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Spec No: 001-48864

Spec Title: AN48864 - OPTIMIZING PERFORMANCE USING WEST BRIDGE(R) CONTROLLERS WITH TURBO-MTP

Replaced by: None

AN48864

Optimizing Performance Using West Bridge® Controllers with Turbo-MTP

Associated Project: No

Associated Part Family: West Bridge Antioch and Astoria (CYWB0125AB,CYWB0225AB)

Software Versions: West Bridge® Antioch™ SDK Version 1.3.2, West Bridge® Astoria™ SDK Version 1.2.1

Related Application Notes: None

To get the latest version of this application note, or the associated project file, please visit http://www.cypress.com/go/AN48864.

AN48864 discusses West Bridge® Turbo-MTP, which is a West Bridge specific implementation of Microsoft® Media Transfer Protocol (MTP). Mobile handsets and portable media devices seek compliance with MTP to transfer digital media from a Windows PC and to synchronize digital media files between the device and the PC. The West Bridge Turbo-MTP implementation provides significant performance improvements over the traditional MTP implementation.

Introduction

The West Bridge® Antioch™ and Astoria™ devices are peripheral controllers that support High-Speed USB and mass storage access. These controllers provide direct access from both a processor interface and a High-Speed USB interface to peripherals such as SDHC (SD 2.0), eMMC (MMC 4.2), CE-ATA, SDIO, and SLC NAND. These capabilities make West Bridge devices an optimal bridge solution for handset devices such as cell phones and portable media devices, by providing the fastest possible sideloading speeds, multitasking, and support for the latest multimedia and storage interfaces.

It is increasingly important that portable devices now be compliant with Microsoft's Media Transfer Protocol (MTP). MTP is becoming a common protocol in US based CDMA networks for transferring synchronizing digital media from a Windows PC to a portable device. This is due to its abilities to facilitate both Digital Rights Management (DRM) and synchronization standards such as AutoSync.

This application note discusses West Bridge Turbo-MTP. This is a West Bridge specific implementation of MTP that provides significant performance improvements over the traditional MTP implementation. West Bridge Turbo-MTP enables a portable media device to achieve Mass Storage Class type sideloading performance while gaining all the features and benefits of MTP.

West Bridge Overview

West Bridge devices employ the Simultaneous Link to Independent Multimedia (SLIM™) architecture that allows three different interfaces (the P-port, S-port, and U-port) to connect to each another independently.

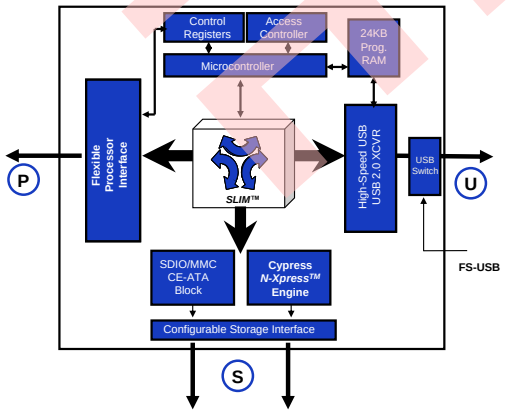
The Processor-port (P-port) of West Bridge is used to interface with a system processor (typically, a baseband or applications processor in a handset device). The P-port can operate in one of multiple selectable interface types such as CRAM, SRAM, Address-Data Multiplexed RAM, SPI, or PNAND.

The Storage-port (S-port) can be configured to simultaneously interface with multiple mass storage devices such as 8 or 16-bit SLC NAND, Controlled NAND, SD/MMC/SDIO, and CE-ATA devices.

The USB-port (U-port) is a High-Speed USB interface that can transfer data independently to and from the embedded host processor and mass storage media, with optimum performance.

Figure 1 shows a block diagram of the West Bridge architecture.

Figure 1. West Bridge Block Diagram



Terminology

In the MTP framework, the MTP host is called the initiator and the MTP device is called the responder. In this application note, the MTP initiator is the USB host PC, the MTP responder is a handset device (mobile phone), and the USB is the physical layer of communication. Here, the main processor refers to the applications or baseband processor connected to the P-port of the West Bridge device.

MTP Overview

MTP is a standard developed by Microsoft that enables portable devices to transfer media files to and from a PC without requiring drivers specific to the device. The MTP protocol is based on the Picture Transfer Protocol (PTP) developed for transferring images. MTP also facilitates DRM and enables other capabilities such as hot unplug and AutoSync (a feature of Windows Media Player that synchronizes files on the PC with the portable media device).

One of the main differences between MTP and mass storage class (MSC) is that MTP operates at the logical file level, rather than at the granularity of a mass storage device block. This also means that an MTP device is expected to maintain the file system.

Another significant advantage of MTP over MSC is that MTP provides for associating metadata with media files. The metadata consists of information such as the name of the audio or video file, date of creation, name of the artist, and so on. MTP also provides for establishing references, such as a DRM certificate, to a media file. Within the MTP standard, media files (that is, actual binary content), the associated metadata, and references are encapsulated as media objects. This organization of objects with properties enables easy enumeration of the objects, without having to interpret the underlying file system.

MTP transfers over USB consist of a Command phase, a Data Phase, and a Response Phase.

The command is always initiated by the host, followed by the Data phase (from the host to the device in case of an OUT transfer, or from the device to the host in case of an IN transfer).

The MTP responder generates the appropriate Response.

Traditional MTP versus Turbo-MTP

Figure 2 shows how MTP transfers are handled in a traditional architecture. In such MTP implementations, all the MTP command and data packets are transferred through the USB bridge to the main applications or baseband processor of the phone. The processor manages both the interpretation of the commands through the MTP software stack and accessing data from the attached storage device. This architecture typically requires the processor to first store the data temporarily in a DRAM before it can be moved to the final storage device. This creates a significant bottleneck and leads to degradation of performance, particularly if the processor is heavily loaded with other concurrent tasks, such as managing the media database.

In the West Bridge Turbo-MTP architecture, the protocol packets are switched such that only command packets are passed to the processor and the data packets are managed by the West Bridge device (see Figure 3). The West Bridge device accesses the attached storage, requiring the processor to communicate only the physical block addresses to West Bridge.

West Bridge provides an optimal data path between USB and storage, and also offloads this functionality from the main processor. The West Bridge Turbo-MTP implementation provides a significant improvement in performance by bringing the values of West Bridge to MTP.

Figure 2. MTP Transfers without Turbo-MTP

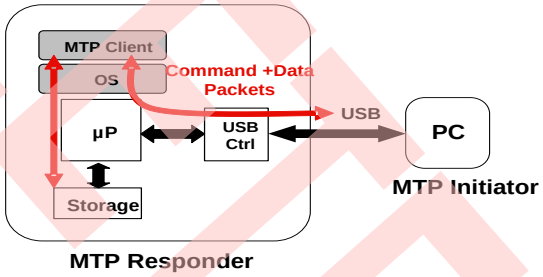
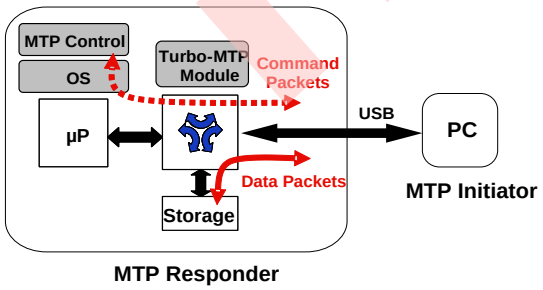


Figure 3. MTP Transfers with Turbo-MTP



Performance Benchmarking

Table 1 shows a comparison of the performance achieved with and without Turbo-MTP enabled.

Table 1. Performance Benchmarking with Turbo-MTP *

Platform	Write Time (sec.)	Read Time (sec.)	Write Perf. (MBps)	Read Perf. (MBps)
Nokia N97	265.8	243.9	3.8	4.2
Blackberry Storm 2	192.3	176.4	5.3	5.8
Turbo MTP	98.6	91.7	10.4	11.2

** Transfer of 1 GB single file*

Turbo-MTP APIs

Cypress provides a Software Development Kit (SDK) specific to West Bridge. This SDK consists of P-port API commands that are used to interface with West Bridge and access its features. The SDK contains firmware that is executed by the West Bridge device.

P-port APIs specific to Turbo-MTP is provided with the West Bridge SDK for Turbo-MTP enabled West Bridge devices.

Specifically, the Turbo-MTP APIs allow high speed handling of MTP SendObject and GetObject operations. This is done by the processor transferring a Block Table to West Bridge, which contains the physical block addresses on the SD card needed to be read or written.

During the handling of a Turbo-MTP operation, the processor only periodically needs to send a new Block Table to West Bridge when requested.

For example, during a file transfer from the USB host to a SD card, the host issues a SendObject command. The processor interprets the command, allocates data blocks in the file system, updates FAT pointers and other file system information, and then transfers the table of allocated blocks to West Bridge. West Bridge then receives the data phase from the USB host and writes the data packets to the SD card, to the specifc block addresses already provided by the processor.

Additional Resources

- Integrating West Bridge® Astoria™ with Android
- Integrating West Bridge® Astoria™ with Symbian
- Integrating West Bridge® Astoria™ with WinCE 6.0
- West Bridge® Astoria™ Datasheet
- West Bridge® Antioch™ Datasheet

Summary

Turbo-MTP is a West Bridge specific implementation of MTP, which provides significant performance improvements over the traditional MTP implementation. As listed in Table 1, the performance achieved with Turbo-MTP is a significant improvement over traditional MTP implementations. West Bridge Turbo-MTP enables a portable media device to achieve sideloading performance similar to a Mass Storage Class device, while gaining the full benefits of MTP.

Document History

Document Title: AN48864 - Optimizing Performance Using West Bridge® Controllers with Turbo-MTP

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Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	2606895	OSG/PYRS	11/24/2008	New Application Note.
*A	3187242	ANOP	03/03/2011	Replaced “West Bridge® Antioch™ SDK Version 1.3.1” with “West Bridge® Antioch™ SDK Version 1.3.2” in Software Versions in page 1. Added Additional Resources.
*B	3374209	DBIR	09/16/2011	Updated Additional Resources: Updated links only.
*C	4556234	DBIR	10/30/2014	Updated to new template. Completing Sunset Review.
*D	5882382	AESATMP8	09/13/2017	Updated logo and Copyright.
*E	5981403	RAJV	12/01/2017	Obsolete document. Completing Sunset Review.

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