

NAS100/101, NAS200/201, NAS400/401, and NAS800/801 Network Attached Storage (NAS) Server Controllers

1 Introduction to Networked Attached Storage Server Controllers

The four NAS device families are system-on-a-chip (SoC) network attached storage (NAS) and media server controller devices that enable low-cost, easy-to-use NAS and digital media server (DMS) devices for home and small- and medium-sized business (SMB) markets. The four NAS device families are differentiated by the number of SATA ports and support for AES.

These devices feature high-performance network interfaces: Gigabit Ethernet (GbE) and universal serial bus (USB) 2.0, low overhead media archive protection via streaming redundant array of inexpensive disks (RAID), session-aware traffic manager enabling high-performance media streaming, and hardware acceleration for upper-layer protocols. They also include an ARM926EJ-S[®] core for control processing.

In addition, the NASn00 device features an advanced encryption standard (AES) encryption and decryption engine for secured data storage and applications such as digital rights management (DRM). The software included in NASn00/NASn01-based systems supports both NAS and Digital Living Network Alliance (DLNASM) applications and also enables third-party developers to provide turnkey solutions.

Table 1. NAS Device Family Matrix

Device ID	SATA Level 1 Ports	AES	DDR2 Interface(s)	
			Single	Dual
NAS100	1	yes	√	—
NAS101	1	no	√	—
NAS200	2	yes	√	—
NAS201	2	no	√	—
NAS400	4	yes	—	√
NAS401	4	no	—	√
NAS800	8	yes	—	√
NAS801	8	no	—	√

Table 2. NASn00/NASn01 Main Features and Applications

Features
<ul style="list-style-type: none"> ■ High-performance network interfaces including GbE and USB 2.0. ■ Hardware RAID4 and RAID5 with in-line parity protection. ■ Hardware acceleration for Layers 2, 3, and 4 protocol processing. ■ High-performance streaming enabled by session-aware traffic manager. ■ Four independent point-to-point, high-speed serial advanced technology attachment (SATA) interfaces. ■ DDR2 memory interface and general-purpose input/output (GPIO) interface. ■ Hardware AES encryption/decryption engine for security and DRM applications (NASn00 only). Three key sizes and several configurable modes of operation are supported. ■ Included <i>Linux</i>[®] based software stack supports both NAS and <i>DLNA</i> applications. ■ Software features include support for various industry-standard protocols such as universal plug-n-play (<i>UPnP</i>[™]), <i>DLNA</i>, server message block/common internet file system (SAMBA/CIFS), file transfer protocol/hypertext transfer protocol (FTP/HTTP) file streaming, etc. ■ Supports <i>Microsoft Windows</i>[®] and <i>Linux/UNIX</i>[®] operating system (OS) clients.
Applications
<ul style="list-style-type: none"> ■ NAS file server. ■ NAS encrypted file server. ■ NAS storage expansion/backup via USB. ■ Home DMS products. ■ Multiuser personal video recorder (PVR).

2 Features

2.1 General Features

- High-performance network interfaces [integrated GbE media access control (MAC) and USB transceiver macrocell interface + (UTMI+™) level 3 low pin interface (ULPI™) USB 2.0] to enable multiuser, multimedia concurrent streaming sessions to network attached storage.
- ULPI USB 2.0 interface supports USB wireless local area network (WLAN), USB hub, and peripheral devices such as cameras, card readers, and printers.
- Embedded ARM926EJ-S processor core provides control to all internal device functions, as well as an external I/O bus for control of discrete devices.
- Low overhead media archive protection via streaming RAID1, RAID4, and RAID5. RAID0 and individual disk access (IDA) are also supported.
- One, two, four, or eight independent point-to-point, high-speed SATA Level 1 interfaces supporting up to eight hard disk drives (HDDs) including transport controllers, link controllers, and serializer-deserializer (SerDes) I/O.
- Hardware acceleration for Layers 2, 3, and 4 protocol processing including Ethernet, IP, TCP, user datagram protocol (UDP), and real-time transport protocol (RTP).
- Extensive embedded support for media session aware streaming.
- SoC enables reduction in total cost (area, power, and devices) of network attached storage and media server platforms.

2.2 Hardware RAID4 and RAID5

- RAID4 and RAID5 supported across two, four, or eight HDDs.
- Automatic failover to degraded mode.
- In-line parity protection for streaming media-object protection with a single failed HDD.
- Support for RAID migration (archive expansion).

2.3 USB 2.0 Interface

- Provides a USB 2.0-based peripheral expansion support for connectivity to a WLAN, USB hub, or a media-reader peripheral(s).
- USB interface supports high speed (480 Mbits/s), full speed (12 Mbits/s), and low speed (1.5 Mbits/s).
- ULPI level 3.
- Support for USB 2.0 host and peripheral mode.

2.4 Digital Rights Management (DRM) Features in the NASn00

- Direct memory access (DMA) engine.
- AES encryption/decryption engine.
- 128-byte nonvolatile memory for key storage.
- 8 kbyte data RAM.
- Operational modes supported:
 - Electronic code book (ECB).
 - Cipher block chaining (CBC).
 - Cipher feedback (CFB).
 - Counter (CTR).
 - Output feedback (OFB).
- Supports 128-bit, 192-bit, and 256-bit key sizes.

2.5 Session-Aware Traffic Manager

- Enables high-performance streaming (up to eight concurrent high-definition streams).
- Allocates resources (network, memory, and HDD) according to session type and whether the bandwidth is guaranteed or best effort.
- Adjusts resources based on application activity, enabling high-speed bursts for multi-PC backups, and guaranteed bandwidth for latency-sensitive media sessions.

2.6 Two Software Releases (Generic NAS and Media Server)

- Both software releases offer:
 - Support for *Linux*.
 - Support for USB 2.0.
 - Protection of application and media archive with RAID1, RAID4, and RAID5.
- Generic NAS:
 - The generic NAS solution provides basic functionality required for network attached storage with streaming optimized drivers and applications including FTP, HTTP, SAMBA, and internet small computer system interface (iSCSI).
- Media server software adds the following functions:
 - Dedicated media file system optimized for video and audio storage, retrieval, and streaming.
 - Support for open control protocols: *UPnP* and *DLNA*-based control.

2.7 Physical Design

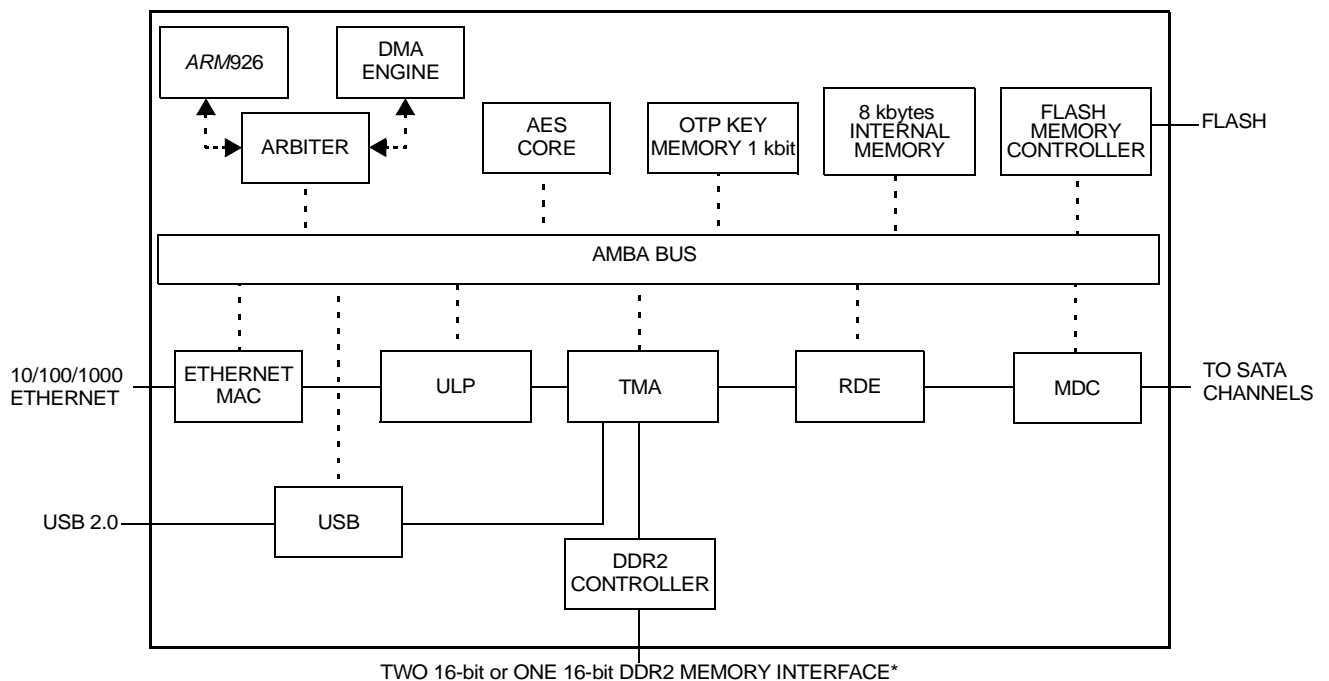
- PBGA packaging (available in a lead-free package):
 - NAS800/801 available in a 524-ball PBGA.
 - NAS400/401 available in a 390-ball PBGA.
 - NAS200/201 available in a 0-ball PBGA.
 - NAS100/101 available in a 0-ball PBGA.
- 3.3 V (I/O), 1.8 V (DDR2), and 1.2 V (SATA + device core) power supplies.

3 Functional Description

Agere Systems' NASn00/NASn01 is a DMS SoC device that manages digital media storage. It also manages serving from a digital media archive onto a network to a DMP appliance. The NASn00/NASn01 enables wired or wireless network interfaces through either a 10/100/1000 Ethernet port (which may be directly attached to a router) or a USB 2.0 port attached to a USB-based WLAN adapter or USB hub.

Figure 1 is a block diagram of the NASn00/NASn01. The NASn00/NASn01 enables concurrent users to share a digital media archive for access to multiple types of media (audio, video, image). The result is a high-performance DMS SoC that can accommodate many concurrent media sessions including several high-definition video streams.

Besides serving media, the NASn00/NASn01 enables the DMS appliance to protect media from data-loss because of a single HDD failure. The user never loses access to streaming media because of a single HDD failure with enhanced-streaming RAID.



*NAS100/NAS101 and NAS200/201 only have one 16-bit DDR2 memory interface.

Figure 1. NASn00/NASn01 Block Diagram

4 Overview of NASn00/NASn01 Architecture

NASn00/NASn01 provides an extensive software architecture based on embedded *Linux* (*MontaVista Linux*, an open-source, royalty-free embedded OS with real-time functionality) and integrated third-party middleware for management of both streaming and RAID applications, network service discovery and advertisement, as well as open protocols based on *UPnP* (www.upnp.org) and *DLNA* (www.dlna.org) services for content directory, connection management, and AV streaming.

The two software stacks offered are NAS and *DLNA*. Figure 2 shows a general-purpose NAS software stack that provides HTTP, FTP, SAMBA, and iSCSI applications. These are the basic building blocks for a small-office NAS application as well as a starting point for a non-*DLNA* HMS application. Figure 3 shows the software stack including support for *DLNA* applications and a base to support a turnkey *Digital 5™ DLNA DMS* application suite.

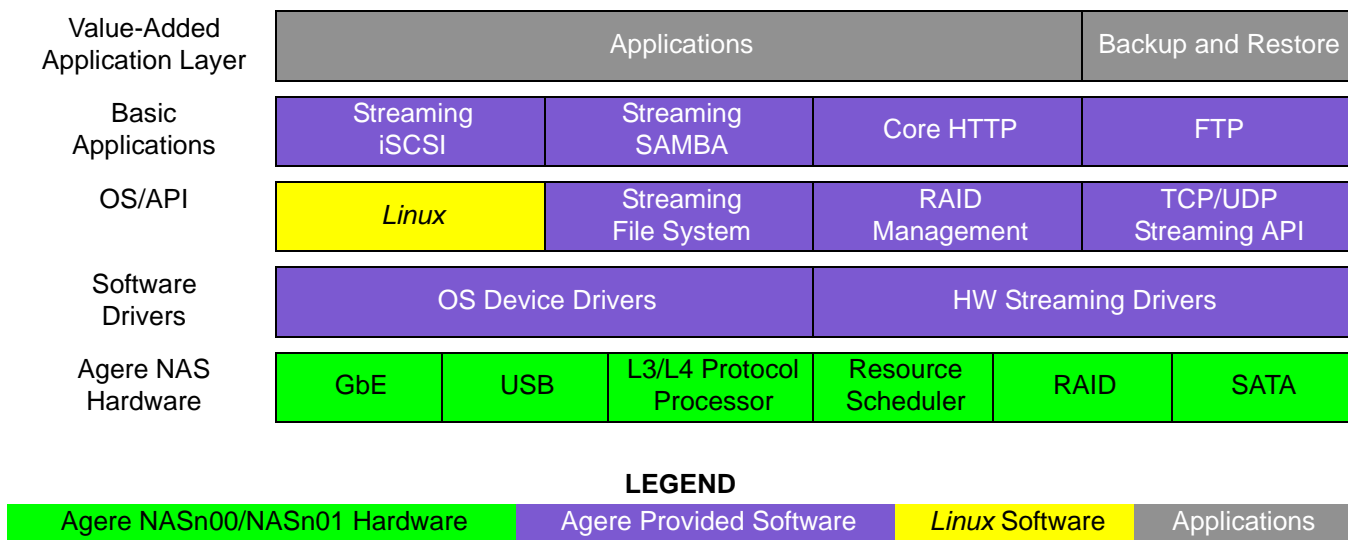


Figure 2. NASn00/NASn01 Architecture Summary

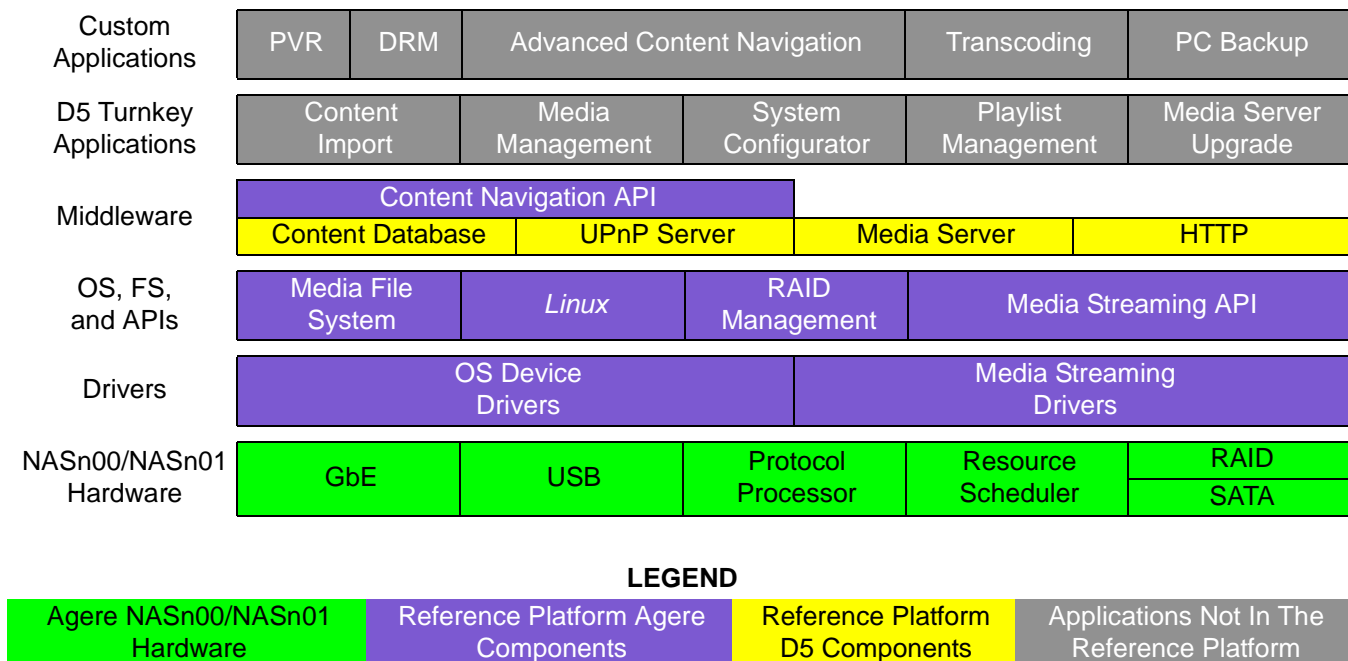


Figure 3. NASn00/NASn01 Media Server Software Hierarchy

5 NASn00/NASn01 Media Server and NAS Applications

The NASn00/NASn01 offers features and capabilities valued for residential use as well as SMB use. This section describes several applications including home media server (HMS), wireless NAS, SATA-based CD-RW NAS, and USB HDD file transfer.

5.1 Home Network Attached Storage (Wired or Wireless)

Figure 4 shows a wired home network where a home router connects several digital media clients (PCs, TVs with network capabilities, digital video recorders [DVRs], PVRs) to a home gateway as well as an HMS using the NASn00/NASn01 device. The HMS provides global storage.

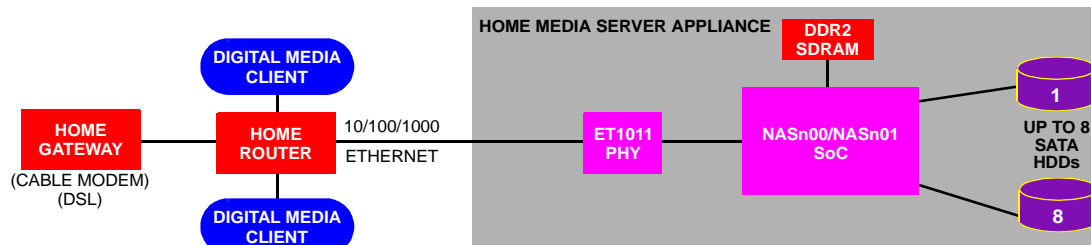


Figure 4. Network Attached Home Media Server Appliance

The wireless home network attached storage appliance shown in Figure 5 uses an 802.11a/b/g wireless module for connection to the wireless home network. An optional Ethernet interface using Agere's ET1011 10/100/1000 PHY device allows connection to a typical wired home network.

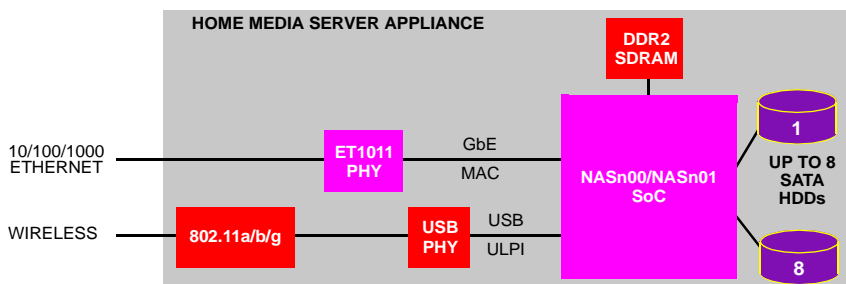


Figure 5. Wireless Network Attached Home Media Server Appliance

Figure 6 shows an example implementation of a wireless-capable NAS appliance with four HDD capability. NASn00/NASn01 is mounted on the control module, and the ARM core provides all command and control for the appliance. A hardwired backplane connects the control module to the HDD bays and plug-in USB wireless LAN card. The wireless LAN card can be included with the appliance or purchased separately, which could lower the base cost of the appliance. For wired home networks, the GbE interface connects the appliance to the network.

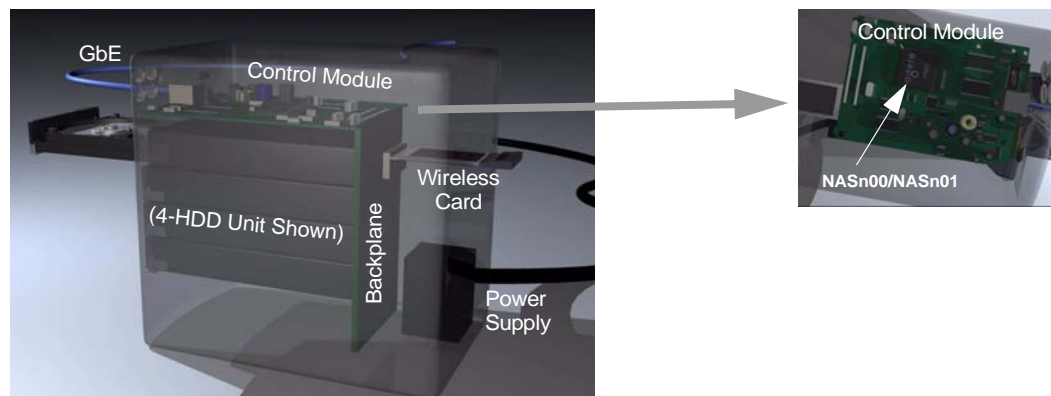


Figure 6. Four HDD NASn00/NASn01 Appliance

5 NASn00/NASn01 Media Server and NAS Applications (continued)

5.2 File Transfer Using Portable USB HDD

Media can be shared between networks using a portable USB HDD or FLASH drive as shown in Figure 7. Media can be read from the HDD or FLASH drive and stored on the NASn00/NASn01 controlled RAID5 HDDs and vice versa. Other media devices could be connected to the USB port to download files from the RAID5 HDD array.

The RAID5 array configuration does not include dedicated USB port(s).

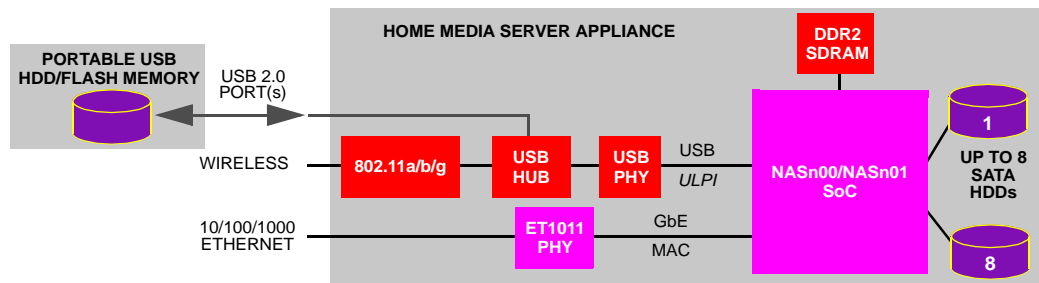


Figure 7. NASn00/NASn01 NAS Appliance File Transfer with Portable USB HDD/FLASH Memory

5.3 Home Network Attached Storage Appliance with SATA-Based CD-RW

The NASn00/NASn01 appliance could be configured to allow one or more SATA-based compact disk-rewritables (CD-RWs) connected to NASn00/NASn01. The RAID5 array configuration does not include the dedicated port or ports for the CD-RW device. Figure 8 shows an NASn00/NASn01 appliance with one dedicated SATA port for SATA CD-RW.

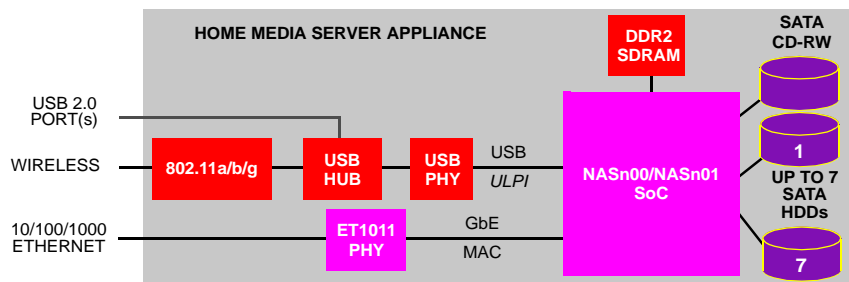


Figure 8. NASn00/NASn01 Appliance with SATA-Based CD-RW Option

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