



HUMAN-COMPUTER INTERACTION AND VIRTUAL REALITY LAB, DEPARTMENT OF INFORMATICS AND TELECOMMUNICATIONS,
UNIVERSITY OF THE PELOPONNESE

Enhancing Cyber Security Education and Training through Gamification

DIAKOUMAKOS Jason
PhD Student

Prof. LEPOURAS GEORGE
Supervisor

Department of Informatics and Telecommunications





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Cyber Security Training

“The backbone of building strong cyber security professionals and informed citizens”

Educate & Train Personnel and Professionals to

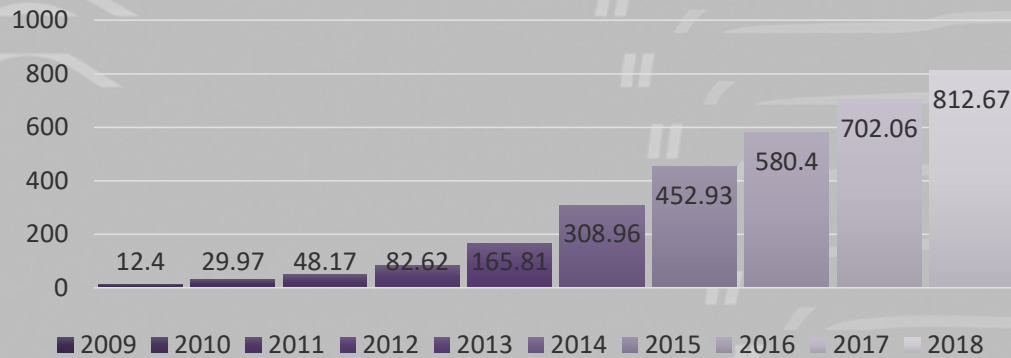
- *Understand security issues*
- *Identify risks*
- *Respond to issues*



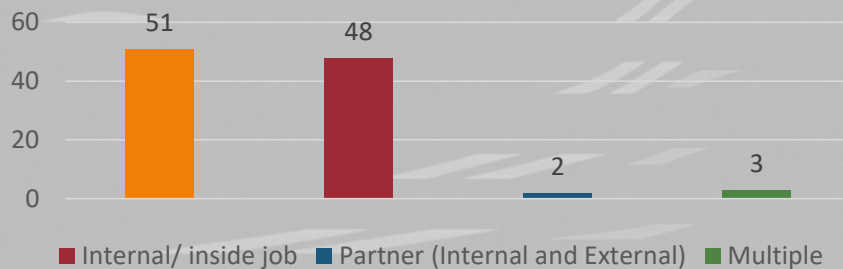
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Cyber Security Statistics

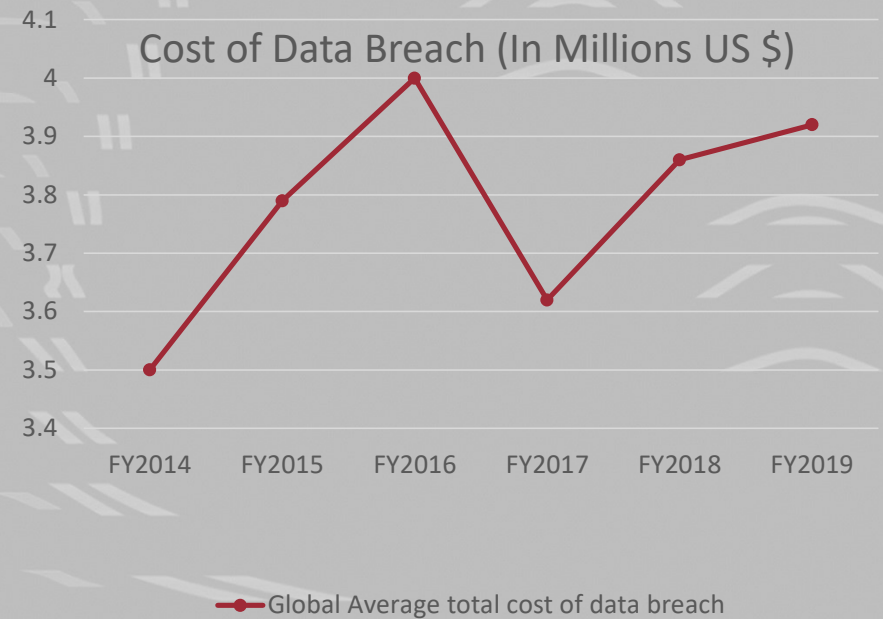
Total Malware Infection Growth Rate (In Millions)



Sources of Data Breaches



Cost of Data Breach (In Millions US \$)





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Training Platforms

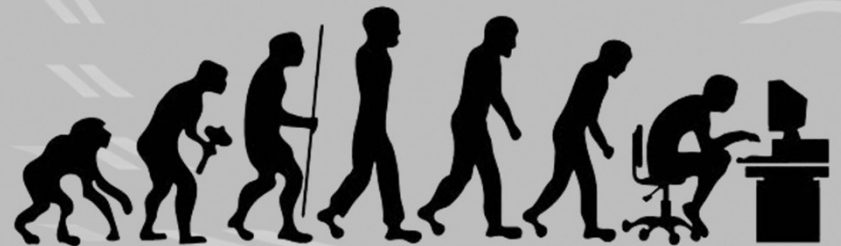
- Simple Games
 - Simple riddles for novice users
 - Introduction to security fundamentals
- Light-Weight Platforms
 - Self-paced
 - Small-scaled projects
- Cyber Ranges
 - Platforms providing hands-on training to security professionals
 - Host large-scale security exercises
 - Realistic and Complex simulation environments
 - Share distinct rules and description upon their scenarios



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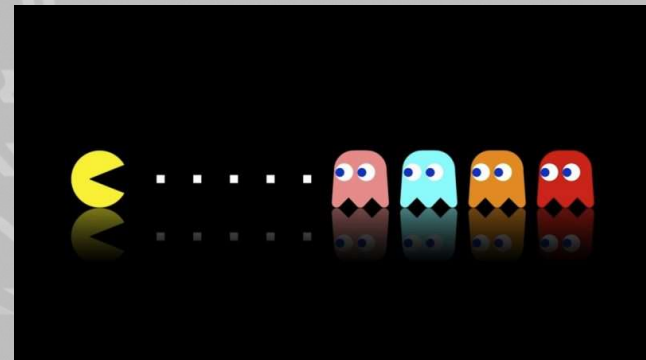
Cyber Security Education

- Cyber Security training is continuous
- Constant evolvement from both ends
- Constant involvement



Gamification and CS

- Positive impact in learning process
- Attract the interest
- Engage Users
- Provide Feedback





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Gamification Elements



Badges



Levels



Leaderboards



Progress Bar



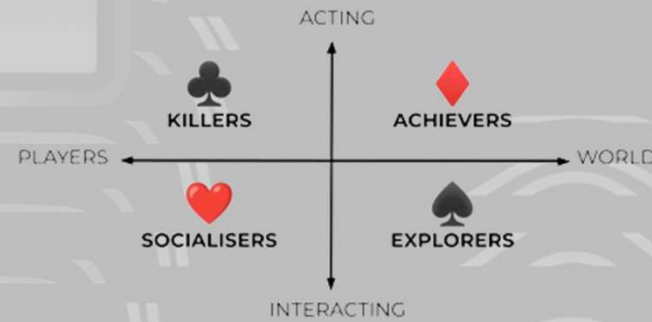
Virtual Currency



Awards, Trading



Challenges between Users



1 Rr Random Rewards										2 Fr Fixed Reward	3 Td Time Dependent
4 Ob On-boarding	5 Si Signposting	6 La Loss Aversion	7 I Investment					8 Pf Progress / Feedback	9 T Theme	10 N Narrative	11 C Curiosity
12 Tp Time Pressure	13 S Scarcity	14 St Strategy	15 F Flow	16 Co Consequences	17 Gt Goals / Teams	18 Sn Social Networks	19 Ss Social Status	20 Sd Social Discovery	21 Sp Social Pressure	22 Cm Competitor	
23 Ch Challenges	24 Ce Certificates	25 L Learning	26 Q Quests	27 Lp Levels / Progression	28 Bb Boss Battles	29 E Exploration	30 Bc Branching Choices	31 Ee Easter Eggs	32 U Unlockables	33 Ct Creativity Tools	
34 Cu Customisation	35 Ap Altruistic Purpose	36 Cg Care Taking	37 A Access	38 Cn Collection	39 Gs Gifting / Sharing	40 Ks Knowledge Share	41 P Points	42 Pr Prizes	43 Le Leaderboards	44 B Badges	
	45 Ve Virtual Economy	46 Lo Lottery	47 Ip Innovation Platform	48 V Voting	49 Dt Development Tools	50 A Anonymity	51 Lt Light Touch	52 An Anarchy			
Reward Schedule	General	Socialiser	Achiever	Free Spirit	Philanthropist	Player	Disruptor				

Problem

- No global scoring mechanism to highlight educational growth
- No standardized practice for user scoring and rewarding schemes
 - No association among award and learning outcome



- **Educational** growth **discrepancy** amongst platforms



Proposition

Global Gamification Mechanism, sharing commonalities amongst the majority of training platforms

- Rewarding Schemes
- Learning Impact
- Educational Objectives
- Hybrid
- Adaptable
- Highly Applicable



Solution – Theoretical Approach



Game-based Systems

VS

Gamified Systems

- Create Virtual interactable & explorable worlds
- Perform tasks to acquire knowledge
- Game has a primary role

- Employ mechanisms & tools within a system
- Supportive role
- Secondary role in user engagement

Consider best approach based on:

- Target audience
- Learning Outcome
- Existing gamification techniques
- User's personality
- User Engagement



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Solution – Implementation Approach



- ❖ **Back-end System** for seamless information exchange with external platforms
- ❖ **Database** used to store user progression, gamification schemes & exercises' information
- ❖ **Customizable rewarding schemes** to be adjusted for each content in respect to its needs



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Current Stage

❖ **Standardized Algorithm**

- ❖ Evaluate progression
- ❖ Non-platform related

❖ **Comprehensive Analysis**

- ❖ Categorize gamification mechanics
- ❖ Examine Engagement impact

❖ **Gamification Techniques Alignment**

- ❖ User Group
- ❖ Exercise Nature
- ❖ Educational Objectives



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Future Work

- ❖ Determine most effective approach (Game Vs Gamification)
- ❖ Development of Comprehensive System
 - ❖ Database
 - ❖ Scoring Algorithm
 - ❖ Educational Environment
- ❖ Ai co-pilot in exercise creation
- ❖ Refine methodologies



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