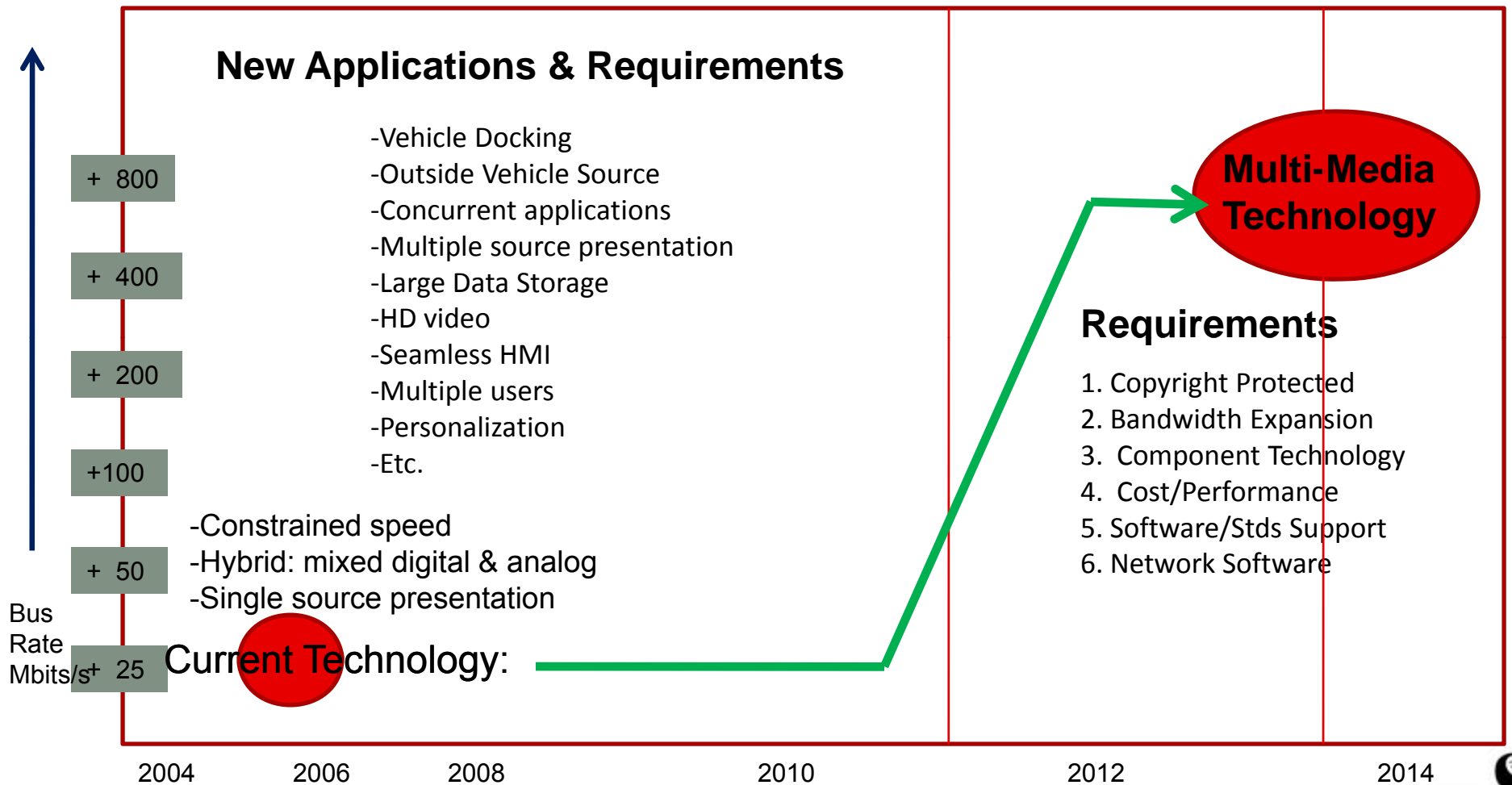




1394 as an ADVANTAGE

Burke Henehan
Henehan Technology

In Vehicle Network – technology evolution



I394SM AUTO Meets Technical Requirements

- ◎ Copy Protection approved by DVD Forum & DTLA
 - Very Strong Content Protection
- ◎ BW 100-800Mbps today, Roadmap to 3200Mbps
 - Backward compatible 100-400 devices, 400-800Mbps, 1394a-2000
- ◎ Guaranteed Quality of Service - Isochronous
- ◎ 8m cable length with 5 inline connectors
- ◎ Many Different Connection topologies allowed
 - May use to form hardware redundancy
- ◎ Power Management Designed in
- ◎ Plug and Play, hot-plugging, self-configuration part of standard
- ◎ Very Efficient Transport, BOSS Arbitration



1394SM **AUTO Content Protection**

DTCP (Digital Transmission Content Protection)

- ◎ 1394TA has worked with Hollywood's Digital Transmission Licensing Authority since 1995. DTCP has been Accepted by MPAA & DVD CCA
- ◎ All Versions of 1394 are Approved
 - 1394-Auto, 1394a, 1394b, future versions of 1394
- ◎ All Transmission Media have been Approved
 - Shielded Twisted Pair / Quad
 - Optical Fiber
 - Coax
 - Un-shielded Twisted Pair CAT5/6
 - Future cabling



I394SM **AUTO Content Protection**

DTCP (Digital Transmission Content Protection)

- ◎ DTCP can be thought of in 5 aspects
 - Authentication – Are both source and sink trusted
 - Localization – is the sink “local”, not across the internet
 - Key Exchange – Continuous Encryption Key Exchange
 - Encryption/Decryption – Blowfish Cypher
 - Key Revocation if discovered compromised
- ◎ DTCP is a combination of Hardware and Software
 - Hardware Accelerators in Silicon for Encryption/Decryption as well as for elliptic curve calculations
 - Software for setup and control



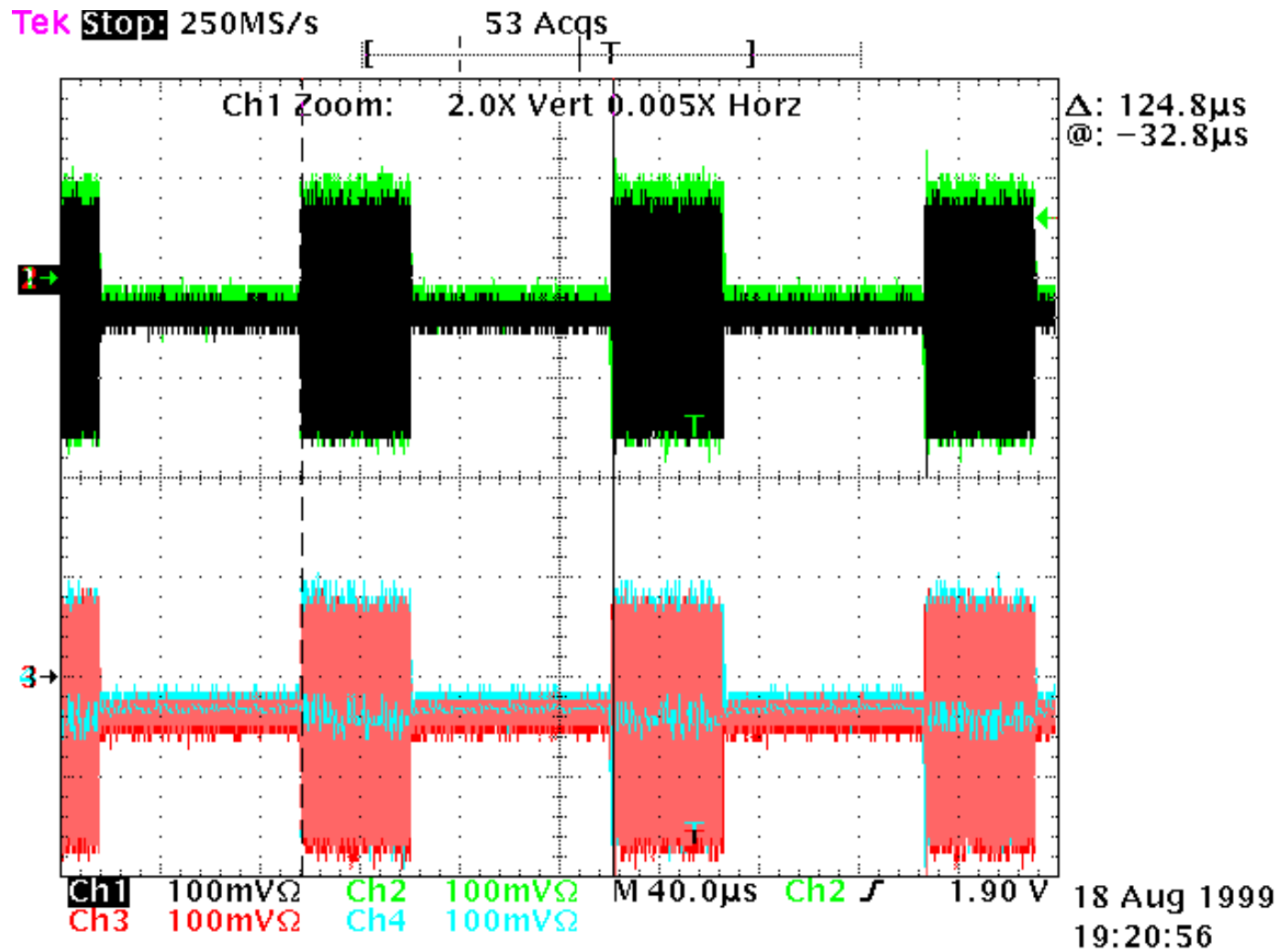
Bandwidth Requirements

Typically >300Mbps, to >600Mbps

| Data Stream | BW required |
|---|-------------|
| Telephone Audio (uncompressed) | 64kbps |
| Audio CD (uncompressed) | 1.5Mbps |
| Video CD 2.0 | 1.2Mbps |
| MPEG2 Video (DVD) Uncompressed 166Mbps 720x480x30fps, YUV16b | 2.5~15Mbps |
| DV (compressed) Uncompressed 125Mbps 720x480x30fps, YUV4:1:1 | 25Mbps |
| Terrestrial DTV (compressed) Uncompressed 166Mbps 720x480x30fps, YUV16b | 23Mbps |
| Navigation (“lightly”, low latency compressed) Uncompressed 415Mbps 800x480x60fps RGB18b | 157Mbps |
| Real Time Camera VGA uncompressed 640x480x30fps YUV16b | 147Mbps |

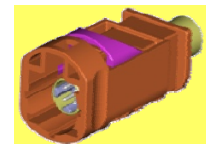
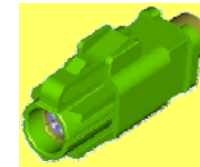
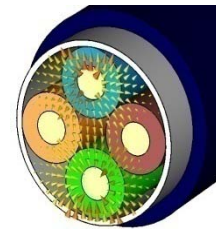
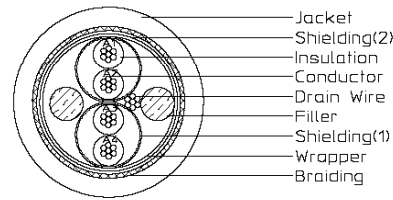


Isochronous Transmission (1394a example)



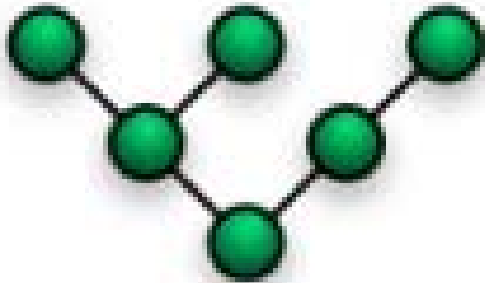
I394SM AUTO Physical media

- ⦿ IEEE-1394 Auto supports a variety of physical media types to meet the cost and performance requirements of the system implementer
 - 983.04 Mb/s at 8 to 10 meters
 - Shielded Twisted Pairs
 - Shielded Twisted Quad
 - Coax
 - With adaptive equalization and pre-emphases 18 meters is achievable
 - DC power may be distributed over signal pairs therefore reducing power harness wiring
 - POF and HPCF also supported
- ⦿ All offer excellent EMI/EMC characteristics

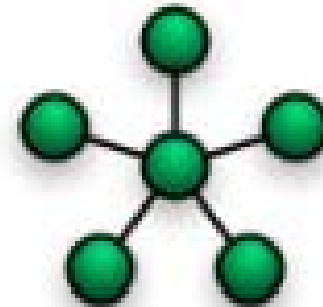


I394SM **AUTO Flexible Topology**

Tree, Star, Bus, Ring

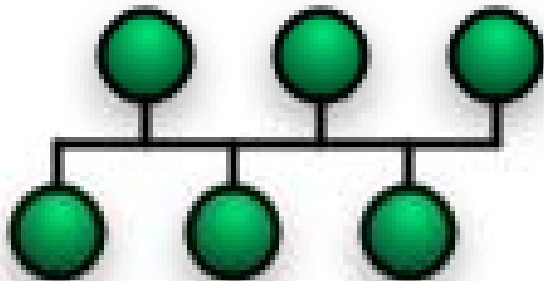


Tree

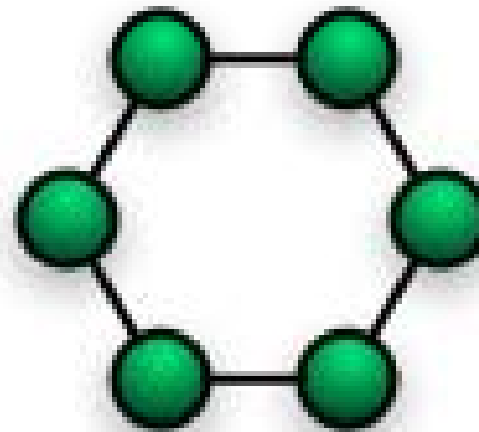


Star

Backplane 1394



Bus



Ring



I394SM **AUTO Power Management**

- ⦿ Both AMIC and VersaPHY based power management protocols defined
- ⦿ Ultra-low power state consumes less than 100 μ A per node allowing long battery life
- ⦿ Wake-on-Tone allows remote wake up using signal pairs rather than external signal
- ⦿ VersaPHY based power management enables PHY only power mode so individual devices consume less power while the bus is operational



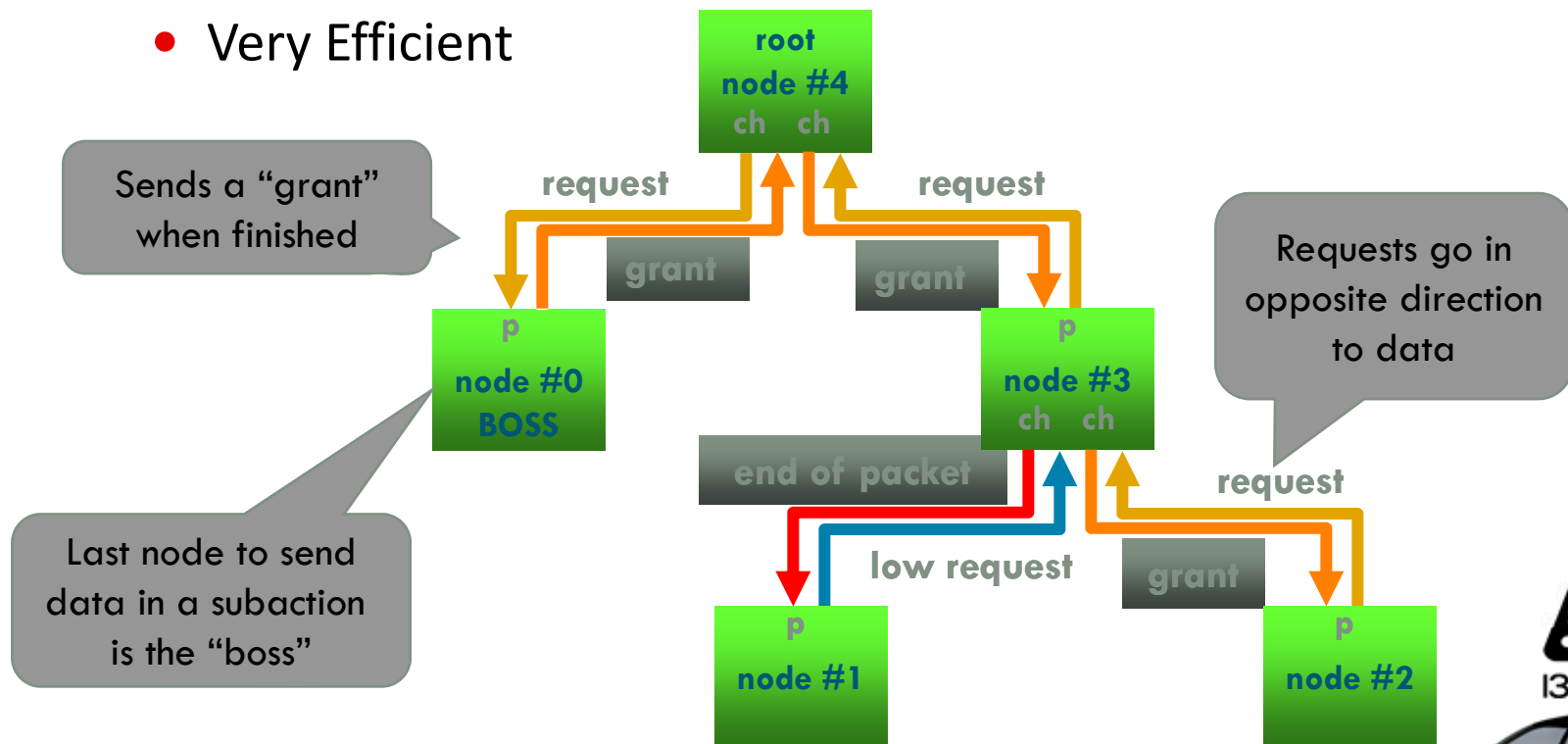
Plug and Play Support

- ⊙ Nodes' are required to have a Configuration ROM
 - It must have standard data
 - It must be in a standard format
 - It must be at a defined address location
- ⊙ Every "Hot-plug" event causes a bus wide indication
- ⊙ When a "hot-plug" event occurs, nodes' can check each others' configuration ROM to determine what happened and how to talk with the new node.



Bus Owner Supervisor Selector (BOSS)

- ⊙ Dual Simplex Operation
 - One Twisted Pair Port Transmits, the other receives
- ⊙ Arbitration requests go in opposite direction of data
 - Each arbitration request overlaps data transmission
 - Very Efficient



I394SM **AUTO Eco-system Today**

⦿ Available today!

- Silicon
- Software
- Connectors
- Cables
- Test and Diagnostic Tools
- Bridging to legacy devices (analog and digital)



Aggregate Feature Score







| | | | | |
|-------------------------------|-----------|-----------|-----------|-----------|
| Automotive Track Record | 3 | 5 | 1 | 1 |
| Bus Speed | 5 | 3 | 4 | 3 |
| Cabling | 5 | 4 | 4 | 5 |
| Network Topology | 5 | 2 | 3 | 3 |
| Bus Access Grant | 5 | 4 | 3 | 2 |
| Quality of Service | 5 | 5 | 2 | 2 |
| Codec | 5 | 2 | 2 | 2 |
| Software Support (multimedia) | 5 | 4 | 2 | 2 |
| Software Support (ip/storage) | 4 | 2 | 5 | 5 |
| Vendor Choices | 4 | 5 | 4 | 3 |
| Scalability | 5 | 1 | 2 | 2 |
| Totals | 51 | 37 | 32 | 30 |



individually ranked 1 – 5, 5 being the best suited for the feature



1394 is the clear choice

| | <i>Aggregate Feature Score¹</i> | <i>Implementation Cost w/audio + video²</i> |
|---|--|--|
|   | ➤ 51 | ➤ 20 |
|  50 | 37 | 27 |
| ETHERnet 100BaseT | 32 | 33 |
|  | 30 | 26 |

¹Higher numbers better

²Lower numbers better



Summary

- ◎ The timing is right to deploy 1394 Automotive
 - 1394 Automotive
 - Supports the requirements of Automotive Networks
 - DTLA copy protected approved technology
 - Low cost AV network
 - Mature technology – Ecosystem is in place
 - Supported by multiple industries
 - Scalable
 - Supports transmission rates from 98.304Mbs to 3.93216 Gbs
 - 1394 Automotive has
 - Economy of scale
 - Broad physical media support
 - Broad protocol support
 - Power management built in
 - Plug and Play support built in





THANK YOU

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