Unstructured Supplementary Service Data
USSD

USSD Module

- Module Objectives.

  - Understand the benefits of USSD.
  - Learn to work with USSD levels
  - Learn to work with USSD menus
  - Create a database oriented USSD application.
  - Understand the role of PRSPS in the mobile market.

Introduction to USSD

- USSD allows for the transmission of information via a GSM network.
- Contrasting with SMS, it offers real time connection during a session is a GSM technology.
- It was originally intended for use where the handset needed supplementary services such as call forwarding without subscriber interference.

Introduction to USSD

- A USSD message can be upto 182 alphanumeric characters in length.
- Unstructured Supplementary Service Data allows interactive services between a MS and applications hosted by the Mobile Operator.
- These messages are composed of digits and the #, * keys, and allow users to easily and quickly get information/access services from the Operator.

How USSD works

- The USSD bearer is accessed by calling a number that starts with the asterisk (*) or hash (#) and then a combination of numerals, asterisks and then finally a hash character (#).

- Examples of USSD codes are the famous *130*0721108XXX#, *100#, *144# and many others.

- *100*2*5# - this ussd code directs the user to a specified menu, This is a ussd level 3.

How It Works

- it gives a very short delay between sending the query and receiving the response.
- This happens because USSD is session oriented,
- This makes it ideal to query information from the network and to provide text content as a service.

USSD vs. SMS

- USSD differs from SMS as follows:

➢ SMS uses a “store and forward” technique to deliver text messages:

➢ USSD information is sent straight from a sender’s mobile receiver to an application platform handling the USSD service – Service providers.

Benefits of USSD

- USSD allows for very fast communication between the user and the application.
- Quick Session Based Interaction.
- GSM standard implementation and supported in all GSM phones.
- No mobile changes needed to launch new services, and new services can be Integrated with no network downtime.

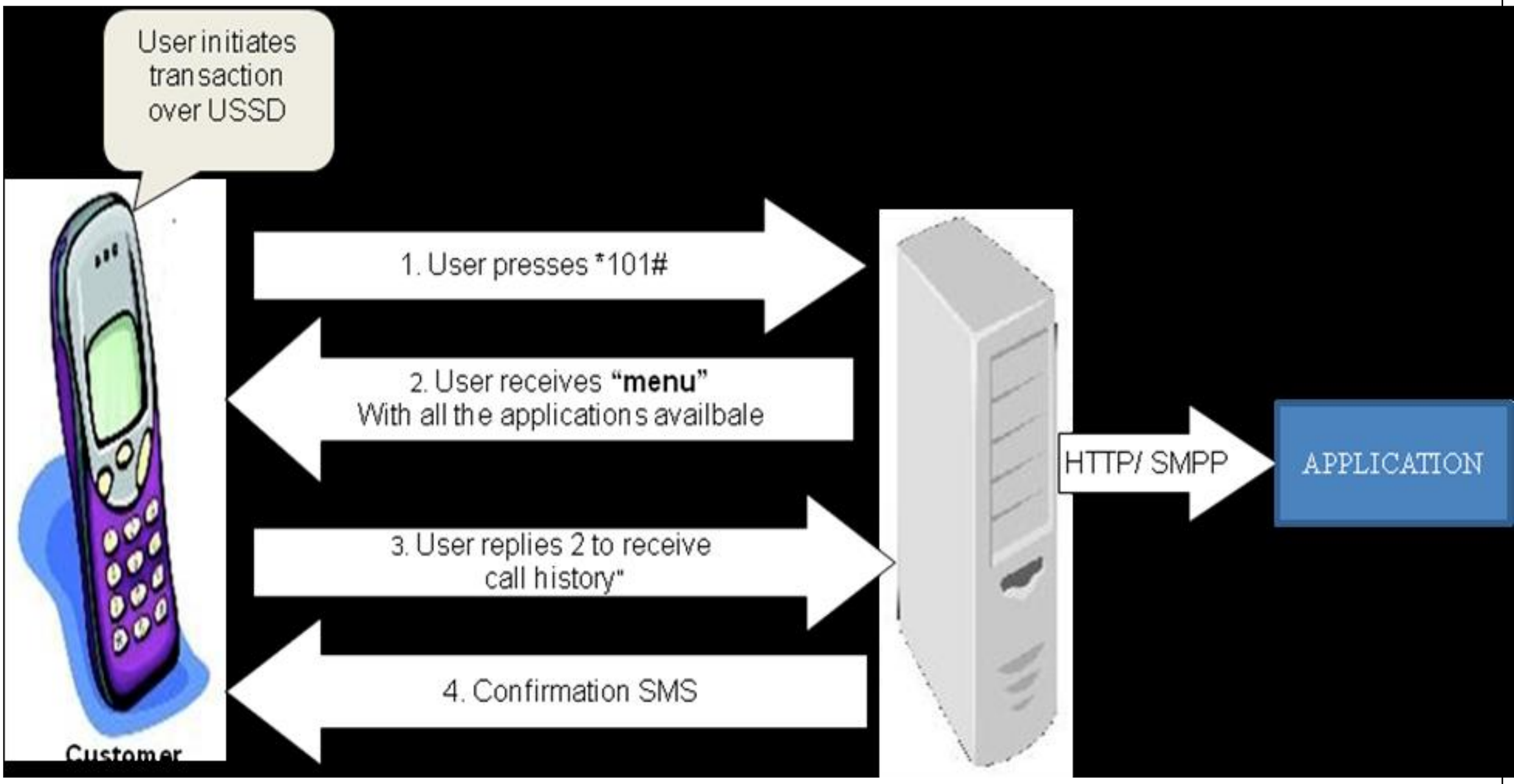
Benefits of USSD

- Operators can generate significant savings in network usage by migrating IVR traffic such as balance inquiries and voice mail to USSD.
- Reduced Marketing Costs.
- User does not have to remember all the short codes. Just a master code can give access to all the services.

Benefits of USSD

- USSD can offer numerous new customers self care applications and secure VAS.
- Increases ARPU by offering interactive services to all the subscribers.
- The ability of services to work just as well and in exactly the same way when users are roaming.

Typical flow of USSD



Explanation

- User presses *101# for a USSD based application.
- User receives browser menu to with various options – bill balance, call history, Sports, music etc.
- User sends replies back with option “2” for call history.
- User gets his call history from the USSD Server.

Applications of USSD

- Information services such as weather forecasts, traffic, news, geo-location services, directory services etc.
- Entertainment services such as games, sports etc.
- Lifestyle services such as dating, horoscopes
- Financial services such as airtime top-up and banking.

Mobile Initiated USSD

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Explanation

- Subscriber initiate a USSD call *101# (Application).
- Subscriber receives menu from the USSD server asking for the inputs, to which subscriber responds with option 2 – call history.
- Subscriber receives the call history with option of 1 for main menu and 9 to quit, to which subscriber responds with option 9.

Explanation ....

- Subscriber receives a thank you message for using the service.

- Note: The time out for the menu varies from operator to operator depending on the network bandwidth.

What is a USSD Gateway?

- A USSD Gateway routes USSD messages from the signaling network to service applications and back. "USSD gateway" and "USSD center" are synonyms.

- **USSD Gateway** is based upon the ability of the delivery agent or the source to send and receive USSD messages.

- An USSD is a session-based protocol unlike its siblings (SMS and MMS), therefore, the session needs to be allocated to each and every interaction.

USSD Network

Explanation

- The USSD transactions flow through the below network elements and session is maintained at each level.

- The menu can be either held at the USSD server or at the application level.

- The application system mainly works as a content provider for various operator business services.

USSD Applications Set Up

- In Kenya one has to apply for an USSD code through a PRSP unless one has a direct partnership with a Telcom.
  - PRSP - Premium Rate Service Provider
- The PRSP will apply for the USSD code requested to the Telcos i.e Safaricom

- This process can be as short as 1 week to 1 month if unlucky, this time include gateway setups, code refinement etc

- Please note when you get *485# on Safaricom, that does not mean you also get *485# on other operators

- This means if you want *350# on all operators, you have to pay the setup cost X 3, for three operators.

PRSP Examples - Kenya

- Mobile Planet
- Shujaa Solutions
- Africas Talking

Deploying USSD Applications

- Also note different PRSPs use different http GET and POST parameters for their USSD gateways

- This means one has to adapt their USSD codebase to the PRSPS gateway's specifications or even the operators, if one is connecting directly

- This means its is very hard to finishing coding a USSD application a today and deploy it to a live code tomorrow

- One has to iron out the integration issues

Making money with USSD Applications

- Most common and easiest way is Premium Billing for the USSD Session
- This means charging more than Ksh.10 when a mobile phone user dials a USSD session
- This is per session
- Usually the operators get the whole Ksh.10

USSD Menus

- The interactive nature of USSD allows an application to give a subscriber options in the form of menus.
- These menus are not stored on phone and actually have very little to do with USSD

Developing USSD applications

- We are going to be using a Wamp Server installation with PHP.
- USSD required the use of a web service which we are going to be implementing.
- Since there is no open source simulation tool for USSD, we will use the normal browsers to test our USSD.

Get Started with USSD Development

eMobilis

USSD Hello World

- Create a folder called ussd on your www root folder.
- Inside this folder create a php file named ussdapp.php with the contents shown on the next slide.

ussdapp.php

```
<?php
//parameters
$phone = $_GET['phoneNumber'];
$session_id = $_GET['sessionid'];
$service_code = $_GET['serviceCode'];
$user_response = $_GET['text'];



?>
```

SESSION_ID

- This is a simple PHP session id generated by the Mobile Service Provider for every USSD request made by a subscriber.

MSIDN

- Stands for Mobile Subscriber Integrated Services Digital Network.

- This is the number that uniquely identifies a subscription from a GSM network.

Cont..

User_Response

This is the core of USSD function; the USSD user responses contains details of menu levels and all input values entered by the subscriber dialing the USSD code.

proceed function in ussd

Add the following ussd progress function to the ussdapp.php file

```
function ussd_proceed ($ussd_text)
{
        echo “CON ”.$ussd_text;
        exit(0);
}
```

Exit is called to stop the code from further execution.

This function parsed any USSD text to be displayed on the subscribers phone when they dial the USSD code.

‘CON’ in this case alerts the USSD gateway that the session is still on

Stop function

Include the following function to the ussdapp.php file

```
function ussd_stop($ussd_text)
{
echo “END”.$ussd_text;
exit(0);
}
```

This function ends the current USSD session.

display_menu function

Next we include the display_menu for the USSD menu

```
function display_menu ()
{
$ussd_text = “1. Send Money\n2. Withdraw Cash\n3. Check
Balance\n4. Buy Airtime”;
ussd_proceed($ussd_text);
}
```

This function displays the main USSD menu when the USSD is dialed.

Level checking..

```php
$service_code = $_GET['serviceCode'];
//get user response
$user_response = $_GET['text'];
//initialize level
$level = 0;
//spli user response
$splitted_data = explode("*",$user_response);
//count the splitted array
$level = count($splitted_data);

//check if level is 0 || 1
if($level == 0 || $level == 1){
main_menu();
}
```

In this case level is equal to zero or 1

Level checking.. Where level > 1

```
if($level > 1){
switch($splitted_data[0])
{
case 1:
University($splitted_data);
break;

case 2:
University($splitted_data);
break;

default:
echo "invalid Entry!!";
break;
}
}
```

In this case level is greater than 1, nested if is used to check the user reply i.e user replied with 1 or 2 or 3

Content display

- Different gateways receive ussd responses in different content format, these include;

  - header('Content-type: text/plain');
  - header('content-type: application/xml');

Testing our USSD string

Open you browser and run the link as shown below:

http://localhost/ussd/index.php?phoneNumber=254721306020&sessionId=1938484028&serviceCode=*384*1234#&text=

USSD User Response explained

%5F represents (_)

%2A represents (*)

%23 represents (#)

Database Driven USSD Applications

Introduction

- USSD is used to create interactive mobile applications, with USSD you can develop a database driven application.

- For instance, a USSD application that allows users to deposit, withdraw, check balance.

- In order to achieve this, a persistence data storage is put in place to create a relational database systems to handle the transactions.

Cont..

- We are going to create a database driven USSD application from our previous example.

- In this class we will be working with a Mysql database and integrate with our USSD Application.

- We are going to create a database “banking”.
- In this database create a table “users”. In our table we will have four fields.
-
  - firstname, lastname, gender, amount

USSD Data Input Validation

- Improper Data Validation (USSD IP Mode Applications).

- Improper data validation in USSD IP mode application can lead to SQL injection, cross site scripting attacks.

- An adversary may purposely insert specifically crafted scripts in user input.

Cont..

- Once successfully inserted in the database, the attacker may try to use the same to perform malicious actions at the database or at other user's active session.

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