Emerging Technologies Extend INI's Reach

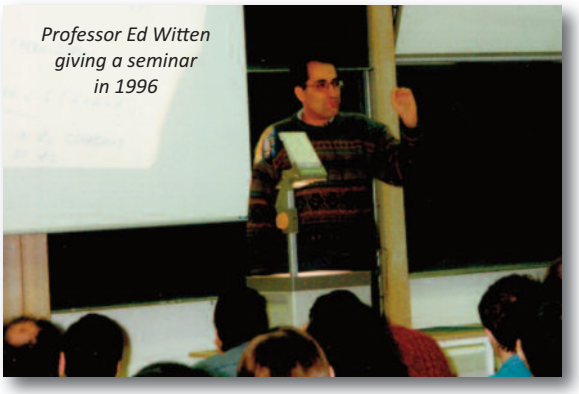
A Case study

24-hour banking. Television on demand. Roaming wifi. We live in a world where the internet rules and on-demand multimedia streaming is ubiquitous: consumers expect access to resources at their convenience. For multimedia resources this means flexible delivery in terms of time, location, format, bandwidth and device.

Since its inception, the Isaac Newton Institute (INI) has embraced emerging technologies and it remains one of the few international visitor research institutes to provide live streaming services.

As early as 1996, as part of the programme *Four Dimensional Geometry and Quantum Field Theory*, a seminar on *Duality and Three Manifolds* by Professor Ed Witten, Princeton, the first Physicist to be awarded a Fields Medal, was video recorded and made available on request. This was shortly after one of the first live-streaming events worldwide, a live radio broadcast over the internet by US-based company ESPN SportsZone of a Major League Baseball game. Audio and video recording of INI events, often with accompanying slide presentations, continued and by 2002 audio recordings of entire workshops were being made available. In 2007, INI installed an AnyCast router and three cameras in Seminar Room One and began to produce HD video recordings.

...the Isaac Newton Institute has embraced emerging technologies and it remains one of the few international visitor research institutes to provide live streaming services.



Professor Ed Witten giving a seminar in 1996

The following year, as Microsoft launched its Smooth Streaming Technology and NetFlix launched its "Watch Instantly" service, INI was routinely streaming live broadcasts of the majority of its seminars. Since then the demand for live streaming and downloads of INI seminars has increased dramatically with almost half a million views of nearly 4000 media items in 2012 alone. This corresponds to a staggering 170TB of data being downloaded in that period, approximately 17 times the amount of data required to store the entire print collection of the Library of Congress.

By streaming lectures INI shares its activities with colleagues in the UK and at large distances or in jurisdictions where it is difficult to obtain a UK visa. An unsolicited email described how academic staff in Brazil use INI lectures and slides from the 2011 *Design of Experiments* programme as part of their graduate teaching. This reflects a significant increase in the impact of INI activities on knowledge and research well beyond the confines of space and time in which the programme is being held, although the essential human interaction between individuals is lost.

This corresponds to a staggering 170TB of data being downloaded in that period, approximately 17 times the amount of data required to store the entire print collection of the Library of Congress.

We see that INI is building up an almost unrivalled resource; indeed in terms of volume of data stored, by a factor of seven it has the largest collection of multimedia items of all colleges and institutes in Cambridge University. This begs the questions: Who is watching INI's online seminars? Where are they watching them? How are they watching them? And possibly most challengingly, why are they watching them?

Answers to some of these questions can be obtained from Cambridge University's Streaming Media Service statistics[1]. For instance, this data reveals downloads in a wide variety of formats including MP3, Flash Video, Windows Media Video, QuickTime and iPod Video with the default format being MPEG-4, an industry standard recognised for its efficiency in compressing data.

Further data analysis shows that viewing numbers are now greatest for China, followed by the USA, France and the UK. Recently there has been a trend towards increased downloads in Asia with six-fold increases in viewing numbers in each of India, China and Iran between 2009 and 2012. Interestingly, there was also an incredible thirty-fold increase in viewing numbers in Greece during the same period.

Streaming media technologies are an excellent vehicle for knowledge exchange and INI's most popular items include:

- A single panel session, *Climate Change Question Time: Policy in the Face of the Uncertainties*, chaired by Oliver Morton (The Economist) with panelists Sir John Beddington (Government Chief Scientific Advisor), Ralph Cicerone (President of the National Academy of Sciences of the USA), Abyd Karmali (Managing Director, Global Head of Carbon Markets, Bank of America Merrill Lynch) and Lord Adair Turner (Chairman, Financial Services Authority and Committee on Climate Change) has reached an incredibly wide audience. With over 14,000 downloads since it was first streamed live at the end of 2010 up until the end of April 2013, it continues to attract hundreds of viewers every month.
- The week-long 2011 LMS *Compressed Sensing* Invited Lecture Series has had 115,000 views up to the end of April 2013
- The 6-month 2009 programme on *Algebraic Lie Theory*, has had 70,000 views of its seminars up to the end of April 2013

INI continues to seek new challenges and take advantage of emerging technologies. In early 2013, a Remote Poster Session was held between participants on the *Mathematics of Liquid Crystals* programme, and graduate students and faculty at the Liquid Crystal Institute at Kent State University. The aim was to bring together geographically separated INI participants and Kent State students and faculty for real-time face-to-face discussions in small groups using social media. With 9 posters, 15 presenters and as many INI participants, the event was hugely stimulating and heralded a great success. Organisers concluded that social media such as Google+ Hangout can provide an effective venue for communicating science remotely, particularly to young people adept with digital technology.

INI Top 10 Seminar Views

Number of views by country during 2012

China	60,408
USA	43,443
France	29,346
UK	21,680
Greece	11,488
Germany	8,603
India	7,238
Japan	6,224
Russian Federation	5,851
Canada	4,560

References

[1] http://sms.cam.ac.uk/institution/INIMS/statistics

Live streaming of seminars and the creation of a world-leading bank of online, freely available mathematics research seminars has been made possible by generous donations from Cambridge University, The Royal Commission for the Exhibition of 1851, through EPSRC's funding of an Audio-Visual Technician, and through the significant and continued support from Cambridge University's Streaming Media Services.

Isaac Newton Institute for Mathematical Sciences
20 Clarkson Road, Cambridge, CB3 0EH, UK
tel: 01223 335999 **email:** info@newton.ac.uk
web: www.newton.ac.uk

The Isaac Newton Institute for Mathematical Sciences is a national and international visitor research centre and runs research programmes on selected themes in the mathematical sciences, with applications in a wide range of science and technology. INI is supported by EPSRC and other Research Councils, private foundations, companies and philanthropy.