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July 2009

PROPOSAL FOR A NEW WORK ITEM

Date of presentation of proposal: 2009-12-22	Proposer: China
Secretariat:	**ISO/IEC JTC 1 N** 9940

A proposal for a new work item shall be submitted to the secretariat of the ISO/IEC joint technical committee concerned with a copy to the ISO Central Secretariat.

Presentation of the proposal - to be completed by the proposer. .

Title (subject to be covered and type of standard, e.g. terminology, method of test, performance requirements, etc.) Specification of Data Value Domain

Services and Interfaces Supporting Collaborative Information Processing in Intelligent Sensor Networks

Scope (and field of application)

Intelligent sensor networks provide desired system performance under dynamic changes of deploying environment, network configuration and application requirement. This new work item proposal proposes a new standard for services and interfaces supporting collaborative information processing (CIP) in intelligent sensor networks. This standard 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

The field of application includes: Anti-intrusion System, Healthcare Services, Public Security System, Infrastructure Surveillance and Transportation Safety System etc.

Purpose and justification - attach a separate page as annex, if necessary

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. Intelligent sensor networks are designed to fulfil tasks adaptively and resource-efficiently. They can adjust their performance according to the variation of observations and evoke an appropriate mechanism. For instance, in an anti-intrusion system, intelligent sensor network will choose different anti-intrusion processes when the weather changes from fine to bad. Collaborative information processing (CIP) is an essential technology which helps intelligent sensor networks achieve these self-adaptability and maintenance capabilities. CIP closely integrates information processing algorithms and collaboration mechanisms in distributed intelligent sensor networks. Information processing algorithms, which are usually sensor dependent and application dependent, belong to application layer issues. Collaboration mechanisms, which are supported by the underlying common services, directly influence the performances of intelligent sensor networks.

A lot of generic common services can be provided by the layers below application layer in sensor networks, such as code management service, group management service, resource discovery service, and resource management service etc. A subset of these generic common services needs to be defined in the context of intelligent sensor networks, and within this service subset, each generic common service needs to be concretized, to be parameterized and sometimes even to be customized or be extended to achieve the capabilities mentioned above. The relationship among these services also needs to be profiled. A set of interfaces, through which CIP entities in the application layer can interact with those services by underlying layers, should be defined.

Specific issues proposed by this new work item proposal includes as follows:

- Event triggering, registration and delivery due to environment parameter changes
- Sensor data synchronization and registration
- Node-to-Node inter-activation
- CIP-driven node wakeup/sleep scheduling
- Mobility supporting
- Logical function group establishment, updating and cancellation
- Proactive and reactive parameter adaptation
- QoS management service

This new work item proposal emphasizes that standardization in sensor network should concern on information exchange, especially on information sensing aspect. Most existing SDOs only focus on the first item. The objective of sensor networks is to sense the physical world. This standard will specify services and standardize interfaces supporting CIP for intelligent sensor networks.

Programme of work

If the proposed new work item is approved, which of the following document(s) is (are) expected to be developed?

__x__ a single International Standard

___ more than one International Standard (expected number: .....)

____ a multi-part International Standard consisting of ..... parts

____ an amendment or amendments to the following International Standard(s) .....

____ a technical report , type .....

And which standard development track is recommended for the approved new work item?

__x__a. Default Timeframe

____b. Accelerated Timeframe

____c. Extended Timeframe

Relevant documents to be considered

Co-operation and liaison

Preparatory work offered with target date(s)

None

Signature:

Will the service of a maintenance agency or registration authority be required? .....No.....
- If yes, have you identified a potential candidate? .....
- If yes, indicate name .....

Are there any known requirements for coding? .....No.....
-If yes, please specify on a separate page

Does the proposed standard concern known patented items? .....No.....
- If yes, please provide full information in an annex

Are there any know requirements for cultural and linguistic adaptability? .....No.....
- If yes, please specify on a separate page

Comments and recommendations of the JTC 1 or SC XX Secretariat - attach a separate page as an annex, if necessary

Comments with respect to the proposal in general, and recommendations thereon:

Voting on the proposal - Each P-member of the ISO/IEC joint technical committee has an obligation to vote within the time limits laid down (normally three months after the date of circulation).

Date of circulation:	**Closing date for voting:**	**Signature of Secretary:**
2009-12-22	2010-03-23	Lisa A. Rajchel

NEW WORK ITEM PROPOSAL - PROJECT ACCEPTANCE CRITERIA		
Criterion	**Validity**	**Explanation**
A. Business Requirement		
A.1 Market Requirement	Essential _X_ Desirable ___ Supportive ___	Intelligent sensor networks are essential to guarantee system performance in order to meet challenges from real application scenarios.
A.2 Regulatory Context	Essential ___ Desirable ___ Supportive ___ Not Relevant _X_	
B. Related Work		
B.1 Completion/Maintenance of current standards	Yes ___ No_X_	
B.2 Commitment to other organisation	Yes ___ No_X__	
B.3 Other Source of standards	Yes ___ No_X_	
C. Technical Status		
C.1 Mature Technology	Yes __X __ No___	
C.2 Prospective Technology	Yes ___ No_X__	
C.3 Models/Tools	Yes ___ No_X__	

D. Conformity Assessment and Interoperability		
D.1 Conformity Assessment	Yes __X_ No_ __	
D.2 Interoperability	Yes _X_ No_ __	
E. Adaptability to Culture, Language, Human Functioning and Context of Use		
E.1 Cultural and Linguistic Adaptability	Yes_____ No___X____	
E.2 Adaptability to Human Functioning and Context of Use	Yes_____ No____X___	
F. Other Justification		

Notes to Proforma

A. Business Relevance. That which identifies market place relevance in terms of what problem is being solved and or need being addressed.

A.1 Market Requirement. When submitting a NP, the proposer shall identify the nature of the Market Requirement, assessing the extent to which it is essential, desirable or merely supportive of some other project.

A.2 Technical Regulation. If a Regulatory requirement is deemed to exist - e.g. for an area of public concern e.g. Information Security, Data protection, potentially leading to regulatory/public interest action based on the use of this voluntary international standard - the proposer shall identify this here.

B. Related Work. Aspects of the relationship of this NP to other areas of standardisation work shall be identified in this section.

B.1 Competition/Maintenance. If this NP is concerned with completing or maintaining existing standards, those concerned shall be identified here.

B.2 External Commitment. Groups, bodies, or for external to JTC 1 to which a commitment has been made by JTC for Co-operation and or collaboration on this NP shall be identified here.

B.3 External Std/Specification. If other activities creating standards or specifications in this topic area are known to exist or be planned, and which might be available to JTC 1 as PAS, they shall be identified here.

C. Technical Status. The proposer shall indicate here an assessment of the extent to which the proposed standard is supported by current technology.

C.1 Mature Technology. Indicate here the extent to which the technology is reasonably stable and ripe for standardisation.

C.2 Prospective Technology. If the NP is anticipatory in nature based on expected or forecasted need, this shall be indicated here.

C.3 Models/Tools. If the NP relates to the creation of supportive reference models or tools, this shall be indicated here.

D. Conformity Assessment and Interoperability Any other aspects of background information justifying this NP shall be indicated here.

D.1 Indicate here if Conformity Assessment is relevant to your project. If so, indicate how it is addressed in your project plan.

D.2 Indicate here if Interoperability is relevant to your project. If so, indicate how it is addressed in your project plan

E. Adaptability to Culture, Language, Human Functioning and Context of Use

NOTE: The following criteria do not mandate any feature for adaptability to culture, language, human functioning or context of use. The following criteria require that if any features are provided for adapting to culture,

language, human functioning or context of use by the new Work Item proposal, then the proposer is required to identify these features.

E.1 Cultural and Linguistic Adaptability. Indicate here if cultural and natural language adaptability is applicable to your project. If so, indicate how it is addressed in your project plan.

ISO/IEC TR 19764 (Guidelines, methodology, and reference criteria for cultural and linguistic adaptability in information technology products) now defines it in a simplified way:

"ability for a product, while keeping its portability and interoperability properties, to:

- be internationalized, that is, be adapted to the special characteristics of natural languages and the commonly accepted rules for their se, or of cultures in a given geographical region;

- take into account the usual needs of any category of users, with the exception of specific needs related to physical constraints"

Examples of characteristics of natural languages are: national characters and associated elements (such as hyphens, dashes, and punctuation marks), writing systems, correct transformation of characters, dates and measures, sorting and searching rules, coding of national entities (such as country and currency codes), presentation of telephone numbers and keyboard layouts. Related terms are localization, jurisdiction and multilingualism.

E.2 Adaptability to Human Functioning and Context of Use. Indicate here whether the proposed standard takes into account diverse human functioning and diverse contexts of use. If so, indicate how it is addressed in your project plan.

NOTE:

1. **Human functioning is defined by the World Health Organization at http://www3.who.int/icf/beginners/bg.pdf as:**
   <<In ICF (*International Classification of Functioning, Disability and Health), the term functioning refers to all body functions, activities and participation.*>>
2. **Content of use is defined in ISO 9241-11:1998 (*Ergonomic requirements for office work with visual display terminals (VDTs) – Part 11: Guidance on usability) as:***
   <<Users, tasks, equipment (hardware, software and materials), and the physical and societal environments in which a product is used.>>
3. **Guidance for Standard Developers to address the needs of older persons and persons with disabilities).**

F. Other Justification Any other aspects of background information justifying this NP shall be indicated here.

Appendix A

Functionality requirement analysis of intelligent sensor network based applications

Appendix B

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Outline of this NP

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Presentation of CIP

Appendix A

Functionality requirement analysis of intelligent sensor network based applications

This document is used as an annex to the “Services and Interfaces Supporting Collaborative Information Processing in Intelligent Sensor Networks” proposal for a new work item to ISO/IEC JTC1. The document analyzes two representative intelligent sensor network based applications and gives out key functionalities which should be implemented in intelligent sensor networks.

1. Introduction

Sensor networks, especially wireless sensor networks, have been intensively investigated in recent years for its wide range of applications, such as battlefield intelligence, environmental tracking, home automation and emergency response. In the viewpoint of service provision, sensor networks should act intelligently and provide desired and sometimes guaranteed quality of service under dynamic application performance requirements, dynamic physical deploying environments and dynamic network status changes. Two representative sensor network based applications, intelligent anti-intrusion system and intelligent transportation safety system are studied below. Key functionalities that should be implemented in intelligent sensor networks are clarified.

2. Sensor network based application case study: intelligent anti-intrusion system

Sensor network is one of the best solutions in designing an anti-intrusion system. Anti-intrusion system has been widely used in both military and civilian areas such as perimeter surveillance, border control, and restricted area safeguard. Due to possibly different types of intruders, different intrusion behaviors and full-time coverage, an anti-intrusion system should be designed to perform anti-intrusion tasks intelligently. Figure 1 depicts a scenario of a sensor network based intelligent anti-intrusion system.

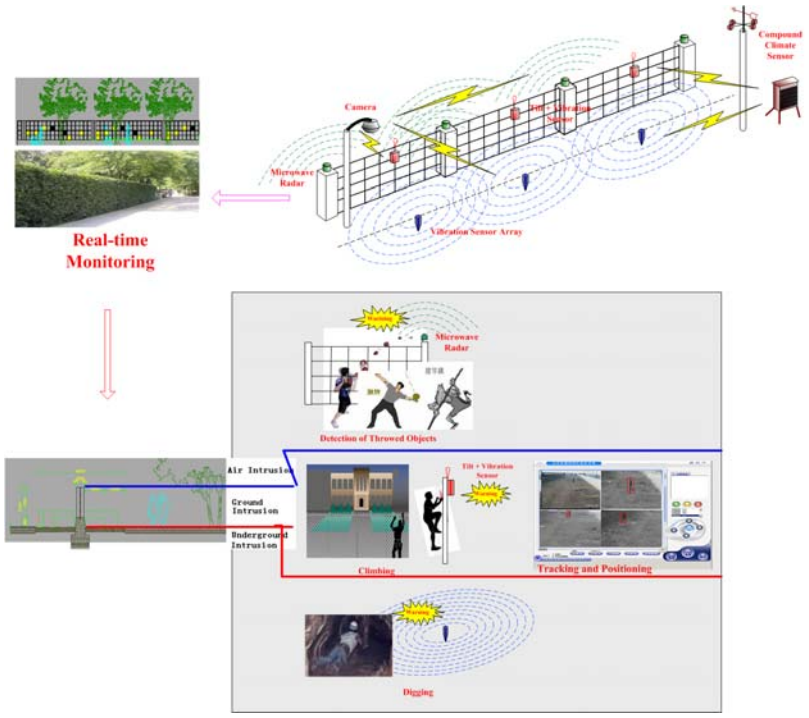


Figure 1. A sensor network based intelligent anti-intrusion system

In this system, sensor network is composed of different types of sensor nodes equipped with different sensors including image sensors, microwave radars, tilt sensors, vibration sensors and vibration sensor arrays. Compound climate sensor node, which aims to sense physical deploying environment, is also used in the system. Depending on the width of the perimeter, hundreds and even thousands of those kinds of sensor nodes can be possibly deployed. The main concerns of such an anti-intrusion system is trying to resource-efficiently get complete, timely and correct knowledge on when intrusion happens, what intruder it is and where it is. Collaborative information processing (CIP), in which information processing is fulfilled distributed and collaboratively among related sensor nodes, plays a critical role in the design of application layer for the system.

From the top-down viewpoint of system architecture, collaborative information processing uses services provided by the underlying layers such as middleware layer, routing, MAC and physical layers. From the bottom-up viewpoint, a set of common services are needed to support collaborative information processing in the application layer. In the context of intelligent anti-intrusion system, some of key common services are listed as follows.

- Logical group management service

Logical group management service here refers to the mechanism and protocols of logical node group establishing, updating and cancellation to fulfill a specific information processing task. Logical group can be established according to the same sensor modality, for example, all the vibration sensor nodes can be logically grouped in order to detect an intruder along the perimeter. Logical group establishment can also be ruled by different sensing mode, for example, acoustic sensor nodes and vibration sensor nodes can work as a logical group for detecting human vehicle mixed intruders.

- Event triggering, registration and delivery service

Though event detection or generation algorithm itself is one of the issues to be concerned in the application layer, mechanisms and hence protocols for event triggering, registration, and delivery should be served by layers below the application layer. These mechanisms or protocols should be carefully designed to meet the requirement on time delay in a time sensitive system such as in the anti-intrusion system. Events due to environment changes, for example, notices generated by a composite climate sensor, should also be triggered, registered and delivered by this service.

- Node-to-node inter-activation service

In the viewpoint of information sensing, node-to-node inter-activation service is very important in intelligent sensor network. If current node can not detect an intruder reliably, maybe a neighbor node can take over this role using its own sensor (probably different types) or being much closer to the intruder. In other words, node-node inter-activation service is one of the fundamental services supporting collaborative information processing.

- Node wakeup/sleep scheduling service

Node wakeup/sleep scheduling is normally used to tackle with energy constraints in sensor networks. It is worth to note that node wakeup/sleep scheduling can be driven by collaborative information processing. When an intruder locates far away from the sensing area of a sensor node, it is rather safe to put this node into sleep state from the information sensing point of view. Node wakeup/sleep scheduling service needs to be renewed to support the CIP-driven scheduling.

- QoS management service

In traditional communication networks, QoS management service is often studied under the communication metrics such as time delay, delay jitter and throughput etc. QoS management service should heavily be renewed in the context of sensor networks. QoS management service in sensor networks needs to define information sensing metrics such as false alarm rate, false negative rate and localization error etc.

3. Sensor network based application case study: intelligent transportation safety system

Intelligent transportation safety system is another interesting application wherein intelligent sensor network can play a full role in order to meet system requirements. Figure 2 shows a simplified intelligent transportation safety system.

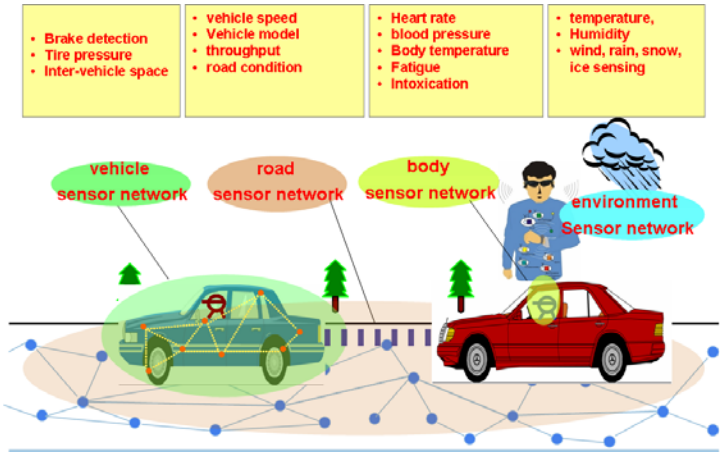


Figure 2. A simplified intelligent transportation safety system

Vehicle sensor network, road sensor network, body sensor network and environment sensor network are integrated together in building an intelligent transportation safety system. Vehicle

sensor network can provide vehicle status information. Road sensor network can give information on road condition and other traffic characteristic statistics. Body sensor network senses vital body parameters such as heart rate, blood pressure, body temperature and it can even detect fatigue and alcohol intoxication. The objective of environment sensor network is to sense any climate changes such as wind, rain, snow and ice etc.

In the intelligent transportation safety system, collaborative information processing play important role not only in the intra-sensor network but also in the inter-sensor network. Common services listed in section 2, such as logical group management service, event triggering, registration and delivery service, node-to-node inter-activation service, Node wakeup/sleep scheduling service, QoS management service are all needed to support collaborative information processing in this system. Other key common services are listed as follows.

- Mobility supporting

Mobility supporting is an inevitable and essential issue due to vehicle movement in an intelligent transportation safety system. Though much effort should be done to ensure information exchange in case of intra-network node mobility, inter-network node mobility and even network mobility, how to successfully guarantee performance of collaborative information processing should not be neglected. Due to vehicle movement, surrounding sensor nodes (for example, road sensor nodes or environment sensor nodes) and information provided by them may change. This kind of underlying changes should be transparent to high-level information processing tasks (e.g., safety warning).

- Parameter adaptation

Parameter adaptation refers to mechanisms through which information processing performance can be enhanced. Parameter adaptation can be logically divided into two classes: proactive and reactive. Proactive parameter adaptation is usually issued upon demand from system users or high-level layers, for example, traffic control center needs to exert stricter rules in a traffic jam and then parameter adaptation process may be applied in an intelligent transportation safety system. Reactive parameter adaptation is demanded by medium information processing results or directly excited by in-network sensor nodes. In an intelligent transportation safety system, when road condition changes, parameter adaptation is triggered in order to ensure collaborative information processing performance. Mechanisms or protocols need to be defined in support of parameter adaptation.

- Data synchronization and registration

Sensor nodes in sensor networks may use different temporal references and spatial references. Data synchronization and registration are essential to form a consistent space-time view of the physical world. It also provides a basis for collaborative information processing. In an intelligent transportation safety system, data from individual nodes or specific sensor networks should be synchronized and registered with the background system.

4. Conclusions

Functionality requirements of sensor network based intelligent anti-intrusion system and intelligent transportation safety system are analyzed. Key common functionalities of intelligent sensor networks are given mainly from the information processing perspective. The clarification of functionality requirement can illuminate the standard development of services and interfaces supporting collaborative information processing in intelligent sensor networks.

Appendix B

Review of reference standards and standard activities

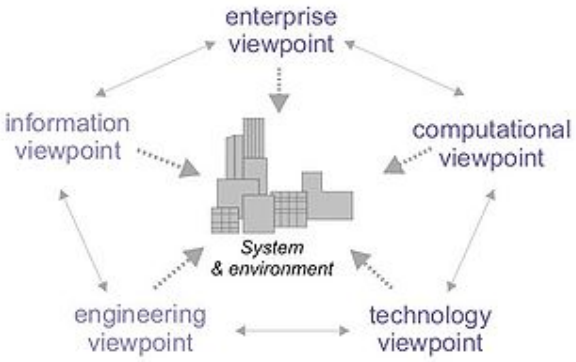
This document reviews several international standards and standard activities, which can be used as references to the standard development of “Services and interfaces supporting collaborative information processing in intelligent sensor networks”.

1. Reference Model of Open Distributed Processing (RM-ODP)

Reference Model of Open Distributed Processing (RM-ODP) is a reference model in computer science, which provides a coordinating framework for the standardization of open distributed processing (ODP). It supports distribution, interworking, platform and technology independence, and portability, together with an enterprise architecture framework for the specification of ODP systems.

RM-ODP, also named ITU-T Rec. X.901-X.904 and ISO/IEC 10746, is a joint effort by the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and the Telecommunication Standardization Sector (ITU-T). The RM-ODP view model provides five generic and complementary viewpoints on the system and its environment.

- The enterprise viewpoint, which focuses on the purpose, scope and policies for the system. It describes the business requirements and how to meet them.
- The information viewpoint, which focuses on the semantics of the information and the information processing performed. It describes the information managed by the system and the structure and content type of the supporting data.
- The computational viewpoint, which enables distribution through functional decomposition on the system into objects which interact at interfaces. It describes the functionality provided by the system and its functional decomposition.
- The engineering viewpoint, which focuses on the mechanisms and functions required to support distributed interactions between objects in the system. It describes the distribution of processing performed by the system to manage the information and provide the functionality.
- The technology viewpoint, which focuses on the choice of technology of the system. It describes the technologies chosen to provide the processing, functionality and presentation of information.



ISO/IEC and the ITU-T also started a joint project in 2004: "ITU-T Rec. X.906|ISO/IEC 19793:

Information technology - Open distributed processing - Use of UML for ODP system specifications". This document (usually referred to as UML4ODP) defines use of the Unified Modeling Language 2 (UML 2; ISO/IEC 19505), for expressing the specifications of open distributed systems in terms of the viewpoint specifications defined by the RM-ODP.

It defines a set of UML Profiles, one for each viewpoint language and one to express the correspondences between viewpoints, and an approach for structuring them according to the RM-ODP principles.

RM-ODP consists of four basic ITU-T Recommendations and ISO/IEC International Standards:

- Overview: Contains a motivational overview of ODP, giving scoping, justification and explanation of key concepts, and an outline of the ODP architecture. It contains explanatory material on how the RM-ODP is to be interpreted and applied by its users, who may include standard writers and architects of ODP systems.
- Foundations: Contains the definition of the concepts and analytical framework for normalized description of (arbitrary) distributed processing systems. It introduces the principles of conformance to ODP standards and the way in which they are applied. In only 18 pages, this standard sets the basics of the whole model in a clear, precise and concise way.
- Architecture: Contains the specification of the required characteristics that qualify distributed processing as open. These are the constraints to which ODP standards must conform. This recommendation also defines RM-ODP viewpoints, subdivisions of the specification of a whole system, established to bring together those particular pieces of information relevant to some particular area of concern.
- Architectural Semantics: Contains a formalization of the ODP modeling concepts by interpreting many concepts in terms of the constructs of the different standardized formal description techniques

Sensor network is a loose-coupled distributed processing system and usually with stringent resource constraints. The RM-ODP standard can be used as a good reference in developing sensor network standards.

2. OGC SWE standards

The Open Geospatial Consortium (OGC) is a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services. OGC initialized a working group named Sensor Web Enablement (SWE), whose objective is to build a unique and revolutionary framework of open standards for exploiting Web-connected sensors and sensor systems of all types: flood gauges, air pollution monitors, stress gauges on bridges, mobile heart monitors, Webcams, satellite-borne earth imaging devices and countless other sensors and sensor systems.

The models, encodings, and services of the SWE architecture enable implementation of interoperable and scalable service-oriented networks of heterogeneous sensor systems and client applications. In much the same way that Hyper Text Markup Language (HTML) and Hypertext Transfer Protocol (HTTP) standards enabled the exchange of any type of information on the Web, the OGC’s SWE initiative is focused on developing standards to enable the discovery, exchange, and processing of sensor observations, as well as the tasking of sensor systems. The functionality that OCG has targeted within a sensor web includes:

- Discovery of sensor systems, observations, and observation processes that meet an

application’s or user’s immediate needs;

- Determination of a sensor’s capabilities and quality of measurements;
- Access to sensor parameters that automatically allow software to process and geo-locate observations;
- Retrieval of real-time or time-series observations and coverage in standard encodings;
- Tasking of sensors to acquire observations of interest;
- Subscription to and publishing of alerts to be issued by sensors or sensor services based upon certain criteria.

Within the SWE initiative, the enablement of such sensor webs and networks is being pursued through the establishment of several encodings for describing sensors and sensor observations, and through several standard interface definitions for web services. Sensor Web Enablement standards that have been built and prototyped by members of the OGC include the following pending OpenGIS® Specifications:

- Observations & Measurements Schema (O&M) – Standard models and XML Schema for encoding observations and measurements from a sensor, both archived and real-time.
- Sensor Model Language (SensorML) – Standard models and XML Schema for describing sensors systems and processes; provides information needed for discovery of sensors, location of sensor observations, processing of low-level sensor observations, and listing of taskable properties.
- Transducer Markup Language (TransducerML or TML) – The conceptual model and XML Schema for describing transducers and supporting real-time streaming of data to and from sensor systems.
- Sensor Observations Service (SOS) - Standard web service interface for requesting, filtering, and retrieving observations and sensor system information. This is the intermediary between a client and an observation repository or near real-time sensor channel.
- Sensor Planning Service (SPS) – Standard web service interface for requesting user-driven acquisitions and observations. This is the intermediary between a client and a sensor collection management environment.
- Sensor Alert Service (SAS) – Standard web service interface for publishing and subscribing to alerts from sensors.
- Web Notification Services (WNS) – Standard web service interface for asynchronous delivery of messages or alerts from SAS and SPS web services and other elements of service workflows.

The goal of SWE is to enable all types of Web and/or Internet-accessible sensors, instruments, and imaging devices to be accessible and, where applicable, controllable via the Web. The vision is to define and approve the standards foundation for "plug-and-play" Web-based sensor networks. Sensor location is usually a critical parameter for sensors on the Web, and OGC is the world's leading geospatial industry standards organization. Therefore, SWE specifications are being harmonized with other OGC standards for geospatial processing. The SWE standards foundation also references other relevant sensor and alerting standards such as the IEEE 1451 "smart transducer" family of standards (see page 8) and the OASIS Common Alerting Protocol (CAP), Web Services Notification (WS-N) and Asynchronous Service Access Protocol (ASAP) specifications. OGC works with the groups responsible for these standards to harmonize them with the SWE specifications.

3. ISO/IEC JTC1 SC32

ISO/IEC JTC1 SC32 is named as “Data Management and Exchange”. SC32 provides enabling technologies to promote harmonization data management facilities across sector-specific areas. Specifically, SC32 standards include:

- Reference models and frameworks for the coordination of existing and emerging standards;
- Definition of data domains, data types and data structures, and their associated semantics;
- Languages, services and protocols for persistent storage, concurrent access, concurrent update and interchange of data;
- Methods, languages, services and protocols to structure, organize and register metadata and other information resources associated with sharing and interoperability, including electronic commerce.

Data management and exchange is also a very important issue in standard development for intelligent sensor networks. Several standards developed by SC32 can be used as normative references, including ISO/IEC TR 10032, ISO/IEC 11178 and ISO/IEC 2382.

4. ISO/IEC JTC1 SC37

ISO/IEC JTC1 SC37 is named as “Biometrics”. The scope of SC37 includes standardization of generic biometric technologies pertaining to human beings to support interoperability and data interchange among applications and systems. Generic human biometric standards include: common file frameworks; biometric application programming interfaces; biometric data interchange formats and related biometric profiles etc. There are currently 6 active working groups in SC37. Several standards can be used as references of the standard development of sensor networks, especially for sensor network based standards aiming to home security and personal healthcare applications. For example, ISO/IEC TR 24722:2007 is named as “Information technology -- Biometrics-- Multimodal and other multibiometric fusion”, in which a description of and analysis of current practice on multimodal and other multibiometric fusion is provided. ISO/IEC 19794 aims to define biometric data interchange formats from various types of sensors. In the context of sensor networks, data representation and interchange formats among different sensor nodes are also needed to be defined.

References

[1] ITU-T X.901 / ISO 10746-1: Basic Reference Model of Open Distributed Processing - Part-1: Overview.

[2] ITU-T X.902 / ISO 10746-2: Basic Reference Model of Open Distributed Processing - Part-2: Descriptive Model.

[3] ITU-T X.903 / ISO 10746-3: Basic Reference Model of Open Distributed Processing - Part-3: Prescriptive Model.

[4] ITU-T X.904 / ISO 10746-4: Basic Reference Model of Open Distributed Processing - Part-4: Architectural Semantics.

[5] OGC White Paper, “OGC Sensor Web Enablement: Overview and High Level Architecture”, OGC 07-165, Open Geospatial Consortium Inc., 2007

[6] http://www.iso.org

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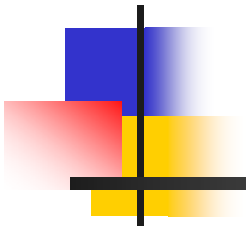

Appendix D
Services and Interfaces Supporting Collaborative Information processing in Intelligent Sensor Networks

China

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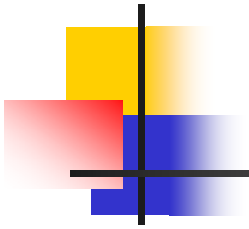
- Review of normative references and standard activities
- Conclusions

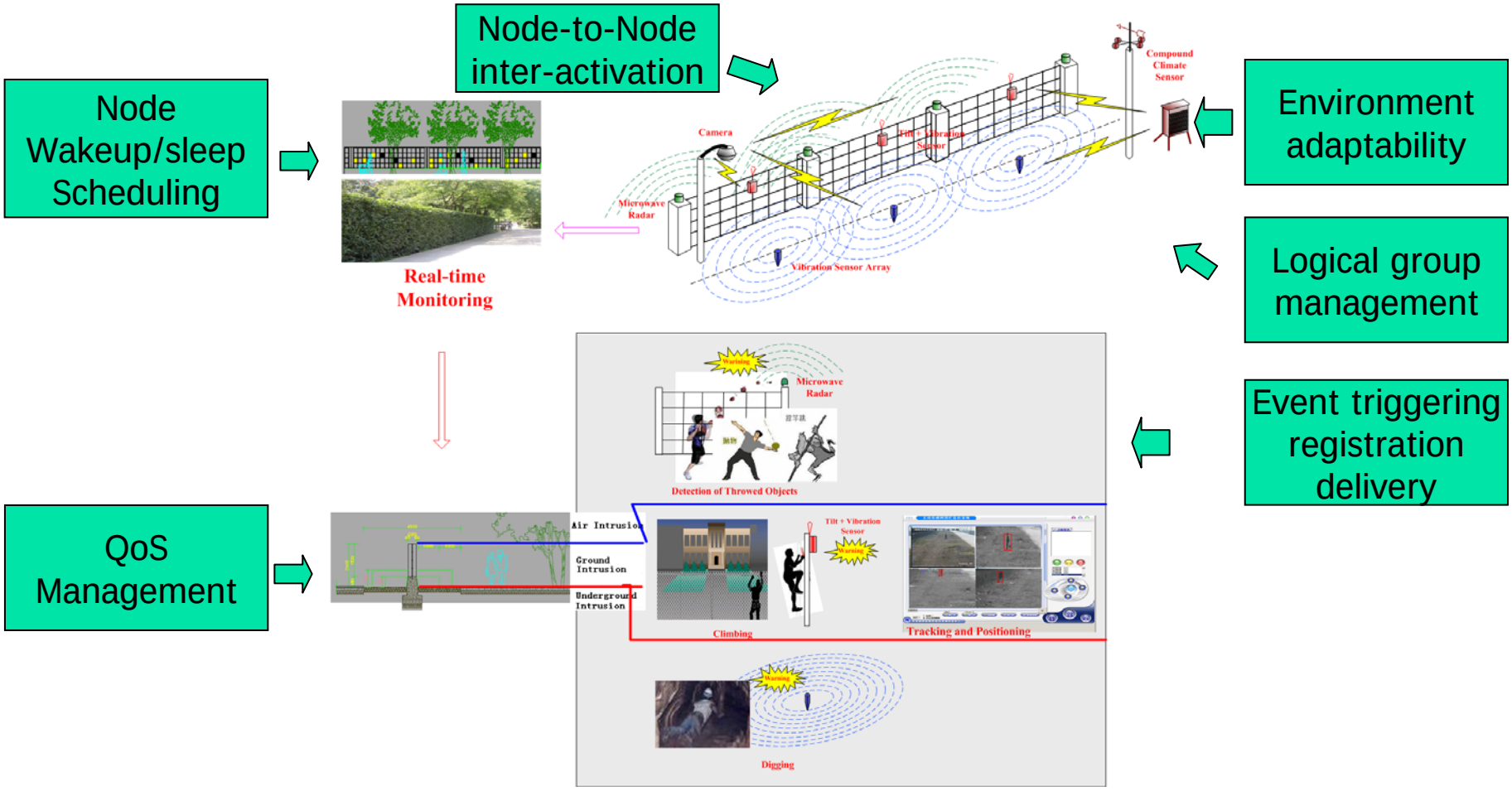


Intelligent sensor network overview (1)

- Environment self-adaptability
  - Intelligent sensor network can adaptively choose the best method to obtain required system performances in case of environment changes.
- Dynamic task supporting
  - Intelligent sensor network can support dynamic tasks including dynamic task assigning, dynamic service-providing and dynamic quality of service.
- Autonomous system maintenance
  - Intelligent sensor network can autonomously maintain system functionalities in case of mobility and node failures.

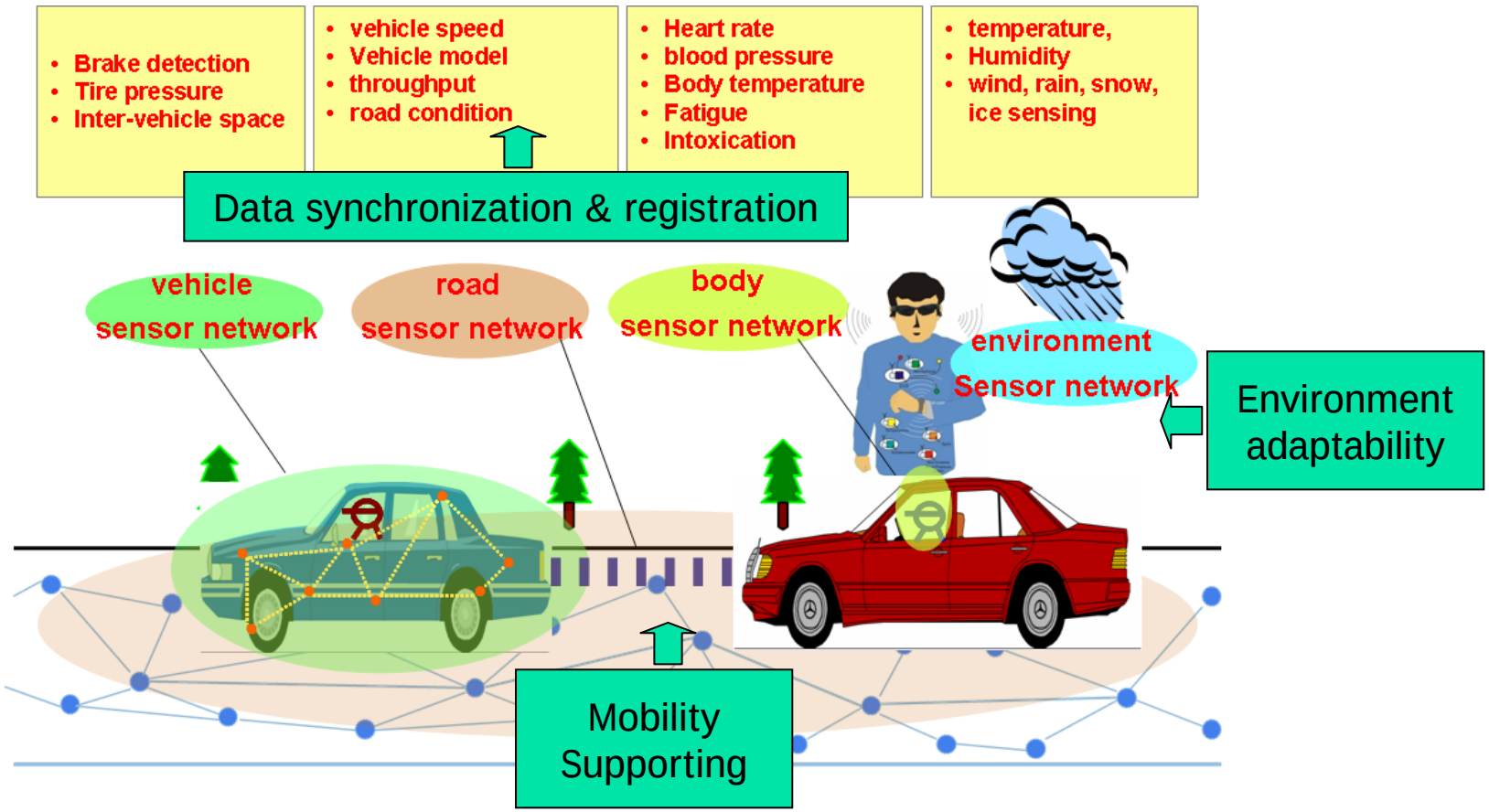
Intelligent sensor network overview (2)

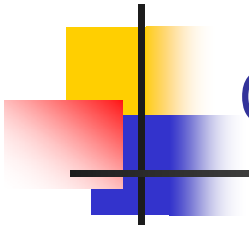
- Sensor network based intelligent anti-intrusion system



Intelligent sensor network overview (3)

- Sensor network based intelligent transportation safety system





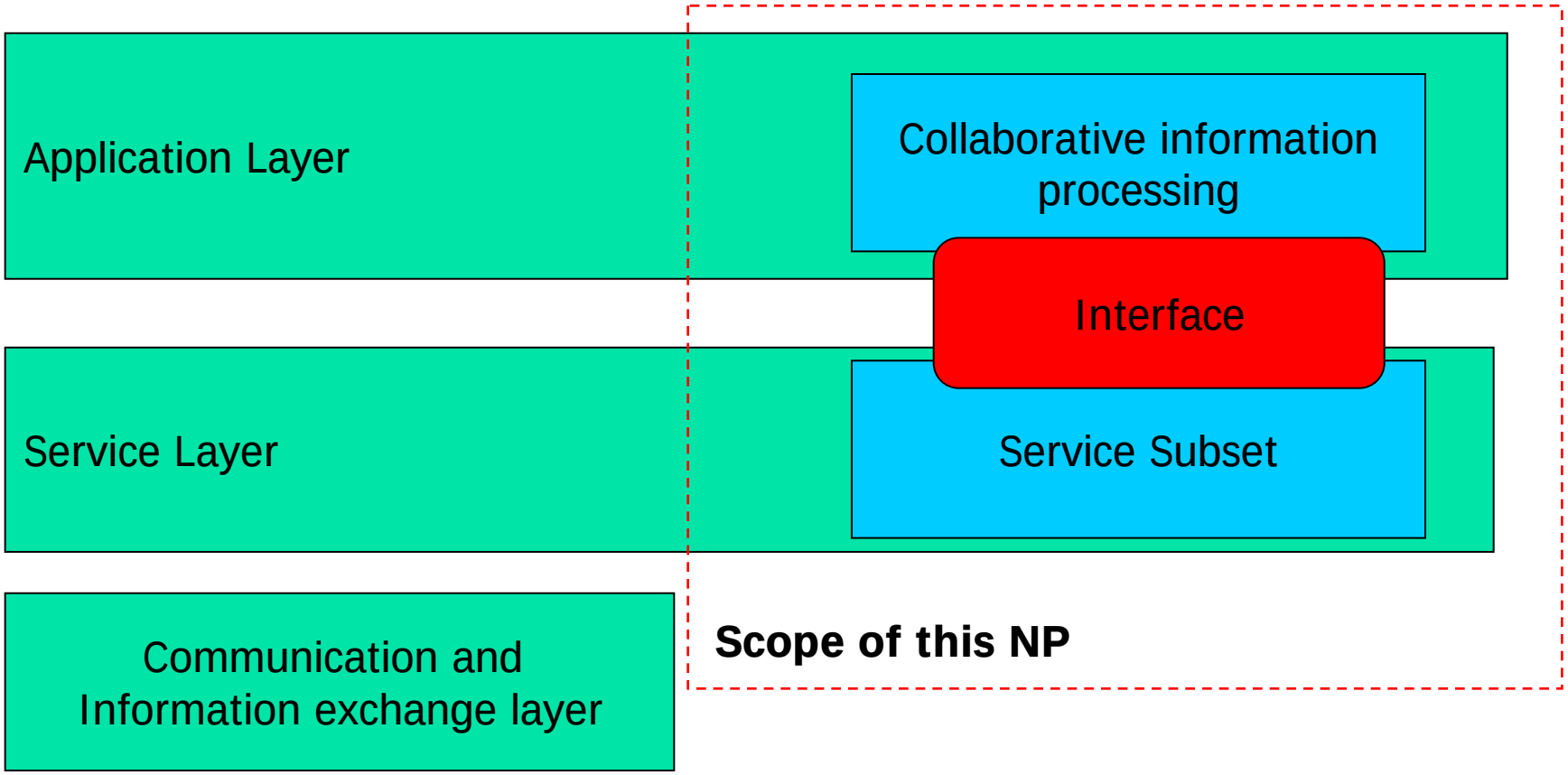
Collaborative information processing overview

- Constraint resources
  - Energy, communication, computing, storage, etc.
- Information sensing performance requirement
  - Complete, Accuracy, timely, efficiently
- Integrated service providing
  - Complex task based on individual subtasks
- Complicated application scenario & environment
  - Noise, interference, data packet loss, incorrect/inconsistent sensor measurement

Collaborative information processing is an essential solution to meet above challenges in sensor networks.

Scope of this NP

- Conceptual model of sensor networks



Specific standard issues in this NP (1)

- Event triggering, registration and delivery
  - In case of environment changes or events
  - Primitives:
    - ServiceLayer-eventtriggering.request{…}
    - ServiceLayer-eventtriggering.indication{…}
    - ServiceLayer-eventregistration.request{…}
    - ServiceLayer-eventregistration.indication{…}
    - ServiceLayer-eventregistration.response{…}
    - ServiceLayer-eventregistration.confirm{…}
    - ServiceLayer-eventcancellation.request{…}
    - ServiceLayer-eventcancellation.indication{…}
    - ServiceLayer-eventcancellation.response{…}
    - ServiceLayer-eventcancellation.confirm{…}
    - ServiceLayer-eventdelivery.request{…}
    - ServiceLayer-eventdelivery.indication{…}
    - ServiceLayer-eventdelivery.confirm{…}

Specific standard issues in this NP (2)

- Sensor data synchronization and registration
  - Primitives:
    - ServiceLayer-datasyn.request{…}
    - ServiceLayer-datasyn.indication{…}
    - ServiceLayer-datasyn.response{…}
    - ServiceLayer-datasyn.confirm{…}

    - ServiceLayer-dataregistration.request{…}
    - ServiceLayer-dataregistration.indication{…}
    - ServiceLayer-dataregistration.response{…}
    - ServiceLayer-dataregistration.confirm{…}

    - ServiceLayer-dataregistrationQuery.request{…}
    - ServiceLayer-dataregistrationQuery.indication{…}

Specific standard issues in this NP (3)

- Node-to-Node inter-activation
  - Primitives:
    - ServiceLayer-N2NStateQeury.request{…}
    - ServiceLayer-N2NStateQeury.response{…}

    - ServiceLayer-N2Nactivation.request{…}
    - ServiceLayer-N2Nactivation.indication{…}
    - ServiceLayer-N2Nactivation.confirm{…}

    - ServiceLayer-N2NParametersetting.request{…}
    - ServiceLayer-N2NParametersetting.indication{…}
    - ServiceLayer-N2NParametersetting.confirm{…}

Specific standard issues in this NP (4)

- CIP-driven node wakeup/sleep scheduling
  - Primitives:
    - ServiceLayer-nodeWSchedulingconnect.request{…}
    - ServiceLayer-nodeWSchedulingconnect.confirm{…}

    - ServiceLayer-nodeWScheduling.request{…}
    - ServiceLayer-nodeWScheduling.indication{…}
    - ServiceLayer-nodeWScheduling.response{…}
    - ServiceLayer-nodeWScheduling.confirm{…}

    - ServiceLayer-nodeWSchedulingdisconnect.request{…}
    - ServiceLayer-nodeWSchedulingdisconnect.confirm{…}

Specific standard issues in this NP (5)

- Mobility supporting
  - Primitives:
    - ServiceLayer-nodeContextQuery.request{…}
    - ServiceLayer-nodeContextQuery.response{…}
    - ServiceLayer-nodeContextData.request{…}
    - ServiceLayer-nodeContextData.indication{…}
    - ServiceLayer-nodeContextData.response{…}
    - ServiceLayer-nodeContextData.confirm{…}
    - ServiceLayer-nodeContextUpdating.request{…}
    - ServiceLayer-nodeContextUpdating.indication{…}
    - ServiceLayer-nodeContextUpdating.response{…}
    - ServiceLayer-nodeContextUpdating.confirm{…}

Specific standard issues in this NP (6)

- Logical group establishment, updating and cancellation
  - Primitives:
    - ServiceLayer-Lgroupestablishing.request{…}
    - ServiceLayer-Lgroupestablishing.indication{…}
    - ServiceLayer-Lgroupestablishing.response{…}
    - ServiceLayer-Lgroupestablishing.confirm{…}

    - ServiceLayer-LgroupmemberJoining.request{…}
    - ServiceLayer-LgroupmemberJoining.indication{…}
    - ServiceLayer-LgroupmemberJoining.confirm{…}

    - ServiceLayer-LgroupmemberQuit.request{…}
    - ServiceLayer-LgroupmemberQuit.indication{…}
    - ServiceLayer-LgroupmemberQuit.confirm{…}

    - ServiceLayer-LgroupQuery.request{…}
    - ServiceLayer-Lgroupestablishing.response{…}

    - ServiceLayer-Lgroupdisband.request{…}
    - ServiceLayer-Lgroupdisband.indication{…}

Specific standard issues in this NP (7)

- Proactive and reactive parameter adaptation
  - Primitives:
    - ServiceLayer-ParameterQeury.request{…}
    - ServiceLayer-ParameterQeury.response{…}

    - ServiceLayer-Parameteradaptingbind.request{…}
    - ServiceLayer-Parameteradaptingbind.indication{…}
    - ServiceLayer-Parameteradaptingbind.confirm{…}

    - ServiceLayer-Parameteradapting.request{…}
    - ServiceLayer-Parameteradapting.indication{…}
    - ServiceLayer-Parameteradapting.confirm{…}

Specific standard issues in this NP (8)

- QoS Management Service
  - Primitives:
    - ServiceLayer-QoSParameterQeury.request{…}
    - ServiceLayer-QoSParameterQeury.response{…}

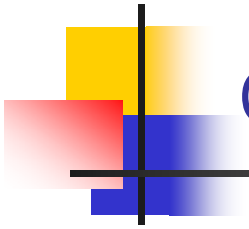
    - ServiceLayer-QoSParameterupdatebinding.request{…}
    - ServiceLayer-QoSParameterupdatebinding.indication{…}
    - ServiceLayer-QoSParameterupdatebinding.confirm{…}

    - ServiceLayer-QoSParameterupdate.request{…}
    - ServiceLayer-QoSParameterupdate.indication{…}
    - ServiceLayer-QoSParameterupdate.response{…}
    - ServiceLayer-QoSParameterupdate.confirm{…}

    - ServiceLayer-QoSParameterswitching.request{…}
    - ServiceLayer-QoSParameterswitching.indication{…}
    - ServiceLayer-QoSParameterswitching.response{…}
    - ServiceLayer-QoSParameterswitching.confirm{…}

Review of normative references and standard activities

- RM-ODP
  - ISO/IEC 10746 (ITU-T Rec. X.901-X.904)
  - Five generic and complementary viewpoints on the system and its environment
- OGC SWE
  - Sensor Web service oriented
  - SOS, SPS, SAS, WNS as key services for sensor web
- ISO/IEC SC32
  - Data management and exchange
  - SC32 is beginning working in capturing, storing, and mining the information from the sensors.
- ISO/IEC SC37
  - Biometric data exchange format
  - Related biometric profiles



Conclusion

- Intelligent sensor networks have capabilities of environment self-adaptability, dynamic task supporting and autonomous system maintenance.
- Collaborative information processing is an essential technology to support intelligent sensor networks.
- We propose a NP, for “Services and Interfaces supporting collaborative information processing in intelligent sensor networks”.