

**A NETWORK DECOMPOSITION  
MODEL FOR RAPIDLY DEVELOPING  
REVENUE-GENERATING  
CONVERGED SERVICES**

**PATRICIA HUANG**

Product Group Manager  
phuang@dynamicsoft.com

**VADIM VINSHTOK**

Technical Marketing Manager  
vvinshok@dynamicsoft.com

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## TARGET AUDIENCE AND PURPOSE

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This document is targeted towards businesses interested in rapid development and deployment of revenue-generating Converged Applications.<sup>1</sup>

IDC(1) defines Converged Applications as “Web Talk”, or “live voice communications on the Internet...including personal phone calls, voice messaging, conference calls, voice chat, voice enabling, Web-based customer support services, web-enabled ecommerce, and many others.”

Businesses interested in rapid development and deployment of Converged Applications include:

- Communications Application Service Providers (“CommASPs”)

- Internet Telephony Service Providers (“ITSPs”)<sup>2</sup>

- Independent Software Vendors (“ISVs”)

- Competitive Local Exchange Carriers (“CLECs”), including “Building” LECs (“BLECs”)<sup>3</sup> and Data LECs (“DLECs”)<sup>4</sup>

- Original Equipment Manufacturers (“OEMs”)

The purpose of this document is to define an application development model that will enable the above businesses to rapidly offer revenue-generating Converged Applications.

This document will provide:

- An Overview of the Converged Applications market and revenue opportunity

- A network decomposition model for developing converged applications

- A decomposed architecture based on the dynamicsoft AppEngine and network components from dynamicsoft NetValue partners.

- Converged Application Examples

<sup>1</sup>The terms Web Talk, enhanced VoIP services, converged applications, and converged services are used interchangeably in this discussion.

<sup>2</sup>Retail ITSP: Retail ITSPs are defined as service providers that own VoIP gateway POPs and market services to end users either directly or through a distributor network.

<sup>3</sup>BLEC: Facilities-based broadband access providers offering multiple services over a single pipe. These services tend to be targeted to enterprise customers and typically include data services Class 5 services. (i.e. Allied Riser)

<sup>4</sup>DLEC: Facility-based broadband service providers offering multiple data-centric services over a single pipe. (Internet Access, VPN services, etc.)

## CONVERGED APPLICATIONS MARKET AND REVENUE OPPORTUNITY

Examples of Converged Applications and representative Service Providers include:

Service Type	Definition	Representative providers
Voice enablement	Click-to-chat, click-to-talk and click-to-conference capabilities implemented in web merchant sites, community and portal sites.	<b>eStara*</b>
Telephony	Communications using PC-to-PC, PC-to-phone, phone-to-PC and phone-to-phone calling with advanced features such as messaging, conferencing, etc.	dialpad
Web conferencing	Integration of traditional telephony conferencing with Internet. Productivity benefits of shared presentations, messaging services, schedulers, etc. Leverages Presence too.	<b>Webley*</b>
Messaging	Communication services such as voicemail, email, fax services and UM.	<b>Webley*</b>
Voice Portals	Information/infotainment services available over PC and regular PSTN phone to consumers and businesses.	<b>TellMe*</b> <b>Webley*</b>

**TABLE 1:  
CONVERGED  
APPLICATIONS  
OVERVIEW**

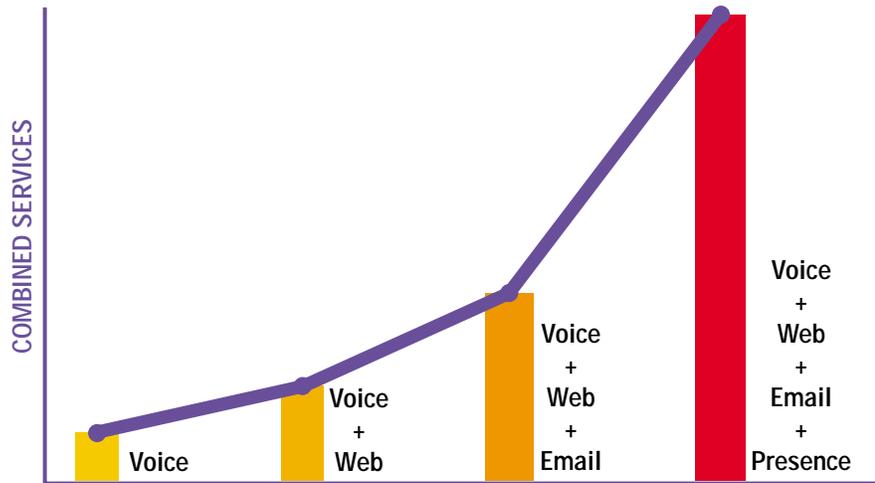
\* *dynamicsoft customers*  
Source: IDC and dynamicsoft analysis

The range of Converged Applications being offered, and the number and type of businesses developing and deploying converged applications is growing rapidly for several reasons:

- Deregulation and competition and the availability of alternate communications tools such as Instant Messaging are driving down the revenues available from basic voice services.
- Telephony's increasing integration with Internet Protocol ("IP") is driving a Web model of telecom service development (see dynamicsoft's Service Delivery Architecture white paper, <http://www.dynamicsoft.com/resources/index.html>)
- The margins available to VoIP carriers for arbitrage minutes is rapidly decreasing.

As valuable IP services such as the Web, email, Instant Messaging and Presence are combined with voice services, the number of potential applications grows exponentially. This phenomenon, the Feature Exponentiation Effect, is depicted in the figure below.

**FIGURE 1:  
FEATURE  
EXPONENTIATION  
EFFECT**



IDC and Gartner believe it is these factors that will make Converged Applications the primary driver of VoIP revenue over the next five years.

**TABLE 2:  
CONVERGED  
APPLICATIONS  
MARKET**

IDC	2000	2005	CAGR
VoIP minutes	5.5B	470B	143%
Total Retail ITSP Revenue	\$292M	\$38B	164%

Notes:

1. The growth in VoIP minutes is indicative of the overall potential that exists in the IP telephony market.
2. Retail ITSP revenue refers to revenue realized from the sale of pure VoIP services and converged IP services to businesses and consumers.

The combinations of voice, Web, instant messaging, presence, and email provide the opportunity for service providers to offer the new, innovative, and highly differentiated revenue-generating services.

## COMPELLING REASONS TO DEPLOY A DECOMPOSED NETWORK ARCHITECTURE

The dynamicsoft AppEngine addresses the needs of businesses interested in evolving their current PSTN applications to an IP infrastructure, as well as deploying new converged applications.

### Rapid development of innovative applications

An attractive market, combined with an easy-to-use standard APIs and a large development community, equals rapid development of innovative applications. The dynamicsoft AppEngine makes developing new applications easy by offering familiar Java Servlet APIs. With these APIs, the dynamicsoft AppEngine opens up a large existing community of developers capable of creating Converged Applications rapidly.

### **Feature-rich architecture of Carrier-Class, interoperable, best-in breed components**

Converged Applications require capabilities such as presence, instant messaging (“IM”), unified messaging, conferencing, interactive voice response (IVR) / speech recognition, and others. Through a decomposed architecture, applications can be centralized such that they call other network resources when they need them. Since these resources can be called via open protocols such as HTTP, SMTP, SOAP, and SIP, Service Providers and solution vendors can use best in class components for these specialized needs. In this model, application developers are free to focus on those applications that their customers are looking for rather than tracking all the needed technical components. The result is a lower cost of doing business and better customer focus to rollout differentiated services.

## **A NETWORK DECOMPOSITION MODEL FOR DEVELOPING CONVERGED APPLICATIONS**

Communication applications range from voice only services (e.g., basic call forwarding) to advanced applications (e.g., Presence-enabled Auto-Conferencing). These applications may require a large set of functions including presence detection, speech recognition, digit collection, audio bridging, etc. Supporting such a large set of functions on the same box presents a major challenge. To solve this problem, dynamicsoft proposes a new model that “decomposes” each solution into discreet functions that can be integrated to deliver a converged service. Following is a list of functions:

- **Call Control and Signaling Function** – Establishes and manages the Converged Applications sessions and the interaction between the various other functions. Example product: dynamicsoft AppEngine.
- **Media Server Function** – consists of interoperable, best-in-breed platforms optimized for specific media processing tasks. This includes conferencing, messaging, IVR, and other media capabilities.
- **Presence Function** – Provides real-time availability information on subscribers. Example product: dynamicsoft Presence Server.
- **Subscriber Data and Provisioning Function** – Provides subscriber provisioning, subscriber feature data management, and data repository capability. Example product: dynamicsoft Location Server.
- **Web Function** – Web server. Example product: a Web server is provided with the dynamicsoft AppEngine.
- **Email Function** – Mail server to relay email messages.

Each functional component can be viewed as an “application server” in its own right, but the combination of these elements is what allows Service Providers and Vendors to easily and quickly build Converged Applications.

### *Why Decompose?*

Decomposition is the act of breaking a large, monolithic system into a number of smaller components that interact according to specified behaviors.

Decomposition of large components offers a number of benefits:

- **Scale** – As systems need to serve more and more users, there are two approaches to scaling. One is to buy increasingly faster hardware, so that the monolithic servers can attempt to stay ahead of user demand. The second is to distribute the work across components so that multiple servers perform the work. Distribution is fundamentally cheaper, since the cost of large monolithic systems increases exponentially compared to the linear increase in cost with multiple, smaller units. Distribution of work across components has the added benefit of supporting specialization of components. Specialization is ideal when the application requires support for different kinds of work. For example, an application server can distribute text-to-speech processing to an IVR system optimized for this task while distributing presence requests to a presence server that is similarly optimized.
- **Sharing of Resources** – By designing a solution with decomposed components, each component can support many different applications. With this approach, a conferencing server, for example, can support a number of different applications aimed at different target markets. This sharing of resources results in a significant cost reduction.
- **Expertise** – Building a complex application requires expertise in call control, media services, compression, web, speech recognition, etc. It is highly unlikely that one Service Provider or solution vendor will have expertise in all of these capabilities. Decomposition allows a development organization to focus on its areas of expertise while outsourcing the other required components to best in breed vendors.
- **Speed of Deployment** – A decomposed architecture makes upgrading existing applications and deploying new ones much easier. The isolation of functions means that any component can be changed or upgraded without affecting the others. That makes adding new features to an application fast and easy.
- **Separation of Businesses** – Decoupled components are needed to allow a layered Service Provider model. Each Service Provider provides the components they need to offer their specialized service, which is part of the end-to-end application (e.g., service providers that specialize in content may only need an IVR; see dynamicsoft's Service Delivery Architecture white paper: [www.dynamicsoft.com/resources/index.html](http://www.dynamicsoft.com/resources/index.html)).
- **User Interface Independence** – Another aspect of decomposition is that supports a variety of user interfaces for each application. For example, an application prompt for user input can be addressed through an instant message, a recorded or text to speech voice prompt or a Web interface. This allows for support of multiple end-devices.

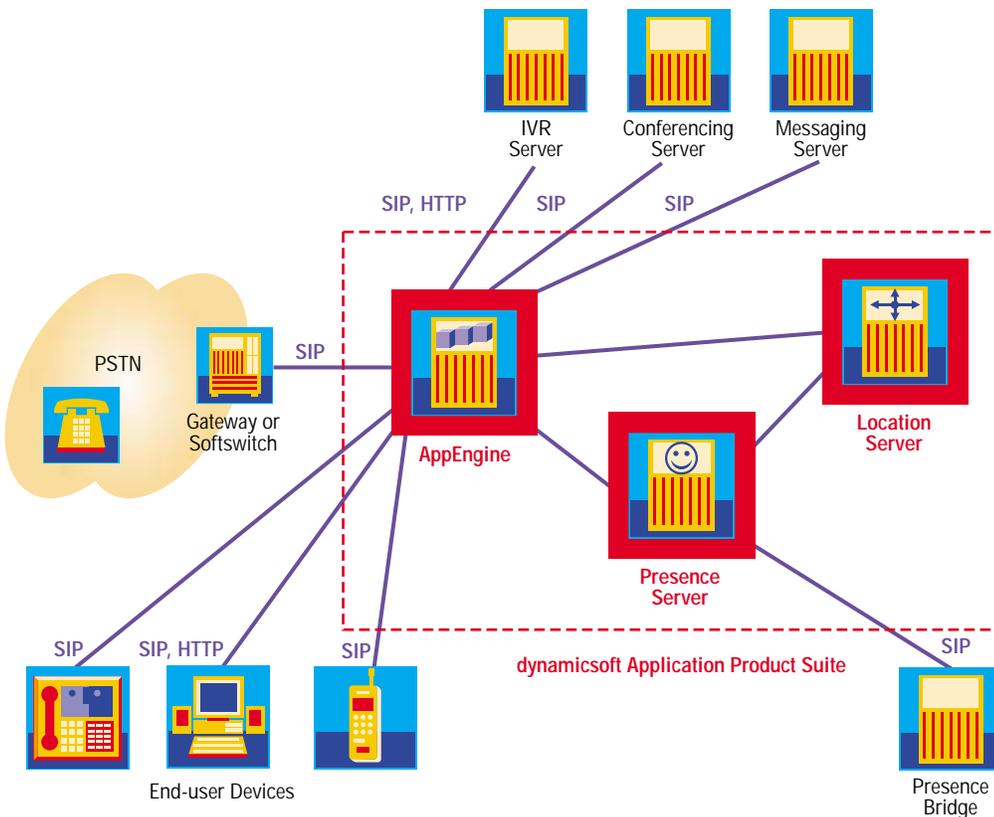
## Role of the dynamicsoft AppEngine

The dynamicsoft AppEngine plays an integral role in this architecture. Providing “3rd party call Control,” it serves as the coordinating entity that is aware of the application, its subscribers, and the additional network components required. In many cases, it is not the sole resource in an Application. Rather, it invokes a particular network component when necessary. Effectively, the dynamicsoft AppEngine coordinates the Application by Invoking different kinds of network resources including:

- Session Level Resources (e.g., media servers and conferencing servers)
- Transactional Resources (e.g., web servers and databases)
- Data Collection Resources (e.g. Collecting user input through a variety of means such as voice, IM, web)

## The Decomposed Network Architecture and Components

The diagram below depicts a decomposed network architecture. Each of the components in the architecture plays a role in delivering converged services. These components are offered by several participants of dynamicsoft’s NetValue Partner Program.



**FIGURE 2:**  
**DECOMPOSED NETWORK**  
**ARCHITECTURE**

### ***dynamicsoft AppEngine***

The dynamicsoft AppEngine is a platform that supports converged applications incorporating:

- Voice (PSTN and VoIP)
- Web
- Presence
- Instant Messaging
- Email

The AppEngine provides users with a rich development and execution environment on which to build a virtually limitless number of applications. This platform's key advantages are its supported protocols and programming interfaces. These allow developers to:

- Build applications that integrate multiple Internet technologies (Web, email, presence, Instant Messaging, etc.)
- Develop applications easily and quickly using standard APIs such as Servlets and CPL (an XML based scripting language for simple call forwarding, screening and prioritization services that is an IETF standard)
- Develop applications that adhere to existing and upcoming standards for reasons of interoperability with a large set of devices and endpoints

With the dynamicsoft AppEngine, application development mirrors web application development in terms of programmability and speed of development.

### ***dynamicsoft Presence Server***

The dynamicsoft Presence Server manages subscriber presence information including:

- Receipt of subscriptions (e.g., "I want to know when Jonathan is online")
- Notifications of users availability changes (e.g., "Jonathan is now online")
- Request authorization of subscriptions (e.g., "Jonathan, is Peter authorized to know your status?")

This is supported for both on-line and off-line users. This product is used primarily by Service Providers who offer presence services either stand-alone (e.g., buddy lists and text chat) or integrated in other applications.

### ***dynamicsoft Location Server***

The dynamicsoft SIP Location Server provides subscriber provisioning, feature data management, and a data repository in support of converged services. Specifically, it handles registration and location information (SIP REGISTER method) which is used by the dynamicsoft Presence Server, AppEngine, and Proxy Server products.

## ***IVR Server***

Interactive Voice Response (IVR) Servers are also referred to as “dialogue servers”, “media servers”, and “VoiceXML servers”. These servers provide many of the following capabilities:

- Text-to-speech (TTS) translation
- Speech recognition
- Playing of announcements
- DTMF digit collection

These systems provide a standard VoiceXML interface for programming the dialogue interaction. VoiceXML is an XML based scripting language for describing IVR services at an abstract level. VoiceXML supports DTMF recognition, speech recognition, text-to-speech, and playing out of recorded media files. The results of the data collected from the user are passed to the dynamicsoft AppEngine through an HTTP form POST operation. The AppEngine can then return another script, or terminate the interaction with the IVR server.

Two protocols must be supported. HTTP, as mentioned above, is used to pass intermediate data, and SIP, which is used to initiate the request for the IVR server to join the application.<sup>5</sup>

## ***Conferencing Server***

Conferencing servers, a.k.a Multipoint Conferencing Units (MCUs), today vary in type and complexity. Some are scheduled dialup while others support ad-hoc conferencing.

At the core of each of these conferencing servers is a mixing service. This service is responsible for taking multiple audio and/or video streams, mixing them according to some matrix, and returning the mixed stream to each participant. Issues such as conference policy, provisioning of conferences, and authentication are all completely separate and outside of this basic mixing component.

Similar to the IVR server, SIP is required in order for the dynamicsoft AppEngine to initiate and “invite” and conferencing server.

## ***Messaging Server***

Messaging servers provide basic services such as message drop, message retrieve, and message management. Callers record audio messages for the users on the system. Users retrieve, delete, file, and forward these messages.

Similar to the IVR server, SIP is required in order for the dynamicsoft AppEngine to initiate and “invite” and messaging server.

<sup>5</sup> RTP is also needed by all systems that handle the media stream.

### ***Gateway or Softswitch***

Gateways and softswitches are needed in the solution to provide connectivity to the PSTN and legacy IP (e.g., H.323) networks.

### ***End-user Devices***

SIP-enabled end-user “Client” devices such as PC-based softphones, hardphones, wireless handsets, and PDAs are needed by IP users who, based on the nature of their device, may be able to take advantage of the various interfaces of converged applications (e.g., web browser, text chat client).

### ***Presence Bridge***

A presence bridge supports multiple presence protocols such as AOL IM, ICQ, Yahoo! IM, and MSN IM. Bridges that support these protocols, along with SIP for Presence, provides interoperability and the ability to integrate existing presence applications in converged applications.

## **SAMPLE APPLICATIONS**

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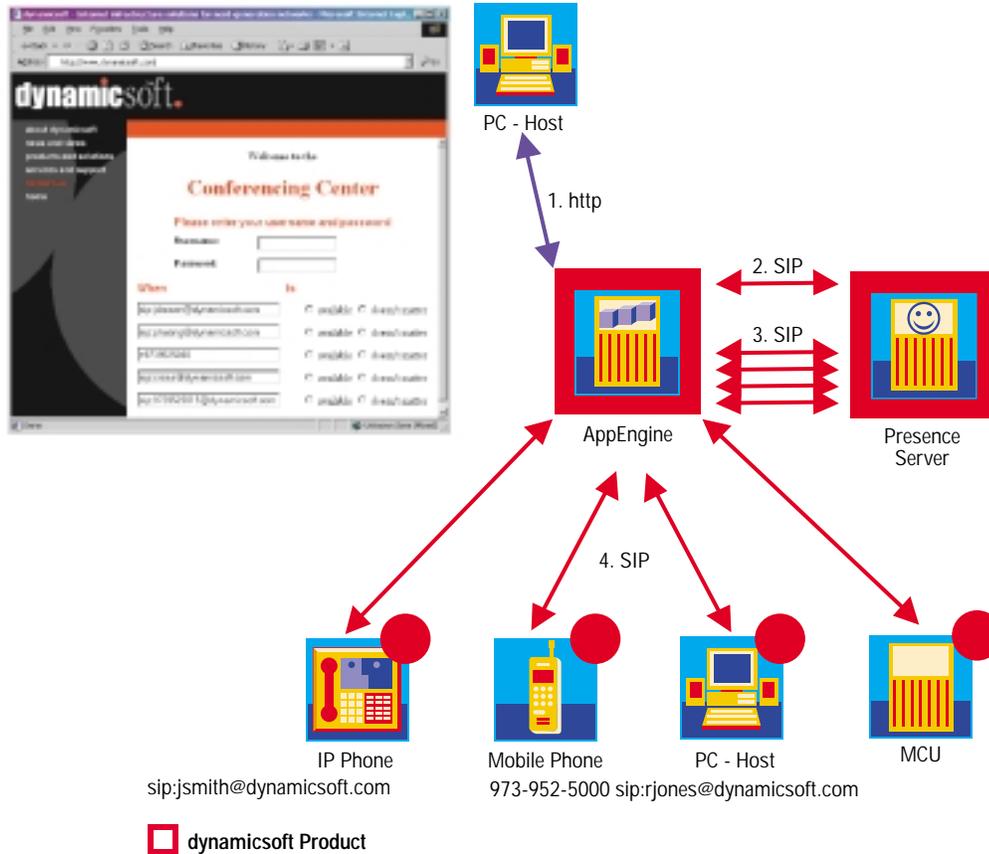
The applications in this section provide samples for the types of applications that can be built with this solution as well as examples of component interaction. For further details on the applications, including high-level call flows, please refer to section 7.

### ***AutoConferencing Application***

*Auto-Conference* addresses a common problem – setting up conference calls. Normally, this is done by trying to schedule a call based on the schedules of the participants. However, ad-hoc meetings, phone calls, and last minute fire drills make this difficult. What is really preferred is to have the conference automatically occur when all requested participants are available.

A list of participants are entered in a web page form. The Application collects presence information (aka buddy lists, instant messengers, etc.). At the time when all participants are online and available, the Application initiates a call to each participant and connects them all via a conference bridge.

In this example, it is the combination of Web, presence, voice, and conferencing that has yielded something innovative and new.



**FIGURE 3:**  
**AUTOCONFERENCE**

### ***Voice Enabled Presence Application***

The Voice Enabled Presence Application links the buddy list and instant messenger user with voice access (e.g., calling-in via your cellphone or calling-in from a remote location).

In this application, the user dials a special number and is “read” their buddy list (e.g., “johnfriend is available, bettysister is available, davidboss is unavailable...”). The caller can initiate a call to any of their “buddies” by speaking (e.g., “call bettysister”).

### ***WakeUp Service***

In this application, users request a “wakeup call” by entering the alarm time on a web page form. When that specified time occurs, the Application will call the user (at the phone number or address they pre-specified) and play them a set of announcements (e.g., the day’s weather, traffic report, stock quotes, etc.).

This service is very attractive especially with customized reports (e.g., your stock portfolio, traffic on your driving route, etc).

### *Calling Card Service*

This service allows users to make prepaid and postpaid calling card calls. The calling cards can either be sold via retail or self refreshed by subscribers through a web-based form. Flexible announcements tailored to each subscriber can provide multilanguage support, branding, advertising, news, and other information. The service can also be adaptive along the pricing dimension.

dynamicsoft AppEngine is the natural platform for such application since it can easily coordinate and integrate functionality of a media server, a web server, and a billing system into one converged solution.

## **REFERENCES**

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“An Application Server Component Architecture for SIP”, Rosenberg/Mataga/Schulzrinne, IETF Internet Draft, draft-rosenberg-sip-app-components-00.txt, November 15, 2000.

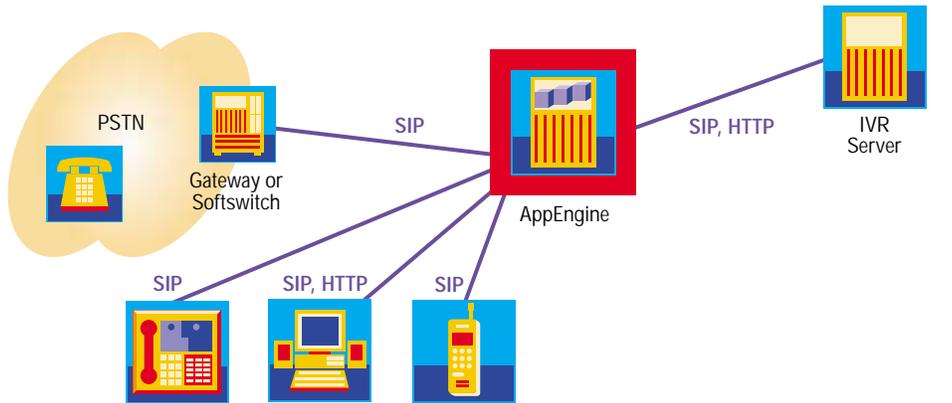
## APPENDIX: EXAMPLE APPLICATION DETAILS

This section provides more details on the applications mentioned in Section 5 and additional call flows on basic IVR and conferencing interaction.

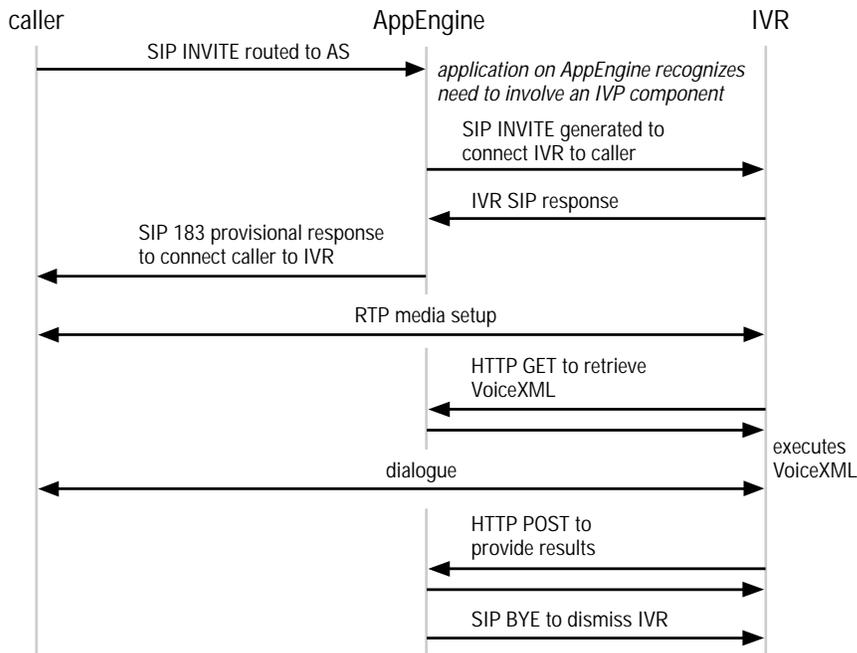
### IVR Interaction

This simple application demonstrates the basic interaction between a caller, a dynamicsoft AppEngine, and an IVR server. This is often used in more complex applications such as “Voice Enabled Presence” which is described in a later section.

In this example, the dynamicsoft AppEngine initiates a call to the IVR server, some kind of IVR dialogue is executed, and the collected data is returned to the AppEngine.



**FIGURE 4:**  
**IVR INTERACTION EXAMPLE**



### Web Scheduled Conference Service

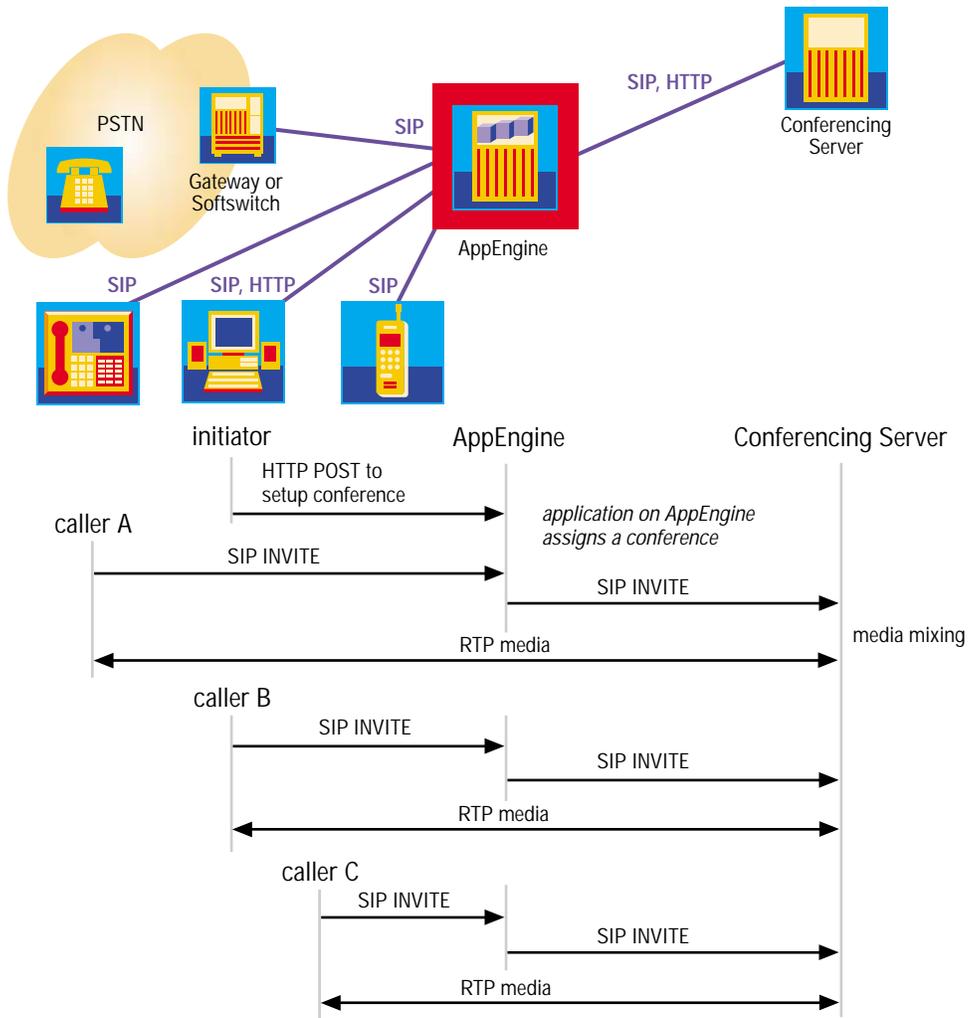
This simple application demonstrates the basic interaction between a conference initiator via web page, a dynamicsoft AppEngine, multiple conference participants, and a conference server. This is also often used in more complex applications such as “AutoConference” which is described in a later section.

In this application, the conferencing service is pre-scheduled via a web page. The conference initiator enters a start time of the conference and the number of attendees. As the participants call in, the AppEngine invites the conference server each time.

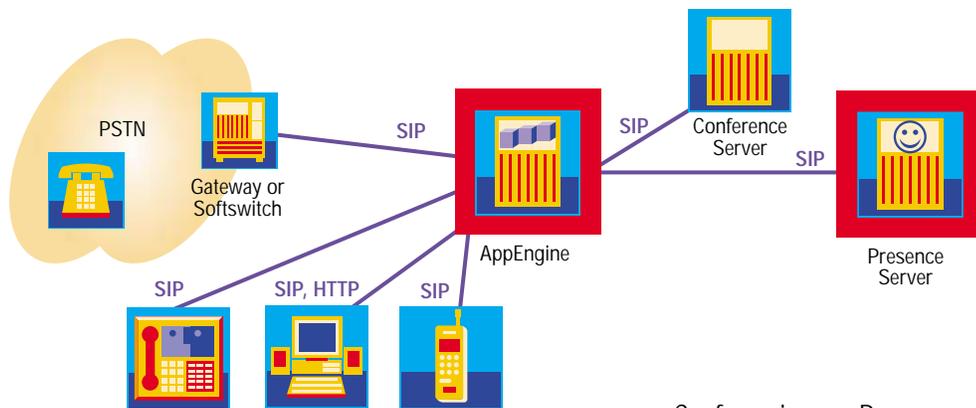
This example is fairly simple and although it demonstrates the interface between an AppEngine and a conference server, it does not demonstrate the potential enhancements such as:

- providing the list of participants (e.g., web page display or instant message of who’s in the conference)
- providing the ability to kick out participants (e.g., kick out external participants after the first half hour)
- providing the ability to dial-out participants (e.g., real-time invite participant X to call)

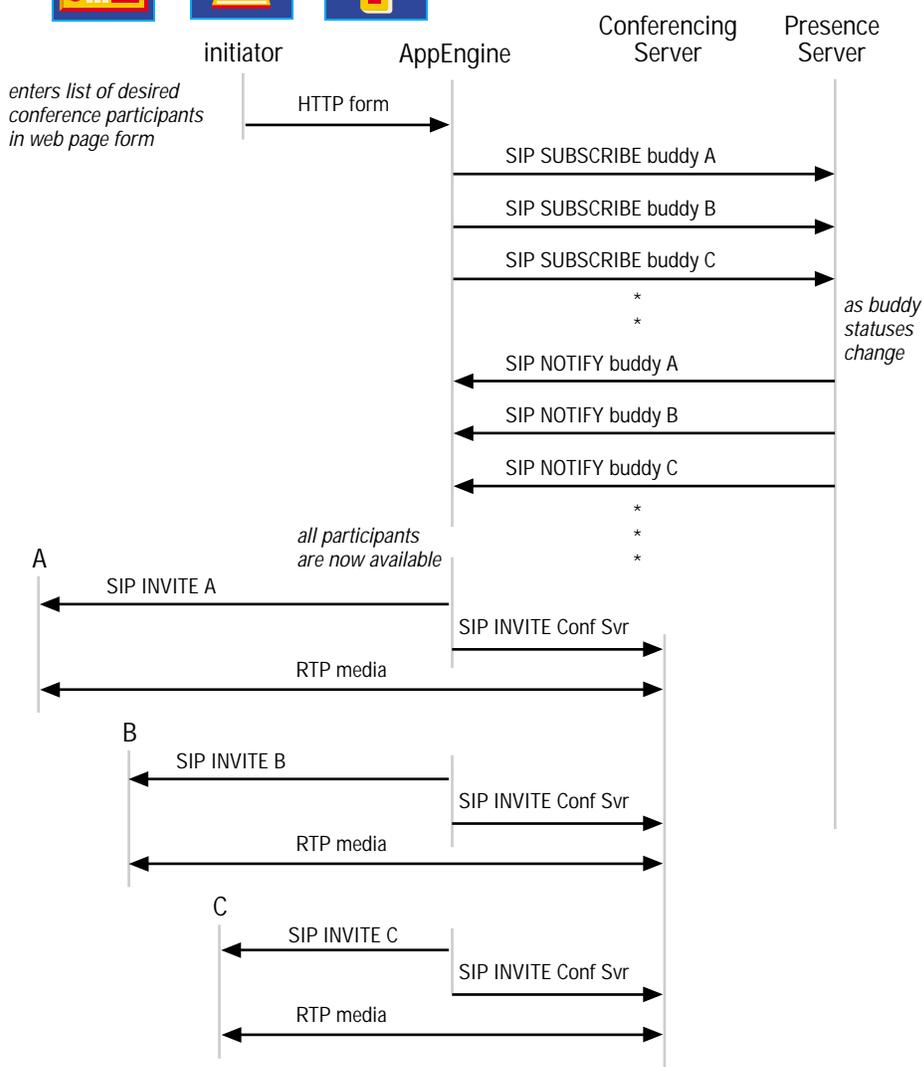
**FIGURE 5:**  
**CONFERENCING EXAMPLE**



## AutoConferencing Application

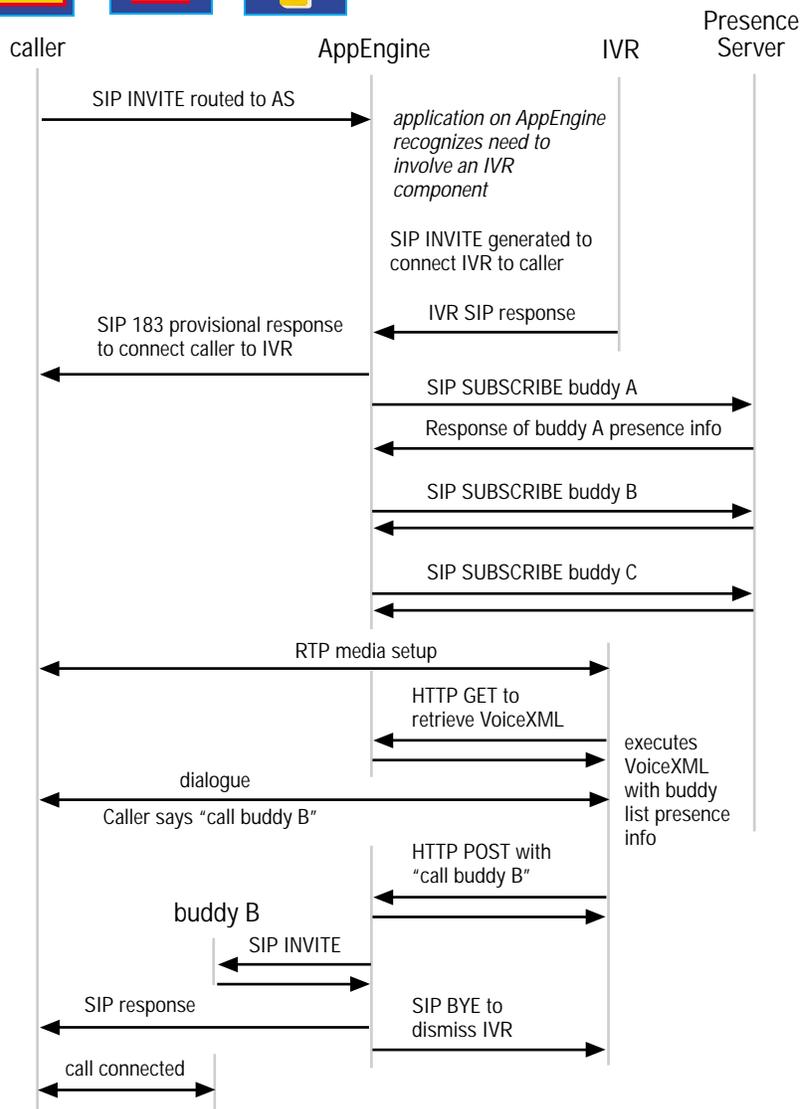
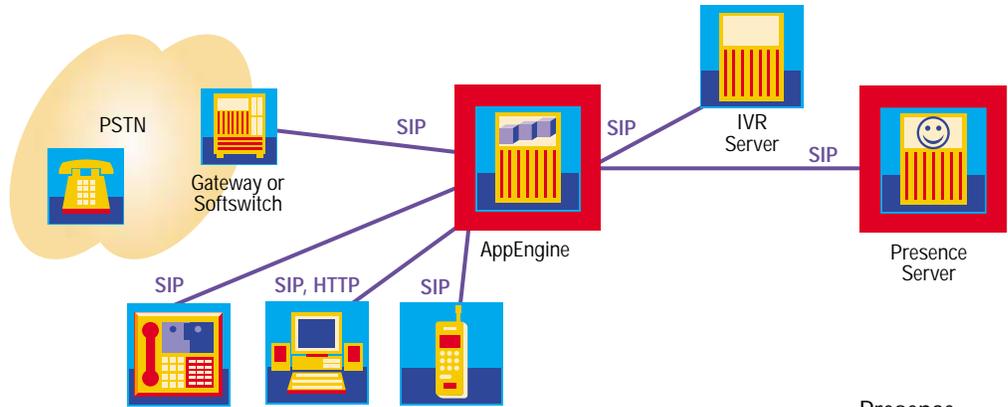


**FIGURE 6:**  
**AUTOCONFERENCING**  
**PRESENCE APPLICATION**

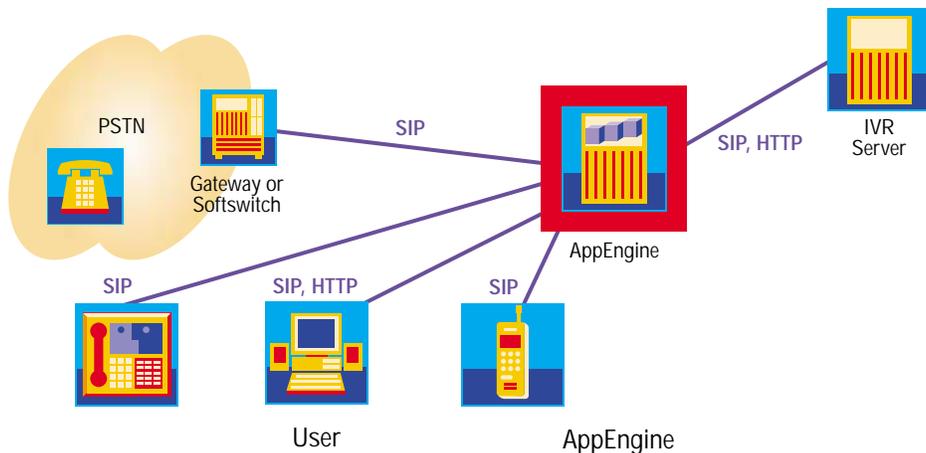


### Voice Enabled Presence Application

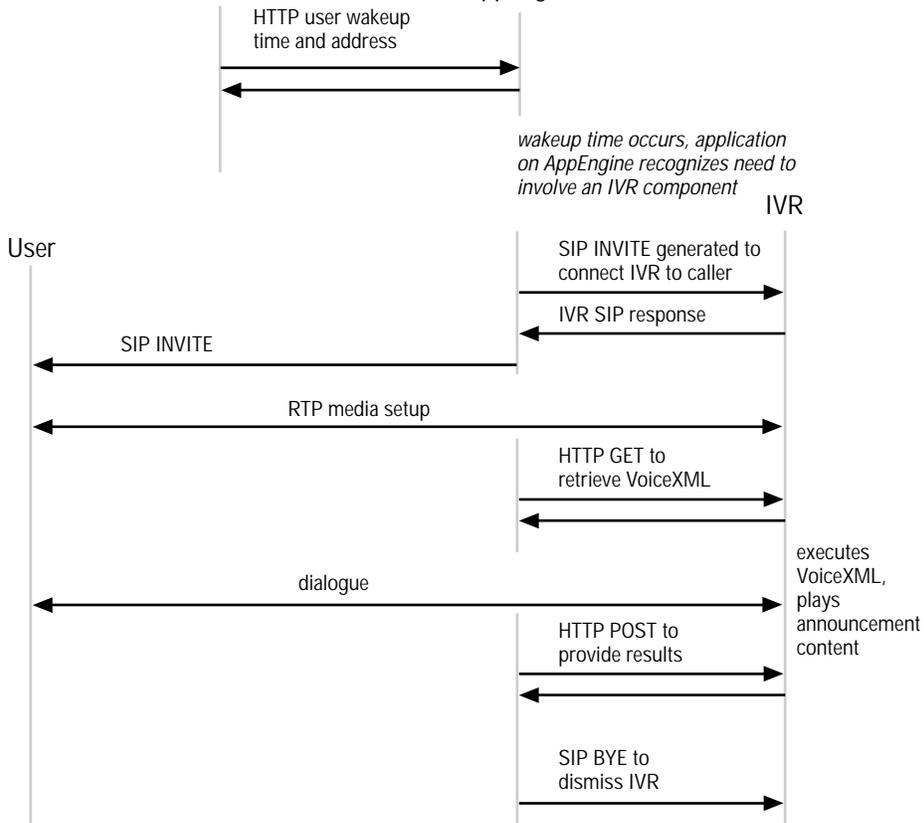
**FIGURE 7:**  
**VOICE ENABLED**  
**PRESENCE APPLICATION**



## WakeUp Service



**FIGURE 8:**  
**WAKEUP SERVICE**

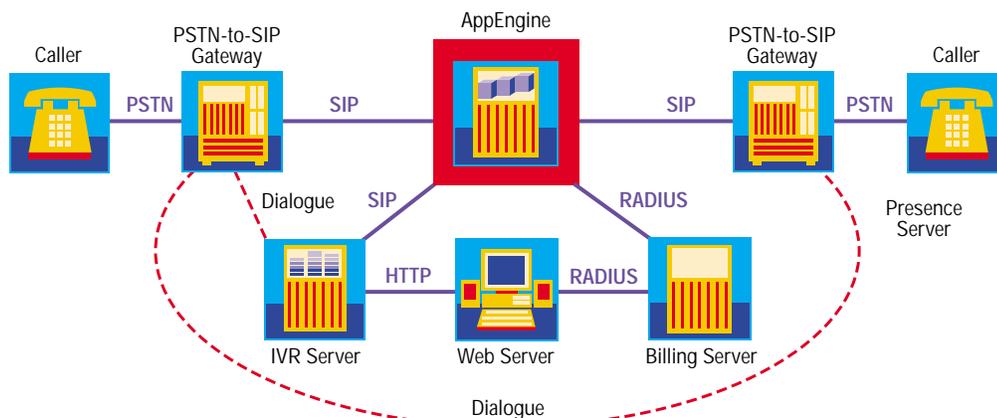


### ***Calling Card Service***

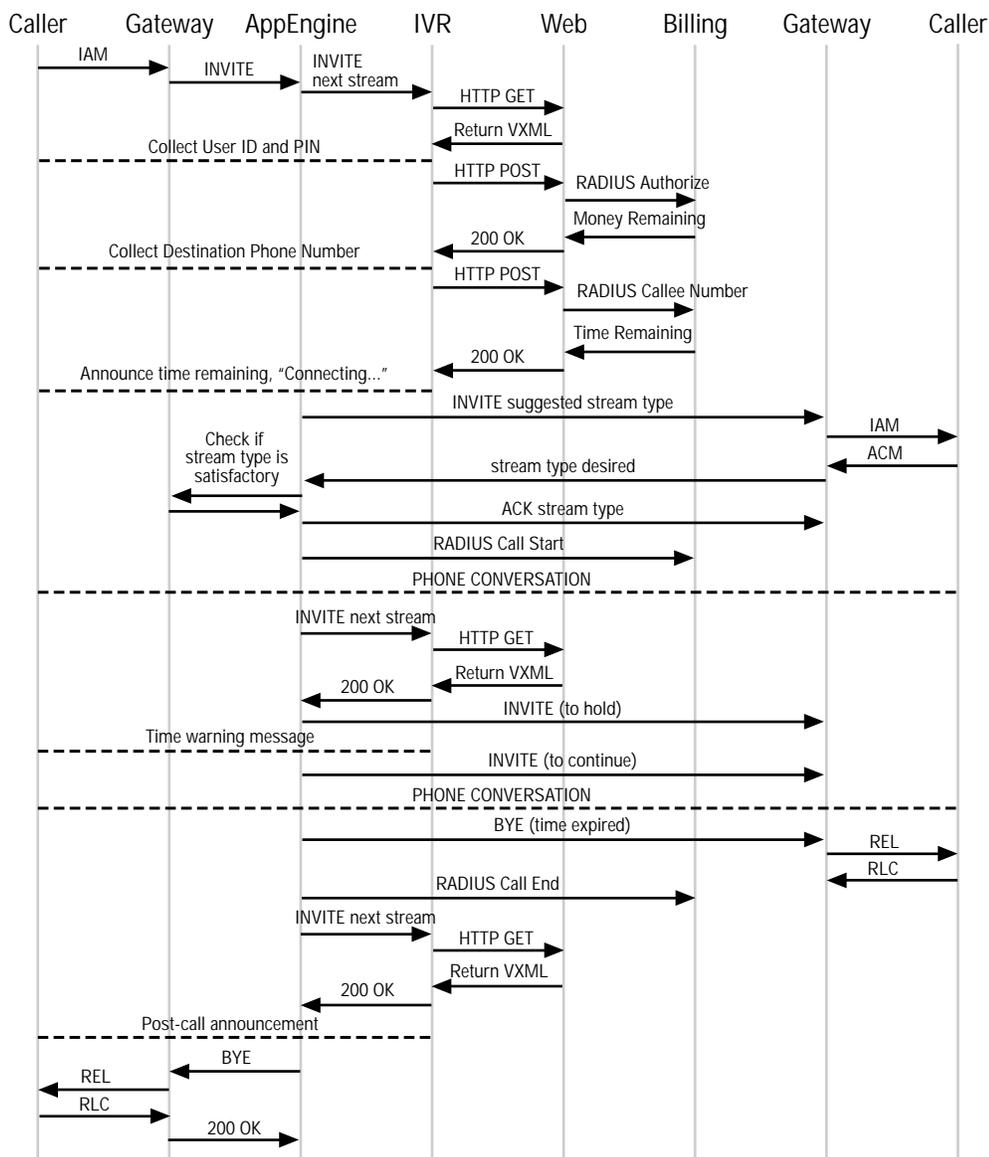
This application demonstrates interactions among multiple, task specific components such as AppEngine, IVR Server, Web Server, Billing Server, Gateway, and client devices.

The subscribers can initiate a call from either softphone or PSTN through designated access number. IVR system then prompts the user for ID and PIN number and plays “Account Balance” announcements. The next prompt asks the user for the destination telephone number followed by “Minutes Remaining” announcement. The system then connects the call. Time expiration warnings can be played out during the conversation. Upon termination of the call, the system can prompt for the next destination number.

Please note that it is relatively easy to utilize user ID and PIN to add innovative services to the solution. Examples of such services can be language customization, advertising, branding, news, call pricing, etc. For instance, the entire system-user dialog can be completely customized after the authentication just by feeding the media server different VoiceXML scripts.



**FIGURE 9:**  
**CALLING CARD SERVICE**





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**CONTACT US @ +1 973.952.5000**

**[www.dynamicsoft.com](http://www.dynamicsoft.com)**

**[sales@dynamicsoft.com](mailto:sales@dynamicsoft.com)**

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