

ciena. : the network specialist

Redefining the Service-Enabled Optical Network

The 4200 Family optimizes WDM transport with integrated switching and services management while addressing performance and cost requirements for telecom infrastructure and enterprise services.



The 4200 Family

Whether interconnecting routers, data centers, or delivering high-end enterprise connectivity, a flexible multiservice metro optical network addresses the myriad services end-users are demanding. In addition, these services must have full transparency and granular service level management that ensure customers get the performance they need—and the ability to satisfy the mission-critical requirements of the end-user applications.

The 4200 Advanced Services Platform changes the paradigm from building more networks, to building more efficient networks with the flexibility to support any optical service—such as SONET/SDH, Ethernet, video, and storage—on any port, with the flexibility to switch it anywhere on the network on demand.

With its unique FlexiPort technology and advanced multiplexing capabilities, the 4200 provides IT departments with unique ways to:

- Reduce high network costs
- Consolidate and simplify operational complexity
- Establish and meet realistic Service Level Agreements (SLAs)
- Meet or exceed performance expectations
- Increase management visibility
- Quickly adjust to new requirements and reduce time to market
- Provide resiliency with no single failure points

Key Benefits of 4200 Platforms

- Offers a common technology platform in multiple form factors to meet requirements of all network locations from the smallest business site to the largest data center
- Provides most efficient utilization of network assets by leveraging ITU G.709 OTN technology and allowing grooming and aggregation of multiple service types on a single wavelength
- Includes support for all client interface cards in every chassis form factor to lower sparing costs and ensure seamless operation
- Allows all chassis types to operate in a network—linear, ring, or mesh—simultaneously
- Supports optional integrated CWDM and DWDM filters
- Combines optical and electrical ROADM functionality in a single node, extending ROADM benefits to sub-wavelength services without substantial cost penalty
- Provides a future-proof investment with its ability to scale to 40G and 100G transmission speeds



Overview

Ciena's 4200 is a multiservice aggregation and transport solution that can converge virtually any service—from 10 Mb/s Ethernet to 10G Ethernet, SONET/SDH, storage and video—to meet all business application transport requirements over a single network with carrier-grade reliability.

Key benefits of the 4200 include unprecedented service flexibility with software-programmable FlexiPort line modules that deliver any service at any rate on any port; extensive grooming capabilities for optimal utilization of bandwidth resources; the ability to scale to 100G speeds; carrier-grade reliability; and ease of management. Deploying the 4200 enables IT organizations to achieve an immediate return on investment with more efficient data transport and a future-proof architecture able to support new networking requirements as they unfold.

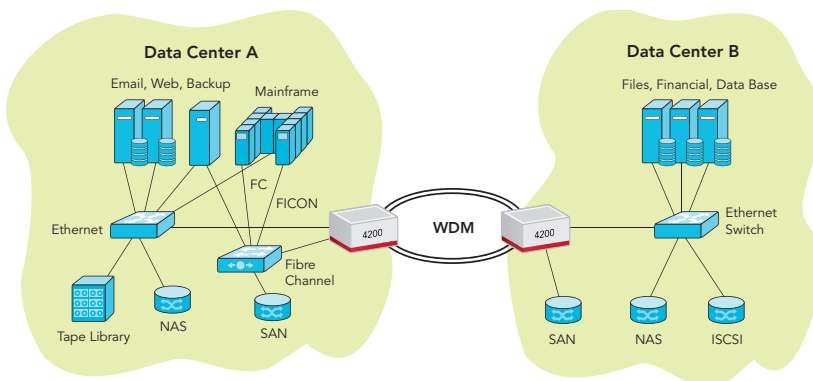


Figure 1. Enterprise networking with unprecedented flexibility, efficiency, and simplicity

The 4200 provides a service-enabled transport layer that allows network operators to manage and provision individual services with packet-like ease and flexibility, without sacrificing the carrier-class performance, management features, and reliability of SONET/SDH. To optimize transport cost and efficiency in all areas of the network, Ciena offers a family of 4200 products—4200 MC 2-slot, 4200 5-slot, and 4200 RS 17-slot—for complete deployment flexibility from the smallest business site, where space and power are critical, all the way to the largest data center, where the need for high capacity and scalability becomes essential. As a true product family, a common set of modules can be used in any chassis, reducing sparing costs as well as ensuring seamless interworking between nodes.

Key Features Common to All 4200 Platforms

- Provides multiservice transport supporting C/DWDM
- Manages aggregation, grooming, and transport of various multi-rate client services into OTU-1, OTU-2, and OTU-3 transport signals and supports future protocols with existing hardware
- Employs FlexiPort technology for flexible assignment of ports as client or network ports
- Provides extensive performance monitoring on all client and network services
- Offers optional Gateway Network Element (GNE) feature for remote management of subtended network elements
- Provides SONET/SDH-like protection switching, with 1+1 protection for 99.999% service availability
- Features service-level loopbacks for fault isolation
- Provides front chassis accessibility for all connections and servicing
- Managed by ON-Center Network and Services Management Suite
- Supports standard management protocols for easy integration into customers' NOC: SNMPv1 (RFCs 1155-1157), SNMPv2c, SNMPv3, CLI, TL1, Telnet, HTTP, FTP
- Supports standard SDH/SONET OTN (GCCO) management planes with embedded signaling and control channel

Ciena's FlexiPort is the industry's first remotely programmable transport technology, providing on-demand service delivery through a few simple mouse-clicks. Operators will realize faster provisioning and turn-up of new services across the network, as well as simpler moves and changes for existing services, including bandwidth and service upgrades.

While client service identities such as OC-3/STM-1 or GbE are software-defined to allow a wide mix of traffic types on the same card, all processing is done in hardware to assure performance. This unprecedented flexibility not only eases service deployments, but also drastically lowers sparing requirements by 66 percent over conventional multiservice transport equipment. In addition, FlexiPort technology offers investment protection as service requirements shift from TDM to IP/Ethernet, or new protocols and standards emerge. Ports originally configured as OC-n/STM-n or ESCON® can be simply reprogrammed for GbE or Fibre Channel as new applications are introduced into the network.

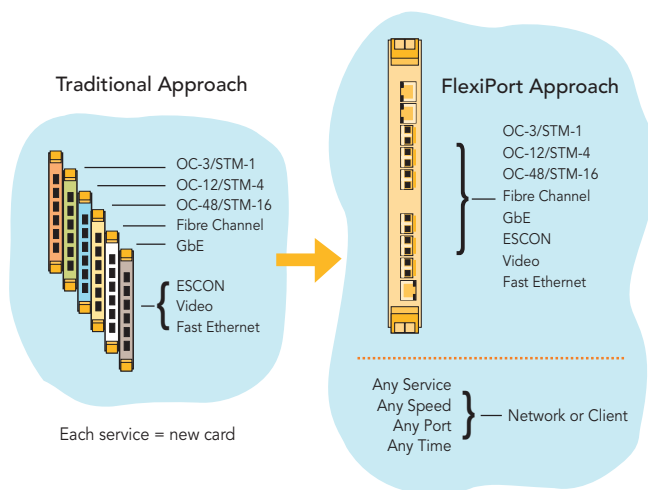


Figure 2. FlexiPort accelerates service delivery, mitigates risk, and reduces network cost

All 4200 platforms use the ITU-T G.709 Optical Transport Network (OTN) protocol as the primary transport medium for conveying traffic across the network. OTN is a scalable, standards-defined transport mechanism that insulates the network against a changing service mix. OTN provides a mapping or encapsulation function that creates variable-sized, protocol-agnostic traffic

containers, so it can accept any traffic—such as legacy, Ethernet (including 100GbE), storage, and video—and puts it into a standards-defined container for transport, allowing for simpler service deployment and network management as well as multi-vendor interoperability.

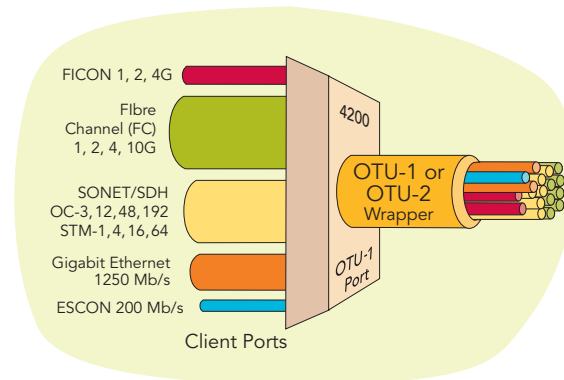


Figure 3. Enterprise OTN: Data, voice, and video on one platform, and one wavelength

The 4200 is the only transport platform on the market that offers innovative timeslot technology or sub-wavelength grooming, based on ITU G.709 OTN. Ensuring optimal utilization of network resources, the 4200 allows network operators to transport the most services over the least number of wavelengths with the ability to aggregate up to 20 different service types into a single OTU-2, or 16 services into a single OTU-1 wavelength. Each individual service is carried with full transparency and management and can be delivered at any location on the network for optimal wavelength utilization.

Using the information in the OTN header, the 4200 offers a robust performance monitoring and alarming scheme that extends carrier-grade fault localization capabilities to all delivered services, allowing operators to assure service quality and delivery. This capability facilitates the following SONET/SDH-like features:

- Quality-of-Service (QoS) statistics
- Fault isolation to the section, line, and path levels, depending on the service
- Automatic protection switching (faster than SONET/SDH)
- Forward and remote defect propagation for downstream alarm suppression, analogous to SONET/SDH alarm indication signal

The 4200 collects service-related performance monitoring data that quantifies the transmission performance of a service such as bit errors, as well as optical-layer performance monitoring that measures the health of the optical signal—such as optical power—and transceivers. The platform also supports protocol-specific performance monitoring, like Remote Monitoring (RMON) for Ethernet connections, providing additional service delivery and troubleshooting capabilities. This robust monitoring and management scheme enables operators to offer unambiguous QoS assurances to data customers through detailed and enforceable SLAs.

The 4200 platforms are true carrier-class network elements that deliver reliable transport of critical business traffic. They provide service protection through built-in and add-on hardware redundancy. Optional redundancy of interfaces and common elements guarantees availability with industry-leading protection switch times.

Greatly simplifying the network and its operation, the 4200 eliminates the need for multi-box transport by integrating Coarse and Dense WDM (C/DWDM), service aggregation, automatic power balancing, cross-connect, add/drop multiplexing, and transponder functions. Furthermore, the 4200 RS chassis can function as a state-of-the-art, multi-degree Reconfigurable Optical Add/Drop Multiplexer (ROADM) that enables on-demand routing of any service, anywhere on the network using a dynamic wavelength routing module based on Wavelength Selectable Switch (WSS) technology. Finally, with its integrated coherent 40G optics and the ability to scale to 100G using the FlexSelect Optical Shelf, the 4200 offers a future-proof network investment that is able to handle capacity requirements for years to come.

4200: Differentiating Benefits for a Variety of Applications

The 4200 is an ideal solution for any vertical market that requires high-capacity, fiber-based connectivity of two or more data centers or sites; or for ones that have access to dark fiber or own fiber assets.

The 4200 is ideal for enterprises looking to have a future-proof network design to integrate customers' legacy networks to new data-centric applications. In addition, the 4200 is designed for customers needing

carrier-class, cost-effective, optimized, secure service transport. This platform also suits customers who are looking for absolute control and security of optical transport services.

Data Center Connectivity and Cloud Networking

Ciena's 4200 provides high-performance data center connectivity for latency-sensitive applications requiring greater than 2.5G of bandwidth. These services often consist of a variety of interfaces supporting multiple customer applications such as synchronous disk replication and EMC Geographically Dispersed Disaster Restart (GDDR) applications, SAN and LAN transport, and video transport.

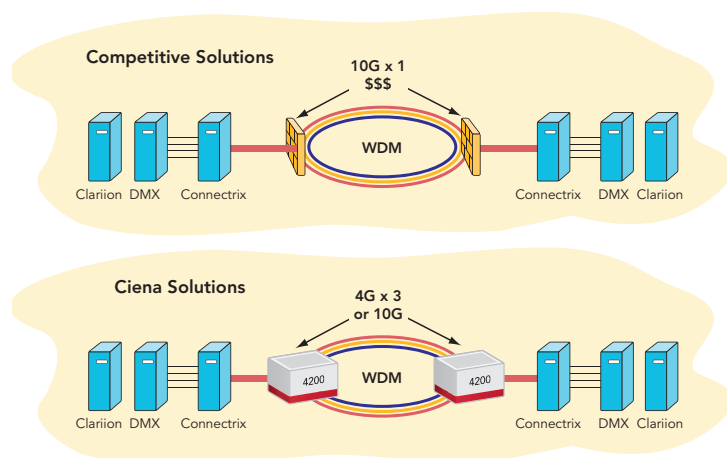


Figure 4. High-performance data center networking

The 4200 supports an Enterprise Services Optimization Module (ESOM) equipped with Fibre Channel, FICON®, or GbE FlexiPorts, and provides efficient, flexible and application-intelligent wide area networking services for enterprise applications like data replication and Ethernet transport. ESOM supports both data compression and Dynamic Bandwidth Assignment (DBA) to provide port-level QoS to 20 client connections. ESOM provides enterprise data center edge functionality supporting the storage vendor's data replication and tape systems in addition to GbE traffic for LANs, iSCSI or server-based storage applications. Enterprise data centers can be supported with Carrier Ethernet services, SONET/SDH or Layer 3 IP networks. Each network type ensures guaranteed data delivery and lossless, deterministic performance required for mission-critical storage applications. This approach creates a scalable, flexible,

cost-effective data center network that can easily scale to new IT requirements as applications drive more storage, and business continuity pressures demand tier one replication support.

With respect to cloud networking, 4200 with ESOM can be deployed as an edge or metro platform supporting transport of high-speed Fibre Channel storage protocols and interfaces in addition to Ethernet used for Virtual Machine (VM) migrations. ESOM's DBA feature is the key ingredient used for re-allocating the pre-provisioned bandwidth. DBA enables assigning a percentage of the bandwidth for every client to guarantee a QoS level for the application on that port, while also enabling those assignments to be dynamically re-allocated as needed, or as driven by higher-level policy managers. 4200 with ESOM can be used to easily adjust network bandwidth to improve the performance of demanding cloud-based VM migrations.

Low-Latency Networking

Ciena has developed industry-leading networking capabilities on the 4200 to address low-latency, high-capacity networking requirements over fiber. Ciena's 2RS and Quad 10T modules on the 4200 offer the fastest, lowest-latency GbE and 10GE interconnections in the industry. These modules simply reshape and retransmit the data signal, adding virtually no latency. The latency tested for each of these modules is less than 0.060 μ s (60 nanoseconds), a 25 times reduction over typical interfaces. Low latency has also been designed into the photonic components; Ciena's 4200 supports Fiber Bragg Grating (FBG) dispersion compensation modules as well as reduced latency amplifiers to further reduce transport latency in the network.

Benefits for Financial Institutions

The 4200 provides low-latency, high-bandwidth optical transport with highly reliable deterministic connectivity. Available line rates of 10G, 40G, and 100G ensures the network can meet both immediate and future needs. The 4200 can replace local inefficient network solutions, providing better and simpler operations, and better aggregation to consolidate traffic on higher bandwidth pipes with optimized wavelength utilization. The 4200 network is versatile and agile and can grow with changing needs. Network flexibility is provided by the 4200's

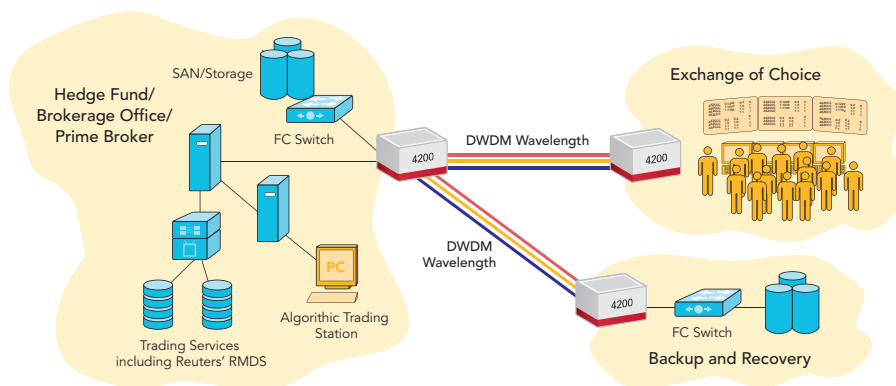


Figure 5. Low-latency networking, financial trading exchange application

ROADM, which allows for easy topology reconfiguration and growth, as well as by its programmable ports capability for simple remote provisioning and re-provisioning.

Benefits for Media and Entertainment

The 4200 addresses the needs of the media and entertainment market by offering a flexible optical network platform with superior video protocol support and performance monitoring for connection assurance. Different chassis options offer cost-optimized solutions for both mobile production units as well as production studios. The 4200 supports a variety of video formats including DVB, SD-SDI, and HD-SDI, and its flexible architecture allows users to add HD feeds as needed. The 4200's advanced service aggregation capabilities enable cost-effective and maximum use of bandwidth and equipment, and programmable ports simplify service turn-up and network management.

Benefits for Government Agencies

The flexibility of the 4200 makes it an excellent fit for government agencies building a modernized network that can foster agency collaboration, enable rapid adaptation to a changing mission, improve budgetary efficiency, and deliver public benefit. The 4200's integrated Ethernet and OTN offer the ability to consolidate application-specific networks and build an assured, adaptive network that is an essential asset to completing the agency's mission.

The 4200's highly flexible, efficient, and reliable advanced services platform offers a key advantage for government agencies. It supports both legacy and Ethernet services with options for ROADM for flexible future reconfigurations. Its software programmable ports further add to the flexibility and cost efficiency of the network.

Finally, the 4200 provides a future-proof investment with its ability to scale to 40G and 100G.

Unified Network and Service Management

Ciena's ON-Center® Network and Services Management Suite is the network management system for the 4200. ON-Center provides network operators a unique set of tools for efficient service deployment and proactive network management. It employs a distributed, scalable architecture capable of managing a wide range of network technologies and service types as a standalone solution or as part of an operator's existing infrastructure. ON-Center's modular architecture, a common Graphical User Interface (GUI) and unified management model, allow personnel to monitor and manage new Ciena technologies and services while leveraging current back-office Network Operations Center (NOC) systems. ON-Center offers scheduled and on-demand

performance reports that monitor critical 4200 network attributes such as network utilization, service availability, latency and network throughput, aiding in proactive management and capacity planning of the deployed services. ON-Center's Service Layer Management (SLM) allows service providers to generate meaningful SLA reports that support the creation of services beyond basic connectivity, and to offer a secure Web portal for customer network management. New value-added performance metrics with service-level manageability gives deployed 4200 packet-based services the same control and performance as circuit-based services. Through the Universal OSS Gateway (UOG), ON-Center can integrate seamlessly into a network operator's management infrastructure, leveraging already deployed critical network functions such as billing, inventory reports and consolidated event reporting for the management of a 4200 network.

4200 MC Features

- The 4200 MC 2-slot Advanced Services Platform is designed for locations with limited service density for access service aggregation, cross-connect, and add/drop multiplexing. The 4200 MC also provides the ideal solution for sites with highly-focused requirements such as access nodes, In-Line Amplifiers (ILAs), and repeater nodes.
- Two fully interconnected card slots to support switching and grooming
 - Up to 12 service-agnostic ports per two-slot shelf to support sub-wavelength interface ports up to 2.7 Gb/s, two 10G client interface ports, or a combination of both
 - Highly cost-effective solution for sites with limited service requirements
 - AC and DC power options to operate in both central offices and on customer premises, giving operators a managed demarcation at the end-customer site
 - Front or rear power compatible
 - EIA, NEBS, 300 mm ETSI and 600 mm ETSI rack compatible



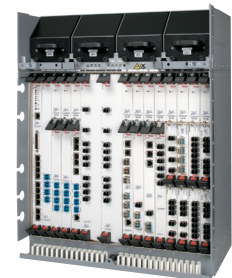
4200 Features

- The 4200 5-slot Advanced Services Platform is suitable for any location that requires moderate service density for access service aggregation, cross-connect, and add/drop multiplexing.
- Four fully interconnected card slots to support switching and grooming
 - One card slot for optical filters and amplifiers
 - Up to 24 service-agnostic ports per shelf to support sub-wavelength client interface ports, up to 2.7 Gb/s each; four 10G client interface ports; or a combination of both
 - AC and DC power options to operate in both central offices and on customer premises, giving operators a managed demarcation at the end-customer site
 - Front or rear power compatible
 - EIA, NEBS, 300 mm ETSI, and 600 mm ETSI rack compatible



4200 RS Features

- The 4200 RS 17-slot Advanced Services Platform is designed for high-density sites that require large access service aggregation, cross-connect, add/drop multiplexing, automatic power balancing, and/or multi-degree ROADM functionality. The 4200 RS is designed to operate in the central office (-48V DC) with increased capacity equivalent to four 4200 chassis. The 4200 RS also includes a separate Node Controller card that can control any combination of up to a total of 32 additional 4200 RS chassis as a single consolidated node for ultra-high scalability of client interface ports.
- 16 service card slots, per chassis
 - Up to 96 sub-wavelength client interfaces up to 2.7 Gb/s, 64 x 10G interfaces, or a combination of both, per chassis
 - Node Controller can support up to 32 additional subtending 4200 RS platform shelves, including itself for a total of 33 shelves supported by a single Node Controller
 - Four slots on the far right can be divided into two half-width slots to support a total of eight half-width modules
 - Modules are shared between 4200 RS, 4200 and 4200 MC chassis
 - EIA, NEBS, 300 mm ETSI and 600 mm ETSI rack compatible



| Technical Specifications | 4200 MC | 4200 | 4200 RS |
|--|---|---|---|
| System Level I/O Connectivity at Client Interface Backplane Capacity | 30 Gb/s 60 Gb/s | 60 Gb/s 120 Gb/s | 240 Gb/s 480 Gb/s (120 Gb/s per quadrant) |
| Agency Approvals ETSI/CE NEBS Level 3 Safety | ETS 300 019/IEC 68, EN 300 386/EN 55022, EN 61000, ETS 300 753, EN 60950 GR-63, GR-1089 UL 60950, CSA C22.2 60950, FCC Part 15, Class A | ETS 300 019/IEC 68, EN 300 386/EN 55022, EN 61000, ETS 300 753, EN 60950 GR-63, GR-1089 UL 60950, CSA C22.2 60950, FCC Part 15, Class A | ETS 300 019/IEC 68, EN 300 386/EN 55022, EN 61000, ETS 300 753, EN 60950 GR-63, GR-1089 UL 60950, CSA C22.2 60950, FCC Part 15, Class A |
| Power Requirements DC Power AC Power | -40V DC to -60V DC 100V AC to 240V AC | -40V DC to -60V DC 100V AC to 240V AC | -40V DC to -60V DC |
| Environmental Characteristics Ambient Temperature Relative Humidity Altitude HVAC | +5° C to +50° C; -5° C to +55° C short term 5% to 85% (non-condensing) 13,000 ft; 4000 m Cooling available for 2049 BTU/hr maximum | +5° C to +50° C; -5° C to +55° C short term 5% to 85% (non-condensing) 13,000 ft; 4000 m Cooling available for 2049 BTU/hr maximum | +5° C to +50° C; -5° C to +55° C short term 5% to 85% (non-condensing) 13,000 ft; 4000 m Cooling available for 6192 BTU/hr maximum |

| Physical Characteristics | 4200 MC | 4200 | 4200 RS |
|---------------------------------|------------------------------------|------------------------------------|---------------------------------------|
| | Side Exhaust Configuration | Side Exhaust Configuration | Top Rear Exhaust Configuration |
| Height | 3.9 in (99 mm) | 7.0 in (178 mm) | 22.75 in (578 mm) |
| Width | 17.5 in (445 mm) | 17.5 in (445 mm) | 17.6 in (448 mm) |
| Depth | 11.8 in (300 mm) | 11.8 in (300 mm) | 11.0 in (279 mm) |
| Weight | 14 lbs; 6 kg (max.) | 26 lbs; 12 kg (max.) | 98 lbs; 44.5 kg (max.) |
| | Front Exhaust Configuration | Front Exhaust Configuration | |
| Height | 3.9 in (99 mm) | 7.0 in (178 mm) | |
| Width | 19.5 in (495 mm) | 19.5 in (495 mm) | |
| Depth | 11.8 in (300 mm) | 11.8 in (300 mm) | |
| Weight | 14 lbs; 6 kg (max.) | 26 lbs; 12 kg (max.) | |
| | Rear Exhaust Configuration | Rear Exhaust Configuration | |
| Height | 3.9 in (99 mm) | 7.0 in (178 mm) | |
| Width | 19.5 in (495 mm) | 19.5 in (495 mm) | |
| Depth | 12.0 in (305 mm) | 12.0 in (305 mm) | |
| Weight | 14 lbs; 6 kg (max.) | 26 lbs; 12 kg (max.) | |

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Networks that change
the way you compete.

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