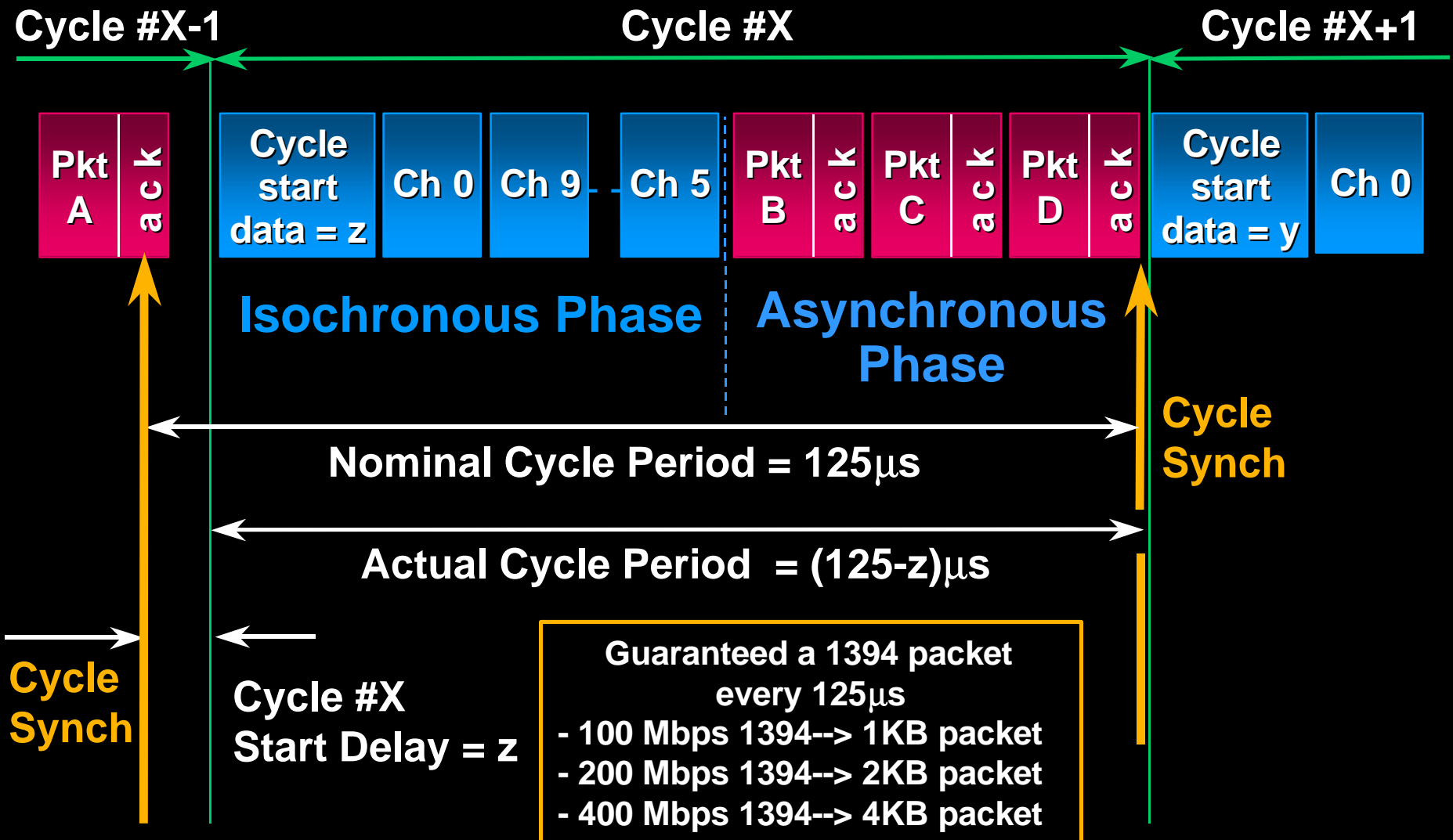# *TI-1394 Camera CaseStudy*

Randall Lawson
Sandhya Seshadri
Texas Instruments

Abstract

- Brief overview of IEEE-1394 Camera including:

  - Bandwidth (100, 200, and 400 Mbps)
  - Isochronous support for real-time data
  - Auto-configuration (Plug-N-Play: no switch settings)
  - Consumer-grade cable and connector
  - Hot plugging
  - Low-cost solution
  - etc...
- * Design of the 1394 digital camera (block diagram).
- * Design of the 1394-PCI interface card (block diagram).
- * Software design for Win '95, WIn '98, NT 4.0, NT 5.0).
- * Why a 1394 digital desktop camera is technically superior to the
- current analog cameras.
- * Why a 1394 digital desktop camera solution is less expensive than the
- current analog camera solutions.
- * Major support for 1394 enabled PCs and cameras

1394 Isochronous Cycle
Packet Timing and Bus Bandwidth

Cycle #X-1   **Cycle #X**   **Cycle #X+1**

| Pkt A | ack | Cycle start data = z | Ch 0 | Ch 9 | Ch 5 | Pkt B | ack | Pkt C | ack | Pkt D | ack | Cycle start data = y | Ch 0 |

Isochronous Phase   **Asynchronous Phase**

Cycle Synch

Nominal Cycle Period = 125μs

Actual Cycle Period = (125-z)μs

Cycle Synch

Cycle #X Start Delay = z

Guaranteed a 1394 packet every 125μs
- 100 Mbps 1394--> 1KB packet
- 200 Mbps 1394--> 2KB packet
- 400 Mbps 1394--> 4KB packet

Architecting Flexible Peripherals
For Low Cost and High Performance

- Internal Timing, 125 μs is Key

  - Optimizing New Peripheral Designs With 1394 Capability

- "The Digital Pipe"

  - Guaranteed 1394 Bandwidth Every 125μs

- No Buffering Required

  - Direct Digital Access to 1394 Bus

Architecting Flexible Peripherals
For Low Cost and High Performance

◆ Using the 1394 Bus as RAM

 ■ Substitute RAM With 1394 Isochronous Data Transfer Capability

◆ 1394 Flexibility for Cost and Performance Considerations

 ■ Match 1394 Bus Speed With Desired Peripheral Performance
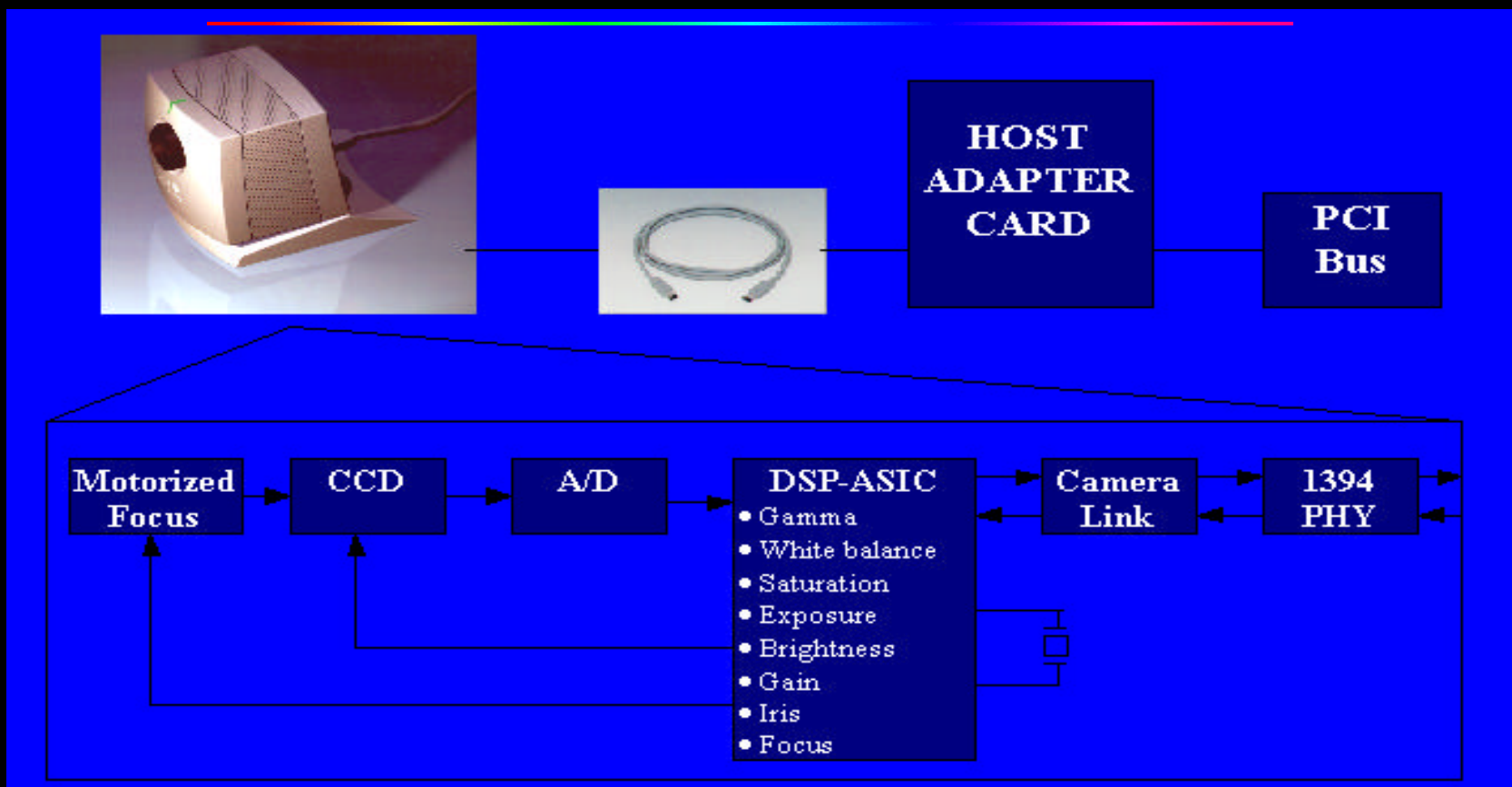
 ■ 100, 200, 400 Mbps availability

1394 Camera Features

- Video Formats:
  640 x 480,   320 x 240,   160 x 120

- Data Transfer Modes :
  24bit YUV 4:4:4,   YUV 4:2:2,   YUV 4:1:1,   RGB -

- Max Color Resolution 640 x 480, 24 bit RGB
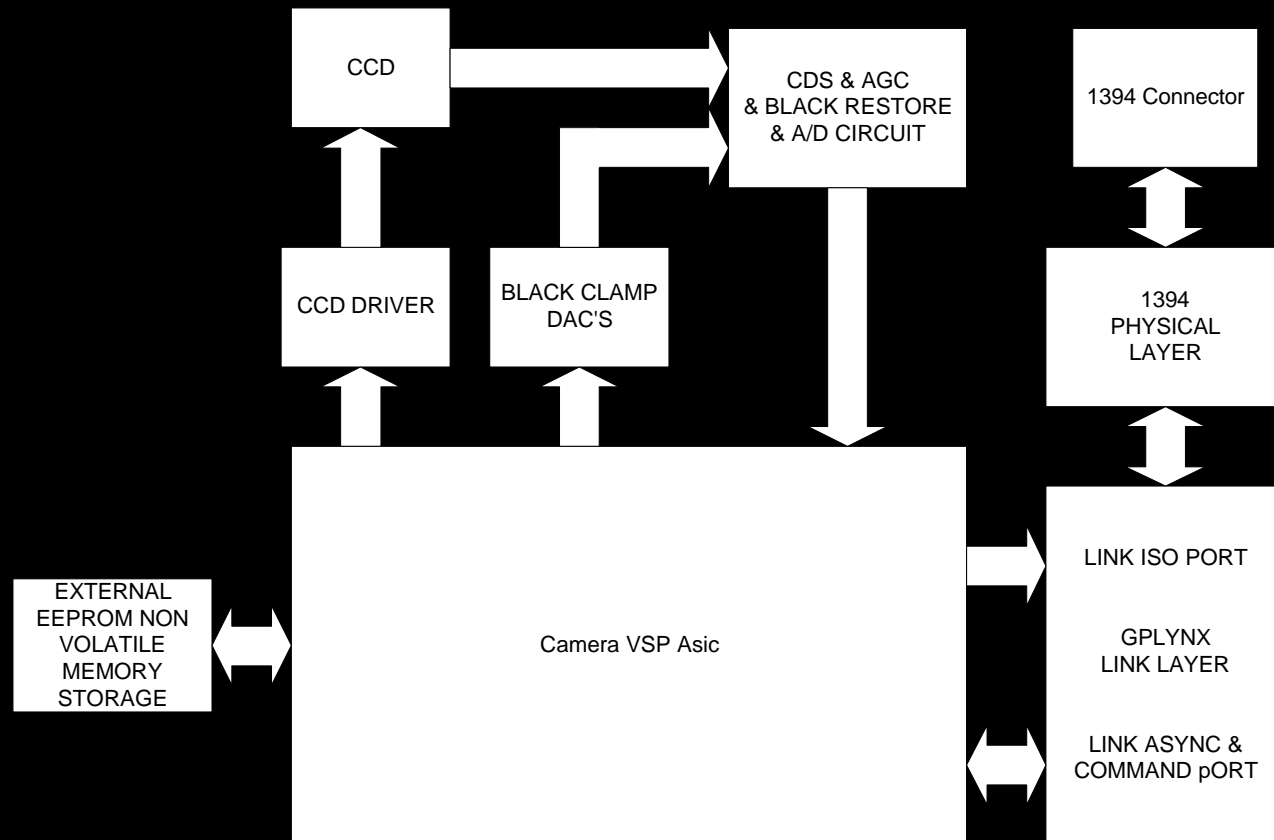
- Digital Video, Complying to 1394TA Spec

1394 Camera Features

- Scan Rate: 30 , 15, 7.5, 3.75   FPS
- Power Supplies: Provided by 1394 Cable
- Focusing by PC with Zero Idle Current
- Lens: 57° Angle of View, with Fixed Iris f2.0
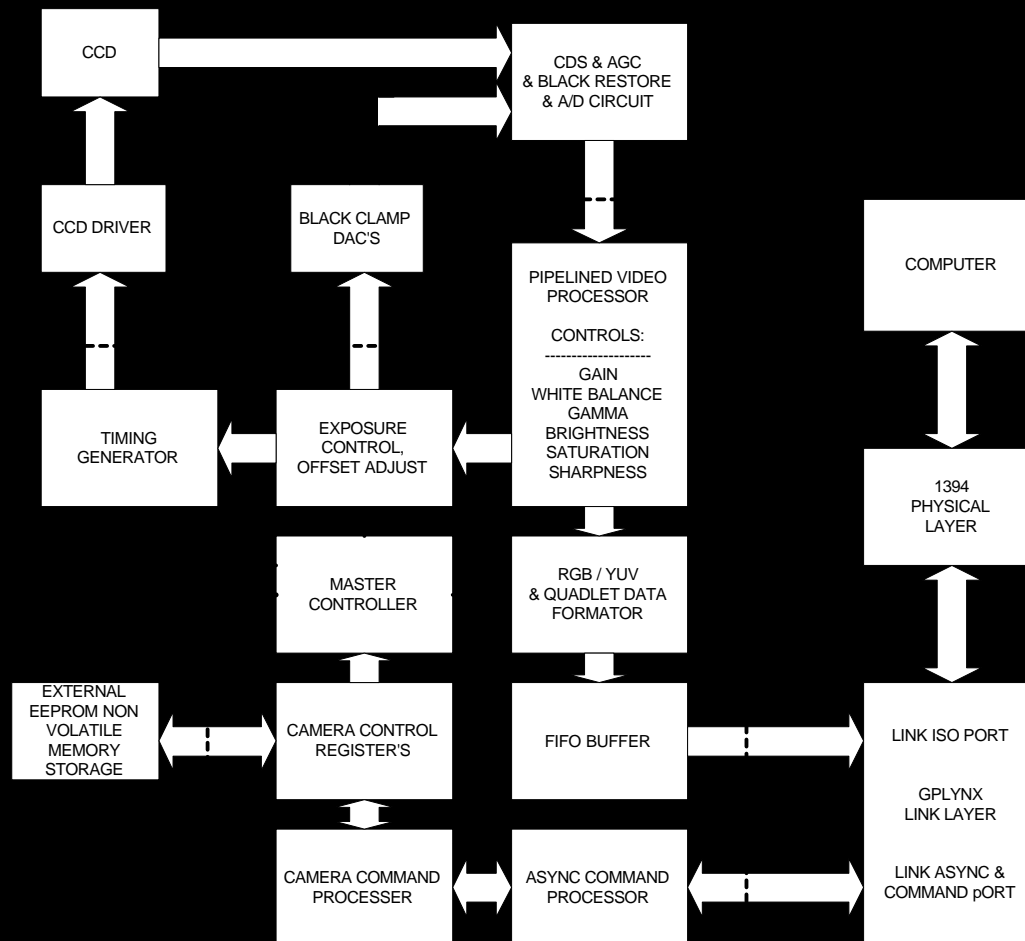- All Camera Features, Controllable by PC

Connection Diagram

Camera Chip Set Block Diagram

Detailed Block Diagram

PC Controlled Focus System

- Stepper Motor Driven
- Light Weight
- Low Cost
- Close Focus through Infinity
- Software Controlled
- Zero Idle Current Drain
- Address Driven Control

Software Support

- Microsoft® Windows®95
  - ◆ Video for Windows driver currently under development by both TI–DISP and TI–1394 groups
  - ◆ Demonstration software developed by TI–DISP
- Windows®NT™ 4.0
  - ◆ Video for Windows driver currently under development by TI–1394 groups

Software Support

- Microsoft® Memphis DDK Release
  - Driver support developed by Microsoft®.
  - Demonstrated via VidCap and NetMeeting™ under Memphis

Sources of Information

- ## Web Sites
  - www.ti.com/sc/1394
  - http://www.1394ta.org

- ## 1394 TImes™ Newsletter