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# Experience from the 1st Year running a Massive High Quality Videoconferencing Service for the LHC

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**Abstract**. In the last few years, we have witnessed an explosion of visual collaboration initiatives in the industry. Several advances in video services and also in their underlying infrastructure are currently improving the way people collaborate globally. These advances are creating new usage paradigms: any device in any network can be used to collaborate, in most cases with an overall high quality. To keep apace with this technology progression, the CERN IT Department launched a service based on the Vidyo product. This new service architecture introduces Adaptive Video Layering, which dynamically optimizes the video for each endpoint by leveraging the H.264 Scalable Video Coding (SVC)-based compression technology. It combines intelligent AV routing techniques with the flexibility of H.264 SVC video compression, in order to achieve resilient video collaboration over the Internet, 3G and WiFi. We present an overview of the results that have been achieved after this major change. In particular, the first year of operation of the CERN Vidyo service will be described in terms of performance and scale: The service became part of the daily activity of the LHC collaborations, reaching a monthly usage of more than 3200 meetings with a peak of 750 simultaneous connections. We also present some key features such as the integration with CERN Indico. LHC users can now join a Vidyo meeting either from their personal computer or a CERN videoconference room simply from an Indico event page, with the ease of a single click. The roadmap for future improvements, service extensions and core infrastructure tendencies such as cloud based services and virtualization of system components will also be discussed. Vidyo's strengths allowed us to build a universal service (it is accessible from PCs, but also videoconference rooms, traditional phones, tablets and smartphones), developed with 3 key ideas in mind: ease of use, full integration and high quality.

## 1. Introduction

CERN and the LHC community at large have a long experience using videoconferencing. The requirements and the need for connecting remotely dispersed groups at a global scale have been present since the middle 90s.

At this time, VRVS/EVO was developed within the HEP community, completely built on its requirements. The tool served the LHC community until 2008. At that time, a tender was required due to a change of business model. This change of model implied the setup of a committee with representatives of the major user communities in order to establish the user requirements and make a market assessment. This effort is still seen as an excellent example of strong coordination and cooperation between CERN IT, the Experiments and main Research Labs.

After a pilot phase of 6 months, the Vidyo system was selected. On 1st of January 2013, it was announced as the sole official Desktop videoconference system supported for the LHC community ending the CERN support of the EVO system.

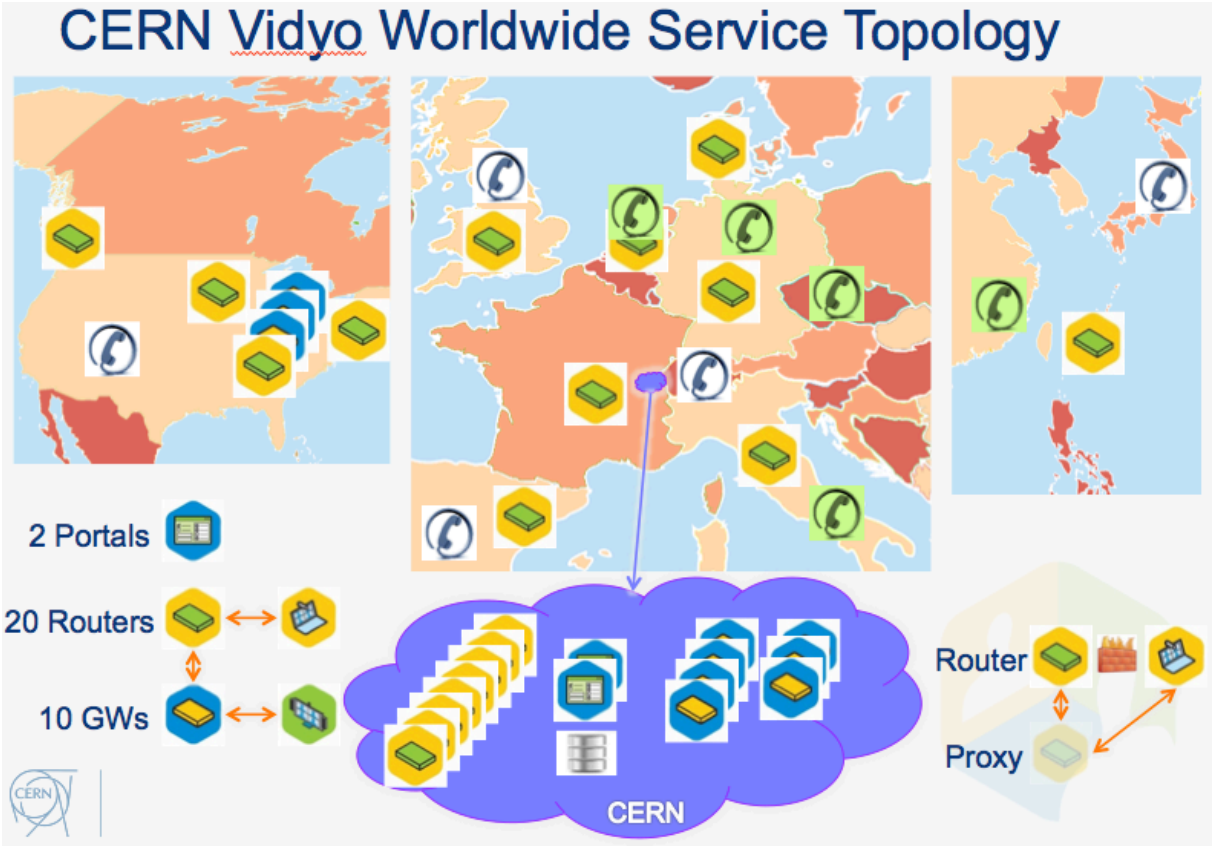
## 2. Vidyo@CERN

### *2.1. Use Cases*

The use cases for videoconferencing at CERN are several. The most typical is the weekly working meeting involving desktop participants, mobiles and rooms equipped on videoconferencing. They normally go up to 20 participants and happen at a rate of 250 meetings per day. There are also large and very large collaboration sessions. This is typically the case for Experiment Collaboration meetings. Having a frequency of 2-4 per month the range of attendance is between 100 and 250 participants (desktop, mobiles and room systems). Other use cases include public Outreach activities (Control room virtual visits, IPPOG Masterclasses etc.), permanent links between remote operation centers, remote teaching and job interviews.

### *2.2. Scale*

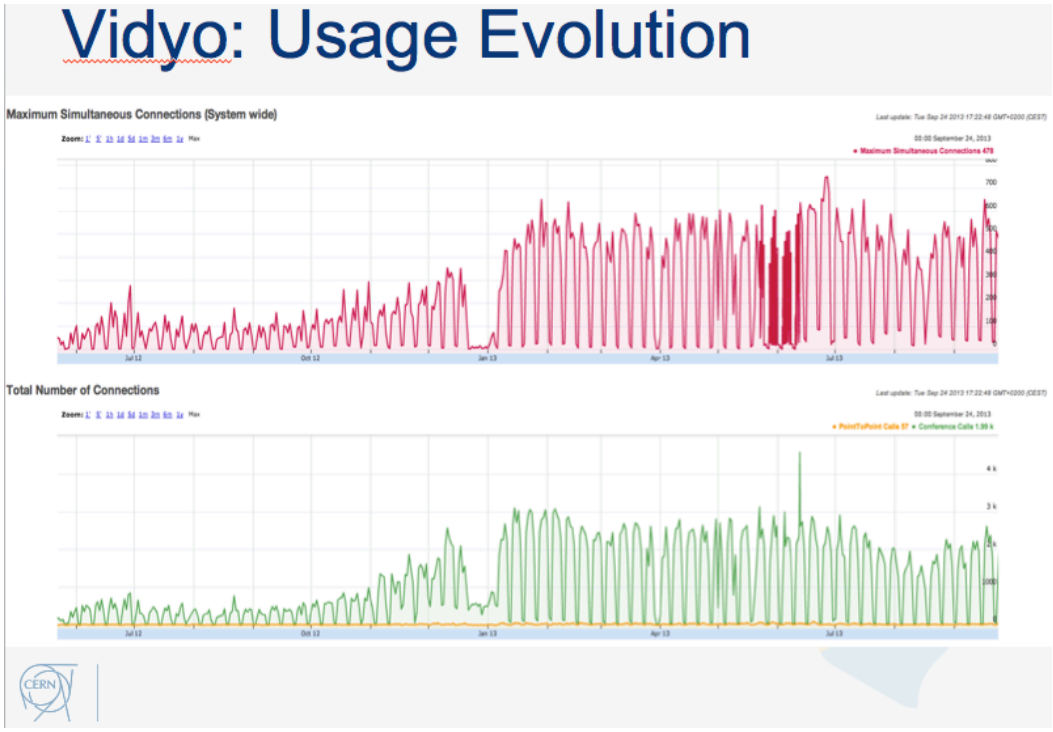
To serve the use cases listed and the entire system load that it implies, a massively distributed service based on Vidyo has been deployed. The strong points about Vidyo lay on the multiplatform capabilities (from Desktops to Mobiles and H.323/SIP room codecs), the scalable architecture and the strong resilience to poor network conditions. The current service topology is depicted below.



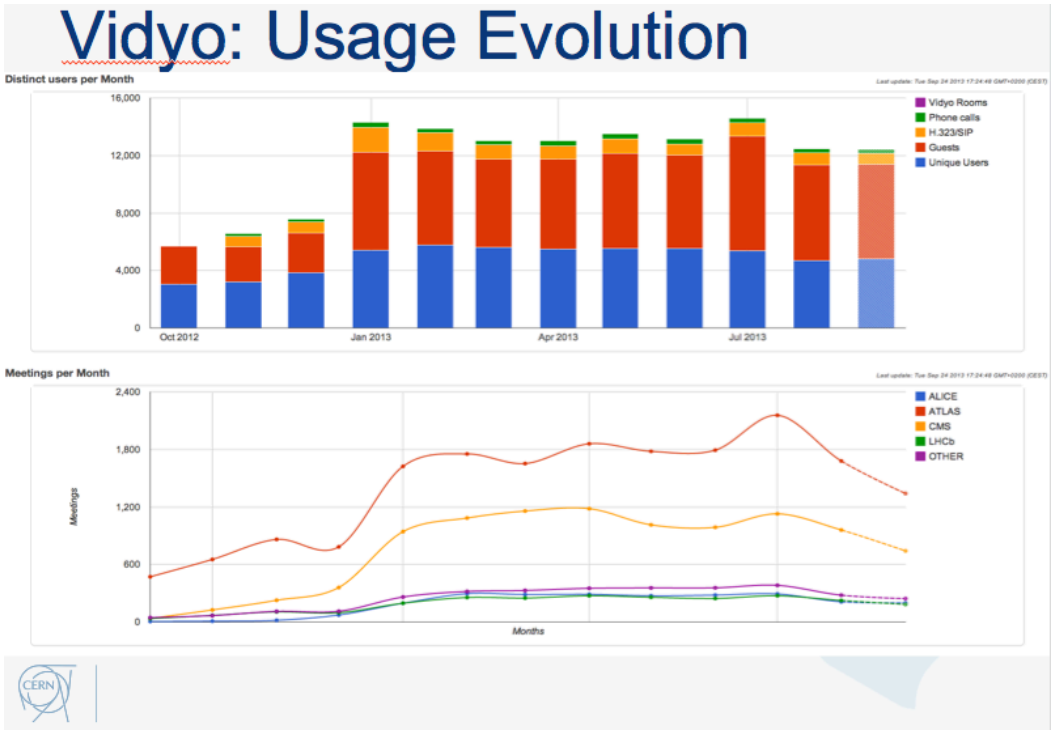

The current service has the capacity of hosting 50000 user accounts, 800-1600 simultaneous connections, up to 168 H323/SIP simultaneous connections, 11 phone access points worldwide and 12 simultaneous recordings.

### *2.3. Usage*

In the following graphs, the usage of the service is depicted. One should note the double figures after the date of having Vidyo as the sole production system for the LHC (January 2013).

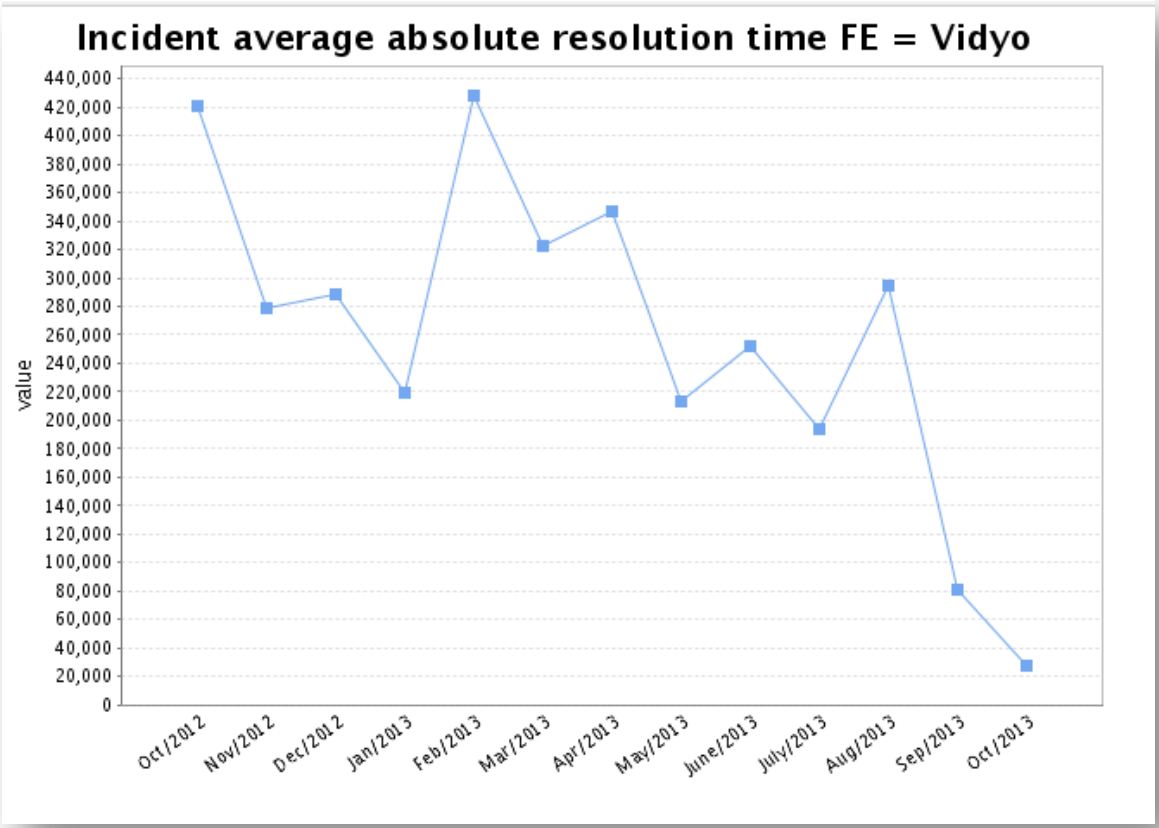



The current peaks of the usage are at 750 simultaneous calls, 252 participants in one single meeting, more than 3200 meetings per month. 30000 VidyoDesktop clients have been installed. The whole activity corresponds to an average of one million “vidyoconferencing” minutes per year.



### *2.4. Technical Support*

The support activity has had its peak on the first months of the service operation. The number of incidents has decreased month after month, which proves that the user adoption has been successful, as its evolution is completely opposite of the usage.




## 3. Integrations

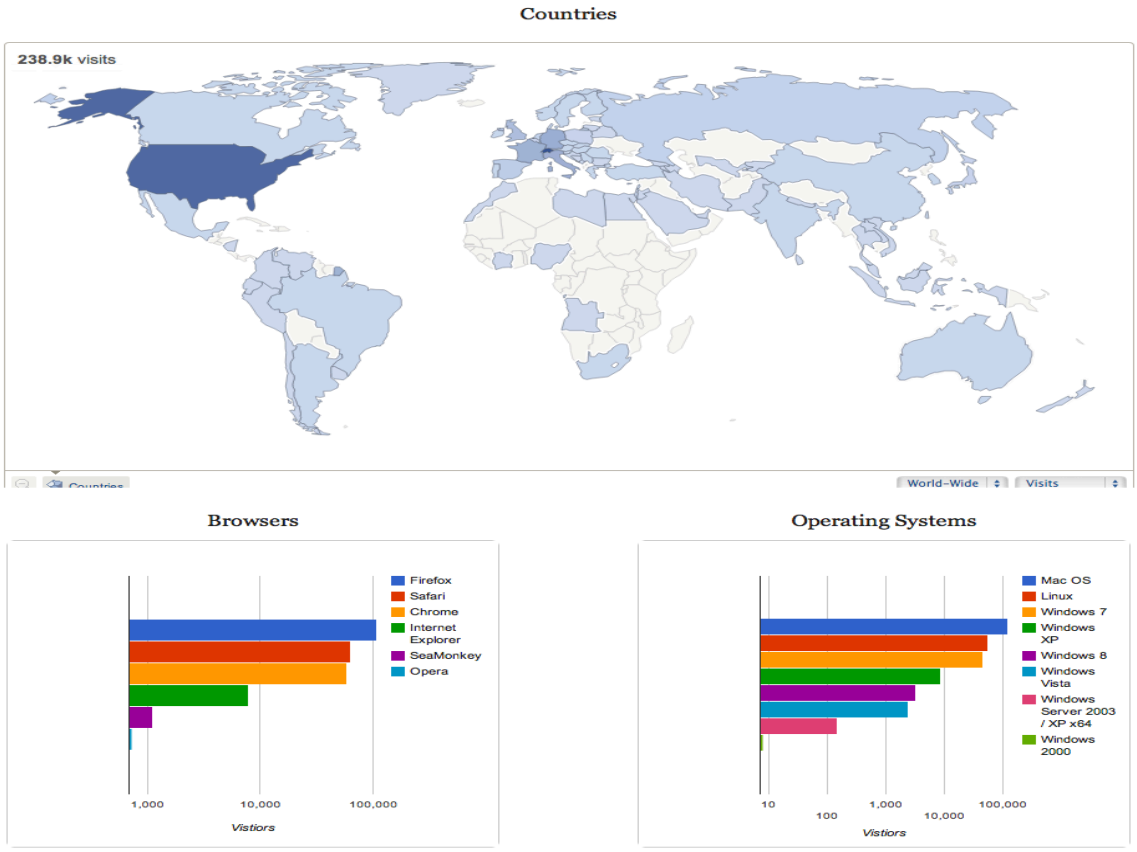
One of the key components from the very beginning was the service integration available from day one with the current IT infrastructure serving the LHC. The main integration is on the Indico service. Users are now able to book, manage and join a Vidyo session from any Indico event.

Other integrations include the CERN LDAP link on the Vidyo Portal, where the CERN user accounts are imported directly to the Vidyo service database.

## 4. Reporting & Monitoring Tools

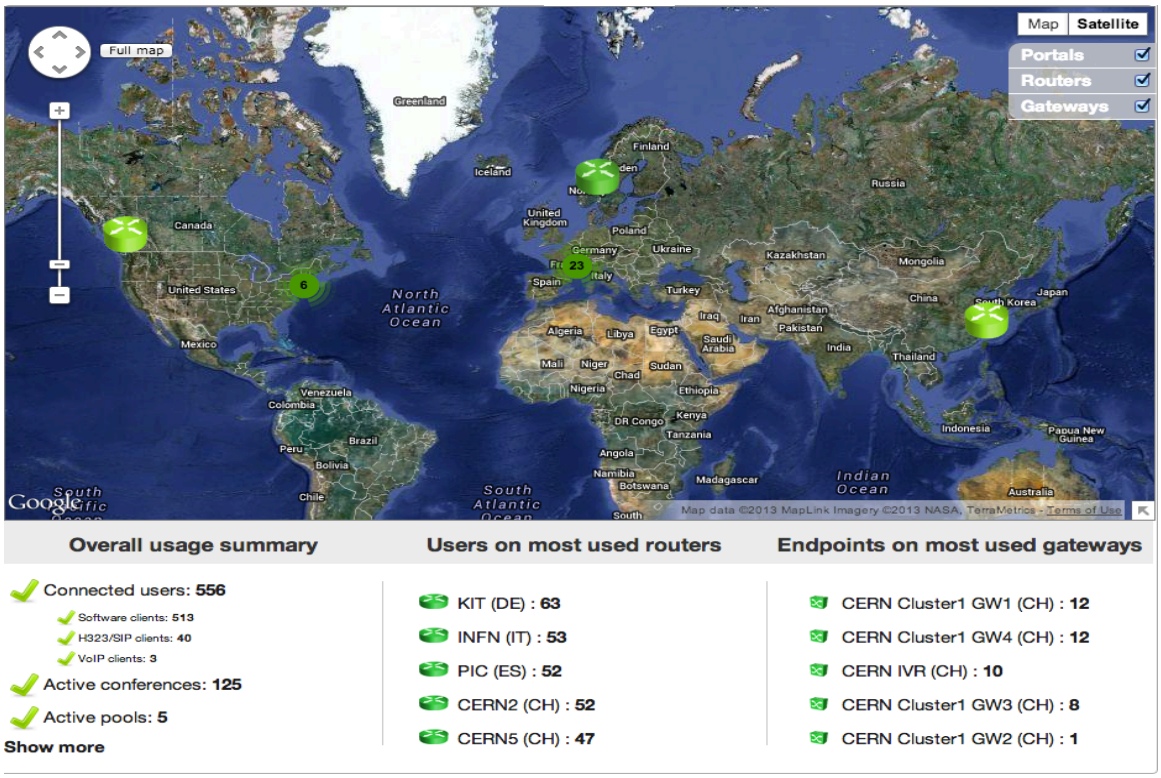
The Vidyo Inc. Company provided the product upon which the CERN IT Department built a service.

The product didn't include extensive reporting and monitoring tools. These are necessary for Service Managers and Vidyo Administrators to measure and monitor the very large and massively distributed service being deployed. For this reason, CERN IT decided to develop in-house a set of reporting and monitoring tools adapted to CERN Vidyo Service. Concerning the reporting, a live Web reporting tool has been developed, available either for users or managers, based on queries to the Vidyo CDR (Call Detail Record) database. Together with these queries, using an open source tool to analyze Web accesses (Piwik), an interface has been built using the Google Charts API for data displays. The view for the accesses per country, browsers, and operating systems reports are depicted below.




Concerning the monitoring a similar approach has been put in place. A live monitoring infrastructure for managers has been developed at CERN, using an open-source monitoring framework (Nagios), consisting on agents running on each system component to monitor. A Proxy server collects and combines the whole system data: the monitoring agent reports, the Vidyo CDR and Vidyoportal DB queries for usage. The combined data is then displayed using the Google Charts API and Google Maps API, which include also the components geo-location.

Some examples of data displayed are system status for each component (CPU, Network, Disk I/O, Uptime, etc.) and current usage per component (number of desktop and mobile users per active router, number of H323/SIP per gateway, number of active conferences, history of usage per component, etc.). The following picture depicts the main view of the monitoring interface.




## 5. Future Improvements and Challenges

The service is going to evolve considerably in the short and mid-term. The first enhancement scheduled to happen during Q4 2013 is the release of a new VidyoDesktop client with a new interface that includes an integrated chat facility. This new client will also allow the display of up to 16 videos (the current one displays up to 8) and the setup of 2 HD displays. Still on Q4 2013, more phone access numbers are going to be available worldwide and the Vidyo recording service is going to be extended to all meetings.

In 2014, the enrichment of the Unified Vidyo Desktop with more features will continue with the ultimate goal of merging the VidyoPortal and VidyoDesktop functionality. A browser plugin is also being released to allow participation of Guests without the need of installing a native client on their machines. New sharing capabilities will be available on iPads, providing whiteboard and mark-up features.

In terms of infrastructure enhancements, the roadmap is also very rich: new infrastructure additions will be completely virtualized and the introduction of dynamic distribution of clients in routers (router proximity) will take place. In addition, to cope with possible extensions of the service to other communities than the LHC, scalability tests (Database Multitenant modes) are going to be performed.

Full support of SSO/SAML will also be available in 2014.

A final note about WebRTC:

WebRTC is an open source project aiming to enable Web browsers with Real Time Communication (RTC) capabilities. It's considered right now as the next big vision in new communication possibilities on the Web. Some of the main players are Google, Firefox, Apple and Microsoft. Vidyo is currently on active collaboration with Google to develop Scalable Video Coding (SVC) as part of the WebRTC client open-source project. CERN will be part of this effort and the community should witness the first developments using WebRTC in a beta phase by the end of 2014.

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