Cloud gaming virtual community - A case study in China

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Abstract

Cloud gaming is an emerging Cloud service that trust and trust building in the gaming community is highly important. This paper aims to further investigate a Chinese case study for Cloud gaming by collecting and analyzing data from two most populous cities in China, Beijing and Shanghai. Data analysis and discussion were explained. Results highly support questionnaires designed based on our hypotheses with mean scores 3.5 and above, low standard deviations, high R-squared values above 0.96 and low p-values 0.05 and below. Data between Beijing, Shangia and Chengdu are compared with each other with explanations for all the outputs. We plan to develop a new method that can offer large-scale ANOVA analysis in a single attempt. Limitations and future directions of this research have been addressed, whereby critical factors that can guarantee successful delivery and services of Cloud gaming including trust will be investigated.

1   Introduction

There are more than two billions people in the world using the Internet for emails, office work, communications, e-commerce, social networks, online games and other activities (Miorandi et al, 2012). The Internet will be used as a global information and infrastructure for people of different parts of the world to discuss, collaborate, communicate and compute. To cope with a growing number of users for Internet services in the world, the infrastructure and services will be upgraded and modernized. New and improved services will be provided to meet the market demands and ensure a good user satisfaction. These services can be offered by Cloud Computing in the form of Software as a Service (SaaS), which includes online banking, payment, gaming, social networks, customer relationship management, accounting, business intelligence and analytics. Amongst different types of SaaS, Gaming as a Service (GaaS) is an increasingly important area due to its rise of user communities and revenues, since GaaS has brought in billions of revenues for the global market (Lehdonvirta, 2009; Yao and Chang, 2014). However, there are challenges that need to be resolved for GaaS. One area is trust, which investigates the trust building between different players, and between players and GaaS service providers and between players and third-party vendors. Although existing literature do describe the importance and impacts, few literature have presented an in-depth study about the investigations of trust building on GaaS in the Cloud. Often there

are issues associatyed with trusts in GaaS, which can result in the financial loss, emotional upset and reputation damage for both players and service providers.

The purpose of this paper is to further extend our previous study (Yao and Chang, 2014), whereby a Chinese game was identified and illustrated as a case study for our investigation. Four major hypotheses based on the literature review were set up with its respective questionanaires presented. However, data collection and results were based on only one city, Chengdu, which would require data collection in more cities to ensure a fair representation as a Chinese case study. This motivates us to investigate additional work and data collection in two most populous cities, Beijing and Shanghai, to ensure our work has more data to support a Chinese gaming case study and follow a robust methodology.

The structure of our paper is as follows. Sectrion 2 presents the literature of Cloud gaming literature and Section 3 describes the background information about Cloud gaming including our motivation, continuation from the previous research and the walkthrough of our selected game. Section 4 explains the hypotheses of trust and extension of our previous research. Section 5 outlines our methodology and results. The data collection process, demographics and data analysis. Section 6 illustrates the detailed analysis including the one-way ANOVA analysis and comparisons between different data and two other topics for discussion. Section 7 presents the conclusion and futrue work of our research.

2   Literature about the Cloud Gaming

This section is divided into the literature for the Cloud Computing adoption and the general literature of Cloud gaming.

2.1 The literature for the current and future Cloud Computing adoption

While Gaming as a Service (GaaS) is the topic for investigation, it relates to related topics including Cloud Computing and Internet of Things (IoT). GaaS is delivered as a service in the Cloud. Similarly, all the data such as the gamer's statistics, game server data, conversations between gamers in the game or between gamers on social networks and community data can be found in the Internet or the gaming Cloud. One way or the other, all these information can be retrieved and obtained by Cloud Computing and IoT. Hence, the future-proof adoption techniques, architecture and business models are essential for the Cloud gaming development. A specific GaaS system design, implementation and service is required to develop the next generation of GaaS. Related literature and services will be explained in the following section.

2.2 General literature about the Cloud Gaming

There is an increased number of games hosted in the Cloud. The benefits include the consolidation of resources and cost-savings for service providers and the ease of use and accessibility for players (Chang et al., 2010; Chang and Wills, 2013). The role-playing

game (RPG) is one of the most popular Cloud Gaming. The RPG game used for our case study is http://jx3.xoyo.com/ which has over one million of users at all times. Due to the large user based community and the billions of revenues the game has generated, this game is very stuiable for our study. Cloud gaming has been a popular way for online entertainments. The emphasis from the main stream papers is on the performance and latency of Cloud gaming and not about the investigation of trust and user community in the Cloud gaming (Chen et al., 2011; Jarschel et al, 2011 a). Similarly, business model approach is important, whereby Ojala and Tyrväinen (2011 a) have explained the buisiness model of Cloud gaming and have presented their case study to support their rationale.

Huang et al (2013, 2014) have proposed an Open Cloud Gaming System. They explain their motivation, charactersitcis of open Cloud gaming system, the architecture, performance measurement and their proposed GamingAnywhere model. According to their paper, there are four major chacrateristics of Cloud gaming, which are as follows.

- Extensibility: Developers can follow their programming interfaces.
- Portability: Games should be available for portable devices.
- Configurability: Games should be easy to configure.
- Openness: All the details of the game should be made open and publicly available.

However, not all the Cloud games can follow concepts proposed by Huang et al (2013, 2014). Ojala and Tyrväinen (2011 a; 2011 b) assert that managing the business model is more important than possessing the major characteristics of Cloud gaming. This is true and valid since all Cloud games should have a sustainable business model and a strong user community with high levels of loyalty and interests from millions of users. In our previous study, the majority of gaming community users have spent three or more hours a day on the game and the interactions with other players. Cloud gaming is also an emerging business model, since it can generate billions of revenues (Teece, 2010; Ojala and Tyrväinen, 2011 b). While the opinions from opposite sides for Cloud gaming have their own valid points, we propose that Cloud gaming should fulfill four revised characteristics to help secure a sustainablke business model and the user community. These include:

- Usability: Games should be easy to use for anyone and make use of graphics, videos, interactions between players, interesting story and characters Ojala and Tyrväinen (2011 a).
- E-commerce readiness: In our previous study, we have investigated the link between the e-commerce readiness and trust. Our hypotheses support that e-comemrce readiness is a main factor driving users for continuous support and frequent usage of the Cloud gaming services (Miorandi et al, 2012).
- Developer readiness: The Cloud games should allow the developers to be able to modify, configure and update performance, portability, extensibility and other issues (Huang et al., 2013).
- Open information and support: All the information should be available and searchable, including how to enhance skills, complete the mission, game walkthrough and methods of support. The method of support is increasingly important since some Cloud service providers have charged the players per

usage or per month and some only charge fees for buying special equipment (Huang et al., 2014).

All these characteristics are essential for the development and operation of the Cloud gaming. Cloud gaming has been a popular way for people in PR China to have their entertainment. This is also a complex issue since not all forms of online activities can be fully supported by the PR China government. However, Cloud gaming with online transactions have been approved by the central government, industry and players from all types of background.

2.3 Continuation from our previous research studies

Our previous study has investigated the feedback of the user community based in Chengdu, South Western China. We have collected 100 valid feedback out of 800 people that we have approached. As previously discussed, the results and their analysis are based on the user community from one particular city although they support our four main hypotheses. In order to ensure that our hypoithese are consistent with our results, we have collected data from two more cities in China: Beijing and Shanghai. These two are the most populaous cities in China and have a great influence on the way that the mainland Chinese behave and think towards a new concept or a new game. Additionally, the aim is to investigate whether the results of our data analysis are consistent with our hypotheses and whether users of our online gaming community can be categorized based on our recommendations. The details of the data collection results and their analysis will be discussed in Section 4.

3   Background information about Cloud Gaming

Before introducing our latest data collection and the analysis of their results, we introduce the game on http://jx3.xoyo.com/ in Section 3. We aim to demonstrate how to fulfill any of the four revised characteristics that we have proposed in Section 2. Usability is its strength of this Cloud gaming due to its advanced graphics, excellent quality of services and the interactive user community. There are two parts in this section. The first part is focused on the exploration of the map within the game and the second part is focused on the missions to be completed and interaction with other users in the Cloud gaming.

3.1 Exploration of the map

Players can choose any characters available in the game and each character beongs to a dedicated clan with their own skills, fighting techniques, powers and weapons. There are several missions in the game. The first one is to go to specific places to perform a task. Virtual tours are part of the mission requirement. The map of the virtual tours can be as huge as mainland China in reality. This means that moving from one place to another may take some time. As a supreme martial artists, the players can choose to "speedy fly" all the way to the destination. Speedy fly will not weaken the power and stamina of the players and can save them time to reach their destination. The players can also choose

using a horse as a transport carrier to the destination if they want to explore other unknown places to get herbs or train up their skills. In the process of doing so, it will take several minutes at least. The excellent quality and content of the graphics is a great attraction to the game. Occasionally some players left their messages on the open chatrooms that they played this game because of beautiful scenes that they had never been to and the excitement that the adventures could offer. For example, this game can provide the simulated graphics near "Taiyuan", one of the well-known places of interest in mainland China. By visiting Taiyuan the in the virtual world, the player could visit this place as if he or she could visit in person. Figure 1 shows that a player had visited Taiyuan by a horse. Figure 2 shows another character of the player visited the Taiyuan by following a walking path.

Figure 1: A player visited Taiyuan by a horse

Figure 2: A player visited the other scenes of Taiyuan

3.2 Completion of missions

The game has classified two major missions for all the players. The first is known as People versus People (PVP) which is focused on duals between different individuals and

clans. The winners will improve on their skills, fighting points and experiences. The second is known as People versus Episode (PVE), which means that the players are only involved with the game's tasks such as killing the monsters, involved with mega fights with a superpower evil clan generated by the gaming service providers. Those mega fighting with the superpower evil clan will require teams of individual players with different characters and clans of the game to work together collaboratively. If the teams of the the players have succeeded, they can get equipment with the supreme qualities such as sword, armour and medicine. There are also a significant number of players that have been involved with both PVP and PVE ways to complete their missions.

Figure 3 shows the dual between two individual players. The top-left corner shows the level of blood for both players. The other players are waiting for the next duals. Having regular duals have been useful for many players since they can improve their skills and sharpness before facing off the supreme evil clans generated by the gaming service provider. However, this has negative impacts since some players are only interested in dualing with other players and ignorant to PVE missions. To prevent the violence spread across the game, the dual system can penalize serious offenders. The winner must stop when the loser of the dual has the "one drop of blood" left in place, which will display a warning message with a bold yellow line on the top of the losing player. At this point, the winner should stop and get his bonus points. If the winner does not stop and "kill" the loser in the virtual world, then the offender will have to be in the jail. So even if the player then logs into the system later, the player is in the jail and cannot be released after the sentence is over. This has created positive impacts that a high majority of players will always stop the dual when there is a winner in the each duel.

Figure 3 shows the dual between two individual players (permission obtained)

Another way for players is to get involved with PVE route, in which the players can obtain the supreme equipment after the completion of the mission. Often players have to organize and team with different characters. For example, there are at least two players with strength, at least two players with swift sword fighting techniques and at least one or

two healing players. Players need to deploy winning tactics. For example, they can kill the monster boss at the right beginning. Then the healing will begin to heal the players that losing bood and continue doing so before the end of their mission. The combination of the characters of strength and sword fighting is also important. Those who can hit the monster boss with more blood tend to move slower than the sword fighters. Thus, players can learn how to co-ordinate between the strength and speed, and attack from the differne tdirections while cover for each other for protection. Figure 4 shows a team of players fighting with the monster boss and Figure 5 shows another team of players obtaining their ultimate prizes after beating another monster boss.

Figure 4: a team of players fighting with the monster boss (permission obtained)

Figure 5: A team of players obtaining their prizes after beating a monster boss (permission obtained)

The benefits of competing the mission with other players together allow players to build up trust and friendship. In the process of overcoming the evil clan and the monster

boss, the players may need to trust the healers to make them physically fit with full blood. The healers need to trust the fighters to beat the monster boss and to protect them. The fighting pair between the players with strength and players with dexterity need to co-operate in a way to counter attack and defend at the same time to make the maximum damage to the enemies. After beating the evil clan, the players may have the opportunity to extend their trust and friendship by equally sharing their prizes and following the fair play policy encouraged by the gaming service provider and this gaming community. Although there are always a number of players not following the recommended policies, the majority of players can develop this extent of trust according to our previous study.

4   The hypotheses of trusts and the extension from our previous study

In our previous study, we define the scope of trust and set four major hypotheses based on selected literature review. There are several classifications, where Gefen et al. (2003 a; 2013 b) classify the antecedents to trust into four types:

1. Knowledge-based trust, which focuses on trust-building through repeated interactions
2. Cognition-based trust, which focuses on trust building by the first impressions and reputation rather than interactions over a period of time.
3. Institution-based trust, which focuses on relying on an institution or third-party to build trust
4. Personality-based trust, which refers to individual personalities that influence trust building.

We explain how these four types of trust come from with their supporting literature. Gaming and e-commerce communities can successfully be blended together. In such cases, they are part of virtual communities which include groups of people with similar interests and have establish a strong relationship. The e-commerce system provides a platform for payment of items or services. We elaborate that under each category of trust, there are related literature with explanations about how they are developed into each hypotheses. In summary of our previous work (Yao and Chang, 2014), the hypotheses are presented as follows.

1. Knowledge-based trust antecedent: familiarity
H1a Familiarity with other members in a VC can positively influence trust in other members' 'integrity and benevolence'.
H1b Familiarity reduces uncertainty and builds up trust.

2. Characteristic-based trust antecedent: perceived similarity
H2a Perceived similarity with other members in a VC positively affect trust in other member's 'integrity and benevolence'
H2b Perceived similarity with other members in a VC build up trust

3. Institution-based trust antecedent: structural assurances

    H3a. Perception of structural assurances positively affect trust in other members' 'integrity and benevolence'.

    H3b. Perception of structural assurances positively affect trust in the website or vendor's integrity.

    H3c. Perception of structural assurances can positively affect trust in the website or vendor's benevolence.

4. Personality-based trust antecedent: trust propensity

    H4a. Trust propensity positively affect trust in other members' 'integrity and benevolence'.

    H4b. Trust propensity positively affect trust in the website/vendor's integrity.

    H4b. Trust propensity can positively affect trust in the website/vendor's benevolence.

As previously discussed, more results from different parts of China will help validate the accuracy of our hypotheses. This also helps us identify whether our hypotheses can stay consistent and robust while different user groups have been surveyed. We defend that strong and robust hypotheses can be validated fully by data analysis from user groups located at different parts of China.

5 Methodology and results

Survey questions were designed and set up based on hypotheses presented in Section 4 and was identical to our previous studies. The four hypotheses are classified under familiarity (FA), perceived similarity (PS), structural assurances (SA) and trust propensity (TP). Corresponding survey questions are presented in Appendix. Results and comments received from the surveys could be used for analysis.

5.1 Data collection

Three methods were used to collect data from subjects who were members of the community. First, paper questionnaires were distributed to undergraduate and graduate students in a university in Shanghai and Beijing, China. Second, an online version of the questionnaires was distributed for about four weeks to ensure sufficient data collection. Additionally, an allied to the VC community helped us distribute the online survey to their student members. All these three ways could ensure a sufficient sample size was collected. We sent out the questionnaires to 2,000 people, with 1,000 each in Shanghai and Beijing respectively. Altogether 250 responded the questionnaires including 129 responded in Beijing and 121 responded in Shanghai with 12.5% of return rate altogether. Only 230 of them, including 120 from Beijing and 110 from Shanghai, answered all the questions and provided useful feedback to our hypotheses. This means 92% of valid sample size.

Table 1 shows the descriptive information about the dataset for Beijing and Table 2 shows the information about the dataset for Shanghai. Both tables show the sample

demographics with six major categories: gender, age, education, the length of membership history, whether they have purchased online, types of products purchased and equipment purchased the most frequent.

In our Beijing survey, 62.5% of the respondents were male and 37.5% were female. The majority (85.83%) of the respondents were aged between 19 and 35 since the questionnaires were distributed to a university students in Beijing and student members in an allied VC. 92.5 % of them had the education level as university undergraduate or above. This supported our previous case study that well-educated young adults are main shoppers of consumer to consumer (C2C) websites which have worked with Cloud gaming websites. In our Shanghai survey, 74.55% of the respondents were male and 25.45% were female. The majority (86.36%) of the respondents were aged between 19 and 35 with similar reasons like Beinjing's. 91.82 % of them had the education level as university undergraduate or above which support our hypotheses that C2C spending on Cloud gaming were young and educated adults. With regard to the period of membership, both surveys show similar results, most of players had played the game for 6 months and above. Similar to our previous studies, the top three were computer and accessories, books and clothing and footwear if the participants use Taobao for general purposes and not for gaming since students needed them as utilities and consumables.

The next point for discussion is the online purchase. In Beijing, 81.67% of respondents purchased items online and amongst them, 91.84% purchased the items for enhanced game performance and 8.16% purchased the services. In Shanghai, 84.55% of respondents purchased items online and amongst them, 93.55% purchased the items for enhanced game performance and 6.45% purchased the services. Players have purchased items and services through trusted third-party websites such as Taobao. This offer incentives for players since their lives can be prolong with the enhanced fighting skills, powers and equipment. Players purchased tools for automated playing the most frequent due to their busy university life, and they used those tools to ensure that their main characters can be in a continuous playing mode. Players bought tools for the enhanced life, so that their played characters could have more supplies of blood and power and could preserve their lifeline longer.

There are also tools for automated players to ensure the players can improve their level of experience in the shortest amount of time. There are services such as playing the game on the behalf of players to make profits. The average salary can be approximately between RMB 40,000 and 50,000 a month based on our interviews with the respondents. This makes it attractive for some young players to develop into a new business model. However, this sort of business is not stable since some demands from clients can be high or low dependent on the "season". In the season where there are examinations and assignments due, or graduation period, the demands are low. On contrast, the summer vacation and short public holidays have more than between 20 and 30 client requests a day. Currently this is not our research focus as it involves with deeper level of trust and understanding about the players' life style. Similar to our previous study, respondents declined to be interviewed for further details.

Table 1: Sample demographics (N = 120) for Beijing survey

Measure	Item	Count and percent
Gender	Male	75
	Female	45
Age	18 and below	11
	19 to 24	60
	25 to 30	29
	31 to 35	14
	36 and above	6
Education	High school or below	9
	Two-year college	24
	Four-year university	61
	Graduate school and above	26
Length of membership history	Less than 3 months	9
	3 to 6 months	14
	6 months to 1 year	16
	1 year to 2 years	26
	2 years and 3 years	18
	Over 3 years	27
Have purchased online (such as Taobao)	Yes	98
	No	22
Types of products purchased (out of 98)	Equipment on games	90
	Services on games	8
Equipment purchased the most frequent (out of 90)	Tools for automated playing	41
	Tools for enhanced fighting	19
	Tools for enhanced life	30

Table 2: Sample demographics (N = 110) for Shanghai survey

Measure	Item	Count and percent
Gender	Male	82
	Female	28
Age	18 and below	9
	19 to 24	55
	25 to 30	27
	31 to 35	13
	36 and above	6
Education	High school or below	9
	Two-year college	21
	Four-year university	54
	Graduate school and above	26

Length of membership history	Less than 3 months	8
	3 to 6 months	12
	6 months to 1 year	15
	1 year to 2 years	24
	2 years and 3 years	16
	Over 3 years	25
Have purchased online (such as Taobao)	Yes	93
	No	17
Types of products purchased (out of 93)	Equipment on games	87
	Services on games	6
Equipment purchased the most frequent (out of 87)	Tools for automated playing	38
	Tools for enhanced fighting	20
	Tools for enhanced life	29

5.2 The data analysis of the collected data

This section presents the data analysis of the collected data. Table 3 shows results for mean scores, standard deviations and p-values for all the items in the hypotheses. Scores were rated between 1 and 5 with 5 as the highest and 1 is the lowest. Explanations are as follows. The p-value should be below 0.05 to indicate that the results falls into the 95% of confidence interval. Table 3 and Table 4 show the mean scores and standard deviations for our Beijing and Shanghai survey respectively.

Table 3: The mean scores and standard deviations from our Beijing survey

Items	Mean	Standard deviations	p-values (p less than)	Remarks
FA1	3.70	0.40	0.03	TP category has the higher standard deviations in general.
FA2	3.70	0.50	0.04	
FA3	3.40	0.40	0.03	
FA4	3.30	0.40	0.03	
PS1	4.00	0.20	0.02	PS category has a lower standard deviation in general.
PS2	4.10	0.15	0.01	
PS3	3.70	0.20	0.02	
PS4	3.60	0.30	0.03	
SA1	4.00	0.20	0.02	SA category has the lowest standard deviation in general.
SA2	4.10	0.20	0.02	
SA3	4.20	0.10	0.01	
SA4	4.10	0.20	0.02	

TP1	3.40	0.60	0.04	This has the widest standard deviations, since some members had an unpleasant experience and some had the opposite.
TP2	3.50	0.50	0.05	TP category has the highest standard deviations.
TP3	3.70	0.20	0.02	

Table 4: The mean scores and standard deviations from our Shanghai survey

Items	Mean	Standard deviations	p-values (p less than)	Remarks
FA1	3.80	0.40	0.04	TP category has the higher standard deviations in general.
FA2	3.80	0.50	0.05	
FA3	3.60	0.40	0.02	
FA4	3.40	0.40	0.02	
PS1	4.10	0.20	0.02	PS category has a lower standard deviation in general.
PS2	4.20	0.20	0.02	
PS3	3.80	0.20	0.01	
PS4	3.60	0.30	0.03	
SA1	4.10	0.20	0.02	SA category has the lowest standard deviation in general.
SA2	4.20	0.20	0.02	
SA3	4.20	0.10	0.01	
SA4	4.10	0.20	0.02	
TP1	3.50	0.60	0.05	This has the widest standard deviations, since some members had an unpleasant experience and some had the opposite.
TP2	3.50	0.50	0.05	TP category has the highest standard deviations.
TP3	3.70	0.20	0.02	

In comparison of results in both tables, there are higher mean scores in Shanghai survey than Beijing survey. However, standard deviations (SD) and p-values are fairly similar. In the category for the first hypotheses (FA1 to FA4), the mean values in Beijing survey are between 3.30 and 3.70 with standard deviations (SD) between 0.40 and 0.50. The mean scores in Shanghai are between 3.40 and 3.80 with SD between 0.40 and 0.50. In the category for the second hypothesis (PS1 to PS4), the mean scores in Beijing survey are between 3.60 and 4.00 with a smaller range of SD between 0.15 and 0.30. The mean values in Shanghai are between 3.60 and 4.10 with SD between 0.20 and 0.30.

In the category for the third hypotheses (SA1 to SA4), the mean scores in Beijing survey are between 4.00 and 4.20 with a smaller range of SD between 0.10 and 0.20. The mean scores in Shanghai are between 4.10 and 4.30 with SD between 0.10 and 0.20. This category has the most positive outcomes with the least of SD for both surveys. The p-

values have the lowest values in all four categories to further support this observation. In the category for the fourth hypotheses (TP1 to TP3), the mean values in Beijing are between 3.40 and 3.70 with the large range of SD between 0.20 and 0.60. The mean scores in Shanghai are between 3.50 and 3.70 with SD between 0.20 and 0.60.

All p-values are 0.05 and below, which support our hypotheses. Results from Beijing and Shanghai survey also support our hypotheses and have similar results that higher mean values in the third category since respondants have agreed with the survey questions. Results in Table 3 and 4 are consistent and close to our survey results in Chengdu, another city in China. However, there are two differences between our previous study. First, the first category is not necessaruily the lowest. Both Beijing and Shanghai surveys suggest the first and fourth category have lower mean scores and it is difficult to determine which one has the lowest mean scores. Secondly, the mean scores in Beijing and Shanghai are lower than the one taken at Chengdu, with Beijing the lowest. One possible explanation is that Cloud gaming users living in the most populous and modern city in China, Beijing and Shanghai, have seen many more games, more varities and more options, hence they have higher expectations and demands on the Cloud gaming. However, further work will be conducted to validate this rationale.

5.3 Data analysis while comparing the current and previous collected data

Table 5 presents the key inputs for comparison with our previous studies. Due to the agreement, some details of the work are not enclosed in this paper. However, the mean scores of the previous data can be used as a baseline, which means the target scores for each category in the survey.

Table 5: Comparison between Beijing, Shanghai and Chengdu surveys

Items	Mean scores of Beijing survey	p-values of Beijing survey	Mean scores of Shanghai survey	p-values of Shanghai survey	Mean scores of Chengdu survey	p-values of Chengdu survey
FA1	3.70	0.03	3.80	0.04	3.90	0.03
FA2	3.70	0.04	3.80	0.05	4.00	0.04
FA3	3.40	0.03	3.60	0.02	3.70	0.03
FA4	3.30	0.03	3.40	0.02	3.50	0.03
PS1	4.00	0.02	4.10	0.02	4.20	0.02
PS2	4.10	0.01	4.20	0.02	4.40	0.02
PS3	3.70	0.02	3.80	0.01	4.00	0.02
PS4	3.60	0.03	3.60	0.03	3.90	0.03
SA1	4.00	0.02	4.10	0.02	4.30	0.02
SA2	4.10	0.02	4.20	0.02	4.40	0.02
SA3	4.20	0.01	4.20	0.01	4.50	0.02
SA4	4.10	0.02	4.10	0.02	4.40	0.02
TP1	3.40	0.04	3.50	0.05	3.70	0.05
TP2	3.50	0.05	3.50	0.05	3.80	0.05
TP3	3.70	0.02	3.70	0.02	4.00	0.05

Mean	3.50	0.026	3.84	0.027	4.05	0.03

Baseline from the previous record has been widely adopted. One example is the stock market exchange that the baseline is based on the previous day's trading index values. All the survey data are compared in Table 5. Beijing survey has the lowest mean value of 3.50 and the lowest p-values of 0.026. This suggests that users have high expectations on the Cloud gaming and they have more consistent results. Additionally, the company of this Cloud gaming is based in Beijing and some users have confirmed that they have a fairly good knowledge about it. Some respondents left the comments that since the Cloud gaming's data center is absed in Beijing, they cannot understand why the bandwidth and speed are not as fast as they might expect. Shanghai has the mean score of 3.84 with low p-value of 0.027. It also means results are fairly consistent. Chengdu has the highest mean score and the result is the most supportive to our hypotheses. However, it has higher p-values than the other two but is still a low value of 0.03.

Results show an interesting approach. Although the scores are above 3 out of 5 in order to justify that results support hypotheses, results do vary between different cities in China. We will set the hypotheses for the next level to find out the factors that drive people's perception about trust and loyalty to the Cloud gaming and conduct more surveys in different cities in China to analyze data from our comparisons. Additional test or analysis is required to further support this. See Section 6 for details.

6   Detailed analysis

This section presents detailed analysis for Analysis of Variance (ANOVA), which is a useful method to analyze two sets of data, particularly if these two sets of data involved with two different groups (Chang and Wills, 2013).

6.1 Advanced statistical analysis: One-Way ANOVA

The One-Way ANOVA is chosen because it was the same survey for two different groups of gamers who do not have huge difference in the culture and the language of communication on the Cloug gaming. Statistical results are computed by STATA 11, which is an statistical package used by researchers, statisticians and industry. The variable "beijing" is referred to the mean score of Beijing survey, variable "shanghai" is referred to the mean score of Shanghai survey and variable "chengdu" is referred to the mean score of Chengdu survey. One-way ANOVA is used to compare the results based on the points of the view offered by current data. In other words, Beijing survey is used to compared with Chengdu survey and Shanghai survey is compared with Chengdu survey. Explanations for the terminology is as follows. The term SS is referred to sums of squared errors, df is referred to degree of freedom, MS is referred as the mean squared errors and F is the result of the F-test. In terms of accuracy measurement, values in SS and MS should be as low as possible to indicate that all the sums of errors are low in values. F-test should have a higher value. This is reflected in the term Prob > F, which corresponds to the p-value of this data analysis (Lee et al., 2010). The p-value should be

below 0.05 to indicate that the results falls into the 95% of confidence interval. R-squared value refers to how fit the regression line is. It should be as close as to 1 to show that results are consistent and do not have large discrepancies (Lee et al., 2010).

Table 6: Results of the analysis of Beijing vs Chengdu (current vs previous data)

```
            One-way Analysis of Variance for beijing:

                        Number of obs =      16
                        R-squared =   0.9962

    Source          SS       df     MS        F     Prob > F
    -------------------------------------------------------------------
    Between chengdu      1.2949995    9   .14388884   172.67    0.0000
    Within chengdu       .00500001    6   .00083334
    -------------------------------------------------------------------
    Total            1.2999995   15   .08666664

        Intraclass    Asy.
        correlation    S.E.     [95% Conf. Interval]
        ------------------------------------------------
         0.99102     0.00695     0.97739   1.00465

        Estimated SD of chengdu effect      .3032561
        Estimated SD within chengdu         .0288676
        Est. reliability of a chengdu mean   0.99421
           (evaluated at n=1.56)
```

Table 7: Results of the analysis of Shanghai vs Chengdu (current vs previous data)

```
         One-way Analysis of Variance for shanghai:

                        Number of obs =      16
                        R-squared =   0.9668

     Source          SS       df     MS        F     Prob > F
     -------------------------------------------------------------------
     Between chengdu      1.1176661    9   .12418513   19.44    0.0009
     Within chengdu       .03833331    6   .00638888
     -------------------------------------------------------------------
     Total            1.1559994   15   .07706663

         Intraclass    Asy.
         correlation    S.E.     [95% Conf. Interval]
         ------------------------------------------------
          0.92220     0.05854     0.80746   1.03693

         Estimated SD of chengdu effect      .2751839
         Estimated SD within chengdu         .0799305
         Est. reliability of a chengdu mean   0.94855
            (evaluated at n=1.56)
```

With regard to Table 6, R-squared value is 0.9962 show that result of regression is excellent. Intraclass correlation shows the correlation relationship between the currentdata and previousdata and it should be above 0.5 to show that there are close correlation between two data. The estimated stadandard deviations (SD) for previousdata and currentdata is 0.268 and 0.152 respectively. Both SDs are low to support that the difference between all mean scores are low and fairly consistent. All these results are very positive to support to our four hypotheses.

6.2 One-Way ANOVA comparing between Beijing and Shanghai data

While Beijing and Shanghai are the new data collected for this research, direct comparion can be made to distinguish any differences. In our survey, Beijing was taken first before Shanghai, hence, the one-way ANNOVA analysis can be compared between Beijing and Shanghai. A variable called "beijinshanghai" was created to make direct ANOVA analysis and comparison. See Table 8 for details.

Table 8: Results of the analysis of Beijing vs Shanghai data (two recent studies)

```
        One-way Analysis of Variance for beijingshanghai:

                    Number of obs =      16
                    R-squared =    0.9705

    Source          SS      df    MS        F     Prob > F
    ------------------------------------------------------------
    Between shanghai  1.2616663   7   .18023804   37.61   0.0000
    Within shanghai    .03833326   8   .00479166
    ------------------------------------------------------------
    Total            1.2999995   15  .08666664

    Intraclass    Asy.
    correlation   S.E.    [95% Conf. Interval]
    -----------------------------------------------
     0.94952    0.03759    0.87585    1.02320

    Estimated SD of shanghai effect      .3002292
    Estimated SD within shanghai         .0692218
    Est. reliability of a shanghai mean   0.97341
       (evaluated at n=1.95)
```

Results show that there is a high R-squared value, indicating that the results are fairly consistent with the hypotheses. The value of Prob > F is 0.000, which is equivalent to the p-value of the ANOVa test and supportive to the hypotheses. There is a strong correlation between the data.

6.3 Limitations of this research

Although more data has been collected for analysis, limitations of this research are as follows. First, this is still a Chinese case study and another game will be used for

comparison. Second, innovative way to perform large scale ANOVA analysis and comparison should be made. This will allow the researchers to compare different data at one attempt rather than three separate attempts as demonstrated in Section 6. Last, more data and their statistical analysis will be used to validate our hypotheses. We will also investigate other factors influencing the success of Cloud gaming apart from trust. Factors may include adoption of new technologies, security, usability and performance.

6.4 Future direction

Chang (2014) demonstrate a Business Intelligence for Cloud Computing which can provide financial services and forecast the financial performance with selected stocks which can enhance the e-commerce and development of Cloud gaming services. A future plan is to blend GaaS with Business Intelligence, so that all e-commerce, user management, payment and network performance can be fully integrated in one application. Business Intelligence as Service (BIaaS) can provide business values and enhance Cloud gaming business models. Similarly, BIaaS can track all the activities in real-time and monitor, manage and process financial transactions of all the players. It can improve the user management and trust between players.

7   Conclusion and Future Work

Followed by our previous studies, we have proceeded to our next phase to collect more data from the most two populous cities in China to validate our hypotheses. The process and methodology of data collection anad analysis have been explained, including the demographics of each data, the one-way ANOVA method and comparisons between different ANOVA results. Results are very supportive to the four major hypotheses that we have set. Results in Beijing and Sahnghai are lower than Chengdu in general and possible explanations have been provided.

Cloud gaming is an emerging area that have gained popularity and increased aware in China and other countries. Our study has focused on trust and trust building in the Cloud gaming and have used survey as the main methodology. We plan to provide surveys for players in other cities in China and also offer the opportunities for face-to-face or Skype interviews to understand the rationale and reason for these players' choices. We will also develop innovative method to make large-scale ANOVA analysis through Cloud Computing or Big Data processing techniques to allow us to make cross comparisons with different data at one attempt rather than three separate attempts as illustrated in this paper.

Appendix: A full list of questionnaires

Items	Questions	Additional comments
FA1	I become familiar with the IDs of some members through reading posts, posting, or replying to messages in the Cloud gaming Community	These four questions support hypotheses presented in Section 4 and our previous study.

FA2	I become familiar with the interests and behavioral characteristics of some members such as their writing styles through reading, posting, or replying to messages in the Cloud gaming Community	The preferred community is http://jx3.xoyo.com, and if not, a similar role-based Cloud gaming is required.
FA3	I become familiar with other members through reading, posting, or replying to messages in the Cloud gaming Community	
FA4	I communicated with some members in the Cloud gaming Virtual Community frequently	
PS1	I feel members in the Cloud gaming Virtual Community have common goals	These four questions support hypotheses presented in Section 4 and our previous study.
PS2	I feel members in the Cloud gaming Virtual Community have similar interests to mine	
PS3	I feel members in the Cloud gaming Virtual Community have similar values to mine	
PS4	I feel members in the Cloud gaming Virtual Community have similar experience to mine	
SA1	I am at ease communicating with other members because Cloud gaming establishes rules for the community	These four questions support hypotheses presented in Section 4 and our previous study.
SA2	I am at ease communicating with other members because there are administrators and forum owners managing the Cloud gaming Virtual Community	
SA3	I feel safe communicating with other members because Cloud gaming Virtual Community provides Internet safety alerts	
SA4	I feel safe communicating with other members because I accessed Cloud gaming Virtual Community through a well-known, reputable portal	
TP1	I generally have faith in humanity	These three questions support hypotheses presented in Section 4 and our previous study.
TP2	I feel that people are generally reliable	
TP3	I generally trust other people unless they give me reason not to	

8   References

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