IBM Podcast

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MATHENY: Welcome to this IBM podcast, What are the odds? I'm Angelique Matheny with IBM. It's well known that on-time delivery of a complex system is never certain. It's also often unclear whether the product or system created will deliver the value that the stakeholders need. These facts raise two questions every project lead should be able to answer: what are the odds of making the date; and, am I delivering the expected value?

And today's podcast provides a method for answering these key questions. Joining me today for today's discussion is Murray Cantor, IBM Distinguished Engineer, and Brian Nolan, market manager for aerospace and defense. Hi, Murray, hi, Brian. Welcome to the podcast. Thanks for joining us today.

CANTOR: Hi, Angelique.
NOLAN: Hi, Angelique. Thank you.

NOLAN: Murray, you and I have talked about this quite often. So the questions are, will it be on time and will it deliver value? Can you talk about some of the challenges that companies, especially aerospace and defense companies,

face in trying to answer these questions and meet these challenges?

CANTOR: Well, first of all, the aerospace and defense industry is under some unique challenges or at least maybe better put, some of the challenges they've always had are being more brought into focus. The systems that are being built in aerospace and defense are increasingly complex, increasingly integrated. And at the same time, there is much more focus on affordability and the usefulness of the systems being built.

So in the past, various methods of reasoning about that being more qualitative are probably insufficient. We know some examples probably we shouldn't discuss in too much detail of both the integrators and the acquisition agencies are looking much harder at how does one reason about the effectiveness of the programs being developed and in particular, the issue of timeliness and value being created.

So [INAUDIBLE] along with this a little bit, what's supposed to happen in the aerospace and defense industries in particular with these long acquisition cycles is that as you go through the cycle you're supposed to de-risk the program. And they'll go off and go into a multi-phased acquisition but maybe each phase, we're looking at one instance with a 15-year acquisition cycle and then going into the first

phase being four or five years, where they're looking at design alternatives and the down selects.

And so they're supposed to be de-risking, and this raises two questions: one, how would they know the program was less risky at the end of the program? What would be the appropriate ways of measuring that? And secondly, even as they progressed for four or five years, can they see if they're on track to getting a less risky program at the end of the first cycle?

And the key point here is, risk in the end should be measured in terms of the uncertainty of meeting key program parameters. I think we've talked about this in previous podcasts, but certainly we've been talking about this in Rational for quite a while.

And the key program parameters in this case are timeliness. Will this system deliver on time to meet the mission effectiveness window? And secondly, will the system really deliver on the concept of operations so that it will deliver the value that the acquisition agency was looking for?

NOLAN: So, Murray, how can companies.... You've mentioned risk and uncertainty. How can companies improve their odds? And why are we talking about odds in the first place? It's so uncertain. Could you talk about that for a

little bit?

CANTOR: Yes. So, the key idea here is that you're never certain at the beginning of a program that the program will deliver in the future on time and deliver the value needed. So you're always making some sort of informed bet that the thing will deliver on time and with the appropriate value.

Now, as gamblers making bets you want to know what the odds are of you winning that bet, and that's where applying some statistical reasoning and probability theory comes into play. So, let's take a simple example first and we'll talk about some...and applying some techniques actually that have been around for a while but Rational's also implementing now in our tools, which has to do with looking at the schedule risk in terms of the likelihood of actually making the dates.

So, if you were to look at the time to complete of a program, that is, when is the likely delivery date or completion date of the program -- when will it go into service -- and you look at the hope for or expected or target date. With those two values, you can figure out if the likelihood is of the actual delivery being within the target window.

Now, to be a little bit more explicit -- and we're going to put the link to some simple diagrams to show this connected with the Webcast -- the time to complete is what the statisticians call a random variable. That is, it describes by some sort of statistical distribution. An example that we're all familiar with of such a distribution would be the bell-shaped or normal distribution we all learned about in school. The actual time to complete distributions look a little different than that, but the same idea.

And then, if you may recall, that the percent of that, the amount of area under the curve of this distribution is...that's within the target date is the likelihood of delivering when you want to. And the area of the curve that goes beyond the target date is the likelihood of not making the schedule. And so the ratio of those two areas is in fact the odds of successfully completing the program on time.

By looking at the uncertainty of completing the various tasks in the program plan and then looking at those tasks in the critical path, and by running Monte Carlo simulation, it's a fairly standard technique in the advanced program management tools that you can from that calculation actually compute the distribution of the time to complete and therefore you can look at the odds of completing on time.

And again, we're now beginning to support that in agile development tools and bringing that to market in a variety of ways in our own Rational tool set to help people with this.

Now, what's neat about program management is you can actually affect the odds by doing the right things, investing in those things that by looking at those, the things that contribute to the uncertainties -- which tasks in the critical path are most uncertain going in -- and you can estimate the time to complete of each task with simple best case, worst case, likely case estimates.

And if you look at the ones that have the biggest range between best case and worst case, you could ask the question, how would I invest in lowering that range and thereby improve the odds of making the delivery? And that's the essence of good iterative development.

Now, in the A&D industry, people will sometimes track these things, will complete these things at the beginning of the program and then set the program...figure out what the likelihood of the proposal being successful and change the expectations based on the risk assessment of the acquisition agency.

So, what we don't see happening is an ongoing interactive

assessment of how the odds are improving over time, and in particular, whether you are in fact de-risking the program by improving the estimates of the task completion and the contributors to that as you go through, even as you go through the various phases of the acquisition cycle.

Now, this can also be applied to thinking about the value of a program. And this gets you to something that is a little less conventional but applies exactly the same sort of reasoning.

If you look at the concept of operations for an A&D system, those...underlying them is some sort of quantitative measure as to the effectiveness, measures of effectiveness, of the system. And sometimes those measures are monetary and sometimes they're not. Actually, quite often they're more monetary than you might think.

So, for example, force protection, which is the effectiveness of a system being deployed and protecting the lives of say, the sailors or the soldiers or the pilots, they actually do know how much it costs to train and the monetary value to the military of a trained member of the forces.

And you can reason about what a reasonable return on investment is in protecting the forces from a purely

monetary basis. Now, if that's too cold-hearted, you could just look at number of lives saved as a measurement.

But what people don't do is actually calculate statistically what is the likelihood of getting the right measures of effectiveness by looking at the expected cost and benefit stream of one of these systems and tracking them over time. So what you do is apply the same kind of Monte Carlo approach, but this time not to the critical path of the schedule but to the net present value of the cost and benefit stream for the program.

In the A&D context, you tie the benefit stream to the measures of effectiveness as defined in the concept of operations for that system. With that set of benefit streams and that set of cost streams, we now have a tool component Focal Point which allows you to reason about over the total lifespan of the system not only the total cost of ownership, the development costs, but also the quantitative and monetary value of the benefit stream and look at the odds of receiving the value and the return on investment in the system.

And again, making good content management decisions and de-risking the program in terms of its delivery, and making good decisions on the trade-off between development costs and total cost of ownership, you can improve the odds of

getting a more valuable system.

NOLAN: So, Murray, you've mentioned Focal Point as a tool for doing this. Are there other tools, best practices, that Rational provides that can help in these areas?

CANTOR: Well, yes. In fact, one of the interesting connections is the relationship between quality management and value management. The decision to improve the quality, say the reliability of one of these systems is an economics decision in the end.

It costs money to improve quality, and it takes time, so going from, say, .999 reliability of a system to .99999 reliability of a system, takes more testing, more debugging, maybe more architecting, and will almost certainly delay the delivery.

So the question is, for any given system the decision to improve the various quality measures, particularly the so-called non-functional "ility" measures like reliability, is also an economic decision.

And if you ahve tools that help you understand what your current reliability measure is, like the system testing tools, and then you sort of track where you are using automated testing and measuring times to failure, looking at

those histograms and getting an estimate of what's called the failure density function...

Then you ask the question, how much would it cost, with the various subject matter experts, you ask the question, what would it cost to improve the reliability and what benefits would I accrue from the reliability improvements, you can then start making, again, looking at this from a statistical approach is, well, the odds are I'd have a much more cost effective, mission effective tool that would deliver better net present value if I improve the quality measure by such. And therefore, it's a good decision.

Or, you could make the decision, it will be so expensive to get the quality to the next level, and the benefits of getting this product or system to market or to the field sooner outweigh the benefits of getting the reliability built up.

And this helps you make the decision, are we ready to ship and when is the product good enough to both deploy and in particular, is it affordable to improve it? Now, what's fascinating here, if you get to...

You might find yourself at an impasse where it's not good enough and not affordable to improve it. And if you find yourself at such a situation, heaven forbid, then you know

that you have to do some major rearchitecting.

Now, ideally if you're tracking these things sooner in the program you can detect more quickly that you'll be in that situation and do the architecture fixes earlier in the program rather than later. And now, at that point, the value of the architecture itself becomes a key component in building out these complex mission-critical life-critical systems.

NOLAN: Okay, Murray. Yes, it seems to me from what you've said that there's an awful lot of data that needs to be gathered here as programs are going on and the number of best practices that need to be put into place, primarily...or at the forefront, iterative development in whatever way one can do it in the aerospace and defense context.

So, I'd like to kind of wrap up by saying that we have a platform that helps people pull these kinds of data together, and best practices to guide them along the path of de-risking the program and ensuring that the value is provided, and sets of metrics that in addition to these that can help companies try to get a better sense of the status of a program as they're moving along.

CANTOR: I would agree with that completely, Brian. And

I would add to that, though. What this allows us to do is essentially instrument the iterative processes in a way that aligns the various stakeholders in jointly addressing the risk and improving the odds of successful delivery.

So in the past we've always asserted with good reason that iterative development was a key in successfully delivering innovative programs and dealing with the uncertainties. That hasn't changed.

What's new here and the challenges we can now meet is instrumenting these programs so at each of the iteration boundaries, whether these are major or minor iterations or milestone boundaries, you can look at whether you've improved the likelihood of meeting the time and value targets...

And in particular, you get better decision support on whether [maybe] readiness to ship, which essentially then you know the iterations are, time to move into the transition phase and get the product out the door. So, it's all the practices we had before and the support we had with them, along with more sophisticated, more informing instrumentation.

MATHENY: And I just want to ask one final question before we leave today. Where can our listeners find further

information?

CANTOR: We have a Webcast coming up on March 8th. The URL for that is http://bitly/achievingagility. And that will be posted with the podcast as well.

MATHENY: Yes, it will. So, Murray and Brian, thank you so much for sharing your time today. This was a great discussion, and we really appreciate it.

NOLAN: Thank you, Angelique.

CANTOR: Thank you very much, Angelique.

MATHENY: That was IBM's Murray Cantor and Brian Nolan, discussing, What are the odds? To share this podcast with your colleagues, or if you're interested in more podcasts like this one, check out the Rational Talks To You Podcast Page at www.ibm.com/rational/podcasts. We'll post a link to the Webcast that Brian just mentioned. It's titled, “Measuring Agility in Aerospace and Defense” with Walker Royce. And also the diagrams that Murray mentioned earlier in his discussion. So, check them both out today.

This has been an IBM podcast. I'm Angelique Matheny. Thanks for listening. Keep tuning in as Rational Talks To You.

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