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An Interactive Visual Communication Architecture Proposal For Telehealth

How to improve healthcare services
with Visual Communication technology

Abstract

Amongst the one-and-a-half billion people around the world surfing the Internet regularly, millions have gone online seeking medical information. The widespread access to broadband Internet, together with the evolution and increased adoption of visual communication technology, are taking this trend one step forward: according to recent researches, 78% of healthcare consumers are willing to interact with physicians online, over 85% of physicians would rely on web services to simplify their operations and 90% of them see the Internet as a source of competitive advantage.*

With such premises, the delivery of health-related preventive, promotive and curative services over convergent networks, also known as Telehealth, appears to be a great response to the supply-demand mismatch in the health market, while representing a challenging opportunity for service providers in the visual communication space.

This whitepaper focuses on how to design, engineer and deploy a best-practice interactive visual communication architecture for Telehealth services.

*Sources:
- California HealthCare Foundation, *Uncoordinated Care: A Survey of Physician and Patient Experience, 2007*

- Gartner, *Survey of Web Portal Uses and Trends in US Care Delivery Organizations, 2006*

Scenario

Telehealth is not intended to replace in-person care; on the contrary, it is supposed to work as its ideal complement and fill the gaps in healthcare supply. In countries where traditional delivery of health services is affected by distance and lack of local specialist clinicians, for example, Telehealth benefits patients giving them access to timely healthcare services. Moreover, Telehealth can bring true innovation and added therapeutic value for specific areas of medicine: remote psychiatric consultation might be a valid alternative for the young, who are familiar with Internet-based communication and might initially have low acceptance for a more direct, person-to-person approach; for those medical specialties - like dermatology - which strongly rely on the sight, a look through a high-quality webcam could be sufficient for a first diagnosis and help optimize the scheduling of physical examinations; the ability to connect remotely with patients in need is also fundamental in cases of emergency (hazardous situations like fires or calamities, locations difficult to reach).

Online care programs, each one with its specific focus and distinctive method, are already available and represent a concrete and efficient response to the lack of healthcare supply. Thanks to the evolution of video technology, to the quality reached by Video and Voice over IP (VVoIP) communication and to the spreading of these solutions, these services are easy and cost-effective to implement: moreover, US Centers for Medicare & Medicaid Services as well as private insurers have now probated these services and are reimbursing for care.

Benefits of Telehealth

Relying on a widespread, standards-based and flexible technology and not requiring a substantial change in the patients' behaviour, Telehealth appears to offer noticeable benefits for both the consumers and the physicians, as it:

- Complements existing health plan programs, systems and processes

- Fills the gap in the supply of medical services providing timely access to care
- Is easy and cost effective to deploy, due to its compatibility with visual communication standards
- Has shown to be highly accepted by both the consumers and the physicians
- Helps specialists optimize their resources and allows remote teamworking
- Represents an opportunity of generating new revenues for service providers in the visual communications space.

Step 1 – Service Planning

This paragraph describes some important elements that need to be taken into account when planning a Telehealth service.

How do Patients access the service?

There are two ways a Patient can receive remote assistance through a video terminal:

- **Live Operator:** Patients can be connected to a live, remote Operator either by *inbound* or *outbound* video calls. Outbound calls (from Operator to Patient) could be more suitable for scheduled assistance whereas inbound calls (from Patient to Call Center) can be placed anytime by the Patient, who gets subsequently connected to an interactive menu through which he will select the desired Operator.
- **Pre-recorded video tutorial:** the Patient places a call to the interactive platform and selects the required assistance for simple daily tasks (e.g. how to check the blood pressure) through a video menu.

In both cases a straight-forward navigation tree can facilitate the Patient experience and prevent inefficiency in the call distribution process; for some specific scenarios the direct queuing of the incoming call is the best option, as it allows to minimize the waiting time (e.g. for Emergency numbers). The Service Provider can rely on both static slides or video clips while implementing the IVVR, depending on the amount and type of information that he needs to provide to the Patients.

How are Operators engaged?

Service Providers will need to run a video call center solution able to provide live assistance through Operators and Physicians.

The dispatching of calls to Operators is the critical point of a successful deployment, since inaccurate implementations could lead to unbalanced queuing of incoming requests and cause long delays. Consequently, the interactive video platform must provide the following features:

- Comprehensive interactive menu for the navigation of media contents
- Advanced Call Routing functionalities
- Skill-based call distribution
- QoS-based dispatching and prioritization algorithms
- Intuitive Operator interface for the management of video session (including common features such as hold, transfer, requeue, etc)
- Easy integration with external CRM/OSS

Which is the big expectation that can't be missed?

Needless to say, the audio and video quality is the real differentiator from a User perspective: the effectiveness of Telehealth strictly requires a hassle-free communication between Patients and Operators/Phisicians. Therefore, the

following points have to be taken into account while engineering a Telehealth service:

- Asymmetric bandwidth, commonly available on residential DSL access, is a major issue for the quality of the video received by the Operators (due to the limited upstream)
- Crystal-clear audio and video make the Patients comfortable with the service
- Resiliency against bandwidth drops and packet loss is a must-have feature
- Automatic adaptation of the video resolution to the actual network conditions is an effective way to deal with mismatch of negotiated capabilities/bandwidth.

How to simplify the connectivity?

Telehealth services have to be accessible from a variety of Users, including those not familiar with networking and video conferencing devices. This fundamental requirement implies that, regardless of the adopted video endpoints (hardware or software), a configuration wizard and simplified procedures will take care of guiding the User through the following tasks:

- Registration /Authentication process (simple login by username and password)
- NAT/Firewall traversal automatic configuration
- Intuitive setup of audio/video peripheral (microphone, speakers and webcam) with interactive feedback upon any change of settings.

How can the service be enhanced?

Starting from a standard implementation of the video contact center, a substantial enhancement of the service can be achieved through the integration with external databases; the access to additional information (by means of WebService and APIs) allows to take advantage of Users' profiles and preferences, customizing the entire call flow according to the retrieved data.

The integration is beneficial for both the Patients and the Operators, since the Operator interface automatically retrieves and displays a set of information, such as Personal Data and Case History, and avoids the burden of frequently asked questions and possible misunderstandings.

Moreover, the Users' preferences can be included in the call routing/distribution process, for a faster and efficient selection of the best queue/Operator combination.

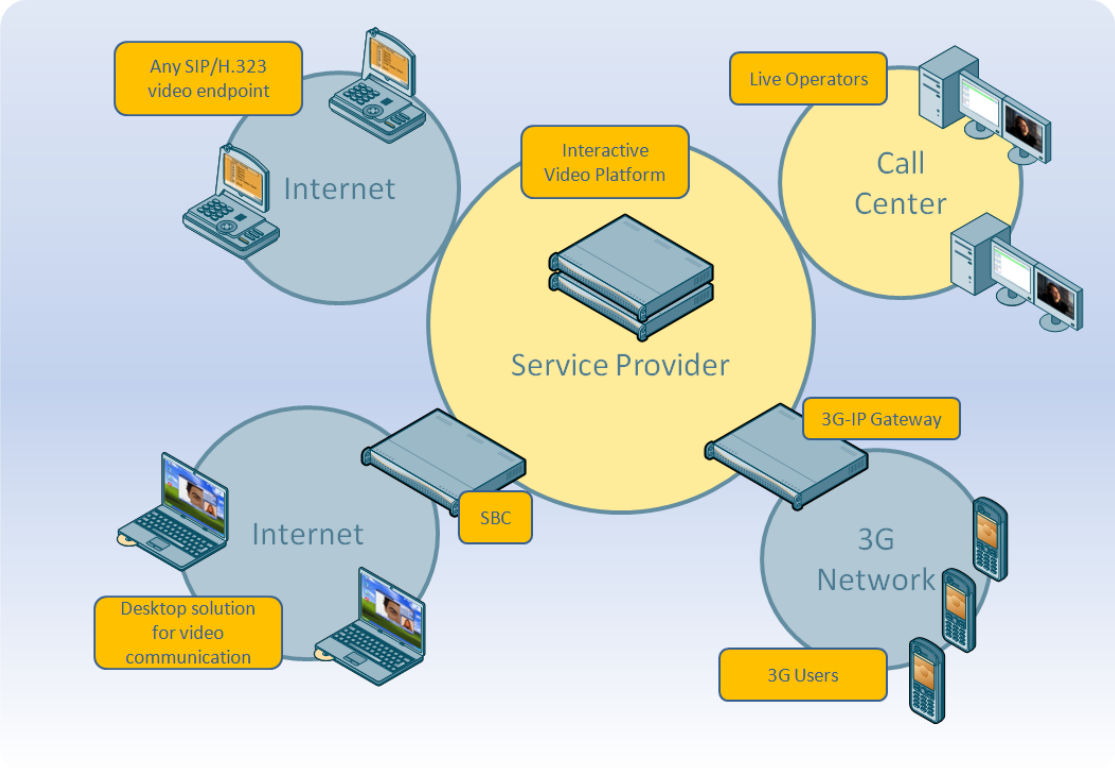
Step 2 – Architecture description

This paragraph describes the actual building-blocks for the proposed architecture.

Interactive Video Platform

The Interactive Video Platform is the core of a Telehealth architecture and aims to provide the following functionalities:

- **Media Streaming Engine:** since the main goal of the Service is to grant the access to any video terminal compliant with standard telecommunication protocols, SIP and H.323 have to be supported along with the standard audio and video codecs commonly used in the videoconferencing space. Further to interoperability, the video platform is meant to serve both the Call Center Operators (either in the local network or from remote premises) and the Patients from home: in terms of network deployment, the platform must expose its interfaces to both the public and local IP networks.
- **Service Logic Application:** the Application level of the Service is the brain of the solution and has two fundamental



components: the embedded standard features and the integration with external application servers.

For what concerns the embedded standard features, the Application must enable the traditional features of a call center and provide a comprehensive interface in order to shorten the preliminary training sessions for the Administrator and the Call Center Operators as much as possible; web-based solutions are a viable option with the additional advantage of no required installation processes.

The integration with external servers (CRM, OSS, centralized databases, etc..) introduces a remarkable enhancement of the Service Logic since the flow can be customized according to specific requirements. Web Services and/or HTTP APIs address these needs, allowing the Service Provider to take advantage of the existing platform and avoid a complete replacement of Users' database. Depending on the network topology, a reverse-proxy between the Interactive platform and the external servers might be recommended for security issues.

Desktop Solution for Visual Communication

Provided that any video terminal should be able to access the Telehealth platform, additional solutions can be considered as well in order to facilitate the access and attract new customers.

Following the increasing demand for PC/MAC-based desktop video communication, the distribution of a Softphone to the End Users could be an effective way to spread the usage of Telehealth services, as the Softphone interface can be customized according to the actual needs of Patients. Amongst the main functionalities requested to a Softphone-based solution, we could cite:

- Custom interface, optimized for the Telehealth service
- NAT and firewall traversal handling (through Session Border Controller server)
- Authentication and authorization process

- Automated provisioning of main configuration parameters and remote feeding of the contact list with emergency numbers
- User Profiles management on a group basis, according to the actual usage of the service

The same desktop client can be offered to Operators and Physicians (in conjunction with the above mentioned web interface), allowing them to access the service from heterogeneous networks.

A further extension in the service access could be represented by 3G mobile devices, such as circuit-switched, video-enabled handsets or PDA/Smartphone devices supporting video communication over 3G/4G data networks.

Step 3 – Implementation

This paragraph describes an implementation of the proposed architecture based on some of the Mirial products.

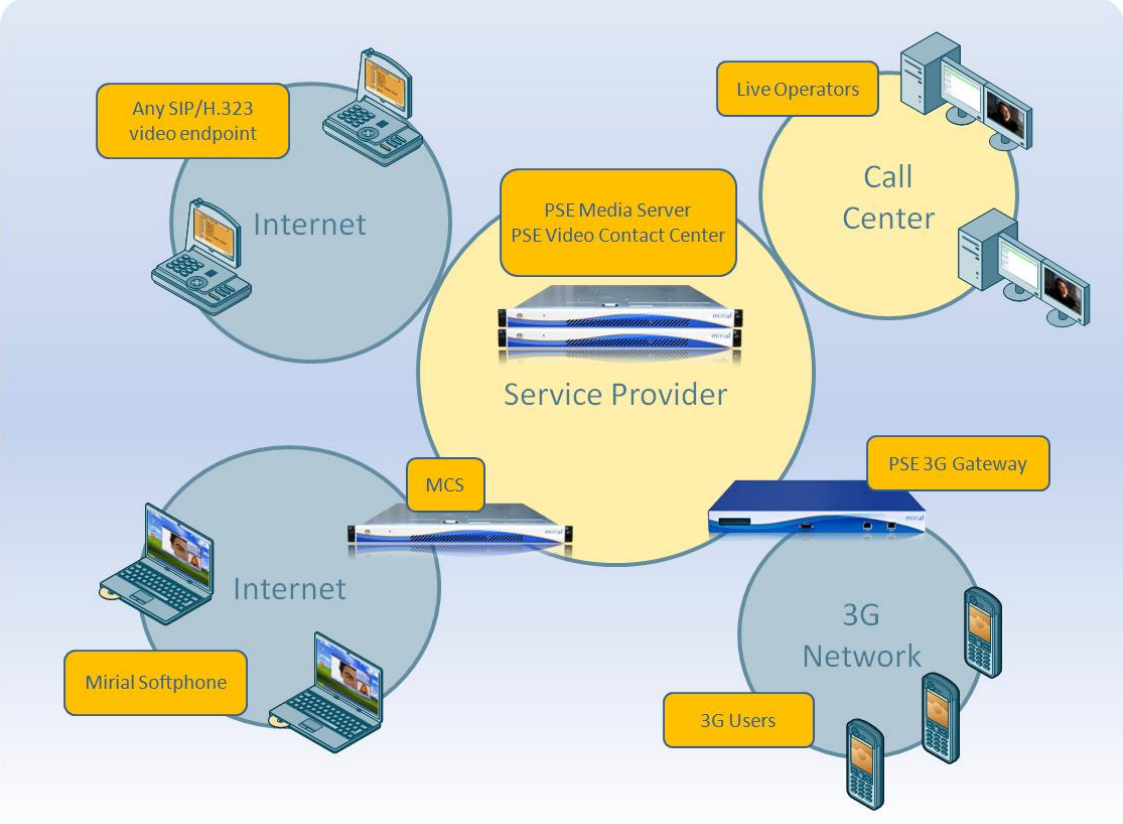
Mirial PSE Video Contact Center

PSE Video Contact Center is an application server capable of handling the complex service business logic, allowing to easily deploy a brand new voice-and-video enabled contact center.

The AJAX-based web interfaces makes the service creation and management intuitive; in the same way, the web-based Operator interface enables a ready-to-go service fruition.

The overall User experience is improved through the following features:

- Full support of both audio-only and audio/video scenarios
- Fully-customizable IVVR, including "self-



help" video contents

- Enhanced call routing policies through skill-based distribution
- Prioritization of queues and emergency calls according to configurable QoS thresholds
- Call management capabilities allowing Operators to hold, re-queue and transfer the calls.

Mirial PSE Media Server

PSE Media Server is a powerful media engine that handles both the signaling and streaming levels of IP-based interactive platforms.

The compliancy with all major visual communication standards guarantees great interoperability with any SIP and H.323 video endpoint; common audio and video codecs are supported as well.

The interaction with Application Servers is based on VXML, allowing easy integration with both pre-packaged applications (such as the PSE Video Contact Center) and custom VXML scripts.

The video quality is impressive since the Media Server supports H.264 video calls, with resolutions up to HD 720p and a maximum bitrate of 2048kbps.

PSE Media Server offers carrier-grade performances with a flexible (horizontal and vertical) scalability model, starting from the 10 concurrent video calls for the entry-level unit up to thousands of sessions supported by clustered, geographically distributed and fault-tolerant architectures.

Mirial Softphone and MCS

Mirial Softphone is the most advanced software-only client for real time desktop communication, specifically designed to be deployed by service providers in order to offer Audio and Video services over public networks.

Mirial Softphone is available for both PC and MAC, it supports both audio and video conversations at bitrates ranging from 20kbps to 2048kbps and is compatible and field-proven with almost every audio/video terminal supporting H.323 and/or SIP.

MCS is a network element targeted to VVoIP Service Providers, specifically designed to manage and control wide installations of Mirial Softphone; the deployment of Mirial Softphone Softphone along with MCS enables:

- Automated provisioning and distribution of Mirial Softphone, single click installation (no configuration required by the End User)
- High quality wideband audio and true high definition video, up to 30fps and FULL-HD 1080p resolution
- SIP Proxy/Registrar with Advanced Call Routing capabilities
- Firewall/NAT traversal and automatic network discovery
- Branding option for the customization of the Mirial Softphone GUI

PSE 3G Gateway

PSE 3G Gateway act as a bridge between circuit-switched and IP-based networks, extending the interactive video services to 3G mobile handsets compliant with H.324m/3GPP-324m.

Glossary

Operators: First-level contacts in a call center, they can be either assistants in charge of forwarding to a right contact or specialized Operators able to provide assistance to Patients.

Physicians: Specialists contacted by Operators or reached through dedicated phone numbers/queues.

Users/Patients: people connected to the Call Center through a video call in order to receive remote assistance.

IVVR: video menu based on a navigation tree; it can be browsed to select options, access media contents or get connected to an Operator/Physician using DTMF keys

Softphone: a software application for personal computers that can be used in order to place/receive audio and video calls.

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