The One Universal Graph – a free and open graph database

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Abstract. Recent developments in graph database mostly are huge projects involving big organizations, big operations and big capital, as the name Big Data attests. We proposed the concept of One Universal Graph (OUG) which states that all observable and known objects and concepts (physical, conceptual or digitally represented) can be connected with only one single graph; furthermore the OUG can be implemented with a very simple text file format with free software, capable of being executed on Android or smaller devices. As such the One Universal Graph Data Exchange (GOUDEX) modules can potentially be installed on hundreds of millions of Android devices and Intel compatible computers shipped annually. Coupled with its open nature and ability to connect to existing leading search engines and databases currently in operation, GOUDEX has the potential to become the largest and a better interface for users and programmers to interact with the data on the Internet. With a Web User Interface for users to use and program in native Linux environment, Free Crowdware implemented in GOUDEX can help inexperienced users learn programming with better organized documentation for free software, and is able to manage programmer’s contribution down to a single line of code or a single variable in software projects. It can become the first practically realizable “Internet brain” on which a global artificial intelligence system can be implemented. Being practically free and open, One Universal Graph can have significant applications in robotics, artificial intelligence as well as social networks.

1. Introduction
Recent development in graph database mostly are huge projects involving big organizations, big operations and big capital, as the name Big Data attests. Recently, Fernandez et al [1] gave a comprehensive overview on Big Data, outlining the states of the art and future challenges. An ironic fact regarding Big Data is that, the development involves only a small number of people from the population, i.e. highly trained scientists, programmers, engineers, investors and managers running the projects. In this paper, we propose a radical approach to Big Data that reduces the “barrier of entry” so that more users and programmers can contribute to Big Data. In fact, we also propose to implement an obvious but little known property of graph database, that is, only one graph is required to connect to all accessible data on the Internet. Based on this property, we call our work One Universal Graph, and its implementation One Universal Graph Data Exchange (GOUDEX) (https://github.com/udexon/goudex, http://bit.do/goudex).

The outline of this paper is as follows:
(i) We begin our paper with a simple but perhaps surprising example that highlights the shortcomings of major websites like Alibaba.com and Twitter, i.e. How a user faces difficulties in finding “fish” of ordering quantity below 1 metric tonne on Alibaba.com, and solves this problem using GOUDEX to merge data from Alibaba.com and Twitter.com.

(ii) We next demonstrate how GOUDEX can scale to include hundreds of millions Android devices and Intel compatible computers shipped annually, using a latest virtualization technology called GNURoot, that enables native Linux distributions to run without root access on Android devices.

(iii) We then propose Free Crowdware (FCW), a term we coin encompassing free software and crowd computing. We show how GOUDEX Free Crowdware can be used to manage individual user or programmer’s contribution down to one line of code or a single variable. We also show a web user interface (WUI) that helps younger phone users who are not familiar with keyboard and terminal interface to learn Linux.

(iv) After discussing GOUDEX potential to develop Free Crowdware applications for processing web data, we turn our attention to computing intensive applications, by demonstrating an OpenCV example, running within GNURoot on an Android device.

(v) We then explore the future of computing based on some latest development related to the Linux operating systems, notably the possibility of eliminating the Android environment or merging it with native Linux distributions, as the silicon footprint of devices get smaller (e.g. Next Thing Co.’s $9 CHIP card-sized Linux-ARM computer.)

(vi) We also propose a novel business model for Android/Linux device manufacturer where GOUDEX could be deployed for “processor time trading” i.e. selling CPU time of unsold devices, or renting instead of selling devices to customers.

(vii) Finally, we briefly mentioned how GOUDEX may lead to the first practical implementation of “Internet brain” that can lead to novel artificial intelligence and robotics applications and research.

We wish to remind readers that as some concepts we establish in this paper are novel, we will compare the relevant systems after a novel concept is introduced.

2. GOUDEX: A Free and Open Graph Database

2.1. A Preliminary Example – Price comparison

We start by describing a price comparison application using GOUDEX, where data from Alibaba.com and Twitter are merged, overcoming some of the most common problems with E-commerce websites. We choose this as our first example for its simplicity in order to illustrate the principles of GOUDEX. We then explore in details concepts and mechanism in GOUDEX.

Although being one of the largest electronic website in the world, we wish to highlight some rather surprising fallback in Alibaba.com, and by extension, other similar websites. For example, when searching for “fish” (see figure 3) or “cabbage” (see figure ??), the first few pages of search results did not show anything whose minimum order is less than 1 metric tonne. In-depth investigation as to why this occurred and its consequence is beyond the scope of this paper and could be a significant research by itself. We hereby propose and show how this problem can be overcome using GOUDEX.

Figure 1 shows a typical scenario of a user accessing a web server. Figure 2 shows the operations of GOUDEX. The definitions of GOUDEX are given in table 1.

In example 1, User #1 (U1) saved Alibaba.com search results for “fish” as file #1 (F1). OUGM module #1 (OM1) is a process which copied F1 to the working directory (WD1) on OUG Node #1 (OUGN1).
Figure 1. A typical web session.

Figure 2. Operations of GODEX.
### Table 1. GOUDEX Definitions

| Term   | Definition |
|--------|------------|
| OUG    | One Universal Graph (OUG) is a graph where all observable objects are connected. |
| OUGM   | OUG Module(s): A set of programs (processes) which copy, store and manage data users retrieved from web servers. |
| OUGN   | OUG Node: A physical device or virtual machine, executing OUGM. |
| GOUDEX | “One Universal Graph Data Exchange”: is a collection of OUGN. |
| OUGDB  | “One Universal Graph Database”: is a collection of text files or equivalent database files which implement OUG, being managed by OUGM. |
| FCW    | Free Crowdware |

**Example 1:**

```
node_ID timestamp user transaction id other data json etc
OUGN1_2015-02-16T23:56:58+0800 U1 54e2134a52001 u_php/cp  
"Fish-Fish Manufacturers, Suppliers and Exporters on Alibaba.comFish.html"  
tmp_d/o_54e2134a40001
```

User #2 (U2) saved "twit" by Twignu as file #2 (F2). OUGM module #2 (OM2) is a process which copied F2 to the working directory (WD2) on OUG Node #2 (OUGN2).

**Example 2:**

```
node_ID timestamp user transaction id other data json etc
OUGN2_2015-02-16T23:59:28+0800 U2 54e2134a52002 u_php/cat  
"Twignu Twitter Keli catfish, Kuala Pahang, RM3 per kg..html"  
tmp_d/o_54e2134a40002
```

OUGM module #3 (OM3 running on OUG Node #3 (OUGN3)) retrieved F1 and F2 from OUGN1 and OUGN2 respectively. It then parsed F1 and F2 using simplehtmldom.php and saved the results in json format in files J1 and J2. OM3 used Datatable javascript library to read J1 and J2, and display them using the Firebox browser as in figure 5.

```
OUGN3_2015-02-17T00:03:20+0800 U3 54e2134a52003 u_php/merge  
OUGN1:o_54e2134a40001 OUGN2:o_54e2134a40002
```

We shall discuss the detailed concepts and mechanisms of GOUDEX in subsequent sections. We just wish to highlight for now the justification of equating OUGDB as graph database: A web page has an address and contents stored in HTML format. The examples of OUGDB as shown above include node ID and URI (filenames being a subset of URI) in one single record (one line of text, or equivalent). The node ID is used by OUGM and OUGN within GOUDEX in conjunction with URI to identify a data object. The implementation of OUGM may include graph database algorithms or non-graph database algorithms (e.g. traditional SQL type). As GOUDEX connects both graph-oriented OUGM and non-graph-oriented OUGM (represented by OUGDB), we assume non-graph database (e.g. traditional SQL type) as a subset of graph database, and therefore qualify OUGDB as graph database.

The readers may wonder about the relevance of the ability of general users processing web page data to graph database.

### 2.2. Scale of GOUDEX

Having considered a simple application of GOUDEX, ie. price comparison and illustrated some basic principles of GOUDEX, we shall now look into more details.

The two questions that we wish the readers to consider are:
Figure 3. Search results for “fish” on Alibaba.com.

Figure 4. A fisherman in Malaysia tweeted his fish for sale.
(I) How big can GOUDEX scale?

(II) What kind of applications can GOUDEX deliver?

To answer the first question, we shall look into GNURoot [2], a breakthrough in virtual machine implementation on the Android operating system.

After looking at the answer for the first question, we shall describe how GOUDEX can be used to implement “Free Crowdware”, a novel software collaboration model where GOUDEX is used to manage contributions by individual users or programmers as microscopic as one line or one variable.

2.3. Virtualization and GNURoot

Figure 7 and table 2 show the shipments of (Intel compatible) computers [3] and Android devices [4] in recent years, respectively.

Recently, an Android app called Gnuroot implemented what essentially the functions of chroot (a virtualization tool in Linux) are as a user app, without requiring users to acquire root access.
to the Android device. With it, most packages in the Debian and other Linux distributions can now run on Android devices without rooting the device.

A similar work on Android virtualization can be found in et al [5][6]. Wessel et al [7] and Li et al [8] investigated the role of virtualization in security applications. Kulkarni et al [9] gave a concise survey on virtualization techniques used in mobile devices.

The authors see this as what Android should have been since its birth, or the best thing ever happened since Android itself.

Amongst the endless possibilities, here are a few major applications of an “Android chroot” GNURoot environment:

(i) Every Android device can be used as a fully functional Linux server, capable of running GCC, python, web servers, MySQL server etc.

(ii) Android devices can be a new platform to educate users and programmers free software tools.

2.4. Free Crowdware

With GNURoot enabling potentially hundreds of millions of Android devices as GOUDEX nodes, user interface and documentation remain the two biggest hurdles which must be overcome. Fortunately GOUDEX and OUG themselves provide solutions to these problems.

We coin the word “Free Crowdware” (FCW) from “free software” and “crowd computing”. As discussed in previous sections, OUGDB can assign a unique node ID each of the physical devices or virtual machines connected to GOUDEX. (Some users may implement GOUDEX on their own intranets, isolated from the Internet.)

The debate over the choice of Command Line Interface (CLI) and Graphical User Interface (GUI) has faded in recent years, perhaps due to many factors, one of which might be described
as “the hardening habits of a relatively diminishing community (programmers)”. By this, we meant the following:

(i) The huge growth of mobile devices created more ordinary users faster than programmers.

(ii) Although the absolute numbers of programmers might be growing, its ratio over the number of users would be shrinking. (“relatively diminishing community”)

(iii) As the number of free software projects grows (indicated by github.com or similar websites), we notice that the most popular compiling tools are still CLI based (e.g. cmake, git, etc.), despite the growing number of Android or other GUI applications. (“hardening habits”)

The lack of statistics, or the difficulties in generating statistics for the above example, is yet another application that GOUDEX can readily deploy. By using the same principles and mechanisms we used for the price comparison example above, we can easily extract statistics from software project websites like github.com or similar websites.

As we can see from the two examples mentioned so far, ie. price comparison and programmer statistics, we may assume that there are many other applications for extracting and processing data from websites that can be developed using GOUDEX. Suppose we are able to manage the microscopic contribution from individual users or programmers, down to one line of code or a single variable, using GOUDEX, then the unit cost of individual (user or programmer) contribution will tend towards zero. In fact, the Free Software or Open Source repositories
Figure 8. A prototype of Web based User Interface for Android GNURoot, where user entered the command ‘lsl *’ (a PHP implementation of ‘ls -l’).
Documentation on a specific topic (e.g. “php preg-match”) are “scattered” across many unrelated and unorganized websites. As with the GOUDEX applications above (price comparison and web data processing), GOUDEX can be used for the following tasks, in order to help users and programmers when accessing documentation:

(i) Authors or any readers can extract and mark the update time of a documentation page, and store this in OUGDB. This will help other readers when looking for documentation on a certain topic in chronological order.

(ii) Authors or any readers can create a list of related documentation pages, and store this in OUGDB. This will help other readers to quickly understand a certain topic by looking at the documentation pages, already organized by other experienced readers or authors.

(iii) Readers can provide feedback or corrections on a certain documentation page, and store this in OUGB. This is useful especially when the original author published his or her article on web pages without capabilities for commenting. Other readers may then find the latest, corrected information easily.

(iv) Readers may vote for a certain documentation page, and the results are collected on OUGDB. This will help other readers find the best documentation.

The features described above are in fact rather “trivial” (technically) for the programmers under employment by the giant website operators. However, monolithic management prevented such creativity to be implemented. As such, GOUDEX has the potential to make the Internet a level playing field, by providing an intermediate platform to share the data from any websites (hence the name “One Universal Graph”), i.e. “if you (company owning website) do not want to implement this feature, I (any user or programmer) will just do it myself with GOUDEX.”
2.5. Miscellaneous GOUDEX Applications

Bollacker et al [10], Ciglan et al [11] and many other authors [12] developed graph database software for various different applications. We wish to highlight two rather ironic facts regarding existing graph database systems:

(i) Can the graph database software itself be used to track user statistics?
(ii) Can the graph database system exchange data easily with other graph database systems?

These are amongst the questions we wish to address in this paper.

Here we recap the potential applications of GOUDEX as we have discussed, and generalized the principles to other useful applications:

(i) price comparison
(ii) extract and process web data (programmer and project information from websites like github.com)
(iii) building web based user interface (WUI) on Android for software development (Free Crowdware/FCW)
(iv) enhancing documentation systems for free software projects

Other potential applications of GOUDEX may include:

(i) A “better” search engine than Google: Most recent development on “better search engine” have been based on enhancement of algorithms (and the associated data structure) (eg. Anmol Tukrel’s recent news [13]). GOUDEX provides a radically different approach – it provides a platform for ALL programmers in the world to SHARE data AS WELL AS algorithms. All algorithms contributed to GOUDEX will be collaborative and collectively improving, rather than competitive (“winner takes all”). In fact, by the very nature of “One Universal Graph”, ie. “one graph is all that is required to connect all accessible web data”, any code every written by any programmers can be included into GOUDEX repositories. Even if the programmer does not wish his (or her) code to be included in GOUDEX, he (or she) will not be able to stop others reusing the results from his (or her) program execution that is published on the web. And even if, this (selfish) programmer manages to conceive a law to prevent GOUDEX from reusing the data from his program (published on the web), the collective intelligence of other programmers participating in GOUDEX is likely more competent than the “lone and selfish” programmer. In fact, we may view existing giant technological companies as entities similar to GOUDEX, only sharing data and knowledge amongst their employees and partners. The success of Android operating system itself is proof that free software or open source project can and has outdone any single closed entity such as a company. GOUDEX and Free Crowdware has the potential to extend the power and creativity of free software programming to more users and programmers, by reducing the “barrier of entry” of individual contribution down to one single line of code or a single variable.

(ii) “Better” picture searching or sharing applications: Many social networks based on sharing of photographs have gain large number of users in recent years. These include Facebook, Twitter, Instagram, Snapchat, Flickr to name just a few. However, just like how the GOUDEX price comparison application above extends the functionalities of Alibaba.com and Twitter, GOUDEX can add many rather “simple” functionalities which would otherwise almost impossible given the monolithic nature of decision making within these technological giants. For example, GOUDEX can catalog the photographs on these social networks by the number of “likes” or “shares” or equivalent, apply certain time period information, or geographical criteria. One potential application that can benefit many small business
owners is a “Selfies Contest”, where small business owners, eg. restaurant operators, give customers who manage to get a high count of “likes” or “shares” on their selfies, a discount or free gift as incentive. The costs of this advertising method is nearly zero, and similar methods has only been used by some large corporations to date.

(iii) “Better” news search engine: The principles of making a “better” news search engine are rather trivial – sort by time and location. However, it may dismay future historians that such features have not been implemented by technological giants such as Google or Yahoo! circa 2015. Again, as we have mentioned several times previously, such features which were prevented by monolithic corporate decision making hierarchy can be easily done using GOUDEX.

(iv) In all the examples above, data are extracted from various independent websites and merged into OUGDB, making GOUDEX one common repository for all, making it very useful.

(v) The examples in previous sections use published data on the web. GOUDEX can also be used to connect “the back end” database servers directly, as figure 2 shows.

(vi) Table 3 shows a brief comparison of GOUDEX vs. existing popular “cloud” applications. It is clear that GOUDEX satisfy all the significant criteria of being open, applicable to both data sharing as well as application development.

2.6. Section Summary

We now summarize the discussions on GOUDEX so far, and present several technical elaborations, before proceeding to more applications of GOUDEX in the following sections.

Figure 1 shows a typical scenario of a user accessing a web server. Figure 2 shows a scenario of GOUDEX. GOUDEX operates as described below:

(A) In every second, billions of http connections are made from browsers on computers as well as mobile devices.

(B) Suppose S% of the web pages retrieved in (A) are saved on hard disks or SD cards.

(C) The web pages saved in (B) are in HTML format, assuming the browsers interpreted the Javascript code correctly.

(D) The web pages in (B) are loaded using a PHP script and parsed with simplehtmldom.PHP library or equivalent.

(E) Each node in parsed in (D) can be converted to a PHP associative array or vice versa.

(F) New elements can be added to each of the associative array or nodes in (E).

(G) The computers and mobile devices in (B) are equipped with PHP and web server to serve the data in (F) to the Internet.

(H) We define the network of computers and mobile devices in (G) as GOUDEX and its data One Universal Graph.

| System     | Functions                              |
|------------|----------------------------------------|
| BitTorrent | Data only                              |
| File Sharing | Data only                              |
| Bitcoin   | Single Application                     |
| Google Drive | Limited Applications, has API         |
| GOUDEX    | Open, for data & unlimited applications |
The most significant advantage of GOUDEX arises from its ability to extract data from multiple sources, process them, **REFORMAT** and **PUBLISH** on the web.

To show the significance of **OUG data versus all data on the Internet**, we begin by considering Berkeleys (1710) tree falling conjecture [14], which has been paraphrased as,

“When a tree falls in a lonely forest, and no animal is near by to hear it, does it make a sound? Why?”

We would modify the original postulate as the following:

(i) Let a visitor to a web site (using a browser or equivalent application on a computer or a mobile device) be analogous to a visitor to a forest.

(ii) Let the web page viewed by the visitor be analogous to a leaf on a tree.

(iii) The forest visitor touches but do not remove the leaf on the tree.

(iv) The forest visitor make a copy of the leaf (using some advanced 3D printing technology) and place the leaf in a box. One thousand visitors visit the forest, each making a copy of one leaf, and place them in the box.

(v) The practical and philosophical questions now become:

(a) Are the leaves in the box more useful to the next visitor than the leaves in the forest?

(b) Are the web pages (or objects) cached by GOUDEX more useful to the next visitor than the web pages of the whole of the Internet?

(c) We may now attach commercial value to each leave or data object:

If no one else is interested, it has no value.
If others are interested, the first and subsequent sharers can gain value, besides the owner of data.

As an analogy to “middleware”, we may call OUG a middlebase or middle layer database, as illustrated in figure 2. We now consider a simple inference to prove the **One Universal Graph property**, although a complete mathematical proof is beyond the scope of this paper i.e.

(I) All observable and known objects and concepts (physical, conceptual or digitally represented) can be connected with only one single graph.

(II) Only one graph is required to connect to all accessible data on the Internet.

**Proof for the One Universal Graph property:**

(i) Let each connection from a user to a website in figure 2 be represented by an edge.

(ii) Let each edge be split into two edges, and connected in the middle with a node, namely OUGN (see table 1).

(iii) As each OUGN as a fully qualified node with an IP (Internet protocol) address, therefore it can be connected to other OUGN on the Internet.

(iv) As such, all the OUGN can be connected into **ONE graph**, thus satisfying the One Universal Graph property.
2.7. Big Data for “Small People”

Let us discuss the theme of “Big Data for Small People” further by looking at the farmers behind the price comparison above. As the readers may have realized by now, Big Data has huge potential for the “small people” neglected by “Big Corporations” so far. We demonstrated how Free Crowdware can enable more individual users and programmers contribute to Big Data using GOUDEX. We now look the producers, i.e. farmers whose produce actually contribute to “real economy” in a society.

Along Pahang River in Malaysia, patin fish are grown in floating cages. Typically, patin fish are sold at supermarkets at under RM10 per kg. Let us consider 2 practical questions:

(i) Suppose some one who lives in Pekan, a town at the downstream of Pahang River, wishes to buy 1kg of patin fish from the breeder, which web services can he use?

(ii) For the fish farmers wish to advertise his produce, which websites would they use?

Most users are accustomed to giant E-commerce websites like Amazon, eBay or Alibaba. Small farmers in Malaysia and many other developing countries are typically teams of family members, usually less than 5. They lack the training and motivation to advertise on giant E-commerce websites, besides facing the “long tail effect” where search results only show big players at the top, and these mainstream E-commerce websites do not provide sufficient search functions to zoom into small and local vendors, which future historians may deem an inexplicable mystery given the advancements in technologies.

Although lacking training or motivation to advertise on mainstream E-commerce websites, family members of farmers, especially the younger ones, would use social media such as Facebook or Twitter. In our example, a fictitious fish farmer posted his harvest on Twitter. A GOUDEX script extracted the information, and merge it with search results from Alibaba (see figure 5).

The significance of the example above must not be underestimated, for the following reasons:

(i) Small farmers form a large percentage of global population. Their income can be improved significantly using the GOUDEX solution above. Every percentage point in the sales price of their products, could be improvement of multiple of 10% of their profit, as their profit margin could be as low as 10%.

(ii) The improvement in farmers income provide significant new sources of revenues for programmers, especially individual, free software programmers.

(iii) Mainstream commentaries on benefits of Big Data applications are mostly concerned with large corporations. GOUDEX provide a refreshing perspective on how Big Data (“in small ways, by small people, for small people”) affect “small users” (small farmers, small producers, small businesses) and individual programmers, who may contribute their efforts for free.

(iv) To put the arguments above in plain languages: We are not concerned primarily about how many more billion US dollars can Big Data bring to billionaire shareholders of billion dollar Corporations. We are more concerned with how many more cents can free software programmers help billions (“Big Population”) of small farmers worldwide make everyday.

(v) The financial incentive to Free Crowdware programmers derived from helping smaller producers is actually significant, considering most Free Software programmers today do not generate any income from their software projects. Further, this will encourage more users and programmers to contribute to Free Crowdware (and by extension, Free Software).

3. The Future of Computing

As shown in figures 7 and table 2, the annual shipments of Android devices have exceeded personal computers by 3 folds (900 plus millions vs. 300 plus millions). The growth in Android
shipments may continue for several more years as devices are getting cheaper, where each customer in developed countries may purchase multiple units, and more customers in developing countries can afford it.

At the same time, several recent technological developments may have significant impacts on the future of computing:

(i) Meizu, a major Chinese smart phone manufacturer, ships Ubuntu Phone. [15]
(ii) CHIP, a Linux-ARM card-sized computer at $9, by Next Thing Co. [16] competes with Raspberry Pi.
(iii) Better understanding of virtualization: Android OS in Linux on Android device (see gmail).
http://whiteboard.ping.se/Android/Debian
(iv) Windows 10 ships for free [17].

The free installation of Windows 10 raises doubts in us if Windows might be discontinued in the future. From the technology perspective, the internal architecture of Windows is understood by a far smaller group of programmers and engineers (that of Microsoft’s and its partners), compared to the Linux kernel, which is open source. As such, our confidence in Windows being able to produce better innovations faster in the future (or in fact, in the past and present) has never been positive, despite Microsoft’s financial prowess. As Android shipments has exceeded PC shipments by 3 folds, Android devices will become the next battleground for operating systems (OSes). In fact, Android devices becoming a battleground for OSes would have been inconceivable without GNURoot enabling native Linux distributions (distros), as there would have been no other significant alternatives on the Android platform, as the requirement of “rooting the device” (gaining root access especially to the SD card partitions) to install alternative Android OS (such as Cyanogenmode) remains a huge hurdle for most programmers and users. The development (in terms of software development as well as user base and programmer participation) of GNURoot must be seen in conjunction with developments such as Ubuntu Phone as well as CHIP. Before we elaborate further, we wish to summarize our opinion by saying that these developments can significantly change investors’ perspectives on Linux.

Our first argument is that, CHIP will bring a price revolution to the current Android ecosystem (comprising manufacturers and programmers). As CHIP successfully shows that a Linux computer can be deployed at $9, it may induce or even shock existing Android manufacturers into making a cheaper smart phone than the existing Android phone. As Ubuntu Phone shows the manufacturers how native Linux applications can co-exist with Android tools and apps, manufacturers may start even considering the unthinkable:

- Why do we even need the Android operating system in the first place?

If manufacturers start dumping Android OS in order to make cheaper CHIP-style phones (by eliminating disk space and CPU requirements by cumbersome Android drivers), perhaps equally powerful as well, that will initiate an avalanche that may even kill Android as an OS within the next few years.

The roles that GNURoot can play in this “revolution”, or shall we say “coup”, as Android runs on a Linux kernel anyway, are educational as well as technical. Current download count for GNURoot on Google Play Store is “10,000 to 50,000”. No amount of theoretical arguments on virtualization can beat a live demonstration of GNURoot, as far as non-technical users, especially potential investors are concerned. GNURoot will help many programmers understand the issues of virtualization on Linux and Android better as it is open source. Such understanding will further help the transition or merging of Android with the native Linux environment, which we believe has been withheld by “monolithic shareholders’ interests” for a full decade since
Android’s inception. A decade in the fast paced technology world is one whole generation if not more. Future historians may surmise how such intense human selfishness could have originated from the most intelligent brains amongst the richest companies on Earth, thus delaying perhaps one of the most significant technological progress in modern history.

3.1. Processor time trading (PTT) A Truly Free and Open Cloud
One of the potential application of GOUDEX is processor time trading (PTT). Consider the scenario in which a large number of Android device owners execute GOUDEX modules on their Android devices. This is as if the owners of Android devices are running their own cloud servers. GOUDEX can be used to connect manage not only Android devices. It can used to connect and manage permanently connected servers too. Manufacturers of Android or Linux compatible servers can turn the devices into profit centres, selling CPU time before the device is being sold to the customers. They may even allow the customers to opt for a “rent a device” model, so that the customers would pay less while the manufacturers (or their partners) generate income from selling CPU time.

3.2. Robotics and Artificial Intelligence
Vijaykumar et al [18] and Dietrich et al [19] proposed using graph database for robotics applications. While their works investigated robots as mechanical units dealing with large amount of data, GOUDEX provides a more flexible and comprehensive model, which encompasses theirs, as well as modeling the whole Internet as one giant brain. Although Goertzel et al [20] wrote about “internet intelligence”, we believe GOUDEX is perhaps the most practical and realizable system proposed thus far.

One of our proposals is to use GOUDEX to link existing online and offline robotics or artificial intelligence simulation (RAIS) systems to real world sensors (cameras and other sensors) as well as geographical data such as satellite maps. Our hypothesis is that human babies learn by interacting with real world. A baby would grow up to be a dumb adult if he or she is deprived of the opportunities to interact to the physical world, human beings, animals and plants. We may consider the existing RAIS as our “baby robots”, although they are “virtual”. This however, has the big advantage of real physical mechanical units as the “virtual baby robots” can access all the data on the Internet via GOUDEX, which of course can also be accessible to a physical robot connected to GOUDEX. We will use GOUDEX to manage the participants of this project.

4. Conclusions
In this article, we proposed OUG / GOUDEX, a free and open graph database, designed to connect and store all accessible data on the Internet. The initial implementation is based on PHP running on Linux servers. A virtualization tool called GNURoot enable GOUDEX to be executed on Android devices, thus making it possible to run GOUDEX on potentially hundreds of million of Android devices and Intel compatible computers shipped annually.

We looked at some obvious short comings of current major websites such as Alibaba.com and Twitter.com, and pointed how Free Crowdware, an application based on GOUDEX can extend their functionalities by third party user coding. We showed that how FCW can manage user contribution down to one single line of code or one single variable, and how it can help new users learn Linux or free software programming by organizing thus far unorganized documentation on the web.

Free Crowdware has the potential to change future programming trend from driven by user interface at present (Facebook differs from Twitter or LinkedIn very much in UI design only, rather than the data they carry), to data driven, controlled by individual users or smaller programming teams, compared to today’s technological giants.
GOUDEX also created a new business model called “processor time trading” which can position manufacturers in a leading role by selling processor time on its unsold devices or renting devices to users instead of selling them.

Finally, we briefly proposed using GOUDEX to create an “Internet brain” where future artificial intelligence system can be developed.

Being practically free and open, One Universal Graph can have significant applications in robotics, artificial intelligence as well as social networks.

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