



Public Wireless Networks & Hotspots

May 15th, 2008



Overview

- Who are we?
- Solving the problem
- Network Design Approach
- Hotspot System Design
- Marketing / Deployment



Who are we?

Who we are....

- Wireless neutral-host provider since 1997 with offices in Chicago, Dallas, New York and Los Angeles.
- Industry leader in turnkey cellular/Wi-Fi with 38% market share of top 100NA airports and 1.5M daily passengers across 22 airports.
- Roaming relationships with top worldwide WISPs enabling the most choices to the public.
- Boingo provides Wi-Fi service in over 120,000 hotspots worldwide.
- Focused in non-airline business - adding value to ALL airport stakeholders.

What we do

- Architect, design and install in-building carrier-class wireless networks.
- Operate, maintain and manage in-venue infrastructure and operate a global AAA and commerce platform.
- Promote and market services to the traveling public, concessions and WISPs.

Business Model

- Boingo and airport share the capital investment on infrastructure as well as income generate from all sources leveraging the network including:
 - Wi-Fi public hotspot access
 - Private services for concessions and airlines
 - Walled garden sponsorship
- Maintain a neutral policy for optimal network use.



Neutrality Is Best



- Business model ensures collaboration.



- Turnkey support for transaction-based users with predominant airport brand.



- Promote seamless integration of WISPs and other value-added partners.



- Dedicated to serve passengers, airport authority, airlines and concessionaires.





Solving the Problem

Solving the Problem

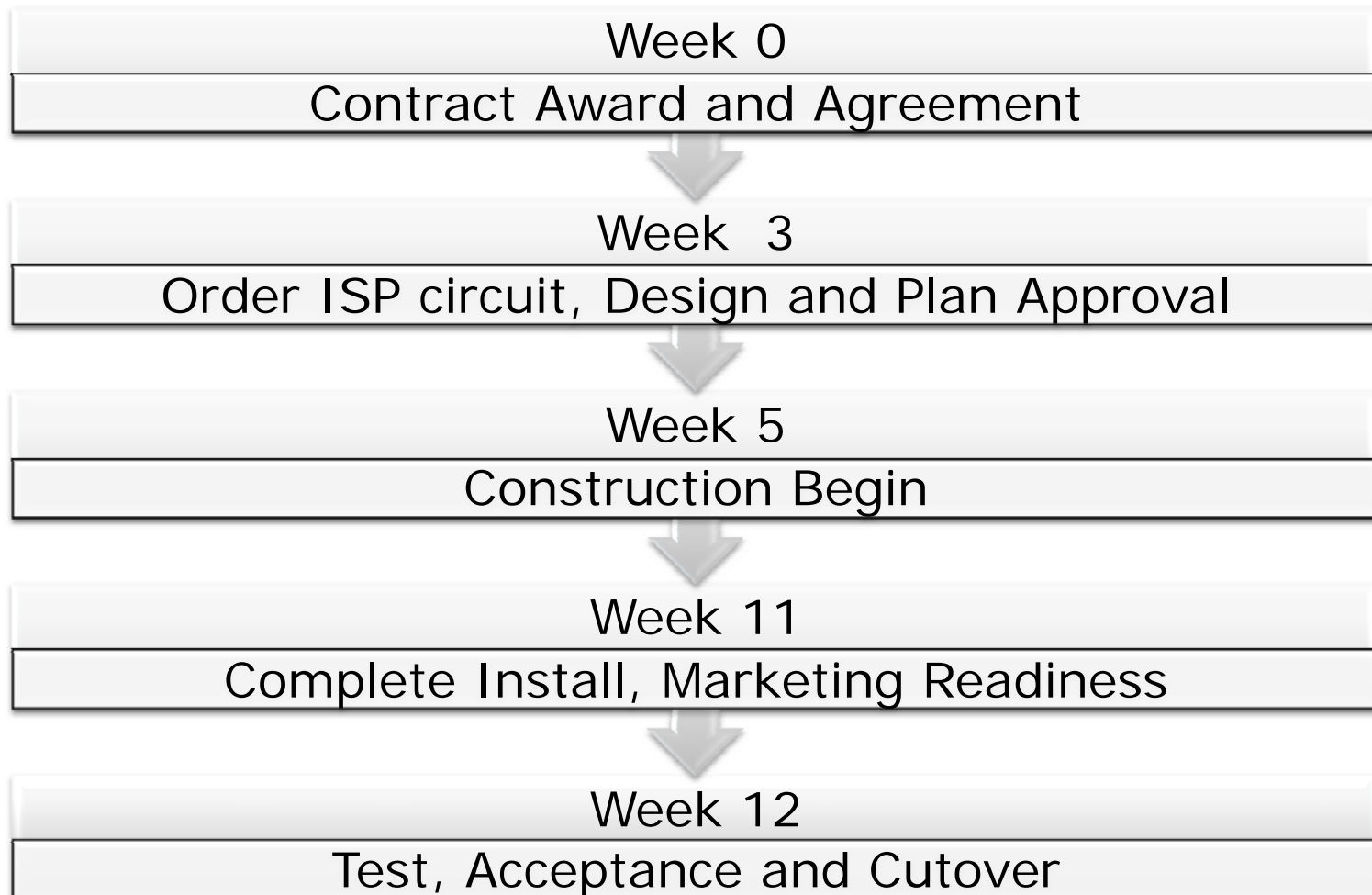
- Designing for a hotspot system that supports over 100,000 sessions a month
- Perform flexible proactive network monitoring
- Offer 24/7 customer support
- Offer flexible billing options & monthly accounts
- Be reliable, but cost effective

Network Design Approach

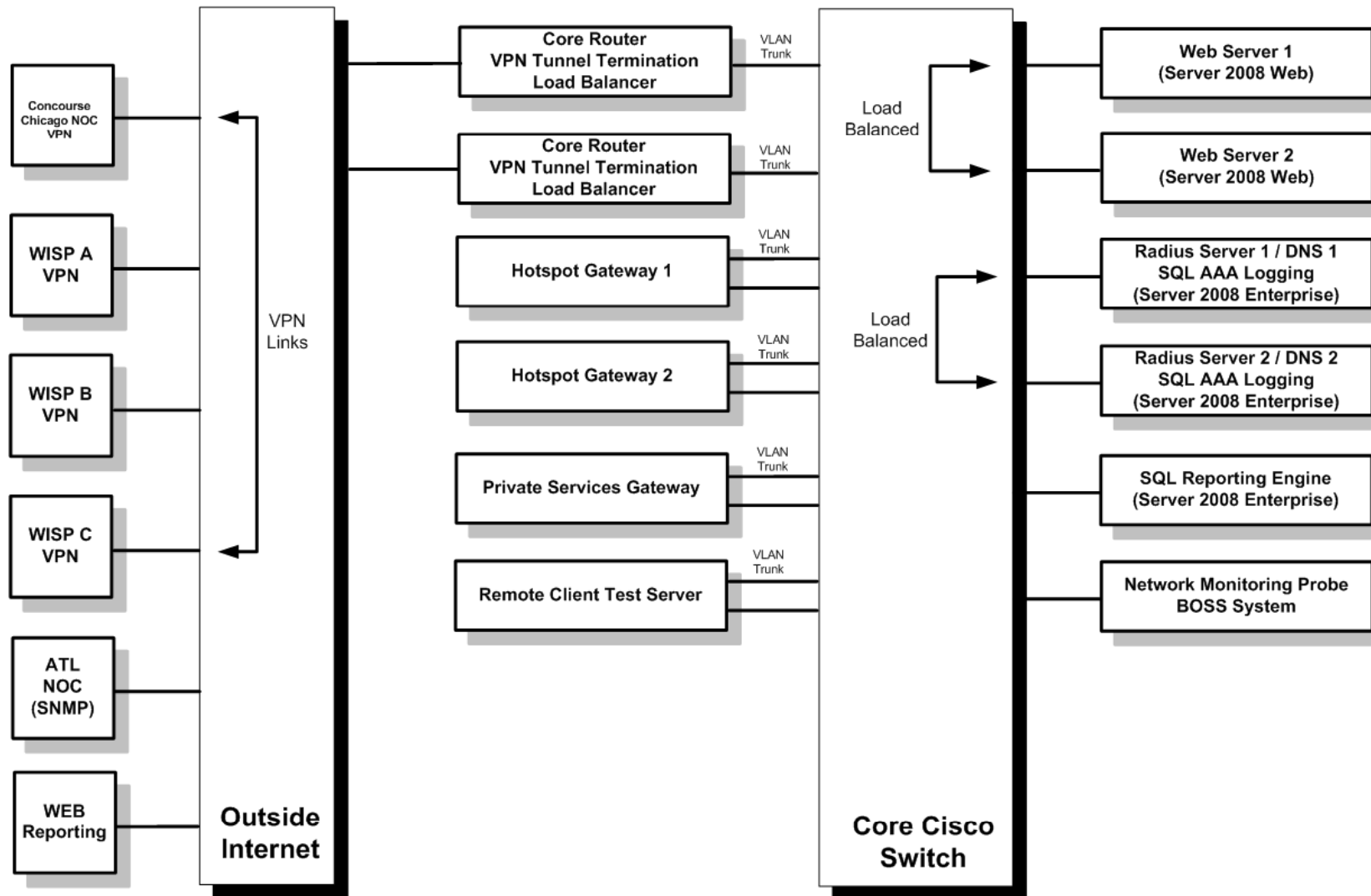
Network Design Approach

- Support for 802.11g/b with VLAN, VPN and QoS/CoS
- VoIP capability w/ fast roaming and packet prioritization
- Centrally managed and redundant AAA and mobile application platform
- Transparent integration for seamless roaming
- Robust tools for security, network operations and maintenance

Building a Implementation Plan



Block network design



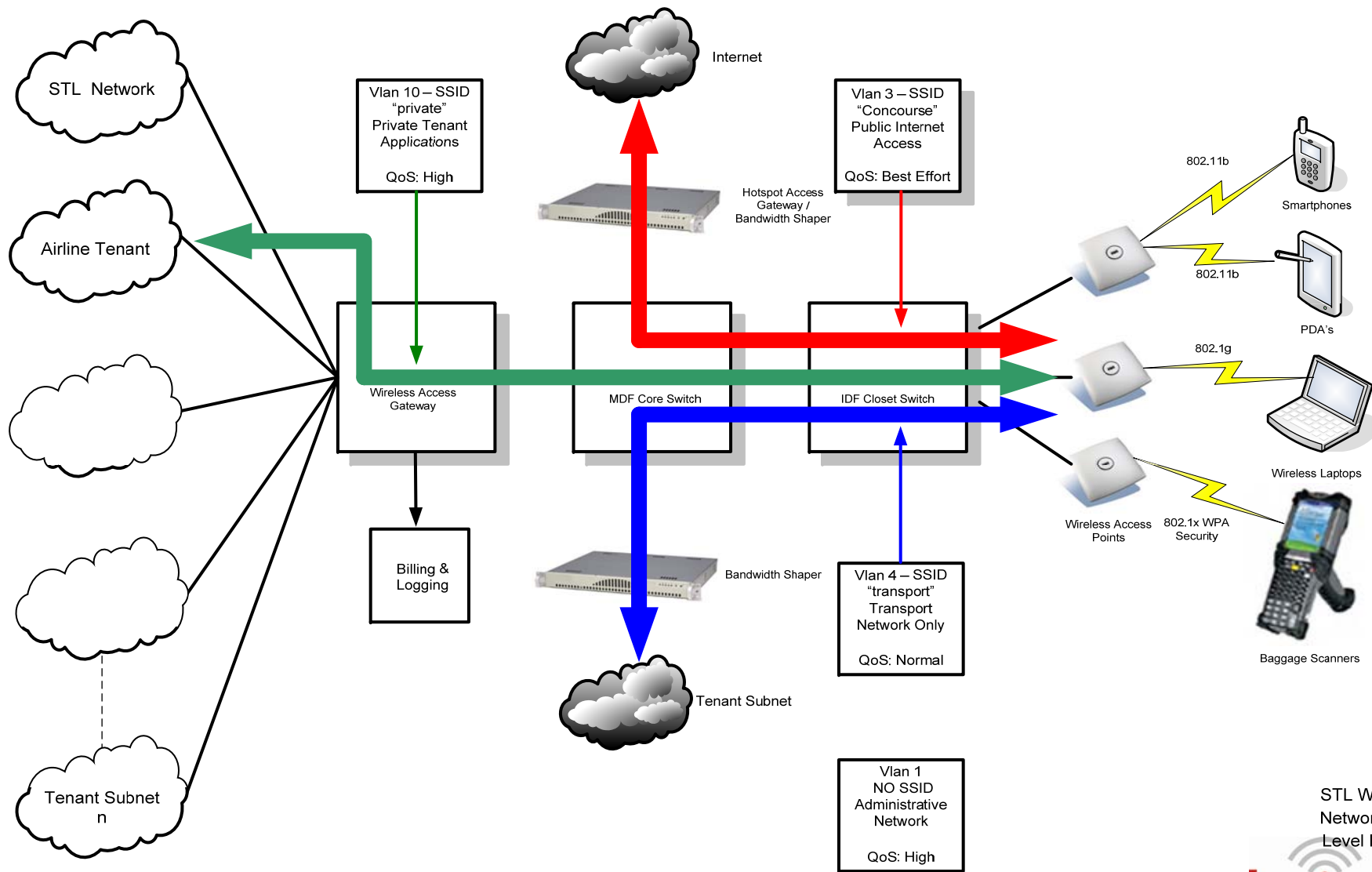


Hotspot System Design

Hotspot System Design

- Reliable hardware from proven vendors
- Overlapping wireless coverage in all designated areas
- 802.11a/g & WMM (QoS, VoIP, Power Control)
- Power over Ethernet (PoE) is your friend!
- Bandwidth – need to scale, plan for at least 3 to 100Mbps (Metro Ethernet)
- Manageable Access Points (Cisco, Mikrotik..)
- VLAN's on switch network to partition traffic by SSID
- Fast Build: Mikrotik Mesh Nodes using WDS

Typical Network Architecture



Vendor Relationships

- Cisco (Core switches & AP's & Controllers)
- Microsoft (Server OS & Back Office Systems)
- Mikrotik (Hotspot Gateways, AP's & Mesh Nodes, RB1000)
- Supermicro & IBM (Server Hardware)
- Tivoli Netcool (Network Monitoring)

RouterOS core HSGW

- Very affordable, Linux based operating system (\$60-\$250 / license)
- Scales based on amount of server hardware
- Almost unlimited users, over 200+ per system
- VLAN Support, Firewall, P2P Filtering, PCQ Bandwidth Shaping & QoS
- Built in Web Proxy
- WISPr Compliant – XML Embedded Tags
- Ease of use and easy to train technical support

Why x86 Hardware?

- RouterBOARDS cannot handle the load of a typical airport hotspot
- They make affordable server platforms
- BIOS console redirection (No monitor needed)
- Dual Intel gigabit integrated LAN ports
- RouterOS V3 will support dual processor configurations
- 200 hotspot users per 3Ghz, P4 Box & 1gig RAM
- Have begun testing RB1000 as replacement for x86 Hardware.

NOC Operations

- IPSwitch What's UP Gold Professional 2006 for device monitoring & reporting
- Tivoli Netcool (Core Monitoring)
- Dude Server (RouterOS Upgrades / Mesh)
- CACTI (PHP/MySQL MRTG) – raxnet.net
- ASP.NET extranet portal for roaming partners
- 24 / 7 Help Desk Tier 1
- 8-5 Help Desk Tier 2
- Trouble ticket system using Remedy

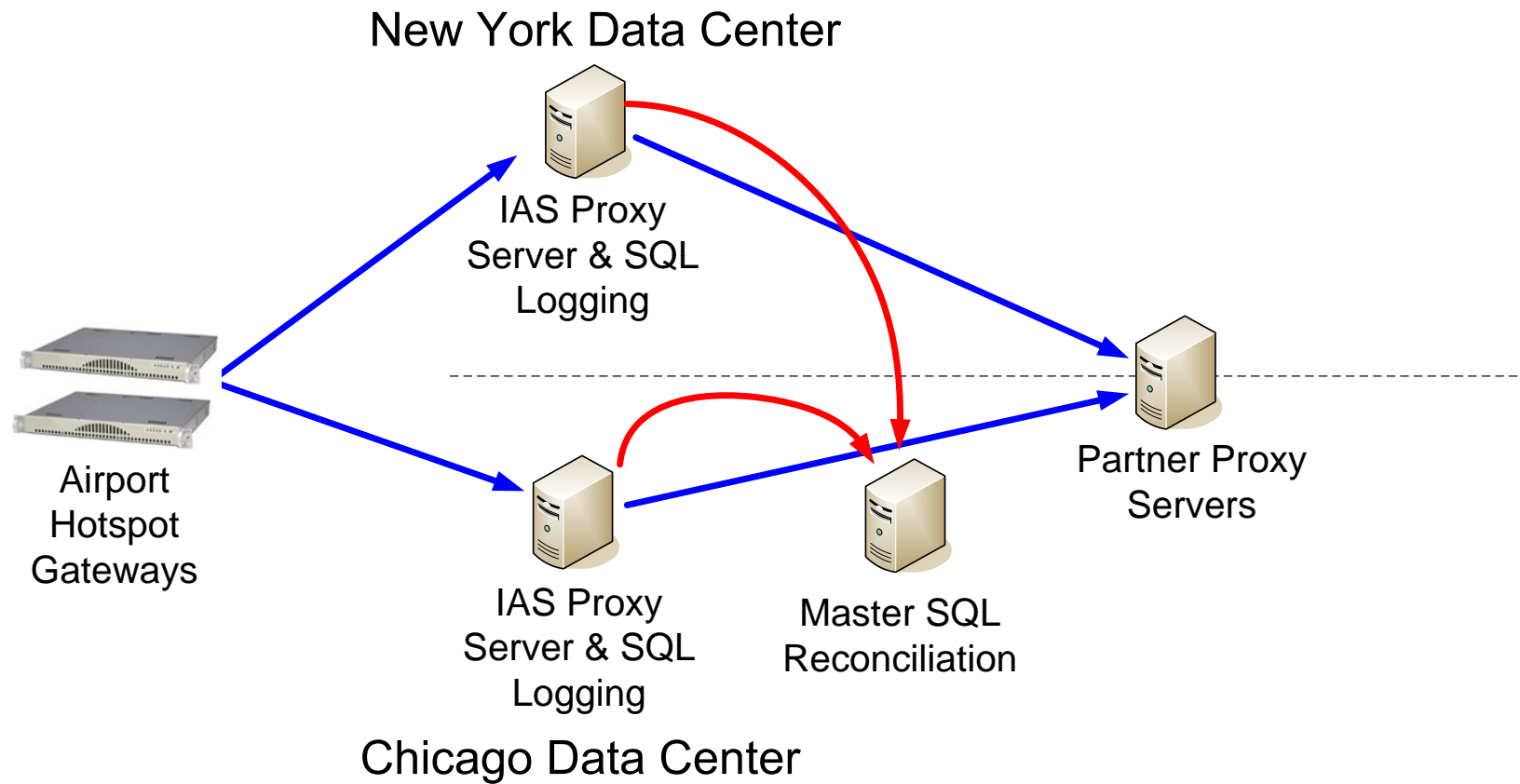
Security

- Cisco IOS IDS Firewall Edge Protection
- Mikrotik RouterOS 2.9.51 (Evaluating 3.x)
- IPSec VPN connections to NOC
- VLAN Separation – AP Management
- Device Management Network (Out of Band Serial)
- Protect your hotspot gateway with input chain firewall rules & DoS Attacks (tarpit)
- Turn off all RouterOS IP services and use rules to allow NOC / Dude Server to monitor

AAA Services

- Microsoft Server 2003 Internet Authentication Service – Provides radius proxy services
- Steel Belted Radius for local SQL Auth from loopback interface on IAS
- FreeRadius on CentOS 5.1 also a good choice.
- SQL local server logging
- Distributed across multiple systems

AAA Redundancy



Redundancy Through DHCP

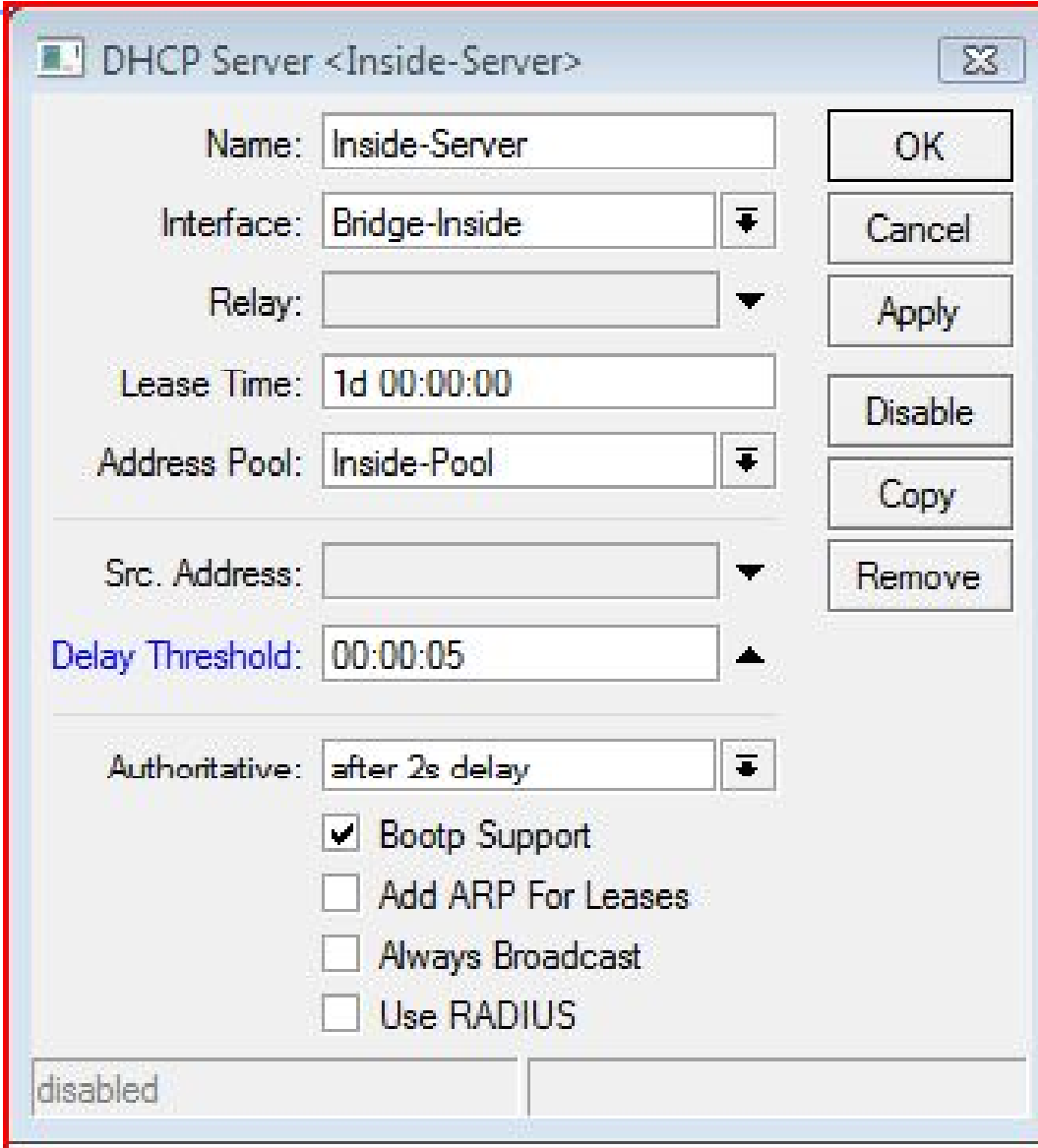
The Good:

- Running two hotspot gateways at same time
- Each hotspot uses /16 address space for DHCP
- Users connect to least loaded server

The Bad:

- Disconnections cause random re-connection
- Can be fixed using DHCP delay feature in RouterOS

DHCP Delay Feature

A screenshot of a network configuration dialog box titled "DHCP Server <Inside-Server>". The dialog has a light blue background and a red border. It contains several input fields and checkboxes. The "Name" field is "Inside-Server", "Interface" is "Bridge-Inside", "Relay" is empty, "Lease Time" is "1d 00:00:00", "Address Pool" is "Inside-Pool", "Src. Address" is empty, "Delay Threshold" is "00:00:05", and "Authoritative" is "after 2s delay". There are four checkboxes: "Bootp Support" (checked), "Add ARP For Leases", "Always Broadcast", and "Use RADIUS" (all unchecked). On the right side, there are buttons for "OK", "Cancel", "Apply", "Disable", "Copy", and "Remove". At the bottom left, there is a status indicator that says "disabled".

DHCP Server <Inside-Server>

Name: Inside-Server

Interface: Bridge-Inside

Relay:

Lease Time: 1d 00:00:00

Address Pool: Inside-Pool

Src. Address:

Delay Threshold: 00:00:05

Authoritative: after 2s delay

Bootp Support

Add ARP For Leases

Always Broadcast

Use RADIUS

disabled

OK

Cancel

Apply

Disable

Copy

Remove

Troubleshooting

- Create the virtual user experience remotely!
- Use APC Power switching hardware
- Console server with built in modem
- SNMP Management
- Help desk support calls (last resort!)



Marketing & Deployment

Marketing Plan



Revenue
Generation



Customer
Satisfaction

Market Service Plan

Revenue Generation

- Wi-Fi access to
 - DayPass users
 - Roaming user access
- Airport Tenants (private)
- Portal sponsorship
- Indirect advertising income & value-added applications

Customer Satisfaction

- Business, public & community awareness
- 24x7 customer support English/Spanish/French
- Online Surveys
- Best IT practices

Generating Revenue

- WiFi Public Internet Access (DayPass & Monthly)
- Private Wireless Access Service (PPPoE or MAC auth using 802.1x)
- Airport Employee User Access – Fixed Accounts
- Club Room Branding by using Mikrotik virtual hotspots
- Value-added applications
(remote printing, download music, movies)



Private Wireless Access Service

Service Type	Description	Price
Dedicated Wireless Internet Service	1M PPPoE Internet. Secured and encrypted	\$299/setup \$159/mon
VLAN unmanaged	512kbps - layer 2 access to customer cross connect Customer selected SSID	\$1,000/setup \$500+/mon + usage
VLAN managed	512kbps w/ QoS, over-air authentication, security and encryption	\$per device

- Wireless DSL
- Based on bandwidth and security type
- Support QoS
- VoIP support
- Make it self managed...




Do a Print Campaign

Wi-Fi before you fly.



Stay Connected!
Wi-Fi now available terminal-wide.

unbranded

 **Welcome to Wi-Fi!**

Stay connected when you travel with Wi-Fi access throughout the airport. Wi-Fi is available in most public areas, so you can get online near ticketing, your boarding gate and even in the food court!

Getting Online is Easy!

1. Set your SSID to **concourse**.
2. Launch your Internet browser.
3. Sign up for a Wi-Fi account, or use an existing account to login.

Choose a Plan

1. **Day Pass.** Unlimited access for a 24-hour period.
2. **Unlimited Access.** Sign up for a subscription and get unlimited monthly access in North America.
3. **Existing Wi-Fi Account.** Simply connect using your roaming Wi-Fi account user name and password.

What should I do if I don't see a welcome page?
Configure your network by changing the wireless SSID to **concourse**.

Where can I get some help?
Easy. Just call toll-free **(866) 3-BOINGO**. Our customer specialists are here 24/7/365.

Quick Connect
Get online or get some help.

1. Set your SSID to **concourse**
2. Call **(866) 3-BOINGO** for live customer service



Wi-Fi before you fly.

Why sit and wait, when you can sit and Boingo?

Get online at over 475 airports and 100,000 hotspots around the globe.

Only from the world's largest Wi-Fi network.

Don't just go. Boingo.

 **boingo**
Don't just go. Boingo.

Sign up at boingo.com or call (866) 3-BOINGO

branded





You airport brand

- Home
- My Account
- bwairport.com
- Help & Feedback

Roaming Login Boingo Username: Password: Login Access Pass?



Option 1: Boingo Unlimited

SALE
\$9.95
 per month for the first 3 months*

Enjoy UNLIMITED access to 100,000+ hotspots worldwide, including over 400 airports, major hotel chains like Marriott® and Hilton® and retail locations like Barnes & Noble® or Coffee Bean & Tea Leaf® - all for just \$9.95 per month.

Get Online Now!
 No Contract Required!

*For the first 3 months. Billed monthly @ \$21.95 thereafter.

Option 2: Boingo AsYouGo

Stay connected on the road with Boingo AsYouGo. For just \$7.95, you can enjoy Boingo access anywhere in the airport for a full 24 hours.

Get Online Now!

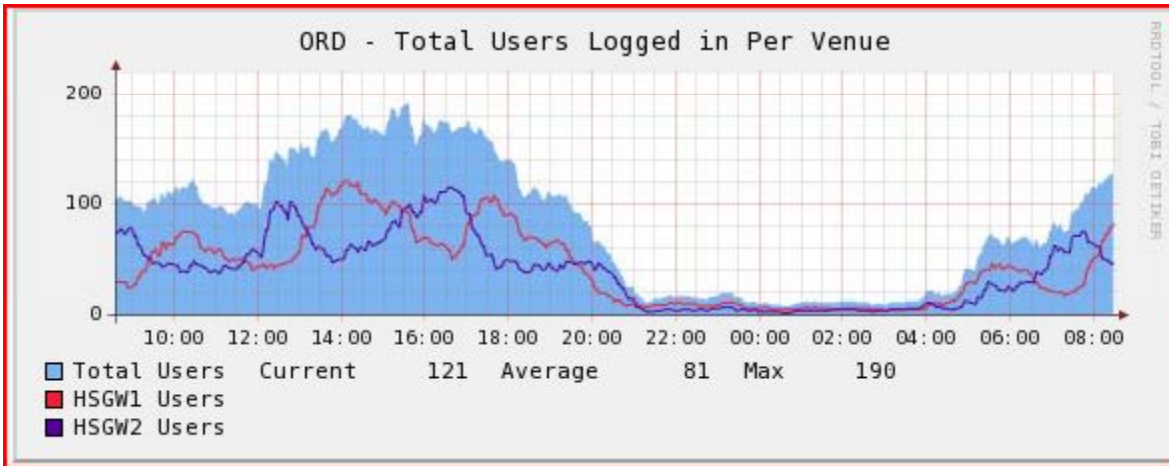
Welcome Flight Tracker

NOKIA Nseries

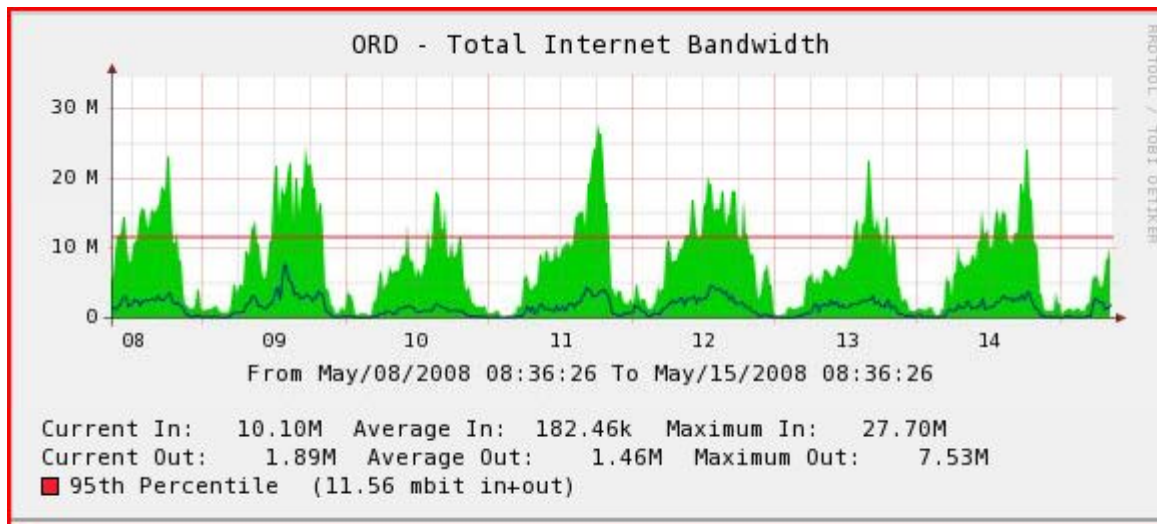
Nokia N810 Internet Tablet

Stream music for every moment.

Total Customer Satisfaction



- Access to NOC information in real-time
- Flexible and scalable



Summary

- Solve the problem
- Design a hardened non-stop system
- Research industry best practices throughout.
- Create awareness through marketing



Thank You
Questions?
brianv@boingo.com

Brian vargyas | director, network engineering
boingo wireless | 200 w madison, suite 2830 | chicago, il 60602
312-521-7214 | brianv@boingo.com

