Technology Insight Report

Billing Technologies in Cloud Computing

Patent iNSIGHT Pro
Transform Patents to Intelligence

Cloud computing is a paradigm shift in the way computing resources such as processing power, memory, data storage and bandwidth are utilized by businesses as well as individuals as per their requirements just like other utilities as against having to purchase the hardware. It's clear that this marks the future of computing and the innovation around creating unique billing technologies used in cloud computing is having an impact on access to high capacity computing infrastructure and even the way businesses can scale technology in tandem with their own growth. These are the billing technologies that are gradually redefining the way people consume computing technology and this technology insight report explores this domain and looks into the innovation that drives the billing technologies of the new era of computing.

Overview

Introduction to Cloud Computing

Cloud computing is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid.

Cloud computing is a paradigm shift following the shift from mainframe to client–server in the early 1980s. Details are abstracted from the users, who no longer have need for expertise in, or control over, the technology infrastructure "in the cloud" that supports them. Cloud computing describes a new supplement, consumption, and delivery model for IT services based on the Internet, and it typically involves over-the-Internet provision of dynamically scalable and often virtualized resources. It is a byproduct and consequence of the ease-of-access to remote computing sites provided by the Internet. This frequently takes the form of web-based tools or applications that users can access and use through a web browser as if it were a program installed locally on their own computer. NIST provides a somewhat more objective and specific definition here. The term "cloud" is used as a metaphor for the Internet, based on the cloud drawing used in the past to represent the telephone network, and later to depict the Internet in computer network diagrams as an abstraction of the underlying infrastructure it represents. Typical cloud computing providers deliver common business applications online that are accessed from another Web service or software like a Web browser, while the software and data are stored on servers. A key element of cloud computing is customization and the creation of a user-defined experience.

Most cloud computing infrastructures consist of services delivered through common centers and built on servers. Clouds often appear as single points of access for all consumers' computing needs. Commercial offerings are generally expected to meet quality of service (QoS) requirements of customers, and typically include SLAs. The major cloud service providers include Microsoft, Salesforce, Skytap, HP, IBM, Amazon and Google.

Source: *http://en.wikipedia.org/wiki/Cloud_computing*

Characteristics of Cloud Computing

In general, cloud computing customers do not own the physical infrastructure, instead avoiding capital expenditure by renting usage from a third-party provider. They consume resources as a service and pay only for resources that they use. Many cloud-computing offerings employ the utility computing model, which is analogous to how traditional utility services (such as electricity) are consumed, whereas others bill on a subscription basis. Sharing "perishable and intangible" computing power among multiple tenants can improve utilization rates, as servers are not unnecessarily left idle (which can reduce costs significantly while increasing the speed of application development). A side-effect of this approach is that overall computer usage rises dramatically, as customers do not have to engineer for peak load limits. In addition, "increased high-speed bandwidth" makes it possible to receive the same response times from centralized infrastructure at other sites

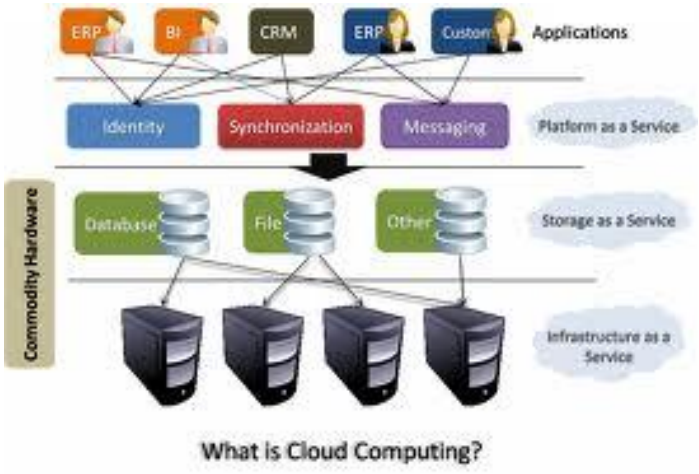

Image Source: http://mobilewellbeing.info/2009/05/20/a-private-cloud-for-your-mhealth-system/

Cloud Computing Billing Technologies

With all previous computing environments the infrastructure costs including the hardware and software had to be borne by the user. Often, purchased and owned by the users. At the most, a user could rent a fixed amount of space, with a limited amount of data transfer as one would find offered by most web hosting service providers but even then, billing would depend on capacity allocated and not really based on actual usage of hardware or software resources. With the advent of cloud computing, these billing technologies became redundant since the real benefits come from the “pay as you go” or “pay per use” models that opened up to people with this technology. To understand the need for innovation around billing technologies for cloud computing, one needs to look into the economics of cloud computing itself.

The Economics of Cloud Computing

Cloud computing users avoid capital expenditure (CapEx) on hardware, software, and services when they pay a provider only for what they use. Consumption is usually billed on a utility (resources consumed, like electricity) or subscription (time-based, like a newspaper) basis with little or no upfront cost. Other benefits of this approach are low barriers to entry, shared infrastructure and costs, low management overhead, and immediate access to a broad range of applications. In general, users can terminate the contract at any time (thereby avoiding return on investment risk and uncertainty), and the services are often covered by service level agreements (SLAs) with financial penalties.

According to Nicholas Carr, the strategic importance of information technology is diminishing as it becomes standardized and less expensive. He argues that the cloud computing paradigm shift is similar to the displacement of electricity generators by electricity grids early in the 20th century.

Although companies might be able to save on upfront capital expenditures, they might not save much and might actually pay more for operating expenses. In situations where the capital expense would be relatively small, or where the organization has more flexibility in their capital budget than their operating budget, the cloud model might not make great fiscal sense. Other factors impacting the scale of any potential cost savings include the efficiency of a company's data center as compared to the cloud vendor's, the company's existing operating costs, the level of adoption of cloud computing, and the type of functionality being hosted in the cloud.

Among the items that some cloud hosts charge for are instances (often with extra charges for high-memory or high-CPU instances); data transfer in and out; storage (measured by the GB-month); I/O requests; PUT

requests and GET requests; IP addresses; and load balancing. In some cases, users can bid on instances, with pricing dependent on demand for available instances

Source: *http://en.wikipedia.org/wiki/Cloud_computing*

Billing Attributes

The key to the cloud computing environment is the ability to offer computing requirements as a service. Whether it's "Infrastructure as a Service", "Software as a Service" or even "Integration as a Service" the ability to offer it on demand to consumers like any other utility is what distinctly characterizes this model. For service providers to be able to come up with optimum billing models, they need to take into consideration various attributes such as subscriptions, metering usage, units of resources used, internet bandwidth, data transfer amounts, storage capacity units utilized, time, calls to the server, number of users and several others to factor into the billing. At the same time, they also need to offer consumers a billing technology they can align with their usage and business objectives which helps them scale computing requirements along with their revenues.

All these attributes have sparked the need to develop new and improved billing technologies for cloud computing as this relatively infant model of computing shapes the next generation of information technology. As key players develop their models, patenting these technologies offers them an upper hand in a newly developed and rapidly growing space.

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Categorization defined for Billing Technologies across different Cloud Categories

We categorized cloud computing patents along the following lines:

- Infrastructure as a Service

- Software as a Service

- Integration as a Service

Categorization: Infrastructure as a Service

- Compute as a service
- Database as a service
- Networking as a service
- Storage as a service

Categorization: Software as a service

- Content Delivery
- E-Commerce

Categorization: Integration as a service

- No sub-categories

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Cloud Computing Billing Technologies – Insights from Patents

IP activity and patent data are great indicators of exactly what is happening in this space and could help uncover several insights while answering questions that manufacturers, technology enthusiasts, inventors, scientists, investors and others would seek answers to.

- When did research into cloud computing start gaining momentum?
- Who are the key players in this space?
- Who are the key innovators? How do their patents compare?

Looking into this will also help provide an idea of how this trend of cloud computing is growing and what we can expect to see in the future of both computing requirements as well as the way we as consumers will pay for what is now comparable to commodities.

The following are some insights generated through analysis of a patent set using the Patent iNSIGHT Pro software.

The Search Strategy

Using the commercial patent database PatBase as our data source we used the following search query to create our patent set.

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((FT=
(
((grid or utility or mesh or on-demand or "on demand" or distributed or parallel or elastic or autonomic or self-healing or “self healing” or platform or infrastructure or cloud or network or cluster or pervasive or disruptive or community or meta or public or super or edge or service or services or virtual*) and comput*)
or
((SaaS or PaaS or IaaS or (Software w/2 service) or (platform w/2 service) or (Infrastructure w/2 service)) or (multi w/2 tenant) or MSP or (managed w/2 provider*) or MTC or (many w/2 computing) or HTC or (high w/2 computing)or (SoA or (service w/2 architect*)) or (peer w/2 computing) or "computational grid" or "private cloud"))
)
and (UC=705/34)
)
```

The query was directed to search with the assumption that all related patents would be filed in US and the search was limited to US publications. The result was a patent set of 920 records which would form the basis of our research.

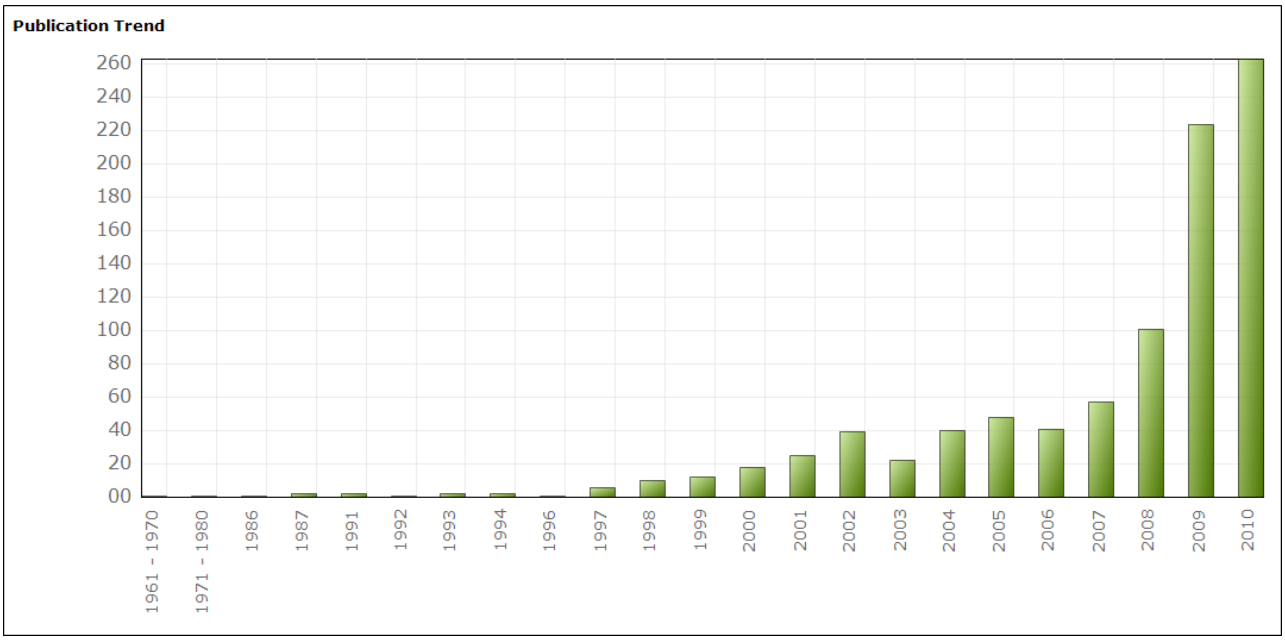
FT – Full Text

Class Description:

705: DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION
705/34: BILL PREPARATION

Publication Trend

What has been the IP publication trend for Billing Technologies within Cloud Computing?



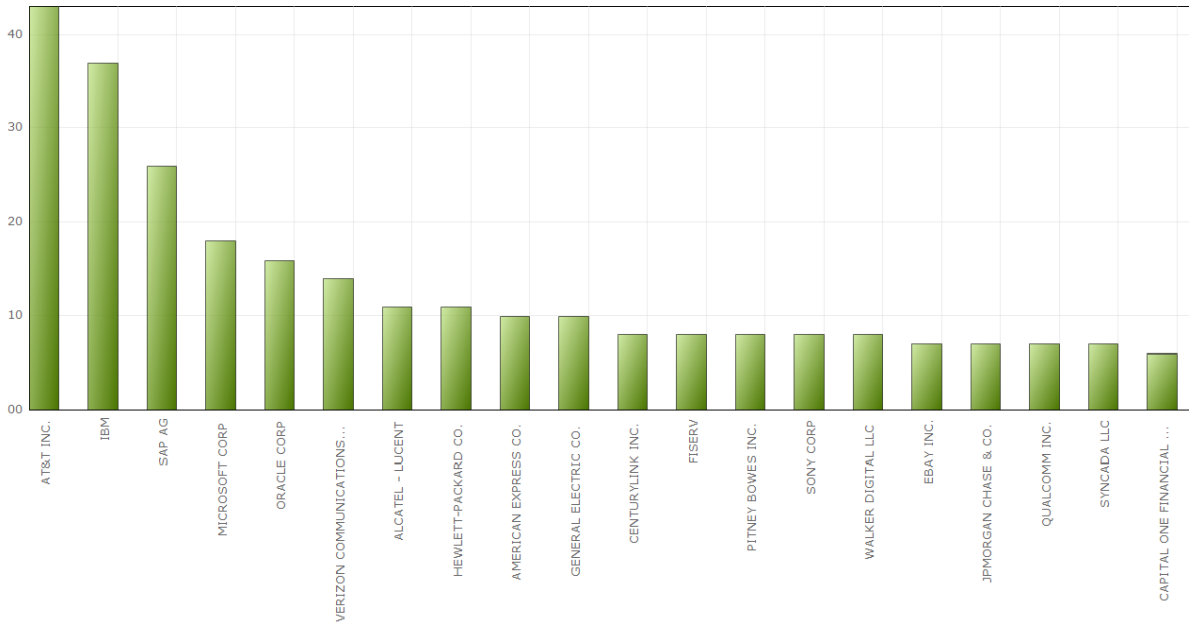
The patent publication trend in the form of a bar graph shows activity in this field surface from the late 90's, start picking up from the year 2000 and then really start to spike in the last 3 years with over 100 patents published in 2008, over 220 in 2009 and then climb much further through the start of this current year. It's clear the current activity around these billing technologies is likely to continue seeing more innovation in the near future.

How we did it?

Once the patents were populated in Patent iNSIGHT Pro, the publication trend chart was generated on a single click using the dashboard tool.

Top Assignees

Who have been the top assignees or the key players for cloud computing billing technologies?



The top assignees are:

1. AT&T INC.
2. IBM
3. SAP AG
4. MICROSOFT CORP
5. ORACLE COR
6. VERIZON COMMUNICATONS INC.
7. ALCATEL - LUCENT
8. HEWLETT-PACKARD CO.
9. AMERICAN EXPRESS CO.
10. GENERAL ELECTRIC CO.
11. CENTURYLINK INC.
12. FISERV
13. PITNEY BOWES INC.
14. SONY CORP
15. WALKER DIGITAL LLC.
16. EBAY INC.
17. JPMORGAN CHASE & CO.
18. QUALCOMM INC.
19. SYNCADA LLC
20. CAPITAL ONE FINANCIAL CORP

How we did it?

Once the patents were populated in Patent iNSIGHT Pro, the assignee clean-up tools were used to normalize the names. Different cleanup tools were leveraged:

- To locate assignees for unassigned records
- To clean up records having multiple assignees
- To locate the correct assignee names for US records using the US assignments database
- To merge assignees that resulted from a merger or acquisition or name change.

Once the Assignee names were cleaned up, the dashboard tool within Patent iNSIGHT Pro was used to find the top 20 assignees within the given patent set. A visual graph was created based on the results of the top assignees with the number of patents alongside each one.

Also, see full Assignee count table in following excel sheet:

List of top assignees
http://www.patentinsightpro.com/techreports/0810/Top%20Assignees.xls

Assignee - Key Statistics

Here we summarize key parameters of Top 15 Assignees such as filing trend, Avg. number of Forward citations per record, Top inventors, Top Co-Assignees and Coverage of underlying patent families

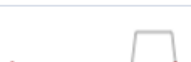
Assignee	Total No. of Records	Average No.of Fwd Cites per Patents	Filing Trend (Absolute)	Filing Year Range	Key Inventor (Top 5)	Coverage (Includes families)				
						US	EP	WO	JP	GB
AT&T INC.	43 (4.7%)	3.53		1997-2009	TISCHER STEVEN(2) ZELLNER SAMUEL N(2) O NEIL DOUGLAS(2) ARNOLD JR DAVID J(2) CONRAD GLENN(1)	28	0	1	0	2
IBM	37 (4%)	6.14		1995-2010	DUTTA RABINDRANATH(3) HAMILTON II RICK A(2) AGARWAL VIKAS(2) KARNIK NEERAN M(2) KUMAR ARUN(2)	29	1	4	4	0
SAP AG	26 (2.8%)	0.35		2003-2009	SUDBRACK ANDREA(5) STEINBACH JOCHEN(3) BACH THOMAS(3) BREITLING THOMAS(3) HARTIG STEFFEN(3)	18	9	6	0	0
MICROSOFT CORP	18 (2%)	28.83		1992-2010	EDERY YIGAL(1) BUCCI JOSEPH J(1) NICE NIR(1) REEDER MARY(1) BADWE ASHUTOSH(1)	12	1	2	1	0
ORACLE CORP	16 (1.7%)	11.63		1996-2009	LABUDA DAVID S(2) TADEPALLI SRIDHAR(2) DAWSON TIM(1) CHALLAVEERA SATHEESH(1) HANSON PAUL(1)	13	1	1	0	0
VERIZON COMMUNICATIONS INC.	14 (1.5%)	3.21		1997-2009	HOGUE KOLIN G(1) NEYMAN DAVID LLOYD(1) MOORE RICHARD G(1) TRIGONOPLOS PATRICK STEWARD(1) MUMFORD GREGORY(1)	11	0	2	0	0
ALCATEL - LUCENT	11 (1.2%)	4.55		1996-2007	CAI YIGANG(2) KRANK LOTHAR(1) LAUTENSCHLAGER WOLFGANG(1) STAHL UWE(1) WEIK HARTMUT(1)	8	3	2	2	0
HEWLETT-PACKARD CO.	11 (1.2%)	3.73		1996-2008	VAIDYA SAMEER(1) WALICKI JACK S(1) ANDREWS PATRICIA C(1) DONOVAN JOSEPH M(1) ELSTROD JOHN(1)	9	3	4	2	2
AMERICAN EXPRESS CO.	10 (1.1%)	0.1		2001-2009	SYKES DANIELLE(1) KRISHNAN VILAYANUR PARAMESWARAN(1) MILTON CHARLES(1) WINTER URSULA(1) MADHINENI MADHUKAR(1)	2	0	0	0	0
GENERAL ELECTRIC CO.	10 (1.1%)	4.2		2000-2008	GETGOOD ALAN(3) LAND DAVID(3) GRUBB JEFFREY L(1) HINKLE BURL SHANNON(1) STARKMAN HARTLEY C(1)	7	0	3	3	0
CENTURYLINK INC.	8 (0.9%)	0.5		1997-2009	SWEENEY JEFFREY M(2) BUGENHAGEN MICHAEL(2) MORRILL ROBERT J(1) POLLARD LARRY C(1) REBENACK LARRY M(1)	5	0	1	0	0
FISERV	8 (0.9%)	3.5		1998-2010	KIGHT PETER J(2) DREYER HANS DANIEL(1) GANESAN RAVI(1) HARRIS MARK TODD(1) WOLFE KATHRYN RANDALL(1)	2	1	0	0	0
PITNEY BOWES INC.	8 (0.9%)	1.63		1998-2004	LAU MARIANO(1) SALVATI LAURIE(1) WOODMAN CLARE E(1) BRAND PATRICK M(1) ECKERT JUDITH M(1)	7	3	0	0	0
SONY CORP	8 (0.9%)	1.63		1999-2009	INOKUCHI TATSUYA(2) ITO SHUICHI(2) OBATA MASAYUKI(2) SAKO YOICHIRO(2) SAKURAI KAZUKO(2)	1	1	1	1	0
WALKER DIGITAL LLC	8 (0.9%)	4.13		1997-2009	WALKER JAY S(8) TEDESCO DANIEL E(5) JORASCH JAMES A(4) VAN LUCHENE ANDREW S(4) SAMMON RUSSELL P(3)	4	0	1	0	0

How we did it?

In order to compress all the information into a single report, we used the new 360 ° series of reports available in the software. From the Assignee 360° report options, we selected the different pieces of information we wanted to include in the singular display and then ran the report. The generated report was then exported to Excel using the option provided for the same.

Inventor - Key Statistics

Here we summarize key parameters of Top 15 Inventors such as filing trend, average number of forward citations per record, key associated companies and top 5 co-inventors.

Inventor	Total No. of Records	Average No. of Fwd Cites per Patents	Filing Trend (Absolute)	Filing Year Range	Key Assignees (Top 5)	Co-Inventors
WALKER JAY S	9 (1%)	3.67		1997-2009	WALKER DIGITAL LLC(8) JORASCH JAMES A(3) VAN LUCHENE ANDREW S(2) TULLEY STEPHEN C(2) TEDESCO DANIEL E(2)	TEDESCO DANIEL E(5) JORASCH JAMES A(4) VAN LUCHENE ANDREW S(4) SAMMON RUSSELL P(3) TULLEY STEPHEN C(3)
HAHN CARLSON DEAN W	7 (0.8%)	0.14		2007-2010	SYNCADA LLC(7)	SUITS DAVID A(2) BECK ELIZABETH A(1) KANATHUR RAGHUNANDAN N(1) LANGER RICHARD G(1)
SUDBRACK ANDREA	5 (0.5%)	0		2008-2008	SAP AG(5)	BACH THOMAS(3) HEUN RAINER(3) ADELMANN STEFAN(2) BOCK DANIEL(2) BREITLING THOMAS(2)
TEDESCO DANIEL E	5 (0.5%)	6.6		1997-2009	WALKER DIGITAL LLC(5) TEDESCO DANIEL E(2) JORASCH JAMES A(2) KOBAYASHI MICHIKO(1) MASCHOFF KURT M(1)	WALKER JAY S(5) JORASCH JAMES A(3) VAN LUCHENE ANDREW S(3) GELMAN GEOFFREY M(2) GOLDEN ANDREW M(2)
JORASCH JAMES A	4 (0.4%)	1		2001-2009	WALKER DIGITAL LLC(4) JORASCH JAMES A(3) TEDESCO DANIEL E(2) SAMMON RUSSELL P(2) GELMAN GEOFFREY M(1)	WALKER JAY S(4) SAMMON RUSSELL P(3) TEDESCO DANIEL E(3) GELMAN GEOFFREY M(2) GOLDEN ANDREW M(2)
VAN LUCHENE ANDREW S	4 (0.4%)	7.25		1997-2009	WALKER DIGITAL LLC(4) VAN LUCHENE ANDREW S(2) MIK MAGDALENA(1) TEDESCO DANIEL E(1) OSHEA DEIRDRE(1)	WALKER JAY S(4) TEDESCO DANIEL E(3) ALDERUCCI DEAN(1) FINCHAM MAGDALENA M(1) JORASCH JAMES A(1)
BACH THOMAS	3 (0.3%)	0		2008-2008	SAP AG(3)	HEUN RAINER(3) SUDBRACK ANDREA(3) ADELMANN STEFAN(2) BREITLING THOMAS(2) HARTIG STEFFEN(2)
BREITLING THOMAS	3 (0.3%)	0		2008-2008	SAP AG(3)	HARTIG STEFFEN(3) BACH THOMAS(2) COLLE RENZO(2) HETZER STEPHAN(2) HEUN RAINER(2)
CIRULLI SUSAN BUMGARDNER	3 (0.3%)	4.33		1999-2007	SJOSTROM WILLIAM MONTGOMERY(1) WILSON SHERRY LEE(1) IBM(1) ABER THOMAS ALEXANDER(1)	MODRAK GLENN P(2) WILSON SHERRY L(2) ABER THOMAS ALEXANDER(1) BAUMANN CARL S(1) CHAUNCEY PATRICIA ANN(1)
DUTTA RABINDRANATH	3 (0.3%)	0.33		2002-2008	IBM(3)	HARTLEY JOHN C(2) SCHWERDTFEGER RICHARD SCOTT(2) BANERJEE DWIP N(1)
GETGOOD ALAN	3 (0.3%)	7.33		2000-2000	GENERAL ELECTRIC CO.(3)	LAND DAVID(3)
HARTIG STEFFEN	3 (0.3%)	0		2008-2008	SAP AG(3)	BREITLING THOMAS(3) BACH THOMAS(2) COLLE RENZO(2) HETZER STEPHAN(2) HEUN RAINER(2)
HETZER STEPHAN	3 (0.3%)	0		2008-2008	SAP AG(3)	HIRTH JOCHEN(3) STEINBACH JOCHEN(3) ADELMANN STEFAN(2) BACH THOMAS(2) BREITLING THOMAS(2)
HEUN RAINER	3 (0.3%)	0		2008-2008	SAP AG(3)	BACH THOMAS(3) SUDBRACK ANDREA(3) ADELMANN STEFAN(2) BREITLING THOMAS(2) HARTIG STEFFEN(2)
HIRTH JOCHEN	3 (0.3%)	0		2008-2008	SAP AG(3)	HETZER STEPHAN(3) STEINBACH JOCHEN(3) ADELMANN STEFAN(2) BACH THOMAS(2) BREITLING THOMAS(2)

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Assignee Portfolio spread across different Cloud Categories

This chart helps get an insight into some of the Billing Technologies across different cloud categories along with a listing of the top assignees in each category. It highlights the focus areas within the energy storage device being pursued by each company.

Billing Technologies across different Cloud Categories (Columns) / Key Assignees (Rows)	Total	Infrastructure as a Service					Software as a Service			Integration as a Service
		Total	Database as a Service	Networking as a Service	Storage as a Service	Compute as a Service	Total	E-Commerce	Content Delivery	
Total	186	138	55	66	12	3	106	51	30	9
AT&T INC.	30	25	9	15	3		15	3	4	5
IBM	19	12	5	3	3	1	10	7	2	1
SAP AG	15	9	7				14	3	5	
VERIZON COMMUNICATIONS INC.	14	13	9	10	1	1	5	2	3	
MICROSOFT CORP	13	13	3	8	1		3	2	1	1
HEWLETT-PACKARD CO.	9	8	3	3		1	2	2	1	1
AMERICAN EXPRESS CO.	9	4	2				9	8		
GENERAL ELECTRIC CO.	7	7	1				4	1		
FISERV	7	2		2			7	6	1	
CENTURYLINK INC.	7	4	2	4	1		6		2	
QUALCOMM INC.	6	5	2	1	2		5		5	
ORACLE CORP	6	3	2				4	3		
NOKIA CORP	6	6	1	6			2	1	1	
EBAY INC.	6	2	2				4	3	1	1
WALKER DIGITAL LLC	5	3					2	2		
SYNCADA LLC	5	2			1		4	4		
CISCO SYSTEMS INC.	5	5		4			1		1	
ALCATEL - LUCENT	5	3	1	3			4	2	2	
HUAWEI TECHNOLOGIES CO. LTD.	4	4		4						
ERICSSON	4	4	2	2			3	2	1	

How we did it?

We used the Co-occurrence analyzer in Patent iNSIGHT Pro to generate a matrix of Assignee vs. billing technologies across different cloud categories. The generated matrix was filtered to top 20 Assignees and then exported to Excel.

Tech Category vs. Billing Technologies (top keywords) – White Space Analysis

What are the top keywords in billing technologies and how do they vary across the different cloud categories? For this a cleaned list of keywords that were generated from the Title, Abstract and Claims. Such a table can be used for preliminary insights toward White Space Analysis. (White-spaces are gaps in a technology landscape that have potential for attaining exclusivity.)

So for example as can be seen in the table below the concept of "Referral fee" hasn't been used in any of the Infrastructure Service categories and is only present in Software-as-a-Service Categories. Such an indication can be further verified via patent search to confirm existence of a white space.

Billing Technologies across different Cloud Categories (Columns) / Top Keywords (Rows)	Total	Infrastructure as a Service					Software as a Service			Integration as a Service
		Total	Database as a Service	Networking as a Service	Storage as a Service	Compute as a Service	Total	E-Commerce	Content Delivery	
Total	538	365	158	154	28	9	334	162	101	29
Accepting unit	2	1				1	1	1		
Access point	41	31	14	21	2	1	26	7	14	3
Access rights	30	22	11	10	3		26	14	7	1
Account holder	22	9	6	3	1	1	20	12	7	2
Accounting process component	7	1	1				7		4	
Accounts payable	51	32	21	5			38	23	7	2
Bar code	42	26	13	5			34	23	9	
Batch mode	19	15	8	4	1		12	4	1	
Bill dispute	2	2			1		1	1		
Bill summary	12	11	10	1	1		7	5	1	
Billing cycle	65	47	22	19	6	1	43	22	13	4
Billing platform	7	5	1	3	1		5	2	3	
Billing procedure	7	6		3	1		2		1	
Billing statement	34	22	13	9	4	2	21	13	5	3
Billing the user	4	2	1	1			4	4	2	
Business enterprise having a client	3	3					3			
Business entity	37	26	13	3	4	1	29	14	12	2
Buyer organization	2	1	1	1			2	2		
Buyers and sellers	38	21	9	7	1		32	24	8	1
Calculated by multiplying	8	6	3	1			6	3	2	
Call center	30	24	16	12	2	1	18	5	6	3
Call detail records	17	15	5	11			8	3	5	1
Communication session	21	16	4	9	1	1	15	6	7	2
Computer infrastructure	2	2	1	1						
Computer program product	87	61	23	30	5	2	51	25	17	8
Computer usable	21	15	6	8			11	8	5	2

Computer-readable storage	79	56	22	21	5	2	44	21	11	5
Computing resources	22	17	10	6	2	2	17	12	7	2
Cost savings	35	26	15	6	1		26	16	6	2
Counting a number	6	5	2	3	1	2	3		1	
Credit card	203	128	59	50	8	4	138	89	41	9
Data elements	54	37	28	7	3	1	44	24	13	
Data feed	10	8	7	3	1		9	5	1	1
Data packet	22	21	8	11	2		12	3	6	2
Data structure	85	61	37	12	4	3	63	31	21	5
Demand deposit account	9	4	2	2			9	8	1	
Description language	10	7	5	7	1	1	6	4	2	2
Detecting the presence	5	3	1	2			4	3	1	
Digital camera	16	11	4	7		1	13	8	5	2
Digital content	23	13	5	10	1		21	8	18	1
Digital rights management	15	12	4	11	1		10	1	10	1
Digital signature	34	21	9	10	1	1	25	15	8	3
Domain name	28	21	8	14	3	2	19	13	7	3
Electric power	8	4	3	1			6	1	1	1
Electronic mail	112	74	31	27	4	3	79	44	32	4
Encoded thereon	6	5	1				2	1	1	
End user	102	79	39	42	5	3	68	32	33	9
Energy usage	10	8	4	2			8		2	
Enterprise resource planning	16	11	9	3	1	1	13	6	1	1
Exception handling	8	5	5	3			7	1	4	
External server	3	3	2	1			1		1	
Financial account	27	14	5	3	2		21	14	4	
Financial institution	78	50	26	15	3		59	41	15	5
Financial transaction	48	32	19	10			36	27	10	1
First billable	3	2	2	1			1			
First biller	4	2	2	1			3	3	1	
Gateway configured	2	2	1	2	2		1	1		1
Geographic location	46	37	21	15	2	1	33	19	13	1
Hardware resources	13	10	5	6	3	3	9	5	3	1
Hash function	11	4	3	3		1	9	6	4	
Health care provider	12	9	6	2	1		5	1	2	1
Health insurance	11	8	5	2			3	1		1
Higher priority	14	13	8	5	3		9	4	5	1
Higher rate	14	6	2	2	2		13	4	7	
Host computer	30	24	9	11	3		19	14	6	2
Hypertext transfer protocol	54	35	22	18	1	2	37	25	15	4

Image processing	12	9	4	3	1		7	4	4	
Insurance company	27	22	11	5	3		12	5	1	1
Insurance policy	21	17	14	1	2		9	4	1	1
Interest rate	19	13	6	1			12	8	1	
Inventory processing process	5						5		4	
Invoice	32	20	14	5			23	12	9	1
Large number	89	62	29	28	4	1	57	31	26	4
Line item	37	24	17	9	2		24	14	4	2
Lookup table	22	20	13	8	5	1	11	9	5	1
Loyalty points	13	5	3	1			11	9	1	1
Machine readable medium	93	64	31	19	7	2	64	35	22	6
Marketing campaign	12	4	3				12	4	5	
Markup language	115	73	45	26	3	1	86	58	26	5
Means for analyzing	6	3	2	2			5		3	
Means for compiling	2						2	1	1	
Means for preparing	5	4	2	1			1	1	1	
Media content	14	10	3	6	1		13	5	9	1
Member of a group	11	8	5	2			8	5	3	
Membership fee	4	3	2	1			2	2		
Memory circuit	2	2	1		1		1			
Meter reading	9	8	7	2	1		6		2	2
Mobile device	107	72	27	39	10	2	75	37	32	4
Mobile radio network	5	4	1	4			1	1		1
Mobile telephone number	7	4	1	2			4	3	1	
Monitoring energy consumption	1	1		1			1		1	
Natural gas	8	6	3	2			5	3	1	1
Natural language	7	7	3	2			4	3	1	
Nature of the call	1	1		1						
Network element	20	18	8	16	2	1	11	4	8	3
Number of discrete	5	4	3	1	1		5		1	1
Number of hours	9	4	1	1			7			1
Number of packets	11	10	3	6	2	1	5		4	
Numerical value	9	7	3	3		1	2	1		
One or more processors	177	127	51	45	15	4	116	59	39	11
Optical character recognition	18	16	9	4	1	1	7	5	4	
Outstanding balance	19	14	4	3			13	7	3	
Packet switched network	16	14	5	7	2		10	5	5	1
Patient data	8	6	4		1		5	2	2	
Payee name	7	2	1				6	4	1	
Payment schedule	6	2	1				6	4	1	
Payor and a payee	16	7	3	4			13	10	3	
Plurality of billers	7	6	5	1			6	3	1	
Point of sale	58	37	19	13	2		45	32	9	4
Positioned adjacent	6	4		1			2	2		
Postal service	31	23	13	7	2		23	12	8	1
Power consumption	13	10	3	5	1		10	3	4	1
Print job	8	8	3	3	2	1	2		1	
Priority level	9	5		3	2		7	2	3	
Processing process component	7	1	1				7		4	
Procurement system	7	7	4	2			4	3		

Promotional materials	6	3	3				4	2	2	
Providing compensation	2						2	1	1	
Public key	32	23	10	13	3	1	24	15	15	1
Purchase order	52	30	18	7	1		45	23	11	2
Quality of service	52	48	18	36	6	5	30	12	18	5
Rate multiplied	4						4	1	2	1
Readable media	98	68	28	29	2	1	64	28	24	7
Reception module	4	2			1		2	1	1	1
Recognition means	2	1					1		1	
Records reflecting	4	3	1	1			2	1	1	
Referral fee	4	1					3	3	1	
Regular intervals	22	17	10	7	4		16	5	6	3
Reimbursement management	3	1	1				2			
Remittance advice	10	5	2	3			9	7	2	1
Remittance data	9	6	3	2	1		7	4	3	1
Remittance processing module	4	4	1				3			
Rental property	2						1	1	1	1
Residing in the memory	5	3	1	1			4	1	2	1
Retail store	21	14	8	3			17	12	6	
Search engine	27	19	8	7	1		23	15	9	
Search request	21	15	4	7		1	15	7	8	
Second billable	2	1	1				1			
Sensors	4	3	2				3	1	1	
Service contract	17	13	6	9	3		11	3	5	2
Services rendered	53	38	21	12	4		31	14	10	5
Set top box	48	29	11	18	2		35	19	18	4
Short message service	54	32	14	19	1		43	23	25	3
Software module	43	34	20	14	1		32	19	11	1
Sound file	1	1		1			1	1		
Step of evaluating	4	4	3				3	2		
Step of negotiating	1	1		1			1		1	
Storage medium encoded	3	2		1	1		2	1		1
Subject matter	83	58	24	18	5	2	59	29	25	6
Subscriber identity	22	19	10	14	2		14	10	6	4
Subscriber terminal	3	2	1	1			2		1	
Subscription fee	14	9	4	4	2	1	10	9	4	2
Supply chain	27	18	13	6	1		23	12	11	1
Task list	4	2	1	1			3	1	2	
Telecommunications network	31	27	12	21		1	14	3	6	2
Telecommunications service	28	23	16	15	1	1	14	5	3	4
Telephone number	123	87	37	38	7	1	75	34	28	5
Television service	12	10	5	7			4	1	1	1
Textual description	9	5	3	1	1	1	9	6	4	1
Threshold	31	21	8	8	2		21	8	6	
Total price	14	10	6	4	3		10	6	1	
Trusted third party	14	11	2	8	1		10	8	3	1
Usage event	6	4	4	1	1		5	1	1	1
User ID	62	43	19	21	3	1	41	22	21	4
User profile	63	46	22	26	6	1	41	29	17	3
Virtual machine	25	15	7	9	4	3	16	7	3	2
Virtual private network	51	44	24	20	5	3	29	15	17	6
Visual content	2						2		2	
Voice recognition	34	26	15	13	3	1	20	11	8	4
Weighting factors	5	4	1	1	1	1	2	1	1	
Wide area network	148	111	50	44	6	5	82	40	25	13
Wireless access point	8	7	2	4			5		4	
Workflow engine	2	2	2				1			

How we did it?

A clean set of keywords was generated using Patent iNSIGHT Pro using a combination of keyword list Cleanup and Auto Custer features. We then used the Co-occurrence analyzer in Patent iNSIGHT Pro to generate a matrix of keywords vs. technology category. The generated matrix was exported to Excel.

Appendix A: Search Strings Used for Classification

Categorization: Infrastructure as a Service

Infrastructure as a Service	
((database or disk w/2 storage) or virtual) w/2 server	8 results
((database or disk w/2 storage) or virtual) w/3 server	14 results
virtual w/3 server or (VPS or VDS)	12 results
(database or disk) w/3 storage	124 results
utility w/3 computing	9 results
utility w/3 comput*	14 results
desktop w/2 virtual*	3 results
storage w/2 service	17 results
storage w/3 service	28 results
network* w/3 service	154 results
database* w/3 service	66 results

Categorization: Software as a service

Software as a Service	
((ondemand or on-demand) w/2 software) or SoD	4 results
((ondemand or on-demand) w/3 software) or SoD	5 results
SaaS or SAAS	5 results
CRM	25 results
((software w/3 service) or SAAS or SaaS) and CRM or (customer w/3 management*)	14 results
(customer w/3 manag*) or CRM	104 results
aclm contains pay w/2 per	5 results
(content or message) w/3 deliver*	101 results
(ecommerce or ebusiness or mcommerce) or (e w/2 commerce or m w/2 commerce)	162 results
(ecommerce or ebusiness or mcommerce) or (e w/2 commerce or m w/2 commerce) or electronic w/3 commerce	151 results
(web or intenet) w/3 commerce	10 results

Categorization: Integration as a service

Integration as a Service	
integrat* w/3 service	27 results
integrat* w/3 servic*	83 results
integration w/3 servic*	8 results
Cloud w/3 integrat*	1 result

Summary

The arrival of cloud computing itself signifies just how information technology and computing requirements have gone from an exclusive technology that only a select few wealthy businesses could afford to something which is now being commoditized and turning towards becoming a utility. Computing is quickly becoming disassociated with its reputation of being capital intensive and expensive as an investment and the billing models of today are moving towards metering the amount of computing or software resources required per consumer or per measurable unit consumed so that the costs can be apportioned to its usage. This will radically impact the way technology businesses are built as well as scaled in the future offering the once “more costly” resources as more accessible. From the patent trends, it’s clear this is still an infant technology still undergoing intensive research and development with billing technologies for this kind of computing also constantly changing. However, it seems to have picked up momentum and is clearly one of the most promising developments in information technology for both businesses as well as consumers.

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