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Abstract. I report on a pilot project launched in 2010 focusing on facilitating communication and information exchange within the ATLAS Collaboration, through the combination of digital signage software and webcasting. The project, called ATLAS *Live*, implements video streams of information, ranging from detailed detector and data status to educational and outreach material. The content, including text, images, video and audio, is collected, visualised and scheduled using digital signage software. The system is robust and flexible, utilizing scripts to input data from remote sources, such as the CERN Document Server, Indico, or any available URL, and to integrate these sources into professional-quality streams, including text scrolling, transition effects, inter and intra-screen divisibility. Information is published via the encoding and webcasting of standard video streams, viewable on all common platforms, using a web browser or other common video tool. Authorisation is enforced at the level of the streaming and at the web portals, using the CERN SSO system.

1. Introduction
ATLAS *Live* employs a combination of professional signage software, video encoding algorithms, and webcast servers to produce high quality video information streams that can be viewed anywhere in the world, using standard web browsers with freely available plug-ins. The software components of the system are installed, tested and supported by the CERN IT UDS/AVC section and the ATLAS *Live* development has proceeded in close collaboration with that group. The computing systems and displays used for the channel design, programming, encoding, and monitoring, were installed in the ATLAS Data Quality Centre, as part of the recent refurbishment of that location.

The pilot project, requested by the ATLAS management in January 2010, was inaugurated in June 2010 and demonstrated at the ATLAS Overview Week in Copenhagen. It features three primary video streams:
1. The Collaboration Information Channel;
2. The Control Room Overview Channel;
3. The Public Outreach Channel.

All of these streams, which are described in detail below, are accessible using a standard web browser on the ATLAS *Now* web page [1] or via the dedicated ATLAS *Live* portal [2].

2. Motivation
The size and globally distributed nature of the LHC collaborations present new challenges to the physics community for providing effective channels of communication among its members. The dynamic nature of our work, especially during the discovery years ahead, requires that all members be able to contribute actively to the experiment, regardless of physical location, and that the experiment be able to quickly broadcast important information to the community.

The ATLAS *Now* web page was designed to help address this challenge by providing one unambiguous portal of the most recent and pertinent information, concerning ATLAS and the LHC. The goal of ATLAS *Live* is to complement that site with a set of video streams, summarizing and highlighting the most critical information. The streams are accessible on that site, on monitors located at CERN and participating institutes, and can be viewed on personal media devices, such as laptops and mobile phones. Centralized maintenance of the information streams ensures that all members of the collaboration, regardless of location, are kept current of major activities, thus ensuring and reinforcing their active involvement in the running of the experiment.

3. Technical Implementation

The ATLAS *Live* video streams are constructed from data, in the form of CDS documents [3], Indico meeting schedules [4], announcements, and other local information sources, and then assembled into scheduled programs using a professional signage software package, called SCALA [5]. This is a secure, robust system designed for the broadcasting of multimedia content to dedicated video screens. CERN selected this software system in 2007 for the dissemination of information inside the laboratory. Screens have been installed outside of the main auditorium, in building 513, and in the cafeteria, and the directorate has announced an expansion of the system throughout the laboratory.

Early ATLAS pilot projects based on SCALA evaluated the ability of the system to handle our needs. At the request of the run coordination, a dedicated screen was installed in the ATLAS control room, displaying LHC and ATLAS operation information, meeting schedules from the Indico Agenda system, webcam views, and a variety of other relevant information. In addition, the ATLAS Collaboratory Project [6] at the University of Michigan installed a screen on campus to test the ability of the system to display content remotely, over large distances.

The general conclusion of those pilot projects is that the SCALA software system works well for the ATLAS requirements. It is relatively simple to program, secure, and the project benefits from central support provided by the CERN AVC Section. This includes central storage of the content, security, and help with the installation and maintenance of screens at CERN.

A priori, licenses are required for both the design and display of content. If one implements a system that relies only on the installation of screens and the SCALA software, a license must be purchased for every display. To avoid this fee, we designed a system architecture that employs the CERN webcast servers [7] to broadcast the content of each channel. This allows one to view content from any location via any web browser with a standard viewing plug-in.

4. Core Services

The services provided by the ATLAS *Live* project follow a layered strategy that includes:

- **Core services** designed to serve the entire collaboration;
- **Supplemental services** designed for individual institutes or projects, depending on specific needs and resources.

The core services include:

- Development and maintenance of several general-purpose video streams, targeting the entire collaboration or the public;
- Installation and maintenance of dedicated screens at CERN and Point 1, to serve ATLAS needs at specific locations, by displaying the appropriate streams;
- Encoding and webcasting of a limited number of streams in a standard format, making them available worldwide to the collaboration or public, via a protected interface, as needed.

The core video streams are organized into general topics, covering major aspects of the experiment. Content of the three streams that are currently offered via webcast is described in section 4.1. There are other streams that have been designed for display on screens at CERN and Point 1. Content of those streams is not described here, as it is currently undergoing the continual development and revision that can be expected at this early stage of the project.

4.1. Webcast Channel Content

The project currently implements three pilot channels that are webcast to the Internet:

1. The Collaboration Information Channel;
2. The Control Room Overview Channel;
3. The Public Outreach Channel.

These channel types were chosen to test the effectiveness of the project to address a variety of internal and external communication challenges to the collaboration. Feedback is currently being solicited from the collaboration concerning the channel categories, their content, appearance, and effectiveness. Below we describe the existing channel content.

4.1.1. The Collaboration Information Channel. The Collaboration Information Channel provides quick access to the most current and relevant information on ATLAS. This includes information on the physics program, schedules for major events, daily meeting agenda, announcements from management and the secretariat, and anything else considered to be important and useful for the collaboration. Scripts are used, whenever possible, to automate the process and to ensure the content is kept up to date. The basic idea is not to replace the ATLAS web pages and other sources of detailed information, but to provide a quick snapshot to alert the viewer of key events and current activities.

4.1.2. The Control Room Overview Channel. The Control Room Overview Channel (see Figure 1) provides a snapshot of the current conditions in the LHC and ATLAS. It includes key general information, such as LHC schedule and status, DCS overview of the detector, overall DAQ status, and online event displays. This channel essentially mimics the large central displays in the control room; its target audience includes run coordination, remote monitoring stations, and the collaboration at large.

4.1.3. The Public Outreach Channel. The Public Outreach Channel targets the public at large. Its current content includes educational and informative videos about the ATLAS Experiment. This includes video from major media events, such as LHC First Physics, interviews with ATLAS members, detector construction video, and educational physics videos. Decisions for the type of content are the responsibility of ATLAS Outreach Group and the ATLAS *Live* development team simply provides a means to assemble the material for easy broadcast to the public.

4.2. CERN Displays

In addition to the above webcast channels, several specific channels have been designed for dedicated ATLAS displays, such as those installed in the lobby of building 40, in the control room, and other locations at Point 1. The SCALA Player license has been installed on these screens, in order to simplify maintenance and to provide a robust viewing environment. Content on these screens currently includes items such as latest public event displays, LHC running conditions, and other content appropriate for the location. Usage of the screens and the choice of content will certainly evolve in the next year, as the collaboration adapts to the screens and provides feedback on their optimal usage.

4.3. Information Protection

All ATLAS *Live* video streams are currently protected, requiring the standard CERN Single Sign-On authentication and providing access only to authorized current ATLAS members. The protection is applied at all steps of the information flow, from original source to the ATLAS *Now* and ATLAS *Live* portals. The Public Outreach Channel is the only channel currently planned to become open, once the content and scheduling has been refined and approved.

Members of the collaboration viewing the content in public and/or displaying the streams on screens at their home institutes are bound by the rules of the collaboration, concerning information protection. When authenticating with username/password or certificate, each collaboration member is responsible for whom and where the content is displayed. It is foreseeable that there will be requests

for putting ATLAS-specific detector and LHC machine information on screens in institutional corridors or other semi-public locations. These requests will be examined on a case-by-case basis and approval of the content will be required for any public display of protected material.
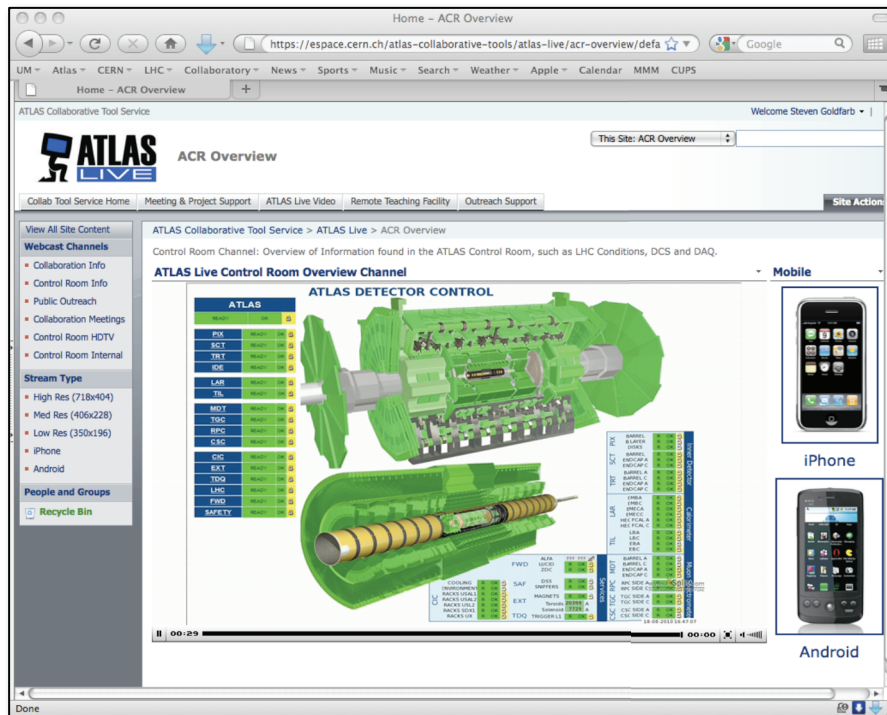

Figure 1. Screen capture of the Control Room Overview Channel.

5. Supplemental Services

5.1. Institutional Displays

Although the project is in its nascent stages, requests have already been received for the usage of ATLAS *Live* content in dedicated monitors located at remote institutes. It is quite common these days for an institute to have a signage system installed for displaying departmental and university or laboratory information. This typically includes news announcements, seminar and class scheduling, special events, etc. For locations frequented by ATLAS members, their colleagues, or potential student recruits, it would be appropriate for LHC and ATLAS-specific information to be included on the displays.

We envision several possibilities to provide such a service:

1. The ATLAS *Live* standard webcast streams can be included, as is, in existing systems. Since the streams are available in a standard video format, most signage systems should easily accommodate this possibility. In this case, no effort is required on the part of the ATLAS development team.

2. A screen could be installed specifically to display a standard ATLAS *Live* channel using the standard webcast stream. Again, no effort would be required on the part of the ATLAS development team, although processors driving full HD webcast streams need to have their IP numbers registered in the CERN database.

3. A screen could be installed specifically to display standard ATLAS *Live* channels using the SCALA Player software. The advantage of this is for the client is twofold:

a. Different channels of content can be displayed at different times, controlled by a scheduler at CERN.

b. This method has been found to be more robust than the webcast player method, as the latter more susceptible to local computing and network limitations, including the configuration of the browser and video player software.

In this case, a small maintenance fee would be charged to the institute to recover the license, software and maintenance costs. Note that the client could probably be given secure remote control over the scheduling of content, but this remains to be tested.

4. A new ATLAS *Live* channel could be designed and played directly to a screen installed at the remote institute. That channel would use the SCALA Player software to display content specifically designed for the institute and would require the following effort:

a. A representative from the remote institute would need to define the content, play list, and schedule for their channel. They would do this in coordination with the ATLAS developers.

b. The content to be displayed would need to be imported to the local CERN databases.

A maintenance fee would be charged to the institute to recover the license, software, storage and maintenance costs, as well as the time required for development of the content. Requests like this would be evaluated in light of the current development activities of the group, the need of the institute, and the priorities of the collaboration.

5.2. Education and Outreach

The number of possibilities for the usage of the ATLAS *Live* video streams in public education and outreach is only limited by our imagination. Although most of the material used for the Public Outreach channel today is available on the ATLAS Public Home Page [8], its broadcast format allows members of the collaboration to promote ATLAS at their own institutes as well as at schools, public places, media events, discussion forums, etc.

The ATLAS Public Outreach Channel played an important role during the *LHC First Physics* event organized by CERN on March 2010, in which several ATLAS institutes hosted media and public to watch the LHC colliding protons at 7 TeV for the first time [9].

Video is a powerful tool whose popularity continues to grow. It represents an important resource for communicating the purpose, importance and value of our accomplishments to the public at large, as well as in encouraging young students to pursue careers in basic scientific research. The ATLAS Outreach coordination has recognized this immediately and is already pursuing other projects to take advantage of the medium.

For example, an "ATLAS Travel Exhibition Kit" project has been launched, featuring a display stand with ATLAS information in the form of fixed text and images, as well as support for a dedicated ATLAS *Live* screen. The panel and screen support are included in a simple, inexpensive, travelling exhibit kit that any institute can use to promote ATLAS at home.

We expect the current Public Outreach Channel to evolve into one of several possible public channels. However, ideas have already been discussed for variations, including an ATLAS Status Channel designed for the public, with a view of current running conditions and recent accomplishments, and an ATLAS Education Channel that focuses on learning material for students.

6. Project Organization

6.1. Development Centre

The hardware, software and licenses required to develop the content, display it on local screens, encode the video streams, and webcast to the Internet, have already been purchased, installed and are maintained at Point 1 in building 3162 (above the ATLAS control room). Much of the material was acquired in preparation for the *LHC First Physics* media event in March 2010, as part of the

renovation of the Data Quality and World-Wide Computing Control Rooms. The ATLAS *Live* Webcast Centre includes:

- Two development PCs with high quality displays, SCALA Designer software and licenses;
- Six quad-core CPU's with SCALA Player software and licenses for the playing, monitoring and encoding of the standard video streams;
- Two 42" JVC monitors with attached mini-PCs for testing and monitoring developmental streams.

In addition to this equipment, spare Designer and Player licences are maintained for remote development and testing. It should be noted that the installation price of each additional webcast channel includes one small display, CPU, and a Player License, but no other significant hardware costs.

6.2. CERN Displays

Four professional monitors with attached mini-CPUs have been installed in the cafeteria of building 40, also as part of the *LHC First Physics* media event. These monitors are now being used to display ATLAS *Live* channel content both from the standard webcast channels and from dedicated channels being designed for that area. A large monitor is also installed on the south wall of the control room for the viewing of specific LHC and ATLAS run information by shifters, and a monitor on the north wall is used to display the current status of the HD cameras and to announce upcoming events.

The installation of additional monitors is being considered for other locations at CERN frequented by collaboration members and the public. Example new locations include the ATLAS Visitor Centre and other office buildings at CERN. In addition, a monitor outside the ATLAS secretariat would serve both those working in the office, as well as the numerous visitors, and could display information relevant to the secretariat, such as working hours, announcements, and other relevant general collaboration information.

7. Summary and Future

Over the past year, the ATLAS Collaborative Tool Service has installed and developed a high quality, secure video streaming system in support of the communication of machine, detector and collaboration information. The pilot project, featuring a combination of professional signage software, encoding and webcast technologies, has not only demonstrated the effectiveness of the system for bringing key information to the collaboration, regardless of location, but appears to be a promising tool for the broadcasting of outreach and educational material, as well.

Future plans are to continue the programming development of several general channels of content, based on feedback and requests from the clientele, to develop prototype channels with specific content defined by remote users, and to integrate screens of ATLAS *Live* content within dedicated monitoring stations at remote institutions. Technological advances will include the development of applications and/or dedicated sites for mobile and small-platform devices, integration of automatic resolution detection for improved viewing, and development of channels for interactive screens.

References

[1]   ATLAS *Now* Web Page: http://cern.ch/atlas-now.
[2]   ATLAS *Live* Portal: http://cern.ch/atlas-live.
[3]   CDS: CERN Document Server: http://cdsweb.cern.ch.
[4]   Indico: Integrated Digital Conference System: http://indico.cern.ch.
[5]   SCALA Broadcast Multimedia: http://www.scala.com.
[6]   ATLAS Collaboratory Project: A University of Michigan project supporting research and development for large-scale collaborative research experiments: http://atlascollab.umich.edu.
[7]   CERN Webcast Server: http://webcast.cern.ch.
[8]   ATLAS Public Home Page: http://atlas.ch.
[9]   LHC First Physics Media Page: http://cern.ch/press/lhc-first-physics.