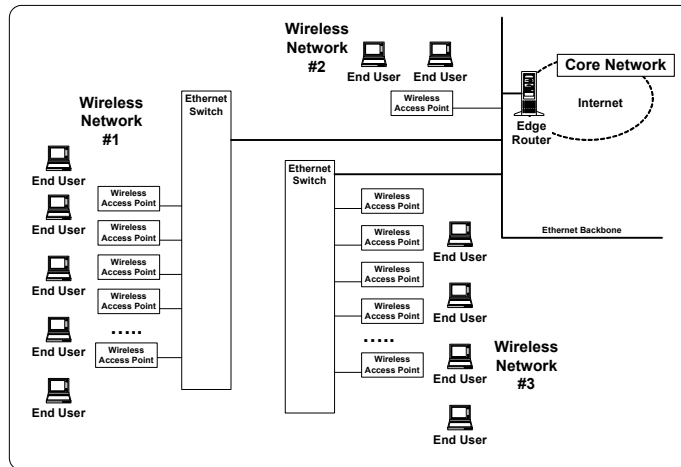# QoS Provision
for
Wireless Access
Networks

John Cushnie   ✉ j.cushnie@lancaster.ac.uk

David Hutchison   ✉ d.hutchison@lancaster.ac.uk

Distributed Multimedia Research Group

www: http://www.comp.lancs.ac.uk/computing/users/cushniej/

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Wireless Access Networks

- 802.11b Wireless Access Networks

- Corporate/Academic/Public Usage
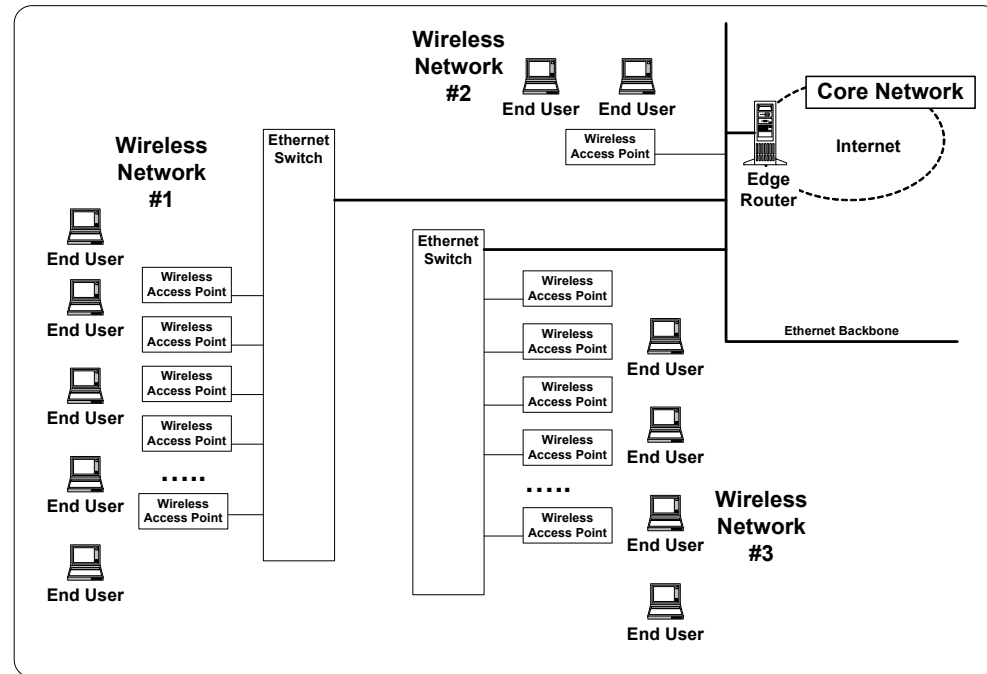
Lancaster University, UK   HP Labs, Bristol, UK

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Wireless Network Architecture

- **Uses standard Wireless Access Points**
- **Multi Vendor – Orinoco, Apple and Cisco so far**
- **Standard routers to the Internet and Core networks**
- **Open Access – no admission control or authentication**
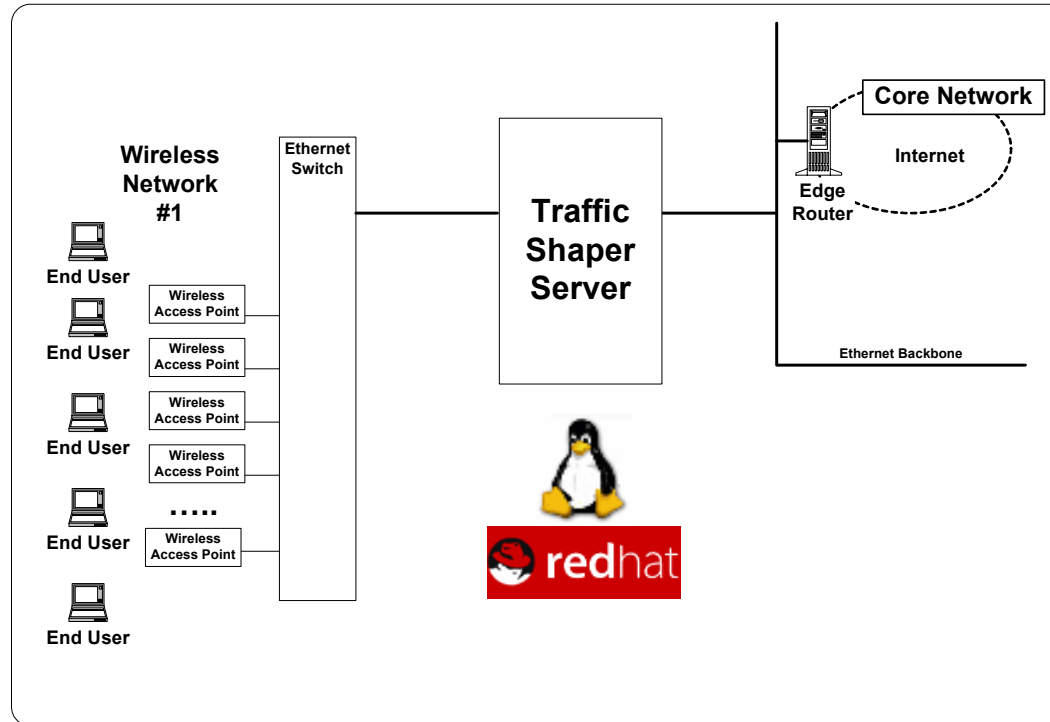- **Best Effort service only**

- **Wireless Network provided for student/researcher departmental Internet access**
- **Service to be extended campus wide and into local area and Lancaster City**

Is Best Effort good enough ?

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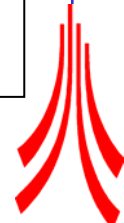
Wireless Network and Traffic Shaper Server

- **RedHat Linux Server**
- **Server runs on Free/GNU software**
- **Traffic shaping on Linux using tc and iproute2**
  Linux Advanced Routing Traffic Control (LARTC)

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Traffic Shaper Server

- **RedHat Linux Server**

- **Server runs on Free/GNU software**

- **Traffic shaping on Linux using tc and iproute2
   Linux Advanced Routing Traffic Control (LARTC)**

- **Database implemented in MySQL**

- **Apache Web-server**

- **CGI Scripting using C, PHP and PERL**

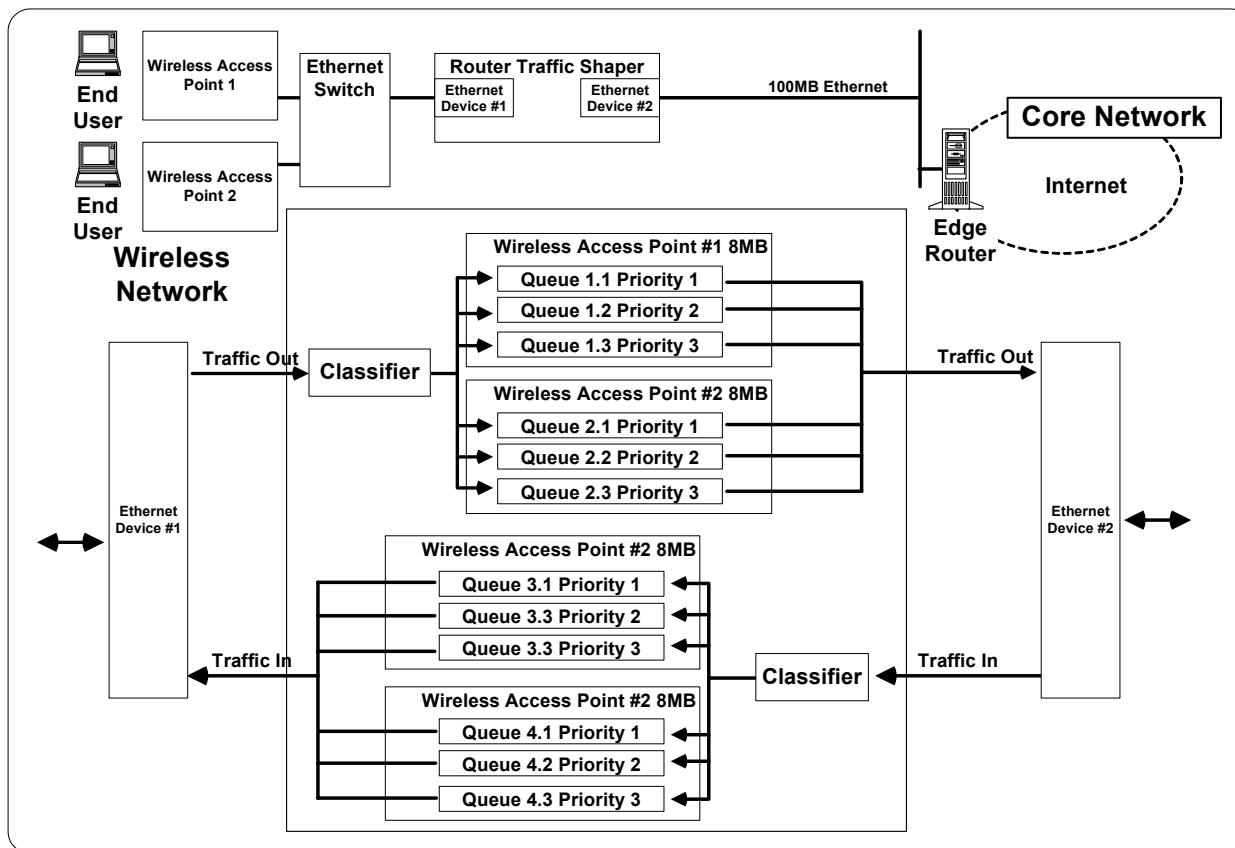- **Free/GNU software – MRTG, Wave, SNR, ttt, Wave…..**

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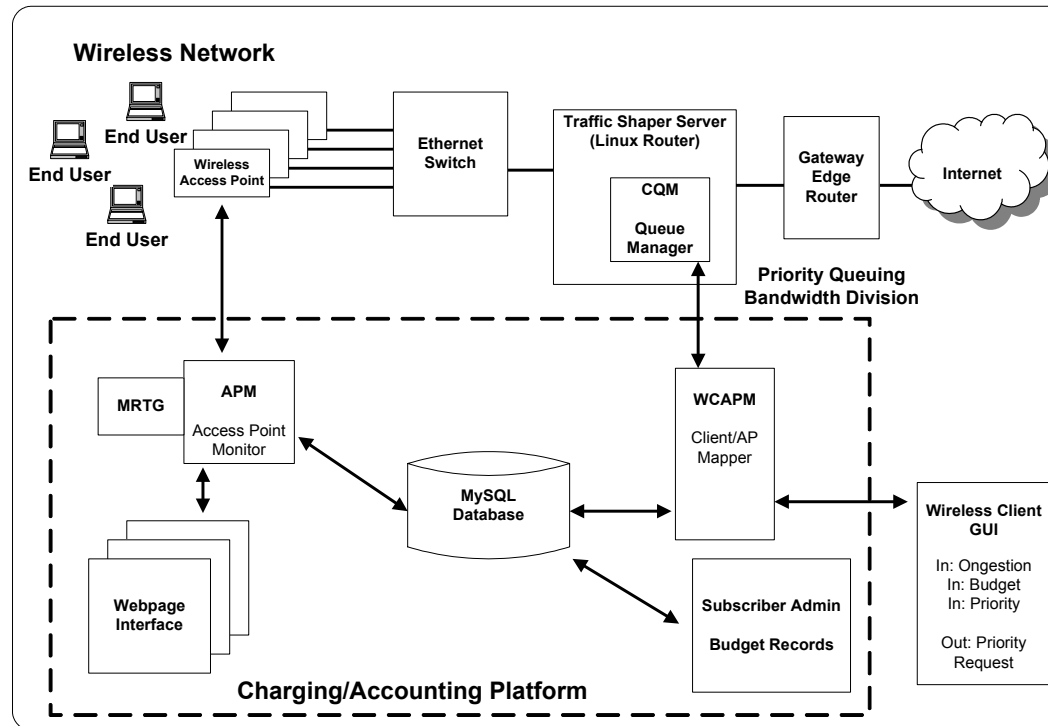
QoS via Dynamic Bandwidth/Priority Allocation

Strict Priority Schemes

Class Based Queuing

Custom Queuing Mechanisms

Based on

   IP address,

   Application Port

Traffic shaping on Linux using tc and iproute2
Linux Advanced Routing Traffic Control (LARTC)

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QoS via Dynamic Bandwidth/Priority Allocation

Subscriber Administration System
- **Authentication**
- **Budgets**
- **Accounts**

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Managing the Wireless Network Access Points

- **Data stored in MySQL database**
- **Data served by HTML and PHP**
- **Add/Delete/Halt monitoring of AccessPoints**
- **Automatic download of Access Point Details**
- **Summary of Access Point traffic and Clients**

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Monitoring the Wireless Network

Traffic Measurement using MRTG
Multi Router Traffic Grapher
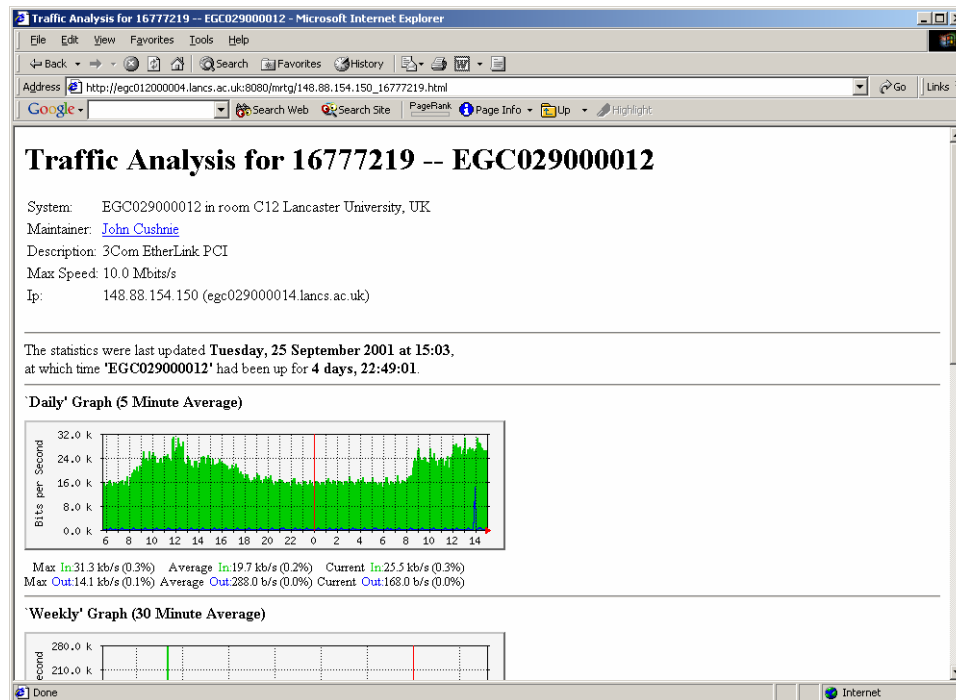
- **Data collected from network devices via SNMP**
- **Data served by HTML**
- **Widely used on the Internet**

MRTG Software available from:
http://people.ee.ethz.ch/~oetiker/webtools/mrtg/

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Monitoring the Wireless Network

- **Monitor by subnet or all subnets**
- **Monitor by individual access point**

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Monitoring the Wireless Network

Challenges posed by the Wireless Access Points

- **Wireless Access Points are propriety technology**

- **SNMP and/or HTML interfaces are supplied**
  - **Undocumented MIBs**
  - **Complicated HTML to parse out**

- **Limited documentation and functionality**

- **Bespoke software required for monitoring**

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Monitoring the Wireless Network - Orinoco

Description: WavePOINT-II V3.83 SN-00UT04203676 V3.20 | Access Point: 194.80.34.226
Location: Computing Department (B-Floor North 2) | SSID: "

MAC Address Nickname	IP Address IP Name	Vendor	Bytes/Pkts TX/RX	SNR	First Seen Last Seen
00-02-B3-BA-55-38 lancaste-t1enhu	194.80.34.224 wavelan24.comp.lancs.ac.uk	Intel Corporation	330407 4712	20	16-10-2002 18:02 22-10-2002 14:40

Daily MRTG summary for the Access Point
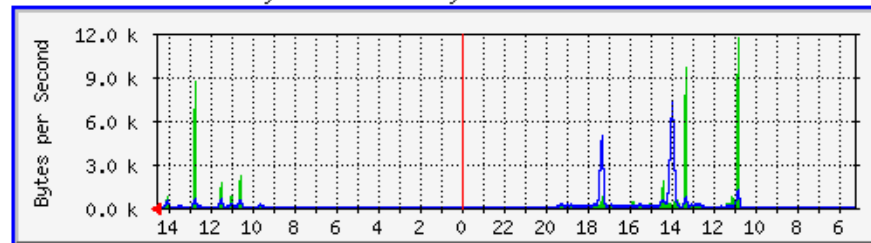
Click about graph for full MRTG details on the Access Point

- • Data collected from Orinoco Access Points via SNMP
- • Data stored in MySQL database
- • Data served by HTML and PHP

Note:

1. SSID (Service Set Identifier) is not available via SNMP
2. IP addresses/names not available via SNMP

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Monitoring the Wireless Network - Cisco

| Description: Cisco 350 Series AP 11.21 | Access Point: 194.80.34.231 |
| Location: Skylab | SSID: 'WaveLAN Network' |

MAC Address Nickname	IP Address IP Name	Vendor	Bytes/Pkts TX/RX	SNR	First Seen Last Seen
00-02-2d-1d-56-3f Unknown	194.80.34.223 wavelan23.comp.lancs.ac.uk	Agere Systems	2497785 3607	47	22-10-2002 14:26 22-10-2002 14:40

Daily MRTG summary for the Access Point

Click about graph for full MRTG details on the Access Point

- Data collected from Cisco Access Points via HTML
- Data stored in MySQL database
- Data served by HTML and PHP

Note:

1. SSID is now available via HTML
2. IP addresses/names are available via SNMP
3. Nicknames not supported

CISCO SYSTEMS

EMPOWERING THE
INTERNET GENERATION®

WIFI

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Wireless Radio Stats - SNR
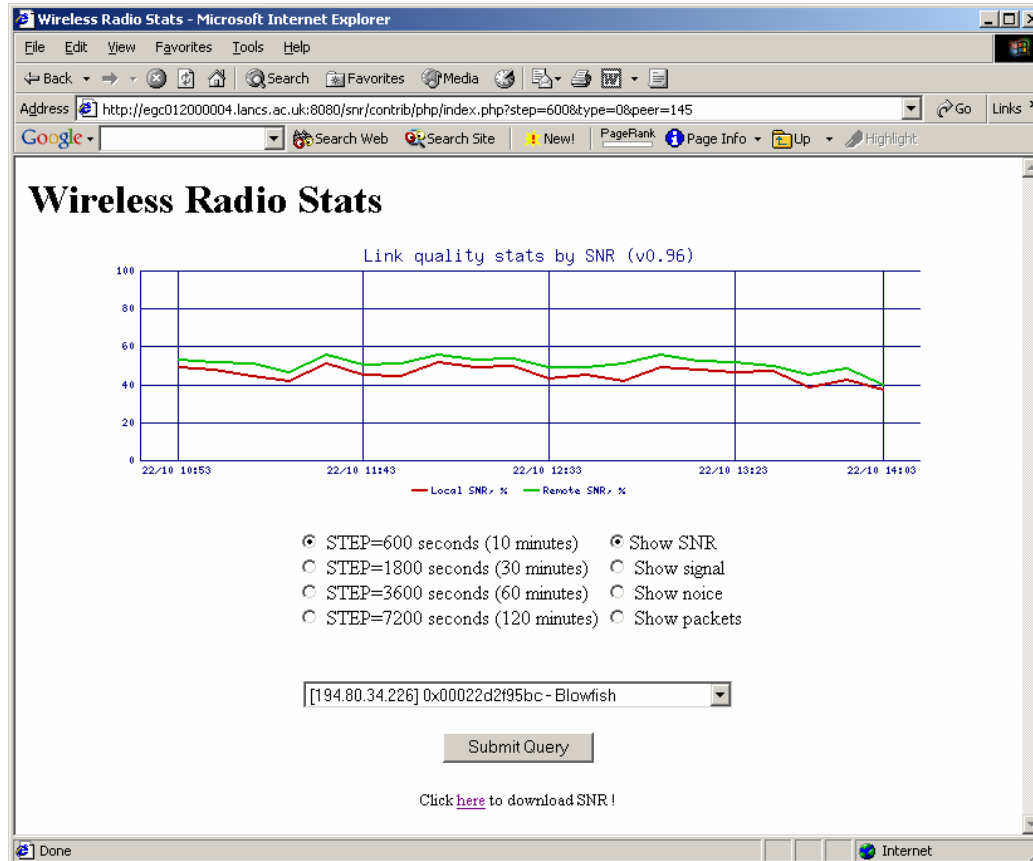
- **Data collected from Orinoco Access Points via SNMP**
- **Data collected in MySQL database**
- **Data served by HTML and CGI**

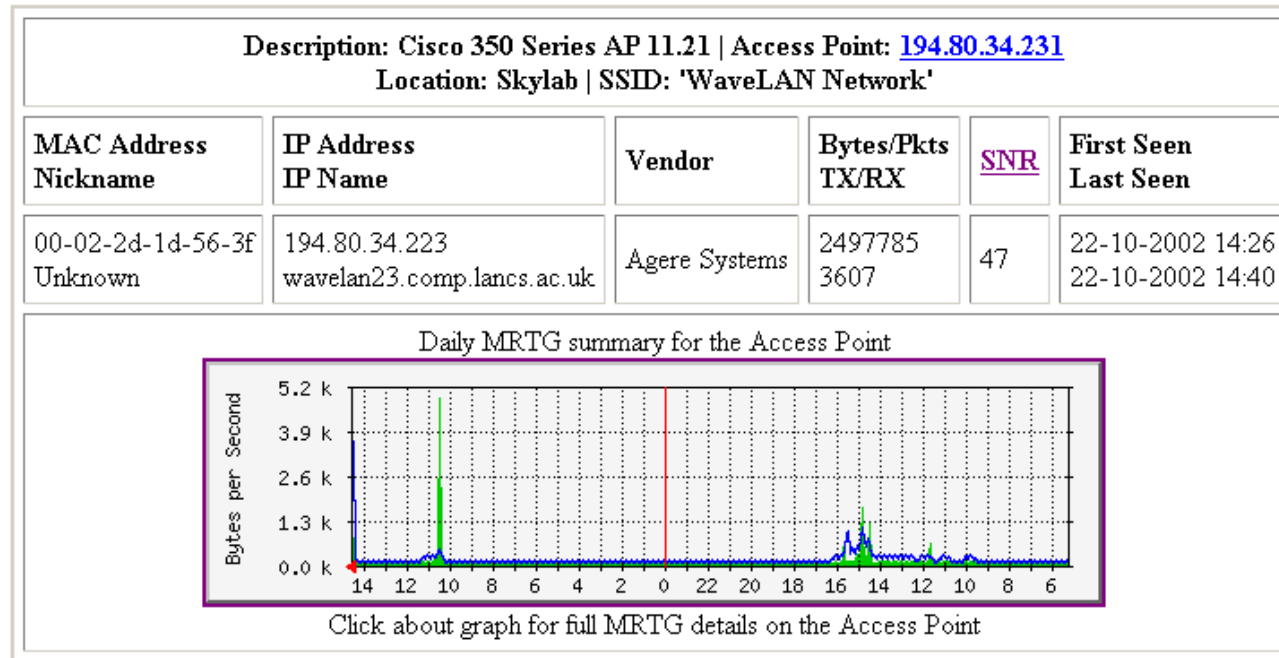**SNR Software available from - http://www.raccoon.kiev.ua/projects/snr/**

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The Wireless Network – Client Interface
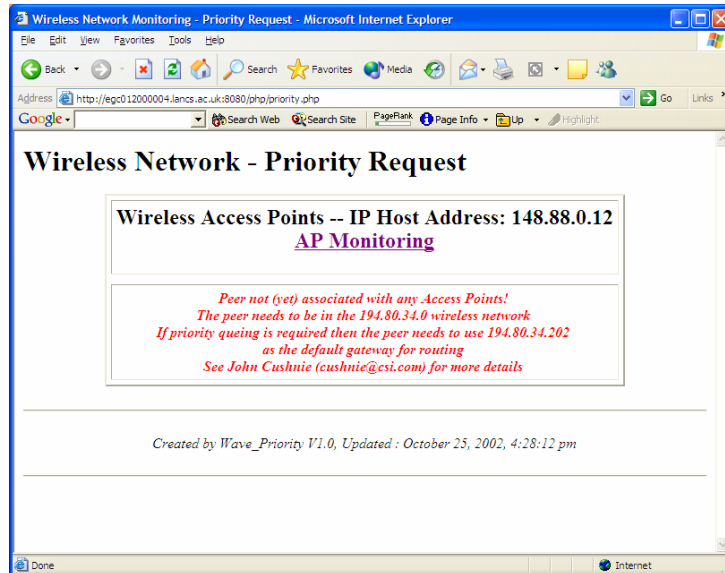
Peer IP Address NOT associated with an Access Point
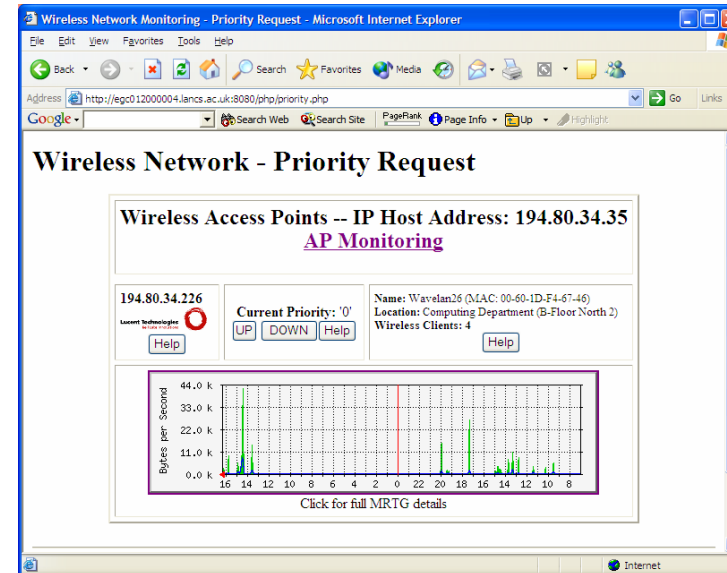
Peer IP Address associated with an Access Point

- **Data served by HTML and PHP**
- **Client identified by IP address passed to the web-server**
- **Instant feedback to the user**
- **Help system for users**
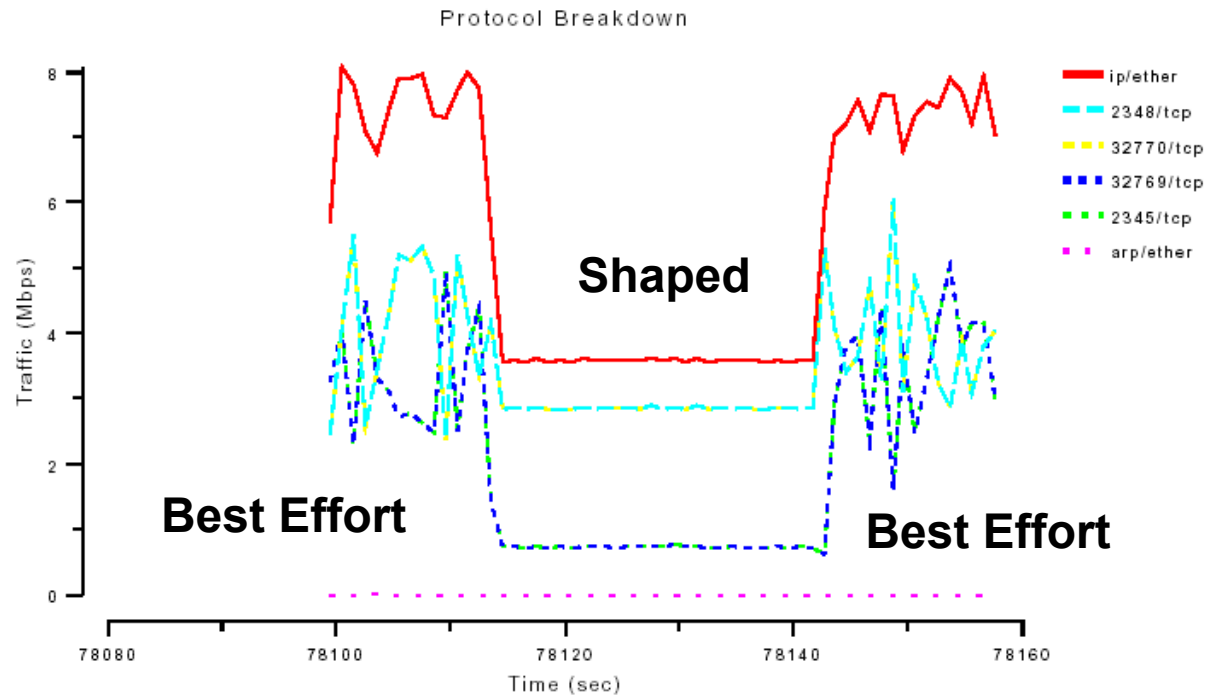
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QoS via Dynamic Bandwidth/Priority Allocation

Protocol Breakdown

Shaped

Best Effort

Best Effort

Traffic shaping on Linux using tc and iproute2
Linux Advanced Routing Traffic Control (LARTC)

Graph Software available from:
http://www.csl.sony.co.jp/person/kjc/software.html#ttt

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The Wireless Network – Extending Functionality

- **IPV6**

- **Hybrid roaming networks, Wireless/IPV6/GSM/3G/4G etc.**

- **Usage Charging & Content Charging**
  - **Metering using NeTraMet, IPFIX**

- **Authentication, Authorisation and Accounting (AAA)**
  - **Radius**
  - **Diameter**
  - ***Role your Own***

- **Network Fraud/Abuse Detection**
  - **Database trend analysis**

- **Dimensioning Network Provision**
  - **Database trend analysis**

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Research Objectives

Data Capture and Network Monitoring

    From Wireless Internet

    Processing of data and representations

    Privacy of captured data

Charging Models

    QoS /priority based charging models

    Implementation and evaluation

AAA Architectures   (IETF led)

    Use Of Diameter in fixed and wireless Internet

    AAA overhead evaluation

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Some conclusions so far

Data Capture

> **Potentially enormous amounts of data**
>
> **Reducing data into information is vital**
>> **Aggregation & Correlation**
>>> ***Simplification is the key***
>
> **Privacy of captured data - difficult**

Charging Models

> **Mobility and QoS are chargeable as premium services**
>
> **Combination charging models make sense**
> - **Charge for access**
> - **Charge for content**
> - **Charge for QoS/Priority/Bandwidth**
>
> **Metering using standard protocols is required**
>> **e.g. Diameter, IPFIX,**

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Related Research

M3I - Market Managed Multiservice Internet
http://www.m3i.org/

GUIDE II
http://www.guide.lancs.ac.uk/
http://www.equator.ac.uk/

Authentication, Authorisation and Accounting Architecture

IETF AAA WG - http://www.ietf.org/html.charters/aaa-charter.html

Diameter Protocol
http://www.diameter.org

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QoS Provision for Wireless Access Networks

Any Questions ?

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Distributed Multimedia Research Group

www: http://www.comp.lancs.ac.uk/computing/users/cushniej/

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