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Helena Bijmens
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(editors)



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Anton Knierzinger/Caroline Weigner

EDUCATION HIGHWAY
Innovation Center For School
And New Technology

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2. Executive Summary

2.1. English

Video and sound can support education in Europe in a significant way as they appeal to learning modalities other than the purely textual linguistic ones usually found in traditional learning environments. Their use can also lead to increased visual literacy. However despite the fact that video and sound have been used for educational purposes since television was invented most practitioners agree they have never had the impact that was expected. This is largely due to the many challenges faced in making effective use of video and sound, the expensive and complex delivery process and the lack of integration with other media. It is also probably due to a lack of awareness on the side of most educators as to the didactical opportunities offered by video and sound.

Fortunately, streaming technologies now allow video and sound to be delivered online via IP, making seamless integration with other media possible and resulting in a rich learning environment capable of supporting texts, slides, self assessment exercises, etc.

Practitioner networks using (streaming) video for educational purposes are increasingly common and there are many examples of projects and on-going initiatives in Europe and elsewhere already in existence. It is useful to investigate these examples to understand the various pedagogical, technological and organisational issues that arise in using streaming technologies to support didactical goals in any kind of learning environment.

Aspects of good educational practice in the use of streaming technologies worth mentioning are:

- Streaming an educational event, e.g. a lecture or seminar
- Streaming an external real life event (by inclusion of original material)
- Streaming explanatory documentaries, tutorials, experiments
- Consulting an online library of educational resources
- Constructing and using one's own resources

We have only just begun using this new technology and for the time being, given that it is only available on small screens and at low resolution, the quality may be somewhat disappointing. However it is important to note that despite this reservation, we can now use the Internet to both request and deliver rich media as fast as connections allow us, a development that offers terrific benefits to learners independent of time and place.

The examples of good practise, referred to in this report, can also be accessed on the eStream web site at <http://estream.schule.at>. There is also an option on this site to add comments and/or to add new examples.

2.2. Dutch

Video en geluid spreken vaardigheden aan die minder aan bod komen in traditionele leersituaties waar vooral teksten het uitgangspunt zijn. Daardoor spelen ze een belangrijke rol in de ontwikkeling van het onderwijs in Europa. Bovendien leidt het gebruik van video en geluid in het klaslokaal tot meer ‘visuele geletterdheid’: het geeft meer inzicht in de betekenis van beelden en draagt bij tot een algemene media-educatie. Maar hoewel video en geluid sinds de uitvinding van televisie regelmatig in de klas gebruikt werden, hebben ze toch nooit de verwachtingen kunnen inlossen. Dit is vooral te wijten aan de vele uitdagingen die gepaard gaan met het efficiënt gebruik van video en geluid, met het dure en complexe distributieproces en het gebrek aan integratie met andere media. Een andere reden is waarschijnlijk ook een gebrek aan inzicht in de didactische mogelijkheden van video en geluid.

Gelukkig laten streamingtechnologieën het nu toe om video en geluid online via IP aan te bieden, waardoor een naadloze integratie met andere media mogelijk is. Zo ontstaat er een rijke leeromgeving die zowel tekst, presentaties, interactieve oefeningen, enz. kan ondersteunen.

Netwerken die het educatief gebruik van (streaming) video promoten, worden steeds talrijker. En zowel in Europa als elders vind je alsmear meer projecten en initiatieven die het gebruik van streaming willen bevorderen.

Er zijn verschillende manieren om streaming in het onderwijs te gebruiken:

- Het streamen van een onderwijsactiviteit, zoals een les of een seminarie
- Het streamen van een gebeurtenis uit het ‘echte leven’ (door het gebruik van origineel materiaal)
- Het streamen van documentaires, leerprogramma’s en experimenten
- Het consulteren van een online bibliotheek met educatief materiaal
- Het maken en gebruiken van eigen materiaal

Omdat het gebruik van streamingtechnologieën nog in zijn kinderschoenen staat, kan het resultaat voorlopig wat ontgoochelend zijn, onder meer door de lage resolutie waarin het beeldmateriaal aangeboden wordt. Maar ondanks deze beperking stelt op dit moment het internet ons in staat om zowel multimedia aan te bieden als op te vragen, aan een snelheid afhankelijk van de aard van de verbinding. Dat is een ontwikkeling die, onafhankelijk van plaats en tijd, geweldige mogelijkheden biedt aan studenten.

De voorbeelden uit de praktijk waarnaar dit rapport verwijst, kunnen ook geconsulteerd worden op de eStream website op <http://estream.schule.at>. De site laat eveneens toe opmerkingen en nieuwe voorbeelden toe te voegen.

2.3. Gaelic

Is féidir le fíís agus fuaim tacú go suntasach le oideachas bhunúsach san Eoraip mar go gcothaíonn siad suime i modhanna foghlamtha seachas na cinn bunaithe ar theasc liteartha atá le fáil sna timpeallachtaí foghlamtha thraidisiúnta. Is féidir freisin go stiúirann siad an foghlaimeoir chuig breis scileanna liteartha radharcach. Cé gur úsáideadh fíís agus fuaim san oideachais ó bunaíodh an teilifís, riamh ní raibh an tionchar chomh mór agus a bhí súil leis. An fáth bhí leis seo dar linne, ná na deacrachtaí a bhí ann chun úsáid éifeachtúil a bhaint as fíís agus fuaim, an chóras sheachadúil chasta a bhain leis agus an easpa shnímh le na meán eile. Is dócha freisin go bhfuil cuid den mhilleán ar roinnt mhaith oideachasóirí nár aithin na féidireachtaí oideachasúla a bhain le fíís agus fuaim.

Ámharach go leor, ligeann teicneolaíocht srutha dúinn fíís agus fuaim a sheachadadh ar an ngréasán ar IP, ag ceadú dúinn sníomh ghlan a dhéanamh le meán eile agus dá bhí sin ag cruthú timpeallacht saibhir foghlamtha atá in ann teasc, stiallanna, cleachtaí féin-mheasta agus níos mó fós a thacú.

Tá gréasáin chleachtóirí, ag baint úsáide as theicneolaíocht srutha ag eirí níos coitianta agus tá neart samplaí ar fáil de thionscnaimh agus de threallúis san Eoraip agus in áiteanna eile cheana féin. Tá sé úsáideach dúinn uilig cíoradh éigin a dhéanamh ar na samplaí seo chun tuiscint a fháil ar na gnéithe éagsúla oideolaíocha, theicniúla agus eagraithiúla a éiríonn as bheith ag úsáid theicneolaíocht srutha chun tacú le aidhmeanna múinteoireachta in aon timpeallacht foghlamtha.

Na gnéithe maithe ó thaobh chleachtach oideachasúil gur fiú a trácht orthu ná:

- Taifeadadh agus athúsáid ar ócáid oideachasúil, m.sh. ar léacht ná seimineár
- Bealach isteach agus doimhneacht an fíor-shaoil a chur ar fáil (le ábhar bhunúsach a chur leis)
- Tacú leis an bpróiséis foghlamtha i bhfoirm faisnéisí, ranganna teagaisc agus triail.
- Tógáil agus comhairle i leith leabharlainn áiseanna foghlamtha ar an ngréasán
- Cruthú agus bunú áiseanna pearsanta le roinnt ar dhaoine eile.

Níleamar ach tosaithe ag baint úsáide as an dteicneolaíocht nua seo agus go ceann tamaillín eile, ós rud é nach bhfuil sé ar fáil ach ar scáileáin bheaga, ar bheag-chruinneas íomhá, seans go mbeidh an mianach gann. In ainneoin seo tá sé tábhachtach go dtuigfear go bhfuileamar in ann úsáid a bhaint as an ngréasán chun meáin shaibhir a iarraidh agus a sheachadadh chomh sciopaí agus a ligeann na ceangail dúinn, forbairt suntasach a fhógraíonn buntáistí iontacha do neacha léinn go neamhspleách ar am ná áit.

Is féidir na samplaí maithe oideachasúla, a thagraíodh dóibh sa tuairisc seo, a fheiceáil ar ghréasán eStream ar <http://estream.schule.at>. Tá rogha ar an suíomh seo freisin aon tuairim a chur leis na cin atá ann cheana féin ná aon sampla nua a chur leis an liosta atá at fáil go dtí seo.

2.4. German

Video- und Sound(-dateien) können Bildung und Unterricht in Europa wesentlich unterstützen, da sie andere Lernertypen ansprechen als rein textbasierte Lernunterlagen wie man sie gewöhnlich in traditionellen Lernumgebungen findet. Ihr Einsatz kann auch zur Stärkung der Kompetenz im Umgang mit visuellen Medien beitragen. Obwohl Video und Sound für Bildungszwecke seit Einführung des Fernsehens eingesetzt werden, hatten sie nie die Wirkung, die man eigentlich erwartet hatte. Dies ist weitgehend auf die vielen Probleme zurückzuführen, denen man beim wirkungsvollen Einsatz von Video und Sound gegenübersteht, wie den hohen Entwicklungskosten, der komplexen Produktion und dem Fehlen von Verknüpfungsmöglichkeiten mit anderen Medien. Weiters fehlt es auf Seiten der meisten Lehrenden wahrscheinlich auch am Bewusstsein bezüglich der didaktischen Möglichkeiten die Sound und Video bieten.

Streaming-Technologie macht es heute möglich, Sound und Video über das Internet-Protokoll (IP) zur Verfügung zu stellen und sie damit nahtlos in andere Medien zu integrieren, was zu einer multimedialen Lernumgebung führt, in der Text, Bilder, Folien, interaktive Selbstbewertungsübungen u.v.m. verknüpft werden.

Netzwerke von Lehrenden, die Video (Streaming-Technologie) zu Bildungszwecken einsetzen, sind im Kommen und es gibt bereits viele Beispiele von Projekten und bereits laufenden Initiativen in und außerhalb Europas. Es ist wichtig diese Beispiele zu untersuchen, um die diversen pädagogischen und technologischen Aspekte und organisatorischen Fragen im Zusammenhang mit Streaming-Technologie zu verstehen, um didaktische Ziele in jeder Art von Lernumgebung verfolgen zu können.

Folgende Aspekte des Einsatzes von Streaming Technologie im Bildungsbereich sollen hier erwähnt werden:

- Das Aufzeichnen und Wieder-Verwenden jeder Form von Lehrveranstaltung wie Vorlesung, Seminar, etc.
- Zugang zu Ereignissen des (wirklichen) Lebens außerhalb des Bildungsbereichs in allen Dimensionen durch Verwendung von Original (Video und Sound) Material ermöglichen
- Die Unterstützung des Lernprozesses durch Dokumentationen, videogestützte Tutorials, Videoaufzeichnungen von Experimenten, etc.
- Der Aufbau und Einsatz von Online-Verzeichnissen/Bibliotheken von Lern-Ressourcen
- Der Aufbau und das Zur-Verfügung-Stellen eigener Ressourcen

Wir haben gerade erst begonnen diese neue Technologie einzusetzen und derzeit – unter der Voraussetzung, dass sie nur auf kleinen Bildschirmen bei geringer Auflösung zur Verfügung steht – mag die Qualität etwas enttäuschend sein. Es ist jedoch wichtig hier festzuhalten, dass wir trotz dieser Einschränkung heute das Internet – je nach Bandbreite der Netzanbindung - zur Übermittlung und Bereitstellung multimedialer Inhalte verwenden können und damit am Beginn einer Entwicklung stehen, die ungleiche Vorteile der Zeit- und Ortsunabhängigkeit auf Seiten der Lernenden bietet.

“Best Practice”-Beispiele, auf die sich dieser Bericht bezieht, finden sich auf der eStream Website unter <http://estream.schule.at>. Dort können auch Kommentare und Feedback deponiert, sowie neue Beispiele (Projekte und Initiativen) hinzugefügt werden.

2.5. Greek

Το video και ο ήχος μπορούν να χρησιμοποιηθούν υποστηρικτικά στην εκπαίδευση στην Ευρώπη (και όχι μόνο) καθώς ταιριάζουν σε μεθόδους μάθησης διαφορετικές από τις αμιγώς γλωσσικές μεθόδους κειμένου, που συνήθως απαντώνται στα παραδοσιακά μαθησιακά περιβάλλοντα.. Η χρήση τους, επειδή προσθέτει διαφορετικά οπτικά και ακουστικά ερεθίσματα (λ.χ. μουσική, φωνές ζώων) μπορεί να οδηγήσει σε βελτιωμένο επίπεδο παιδείας, που χαρακτηρίζεται ως «οπτικός αλφαριθμητισμός». Το video και ο ήχος χρησιμοποιήθηκαν στην εκπαίδευση από την εποχή που εφευρέθηκε η τηλεόραση. Παρ' όλα αυτά, η χρήση τους ποτέ δεν είχε την αναμενόμενη επίδραση στην εκπαίδευση. Αυτό οφείλεται κυρίως στις πολλές δυσκολίες που πρέπει να αντιμετωπιστούν για την αποτελεσματική χρήση τους, όπως και στην ακριβή και πολύπλοκη διαδικασία διανομής τους, και τη δυσκολία ενοποίησης τους με άλλα μέσα διδασκαλίας. Επίσης οφείλεται και στην έλλειψη συνειδητοποίησης από τους περισσότερους εκπαιδευτικούς, των εξαιρετικών διδακτικών δυνατοτήτων που προσφέρουν το βίντεο και ο ήχος.

Ευτυχώς, οι τεχνολογίες ροής (streaming technologies) επιτρέπουν τώρα σε εκπαιδευτικά μέσα όπως ο ήχος και η εικόνα βίντεο να φτάνουν on-line μέσω IP (internet protocol), κάνοντας εφικτή την ενοποίηση με άλλα μέσα διδασκαλίας, δημιουργώντας έτσι ένα πλούσιο περιβάλλον μάθησης, που περιέχει επιβοηθητικά κείμενα, στατικές εικόνες που εναλλάσσονται (slides), ασκήσεις αυτο-αξιολόγησης κ.λ.π.

Ο αριθμός των σχολικών δικτύων (ή και ακόμη μεγαλύτερων εκπαιδευτικών δικτύων) που προσφέρουν βίντεο και ήχο ροής (streaming) για εκπαιδευτική χρήση αυξάνει συνεχώς, και ήδη υπάρχουν αρκετά ερευνητικά προγράμματα όσο και προγράμματα υλοποίησης και εκπαιδευτικής εφαρμογής τόσο στην Ευρώπη όσο και σε άλλα μέρη του κόσμου. Η μελέτη αυτών των παραδειγμάτων είναι χρήσιμη, γιατί βοηθάει στην κατανόηση των διαφόρων παιδαγωγικών, τεχνολογικών και οργανωτικών θεμάτων που προκύπτουν από τη χρήση των τεχνολογιών ροής (streaming media) ως υποστηρικτικό διδακτικό εργαλείο σε μαθησιακά περιβάλλοντα κάθε είδους και μορφής.

Ως χαρακτηριστικά καλής χρήσης στην εκπαιδευτική πρακτική των τεχνολογιών ροής (streaming technologies), αξίζει να αναφερθούν τα εξής:

- η λήψη και επαναχρησιμοποίηση ενός εκπαιδευτικού συμβάντος, όπως μιας διάλεξης ή ενός σεμιναρίου
- η μετάδοση μέσω βίντεο ροής (Streaming) ενός πραγματικού γεγονότος που συμβαίνει εκτός σχολείου (σε αυτό συμπεριλαμβάνεται μετάδοση κάποιου ήδη αποκτηθέντος πρωτογενούς υλικού, όπως και η εκπαιδευτική ανάλυση ενός τέτοιου γεγονότος)
- η υποστήριξη της εκπαιδευτικής διαδικασίας με τη μορφή εκπαιδευτικών (επεξηγηματικών) ντοκιμαντέρ, φροντιστηριακών μαθημάτων, ή πειραμάτων
- η κατασκευή και η εκπαιδευτική χρήση on-line βιβλιοθηκών (στο διαδίκτυο) που να περιέχουν πρωτογενές εκπαιδευτικό υλικό υποστηρικτικό της μάθησης
- η παραγωγή και χρήση προσωπικών εκπαιδευτικών πόρων και η διάθεσή τους σε άλλους ώστε να τις χρησιμοποιήσουν.

Η χρήση αυτής της νέας τεχνολογίας μόλις ξεκίνησε. Πολλά από τα video είναι διαθέσιμα σε χαμηλή ποιότητα ανάλυσης (low resolution), και πολλά χρησιμοποιούν μικρό μόνο τμήμα της οθόνης (small frame size), και έτσι η πρώτη εντύπωση μπορεί να είναι κάπως απογοητευτική. Ωστόσο, είναι γεγονός ότι μέσω του διαδικτύου (internet) μπορούμε πλέον να αναζητήσουμε και να λάβουμε πλούσιο εκπαιδευτικό υλικό με ήχο και εικόνα, τόσο γρήγορα όσο μας επιτρέπει η δικτυακή μας σύνδεση. Η προοπτική αυτή προσφέρει θαυμάσια πλεονεκτήματα στους εκπαιδευόμενους, κυρίως γιατί απελευθερώνει τη μάθηση από τοπικούς και χρονικούς περιορισμούς.

Τα παραδείγματα καλής εφαρμογής που παρατίθενται στο παρόν κείμενο αναφοράς μπορούν επίσης να προσπελαστούν στο δικτυακό τόπο του eStream στην ιστοσελίδα <http://estream.schule.at>. Στον διαδικτυακό αυτό τόπο υπάρχει, ακόμα, η δυνατότητα να προσθέσετε δικά σας σχόλια ή ακόμα και νέα παραδείγματα.

2.6. Italian

Le componenti audio e video possono supportare l'educazione di base in Europa in modo rilevante, dal momento che fanno appello a modalità di apprendimento "altre", diverse rispetto a quelle puramente testuali che normalmente vengono usate nell'insegnamento tradizionale. Il loro uso può, inoltre, condurre ad aumentare l'alfabetizzazione "visuale" e quindi educare all'immagine. Sebbene video e suono siano stati usati con intenti educativi da quando è nata la televisione, non hanno mai avuto l'impatto atteso.

Questo è stato largamente dovuto alle molte sfide fronteggiate nel fare un uso efficace di queste tecnologie, al costoso e complesso processo di trasmissione e all'insufficienza di integrazione con altri media. Questo è stato inoltre probabilmente da imputarsi sia alla mancanza di preparazione della maggior parte degli educatori sia alla scarsa conoscenza delle opportunità offerte dalla componente audio e video.

Fortunatamente, le tecnologie streaming ora consentono la trasmissione di questo tipo di media via IP, rendendo possibile allo stesso tempo l'integrazione con altri media e l'arricchimento dell'ambiente di apprendimento tramite testi, slides, esercizi di autovalutazione, ecc.

Network di professionisti che usano (streaming) video con scopi formativi stanno cominciando ad essere sempre più significativamente diffusi. A tale proposito, inoltre, sono numerosi gli esempi di progetti e di iniziative in corso in Europa e altrove. Risulta particolarmente utile indagare questi esempi per affrontare consapevolmente, dal punto di vista pedagogico, tecnico e organizzativo, l'uso delle tecnologie streaming con obiettivi didattici e in ogni tipo di ambiente di apprendimento.

Gli aspetti degni di essere menzionati come buone prassi nell'uso di tecnologie streaming in campo educativo sono:

- La registrazione e l'utilizzo ripetuto di un evento educativo, come ad esempio una lezione o un seminario
- L'accesso attivo ad eventi esterni (tramite il contributo di materiali originali)
- Il supporto al processo educativo nella forma di documentario, tutorial, esperimenti
- La costruzione e la consultazione di una biblioteca online di risorse e materiali di apprendimento
- La costruzione e la condivisione delle risorse e dei materiali individuali

Si è appena cominciato ad utilizzare questa nuova tecnologia e, allo stato attuale, dato che è disponibile solo su schermi ridotti e a bassa risoluzione, la qualità può essere a tratti scadente. Tuttavia, è importante sottolineare che, nonostante questi limiti, è ora possibile avvalersi di Internet per richiedere e trasmettere media a seconda della connessione possibile. Questa è una possibilità che offre ai discenti importanti benefici, indipendenti dal luogo e dal tempo.

Gli esempi di buone prassi raccolti in questa relazione sono reperibili anche sul sito web del progetto eStream alla URL <http://estream.schule.at> dove è inoltre possibile aggiungere commenti e/o nuovi esempi.

2.7. Swedish

Video och ljud kommer att kunna stödja skolutbildning i Europa på ett högst märkbart sätt då detta gynnar nyttjande av andra lärmedia än de textburna som oftast används i det traditionella lärandet. Dess användning kan även leda till ett ökat läsförståelse. Även om video och ljud har nyttjats i utbildningsyften sedan televisionen uppfanns så har det inte haft den influens på lärandet som man skulle kunna förvänta sig. Detta är till stor grad beroende av de utmaningar som det innebär att effektivt nyttja dessa media, den kostnad och komplexitet som det innebär, svårigheter med integreringen till andra media, samt bristen på insikt om de pedagogiska möjligheterna med video och ljudmedierna bland de flesta utbildare.

Lyckligtvis tillåter 'streaming' teknologin nu dessa media att ske med nätburen levereras via IP, vilket möjliggör en sömlös integration med andra media och som i sin tur resulterar i berikade lärsituationer som kan stödja text, bilder självstyrda övningar, etc.

Användningen av streaming video för utbildningsändamål är allt vanligare och det finns många exempel på projekt och pågående initiativ både i Europa och på andra kontinenter. Det kan vara värt att studera några av dessa exempel för att förstå de pedagogiska, tekniska or organisatoriska frågeställningar som uppstår vid användningen av streaming teknologi för stöd till pedagogiska ambitioner i olika lärsituationer.

Som exempel på goda praktiska utbildningsapplikationer av streaming teknologin som kan vara värda att begrunda kan nämnas:

- Inspelning samt återanvändning av ett lärtillfälle, en lektion eller föreläsning
- Ge tillgång till och förståelse av livssituationer (genom faktisk material)
- Stöd till läroprocesser i form av dokumentärer, förklaringar och experiment
- Sammanställning och nyttjande av ett bibliotek med lärresurser
- Produktion och utbyte av egna och andras lärresurser

Då vi bara är i början av nyttjandet av denna nya teknologi och för tillfället, med den begränsade bildstorleken och den låga resolutionen, kan vi i vissa fall bli besvikna på dess kvalitet. Faktum kvarstår dock att vi nu genom Internet kan båda kalla upp och leverera berikade lärmedia så snabbt som våra nätkopplingar tillåter oss, en utveckling som ger fantastiska fördelar bl.a. till ett tids- och platsoberoende lärande.

Illustrationer på goda exempel, refererade till i denna rapport, kan också nås från eStream projektets hemsida; <http://estream.schule.at>. Det finns även möjligheter på denna webbplats att både kommentera exemplen och att bidra med egna goda exempel.

3. Introduction

The objective of this report is to describe the 'state of the art' of streaming media technologies in education, to highlight opportunities for their use in education and to provide practical, hands-on information for everyone interested in planning a streaming activity.

It is aimed at those working in compulsory-level education (basic, primary or secondary) particularly teachers and ICT decision-makers and support staff within schools and school networks. It is also aimed at content developers and distributors.

3.1. Outline

The report is divided into 10 main sections:

- **Streaming explained** provides the reader with a basic technical understanding of streaming, how it works and how it differs from other media.
- **Streaming in education** provides information about how streaming technologies are being used in education, what the pedagogical advantages are and how education providers should plan their streaming activities.
- **Creating streamed media** explains the process of creating streaming media and what cost and service considerations should be taken into account.
- **Standards and multimedia formats** gives an overview of the most common standards and multimedia formats.
- **Future developments** describes the technology evolutions that will have an impact on the future use of streaming in education.
- **Case studies** provides the reader with a selection of case studies that describe a relevant or revealing usage of streaming media in higher education, compulsory education or continuing education.
- **Useful tools** provides an overview of tools and techniques that can be used to support educational applications of streaming.
- **Networking and support consortia** gives information about initiatives and consortia that have specifically chosen to support the use of streaming media in education and to disseminate information about its use at national, regional, or some other level.
- **Glossary**
- **Further resources**

3.2. Background

PROJECT BACKGROUND

This report has been written in the framework of the eStream project, funded by the European Commission within the SOCRATES – MINERVA programme from October 2003 to October 2006. eStream is coordinated by EDUCATION HIGHWAY, Linz (Austria). Project partners are ATiT (Belgium), CSP (Italy), Mayo Education Centre (Ireland), University of Patras (Greece), and the Swedish Telepedagogic Knowledge Centre (Sweden).

In Europe, it is clear that there is a lack of awareness about the huge educational potential of streaming media for school education. There is also an urgent need to compare and evaluate the impact of these emerging technologies on the learning process and of their pedagogical effectiveness. Given this context, the role of eStream is to explore the possibilities and further encourage the use of streaming technologies for educational and organisational tasks in school education. By providing insight and knowledge about the effectiveness of streaming technologies in education, eStream is therefore making an important contribution to the media education of teachers and pupils in Europe.

The aim of the project is three-fold:

- to promote the exchange of experiences and to share good practise on the use of streaming media for school education/in classroom practise in Europe, taking into account pedagogical, organisational, economical and technical aspects
- to raise awareness and to promote a better understanding as to the educational potential of streaming media by disseminating good practise to European school education systems at various levels
- to address educational/didactical aspects of the use of streaming media by actively involving the end users

An important objective of eStream is to find out in which way the use of streaming media in school education influences and innovates teaching and learning. This includes the impact on school organisation and questions linked to the distribution of media as well as how streaming media might contribute to the promotion of the European dimension in education.

The eStream website (<http://estream.schule.at>) functions as an important tool for dissemination and sharing of experiences and good practise. An online forum will address the issue of sharing of streaming material between the partner countries. Technical, financial, legal and educational aspects will be taken into consideration as well as questions related to standardisation, multilinguality and the issue of cultural and contextual adaptation of content.

Eventually, forthcoming technical standards will be explored, jointly discussed and brought into other fora where streaming media are discussed.

eStream will apply existing, state-of-the-art and off-the-shelf solutions as far as they are or become available. eStream will also act as an observatory for technology development as well as for developments and trends related to pedagogy and content.

eStream will provide a final conclusive report aimed at regional, national and transnational decision-makers, teachers, teacher educators, trainers and multimedia companies throughout Europe. This report will promote innovation in education through the use of streaming media.

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For Chapter 8, 9 and 10, input has been received from the eStream project partners who contributed in the identification and description of case studies, technical projects and networking initiatives.

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¹ Names are given in alphabetical order.

4. Streaming Explained

Ever since the inception of the web, educators have been interested in the use of multimedia. The earliest web-based multimedia took ages to download and occupied large amounts of disk space on the viewer's computer. With the introduction of streaming technologies, multimedia consisting of video, audio, data and/or text can at last be transferred over the Internet or Internet-like networks relatively simply. It can then quickly and efficiently be embedded within web environments and integrated with text, images, graphics, etc.

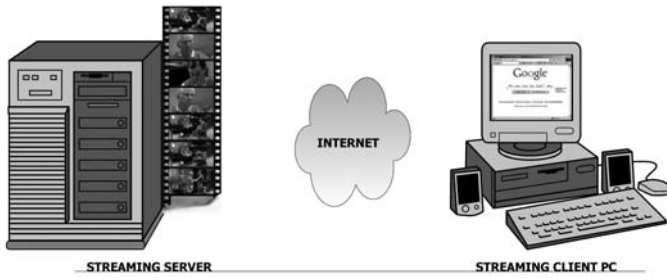
Media players such as Apple's QuickTime have been around since 1992 but streaming was really pioneered in 1995 by RealNetworks with their RealPlayer, an invention of former Microsoft engineer Rob Glaser. Soon after the introduction of RealPlayer, streaming clients from Microsoft (Windows Media Player), Apple (QuickTime), VDOLive, Vivo Active, Macromedia (Shockwave or Flash) and others became available.

Streaming media technology allows real time or on demand delivery of multimedia. Using Internet based technologies, what happens is that media data are transmitted to the user while the media is being viewed. Video, voice, text or data are received in a continuous or almost continuous stream. Applications begin displaying these media as soon as enough data has been transferred from the streaming server to the receiving station's buffer. Streaming media is about access, and not so much about quality: pictures may be a bit blurry and the sound sometimes poor, but when a user clicks on a streaming link and gets media on-demand, wherever he or she may be, the result can be really powerful. And fortunately, streaming tools are rapidly improving, resulting in higher quality and even better access.

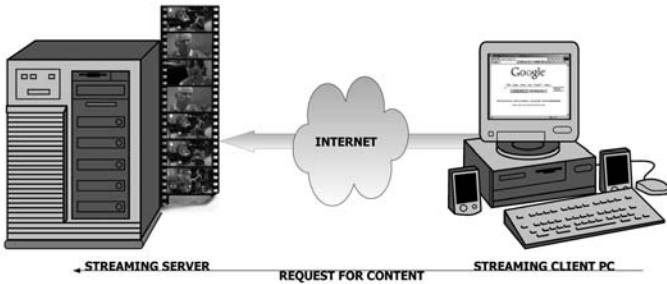
Is streaming necessarily done via the Internet? There is a lot of confusion about the network requirements or network architecture that is at the heart of streaming. Most definitions refer to the Internet as the enabling network, but in our examples and case studies, there are some applications that are called streaming but that do not necessarily use the Internet as the transmission network at all. What we see as common is the use of IP-based technologies: all streaming servers and clients depend on IP as the protocol of choice to prepare the streams for serving and accessing.

4.1 How does video streaming work?

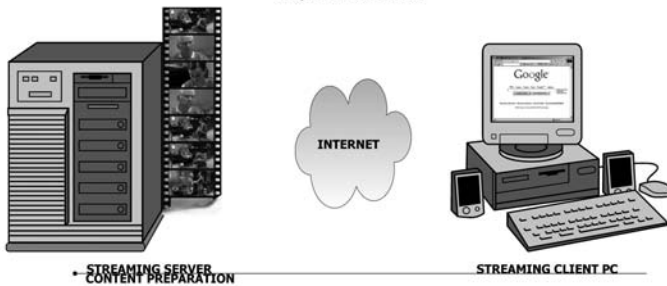
In order to play smoothly, video cannot be interrupted. Until recently with poorly performing networks and a lack of bandwidth, video had to be downloaded in its entirety to a computer before it could be played. With streaming, the requested media file residing on the streaming server is sent to a buffer on the client computer and starts to play as soon as enough of the file has been buffered. The server then regulates the stream according to network congestion.



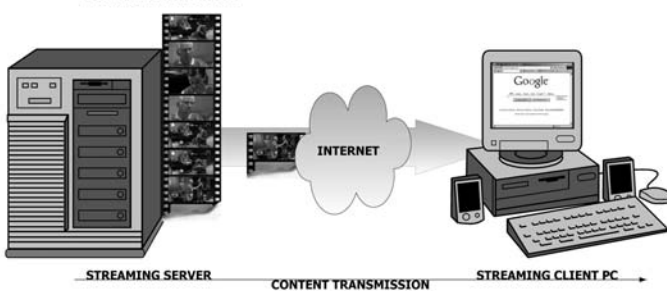
Step 1: User connects to streaming server



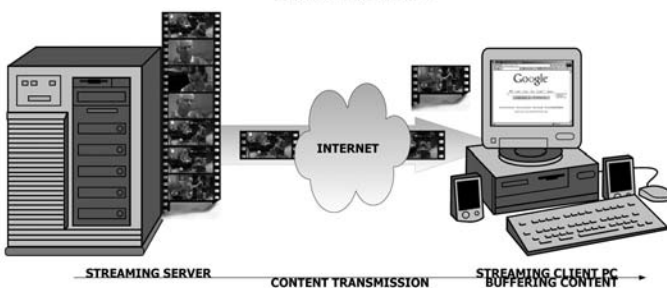
Step 2: User requests streaming media from server



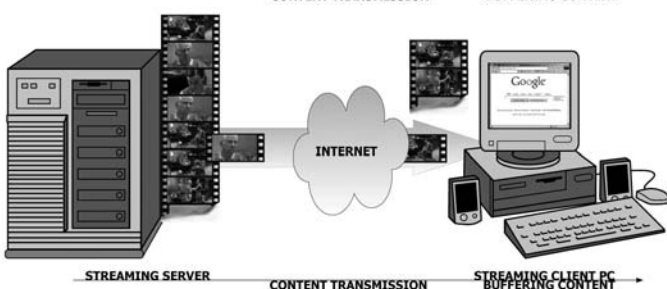
Step 3: Streaming server acknowledges request and prepares for the transmission



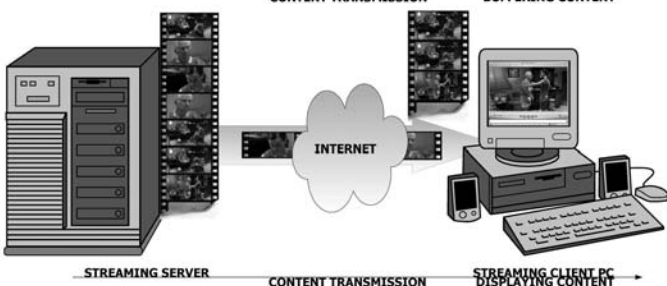
Step 4: Streaming server sends first parts of the media



Step 5: Streaming client buffers first incoming media parts



Step 6: Buffer fills up until sufficient media parts have reached the client



Step 7: Streaming client starts displaying media while server keeps transmitting additional media parts

4.2. Streaming vs. other types of delivery media

TV and radio are the most common technologies for the transmission of media content. They are in essence online media in the sense that one needs to switch on the receiver to be able to select and display the radio or TV programme that is on *at that moment*. Radio and TV are not on-demand: it is the broadcaster who decides for you what you will see at any particular moment in time.

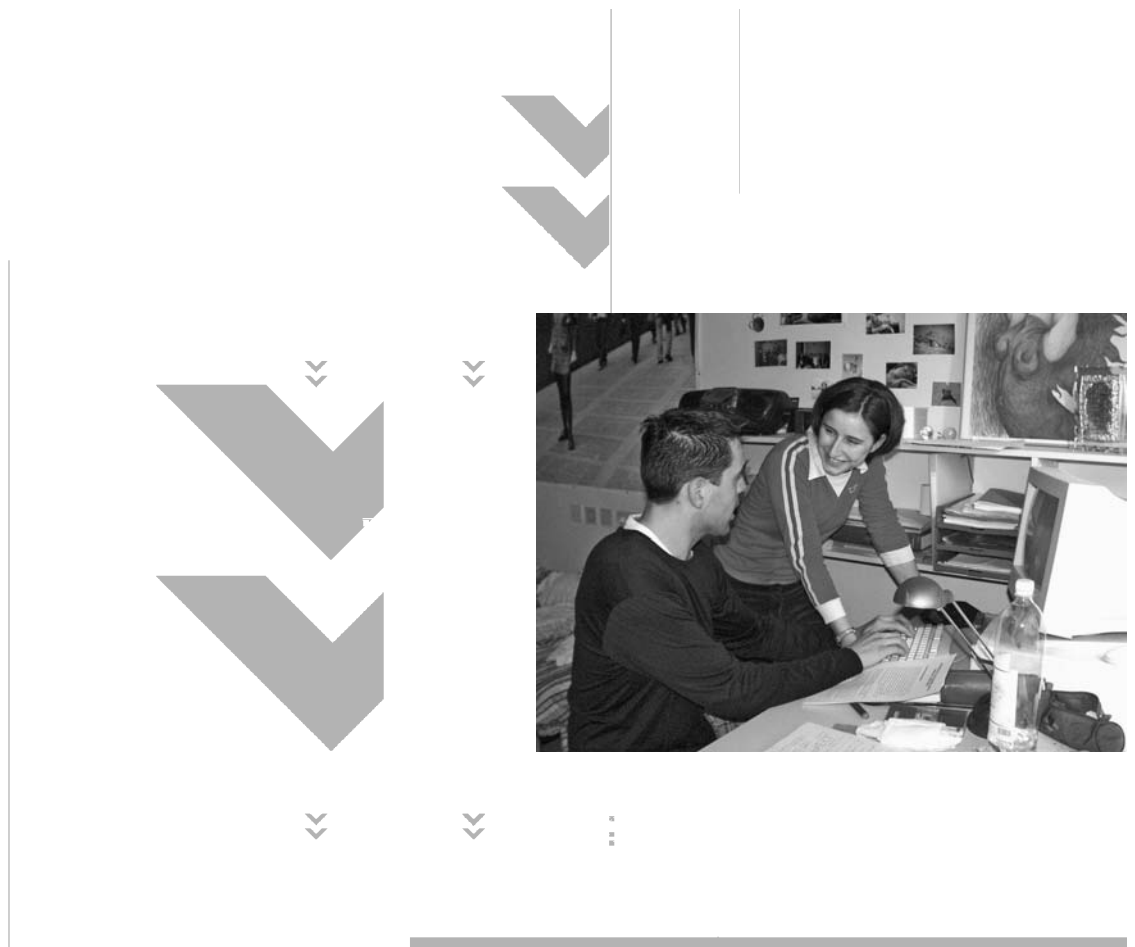
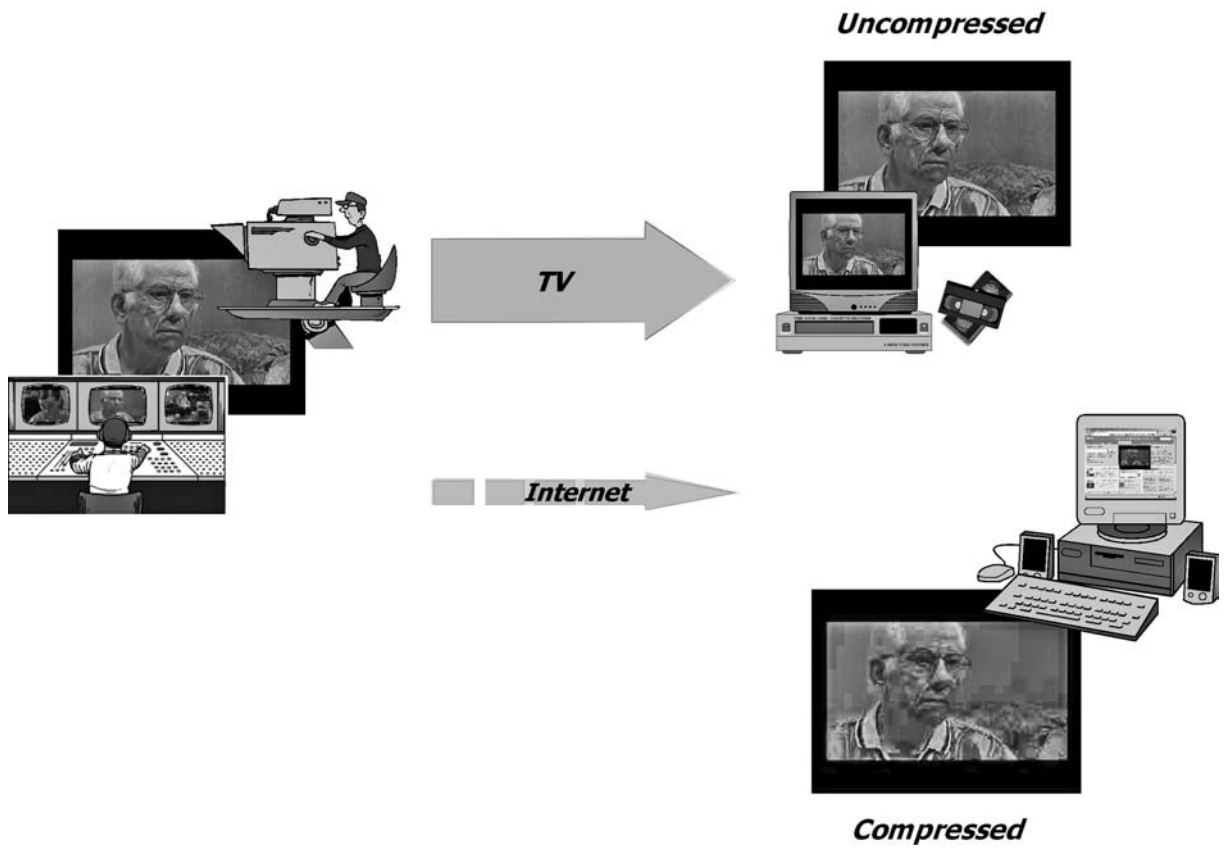
Thanks to the invention of the recorder (tape, cassette, videocassette, etc.) it is now also possible to record a particular programme and to display it later. This means that the viewer has to make the recording *exactly at the time of the transmission* and that he/she then has to store the recording (in whatever format that is, tape, cassette, even disk) until the moment when he/she wants to review it. Video and audio recordings of TV programmes are not on-demand.

Video and audio becomes an on-demand service with the advent of video rental shops, or public media libraries. These are places where you can go to select and take away the media programme of your choice, depending upon availability.

Streaming brings all of this together: displaying ad hoc and online transmissions, in some cases being able to record the transmission (or to download the media and store it in digital format locally for later re-use), or going to collect a media for immediate display or for recording. Streaming is different because it goes beyond the reach of ordinary TV and radio transmission channels (beyond the reach of transmission antennae, and beyond the reach of cable TV networks). Streaming is not restricted to a physical location but only to the quality of your connection to the network: sitting at your desktop, you can watch a programme broadcast by an American, Japanese or local TV station. Streaming offers more in that it can be embedded in a web page, which might provide additional information, links to related pages, for example, where interactivity might be offered in games, quizzes, etc.

4.3. The quality of streamed media

The media that are streamed to you have, at their origin, exactly the same images as you see on your TV screen and/or the same sound that you hear on your radio station. But as they are streamed to you on your PC, they do not look and sound quite as good. This is because radio and TV transmission via the airwaves or via Cable TV allows for the best possible transmission quality. When you want to transfer the same images and sound over an Internet connection, they need to be compressed in order to fit within the bandwidth that is provided by the connection you are using, even when this connection is called broadband. A simple experiment, switch on your radio to your favourite station, now make a phone call to a friend or colleague in another location and ask him or her to switch on the same radio station at their end and to put the telephone receiver near the radio receiver. You can now compare the uncompromised quality via radio and the compressed quality via a telephone line. Radio has a bandwidth of about 20,000 Hz, telephone has a bandwidth of less than half of that.



5. Streaming in Education

5.1. *Image and sound in education*

Images and sound, photographs, film and video, radio and TV have a long history in education. Back as far as 1910, film was introduced in public schools in Rochester, New York. In 1934 the State University of Iowa began televised course broadcasts in subjects including oral hygiene and identifying star constellations. In 1976 a Japanese electronics company launched the VHS format, a tape format that allowed consumers to record video programmes.

In 1922, the famous inventor Thomas Edison declared „I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks.“

Since film was first introduced in schools, nearly a century ago, a succession of moving image technologies have rapidly been taken up by the educational sector: film, television, videotapes, videodisks, digital desktop video, multimedia, CD-ROM, interactive TV and now web-based media. The reason for this is that they add authenticity and reality to the learning context, bringing the course content alive. Since the late 1980's, with the introduction of videotapes, videodisks, digital desktop video, multimedia and CD-ROM, a new feature, interactivity, has given moving images added educational value by providing easier and more controllable access for the user to the materials. With the advent of interactive video, the focus shifted from representation of images to control. Now the learner can control the pace and the content of whatever he or she is watching, choosing the parts of the video to be shown, pausing, rewinding and forwarding whenever necessary, independent of time and location. Before interaction became possible, video could be used only as a presentation tool, focussing on the moving image itself. In a classroom context, everyone watched the same sequences, chosen by the teacher, at the same moment in time which meant that students passively viewed whatever the teacher had decided they should view.

Rosenberg (2001): “the main reason why television did not become everyone’s teacher was because it lacked the very essential quality of teaching: the ability to interact with the learner.” With “interactivity” Rosenberg does not mean “computer-human transactions” but rather the original sense, namely “access” or the availability of material asynchronously and independent of location, “choice” or the possibility of on-demand viewing of materials, and “control” or the possibility to start, stop, pause, skip and review material.

But, despite the multiple educational values (like orientation, motivation, illustration, contextualisation) of an interactive media-enhanced environment, the widespread use of these media was always limited by production costs and delivery difficulties. This ensured that Edison's prediction remained untrue. This was despite the fact that production costs have significantly dropped due to the availability of cheap and high quality cameras, recorders and editing equipment.

Two reasons may be at the heart of why there is a slow take-up of such media in the classroom. First of all, there remains a huge lack of awareness amongst end-users (teachers, tutors, course designers) as to the pedagogical and didactical opportunities offered by such media, which is not helped by a general lack of media and digital literacy. Our focus has always been upon learning from the word rather than from the image and by consequence, we are often unable to create videos that are really *moving* and *engaging*. Secondly, even when you have finally managed to produce a piece of video that you really want to show to others outside your immediate circle of friends and family, access to cheap and effective distribution mechanisms is often not available. Copying on videotape, or on disk is a possibility but transmission via the air or satellite is simply not accessible to end users.

This is where the Internet becomes important. The Internet is already around for some time, in fact as far back as 1969 we already had its first predecessor. In 1982 Vint Cerf and Bob Kahn created Transmission Control Protocol/Internet Protocol (TCP/IP), which became the corner stone technology of the Internet. In 1991 Tim Berners-Lee developed the first code for the World Wide Web (WWW) at CERN (Conseil Européen pour la Recherche Nucléaire) which immediately generated enthusiasm due to its ability to integrate text, sound, and graphics.

In 1984 Seymour Papert says: “I think the computer will blow up the school. That is, the school defined as something where there are classes, teachers running exams, people structured in groups by age, following a curriculum— all of that.”

Thanks to the Internet, media delivery has been revolutionised by the growth of the web as an integrated educational medium together with the rapid uptake of web-based video streaming technologies.

The Internet has not only facilitated the distribution of content, but it has also added another interesting potential to the use of video in the classroom, namely “integration” as it is called by Thornhill, Asensio and Young (2002). Learners view videos together with other learning materials, such as slides, supporting texts, chat, discussion groups, references, quizzes, etc. that are related or linked to them. Streaming videos together with these other materials constitute a “Virtual Learning Environment”. Or in other words, one has only to access one medium, the Internet, in order to view all the materials. In our D-Lecture case-study (Chapter 9), you can, for example, view a recorded lecture and at the same time, view the PowerPoint slides that are related or linked to it. In the Ashcombe Digital Video project, you can watch a foreign language video and at the same time do some self-assessment exercises on the content presented in the video.

This integrative combination of digital video with other tools converts video as a passive presentational tool into a dynamic medium that complements and adds visual richness to static text and graphic content.

Nelson said in 1987 “the trouble with interactive media is that they all tend to be closed objects that can’t be combined or viewed together (whereas books can quote each other and lie open at once on the same desk).”

Asensio and Young (2002) summarise the history of video in education as follows:

Phase	Medium	Control
image	film, television, videotapes	teacher in control
image and interactivity	videodisks, digital desktop video, multimedia, CD-ROM	learner in control
image, interactivity and integration	web media	distributed control

Despite the potential of streaming media to combine the three aspects of “image”, “interactivity” and “integration”, it does not mean that all streaming applications are necessarily characterised by them. An online library of video resources lacking metadata or related materials will have a low integration ratio. Educational events, such as seminars and conferences, which are streamed live and where the learner control is limited to play and stop, will score low when it comes down to interactivity since watching the event at your own pace is not possible.

5.2. Educational Applications

Streaming technologies can be used for several audio-visual educational applications. We have distinguished 5 types of categories based on the typology of Peters and Collis (2000) and Asensio (2002):

1. Streaming an educational event
2. Streaming an external life event
3. Streaming explanatory documentaries, tutorials, experiments
4. Consulting an online library of educational resources
5. Constructing and using ones own resources

5.2.1. STREAMING AN EDUCATIONAL EVENT

Events or lectures can be recorded and broadcast on the internet and/or they can be stored in an online archive where they can be viewed later on-demand. A sense of direct involvement and “physical presence” is built. Furthermore, “virtual” guest lectures from outside experts are possible regardless of time and geographical constraints. A recording can be used in more interactive ways by, for example, assigning tasks to the students that refer to certain fragments of it.

Best Practise Example: D-Lecture – Bremen University, Germany

D-Lecture is a web environment whereby previously recorded university lectures are shown, together with accompanying materials such as a PowerPoint presentation, documents, simulations, etc. The video image is embedded in the left hand window with the slides on the right. Both video and slides are synchronised and both have interactive control buttons. Thus clicking back to slide 10 will bring up the appropriate section of video, or fast forwarding the video will cause the slides to catch up. The user can also navigate using the menu of bookmarks on the left of the video image. This is also synchronised. More information about D-Lecture can be found in Chapter 9.

The screenshot displays the D-Lecture web interface. At the top, the browser address bar shows http://www.d-lecture.de/Demo_Kirchner/index.htm. The page header includes the logos for 'Universität Bremen' and 'ZMML', along with the text 'Bremen Briteline'. Below the header, the title '@ - Lecture Digitale Veranstaltungen' is visible, followed by the event details: 'Veranstaltungsdatum: 12.06.2003' and '© Bremen Briteline GmbH 2002 Master Programme in European and International Law - Dr. Andree'.

The main content area is split into two sections. On the left, a video window shows a lecturer at a podium. Below the video is a 'Gliederung' (Table of Contents) menu with 13 items, where '2. Today's topics' is selected. On the right, a slide presentation titled 'Law of the Sea and International Marine Environmental Law' is displayed. The slide lists 'Today's topics' as follows:

- New developments in ocean affairs
- Amendments to UNCLOS (Art. 312 *et seqq.*)
- Marine Scientific Research (Part XIII)
- Development and Transfer of Marine Technology (Part XIV)

At the bottom of the slide presentation, there are five tabs: 'Folien', 'Notizen', 'Links', 'Hilfe', and 'Kontakt'. The 'Folien' tab is active, showing a grid of slide thumbnails.

<http://www.d-lecture.de/>

Education providers who wish to implement this type of streaming application into their teaching practises could use the following template when planning the activity:

Step 1: Defining your objectives

- Who is your audience?
- What are your instructional goals?
- What media will meet these goals?
- How will learners use the media in order to meet these goals?
 - On-demand vs. Live
 - Location (home/classroom)
 - Individual/group activity

- Level of interactivity
- Level of integration

Step 2: Capture the media content

- ⊙ Idea
- ⊙ Scenario
- ⊙ Shooting
- ⊙ Capture and edit
- ⊙ Compression

Step 3: Make a web site

Step 3a: Design and create the web site, if it doesn't exist yet

Step 3b: Plan the media content

- ⊙ Organise and label the media content on the web site
- ⊙ Create material so it can be easily found, divided and structured

Step 3c: Plan the support materials (text, slides, quizzes, etc.)

- ⊙ Organise support materials on the web site

Step 3d: Plan a feedback mechanism

- ⊙ Design and set-up of the communication and collaboration channels, if any
- ⊙ On-line (e-mail/forum/chat/webcast etc)
- ⊙ Off-line (telephone/face-to-face/in class etc)

Step 4: Learner activities

- ⊙ Prepare the learners:
 - inform learners about the purpose of the video(s), explain where they fit into the curriculum and go over any advanced concepts and vocabulary the video will cover
 - inform the learners about organisational issues (login, technical requirements, etc)
- ⊙ Learners view media content and support materials
- ⊙ If classroom activity, stop or pause the video stream and explain key points to make sure that the class understands the information they are seeing in the video AND how it relates to what you are doing in the lesson.

Step 5: Learners do something with what they have learned

To reinforce what they have just seen,

- ⦿ The learners complete certain tasks
- ⦿ The learners answer certain questions
- ⦿ The learners participate in a discussion
 - on a certain topic
 - online or offline

Step 6: Assessment of learners

- ⦿ exams yes/no

Step 7: Evaluation of the streaming application

- ⦿ Do you, as a teacher, consider this as a successful teaching experience and why?
- ⦿ Do the learners consider this as a successful learning experience and why?

Step 8: Future implementation

- ⦿ Has this experience led to new ideas or plans?
- ⦿ What elements will be kept and what will be done differently?

5.2.2. STREAMING AN EXTERNAL REAL LIFE EVENT

In this situation, streamed materials provide access and depth to real life events that happen, by their very nature, outside the classroom. The purpose of this application is to be able to view an outdoor action that cannot be physically brought into the classroom: political recordings, sports events, wildlife, linguistic samples, a fashion show or a dramatic performance. When these real life events are brought into the context of the formal classroom, they can be observed, analysed, interpreted and discussed. Live recordings of outdoor scenes also belong to this category.

Best Practise Example: Parliament Live UK

This public web cast coverage of parliamentary proceedings started as a pilot project in January 2002 and was permanently launched in September 2003. Parliament Live carries live audio-visual coverage of the Chambers of both the House of Commons and House of Lords and of Sittings in Westminster Hall. The recordings also offer captioning to aid the identification of speakers as well as direct links to order papers and other background material available on the Parliamentary web site www.parliamentlive.tv. All live recordings are stored in the archive so they can also be viewed later. This site is not intended specifically for education providers but can be used in the classroom to initiate discussion.

<http://www.parliamentlive.tv/>

Education providers who wish to implement this type of streaming application into their teaching practises might like to use the following template when planning the activity:

Step 1: Define your objectives

- Who is your audience?
- What are your instructional goals?
- What media will meet these goals?
- How will learners use the media in order to meet these goals?
 - On-demand vs. Live
 - Individual viewing/viewing in groups
 - With/without supervision
 - Location (home/classroom/elsewhere)
 - Level of interactivity
 - Level of integration

Step 2: Plan your content

- What real life event will be shown?
- What are the supporting materials and where and how can they be consulted or how will they be taught?

Step 3: Plan a feedback mechanism

- ⊙ Will the learners be able to ask questions and provide comments
 - To other learners
 - To the teachers
- ⊙ How will this happen?
 - On-line
 - Off-line

Step 4: Integration of media with student activities

- ⊙ Preparation of the learners
 - Introduce video (who has made it, where, what is shown)
 - Explain purpose (why is it to be watched by the learners, where does it fit into the curriculum)
 - Explain what to watch or listen to especially
- ⊙ Students view clip
- ⊙ If classroom activity, stop or pause the video stream and explain key points to make sure that the class understands the information they are seeing in the video AND how it relates to what you are doing in the lesson.

Step 5: Learners do something with what they've learned

- ⊙ Learners complete certain tasks:
- ⊙ Learners answer certain questions:
- ⊙ Learners participate in a discussion
 - on a certain topic:
 - online or offline

Step 6: Learners assessment

Step 7: Evaluation

- ⊙ Develop an evaluation mechanism in order to understand whether
 - You as a teacher consider this to be a successful teaching experience?
 - Learners consider this to be a successful learning experience?

Step 8: Future implementation

- ⊙ Has this experience led to new ideas or plans?
- ⊙ Which elements will be kept and which will be done differently?

5.2.3. STREAMING EXPLANATORY DOCUMENTARIES, TUTORIALS, EXPERIMENTS

These videos are purely instructional, i.e. they demonstrate the process of something concrete, the procedures, the different stages. Examples include language learning materials, laboratory experiments where there is a potential safety risk or role-playing situations where the students can experiment with different roles and behaviours. The purpose of these materials is to make complex processes understandable and/or to motivate students. The difference with the previous category “streaming an external real life event” is that here the materials are especially created for educational purposes whereas in the previous category the video materials witness events that would have happened anyway. What they both have in common is that they are used in the same way as traditional video has been used for many years in education. More innovatively these videos can be integrated in a web site with other sources of information such as texts, animation, discussions so creating a virtual workshop.

Best Practise Example: Parliament Uncovered, UK (documentary)

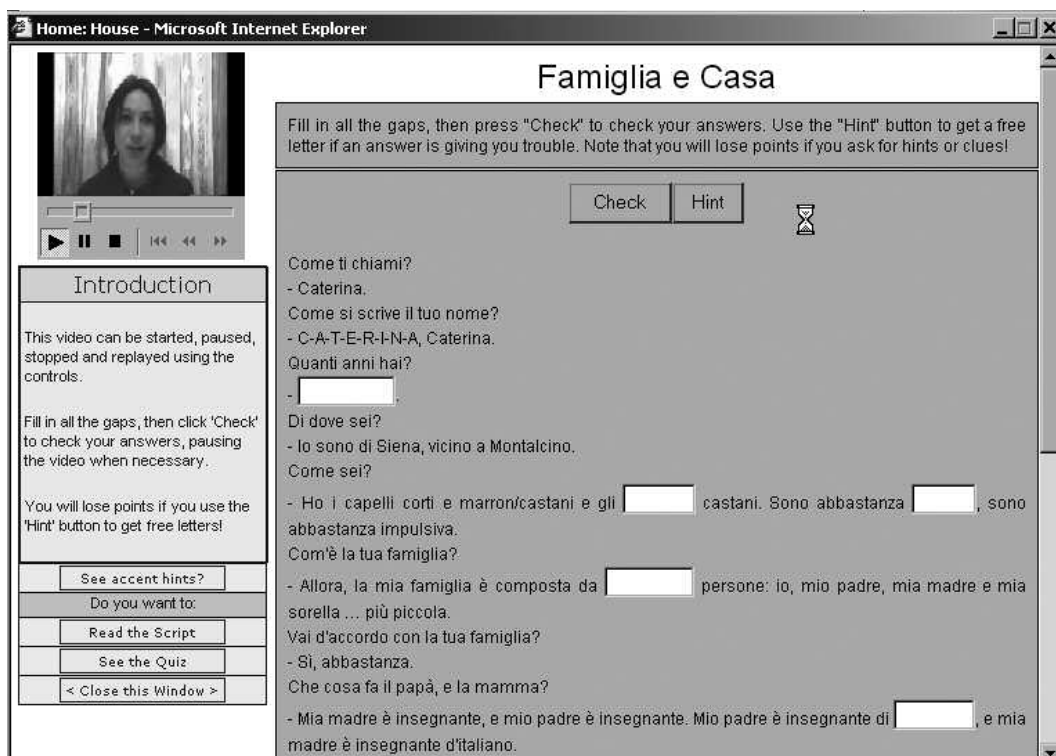
Parliament Uncovered is a documentary video produced for the Parliamentary Education Unit in the UK. It is available from the Parliament live web site at www.parliamentlive.tv. It goes behind the scenes of the British Political System to explain how the democratic system works, the distinct roles of the House of Commons and the House of Lords and the tradition and procedures which underpin their work. The video is aimed primarily at young people – whether studying AS and A level Politics or taking part in the Citizenship studies which are now part of the curriculum – and while it sets out to explain, it also questions. It includes interviews with many people involved in the political process – from parliamentary candidates to the Speaker of the House of Commons.

Interested teachers can purchase VHS copies of the documentary. A student activity book and associated teacher handbook to accompany the video can also be ordered.

The screenshot shows the ParliamentLive TV website interface. At the top, it says "PARLIAMENTLIVE TV BROADCASTING LIVE FROM WESTMINSTER" and "Wednesday 14 April 2004 3:40pm". On the left is a navigation menu with links: Parliamentary Diary, Archive, About Parliament Live, More About Parliament, Hansard, Parliament Uncovered, Help, and Contact Us. The main content area features a video player for "Parliament Uncovered" with a play button and a progress bar showing "01:10 / 19:05". To the right of the video player is a text area that says "A student activity book and". Below the video player, there is contact information for pfp Publishing, including their address in London, telephone and fax numbers, and an email address: bookshop@parliament.uk. The website footer includes the URL <http://www.parliamentlive.tv/>.

Best Practise Example: The Ashcombe digital video project (tutorial)

The Ashcombe Language College in the UK aims to share its teaching resources with others on-line, amongst which a library of circa 80 streamed video clips. The videos are available in 4 languages (Italian, Spanish, German, French) and are interviews with young people on certain topics (health, living, sports, etc) that are part of the secondary school curriculum (GCSE syllabus). Most clips include language approximately equivalent to grade C/D GCSE. The clips are integrated in an online environment offering quizzes to test vocabulary and grammar and hints. The aim of the clips is to support language acquisition by bringing native speakers into the classroom.



The screenshot shows a Microsoft Internet Explorer browser window with the address bar displaying 'Home: House - Microsoft Internet Explorer'. The main content area is titled 'Famiglia e Casa'. On the left, there is a video player showing a woman speaking. Below the video player is an 'Introduction' box with instructions: 'This video can be started, paused, stopped and replayed using the controls.' and 'Fill in all the gaps, then click 'Check' to check your answers, pausing the video when necessary.' Below the introduction are several buttons: 'See accent hints?', 'Do you want to:', 'Read the Script', 'See the Quiz', and '< Close this Window >'. The main quiz area contains the following text: 'Fill in all the gaps, then press "Check" to check your answers. Use the "Hint" button to get a free letter if an answer is giving you trouble. Note that you will lose points if you ask for hints or clues!'. There are 'Check' and 'Hint' buttons, and a timer icon. The quiz questions are: 'Come ti chiami?' with the answer '- Caterina.', 'Come si scrive il tuo nome?' with the answer '- C-A-T-E-R-I-N-A, Caterina.', 'Quanti anni hai?' with a text input field, 'Di dove sei?' with the answer '- Io sono di Siena, vicino a Montalcino.', 'Come sei?' with the answer '- Ho i capelli corti e marron/castani e gli [input] castani. Sono abbastanza [input], sono abbastanza impulsiva.', 'Com'è la tua famiglia?' with the answer '- Allora, la mia famiglia è composta da [input] persone: io, mio padre, mia madre e mia sorella ... più piccola.', 'Vai d'accordo con la tua famiglia?' with the answer '- Sì, abbastanza.', 'Che cosa fa il papà, e la mamma?' with the answer '- Mia madre è insegnante, e mio padre è insegnante. Mio padre è insegnante di [input], e mia madre è insegnante d'italiano.'

<http://www.ashcombe.surrey.sch.uk/>

Education providers who wish to implement this type of streaming application into their teaching practises could use the following template when planning the activity:

Step 1: Define your objectives

- Who is your audience?
- What are your instructional goals?
- What media will meet these goals?
- How will learners use the media in order to meet these goals?
 - Individual viewing/viewing in groups
 - With/without supervision
 - Location (home/classroom/elsewhere)
 - Level of interactivity
 - Level of integration

Step 2: Plan your content

- ⊙ What media will be viewed?
- ⊙ What are the supporting materials and where and how can they be consulted or how will they be taught?

Step 3: Plan a feedback mechanism

- ⊙ Will the learners be able to ask questions and provide comments
 - To other learners
 - To the teachers
- ⊙ How will this happen?

Step 4: Integration of media with student activities

- ⊙ Prepare the learners
 - Introduce media (who has made it? where? what is shown?)
 - Explain purpose (why is it to be viewed by the learners?)
 - Explain what to watch or listen to in the video
- ⊙ Students view clip
- ⊙ If classroom activity, stop or pause the video stream and explain key points to make sure that the class understands the information they are seeing in the video AND how it relates to what you are doing in the lesson.

Step 5: learners do something with what they've learned

- ⊙ Learners complete certain tasks
- ⊙ Learners answer certain questions
- ⊙ Learners participate in a discussion
 - on a certain topic
 - online or offline

Step 6: Assessment of the learners

Step 7: Evaluation

- ⊙ Develop an evaluation mechanism in order to understand whether
 - You as a teacher consider this to be a successful teaching experience
 - Learners consider this to be a successful learning experience

Step 8: Future implementation

- ⊙ Has this experience led to new ideas or plans?
- ⊙ What elements will be kept and what will be done differently?

5.2.4. CONSULTING AN ONLINE LIBRARY OF LEARNING RESOURCES

A collection or database of video materials can be made available to different educational institutions, and perhaps also used in courses that were not in the original scope of the production. This is sometimes done using archived video materials produced by national broadcasters (news, documentaries, etc.) so they can be re-used.

Best Practise Example: SchoolTV Beeldbank, The Netherlands

The SchoolTV Beeldbank is the online streaming version of the typical school television broadcasts and videos in the Netherlands. Material is published freely online for streaming purposes. Teachers as well as students can visit the web site and search in the school TV catalogue on the basis of subject. SchoolTV Beeldbank functions purely as a library of clips. The only additional information that is available are the texts of the voice-over and some images (taken from the clips). Lesson plans are not available, nor is there any form of interactivity apart from play, pause and stop.



<http://beeldbank.schooltv.nl>

Education providers who wish to implement this type of streaming application into their teaching practises could use the following template when planning the activity:

Step 1: Define your objectives

- ① Who is your audience?
- ① What are your instructional goals?
- ① What media will meet these goals?
- ① How will learners use the media in order to meet these goals?
 - Individual use/use in groups
 - With/without supervision
 - Location (home/classroom/elsewhere)

- Level of interactivity
- Level of integration

Step 2: Plan the content

- ⊙ What online library will be used?
- ⊙ What parts and clips will be used?
- ⊙ What are the supporting materials and where and how can they be consulted or how will they be taught?

Step 3: Plan a feedback mechanism

- ⊙ Will the learners be able to ask question?
 - To other learners
 - To the teachers
- ⊙ How will this happen?

Step 4: Integration of media with student activities

- ⊙ Preparation of the learners
 - Introduce clip(s)
 - Explain purpose
 - Explain what to watch of listen to in the clip
- ⊙ Students view clips
- ⊙ If classroom activity, stop or pause the video stream and explain key points to make sure that the class understands the information they are seeing in the video AND how it relates to what you are doing in the lesson.

Step 5: learners do something with what they have learned

- ⊙ Learners complete certain tasks
- ⊙ Learners answer certain questions
- ⊙ Learners participate in a discussion
 - on a certain topic
 - online or offline

Step 6: Assessment of the learners

Step 7: Evaluation

- ⊙ Develop an evaluation mechanism in order to understand whether
 - You as a teacher consider this to be a successful teaching experience
 - Learners consider this to be a successful learning experience

Step 8: Future implementation

- Has this experience led to new ideas or plans?
- What elements will be kept and what will be done differently?

5.2.5. CONSTRUCTING AND SHARING OWN RESOURCES

Both the lecturer and the students can be creators of their own teaching and learning material. From a constructivist approach, this is the most innovative way to offer content. Students deliver the material themselves and distribute it in a – probably – self-designed learning environment. Other students can then watch the materials as well, and a community is born in which the tutor acts as a guide and the students interact with each other and with the available learning objects.

Best Practise Example: Boeken kijken (Watching books), Belgium

The project 'Boeken kijken' was a 'learning by doing' project whereby secondary school children worked together on the creation of a streaming video. Students of the first year secondary school had to read a book, make a scenario or a part of it, play it and record it on video. Sixth year students adapted the recordings to streaming format and designed a web site to show the results.

The project had a highly motivational aspect as instead of doing a typical reading assignment, the students could work in a different way with books, learning about scripts, story lines, acting, camera positions etc., all at the same time. Furthermore, instead of passive learning about technologies, such as streaming, and about web sites, students could build their own materials. The fact that the results of their work were shown on a web site also had a stimulating effect on the students.



The screenshot shows a Microsoft Internet Explorer browser window displaying the website <http://www.sip.be/boekenkijken/bk1/start.htm>. The page title is "Project 'Boeken kijken'". On the left, there is a navigation menu with buttons for "Home", "Het project", "Het boek", "De auteur", "Filmfragmenten", "Nieuws te zien", and "Nieuws o.d.v.". The main content area is titled "Filmfragment gespeeld door 1Ac". Below the title is a video player showing a film still with the text "Nee, ik mag niet mee!!!". To the right of the video player, there is a text block describing the character Floor and her experiences. The text reads: "Het hoofdpersonage is Florian Firijn, ook Floor genoemd. Haar moeder ontdekt al vlug dat Floor zeer muzikaal is en laat haar aan allerlei zangwedstrijden deelnemen, met wisselend succes. Floor is bevriend met Chaïm, een Joodse jongen. Zijn vader heeft een winkeltje in de straat van Floor. Op een dag ziet Floor in de etalage van die winkel een viool liggen. Ze is meteen verkocht en wil die viool kopen. Na wat tegenwind thuis krijgt ze de viool. Eerst geeft Mosje vioolles en daarna mag Floor zelfs op muzikles. Ze wordt steeds beter en beter en neemt deel aan verschillende wedstrijden. Ondertussen zit Floor al in het middelbaar. In de klas is ze niet echt populair. De klasgenoten vragen haar wel mee om iets te gaan drinken of zwemmen maar Floor moet steeds weigeren. Ze mag niet mee omdat ze moet oefenen op haar viool".

<http://www.sip.be/boekenkijken/bk1/start.htm>

Education providers who wish to implement this type of streaming application into their teaching practises could use the following template when planning the activity:

■ **Step 1: Define your objectives**

- Who will be involved?
- What are your instructional goals?
- What media will meet these goals?
- How will learners use the media in order to meet these goals?

■ **Step 2: Planning**

- What activities will have to be performed by the students?
- What support will be provided to them?

■ **Step 3: Student activities**

■ **Step 3a: Preparatory activities**

- Reading
- Discussion
- Other

■ **Step 3b: Creating the streamed media content**

- Idea
- Scenario
- Shooting
- Capture and edit
- Compression

■ **Step 3c: Creating the web environment**

- Web design
- Storage, distribution and management of media content
- Publication of other materials

■ **Step 4: Assessment of the learners**

■ **Step 5: Evaluation**

- Develop an evaluation mechanism in order to understand whether
 - You as a teacher consider this to be a successful teaching experience
 - Learners consider this to be a successful learning experience

Step 6: Future implementation

- Has this experience led to new ideas or plans?
- What elements will be kept and what will be done differently?

5.3. Pedagogical Advantages

From an organisational point of view, streaming media gives the instructor the possibility to decide when to make material available:

- before class to prepare students for classroom discussion and practise
- during the class itself
- after class as a review of topics covered in class
- instead of a class for those who missed class or as self-study

Because of this flexibility, valuable class time can be saved for focused discussions or applied work, as course material can be accessed outside the classroom. In this way, learning is put in the hands of students who can access material in their own time, according to their own schedule and pause and replay as required.

Furthermore, web sites with streamed video allow teachers and students to jump with ease from one piece of video to another and provide easy access to other related materials (URLs, text documents, interactive exercises, slides, etc.).

Organisational flexibility is not the only advantage of streaming media. It can also help to achieve a wide range of instructional goals, including:

- **Illustration:** Media to reinforce the power of text, a still image or graphic, showing how something works, moves or performs, e.g.
 - filmed performances or documentaries
 - field trips
- **Contextualisation:** Media to help students gain understanding of unknown cultural habits, rituals, etc. by seeing the original context in which they occur, e.g.
 - In foreign language learning, videos with real linguistic samples and interviews with native speakers can illustrate different inflections, accents and cultural settings that every linguistic context reflects.
- **Motivation:** Media to bring the course content alive
- **Orientation:** Media to prepare students before the start of a new course or module
- **Conceptualisation:** Media to make a difficult or abstract concept clearer by, for example, showing graphs, stages in a process or changes occurring over time. By concentrating vision and sound, difficult concepts can be made memorable.

- Instruction and visualisation: Media to demonstrate the process of doing something concrete, the procedures, the different stages
 - Laboratory experiments
 - Natural processes students will not see otherwise, e.g. the growth of a plant or the birth of an animal
 - Demonstrations, like the use of equipment or details of a procedure
- Analysis: Media to encourage students in identifying interrelationships, interpreting them and commenting upon them
 - Video can help students to observe and analyse their own behaviour and personal interaction when involved in a group decision-making process
- Discourse: Media to foster discussion and feedback
 - Students can view a piece of art on which they comment

Using video, and thus also streamed video, to reach these instructional goals, enhances learner intelligences other than the “verbal-linguistic” and the “mathematical-logical” ones, that are involved in more traditional forms of teaching. According to Howard Gardner’s Theory of Multiple Intelligences (1983,1993,2000) these other learner intelligences include visual-spatial and intra- and interpersonal intelligences. According to Gardner, all learners possess each of these intelligences to a varying degree. By addressing the students’ multiple intelligences through the use of diverse teaching methods, you can more effectively communicate the information you are teaching. For example, supplementing discussion with relevant video resources uses students’ visual-spatial as well as their verbal-linguistic intelligences, thereby increasing retention rate.

The use of video in the classroom also addresses the notion of Learning Modalities, which resembles that of Multiple Intelligences. Learners are traditionally categorised by three modalities: Visual, Auditory, and Kinaesthetic (Tactile). The use of video to supplement classroom teaching assists learners who best comprehend material presented through the visual and auditory mediums.

Another similar theory is that of Visual Literacy, a term introduced in 1969 by John Debes, one of the founders of the International Visual Literacy Association. Debes offered the following definition of visual literacy:

“Visual Literacy refers to a group of vision-competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences. The development of these competencies is fundamental to normal human learning. When developed, they enable a visually literate person to discriminate and interpret the visible actions, objects, symbols, natural or man-made, that he encounters in his environment. Through the creative use of these competencies, he is able to communicate with others. Through the appreciative use of these competencies, he is able to comprehend and enjoy the masterworks of visual communication.”

An increased use of video in education will certainly contribute to the development of the learner’s vision-competencies.

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6. Creating Streamed Materials

To better understand why streaming media looks the way it does, it is important to explain the whole process of production and distribution. This process begins with an idea, a concept ...

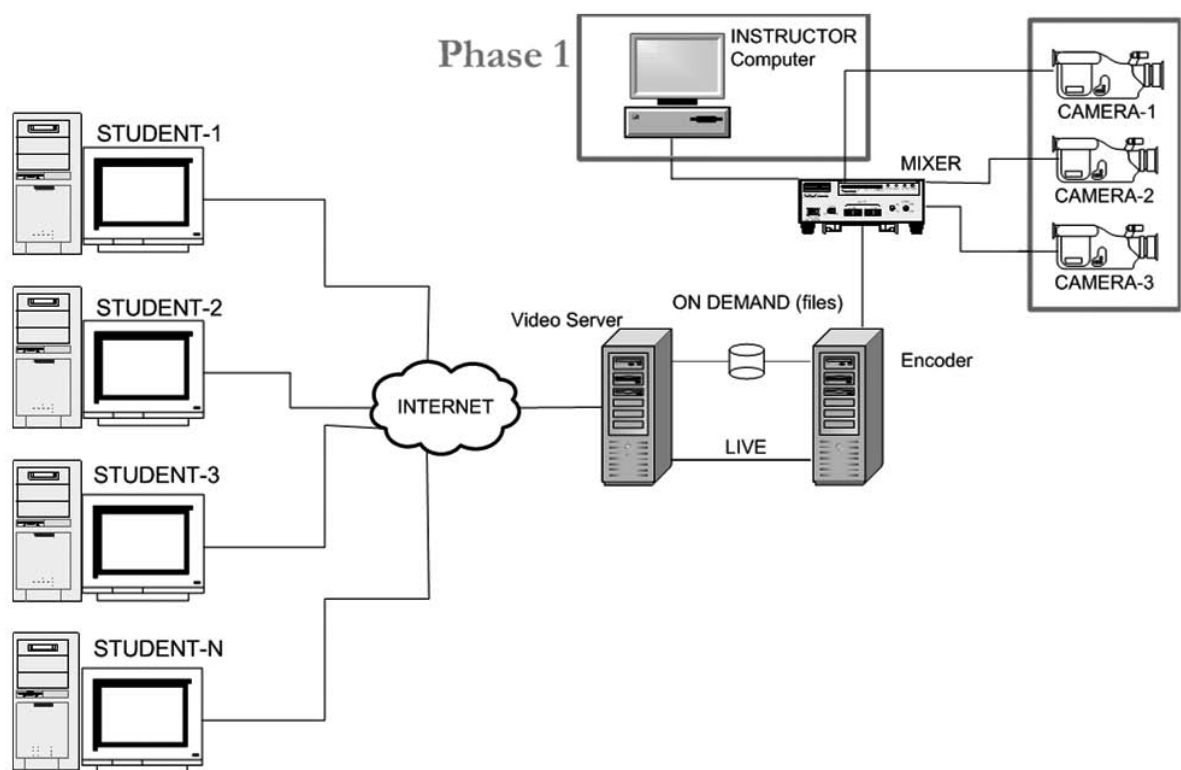
6.1. Idea: The Concept

Before you begin to record the first images and sounds, you need to have a good idea of what format you want to use. This might be a documentary about a famous person, a report about a ceremony or a lecture by a professor. It is important to prepare well beforehand, to create a scenario perhaps and to organise the equipment, lighting, sound and personnel necessary to do the job. At this stage it is also important to plan how you foresee using the media when it is streamed, are you planning to embed it in a web site for example, or in a learning platform? You also need to decide whether the media be supported or complemented with other elements (texts, interaction, etc.) Good planning at this stage will not only save time at the end of the project but will also mean that the final product is of better quality.

6.2. Shoot: The Recording

When you have a clear idea of what is to be recorded, the equipment needs to be set up and the shooting can begin. At this point, there is one principle that you need to bear in mind: RIRO - Rubbish In, Rubbish Out. Start with the best possible recording set-up, use good quality cameras (for example a camera that records in a digital format such as DV), good microphones, make sure that the scene is well lit, avoid unnecessary background noise and always use a tripod. If possible seek professional help or advice, it will certainly pay in the end in less frustration, time gained, and a better quality end-product.

Don't think that because of the small size, quality does not matter. On the contrary, errors and faults will simply increase during the remaining stages of the process. Be careful with too fine detail, with low contrast pictures, with delicate colours, excessive movement, etc. because they may not pass through the compression stage as you would like them to.



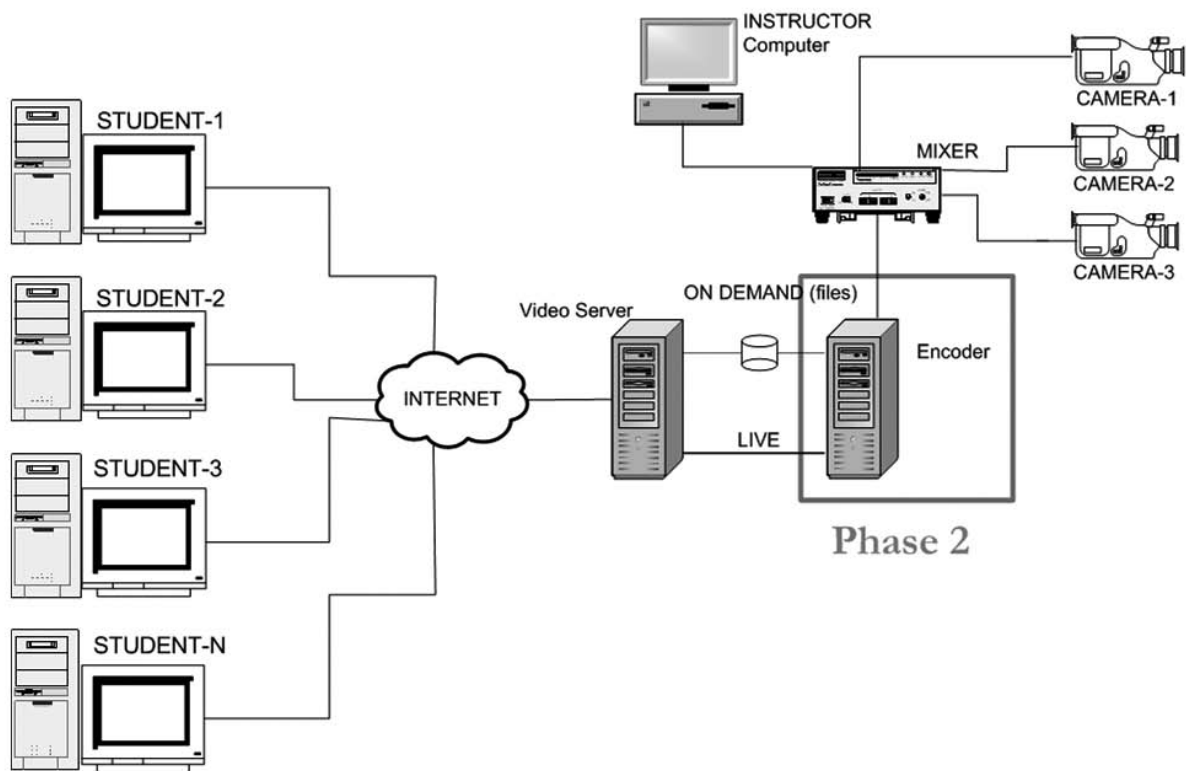
Streaming content generation

6.3. Capture and Edit

Once all the raw materials are collected, they can be transferred (captured) to a workstation or PC where they will be assembled, trimmed, polished, titled, etc. i.e. edited. At this stage the media product begins to take its final shape, sound is added (music, voice-over, sound effects) as well as any necessary additional visual elements (graphics, titles, visual effects) until the product is as you envisaged it to be. Needless to say that the PC needs to be powerful and in good shape for this job, equipped with appropriate software² and devices. Some editing solutions are rather high-performance and allow you create effects that you might normally only expect from Hollywood studios. Again, the better your original material, the better the edited output will be.

Note that if you want to transmit your media as they were recorded without modifying or editing (for example you may want to transmit a lesson exactly as it is recorded), then you can skip this stage and go directly to Compression.

² Popular editing software includes: Adobe Premiere 6, iMovie, Final Cut Pro, MS Windows Movie Maker, Ulead VideoStudio 6, Sonic Foundry Vegas@ Video 3.0, Sonic Foundry VideoFactory™ 3.0, Discreet edit 6.5, AvidXpress.



Streaming content encoding

6.4. Compression

The next step to delivering the video content is to compress it. Raw digital audio and video files are very large. One second of uncompressed video is more than 20 Mbytes. This means that a CD can hold less than a minute of uncompressed video. To get the video and audio down to a size that works for transmission over a modem or a LAN, files need to be compressed. During compression data that are redundant or unnecessary are removed. This makes the file size much smaller, but it also degrades the image and sound. Smaller files require less hard disk space, less memory to run, and less bandwidth to play over networks such as the Internet.

Codecs (or compressor/decompressors) work by identifying redundancy in audio and video and removing it. If you look at a recording of someone speaking in a typical office environment for example, sometimes called a 'talking head' image, the background image usually remains the same. A codec is designed to recognize this and to only save the parts of the image that change. In this way file sizes can be reduced by as much as 100 times.

Up to a few years ago, video compression was complicated and expensive and could only be successfully achieved by experienced people with special hardware and software. However nowadays tools are available that are easy to use and require no in-depth knowledge of the complexities of compression technology.

The fact remains however, that the producer and/or distributor of the media need to know their audience, in order to specify an appropriate compression rate. For example, if the target audience

of the media are all on the same Local Area Network (LAN) and if there is ample bandwidth available on that LAN, or when all users have very high bandwidth Internet connections with a high guaranteed throughput (allowing for example transfer speeds of 300 Kbps or more), the compression rate does not have to be as high as when end users only have a dial-up Internet connection with modem speeds of 28.8 or 56 Kbps. The bottom line is that smaller video files are easier to distribute over the Web, but smaller files also mean lower quality. A good compressionist is an artist who hits the right balance between file size and quality bearing two factors in mind: 1) the higher the data rate, the better quality the media 2) the need to keep the weakest link in mind when selecting the compression settings, i.e. users with a dial-up modem will have a hard time displaying media encoded for broadband rates.

At this stage the producers have to decide which streaming technology or application they plan to use because during the compression phase media are directly transferred to one or more streaming formats of choice, e.g. QuickTime, Windows Media, Real Media, MPEG-4, or Flash media.

Another decision to make is whether content will be streamed or downloaded progressively. **Streaming** keeps your computer in contact with the server while running the movie: the digital media is transferred, displayed and then discarded. If the end user's connection is of poor quality the server automatically reduces the data transfer rate in order to preserve continuous playback, however movies can still stutter or break up if the connection is too slow. This type of streaming delivery is best suited for very long media and for live events. Streaming allows for random access within streaming media and doesn't leave a copy of the file on viewers' hard drives. This type of content can't be saved on the end user computer.

Progressive download dumps the entire video on the local computer's hard disk. Once enough of the file has been transferred and buffered at the end user computer, the media automatically starts to play. Progressive download is used mainly for short media. The advantage of a progressive download is high quality at any connection speed: it may take much longer for a user on a 28.8 Kbps modem connection to download a video, as someone with a fast cable modem, but once downloaded, the clip will have exactly the same quality on both computers. Progressive downloads use the same protocol as common web content (http or ftp) and therefore you are less likely to encounter problems getting past firewalls than with content from a streaming server.

It is relatively easy to distinguish between downloading and streaming by using the following analogy: streaming comes closest to watching TV, while the programme is transmitted and only at that time, can you view it on your TV set at home. Downloading compares more to recording a programme on videotape: you wait until the programme is recorded and then you watch it as often as you like. Streaming experts will tell you that the comparison is not fully correct, as, unlike with videotape recording, progressive download allows you start viewing before the whole programme is downloaded or so to speak "recorded".

It is important also to note that streaming does not leave a copy of the media on the end user computer while download does where it is possible to re-call the downloaded video and re-play it as often as one wants. Note that this can have consequences with regard to copyright.

6.5. Storage, Management, Distribution

After compression, the media still needs to be stored, managed and delivered to its target audience. At a technical level there are three key components that need to be considered: hard disk storage space, the processing power of the streaming server, and the network between the user and the video server.

Depending on the file size or the level of compression used, files to be stored can be quite large: a one hour video encoded for modem speed (28.8 Kbps) takes up 9 MB of storage. The same video for ADSL at 300 Kbps is almost 100 MB or more than 10 times bigger. It is easy to see that storing large amounts of video will require storage management. Similarly it is important to estimate how much bandwidth usage streaming will consume: broadcasting a 300 Kbps stream 10 hours per week to 100 users will result in a transmission of 135 GB in one month. Depending on the number of concurrently connected users, the bandwidth capacity from the server to the Internet will need to be quite large; if, for example, all 100 users are streaming more or less at the same time, then the outgoing bandwidth needs to be $300 \text{ Kbps} \times 100 = 30 \text{ Mbps}$...

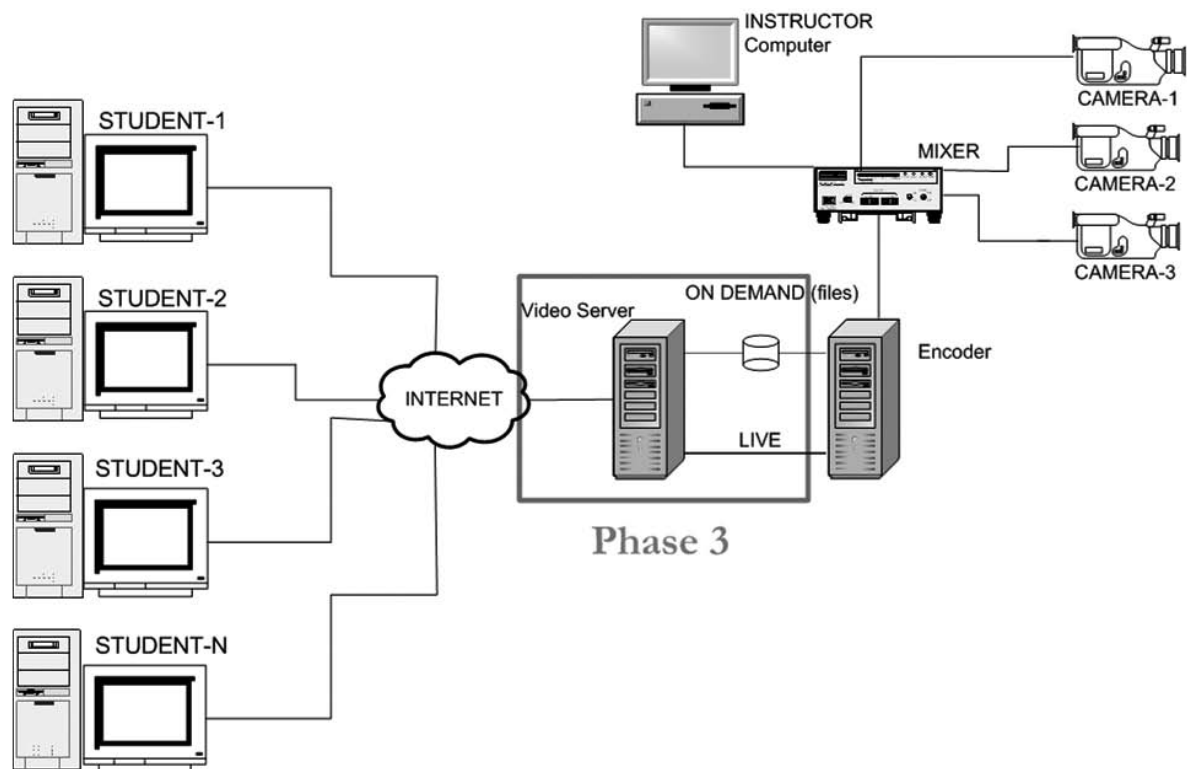
Two main modes of access to the media are on-demand or live: on-demand means that users can connect to the streaming server when they want and select the media that they want to display. This means that the server must be capable of transmitting several streams to different users at the same time: this will make the service much more expensive to run because it needs to be dimensioned appropriately.

Live streaming is less demanding on the server: users can connect to the streaming server to have access to the media as they are transmitted to all connected clients at that time. Live streaming supports broadcasts (sending one stream to all viewers that are accessing the service without restricting access to any member of the audience) and multicasts (when access to the transmission is restricted, possibly on the basis of IP addresses, to a well-defined sub-segment of the audience).

While nowadays production and even compression are commonly carried out in the institution that puts in place the streaming services, the management of the streaming server itself is often outsourced. It is worth noting that if an institution decides to provide its own streaming services, it will need its own hosting space, servers, support people and appropriate connection to the Internet. In such a case it is important for the institution to check if it has the capacity in-house to monitor the bandwidth it uses, to supervise the streaming hardware, etc..

At this stage in the delivery process, attention should be paid to web site integration or interactivity. Streaming on the Internet allows for integration with interactive functions such as chat, polling and PowerPoint slides. Many options are available when it comes to interactivity and the media can be integrated in a web site with additional functionality. It is also possible to add elements of interaction within the video itself, using, for example, hyperlinks and clickable objects, subtitles, etc.

It is obvious that this all requires both technical expertise and good resources including suitable hardware and software to serve the streams and sufficient bandwidth to the Internet to allow adequate numbers of users access the server.



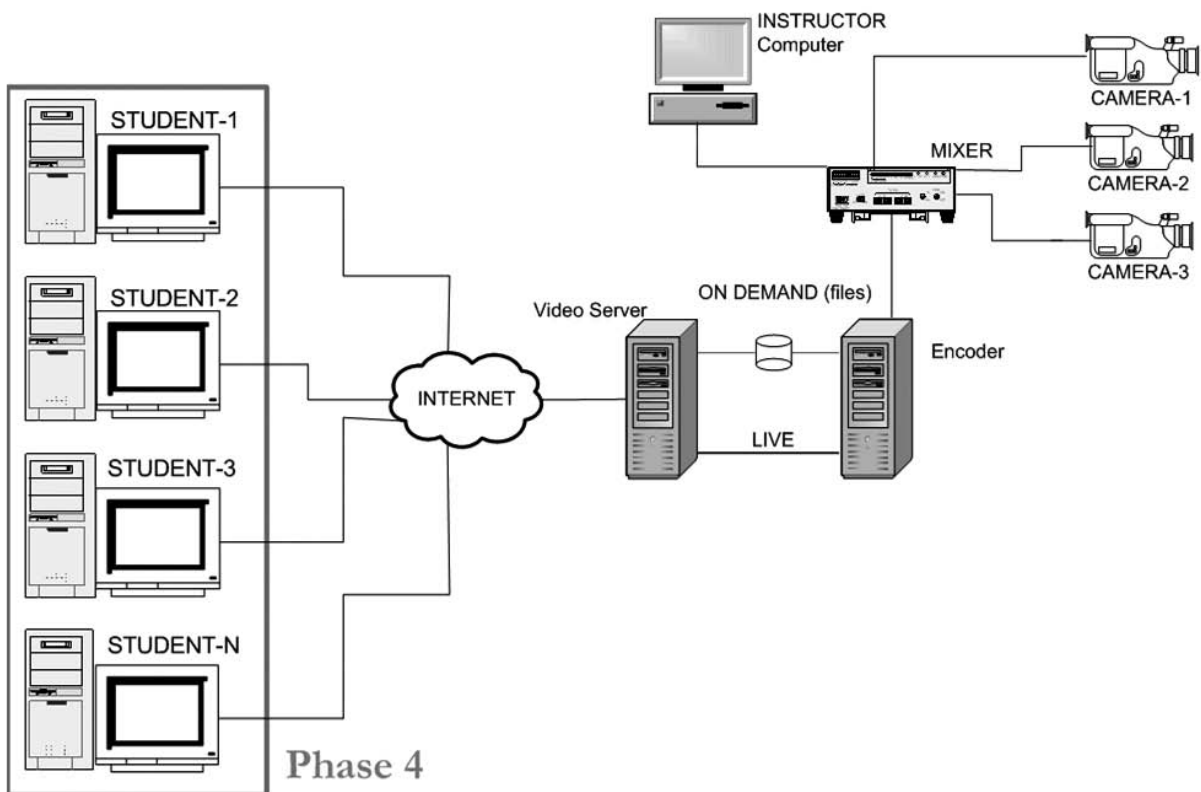
Streaming content: the server side

6.6. On the Desktop: the User Side

The user at his or her desktop needs a streaming client, which will depend on the specific streaming application selected by the streaming media provider. Nowadays, all major streaming technology providers provide free clients (players) available on their web site, e.g. Microsoft Windows Media Player, Apple QuickTime, VDOLive, Vivo Active, Macromedia Shockwave or Flash. Some of these players are also made available to the Open Source (Linux) community, where the free Helix player is rapidly becoming the preferred choice.

Almost all streaming clients are available in free or paid versions. If you only playback existing and available streaming media, then the free streaming client is adequate for your needs. Paid streaming players offer additional functionality (for example the QuickTime Pro allows you to edit and save media) or other features such as access to content (RealPlayer 10 integrates access to music stores, Internet radio channels, etc.).

System requirements for installation of streaming clients are modest but what is generally recommended is an up-to-date Operating System (Windows 98, ME, 2000, XP or Mac OS X); 128 MB Ram, 300 MHz Intel Pentium 3 processor or better or MAC OS X compatible, minimally 56 Kbps modem for access to the Internet, full duplex sound card and speakers, video card with, at a minimum, 65000 colours and a minimal video resolution of 1024x768 and Internet Explorer 5.5, Netscape 6.2 or better. Linux based computers have less demanding system requirements.



Streaming media: the client side

The quality of the media experience at the user side depends mainly on two factors:

- **The quality of the network connection:** users with broadband access via DSL or cable, will, in general, have better results than those using dial-up modems. In the case of progressive downloads this is not expressed in display quality but rather in shorter wait time. The network between the user and the video server is the most difficult aspect to get right. On most networks all users compete for bandwidth. This is fine for applications like e-mail and file transfer where delays caused by network contention are not disruptive and often remain unnoticed. Moving images and sound need to be played back without a break. To deliver uninterrupted streams of media is the main challenge especially for users that are remote from the video server.
- **The quality of the computer:** faster processors, better bus transfer speed, better video and audio cards, good quality monitor and loudspeakers will contribute to better display. The effect of these is however not as significant as the quality of the network connection: investing large amounts of money in the hardware will not show to the same extent or proportion on screen.

Quality of experience is also influenced by the environment in which media are played: noise, uncomfortable seating and poor lighting can all have an adverse effect.

6.7. Cost and Service Considerations

Cost elements can easily be deducted from the different stages identified above: the full production cycle from concept through recording, editing and compression can cost as much or as little as you like to spend or as the programme requires. If you plan to record a live lecture, all you need to do is to put a camera, recorder and microphone in front of your lecturer, little or no costs other than investment in hardware and software will be involved. On the other hand, if your plan is more ambitious and you carefully script and organise a recording with actors, extensive editing, additional graphics, location shooting, voice-over, music, etc. naturally the cost will be different. As a simple rule of thumb, the high quality production of educational multimedia by multimedia facilities within education institutions like the audiovisual centre of a University will cost on average €400 per minute of finished product.

It is probably more important to consider the cost of distribution. Setting up streaming services at the institution may require investing in specialised hardware, streaming server(s), enhanced Internet connectivity and/or support services. Costs can easily run out of control when the institution/provider has no experience in dimensioning this type of service.

For Video on-Demand streams, it takes only about 30 viewers using 56 Kbps modems to saturate a 2 Mbps E1 or leased line which is already quite expensive. Outsourcing streaming to a streaming media service provider can be a viable alternative. Such services cost about €150 per month for narrowband access (28.8 Kbps) to 100 seats (or concurrent users) or €1,800 per month for broadband access (300 Kbps) to 100 seats. Live streaming is much less expensive to run than on-demand: Jupiter Research Corporation estimated in 2002 that at the server side, large scale streaming events cost roughly \$1.60 per user in the US. European prices are on average between 30 and 50% higher.

Note that costs occur not only at the provider's side but can also occur at the end user side. If, for example, the provider uses inadequate compression the end user may be forced to invest in better (and thus more expensive) access to the network and/or in a more powerful computer.

It is also very important to consider the question of copyright in the operation of streaming services. Take for instance the example of progressive streaming which puts copies of the media on the viewer's hard drive. This enables the viewer to redistribute the media beyond the control of the original provider.

7. Standards and Multimedia Formats

There seems to be a jungle of formats used for encoding streaming media. While people call for standards, it is the competition between the different key players (mainly Apple, RealNetworks and Microsoft) that has resulted in technological progress regarding the quality and capability of streaming technologies. However the downside of this competition is the high number of media formats, which are not always compatible with each other. Always check if the player that you have installed, plays the file format you are receiving, and remember many players playback formats from their competitors.

7.1. The Moving Pictures Expert Group (MPEG)

Moving Picture Experts Group, Level 4 (.mp4) or MPEG-4 was defined using the International Organization for Standardization (ISO) MPEG-4 de facto standards for encoding of video, audio, and system components. These specifications are used by manufacturers and developers to build products for production, encoding and delivery of audio/video content over various types of networks to a variety of clients such as personal computers, personal digital assistants, mobile phones, wireless devices, web browsers etc. MPEG-4 is, to a large extent, based on the Apple QuickTime architecture.

7.2. Digital Video

Digital Video (.dv) is the industry standard for processing and storing video on a computer in a binary format. Current digital video cameras are capable of outputting .dv video files directly to a hard drive, where it has become the preferred format for editing and compression. Uncompressed, the file sizes are too big to be transmitted via the Internet.

7.3. Microsoft

The Advanced Streaming Format (.asf) is adapted to the MS Windows Media Player file format for audio and video on the Internet or other network. It can contain streaming audio, video, slide shows and synchronized events. ASF is a streaming format and .asf files begin playing before downloading is complete. A similar format is the MS Windows Media File (.wmv) which is used to download and play files or stream content containing audio and/or video.

Audio Video Interleaved (.avi) is the most common bitmap-based format for audio/video data on PC and an example of a de facto standard. Raw .avi files are the result from video capture and a good starting point for editing and compression. .avi files are normally too large for distribution across the Internet, although the format can be used as a container for DivX or Xvid formatted videos.

MS Windows Media Audio (.wma) is an audio format for streaming audio content at CD quality.

7.4. RealNetworks

RealNetworks files (.ra, .rm, .ram) are streams that contain live or pre-recorded audio/video delivered directly to a client, such as a web browser. Decompression is done dynamically to allow play back in real time even on lower quality networks.

7.5. Apple

QuickTime Movie (.mov) is the Apple media format that allows for streaming and progressive download.

7.6. Macromedia

Flash MX Video (.flv) is a Macromedia video format for encoding and compressing video and audio and can be played from within a browser. A flash file (.fla) can be published directly to the web and becomes a .swf file (ShockWave Flash) that can be played with the widely distributed Flash player. Flash also allows for enhanced functionality and programming elements through the use of ActionScript.

8. Future Developments

As always, it is difficult to predict what the future will bring. One thing that is certain is that changes are happening quickly in the media world, driven in particular by content providers (TV channels, media producers, value added resellers) who see new markets especially with young people who are not necessarily sitting in front of TV sets.

Obviously, leading competitors are working relentlessly to improve their products, delivering better compression on the streaming server side, better decompression and playback on the user side, more functionalities such as access to content channels and online media shopping. As well as these developments, several other significant trends are emerging.

First of all, the handling of IPR and copyright will be a major subject of development and the introduction of Digital Rights Management (DRM) using technologies like digital watermarks should allow more content owners join the growing number of streaming media providers.

Secondly, network congestion problems are being overcome by distributed content delivery systems that place identical copies of media files on strategically located servers on the global network. When a user requests content, the player will look for the optimal place to download from and will even start to download different sections of the file from different servers at the same time. This means that the entire file must be downloaded before playback can begin, but playback quality can be very high. New developments are tending towards a peer-to-peer approach to this method, spreading the file download over a number of PCs to again reduce bandwidth limitations. It is obvious that these solutions require solid mechanisms for the management of rights.

The single most important evolution will be towards streaming on mobile devices. Major developers have already started adopting 3GPP and 3GPP2 as the new worldwide standards for the creation, delivery and playback of multimedia over 3rd generation, high-speed wireless networks, allowing access to rich multimedia on mobile phones, personal digital assistants, etc. KDDI, a Japanese mobile phone operator, has taken the first steps in its implementation of AMC, which includes MPEG-4 video, QCELP audio, and STML text. With the advent of UMTS and the possible future introduction of IPv6, mobile, wireless videoconferencing will also become more feasible.

The SMIL standard for the synchronisation of different multimedia elements allows multimedia producers enrich the media experience with additional functionalities such as subtitles in various languages, interactive elements, synchronisation with text, audio and slides, etc. The SYMM Interest Group is now the active group within the World Wide Web Consortium (W3C) maintaining the SMIL specification. W3C's Synchronized Multimedia Activity has focused on the design of this new language for choreographing multimedia presentations where audio, video, text and graphics are combined in real-time. The Synchronized Multimedia Integration Language (SMIL) is written as an XML application and it enables authors to specify what should be presented when, enabling them, for example, to control the precise time that a sentence is spoken and make it coincide with the display of a specific image on the screen.

The Timed-Text Working Group, another part of W3C's Synchronized Multimedia Activity, is focusing on the design of a new language to cover all necessary aspects of timed text on the Web. Typical

applications of timed text are real time subtitling of foreign-language movies on the web, captioning for people lacking audio devices or with hearing impairments, karaoke, scrolling news items and teleprompter applications.

Another possible future development is the introduction of a metadata standard that dynamically describes events, content and even manipulations related to or even caused by streaming media. Applications that can be imagined are tacit user feedback, adaptive and personalised content, personalised interaction, and even applications of virtual reality. The close integration of Apple's QuickTime with Virtual Reality seems to be a first step in that direction. The evolution of MPEG7 and MPEG21 also seem to pave the way for even richer media experiences.

9. Case-Studies

9.1. Compulsory Education

ASHCOMBE DIGITAL VIDEO PROJECT	
URL	http://www.ashcombe.surrey.sch.uk/dv/dv.htm
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The Ashcombe School Digital Video project includes several interactive language resources where students can view streamed videos accompanied by exercises and interactive assignments like quizzes.

These resources were developed within the school but since they are commonly recognised as being very useful, they are widely accessed by modern language teachers throughout the UK.

Technology

Different types of video formats were tested and used for the project. MPEG, Windows Media Player and QuickTime movies are available. Ashcombe also tested downloadable formats but these were unable to provide an integrated interactive learning environment. Ashcombe does not have access to a streaming media server but because their files are small, the media can be stored on their regular web space.

User group

The project was first intended to serve the modern language teachers and students at Ashcombe School. Access is public and students and teachers of other institutions are also using the resources. Ashcombe have an explicit policy to share resources with the entire educational community.

Pedagogy and methodology

The online resources and accompanying interactive learning materials are ideally suited for self-paced learning. Students can watch a video and try to answer the questions independently when they choose. The learning topics have been selected to blend in with the AQA GCSE specifications and complement other work and resources.

Organisation and financing

The rationale behind this project was quite straightforward albeit with several distinct, though related, elements:

- The finished product had to be simple to use.
- It had to be suitable for use in the classroom and at home.
- It had to be accessible to as wide an audience as possible.
- It had to add value to the learning experience.

Above all, its educational usefulness was always to be the driving force, with the technology providing the means not the reason.

The Aschombe Digital Video project including the video content was fully developed by the school itself. Their hardest task was the integration of video and interactive elements like quizzes and exercises. Hot Potatoes software was used and adapted for this purpose.

AVD – AUDIO VISUELLE DIENSTE – AUDIOVISUAL SERVICES	
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AVD stands for “AudioVisuelle Dienste” which means “audiovisual services”.

It is a national Austrian project which is based on a network of tools and services, through which digitalized educational movies are produced, stored in a searchable database, delivered via the Internet and satellite, and integrated into classroom education in a flexible and interactive manner.

The AVD project was made up of 2 main components:

- AV media: A web based database which contained about 300 professional educational movies in digitalized form. The videos covered a wide spectrum of topics, ranging from physics to geography, and also addressed different age groups of students.
- AV academy: A learning platform where students could attend interactive video based live lectures via the Internet.

Technology

AVD set up a technical infrastructure whereby schools could choose or order videos or lectures to be transmitted to the server of their respective school via broadband satellite technology. Every school was equipped with a satellite antenna and a proxy server and the necessary software to receive data from the satellite. The infrastructure was based on Windows Media. The recordings of the lectures (archive) were formatted into streaming video in the Windows Media Player format. The videos of the media on demand service were available in two qualities: modem and broadband (32, 56, 100, 200,300 Kbps for streaming) and an MPEG1 file with 1,5 MB for downloading over satellite.

User group

100 schools ranging from secondary school to upper secondary school and vocational schools all over Austria took part in this project.

Pedagogy and methodology

The aim of the project was to create an internet-based platform which allowed teachers and pupils to access a large database of digitized educational movies, to equip it with convenient tools for searching, ordering and downloading, and to gain some empirical insights into the acceptance of such a platform by teachers and students. The project also aimed to find out how feasible such a platform was for classroom teaching and whether the instructional scenarios were appropriate.

The project intended to test, compare and evaluate the use of these two streaming media applications in different learning contexts and analyse their impact on the learning process. AV media: The videos covered a wide spectrum of topics, ranging from physics to geography, and also addressed different age groups of students. The database possessed a range of features which allow for a very flexible use, including extended searching possibilities, detailed content description as well as the possibility to preview the videos and to order them for classroom usage.

AV academy: The live lectures were recorded and stored in a second database using comparable characteristics to AV media. Again, these “eLectures” could be searched, previewed and ordered in a largely self-regulated manner.

Organisation and financing

Schools could participate for free. The project, which lasted over 2 years, was funded by a partnership between the Federal Ministry of Education, Science and Culture, Education Highway and the Austrian telecom. Education Highway took care of the organization and didactical implementation of the project.

BOEKEN KIJKEN	
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The project Boeken kijken (viewing books) is a project whereby secondary school children in Belgium worked together on the creation of a streaming video. First year secondary school students (12/13 yrs) had to read a book, make a scenario for a part of it, play out the scenario and record it on video. Then sixth year students (17/18 yrs) made streaming media of these recordings and designed a web site to show the results.



Technology

The recordings were formatted into streaming video in the Windows Media Player format or MPEG. The available streaming media is not downloadable. The schools used Videowave 3 to transform video into a digital format. Software and production equipment such as cameras were provided by SIP (Support organisation Internet and Informatics Projects), a Belgian institution supporting the usage of informatics in schools.

User group

Participating schools are members of SIP and made an explicit agreement to participate in the project. As already mentioned the project was aimed at first and sixth year students.

Pedagogy and methodology

This project is an example of learning by doing. The project had a motivational aspect: instead of a typical reading assignment students could work in a different way with books, instead of learning about streaming and web sites they really used them. Students learned about scripts and story lines, about acting and camera positions. The entire production process was covered and therefore it combined real life experience and learning at the same time.

The fact that the results are shown on the web has a highly stimulating effect on the pupils. Within the typology already described in chapter 5, this project is an example of 'constructing and sharing ones own resources'.

The SIP provided participating teachers with a practical production and recording self-study guide and support so that they could learn what to do. In this way, teachers are learning how to set up these kinds of projects.

Organisation and financing

All participating schools are members of SIP, and can join ICT projects for free. SIP is responsible for the coordination and for provision of material and support, knowledge, web space, etc.

BOTTEGA DELLA COMUNICAZIONE E DELLA DIDATTICA	
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Bottega della Comunicazione e della Didattica is an initiative from the Regional Education Office of Campania and the Administrative Service Centre of Naples in Italy. This media lab conducts research and analysis into the media world. Student groups can come to the media lab to make their own productions. They learn how to find ideas for a film, what a storyboard is, etc. Their films are then created, with some students producing, others acting. The final goal of the Bottega is to turn students into critical viewers of any kind of visual material.

One of the online services of the Bottega is a Mediateca with videos and links to web sites. The videos are made by or for students and are offered via streaming and download.

Technology

The downloadable videos all require Windows Media Player. They are all compressed as RAR files and therefore require WinRAR to unpack them.

User group

The media lab of the Bottega currently works with 5 secondary regional schools but they are open to all interested educational institutions, offering customised learning paths or visits to the schools. The Bottega not only offers its services for the benefits of students but also for teachers. Their “Il Cinema Racconta” training project aims to make teachers cinema literate so they are better prepared when teaching about film and video.

Pedagogy and methodology

The Mediateca videos are closely related to the curriculum. There are no assessment or feedback mechanisms provided. The purpose of the Bottega lies primarily in raising students’ and teachers’ awareness of media in education and in helping them create materials, which are then published online. The creation of an online collection of video materials can therefore be considered more as a result than as a goal in itself.

Organisation and financing

The web site is freely accessible to everyone and requires no registration.

DSCHOLA

URL	http://www.dschola.it
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Dschola is a regional project set up in Piemonte, Italy aimed at stimulating greater attention to ICT, by involving students, teachers and families in partnership with schools. It involves 2,828 educational structures and 50,000 teachers. The Dschola school network is currently made up of 18 technical secondary schools, reference points for technological issues in their regional area and with proven experience within the ICT area.

There are two different examples of the use of streaming in education within Dschola:

- Tg Diddatico – educational news in English
- Video Gallery - broadcast of events related to Dschola and other education and ICT events

Technology

The viewer needs a standard Pentium 2 computer with sound and video card to watch the streaming content of Dschola as well as software like a web browser, Macromedia Shockwave and Quicktime. Software is available on the Dschola web site for the specific Hypervideo applications which are included.

User group

The Dschola project is specifically intended for primary and secondary teachers and students of the schools taking part in the project. Access to some project pages is restricted. The video galleries are public.

Pedagogy and methodology

The content of the streaming videos of Dschola is curriculum related. Tg Diddatica, providing news in English, is intended to be used by English teachers. It also delivers accompanying learning materials like texts. Hypervideo, which allows the user connect to other content, is used in some cases in the video gallery. This allows connections (links and hot-spots) to be synchronised so that connections are made at the exact moment prescribed by the author.

Organisation and financing

The Dschola project is an initiative of the region of Piemonte and was largely funded by the CRT bank foundation.

EDMOND	
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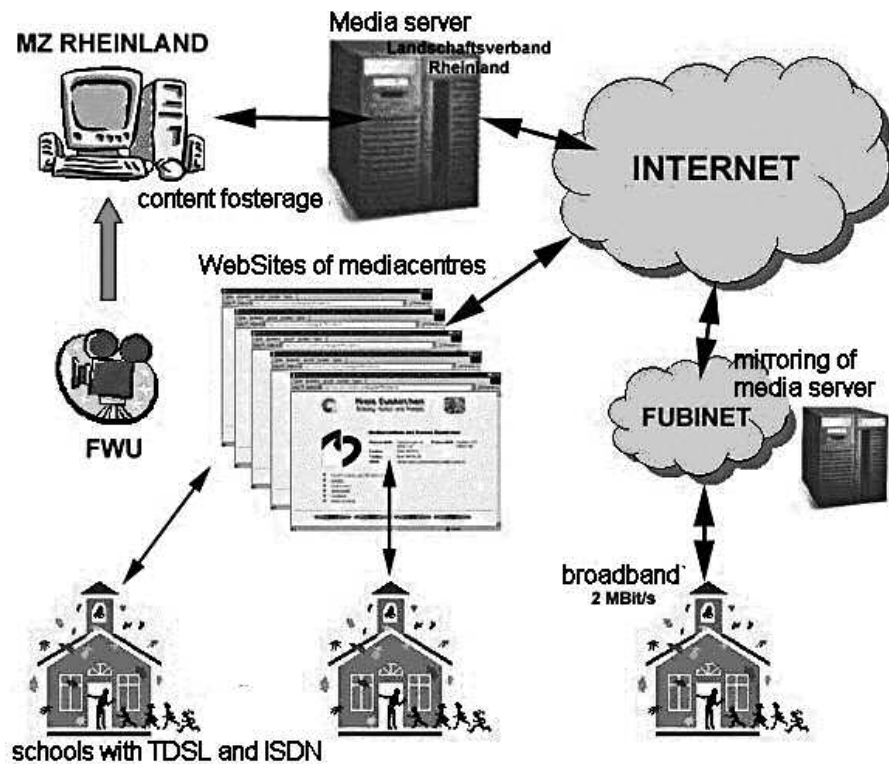
Edmond (Electronic Delivery of Media on Demand) is a pilot project carried out in Germany between February 2001 and July 2003. Its main objectives were the evaluation of the potential of electronic media and the testing of online distribution of digital media for educational purposes. In addition the project aimed to make learning more active through the use of media. Edmond provided media modules to participating schools through streaming.

<http://www.edmond-nrw.de>

Technology

The initial project plan was to connect a school with a private high capacity (2-4 Mbit) connection to a video server. However it was decided that this plan was too cost intensive and too limited for educational usage. When ADSL became more widespread to users including schools, the approach shifted towards online delivery of media.

The Edmond project used Windows Media Player for playing the streaming media in .asf format.



User Group

Streaming video material was available to 23 participating schools in the Nordrhein Westfalen region. It involved primary as well as secondary schools. Usage was free during the pilot for participating schools. In the future, the Nordrhein Westfalen region intends to enlarge this streaming video distribution to all schools in the region.

Pedagogy and methodology

The Edmond project focused on the useful delivery of educational video material to schools. Videos came from the Institut für Film und Bild in Wissenschaft und Unterricht GmbH (FWU), which is essentially an organization for the use of image in education. The videos were closely curriculum related and fitted well within lessons. Videos in the catalogue were clearly identified indicating for what grade they were intended and in which class they should be used.

The Edmond project was a clear example of content illustration. Videos that illustrated courses were distributed and teachers used them to support their classes. These videos were available for individual usage in computer classes as well as for whole class teaching by making use of a beamer.

Organisation and financing

Edmond was one of 3 sponsored projects from the Nordrhein Westfalen region. Content is available as the result of a cooperation between the FWU and the Medienzentrum Rheinland (MZR) in Düsseldorf. The local media centres act as partners of the MZR and provide the web site/portal and consulting support.

From an organisational point of view, schools need to be equipped with a reasonable standard PC classroom with an Internet connection. Secondly, teachers in the participating schools needed to be motivated and prepared to use digital media such as streaming video.

FEDIC SCUOLA	
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Fedic Scuola is an initiative from the Federazione Italiana dei Cinemaclub (FEDIC), founded in 1985. It aims to promote cinema education through viewing and producing films within didactical projects in schools at any level. Activities include:

- Courses for teachers
- The organisation of film broadcasts for schools
- The organisation of film competitions for schools
- The provision of short streamed videos on the web. These are fiction, documentaries, video art, etc. that can be used in the classroom. Videos that have been created by students themselves, in the framework of film competitions, are also provided

Technology

Minimal requirements are a Pentium 2 computer with audio and video and regular colour screen. Software requirements include Microsoft Internet Explorer or Netscape Navigator 6 and Windows Media Player. The streaming content is pure streaming and not available as download. It comes in two formats (37 Kbps and 150 Kbps)

User Group

The objective of Fedic is to provide image education to students from different age groups and it has a variety of didactical purposes. The films that have been made by schools are freely accessible by everyone, without registration. Other video material from the database require a log in but this can be obtained for free.

Pedagogy and methodology

Videos can be used individually or in the classroom context. They are not explicitly related to formal courses or class subjects. The content of the videos is purpose built, made with the involvement of students.

Organisation and financing

The project partners are AGIS - Associazione Generale dello Spettacolo, UNICA - Union International du Cinema d'Amateur, UNESCO - Conseil International du Cinema et Television and ECFA - European Children Association.

MEDIATECHE

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Mediateche is a cooperative project of the Regione Campania, Rai Educational and the Ministeria dell Istruzione, dell Universita et della Ricerca in Italy. Mediateche offers online streaming lessons about ICT in education for teachers in primary and secondary education. These lessons are guide-lines and best practice models.

Technology

The streaming video elements of the lessons are available for windows media player or RealPlayer. Viewing these lectures requires at least a Pentium 2 PC equipped with a sound and video card and a regular colour screen. A broadband type of connection is recommended.

User group

Lessons are intended for teachers in primary and secondary education. The project is carried out on a national scale and in Italian only.

Pedagogy and methodology

The online lessons of Mediateche are in fact best practice models and guidelines on the use of new media in education. Topics covered include the use of a multimedia library, use of the web, moving images. The Mediateche project aims to teach teachers about the usefulness of multimedia for educational purposes.

Organisation and financing

The video content of Mediateche is purpose-made by Rai Educational, the educational division of the Italian public broadcaster. Access to material is free but registration is required.

MEDIAMENTE	
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E-MAIL	mediamente@rai.it

The learning centre of MediaMente, an educational service of Rai in Italy, offers courses in multimedia that use streamed video materials together with textual information. One such course is called Multimedia Scuola, which aims to be a distance course for teachers on the didactical use of multimedia. Another course is called Mediamente Learning, which aims to inform teachers and students about different aspects of multimedia through short learning modules.

Technology

Video materials are only available in streaming so no local storage is possible. A Pentium 2 computer is required with audio and video and regular colour screen. Content is made for Windows Media Player or RealPlayer.

User group

These courses are open to everyone and are aimed at both teachers and students.

Pedagogy and methodology

Every course module is made up of video, descriptive texts and self-assessment exercises. Videos are interactive in the sense that they can be watched at one's own pace, allowing the viewer stop, start, pause, rewind and play forward whenever needed. Courses are entirely based on self-study materials, which require neither support nor feedback from the production team.

Organisation and financing

There are no costs for the users.

NOBEL PEACE PRIZE PROJECT, AMOT SECONDARY SCHOOL

URL	http://www.amot.gs.hm.no/eschola2003/index.htm
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The Nobel Peace Prize project was a media project conducted by Amot Secondary school in Norway in 2002 where pupils had to prepare and cover the Nobel Peace Prize award. They took photographs, made videos and interviewed some of the attendees. The streaming part of this project is about the diffusion of the results of the project. While some students were responsible for the content and the journalism, others had to make a web site and transfer video into a streamed format. This means that the streamed video is in fact the result of the work done where the web site shows all the materials that were produced.



Technology

All content is viewable in streaming format, windows media format 9. Content is not downloadable. The special web site made for this project is also PDA ready, which means in fact that there are two web sites, one for the regular visitor and one for the PDA visitor. The streaming files are available at three different quality levels, so that each connection type can choose the best option to view the movies or hear the sound recordings.

User group

The core user group is in fact the group of pupils who made the web site and produced all the material that is shown online. All the pupils who participated came from one school, Amot secondary. However, users can be in fact be anyone interested in the results of the project. The streaming content is not directly used for learning of itself but more as a way to express what was learned to interested audience on the world wide web.

Pedagogy and methodology

The Peace Prize project is an example of 'learning by doing'. Pupils did interviews, made pictures, produced video material and finally integrated all this into one web site. The streaming part, the audio and video files on the web site, were also transformed into streaming format by students interested in informatics. Rather than using streaming for educational purpose, streaming media was produced and students took part in each stage of the production process. Within the typology already described in chapter 5, this is an example of 'constructing and sharing ones own resources' which also has a motivational value. Learning how to make a streaming file of a video in class or doing it with self-produced material is very different from this perspective.

Organisation and financing

This project was made possible through close collaboration with the Norwegian Ministry of Foreign Affairs and the Nobel Peace Prize Committee. Information about costs are not available. A project like this requires sufficient technical know-how in the school as well as specific knowledge about new media like streaming, web site building, etc. In this case, extensive organization was also necessary for the planning and organisation of such an important international event.

RAI MOSAICO	
URL	http://www.mosaico.rai.it/
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Mosaico is a Rai-Educational project in Italy created to supply teachers with audio-visual and multimedia teaching and learning materials integrated with and complementing lessons and textbooks. Mosaico works as a kind of Video on-Demand using the combined potential of the Internet, Satellite Television, Newspapers and VCRs. The teachers post their demand online by submitting a form. The programmes they have requested are then broadcast via satellite. The person who has requested the programme needs to regularly check the web site to find out when the programme will be transmitted. Most broadcasts happen overnight so the teacher needs to tape the programme on a VCR to be able to re-use it in class. There are plans to offer the educational programmes through streaming in the future.

Technology

Mosaico does NOT make its video materials available via streaming. The broadcasts happen via satellite using digital technology. A dish and a digital decoder are required. Unfortunately such equipment is still not as widespread as it might be in schools. Therefore RAI-Educational in agreement with the Ministry of Education, has installed, at its own expense, satellite dishes and decoders in 5000 Italian schools so as to make its educational programmes more widely available.

User group

The media catalogue of Rai Mosaico is intended for pupils in primary and secondary schools. Each film is no longer than 15 minutes and RAI publishes the broadcast schedule via the internet. The teacher then records the video and uses it in class as required.

Pedagogy and methodology

RAI Mosaico is a clear example of a content distribution system through media on demand where teachers request certain content and the requested content is then scheduled two weeks later on the satellite broadcast. The intention is to provide teachers with 'raw' material only (videos or clips), where they themselves cannot provide such videos. The teaching remains in the hands of the teacher. The videos last between five and fifteen minutes so they are mainly intended to support the teacher in his or her classroom. It is therefore also an example of a catalogued video collection for content illustration. The teacher's role is crucial for the pedagogical use of the videos. Material is not integrated into an entire 'learning concept' and the material is not, of itself, interactive.

Organisation and financing

The Rai Mosaico project plans to collaborate in the future with other European broadcasters. For example, where teachers in France might consult the web site catalogue of available teaching units and e-mail Rai with requests for the broadcast of their specific choice of items. Likewise, once the French have their own version of Mosaico, teachers in Italy might then be able to ask La Cinquième (the French equivalent of Rai-Educational) to broadcast items from the French catalogue. A similar exchange will eventually be possible between all other European Union countries. Rai-Educational has already taken steps towards this goal by organising a series of meetings, through the E.B.U (European Broadcasting Union), to plan and set up this educational „Eurovision“.

The service itself is free for interested teachers and institutions.

SCHOOLTV BEELDBANK	
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The SchoolTV Beeldbank is the online streaming version of the traditional school television broadcast in the Netherlands. Material is published freely online for streaming purposes. Teachers as well as students can visit the web site and search in the school TV catalogue on the basis of subject (e.g. history or geography).

Technology

There are no specific technical requirements to view the streaming media. A regular PC, Pentium 2 or higher is sufficient. A broadband type of connection is recommended but the streaming media is also available in a low bandwidth version. The SchoolTV Beeldbank uses RealPlayer as well as Windows Media Player.

User group

This service is aimed mainly at pupils and teachers in primary and secondary schools although the streaming media are in fact freely available to all interested users. They are catalogued per subject or per age group (primary/secondary).

According to the SchoolTV Beeldbank forum, most users use the Beeldbank individually at home or in the class. Due to the small format of the streaming media, it is difficult to use for whole class viewing. Reactions vary but most children on the forum are enthusiastic about the streaming videos they see. 80% of students in primary education have said they have been in contact with Beeldbank videos and 50% of teachers in primary education say they will use Beeldbank in the classroom.

The site has an average of 700 visitors per day.

Pedagogy and methodology

As SchoolTV Beeldbank is simply the online version of a typical school television service, it offers its videos in a traditional catalogue and neither guidelines nor accompanying documents are available. However its videos are highly curriculum related and therefore usable in class. There is a tendency on the part of TELEAC/NOT, the producers, towards an approach whereby the Beeldbank will also provide a full learning environment with texts, animations and other accompanying materials for learning. TELEAC is also working on teacher's guidelines about how to integrate video streaming in class situations.

For the moment SchoolTV Beeldbank is a clear example of content illustration, teachers and pupils use the videos to see real live examples of what they have learned in class. The teachers themselves are responsible for their integration in the classroom.

Organisation and financing

SchoolTV Beeldbank is a non-commercial service of TELEAC/NOT which is a public institution that is also responsible for the production of videos for School TV.

UNITED STREAMING	
URL	http://www.unitedstreaming.com
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United Streaming is a commercial Video on-Demand service aimed at the educational community in the US. It offers approximately 2200 videos for K12 education as well as practical resources for teachers and students.

Technology

Institutions who wish to receive streaming videos from United Streaming can choose between three different delivery options:

- Full online streaming: On demand streaming of media through the internet, this requires no special hardware or storage capacity
- Local Host: All the streaming media are stored on a local host within the institution. When content is updated, the local host will update automatically. This setting requires a local streaming server with enough storage capacity and a fast local network within the school
- Network manager: In this case software is needed to schedule download of content to a local school server during off-peak Internet hours. Only the videos that teachers requested are downloaded and stored. In this case the local network must also be fast but the need for extra server storage capacity is reduced

User group

United Streaming services are specifically intended for primary and secondary education. All streaming videos are related to the school curriculum for different age groups. United Streaming also offers teachers educational guidelines for the use of new media in classroom.

Pedagogy and methodology

United Streaming is first and foremost a video and clip library, offering a large number of educational media for use in class. Apart from these videos, United Streaming also provides general information on the pedagogical use of video and streaming video in class. This is done by offering information and organising workshops and seminars for teacher training on the use of video and new media in class.

In practice, the video library offers a lot of search and use functions:

Video can be searched from a library by: curriculum standard, keyword, subject area, grade, producer, new releases, or all available titles. The search results are shown with a short description with keywords highlighted in red and a relevance rating percentage. There is also information on grade (class), level (expressed as range), runtime, production year and the content provider.

A correlations link opens a new individual window with curricular topics (for various US states).

After selection of a clip the user can select the file type through radio buttons (if there are various formats). With the radio buttons, a user can select if the video player will run in a separate window or not. Users can also put the file in their own play-list.

In the middle of the window on the left side of the screen there is text indicating key points within the video clip. To the left of each key point there is an „S“ button that starts or jumps the stream to that key point. There is also a similar „A“ button that adds part of the video clip (from the selected key point) to the play-list. On the embedded player there are the Play, Pause, Stop buttons with their familiar icons. There is also a „View Full Screen“ button.

Organisation and financing

United Streaming is a commercial initiative. Schools and educational institutions can sign in to have access to the streaming material. There are three different delivery options (online/local storage/managed storage). A one year subscription costs \$ 1495 for a secondary school and \$ 895 for a primary school.

United Streaming relies on production companies like the Discovery Channel, United Learning and Rainbow Educational Media for the production of new content. Every year, 400 new titles are added to the catalogue.

9.2. Higher education

AV@LON	
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Av@lon was a project involving the National Institute for Sound and Image (NIBG), the Rijksuniversiteit Groningen (RuG) and SURFnet in the Netherlands. This pilot project began in September 2000 and ended in May 2002. Its goal was to provide the educational community with access to streaming video and audio via SURFnet. The purpose of Av@lon was to try out the educational possibilities of Video on-Demand through streaming delivery using content mainly related to video material about journalism and history taken from the national audiovisual archive, the NIBG.

The Av@lon pilot was followed by a comparison pilot called Davideon. Both pilots used archived media material for educational purposes, however they differ in that Av@lon tested the technical feasibility while Davideon is testing educational models of usage and the integration of streaming media in a learning methodology.

Technology

The Av@lon database contains 750 audio or video files in MPEG1 format and uses a RealMedia server and RealPlayer to view these streaming files. Files are only available in streaming format and are not downloadable.

An interesting feature that was developed under the Av@lon project is the Virtual Cutter. This is a tool that allows parts of streaming video files to be cut into a separate web page. This technology is further described in chapter 10.

User group

The Av@lon project was a pilot aimed at students in Rijksuniversiteit Groningen studying journalism and contemporary history. Students were required to work independently with the streaming archive and it was assumed that they were familiar with FrontPage, Blackboard and web environments.

Pedagogy and methodology

The Av@lon databank of streaming audio and video is an example of illustration of relevant content. The videos are simply streamed versions of video from the national audiovisual archive used to support class content and not formally classroom related. One objective was that students

would independently learn to analyse video and make use of the video archive in their tasks. The Virtual Cutter made it possible for students to effectively use parts of streamed material within other applications like Blackboard. The integration of this archive in Blackboard resulted in a rich learning environment where storage, usage and other resources are integrated.

Organisation and financing

The Av@lon project was led by RuG and cost in total € 157 500 of which € 57 500 was grant aided. The main budget categories were local infrastructure, PC equipment, user interface and web site, didactical design of learning material, a pilot college with support and project management.

One of the concluding remarks of the pilot with regard to organisation is that for a large-scale use of a Video on-Demand databank, more specific knowledge has to be available in the educational institutions. Teachers will need support when they make use of this kind of technology. The sequel pilot to Av@lon (Davideon) focuses more on the elaboration of didactical models and usage support of streaming in education.

An important practical issue that is raised in the final report with this kind of application is copyright. Streaming is essentially a technology that duplicates content and makes it publicly available. Content is no longer attached to its physical carrier. Jurisdiction in Europe and, in this case, the Netherlands was not entirely clear on this issue. The pilot was neither open nor public, so only participating partners made use of the streaming videos but the question remains as to what would be legally possible should the system be developed on a larger scale.

CANAL-U	
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Canal-U is a project of the French university community piloted by the National Ministry of Research and Education. SFRS-Cerimes is responsible for effectively carrying out the project. Canal-U consists out of various educational broadcast channels each within a specific domain.

There are several project objectives:

- Increasing visibility and coherence of research achievements in the scientific and educational community
- Contributing to the diffusion of scientific and cultural knowledge through new media
- Stimulating actors in the field towards audiovisual production of relevance aimed at the educational community

Technology

Canal-U uses RealPlayer and Windows Media Player for its streaming videos. The user is also recommended to install Flash for optimal web browsing.

User group

Canal-U targets the international French speaking community, offering curriculum based content, mainly at a university level. Each of the different channels presents different categories of content. Content includes recorded lectures, interviews, videoconferences as well as documentaries on specific topics such as biomedicine, arts and humanities and economics.

Pedagogy and methodology

The streamed content is embedded in accompanying resources like texts, biographies, contact information, further resources and links.

The content is curriculum related and is suitable for use both within and outside formal classroom situations.

Organisation and financing

Canal-U is an open initiative, videos and resources are publicly available at no cost and a registration fee is not required. Funding for the project comes from the French National Ministry of Research and Education.

CERN WEBCAST AND 'LIVE FROM CERN'	
URL	http://webcast.cern.ch/
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CERN is the European Centre for Nuclear Research and provides researchers with the necessary tools to carry out their studies. CERN use streaming media in different ways to provide information to the general public and to provide students and researchers with the latest scientific news. CERN hosts a web cast service, an online archive of lectures and seminars, and is also responsible for 'Live from CERN', a series of live web broadcasts.

The CERN web cast service opens CERN lectures and seminars to universities, schools and the general public. This service allows people to watch live web casts 'as they happen' or watch archived lectures at their convenience.

Technology

The user needs a standard PC to view the streaming videos. Streaming videos are in the RealPlayer Format, except for the LHC video project, these videos are in Quick Time.

The development platform uses the following: a RealServer G2 running on Linux that serves all the multimedia content of the site, an Apache Web Server that serves all static and dynamic (via PHP) web pages, MySQL for storing the full catalogue of archives (only information, no media) and handling archived lectures and live events. The development platform is actually stored in the CERN eAgenda System and PHP, which is Hypertext Preprocessor, this generates all the dynamic pages which retrieve their content from the MySQL database.

User group

The CERN web cast services and 'Live from CERN' are primarily intended for higher education students in the scientific (physics) area. Some streaming media offered at CERN is also aimed at the general public as a way of popularising science and reaching a broad audience.

Pedagogy and methodology

The web cast archived lectures are embedded in an academic training programme for distance learning, e.g. lectures for postgraduate students, summer lectures and a regular lecture programme. They are all accompanied with slides, although the slides and the videos are not integrated in one user interface. The entire lecture programme is available so complete self-paced learning is possible.

The 'Live from CERN' broadcasts are accompanied by web pages in html that provides additional information. Apart from that, there is a discussion forum and questions can be sent via e-mail.

Organisation and financing

The lecture programmes are an initiative of CERN, the European Organization for Nuclear Research. CERN has an particular focus on sharing scientific knowledge with the education and research world.

DAVIDEON	
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Davideon is a co-operative project of the University of Groningen (RuG), the University of Amsterdam(UvA), Windesheim Hogeschool, SURF and the Dutch Institute for Sound and Images (NIBG). It is the sequel of Av@lon and is built around more or less the same concept, making available a catalogue of streaming videos from the archive of the NIBG. However it has a slightly different focus. While Av@lon tested feasibility and technical implementation, Davideon is more about the didactical approach and value of the proposed technology and it's usage. The main aim is to redesign courses in such a way that video can be integrated into the curriculum in a valuable way.

Technology

The streaming content of the Davideon catalogue is available in RealPlayer, MPEG, QuickTime and Media Player format. None of the clips are downloadable. All the user needs to watch the clips is a standard PC with a broadband type connection.

An important technical specification in an 'archive' databank-like project is the search methodology and the protocols for metadata specifications. The Davideon project participants considered several ways of storing, searching and working with the available content: including the VIP tools developed by the Telematics institute, the Virtual Cutter developed by the University of Groningen and also used in Av@lon, and the Amicitia public web access interface.

User group

The aim of the pilot was to integrate and adapt the curriculum so that it would make optimal use of video in education. Each of the three participating institutions adapted several courses for the Davideon pilot. The user group is thus specified and limited to those courses and their attendees. Apart from the students, project participants also used the pilot to test the usability of streaming material from the teachers point of view taking into account their chosen pedagogical approach.

Pedagogy and methodology

The aim of the Davideon project is to develop a didactically useful integration of video into courses. The videos that are made available are selected on the basis of their relevance to a specific

course and each course is developed with usage of video in mind. This means that they are intended for use beyond simple illustration. Videos are integrated in Blackboard and students work on specific tasks with the available material. The content is not originally classroom related and is taken from NIBG. Because of the integration of the video material in Blackboard and the design of course specific usage, interaction between learners and the materials is possible.

Organisation and financing

The total budget for this pilot was € 675880 of which half is paid by the participating institutions and the other half is grant aided by SURF. Students participating in the courses did not have to pay for the streaming content (costs were carried by their institutions).

A specific aim of this project was to test the practical organisation of developing adapted courses, integrating the usage of video and the new role of the teacher when using this approach. This meant that training and implementation concepts had to be developed. Typical organisational aspects like co-operation between different partners were also assessed as developing working procedures will be necessary should this project be carried out on a larger scale. The ultimate goal is to make a catalogue of material and the accompanying didactical usage a national element of education in the Netherlands.

One specific aspect of the pilot was the selection of image material from the national archive. The archive was so huge that selection was absolutely necessary. This had to be done in a coordinated way so that useful content was extracted. Developing selection mechanisms and working practices to make use of this material is another practical objective of the pilot.

The copyright issue is also important in this case example and remains rather unclear.

D-LECTURE	
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D-Lecture is a project led by the Zentrum für Multimedia in Lehre (ZMML), University of Bremen in cooperation with Bremen Briteline GmbH. D-Lecture is an online web environment where previously recorded lectures are shown, together with accompanying materials like PowerPoint presentations, documents and simulations.

Technology

The D-Lecture system uses RealPlayer for the streaming videos. For the other parts of the lecture Adobe Acrobat Reader, Microsoft Office and/or other standard software may be necessary to view the content. No specific PC requirements are necessary. Although a broadband type of connection is recommended, the streams are also available for 56kbs or dual ISDN. Bremen Briteline GmbH



developed the software for the integration of the different parts into one presentation environment.

User group

The lectures are mainly intended for students at the Bremen University but are open for everyone. Another target group are students abroad or students who cannot attend classes when they are taking place. With the D-Lecture system, students can hear and see courses, as well as receiving course documents like text material.

Pedagogy and methodology

D-Lecture aims to make courses available and individually usable for review outside the university. It is an example of capturing and archiving educational events where all the relevant learning materials can be found in one place. The individual user is independent in his or her learning and can decide to watch the entire lecture, parts of the lecture, slides and/or the accompanying documents.

Evaluation of the pilot system by the students is positive and 71% of those asked said the D-Lecture system was a clear improvement in the learning offer, 75% of those asked regretted that the system was not available for all courses.

Organisation and financing

The University of Bremen developed D-Lecture in cooperation with Briteline GmbH as a pilot project during the 2001-2002 academic year. In 2003 the lectures were entirely redesigned. Students can use the D-Lecture system for free and it is open to anyone.

FUNET TV	
URL	http://tv.funet.fi/index.jsp.en
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ADDRESS	CSC – Scientific Computing Ltd PO Box 405 FIN-02101 Espoo Finland
E-MAIL	helpdesk@csc.fi

Funet TV is the joint development project of CSC and the Finnish universities. Its purpose is to produce Internet networked multimedia services to the Funet network to support research and education activities in the Finnish universities. Funet TV contains several services; transmission of live video; videoconferencing and Video on-Demand material stored in media archives.

Technology

The Funet TV streaming media comes in various formats. Streaming videos can be Real, MPEG1, MPEG2 and QuickTime. The newest films however are MPEG4. Hardware requirements are a standard PC with sound and video and an internet connection of sufficient capacity.

User group

Funet TV is a Finnish service, primarily aimed at the Finnish academic sector.

Pedagogy and methodology

The video-on-demand archive is searchable. Videos are not integrated in other applications or accompanied by other materials. Most of the time, only the videos are presented although in some cases you can also find a link to a web page with relevant information on that topic. The interaction is limited to start, stop and pause.

Organisation and financing

Funet TV co-operates with universities, learning and computing centres, virtual university projects, ISPs and content producers. They also have cooperation with software developers and manufacturers. Educational and scientific multimedia material is continuously added to the media archive, which is maintained at CSC.

Users can search and view the archived films for free.

HYPERVIDEO APPLICATION, CDED

URL	http://www.cded.uni-mb.si/ (information about the Hypervideo application is only available upon e-mail request)
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The Hypervideo Application was developed in 1999 by the CDED, Maribor, Slovenia in cooperation with the University of Oldenburg, Germany, Interface Consult, Austria and the University of Tuzla, Bosnia-Herzegovina.

This project is a hypervideo presentation of an engineering experiment on the magnetic suspension system and is an example of an effective transfer of lectures and online exercises supported by the synchronized combination of real time video streaming with links to clips, sound, slides, text and static images.

Hypervideo as developed in this project is a form of streaming whereby the user can use hyperlinks within a video to find more information, a new video or a web site. Essentially hypervideo links work the same as hyperlinks but within a video environment, with so called clickable 'hot spots'.

Technology

This Hypervideo application was accessible via a streaming client at the faculty and is a typical example of streaming in RealVideo format. A regular PC with colour display and a fast Internet connection is necessary. It was also available as a CD-Rom for use at home by students as most students in Slovenia have no access to fast Internet connections at home.

The application itself made use of SMIL and HTML. SMIL is a mark-up language that enables sequential timing of certain components within a multimedia environment and allows the author of the application to decide what and when each element of the application is presented.

User Group

The application was developed as a pilot project and intended for local teachers and learners within the Faculty of Electric Engineering and Computer Science. 40 students from the faculty used the streaming application at home or at the University which showed an example of a magnetic suspension system. By clicking on hot spots they could find out more about parts of the content being shown. Although it was made for local use, it was also intended to show the project to a general international audience, therefore an English voice-over and subtitles are included.

Together with the application, in streaming format or stored on a CD-Rom for use at home, students also received accompanying materials about the experiment being shown, as well as some instructional guidelines about how to use the application.

Pedagogy and methodology

This application dealt with one clear and specific study topic, the intention was to show students a single Electric Engineering experiment, the functioning of magnetic suspension. By using video, audio, text, pictures, animation and interactive elements in the streaming video, the experiment could be shown in an interactive way. The application succeeded in that it showed the experiment as well as providing relevant educational information together with the video. The hotspots within the video stimulate the student to go and look for further information. The application is in fact a combination of content distribution, content illustration and content interaction. Information is provided and illustrated through interactive video. A supplementary advantage of this application is the integration of these elements where content delivery, illustration and interaction are presented in an integrated way.

Within the typology already described in chapter 5, this project is an example of capturing and re-using a real event (the experiment) as well as providing in depth insight into the event and by making use of supportive documents and hyperlinks, it is also an example of video supporting a learning process.

Organisation and financing

This Hypervideo project is a pilot project. Students and teachers in the Faculty of Engineering can use the application for free. Other interested institutions can also make use of the application under special contract with the university. This means that the application is not publicly accessible. The intention was to continue with the pilot project but lack of funding has made this impossible.

LIFESIGN	
URL	http://www.lifesign.ac.uk/ and http://www.lifesign.ac.uk/default.asp
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Lifesign started as a JISC funded project in the UK to test and evaluate the feasibility of delivering streaming media to support learning in Life Sciences. Lifesign has now evolved into an ongoing service for further education students. Although the funding from JISC has ceased, Lifesign continues and is hosted by the University of Portsmouth. The concrete objectives of the project were to compile a comprehensive collection of video resources relevant to the life sciences discipline, testing how these resources might be delivered over networks, develop software that enables integration of the resources in library systems, developing a licensing framework, providing guidelines and supportive material to embed the use of streaming media, evaluating the pedagogical effectiveness of streamed media and finally developing a sustainable infrastructure to guarantee the continuation of the initiative beyond the lifespan of the project.

Technology

The streaming media of Lifesign are available through Windows Media Player and there are various options so that you can choose according to the connection you have available. No other specific technical requirements are necessary.

A great deal of attention of the Lifesign project went into the catalogue and how to prepare it for searching and using the material. Both Dublin Core and IMS metadata have been reviewed in detail for the project.

In order to have workable streaming media that can be used rather than viewed only, the web database also showed a 'get url' function, so that the url of the video can be integrated in other environments that enable hyperlinks. Another feature of the Lifesign project is the cutter tool that can be used to mark parts of streaming media and add these to a personal play-list.

User group

The Lifesign catalogue is open for every higher or further education assigned IP address. Essentially this means that every networked computer of higher education institutes has access; students at home however do not have access. This restriction comes as a result of copyright and legal issues. The intention is to make Lifesign available to all life sciences students as well as teachers who want to make use of these images in their courses. Usage is free.

Pedagogy and methodology

The Lifesign project has several clear pedagogical goals:

- To evaluate the pedagogical effectiveness of streamed video within a number of taught units in the life sciences
- To assess the impact of streamed video on current curriculum delivery within participating institutions on two Metropolitan Area Networks (MANs)
- To contribute to the wider debate on the use of streaming video to support learning and teaching in UK life sciences

The Lifesign web site represents some case studies about the pedagogical effectiveness of the usage of streaming media to teach specific issues. Streaming media is compared for example with a PowerPoint presentation or a lecture to present the same sort of content. However, the evaluation report states that impact and usage are difficult to assess.

In our typology of usage, Lifesign represents 'content illustration' and in the case of using fragments via the cutter tool and integrating them into other applications we can say that it is about content integration and content interaction.

Organisation and financing

Lifesign, networked moving images for the life sciences, is a result of collaboration between the universities of Glamorgan, Southampton, Portsmouth and University of Wales Institute Cardiff (UWIC). Talis Information also supports the project.

Access to the Lifesign catalogue was free for institutions and students of higher education.

Lifesign had several aims, of which one of the most important was the cataloguing of existing video material. It is important to stress the rights clearing issues here. Content was mainly provided by

the BBC but could not be distributed openly. Lifesign chose to restrict access on an IP basis, so that only predefined IP addresses could log on to the system. The evaluation report states that a password log in could have been a better option.

MEDIALAB AALEN	
URL	http://www.medialab.fh-aalen.de/elearning/
MAIN CONTACT	Prof. Dr. Bauer and Prof. Dr. Dietmar Kümmel
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E-MAIL	e-mail medialab@fh-aalen.de

The Technical High School of Aalen in Germany takes a blended learning approach where streaming video supports teaching. Lectures are recorded and made available for students over the Internet. Together with these lectures, students can see slides or other documents accompanying the course.

Technology

Aalen uses RealPlayer 8.0 for its streaming media and Internet Explorer 5.0 is required as a minimum. A broadband connection for Internet access with a minimum transfer rate of 256 Kbps is recommended.

User group

The service is aimed at students of the Technical High School and is therefore an institutional initiative. It is however possible as an outsider to request a log in to view lectures and other content. The institution sees several advantages for students like the high level of independence and the integration of learning elements and their availability in one place as well as the flexibility in handling learning material.

Pedagogy and methodology

Aalen uses streaming and ICT within their concept of blended learning, which means that learning should not be entirely virtual, but that virtual means can support the learning process. Therefore, the lectures in streaming media and the accompanying presentations are integrated in WebCT, the chosen virtual learning environment.

The use of streaming is an example of content distribution to all students and content integration whereby the streaming media are synchronised with and accompany other information resources. Interactivity is rather low, the streaming videos can only be played, paused or stopped. In the virtual learning environment there are, however, discussion forums and collaborative tools for working with content.

Organisation and financing

The streaming media available at the Technical High School of Aalen is self recorded and produced. The institution takes care of transformation into streaming media and its integration within the virtual learning environment. Streaming media are used for two courses: Masters of Science in Business and Vision Science (in cooperation with Newenco Boston), for marketing lectures (International Business Management) and for streaming internal and external live events (e.g. recording of educational events, conferences and congresses).

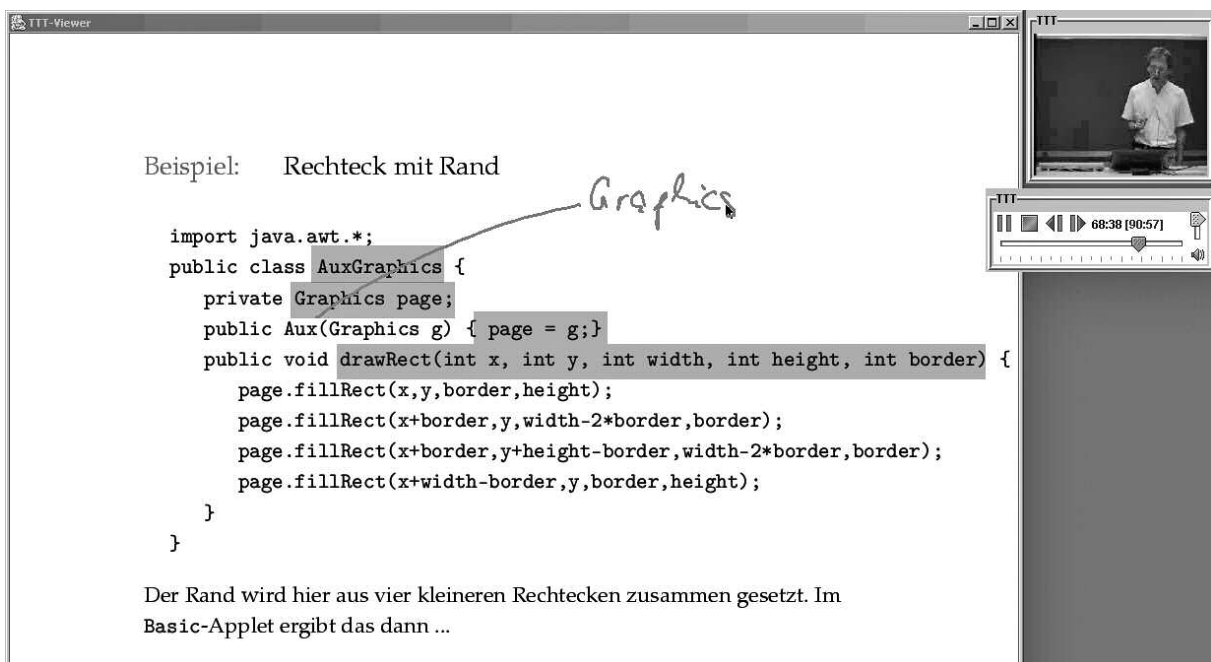
As the material is part of the curriculum, students don't have to pay an extra fee for usage of the streaming media and the virtual learning environment.

The advantages identified by Aalen are the low production costs, relative ease of production and usage, low production costs and the possibility to monitor interest and usage by the teacher. In the long term, Aalen sees a possibility to market all their educational content in this way.

TELETEACHING @ UNIVERSITY OF TRIER

URL	http://teleteaching.uni-trier.de/news.en.html
MAIN CONTACT	Peter Ziewer
ADDRESS	Universität Trier FB IV - Computer Science D-54286 Trier Germany
E-MAIL	ziewer@uni-trier.de

The University of Trier has developed it's own TeleTeachingTool to be able to deliver online lectures. The tool enables recording and transmission of arbitrary content with the special platform independent, java based TeleTeachingTool.

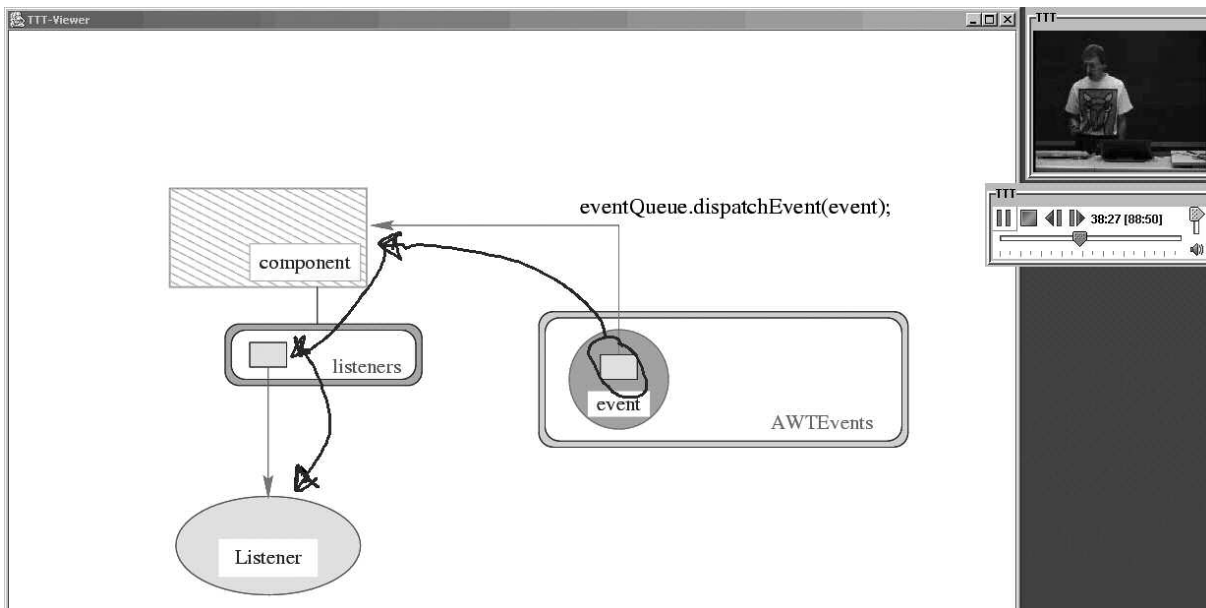


Beispiel: Rechteck mit Rand

```
import java.awt.*;
public class AuxGraphics {
    private Graphics page;
    public Aux(Graphics g) { page = g;}
    public void drawRect(int x, int y, int width, int height, int border) {
        page.fillRect(x,y,border,height);
        page.fillRect(x+border,y,width-2*border,border);
        page.fillRect(x+border,y+height-border,width-2*border,border);
        page.fillRect(x+width-border,y,border,height);
    }
}
```

Der Rand wird hier aus vier kleineren Rechtecken zusammen gesetzt. Im Basic-Applet ergibt das dann ...

<http://teleteaching.uni-trier.de/news.en.html>



<http://teleteaching.uni-trier.de/news.en.html>

Technology

Technical requirements for the PC are that it should be equipped with an audio-/video-capture card(s) and a soundcard supported by the Java Media Framework.

The TeleTeachingTool itself works with the following different kinds of files: ttt'-file: the speaker's desktop recording (e.g. the slides), '.mp3'-file: the audio data, '.mov'-file: the video data (optional). Lectures are delivered in multicast or unicast transmission. Multicast transmissions can only be received if they are supported by an operating system and the network connection/provider.

Technologically spoken, only live transmissions of the lectures can be regarded as streaming while the recorded lectures are typical downloads.

User group

Content is used by individual learners for self paced learning as an additional offer to the standard lectures and is intended for all students of the university. Access to the lectures is however free and therefore open for everybody. Content is produced by the university professors.

Pedagogy and methodology

Teleteaching at the University of Trier is intended to support the normal traditional lectures. The TeleTeachingTool enables the integration of lecture slides, lecture video and additional 'marking' made by the professor. In this way, the online lecture becomes more active and lively than would otherwise be the case. The use of the TeleTeachingTool is an example of content distribution and content integration. This is because the lecture is delivered online and the fact that a recorded lecture is integrated with other learning materials and the personal input of the professor.

Organisation and financing

The TeleTeachingTool is developed and intended for use in the University of Trier. All the lectures are transmitted live. An archive of recorded lectures is available on the web site. The production of lectures and recordings also takes place in the university.

VIRTUELLE UNIVERSITÄT REGENSBURG

URL	http://vur.uni-regensburg.de/
MAIN CONTACT	Dr. Klaus J. Schäfer
ADDRESS	Virtuelle Universität Regensburg Universitätsstraße 31 D-93053 Regensburg Germany
E-MAIL	

Students in the University of Regensburg have access to streaming videos of their courses where lectures at the university are recorded and transformed into streaming video.

Technology

The streaming lectures are in the Real format and you have to use the RealPlayer plugin to play them. A standard PC is required (regardless of operating system, Windows, Linux, MacOS are all possible), a Web browser (for example Netscape, Mozilla, Internet Explorer, Konqueror) and two plugins (Acrobat Reader, RealPlayer). Streaming videos are not downloadable.

User group

The user group is well defined, students attending the Virtuelle Universität Regensburg who receive a log in and password to access the material. Guests can log in as a visitor and see one example of a streamed lecture about information management.

Pedagogy and methodology

The thinking behind the Virtuelle Universität Regensburg initiative is that enabling students to review lectures, accompanied with course documents in .pdf format should expand the quality of learning. The streamed lectures are a clear example of content distribution. The lectures in this case are not integrated in a wider learning environment and interaction is not possible. The lectures in streaming video however make it possible for the student to review the lesson on line. This is especially useful for students who were not present in class.

Organisation and financing

This pilot project happened as a result of a dissertation by a student of the University of Regensburg. All students at the university have free access to the streaming media. The system is based on open source software, the hardware, maintenance and service costs of the system are paid by the institution.

VORMTHEORIE LECTURES ONLINE

URL	http://www.tudelft.nl/matrix/index.cfm?usertype=bezoeker
MAIN CONTACT	Paul Hekkert
ADDRESS	Julianalaan 134 NL-2628 BL Delft The Netherlands
E-MAIL	p.p.m.hekkert@io.tudelft.nl

The Technical University of Delft (TU Delft) in the Netherlands makes recordings of guest lectures and provides them to the students online. Additional information about practical issues such as exams and time schedules are also available online.

Technology

RealPlayer 8 is used to stream the media.

User group

The streaming videos are intended to support students who attend one of these guest lectures, they are also freely available to the public via the web site.

Pedagogy and methodology

Online lessons and lectures are intended as a pedagogical support to students who have already attended the lectures in person. They can use the streamed videos to review the lecture and check whether their notes are correct and complete. This is a typical example of content distribution, where the entire lecture is placed online in streaming format. It has purely a supportive function and is not integrated with other learning resources. Interactivity is limited to play, stop and pause.

Organisation and financing

The lectures are freely available online for anyone who visits the site. The university records and produces the material.

WEB LECTURE ARCHIVE PROJECT

URL	http://wlap.physics.lsa.umich.edu/ http://webcast.cern.ch/Projects/WebLectureArchive/lillestol/
MAIN CONTACT	Steven Goldfarb
ADDRESS	CERN Genève 23 CH-1211 Geneva Switzerland
E-MAIL	Steven.Goldfarb@cern.ch

The Web Lecture Archive Project is a joint venture between the UM-ATLAS Collaboratory Project, the University of Michigan Media Union and CERN (the European Laboratory for Particle Physics). Its goal is to implement an electronic archival system for slide-based presentations on the Internet.

Technology

Viewers of online lectures require a standard PC preferably with a 1024X768 screen resolution and a minimal network connection of 56 Kbps. The streaming media use RealPlayer. The browser needs a PowerPoint plugin to show lecture slides.

User group

The target user group for the web lecture archive project are mainly university students, science teachers and researchers. Content is quite specific and scientific.

Pedagogy and methodology

The web lecture archives provide lectures together with the lecturer's slides of the content. It is an example of archiving an event (lecture) so that students can review it or so that a worldwide audience is able to view the lecture and keep the information it contains for later.

The web site also offers instructional guidelines on how to record lectures so that they can easily be transformed to streaming media as well as information for teachers on how to use the streaming lectures for pedagogic purposes.

Organisation and financing

The Web Lecture Archive Project is organised by UM-ATLAS, the University of Michigan Media Union and CERN.

9.3. Continuing Education

ATVN PROJECT	
URL	www.atvn.pl
MAIN CONTACT	Krystyna Rudowska
ADDRESS	ICM UW, ul Pawińskiego 5a PL-02-106 Warszawa Poland
E-MAIL	K.Rudowska@icm.edu.pl

Academic Internet Television Network (ATVN) is an extension of the ICMAITN project, an accompanying measure that started on August 1, 2002 at the Interdisciplinary Centre of Mathematical and Computational Modelling in Poland. It's main objectives are to create awareness in Central Europe's research community of international cooperation through ATVN and the creation of a technological platform for real time knowledge exchange over the Internet. These goals have been achieved through a series of workshops, conferences, consultations with important and knowledgeable speakers, and other dissemination activities. ATVN is a good example of how to organize and run a TV channel on the Internet. An archive of 300 videos can be viewed and new videos are regularly added, all within the scientific sphere.

Technology

The streaming videos are available in the RealPlayer format. Decisions about what technology to use in ATVN were guided by several requirements. First of all the technology chosen needed to be open therefore ATVN only considering solutions that are format independent, not tied to a single platform and where possible with a published source code. ATVN also only considered solutions which were suitable for narrow (up to 128 Kbps) and medium band (up to 1Mbps) application. ATVN therefore decided to consider streaming formats only, which left them with a choice between RealNetworks' Helix server or Apple's Darwin system. Linux PLD distribution was chosen to provide a robust OS platform for the server. The first format chosen was Real Media Surestream.

ATVN is netcasting in 384x288 resolution at 7 different quality/compression options from one suitable for lowest bandwidth stream for dial-up users (33 Kbps), which is 10 Kbps video (15 fps), 6 kbps audio (8000 Hz mono) to the best quality stream for broadband users (0.5 Mbps connection or better) using 353.5 Kbps video (25 fps), 96.5 Kbps audio (44100 Hz stereo).

User group

The main aim is to design, implement, develop and run the multimedia Internet television platform to give scientists around the world opportunities to exchange knowledge and information about the latest scientific achievements and discoveries and to promote the people behind such developments. The initiative is thus primarily intended to serve the scientific research community in various scientific fields.

Pedagogy and methodology

There is no specific pedagogic approach. ATVN simply broadcasts and archives videos on scientific issues, aimed at the scientific sector, in order to make a broad exchange of information possible. ATVN not only serves the academic community but is also involved in popularising science to a wider audience. All the videos are publicly available.

Organisation and financing

Partners in ATVN are:

- ICM; Interdisciplinary centre for mathematical and computational modelling, project organisation and management
- KBN; Ministry of scientific research and information technology
- Polish Foundation for Science Advancement; which provides material
- Media Corporation; which provides material

LAWLINE.COM	
URL	http://www.lawline.com
MAIN CONTACT	Ron Diorio, Vice President of Programming
ADDRESS	Lawline.com 63 Wall Street 27th Floor NY 10005 New York USA
E-MAIL	info@lawline.com

The Lawline.com web site offers a large and comprehensive selection of law-related programming, combining audio and video web casting with downloadable text materials.

Technology

The streaming media of Lawline.com requires standard computer equipment with sound and video. The streaming media is played with a RealPlayer.

User group

Lawline.com media is specifically aimed at law students and more specifically the continuing legal education (CLE) sector where Lawline.com offers various CLE programmes in a distance learning setting. Courses offered are intended for bar associations, lawyers, law students and people who interested in legal issues.

Lawline.com offers CLE in certain US states: Alaska, Arizona, California, Connecticut, Hawaii, Illinois, Massachusetts, Maine, Maryland, Michigan, Missouri, Nebraska, New Jersey, New York, South Dakota, Virginia and Washington, D.C.

Pedagogy and methodology

Each example of available streaming media belongs to a specific CLE programme with its own specific pedagogy and methodology. CLE programmes can be completed by doing tests or other assignments to earn credits for specific courses.

Organisation and financing

Lawline.com is a commercial law education initiative. Each course is offered for \$25 per credit hour, although some demonstration courses are free. Lawline.com is the online version of Lawline television programmes (Lawline TV) and Lawline radio, all intended to serve the law community with up-to-date information.

LANDESFILMDIENSTE	
URL	http://www.landesfilmdienste.de/streams/streams.html
MAIN CONTACT	
ADDRESS	Landesfilmdienste Rheinallee 59 D-53173 Bonn Germany
E-MAIL	info@kipconcept.de

Landesfilmdienste in Germany provides a non-commercial streaming media service for public and private institutions offering a range of educational videos.

Technology

Access is offered in 2 bandwidth options: 56KB and 300 KB. A standard PC is required with an 800MHz processor, 32MB RAM, a 56k modem and a video card with 65,000 colours.

User Group

This service is intended for public and private organisations like universities, adult education centres, educational institutions, labour unions, press, parochial, social, political, communal and other institutions/agencies.

Pedagogy and methodology

The service offers pedagogical and didactical concepts and seminars, audio and video productions and additional educational material. The web site includes a media resource covering:

- job descriptions and industry
- health and prevention
- environment and nature
- politics and society
- economical collaboration and development
- feature films for cultural and educational work.

MEDICAL ROUNDS MULTIMEDIA ON DEMAND

URL	http://www.medicalrounds.com/
MAIN CONTACT	Kenneth F. Cunningham, MD, FRCPC
ADDRESS	Medical rounds 102-160 E. 14th St. V7L 2N1 North Vancouver, British Columbia Canada
E-MAIL	mr@medicalrounds.com

MedicalRounds develops online multimedia presentations and conferences for contributing medical groups. Incorporating not only static slide images and audio but also full-motion embedded video and animations, the presentations reliably reproduce the original content for online delivery in a way not possible with inferior web casting methods.

Technology

The hardware requirements are any Power Macintosh computer, or a Windows computer with a Pentium 166 or better with at least 32 MB of RAM and 20 MB of free hard disk space, a sound card and external speakers. The monitor has to be capable of at least 800x600 pixels resolution and „thousands of colours“ or „high colour“ mode; however, a larger monitor with higher resolution gives a better picture.

The presentations are technically delivered in such a way that any speed of Internet connection will work, however institutional, xDSL, cable, or ISDN Internet connections are certainly preferred due to the amount of data transmitted. A dial-up modem will still work, with a little patience at the beginning to allow some of the presentation to preload. Software needed is QuickTime Player, Acrobat Reader and Real One Player.

User group

The presentations are freely available to those who wish to see them. The targeted audience are people in the medical field including students, researchers, and doctors.

Pedagogy and methodology

Presentations are generally accompanied with information and slides in .pdf format. MedicalRounds is an archive of relevant streaming films on medical issues which also offers an extensive databank with links to other information resources.

Organisation and financing

The service is offered by MedicalRounds, an organisation of university medical campi, medical organisations and hospitals in the United States.

Through partnerships with government, institutions, and industry, the service is free.

UCTV	
URL	http://www.uctv.tv
MAIN CONTACT	Lynn Burnstan, Managing Director
ADDRESS	UCTV University of California Television, The Knowledge Channel Gilman Drive 9500 La Jolla CA 92093-0176T USA
E-MAIL	knowledge@uctv.tv

The University of California offers a live and on demand video service called UCTV. Lectures, documentaries and research symposiums are broadcast through the Echostar satellite network and on the web site of UCTV in streaming format.

Technology

The user needs RealPlayer to view the streaming media. Most streaming media is in the .rm format although the latest added media is available in MPEG4. The videos are not available as downloads, only as streaming.

User group

UCTV films are intended to serve an audience including students and those interested in the wider public. The main goals of UCTV are to increase public knowledge of research developments, to provide the public with in-depth information and to enrich classroom experience by providing access to streaming media.

Pedagogy and methodology

The UCTV channel offers all archived films as streaming media on their web site. Searching in the archive is based on categories (agriculture, arts and music, business, education issues, health and medicine, humanities, public affairs, science, series, short programs) and with search keywords. After the title selection an individual window opens with a short description of the film, duration, a relative image, and a 'watch it now' link. The player opens in its own window and therefore interaction is limited to its own characteristics such as start/stop/pause.

Organisation and financing

The UCTV channel is an initiative of the University of California. The affiliated university campi of the University of California deliver the content of the films. The streaming content is openly available for viewing on line.

10. Tools

LTSS, LEARNING TECHNOLOGY SUPPORT SERVICE, UNIVERSITY OF BRISTOL	
URL	http://www.ltss.bris.ac.uk/interact/22/in22po8.html
MAIN CONTACT	Ian Craddock and Gosia Mendrela
ADDRESS	Department of Electrical and Electronic Engineering University of Bristol Merchant Venturers Building Woodland Road BS8 1UB Bristol UK
E-MAIL	ian.craddock@bris.ac.uk or gosia.mendrela@bris.ac.uk

The Learning Technology Support Service of the University of Bristol has developed a technique which allows the handwritten, audio and video content of a lecture to be delivered over the Web. This technique requires no special effort from the lecturer, is inexpensive and can be used routinely to capture lectures for off-campus use.

Technology

The recording of lectures requires:

- A Mimio whiteboard capture bar (£400) attached to the whiteboard in order to digitise written material - this senses the movement of the pen on the board using infrared and ultrasonic sensors.
- A wireless microphone for recording the lecturer (£150)
- A web cam for capturing the video (£80)
- These three inputs are presented to standard recording applications on a PC or laptop.
- The streaming content, as well as the lecturer's notes synchronised to the video by making use of SMIL, are available in RealPlayer format. Lecture data is held on a Real streaming media server.

User group

The project is largely aimed at recording and delivering university lectures to off-campus students (typically individuals, such as engineers and lawyers, who require continuing professional development throughout their careers), however the possibility of on-campus students being able to view (or review) lectures on demand is also interesting.

Pedagogy and methodology

The starting point for this project was the need to deliver learning materials to students at a distance, without imposing extra work on the teacher. The choice was then made to record the standard lectures that the professors were already giving while also recording their notes electronically. In this way, double work is avoided for the teacher, and the learner at a distance has a idea of what was said and done in class. The lectures are also useful for traditional students who use them for review.

Organisation and financing

The system of recording and delivery was specially designed to be simple and easy to set up at a low cost. It was developed by the University of Bristol and the project was funded by a Learning and Teaching Award from the university's Education Committee.

eTEACH LEARNING ON DEMAND	
URL	http://eteach.engr.wisc.edu
MAIN CONTACT	Gregory A. Moses
ADDRESS	Department of Engineering Physics Univ. of Wisconsin-Madison 407 Engineering Research Building 1500 Engineering Drive WI 53706 Madison USA
E-MAIL	moses@engr.wisc.edu

The eTEACH learning on demand project is part of the National Partnership for Advanced Computational Infrastructure (NPACI) and provides an electronic integrated system for lecturing and authoring. An eTEACH presentation combines a video frame (Microsoft MediaPlayer) with a slide frame (Microsoft PowerPoint), an external web link frame and a dynamic table of contents that titles the major portions of the lecture and allows the user jump to any portion of the lecture.

Technology

Users of eTEACH need a standard PC equipped with sound and video cards. Windows Media Video Codec V8 and ACELP.net Audio Codec are required for the codification of audio and image. An internet connection of sufficient quality is required to view the streaming media.

User group

The eTEACH authoring and presentation software was used to reform the curriculum of a large enrolment sophomore-level computer sciences course (CS 310) taken by engineering students at the University of Wisconsin-Madison. Two weekly lectures were replaced with online eTEACH presentations viewed at the student's convenience and students attended an additional computer laboratory each week in a specially designed computer "team lab".

Pedagogy and methodology

This laboratory experience was mentored by the faculty in an active learning format and was formally evaluated positively by the LEAD Centre at the University of Wisconsin – Madison, an evaluation service and research centre, to measure the outcomes.

Organisation and financing

Major support for eTEACH comes from the National Science Foundation through NPACI, and from the University of Wisconsin-Madison through the University of Wisconsin Graduate School, the College of Engineering, the Computer Sciences Department, and the Wisconsin Center for Education Research. Additional support was provided by Microsoft and Sonic Foundry.

At a practical level, extensive support material is available. Potential eTEACH authors (media creators) are offered the following:

- 1) eTEACH Author's Manual (online)
- 2) eTEACH Authoring Tool Downloads with installation instructions (the latest authoring tool offered is version eTEACH Author 2.3.6)
- 3) eTEACH Authoring Demo which is a lecture introducing current and prospective authors to the eTEACH Authoring Tool
- 4) Tips and Tricks

In addition, potential eTEACH users are offered an extensive user manual.

HYPERFILM S.R.L.	
URL	http://www.hyperfilm.it
MAIN CONTACT	Roberto Tua
ADDRESS	HyperFilm srl Environment Park Via Livorno 60 IT-10144 Torino Italy
E-MAIL	roberto.tua@hyperfilm.it

Technology

HyperFilm is a software that allows the user to create and distribute digital videos enriched with links and connections to various types of contents. The connections (links and hot-spots) are synchronized and the player shows them at the moment and in the manner previously arranged by the author, providing the user with a great deal of freedom.

Target group

Although HyperFilm comes from an educational setting it can be used for any kind of streaming application.

Pedagogy and methodology

HyperFilm was used by the schools taking part in the project Dschola. Some examples of its use in the project are available here:

http://www.dschola.it/content_r.php?op=modload&name=dvideo/galleria.php&file=index

Organisation and financing

HyperFilm was created in Turin in 2000 when CSP, an Italian research centre, supported the development of a HyperFilm prototype, then called EdVideo, in the local project „Crescere in città con Torino 2000“ („Growing in the city with Torino 2000“). HyperFilm became a project in its own right when it was run by CSP and co-financed for a year by the European Commission IST Programme - Take Up Actions (Action Line 3.2.1.). Input to the development of the tool came from CSP, the City of Turin, Pubbliviva, the GAM of Turin, IRRE Piemonte, Primo Liceo Artistico and many teachers. Further background information is available on: <http://www.hyperfilm.it/en/index-UK.htm>

The HyperFilm software is freely available to schools.

INHOLLAND VIDEOPOORT	
URL	http://www.icholland.nl/videopoort/videopoort2.html
MAIN CONTACT	Tom Visscher
ADDRESS	Inholland Hogeschool Wildenborch 6 NL-1112 XB DIEMEN Postbus 261 NL-1110 AG DIEMEN The Netherlands
E-MAIL	Tom.Visscher@INHOLLAND.nl

The Institute for Higher Education Inholland Diemen has developed Videopoort, a physical video ‘pillar’ that converts simple VHS videos to a streaming file on the Inholland server. Converted fragments of video can be viewed then as streaming with a regular Windows Media Player.

Videopoort uses the metadata model developed by SURFnet in cooperation with the Royal Library, the Dutch Archive for Audiovisual Material, the University of Groningen and the University of Utrecht.

The Videopoort is an example of a technical device that makes the use of streaming easier to handle.

Visit this web site for a short explanation of how the Videopoort works:

<http://www.icholland.nl/videopoort/videopoort2.html>

DE VIRTUELE SNIJMACHINE (THE VIRTUAL CUTTER)

URL	http://video.surfnet.nl/snijmachine/select_file.php
MAIN CONTACT	André Rosendaal
ADDRESS	Centrum voor ICT en Onderwijs Letteren (ICTOL)/ Centre for ICT and Learning in the Humanities Faculty of Arts University of Groningen PO Box 716 NL-9700 AS Groningen, The Netherlands
E-MAIL	a.j.m.rosendaal@let.rug.nl

The Virtual Cutter was developed in the framework of the Av@lon pilot, when films from the Dutch audiovisual archive were made available in streaming format. The Virtual Cutter is essentially a web-based tool that generates html code of a selection of a streaming media file. The html code can then be used in other documents and programmes that support html, e.g. a PowerPoint presentation or a word document.

Technology

Virtual Cutter can be used for the following file formats (and players):

- MPG, MP3, MPA, RM, RAM (RealPlayer Version 5 or more recent)
- ASF, WMV, WMA, ASX (Windows Media Player Version 6.4 or more recent)
- MOV (QuickTime Player Version 4 or more recent)
- MP4 (MPEG-4) (QuickTime Player Version 6 or more recent)
- Kasenna Media Base files (MPEG-1 en MPEG-2) (Kasenna Broadband Player 3.01 en 3.0.2. Version 3.0.3 is not supported because of the different formatting of time codes. For MPEG-2 the Mediamatics StreamExpress software is required)

The Virtual Cutter can be used for cutting any streaming file location on the internet, except if the link to a streaming file does not directly refer to the streaming file itself but to a metafile, for example ram and asx files do not refer directly to the streaming video itself. The solution for this requires some cutting and pasting of references in the metafile.

Options

It is also possible to generate a playlist (which is essentially a list of cuts of different streaming films) using the Virtual Cutter. This playlist can then be used to view the selection of media at once, in one stream. This means that the Virtual Cutter is also a tool which can be used to edit streaming video. Output is always an html link so use of this is only possible in an html-supported environment (an electronic learning environment, word processing, slide presentations etc.)

Networking and Support Consortia

THE BERKELEY MULTIMEDIA RESEARCH CENTER (BMRC)	
URL	http://bmrc.berkeley.edu
MAIN CONTACT	David Wessel
ADDRESS	Center for New Music and Audio Technology 626 Soda Hall University of California CA 94720-1740 Berkeley USA
E-MAIL	

The Berkeley Multimedia Research Center (BMRC) is an interdisciplinary group of artists, educators, professionals, and scientists in the United States who are experimenting with interactive multimedia technology in professional practice, scholarship, and education. The Center is active in building partnerships with the academic community and industry. Their work focuses on four areas:

Multimedia Authoring

BMRC researchers are developing an authoring environment that integrates asset management and streaming content with hypertext documents and computer mediated interactions, using both new and existing tools and focusing on adaptation of computer science research tools to broader multimedia applications. BMRC projects are creating a number of hypermedia titles using novel paradigms of content representation. They also co-develop multimedia content with UC Berkeley faculty members as part of ongoing research initiatives and projects to create advanced learning environments.

Teaching and Learning

BMRC aims is to develop and study interactive hypermedia courseware, distance learning models, and new classroom and working environments. They create tools for distance learning and high quality Internet video broadcasting. Other areas of investigation include the effectiveness of learner-centred courseware and groupware for collaborative learning and problem solving.

Infrastructure

BMRC is developing systems to support storage and delivery of digital media objects (e.g. documents, images, audio, video, and animation) on the UC Berkeley campus. The Center runs a high-speed network for access to multimedia content and is deploying a very large digital media storage system. They provide facilities for multimedia authoring and servers for hosting multimedia web content. Access to these facilities is provided to the campus community through the BMRC supported project programme. They are also developing facilities to support live and on-demand streaming of digital audio and video on the campus Internet.

Public Programmes

In addition to basic research, BMRC sponsors public programmes that include lecture series, symposia, and seminars.

BUFVC	
URL	http://www.bufvc.ac.uk/
MAIN CONTACT	Murray Weston
ADDRESS	BUFVC 77 Wells St W1T 3QJ London UK
E-MAIL	murray@bufvc.ac.uk

The British Universities Film & Video Council (BUFVC) is a representative body that promotes the production, study and use of film and related media in higher and further education and research. It was founded in 1948 as the British Universities Film Council. The Council receives core grant support from the Joint Information Systems Committee (JISC) of the Higher Education Funding Councils via the Open University. BUFVC currently employs about 17 staff and has an annual turnover of approximately £700,000. Around 30% of total revenue is raised through income from subscriptions, conferences, publishing, grants and sponsorship.

The BUFVC has a variety of services, databases, publications and other activities to offer in the field of image and education. They are involved in two major projects to make moving image materials available across high-speed networks to UK higher and further education - Educational Media Online, and Newsfilm Online. BUFVC focuses in these projects on progressive download, not streaming, as they view it as essential that users are able to download, retain, manipulate and re-use such content for learning, teaching and research. Access to materials is restricted to UK Further and Higher Education institutions only.

In the field of streaming, BUFVC is about to begin a major project with the ITN Archive. ITN is the leading commercial news film producer in the UK. The project will encode some 3,000 hours of news film content (1920-2004), and deliver this to UK Higher and Further Education only (access protected through Athens authentication software). About 40 clips are already freely available at www.bufvc.ac.uk/itnstudy. Twenty-five new clips will be added in May 2004. This site also includes

a report of the scoping study the BUFVC conducted prior to the full project. This report contains an analysis of the educational value of news film, and its application in downloadable form for higher, further and potentially wider education in the UK.

The BUFVC also hosts a database, the Moving Image Gateway (MIG), which provides a guide to online resources which either provides information on moving images as they might be used in education, or delivers the moving images themselves. Most of these are delivering streamed media. The MIG can be found at www.bufvc.ac.uk/gateway, and it classifies the web sites by subject discipline, from Agriculture to Women's Studies, collected within the four main categories of Arts and Humanities, Bio-Medical, Social Sciences and Science and Technology. Each site has been evaluated and described by the BUFVC's Information Service, which regularly checks and updates the database. Sites are highlighted which have video or audio streaming. There are some 600 sites on the MIG database at present, and it continues to grow at the rate of ten per month.

The British Universities Film & Video Council and the Open University have together formed the Managing Agent and Advisory Service (MAAS). MAAS Media Online is a national body acquiring moving pictures and sound for delivery to the UK Higher and Further education community.

The Advisory Service offers assistance to those working in the creation, access and use of moving images and sound online for learning and teaching as well as supporting technology focused fields. As part of this service, they run a helpdesk which provides advice and information to those wishing to use moving images in their learning and teaching as well as those with more complex queries about streaming, web casting, encoding and delivering material on a network.

MAAS aims to acquire and promote the use of electronic moving picture and sound resources for UK Higher and Further Education in the evolving Distributed National Electronic Resource (DNER).

CANAL EDU 365	
URL	http://www.edu365.com/canaledu365/index.htm
MAIN CONTACT	
ADDRESS	Generalitat de Catalunya Departament d' Ensenyament Sant Sever 12, Palau de la Generalitat ES-08003 Barcelona Spain
E-MAIL	info@correu.edu365.com

Canal Edu 365 is an initiative of Generalitat de Catalunya Departament d' Ensenyament and XTEC - Xarxa Telematica Educativa de Catalunya in Spain.

Their main objective is to make educational audiovisual materials available to schools via the Internet, to improve their collaboration with Televisio de Catalunya and to promote the use of broadband in schools. A themed video store called Series Thematiques has also been established where educational videos are provided for various subjects including literature, history, health, nutrition and the universe. A video store with self-made videos from teachers and educators called Produccions de Centres is also available. The video store is updated monthly and provides video material suitable according to the time of year. All videos are streamed in Real format and there are two different bandwidth options, 256 and 512 Kbp/s. The section Mon Docent provides video material that shows projects and technologies used in schools to help teachers and to encourage col-

laboration, one video clip, for example, shows how a school in Barcelona used the services of Canal Edu 365.

The screenshot shows the website interface for Canal Edu 365. At the top, there are logos for 'CANAL edu365' and 'HORIZONS', along with the text 'Horitzons, en, xarxa' and 'GENER '04'. Navigation links include '<<enrera', 'home', and 'endavant>>'. A video player area on the left shows a black and white image of people in a kitchen. Below it are video quality options: 'video - 512 kbp/s' and 'video - 256 kbp/s'. A sidebar on the left contains links: 'Sobre Horitzons en Xarxa', 'Catàleg', 'Demana's un video', and 'Molt aviat'. The main content area features the title 'Les coses com són: Immigració' and the subtitle 'Viure la immigració des de dins'. It lists 'Matèries | Ciències Socials', 'Continguts | Set adolescents viuen tres experiències diferents: una festa islàmica tradicional, un dinar amb una família marroquina i una visita a un grup d'immigrants que viu en condicions precàries. Debat final on els adolescents expressen la seva opinió.', 'Nivells acadèmics recomanats | ESO, Batxillerat i FP', and 'Tipologia | Reportatge i debat'. A synopsis follows: 'En tres reportatges d'uns deu minuts cadascun els adolescents visiten tres escenaris diferents que els permeten conèixer el fenomen de la immigració. Set adolescents es divideixen per visitar en paral·lel el campament de barraques d'Olesa de Montserrat, on mantenen converses amb immigrants que tenen opinions contraposades sobre la seva situació a Catalunya; una mesquita musulmana de Rubí, on assisteixen a la celebració dels ritus religiosos; i un àpat familiar amb una família marroquina, en el qual els adolescents plantegen a la família dubtes sobre el seu tipus de vida, creences, etc. La part final del programa es converteix en un debat en què els joves, en companyia de Liberata Sepa'. At the bottom left are logos for 'TVC On line', 'KE', and 'edu365.com'. The website URL 'www.edu365.com' is centered at the bottom.

CINECA STREAMING SERVICES

URL	http://www.cineca.it/networking/txt/streaming.php
MAIN CONTACT	
ADDRESS	CINECA Consorzio Interuniversitario via Magnanelli 6/3 IT-40033 Casalecchio di Reno (Bologna) Italy
E-MAIL	info@cineca.it

CINECA (Interuniversity Consortium established by law in 1969) is a Consortium consisting of 21 Italian Universities and the CNR (Consiglio Nazionale delle Ricerche). The main objective of CINECA is to promote the use of advanced computer networks for scientific and research purposes, specifically in the area of high performance computing.

CINECA provides 3 types of streaming services to public and private research institutions in Italy:

- CINECA Live: live broadcast of events via streaming
- CINECA Stream: on-demand broadcast of events and films
- Codification and post-production of streamed educational materials

CLICK AND GO VIDEO PROJECT

URL	www.clickandgvideo.ac.uk
MAIN CONTACT	Clive Young
ADDRESS	Learning Services Office, Glasgow Caledonian University, City Campus, Cowcaddens Road, Glasgow G4 0BA
E-MAIL	Clive.Young@gcal.ac.uk

The JISC funded Click and Go Video project in the UK aimed to provide academic and support staff with the resources and information necessary to evaluate and choose the most appropriate technology and pedagogy to use with their students.

Click and Go was based on the need to use freely available streaming technologies, making the set up process quick and non-intrusive, automating the capturing, archiving and playback and finally demonstrating that streaming media can provide an engaging and compelling learning environment.

Building a framework covering all the information needed to integrate video into other media was one of the main aims of the Click and Go project. This was done by:

- Establishing the Click and Go Video Web for access to guidance and illustration
- Determining and validating video streaming technologies
- Drawing on issues of implementation, technology and pedagogy from 3 case studies
- Running a series of workshops to provide a practical insight
- Developing a user interface to provide simple adaptive presentations using streamed video
- Establishing a user forum

Click and Go ended as a supported project in August 2002, However, information about the framework developed by Click and Go, streaming guides and case studies continue to be available on the web site.

DIVERSE

URL	http://www.sar.bolton.ac.uk/diverse/default.htm
MAIN CONTACT	Ian Jackson
ADDRESS	Faculty of Arts, Science & Education, Bolton Institute Deane Road BL3 5AB Bolton UK
E-MAIL	i.jackson@bolton.ac.uk

Disseminating Innovative Video Educational Resources for Students Everywhere (DIVERSE) is an initiative from Bolton University in the UK. The primary aim of this initiative is to evaluate the transferability of an innovative video production system, called VESOL, to a wide range of academic and student support settings. Their web site offers examples of educational uses of video and provides lots of streaming resources.

INTERNET STREAMING MEDIA ALLIANCE

URL	http://www.isma.tv/home
MAIN CONTACT	Laura Nugent, ISMA Executive Director
ADDRESS	ISMA 2570 West El Camino Real Suite 304 CA 94040-1313 Mountain View California, USA
E-MAIL	execdirector@isma.tv

The Internet Streaming Media Alliance, Inc. is a non-profit corporation formed to create specification(s) that define an interoperable implementation for streaming rich media (video, audio and associated data) over Internet Protocol (IP) networks.

Just as the adoption of standard mark-up languages has fuelled innovation and the explosive use of today's World Wide Web, the goal of ISMA is to accomplish the same for the next wave of rich Internet content, streaming video and audio. The Alliance believes that in defining an interoperable approach for creating, transporting and viewing streaming media, content creators, product developers and service providers will have easier access to the expanding commercial and consumer markets for streaming media services. They argue that prohibitive costs associated with rolling out streaming video services that support all current, disparate formats has kept many potential service providers and other adopters from taking full advantage of existing market opportunities. Likewise, the emerging class of Internet appliances will benefit from a single standard as these devices often cannot afford to have multiple streaming media players installed to view differently formatted media files from the web.

In developing the specification(s), ISMA relies on relevant, established standards and sometimes proposes additions, as needed, to relevant standards body efforts that are still in development.

The primary goal of ISMA is to complete, publish and promote systemic, end-to-end specifications that enable cross-platform and multi-vendor implementations. The first specification from the ISMA defines an implementation agreement for streaming MPEG-4 video and audio over IP networks. The Alliance's ongoing work includes digital rights management, interactive content, and next generation audio/video streaming specifications.

The Internet Streaming Media Alliance maintains relationships and liaison with educational institutions, government research institutes, other technology consortia, and other organizations that support and contribute to the development of relevant specifications and international standards.

SURFnet VIDEOPORTAL	
URL	http://video.surfnet.nl/
MAIN CONTACT	
ADDRESS	SURF Leidseveer 35 P.O. Box 2290 NL-3500 GG Utrecht The Netherlands
E-MAIL	redactie@surfnet.nl

The SURFnet Videoportal, which is essentially an online video library with a large amount of catalogued and searchable streaming media, aims to be the central point for streaming in Higher Education in the Netherlands.

For those who want to produce their own streaming media, a range of support information and services are available.

SURFnet also offers tools like as the Virtual Cutter that enables cutting and pasting of fragments of streaming video, without physically editing, and the transcoder service for converting video into streaming.

With its knowledge base and forum, the SURFnet Videoportal is also the central point with regard to information and sharing of peer experiences.

Services are aimed towards higher education institutes and although most of the information on the portal is open, some parts are for logged in users only.

TERENA TASK FORCE STREAM	
URL	http://www.terena.nl/tech/archive/tf-stream/
MAIN CONTACT	Valentino Cavalli, Egon Verhaeren
ADDRESS	TERENA Singel 468 D NL-1017 AW Amsterdam The Netherlands
E-MAIL	cavalli@terena.nl

TF Stream, the TERENA Task Force on Real Time multimedia applications, started in January 2000 and aims to coordinate research and testing in Europe on real usage and scalability of audio/video streaming and conferencing. Significant advantages are expected by using multicast as well as by the deployment of distributed network storage technologies like replication and caching. The objectives of the Task Force were:

- to provide a forum for exchanging experiences and knowledge
- to determine the suitability of audio/video streaming and conferencing for the research community in Europe
- to identify and promote sources of audio/video content
- to coordinate diverse real time multimedia initiatives
- to assist and validate high-bandwidth pilot projects

Among the results of the work done by the TF Stream are: an information site on the Terena web server, a glossary in the field of digital video streaming, a study and experiments on network infrastructure for streaming live events, a policy document for publishing audio and video in the public domain, a web repository, best practice guidelines, a clearinghouse of multicast monitoring tools and several other actions undertaken by TF Stream.

A report on TF Stream is publicly available on their web site.

WEBSTROOM	
URL	http://www.edusite.nl/webstroom/community
MAIN CONTACT	Chris Nieuwenhoven
ADDRESS	The Netherlands
E-MAIL	c.nieuwenhoven@kub.nl

Webstroom - which means 'Working group for Educational Audiovisual Material' - was formed as a subsidiary of the Platform ICT in Education in the Netherlands, to develop, share and exploit the use of streaming media and videoconferencing in Higher Education. Members are drawn from Dutch institutes for Higher Education, however the intention of Webstroom is to widen their brief to address European Higher Education institutions.

The focus of Webstroom is the integration of streaming media into Higher Education. The need to digitise learning resources in curricula is driven by two major developments; both a broad demand for flexible forms of education, independent of time and place as well as an opportunity to bring contemporary ideas about teaching and learning into practice.

Streaming techniques have been available in the Netherlands for several years, and following support from Webstroom, many practitioners now see a shift in the learning paradigm. First were the pioneering years, where projects had a strong technical focus and where many isolated projects led to a number of short-lived successes and failures. Now there is a trend in the Netherlands for projects where the educational value of streaming media is the main point of interest. As the infrastructure and other preconditions have now been set up, isolated experiments belong in the past. Those involved in Webstroom believe that what is needed now are demonstrations of how streaming media can be interwoven in the curricula. For Webstroom, it is time to harvest the added value of the techniques developed and make it easy to use and adapt, eventually making streaming a ubiquitous part of delivering higher education to a heterogeneous student population.

To achieve better and more sustainable results, Webstroom have opted for a collaborative approach. Several instruments are used to support streaming activities in the Netherlands, most notably pilot projects that have received funding from Webstroom. Four Webstroom projects have been supported, each costing € 13,333 of which Webstroom funded 75%. These projects provided a useful opportunity for practitioners to discuss issues like standardisation, best practices, Intellectual Property Rights, technical trends and evaluating the educational benefits. The Webstroom working group also put in place other instruments to support projects including the web site, mailing list and several regular face-to-face meetings.

In its two year's existence, Webstroom gained a lot of momentum both nationally and internationally. Different instruments were deployed in support of a dynamic community of peers from different academic disciplines. This type of facilitated knowledge sharing enabled professionals to learn from one other so they could in effect save time, money and energy. Initiating projects oriented towards results and dissemination proved to be very fruitful. Additional funds have been made available to the Webstroom working group so they can continue their useful work.

12. Glossary

ADSL	Asymmetric Digital Subscriber Line is a technology for transmitting digital information at a high bandwidth on existing phone lines to homes and businesses. Unlike regular dial-up phone service, ADSL provides a continuously available, „always-on“ connection. ADSL is asymmetric in that it uses most of the channel to transmit downstream to the user and only a small part to receive information from the user. ADSL simultaneously accommodates analogue (voice) information on the same line. (source http://www.whatis.com)
Analogue	Information represented by a measurable physical quantity with continuous values, as opposed to information in digital form.
Aspect ratio	This is the ratio of the width to the height on a monitor or television screen. Most TVs and monitors have a 4:3 aspect ratio. The screens are 4 units wide and 3 units high.
Bandwidth	The amount of data per second that can be delivered to your computer. A 56K modem has a bandwidth of 56 kilobits/second. The term bandwidth is also used in conjunction with data rate when discussing video.
Bit Rate	The speed at which binary content is streamed, i.e., travels from one place to another on a computer network, such as the Internet. Bit rate is measured in kilobits per second (kbps). Thus, a 28.8 Kbps modem, for example, can transmit or receive around 29,000 bits per second.
Broadcasting	A means of one-way, point-to-multipoint transmission where the end receiver is not known to the broadcaster, i.e. it is an ‘open’ system, which does not restrict access to any member of the audience. Broadcasting is typical for radio and television transmission where the audience are only defined by virtue of having the correct receive equipment.
Browser	The programme that finds and displays web pages. Microsoft Internet Explorer and Netscape Navigator are browsers.
Buffer	Space allocated on a system’s Random Access Memory (RAM) where data is stored temporarily until it is transferred to another part of the system. In streaming applications, buffers store video or audio data until there is enough information for the stream to be composed.
Caching	Using a buffer within your own computer’s fast memory to hold recently accessed data. It is designed to speed up access to the same data later.
Capture card	A device used for transferring video and audio to a hard drive. If the source material is analogue, it also converts it to digital format. If it was digital already, it is transferred to the hard drive.
Capturing	The process of saving video from an external source to your hard drive. Analogue video is converted to digital.

Client	A client is a computer running a software programme that requests a service from a server. In the context of streaming, the software running on the client is the player needed to view the stream. Clipstream™ is a technology that allows viewing and listening to streaming media without any player. The advantage for the end user is that there is nothing to download or configure. Clipstream™ plays and works on all popular Java compatible platforms and browsers. Codecs (or compressor/decompressor) work by identifying redundancy in audio and video and removing it. When taking an image of someone speaking in an office, most likely the background around the person remains the same. A codec is designed to recognise this and to only save the parts of the video that change. In this way file sizes can be reduced by as much as 100 times.
Compression	During compression, data that are redundant or unnecessary are thrown away. This makes the file size much smaller, but it may also degrade the quality of image and sound. Smaller files require less hard disk space, less memory to run, and less bandwidth to play over networks such as the Internet. Decompression reverses the result of compression.
Data Broadcasting	Data can be broadcast or transmitted to users over various wireless and cable mediums. The most typical being radio broadcasts (VHF, UHF, satellite) and cable broadcasts (such as simple cable television).
Decoding	Reconstructing an encoded file or data stream.
Decompression	See compression
Digital	Information represented as discrete numeric values, e.g. in binary format (zeros or ones), as opposed to information in continuous or analogue form. Binary digits (bits) are typically grouped into “words” of various lengths – 8-bit words are called bytes.
Digital Rights Management	Digital media files can be easily copied and distributed, without any reduction in quality. As a result, digital media files are now distributed widely on the Internet, through both authorised and unauthorised distribution channels. Piracy is a concern when security measures are not in place to protect content. Digital Rights Management (DRM) enables content providers to protect their content and maintain control over distribution. Content providers can protect and manage their rights by creating licenses for each digital media file. Consumers will also be able to access higher quality digital media content on the Internet because content providers using DRM will be more willing to make such content more widely available. Windows Media DRM is one of the systems that provides end-to-end DRM offering content providers and retailers a flexible platform for the secure distribution of digital media files.
Digital Video (DV)	A video signal stored in binary format. To process and store video on a computer, it must first be converted to a binary format. Most digital video cameras are capable of outputting video directly to a hard drive in this format via IEEE 1394 interface. DV is a good format to input into a compression and editing application, but the file sizes are too large for effective delivery over the Internet.

Download	To move a digital file (such as a media file) from a server where it is stored to a local system for viewing or editing.										
D-to-A converter	A device for converting digital signals to analogue.										
DVB	DVB stands for Digital Video Broadcasting, the European standard for Digital TV. This standard provides a very high-speed, robust transmission chain capable of handling the many megabytes per second needed for hundreds of MPEG-2 digital TV channels.										
Encoding	Analysing and compressing a file or data stream.										
Frame rate	The number of frames per second. Higher frame rates should be used to more accurately portray high-motion video. The following table shows some common frame rates: <table border="1" data-bbox="924 613 1441 860"> <thead> <tr> <th>Format</th> <th>Frame Rate</th> </tr> </thead> <tbody> <tr> <td>Film</td> <td>24</td> </tr> <tr> <td>NTSC (USA)</td> <td>29.97</td> </tr> <tr> <td>PAL (Europe)</td> <td>25</td> </tr> <tr> <td>Web</td> <td>30, 15, 12</td> </tr> </tbody> </table>	Format	Frame Rate	Film	24	NTSC (USA)	29.97	PAL (Europe)	25	Web	30, 15, 12
Format	Frame Rate										
Film	24										
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Web	30, 15, 12										
Hypervideo	A type of interactive television technology invented by a company called Veon in San Francisco, California (this company was recently bought by Philips in 2001). In essence, Hypervideos are digital video clips embedded with hotspots and markings, links to the web or to other movies and media formats, and/or other triggers leading the viewer in different directions. Veon has created authoring and backend tracking tools that allow the content producer to create these clips using complex object tracking and key frame interpolation algorithms and then track in detail how viewers interact with them. In some ways, this technology is closer to the ideal realisation of interactive TV as it allows the fabric of the video to become completely dynamic. At the moment, this technology is only available over digital broadband networks. A competitor, ISurfTV, develops similar technology; although their authoring tools focus on key frame interpolation and 3D techniques .										
Intelligent stream	A type of streaming that detects network conditions and adjusts the properties of a video or audio stream to maximise quality.										
Internet	A decentralised, global network. The World Wide Web is only a part of this network. Other components of the Internet include email, news servers, Gopher and Telnet.										
Intraframe	A spatially compressed frame (see spatial compression).										
Intranet	A localised, private network based on the same technology as the Internet.										
IP	Transmission Control Protocol/Internet Protocol. TCP/IP is the de facto protocol for sending and receiving information over the Internet.										
IP/TV	IP/TV delivers desktop video to networked computers by broadcasting both live and prerecorded video. It uses IP Multicast technology so that a single stream of video can be delivered to numerous PCs simultaneously.										

LAN	Local Area Network
Player	Software running on the client to view a stream.
Mirroring servers	Network server maintaining an identical copy of its files in (a) another network server, or (b) a redundant drive in the same server. Note: Mirroring can be used as a rudimentary backup system for the original files, but is more often used to spread out the access load for popular web sites by offering users several different locations from which identical files can be accessed.
MPEG	MPEG is the „Moving Picture Experts Group“, working under the joint direction of the International Standards Organization (ISO) and the International Electro-Technical Commission (IEC). This group works on standards for digital video compression and file formats. The purpose is to standardise compressed moving pictures and audio. The most notable current MPEG standards are MPEG-1, MPEG-2 and MPEG-4.
Multi-camera angle	or individualised television: This technology allows viewers to control camera angles during live events, select which commercials they want to watch, and generally control a selection of choices content producers provide as part of the broadcast. eCommerce and interaction with those commercials is possible. At the backend, servers collect choice information and offer viewers further selections based on those choices.
Multicast	A one-to-many client/server connection in which multiple clients receive the same stream from a server. To receive a multicast, a client listens to a specific IP address on a multicast-enabled network, like tuning a television to a specific channel. In contrast, a unicast is a one-to-one connection in which each client receives a separate stream from a server. Multicasting is a technique whereby information is transmitted to a well-defined and controlled group of users on your network.
Narrow-band	A low-bandwidth (low capacity) communications path. Narrow-band networks are designed for voice transmission (typically analogue voice), but which have been adapted to accommodate the transmission of low-speed data.
Network congestion	When data being sent on the network has flow control problems between source and destination (e.g. data packets are lost), it results in network congestion.
NVOD	or Near Video on-Demand: The service of providing a movie to subscribers on multiple channels and staggering its start time (for example every fifteen minutes). Subscribers can then tune in to the next available showing.
On demand	The ability to request at any moment video, audio, or information to be sent to the screen immediately by clicking on the appropriate position on the screen.
Open source	Open source is a term used to refer to software with accessible source code and a set of pre-defined distribution criteria. A complete definition can be found at http://www.opensource.org
PoP	or Point of Presence: The specific physical place where you make connection to the Internet.

Progressive download	<p>Progressive downloads are an HTTP/FTP-based delivery method in which the entire video is downloaded to the user's machine. In a progressive download, lost packets are retransmitted until they are received, providing consistently high quality from download to download. Because they rely on the same protocol as web pages for delivery, they are less likely to encounter problems with firewalls than streaming downloads. The movie does not need to be downloaded entirely to start watching it, so it can appear as if it were a streaming file on a fast enough connection.</p> <p>Progressive downloads also have disadvantages. They cannot be broadcast, multicast, or transmit live feeds. The user does not have the possibility to jump ahead to different parts of the movie until it has been downloaded. Finally, limiting distribution or modification of your movie can be very difficult, as the user has the option to save a copy locally.</p>
Proxy	<p>A proxy server is software that acts as an intermediary between a web browser and a web server. To give users rapid access to popular web destinations, ISPs use proxy servers as „holding bins“ to store frequently requested pages, rather than going out on the web and fetching them repeatedly from the server on which the content was originally stored.</p>
Real time	<p>The reception, processing and delivery of data in such a way that it appears to be instantaneous.</p>
Server	<p>A server is a computer running a software programme that systematically controls network access and provides the functionality requested by users on the network (e.g. the clients). Basically, a server waits for and then fulfils requests from the clients. In the context of streaming, the server is the software responsible for sending the stream to the client.</p>
SHOUTcast	<p>SHOUTcast is a free-of-charge audio “homesteading” solution. It permits anyone on the Internet to broadcast audio from their PC to listeners across the Internet or any other IP-based network (office LANs, college campuses, etc.). SHOUTcast’s underlying technology for audio delivery is MPEG Layer 3, also known as MP3 technology. The SHOUTcast system can deliver audio in a live situation, or can deliver audio on-demand for archived broadcasts.</p>
SMIL	<p>The Synchronized Multimedia Integration Language (SMIL, pronounced „smile“) enables simple authoring of interactive audiovisual presentations. SMIL is typically used for rich media/multimedia presentations which integrate streaming audio and video with images, text or any other media type. SMIL is an easy-to-learn HTML-like language, and many SMIL presentations are written using a simple text-editor.</p> <p>For a more detailed description of the goals of the SMIL language, see the W3C Activity Statement (http://www.w3.org/AudioVideo/Activity.html) on Synchronized Multimedia; a regularly updated report to W3C members that is also available to the public.</p>

Streaming	Video or audio transmitted over a network that users can begin to play immediately instead of waiting for the entire file to download. Typically a few seconds of data is sent ahead and buffered in case of network transmission delays, (although some data is buffered to the hard drive, it is written to temporary storage and is gone once viewing is complete).
Two-way	Operating method in which transmission is possible in both directions of a telecommunication channel.
Unicasting	Data is delivered to only one user within a network as opposed to multicasting. Each packet in a unicast contains a user ID number. The user ID must match the ID in the header of the unicast packet, only then can data be received.
VDO Live	VDO Live Player is a programme used to view streaming video on the Internet. It is an old programme and rarely used.
VIP	Video Over IP
VOD	Video-on-demand. VOD is pre-recorded video stored on a server for access at the user's convenience. Vcast is an example of a programme that can provide VOD.
Webcasting	<p>Webcasting is a combination of push and smart-pull technologies that allows users subscribe to individual web pages or entire web sites. It also allows for the broadcast delivery of multimedia information (like streaming audio). Microsoft uses the term webcast together with their new Internet Explorer (ver. 4.x) and Netshow technology, Netscape uses the term NetCast with their browser and plugin technology (ver. 4.x). Webcasting consists of three distinct tiers:</p> <ol style="list-style-type: none"> 1. Subscriptions (basic webcasting, smart pull): You subscribe to a URL (web site) and the selected web pages (from this site) are downloaded and/or updated automatically in the background (for later cache browsing). 2. Channels (managed webcasting): In this context, channels are web sites that offer a special information file that will start a subscription wizard in the browser. 3. Casting (true webcasting, or true push technology): Live Video and Audio streaming. Sometimes also referred as MultiCast - ill suited because media streaming might use unicast (today) and multicast (today and in the future) transport networks.

13. Further Resources

13.1. Products and Companies

Akamai

www.akamai.com

This is an international content delivery service ensuring a high-performing, scalable, and secure environment for organizations to cost effectively extend and control their e-business infrastructure.

Apple

www.apple.com/quicktime

Here you can find Quicktime encoding information.

Cisco Systems

www.cisco.com/warp/public/44/solutions/network/video.shtml

Cisco systems provide networking solutions for small, medium-sized and large companies.

Discreet

<http://www.discreet.com/>

<http://www4.discreet.com/cleanerxl/>

This is an excellent site, for all levels from beginners to advanced, offering interactive streaming media encoding products (including Media Cleaner software) which allow you to create new kinds of dynamic streaming content.

ITS Video Networking

www.unc.edu/video

ITS provides design services and infrastructure development for campus networks in the USA to ensure that the campus architecture will support the demanding applications of the research and education community. Examples of applications which utilize the networks include: policy-based networking, distance education, real-time and stored compressed video, interactive voice and video conferencing, digital television, haptics, and remote instrumentation.

Microsoft

www.microsoft.com

Here you can find information on Windows Media Player.

RealNetworks

www.realnetworks.com

Supplies information and tools you need to start streaming your own media, including a video series on all aspects of streaming media production.

Sorenson

www.sorenson.com

This is an excellent site full of precise details, product trials and tutorials on quality video for the web.

WebFree TV

<http://www.webfreetv.com/webfreetv/produkte/index.html>

WebFreeTV is a German company which produces streaming e-learning sequences along with many other services in the field of streaming media (company TV, promotion videos, streaming media studio ...). One example is audiogalaxy. There is a demo available under the link <http://www.webfreetv.com/webfreetv/produkte/index.html> (click on e-learning on the right side and then on easy;) audiogalaxy) This is an e-learning sequence about music exchange. A second demo is available under the link http://www.videomail.at/linklist/vossen_easy.html (click on e-learning). This is an e-learning sequence about Photoshop.

VIDOS

www.vidos.ac.uk

VIDOS is a Web-based digital video editing and customisation service for the UK academic community, available free of charge to all members of Higher and Further Education establishments and research institutions throughout the UK.

ViewCast Corporation

www.mmac.com/vc_intro.html

ViewCast develops products (such as capture cards) and services that provide video networked solutions, including streaming digital video on the Internet and distribution of broadcast-quality video. The site also has a streaming media newsletter and streaming media white papers.

13.2. Educational Applications

Ethics Updates

<http://ethics.acusd.edu/video/index.html>

Ethics Updates is a free service from San Diego University in the USA and is designed primarily to be used by ethics instructors and their students. It is intended to provide updates on current literature, both popular and professional, that relates to ethics and offers an extensive library of accompanying video lectures on ethics.

Greek VoD project

<http://vod.sch.gr/index.asp?content=eductv-intro>

This project offers Greek Videos on-Demand.

Indiana Department of Education

<http://www.doe.state.in.us/media/video/guide.html>

Official Web Site of the Indiana Department of Education in the US that contains several educational videos.

Microsoft, Windows Media Player 9 in education

<http://www.microsoft.com/windows/windowsmedia/Enterprise/sectors/EducationSector/default.aspx>

This web site from Microsoft demonstrates some implementations of the Windows Media 9 platform in Higher Education.

Nature videodatabase

<http://www.pbs.org/wnet/nature/database.html>

This is the video database of “Nature”, also offering accompanying lesson plans and guides for teachers.

Oregon State University

<http://oregonstate.edu/education/research/docResearch.html>

Doctoral Research Presentations from the Oregon State University’s School of Education in the US are streamed on this site.

Peachstar

<http://www.gpb.org/peachstar/>

Peachstar, a service from Georgia Public Broadcasting in the US, has developed online course listings as a ready resource for busy teachers who have expressed the desire for assistance with enhancing their teaching methods using video resources. These lists comprise sequenced lists of relevant video resources organized by course.

Research Channel

<http://www.researchchannel.org>

Research Channel is an international consortium of research universities and corporate research divisions dedicated to broadening access to and appreciation of individual and collective activities, ideas, and opportunities in basic and applied research. One of the major goals of ResearchChannel is to use programme content creation and manipulation processes as testing medium for analogue and digital broadcast and on-demand multimedia offers, thus providing an unusual opportunity to experiment with new methods of distribution and interaction on a global basis. Research channel can be viewed via satellite, cable television or via web streaming. Web streaming allows for live webcasts or for Video-on-Demand after consulting the video library. Free access, no registration necessary.

Streaming Futures

<http://www.kidzonline.org/StreamingFutures/index.html>

Streaming Futures is a free, web-based show dedicated to helping American teens choose the right career path. There are over 90 streaming video interviews on the site with career professionals from all different industries.

University of California

<http://www.oid.ucla.edu/Webcast/Archives/index.html>

This web site is freely accessible and provides short clips about chemistry.

University of Hong Kong

<http://www.cityu.edu.hk/cityvod/>

Videostreams from several departments of the University of Hong Kong (in Chinese).

University of Ohio

<http://www.oit.ohio-state.edu/video/showcase.html>

The University of Ohio in the US offers tutorials, showcases, comparisons and resource downloads about streaming for educational purposes. Examples include ways streaming media has been used to support courses and other events on campus (such as broadcasting commencement speakers).

University of Wisconsin

<http://www.doit.wisc.edu/streaming/index.asp>

This web site created by the University of Wisconsin in the US offers advice on viewing and producing streaming media, demos of existing streaming media content, and links where plug-ins can be downloaded.

13.3. Research Communities

BroadbandBananas

<http://www.broadbandbananas.com/>

BroadbandBananas is a networking organisation for the Interactive TV and Broadband industry and manages an online digital archive of interactive television services from around the world. It holds international networking events, provides a free e-mail service directly reaching over 16,500 qualified professionals and operates a web site which provides a showcase for the work of the interactive television industry.

Internet2

<http://www.internet2.edu>

Internet2 is a consortium being led by 206 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet. Internet2 is recreating the partnership among academia, industry and government that fostered the current Internet in its infancy. The primary goals of Internet2 are to:

- Create a leading edge network capability for the research community
- Enable revolutionary Internet applications
- Ensure the rapid transfer of new network services and applications to the broader Internet community.

Mash Consortium

<http://www.openmash.org/>

The consortium mission is to produce public domain distributed collaboration and streaming media applications and systems in support of the Internet research community. The idea of forming the Open Mash consortium was originated by Larry Rowe and Steve McCanne to overcome the problem that there is no public domain, portable toolkit for doing research on distributed collaboration and streaming media applications.

Video Development Initiative (ViDe)

<http://www.vide.net>

The Video Development Initiative (ViDe) promotes the deployment of digital video in research and higher education. Leveraging their collective resources and expertise, ViDe advances digital video deployment through promotion and development of interoperable, standardized, and cost-effective technologies.

13.4. Study Guides, Tutorials and Research Materials

Designing Web Usability

by Jakob Nielsen, 432 pages, New Riders, ISBN 156205810X (Paperback), January 2000
For courses in Web Design, User Interface Design, Graphic Design, and Graphic Communication.

Developing Streaming Video: A Primer

<http://www.cvc3.org/streamingprimer.htm>

The California Virtual Campus Summer Institute has written a web based primer on streaming and its use in education. The primer accompanies a live web session about streaming. The primer is a good introduction for newcomers in the streaming area and it provides information on how to record, convert and play streaming media as well as how to use the streaming media in a class context. Five examples are available of how streaming media are used for educational purposes.

i-cubed

www.i-cubed.co.uk/ethnet.html

This is the educational user's guide to ethernet. As designing a large ethernet network to give high performance throughout is a fairly complex task, this guide can provide an introduction to the issues involved.

Internet en het nieuwe leren: de inzet van streaming media

Johan Oomen, Doctoraalscriptie, january 2003.

http://www.edusite.nl/docs/webstroom/deel_i_tot_en_met_hoofdstuk_1.pdf (Part one)

This thesis in Dutch is about streaming media in Higher Education

Looking through three 'I's: the pedagogic use of streaming video

Clive Young & Mireia Asensio,

http://www.edusite.nl/docs/webstroom/pedagogic_use_of_streaming.pdf

The pedagogical challenge faced by teaching staff and practitioners is not only to choose the appropriate streaming technology but also to design meaningful learning events. This paper introduces a way to analyse video use through what is called the Three'I's" Framework – Image, Interactivity and Integration.

Principles of Learning: Guiding Practice for Streaming Media

Donna L. Vakili, University of Idaho,

http://www.edusite.nl/docs/webstroom/video_distance_education.pdf

This paper examines the American Psychological Association's four cognitive domains of learning and the corresponding research in streaming media. It provides a theoretical construct by which distance educators can infuse learner-centered principles and examine the possibilities for streaming media in online education.

Streaming Video

by Jupiter Research Corporation, 37 pages, MarketResearch.com, ISBN: B00006RGS3, August 2002
On the economic aspects of streaming media

Streaming Media in Higher Education: Possibilities and Pitfalls

By Brian Klass, syllabus magazine,

<http://www.syllabus.com/article.asp?id=7769>

Streaming Media to Enhance Teaching and Improve Learning

by Virginia Michelich, February 2002.

<http://ts.mivu.org/default.asp?show=article&id=941>

This article is about how streaming can best be used in education, including case-studies, tools, student perceptions.

TF-STREAM - Real Time Multimedia Applications

Terena Technical Report, by Valentino Cavalli and Egon Verharen, March 2002

<http://www.terena.nl/task-forces/tf-stream/>

The Networked Learning in Higher Education project

http://csalt.lancs.ac.uk/jisc/About_the_project.htm

The Networked Learning in Higher Education project, was designed to create a coherent picture of students' experiences of networked learning, which includes video, in UK Higher Education. This site based in Lancaster University provides some useful advice and guidelines.

The Technology of Video and Audio Streaming

by David Austerberry, 352 pages, Focal Press, ISBN: 024051694X, April 2002 [All technical aspects and terminology explained]

Video Streaming: A Guide for Educational Development

Thornhill S., Asensio M., Young C., November 2002,

<http://www.clickandgovideo.ac.uk>

13.5. News and Information Portals

NetworkWorldFusion

<http://www.nwfusion.com/research/streaming.html>

This information portal aims to provide tutorials, research reports, articles, etc., that help newcomers take wise decisions when implementing streaming media on the web.

Sohonet

www.sohonet.co.uk/links.html

This is a collection of high-quality starting-points for exploration in the fields of video, audio, networking and telecommunications.

Streamalot

<http://www.streamalot.com/>

Streamalot is owned and maintained by a network of streaming specialists in Colorado, US. Their focus is to answer people's streaming media needs in an easy to understand, well laid out, and unbiased environment. The site offers media tips, tricks, hints, tutorials, etc.

Streamingmedia.com

www.streamingmedia.com

This web site offers advice, research reports, an industry directory, discussion lists and tutorials on all aspects of streaming delivery.

Streaming Media IQ

<http://www.streamingmediaiq.com>

Streaming Media IQ serves the streaming media market, specifically the individuals within an enterprise who are the planners and executors of enterprise-wide streaming media deployments in their companies. These are the people who are charged with researching, purchasing, implementing, managing and evaluating their companies' streaming and rich media technologies.

Streaming Media Land

<http://www.streamingmedialand.com/>

Streaming Media Land is an industry portal with Resources for Engineers, Researchers and Marketeers in the Streaming Media Field. Written by Streaming Media Professionals.

Streaming Media World

<http://www.streamingmediaworld.com/>

This is a very useful resource for streaming media technologies. It comprises articles about new developments, descriptions of technologies and good links to tutorials.

Streamline Newsletter

<http://www.streamlinenewsletter.com/>

Streamline Newsletter for streaming media professionals, is a weekly e-mail newsletter that covers the latest trends and information from the streaming media market. Each week a new Stream of the Week is chosen, highlighting some of the best streaming media examples in the marketplace. Streamline newsletter is a service from <http://www.digitalmedianet.com/>

Syllabus magazine

<http://www.syllabus.com/>

Syllabus magazine is the only monthly publication that focuses on the role of technology in higher education. Published since 1988, Syllabus' mission is to inform educators on how technology can be used to support their teaching, learning and administrative activities. Each issue includes feature articles, case studies, product reviews and profiles of technology use at the individual, departmental and institutional level. Regular features cover multimedia, distance learning, the Internet, quantitative tools, publishing and administrative technology. A variety of platforms are covered, among them, computers, video, multimedia and telecommunications equipment. The Syllabus web site supports and expands upon the publication's content covering the latest technology for higher education. It contains several articles on video streaming.

The e-learning centre

<http://www.e-learningcentre.co.uk/eclipse/vendors/presentations.htm>

The e-Learning Centre is both an Information Resource Centre for e-learning aimed at educators and training professionals; and an e-Learning Services business offering e-learning consultancy services to a wide range of organisations. It offers many useful web links and information resources.

Video-on-demand Portal

<http://www.vodnews.tv>

This is an information portal on the topic of video-on-demand containing news articles, discussion forums and bulletin boards. Free registration is required to participate fully.

Webmonkey

<http://hotwired.lycos.com/webmonkey/>

This is a popular site about new tools associated with the web, containing lots of good articles and hot tips.