

WiNOC Hotspot Operations Support System Features and Benefits

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Last update: 2012/01/06

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1. Introduction

WiNOC Hotspot Operations Support System is a total solution designed for WISP to offer reliable and manageable wireless service in public area. Thanks to the continuous decrease of cost and the general acceptance of Wi-Fi, the scales of deployed Wi-Fi based networks grow up larger and larger. In addition, identification of wireless users and network access must be controlled and monitored for security and management reasons. All of these requirements are challenging tasks for administrators of large-scale public wireless networks. The solution includes automatic pre-paid user account/password generation, post-paid billing support, user session time/idle time/logon hours/simultaneous logon control, user list import/export/print, electronic map-based graphical network device management, role-based system administration interfaces, lawful intercept of Internet access tracking support, hierarchically grouping wireless users and devices etc.

The innovative system design integrates “user account management” and “network equipment management” so the system acts as a substitute network administrator that automatically monitors the network’s operation and generates alerts. For customer-service receptionist with no professional IT knowledge, the system may also provide them with updates and suggestions at the administrative interface or troubleshoot guests’ connection problems. The system offers an effective way to reduce the operating costs.

1.1. Benefits

The system not only creates values for IT but also all the parties involving public wireless access service. The Fig. 1: WiNOC benefits diagram describes the benefits of the solution to these parties.

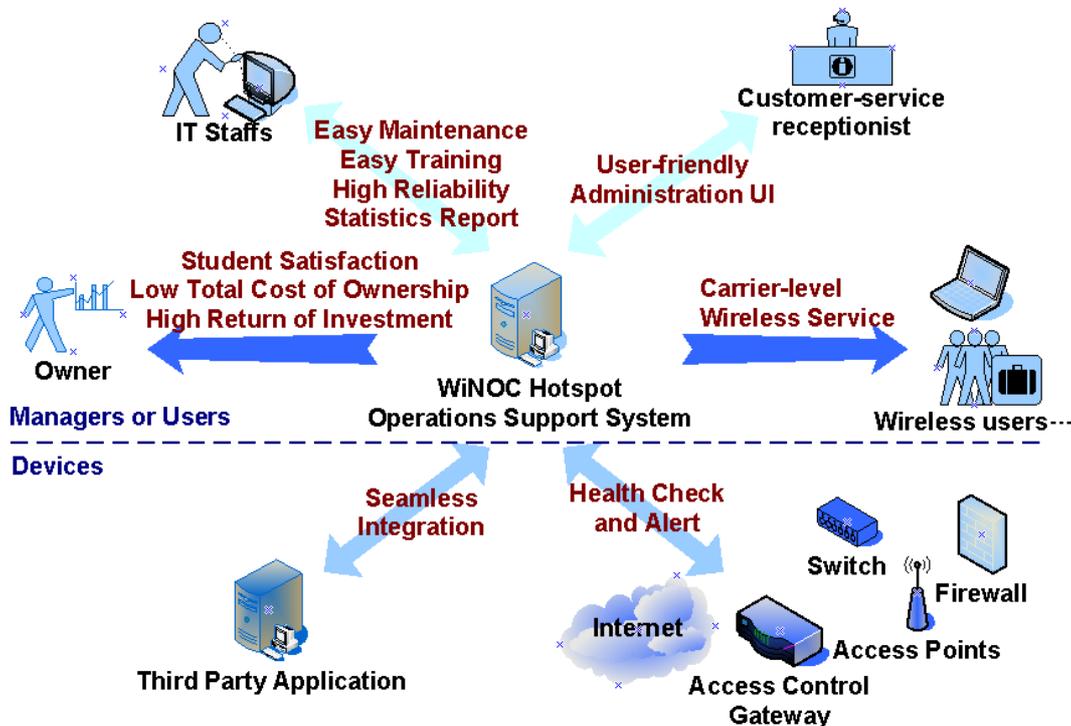


Fig. 1: WiNOC benefits

1.2. Reference Sites

- Adopted by the Taipei City government's TPE-Free project to manage 4000+ hotspots APs and WiMAX Hotspot IADs to provide free Wi-Fi coverage in Taipei City public area (including Indoor, outdoor and bus) and serviced around 1 million registered users.
- Adopted by the Taiwan central government's project to manage 100+ hotspots within three undeveloped counties.
- Management of 1500+ APs, 300+ AGs and 1000+ PoE Switch in 300+ elementary and middle schools of Taipei County, Taiwan. And, Web UAM and IEEE 802.1x PEAP wireless user access control.
- Management of 660+ APs and 220+ L3 Switch in 220+ elementary and middle schools of Tainan County, Taiwan. And, IEEE 802.1x PEAP wireless user access control.
- Management of 250+ APs and 60 AGs in 60+ elementary and middle schools of Kee-Lung City, Taiwan. And, Web UAM and IEEE 802.1x PEAP wireless user access control.
- Management of 750+ Orinoco access points as well as wireless AAA (w/ 2000+ users) in **National Taiwan University of Science and Technology** (<http://www.ntust.edu.tw>), Taipei City, Taiwan.
- Management of Orinoco and Aruba access points as well as IEEE 802.1x PEAP wireless user access control supporting user roles including teacher, student, employee, visitor and guest, etc, in a military-based hospital and university.
- Management of 35 Cisco access points, 37 InterEpoch access points as well as wireless AAA (w/ 6400+ users) in **Taipei Commercial College** (<http://www.slsh.tpc.edu.tw/>), Taiwan.
- Billing for Internet access service in **Shangri-la Far Eastern Plaza Hotel Taipei** (<http://www.feph.com.tw/>) with Fidelio Opera PMS integration.
- Billing for Internet access service in the **Grand Hi-Lai Hotel Kaohsiung** (<http://www.grand-hilai.com.tw/>) with PMS integration.
- Billing for Internet access service in the **MGM GRAND Macau Hotel** (<http://www.mgmgrandmacau.com/>) with Fidelio Opera PMS integration.
- Billing for Internet access service in the **Intercontinental Crowne Plaza Kaohsiung E-Da World Hotel** (<http://www.edaworld.com.tw/>) with Fidelio Opera PMS integration.
- Management of 200+ Outdoor APs and 1 Nomadix AG in Chicago area, US as well as Web UAM wireless user access control.
- More...

2. Solution Network Architecture

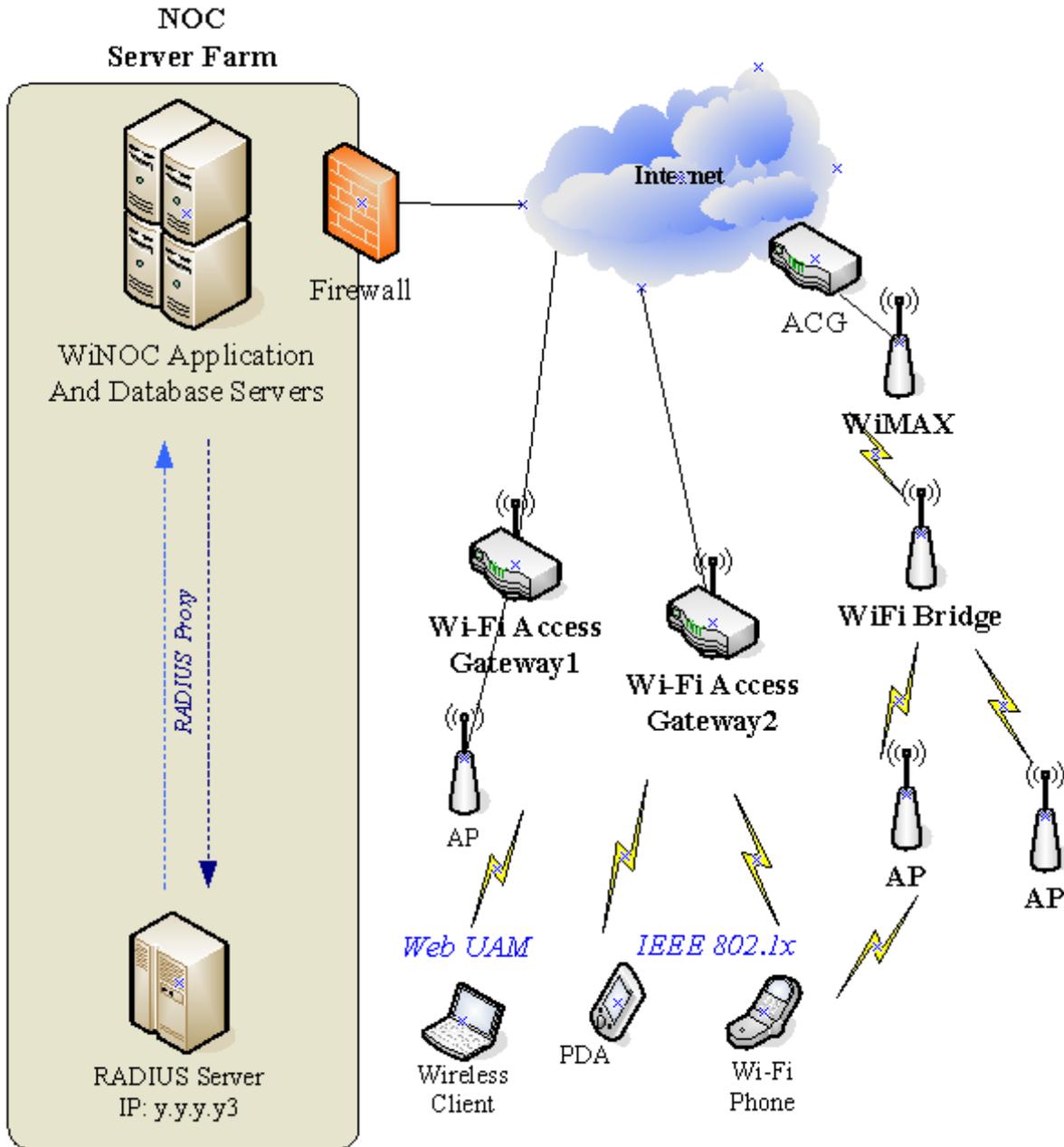


Fig. 2. Solution network architecture

The network architecture of WiNOC Hotspot Operations Support System is composed of the following facilities:

- **WiNOC:** The hotspot wireless Internet access services operations support system. The solution includes external user account integration interface, automatic pre-paid user account/password generation, post-paid billing support, user session time/idle time/allowable minutes/allowable bytes/simultaneous logon control, user list import/export/print, electronic map-based graphical network device management, role-based system administration interfaces, lawful intercept of Internet access tracking support, hierarchically grouping wireless users and devices etc.

- For the scalability, high-availability and load-balance consideration, the WiNOC servers is suggested to have one WiNOC database server and at least two WiNOC application servers.

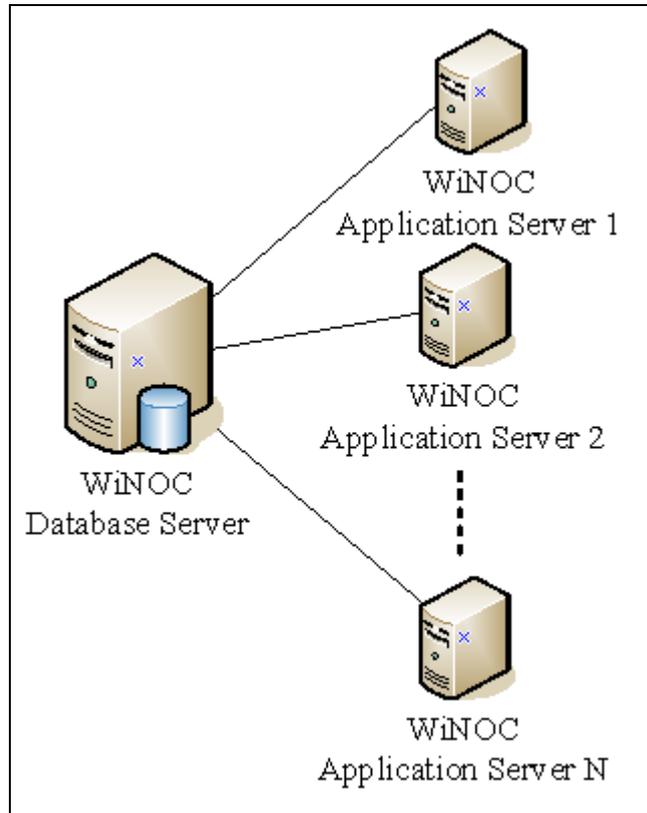


Fig. 3. WiNOC high-availability server's architecture

- System basic requirements

1. WiNOC Database Server

- H/W PC Server * 1 (Suggest model: HP ProLiant DL380 G6 CPU: Intel Xeon X5550 2.66GHz*2/RAM:12G/HD:250G*4 RAID5)
- S/W OS: Windows Server 2008 Standard
- S/W DB: SQL Server 2008 Standard

2. WiNOC Application Server 1

- H/W PC Server * 1 (Suggest model: HP ProLiant DL360 G6 CPU: L5520 2.26GHz *1/RAM:4G/HD:250*2 RAID 1)
- S/W OS: Windows Server 2008 Enterprise (Standard version has limitation of 50 RADIUS clients)

3. WiNOC Application Server 2

- H/W PC Server * 1 (Suggest model: HP ProLiant DL360 G6 CPU: L5520 2.26GHz *1/RAM:4G/HD:250*2 RAID 1)
- S/W OS: Windows Server 2008 Enterprise (Standard version has limitation of 50 RADIUS clients)

4. Firewall (Suggest model: FORTIGATE-300A)

5. Giga Ethernet Switch

- *Firewall:* The device that protects server farm network and WiNOC from being hacked by malicious users.

- *UAM Gateway*: The UAM AAA access control gateway. It works with WiNOC to authenticate users trying to access the wireless and control bandwidth utilization via web portal redirection technology.
- *Wi-Fi Access Gateway*: The UAM access gateway with build-in Wi-Fi. It works with WiNOC to authenticate users trying to access the wireless and control bandwidth utilization via web portal redirection technology.
- *External RADIUS Server*: The RADIUS server of external or other internal user account system, which the accounts of both parties could be roamed for wireless access login at each other's wireless coverage.

3. Solution Features and Advantages

3.1. For Wireless Users

A. Bandwidth Management

The WiNOC policy-based bandwidth management feature enables bandwidth control on a per guest basis such as for normal users 512/512 kbps and for VIP users 1M/1M. The service level could be specified by the user's group. The bandwidth limitation will be applied to AP or UAM gateway after the user is logged in.

Note: For WiNOC policy-based bandwidth management, it's required the access point or UAM gateway to support RADIUS vendor specific attribute or WISPr RADIUS attribute for user-based bandwidth control.

3.2. For Operations and Customer Services

A. User-friendly welcome portal provides maximal branding benefits

WiNOC provides welcome portal log-in pages customization service for the wireless users' pleasant experience. The welcome portal could be design to follow the company standard of artwork and procedures. It is multilingual support according to operator's requirement.

B. File-Explorer-Like administration interface

User-friendly and File-Explorer-Like Web-based administration interface for operator's IT, administration staffs easy to be trained and learned (Multilingual support). Web-based management interface could be accessed by any computer on the Internet or the intranet.

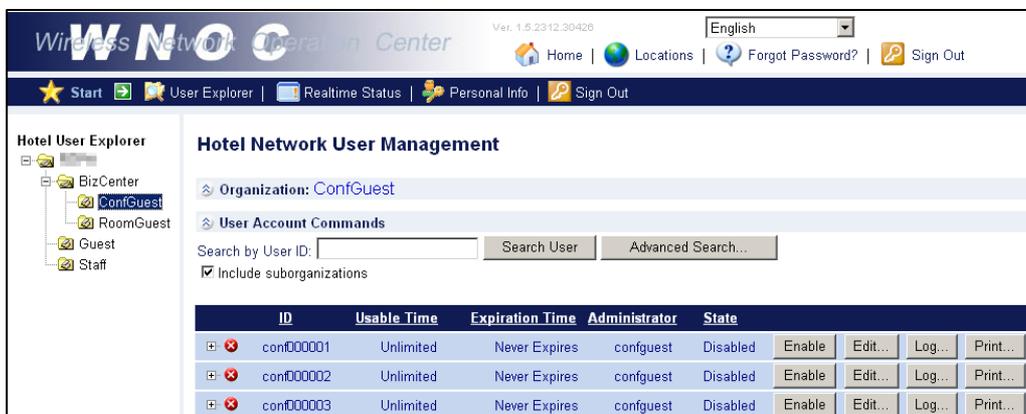


Fig. 4: File-Explorer-Like administration interface

C. Flexible and definable role-based administration authorization control

Support to apply operator's authorization policy such as IT has full permissions, administration has limited permissions and auditor has read-only permission.

Adding an Organization

Organization name:	<input type="text" value="BizCenter"/>
Organization administrator ID:	<input type="text" value="bc"/> <small>ID must consist of a-z, 0-9 and underscores, and be 2-10 letters long.</small>
Password:	<input type="password" value="•••••"/> <small>Password must be 5-10 letters long.</small>
Organization administrator permissions:	<input checked="" type="checkbox"/> Add Organizations <input checked="" type="checkbox"/> Delete Organizations <input checked="" type="checkbox"/> Edit Organizations <input checked="" type="checkbox"/> View Organization Reports <input checked="" type="checkbox"/> Add a Single User <input checked="" type="checkbox"/> Add Multiple Users <input checked="" type="checkbox"/> Delete Users <input checked="" type="checkbox"/> Edit & Move Users <input checked="" type="checkbox"/> View Per-User Reports <input checked="" type="checkbox"/> Import User Lists <input checked="" type="checkbox"/> Export User Lists <input checked="" type="checkbox"/> Print Users <input checked="" type="checkbox"/> View User Realtime Statuses <input checked="" type="checkbox"/> Add Device Guests <input checked="" type="checkbox"/> Add Hotel Administrators

Fig. 5: Role-based administration authorization control

D. Automatic pre-paid user account and password generation

<input type="button" value="Edit Users..."/> <input type="button" value="Print Users..."/>										
All	ID	Name	Usable Time	Expiration Time	State					
<input type="checkbox"/>	bc001205		24 hr 0 min 0 sec	Never Expires	Disabled	<input type="button" value="Enable"/>	<input type="button" value="Edit..."/>	<input type="button" value="Log..."/>	<input type="button" value="Event..."/>	<input type="button" value="Print..."/>
<input type="checkbox"/>	bc001206		24 hr 0 min 0 sec	Never Expires	Disabled	<input type="button" value="Enable"/>	<input type="button" value="Edit..."/>	<input type="button" value="Log..."/>	<input type="button" value="Event..."/>	<input type="button" value="Print..."/>
<input type="checkbox"/>	bc001207		24 hr 0 min 0 sec	Never Expires	Disabled	<input type="button" value="Enable"/>	<input type="button" value="Edit..."/>	<input type="button" value="Log..."/>	<input type="button" value="Event..."/>	<input type="button" value="Print..."/>
<input type="checkbox"/>	bc001208		24 hr 0 min 0 sec	Never Expires	Disabled	<input type="button" value="Enable"/>	<input type="button" value="Edit..."/>	<input type="button" value="Log..."/>	<input type="button" value="Event..."/>	<input type="button" value="Print..."/>
<input type="checkbox"/>	bc001209		24 hr 0 min 0 sec	Never Expires	Disabled	<input type="button" value="Enable"/>	<input type="button" value="Edit..."/>	<input type="button" value="Log..."/>	<input type="button" value="Event..."/>	<input type="button" value="Print..."/>

Guest Information of High Speed Internet Access Service

Full name:	
User ID:	bc001205
Password:	rw8dz
Available time:	1 day(s)0 hr 0 min 0 sec
Expiration date:	Unlimited

Fig. 6: Pre-paid user account generation

E. Detailed event logs of wireless users' status for troubleshooting

WiNOC provides several event logs for tracking “wireless user account registration”, “wireless user login/logout”, etc. Information recorded in these logs is extremely useful when troubleshooting.

S/N	Type	Time	Source	Category	Account ID	Event	User	Computer	Description
688800		4/13/2007 9:08:55 PM	WNOC	ServicePurchase	3510	1	(User)	HSIA_WNOC	Hotel guest purchase Internet service succeeded . Access plan ID: 2; Bandwidth: 768Kbps/768Kbps; Duration: 1440 min; Charge: NTD\$600 Login password: kreiling; IP Up-Sell: False
688799		4/13/2007 9:08:22 PM	IAS	AccessReject	3510	1	N/A	hsia_wnoc	User "3510 (00-18-DE-83-E7-FC)" rejected by IAS
688798		4/13/2007 9:08:22 PM	lasExAuth	AccessRequest	3510	1	N/A	hsia_wnoc	User "3510 (00-18-DE-83-E7-FC)" rejected because nonstopped accounting account expired

Fig. 7: WiNOC detailed event log for troubleshooting

F. Secure Wireless Intranet Access Control for Operation Needs

WiNOC provides the operations with several authentication methods for different kind of mobile application. IEEE802.1x / PEAP method is for the application requires high transmitting security; MAC address authentication is for the mobile device with limited function to support advanced authentication method (such as Wi-Fi phone, RFID mobile reader); *For these authentication methods, it's required the access points to support multiple SSIDs/VLANs, IEEE802.1x/PEAP authentication and RADIUS MAC authentication function.*

3.3. For Operator's IT Support

A. Lawful Intercept of wireless client Internet access tracking

The UAM gateway may provide tracking IP logs, which can be enabled to track all the TCP/IP sessions of the users accessing a public network. These tracking logs enable IT to trace-back to a particular MAC address and username based on port and IP address information of the external site that has been attacked, hacked or used in an illegal way.

WiNOC build-in Syslog server enables the IT to store and manage the lawful intercept tracking logs in the database server. WiNOC build-in RADIUS server also keeps wireless user's log-in/log-out time, MAC address, IP address, port number, transmitted bytes and usage time in database for tracking, statistics and analysis.

Login Time	Logout Time	Used Time (sec)	In Data (KB)	Out Data (KB)	Location	Region	MAC Address
11/17/2008 5:55:05 PM					MachineRoom	FEPH	00-17-42-85-34-47
11/17/2008 9:30:43 AM	11/17/2008 2:30:48 PM	18005	2228	8719	MachineRoom	FEPH	00-17-42-85-34-47
11/16/2008 12:22:46 AM	11/17/2008 9:30:23 AM	119257	24024	527307	MachineRoom	FEPH	00-1A-80-D7-27-5E
11/14/2008 9:49:41 PM	11/16/2008 12:22:46 AM	95585	12072	45324	MachineRoom	FEPH	00-17-42-85-34-47
11/13/2008 4:51:51 PM	11/14/2008 8:43:52 AM	57121	6436	11441	MachineRoom	FEPH	00-17-42-85-34-47

Fig. 8: Lawful Intercept of guest Internet access tracking

B. Manage multiple UAM gateways, WLAN switches and access points

According to the network planning and policy, WiNOC enables the operator to manage multiple wireless access control devices which might be located within the same campus or different campuses. The wireless user account roaming between the multiple wireless access control devices could be supported. The wireless users could access wireless network with the same username and password across these wireless coverage areas.

C. Network devices monitoring and management

WiNOC device health monitoring function supports background network devices (such as UAM gateway, Firewall, Ethernet switch and AP) health monitoring and anomaly alerting by Email. WiNOC device status monitoring feature enables SNMP-based device status and performance statistics reporting and analysis.

Operator's IT specialists can scan floor plans as JPG, GIF, or PNG files and upload them to WiNOC. Then, the positions of the wireless access points can be marked on the floor plans, so that these devices can be managed graphically and easily. The Google map integration is also supported for large-scale outdoor devices management.



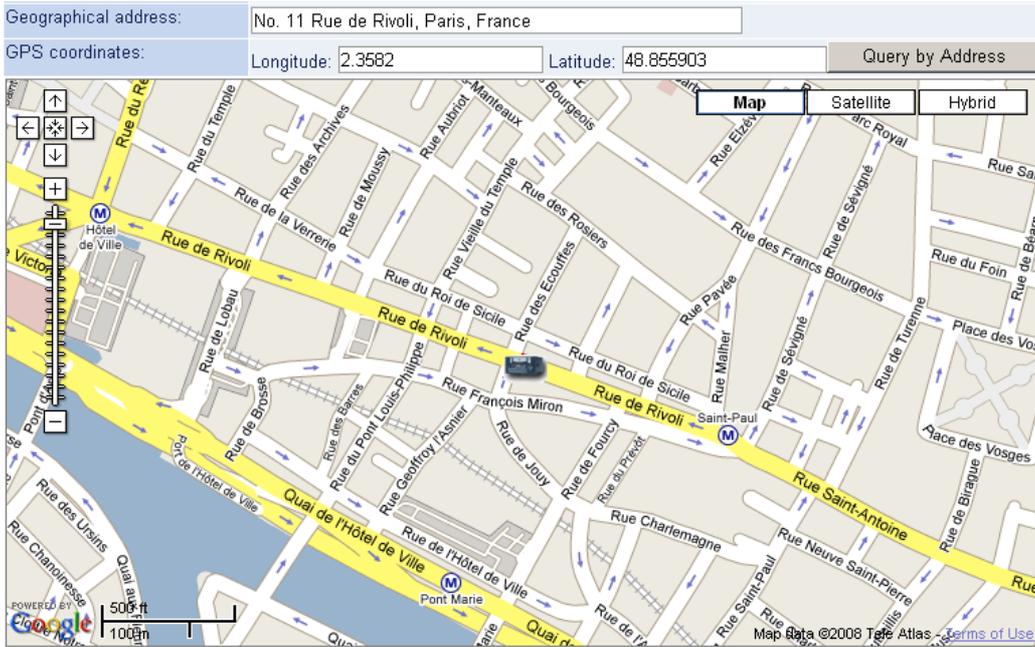


Fig. 9. Managing network devices graphically

D. Various Monitoring Reports

- **User accounts searching and monitoring** user friendly searching, monitoring, troubleshooting and user account properties change user interface.

All	ID	Name	Usable Time	Expiration Time	State	
<input type="checkbox"/> <input checked="" type="checkbox"/>	4114	DERRY MR WILLIAM JAMES	9 hr 20 min 1 sec	2/24/2010 9:44:51 PM	Online	Terminate Edit... Log... Event... Print...
<input type="checkbox"/> <input checked="" type="checkbox"/>	4112		23 hr 14 min 36 sec	Never Expires	Disabled	Enable Edit... Log... Event... Print...
<input type="checkbox"/> <input checked="" type="checkbox"/>	4110	RUETZ MR JAMES PETER	21 hr 43 min 39 sec	2/25/2010 10:08:29 AM	Offline	Disable Edit... Log... Event... Print...
<input type="checkbox"/> <input checked="" type="checkbox"/>	4111	TELGE MR JUERGEN	0 hr 0 min 0 sec	2/22/2010 11:17:32 AM	Expired	Disable Edit... Log... Event... Print...
Total: 4						

- **Managed devices searching and monitoring** user friendly searching, device health status and current operating configuration, troubleshooting and device properties change user interface.

Device Account Commands

No conditions specified.

Include sublocations

Add a Device...	Add Devices...	Move Devices...	Delete Devices
Export Device List...	Import Device List...	Print Device List	
Select All Devices	Cancel All Selections		

Device Management Commands

By: Ping HTTP TCP SNMP

All	Name	Device ID	IP Address	Firmware Version	System Up Time	Net ID	Device Type	Ping	HTTP	TCP	SNMP	Trap L
<input type="checkbox"/>	Dlink DGS-3426	ND001	163.26.113.126	Build 2.70.T03	21 days, 10:23:52.09		Ethernet Switch	OK	OK	OK	OK	<input type="button" value="View..."/>
<input type="checkbox"/>	Dlink DWL-3200AP-23	AP001	163.26.113.23	v2.50	1 day 11:50:03.00	tnc	AP	OK	OK	OK	OK	<input type="button" value="View..."/>
<input type="checkbox"/>	Dlink DWL-3200AP-24	AP002	163.26.113.24	v2.50	1 day 11:50:01.00	tnc	AP	OK	OK	OK	OK	<input type="button" value="View..."/>
<input type="checkbox"/>	Dlink DWL-3200AP-25	AP003	163.26.113.25	v2.50	1 day 11:49:32.00	tnc	AP	OK	OK	OK	OK	<input type="button" value="View..."/>
Total: 4												

- **System Event Viewer** including the events about user log-in/out, user password error, user VIP bandwidth upgrade etc.

Event Log

Query By Date & time

Last 1 day 1 week 1 month

/ / (yyyy/mm/dd)
 / (yyyy/mm)
 / / (yyyy/mm/dd) ~ / / (yyyy/mm/dd)

S/N	Type	Time	Source	Category	Account ID	Event	User	Computer	Description
951622		2010/3/31 下午 03:28:57	lasExAuth	AccountingStop	f223308034	1	N/A	WINOCAPP1	lasExtAuth: User "f223308034 (90-4c-e5-05-7b-a1)" logged off (accounting stopped). Termination Cause: "User-Request (1)"
951326		2010/3/31 下午 03:18:04	lasExAuth	AccountingStart	f223308034	1	N/A	WINOCAPP1	lasExtAuth: User "f223308034 (90-4c-e5-05-7b-a1)" accounting started
951280		2010/3/31 下午 03:17:57	lasExAuth	AccessAccept	f223308034	1	N/A	WINOCAPP2	User "f223308034 (90-4C-E5-05-7B-A1)" logged on; SessionTimeout (sec): unlimited, MaxUpBandwidth (KBps): unlimited, MaxDownBandwidth (KBps): unlimited, MaxUpBytes (KB): unlimited, MaxDownBytes (KB): unlimited, CalledStationID: 00-26-5A-0B-9B-14:tnc, MaxCreditTime: N/A
951278		2010/3/31 下午 03:17:57	lasExAuth	AccessRequest	f223308034	1	N/A	WINOCAPP2	lasExtAuth: User "f223308034 (90-4C-E5-05-7B-A1)" with password "" is trying to log on. NAS Port: 7

- **Current Online Users**

Current Online Users										
	S/N	User ID	Login Time	Logout Time	Online Time	User MAC Addr.	User IP Addr.	AP MAC Addr.	NAS ID	NAS IAS Client Name
Terminate	121324	2801	2/24/2010 10:24:13 AM			00-C0-9F-CB-C3-5A	10.2.0.73			WNOC_RC00003
Terminate	121323	3228	2/24/2010 9:05:00 AM			00-0B-97-BB-CB-A6	10.2.1.249			WNOC_RC00003

NAS IP Addr.	NAS MAC Addr.	Class	Accounting Session ID	Organization	Location	Region	Download Bytes	Upload Bytes	Idle Timeout
122.146.192.195	00-50-E8-01-79-83	311 1 10.2.0.3 12/28/2009 18:35:20 3683	43000288	TopRoot	25F Machine Room	25F			86400
122.146.192.195	00-50-E8-01-79-83	311 1 10.2.0.3 12/28/2009 18:35:20 3682	43000287	TopRoot	25F Machine Room	25F			86400

E. Various Statistics Reports

WiNOC's "Report Wizard" provides various types of reports on how the system performs during a specified period of time. These reports can be used as a basis for correcting operational strategy of the Internet access service. The Report Wizard can generate the following reports:

- **Per user, by-Interval distribution graph** for the number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-location top n billboard graph** for the number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-hour top n billboard graph** for the number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-week top n billboard graph** for the number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-month top n billboard graph** for the number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-year top n billboard** for the number of user online sessions, used time, uploaded bytes, or downloaded bytes

- **By-location text report** for the total/average number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-hour text report** for the total/average number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-week text report** for the total/average number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-date text report** for the total/average number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-month text report** for the total/average number of user online sessions, used time, uploaded bytes, or downloaded bytes
- **By-year text report** for the total/average number of user online sessions, used time, uploaded bytes, or downloaded bytes

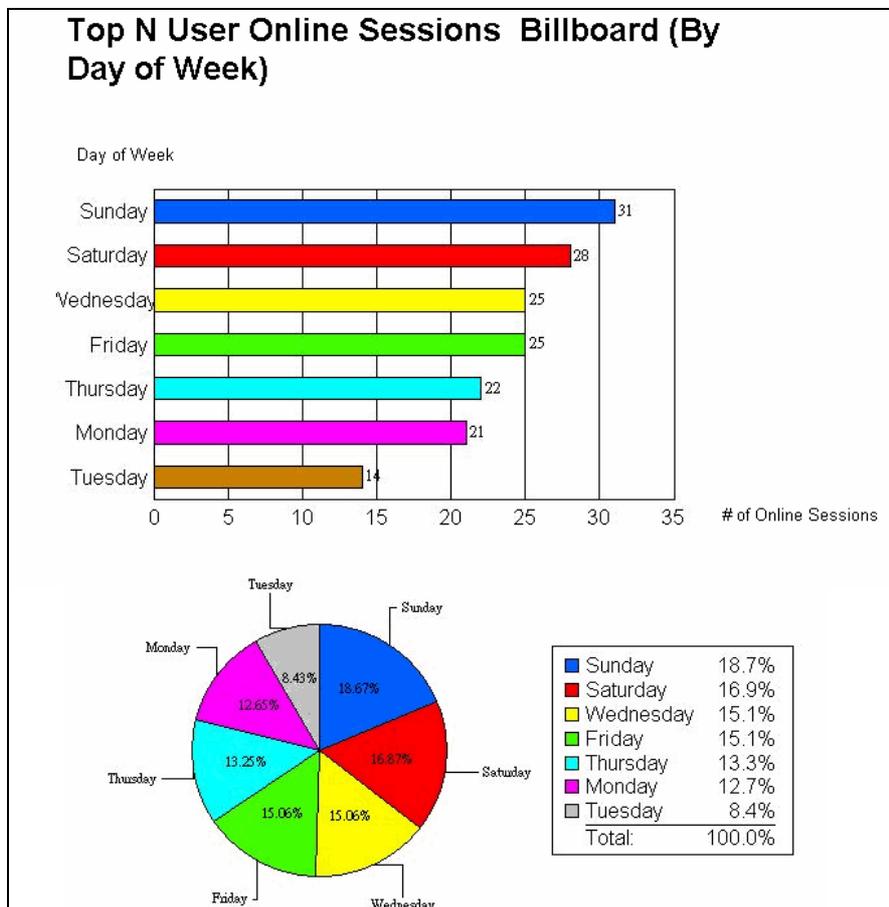


Fig. 10. Graphical statistics report

F. Hierarchically grouping administration accounts, user accounts and devices

WiNOC File-Explorer-like administration interface supports hierarchically grouping administration accounts, user accounts and devices by organization and location for flexible role-based authorization based on different deployments. For example, headquarter could manage all user accounts and devices of all branches. The branch A could only

manage the user accounts and devices under the branch A's organization folder.

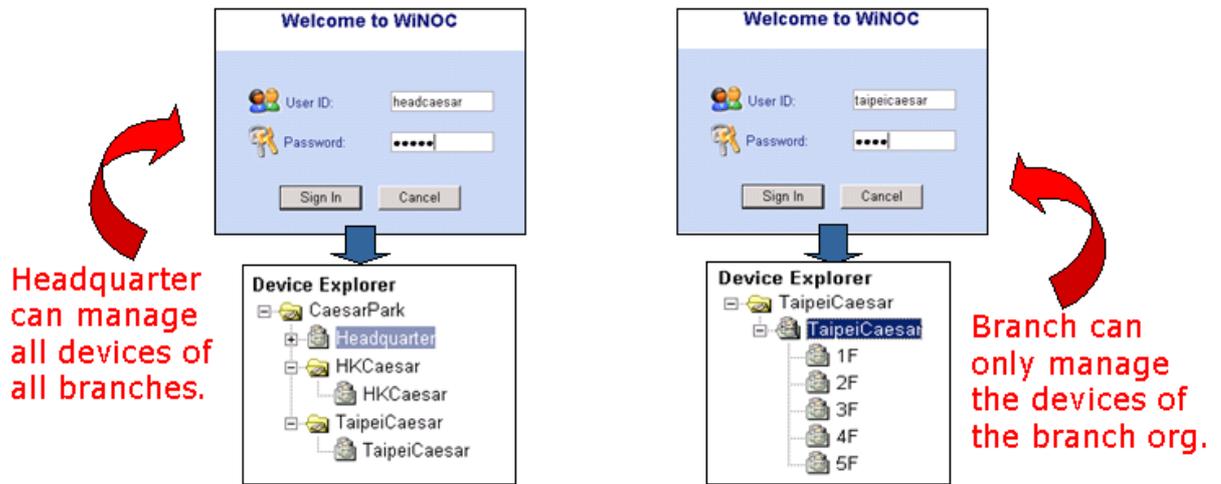


Fig. 11: Hierarchically grouping administration

G. Support for high availability

By using WiNOC's Server Clustering functionality, multiple WiNOC servers can be used to provide nonstop service.