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Everything as a Service(XaaS) on the Cloud: Origins, Current and Future Trends

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***Abstract*—For several years now, scientists have been proposing numerous models for defining anything "as a service (aaS)", including discussions of products, processes, data & information management, and security as a service. In this paper, based on a thorough literature survey, we investigate the vast stream of the state of the art in Everything as a Service (XaaS). We then use this investigation to explore an integrated view of XaaS that will help propose approaches for migrating applications to the cloud and exposing them as services.**

***Index Terms*—Everything as a Service; Anything as a Service; Cloud computing; SOA**

I. Introduction

New IT paradigm is increasingly shaped by various emerging trends especially Cloud Computing and Big Data that can be identified by different "as a Service (aaS)" models. The trend of providing everything as a service (XaaS) depicts a promising scenario where service-oriented architecture and design supports the development & deployment of software applications as services[1]. However, it has been verified [34] that in the last several years related terms in this area have been used arbitrarily creating some confusion. For example, Esteves [34] regarded XaaS as the universe of all cloud deliverable services; whereas, Robison et al. [78] proposed that *Everything as a Service* refers to the services that have been or will be migrated to the Cloud. This confusion should be avoided via a unified classification based on a clear understanding of the state of the art of various "aaS". None of the existing literature or efforts has yet dealt with this issue, which demands a survey covering the broad existing work that extends back to the very early notions of services. Based on the hypothesis that the classification under the name of "aaS" partially reflects the trends of natural evolution of services sharing common characteristics, we present in this work our literature survey towards describing a technical classification of various "aaS" which include explicitly focused "aaS", mentioned "aaS" and implicitly derived "aaS" covering the work from traditional IT applications. Through the survey on various "aaS", we propose the following contributions:

1) Provide a historical understanding of various sources of "aaS" which would help to forge a clear meaning of "XaaS" as an active and continuously evolving concept.

2) Alongside the general development routine of "$SaaS \rightarrow PaaS \rightarrow IaaS \rightarrow DaaS$", we will explain the formation of existing "aaS" in the Cloud, the migration of them to the Cloud and their durations, and the prediction on the trends of the formation of new "aaS" in the Cloud.

The rest of the paper is structured as follows: Section II presents our survey method and operation process. Section III shows origin of "XaaS" with collected "aaS" and empirical classifications. Section IV analyzes the relationship among "aaS" and trends of application migration towards the Cloud. Section V concludes the work with future directions.

II. Survey Method

We consider DBLP [2] as the primary search tool. The search words include "as a service" and "as-a-service". In addition, we also browsed the following databases:

1) IEEE Xplore Digital Library http://ieeexplore.ieee.org/Xplore/home.jsp

2) ACM Digital Library http://dl.acm.org

With the keywords and different databases, we snapshot first 500 items in each database and select about 100 papers full text for further analysis. The selection criteria include:

1) Selecting from as many papers with different uses of the "* as a Service" terminology as possible. During the searching process, we introduced keywords like "XaaS", "*aaS", "EaaS' and even "as services".

2) Excluding disturbing papers, for example, papers including "* as a Service" but focusing on "as a service system", "as a service archive", "as a service voter", etc.

While reading existing papers, we also searched earlier published papers from their bibliographies. In this way, we trace back to earlier related literature. We managed to keep the balance between literature in the pre-Cloud era and the Cloud era. For example, we kept Database-as-a-service model proposed in [42] in 2002 when database was not yet proposed as a Cloud service, while retaining DaaS proposed in the Cloud.

III. Sources, Origin and Types of Various "aaS"

A. Information collection

Figure 1 shows that most of the surveyed papers are proceedings or journal articles and a few of them are technical

[1] http://en.wikipedia.org/wiki/Service

[2] http://dblp.uni-trier.de

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reports and books.

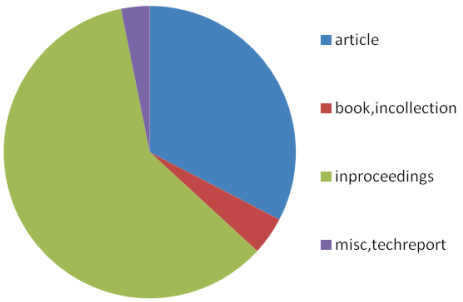

Fig. 1: Distribution of surveyed literatures

TABLE I: Origin, type and strength of various "aaS" by year

Year	Literature	Type	Source of "aaS"	EMD	Abbr.
1984	Ives and Learmonth [47]	traditional	information	E	
1988	Howson et al. [45]	traditional	mathematics	E	
1997	Beaumont et al. [8]	traditional	ownership	M	
1999	Kailer and Scheff [51]	traditional	consulting	D	
			education	D	
			knowledge management	E	
2000	Bennett et al. [11]	SaaS,ASP	software	E	SAAS
	Sarawagi and Nagaralu [81]	Internet	data mining models	E	
2001	Edworthy [32]	traditional	health	D	
			telemedicine	D	
2002	Fano and Gershman [35]	traditional	medical care	M	
	Furmento et al. [38]	WebService	computational resource	E	
	Hacigumus et al. [42]	SaaS,ASP	database	E	
			database management	E	
2003	Figueiredo et al. [37]	programming	virtual cpu	M	
	Papazoglou [68]	SaaS	business process	D	
			transactions	D	
	Perrey and Lycett [74]	SOA	print	D	
			quote	D	
	Sirin et al. [84]	WebService	web service composition	D	
	Viroli and Omicini [93]	programming	coordination	E	
2004	Dunkels et al. [30]	programming	communication	M	
			function	M	
			program call	M	
2005	Laitinen et al. [55]	network	authentication	E	
			cellular authentication	E	
	Panlilio et al. [67]	traditional	health	M	
	Ott et al. [66]	WebService	experiments	E	
	Xu and Zhang [100]	SOA	knowledge	E	
			application	M	
			database	M	
2006	Gilart-Iglesias et al. [39]	SOA,WebService	industrial machines	E	IMaaS
	Lakshminarayanan et al. [56]	network	routing	E	
	van Deursen and Pieterson [91]	traditional	Internet	M	
2007	Bender et al. [10]	network	accountability	E	
	Bottaro et al. [14]	traditional	media rendering	D	
			washing machine	D	
	Dan et al. [27]	programming	data access	D	
		SOA	information	E	IaaS
	Emig et al. [33]	WebService	identity	E	
	Milanovic and Malek [61]	SOA	operating system	E	
	Papazoglou et al. [69]	SOA	function	D	
2008	Aymerich et al. [6]	Cloud	hardware	E	HaaS
			platform	E	PaaS
		SaaS	software	E	SaaS
	Dwivedi and Kulkarni [31]	SOA	data	M	
			data analytics	M	
	Robison et al. [78]	Cloud	everything	E	
2009	Agrawal et al. [2]	Cloud	database management	E	
	Cai et al. [16]	Cloud	commerce	E	CaaS
	Grossman et al. [41]	IaaS	storage	E	
	Itani et al. [46]	Cloud	privacy	E	PaaS
	Jansen et al. [48]	programming	component	D	
			functionality	D	
	Kaufman [53]	Cloud	application	M	
			business process	M	
			UML modeling tools	M	
		IaaS	hardware	M	
			IT infrastructure management	M	
		SaaS	custom relationship management	M	
			middleware	M	
	Maamar and Badr [59]	SaaS	social network	E	SNaaS
	Patel et al. [70]	Cloud	computing resources	M	
		Cloud,SOA	infrastructure	M	IaaS
		SOA	functionality	D	
	Pauwels et al. [71]	traditional	dashboards	E	
	Rimal et al. [77]	Cloud	infrastructure	E	IaaS
			business	M	BaaS
			database	M	DaaS
			desktop	M	DaaS
			development	M	DaaS
			framework	M	FaaS
			organization	M	OaaS
	Rodríguez et al. [79]	Cloud	videoconference	E	VaaS
	Singh et al. [83]	Cloud	search	E	
	Truong and Dustdar [87]	Cloud	storage	M	
		SaaS,WebService	data	E	
	van der Aalst et al. [90]	SOA,WebService	flexibility	E	FAAS
2010	Bruneliere et al. [15]	SaaS	modeling	E	MaaS
	Candea et al. [18]	Cloud	automated software testing	E	TaaS
	Craciunas et al. [26]	Cloud	information acquisition	E	
	Dawoud et al. [28]	Cloud,SOA	component	M	
	Doerr et al. [29]	traditional	music	E	
	Kaliski Jr and Pauley [52]	Cloud	risk assessment	E	
	Tsai et al. [89]	IaaS	communication	M	
			computing	M	
		PaaS	development	M	
			modeling	M	
			testing	M	TaaS
		SaaS	design	M	
			Email	M	
			ERP	M	
			Office	M	
			user interface	M	
	Wang et al. [94]	SOA	process	E	
	Wood et al. [98]	PaaS	disaster recovery	E	
	Wu et al. [99]	cloud	virtual machine	D	
	Yu et al. [102]	SaaS	testing	E	
2011	Aho et al. [3]	Cloud	IDE and hosting	E	
	Alabbadi [4]	cloud	education and learning	E	ELaaS
			IT	M	ITaaS
	Amelung et al. [5]	WebService	E-assessment	E	
	Banerjee et al. [7]	Cloud	IT management	D	
	Beimborn et al. [9]	SaaS	Application based PaaS	E	aPaaS
	Chen et al. [22]	SaaS,PaaS	continuous analytics	E	CaaS
	Chen et al. [20]	Cloud	routing	E	RaaS
	Christophe et al. [23]	WoT,Cloud	Things	E	
			environment	M	
	Howe et al. [44]	PaaS	database	E	
	Mizusawa and Kitsunezaki [62]	Cloud,network	hybrid network	E	HaaS
	Nascimento et al. [63]	Cloud	IP networks	E	
			virtual routers	E	
	Peraković et al. [72]	Cloud	secure communication	D	
	Senk and Dotzler [82]	SaaS	authentication	E	AaaS
			Biometric authentication	E	BioAaaS
	Subashini and Kavitha [85]	Cloud	capabilities	D	
	Feng et al. [36]	Cloud,network	networking	E	
		programming	network protocol	M	
	Wang et al. [95]	SOA	cashier	E	CaaS
2012	Agmon Ben-Yehuda et al. [1]	IaaS	resource	E	RaaS
	Grier et al. [40]	SaaS	exploit	E	
	Horey et al. [43]	IaaS	big data platform	E	
	Rajagopalan et al. [75]	Cloud	disaster tolerance	E	
	Tsai et al. [88]	Cloud	threat	E	
2013	La et al. [54]	SaaS	component	E	
	Wong et al. [97]	Cloud	MPP database	E	MPPDBaaS
			OLTP database	M	
			Parallel database	M	
	Zargari and Smith [103]	Cloud	auditing	D	
			forensics	E	
			policing	E	
2014	Bitterman et al. [12]	Cloud	E-commerce	D	
		Internet	integrated AAA	D	
		SaaS	simulation	E	SMaaS
		WebService	modeling	D	
			training	D	
	Black et al. [13]	Cloud,SOA	E-health	E	eHaaS
	Caminero et al. [17]	WebService	laboratories	E	LaaS
	Chang [19]	SaaS	business analytics	E	BAaaS
			business intelligence	E	BIaaS
			heston volatility and pricing	E	HVPaaS
	Jingliang et al. [50]	Cloud,BigData	analysis	E	AaaS
			value	E	VaaS
	Chen et al. [21]	Cloud,IoT	data	E	DaaS
			information	E	InaaS
			knowledge	E	KaaS
			wisdom	E	WaaS
	Chu et al. [24]	SOA,SaaS	traffic analysis	E	
	Cicic and Elmokashfi [25]	Cloud	media network	E	MNaaS
			telepresence	E	TPaaS
	Jin et al. [49]	Cloud	content delivery	E	CoDaaS
			content distribution	M	CoDaaS
	Lomotey and Deters [58]	Cloud,SOA	analysis	E	
	Perera et al. [73]	Cloud,IoT	sensing	E	
	Liu et al. [57]	Cloud	consistency	E	CaaS
	Varadharajan and Tupakula [92]	IaaS	security	E	
	Yao et al. [101]	SaaS	hospital information software	E	HI-SaaS

Table I shows our sorted sources of various "aaS" in the time order from the earliest to the newest. We denote the strength of the relativeness of different from strong to weak with symbols of E(explicit), M(mentioned) and D(derived) as are explained in Table II.

We keep the original proposed abbreviation of the "aaS" in the column of "Abbr.". For example, we keep "SAAS" which is created by Bennett et al. [11] for Software as a Service instead of replacing it with "SaaS". We filter those literatures which only propose an abbreviation of "aaS" without any other content.

TABLE II: Strength of the surveyed ”aaS”

Abbr.	Explanation
E	**E**xplicit: ”aaS” is explicitly investigated.
M	**M**entioned: ”aaS” is mentioned but not in depth.
D	**D**erived: we derived “aaS” based on the content.

B. Types of ”aaS”

Classifying ”aaS” is a challenging work since it involves evolving terminologies. During the covered period from 1984 to 2014, the meaning of the ”aaS” has been continuously evolving. For example, software is proposed as a service in 2000 however it is redefined in NIST’s definition [60] as a Cloud service. So we classify the former appearance of ”SAAS” in 2000 under ASP (Application Service Provider) and classify the latter appearance under Cloud. Towards revealing the concept of ”aaS”, based on our survey, we empirically identify the following types of ”aaS” as classifications (which, however, may be overlapping). In this manner we keep the complete evolutionary meaning of every “aaS” and will also provide clues on service evolution and migration towards the Cloud.

⋆ **Traditional [80]** These services are provided either by individual people directly with concrete actions, or nominally by institutions/society at conceptual level but still implemented by real people who interact with end users.

⋆ **Network [96]** The services are applications running at the network application layer and above which are based on application layer network protocols for provision of data storage, manipulation, presentation, communication or other capability in an end to end/server architecture.

⋆ **ASP** [86] The services are provided under the Application Service Provider (ASP) model.

⋆ **Internet [65]** The services are delivered through Internet.

⋆ **Programming [76]** The services are used in the context of programming, operating system and as a daemon process in a computer system by a process to response to users’ requests.

⋆ **SOA [68]** The category marks services which follow the design pattern of Service-Oriented Architecture in which distinct pieces of software provide application functionality as services to other applications via a protocol.

⋆ **Web Service [64]** It refers to software functions, at a network address with machine-processable format of interfaces, provided over the Web with Web-related standards.

⋆ **Cloud [78]** These ”aaS” are proposed under the paradigm of Cloud Computing which aims to leverage utility and consumption of computing resources specifically related to public, private or hybrid cloud infrastructures.

- **IaaS:** The services provide computing resources such as virtual machines, servers, storage, load balancers, networks, etc, with scalability according to customers’ requirements.
- **PaaS:** The services deliver computing platforms including operating system, programming language execution environment, database, and web server onto the Cloud infrastructure without the cloud users’ need to allocate resources manually.
- **SaaS:** The services are referred to as “on-demand software” where the Cloud takes over the infrastructure and platform while scaling automatically.

⋆ **Internet of Things (IoT)[3]:** The services represent the utility and resource perspective capability of the Internet of Things (IoT) which converges technologies such as cloud and mobile, partially relying on uniquely identifiable embedded computing devices within the existing Internet infrastructure.

⋆ **Web of Things (WoT)[4]:** The services sit at a web scale layer above the IoT where real world objects and cloud services interact through the web.

IV. The Analysis

A. Statistical analysis

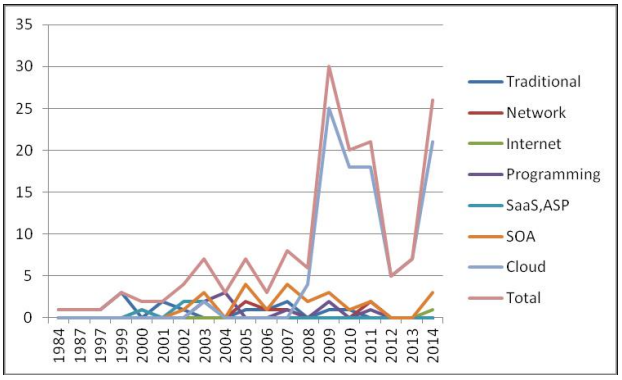

Fig. 2: “aaS” proposed by year

Figure 2 shows the curves representing the amount of the proposed ”aaS” categories in each year. The growth, top, fall and the horizon of each curve represents the different current states of each ”aaS” categories ranging from the growth phase, the top, the falling stage to the stabilized phase. In general we can see that ”aaS” as a whole has just experienced a sharp grow from 2007 to 2009. After reaching the top at 2009, the general curve experienced two stages of falling from 2009 to 2012. After 2012, the curve begins to grow again with increased acceleration until now. This falling at 2009 and the subsequent raises and falls surprisingly coincides with the **Global financial crisis**[5] in 2009 and the subsequent remedy effort and struggles also coincides with the **Great Recession** which lasted until 2012 following the financial crisis. Based on the observation that the application of IT technologies is very sensitive and interactive with the social economic development, we boldly propose that the general curve of the ”aaS” reflects the investment and strategy on ”aaS” related researches in both academic and industry with a delay of months. If this assumption is further confirmed, we can predict the trends of ”aaS” from the financial data.

Table III shows a statistical view of surveyed “aaS” in the time order from the earliest to the newest. The labels of ”a, b, c, d, e...” are used to mark the situations where the counting includes the situation that more than one “aaS” appeared in a single paper. We can observe an increase of the counted amount from the left corner down to the right corner. The data forms a general direction that traditional services and old

[5]http://en.wikipedia.org/wiki/Global_financial_crisis_in_2009

IT services in the higher part of the table are migrating to the SOA implementation and the Cloud platform in the lower part. Therefore we raise the following hypothesis:

Service migration hypothesis: During the year past and in the years ahead, services are migrating from traditional areas and old IT infrastructure to the more advanced SOA pattern and the Cloud.

We can also observe a branch of this general trend which directed from "aaS'' of SOA to "aaS'' of the $Cloud$. We would like to propose that the services applying SOA partially contribute to the forming of a ecosystem which fuels the service migration to the Cloud. We find that only part of SOA and Web Service based services were moved to Cloud environment, partially because some former services are proposed on the conceptual level and are not further developed.

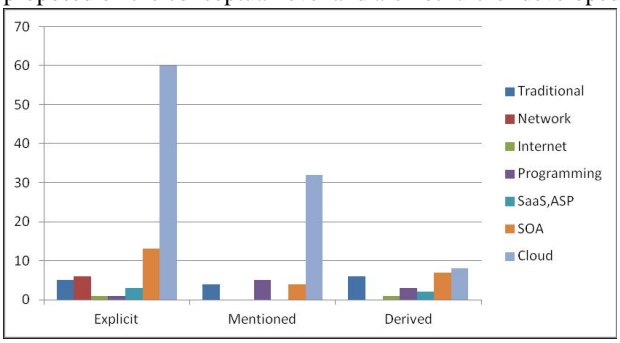

Fig. 3: Various "aaS" with strength indicators

Figure 3 shows the histogram of proposed "aaS" with different strength of relativeness marked with E(xplicit), proposed, M(entioned) and D(erived), which denote strong, medium and weak of the matureness of the concept of a group of "aaS" respectively. In every group, we see that the extent of "aaS" of the Cloud far exceeds the other types of "aaS", which reflects today's reality. For every group of "aaS", the amount of "aaS" marked with E well exceeds the amount of "aaS" marked with M and D. This shows that the "aaS" as a whole is more at a mature defined stage than at an immature conceptualization stage, thereby reflecting the fact that "aaS" implementations are now at a stage where they require standardization.

Figure 4 shows the ratio of E, M, D of every group of "aaS". For a specific group of "aaS", the matureness can be reflected by the ratios of $amount(D)/amount(E)$, $amount(M)/amount(E)$, $(amount(D) + amount(M))/amount(E)$, etc. In general, the smaller these ratios, the maturer the corresponding group of "aaS". We can see that the Cloud group and the SOA group are the most mature groups and the Traditional and the Programming group are the least mature groups. Therefore a lot of effort is needed to be invested to help the immature groups to turn mature, probably through migrating to the Cloud. For two groups of A and B, the ratio of $(amount(E(A)) : amount(M(A)) : amount(D(A)))/(amount(E(B)) : amount(M(B)) : amount(D(B)))$ can reflect the similarity of matureness between them, etc. Based on this similarity formula, we can observe that the matureness of the Cloud is similar to that of SOA.

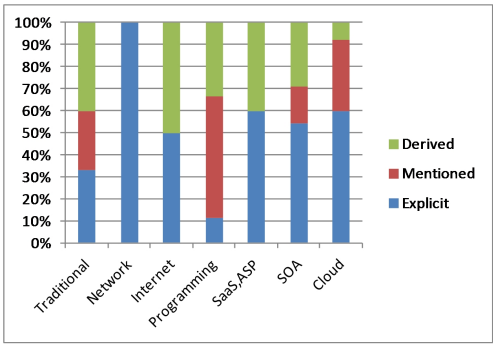

Fig. 4: Various"aaS" by ratio of E, M and D

By combining Figure 2 and Table III, we identified that services under other classifications are migrating into Cloud environments since related "aaS" are reappearing in the Cloud.

B. Visual analysis

Through the literature survey, we construct the conceptual hierarchy on top of the raw data of Table I in Figure 5 where each "aaS" is marked as a class with attributes of the author, time, etc., for explicitly proposed "aaS". The classification relationship of "is a" or Generalization among the classes of "aaS" is decided mostly by referring to the related description in corresponding literature. Although it might not be fully objective and precise, we can still identify the following interesting phenomena:

- **Prevalence of the Cloud:** The Cloud related "aaS" are the most prevalent, comprising almost half of all proposed "aaS", as shown in Figure 5.
- **Migration to the Cloud:** At the right of Figure 5 we find that there are several "aaS" which belong to more than one core "aaS". We abstract a pattern of the model of "aaS" migration as that of an "aaS" changing classification from an older to a newer classification. By referring to the year of these happening in Table I, we found that the "aaS" of SOA, Internet of Thing and Web of Thing, etc, are migrating to the Cloud. And, the "aaS" under Traditional services are migrating to the Cloud by way of SOA, Internet of Things and Web of Things, etc.

In Figure 6 we use Python's `networkx` library's graph drawer to generate the relationship network of all surveyed "aaS" as a directed graph by inputting the name concept of the surveyed "aaS" and its categories. It contains the mentioned and derived "aaS" besides the explicit "aaS" in Figure 5. Intuitively the strength of a core "aaS" can be seen in the form of the amount of the congregated lines related to it. Visually we find that with the surveyed "aaS" the congregations of core "aaS" including the Cloud, Traditional, IaaS, SaaS, WoT, IoT, etc., in Figure 5 and observations on the migrations trends from Figure 5 are strengthened instead of being weakened or blurred.

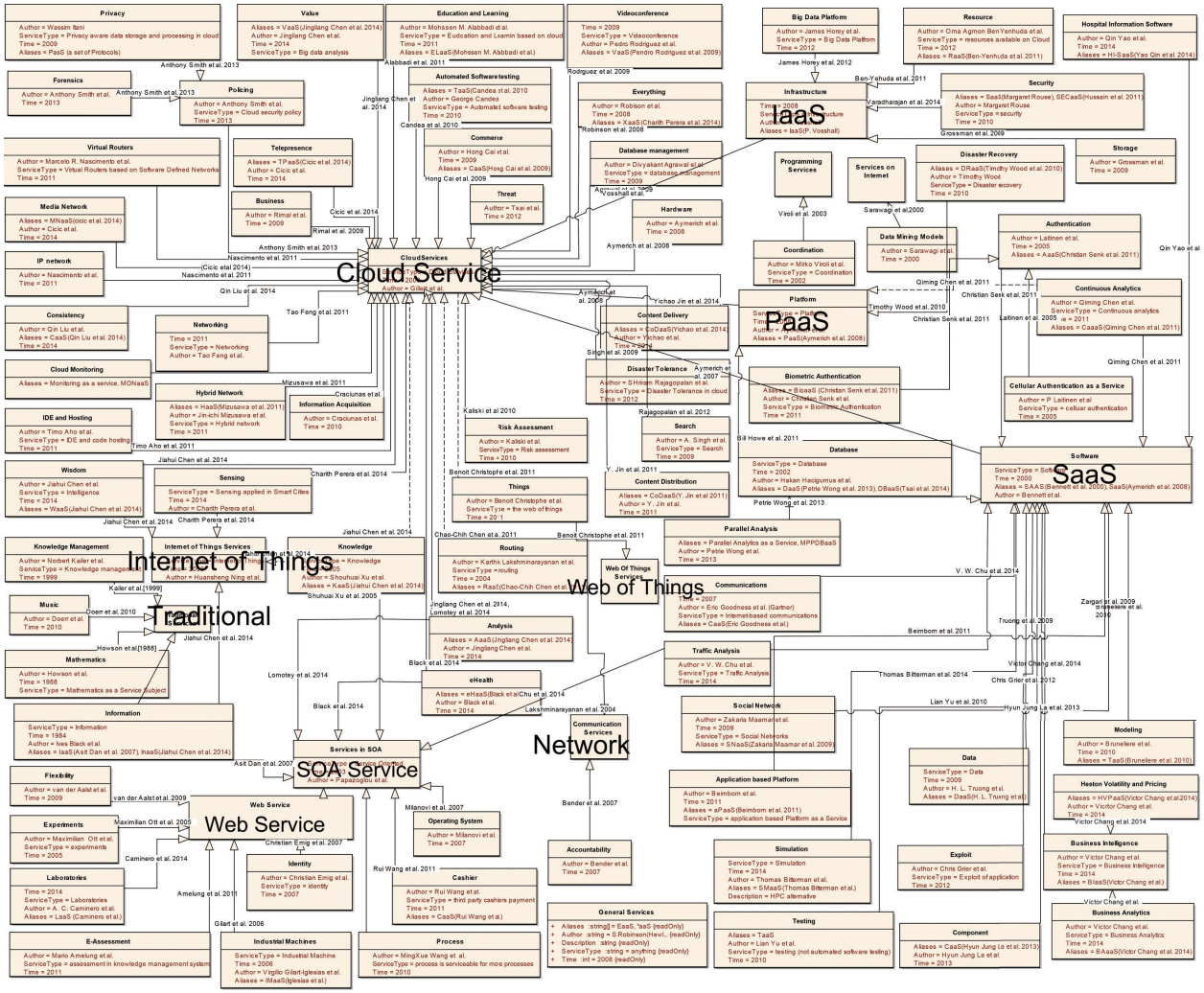

Fig. 5: Hierarchy of the concepts of explicit ”aaS”

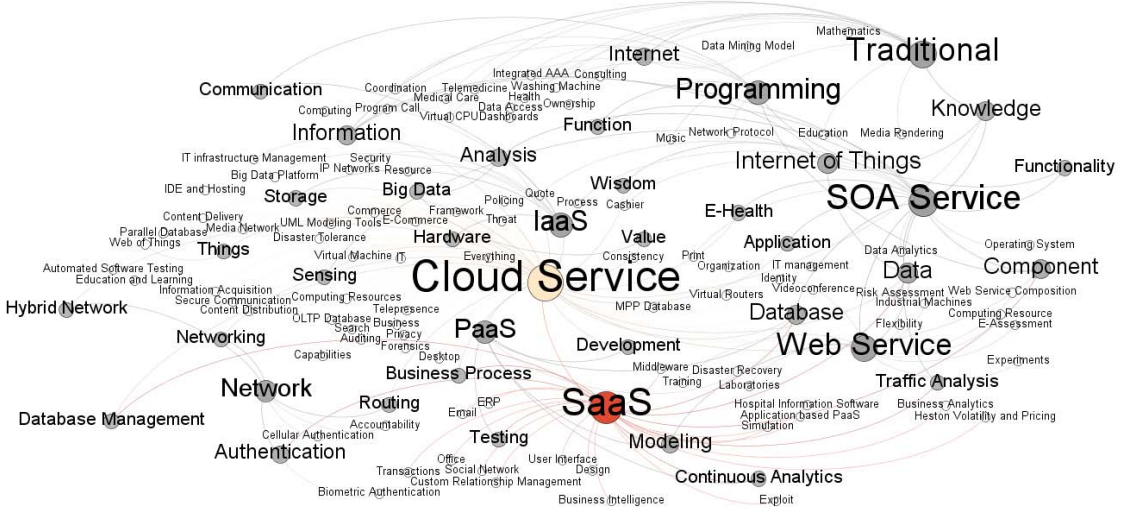

Fig. 6: Network view of all surveyed ”aaS” (E, M, D)

TABLE III: Classfication and distribution for "* as a Service"

Class		Explicit	Referred	Derived	Total	1984	1987	1997	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Traditional		5	4	6	15	1	1	1	3		2	1			1	1	2		1	1				
Network		6	0	0	6										2	1	1				2[a]			
Internet		1	0	1	2					1														1
Programming		1	5	3	9								2	3			1		2		1			
SaaS		3	0	2	5					1		2	2											
SOA	[b]	6	4	4	14								2		3		3	2	1	1	1			1[c]
	Web Service	8	0	3	11							1	1		1	1	1		2[d]		1			3
	Total	13	4	7	24							1	3		4	1	4	2	3	1	2			4
Cloud	[e]	28	15	6	49													3	17	4	11	2	6	6
	IaaS	4	4	0	8														3	2		2		1
	PaaS	3	3	0	6															4	2[f]	2		
	SaaS	16	7	0	23													1	4	7	3	1	1	6[g]
	Total	51	29	6	86													1	7	13	5	5	7	13
	SOA	2	2	0	4														1	1				2
	Big Data	2	0	0	2																			2
	Web of Things	1	1	0	2																2			
	Internet of Things	5	0	0	5																			5
	Total	10	3	0	13														1	1	2			9
Total		87	45	25	157	1	1	1	3	2	2	4	7	3	7	3	8	6	30	20	21	5	7	26

[a] Also In cloud Enviroment
[b] Services that proposed under SOA, but did not point out how to implement
[c] Also provided under SOA
[d] One of them is provided under SaaS
[e] Cloud services but not classified by the proposers
[f] One of them is both SaaS and PaaS
[g] One of them is under SOA

C. Analysis referring to the Gartner Hype Cycles

Gartner Hype Cycle methodology[6] uses a graphical presentation to show how a technology or application will evolve over time spanning over its maturity, adoption and social application. Each Hype Cycle models a technology's life cycle with the five key phases: Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment and Plateau of Productivity. After comparison of the Gartner Hype Cycles with the data in Table I, we can observe the partial conformance of the Hype Cycle in the table. According to the Gartner Hype Cycle of Cloud Computing and IT in general during the years of 2011-2014, Cloud service is currently from the trough of disillusionment to slope of enlightenment. Figure 2 confirms this by showing that the "aaS" of the Cloud experienced a blooming in 2009 corresponding to the phase of Peak of Inflated Expectations, and then running at a low level in 2012 and 2013 which confirms to the phase of Trough of Disillusionment, and active again from 2014 might indicate that parts of the "aaS" of the Cloud have started to enter the phase of Slope of Enlightenment. We see the positions of Trough of Disillusionment, Slope of Enlightenment of SaaS, PaaS and IaaS in the Cycles from 2011-2014 confirming to the distribution of the amount of the appearance count during the corresponding periods. We also observe the conformance between the Hype Cycles' positions of the WoT and IoT related services on the rise and the recent increase of the appearances of related "aaS". Referring to Table I, we can identify that the amount of "aaS" of IoT is on the rise which confirms to the Gartner Cloud Computing Hype Cycle that IoT reaches the Peak of Inflated Expectations in 2014.

[6] http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp

V. Conclusions and Future Work

The service computing field had many advances in the last years characterized partially by the emerging of various "as a Service (aaS)". New classifications and definitions are proposed in a discretionary way. Despite some attempts, we identified that there lacks a unified view to support an agreed understanding of "aaS". This paper has analysed the related literature and practical implementations describing the diverse existing works covering explicitly focused investigations, mentioned works and derived topics from implicitly mentioned works from both traditional services and IT services. With identified classifications, we also analysed the trends of service development partially referring to the Gartner Hype Cycle. We demonstrated that the information derived from the analysis confirms to the existing knowledge sources including the Gartner Hype Cycle.

To fully explore the information such as the road of migration to the Cloud as per Figure 5, we need to mine the more complex situations where concepts marking certain "aaS" may be decomposed into more than one sub-concept and in layered manner. We will continue to explore in this direction. The categories of "aaS" and their relationships can be referred for related companies to identify promising "aaS" and foresee the trends of service migration towards the Cloud. Currently some of the empirically created classifications lack systemic guidance which well explains the structure and interplay among interconnected "aaS". To this end, we will work towards creating a relevant ontology model to enhance the classification and improve the precision of service migration prediction based on collected "aaS" data. We will also extend

current survey to cover web pages and informal reports which reflect industry interests and compare them with research interests to see whether they follow one another and where they intersect.

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