

**KELVIN TAM:** All right, good morning. Wow, quite a full house class. So welcome to AU. Everybody wake up. Welcome to AU. So this is the first session of AU. The first day, so I haven't been talking for the first session. So it's kind of a challenge. Usually I speaking at conference. It's like the last class of the last day so everybody was so tired to listen to me. So anyway, this is a good sign. So today's topic-- first off, let me introduce me. I'm Kelvin Tam. I'm an architect, American registered architect. Been working all over the place in the United States for 16 years. And in Hong Kong for a short period of time. And then I was in the Middle East. And come back to Hong Kong for a short period again. And then now based in St. Paul. So now my co-speaker Allen, he is not able to make it today. So this morning you are going to see me only OK.

All right so let's introduce a little bit of the idea of this talk today. And again I want to say this is not a lecture. This is-- I would encourage more discussion. So this is not something like a showcase showing off how big a project I have been doing, or wow how intelligent this project. But I really want to share with you frustrations first. Yeah, I do think a lot of you guys have been managers or more hands on to Revit it and I think this topic is a hot topic ever since Revit was first used by architects or engineer.

OK, strategizing megaproject. First, let me ask you guys how many of you are architects? Give me some hands. Wow, OK. So we are talking. We are talking in the same language. How many you are engineer? OK, contractor? OK, good. How many of you are been managers? Now we are talking. We have more to talk, all right. I think most of you have handled this kind of project before, megaproject, right? First, I want to clarify by megaproject is not something as mega as an airport. It's not airport, right? Is something we architects usually we are doing huge projects, mostly residential or mixed use, especially in Asia. A lot of those are mixed use high rise project with a podium of retail, car park underneath, and then at least three, four tower on top of the podium. And as architect, for our desire, for our utilization of the space, or make it even a lot of project those are very complex, but we're trying to make typical floor unit. Unit A, unit B, studio studio type one, studio type two and also one back room, two back room. But we make it typical. And then we are trying to repeat it. And then we repeat it on the typical floor. And the typical floor will be repeated-- depends on how high your tower is. Some of it may be 50 story repeated 50 times.

So, I think most of you have done this before. And what have you tried to make this repetition

very, very efficiently? Groups, right. Anybody use group? Right. How do you like group? Group is a pain, right? Whenever you copy the group you modify the group. Give's you a whole bunch of error, right? Some of the group-- some of the group insist something is missing, right? And then some of that-- But some of that will be deleted. Some group member will be deleted in certain group instance, right? Anybody have try link? How do you like link? Is OK, but thing about this if I have a project, event one tower with 50 story. Are you linking each floor as a separate then you are repeating it 50 times? Not that you efficient. Linking strategy allows you to have a small size project file. But remember, once you are trying to open the over all project all the links are opening up. That means at the same time you are opening more than 50 times the link file. Right, everybody understand these two major strategy.

So today I'm going to kind of like an open discussion. I would encourage an open discussion of how you feel like using these strategies. And I will explain five different options, five different strategies that I'm thinking it can be possible to be applied in a mega project. And I will list out the good thing, the bad thing, the pros, and cons, and let you decide based on your project requirement. OK. All right, let's start it. So as I explained before, the modeling strategies is very important. This class is not about any super parametric thing. I have done that before and a lot of people fell asleep when I talking about parametrics. So let's make this class pretty simple that every day you have to deal with that.

Model strategy is very important everybody knows that. If you don't know a thing about model strategy, don't do the project. It will be completely a failure. So again, some of my ex-colleagues is here. When I-- I think this topic-- while I was writing up this topic to AU, the topic was-- I was inspired by a project when I was in the Middle East, which gave me this challenge. So first of all I want to make of this trauma that these two days the material will not reveal, or it will expose any project material, project material, or document, or any project model. And I will try to not mention about my company, ex-company, and I'm trying to not mention about the name of one project I have done.

But I'm trying to make these as a enormous project that inspire me to have these exercise with you. So I just interested in the number, right. So this was a project that inspired me. Why it is inspiring me to do such a talk to these customers with you. It has it has nine plots, nine plots. And it has, as I explained, it has a podium on it. And every podium has at least three, four tower on top of it. And each tower is at least like more than 20 story. Some of it will be-- the number of story of each tower those are different. So maybe you will have three towers on top

of one podium on one plot. You have another plot which has a podium and then five tower on top of it, and all the tower are typical. What I mean this typical is the typical floor repeated. But each tower the number of repetition of the typical floor are different. Some of it may be 20 story, some of it may be 25 story. But the shape, the layout of each of the typical floor all are exactly the same. So that was making these project.

You can think about it is very simple because it contain simply repetition of units, unit types, and then the repetition of typical floor. But you can also think about, oh this is very complex because this is a huge site of at least nine plot. And with all these typical units, 30 unit types and more than 30 typical floor stack to gather, scattered all across the site. So you may think, oh, this is a very, very complex project. Complexity is not about the form of the building. Complexity is not about the facade. Complexity is about the number of unit you have to handle. The number of typical floor you will have to handle, not just about modeling. But everybody knows that architects keep changing the design, keep changing the layout. Engineer contractor you will-- you-- I'm sure you hate architect. We change our floor layout at least five times a day.

My [INAUDIBLE] assignment, assignment he's a [INAUDIBLE] consultant. He receiving architects design and then turn it into a 3D model. So you understand that we keep-- architects keep changing, keep changing. So also this challenge, I think we are facing it every day. How can we maintain our design when it keeps changing and then need to be synchronized to the over all model. And the overall model is consist of all this repetition of the typical unit and typical floor. So I would like you to understand after this class you understand repetition in a megaproject, to analyze it, and to think about strategy by linking. And also to use different strategy by grouping, linking, and families. Also, you have to think about in this kind of project-- you have to think about a maintenance plan. What do I mean by maintenance plan? Yes, you have all these components of a project but all this component is not just, OK the assigned one time and it's done. We are designing the same thing every day, every hour, keep changing it. How can you make a plan to maintain all that? So that it will-- your design model is always reflecting the most updated or the most reason design.

Maintenance plan. OK, we have this challenge. OK, so this is an image of a particular project. But it's not the full picture. So just show you the process of making this typical unit types. I have at least 30 unit types. And all these different 30 units that may be one bedroom, two bedroom, one bedroom A, one bedroom B, two bedroom A, two bedroom B, studio 1 2, studio

2 different, layout different option for the units. And all of these will come together to make a typical floor with different mix, unit mix. And I have 23 different-- I call it prototype, which is the floor, which is the floor. So the these are unit, unit become the floor. And I have 11 towers, 11 tower types Type means composed of different prototypes stack together. And of course each of the tower will have a different floor, different number of story. But say two tower is the same type. But it may have a different number of story. And altogether I have 20 towers on five podiums, so that is the project requirement.

Show you another way to show the size of this project. So kind of very complicated matrix here. You can see all these plots and all these plots has A1, A2, A3, A4, B1, B2, B3, B4, C2. Those are the tower those are the tower on plot eight. On plot number two, plot number two I have A1 tower and type C2 tower I have one. So if you look at here plot against these axes. So this is showing you what you would do, not how many unit types. For each unit type I have. Say I have on plot two I have 91 unit 1A. And I have 10 of unit 1B, 30 unit 1C. So add together for 1A. For the overall site of 5 plot I have 1,270 of unit 1A a repeated. So you can see it is a big number. How can we handle that?

And now this picture. I have another diagram here showing it more graphically. So all these the light orange one representing the unit types. So I have 1A, 1B, 1C, 2A, all the way. So the light blue ones are the typical floor. So typical for containing the typical unit, and you can see all the wires. This is not a Dynamo. I'm not teaching Dynamo today. So the green light are the typical floor, which I compose them with all the different mix of the unit type and then again. The white or gray boxes those are representing the tower. So the tower will have all these come together, the typical floor come together to make the tower. And the tower-- different tower will come to each of plot. So I don't know how many there lies here. Option.

We have a lot of options in our life. So which one you want to pick is really critical. So I have five options for you. One is a linking strategy. First, everybody has tried that. Second, single file grouping strategy. Third one linking plots group strategy. The fourth one, multiple file groupings strategy. And the final one family strategy. I am going to discuss it a little bit one by one.

Linking strategy. So most of you have try it. But it depends on how many level of linking you're doing. You can do nested linking. You can do it linking attached, always attached to a certain link. OK basic idea is I make all these little unit type as a separate RVT file and then link it to another Revit model, which is a typical floor Revit model. So inside the prototype-- I call it

prototype floor-- I have all these link, and then place it whatever the location . Is and repeat. It and then finally the prototype floor is linked to the overall tower model. And then repeat the prototype floor what ever number of times 20 or 30 depending on how high your power is.

So this is a diagram about the overall linking strategy. So first of all, the unit is link and then attach, right. You will have to attach it because if it is not attached when you open the overall tower model, it will not appear. everybody knows that. And then once it is linked to the prototype again it has to link the second time to the tower and then also attach. Once the tower is finished, it will be link the third time to the building. Where the building contain what? Contain the podium and a number of tower on top of the podium. Podium is a separate model. So you see the podium linked to the over all building. And the tower also linked to the overall building. So again, there are secondary link like the podium. We have the core, it will be link to the podium. Quite complicate and quite-- many level of linking. And most of this linking can to be attach. So give you the number for the strategy for the number of links. Say for the tower file, individual tower type, each one type tower I have three link, six nested links, 140 links instance. So there are some more or bigger number like C4. I have three links, eight nested links and 193 link instances. Quite scary this number, right. Now when we come to a plot you will looking at the complete tubing. That we are not just looking at the podium file. We are not just looking at individual tower because this is not representing the whole building.

In [INAUDIBLE] for instance, I have four links 21 nested link and then 730 link instance. Nested link means that inside the tower I have the unit. So putting all the tower together I have 700 links. And the biggest number is plot 8 and 9 those are combined. One plot has two boundary. I have six links, 46 nested links and I have 897 link instance. How can you handle that, right? I have watched one of the team members handling this kind of project when everything was brought together in the over all building Because he was trying to generate elevation sections and then trying to do dimension and notation.

It takes about an hour to open one building model, overall building model. Because at the same time you are opening up 700 files. Even you have the super computer the Hollywood movie guy are using can you imagine how much memory you need? 700 even you have that amount of the time to wait for it, every morning come to the office just wasting an hour to open the file. I have one of my office-- one of the studio I have worked in work like over 50 architects working on the big project. And we have not that many links, but we have a lot of modeling together. And everybody's has need to wait for at least 30 minutes to wait for the file to open.

And I asked the project manager, hey if I have a way that you guys can save more time all those money come to me?

[LAUGHTER]

**KELVIN TAM:**

So I go back to that example. Even you are willing to spend an hour to wait for the computer to load all those models to the overall, once you generate the section or you generate the elevation and you take another 15 minutes for it to generate the elevation for you to put dimension, for you to put some annotation on it. Fine. OK. And once you put the wheels the elevation wheel onto the sheet it crash. It crashed the computer. So what can you do? Wasting another hour to do it again, and again. You have no way. OK.

So let me talk about some pros and cons on these strategy. So for the linking strategy the pros are added elements and prototypes in relatively small size project file. Good, right? I have like 30 different unit types. And every unit type file is just containing several piece of wall, several doors, and maybe some cabinet new thing. Right. Keeping it really, really small. Maybe less than 100k. Easy to handle. The pros it also the system family in the unit and prototype file easy to add it. You add it the wall. You can stretch it longer, reappraising the door, relocating the door, easy to add it. Also linking allow instant update of unit type and prototype. Right. OK. I have made change in the unit types I can reload it. Fine. Done. Good.

How about the cons, disadvantage? Wow taking a long time and opening the tower file in the over all composite building file. One hour, two hour can you afford that? Second, tremendous amount of time for linking tower to structure or MEP. And in a project I'm not just thinking about my architectural team. I have to think about MEP and structure. Structure will have their own file. MEP will have their own file. And then there is another level of linking. You are linking to architectural model and architectural office model has already 700 link instant. And then you will have to link the overall into your MEP. Unbelievable I also explain to you computer precious when working on the overall building file.

Elements cannot be scheduled by floor in tower because those are all linked element. Linked elements will not-- link instance I mean cannot know that what level they are placed. They only know that they are placed in their file level one. But when you repeat that process in different file you cannot schedule it by level. And a lot of project we want to know how many of these door, how many of these wall are placed on certain level. Copy monitor when linked to the model of other its not allowed. If you will have all the projects to unit type link for MEP guy they

always want to use copy monitor. This is allowed to use copy monitor, especially for multiple level of linking.

Possible solution, I'm pretty optimistic. Every thing, every problem we can think of a solution. So if we have is taking a long time when opening the overall file use workset to control it. Everybody use workset. You will end up with a lot worksets. But you know, a lot of people using workset to control with ability graphic. I am not into it. I totally disagree with it. Also a lot of people using worksets I would call it abusing workset. Over 50 worksets, number of worksets in one project. Is that healthy? It is kind of confusing to other user. Workset may be a solution.

And then for the second one that take a tremendous amount of time for linking tower. Open close work set. Not for attach link, second level link when linking architect model to MEP. OK. Open close workset. But you have to tell your user this is the best practice. Remember to do it. Right. If somebody forgot to do it, OK another two hours waiting. Upgrading computer, right. I have experience in a lot of them that I apply for a new computer take me two years processing, getting the funding, getting some director to approve it. And you know that our director are so busy. And it may not in time for over two months. So I have to wait for director to come back to the office to sign that paper. And then wait. So many levels go into that department. OK. Upgrading network is even maybe I apply maybe take me two years to upgrade the whole office network. Well but my project I have submission next week. OK. OK.

Single file grouping, this sounds pretty crazy idea. But maybe it is a solution. So what does it mean by a single file grouping? Let's forget about having so many files. Let's think of the overall site is a single file. Can it be possible? So again, I am not thinking about linking anymore because linking giving me so many problems. Opening one file, you are opening 700. I don't want to do that. So let's keep it simple. One single file with the whole site and then every unit used as a groups. And then group inside group to make a typical floor. And then those group are scatter all on the site. Is that possible? Right. You are simplifying the linking. You are getting rid of the linking. Go ahead.

**AUDIENCE:** [INAUDIBLE]

**KELVIN TAM:** Yes, but it is just a thought.

**AUDIENCE:** It's a good thought.

**KELVIN TAM:** Yeah.

**AUDIENCE:** [INAUDIBLE]

**KELVIN TAM:** Yeah, so you are dealing with groups only one file. So last thing about if I have a single file of these groups. What are the challenge? First of all, why you think about it this way is better than the others? Because group cannot be shared across projects, right. So if I have a project - say I have two project. And two project I need you to use exactly the same group. How can you make sure? But the group will be changing all the time. So I have to make the group inside one project and then make exactly the same group in another project. How can I synchronize say the tool project? We're making sure that it's using the same group. But if I have one single file I don't have to worry about it. Because the group is define and that file and the group is being used in only one file. Another one 30 units group, how many group instances? We will give you 2,962 group instances. Trying to free prototype group will give you 270 a group instance. 11 tower group will be 20 group instance. And then I think most of you have this problem, find out the problem of group. Group within a group, inside a group give you a lot of errors. All right. OK.

Again, pros and cons. I see some family in group I used to edit. Of course click on the group and then added the group, moving thing around, add the thing, easy. And then because the group will be all the-- all the other group instance will be updated automatically. Number of link instance reveals as slash number of unit and group. So you don't have link anymore. good. Disadvantage, group are defined in each project but they need to be consistent in all files. So again, very inconvenience because you have those in different files. You have to make sure that because we are dealing with unit grouping into a prototype-- so each prototype you have to make sure that using the most updated unit. Another disadvantage, don't know if the grope in prototype are the most updated one. You have to keep watching it. Is this a prototype group using the most updated unit? The third one, most of you have come across mirror group. What happened when you mirror group? Not good.

**AUDIENCE:** [INAUDIBLE]

**KELVIN TAM:** Very nasty. Elements cannot be scheduled by floor level in tower. Yeah, because it is a group. Copy monitor when link to the model of other [INAUDIBLE] not allowed. Also in group.

So possible solution. For system family group in each project file but need to be consistent in file. So create a master file to maintain the groups so that I can keep changing it and can



update it. So a lot of things that need to be manually checking. Also some element need to be excluded from the group. You have no way if Revit tell you that these things need to be deleted, no way. You have to accept it, sorry.

The third strategy, linking and grouping. So what about linking and grouping? I have all the units as group first. And then I will praise all the group into a separate file, all with the project file. So I am dealing with only the project files are the prototype. And within the prototype I have the group. So that reveals as compared to the linking strategy. That reveals one level of linking. So now I am linking the prototype floor into the tower. OK better than linking, linking, three level of linking. Now this is just one level of linking. Again groups cannot be shared across projects. Use master file for unit. Save group [INAUDIBLE] unit group folder from each group are reloaded to the prototype. Right. What I'm talking about is you have to create a kind of a master file to look at all those groups. So the group you know that how often they are changing and there is several designer who is maintaining the unit type master file because it keeps changing. And then once it is updated today and it will be updated to the prototype file, and then prototype file will be linked to the overall tower file. Thirty unit group inside a prototype file that may be OK.

Pros and cons. A system family in group are easy to add as we always know that a number of links element reduce as large number of unit grow. Good , because we are getting rid of the linking for the unit type. We are only linking the overall floor type. Disadvantage, group are defined in each project but they need to be consistent. Also how can you do the same group in various project? You have too many really maintain it you have to compare each of the project file to make sure that they are using the same group definition. Again the same problem. You do not know if the prototype of the most updated one you have to keep an eye on it every time. Mirroring growth will give you error, elements cannot be scheduled by floor level in Tower, copy monitor is not allowed.

Possible solution, again, create master file to maintain the group. So once you know that this is the most updated group then lower the group into the prototype. Manual checking also required. Some element may be excluded in group. So we are always trying to avoid grouping strategy because of these error giving me whenever I update a group. Let's think out of the box again. Multiple file grouping, let's think about that. I think this is a very, very typical strategy. But if we are using group then we have to face all these errors again. The unit are in group and then pass it to the prototype group, and group in group. And then the group-- how--

this is very interesting-- how can I maintain those prototype group as well as the unit group and then populate all these groups, which will be updated every day, every hour, and then put it into the tower?

I want to do a demonstration now showing the work flow. OK. Let's close Revit a little bit. Let's do Revit. For example, this is what I-- I have to close PowerPoint. Let's close. OK. So this is what I'm calling it a master file. To keep my groups as updated. And as a working file I can always change the definition or change the layout of each unit. Say for example, I have in this project-- say I have unit A, unit B, unit C, unit D. Make it very simple no floor plan like that. And then with these unit types, four different unit type, I will compose prototype one of different number of each unit type. Prototype two give a different configuration by the number of unit type and different unit mix.

Prototype three and prototype four. Imagine this is a project. So this prototype is going to be on different level of your tower. And I have so many different towers depending on what are the mix of these produce had floor. But now here is come, how can I maintain it? Because these unit will is going to be changed every day, every hour. First of all, let me show you another file. This is a separate file, which represents your tower model. The tower model say I have praised it for. The prototype for prototype [INAUDIBLE]. It's not link. Remember, it's not linked. It's separated. It's the group inside this file. So because those are group how can I know that in the tower file all those group will be updated when I change the master file?

So I will suggest a way to do it. If I going to make changes on four of these unit. First of all, I want to go to the project browser. I want to duplicate. Right-click. I want to duplicate a group. So it will give me unit type. Unit A2. I'm going to rename it. I'm going to rename it as today's date, 2016. 11 15, right. Now this group, the new group will be exactly the same of the original one. Unit type B, do the same thing, duplicate and then rename. 2016 11 15. And then unit C. Duplicate rename it 2016 11 15 and unit D duplicate and then rename it 2016 11 15. OK. Now I'm placing it another one on my screen, like B, and then like C, and then like D. OK. Now I want to change this, add group. All right, for example, just want to add a couple walls here. They several piece of wall and then finish. OK. With me we define the group, right. Add it and then maybe put a couple walls here finish, and then here and then I added group. Maybe another pentagon, and then this one add it, this one at added group, and then maybe another circle inside. OK, now finished, right. I duplicate the group first.

Now I want to make change on each of that. I want to update all these so-called prototype of

this. How can I do that? If go ahead and then edit that and update it, because it is group inside group, it will always give me an error. You do not know what the error will be. Now I can simply go to my project browser. Go to unit A, for example. Go to unit A. I all select. I select unit A and then I can see that all instant, an entire project. And then I can swap to this. And then go to unit B, select all instant, an entire project swap to unit B. C again, C all instant, an entire project swap to unit C with today's date. And then number four unit D select instant, entire project, unit D.

OK now, in this file in this file all the prototype are updated. But in this real project file it is not updated. So how can I do that? I'm going to save the prototype in a separate folder, right. Which I can show you I already created in here, this is prototype one, prototype B, which already save in a separate folder. So I'm going to update this prototype one with the version in my master file. So what I'm going to do is-- I know, I think most of you may have tried that, right. Click on prototype 1 safe group. And then I will browse to my original folder, save. All right, asking me you want to replace the old one, of course yes. Again prototype B, save glow, browse into my folder, prototype save, yes. And then the third one is save group and then three, yes. And then number four, save group, save, yes. Now on my folder all the prototype model those are updated. Now the next step. I go to this file. This will be my building file. I want to update that, very easy. You go back to prototype one then we load from that folder, prototype one, now it's updated. The we load two. OK, good.

Anybody has tried that technique before? Good. Right, what is good about that is whenever the unit type updated I do not need to add to the group and then update the group. In this way is kind of recreating the group. So when you recreate the group rather than you update group you will reduce a lot of error. Because it is replacing a new group instead of updating the group. Again, how can I know that I have the most recent unit type here? Because I named the unit type with today's day. So all the user they understand, OK this is updated to 2016, November 15. In this way, right. So I think for all the strategy I want to make this kind of file, a master file. Then keep maintaining this master file, making sure that all the updates at the site happen here in the master file. And then transfer all these into individual building model. Right, OK.

I think give me five minutes more. I explain the final strategy. OK. Multiple file. Finally, I would suggest kind of an alternative way using family. Right, sounds, right? How can a room be a family? A room is a system family. How can you make it into a family? Here is the trick. Right,

say if I can make this one, each unit as RFA, as a family, and this family-- this unit can nest to another family, which we call prototype floor. OK, you can do any kind of mixture of this unit type to compose the prototype family. And then if those are the family those will be placed in the tower model, right. Family is the most stable. And will keep your file size small, right. Unless you have super parametric family. All right, sounds a good strategy. But the challenge is how can we make the family room binding? If you place a family, a furniture family, or a [INAUDIBLE] family, it is not binding. How can you make it? Here is the trick. Here is some kind of-- you can read my hand out.

Let's five minutes. I can do a demonstration. Let's go back to Revit. OK. If I have a-- I want to create a family that can be room binding for my house. Everybody has tried in place family? I think this is a trick some of you may know. In place family if I do-- in place family, architecture--

**AUDIENCE:** Component.

**KELVIN TAM:** Thank you very much. Model in place, right. So what I'm going to do, I'm going to do wall family in place. OK, OK. Let's say wall one, good. All right, now my [INAUDIBLE] become three columns. Now I can do extrusion. Now say just do a simple rectangle, finish, right. Now remember, once I create a form and the geometry in the place family, all I have to click on this green button, the check map, the tech map. Now if I click on the check map I will finish this family in place. But don't click on that. Before you click on that, you select that. You make group, right. Then it will give you group. OK. Now don't exit this. Don't hit finish model. Now go to your browser and look for group one, right. So group, and then model group. You will see group one here, right click on that, save group. Let me save it on my desktop. Let me save it here. OK. Now you will see I'm able to save the room. Save. , OK now you can cancel the group. You can cancel the in place. I don't need it anymore.

Now if you go back to here, you will find this is a group. And this is a another family. Now if I open this it will give me this guy, which I did it inside a project and run and that export out to be a family. I can easily manipulate it or even-- this is now a family and enrollment you can do whatever you want, right. You can do whatever you want. You want you can do parametric. OK, let's see what these-- what can we use this one. Say I want to save this, the name is group one. Now I can lower it to my project. Let's say I load it into this one. Make a project. Now I can place it. Now I can place it a couple of times. See this is a wall created as an in place, and then I export it, and then I bring it back. Now this is a family. But it's a wall family. Now I can place a room here. Anybody knows that. Now you can create a loadable family,

which is able to room bind, room binding. Go ahead.

**AUDIENCE:** Can you show us just one instance of the browser [INAUDIBLE]

**KELVIN TAM:** Now it is not something you will expect it like in place. So it will be like a regular family. Wall, under wall I have this core group one. I can always rename it. Now only group one has for instant. But it only show up one time. And like in place family you trying to copy it. It will give you a new in place, right. So if I can make a wall. Now I can nest this wall into a separate unit. And then place it a couple of time to make my floor plan. Again, the floor plan can be nested in another so-called room binding family, and then create my prototype floor, and then place it in the house. OK, sorry I don't have enough time to do demonstration, is already overrun.

So that is-- let's go back to the PowerPoint again, finish this presentation. So familying. Again, this is another question, how can you maintain the family? You have-- now you will have like 30 unit type and then another 50 prototype family. And then you have to always making sure every tower has the most updated family. There is several-- I think there are several API or a third party application you can use. And one is called the-- what is it called? CTC express. Anybody use that? That allow you to batch reloaded family in multiple projects. You can try that. So again, what are the pros and cons for this familying strategy? Fast processing when opening tower file because those code containing no link, no group, only family. And family is the most stable element in Revit model.

Pros is added unit and prototype are relatives more families and insure all components are consistent in all towers. So you have to do the batch reloading of the update family. Element life in project allows scheduling by level. This is really important because the old way of either is linking or grouping. And then grouping and linking again to the final models. It doesn't allow you to schedule it by level. Family, of course, it can. Copy monitor, this is allowable for [INAUDIBLE] guys for structural guy. Disadvantage, require more skill because you have to do so many family. And I do believe that not everybody is family creation capable. Require to load family to individual houses. You have to maintain all the family to be all updated in the building model. Your family not created properly it will give you error. I think everybody has experience that family is the high maintenance guy. Possible solution use should be more discipline. When we do family we have to know that all of the parameter name, the file name, will need to be very consistent. Use batch family loader and audit repair family. If something get screwed up you have to audit it

Finally, I want you can compare all that with family strategy, linking strategy, single file group linking, group strategy, and then multiple file groupings strategy. Those are which one is good, which one is bad. You make your own choice. And finally, you have the choice. So as a manager, I would say no there is no universal solution for all your projects. You have to understand what your project challenge. What is the requirement of your project. So to make your decision. The five strategy you can invent your own by mixing those two or three of it. So again, my message today about handling this kind of project, make a maintenance plan. How to maintain all these ever changing unit type and ever changing prototype floor file. OK, thank you very much.