



spring 2010 issue

Perspective

A Decade of Change



The past or present decade? Both!

In December 2000, Mobile VCE published its 'Visions of 4G' document. As I recently sat at home watching live coverage of CES from Las Vegas on my widescreen HD TV, enabled by an independent podcaster-journalist via a cellular uplink to the internet, it caused me to ponder on the prescience of our industrial members who crafted that document.

Much has changed in the past decade and, as Mobile VCE now implements research informed by its new '2020 Vision', as yet published only to our membership, much more change is coming. As a pioneer, Mobile VCE's focus is always forward-looking – but learning from the past is an important way to inform the future.

In this first newsletter of 2010 it is timely to consider such change and its implications for the future. Never has the communications industry faced such rapid and unprecedented change, in technology, in business models, in industry structure, and in market opportunities.

Our Core 5 research – in Green Radio, Flexible Networks, User Interactions and Instant Knowledge – all reflects this profound change. The mutual exchange between VCE's academic researchers and its industry members benefits both hugely, as we seek to 'enable the digital future'.

Mobile VCE's research continues to evolve and we invite new industry players to join us on our journey, to share in the creation of and benefit from this next decade of change.

Dr Walter Tuttlebee *Chief Executive*

Outlook

From Cellular to Digital Britain

On New Year's Day 1985, the first mobile phone call was made in the UK on an analogue network built by the company which later became known as Vodafone. That company, and the telecoms industry, has come a very long way in 25 years.

Sir Christopher Gent, former Vodafone CEO, was recently quoted as anticipating at that time a total UK market size of only one million mobile phone users. If the price of a phone had stayed at the £3,000 of those days, that might have been correct. However, the creativity that has enabled today's \$20 GSM phones and a global market of 4.5 billion has been the hallmark of the industry from the outset, and is a characteristic that shows no sign of reducing.

On 21st January 2010, the industry will gather at the Science Museum in London to celebrate. Organised by Cambridge Wireless and supported by all the major players, including Mobile VCE, the 'Cellular 25' event will be opened by Stephen Timms, Minister for Digital Britain.

With a personal background in telecoms – he used to work for Logica and Ovum – Stephen Timms appreciates more than most politicians the way in which mobile telephony has transformed business and society in the past 25 years. Having inherited responsibility for Digital Britain from Lord Carter, Timms also appreciates the potential of digital comms to be equally transformative in the coming decade, as a fundamental enabler of the emerging digital economy. Just as the UK played a major role in GSM and 3G, resulting in R&D investments from most of the world's telecom companies in the UK, so Digital Britain is set to provide ongoing rationale for such companies to maintain and grow their

UK-based R&D, via opportunity to participate in industry transformation in the UK, learning from its implementation, and taking that experience to their own home and export markets.

Governments around the world of course, not just in the UK, have in recent years recognised the potential of digital comms to be a major force for positive change – not only in transforming other industries but also in making a positive contribution to CO₂ reduction in those industries.



Stephen Timms, Minister for Digital Britain

The Cellular 25 celebration will provide an opportunity not just to look back, but also to the future.



Vision 2010

Mobile VCE's Visions Group was created to help develop a shared long term vision, following the establishment of the Virtual Centre of Excellence in 1996.

Its initial outcomes, as a ten-year vision, were published entitled 'Visions of 4G' in December 2000. The five key elements as seen at that time were summarised in the simple diagram below and formed the basis for much of VCE's subsequent research. Whilst all aspects have been partially fulfilled some elements still remain on the future roadmap.

In 2000 the WCDMA 3G standards had just been published. The Visions Group did not predict the dotcom bust nor the 2008 banking crisis, both of which slowed developments. It did however correctly anticipate many significant innovations, including:

- Enhancement of WCDMA to support higher speeds (HSPA)
- Emergence of OFDM & OFDMA, now incorporated in LTE, WiMAX and digital broadcasting
- Improved access network efficiencies through MIMO and Interference Cancellation, now incorporated in 802.11n and LTE
- Consumer demand for short range high capacity wireless
- Emergence of 'liquid media' – content available across multiple screens, viz. PC, TV & mobile
- Adoption of IP-based telecom infrastructures
- The need for improved spectrum usage in the 2GHz bands and the need for significantly more, now imminent through the digital dividend



The Five Elements of 'Visions of 4G', as seen in 1999

The 'Visions of 4G' paper succeeded in instigating new research, not only within Mobile VCE and its member companies, but also, through the latter, more widely. In many areas such research has not yet become mature or been operationally deployed, but is now clearly on the future roadmaps, of LTE Advanced, for example. Such areas include:

- Reconfigurable and self-organising networks
- Ad hoc networking
- Evolution of software defined radio towards cognitive radio and networks
- Context awareness to enable personalisation
- The role of middleware in service delivery

When these developments and future directions were first espoused in 1999 many or most of them were far from 'accepted wisdom'.

Core Research

Research Update...

Green Radio

Green Radio became a mainstream issue in 2009, culminating in the announcement of the industry's Green Manifesto at the GSMA's Mobile Asia Conference in November.

Earlier in the year, Mobile VCE had continued to socialise its Green Radio research programme via presentations and visits in the USA, China, Japan and Europe.

Identification of appropriate metrics and methodologies, to ensure holistic, system-level optimisation, were the starting point in VCE's programme, with these achievements presented at a major members' workshop hosted at Swansea in September 2009.

The industry-staffed Energy Focus Group worked throughout 2009 with the academic team to define priorities so that the programme can deliver results of shorter-term value to the industry, alongside its strategic longer term targeted innovations, by using LTE and LTE Advanced as initial and interim baselines.

Technical reports finalised in the first year address backhaul link protocols, the role of MIMO in guaranteeing QoS, and energy efficient relaying techniques. A dozen further reports exist as work in progress addressing, inter alia, dynamic scheduling and allocation algorithms, energy and QoS in femtocells, and sleep mode design for LTE. www.mobilevce.com/greenradio



Mobile VCE organised a 'Green Radio Zone' at the Technology World exhibition last November. Industrial Chairman, Simon Fletcher of NEC, presented the VCE programme to an audience of international attendees, including mobile operators from Asia and America.

The term 'Green Radio' first emerged in Mobile VCE in early 2007 in discussions of the Visions Group as it considered environmental drivers for Core 5 research. With broad industrial participation, to build member consensus on research priorities, the ideas rapidly diffused throughout the industry. Detailed planning of VCE's Green Radio programme involving all our members followed, with launch in October 2008.

Several past VCE programmes have been followed, a year or two later, by European Framework

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2020 Vision

By the late 2000's, the term 'Digital Economy' had emerged to supplant 'The Knowledge Economy', prevalent a decade earlier, broadband Internet was widespread and the mobile industry had grown tenfold, to over 4.5bn users in less than decade.

In this new world, a refreshed Visions Group, a dozen senior research executives from VCE's member companies, under the independent chairmanship of Prof Barry Evans, began evaluating the impact of a range of environmental and demographic trends. It also revisited the earlier vision, evaluated enabling trends in technologies and infrastructures, and considered user behaviour, services, and business model evolution.

Collisions and synergies between different driving forces, industry priorities and



Prof Barry Evans, Chair of the Visions Group

technology capabilities led the team to acknowledge an underlying need, from the user perspective, to mask increasing complexity, so that future services appear simple, uncomplicated and easy to use, summarised in the phrase 'UI – It Just Is'.

Building from this base, through an Industry Futures Day involving all member companies, VCE's academic thought leaders,

and subsequent industrial consultation, four key research challenges were identified. These in turn were developed by the wider membership into the current research programmes which ramped up during 2009, focusing upon Green Radio, Flexible Networks and User Interaction, complemented by the services research within the Instant Knowledge programme.

With hindsight, it is clear that, once again, the Vision priorities have been prescient:

- Green Radio - was new terminology when first coined by the Visions Group, yet is now a mainstream priority
- Network Virtualisation - seemed initially a very 'far out' concept, yet, with the rapidly increasing need to reduce CO₂ emissions, it is becoming conceivable that such shared networks could, eventually, be the way forward

■ User Interactions - were identified as a priority prior to the arrival of the iPhone, which has triggered major changes in the user interface. The programme is addressing wider service enablers, not just the user device

■ Instant Knowledge - was premised on an anticipated growth in smartphones and their capabilities. This has happened faster than anticipated, and user feedback is showing commercial interest in the service concepts

Significant research progress is being made in all these programmes, with member companies exploiting different aspects via their internal R&D teams, depending upon their position, role and strategy within the industry. A succinct update on the programmes is given elsewhere in this newsletter.

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programmes building upon them. The 'seed & feed' approach, whereby member companies leverage VCE research to initiate new internal R&D, is also well established. We welcome our member companies building on our work in these and other ways; Green Radio is no exception.

Several related initiatives were proposed or began in 2009, supported by NSF (USA), MOST (China) and the EC (Europe). In January 2010 a global initiative, GreenTouch, coordinated by Alcatel-Lucent, was announced, with partners from Asia, America, Australia and Europe.

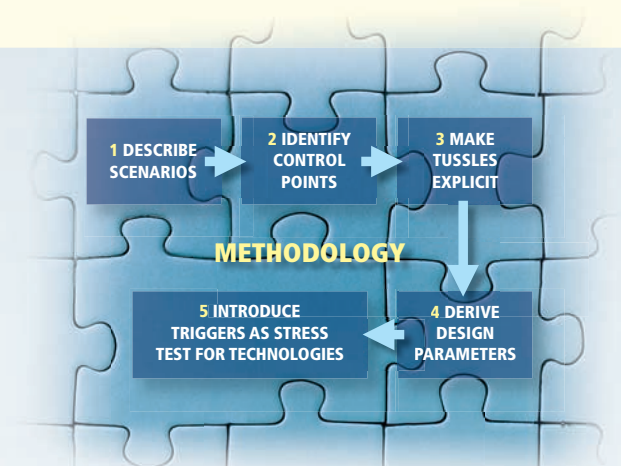
The high profile arrival of these is strengthening the motivation of our industrial leadership team and academic researchers to deliver timely, high quality, industrially relevant, outcomes that others can complement.

Flexible Networks

Over its first year, the socio-economic research within the Flexible Networks programme has looked at drivers for future network usage, the business opportunities and the potential conflicting requirements (tussles) between operators, consumers and other players.

Methodologies have been developed that include an analysis of dynamic competition for resources resulting from these tussles, and the identification of corresponding triggers and control points. Ways to map these onto the physical descriptors or metrics within the network (eg delay, throughput, jitter) are being derived, that can enable dynamic reconfiguration, performance evaluation and functional verification of the network.

The phase one programme is exploring, inter alia, the combination of network coding, multipath routing and network virtualisation as means to reliably deliver such flexibility in



a robust manner. Practical issues associated with the conventional implementation of network coding have limited its realisable benefits; however, in a virtualised network it has been shown that such issues may be sidestepped, so that it can indeed deliver closer to its full potential.

Whereas practical market acceptance of network virtualisation has until recently seemed unlikely, several major trends are in play. Increasing operator outsourcing of network management, alongside escalating demands to reduce OpEx

and reduce carbon emissions, are making the concept of network virtualisation more acceptable, certainly in regions with substantial, centralised, markets. Indeed if the approach can be shown to be able to deliver network sharing alongside effective competition then this could become truly global. The Flexible Networks Phase 1 research continues until mid-2010, at which time it is hoped to transition to a larger second phase activity.

www.mobilevce.com/networks

Research Update... *(Continued from page 3)*

User Interactions

The User Interactions programme, as a new VCE research field, has seen involvement from both new academic teams and different industrial researchers from its member companies.

A useful teambuilding mechanism, early activities included scenario development workshops, leading to an exploration of use cases, triggers and goals for two very different types of users, which might be loosely characterised as the traditional early adopter and the laggard. Focus groups based on these two user types were held, to validate and refine the use

cases with empirical data relating to mobile usage in everyday life, resulting in a deliverable addressing 'User Predispositions, Preferences and Prejudices'.

In the latter part of 2009 technology exploration commenced, initially considering pressure-based and ultrasonic haptic interfaces, thermal interactions, gestural behaviours and enhancements to projector-phone capabilities. To bring sharper focus, the industrial team has recently nominated two primary application areas to serve as a focus as this research moves forward, viz. 'Augmented Travel' and 'Nomadic Media with Collaborative Usage' led by Thales and the BBC respectively. www.mobilevce.com/user



Instant Knowledge

The Instant Knowledge concept seeks to harness employees' tacit knowledge (information which flows through their smartphones, netbooks and PCs) to enable company staff to quickly, even instantly, 'locate the man who knows' within their company. The service is based upon automatic inference of social networks using machine learning algorithms and context information, combined with appropriate security and privacy mechanisms

A service demonstrator is being implemented using Internet Tablet devices which use the Maemo operating system; this OS, of course, has recently gone mainstream, with the launch of the N900 phone. The service concepts and demonstrator code are designed to be portable to a full range of handset OS'es.

In a year which has seen rapid growth of

both smartphone market share and of handset processing power, discussions and demonstrations of the service concept have been held with a variety of enterprise users and their relationship managers within the operator companies; these have shown significant interest in the service.

The service demonstrator architecture has been refined in recent months, reflecting such feedback, complemented by fundamental research and the development of key elements of the demonstrator. Such work includes mechanisms for information sharing, techniques for context extraction, security evaluation of (mis-)use cases and development of a demonstrator User Interface. A novel mechanism for realtime recording and monitoring of end user behaviour, designed to enable optimisation of the UI, has also been created, potentially applicable to a wide variety of other services or UI designs.

www.mobilevce.com/instantknowledge



Patents Status

Decisions on which innovations emerging from Mobile VCE's research should be filed for patents are made by the Industry Steering Groups, based on standard criteria.

Mobile VCE's industry members have full access and exploitation rights to IPR created after joining, and new members enjoy an option to purchase access to patents arising from earlier research.

Patents may also be licensed by non-members, either from Mobile VCE or directly from the inventing University; proceeds received by Mobile

VCE are used to offset patent maintenance costs and thus fund additional research for its industrial members.

Mobile VCE's patent portfolio at the start of 2010 comprised 50 active families. Filings from 30 of these families have been granted, some in multiple jurisdictions, as follows:

- 11 US Grants
- 10 European Grants
- 14 UK Grants

The latest Patent Casebook, and copies of individual patent filings, are available to members on request.

Upcoming Events

Dates or venues may change – please check the Calendar Page of the Mobile VCE website – www.mobilevce.com – to confirm. Events are normally open to all staff from any industrial member company. Registration is usually required - this may be done directly from the Calendar Page.

Remote participation by Webex is available for Industrial Steering Groups and for some other meetings for Industry staff who are based outside the UK or who are otherwise unable to attend.

2010

January 7th Industry Steering Group – Instant Knowledge – Vodafone, London

January 8th Industry Steering Group – User Interactions – Orange, London

January 26th Industry Steering Group – Flexible Networks, Bristol University

January 27th Industry Steering Group – Green Radio, Bristol University

February 19th Energy Focus Group – Green Radio, Vodafone, Newbury

April Industry Steering Groups – Instant Knowledge & User Interactions, dates TBC

April 27/28th Industry Steering Groups – Flexible Networks & Green Radio

May 11th 'Privacy Issues & Solutions for Safer Social Networks' – Members & Invited Guests

June 9th/10th 'Resolving Techno-Economic Conflicts through Network Virtualisation' International Workshop – Members & Invited Guests

July Industry Steering Groups – All four programmes, dates TBC

August 'User Interface Technology Demonstrations' – Members & Invited Guests

September 17th 'Green Radio Technologies' – London

October 7th Annual General Meeting (am) & Research Review (pm) – RSA, London

October Industry Steering Groups – All four programmes, dates TBC

Details of monthly Coordination Steering Group teleconferences and of technical meetings for each research theme are available from the relevant Industry Steering Group Chairman or the relevant pages within the members' area of the Mobile VCE website

Mobile VCE is a not-for profit company which undertakes world class long term research for the global communications industry utilising the UK's leading academic research teams.

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