A PROPOSED UNIFIED COMMUNICATIONS PLATFORM BASED ON OPEN SOURCE TECHNOLOGIES

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ABSTRACT: Unified Communications (UC) have the potential to dramatically simplify and improve enterprise communications, reducing costs and improving revenue opportunities. This paper proposes an architecture of three layers for a UC solution based on open source technologies and open standards. The Infrastructure layer is responsible for the physical IP infrastructure network, the Server Hardware and Operating System layer includes the back-end operating system and server services that can be used by the UC platform and the Business Applications layer integrates the UC with other external applications. Finally, the paper presents the major benefits of UC solutions, giving a special emphasis to the benefits derived for the use of a standards-based IP communications.

Keywords: Unified communications, system architecture, open standards, open source

INTRODUCTION

What is a Unified Communications solution?

Today's traditional business communications tools are inadequate for surviving in this new era of specialization, context and speed. The solution is Unified Communications (UC). UC can be seen as a new business model that enables companies to raise to the next level through a simplified and streamlined, network-based platform for communications [1].

The concept of UC solutions appeared in the IT world in the past few years. By integrating real-time and non-real time communications with business processes, while presenting a consistent unified user interface and experience across multiple devices and media types, UC provides productivity improvements to individuals, workgroups, and companies. It's important to recognize that UC is not a single product, but it is a composite of various components, including messaging (email, IM, voice, video), calling (audio, video), conferencing (audio, Web, video), presence, and mobility. These elements are all tied in together with the user's desktop and/or device of choice, providing a consistent user experience.

Reasons for the need of Unified Communications

Today's business leaders understand they must respond rapidly to changing development to meet customer demands and improve profitability. Business communications have become more complex, and despite investments in technology, such as instant messaging and mobile devices, companies still have difficulties contacting key decision-makers in a timely manner. To maintain a competitive edge and grow profitability, companies need to respond more quickly to their employees and customers and must avoid communication obstructions.

For many organizations there are now more employees who work away from the headquarters than those who are stationary. This increases the difficulty in reaching others when needed, which causes work delays during times of critical decisions. Companies are often unaware of the high cost to their business caused by delayed communications that are considered a normal part of the workday. According to a recent Forrester survey of IT decision-makers, more than 50% of the companies' acknowledge workers experience project delays on a weekly basis due to the inability to reach key decision-makers [2]. An additional 63% of IT decision-makers indicated that these delays caused work to slowdown, which obviously impacts time to market [2]. Even more significant is that the project actually comes to a complete halt, as reported by 25% of survey respondents, when work teams wait to receive necessary approvals.

The Unified Communications approach comes to bring some answers to these open issues and represents a new paradigm for employee communications. A fully integrated UC approach can synergize multiple communication gains and harmonize the entire process of collaboration for decision speed and real-time results.

PROPOSED ARCHITECTURE

We propose an architecture based on three layers like it is presented in Figure 1.

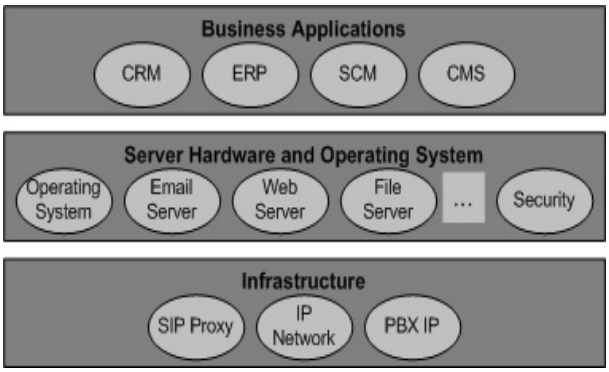

Fig. 1. Proposed architecture for UC [1] [3]

The proposed architecture is original and it is based in the unified communications building blocks model proposed by Allan Bly from Vitel Consulting and in the CISCO Unified Communications Manager (CUCM) architecture.

It is composed by the following layers:

- Infrastructure – a physical IP infrastructure network that supports both real-time and non-real time traffic. The main function of this building block is to allow voice communications using IP telephony platforms, wired/wireless clients and video conferencing;
- Server Hardware and Operating System – a server computer system that has been chosen for running a specific server application. Server applications contain several services that support IP communications. Server applications are designated to run on specific operating system such as Windows NT, Solaris or Linux;
- Business Applications – a package of applications that support an organization's business processes. The core idea is to integrate communications capabilities into software-enabled business processes, by providing applications with the ability to initiate real-time communications.

Infrastructure

The infrastructure of a UC solution shall be responsible for the routing of IP packages, contain a range of IP telephony services such as VoIP gateway, PBX IP and SIP Proxy, and allow real-time communications based in Instant Messaging. At the same time, it is important to provide a QoS manager engine to give high priority to voice traffic and monitor the IP traffic.

There are many protocols used for Voice over IP (VoIP) conversations. The most widespread is Session Initiation Protocol (SIP). This is a signalling protocol, which it only handles call setup and termination. Actual session setup between endpoints is handled by Session Description Protocol (SDP), and data is transmitted by Real Time Protocol (RTP) [4]. There are other major VoIP protocols like H.323 and Inter-Asterisk Exchange (IAX), which was proposed by Asterisk' authors.

There are important common elements among the predominant open source IP telephony models. Basic telephone service, voicemail, and an array of traditional telephone features and telephone instruments are universally supported [5]. Furthermore, open source IP PBXs predominantly use Linux as the operating system. The standardization on SIP and Linux is logical within the context of open source, since both, the SIP protocol and the Linux operating system, are open standards.

In our architecture, we chose to use an implementation of OpenSER as SIP server and sipXecs as IP PBX. It's important to refer that the OpenSER project was forked in Kamailio and OpenSips in the end of 2008. The OpenSIPS keeps the major developers for most critical parts of OpenSER (like core, presence, dialog and media proxy). For this reason, it is preferred to use OpenSIPS as a replacement of OpenSER.

OpenSER is a mature and flexible open source SIP server. It can be used on systems within limited resources as well as on carriers grade servers, scaling to up to thousands call setups per second. It is written in pure C for Unix/Linux-like systems with architecture specific optimizations to offer high performance. The most important features of OpenSER include: support for IPv4 and IPv6 protocols, Network Address Translation (NAT) transversal support, least cost routing algorithm, Telephone Number Mapping (ENUM) and a plug&play module interface, which turns possible to add new extensions, without touching the core and assuring a great stability of core components [6].

Two of the previous listed features deserve a special attention. The Least Cost Route (LCR) algorithm delivers calls according to the lowest cost carrier. The routing system will always try to pass the call through the cheapest of the available configured routes, but in case the connection couldn't be established it will try to use the next alternative route [7]. The ENUM is a protocol that uses the Internet Domain Name System (DNS) system to translate traditional telephone numbers into IP addressing schemes.

sipXecs is an open source software implementation of a SIP based communications system (IP PBX). Similar to a traditional private branch exchange (PBX), it allows a number of attached telephones to make calls to one another, and to connect to other telephone services including the PSTN and SIP Trunking services. sipXecs offers full load-sharing redundancy for the call control system avoiding calls to be interrupted, and it is designed to integrate into an advanced IT environment including Web Services based on SOAP for all configuration. The most important features of sipXecs include: voicemail, auto attendant, flexible configuration of call forwarding, personal call history and a web-based system administrative interface [8].

Server Hardware and Operating System

The Server Hardware and Operating System layer is responsible to offer a package of services that can be used in a UC communications scenario. These services typically include: email server, web servers, file servers, domain servers, printer servers, database servers and communications security. Besides that, these server applications are designed to run on a specific operating system. We proposed to use the Linux system in this architecture.

The use of Linux will increase the interoperability with other vendors' equipment and will allow the users to add new services and applications over the UC solution. The use of open standards will break down the capabilities within the enterprise applications into modular, self-contained components that can communicate with each other and with business applications through a well-defined interface and will definitely extend the life of the UC infrastructure. Besides that, the total costs of Linux are significantly lower compared to the costs of proprietary operating system [9].

The email server is responsible to deal with the virtual messages exchange between users. The most common protocols such as SMTP, IMAP and POP shall be supported. Besides that, the email server shall be integrated with the fax machine. When receiving a new fax message, the UC must identify a fax message, out of the messages stored on the user's mailbox. When sending a fax message, the UC uses SMTP to send messages (email, voice or fax) to the email server or to a fax server connected to the email server.

The Web server is responsible to establish and manage the connections to the Internet. It must accept HTTP and HTTPS connections from web browsers and deliver web pages and other files to other Internet hosts. At the same, it is essential to establish a communication security policy. Typically, it is recommended to have a firewall, Intrusion Detection Systems (IDS), an anti-virus for email and proxy, and an anti-spam system.

The file server is responsible for the central storage and management of data files, allowing other computers on the same network to access them. The domain server is responsible for the translation of domain names into IP addresses and the LDAP protocol should be used to allow clients on multiple platforms to access centralized directory services. The printer server is responsible for the management of printers and printer requests from other nodes, allowing printers to be shared by multiple hosts running multiple network protocols. Finally, the database server provides a central data repository that can be used by the other servers.

The Table 1 presents our suggestions of applications that can be used to provide the previously identified services.

Server	Tool(s)
Email server	Qmail, Sendmail, SquirrelMail
Web server	Apache
File server	ProFTPD, MySecureShell
Domain server	Bind, PowerDNS
Printer server	CUPS, PDQ
Database server	Mysql, Postgresql
Communications security	ClamAV, BitDefender, Fiaf

Table 1. OS servers' applications for LINUX OS

Business Applications

The core idea of this layer is to integrate communications capabilities into software-enabled business processes, by providing applications with the ability to initiate real-time communications. The notion is that by combining integrated communications functionality with the insights that can be gained through the use of enterprise software, organizations will gain the ability to have their systems "sense events, manage communications and track activity to closure" [3]. Within the business world, this is perhaps the most promising aspect of the technological convergence. Enabling workers to access such powerful data applications anytime and anywhere can dramatically increase their off-site productivity.

The UC platform shall be integrated with applications such as Customer Relationship Management (CRM), Enterprise Resource Management (ERP), Supply Chain Management

(SCM) and Content Management Systems (CMS). Attending to our proposed architecture based in open source technologies running in Linux OS system, we suggest the use of SugarCRM as CRM system, Sequoia ERP as ERP and SCM system, and Joomla as CMS system.

MAJOR BENEFITS

In generic terms, UC offers several benefits that can be seen in Table 2.

Major benefits of UC solutions	
Simpler collaboration and improved productivity	Cost savings
Effective management of remote workers	Real-time response
Speed to market	Driving competitiveness

Table 2. Major benefits of UC solutions [10]

While it is undeniable that UC solutions can lead to significant cost savings, their ability to add value to a range of business processes and facilitate more effective collaborative working is just as important. By providing an integrated portfolio of capabilities and services, UC enable organizations to increase business agility and leverage increasingly dynamic and flexible working practices [10].

The proposed architecture based on open standards will also bring important benefits. Support of open industry standards increases the degree of architecture design flexibility and third party interoperability. It reduces dependence on proprietary hardware/software elements and can significantly contribute to minimizing design, engineering, and manufacturing costs [11]. In fact, the successful implementation of UC solutions depends on the interoperability of several subsystems from one or more manufacturers, such as the core communications system, voice processing, contact center, and desktop/mobile computing software programs.

From a customer perspective, a standards-based IP communications system can help to optimize investment protection and to prolong useful operating life. Systems based on open industry standards are also lower risk investments, because there are more equipment options available from a greater number of sources to growth and expansion. A greater degree of customization is possible, because system elements can be “mixed and matched” at more affordable prices than with a proprietary system [11].

CONCLUSIONS AND FUTURE WORK

Unified Communications solutions represent a new paradigm for employee communications and will have a significant role to play in equipping organizations for the challenges of today’s and the future’s global marketplace. The use of UC solutions in the enterprise sector simplifies the communication and collaboration among employees, improves the business agility, minimizes wasted time and alleviates the increasing IT infrastructure burden created by multiple message versions.

The proposed architecture for a UC solution based on open source technologies and open standards will provide enterprises with a UC platform with lower costs of ownership, faster time to deploy new solutions and greater flexibility. At the same time, it will also enable greater mobility and functionality for end users.

As future work, it would be interesting to extend the proposed architecture to integrate Web 2.0 applications. The combination of Web 2.0 and unified communications enables currently the use of social software in business contexts, what is currently referred as Enterprise 2.0.

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