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Abstract

This specification is based on the AMI-C 3013 Power Management Architecture v1.00 document released on August 1, 2005. This document provides the architectural specification for realization of a Host Centric Power Management in 1394-Automotive Networks using an electrical control signal for changing the power state of the Network.

Keywords

IEEE 1394, Serial Bus, AMI-C, Automotive, Power Management Architecture

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2005-08-01	Version 1.00 released for publication. This version is the basis for all future revisions.

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Foreword

The Automotive Multimedia Interface Collaboration (AMI-C) is a non-profit corporation comprised of motor vehicle manufacturers from around the world as Members. It was established to facilitate the development, promotion and standardization of automotive information and entertainment system interfaces to motor vehicle communication networks. AMI-C is supported by Contributing Organizations (automotive suppliers, telematics experts, computer developers and software developers) and works with network developers and standards development organizations.

AMI-C produces a set of AMI-C Technical Documents (requirement, specification and reference documents) concerning automotive information and entertainment system interfaces. An AMI-C requirement document defines the requirements of one or more interfaces for one or more elements in the AMI-C architecture. It may not have technical details for implementation. An AMI-C specification document defines the interfaces of an element in the AMI-C architecture with supporting technical details. An AMI-C reference document helps users of AMI-C requirement documents and AMI-C specification documents understand them.

AMI-C Technical Documents are prepared by the AMI-C technical teams comprised of subject matter experts from AMI-C Members and Contributing Organizations. The AMI-C Program Management Committee approves these documents for publication. In preparing its publications, AMI-C adapts the drafting convention of the ISO/IEC Directive, Part 2, *Rules for the structure and drafting of international standards*, fourth edition, 2001, for its document format.

AMI-C Specifications Release 1 was published in January 2001. They provide overall strategic direction of the AMI-C architectural framework. AMI-C Specifications Release 2 and supporting documents provide the basis for basic network functionality. Release 2 includes specifications, guidelines, and information about proof of concept implementations. Phase 3 includes refinement and enhancement of Release 2 specifications along with guidelines and information about proof of concept implementations.

Future AMI-C publications will reflect the continuous improvements and expansion of the body of AMI-C documentation to match upgrades to existing technologies, evolving market demands, and emerging technologies in the evolution of information and entertainment systems in motor vehicles.

Introduction

The basic architecture for Power Management of 1394-Automotive Networks is based on AMI-C Network Communication Model (NCM) with a Host Centric approach, meaning, there is expected to be a central Host/Master in the Network which supports NCM and has the overall responsibility of managing the power states of the entire network in response to external events. The Host Centric approach is fully described in 3023 AMI-C Power Management Specification and NCM is described in 2001 AMI-C Network Protocol requirements for Vehicle Interface Access.

NCM uses the concept of Functional Modules (FMs) and Instance Numbers (I-Nums) to represent software components running in a node. For inter-component communication, NCM uses AMI-C Vehicle Interface protocol (VIP) which in turn, uses IEC 61883-1 Function Control Protocol (FCP) as the transport layer and AMI-C Common Message Set (CMS) as the data to be exchanged between components. A brief explanation of these items is given below.

In AMI-C NCM, a network is built up of several AMI-C Components where each AMI-C Component is a Physical entity connected to an AMI-C Network (in this case 1394 Automotive Network). Each component can contain one or more Functional Modules (FM). An FM is an abstraction of a device or a particular functionality of the device. For example, the Audio Module can be a type of FM and the door components (e.g., window) can be another type of FM. An FM is addressed by its logical address which is composed of a pre-defined, fixed Functional Module Type number (F-Type) and Instance Number (I-Num). I-Num is used for representation of multiple instances of the same FM (e.g., four or more door modules in a vehicle).The figure below explains the above concept.

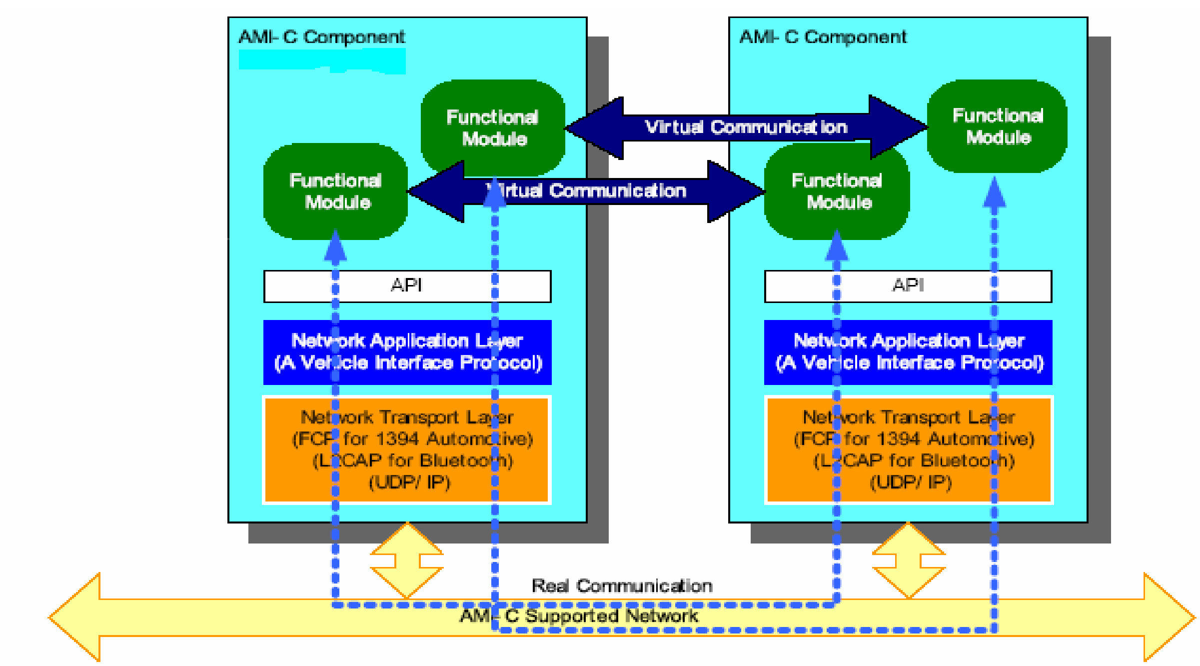


Figure 1 - AMI-C Network Communication Model

Though VIP was originally designed for accessing services available in the automaker's network, the protocol has rendered itself to be flexible enough to be adapted for Power Management purposes of 1394-Automotive Networks.

Scope

This document provides the architectural specification for realization of a Host Centric Power Management in 1394-Automotive Networks using an electrical control signal for changing the power state of the Network. It discusses the following items in details

- High Level Architecture for Power Management
- Functional Module decomposition for Power Management
- Interaction between Functional Modules using newly defined AMI-C CMS Messages related to power management
- System initialization and Power Management use cases

This architecture is specifically applicable to scenarios where Electrical Control signal is used for Power State control and is not applicable in general for Optical Signal Power Control techniques. However, some of the Power management messages, e.g., ones dealing with setting the System Power state can also be used for Optical Signal Power Control scenarios.

1 References

The following documents form a part of the specification to the extent specified herein. In the event of a conflict between the text of this specification and the documents cited herein, the text of this specification takes precedence.

1.1 Normative references

1. 3023 AMI-C Power Management Specification

1.2 Informative references

1. AMI-C Power Management EPoC System Description
2. 2001 AMI-C Network Protocol requirements for Vehicle Interface Access v1.00
3. 3003 AMI-C requirements and guidelines for 1394 Automotive networks v0.91
4. 2002 AMI-C Common Message Set v1.01
5. TA Document 2001018 1394 Automotive Specification (IDB1394) 1.0, March, 18th 2003
6. CCM Specifications Refinement-AMI-C2001_v1.02
7. RM Specifications Refinement-AMI-C2001_v0.82
8. Broadcast and Multicast Messages of Vehicle Interface Protocol_v1.0
9. Specifications refinement - System Transactions_v1.01

2 Architectural overview

The architecture for Host Centric Power Management is shown in **Error! Reference source not found.** below. This architecture is based on AMI-C Network Communication Model (NCM) and AMI-C Vehicle Interface Protocol (VIP). This figure is derived from AMI-C Meta protocol conceptual architecture diagram shown in **Figure 1**.

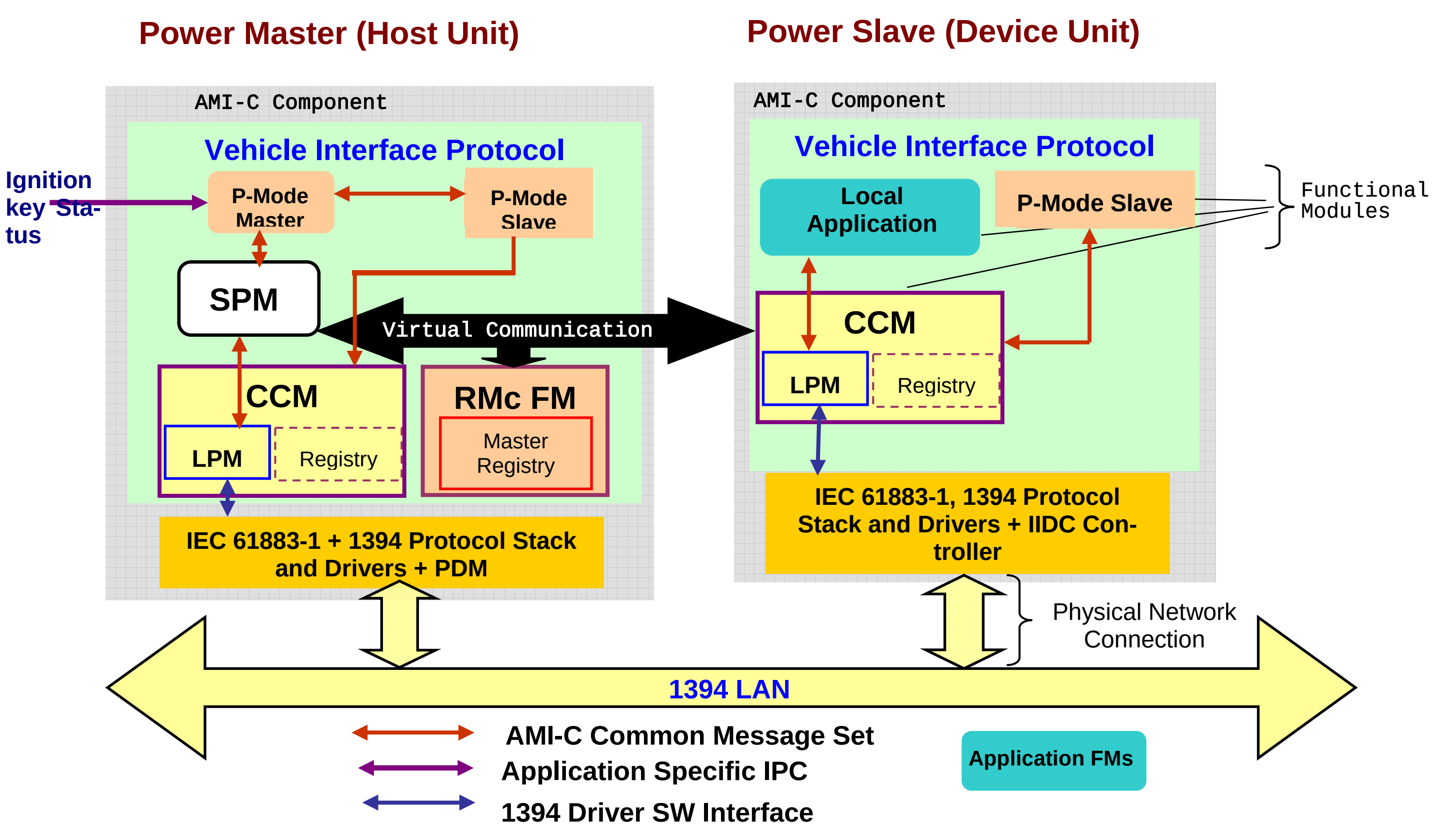


Figure 2 - Architecture for Power Management

Based on the above architecture, the functional modules involved in Power Management can be split in two parts – 1) Components which are responsible for Network Power Management and 2) Components which are responsible for Network Communication and Resource Management as specified in AMI-C NCM.

The above figure does not show the Electrical Control line, hereafter referred as P-Mode Line, and also the interface of P-Mode Master and Slave with this line.

2.1 Network Power Management Components

These components are P-Mode Master, P-Mode Slave, System Power Master, Local

Power Manager and Power Distribution Manager. The first 2 are dedicated towards monitoring and controlling the status of Power Line as well as towards reacting to external power events like Ignition Key ON/OFF while the remaining 3 are dedicated to implement the power management strategy for the whole network.

P-Mode Master shall be present in the Host Unit and shall be responsible for initiation of Wake Up/Shutdown of the network based on external events like Ignition Key ON/OFF and for controlling the status of the P-Mode Line. There shall be only a single instance of P-Mode Master in the entire network.

P-Mode Slave shall monitor the status of the P-Mode Line and interact with local power manager for power management of individual nodes. P-Mode Slave shall be present in all nodes of the network which complies with AMI-C Power Management specifications.

System Power Master (SPM) shall control the power mode of the entire network and hosts the Power mode change decision algorithm. It shall be resident in the Host Unit and like P-Mode Master shall run as a single instance in the entire network. This is in contrast to LPMs which, like P-Mode Slave, shall be present in all nodes of the network which complies with AMI-C Power Management specifications.

Whenever a trigger for power mode change is activated, e.g., a message or event is received by SPM from P-Mode Master, SPM shall announce this power mode change event on the network and direct the individual Local Power Managers in the nodes (LPMs) to switch to new power state. In the event that any Power Manager does not switch to the new power state, the SPM may force the new power state by sending a FORCE message on the network.

Local Power Manager (LPM) shall be responsible for local power management of a node. It shall be present in each node that implements AMI-C Power Management specifications. In fact, a device can be classified as a non-legacy device if it has a LPM managing the node power. LPM controls the node power state based on commands from SPM as well as when the device power is controlled by the power switch of the device. For example, upon receiving a message from SPM to set the new power state in a particular node, the node LPM must decide whether or not it can set this new power state. In case, the LPM can set the new power state, it should send an ACCEPT message to the SPM, otherwise a REJECT message.

For managing the power consumed by a node, LPM may control the power state of the PHY, Link and the local applications running in the node. On receiving a wake up message from SPM, LPM may resume/restart the local applications in the node and on receiving a Shutdown message may suspend/terminate these applications. It may do this with the help of Component Control Manager (explained later) and for those applications which are registered with the CCM.

To control the power of the PHY, LPM can resume/suspend the PHY of the local device with PHY remote command packets. For controlling Link power, LPM may switch on the Link with Link On packet and switch off the Link using Link Off bit in the STATE_SET register.

Note: In case of a PHY capable of Automotive Sleep mode as defined by 1394 TA, PHY state should be changed to Sleep Mode, which is the ultra low power mode, instead of Suspend state.

Power Distribution Manager (PDM) shall be responsible for building a knowledge base of power capabilities of each node in the network by tracking the power class information in the self-ID packet of the nodes in the network. PDM shall use this knowledge base to identify the Legacy devices in the network and control their power state in response to SPM commands of Wake up and Shutdown. PDM shall keep the knowledge base updated across bus resets. PDM may be implemented as part of the 1394 Bus Manager.

To control the power mode of the legacy devices connected to CCP, PDM shall disable/enable the CCP port that is connected to the Legacy device based on power mode change commands from SPM.

Note: In case of a CCP compliant with Automotive CCP specifications as defined by 1394 TA, CCP port connected to the legacy device should be hard disabled instead of disabled.

2.2 Network Communication and Resource Management Elements

These are functional modules that implement AMI-C Network Communication Model. In case of Power Management, two such functional modules - **Resource Manager (RM)** and **Component Control Manager (CCM)** are of significance**.**

RM is responsible for network-wide I-Num allocation/deallocation and, if required, for maintaining Multicast group information. Every AMI-C Network Communication Model compliant system implements at least one RM.

In case of Power Management, RM shall allocate Instance numbers for LPMs and P-Mode Slaves. Like other FMs in the network, RM shall register its F-Type, I-Num and other communication specific data with CCM (if CCM is present in a Component) in order to participate in network transactions. RM is normally present in the Host Unit.

Other than I-Num management, RM does not do any other resource management in the network – like Isochronous bandwidth allocation and management, Isochronous channel number management, etc as these still come under the purview of Isochronous Resource Manager (IRM).

Component Control Manager (**CCM)** is a special FM which may be present in all nodes in the network to centralize the communication and network management requirements of all FMs within a Component. If a CCM is present in a Component, the individuals FMs of the Component are expected not to send their transmission requests directly to the Network Protocol layer but instead route them via the CCM. The CCM should then send the request in the required data frame format to the Network Protocol Stack depending on whether the destination FM is local or remote. Similarly, all incoming messages to a Component should be received by its CCM, which routes the messages to the individual, destination FMs. CCM also routes messages between FMs within the same node. Primary responsibilities of CCM are:

- **Component Initialization** meaning registration of local FMs with CCM and creation of registry or database for maintaining records of local and remote FMs thereby optimizing network traffic. Please refer **Figure 3 – System Start Up sequence**

- and **Figure 4 – Initialization Sequence after Bus Reset** for details of how CCM builds up the Registry on System Start up and updates it after a bus reset.
- **Packetization** meaning formation of VIP Packets, corresponding to Application/System Transaction communication requests.
- **Service Discovery** includes exposing or replying to service discovery related queries from other components. In case of Power management, only, *General Service Discovery* (and not *Specific Service Information*) is applicable.
- **Component Power Management** which means that the CCM contains the Local Power Manager as a sub-module for managing the power state of individual nodes.
- **Network management,** meaning delivery of messages to concerned FMs using the information created in registry as well as network management tasks such as transaction retries, sending confirmations, address resolution using ARP, etc.

2.3 Inter-Module Communication Mechanism

The high level communication architecture between Functional modules is based on AMI-C Vehicle Interface Protocol and AMI-C Common Message Set. This approach along with the usage of CCM as communication coordinator results in following advantages:

- High level Communication mechanism is platform and Operating System (OS) independent.
- All communication and protocol related complexities are confined within CCM which also provides abstraction for local and remote nodes to higher layer applications.
- Flexibility to use platform and OS specific features to optimize power consumption for applications during wake up/ sleep states exist.

This communication architecture is primarily valid for modules which can be potentially located in different network nodes (For example, it is possible that the Host unit (with SPM and LPM) is in a different node than the P-Mode Master).

The communication architecture between modules which do not communicate over the network can be implementation dependent. However, if these modules are assigned Functional Modules e.g., P-Mode Master and P-Mode Slave or SPM and LPM, then, it is recommended that VIP and CMS be used to maintain architectural uniformity.

3 System Initialization and Power Management Strategy

The following sets of sequence diagrams explain the System Initialization process and Power Management strategy. The interactions between the functional modules happen through AMI-C Common Message Set. The details of these messages are explained in a later section.

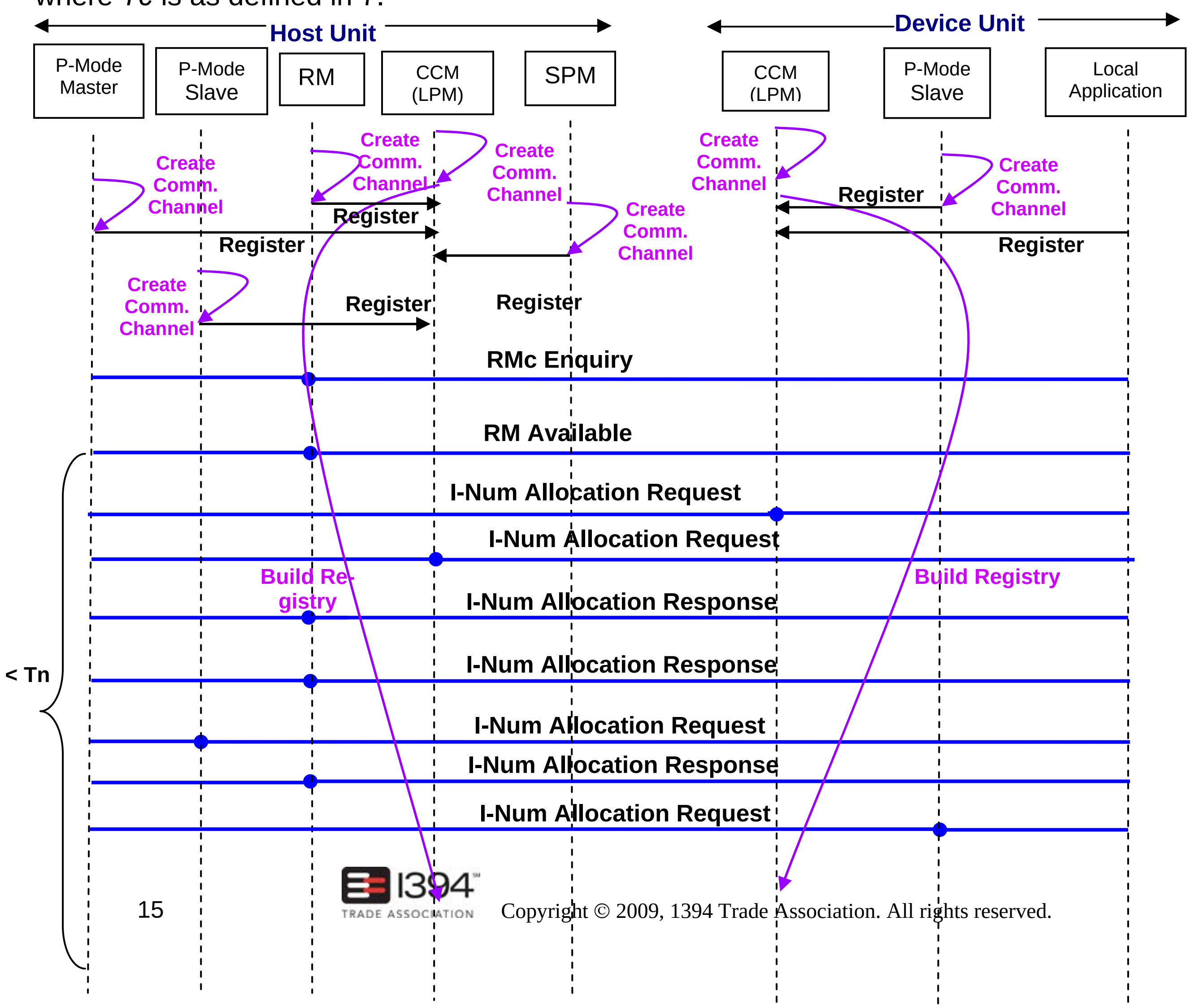
3.1 System Start up

Figure 3 – System Start Up sequence

below shows the sequence of events/actions applicable when the Host Unit and Device Units are first turned on (equivalent to "Battery connects" operation) and the individual System Manager in Host and Device Units load the software modules.

The sequence is shown from the instant of time when the FMs have just been loaded in memory and are about to execute their individual Init/Start routines. The Start routines of the FMs (non-CCM), should create and open their respective Communication channel, register with CCM and wait for ***RM Available*** Broadcast Message.

Entire I-Num allocation process should complete within time ***Tn (= 30*Tc)*** from the issue of RM Available Message and CCM should issue *Component Initialization Complete notification* within time ***4*Tc*** from the last I-Num Allocation message in the network, where *Tc* is as defined in 7.



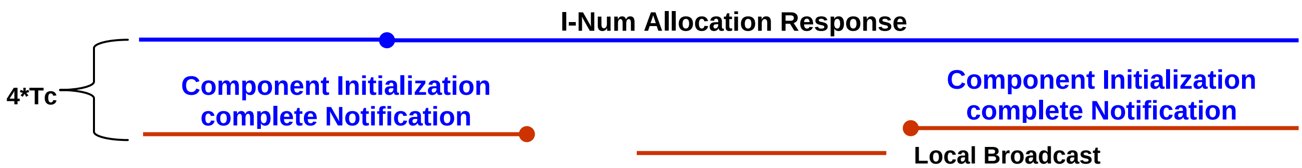


Figure 3 – System Start Up sequence

3.2 Initialization Sequence after Bus Reset

Figure 4 shows the initialization sequence on Bus Reset. This sequence holds good for all cases of Bus Reset, except for ones that happen due to Port Suspend/Disable. The diagram below depicts the activities CCM should carry out to update its Registry after Bus Reset. ARP requests should be initiated by CCM only for those FMs which are already present in its registry due to some previous transactions but residing in a different node.

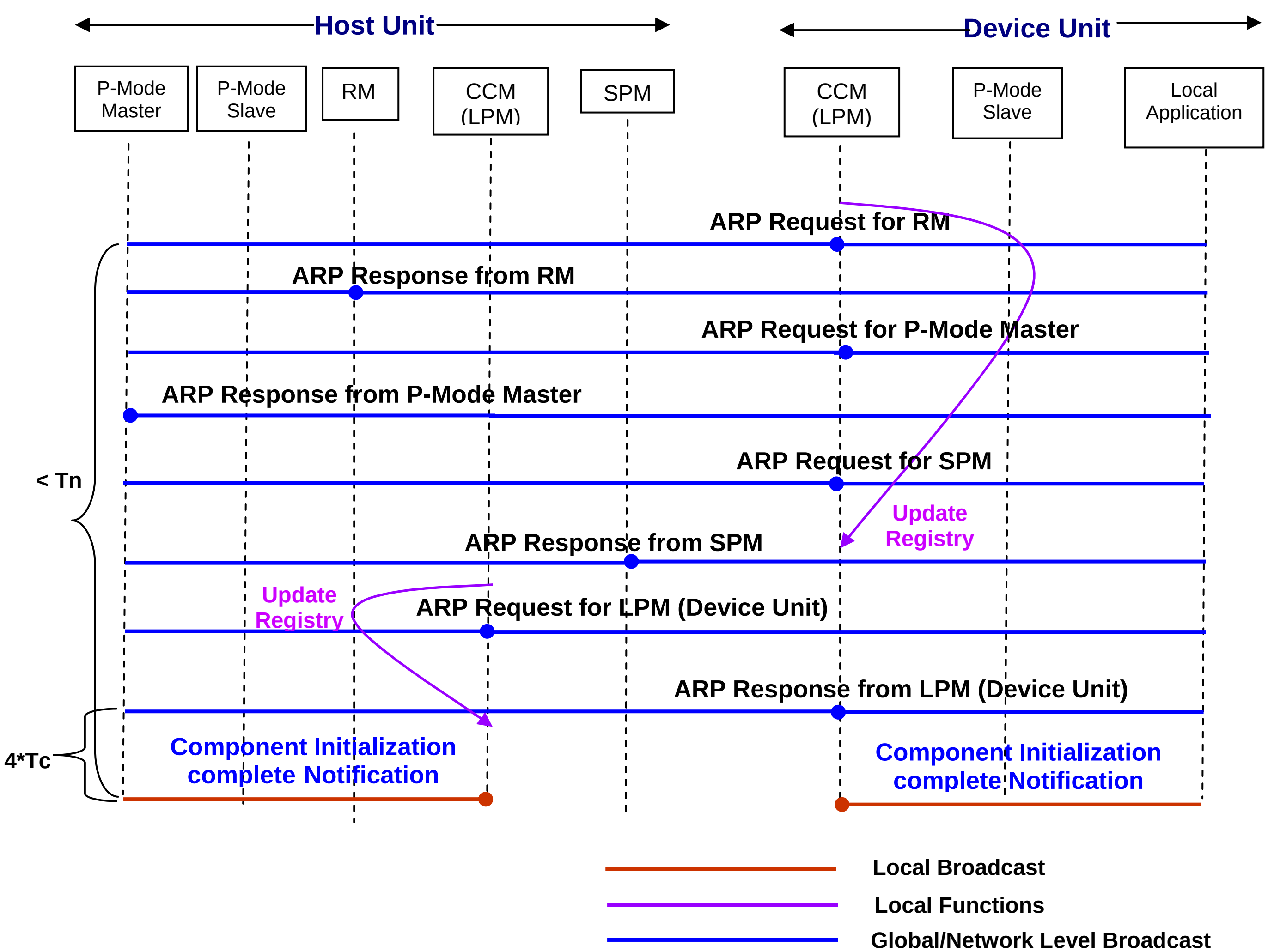
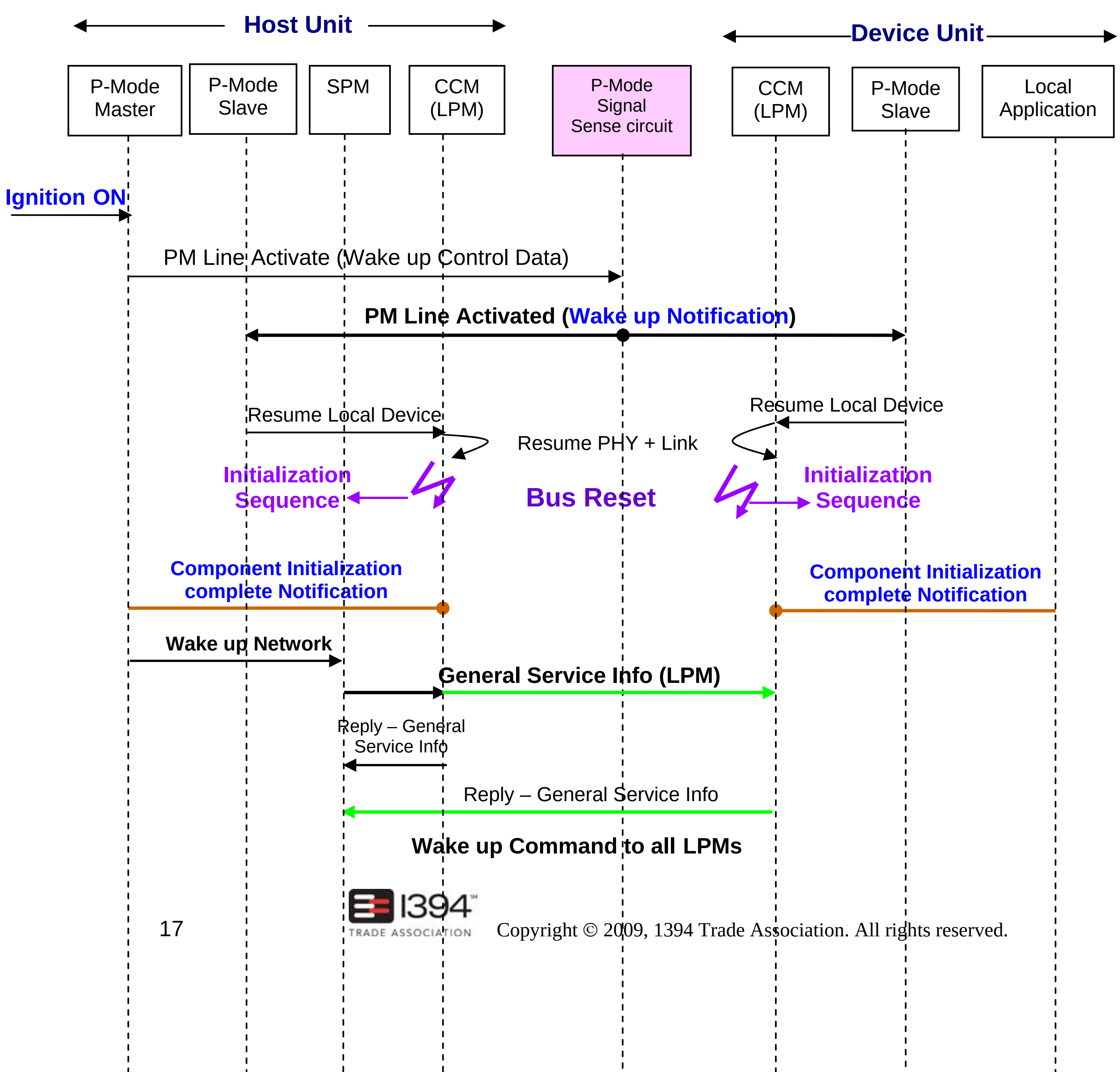


Figure 4 – Initialization Sequence after Bus Reset

3.3 Wake up through Ignition ON event

Figure 5 below depicts the sequence of operations that should take place when P-Mode Master receives an equivalent of Ignition ON event. P-Mode Signal sense circuit is a hardware-software element that senses the change in status of P-Mode Line and informs the P-Mode Slave component in each unit about this status change.



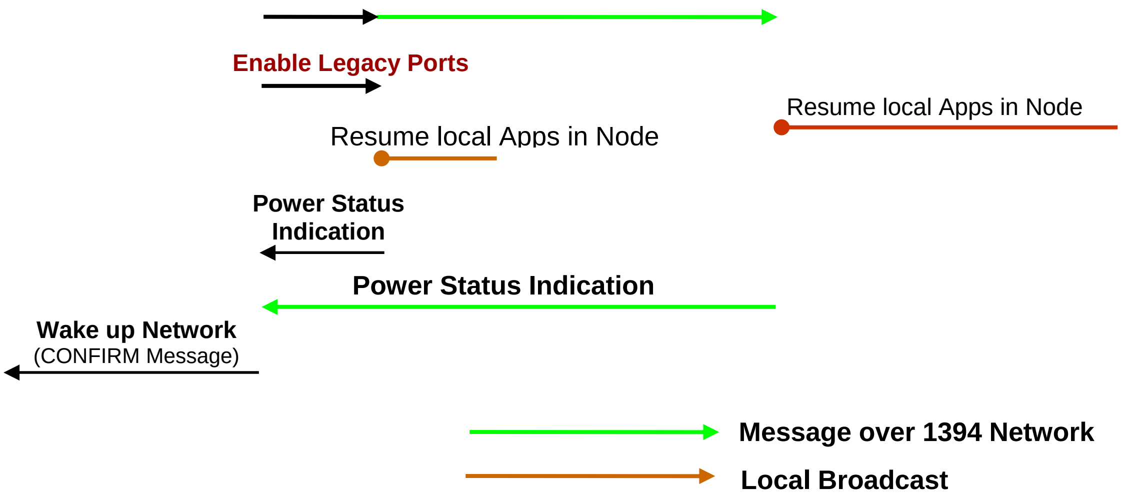
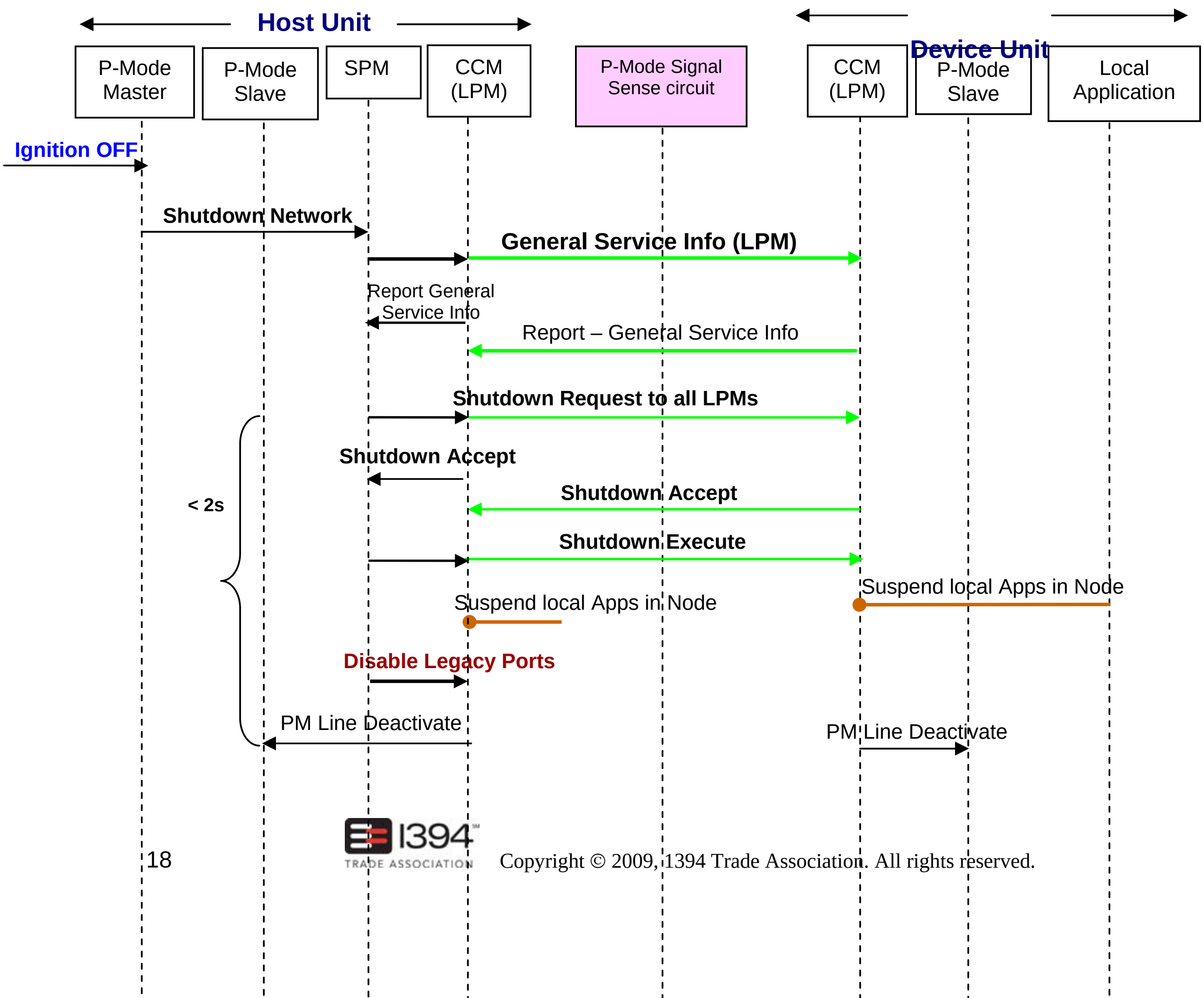


Figure 5 – Wake up through Ignition ON event

3.4 Shutdown through Ignition OFF event (Cooperative)

Figure 6 below depicts the sequence of operations that take place when P-Mode Master receives an equivalent of Ignition OFF event and the individual Local Power Managers in the nodes accept the shutdown command from the System Power Master.



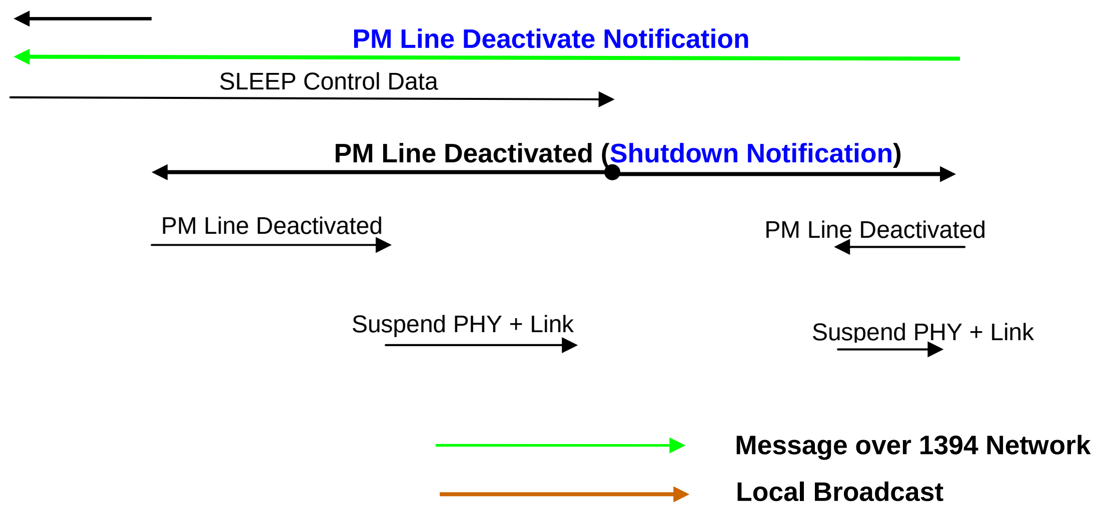
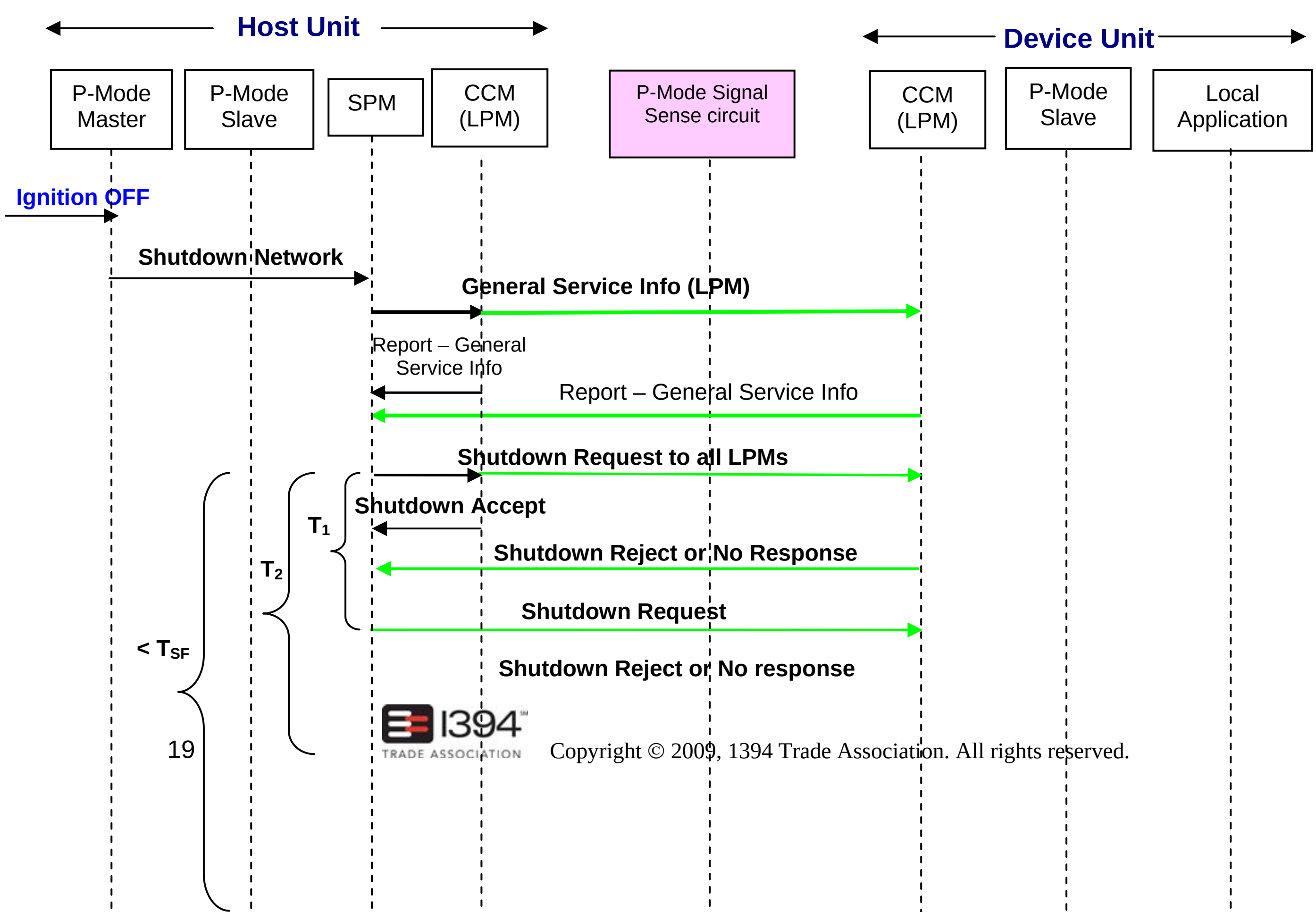
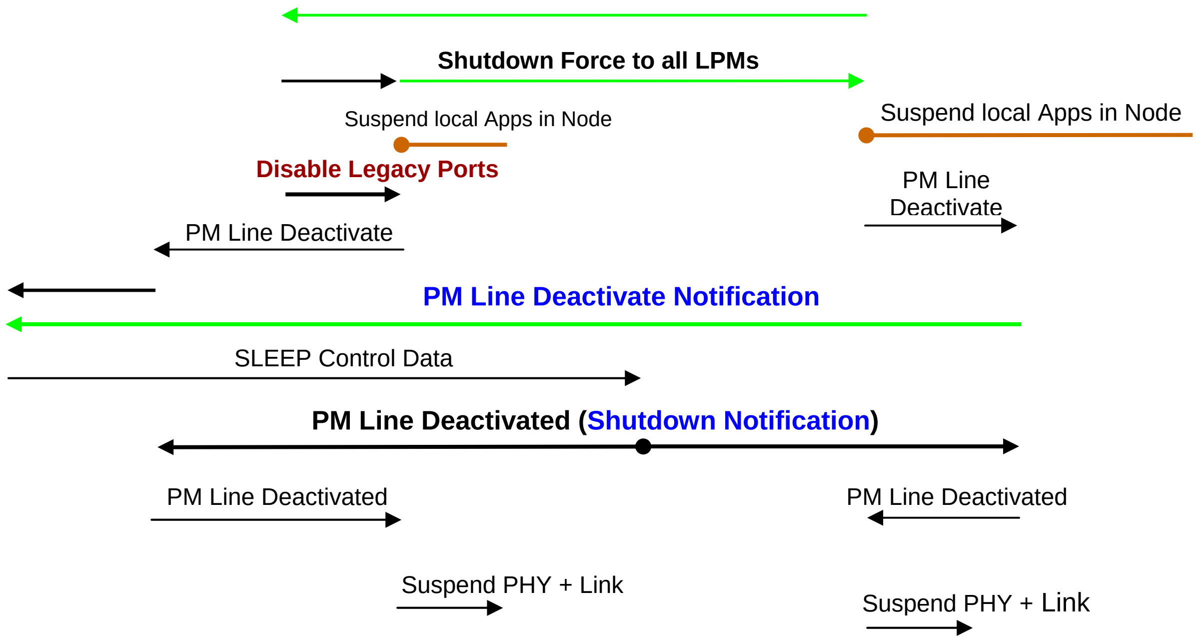


Figure 6 –Cooperative shutdown through Ignition OFF event

3.5 Shutdown through Ignition OFF event (Forced)

Figure 7 below depicts the sequence of operations that take place when P-Mode Master receives an equivalent of Ignition OFF event and one or more individual Local Power Managers either do not respond or refuse the shutdown command from the System Power Master.





T_1 = 1 sec, T_2 = 5secs as defined in 1 , $T_{SF} = T_2 + Tsc$

Figure 7 –Forced shutdown through Ignition OFF event

4 Network Messages

The Network messages under consideration here are the messages that are exchanged between Functional Modules for communicating with each other. The data contents of these messages follow AMI-C Common Message Set and the messages themselves are exchanged using System and Application transactions of AMI-C Vehicle Interface Protocol (VIP).

To support the Power Management requirements, AMI-C Common Message set has been extended and new Functional Modules and Messages have been added the details of which are explained in sections below.

4.1 Functional modules for Power Management

The F-Type and I-Num of SW Modules involved in Power Management are described in the table below. The F-Types of some of the new modules such as P-Mode Master, P-Mode Slave, SPM and LPM are chosen from the current reserved band of *0x41 to 0x4F* after *Diagnostics Module (0x40)* as specified in AMI-C 2002 Common Message Set.

In cases when CCM is implemented, LPM's I-Num shall be same as that of the CCM to which it belongs.

Module Name	F-Type	I-Num	Remarks
P-Mode Master Application	0x46	01	**New**
P-Mode Slave Application	0x47	Dynamic	**New**
CCM	0x00	Dynamic	F-Type as defined in Section 5.3.14.1 of AMI-C 3003
RM	0x0F	01	F-Type as defined in Section 5.3.14.1 of AMI-C 3003
SPM	0x4B	01	**New**
LPM	0x4C	Dynamic	**New**

Table 1 – Functional Modules (FMs) for Power Management

4.2 CMS Messages for Power Management

4.2.1 P-Mode Master and P-Mode Slave

Notifications shall be sent by P-Mode Slave to P-Mode Master when the PM line is to be deactivated in case of shutdown. This Notification message belongs to the ***Management Class*** with Object Property of ***0x17*** and is named as **P-Mode Message**. This is a new Message that is added to *AMI-C 2002 Common Message Set.* The message is further described in the table below.

Source FM	Destination FM	Message Type	Power Mode	Transaction Type
P-Mode Slave	P-Mode Master	WARNING	PM Line Deactivate = 0x01	Unicast Application Transaction

Table 2 – Notification Message from P-Mode Slave to P-Mode Master

4.2.2 P-Mode Master and SPM

The messages exchanged between P-Mode Master and SPM are –

i) Wake up Network and ii) Shutdown Network commands from P-Mode Master to SPM and corresponding responses. These messages belong to the ***Management*** class with Object Property of AMI-C CMS ***Power State*** Messages defined in ***Section 6.3*** *of AMI-C 2002 Common Message Set.* The messages are described in the table below.

Source FM	Destination FM	Message Type	Power Mode / Error Status	Transaction Type
P-Mode Master	SPM	SET (Cf=1)	WAKE-UP Network	Unicast Application Transaction-Parameters as described below
SPM	P-Mode Master	CONFIRM	Error Status	Unicast Application Transaction-CONFIRM Parameters derived from *Section 6.3* of *AMI-C 2002* & described below
P-Mode Master	SPM	SET (Cf=0)	SHUTDOWN Network	Unicast Application Transaction Parameters as described below

Table 3 – Messages between P-Mode Master and SPM

Power Mode	Value	Remarks
Wake-up Network	0x01	
Shutdown Network	0x03	

Table 3.1 – Parameters of SET messages between P-Mode Master and SPM

Power Mode	Value	Remarks
No Error	0x00	Request successful without error.
Unspecified error	0x01	Error that is not possible to identify
Not supported	0x02	Incoming Request not supported
Busy/Cannot accept	0x03	Cannot Accept Request**/ Not all Local Power Managers accepted request**

Table 3.2 – Parameters of CONFIRM messages between P-Mode Master and SPM

4.2.3 P-Mode Slave and LPM

The messages exchanged between P-Mode Slave and LPM belongs to the ***Management Class*** with a **new** Object Property of ***P-Mode State (0x03).*** The Messages are described in the table below.

Source FM	Destination FM	Message Type	Power Mode / Error Status (Operand 0)	Transaction Type
P-Mode Slave	LPM	SET (Cf=0)	Resume Local Device	Unicast Application Transaction Parameters described below
LPM	P-Mode Slave	SET (Cf=1)	Deactivate PM Line	Unicast Application Transaction Parameters described below
P-Mode Slave	LPM	CONFIRM	PM Line Deactivated	Unicast Application Transaction. Parameters described below

Table 4 – Messages between P-Mode Slave and LPM

Power Mode	Value	Remarks
Resume Local Device	0x01	
Deactivate PM Line	0x02	

Table 4.1 – Parameters of SET Messages between P-Mode Slave and LPM

Power Mode	Value	Remarks
No Error	0x00	Request successful without error.
Unspecified error	0x01	Error that is not possible to identify
Not supported	0x02	Incoming Request not supported
Busy/Cannot accept	0x03	Cannot Accept Request

Table 4.2 – Parameters of CONFIRM Messages between P-Mode Slave and LPM

4.2.4 P-Mode Slave, CCM (LPM) and RM

Since there can be multiple instances of P-Mode Slave Applications and LPMs in the network, the instance numbers of these modules cannot be fixed and have to be allocated dynamically by RM. To support this dynamic allocation/deallocation, P-Mode Slave and LPM should use I-Num Allocation/Deallocation Request / Response System transaction messages as defined in *AMI-C 2001* and subsequent refinements.

4.2.5 SPM and LPM

All CMS Messages exchanged between SPM & LPM belong to ***Management class*** (0x02) with Object Property of ***System Power Mode*** (**0x01**, as defined in *Section 6.2 of AMI-C 2002* Common Message Set) and described in the table below:

Source FM	Destination FM	Message Type	Power Mode / Error Status	Transaction Type
SPM	All LPMs	SET (Cf=1)	WAKE-UP	Application level Broadcast to all LPMs : Destination F-Type = LPM F-Type & Destination I-Num = 0xFF, Parameters as described below
LPM	SPM	CONFIRM	Error Status	Unicast Application Transaction-CONFIRM Parameters derived from *Section 6.2* of *AMI-C 2002* **Error! Reference source not found.** & described below
SPM	All LPMs	SET (Cf=1)	SHUTDOWN REQUEST	Application level Broadcast to all LPMs : F-Type = LPM's F-Type and I-Num = 0xFF or Unicast Application Transaction. **Refer Notes**
LPM	SPM	CONFIRM	Error Status (Accept/Reject)	Unicast Application Transaction-CONFIRM Parameters derived from *Section 6.2* of *AMI-C 2002* & described below
SPM	LPM	SET (Cf=0)	SHUTDOWN EXECUTE (Normal/Forced)	Application level Broadcast to all LPMs : Destination F-Type = LPM F-Type & Destination I-Num = 0xFF, Parameters as described below
SPM	LPM	INQUIRE	Power State	Unicast Application Transaction. Parameters described below
LPM	SPM	REPORT	Power Status Indication	Unicast Application Transaction. Parameters described below

Table 5 – Messages between SPM and LPM

Notes - In case one or more LPMs reject the Shutdown request, SPM needs to retry the Shutdown request for those LPMs again after a time gap. In such a situation, the transaction should be of type Unicast and Destination I-Num should be equal to the I-Num(s) of the LPM(s) which rejected the shutdown request.

Power Mode (Operand 0)	Value	Remarks
Wake-up	0x01	Wake up Request
Shutdown Request	0x02	Shutdown Request
Shutdown Execute Normal	0x03	Shutdown Execution – Normal/Cooperative
Shutdown Execute Forced	0x04	Shutdown Execution – Forced

Table 5.1 – Parameters of SET Messages between SPM and LPM

Error Status (Operand 0)	Value	Remarks
No Error	0x00	Request successful without error. **Wake up Successful** / **Accept Shutdown Request**
Unspecified error	0x01	Error that is not possible to identify
Not supported	0x02	Incoming Request not supported
Busy/Cannot accept	0x03	Cannot Accept Request. **Reject Shutdown Request**

Table 5.2 – Parameters of CONFIRM Messages between SPM and LPM

Operand 1 contains the new Power state with values as described under Report Message parameters below.

Power State	Value	Remarks
Power State	0x01	

Table 5.3 – Parameters of INQUIRE Messages between SPM and LPM

Power State	Value	Remarks
Resumed	0x01	
Suspended	0x02	

Table 5.4 – Parameters of REPORT Messages between SPM and LPM

4.2.6 CCM and Local Applications

To build the registry information for the local applications in a component, CCM shall communicate with these Local applications. In case of local applications which have Dynamic I-Nums, CCM should create entries in registry for these applications during I-Num allocation process. However, for applications with Fixed I-Nums, there are no way that CCM can discover these applications as these applications do not make I-Num allocation requests. So, these applications should register with CCM as part of their initialization process. The CMS Messages for Registration is as shown in table below.

Please refer **Figure 3 – System Start Up sequence**

and **Figure 4 – Initialization Sequence after Bus Reset** to have an overview of the registration process during System Start Up and after Bus reset.

4.2.6.1 CCM Registration

CCM registration messages are derived from **Node Information Announcement** (0x05) CMS Message defined in *Section 6.4* of *AMI-C 2002 Common Message Set* with certain modifications described below.

Source FM	Destination FM	Message Type	Parameters	Transaction Type
Local Applications	CCM	CMD (Cf=0)	As described below	Unicast Application Transaction.

Table 6 – Message for Local Application registration with CCM

Message Parameters

Operand 0 - Register (1) / Unregister (0)

Operand 1 – F-Type of Source FM as defined in *Section 6.4* of *AMI-C 2002 Common*

Message Set

Operand 2 – I-Num of Source FM as defined in *Section 6.4* of *AMI-C 2002 Common Message Set*

Operand 3 – Number of Services, as defined in *Section 6.4* of *AMI-C 2002 Common Message Set* and *0* in case of Power Management

Operand 4 – Specific Service info, as defined in *Section 6.4* of *AMI-C 2002 Common Message Set* and *0* in case of Power Management

Operand 5 – User Specified data type and length (Upper 3 bits for data type, lower 5 bits for data length)

Operands 6…37 – User data or Filled with 0 if No user specified data

User Specified Data types: 0 – No Data, 1 – Numeric Data, 2 – SEQUENCE of Numeric Data, 3- UniversalString (SIZE (32)), i.e., Set of 32 octets

4.2.6.2 Registry format of CCM

CCM Registry Format is as defined below. The user specified data consists of 6 quad-lets and 1 byte. This 1 byte identifies the type of user specified data and its length as shown below. The valid data types are listed above

AMI-C Identification (Size = 3 bytes)			**User specified data type & length (Size = 1byte)**	**User Specified data (Size = 32 bytes)**	**Network Identification (Size = 4 bytes)**
F-Type	I-Num	AMI-C Network ID For 1394, this is set to 1			1394 Node Address

Table 7 – Registry format of CCM

4.2.6.3 CCM Notifications

CCM shall send out ***Component Initialized Complete Notification*** as a Local Broadcast after its Registry is created and updated. In case of Wake up, this notification is used by P-Mode Master to command the SPM to Wake Up the network. This process is shown in **Figure 4 – Initialization Sequence after Bus Reset** and **Figure 5 – Wake up through Ignition ON event**.

The above Notification belongs to **Management Class** with Object Property as *Simple Data Transfer* (0x15) as defined in *Section 6.18* of *AMI-C 2002 Common Message Set.*

Source FM	**Destination FM**	**Message Type**	**Component Status (Operand 0)**	**Transaction Type**
CCM	Local Applications	WARNING	Component Initialized Complete = 0x01	Local Broadcast – Destination FM = 0xFF, Destination I-Num = 0x00

Table 8 – CCM Notification Message

4.2.7 LPM and Local Application

The CMS messages exchanged between LPM and local applications in a device/node pertains to resumption/suspension of the local application depending on the power state specified by LPM.

Depending on platform and implementation, resumption and suspension of an application could imply resumption/suspension of the Application main thread/process or complete start-up/shutdown of the application using OS specific techniques and scheduler. Whatever may be the case, resumption implies availability of full-features of the application and suspension implies availability of only the wake-up/resumption detection mechanism of the application.

The table below describes the messages to be exchanged between LPM and the local applications for resumption/suspension. These messages belong to **Management class** with a new Object Property of ***Local Power Mode Message*** (0x04).

Source FM	Destination FM	Message	Power Mode/Error Status	Transaction Type
LPM	Local Applications	SET (Cf=0)	Resume	Local Broadcast – Destination FM = 0xFF, Destination I-Num = 0x00
LPM	Local Application	SET (Cf=0)	Suspend	Local Broadcast - Destination FM = 0xFF, Destination I-Num = 0x00
LPM	Local Application	INQUIRE	Power State Enquiry	Unicast Application Transaction. Parameters described below
Local Application	LPM	REPORT	Power Status Indication	Unicast Application Transaction. Parameters described below

Table 9 – Messages between LPM and Local Applications

Power Mode (Operand 0)	Value	Remarks
Resume	0x01	
Suspend	0x02	

Table 9.1 – Parameters of SET Messages between LPM and Local Applications

Power Status (Operand 0)	Value	Remarks
Power State Enquiry	0x01	Enquiring the Power state of an Application

Table 9.2 – Parameters of ENQUIRE Messages between LPM and Local Applications

Power Status (Operand 0)	Value	Remarks
Can Suspend	0x01	Power Status Indication - Application has resumed and can go into suspended state if requested to do so
Cannot Suspend	0x02	Power Status Indication - Application has resumed but cannot go into suspended state if requested to do so
Suspended	0x03	Power Status Indication – Application is in suspended state

Table 9.3 – Parameters of REPORT Messages between LPM and Local Applications

Annex A Requirement and recommendation language

A.1 Requirements

The following verbal forms are indicative of requirements that are to be followed in order to achieve conformance to this specification. No deviation is permitted from a requirement.

Verbal Form	Equivalent Expressions
Shall, Must, Will	Is to Is required to It is required that Has to Only … is permitted It is necessary
Shall Not, Will Not	Is not allowed [permitted] [acceptable] [permissible]

A.2 Recommendations

The following verbal forms are indicative of recommendations or courses of action that are preferred, but are not necessarily required.

Verbal Form	Equivalent Expressions
Should	It is recommended that Ought to
Should Not	It is not recommended that
May	Is permitted Is allowed Is permissible
May Not	Need not It is not required that No … is required
Can	Be able to There is a possibility of It is possible to
Cannot	Be unable to There is no possibility of It is not possible to

Annex B Request for change form

Use this form to identify errors or deficiencies or to recommend general changes.

Document No.	**Version No.**	**Version Date**
Document Title		

Requestor Information	
Name:	
Organization:	
E-Mail:	
Phone:	
Description of Change:	
Section number:______________________	
Rational for Change:	
Proposed Revision:	
Affected Sections:	