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Solution Guide

Building Tomorrow's Enterprise Platforms Today

INSIDE

XILINX®

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Solution Guide

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Xilinx Programmable Solutions for Storage Area Networks

At Xilinx, we understand the challenges that system architects and designers are facing in developing new products for storage area networks (SAN). With many standards for connectivity, application interfaces, security, and data management, you are left with difficult challenges when designing solutions, especially with increasing time-to-market pressures.

By offering solutions that are prevalent throughout the SAN ecosystem, our goal is to assist you with drop-in standards-compliant building blocks that will solve your system-level design issues. The Xilinx® corporate philosophy is to help you bring cost-effective solutions to market faster, while helping you differentiate your product from the competition.

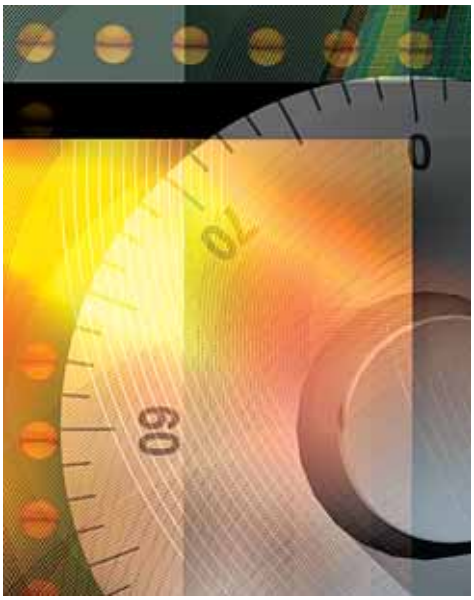
Xilinx has always played a critical role in the development of SAN infrastructure products such as hubs, switches, RAID arrays, and storage appliances used in data compression, encryption, and virtualization. This guide is the first in a series from Xilinx covering SAN-specific IP and reference design guides, application notes, and solutions for storage applications and data security and management. The distinction between pure storage and network storage is also blurring; Xilinx can help you bridge the gap with our experience in data communication networks.

We hope that you will find this series valuable and welcome any feedback on topics or solutions that you would like to see. For access to all of the latest information on Xilinx programmable logic devices, visit *www.xilinx.com/xcell/storage1/*.

Sandeep Vij
Vice President
Worldwide Marketing

Why You Should Use FPGAs in Data Security

Xilinx is an ideal platform for data security applications.



Abstract:
Data security is fast becoming a requirement in communications and enterprise infrastructures. Secure electronic commerce is almost doubling every year. New regulations are mandating the retention and protection of ever more information (Sarbanes-Oxley, HIPAA). Legal liability is dramatically escalating for those who manage such data carelessly. And finally, the value of data as a corporate asset itself is growing in such forms as fully electronic product designs, customer databases, and supply-chain management systems. All of these trends make data security a mandatory element in almost any new system architecture.

But the implementation of data security faces a number of serious challenges:

- Performance requirements vary widely
- System cost pressures remain high
- Standards vary widely and are continuously evolving
- Management becomes an integral aspect of data security

In this article, I'll review the implementation options for data security and compare the relative merits of software, ASICs, ASSPs, and FPGAs with regard to NRE, performance, cost, customization, scalability, device availability, tamper resistance, and reprogrammability. Through this analysis, you will learn how to exploit FPGAs and develop unique, competitive, and compelling solutions that differentiate you from your competition.

Integrating Security Services into Network Equipment

Using Sensory Networks' NodalCore technology, Virtex-4 FPGAs can solve the design challenge of integrating high-performance security acceleration to cope with continually evolving network threats.

Abstract:
In today's network environment, security threats are everywhere – from Web- and e-mail-borne viruses and worms to productivity-hampering spam and spyware to malicious break-in attempts. Security functionality in network equipment is no longer "nice to have" – it is now a fundamental design requirement.

However, the processing power required to handle network traffic growth is simply not available in traditional security appliances built from standard PCs. Although NPUs are very good at processing packets, they break down when scanning content across multiple packets. ASIC-based security appliances are expensive, have long lead times, and are high risk. Furthermore, they are not adaptable to changing threat environments and cannot be upgraded with new performance enhancements and features.

A modern network security appliance must be an adaptable platform, with the ability to:

- Accelerate deep packet inspection
- Adapt to new security applications
- Adapt to new security threats
- Adapt to new content types
- Deal with large databases

In this article, we'll present an FPGA-based solution that can scale to multi-gigabit throughput; support very large signature databases that can deal with today's and tomorrow's threat requirements; and that is extremely adaptable to new security threats.

Mining Data without Limits

FPGAs make high-throughput, low-latency data mining a reality.

Abstract:
Data mining extracts previously unknown information from data for organizations, allowing them to make better, more timely decisions based on hard intelligence versus intuition.

Most large businesses and government agencies use some form of data mining, from unstructured textual-based mining to complex and in-depth statistical analysis. To handle data-mining solutions for today's high-speed networks and multi-terabyte and petabyte data stores, a high-performance application using reconfigurable hardware that can search, analyze, filter, and transform structured and unstructured data on demand is necessary to meet customer requirements.

In this article, I'll review how Exegy has combined software with reconfigurable hardware based on Virtex™-II FPGAs to deliver a data-mining platform that performs at hardware processing speeds while retaining the flexibility of software. This approach allows Exegy to deliver appliances with high performance, a rich feature set, and scalability to meet the requirements for mining large quantities of stored or real-time data.

Enabling Enterprise-Wide Data Security

The Virtex family of FPGAs provides a flexible hardware architecture for Decru's storage security solutions.

Abstract:
The year 2005 was the tipping point when corporate and government IT managers recognized the need to secure sensitive data at rest, before their company became front-page news. The year 2006 will prove to be the year that enterprises address this problem. Gartner, a major industry research group, predicts that "by year-end 2006, failure to encrypt credit card numbers stored in a database will be considered legal negligence in civil cases of unauthorized disclosures."

This article describes the data security challenges encountered by a pure software or ASIC-based solution and how Decru (which makes DataFort storage security appliances) solved some of their design challenges with Xilinx® programmable logic technology. The DataFort appliances represent the first and only unified wire-speed encryption platform for securing stored data across the enterprise, with support for NAS, DAS, SAN, iSCSI, and tape backup environments.

Designing Reconfigurable Computing Solutions

The Virtex family of FPGAs is the foundation for Cray XD1 high-performance coprocessing solutions.

Abstract:
Reconfigurable computing (RC) architecture enables software logic that can be reconfigured or reprogrammed to implement specific functionalities on tunable hardware rather than on a general-purpose processor (GPP). RC can achieve orders-of-magnitude performance improvements in applications like encryption/decryption, the Smith-Waterman algorithm in bioinformatics applications, and complex vehicular traffic simulation, to name just a few.

With the Cray XD1 high-performance computer, RC has taken a major step forward by breaking down performance barriers at a substantially lower cost by using off-the-shelf components from Xilinx to solve difficult computational problems.

In this article, we'll describe what RC is, how it fits into the Cray, Inc. XD1 high-performance architecture, and why Cray selected Xilinx as the foundation for high-performance application acceleration.

FPGA-Based Solutions for Storage Area Networks

Xilinx FPGAs provide a solid foundation for value-add software.

Abstract:
Established companies and venture-funded startups are investing in software services for storage area network (SAN) infrastructure products such as fabric switches, protocol converters, multi-protocol switches and routers, data encryption and compression appliances, and storage and server virtualization products. FPGAs reduce costs, increase design flexibility and scalability, and offer an extremely compelling choice compared to ASICs and network processor-based products. Solutions that require deep data inspection, such as security and storage appliances, firewalls, XML processors, and Web-load balancers are an ideal choice for FPGAs.

The ideas covered in this article will illustrate how product developers can implement cost-effective solutions with FPGAs to reduce time-to-market requirements and stay ahead of the competition, while keeping total cost of development (TCD) within budget.

Coprocessing Solutions for Delivering Storage Services Over Distance

Virtex FPGAs enable a services-based architecture for delivering secure file solutions over distance.

Abstract:
Initially, storage area networks (SANs) have enabled enterprises to consolidate servers and storage, centralize backups, and implement a tiered storage model for data replication and disaster recovery within the data center. SANs are evolving into service area networks, providing geographically dispersed remote file and database access, mirroring and replication for disaster recovery, and truly centralized backups.

In this article, I'll cover solutions that can be enabled by reconfigurable programmable logic in SANs, highlighting file services for remote offices often referred to as wide area data services/wide area file services (WADS/WAFS). As an example, I'll describe how you can implement data security as a coprocessing solution in an x86-based appliance.

By offering proven Ethernet and Fibre Channel IP cores, as well as third-party encryption, compression, and network security solutions, Xilinx and its partners allow developers with flexible multi-protocol IP cores to reduce time-to-market delays and high NRE costs associated with ASIC-based solutions.

Xilinx in Enclosure Management

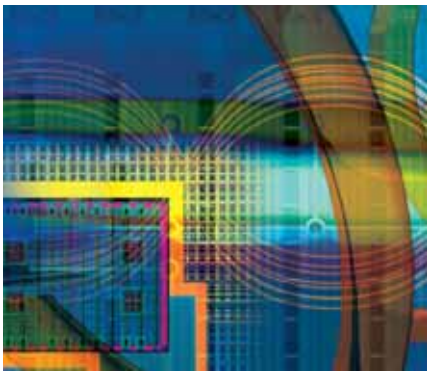
Flexible high-integration solutions for iKVM applications.

Abstract:
Remote operation of a platform's keyboard, video, and mouse (known as KVM) is the foundation for many system management architectures. This approach first gained popularity through the physical connection of all of these signals (for several to many computers) to a single command console through a KVM switch.

More recently, network-attached KVM (iKVM) has emerged, allowing the KVM subsystem to be directly integrated and the management architecture to easily support very large device populations.

In this article, I'll explain the classic approach to network KVM and introduce the Xilinx/Silicon Spectrum iKVM platform. This highly integrated solution is shown to reduce bill of materials complexity, save PCB real estate, and enable state-of-the-art management capabilities in a way that is extremely compatible with today's x86 software and driver environment. I'll also examine the unique capabilities that this platform could support for virtualized environments.

Virtex-II Pro FPGAs Enable 10 Gb iSCSI/TCP Offload



The Ipsil FlowStack enables 10 Gbps TOE solutions using a very small footprint.

Abstract:
Enterprise data-center connectivity solutions have evolved over the years from direct attach storage (DAS) solutions (such as SCSI) to switch-based architectures (like Fibre Channel [FC]) that can encapsulate SCSI/IP or FICON protocols as well as Ethernet-based file servers like Network File System (NFS). With the growth of 10 Gbps Ethernet as the network backbone, iSCSI is now becoming a viable enterprise-caliber data connectivity solution.

This article discusses the current technical challenges of pure software and ASIC-based iSCSI implementations and how Xilinx-based programmable solutions can address these challenges. To demonstrate that you can achieve high performance, low cost, and market adaptability to evolving requirements, Xilinx and Ipsil Corporation jointly developed a 10 Gbps iSCSI TCP Offload Engine (TOE) solution with readily available technology that you can implement on host or target-based systems.

Fibre Channel Solutions from Xilinx

Using the Virtex family and Xilinx Fibre Channel IP, you can build a complete FC solution running as fast as 4 Gbps.

Abstract:
The Fibre Channel (FC) standard enabled IT managers to scale compute and storage needs independently. Unlike protocols used for direct attach like SCSI, FC's switch-based architecture has enabled it to become a major player in the data center. The advantages of FC are its high speed and low latency. Xilinx technology has been used in the development of hubs, switches, and high-end enterprise storage arrays.

In this article, I'll summarize FC protocol and discuss Xilinx FC IP core solutions for Virtex-II Pro and Virtex-4 FX devices. The Xilinx Fibre Channel solution includes both a point-to-point FC and FC arbitrated loop (FC-AL) core. The point-to-point core is designed to support any point-to-point or fabric topology over a broad range of operating speeds. Support for port speeds ranging from 1 and 2 Gbps in Virtex-II Pro FPGAs to as fast as 4 Gbps in Virtex-4 FX FPGAs facilitates storage network port consolidation and aggregation and provides a migration path to each successive throughput level. The FC-AL core supports backward compatibility with legacy high-density enclosure environments.

Utilizing Virtex-4 FPGA-Immersed IP for Hardware Acceleration for RAID 6 Parity Generation/Data Recovery

FPGAs and immersed IP blocks increase data reliability and availability in storage systems.

Abstract:
A redundant array of independent disks (RAID) is a hard disk drive (HDD) array where part of the physical storage capacity stores redundant information. This information can be used to regenerate data if there is a failure in one or more of the arrays' member disks (including a single lost sector of a disk) or in the access path to the member disk.

There are many different levels of RAID. The implemented RAID level depends on several factors, including overhead of reading and writing data, overhead of storing and maintaining parity, plus the mean time to data loss (MTDL). The most recent level is RAID 6, which can have two implementations (Reed-Solomon P+Q or Double Parity). RAID 6 is the first RAID level that allows the simultaneous loss of two disks, which improves its MTDL over RAID 5.

This article summarizes a Xilinx reference design for RAID 6, illustrating the advantages of embedded hard-core blocks of the Virtex-4 architecture, including block select RAMs, the PowerPC™ PPC405, and DSP48 blocks. Our hardware acceleration block supports Reed-Solomon RAID 6 and can support other RAID levels when coupled with appropriate firmware.

READY! SET! GO WITH PLANAHEAD PERFORMANCE!

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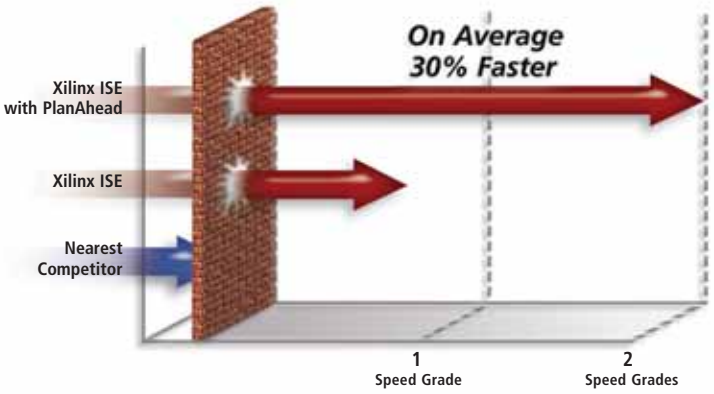

Based on benchmark data from a suite of 15 real-world customer designs targeting Xilinx and competing FPGA Solutions.

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With our unique PlanAhead software tool, and our industry-leading Virtex-4 FPGAs, designers can now achieve a new level of performance. For complex, high-utilization, multi-clock designs, no other competing FPGA comes close to the Virtex-4 PlanAhead advantage:

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* CMP: June 2005 FPGA EDA Survey

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"Solutions that require deep data inspection, such as security and storage appliances, firewalls, XML processors, and Web-load balancers are an ideal choice for FPGAs."

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