Wireless Networks

Changes and policies
Contents

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Introduction

- What is a wireless network?
  - A number of devices or nodes communicating via radio frequency (RF) signalling
  - Lots of common examples
    - Bluetooth
    - RFID in books, door access cards, clothing, price tags
    - Zigbee
    - WiMax
    - Mobile phones
    - Wireless LAN
Introduction

- International frequency bands
  - Wireless LAN uses International Telecommunication Union – Radio (ITU-R) Industry, Scientific and Medical frequency spectrum
  - 2.4 – 2.5 GHz and 5.725 – 5.875 GHz bands
  - Upcoming 802.11n standard can use both bands but not at the same time

- Airport interference
  - 802.11a lower bands are susceptible to interference from airport ILS transmitters
  - So on Reading campuses we cannot use 802.11a band A

<table>
<thead>
<tr>
<th>Freq. GHz</th>
<th>Used by</th>
<th>License?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4 – 2.5</td>
<td>802.11b/g</td>
<td>No</td>
</tr>
<tr>
<td>5.150 - 5.350</td>
<td>802.11a band A</td>
<td>No (Indoor)</td>
</tr>
<tr>
<td>5.470 - 5.725</td>
<td>802.11a band B</td>
<td>No (Outdoor)</td>
</tr>
<tr>
<td>5.725 – 5.850</td>
<td>802.11a band C</td>
<td>Yes (Outdoor)</td>
</tr>
</tbody>
</table>
University of Reading Policy

- IT Services maintains records of Wireless LAN deployments in both ISM frequency bands
- 2.4 – 2.5GHz band (802.11b/g) reserved by IT Services for official University wireless networks
- Departments are not permitted to operate their own wireless LAN equipment in this band
- Departments may operate 802.11a equipment but must register network name, location, channel and transmit power with IT Services
University of Reading Policy

• IT Services will install an officially supported and maintained Wireless LAN on request, subject to a site survey, for a nominal fee.

• The fee covers:
  – Wireless survey cost
  – Installation and management of the appropriate number of access points
  – Central administration and provision of services across the University, to maintain a common experience for end users
  – Maintenance and administration of supporting infrastructure
  – Replacement of access points should they fail or need replacing
UoR Wireless Networks

• For general use:
  – Eduroam
    • Preferred network
    • Secure – uses IEEE 802.1X network-level authentication, combined with WPA / WPA2 (aka 802.11i) encryption
    • Unique network key per user
    • Key has a limited lifetime and is renewed regularly
  – Eduroam-web
    • Less preferred as no encryption, but available for those users who cannot use Eduroam because their device does not support 802.1X
    • Big discussion with JANET and international NRENs over whether this should even be allowed
    • Works the same as ‘rdg.ac.uk’ network, but must put ‘@reading.ac.uk’ on the end of the username
UoR Wireless Networks

• To be retired this academic year:
  – rdg.ac.uk
    • Insecure, no encryption
    • Legacy network specific to UoR
    • Same functionality provided by eduroam-web, just different network name.

• Special networks:
  – UoR-SSE
  – UoR-ARL
Eduroam

- EDUcation ROAMing
- Roaming infrastructure used by research and education community
- Allows visitors to access a wireless network at a visited location using the same credentials they would use at their home institution.
- Countries / regions involved:
  - Austria, Belgium, Bulgaria, Canada, China, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Romania, Slovenia, Slovak Republic, Spain, Sweden, Switzerland, Taiwan, Turkey, United Kingdom
- United States still considering it, via Internet2
Eduroam

- Uses industry-standard systems in a novel way
- International hierarchy of RADIUS servers
- At UoR, non-UoR authentication is passed to JANET, who then pass non-UK authentication to the international root servers, which then passes it to the right country and then institution
- Quite complex to set up properly but works reliably and quickly when set up properly
Eduroam
Eduroam

- Configure once and forget
- Works on many platforms
  - Tested on Windows XP / Vista, Windows Mobile, Windows Pocket PC, Mac OS X, Linux, Nokia Symbian, iPod / iPhone
- International example: Andy visits University of Tartu
  - Logs in using vis02ajg@reading.ac.uk, and UoR password
  - Encrypted tunnel created from UT all the way back to UoR
  - Authentication succeeds and access is granted
  - IP address issued from UT pool
Infrastructure Hardware

• **1st Generation**
  - HP WL520 / Orinoco AP1000 / Orinoco AP2000
  - End-of-life, no further software support available
  - Does not support 802.1X, which is required for Eduroam

• **2nd Generation**
  - Extreme Networks Alititude 300 (A300-2i)
  - Some issues with reliability after long uptime
  - Retrofitted into management via newer Extreme controllers

• **3rd Generation**
  - Extreme Networks Altitude 350 (A350-2i)
  - Works fine but controller doesn’t have many features
Infrastructure Hardware: TNG

- **Aruba Networks**
  - Top-three vendor for Wireless Networks
  - Have won multiple awards for their products

- **Aruba MMC-6000 controller**
  - Supports up to 2,048 access points, with up to 32,768 users
  - 32-core CPU per management card
  - Up to 4 management cards
  - Up to 3 power supplies
  - Up to 8 x 10Gbit/s and 40 x 1Gbit/s uplinks
  - Wireless intrusion detection / prevention
  - Rogue wireless network detection
Infrastructure Hardware: TNG

- **Aruba MMC-6000 controller**
  - Supports a mixture of access points
    - 802.11a, 802.11b/g, 802.11n, indoor, outdoor, weatherproof, wired, wireless
  - All WLAN traffic tunnelled back to controller
  - Makes network topology a lot easier!

- **Aruba AP65 access point**
  - Dual-radio, 802.11a and 802.11b/g
  - Power over Ethernet (PoE)
  - Compact and light-weight
  - Does not work without controller
Infrastructure: Greenlands

- Aruba MMC-3600 controller
  - Based on same hardware and software as MMC-6000
  - Supports 128 APs and 2048 users
  - 4 x 1Gbit/s uplinks
- 64 x AP65 access points
- Almost whole campus covered (inside buildings)
- Eduroam and eduroam-web networks available
- Guest network for non-academic hotel visitors available soon
  - Work in progress, lots of policy decisions
  - Traffic routed out via ADSL link rather than across JANET
Infrastructure: Upgrades

- **Phase 1 - ASAP**
  - Replace all existing HP access points with Aruba AP65
  - Decision needs to be taken on whether this will include Halls of Residence in initial phase

- **Phase 2 – completed by June 2009**
  - Replace all Extreme Altitude 300 access points with Aruba AP65
  - But have to be careful not to mix Extreme and Aruba in the same place
  - Can then remove two devices from network core (used for AP booting)

- **Phase 3**
  - Replace all Extreme Altitude 350 access points with Aruba AP65
  - No urgency on this provided A350 and AP65 networks are kept apart
Eduroam configuration

- UoR documentation at www.reading.ac.uk/eduroam
- Tested on:
  - Windows XP / Vista
  - Windows Mobile / Pocket PC
  - Mac OS X
  - Linux
  - Nokia Symbian
  - Apple iPod Touch / iPhone
- Easy installer created for Windows, as settings can be a bit fiddly for novice users
  - Run installer, click next four times, finish, reboot, enter username and password
Questions?