MOST

Media Oriented Systems Transport

MOST summary

- A network for distribution of infotainment within vehicles
- A network can consist of up to 64 devices
- Sample rates of 44.1 or 48 kHz
- Each distributed frame can consist of three parts
  - Synchronous channel for streamed data
  - Asynchronous channel for packet distributed data
  - Control Channel for control and low speed data
- Two versions
  - MOST25 with optical transport media, 60 Bytes of data/frame
  - MOST50 with optical or electrical transport media, 117 Bytes of data/frame

MOST history

Founders

- BMW
- Daimler Benz
- Harman/Becker Automotive Systems
  - automotive subcontractor
- SMSC (former OASIS Silicon Systems)
  - semiconductors
- Audi

MOST Coorperation

- Stearing committee
  - Consists of the founders and these have the final say
  - Almost all other vehicle companies and others are associated members (close to 100 members)
- Technical Coordination Group
  - All of the members take part
  - Defines projects
  - Establishes Working Groups
  - Appoints coordinators for the projects
- Working Group
  - Works on a specified project

MOST network

A MOST network must have a number of masters for different functions. The masters can be containd in the same device

- Timing Master
  - Controls the timing of the network and thereby the synchronization between the devices
- Network Master
  - Sets up the network and allocates addresses to the devices
- Connection Master
  - Sets up the synchronous communication channels between devices
- Power Master
  - Monitors the power supplies. Handles power up and shut down

MOST channels

There are three communication channels open to applications

- Control Channel
  - For event-oriented transmission with low bandwidth (10 kBits/s) and short package length
- Asynchronous Channel
  - Packet oriented transmission with large block size and high bandwidth
- Synchronous Channel
  - Continous data streams that require high bandwidth

MOST device

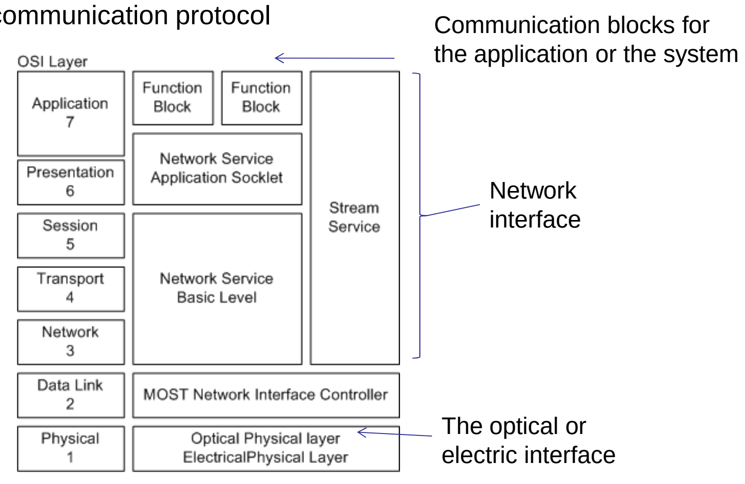
A MOST device consists of three parts

- Physical interface
- Network Services
  - A Network Interface Controller (NIC) handles these services.
    Modern NICs have a built in processor and are called INICs, Intelligent NICs
- Function Blocks (FBlocks)
  - These take care of the services that the device can supply

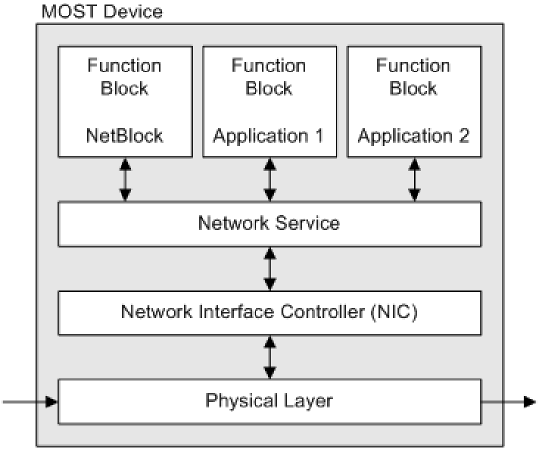
A MOST device is not connected to a bus in the common sense. It has an inport and an outport and passes the information from the inport to the outport

MOST device cont.

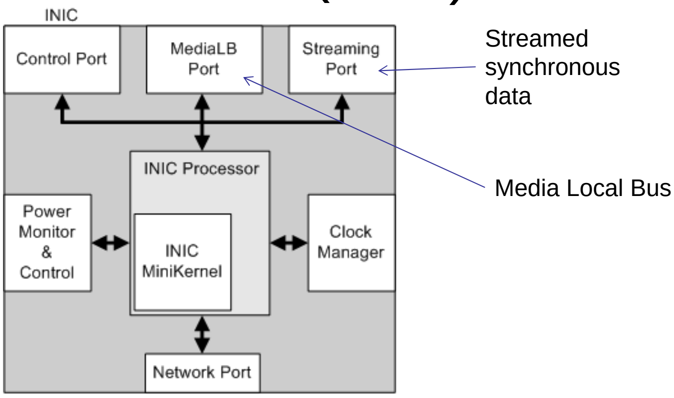
The MOST specification follows the OSI (Open Systems Interconnection) model for a communication protocol



MOST device cont.



Intelligent Network Interface Controller (INIC)



A NIC looks the same but the processing is done by the external processor that controls the application, the External Host Controller (EHC)

FBlocks

FBlocks can have functions with two different targets

- The application
- The MOST system (network)

FBlocks can be of three types

- Controllers
  - Controls one or more FBlocks
- Slaves
  - FBlocks that are controlled by other FBlocks (Controllers)
  - A slave knows nothing about the network
- HMIs – Human Machine Interface
  - Used for the interaction between the user and the device

FBlocks cont.

The FBlocks use three types of functions

- Methods
  - Functions that can be started and will lead to the result after a certain period of time
- Properties
  - Functions that changes the status of a device
- Events
  - Simular to properties but they do not need an external request

Standard FBlocks

A number of standard FBlocks that can be controlled in the same way have been specified. Some examples

- NetBlock – system FBlock must reside in every device
- NetworkMaster
- ConnectionMaster
- Vehicle – interface for vehicle related data
- Diagnosis – access to diagnostic functions
- EnhancedTestability – necessary for compliance tests
- AudioAmplifier

Standard Fblocks cont.

- AuxIn – interface to mobile consumer electronic devices like memory sticks
- MicrophoneInput – interface for microphones
- AudioTapePlayer – tape decks
- AudioDiskPlayer – CD player or CD changer
- DVDVideoPlayer – DVD player
- AmFmTuner – radio tuner
- TMCTuner – trafic information (Traffic Message Channel) signals

Standard Fblocks cont.

- TVTuner
- DABTuner – digital radio (Digital Audio Broadcast) receivers
- SDARS – tuner for Satellite Digital Audio Radio Service
- Telephone – interface to mobile telephone
- GeneralPhonebook – phonebook of a telephone
- NavigationSystem – navigation unit
- GraphicDisplay – display unit

Communication between devices

Communication between devices take place through the FBlocks.

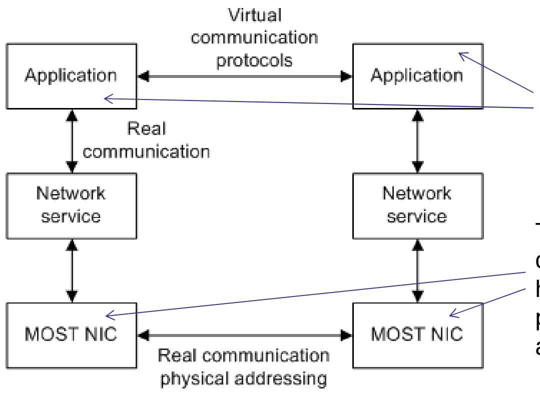
The communication can take place without the sender knowing the address of the receiving FBlock. This is done through so called shadows in the sending device.

The transfer and addressing will be handled by the NIC.

The connection will be somewhat more complicated if the system contains more than one receiving FBlock of the same type and the system will have to give them separate addresses

From the application perspective the communication goes through a virtal channel between the applications

Communication between devices cont.



One application doesn´t know the physical address of the other application

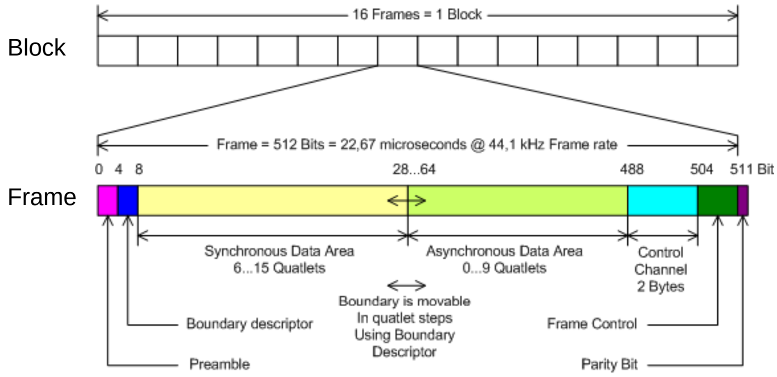
The network controllers (NIC) handle the physical addressing

MOST25

Optical network with a bit rate of just under 25 Mbits/s

- Sampling rate 44.1 or 48 kHz
- A block consists of 16 frames
- Each frame consists of 512 Bits
- A frame can hold 60 Bytes of data
- 24 – 60 Bytes of the data can be synchronous data
- The rest of the 60 Bytes holds asynchronous data
- On top of that the Control Channel can hold 2 Bytes of data
- The total amount of Control Channel data (32 Bytes) is spread out over 16 frames (one block)

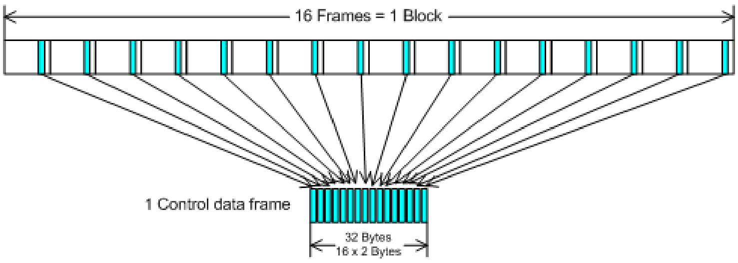
MOST25 cont.



A quadlet is 4 Bytes

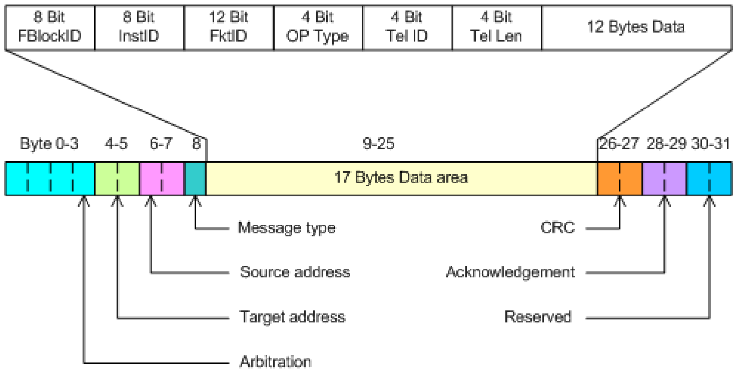
MOST25 cont.

Control Channel



MOST25 cont.

Control Message spread over 16 frames

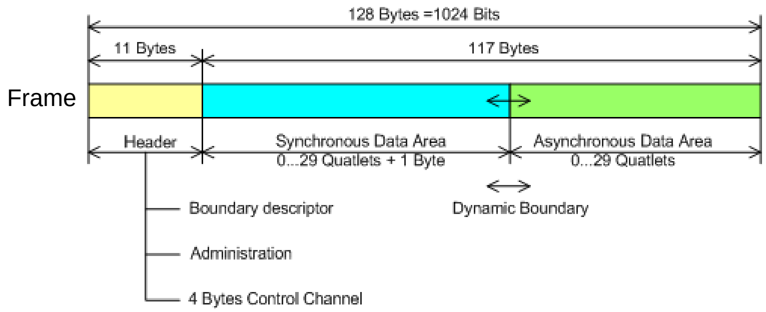


MOST50

Optical or electrical network with a bit rate of just under 50 Mbits/s

- Sampling rate 44.1 or 48 kHz
- Each frame consists of 1024 Bits
- The frame can hold 117 Bytes of data
- The border between synchronous and asynchronous data can change dynamically
- The Control Channel can hold 4 Bytes of data
- The total amount of Control Channel data (64 Bytes) is spread out over 16 frames (one block)

MOST50 cont.



Channel allocation

- In the Synchronous Channel TDM (Time Division Multiplex) is used to allocate the channels
- In the Asynchronous Channel a token is passed between the devices to allocate channels
- In the Control Channel CSMA (Carrier Sense Multiple Access) is used to access the channel
  - Control messages are sent by applications
  - System messages are sent for system administration
  - The NIC uses arbitration to access the channel

System administration

MOST25

Since the conversion between optical and electical data in a node takes time there will have to be a system for delay recognition in the nodes. The delay in a node has two values, one for an active node and one for a passive node.

Unused channels can be detected and this may result in a reallocation of channels

MOST50

In the electical version the delay is so small that there is no need for delay recognition.

All devices are always active

Physical layer

Optical layer

- The media is a plastic optical fiber (POF)
- Transmission is done in the red wavelength area at 650 nm
- The transmitter uses a light emitting diode (LED)
- The receiver uses a PIN photo diode
- The connection to the electrical layer in a device is done using TTL levels

Physical layer

Optical layer cont.

+ Optical medias are immune to EMI (Electro Magnetic Interference)

+ The optical fiber is light weight

+ The optical fiber used has a pretty large diameter (1 mm fiber), this makes it cheap and easy to contact and splice

- The radius when bent must not be tighter than 2.5 cm

- The working temperature is limited (below 85 °C) so it can not be used in the engine room

Physical layer

Electrical layer

- The connection is ballanced
- A shielded twisted pair is used as the media

Addressing

When the system is set up each node is assigned an unique 2 Bytes address starting with address 0 for the Timing Master.

Nodes can be assigned group addresses to facilitate the communication with FBlocks of the same type.

Broadcast messages can be sent to all nodes, for example for wake up or shut down

MOST High Protocol (MHP)

A connecetion-oriented protocol that use some of the mechanisms of the TCP protocol.

This enables a TCP/IP stack to be attached to the data link layer protocol.

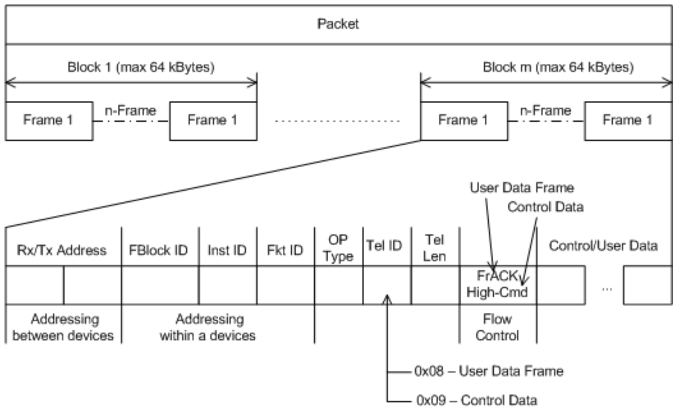
The overhead is reduced and lower than in the TCP protocol.

The protocol can be implemented in the asynchronus channel or in the Control Channel.

The protocol is unidirectional, there is a transmitter and a receiver module.

For bidirectional data transport two connections have to be established.

MOST High Protocol (MHP)



MAMAC

MOST Asynchronous Medium Access Protocol

An adaption layer that enables a simple transmission of TCP/IP protocols over the asynchronous channel

MAMAC maps Ethernet versions 1 and 2, as well as SNAP (Subnetwork Access Protocol) and LLC (Logical Link Control) directly into the asynchronous area of the MOST frame

MAMAC can be used at the same time as MOST High Protocol (MHP)

MOST Compliance Tests

A detailed test and verification system, MOST Certification Test Process, is set up by the MOST Cooperation to enable testing of devices to control if they follow the MOST specification.

A device that are supposed to connect to the MOST network does not have to pass this test.

But if it does it may be part of the MOST IP (Intellectual Property) pool and use the MOST trademark

Further reading

The MOST Specification can be downloaded from www.mostcooperation.com

There you will also be able to download a more readable book on MOST