

Next Generation Communication Processors

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Abstract

The deployment of broadband in the United States showed a year over year growth of 52% between 2005 and 2006.

These broadband connections are used more extensively to exchange digital media and other content. The growth of community sites such as MySpace and MSN Spaces increased with 367% and 286% between 2005 and 2006. Additionally, community sites such as YouTube are used more extensively to share content. YouTube currently has a reach of up to 10% of the internet population.

The exchange of personal content on community sites however, is not the majority of traffic that is traversing over residential lines. P2P programs are very popular to exchange sometimes copyright protected content with other users and are estimated to account for between 40% and 80% of the traffic traversing residential lines.

These are just some of the challenges faced by internet service providers and corporations. The solutions that will enable this growth, increase in performance, increase in control and enable the deployment of a wide variety of new applications is the next generation communication processor.

There are a lot of companies that have a wide variety of products on the market for the next generation network. Most of the innovation of in the market today is done by small, flexible, stealthy start-ups. The more heavy weight companies, such as Broadcom, Freescale and Intel lack some of the innovative technologies that are developed by the start-ups. The industry as a whole is a very dynamic industry with a lot of dependencies on the suppliers on one side and the buyers on the other side. This is one of the reasons why some of the companies in the industry are in a vulnerable position. NetLogic for example depends on Cisco Systems for 60% of their revenue. This position and dependency gives Cisco Systems a lot of bargain power, for example to demand lower prices. The forecasts for the industry are very bright however, with some of the forecasts on market size ranging between \$ 13.4 billion up to \$ 19 billion.

On the technical side, there is a lot of innovation to increase the performance of next generation communication processors. There is a wide variety of technologies deployed to accelerate processing speeds to 10 Gbps and beyond. The most widely used instruction set architecture currently in the industry is the MIPS ISA. However, with heavy weights such as IBM and Freescale behind the POWER architecture, the latter starts to increase its penetration into the next generation communication processor market. Besides products from Freescale, P.A. Semi also uses the POWER architecture in their PWRficient family of processors.

One of the more interesting trends that will have a profound influence on the design of next generation communication processors is parallelism. The number of designs that uses CMP or SMT technology is increasing and this is a suitable method for increasing the overall performance of next generation communication processors. There are clear limits to increasing the number of processing cores on a chip.

The other interesting trend will be on the support side, how will companies like Cavium assist software developers to leverage on the functionality that are offered by next generation communication processors. Additionally, it is interesting to see how many third party developers will start developing and adjusting their applications to leverage on the potential of next generation communication processors.

The technical solutions that are analyzed in this report both use CMP and SMT technology to increase the overall performance of the SoC design.

The first design of P.A. Semi's PWRficient line is the PA6T-1682M. P.A. Semi has an extremely experienced management team, with Dan Dobberpuhl as president and CEO of the company. Before Dan Dobberpuhl started P.A. Semi, he already started SiByte which was later bought by industry heavy weight Broadcom.

P.A. Semi designed the PA6T-1682M with power efficiency in mind. The result is a SoC design that is both impressive in performance, power consumption and flexibility. The ENVIO intelligent I/O subsystem offers some industry standard interfaces that are useful in almost any situation. However, the design misses out on some point, such as offload engines for RegEx and compression / decompression and SPI interfaces. This has to do with the way P.A. Semi is positioning the PA6T-1682M, they target a wide variety of markets, not all of them need some of the functionalities mentioned earlier.

The XLR732 is the high end design from Raza Microelectronics. Raza Microelectronics has an experienced management team with Atiq Raza as the CEO of the company.

The XLR732 is a versatile design that is targeted at a wide variety of markets. The strong points of the XLR732 are the I/O options it offers, the use of the well known MIPS64 instruction set and the enhancement of their processing cores with the MIPS MT ASE.

The XLR732 is equipped with 8 cores that can run at 1.2 GHz speed and support SMT with up to four threads per core. Additionally, there is an NPF-LA1 interface which can be used to connect to Network Search Engines.

Both designs are very competitive and have advantages for their intended target markets.

The evaluative framework can be used to compare several designs on seven different sub dimensions and help to give insight into the characteristics of a next generation communication processor design.

In the next three years, there will be an increase in deployment, development and support for next generation communication processors.