Institution: University of Surrey

Unit of Assessment: UOA 13 Electrical and Electronic Engineering, Metallurgy and Materials

Title of case study: Integrated Satellite and Terrestrial Multimedia Broadcast System

1. Summary of the impact (indicative maximum 100 words)

A new broadcast system involving satellite plus cellular to allow TV and multimedia to be viewed on a handheld or in a car was first proposed by researchers at Surrey. The feasibility was demonstrated within an EU project run by Surrey and then taken to prototype stage via two other EU projects run by industry. A new standard was produced in DVB / ETSI and the EU let licenses for operation. A new company was formed (Solaris-Mobile) by two of Europe's major satellite operators (Eutelsat and SES) who launched a satellite and now operate the system. Investments of circa €200m were made by industry to create this new business.

2. Underpinning research (indicative maximum 500 words)

The basic idea underpinning the system, as proposed by Surrey, is to integrate the satellite broadcast capability with mobile delivery in the urban areas that are shadowed from the satellite.

The opportunity was exposed by Surrey researchers noticing that the mobile allocated satellite bands were adjacent to 3G terrestrial bands and thus a single and simplified mobile handset could be produced to cover both, allowing the satellite signal to be picked up and retransmitted by fixed receivers in the urban areas. In addition it was proposed to have a single integrated resource management between the two systems providing maximum efficiency.

In [1] Surrey demonstrated that only minor changes were needed for operation over the satellite path and an integrated system to be feasible. The integrated resource management was demonstrated by Surrey in the EU project SATIN [2], this being a key element of the system.

Two further EU projects followed, MoDiS (2002) demonstrating the networking principles and MAESTRO (2006) which took the system to a prototype working terminal and operation via a 3G network with a simulated satellite. The latter were led by ThalesAleniaspace but Surrey made major contributions to the research: (1) by producing and demonstrating the resource management scheme [3] and (2) producing models for the propagation between satellite and terrestrial components from measurements made in the trials.

The outcome of MAESTRO was to replace WCDMA in 3G with ofdm (the basis of LTE) as the air interface -- Surrey proved this important update [4], and contributed to technical reports for ETSI/DVB who produced a new air interface standard DVB-SH for the industry to develop equipment.

A Surrey patent was granted on a novel receiver system for this air interface. Subsequent to the commercial interest and take up (see impact template) further research was completed by Surrey on the IP delivery of the services and novel packet schedulers [5,6] were invented that form the heart of the service delivery platform.

The Surrey team was led by Professor Barry Evans throughout. Other key staff; Research Fellows;-Taaghol P, Narentharen K, Fan L, Kasparis C, Research students-Karaliopoulos M, Awoseyila A, Madugamuwa U.,Du H.

3. References to the research (indicative maximum of six references)

1. Taaghol P, Evans B.G.et al 'Satellite UMTS/IMT2000 WCDMA air interface' IEEE Communications Magazine Sept 1999, pp 116-126.
2. Evans B.G, Tafazolli R, Narenthiran K 'Satellite UMTS IP based Network—(SATIN)' AIAA 19th ICSSC conf Toulouse April 2001.
3. Karaliopoulos M, Narentharen K, Evans B.G. et al-Satellite radio interface and resource management strategy for delivery of multimedia broadcast services via integrated satellite and terrestrial systems-IEEE Comms Mag vol 42, No 9, Sept 2004-pp 108-117.
4. Awoseyila A, Kasparis C, Evans B.G. 'Robust time-domain timing and frequency synchronisation for ofdm systems-IEEE Trans on Consumer Electronics vol 55, No 2 pp 391-99, May 2009
5. Du H, Fan L, Evans B.G. 'Adaptive multi dimensional QoS based packet scheduling scheme for multimedia broadcasting over GEO satellite networks' IEEE GLOBECOM 2007, Washington US Nov .
6. Fan L, DU H, Madugamuwa U, Evans B.G-'A cross layer delay differential packet scheduling system for multimedi content delivery in 3G satellite multimedia broadcast systems' IEEE Trans Broadcasting Dec 2008

Patent:

(Awoseyila A, Kasparis C, Evans B.G. 'Frame timing and carrier frequency recovery for frequency selective signals' UK patent GB0803333.4 April 2008.)

EU Framework Projects:

SATIN (1999) - value €3m; MoDiS (2002) - value €7m; MAESTRO (2004) - value €10m.

4. Details of the impact (indicative maximum 750 words)

Impact has been created from the original idea and research on the feasibility of the system. Knowledge transfer to industry involved Surrey working closely with industry in R&D projects. These were first funded by the EU and then funded by private venture funds by industry itself as system definition and products emerged. In this way Surrey was involved in further research which accelerated the movement to a real system.

Knowledge transfer from the University occurred in the following areas;

- Convincing industry of the viability of the system, including-satellite operators, satellite manufacturers, terminal manufacturers and service providers.
- Demonstrating a working system with prototype equipment.
- Convincing EU and ESA to invest €50m in R&D.
- Working with industry to convince DVB/ETSI to develop a new standard for the system.
- Assisting industry to lobby the EU to create a new and harmonised license regime for the system.
- Formation of a new company SolarisMobile with circa €100m capitalisation to run the system.
- Launch of a new satellite and operation of services in Europe.

Thus, from the first research idea created at Surrey in 1999, a system was actually built and launched within 11 years which included the R&D, standards for the industry and agreements on spectrum within Europe. Internationally, Korea launched a similar system in 2008 in partnership with Japan. In the US there have been trials of a similar system and two satellites launched but no commercial service is yet operating.

Impact can be demonstrated in the followings ways:

Economic impact has been created by the ensuing formation of a new business and a new company. Circa 100 jobs and R&D plus satellite rollout of €200m have been created in the sector by just the upstream activity. The potential for downstream wealth creation in terminal sales and services is estimated at around €1B.

Policy impact was created by a completely new intervention by the EU to harmonise the spectrum across Europe. This was the first time that the EU had intervened to operate a 'beauty parade' and to offer pan European licenses.

Societal Impact has been created as the system has enabled multimedia broadcast to reach regions of Europe that wouldn't have been economic with purely terrestrial infrastructure. This has and will continue to contribute to more digital inclusion within Europe and help to mitigate the digital divide that would otherwise exist for the rural and remote areas. Current plans are to extend services to personal protection and disaster warning systems thus adding to the societal impacts.

In recognition the achievement the following statements have been made:

CEO of Solaris says;

'Surrey's role in the formation of this new business area was crucial and was an exemplar of cooperation between academia and industry'

The Chair of ETSI SCN says;

'The SDMB area was unique in rapidly creating new standards and regulations for operation of the system in Europe. Surrey besides being the originator played a key role in the process.'

EU satellite projects coordinator says;

'This is an excellent example of how funding via a series of EU projects can create a new business area. Surrey have played a pivotal role in all of the R&D innovations.'

5. Sources to corroborate the impact (indicative maximum of 10 references)

C1. SATIN website - www.ist-satin.org

C2. MoDiS website - www.ist-modis.org

C3. MAESTRO website - www.ist.maestro.org

C4. CEO of Solaris Mobile (Website-www.solarismobile.com) Contact details provided.

C5. Chair of the ETSI TC SES (SCN WG) Contact details provided.

C6. Senior Associate, Space Services, UK OFCOM. Contact details provided.

C7. EU Project Officer Satellite. Contact details provided.