Title: 웹 소프트웨어의 신뢰성 15

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[00:00]

My name is Jinhee Park.

Today I want to talk about reliability prediction of service oriented systems.

Today the title I will going to present you is collaborative reliability prediction of service oriented systems.

This paper is presented in ICSE, in 2010, and the author is the Zibin Zheng, and Michael Lyu.

The first author is the PhD student in Chinese University of Hongkong, and second author is his supervisor.

Actually second author is a very famous scholar in the reliability research area.

Maybe you guys have read this paper, but this topic is not familiar with you guys.

So I wonder how you feel about this field.

Lots of paper contains a lot of mathematical formular, so someone might feel like it is very complicated.

So, very complex thing.

But this paper is quite easy, and many people say this paper is well written.

So, that's why I choose this paper fot the presentation.

Okay, if you have any question, just try ask anything.

This is outline of my presentation.

First, I will introduce what is th problem of the reliabilty prediction of the solar system.

So we need to know the characteristics of solar systems.

Second, we need to… so I will explain the motivation of this work.

And in the background, I will explain the many technique of this paper.

Accord as a collaborative filtering, I will explain that in motivation period in background.

And in other approach, I will explain the collaborative framework.

And then I will explain the reliability prediction.

How they predict the reliability of our solar system.

And in the experiment, I will describe how they prepared the experiment, what is the result of the experiment.

And then I will conclude my presentation, and we will have the discussion time.

Maybe you guys heard many times about solar.

Solar is the major framework for the distribute system.

So some is oriented in the service system.

Usually, service is global distributed.

And, sorry.

And interact over the network, so you can assume that there are a lot of services.

To generate new service, we can combine those service all around world.

And then we can generate the new sevice program like this.

The interesting thing…

What I think interesting is the reliability of the service floor in this paper.

So, there are a lot of quality of service, like performance, reliability, capability, like ability.

This paper just focus on the reliability.

So the problem is the how to measure the reliability of service of solar system.

So this paper try to solve that problem.

And we want to know what are difficulties for evaluating the reliability of web service.

In the previous class, we discussed a lot about these difficulties.

First of all, solar system have a heaby dependence on the unpredictable communication links.

So, in this tradition, there are a lot of users who want to use the same web service.

[05:00]

But, they have the different reliability.

Because of unpredictable communication link.

So, QS document is not accurate anymore in the solar environment.

So we need new technique for our service problem.

And second difficulty is impossibility of traditional exhaustive testing.

Because usually service is provided by external organization, so it costs a lot.

It means invocatonal web service will be charged and it is time consuming.

It means there are a lot of service candidates.

So, testing all of the candidates is time consuming.

So we cannot test in the exhaustive way.

And the third one is the existing reliability techniques are not applicable.

So we cannot use those component based reliability technique for solar system.

Because there is a lack of internal information of the service components.

So we need another approach to solve this kind of problems.

So I mentioned what are difficulties of prediction of solar system.

So the motivation of this paper is the…

As we know, web service is getting important.

Because software development is toward the component development.

I want to say so.

Web service is getting important and reliability should be predicted, rather than documented.

And as I mentioned previous page, existing exhasutive testing take time and cost

So we can not use obtain failure data from the usual our web service.

And exist techniques are not applicable for predicting web service reliability.

So this paper propose double reliability technique using other user's information who have a similar experience.

This is the goal of the this paper.

(student speaking)

So in the previous page, existing technology, just service provicer provide QS document.

Maybe service provider test their service a lot.

And then they determine the QS of their service and they offer the QS document.

But it is not applicable anymore because unpredictable communication link.

Because users face different reliabilities.

So we need the new technique for reliability prediction rather than the document.

So that's what I am going to say.

(student speaking)

Document accurate.

In the side of service provider they cannot offer the exact reliability because there exists several reasons.

In the user side, maybe they feel different reliability of service.

Even though the service provider offer the same reliability, reliability value to user A, user B,

[10:00]

But users feel different reliability.

(student speaking)

Included in the web service, web service, okay.

(student speaking)

Usually, reliability research, reliability is usually evaluated by in the user side, not a provider side.

So, the important thing is how users feel about that service, that software.

So in the user side the reliability is to be caculated.

So the communication link should be considered when they calculate the service reliability.

Maybe your question is different of my answer.

Okay, I will explain further about it.

So, what this paper want to tell is predict new reliability prediction technique from web service.

The technique this paper adopt is collaborative filtering.

This technique is similar to this example.

There are a lot of users who watch movies, there are also a lot of movies.

If the users evalute the movies they watch it and then we can generate user and item rating matrix.

Evaluation score will be filled in this matrix.

So user A score 9, for movie 'A' like this.

In this example user A and user C have the similar tendency for in the evaluation of movies.

So we can expect that they will have similar tendency when they evaluate the web service.

Ah, when they evaluate the service like that.

And in the next page, this is the user-item rating matrix.

There are a lot of users maybe and there are a lot of movies.

As I mentioned in previous page, user A and C can be a neighbor because they evaluated the movies in the similar manner.

So we can predict the score of… we can predict this rank using neighbor's information like this.

So, we can expect it is likely to rate it near 9.

So user C, maybe like movie 'D' because user A like it.

And this way the web service reliability will be, the failure probability of web service will be predictive.

Also in the similar way, movie 'D' and movie 'C' can be neighbored because they have a similar score.

So, to predict this rank, we can expect it is likely the rate is near 9.

Because movie 'C' maybe that high score, because user D like movie 'B'.

So we can expect user D like movie 'C' as well.

[15:00]

This is the collaborative filtering technique they use.

This is overview of this paper.

At first, they coduct the… they gather the information from users who use the service.

There are a lot of users, a lot of service.

When users use the service, the failure information can be corrected, and that information can be

sent to centralized server.

And centralized server can make this matrix.

User and service failure probability matrix.

So we can expect user A has 0.1 failure probability when they use the service A.
Like this information can be corrected.

And then, we can select the, what is the neighbor of current user.

Using this information, we need to select the neighbors, using a similarity competition.

And then, we can predict the user rate service based failure probability.

There are a lot of nerve point, nerve value, so we need to predict this value.

And then after predicting all of the service reliability, we can gather that reliability information.

Then we can get the reliability application.

(student speaking: what is it mean to fail?)

In this paper, service failure is the failure invocation of a… to the service we failed.

The probability of, the probability that invocatio to the service that fail.

That is the failure probability. Service failure probability.

(Student speaking: Okay, so the failure is the lack of response.)

Yes, your right.

(student speaking)

Ah, similarly.

They used some statistical method P.C.C thats pearson correlation coefficient.

that they use that statistical technique they calculate that who is the neighbor of…

(student questioning)

For instance, they only use the information of a failure probability.

They don't consider what kind of environment they are involved in.

They just focus on the failure probability because...

(student questioning)

Yeah, in that case we can say neighbor or not it depends on similarity value they calculate.

Okay I will explain further in the next page.

This is collaborative framework.

At first they used User-collaboration mechanisms.

as I mentioned there are a lot of users who want to use the web services.

so esch user contribute each value of failuer probability matrix.

In this mechanism there is a Midddle ware to collecting of failure probability information.

This is their pervious work so they didn't mentioned about this middle ware in detail.

[20:00]

So maybe using this middle ware.

they can see the failure probability matrix can be filled with...

Null value means the user B never used the service B.

null value means like that.

0.2 means that user B has a experience failure probability of 0.2 when using service C.

This matrix can be genarated after when a lot of users use services.

This mechanism can be conducted automatically.

Using this matrix we choose the who is the neighbors of accounting users and then calculate that.

As he ask people we can compute the similarity using the pearson correlation coefficient.

This is just user used for when measureing the correlation between two variables.

so this interval is from -1 to +1.

The higher value means the higher similarity.

so close to the +1 has the higher similarity.

This is just a formular in the pearson correlation coefficient.

I will just skip this formula.

Using this formula you can calculate the sinilarity between users and services.

And then we need to choose who is the neighbors of current users.

and what is the neighbor of current service.

So the pick top-k neighbors is important.

Pick the neighbors which who has have the high PCC value is the ...

In this example parameter top-k can be three.

because they are interested in just three neighbors who have the high PCC value.

The neighbor of the service b can be a service C, E, and H.

because they have the high PCC value with service B.

Neighbor of user C can be a user A, B, and G.

but user G is to be exculded from the neighbors.

because it has negative value.

which means it is not good similarity negative a means that.

We selected neighbors of current users for current services.

and then we can predict the reliablilty of the web service.

which means we can predict the null vlaue in this matrix.

This paper suggest five reliability prediction methods.

First as basic matrixs they suggest UMEAN.

which means average failure probability observed by user 'u'.

In this example, UMEAN can be average failure probability observed by user b.

IMEAN is average failure probability of service 'i' can be an average of the service D.

This two can be a basic matrix for reliability prediction method.

[25:00]

They used UPCC and IPCC matrics based on UMEAN.

This paper adjust the mean using neighbors information.

UPCC means compute using neighbor users based on UMEAN.

and IPCC compute using neighbor services based on IMEAN.

In this IPCC example the neighbor of service D can be assumed service C and service G.

To predict this null value we used information form neighbor service C and G.

Based on IMEAN just adjust prediction value using 0.3 value and 0.2 value.

This is the mechanism for using UPCC and IPCC.

This is the final matrix for among reliability prediction methods.

They used valuable information that is the hybrid method.

They combine the UPCC and IPCC which is calculated in the previous page.

Because there might be some situation UPCC value is not applicable or IPCC value is not applicable.

so in this situation just varying the δ value we can get more accurate failure probability.

For example, in this situation to predict this null value.

not enough information from neighbor service C or G.

so we can not use the IPCC value.

because they don't have enough information.

But in this case neighbor users information is much more valuable.

user A, and user I's information is much valuable.

We can use this value for predicting null value.

This is the hybrid method and this paper's main approach.

(student questioning)

Yes, I think so.

(student questioning)

δ is usuall define...

(student questioning) but how?

So this is future work .

so it is not automatically calculated.

this is the uauall define parameter.

After predicting all of the web service we need to combine them.

This is just basic reliability prediction techniqus in the compound based softwares.

This is the very simple techniques.

For the reliability aggregation they used four types of basic composition structures.

For each structure they suggest some formula for calculating the failure probability.

Sequence, branch, loop, and parallel structures they suggest some formulas.

For example, at first this kind of the structure.

they can transform this diagram into the sequence aggregation using this formula.

[30:00]

And then they can combine all of the web service failure probability.

This is the experimaent of this paper.

This paper conducted huge experiment.

actually they used 100 probablilty web service located in more than 20 countries.

User..uh..and 150 users, they used from the planet lab.

which is the global reserch network test bed.

I heard I the KAIST professor 문수북's lab had participated in this reserch group.

Planet lab is world wide distributed nodes.

using this experiment setup they conducted this experiment.

And before, for the experiment preperation each user nodes.

each users envoked each web service 100 times.

and then contribut failuer probability.

So each user envoked web service 100 times.

and then, they calculate the failure probability of each page web service.

That is the preperation of this experiment.

This is the whole picture of this experiment wants to say.

In the experiment preperation we can generate the original failure matrixs.

we envoked every web services 100 times.

we can get a better probability.

That is the density of the failure matrics is 100 precent.

And then to make this experiment more realistic.

they removed some value form the original failure matrix.

they removed this kind of values randomly.

And then they predicted this null value using techniques this paper suggests, like this.

And then they compared the prediction value and the original value.

there is the evaluate techniques they use.

just mean absolute error and root mean square error.

This is commonly used for comparing two factors.

This is the experiment parameters they use.

They use five parameters.

Varying this parameter , they observed the prediction result of the reliability.

The first parameter is number of 20 users.

In this example, 20 users can be 3.

And the given number paremeter is number of service that the testing user used.

In this case with test user used some web service.

…some web service.

In this case, given number can be 2.

They used the 2 web services.

So the purpose of this paper is predict the null value.

Just third one is training matrix density is the density of training matrix.

This can be a 60%, this can be the density of this matrix.

And top-k means the maximum number of neighbors and parameter lamda is ratio of IPCC and User PCC at the hybrid approach.

We will bear in these parameters for comparison.

This is experiment result.

[35:00]

Accuracy of each prediction method, they compared the method they provided.

Actually, IPCC, which is focused on the web service, outperforms the UPCC so they observed that.

And Hybrid method, their main approach, is most accurate, they observed that.

And they started influence of the parameters I explained in the previous page.

The result is more information, more accuracy.

So it means that, in this graph they varied the given number from 5 to 50.

As given number increase, the accuracy of the prediction also increases so…

(Professor speaking) So low is good?

Low is good, yes.

(Professor speaking) Okay, so what is zero, okay, you have MAE there, and there is a 0.4. What is that mean?

0.4, this one?

(Professor speaking) Yeah, yeah. What does that mean?

This is the accuracy of the prediction.

(Professor speaking) So what is that 4%, does that relate to anything?

Relate to anything?

(Professor speaking) No, I mean, so I get that lower is better.

Yep.

(Professor speaking) What I'm trying to understand is what does it mean to be 0.4 versus 0.3?

(Professor speaking) I know you'd rather be 0.3 than 0.4, you see there, the far left one, you've got this blue line.

Blue line.

(Professor speaking) It starts at 0.5 then goes down to 0.025.

(Professor speaking) That's a big drop, I guess.

Big drop.

(Professor speaking) So what does it mean?

(Professor speaking) Other than it's more accurate. Is it as twice as accurate?

(Professor speaking) I'm trying to relate that to the real world. What are the practical implications of that?

Practical implications.

(Professor speaking) And the reason I ask is and all of these at the bottom, you got a lot of things that are really close together. Or they look really close together. And I'm trying to figure out if there's a practical difference in terms of impact…

They just compare the first value, they just observe the phenomenon of what tendency of their graph.

So they, as the given number, given number means the, given number is the number of services that test the users used.
(Professor speaking) Sure, sure, but as the number goes up, the predictive value of it really goes up as well.

Yes, that means more information…

(Professor speaking) Sure, sure, more accuracy. I guess what I'm trying to understand is what does it mean to be 0.05 accurate versus 0.03 accurate?

(Professor speaking) Is that twice as accurate? To be 0.03, is that twice as good? Have you cut down the error by half?

(Professor speaking) I mean, I can look at the formula, it's unclear to me, I have no intuition into what's in here.

So you mean, we cannot say this is accurate enough or not?

(Professor speaking) Yeah, I can't relate that to what it means in the real world so if I have a method into 0.02 means mean average error, does that mean it's going to fail 1 in 100 times? 1 in 5 times?

(Professor speaking) Like, if it's the difference between 1 in 10,000 and 1 in 20,000….if it's the difference between 1 in 10 and 1 in 20, that's really big.

(Professor speaking) Anyway, I mean if you don't know then you don't know but I mean, I'm looking at it and I've looked at it before and I really couldn't figure out what that means…Anyway okay, just curious.

(Student speaking) There is this wacom or…the low score means the wacom and the expected…

Wacom?Yeah, they…

(Student speaking) They originally display some value…

For this famous, compare two values.

They compared two values which is the original, one in the original failure matrix.

This is real value, uh, correct value, and then they, there is a value in the previous value, they compare these two value.

[40:00]

And then they calculate the accuracy of this…accuracy.

I'm not sure I catched your point.

(Student speaking) So Y value is…

Accuracy of comparison.

(Professor speaking) The error?

Error?

(Professor speaking) The Y value is the error.

(Professor speaking) So as Y goes up, the mistake level goes up….

So…

(Student speaking) So Y value means there is…expectation fail?

Yes, yes, you are right, there is a fail, a lot of failure of prediction of failure probability.

They also studied the impact of density of matrix.

They also have the tendencies more information has more accurate, accuracy.

And this figure also has the same phenomenon.

Impact of training user number varied from 20 training user and the 140 user.

And they examed the impact of top-k, top-k from 2 to the 20 values.

In this figure, they say that as top-k increase, the accuracy of the, accuracy of the prediction is increased.

(Professor speaking) What was top-k again, I'm sorry.

Top-k is the number of maximum neighbours.

(Professor speaking) Okay.

So, they examined the effect of top-k so the high number of the top-k performed quite good so we can choose top-k as much, as many as possible.

So, and last one is they studied impact of lamda value.

They started…IPCC is more accurate and especially when given number is small, they observed the IPCC is more accurate.

If the value X, the value in the X axis is closer to the zero, it means the IPCC is more influenced.

So, you can see the IPCC is the more accurate in this, this figure.

This is, I will explain the contribution of this paper, they proposed novel collaborative reliability prediction approach for SOA system.

They demonstrate comprehensive experimental analysis and as future work, as you asked, investigating optimal lamda value effectively is their future work.

I think this paper suggest a simple and brilliant idea for predicting a web service-oriented architecture.

And well-organized experiment is quite, was quite good.

The bad thing is the reliability aggregation part is not complete.

They assume a lot of things like branch selection probability and probability of loop repetition is known.

And they just combine the prediction value of web service.

It means that independent, they assume that independent task failure in the service flow.

This is can be a problem in the practical, practical situation.

[45:00]

And for the new, and the second bad thing is that for the new use and new service, this approach cannot provide any prediction.

Because they, there is no information available, they cannot suggest any neighbours when they, there is no information.

This is all of my presentation.

Do you have any other questions?

Just if you ask me.

(Professor speaking) Can we go back a couple slides?

Okay.

(Professor speaking) Okay.

(Professor speaking) So here you've got the lamda, so this is the key contribution there.

(Professor speaking) And it looks like if lamda is zero, it's not too bad.

(Professor speaking) So lamda is zero means… go back a little more, it only gives you one lamda.

Yes, you're right.

(Professor speaking) So what if that one thing is UPCC.

(Professor speaking) If UPCC is an average across the systems?

Average, UPCC is…they will consider neighbour users.

(Professor speaking) Neighbour users, okay, alright, so considering neighbour users, okay, is better than considering the systems independently?

Uh, considering, this is item, which means the service…

(Professor speaking) Right, right, the services.

The service information, so the lamda is zero, meaning of the lamda is for zero is…

(Professor speaking) ….I mean considering the systems.

Considering the service information is more valuable.

(Professor speaking) I mean the service information almost by itself, by itself, so if lamda is zero, then you consider only the service information.

(Professor speaking) You're doing an average…okay, so let me make sure I get this.

(Professor speaking) So this is the key bin.

(Professor speaking) I'm not really familiar with this type of…go back.

(Professor speaking) Go back to where you were, alright.

(Professor speaking) Okay, where is the lamda, okay.

(Professor speaking) Alright, so this is just an average across the columns.

IPCC?

(Professor speaking) Yeah, yeah.

IPCC is the a1, it use the neighbour information of web service.

(Professor speaking) Okay, so the neighbour, the clustering is then done according to the service system, you find services which are similar

Yes, you're right.

(Professor speaking) Okay, then with the users, this one, you find users which are similar.

Yes, you're right.

(Professor speaking) So the assumption is then with this, is that if you have two services which operate similarly, then if you use this service, this service would behave kind of the same.

(Professor speaking) Okay, okay.

(Student speaking) UPCC and IPCC are existing techniques?

Existing techniques?

(Student speaking) Or is it…

This?

(Student speaking) Yeah, is this the IPCC existing for this ?.

UPCC and IPCC, uh, in this paper, they referenced some paper.

Yeah, maybe it was, the paper was 1990s.

So it's not that…yeah.

(Student speaking) It's not this paper's contribution?

Yeah, this technique might exist…

(Student speaking) So I think if it is a contribution of the paper is just lamda.

Lamda?

(Student speaking) Yeah.

(Professor speaking) [?48:39]…but I'm not familiar with the work that's my discussion.

(Student speaking) So they just suggest lamda.

They just suggest lamda…

This is their main contribution, hybrid method.

I've never read that paper you mentioned.

So… actually in the previous paper, they didn't use IPCC and UPCC for reliability prediction in the SOA system.

So they adopt this technique for reliability prediction of SOA system, that could be a contribution?

(Professor speaking) Yes, I think so…this is a statistical technician, the weighted average…

(Professor speaking) But anyway, it's complete.

So…

(Professor speaking) So okay then, go back to the lamda stuff…

(Professor speaking) Okay, keep going to the figures with lamda, I think it was 22?

Figure 22?

(Professor speaking) That's the one, there you go.

(Professor speaking) Alright, so again, here we come to the already massive, on the right-hand side.

[50:00]

(Professor speaking) And to the left-hand too, there's a bit of a dip and at 0.3 and 0.4 like that but it's really small, right?

(Professor speaking) And so the difference between…and some of it, it really matters a lot, the ideal point appears to be 0.2 and depending on how you measure your 0.4.

(Professor speaking) But it's really small, right, it's like 0.01.

(Professor speaking) And on this case, it's like 0.101, that's really how you see it.

(Professor speaking) So anyways, it's just, it's unclear to me what the practical value is.

Practical value.

(Professor speaking) It's hard to say the difference between 0 and 1 is quite large.

(Professor speaking) But the difference between 0 and just not worrying about anything other than clustering so… and 0.4 in which you start bringing in user data.

(Professor speaking) The difference there is harder to argue, it's harder to justify.

(Professor speaking)So the other question I had is which one of this data point 1 derives?

Data point is 1-1?

There is...

(Professor speaking)That's a parameter back exactly in one time, is that true?

(Professor speaking)The reason of it, back of the slide.

(Professor speaking)You see here impact density matrix.

Impact density matrix.

(Professor speaking)Okay, So the 25%.

25%?

(Professor speaking)Of that slide, this way.

(Professor speaking)25% of the orange line, is about to same as 40%?

About the...

(Professor speaking)It's roughly the same value.

Yeah, the same value.

(Professor speaking)But it's uneven.

(Professor speaking)So give a sufficient numbers of derives.

(Professor speaking)I would expect that to be straight line or a monotonic chain.

(Professor speaking)This is not monotonic, it's falling.

(Professor speaking)So I'm wondering how many runs each one of this represents.

(Professor speaking)It varies in this parameters.

(Professor speaking)I'm wondering how many runs ? of 25% this in matrix.

(Professor speaking)The same value, I didn't catch that.

Density over matrix?

(Professor speaking)That've the experiment well set up.

(Professor speaking)Very good parameters.

Yeah, very good parameters.

(Professor speaking)You got this number of density matrix?

(Professor speaking)So each one of those...

(Professor speaking)Or each combination, I'm curious how many runs were done with those accomodations.

Because just a first generate this matrix.

(Professor speaking)Right, same the doing.

They varying the density of matrix a lot.

(Professor speaking)Right, right, right.

And then they predict the...

(Professor speaking)They got this, the original matrix...

(Professor speaking)I know generate might sparse of this matrix.

(Professor speaking)How many sparse static matrix they got?

(Professor speaking)How many runs...

How many runs?

(Professor speaking)See you can multiply once you randomly generates...

?, and you can do it again.

(Professor speaking)So I'm curious how often they...

(Professor speaking)How many times.

They just suggest...

(Professor speaking)They didn't ...

(Professor speaking)Yeah.

Oh, okay.

(Professor speaking)That's important information.

Just randomly generate...

(Professor speaking)Randomly is fine, you were right but you...

(Student questioning)

For this experiment, this data you can...

Why does this fix, and see this part.

Actually for the preparation, it's usual evoke web service 100times so they correct information fail information from the...

(Student questioning)

(Professor speaking)So I think based on paper and I...

(Professor speaking)One of each step.

(Professor speaking)Which line of this...

(Student questioning)

[55:00]

Using this number of value.

If lamda value is low, miniload of lamda is this umm, this experimental use IPCC value more...

So using IPCC information they gather isolated prediction rate, so they concludes the IPCC for hydrate.

(Student questioning)

Just they conduct a lot of the experiment lamda just...

Impact of the lamda value just one of the experiments.

So that result is just a part of the generation.

Just main part they suggest new technique for last prediction assist, yeah.

So, previous word, there is no this kind of mechanism resolve the problems as I mentioned in just before 2nd page.

They suggest just this collaborative testing, uh, technique is main contribution.

(Student questioning)

Sorry?

There...from 2005 it started to, someone started to approach this area.

This is the first preform which is presented in famous conference or journal.

There are more papers which is published in the famous journal or...

[60:00]

There is no promising result of works or ...

(Student questioning)

Yeah, they don't compare, they just tried to experiment their techniques among the 5 methods they suggest.

Maybe there will be reason why they accept that, that part.

In practical magnity, or some imitation or they experiment...

(Student questioning)

Previous paper, in that paper they suggest 2,3 or 4 papers, similar to this for predicting a web service reliability.

They suggest that so not compare that, those technique.

So what I want to do in the final presention project is compare the comparitive study over reliabily prediction in the environment and some techniques to predict the reliability againt solar system,[?1:02:25], or sense, so I want to compare the [1:02:30] and techniques.

What I want to compare [?1:02:33] techniques.

(Student questioning)

In this paper.

This is not the estimation of...

Yeah there's no service but you can expect that in this graph, this table...

We can expect that...

Static,what is static, maybe they'll change you're right.

In this case?

They just capture 1 snap, 1 moment of the framework.

The time value makes a difference.

Expense of the matrix?

Two make predictions as I created as ?

They just randomly exculde value like this.

Two make experiments environment to the real world, they try to do this.

This value?

You know this value maybe changes as the time goes by...

And this experiment they setup this matrix and then just compare the value [?1:05:55] so...

You guys, no questions?

Let me finish the presentation and thank you very much.