Orange HSCSD Videophone - Pushing the limits…

Professor Andy Sutton
University of Salford

This article first appeared in the Telecommunications Heritage Journal, Issue Number 85, Winter 2013 and is reproduced with the permission of the Telecommunications Heritage Group

Telecommunications, and in particular mobile telecommunications, is such a fast moving industry that a focused effort is required to preserve this history. What seems like last year's device or network feature is in fact a key part of this industry's heritage, this article aims to contribute to the preservation of such heritage by exploring a project, network technology and device that is already considered legacy, yet set a series of actions in motion that are still shaping our future.

The Orange HSCSD (High Speed Circuit Switched Data) Videophone was first conceived as a concept in the last 1990s, the project formally commenced in 1999. This doesn't seem too long ago however at the time, the concept was revolutionary. The basic idea was to build, from scratch, a videophone that worked on GSM technology, commonly referred to today as 2G technology. The concept was driven by Graham Fisher who managed Orange's UK based Strategy and Technology team. Gaining internal approval for the project took some time however by 1999 the commitments were in place and the project's consortium came together.

The objective was to create a device that was not only a videophone, even then this was considered a niche application, but also a full feature PDA (Personal Digital Assistance), a forerunner to todays tablets PCs. The device would be a GSM phone, with at least the same performance as conventional GSM phones on the market at the time, a still and video camera, a PDA and videophone. The device would support E-Mail and calendar that would be synchronised with Orange.net. Internet access and WAP (Wireless Application Protocol) browser would be standard whilst the video codec itself would be proprietary, partially due to the radical nature of this project and therefore lack of standardised solutions. The design and manufacturing would be supported by specialist companies within the consortium.

Figure 1: Orange Videophone

The main enabler for the videophone concept was the Orange network; the UK network was based on the DCS1800 (Digital Cellular System at 1800MHz) standard, later renamed GSM1800. The use of such a high frequency for a national cellular network had previously been considered unrealistic; however, the growth of cellular telephony had resulted in a need for network capacity as well as network coverage, therefore 1800MHz became a viable frequency band. Given the capacity available to Orange in this band, 2x30MHz (30MHz uplink, between mobile device and base station and 30MHz in the downlink, between base station and mobile device, hence 2x30MHz), it was possible to introduce a new and innovative data technology to the GSM1800 network, this technology was HSCSD.

GSM was designed as a mobile telephony technology, providing digital quality mobile voice for a pan-European market (this of course became a Global market over time, the meaning of GSM also changed from Groupe Speciale Mobile to Global System for Mobile Communications). Data services were added in retrospect, initial data services were based on circuit switching, a similar concept to that of modems over the fixed PSTN (Public Switched Telephone Network). GSM, being a digital cellular standard, required some modifications as unlike previous analogue cellular networks, it was not possible to place the modem at the mobile side of the radio interface, as the analogue tones generated by the modem would be corrupted if passed through the GSM voice encoder. The codec was designed for human speech and as such uses specific coding techniques to generate a digital representation of human voice. To send data over the radio interface, it is necessary for it to remain in digital format. The solution is therefore to place the audio modem at the gateway between the GSM PLMN (Public Land Mobile Network) and the PSTN. This modem function was known as the IWF (Inter-Working Function) and was installed as a shelf within the MSC (Mobile Switching Centre), the mobile telephone exchange.

This original circuit switched data service had a maximum speed of 9.6kbps. HSCSD increased this speed to 14.4kbps in a single GSM TDMA (Time Division Multiple Access) timeslot and, had the ability to operate in a multi-slot mode; therefore two TDMA timeslots could offer a maximum of 28.8kbps. This higher speed of 14.4kbps or two slot 28.8kbps required good radio conditions, if conditions were less than ideal this would reduce to 9.6kbps and 19.2kbps respectively, due to additional coding required to manage the poorer radio interface environment. For various reasons it became clear that the videophone would be an on-net service initially, between Orange customers, no service would be available between different networks, the video telephony service would remain a digital data stream between the two devices. So, the network was enabled, 19.2kbps to 28.8kbps was available to support the next generation of mobile devices, the next step was to deliver the videophone…

The consortium consisted of many partners, each bringing a unique skill set or capability to the videophone project. The research and development of the video codec would be led by the University of Strathclyde, with support from Orange, the OS (Operating System) selected would be Microsoft Windows CE. The development of the video codec can be traced back to an earlier engagement between Orange and University of Strathclyde on HARP (Hutchison/Acorn Research Project), this was a collaborative research project sponsored jointly by Orange, then a member of Hutchison Telecommunications and Applied Risc Technologies, then a member the of Acorn group. The research was conducted at the University of Strathclyde in Glasgow between 1995 and 1997 with the objective of developing video codec technology capable of exchanging high quality images over restricted bandwidths, such as GSM data links and running on low power, general purpose processors of the day. Implementations of the technology were developed on Pentium platforms under Unix and Windows 95 and independently on StrongArm platforms under the ACORN operating system. The final deliverable demonstrated both real-time and off-line compression of video sequences with image quality comparing favourably with standard codec implementations.

Encouraged by this Orange continued to sponsor on-going research work at the University but ART

withdrew from collaboration to continue research privately. The ART work eventually resulted in an implementation of H263 on a strongarm platform which was used to benchmark the final output of the Orange/University of Strathclyde collaboration in 1999.

Microsoft Windows CE was selected as the OS, this was an early edition of the OS as this was first released to market in November 1996. There has been lots of debate about what the CE stands for; some say “Compact Edition” whilst other suggests “Consumer Electronics”. The key benefit was that it was optimised for devices with minimal storage capability; a Windows CE kernel can run in under a megabyte of memory.

The final videophone specification included an Intel StrongArm SA-110 (200MHz) and audio DSP processor, 32MB SDRAM along with 32MB of Flash memory. The radio link was a GSM1800 PCMCIA data card capable of 28.8, 19.2, 14.4 and 9.6kbps. The camera was CMOS fixed focus with 2x electronic zoom, the 3.9 inch screen was reflective TFT colour touch screen, quite a novelty at the time, operated via a stylus provided with the device. The video codec used the Strathclyde compression Transform (SCT) whilst the audio offered hands-free operation via earphones or speaker with echo cancellation. A fully charged battery could support >1hour of video calling, over 6 hours of voice calls and/or PDA usage. The battery would last for 24 hours on standby with the phone enabled.

Typical use cases for this device are illustrated in figs 2, 3, 4, 5 and 6.

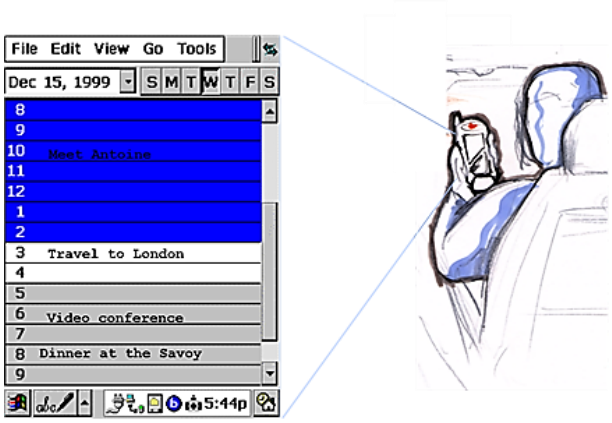

Figure 2: Calendar and diary

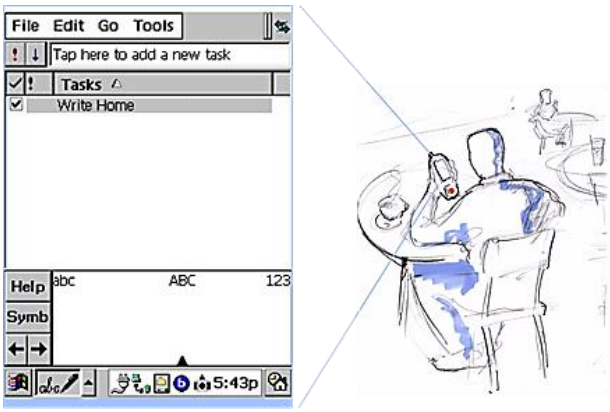

Figure 3: To do lists and notes page

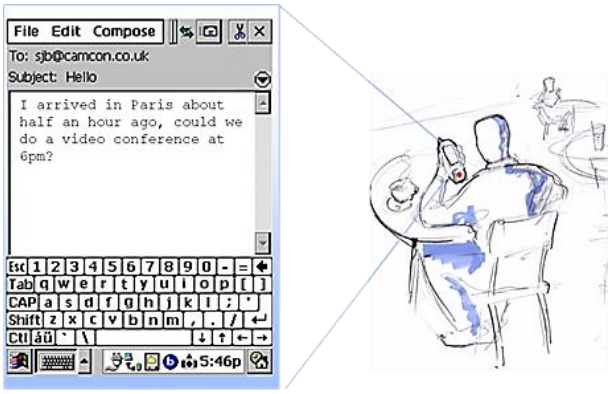

Figure 4: Email on the go

Figure 5: Still and moving image capture, camera and video camera

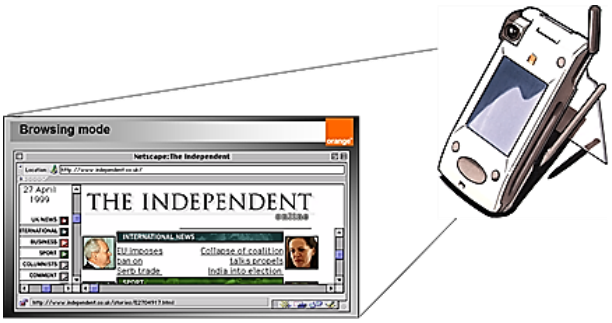

Figure 6: Internet browsing

The possibilities were endless…

The product received plenty of press coverage and generated great interest amongst the general public when launched in the summer of 2000. An Orange customer purchasing a videophone would understandably wish to try it out and is unlikely to have a list of friends who already own videophones. Orange developed a video call centre to address this need and to attempt to understand the practical issues to be addressed when video communication becomes established. The result was surprisingly functional and the field to call-centre video link proved to be among the most compelling use of videophones.

To conclude this article let's take a look at the size of the box and what arrived with the videophone, this is quite remarkable. I'll also review the legacy of the videophone project.

Figure 7: Orange videophone box

I've sat the box from my most recent videophone; we now know them as smart-phones of course, next to the Orange videophone box to offer a representation of scale.

The contents included a cradle, a soft leather carrying case, PC software, charging and connecting cables which included a 9 to 25way D type serial cable adaptor…

Figure 8: Orange videophone and accessories

Look at the size of the instruction manual!

The Orange HSCSD videophone project was hugely ambitious and ultimately successful, delivering a device to market that operated on a 2G/GSM network with services and capabilities that, without this vision, would have required 3G/UMTS to make possible.

Whilst the Orange HSCSD Videophone was a large and expensive device, which wasn't on the market for very long, it did inspire a range of new and innovative GSM smart-phones, the Orange SPV range. SPV stands for Sound, Picture, Video, the name highlight the multi-media capabilities of these new mobile communications devices. The first SPV phone launched late 2002, Microsoft Smart-phone 2002 was selected as the OS. The initial SPV phones supported GSM in three frequency bands, 900, 1800 and 1900MHz, later versions of the device included 3G at 2100MHz. The original SPV phone was eagerly anticipated by the business community; suddenly business went mobile, thanks to the legacy of the Orange HSCSD Videophone

Figure 9: Orange SPV mobile phone

With such a wide range of advanced smart-phones available and in popular use today, it's amazing to think that this phenomena is so young, yet so much heritage is already available for those who wish to study and preserve it.

Figure 10: The author, Andy Sutton, with an Orange videophone

I'm pleased to have an Orange videophone in my collection and to have had the opportunity to contribute this article to ensure that an important piece of early digital mobile telecommunications history is preserved for the future. If you'd like to know more about the Orange videophone, please get in touch.

Find out more from the University of Salford and get in touch with us through:

www.engagingwithcommunications.com

The Telecommunications Heritage Group

www.thg.org.uk