Memorandum

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To : Ana Godinho

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Subject: CERN Virtual Tours development

Context

The CERN visit service organizes and coordinates guided tours for nearly 120'000 visitors each year on CERN sites (2016: expected 119'429 as of 28 November).

Nevertheless: The **Visit Service refuses about 2.5 times more guided visitors per year**, due to limited capacity: number, size and safety rules of the visit points; reception building; number of conference rooms; available guides etc.

Also, **not all people can afford a trip to CERN** to visit the Laboratory (distance, cost, time needed etc.).

In addition, many visitors are **often disappointed not to visit our underground facilities** which are rarely accessible and only for a few hundred at a time.

Finally, during **special events** (exhibitions, fairs etc.), despite lifesize posters and big interactive displays, it is sometimes difficult to give a sense of the size and complexity of the experiments done at CERN.

The development of "Virtual Tours" may address these problems.

Purpose of this document

This document lists the existing and potential "Virtual Tours" formats and technologies. It also proposes 2 paths for the development of Virtual Tours at CERN.

Definition

A **virtual tour** is an off-site visit to a location, that may or may not exist. It is usually composed of videos or still images. It may also use other multimedia elements such as sound effects, music, narration, and text. Virtual tours can integrate various levels of interactivity (from simple selection of content to real live interactive guided visits). The virtual tour can also encompass various levels of immersion (from plain 2D to full virtual reality).

They can be divided in two main categories: Guided Virtual Tours and Self-Service Virtual Tours.

1. Guided Virtual Tour

A guided virtual tour proposes an interactively commented visit, with involvement of an on-site guide. It usually requires video-conferencing equipment and facilities. This type of virtual tour is especially targeted at group audiences (school classes, conference participants, etc).

1.1. Existing offers at CERN

ATLAS and CMS collaborations already offer Guided Virtual Visits. They have their own booking system and are primarily targeted at school audiences.

ATLAS offers about 4 visits per month to groups of less than 50 people (90% of all visits). 85% of visits are for schools.

CMS has had an average of 6 visits per month (770 visitors per month) over the past 2 years. The distribution is as follows: 62% high schools, 22% general public and 15% universities.

LHCb was recently equipped for video conferencing and ALICE, the CCC and the Data Centre were considering investing in the equipment.

The main constraint for this activity are the resources needed: technical rehearsal, preparation of the visit, at least one person to host the visit and one person to handle the video conferencing system. CMS plans to have 5 people per visit as they have multiple and mobile visit points.

ATLAS has informed the Visit Service that they cannot increase the number of visits without external manpower.

1.2. Development of Guided Virtual Tours

Below is a proposal for the development for Guided Virtual Tours.

1. **Include these tours in the standard Visit Service portfolio**

One solution to address the resources issue would be to propose to consider Guided Virtual Tours as a standard offer from the Visit Service. CERN official guides would be trained to host the visit and to use the videoconferencing equipment (this training would be complementary to the training on CERN visit points the guides already receive).

This would not prevent the experiments from keeping their own self-organized visits, or from reserving Visit Service time slots for their own use.

2. **Single point of booking**

As announced at a presentation given at CHEP 2016 (Steven Goldfarb et al.), it would be much more efficient to have a single point of entry for all Guided Virtual Tours at CERN.

Similarly to the current effort to bring all on-site visits to a unique booking system (i.e. Public Outreach application), the Guided Virtual Tours should be booked using the same system through the same portal (http://visit.cern).

3. **Network of Virtual Visitors**

Steve Goldfarb has nice ideas about networking persons who will visit / have visited CERN virtually. People could ask questions online and get answers from specialists, prepare visits beforehand etc.

4. **Recorded visits**

It would be interesting to record some visits in order to make them available to guides, for training purpose, for CERN videos, but also to external persons who could not afford to book one. Of course, this may require management of authorizations if we also record the audience parts.

1.3. Immediate action points

1. IR-ECO should gather with all representatives of LHC experiments and CERN visit points, including those which are not yet equipped for virtual visits but willing to be, and gather their opinion on the integration. We should make a clear inventory of possible use and constraints of each point.

2. Develop training courses and material for guides for the use of Vidyo system and each of the visit points.

3. AIS and IT-CDA should be contacted to seek feasibility of integration of Virtual Guided Tours in the Public Outreach application and Vidyo system.

1.4. Further action points

1. Setup questionnaires to follow up visitors' satisfaction and return on investment.

2. Monitor the activity (statistics, etc)

3. Self-Service Virtual Tour

Unlike the previous category, this type of tour is managed by the visitor. He/she can choose what to see and how to see it. It is mainly targeted at individual visitors. Many different formats exist.

3.1. Formats

1. **On-demand Virtual Tour**

On-demand Virtual Tour give the maximum freedom to the visitor. He/she can choose where to go, what to visit. The most popular example is Google Street View where users choose where to go with thousands of possible tours. This requires massive production of audio visual material and usually does not allow much interactivity or additional information.

Example: https://home.cern/about/updates/2013/09/explore-cern-google-street-view

2. **Pre-defined Virtual Tour**

A pre-defined virtual tour has a pre-defined path. The visitor does not have the possibility to change the proposed scenario. The main advantage is that the author/creator can choose the messages to pass and also keep control over storytelling.

Example: https://www.youtube.com/watch?v=d_OeQxoKocU

3. **Virtual exhibition**

A virtual exhibition, is a collection of various media which the visitor can browse on demand, either following a predefined path or not. It is displayed as a virtual representation of an existing or fictional location.

Example: http://bruxelles.tv5monde.com

4. **Multimedia Kiosk**

More standard collection of photos and videos which the visitor can chose on demand. They can be grouped by categories, follow a certain logic, but should be watchable individually.

Example: http://atlas.cern/resources/multimedia/outreach

3.2. Multimedia technologies

The following multimedia technologies can be used to implement the Self Service Virtual Tours formats. Usually, a combination of various technologies is used for one Virtual Visit solution

1. **Photos**

   Still images, possible in 3D? In various sizes to allow smooth loading on any device and network connection.

2. **Videos**

   2D video. With various video codecs and resolutions to allow smooth playing on any device and network connection.

3. **360° photo**

   Still picture with possibility for viewer to choose view angle. Can be viewed on browser, smartphone, VR goggles.

4. **360° videos**

   Video with possibility for viewer to choose view angle. Can be viewed on browser, smartphone, VR goggles. The difficulty to produce such videos is that we don't know which direction the viewer looks at, is has to be directed in a way we indicate the visitors where to look (audio, augmented data etc).

5. **Immersive Geographic Information System (GIS)**

   Free move in a 360 photo between limited predefined point "à la" Google Street View. Can be viewed on browser, smartphone, VR goggles.

6. **Audio conferencing**

   Interactive audio conference. Requires good audio hardware on both sides as well as trained person to handle the hardware. Ideally completed by some multimedia content (at least images). Many platforms exist: Vidyo (CERN's favourite), Google Hangout, Skype etc.

7. **Video conferencing**

   Interactive video conference. Requires good video and audio hardware on both sides as well as one or two trained people to handle the hardware. May require technical test prior the visit. Many platforms exist: Vidyo (CERN's favourite), Google Hangout, Skype etc.

3.3. Existing solutions

1. **Immersive GIS**

Google has scanned most of CERN's major locations in Google Street View: Meyrin site, Prévessin site, ATLAS, CMS, ALICE, LHCb, PS, Data Centre, CCC etc.

It is available from CERN Visits Pages, but there is no additional content: audio description or text. http://cern.ch/visits/tours/online-visits

2. **360° photos**

CDS already contains multiple high-quality 360° pictures of CERN experiments and sites. But these are raw material lacking any interactivity and / or additional information.

2.4. Proposed development

The following proposals are based on preliminary discussions with ECO management (group leaders and section leaders). It can be used as a base for a more formal project to be started early 2017 and labelled "CERNVR".

The first priority would be to produce various 360° videos (similar to the one produced recently by BBC) which can then be distributed through various channels: website, VR Application, social media etc.

1. **Covered topics**
   Clips will cover the usual sites visitors want to know more about: LHC tunnel, LHC Experiments, CCC, Data Centre etc. but also more atypical sites like Restaurant 1 at lunch time, Main auditorium during a major conference, Restaurant 1 lawn at the annual relay race etc to give more insight in CERN's atmosphere and daily activities.

2. **Short formats**
   Videos should be short (max 2 minutes) as it seems most viewers stop watching 360° videos after 1:30 minute. That does not stop from offering longer contents by combining multiple related short clips. E.g. "The Accelerator tour" made of "Linac", "PS", "SPS", "LHC" and "CCC" clips.

3. **Reusable and self-contained content**
   Videos should be usable on their own, out of the CERN VR context, e.g. on Social Media or as illustration for a more in-depth article. Therefore messages contained in the clips should be self-sufficient with no need to have viewed other clips or text beforehand (except when deliberately

part of a package – see above).

4. **Key and generic messages**
   Clips should pass the key and generic messages you would want a visitor to remember about the shown site if you had 2 minutes to guide. Therefore they should not contain specific messages or actions (e.g. insertion of a new tracking sub-detector during LS2).

5. **Audio guided**
   Clips should be commented by voice-over audio. This will allow an easier translation to other languages. Audio can also be used to attract attention of visitors towards a specific location or item as the visitor has free decision on where to look at.

6. **Augmented data / reality**
   Additional material should be added on top of the video: animations to illustrate what the voice-over explains (e.g. showing protons in the LHC tunnel, showing flow of data between racks of computers), extra 2D videos, extra information in text format (lengths, sizes, volumes etc. - should be as language-neutral as possible). This will also help focusing the visitor's attention to a specific point. The clips could also contain pure virtual content like a 3D animation of proton collisions, LHC computing grid data flow around the planet, cosmic rays hitting the Earth etc.

7. **Quality**
   In order not to have to re-produce the clips within 1 or 2 years, it would be good to produce videos in a quality level which may seem high today but will be the de facto standard in short time (e.g. 4K). This may require purchase of new equipment or need to involve external partners.

2.5. Immediate action points

1. Visit Service and Global Engagement, in collaboration with Editorial Content team, to script one or 2 demo clips to be produced to validate the format.

2. APS to estimate technical feasibility and cost for shooting the videos in high quality. Consider outsourcing option.

3. Graphics Design Team to estimate the feasibility, cost and consequence on shooting for integrating augmented reality data and animations. Consider outsourcing option.

4. Each team to identify representatives to a CERNVR working group to meet weekly as from January 2017.

5. Visit Service to setup a collaboration site (Sharepoint?) to gather all requirements and specifications, and to keep trace of the working group progress

6. Plan shooting of videos in underground facilities during the Year End Technical Stop (YETS) 2016-2017. This should be possible even not knowing the precise script for each clip as the shooting locations are relatively limited.

6.4. Further action points

1. Clarify how the clips will be distributed: web pages (Drupal support? Specific technologies like krpano?), smartphones or VR devices (similar to UNVR application?)

2. Keep regular meetings to follow-up production of clips (shootings, costs, bookings etc).

3. Identify new potential clips to be developed.

4. Monitor the use and impact of the video clips.

5. Gather feedback from end users

6. Consider the production of a Google Cardboard-like solution to be sold in CERN Shop, online or distributed to visitors (Protocol, Council etc).