A

Seminar report

On

xMax Technology

Submitted in partial fulfillment of the requirement for the award of degree
of Bachelor of Technology in Computer Science

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Preface

I have made this report file on the topic **xMax Technology** I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to ……..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

Introduction

xMax is a fixed and mobile wireless broadband system that includes a complete product line of high-performance access points, fixed and mobile personal WiFi hotspots, mobile switching centers (MSC) as well as network management and deployment tools. xG's unique and patented protocol outperforms WiFi, WiMax and traditional cellular technologies like LTE in shared and interference prone radio bands. The xMax over the air waveform has been specifically designed for use in a deterministic (i.e. fixed low latency) cognitive radio network. This waveform, in conjunction with its purpose built Media Access Control (MAC) layer, offers capabilities and performance not found in other wireless solutions.

xMax is an end-to-end Internet Protocol (IP) network solution that incorporates xG's patented cognitive radio technologies to deliver the first fully mobile VoIP and broadband network that also supports any smartphone, laptop, tablet and other commercial WiFi or IP-enabled devices via its xMod personal hotspot – while offering an excellent quality of service (QoS) and fixed, low latency.

xG's approach has been to develop a network that uses available free spectrum instead of costly licensed spectrum and an all-IP architecture that is less expensive to deploy and operate. The company's xMax system addresses the numerous technical hurdles involved with mobile VoIP and data in today's crowded airwaves. The result is an extremely efficient network solution that delivers high quality fixed and mobile wireless Internet services at very low cost.

Every aspect of the technology is designed for the highest possible efficiency and QoS. xMax is designed to prioritize voice calls by delivering dedicated time-slots, as well as a voice calling app for android phones and tablets. This approach guarantees a low and fixed latency for every call, which essential for reliable voice calls on heavily loaded wireless broadband systems. The xMax system ability to provide fixed low latency connectivity for real-time communications is in contrast to technologies like Wi-Fi and WiMAX, both of which are contention-based "best effort" delivery systems that cannot provide scalable voice services without significantly reducing their data carrying capacity. xG's proprietary air interface addresses these limitations, while supporting full sensing-based cognitive network operation.

xMax carrier class cognitive radio networking solutions are made up of the following key products:

- CN5100 Mobile Hotspot
- CN3100 Vehicle Modem
- CN3200 Dual Band Routing Modem
- CN1100 Access Point
- CN7000 Mobile Control Center
- xDrive and xMonitor Network Tools

Why xMax?

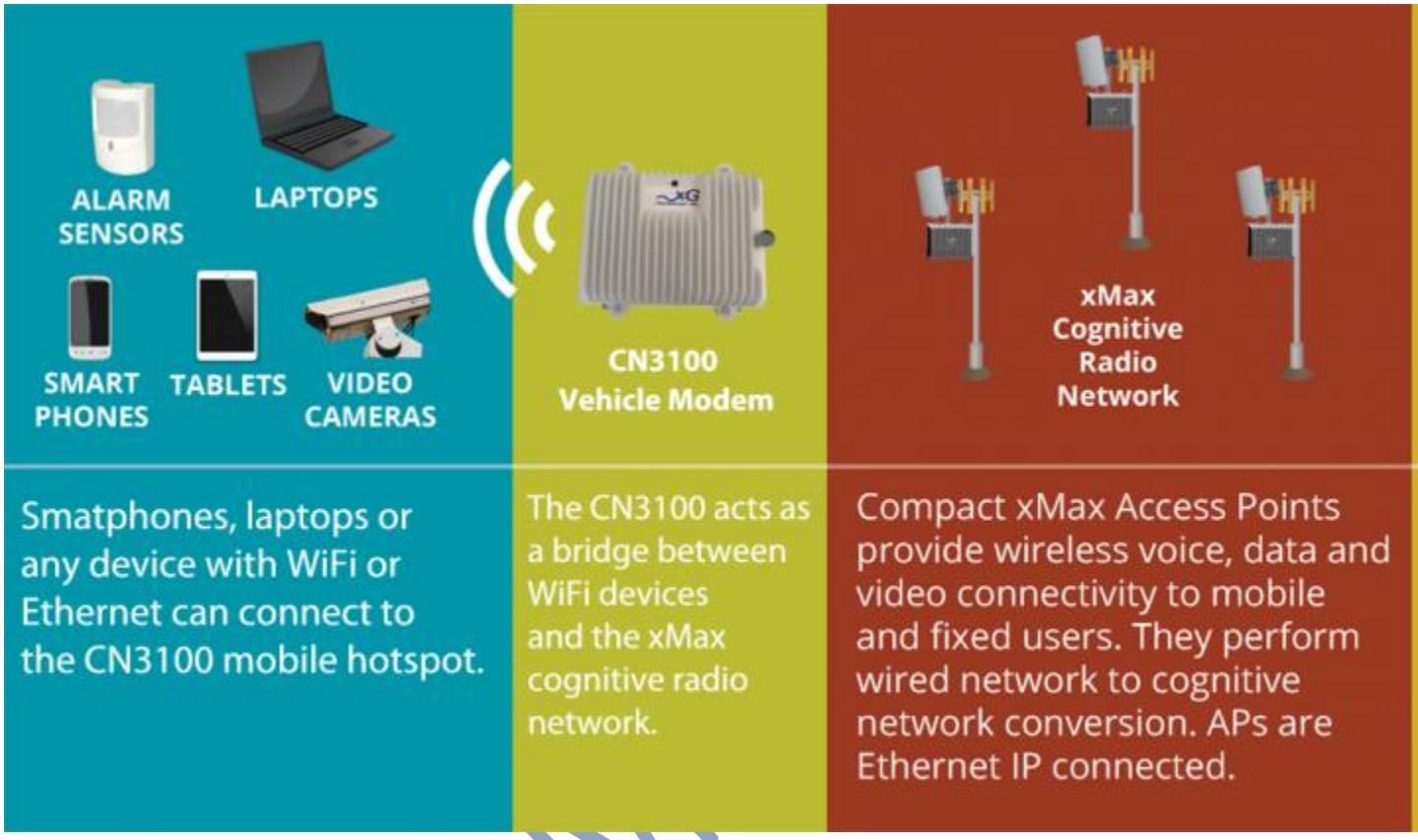
xMax is designed to prioritize voice by delivering dedicated timeslots and bandwidth to every user. This approach guarantees a minimal and fixed latency for every call, which is an essential factor for any high Quality of Service (QoS) mobile VoIP system. This is in contrast to technologies like Wi-Fi and WiMAX, both of which are contention-based "best effort" delivery systems that are limited by scalability constraints.

Network Architecture

Flexible Architecture Enhances and Extends Today's Services

The primary consideration in the network architecture design of the xMax system is to achieve the goal of providing robust, scalable, and full-featured voice and data services to fixed and mobile subscribers at a fraction of the cost of traditional approaches. The system uses a proprietary over the air waveform that has been optimized for our sensing-based cognitive radio. While based on Orthogonal Frequency-Division Multiplexing (OFDM), xG's unique and patented protocol outperforms WiFi, WiMax and traditional cellular technologies like LTE in shared and interference prone radio bands.

In addition to its proprietary and highly optimized over the air protocol, xMax offers several unique and valuable capabilities not found in other cognitive (and traditional) radio networks. These include its all-IP (Internet Protocol) architecture, as well as its support of commercial smartphones, laptops, tablets and other WiFi and Ethernet capable Internet appliances via the xMod personal hotspot. A sample reference model of the resulting Internet Protocol (IP) centric network architecture is shown in Figure 1.



As the diagram indicates, the network architecture includes the following elements:

- A proprietary xMax over the air-interface designed for cognitive radio operation in unlicensed as well as licensed bands.
- xMod fixed and xVM mobile hotspots that bridge WiFi-enabled commercial smartphones, laptops, tablets and other Internet ready devices to the xMax cognitive network.
- xAPs, which provides wide area connectivity to end users devices via xMods. The xAP is a compact, single channel access point optimised for cognitive radio operation. Up to 18 xAPs can be co-located to provide up to 108 Mbps of total data in the 900 MHz ISM band. xMax channelizes the 902-928 MHz band into 18 discrete channels, which are only used when there is traffic to mobile devices that are registered with a particular channel.
- Access Network Gateway (ANG), called the xMSC in an xMax network that provides call process, IP packet delivery services and several other IP, mobility and network signaling related functions.
- Technology-agnostic backhaul links from xAP sites and the ANG (Fiber, Metro Ethernet, PTP Wireless, etc.).

Note: Radio spectrum utilization is highly efficient in that the system occupies only that spectrum which is necessary for individual data streams. The bandwidth of each channel is 1.44MHz with sufficient guard band between channels.

While the xAP appears conventional in both architecture and functionality, it provides flexibility, scalability and reliability not found in conventional mobile or WiFi-based wireless networks. The ANG (xMSC) is a novel piece of wireless infrastructure equipment that consists of 100% off-the-shelf hardware with proprietary software developed by xG:

- Ethernet Switch which aggregates xAP links.
- Firewall which provides private to public network address translation (NAT) services.
- SIP Proxy Server which supports SIP call control, xG's SIP message compression technology, and E911 services.
- Proxy DHCP Server which is used for IP address services.• Network Monitor (xMonitor) software which is responsible for end-to-end network management and monitoring services.

Among the unique characteristics of the xMax network architecture is the way mobility is implemented. The system provides soft handoffs with make-before-break capability (timeslots are acquired before breaking a connection), which result in reliable roaming and a seamless user experience. With all handoff decisions made at the xMod level via proactive channel scanning, there is no need for inter-base station (xAP) communication, which helps drive seamless operation.

The architecture further supports low-cost service deployment objectives by leveraging commercial off the shelf (COTS) voice over IP (VoIP) equipment, software and services within the xMSC. The VoIP core contained within the xMSC consists of the following elements:

- SIP Proxy Server which provides traditional SIP call control services.
- Media Gateway – which provides media transcoding between IP and PSTN networks and is responsible for subscriber accounting/billing, PSTN call termination, "Direct Inward Dialing" (DID) phone number maintenance, voicemail services, and inter-network call signal routing, among others.
- The VoIP core can be owned and operated by the xMax operator, or can be provided as a third party service.

Advantages of xMax:

xMax technology offers advantages for numerous types of prospective domestic and international carriers. These organizations include incumbent local exchange carriers (ILEC), competitive local exchange carriers (CLEC), original equipment manufacturers (OEM), mobile operators, cable companies and other content providers, and infrastructure mobile virtual network enablers (MVNE).

xMax, is a 900MHz wireless technology and uses less than 1 Watt of power. What makes xMax unique is its sharing of crowded radio spectrum, such as the frequencies used by cable television or Wi-Fi. The consumption of power in xMax is less when compared to other wireless technology devices.

xMax offers consumers the prospect of lower phone bills because:

â€¢ xMax transmits over unlicensed spectrum-the same as baby monitors and cordless phones. Major national cellular carriers paid billions of dollars for licensed spectrum that they recoup from customers.Â

â€¢ xMax was built as a totally Internet-based digital system from top to bottom-an extremely cost efficient communication approach.Â

Roger Branton, COO for xG Technology said that xMax is essentially a new long-distance UWB (ultra-wideband)-like wireless technology, and was quick to make the distinction between xG's xMax and UWB technology. He says, "xMax is not UWB. The first xMax products slated for release later this year will utilize the ISM 900MHz unlicensed band, which is only 26MHz wide. UWB utilizes something like 500MHz in the high gigahertz frequencies."Â

xG claims that xMax supports more efficient communication over wireless or wired links than other technologies. About this efficiency, Bobier said that, "We believe efficiency boils down to how many bits you can move over a given amount of spectrum per watt. If you can move more bits of information with less power, you pollute the spectrum less, thereby making it possible for more users to access the spectrum." xMax operates at low, sub-gigahertz frequencies and can be used for communication without the common line-of-sight issues that happen at higher frequencies. Bobier says if you can use these frequencies and still be broadband, you compare with fixed wireless technologies doing things in the microwave area.Â

WiMax, which has been described as Wi-Fi on steroids, has a range of up to 30 miles and can deliver broadband at a theoretical maximum of 75mbps. But today, power consumption is so high on WiMax receivers that they cannot be used in consumer products such as laptops, let alone on handheld devices such as cell phones.

Performance claims

A press report was published in 2005 quoting inventor Joseph Bobier. The technology was said to compete with WiMax, but details were initially not disclosed. By 2006, the company announced it had "completed" the technology after six years of development. In 2009, a blogger wrote that he witnessed a xMax mobile VoIP pilot network operated by the company in Fort Lauderdale: "xMax worked well and is real. When you realize that this company may have found a way to take a frequency riddled with wireless garbage and turn it into a fully functioning wireless voice and data network you start to see how much of a game changer this could be for the wireless industry."

- Antenna: commercially off the shelf antenna
- Range: typically 2–5 miles depending upon tower height and terrain.
- Data rate: 18 Mbit/s per basestation
- Spectrum used: Unlicensed 902-928 MHz band
- Interference: Ability to accept interference found on 902-928 MHz band
- Power: Less than 1 W

From 2007 through 2009 Phil Karn published some analysis of the technology claims.

Uses of xMax in future technologies:

According to Whitely, the technology will benefit rural ISPs due to the lower number of base stations required.

xMax, because it has 20 times the range of Bluetooth, could challenge that technology

Other possibilities are enterprise WLANs and metropolitan networks.

Use of xMax to reduce the power consumptions in wireless technologies to a greater extent.

References

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