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## A Compelling Reason for ARM Cloud Servers:

### *Android in the Cloud* Technology

Ascender Technologies

info@ascender.com

+972 50.597.5146

Ascender's **Android in the Cloud** technology provides compelling reasons to run ARM servers in the Cloud by offering services that Intel servers cannot provide. Ascender's technology, created specifically for ARM processors, runs standard Android apps in the Cloud with the ability to view these apps on a wide variety of remote clients. A broad range of use cases is supported by this technology.

#### **The Current Duopoly**

Coming after many years of a WinTel monopoly, the current ARM-Intel duopoly has been stable with neither side capable of making inroads into the other side's territory.

**Intel** Effectively has control of the Cloud and Data Center markets. Attempts by ARM to penetrate these markets have been unsuccessful.

**ARM** Effectively has control of the Mobile and Embedded markets. Attempts by Intel to penetrate these markets have been unsuccessful.

#### **Compelling reason to adopt ARM servers**

We believe that just achieving "feature parity" with Intel's hardware and software will not lead to ARM's adoption of the Cloud and Data Center. Rather, there must be a compelling reason to use



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ARM hardware. **The only reason to use ARM hardware would be that it delivers something that Intel hardware cannot deliver.**

Ascender Technologies' *Android in the Cloud*, brings the compelling reason to run ARM servers in the Cloud. Hosted on ARM processors, this remote Android technology provides the ability to run standard Android apps in the Cloud, and allows viewing these apps on a wide variety remote clients, thereby enabling a whole new ARM ecosystem. The technology supports a broad range of use cases.

### **Ascender's *Android in the Cloud* technology**

- Enables cost and computer resource efficient remote execution of unmodified Android apps on multiple platforms.
- Enables viewing on the remote client without performance compromise.
- Enables remote access to a large number of the over one million available Android apps.
- Provides a high graphical frame rate using low network bandwidth.
- Solves the BYOD problem of managing multiple systems and platforms.
- Typically uses less than 40 KBytes/sec of network bandwidth, while providing:
  - full resolution
  - low latency
  - lossless compression
  - 60 frames per second graphic stream.
- Reduces cost of cloud hosting:
  - rendering is done on the client side
  - GPU's are not needed on the remote host.

### **Proofs of Concept: Six ARM Servers Tested**

We tested seven ARM platforms as Remote Android hosts. Each platform runs standard Linux distributions with modified Linux kernels which simultaneously support both standard Linux and multiple Android image functionality. The Android image runs in a Linux container using LXC. The Raspberry PI2 was tested running one Android image. Both the Odroid XU4 and the Scaleway C1 were run with four simultaneous Android containers. The HP Moonshot M400 was tested running



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20 Android containers. The HP Moonshot platform would probably host more Android images but more images could not practically be tested. The Packet Dual Cavium ThunderX server has so far been tested with only one Android image. We estimate that it should be able to run about 100 Android images in Linux containers.

**Results**

In general, it was difficult for users to differentiate between the performance of the local servers (RPI2, Odroid C2 and Xu4) and the wide area (international) servers (Scaleway, Moonshot and Packet). The local client is in Israel. The distance to the remote servers for both Paris and Amsterdam is 3,300 km. The distance to Houston is 11,000 km.

All server platforms easily stream graphics at 60 fps, use low network bandwidth and are insensitive to network latency.

Platform	Processor	Cores	Bits	Memory	Location	Images Tested
Raspberry PI2	BCM2836	4	32	1 GB	Israel	1
Odroid XU4	Exynos5422	8	32	2 GB	Israel	4
Odroid C2	Amlogic A53	4	64/32	2 GB	Israel	1
Scaleway C1	Armada 370/XP	4	32	2 GB	Paris, France	4
HP Moonshot M400	AppliedMicro	8	64/32	64 GB	Houston, TX	20
Packet Type 2A	Dual Cavium TX	96	64	128 GB	Amsterdam	~100
Packet Type 2A2	Huawei HiSilicon	64	64/32	128 GB	Amsterdam	~100

Table 1: Android in the Cloud Implementations

**Android in the Cloud service cost - Scaleway C1 Cloud**

The Scaleway bare-metal **C1** Cloud service is powered by quad core ARM-compatible Marvell server SoCs, and is offered at a disruptive price point of 2.00€ / month. This includes a dedicated physical ARM SoC, 50 Gbytes of disk storage, unlimited Internet traffic and a private Scaleway IP number. Internet communication can be handled by VPS's tunneling from the public Internet. One **C1** server can support four Android images running isolated and securely in Linux containers. The cost per Android image, running 24/7, is 0.50€ / month.



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### Some End-User Cases for *Android in the Cloud*

Ascender's technology enables a whole new ARM ecosystem (Fig 1) supported by Cloud ARM servers.

Wearable Devices  
Mobile Enterprise Devices (BYOD)  
Desktop Clients  
App Library / Subscription Model  
WebGL Browser Based Implementations

IoT Devices  
Inexpensive Mobile Devices  
Cloud Gaming  
Set-Top Boxes  
Automated Testing

### Ascender's *Android in the Cloud*

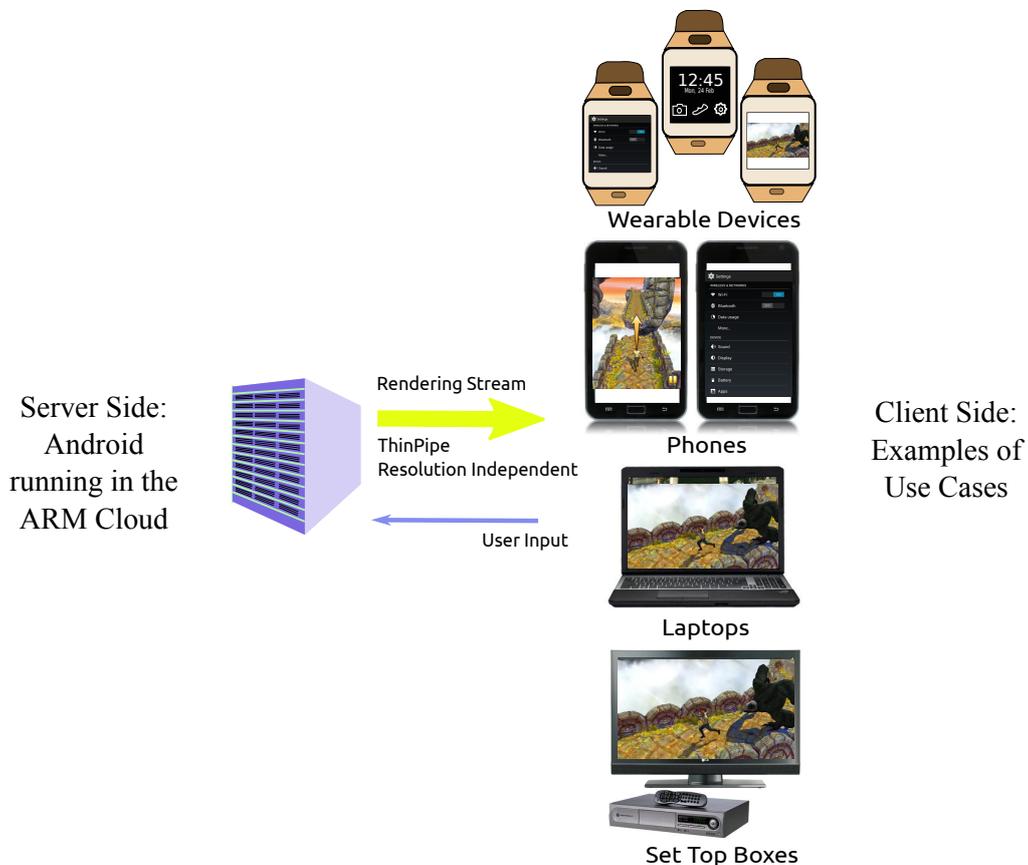


Figure 1: *Android in the Cloud*