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Information technology — Sensor Networks — Services and Interfaces Supporting Collaborative Information Processing in Intelligent Sensor Networks

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Foreword

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Technical Committee ISO/IEC JTC 1, Information Technology, Working Group 7, *Sensor Networks*, prepared ISO/IEC N 20005.

Introduction

Intelligent sensor networks are becoming increasingly attractive in a wide range of applications to meet generic challenges from the dynamic changes of deploying environment, network status and application performance requirement. Collaborative information processing (CIP), which closely integrates information processing algorithms with collaboration mechanisms, is an essential technology helping intelligent sensor networks to guarantee system performance in real application scenarios. This standard specifies services and interfaces supporting CIP in intelligent sensor networks.

(To be revised)

Information technology — Sensor Networks — Services and Interfaces Supporting Collaborative Information Processing in Intelligent Sensor Networks

1 Scope

Intelligent sensor networks provide desired system performance under dynamic changes of deploying environment, network status and application requirement. This international standard specifies services and interfaces supporting collaborative information processing (CIP) in intelligent sensor networks. It covers:

- Performance requirements and analysis on intelligent sensor networks
- Definition of CIP functionalities and CIP functional model
- Clarification of common services supporting CIP
- Standardization of common service interfaces to CIP

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC JTC1 SGSN N149, *SGSN Technical Document Version 3*

ITU-T Recommendation Y.2221, *Requirements for support of Ubiquitous Sensor Network (USN) applications and services in NGN environment (2009)*

ITU-T Recommendation X.902 | ISO/IEC 10746-2 :2010, *Information technology – Open distributed processing – Reference Model: Foundations.*

ITU-T Recommendation X.903 | ISO/IEC 10746-3 :2010, *Information technology – Open distributed processing – Reference Model: Architecture.*

ISO/IEC JTC1 WD 29182, *Information technology – Sensor Networks – Reference architecture for sensor network applications and services.*

(To be added)

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

(Note: This clause will later be re-organized as alphabetical order of terms. And, some terms and definitions are included directly from ISO/IEC JTC1 SGSN N149, *SGSN Technical Document Version 3*)

3.1
sensor networks
A sensor network is a system of distributed sensor nodes interacting with each other and also interacting with other environments in order to acquire, process, transfer, and provide information extracted from a physical world in order to perform certain responses to the physical world. [ISO/IEC JTC1 SGSN N149]

3.2
sensor node
A sensor node is a device that consists of at least one sensor and zero or more actuators, and has processing and networking capabilities through wired or wireless means. [ISO/IEC JTC1 SGSN N149]

3.3
Sensor network service
A structural set of capabilities or functions which are offered by the sensor nodes or sensor networks.

3.4
service set or service subset
A group or subgroup of services organized to provide common mechanisms or facilities to meet certain requirements from users or applications.

3.5
sensor network application
The sensor network application is a user case of sensor networks supporting a set of sensor network services for users. [ISO/IEC JTC1 SGSN N149]

3.6
information
Any kind of knowledge that is exchangeable amongst users or entities, about things, facts, concepts and so on, in a universe of discourse.

3.7
information processing
The manipulation of data or information so that new data or information which is implicit in the original be appeared in a useful form, or with which further information processing can be applied and/or be utilized to make a response suitable within the context of an objective, problem or situation.

3.8
collaborative information processing
A form of information processing in which multiple discrete components or entities participate in a manner of collaboration, in order to enhance processing efficiency and to improve quality and reliability of the results.

3.9
viewpoint
A form of abstraction achieved using a selected set of architectural concepts and structuring rules, in order to focus on particular concerns within a system. [ISO/IEC 10746]

(To be added/revised)

4 Abbreviations

For the purposes of this document, the following abbreviations apply.

QoS	Quality of Service
CIP	Collaborative Information Processing
SAP	Service Access Point

CDE	Capability Declaration Entity
CSPE	Collaborative Strategy Planning Entity
CRSE	Communication Requirement Specification Entity
OSI	Open System Interconnection
GSR	Generalized System Requirement
FCR	Functional Capability Requirement

(to be added/revised)

5 General Description

Sensor networks have been widely deployed in different application domains ranging from environment monitoring, transportation, industries, and healthcare etc. Wired/wireless sensor networks can be regarded as an extension of Internet towards the physical world. In order to meet challenges from intrinsic environment complexity, large orders of magnitude network scaling and dynamic application requirements, intelligent sensor networks are developed to provide new system capabilities such as environment self-adaptability, dynamic task supporting and autonomous system maintenance. Collaborative information processing (CIP) is an essential technology to implement new functionalities of intelligent sensor network and finally to provide improved services to users of intelligent sensor networks.

This clause gives general description of sensor networks and requirements of intelligent sensor networks. Overviews of CIP and its functional models are presented, followed by general explanation on core and enhanced services supporting CIP in intelligent sensor networks.

5.1 Sensor networks overview

Compared with the traditional networks, sensor networks not only provide information transmission service but also provide information sensing, processing, provision and other services. Figure 1 shows a conceptual overview of the functional architecture of sensor networks.

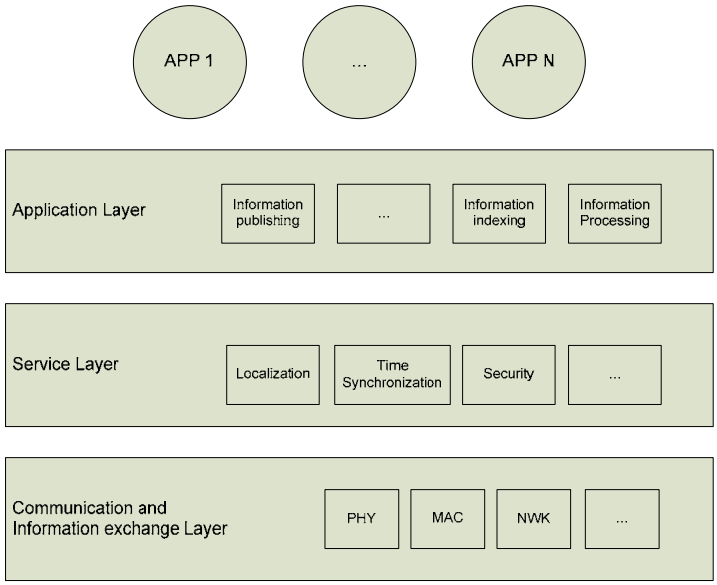

Figure 1 — Overview of the functional architecture of sensor networks

Communication and information exchange layer implements functionalities fulfilled by the lower layers in the OSI stack, including physical layer, data link layer, network layer, and transport layer. Application layer provides services to individual applications and implements functions such as information publishing, information indexing and information processing etc. Between application layer and communication and information exchange layer, the service layer provides generic common services to entities in the above application layer. In the context of sensor networks, a lot of generic common services need to be implemented including localization service, time synchronization service, security service and other services.

5.2 Requirements of intelligent sensor networks

Besides the generalized system requirements (GSR) and generalized functional capability requirements (FCR) of sensor networks, there are additional unique requirements on intelligent sensor networks to meet challenges from the dynamic changes of deploying environment, network status and application performance requirement.

- **Environmental self-adaptability:** Intelligent sensor network shall adaptively choose the best method to obtain required system performances in case of environment changes. As an example, an intelligent sensor network based anti-intrusion system should guarantee consistent system performance such as false alarming rate (FAR) when the deploying environment changes.

- **Dynamic task supporting:** Intelligent sensor network shall support dynamic tasks including dynamic task assigning, dynamic service-providing and dynamic quality of service (QoS).

- **Autonomous system maintenance:** Intelligent sensor network can autonomously maintain system functionalities in case of network scaling, node mobility and node failures.

(To be added/revised. Contributions are requested.)

5.3 Collaborative information processing overview

The key difference between traditional telecommunication infrastructures and sensor networks based information service system is that sensor networks based information service system collects low-level sensory data, extracts application-specific information from these sensory data, and make attempt to obtain high-level data, information, and knowledge about physical world.

Integrated with other entities such as sensory information description, sensor identification and sensory information storage, CIP concerns on how to resource-efficiently fulfil dynamic tasks specified by information service consumer. Though different sensor network application scenarios normally require scenario-specific services, collaboration is an indispensable requirement for senor network based information service to handle constraints in energy, computing, storage and communication bandwidth. To information service provider, it also has to deal with technical challenges from issues such as task dynamics, measurement uncertainty, node mobility and environmental changing.

The aim of CIP in sensor networks is to improve system efficiency, enhance quality of service and guarantee system performance. It provides efficient mechanisms and/or protocols to meet generic challenges from the dynamic changes of deploying environment, network status and application performance requirement.

CIP can be viewed from three distinct viewpoints. Figure 2 shows a three-dimensional functional model of CIP.

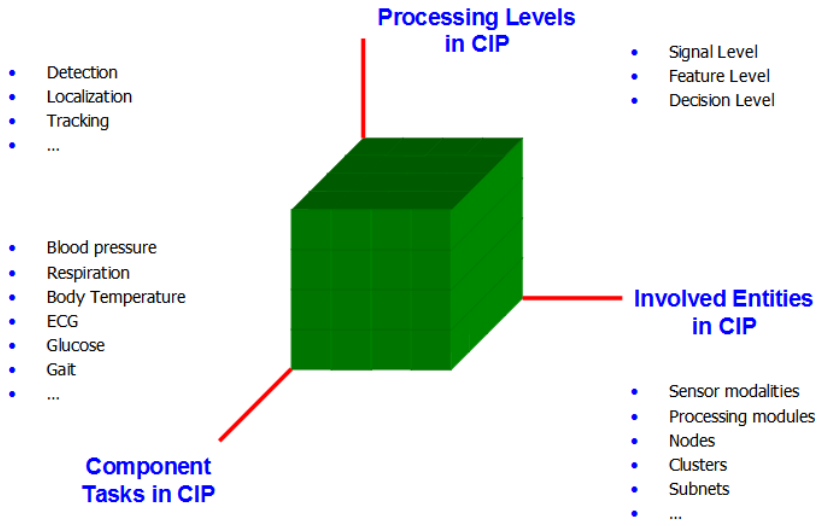

Figure 2 — Functional model of collaborative information processing

The first viewpoint is Processing Level viewpoint. In this viewpoint, CIP can be implemented on different processing levels, which includes data, feature and decision processing levels. The second viewpoint is Involved Entity. Involved Entities in CIP could be sensor modalities, processing modules, nodes, clusters, and even subnets. CIP can thirdly be viewed from Component Task perspective. Elements in this viewpoint depend on the specific application scenarios of sensor networks. In healthcare context, component tasks may include blood pressure/temperature measurement, respiration inspection, and gait analysis. In an anti-intrusion application, target detection, classification, and tracking could be component tasks for security services. Specific selections and combinations using elements from these three dimensions correspond to different application task implementations, or personalized services.

5.4 Functional model of collaborative information processing

Figure 3 shows a functional model of collaborative Information Processing. In this model, CIP can be characterized by three distinct entities, which is named as capability declaration entity (CDE), collaborative strategy planning entity (CSPE) and communication requirement specification entity (CRSE).

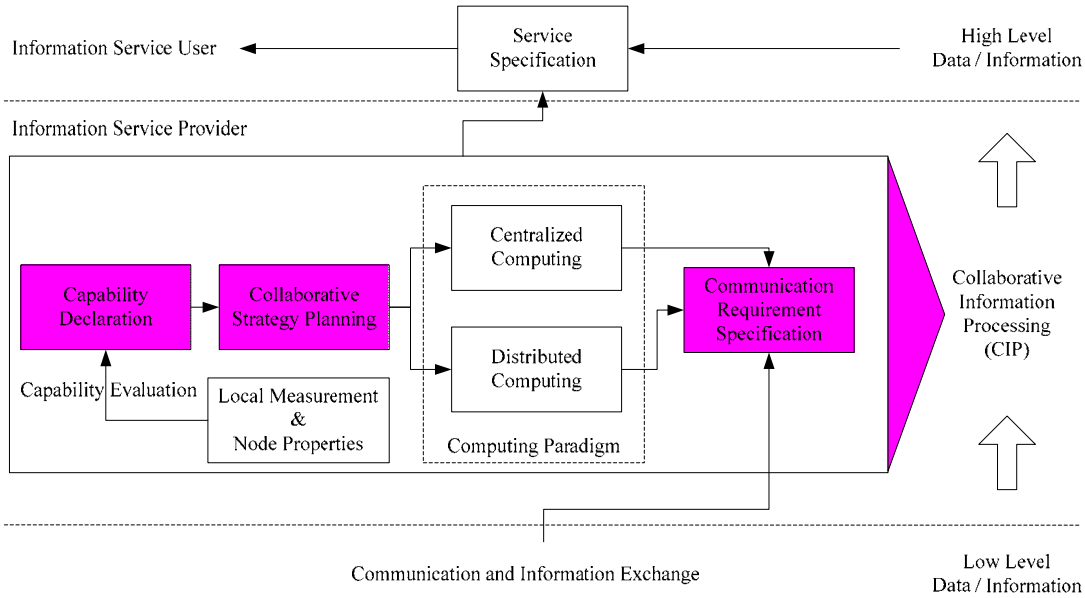

Figure 3 — Functional model of collaborative information processing

Capability declaration entity (CDE) declares capabilities of one sensor node to other nodes. Capabilities include not only individual node information on sensing modality configuration, sensing range, residual energy, storage and communication bandwidth etc., but also include certain characteristic information of sensory data collected by individual sensor node. One of the representative characteristics on sensory data is signal-to-noise ratio (SNR) value. Other characteristics include signal energy, estimated distance from target and sensor nodes, and state parameter prediction, etc. In other words, one sensor node should qualify itself to be a CIP participant before any actual CIP procedure is triggered. CDE requires a preliminary local capability evaluation process which uses information of local measurement and node property.

Collaborative strategy planning entity (CSPE) is the second and probably the most important entity in CIP. CSPE uses available information provided by CDE and forms global or regional maps or scopes on signal and information processing problems. With certain cost functions or utility measures, CSPE tries to find a resource-efficient solution to collaborative strategy planning problem, with which the best information processing performance can be achieved at the same time. Two computing paradigms can be used in the implementation of resulting solution from CSPE. One is centralized computing paradigm; the other is distributed computing paradigm.

Communication requirement specification entity (CRSE) acts as interface between information service provider and Communication and Information Exchange. CRSE defines parameters, languages or protocols to clearly describe requirements on communication and information exchange. Different requirements, such as end-to-end delay, time jitter, bit error and other QoS parameters should be specified.

5.5 Services supporting CIP Overview

A lot of generic common services can be provided by the service layer as shown in Figure 1. In the context of intelligent sensor networks, this standard specifies a subset of these generic common services which interface with CIP entities in the application layer and support implementation of corresponding CIP entity functionalities.

Services supporting CIP can be conceptually divided into two classes: core services and enhanced services. Core services include fundamental and essential services which can be provided directly and individually to CIP entities. Enhance services is implemented through service combination and integration of two or more core services or other generic common services provided by the service layer.

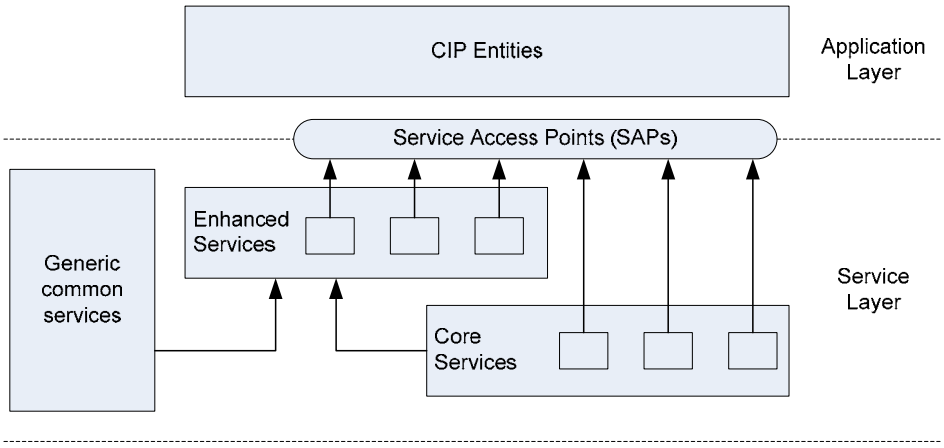

Figure 4 —Overview of services supporting CIP

5.5.1 Core services supporting CIP

The core services supporting CIP includes:

- **Event service:** This service implements functionalities concerning on the process of event subscription, registration, cancellation and un-subscription. Event may be generated due to environmental change, new physical signal occurrence and network status dynamics.

- **Logical grouping service:** This service implements functionalities concerning on the process of establishment and management of logical group for the implementation of CIP in the application layer. Logical grouping service provides mechanism for establishing collaborative relationship among entities in intelligent sensor network.

- **Data synchronization and registration service:** This service implements functionalities to synchronize different types of data sources and provides registration functions.

- **Information description service:** This service provides mechanisms to establish ways or methods to describe information in intelligent sensor network. Information can be the input parameters to CIP processes, and it can also be the output results from CIP processes

- **Node-to-node inter-activation service:** This service provides mechanisms to trigger or initiate tasks executing in one node by another node. Dynamic tasking can be supported by this core service.

- **Parameter adaptation service:** This service provides mechanisms to adapt or reconfigure parameters for CIP. Parameter adaptation service is one of the essential services to guarantee system performance in case of dynamic changes of deploying environment and application requirement.

(To be further revised. Contributions are requested.)

5.5.2 Enhanced services supporting CIP

The enhanced services supporting CIP includes:

- **QoS management service:** This service provides mechanisms to describe QoS metrics or levels, to apply QoS rules, and to configure QoS profiles. QoS management in intelligent sensor network should be implemented from both information processing perspective and communication processing perspective.

- **CIP-driven node state scheduling service:** This service provides functions to control and schedule node states according to the request of CIP entities in stead of node management entities in intelligent sensor networks. This service can help to implement application-oriented networking and on demand task scheduling.

- **Context management service:** This service provides mechanisms to describe, to discover and to manage context information in intelligent sensor network. In case of node mobility, context management service can provide autonomous system maintenance in intelligent sensor network.

(To be further revised. Contributions are requested.)

6 Core Services and Interfaces Specifications

This clause specifies core services supporting CIP in intelligent sensor networks. Service primitives and parameters of primitives are defined for each core service. In Table 1, the names of service access points (SAPs) through which specific service is provided are listed.

Table 1 — Core services and the names of SAPs

Service name	SAP name
Event service	EVENT-SAP

Logical grouping service	LG-SAP
Data synchronization and registration service	SYNREG-SAP
Information description service	INFO-SAP
Node-to-node Inter-activation service	N2NACT-SAP
Parameter adaptation service	PAR-SAP

6.1 Event service

In this subclause, event service in the service layer is defined. Event service is provided through EVENT-SAP. The EVENT-SAP is the logical interface between event service entity in the service layer and CIP entity in the application layer. This logical interface incorporates a set of primitives and their definitions. These primitives and definitions are described conceptually here, but through this the process of the parameters exchanged between the service layer and the application layer can be understood. Table 2 lists the primitives supported by the EVENT-SAP. Table 3 outlines primitive parameters.

Table 2 — EVENT-SAP primitive summary

Name	Request	Indication	Response	Confirm
EVENT-SUB	6.1.1	6.1.2		6.1.3
EVENT-REG		6.1.4		
EVENT-UNSUB	6.1.5			6.1.6

Table 3 — EVENT-SAP primitive parameters

Name	Type	Valid range	Description
EVSubmodel	Enumeration	CHANNEL, TYPE, FILTER, GROUP	Event subscription models.
EVSubValue	Various	Subscription model specific	Value of event attribute under specific subscription model.
EVSubSourceID	Integer		Source of event subscription
EVSubDestinationID	integer		Destination of event subscription

EVSubResultCode	Enumeration	SUCCESS, INVALID_MODEL, INVALID_VALUE, FAILED	The result of the event subscription.
EV_Time	Integer	Implementation specific	A time indication for the event occurrence, as provided by the service layer.

6.1.1 EVENT-SUB.request

This primitive requests the process of event subscription from the application layer.

6.1.1.1 Definition of service primitives

The semantics of this primitive are:

EVENT-SUB.request {

EVSubmodel,

EVSubValue,

EVSubSourceID,

EVSubDestinationID

}

Table 3 defines the parameter of this primitive.

6.1.1.2 When generated

This occurs by CIP entity to subscribe event service from the entity of the service layer.

6.1.1.3 Effect of receipt

On receipt of this primitive, the entity providing the event service implements event subscription in the EVSubDestinationID node for the EVSubSourceID node. Four types of event subscription models are provided: CHANNEL, TYPE, FILTER and GROUP.

In CHANNEL event subscription model, event channels are like television channels – if you view a channel, you receive all program broadcast on that channel. Subscribers in this model may listen to several channels. On the other hand, an event is not necessarily associated with one specific channel – it may be distributed over several channels. In TYPE event subscription model, events are filtered based upon their types. When a subscriber is only interested in a subset of all notifications available at a producer, FILTER event subscription model can be used. The subscriber defines the filter criteria which are checked by the producer. Subscribers using the same filter criteria can be grouped together. A producer in GROUP event subscription model delivers event occurrences to the whole group.

6.1.2 EVENT-SUB.indication

This primitive indicates the event subscription from the service layer to CIP entity.

6.1.2.1 Definition of service primitives

The semantics of this primitive are:

EVENT-SUB.indication {

EVSubmodel,

EVSubValue,

EVSubSourceID,

EVSubDestinationID,

}

Table 3 defines the parameter of this primitive.

6.1.2.2 When generated

This occurs when the service layer indicates a result of event subscription to CIP entity.

6.1.2.3 Effect of receipt

On receipt of this primitive, the CIP entity is indicated the result of event subscription.

6.1.3 EVENT-SUB.confirm

This primitive confirms an event subscription from the service layer to the CIP entity.

6.1.3.1 Definition of service primitives

The semantics of this primitive are:

EVENT-SUB.confirm {

EVSubSourceID,

EVSubDestinationID,

EVSubResultCode

}

Table 3 defines the parameter of this primitive.

6.1.3.2 When generated

This primitive reports a result of event subscription request.

6.1.3.3 Effect of receipt

If the EVSubResultCode is SUCCESS, it means the event subscription is successful, otherwise an error is indicated.

6.1.4 EVENT-REG.indication

This primitive indicates the event occurrence from the service layer to CIP entity.

6.1.4.1 Definition of service primitives

The semantics of this primitive are:

EVENT-REG.indication {

EVSubSourceID,

EVSubDestinationID,

EV_Time

}

Table 3 defines the parameter of this primitive.

6.1.4.2 When generated

This occurs when the service layer indicates event occurrences to CIP entity. If one or more events occur or are detected, this primitive indication can be generated more than once.

6.1.4.3 Effect of receipt

On receipt of this primitive, the CIP entity is indicated the occurrence of events. The time when event occurs or is detected is provided by EV_Time.

6.1.5 EVENT-UNSUB.request

This primitive requests the cancellation of event subscription from the application layer.

6.1.5.1 Definition of service primitives

The semantics of this primitive are:

EVENT-UNSUB.request {

EVSubmodel,

EVSubValue,

EVSubSourceID,

EVSubDestinationID

}

Table 3 defines the parameter of this primitive.

6.1.5.2 When generated

This occurs by CIP entity to unsubscribe event service from the entity of the service layer.

6.1.5.3 Effect of receipt

On receipt of this primitive, the entity providing the event service cancels event subscription in the EVSubDestinationID node for the EVSubSourceID node.

6.1.6 EVENT-UNSUB.confirm

This primitive confirms an event subscription cancellation from the service layer to the CIP entity.

6.1.6.1 Definition of service primitives

The semantics of this primitive are:

EVENT-UNSUB.confirm {

EVSubSourceID,

EVSubDestinationID,

EVSubResultCode

}

Table 3 defines the parameter of this primitive.

6.1.6.2 When generated

This primitive confirms cancellation of event subscription.

6.1.6.3 Effect of receipt

If the EVSubResultCode is SUCCESS, it means the event subscription cancellation is successful, otherwise an error is indicated.

6.2 Logical grouping service

In this subclause, logical grouping service in the service layer is defined. Logical grouping service is provided through LG-SAP. The LG-SAP is the logical interface between event service entity in the service layer and CIP entity in the application layer. This logical interface incorporates a set of primitives and their definitions. These primitives and definitions are described conceptually here, but through this the process of the parameters exchanged between the service layer and the application layer can be understood. Table 4 lists the primitives supported by the LG-SAP. Table 5 outlines primitive parameters.

Table 4 — LG-SAP primitive summary

Name	Request	Indication	Response	Confirm
LG-ESTABLISH	6.2.1	6.2.2		6.2.3
LG-MEMBERIN	6.2.4			6.2.5
LG-MEMBEROUT	6.2.6			6.2.7
LG-DISMISS	6.2.8	6.2.9		6.2.10
LG-QUERY	6.2.11			6.2.12

Table 5 — LG-SAP primitive parameters

Name	Type	Valid range	Description

6.2.1 LG-ESTABLISH.request

This primitive requests the establishment of a logical group from the application layer.

6.2.1.1 Definition of service primitives

(to be added)

6.2.1.2 When generated

(to be added)

6.2.1.3 Effect of receipt

(to be added)

6.2.2 LG-ESTABLISH.indication

This primitive indicates the logical group establishment from the service layer to the local CIP entity.

6.2.2.1 Definition of service primitives

(to be added)

6.2.2.2 When generated

(to be added)

6.2.2.3 Effect of receipt

(to be added)

6.2.3 LG-ESTABLISH.confirm

This primitive confirms a logical group establishment from the service layer to the CIP entity in the application layer.

6.2.3.1 Definition of service primitives

(to be added)

6.2.3.2 When generated

(to be added)

6.2.3.3 Effect of receipt

(to be added)

6.2.4 LG-MEMBERIN.request

This primitive requests a membership of a logical group from the application layer.

6.2.4.1 Definition of service primitives

(to be added)

6.2.4.2 When generated

(to be added)

6.2.4.3 Effect of receipt

(to be added)

6.2.5 LG-MEMBERIN.confirm

This primitive confirms result of the request of a membership of a logical group to CIP entity in the application layer.

6.2.5.1 Definition of service primitives

(to be added)

6.2.5.2 When generated

(to be added)

6.2.5.3 Effect of receipt

(to be added)

6.2.6 LG-MEMBEROUT.request

This primitive requests a membership cancellation of a logical group from the application layer.

6.2.6.1 Definition of service primitives

(to be added)

6.2.6.2 When generated

(to be added)

6.2.6.3 Effect of receipt

(to be added)

6.2.7 LG-MEMBEROUT.confirm

This primitive confirms result of the request of a membership cancellation of a logical group to CIP entity in the application layer.

6.2.7.1 Definition of service primitives

(to be added)

6.2.7.2 When generated

(to be added)

6.2.7.3 Effect of receipt

(to be added)

6.2.8 LG-DISMISS.request

This primitive requests the dismissal of a logical group from the application layer.

6.2.8.1 Definition of service primitives

(to be added)

6.2.8.2 When generated

(to be added)

6.2.8.3 Effect of receipt

(to be added)

6.2.9 LG-DISMISS.indication

This primitive indicates the logical group dismissal from the service layer to the local CIP entity.

6.2.9.1 Definition of service primitives

(to be added)

6.2.9.2 When generated

(to be added)

6.2.9.3 Effect of receipt

(to be added)

6.2.10 LG-DISMISS.confirm

This primitive confirms a logical group dismissal from the service layer to the CIP entity.

6.2.10.1 Definition of service primitives

(to be added)

6.2.10.2 When generated

(to be added)

6.2.10.3 Effect of receipt

(to be added)

6.2.11 LG-QUERY.request

This primitive queries logical group attributes by CIP entities in the application layer.

6.2.11.1 Definition of service primitives

(to be added)

6.2.11.2 When generated

(to be added)

6.2.11.3 Effect of receipt

(to be added)

6.2.12 LG-QUERY.confirm

This primitive returns the results of logical group attributes to CIP entity in the application layer.

6.2.12.1 Definition of service primitives

(to be added)

6.2.12.2 When generated

(to be added)

6.2.12.3 Effect of receipt

(to be added)

6.3 Data synchronization and registration service

In this subclause, data synchronization and registration service in the service layer is defined. Data synchronization and registration service is provided through SYNREG-SAP. The SYNREG-SAP is the logical interface between event service entity in the service layer and CIP entity in the application layer. This logical interface incorporates a set of primitives and their definitions. These primitives and definitions are described conceptually here, but through this the process of the parameters exchanged between the service layer and the application layer can be understood. Table 6 lists the primitives supported by the SYNREG-SAP. Table 7 outlines primitive parameters.

Table 6 — SYNREG-SAP primitive summary

Name	Request	Indication	Response	Confirm
SYNREG-SYNQUERY	6.3.1			6.3.2
SYNREG-SYNEXEC	6.3.3	6.3.4		6.3.5
SYNREG-REGQUERY	6.3.6			6.3.7
SYNREG-REGEXEC	6.3.8	6.3.9		6.3.10

Table 7 — SYNREG-SAP primitive parameters

Name	Type	Valid range	Description

6.3.1 SYNREG-SYNQUERY.request

This primitive queries values of reference time for data synchronization by CIP entities in the application layer.

6.3.1.1 Definition of service primitives

(to be added)

6.3.1.2 When generated

(to be added)

6.3.1.3 Effect of receipt

(to be added)

6.3.2 SYNREG-SYNQUERY.confirm

This primitive returns the values of reference time to CIP entity in the application layer.

6.3.2.1 Definition of service primitives

(to be added)

6.3.2.2 When generated

(to be added)

6.3.2.3 Effect of receipt

(to be added)

6.3.3 SYNREG-SYNEXEC.request

This primitive requests the execution of data synchronization by CIP entity in the application layer.

6.3.3.1 Definition of service primitives

(to be added)

6.3.3.2 When generated

(to be added)

6.3.3.3 Effect of receipt

(to be added)

6.3.4 SYNREG-SYNEXEC.indication

This primitive indicates the execution of data synchronization process from the service layer to the local CIP entity.

6.3.4.1 Definition of service primitives

(to be added)

6.3.4.2 When generated

(to be added)

6.3.4.3 Effect of receipt

(to be added)

6.3.5 SYNREG-SYNEXEC.confirm

This primitive confirms the execution of data synchronization from the service layer to the CIP entity.

6.3.5.1 Definition of service primitives

(to be added)

6.3.5.2 When generated

(to be added)

6.3.5.3 Effect of receipt

(to be added)

6.3.6 SYNREG-REGQUERY.request

This primitive queries reference attributes for data registration process by CIP entities in the application layer.

6.3.6.1 Definition of service primitives

(to be added)

6.3.6.2 When generated

(to be added)

6.3.6.3 Effect of receipt

(to be added)

6.3.7 SYNREG-REGQUERY.confirm

This primitive returns value of the RegRefName attribute to CIP entity in the application layer.

6.3.7.1 Definition of service primitives

(to be added)

6.3.7.2 When generated

(to be added)

6.3.7.3 Effect of receipt

(to be added)

6.3.8 SYNREG-REGEXEC.request

This primitive requests the execution of data registration by CIP entity in the application layer.

6.3.8.1 Definition of service primitives

(to be added)

6.3.8.2 When generated

(to be added)

6.3.8.3 Effect of receipt

(to be added)

6.3.9 SYNREG-REGEXEC.indication

This primitive indicates the execution of data registration process from the service layer to the local CIP entity.

6.3.9.1 Definition of service primitives

(to be added)

6.3.9.2 When generated

(to be added)

6.3.9.3 Effect of receipt

(to be added)

6.3.10 SYNREG-REGEXEC.confirm

This primitive confirms the execution of data registration from the service layer to the CIP entity.

6.3.10.1 Definition of service primitives

(to be added)

6.3.10.2 When generated

(to be added)

6.3.10.3 Effect of receipt

(to be added)

6.4 Information description service

In this subclause, information description service in the service layer is defined. Information description service is provided through INFO-SAP. The INFO-SAP is the logical interface between information description service entity in the service layer and CIP entity in the application layer. This logical interface incorporates a set of primitives and their definitions. These primitives and definitions are described conceptually here, but through this the process of the parameters exchanged between the service layer and the application layer can be understood. Table 8 lists the primitives supported by the INFO-SAP. Table 9 outlines primitive parameters.

Table 8 — INFO-SAP primitive summary

Name	Request	Indication	Response	Confirm
INFO-LEVELGET	6.4.1			6.4.2
INFO-LEVELSET	6.4.3	6.4.4		6.4.5
INFO-DATA	6.4.6	6.4.7		6.4.8

Table 9 — INFO-SAP primitive parameters

Name	Type	Valid range	Description

6.4.1 INFO-LEVELGET.request

This primitive requests information description levels by CIP entities in the application layer.

6.4.1.1 Definition of service primitives

(to be added)

6.4.1.2 When generated

(to be added)

6.4.1.3 Effect of receipt

(to be added)

6.4.2 INFO-LEVELGET.confirm

This primitive returns information description level to CIP entity in the application layer.

6.4.2.1 Definition of service primitives

(to be added)

6.4.2.2 When generated

(to be added)

6.4.2.3 Effect of receipt

(to be added)

6.4.3 INFO-LEVELSET.request

This primitive sets the information description level by CIP entity in the application layer.

6.4.3.1 Definition of service primitives

(to be added)

6.4.3.2 When generated

(to be added)

6.4.3.3 Effect of receipt

(to be added)

6.4.4 INFO-LEVELSET.indication

This primitive indicates the set operation of information description levels from the service layer to the local CIP entity.

6.4.4.1 Definition of service primitives

(to be added)

6.4.4.2 When generated

(to be added)

6.4.4.3 Effect of receipt

(to be added)

6.4.5 INFO-LEVELSET.confirm

This primitive confirms the set of information description levels from the service layer to the CIP entity.

6.4.5.1 Definition of service primitives

(to be added)

6.4.5.2 When generated

(to be added)

6.4.5.3 Effect of receipt

(to be added)

6.4.6 INFO-DATA.request

This primitive requests the transfer of information of specific information description levels by CIP entity in the application layer.

6.4.6.1 Definition of service primitives

(to be added)

6.4.6.2 When generated

(to be added)

6.4.6.3 Effect of receipt

(to be added)

6.4.7 INFO-DATA.indication

This primitive indicates to the CIP entity in the application layer that data unit of specific information description level has been received.

6.4.7.1 Definition of service primitives

(to be added)

6.4.7.2 When generated

(to be added)

6.4.7.3 Effect of receipt

(to be added)

6.4.8 INFO-DATA.confirm

This primitive confirms the transfer of data unit of specific information description level from the service layer to the CIP entity.

6.4.8.1 Definition of service primitives

(to be added)

6.4.8.2 When generated

(to be added)

6.4.8.3 Effect of receipt

(to be added)

6.5 Node-to-node inter-activation service

In this subclause, node-to-node inter-activation service in the service layer is defined. Node-to-node inter-activation is provided through N2NACT-SAP. The N2NACT-SAP is the logical interface between node-to-node inter-activation service entity in the service layer and CIP entity in the application layer. This logical interface incorporates a set of primitives and their definitions. These primitives and definitions are described conceptually here, but through this the process of the parameters exchanged between the service layer and the application layer can be understood. Table 10 lists the primitives supported by the N2NACT-SAP. Table 11 outlines primitive parameters.

Table 10 — N2NACT-SAP primitive summary

Name	Request	Indication	Response	Confirm
N2NACT	6.5.1			6.5.2

Table 11 — N2NACT-SAP primitive parameters

Name	Type	Valid range	Description

6.5.1 N2NACT.request

(to be added)

6.5.1.1 Definition of service primitives

(to be added)

6.5.1.2 When generated

(to be added)

6.5.1.3 Effect of receipt

(to be added)

6.5.2 N2NACT.confirm

This primitive confirms the result of node-to-node inter-activation process from the service layer to the CIP entity.

6.5.2.1 Definition of service primitives

(to be added)

6.5.2.2 When generated

(to be added)

6.5.3.3 Effect of receipt

(to be added)

6.6 Parameter adaptation service

In this subclause, parameter adaptation service in the service layer is defined. Parameter adaptation service is provided through PAR-SAP. The PAR-SAP is the logical interface between parameter adaptation service entity in the service layer and CIP entity in the application layer. This logical interface incorporates a set of primitives and their definitions. These primitives and definitions are described conceptually here, but through this the process of the parameters exchanged between the service layer and the application layer can be understood. Table 12 lists the primitives supported by the PAR-SAP. Table 13 outlines primitive parameters.

Table 12 — PAR-SAP primitive summary

Name	Request	Indication	Response	Confirm

PAR	6.6.1	6.6.2		6.6.3

Table 13 — PAR-SAP primitive parameters

Name	Type	Valid range	Description

6.6.1 PAR.request

This primitive requests the parameter adaptation process by CIP entity in the application layer.

6.6.1.1 Definition of service primitives

(to be added)

6.6.1.2 When generated

(to be added)

6.6.1.3 Effect of receipt

(to be added)

6.6.2 PAR.indication

This primitive indicates to the CIP entity in the application layer that the request of parameter adaptation has been received.

6.6.2.1 Definition of service primitives

(to be added)

6.6.2.2 When generated

(to be added)

6.6.2.3 Effect of receipt

(to be added)

6.6.3 PAR.confirm

This primitive confirms the result of parameter adaptation from the service layer to the CIP entity.

6.6.3.1 Definition of service primitives

(to be added)

6.6.3.2 When generated

(to be added)

6.6.3.3 Effect of receipt

(to be added)

7 Enhanced Services and Interfaces Specifications

This clause specifies enhanced services supporting CIP in intelligent sensor networks. Service primitives and parameters of primitives are defined for each core service. In Table X, the names of service access points (SAPs) through which specific service is provided are listed.

Table X — Core services and the names of SAPs

Service name	SAP name
QoS management service	QoS-SAP
CIP-driven node state scheduling service	NSTATE-SAP
Context management service	CONTEXT-SAP

7.1 QoS management service

(to be added)

7.1.1 Service specification

(to be added)

7.1.2 Primitives and parameters

(to be added)

7.2 CIP-driven node state scheduling service

(to be added)

7.2.1 Service specification

(to be added)

7.2.2 Primitives and parameters

(to be added)

7.3 Context management service

(to be added)

7.3.1 Service specification

(to be added)

7.3.2 Primitives and parameters

(to be added)

Annex – A Core Services and Interfaces Examples

This annex is informative. Examples of core services and interfaces in an intelligent sensor network based anti-intrusion system are given.

(to be added)

(Other examples can be considered. Contributions are requested.)

Annex – B Enhanced Services and Interfaces Examples

This annex is informative. Examples of enhanced services and interfaces in an intelligent sensor network based anti-intrusion system are given.

(to be added)

(Other examples can be considered. Contributions are requested.)

Annex – C Bibliography

(to be added)