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INTRODUCTION

For communications service providers (CSPs) that offer high-speed Internet services, focusing exclusively on hardware-specific benefits is challenging because, once installed, the traditional residential gateway that has been used for decades is a monolithic system. It cannot evolve. The only way to stay ahead of the competition with this approach is to constantly deploy new hardware, increase connection speeds, and reduce prices. This is a race to the bottom.

By adopting a premises operating system (OS) that runs on top of cutting-edge Wi-Fi systems, appealing new services and applications can be offered to subscribers on an ongoing basis. This approach results in increased subscriber satisfaction, while generating additional, recurring revenue.

CALIX EDGE SUITES OVERVIEW

Calix offers a hardware-independent, modular, always-on, intelligent OS that enables you to bring new services and applications to market quickly. EXOS transforms the traditional residential gateway into a dynamic EDGE System that, thanks to the power of software, can be continually improved and enhanced.

Analogous to operating systems like Windows 10 and Linux, EXOS is a hardware-agnostic software solution. EXOS transforms existing business models, taking advantage of the power of software with:

- **Hardware independence**: EXOS abstracts the software layer from the hardware, allowing for an accelerated time to market. Software and hardware are no longer tightly coupled; truly a transformative approach compared to legacy systems.
- **Services abstraction**: The containerized architecture of EXOS allows for simplified software validation and portability across hardware devices, enabling consistency and instant availability across all products and solutions.
- **Modular architecture**: The EXOS architecture is modular, ensuring that changes to one function do not impact other system functions.
- **Stateful operation**: The ‘always on’ nature of EXOS makes network disruptions a thing of the past.

DE-COUPLING THE SOFTWARE FROM THE HARDWARE

EXOS abstracts the software and service applications away from the underlying system on a chip (SoC) found within the residential gateway. This delivers a solution where the software OS (EXOS) is integrated once and future hardware change cycles are largely hidden; improving time to market significantly, while greatly simplifying operational processes and delivering a common experience for subscribers.

Core to EXOS is a System on a Chip Abstraction Layer (SoCAL) that creates a common application platform across all systems, regardless of the SoC, Wi-Fi, or IoT chipsets. This enables rapid development of new functionality, re-use across implementations, and a DevOps approach to development, integration, and test methodologies. In addition, EXOS supports advanced capabilities across WAN, Wi-Fi, and IoT interfaces with rich Layer 2 and 3 services, and a portfolio of expanding features. Because EXOS is a comprehensive OS, it provides the basis for true “intelligence at the edge” as required for a wide variety of scenarios and use cases.
On top of the SoCAL are the application packages. These packages can be inserted via a container architecture, leveraging a stateful OpenWRT framework, allowing fast time to market without regressing the entire portfolio. The management plane is decoupled and centralized, so it can manage all the applications simultaneously even though the applications can be installed independently.

EXOS paves the road for a future that is hardware agnostic, separating the software layer from the hardware layer, giving CSPs the flexibility to develop and integrate applications and services that are free from the limitations of traditional hardware dependencies. Hardware abstraction to allow for silicon independence is, in itself, not the goal. The goal is flexibility. By having a true abstracted OS, we are able to achieve four benefits: speed to market, capability flexibility, always on networks, and open APIs.

SPEED TO MARKET

Today, every new premises system requires feature development within a constrained software development kit (SDK) and TR-069 ACS integration that can take up to 18 months to complete. EXOS is an OS, abstracted from the silicon, allowing CSPs to reuse software applications running on the residential gateway across different hardware implementations. This results in radically reduced lab validation and integration times, with existing systems like OSS and BSS leveraging a hardware agnostic northbound interface to the ACS, as well as integration with other cloud platforms via JSON interfaces. EXOS will allow CSPs to integrate and launch new systems dramatically faster.

CAPABILITY FLEXIBILITY

By embedding capabilities (i.e., band and node steering) into a componentized, abstracted OS, EXOS provides CSPs with the flexibility and speed of software innovation. CSPs will be able to develop their own applications or pick from a rich ecosystem provided by Calix. No more waiting.

ALWAYS ON NETWORKS

The Calix R&D mindset is based in the concept that rapid software innovation can’t come at the expense of the subscriber experience and reliability. The subscriber wants to rapidly consume new features as quickly as they are available, but a software update can’t impact their service. It must be ‘always on’—whether it is a consumer not wanting their 4K movie interrupted, a gamer’s demand for zero interruptions, or a small business never wanting their Wi-Fi enabled point of sale system to go down. EXOS allows CSPs to service systems remotely, without a reboot through a fully stateful OS design.

OPEN APIs

Whether exporting data to a CSP’s data warehouse, using the native REST-based APIs to serve the CSPs mobile app, sharing data with partners, or enabling Calix Marketing Cloud behavioral insights, EXOS is an open architecture committed to enabling broad systems access.
MANAGEMENT FRAMEWORK

EXOS is built on a persistent database and object model that allows CSPs to access several management protocols and interfaces. Whether the device is managed through an internal graphical user interface (GUI), TR-069, or using NETCONF and YANG data modeling, EXOS provides adapters to access, manage, and provision for current and future interfaces.

Based on Linux, EXOS leverages stateful OpenWRT to provide a framework for full customization and integration of contained features. EXOS gives CSPs an OS that is hardened for carrier-grade deployments to manage consumer-grade devices.

With EXOS, CSPs are provided a framework that gives visibility into the connectivity behaviors and management capabilities for the many devices that make up the connected home. You can continue to support, manage, and control the subscriber experience through the standard EXOS framework.

ANALYTICS AND INSIGHTS ARE EVERYWHERE

An enormous benefit of the designs upon which EXOS is based, as previously detailed, is that it provides the perfect OS upon which to identify, mature, and execute advanced analytical models capable of furnishing intelligence. These models leverage the real-time and historical telemetry that they are inherently privy to, set the stage for intelligent behavior in response to real-time events, and leverage proactive behavior based on predictive modelling.

The results of applying analytic analysis within the network is twofold: You can find new opportunities to sell services that matter to your subscribers and fix areas of misalignment. With the former, CSPs can leverage the historical real-time behaviors of subscribers to market new services that best fit their usage, while the latter allows performance or security issues to be dynamically fixed before they impact the subscriber experience. In a rapidly evolving world, where superior subscriber experience is the deciding factor of who dominates, better insights are key. Finally, and perhaps most importantly, we believe every interaction with a subscriber represents a revenue opportunity, but fully embracing this will require a shift in the CSP mindset from premises as a ‘cost’.