

제 1 부

[초청강연] 기술정책 방향

발 표 [3]

유비쿼터스 컴퓨팅을 위한 임베디드 SW 기술 동향

- ETRI 임베디드 SW연구단장 김흥남 -

Embedded S/W Technologies for Ubiquitous Computing

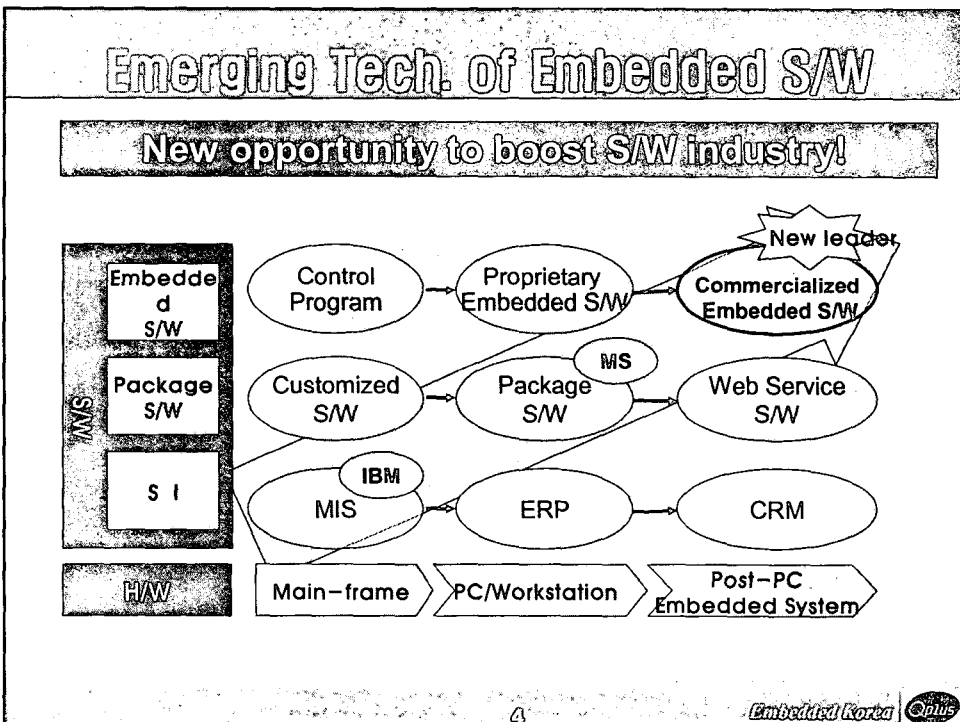
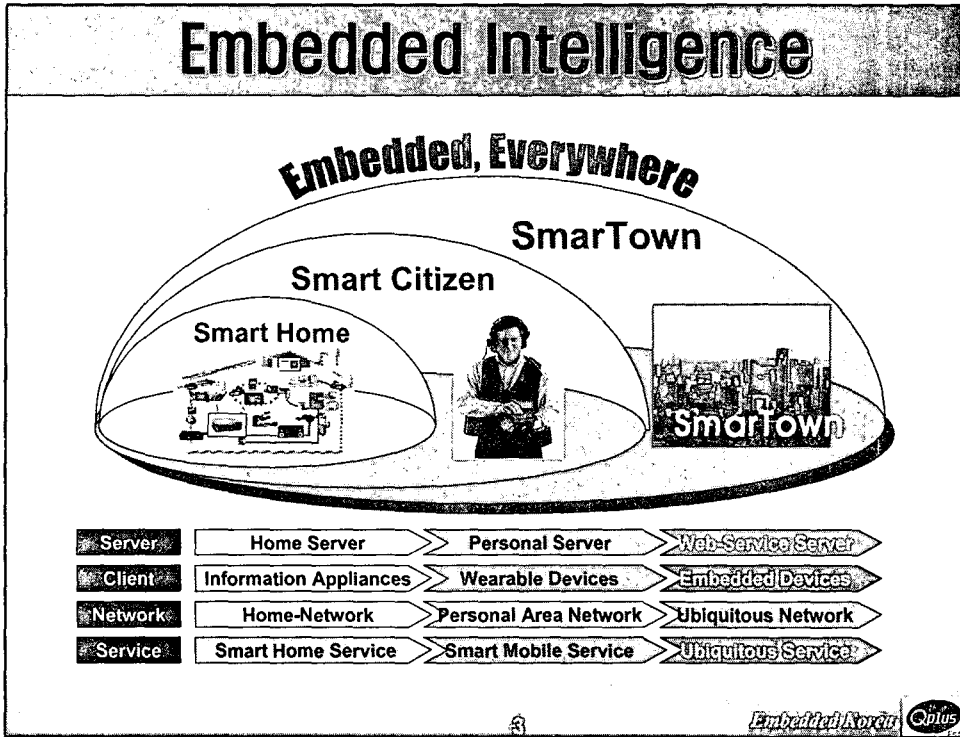
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Electronics and Telecommunications
Research Institute

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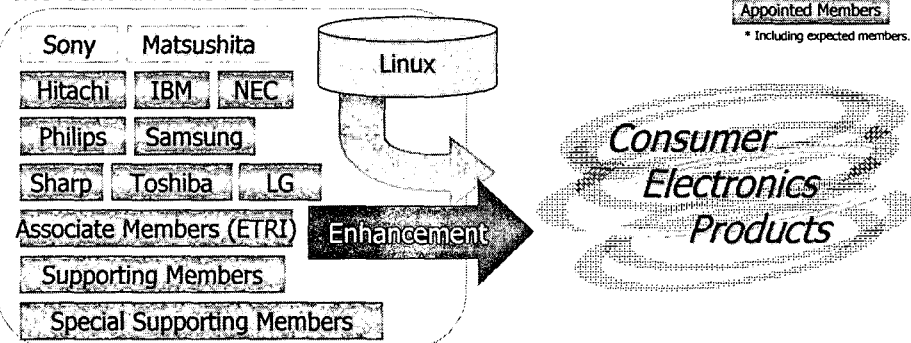
- ❑ Embedded, Everywhere
- ❑ Standard Embedded S/W Platform (*Qplus/Esto*)
 - Qplus Embedded Linux
 - Target Builder – *Qplus Configuration & Embedding Tool*
 - Esto – Embedded Linux Development Toolkit
- ❑ Nano Embedded S/W Platform (*Nano-Qplus*)
 - Nano-Qplus OS (S/W)
 - Smart Sensor Node (H/W)
 - Applications
 - Standardization



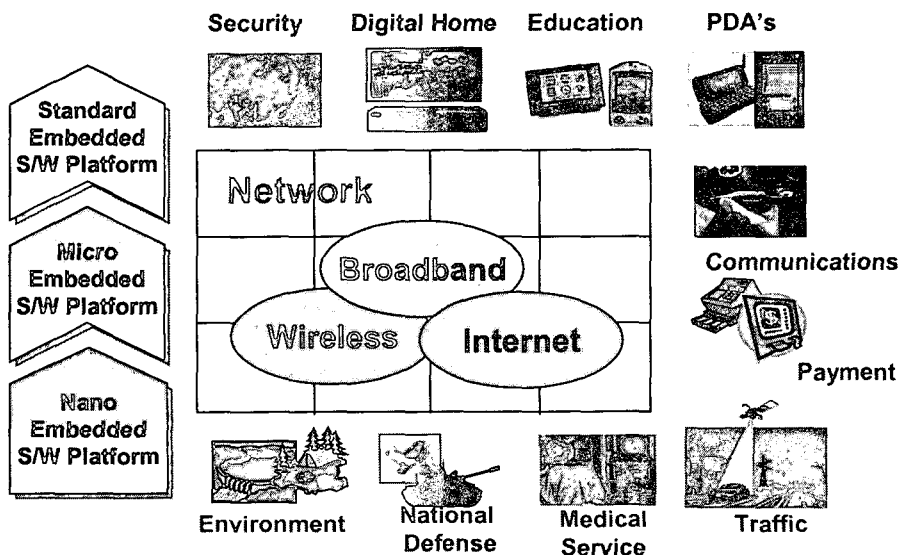
CELF (Consumer Electronics Linux Forum)

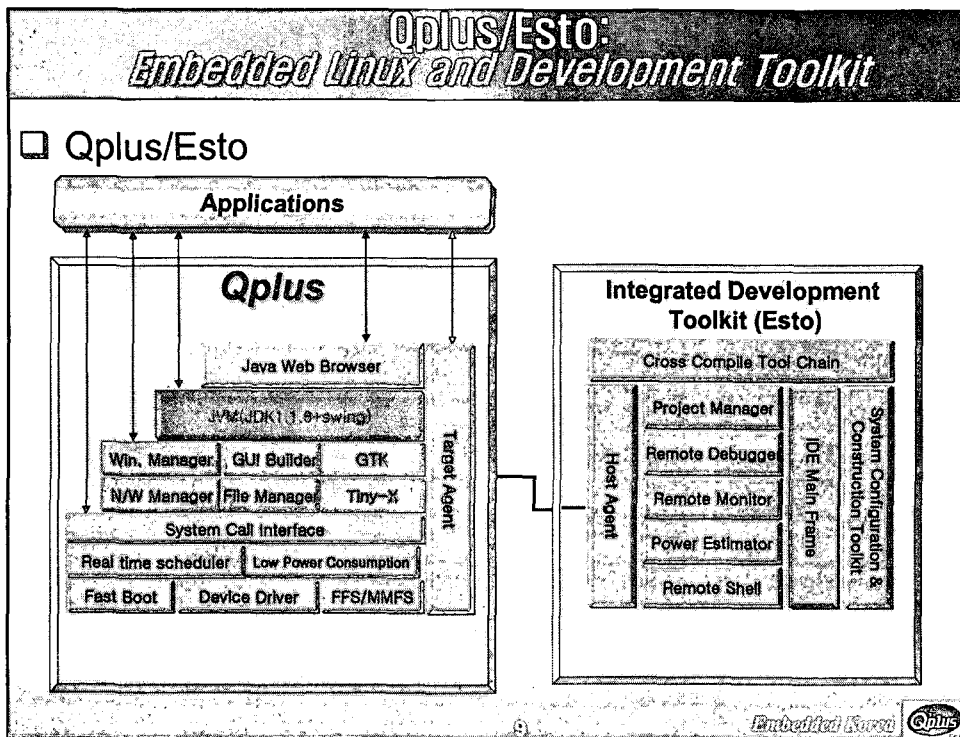
- ❑ Sony & Matsushita founded in Jun. 2003
- ❑ Most world-wide CE companies are participating
 - About more than 50 companies and institutes
- ❑ Use embedded linux in consumer electronics area

GNU General Public License



Embedded, Everywhere





Qplus Embedded Linux

Qplus

- Embedded Linux Solution for Digital Devices

Qplus Components

- Linux Kernel 2.4.x with Lock Break Patch Applied
(New real-time and Low Power Management features to be added)
- Fast Booting for x86 Architecture
 - Much Faster than Other Similar Architectures(3 times)
- Multimedia File System
- GUI Libraries : TinyX/GTK, QT/Embedded, ...
- System Applications : Busybox, Tinylogin, Boa, ...
- Multimedia Applications : MPEG1-2-4, DVD, MP3 player, ...
- Java Applications : Web Brower, E-Book

Foot-print

- Starts from 2MByte ~

Embedded Korea

Target Builder : Optus Configuration & Embedding Tool

Automated development using Target Builder

Product

- ❑ The First CML2 based Unified Configuration System
 - You can configure kernel, packages and target specific options altogether
 - Dependencies are checked automatically
- ❑ Create Embedded Linux System in just a few minutes.
 - Just load provided pre-configurations for each BSP
 - Point & Click selection of OS component with easy to use GUI interface
 - Deploy to the target simply by clicking a 'Deploy' button
- ❑ Create very optimized system ROM image
 - Fine-grain package control: file list, compile options, ...
 - Library optimizer : both file and symbol level

Embedded Korea

Target builder Screen shot

The screenshot shows the Target Builder interface with several key components labeled:

- project view:** Points to the top-left pane showing a tree structure of the project.
- configuration tree:** Points to the central pane displaying a list of configuration options such as 'Networking support', 'Serial port', 'USB support', and 'Sound card support'.
- symbol property:** Points to the right-hand pane showing search results and dependency information.
- Dependency list:** Points to the bottom section of the right-hand pane.

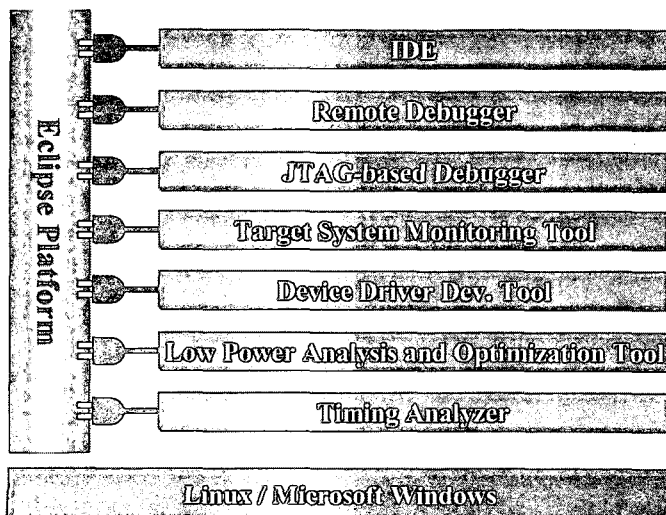
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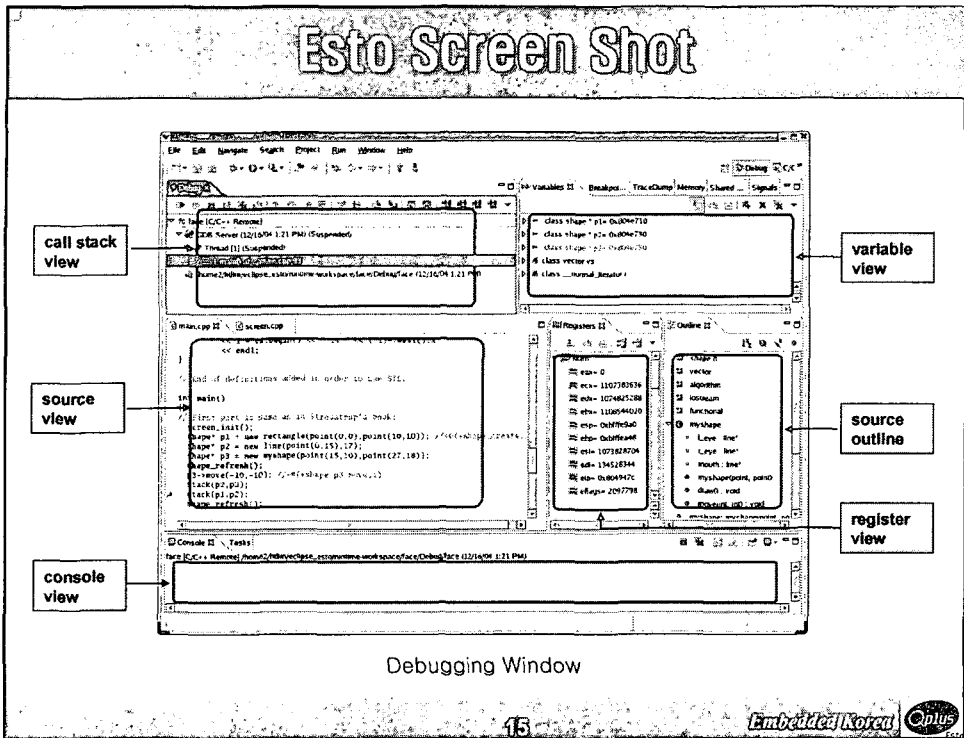
Embedded Korea

Esto: Embedded Linux Development Toolkit

- Accelerate developer productivity of Qplus embedded software
- Support Platforms
 - Target : x86, ARM9, MIPS, SMDK
 - Host : Linux, Windows
- Features
 - Rich Tools : Target Builder, IDE, Debugger, Power Estimator, System Monitor/Tracer, TargetAgent, HostAgent
 - User Friendly GUI : Simple to use, Easy to learn, Same look and feel on both Linux and Windows hosts
 - Embedded Software Tailored Feature : Measure power consumption, Check real time constraint, Tracepoint based non-stop debugging

Software Architecture for Esto





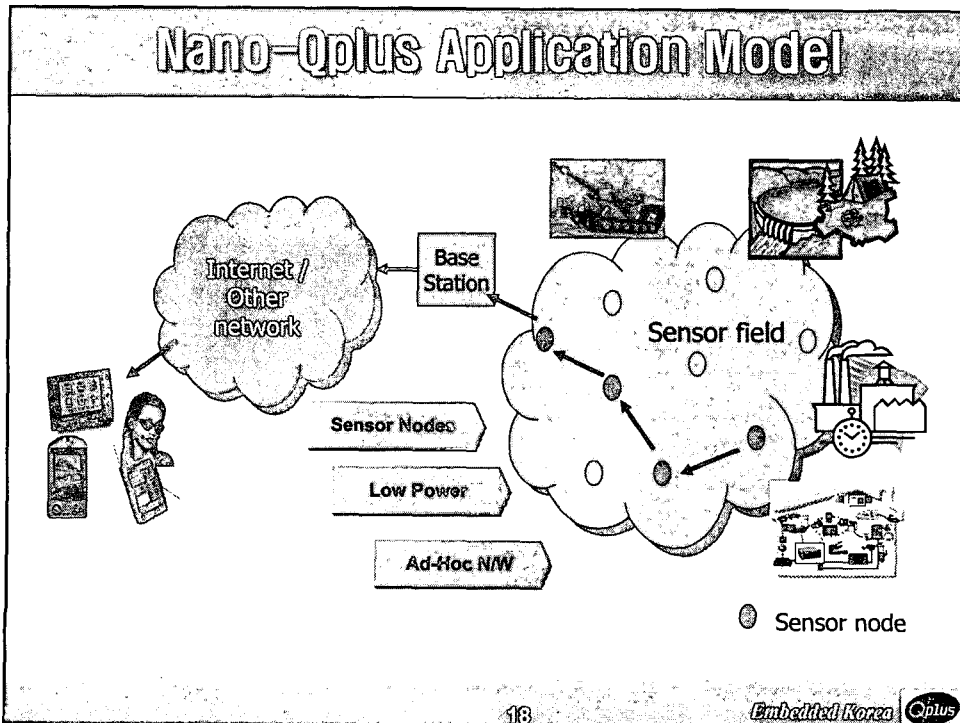
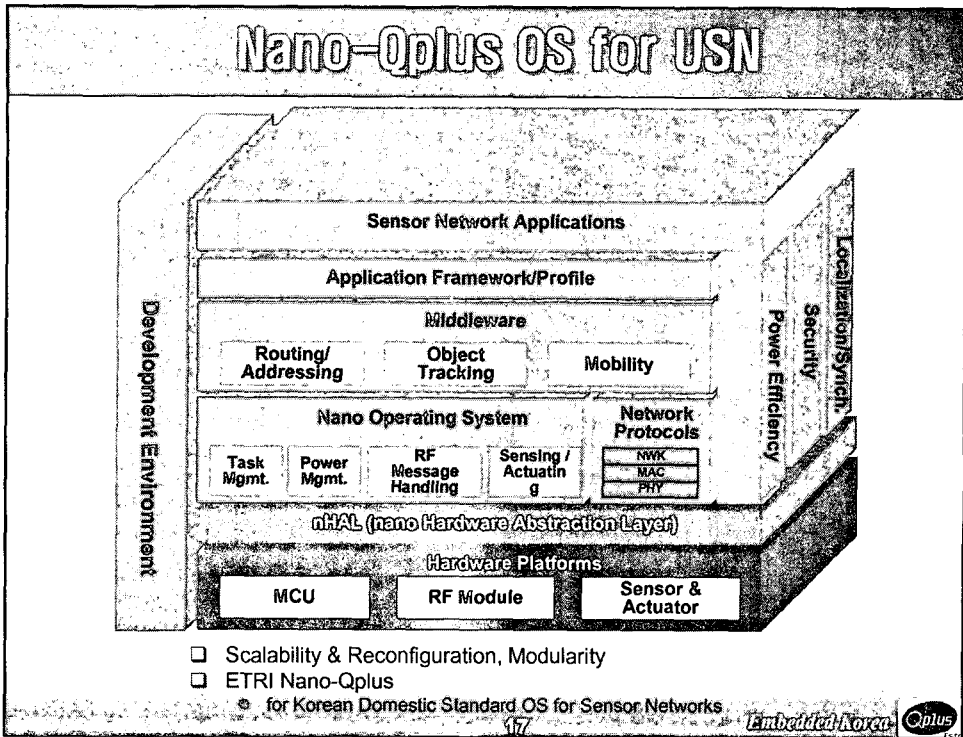
Nano Embedded S/W Platform: Nano-Qplus

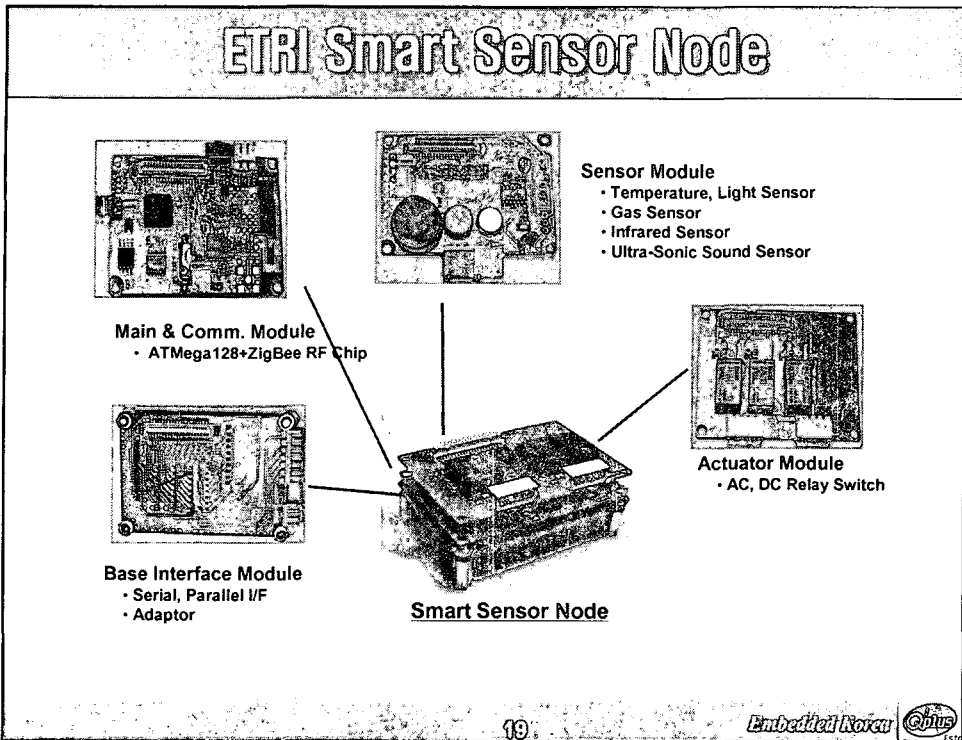
Summary

- Small-sized, Distributed, Real-time, and Smart Operating System suitable for medical services, environmental systems, disaster prevention, digital home, and national defense systems
- Nano-OS platform for sensor networks under ubiquitous environment

Nano-Qplus OS Features

- Re-configurable & scalable OS that can be optimized for various sensors and actuators
 - Supports better S/W architecture than TinyOS of UC Berkeley
- Supports multi-scheduler(FIFO, Preemption, LEDF, etc.) and various wireless communications(RF, ZigBee, Bluetooth, etc.)
- Supports the same API sets as the standard and micro embedded OS(POSIX based)





ETRI Smart Sensor Node

Main Module Feature	
RF	CC2420(2.4GHz,IEEE802.15.4) ZigBee System
RF Data rate	250kbps Effective Data rate
CPU	Atmega128L
External SRAM	32KB
Size	4cm x 6cm or 3cm x 3.5
RF OSC	16MHz
CPU OSC	8MHz
Power	3V Coin Type Battery
Extension	Application connector

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ETRI Smart Sensor Node

Product	mica2	imote	Telos	ETRI-SSN
Organization	Crossbow	Intel Lab.	Telos Corp.	ETRI
Year	2001	2003	2003	2004
Clock Speed	7MHz	12MHz	20MHz	8MHz
CPU	ATmel	ARM	Motorola	ATmel
Flash Memory(KB)	128	512	60	128
RAM(KB)	4	64	4	4
RF Speed(KBaud)	40	460	250	250
Radio Type	Chipcon	Zeevo BT	Zigbee	Zigbee
Operating System	TinyOS	TinyOS	TinyOS	Nano-Qplus

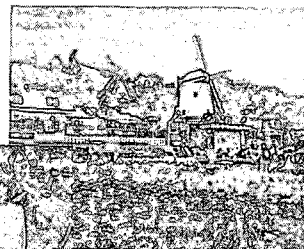
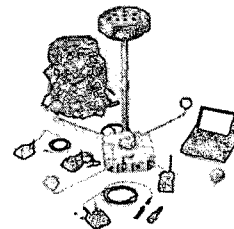
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Sensor Network Applications

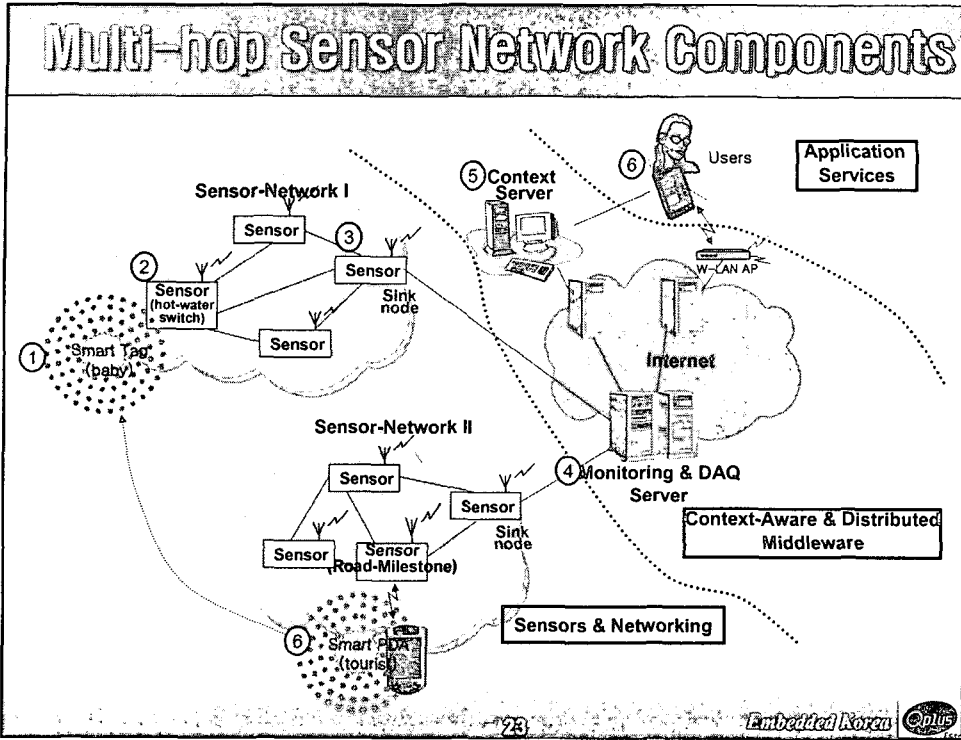
- Military
- Smart Home
- Logistics, Supply Chain Management
- ITS
- Healthcare
- Process Automation
- Environment
- Intelligent Robot
- Automotive (Vehicle)
- Factory Automation
- Smart Park
- Etc.



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H/W & S/W Module Configuration

Node Type	Hardware Module				OS Module				
	Main Module	Base Module	Sensor Module	Actuator Module	Task Mgmt	PWR Mgmt	RF	Sensing (ADC)	UART
Anchor Node	M	M	O	O	M	O	M		M
Sensing Node	M	O	M	O	M	M	M	M	
Actuator Node	M	O	O	M	M	O	M	M	
Moving Tag (with PDA)	M	M	O	O	M	M	M	O	O
Moving Tag Only	M	O	O	O	O	M	M	O	

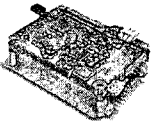
M : Mandatory, O : Option



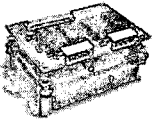
Main Node



Sensor Node

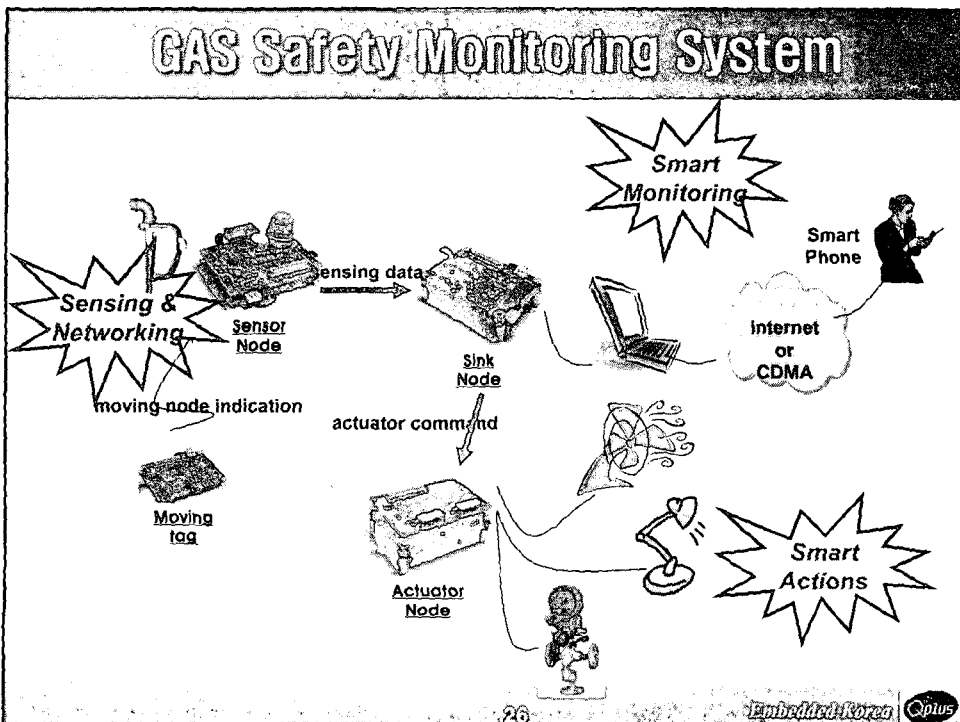
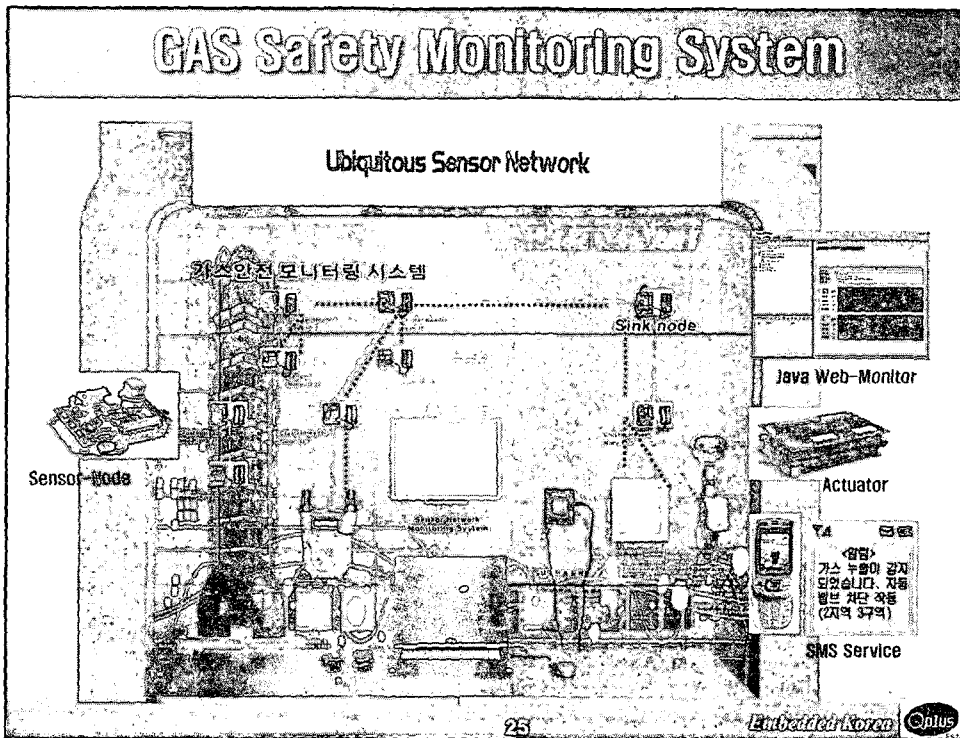


Anchor Node



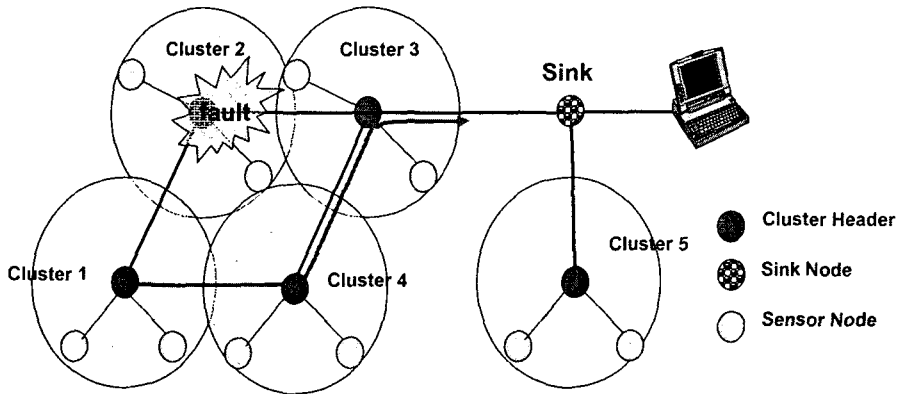
Actuator Node

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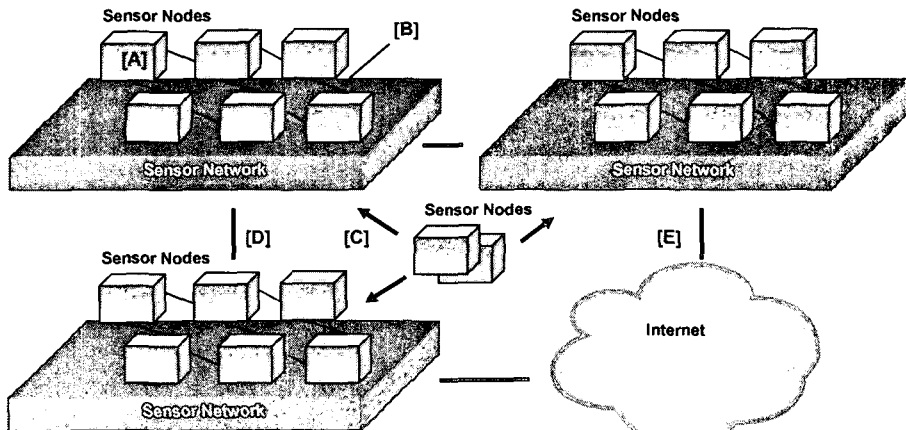


GAS Safety Monitoring System

- Star-Mesh Topology based Zigbee Dynamic Routing
 - 2.4GHz Zigbee RF used, IEEE 802.15.4 MAC based routing
 - CH to CH → Mesh Topology, SN to CH → Star Topology



Standardization



- [A] Sensor Node Reference Model
- [B] Protocol for interoperation among Sensor Nodes
- [C] Sensor Node Plug-in
- [D] Protocol for interoperation among Sensor Networks
- [E] Protocol for interoperation between Sensor Network and Internet

