34 \* 1 thun't (B belowing they protein any assume and Will 1911. ) which what is not under in C and C + purity shimmake in the necessary with a single of the protein and the single of the purity of the single of the purity of the single of the purity of the single of 16 - Big Conder on concern - Succession in Figure 3, point to act any point in least if you may be colleged as the Act of the Conder on the Co 1 find it easiest to understand move semantics with example code. Let's start with a very simple string class which only holds a pointer to a heap-all cested block of memory: advantable for all resempts

The state of th Since we chose to manage the memory ourselves, we need to follow the <u>rule of three.</u> I am going to defer writing the assignment operator and only implement the destructor and the copy constructor for nonreplaced the destrotes and the copy constructor for mose

"consideration of the construction of the constr The copy constructor defines what it means to copy string objects. The parameter coast straigs stait, binds to all expressions of type string which allows you to make copies in the following examples: Stores (Seed, Marketts Americal), (Ministry Computer Seed), (Ministry What have we done here? Instead of deeply copying the hosp data, we have just copied the pointer and then set the original pointer to real (so prevent identify) from scarce original desiration from relating our just intended as ), its effect, we have "haten" the data that originally belonged to the sources storing, Again, the key implied the number or commanders and the desiration fact in sources had been ended as less we don't need a copy since, we sell this constructor a "more constructor", by job is to more resources from one object to another instead of copying them. Congratulations, you now understand the basics of move semantical Let's continue by implementing the assignment operator. If you're unfamiliar with the copy and swap islam, learn it and come back, because it's an assessme C++ idiom related to exception safety. Halo, than's all "Maters's the radiac reference" you might ask. "We don't need it hear!" a my present ?
Note that we past the parameter (ME) by other, so ME) has to be initialized just like any other string olject. Exactly how is MEC going to be initialized in the oldered days of facility. The exempter would have been by the output contention." In C + Vic. the complete houses between the output contention of the mission or construction and the mission of terms of the mission of the output contention of the mission of terms of the mission of So if you say a = 8, the copy constructor will initiatize state (because the expression is it an halvar), and the assignment operator swaps the contents with a firshly created, deep copy. That is the way definition of the copy and swap idom — make a copy, swap the contents with the copy, and then get nid of the copy by leaving the score, bothing new here. es or the copy by saving the steps. Rothing new here.

that fig new y x x x x y is the recommendative of index Select Seneaus the experience | x x y is an explanative to the large and only as efficient terms, y as with an elegender of the large and experience | x x y is an explanative to the large date of the large and experience | x x y is an explanative to the large date and experience to th I hope this example got the main point across. There is a lot more to realus references and move semantics which I intentionally left out to keep it simple. If you want more details please see <a href="mailto:complementary.across">complementary.across</a>. \*\* Other first price pricing critical action for more the cardinal dispersion and pricing first pricing critical action for more the cardinal dispersion and pricing first pricing critical action for more than action and pricing first p The second secon The county of th What is a move?

What is a move?

The C+14 dended library offers a west printer with urinar ensembly sensetics other (Idiocal (Idio)). It can you are unfamilier with 1961, Idio,
In purpose in the generated that departmently allocated objects always related, even in the face of exceptions. The created thing should allow in Veryoning to influence automatically.

The created thing should allow in Veryoning the Individual Control of the Control o Note how the initialization of § with § does not copy the triangle, but instead transfers the consenship of the triangle from § to §. We also say "§ is moved into § or the triangle in moved from § to §". This resy sound confusing because the triangle itself always steys at the same place in memory. To move an object means to transfer ownership of some resource it manages to another object. Dangerous and harmless moves

The despense thing about a parties in the what systectically looks like a copy is actually a move. Trying to call a member function on a moved-from suit, are; will invoke undefined behavior, so you have to be very careful not to ose on sections? after it has been moved from auto\_strcNaper a(new Triangle); // create triangle auto\_strcNaper o(a); // sour a into b nounde area = a-rares(); // sourcelled behavior The limit (all is not independ pringerman. Recitory functions are a perfectly flow save case for Self-Life)

sub\_principles on each\_finise(s):

error sub\_principles(s):

sub\_principles(s Note how both examples follow the same syntactic pattern:
acts\_gth-Shape= variable(equrestine);
and/or are = equrestine=shret(); And yet, one of them invokes undefined behavior, whereas the other one does not. So what is the difference between the expressions and sake, or laught)? Aren't they both of the same type? Indeed they are, but they have different value categories. Value categories

Outsoutly there must be some profound difference between the expression [5] which directles an [60,500] worlds, and the expression association [60,500] which directles are An natus of class type is an expression shows evolution creates a temporary object. Under normal circumstances, no other expression inside the same scope denotes the same temporary object. We now understend that moving from halass is potentially designeous, but moving from realuss in hammlers. If C++ had lenguage support to distinguish halas arguments from reales arguments, we could either completely forbid moving from halass, or at least make moving from halass explicit at all sales, so that we no brigance by accident. C++11's answer to this problem is resturereference. An resture reference is a new kind of reference that only binds to resture, and the syntax is 388.

The good old reference 38, is now known as an house reference. (Note that 388, is not a reference to a reference; there is no such thing in C++) Tooler cost looker route cost roube

cost is a pay yet yet yet

said yet yet yet

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sa An rvalue reference (88) is a new kind of reference that only binds to rvalues. Implicit conversions
Build references were through neural version. Sizes are size 2.1, or notion references 386, shad brief to all value comparing it a different type (g. provided there are implicit commension from (g. to g. in the case, a temporary of type (g. in created, and the notion reference is bound to that temporary). void come\_function(std:\stringEd r);
come\_function("bello werld"); In the above example, "helia work!" is an loake of type casest case[32]. Since there is an implicit convention from casest exist(32), through casest case[43], through passet cases the size of the cases where the distinction between relates (represented) and femocratic (edges) as a bit havy. Reference values represented and semporaries (objects) is a list blazy.

More Constructors

A solid cample is formion with an 386 personate is the more constructor \$10,000 across to be sender commonly of the enanged resource from the source inside. Several register of the more constructor \$10,000 across to be been proposed to the source constructor. See the solid construction of In C+1 - (SECION/ACCENT) to the resignation of SECION/ACCENT, which was adveraged or many contracting of SECION/ACCENT. The resignation of section of sect unique\_pfr/bhapes a(mou friangle); unique\_pfr/bhapes (a); unique\_pfr/bhapes (duma\_pfriangle()); // mbry be search for this complex beauting (2) or private the processor of the pr Note how this implementation of the move assignment operator duplicates logic of both the destructor and the move constructor. Are you familiar with the copy-and-away ident? It can also be applied to move semantics as the move-and-away ident. Now that issued is a variable of type indexpert, it will be initialized by the move constructor that is, the argument will be moved into the parameter. The argument is off required to be an roake, because the move constructor intelf has an roake reference parameter. When control flow reaches the closing brace of ligarization, disside good not of vopon, releasing the difference automatically. The more assignment operator burstlers consorbly of a managed resource into the current object, releasing the old resource. The more and soop idom simplems the implementation. soap often simplifies the implementation.

Moving from Ivalues

Sometime, we want to move been below. That is, sometimes we want the complex to treat on below as if it were at realise, as it can include the move
construction, each beginning in could be apprecisely usuals for this purpose, (\*\*) I after as satisfact theny between template school difficulties invoke the move
construction can be really could be apprecisely usuals for this purpose, (\*\*) I after as a satisfact theory between template school difficulties invoke the
moving beginning to come the control of the purpose of the control of the c Note that after the third lies, is no longer owns a triangle. That's okey, became by explicitly writing stationarily, we made our intentions clear. 'Dear constructor, do whatever you want with is in order to initialize is I don't care about is anymore. Feel free to have your way with is.' Strain that were the rest for the property of the control of the c How come the motion conduction state of the facility as an exponent? The recipied in state is sent as and it will be derivined design state.

If the state is sent as a sent of the state is a sent of the state is sent of Note that in both factory functions, the return type is a value, not an realus reference. Realus references are still references, and as always, you should never return a reference to an automatic object; the caller would end up with a daugling reference if you bricked the compiler into accepting your code, like this: Has This

sites\_fribaged fines\_stamp() // No Not to tests

sites\_fribage very\_bal\_ball(ne fapore)

refler fill(nem(cery\_bal\_ball) // Notes

) Never return automatic objects by rodus reference. Moving is exclusively performed by the move constructor, not by \$141,0000, and not by merely binding an realize to an realize reference. The second compiler and compiler that gassesses is an induse of you load as hype, you was an incluse reference, but an induse reference strepy and the compiler Special member functions

(-+)81 implicitly declars free special member functions on demand, that is, when they are needed somewhere the copy continuator, the copy assignment repeats, and the definitions. X:1X(cont 30);
38 X:10prater=(cont 30); // copy constructor
X:=1(); EliCAM);
16 Niperatur(MA); // more intigenetic
16 Niperatur(MA); // more intigenetic These two new special member functions are only implicitly declared if none of the special member functions are declared manually. Also, if you declare your own move constructor or move assignment operator, neither the copy constructor nor the copy assignment operator will be declared implicitly. Implicitly
White do their rules reason in practice?

If you write a class well-not conversely resources, there is no need to decline any of the five special member functions yourself and you will be performed topy servoice and more assessed to their. Observate, you not the set implement the special member function yourself. Of more if you will be set implement the special member function yourself. Of more if you will be set included from more settled, but not not set the yourself are you will be set included from more settled. Note that the copy assignment operator and the move assignment operator can be fused into a single, unified assignment operator, taking its asymmetr by value: This way, the number of special member functions to implement drops from five to four. There is a tradeoff between exception-safety and efficiency bers, but are not an expert on this issue. Consider the Markon Securious Securi fan(ann\_relample()); // T is unique\_pfreshapen, NB is unique\_pfreshapenik
unique\_pfreshapen s(num triangle);
unique\_pfreshapen s(num triangle);
// T is unique\_pfreshapenik, NB is unique\_pfreshapenik
enc(s); Folia properties for recited rights (2). If it is interest, elements (1), the content of the appeared in an ended rights (2) in it is interest, and the content of the appeared in the state of the 20 in its content of the As you can use, assess any local operation bender to be bounding offering \$100, and it is bent as relate wherein the state assessment of the state o The cell of a function that returns an endor reference, such as (ME)(ME), is an evolun-tion of the returning by reader reference is few in this manifel, because it does not denote an automatic object, but included an object that was passed in by the cells: These ASS Fallow Rang amounts (1,002 of 150 miles page amounts (1, - System Nov. 7, 2014 x 10156

12 
- Please write a book nov. - this areaer has given me reason to believe if you covered other corners of C++ in a lacid manner like this, thousands of more people will be understand in - fallingspars 5 (2.7, 2015 at 22.11). 66 dishalukngaton Thank you very much for your kind feedback, I really apprecise it. The problem with writing a book is: it's much more work than you can possibly imagine. If you want to dig deep into C++1 and beyond, I suggest you buy "Effective Modern C++" by Scott Meyers. - Incloseffice Sep 28, 2015 at 845. Suppress you have a function that whome a submarked subject

(3) market anticological metric key, count market 80);

(4) When you work to code like the few

market e e marked(e), 80); tions on solving C.1. complied the darks temporary elegat for the result of \$200,000 (1) of the copy contribute to include \$\tilde{E}\_{ij}\$ and the deduct the temporary value without height specified. Also we recover as C.2. come for "more construction" the darkters include \$\tilde{E}\_{ij}\$ to proper by account, and the fine facility of temporary value without height policities \$\tilde{E}\_{ij}\$ to proper by account, and the fine facilities the improve value without height policities \$\tilde{E}\_{ij}\$ to proper by the contribution of the proper by the fine facilities of the proper by the fine facilities \$\tilde{E}\_{ij}\$ to \$\tilde{E}\_{ij}\$ to the facilities \$\tilde{E}\_{ij}\$ to proper by the facilities \$\tilde{E}\_{ij}\$ to the facilities \$\tilde{E}\_{ij}\$ There did follow flag

| The complete of the c Pic 3. (1962-24)

The distription is designed on year complet, in agent the complet could conce a temporary plays in loss that facilities, and then stone a temporary plays in loss that facilities are set to extend the concern of th Figure a ready interested in a good, in depth explanation of more remedies, I'd highly recommend reading the original paper on them, <u>Althoused as Malland Americal Sciences and the Association</u>, and the second science of the science of the second science of the science of the science of the second science of the science of the s The transport of the control of the sours position to avoid detecting them bakes

(intex.

(i Oir, but if I move an object, the source object becomes useless, no? Of course, but in certain situations that's very useful. The most evident one is when I call a function with an anonymous object (temporal, nature object, ..., you can call it with different names). wide heapt-section(sersytep(C)):

In that situation, an assempmous object is created, next copied to the function parameter, and alternately deleted. So, here it is better to move the object, because you don't need the annuments adject and you can save fine and memory. This shads be decreased of an "real" are more thought on the state of the state of the concept of an "real" are more thought on the concept of an "real" are more than the state of the given the state of the state Nation A retains exactly the opposition an eligibility on assert deliverses, Statusce of East, encorprose allegat and reduce as a class of East, and the control of East In this case, when an object of type is, should be "topied", the compiler creates a halve reference or a nature reference according to if the passed object is named or not. When ext your transcriptors is called and post been the object is required and you can extend up the object is required and you can extend up the object is required and you can be compiled to the object is a required and you can demonstry.

It is required to remove the "activity displaces and waday copied." There's no ways in "mose" a solar object object in tasks and not on heapy So, the distriction "mose" "topy" when an object has two dynamic members (piletry or reducingly is involved. It is supported to encounter the "Anima" indicate an advance quarter. Toward on any pits "horses" and and on the shoops, So, the distinctions have advanced to a given exceeded positions or enterthing his enterties.

If you shiple is the complex of the distinction has allow assentingly when, the celling to a floory's function, celling to other global functions or wholever it is purposed, but the complex of the distinction has delivered by when, the celling to a floory's function, celling to other global functions or wholever it is purposed, but the complex of the complex of the celling to a floory's function, celling to other global functions or wholever it is purposed to the celling to a floory's function, celling to other global functions or wholever it is purposed to the celling to a floory's function of the celling to the celling t And what is perfect forwarding? It is important to know that "wider reference" is a reference to a named object in the "caller's scope". But in the actual copy, and enference is a name on bodyte, at, actus as around object. By you pass a realize reference to around the copy are a passing a named object, or, the object in in 'received like a temporal object. unid unn\_function(mid a)

function\_function(b);
} The object it would be copied to the extent parameter of initios. As you want the object is continues being treated as a temporary object, you whould use the sectional function.

\*\*Section (Not insect(1))\*\* With this firm, set some will cant a to an review and setter function, will receive the object as a unnamed object. Of course, if seter function has not specific overloading to work with unnamed objects, this distinction is not important. is that perfect forwarding? Not, but we are very close. Perfect forwarding is only useful to work with templates, with the purpose to say: if I need to pass an object to another function, I need that if I receive a named object, the object is passed as a named object, and when not, I want to pass it like a unnamed object. unmand digital

unital man, formatter (ML s)

unital man, formatter (ML s)

other junction (ML (format(+1(s)))

)

) Than's the signature of a prototypical function that uses perfect forwarding, implemented in C++11 by means of 3551 (forward). This function exploits some rules of template instantiation: 186 86 or 661 1866 86 or 668 So, if  $\S$  is a looker reference to  $\S$  ( $T + Adh_{\S} \S$  also  $(Adh_{\S} dh) = Adh_{\S} | \S$  is a realize reference to  $\S$ ,  $\S$  also  $(Adh_{\S} dh) = Adh_{\S} | h$  both cases,  $\S$  is a named object in the actual scope, but  $\S$  contains the information of its "reference type" from the coller scope's point of view. This information ( $\S$ ) is passed as terrorile parameter to  $\S$  ( $\S$ ) and  $\S$  of  $\S$  is more an accuracing to the type accuracing to suppose  $\S$ . Does toll following whether they will be to the following to deplicate all of the day you get to each the data from the days being "month" form.

\*\*Existing copy remarks, but instead of thereing to deplicate all of the day you get to each the data from the object being "month" form. 24 New Edit Folion Reg silver Edit Folion Reg second of 12,200 at 21 at 22 at — You know what a copy servantics means right? It means you have types which we copysize, for user-defined types you define this either loop explicitly attempt on your continents? A uningressed expense or the compiler generates them implicitly. The will do a copy. 14. More amending a copy constructor As a segregarized operation or their complete presents the term replacify. In the self-size a copy, and the self-size a copy of inference using 6th lyes to an approximately

which is now count, this is called a more constructor, save good for an approximation present to present the copy of inference using 6th lyes to an approximation of inference or approximation or approximation or approximation or approximation of inference or approximation of inference or approximation of inference or approximation of inference or approximation or appr Noting group to these contributed from the copy constructor when the function returns if (and in a 1-4-5); and question has a roose constructor increased with the contributed from the copy of the contributed from the copy of the copy In a contrast this is part and experience in the form funds or date in their solder or their solder of their 1. A "team component" offices for programmer to constit for default copy before our former long reference in the opposition when the constitution of the constitution In Buttote the rose for more sementic, left; consider this earning without more sementic.

I ferrit a function that takes an object of type () and returns an edged of the same type (i)

I ferrit a function that takes an object of type () and returns an edged of the same type (ii)

I ferrit a function of the same ()

I ferrit a function of the same ()

The above changes are used by other which means that when this function is called an object must be constructed to be used by the function. Second the function also extern by value, worther new object is constructed for the return value. Because the functions also arrived system, sending one object to constructed for the return value

1 × 10(0),

10 for the square constructed

There are objects better been constructed, one of which is a temporary object that's only used for the distriction.

When the one object is counted from their external value, the range varieties and suffer to expert an external of the function.

When the rear object is counted from their external value, the range varieties and one for the closer process.

All one for the counter object is counted from their external value of the function grows of a disperse of the reason object to.

The port or counter what a stay remainster alone.

The range of the object on places, the range of the release and can be me out of object to the new orders.

Despiting on the class respite his a considerer with vary much data, then their could response much have and memory usage

1 of the consideral value and the consideral value vary much data, then their could response much have and memory usage The control of the co The BB mean "reals reference" and a reference to which we can bind an unable "reals" in intended to complement "hala" which mapply means.
"numering that are appear on the ish hand side of an ariginant." So an enthe means roughly "a value that you can't assign with some present support of the complement and an extra region of the complement and an extra region of the complement and are simple extra region of the complement and are si

What is move semantics?

Asked 11 years, 8 months ago Active 8 months ago Viewed \$158 times

I just finished listering to the Software Engineering radio <u>podcast interview with Scott Mayers</u> regarding <u>C++0</u>c. Most of the new features made sense to me, and I am actually excited about C++0c now, with the exception of one. I still don't get move semontics. What is it exactly?