



# I394b Features and Benefits

**June 2005**





# 1394a Key Features

- High bandwidth; 400 Mbps
- Deterministic; isochronous transfer
- Flexible dynamic topology
- Multiple device support
- Small connector and cable
- Power and data on same cable
- Standard industrial camera protocol

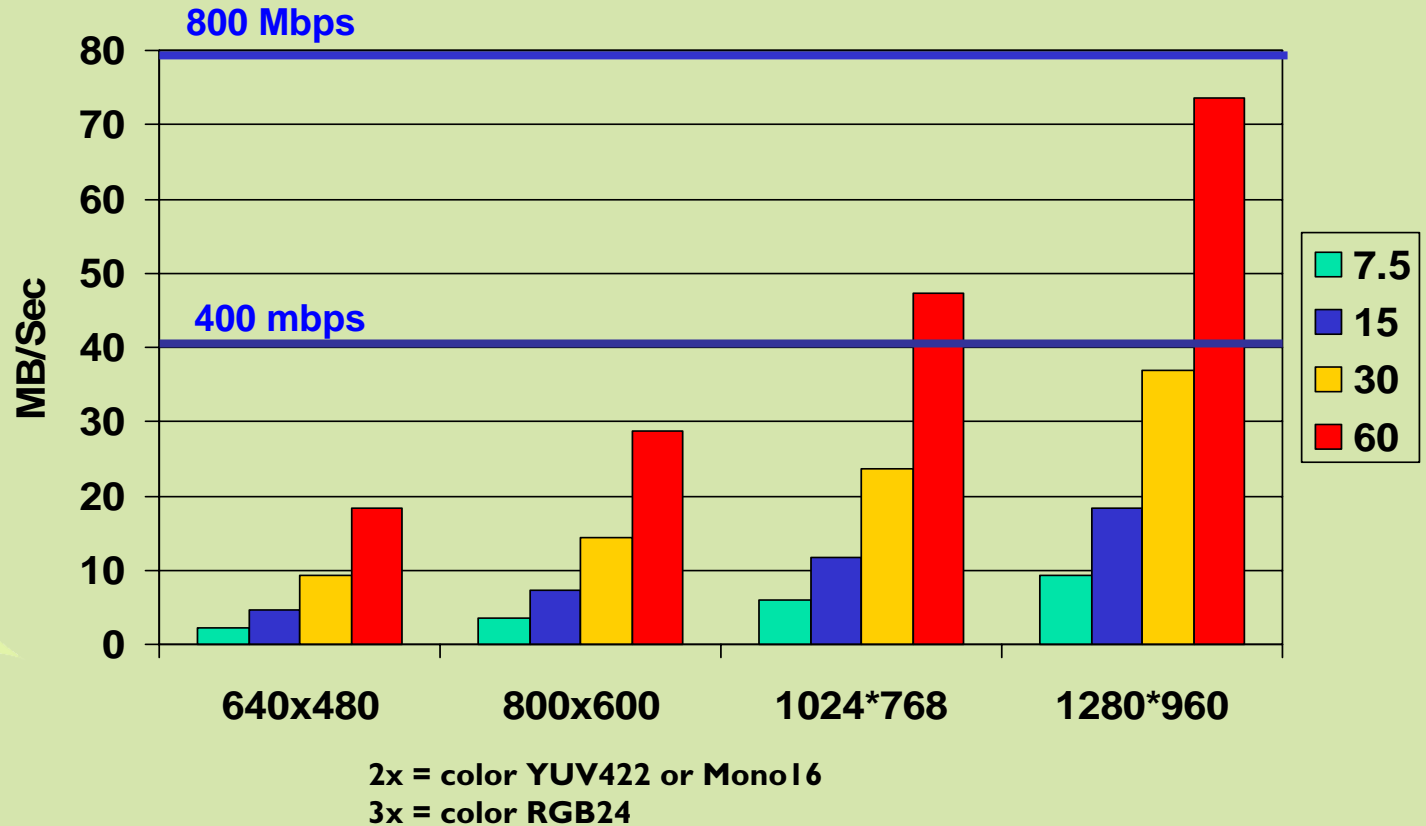


# I 394b New Features

- Higher bandwidth; 800 Mbps
- Better utilization of bandwidth
- All digital signaling
- More types of cables
- Longer cables
- New connectors
- Loops for redundant connections



# Camera Bandwidth at Mono8





# 800 Mbps Bandwidth

- 100 MB/sec data throughput
  - 1 Gbps raw throughput
  - Encoded with 8b/10b method
  - 800 Mbps data throughput
- 80 MB/sec ISO bandwidth
  - 80% of 100 MB/s at 8 bits/byte
- 64 MB/sec max ISO single packet
  - 8192 Byte max ISO packet size
  - 8000 cycles/sec



# Deterministic

- Isochronous transfer
  - Guaranteed Bandwidth
  - Time critical data (video, audio, ...)
  - One to All; broadcast
- Asynchronous transfer
  - Guaranteed Delivery
  - Content critical data (commands, files, ...)
  - One to One; confirmed messaging
- I394 employs both methods of data delivery



# I 394b Low Level Differences

- 8b/10b encoding on 1 pair
  - Frees second pair for arbitration; balanced
  - I 394a: data strobe encoding on 2 pair
- All digital signaling
  - Supports optical cables, longer cables
  - I 394a: voltage level to select speed
- Arbitration during data transmission with bus grant at end of transmission (BOSS)
  - More efficient use of bandwidth
  - I 394a: arbitration after transmission



# Cables Supported

	Length	100 Mbps	200 Mbps	400 Mbps	800 Mbps	1600 Mbps	3200 Mbps
STP (DS)	4.5 m	✓	✓	✓			
STP (Beta)	4.5 m			✓	✓	✓	✓
UTP (cat5)	100 m	✓					
POF	50 m	✓	✓	✓	✓	✓	
GOF	100 m			✓	✓	✓	✓



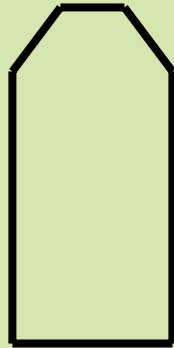


# Connectors

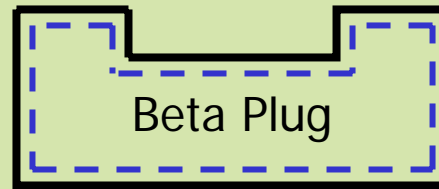
- I394a
  - 6 pin Standard; Latching; Shielded
  - 4 pin Standard (no power)
- I394b
  - 9 pin Standard; Jack screw
    - New: 2 pins for signal integrity
    - New: 1 pin for future use
    - 8mm x 5 mm
  - Beta or Bilingual connectors
    - Beta = only I394b signaling
    - Bilingual = I394a or b signaling



# About Sockets and Plugs

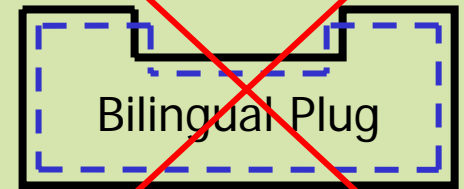


1394a  
6-pin



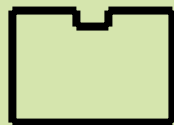
Beta Plug

Beta Socket

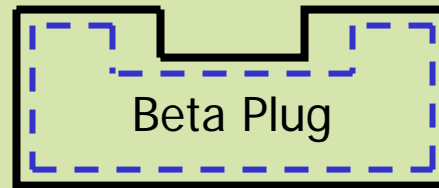


Bilingual Plug

Beta Socket

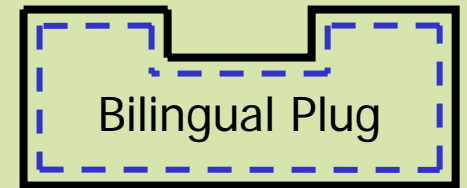


1394a  
4-pin



Beta Plug

Bilingual Socket



Bilingual Plug

Bilingual Socket



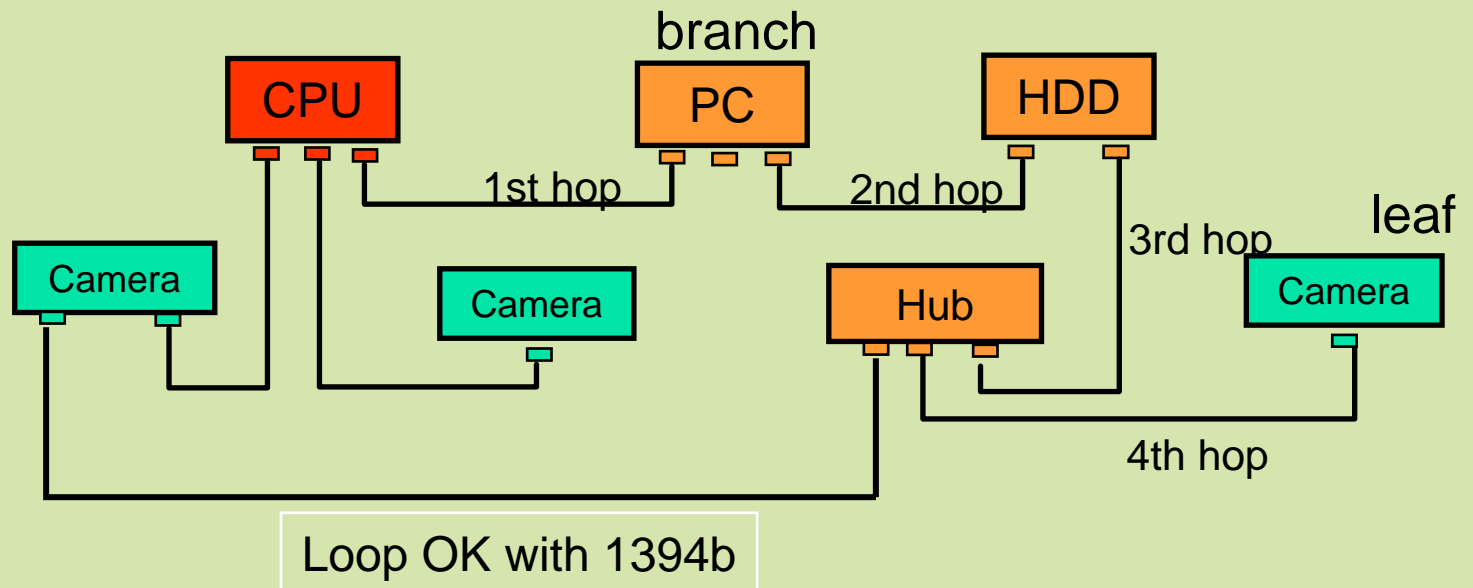
## 3 Cable Assemblies

- I 394a-6 pin Bilingual
- I 394a 4-pin Bilingual
- Bilingual Bilingual



# Flexible Topology

- Up to 63 devices in Tree, Star, or Daisy Chain
- Loops self heal in 1394b





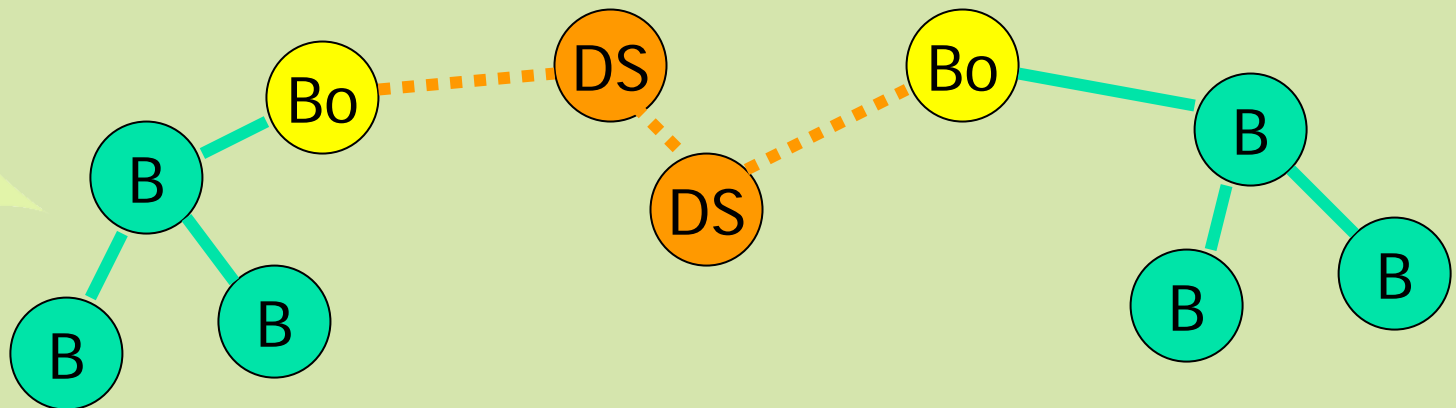
# Easy Configuration

- Hot pluggable
- Plug and Play
- Automatic reconfiguration
  - No switches or address
  - No need to reboot
- Loops healed in 1394b



# Mixing I394a & I394b

- I394a and I394b work on same bus
  - Border (Bo) nodes can link them together
- I394a devices slows whole network
- Recommend I394b on own bus





# 1394a and 1394b differences

	1394a	1394b
Speed (Mbps) future	100, 200, 400	100, 200, 400, 800, 1600, 3200
Encoding	Data Strobe 2 pair - unbalanced	8b / 10b 1 pair - balanced
Cable types	STP	STP, UTP, POF, GOF
Speed signaling	Voltage level	Digital
Connector	6 pin with power 4 pin no power	9 pin with power
Arbitration Packet gaps	Sequential Larger	Overlapped (BOSS) Very small



# Camera Interfaces

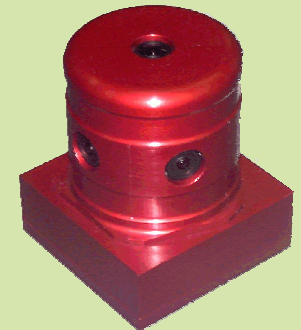
	1394a / b	USB1/2	Ethernet	CameraLink
Type	Network Peer-to-Peer	Network Master-Slave	Network Peer-to-Peer	Point-to-Point
Bandwidth (MB) future	10, 20, 40, 80 160, 320	1, 12, 40	1, 10, 100	255, 382, 680
Wires/cables	4/6 pin STP	4 pin STP	8 pin UTP	26 pin/cable 1 to 2 cables
Length cable with hubs	4.5m 72 m	5 m 30 m	100 m	10 m
Devices	63	127	?	1
Interfaces	Built-in, PCI, PCcard	Built-in, PCI, PCcard	Built-in, PCI, PCcard	PCI
Power	1.5a @ 8-30v	500ma @ 4.7v	None	None
Bus Sync Cams	Yes	No	No	No





# Point Grey 1394b Cameras

- Dragonfly Express
  - 640x480 at 200 fps (dual tap)
  - 1/3" PS CCD
  - 4 GPIO (trigger, strobe, ...)
  - Board level or boxes camera
- Ladybug2 Spherical view camera
  - 4.7 MPixel at 30 fps (6\*1024x768)
  - JPEG compressed
  - 15 fps uncompressed





# Point Grey I394 Software

- Point Grey I394 Driver Stack
  - I394b speeds support
  - Improved bandwidth allocation
  - Error reporting
- PGR FlyCapture SDK with applications & source code



# Summary

- I394b maintains key I394a features:
  - Deterministic performance
  - Flexible topology with small cables
  - One cable with power & data
  - Support for multiple types of devices
  - Low cost
- I394b adds:
  - Higher bandwidth and bus utilization
  - More cable types and longer distance
  - Better industrial connector
  - Loop healing for redundant connections