Vubiq Networks' Wireless Fabric Architecture Patent Portfolio Executive Summary

One of the most important aspects of Vubiq Networks' patented millimeter wave technology is in the field of wireless fabric architecture, spanning chip-to-chip, board-to-board and rack-to-rack connectivity. The progression of the company's wireless fabric patent portfolio is based on the ability to predict the evolution of high-frequency semiconductor technologies – and as a result, predict the new applications that will be enabled.

The ever-present constraint for high-speed data communications, from the small paths between integrated circuits on a computer board, up through links between buildings in cities, has always come from the limits of how fast electrical signals can be transported via copper connections. Even with higher-speed fiber optics, a physical cable must still be installed, so by definition the physical constraint is built into the architecture.

Wireless connectivity means freedom to move information without physical conductors or cables. Starting with the concept of moving data between semiconductor chips, then between circuit boards in a server, and then from server to server in a data center, the company's vision is a "wireless backplane" that creates a virtual network fabric.

Vubiq Networks has been awarded a series of four US patents and one European patent for "System and Method for Wireless Communication in a Backplane Fabric Architecture."

US Patent Number 7929474

Priority Filing Date: June 22, 2007

Awarded: April 19, 2011

Overview: The first patent in the company's wireless fabric architecture portfolio covers chip-to-chip and board-to-board connectivity in a wireless millimeter wave backplane, forming a network or fabric that can communicate between chips, boards and rack cabinets.

Patent claim: A wireless millimeter wave backplane network comprising:

- A first circuit board having a first module thereon, wherein the first circuit board is in a first cabinet structure and coupled to a high-speed backplane
- A first communication node coupled to the first module
- A second circuit board having a second module thereon, the second circuit board is in a second cabinet structure separate from the first cabinet structure, wherein the second circuit board is coupled to the high-sped backplane
- The first and second modules wirelessly communicate using millimeter wave electromagnetic radiation with one another via the first and second communication nodes

Read the first patent.

US Patent Number 8422414

Filed: April 12, 2011

Awarded: April 16, 2013

Overview: The second patent extends the original concept to a wireless millimeter wave mesh network composed of separate radio housings for the network nodes. As a continuation and elaboration of the first patent, it encompasses the node-to-node communications in a millimeter wave mesh network.

Patent claim: A wireless millimeter wave mesh network comprising:

- A first network communication device associated with a first housing, wherein the first network communication device is coupled to a communications network
- A first stationery communication node coupled to the first network communication device and located in the first housing, the first communication node configured to emit millimeter wave electromagnetic radiation to wirelessly communicate data
- A second network communication device associated with a second housing located separate and remote from the first housing, wherein the second network communication device is coupled to the communication network

Read the second patent.

US Patent Number 8897184

Filed: July 30, 2012

Awarded: November 25, 2014

Overview: The third patent covers the use of modular antennas and enclosures for applications using a wireless backplane network. It was filed as a continuation of the prior patents.

Patent claims:

- Claim 1: A wireless backplane network comprising a first antenna system partially located in a first network device cabinet including at least one first network device
- Claim 2: The network of Claim 1, wherein the first millimeter wave antenna further comprises a first antenna pedestal

Read the third patent.

US Patent Number 9537794

Filed: July 30, 2012

Awarded: January 3, 2017

Overview: The fourth patent specifically targets rack-to-rack millimeter wave wireless communications for factory floor and data center applications. It covers specific antenna arrangements optimizing massively high throughputs required for factory automation and high-speed data centers using a wireless millimeter wave network.

Patent claim: An antenna device for wireless backplane network communication comprising:

- A device base configured to be located at least partially in a network device cabinet housing a network device

- An antenna pedestal coupled to the device base and configured to be located external to the device cabinet
- A pedestal base configured to be coupled to the device base
- A plurality of antenna housings coupled to the pedestal base, the plurality of antenna housings configured to house one or more millimeter waveguide antennas therein, the one or more antenna housings radially positioned about the antenna pedestal

Read the fourth patent.

European Patent EP2737718B1

Filed: July 30, 2012

Awarded: April 9, 2019

Overview: The fifth patent, awarded by the European Patent Office, provides additional global protection for the company's backplane fabric architecture. This patent addresses the physical architecture of deployment in and on the rack cabinet in a data center environment. However, it carries through from the earlier patents in the series, chip-to-chip, board-to-board, and ultimately rack-to-rack, high-speed communications.

Read the fifth patent.

Point-to-Point Communications

Point-to-point wireless telecom solutions use millimeter wave radios and directional antennas to provide data communications from one location to another, or from one building to another. Vubiq Networks' offers the 10 Gbps HaulPass V10g and HaulPass E10g wireless point-to-point millimeter wave solutions for building-to-building connectivity, fiber optic extensions, wireless metropolitan area networks, and wireless mobile backhaul. For more information regarding point-to-point applications, see the company's Millimeter Wave Telecom Applications page.

Mesh Networks

A wireless mesh network is a multi-hop wireless network formed by a number of stationary wireless mesh routers. These routers are connected wirelessly using a mesh-like backbone structure. Some of the routers function as wireless access points for client devices (for example, laptops and smart devices with wireless access) to attach themselves to the network. The client devices transmit and receive data via the backbone mesh network. To connect to external networks such as the Internet, one or more routers are connected to transport gateways via fiber or high bandwidth wireless backhaul solutions such as the Vubiq Networks HaulPass V10g.

Smart Factories

Millimeter wave wireless fabric can be used in smart factories, providing ultra-reliable low latency communication (URLLC) connectivity to critical machines, industrial robots, and Internet of Things (IoT) access points throughout the factory environment. The use of advanced analytics and artificial intelligence will help optimize production processes in state-of-the-art factories. Operators can use data insights to identify potential production losses and act to balance quality, cost and throughput. The results include fewer disruptions, less waste and higher yield.

Wireless Data Centers and Cloud Computing

Vubiq Networks' wireless fabric technology can be applied to the challenges of scaling constraints and costs for internal data center connectivity and switching. Today's limits of cabled and centralized switching architectures are eliminated by leveraging the wide bandwidths of the millimeter wave spectrum for the high-density communications requirements inside the modern data center.

Our patented technology has the ability to provide more than one terabit per second of wireless uplink capacity from a single server rack through an innovative approach to create a millimeter wave massive mesh network. The elimination of all inter-rack cabling – as well as the elimination of all aggregation and core switches – is combined with higher throughput, lower latency, lower power, higher reliability, and lower cost by using millimeter wave wireless connectivity.

The Challenge: Data Center Cabling

As the world has become more dependent on cloud computing manifested in the big search engines, social networking, online shopping, and enterprise cloud-based IT systems, the growth of large data centers is exponential. The heart of the data center is the server, with large centers supporting more than 100,000 servers under one roof.

Server-to-server communications requires huge interconnected bandwidth to enable the surge in applications now running in the cloud. Any server to any server high-speed communications must be supported by the switching architecture within the center. The traditional approach is to interconnect the servers with a localized "top of rack" (TOR) switch located in each server rack cabinet. The TOR switch is in turn connected to aggregation switches at the next tiered level, called the fabric.

With larger numbers of servers, additional tiers are added at what's called the core or spine. The switches are all interconnected with cable or fiber, and the amount of data center resources dedicated just to solving the cabling problem is staggering. A large data center can have more than 25,000 miles of fiber to provide the connectivity needed. The costs associated with tiered level switching and interconnecting cabling have become a major portion of the total data center cost.

The Solution: The Wireless Data Center

Vubiq Networks' high-bandwidth millimeter wave technology can enable short-range inter-server communications without the need for cabling or external switches, providing a huge potential improvement in the ability to scale and support growth for the data center and cloud computing.

The approach is to have a wireless turret on top of the sever rack, with the servers interconnected through the turret for connectivity to any other sever in the center. Multiple channels of high-speed millimeter wave connectivity can be established with other rack turrets in the center. The turret is divided into 16 sectors, with each sector module capable of up to 100 Gbps. This provides a total rack uplink capacity to the mesh of more than 1 Tbps. This is an order of magnitude greater than the planned 40 Gbps and 100 Gbps TOR uplink capacities using traditional tiered switches and fiber.

The company's approach completely eliminates all inter-rack and inter-switch cabling, as well as all aggregation and core tiered switches. The savings in power, cabling infrastructure, and switch costs more than justify moving to a wireless approach for the data center.

VUBIQ NETWORKS

Making Millimeter Wave Ubiquitous

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