The PowerEdge FX Architecture Portfolio Overview

Re-inventing the rack server for the data center of the future

An adaptable IT infrastructure is critical in helping enterprises keep pace with advances in computing technology. The Dell PowerEdge FX converged architecture provides a flexible, modular platform that can be easily customized to match the requirements of specific data center workloads.

Enterprise computing needs are dynamically changing as business and technology leaders embrace strategic computing innovations to create novel opportunities and gain competitive advantage. The ever-increasing demand for cloud computing, the exponential expansion of mobile use, the widespread adoption of big data techniques and the rise of software-defined infrastructures - all these factors drive IT decision makers to evaluate fresh approaches in the data center.

Many IT leaders are looking to adopt the latest application workload paradigms that industry leaders are pioneering. Wherever possible, they want to gain the economic advantages that scale out technologies have achieved for public cloud providers.

To address the challenges introduced by the latest computing trends, the Dell PowerEdge FX converged architecture is designed to give enterprises the flexibility to tailor the IT infrastructure to specific workloads — and the ability to scale and adapt that infrastructure as needs change over time.

This paper is an overview of the FX Architecture and product portfolio and will cover:

- FX Scalable architecture
- FX Easy workload optimization
- FX Component overview
- FX Advanced enterprise systems management
- FX Component details

Note that the FX components discussed in this paper will roll out over time - from now until mid-2015. This paper is intended to provide enough information to allow an understanding of the overall FX portfolio and to begin planning how the FX architecture can improve existing or future infrastructures. Details of later-releasing components may vary slightly.
The PowerEdge FX architecture is based on a modular, building-block concept that makes it easy for enterprises to focus processing resources where needed. This concept is realized through the PowerEdge FX2 chassis, the foundation of the FX architecture. The FX2 is a 2U rack-based, converged computing platform that combines the density and efficiencies of blades with the simplicity and cost advantages of rack-based systems.

The FX2 hosts flexible blocks of server and storage resources while providing outstanding efficiencies through shared power, networking, I/O, and management within the chassis itself. Although each server block has some local storage, the FX architecture allows servers to access multiple types of storage, such as a centralized storage area network (SAN) or direct attach storage (DAS) in FX storage blocks or in Just a Bunch of Disks (JBODs). Dell expects to release the FX storage block in early 2015.

The PowerEdge FX architecture lets data centers easily support an IT-as-a-service approach because it is specifically designed to fit the scale-out model that this approach embraces. At the same time, its inherent flexibility also adds value to existing environments. In data centers of all sizes, deployments incorporating the FX architecture are designed to be right-sized, efficient and cost-effective.

“On our ships, a blade chassis is too large and power-intensive for us. But the Dell FX2 architecture offers us better power consumption, more core density and a smaller footprint.” — John Ashmore, Mgr of Systems Infrastructure, Carnival Cruise Lines

A key design tenet of the PowerEdge FX architecture is ease of workload optimization. The modular blocks of computing resources and the range of components available in the FX architecture enable data center operators to quickly size infrastructure needs to respective workloads. Moreover, the rich set of features that are hallmarks of PowerEdge servers also make the individual FX server nodes especially flexible in the functionality they can offer. In addition to the FX2 chassis, the portfolio of FX converged servers; storage blocks and IO modules will be released over the course of approximately a year and are described below. The sidebar sections at the end of this brief contain more detailed descriptions of each component.
Server blocks
The PowerEdge FM120x4 microserver addresses the requirements of scale-out computing by optimizing power consumption and footprint. Web services providers can benefit tremendously from the high density, easy manageability and cost-effectiveness that the PowerEdge FM120x4 affords. It is also suited for processing tasks such as batch data analytics.

The PowerEdge FC430 is an excellent mid-tier processing option for data centers. It is well suited for web serving, virtualization, dedicated hosting and other midrange computing tasks. Its extra-small, quarter-width size is designed to make the PowerEdge FC430 one of the densest solutions in the market. In addition, its diminutive form factor allows more discrete physical servers to be packed into a smaller space than usual to support higher levels of availability.

The PowerEdge FC630 server, with its high-performance processors and large memory capacity, can serve as a strong foundation for corporate data centers and private clouds. It readily handles demanding business applications such as enterprise resource planning (ERP) and customer relationship management (CRM), and it also can host a large virtualization environment.

The PowerEdge FC830 server, with its 4 high-performance processors and exceptionally large memory capacity, offers a highly reliable solution for the most demanding workloads of midsize and large enterprises, whether they are large scale virtualization environments, or centralized corporate business processing applications.

Storage block
The PowerEdge FD332 storage block provides dense, highly scalable, direct attached storage for most FX infrastructures (it does not support the FM120 microserver). It is a critical component of the FX architecture, enabling future-ready scale out infrastructures that bring storage closer to compute for accelerated processing.

IO blocks
The FX2 chassis can be ordered with 1Gb or 10Gb pass through IO modules, or optional IO aggregator modules. The FN410s, FN410t, and the FN2210s are powerful IO aggregators providing plug-and-play network switch layer 2 functions. These IO aggregators simplify cable management while also enabling other networking features, like optimized “east/west” server to server traffic within the chassis, LAN/SAN convergence, and simplified network deployment.

Dell is releasing the FX2 chassis, FC630, FM120x4 and IO modules in December 2014 and expects to release the FC430, FC830 and FD332 in the first half of 2015.
FX advanced enterprise management

The exceptional enterprise-class systems management options available to PowerEdge servers are also offered across the FX portfolio, including the entry-level microservers.

With the new FX architecture, customers can leverage their past experience with OpenManage and maintain all of the proven benefits of comprehensive agent-free management for the entire platform lifecycle: deploy, update, monitor and maintain. And all of this is done with additional levels of automation, simplicity, and consistency across IT-defined configurations. Additionally, the FX platform offers IT Administrators more choice and systems management capabilities, regardless of the methods or tools they prefer to use.

FX customers can elect to manage FX systems either like a rack server (locally or remotely) using the iDRAC8 with Lifecycle Controller or manage the servers and chassis collectively – in a one-to-many fashion using the innovative Chassis Management Controller (CMC), an embedded server management component. These options enable IT Administrators to easily adopt FX servers without changing existing processes.

The CMC interface for the FX platform
Each FX server block’s iDRAC8 with Lifecycle Controller provides agent-free management with no dependence upon a hypervisor or OS being installed. When managing the FX platform’s shared infrastructure, the iDRAC monitors shared infrastructure components such as fans and power supply units, and if an alert occurs, it will be reported by each server block, just as with a traditional rack server. When managing FX infrastructure via the CMC, these same alerts will be routed through the CMC. The CMC, of course, can also manage the server blocks via iDRAC with Lifecycle Controller as well as platform networking in its intuitive, easy to use, web interface.

The CMC can also monitor up to 20 FX systems at a glance, perform one-to-many BIOS and firmware updates, and maintain slot-based server configuration profiles which will update BIOS and firmware when a new server is installed. Each one of these abilities delivers time savings over conventional management and reduces the risk of human-entry errors by automating repetitive tasks.

Finally, OpenManage Essentials and OpenManage Mobile provide remote monitoring and management across FX and PowerEdge servers as well as for Dell storage, networking, and firewall devices. To learn more about the entire portfolio of Dell OpenManage tools and technologies, please visit dell.com/openmanage

“By keeping the chassis management controller uniform across its blade platforms — including the M1000e, VRTX and FX2 — Dell has made it possible for our clients to evolve their infrastructure without having to learn a new management application. If you’ve used one, you can use the other.” —John Dembishack, Senior Systems Engineer, Flagship Networks

### FX Component details

The Dell PowerEdge FX architecture enables IT infrastructures to be constructed from small, modular blocks of computing resources that can be easily and flexibly scaled and managed. The initial release of the FX portfolio is comprised of the PowerEdge FX2 chassis, two servers, and three IO Aggregator modules.

**PowerEdge FX2 enclosure: Modular platform**

A small, modular foundation for the FX architecture, the flexible and efficient PowerEdge FX2 can be easily customized to fit an organization’s specific computing needs. The PowerEdge FX2 is a standard 2U rack-based platform with shared, redundant power and cooling; I/O fabric; and management infrastructure to service
flexible blocks of compute and storage resources. It can be configured to hold half-width, quarter-width, or full-width 1U blocks. The switched configuration, the PowerEdge FX2s, supports up to eight low profile PCI Express (PCIe) Gen 3 expansion slots. (Note: one version of the chassis does not have expansion slots – the FX2 – no subscript “s”).

FX 2 Chassis with 4 FC630 servers, each with eight 1.8 inch drives

Part of the shared fabric in the PowerEdge FX2 is reserved for systems management performed through the Dell OpenManage Integrated Dell Remote Access Controller 7 (iDRAC7). Using this fabric and redundant ports, iDRAC can monitor, manage, update, troubleshoot and remediate FX servers from any location — without the use of agents.

Additionally, the PowerEdge FX2 enclosure hosts redundant, quad-port pass-through Gigabit Ethernet (GbE) or 10 Gigabit Ethernet (10GbE) I/O modules. Administrators have the option of replacing these modules with FN I/O Aggregator modules that add more network functionality, simplify physical cabling and reduce the complexity and cost of upstream switching.

And, finally, the PowerEdge FX2 chassis improves cost-efficiency through its shared cooling and power architecture.

PowerEdge FC830 server: Dense, scale up server
Providing dense compute and memory scalability and a highly expandable storage subsystem, the FC830 excels at running a wide range of applications and virtualization environments for both mid-size and large enterprises. The FC830 is a full width 4-socket server module that has either eight 2.5 inch drives or sixteen 1.8 inch drives and can access up to 8 PCIe expansion slots.

The FC830 can provide flexible virtualization with great VM density and highly scalable resources for the consolidation of large or performance-hungry virtual machines, and can incorporate the use of SAN, DAS or virtual storage environments.
An FX2 chassis with an FC830 server (with sixteen 1.8 inch drives) and two FD332 storage blocks

It’s also an excellent solution for very demanding, mission critical workloads, like database driven, centralized business applications, for example, customer relationship management (CRM) and enterprise resource planning (ERP), as well as the database tier of WebTech and High Performance Computing (HPC) environments.

**PowerEdge FC630 server: High-performance workhorse**

Designed for enterprises looking for high-performance computational density, the PowerEdge FC630 is a powerful workhorse for IT infrastructures. The half-width, two-socket server delivers an exceptional amount of computing power in a very small, easily scalable form factor, with the latest 18-core Intel® Xeon® E5-2600v3 processors and up to 24 dual in-line memory modules (DIMMs). Consider that a 2U PowerEdge FX2 chassis fully loaded with four PowerEdge FC630 servers can be scaled up to 144 cores and 96 DIMMs.

An individual 1U, half-width FC630 server block (with eight 1.8 inch drives)

Note that the FC630 offers two internal storage options - an eight 1.8 inch drive configuration and a two 2.5 inch drive configuration, the latter of which supports Express Flash NVME PCIe devices. So, the FC630 can benefit from the ultra-high performance and ultra-low latency of those devices and also participate as a cache provider in Fluid Cache for San infrastructures.
And the PowerEdge FC630, like the FC830 takes advantage of other PowerEdge innovations like Select Network Adapters, Switch Independent Partitioning, fail-safe hypervisors and OpenManage agent-free systems management.

**PowerEdge FC430 server: High-density computing**
Offering outstanding shared infrastructure density, the Dell PowerEdge FC430 is an excellent choice for data centers where a large number of computational nodes, or virtual machines, are needed to run mid-tier applications. The quarter-width, two-socket PowerEdge FC430 is designed with the right balance of performance, memory and I/O to deliver the necessary resources to many client applications in a highly efficient fashion.

*An FX2 chassis with 8 FC430 server blocks (each with two 1.8 inch drives)*

Powered by the Intel Xeon processor E5-2600v3 (up to 14-core) and supporting up to eight DIMMs, the PowerEdge FC430 provides a tremendous amount of processing resources in an ultra-small space. By fully loading the PowerEdge FX2 with eight PowerEdge FC430 servers, administrators can scale up to 224 cores and 48 DIMMs of memory.

Moreover, for caching and storage, each PowerEdge FC430 has one of 2 configurations; either two internal 1.8-inch SATA SSDs and access to a PCIe Gen 3 expansion slot in the PowerEdge FX2s (switch) chassis, or one 1.8 inch SSD drive with an additional front-access Infiniband mezz card connection. This second configuration is particularly attractive to HPC customers who value the lower latency and higher throughput that Infiniband provides. The FC430 supports networking with either a 1Gb or 10Gb LOM.
The small, modular form factor of the PowerEdge FC430 enables data centers to host a large number of virtual machines and applications on physically discrete servers, minimizing the impact of potential failures on overall operations. This capability makes the PowerEdge FC430 an outstanding choice for distributed environments that require physical separation for security, regulatory compliance or heightened levels of reliability.

**PowerEdge FM120x4 microserver: Cost-effective scalability**
The PowerEdge FM120x4 is designed for workloads that prioritize scale-out density and power efficiency over performance. Merging four single-socket microservers on a single, half-width sled, the PowerEdge FM120x4 provides impressive density, which is enabled by the innovative system-on-chip (SOC) design of the Intel® Atom™ processor C2000. A fully loaded PowerEdge FX2 chassis can host 16 individual microservers, each with two DIMMs and either one 2.5-inch front-access hard drive or two 1.8 inch SSD drives. By using the maximum number of eight-core processors, administrators can add 160 cores and 48 DIMMs to an infrastructure with each 2U system.

*An FX2 chassis with 4 FM120x4 server blocks (each with four 2.5 inch drives)*

The entry-level PowerEdge FM120x4 is especially well suited to scale-out web services. For example, the Intel Atom processor is designed to consume very little energy while it adds processing density, so it saves on operating costs as it scales. Moreover, the processor’s SOC design minimizes footprint for added space savings.

**PowerEdge FD332 storage block: dense and flexible DAS storage**
The PowerEdge FD332 is a densely packed storage module that allows FX–based infrastructures to rapidly and flexibly scale storage resources. Designed as a half-width, 1U storage block that holds up to sixteen 2.5” hot plug SAS or SATA disk drives (SSD or HDD), the FD332 can, for example, provide up to 48 drives in a single 2U FX2 – leaving one half-width chassis slot to house an FC630 for processing. This flexibility results in 2U rack servers with massive direct attach capacity, and enables a pay-as-you-grow IT model. (Note: the FM120 microservers are not supported to work with the FD332.)
FX servers can be attached to a single FD332, or multiple FD332s, and can either attach to all 16 devices in the storage block or split access to the block and attach to 8 devices separately. So you can combine FX servers and storage in a wide variety of configurations to address specific processing needs – and FD332 storage blocks are independently serviceable while the FX2 chassis is still in operation.

This innovative approach to IT infrastructure is great for consolidation of performance hungry environments that require high performance, low cost scale-out storage (like Hadoop, and can be an excellent option for dense vSAN environments, using SSD caching drives in the server block(s) and low cost, high capacity HDDs in the FD332 storage.

**FN-IO Aggregator modules: microserver: Cost-effective scalability**
The FN IO Aggregators provide simplified cabling for the FX2, aggregating cabling by as much as 8:1. The IO Aggregators are also designed to optimize “east/west” server to server traffic communication within the FX2, greatly increasing overall performance by enabling faster VM migration and significantly lowering overall latency.

In addition, automated networking functions with plug-and-play simplicity are included that allow fast, easy network deployment using a simple graphical user interface (GUI) through Dell’s Chassis Management Controller (CMC), or custom network management with a command line interface (CLI). The IO aggregators are also able to provide Virtual Link Trunking (VLT) as well as uplink link aggregation (LAG).
The FN IO Aggregator enables converged IO capabilities with full DCB, FCoE, and iSCSI optimization. By converging the IO through the IO Aggregators, it is possible to eliminate redundant SAN and LAN infrastructures within the data center. The result is that cabling can be reduced up to 75 percent, while connecting server nodes to upstream switches like the Dell Networking S5000 10/40GbE Unified Storage Switch, for full fabric Fibre Channel breakout. With the FN IO aggregators using converged IO, IO adapters can also be reduced by 50%.

There are three options for FX IO aggregators:

- FN410s: 4-port SFP+ IO aggregator
- FN410t: 4-port 10GBASE-T IO aggregator
- FN2210s: 4-port combination Fibre Channel/Ethernet IO aggregator

**PowerEdge FN410s: 4-port SFP+ IO aggregator**

Providing all the benefits of the FN IO aggregator including up to 8:1 cable aggregation, east/west performance optimization, and converged IO, the PowerEdge FN410s uniquely provides 4 ports of SFP+ 1/10GbE connectivity.

With SFP+ connectivity, the IO aggregator supports optical and DAC cable media. Along with each of the IO aggregators, 8x10GbE internal ports are included. It also provides full DCB, FCoE, and iSCSI optimization enabling converged data and storage traffic. All networking features including converged IO are plug-and-play giving the server admin access layer ownership.

**PowerEdge FN410t: 4-port 10GBASE-T IO aggregator**
Also providing the benefits of the FN IO aggregator including up to 8:1 cable aggregation, east/west performance optimization, and converged IO, the PowerEdge FN410t provides 4x1/10bE 10GBase-T connectivity.

The 10GBase-T connectivity supports cost effective copper media with maximum transmission distance up to 100 meters. It also provides 8x10GbE internal ports with full DCB, FCoE, and iSCSI optimization for converged IO data and storage traffic.

**PowerEdge FN2210s: 4-port combination Fibre Channel/Ethernet IO aggregator**

Offering unique flexibility for convergence within the FX2, the FN2210s delivers up to 2 ports of 2/4/8Gbps Fibre Channel bandwidth through NPIV proxy gateway mode (NPG), along with 2 ports of SFP+ 10GbE. It also can provide 4 ports of SFP+10GbE with a reboot.

Through NPG mode technology, the FN2210s provides the capability to use converged FCoE inside the FX2 chassis while maintaining traditional unconverged Ethernet and native Fibre Channel outside of the FX2. To the converged network adapters (CNAs), the FN2210s appears as a Fibre Channel forwarder (FCF) while the Fibre Channel ports appear as NPIV N_ports or host bus adapters (HBAs) to the external Fibre Channel Fabric. This allows for connectivity upstream to the S5000 storage switch or many widely deployed Fibre Channel switches providing full fabric services to the SAN array. The FN2210s itself does not provide full Fibre Channel fabric services.

**Conclusion: FX is foundation for a future-ready agile infrastructure**

By creating PowerEdge FX as a flexible converged architecture that can grow and advance with the latest technologies, Dell enables enterprises to deploy IT infrastructure that easily adapts to the ever-shifting business and technology landscape. The foundations that IT decision makers invest in today are designed to support the changes that they implement tomorrow, giving enterprises the agility to remain competitive in a fast-moving marketplace.