. A Long-Term Evolution (LTE) network provides customers with ubiquitous coverage, built-in mobility support, and superior QoS management to provide the services they need, including support for remote locations and mobile equipment.

The Brocade® Virtual Evolved Packet Core (Brocade vEPC) in conjunction with LTE radios provides a scalable and reliable LTE-based solution for oil and gas field communications. This solution securely supports multiple industrial applications simultaneously in an agile and cost-effective way. Its innovative virtualized and modular architecture enables the Brocade vEPC to be deployed according to need: at a central data center location, from which it serves multiple remote oil and gas fields, or directly at remote sites where communication demands are great enough to require on-site capabilities.

The Business Challenge of Oil and Gas Field Communications
Much of the time, oil and gas fields cover hundreds of square miles across remote areas and pose some of the most demanding communications requirements. Supporting reliable communications between offices, pipelines, remote drilling, production facilities, and exploration teams in remote locations is critically important for successful operation of the oil and gas fields, while providing a full range of regular business communications. Extreme outdoor conditions such as intense cold, ice and snow, extreme heat, heavy dust, high humidity, strong wind, heavy rain, and salt fog are typical conditions that pose challenges to oil and gas field communications. Business continuity and disaster recovery are also vital components of the overall communications strategy for oil and gas operations.

To meet these challenging requirements, operations often demand private and secure wireless communications capabilities, which typically are not well served by traditional commercial cellular networks. Such solutions do not integrate well with rest of the IT infrastructure.
Brocade vEPC for Simple and Reliable Communications

Oil and gas field communications require reliable, resilient, and high-capacity wireless networks that operate over large areas under extreme environmental conditions. An ideal scenario for wireless oil and gas communications networks would be to provide broadband speeds and form a scalable foundation to securely support multiple applications that would increase operational efficiency and safety in a cost-effective way.

Brocade Virtual Evolved Packet Core (vEPC) is an innovative virtualized EPC solution that provides a key building block for enabling private LTE network deployments as described. The Brocade vEPC can easily integrate with eNodeBs and small cells on one end and vertical-specific IT applications on the other end to provide a total solution for oil and gas field communications. The Brocade vEPC is the first mobile infrastructure software that is designed from the ground up to use computing units efficiently in a virtualized environment. The Brocade vEPC maps all network functions to computing units, so it is capable of scale-in as well as scale-out, enabling any size deployment and incremental growth. The Brocade vEPC approach achieves unprecedented performance and independent scaling in signaling, data throughput, and storage. It thus enables system performance combinations (for example, a small number of mission-critical devices with high throughput) in an efficient manner that was not feasible previously. The simplification of architecture achieved by the Brocade vEPC also results in ease of provisioning and operation, an important consideration for private network deployments.

Simplicity and Ease of Operations

Simplicity is a key requirement for private networks, as the installation and operations personnel may not be subject matter experts in mobile networks. Traditional mobile packet core solutions are typically very complex to operate, which can cause difficulties for deployment. The simplified design of the Brocade vEPC reduces the time required to bring up a new system and also enables easy monitoring and maintenance. This dramatically lowers expenses and simplifies operations.

Any Size Network

Given its elasticity and distributed nature, the Brocade vEPC can support traffic of any size, from a few devices in a remote area to many devices or users in a dense metropolitan area. Because of this, oil and gas field operators can benefit from the same software that runs large mobile networks, instead of being forced to pick closed, private, network-specific solutions “in a box.”

High Availability

Each software component of the Brocade vEPC is implemented with the goal of high availability, so it has no single point of failure. Well-distributed deployment of multiple instances of computing units at each tier enables clusters to detect failures and route subsequent requests to available instances. The Brocade vEPC detects and recovers failure at the process, network interface, virtual machine (VM), and server level. Each VM or component is modeled appropriately in a Service Availability Management Framework (AMF) to 99.999 percent availability.

Easy Integration with Vertical-Specific Applications and IT Systems

Private networks provide connectivity for enabling vertical-specific applications in remote locations. It is critical for private network solutions to easily integrate into overall vertical-specific IT systems, in order to facilitate the successful operation of end-to-end solutions. The Brocade vEPC provides Application Programming Interfaces (APIs) for easy integration in areas of provisioning, monitoring, policy, and security.

Partnering for an End-to-End Solution Offering

Brocade is working with multiple partners to provide an end-to-end solution offering, including User Equipment (UE) partners for ruggedized devices that can withstand harsh environmental conditions. Radio Access Network (RAN) partners for providing fixed and wireless RAN equipment and backhaul to the Brocade vEPC, and service integrators that can integrate the system with applications specific to the oil and gas field environment.

An End-to-End Solution Offering

Brocade offers an end-to-end solution offering for oil and gas field communications. The solution consists of multiple components that can be fulfilled through multiple partners, as shown in Figure 1.

- **Devices**: These use a variety of rugged LTE modems for ready integration in heavy equipment, as well as traditional handsets for field workforce personnel.
- **Radio**: For LTE based services, eNodeBs or small cells are used. For remote area operations, there is an option to use outdoor small cells with high power, preferably solar powered with battery backup.
- **Backhaul**: This connects the radio equipment to the Brocade vEPC. There are options to use point-to-point wireless or regular wire or fiber, depending on field conditions.
- **Packet core**: The Brocade vEPC provides full-function EPC running on an x86-based platform. The Brocade vEPC provides Subscriber Identity Module (SIM) provisioning features to provision and support all of the devices on the field. It has a small footprint to
support any size network and open architecture APIs to enable easy backend integration.

- **Business process integration:** The Brocade vEPC provides the ability to directly address end devices by storing the complete history of device access and states. Data provided by devices can be fed into various IT systems and applications through APIs.

**Oil and Gas Communications Made Simple with Brocade vEPC**
The Brocade vEPC solution provides a scalable and reliable foundation to securely support multiple industrial applications simultaneously, including a range of oil and gas exploration and production applications.

- **Supervisory Control And Data Acquisition (SCADA):** The Brocade vEPC is designed to support Machine-to-Machine (M2M) and Internet of Things (IoT) communications through its modular scalability and rich APIs. Data that is needed for SCADA can be collected from multiple sensors and sent to the application through the Brocade vEPC APIs. The SCADA system for oil and gas fields is used for production and injection well monitoring, measurement, logging and control, source and disposal water well monitoring, storage tank monitoring and control, emergency equipment shutdown and recovery, and so on.

- **Real-time video feeds and surveillance:** The Brocade vEPC supports line-rate performance of 10 Gbps per data plane VM. This high throughput solution is ideal for 24x7 real-time video feeds, as well as surveillance that provides operations with remote situational awareness and information that can facilitate decisions, improve safety, and deliver early visibility into critical situations that are happening in the field.

- **Security and surveillance systems:** Facility security is enhanced with electronic and video access control at entry points or secure locations in the facility.

- **Drill rig communications and diagnostics:** The Brocade vEPC can send the data from drill rig sensors to backend applications, to monitor drill bit depth and tilt, mud weight, temperatures, and pressures. With its UE data storage and API, the Brocade vEPC enables applications to remotely run diagnostics and analyze results simply and easily.

- **Asset tracking:** The built-in mobility of the Brocade vEPC helps customers track and update the location of fixed and mobile assets in the field to improve operations, safety, and security.

- **Field workforce connectivity:** Brocade vEPC supports human users and devices and sensors effectively through a single solution deployment. It helps work crews in the field connect to and access SCADA data, instant messaging, and email at remote sites.

- **Voice:** The availability of IP phones for mobile workers even in remote areas improves operational efficiency and worker safety.

**Application Example: Video Monitoring and Surveillance**
Using video in oil and gas operations offers increased visibility into field operations, boosts operational efficiency, and enhances both worker safety and environmental safety. Video provides remote visibility into areas in and around

![Diagram](image)
the drill site, reducing the need for on-site personnel and improving the ability to make decisions based on information about current conditions.

Real-time video 24x7 requires a reliable, secure, high-performance communications network between cameras and applications. The Brocade vEPC supports line-rate performance of 10 Gbps with tight QoS control and is suited to fulfill the requirements of continuous broadband data. Through Brocade vEPC, customers can use video monitoring and surveillance applications in a number of ways:

- Use downhole video technology to view downhole problems in real time and improve decision making
- Perform crane monitoring
- Perform wellhead video surveillance to remotely monitor all activities during the completion and production phases
- Perform drill rig monitoring to provide an overview of the drilling area 24x7
- Use portable video cameras for equipment diagnostics used by field workers
- Perform video surveillance of authorized personnel entering and exiting a gated site or area

Application Example: Mobile Workforce
The Brocade vEPC provides real-time mobile communications that enable mobile workers to bring a virtual office to oil and gas fields. Field workers can collect and share information and communicate this information among other field workers, to improve workflow. Mobile workforce applications enabled by Brocade vEPC technology include the following:

- Mobile workforce authentication and authorization through a built-in user database that grants access to appropriate services
- Remote equipment diagnostics, to enable field workers to communicate with operations in real time and to troubleshoot problems
- Production data acquisition, to enable workers to manage the daily capture of information electronically from various sensors, including tanks, gauges, meters, and so forth
- Workflow management to enable workers to use field asset monitoring data, and to schedule and sequence work for optimal efficiency
- Mobile asset tracking, to enable operations to track the location of assets through various location-based services

Conclusion
The flexible design and interface abstraction layer of the Brocade vEPC enables oil and gas field operators to virtualize the whole EPC in an agile and cost-effective way. The Brocade vEPC and its unique approach to elastic packet core deployment provides these benefits:

- Guarantees a highly available and reliable deployment
- Provides access to the same open and standards-based solution that supports global commercial mobile networks
- Ensures ease of use and simplicity of provisioning, dramatically lowering the total cost of ownership for private network owners
- Provides flexible scale-in and scale-out potential through the use of virtualization techniques
- Enables easy and secure integration with other IT components that are present in private networks

Learn More
Brocade partners with companies of all sizes to deliver innovative solutions that help organizations maximize the value of their most critical information. To learn more, visit www.brocade.com.

About Brocade
Brocade networking solutions help organizations transition smoothly to a world where applications and information reside anywhere. Innovative Ethernet and storage networking solutions for data center, campus, and service provider networks help reduce complexity and cost while enabling virtualization and cloud computing to increase business agility. Learn more at www.brocade.com.