MOST150 – The Next Generation Automotive Infotainment Backbone

Harald Kohler, SMSC Automotive Infotainment Systems

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In-Car Infotainment Trends

Number of Multimedia Components in Daimler Car Platforms:

- **More and more features and components per car**
- **Introduced in luxury segment but migrating into mid and low range**
- **Components increasingly interact to provide higher value features**

- **Issues with that:**
  - **Need for extensive exchange of signals**
  - **Complexity and weight of cabling**
  - **Avoiding Electromagnetic Emissions becomes more complex**

- **Flexible and powerful communication backbone needed!**

1979 S-Class*	**1991** S-Class	**1998** S-Class	**2005** S-Class
1. Radio 2. Amplifier	1. Radio 2. Amplifier 3. CD 4. Telephone	1. Radio 2. Amplifier 3. CD 4. Telephone 5. Microphone 6. E-Call 7. Navigation	1. Radio 2. Amplifier 3. CD 4. Telephone 5. Microphone 6. E-Call 7. Navigation 8. PDA I/F 9. TV-Tuner 10. DVD 11. Displays 12. Headphones

* Predecessor Model (500 SE)

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Our Next Generation Connectivity Vision

- **MOST as Infotainment Backbone**
  - High QoS Audio, Video, Data and real-time Control over a single medium
  - Standard controlled by car makers and developed for their needs
  - Optimized for automotive environment (EMC, temperature, reliability)
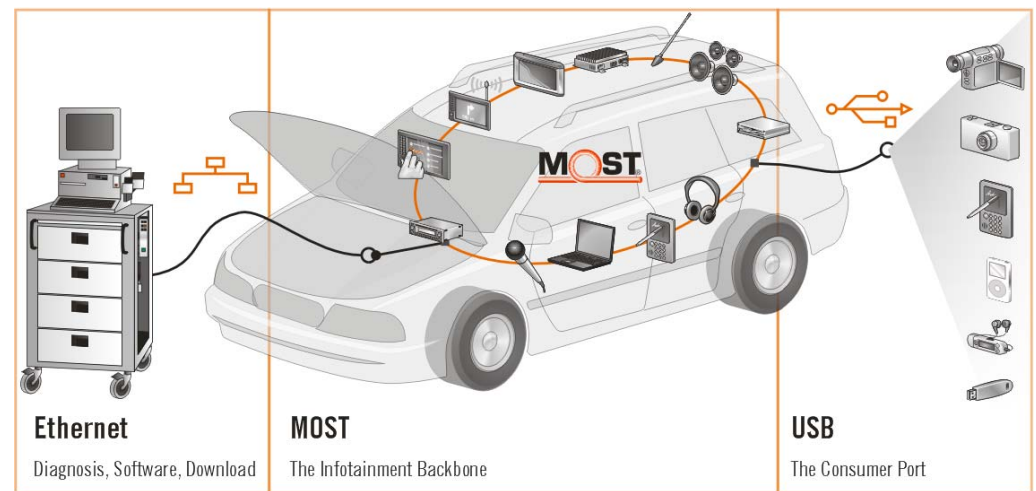 - Big peer-to-peer networks possible

- **Ethernet as Diagnosis and SW Download Interface**
  - Optimized for packet communication
  - Simple adaptation to repair shop IT infrastructure
  - Not active while driving (limited suitability for auto environment)

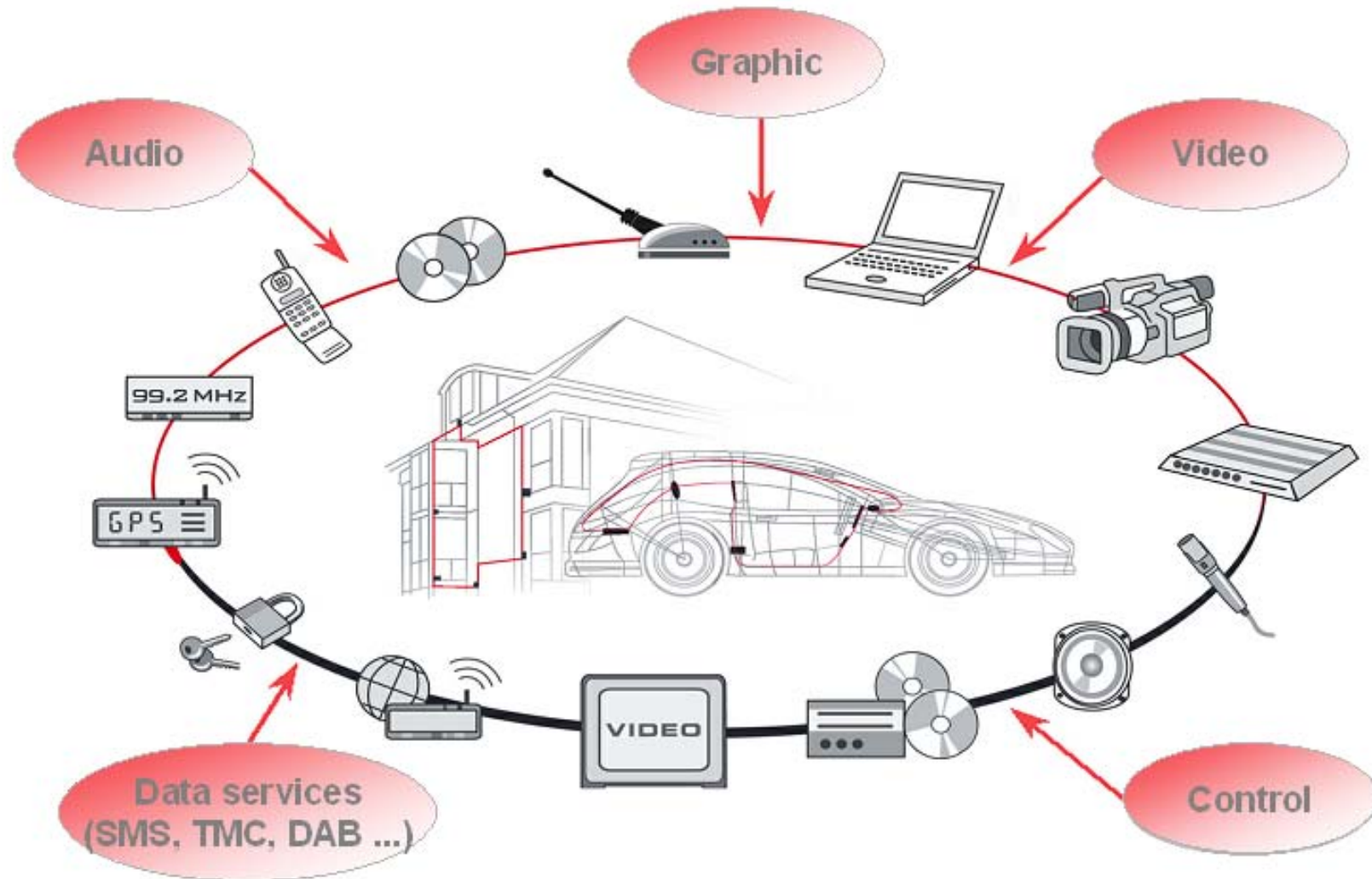- **USB as Consumer Connectivity Port**
  - Simple Plug&Play
  - Integrated battery charging
  - Cabling ideally only by user (limited suitability for auto environment)
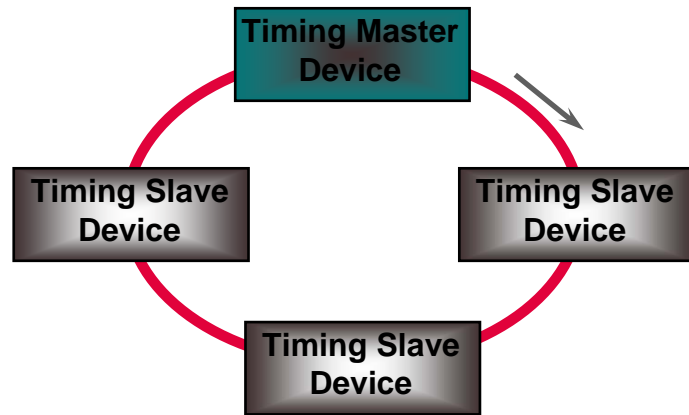 - Port and no network

- Seamless connectivity between the different networks

Ethernet
Diagnosis, Software, Download

MOST
The Infotainment Backbone

USB
The Consumer Port

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MOST – The Multimedia Network

Data Transport – MOST150 Frame

- Synchronous mechanism
- Cyclic continous repetition of Frames
- Unused bandwidth is available for Ethernet packets

Timing Master Device

Timing Slave Device

Timing Slave Device

Timing Slave Device

Control Data	Synchronous / Isochronous Data	Asynchronous / Ethernet Packet Data

MOST Frame

STREAMING DATA

PACKED DATA

CONTROL INFORMATION

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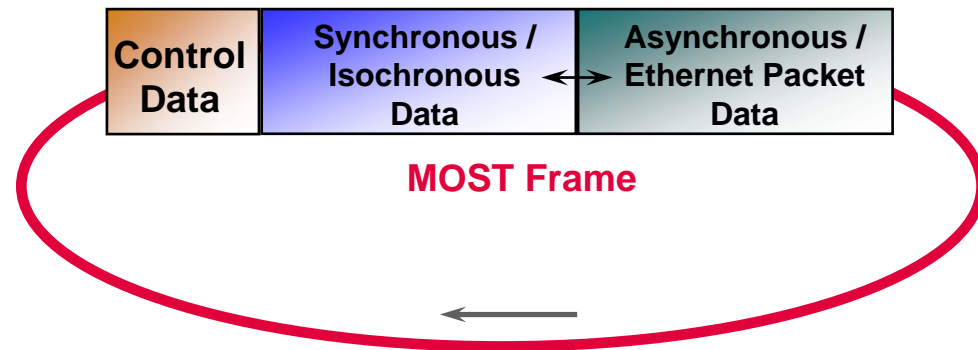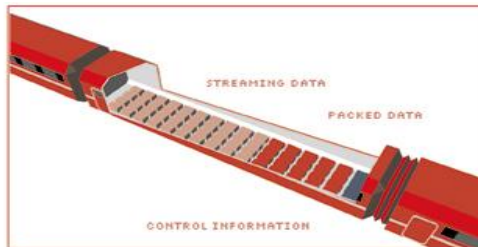
The MOST Cars from 2001 to 2008

- Since the first vehicle was introduced in 2001:
  - 55 car models in production
  - First vehicle of Toyota launched with MOST50
  - Hyundai & Kia select MOST for first vehicle models

|								
Aston Martin Db9	Aston Martin Vantage	Audi A4	Audi A5	Audi A6	Audi A8	Audi Q7	BMW 1 Series	BMW 3 Series
BMW 5 Series	BMW 6 Series	BMW 7 Series	BMW X5	Citroen C8	Dodge RAM*	Hyundai Genesis	Jaguar XF	Jaguar XK
Kia Mohave	Lancia Phedra	Land Rover Discovery	Land Rover Freelander	Land Rover RangeRover	Maybach	MB A-Class	MB B-Class	MB C-Class
MBCL-Class	MB CLK-Class	MB CLS-Class	MB E-Class	MB GL-Class	MB M-Class	MB R-Class	MB S-Class	MB SL-Class
MB SLK-Class	MINI	Mitsubishi Colt	Peugeot 807	Porsche 911	Porsche 911 Carrera	Porsche Boxter	Porsche Cayenne	Rolls-Royce Phantome
Saab 9-3	Smart Forfour	Toyota Mark X ZiO	Volvo C30	Volvo C70	Volvo S40	Volvo V50	Volvo V70	Volvo S80
Volvo XC90								

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Focal Points of MOST Development

- Ongoing technology development since first SOP:
  - Increase of Robustness & Ease of Use
  - Realization of Cost Down
  - Increase of Network Speed
  - Realization of Video over MOST
  - Addition of High-Speed Data over MOST

- Requirement discussions within MOST Cooperation

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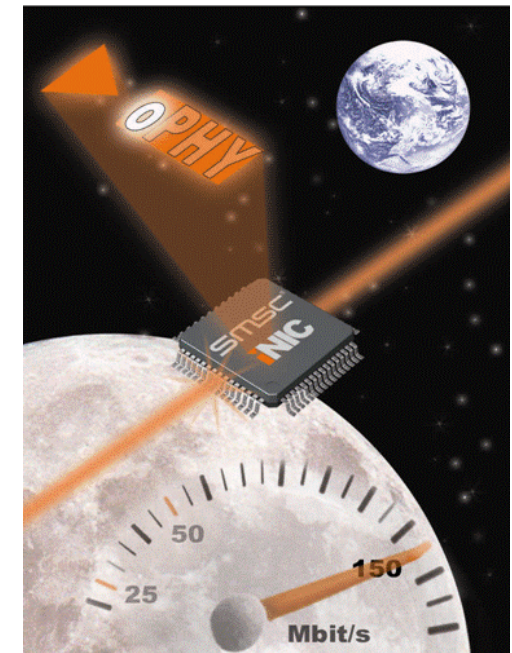
INIC Architecture – Key Benefits

- Self-contained quick start-up of network node – independent of (slow) application startup

- Protection of system against failures of individual application through network protected mode

- Less possibility for application to corrupt network function due to high-level INIC API and encapsulated network management

- Simple design-in, lower verification effort and quicker time to market

Traditional Architecture

INIC Architecture
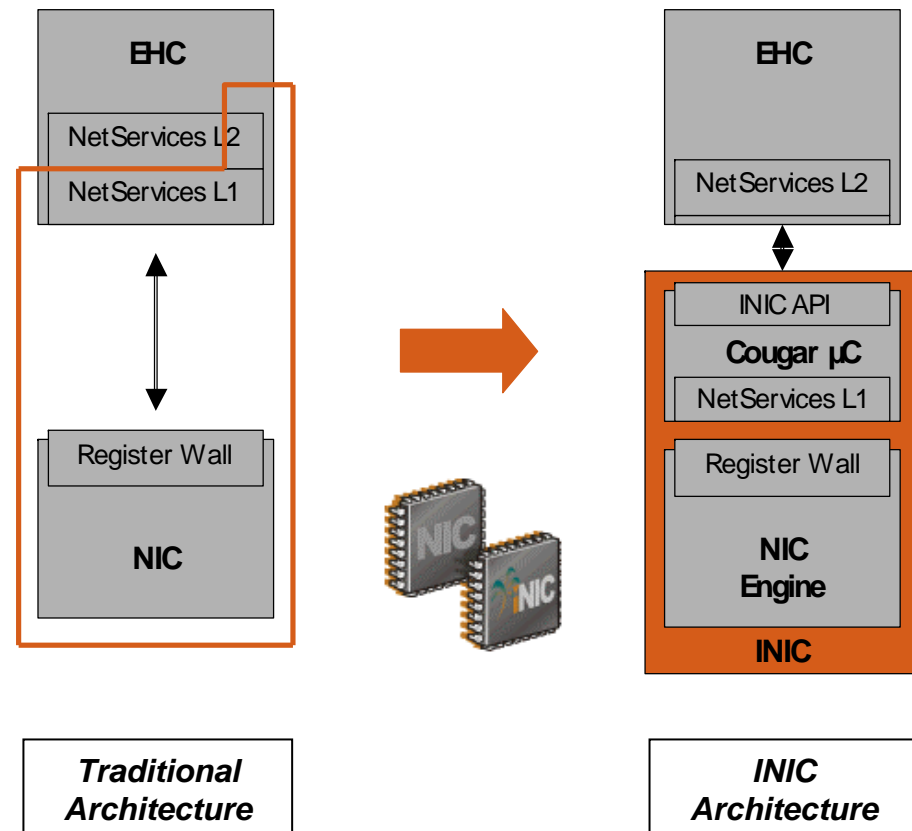
Focal Points of Cost Reduction

1. NIC/INIC
2. FOT + Connector
3. Peripherals
4. Application Connectivity

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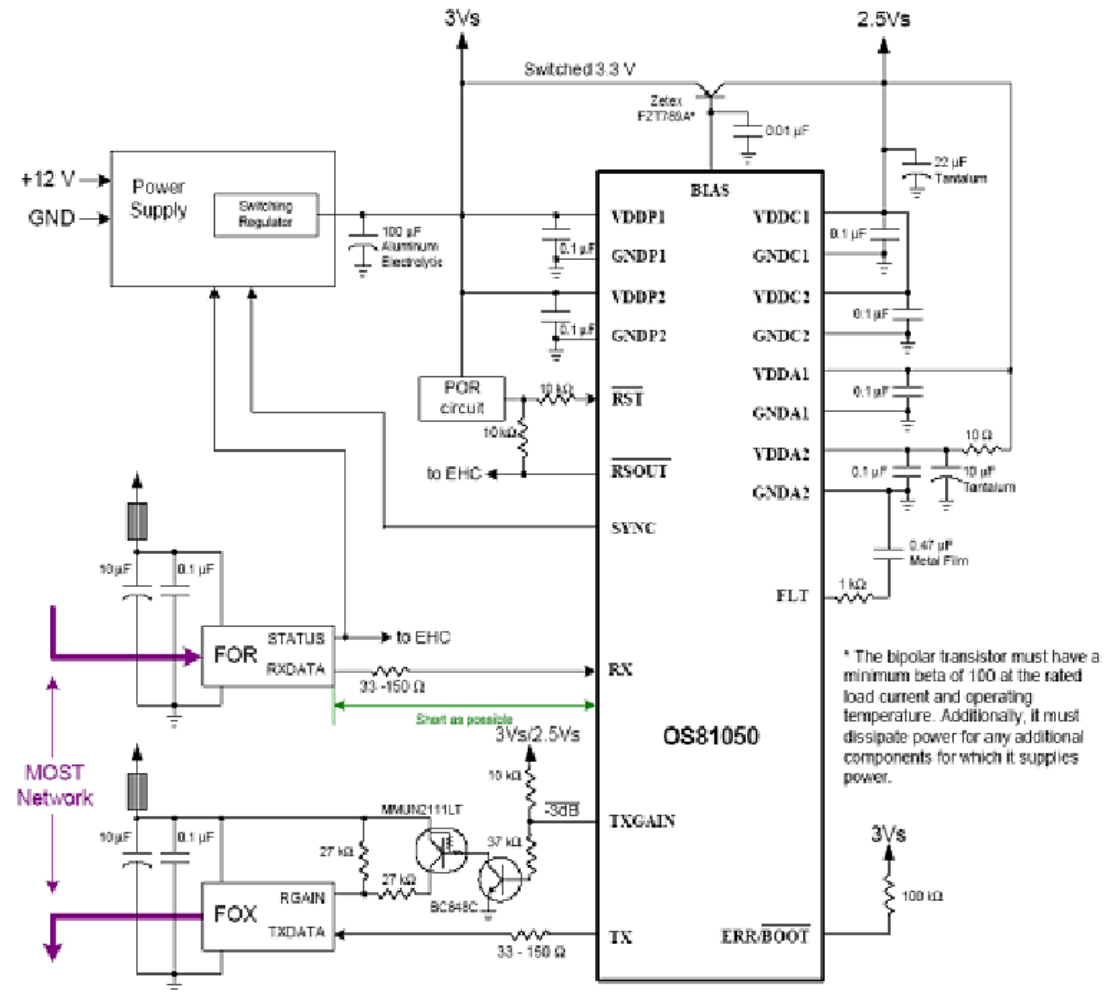
Longer Term Cost Optimization - iFOT

- Encapsulation of complete network function „in the header" (iFOT)

- Very low number of variants are used in high volume

- Production by several foundries/fabs

- Cost-Down through volume production and optimization of value chain
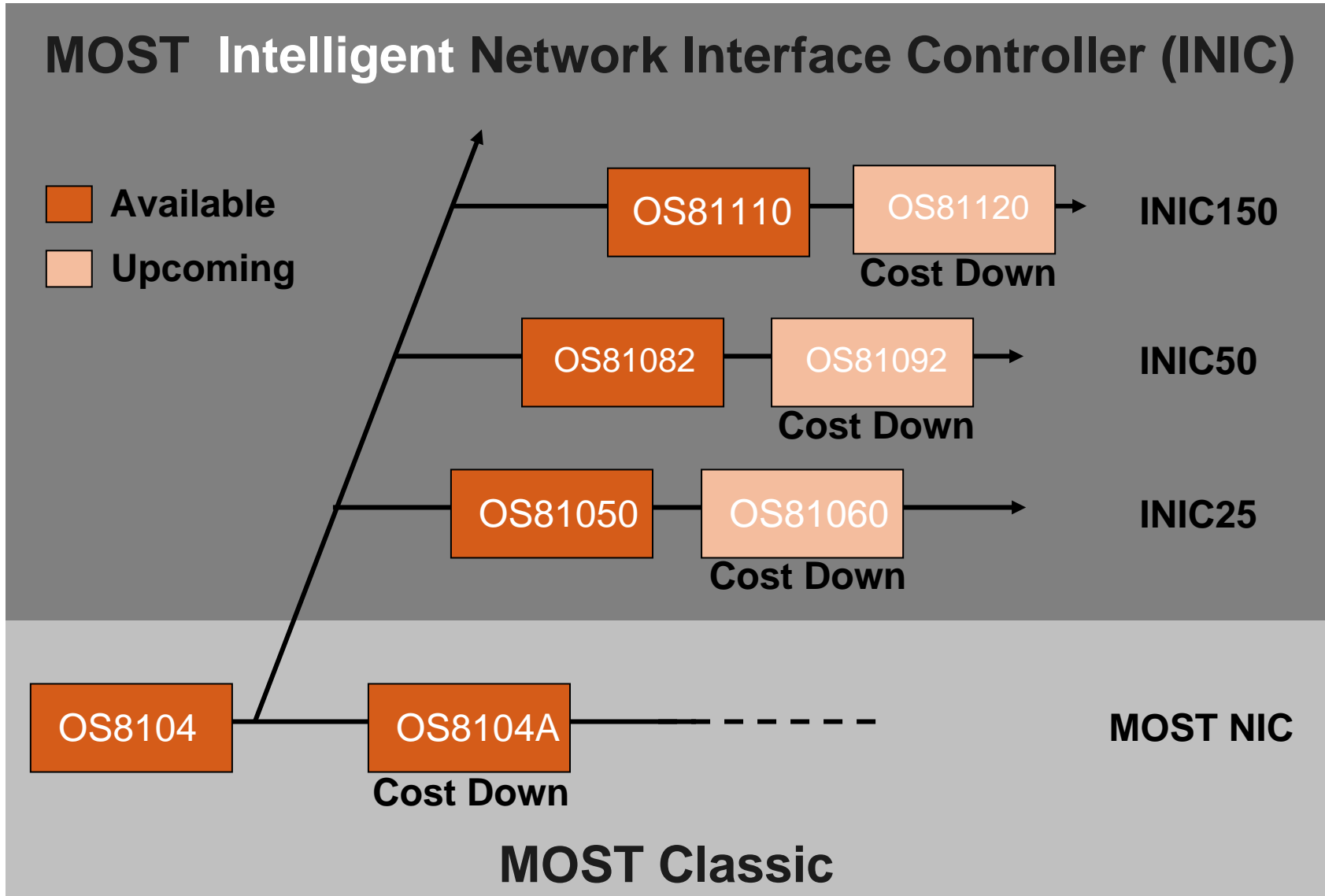
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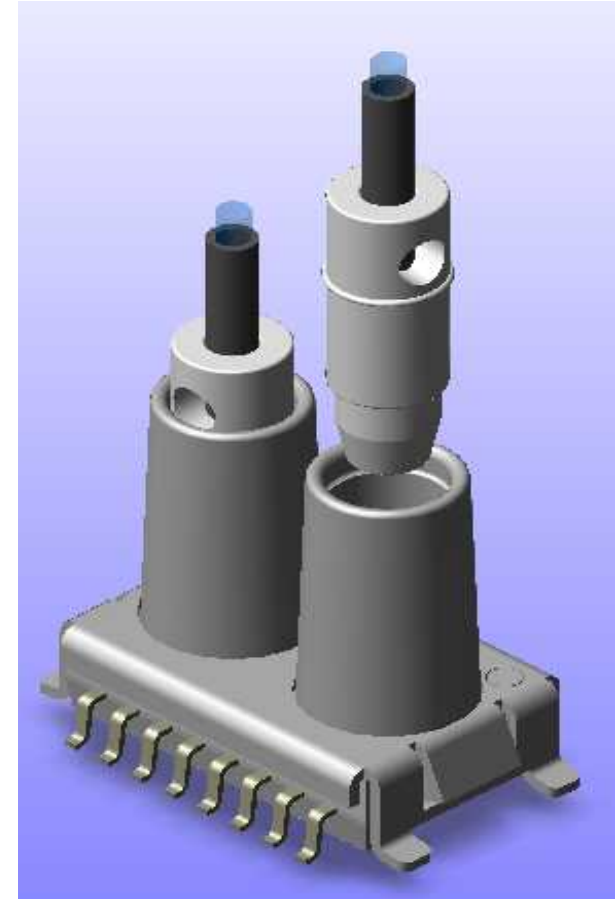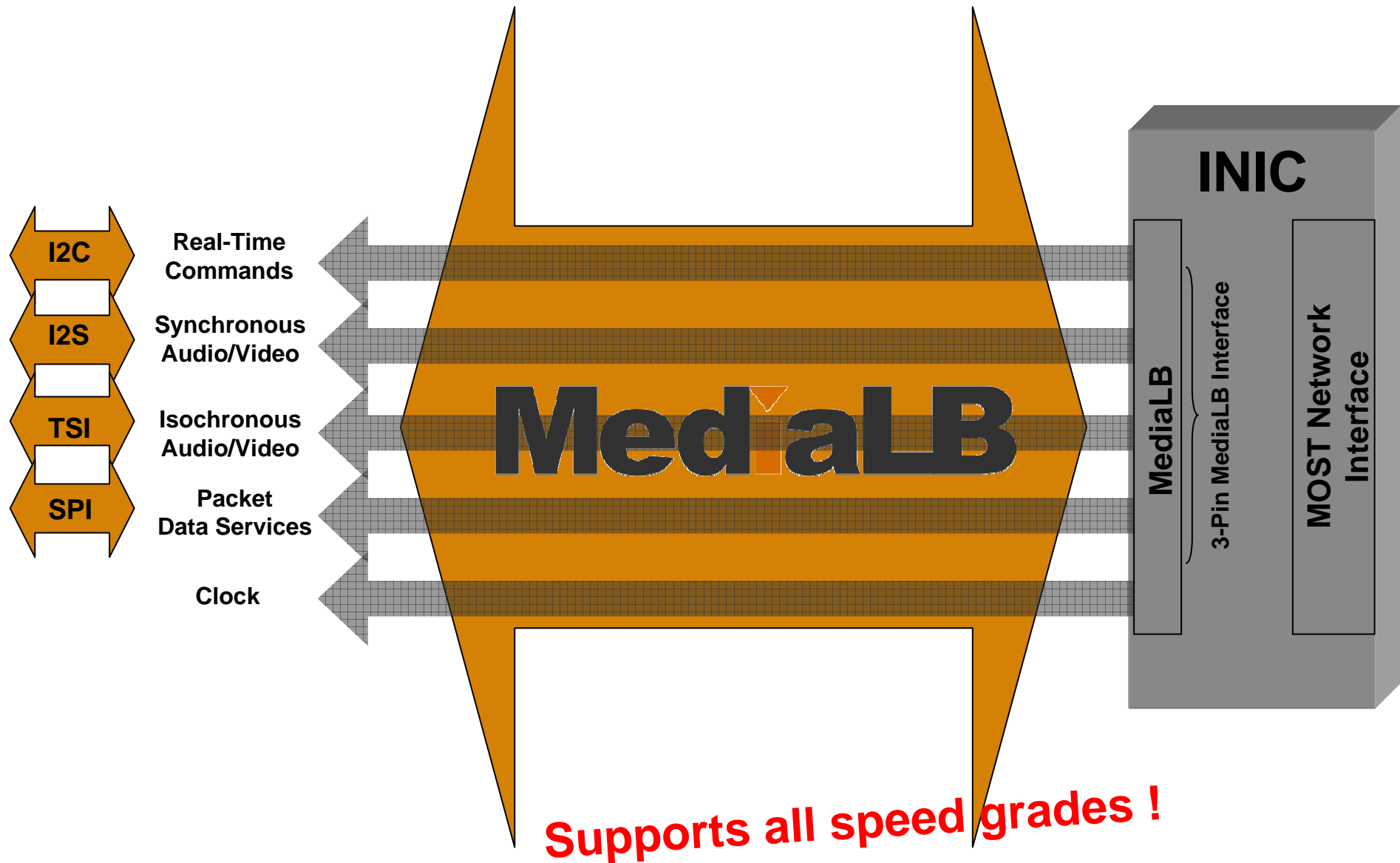
MOST IP Licensing

- Data Link Layer of MOST has been developed by Harman/Becker and SMSC before and outside of MOST Cooperation

- Its specification had not been opened and is not part of MOST Cooperation

- Oct. 1st 2007, Harman/Becker and SMSC:

    - Have opened MOST25 Link Layer specification and offer CAN-like **Protocol IP** license

    - This allows other IC makers to do their own interoperable MOST ICs (own design)

    - Provided roadmap for IP opening for new generations of MOST with market growth

- SMSC offers MOST25 **Design IP** licenses for integration on SoCs that broaden the market (using SMSC's design)

Overview MOST Network Interface Controller

MOST **Intelligent** Network Interface Controller (INIC)

- ■ Available
- ■ Upcoming

OS81110 → OS81120 INIC150
Cost Down

OS81082 → OS81092 INIC50
Cost Down

OS81050 → OS81060 INIC25
Cost Down

OS8104 — OS8104A - - - - - MOST NIC
Cost Down

MOST Classic

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MediaLB – The Multiplex Interface

I2C

I2S

TSI

SPI

Real-Time
Commands

Synchronous
Audio/Video

Isochronous
Audio/Video

Packet
Data Services

Clock

MediaLB

INIC

MediaLB

3-Pin MediaLB Interface

MOST Network
Interface

Supports all speed grades !

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MediaLB Products (44 Products)

■ **16 Products with MediaLB support available in 2007**

freescale semiconductor — **MPC5533/34/53/54/65/66, MPC5567 (Tiger)** [1] **Gateway-Processor**
http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=MPC5567&nodeId=0162468rH3bTdG0325&tid=tAlp5567

freescale semiconductor — **MPC5514/17** [2] **Dual-Core Processor for Gateway, Display, Dashboard**
http://www.freescale.com/files/32bit/doc/fact_sheet/MPC5510FS.pdf?fpsp=1

FUJITSU — **MB86R01 (Jade)** **Graphics Processor for Car Navigation and Display Appl.**
http://www.fujitsu.com/in/news/pr/fmal_20070410.html

NEC — **V850E/CAG-4M (Cargate-M)** **Gateway-Processor**
http://www.eu.necel.com/applications/automotive/documents/pa-06-11-10-2713.pdf

Parrot — **Parrot5** **ASIC for Navigation, Car Multimedia and Telematics**
http://www.parrot.biz/uk/oemsolutions/parrot5

TEXAS INSTRUMENTS — **OMAP** **Processor for Automotive Infotainment**
http://focus.ti.com/docs/pr/pressrelease.jhtml?prelId=sc05141

TOSHIBA — **TX4961/62 (Capricorn-M/-L)** **Graphic Processor for Display and Graphic Appl.**
http://www.toshiba-components.com/prpdf/5635E.pdf

ALTERA — **Altera FPGA's** **FPGA Makro for Automotive Infotainment**
http://www.altera.com/products/ip/iup/additional_functions_iup/m-mediaLB-device-interface.html

SMSC SUCCESS BY DESIGN — **SMSC IP for FPGA's (e.g. XILINX Spartan-II)** **VHDL implementation on Xilinx FPGA for Automotive Infotainment**
http://www.smsc-ais.com/AIS/content/view/466/440/

■ **More than 4 Customer Specific Products with MediaLB support available in 2007 from**

RENESAS · **HARMAN/BECKER AUTOMOTIVE SYSTEMS** · **Panasonic** · **OKI**

Notes:
(1) SW-Emulation via eTPU
    Runs on all MPC55xx with eTPU
(2) SW-Emualtion via 2nd Core
    Runs on all MPC551x with 2nd Core

■ **More than 24 new Products are in development with MediaLB support from**

TEXAS INSTRUMENTS · **freescale** semiconductor · **FUJITSU** · **NEC** · **NXP** founded by Philips
HYUNDAI · **MITSUBISHI ELECTRIC** · **KETI** · **VIA** we connect

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Evolution of Features and Use Cases

■ **MOST Evolution**

+ transparent Ethernet transport channel
    + IP based applications
    + full featured WLAN support
    + high speed SW download capability
+ isochronous channel
    + multiple video streams incl. cameras
    + HD-Video content
+ next generation optical physical layer

Bandwidth MBit/sec

150

+ DVD audio/video
+ DVB-T
+ discrete multi-channel
  audio streaming
+ electrical
  physical layer

50

16 audio channels
+ navigation graphics

25

2003　　**2007**　　**2009 +**

MOST150…

■ **Physical layer**
- MOST150 can use same wire harness and connectors as MOST25 !

■ **Bandwidth**
- MOST provides premium QoS with high bandwidth efficiency !

■ **New MOST Ethernet Packet Channel**
- Transparent transport of Ethernet Frames
- Addressing via IEEE Ethernet MAC address
- All types of IP communication possible

- MOST150 is the auto grade Physical Layer for Ethernet !

Example:

| C | Syn/Iso | Asyn | 100 baseT Ethernet |

MOST150

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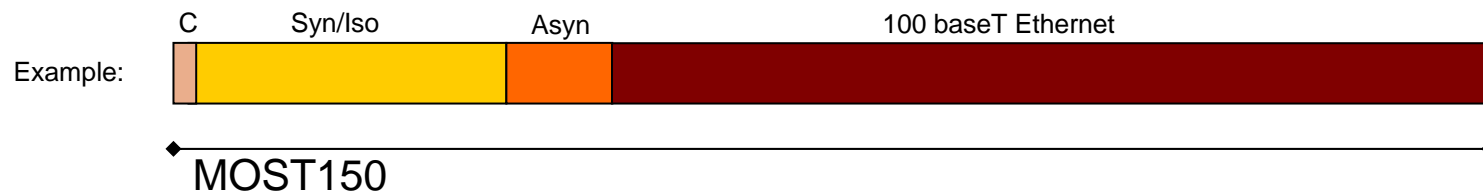
Summary New Features of MOST150

- Optimizations of **CONTROL** communication:
  - Double bandwidth

- Extended support of **AUDIO**:
  - Isochronous channels with Constant Rate Streaming for tunneling non-synchronized audio (saves SRCs)

- Seamless and cost effective support of **VIDEO** transmission:
  - Isochronous channels with Burst Rate Streaming (e.g. transport of MPEG streams)
  - Transport Stream Interfaces for glue-less low cost connectivity to video ICs

- Extended support for high-speed **DATA** transmission:
  - Direct support of Ethernet packets and MAC addressing
  - High speed SPI interfaces
  - Isochronous channels with Packet Streaming – private QoS channels for IP streaming

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**Thank you very much
for your attention.**

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