A White Paper from
Emerson Network Power™
Embedded Computing

MicroTCA™: Compact, Flexible, Economical Shelf Architecture for Telecom Systems

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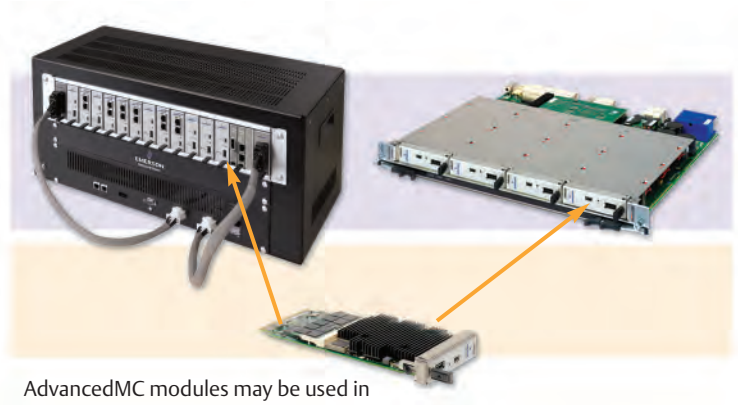
Overview

MicroTCA (Micro Telecommunications Computing Architecture or MTCA.0) is an open system-level chassis specification developed by PICMG (PCI Manufacturers Group) for low-cost, small-form-factor utilizing AdvancedMC modules plugged directly into a backplane. MicroTCA is defined to be complementary to AdvancedTCA targeting edge and access applications, customer premises equipment (CPE) and other applications where cost and size are major constraints including: data centers, industrial control and medical. Emerson Network Power's Embedded Computing business continues to take an active role in the PICMG MicroTCA subcommittee. It is an early MicroTCA technology provider, and is fully engaged in helping drive the specification in making it a reality for the telecom space.

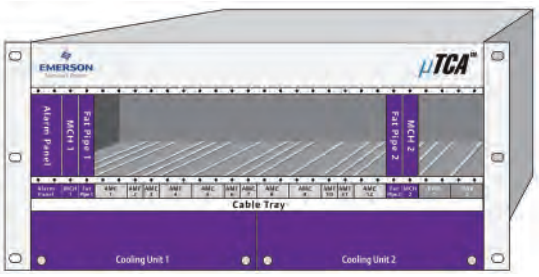


AdvancedMC modules may be used in both ATCA and MicroTCA environments

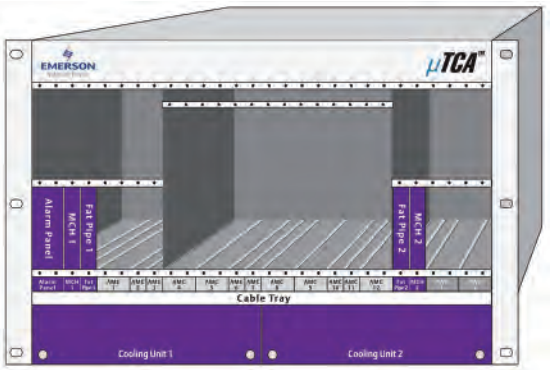
MicroTCA Background

ATCA and AdvancedMC continue to mature, providing a hot-swappable, multiprotocol switched fabric with a large form factor and high-power capability that make it ideal for today's high-performance, high-density, high-availability, packet-based telecom systems. Together, this duo gives Telecom Equipment Manufacturers (TEMs) a versatile platform for building modular telecom systems in a more cost-effective manner with reduced time to market.

MicroTCA extends Hardware Platform Management functionality, granularity, and hot swappability of modular ATCA/AdvancedMC blades to central office, network edge, and outside plant systems with tight space constraints. MicroTCA's use of AdvancedMC technology also drives down cost by enabling equipment providers to reuse modules across a broader range of platforms and applications, thereby leveraging higher production volume and economies of scale.



19-inch Single 4U Chassis



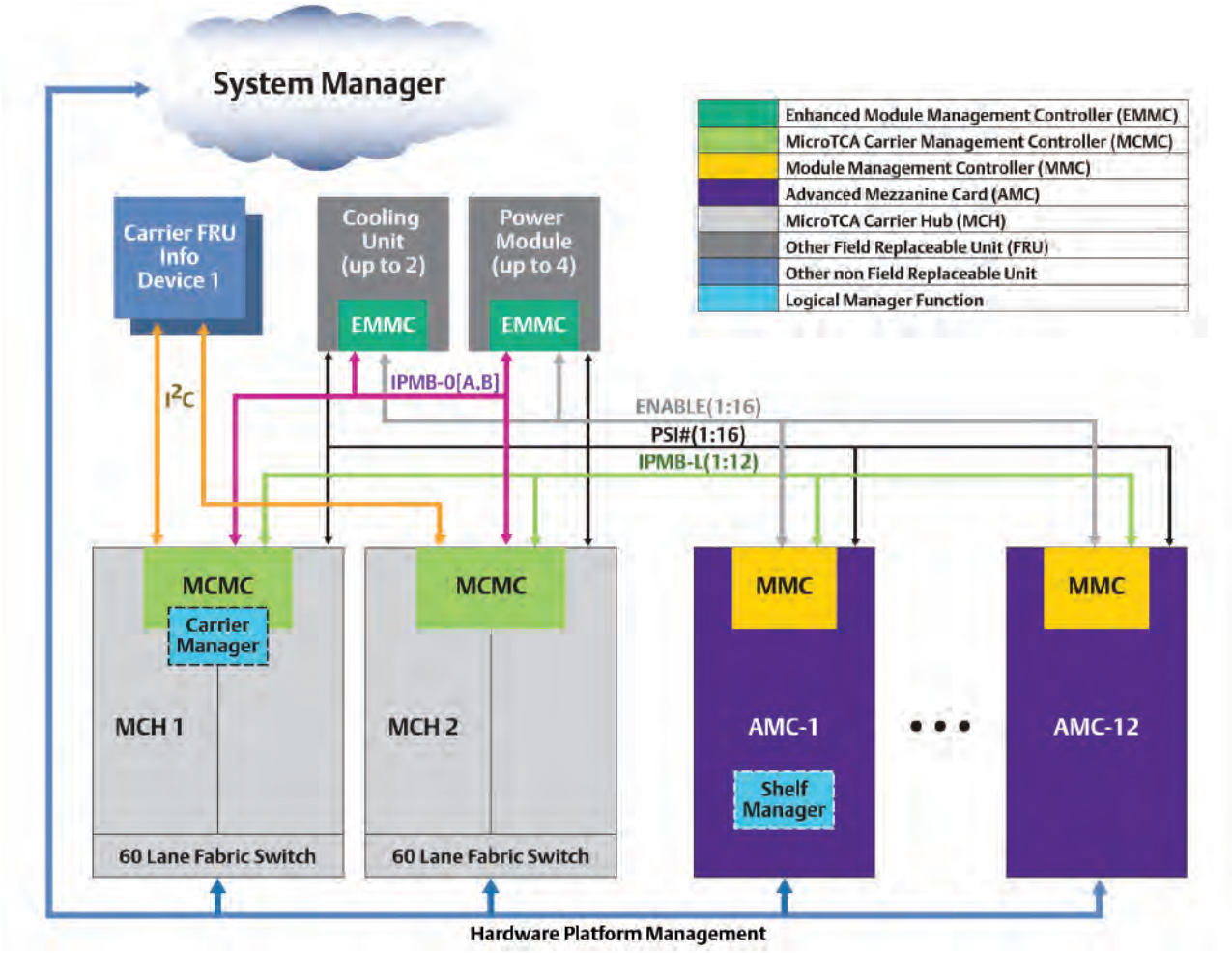
19-inch Single/Double 6U Chassis

What is MicroTCA?

MicroTCA is an open system-level standard that allows AdvancedMC modules to be plugged directly into a backplane. The MicroTCA specification proposes several compact chassis formfactors from, for example, 19-inch wide x 300mm deep x 6U (266.7mm) high to ultrasmall cube (200mm per side) and pico board-mounted configurations.

The MicroTCA specification defines the mechanical, electrical, thermal, and management requirements and properties for systems that use AdvancedMC modules directly in a backplane environment. PICMG's intent is to make the MicroTCA specification a complementary technology to ATCA, preserving ATCA's most important philosophies, including its basic interconnect topologies and management structure, where appropriate. The MicroTCA specification was released on July 24, 2006. The short form specification followed on October 3, 2006.

MicroTCA provides two redundant GbE based links in the AdvancedMC



common region fabric to each module via a pair of MicroTCA Carrier Hub (MCH) modules (one GbE star per MCH). In addition, the MCHs can provide what's known as a Fat Pipe fabric. The Fat Pipe fabric provides high-speed connectivity for the AdvancedMC modules, giving up to eight protocol independent 12.5 Gb/s SERDES based lanes per module. These Fat Pipe lanes can run protocols such as sRIO, PCIe, GbE, XAUI, commonly organized into two independent dual-star groups of four lanes each (one group of four lane stars per MCH). The combination of the connectivity for the Common Region and FatPipe region can therefore provision an aggregate bandwidth of 1224 Gb/sec for a MicroTCA shelf populated with 12 AMC modules [(2 lanes * 1Gbit/sec + 8 lanes * 12.5Gbit/sec) * 12 modules = 1224 Gbit/second aggregate bandwidth].

The MicroTCA specification supports star, dual-star, and mesh topologies. The MicroTCA serial packet transport is protocol agnostic, and supports all of the protocol options defined for AdvancedMC modules, including Gigabit Ethernet, RapidIO, and PCI Express.

The MicroTCA backplane provides an I²C-based Integrated Peripheral Management Interface (IPMI), which enables chassis management to monitor and control individual AdvancedMC modules as well as power modules and cooling units. Each AdvancedMC module, as defined in PICMG AMC.0, is equipped with a module management controller (MMC), which enables it to communicate with the shelf's IPMI controller. The MMC gathers information for key parameters like temperature and voltage. It then conveys this information to chassis management, which identifies boards that may require

servicing and takes the appropriate actions needed to ensure proper operation.

A MicroTCA Carrier Hub provides the core functionality for MicroTCA chassis, including the switch fabric, shelf management, and optional clocking and JTAG support. The MCH can support up to 12 AdvancedMC modules utilizing any standard AdvancedMC form factor.

MicroTCA systems utilize a separate power module to supply 12-Vdc and 3.3-Vdc power to each AdvancedMC module. The power budget for each AdvancedMC module ranges from 20 watts to 80 watts, depending on the configuration and size of the module. The power module is designed to work cooperatively with other power supplies in order to support redundant configurations.

Benefits of MicroTCA

MicroTCA provides a scalable shelf architecture that spans a broad range of configurations, from a pair of AdvancedMC modules, to frames with hundreds of modules. This scalability facilitates a "build as you grow" capability that reduces start-up cost, inventory cost and overall complexity.

MicroTCA's modularity and granularity encourage a building block approach to system design that enables TEMs to build a broad range of application-specific equipment using a relatively small number of generic components. These functionally interchangeable elements reduce production cost by increasing production volume. They also speed time to market by reducing the number of unique modules that TEMs have to develop and test.

MicroTCA also offers the potential for significant cost savings for fielded systems. MicroTCA's modular, hot-swappable framework, for example, increases system availability by reducing the impact of line card failures and facilitating in-service upgrades. It reduces sparing costs by reducing the number of unique modules that service providers have to keep on hand. And it reduces provisioning costs by enabling service providers to provision their systems in smaller increments according to actual demand. Longer term, as standardized function modules emerge, the MicroTCA framework will also lower service costs by paving the way for standardized online functional tests that reduce the time required to repair and/or replace modules.

With a target lifespan of at least eight years, MicroTCA is the first open architecture specification that meets the cost, performance, and availability requirements of low- to mid-range, packet-based wireline and wireless telecom applications. Equally important, it does so in a way that leverages existing ATCA and AdvancedMC infrastructure. This not only gives TEMs easy access to best-of-breed, off-the-shelf AdvancedMC technology, but also enables them to preserve their investment in existing shelf management and application software.

Emerson is at the forefront of MicroTCA standardization efforts, and a leading supplier of blade products to telecom OEMs. At Supercomm in June 2005, Emerson teamed with members of the PICMG MicroTCA committee to demonstrate the industry's first physical MicroTCA solution, which simulated a wireless application servicing millions of subscribers. Emerson followed this in February 2006 at the 3GSM show in Barcelona with a demonstration of the industry's first complete MicroTCA development system. Today, Emerson is offering a development system to select customers and moving forward with an aggressive MicroTCA roadmap.

Finally, Venture Development Corp (Natick, MA), a leading telecom research firm projected that the market for MicroTCA as an integrated platform (chassis, power, MCH) will grow to about $218M in 2009. VDC expects the total AdvancedMC market to approach $700M in that same time period. Forward thinkers like Emerson are leading the way, providing MicroTCA products and solutions that give TEMs and service providers the flexible, scalable, upgradeable platforms needed to quickly and profitably deploy next-generation IP infrastructure and services.

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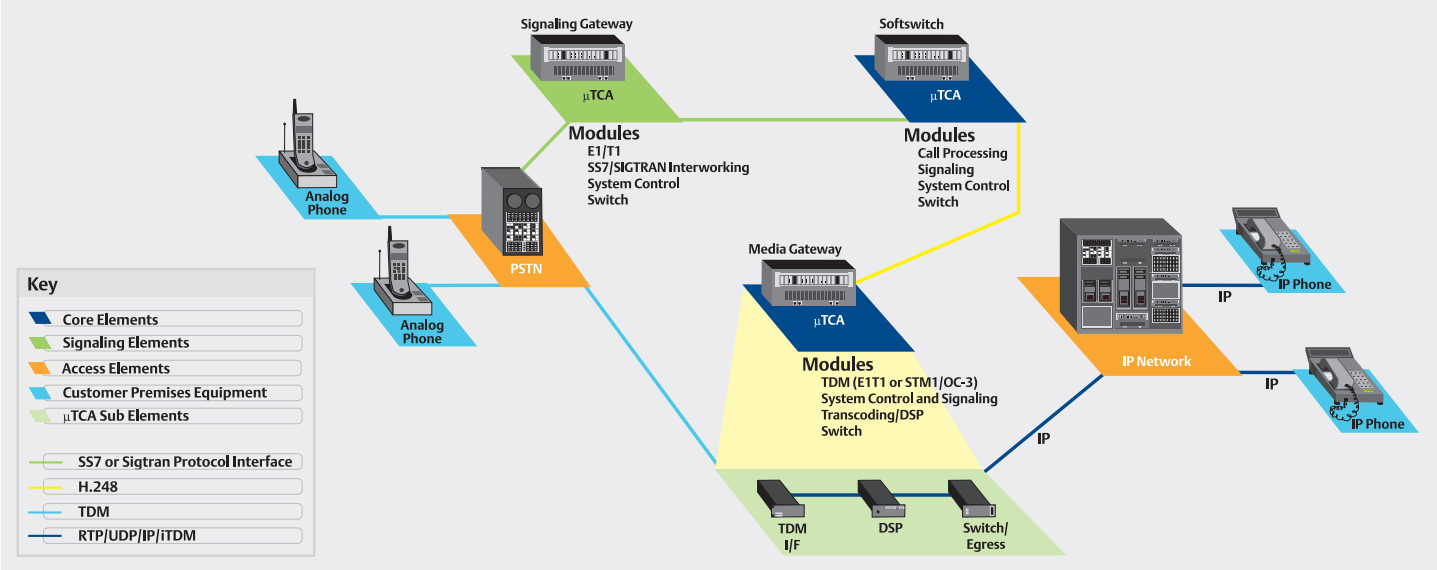
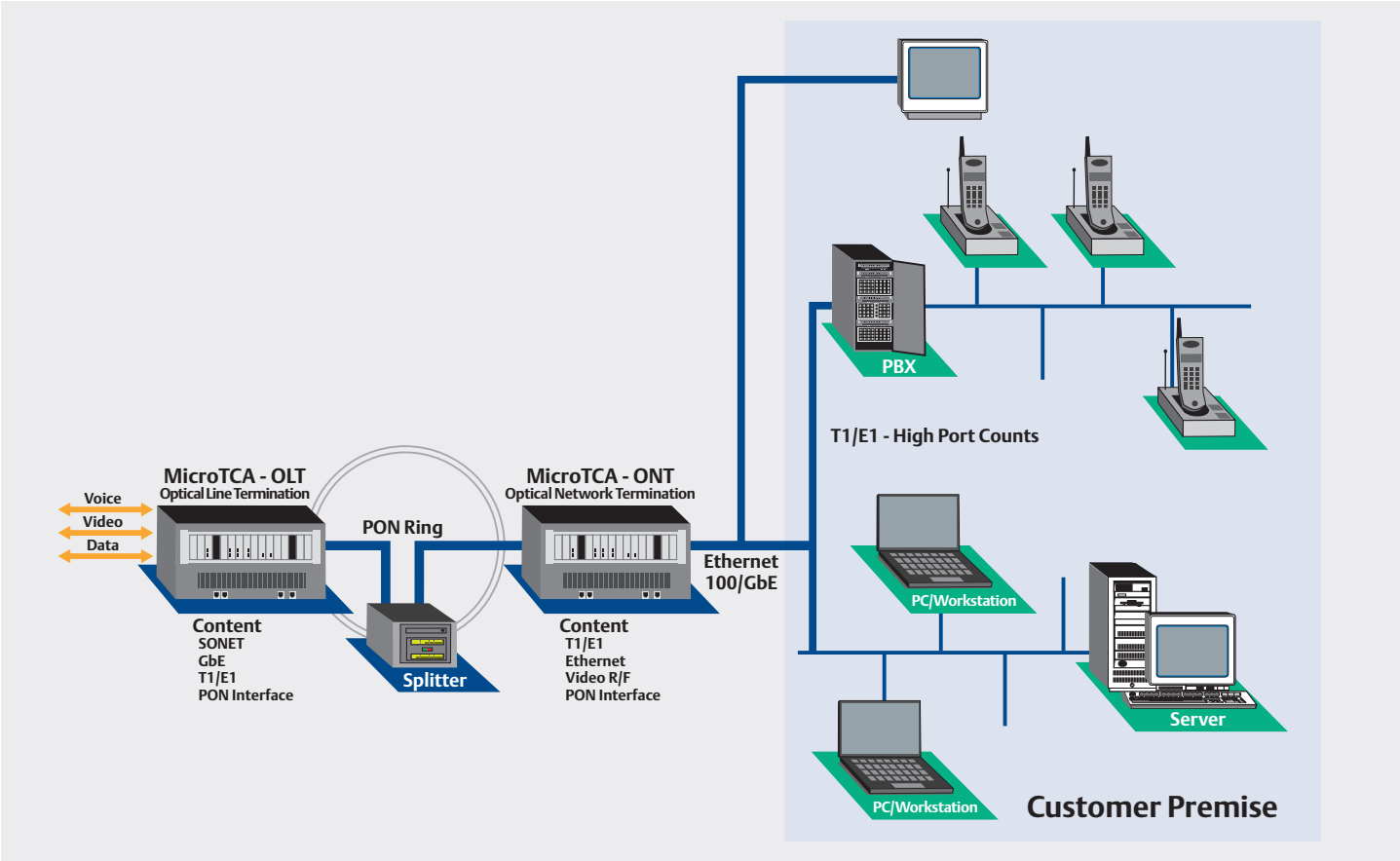
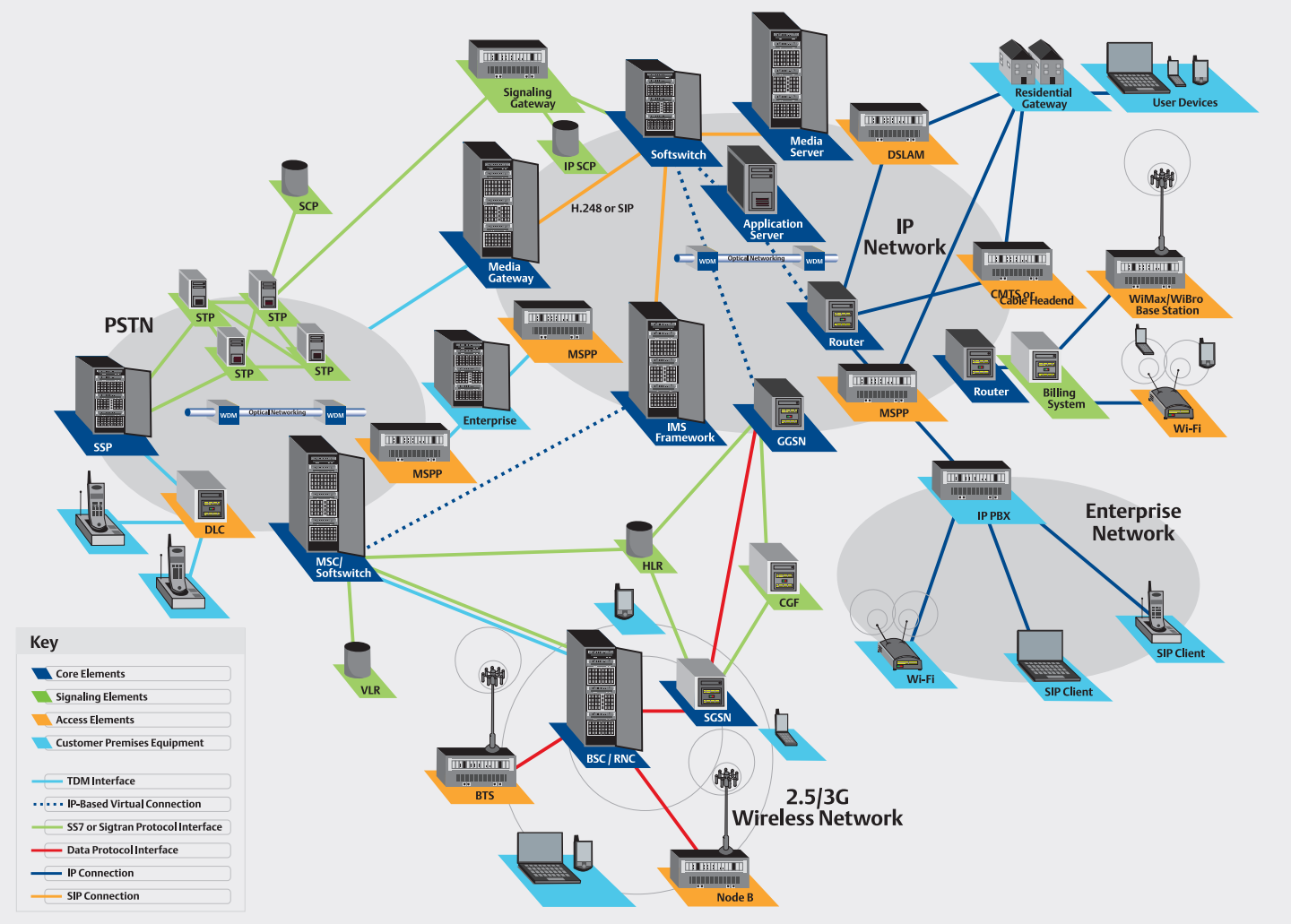
VoIP Applications



uTCA GPON



The Teledatacom™ Network



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