



Debugging Domain-Specific Modelling to Android

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Overview

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- ❖ Debugging Tool
- ❖ Debugging DSM
- ❖ Meta Models
- ❖ Android
- ❖ Aspect Oriented Programming
- ❖ Socket Programming
- ❖ Simple Debugging Example
- ❖ Future Work



Why do we need to debug?

- We want to know where the bug occurs
- Debugging provides different techniques
- Easily check with debugging tool
 - E.g : breakpoint



Breakpoint

- A *breakpoint* is a signal that tells the debugger to temporarily suspend execution of your program at a certain point
- Can be set as disable or enable without having change your program's source code
- Stop / Resume mode
- Provide a powerful tool where you need

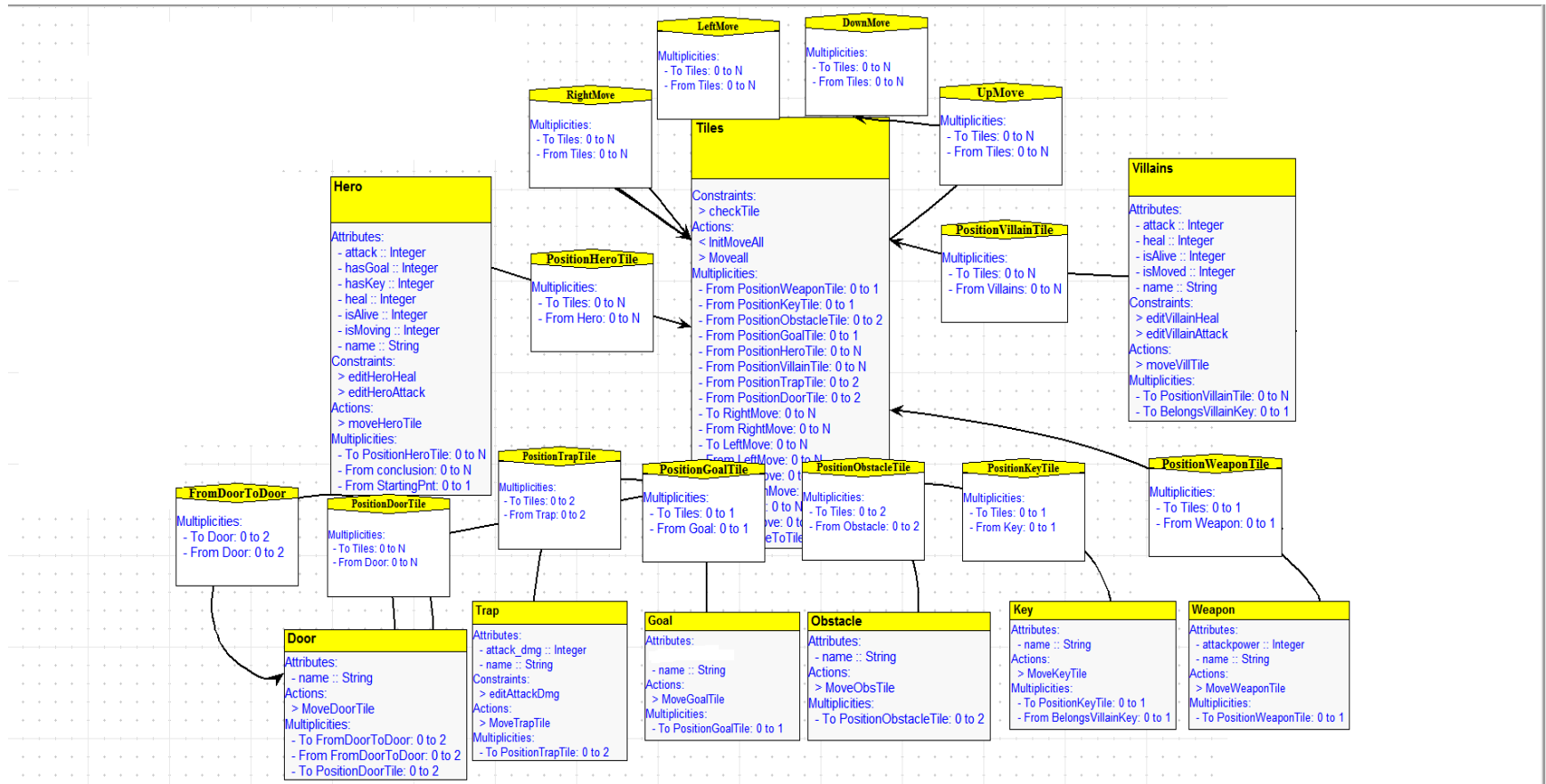


Debugging DSM

- DSM permits a special role for each debugging facility
- It is essential to make a transform from graphical entities to the code
- DSM is providing to set breakpoint into the domain-specific code,
for instance → pause/resume execution

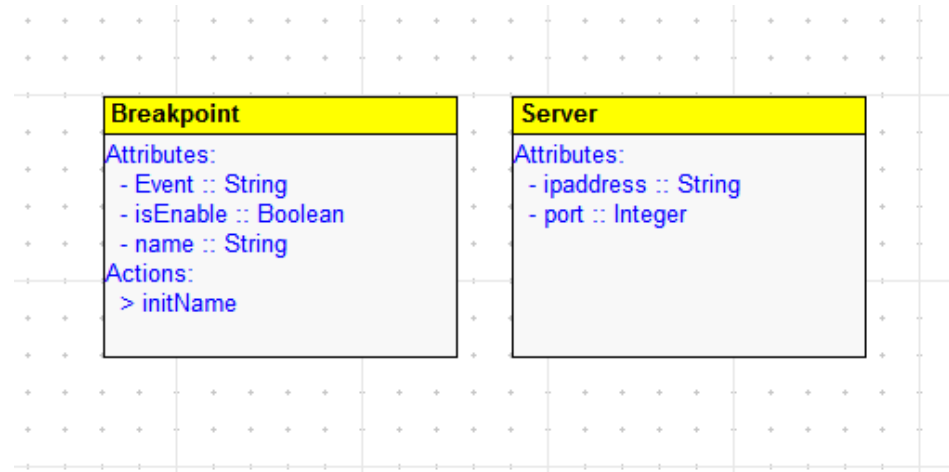


Meta Model RPG Game





Meta Model Breakpoint





Android Application

- Android Manifest → provides user permissions, activity, service, provider elements and presents important information
- E.g:

```
<uses-permission android:name="android.permission.INTERNET" />  
<uses-permission android:name="android.permission.ACCESS_WIFI_STATE" />  
<uses-permission android:name="android.permission.ACCESS_NETWORK_STATE" />
```
- Layout is typically a xml file → presents the visual structure for user interface



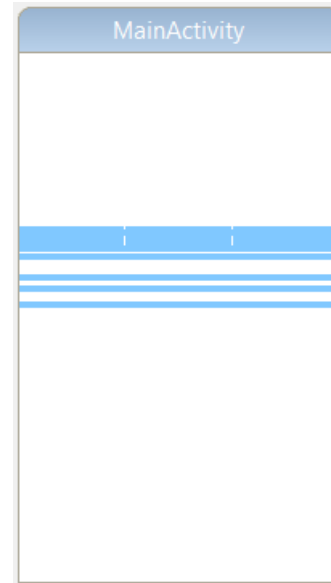
Aspect Oriented Programming

- AOP languages typically extend object-oriented languages.
- AOP provides to separate each concern
- AspectJ is an extension of Java.
- AspectJ is an implementation of aspect-oriented programming (AOP) for Java.
- It is a new way to improve the separation of concerns of programs.
- There are several new constructs which are pointcuts, advice and aspects



Aspect Oriented Programming(Cont.)

- The aspect oriented programming tries to solve two main problems basically
 - code tangling
 - code scattering





Aspect Oriented Programming(Cont.)

Main Aspect constructs;

- **Join point**: some point in the execution of an application
- **Pointcut**: a set of logically related join points
- **Advice**: some behavior that should become active whenever a join point is encountered



Aspect Oriented Programming(Cont.)

```
205 pointcut ObserverGetsObject(RPGGame rpg, object obj) :  
206     (call(* RPGGame.get*(..)) || call(* RPGGame.dmgTrap(..))) && withincode(* RPGGame.run()) && this(rpg) && args(obj);  
207  
208 after(RPGGame rpg, object obj) returning: ObserverGetsObject(rpg,obj){  
209     for (BreakPoint ob : rpg.breakpoints) {  
210         if (ob.getEnable() && rpg.Xin.existBreakPoint(ob)  
211             && obj.existBreakPoint(ob)) {  
212             Message msg = MainActivity.myHandler.obtainMessage(1,"Breakpoint is triggered! -> " + ob.getEvent());  
213             MainActivity.myHandler.sendMessage(msg);  
214             run(ob.getEvent(), rpg);  
215             Message msg2 = MainActivity.myHandler.obtainMessage(1, "Pause");  
216             MainActivity.myHandler.sendMessage(msg2);  
217             rpg.onPause();  
218         }  
219     }  
220 }
```

```
{-}> RPGGame: method-call(void mde.project.RPGGame.getKey(mde.project.object))  
{-}> RPGGame: method-call(void mde.project.RPGGame.getWeapon(mde.project.object))  
{-}> RPGGame: method-call(void mde.project.RPGGame.getGoal(mde.project.object))  
{-}> RPGGame: method-call(void mde.project.RPGGame.dmgTrap(mde.project.Trap))
```



Socket Programming in Python

- A socket is an endpoint of a two-way communication link between two programs running on the network
- two basic sockets constructs
 - *Socket*, provides standard low-level networking interface
 - *SocketServer*, provides classes that simplify the development of network servers

```
sock = socket.socket ( socket.AF_INET , socket.SOCK_STREAM )  
sock.bind( ( ' ', 2525 ) )  
sock.listen( 5 )  
newsocket, (host , port) = sock.accept()
```



Socket Programming in Java

- two key classes from the java.net
 - Socket
 - ServerSocket

```
Socket s = new Socket ( MainActivity.ipaddress , MainActivity.portn );  
PrintWriter outp = new PrintWriter ( s.getOutputStream() , true);  
outp.println (event);  
s.close ()
```



Simple Debugging Example

RPG_Game_META BreakPoint_META GenericGraph

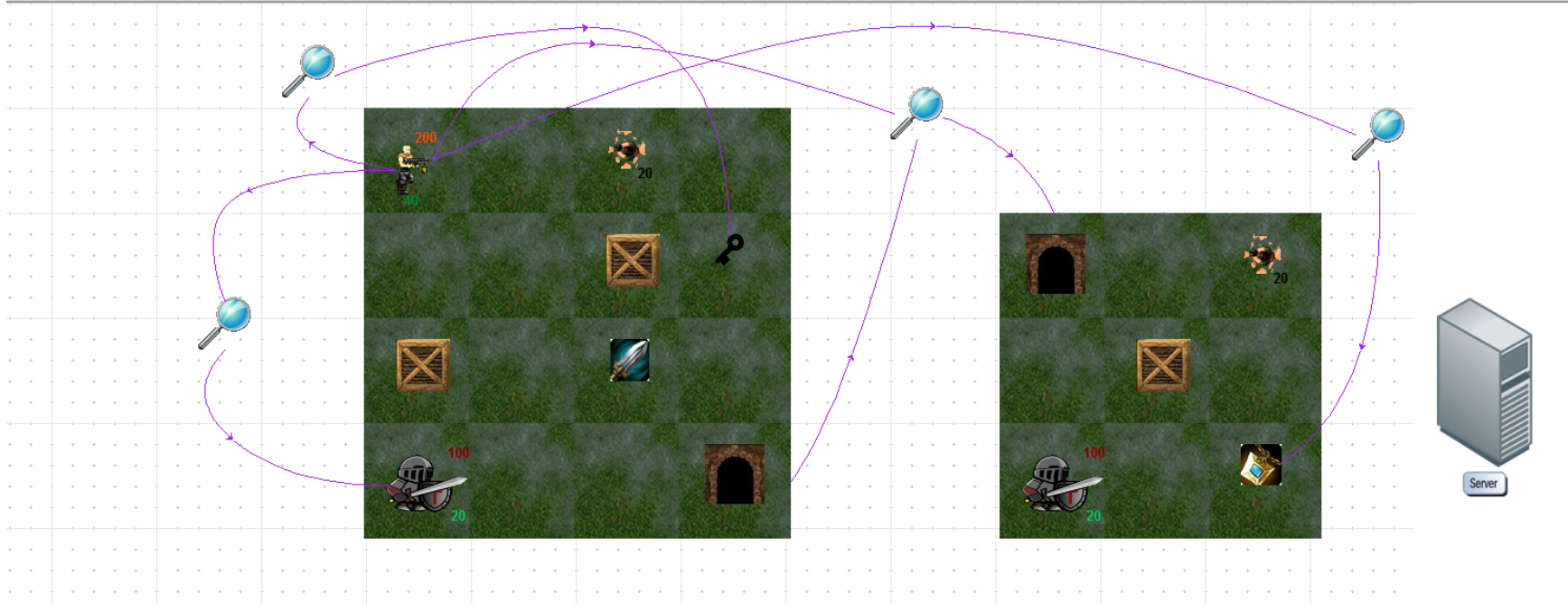
Edit New StartPoint New Result

Generate .java

Edit Help

Server

Generate Aspect for RPG Start Server





Simple Debugging Example(Cont.)

The screenshot shows the AToM3 v0.3 application interface. The main workspace contains a game map with a character and a server icon. A terminal window in the foreground displays the following output:

```
C:\Python27\python.exe
Meta-Model: Buttons
  loaded in 0.175 seconds
Model RPG_Game_META opened in 0.561 seconds
Loading model: MDE_Images_BP_RPG_MDL
  Meta-Model: RPG_Game_META
    loaded in 0.312 seconds
  Meta-Model: BreakPoint_META
    Attribute name collisions occurred during load (could affect old formalisms)
    The following attributes collided: ['description', 'name', 'author']
    loaded in 0.302 seconds
Model MDE_Images_BP_RPG_MDL opened in 1.872 seconds
Meta-Model: GenericGraph
  loaded in 0.166 seconds
aspectRPG not unloaded
rpg not unloaded
server_init not unloaded
Socket listens on port 8888
_
```

The interface also shows a 'Server' icon and buttons for 'Generate Aspect for RPG' and 'Start Server'. The terminal window is titled 'C:\Python27\python.exe' and shows the execution of a Python script.



Simple Debugging Example(Cont.)

The screenshot displays the AToM3 v0.3 software interface. The main window is titled "RPG_Game_META" and contains a grid-based map editor. The map shows a character (a knight) and various objects like a key, a sword, and a gold key. A terminal window is open in the foreground, showing the following output:

```
C:\Python27\python.exe
Attribute name collisions occurred during load (could affect old formalisms)
The following attributes collided: ['description', 'name', 'author']
loaded in 0.302 seconds
Model MDE_Images_BP_RPG_MDL opened in 1.918 seconds
Meta-Model: GenericGraph
loaded in 0.192 seconds
rpg not unloaded
server_init not unloaded
Socket listens on port 8888
2013-01-18 16:34
*****
['Attack', '(hero=180,40,Tile6.1,1,0,0)', '((Villain1=60,20,Tile6.1,1)-(Villain2=100,20,Tile23,0,1))', '(Sword=Tile11)', '(Icecrown=Tile25)', '(Gold Key=Tile8)']
Breakpoint is triggered! -> Attack
-
```



Simple Debugging Example(Cont.)

The screenshot displays a game development environment with a grid-based map and a terminal window. The map shows a character with 160 health, a villain with 20 health, and various objects like a key, a sword, and a gold key. The terminal window shows the following output:

```
C:\Python27\python.exe
loaded in 0.192 seconds
rpg not unloaded
server_init not unloaded
Socket listens on port 8888
2013-01-18 16:34
*****
['Attack', '(hero=180,40,Tile6,1,1,0,0)', '((Villain1=60,20,Tile6,1,1)-(Villain2=100,20,Tile23,0,1))', '{Sword=Tile11}', '{Icecrown=Tile25}', '{Gold Key=Tile8}']
Breakpoint is triggered! -> Attack
2013-01-18 16:35
*****
['Attack', '(hero=160,60,Tile2,1,1,0,0)', '((Villain1=0,20,null,0,0)-(Villain2=100,20,Tile23,0,1))', '{Sword=null}', '{Icecrown=Tile25}', '{Gold Key=Tile8}']
Breakpoint is triggered! -> Attack
```



Simple Debugging Example(Cont.)

AToM3 v0.3 using: RPG_Game_META + BreakPoint_META + GenericGraph

File Menu Model Menu Transformation Menu Layout Menu Export Menu

RPG_Game_META

Edit New StartPoint New Result

Generate .java

```
C:\Python27\python.exe
*****
['Attack', '(hero=180,40,Tile6,1,1,0,0)', '((Uillain1=60,20,Tile6,1,1)-(Uillain2=100,20,Tile23,0,1))', '{Sword=Tile11}', '{Icecrown=Tile25}', '{Gold Key=Tile8}']
Breakpoint is triggered! -> Attack
2013-01-18 16:35
*****
['Attack', '(hero=160,60,Tile2,1,1,0,0)', '((Uillain1=0,20,null,0,0)-(Uillain2=100,20,Tile23,0,1))', '{Sword=null}', '{Icecrown=Tile25}', '{Gold Key=Tile8}']
Breakpoint is triggered! -> Attack
2013-01-18 16:36
*****
['Getkey', '(hero=100,60,Tile8,1,1,1,0)', '((Uillain1=0,20,null,0,0)-(Uillain2=100,20,Tile23,0,1))', '{Sword=null}', '{Icecrown=Tile25}', '{Gold Key=null}']
Breakpoint is triggered! -> Getkey
```



Simple Debugging Example(Cont.)

AToM3 v0.3 using: RPG_Game_META + BreakPoint_META + GenericGraph

File Menu Model Menu Transformation Menu Layout Menu Export Menu

RPG_Game_META BreakPoint_META GenericGraph

Edit New StartPoint New Result Generate .java

Edit Help Generate Aspect for RPG Start Server

Server

The screenshot displays the AToM3 software interface. At the top, there are three tabs: 'RPG_Game_META', 'BreakPoint_META', and 'GenericGraph'. Below the tabs are various toolbars and buttons. The main workspace shows a game world with several breakpoints (magnifying glass icons) and arrows indicating relationships between them. A terminal window is open in the foreground, showing the following output:

```
C:\Python27\python.exe
00_20_Tile23_0_1))', '(Sword=null)', '(Icecrown=Tile25)', '(Gold Key=Tile8)']
Breakpoint is triggered! -> Attack
2013-01-18 16:36
*****
['Getkey', '(hero=100,60,Tile8,1,1,0)', '({Villain1=0,20,null,0,0})-(Villain2=1
00_20_Tile23_0_1))', '(Sword=null)', '(Icecrown=Tile25)', '(Gold Key=null)']
Breakpoint is triggered! -> Getkey
2013-01-18 16:37
*****
['Teleport', '(hero=80,60,Tile17,1,1,0,0)', '({Villain1=0,20,null,0,0})-(Villain2
=100,20,Tile23,1,1))', '(Sword=null)', '(Icecrown=Tile25)', '(Gold Key=null)']
Breakpoint is triggered! -> Teleport
-
```



Simple Debugging Example(Cont.)

AToM3 v0.3 using: RPG_Game_META + BreakPoint_META + GenericGraph

File Menu Model Menu Transformation Menu Layout Menu Export Menu

RPG_Game_META BreakPoint_META GenericGraph

Edit New StartPoint New Result Generate .java

Edit Help Server Generate Aspect for RPG Start Server

```
C:\Python27\python.exe
00,20,Tile23,0,1)), '(Sword=null)', '(Icecrown=Tile25)', '(Gold Key=Tile8)']
Breakpoint is triggered! -> Attack
2013-01-18 16:36
*****
['Getkey', '(hero=100,60,Tile8,1,1,1,0)', '((Uillain1=0,20,null,0,0)-(Uillain2=1
00,20,Tile23,0,1)), '(Sword=null)', '(Icecrown=Tile25)', '(Gold Key=null)']
Breakpoint is triggered! -> Getkey
2013-01-18 16:37
*****
['Teleport', '(hero=80,60,Tile17,1,1,0,0)', '((Uillain1=0,20,null,0,0)-(Uillain2
=100,20,Tile23,1,1)), '(Sword=null)', '(Icecrown=Tile25)', '(Gold Key=null)']
Breakpoint is triggered! -> Teleport
2013-01-18 16:38
*****
socket closed!
```

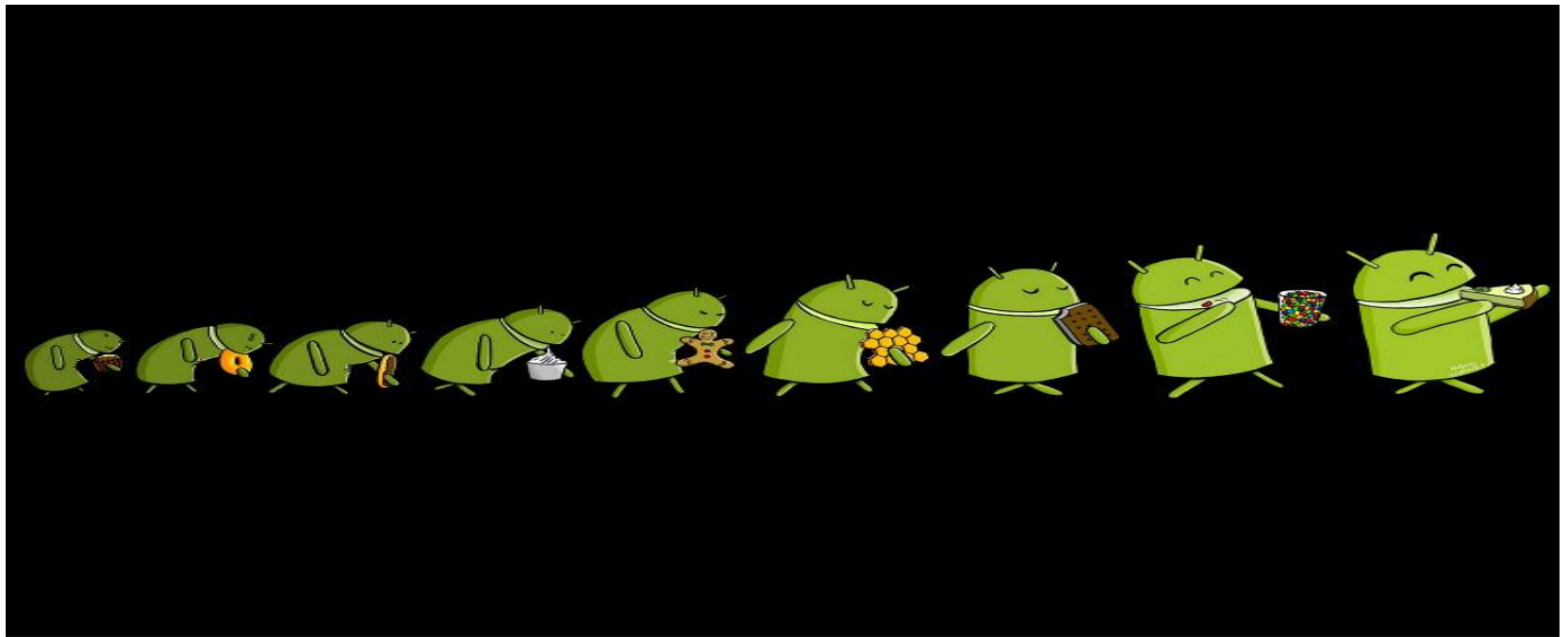


Future Work

- It can be made more complex breakpoint models
- It can be made when incoming message comes then Atom³ send an ack message to android devices
- It can be created to send a message step-by-step for each execution



Thank you for your attention!





References

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Demo & Questions?