

Data Communication and Networking





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DCN-100

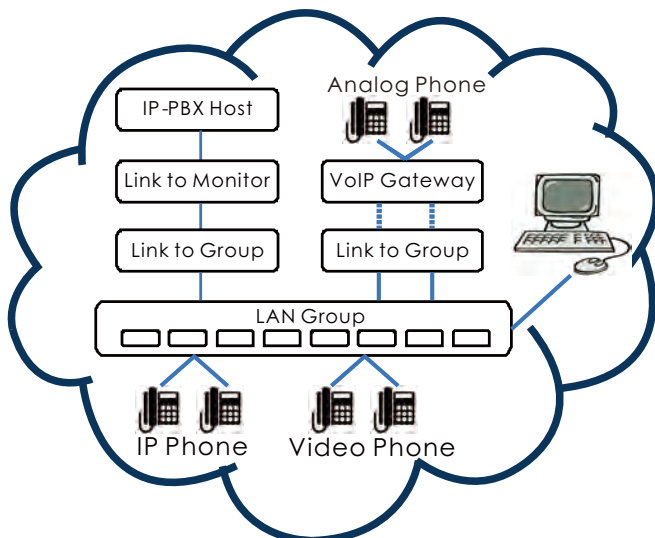
IP-PBX Training System



IP-PBX (Internet Protocol-Private Branch Exchange) is an Internet phone system. In comparison with a traditional PBX network, IP-PBX transmits all calls via data packets over a TCP/IP network. The IP-PBX Training System (DCN-100) is an ideal platform for exploring the functions of the IP-PBX. It utilizes the SIP (Session Initiation Protocol) technology to establish audio and video communication within data network. Along with DCN-100, the open-source software – “Wireshark Network Analyzer”, is used to capture and observe the SIP packets. In recent years, the protocol extensions of the SIP have lead to the continuous expansion of the SIP application scope. As a result, the SIP has emerged to be one of the next-generation key technologies in data networking / telecommunication/communication networking realm.

● Features

1. Software-aided, controlling the SIP main unit to execute establishment, modification, and maintenance of SIP accounts.
2. Demonstrates the configuration of the IP-PBX Training System.
3. Analyzes various scenarios involving hands-on communication between two or more endpoints across various phone devices (eg: traditional telephones, IP phones, and video phones) to embody the theory of data transmission through the IP-PBX system.



● Specification

DCN-11001 Main Unit

1. IP-PBX Host

- (1) Communication protocol : SIP (Session Initiation Protocol), complying with the standard RFC 3261
- (2) Speech compression:
 - a. G.711A-law/ μ -law
 - b. G.729,
 - c. H.263(video)
- (3) System capacity : Max. 15 calls can be made simultaneously by 100 registered users at once



2. VoIP Gateway/Gateway Group

- (1) Speech compression:
 - a. G.711A-law/ μ -law
 - b. G.723.1
 - c. G.726
 - d. G.729a/G.729b
 - e. PSTN audio detection and generation
 - f. Equipped with self-diagnostic function of FXS interface.
- (2) Voice interface: 8 ports in total (FXO+FXS)



3. Network Device

- (1) IP-PBX Host Monitor : 10/100 MB Ethernet(802.3) 1 Port
- (2) IP-PBX Host WAN : 10/100/1000 MB Ethernet(802.3) 1 Port
- (3) LAN Group : 10/100/1000 MB Ethernet(802.3) 8 Port
- (4) Link Group : 10/100/1000 MB Ethernet(802.3) 3 Port
Line to Monitor : 10/100 MB Ethernet(802.3) 1 Port

4. Power Input : 100V~240V AC, 50Hz/60Hz

DCN-13001/DCN-13002 IP Phone

- 1. Ethernet port (RJ-45, 10/100 base-T)
- 2. PoE (IEEE 802.3af)



DCN-13003/DCN-13004 Video Phone

- 1. Ethernet port (RJ-45, 10/100 base-T)
- 2. PoE (IEEE 802.3af)
- 3. Video codec : H.264 / H.263



DCN-13005/DCN-13006 Analog Phone

Dialing mode : Tone / Pulse



DCN-13011 PoE Module

- 1. IEEE802.3af compliant.
- 2. Support end-point and mid-span mode.
- 3. Support PD power classification from class 0 to class 4.
- 4. Per port over/under voltage protection.
- 5. Per port short circuit protection.
- 6. Per port over current protection.
- 7. Power Input : 90V~132V AC/180V~264V AC,
47Hz~63Hz (Setting by region)



● List of Experiments

- Setting of the IP-PBX main unit
- Installation and application of an IP Phone
- Instruction of the VoIP Gateway operation—software and hardware
- Gateway settings and Applications: Analog Phone (FXS)
- Gateway settings and Applications (1): Foreign exchange Office (PSTN)
- Gateway settings and Applications (2): Foreign exchange Office (PSTN)
- Settings of Automatic exchange switchboard
- Gateway settings and the integration of Auto-Attendant
- Video Phone configuration
- DTMF
- Voice mail
- Group Phones
- Call Pickup
- The Broadcasting System
- Voice Conference Room
- Setting and Dialing of IP-PBX phones in the computer
- PoE (Power of Ethernet)

● System Requirements

- 1. PC : 1GHz or faster 32-bit (x86) or 64-bit (x64) processor
4GB RAM, 2GB more free disk space
with Ethernet Card and CD-ROM drive
- 2. OS : Windows 7 Service Pack 1 or above

● Accessories

- 1. Experiment manual
- 2. RJ-45 cable set x 1
- 3. RJ-11 cable set x 1
- 4. Setup CD x 1



DGS-200 GSM / GPS Experimental Set



DGS-200 covers two topics in modern communication: GPS technology and GSM/GPRS technology.

In GPS module, the GPS receiver decodes the NMEA data strings from the satellites and output to software interface for the discussion of current position, speed, direction, time, etc.

In GSM / GPRS module, the usage of AT commands is introduced. Students can use software interface to send AT command to control GSM / GPRS module, send SMS message and make a phone call through headset interface, or access to the Internet.

When integrating both GPS and GSM / GPRS modules, the latitude and longitude data received by GPS module, this reference data will be sent to internet by GPRS service and reported in Google Map Website.

● Features

It's a powerful platform for wireless communication experiments when training and integrating GSM/GPRS with GPS modules, FAX Class1, TCP/IP, NMEA0183, 3GPP TS 27.005 and 3GPP TS 27.007 protocols to be one set.

● Specification

Hardware Specification

GSM/GPRS Module : Telit GC864-Quad V2

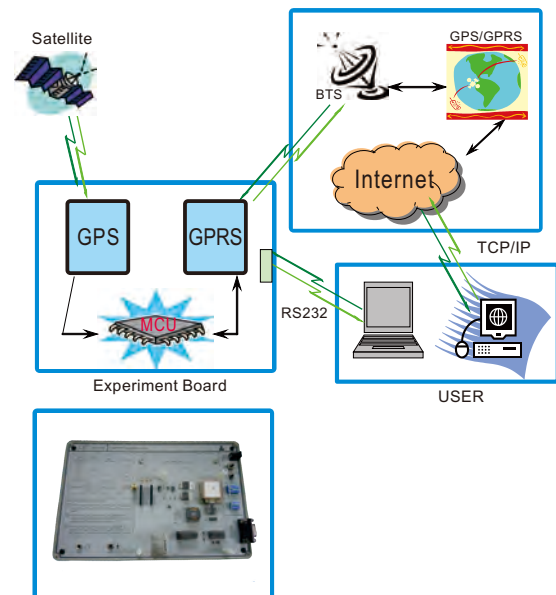
1. Support 3GPP TS 27.005, 3GPP TS 27.007, FAX class 1, TCP/IP protocol
2. Bandwidth : 850/900/1800/1900 MHZ
3. GPRS follows PPP(Point-to-Point Protocol) transmission protocol

GPS Module : Global Positioning System module EM-406A

1. SiRF star III high performance GPS chipset
2. Support NMEA0183 data protocol
3. Built-in patch antenna, bandwidth 1575.42MHz

Micro-controller : Philip P89LPC922FN

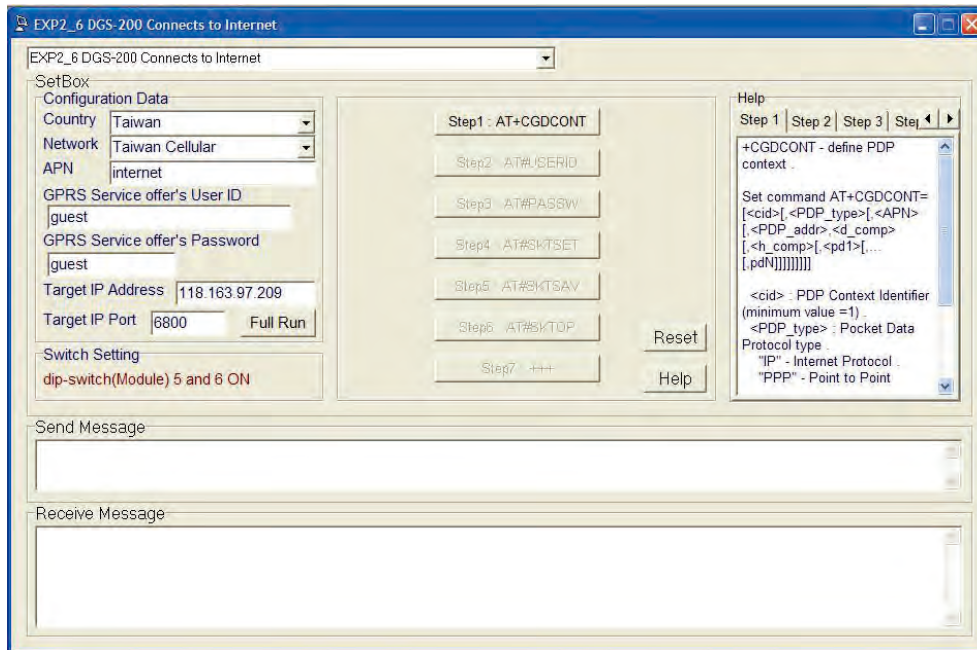
1. 8KB flash memory, 256 byte RAM
2. Microcontroller is responsible for transferring longitude and latitude message received from GPS module. The related message will be sent to GSM/GPRS module through GPRS service to appointed IP address.





Software Function

The user interface supports an experimental environment friendly and clear. All experiments can be implemented step by step. Moreover, students can follow the relevant description of each step listed in our manual to complete the experiment easily.



● List of Experiments

- Exp1-1 : GPS module baud rate setting
- Exp1-2 : GPS module update rate control
- Exp2-1 : DGS-200 dials cell phone by AT command
- Exp2-2 : DGS-200 answers cell phone by AT command
- Exp2-3 : DGS-200 sends message to cell phone by AT command
- Exp2-4 : DGS-200 receives cell phone message by AT command
- Exp2-5 : DGS-200 checks signal quality by AT command
- Exp2-6 : DGS-200 connects to internet
- Exp 3 : Micro-controller experiment
- Exp 4 : DGS-200 application experiment

● Accessories

1. RS-232 to USB adapter : 1 pce
2. GSM/GPRS antenna : 1pce
(bandwidth: 850/900/1800/1900)
3. AC adapter : 1pce
(input AC 100~240V, output DC 9V/1A)
4. Microphone-earphones: 1 set
5. Audio line : 1pce
6. Battery container : 1 pce
(without battery)
7. Experiment manual : 1 pce
8. CD-ROM : 1 pce



ITS-101A Internet TCP/IP Protocol Training System



The Internet has permeated among our daily life in every aspect, and it provides the fundamental connection with many state-of-the-art technology such as third-generation cell phones, video communication and information appliances.

The core technology of the Internet is TCP/IP protocol suite. Understanding TCP/IP protocol suite is crucial to users of the Internet at all levels, and it facilitates better application of the Internet. Internet TCP/IP Protocol Training System is designed to meet this need.

There are seven layers of OSI model and from the second to the fourth of which plays the key role in operating system kernels such as Linux and Windows which are difficult for users to understand. Internet TCP/IP Protocol Training System not only reveals the inner workings of TCP/IP protocol software, but also provides methods to modify the behavior of TCP/IP protocol software for experiment purpose.

● System Features



1. Real-time packet monitor
 - Observe TCP segments, IP datagrams, ICMP datagrams, UDP datagrams and Ethernet frames



2. Packet generator
 - Generate actual TCP segments, IP datagrams, ICMP datagrams, UDP datagrams and Ethernet frames
 - Manual or programmable packet generation (packet size up to 1500 bytes)



3. Congestion generator
 - User programmable packet generation speed up to 1.2 Mbps
 - User programmable packet delay, error and lost



4. Programmable router
 - Configurable as a router or host
 - Can emulate as a firewall or NAT
 - Provide a platform to install user-defined network message procedures for experiment

● ITS-101A Specification

1. CPU : ARM9, Samsung, 32-bit RISC, 166MHz
2. Flash ROM first level : 512K bytes
3. Flash ROM second level : 2M bytes
4. SDRAM : 64M bytes (data width 32 bits) at 133MHz
5. Timer/counter : Six 16-bit multi-function
6. Watchdog timer : 8-bit
7. USB port
8. Upgrade button
9. LED : 10/100/active
10. Ethernet : 2 ports, 10/100 Mbps, RJ-45
11. Power requirements : 100V~240V, 50Hz/60Hz, 60VA Max.
12. Environment :
 - (1) Humidity : $\leq 70\%$ relative
 - (2) Operation temperature : 0~40°C

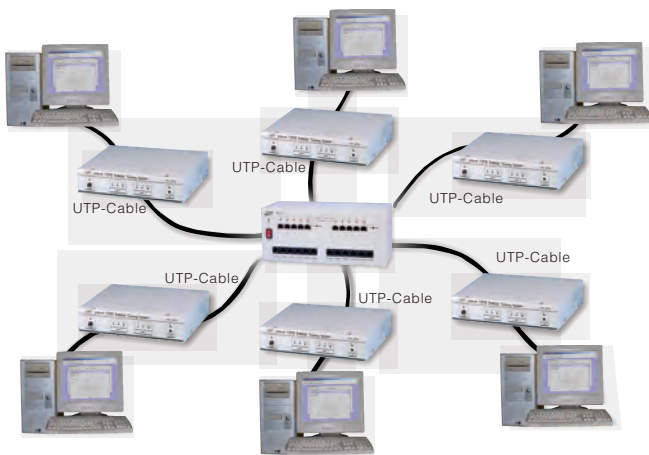
● HUBOX Specification

1. 6 Port RJ-45 sockets : 2pcs
2. 5 Port 10/100 Mbps Ethernet switch : 2pcs
3. DC power adapter : 1pce

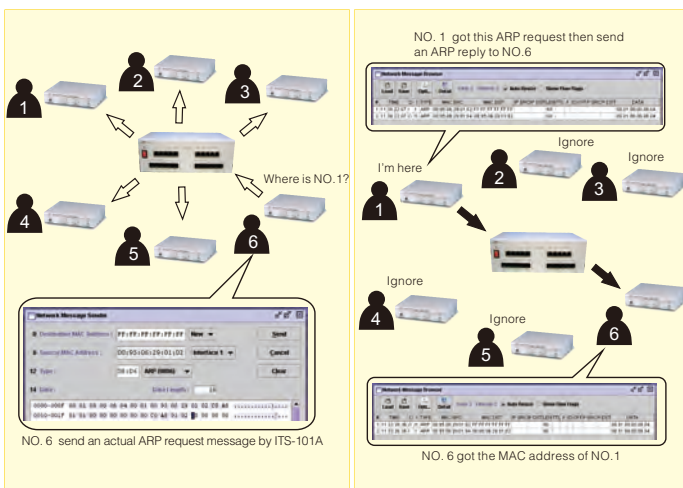


Platform

1. Module ITS-101A : 6pcs
2. USB cable : 6pcs
3. Power cord : 6pcs
4. HUBOX : 1pce
5. UTP cable : 12pcs
6. Software CD : 6pcs
7. ITS manual : 6pcs
 - Operation manual
 - Experiment manual
 - Message-driven dataflow language manual
 - MDDL jumpstart



Experiment Example : ARP

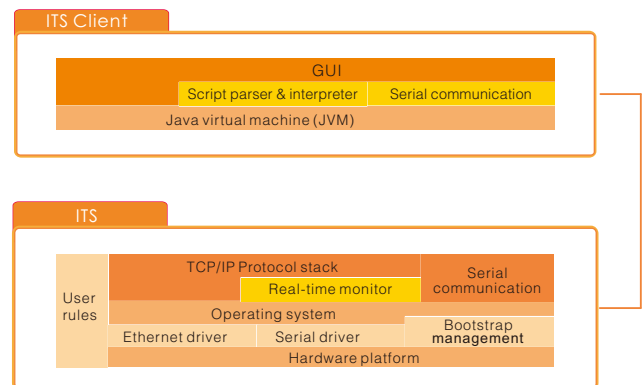


• List of Experiments

1. Ethernet messages sending & observing
2. MAC address discovery
3. Address Resolution Protocol (ARP)
4. ICMP ping and checksum
5. IP direct delivery and IP routing using default gateway
6. IP routing using Next-Hop routing
7. TTL in IP routing

8. Trace of IP routing
9. Path MTU discovery
10. Network disturbance for IP
11. Error control
12. Sliding window
13. Congestion avoidance
14. Full TCP implementation
15. TCP vs. UDP
16. The domain name system
17. Echo
18. SMTP client
19. HTTP
20. Telnet
21. FTP
22. NAT
23. Firewall
24. Proxy ARP
25. IP aliasing

Software Modules



1. Embedded multitasking operating system
2. TCP/IP protocol stack
3. TCP/IP protocol stack real-time monitor
4. Bootstrap management
5. Serial communication and console management
6. Java-based graphical user interface client (GUI)
7. Parser and interpreter for protocol behavior specification script
8. Protocol behavior specification scripts for the laboratory sessions

• System Requirements

Operating System

1. Windows 2000
2. Windows XP
3. Windows 7 / 10

Recommended Hardware

1. Pentium 4 or newer processor
2. 512MB of RAM
3. 200MB of hard drive space



ITS-200 series IPv6 Training System



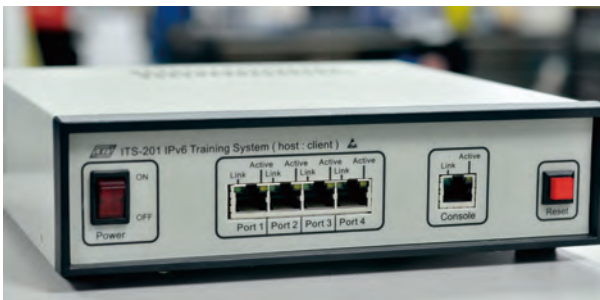
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Explosive growth in network device diversity and mobile communications, along with global adoption of networking technologies, have overwhelmed IPv4 and have driven the development of a next-generation Internet Protocol (IPv6).

In addition to providing more address space, IPv6 not only increases routing efficiency and network-layer security (built-in the IPSec encryption mechanism) but also creates new ways of addressing and more advanced QoS mechanisms, as the protocol develops.

The design purpose of ITS-200 series is to provide learners with a clear and comprehensive understanding of the protocol and operating behavior of the IPv6 specification. The complete system includes ITS-201(host:client) , ITS-202(host:server) and ITS-203(router). The interaction of these three devices can perform experiment as a group or stand alone.

● Package A



ITS-201 (host: client)

1. In order to conveniently observe various operating behavior of network packet flow under the different protocols, ITS-201 offers a console Ethernet port and a 4-port switch hub to set up different network topologies. ITS-201 follows IPv4 and IPv6 Dual Stack protocol. In addition, we design a methodology to capture the network packet flow through console and switch hub port. The RPCAP (Remote Packet Capture) service enables remote network packet browse.
2. A customized graphical interface is designed to send IPv4 and IPv6 network packets. The “Wireshark Network Analyzer” software is used to capture and observe network packets. All experiments designed are following IPv6 RFC standard.
3. In order to completely present the function of IPv6 network server and router, Cisco 1905/K9 is specifically selected to serve as DHCPv6 server, router and firewall ...etc . By following IPv4 and IPv6 dual stack protocol. The embedded IOS system offers a user-friendly platform to operate IPv6 mechanism.

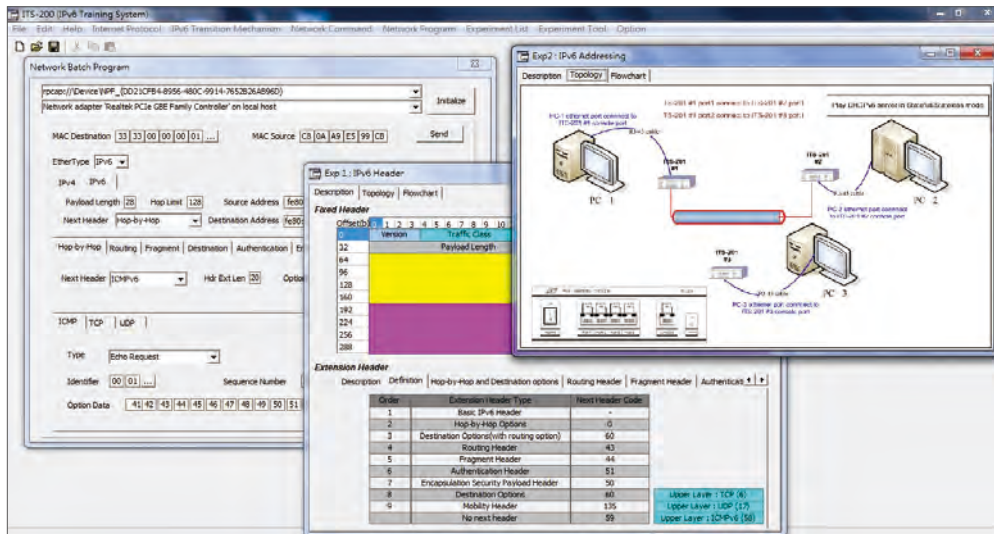
● Features

1. IPv4 and IPv6 Dual-Stack system
2. Support Remote Packet Capture Service (RPCAP)
3. Using filterable TAP to complete load-balancing and port-bonding to avoid browsed packet loss.
4. Provide GUI software to send and browse IPv4 and IPv6 packet.
IPv4 : ICMP, TCP, UDP
IPv6 : Support ICMPv6, DHCPv6, Upper layer packet format and “Next Header” with Hop-by-Hop, Routing, Fragment, Destination...etc.
5. Console and Port1~Port4 connect ports all support Auto-Negotiation.
6. Experiments cover OSI Model 2~7 layer.

● Specification

ITS-201

1. AC power supply : 100V~240V AC, 47Hz~63Hz
2. CPU: ARM11, 32-bit RISC @667MHz
3. Network device : (Auto-Negotiation)
(1) Console : 10/100 Mb Ethernet (802.3) 1 Port
(2) Port 1~4 : 4-port Switch Hub
4. Embedded multi-tasking operating system
5. IPv4/IPv6 dual stack
6. Configuration parameters setting through web browser
7. Customized graphical user interface(GUI)
(1) Offer several types of IPv4 and IPv6 header to allow user to freely modify and send packet
(2) Offer Windows 7 OS IPv6 command list
(3) Offer IPv6 experiment list and relevant information
8. Enable Remote Packet CAPture service (RPCAP) and use Wireshark software to observe network packets.



Cisco Router:

(Standard : Cisco 1905/K9,
Option : Cisco 1905-SEC/K9)



Cisco 1905

1. AC power supply : 100V~240V AC, 47~63Hz
2. Embedded IP Security / Secure Sockets Layer (IPSec / SSL) VPN hardware acceleration
3. Integrated Gigabit Ethernet ports : 10/100/1000 Mb Ethernet WAN-routed ports
4. Integrated serial port (HWIC-1T) : for serial WAN connectivity
5. Innovative universal-serial-bus (USB) based console access : mini-Type B USB console port supports management connectivity
6. IPv4/IPv6 Dual Stack
7. IPv6 Transition –Tunnel Mode (Cisco 1905-SEC/K9)
8. IPv6 Transition –Translator Mode
9. Protocols : IPv4, IPv6, static routes, Open Shortest Path First (OSPF), Border Gateway Protocol (BGP)...etc.
10. Encapsulations : Ethernet, 802.1q VLAN, Point-to-Point Protocol (PPP), Point-to-Point Protocol over Ethernet (PPPoE), and ATM.
11. Flow Control : QoS, Class-Based Weighted Fair Queuing (CBWFQ), Policy-Based Routing (PBR), Performance Routing (PFR), and Network-Based Advanced Routing (NBAR)

● List of Experiments

- Exp. 1 : Introduction to ITS-201
 - Unit 1 : ITS-201 hardware
 - Unit 2 : ITS-201 software
- Exp. 2 : Overview for Cisco 1905 router
 - Unit 1 : Configuration
 - Unit 2 : IPv6 Command list
- Exp. 3 : IPv6 Header
 - Unit 1 : send IPv4 packet and the mechanism of RPCAP
 - Unit 2 : send IPv6 packet and observe the IPv6 header
- Exp. 4 : IPv6 Extension Header
 - Unit 1 : Next Header is Hop-by-Hop Options Header
 - Unit 2 : Next Header is Fragment Header
 - Unit 3 : Next Header is TCP Header (HTTP)
 - Unit 4 : Next Header is UDP Header (DNS)
- Exp. 5 : IPv6 Addressing
 - Unit 1 : Stateful DHCPv6(Dibbler Server/Client)
 - Unit 2 : Stateless DHCPv6(Dibbler Server/Client)
 - Unit 3 : Windows command-ipconfig/release6
 - Unit 4 : Windows command-ipconfig/ renew6
- Exp. 6 : DHCPv6
 - Unit 1 : Stateful DHCPv6(Cisco 1905)
 - Unit 2 : Stateless DHCPv6(Cisco 1905)
 - Unit 3 : Stateless Autoconfiguration(Cisco 1905)
- Exp. 7 : ICMPv6 – Error Messages
 - Unit 1 : Destination Unreachable
 - Unit 2 : Packet Too Big
 - Unit 3 : Time Exceeded
 - Unit 4 : Parameter Problem
- Exp. 8 : ICMPv6 – Information Messages
 - Unit 1 : Ping IPv4 address and ARP command
 - Unit 2 : Ping IPv6 link-local address and NetSH command
 - Unit 3 : Ping IPv6 global unicast address
- Exp. 9 : Neighbor Discovery
 - Unit 1 : Link-Layer Address Resolution
 - Unit 2 : Duplicate Address Detection
 - Unit 3 : Router Discovery
- Exp. 10 : IPv6 Transition
 - Unit 1 : Dual Stack
 - Unit 2 : Tunnel (6 to 4, require Cisco 1905-SEC/K9 at option)
 - Unit 3 : Translator (NAT-PT)
- Exp. 11 : IPv6 Gateway and Route
 - Unit 1 : IPv4 Gateway
 - Unit 2 : IPv6 Gateway
 - Unit 3 : Static Route



ITS-200 series

● Products Combination Package A

1. ITS-201 : 3 pcs
2. Cisco 1905/K9 : 1 pce
3. Cisco 1905-SEC/K9 : 1 pce (option)

● System Requirements

1. PC with Pentium IV or above CPU
2. Windows 7 Service Pack 1 or upper version

● Accessories

1. Experiment manual : 3 pcs
2. Setup CD : 3 pcs
3. RJ-45 cable 1M : 15 pcs

● Package B



ITS-202 (host: server)

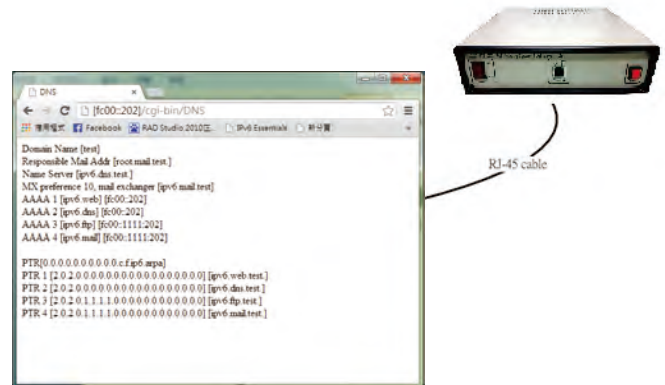
● Features

1. ITS-202 (host : server), one of ITS-200 series, is designed by a series of internet service and web-based GUI interface.
2. ITS-202 can be configured as 2 types of server :
 - A type offers IPv6 DHCP, IPv6 DNS and IPv6 web services.
 - B type offers IPv6 FTP, IPv6 SMTP, IPv6 POP and IPv6 web services.
3. In order to provide cross-platform design, ITS-202 can also be configured through Microsoft Internet Explorer, Mozilla Firefox, Google Chrome and other browsers.

● Specification

ITS-202

1. AC power supply : 100V~240V AC, 47Hz~63Hz
2. CPU: ARM11, 32-bit RISC @667MHz
3. Network interface : 10/100 Mb Ethernet(802.3) 1 port (Auto-Negotiation)
4. Embedded multi-tasking operating system
5. IPv4/IPv6 dual stack
6. Configurable routing parameters through web browser



● List of Experiments

- Exp. 1 : Observe IPv6 HTTP Packet
- Exp. 2 : Observe IPv6 DHCP Packet
 - Unit 1 : Stateful DHCPv6
 - Unit 2 : Stateless DHCPv6
- Exp. 3 : Observe IPv6 DNS Packet
 - Unit 1 : AAAA record
 - Unit 2 : PTR record
- Exp. 4 : Observe IPv6 FTP Packet
 - Unit 1 : Upload
 - Unit 2 : Download
- Exp. 5 : Observe IPv6 Mail Packet
 - Unit 1 : SMTP
 - Unit 2 : POP3

● Products Combination Package B

- ITS-202 : 1 pce

● System Requirements

1. PC with Pentium IV or above CPU
2. Windows 7 Service Pack 1 or version later

● Accessories

1. Experiment manual : 1 pce
2. RJ-45 cable 1M : 1 pce



ITS-200 series

● Package C



ITS-203 (router)

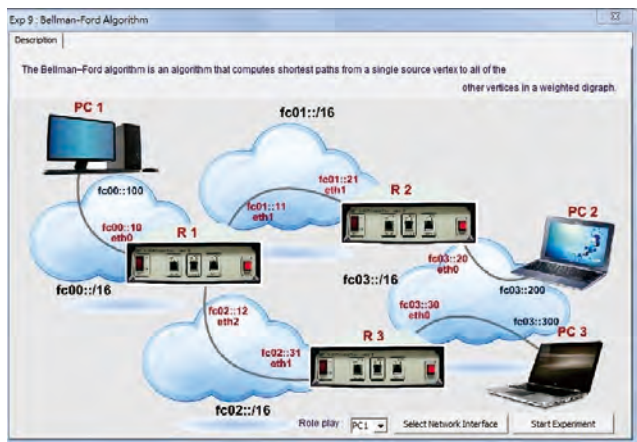
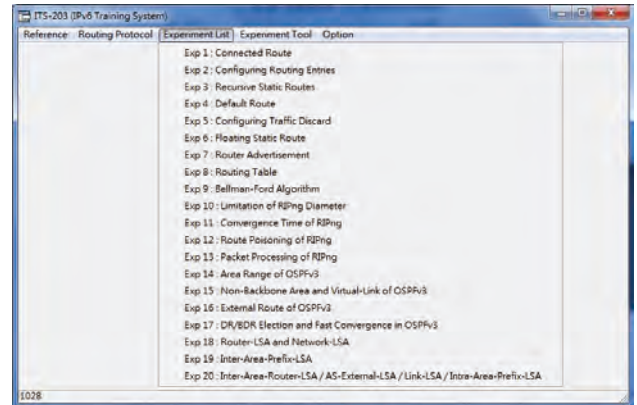
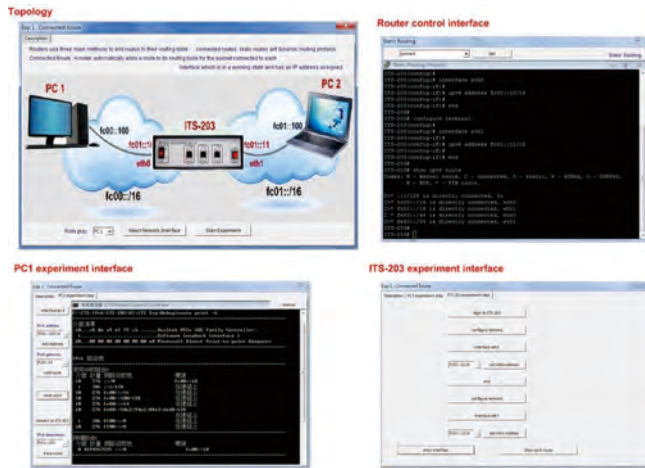
● Features

ITS-203(router) , one of ITS-200 series , is designed by a series of network topology and user friendly GUI software. It supports static and dynamic routing protocols. ITS-203's dynamic routing protocol supports RIPng (Routing Information Protocol next generation) and OSPFv3 (Open Shortest Path First for IPv6). Both are Interior Gateway Protocol(IGP) .

● Specification

ITS-203

1. AC power supply : 100V~240V AC, 47Hz~63Hz
2. CPU: ARM11, 32-bit RISC @667MHz
3. Network interface : 10/100 Mb Ethernet(802.3) 3 ports (Auto-Negotiation)
4. Embedded multi-tasking operating system
5. IPv4/IPv6 dual stack
6. Configurable routing parameters through GUI or web browser
7. Customized graphical user interface(GUI) : Offer IPv6 routing experiment instruction



You can dynamically change the configuration and observe routing table information from ITS-203 GUI software or terminal interface.



● List of Experiments

- Exp. 1 : Connected route
- Exp. 2 : Configuring Routing Entries
- Exp. 3 : Recursive Static Routes
- Exp. 4 : Default Route
- Exp. 5 : Configuring Traffic Discard
- Exp. 6 : Floating Static Route
- Exp. 7 : Router Advertisement
- Exp. 8 : Routing Table
- Exp. 9 : Bellman-Ford Algorithm
- Exp. 10 : Limitations of RIPng
- Exp. 11 : Convergence Time of RIPng
- Exp. 12 : Route Poisoning of RIPng
- Exp. 13 : Packet Processing of RIPng
- Exp. 14 : Area Range of OSPFv3
- Exp. 15 : Non-Backbone Area and Virtual-Link of OSPFv3
- Exp. 16 : External Route of OSPFv3
- Exp. 17 : DR/BDR Election and Fast Convergence in OSPFv3
- Exp. 18 : Router-LSA and Network-LSA
- Exp. 19 : Inter-Area-Prefix-LSA
- Exp. 20 : Inter-Area-Router-LSA / AS-External-LSA / Link-LSA / Intra-Area-Prefix-LSA

● Products Combination Package C

- 1. ITS-203 : 3 pcs
- 2. ITS-201 : 1 pce (option)

● System Requirements

- 1. PC with Pentium IV or above CPU
- 2. Windows 7 Service Pack 1 or version later

● Accessories

- 1. Experiment manual : 3 pcs
- 2. Setup CD : 3 pcs
- 3. RJ-45 cable 1M : 9 pcs

● Package D

● Products Combination Package D

- 1. ITS-201 : 3 pcs
- 2. ITS-202 : 2 pcs
- 3. ITS-203 : 3 pcs
- 4. Cisco 1905/K9 : 1 pce
- 5. Cisco 1905-SEC/K9 : 1 pce (option)

● Specification

ITS-201

- 1. AC power supply : 100V~240V AC, 47Hz~63Hz
- 2. Network device : (Auto-Negotiation)
 - (1) Console : 10/100 Mb Ethernet (802.3) 1 Port
 - (2) Port 1~4 : 4-port Switch Hub
- 3. Embedded multi-tasking operating system
- 4. IPv4/IPv6 dual stack
- 5. Enable Remote Packet CAPture service (RPCAP) and use Wireshark software to observe network packets.
- 6. Configurable routing parameters through GUI or web browser

ITS-202

- 1. AC power supply : 100V~240V AC, 47Hz~63Hz
- 2. Network interface : 10/100 Mb Ethernet(802.3) 1 port (Auto-Negotiation)
- 3. Embedded multi-tasking operating system
- 4. IPv4/IPv6 dual stack
- 5. Configurable routing parameters through web browser

ITS-203

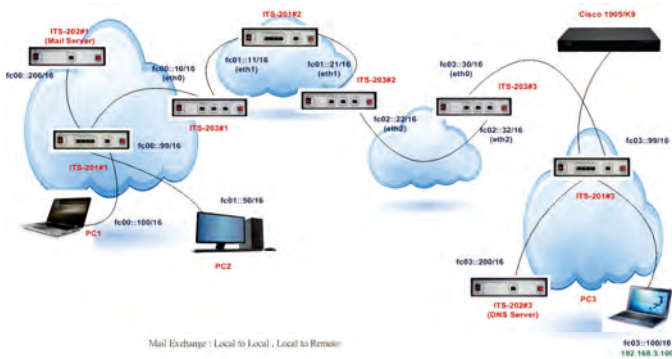
- 1. AC power supply : 100V~240V AC, 47Hz~63Hz
- 2. Network interface : 10/100 Mb Ethernet(802.3) 3 ports (Auto-Negotiation)
- 3. Embedded multi-tasking operating system
- 4. IPv4/IPv6 dual stack
- 5. Configurable routing parameters through GUI or web browser

Cisco-1905/K9

- 1. AC power supply : 100V~240V AC, 47Hz~63Hz
- 2. Embedded IP Security / Secure Sockets Layer (IPSec / SSL) VPN hardware acceleration
- 3. Integrated Gigabit Ethernet ports : 10/100/1000 Gigabit Ethernet WAN-routed ports
- 4. IPv4/IPv6 Dual Stack
- 5. IPv6 Transition –Tunnel Mode
- 6. IPv6 Transition –Translator Mode
- 7. Protocols : IPv4, IPv6, static routes, Open Shortest Path First (OSPF), Border Gateway Protocol (BGP)...etc.



Topology



List of Experiments

ITS-201*3 + Cisco 1905/K9 :

- Exp. 1 : Introduction to ITS-201
- Exp. 2 : Overview for Cisco 1905 Router
- Exp. 3 : IPv6 Header
- Exp. 4 : IPv6 Extension Header
- Exp. 5 : IPv6 Addressing
- Exp. 6 : DHCPv6
- Exp. 7 : ICMPv6 - Error Messages
- Exp. 8 : ICMPv6 - Information Messages
- Exp. 9 : Neighbor Discovery
- Exp. 10 : IPv6 Transition
- Exp. 11 : IPv6 Gateway and Route

ITS-202*1 :

- Exp. 1 : Observe IPv6 HTTP Packet
- Exp. 2 : Observe IPv6 DHCP Packet
- Exp. 3 : Observe IPv6 DNS Packet
- Exp. 4 : Observe IPv6 FTP Packet
- Exp. 5 : Observe IPv6 Mail Packet

ITS-203*3 :

- Exp. 1 : Connected Route
- Exp. 2 : Configuring Routing Entries
- Exp. 3 : Recursive Static Routes
- Exp. 4 : Default Route
- Exp. 5 : Configuring Traffic Discard
- Exp. 6 : Floating Static Route
- Exp. 7 : Router Advertisement
- Exp. 8 : Routing Table
- Exp. 9 : Bellman-Ford Algorithm
- Exp. 10 : Limitations of RIPng
- Exp. 11 : Convergence Time of RIPng

- Exp. 12 : Route Poisoning of RIPng
- Exp. 13 : Packet Processing of RIPng
- Exp. 14 : Area Range of OSPFv3
- Exp. 15 : Non-Backbone Area and Virtual-Link of OSPFv3
- Exp. 16 : External Route of OSPFv3
- Exp. 17 : DR/BDR Election and Fast Convergence in OSPFv3
- Exp. 18 : Router-LSA and Network-LSA
- Exp. 19 : Inter-Area-Prefix-LSA
- Exp. 20 : Inter-Area-Router-LSA/AS-External-LSA/Link-LSA/ Intra-Area-Prefix-LSA

ITS-201*3 + ITS-202*2 + ITS-203*3 +Cisco 1905/K9:

- Exp. 1 : Network Topology
- Exp. 2 : Domain and IP Address
- Exp. 3 : Static Routing Rule
- Exp. 4 : Observe Remote Capture HTTP Packets
- Exp. 5 : Observe IPv6 DNS Service
- Exp. 6 : Observe : Stateful DHCPv6 ,
Stateless DHCPv6 ,SLAAC
- Exp. 7 : Observe FTP Upload and Download Packets
- Exp. 8 : Observe IPv6 SMTP and POP Service
- Exp. 9 : Observe IPv6 Dynamic Routing Protocol – RIPng
- Exp. 10 : Observe IPv6 Dynamic Routing Protocol – OSPFv3

System Requirements

1. PC with Pentium IV or above CPU
2. Windows 7 Service Pack 1 or upper version

Accessories

1. ITS-201 Experiment Manual : 3 pcs
2. ITS-202 Experiment Manual : 2 pcs
3. ITS-203 Experiment Manual : 3 pcs
4. Integrated Experiment Manual : 3 pcs
5. ITS-201 Setup CD : 3 pcs
6. ITS-203 Setup CD : 3 pcs
7. RJ-45 cable : 26 pcs



IOT-100

Innovative IoT Experiment Platform



**Notebook is excluded.*

With the advent of IoT (Internet of Things), more physical objects are connected to internet to make everyday life easier. Topics about creating a user-friendly IoT experience become popular to IoT solution providers.

The Innovative IoT Experiment Platform (IOT-100) is a module-based solution to IoT experiment systems. It is constructed by various communication node boards, sensor modules, wireless integrated gateway, and open-source applications. The experiment topics include not only traditional “wireless sensing technology”, but also embedded system development, intelligent sensing technology, IoT composition technology, IoT chip control technology, and IoT engineering applications.

IOT-100 adopts 4 different wireless protocols: ZigBee, Bluetooth, WiFi, and EnOcean. Users can select one (or more) wireless sensing technology and transmit data to wireless integrated gateway via MQTT (Message Queuing Telemetry Transport) protocol for observation.

The functions of the Wireless Integrated Gateway are acquisition, packaging, and transmission of data. The data is transmitted to the cloud using MQTT protocol. On the webpage, students can observe the experiment results of data acquired from the wireless sensing node boards and sensor modules.

● Components

1. Wireless Integrated Gateway (IOT-13011):

- Wireless Cortex-M4 processor x 1
- Ethernet interface
- UART interface * 2
(1 for setting and 1 for transmission)



2. Communication Node Boards :

- (1) IOT-13001 : WiFi communication node board x 1
TI CC3200, Cortex-M4, compatible with 802.11b/g/n 2.4GHz
- A. USB Interface : Used for program and debug for Wi-Fi Communication Node Board
 - B. LCD Display : 3.5" dot matrix monochrome LCD
 - C. Peripherals :
 - (a) RGB LED x 3pcs, Switch Button x 4pcs
 - (b) Joystick x 1pce, with 6 statuses such as up, down, left, right, push and default state
 - (c) Supports I²C/SPI/GPIO/UART/ADC extension applications



(2) IOT-13002 : Bluetooth communication node board x 2

- Tiva TM4C123GH6PMI+CC2564B
Dual-mode Bluetooth controller 2.4GHz
- A. 20pin JTAG : 20-PIN JTAG connector, used for program and debug for Bluetooth Communication Node Boards.
 - B. USB Interface : Used for debug
 - C. LCD Display : 3.5" dot matrix monochrome LCD
 - D. Peripherals :
 - (a) RGB LED x 3pcs, Switch Button x 4pcs
 - (b) Joystick x 1pce, with 6 statuses such as up, down, left, right, push and default state
 - (c) Supports I²C/SPI/GPIO/UART/ADC extension applications





- (3) IOT-13003 : EnOcean communication node board x 2
 Tiva TM4C123GH6PMI +TCM310F, 868.3MHz, FSK
 A. 20pin JTAG : 20-PIN JTAG connector, used for program and debug for EnOcean Communication Node Boards.
 B. USB Interface : Used for debug
 C. LCD Display : 3.5" dot matrix monochrome LCD
 D. Peripherals :
 (a) RGB LED x 3pcs, Switch Button x 4pcs
 (b) Joystick x 1pce, with 6 statuses such as up, down, left, right, push and default state
 (c) Supports I²C/SPI/GPIO/UART/ADC extension applications



- (4) IOT-13004 : ZigBee communication node board x 5
 TI CC2538 Cortex-M3 Processor , 2.4GHz
 A. 20pin JTAG : 20-PIN JTAG connector, used for program and debug for ZigBee Communication Node Boards.
 B. USB Interface : Used for debug
 C. LCD Display : 3.5" dot matrix monochrome LCD
 D. Peripherals :
 (a) RGB LED x 3pcs, Switch Button x 4pcs
 (b) Joystick x 1pce, with 6 statuses such as up, down, left, right, push and default state
 (c) Supports I²C/SPI/GPIO/UART/ADC extension applications



3. Wired Sensor Modules :

- (1) IOT-13021 : Temperature and humidity sensor module x 1



- (2) IOT-13022 : Alcohol sensor module x 1



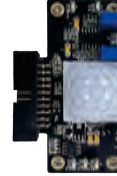
- (3) IOT-13023 : Smoke sensor module x 1



- (4) IOT-13024 : Triaxial accelerometer sensor module x 1



- (5) IOT-13025 : Pyro-electric infrared detector module x 1



- (6) IOT-13026 : Relay control module x 1



- (7) IOT-13027 : Illuminance sensor module x 1



- (8) IOT-13028 : Ultrasonic distance sensor module x 1



- (9) IOT-13041 : Voltage detection sensor module x 1



- (10) IOT-13042 : Current detection sensor module x 1



- (11) IOT-13043 : Barometric pressure sensor module x 1

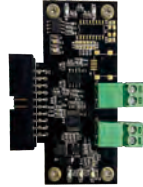




(12) IOT-13044 : 9-axis motion tracking sensor module x 1



(13) IOT-13045 : Voltage output sensor module x 1



(14) IOT-13046 : Displacement sensor module x 1



(15) IOT-13047 : Photoelectric switch counting sensor module x 1



(16) IOT-13048 : Carbon dioxide sensing device module x 1



(17) IOT-13049 : Hall (magnetic) detection sensor module x 1



4. Wireless Sensor Modules:

(1) IOT-13029 : EnOcean door/window magnetic sensing module x 1



(2) IOT-13030 : EnOcean rocker switch sensing module x 1



5. IPv6 Network Device (ITS-200 Package E)



(1) ITS-201 Host : Client x 1

A. Input power : 100V ~ 240V AC, 47Hz ~ 63Hz

B. Network interface: (Auto-Negotiation)

(a) Console: 10/100 MB Ethernet (802.3) 1 Port

(b) Port 1 ~ 4: 4-port Switch Hub

C. Embedded multi-tasking operating system

D. IPv4 / IPv6 dual stack

E. Configuration parameters setting through web browser

F. Enable Remote Packet Capture Service (RPCAP)

and use Wireshark software to observe network packets

(2) ITS-202 Host : Server x 1

A. Input power : 100V ~ 240V AC, 47Hz ~ 63Hz

B. Network interface : (Auto-Negotiation)

C. Embedded multi- tasking operating system

D. IPv4 / IPv6 dual stack

E. Configurable network-related parameters through web browser

(3) ITS-203 Router x 2

A. Input power : 100V ~ 240V AC, 47Hz ~ 63Hz

B. Network interface : 10/100 MB Ethernet (802.3) 3 Ports (Auto-Negotiation)

C. Embedded multi- tasking operating system

D. IPv4 / IPv6 dual stack

E. Configurable routing parameters through GUI or web browser

(4) ITS-200 Package E Accessories :

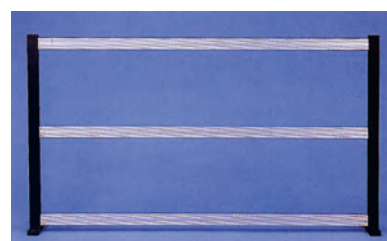
A. RJ-45 cable 1M x 10

B. Integrated Experiment Manual x 1

(5) ITS-200-P3 Rack

6. IOT-13088 : 802.11 b/g/n Wireless broadband router with built-in 4-port(or more) 10/100 MB switch hub

7. IOT-13092 : Rack frame





● Experiment List

1. Network Chip

| | ZigBee | WiFi | Bluetooth | EnOcean |
|-----------------------------|--|--|---|-------------------------------------|
| ■ Fundamental experiments | 1 IAR project establishing experiment | IAR project establishing experiment | IAR project establishing experiment | IAR project establishing experiment |
| | 2 GPIO experiment | GPIO experiment | GPIO experiment | GPIO experiment |
| | 3 | | Watchdog experiment | |
| | 4 I ² C experiment | I ² C experiment | I ² C experiment | I ² C experiment |
| | 5 GPIO interrupt experiment | GPIO interrupt experiment | GPIO interrupt experiment | GPIO interrupt experiment |
| | 6 ADC experiment | ADC experiment | ADC experiment | ADC experiment |
| | 7 Timer experiment | Timer experiment | Timer experiment | Timer experiment |
| | 8 Hibernation experiment | | Hibernation experiment | |
| | 9 UART experiment | UART experiment | UART experiment | UART experiment |
| | 10 SPI experiment | SPI experiment | SPI experiment | SPI experiment |
| | 11 USB to Serial experiment | | USB to Serial experiment | USB to Serial experiment |
| | 12 External sensor module experiment | External sensor module experiment | External sensor module experiment | External sensor module experiment |
| ■ Communication experiments | 1 Peer to peer communication experiment | WLAN station example experiment | HID: Human Interface Device Profile experiment | |
| | 2 Power Transmission setup experiment | WLAN AP example experiment | ANP: Alert Notification Profile experiment | |
| | 3 Wireless channel setup experiment | | HRP: Heart Rate Profile experiment | |
| | 4 Wireless monitoring experiment | | HTP: Health Thermometer Profile experiment | |
| | 5 ACK Response experiment | | PASP: Phone Alert Status Profile experiment | |
| | 6 | | SPP: Serial port Profile experiment | |
| | ※ At least 2 ZigBee sensing node boards for communication experiments. | ※ At least 2 WiFi sensing node boards for communication experiments. | ※ At least 2 Bluetooth sensing node boards for communication experiments. | |
| ■ Comprehensive experiments | 1 Star network topology experiment | | | |
| | 2 Mesh network topology experiment | | | |
| | 3 Grouping control experiment | | | |
| | 4 Binding Control experiment | | | |
| | At least 5 ZigBee sensing node boards for comprehensive experiments. | | | |

Remark : Please refer to above ※ for minimum quantity of node boards required for Communication experiments.



IOT-100

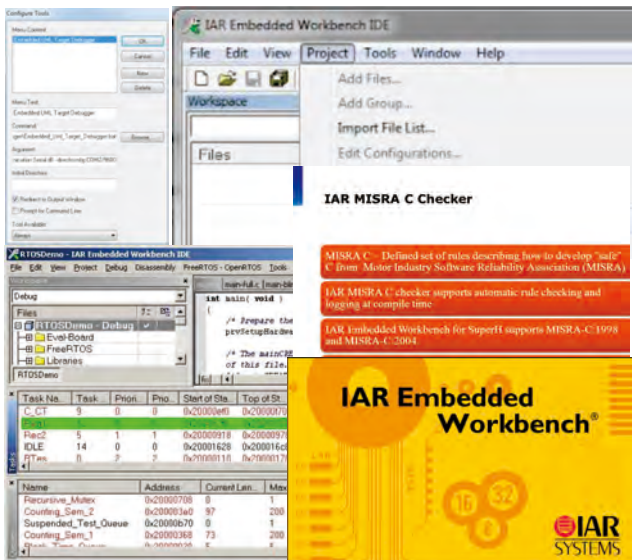
2. Integrated Experiment

- (1) IPv6 Host - Client
 - Exp 1: Configuration settings
 - Exp 2: IPv6 Packet sniffer
- (2) IPv6 Host - Server
 - Exp 1: IPv6 DHCP
 - Exp 2: IPv6 DNS
 - Exp 3: IPv6 Web service
 - Exp 4: IPv6 Mail service
 - Exp 5: IPv6 FTP service
- (3) IPv6 Router
 - Exp 1: Static routing
 - Exp 2: Dynamic routing (RIPng)
 - Exp 3: Dynamic routing (OSPFv3)
- (4) IPv6 Integration experiments:
 - Exp 1: Network topology
 - Exp 2: Network segment and IP address
 - Exp 3: Routing rule
 - Exp 4: Observes HTTP Packet
 - Exp 5: Observes remote packets via ITS-201
- (5) IOT-100 + IPv6 Integration experiments:
 - Exp 1: Integrates network topology
 - Exp 2: IPv4 and IPv6 Network settings
 - Exp 3: IOT-100 Configuration setting
 - Exp 4: IOT-100 + IPv6 Integrated demonstration
 - Exp 5: IOT-100 Packet sniffer

Optional (but necessary):

IOT-13089 IAR Embedded Workbench

- (1) Supports Cortex M
- (2) Includes C/C++ Compiler, Assembler, Linker/Lib, MISRA C Checker, Debugger, IDE



(※ please prepare the IAR Embedded Workbench compilation software locally or download the free trial version on the IAR official website.)

System Requirements

1. PC with Pentium IV or above CPU
2. Windows 7 Service Pack 1 or upper version

Accessories (IOT-19001)

1. Storage case x 1



2. USB Hub
IOT-100-P2 USB Hub Plate x 1

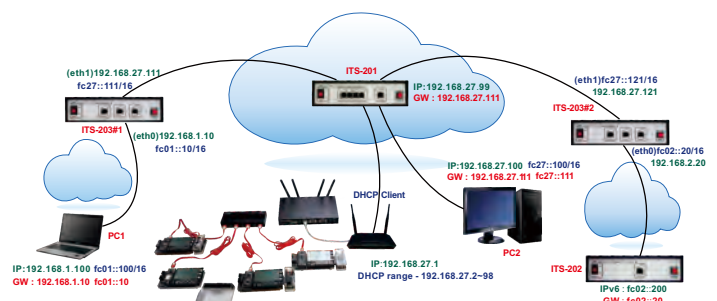


IOT-100-P2

3. USB-to-Serial Cable x 1
4. Operation Manual x 1
5. Sensor Experiment Manual x 1
6. WiFi Experiment Manual x 1
7. CD of Source code for IOT-100 Experimental Resources x 1

ITS-203#1: IPv6 route fc02::/16 fc27::121 eth1
IP route 192.168.2.0/24 192.168.27.121

ITS-203#2: IPv6 route fc01::/16 fc27::111 eth1
IP route 192.168.1.0/24 192.168.27.111





COS-100

Android APP Experiment Module



*Notebook is excluded

Android system, mainly used on mobile devices, is an open source operation system based on Linux kernel. Android APPs, the applications mounted on the Android system, are widely developed and used. COS-100 adopts free and open source Android SDK (Android Software Development Kit), JDK (Java Development Kit) and Eclipse (Integrated Development Environment).

COS-100 offers easy-to-follow courses available for users to learn Android APP development environment setup and Android APP programming. In addition to the introduction for basic principles of the Android development environment, experiments of some of APPs are also designed. Topics included in the course: understanding the Eclipse operating environment, capture of images from a USB UVC camera, discussion of the Android APP version compatibility issues, introduction and application of e-books, application of accelerometer, application of touch panel control. Moreover, ZigBee Transceiver Module and ZigBee Sensor Module are also provided for making experiments.

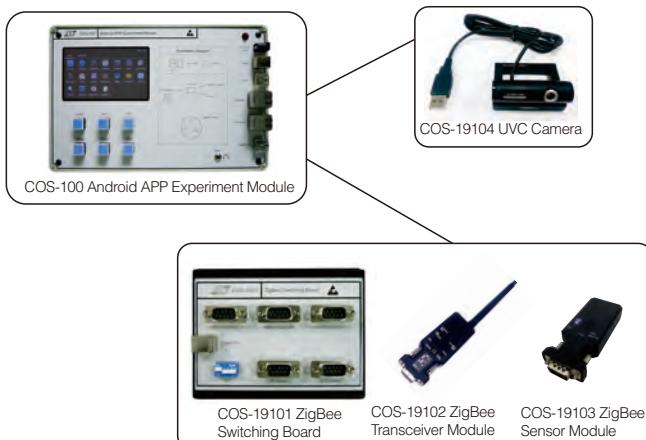
● Features

1. Setup Android APP development environment, create Android APP and execution file of Android APP by Android SDK, JDK and Eclipse
2. Download and execute Android APP on COS-100
3. User-friendly Debugging mode
4. User-friendly APP Experiment Module with TI AM3354 ARM Cortex-A8 processor, DDR3 RAM and Touch Panel
5. Wi-Fi or Ethernet for Internet connection
6. UVC Camera and its functions of auto focus, image capture and storage
7. Construct ZigBee network to learn ZigBee protocol and application by ZigBee Transceiver Module and ZigBee Sensor Module

● Specification

Introduction to COS-100 Hardware

1. Android APP Experiment Module x 1
 - (1) TI AM3354 ARM Cortex-A8 processor, up to 720MHz
 - (2) 256MB DDR3
 - (3) 4.3" LCD Touch Panel
 - (4) Wi-Fi / Two ports Ethernet
 - (5) Audio Out - Stereo
 - (6) Six Function Button
 - (7) Two USB Port and One ZigBee Port
2. COS-19101 ZigBee Switching Board x 1
3. COS-19102 ZigBee Transceiver Module x 3
 - (1) Core Chips : TI CC 2530
 - (2) Coverage : 30m~50m
 - (3) Tx. Power : 4.0dBm
 - (4) Rx. Sensitivity : -95dBm (Nominal)
 - (5) Baud Rate Supports :
 - 1.2/2.4/4.8/9.6/19.2/38.4/57.6/115.2/230.4 Kbps
 - (6) Connection Point-to-Multi points
 - (7) Standard 2.4 GHz IEEE 802.15.4/ZigBee Protocol
 - (8) Data rate : 250Kbps
 - (9) Frequency : 2.4GHz~2.5GHz
 - (10) Modulation : DSSS
 - (11) Antenna (SMA female) + external dipole antenna
 - (12) Antenna Impedance : 50 ohm
 - (13) Power Supply : DC 5V ~ 6V
 - (14) Current Consumption : TX : 35.5 mA @ +4.5 dBm, RX : 24 mA
 - (15) Operation Temperature : -20°C to +75°C





4. COS-19103 ZigBee Sensor Module x 2
(Temperature and Humidity Meter)
 - (1) Operation Voltage : 5V ~27V DC
 - (2) Operation Temperature : -40°C~125°C
 - (3) Operation Humidity : 0~100%RH
 - (4) Accuracy :
 - Temperature $\pm 0.3^{\circ}\text{C}$
 - Humidity $\pm 3\%$ RH at 25°C
 - (5) Baud Rate : 9600 bps, 8 Data bits, None parity, 1 Stop bit
5. COS-19104 UVC Camera x 1
 - (1) Sensor : CMOS Sensor
 - (2) Max. Dynamic Preview Resolution : 2.0M up
 - (3) Max. Static Photo Resolution : 8.0M up
 - (4) Static Photo Storage Format : JPG, BMP
 - (5) Interface : USB 2.0
 - (6) Power Supply : USB port supply or 5V DC, 120mA

● List of Experiments

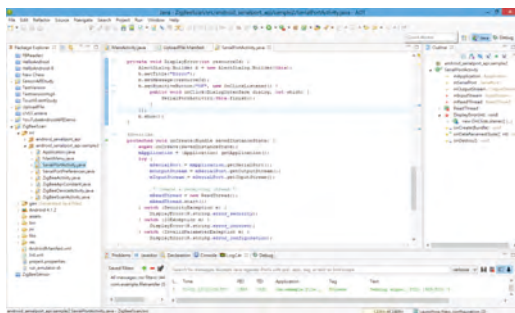
- Exp. 1 : Hello Android
- Exp. 2 : Chess
- Exp. 3 : e-Book Reader
- Exp. 4 : Video player - YouTube
- Exp. 5 : Video player - Media Transfer Protocol (MTP)
- Exp. 6 : Android APP version compatibility issues of Debug Message
- Exp. 7 : UVC Camera
- Exp. 8 : Accelerometer
- Exp. 9 : Touch Event
- Exp. 10 : ZigBee Transceiver Module
- Exp. 11 : ZigBee Sensor Module

● System Requirements

1. PC : 1GHz or faster 32-bit (X86) or 64-bit (X64) processor, 1GB RAM, 5GB more free disk space
2. OS : Windows XP / 7 / 8 / 10

● Accessories

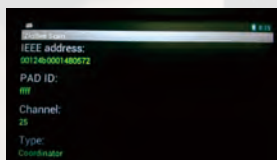
1. USB cable (Type A to Type B) : 2 pcs
2. D-SUB cable (Female) : 2 pcs
3. AC adaptor (input : 100V~240V AC, output : DC 5V/3A) : 1 pce
4. Experiment manual : 1 pce
5. Installation CD : 1 pce



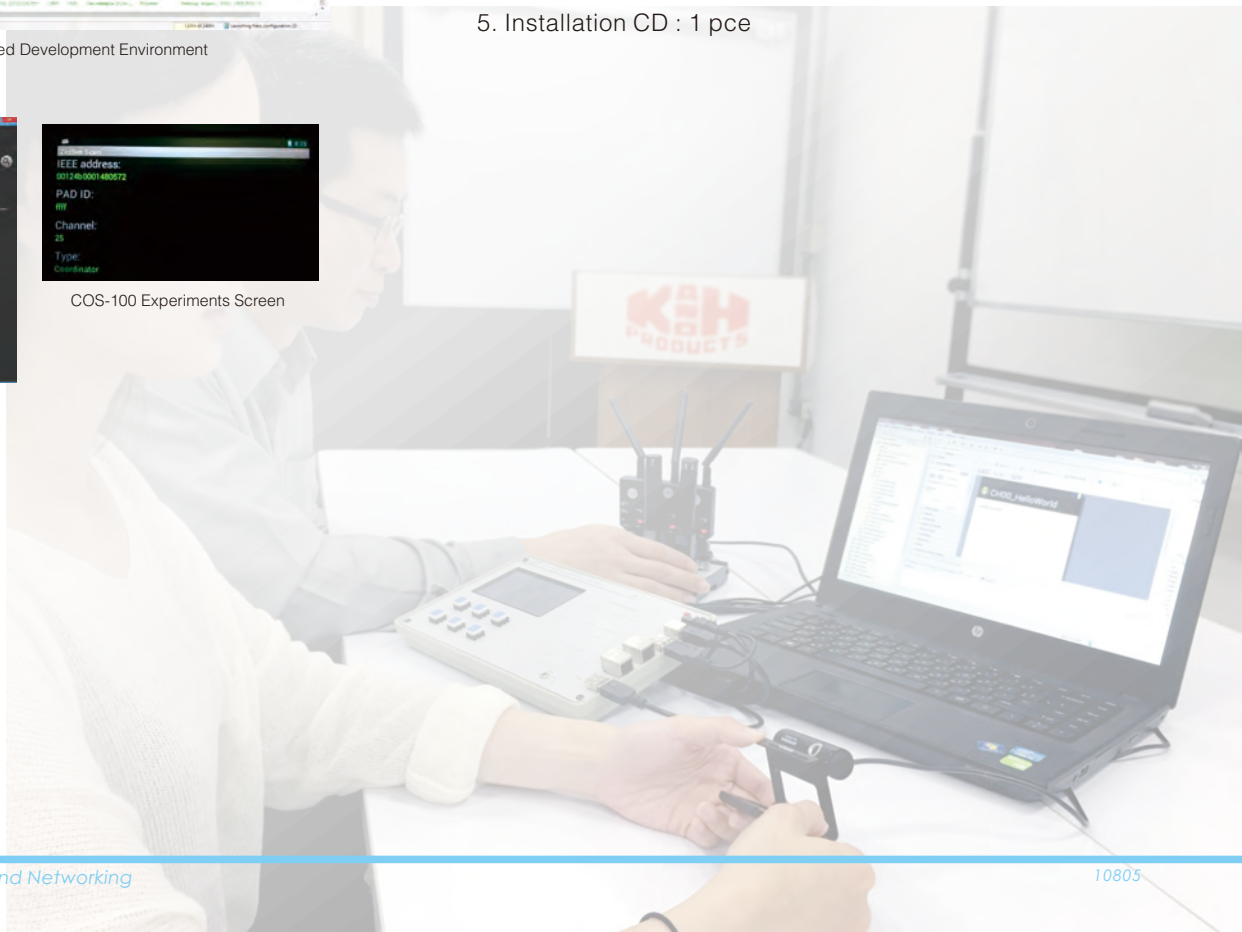
Eclipse Integrated Development Environment



Android Virtual Device



COS-100 Experiments Screen



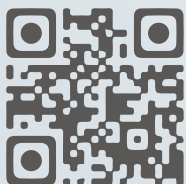


Data Communication and Networking

KNOWLEDGE AND HOPE



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