PII

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Study on incorporation of alternative control architectures in testbed federations

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Executive summary

In an IMS environment, many functional instances are involved in the proper setup of voice and multimedia calls, such as border elements, service trigger points, media and transcoding servers, application servers, gateways, databases.

P2P networks introduces a new paradigm of self-organizing co-equal nodes as well as related new technologies, which have proven their potential to enhance the operational cost of such systems. The expected outcome of this study includes simplification aspects of the complex call-control layer infrastructure of IMS, e.g. by evaluating more lightweight and cost-efficient alternative P2P architectures, thus providing a high level of scalability and robustness.

This study is executed in cooperation with VITAL++. We present a scenario of provisioning Vital++ through Panlab's mechanisms, in order to exploit p2p and distributed paradigms into IMS-based architectures.

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Abbreviations

DMZ	Demilitarized Zone
HSS	Home Subscriber Server (IMS component)
IGW	Interconnection Gateway
IMS	Internet Protocol Multimedia Subsystem
IP	Internet Protocol
IPTV	Internet Protocol Television
ISC	IMS Service Control
MRF	Multimedia Resource Function (IMS component)
NAT	Network Address Translation
NGN	Next Generation Network
NGOSS	New Generation Operations Systems and Software
NMTP	Negotiable Mail Transfer Protocol
PII	Pan-European laboratory Infrastructure Implementation II (2nd phase of
PTM	Panlab Testbed Manager
QoS	Quality of Service
RMON	Remote Monitoring
RA	Resource Adapter
S-CSCF	Serving Call Session Control Function
SID	Shared Information & Data (model)
SIP	Session Initiation Protocol
SLA	Services Layer Agreement
SNMP	Simple Network Management Protocol
SOAP	Simple Object Access Protocol
SSA	Specific Support Action (EU FP6 project instrument)
SSH	Secure Shell
SSL	Secure Sockets Layer
TLS	Transport Layer Security
UC	Use Case
UI	User Interface
UML	Unified Modelling Language
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
VCT	Virtual Customer Testbed
XML	Extensible Markup Language

Glossary

User	The term user is referring to a person that is actively using or testing services provided by a customer's resource inside the testbed federation. Differentiation between End-User and Test-User may only be useful when directly referring to the special task of active service testing or the usual task of common service usage.
User Driven Innovation	Inclusion of the user as part of the testing process in order to take into account early feedback. In this project two levels of User Driven Innovation (UDI) will be applied. • The first level refers to the customer (the organisations and companies that use the federation to test their products and services). • The second level refers to the potential end-users of the services. To generally differentiate between these two groups in this document, we will refer to the first as federation-customers, service-testers or service-providers and the second we will refer to as end-user.
Provider	This term refers to a party owning testbed infrastructure and has entered an agreement allowing a customer to use its testing infrastructure and resources to develop and test services.
Testbed	A testbed is an environment which allows experimentation and verification for research and development products. A testbed provides rigorous, transparent and replicable testing and herein it is always used in the context of new information and (tele-) communications technologies for networks and services.
Testbed federation	A testbed federation or federated testbeds is the interconnection of two or more independent testbeds for the creation of a richer environment for testing and experimentation, and for the increased multilateral benefit of the users of the individual independent testbeds.
Customer	A customer of Panlab is someone that used TEAGLE to set up testbed resources for the purpose of testing or developing services. The customer is able to directly connect to the rented resources (his VCT) using a VPN client (U3 interface). The customer can offer his services under the terms of Panlab user domain access (U2 interface) to external Test-/End- Users
Testing session	Herein the term testing session refers to a well-defined temporal and spatial relation of testing infrastructures and testing resources by the customer or user(s).
TEAGLE	TEAGLE is the central Pan-European Laboratory search and composition engine. It provides a web-based customer interface for browsing the Panlab federation offerings and the instantiation of a VCT.
VCT	A Virtual customer Testbed is the sum of all resources, including interconnections, rented by the customer. It basically is an isolated network in that the customer is able to "dial in" and directly access the items assembled in TEAGLE. Each customer operates inside it´s own VCT and has no access to other VCTs. The purpose of direct VCT access is to configure and develop but not to widely test new services; such testing is intended to be done from outside using external Test- and/or End-Users.

1 Introduction

IMS is the interoperable SIP-oriented call control and service platform favoured by large telecom vendors and operators. IMS offers the architecture nucleus for the convergence of fixed and mobile operator networks. It is mainly characterised in that all applications are consequently realised on IP. Today these are mainly voice and video communication services, in future also TV, gaming and many more. In the standardisation at 3GPP and TISPAN, where in the meantime all telecom operators and vendors are involved, IMS is burdened by a large and slow standardisation effort in 3GPP2 and ETSI TISPAN to integrate some access awareness (DSL, 3G, 4G like Wi-MAX, etc.), network QoS and session border functionality. This is becoming even more difficult against the different backgrounds of FMC and is expected to result in a heavy-weight call control layer infrastructure.

At the same time, lowest-cost VoIP infrastructures on SIP basis are emerging: A large variety of small and large, incumbent and alternative operators currently offer solutions for VoIP infrastructures for internet customers, mainly based on free SIP implementations. These Internet VoIP Technologies (Pre-/Non-IMS) solutions are divided into two domains: VoIP installations based on plain SIP proxies, and proprietary (and closed) VoIP system like Skype or Google. The problems faced by these operators for public services offerings are multifaceted: The non-carrier-grade, often home-made SIP solutions are not reliable and secure enough to offer first-line services at global scale, while at the same time keeping the growth cost under control. On the other hand, today's highly scalable P2P oriented approaches rely on proprietary protocols with issues regarding complex interoperability, lower innovation cycle and inherent architecture weaknesses like distributed user data bases. Over the last five years, P2P has become one of the most popular user applications on the Internet and is acknowledged as one of the key drivers for consumer broadband uptake.

The SIP community recognizes this trend and sees an opportunity to counter proprietary Skype at their weak points, in particular the use of completely closed architectures and protocols. Consequently, the members of the SIP oriented working group of are currently driving the so-called P2PSIP initiative to standardise an open P2P-like network architecture P2P-like architecture and protocols. The worldwide telecommunication industry (Ericsson, Siemens/Nokia, Alcatel-Lucent, Motorola, Cisco, Avaya, TI, etc.) is actively involved in the IETF P2PSIP standardization.

2 IMS as a starting point

The Internet Protocol (IP) Multimedia Subsystem (IMS) is an open and standardized functional architecture designed to fullfill the requirements of telecommunication Service Providers and the customers in times where fixed and mobile networks converge towards an all IP next generation network[5]. It is designed and standardized by the 3rd Generation Partnership Programm (3GPP) [6] for wireless networks, and further adopted by Telco and Cable Operators for their fixed networks in the Telecoms & Internet converged Services & Protocols for Advanced Networks (TISPAN) [7], a standardization body of the European Telecommunications Standards Institute (ETSI)[8]. The end-to-end signaling of multimedia sessions in IMS is based on the Session Initiation Protocol (SIP) which has been originally defined in IETF[9].

Along Figure 1, we summarize in short the major functionalities, technical requirements and business factors leading to the IMS architecture:

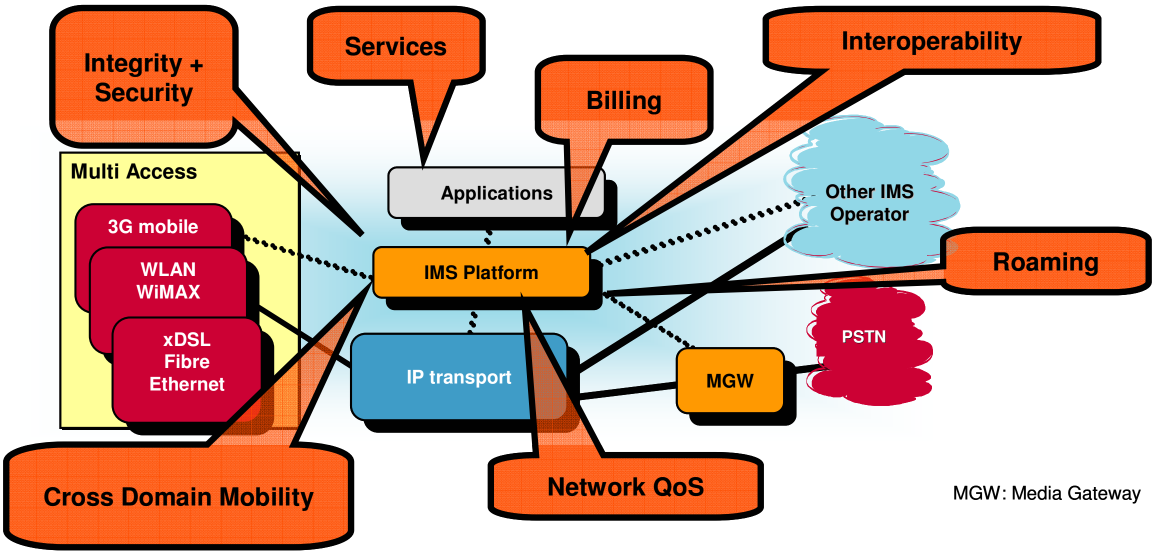

Figure 1: Major IMS functionalities Technical Requirements and Business Factors

- The *convergence to Internet technology of multiple fixed and mobile access networks* for voice and data services leads to a system that is based on *all IP*. Every device that has IP connectivity is able to access the IMS, it is thus access independent. Users of traditional networks are accustomed to a bundle of services that IMS realizes in the packet-switched domain by offering IP based multimedia session establishment, such as voice, video or messaging. In addition users can integrate further services such as content sharing or presence and add or drop services on their behalf (Note that this is not implemented by Service Prividers which deploy and manage a close IMS infrastrcure).
- The IMS preserves from the classical wired and wireless telephony world the *multi-domain concept* with different interconnected Operator networks. Based on the all-IP infrastructure, the IMS offers *roaming* of calls and services between home and visited networks of different Service Providers. Users of IMS always have full access to their subscribed services and their defined settings in both, a home and a visited network. Also *cross domain mobility* is provided for sessions and services.
- A further design goal of IMS is to control the end-to-end *network layer Quality of Service (QoS)* for multimedia sessions with real-time constraints. The end devices and the traversed networks are able to define the demand of resources for different media types which are reserved in the access and core networks in a vertical way, i.e. the bandwidth and delay requirements are derived from passing signaling messages and enforced in the transport network. Interconnection Agreements between different IMS Operators allow the provisioning of end-to-end QoS across IP network borders.

- While preserving the classical telephony Intelligent Network (IN) applications, the flexible deployment and orchestration of new *services and applications* beyond voice is a main goal of IMS. Standardized and open enablers offer the possibility to implement innovative services and applications in the network [10] with a very high innovation cycle, similar to the so called over-the-top Service Providers like Google. To compete with these global actors the IMS service framework brings Operators into the position to integrate new services, across all access network technologies, and independent from the location and the domain the user device is registered. This is supported by the home subscriber database that comprises all subscriber and service related data, such as user identities, registration information, access parameters and service-triggering information.
- To be able to connect as many people as possible on a global scale, IMS provides standardized *interoperability* with foreign IMS domains and other networks. IMS users can also establish connections to users of traditional fixed and mobile voice networks, and with the help of appropriate gateways also to Internet users with proprietary multimedia applications.
- *Secure communication* between the user devices and the IMS servers is a further central feature and is provided by the respective authentication and authorization mechanisms [9]. Integrity and confidentiality of the signalling messages are provided.
- IMS allows Operators to run different and *flexible billing models*. For example the involved parties can be charged per minute, per volume, per usage or with flat schemes. As the called party might modify the transported media of the session, IMS supports also to charge the called party respectively.

IMS is focused on services and applications, making possible to offer multimedia services across both, next-generation packet-switched and legacy networks as the circuit-switched network. One huge benefit is that IMS is standards-based and uses open interfaces and functional components that can be assembled flexibly into hardware and software systems to support real-time interactive services and applications and it will have a major impact on the telecom industry – including Telcos, Mobile Operators, Service Providers, Vendors, and others. This impact results from new business models and opportunities and cost reducing due to standards-based procurement. At the same time, it will allow that network owners obtain added value from their networks, through the development and offer of enhanced and tailored services. In short, IMS will improve service control (call control, bandwidth control across the core, charging, etc), will allow independence of end-services accesses and the support of advanced services and will (hopefully) lower the costs.

Despite the plethora of claimed advantages of IMS, several hurdles and drawbacks have been identified regarding IMS-based architecture. One the major technical issue is the assumption that Service Provider should control also the IP underlying infrastructure (even if this is not explicitly mentioned in the specifications) in order to offer QoS-enabled service offerings. Beside the emergence of IMS/TISPAN architectures, other promising techniques have been disseminated within IP community. These new emerging techniques claim to be autonomic and dynamic. We believe that viable and concrete solutions inspired from these techniques are “implementable” within traditional Telcos domains in order to build survival networks and service offerings. For backward compatibility reasons, and since some Service Providers have already launched the renewal of their PSTN (Public Switched Telephone Network) based in IMS, we adopt an incremental approach and consider IMS/TISPAN as the starting point for the exploitation scenarios. Enhancements and new proposals are based on IMS/TISPAN functional model.

3 Challenges and New Opportunities

3.1 Non IMS architectures

Service Providers are mainly focused on the delivery of profitable IP services and not on the underlined technology used, Many IP based Service Providers are using non IMS solutions, fearing IMS complexity, feasibility, and manageability. These operators are either not convinced about IMS benefits or just waiting until there is sufficient longer-term experience available before they full implement IMS. Some operators are slowly and incrementally migrating to IMS and one fact is that almost all existent Telco's architectures have some elements of the system already in place but are not fully IMS.

Many peer-to-peer applications are non real-time, not SIP-based, and, for the most part, not yet being merged in single sessions with other applications. It is clear that IMS will provide QoS but it is worth to note that Skype, for instance, is a heavily used P2P application and it is not built upon the IMS architecture, nor uses SIP. Skype does not have the NAT/firewall obstacles that SIP does, and Skype customers don't really care if they have a not so good quality as long as they are able to have global connectivity at reasonable prices.

Moreover, according to [2], "…most of the service innovation today is happening in the data-network space, social networking and Web 2.0 and very few, if any, of these services require IMS capabilities, and most of them can be delivered on existing broadband, wireline and wireless infrastructures... ". This may further delay the need to deploy NGN infrastructures just to deliver new services".

An architecture that must be considered is the Internet itself, and P2P technologies offer scalability and redundancy advantages over the Internet since the Internet is based on a peer-to-peer model. P2P systems inherently have high scalability, robustness and fault tolerance because there is no centralized server and the network self-organizes itself. This is achieved at the cost of higher latency for locating the resources of interest in the P2P overlay network, but again there are also work being done that is focused in finding forms of file retrieving from the nearest node to minimize client latency and network load. An example of a platform that is capable of handling in a geographical distributed manner millions of subscribers with close to zero operational cost is the SIP Thor platform [3]. SIP Thor is based on P2P-SIP technology that enables scalability with no single point of failure, providing a cost effective alternative to the classic IMS design by eliminating its complexity while enabling IP communication services, like voice and video, fixed-mobile convergence, IM and Presence supported by today and tomorrow's end-user SIP devices.

Due to the difficulty of performing data tracking management, the adoption of P2P concepts promises a simpler and more flexible network infrastructure. Operators may directly go for a P2P solution avoiding the costs of a full IMS network, saving money in both deployment and operations.

3.2 P2P provisioning

What is expectable is a higher degree of processes automation, capable of combining self-provisioning and flexibility for new services provisioning (through the mapping of service requirements on any possible network resource). Automation of processes is a key issue concerning OSS and is been gradually implemented in almost all operators enabling them to increase flexibility and agility. Once the service is provisioned, all the factors related with quality begin to be processed to take care of any degradation that could occur both at network (network operators) and at service (service provider/user) level through the usage of assurance procedures.

OSS/BSS has known a significant development with the provision of broadband services to customers and is still experiencing a tremendous evolution with the offer of new and innovative services and also in the area of distributed services provisioning. P2P provision comprises the resource provisioning and allocation to P2P service. These processes encompass the configuration of resources and logical resource provisioning for individual customer instances. The major activity involved is assigning resources (i.e. circuits) to customers to provide the P2P services. The goal behind this is to build self managing and dynamic systems able to take advantage of user and service provider resources available at a particular instant to offer cheaper services as P2P technology brings new business opportunities through extending the service portfolio to user provided services and to ubiquitous environments.

Regarding future networks, a major industry initiative with active participation from many TM Forum members, is the NGN-M Team that is developing the management capabilities which are needed to be put in place, to manage future IP based networks with QoS guarantee. This team provides a focal point for developing the strategy and policy recommendations required for TM Forum NGN Management standardization [4].

NGN management process priority has a focus on product lifecycle management and some of the challenges for the migration of actual OSS to NGNs management are the OSS to support real time provisioning and activation, the business intelligence system, the increased automation and the decrease of integration cost.

There is also being done an increasing research on Autonomic Network Management (ANM) area, where the network has augmenting capabilities to detect, diagnose and correct failures or even prevent malfunctions through continuous quality monitoring, with self adaptation features optimising the performance and delivery of services.

It is usual that nodes in an overlay network maintain some small set of neighbours spread through the underlying network and use these neighbours to perform a set of tasks that could be forwarding decisions based on network performance gathered information. These nodes could also be efficiently used to endow the overlay network with capabilities that could be taken into account in the provisioning of the applications reducing the time to market, improving security or even in the improvement of proactive measures to control and manage the overall e2e quality.

In conclusion, the automation of some procedures, among them the provisioning ones, leading to a dynamic and intelligent network could be done by the overlay network nodes, providing available tools to improve the efficiency in the provisioning tasks while allow self-restructuring capabilities.

3.3 P2P-based techniques to deploy services offerings across heterogeneous domains

P2P-based techniques may be used so as an alternative means to emulate at the application layer capabilities which are not natively offered in the transport layer and therefore ensure a service presence in related regions. To illustrate this, let consider the example of IP TV Service Provider. Ideally, the availability of multicast capability is suitable for the delivery of such services. Nevertheless, multicast is not globally enabled and multicast holes can be crossed to reach a given destination. In order to solve this technical issue, a model based on the collaboration between native multicast domains and P2P should be investigated. P2P techniques would ensure service continuity when multicast holes are experienced. Another approach would be to benefit from multicast capability at the last mile, mainly at access segment. Doing so, quality of experience would be enhanced (mainly zapping delays).

As illustrated above, P2P techniques are suitable to be considered when the Service Provider has no control on the underlying infrastructure.

4 Potentials of P2P and distributed techniques

4.1 Introduction

This section aims to highlight the potentials of P2P and distributed networking in Service Providers' service infrastructure. It focuses only on schemes targeting to adapt P2P techniques within a centralized service platforms a la IMS. The value creation considerations in pure P2P-SIP realms are not detailed in this deliverable and are out of scope of this study.

4.2 Technical challenges

In order to ease the deployment of IP-based services and therefore to assist both Service Providers and IP Network Providers to deliver robust, reliable and QoS-able service offerings, several features must be supported by the underlying service (including connectivity) infrastructure. The features are considered as challenges to be met by IP transport networks. Introducing P2P and distributed means into operational networks is constrained by the ability of such techniques to implement those challenges.

Hereafter are provided a set of pertinent challenges which might be met by P2P-based architectures:

- Allow dynamic and autonomous behaviours instead of static/frozen one. This allows to adapt to the running environment and to minimize human intervention. Dynamic Service discovery is also a functionality that may be considered when deploying dynamic solutions. As far as service provisioning is concerned, dynamic provisioning means and zero provisioning solutions should be privileged;
- Implement scalable service offerings through “intelligent”/”suitable” load distribution;
- Avoid DoS (Denial of Service) and SPAM attacks since the service logic is distributed among several nodes. The impact of a DoS attack may not be critical as for a centralised service platform;
- Enable fast re-route, failure detection and failure repair: these functionalities are critical one to ensure highly available service offerings. Enhancing service reliability is also a valid challenge. Moreover, enhancing service robustness and prevent against crisis situations should be investigated: e.g. flash crowds, avalanche restart, etc;
- Allow fast convergence, stabile and with no oscillation phenomena;
- Reduce system complexity and advocate for lightweight solutions;
- Reduce CAPEX and OPEX;
- Enhance QoS;
- Ease management functions;
- Allow load balancing and load sharing;
- Ease crossing middleboxes (e.g. NAT traversal);
- Allow deterministic behaviours.

Of course, additional issues should be solved such as: (1) Based on what criteria two systems, one of the two is P2P-based, offering the same service should be compared. (2) How to quantify the level of complexity of a given solution. (3) Evaluate induced cost, mainly OPEX/CAPEX, of distributed and P2P systems and assess that P2P systems are actually low cost solutions. (4) Select the functions candidate to be distributed and what is the induced complexity. (5) Assess the ability of P2P system to meet legal requirement such as emergency and legal interception, etc.

In the remaining part of this document, we focus only on a subset of these challenges. Further investigation should be undertaken to assess the applicability of P2P to meet those challenges in operational networks.

4.3 A Service Provider requirement: Towards autonomic and deterministic networks

Evidently, Service Providers need to be convinced by the viability of the proposed P2P-based schemes through concrete and realistic proposals which integrate Service Providers specificity and requirements. Particularly, incremental approaches should be investigated and proposed to Service Providers mainly because of the weight of backward compatibility.

Concretely, in order to promote autonomic networking and computing techniques, particularly P2P and distributed ones, within Service Providers community and to introduce these promising and emerging techniques within operational networks, Service Providers requirements should be taken into account. Indeed, designers should integrate in the proposed architectures the need of Service Providers to control the behaviour of their deployed networks and built-on services. Service Providers should be able to assess the compliance of their offered/delivered services over the networks they are operating. They also need to check the level of quality of the services resulting from engineering operations, through measurements or other alternative means. P2P-based techniques should be designed in the context of end-to-end and cross-layer services.

The engineered networks must be compliant with the targets fixed by the service planning and design processes enforced by a given Service Provider. The behaviour of deployed networks and offered services should be known in advance by Service Providers and no “fuzzy” behaviours should be experienced. In order to introduce P2P and distributed techniques into real networks operated by Service Providers, operational constraints should be assessed. This requirement can be for instance implemented owing to elaborating torture tests and validation methodologies dedicated to a given P2P-based technique.

It is obvious that Service Providers need to go a step forward for enforcing service automation, dynamic provisioning and deterministic behaviours. This “ambition” is not motivated only by their need to reduce the OPEX but also for easing the service creation, service provisioning and maintenance, service troubleshooting, and also to reduce the TTM (Time To Market).

5 Exploitation scenario of P2P and distributed paradigms into IMS-based Architectures: the Vital++ Platform

5.1 Introduction

The federation of the Vital++ platform regards the process of preparing and installing the outcomes of the Vital++ (at least those that constitute the core of the platform) as testbed offerings. The term testbed in the previous sentence regards the operation of an aggregation of equipment and hardware/software resources under the principles and techniques defined in the context of the PII platform.

Vital++ has dealt with techniques for provisioning of multimedia content by combining IMS with P2P methodologies and concepts. The design of a migration frame for P2P services in NGN networks was driven by the concept of a gradual integration of the two different technologies in the context of the identification of an optimum point between the two planes. The process of such integration involved the replacement of certain functionality in the one plane with mechanisms provided by the operation of the other. The overall target was the enhancement of IMS controlled media related services by the power offered by P2P networks and techniques.

From the testbed point of view, Vital++ has produced a number of components that can be associated in certain ways that lead to the instantiation of an experimentation setup that allows evaluation of certain techniques for session control, media transfer, media generation and event media playback. The intention of the federation is to experiment with various instantiations of the platform components so as to identify and indicate possible ways and use cases in which the Vital++ offerings can be involved. Ideally the process should indicate ways on how other variations can be produced either by modifying the original setup or by isolating parts of the platform and complementing these with other offerings. The experiment of federation is expected to indicate additional requirements with respect to the granularity and interoperability of the platform.

5.2 Identification of Components

The latest demonstration of Vital++ involved a significant number of components and network architectures for realizing an extensive set of use cases. An indicative list follows:

- OpenVPN based VPN interconnections among testbeds including routing and DNS services offered by TID OpenVPN Server installation
- OpenIMS installation at Fokus in the role of the home domain for all subscribers
- OpenIMS installations at UoP, TA, TID in the role of visited domains
- Peer to Peer Authentication Subarchitecture (P2PA-SA) at Fokus
- Content Protection Subarchitecture (CP-SA) at WIT
- Content Indexing Subarchitecture (CI-SA) and Overlay Management Subarchitecture (OM-SA) at UoP
- Monster and BCT clients launched on demand in the demo room and UoP testbed
- Satellite and VLC equipped CTRC testbed for generation of media streams
- OpenSwan VPN tunnel between CTRC and UoP for delivering the media streams to the Vital++ platform
- Satellite Relay entity at UoP for publication and adaptation of the CTRC content in the Vital++ platform
- Mobile Relay entity at VG for adaptation of P2P acquired media content to regular SIP subscribers
- SoftMix Application Server at RBB offering metadata and media files

- SuperPeer at UoP for publication and adaptation of the content offered by RBB for delivery in the Vital++ platform
- Transcoding Service at TID for preparation of a number of alternatives of the RBB offered media

In the context of federating Vital++ not all the above listed components will be made available via PII methodology, although the overall approach can be possible to be applied to any of the excluded components. The included ones are mentioned in the next two paragraphs.

5.2.1 Network Setup and Server Side Components

It was decided not to cover the establishment of the VPN connections but to offer all the components via public Internet connections, so that the exact VPN establishment approach (if it is mandatory) is not limited to the techniques Vital++ has adopted. On the other hand testbed interconnections are expected to be covered by PII offered techniques (IGW concept).

The same applies to the foreign/home IMS domains approach that was used in the latest demonstration. There is no evident reason for reproducing the same architecture via PII methodology since the actual IMS topology should be left open and the focus should be put on the process of building on top end enhancing existing IMS installations.

Therefore the server side components are the four subarchitectures and one OpenIMS installation. The OpenIMS installation should be treated in a way that does not impose any specific requirements on the rest of the components so that other alternatives can be also selected. The use of a regular open-source SIP Proxy in the role of the OpenIMS is also subject to evaluation.

5.2.2 Client Side Components

The selection of the client side components to be installed via the PII methodology depends on the actual use cases. It was decided that LiveStreaming and SoftMix should be the two scenarios to be presented.

Therefore there is need for a number of clients scattered around testbeds. Since the client is a piece of software designed for desktop and not background usage there is need for adapting it so that it can be launched and operate in an autonomous manner without requiring user intervention. This will be offered by a GUI-less mockup of the BCT client. Obviously, operation of a client in background autonomous mode is intended to be used for measurements with respect to evaluation of the P2P algorithms. In this concept the Vital++ P2P engine will be used in a way that can allow the replacement of it by other similar packages that are compliant with the integration interface used by the Client architecture.

For SoftMix the presence of the SuperPeer is necessary.

5.3 Requirements, Implementation Details

5.3.1 Resources

Resources can be installed on demand or be preexisting installations for which RAs have been activated to cater for controlling the resource under the commands of the Panlab infrastructure.

In the context of this task the following approach is followed:

1. OpenIMS will be used as an existing resource offered by one of the testbed. An RA will be developed for it in order to allow for associating user accounts with client instances. This means that at least the realm and port number of P-CSCF should be reported by this RA.
2. P2PA-SA can be considered as a preexisting resource with an RA reporting its access details (SIP URI)
3. CP-SA can be installable via a Virtual Image on a Virtual Server. There is need for an RA for the Virtual Server to handle the create command for the CP-SA. The Server will be preexisting resource reporting only the IP address of the installation. An RA is required for the CP-SA to expose the SIP URI of it to client instances. The IP address will be inherited from or allocated

by the Server. Alternatively, the SA can be used from its current location as a pre-existing resource with its RA reporting the information described above.

4. CI-SA and OM-SA can be bundled in a Virtual Machine that can be installed on a preexisting Virtual Server. CI-SA needs to know the CP-SA URI as well as a valid account on the OpenIMS. RA for Virtual Server, RA for CI-SA, RA for OM-SA.
5. The SuperPeer can be also bundled in Virtual Machine. An RA is required for configuring the Super Peer with the User Account as well as with the access details of the RBB SoftMix AS. Considering the fact that the SoftMix AS will be used from its current installation, the possibility to present this as a PII provisioned resource as well should be evaluated. In this case an RA will be required to cater for replying with the access details of the SoftMix AS in the relevant queries.
6. A number of GUI-less BCT clients acting according to a predefined scenario need to be installed in various places in the testbeds involved in this scenario. An RA will be required for this client instances as well. The client installation can be also done via Virtual Images, however, other solutions are also evaluated.

5.4 Resource Adapters Development

5.4.1 OpenIMS

The OpenIMS resource can be any preexisting installation containing a number of user accounts. The role of the RA in this case will be to reply to queries from the PII platform the responses of which should contain mainly information regarding the realm, port number and optionally the IP address of the installation in case the realm cannot be resolved properly. This means that the RA will be activated with the proper parameters via the PTMManager and will not have any interaction with the actual resource (installation of the OpenIMS).

Add-on: An extra feature in the RA of the OpenIMS would be to make it able to create new user accounts on the OpenIMS. This would require interaction with the OpenIMS when *create* requests are sent to the RA. The content of the "*create*" will indicate something like *UserAccount* for which and additional RA would be required since this will be the resource associated with the client installations.

5.4.2 P2PSA

This SA is not actually used in the demonstration scenarios. It can be omitted or considered as a pre-existing resource with a very trivial RA reporting only the URI for accessing this SA's services.

5.4.3 CP-SA

Supposing that this SA is bundled in a Virtual Image, there is need for having a pre-existing VMware Server and the corresponding RA. The RA should be able to instruct the activation of the specific image on the server when *create (<cpsa><uri>…</uri></cpsa>)* is requested. The URI can be included in the content of the request or be sent to the newly launched RA for the CP-SA. In both cases the RA has to configure this parameter on the CP-SA. This value needs to be sent back when queries are sent from the Panlab platform.

The simplest approach could be having the CP-SA already up and running and associating with it only an RA that replies the access URI back.

5.4.4 CI-SA and OM-SA

Both SAs will be bundled in VM for XEN. The XEN server will be exposed via an RA and will be launching the specific VM when *create* is requested. CI-SA has to be configured with a user account as well as with the details of the CP-SA and OM-SA.

5.4.5 SuperPeer and GUI-less clients

The actual installation of the SuperPeer and of the clients is under consideration due to the fact that it is not reasonable to install an entire VM for a single instance of the client.

More specifically, in the case of the clients, the adopted methodology will be used in any other testbed for which a PTM/RAL installation exists. In these cases the client resource will be considered as a child of an existing computing resource offered by a testbed. There is a thought to collocate the client with its RA in a single OSGi bundle or at least to deploy the client on the same machine with the PTM/RAL. Since the P2P Engine is the key component it may be useful to be offered as a separate resource as well. In this case the Client resources should be configurable with respect to the P2P engine that should be used.

Add-on: The SoftMix AS can be considered as a resource as well. In such case there is need for a trivial RA that will be associated with the details of the installation so that the access parameters can be configured via a reference association directly to the SuperPeer.

6 Conclusions

This study focused on the simplification aspects of the complex call-control layer infrastructure of IMS by evaluating more lightweight and cost-efficient alternative P2P architectures, thus providing a high level of scalability and robustness. The study presented also p2p techniques for deploying service offerings across heterogeneous domains by means of an IP TV Service Provider. Potentials of P2P and distributed techniques discussed also by means of technical challenges as well as service provider requirements were presented. Service Providers should be able to assess the compliance of their offered/delivered services over the networks they are operating. In order to introduce P2P and distributed techniques into real networks operated by Service Providers, operational constraints should be assessed.

This document presented also the provisioning of Vital++ platform through PII. Vital++ has dealt with techniques for provisioning of multimedia content by combining IMS with P2P methodologies and concepts. The overall target was the enhancement of IMS controlled media related services by the power offered by P2P networks and techniques.

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