



Creating and using multi-tenant IVR systems: IVR multi-tenanting for VAS services

A White Paper from Telesoft Technologies

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meets **engineering excellence**



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Executive Summary

Multi-tenant IVR solutions enable multiple Companies and/or applications to run interactive voice services on the same server. This white paper describes what multi-tenanting is, where such platforms may connect into current and next-generation networks and how they are controlled using CCXML/VoiceXML scripts or via internal configuration.

Multi-tenanting IVR services are often offered by VAS services Companies as a business proposition for SMEs who cannot afford or do not want the overhead of setting up and owning their own IVR platform(s). Putting many services on one platform ensures high server utilization, providing a good return on investment and a profitable business model for these Companies.

Introduction to multi-tenant solutions

Multi-tenant IVR (interactive voice response) environments serve multiple client organizations (tenants) from a single IVR (or media server). Multi-tenant IVRs also support multiple applications within the same IVR using the same control mechanisms.

Consolidation via multi-tenancy allows business models where organizations rent space on an IVR rather than buy, install and maintain their own infrastructure. For tenants this make/buy trade-off allows them to minimize capital expenditure in favor of ongoing operational expenses, and allows them to concentrate on their core business. For service providers that provide this infrastructure, multi-tenant IVR architectures allow them to maximize their investment and sustain a profitable business model.

Other advantages of multi-tenant IVR solutions are

- Easy expansion – clients can expand (or reduce) the number of voice channels as their needs change. Service providers increase the number and capacity of servers as needed to service the load and offer redundancy options, splitting the service over multiple boxes to offer resilience in event of hardware failure.
- Green – putting multiple tenants onto a central IVR cluster provides a higher utilization of equipment saving electrical power, cooling needs and physical space.
- Specialist knowledge – the multi-tenant IVR service provider takes care of connection to the telephone network and provisioning the boxes as needed. Some will provide application development, creating and modifying VoiceXML/CCXML scripts as a service. Thus the tenant, who may be just looking for an automated service environment to support their call centers or voice service to offload traffic to automated services, needs very little knowledge to begin accessing multi-tenant IVR services.
- Central location - a multi-tenant IVR cluster tends to be connected into a reliable hub within the telecoms network, within a stable IT type environment. Being remote to the tenant, like website servers, has advantages such as uninterruptable power supplies, high-speed/reliable telecom links and security/stability of equipment. In developing countries especially, this can be a major factor.

Connecting a multi-tenant IVR to telecom networks

Today's telecom networks fit into two broad categories: traditional PSTN networks (including mobile and fixed TDM networks); and next generation IP based networks. Multi-tenant IVR solutions need to fit into both scenarios for maximum flexibility.

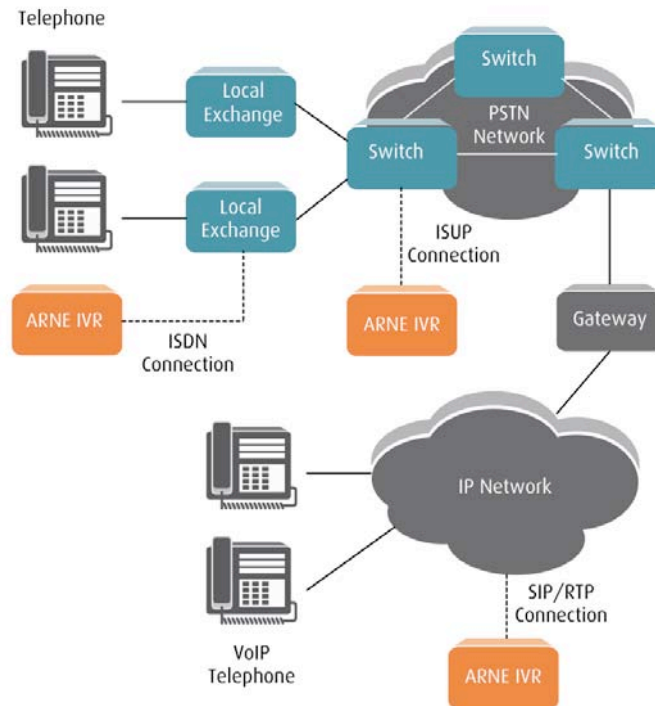


Figure 1: Alternative multi-tenant IVR connection points for PSTN and IP based networks

In traditional PSTN networks multi-tenant IVR solutions are often connected to ISDN PRI interfaces, similar to customer telephone equipment. The ISDN PRI interface contains a signaling channel and a number of voice channels. Each E1 link would contain a signaling channel, 30 voice channels (and one alarm channel). The number of voice channels required governs the number of E1s provisioned on the link.

Multi-tenant IVRs can also be connected into the core PSTN network, directly into a switch type node. Tightly controlled by the operator this interface uses ISUP (SS7) signaling. A number of E1 links connect the IVR platform to the network with 1 or more signaling links (depending on configuration) configured within the bundle of E1 links. Again the number of voice channels needed decides the number of E1s.

Today many IVRs are software only based solutions that connect directly into the IP network. They use session initiation protocol (SIP) to control voice sessions, in a similar way to ISDN and ISUP, and real time protocol (RTP) to deliver the voice content over IP networks. Since most telephones and telephony networks are, at some level, still using PSTN protocols then a gateway is often used to connect the IP based multi-tenant IVR solution. In practice this gateway may either connect into the network end-point ISDN solution (even via an enterprise PBX into this) or the core network ISUP solution – the architecture makes no difference.

Modern multi-tenant IVR platforms

IVR platforms have come a long way from early days when bespoke hardware and software made them difficult to work with. Today's IVRs (also known as media servers, media platforms and media resource functions among other things) invariably have open interfaces based around VoiceXML and CCXML to control it.

VoiceXML is a standard format for specifying interactive voice sessions between a human and a computer. The usual analogy is with web browsing: just as a visual web browser interprets HTML documents, a voice "browser" interprets VoiceXML documents and specifies what the IVR should next play and/or hear in response – a conversation. Because it is standard it can be played on any compliant IVR platform.

CCXML (call control XML) similarly specifies to the IVR how calls are answered, transferred, conference and so on. A multi-tenant IVR, as we shall see later, relies on call control to lead it to the right voice application at the start of a call.

The platform hardware may also be a standard compute/blade server or may include specialized hardware to offload some of the CPU load or enable it to interface with ISDN and ISUP type interfaces of a PTSN telephony network directly.

This simple example VoiceXML script asks the user where they want to travel to and how many are travelling, collecting this information and submitting it to the server:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<vxml version="2.0" lang="en">
<form>

<field name="city">
<prompt>Where would you like to travel to?</prompt>
<option>London</option>
<option>Atlanta</option>
<option>New Delhi</option>
</field>

<field name="travellers" type="number">
<prompt>How many people are travelling to <value expr="city"/>?</prompt>
</field>

<block>
<submit next="http://localhost/handler" namelist="city travellers"/>
</block>

</form>
</vxml>
```

For other examples of CCXML/VoiceXML scripts see Appendix A.

Controlling multi-tenant IVR applications

In multi-tenant IVR applications the called party number (B number) is most frequently used to differentiate services. In this example the multi-tenant IVR has two services:

Service	Tenant	Application	Tel number
1	Insurance company	Automated help line	0800-001
2	Train operator	Train timetable	0800-002

Off-box multi-tenant control

In off-box multi-tenant control the external application server controls which caller is serviced with which tenant/application.

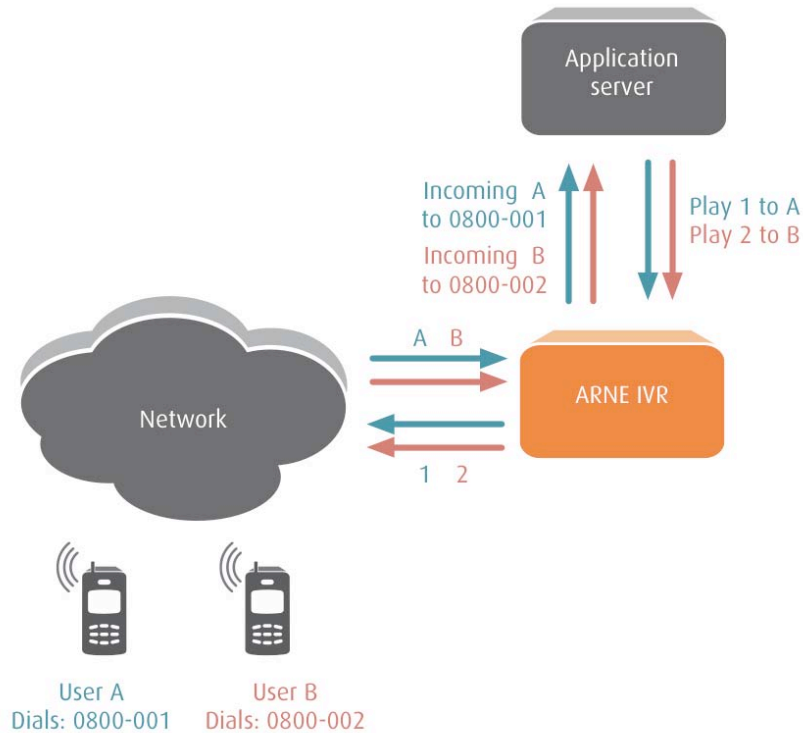


Figure 2: Multi-tenant control using CCXML

User A rings the insurance company (0800-001). The network directs this number to the multi-tenant IVR. The multi-tenant IVR sees that user A has called 0800-001 and therefore requires and passes this information on to the CCXML application server. From the number called the server knows this is for service 1 and asks the multi-tenant IVR to play the opening CCXML/VoiceXML script this (insurance) service. The number of active calls allowed by service 1 is typically limited by service agreement and either limited by the IVR or coded into the CCXML script as a limit.

Similarly user B ringing the train operator (0800-002) is directed to and played service 2 by the multi-tenant IVR. In this way service providers can provision many simultaneous services on the multi-tenant IVR.

On-box multi-tenant control

An alternative to CCXML scripting, if supported by the IVR platform, is to configure call control/multi-tenanting on box. The ARNE IVR can easily support multi-tenant applications via this mechanism. It does this via the support of two optional files:

- tenant_called_numbers.csv and
- tenant_concurrent_calls.csv.

The called numbers file defines the tenant number or application to be played. Here 2 tenants are defined, 0 and 1, with the called numbers allowed mapped to those tenants. Wildcards are allowed as well as exact pattern matches:

- 11[0-5] Match any called number from 110 to 115.
- ^12 Matches any called number prefixed with 12.
- 158 Matches the called number of 158.

#called_number	tenant_number
11[0-5]	0
^12	0
158	0
123456789	1

The concurrent calls file limits the number of concurrent calls allowed by each tenant. Here tenant 0 is allowed 230 concurrent calls while tenant 1 is allowed 3 concurrent calls.

#tenant_number	tenant_name	allowed_calls
0	customer_0	230
1	customer_1	3

On-box multi-tenant control provides an easy and quick mechanism to setup tenants on an IVR platform, though each variant of IVR will be different in the way it controls multiple tenants on-box requiring some customization of scripts.

Multi-tenant IVR using the ARNE IVR

Telesoft Technologies ARNE IVR allows multi-tenant IVR via the use of on box configuration, as described above. Up to 100 tenants are allowed, each with a pre-set number of voice channels. These limits can be easily reconfigured in service as needed.

When a new call is received the ARNE IVR matches the called party number and checks to ensure the concurrent call limit is not reached. If this limit is reached the call is rejected, otherwise the call is accepted and passed to the apps server that plays the appropriate script (CCXML and/or VoiceXML) for the particular service requested.

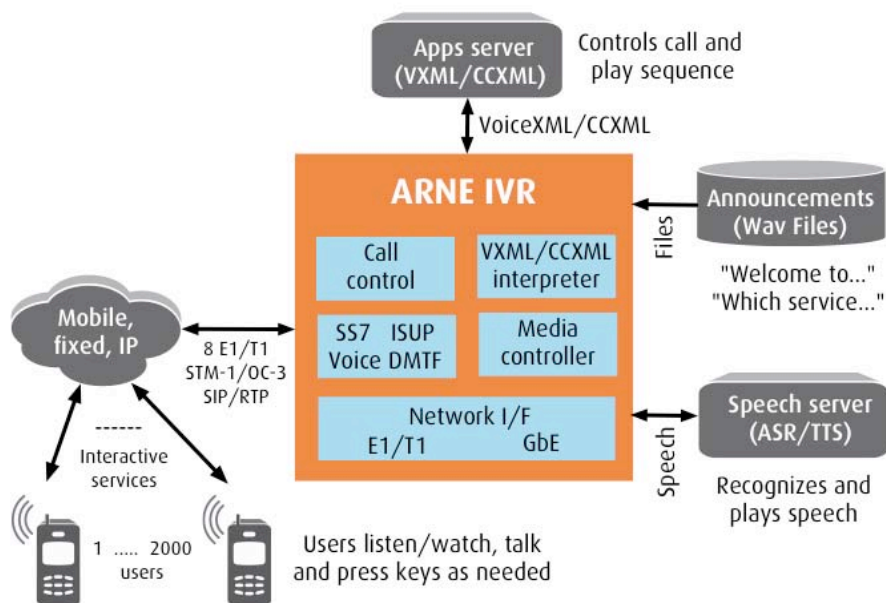


Figure 3: ARNE IVR architecture

The main benefits of the ARNE IVR as a multi-tenant IVR are:

- Allows up to 100 concurrent tenants (or up to 100 different applications from the same customer)
- Connects easily to PSTN and IP networks, allowing exactly the same software and hardware to be used wherever deployed
- Excellent cost/performance tradeoff, the lowest cost multi-network IVR on the market
- High-density optical STM-1/OC-3 interface option available with capacity for 2000 simultaneous calls
- Ideal for VAS developers of multi-tenant IVR services

For further product details please see:

<http://www.telesoft-technologies.com/products/arne>

Appendix A: CCXML/VoiceXML examples

The following are standard references for CCXML coding examples:

1. <http://www.w3.org/TR/2002/WD-ccxml-20020221/#examples>
WC3.org working group
2. <http://docs.voxeo.com/ccxml/1.0-final/>
Voxeo CCXML Developers Guide
3. <http://en.wikipedia.org/wiki/CCXML>
Wiki link

The following are standard references for VoiceXML coding examples:

1. <http://www.voicexml.org/voicexml-tutorials/introduction>
VoiceXML Forum tutorial
2. <http://www.w3.org/Voice/#tutorials>
WC3.org working group
3. <http://en.wikipedia.org/wiki/VoiceXML>
Wiki link

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