Basic Safety Message Definitions

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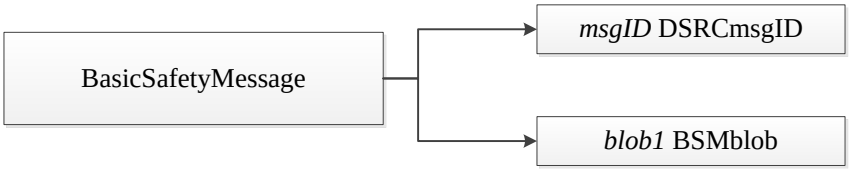
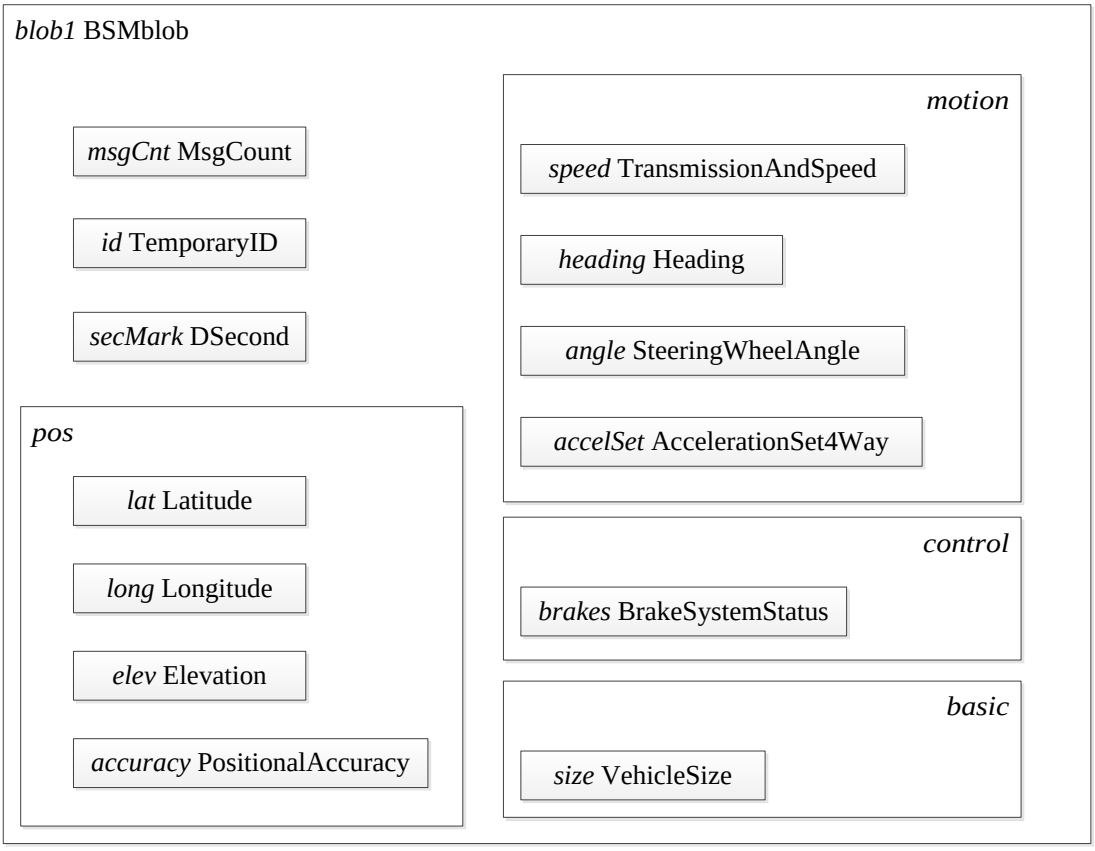
This white paper entails the message set description pertaining to the DSRC format as set by the standards given in SAE J2735 for the Part 1 of Basic Safety Message. Part 1 messages are broadcasted 10 times per second and Part 2 messages are optional information which can be tailor-made for each scenario. There are three levels of information carried by the Dedicated Short-Range Communication. They are, Message Sets, Data Frames and Data Elements. As the name suggests, message sets form the top of the hierarchy. Each message set consists of many data frames and each data frame consists of data elements. Data elements can also consist of multiple parts.

As far as the Basic Safety Message is concerned, the hierarchy of data elements is given in the following figure.





The definitions of the data frames and data elements are given in the following indented list:

1. *msgCnt* stands for MsgCount (1 byte)
2. *id* is a TemporaryID (4 bytes)
3. *secMark* is the DSecond (2 bytes) – represented as milliseconds within a minute.
4. *pos* consists of PositionLocal3D data:
    a. *lat* stands for Latitude (4 bytes) – expressed in $1/10^{th}$ of a micro-degree
    b. *long* stands for Longitude (4 bytes) - expressed in $1/10^{th}$ of a micro-degree
    c. *elev* stands for Elevation (2 bytes) – expressed in decimeters above or below the reference ellipsoid
    d. *accuracy* stands for Positional Accuracy (4 bytes)
        i. Semi-major accuracy – represented as 0.05m
        ii. Semi-minor accuracy – represented as 0.05m
        iii. Orientation of semi-major axis relative to true north
5. *motion* consists of the following:
    a. *speed* denotes TransmissionAndSpeed (2 bytes)
        i. Bits 1 to 13 is Speed represented as 0.02 m/s
        ii. Bits 14 to 16 is TransmissionState
    b. *heading* denotes Heading (2 bytes) expressed as 0.0125 degrees from North
    c. *angle* denotes SteeringWheelAngle (1 byte) expressed at 1.5 degrees with right being positive
    d. *accelSet* denotes AccelerationSet4Way (7 bytes)
        i. long Acceleration – represented as 0.01 m/s2
        ii. lat Acceleration - represented as 0.01 m/s2
        iii. vert Acceleraion - represented as 0.01 m/s2
        iv. yaw YawRate – expressed as 0.01 degrees per second with right being positive
6. *control* consists of any motion control terms:
    a. *brakes* which shows the BrakeSystemStatus (2 bytes)
        i. wheelBrakes as BrakeAppliedStatus (4 bits)
        ii. wheelBrakesUnavailable (1 bit)
        iii. spareBit (1 bit)
        iv. traction as TractionControlState (2 bits)
        v. abs as AntiLockBrakeStatus (2 bits)
        vi. scs as StabilityControlStatus (2 bits)
        vii. brakeBoost as BrakeBoostApplied (2 bits)
        viii. auxBrakes as AuxiliaryBrakeStatus (2bits)
7. *size* includes the VehicleSize (3 bytes)
    a. *VehicleWidth* – in centimeters (10 bits)
    b. *VehicleLength* – in centimeters (14 bits)

All definitions and terms are taken from the SAE International Surface Vehicle Standard, Dedicated Short Range Communications (DSRC) Message Set Dictionary (11/2009).