

## Cybersecurity Championship Cup – Collegiate

**Some Examples:** To illustrate how the calculations are made to use in evaluating the current system, several examples are provided below.

Large international team competition: The competition consists of 110 teams (schools) from several nations. The competition runs at one time (one tier) with everybody competing at the same time (head-to-head). It is team-based with a maximum of 10 members per team. It is a hands-on competition with everybody connecting via the Internet. It is an expert-level competition with the maximum of skills being tested. For illustrative purposes several final places will be considered for teams. The calculation would be as follows:

$$\text{Base Score} = 50 + (10 \cdot 10 / 150) = 50.67$$

$$\text{Team Size Multiplier} = 1.0$$

$$\text{Scope/Scale Multiplier} = 1.5$$

$$\text{Tiered Multiplier} = 1.0$$

$$\text{Format Multiplier} = 1.2$$

$$\text{Nature Multiplier} = 1.5$$

$$\text{Breadth Multiplier} = 2.0$$

$$\text{Depth Multiplier} = 1.3$$

$$\text{1}^{\text{st}} \text{ place finish Multiplier} = 2.0$$

$$\text{TOTAL SCORE} = 50.67 \cdot 1.0 \cdot 1.5 \cdot 1.0 \cdot 1.2 \cdot 1.5 \cdot 2.0 \cdot 1.3 \cdot 2.0 = \mathbf{711.36}$$

$$\text{2}^{\text{nd}} \text{ place finish Multiplier} = 1.7$$

$$\text{TOTAL SCORE} = 50.67 \cdot 1.0 \cdot 1.5 \cdot 1.0 \cdot 1.2 \cdot 1.5 \cdot 2.0 \cdot 1.3 \cdot 1.7 = \mathbf{604.656}$$

$$\text{3}^{\text{rd}} \text{ place finish Multiplier} = 1.5$$

$$\text{TOTAL SCORE} = 50.67 \cdot 1.0 \cdot 1.5 \cdot 1.0 \cdot 1.2 \cdot 1.5 \cdot 2.0 \cdot 1.3 \cdot 1.5 = \mathbf{533.52}$$

$$\text{20}^{\text{th}} \text{ place finish Multiplier} = 1.0$$

$$\text{TOTAL SCORE} = 50.67 \cdot 1.0 \cdot 1.5 \cdot 1.0 \cdot 1.2 \cdot 1.5 \cdot 2.0 \cdot 1.3 \cdot 1.0 = \mathbf{355.68}$$

Large national team competition: The competition consists of 160 teams (schools) from across a single nation. The competition has state qualifiers, regional competitions, and a national final championship (three tiers) with everybody competing at the same time (head-to-head) at each level. It is team-based with a maximum of 8 members per team. It is a hands-on competition with everybody connecting via the Internet or in person at the competition site. It is an expert-level competition with the maximum of skills being tested. For illustrative purposes several final places will be considered for teams. The calculation would be as follows:

$$\text{Base Score} = 50 + (10 \cdot 60 / 150) = 54$$

$$\text{Team Size Multiplier} = 1.0$$

$$\text{Scope/Scale Multiplier} = 1.3$$

Tiered Multiplier = 1.5  
Format Multiplier = 1.2  
Nature Multiplier = 1.5  
Breadth Multiplier = 2.0  
Depth Multiplier = 1.3  
1<sup>st</sup> place finish Multiplier = 2.0

TOTAL SCORE =  $54 * 1.0 * 1.3 * 1.5 * 1.2 * 1.5 * 2.0 * 1.3 * 2.0 = 985.608$

2<sup>nd</sup> place finish Multiplier = 1.7

TOTAL SCORE =  $54 * 1.0 * 1.3 * 1.0 * 1.2 * 1.5 * 2.0 * 1.3 * 1.7 = 837.767$

3<sup>rd</sup> place finish Multiplier = 1.5

TOTAL SCORE =  $54 * 1.0 * 1.3 * 1.0 * 1.2 * 1.5 * 2.0 * 1.3 * 1.5 = 640.645$

10<sup>th</sup> place finish Multiplier = 1.1

TOTAL SCORE =  $54 * 1.0 * 1.3 * 1.0 * 1.2 * 1.5 * 2.0 * 1.3 * 1.1 = 542.084$

Regional team competition: The competition consists of 30 teams (schools) from across several states. The competition has state qualifiers leading to the regional competition (two tiers) with everybody competing at the same time (head-to-head) at each level. It is team-based with a maximum of 8 members per team. It is a hands-on competition with everybody connecting via the Internet or in person at the competition site. It is an expert-level competition with the maximum of skills being tested. For illustrative purposes several final places will be considered for teams. It is important to note that a team finishing first in a regional competition will not get scored at this level if there is an additional (national) level they compete in later. A team involved in this situation should not be penalized for a poor showing at the national competition, thus the last place score at the national level should be greater than the first place score at the regional level. Using the two examples here as a test case, the last place team above would have earned 542 points while as the top finisher at the regional they would only have earned 359 points. Thus, the team is rewarded for the one additional level and competition they compete in. The calculation would be as follows:

Base Score =  $30 + (10 * 5 / 25) = 32$   
Team Size Multiplier = 1.0  
Scope/Scale Multiplier = 1.0  
Tiered Multiplier = 1.2  
Format Multiplier = 1.2  
Nature Multiplier = 1.5  
Breadth Multiplier = 2.0  
Depth Multiplier = 1.3  
1<sup>st</sup> place finish Multiplier = 2.0

TOTAL SCORE =  $32 * 1.0 * 1.0 * 1.2 * 1.2 * 1.5 * 2.0 * 1.3 * 2.0 = 359.424$

5<sup>th</sup> place finish Multiplier = 1.2

TOTAL SCORE =  $32 * 1.0 * 1.0 * 1.2 * 1.2 * 1.5 * 2.0 * 1.3 * 1.2 = 215.654$

State team competition: The competition consists of 12 teams (schools) from a single state or community. The competition has no qualifiers (one tier) with everybody competing at the same time (head-to-head). It is team-based with a maximum of 8 members per team. It is a hands-on competition with everybody connecting via the Internet or in person at the competition site. It is an expert-level competition with the maximum of skills being tested. For illustrative purposes several final places will be considered for teams. The calculation would be as follows:

$$\text{Base Score} = 20 + (10 * 2 / 15) = 21.33$$

$$\text{Team Size Multiplier} = 1.0$$

$$\text{Scope/Scale Multiplier} = 0.8$$

$$\text{Tiered Multiplier} = 1.0$$

$$\text{Format Multiplier} = 1.2$$

$$\text{Nature Multiplier} = 1.5$$

$$\text{Breadth Multiplier} = 2.0$$

$$\text{Depth Multiplier} = 1.3$$

$$\text{1}^{\text{st}} \text{ place finish Multiplier} = 2.0$$

$$\text{TOTAL SCORE} = 21.33 * 1.0 * 0.8 * 1.0 * 1.2 * 1.5 * 2.0 * 1.3 * 2.0 = \mathbf{159.744}$$

$$\text{5}^{\text{th}} \text{ place finish Multiplier} = 1.2$$

$$\text{TOTAL SCORE} = 21.33 * 1.0 * 0.8 * 1.0 * 1.2 * 1.5 * 2.0 * 1.3 * 1.2 = \mathbf{95.846}$$

International mixed team competition: The competition consists of 878 teams from around the world. There has been no attempt to determine the number of college teams in the competition. The winning team consists of 20 team members, 5 of whom are from one school (thus a penalty of 0.9 \* the percentage of school team members on the team will be applied). The competition has 1 qualifier (two tiers) with everybody competing at the same time (head-to-head). It is team-based with no maximum number of members per team. It is a hands-on competition with everybody connecting via the Internet or in person at the competition site. It is an expert-level competition with the maximum of skills being tested. The calculation would be as follows:

$$\text{Base Score} = (60 + (10 * 628 / 750)) * 0.90 * (5 / 20) = 15.384$$

$$\text{Team Size Multiplier} = 1.0$$

$$\text{Scope/Scale Multiplier} = 1.5$$

$$\text{Tiered Multiplier} = 1.2$$

$$\text{Format Multiplier} = 1.2$$

$$\text{Nature Multiplier} = 1.5$$

$$\text{Breadth Multiplier} = 2.0$$

$$\text{Depth Multiplier} = 1.3$$

$$\text{1}^{\text{st}} \text{ place finish Multiplier} = 2.0$$

$$\text{TOTAL SCORE} = 15.384 * 1.0 * 1.5 * 1.2 * 1.2 * 1.5 * 2.0 * 1.3 * 2.0 = \mathbf{259.19}$$

**A Sampling of Actual University Competition Events:** In order to obtain a better view of how the championship cup might play out, we asked several universities we knew were active in cyber security competitions to provide a list and description of the events that they participated in. We also provided a survey to all of the teams at the 2013 NCCDC championship to obtain information on the competitions they had participated in and to obtain an assessment of the strength of the individual competitions. We then created fictitious competition schedules and results for 6 hypothetical schools. To compare how teams might score in the C4 calculations, consider the following scenario year with the schools participating in and their place (and C4 points for this place) in the following competitions (the number of schools in the competition is also shown):

Competition	School 1	School 2	School 3	School 4	School 5	School 6
National Defense (160)		1 (985)	5 (591)	10 (542)		
Regional Defense 1 (30)	2 (305)				5 (215)	
International CTF 1 (110)	46 (320)	10 (391)		20 (355)		1 (711)
International CTF 2 (878)					1 (1329)	
National CTF 1 (636)	100 (202)		40 (252)		1 (506)	
National CTF 2 (486)	110 (268)				10 (423)	
International CTF 3 (260)	75 (344)			10 (422)		1 (861)
National Tournament (64)	17 (300)	2 (510)		9 (330)		
National CTF 3 (153)	60 (260)		18 (325)	15 (325)	5 (390)	
International CTF 4 (261)	89 (253)		37 (285)	18 (316)		1 (633)
Regional Defense 2 (6)				1 (112)		
International CTF 5 (93)	38 (307)			8 (375)		1 (682)
National CTF 4 (111)	47 (208)	5 (277)	30 (208)		4 (300)	
Individual School comp (1)	1 (14)					
National Online Quiz (65)	31 (45)					
<b>TOTAL POINTS</b>	2826	2163	1661	2777	3163	2887

School 1: 12 competitions, never doing extremely well in any of them (so, quantity over quality)

School 2: 4 competitions, does well in them but just didn't enter a lot

School 3: 5 competitions, does fairly well in all, nothing overly stellar

School 4: 8 competitions, does well in all, nothing lower than 20<sup>th</sup> place

School 5: 6 competitions, does very well, nothing lower than 10<sup>th</sup> but fewer competitions.

School 6: 4 competitions, does extremely well winning all they enter, but few entered.

Based on the sample above, we believe that we have accomplished the goal of blending quality and quantity of competitions to arrive at the C4 championship team. In the above example, School 1 definitely represents the quantity side. The school doesn't do exceptionally well in any one contest but attended a number of them. Even though the school participated in 4 competitions more than anybody else, it did not win the cup. At the other end is School 6 which had quality but not quantity. With just 4 competitions in which they won all of them, the team comes out in second. The winning team in the group is School 5 which had 6 competitions but did well in all of them, winning 2 of them. Having said

this, the order is HIGHLY dependent on the details of the competitions. For example, if schools 5 and 6 had swapped 1<sup>st</sup> place finishes in their largest competitions, then School 6 would win the competition with only 4 competitions but all first place finishes. What this stresses is doing well in large competitions will provide the largest number of points and will require a school to compete in fewer competitions.

Having said this, there was no school that performed that well in international and national competitions. We believe that it will be highly unlikely that any collegiate team will come away with wins in four large international and national competitions. What is much more likely is the situation shown for School 1 and possibly School 4. In these cases the teams competed in a reasonable number of competitions with one doing fairly well in them, and the other competing in more but not doing as well. This shows that schools wanting to be competitive will need to compete in close to the maximum allowed in order to not “give away” any points. With the maximum set at 12, we don’t believe that this will be a burdensome requirement.