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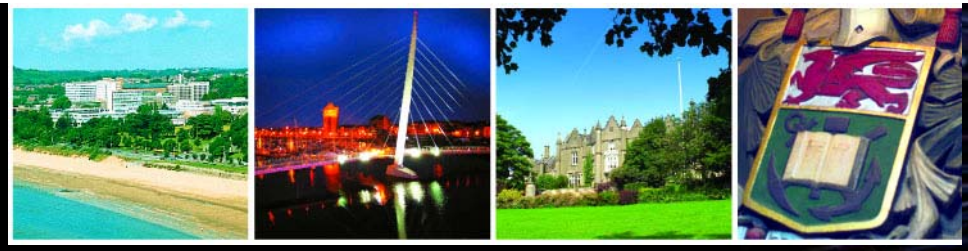

MOBILE VCE

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IAT's Wireless Future!

Professor Tim O'Farrell

Chair of Wireless Communications Systems
& Head of Networks Research Group

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Outline

- Critical Mass in Wireless Research
- Key Competencies in Wireless Research
- Laboratory Facilities for Wireless Research
- A Case for Cellular Mobile Research:
  - The Research Vision
  - Research Activity
- The Horizon

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Critical Mass in Wireless Research

- Wireless research is carried out by the Wireless and Networks groups within IAT
- Critical mass is realised with:
  - 10 academic staff (Chen, Choi, He, Hong, Kim, Loskot, Mehmood, Metha, O'Farrell, Wang)
  - 7 contract researchers (Badic, Joyce, Li-Shancang, Li -Yue, Nguyen, Royds, Xing)
  - 20 PhD students (expanding rapidly)

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Key Competencies in Wireless Research

- Major Competencies in Physical layer, Radio Resource Management and Routing
- Examples of PHY layer research include
  - Multiple-access techniques (OFDM, CDMA…)
  - Coding & modulation (adaptive, iterative…)
  - MIMO (ST coding/ layered transmission)
  - Antennas (steerable small form)

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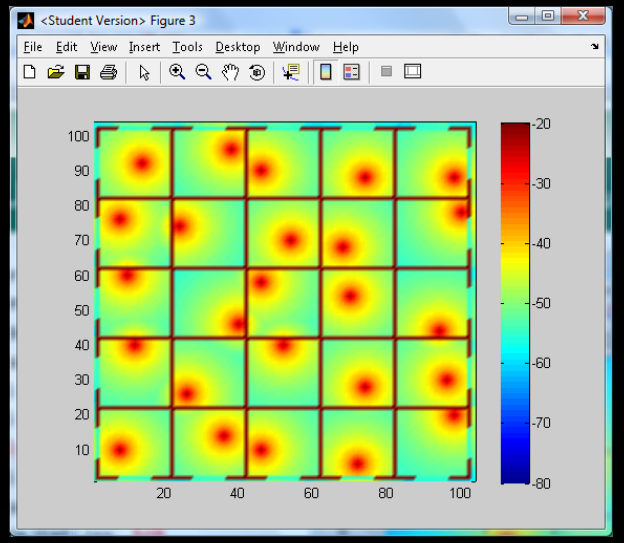
Key Competencies in Wireless Research

- Examples of RRM research include
  - Mobile Network planning & optimisation
  - MAC & Packet Scheduling
  - Scalable Routing



Femto Cell Coverage

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Key Competencies in Wireless Research

- Key technologies addressed include
  - WWAN (GSM, 3G, HSPA, FEMTO and LTE)
  - WLAN (802.11g/a/n, 802.11 e, video QoS)
  - WMAN (802.16e)
  - Intelligent Transport Systems (models, DTN)
  - E-Health (“NanoHealth” WSN)
  - Infrared Communication (WLAN, P2P)

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Wireless Research Laboratory Facilities

- £1.5m capital equipment expenditure
- Significant testbeds include
  - Anechoic Chamber (Satimo 0.8-18 GHz)
  - RF Wireless Testbed (Propsim C2, Agilent)
  - IR Wireless Testbed (Cage, APD)
  - Cellular Drive Test Sets (NEMO, ZX-SAM)

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RF Wireless Testbed

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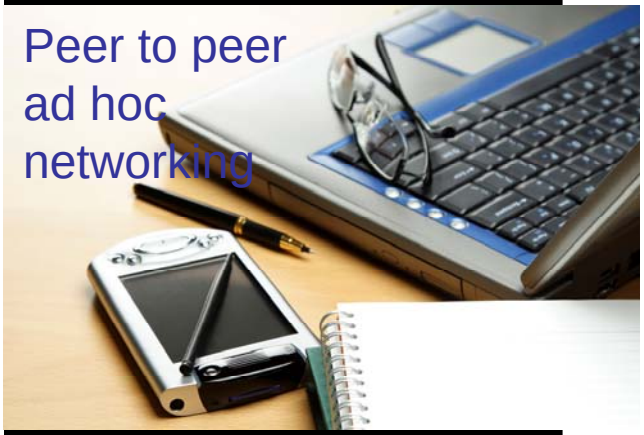
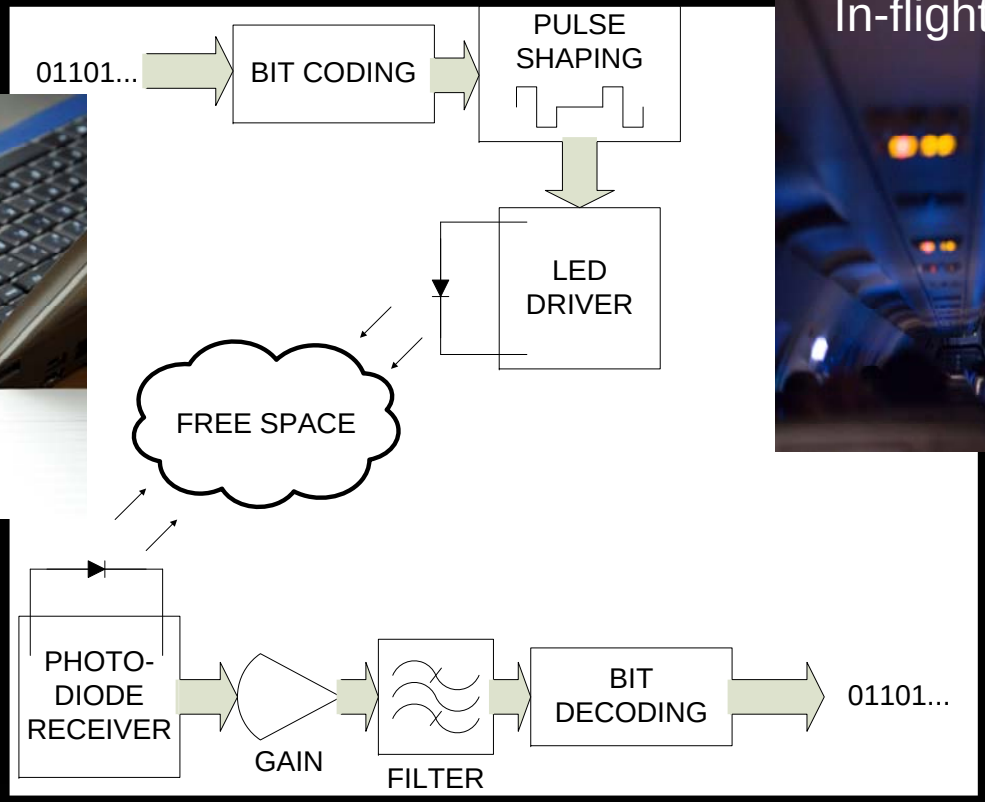
IR Wireless Testbed





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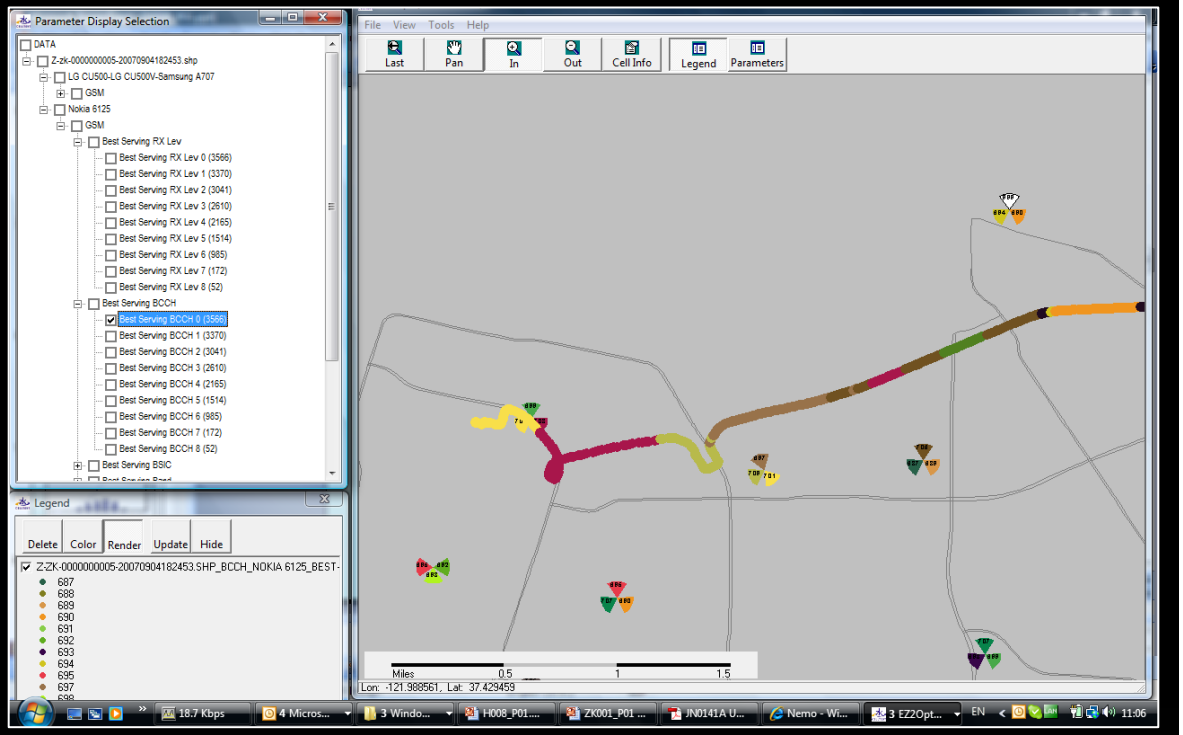
Cellular Drive Test Sets

ZK Celltest ZX-SAM

Nemo Outdoor

Analysis Tool (Actix)



Digital Futures 16th September 2008

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Cellular Mobile Research

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2020 Vision

- Vision of 4G – Implementation to Date
  - Enhanced WCDMA, OFDM/A, MIMO/ Interference cancellation, FEMTO cells, UWB standardised, converged digital broadcasting & mobile
- Vision of 4G – Ongoing Research
  - Reconfigurable & self organising networks, ad-hoc & mesh networks, cognitive radio, context awareness via personal information manager

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2020 Vision – Towards the Future

- Environment & Demographic Factors
  - Global economy, population, population > 65yo all larger by 80%, 17%, ~10%
  - Pressing need for *Energy Efficiency* due to climate change and scarce energy resources
- Technology & User Factors
  - Convergence (mobile & internet), evolving networks (relay, ad-hoc, mesh), optimise wireless IP, spectrum
  - Multimedia, Web2.0, multi-connected, open-access to other markets, & enabling “Mash-up”

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2020 Vision – It Just Is (IJI)

- User Interaction
  - Delivery of desired information or services in intelligent anticipation of a user's intention using contextual information from sensors embedded in user-owned products, property & surroundings.
- Flexible Networks
  - Autonomous & self-evolving networks must meet the needs of service providers and "dynamic" users.
  - New design approaches to future network evolution will encompass adaptability & agility, verification & accountability, and robustness & efficiency.

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2020 Vision – It Just Is (IJI)

- Green Radio
  - Summarised as “power & spectrally efficient wireless ubiquity”
  - Identify the best radio techniques across all protocol layers that economically achieve 100x total power reduction
  - A green network architecture – a low power wireless network and backhaul that meets prevailing QoS requirements

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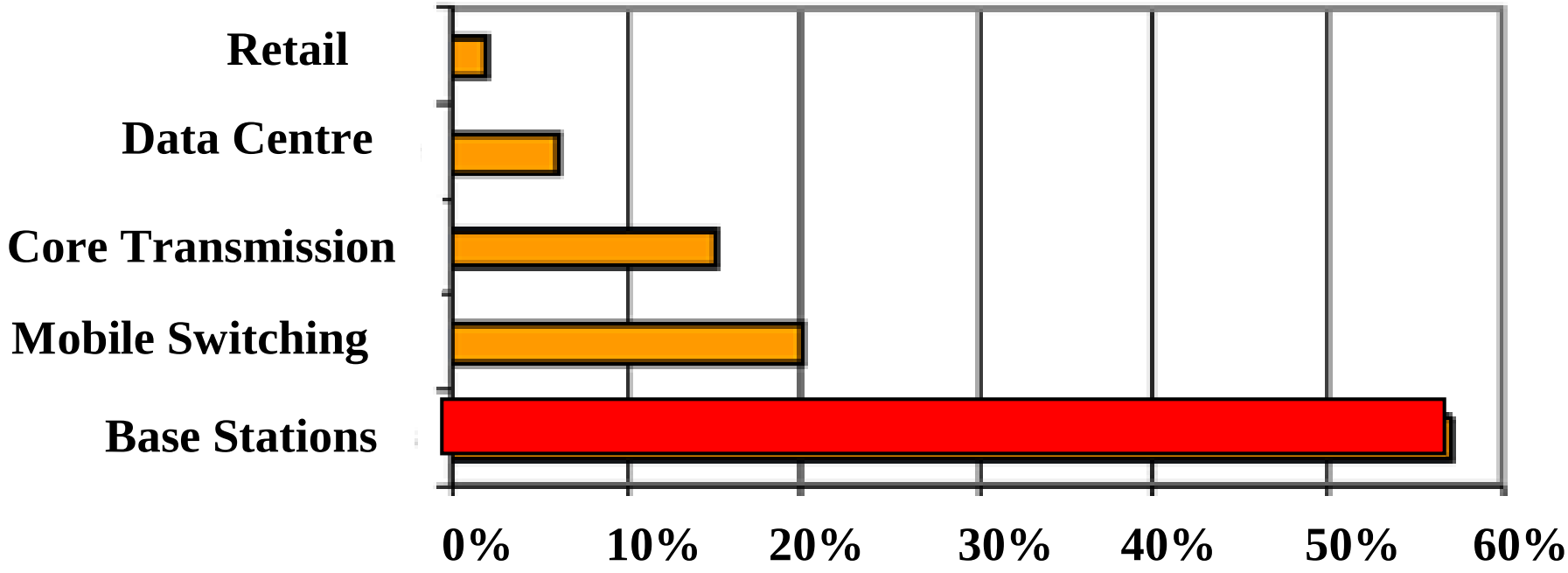
Cellular Network Power Consumption Statistics (source: Vodafone)



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Green Radio Research

Architectural Aspects for Green Radio

- Key Metrics & Network Architecture
- Energy Efficient Architectures
- Multi-hop Routing
- Frequency Management

Techniques across the Protocol Stack for Power Reduction

- Novel Power Reduction Approaches
- Resource Allocation Schemes
- Power Efficient DSP
- Power Efficient Hardware

University of BRISTOL

The University of Edinburgh

King's College London
University of London

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Green Radio Research

- Swansea/IAT Contribution
  - WWANs, Enterprise & Home Networks
  - Metrics
  - Architectures
  - Network coding techniques
  - RRM techniques

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The Horizon

- Internationally recognised research with industrial/commercial relevance
- Strong academic, RA & PhD critical mass
- Excellence in MSc Teaching
- Outward looking commercial team
- Resource to local industry and Government

Thank You

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