

BRING. IT. ON.



**OnTime networks**

RUGGED ETHERNET AND TIMING SOLUTIONS



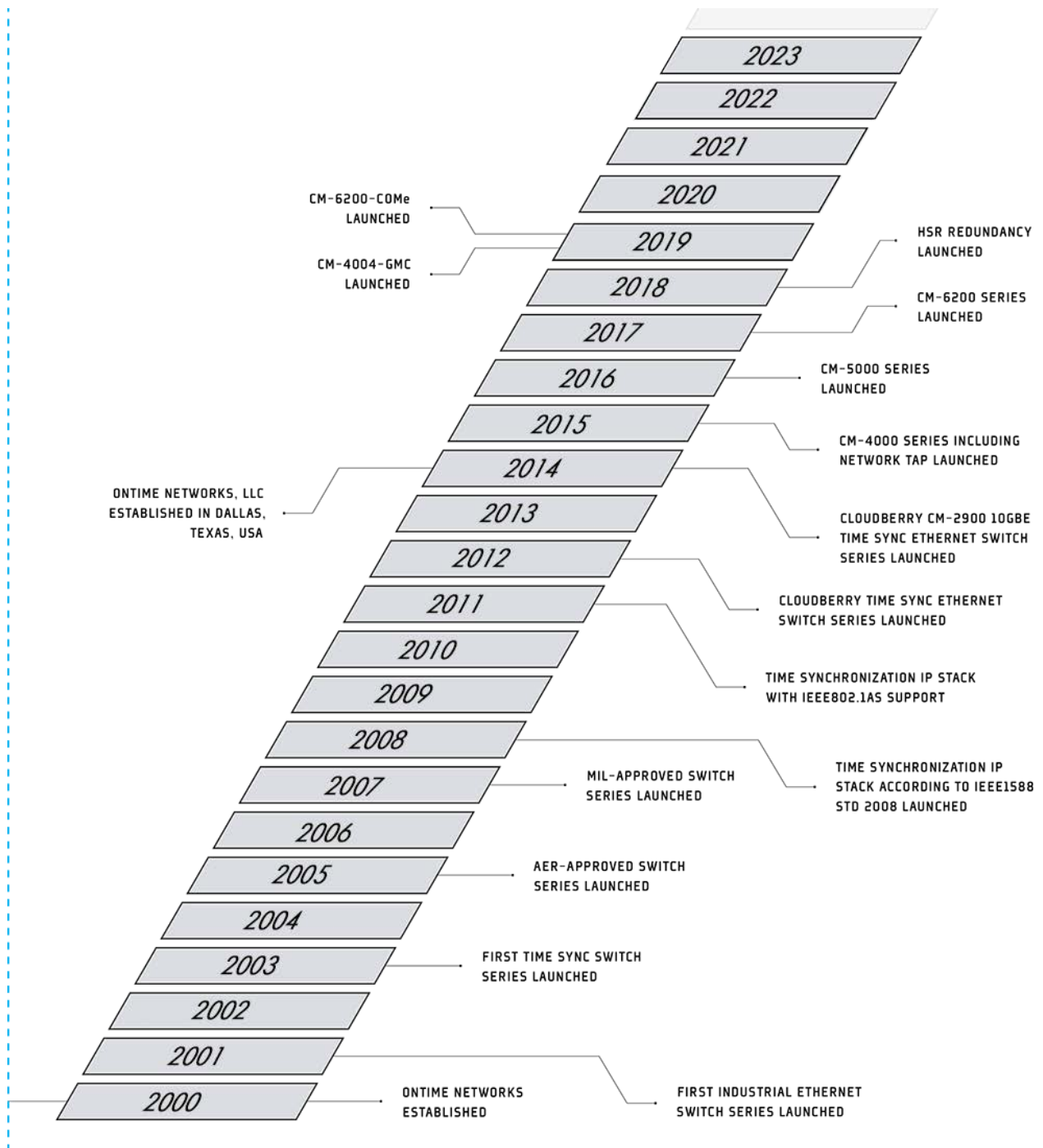
OnTime Networks was founded in 2000 and is recognized as an innovator in rugged ethernet solutions for real-time applications within the aerospace and defense industries. As a pioneer in timing solutions, data communication products and engineering services, we are a proven resource for small and major clients in the U.S. and around the world. Our mission is to deliver rugged data communication products for applications with demanding environmental requirements, including airborne, military, railway and subsea applications.

OnTime's equipment is used by renowned companies, such as Boeing, L3 Harris Technologies, Northrop Grumman, General Atomics, U.S. Army, U.S. Navy, U.S. Air Force, Zodiac, Airbus Helicopter, EMGS, Schlumberger, WesternGeco, Diehl Defence GmbH, HENSOLDT Sensors GmbH, Thales, Lockheed Martin, Airbus Defence and Space, to name a few.

OnTime Networks is one of the founding fathers of the IEEE 1588 standard for Precision Time Protocol (PTP) and is also recognized as one of the inventors for the IEEE1588 Transparent Clock (TC) technology, which is a core part of the IEEE1588-2008 (PTPv2) standard.

**OnTime**  
networks

## TIMELINE



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In today's aerospace and defense industries, mobile datacom platforms demand both impeccable synchronization and rugged reliability. As pioneers and makers of advanced timing technologies, OnTime Networks delivers proven solutions designed to endure the harsh climates and conditions of airborne, ground, and naval defense applications.

Our innovative products incorporate time synchronization support, network clocks and IPs for distribution of precise time over ethernet, enabling fast and flexible communication among dozens of network devices. With Precision Time Protocol

IEEE 1588 as our core technology, OnTime Networks provides clock accuracy in the sub-microsecond range. This makes our solutions especially well-suited for communication, measurement, and control systems.

OnTime Networks is proud to provide leading-edge technologies for such well-known clients, such as Airbus,

Boeing, Schlumberger, L3 Harris Technologies, Northrop Grumman, Embraer, WesternGeco, and Zodiac Aerospace, to name a few. In addition to our rugged, high-performance products, we offer comprehensive network and software engineering services to help our clients solve unique challenges.

### CAPABILITIES

Customers rely on OnTime Networks to provide expertise in a wide range of electronic, mechanical and software engineering applications with a particular focus on network switching, routing, "tapping" and timing technology. From feasibility studies and due diligence to component design and turnkey implementation, OnTime Networks follows rigorous development and testing procedures to support even the most demanding timelines and quality control standards.







#### DEVELOPMENT CYCLE CAPABILITIES

- › Design reviews and architecture studies
- › System architecture and design
- › Electronic circuit design and analysis
- › Real-time software design
- › Control system modeling and design
- › Printed circuit board design
- › Product qualification testing and validation
- › Troubleshooting and reliability analysis
- › Mechanical packaging design

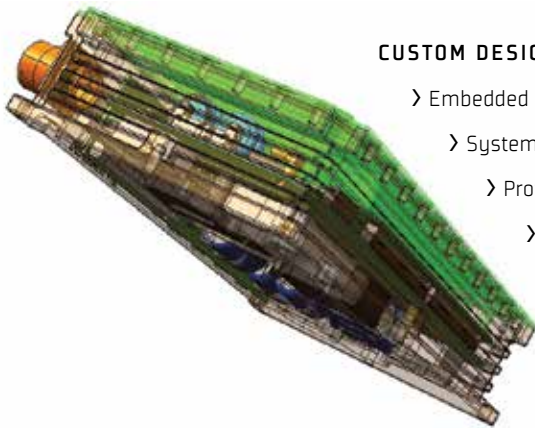
#### ENGINEERING FOR KEY CONSTRAINTS AND METRICS

- › Low power
- › Low noise
- › SWaP-C optimized
- › High speed up to 10 Gbps
- › Highly integrated, smallest size
- › High reliability
- › Long service life
- › Time synchronization accuracy in sub- $\mu$ s range
- › Guaranteed worst-case network latency for latency-sensitive data in sub-ms range

OnTime Networks is a **one-stop solution** provider of finished or embedded Ethernet switching, routing and deterministic networking solutions. Our electrical and mechanical engineers combine technical expertise with creative thinking to take your ideas from concept to market.

We specialize in rapid hardware and software development for a broad and diverse range of network products and applications, and we take great care to deliver a robust design that meets end-user requirements as well as cost objectives. Our internal processes provide added assurances that OnTime Networks will get it right the first time, keeping things on schedule and on budget by avoiding costly redesigns.

## DESIGNED FOR COMPLEXITY, MODULARITY, AND FUTURE GROWTH



### CUSTOM DESIGN

- › Embedded hardware and software design and development
- › System-level architecture and system concept development
- › Prototype production
- › Design verification and validation
- › Hardware production
- › System integration on the platform and with other systems
- › Post-production support
- › Manufacturing

### ELECTRICAL ENGINEERING

- › Single-board switches and routers (10/100/1000/10000 Ethernet)
- › I/O interfaces (digital I/O, analog I/O, analog-to-digital designs)
- › Power systems (AC/DC power supplies, low voltage (28V))
- › Diverse application software products
- › Field-programmable gate arrays
- › Embedded Linux, eCos and other operating systems
- › Design optimized for best EMC/EMI and climatic properties

## SYSTEM DESIGN

Beyond advanced technology and innovative engineering, the ultimate test is a product's ability to survive in the real world, not only in challenging environments, but also within your business landscape. That's why our experts are here to guide your program through these and other issues:

- › Business-related requirements, including, cost, schedule and manufacturability
- › Hardware specifications (electrical, mechanical, environmental requirements)
- › Software documentation controls, responses and system operation
- › Interactions with other engineering components and disciplines
- › Subjective issues in the form of the user interface and human factors

## ELECTRONIC CIRCUIT DESIGN & ANALYSIS

Our deep circuit design experience allows us to implement the necessary circuitry to meet customer requirements while avoiding problems induced by EMI, extreme temperature, pressure excursions, and high-shock or vibration impetus, to name a few. Our scalable design solutions have included high-speed multiprocessor systems, microcontrollers, power and analog circuits, and our extensive experience in diverse markets puts our in-depth understanding of Ethernet switching, routing and timing solutions at your command.

## ELECTRONIC MANUFACTURING

When it comes to the manufacture and assembly of your electronic product, OnTime Networks oversees quality at every step. We provide detailed product acceptance test documentation, reports and failure analysis, and we have the ability to perform 100 percent functional testing, at load, of every deliverable unit. In support of these activities, we routinely develop various levels of simulators and automatic test equipment to produce repeatable, static or dynamic test conditions to validate your product or system.

## ENGINEERING

In order to support applications with strict service demands, OnTime Networks places particular importance on quality of service (QoS), traffic shaping and network redundancy. Our network engineers can help you enhance network utilization and productivity, reduce architecture complexity, increase throughput and agility, and adapt and optimize network systems to meet changing demands.

- › Layout and design of logical and physical network architectures
- › Network optimization based on QoS and traffic shaping
- › Ethernet hardware selection
- › Project management
- › Network redundancy
- › Security
- › Routing
- › Firewalls
- › Network management
- › Troubleshooting of network problems
- › Copper, wireless, fiber
- › Digital/serial
- › Audio/visual



## ENVIRONMENTAL QUALIFICATION TESTING & ANALYSIS

Our engineering team has the know-how to test for compliance.

- › Developing individual test plans or coordinating entire test programs
- › Designing test equipment and software
- › MTBF and FMECA analysis
- › Coordinating, monitoring and documenting laboratory tests
- › Troubleshooting and debugging hardware and software solutions
- › Performing successful qualification tests on platforms such as manned and unmanned flight vehicles, ground vehicles, submersibles and ships, including:
  - › Environmental conditions testing for airborne equipment
  - › Electromagnetic interference and compatibility testing
  - › Customer-defined environmental testing



#### ETHERNET SWITCHING

Network switches are networking devices that are used to connect other devices together on a computer network by performing a form of packet switching. Our advanced switching technology provides multiport network-bridging capabilities for processing and forwarding data at the data link layer (layer 2), as well as static routing of packets (layer 3). Our switching expertise encompasses various types of networking technologies, including Fibre Channel and Ethernet.



#### ROUTING

Network routers are the devices that direct data traffic between computer networks, forwarding data packets from one router to another until they reach their destination node. OnTime Networks provides sophisticated routers that forward data at high speeds along network backbones. Routers are typically dedicated hardware devices, but we can also provide software-based routing solutions, including solutions based on VyOS, Cisco and Architecture Technology Corp. (ATCorp) advanced router packages.

We offer NIAP, NSA Commercial Solutions for Classified (CSfC), and Common Criteria (CC) certified products to protect classified National Security Systems (NSS) information.



#### ETHERNET TAPS

Network taps are networking devices that allow access to data flowing across a network without interfering with the data. An advanced network tap can also pass packets when the tap is not powered or a malfunction is detected on the device via an integrated by-pass function. These network taps can either be based on copper or fiber technology, and as a "filterable" network tap they can also provide advanced packet-filtering capabilities.



#### IEEE 1588 PTP AND OTHER TIMING SOLUTIONS

OnTime Networks not only helped pioneer the IEEE 1588 standard for precision time protocol, we also invented the IEEE1588 transparent clock, which is a core part of the IEEE1588-2008 (PTPv2) standard. This protocol is used on local area networks to synchronize clocks with accuracy in the sub-micro-second range, making it ideal for measurement and control systems. IEEE 1588 fills a niche not well served by either of the two dominant protocols, NTP and GPS. IEEE 1588 is designed for local systems requiring accuracies beyond those attainable using NTP. It is also designed for applications that cannot bear the cost of a GPS receiver at each node, or for which GPS signals are inaccessible.



#### TIME-SENSITIVE NETWORKING

Time-Sensitive Networking (TSN) is a set of standards developed by the Time-Sensitive Networking Task Group (IEEE 802.1).



#### AUDIO VIDEO BRIDGING

Audio Video Bridging (AVB) is a set of technical standards developed by the Institute of Electrical and Electronics Engineers (IEEE) Audio Video Bridging Task Group of the IEEE 802.1 standards committee.



#### HIGH-AVAILABILITY SEAMLESS REDUNDANCY (HSR)

HSR is similar to Parallel Redundancy Protocol (PRP) but is designed to work in a ring topology. Instead of two parallel independent networks of any topology (LAN-A and LAN-B), HSR defines a ring with traffic in opposite directions.



#### FIBER-OPTIC CONNECTIONS

Although we have developed and produced network-switching solutions using copper as well as fiber-optic connections, it's important to note that fiber connections significantly outperform copper, offering greater speeds over longer distances.



#### POWER OVER ETHERNET

OnTime Networks has developed and produced a number of network-switching solutions that deliver electrical power over Ethernet, also known as PoE. Equipment with PoE functionality allows a single cable to provide both data connectivity and electrical power to devices such as wireless access points or IP cameras. Power may be carried on the same conductors as the data, or on dedicated conductors in the same cable.



#### EMBEDDED SOFTWARE APPLICATIONS

Our software engineers develop, document and test deterministic embedded software ranging from simple equipment monitoring to sophisticated, real-time system applications.



#### RUGGED DESIGN

Sometimes a commercial off-the-shelf solution doesn't meet all the needs of a particular military or aerospace application. OnTime Networks can combine our packaging and design expertise to engineer a solution to satisfy your exact needs, meeting DO-160 or MIL-STD-883C standards. The engineering expertise and problem-solving capabilities of OnTime Networks are comprehensive and industry-tested.







The **CloudberryAERO** Series is a rugged, fully managed, Commercial-Off-The-Shelf (COTS) gigabit ethernet switch, router and GPS time server product line, providing timing solutions according to the IEEE 1588 PTP standard. The product line is optimized for **commercial and military aircraft applications, such as flight test network and military ISR mission systems**. Designed to comply with RTCA DO-160G, MIL-STD 461E, MIL-STD 704E, and MIL-STD 810G standards, the product line offers solutions which can be used inside the pressure vessel as well as for external environments up to 85,000ft. Offering 10G copper or fiber connectivity, the products provide enhanced low latency network-centric solutions for critical mission data applications.



The **CloudberryMIL** Series is a rugged, fully managed, military-grade Gigabit Ethernet switch product line, providing timing solutions according to the IEEE 1588 PTP standard. The CloudberryMIL products are optimized for military network system applications and comply with MIL-STD 461E, MIL-STD 1275E, and MIL-STD 810G standards to enhance network-centric systems onboard airborne, ground and naval defense applications. These products serve as ideal solutions for connecting IP-enabled devices. The CloudberryMIL Series is designed for today's modern platforms that demand sophisticated communication technologies and a reduction in system Size, Weight, Power and Cost (SWaP-C) to comply with operational life and budgetary constraints.



The new **OEMbedded** product line provides switches, routers and time synchronization solutions, to be embedded by equipment manufacturers, in order to help them add Ethernet capabilities to their product portfolio. OnTime Networks expertise and engineering capacity in the field of Ethernet network products enables customers to fast track their development and bring their products to realization more quickly. The products under the OEMbedded line provide a complete, ready-to-use, out-of-the-box integrated solution, enabling the immediate start of integration development.

OnTime Networks provides network-centric solutions that are specifically designed for the unique requirements of mission critical applications within the Aerospace and Defense industry. We specialize in rugged, time-synchronized Ethernet switches, routers and taps.

OnTime is a technology leader for rugged, time-synchronized (integrated IEEE 1588 PTP Grandmaster Clock (GMC)/ NTP Network Time Servers (NTS)), fully managed, modular Gigabit Ethernet switches and 10GB Ethernet switches. In addition, we also manufacture Ethernet routers, taps and timing solutions (IEEE 1588 PTP, IRIG-B, 1PPS, 10MHz, NTP, NMEA).

We provide a full range of advanced, highly engineered products from Commercial-Off-The-Shelf (COTS) systems to fully customized electronic subsystems. Our products are specifically designed to operate reliably in the harsh and climatically demanding environments of the aerospace and defense industry and can be found in Airborne, Ground and Naval Defense applications.

Our rugged systems are at the forefront of technology and provide innovative solutions that address complexity, enable modularity and provide growth, while delivering optimal performance for SWaP-C (Space/Weight/Power/Cost) constrained applications.

We have significant technical expertise in rugged, time-synchronized Ethernet switching, routing and timing solutions. We utilize Precision Time Protocol (PTP) IEEE1588 as the core technology to provide clock accuracy in the sub-microsecond range, making our products suitable for communication, measurement and control systems. For example, PTP is able to provide synchronization to sensors, measuring equipment, data acquisition units, network equipment and recorders. We support a variety of market segments, such as the aerospace, defense, energy and remote sensing markets.

Our highly reliable and rugged Gigabit Ethernet switches are designed to be RTCA DO160G, MIL-STD 461D, -704E, 810G and 1275E compliant and are hardened for thermal, shock and vibration extremes.

WE DELIVER OPTIMAL PERFORMANCE WITHIN GIVEN

## SWITCHES

## SMALL FORM FACTOR



CM-1608F0-LP-AERO (RJ45)



CM-1608FM-LP-AERO (TP)



CM-1608F0-AERO



CM-4012



CM-6212



CM-6224F4



CM-6228

## 19 IN. RACK MOUNT



CM-1608FC4 1U (RJ45)



CM-2939F2 1.5U (RJ45)



CM-2939F2 2U (MM)



CM-6953F2 1U (RJ45)



CM-6953F2 2U (RJ45)

## EMBEDDED



CM-5028 3U VPX

## OEM



CM-4012-OEM-SW



CM-4018-OEM-SW

## ROUTERS

## SMALL FORM FACTOR



CM-6224F4



CM-6228

## 19 IN. RACK MOUNT



CM-6953F2 1U (RJ45)



CM-6953F2 2U (RJ45)

## EMBEDDED



CM-5028

## OEM



CM-4018-OEM

OTN PRODUCT	PORT COUNT AND SPEEDS			CONNECTOR TYPES AND MEDIA			NETWORK TIME SERVER PRODUCTS					
	Total Port Count	GBE	10GBE	Connector Types	Copper	Fiber	IEEE 1588	EXT GPS (*)	NTP	IRIG-B	PPS	10MHz
CM-1608FC4	8	8	—	4x RJ-45/4x Combo Port	4 (8)	4x SFP	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM-1608F0-LP	8	8	—	8x Terrapin	8	—	GMC/TC/SC	Yes	Server	In- and Output	Output	No
CM-2939F2	39	36	2 (SR)	36x RJ45/ 2x SFP	36	2x SFP	GMC/TC/SC	No	Server	—	Output	No
CM-2939F0	33	32	—	32x 10-pin Mighty Mouse	32	—	GMC/TC/SC	No	Server	—	Output	No
CM-4004F0-GMC	4	4	—	2x 22-pin 38999	4	—	GMC/TC/SC	No	Server	In- and Output	Output	No
CM-4004F0-ITAP	4	4	—	4x Cee-Lok FAS-T	4	—	—	No	—	—	—	No
CM-4008F0	8	8	—	2x 37-pin Mighty Mouse	8	—	TC/SC	No	—	—	—	No
CM-4012F0	12	12	—	3x 37-pin Mighty Mouse	12	—	TC/SC	No	—	—	—	No
CM/CR-5028	28	24	4	VPX	24	Optional	GMC/TC/SC	Yes	Server	—	Output	No
CM/CR-6212F0	12	8	4	12x Cee-Lok FAS-T	12	12	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6212F4	12	8	4 (SR)	8x Cee-Lok FAS-T/4x ARINC	8	4	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6224F0	20	20	—	10x 22-pin 38999	20	—	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6224F4	24	20	4 (SR)	10x 22-pin 38999/ 1x MT801	20	4	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6224F0	24	24	—	2x 128pin 38999	24	—	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6228F0	28	24	4	2x 128-pin 38999/4x Cee-Lok FAS-T	28	—	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6228F4	28	24	4 (SR)	2x 128-pin 38999/ 1x MT801	24	4	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6917	16	12	4 incl. 2x SR	12x RJ-45	12	2x SR	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6929	28	24	4 incl. 2x SR	24x RJ-45	24	Optional 12	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM/CR-6941	40	36	4 incl. 2x SR	36x RJ-45	36	Optional 24	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes
CM-6953	52	48	4 incl. 2x SR	48x RJ-45	48	Optional 36	GMC/TC/SC	Yes	Server	In- and Output	Output	Yes

(\*) Pulse per second (PPS) and NMEA

# CONSTRAINTS FOR SPACE, WEIGHT, POWER, OR COST

**TAPS**

**SMALL FORM FACTOR**

CM-1608FM-LP-AERO (TP)

CM-4004 ITAP

**19 IN. RACK MOUNT**

CM-1608FC4 ETAP

**TIME SYNC SOLUTIONS**

**SMALL FORM FACTOR**

CM-1608F0-LP-AERO (RJ45)

CM-1608FM-LP-AERO (TP)

CM-1608F0-AERO

CM-4004

CM-6212

CM-6224F4

CM-6228

**19 IN. RACK MOUNT**

CM-1608FC4 1U (RJ45)

CM-2939F2 1.5U (RJ45)

CM-2939F2 2U (MM)

CM-6953F2 1U (RJ45)

CM-6953F2 2U (RJ45)

**CPU SOLUTIONS**

**SMALL FORM FACTOR**

CM-6224F4

CM-6228

**19 IN. RACK MOUNT**

CM-6953F2 1U (RJ45)

CM-6953F2 2U (RJ45)

OTN PRODUCT	SWaP COMPARISON			
	Size	Weight	Power	Ports
CM-1608FC4	(W) 443.7mm [17.5in], (D) 260.0 mm [10.2in], (H) 44.0 mm [1.73in]	4000g / 8.82lbs	30W	8
CM-1608F0 LP	(W) 250.0 mm [9.84in], (D) 143.5 mm [5.65in], (H) 50.0 mm [1.96in]	2400g / 5.47lbs	30W	8
CM-2939F2	(W) 482.6mm [18.98in], (D) 330mm [13.0in], (H) 84mm [3.31]	approx. 6400g / 14.2bs	45W	36
CM-2933F0	(W) 482.6mm [18.98in], (D) 330mm [13.0in], (H) 84mm [3.31in]	approx. 6400g / 14.2bs	38W	32
CM-4004F0-GMC	(W) 142.3mm [5.64in], (D) 95mm [3.74in], (H) 51.7mm [2.03in]	922g / 2.0lbs	15 W	4
CM-4004F0-ITAP	(W) 149mm [5.86in], (D) 95mm [3.74in], (H) 45mm [1.78in]	930g / 2.0lbs	8 W	4
CM-4008F0	(W) 149mm [5.86in], (D) 95mm [3.74in], (H) 45mm [1.78in]	930g / 2.8lbs	10W	8
CM-4012F0	(W) 149mm [5.86in], (D) 95mm [3.74in], (H) 45mm [1.78in]	930g / 2.8lbs	10W	12
CM/CR-5028	3U VPX board occupying 1 slot, 100 mm [H] x 160 mm [D]	146g / 0.32lbs	31W	24
CM/CR-6212F0	(W) 215mm [8.46in], (D) 143.5mm [5.65in], (H) 88mm [3.46in]	3100g / 6.13lbs	26W	12
CM/CR-6212F4	(W) 215mm [8.46in], (D) 143.5mm [5.65in], (H) 88mm [3.46in]	3100g / 6.13lbs	26W	8
CM/CR-6220F0	(W) 250mm [9.84in], (D) 148.5mm [5.85in], (H) 106.4mm [4.19in]	3700g / 8.15lbs	30W	20
CM/CR-6224F4	(W) 250mm [9.84in], (D) 148.5mm [5.85in], (H) 106.4mm [4.19in]	3700g / 8.15lbs	30W	20
CM/CR-6224F0	(W) 250.0 mm [9.84 in], (D) 165.13mm [6.5 in], (H) 106.4mm [4.18 in]	3700g / 8.15lbs	50W	24
CM/CR-6228F0	(W) 250.0 mm [9.84 in], (D) 165.13mm [6.5 in], (H) 106.4mm [4.18 in]	3700g / 8.15lbs	50W	28
CM/CR-6228F4	(W) 250.0 mm [9.84 in], (D) 165.13mm [6.5 in], (H) 106.4mm [4.18 in]	3700g / 8.15lbs	50W	24
CM/CR-6917	(W) 482.6mm [18.98in], (D) 400mm [15.75in], (H) 44mm [1.73in]	approx. 10000g / 22.7lbs	54W	12
CM/CR-6929	(W) 482.6mm [18.98in], (D) 400mm [15.75in], (H) 44mm [1.73in]	approx. 10000g / 22.7lbs	54W	24
CM/CR-6941	(W) 482.6mm [18.98in], (D) 400mm [15.75in], (H) 44mm [1.73in]	approx. 10000g / 22.7lbs	54W	36
CM-6953	(W) 482.6mm [18.98in], (D) 400mm [15.75in], (H) 44mm [1.73in]	approx. 10000g / 22.7lbs	54W	48

OSI MODEL		
OTN PRODUCT	OSI Layer	Functionality
CM-1600	Layer 2	Switching and Time Server
CM-2900	Layer 2 and 3 (static routing)	Switching, Static Routing and Time Server
CM-4000	Layer 2	Switching
CR-4000-OEM	Layer 2 and 3	Switching and Dynamic Routing
CM-5000	Layer 2 and 3 (static routing)	Switching, Static Routing and Time Server
CR-6200	Layer 2 and 3	Switching, Dynamic Routing and Time Server
CR-6900	Layer 2 and 3	Switching, Dynamic Routing and Time Server

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